DOT/280

Report No. to be assigned by NHTSA

FMVSS 212/219/301
TESTING OF ELECTRIC VEHICLE

Electric Vehicle Associates

1980 EVA Ford Fairmont 4-Door Station Wagon

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FINAL REPORT

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Prepared by _____

Approved by E. Engelhardt

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_____
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Date

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16. Abstract

This report presents the results of an electric vehicle-to-load measuring fixed-barrier head-on crash test. This test was conducted to determine if the vehicle would comply with the fuel spillage requirements of the Federal Motor Vehicle Safety Standard (FMVSS) 301, Fuel System Integrity; the windshield retention requirements of FMVSS 212; and the windshield zone intrusion requirements of FMVSS 219. The standard fixed barrier was replaced by the 36-cell, load measuring fixed barrier.

The electric vehicle, a 1980 EVA Ford Fairmont, 4-door station wagon, manufactured by Ford Motor Company of Canada and altered by Electric Vehicle Associates of Cleveland, Ohio, was tested on January 8, 1981, at a speed of 30.57 mph, with the following results:

a) FMVSS 212 - no loss of windshield periphery;
b) FMVSS 219 - no intrusion into windshield protected zone;
c) FMVSS 301-75 - no fuel leakage occured after impact.

The EVA Fairmont appears to meet the requirements of FMVSS 212, 219, and 301-75.

Occupant and vehicle acceleration data were also acquired during the test.

17. Key Words	18. Distribution Statement
Frontal Impact, Load Measuring Fixed-Barrier, Fuel System Integrity, Windshield Retention, Windshield Intrusion, Occupant Response, Electric Vehicle	Copies available to the public through the National Technical Information Service, Springfield, Virginia 22161

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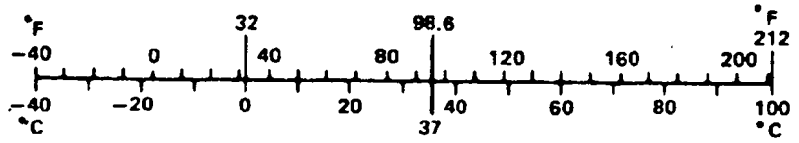
METRIC CONVERSION FACTORS

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	metric ton	t
		VOLUME		
tsp	teaspoons	5	milliliters	mL
Tbsp	tablespoons	15	milliliters	mL
in^3	cubic inches	16	milliliters	mL
fl oz	fluid ounces	30	milliliters	mL
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	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	degrees Fahrenheit	5 9 (after subtracting 32)	degrees Celsius	°C

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	metric ton. (1000 kg)	1.1	short tons	
		VOLUME		
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in^3
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	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F



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1.0 INTRODUCTION

This report presents the results of an electric vehicle-to-load measuring fixed barrier head-on crash test. This test was conducted to determine if the vehicle would comply with the fuel spillage requirements of Federal Motor Vehicle Safety Standard (FMVSS) 301-75 (Fuel System Integrity), the windshield retention requirements of FMVSS 212, and the windshield zone intrusion requirements of FMVSS 219. The electric vehicle tested was the 1980 EVA Ford Fairmont manufactured by Electrical Vehicle Associates.

Table 1-1 contains a summary of electric vehicle crash test conditions.

TABLE 1-1. SUMMARY OF ELECTRIC VEHICLE CRASH TEST CONDITIONS

Test Date	Test Configuration	Vehicle Model/ Dynamic Science Number	Vehicle Weight (lb)	Closing Speed (mph)
1/8/81	Car-to-Load Cell Barrier, Head-on	EVA Fairmont DSI 1107	4755	30.57

The load cell barrier face is pictured in Figure 1-1. The barrier consists of a 9 x 4 array of 50 klb load cells each faced with a section of 1-3/4-inch thick plywood. Plywood sections for Rows C and D (upper two rows) each measure 10 inches high and 9 inches wide. Plywood sections for Rows A and B (lower two rows) each measure 9 inches high and 9 inches wide. Overall width of the barrier is 83 inches and overall height is 38-3/4 inches. The lower edge of the barrier is 2-5/8 inches above the surface of the ground.

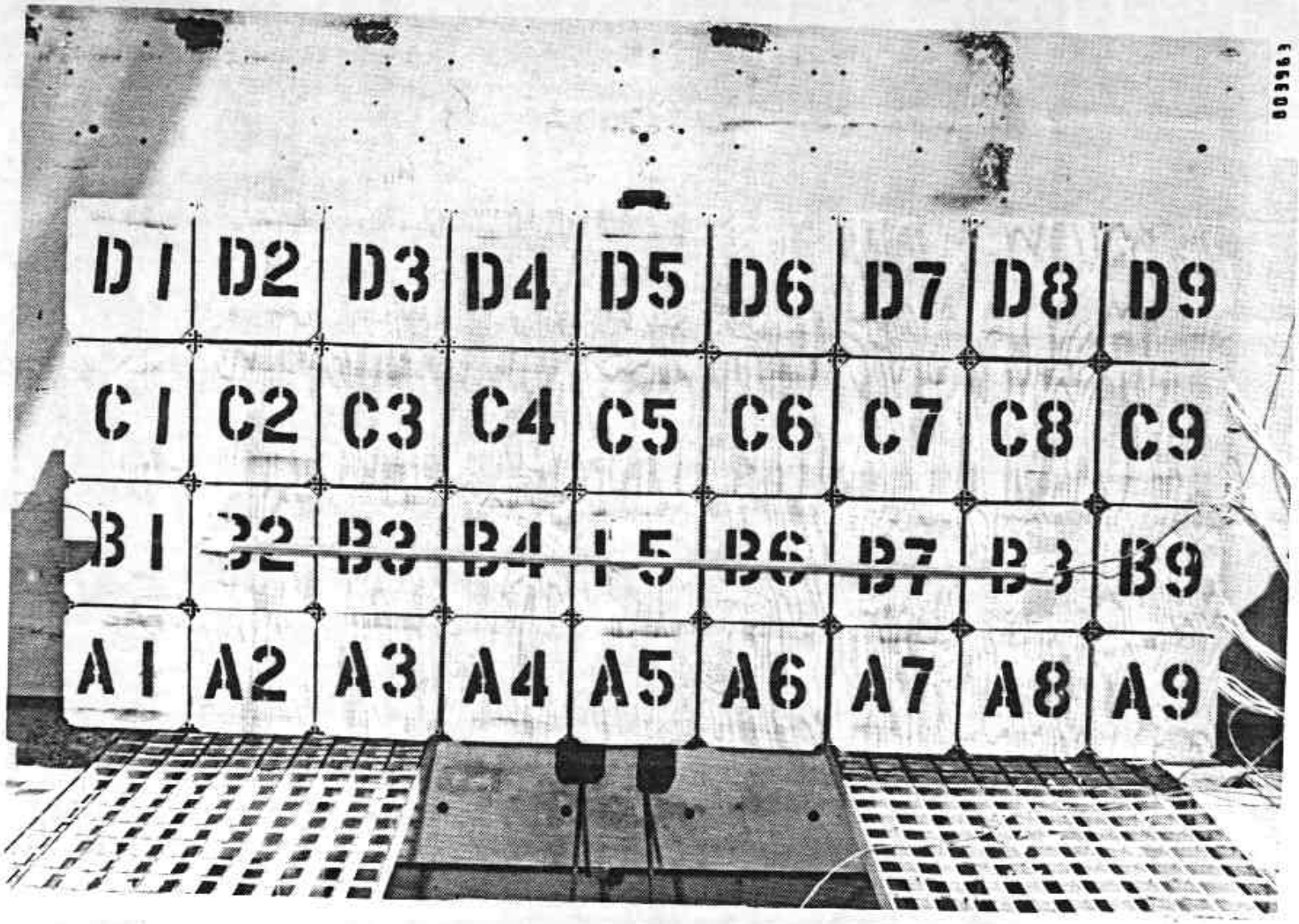


FIGURE 1-1. LOAD CELL BARRIER FACE.

2.0 HIGHLIGHTS OF TEST RESULTS

This section of the report highlights the results of the three compliance tests (FMVSS 212, 219, and 301-75) conducted on the electric vehicle. Tables 2-1 and 2-2 contain general test and vehicle parameter data followed by summaries of the EVA Fairmont station wagon FMVSS performance. Section 3.0 presents a detailed summary of the structural and dummy performance results obtained. Section 4.0 contains photographs. Section 5.0 contains Calcomp plots.

2.1 FMVSS 212 - WINDSHIELD RETENTION TESTING

Docket 69-29, Notice 5, states the following requirements with respect to FMVSS 212:

> "When the vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle...the windshield mounting of the vehicle shall... retain not less than 75 percent of the windshield periphery."

Summary of the EVA Fairmont Station Wagon Performance - 212 Test

The windshield showed no loss of retention and the vehicle consequently appears to meet the requirements of FMVSS 212.

2.2 FMVSS 219 - WINDSHIELD ZONE INTRUSION

FMVSS 219 requires that:

> "When the vehicle traveling longitudinally forward at...30 mph, impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle...no part of the vehicle outside the occupant compartment, except windshield molding and other components designed to be normally in contact with the windshield, shall penetrate the protected zone template, affixed according to [Standard 219], to a depth of more than one-quarter inch, and no such part of a vehicle shall penetrate the inner surface of that portion of the windshield below the protected zone..."
>
> (Code of Federal Regulations, Title 49, Section 571.219)

Summary of the EVA Fairmont Station Wagon Performance - 219 Test

The windshield protected zone template was affixed according to procedures specified in FMVSS 219. During the frontal barrier crash, there was no intrusion into the windshield protected zone.

2.3 FMVSS 301 - FRONTAL IMPACT FOR INTEGRITY OF MOTOR VEHICLE FUEL SYSTEMS

FMVSS 301 specifies the following compliance requirements.

> "When the vehicle traveling longitudinally forward at . . . 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle . . . fuel spillage shall not exceed a total of 5 ounces by weight in the 5-minute period following cessation of motion. For the subsequent 25-minute period, fuel spillage during any 1-minute interval shall no exceed 1 ounce by weight."
>
> (Code of Federal Regulations, Title 49, Section 571.301-75)

During the static rollover which follows barrier impact, the following requirements must be met.

> "When the vehicle is rotated on its longitudinal axis to each successive increment of 90 degrees . . . fuel spillage shall not exceed a total of 5 ounces by weight for the first 5 minutes of testing at each successive 90-degree increment. For the remaining testing period, at each increment of 90 degrees, fuel spillage during any 1-minute interval shall not exceed 1 ounce by weight."
>
> (Code of Federal Regulations, Title 49, Section 571.301-75)

Summary of the EVA Fairmont Station Wagon Performance - 301 Test

The vehicle impacted the barrier at a speed of 30.57 mph.

In the five-minute period following the barrier impact there was no fuel leakage.

When the vehicle was placed in the static rollover fixture and rotated, there was no fuel leakage throughout the test. The vehicle therefore appears to meet the requirements of FMVSS 301-75.

2.4 EVA Fairmont Battery Safety

During impact the front battery compartment ruptured with massive battery electrolyte leakage. No leakage into the passenger compartment occurred.

No batteries were detached or broken in the rear battery compartment and the overall structure was undamaged, although the battery compartment inertia caused the rear frame of the vehicle to shift forward and downward. Acid leakage from the batteries occurred during the static rollover. This acid leaked into the occupant compartment, reaching as far as the windshield header area and firewall.

3.0 PRESENTATION OF RESULTS

This section presents all test results without analysis or discussion. Included in this document are: data summary sheets for each Federal Motor Vehicle Safety Standard, summaries of the simulated occupant data including injury criteria values, tabulated pre- and post-test dimensions, and summaries of vehicle accelerometer location and data. High-speed motion pictures were also obtained. Section 4.0 contains photographs of the overall vehicle, batteries, windshield, and occupants. Section 5.0 contains Calcomp plots for all vehicle accelerometer data, occupant response data, seat belt loads, and barrier load cell data.

GENERAL TEST AND VEHICLE PARAMETER DATA

PRE-IMPACT DATA

Make/Model: EVA Fairmont Station Wagon
Body Style: 4-door Station Wagon Model Year: 1980
NHTSA No.: N/A DSI No. 1107 Color: Green

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Company of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN: 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear = 2740 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL

Vehicle Capacity:	FRONT	REAR	RECOMMENDED TIRE SIZE:	LOAD RANGE:
Tire Pressure:	35 psi	35 psi	P195/75R14	B

Designated Seating: 2 Front 2 Rear 4 Total
Cargo load = 300 lb Is Spare Tire: Space Saver? No
TOTAL = 600 lb Standard Equipment? No
Engine: Electric Motor
Transmission: 3-speed automatic Rear Wheel Drive
Date Vehicle Received by Laboratory: 8/4/80 ; Odometer: 1904.3
Remarks: Vehicle altered by Electric Vehicle Associates 7/80

WEIGHT (LB) OF TEST VEHICLE AS RECEIVED (WITH MAX. FLUIDS) = UDW

Left Front 924 Right Front 900 Left Rear 1134 Right Rear 1173

TOTAL FRONT WEIGHT = 1824 lb (44.2% of Total Vehicle Weight)
TOTAL REAR WEIGHT = 2307 lb (55.8% of Total Vehicle Weight)
TOTAL DELV. WEIGHT = 4131 lb
TARGET WEIGHT = UDW + Cargo Load + 328 lbs Dummies = 4759 lb

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 300 lb CARGO:

Right Front = 986 lb Right Rear = 1420 lb
Left Front = 976 lb Left Rear = 1373 lb
TOTAL FRONT WEIGHT = 1962 lb (41.3% of Total Vehicle Weight)
TOTAL REAR WEIGHT = 2793 lb (58.7% of Total Vehicle Weight)
TOTAL TEST WEIGHT = 4755 lb
Weight of ballast secured in vehicle trunk area = 90 lb

VEHICLE ATTITUDE: (inches)

Delivered Attitude:	RF	29.0	LF	29.0	RR	29.0	LR	29.0
Test Attitude:	RF	28.8	LF	28.8	RR	27.8	LR	27.8

POST-IMPACT DATA

Type of Test: Frontal (0°) Impact.
Date of Test: 1/8/81 Time: 1155 Temperature 62 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph

Distance from the vehicle's front bumper to barrier face entering the vehicle velocity measurement device is 5.0 feet and distance exiting the vehicle velocity measurement device is 1.0 foot.

VEHICLE REBOUND AND CRUSH (in.)

		R	L
Vehicle Length:	Pre-test =	189.1	189.0
	Post-test =	165.4	165.3
	Crush =	23.7	23.7

Distance from front of test vehicle to point of impact: R 7.5 L 7.5

VISIBLE DUMMY CONTACT POINTS

	Driver	Passenger
Head	Upper Dash	Upper Dash
	Steering Wheel Rim	Glove Box
Chest	Steering Wheel Rim and Hub	None
Abdomen	Steering Wheel Rim	None
Left Knee	Lower Dash to Mountings	Lower Dash to Mountings
Right Knee	Lower Dash to Mountings	Lower Dash to Mountings

DOOR OPENING	Front		Rear	
	Left	Right	Left	Right
	Tools Required	Tools Required	Difficult	Difficult

SEAT MOVEMENT				
Seatback Failure	None	None	None	None
Seat Shift (in.)	None	None	None	None

GLAZING DAMAGE

Backlight/Windshield 100% shattered, lowest 3 inches severely folded.

OTHER NOTABLE IMPACT EFFECTS: Rear batteries caused longitudinal crush of rear frame. All four tires pinned by crushed sheet metal. Severe deformation of roof at B pillars. Front doors severely crushed. Top dash panel completely broken from mountings. Steering column shifted down and leftward, remaining rigid (insufficient functioning of collapse mechanisms.) Steering wheel pinned dummy legs against seat: tools required to remove dummy.

SUMMARY OF FMVSS 212 DATA

PRE-IMPACT DATA

Make/Model: EVA Fairmont
Body Style: 4-door Station Wagon Model Year: 1980
NHTSA No. N/A DSI No. 1107 Color: Green

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Co. of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear 2740 lb

POST-IMPACT DATA

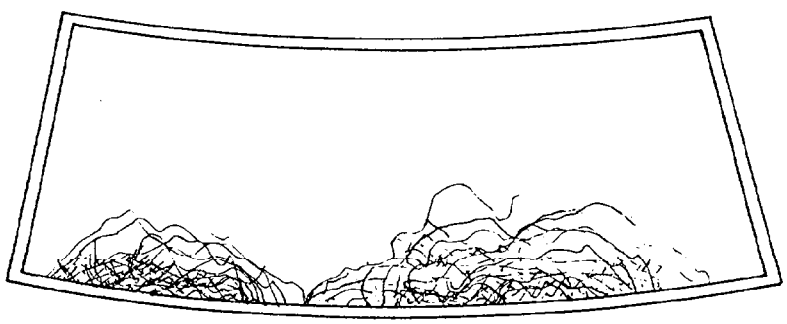
Type of Test: Frontal (0°) Impact
Date of Test: 1/8/81 Time: 1155 Temperature 62 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph
Test weight: 4755 lb Static crush: 28.6 in.
Rebound distance: 7.5 in.

DETAILS OF WINDSHIELD MOUNTING: Windshield is bonded on all sides by a one-inch-wide black mastic. The periphery is overlaid by a one-inch-wide metal molding secured by plastic circlips at 10-inch intervals. No retention brackets are evident.

	WINDSHIELD PERIPHERY	
	Pre-test	Post-test
RIGHT SIDE	75.5	75.5
LEFT SIDE	75.5	75.5
TOTAL	151.0	151.0

The standard requires that POST-TEST be a minimum of 75 percent of the PRE-TEST total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

AREA OF RETENTION FAILURE: None. Severe folding in lowest 3 in.



SUMMARY OF FMVSS 219 DATA

PRE-IMPACT DATA

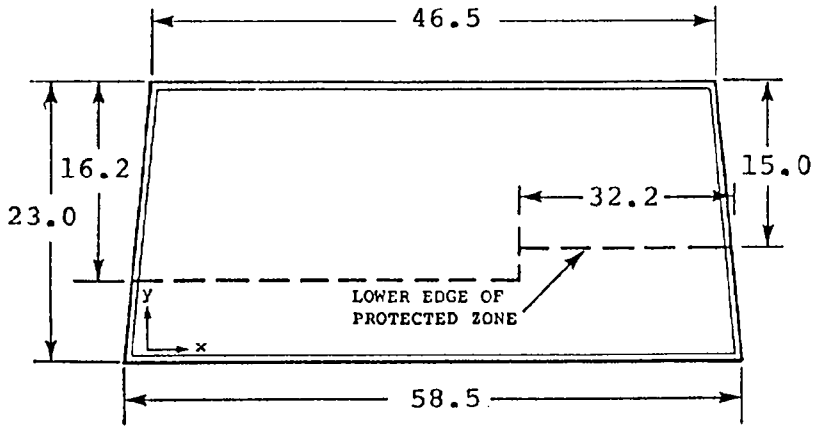
Make/Model: EVA Fairmont
Body Style: 4-Door Station Wagon Model Year: 1980
NHTSA No.: R&D DSI No. 1107 Color: Green

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Co. of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN: 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear = 2740 lb

POST-IMPACT DATA

Type of Test: Frontal (0°) Impact
Date of Test: 1/8/81 Time: 1155 Temperature 62 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph
Test weight 4755 lb Static Crush 28.6 in. Rebound 7.5 in.



FRONT VIEW OF WINDSHIELD

A. The area that the "Protected Zone" template was penetrated more than 0.25 inch by a vehicle component other than one which is normally in contact with the windshield.

Coordinates

X	Y
N/A	N/A

SUMMARY OF FMVSS 219 DATA (CONTD)

B. The area beneath the "Protected Zone" that the inner surface of the windshield was penetrated by a vehicle component.

Coordinates	
X	Y
N/A	N/A

PRE-IMPACT DATA

Make/Model: EVA Fairmont
Body Style: 4-Door Station Wagon Model Year: 1980
NHTSA No.: R&D DSI No. 1107 Color: Green

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Co. of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN: 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear = 2740 lb

POST-IMPACT DATA

Type of Test: Frontal (0°) Impact
Date of Test: 1/8/81 Time: 1155 Temperature 65 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph
Test Weight 4755 lb Static Crush 28.6 in. Rebound 7.5 in.

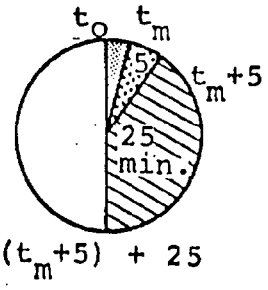
FUEL SYSTEM DATA

Test fluid: Stoddard Solvent Specific Gravity: 0.764
Temperature: 70 °F
Kinematic Viscosity: 0.99 centistokes Test Volume: 1.9 U.S. gal

Test vehicle fuel tank filled to 93% of "usable" plus "unusable" capacity with Stoddard Solvent and with electric fuel pump operating (if it will operate without engine operation) until start of static roll.

Details of fuel system: Cylindrical metal fuel tank is attached to the right rear quarter panel by two metal straps. The standard Ford filler neck and cap are used. The sender tubes proceed forward along right rocker panel to heater. Manufacturer of heater: Eberspächer Model: 20147201

FUEL SPILLAGE MEASUREMENT

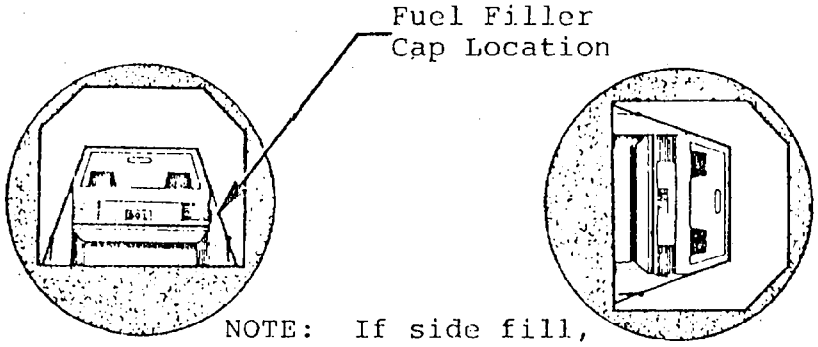


		ACTUAL	MAXIMUM ALLOWABLE
1.	From impact until vehicle motion ceases. . . .	0	1 oz
2.	For 5-minute period after vehicle motion ceases	0	5 oz
3.	For next 25 minutes. . .	0	1 oz/1 min

SOLVENT SPILLAGE DETAILS: None

FMVSS 301-75 STATIC ROLLOVER DATA

TEST PHASE: 0° to 90° VEHICLE EVA Fairmont



NOTE: If side fill, rotate so that filler cap is down.

DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time.... = 1 min, 39 sec +
(Spec. Range = 1 to 3 min)

FMVSS 301 Position Hold Time..... = 5 min, 0 sec =

Total..... = 6 min, 39 sec

Next Whole Minute Interval..... = 7 min

FMVSS 301 REQUIREMENTS AND ACTUAL TEST RESULTS:

Time Period	First 5 min (from onset)	6th min	7th min	8th min (if req'd)
Maximum Spillage Allowed (oz)	5	1	1	1
Actual Spillage Recorded	0	0	0	---

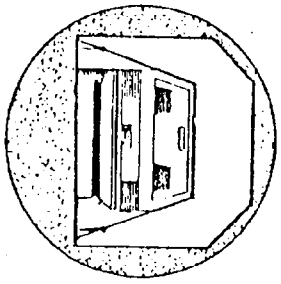
NOTE: Spillage is recorded in whole minute intervals only - as -determined above.

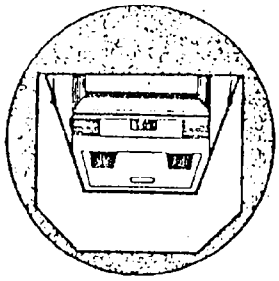
SOLVENT SPILLAGE LOCATION(S): None.

Battery acid leakage from front compartment continuing throughout entire roll period. Rear battery compartment begins leaking into rear occupant compartment.

FMVSS 301-75 STATIC ROLLOVER DATA

TEST PHASE: 90° to 180° VEHICLE EVA Fairmont





DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time.... = 1 min, 38 sec +
(Spec. Range = 1 to 3 min)

FMVSS 301 Position Hold Time..... = 5 min, 0 sec =

Total..... = 6 min, 38 sec

Next Whole Minute Interval..... = 7 min

FMVSS 301 REQUIREMENTS AND ACTUAL TEST RESULTS:

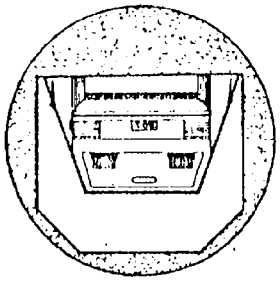
Time Period	First 5 min (from onset)	6th min	7th min	8th min (if req'd)
Maximum Spillage Allowed (oz)	5	1	1	1
Actual Spillage Recorded	0	0	0	---

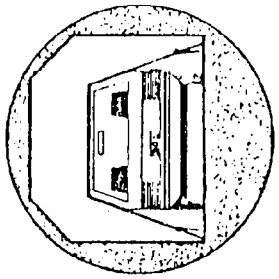
NOTE: Spillage is recorded in whole minute intervals only - as determined above.

SOLVENT SPILLAGE LOCATION(S): None. Continued leakage from front battery compartment. Massive battery acid leakage into rear occupant compartment due to poorly sealed edge of rear battery compartment cover.

FMVSS 301-75 STATIC ROLLOVER DATA

TEST PHASE: 180° to 270° VEHICLE EVA Fairmont





DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time.... = 1 min, 36 sec +
(Spec. Range = 1 to 3 min)

FMVSS 301 Position Hold Time..... = 5 min, 0 sec =

Total..... = 6 min, 36 sec

Next Whole Minute Interval..... = 7 min

FMVSS 301 REQUIREMENTS AND ACTUAL TEST RESULTS:

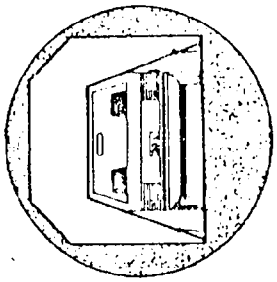
Time Period	First 5 min (from onset)	6th min	7th min	8th min (if req'd)
Maximum Spillage Allowed (oz)	5	1	1	1
Actual Spillage Recorded	0	0	0	---

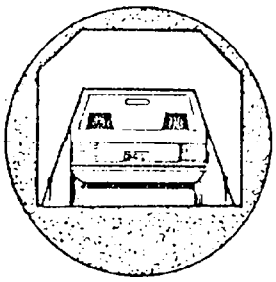
NOTE: Spillage is recorded in whole minute intervals only - as determined above.

SOLVENT SPILLAGE LOCATION(S): None. Continued leakage from front battery compartment. Massive battery acid leakage into rear occupant compartment due to poorly sealed edge of rear battery compartment cover.

FMVSS 301-75 STATIC ROLLOVER DATA

TEST PHASE: 270° to 360° VEHICLE EVA Fairmont





DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time.... = 1 min, 38 sec +
(Spec. Range = 1 to 3 min)

FMVSS 301 Position Hold Time..... = 5 min, 0 sec =

Total..... = 6 min, 38 sec

Next Whole Minute Interval..... = 7 min

FMVSS 301 REQUIREMENTS AND ACTUAL TEST RESULTS:

Time Period	First 5 min (from onset)	6th min	7th min	8th min (if req'd)
Maximum Spillage Allowed (oz)	5	1	1	1
Actual Spillage Recorded	0	0	0	1

NOTE: Spillage is recorded in whole minute intervals only - as - determined above.

SOLVENT SPILLAGE LOCATION(S): None. Continued leakage from front battery compartment. Rear battery compartment leakage same as previous roll period.

Part 572 DUMMY IN-VEHICLE POSITION DATA

PRE-IMPACT DATA

Make/Model: EVA Fairmont
Body Style: 4-Door Station Wagon Model Year: 1980
NHTSA No.: N/A DSI No. 1107 Color: Green

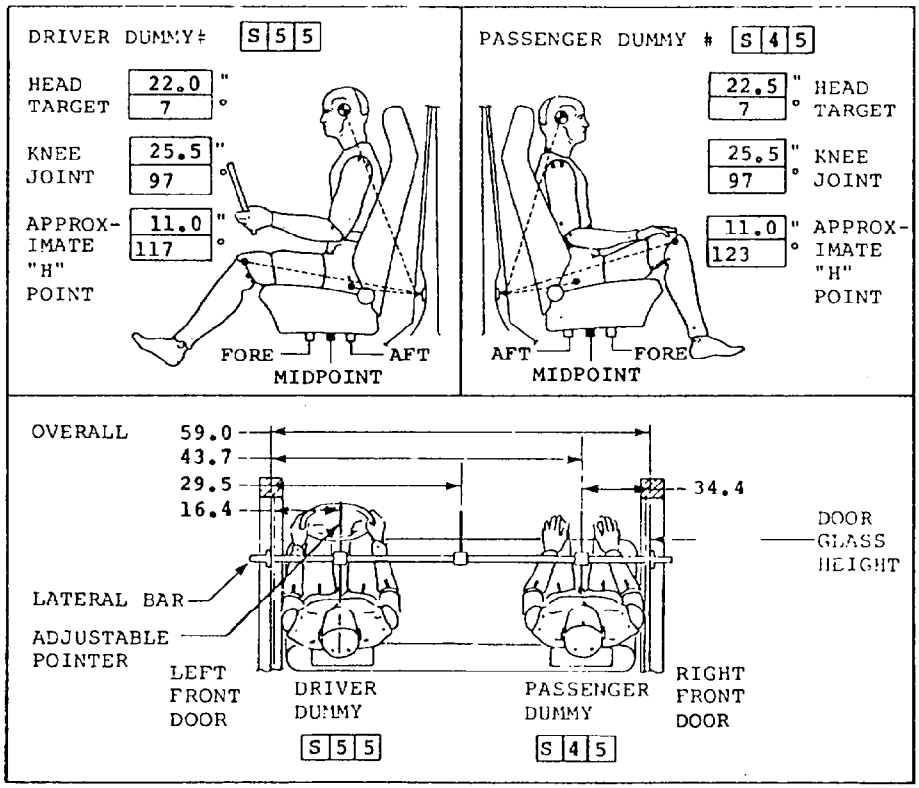
DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Co. of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN: 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear = 2740 lb

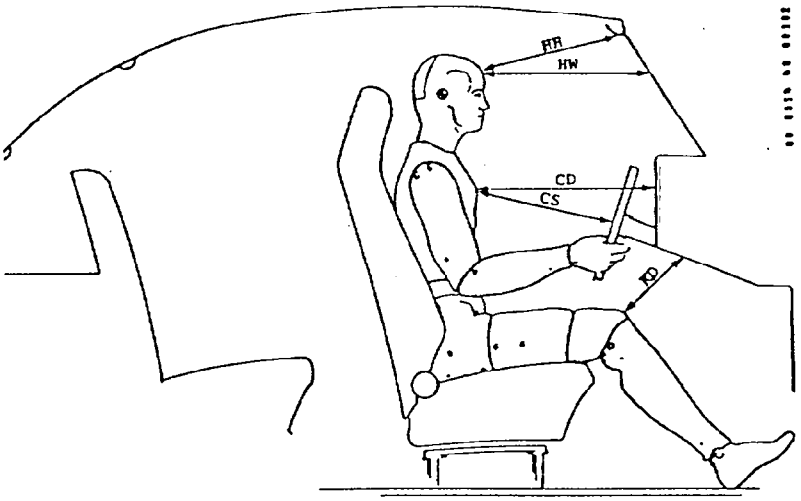
POST-IMPACT DATA

Type of Test: Frontal (0°) Impact
Date of Test: 1/8/81 Time: 1155 Temperature 62 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph
Test Weight 4755 lb Static Crush 28.6in. Rebound 7.5 in.

