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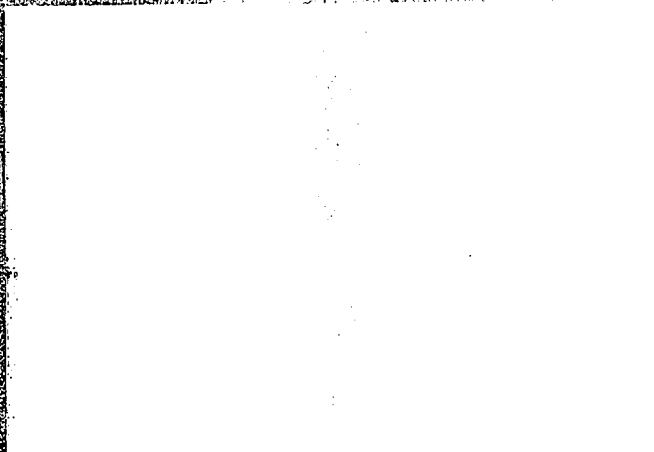
417

223

~~250~~

~~260~~

~~265~~



Dynamic Science Inc.

A SUBSIDIARY OF TALLEY INDUSTRIES

1850 WEST PINNACLE PEAK ROAD • PHOENIX, ARIZONA 85027 • (602) 869-9331

Report No. (to be assigned by NHTSA)

TEST REPORT NO. 2
STRAIGHT SIDE IMPACTOR-TO
MODIFIED VW RABBIT
FRONT-TO-SIDE TESTS @ 60°

TESTS 8327-6.5 AND 8327-6.6
APPENDICES A, B, C, D, E, F

CONTRACT NO. DOT-HS-8-01933 (II)

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February 1981

TEST REPORT

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U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

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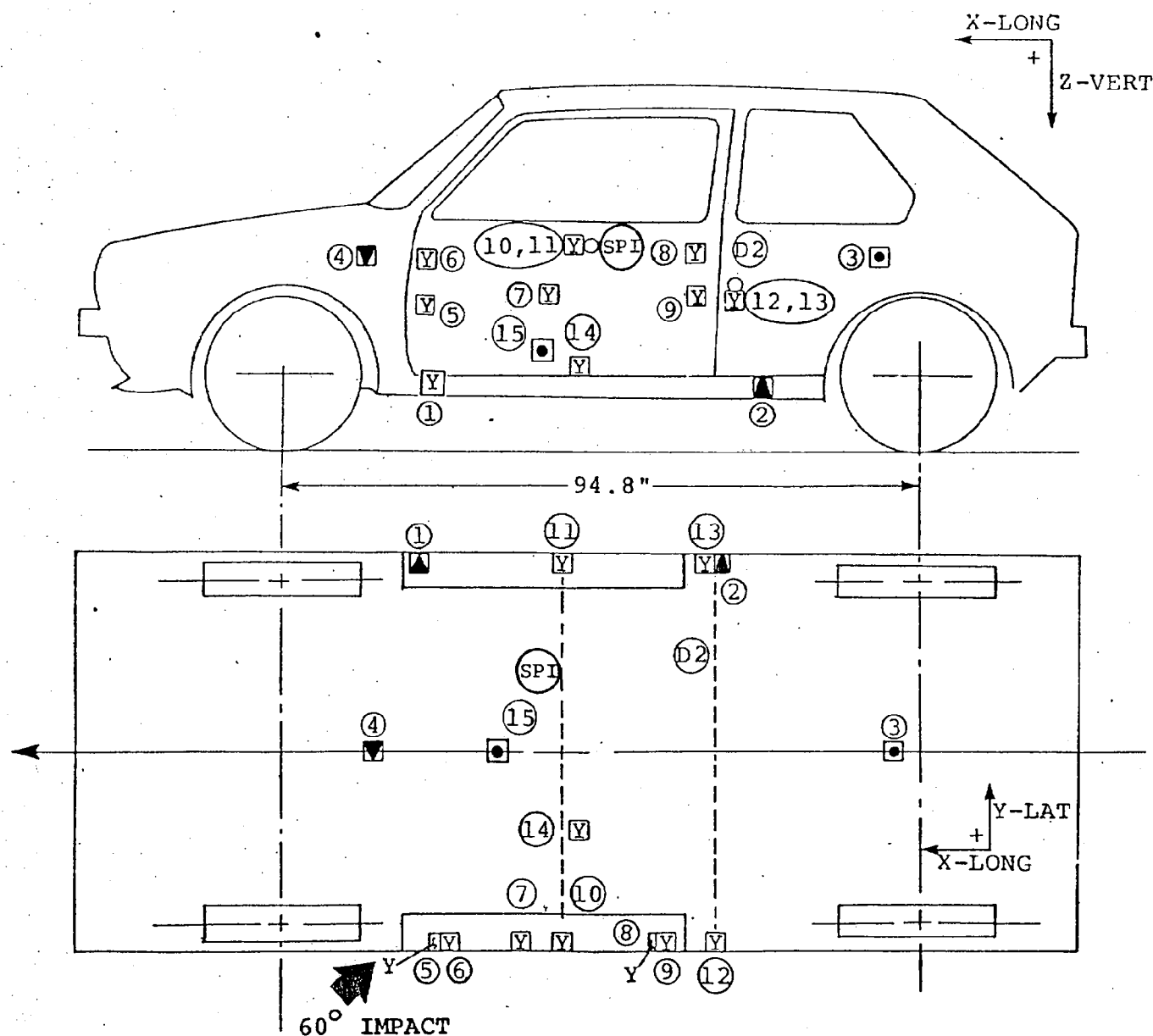
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APPENDIX A

INSTRUMENTATION SUMMARY AND
CAMERA LOCATION MATRIX
FOR TESTS 8327-6.5 AND 6.6

STRAIGHT SIDE IMPACTOR-INTO-MODIFIED
VW RABBIT AT 60°
BOTH VEHICLES MOVING

(FRONT: APR REAR: SID)



NOTE: SEE TABLE A-1 FOR ADDITIONAL INFORMATION

- Y AXIAL ACCELEROMETER (Y DIRECTION)
- ▲ BIAXIAL ACCELEROMETER (Y, Z DIRECTION)
- ◼ BIAXIAL ACCELEROMETER (X, Z DIRECTION)
- ◻ TRIAXIAL ACCELEROMETER (X, Y, Z DIRECTION)
- DISPLACEMENT TUBE (Y DIRECTION)
- ▼ BIAXIAL ACCELEROMETER (X, Y DIRECTION)

FIGURE A-1. TARGET VEHICLE INSTRUMENTATION - VW RABBIT.

TABLE A-1. SUMMARY OF TARGET VEHICLE INSTRUMENTATION - VW RABBIT

No.	Accelerometer Location	Coordinates			Maximum Expected Range		
		X*	Y*	Z*	Long (X)	Lat (Y)	Vert (Z)
1	Occupant compartment, right front doorsill	103.8	22.5	11.0		100G	
2	Occupant compartment, right rear doorsill	65.0	23.0	10.5		100G	100G
3	Rear deck over vehi- cle centerline	38.0	0.0	15.0	100G	100G	100G
4	Front firewall over vehicle centerline	112.0	9.8	31.5	100G	100G	
5	Mid-front edge of left front door	99.3	-26.0	25.5		750G	
6	Upper front corner of left front door	99.3	-26.0	33.5		750G	
7	Middle of left front door	81.0	-26.0	25.3		750G	
8	Upper rear corner of left front door	59.0	-26.0	33.0		750G	
9	Mid-rear edge of left front door	60.5	-26.0	23.8		750G	
10	Left front door on windowsill, slightly forward of surrogate's chest	81.0	25.0	33.3		750G	
11	Right front door on windowsill, directly across from No. 10	81.0	26.0	33.6		100G	
12	Left B-pillar near door latch	59.0	-25.5	31.3		100G	
13	Right B-pillar across from No. 12	59.0	25.5	24.8		100G	
14	Underneath left front seat attached to seat	73.0	-12.5	11.0		200G	
15	Vehicle center of gravity	82.3	0.0	11.0	100G	100G	100G

*Reference Points:

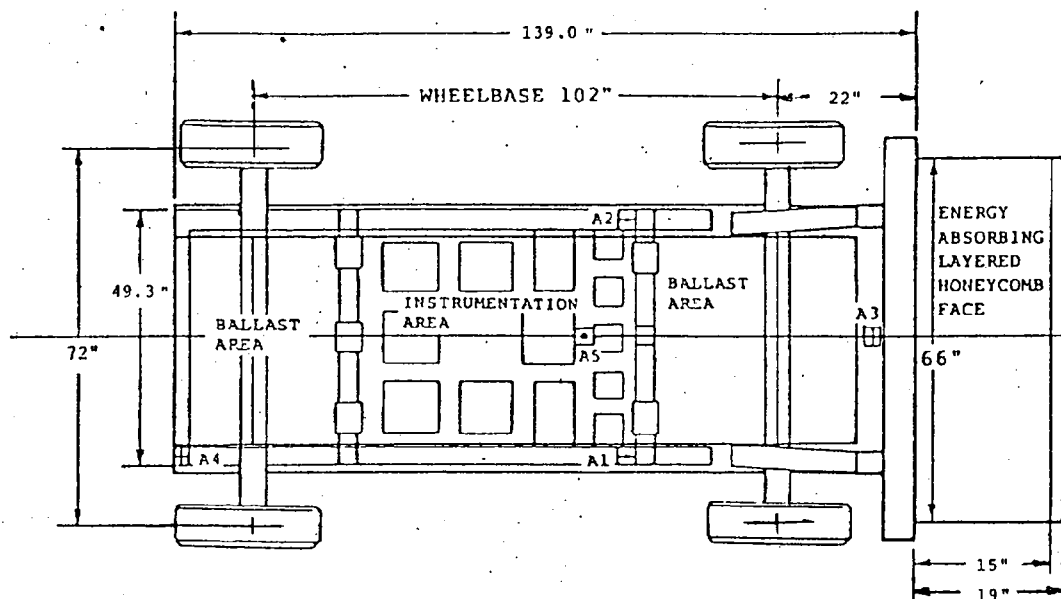
X - rear bumper, Y - vehicle centerline, Z - ground level.

TABLE A-1. SUMMARY OF TARGET VEHICLE INSTRUMENTATION - VW RABBIT
(CONTD)

Displacement Transducer		Coordinates			Maximum Expected Range		
No.	Location	X*	Y*	Z*	Long (X)	Lat (Y)	Vert (Z)
SP1	String potentiometer	81.5		33.5	25"	Retraction	
D2	B-pillar, next to ac- celerometers 12 and 13	57.0		28.3	25"	Retraction	
1	Impact switch attached to point of initial contact				Hardline		
Side Impact Dummy Instrumentation (Two Dummies)							
	Head-mounted accel- erometers (X, Y, Z)				200G	200G	200G
	Longitudinal mounted accelerometers (X) - (4 SID, 5 APR III)				400G		
	Lateral mounted chest accelerometers (Y) - (6 SID, 5 APR III)					400G	
	Vertical mounted chest accelerometers (Z) - 2 locations						
	Pelvis-mounted accel- erometers (X, Y, Z)				200G	200G	200G
	Displacement Transducers (1 SID, 2 APR III)						
Total number of required data channels					62		
Number of requied RSCM's					5		

*Reference Points:

X - rear bumper, Y - vehicle centerline, Z - ground level.

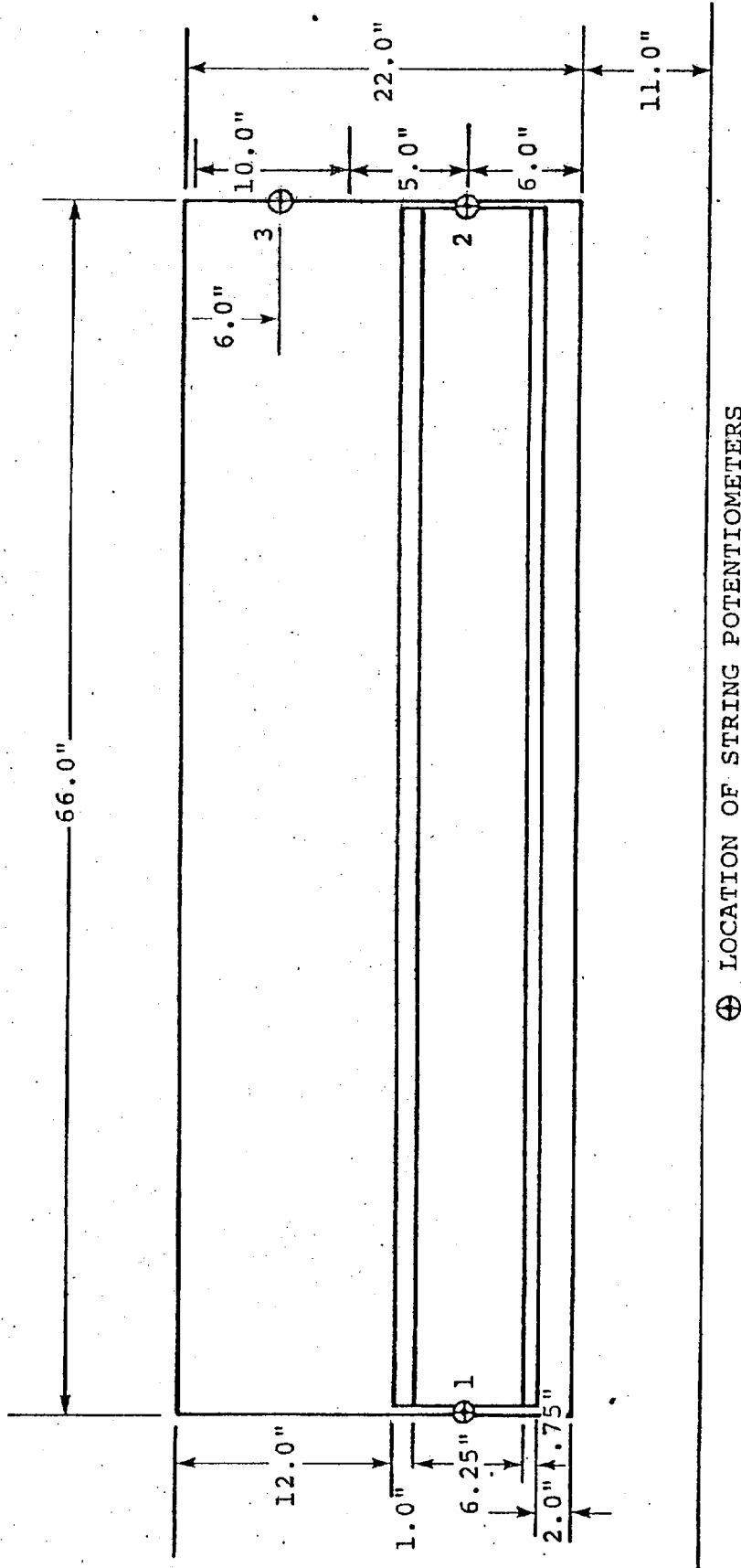


- ⊞ AXIAL ACCELEROMETER, LONG.
- ⊞ BIAXIAL ACCELEROMETER, LONG., LAT.
- ⊞ TRIAXIAL ACCELEROMETER, LONG., LAT., VERT.

REF - CARRIAGE DRAWING DSL - 1278

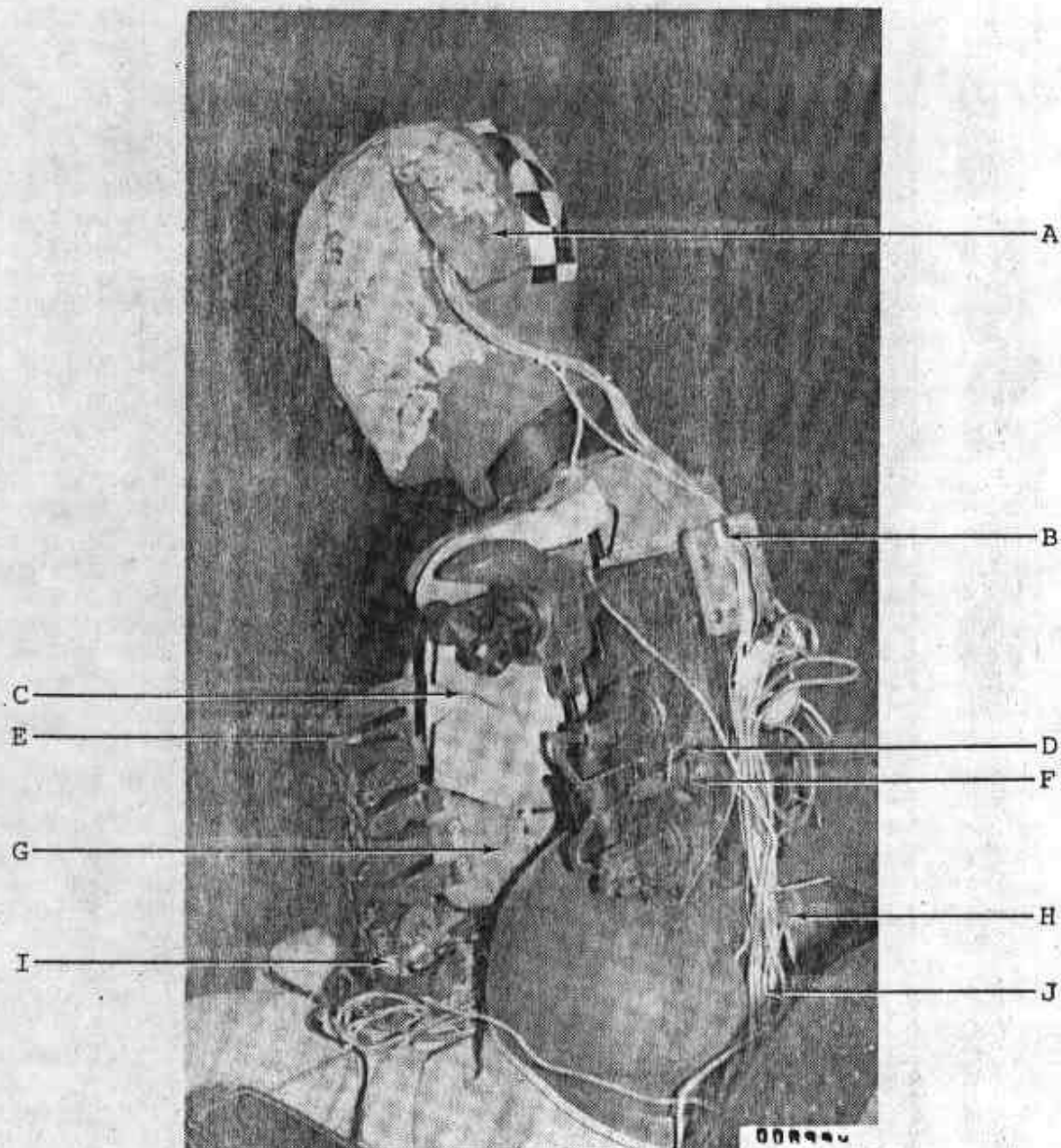
SIDE IMPACTOR ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES					MAXIMUM EXPECTED READINGS (G)		
No.	Description of Location	X*	Y*	Z*	Long	Lat	Vert
1	Right frame rail	84.0	22.5	19.8	50		
2	Left frame rail	84.0	-22.5	19.8	50		
3	Front crossmember at centerline	129.0	0.0	23.0	50		
4	Right rear vertical frame rail	8.5	23.0	15.0	50		
5	Side Impactor center of gravity				50		
*Reference Plane: X - rear of Side Impactor; Y - Side Impactor centerline; Z - ground.							

FIGURE SIDE IMPACTOR ACCELEROMETER LOCATIONS.



REFERENCE: DYNAMIC SCIENCE DRAWING NO. DSL-1266.

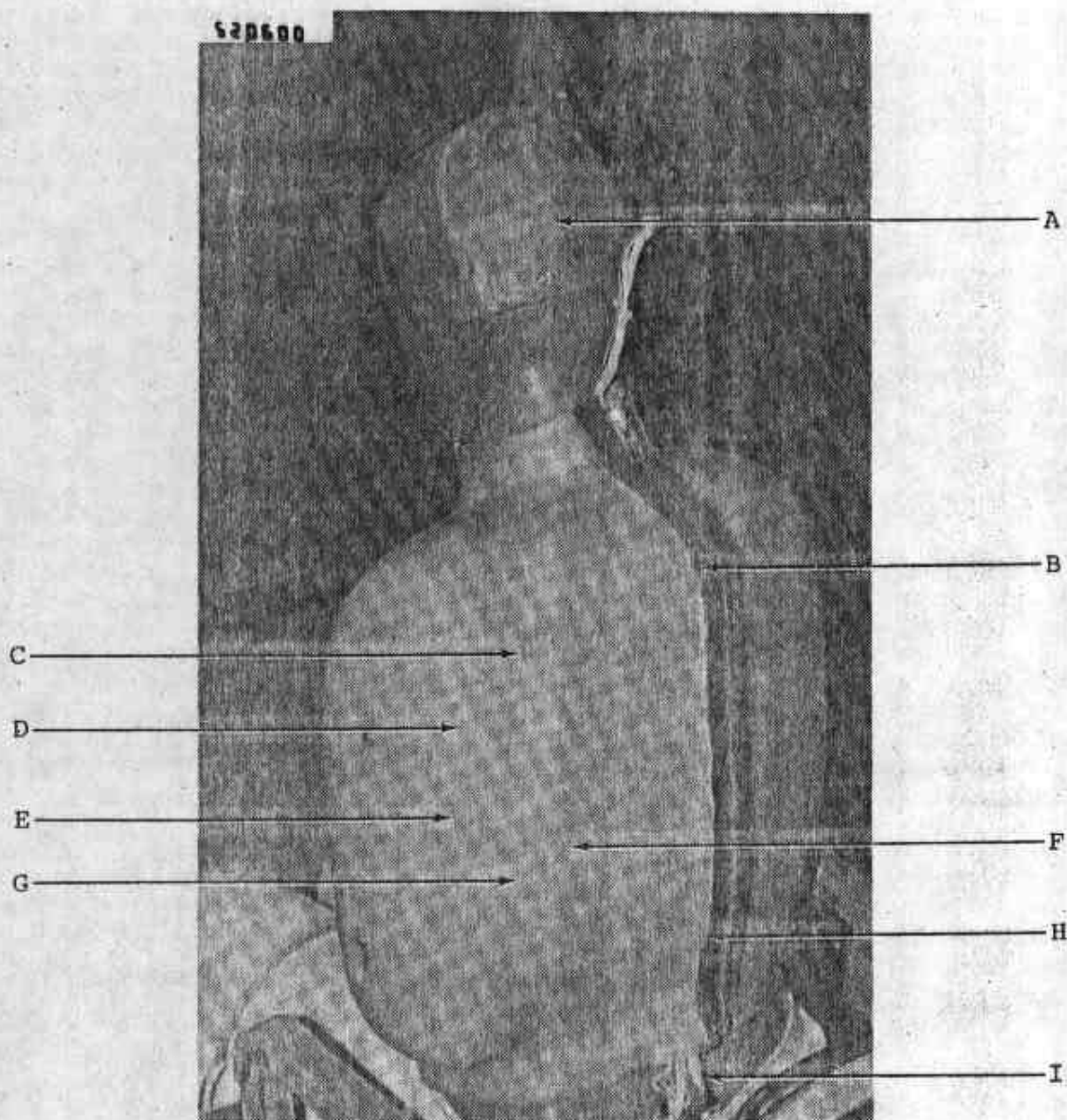
FIGURE A-3. FRONT VIEW OF SIDE IMPACTOR FACE SHOWING STRING POTENTIOMETER LOCATIONS.



- | | |
|----------------------------------|----------------------------------|
| A. HEAD TRIAXIAL | F. LOWER DISPLACEMENT TRANSDUCER |
| B. UPPER THORAX (T-1), TRIAXIAL | G. LOWER STERNUM, LONGITUDINAL |
| C. UPPER STERNUM, LONGITUDINAL | H. LOWER THORAX (T-12), TRIAXIAL |
| D. UPPER DISPLACEMENT TRANSDUCER | I. LEFT LOWER RIB, LATERAL |
| E. LEFT UPPER RIB, LATERAL | (RIGHT LOWER RIB, LONGITUDINAL) |
| (ALSO ON RIGHT) | J. PELVIC, TRIAXIAL |

NOTE: LEFT SIDE RIBS ARE UNATTACHED IN THIS PICTURE.

FIGURE A-4. LOCATIONS OF EIGHTEEN ACCELEROMETERS AND TWO DISPLACEMENT TRANSDUCERS FOR THE APR III SIDE IMPACT DUMMY.



- | | |
|---------------------------------|----------------------------------|
| A. HEAD TRIAXIAL | F. LOWER DISPLACEMENT TRANSDUCER |
| B. UPPER THORAX (T-1), TRIAXIAL | G. LEFT LOWER RIB, LATERAL |
| C. UPPER STERNUM, LONGITUDINAL | (ALSO ON RIGHT) |
| D. LEFT UPPER RIB, LATERAL | H. LOWER THORAX (T-12), TRIAXIAL |
| (ALSO ON RIGHT) | I. PELVIC, TRIAXIAL |
| E. LOWER STERNUM, LONGITUDINAL | |

NOTE: LOWER RIB ACCELEROMETERS ARE MOUNTED OUTWARD POSITIVE.

FIGURE A-5. LOCATIONS OF EIGHTEEN ACCELEROMETERS AND ONE DISPLACEMENT TRANSDUCER FOR THE NHTSA SIDE IMPACT DUMMY (FIVE RIB DESIGN).

TABLE A-2. SIDE IMPACT DUMMY INSTRUMENTATION

a) Instrumentation Locations

APR III (20 channels)	SID (19 channels)
Head - X, Y, Z	Same
Upper Thorax (T-1) - X, Y, Z	Same
Upper Sternum - X	Same
Left Upper Rib - Y	Same
Right Upper Rib - Y	Same
Lower Thorax (T-12) - X, Y, Z	Same
Lower Sternum - X	Same
Left Lower Rib - Y	Same
Right Lower Rib - X	Right Lower Rib - Y
Pelvis - X, Y, Z	Same
Upper Displacement Transducer	None
Lower Displacement Transducer	Lower Displacement Transducer

b) Dummy Data Plot Digital Filters*

Head	None
Spine	300 Hz
Sternum	100 Hz
Ribs	100 Hz
Pelvis	300 Hz
Displacement Transducers	100 Hz

*Analog-to-digital conversion uses 1600 Hz analog filter.

CAMERA LOCATIONS

Test No: 8327-6.5 Test Date: 11-12-80

Test Type: 60° Side Impact

Vehicle A (Bullet)

Side Impactor

Vehicle B (Target)

VW Rabbit

Comments: Two-vehicle Moving

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

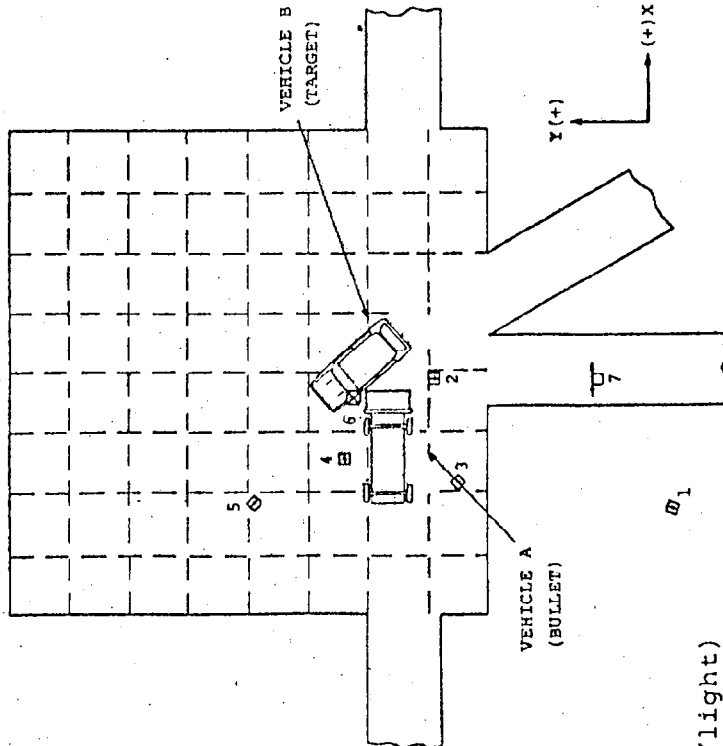
TIMING LIGHT SPEED

1. 100 Hz (10 msec/light)

2. 200 Hz (5 msec/light)

3. Other

CAMERA	YES
STILLS	X
SLIDES	
MOVIE	X
POLAROID	
VIDEO	



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	South Side	Overall of Both Vehicles and Post-test Trajectory (Milikin)	25	4	1		-26'4"	-54'2"	NA
2	South Side - Parallel to Bullet Face	Close-up of Both Vehicles at Impact (Photosonic)	25	1	1		+ 1'2"	-15'1"	NA
3	South Side	Broadside View of VW Rabbit over Side Impactor (Milikin)	25	4	1		-19'11"	-12'7"	NA
4	North Side - Parallel to Bullet	Close-up Both Vehicles at Impact (Photosonic)	25	1	1		-32'8"	+18'6"	NA
5	North Side - Parallel to Target	Overall of Both Vehicles at Impact (Photosonic)	50	1	1		-28'9"	+35'0"	NA
6	Overhead	Elevated - Looking Down at Impact Point (Milikin)	16	4	1		+1'2"	+ 1'7"	21'
7	South Side	Panning - Test and Results (Canon)	zoom	3	N/A				

FIGURE A-6. CAMERA LOCATIONS - GROUND BASED.

CAMERA LOCATIONS

Test No: 8327-6,6 Test Date: 12-19-80

Test Type: 60° Side Impact

Vehicle A (Bullet)

Side Impactor

Vehicle B (Target)

VW Rabbit

Comments: Two-vehicles - Moving

CAMERA	YES
STILLS	X
SLIDES	X
MOVIE	X
POLAROID	
VIDEO	.

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

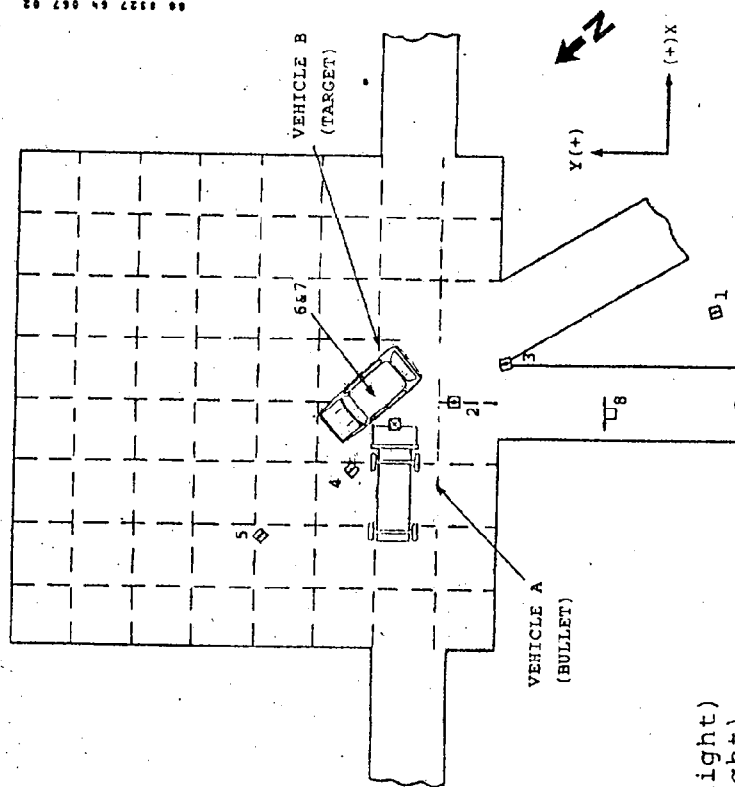
5. 500 fr/sec

TIMING LIGHT SPEED

1. 100 Hz (10 msec/light)

2. 200 Hz (5 msec/light)

3. Other



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	South Side -	Overall of Both Vehicles and Post-test Trajectory (Milikin)	25	4	1		+17'8"	-71'9"	37"
2	South Side - Parallel to Bullet Face	Close-up of Both Vehicles at Impact (Photosonic)	25	1	1		+ 1'2"	-15'1"	40"
3	South Side - Parallel to Target	Close-up of Both Vehicles at Impact (Milikin)	25	4	1		+12'0"	-26'9"	35"
4	North Side	Close-up of Impact Point (Photosonic)	25	1	1		-10'3"	+10'5"	48"
5	North Side - Parallel to Target	Overall of Both Vehicles at Impact (Milikin)	35	4	1		-26'6"	+49'9"	47"
6	Overhead	Elevated - Looking Down at Impact Point (Milikin)	16	4	1		0	0	21' 0"
7	Overhead (redundant)	Elevated - Looking Down at Impact Point (Photosonic)	15	1	1		+10"	-8"	20'0"
8	South Side--	Panning - Test and Results (Canon)	zoom	3	None				

FIGURE A-7. CAMERA LOCATIONS - GROUND BASED.

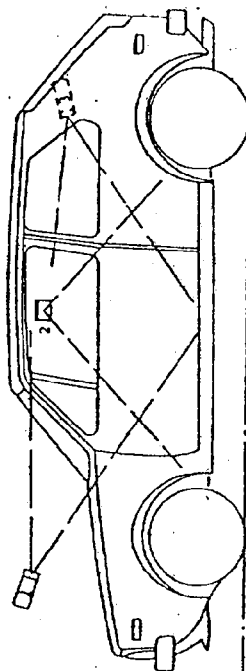
Test No: 8327-6.5-6.6 Test Date: 11-12-80 (6.5) 12-19-80 (6.6)

Test Type: 60° side Impact

Vehicle A (Bullet)	Side Impactor
1. 1000 2. 1000 3. 1000 4. 1000 5. 1000 6. 1000 7. 1000 8. 1000 9. 1000 10. 1000 11. 1000 12. 1000 13. 1000 14. 1000 15. 1000 16. 1000 17. 1000 18. 1000 19. 1000 20. 1000 21. 1000 22. 1000 23. 1000 24. 1000 25. 1000 26. 1000 27. 1000 28. 1000 29. 1000 30. 1000 31. 1000 32. 1000 33. 1000 34. 1000 35. 1000 36. 1000 37. 1000 38. 1000 39. 1000 40. 1000 41. 1000 42. 1000 43. 1000 44. 1000 45. 1000 46. 1000 47. 1000 48. 1000 49. 1000 50. 1000 51. 1000 52. 1000 53. 1000 54. 1000 55. 1000 56. 1000 57. 1000 58. 1000 59. 1000 60. 1000 61. 1000 62. 1000 63. 1000 64. 1000 65. 1000 66. 1000 67. 1000 68. 1000 69. 1000 70. 1000 71. 1000 72. 1000 73. 1000 74. 1000 75. 1000 76. 1000 77. 1000 78. 1000 79. 1000 80. 1000 81. 1000 82. 1000 83. 1000 84. 1000 85. 1000 86. 1000 87. 1000 88. 1000 89. 1000 90. 1000 91. 1000 92. 1000 93. 1000 94. 1000 95. 1000 96. 1000 97. 1000 98. 1000 99. 1000 100. 1000	1. 1000 2. 1000 3. 1000 4. 1000 5. 1000 6. 1000 7. 1000 8. 1000 9. 1000 10. 1000 11. 1000 12. 1000 13. 1000 14. 1000 15. 1000 16. 1000 17. 1000 18. 1000 19. 1000 20. 1000 21. 1000 22. 1000 23. 1000 24. 1000 25. 1000 26. 1000 27. 1000 28. 1000 29. 1000 30. 1000 31. 1000 32. 1000 33. 1000 34. 1000 35. 1000 36. 1000 37. 1000 38. 1000 39. 1000 40. 1000 41. 1000 42. 1000 43. 1000 44. 1000 45. 1000 46. 1000 47. 1000 48. 1000 49. 1000 50. 1000 51. 1000 52. 1000 53. 1000 54. 1000 55. 1000 56. 1000 57. 1000 58. 1000 59. 1000 60. 1000 61. 1000 62. 1000 63. 1000 64. 1000 65. 1000 66. 1000 67. 1000 68. 1000 69. 1000 70. 1000 71. 1000 72. 1000 73. 1000 74. 1000 75. 1000 76. 1000 77. 1000 78. 1000 79. 1000 80. 1000 81. 1000 82. 1000 83. 1000 84. 1000 85. 1000 86. 1000 87. 1000 88. 1000 89. 1000 90. 1000 91. 1000 92. 1000 93. 1000 94. 1000 95. 1000 96. 1000 97. 1000 98. 1000 99. 1000 100. 1000

Vehicle B (Target) . VW Rabbit

Comments: Two-vehicles - Moving



CAMERA SYMBOLS	FRAME RATE
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
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89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

CAMERA	YES
STILLS	X
SLIDES	
MOVIE	X
POLAROID	
VIDEO	

III
O

GROUND

△ BARRIER

☒ OVERHEAD

ON-BOARD

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

[illegible]

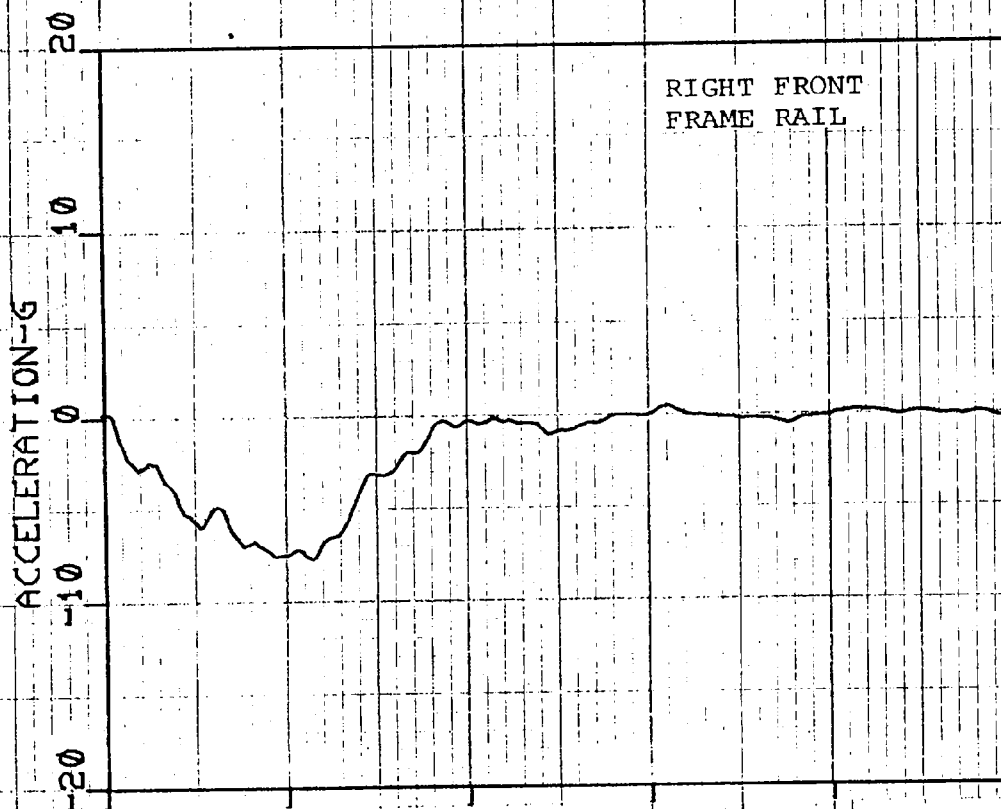
FIGURE A-8. CAMERA LOCATIONS - GROUND BASED.

APPENDIX B

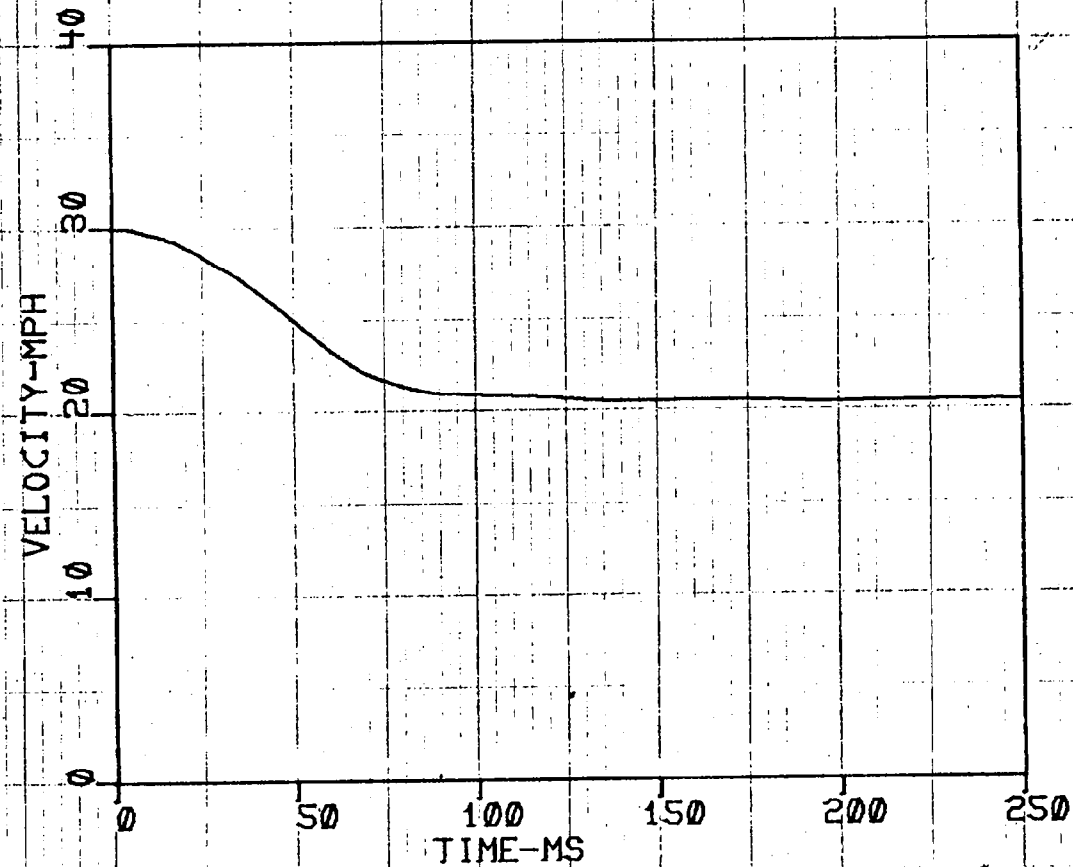
CALCOMP PLOTS
FOR TEST 8327-6.5

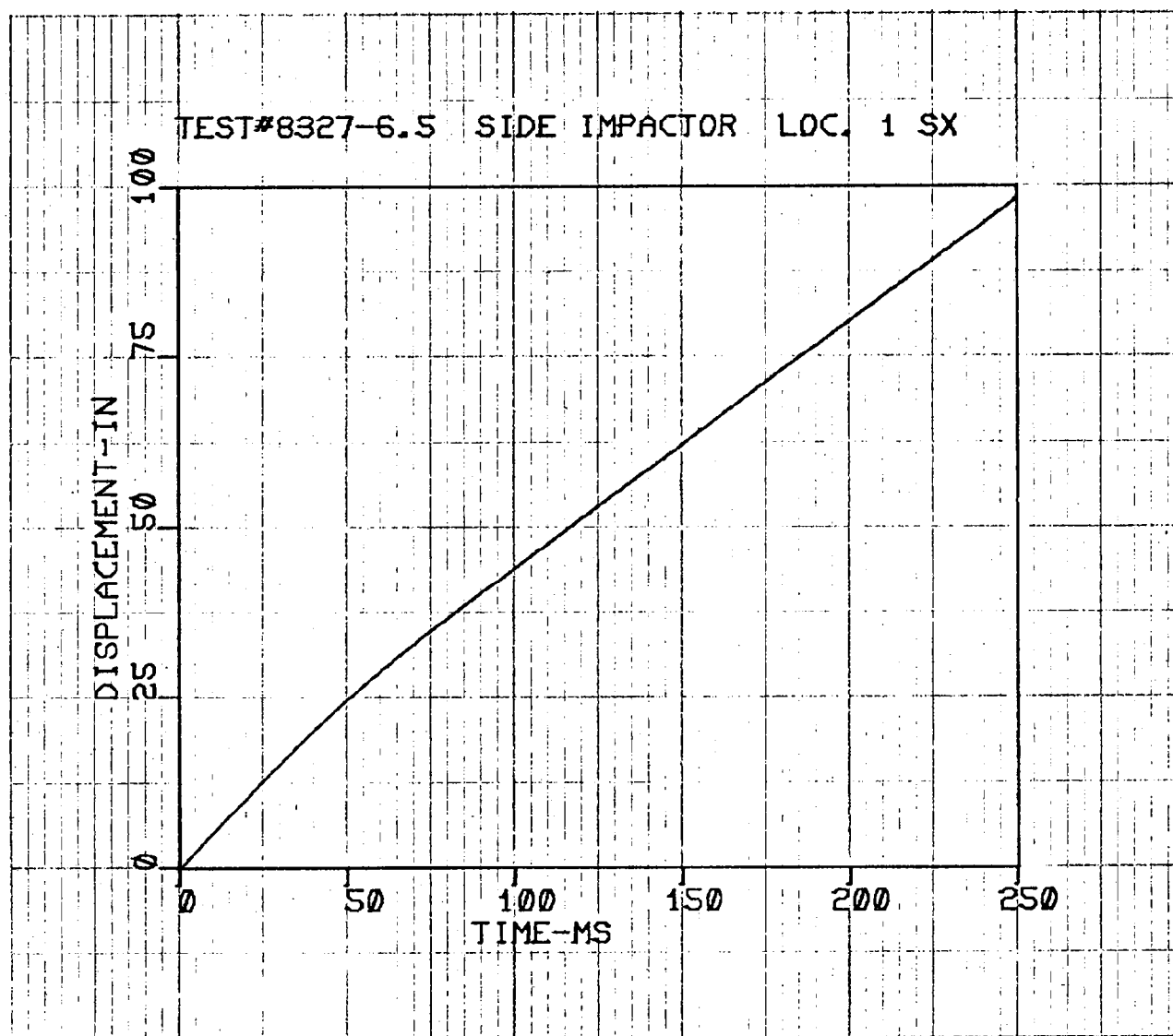
STRAIGHT SIDE IMPACTOR-INTO
MODIFIED VW RABBIT AT 60°
(BOTH VEHICLES MOVING)
(FRONT: APR REAR: SID)

TEST#8327-6.5 SIDE IMPACTOR LOC. 1 AX

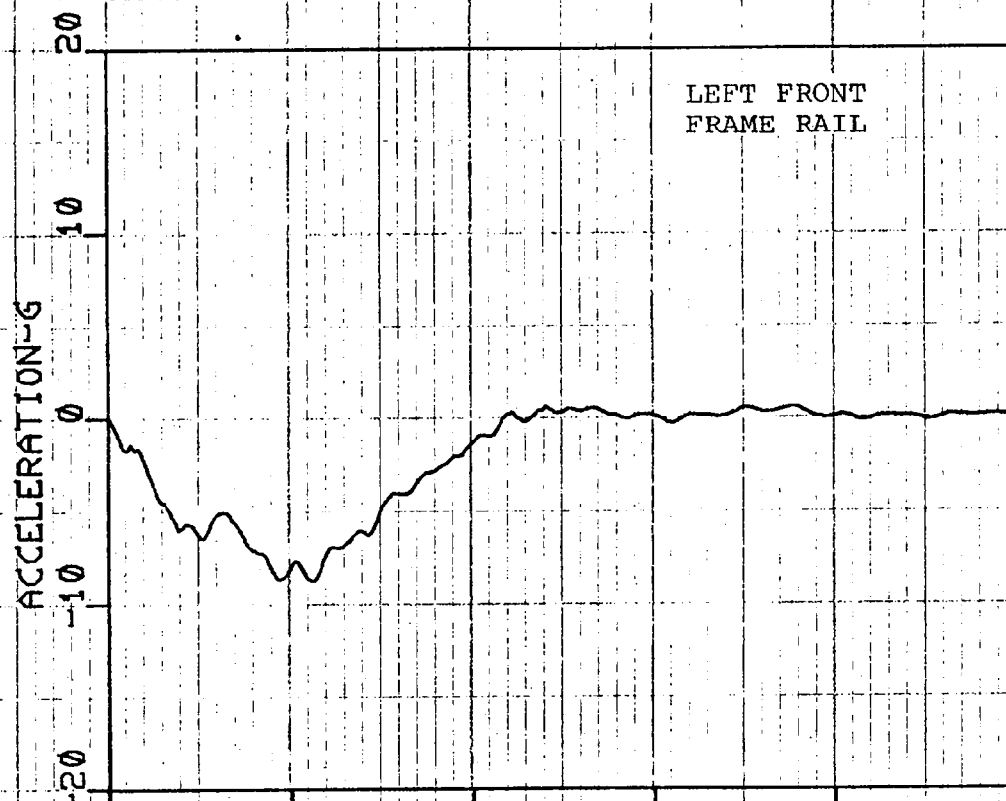


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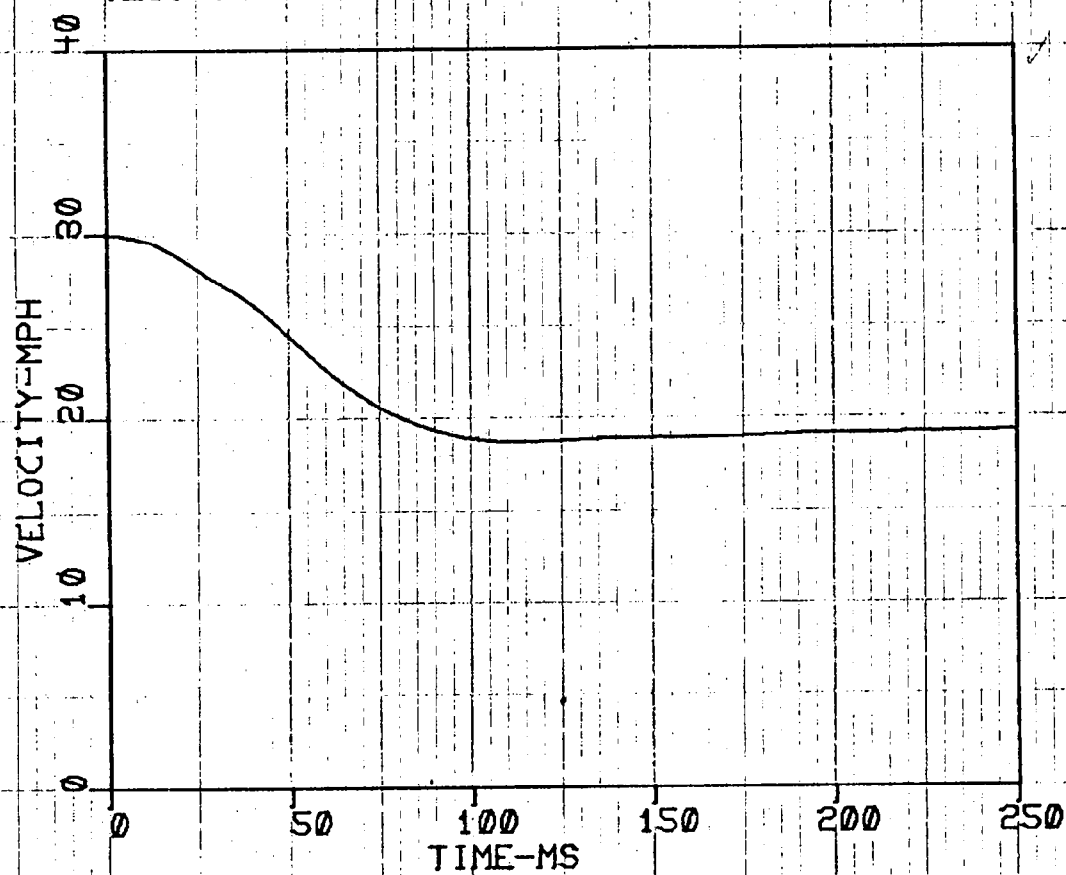


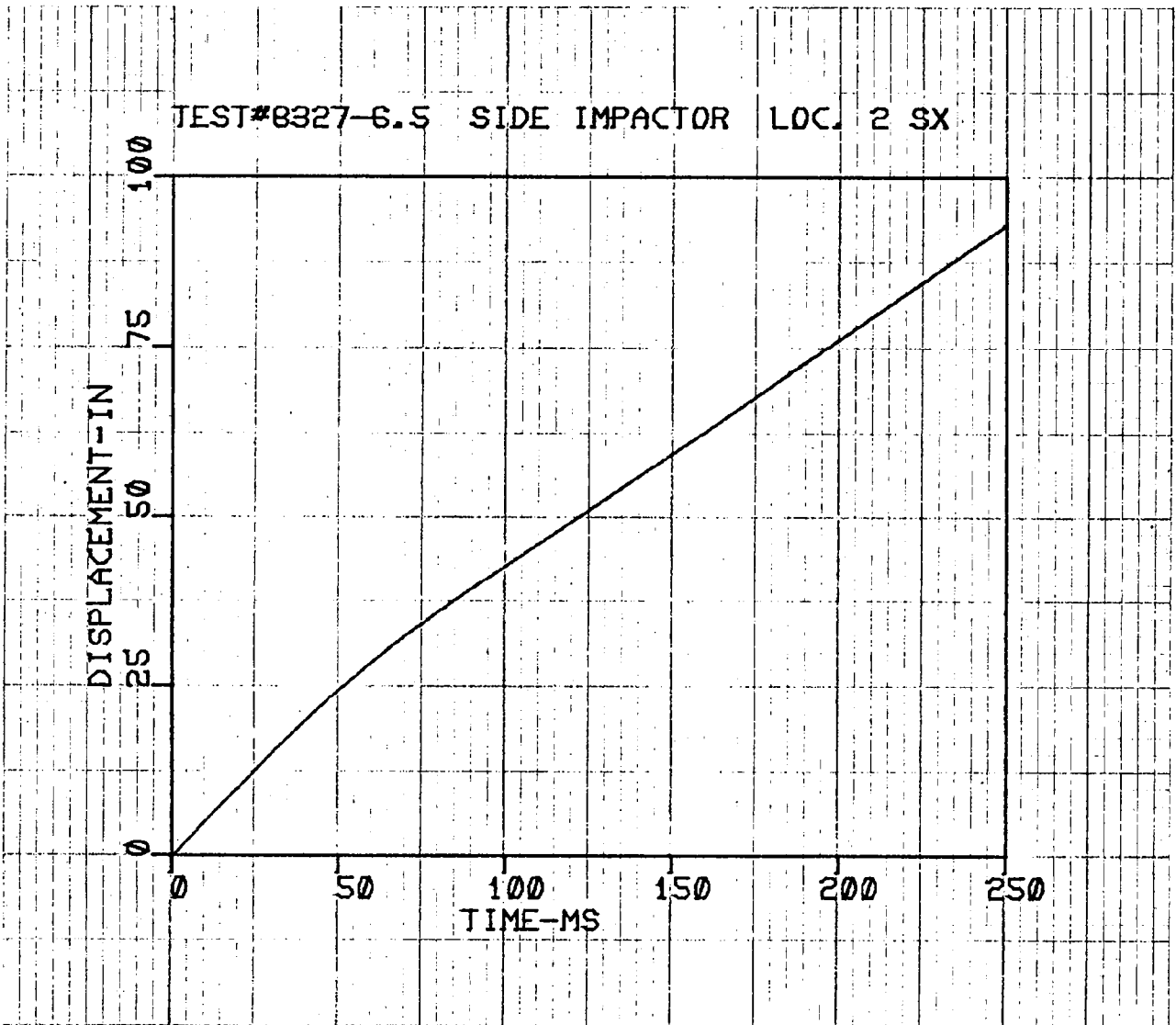


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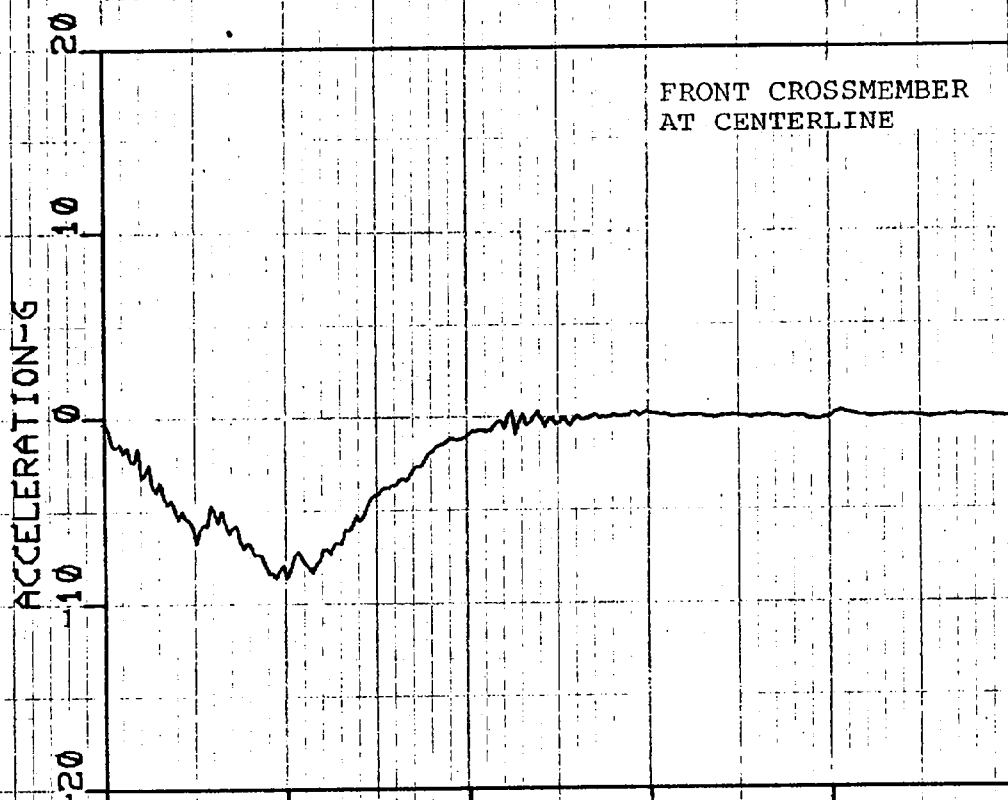


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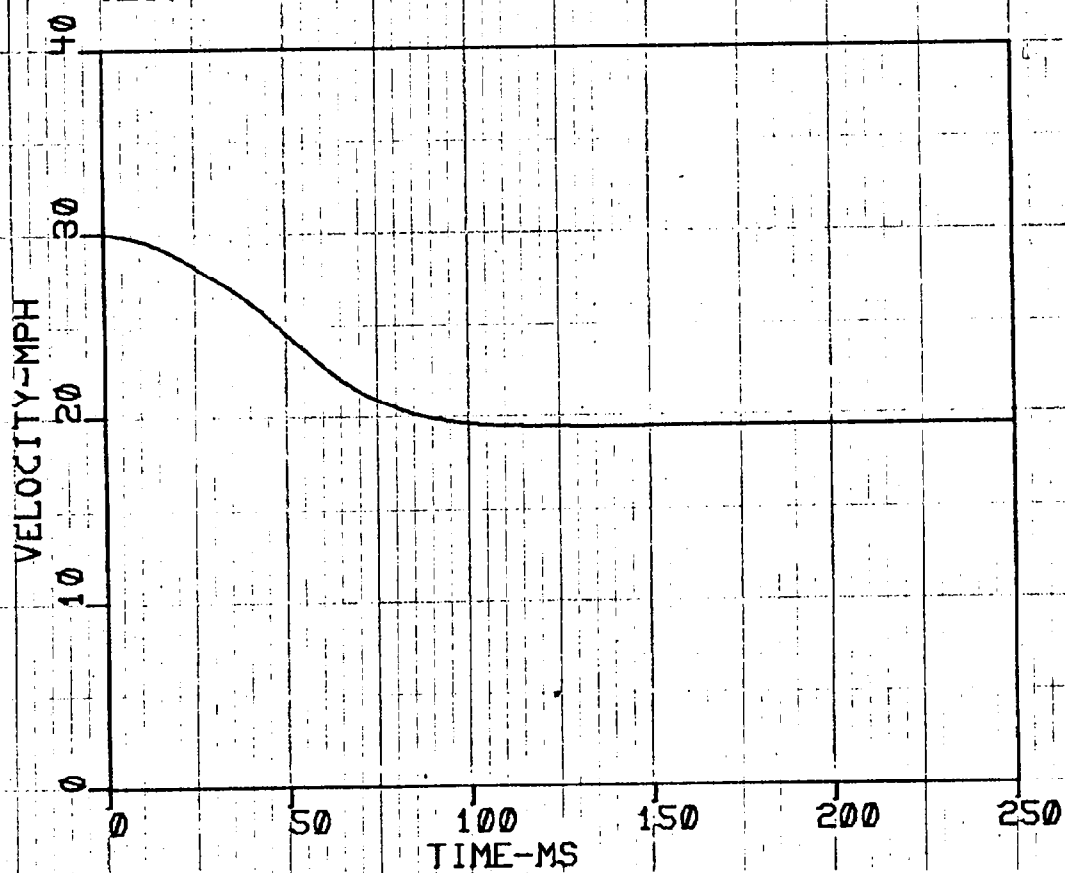


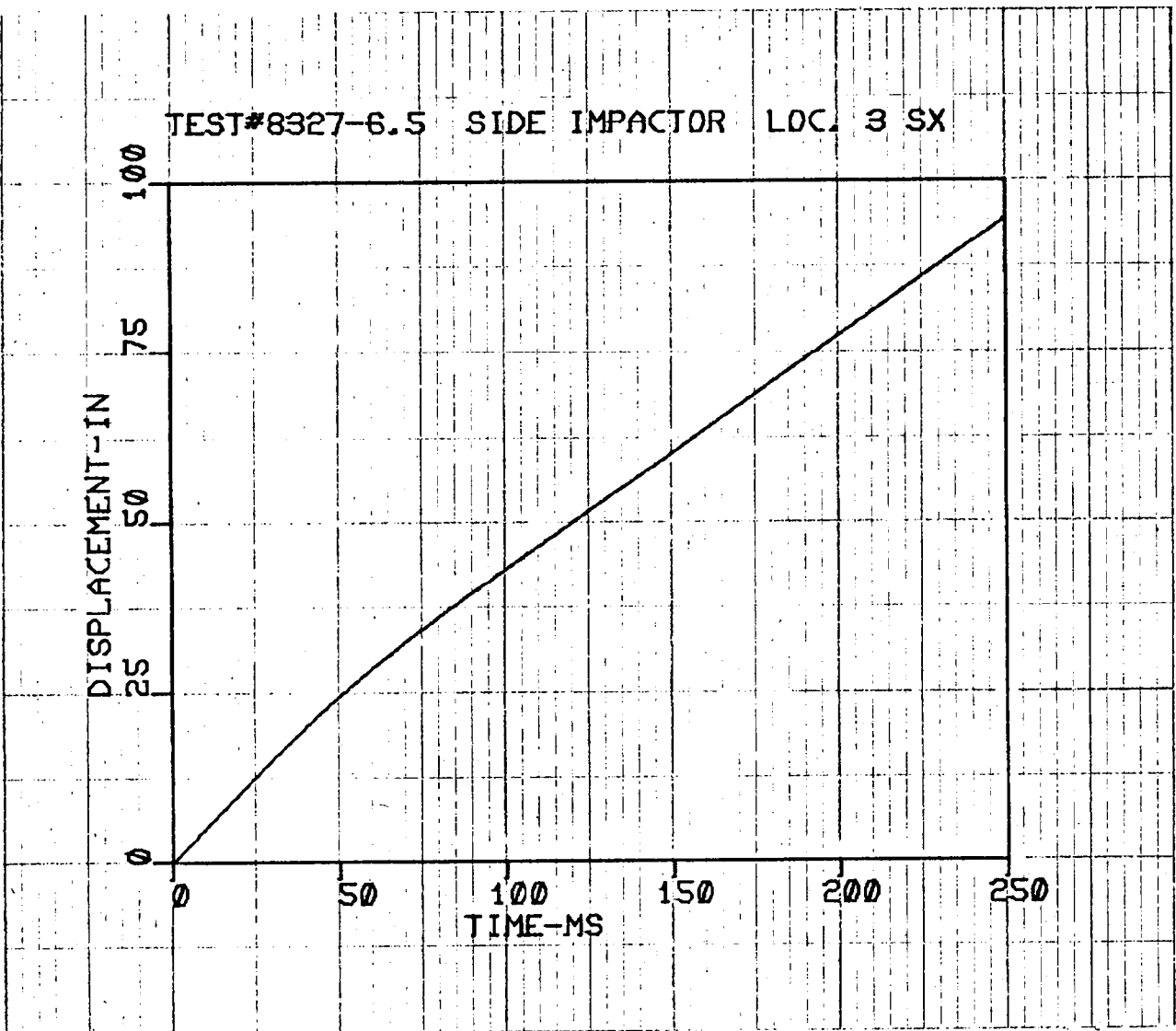


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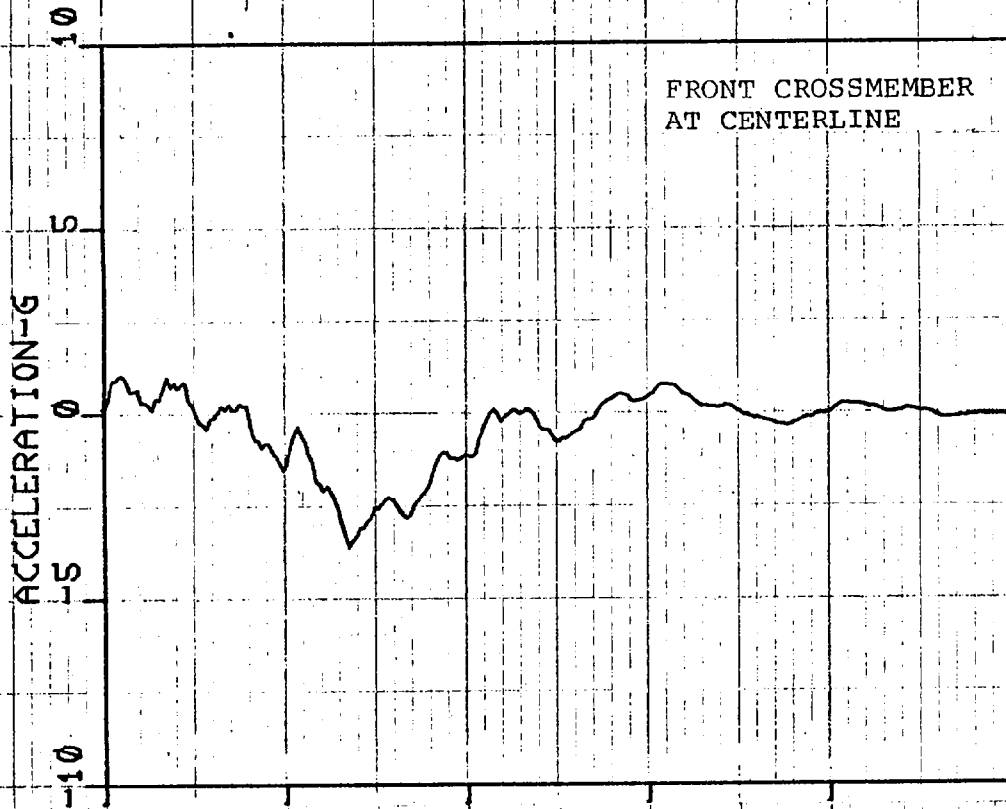


