DOT-HS-805-611

LIGHT TRUCK AGGRESSIVITY STUDY-
TEST REPORT 4-
TRUCK-TO-CAR REAR-END IMPACT TEST

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Contract No. DOT-HS-8-01942
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FINAL REPORT

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TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract

A series of seven full-scale truck-to-car crash tests was conducted as required under Task 2 of DOT-HS-8-01942, "Light Truck Aggressivity Study," sponsored by the National Highway Traffic Safety Administration. This test report presents the results of Test No. 3051-7, rear-end, symmetric, truck-to-car collision. One 1979 Chevrolet C-10, 8-foot, full-bed, 8-cylinder, pickup truck was used as the bullet vehicle for the test. The target vehicle used was a 1978 Plymouth Horizon 4-door sedan.

The object of these tests is to provide truck-to-car collision data. The crash test data from this program will be used to study the aggressivity of light trucks compared to passenger cars, support current vehicle standards, and provide information to upgrade future standards.

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Unclassified	Unclassified	60	

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METRIC CONVERSION FACTORS

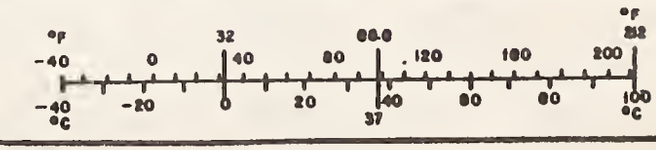
Approximate Conversions to Metric Measures

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	5	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	0.95	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	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

A series of seven full-scale truck-to-car crash tests was conducted as required under Task 2 of DOT-HS-8-01942, "Light Truck Aggressivity Study," sponsored by the National Highway Traffic Safety Administration. This test report presents the results of Test 3051-7, a symmetric, rear-end, truck-to-car collision. A 1979 Chevrolet C-10, 8-foot, full-bed, 8-cylinder, pickup truck was used as the bullet vehicle for the test. This truck was repaired from a previous crash test (Test 3051-3). The target vehicle used in Test 3051-7 was a 1978 Plymouth Horizon 4-door sedan.

1.1 TEST OBJECTIVE

The object of this test is to provide truck-to-car collision data. The crash test data from this program will be used to study the aggressivity of light trucks compared to passenger cars, support current vehicle standards, and provide information to upgrade future standards.

1.2 TEST SCOPE

The test matrix and summary of test conditions for conducting the truck-to-car collision are shown in Table 1-1. For this test, the truck is designated as the bullet vehicle and the car designated as the target vehicle. The target vehicle (Vehicle B) contained two instrumented, Part 572, 50th percentile male anthropomorphic dummies (GFE) in the left front and right rear seating positions.

The truck (Vehicle A) contained one instrumented (driver) and one uninstrumented (passenger) 50th percentile dummy used as ballast. Each occupant was properly restrained with the vehicle's production restraint system. The seat tracks were put at midposition but not welded in place. The centerline of the truck struck the rear centerline of the car.

TABLE 1-1. SUMMARY OF CAR-TO-CAR TEST CONDITIONS - 3051

Test No.	Test Date	Test Condition	Test Vehicle*	Test Weight (lb)	Closing Speed (mph)
3051-1	10/10/78	Head-on (Symmetric)	A - 1979 C-10 Chevrolet Pickup Truck	5180	61.54
			B - 1978 Plymouth Horizon	2688	
3051-2	10/12/78	Head-on (Symmetric)	A - 1979 C-10 Chevrolet Pickup Truck	5182	74.50
			B - 1979 Chevrolet Impala	4404	
3051-3	10/23/78	Left Side - 90° (℄ of A at H-pt.)	A - 1979 C-10 Chevrolet Pickup Truck	5189	29.74
			B - 1978 Plymouth Horizon	2686	
3051-4	11/17/78	Left Side - 90° (℄ of A at H-pt.)	A - 1979 C-10 Chevrolet Pickup Truck	5183	29.99
			B - 1979 Chevrolet Impala	4398	
3051-5	10/30/78	Right Offset (21 in.)	A - 1979 C-10 Chevrolet Pickup Truck	5183	61.62
			B - 1978 Plymouth Horizon	2682	
3051-6	11/28/78	Right Offset (21 in.)	A - 1979 C-10 Chevrolet Pickup Truck	5176	75.78
			B - 1979 Chevrolet Impala	4397	
3051-7	2/01/79	Rear-end (Symmetric)	A - 1979 C-10** Chevrolet Pickup Truck	5178	40.28
			B - 1978 Plymouth Horizon	3008	

2/9/79

*A = Bullet Vehicle; B = Target Car
**Repaired truck from Test 3

2.0 PRESENTATION OF RESULTS (TEST 3051-7)

This section of the report presents the results of Test 3051-7, a symmetric rear-end impact crash test between a 1979 Chevrolet C-10 pickup truck (bullet vehicle) and a 1978 Plymouth Horizon 4-door sedan (target vehicle).

This report presents all test results without analysis or discussion. Included in this document are: still photographs, film chronologies, vehicle damage sketches and tabulated pre- and post-test dimensions, accelerometer location identification, summaries of electronic data, and summaries of the simulated occupant data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the sponsor. Appendix A contains Calcomp plots of all electronic data for this test.

TABLE 2-1. CRASH TEST SUMMARY (TEST 3051-7)

TEST NO. 3051-7 CONTRACT: DOT-HS-8-01942

TEST DATE: February 1, 1979 TIME: 1222 TEMPERATURE: 58 °F

TEST CONFIGURATION: Truck-to-car, symmetric, rear impact

VEHICLE NO. 1: 1979 Chevrolet C-10 Truck

VEHICLE NO. 2: 1978 Plymouth Horizon, 4-door Sedan

VEHICLE DATA:	VEHICLE NO. 1	VEHICLE NO. 2
Overall Length/Width (in.)	217.0/78.0	162.4/66.2
Test Weight by Wheel (lb)	LF: 1406 RF: 1320 LR: 1227 RR: 1225	LF: 882 RF: 959 LR: 555 RR: 612
Test Weight (lb)	5178	3008
Wheelbase (in.)	131.8	99.3
Longitudinal C.G. (From Center of Front Axle) (in.)	62.4	38.5
Impact Angle (deg)*	0	0
Offset Distance (in.)	0	0
Car Speed (mph)	40.28	0
Final Speed (mph @ msec)	+23.5 @ 161	+29.7 @ 161
Velocity Change (mph)	-16.78	+29.7
Maximum Average Compartment Acceleration (G @ msec)	-15.9 @ 33	+19.4 @ 65
Maximum Engine Acceleration (G @ msec)	-12.6 @ 71	+72.6 @ 63
Maximum Mutual Dynamic Crush (Film Data) (in.)	47.2	
Maximum Static Crush		
• Hood Level (in.)	11.2	13.6**
• Between Hood/Bumper (in.)	13.6	22.3***
• Bumper Level (in.)	6.3	15.7
Maximum Post-test Intrusion (in.)	0.4	Not Applicable.
OCCUPANTS		
Type	Alderson Part 572	Alderson Part 572
Location	LF - Driver RF - Passenger	LF - Driver RR - Passenger
Restraints	Standard Lap/ Shoulder Belts	Standard Lap/ Shoulder Belts
INSTRUMENTATION		
Number of Data Channels	14	26
Number of Cameras	5	

*With respect to tow track centerline.

**Vehicle No. 2 Trunk Level.

***Vehicle No. 2 Between Trunk/Bumper.

TABLE 2-2. BULLET VEHICLE INSPECTION SHEET (TEST 3051-7)

Contractor: Dynamic Science, Inc. Contract No.: DOT-HS-8-01942

VIN NO.: CCL449F319894 Make: Chevrolet

NHTSA No.: R&D

Year: 1979 Color: White Model: C-10 Truck

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

Tire Size: L78-15 Ply Rating: Mfg. & Line: Uniroyal F-glass belt R-Snow Plow

Bias Ply: Belted: X Radial /Eng.Type: V-8 Cylinders: 8 Total Displ: 350 CID

Trans, # Fwd. Speeds: 4 Shipping Weight: Odometer: 23

Dealer (name, address, and phone number)

Courtesy Chevrolet
1233 East Camelback Road
Phoenix, Arizona

Remarks (list additional accessories not listed above)

Date of Manufacture: 9-78 Dynamic Science No.: 760 Date Received: 10-12-78

Tilting Steering Wheel: yes (no) Telescoping Steering Wheel: yes (no)

Fuel Capacity: (from owner's manual) "Space Saver" Spare Tire yes (no)

Restraint System: Standard Lap and Shoulder Belts

1. Is the vehicle stock throughout? Describe: Used in Test 3051-3. Bumper, fenders, hood, and left door replaced. Grille replaced with GMC grille. Mirrors, wipers, wheel covers removed. Gas tanks filled 100% with water.

2. Does vehicle show evidence of prior accident history? Describe: See above. Left side of bed dented.

3. Does vehicle show any significant corrosion? Describe: No.

4. Check condition of the front bumper and frame: Satisfactory.

TABLE 2-3. TARGET VEHICLE INSPECTION SHEET (TEST 3051-7)

Contractor: Dynamic Science, Inc. Contract No.: DOT-HS-8-01942

VIN NO.: ML44A8D11B111 Make: Plymouth

NHTSA No.: R&D

Year: 1978 Color: Blue Model: Horizon 4-door sedan

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

Tire Size: P165/75R-13 Ply Rating: 4 Mfg. & Line: Firestone

Bias Ply: Belted: Radial X /Eng.Type: Cylinders: 4 Total Displ: 105 CID

Trans, # Fwd. Speeds: 4 Shipping Weight: Odometer: 15,837.3

Dealer (name, address, and phone number)

Courtesy Chevrolet
1233 East Camelback Road
Phoenix, Arizona

Remarks (list additional accessories not listed above) No front or rear rubber bumper strips as in previous tests.

Date of Manufacture: 01-78 Dynamic Science No.: 802 Date Received: 1-22-79

Tilting Steering Wheel: yes (no) Telescoping Steering Wheel: yes (no)

Fuel Capacity: (from owner's manual) "Space Saver" Spare Tire yes (no)

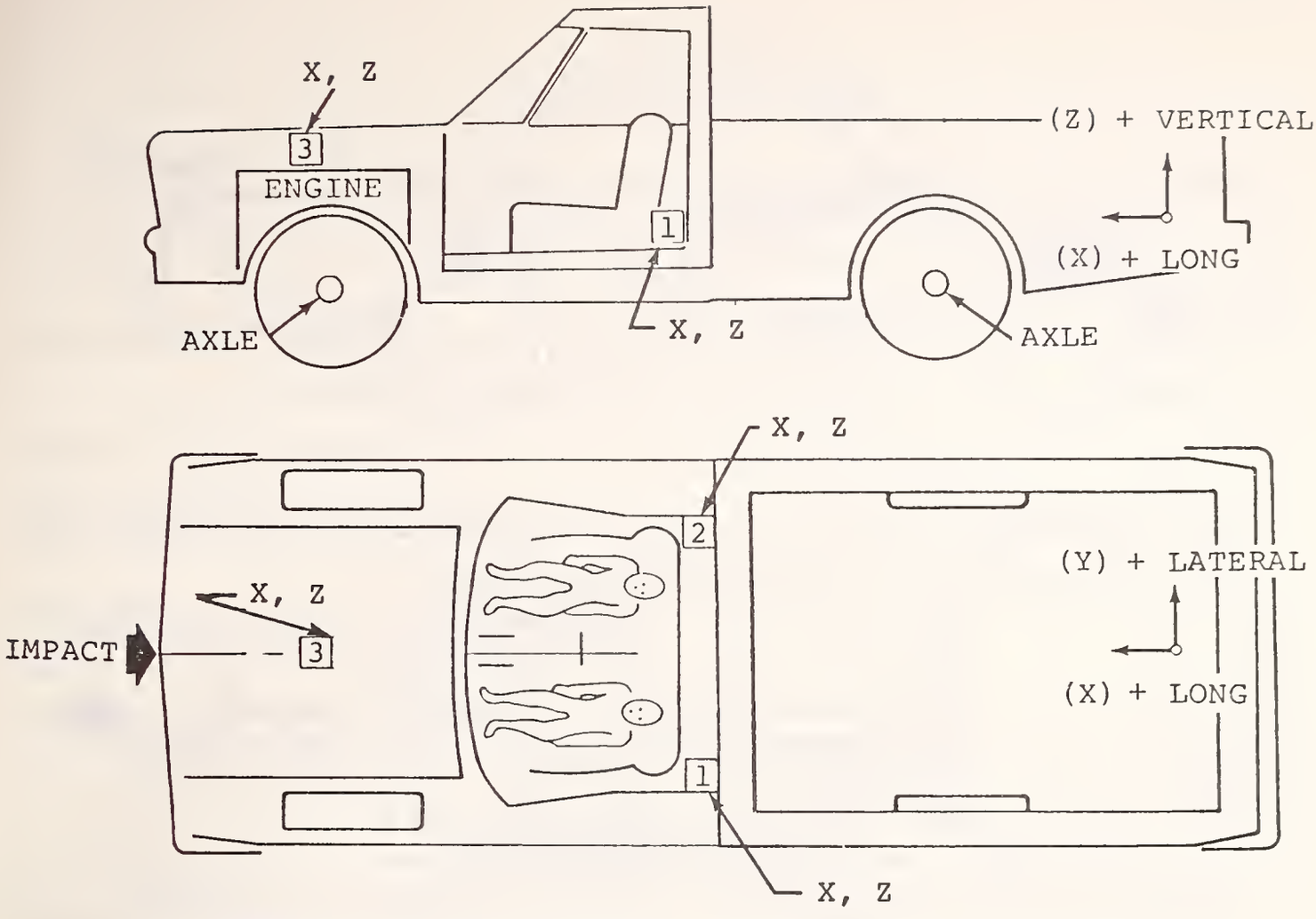
Restraint System: Standard Lap and Shoulder Belt

1. Is the vehicle stock throughout? Describe: Fluids removed except for engine coolant. Hood and battery removed. Gas tank filled with 93% Stoddard Solvent.

2. Does vehicle show evidence of prior accident history? Describe: No.

3. Does vehicle show any significant corrosion? Describe: No.

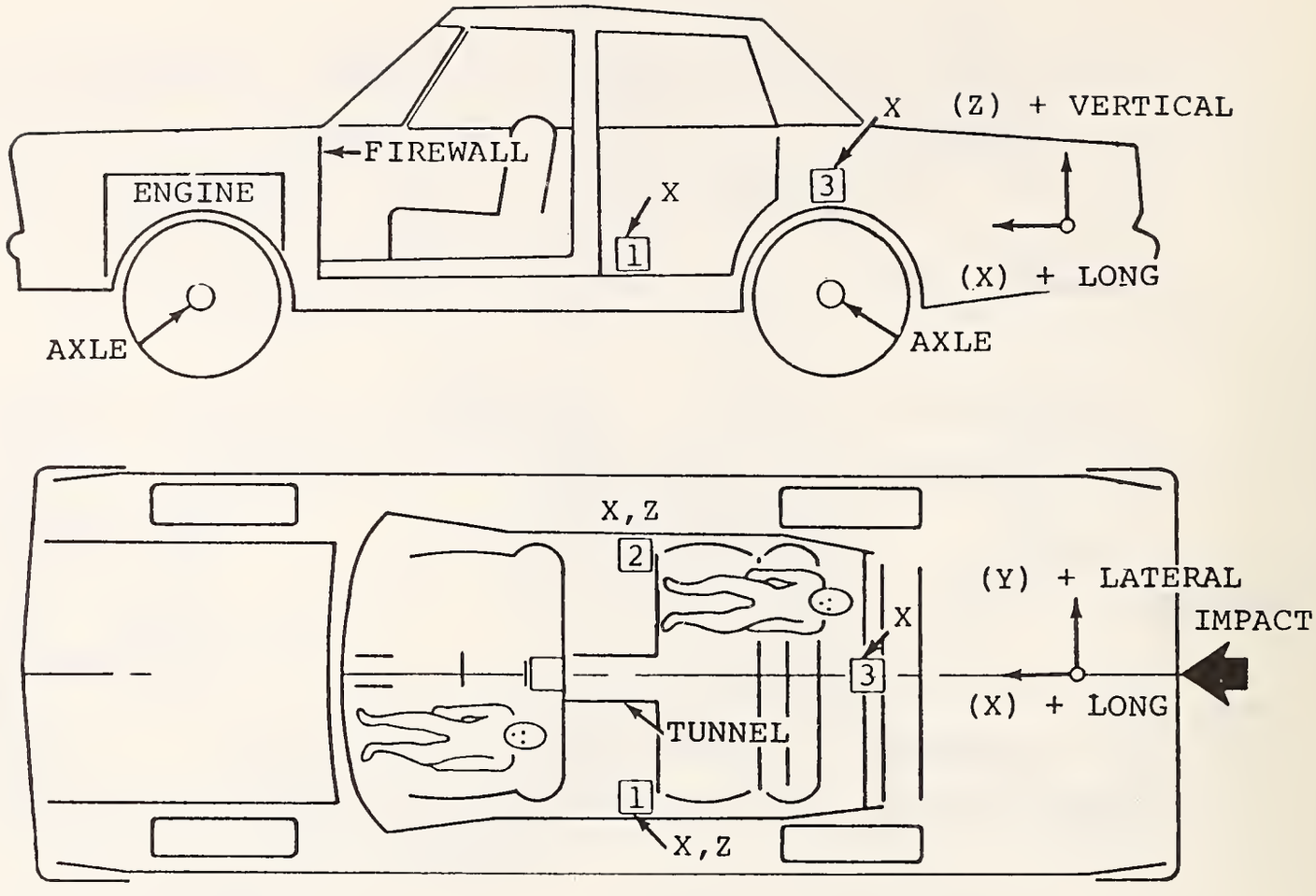
4. Check condition of the front bumper and frame: OK. No rubber bumper strip. Previous Horizons had 1/2-in. rubber strip on bumpers.