Seat Type: Bench Adjuster Type: Manual
Seat Back Type: N/A
Technicians: Mark Pozzi, Ron Thomas

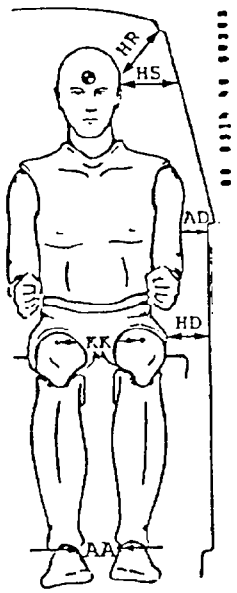


PART 572 DUMMY IN-VEHICLE POSITION DATA



	Driver	Passenger
HH	12.4	12.5
HW	17.4	16.5
CD	18.5	20.5
CS	12.0	N/A
KD	5.7	6.0
Torso Angle	23°	Torso Angle 23°
Seat Back Angle	21°	Seat Back Angle 21°

HH = Head to Windshield Header
HW = Head to Windshield
CD = Chest to Dash
CS = Chest to Steering Wheel
KD = Knees to Dash
HR = Head to Side Roof
HS = Head to Side Window
AD = Arm to Door
HD = Hip to Door
KK - Knee to Knee
AA = Ankle to Ankle
Torso and seat back angles are relative to vertical.



Remarks: Dummies positioned according to OVSC recommended procedure for positioning part 572 dummies in test vehicle.

	Driver	Passenger
HR	7.0	7.5
HS	9.0	9.5
AD	4.6	4.8
HD	6.7	7.7
KK	9.0	9.0
AA	10.0	10.0

PART 572 DUMMY DATA SUMMARY

	Driver Dummy				Passenger Dummy			
	Positive Direction*		Negative Direction**		Positive Direction*		Negative Direction**	
	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)
Head Acceleration								
Longitudinal	6.6	199	89.7	107	2.4	33	59.4	109
Lateral	2.2	66	25.3	107	55.1	109	4.8	165
Vertical	72.2	97	2.5	21	37.2	109	3.4	149
Resultant	95.8	107			89.2	109		
HIC	959.0 between 85 and 117 msec				305.7 between 81 and 133 msec			
Chest Acceleration								
Longitudinal	4.4	136	36.4	89	1.7	190	22.5	89
Lateral	2.1	56	16.8	72	17.2	111	0.8	22
Vertical	15.0	53	9.8	117	9.1	54	4.9	147
Resultant (Max)	36.7	89			23.7	89		
Resultant (clip)	33.3	91			21.2	114		
TIME > 60 G	0 msec				0 msec			
SEVERITY INDEX	255.2 @ 200 msec				123.5 @ 200 msec			
	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)
Femur Loads								
Left			866.6	73			368.4	134
Right			984.4	63			441.6	72
Belt Loads								
Torso	960.2	62			1047.5	74		

Vehicle Impact Speed (mph): 30.57

*Longitudinal: Forward
Lateral: Rightward
Vertical: Downward

**Longitudinal: Rearward
Lateral: Leftward
Vertical: Upward

DUMMY KINEMATIC SUMMARY

DRIVER - Struck lower steering wheel rim with abdomen and then upper steering wheel rim with center of sternum. Upper dash panel separated, permitting dummy forehead to strike upper dash padding and right orbit to strike instrument panel edge directly above steering column. Dummy rebounded to center of seat back and came to rest leaning medially.

PASSENGER - Upper dash panel separated, permitting left orbit to strike upper edge of glovebox. Dummy rebounded into seat back and came to rest upright with a slight medial lean.

OTHER COMMENTS: Steering column moved downward and 4.4 inches rearward prior to initial dummy chest contact. Steering wheel rim was cracked at spoke junctions due to dummy thorax contact. Both dummies experienced severe knee impacts with dash panel.

PRE/POST TEST STATIC MEASUREMENT DATA

PRE-IMPACT DATA

Make/Model: EVA Fairmont
Body Style: 4-Door Station Wagon Model Year: 1980
NHTSA No.: R&D DSI No. 1107 Color: Green

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Ford Motor Co. of Canada/Electric Vehicle Associates
Date of Manufacture: 8/79 ; VIN: 0X94B101367
GVWR: 4960 lb; GAWR: Front = 2220 lb; Rear = 2740 lb

POST-IMPACT DATA

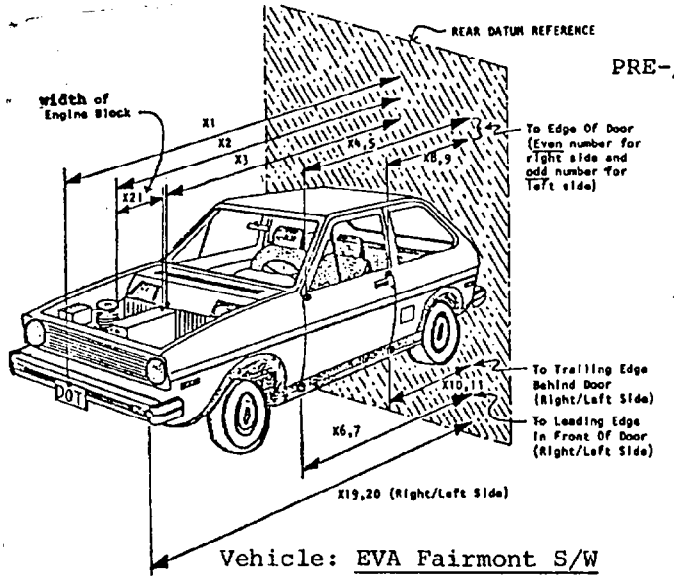
Type of Test: Frontal (0°) Impact
Date of Test: 1/8/81 Time: 1155 Temperature 62 °F
Required Impact Velocity Range: 30.0 to 31.0 mph
Impact Velocity: Primary = 30.57 mph Secondary = 30.61 mph
Test Weight : 4755 lb Crush: 28.6 in. Rebound: 7.5 in.

VEHICLE PROFILE DATA

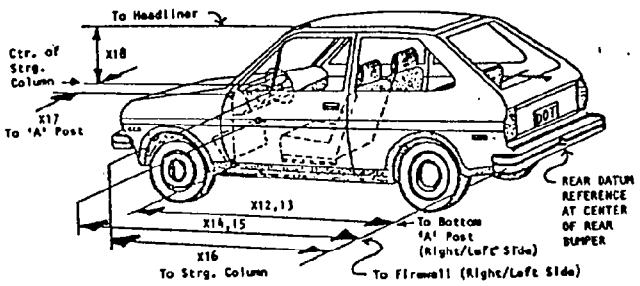
Measurements Referenced to Plane 17 Feet Forward of Rear Bumper ℄

		Vehicle Left (in.)				Vehicle Right (in.)		
Location	Height	32.5*	19.5	6.5	℄	6.5	19.5	32.5*
		Pre-test Profile (in.)						
Top of Front Bumper	19.2	15.0	13.0	11.2	10.2	11.2	13.0	15.1
Front of Hood	29.2	17.7	16.9	15.1	14.1	15.1	16.9	17.8
		Post-test Profile (in.)						
Top of Front Bumper	18.0	38.7	38.1	38.5	38.8	38.6	37.8	38.8
Front of Hood	29.1	37.3	37.5	37.7	37.8	37.7	37.5	37.3
		Post-test Static Crush (in.)						
Top of Front Bumper	1.2	23.7	25.1	27.3	28.6	27.4	24.8	23.7
Front of Hood	0.1	19.5	20.6	22.6	23.7	22.6	20.6	19.5

* 30.0 inches left and right of center for the hood profile



PRE-/POST-TEST STATIC MEASUREMENT DATA



Vehicle: EVA Fairmont S/W NHTSA No.: N/A

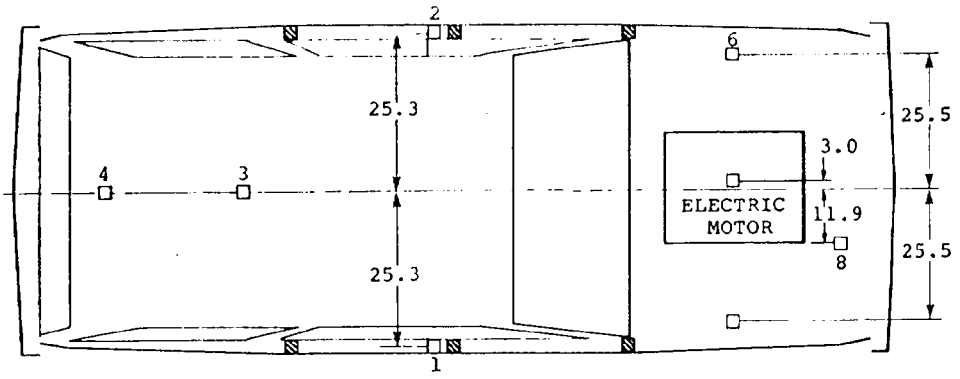
Test Date: 1/8/80 D.S. No.: 1107

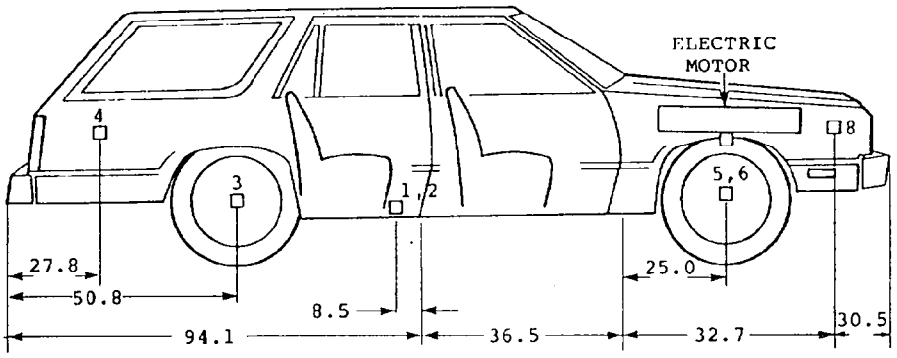
Reference Dimension	Pre-test Measurement	Post-test Measurement	Change
X_1*	193.8	166.5	27.3
X_2	182.5	164.4	18.1
X_3	142.5	130.0	10.5
X_4	128.5	124.2	4.3
X_5	128.5	126.3	2.2
X_6	131.4	126.9	4.5
X_7	131.4	127.2	4.2
X_8*	91.5	88.3	3.2
X_9*	91.5	90.0	1.5
X_{10}	90.2	85.7	4.5
X_{11}	90.2	86.3	3.9
X_{12}	130.6	126.3	4.3
X_{13}	130.6	125.5	5.1
X_{14}	143.3	131.2	12.1
X_{15}	143.3	131.6	11.7
X_{16}	115.8	108.0	7.8
X_{17}	17.5	13.7	3.8
X_{18}	19.0	23.9	4.9
X_{19}*	189.1	165.4	23.7
X_{20}*	189.0	165.3	23.7
X_{21}	20.0	10.5	9.5

*Rear Impact Data Requirements

Top of Front Battery Case Rotated Forward

VEHICLE ACCELEROMETER SUMMARY





No.	Location Description	Component Direction* X	Y	Z	Data Summary Peak G @ msec X "+"	X "-"	Y "+"	Y "-"	Z "+"	Z "-"
1	Rocker panel Aft of B-pillar Right side			✓	5.1 25	34.1 82			14.3 28	9.4 51
2	Rocker Panel Aft of B-pillar Left side			✓	1.3 151	31.6 30			15.4 29	11.5 36
3	Rear Axle Centerline*			✓						
4	Rear Battery Compartment			✓	0.8 -2	17.5 51				
5	Right Front Brake Caliper			✓	5.0 108	36.1 31				
6	Left Front Brake Caliper			✓	10.4 62	51.2 42				
7	Underside of Propulsion motor			✓	25.2 50	53.2 57				
8	Front Battery Compartment			✓	70.6 59	63.3 63				

*Sensor lead severed

4.0 PHOTOGRAPHIC COVERAGE

This section consists of pre-test and post-test photographs of the overall vehicle, windshield, fuel system, and occupants.

FIGURE 4-1. PRE-TEST FRONT VIEW - 1980 EVA FAIRMONT.

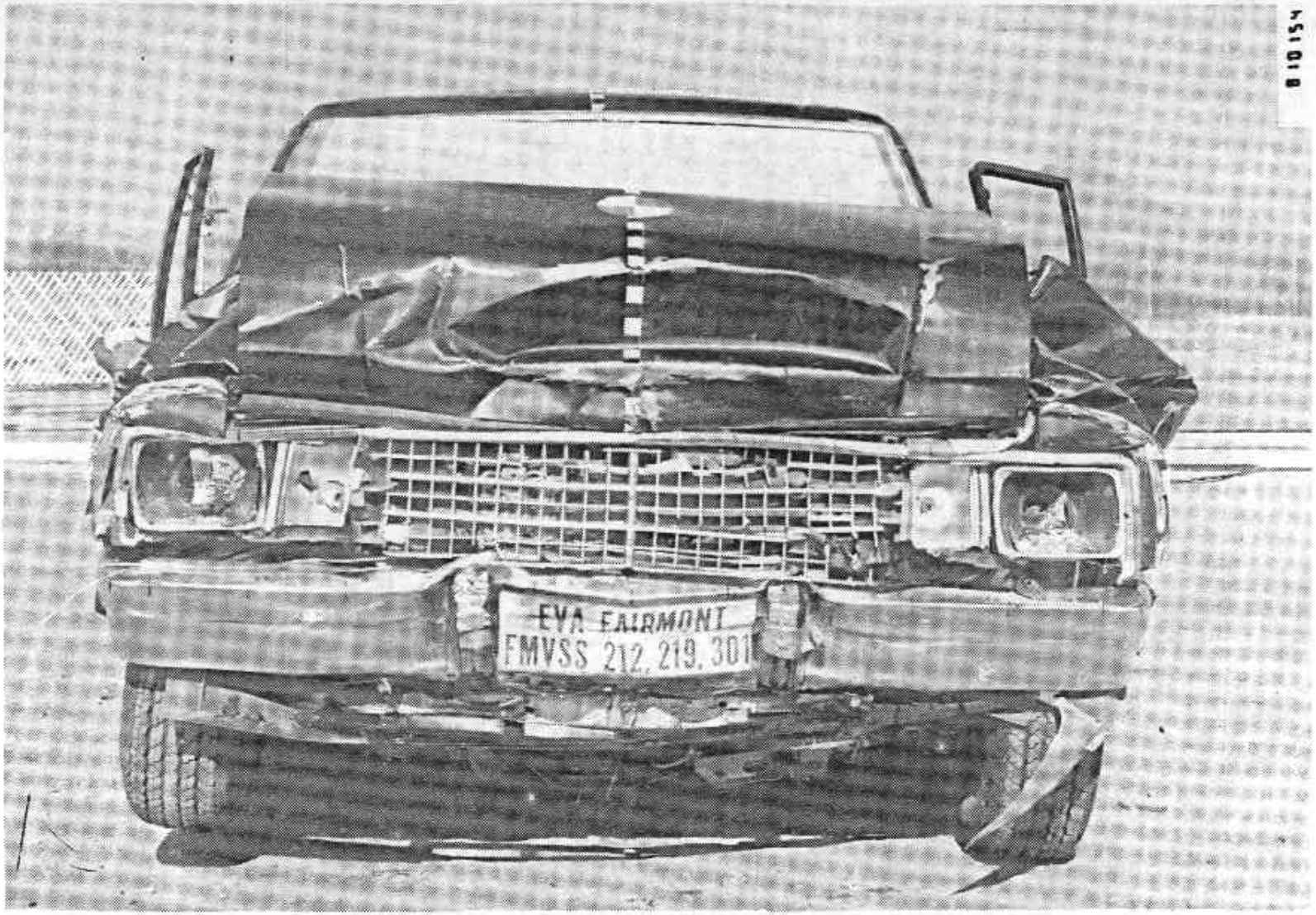


FIGURE 4-2. POST-TEST FRONT VIEW - 1980 EVA FAIRMONT.

FIGURE 4-3. PRE-TEST SIDE VIEW - 1980 EVA FAIRMONT.

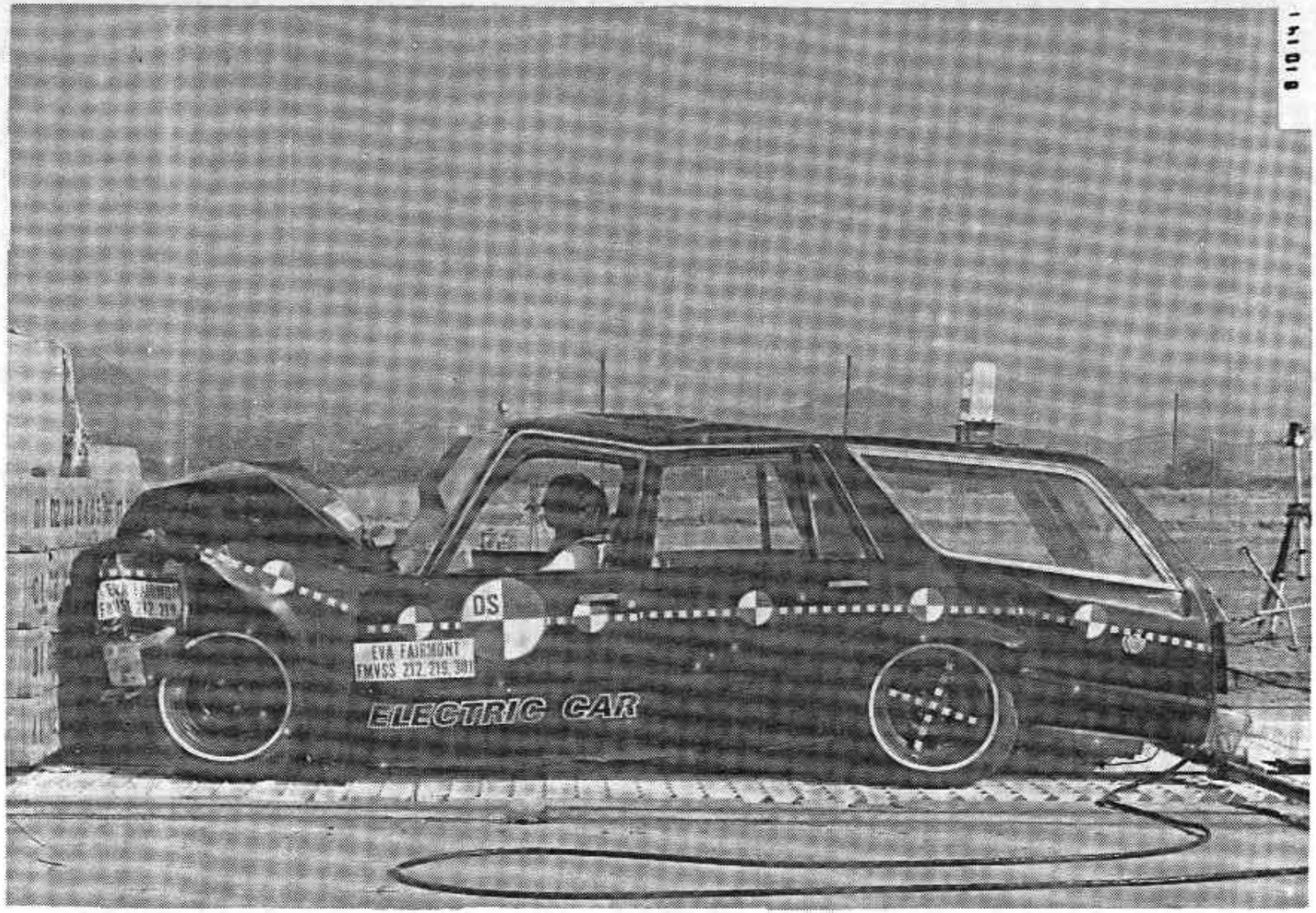


FIGURE 4-4. POST-TEST SIDE VIEW - 1980 EVA FAIRMONT.

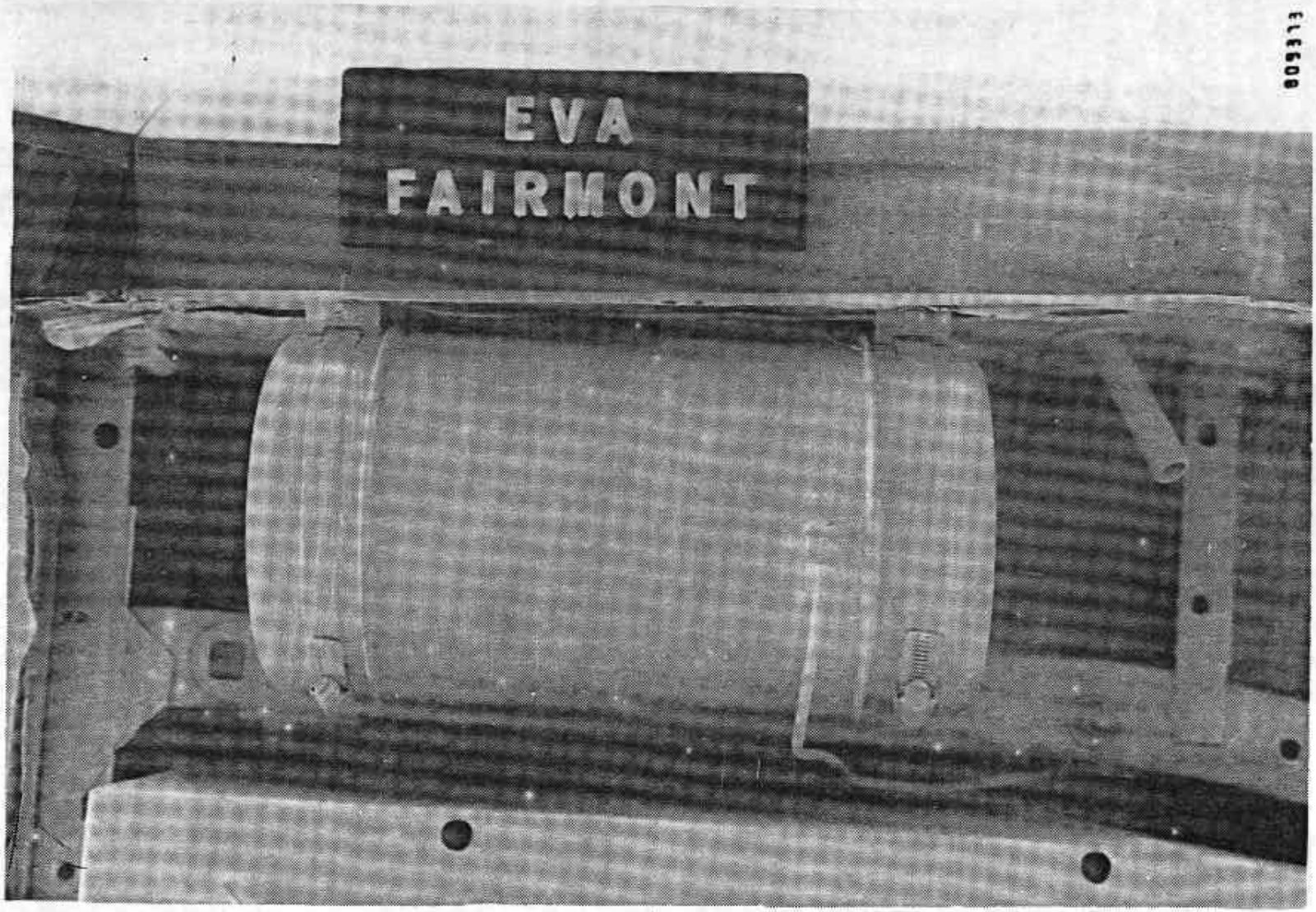


FIGURE 4-5. PRE-TEST FUEL TANK - 1980 EVA FAIRMONT.

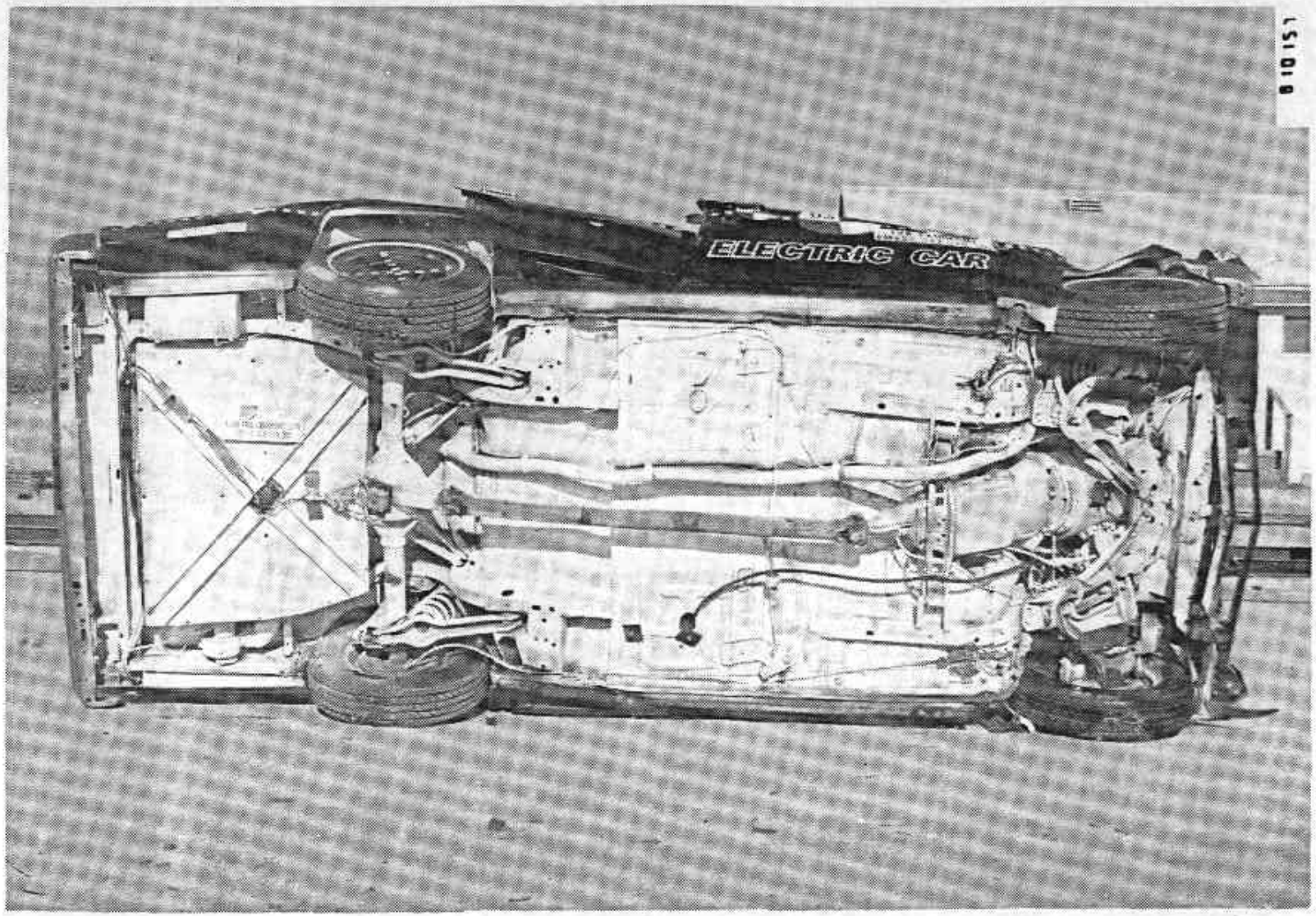


FIGURE 4-6. POST-TEST OVERALL UNDERSIDE VIEW SHOWING FUEL TANK - 1980 EVA FAIRMONT.

FIGURE 4-7. POST-TEST REAR BATTERY COMPARTMENT - 1980 EVA FAIRMONT.