TEST#8327-6.5 SIDE IMPACTOR LOC. 3 VX

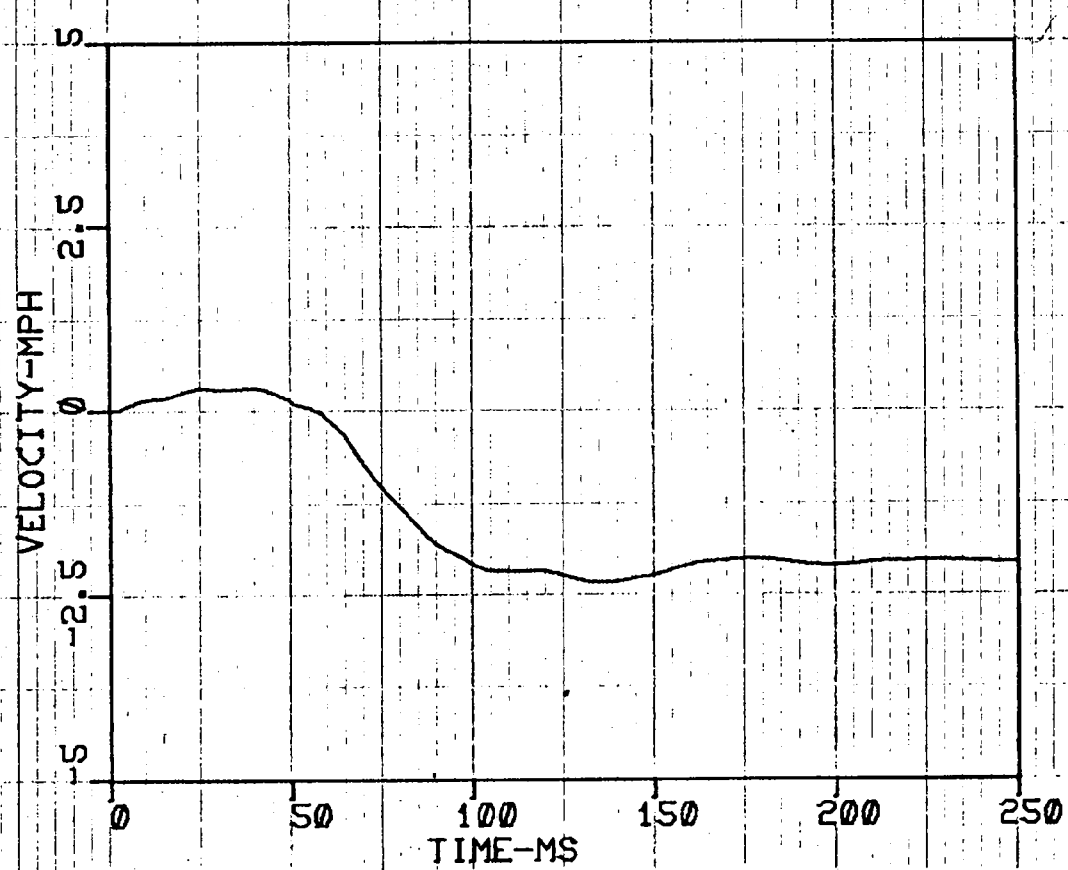


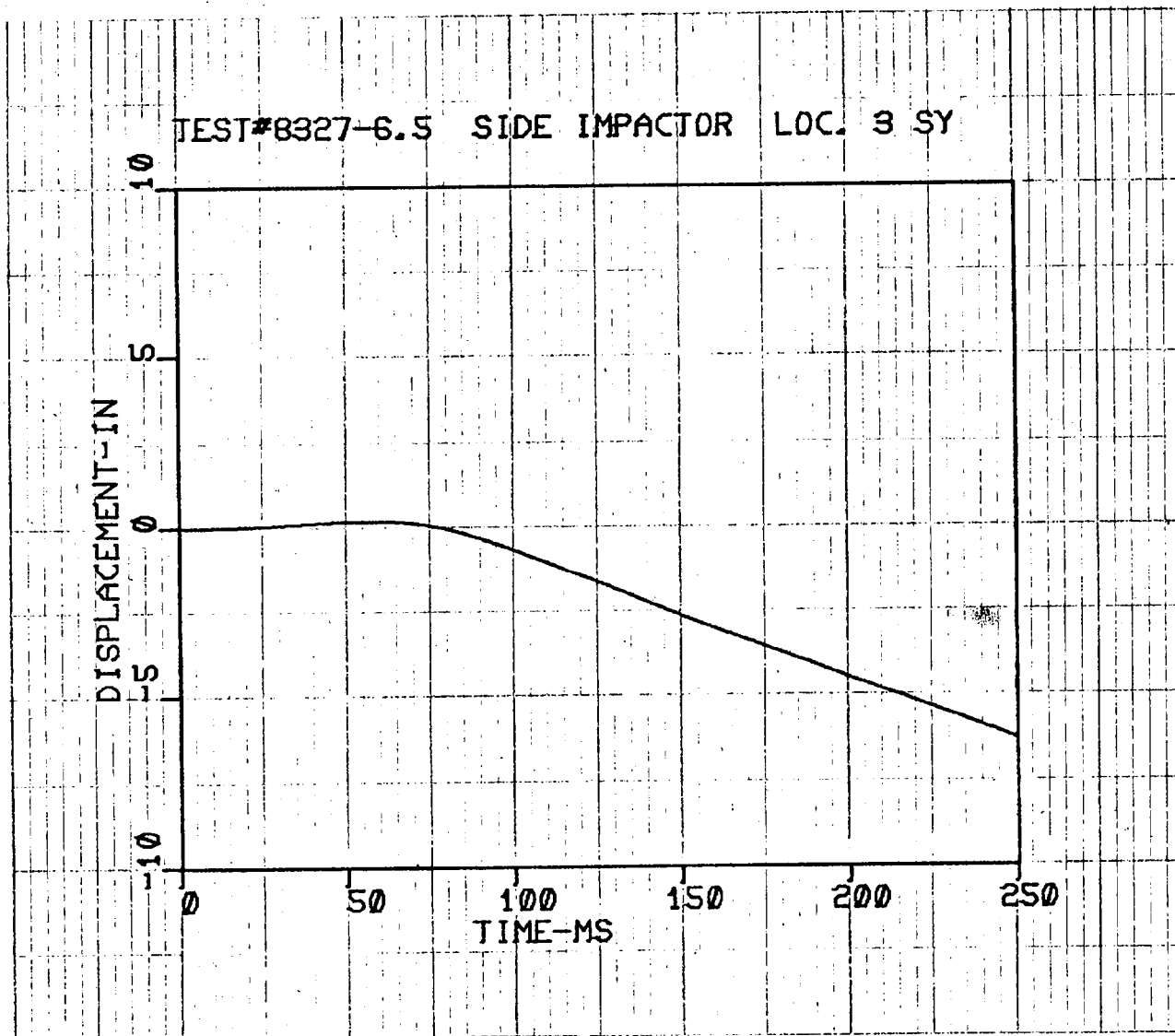


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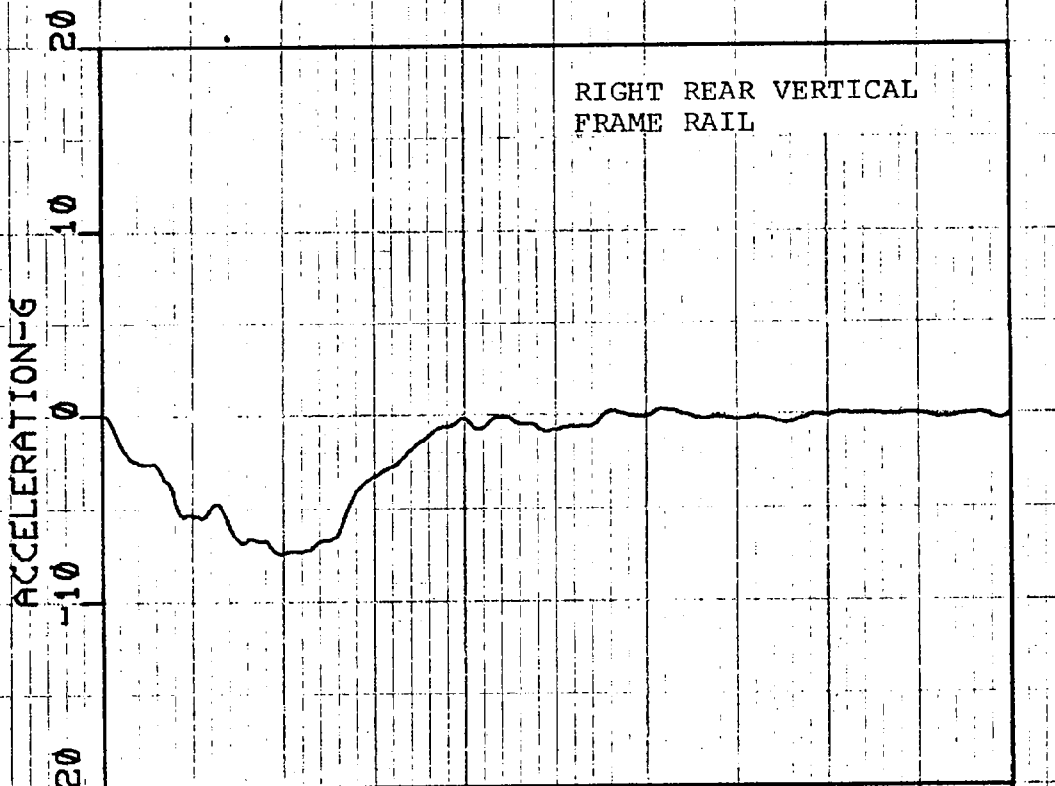


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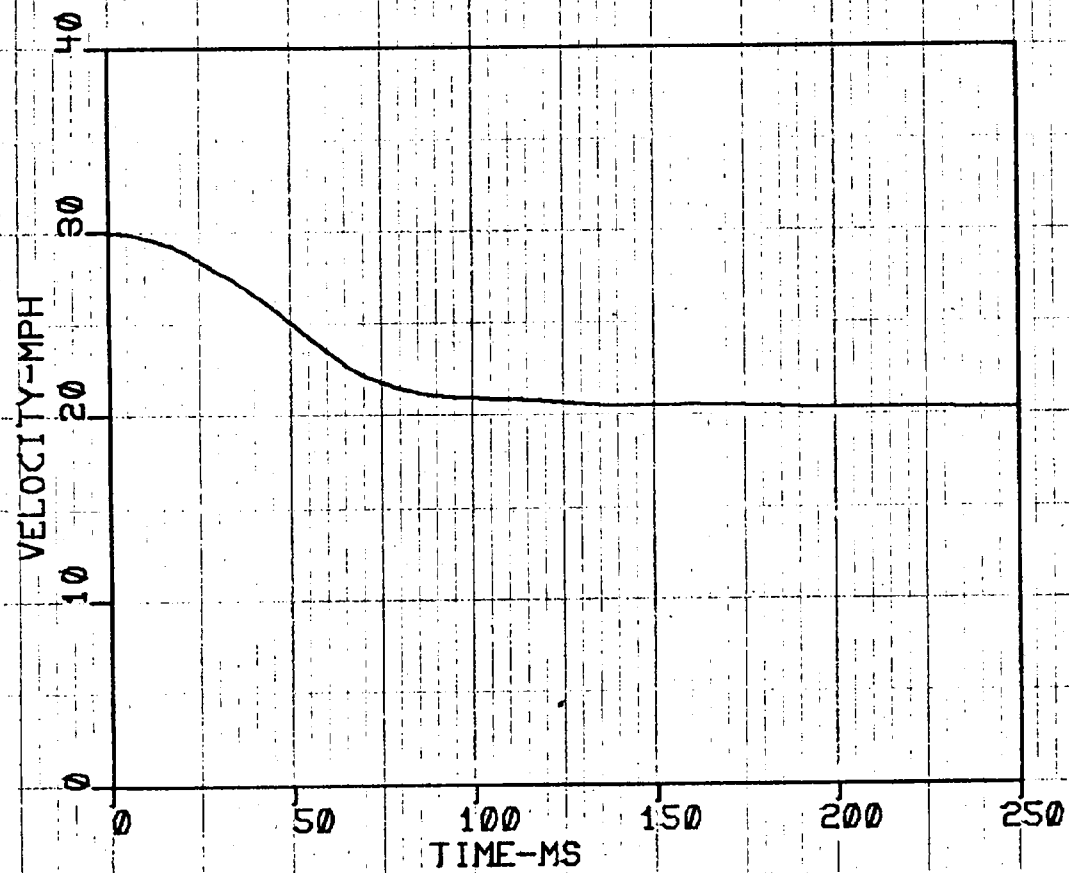


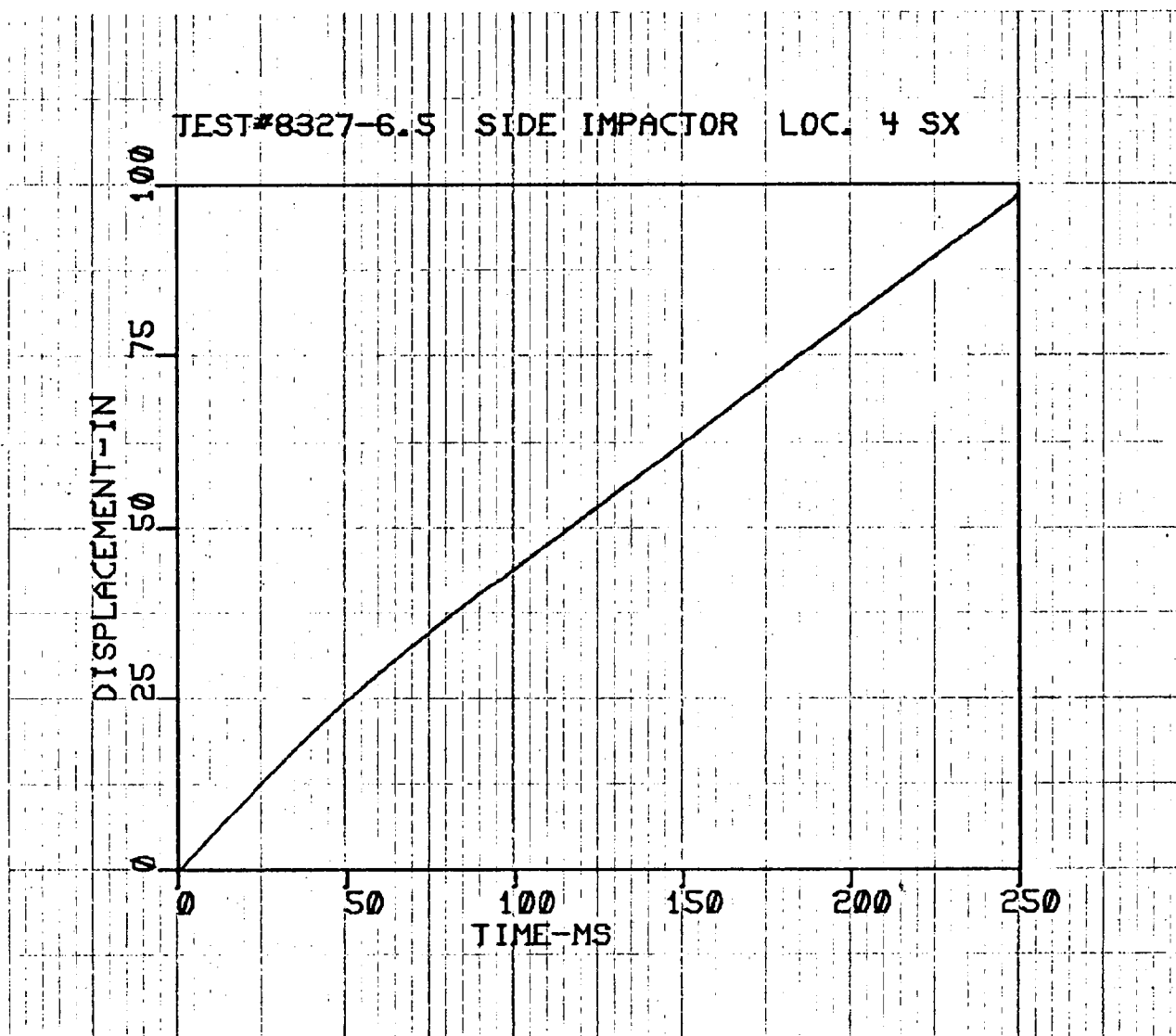


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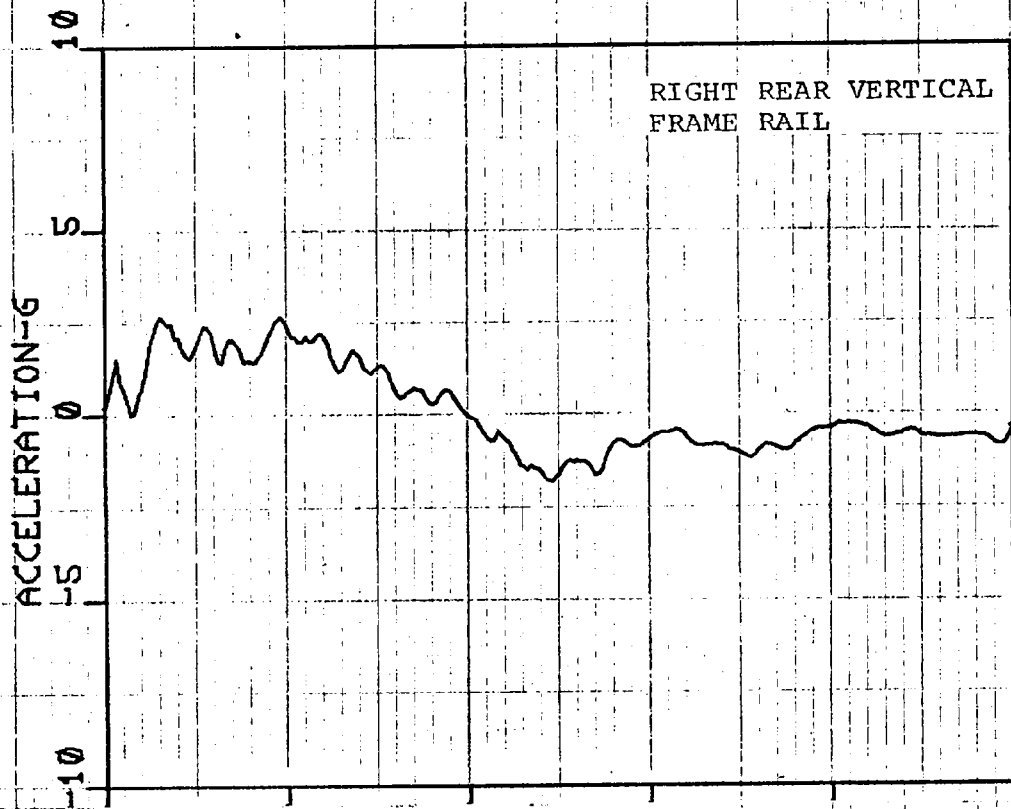


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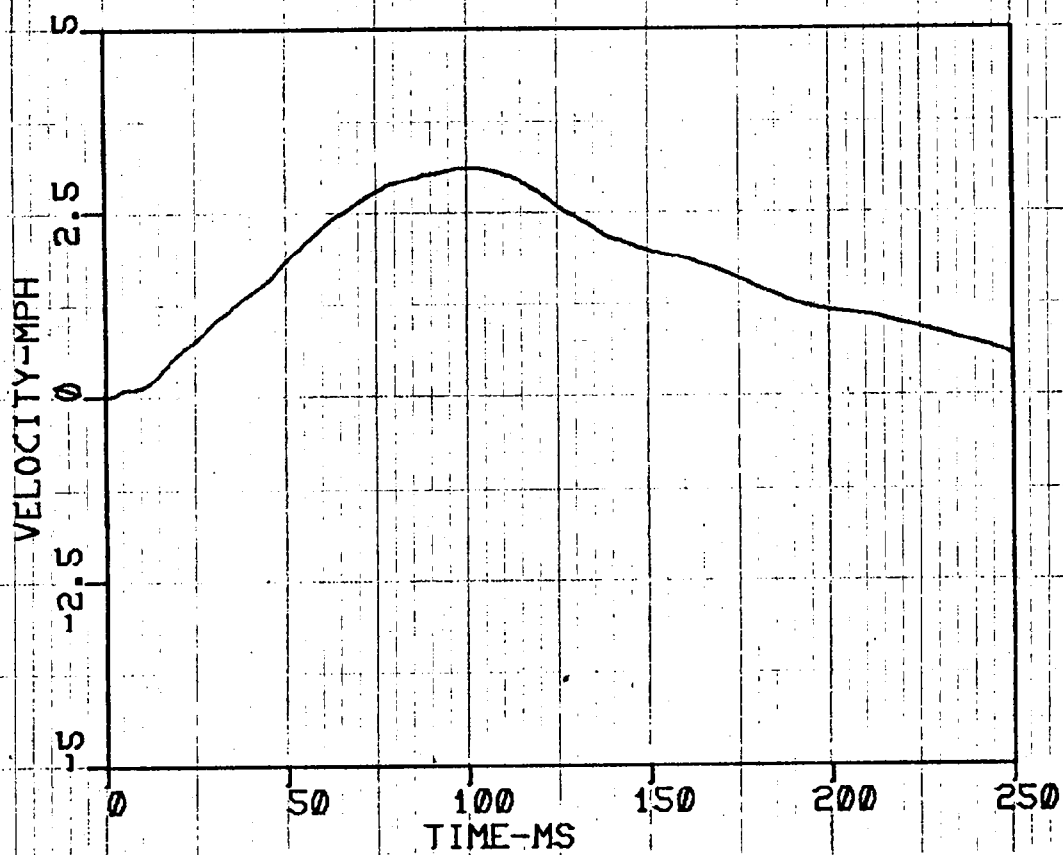


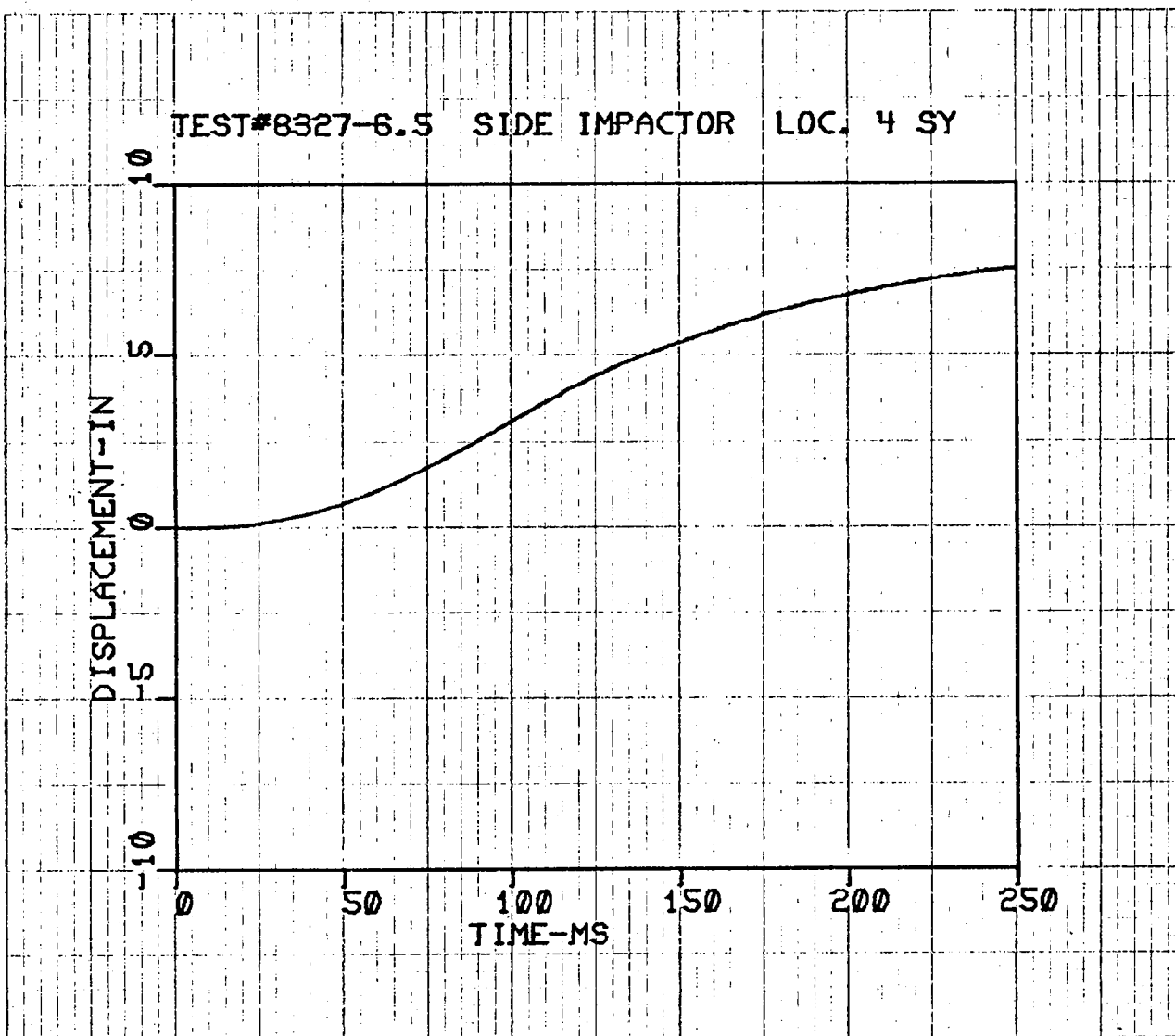


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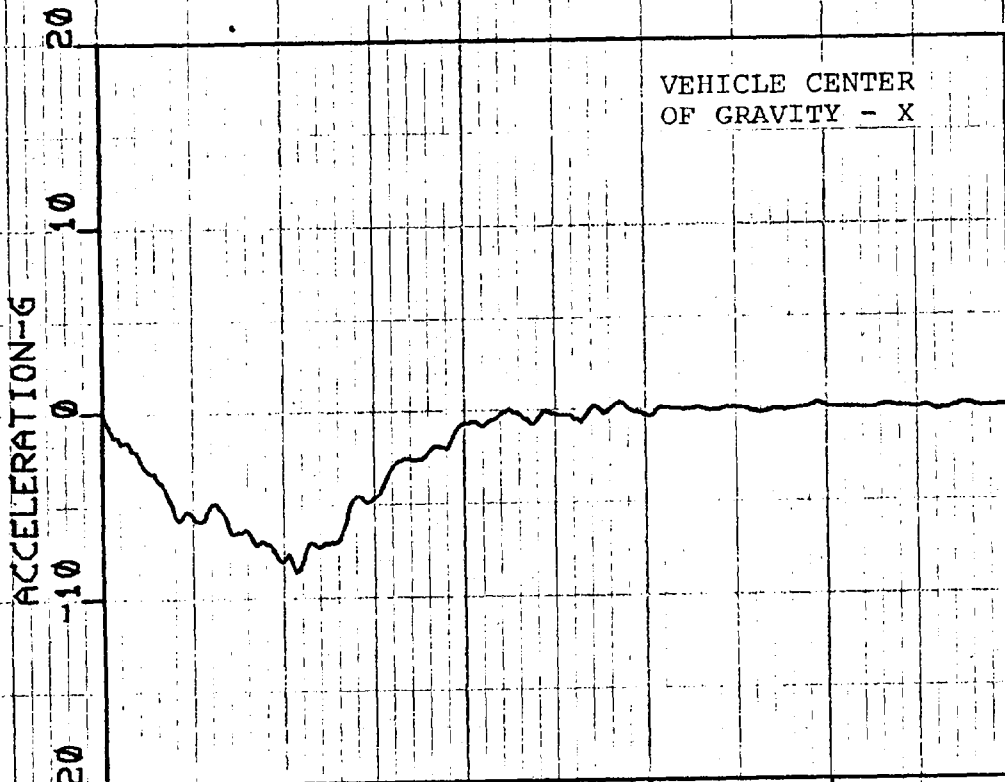