VEHICLE ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES					MAXIMUM EXPECTED READINGS	
NO.	DESCRIPTION OF LOCATION	X**	Y**	Z**	LONG* LAT*	VERT*
1	Rocker panel near B-pillar behind driver's seat	112	-28	30	50	50
2	Rocker panel near B-pillar behind passenger's seat	112	28	30	50	50
3	Top of engine block	180	0	36	125	125

*G's
**Reference points:
X - Direction - Centerline of rear bumper
Y - Direction - Centerline of vehicle - left centerline (-), right centerline (+)
Z - Direction - Ground level

Figure 2-1. 1979 Chevrolet C-10 Truck Accelerometer Instrumentation (Test 3051-7)



NO.	DESCRIPTION OF LOCATION	VEHICLE ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES X**	Y**	Z**	MAXIMUM EXPECTED READINGS LONG*	LAT*	VERT*
1	Rocker panel near B-pillar behind driver's seat	94	-24	13	50		50
2	Rocker panel near B-pillar behind passenger's seat	94	+24	13	50		50
3	Rear deck above rear axle	122	0	19	125		

*G's
**Reference points:
X - Direction - Centerline of front bumper
Y - Direction - Centerline of vehicle - left centerline (-), right centerline (+)
Z - Direction - Ground level

Figure 2-2. 1978 Plymouth Horizon Accelerometer Instrumentation (Test 3051-7).

TABLE 2-4. INSTRUMENTATION SUMMARY (TEST 3051-7)

Instrument	Numbers	Total No. of Data Channels
1979 Chevrolet C-10 Truck		
Vehicle Accelerometers*	3 locations	6
Dummy Instrumentation = Head (3), Chest (3)	1 location	6
Seat Belt Load Cells = Lap (1), Shoulder (1)	1 location	2
Impact Switch (Hard Line)	1 location	0
	TOTAL	14 - 1 RSCM
1978 Plymouth Horizon		
Vehicle Accelerometers**	3 locations	5
Dummy Instrumentation = Head (3), Chest (3), Femur (2)	2 locations	16
Seat Belt Load Cells = Lap (2), Shoulder (1)	2 locations	5
Impact Switch	1 location	1
	TOTAL	27 - 2 RSCM's

*See Figure 2-1 for locations.

**See Figure 2-2 for locations.

TABLE 2-5. CAMERA LOCATIONS - REAR IMPACT TESTS (TEST 3051-7)

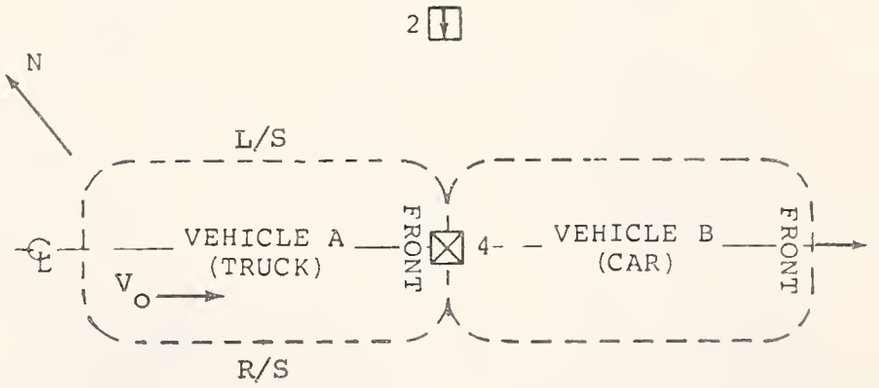
Test No: 3051-7 Test Date: 2-1-79

Test Type: Truck-to-Car Rear Impact Test

Vehicle A (Away): 1979 Chevrolet C-10 Pickup Truck

Vehicle B (Barrier): 1978 Plymouth Horizon

Comments: All high-speed cameras will be perpendicular to the line of vehicle travel.



CAMERA	YES
STILLS	X
SLIDES	X
MOVIE	X
POLAROID	

CAMERA SYMBOLS

- PIT
- GROUND
- BARRIER
- OVERHEAD
- ON-BOARD

FRAME RATE

1. 1000 fr/sec
2. 200 fr/sec
3. Other 24 fr/sec
4. 400 fr/sec
5. 500 fr/sec

TIMING LIGHT SPEED

1. 100 Hz (10 msec/light)
2. 200 Hz (5 msec/light)
3. Other

3

HAND HELD 5

6 1

Loc. No.	Location	Field of View	Lens Size	Frm Rate	Tmng Spd	Ser No	Impact Dist-X	C.L. Dist-Y	CAM Hght-Z
1	Right Side	Overall of Truck and Car	13	1	1	M7			
2	Left Side	A-Pillar of Truck-to-Front of Car B	13	1	1	4			
3	Right Side	Left Front Occupant Compartment Car B	25	5	1	10			
4	Overhead	B-Pillar of Truck-to-Front of Car B	8	1	1	7			
5	Right Side	Panning Test and Overall Results		3					
6	Right Side	Impact of Cars at ≃ 100 msec (Still Camera 4x5 Negative)							

TABLE 2-6. SUMMARY OF PRE-TEST ENGINE/BUMPER/FIREWALL CHARACTERISTICS - CHEVROLET C-10 TRUCK (TEST 3051-7)

Test No.	3051-7	Type	Symmetric, rear impact
Car Model	Chevrolet C-10 Truck	Dynamic Science No.	760

Engine Size	350 CID
Engine Weight* (lb)	675
Engine Height/Width (in.)	35.0/21.1
Bumper to Engine (in.)	28.3
Engine Length (in.)	21.7
Engine to Firewall (in.)	2.2
Bumper to Firewall (in.)	52.2
Bumper Height (in.)	24.4/15.1

*Includes engine and rigid attachments such as transmission and drive train.

TABLE 2-7. CHEVROLET C-10 TRUCK PRE-TEST DUMMY POSITIONS (TEST 3051-7)

Distances (in.)	Driver	Passenger
Chest to Steering Wheel Hub (horizontal)	11.4	
Nose to Steering Wheel Upper Rim	15.2	
Nose to Windshield (horizontal)	25.0	25.2
Knee to Lower Panel (closest point)		
Left	7.9	6.6
Right	7.8	6.9
Chest to Dash (horizontal)	25.1	23.1
Forehead to Header	18.8	19.9

TABLE 2-8. SUMMARY OF PRE-TEST ENGINE/BUMPER/FIREWALL CHARACTERISTICS - PLYMOUTH HORIZON (TEST 3051-7)

Test No. 3051-7	Type Symmetric, rear impact
Car Model Plymouth Horizon	Dynamic Science No. 802

Engine Size	105 CID
Engine Weight* (lb)	475
Engine Height/Width (in.)	30.0/16.2**
Bumper to Engine (in.)	17.1
Engine Length (in.)	12.2
Engine to Firewall (in.)	10.2
Bumper to Firewall (in.)	39.5
Rear Bumper Height (max./min.) (in.)	17.9/12.6

*Includes engine and rigid attachments such as transmission and drive train.

**Engine plus transmission width = 36 in.

TABLE 2-9. PLYMOUTH HORIZON PRE-TEST DUMMY POSITIONS (TEST 3051-7)

Distances (in.)	Driver	Rear Passenger
Chest to Steering Wheel Hub (horizontal)	16.6	
Nose to Steering Wheel Upper Rim*	18.2	21.0
Nose to Windshield (horizontal)**	21.0	8.7
Knee to Lower Panel (closest point)*		
Left	7.2	3.9
Right	8.3	4.0
Chest to Dash (horizontal)*	21.0	19.4
Forehead to Header**	14.0	1.8

*Measured to seat back (closest point).

**Measured from nearest point of dummy head.

a) Pre-test

b) Post-test

Figure 2-3. Pre- and Post-test Vehicle Configuration (Test 3051-7).

Figure 2-4. Post-test Chevrolet C-10 Truck Configuration (Test 3051-7).

Figure 2-5. Post-test Plymouth Horizon Configuration (Test 3051-7).

a) Pre-test Driver

b) Pre-test Passenger

c) Post-test Driver

d) Post-test Passenger

Figure 2-6. Chevrolet C-10 Truck Dummy Configuration (Test 3051-7).

a) Pre-test Driver

b) Pre-test Passenger

c) Post-test Driver

d) Post-test Passenger

Figure 2-7. Plymouth Horizon Dummy Configuration (Test 3051-7).

TABLE 2-10. CHRONOLOGY OF EVENTS (TEST 3051-7)

Time (msec)	Chevrolet C-10 Truck	Time (msec)	Plymouth Horizon
0	Impact (visual).	0	Impact (visual).
8	Truck bumper overrides car bumper and strikes rear of car.	22	Rear fenders buckle.
36	Fenders buckle.	30	Rear window shatters.
39	Dummies start forward motion.	36	Driver and seat move rearward.
70	Hood latch fails.	43	Horizon starts to roll down track.
123	Maximum mutual dynamic crush (47.2 in.).	83	Rear passenger torso starts forward motion.
145	Driver stops forward motion.	90	Rear wheels lock up due to sheet metal intrusion.
150	Passenger stops forward motion.	134	Rear passenger head starts forward motion.
268	Driver recontacts seat back.	184	Driver stops rearward motion.
276	Passenger recontacts seat back.	209	Maximum vehicle inclination, 3.0° downward.
339	Maximum vehicle inclination 1.5° upwards.	422	Rear passenger hits head on front seat headrest.

TABLE 2-11. SUMMARY OF POST-TEST OBSERVATIONS - CHEVROLET C-10 TRUCK (TEST 3051-7)

VEHICLE: 1979 Chevrolet C-10 Truck

Dummy Contact Points:	Left Front	Right Front
Head	None	None
Chest	None	None
Knees	None	None

Glazing: 100% intact and unbroken.

Doors: Both doors difficult to open.

Seat Belt Anchorages and Restraints: OK. No seat movement.

Vehicle Centerline to Barrier Centerline:

Fuel Leakage: None.

General Observations: Truck abort brakes applied 76 ft from impact. Truck came to rest 77.5 ft from impact. Hood latch failed.

TABLE 2-12. SUMMARY OF POST-TEST OBSERVATIONS - PLYMOUTH HORIZON (TEST 3051-7)

VEHICLE: 1978 Plymouth Horizon 4-door Sedan

Dummy Contact Points:	Left Front	Right Front
Head----------	Headrest	Front seat Headrest
Chest----------	None	None
Knees----------	None	Back of front seat

Glazing: Front windshield unbroken and retained. Rear window shattered and 0% retained.

Doors: Latch striker of left rear door sheared off. Door opened easily. All other doors required tools to open.

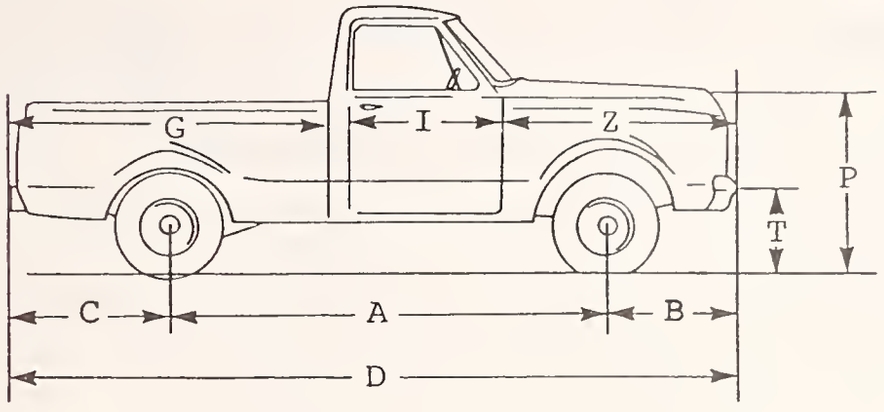
Seat Belt Anchorages and Restraints: Driver seat back bent back and seat was pulled from right side track. Rear seat right side latch and hinge failed.

Vehicle Centerline to Barrier Centerline:

Fuel Leakage: None.

General Observations: Vehicle pushed off concrete onto oval track. Rear of car 77.5 ft from impact. Driver headrest came off. Abort brakes applied 34.5 ft from impact.

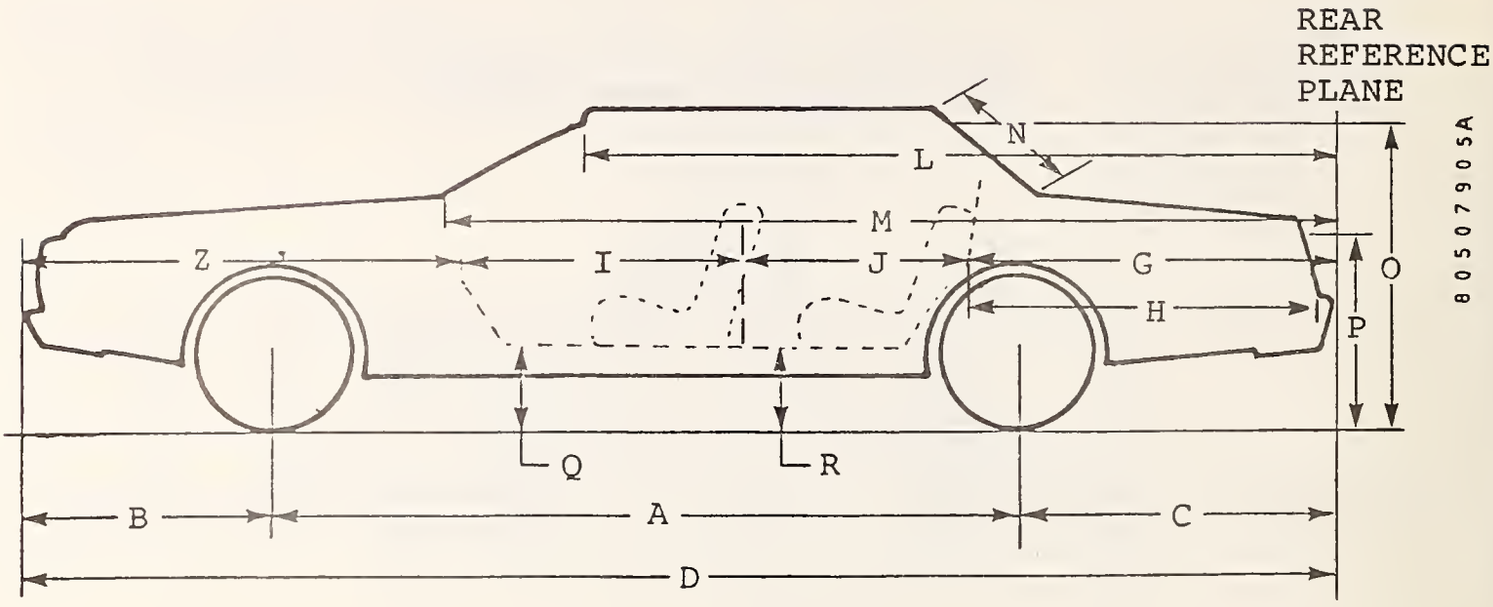
TABLE 2-13. PRE- AND POST-TEST DIMENSION MEASUREMENTS - BULLET VEHICLE (TEST 3051-7)



VEHICLE: 1979 Chevrolet C-10 Truck

	Pre-test (in.)		Post-test (in.)		Difference (in.)	
	LS	RS	LS	RS	LS	RS
A	131.9	131.6	131.6	131.8	0.3	-0.2
B	32.5	33.2	31.1	31.1	1.4	1.1
C	52.1	52.2	52.0	52.2	0.1	0.0
D	216.5	217.0	214.7	215.1	1.8	1.9
I	38.4	38.7	38.3	38.6	0.1	0.1
G	107.6	107.9	107.5	108.0	0.1	-0.1
P	39.2	39.6	38.9	37.8	0.3	1.8
T	22.8	23.6	23.9	25.2	-1.1	-1.6
Z	63.6	63.4	62.1	61.7	1.4	1.7

TABLE 2-14. PRE- AND POST-TEST DIMENSION MEASUREMENTS - TARGET VEHICLE (TEST 3051-7)



VEHICLE: 1978 Plymouth Horizon 4-door Sedan

	Pre-test (in.)		Post-test (in.)		Difference (in.)	
	LS	RS	LS	RS	LS	RS
A	99.2	99.3	96.5	98.4	2.7	0.9
B	31.3	31.1	31.2	31.3	0.1	-0.2
C	31.9	32.0	18.5	19.7	13.4	12.3
D	162.4	162.4	146.2	149.5	16.2	12.9
I	37.6	37.7	37.3	37.3	0.3	0.4
J	31.7	31.6	30.5	31.0	1.2	0.6
G	38.6	38.7	26.3	26.2	12.3	12.5
H	31.9	32.3	15.6	11.2	16.6	21.1
L	89.1	89.3	75.4	76.5	13.7	12.8
M	108.8	108.8	92.4	95.7	16.4	13.1
N	34.7	35.0	32.6	30.9	2.1	4.1
O	52.8	52.8	56.8	55.0	-4.0	-2.2
P	30.5	30.7	28.0	31.0	2.5	-0.3
Q	13.2	13.2	13.6	12.5	-0.4	0.7
R	13.6	13.3	14.1	12.4	-0.5	0.9
Z	51.8	51.7	52.0	52.0	-0.2	-0.3

TABLE 2-15. CHEVROLET C-10 TRUCK EXTERIOR PROFILES AND STATIC CRUSH (TEST 3051-7)

Location	Height at ℄	RP**	Distance Left of Center (in.)*							Distance Right of Center (in.)*					
			36	30	24	18	12	6	0	6	12	18	24	30	36
Pre-test Profile (Distance From R.P. - in.)															
Hood Level	39.5	220	8.4	8.1	6.3	6.1	5.9	5.7	5.6	5.6	5.7	5.8	6.0	8.0	8.0
Between Bumper/Hood	32.6	220	9.0	9.7	6.5	6.2	6.0	5.9	5.8	5.7	5.8	6.0	6.1	9.5	8.5
Bumper Level	20.4	220	5.7	4.4	4.0	3.8	3.6	3.9	3.9	3.9	3.4	3.5	3.6	4.0	5.1
Post-test Profile (Distance From R.P. - in.)															
Hood Level	39.5	220	9.9	13.6	14.0	12.9	12.0	12.0	12.0	11.9	13.2	14.5	17.2	16.5	12.5
Between Bumper/Hood	31.0	220	10.7	16.1	16.5	16.6	15.6	15.9	16.1	14.4	15.0	15.7	19.6	18.4	13.5
Bumper Level	23.0	220	8.0	6.4	6.0	5.4	5.1	5.8	5.8	5.7	5.0	6.1	7.5	8.9	11.4
Post-test Static Crush (in.)															
Head Level	0.0		1.5	5.5	7.7	6.8	6.1	6.3	6.4	6.3	7.5	8.7	11.2	8.5	4.5
Between Bumper/Hood	1.6		1.7	6.4	10.0	10.4	11.6	10.0	10.3	8.7	9.2	9.7	13.6	8.9	5.0
Bumper Level	-2.6		2.3	2.0	2.0	1.6	1.5	1.9	1.9	1.8	1.6	1.6	3.9	4.9	6.3

*As viewed from driver position in truck.