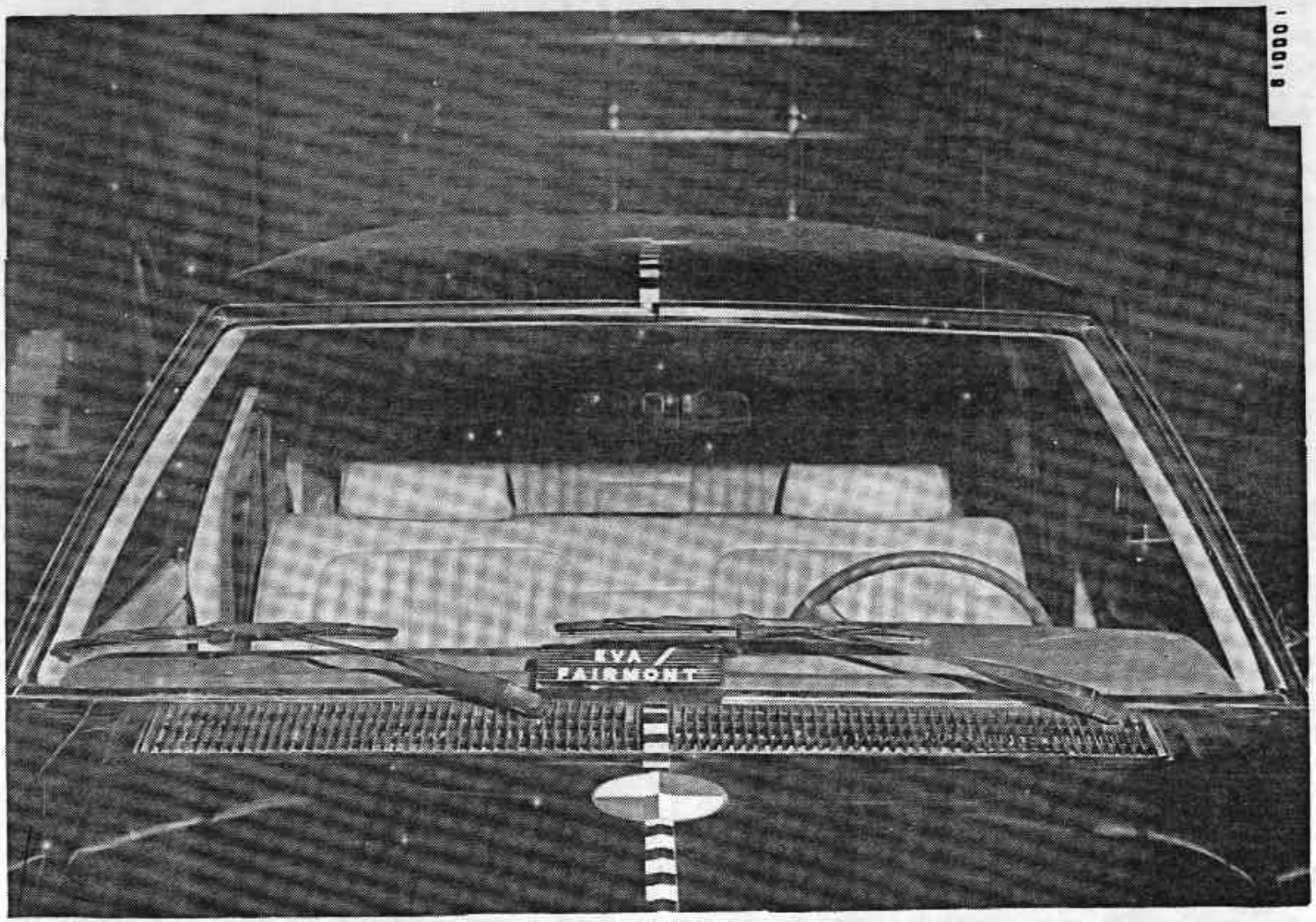


FIGURE 4-8. PRE-TEST WINDSHIELD - 1980 EVA FAIRMONT.

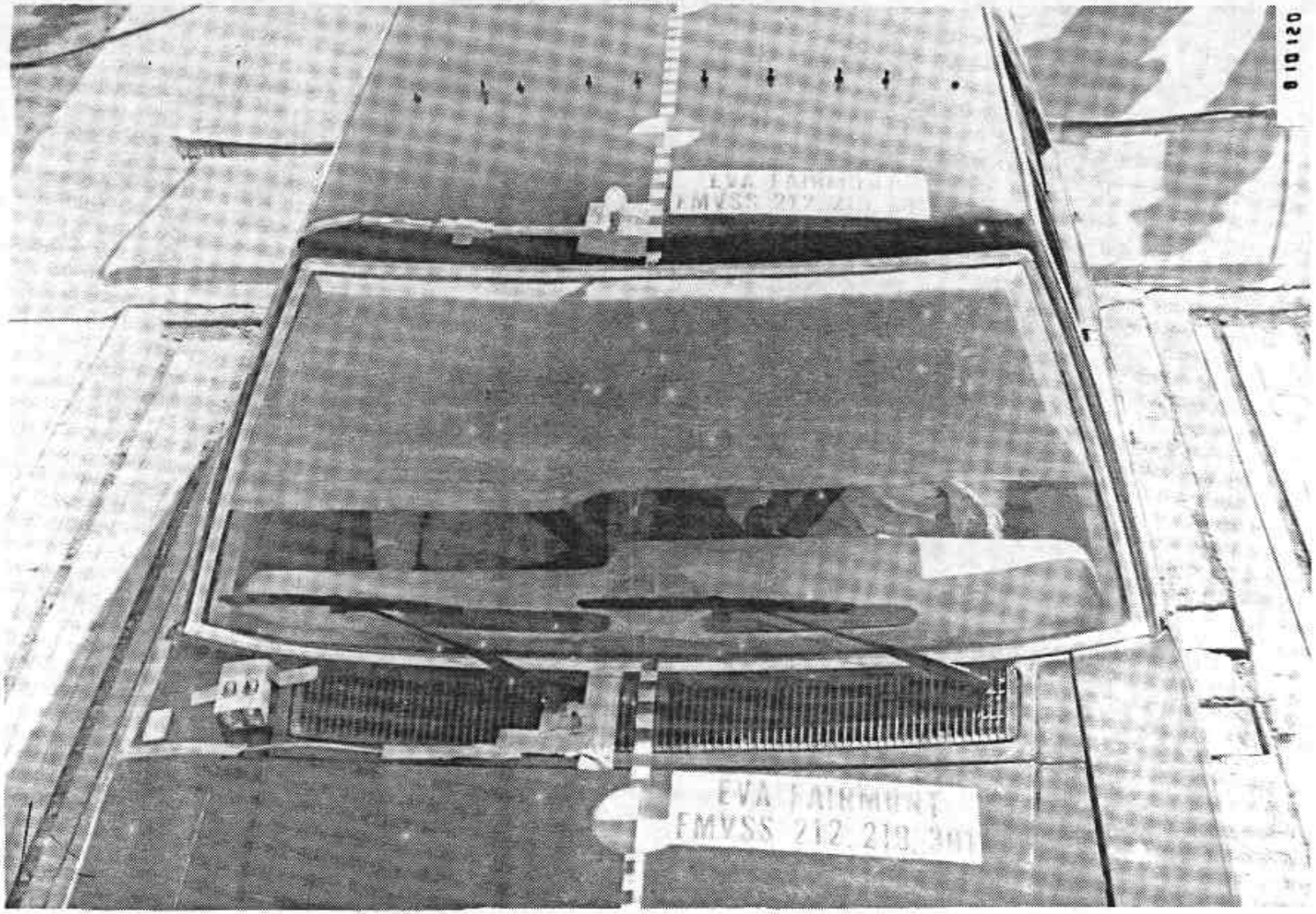


FIGURE 4-9. PRE-TEST WINDSHIELD WITH STYROFOAM TEMPLATE IN PLACE - 1980 EVA FAIRMONT.

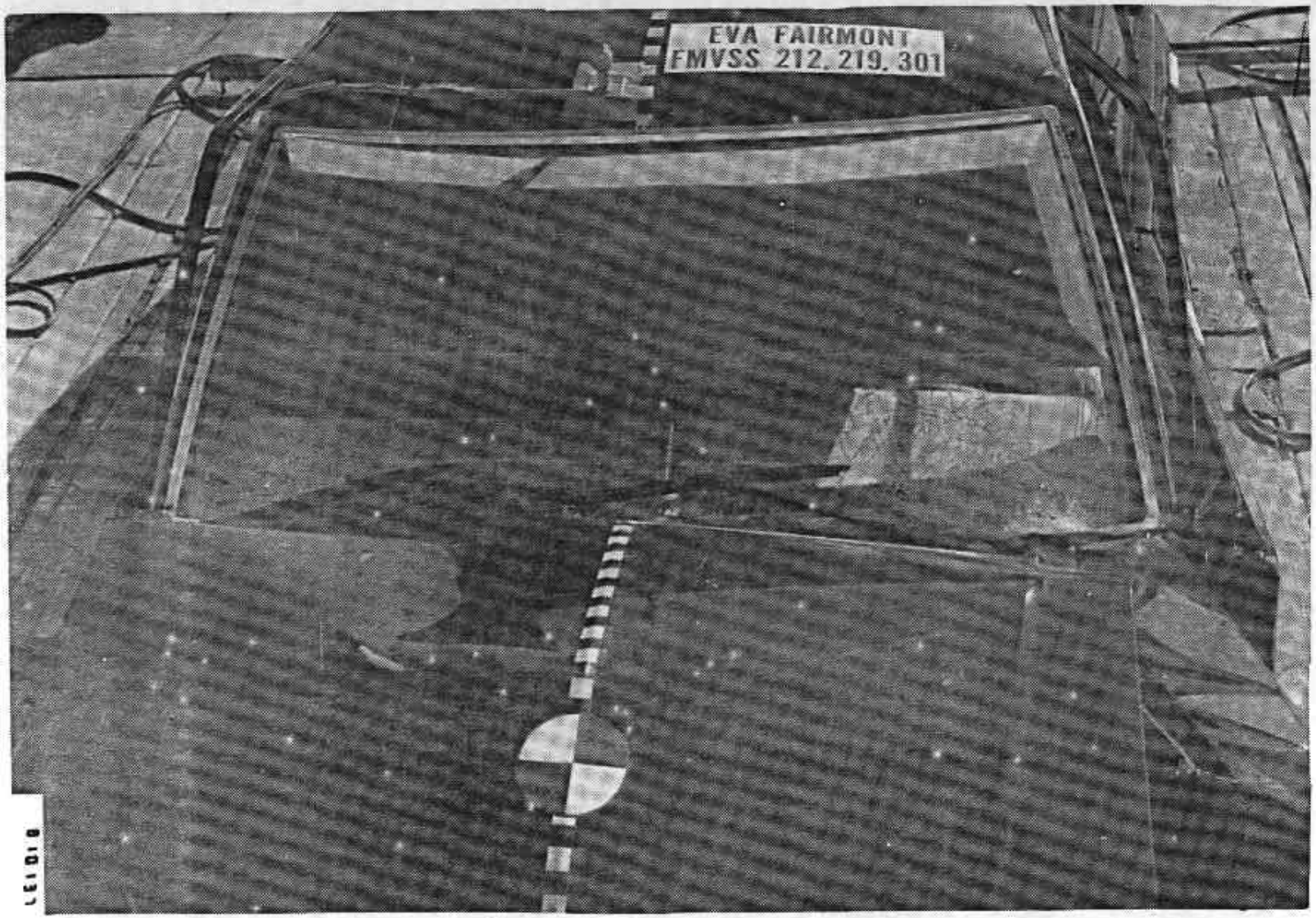


FIGURE 4-10. POST-TEST WINDSHIELD - 1980 EVA FAIRMONT.

FIGURE 4-11. PRE-TEST DRIVER DUMMY POSITION - 1980 EVA FAIRMONT.

FIGURE 4-12. POST-TEST DRIVER DUMMY POSITION - 1980 EVA FAIRMONT.

FIGURE 4-13. PRE-TEST PASSENGER DUMMY POSITION - 1980 EVA FAIRMONT.

FIGURE 4-14. POST-TEST PASSENGER DUMMY POSITION - 1980 EVA FAIRMONT.

5.0 CALCOMP PLOT PRESENTATION

Calcomp plots generated from the crash test data are presented on the following pages. All data will be recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data was filtered according to SAE J211. Plot legends and test anamolies are listed below:

PLOT LEGEND

Dummy Data*

Driver	RF Outboard Passenger	Data Description
LF Head	RF Head	Head Acceleration (G)
LF Chest	RF Chest	Chest Acceleration (G)
LF Femurs	RF Femurs	Femur Loads (lb)
LF Belt Load	RF Belt Load	Torso Belt Loads (lb)

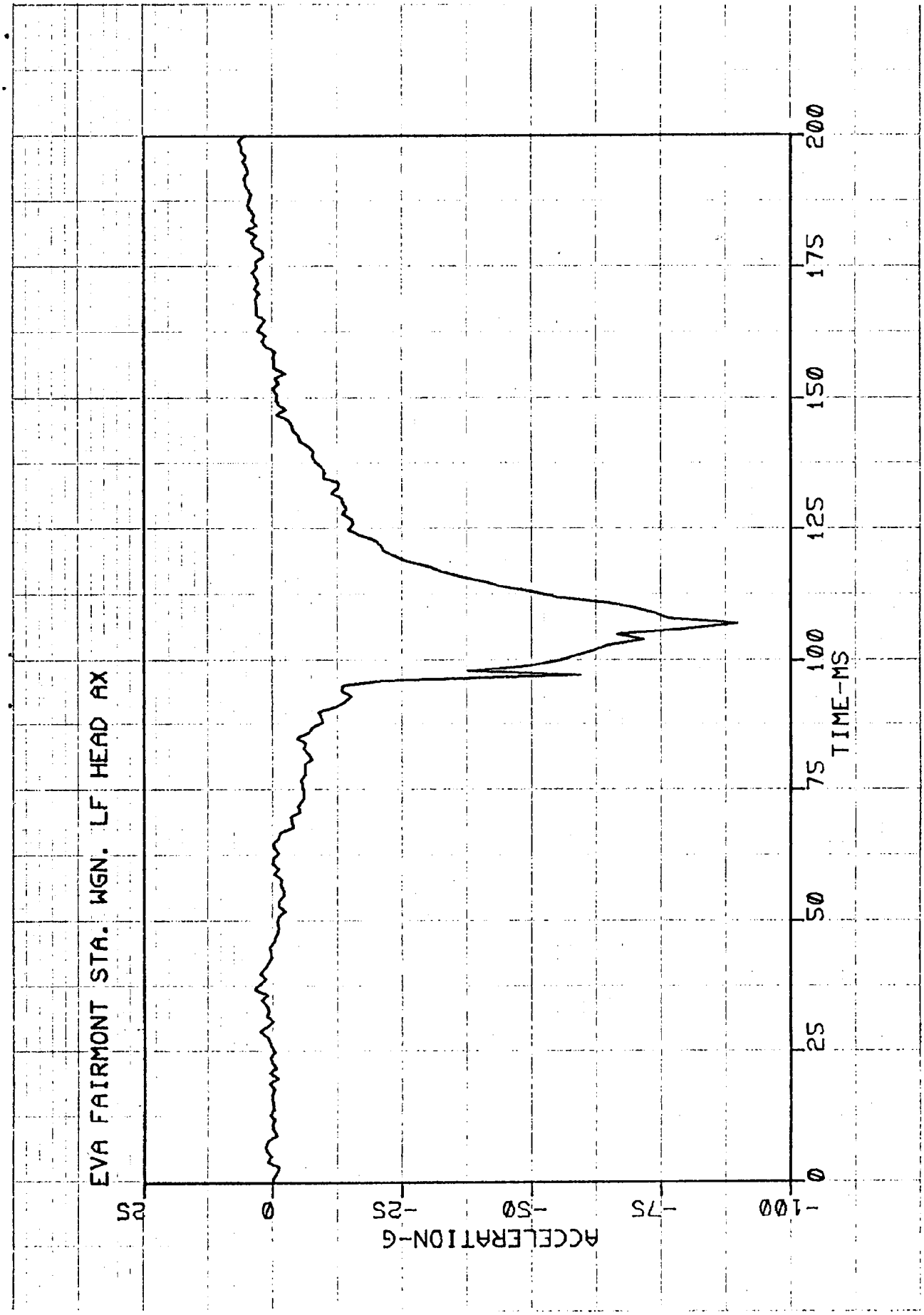
Vehicle Data**

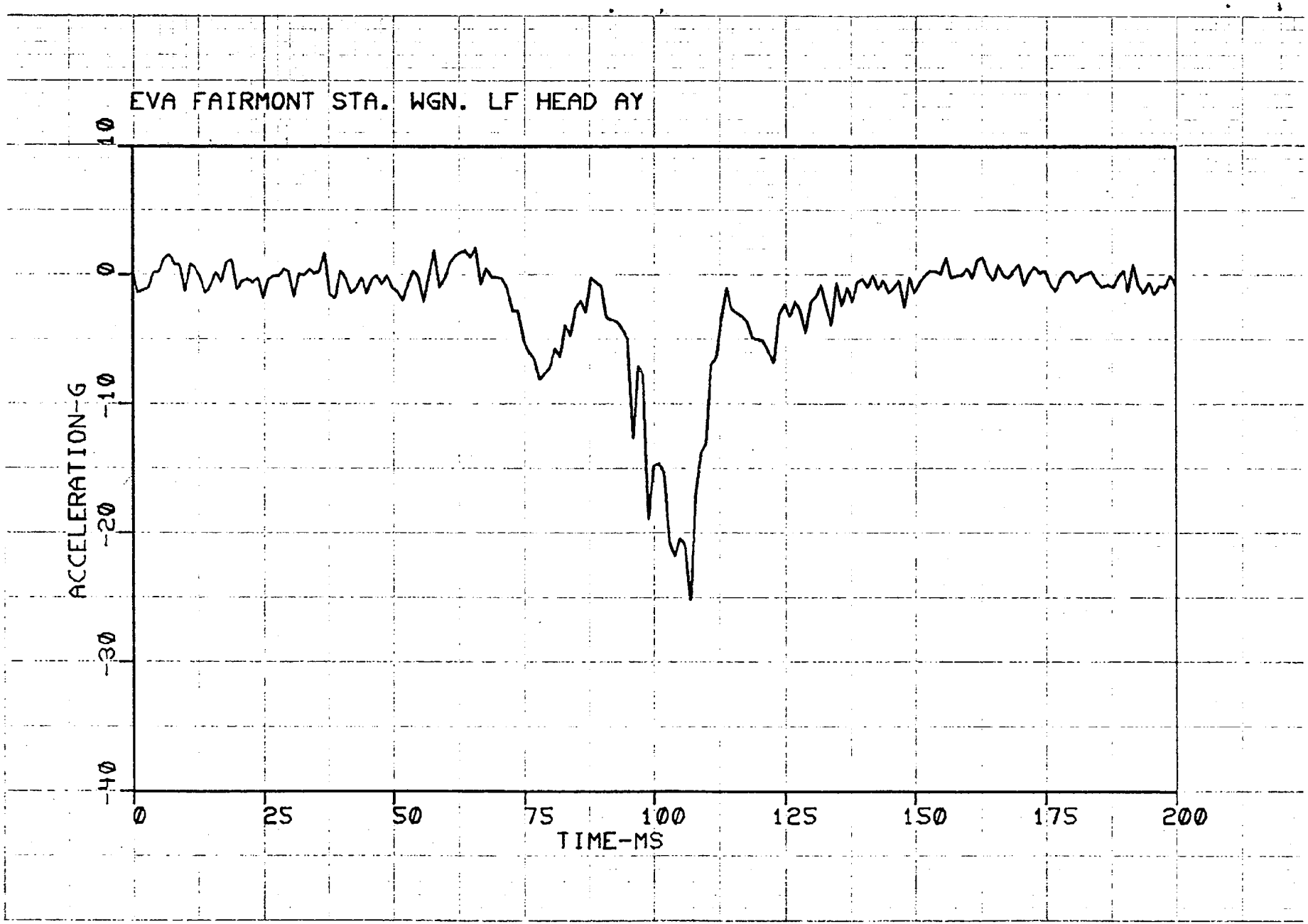
	Location
Loc 1	Rocker panel aft of B-pillar (right side) acceleration
Loc 2	Rocker panel aft of B-pillar (left side) acceleration
Loc 3	Rear axle centerline acceleration
Loc 4	Rear battery compartment acceleration
Loc 5	Right front brake caliper acceleration
Loc 6	Left front brake caliper acceleration
Loc 7	Underside of propulsion motor acceleration
Loc 8	Front battery compartment acceleration

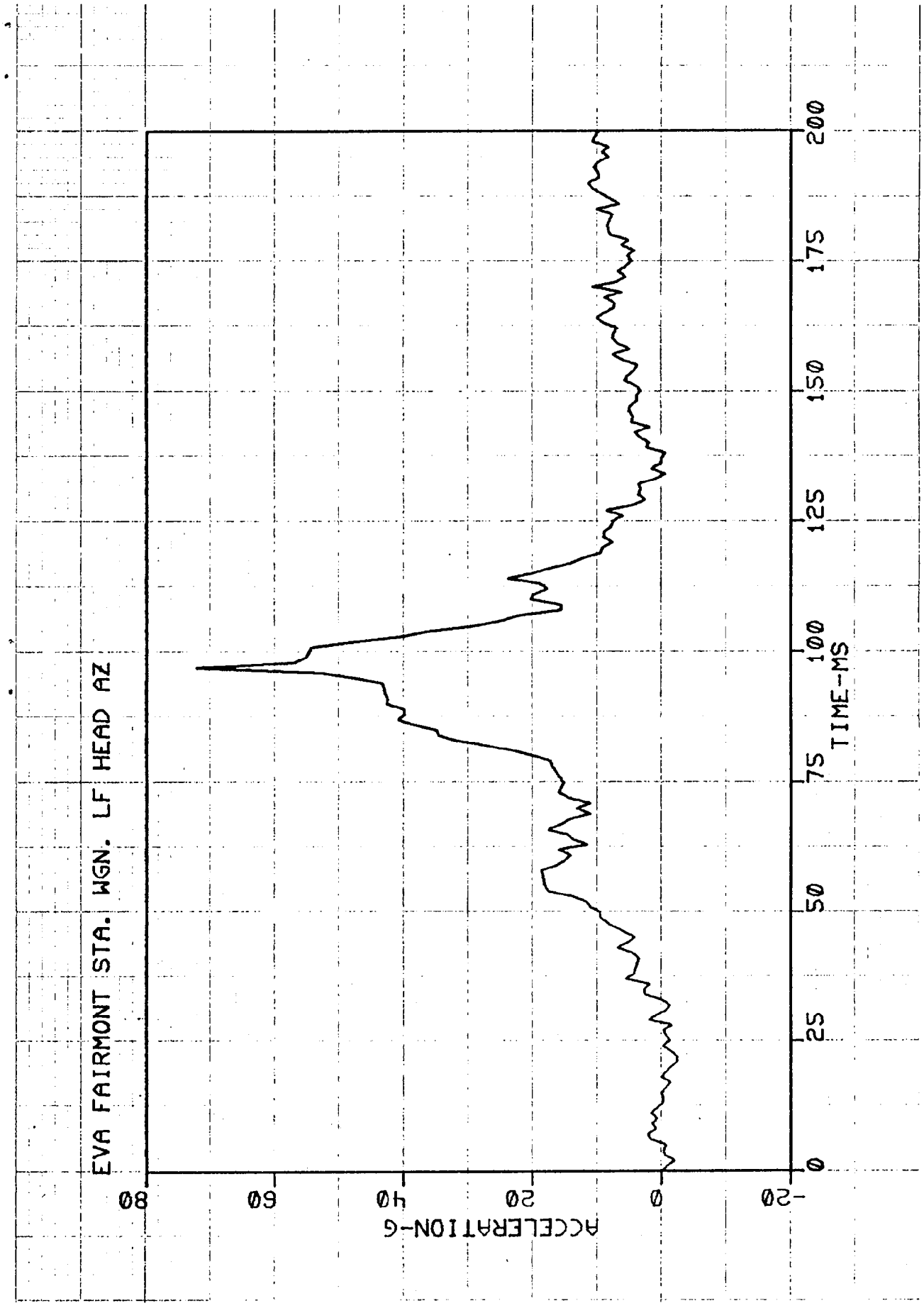
Barrier Data

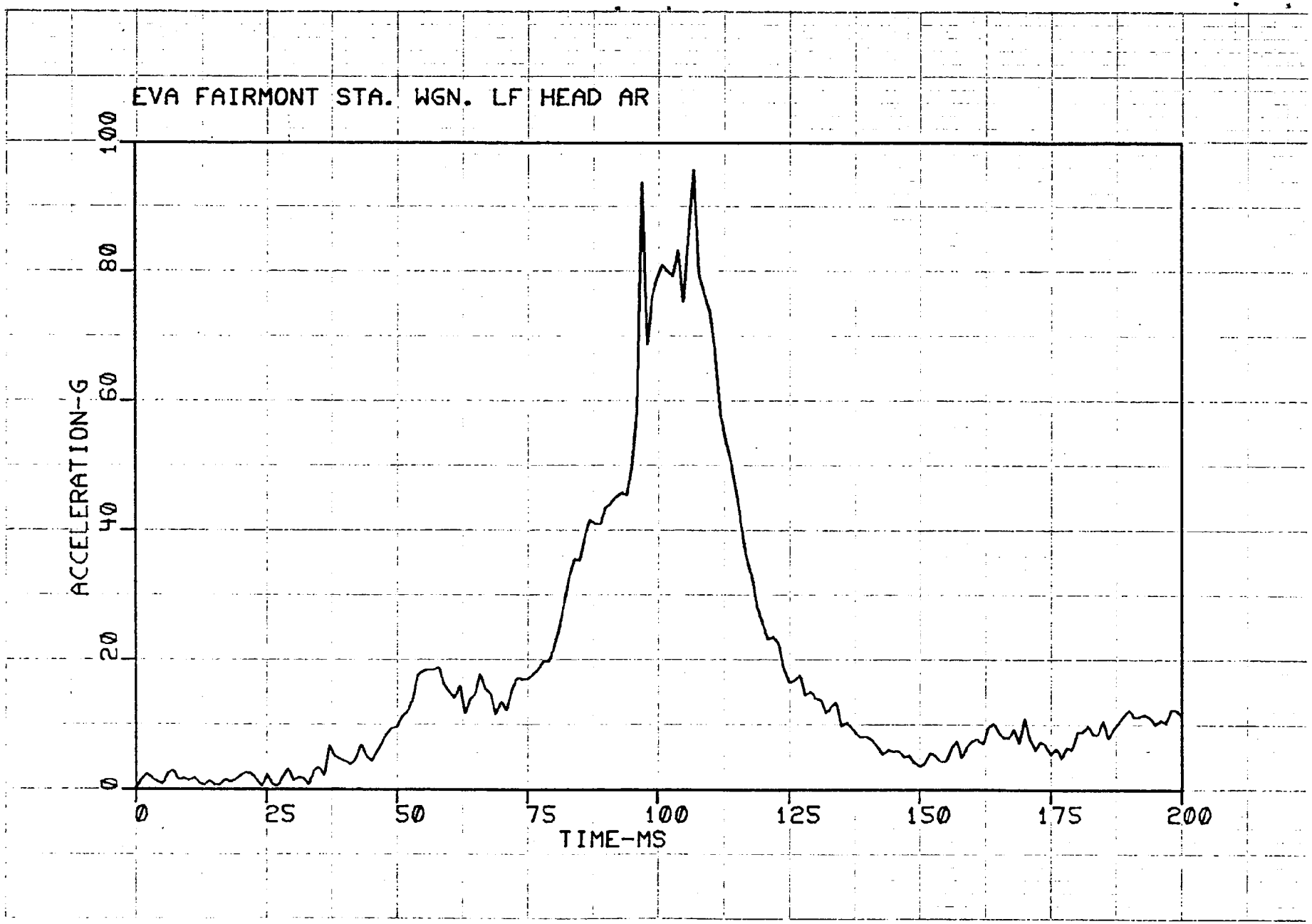
Columns 1-9	Force (lb)
Sum A&B	Force (lb)
Sum C&D	Force (lb)
Total Load	Force (lb)
Location 2	Force (lb)

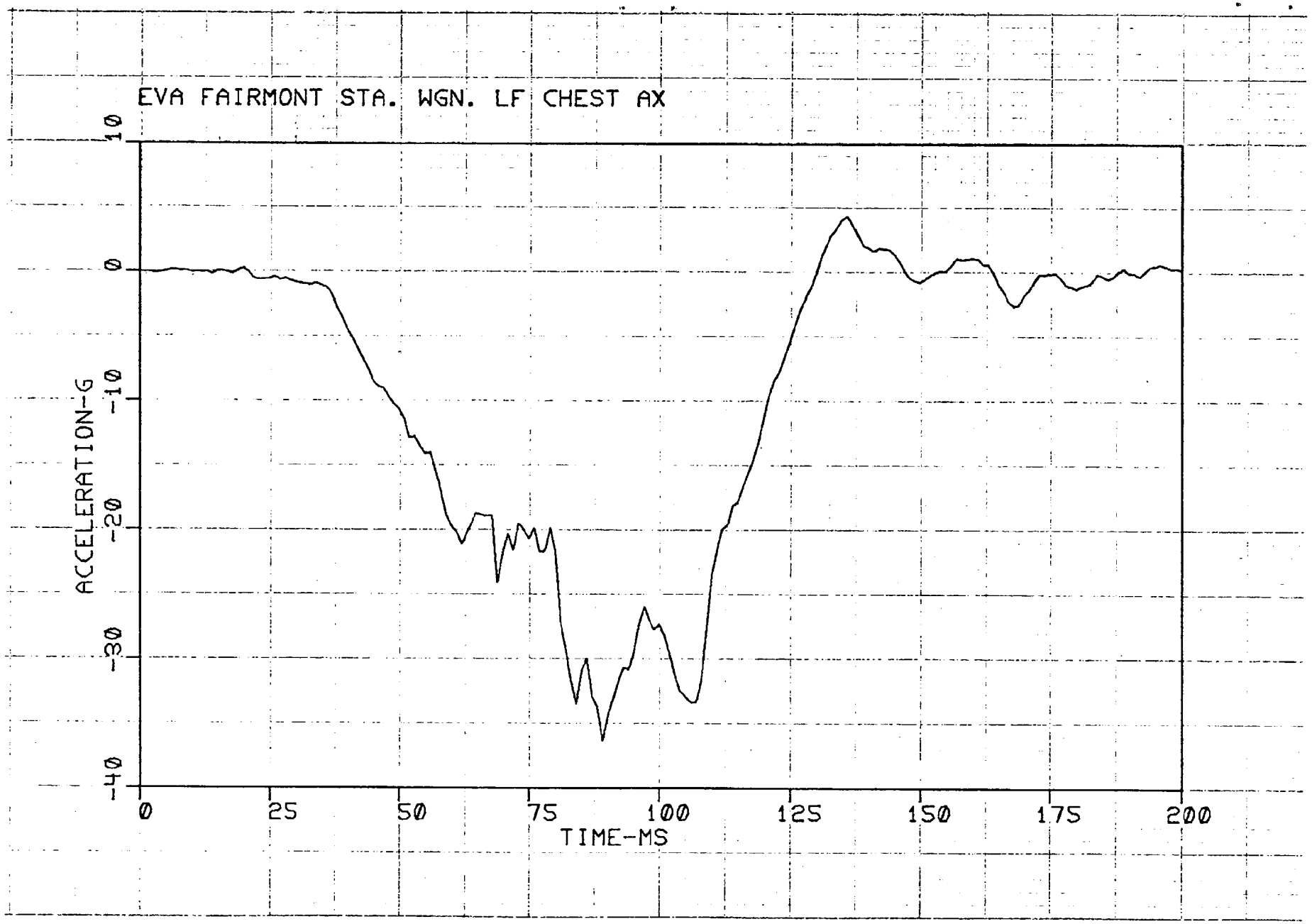
*Dummy Injury Summary presented on pages 3-14 and 3-15.
**Vehicle accelerometer location and data summarized on page 3-18.