TEST#8327-6.5 SIDE IMPACTOR LOC. 4 VY

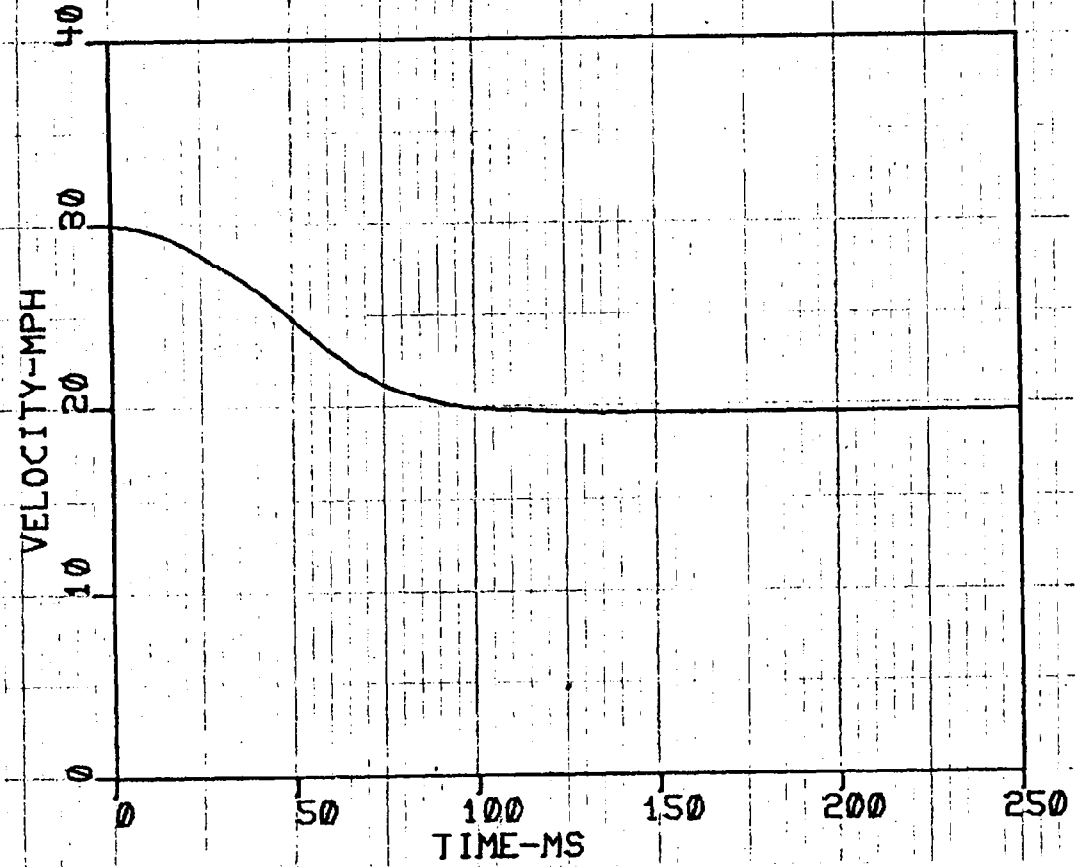


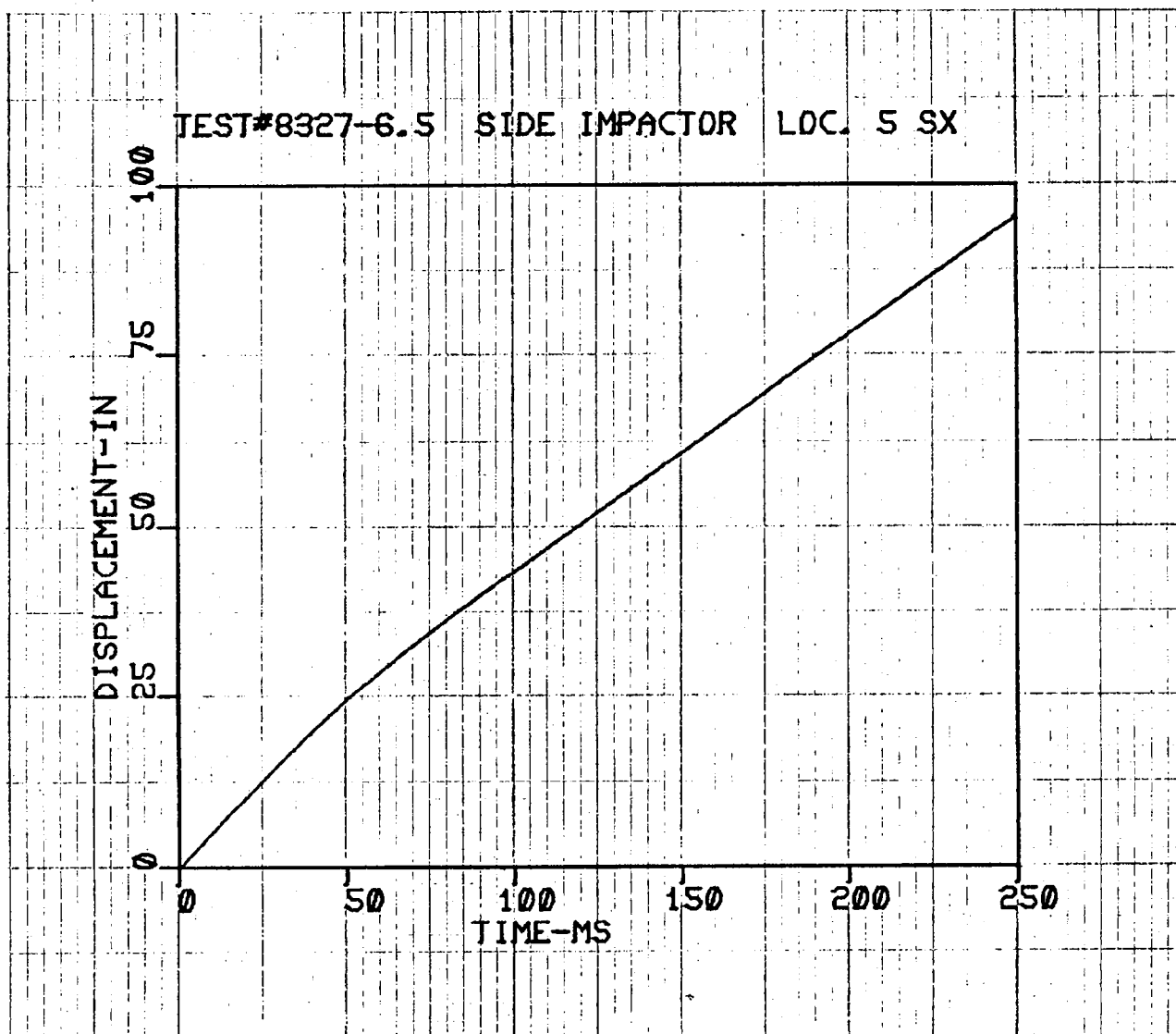


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 AX

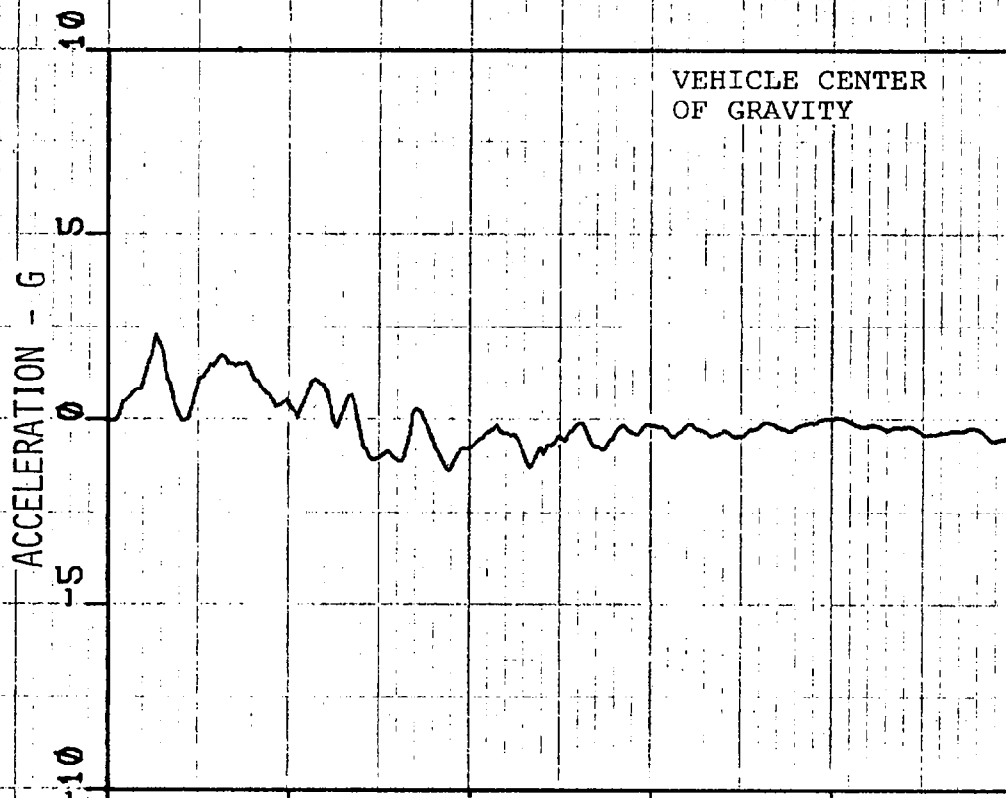


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 VX

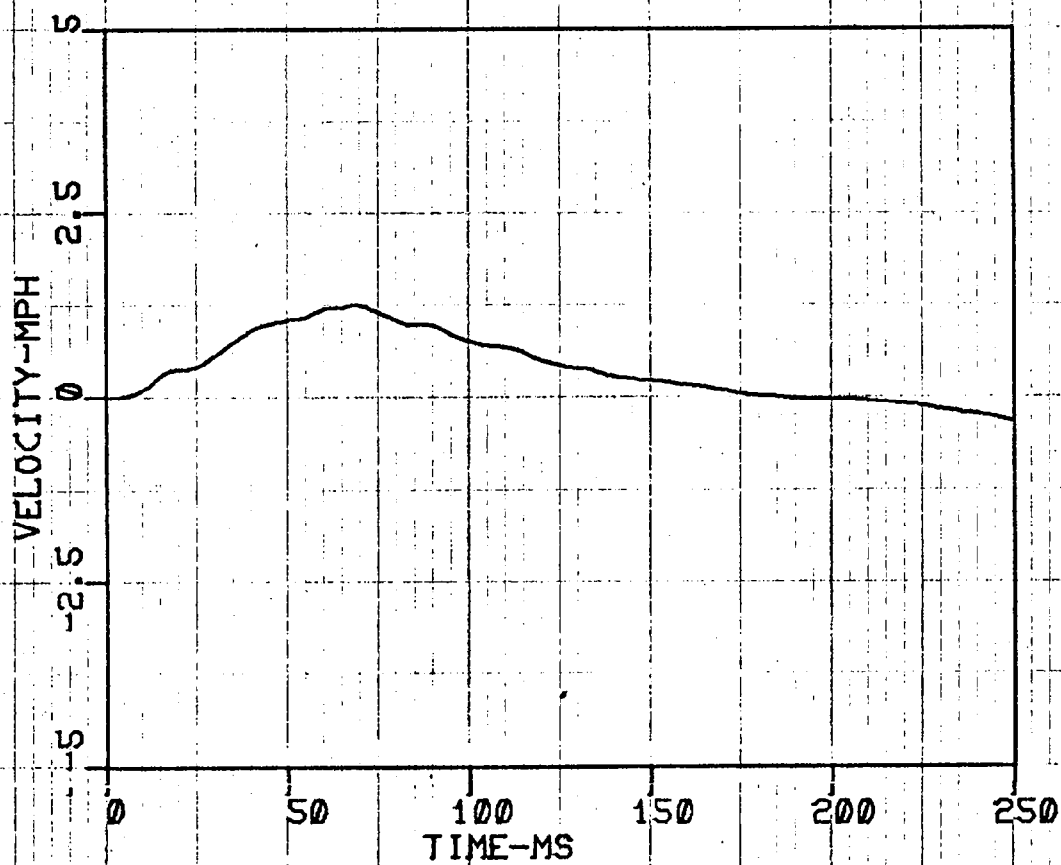


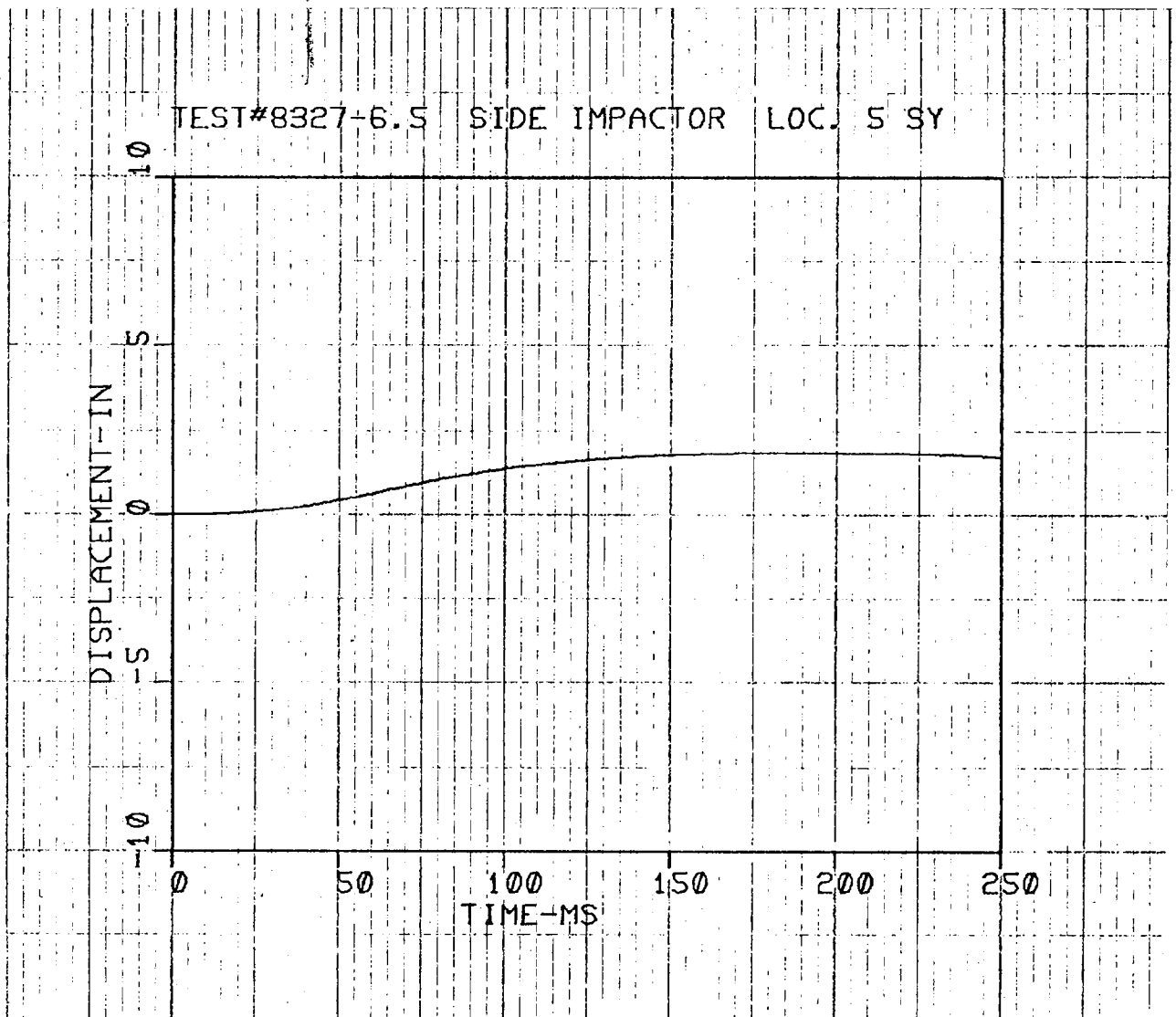


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 AY

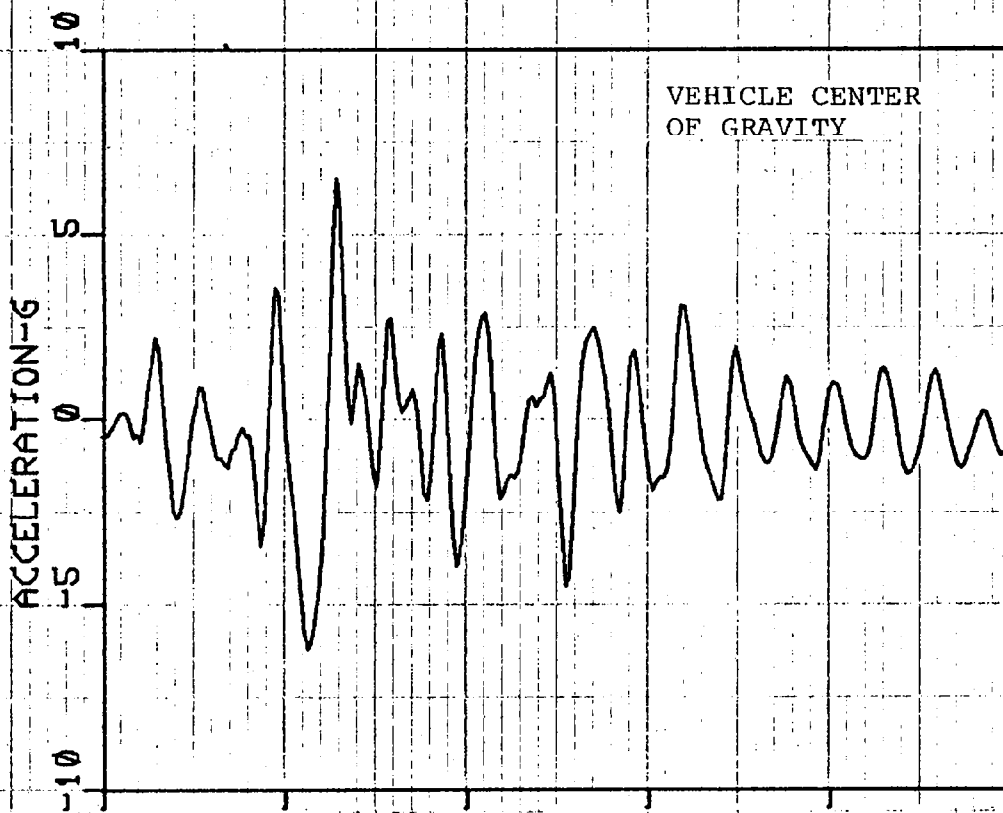


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 VY

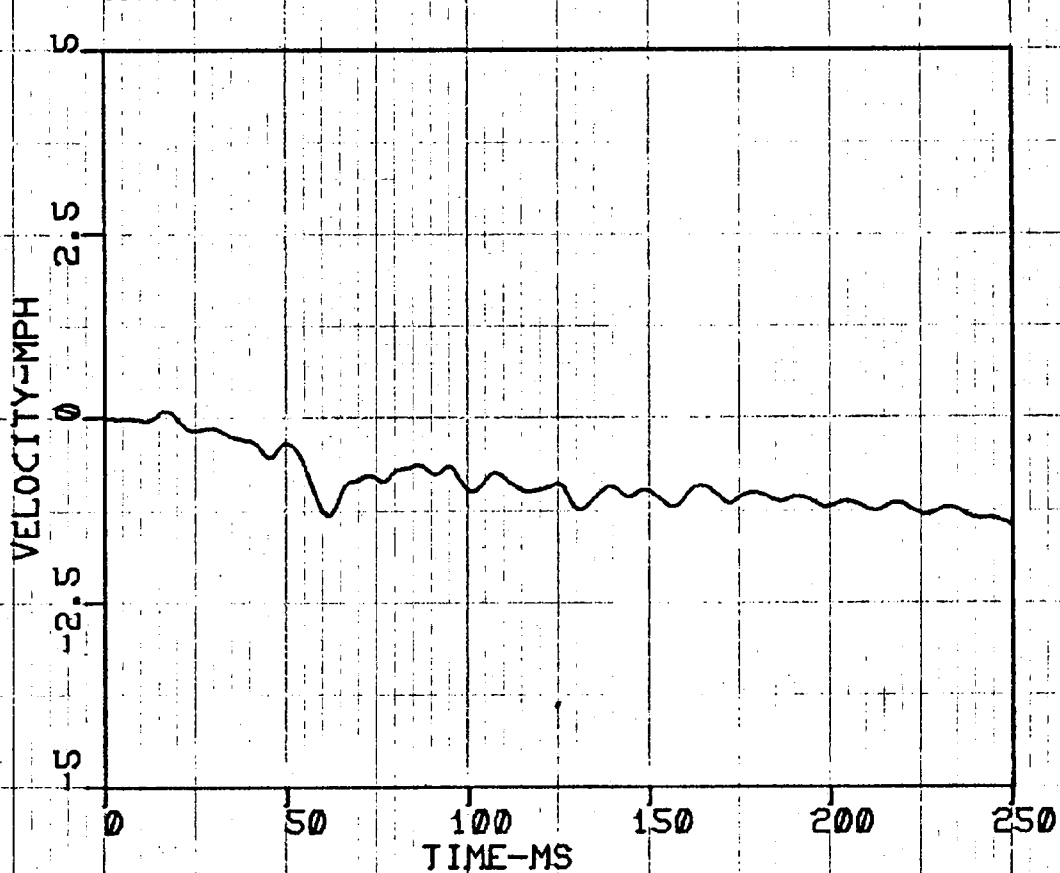


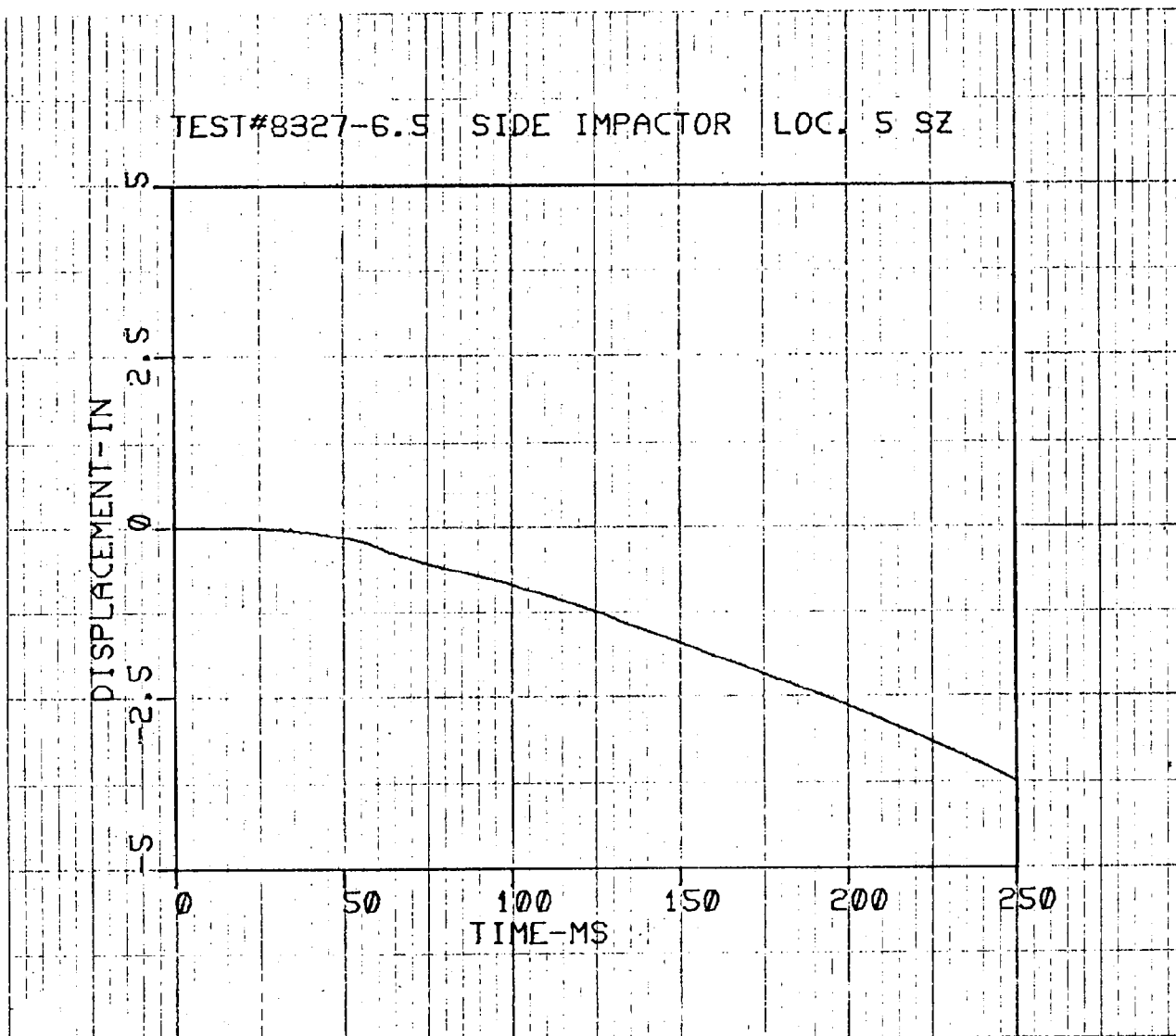


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 AZ

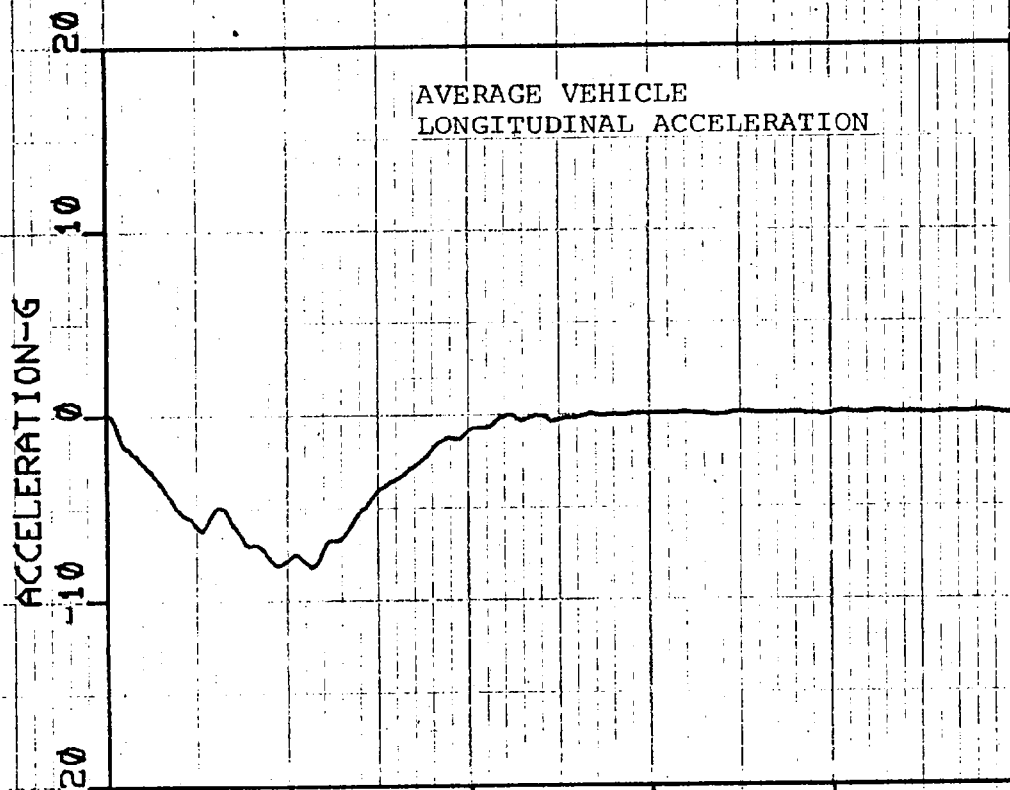


TEST#8327-6.5 SIDE IMPACTOR LOC. 5 VZ

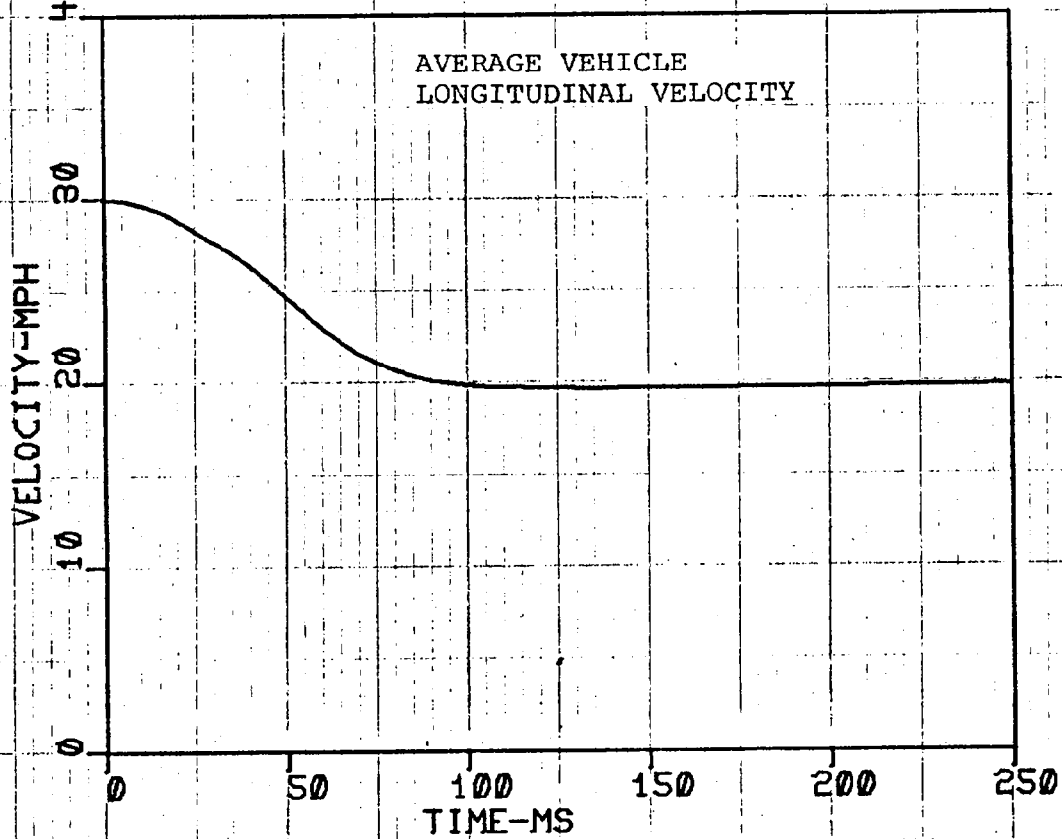


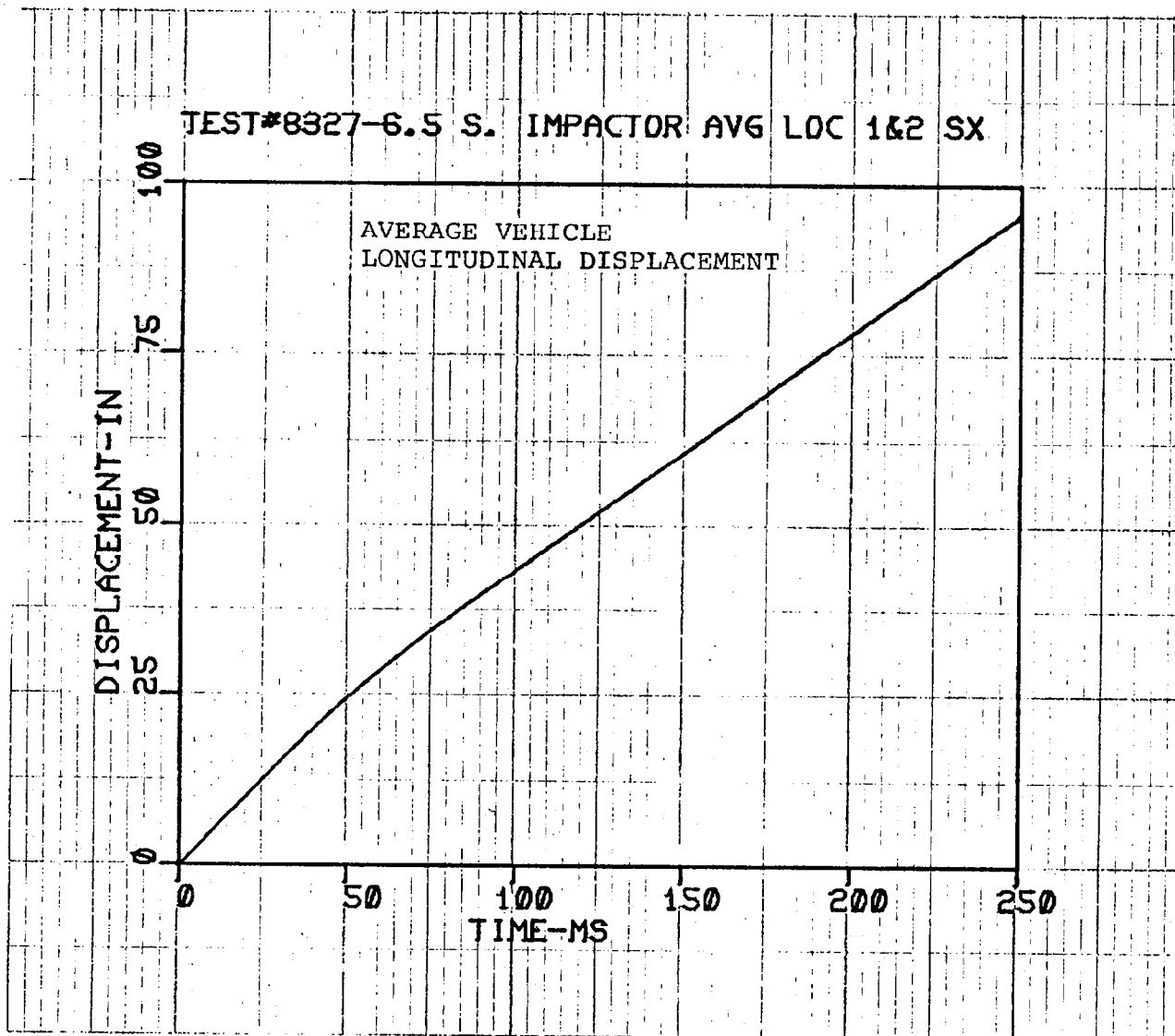


TEST#8327-6.5 S. IMPACTOR AVG LOC 1&2 AX

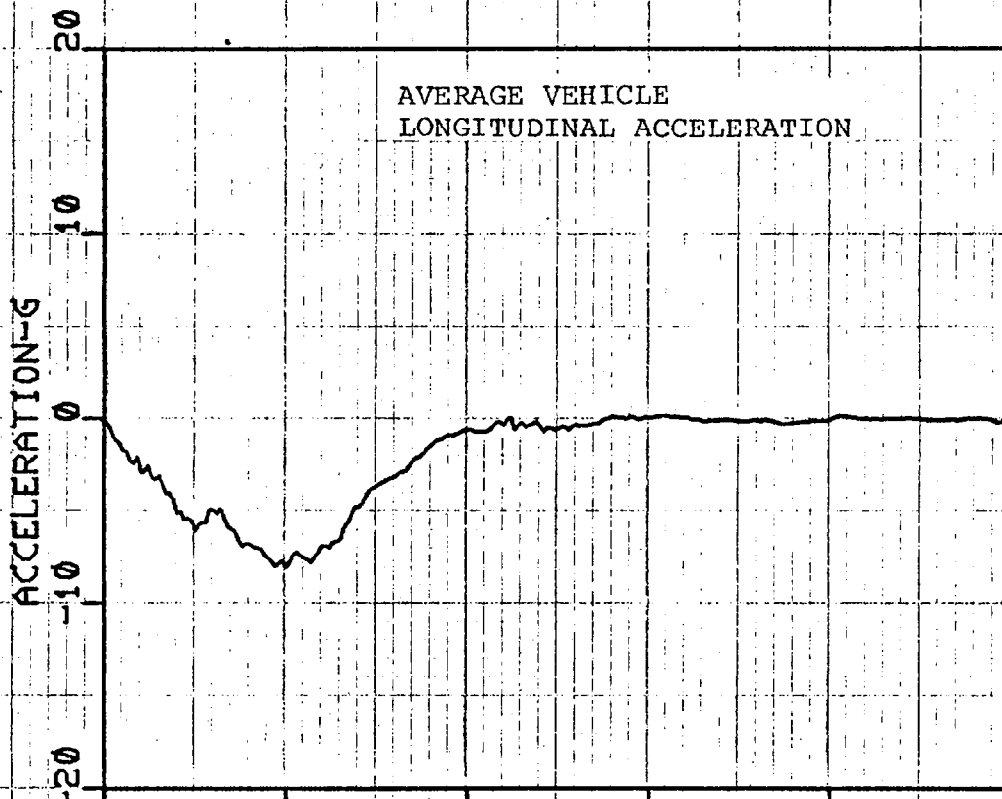


TEST#8327-6.5 S. IMPACTOR AVG LOC 1&2 VX

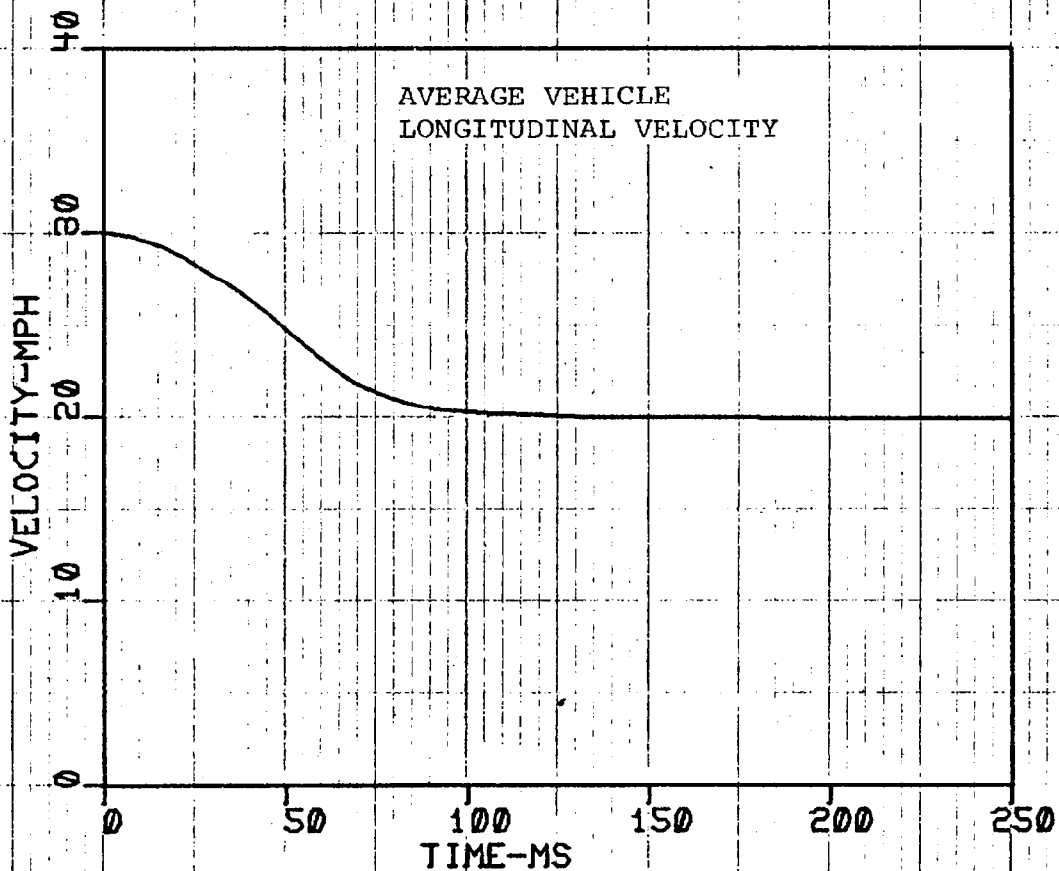


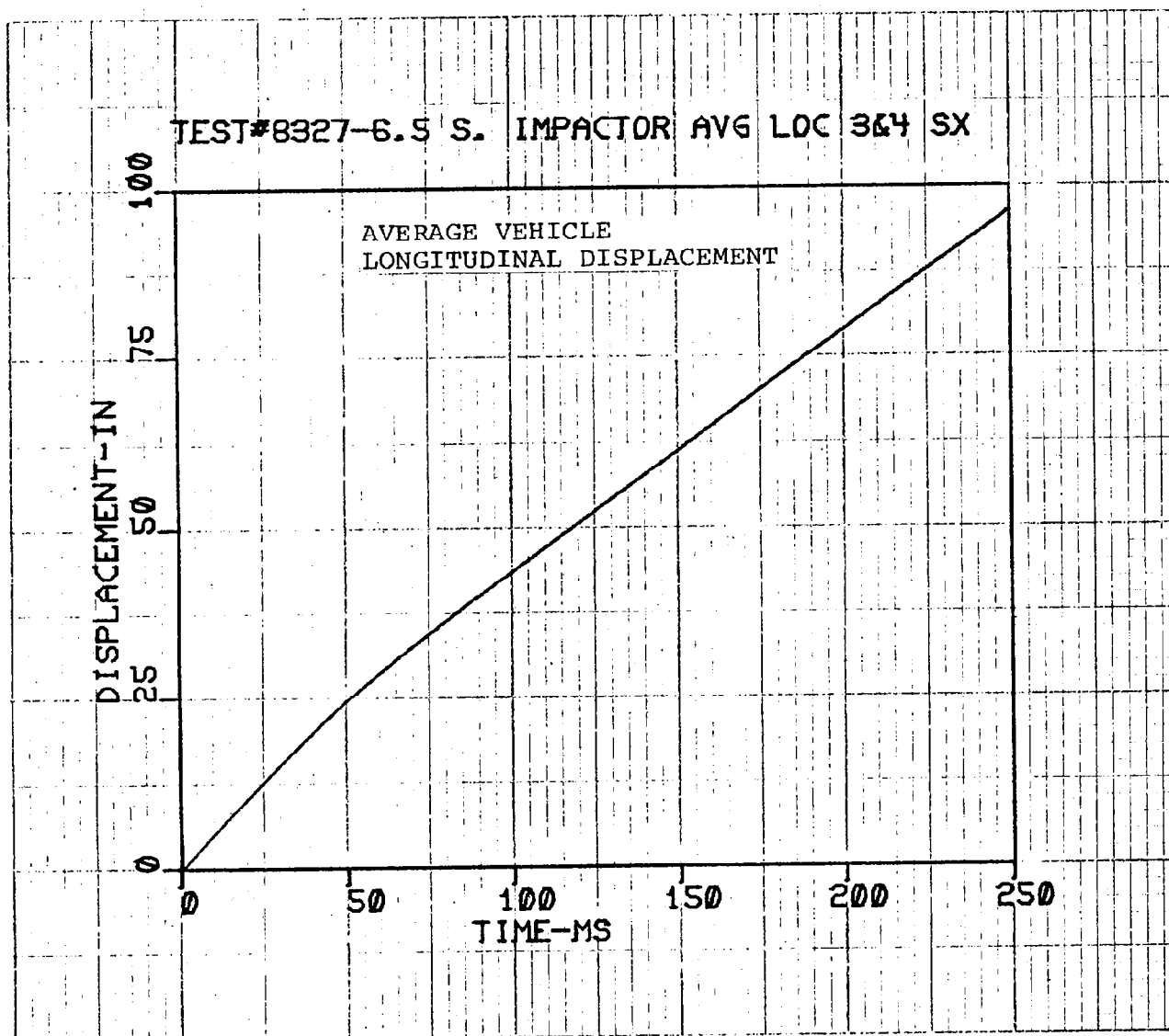


TEST#8327-6.5 S. IMPACTOR AVG LOC 3&4 AX

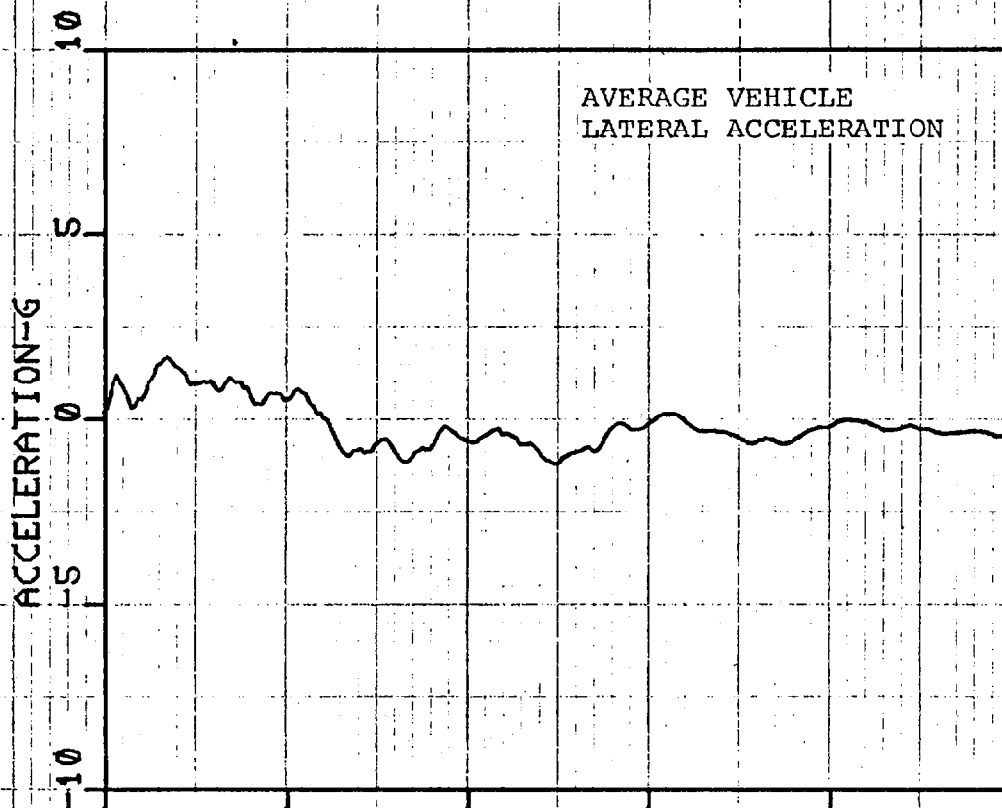


TEST#8327-6.5 S. IMPACTOR AVG LOC 3&4 VX

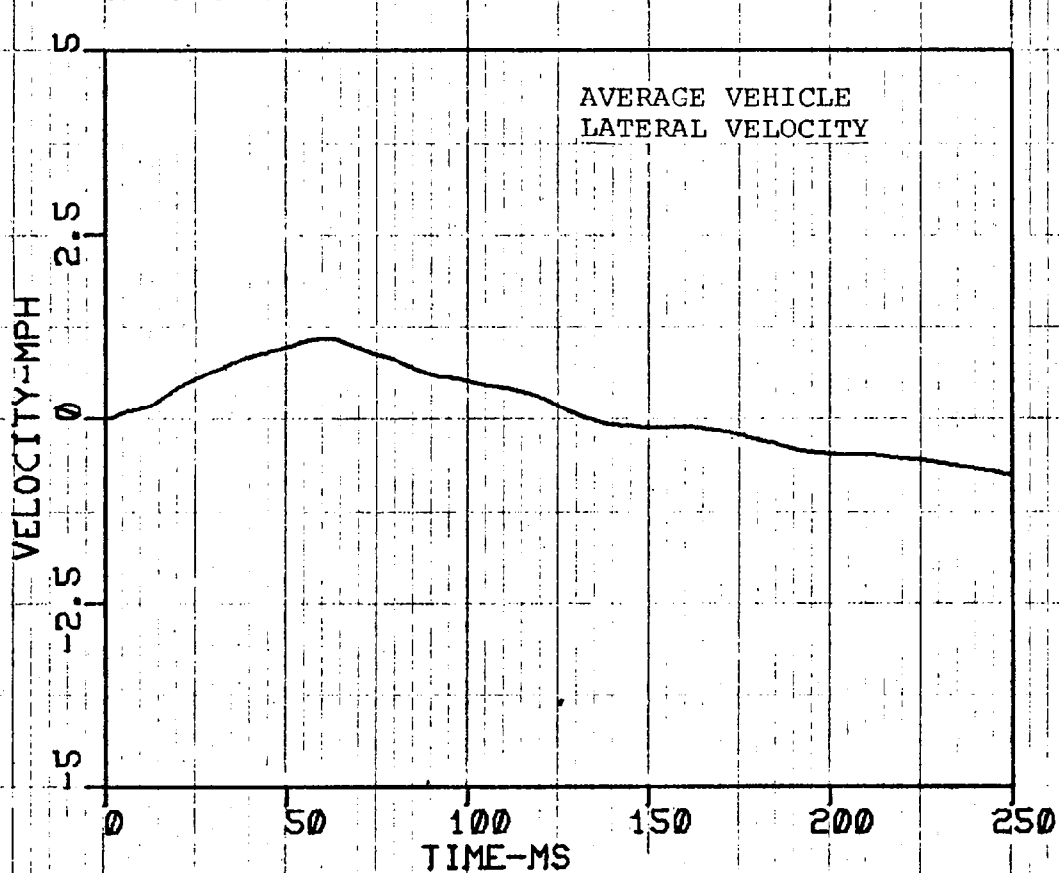


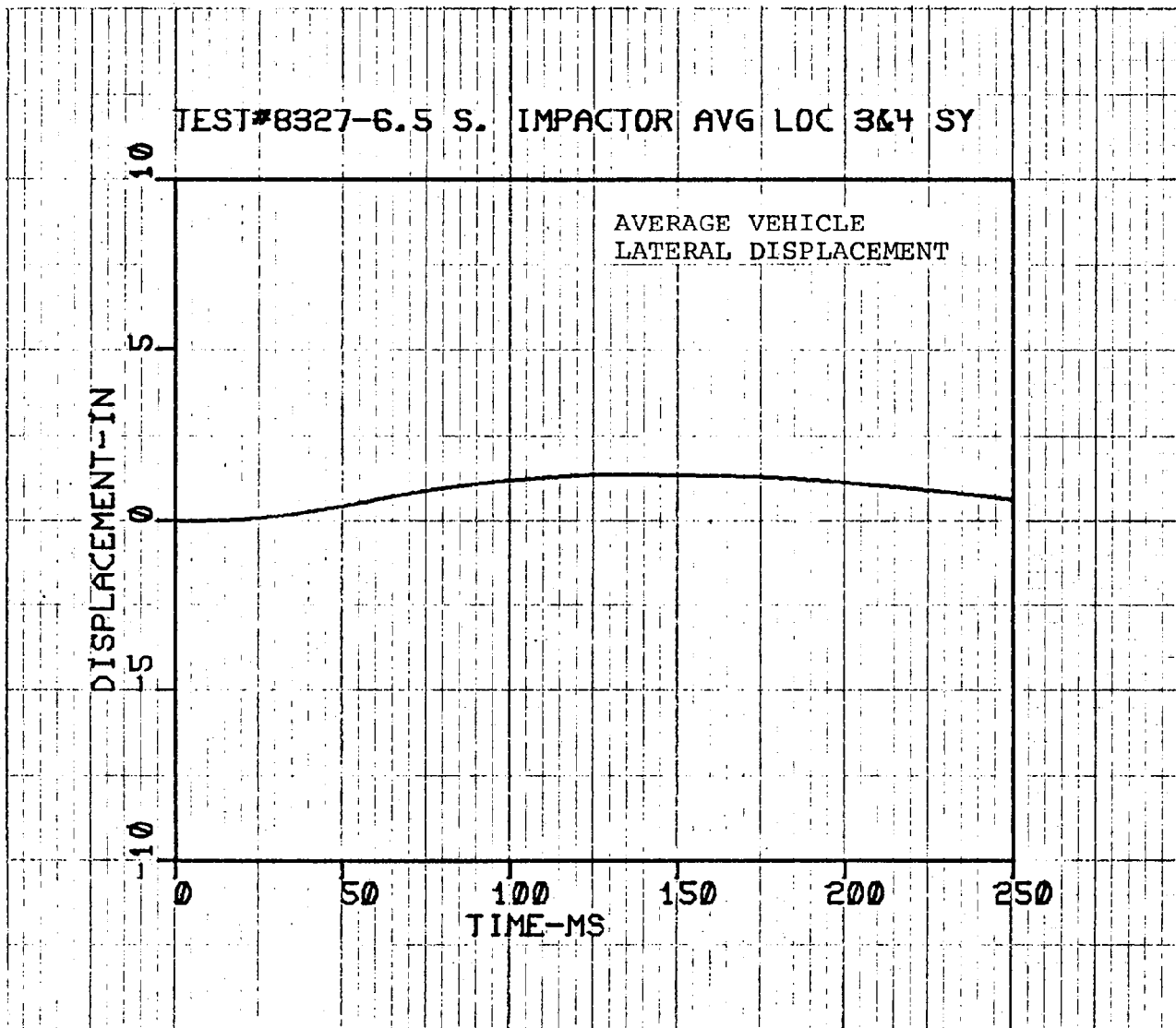


TEST#8327-6.5 S. IMPACTOR AVG LOC 3&4 AY

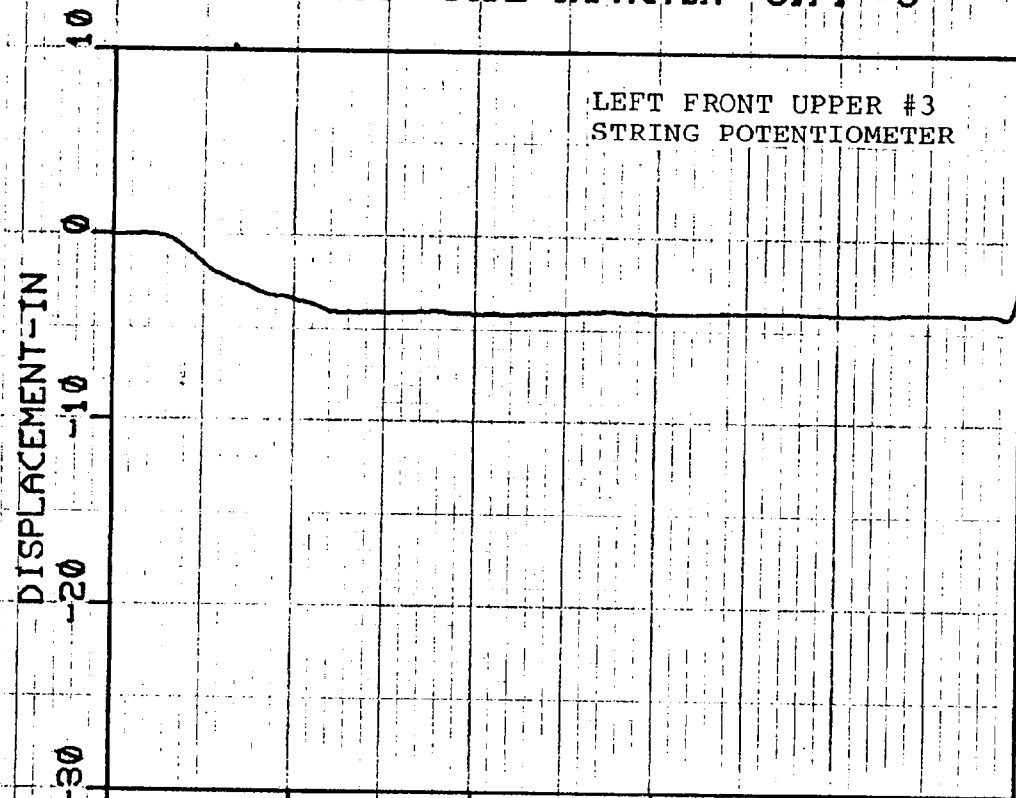


TEST#8327-6.5 S. IMPACTOR AVG LOC 3&4 VY

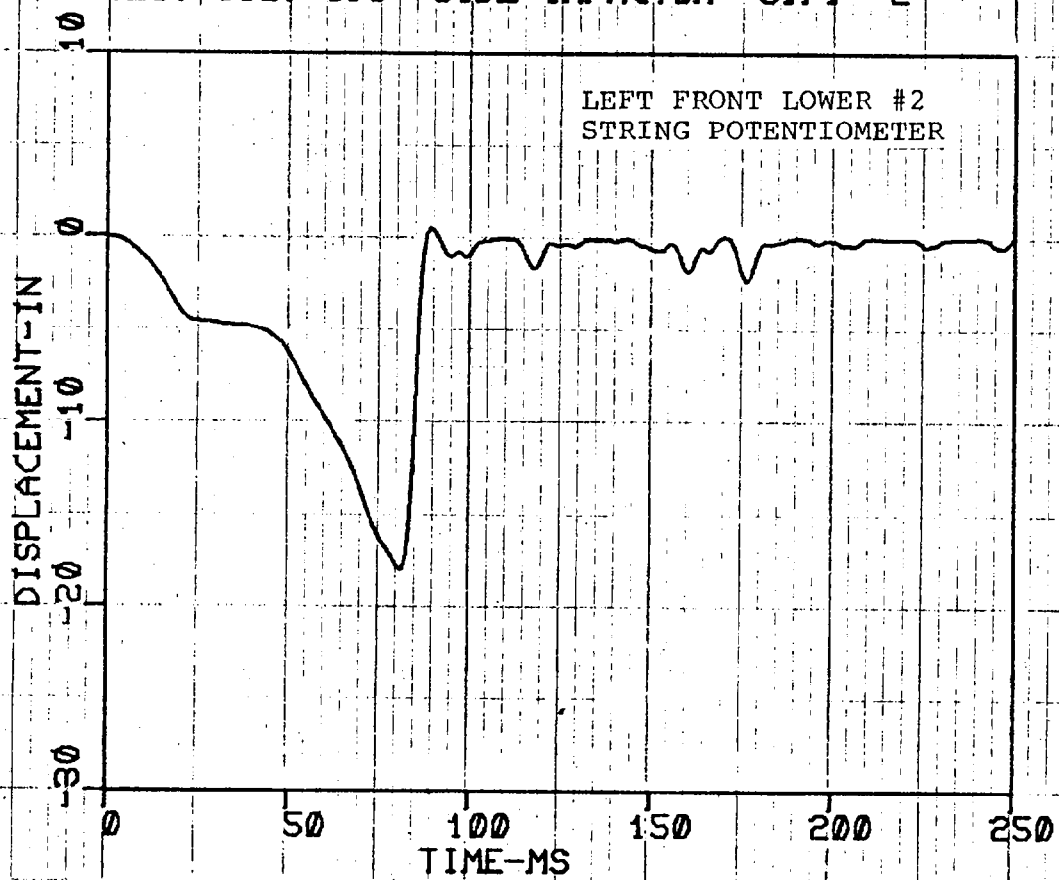


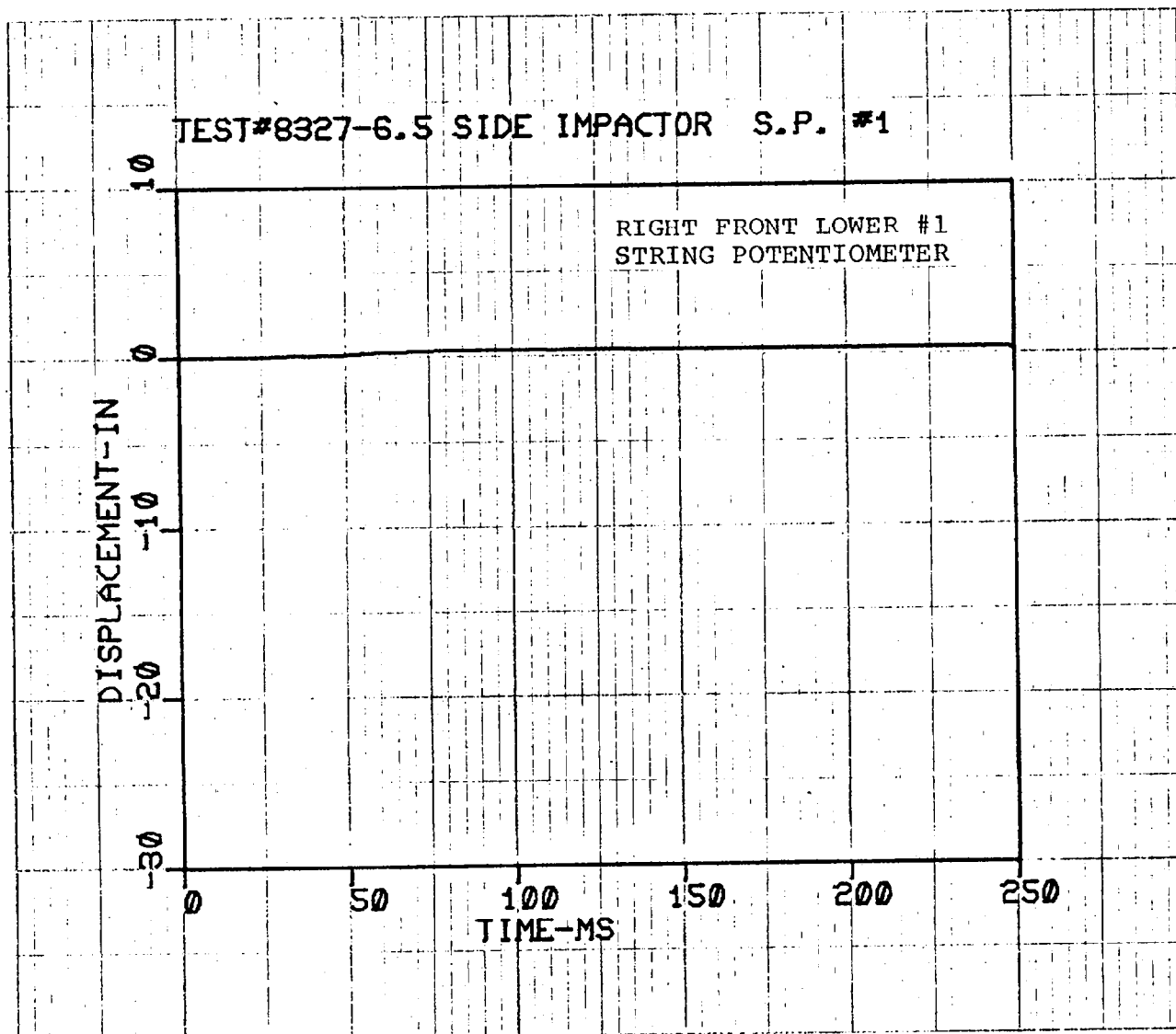


TEST#8327-6.5 SIDE IMPACTOR S.P. #3

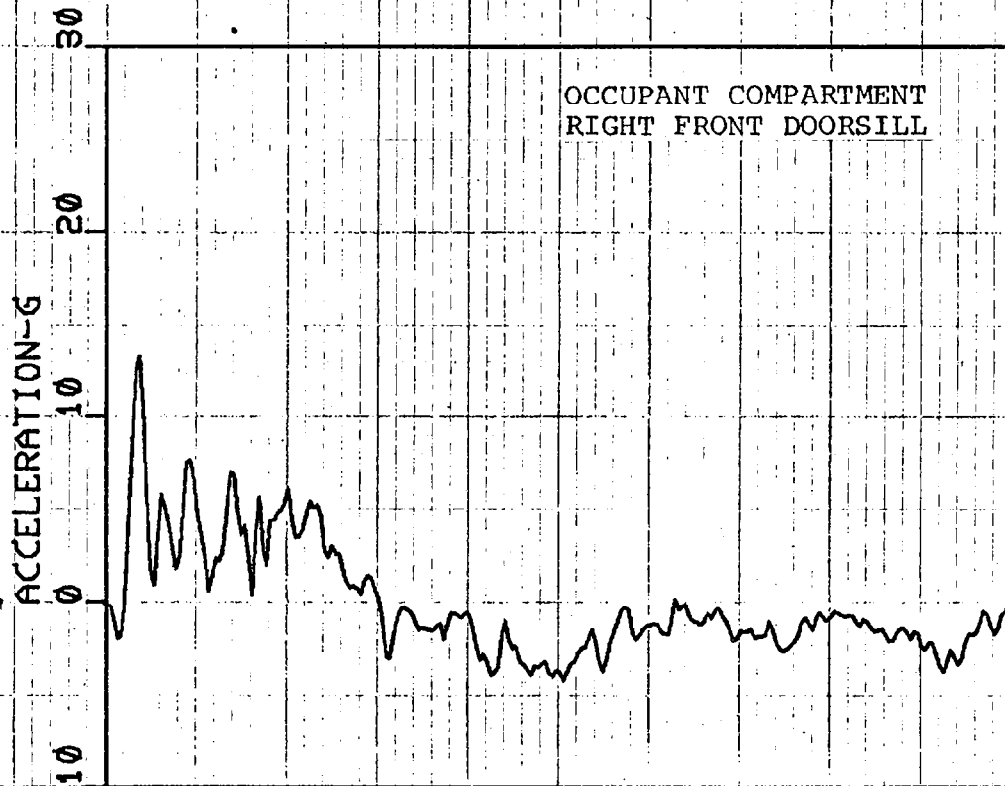


TEST#8327-6.5 SIDE IMPACTOR S.P. #2

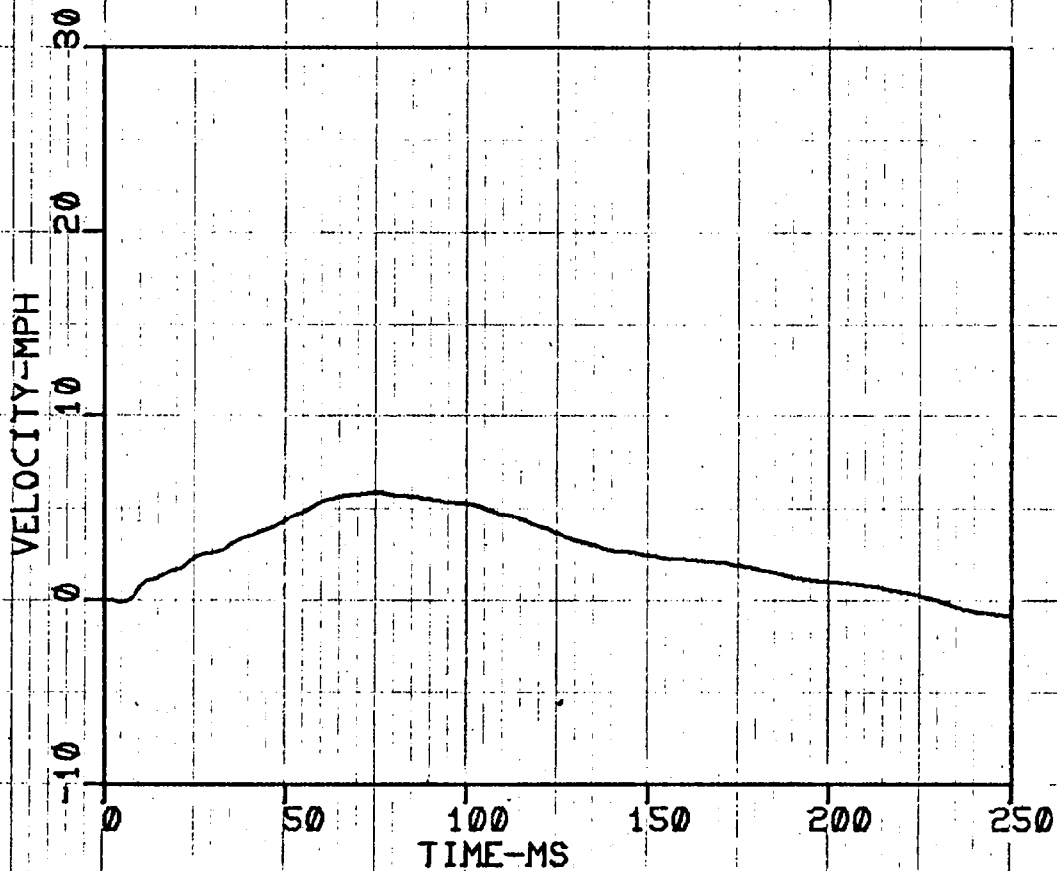


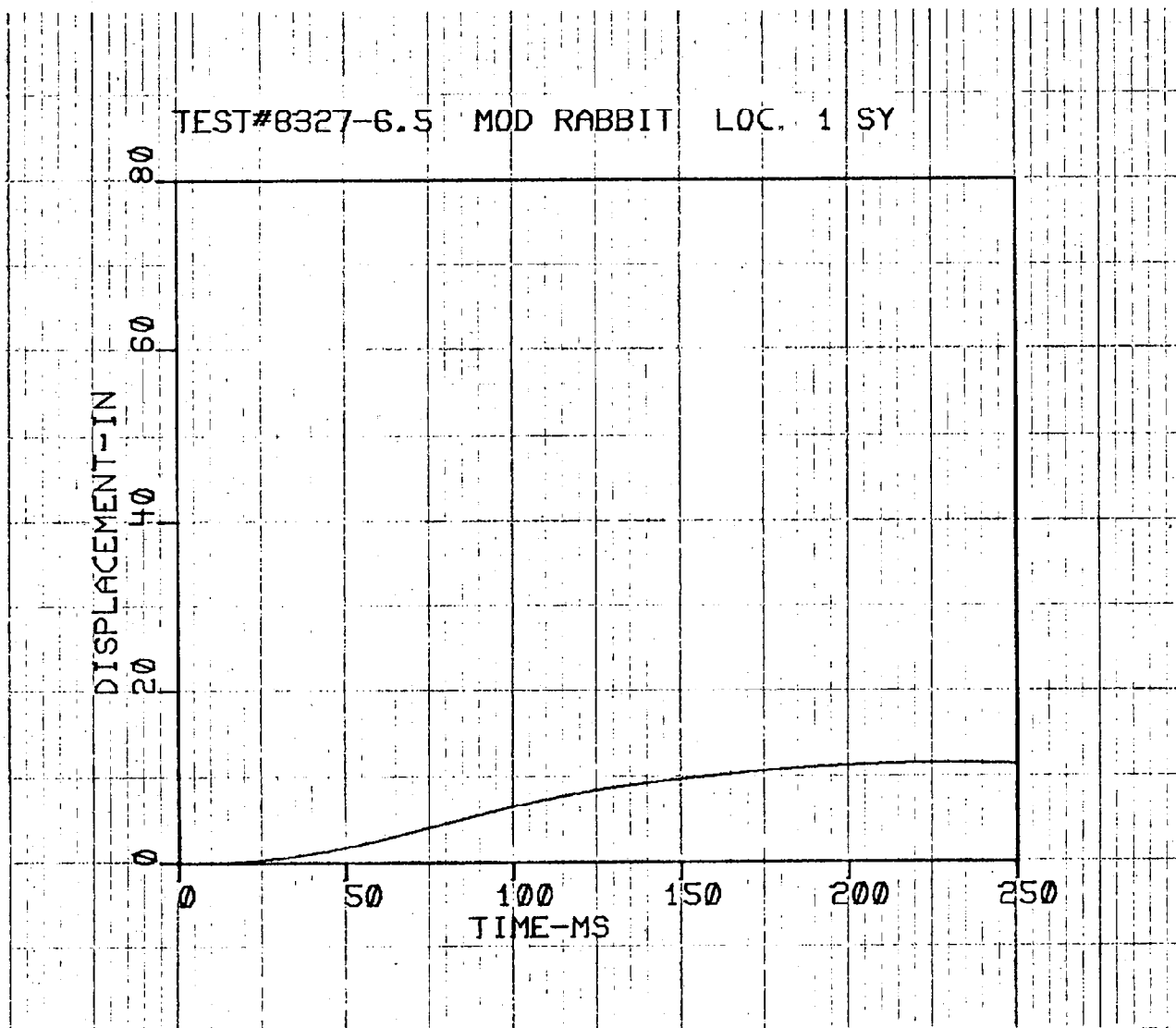