**Reference Plane from rear bumper of truck.

TABLE 2-16. CHEVROLET C-10 TRUCK INTERIOR PROFILES AND STATIC INTRUSION (TEST 3051-7)

Location	Height at ℄	RP**	Distance Left of Center (in.)*							Distance Right of Center (in.)*					
			36	30	24	18	12	6	0	6	12	18	24	30	36
Pre-test Profile (Distance From R.P. - in.)															
Dash Level	49.3	130		19.3	21.3	21.5	21.1	19.1	24.3	24.3	24.3	24.1	23.6	23.0	
Knee Level	37.1	130		20.4	22.6	22.8	22.6	20.7	23.5	23.7	23.7	23.7	23.3	23.1	
Floor Level	27.9	140		21.7	21.8	22.1	22.7	21.6	20.9	21.1	22.0	21.8	21.6	21.5	
Post-test Profile (Distance From R.P. - in.)															
Dash Level	49.5	130		19.1	21.1	21.4	21.1	19.0	24.3	24.2	24.1	23.9	23.4	22.0	
Knee Level	37.0	130		20.1	22.4	22.5	22.3	20.3	23.4	23.5	23.6	23.6	23.2	23.0	
Floor Level	27.9	140		21.6	21.7	22.1	22.7	21.6	20.9	21.1	22.0	21.8	21.6	21.5	
Post-test Static Crush (in.)															
Dash Level	0.02		0.2	0.2	0.1	0.0	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.2	
Knee Level	-0.01		0.3	0.2	0.3	0.3	0.4	0.1	0.2	0.2	0.1	0.1	0.1	0.1	
Floor Level	0.0		0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

*As viewed from driver position in truck.

**Reference Plane from rear bumper of truck.

TABLE 2-17. PLYMOUTH HORIZON EXTERIOR PROFILES AND STATIC CRUSH (TEST 3051-7)

Location	Height at ℄	RP**	Distance Left of Center (in.)*						Distance Right of Center (in.)*				
			27	24	18	12	6	0	6	12	18	24	27
Pre-test Profile (Distance from R.P. - in.)													
Trunk Level	30.1	165	10.1	9.4	8.7	8.4	8.1	8.1	8.1	8.3	8.6	9.2	9.7
Between Bumper/ Trunk	22.4	165	10.0	9.3	8.6	8.2	8.0	8.0	8.0	8.3	8.7	9.4	10.1
Bumper Level	17.8	165	3.8	4.0	3.5	3.2	2.9	2.9	2.9	3.2	3.5	4.0	3.9
Post-test Profile (Distance from R.P. - in.)													
Trunk Level	24.8	155	12.2	12.1	12.3	11.2	10.5	11.3	11.4	11.5	12.1	11.2	10.6
Between Bumper/ Trunk	15.0	155	15.4	16.0	17.5	19.5	19.9	20.3	20.0	20.0	19.0	15.5	14.2
Bumper Level	7.1	155	--	7.1	7.1	8.1	8.1	8.2	8.5	8.9	9.2	9.6	9.1
Post-test Static Crush (in.)													
Trunk Level	5.3	10	12.1	12.7	13.6	12.8	12.4	13.2	13.3	13.2	13.5	12.0	10.9
Between Bumper/ Trunk	7.4	10	15.4	16.7	18.9	21.3	21.9	22.3	22.0	21.7	20.3	16.1	14.1
Bumper Level	10.7	10	--	13.1	13.6	15.1	15.2	15.3	15.6	15.7	15.7	15.6	15.2

*As viewed from driver position in car.

**Reference Plane from front bumper of car.

TABLE 2-18. PLYMOUTH HORIZON EXTERIOR PROFILES AND STATIC CRUSH (TEST 3051-7)

Location	Height	R.P.* (in.)	Distance Left of Center (in.)** 24	18	12	6	0	Distance Right of Center (in.)** 6	12	18	24
Pre-test Profile (Distance from R.P. - in.)											
Upper Windowsill	53.3	165	37.9	38.1	38.6	38.7	38.7	38.7	38.6	38.1	37.7
Midwindow	43.4	165	26.2	26.8	26.8	26.7	26.6	26.6	26.6	26.6	25.9
Lower Windowsill	35.4	165	14.5	13.2	12.9	12.6	12.5	12.6	12.9	13.1	14.3
Post-test Profile (Distance from R.P. - in.)											
Upper Windowsill	57.2	165	38.8	38.9	39.4	39.4	39.4	39.3	39.0	38.4	38.3
Midwindow	47.4	165	29.6	29.1	28.6	28.1	27.6	27.0	26.5	26.0	25.5
Lower Windowsill	35.0	165	21.6	23.1	22.4	21.9	21.6	21.5	21.5	21.9	19.7
Post-test Static Crush (in.)											
Upper Windowsill	3.9	165	0.9	0.8	0.8	0.7	0.7	0.6	0.4	0.3	0.6
Midwindow	4.0	165	3.4	2.3	1.8	1.4	1.0	0.4	-0.1	-0.6	-0.4
Lower Windowsill	0.4	165	7.1	9.9	9.5	9.3	9.1	8.9	8.6	8.8	8.4

*Reference Plane from front bumper of car.
**As viewed from driver position in car.

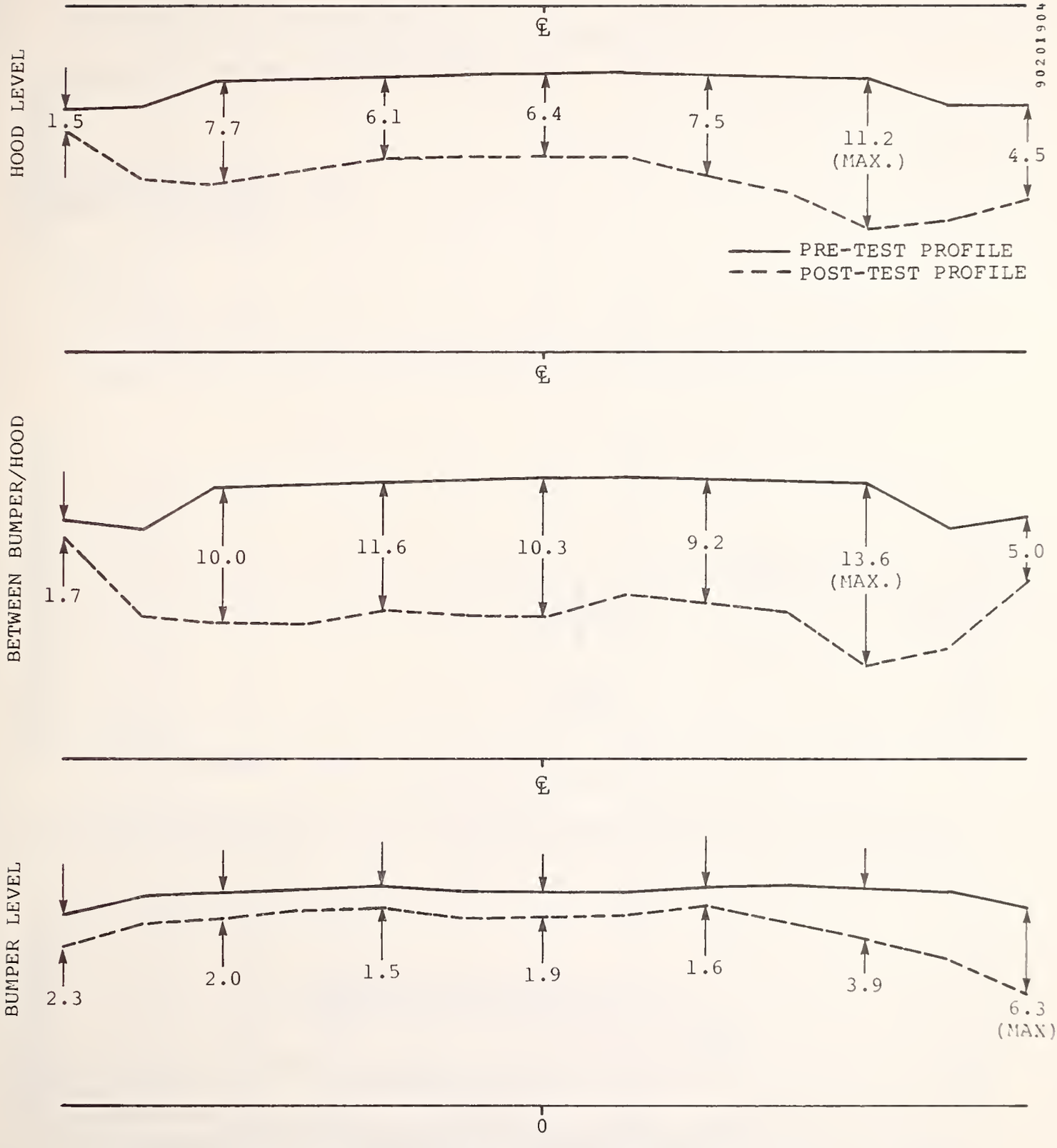


Figure 2-8. Chevrolet C-10 Truck Exterior Static Crush (Test 3051-7).

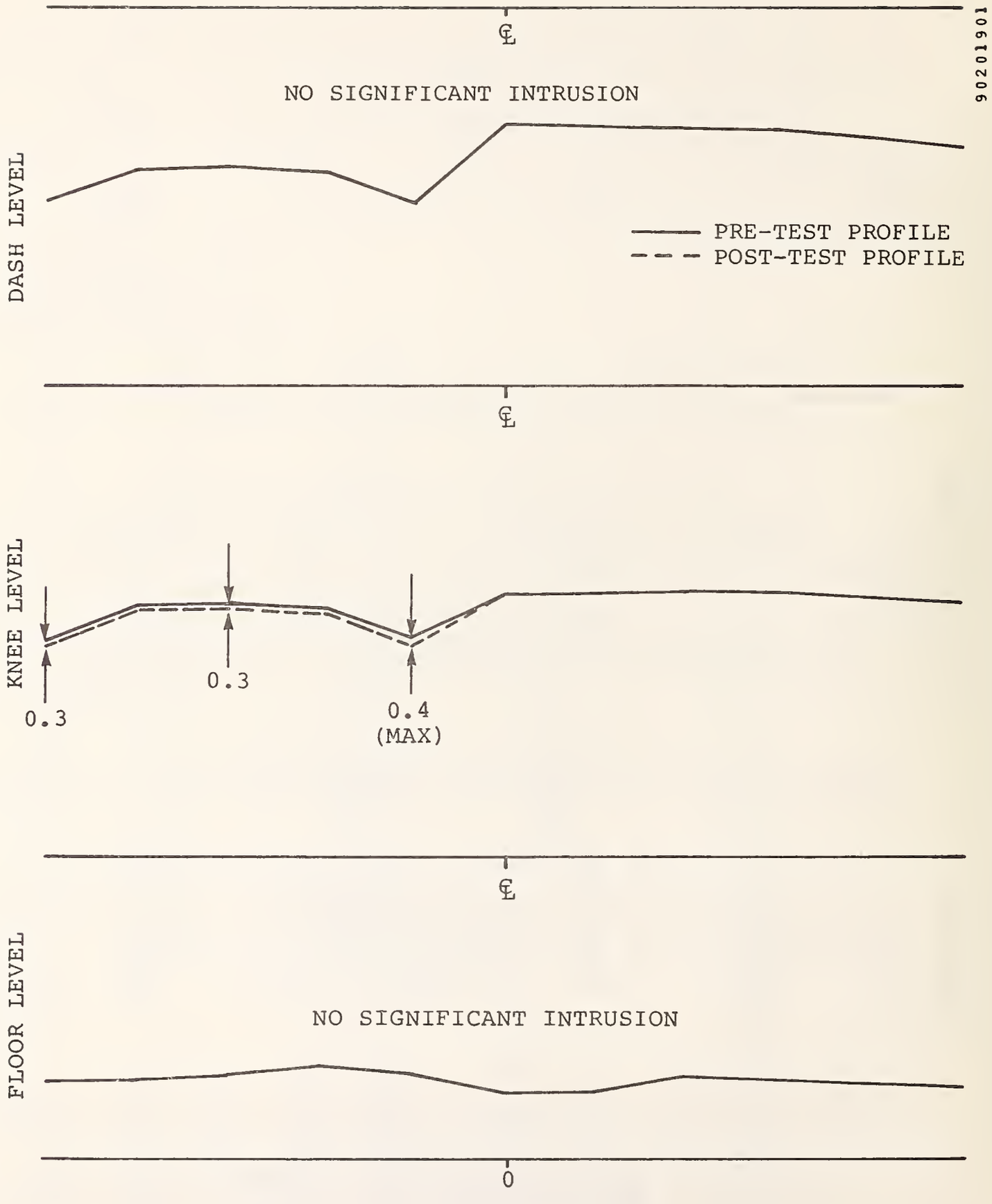


Figure 2-9. Chevrolet C-10 Truck Interior Intrusion (Test 3051-7).

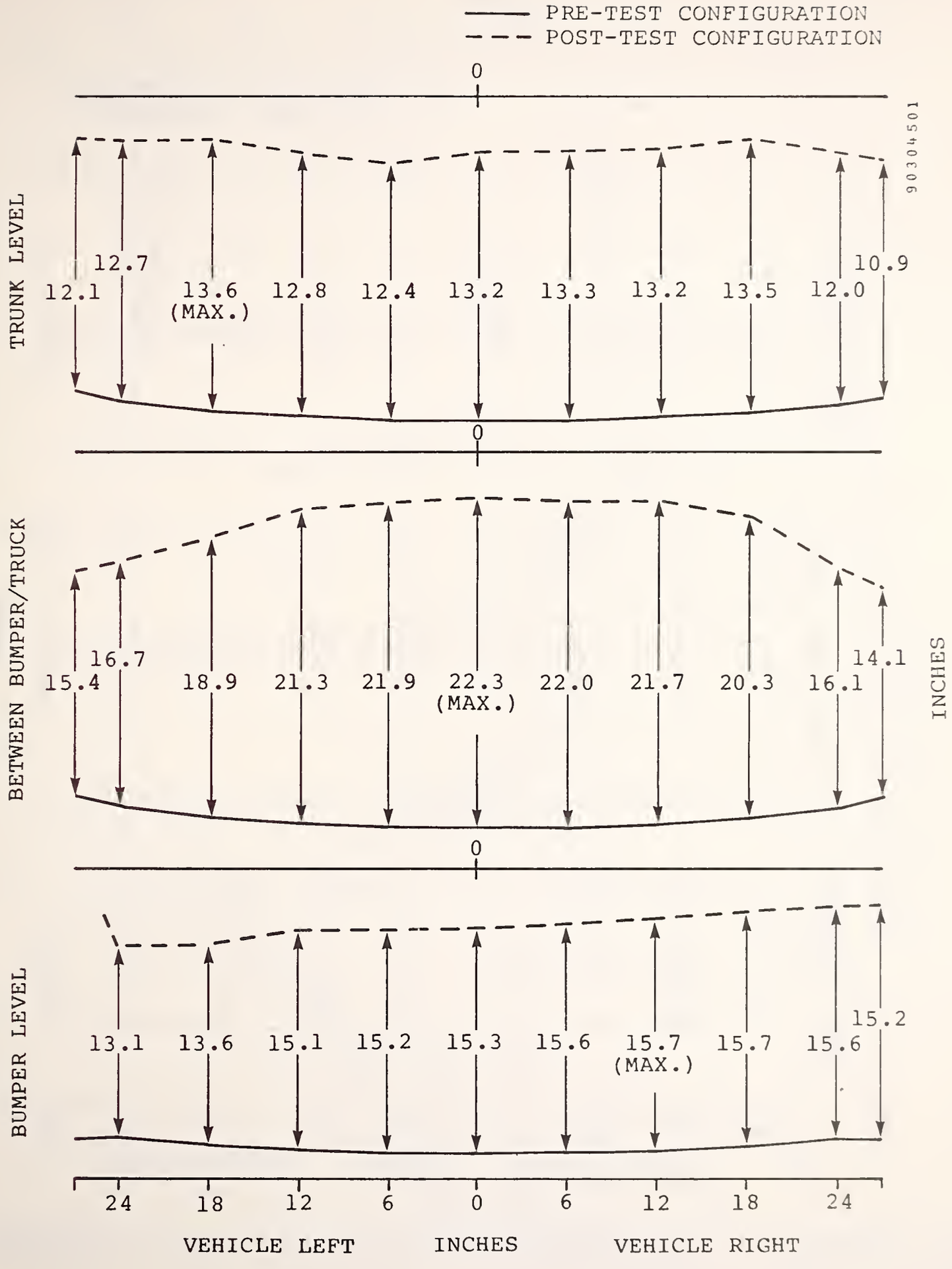


Figure 2-10. Plymouth Horizon Rear Exterior Crush (Test 3051-7).