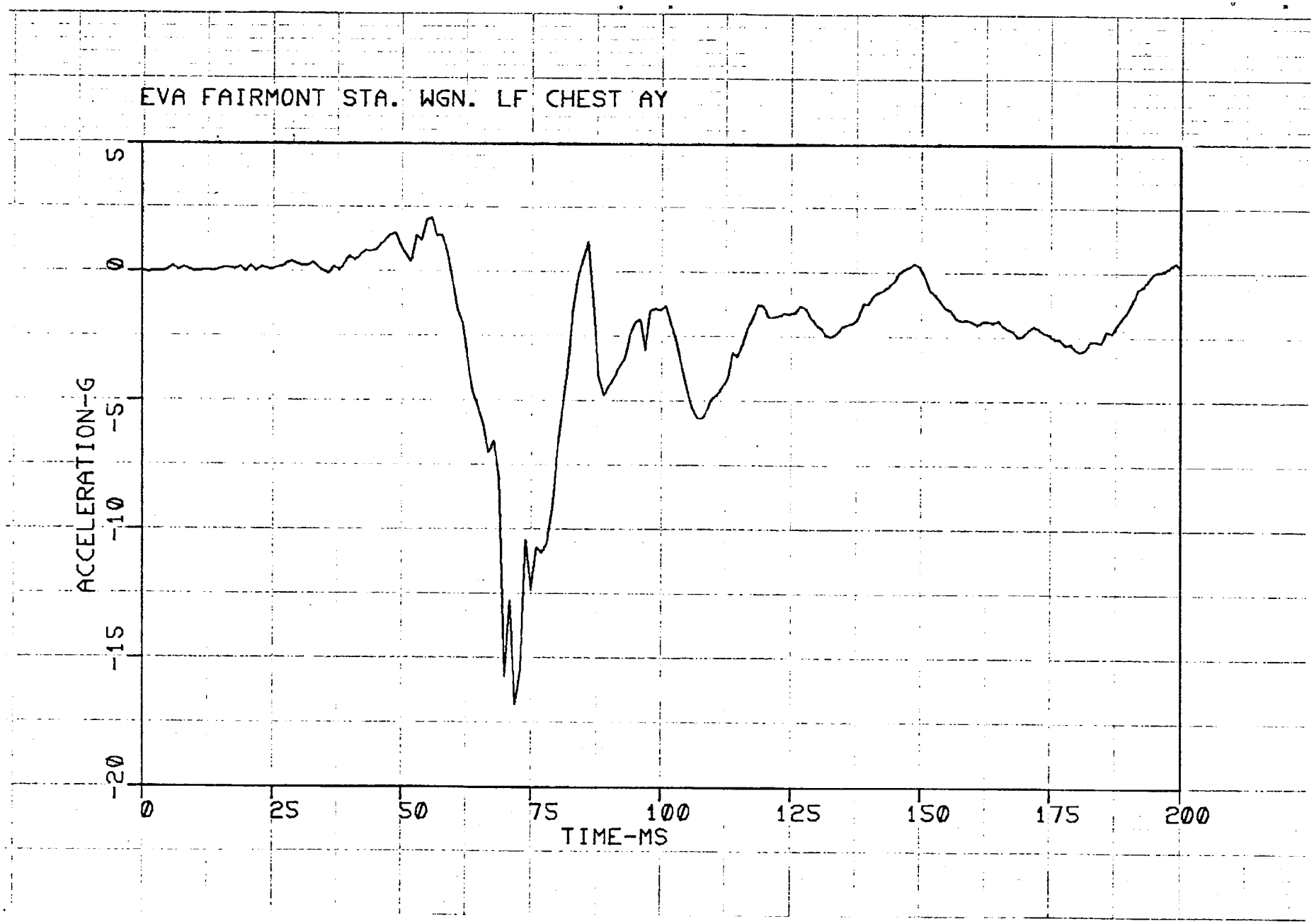

EVA FAIRMONT STA. WGN. LF HEAD AX
ACCELERATION-G
25
0
-25
-50
-75
-100
0
25
50
75
100
125
150
175
200
TIME-MS

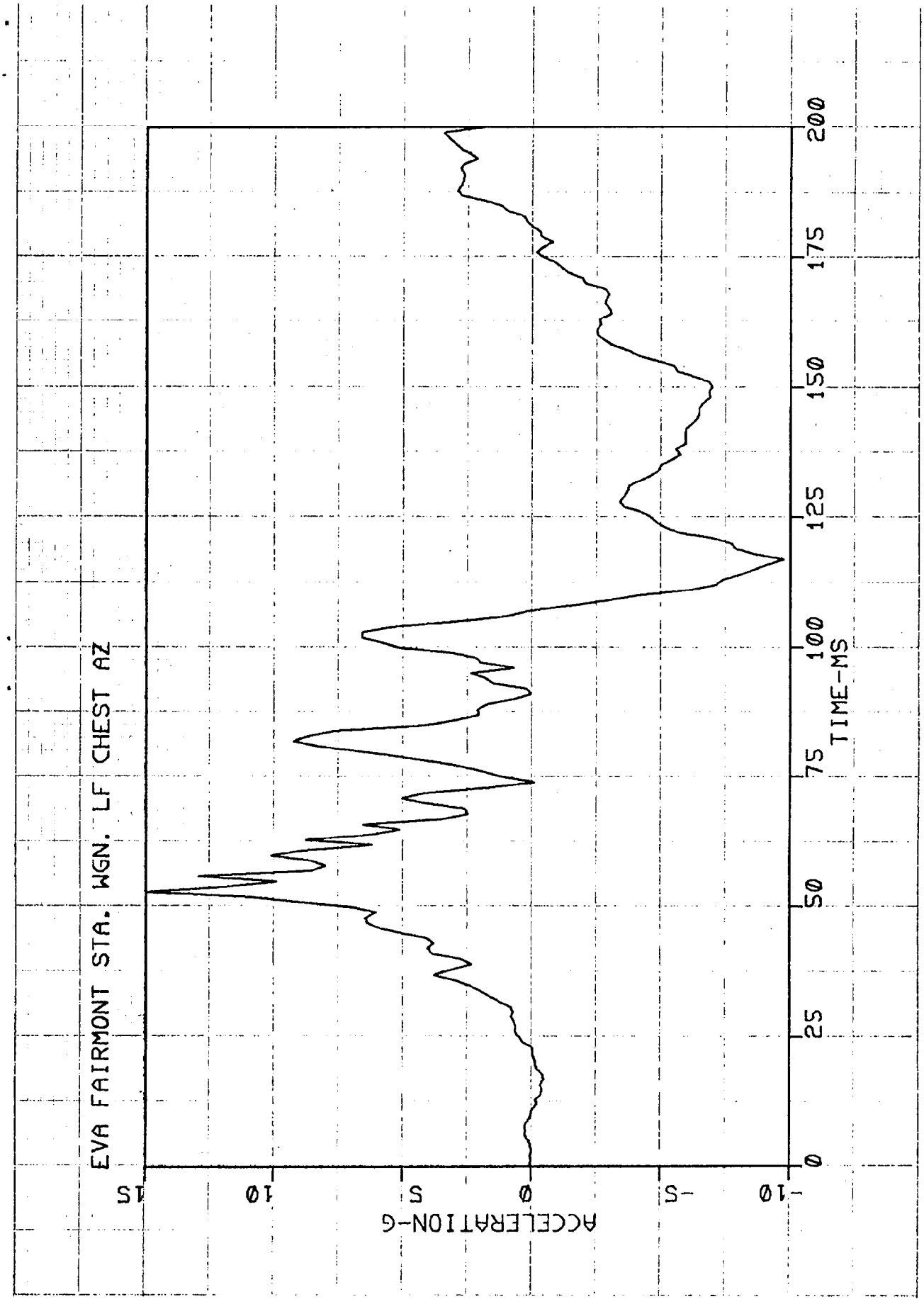

EVA FAIRMONT STA. WGN. LF HEAD AY
10
0
-10
-20
-30
-40
ACCELERATION-G
0
25
50
75
100
125
150
175
200
TIME-MS

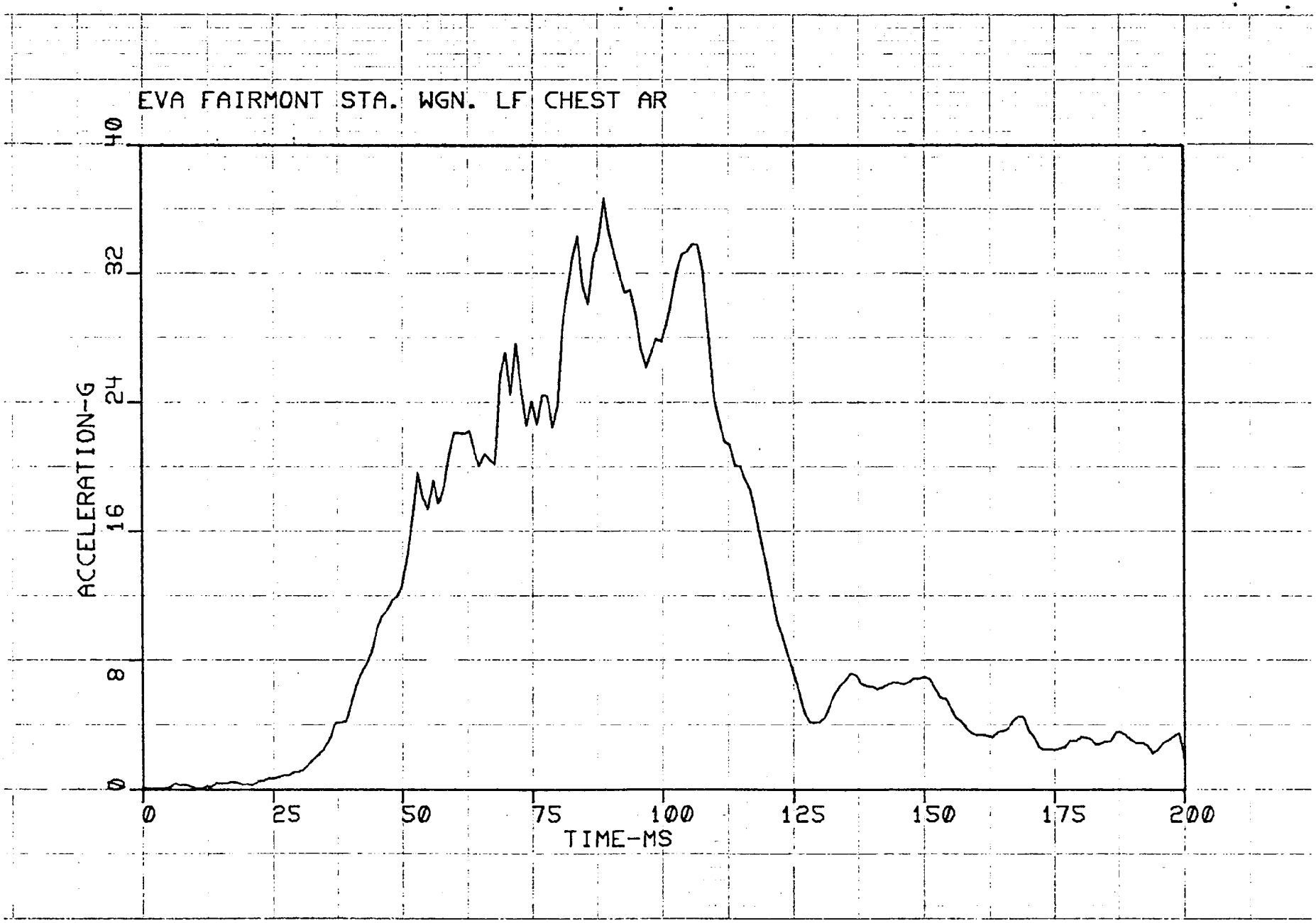

EVA FAIRMONT STA. WGN. LF HEAD AZ
ACCELERATION-G
80
60
40
20
0
-20
0
25
50
75
100
125
150
175
200
TIME-MS

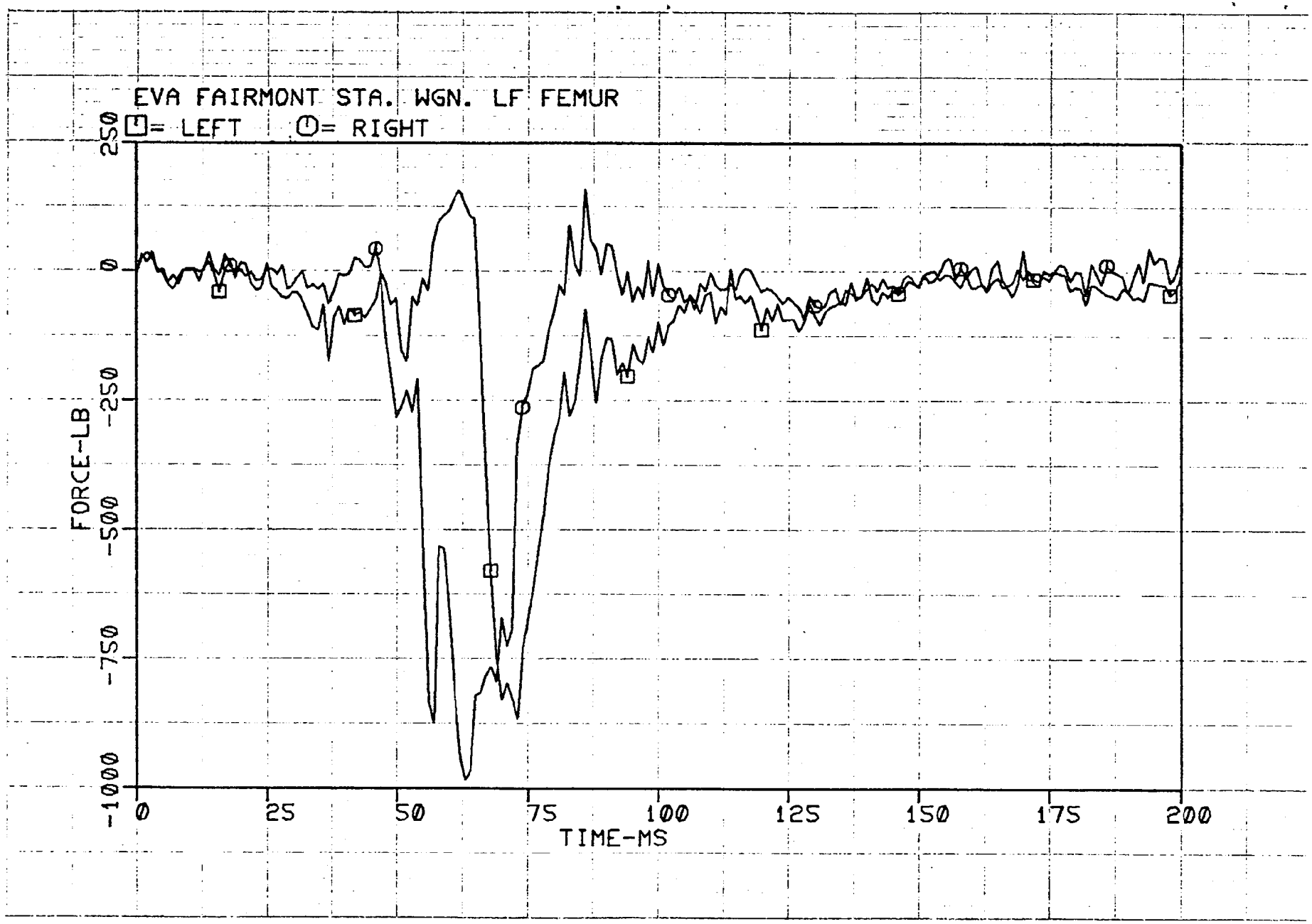

EVA FAIRMONT STA. WGN. LF HEAD AR
ACCELERATION-G
0
20
40
60
80
100
0
25
50
75
100
125
150
175
200
TIME-MS

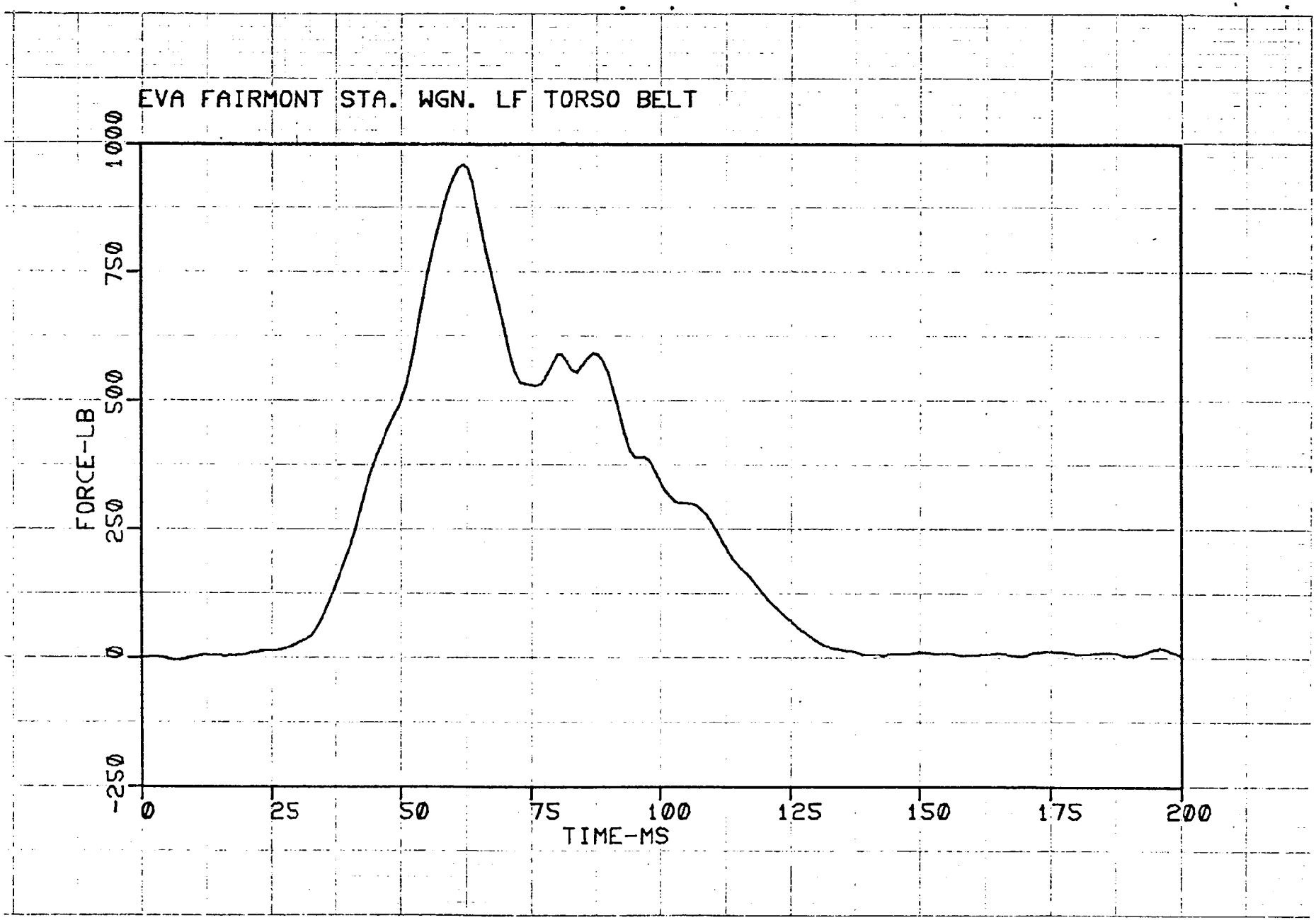

EVA FAIRMONT STA. WGN. LF CHEST AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
25
50
75
100
125
150
175
200
TIME-MS