TEST#8327-6.5 MOD RABBIT LOC. 1 AY

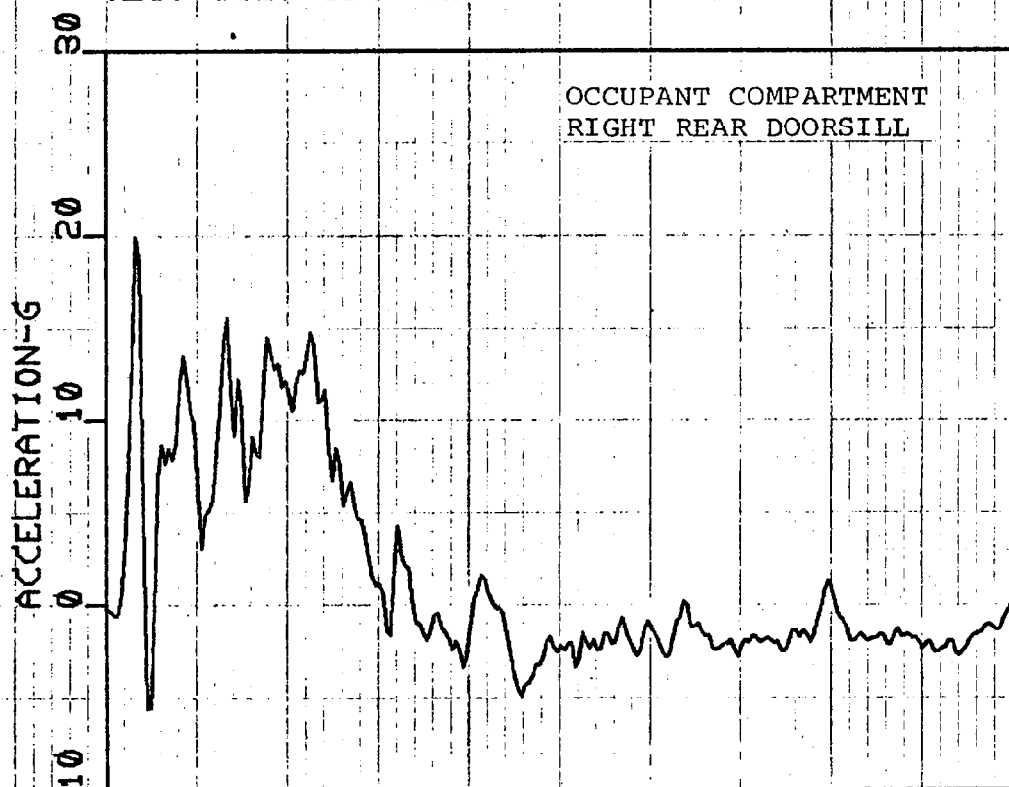


TEST#8327-6.5 MOD RABBIT LOC. 1 VY

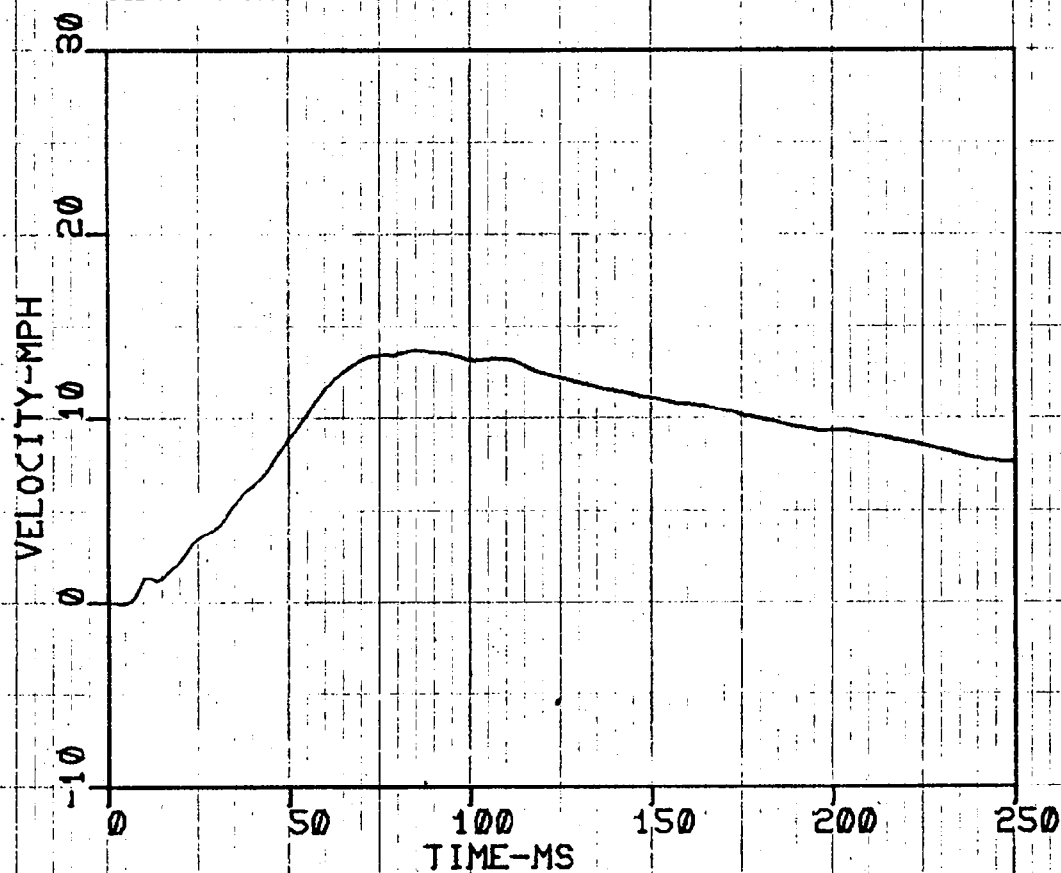


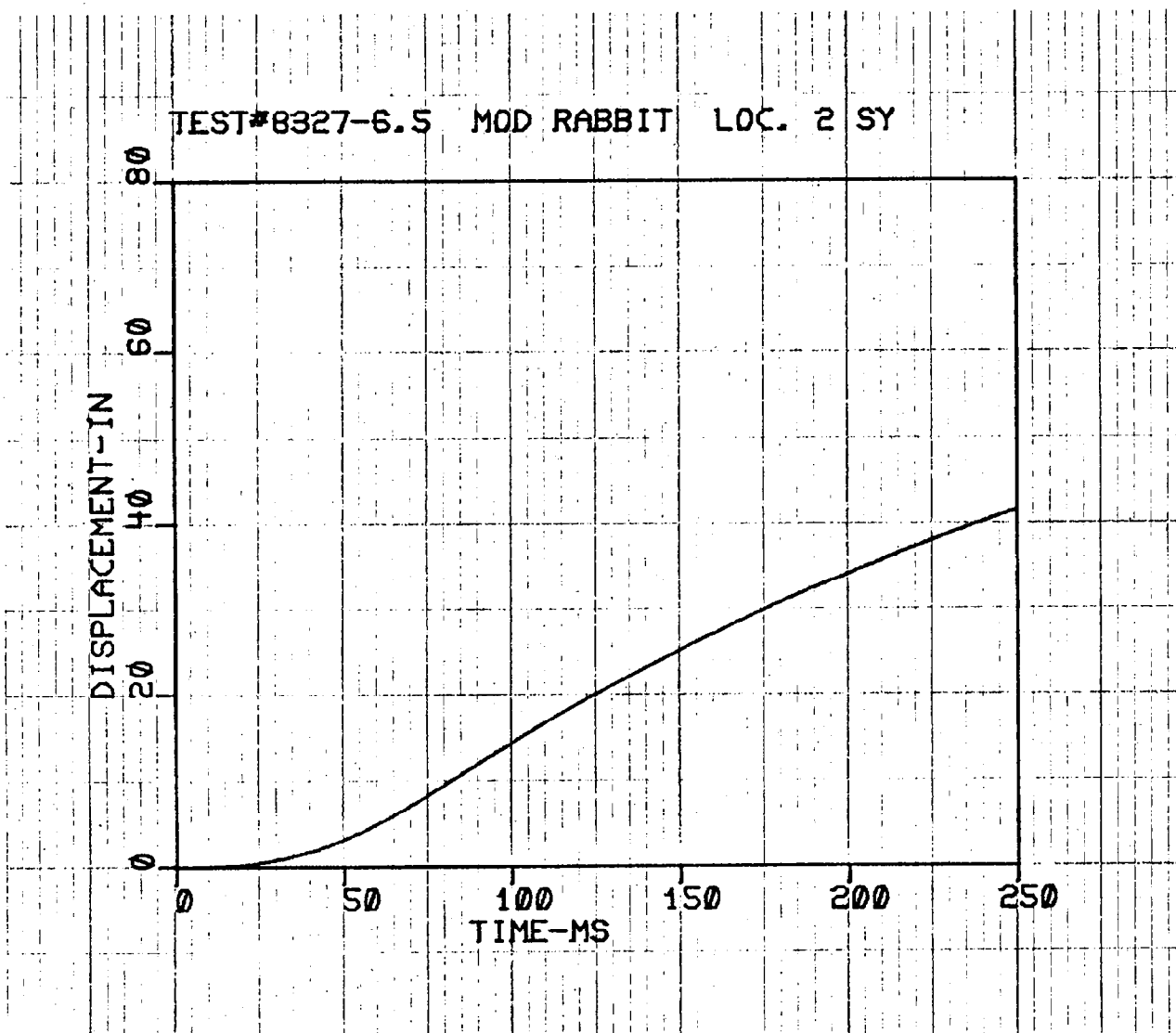


TEST#8327-6.5 MOD RABBIT LOC. 2 AY

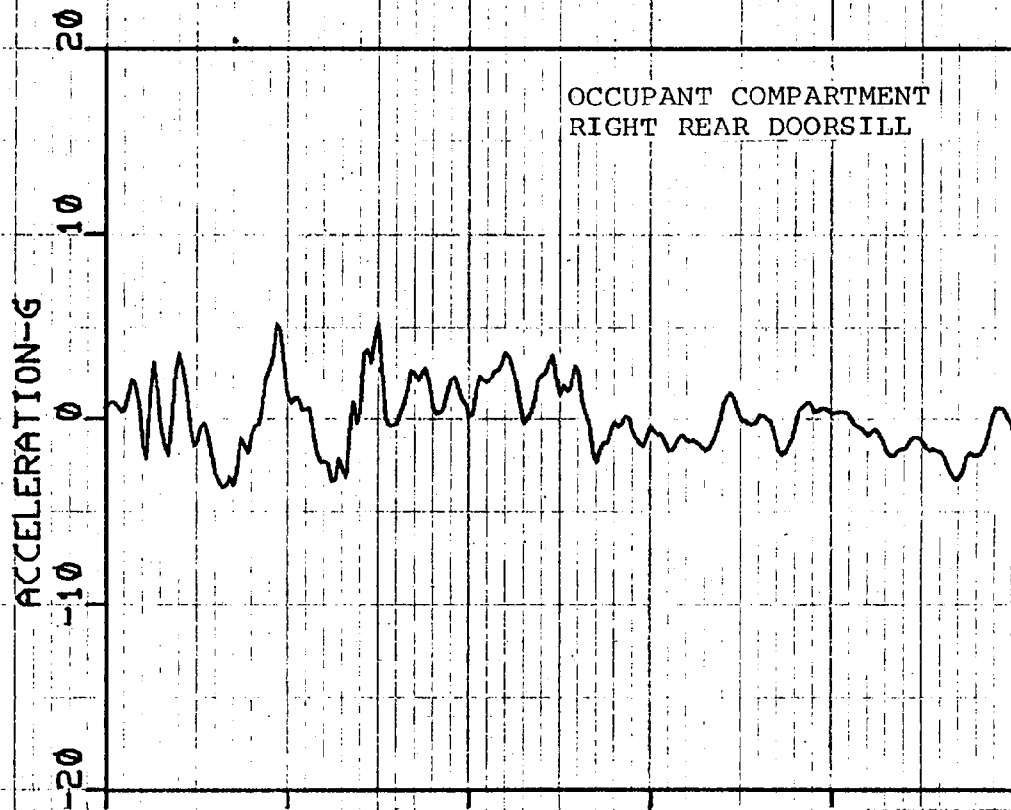


TEST#8327-6.5 MOD RABBIT LOC. 2 VY

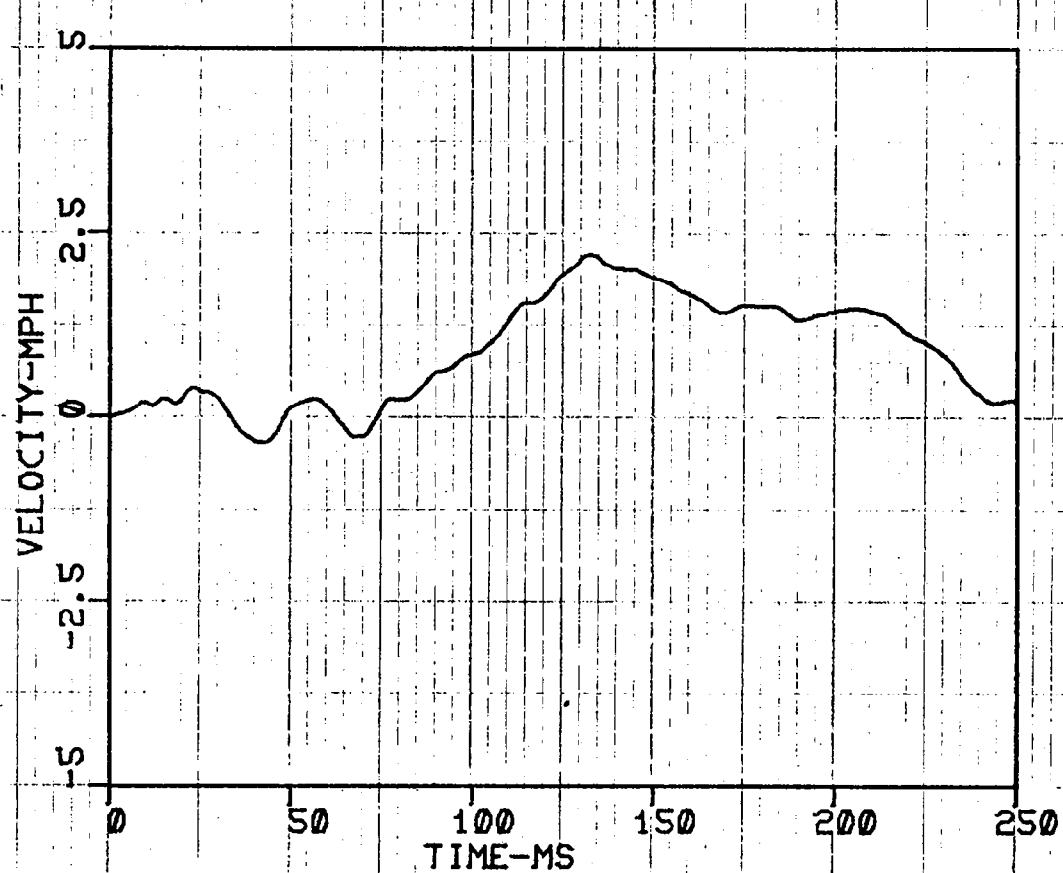


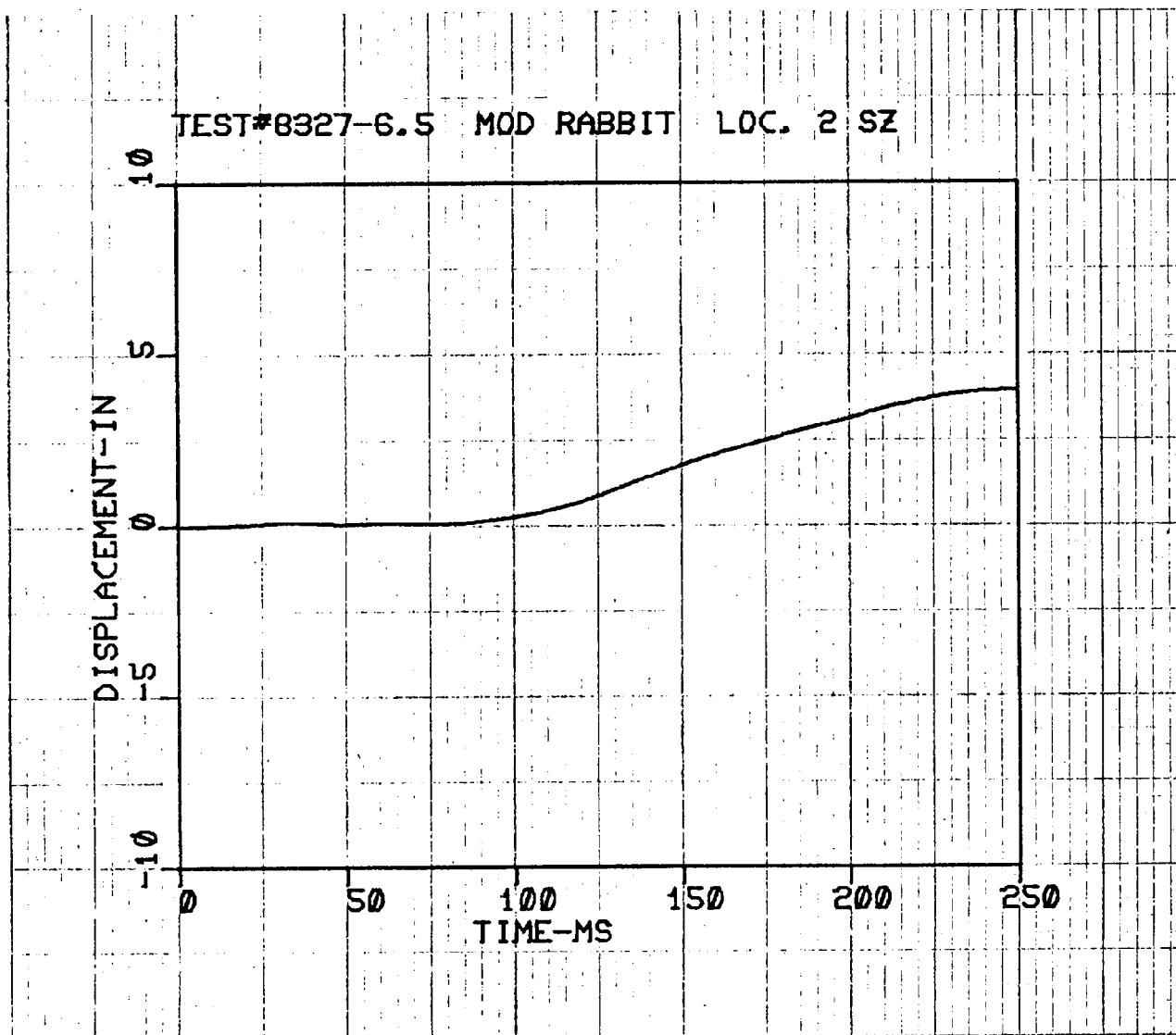


TEST#8327-6.5 MOD RABBIT LOC. 2 AZ

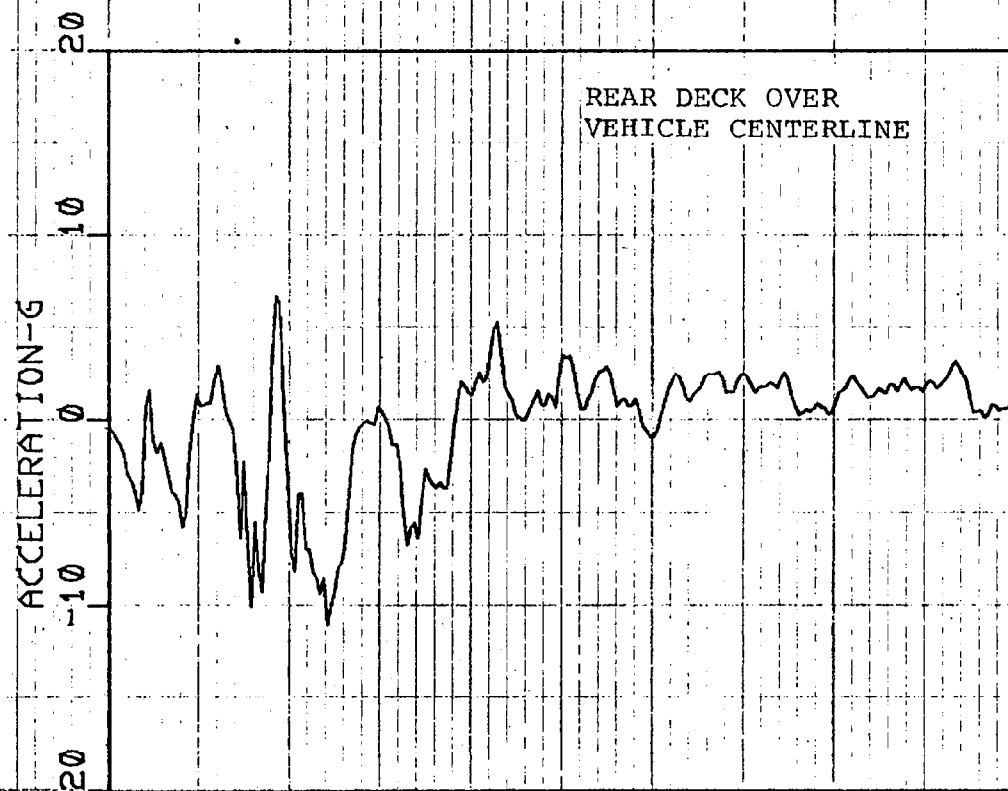


TEST#8327-6.5 MOD RABBIT LOC. 2 VZ

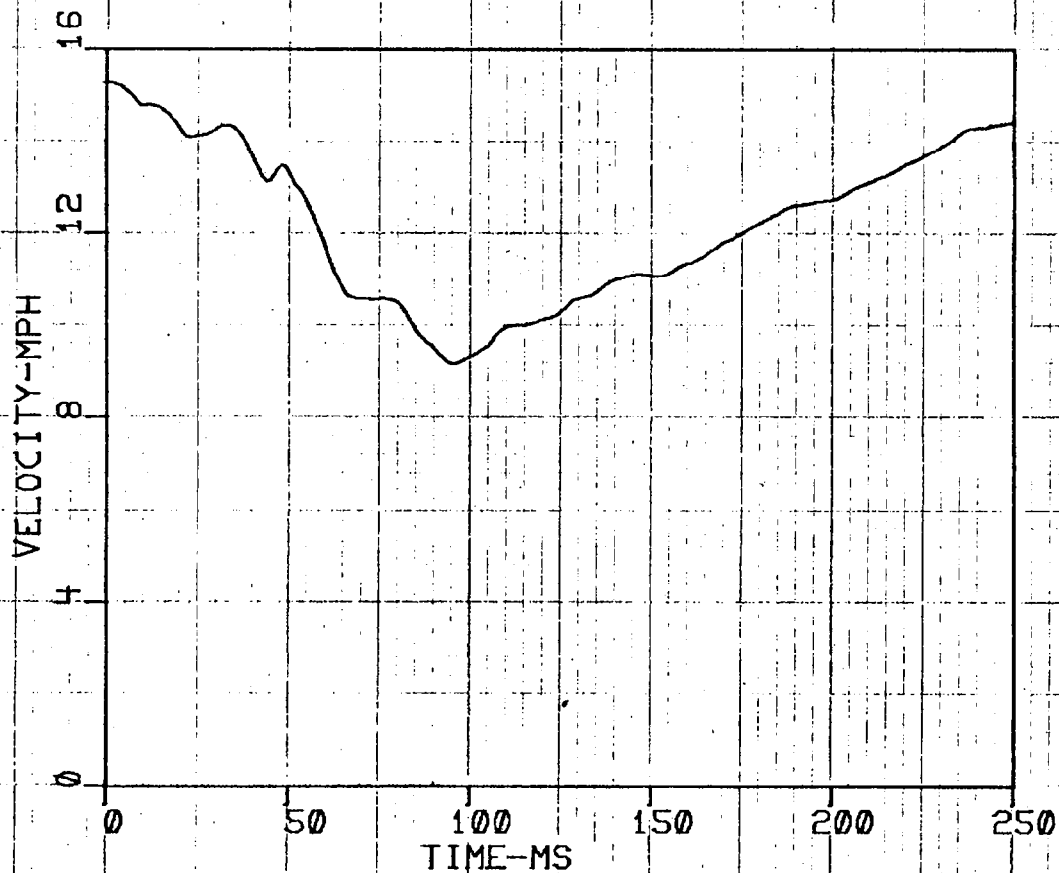


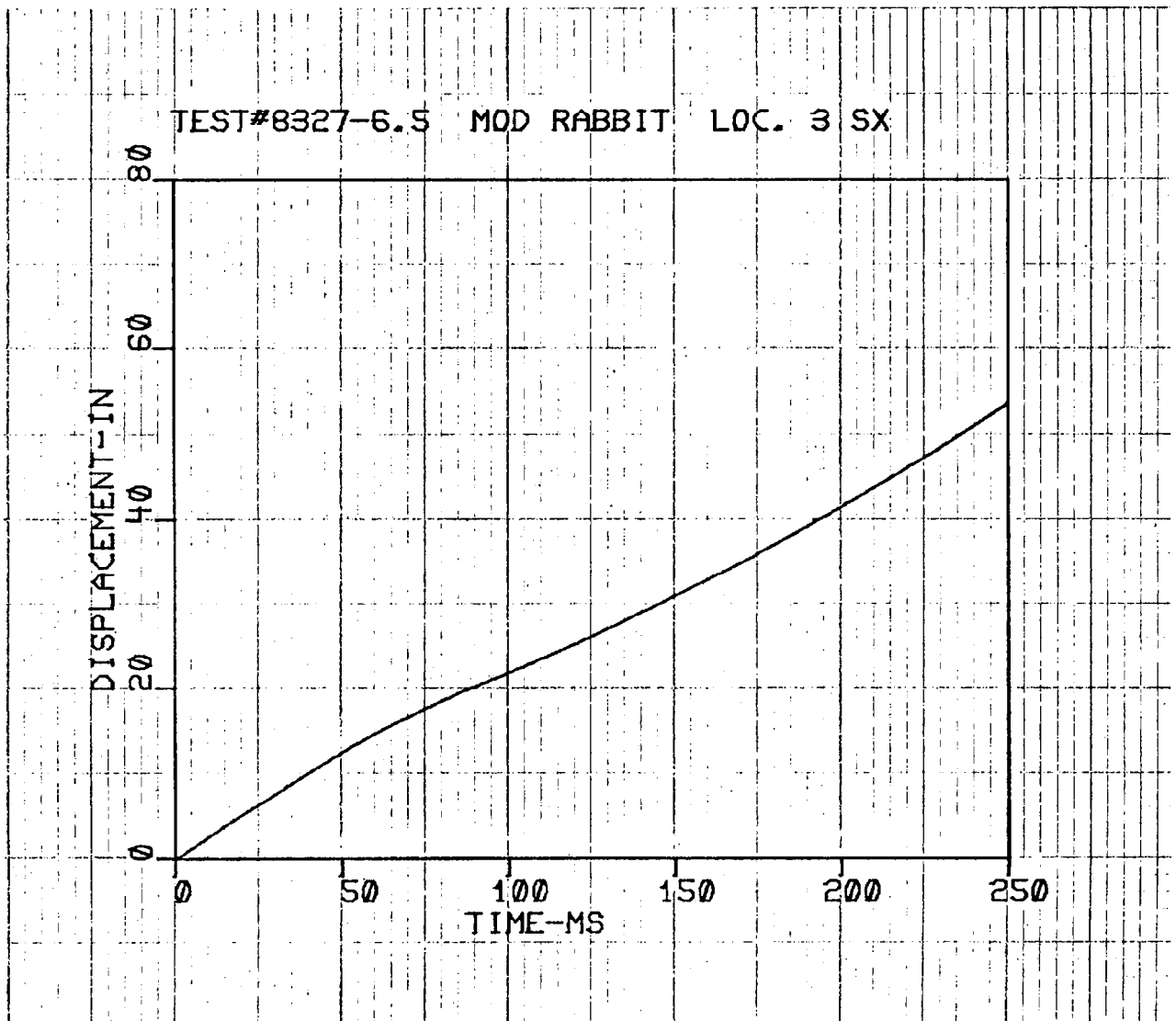


TEST#8327-6.5 MOD RABBIT LOC. 3 AX

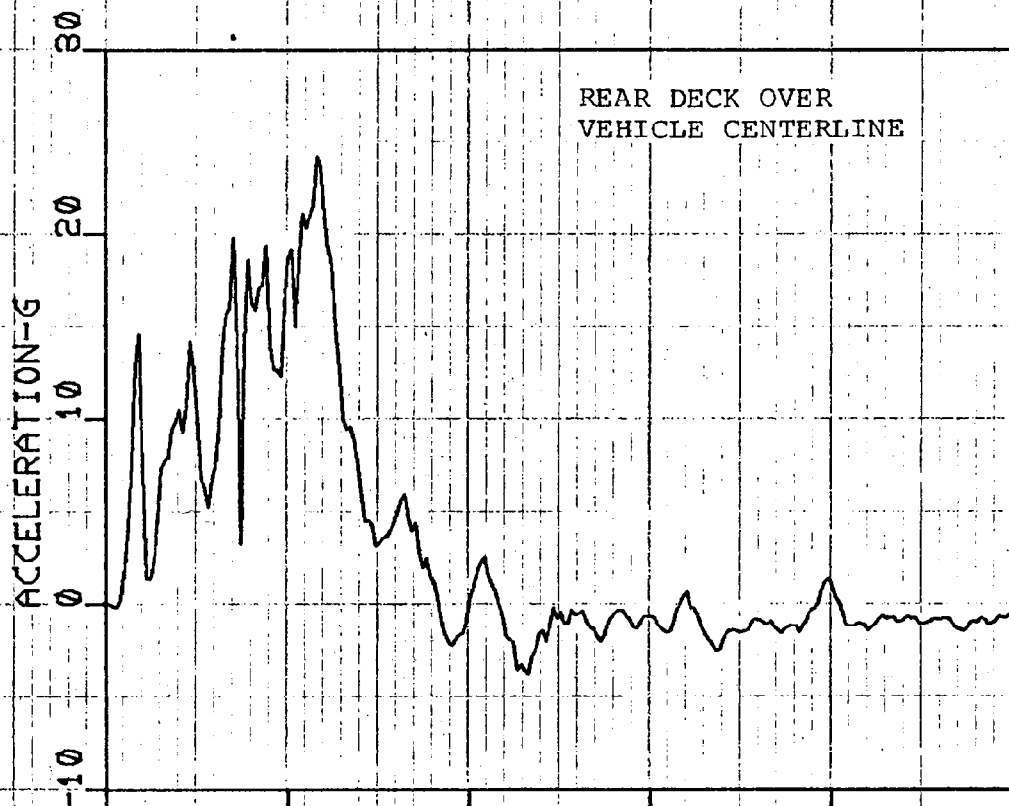


TEST#8327-6.5 MOD RABBIT LOC. 3 VX

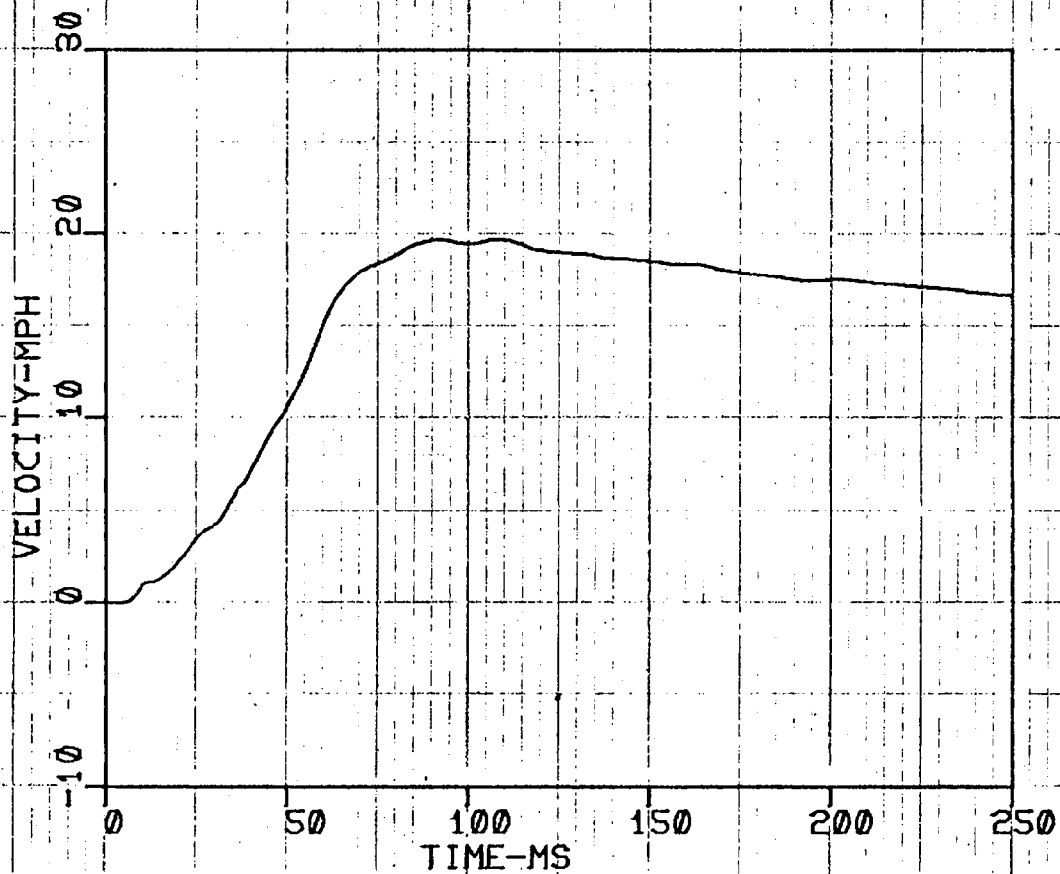


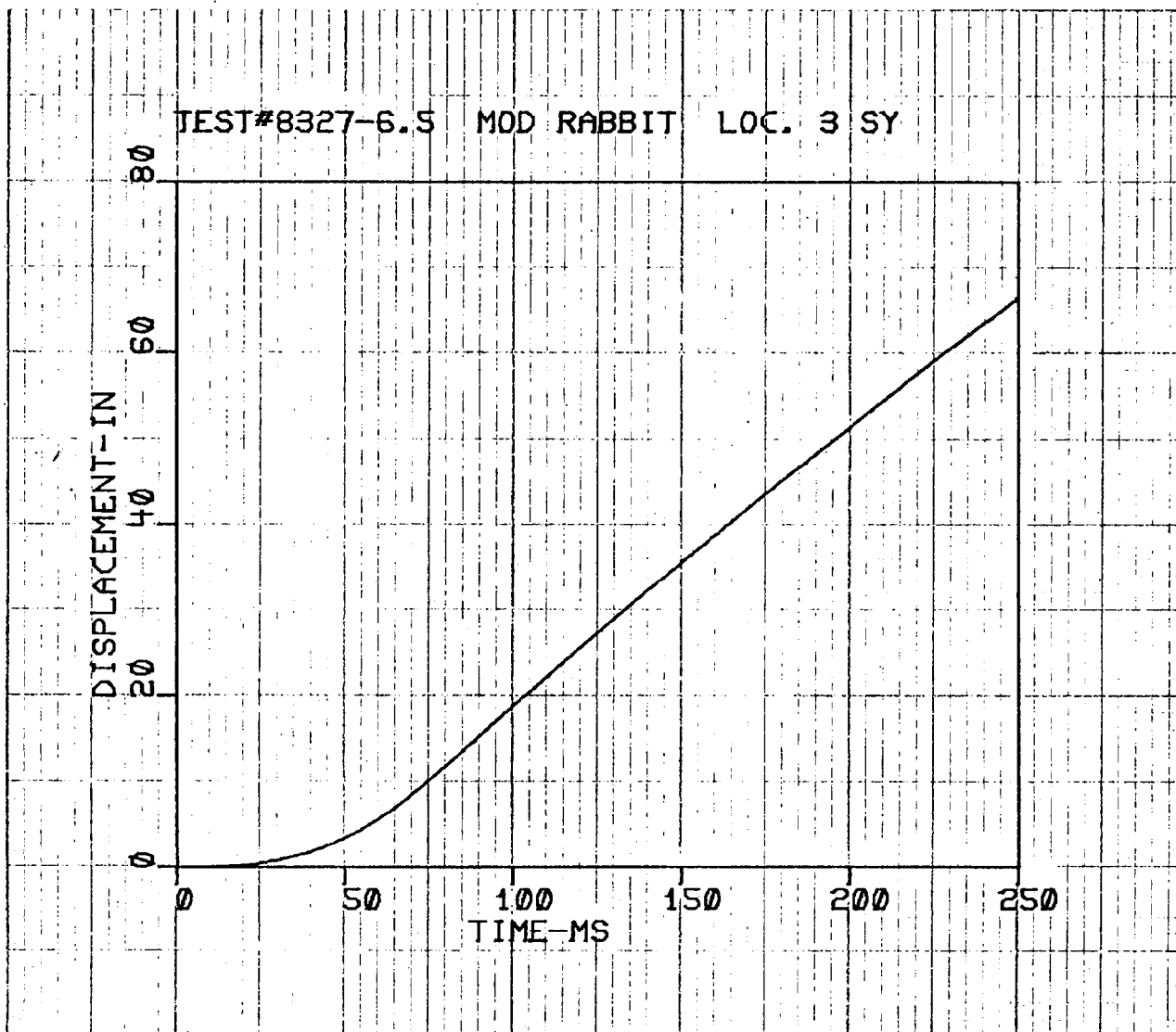


TEST#8327-6.5 MOD RABBIT LOC. 3 AY

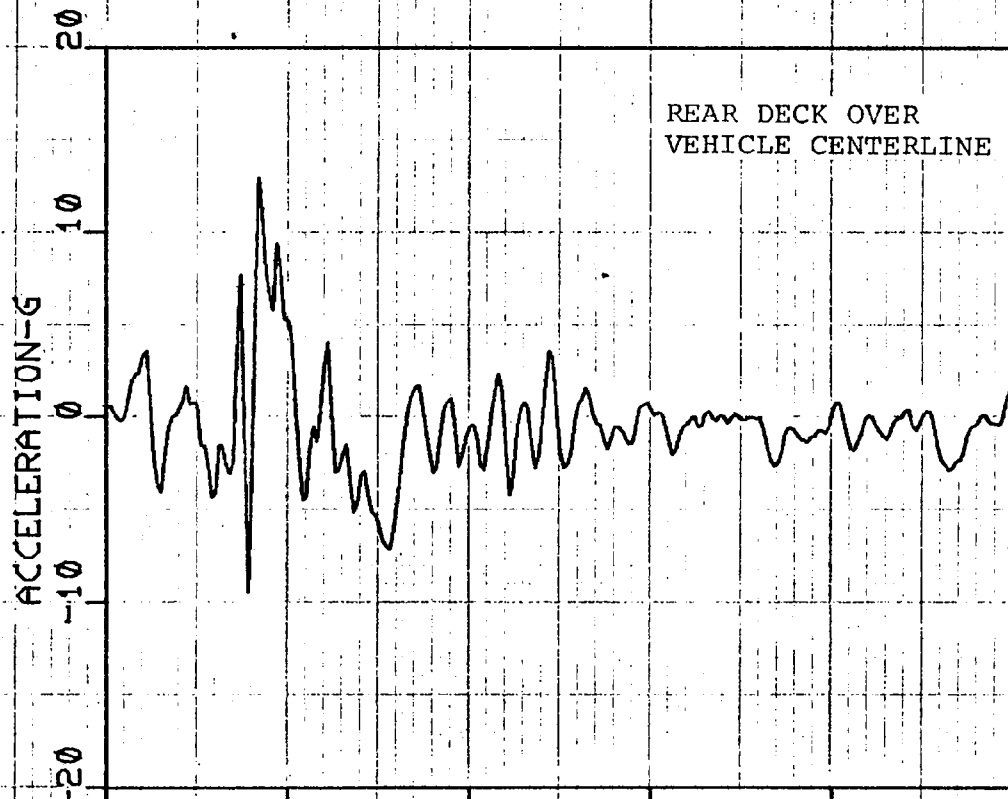


TEST#8327-6.5 MOD RABBIT LOC. 3 VY

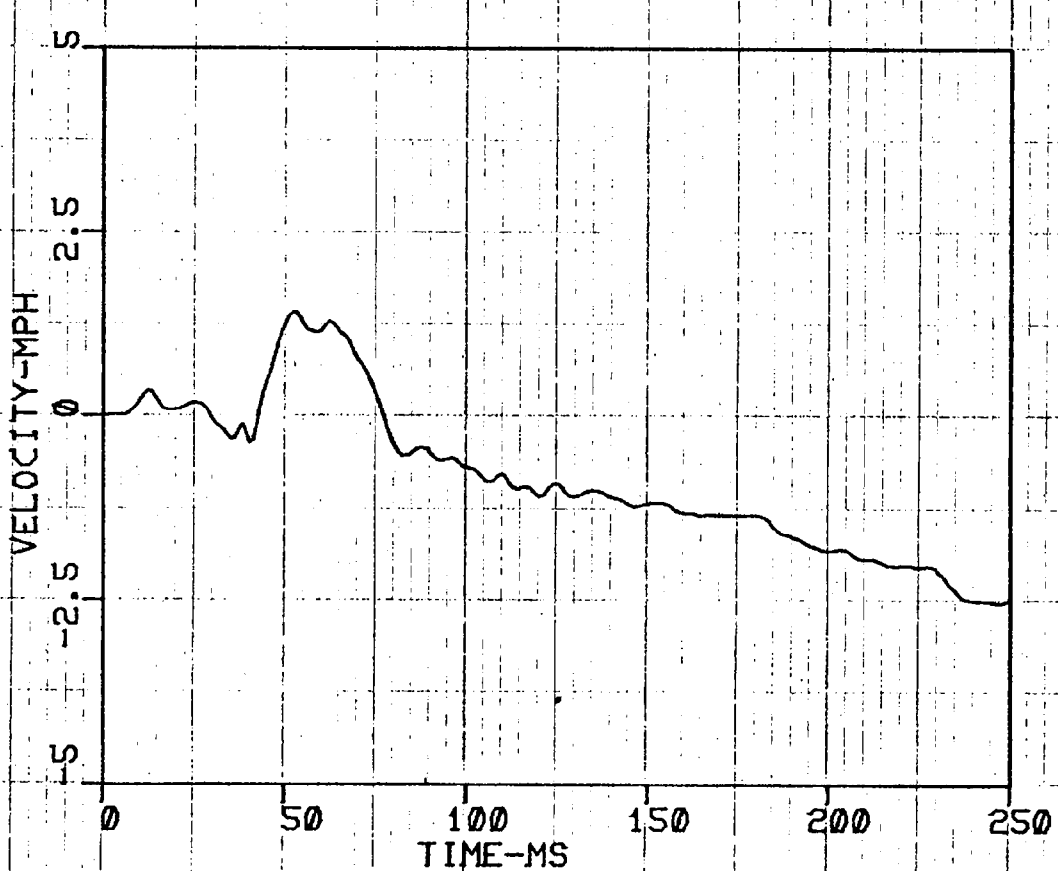


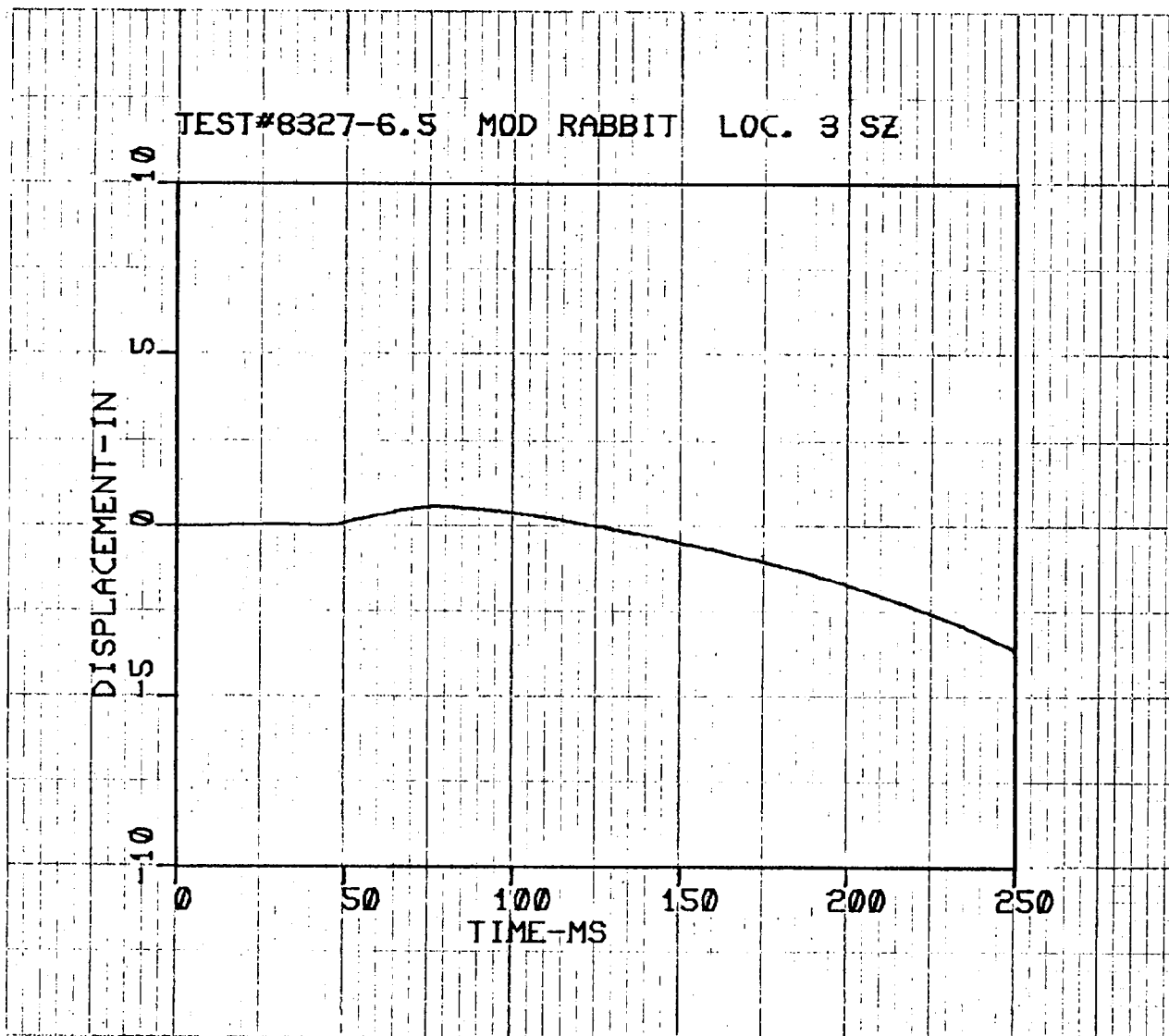


TEST#8327-6.5 MOD RABBIT LOC. 3 AZ

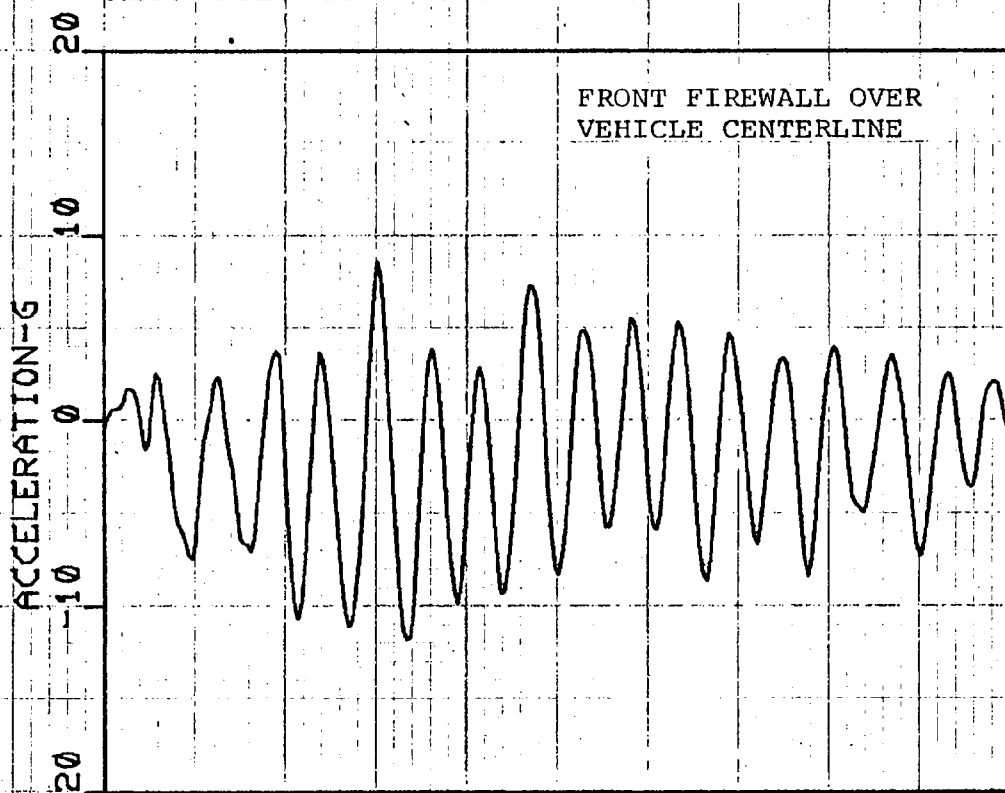


TEST#8327-6.5 MOD RABBIT LOC. 3 VZ

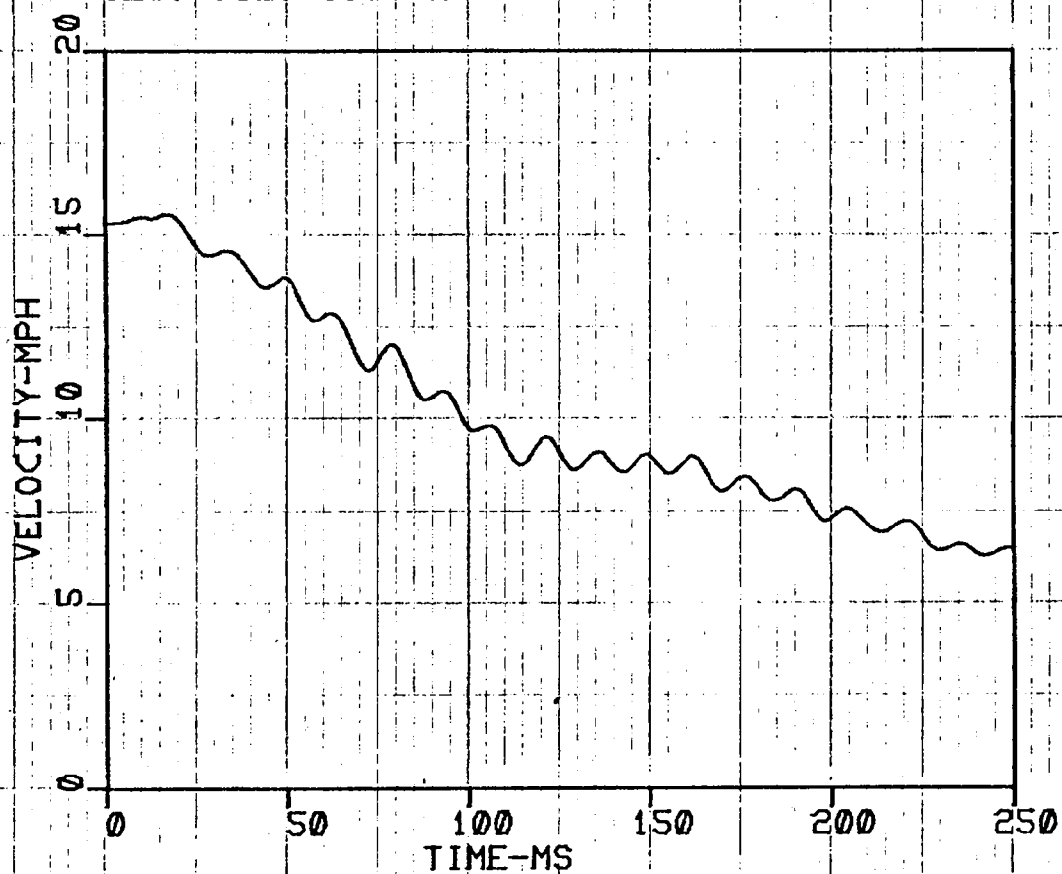


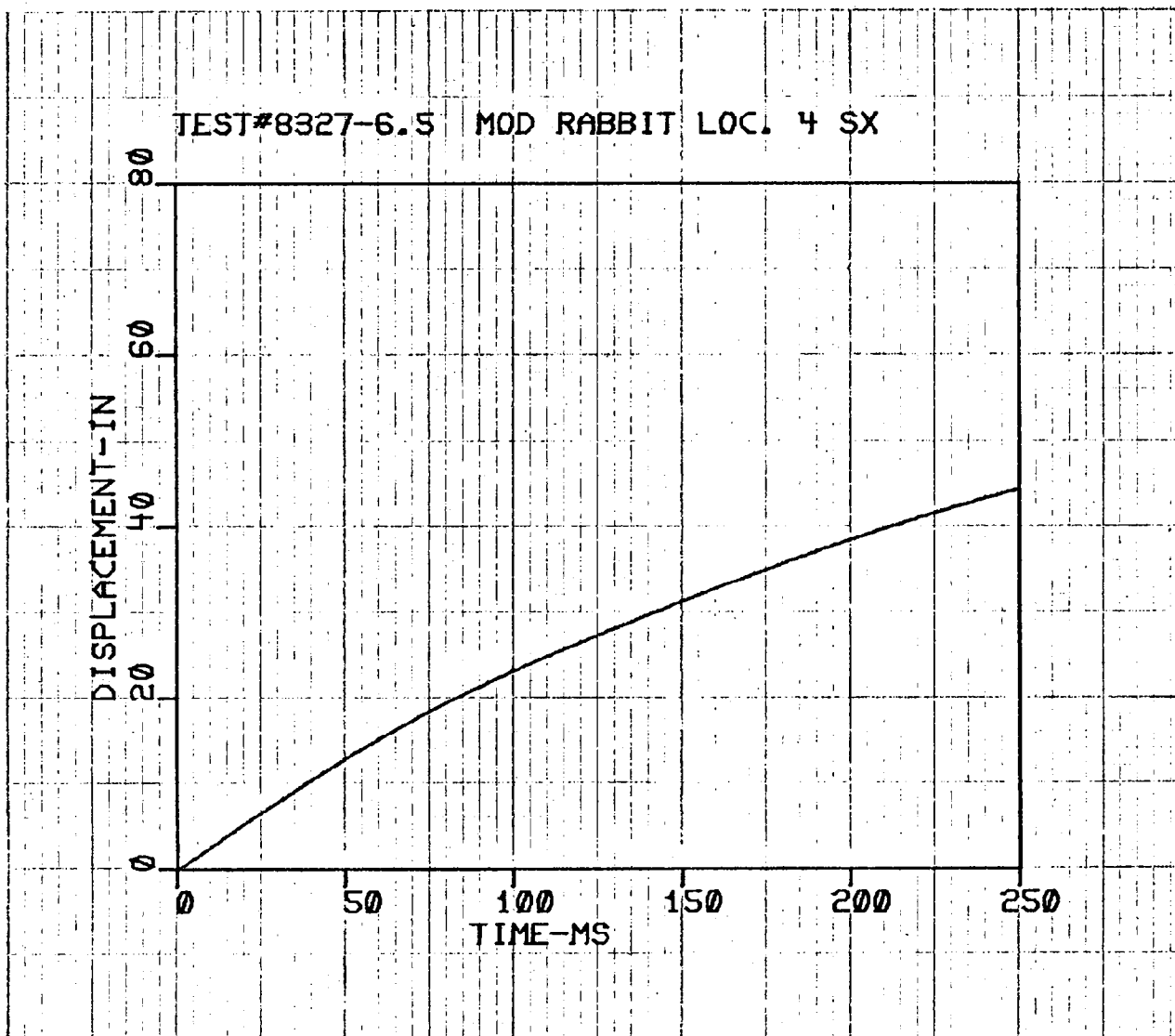


TEST#8327-6.5 MOD RABBIT LOC. 4 AX

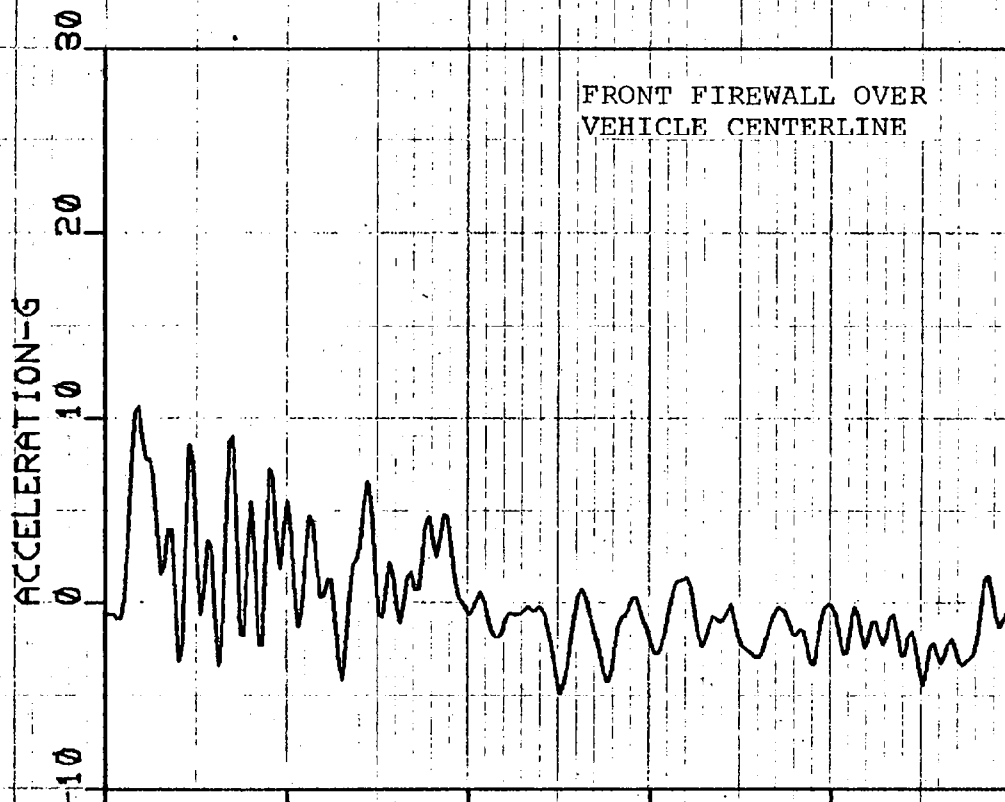


TEST#8327-6.5 MOD RABBIT LOC. 4 VX

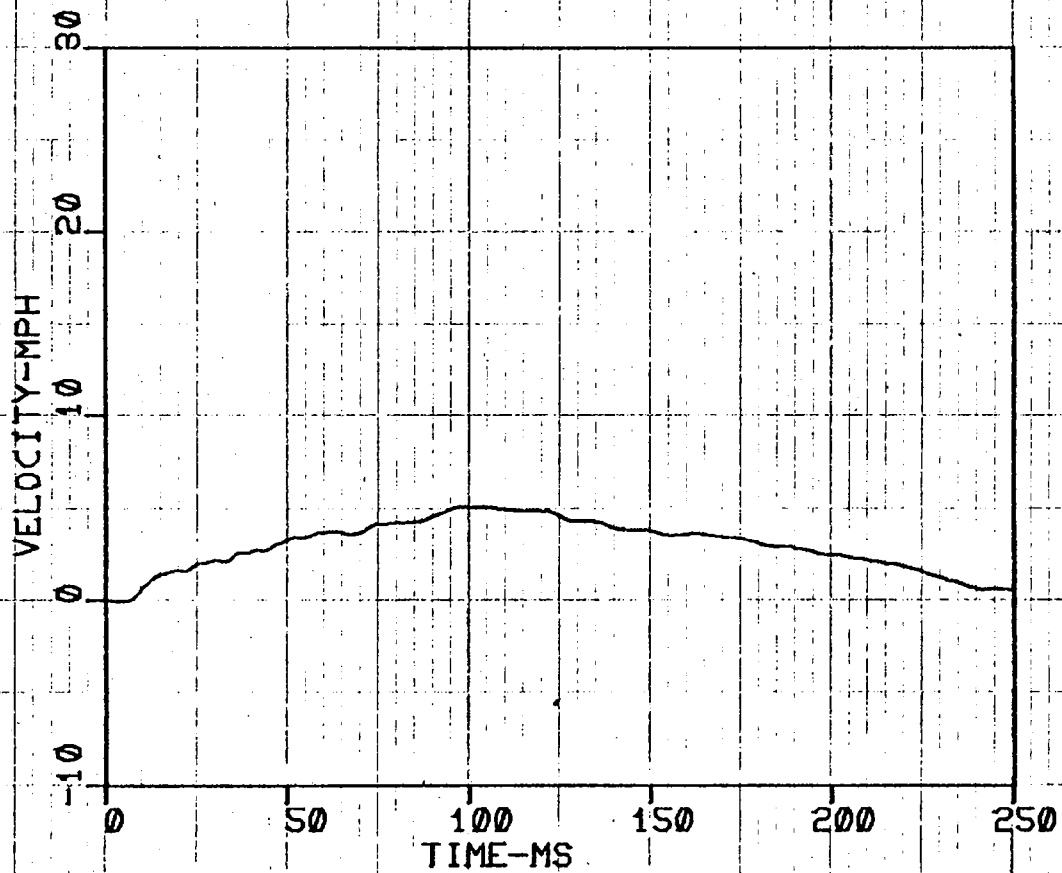


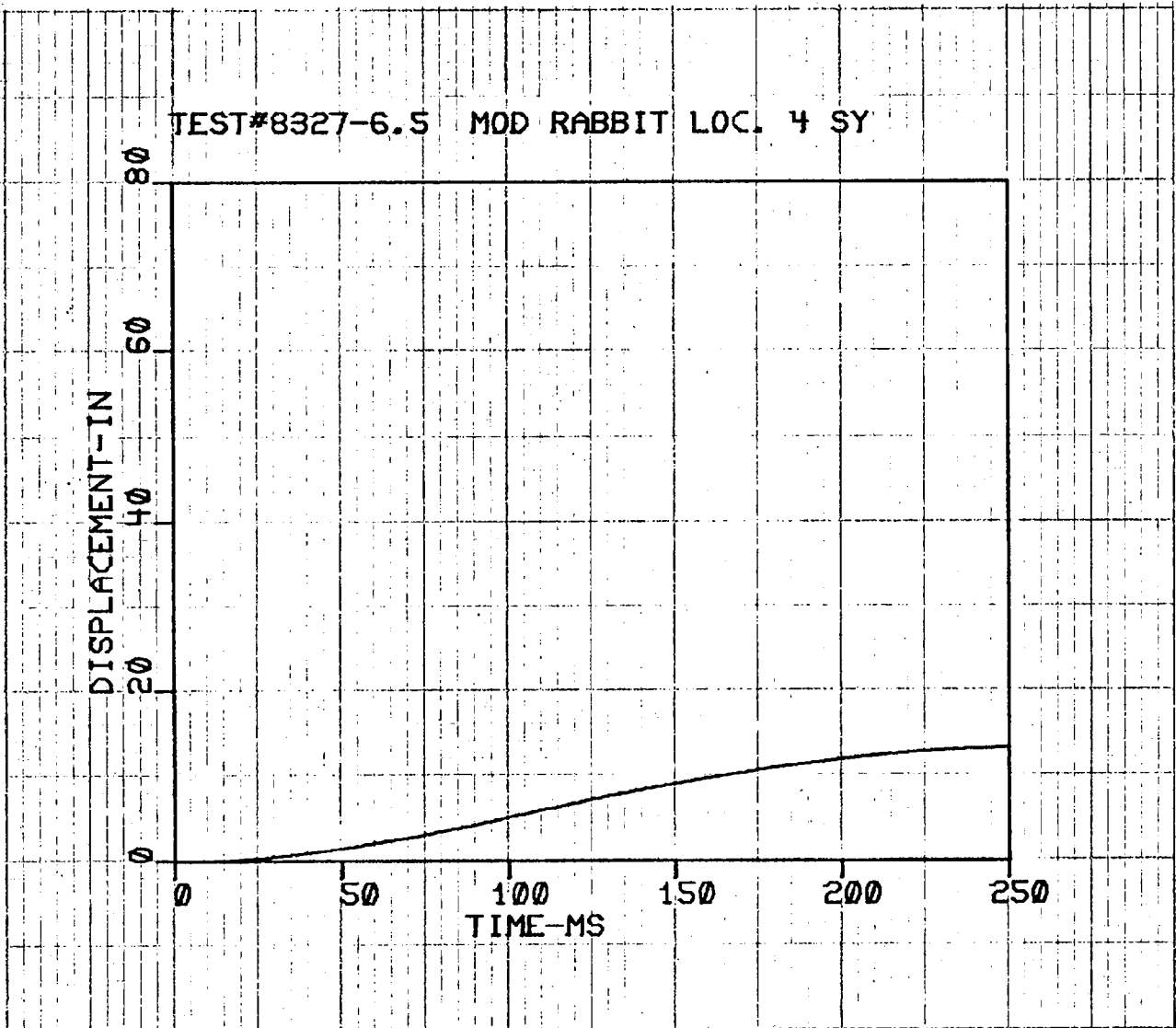


TEST#8327-6.5 MOD RABBIT LOC. 4 AY

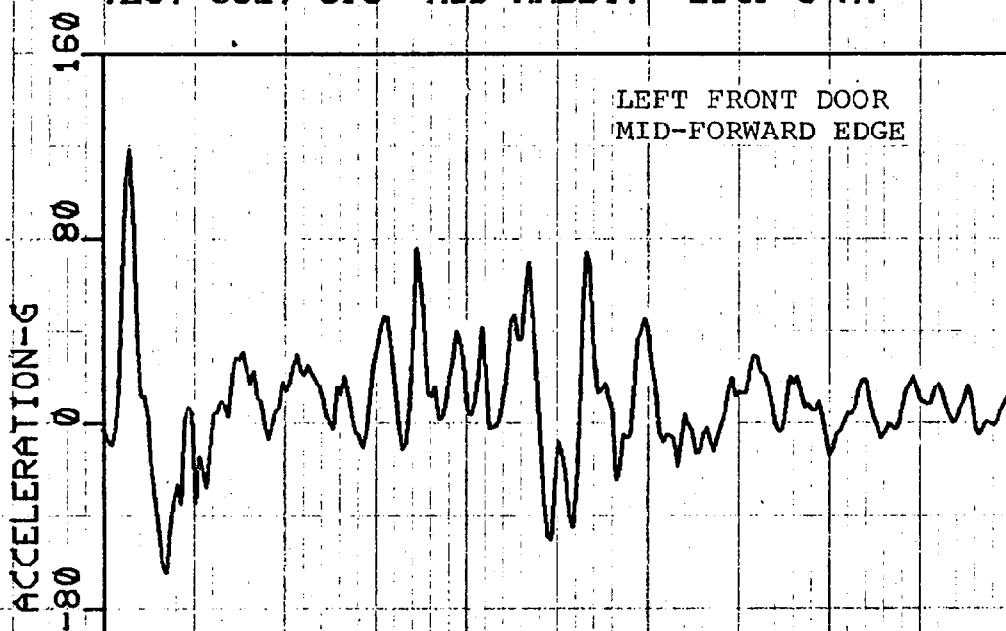


TEST#8327-6.5 MOD RABBIT LOC. 4 VY

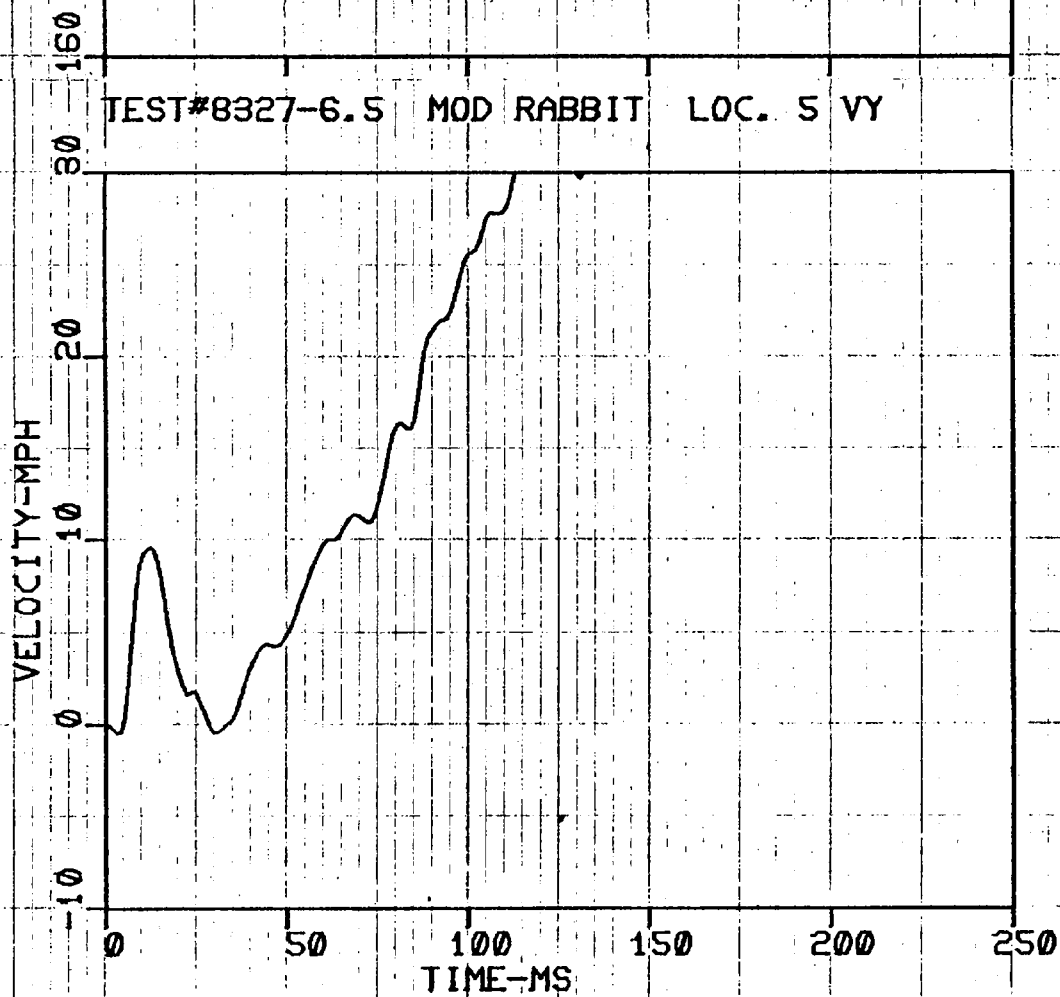


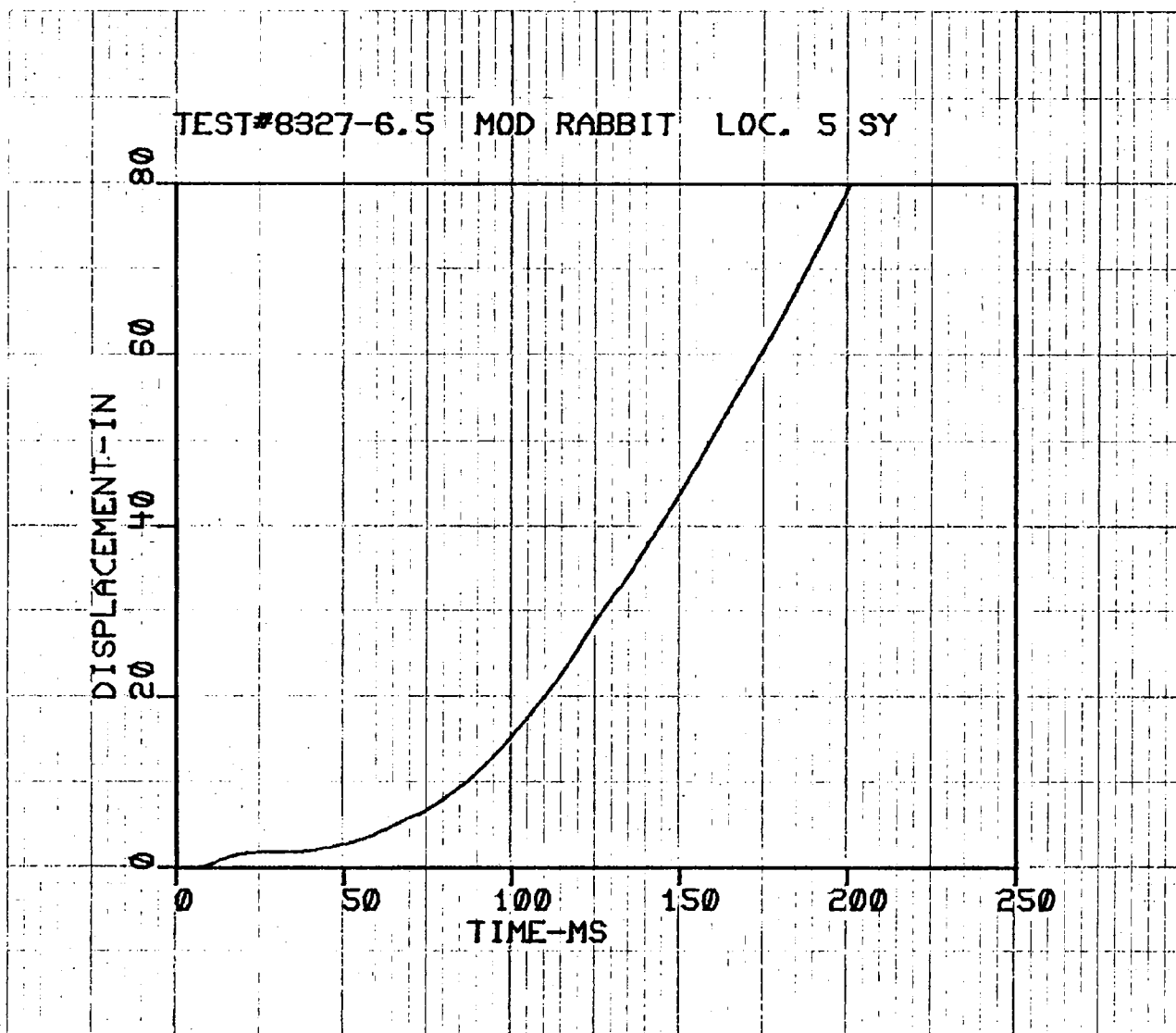


TEST#8327-6.5 MOD RABBIT LOC. 5 AY

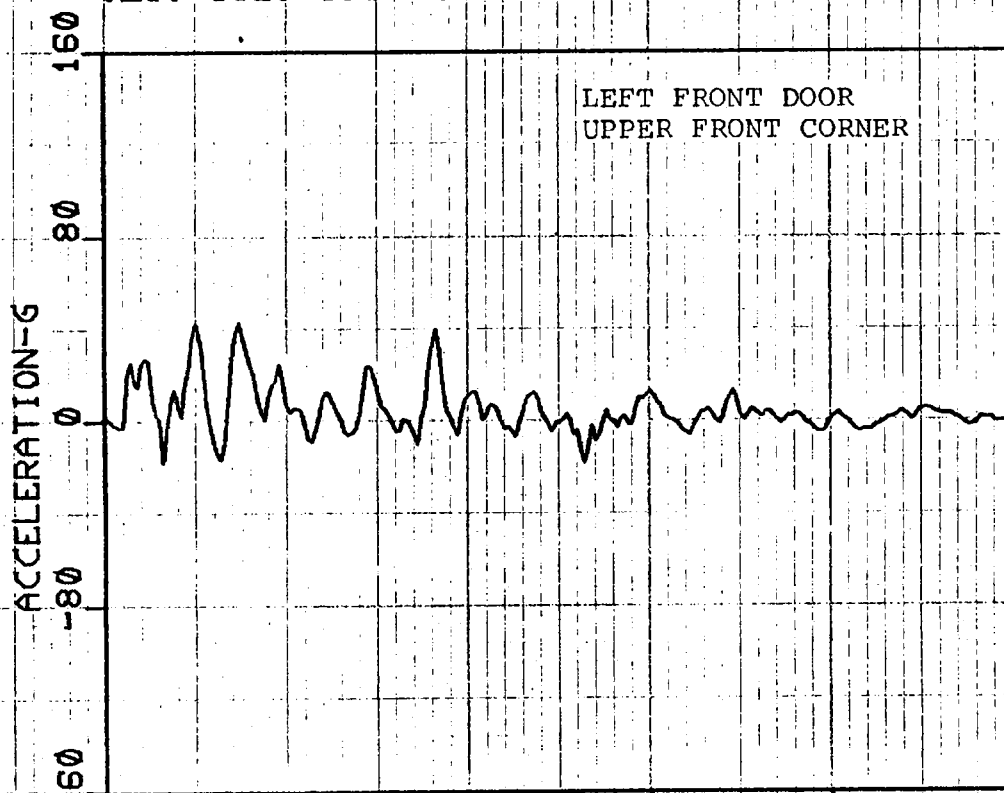


TEST#8327-6.5 MOD RABBIT LOC. 5 VY