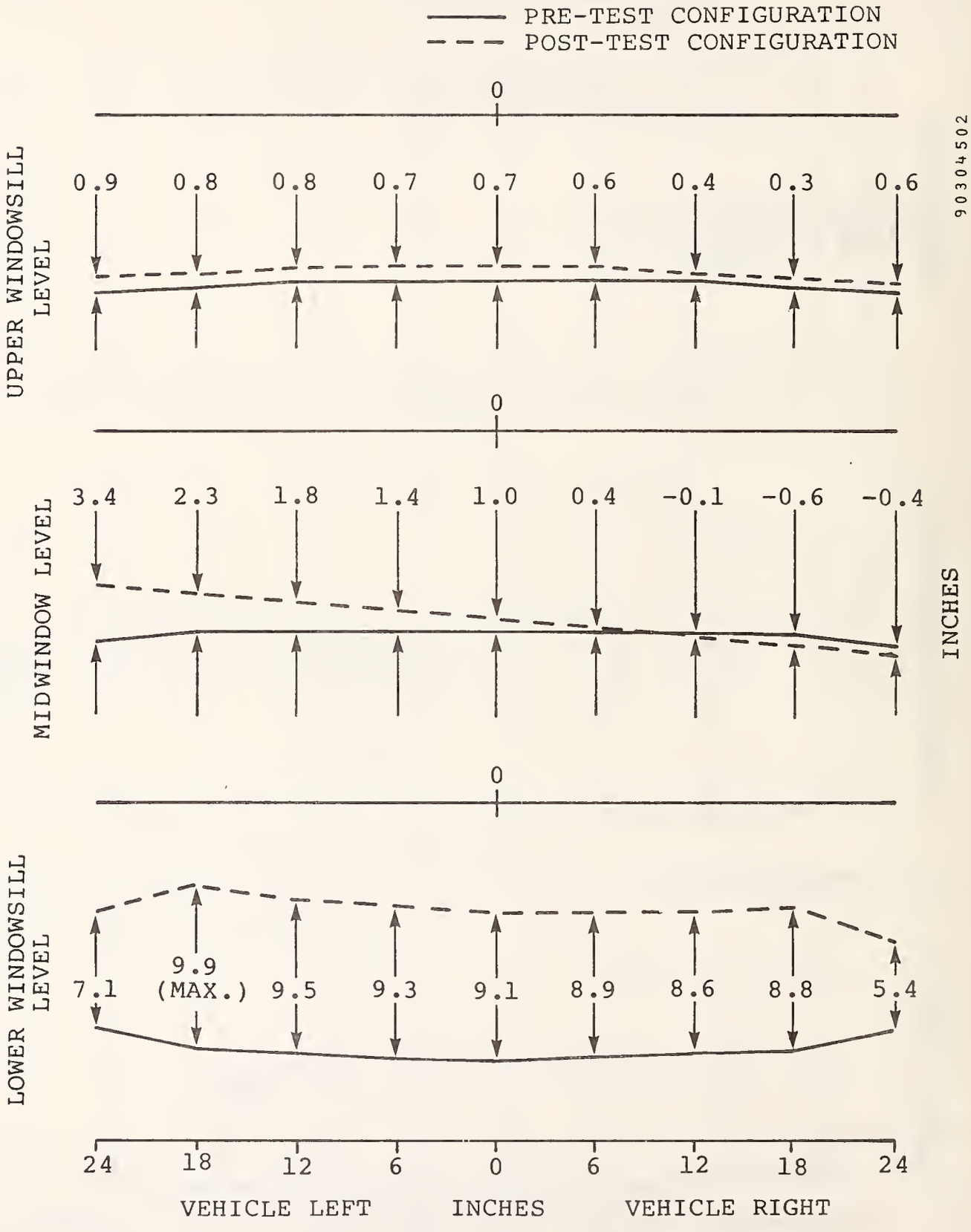


Figure 2-11. Plymouth Horizon Rear Exterior Crush of Hatchback (Test 3051-7).

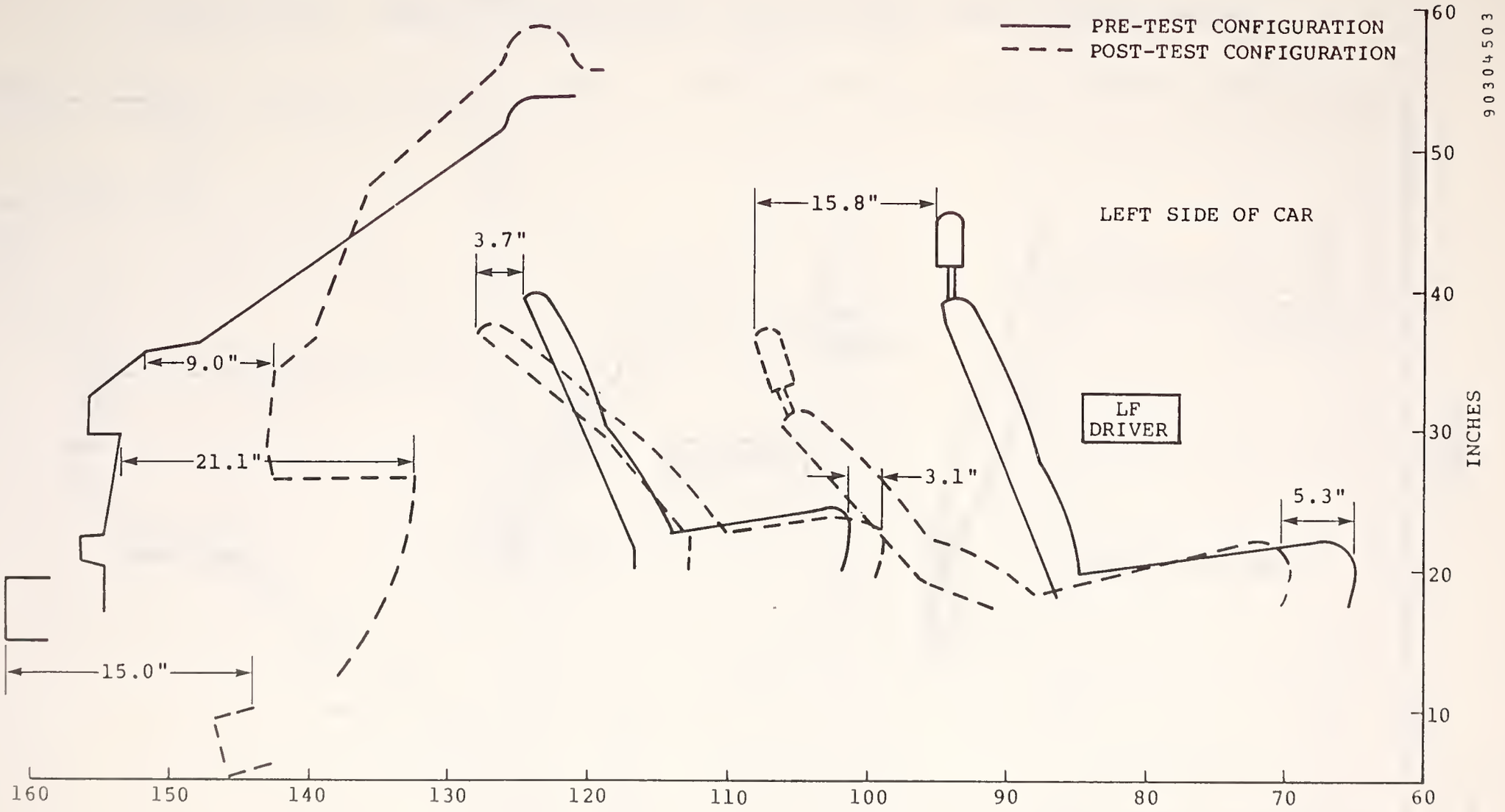


Figure 2-12. Plymouth Horizon Pre- and Post-test Seat Configurations - Left Side (Test 3051-7).

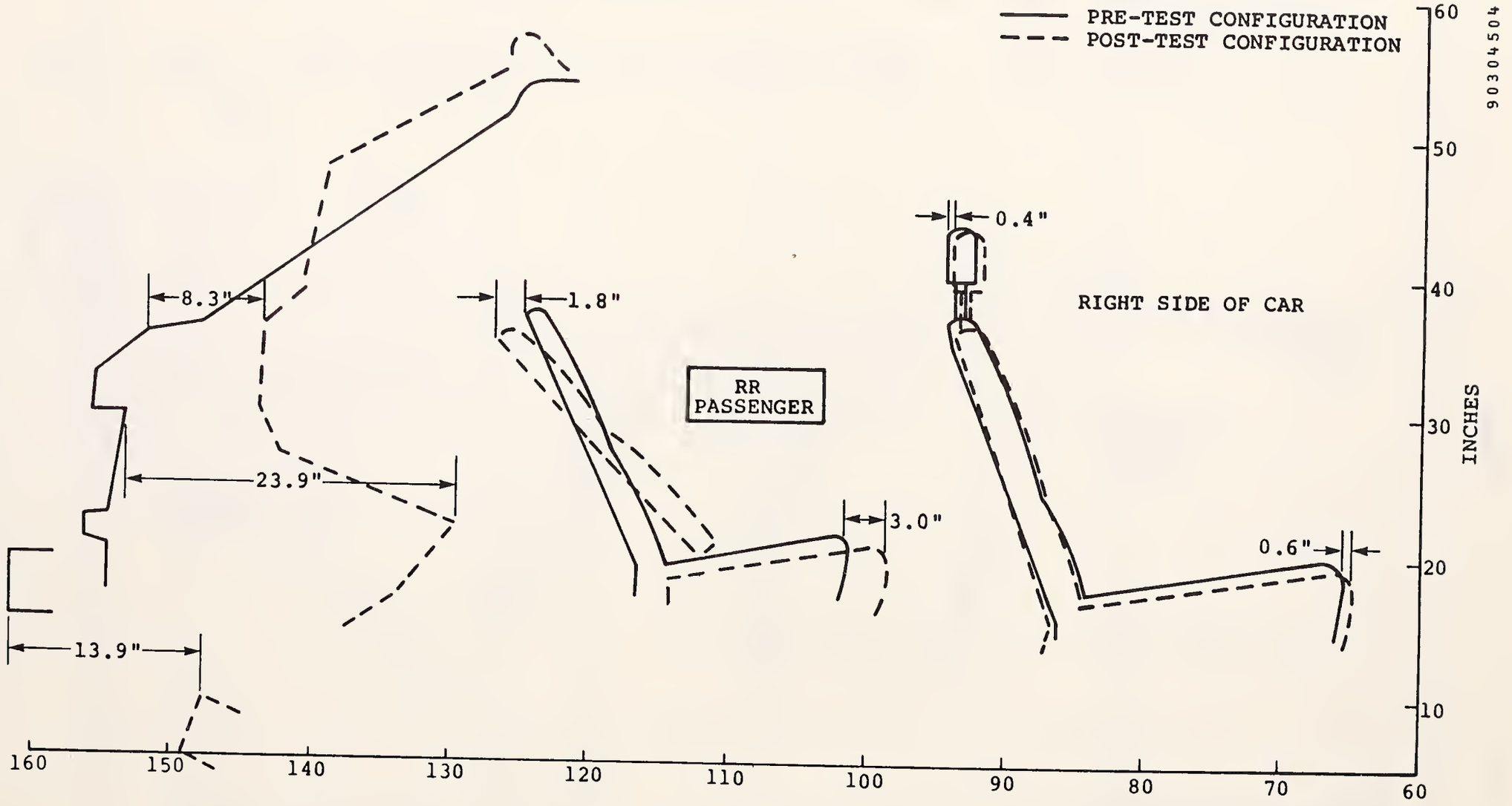


Figure 2-13. Plymouth Horizon Pre- and Post-test Seat Configurations - Right Side (Test 3051-7).

TABLE 2-19. CHEVROLET C-10 TRUCK STEERING WHEEL MEASUREMENTS AND DISPLACEMENT VALUES (TEST 3051-7)

Wheel Location	Pre-test (in.)			Post-test (in.)			Displacement (in.)		
	X*	Y*	Z*	X	Y	Z	X	Y	Z
Top	140.7	-18.3	53.2	140.6	-18.3	53.4	-0.1	0.0	0.2
Hub	138.5	-18.3	45.5	138.4	-18.3	45.8	-0.1	0.0	0.3
Bottom	134.8	-18.3	39.2	134.6	-18.3	39.5	-0.2	0.0	0.3

*Reference for X, Y, and Z measurements are rear bumper, vehicle centerline, and ground level, respectively.

TABLE 2-20. PLYMOUTH HORIZON STEERING WHEEL MEASUREMENTS AND DISPLACEMENT VALUES (TEST 3051-7)

Wheel Location	Pre-test (in.)			Post-test (in.)			Displacement (in.)		
	X*	Y*	Z*	X	Y	Z	X	Y	Z
Top	63.6	-13.2	40.9	63.6	-13.2	40.9			
Hub	63.1	-13.2	32.7	63.1	-13.2	32.7	No change		
Bottom	70.1	-13.2	28.4	70.1	-13.2	28.4			

*Reference for X, Y, and Z measurements are front bumper, vehicle centerline, and ground level, respectively.

TABLE 2-21. SUMMARY OF VEHICLE ACCELEROMETER DATA (TEST 3051-7)

Accelerometer No.**	Maximum Acceleration A (G)	Maximum Acceleration Time (msec)	Minimum Velocity* V (mph)	Minimum Velocity* Time (msec)	Maximum Displacement S (in.)	Maximum Displacement Time (msec)
VEHICLE: 1979 Chevrolet C-10 Truck						
1X	-18.2	34	23.0	200	104.3	200
1Z	-7.5	91	-1.6	149	-2.1	200
2X	-14.7	32	23.1	184	103.9	200
2Z	-7.0	29	-0.5	52	0.4	136
Average 1X and 2X	-15.9	33	23.1	188	104.1	200
3X	-12.6	71	23.1	198	104.3	200
3Z	5.2	50	-1.3	129	-1.5	200
VEHICLE: 1978 Plymouth Horizon 4-door Sedan						
1X	24.8	64	27.6	148	60.2	200
1Z	26.5	60	1.9	23	-1.2	200
2X	20.0	104	32.0	159	68.1	200
2Z	-12.5	105	1.8	76	1.8	135
Average 1X and 2X	19.4	65	29.7	161	64.2	200
3X	72.6	63	28.8	94	71.5	200

*Maximum velocity for Plymouth Horizon.
**See Figures 2-1 and 2-2 for definition of accelerometer locations.

TABLE 2-22. OCCUPANT RESPONSE DATA SUMMARY (TEST 3051-7)

	VEHICLE: 1979 Chevrolet C-10 Truck				VEHICLE: 1978 Plymouth Horizon 4-dr Sedan			
	LEFT FRONT OCCUPANT		RIGHT FRONT OCCUPANT		LEFT FRONT OCCUPANT		RIGHT REAR OCCUPANT	
	MAX VALUE (G)	T (MSEC)	MAX VALUE (G)	T (MSEC)	MAX VALUE (G)	T (MSEC)	MAX VALUE (G)	T (MSEC)
HEAD								
X	-17.6	144	ND		106.9	125	53.6	61
Y	-5.5	125	ND		-18.6	125	-15.8	64
Z	13.9	86	ND		21.9	123	27.3	73
R*	16.4	127	ND		48.5	130	36.1	71
HIC	53.3 @ 79 - 160				108.6 @ 119 - 174		177.4 @ 60 - 101	
CHEST								
X	-16.0	93	ND		29.0	125	32.8	60
Y	-3.2	97	ND		-5.5	167	10.6	82
Z	-4.7	138	ND		11.2	139	17.0	69
R*	15.2	91	ND		27.1	128	35.4	68
SI	31.2 @ 200				94.5 @ 200		178.5 @ 200	
	MAX VALUE (LB)	T (MSEC)	MAX VALUE (LB)	T (MSEC)	MAX VALUE (LB)	T (MSEC)	MAX VALUE (LB)	T (MSEC)
FEMURS								
LF	ND		ND		-210	70	-1098	84
RT	ND		ND		+175	132	-921	84

*3-msec clip.
ND - data was not measured.