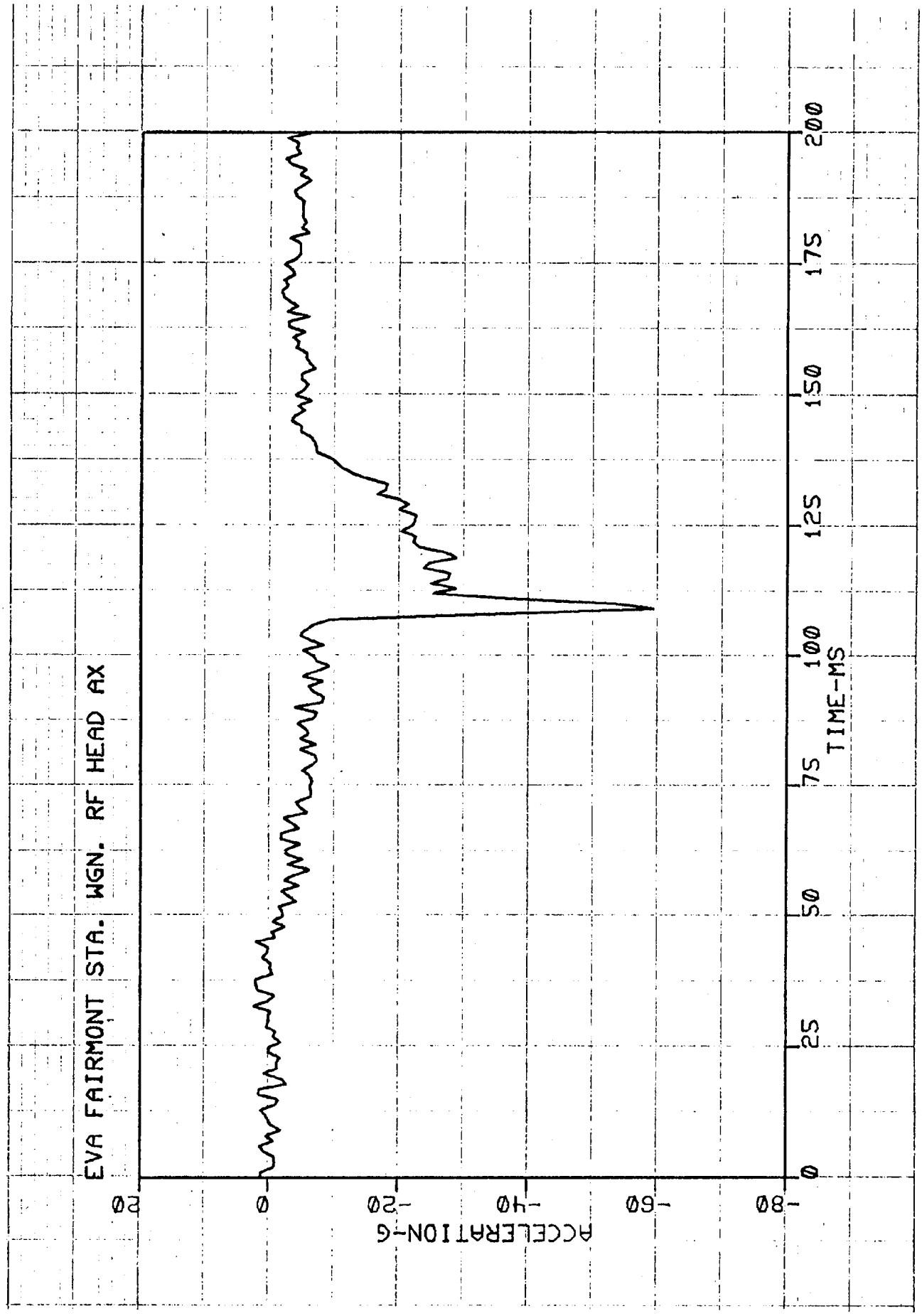

EVA FAIRMONT STA. WGN. LF CHEST AY
ACCELERATION-G
5
0
-5
-10
-15
-20
0
25
50
75
100
125
150
175
200
TIME-MS

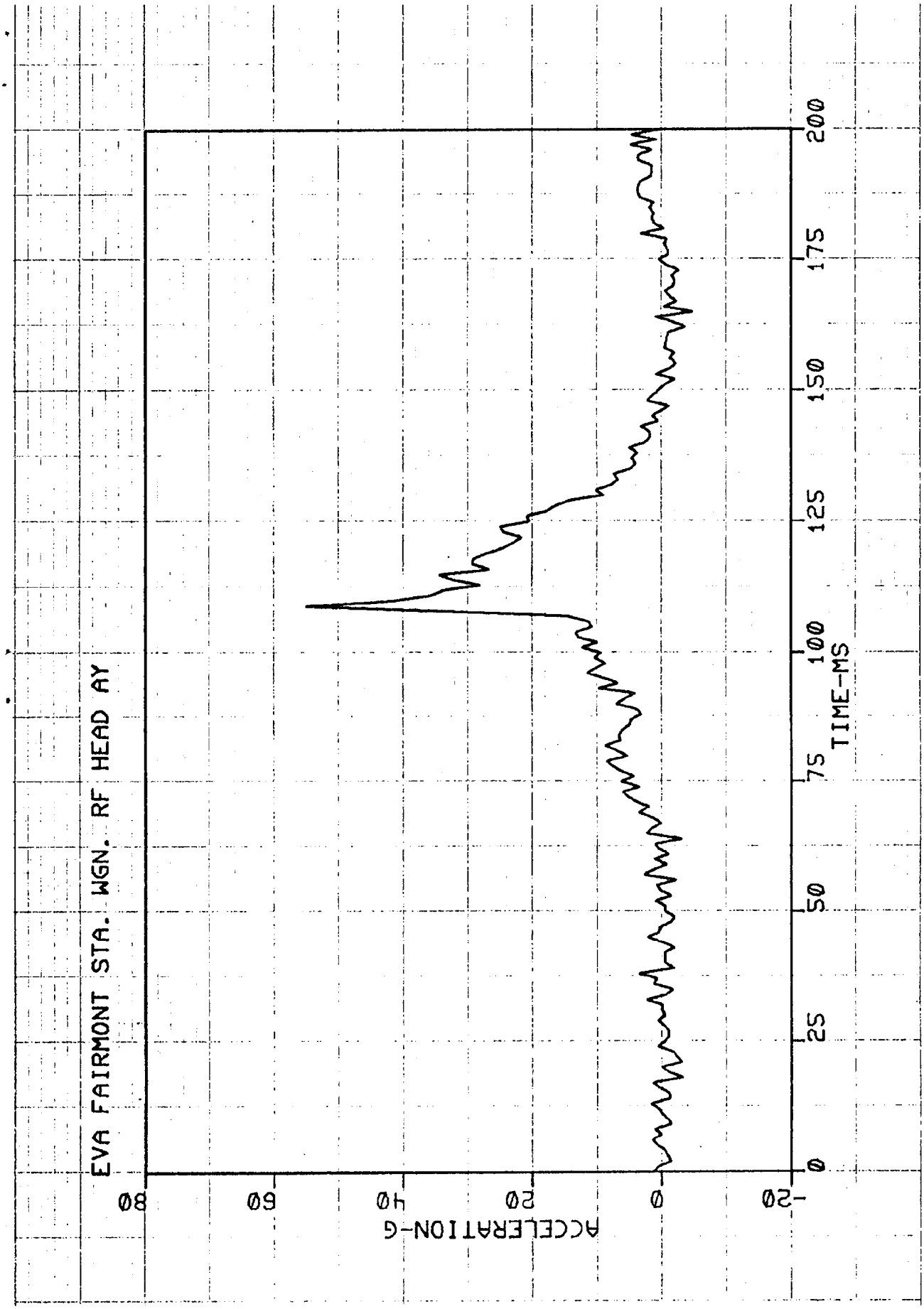

EVA FAIRMONT STA. WGN. LF CHEST AZ
ACCELERATION-G
15
10
5
0
-5
-10
0
25
50
75
100
125
150
175
200
TIME-MS

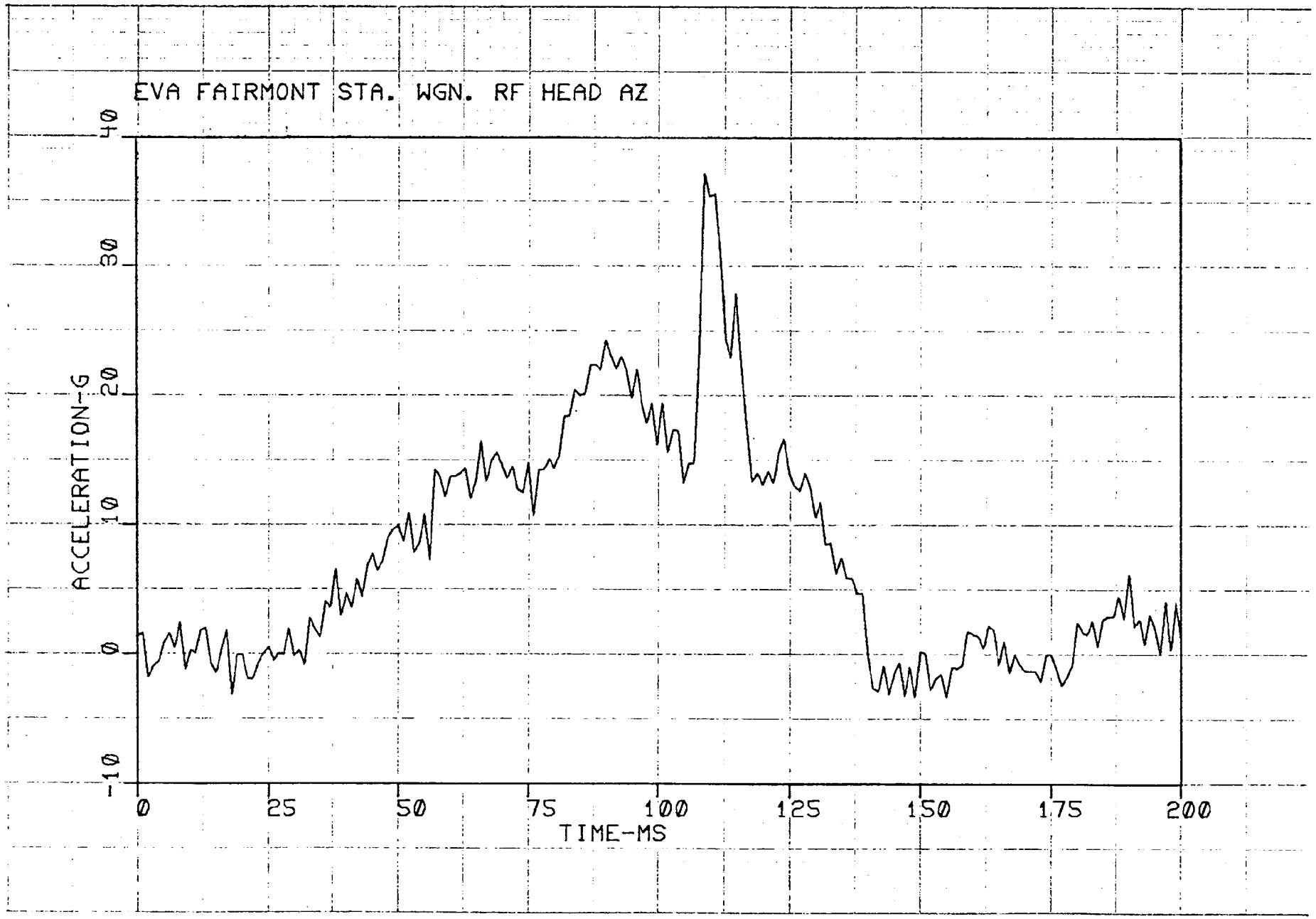

EVA FAIRMONT STA. WGN. LF CHEST AR
ACCELERATION-G
0
8
16
24
32
40
0
25
50
75
100
125
150
175
200
TIME-MS

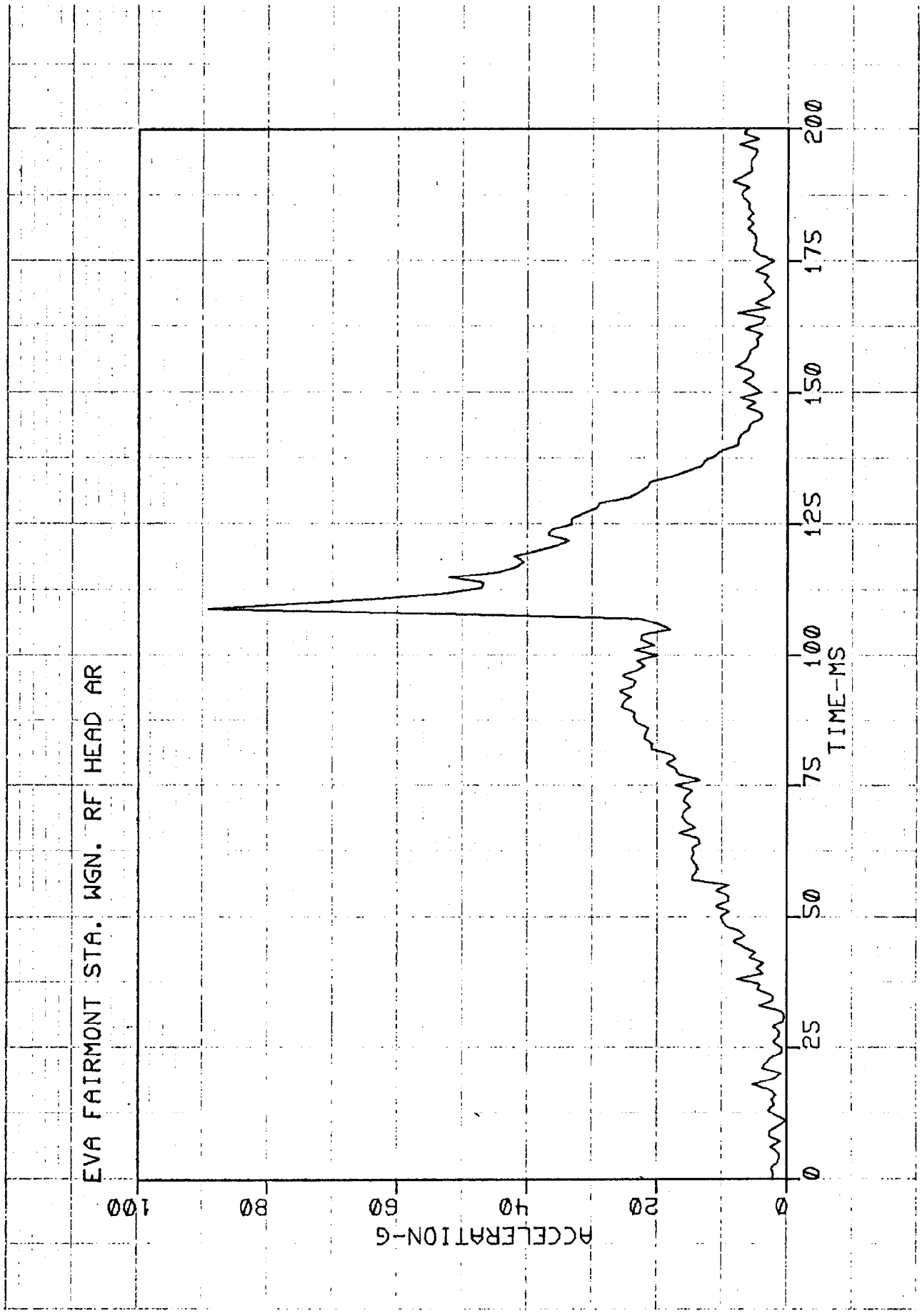

EVA FAIRMONT STA. WGN. LF FEMUR
□= LEFT
○= RIGHT
250
0
-250
-500
-750
-1000
FORCE-LB
0
25
50
75
100
125
150
175
200
TIME-MS

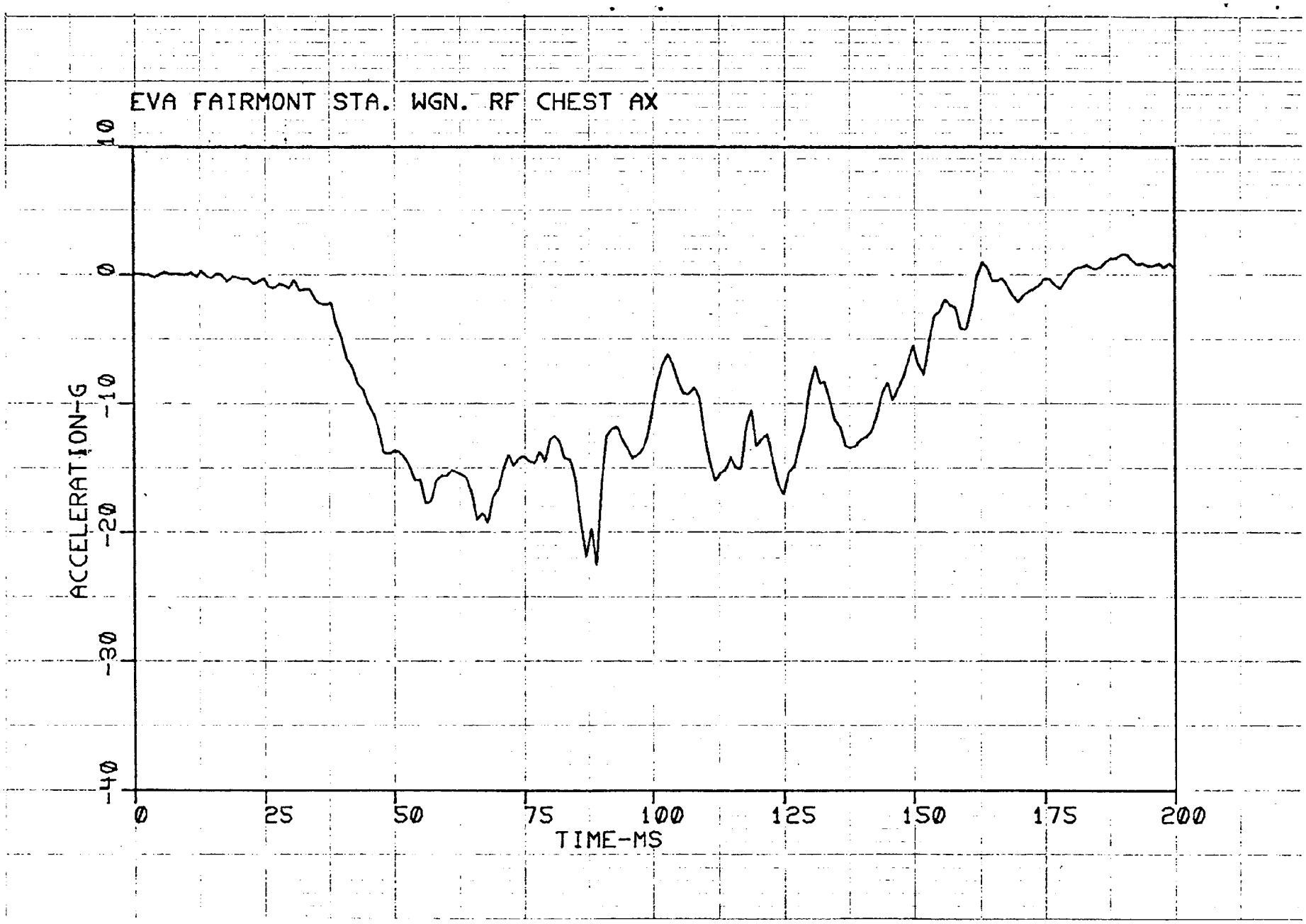

EVA FAIRMONT STA. WGN. LF TORSO BELT
FORCE-LB
1000
750
500
250
0
-250
0
25
50
75
100
125
150
175
200
TIME-MS

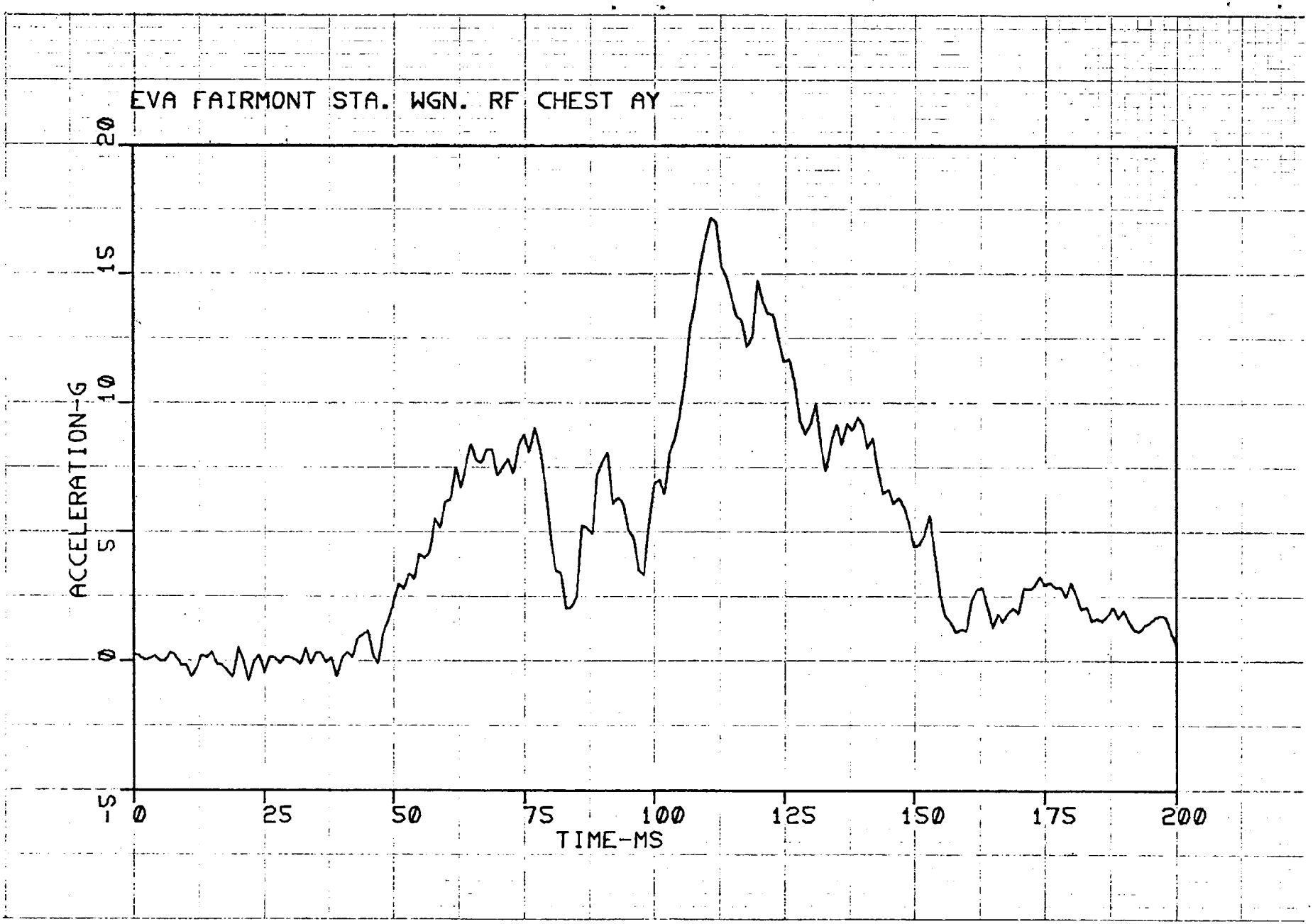

EVA FAIRMONT STA. WGN. RF HEAD AX
ACCELERATION-G
20
0
-20
-40
-60
-80
TIME-MS
0
25
50
75
100
125
150
175
200

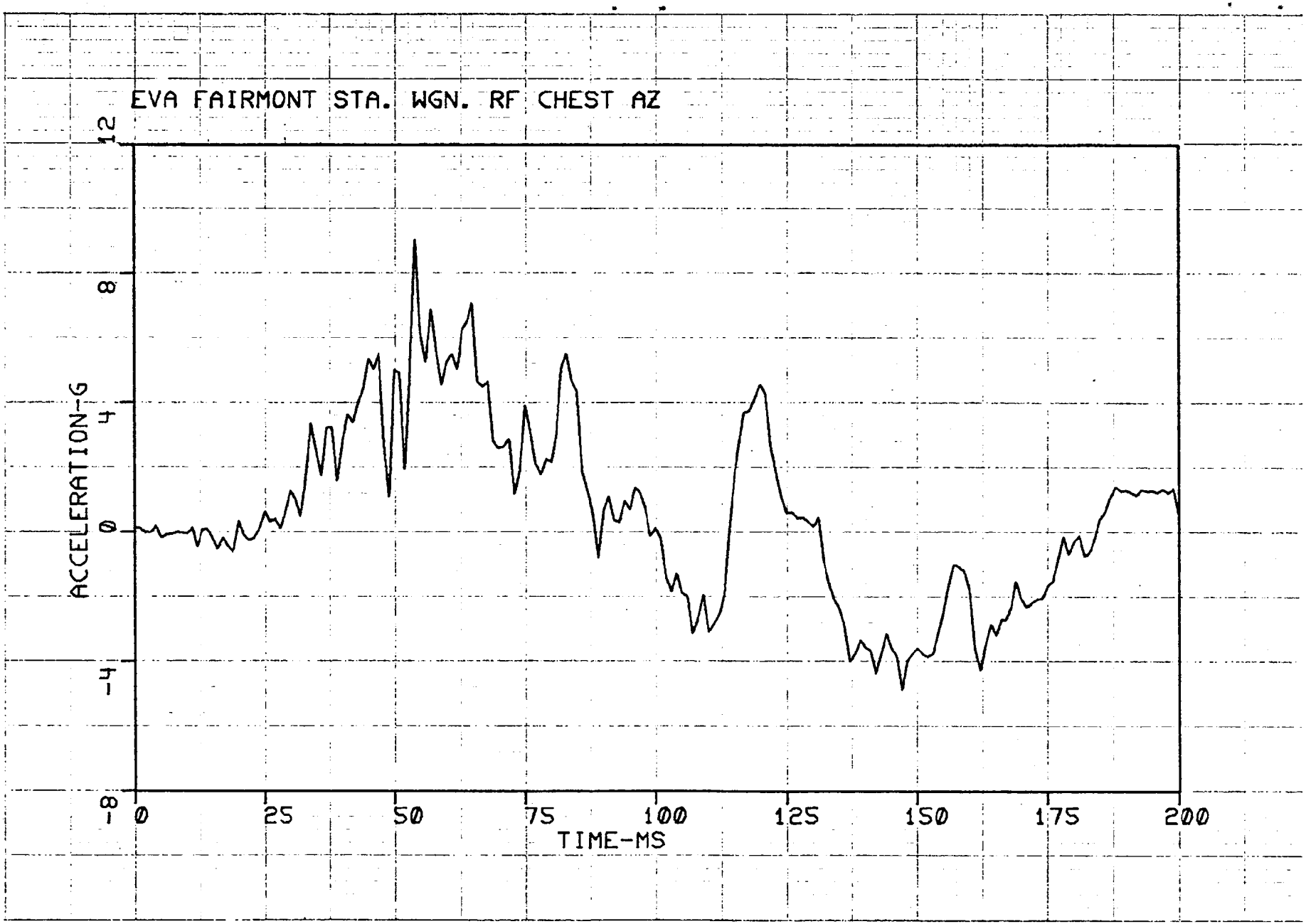

EVA FAIRMONT STA. WGN. RF HEAD AY
ACCELERATION-G
80
60
40
20
0
-20
TIME-MS
0
25
50
75
100
125
150
175
200

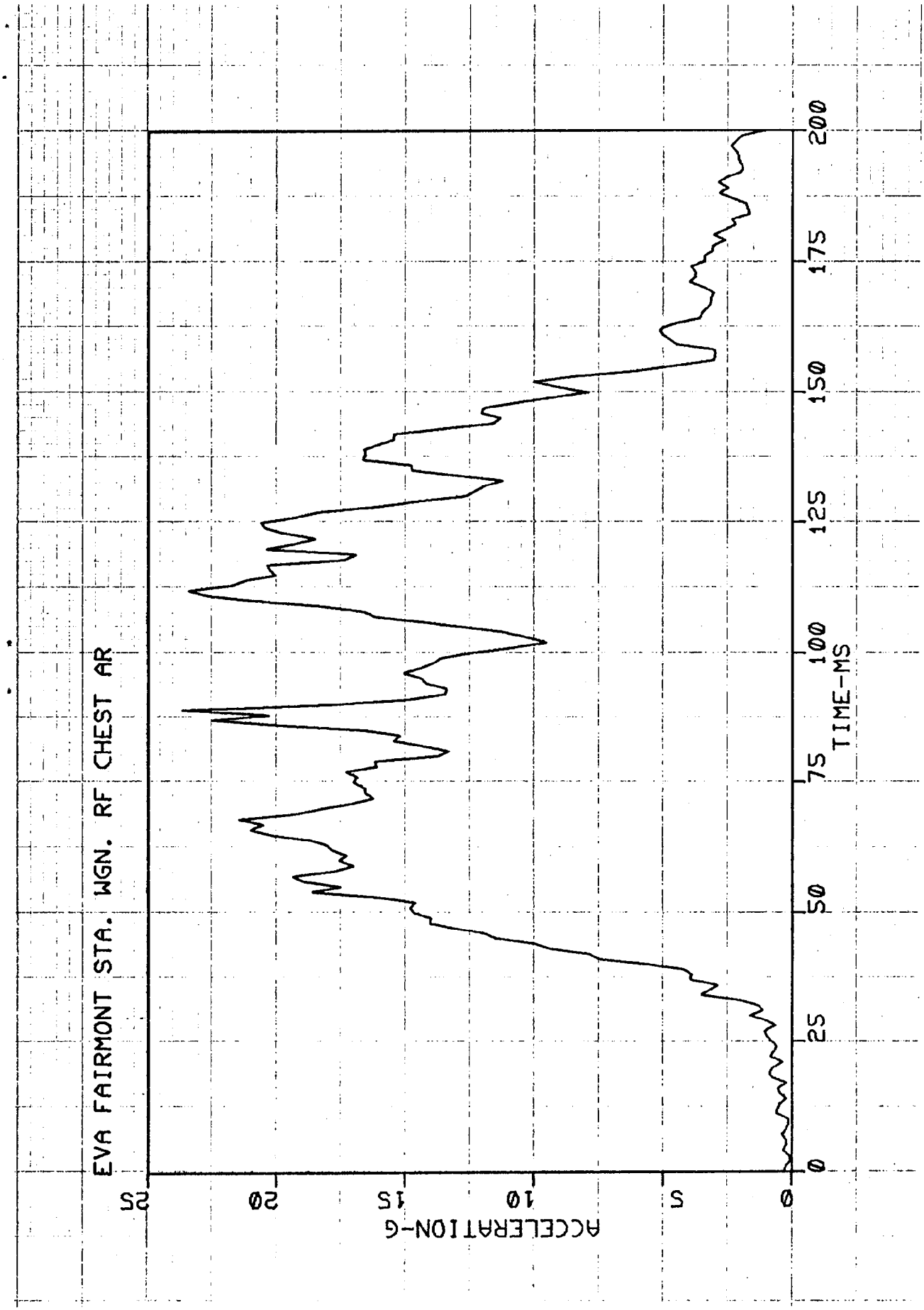

EVA FAIRMONT STA. WGN. RF HEAD AZ
ACCELERATION-G
40
30
20
10
0
-10
0
25
50
75
100
125
150
175
200
TIME-MS

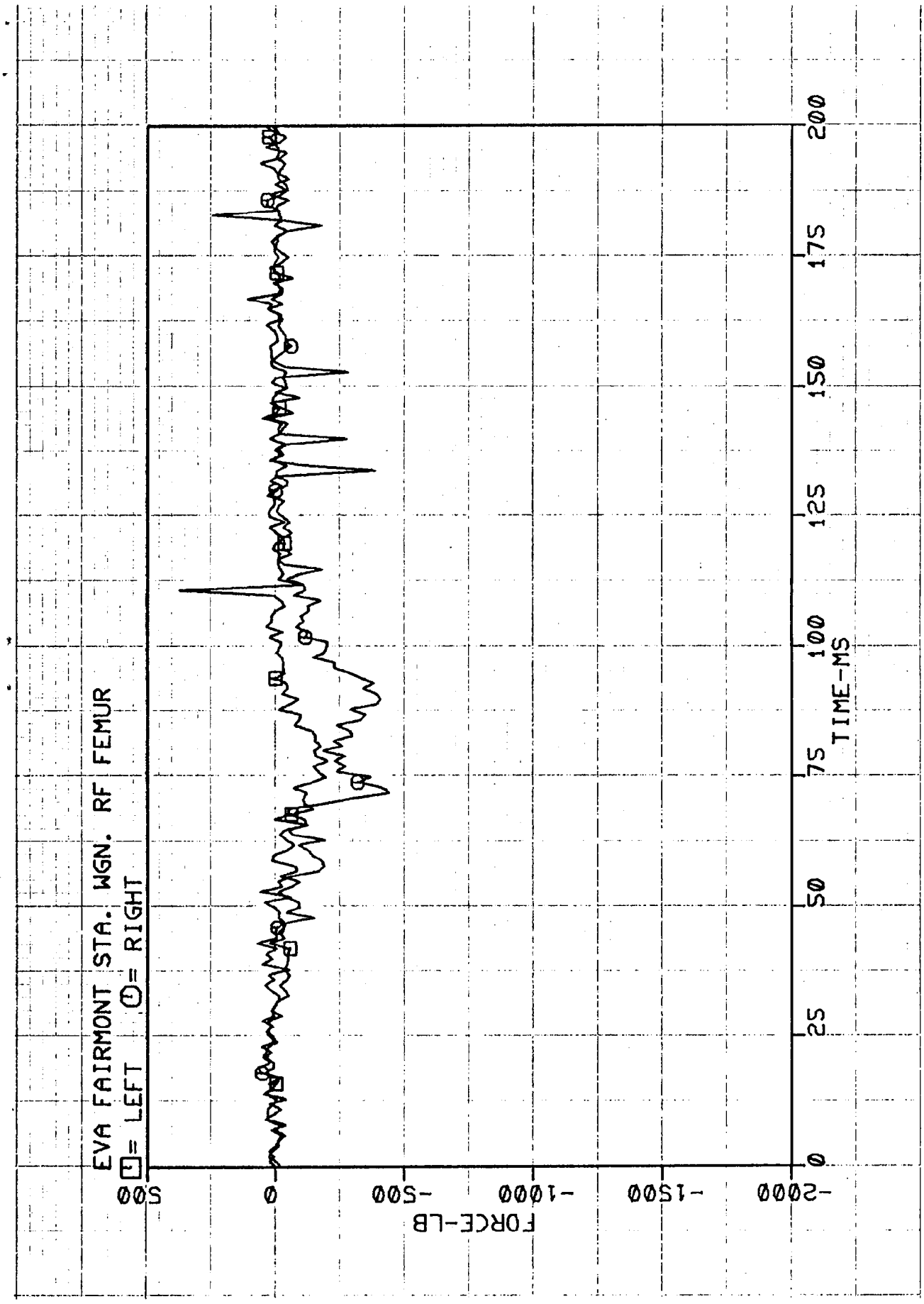

EVA FAIRMONT STA. WGN. RF HEAD AR
ACCELERATION-G
0
20
40
60
80
100
TIME-MS
0
25
50
75
100
125
150
175
200

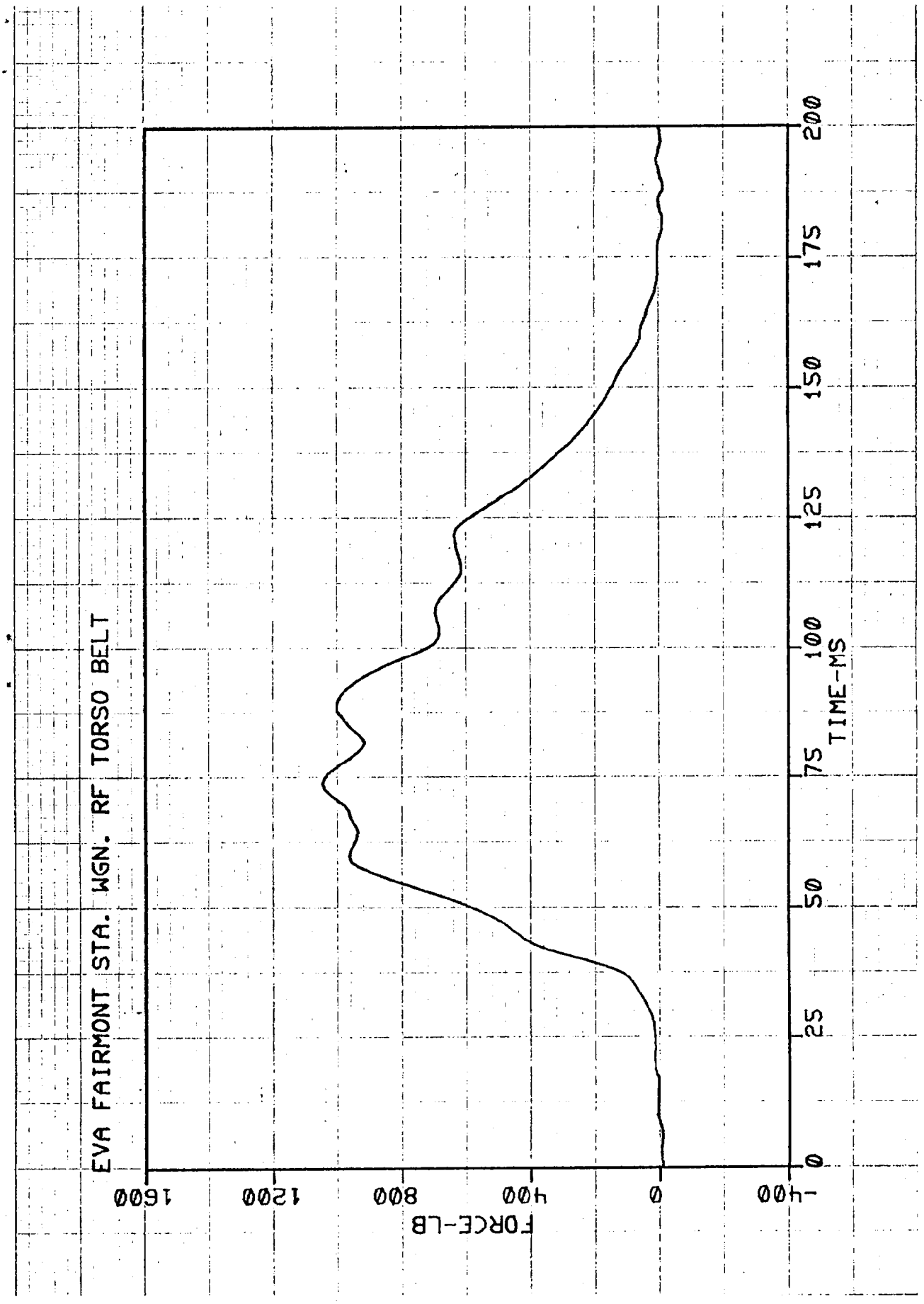

EVA FAIRMONT STA. WGN. RF CHEST AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
25
50
75
100
125
150
175
200
TIME-MS