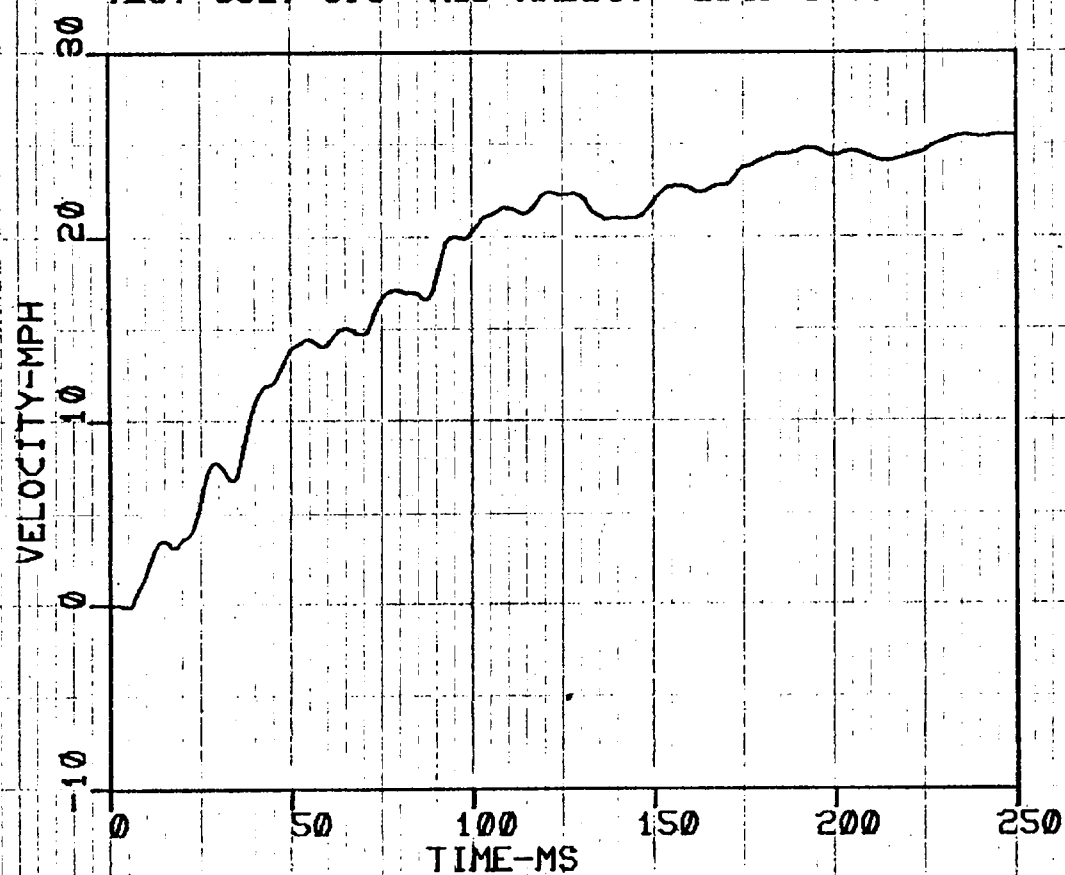


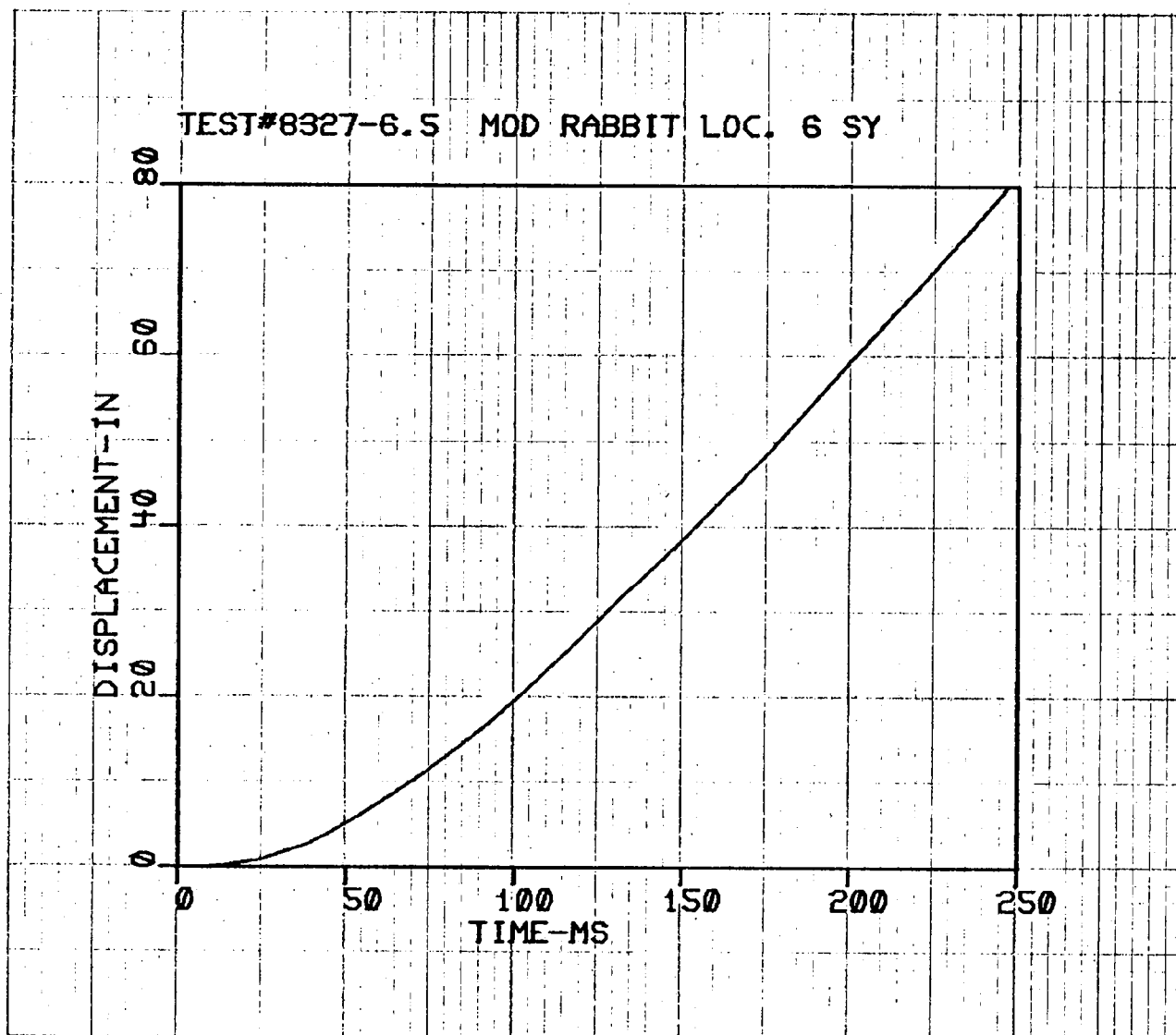


TEST#8327-6.5 MOD RABBIT LOC. 6 AY

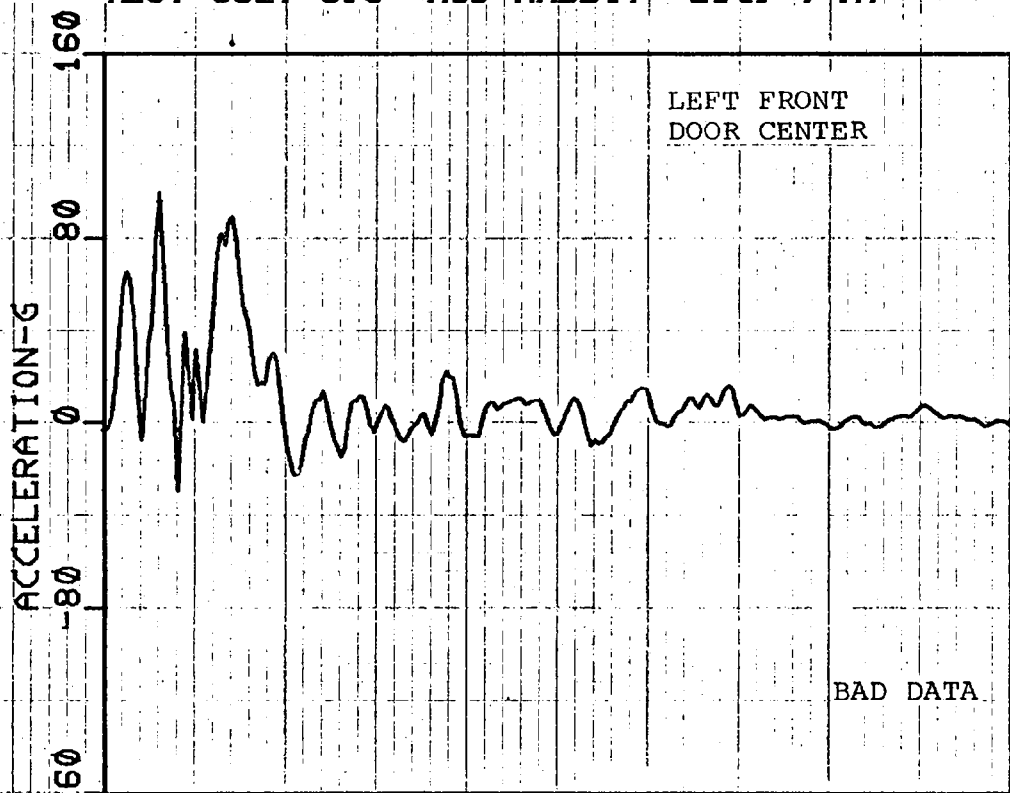


TEST#8327-6.5 MOD RABBIT LOC. 6 VY

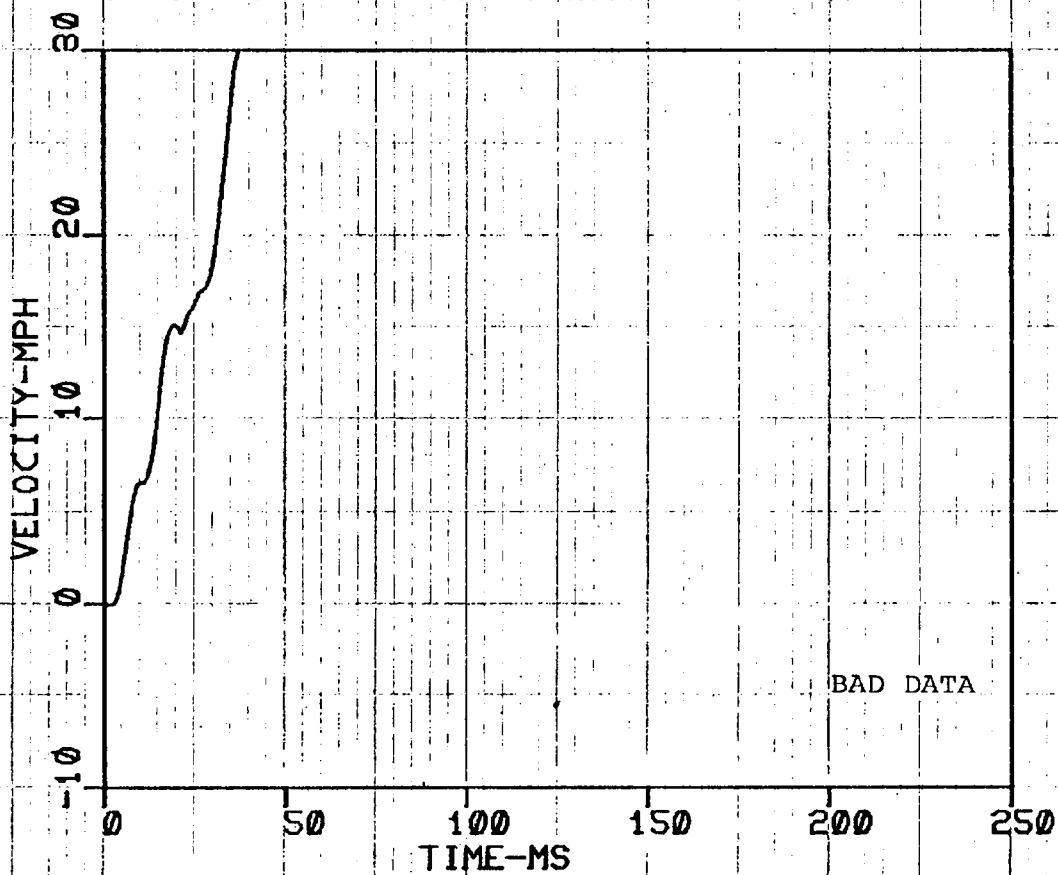


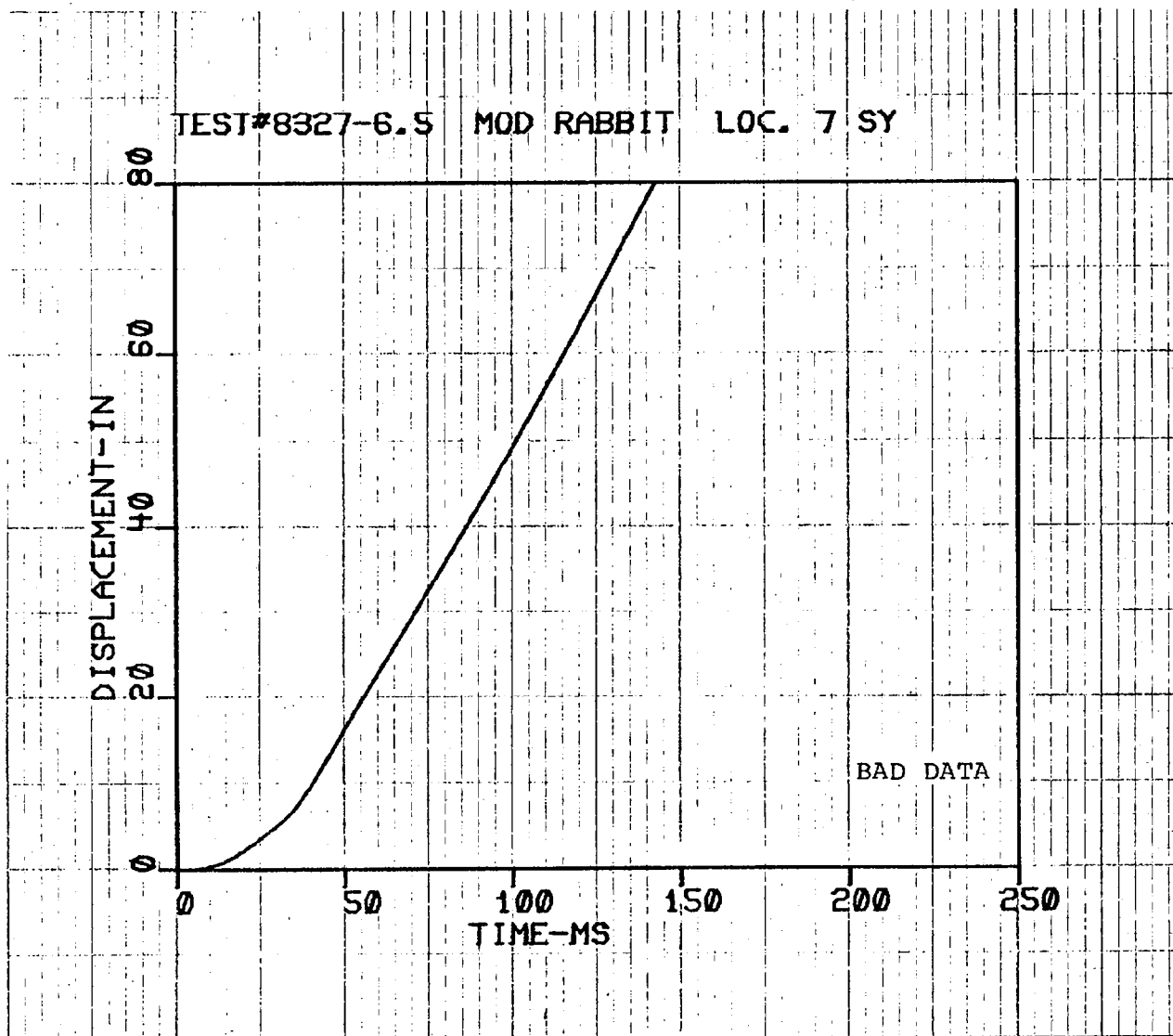


TEST#8327-6.5 MOD RABBIT LOC. 7 AY

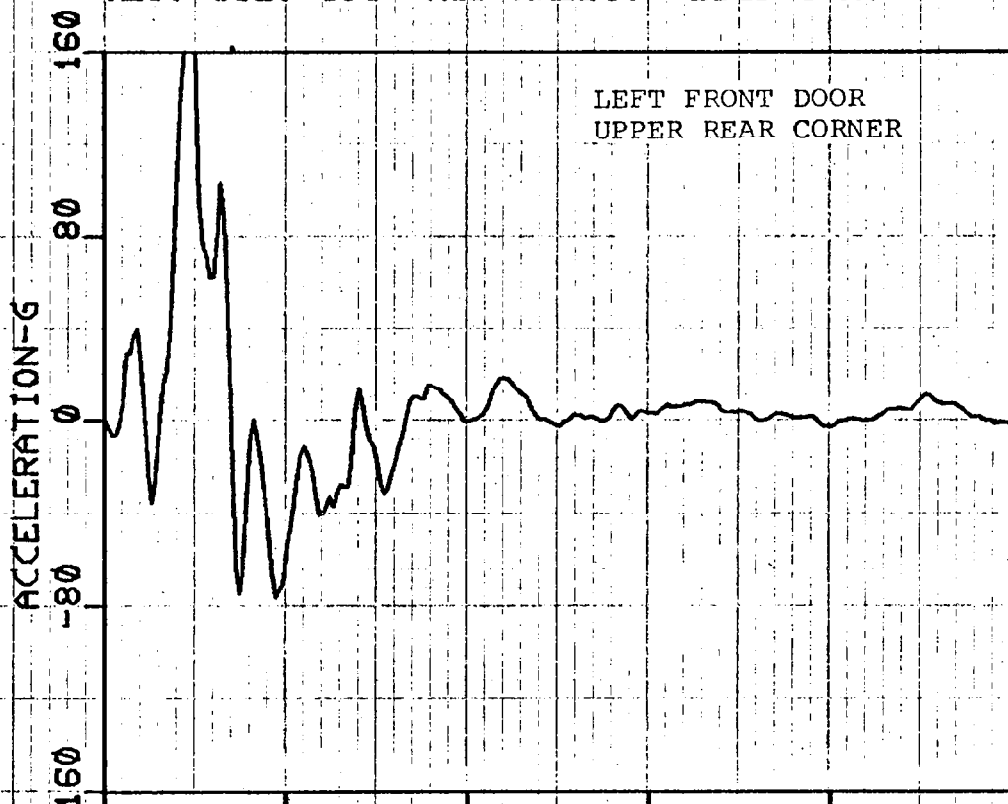


TEST#8327-6.5 MOD RABBIT LOC. 7 VY

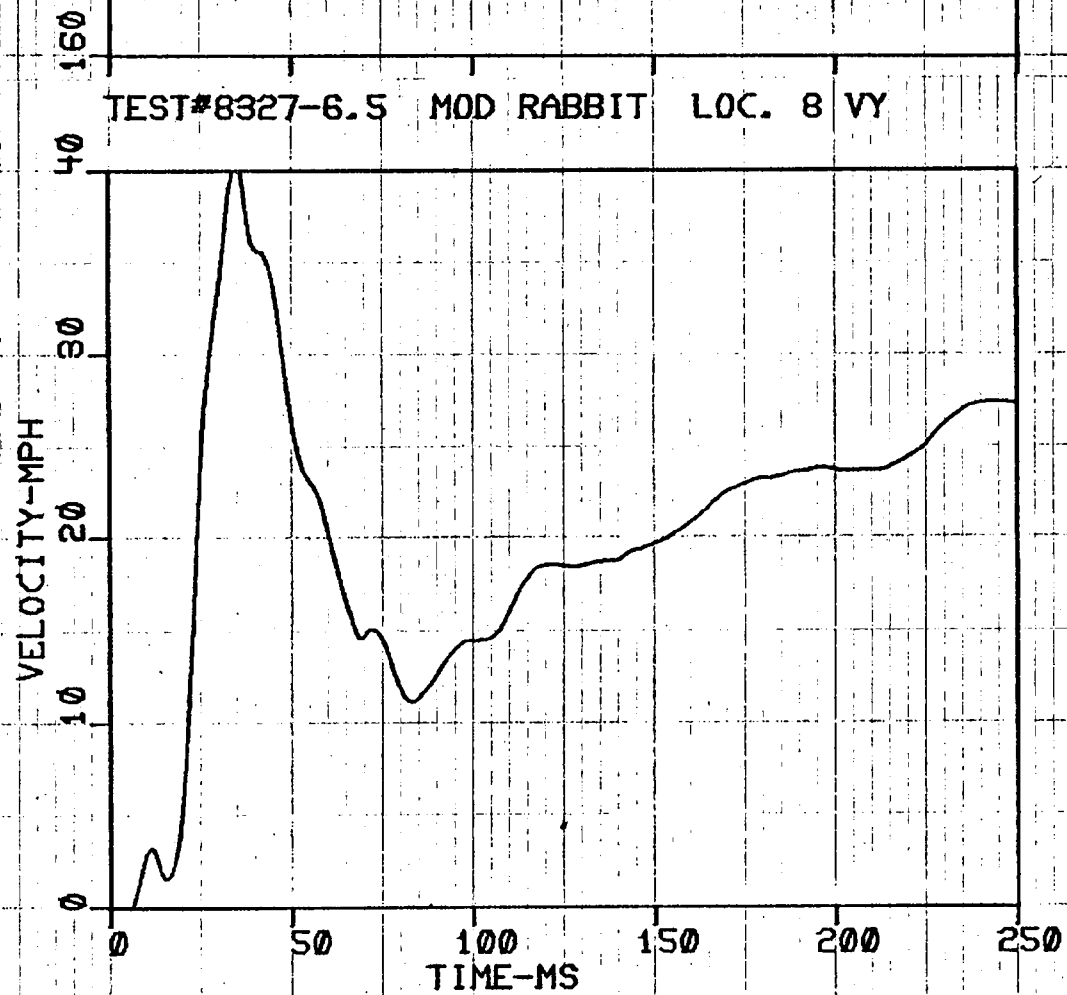


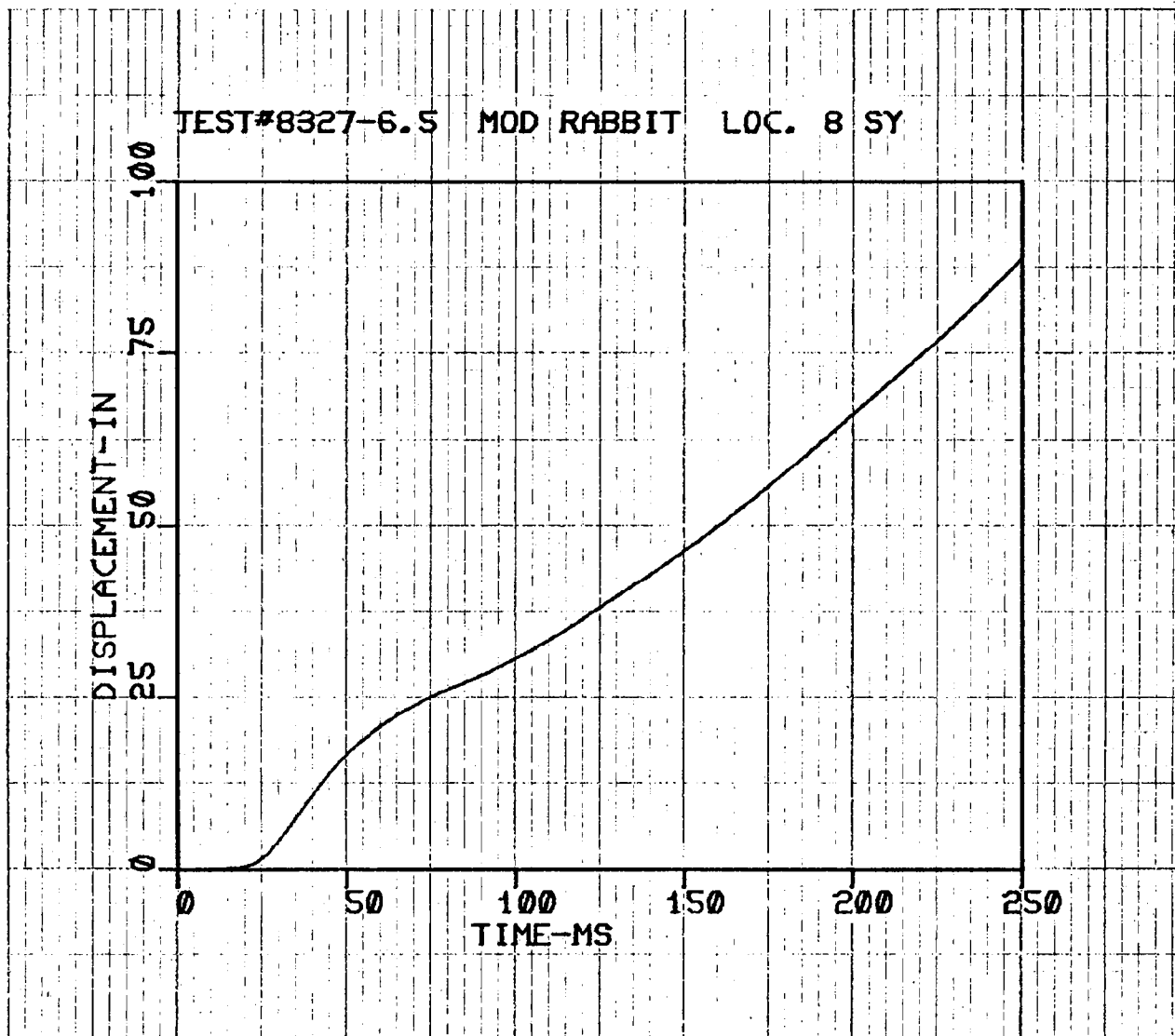


TEST#8327-6.5 MOD RABBIT LOC. 8 AY

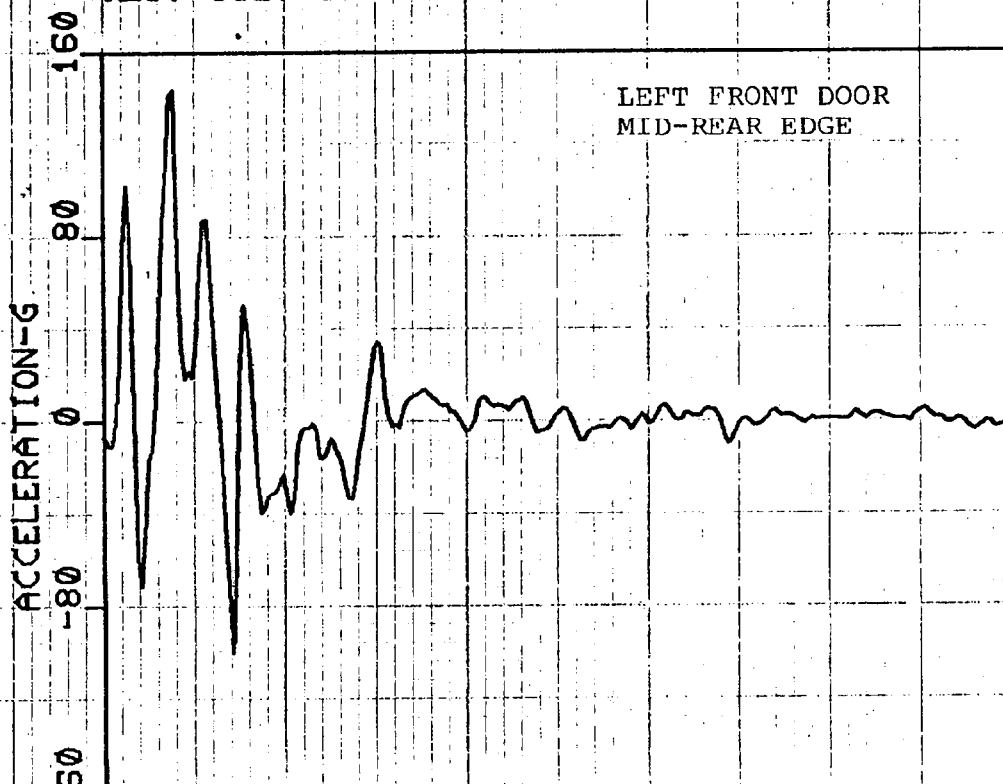


TEST#8327-6.5 MOD RABBIT LOC. 8 VY

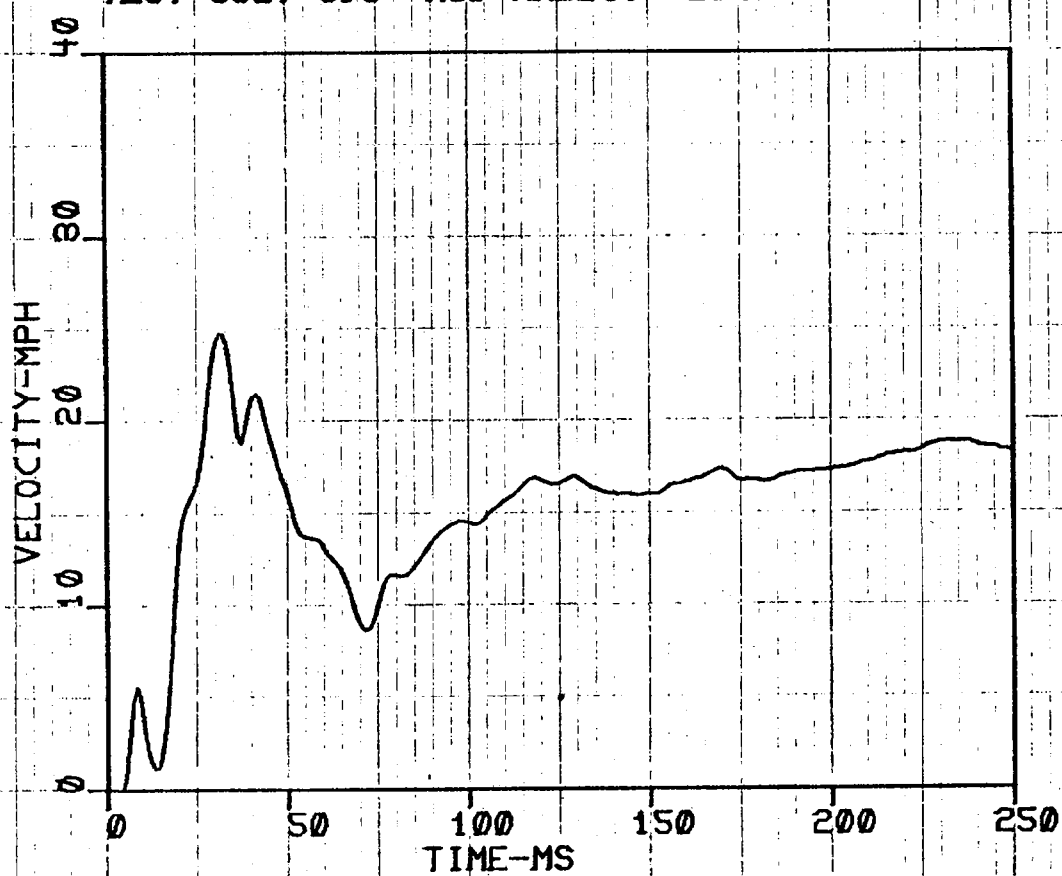


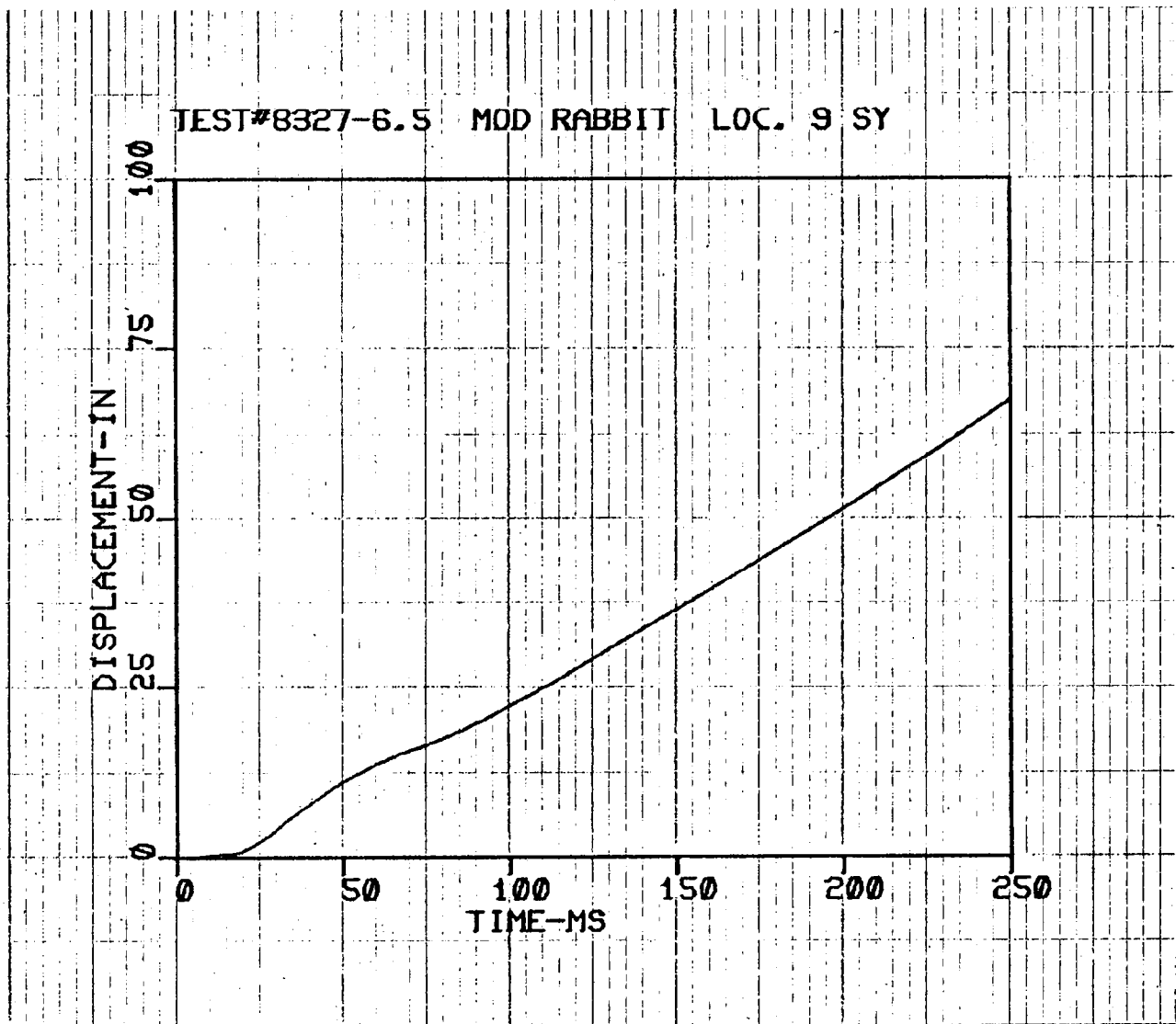


TEST#8327-6.5 MOD RABBIT LOC. 9 AY

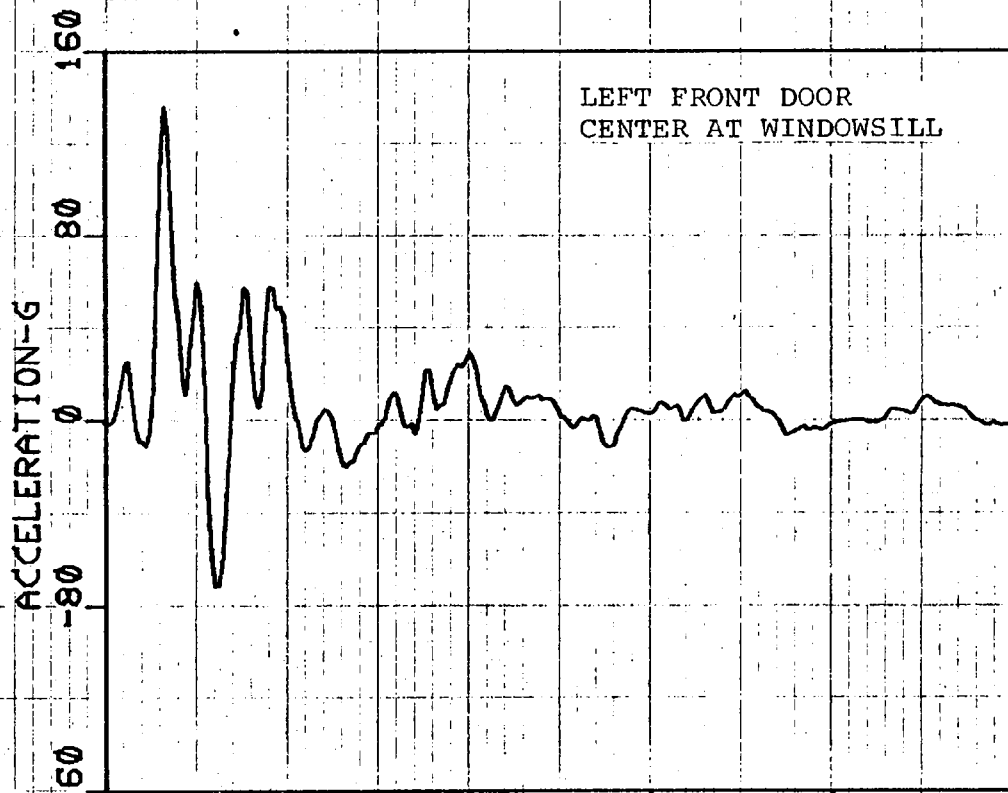


TEST#8327-6.5 MOD RABBIT LOC. 9 VY

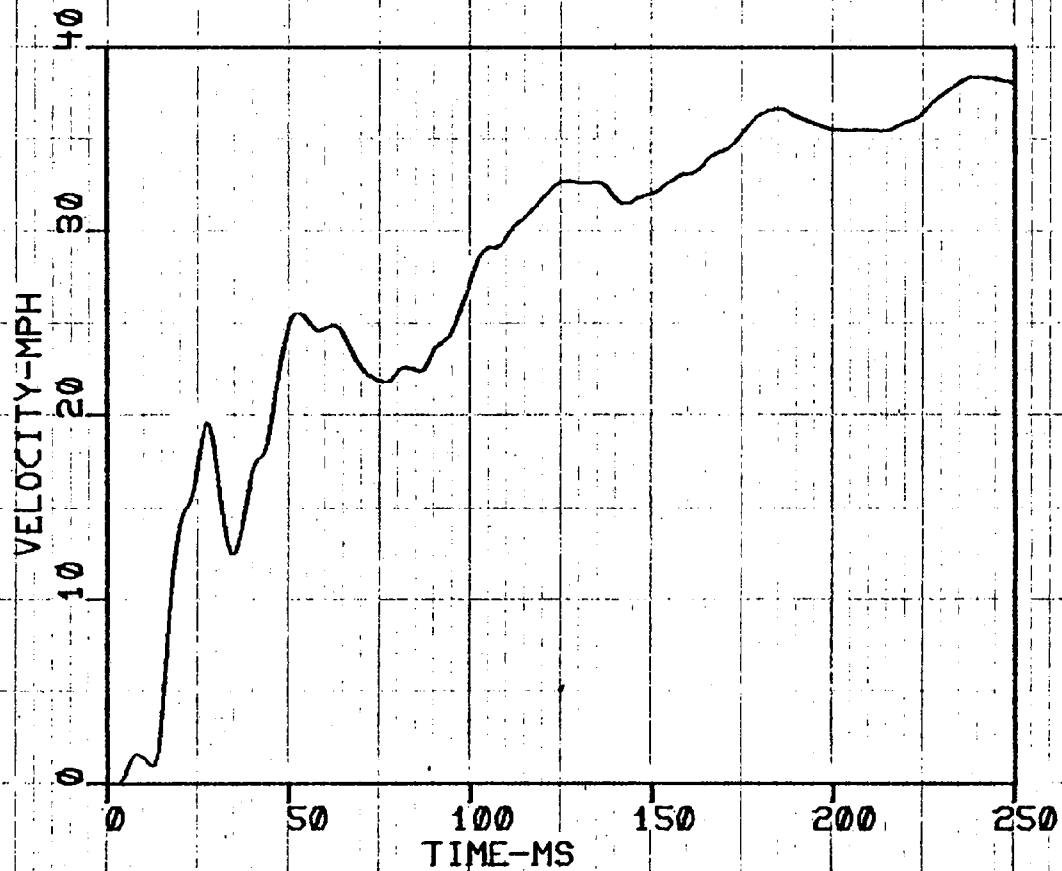


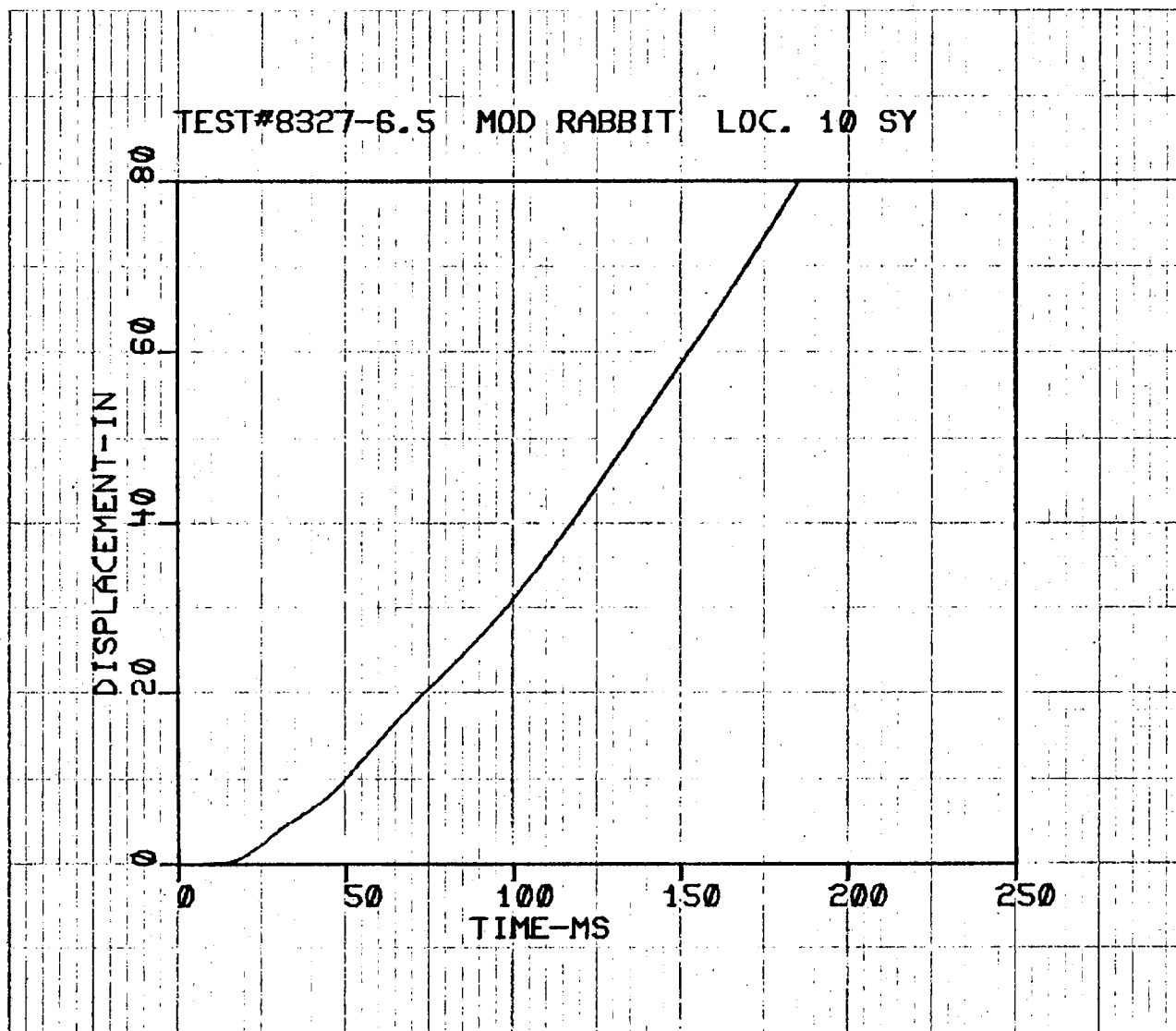


TEST#8327-6.5 MOD RABBIT LOC. 10 AY

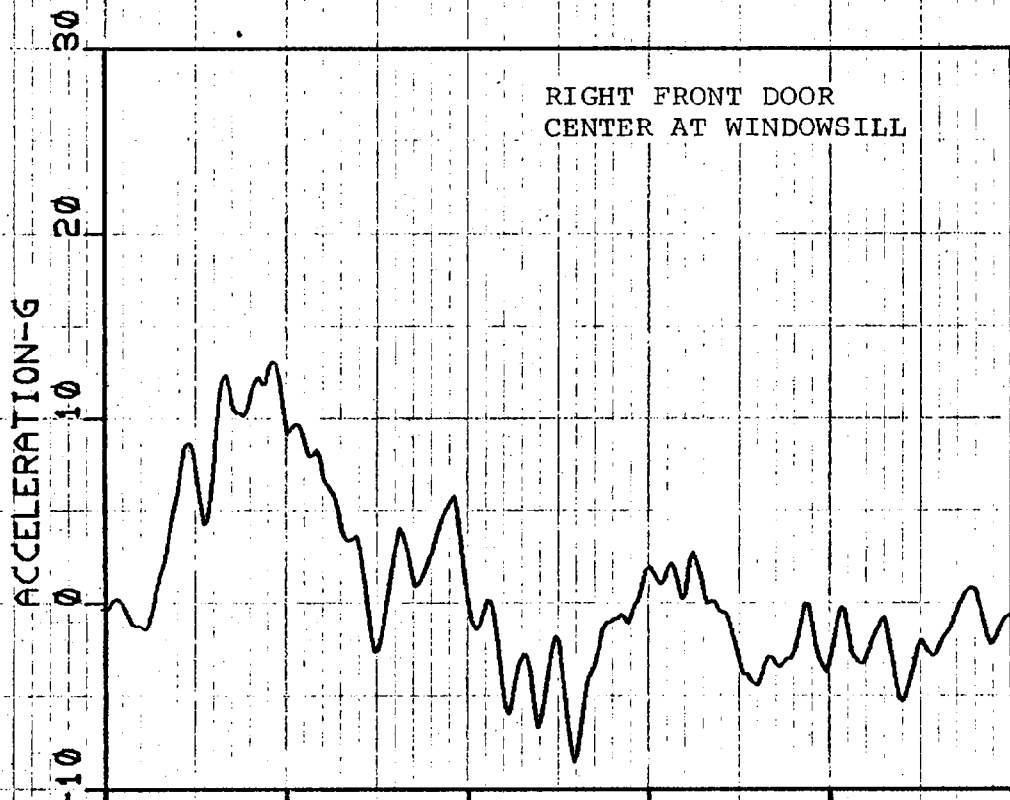


TEST#8327-6.5 MOD RABBIT LOC. 10 VY

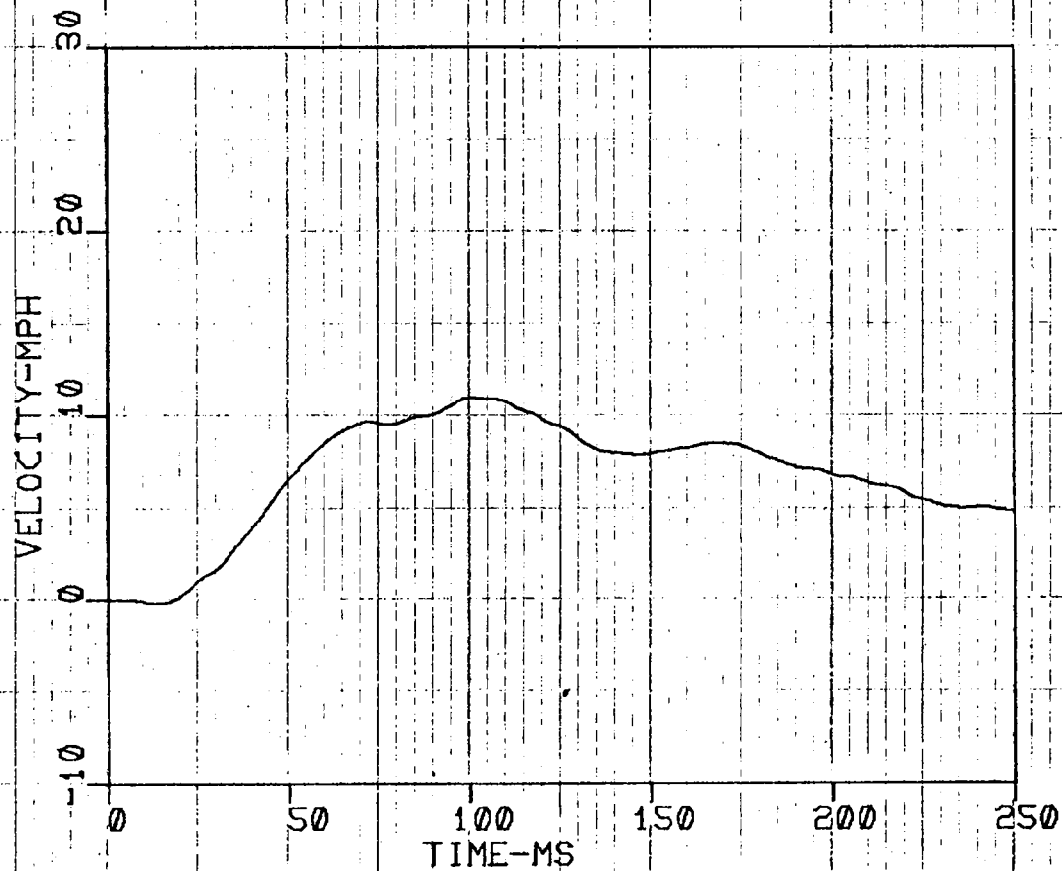


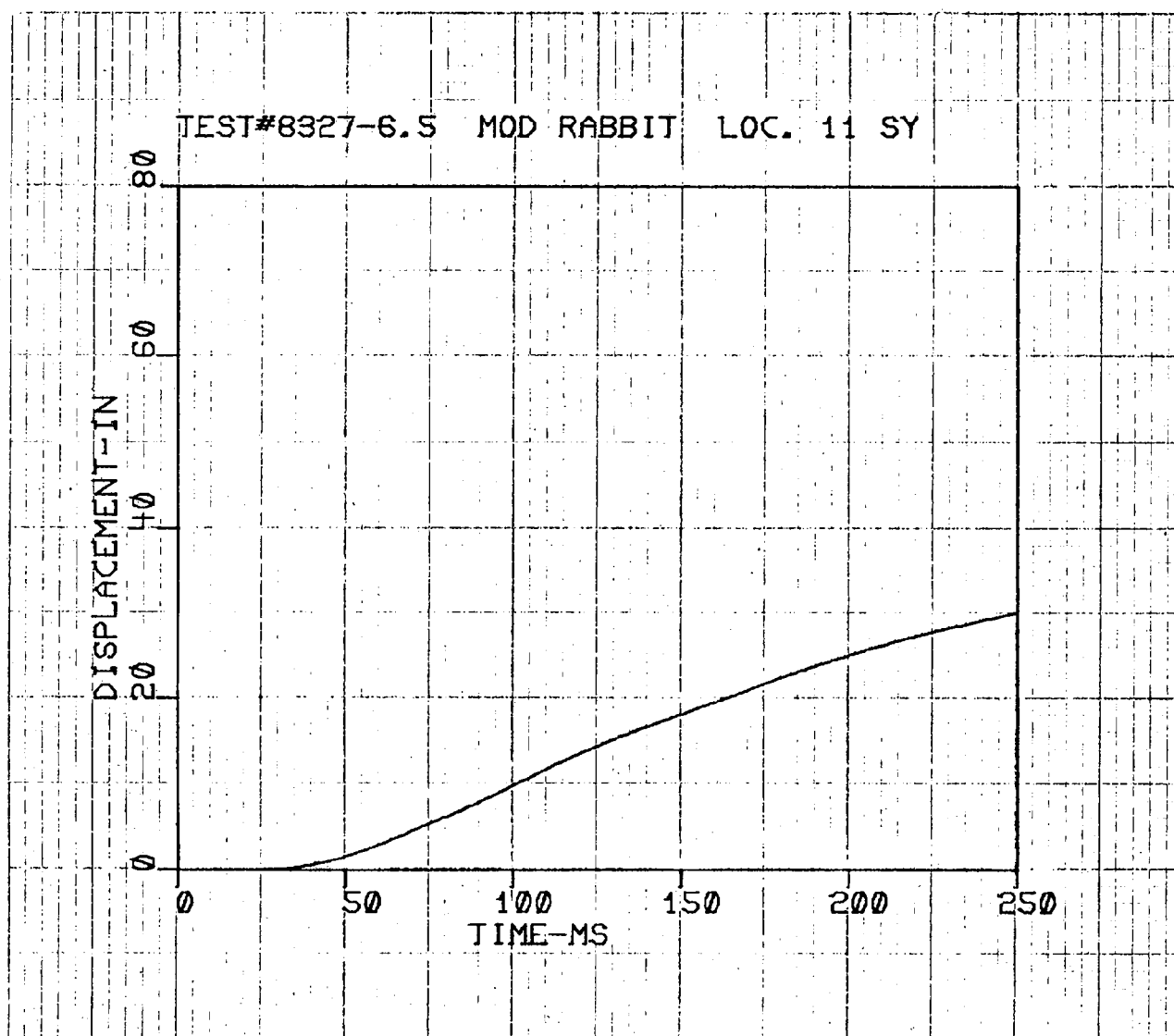


TEST#8327-6.5 MOD RABBIT LOC. 11 AY

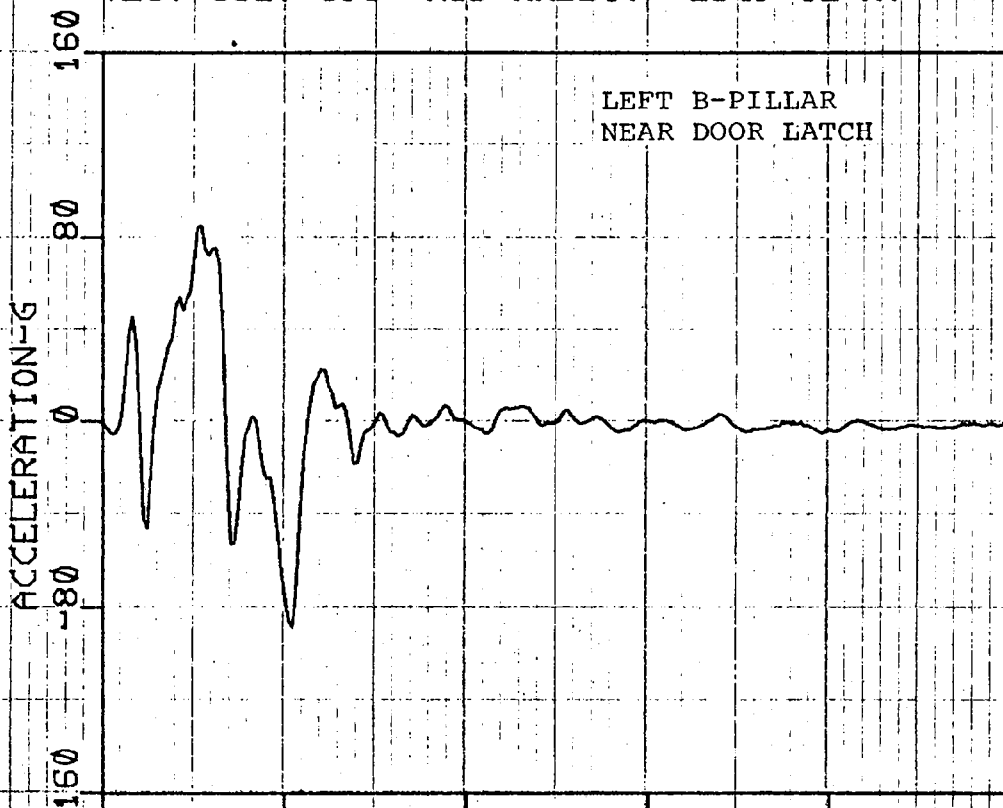


TEST#8327-6.5 MOD RABBIT LOC. 11 VY

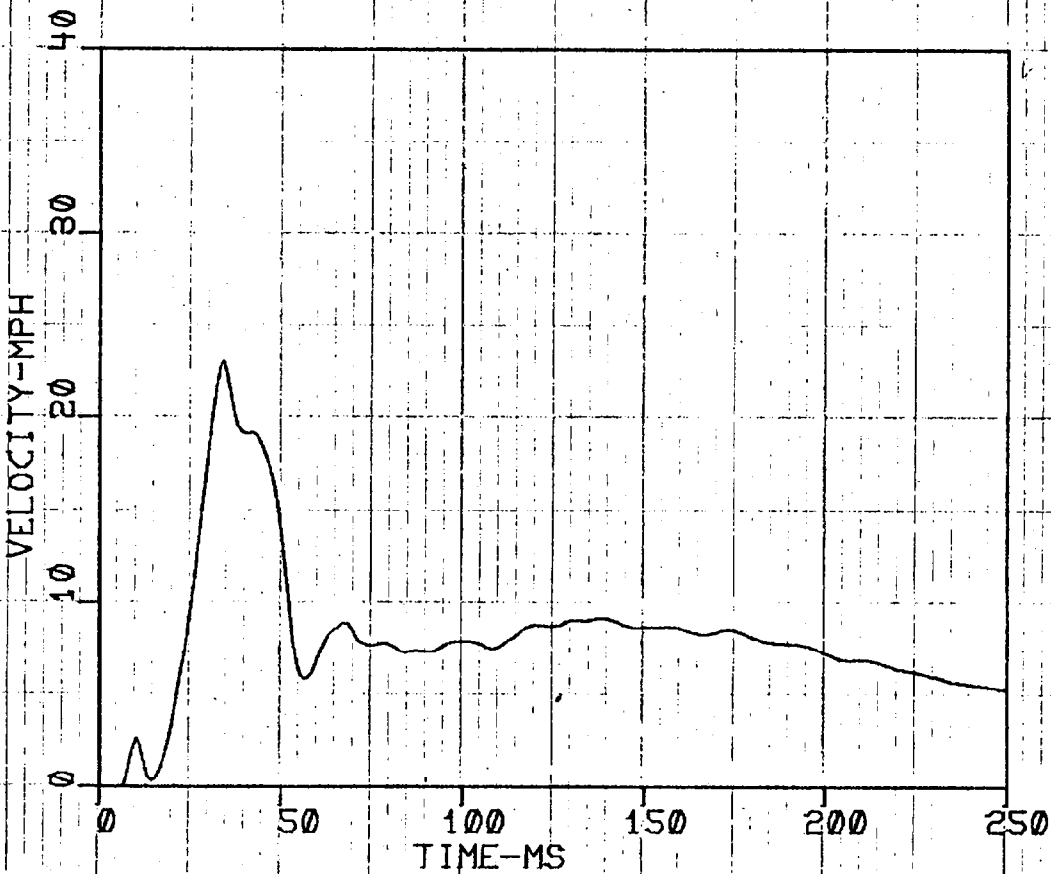


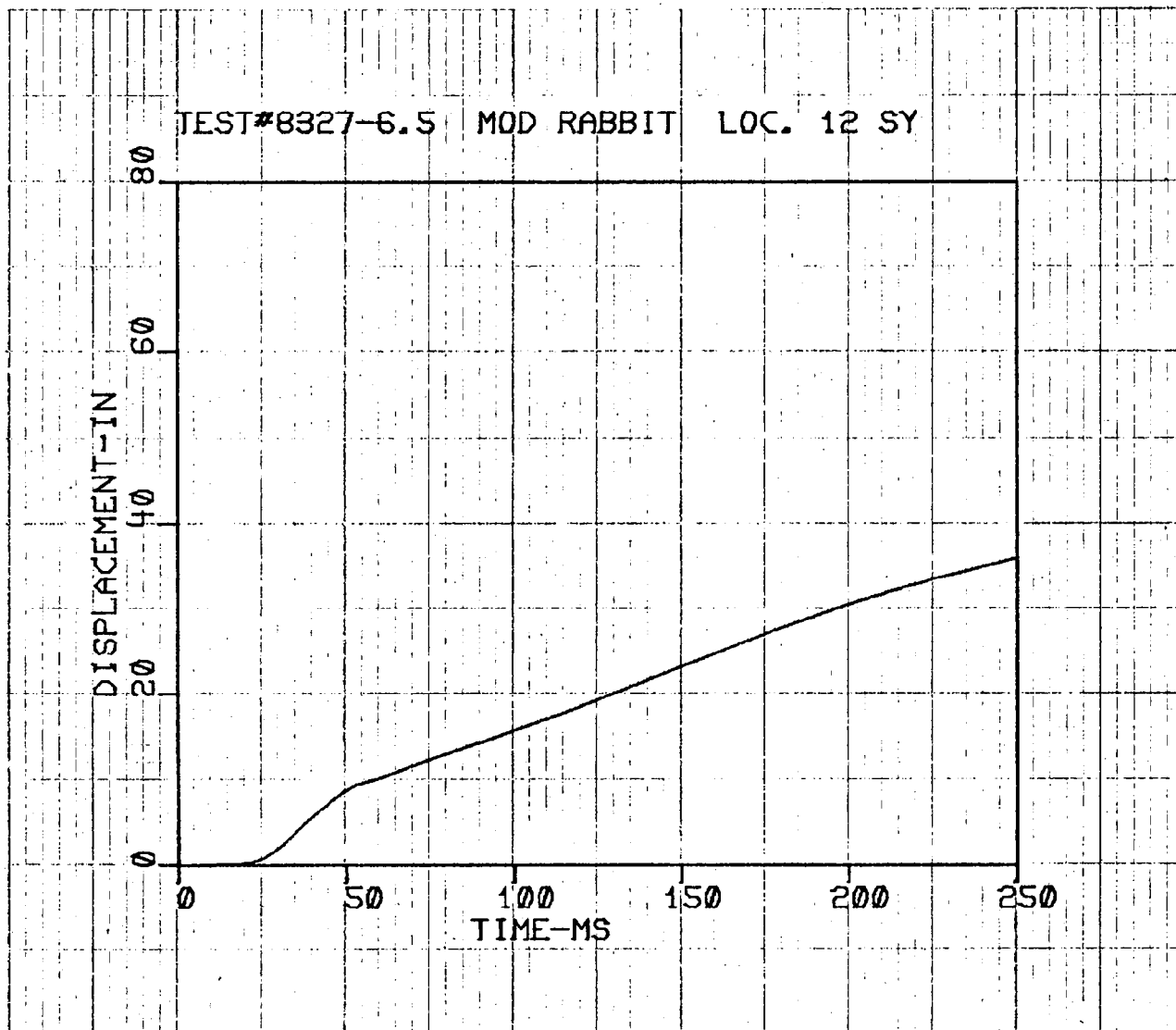


TEST#8327-6.5 MOD RABBIT LOC. 12 AY

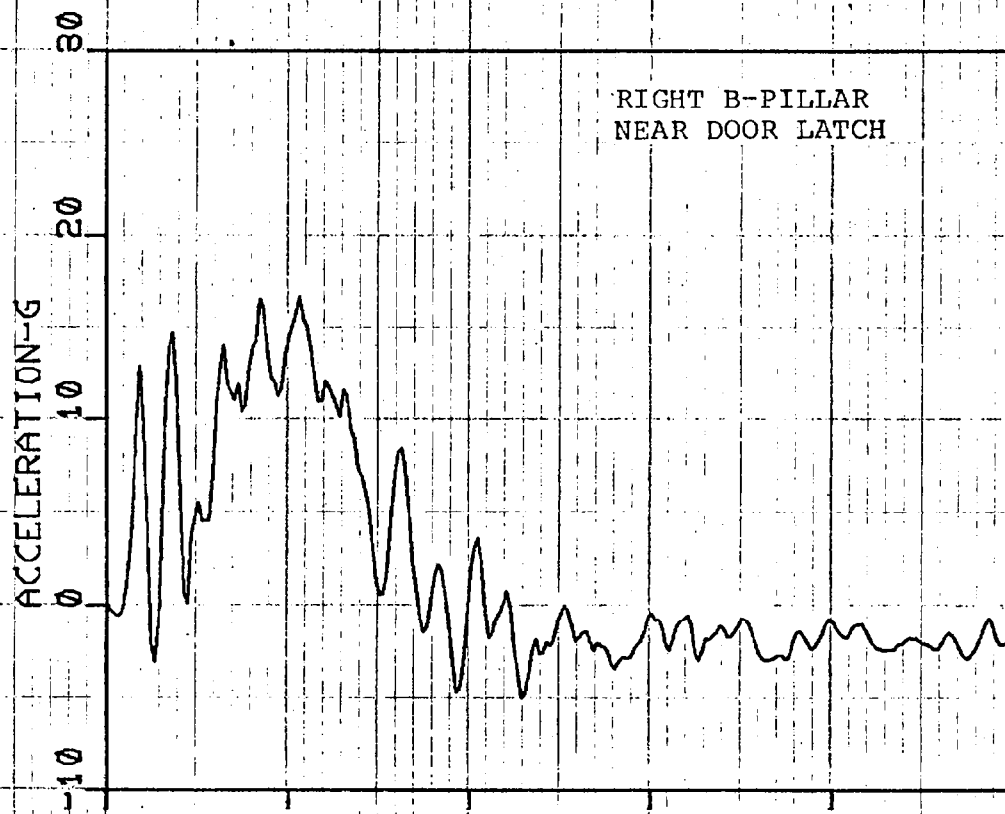


TEST#8327-6.5 MOD RABBIT LOC. 12 VY

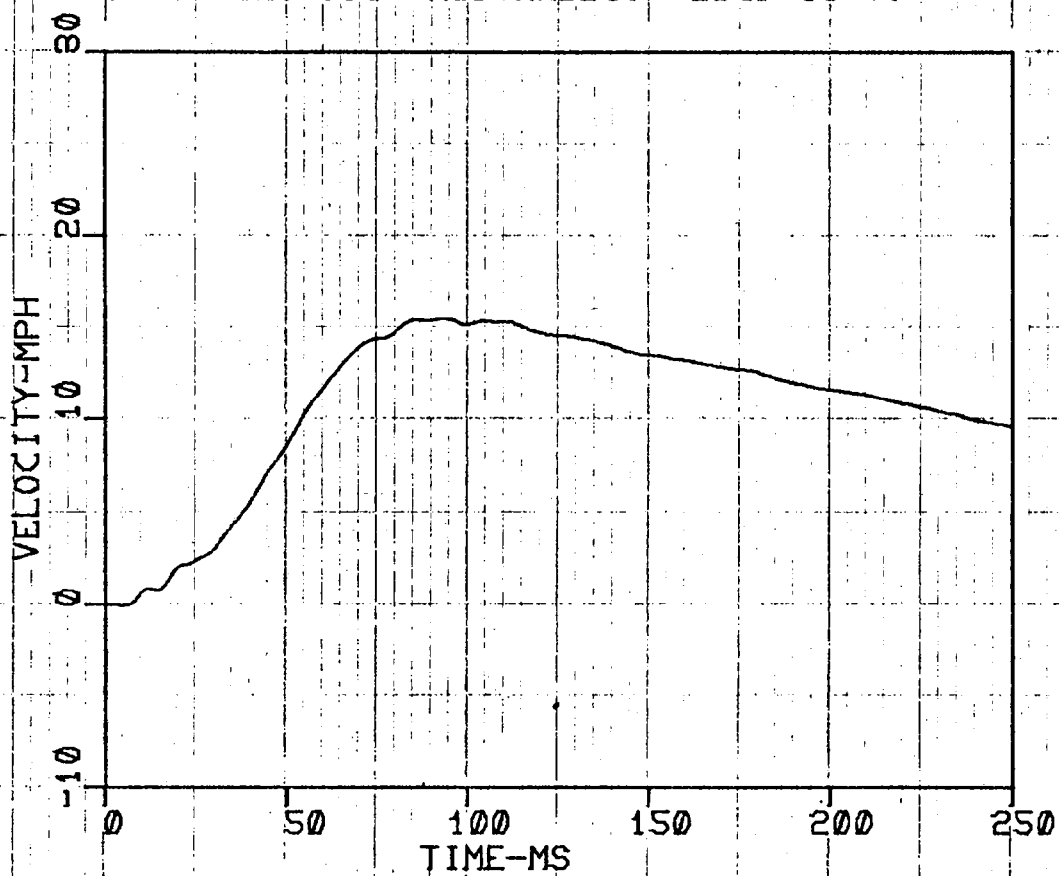


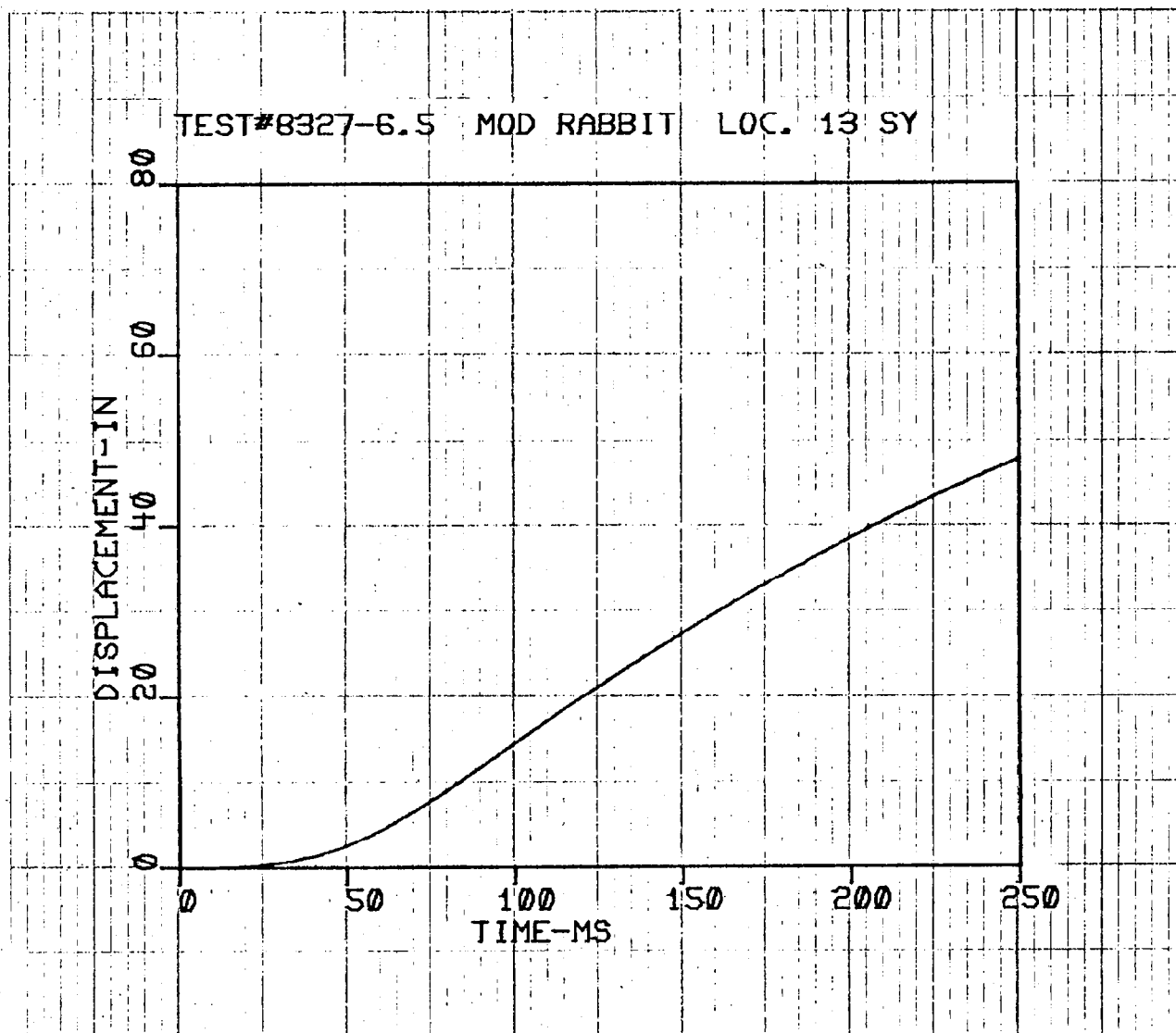


TEST#8327-6.5 MOD RABBIT LOC. 13 AY

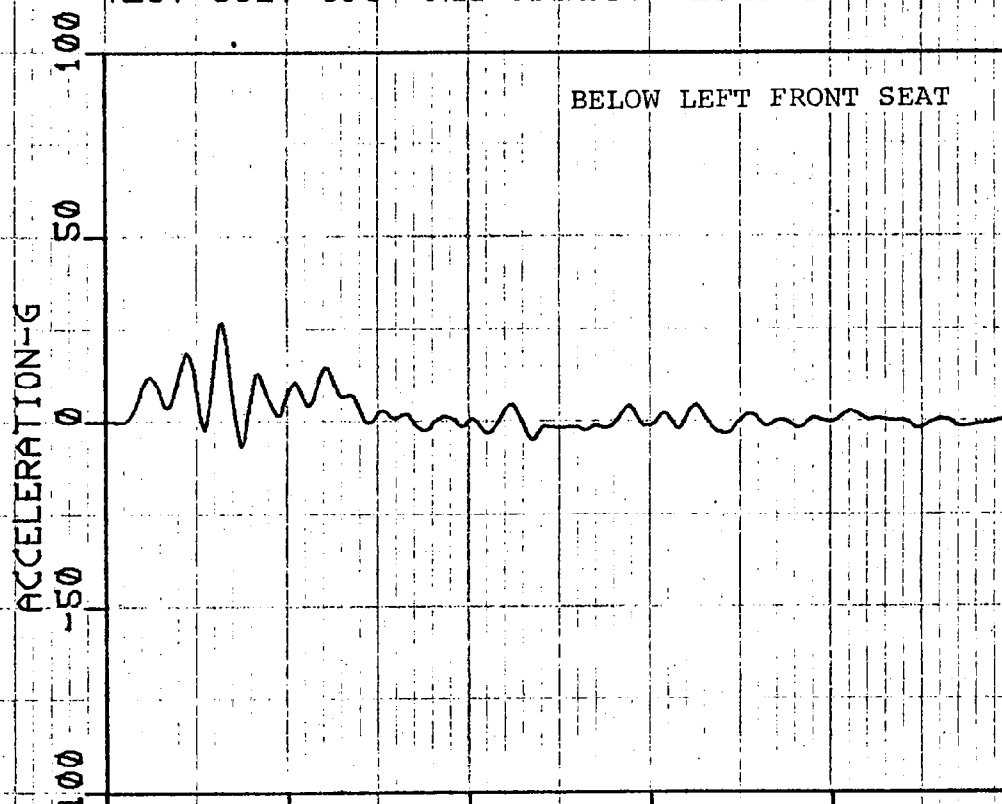


TEST#8327-6.5 MOD RABBIT LOC. 13 VY

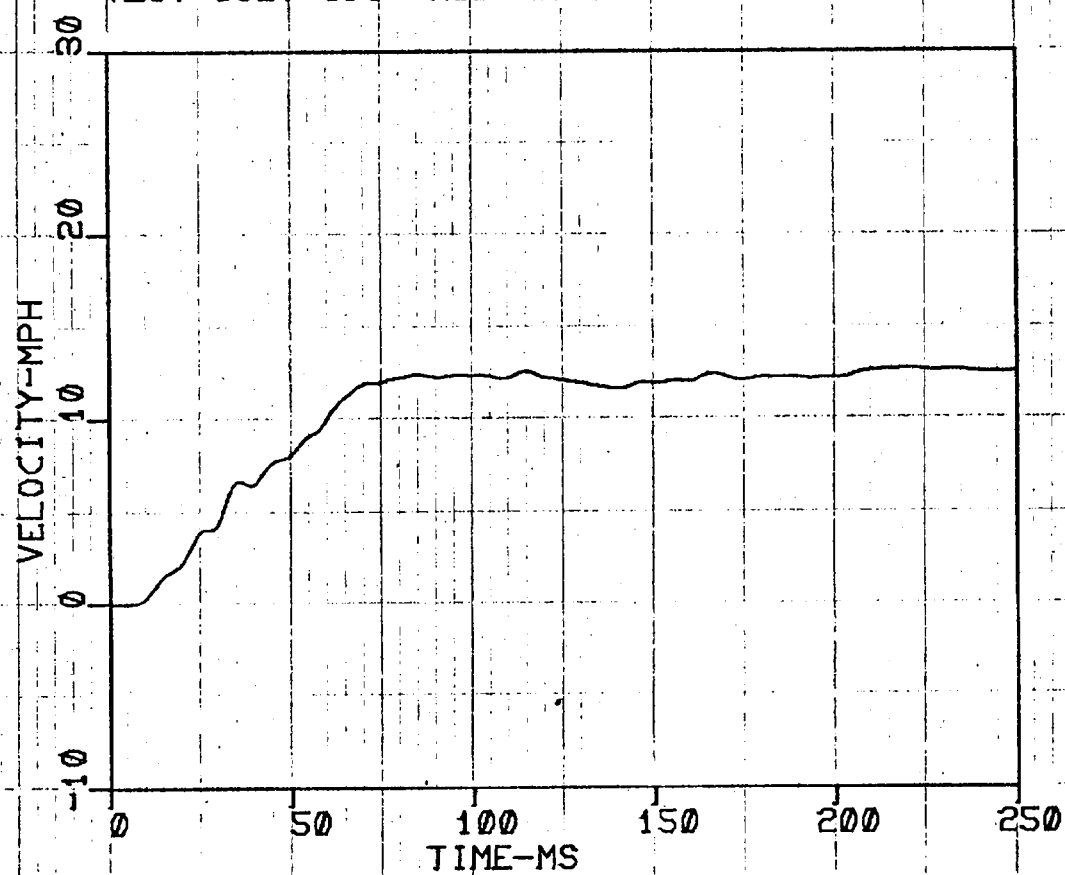


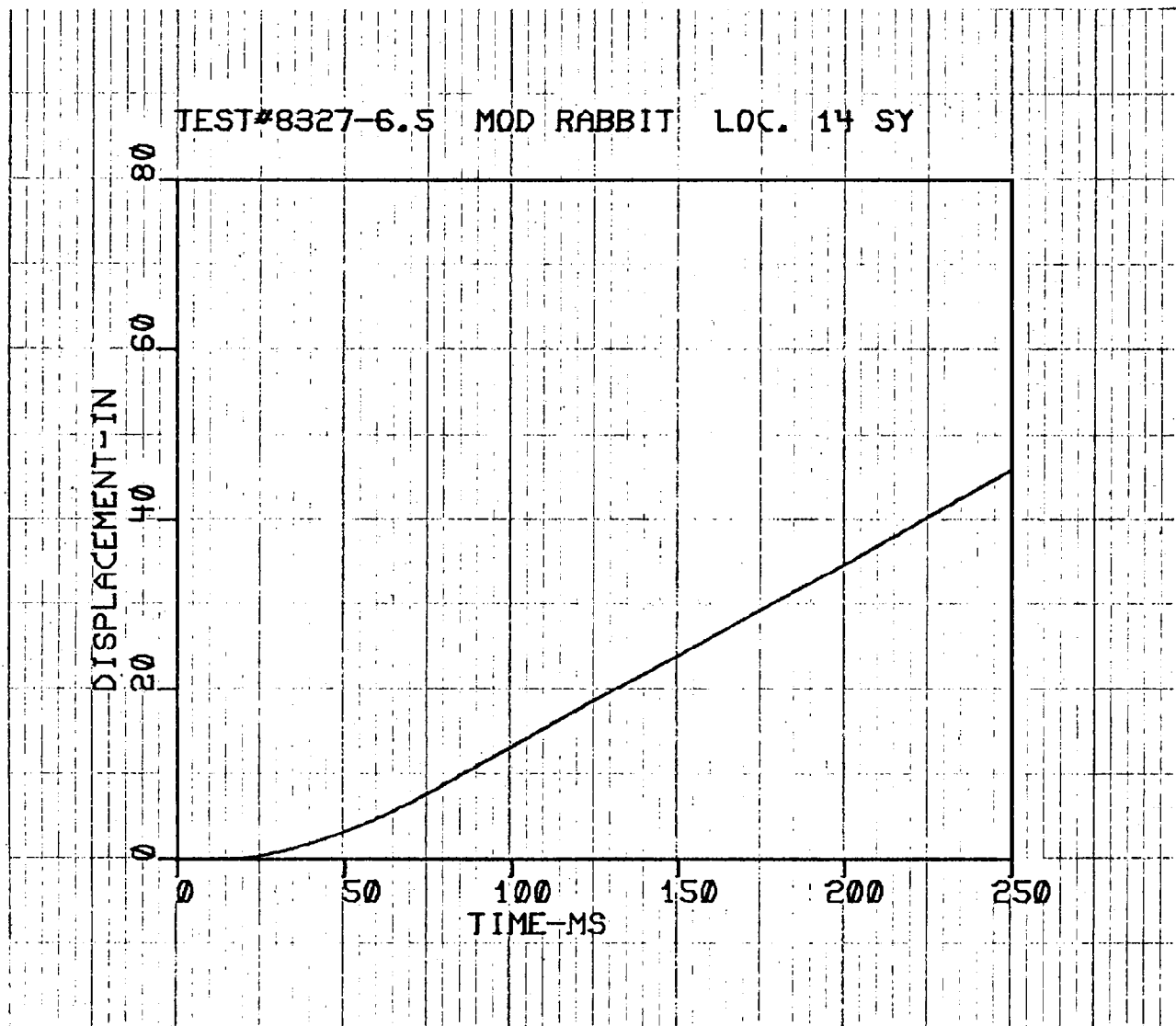