TABLE 2-23. SUMMARY OF RESTRAINT SYSTEM DATA (TEST 3051-7)

	Peak Load (lb) @ Time (msec)
VEHICLE: 1979 Chevrolet C-10 Truck	
Left Front Occupant	
Peak Shoulder Belt Load	905 @ 94
Peak Left Lap Belt Load	620 @ 101
Peak Right Lap Belt Load	ND
Right Front Occupant	
Peak Shoulder Belt Load	ND
Peak Left Lap Belt Load	ND
Peak Right Lap Belt Load	ND
VEHICLE: 1978 Plymouth Horizon 4-door Sedan	
Left Front Occupant	
Peak Shoulder Belt Load	41 @ 106
Peak Left Lap Belt Load	164 @ 200
Peak Right Lap Belt Load	212 @ 134
Right Rear Occupant	
Peak Left Lap Belt Load	167 @ 138
Peak Right Lap Belt Load	*

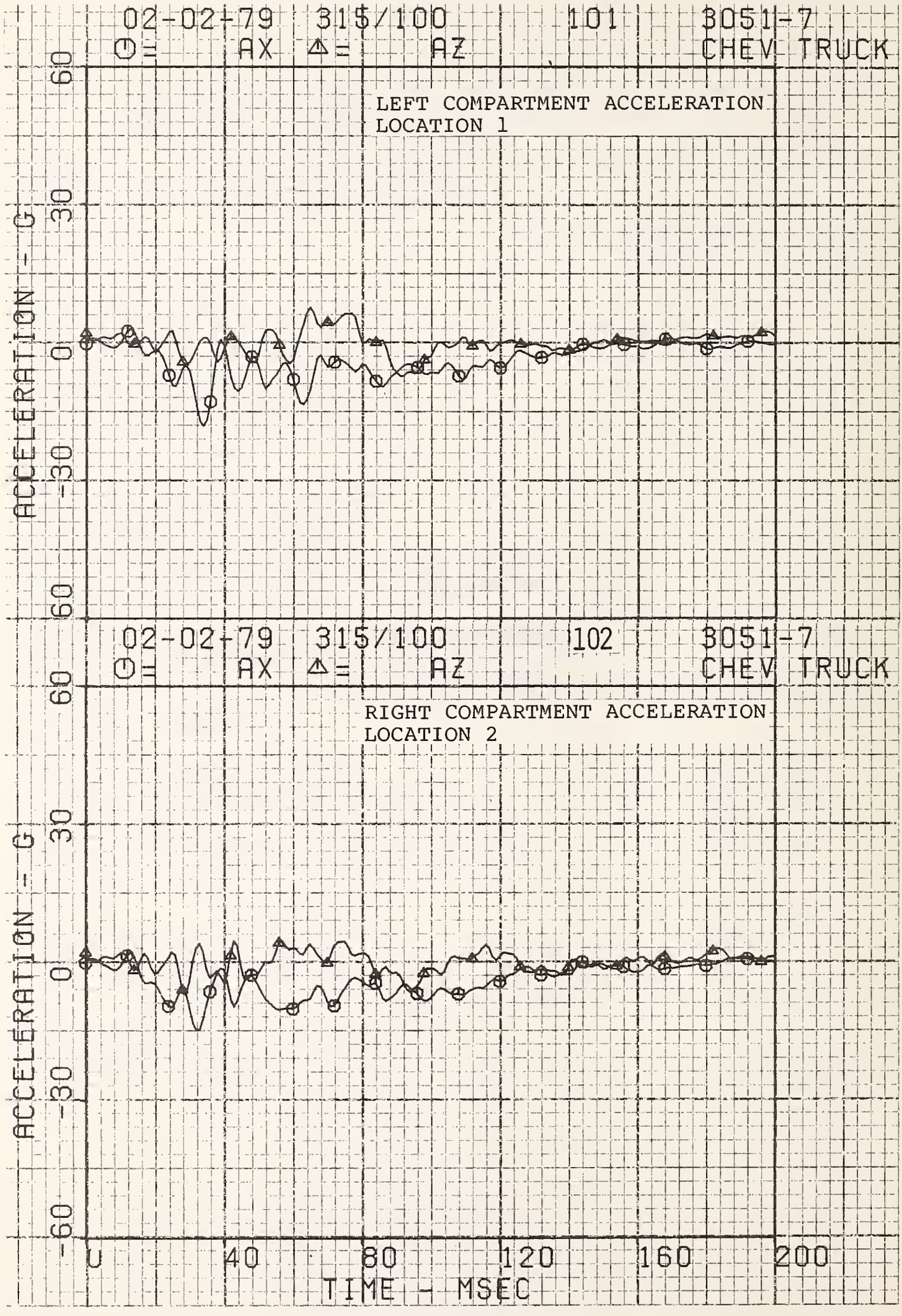
ND = No Data (Data not measured)

*Transducer Failure

APPENDIX A

CALCOMP PLOTS

(TEST 3051-7)


02-02-79 315/100 101 3051-7
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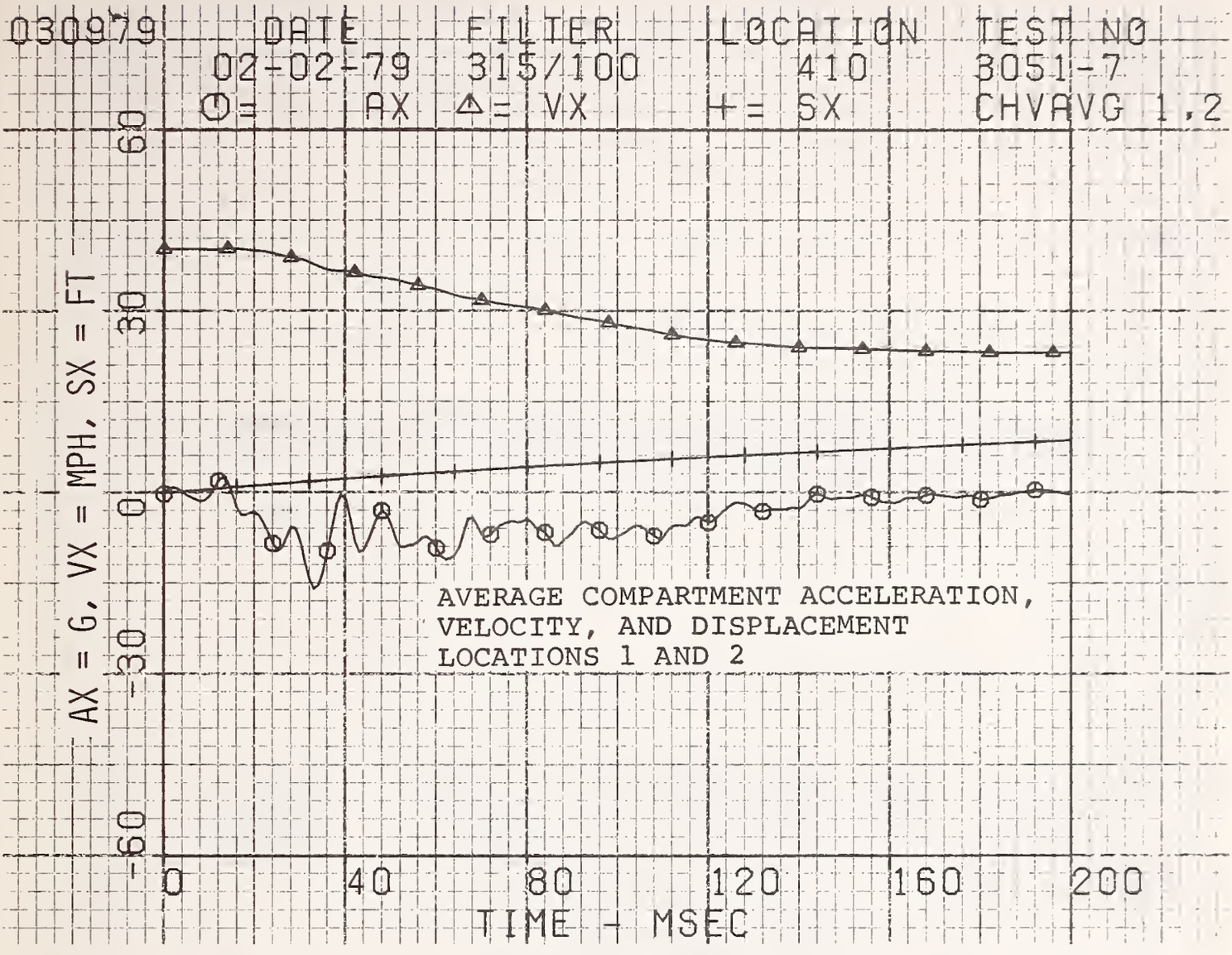
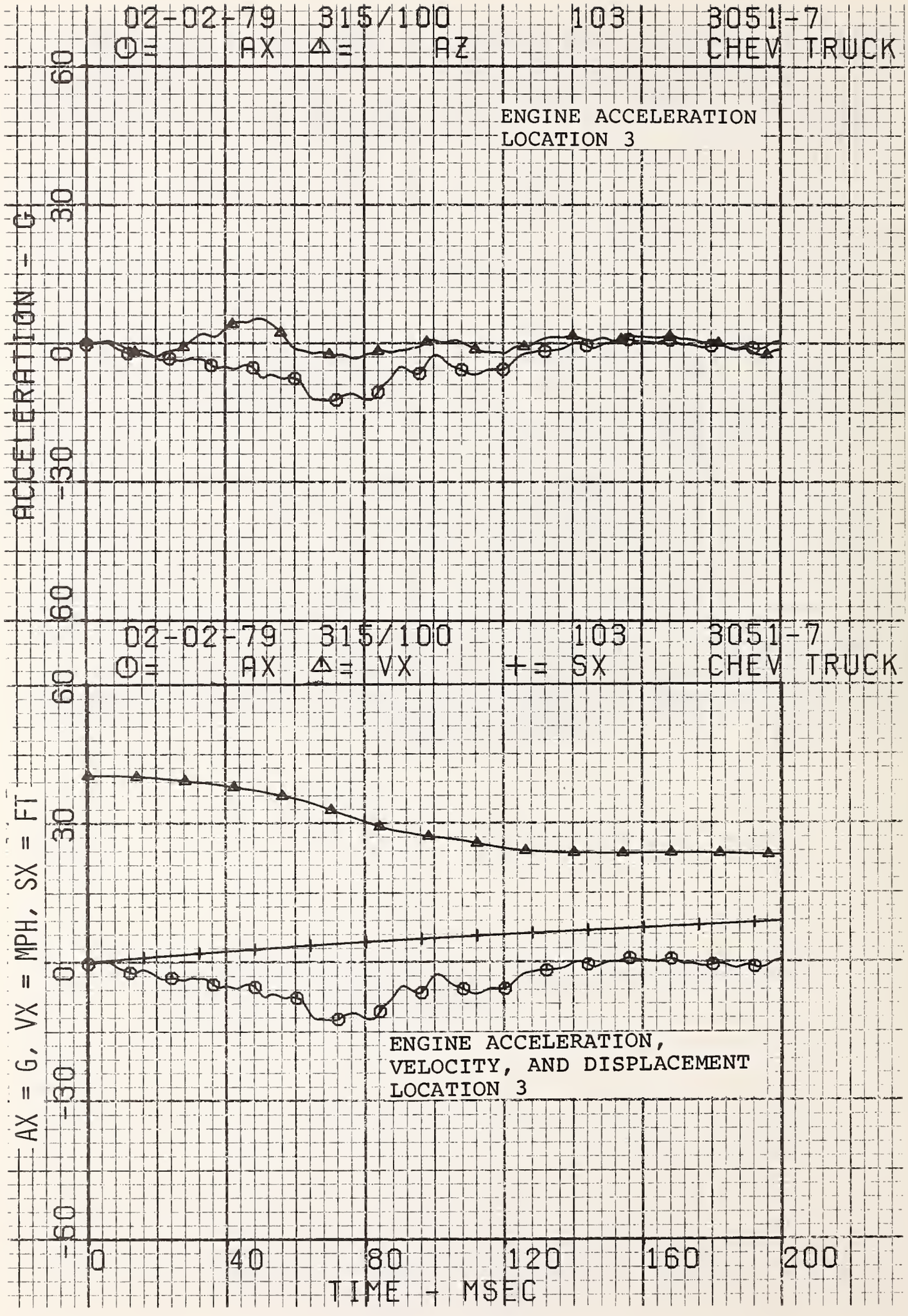
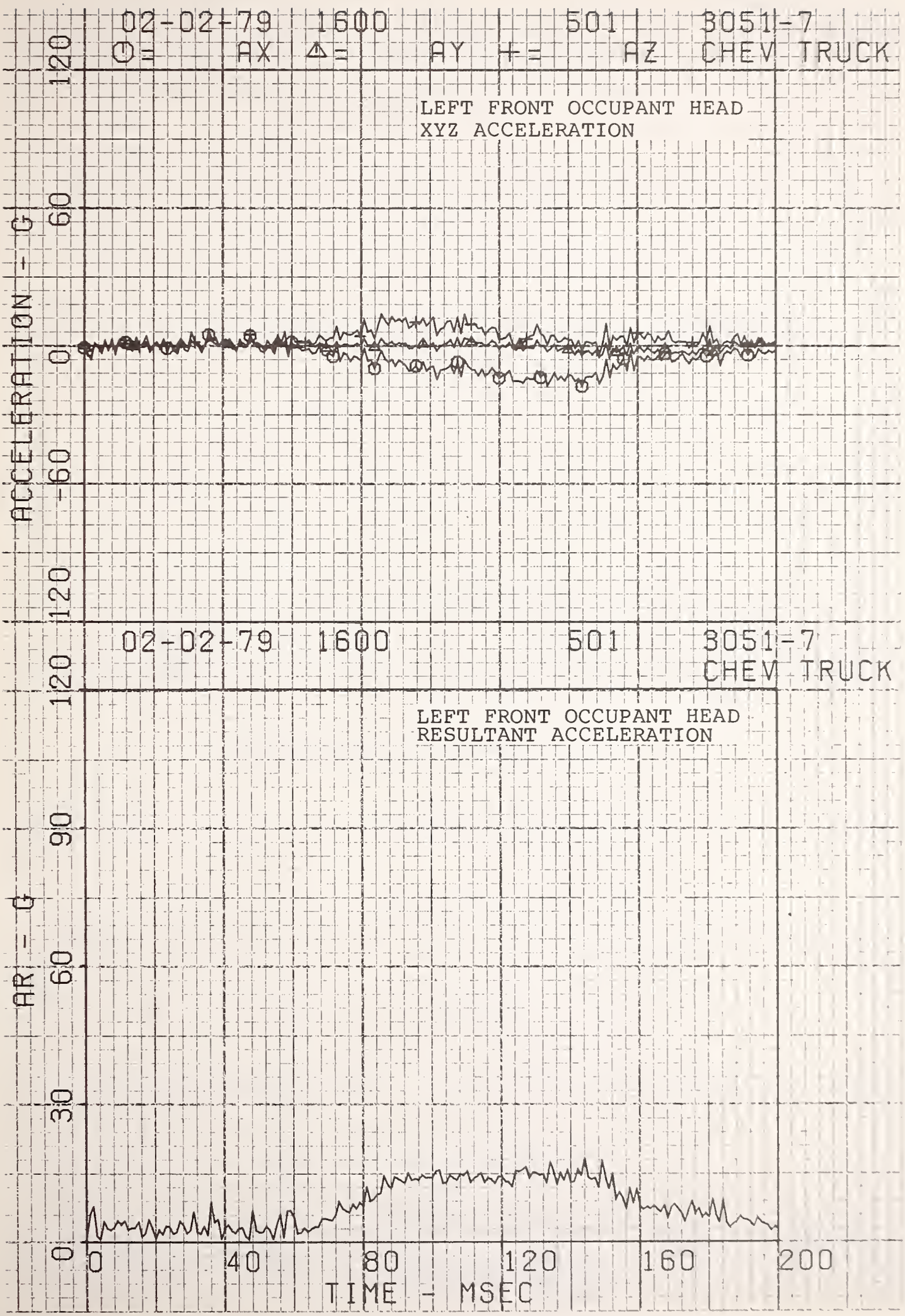
LEFT COMPARTMENT ACCELERATION
LOCATION 1
ACCELERATION - G
60
30
0
-30
-60
02-02-79 315/100 102 3051-7
○ = AX △ = AZ CHEV TRUCK
RIGHT COMPARTMENT ACCELERATION
LOCATION 2
ACCELERATION - G
60
30
0
-30
-60
0
40
80
120
160
200
TIME - MSEC


030979
DATE
02-02-79
FILTER
315/100
LOCATION
410
TEST NO
3051-7
O= AX
Δ= VX
+= SX
CHVAVG 1.2
AX = G, VX = MPH, SX = FT
60
30
0
-30
-60
0
40
80
120
160
200
TIME - MSEC
AVERAGE COMPARTMENT ACCELERATION,
VELOCITY, AND DISPLACEMENT
LOCATIONS 1 AND 2