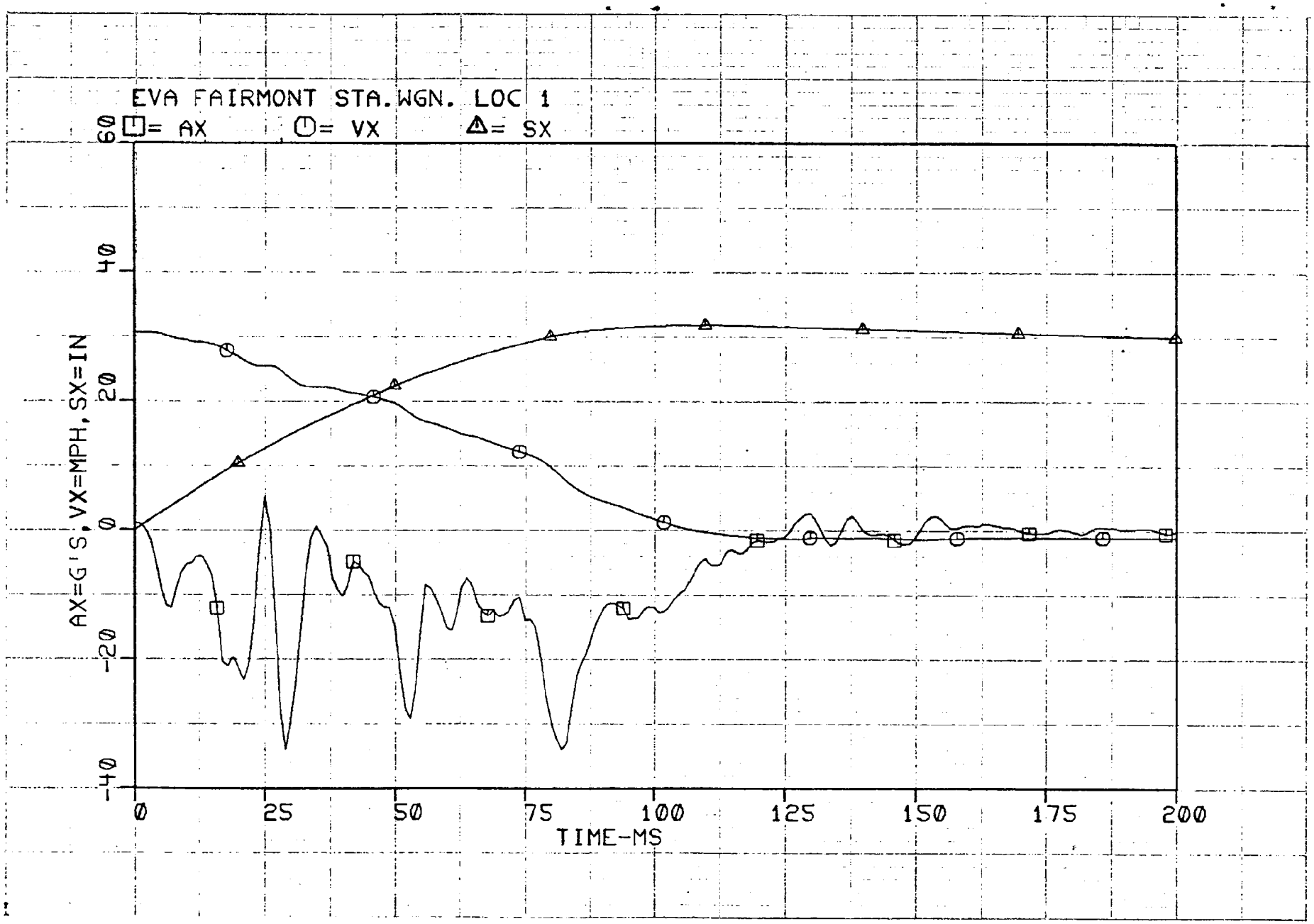

EVA FAIRMONT STA. WGN. RF CHEST AY
ACCELERATION-G
20
15
10
5
0
-5
0
25
50
75
100
125
150
175
200
TIME-MS

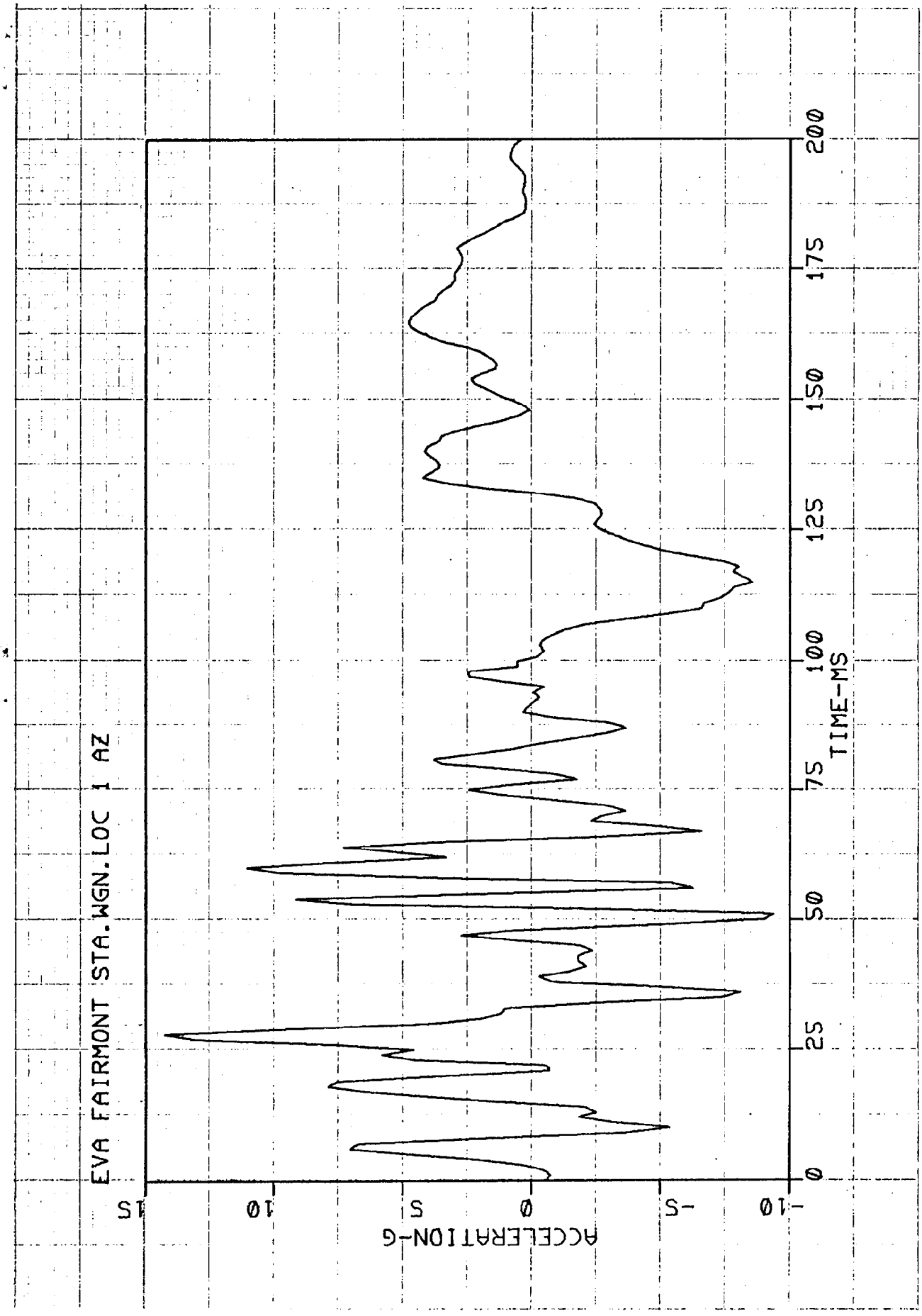

EVA FAIRMONT STA. WGN. RF CHEST AZ
ACCELERATION-G
12
8
4
0
-4
-8
0
25
50
75
100
125
150
175
200
TIME-MS

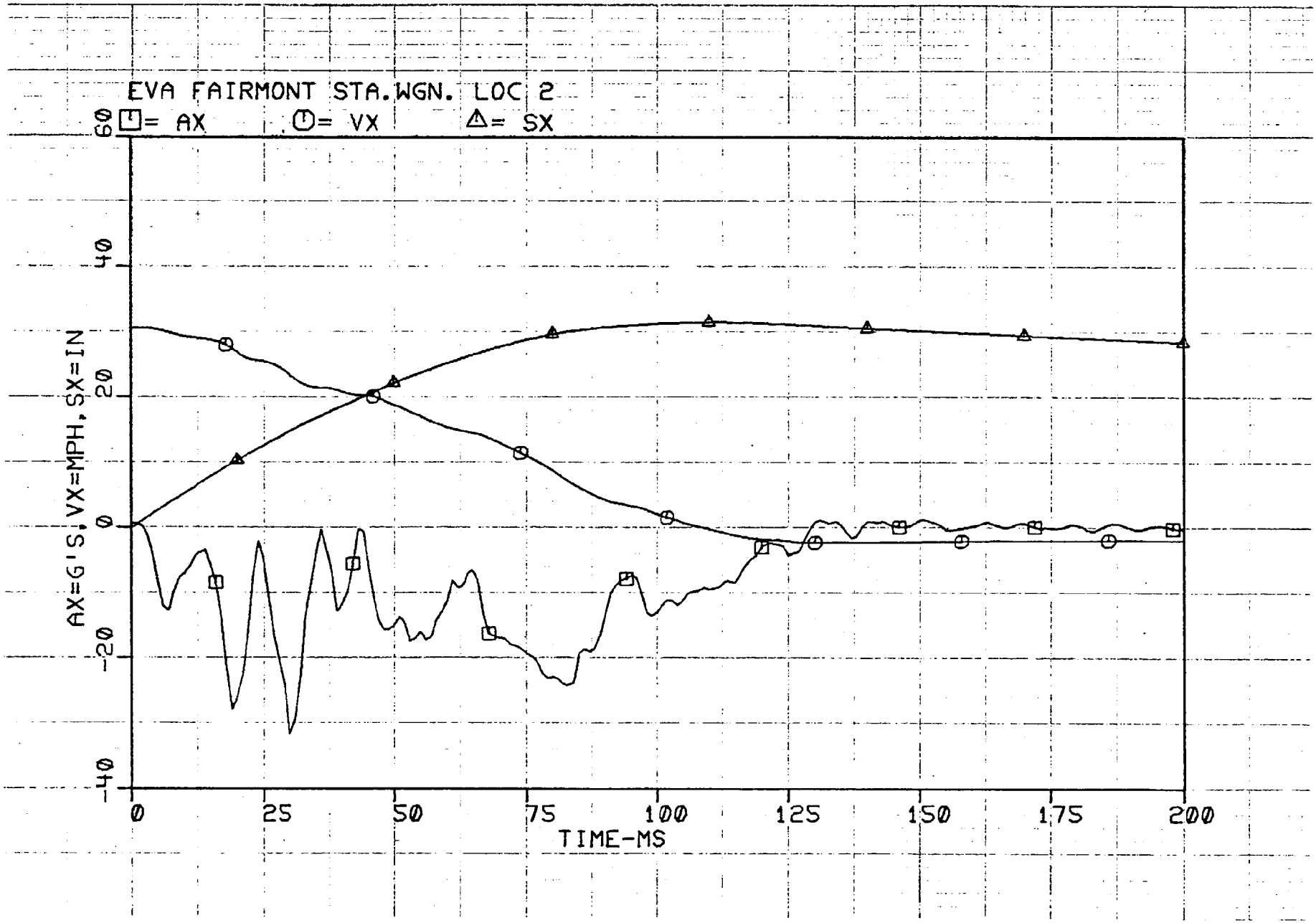

EVA FAIRMONT STA. WGN. RF CHEST AR
ACCELERATION-G
0
5
10
15
20
25
TIME-MS
0
25
50
75
100
125
150
175
200

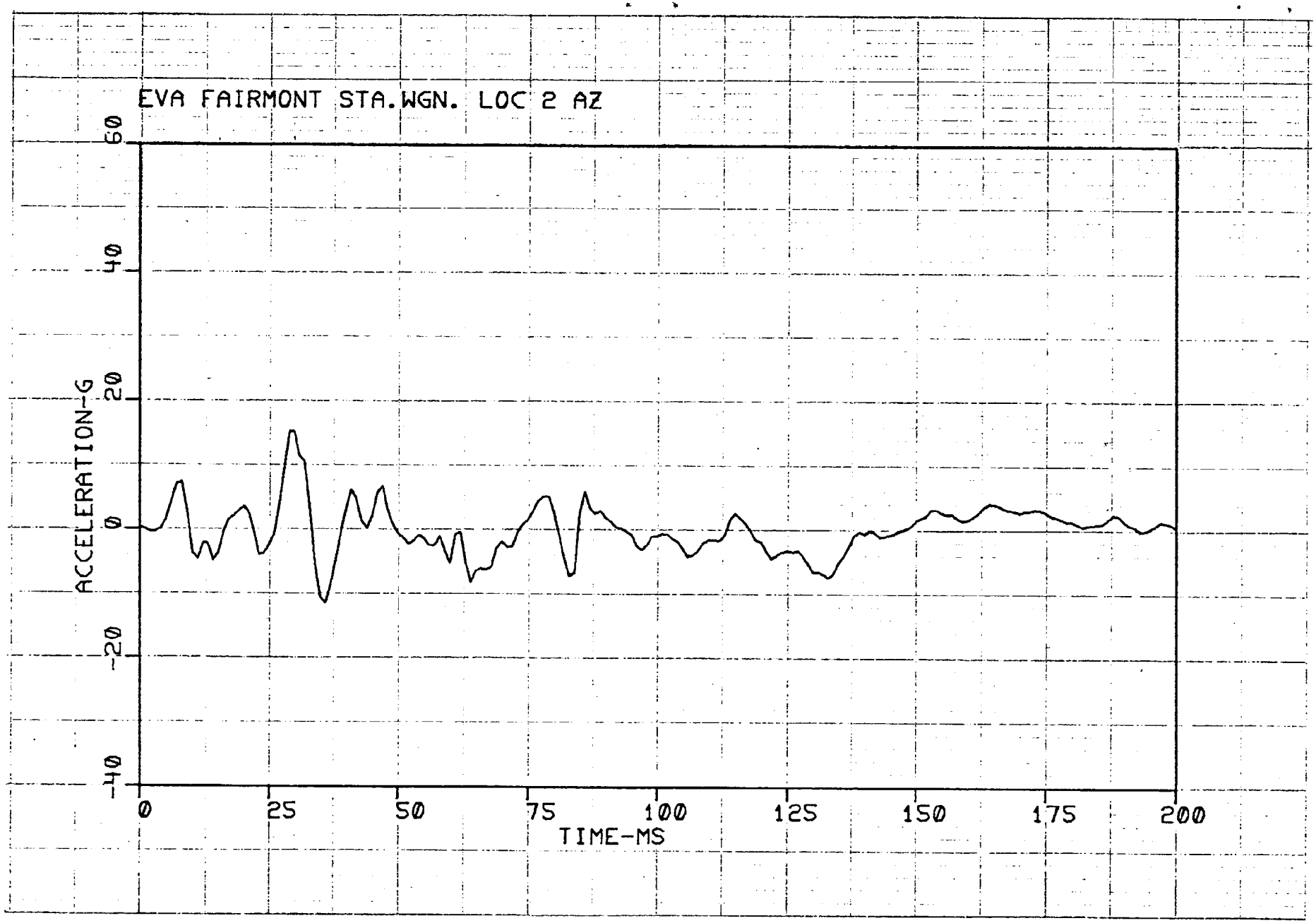

EVA FAIRMONT STA. WGN. RF FEMUR
□= LEFT ○= RIGHT
FORCE-LB
500
0
-500
-1000
-1500
-2000
0
25
50
75
100
125
150
175
200
TIME-MS

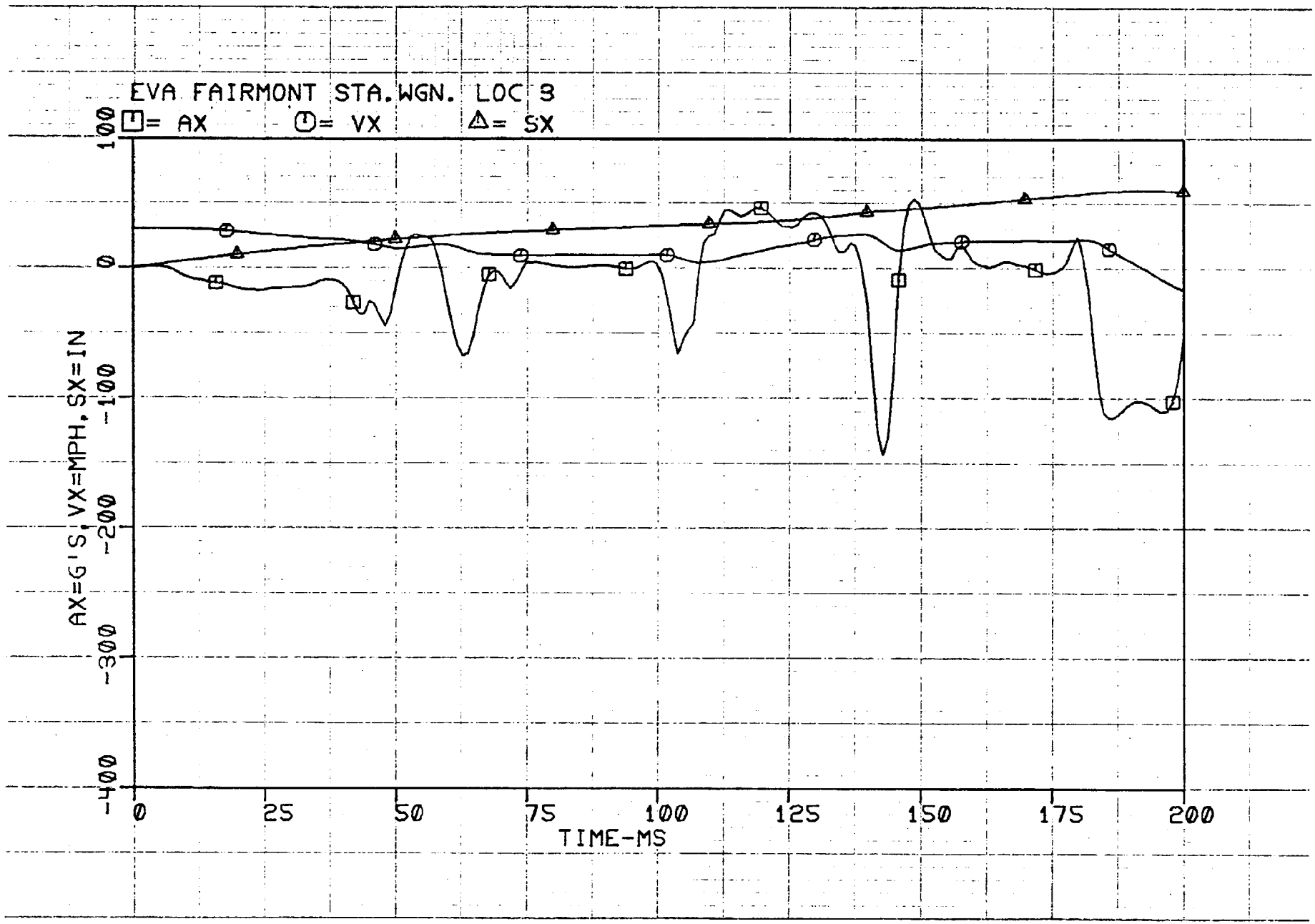

EVA FAIRMONT STA. WGN. RF TORSO BELT
FORCE-LB
-400
0
400
800
1200
1600
TIME-MS
0
25
50
75
100
125
150
175
200

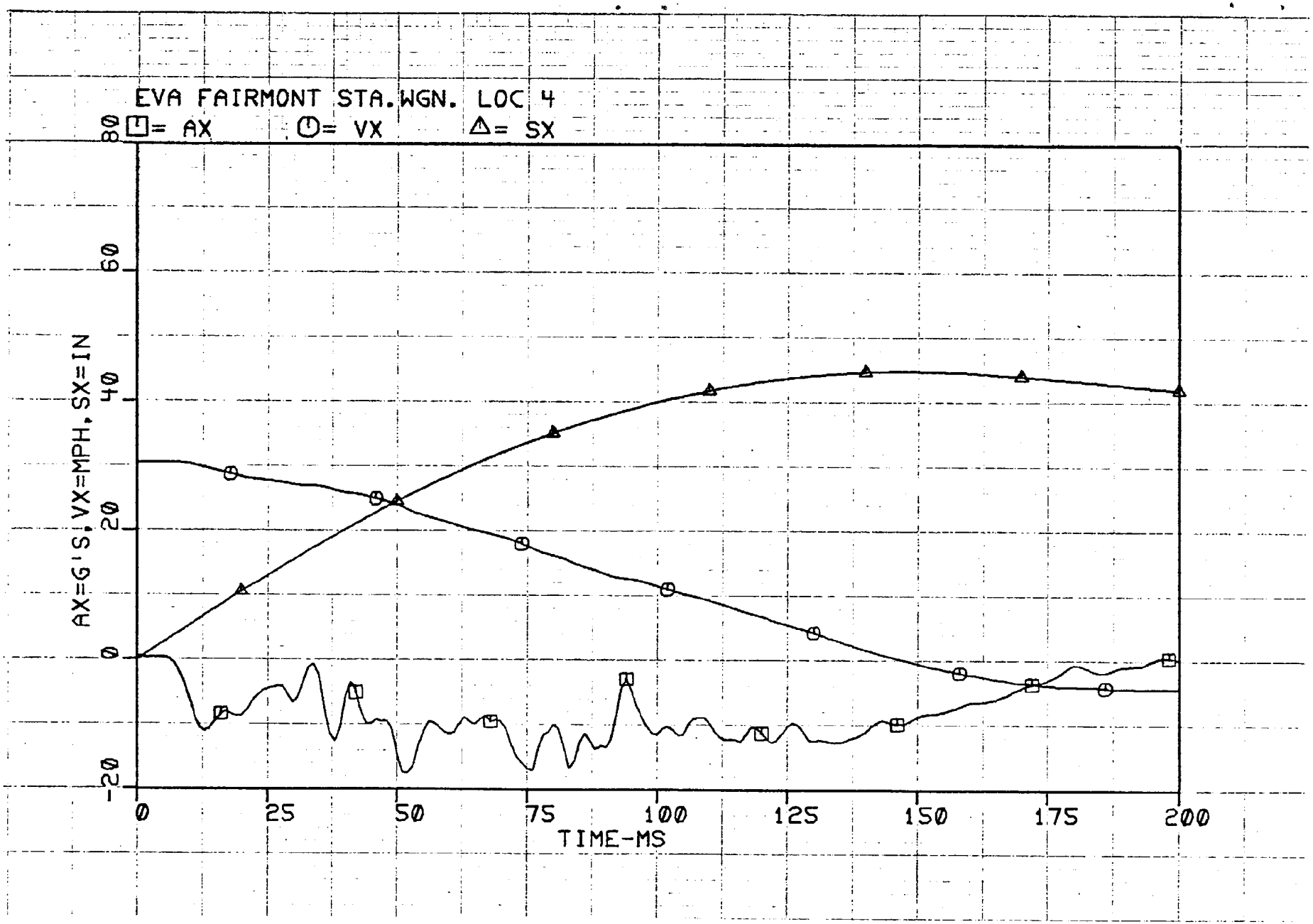

EVA FAIRMONT STA.WGN. LOC 1
□= AX
○= VX
△= SX
60
40
20
0
-20
-40
AX=G'S, VX=MPH, SX=IN
0
25
50
75
100
125
150
175
200
TIME-MS

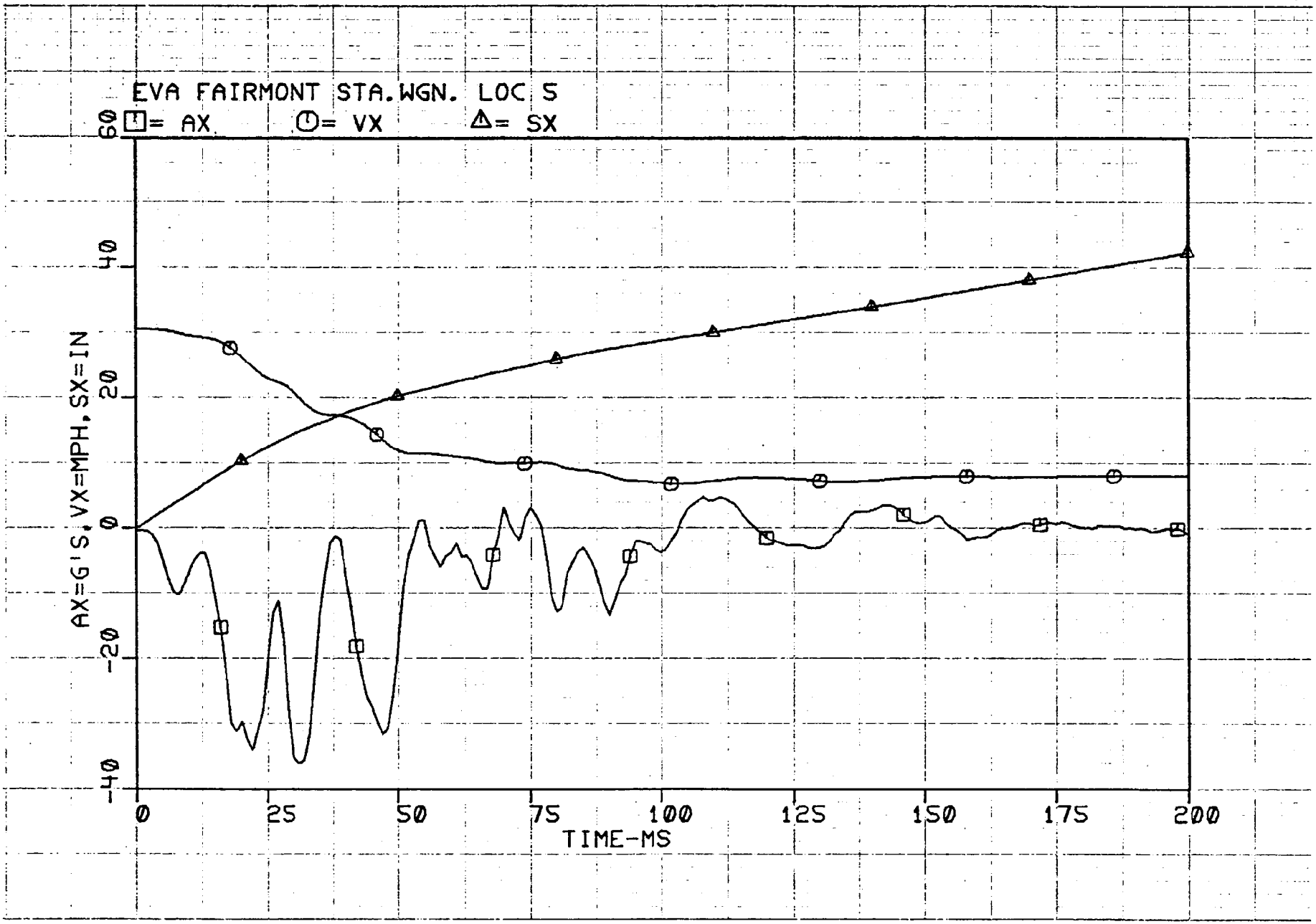

EVA FAIRMONT STA.WGN.LOC 1 AZ
ACCELERATION-G
15
10
5
0
-5
-10
0
25
50
75
100
125
150
175
200
TIME-MS

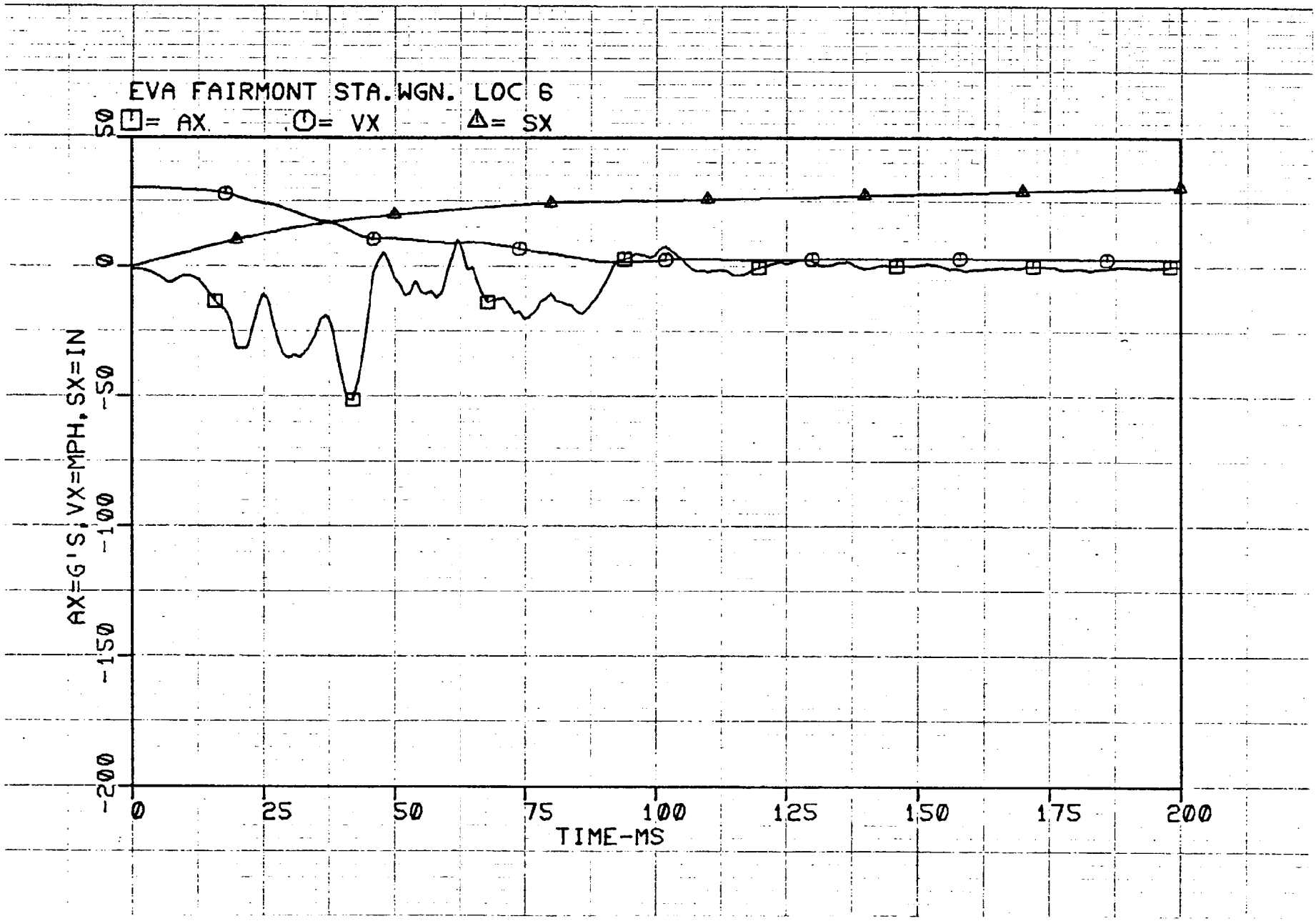

EVA FAIRMONT STA.WGN. LOC 2
□= AX
○= VX
△= SX
AX=G'S, VX=MPH, SX=IN
60
40
20
0
-20
-40
0
25
50
75
100
125
150
175
200
TIME-MS