TEST#8327-6.5 MOD RABBIT LOC. 14 AY

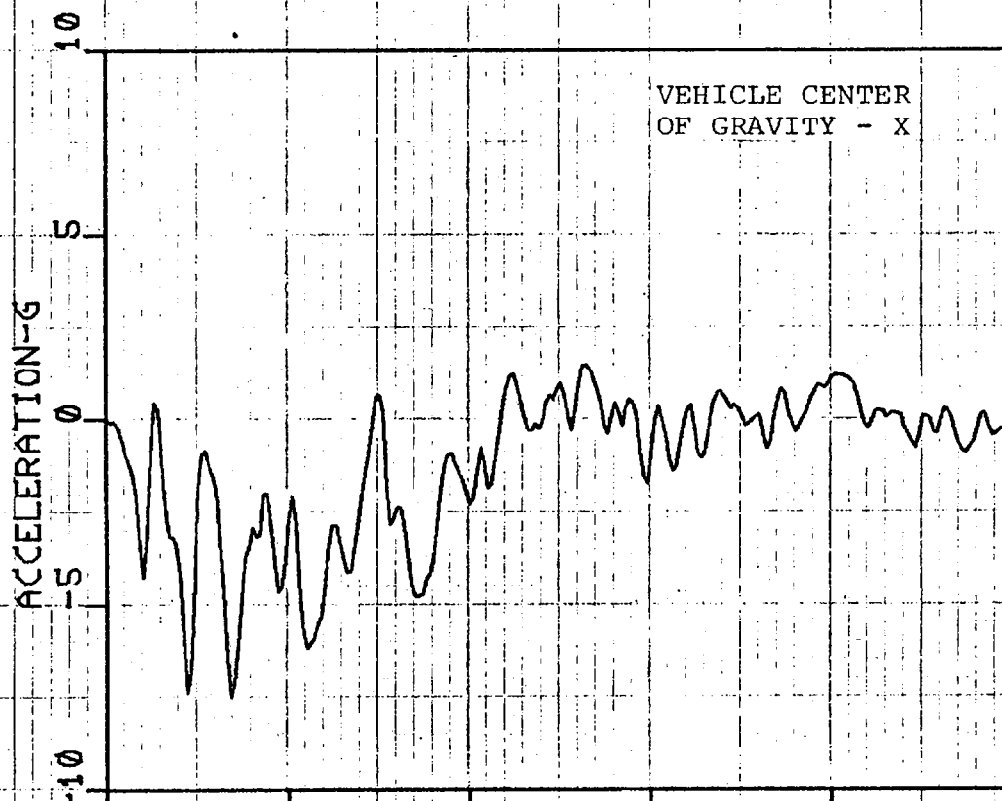


TEST#8327-6.5 MOD RABBIT LOC. 14 VY

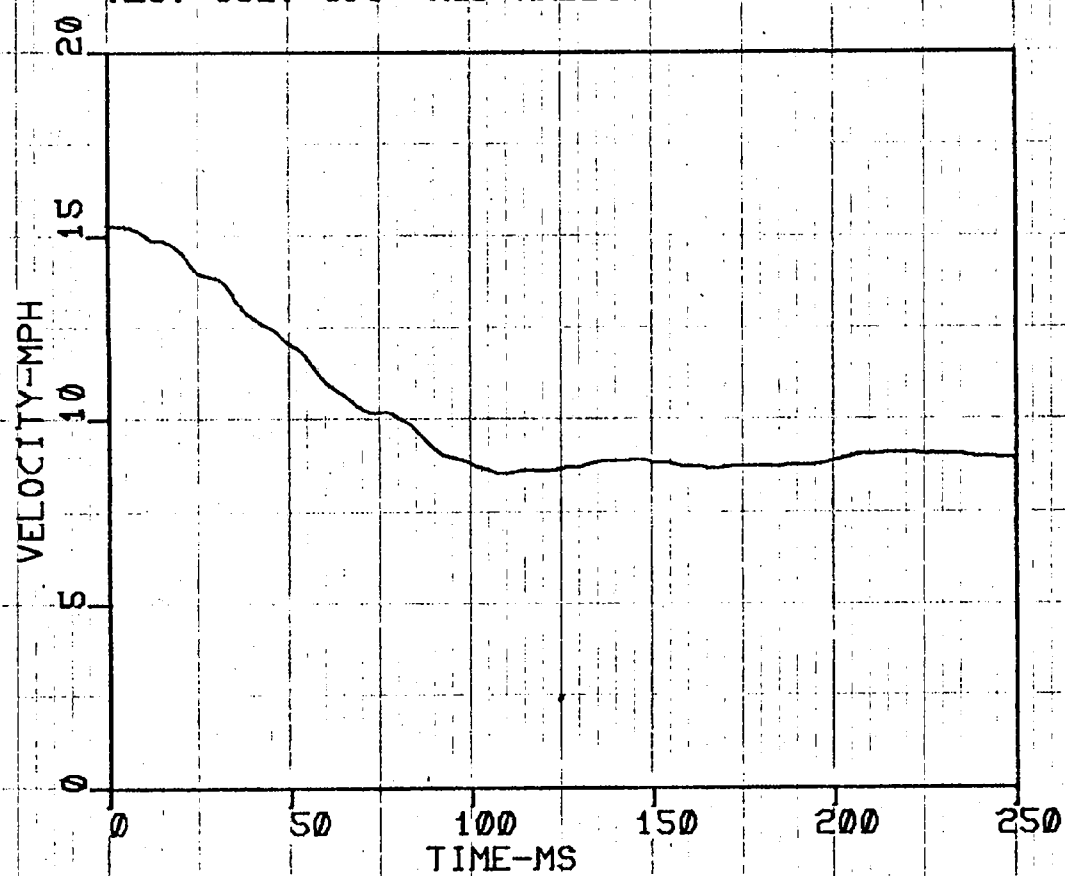


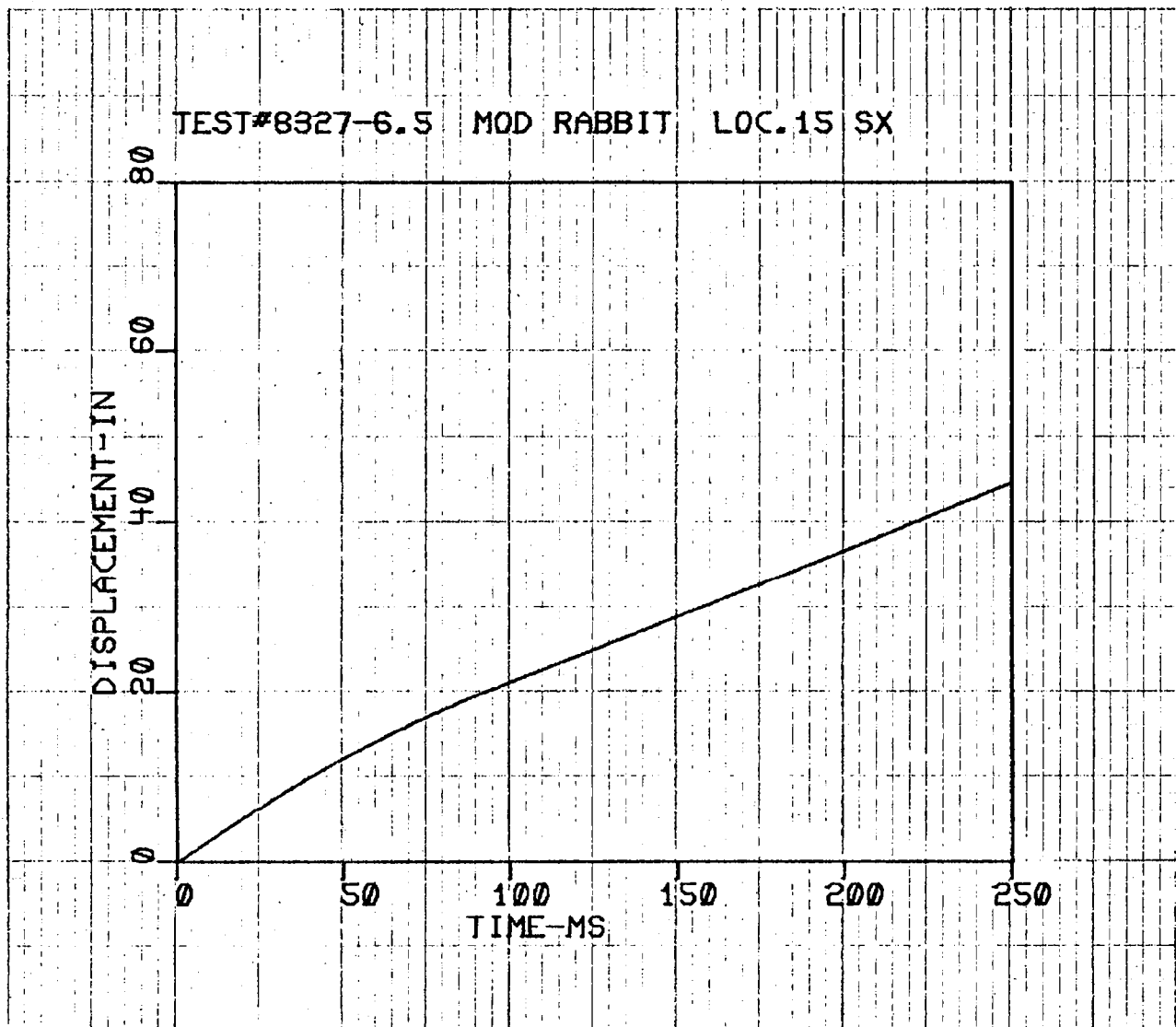


TEST#8327-6.5 MOD RABBIT LOC. 15 AX

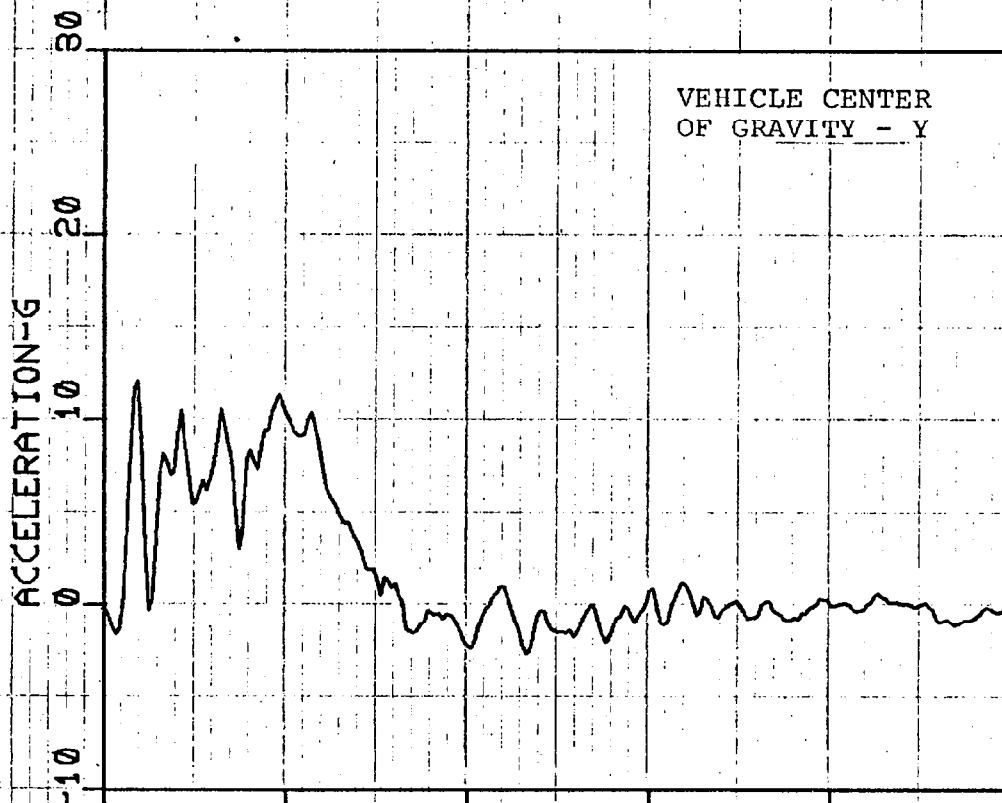


TEST#8327-6.5 MOD RABBIT LOC. 15 VX

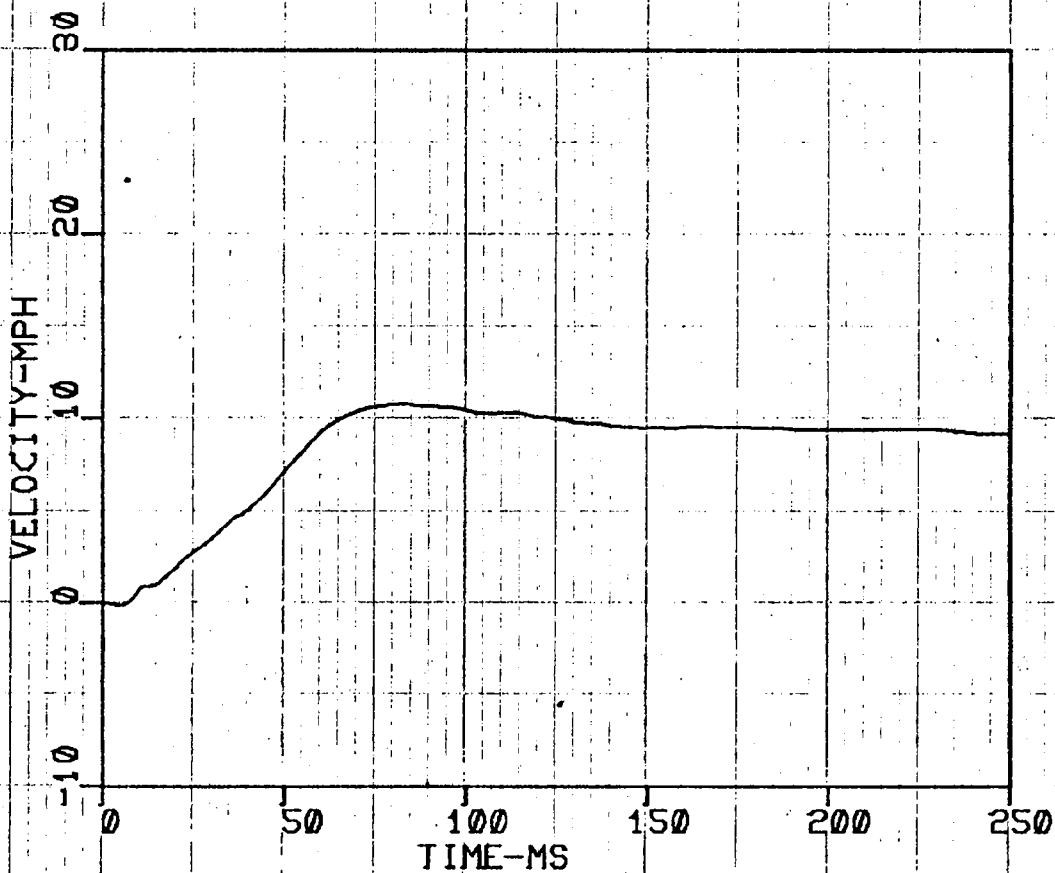


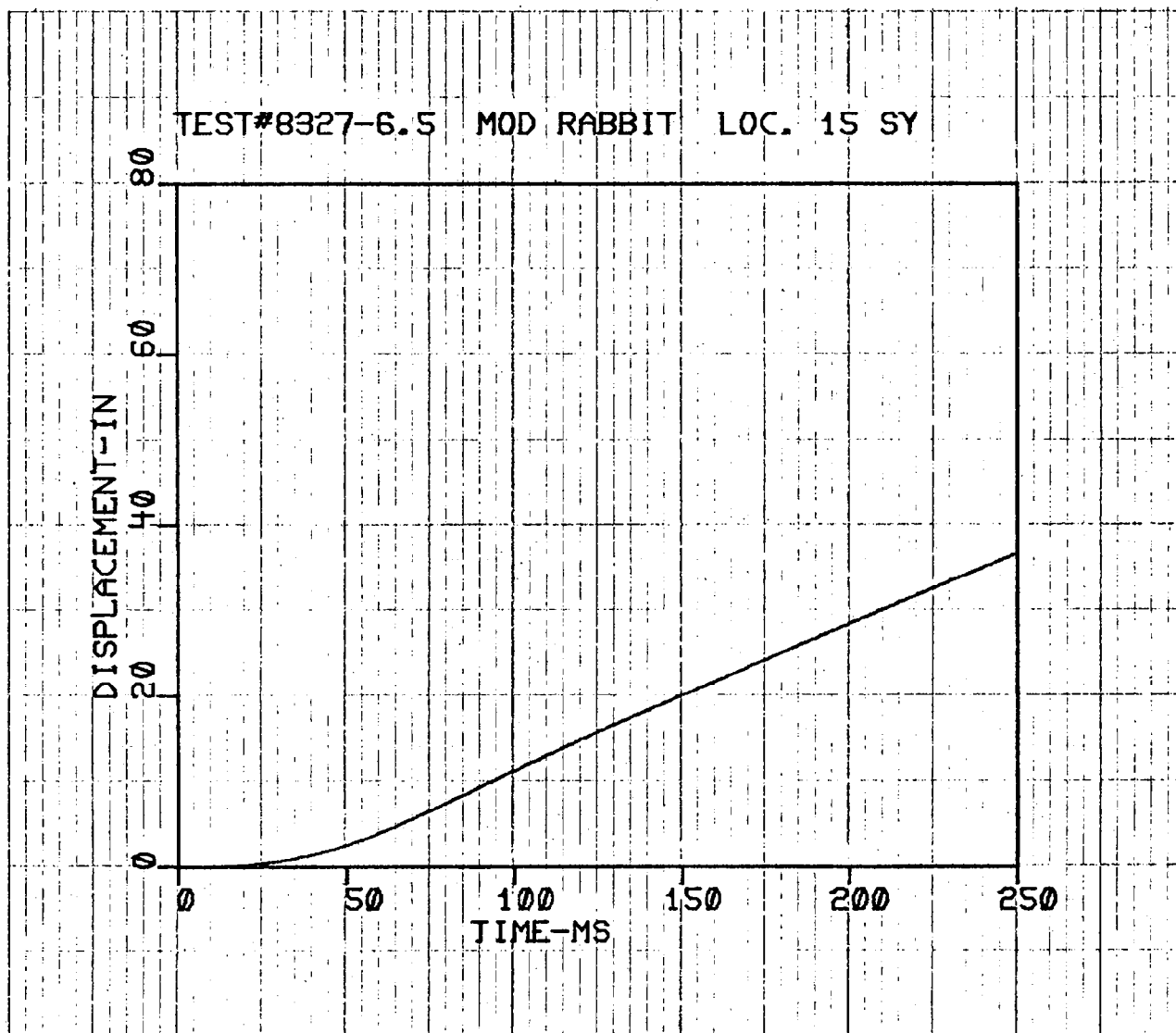


TEST#8327-6.5 MOD RABBIT LOC. 15 AY

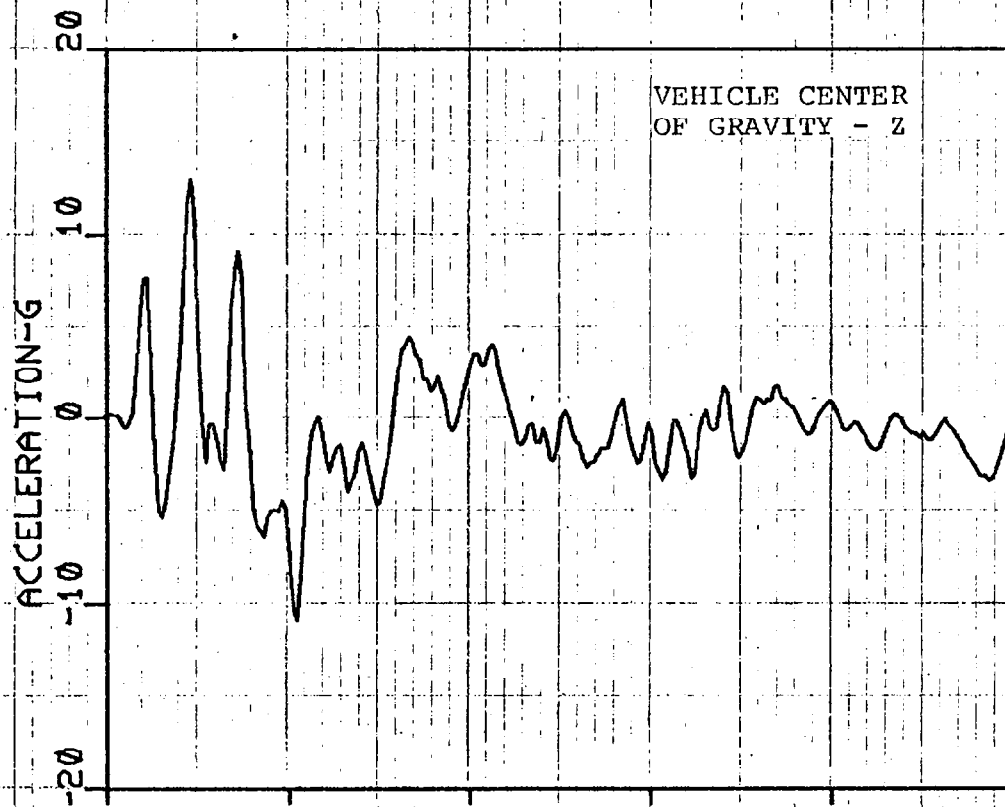


TEST#8327-6.5 MOD RABBIT LOC. 15 VY

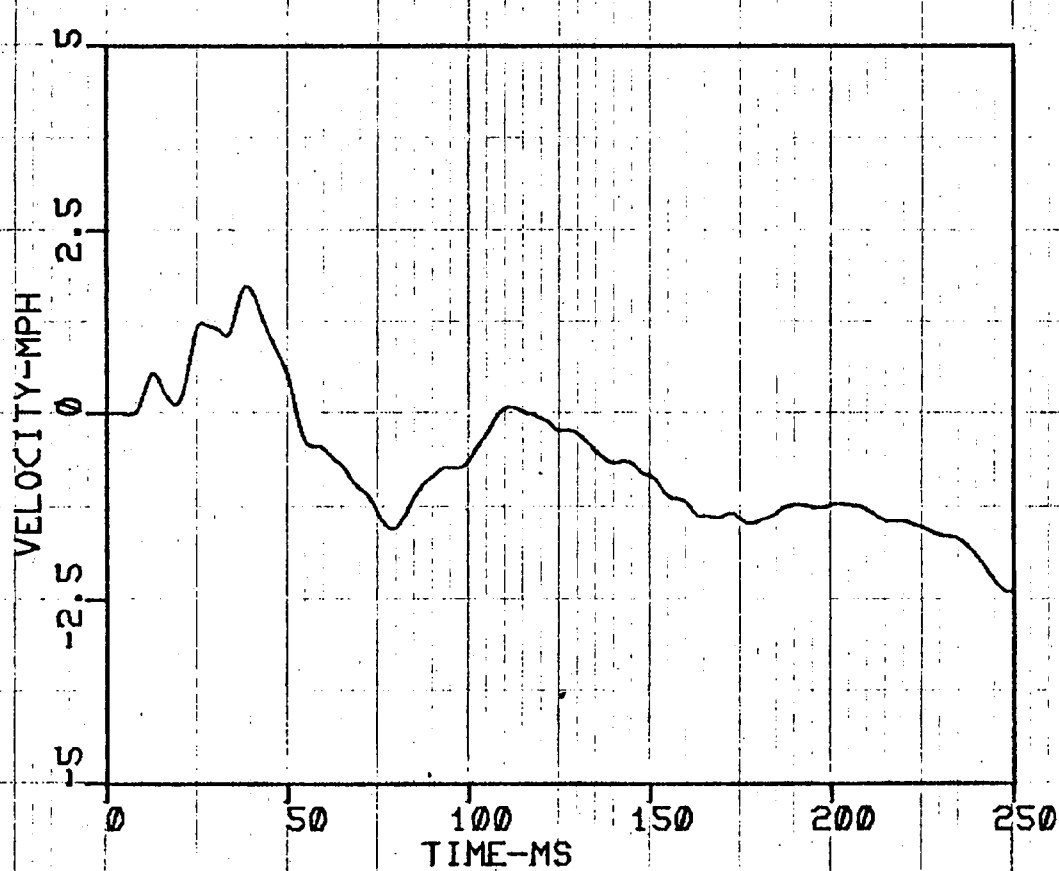


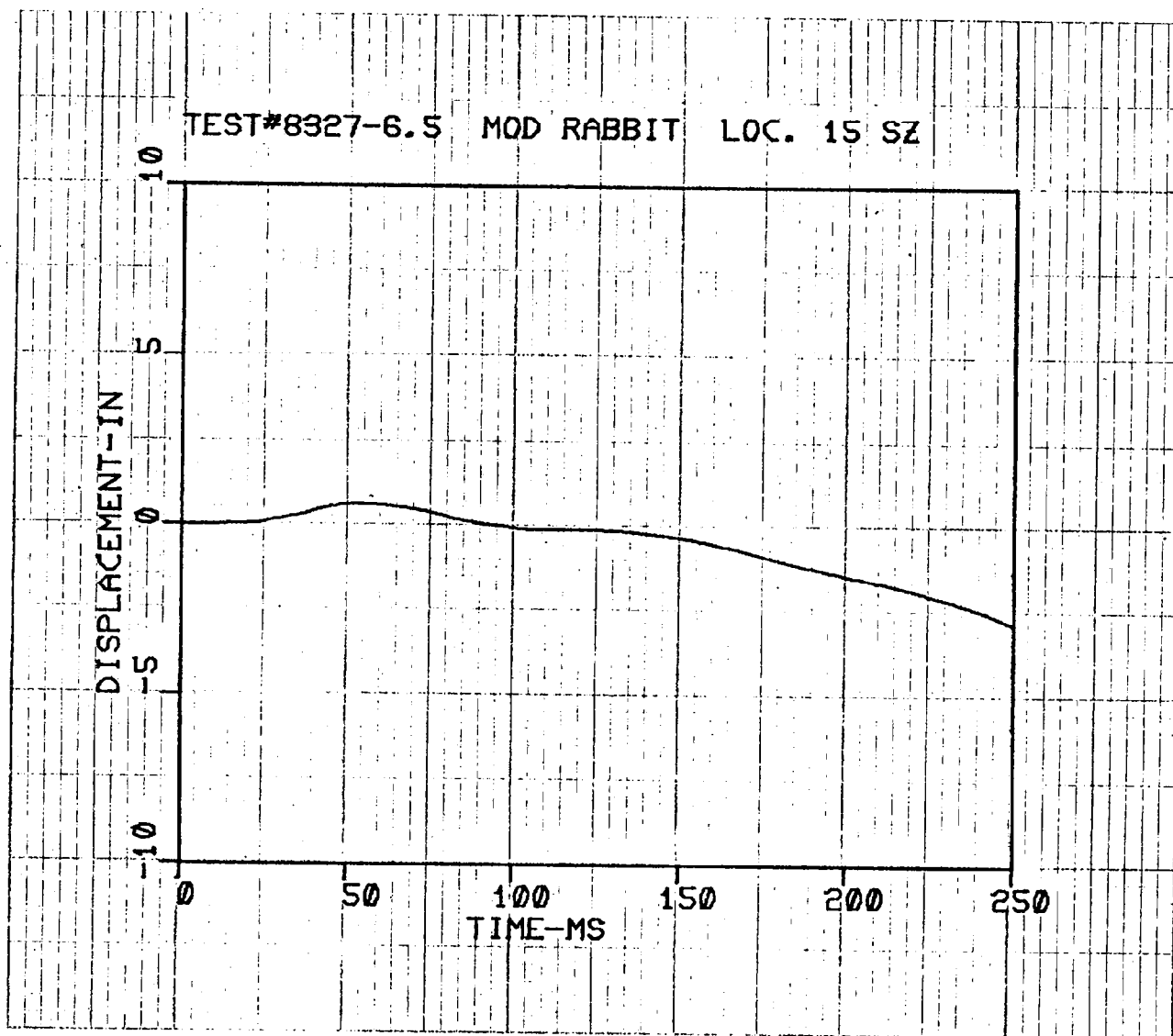


TEST#8327-6.5 MOD RABBIT LOC. 15 AZ

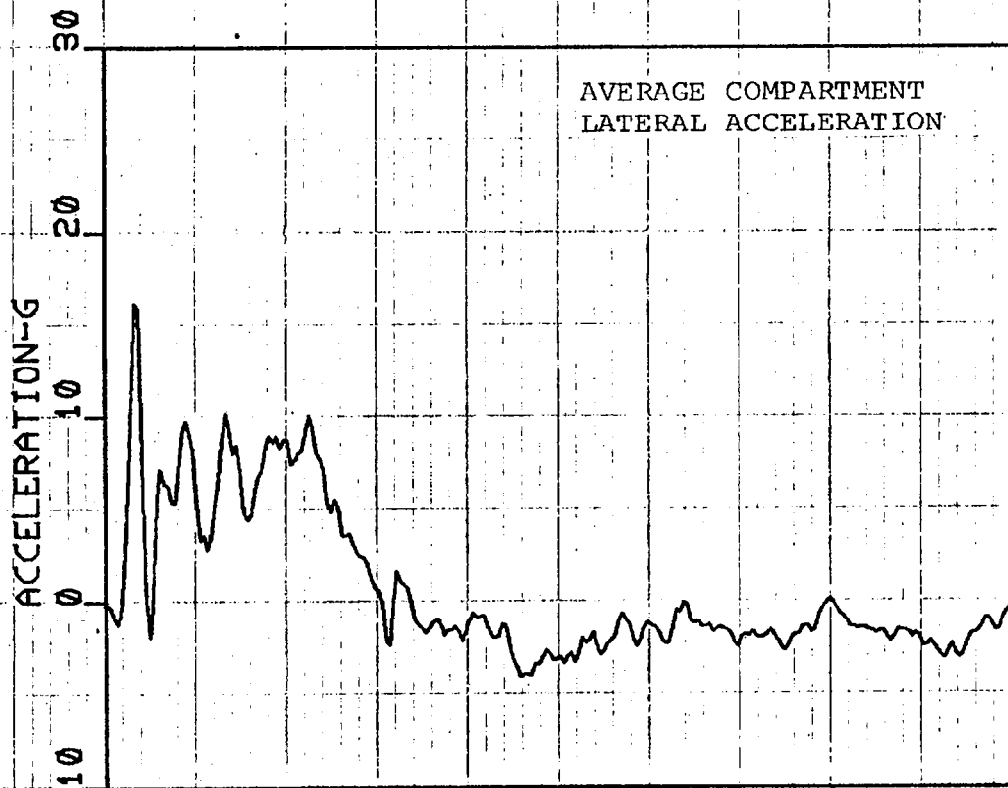


TEST#8327-6.5 MOD RABBIT LOC. 15 VZ

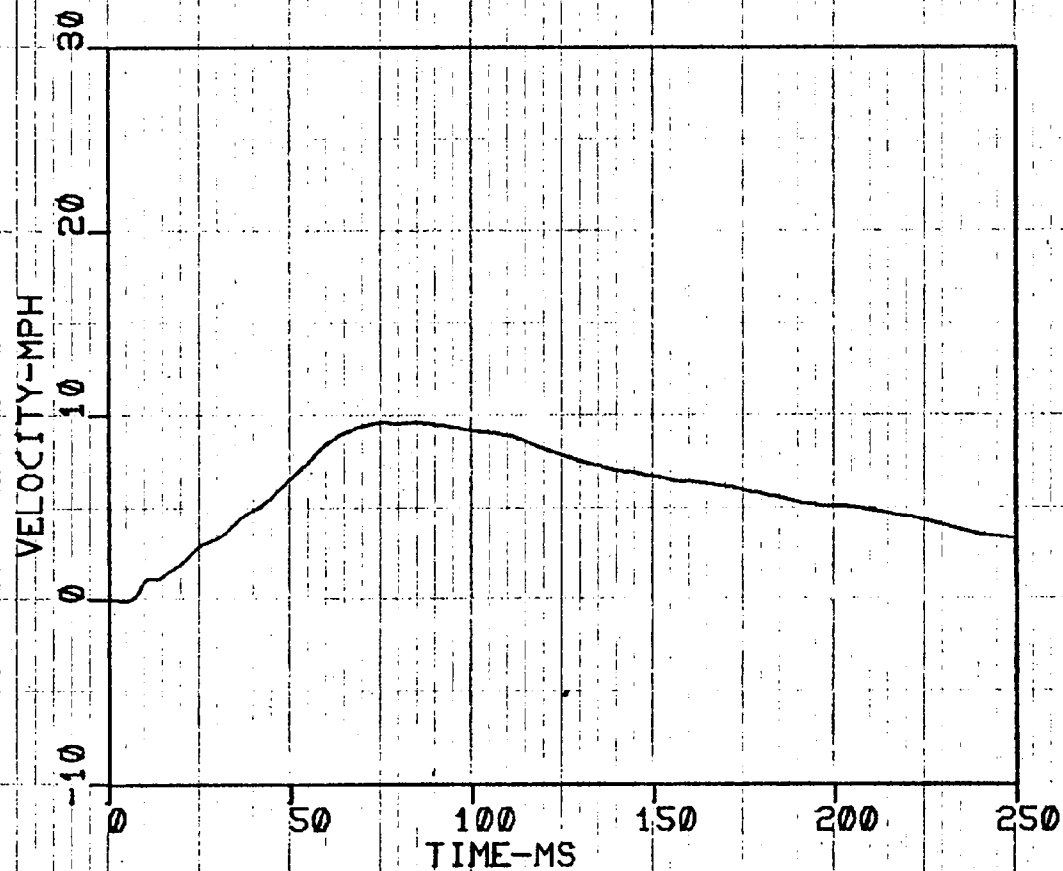


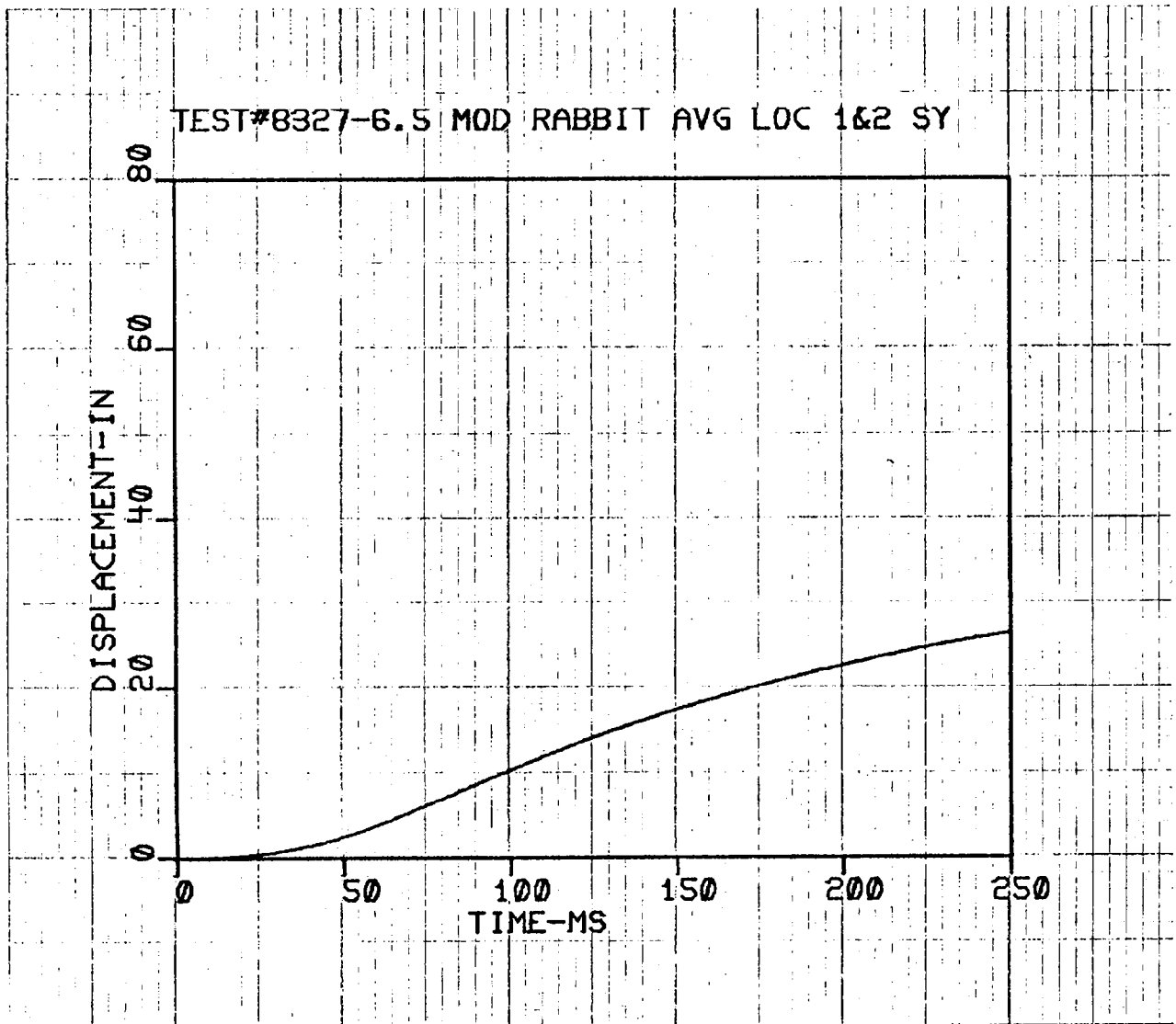


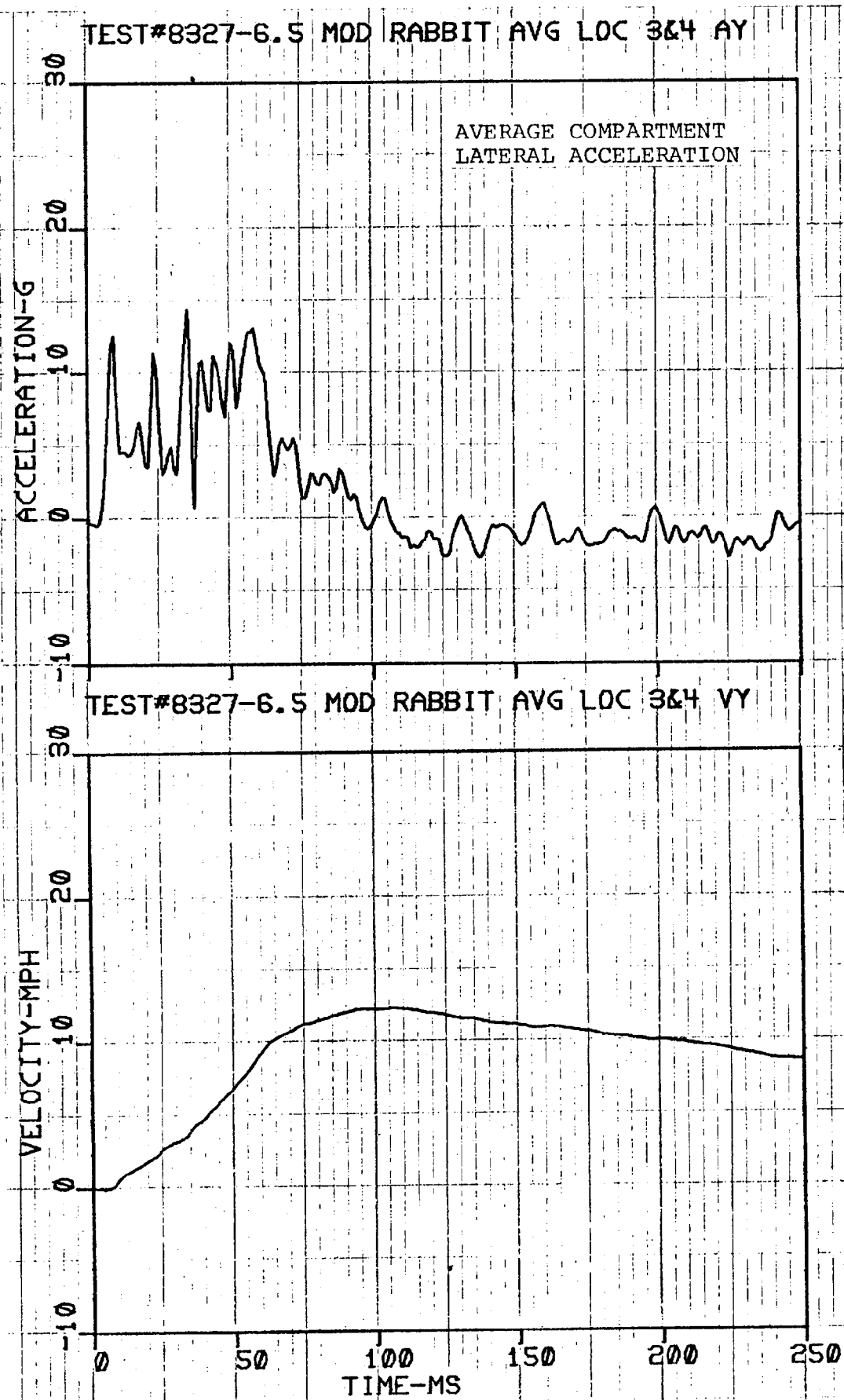
TEST#8327-6.5 MOD RABBIT AVG LOC 1&2 AY

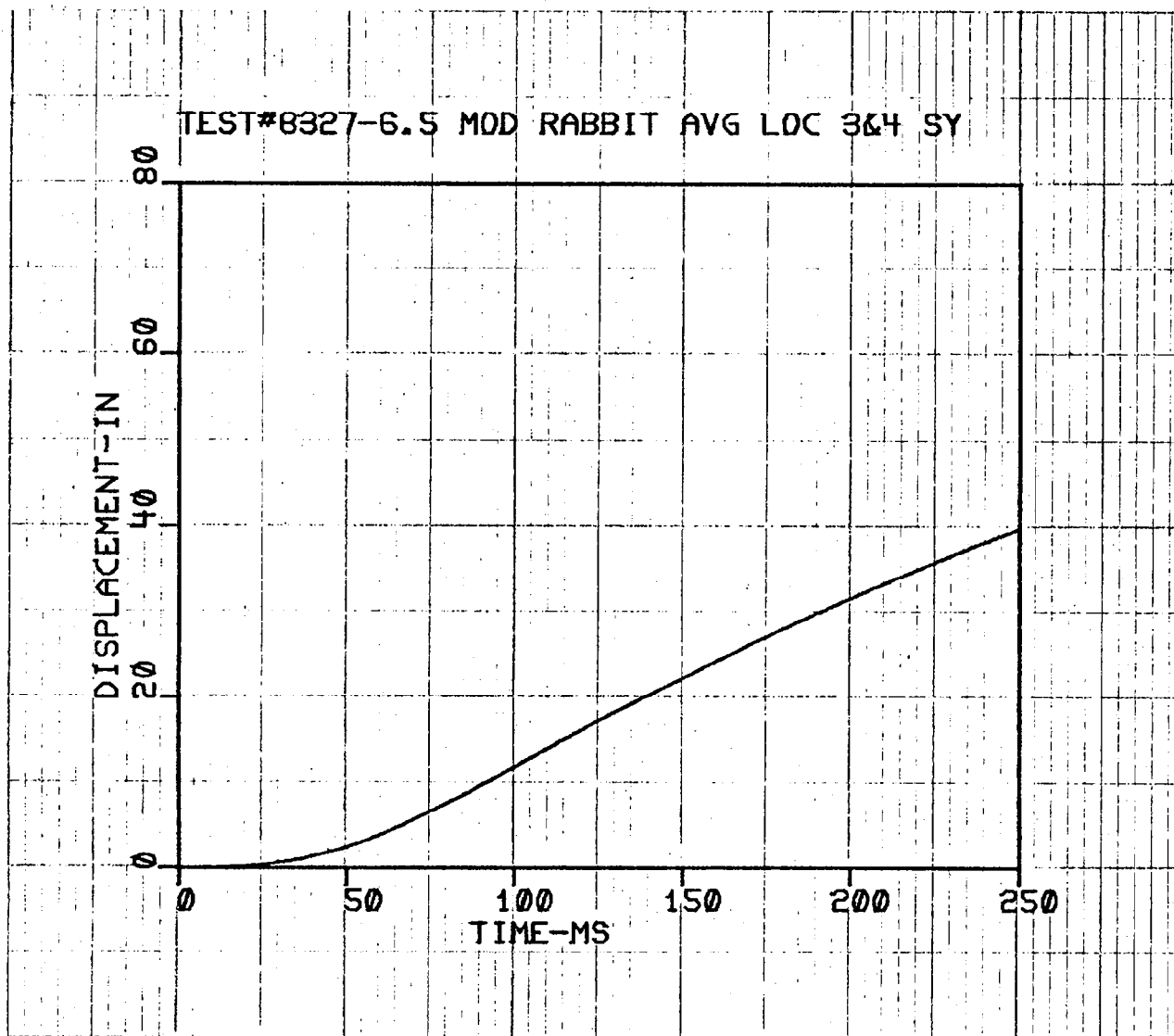


TEST#8327-6.5 MOD RABBIT AVG LOC 1&2 VY

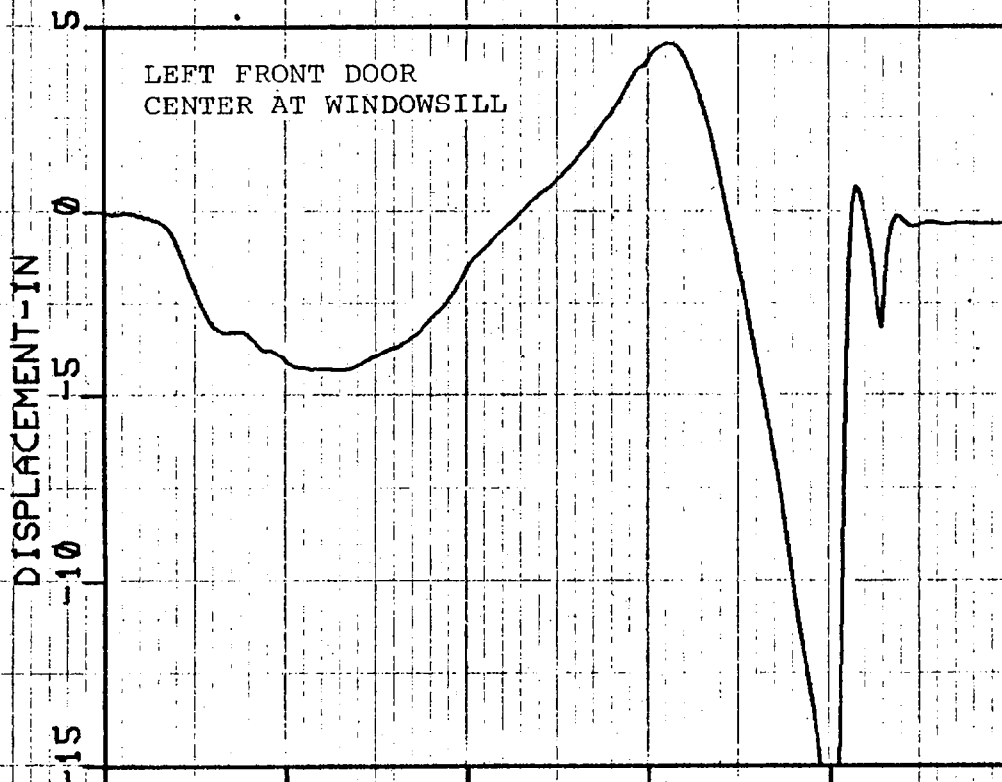




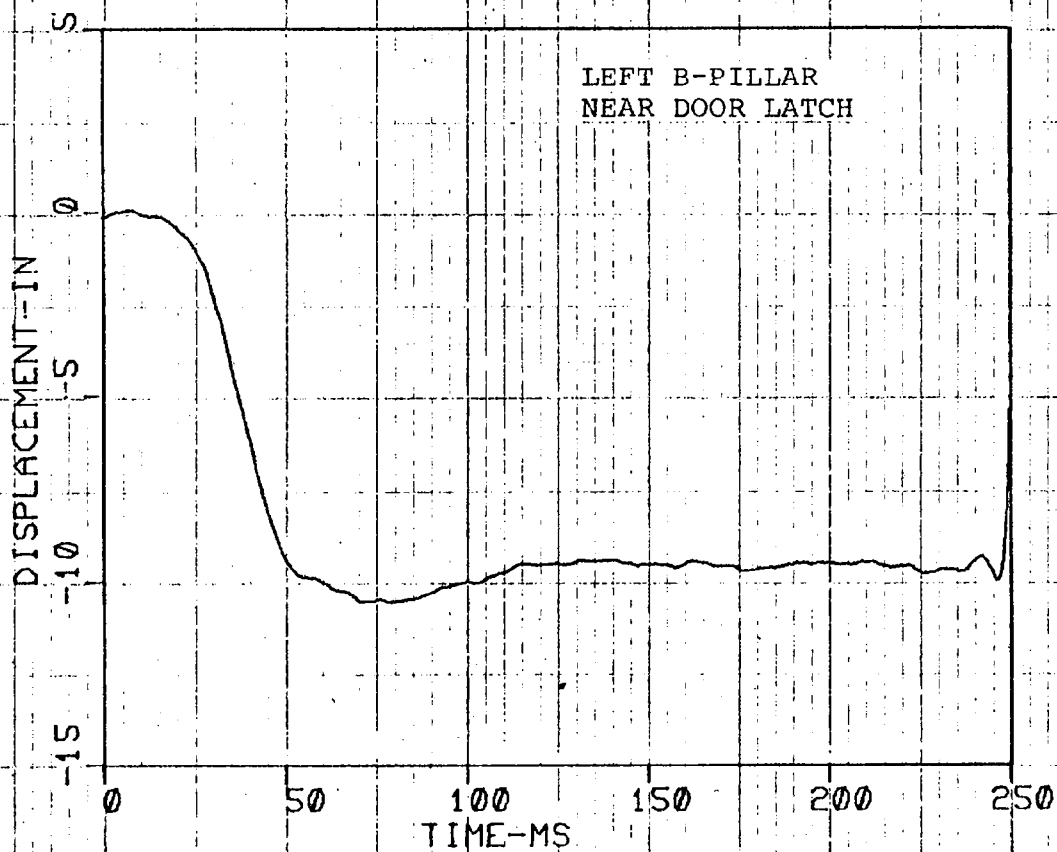




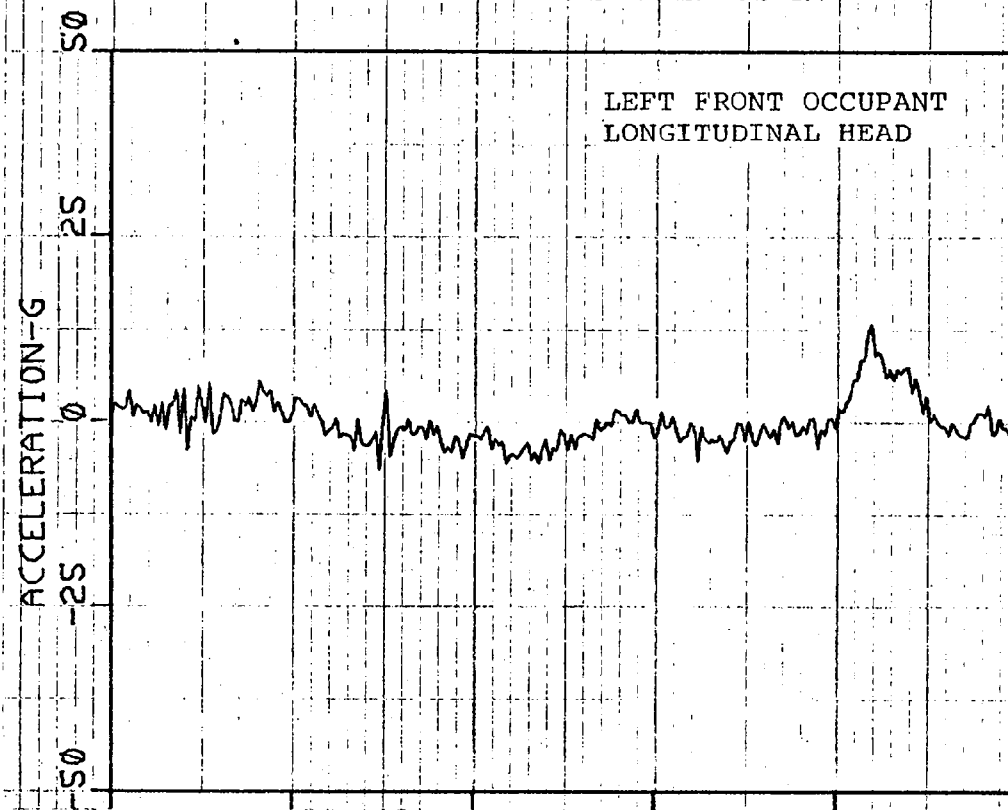
TEST#8327-6.5 MOD RABBIT S.P. #1



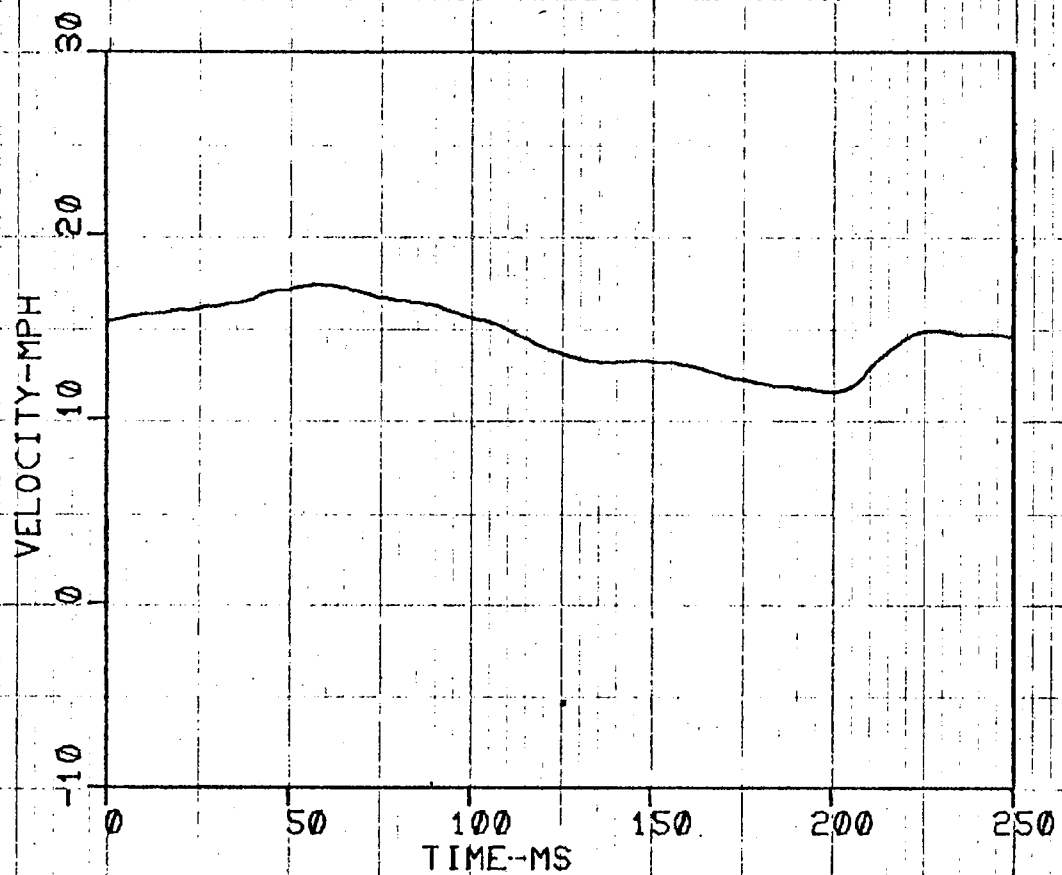
TEST#8327-6.5 MOD RABBIT D.T. #2

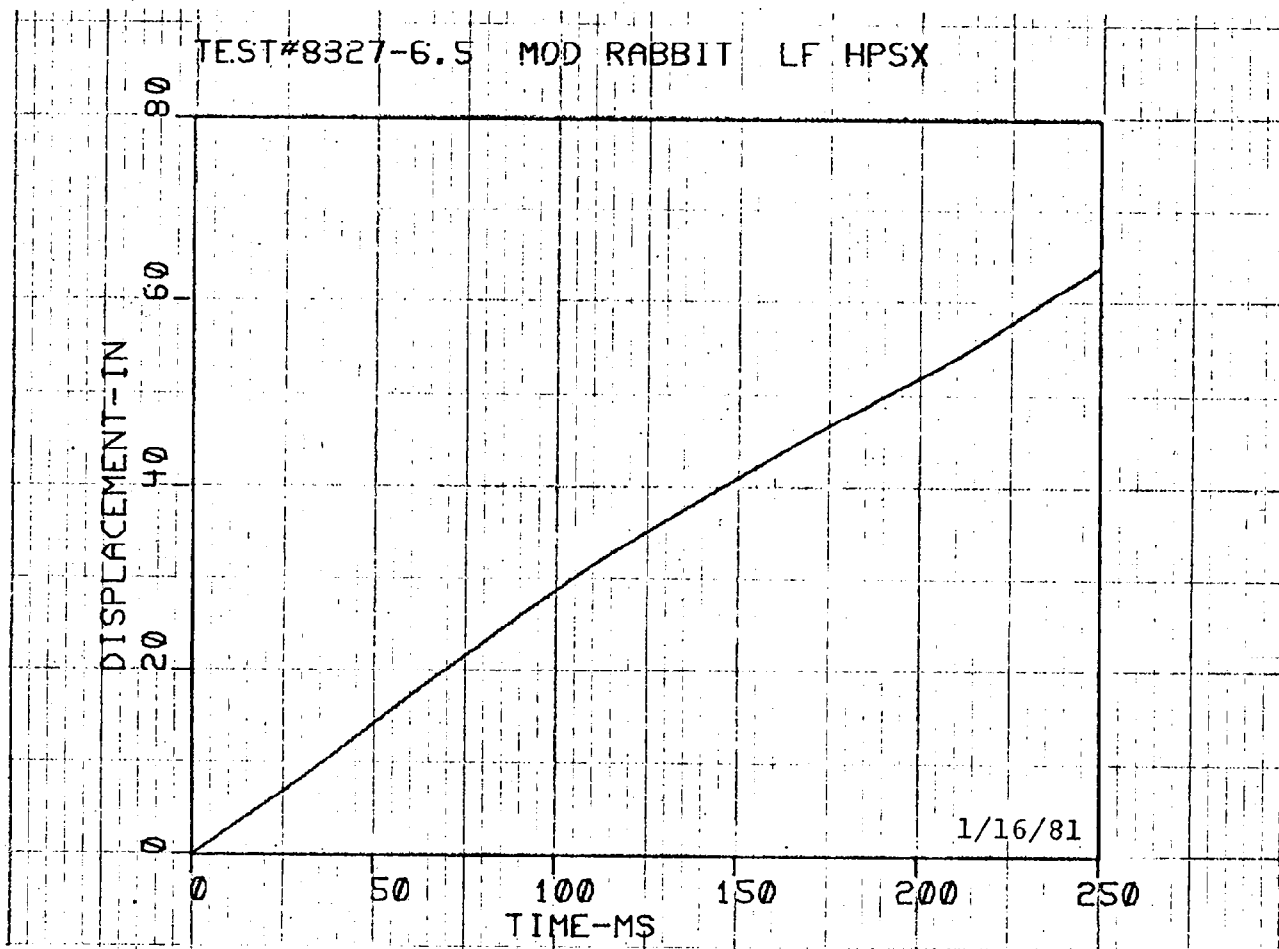


TEST#8327-6.5 MOD RABBIT LF HPGX

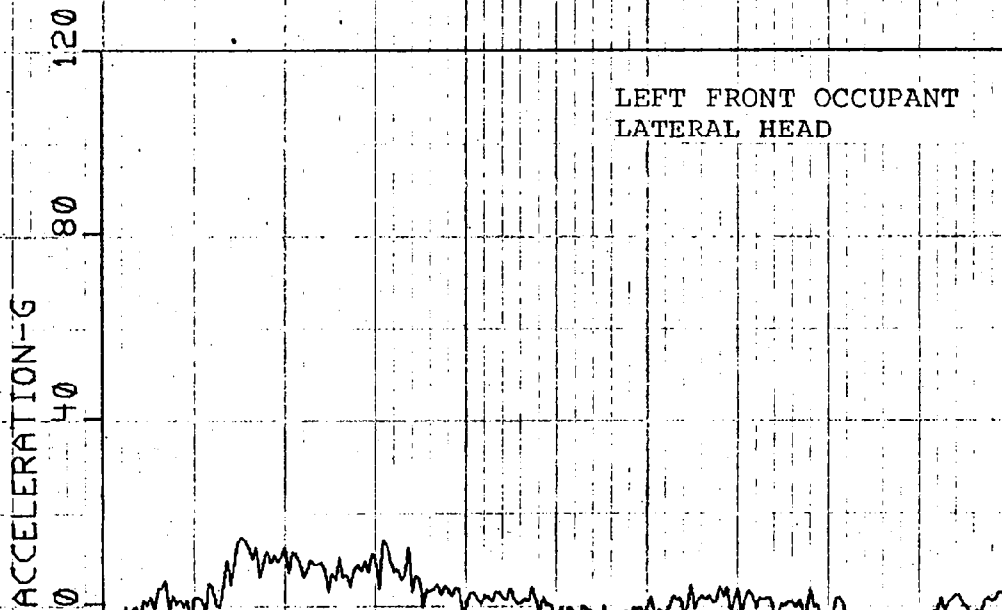


TEST#8327-6.5 MOD RABBIT LF HPVX

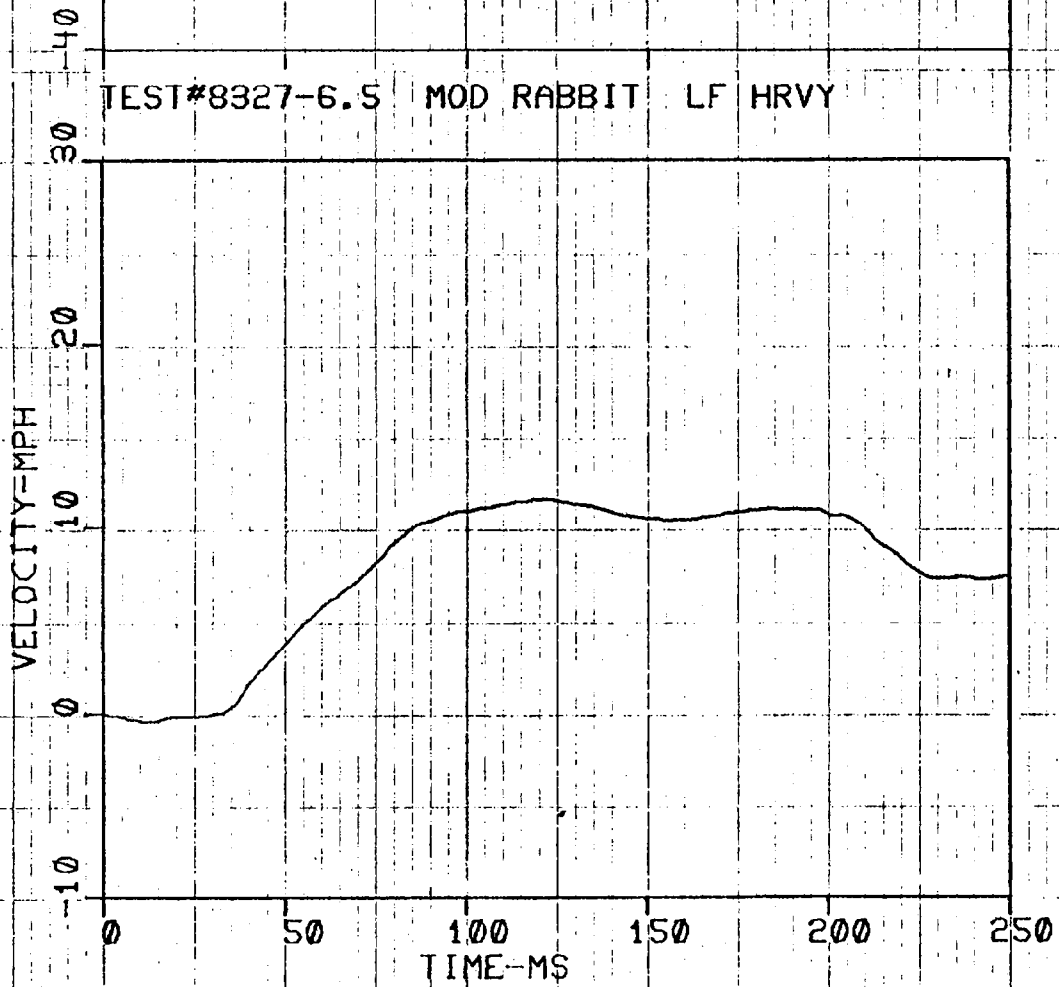


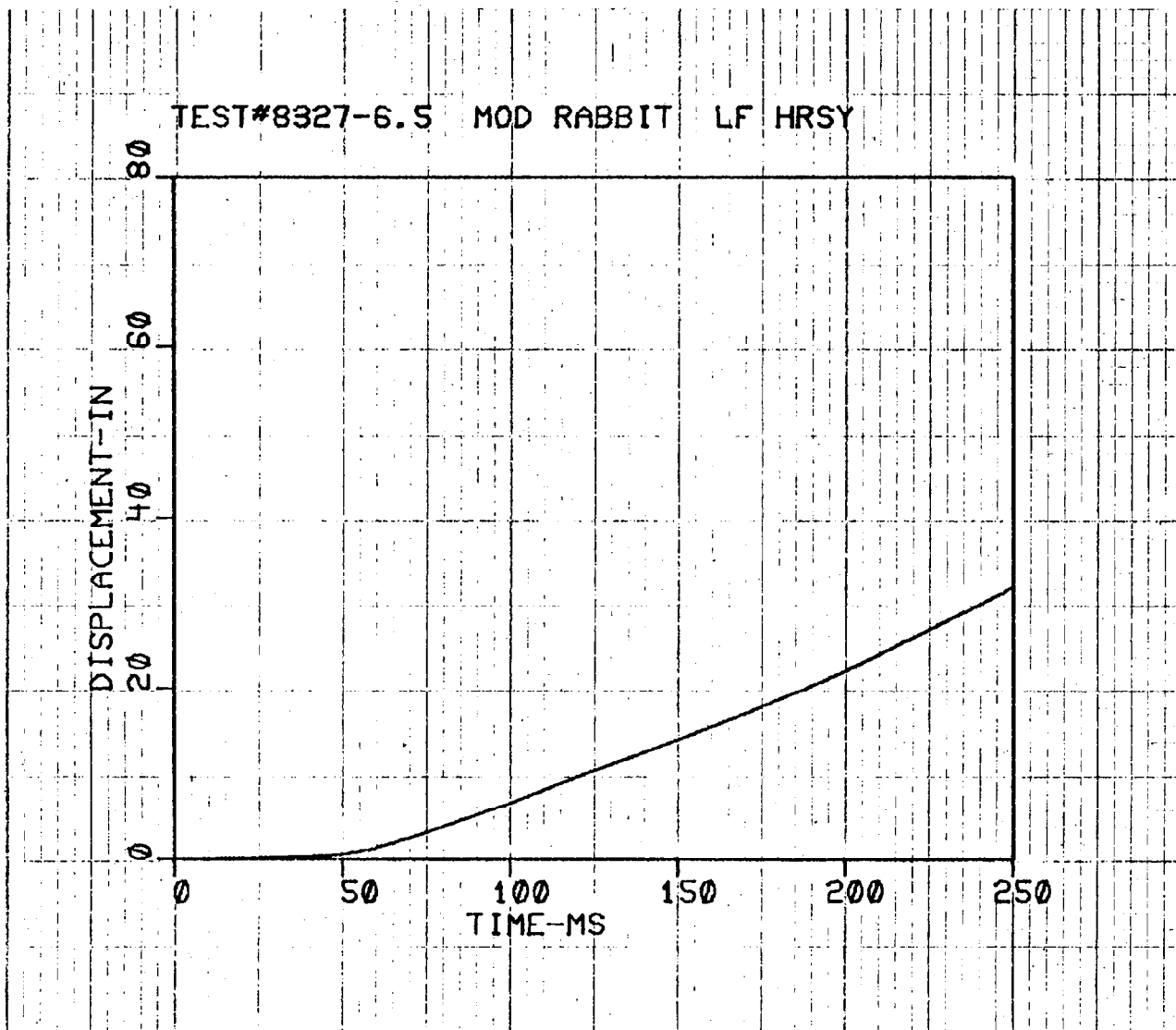


TEST#8327-6.5 MOD RABBIT LF HRGY

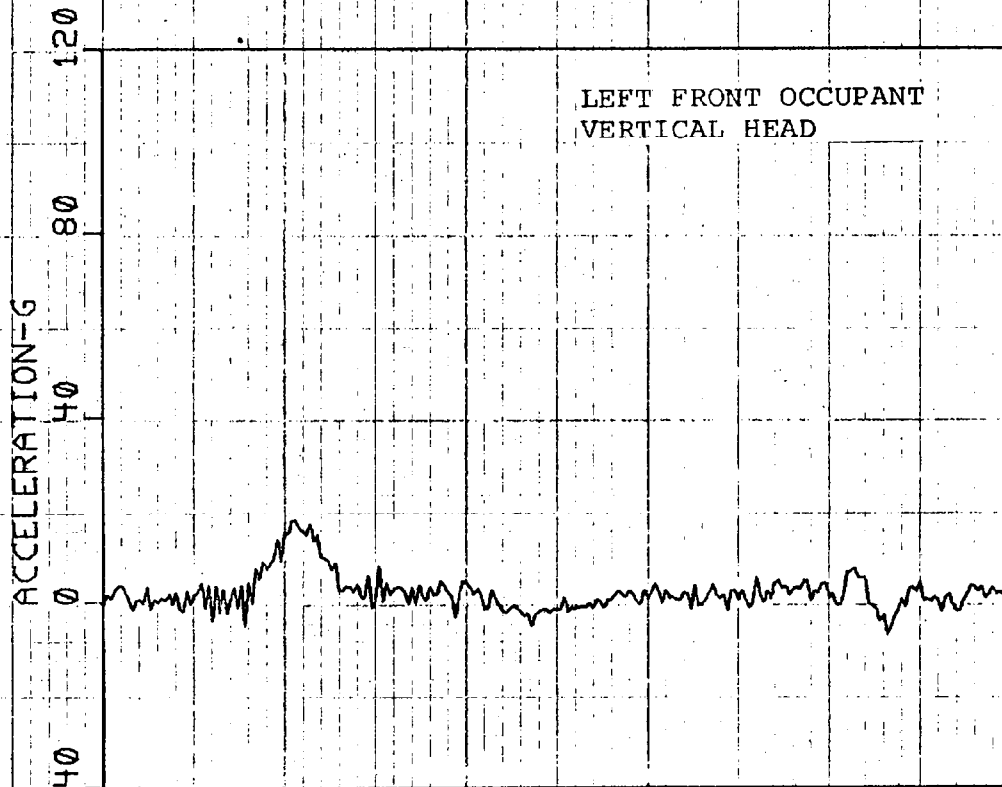


TEST#8327-6.5 MOD RABBIT LF HRVY

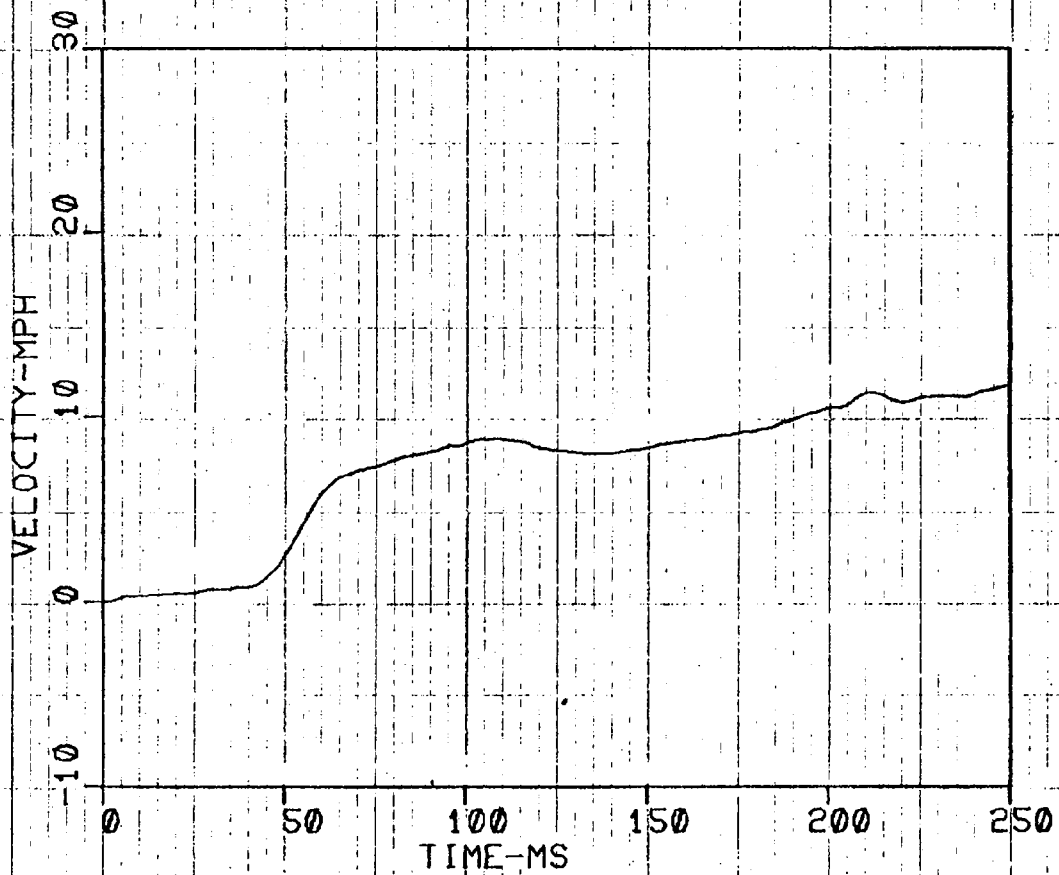


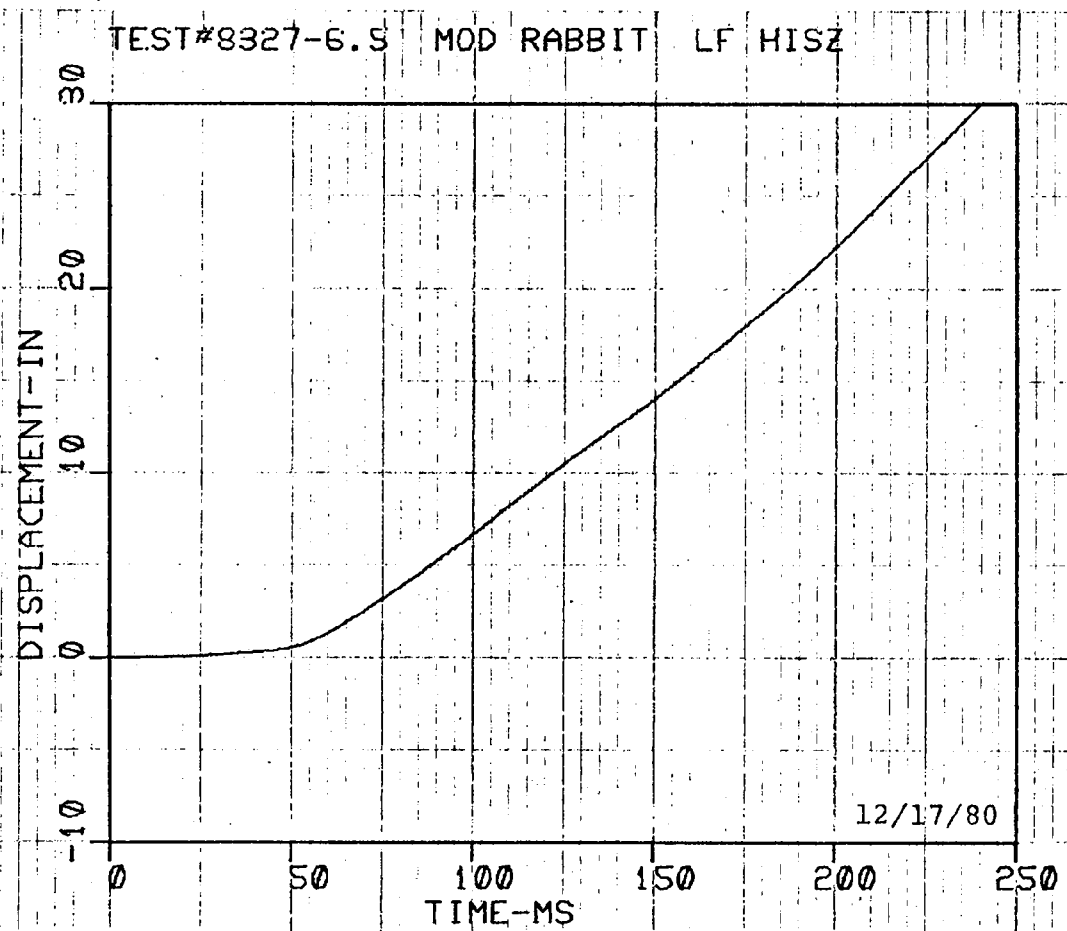


TEST#8327-6.5 MOD RABBIT LF HIGZ