02-02-79 315/100 103 3051-7
○= AX △= AZ CHEV TRUCK
ENGINE ACCELERATION
LOCATION 3
ACCELERATION - G
60
30
0
-30
-60
02-02-79 315/100 103 3051-7
○= AX △= VX +=SX CHEV TRUCK
AX = G, VX = MPH, SX = FT
ENGINE ACCELERATION,
VELOCITY, AND DISPLACEMENT
LOCATION 3
0
40
80
120
160
200
TIME - MSEC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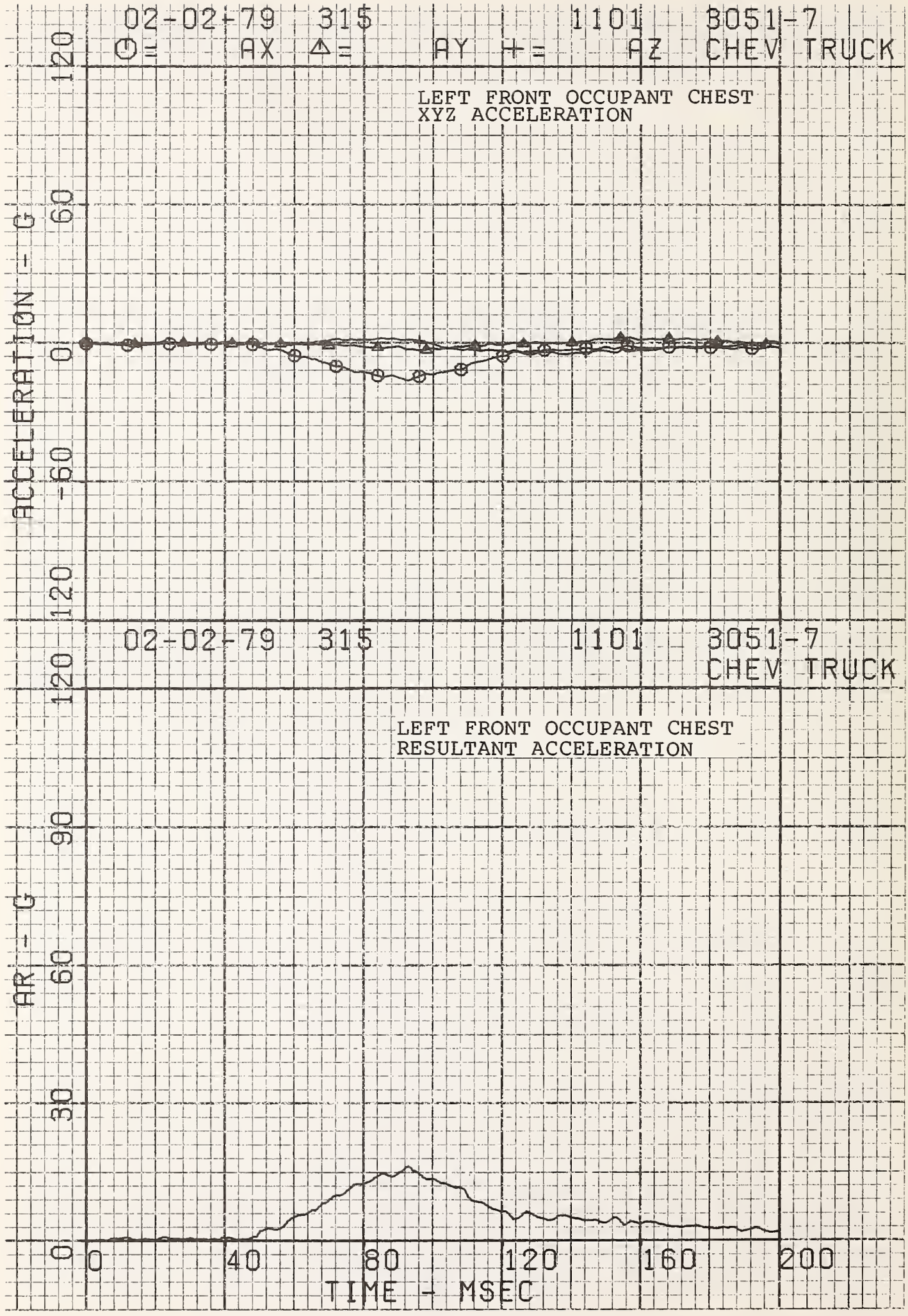
○ = AX △ = AY + = AZ CHEV TRUCK
LEFT FRONT OCCUPANT HEAD
XYZ ACCELERATION
ACCELERATION = G
120
60
0
-60
-120
02-02-79 1600 501 3051-7
CHEV TRUCK
LEFT FRONT OCCUPANT HEAD
RESULTANT ACCELERATION
AR = G
120
90
60
30
0
0
40
80
120
160
200
TIME - MSEC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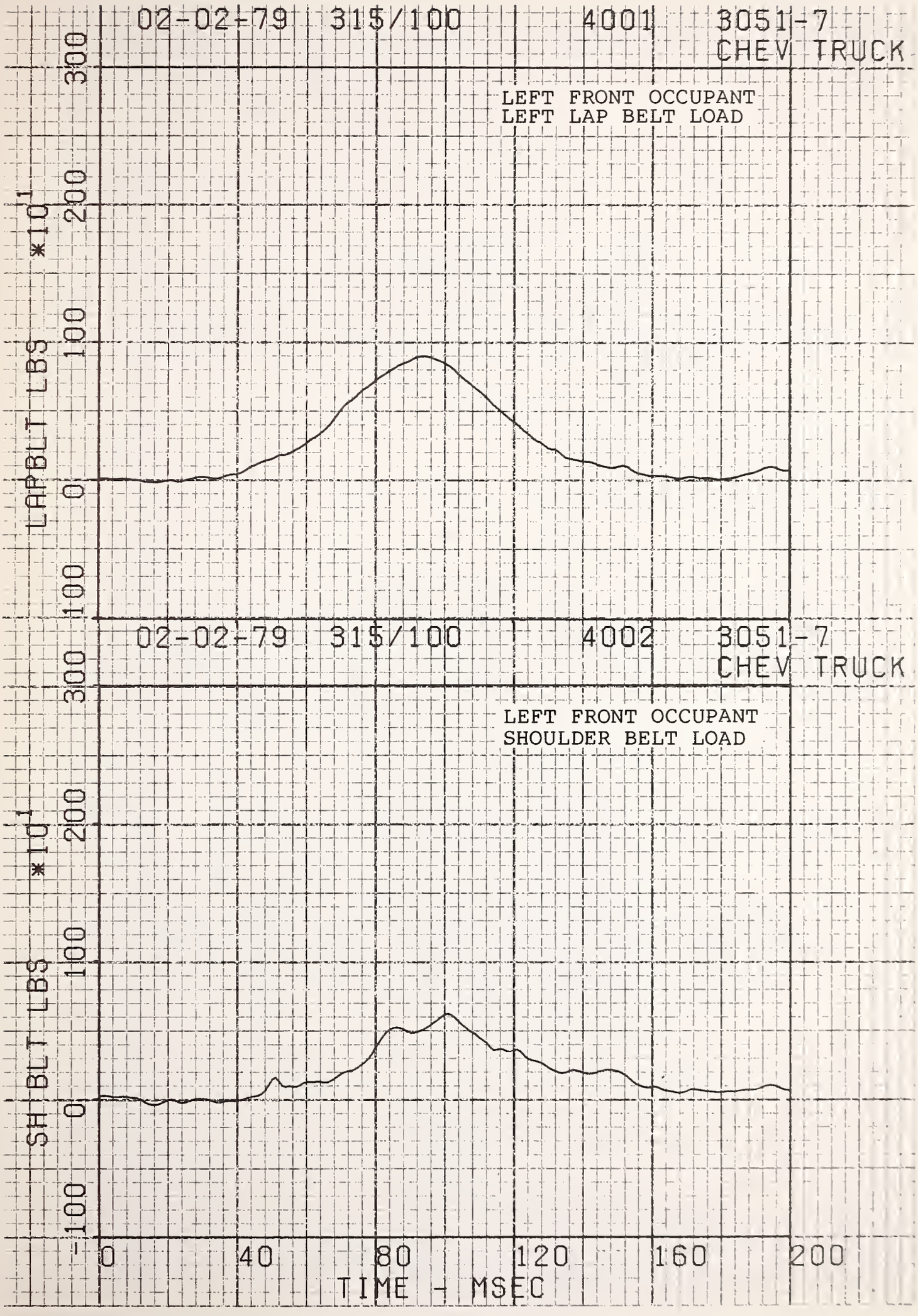
LEFT FRONT OCCUPANT CHEST
XYZ ACCELERATION
ACCELERATION - G
120
60
0
-60
-120
02-02-79 315 1101 3051-7
CHEV TRUCK
LEFT FRONT OCCUPANT CHEST
RESULTANT ACCELERATION
AR - G
120
90
60
30
0
0
40
80
120
160
200
TIME - MSEC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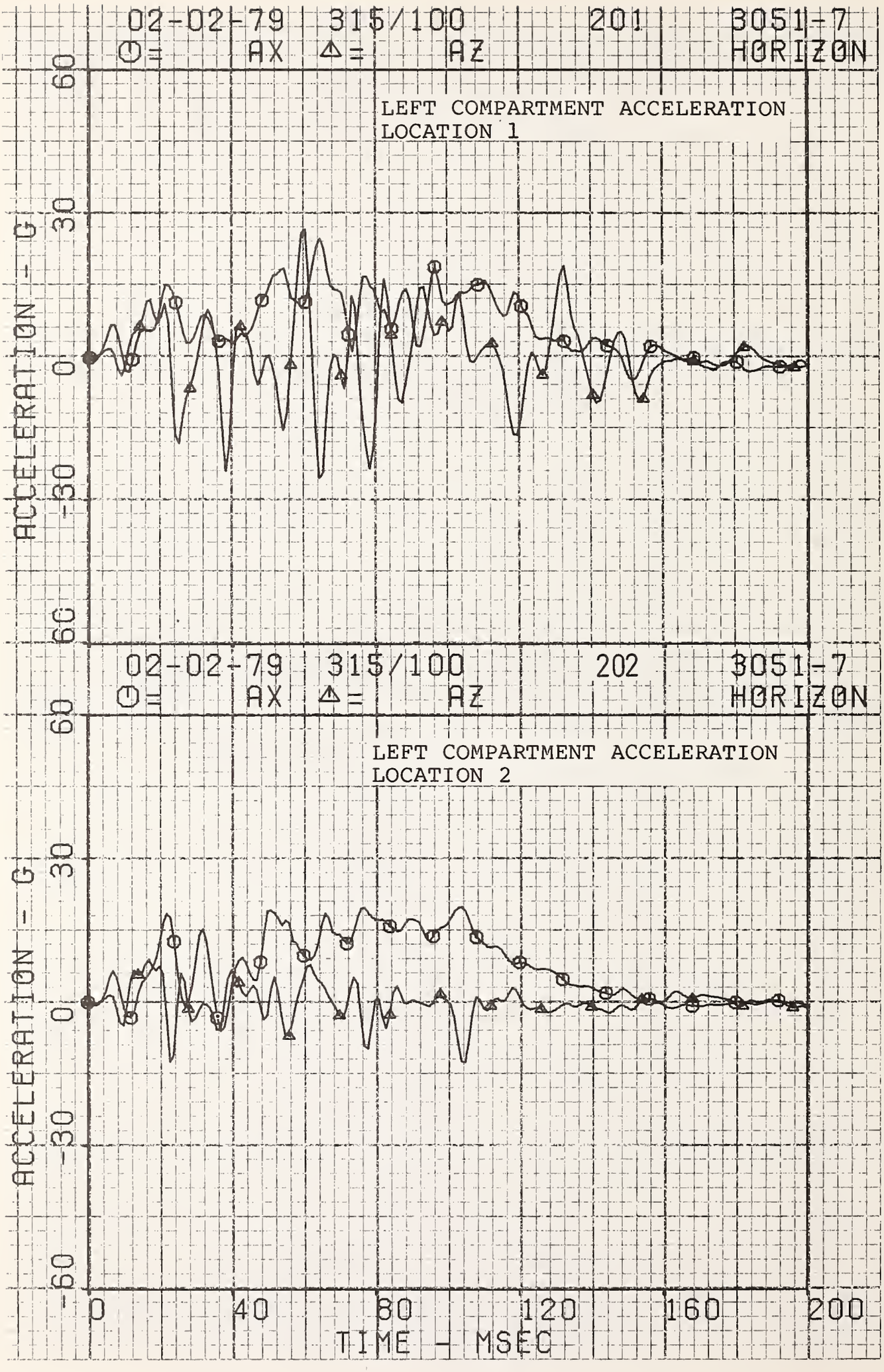
LEFT FRONT OCCUPANT
LEFT LAP BELT LOAD
LAP BLT LBS *10^1
300
200
100
0
100
02-02-79 315/100 4002 3051-7
CHEV TRUCK
LEFT FRONT OCCUPANT
SHOULDER BELT LOAD
SH BLT LBS *10^1
300
200
100
0
-100
0
40
80
120
160
200
TIME - MSEC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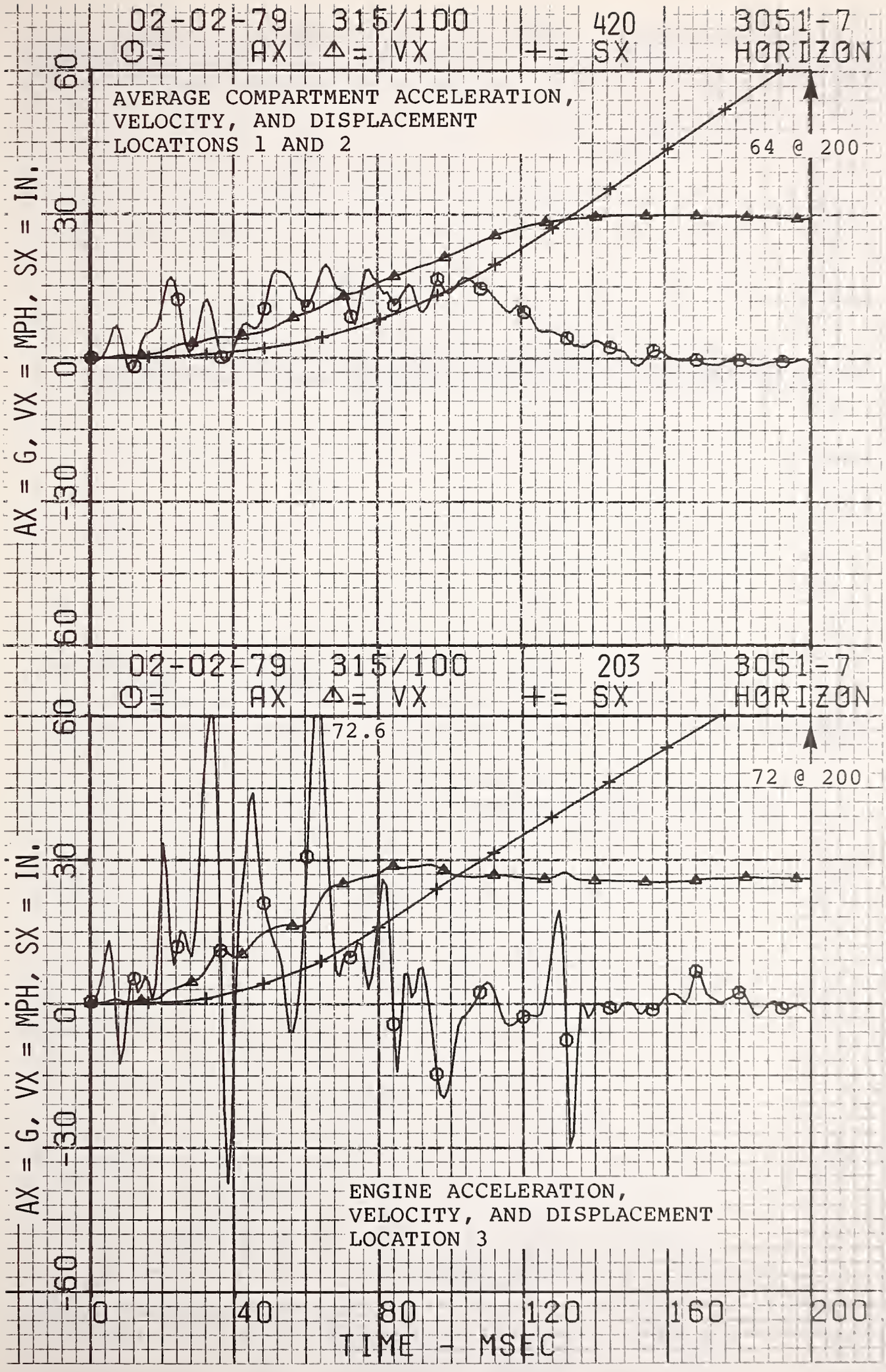
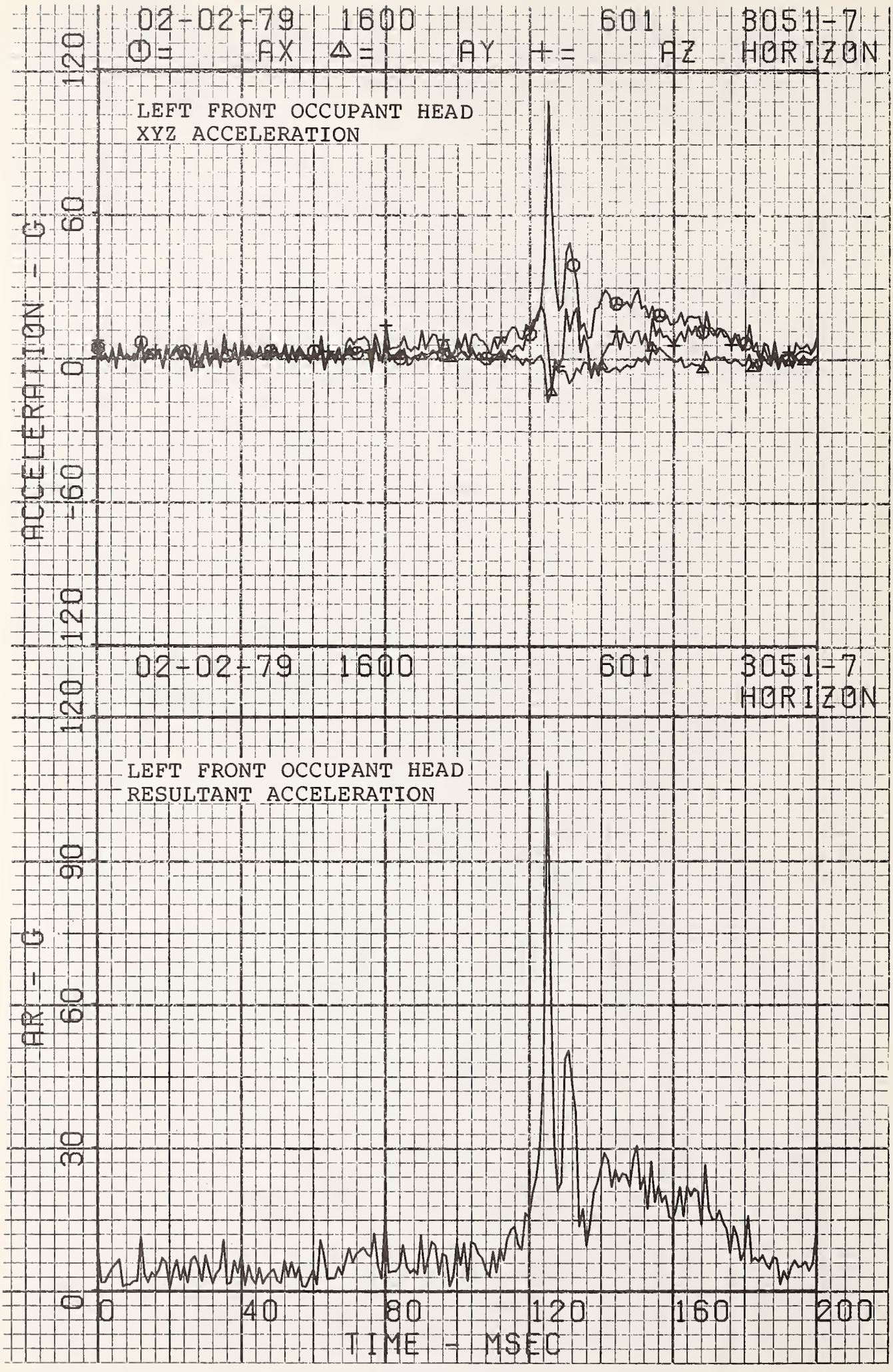
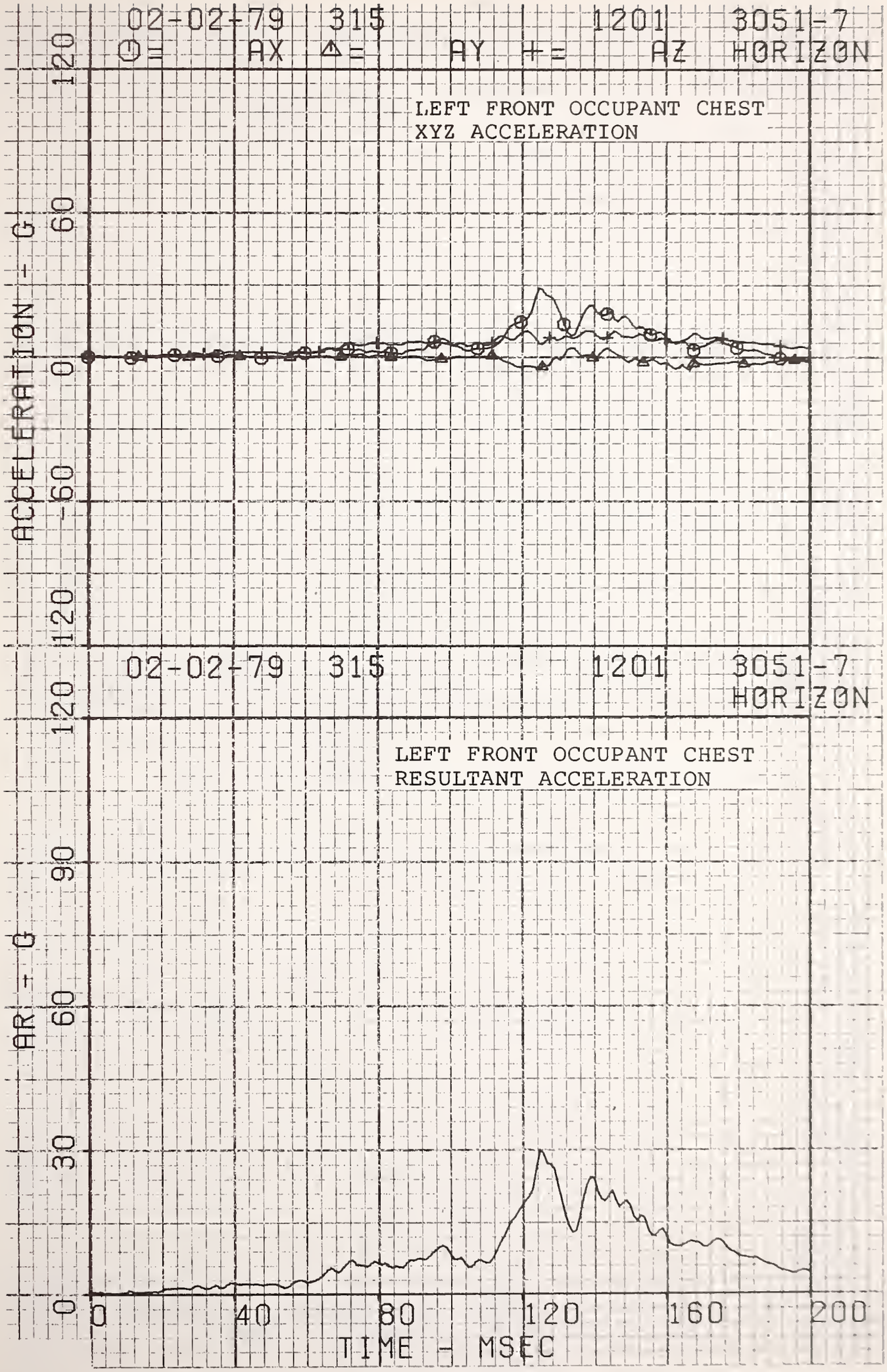
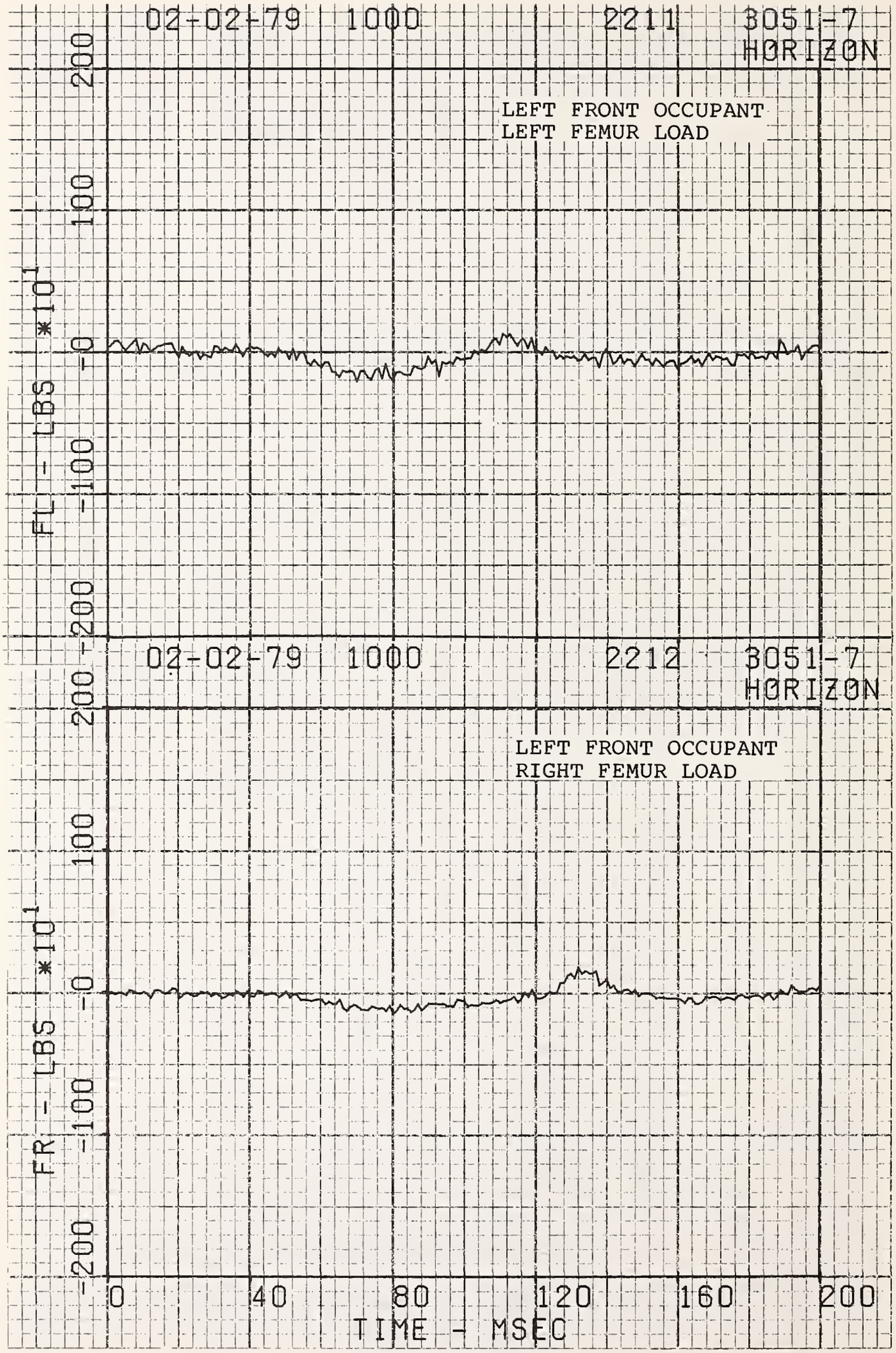
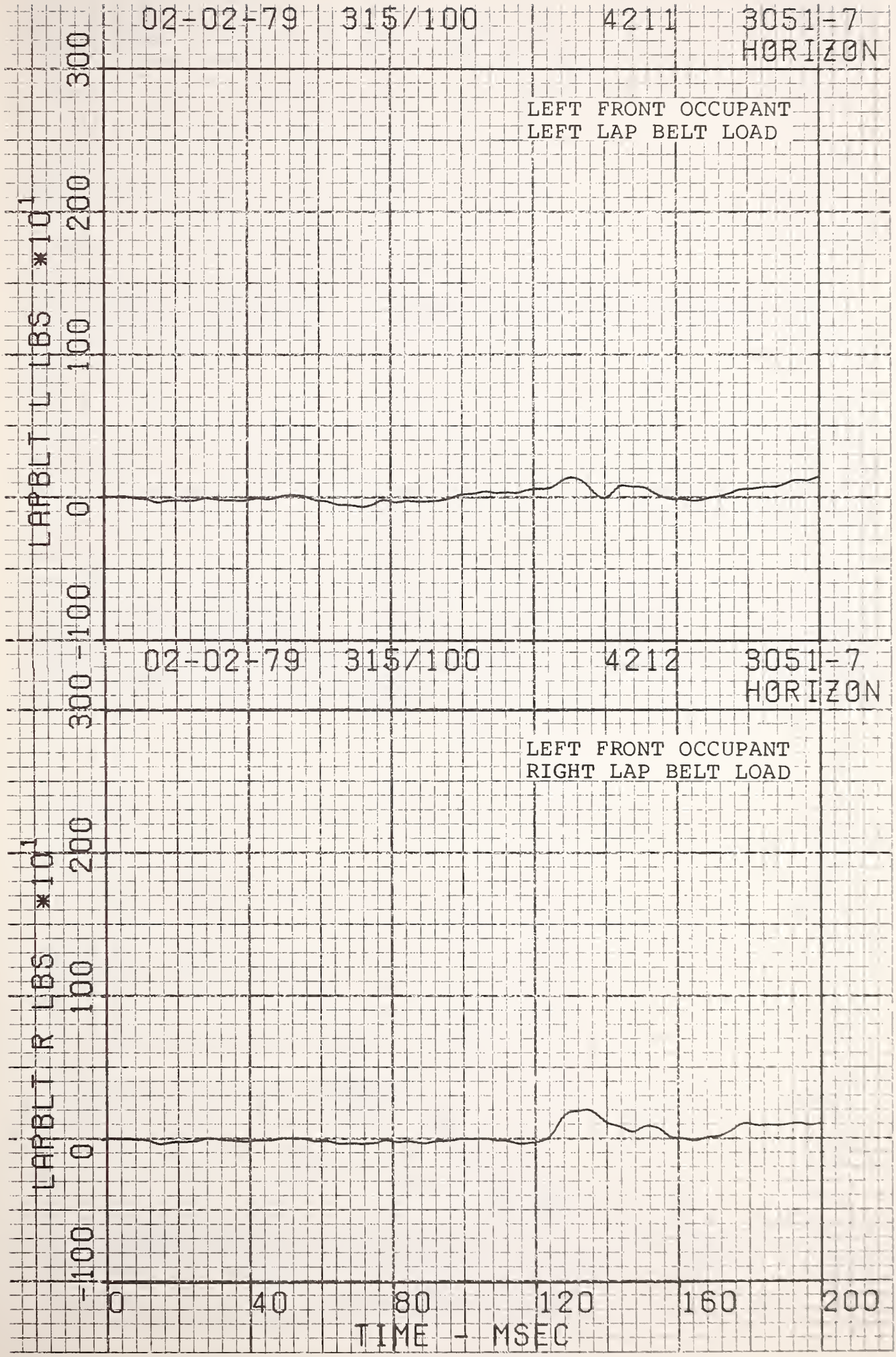
○= AX △= AZ HORIZON
LEFT COMPARTMENT ACCELERATION
LOCATION 1
ACCELERATION - G
60
30
0
-30
-60
02-02-79 315/100 202 3051-7
○= AX △= AZ HORIZON
LEFT COMPARTMENT ACCELERATION
LOCATION 2
ACCELERATION - G
60
30
0
-30
-60
0
40
80
120
160
200
TIME - MSEC