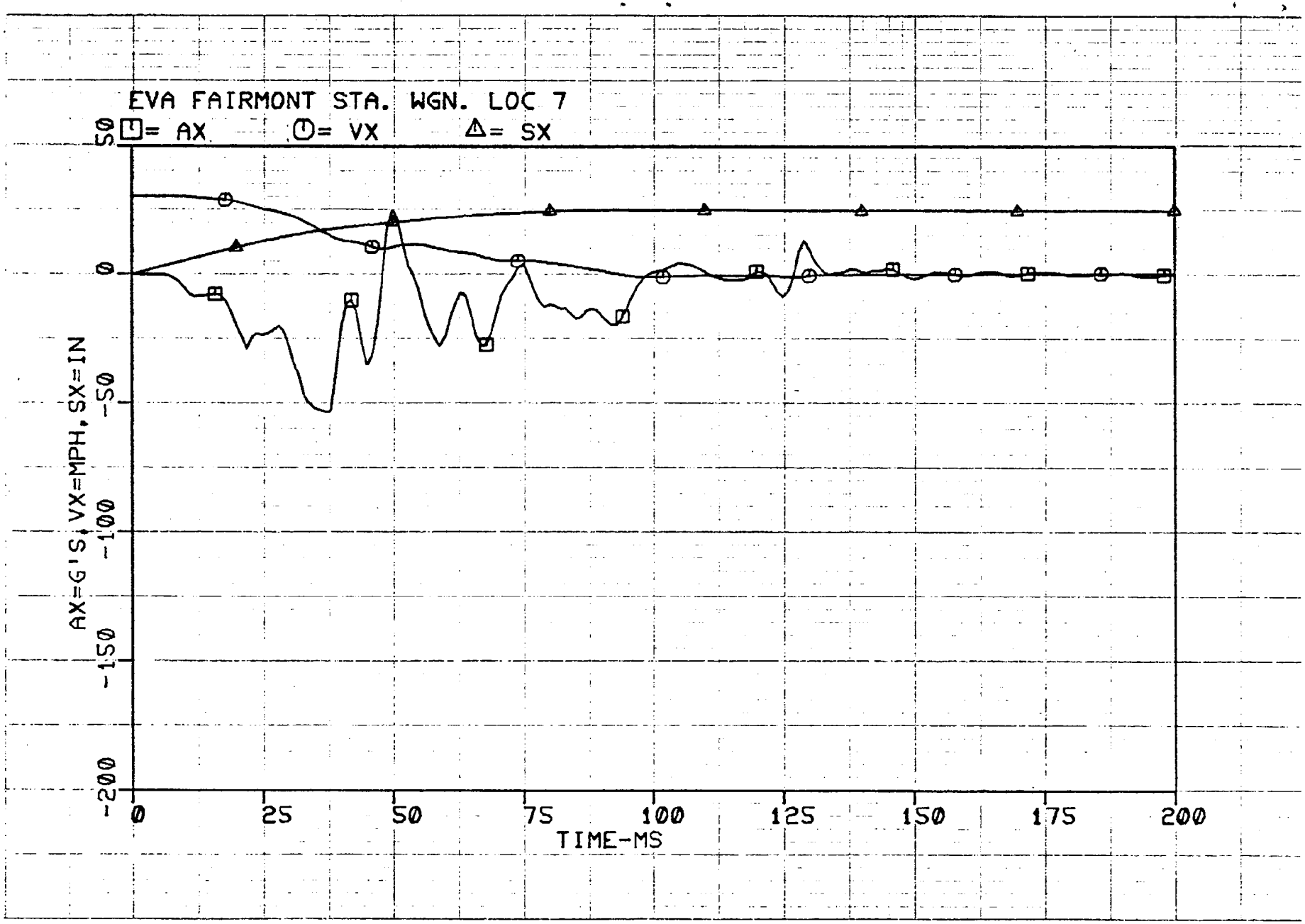

EVA FAIRMONT STA.WGN. LOC 2 AZ
ACCELERATION-G
60
40
20
0
-20
-40
0
25
50
75
100
125
150
175
200
TIME-MS

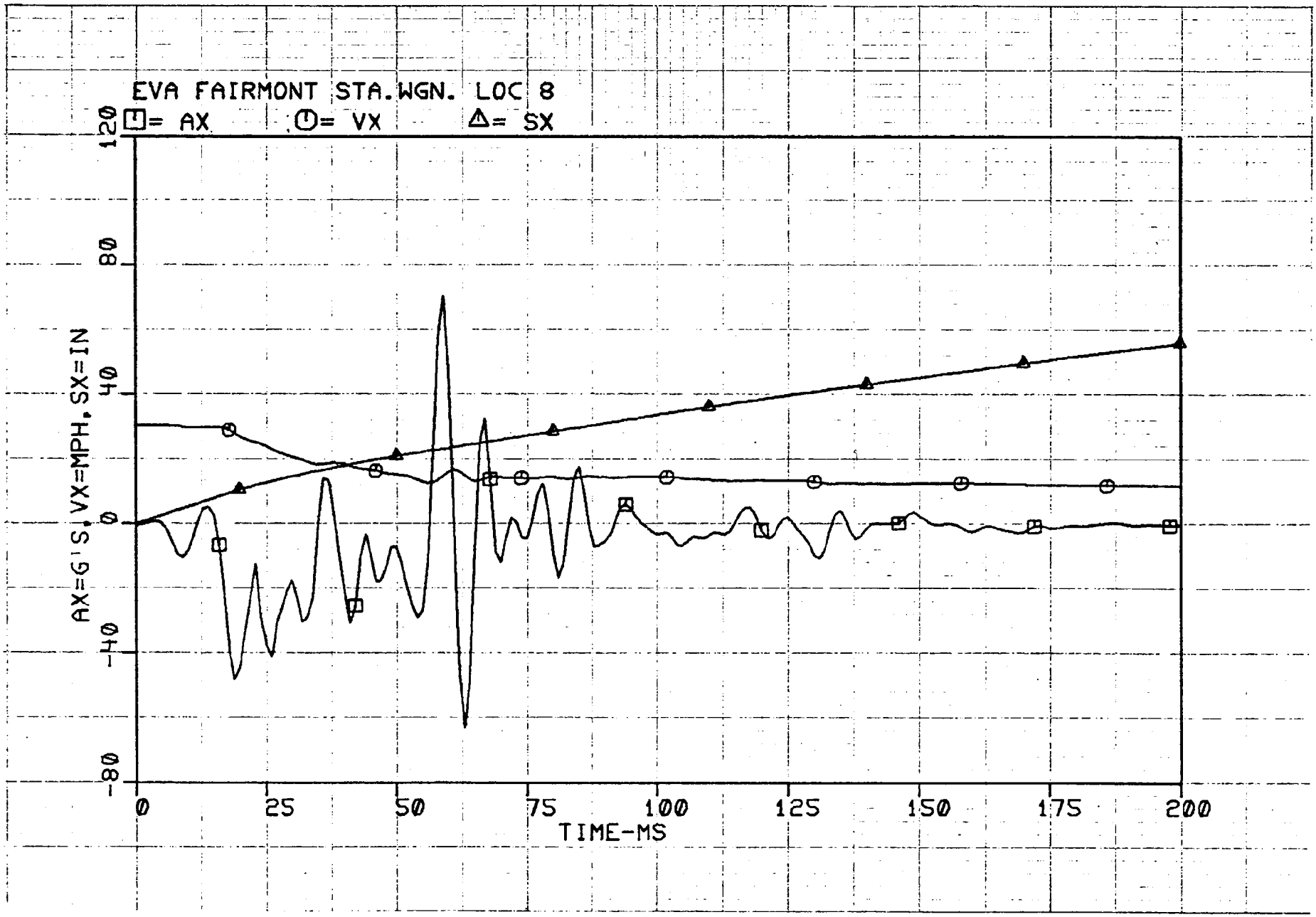

EVA FAIRMONT STA. WGN. LOC 3
□= AX
○= VX
△= SX
100
0
-100
-200
-300
-400
AX=G'S, VX=MPH, SX=IN
0
25
50
75
100
125
150
175
200
TIME-MS

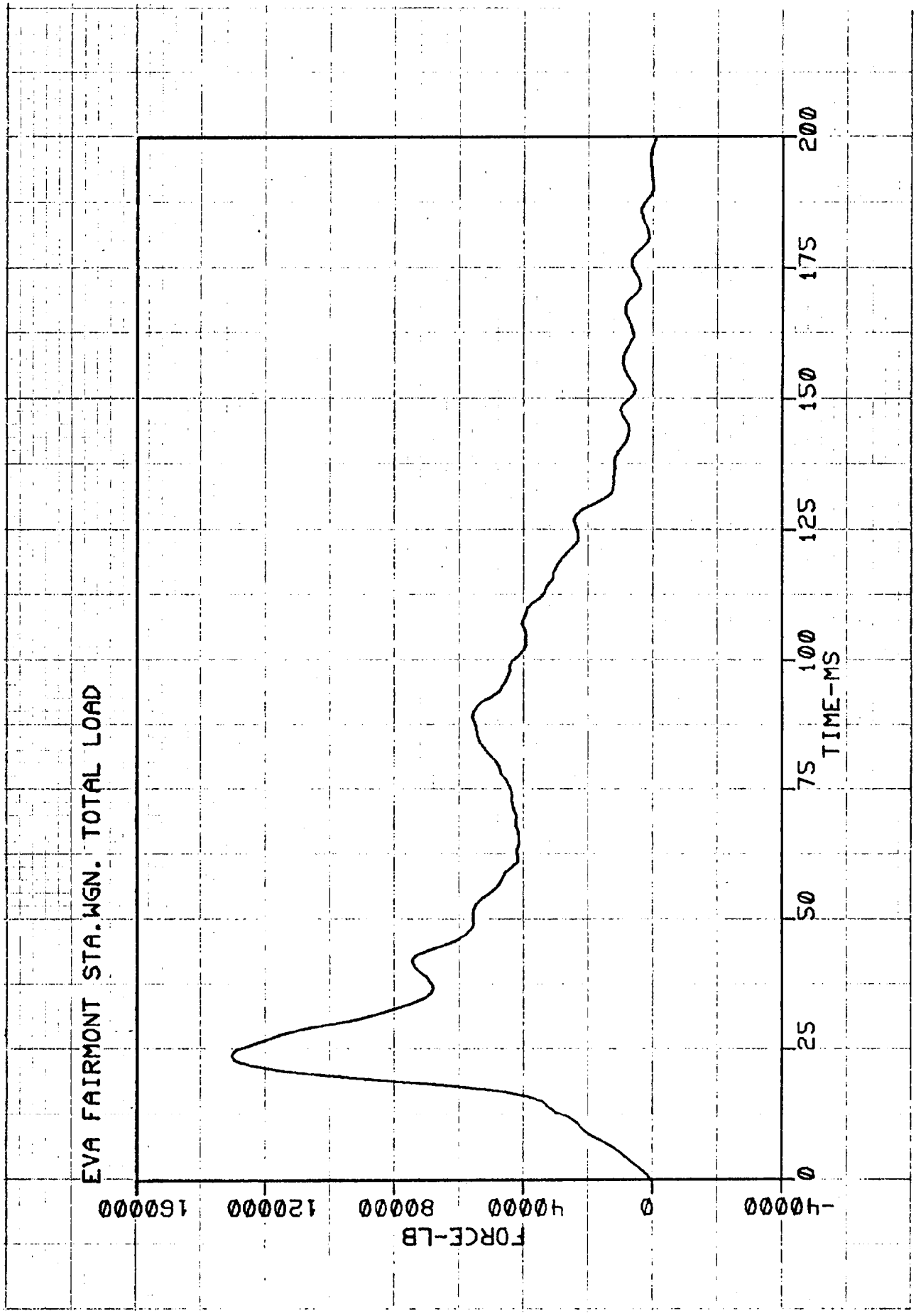

EVA FAIRMONT STA.WGN. LOC 4
□= AX
○= VX
△= SX
AX=G'S, VX=MPH, SX=IN
80
60
40
20
0
-20
0
25
50
75
100
125
150
175
200
TIME-MS

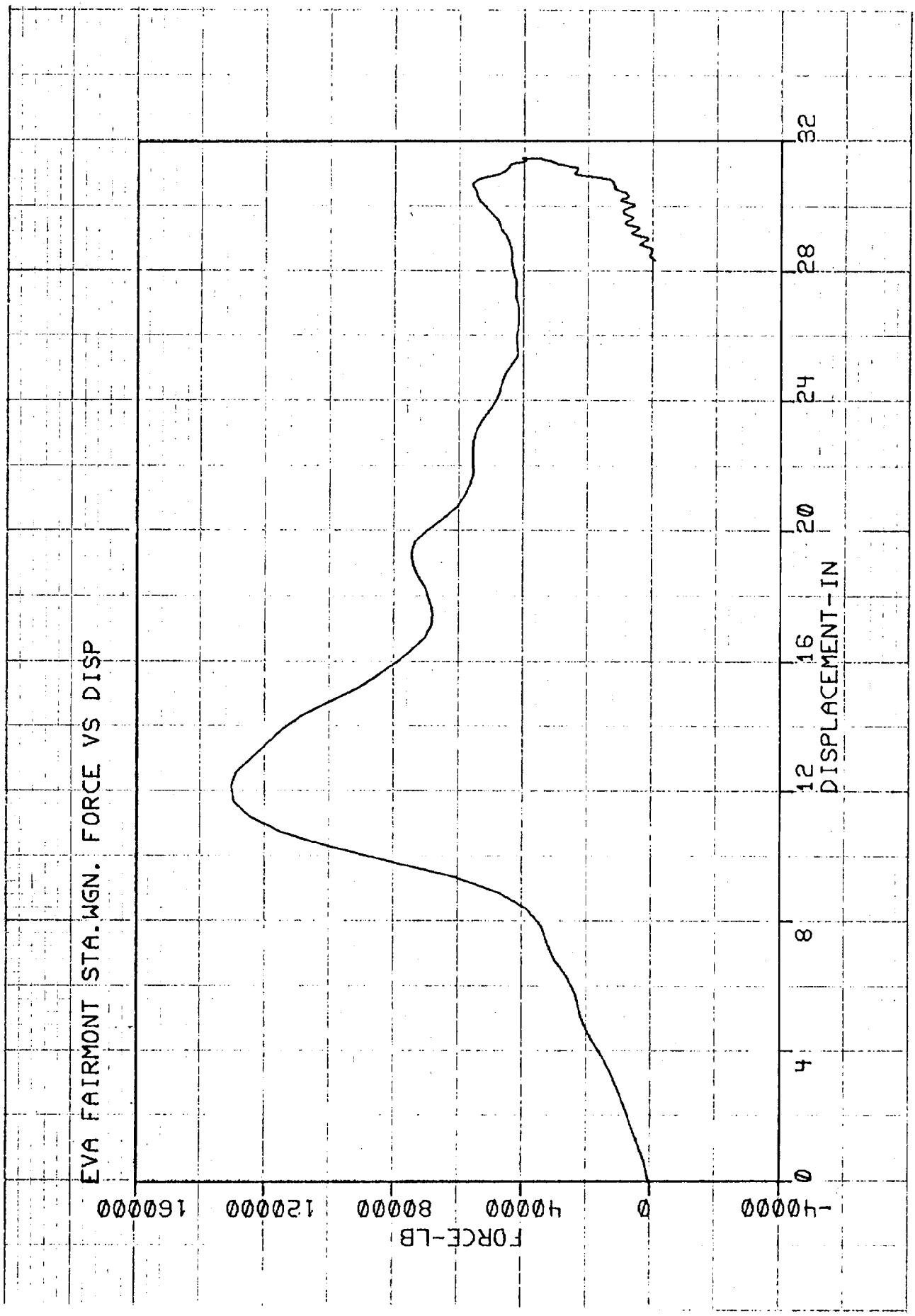

EVA FAIRMONT STA.WGN. LOC 5
□= AX
○= VX
△= SX
AX=G'S, VX=MPH, SX=IN
60
40
20
0
-20
-40
0
25
50
75
100
125
150
175
200
TIME-MS

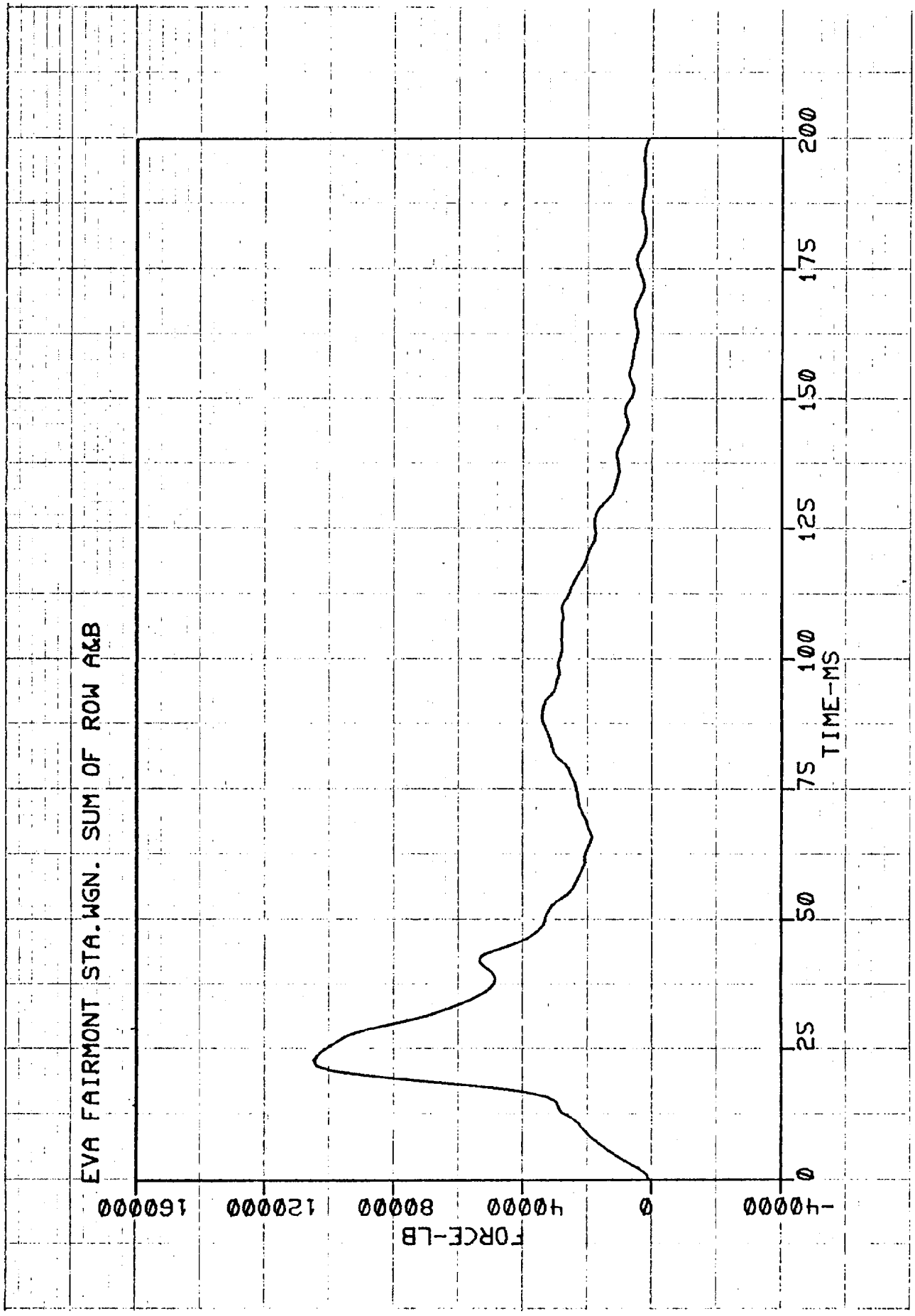

EVA FAIRMONT STA.WGN. LOC 6
□= AX
○= VX
△= SX
AX=G'S, VX=MPH, SX=IN
50
0
-50
-100
-150
-200
0
25
50
75
100
125
150
175
200
TIME-MS

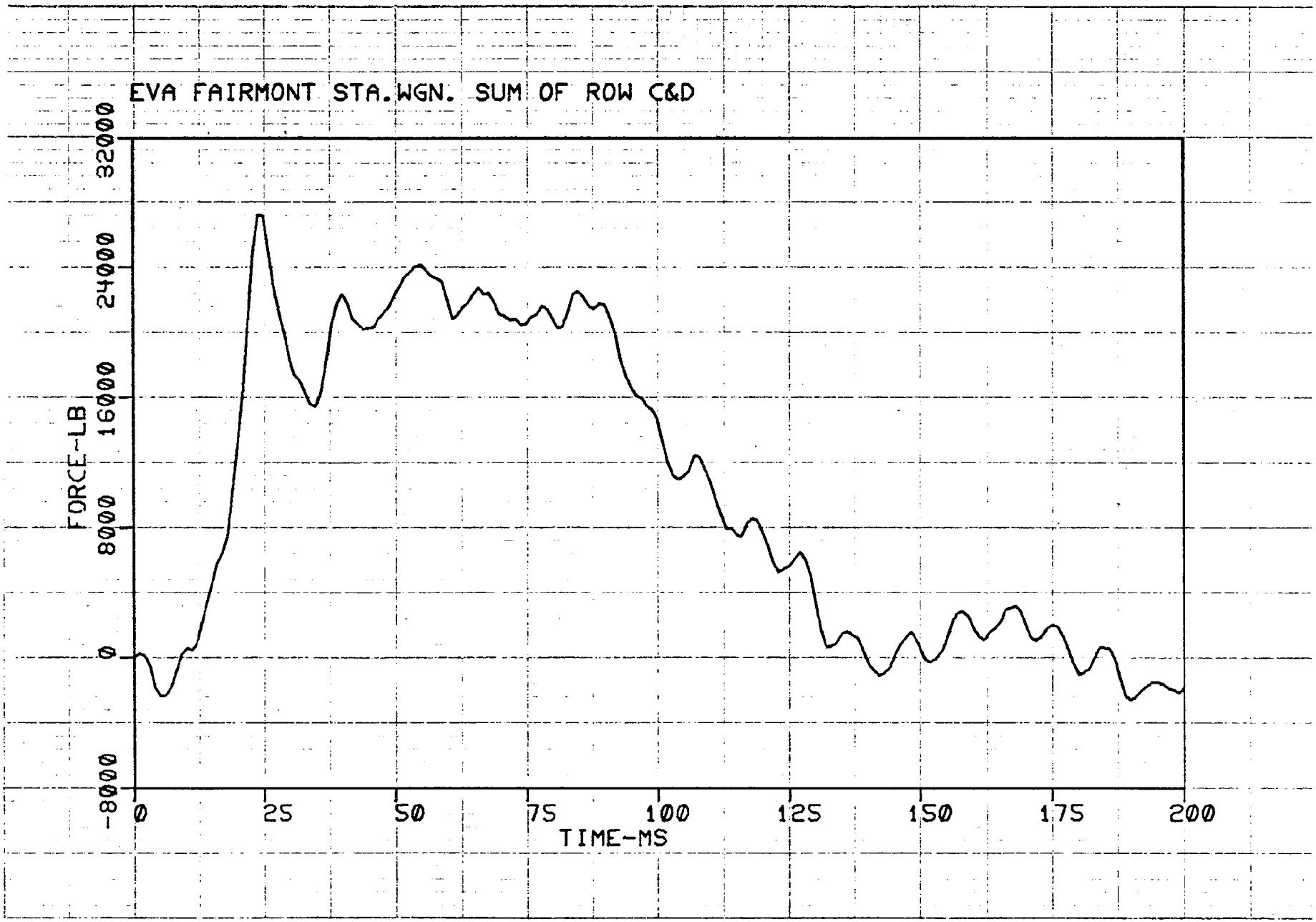

EVA FAIRMONT STA. WGN. LOC 7
□= AX
○= VX
△= SX
50
0
-50
-100
-150
-200
AX=G'S, VX=MPH, SX=IN
0
25
50
75
100
125
150
175
200
TIME-MS

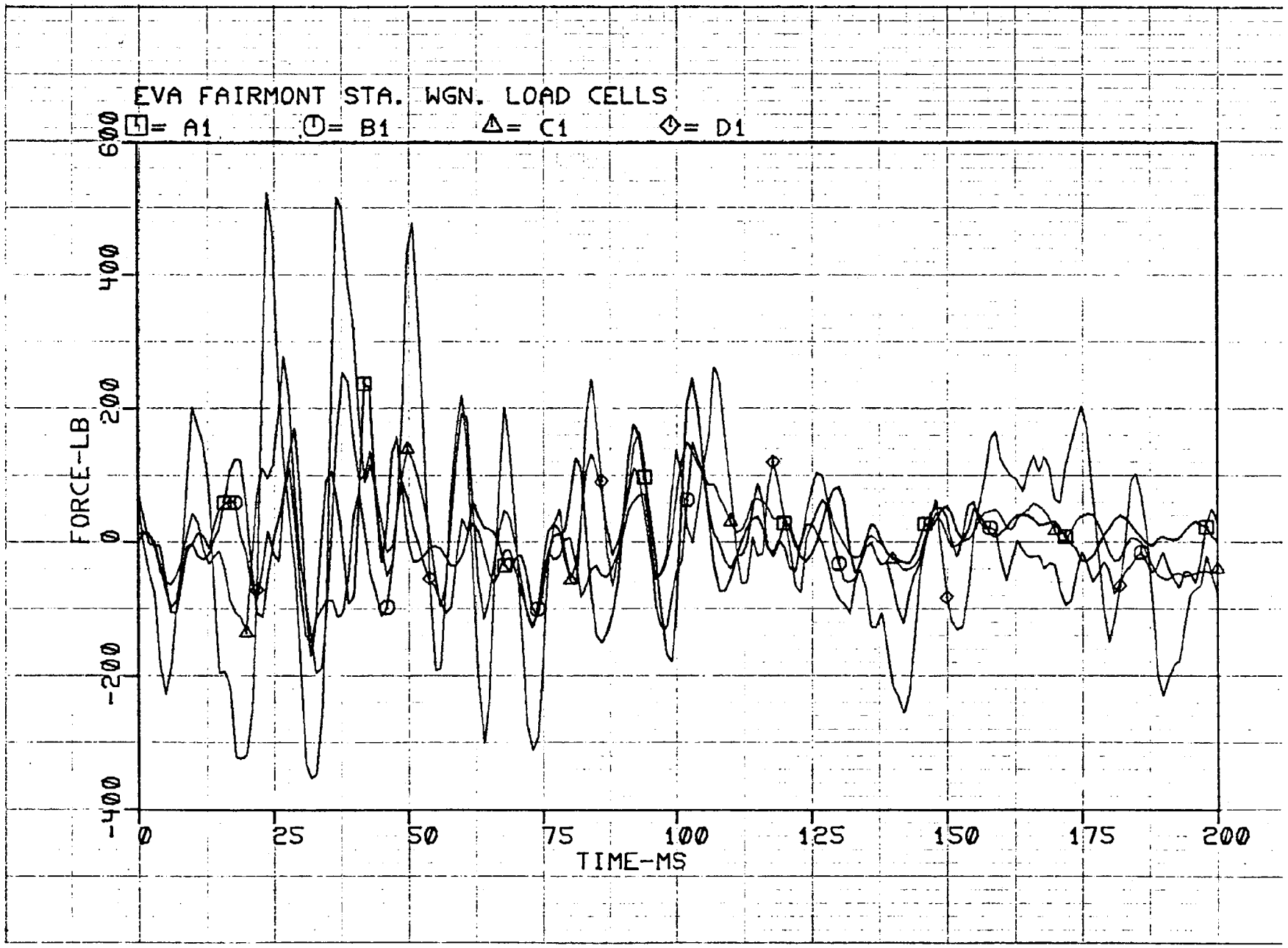

EVA FAIRMONT STA.WGN. LOC 8
□= AX
○= VX
△= SX
AX=G'S, VX=MPH, SX=IN
120
80
40
0
-40
-80
0
25
50
75
100
125
150
175
200
TIME-MS