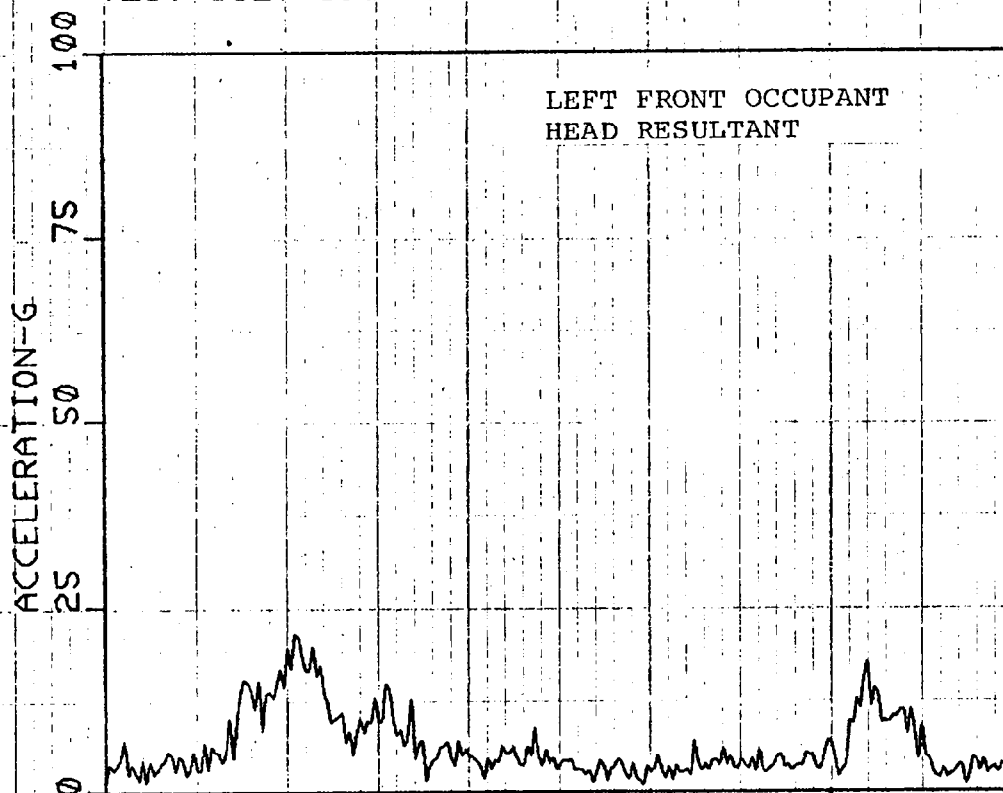


TEST#8327-6.5 MOD RABBIT LF HIVZ

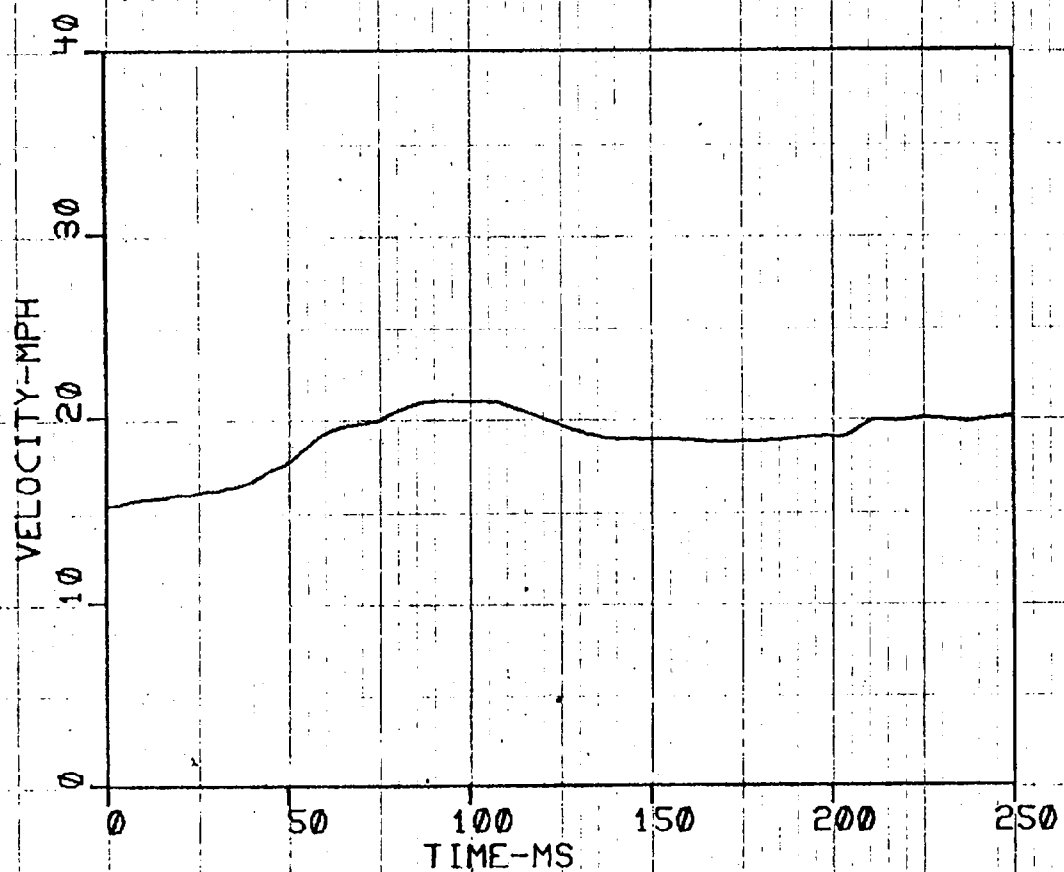


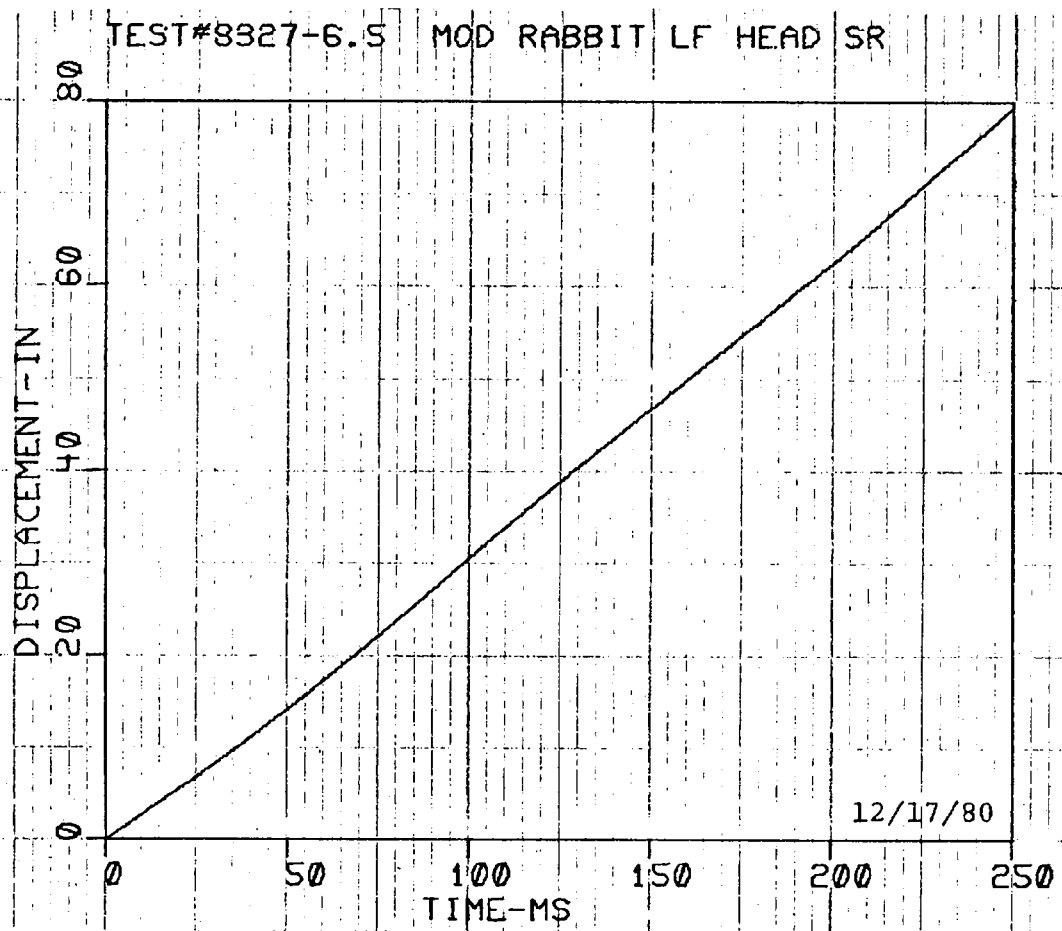


TEST#8327-6.5 MOD RABBIT LF HEAD AR

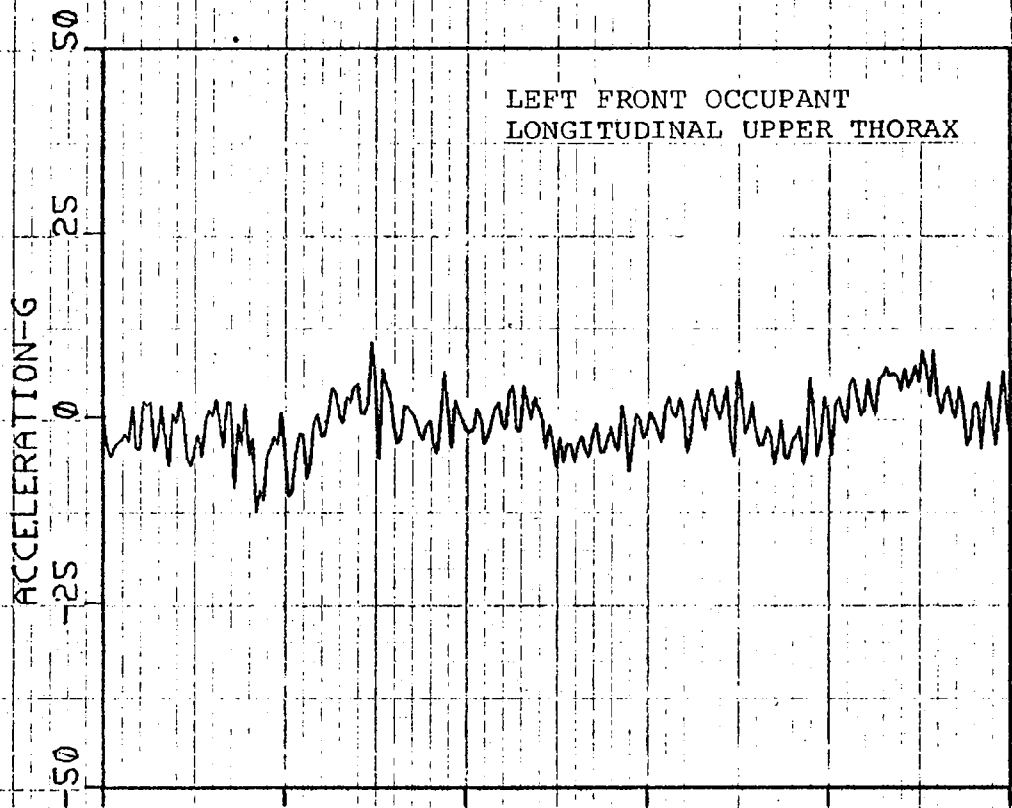


TEST#8327-6.5 MOD RABBIT LF HEAD VR

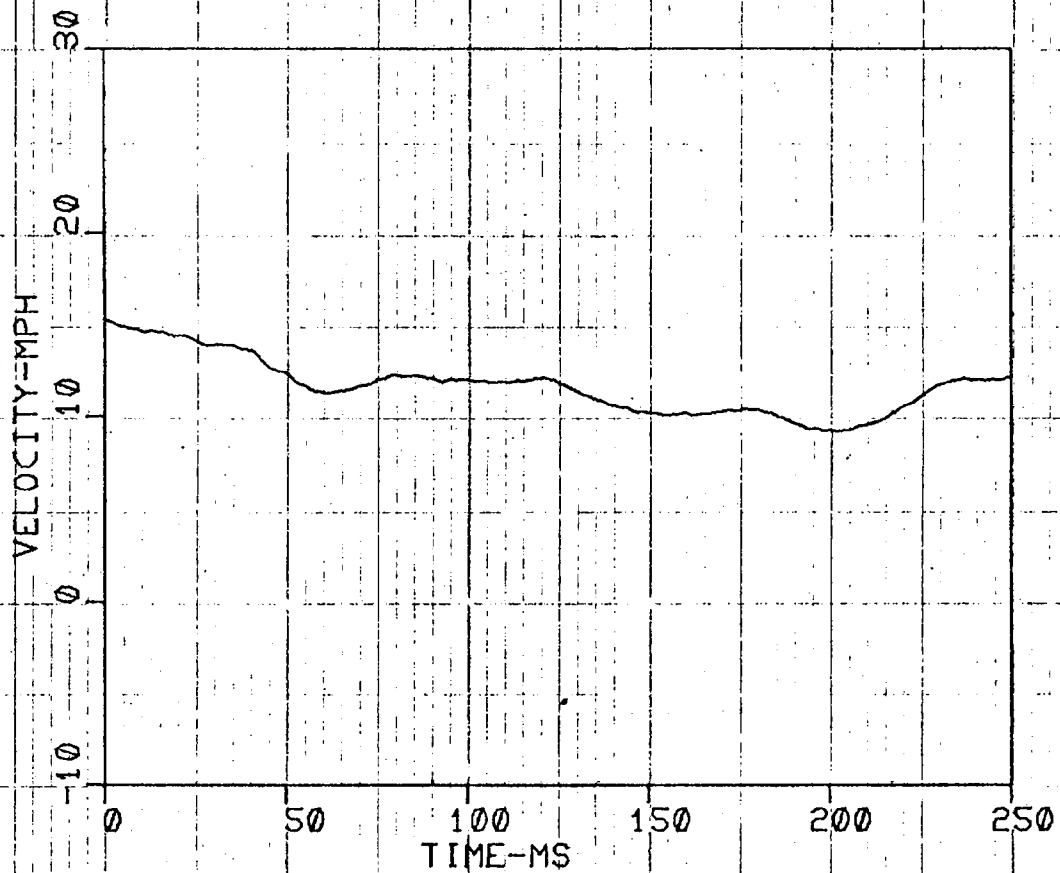


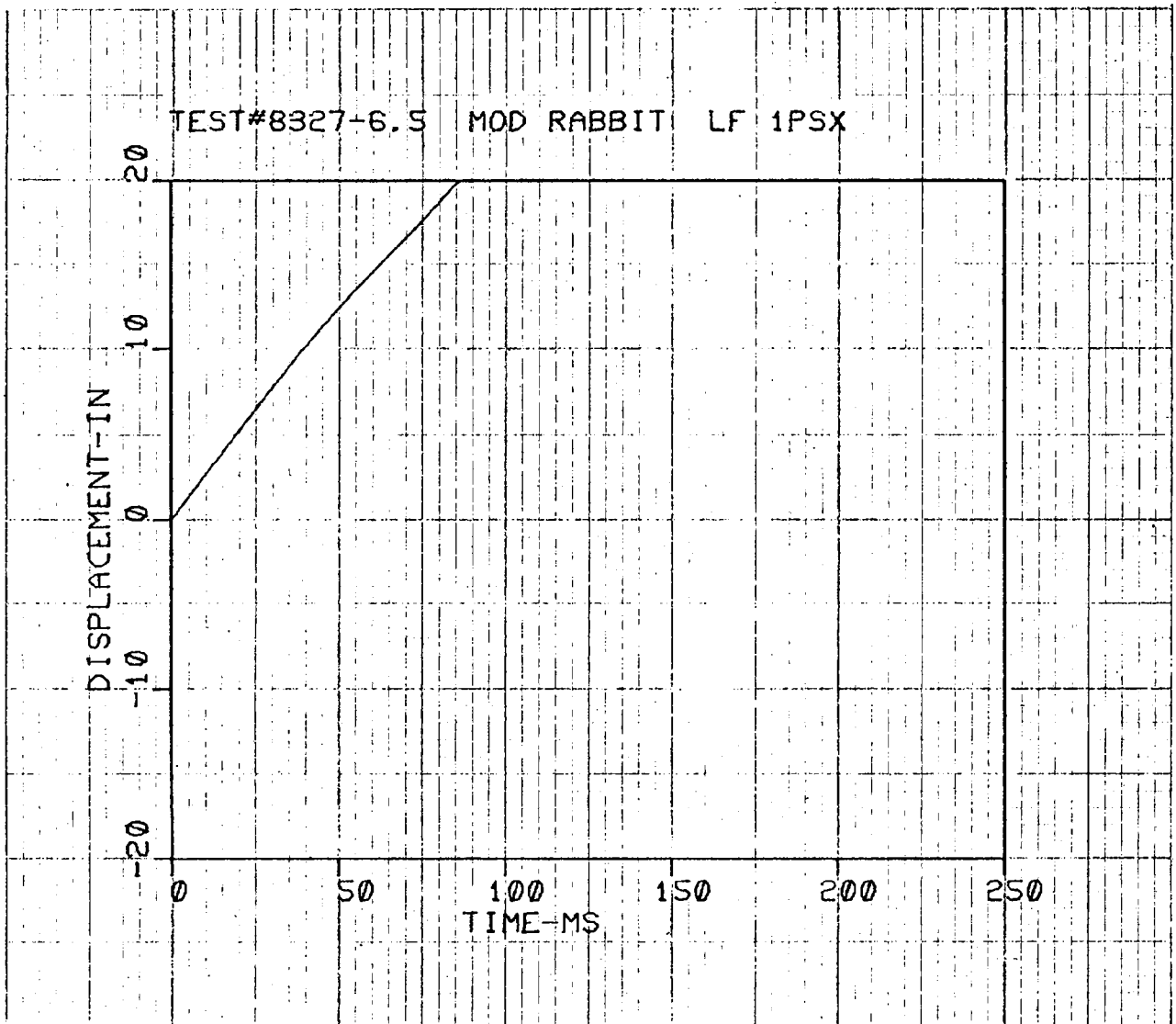


TEST#8327-6.5 MOD RABBIT LF 1PGX

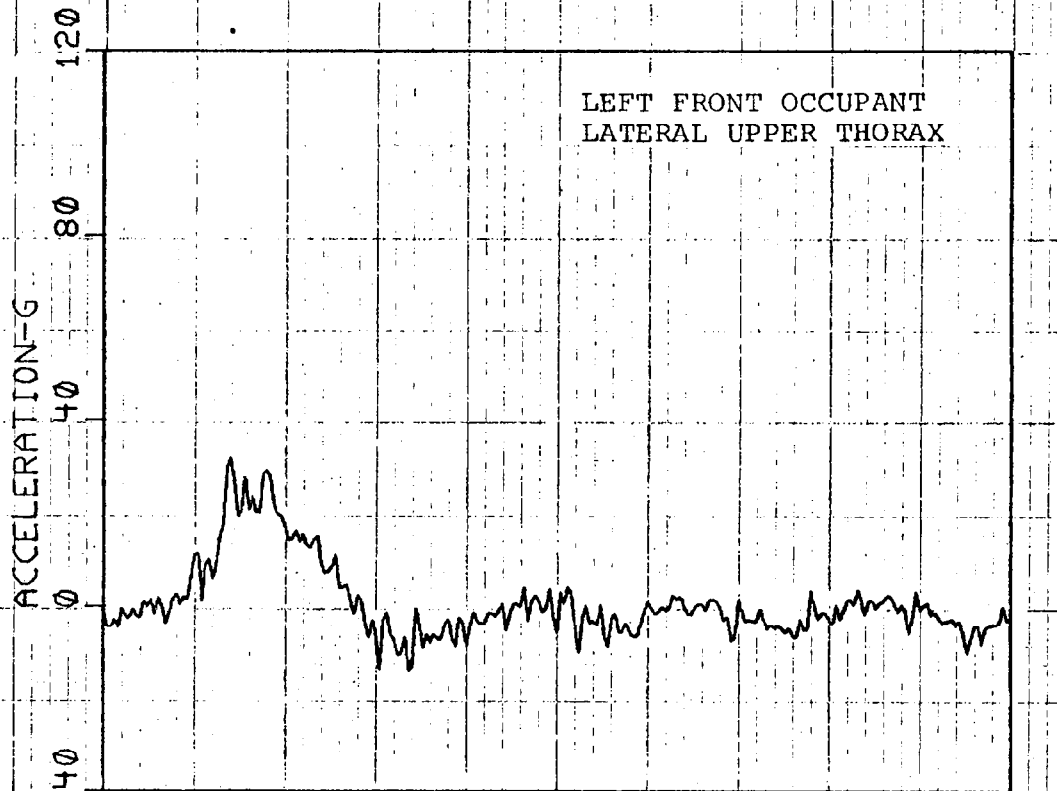


TEST#8327-6.5 MOD RABBIT LF 1PVX

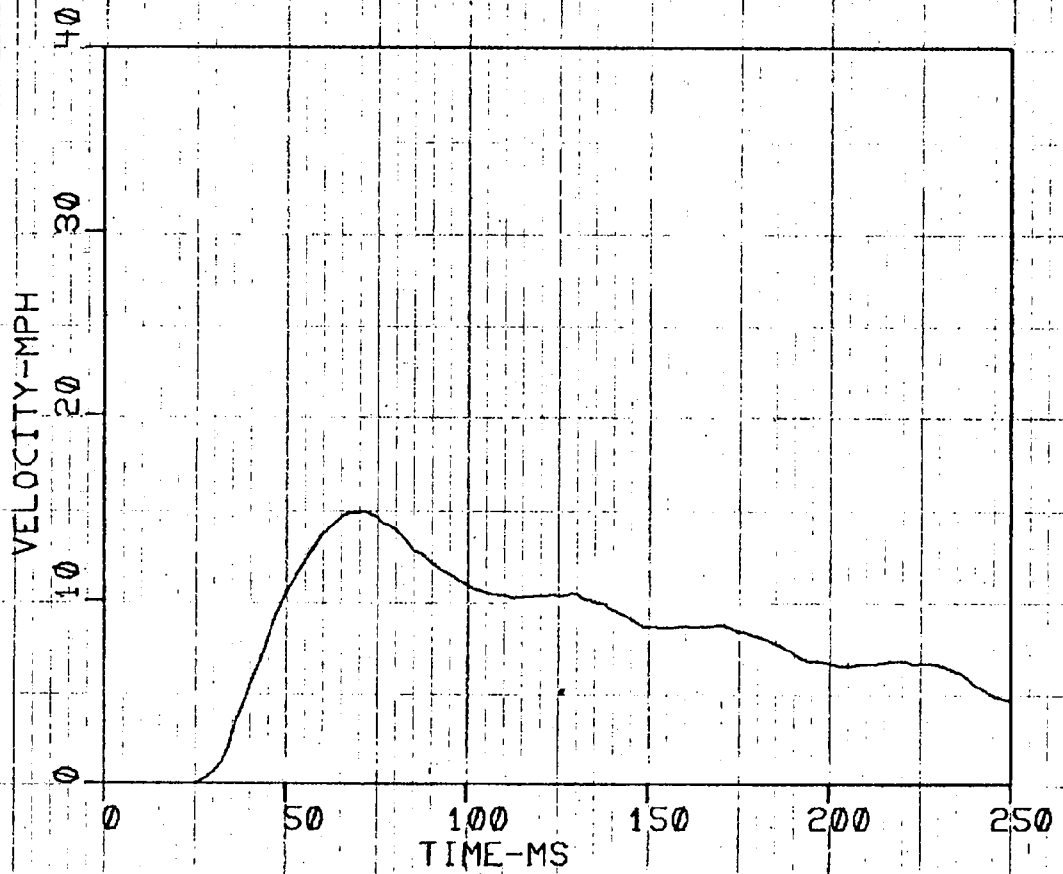


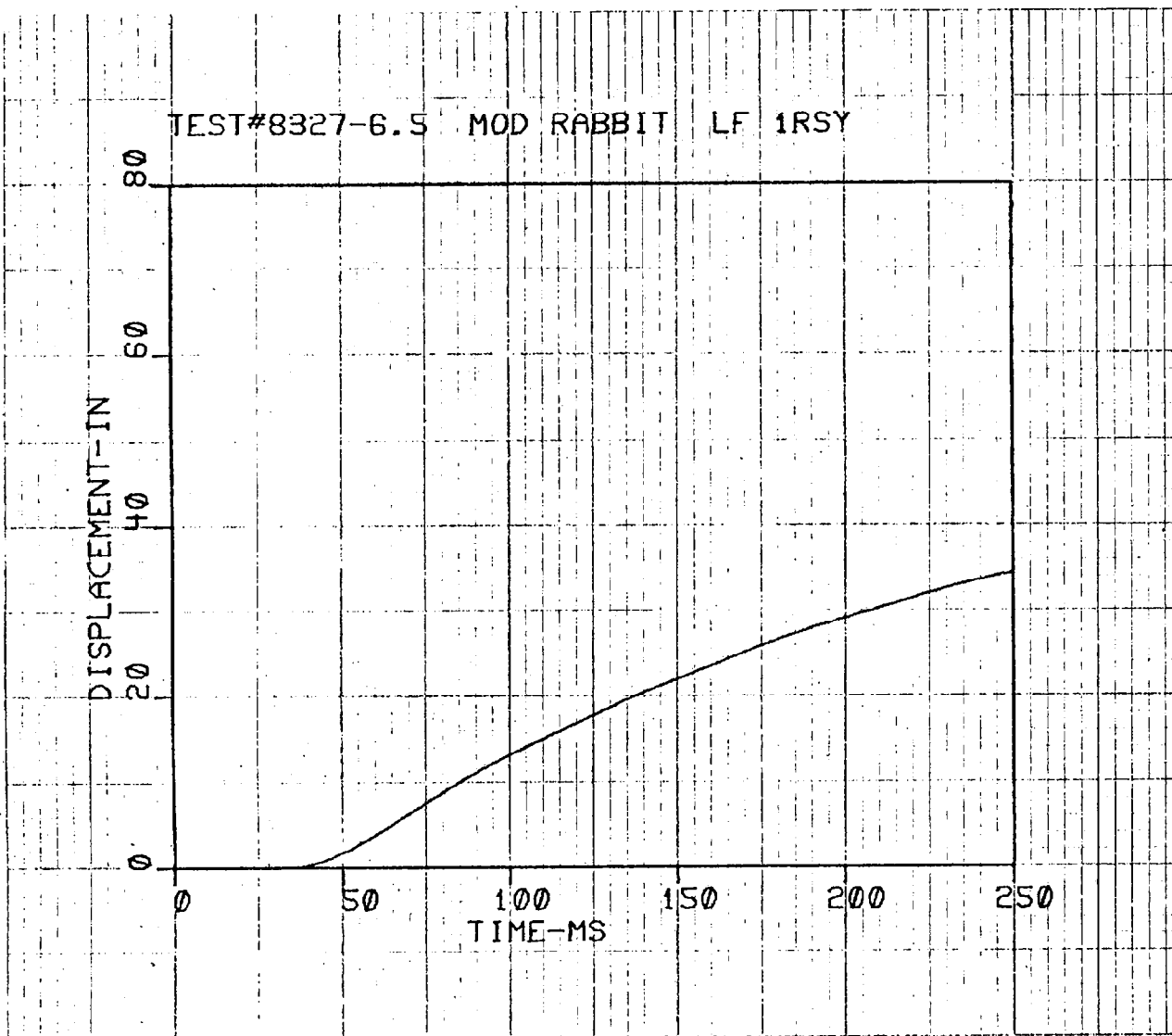


TEST#8327-6.5 MOD RABBIT LF 1RGY

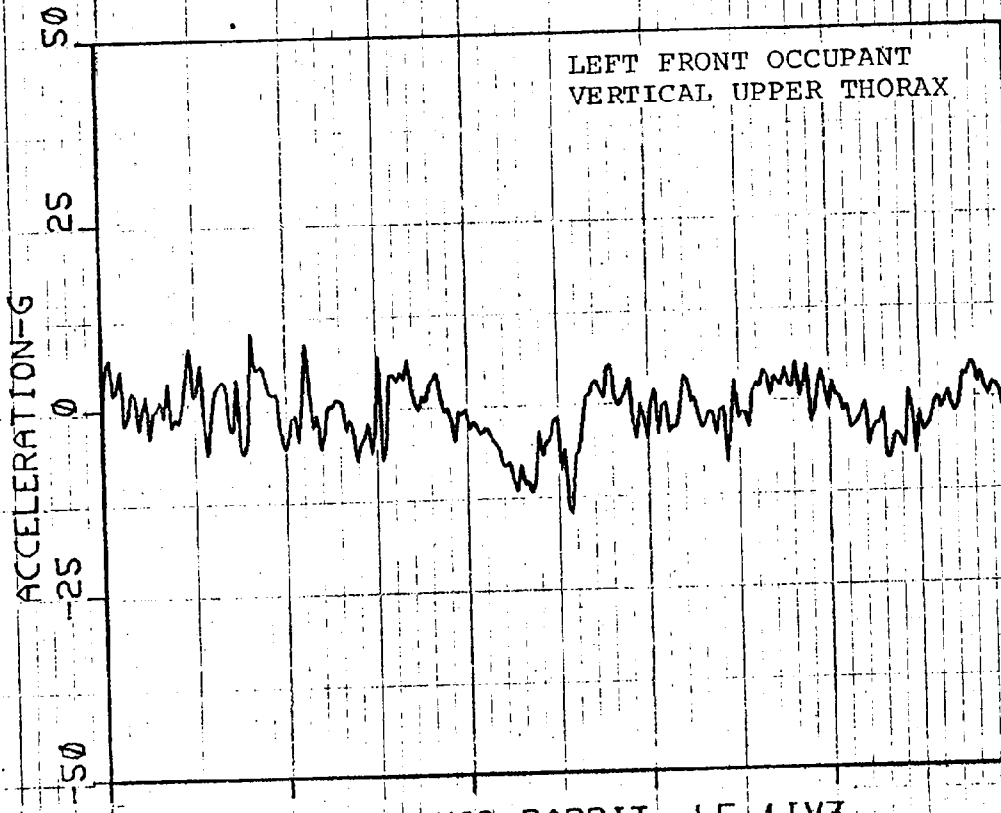


TEST#8327-6.5 MOD RABBIT LF 1RVY

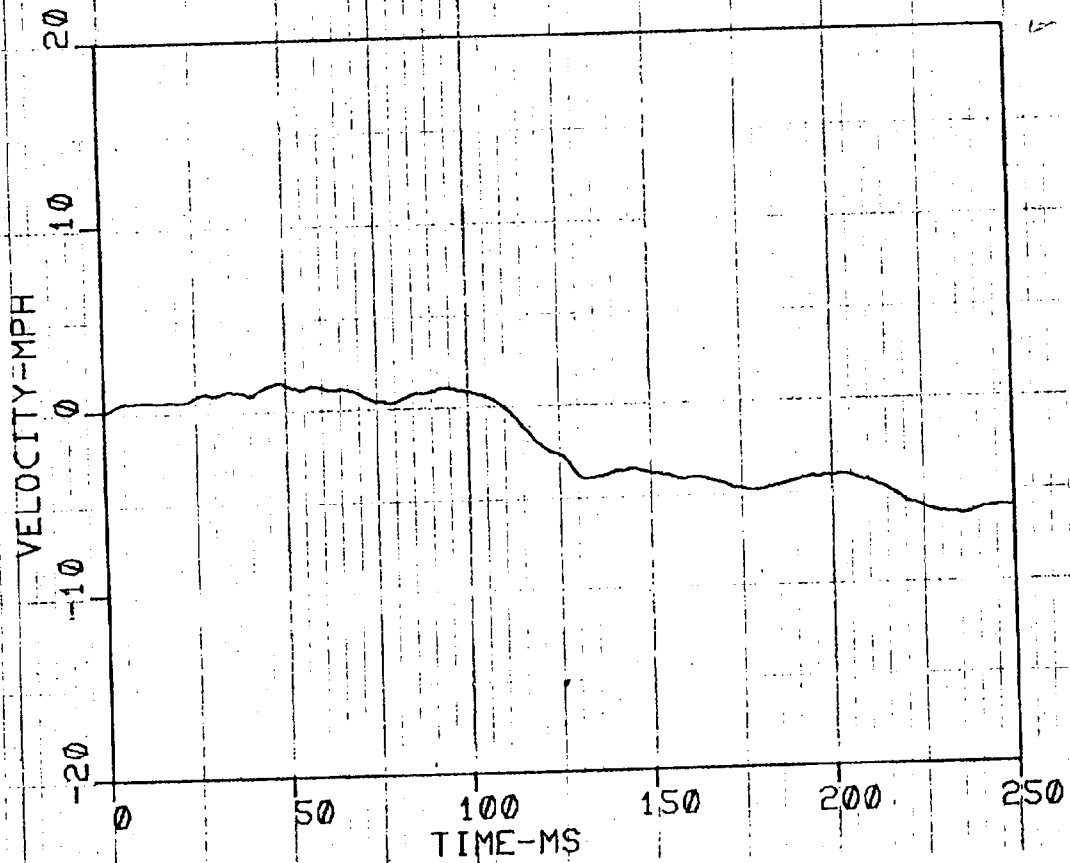


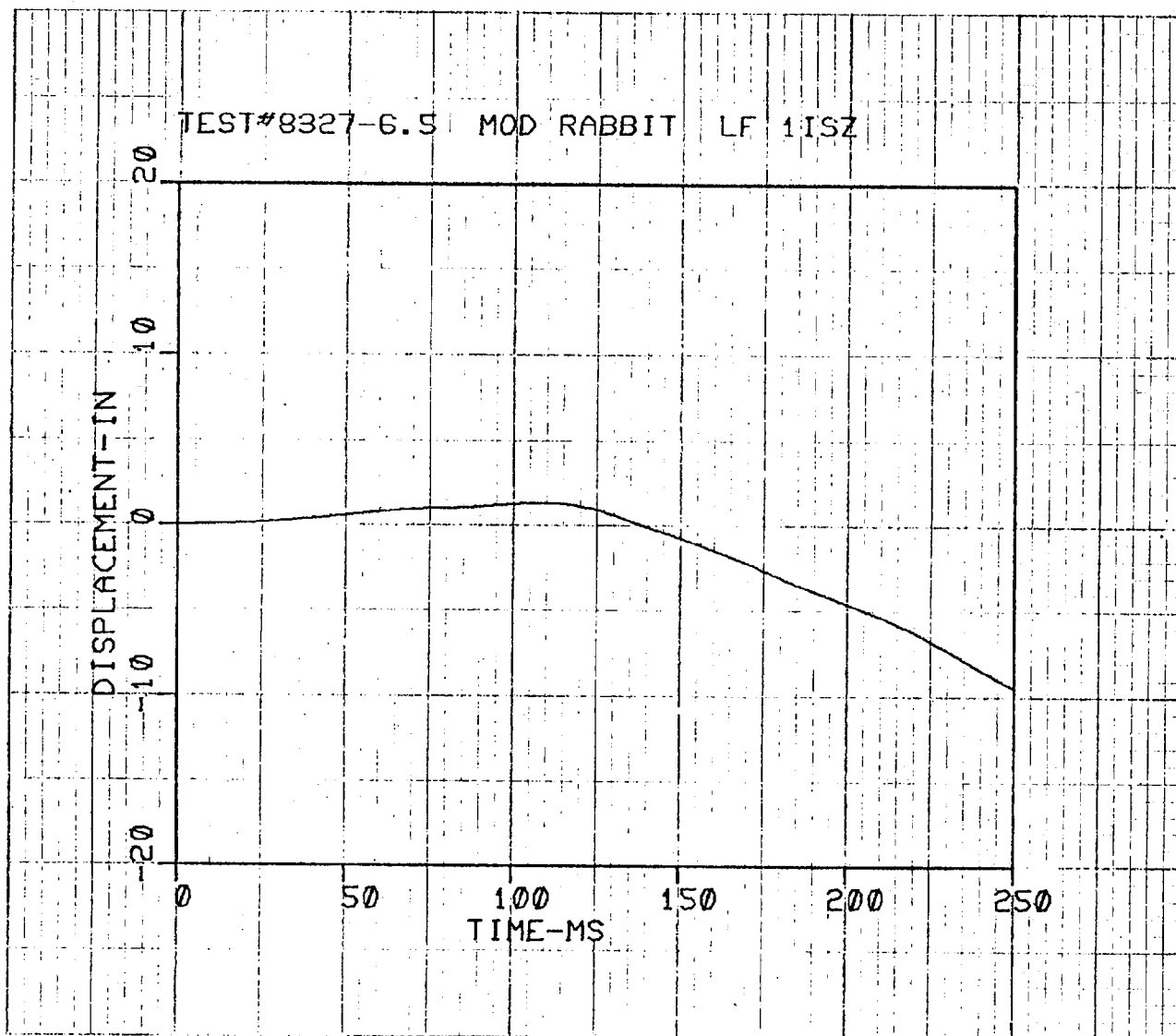


TEST#8327-6.5 MOD RABBIT LF 1IGZ

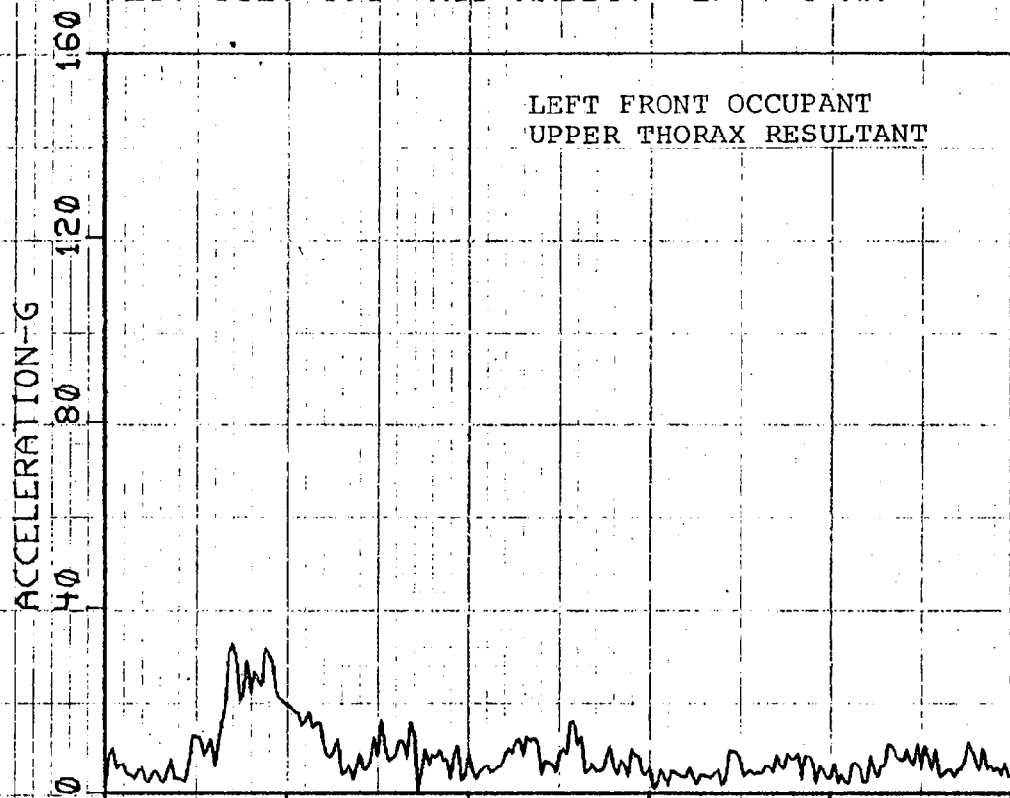


TEST#8327-6.5 MOD RABBIT LF 1IVZ

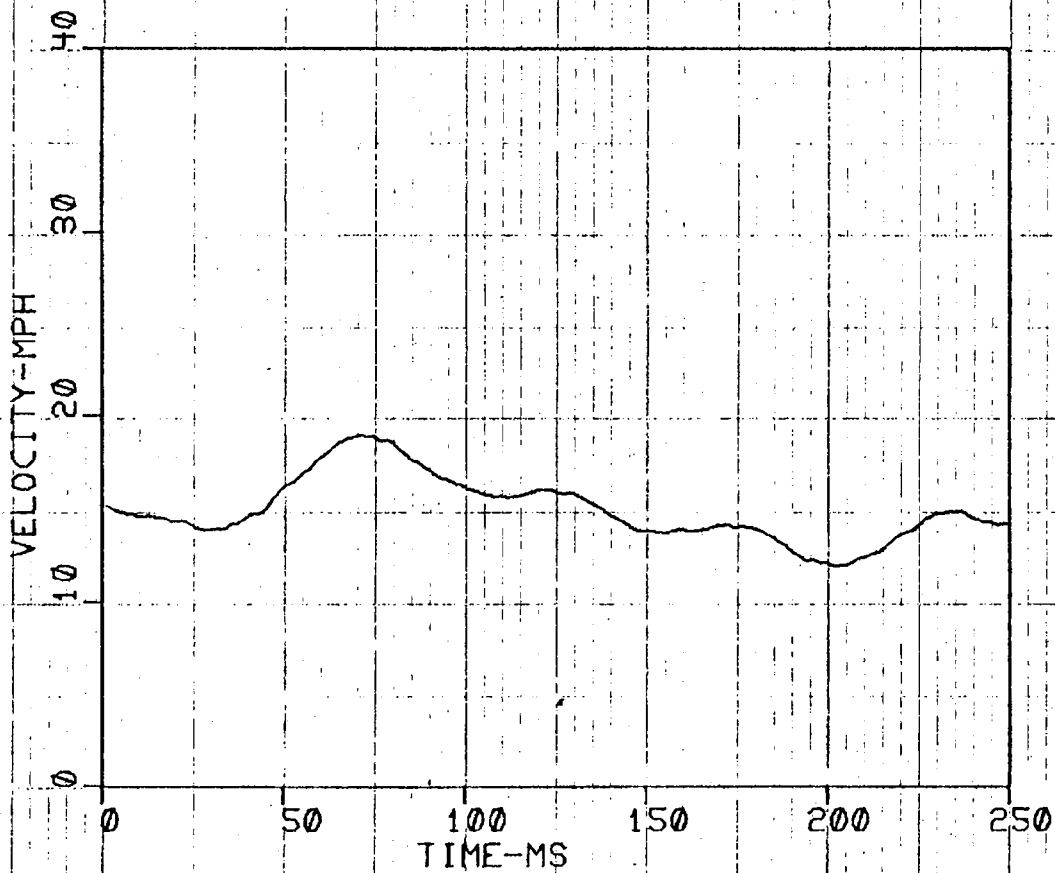


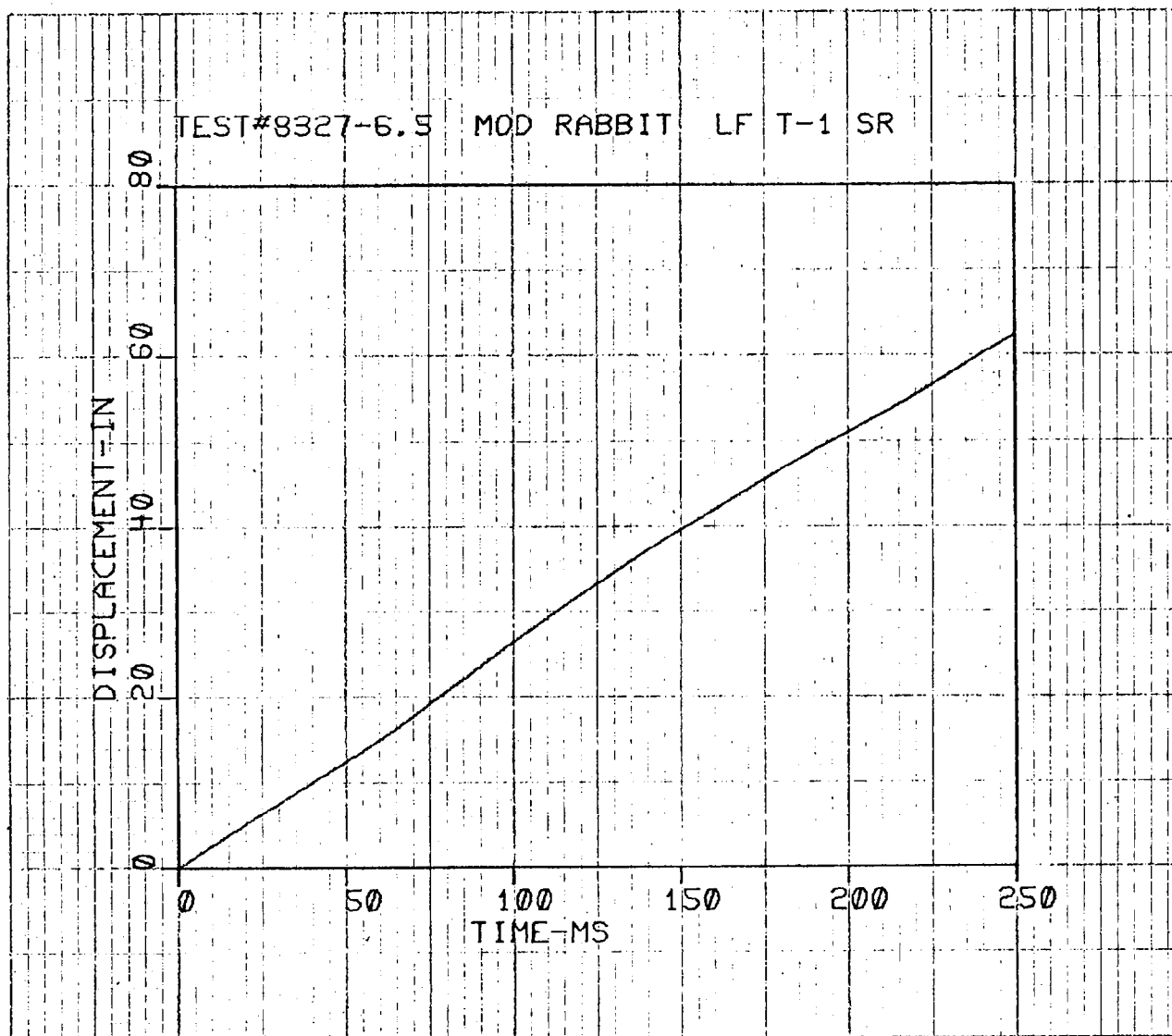


TEST#8327-6.5 MOD RABBIT LF T-1 AR

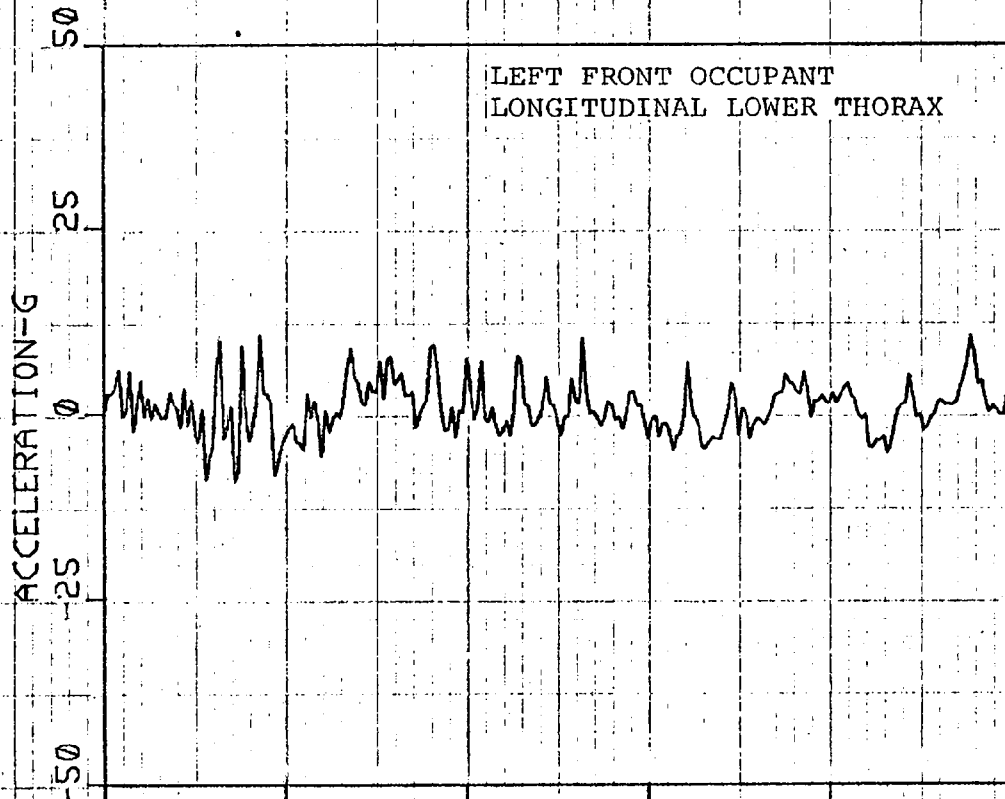


TEST#8327-6.5 MOD RABBIT LF T-1 VR

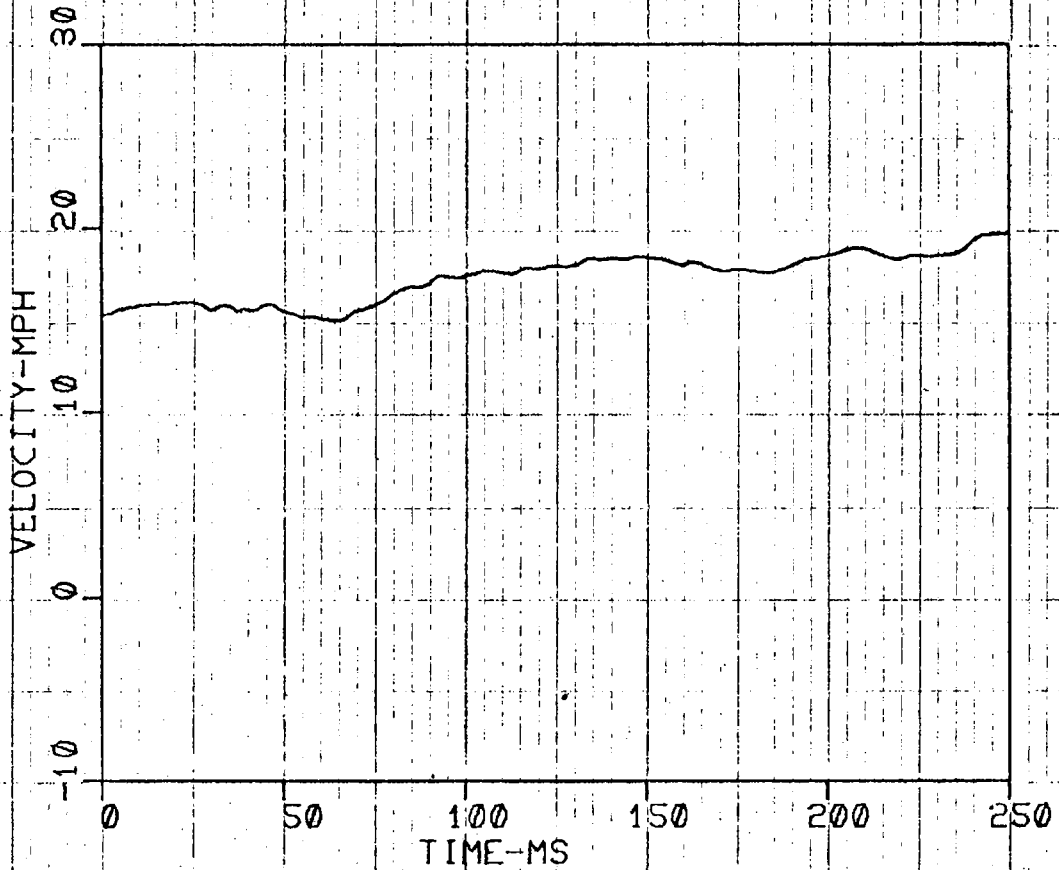


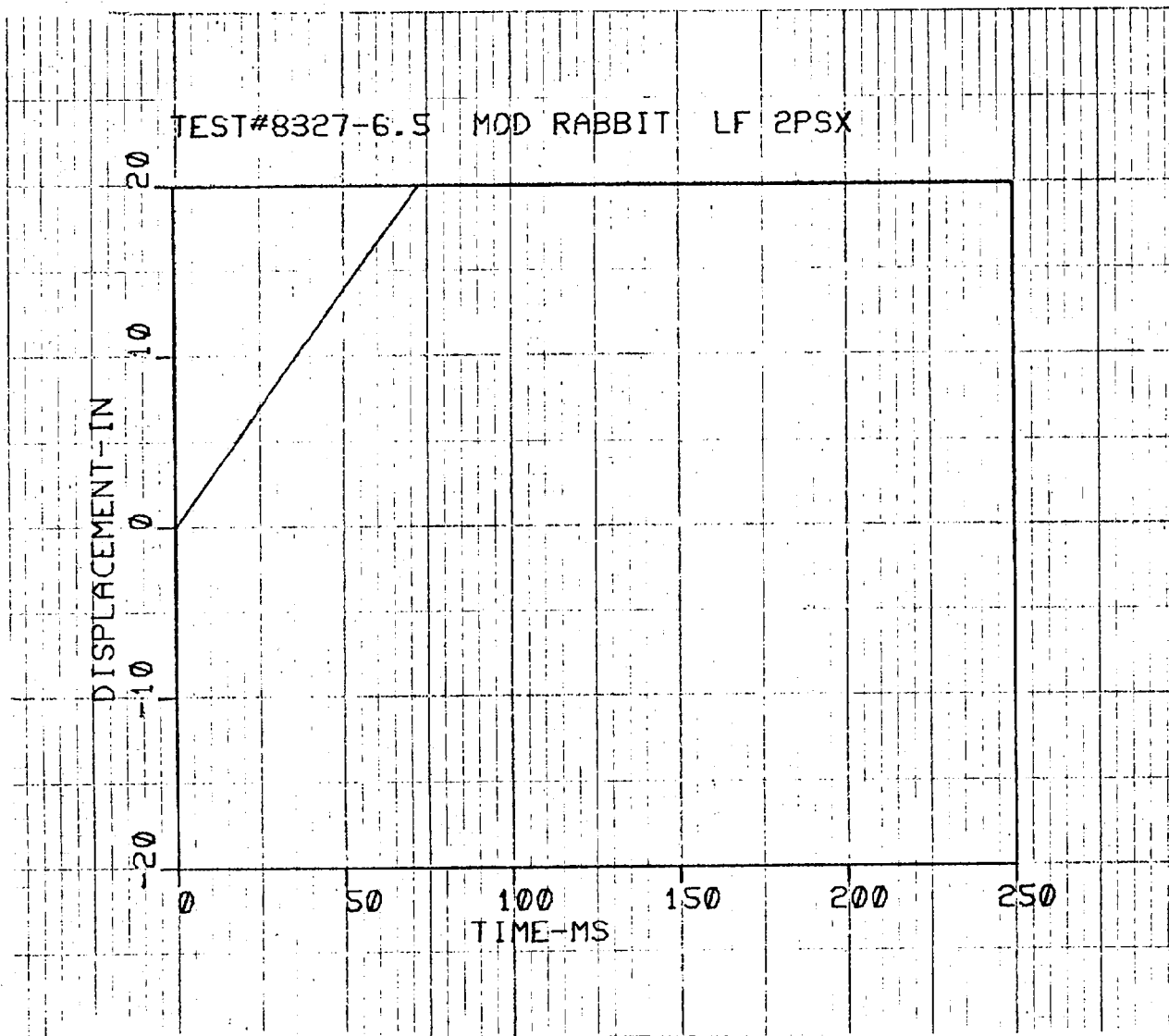


TEST#8327-6.5 MOD RABBIT LF 2PGX

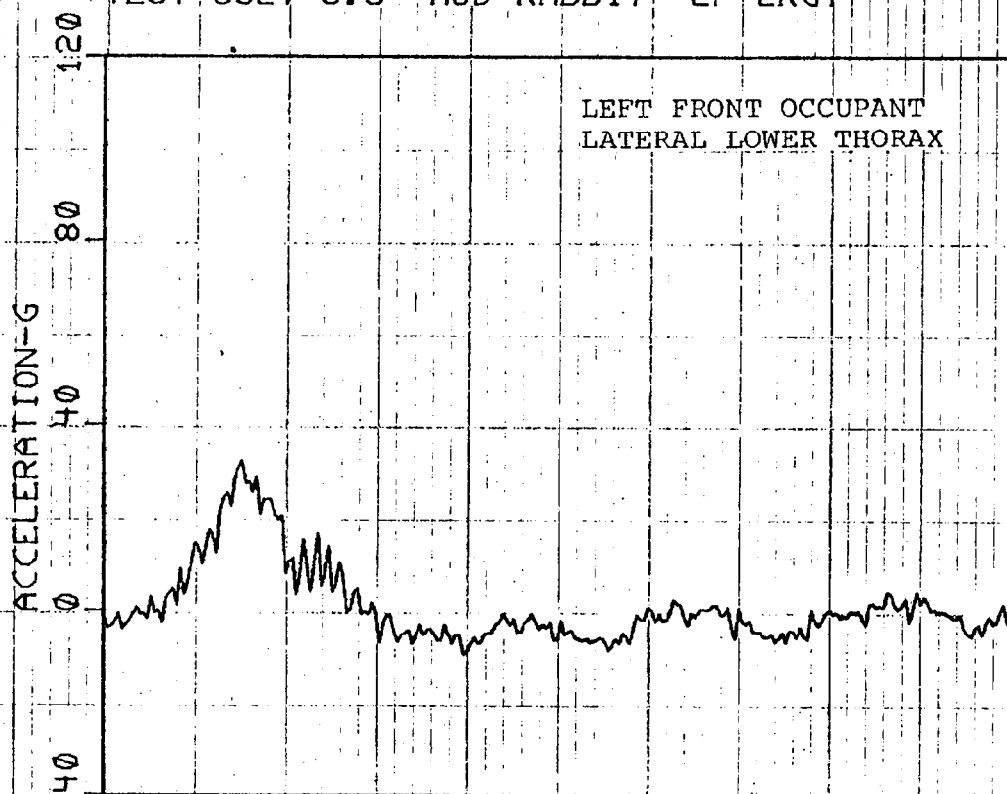


TEST#8327-6.5 MOD RABBIT LF 2PVX

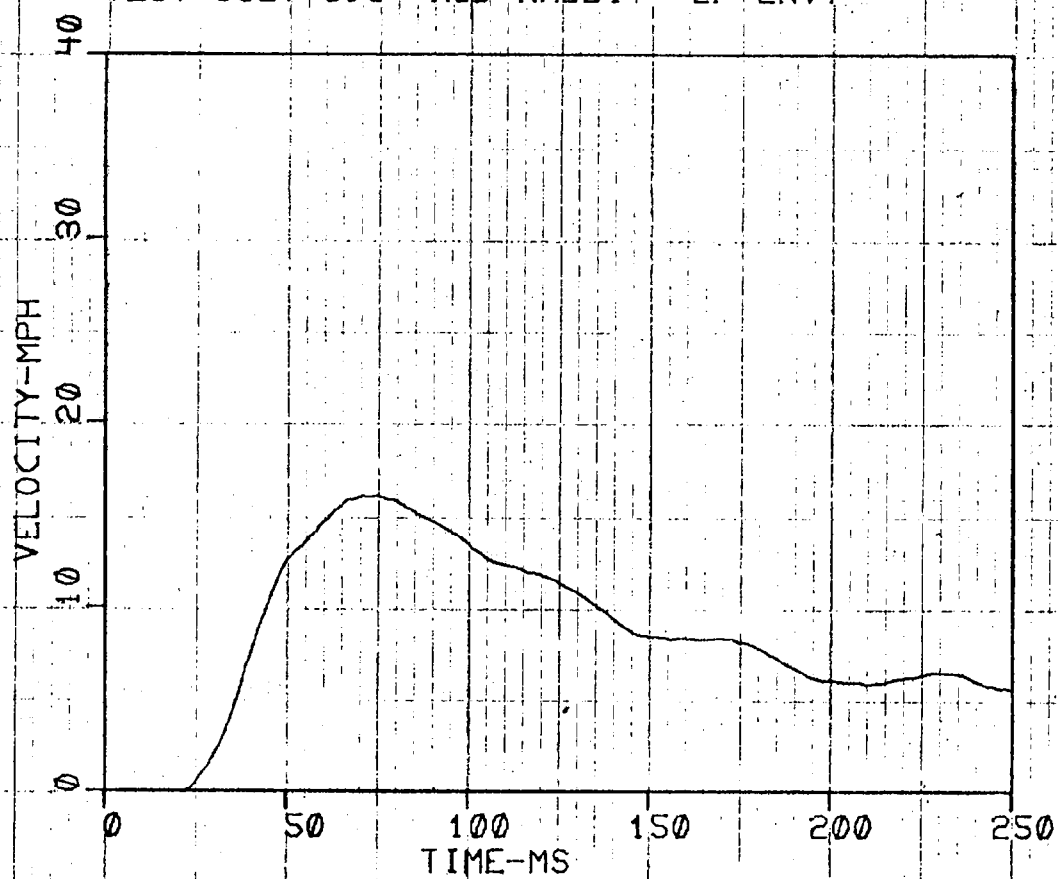


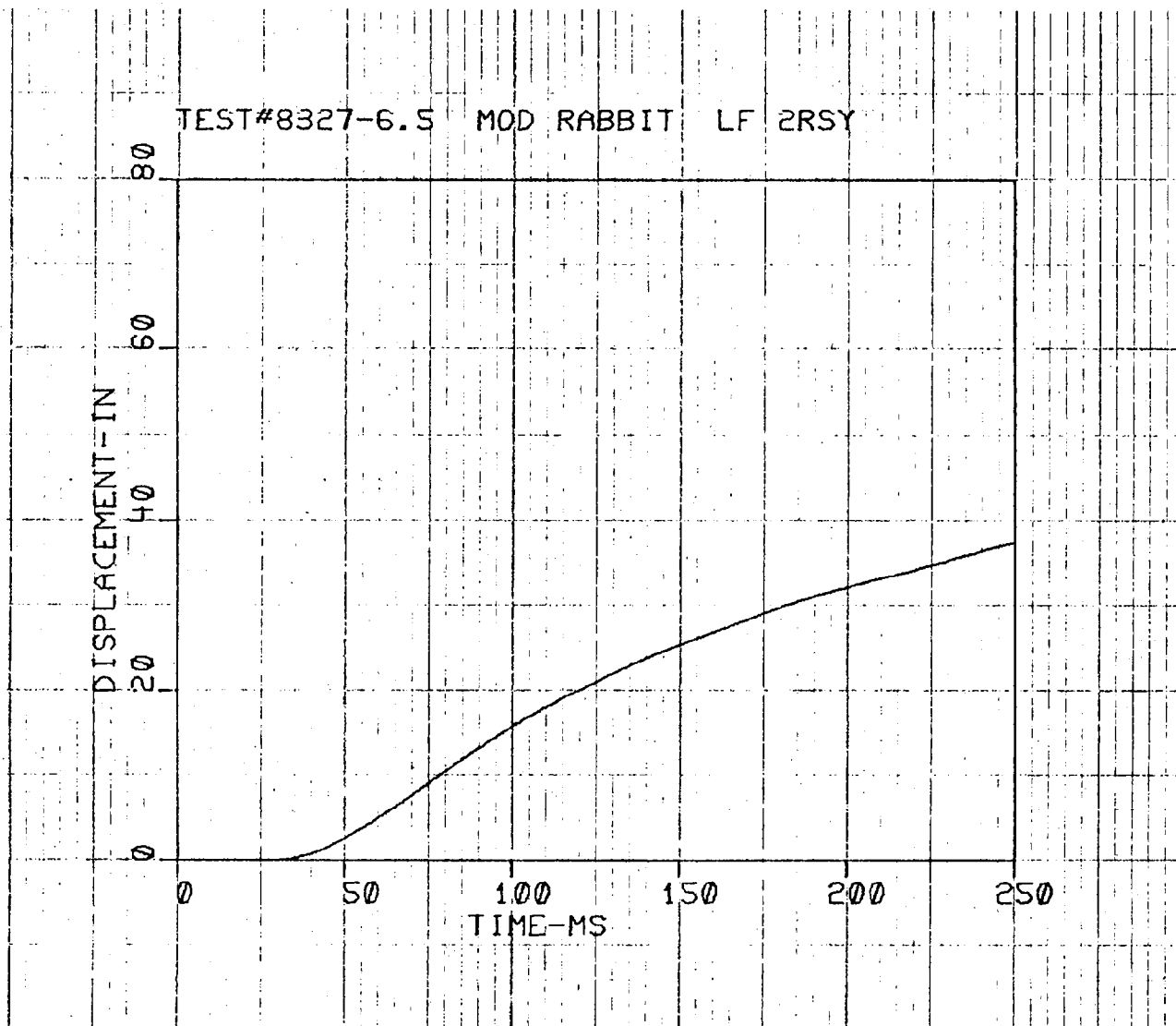


TEST#8327-6.5 MOD RABBIT LF 2RGY

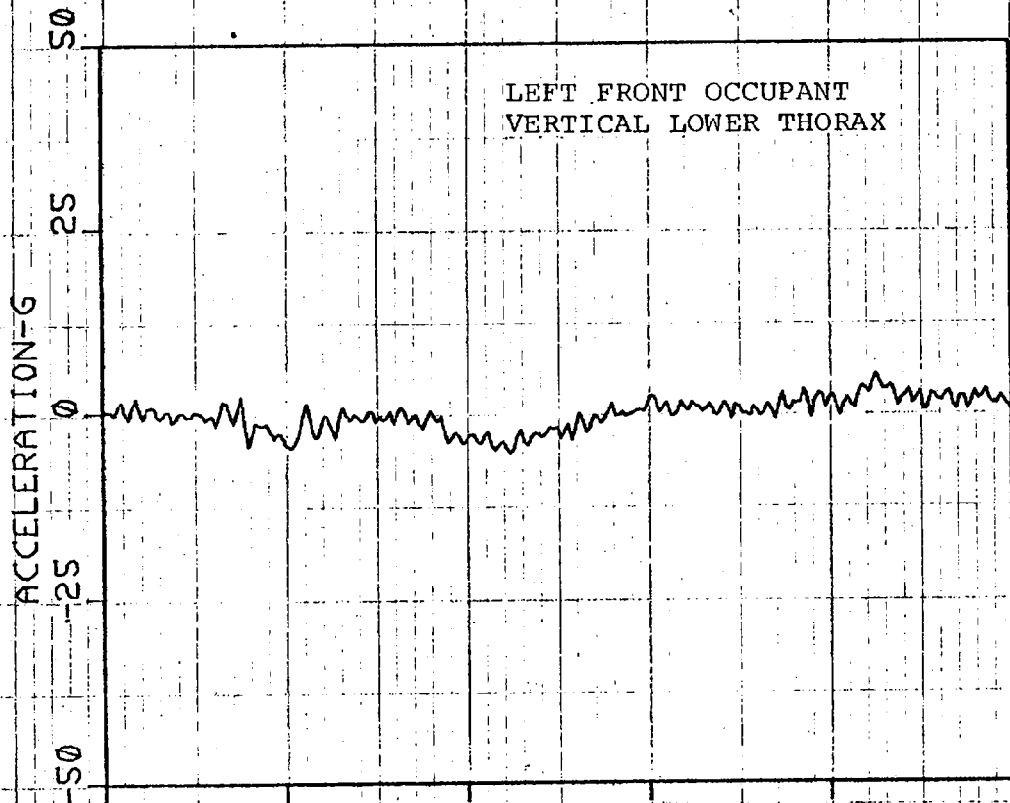


TEST#8327-6.5 MOD RABBIT LF 2RVY

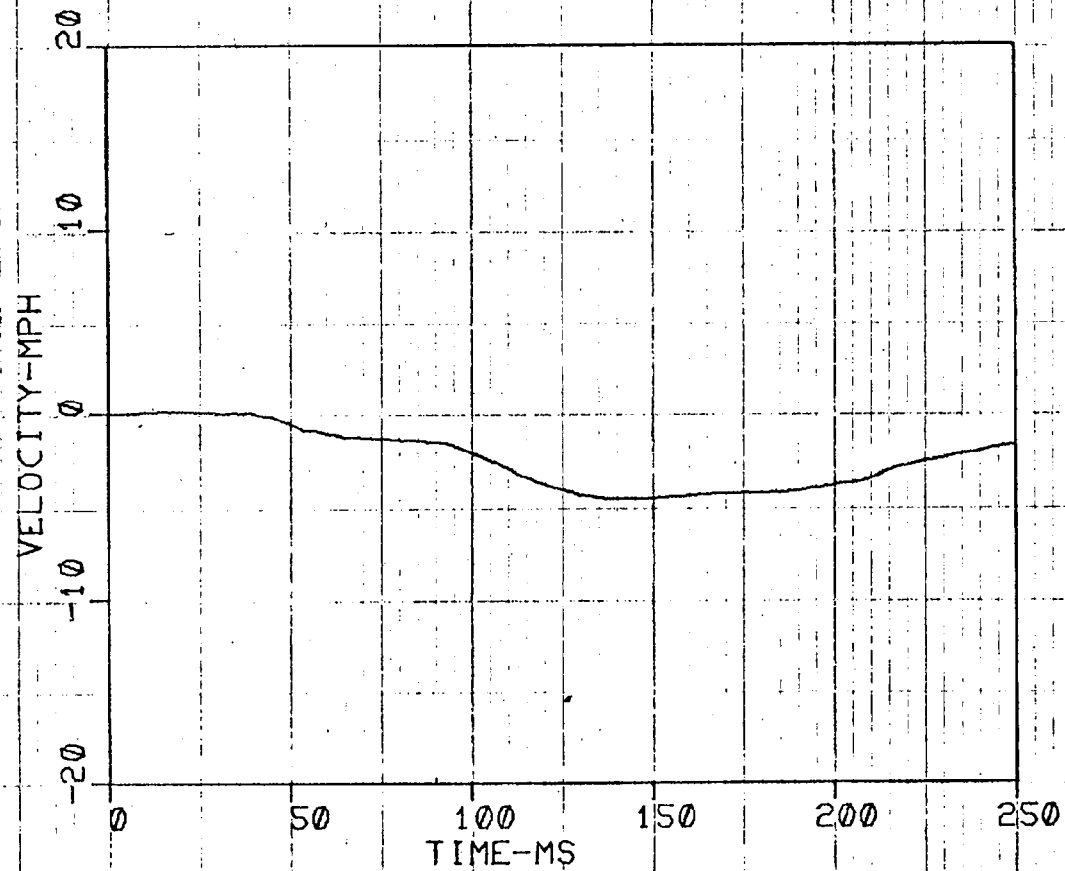


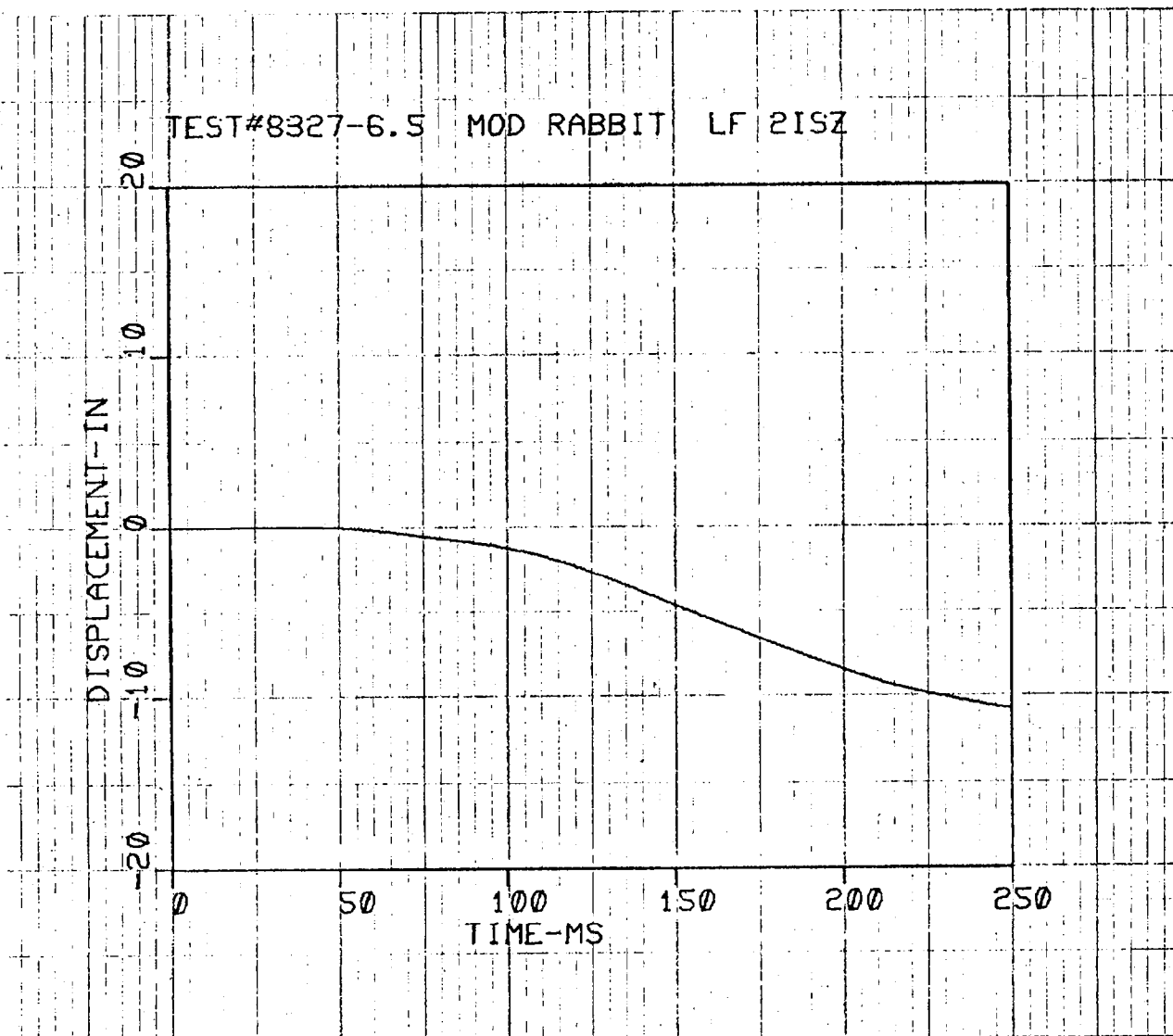


TEST#8327-6.5 MOD RABBIT LF 2IGZ

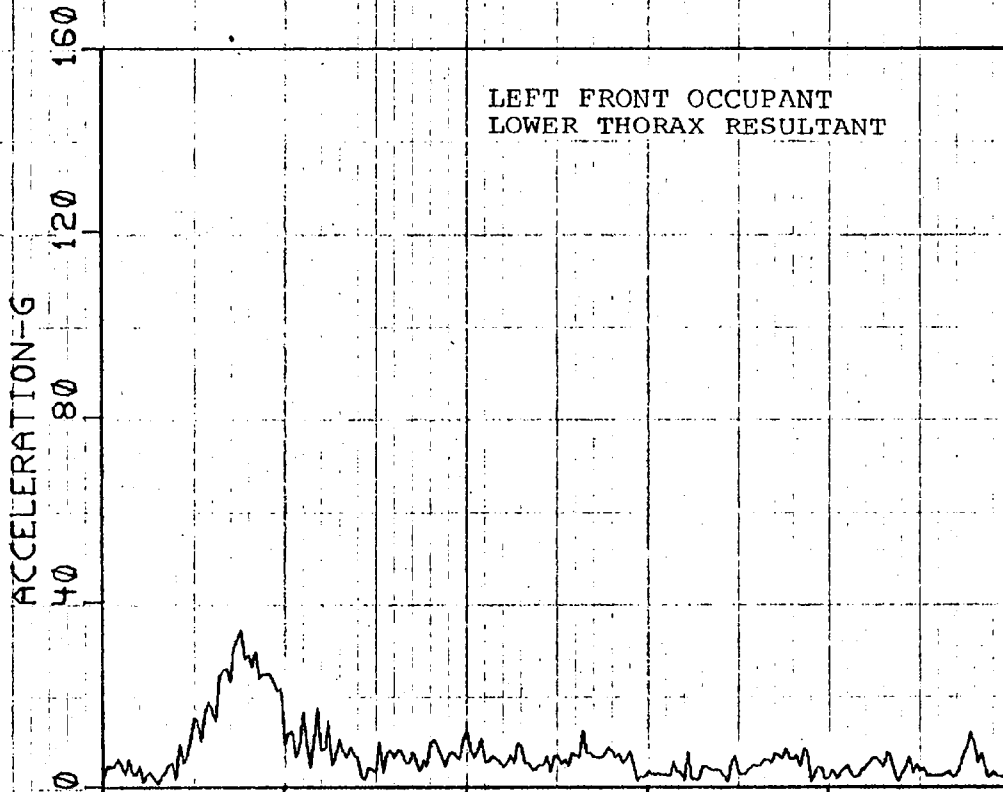


TEST#8327-6.5 MOD RABBIT LF 2IVZ

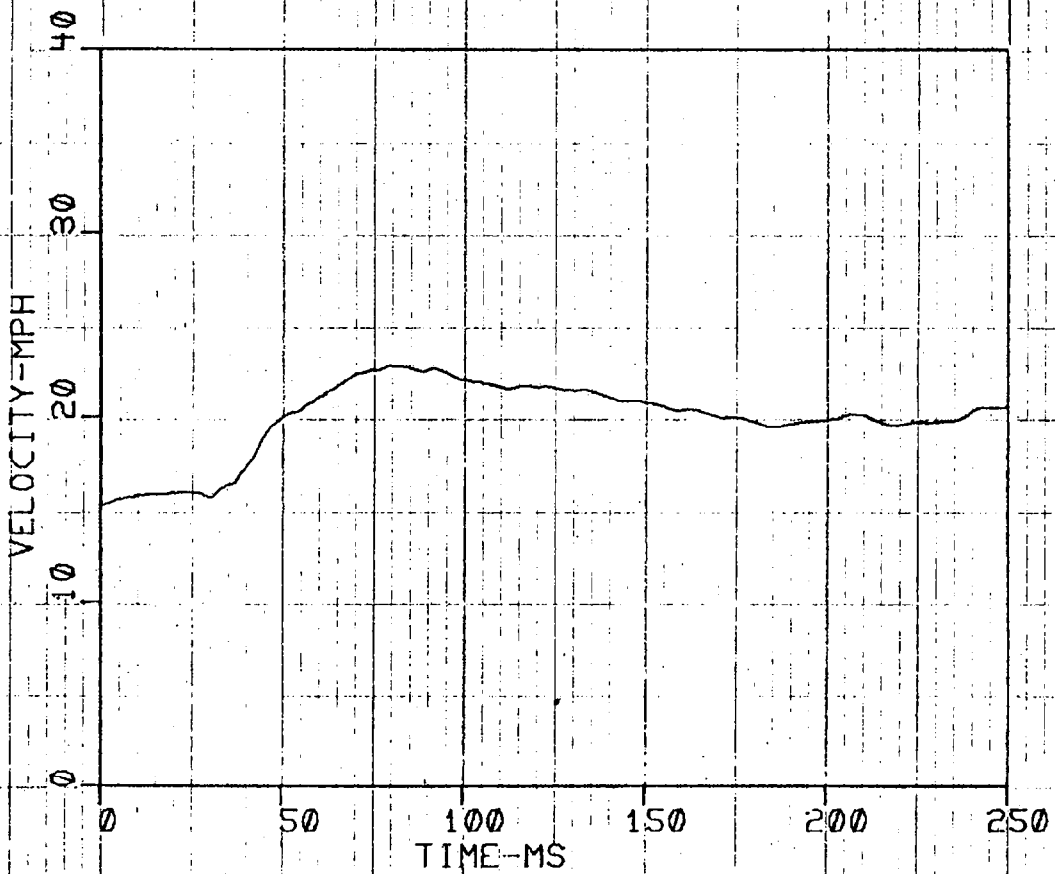