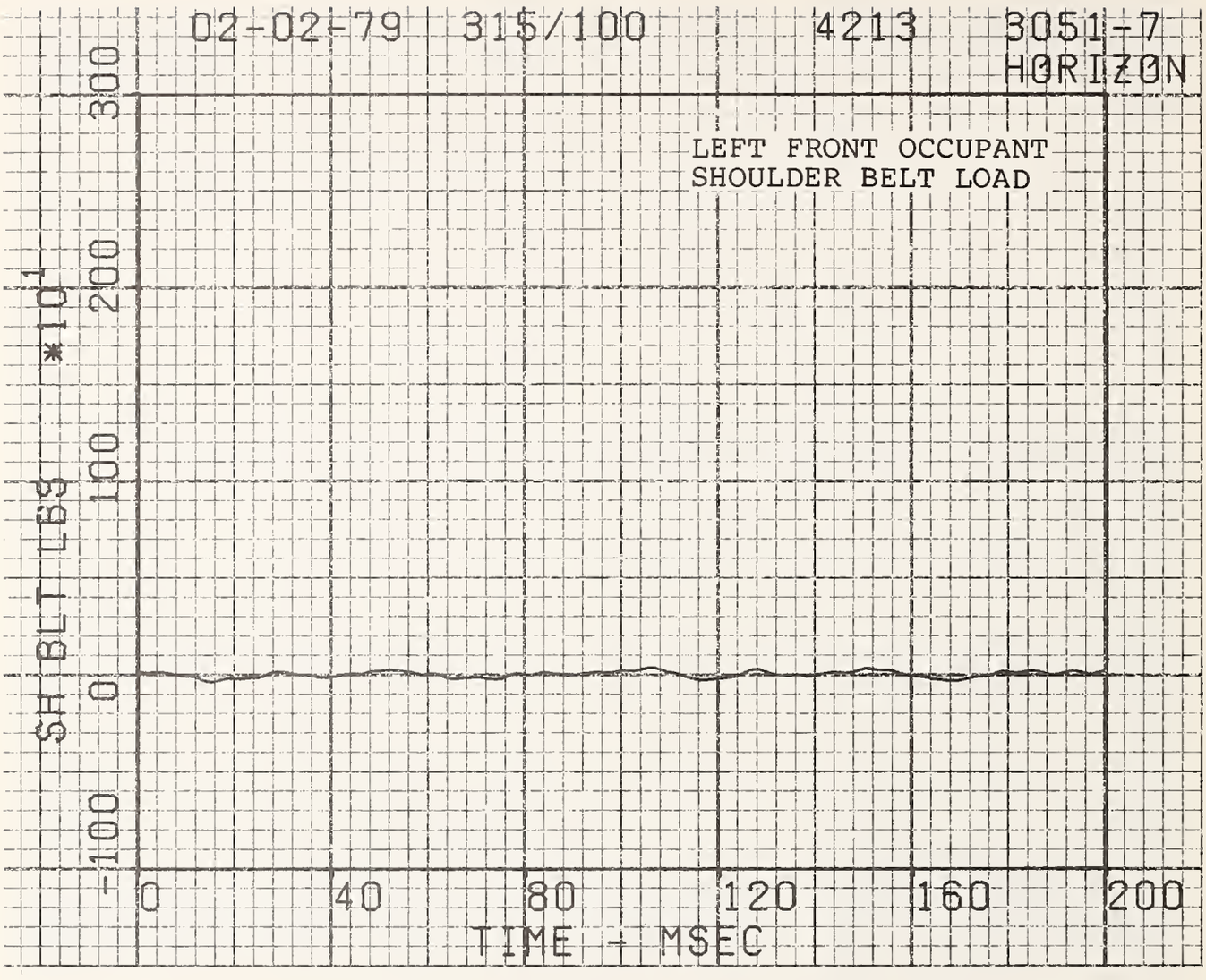

02-02-79 315/100 420 3051-7
O= AX Δ= VX += SX HORIZON
AVERAGE COMPARTMENT ACCELERATION,
VELOCITY, AND DISPLACEMENT
LOCATIONS 1 AND 2
64 @ 200
AX = G, VX = MPH, SX = IN.
60
30
0
-30
-60
02-02-79 315/100 203 3051-7
O= AX Δ= VX += SX HORIZON
72.6
72 @ 200
ENGINE ACCELERATION,
VELOCITY, AND DISPLACEMENT
LOCATION 3
0
40
80
120
160
200
TIME - MSEC