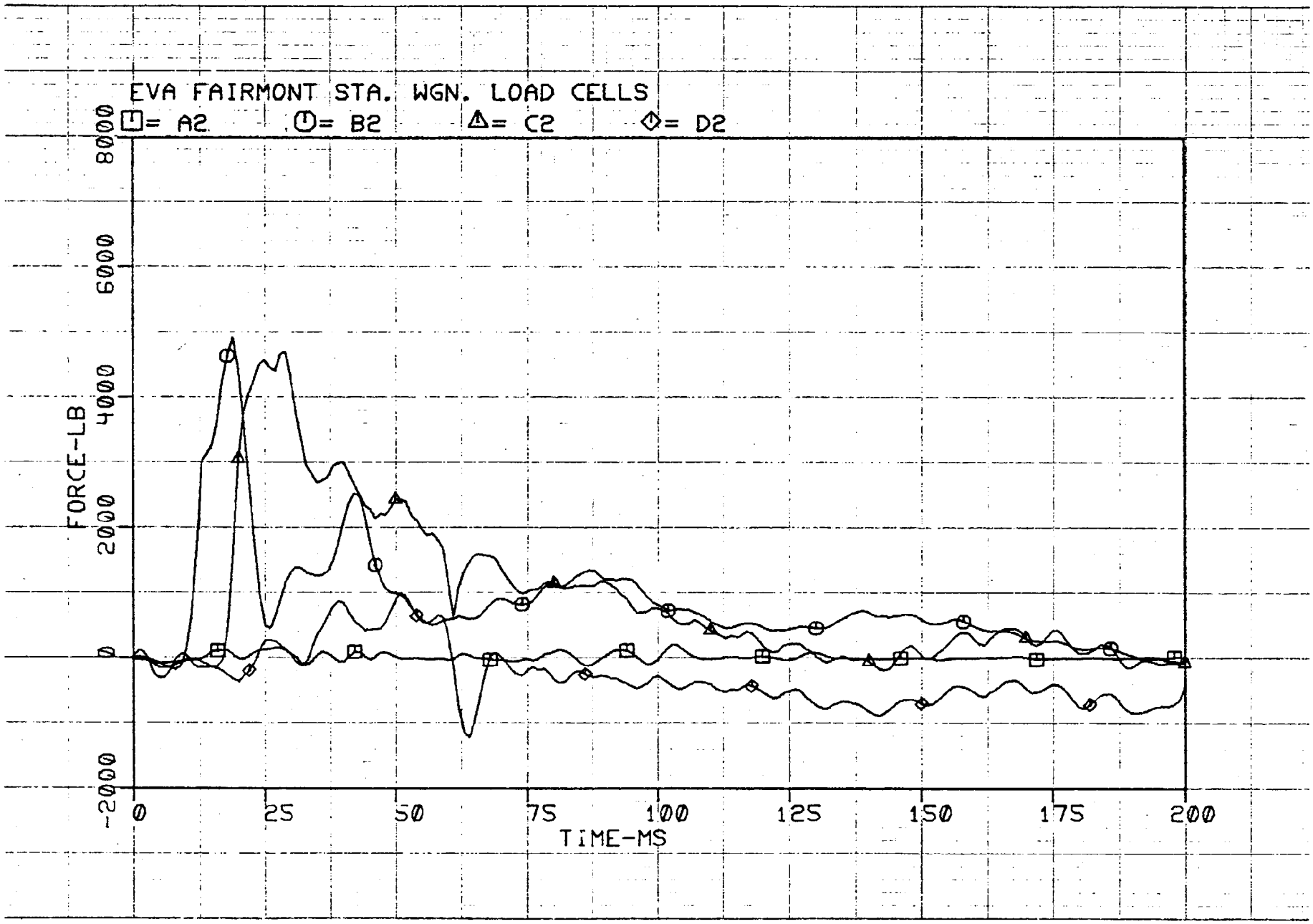

EVA FAIRMONT STA.WGN. TOTAL LOAD
FORCE-LB
160000
120000
80000
40000
0
-40000
0
25
50
75
100
125
150
175
200
TIME-MS

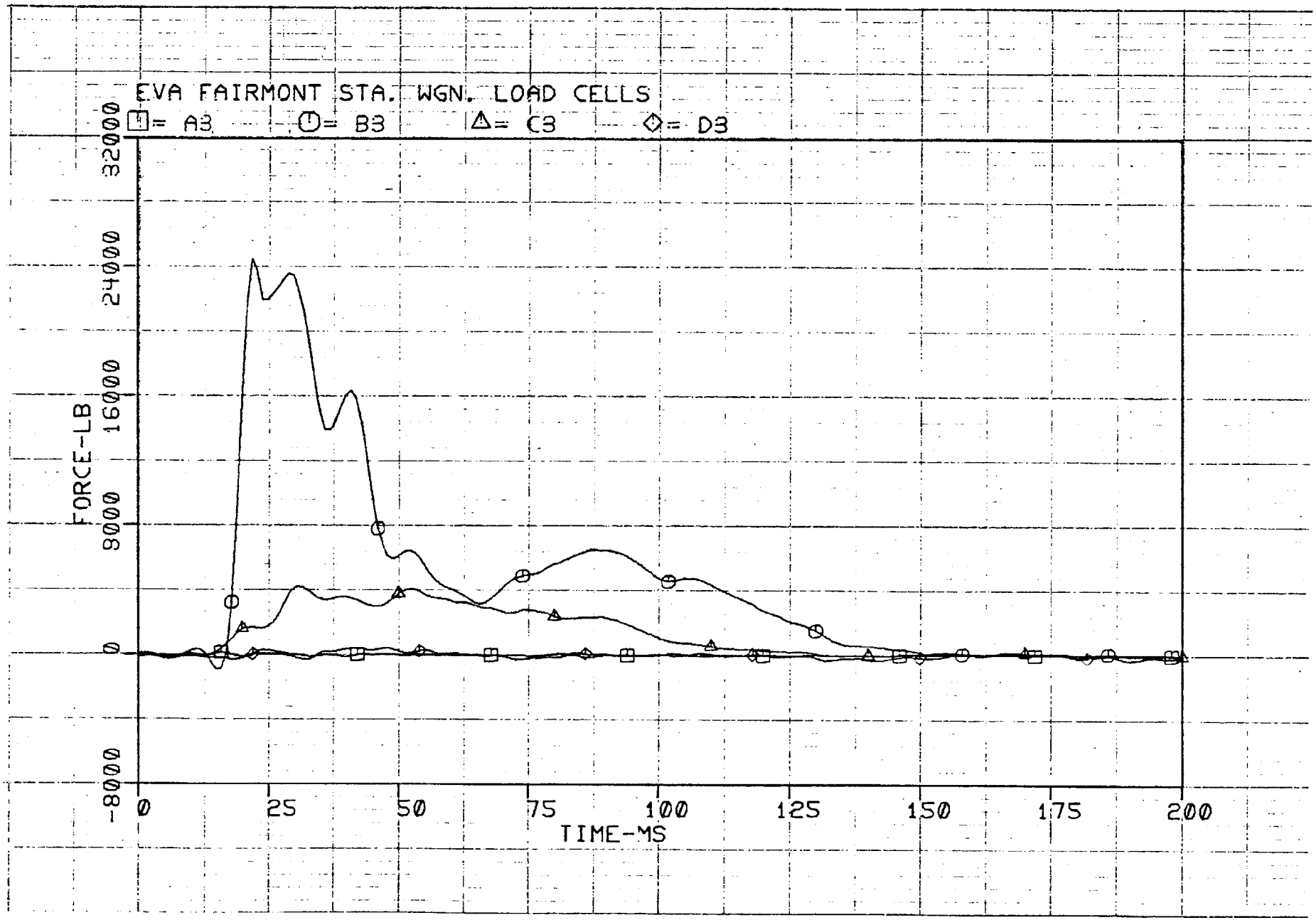

EVA FAIRMONT STA.WGN. FORCE VS DISP
FORCE-LB
-40000
0
40000
80000
120000
160000
DISPLACEMENT-IN
0
4
8
12
16
20
24
28
32

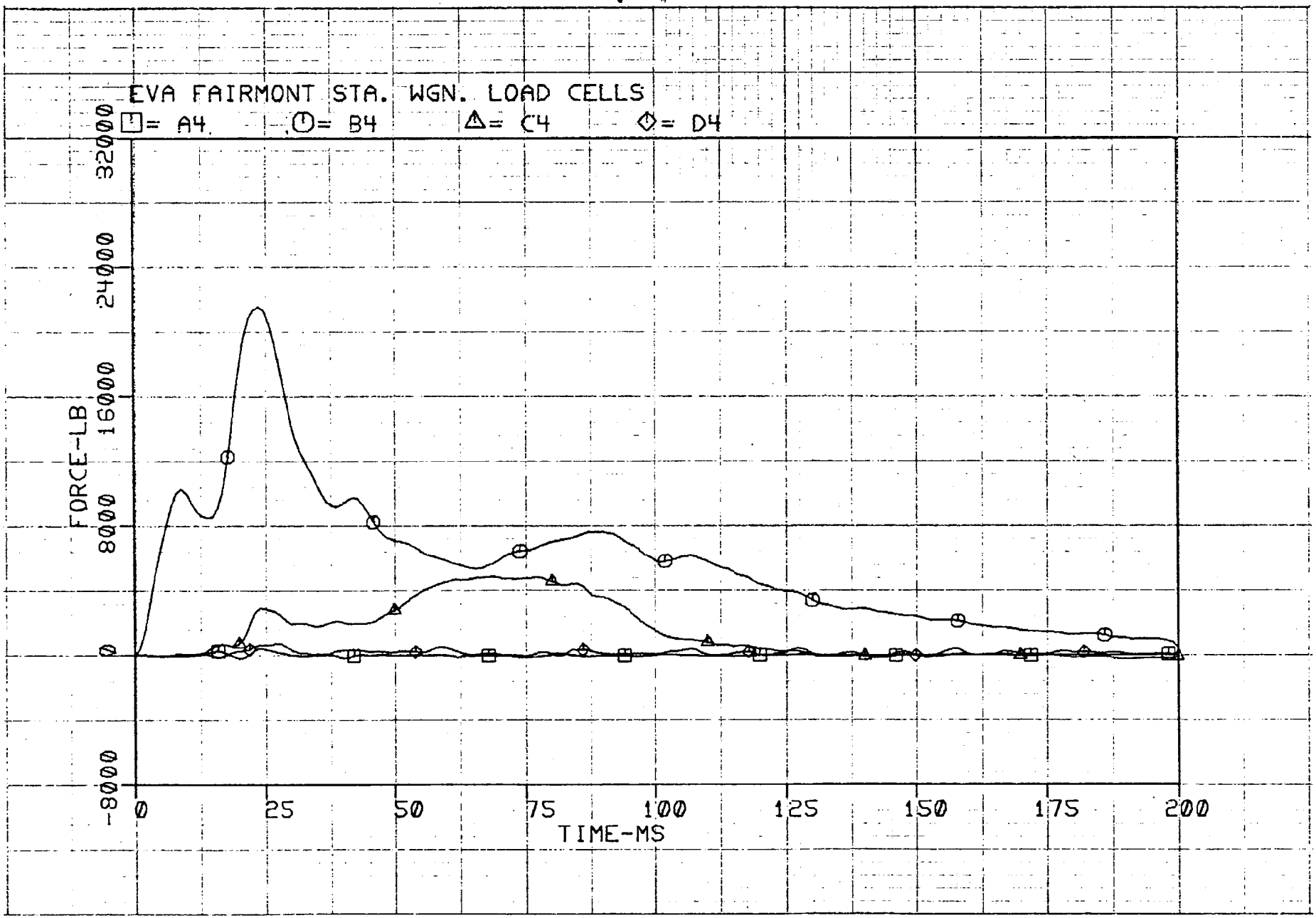

EVA FAIRMONT STA.WGN. SUM OF ROW A&B
FORCE-LB
-40000
0
40000
80000
120000
160000
TIME-MS
0
25
50
75
100
125
150
175
200

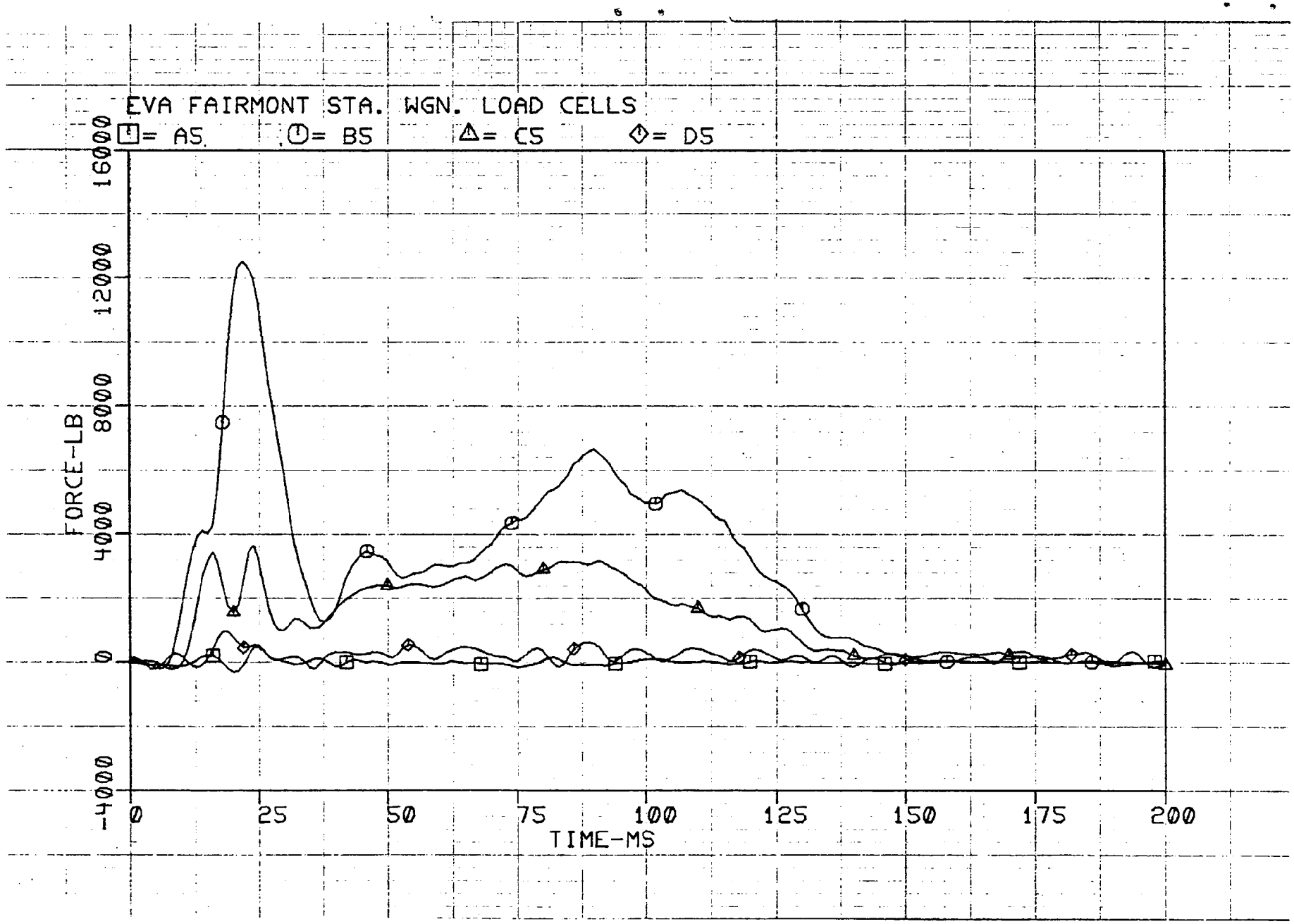

EVA FAIRMONT STA.WGN. SUM OF ROW C&D
FORCE-LB
32000
24000
16000
8000
0
-8000
0
25
50
75
100
125
150
175
200
TIME-MS

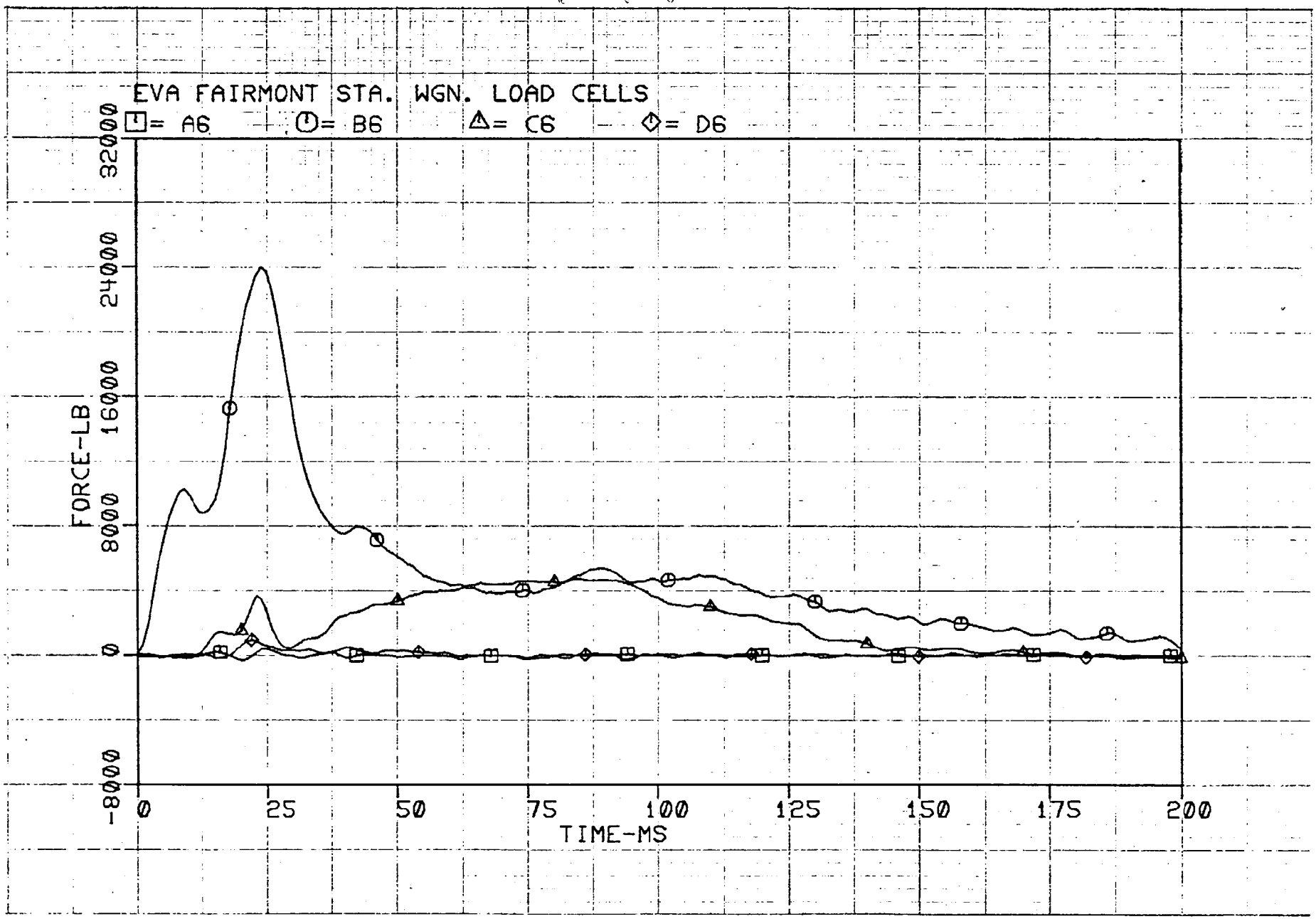

EVA FAIRMONT STA. WGN. LOAD CELLS
= A1
= B1
= C1
= D1
600
400
200
0
-200
-400
FORCE-LB
0
25
50
75
100
125
150
175
200
TIME-MS

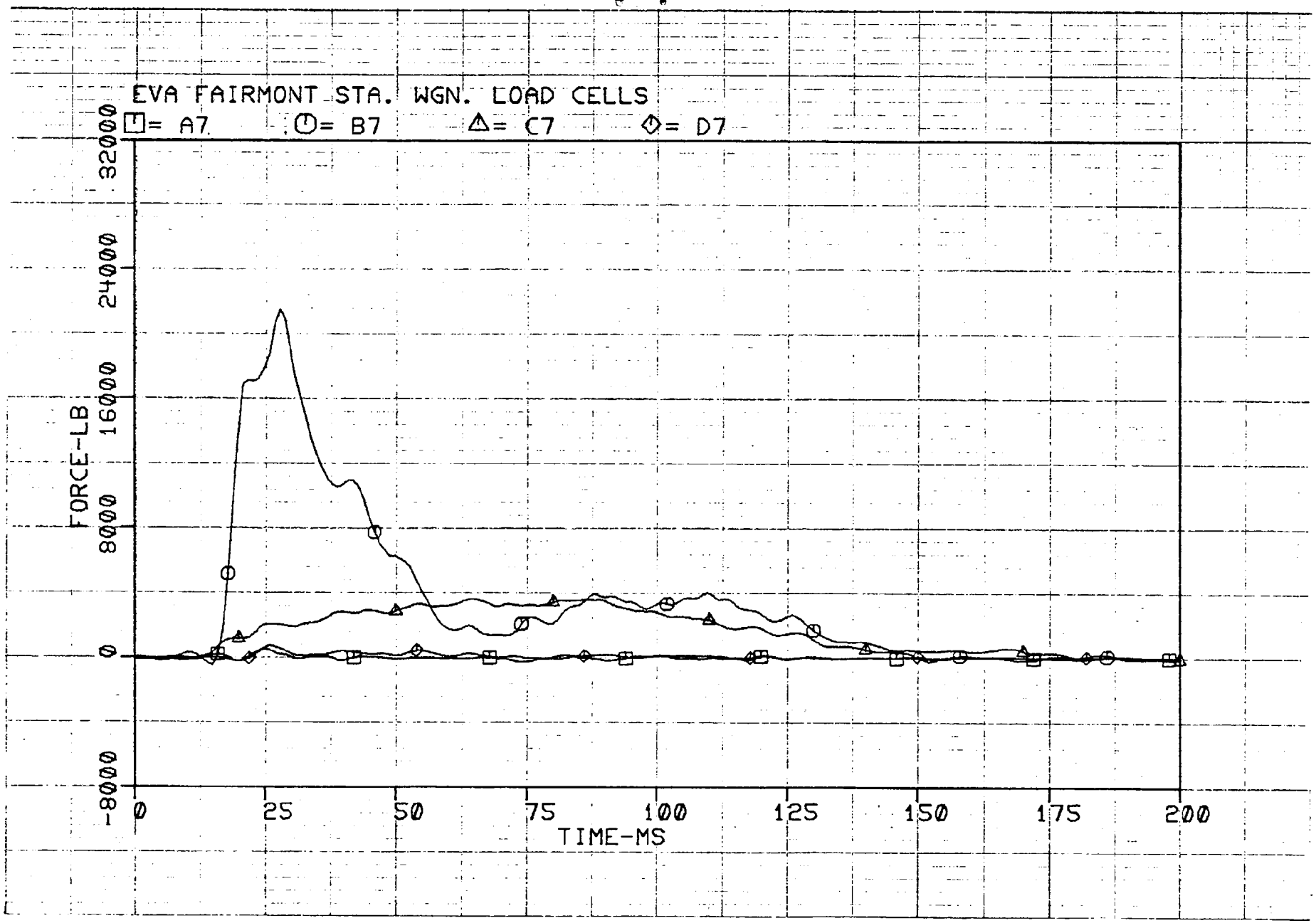

EVA FAIRMONT STA. WGN. LOAD CELLS
□= A2
○= B2
△= C2
◇= D2
FORCE-LB
8000
6000
4000
2000
0
-2000
0
25
50
75
100
125
150
175
200
TIME-MS

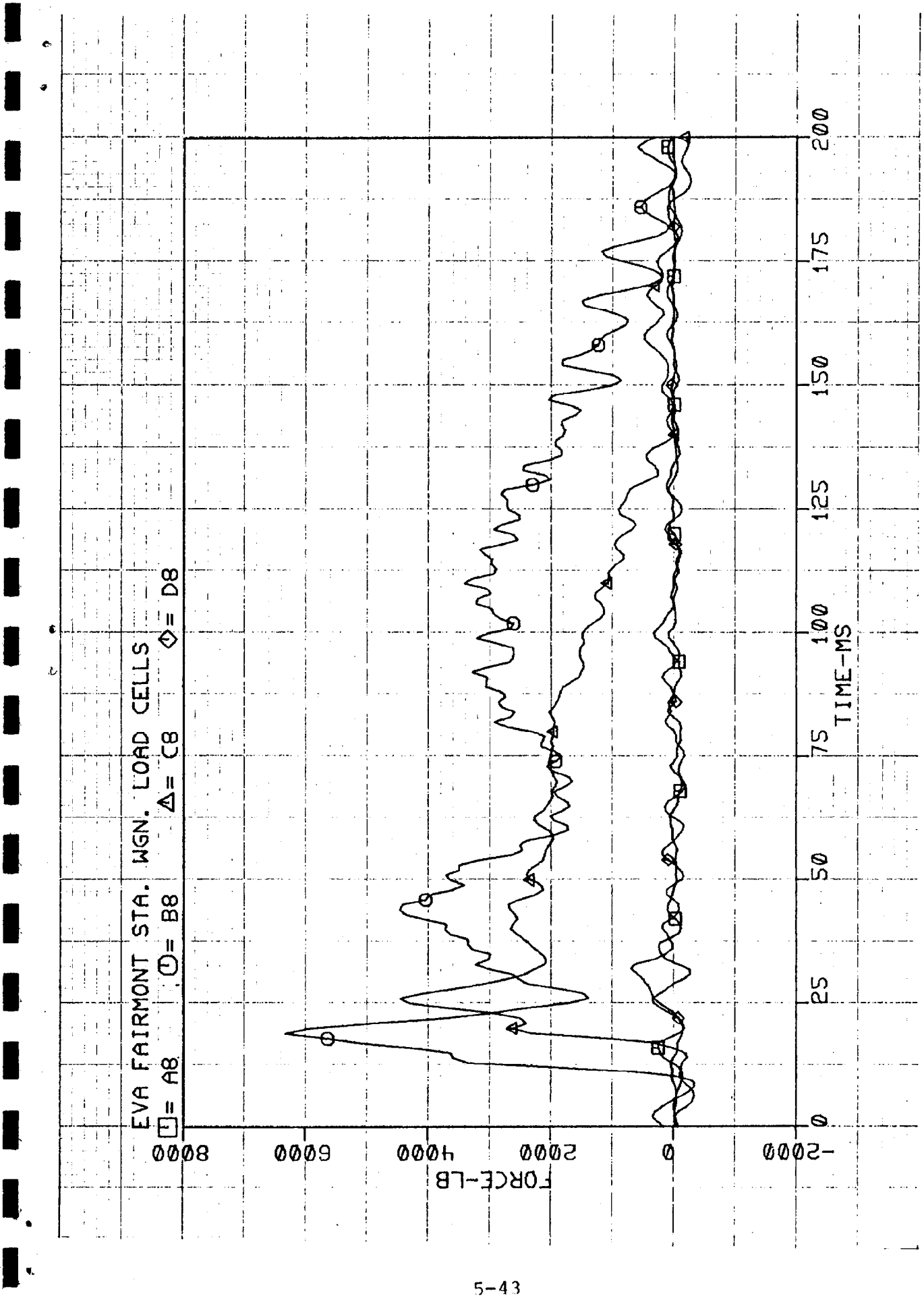

EVA FAIRMONT STA. WGN. LOAD CELLS
□= A3
○= B3
△= C3
◇= D3
FORCE-LB
32000
24000
16000
8000
0
-8000
0
25
50
75
100
125
150
175
200
TIME-MS

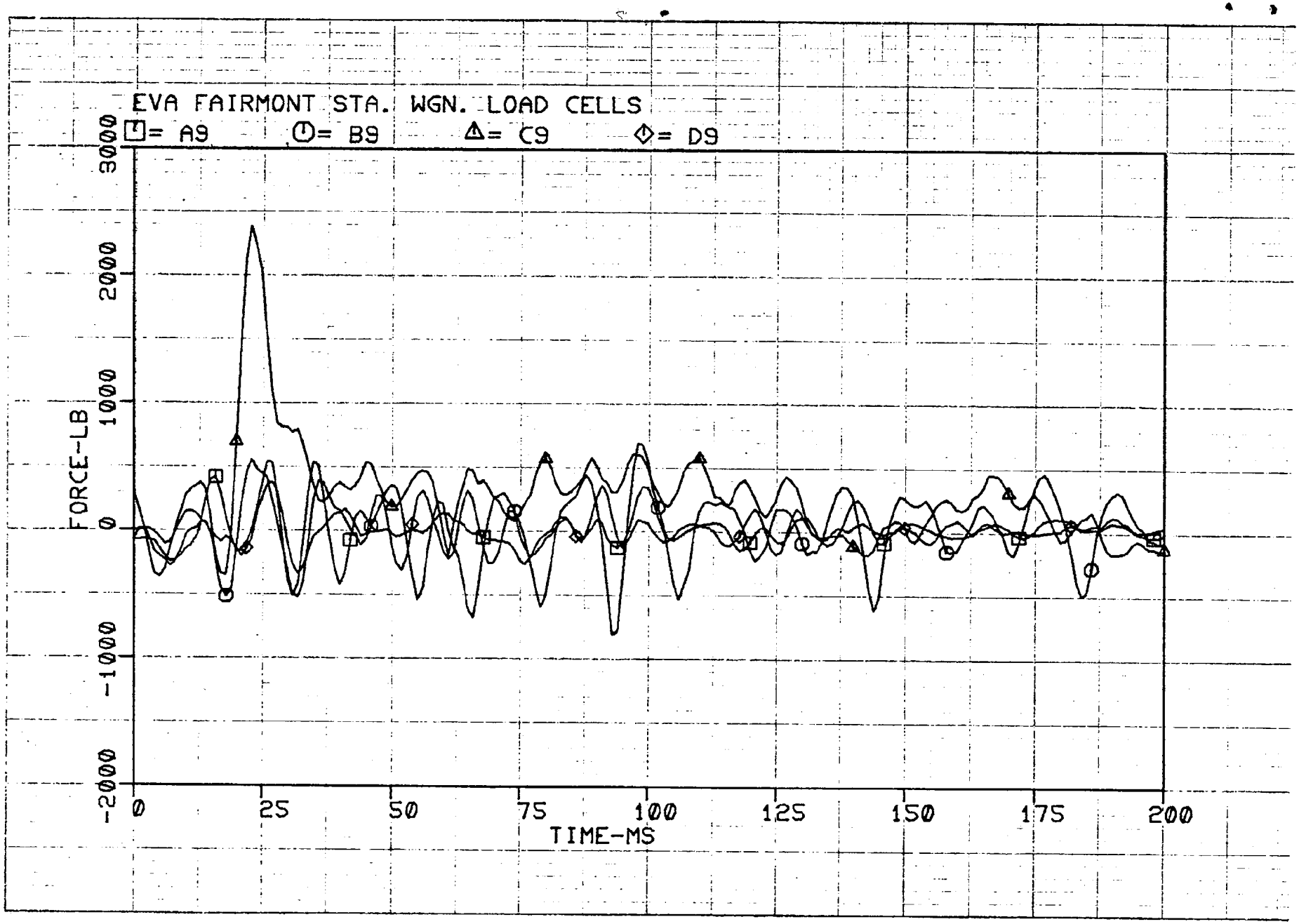

EVA FAIRMONT STA. WGN. LOAD CELLS
□= A4
○= B4
△= C4
◇= D4
32000
24000
16000
8000
0
-8000
FORCE-LB
0
25
50
75
100
125
150
175
200
TIME-MS


EVA FAIRMONT STA. WGN. LOAD CELLS
= A5
= B5
= C5
= D5
FORCE-LB
16000
12000
8000
4000
0
-4000
0
25
50
75
100
125
150
175
200
TIME-MS


EVA FAIRMONT STA. WGN. LOAD CELLS
□= A6
○= B6
△= C6
◇= D6
FORCE-LB
32000
24000
16000
8000
0
-8000
0
25
50
75
100
125
150
175
200
TIME-MS


EVA FAIRMONT STA. WGN. LOAD CELLS
□= A7
○= B7
△= C7
◇= D7
FORCE-LB
32000
24000
16000
8000
0
-8000
0
25
50
75
100
125
150
175
200
TIME-MS


EVA FAIRMONT STA. WGN. LOAD CELLS
□= A8 ○= B8 △= C8 ◇= D8
FORCE-LB
8000
6000
4000
2000
0
-2000
TIME-MS
0
25
50
75
100
125
150
175
200


EVA FAIRMONT STA. WGN. LOAD CELLS
□= A9
○= B9
△= C9
◇= D9
FORCE-LB
3000
2000
1000
0
-1000
-2000
0
25
50
75
100
125
150
175
200
TIME-MS