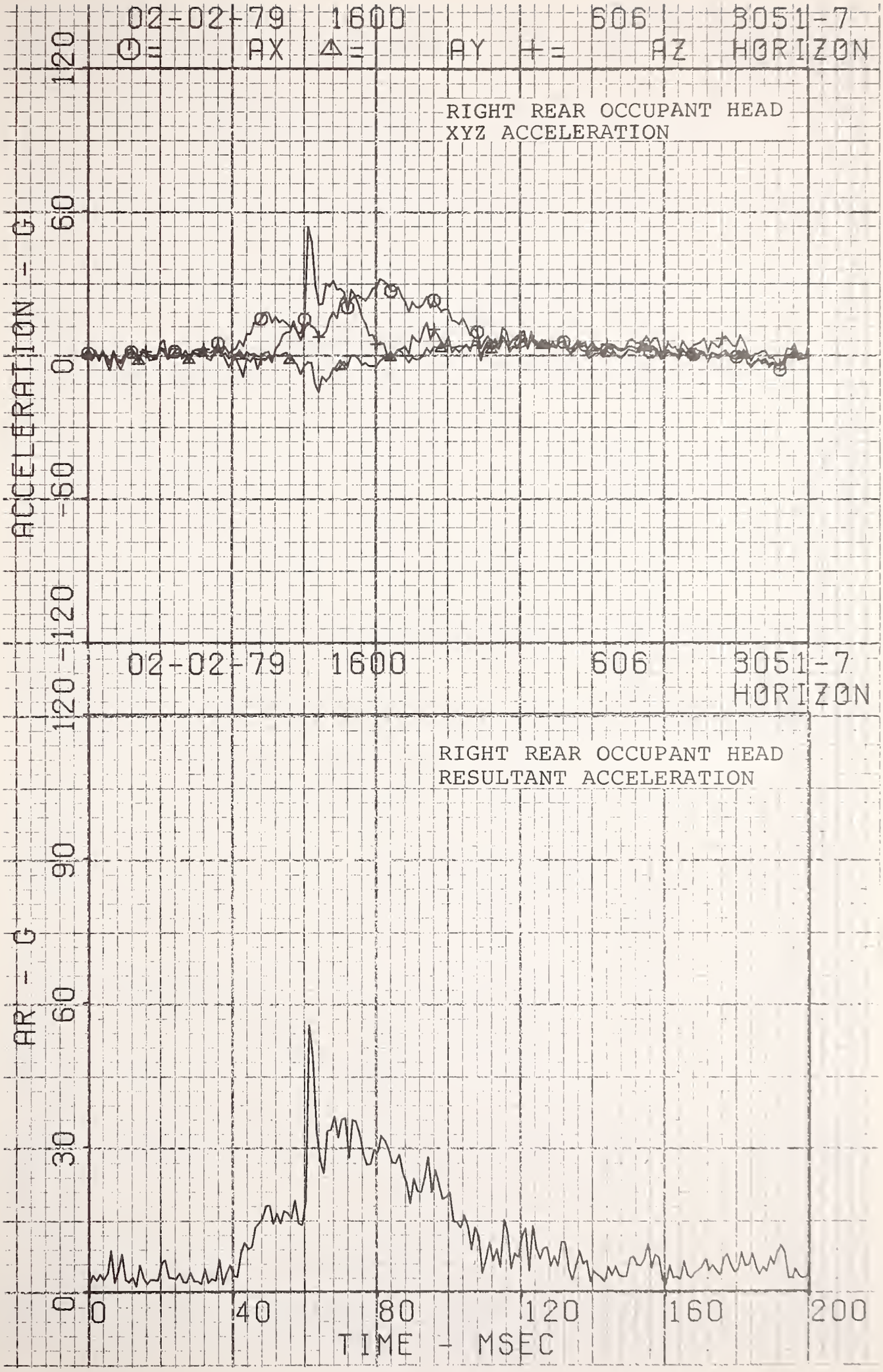

02-02-79 1600 601 3051-7
○= AX △= AY += AZ HORIZON
LEFT FRONT OCCUPANT HEAD
XYZ ACCELERATION
ACCELERATION - G
120
60
0
-60
-120
02-02-79 1600 601 3051-7
HORIZON
LEFT FRONT OCCUPANT HEAD
RESULTANT ACCELERATION
AR - G
120
90
60
30
0
0
40
80
120
160
200
TIME - MSEC

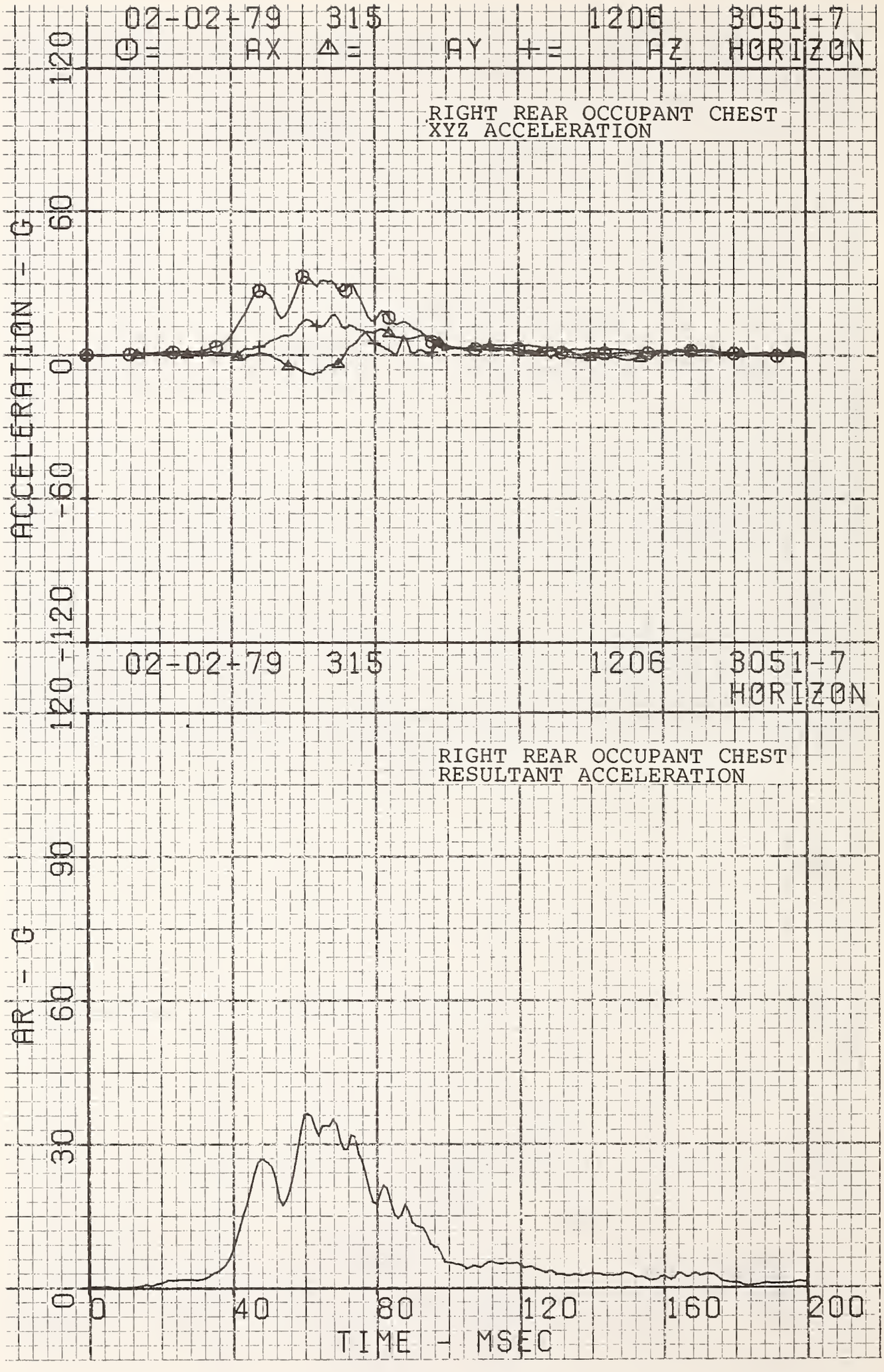

02-02-79 315 1201 3051-7
○ = AX △ = AY + = AZ HORIZON
LEFT FRONT OCCUPANT CHEST
XYZ ACCELERATION
ACCELERATION - G
120
60
0
-60
-120
02-02-79 315 1201 3051-7
HORIZON
LEFT FRONT OCCUPANT CHEST
RESULTANT ACCELERATION
AR - G
120
90
60
30
0
0
40
80
120
160
200
TIME - MSEC

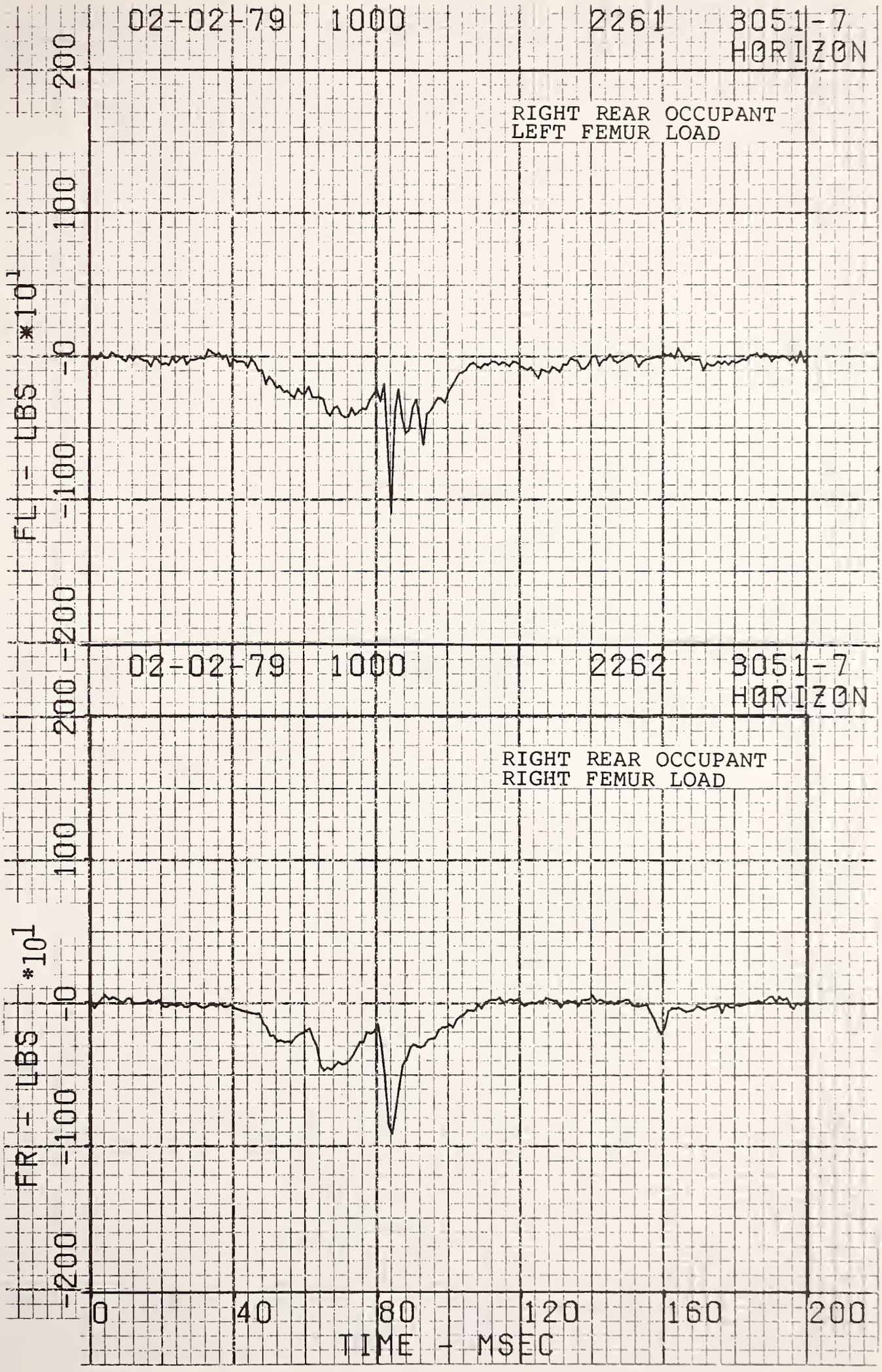

02-02-79 1000 2211 3051-7
HORIZON
LEFT FRONT OCCUPANT
LEFT FEMUR LOAD
FL - LBS *10^1
200
100
-0
-100
-200
02-02-79 1000 2212 3051-7
HORIZON
LEFT FRONT OCCUPANT
RIGHT FEMUR LOAD
FR - LBS *10^1
200
100
-0
-100
-200
0
40
80
120
160
200
TIME - MSEC

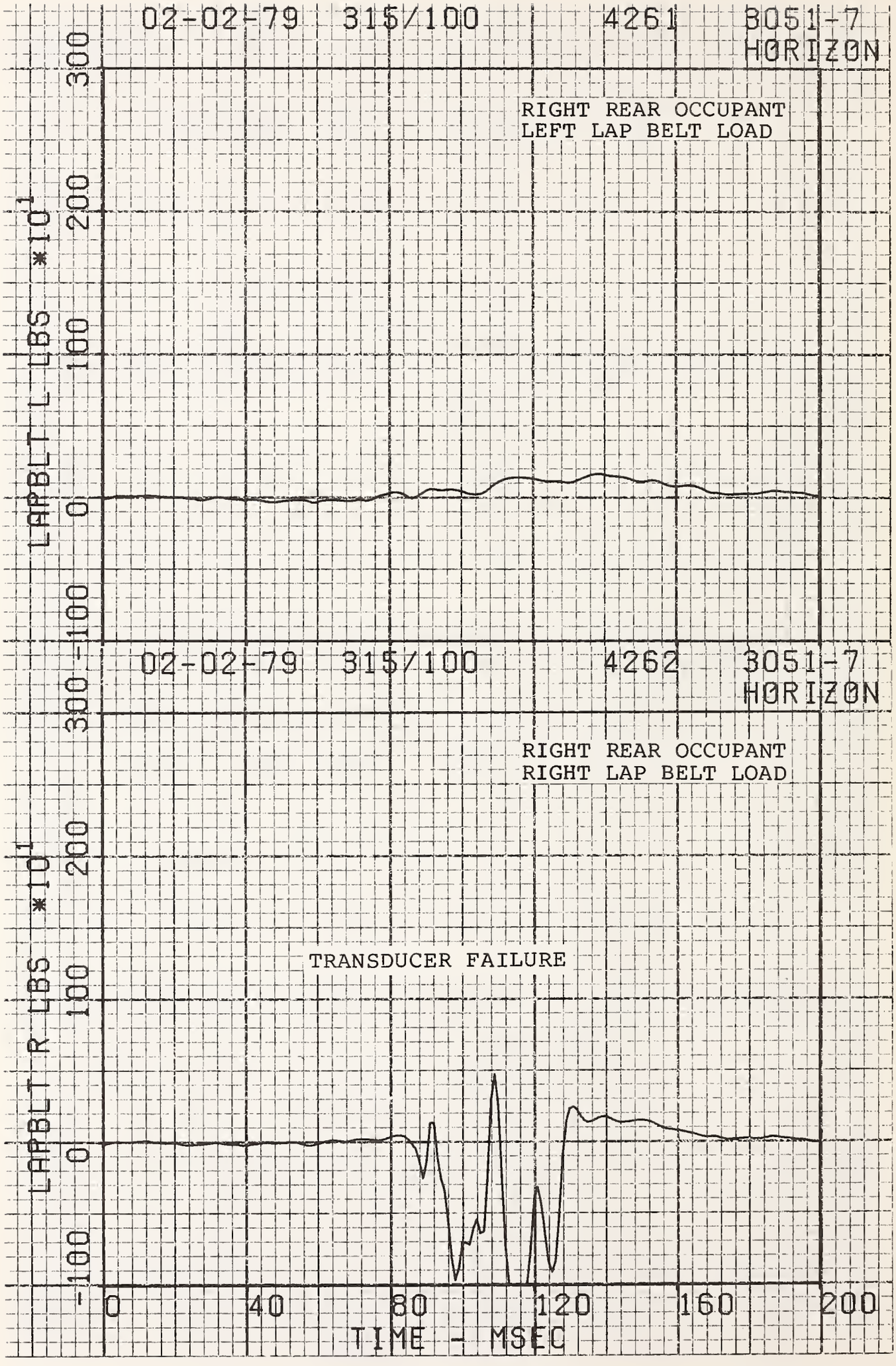

02-02-79 315/100 4211 3051-7
HORIZON
LEFT FRONT OCCUPANT
LEFT LAP BELT LOAD
LAPBLT L LBS *10^1
300
200
100
0
-100
02-02-79 315/100 4212 3051-7
HORIZON
LEFT FRONT OCCUPANT
RIGHT LAP BELT LOAD
LAPBLT R LBS *10^1
300
200
100
0
-100
0
40
80
120
160
200
TIME - MSEC


02-02-79 315/100 4213 3051-7
HORIZON
LEFT FRONT OCCUPANT
SHOULDER BELT LOAD
SH BLT LBS *10¹
300
200
100
0
-100
0
40
80
120
160
200
TIME - MSEC


02-02-79 1600 606 3051-7
○= AX △= AY += AZ HORIZON
RIGHT REAR OCCUPANT HEAD
XYZ ACCELERATION
ACCELERATION - G
120
60
0
-60
-120
02-02-79 1600 606 3051-7
HORIZON
RIGHT REAR OCCUPANT HEAD
RESULTANT ACCELERATION
AR - G
90
60
30
0
0
40
80
120
160
200
TIME - MSEC


02-02-79 315 1206 3051-7
○ = AX △ = AY + = AZ HORIZON
RIGHT REAR OCCUPANT CHEST
XYZ ACCELERATION
ACCELERATION - G
120
60
0
-60
-120
02-02-79 315 1206 3051-7
HORIZON
RIGHT REAR OCCUPANT CHEST
RESULTANT ACCELERATION
AR - G
90
60
30
0
0
40
80
120
160
200
TIME - MSEC


02-02-79 1000 2261 3051-7
HORIZON
RIGHT REAR OCCUPANT
LEFT FEMUR LOAD
FL - LBS *10¹
200
100
-0
-100
-200
02-02-79 1000 2262 3051-7
HORIZON
RIGHT REAR OCCUPANT
RIGHT FEMUR LOAD
FR - LBS *10¹
200
100
-0
-100
-200
0
40
80
120
160
200
TIME - MSEC



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