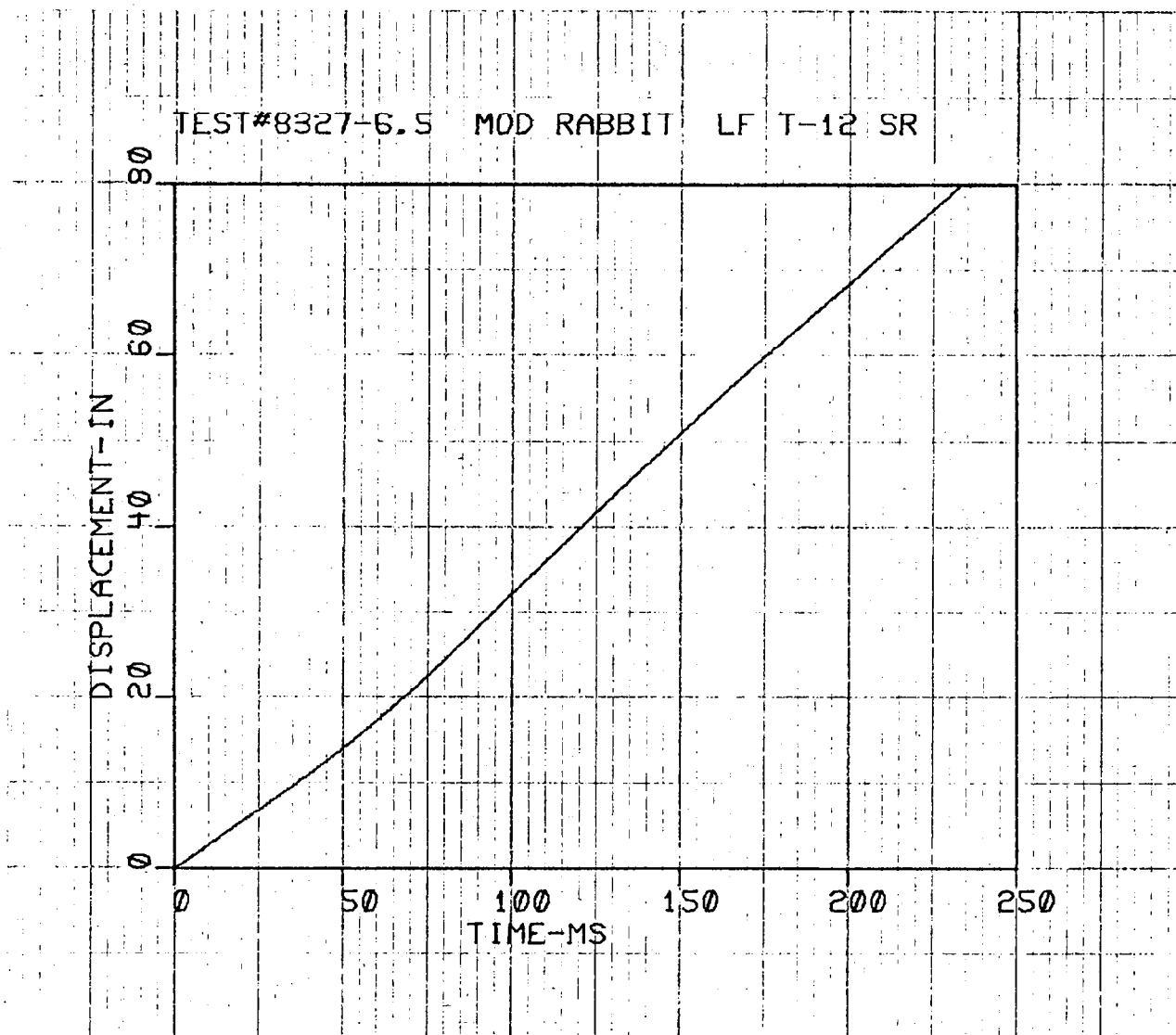


TEST#8327-6.5 MOD RABBIT LF T-12 AR

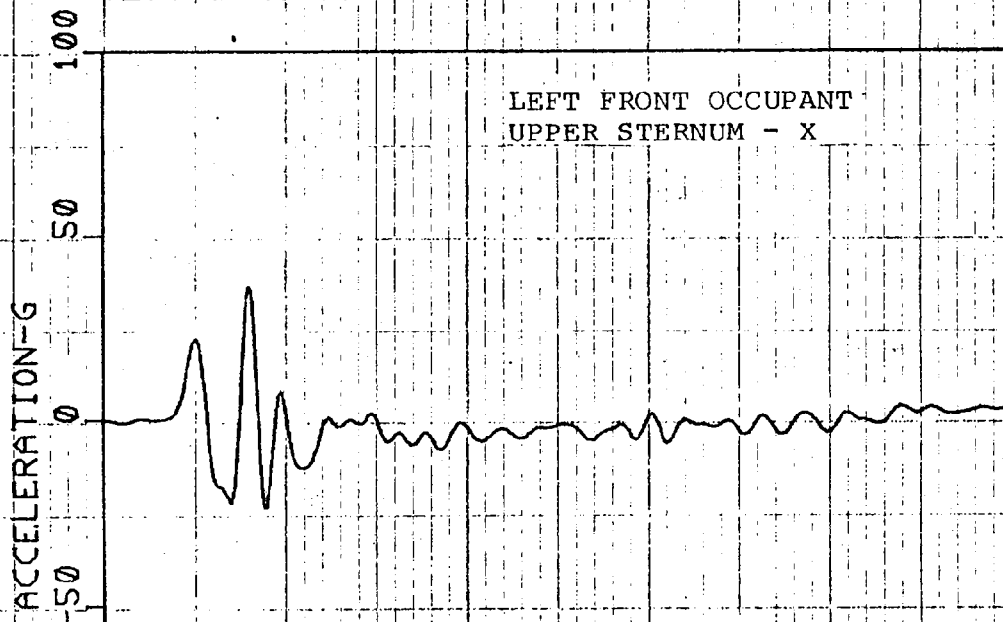


TEST#8327-6.5 MOD RABBIT LF T-12 VR

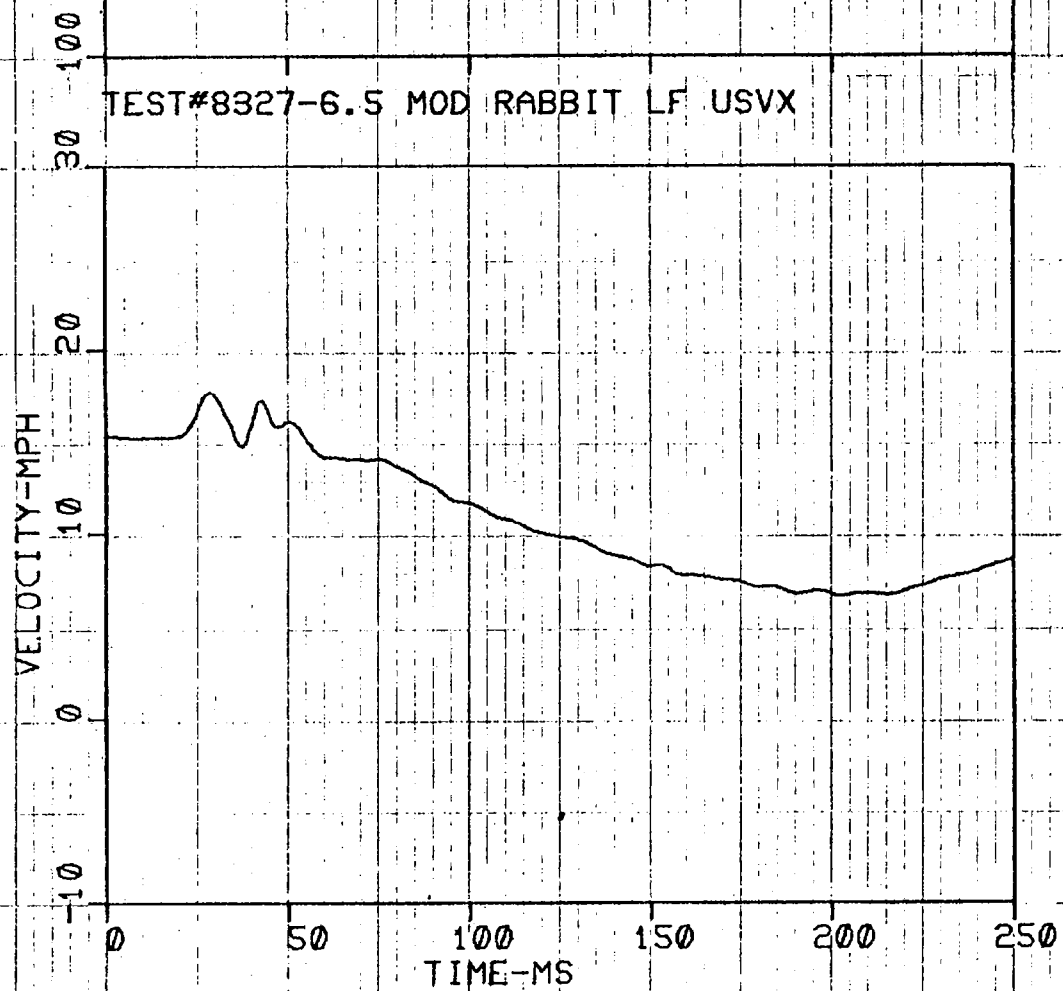


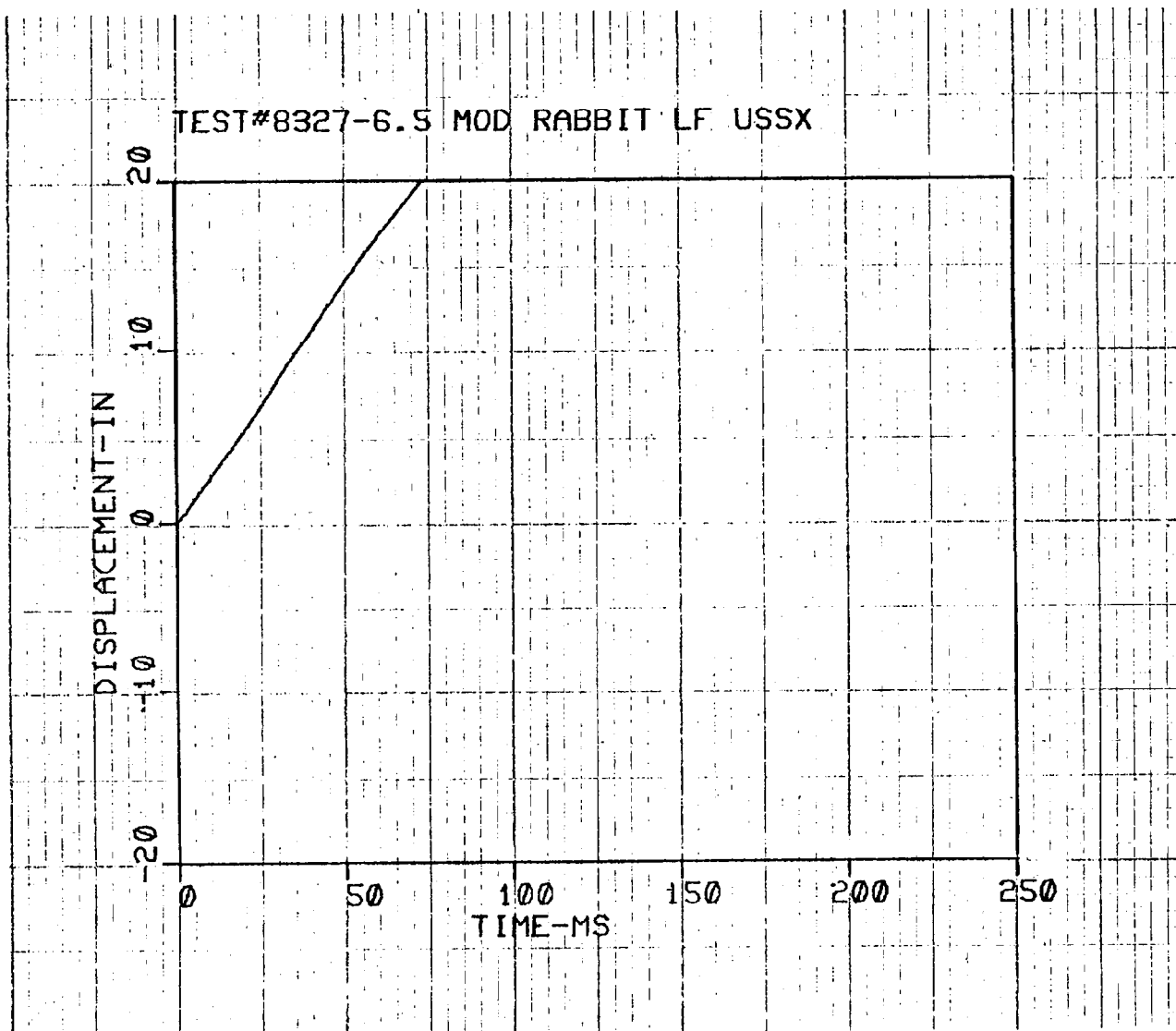


TEST#8327-6.5 MOD RABBIT LF USGX

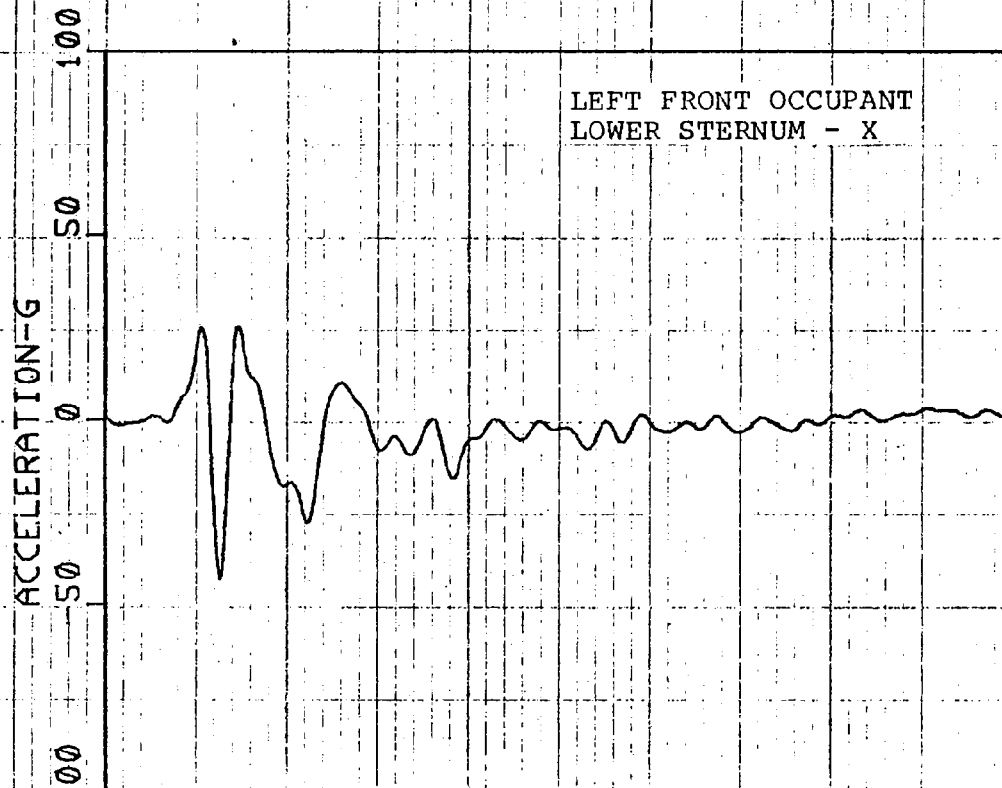


TEST#8327-6.5 MOD RABBIT LF USVX

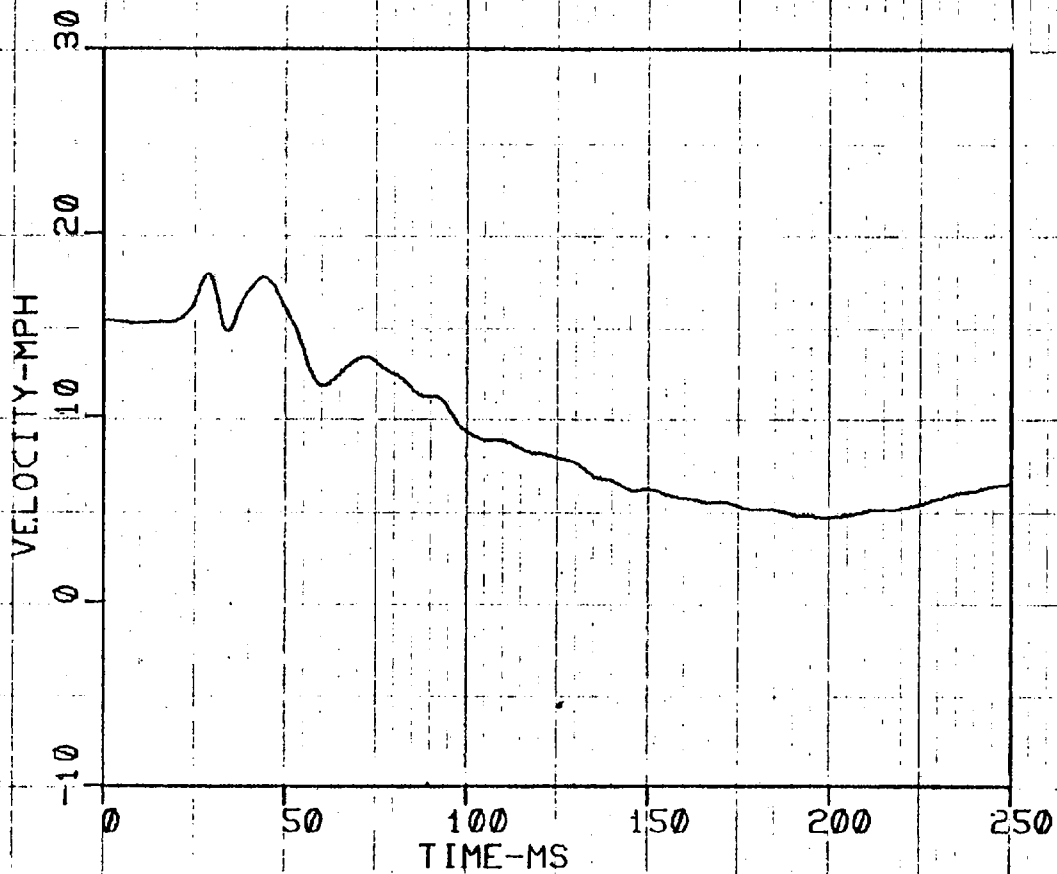


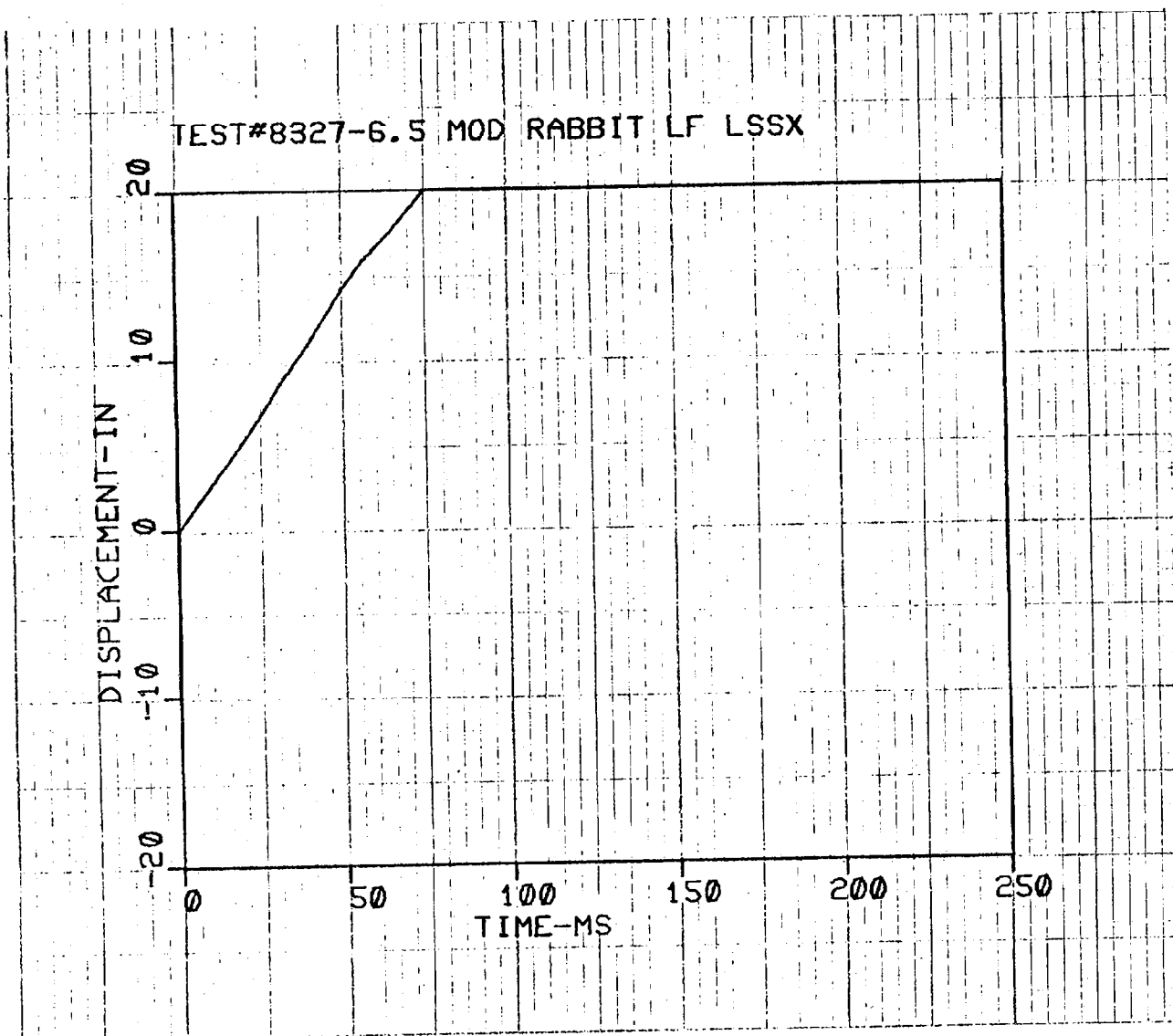


TEST#8327-6.5 MOD RABBIT LF LSGX

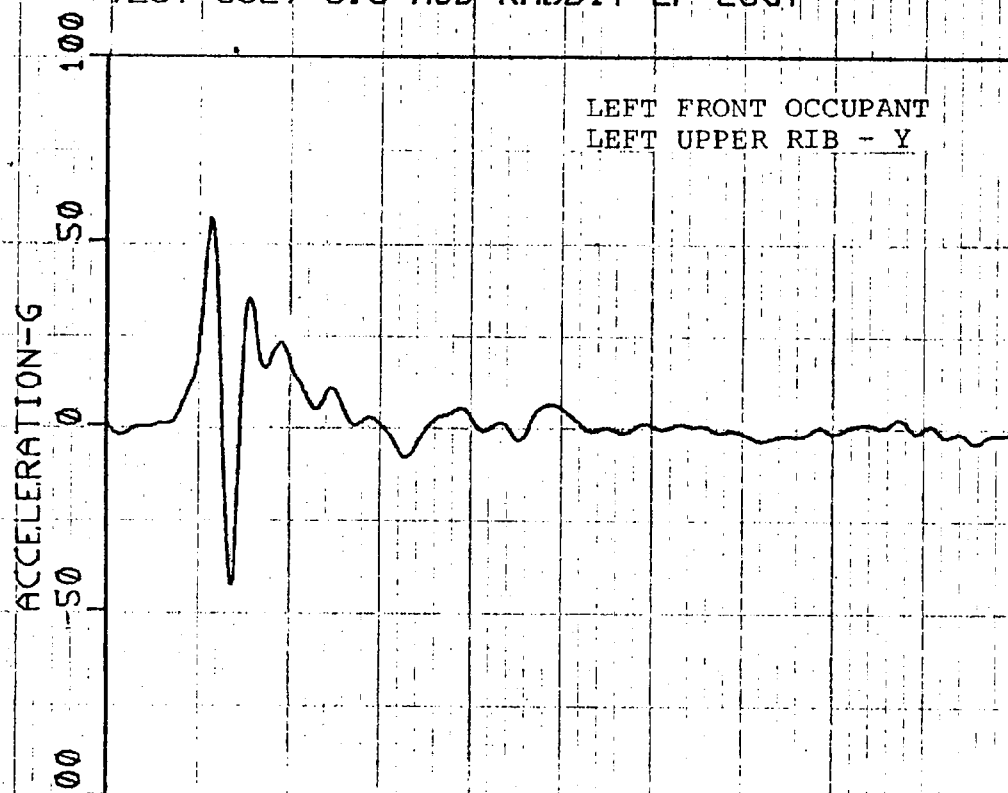


TEST#8327-6.5 MOD RABBIT LF LSVX

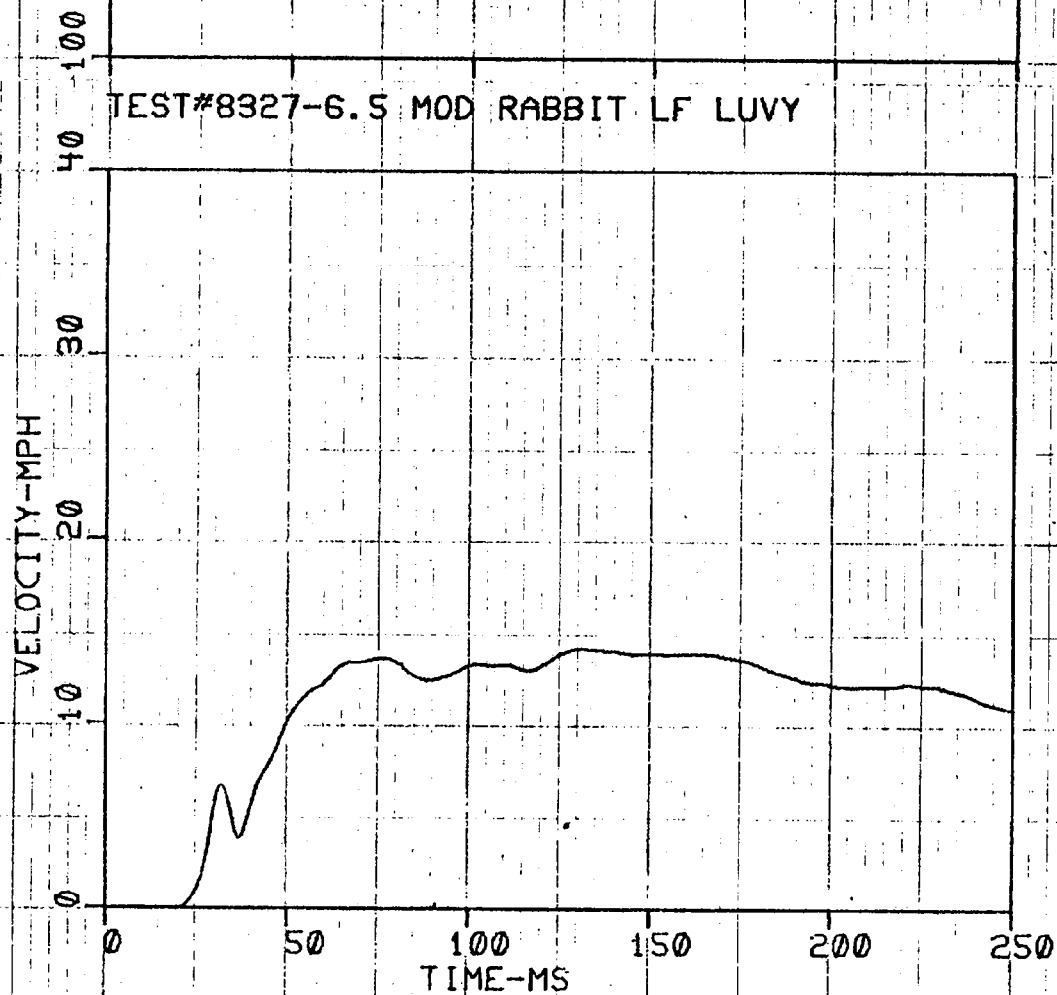


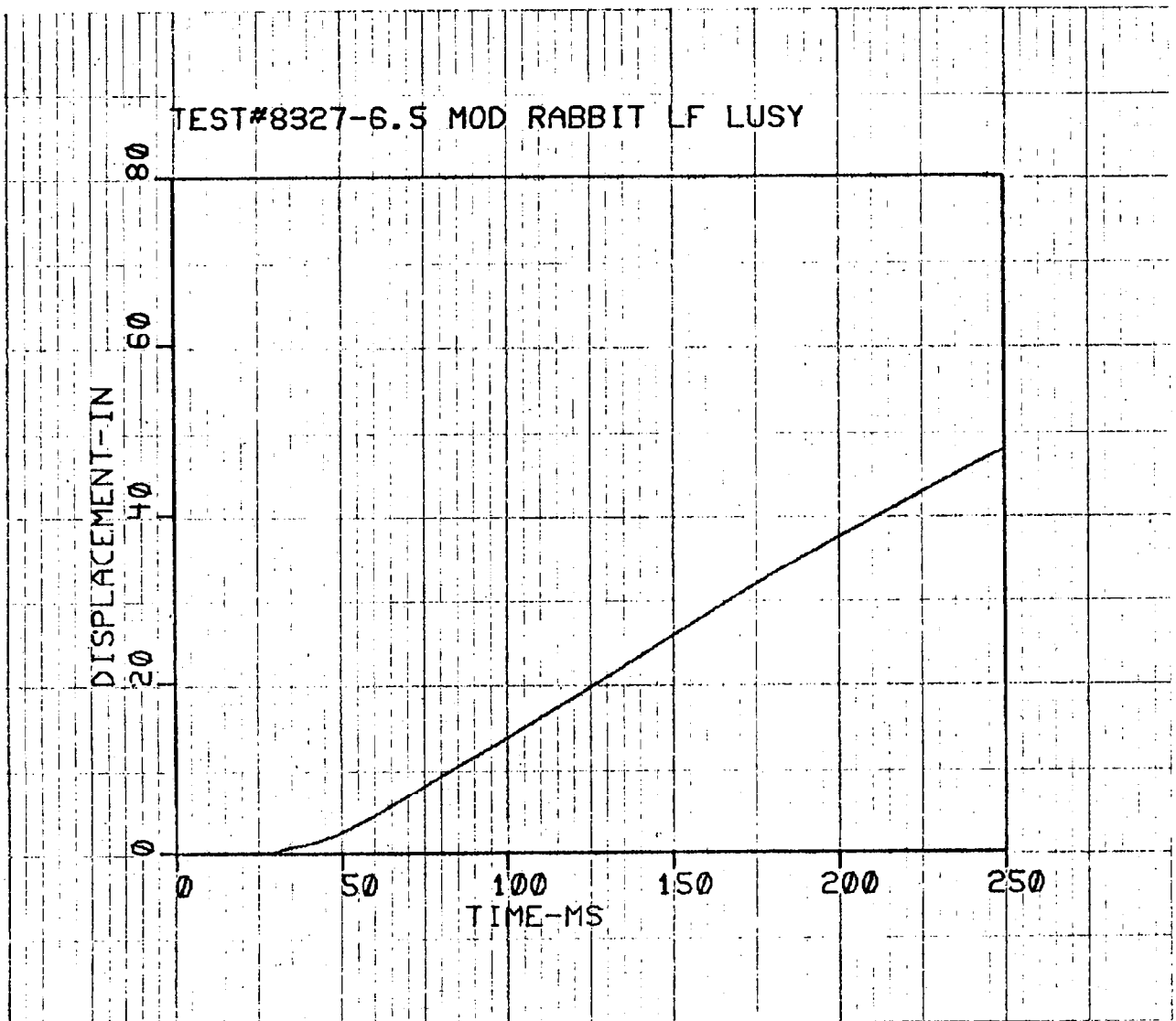


TEST#8327-6.5 MOD RABBIT LF LUGY

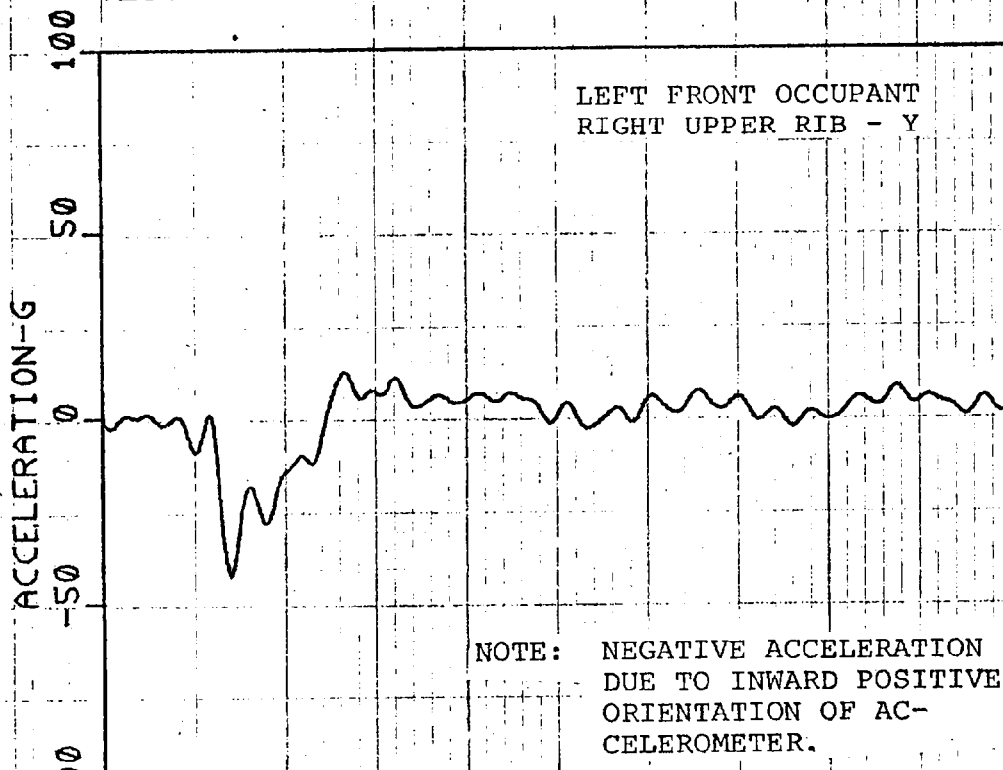


TEST#8327-6.5 MOD RABBIT LF LUVY

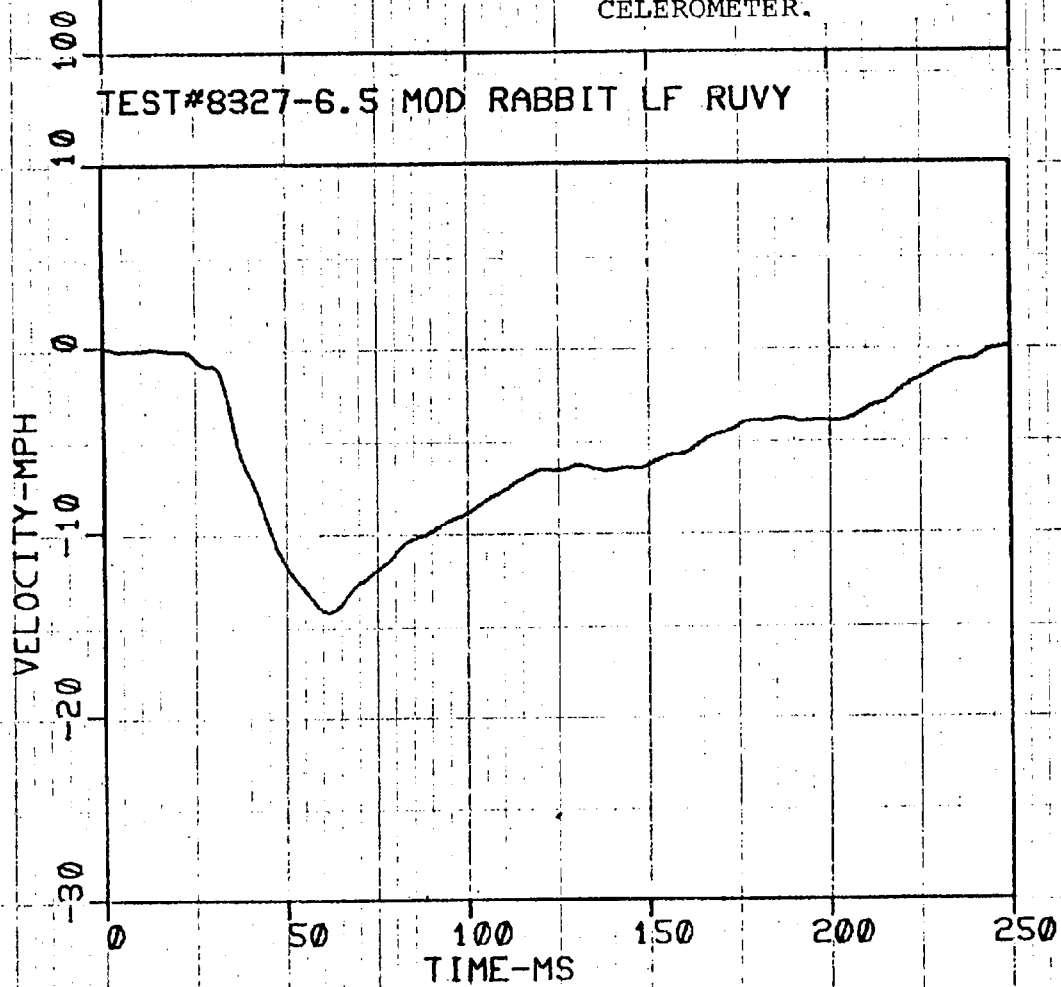


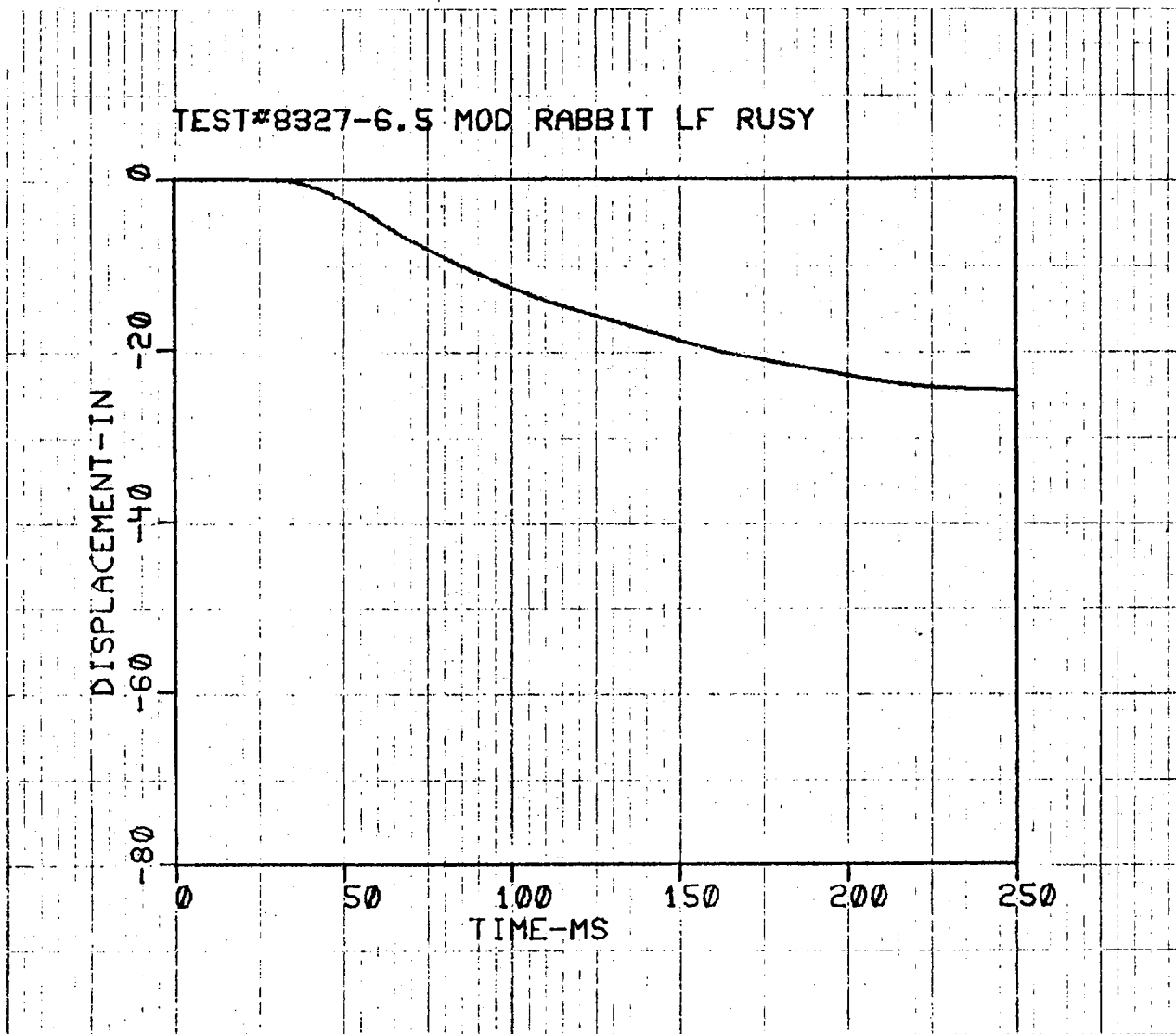


TEST#8327-6.5 MOD RABBIT LF RUGY

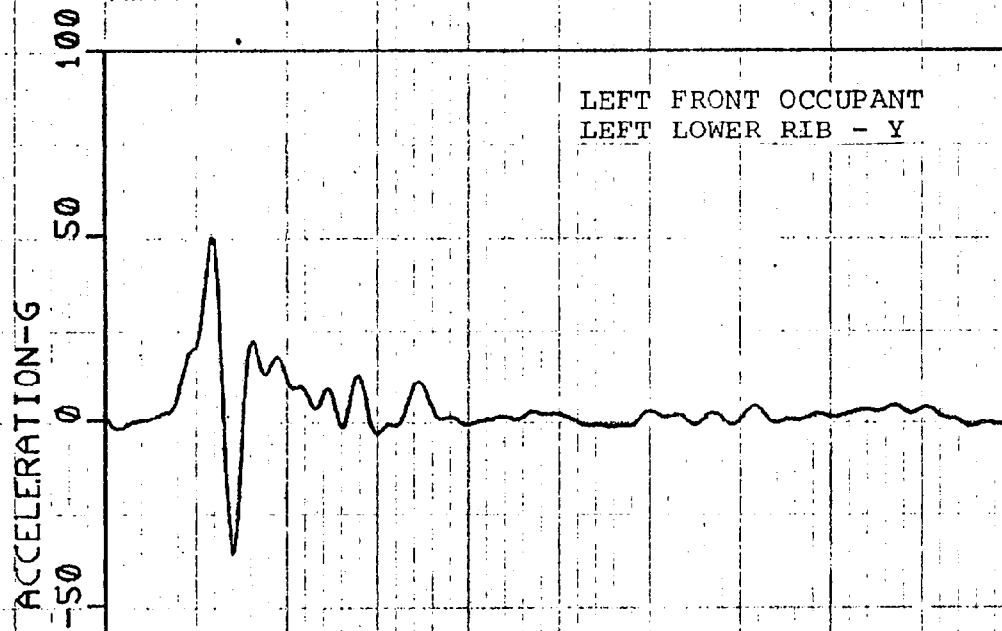


TEST#8327-6.5 MOD RABBIT LF RUVY

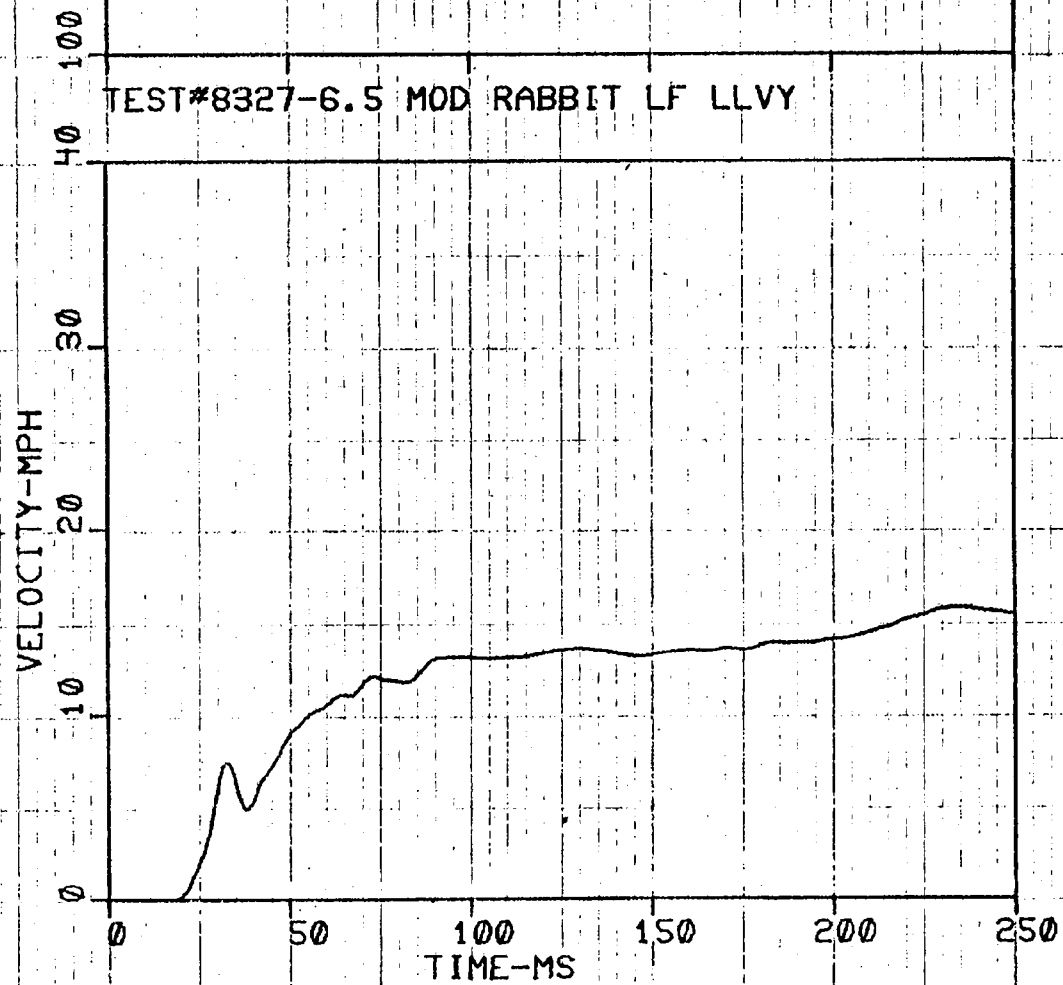


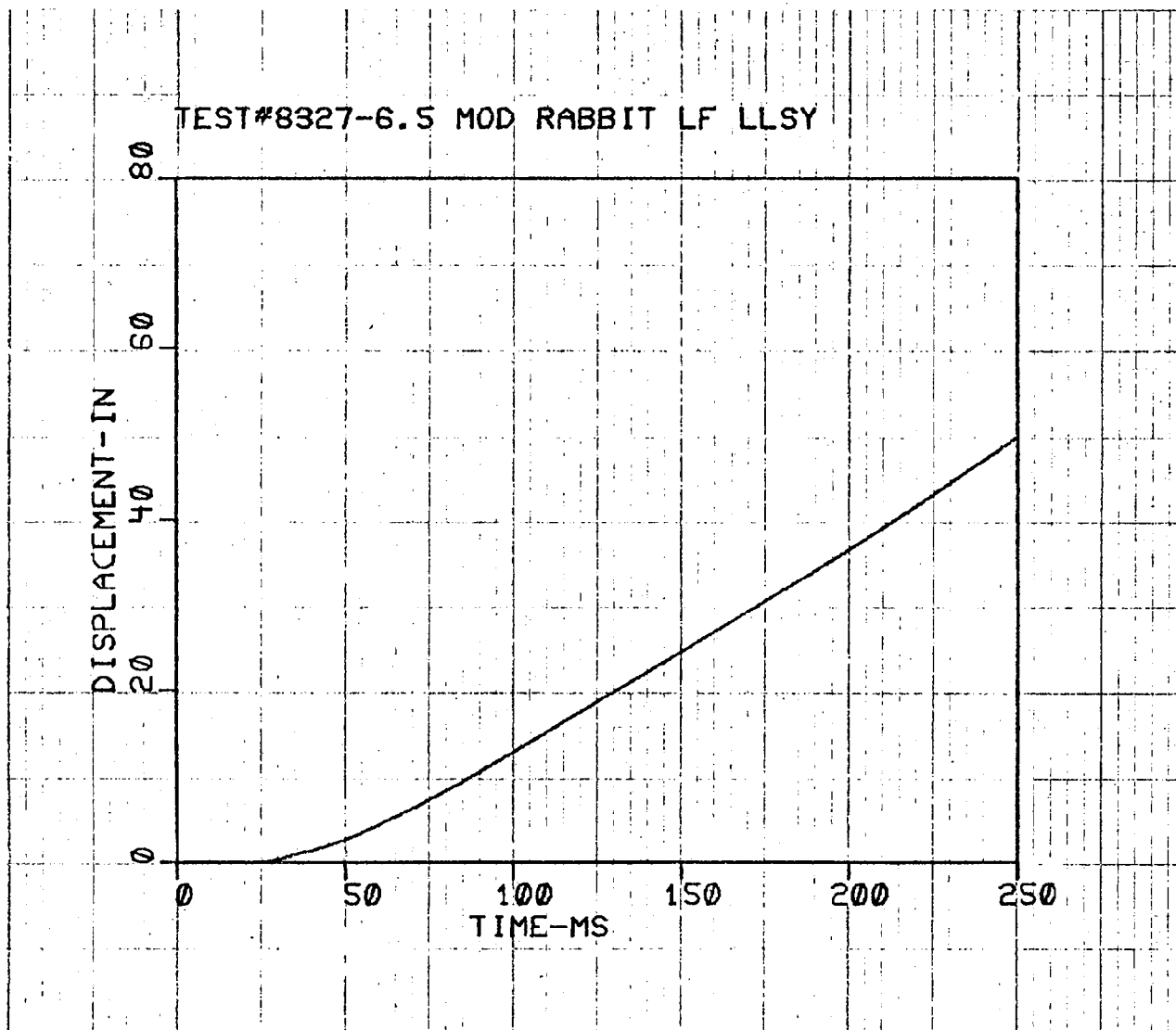


TEST#8327-6.5 MOD RABBIT LF LLGY

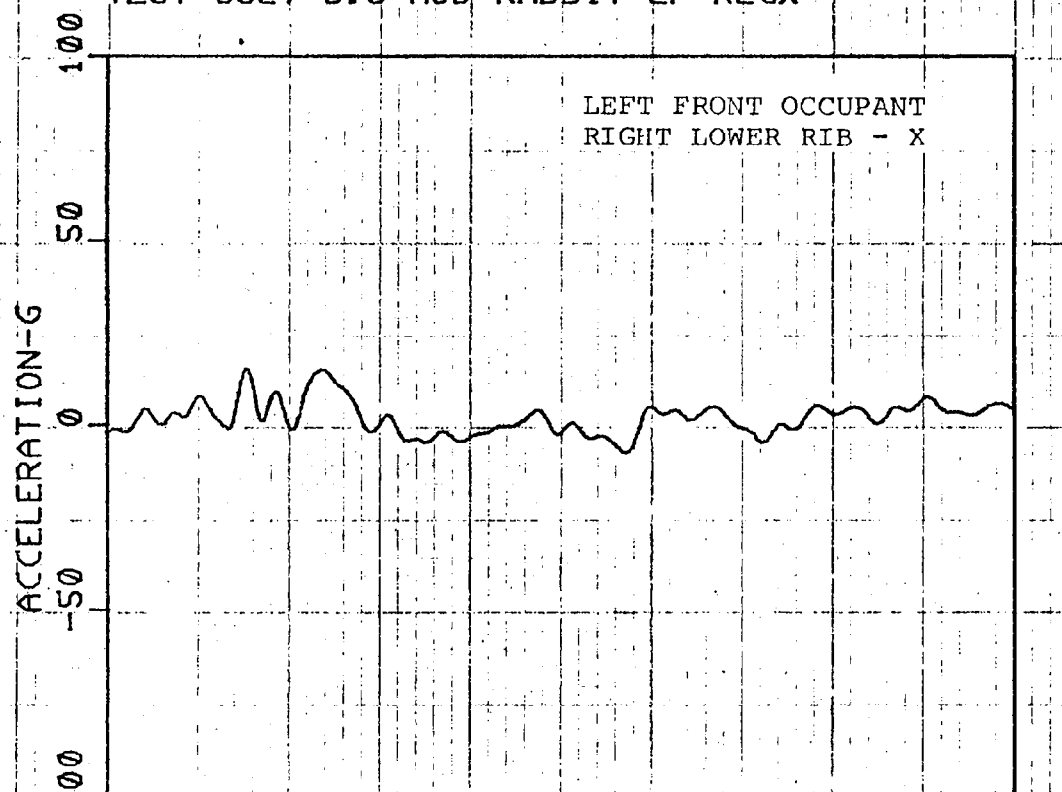


TEST#8327-6.5 MOD RABBIT LF LLGY

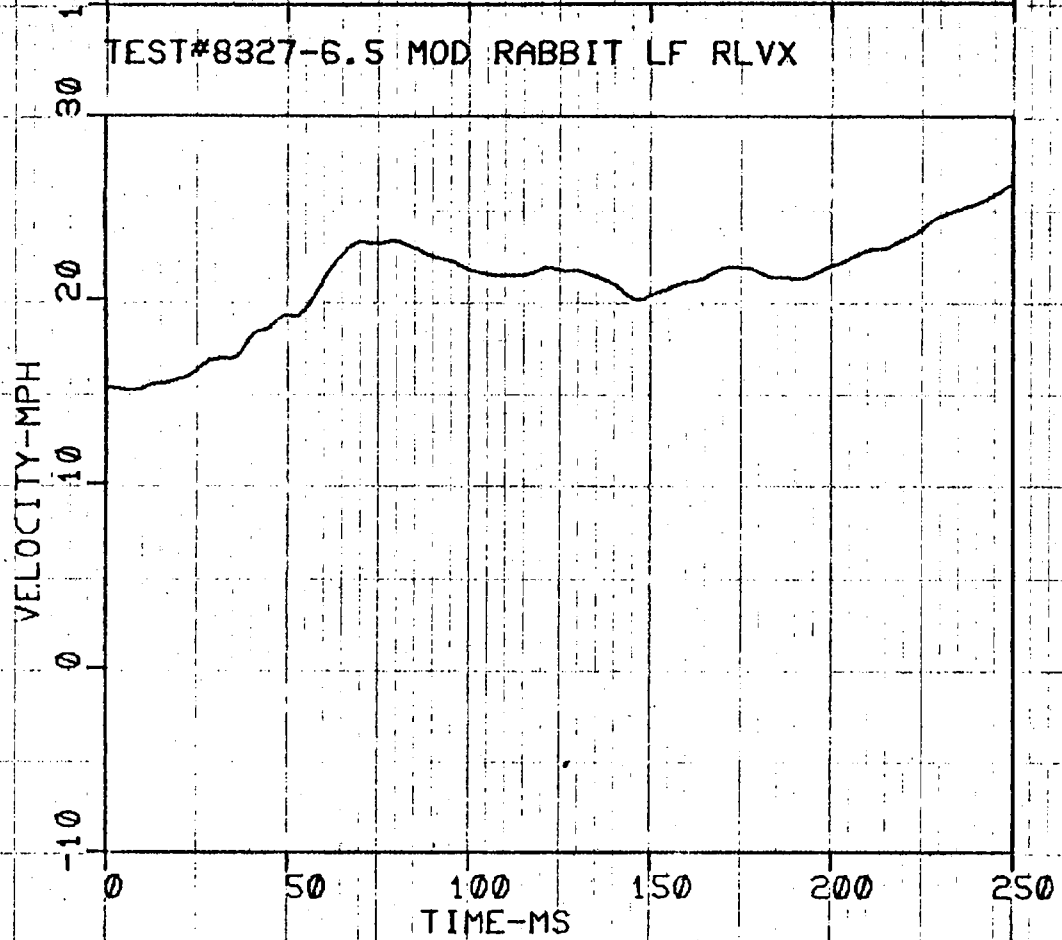


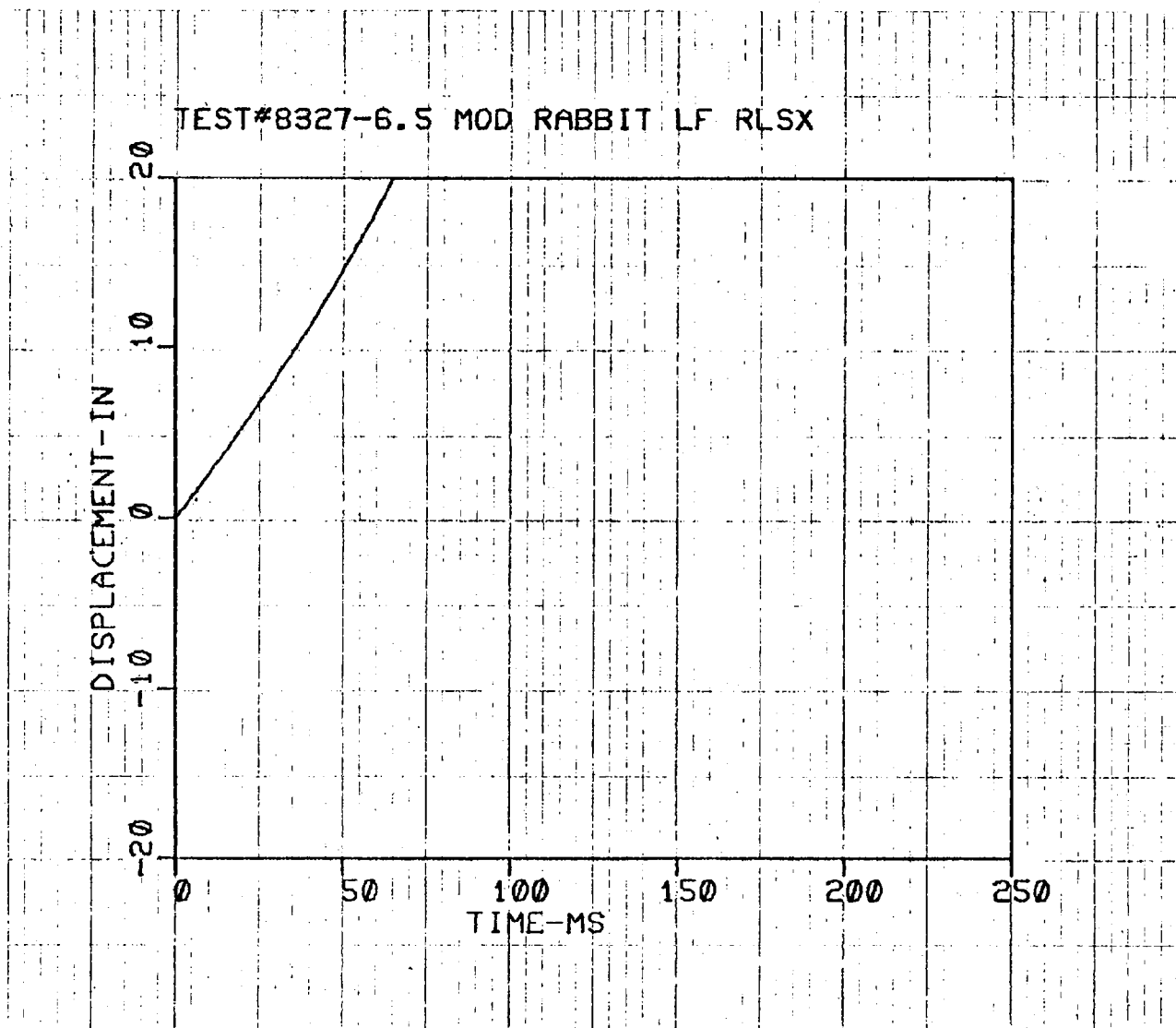


TEST#8327-6.5 MOD RABBIT LF RLGX

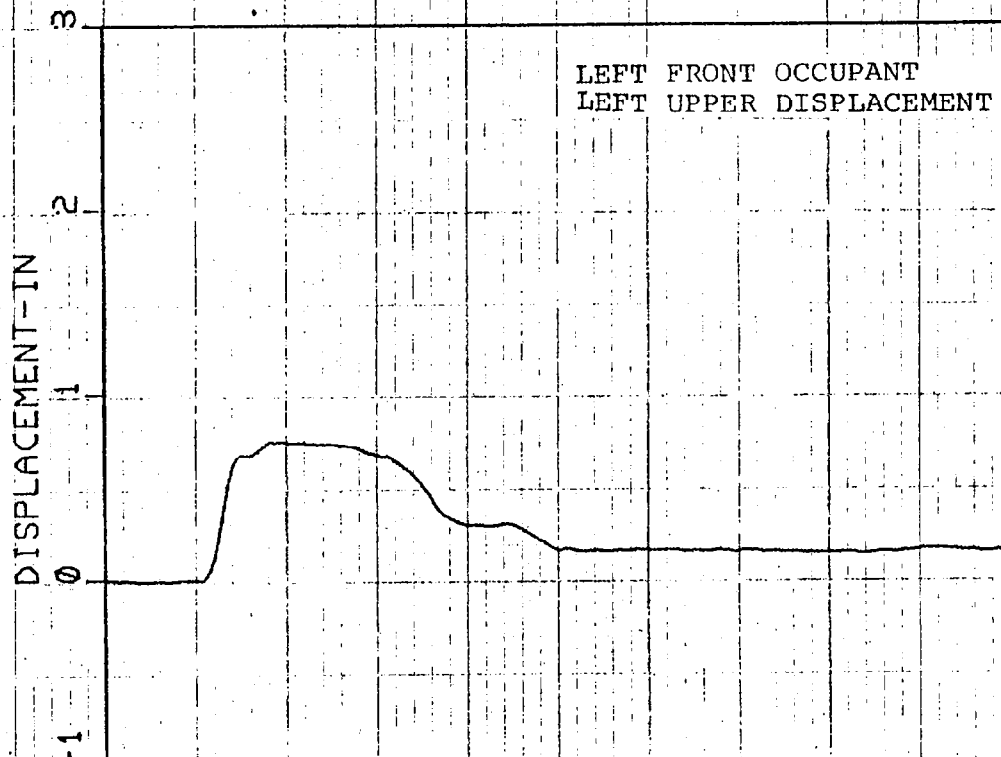


TEST#8327-6.5 MOD RABBIT LF RLVX

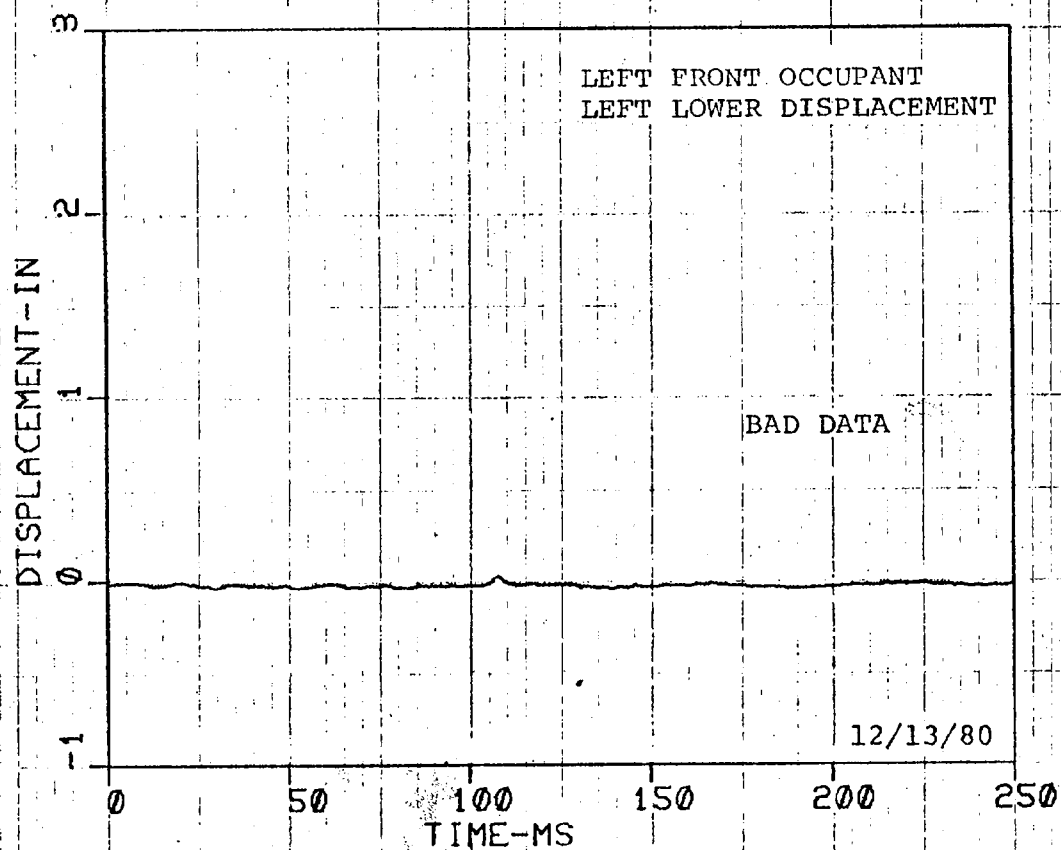




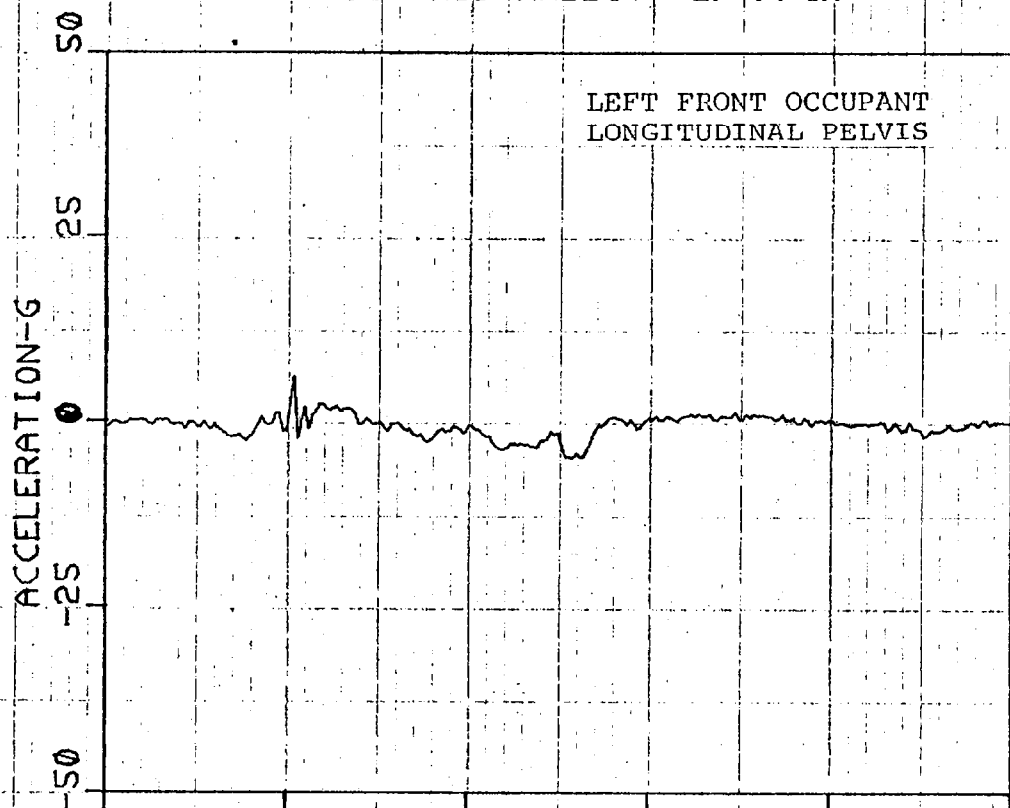
TEST#8327-6.5 MOD RABBIT LF LUDY



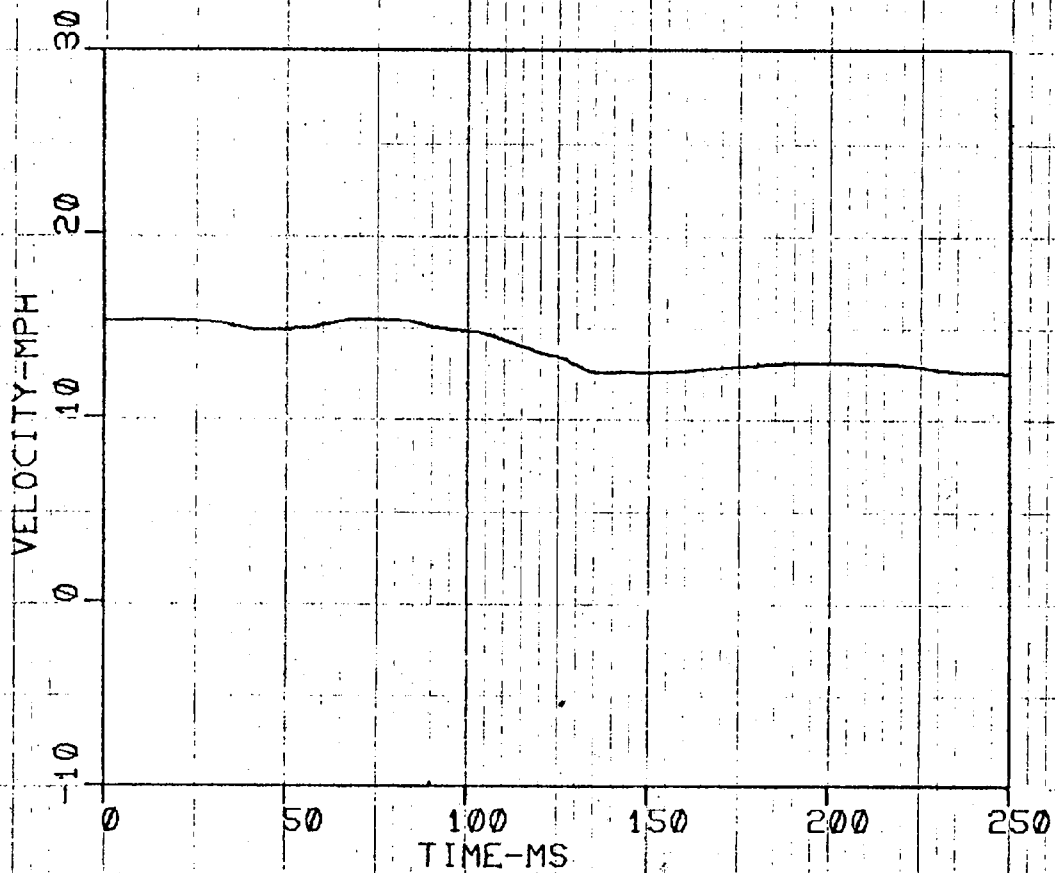
TEST#8327-6.5 MOD RABBIT LF LLDY

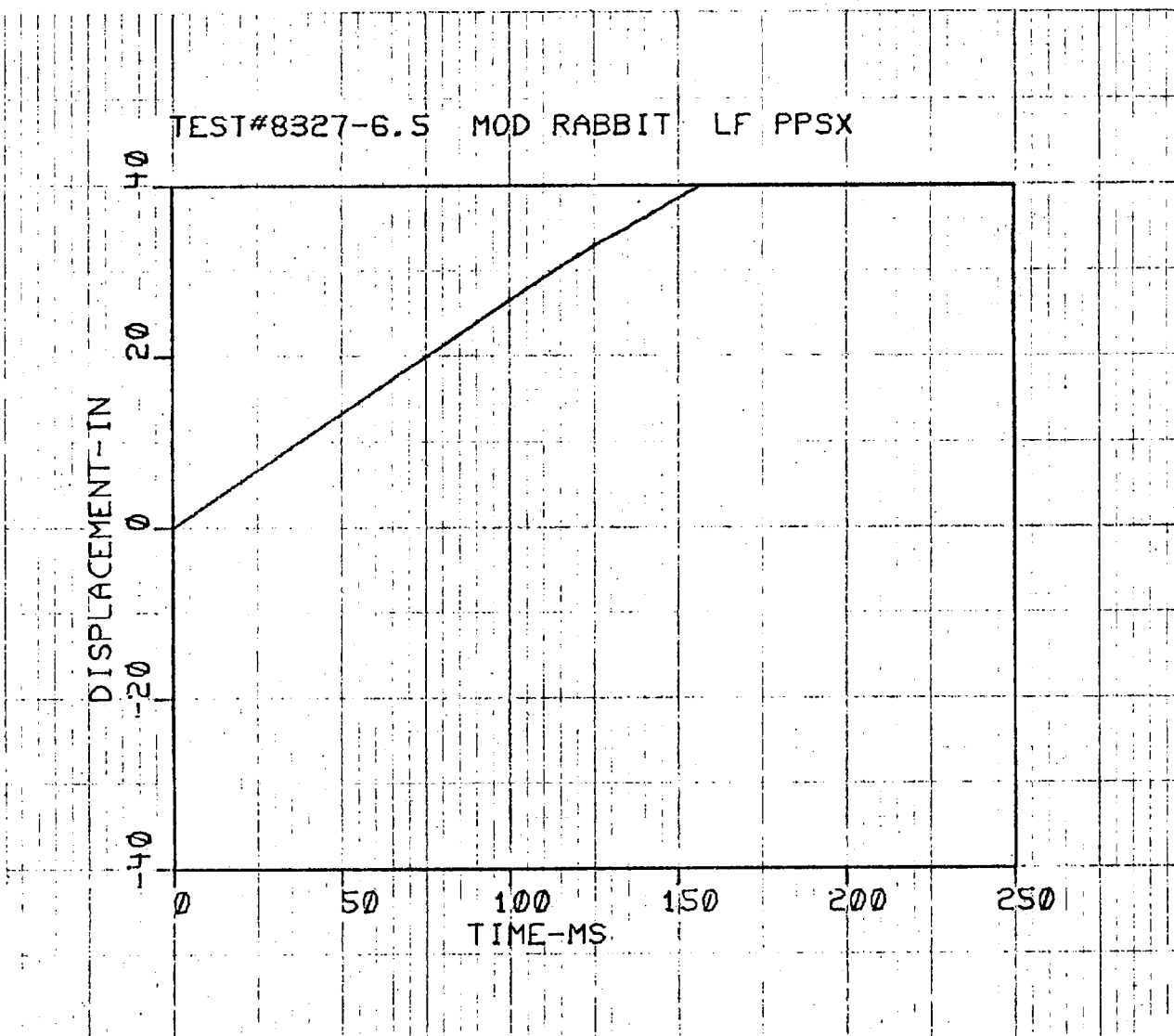


TEST#8327-6.5 MOD RABBIT LF PPGX

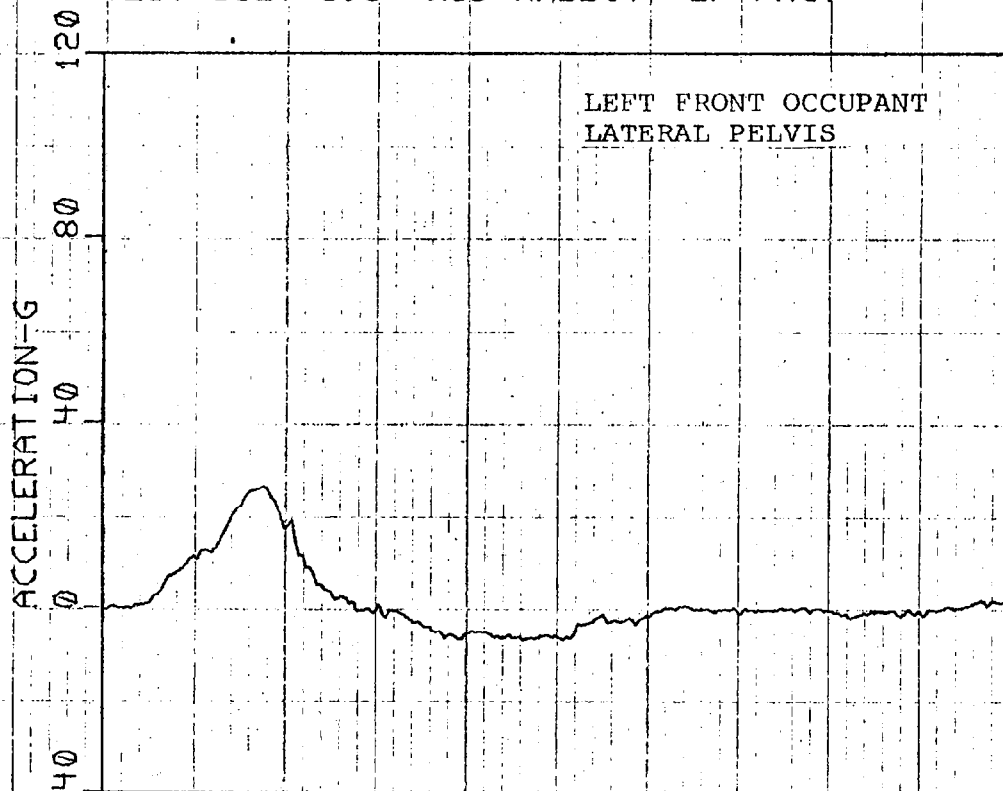


TEST#8327-6.5 MOD RABBIT LF PPVX

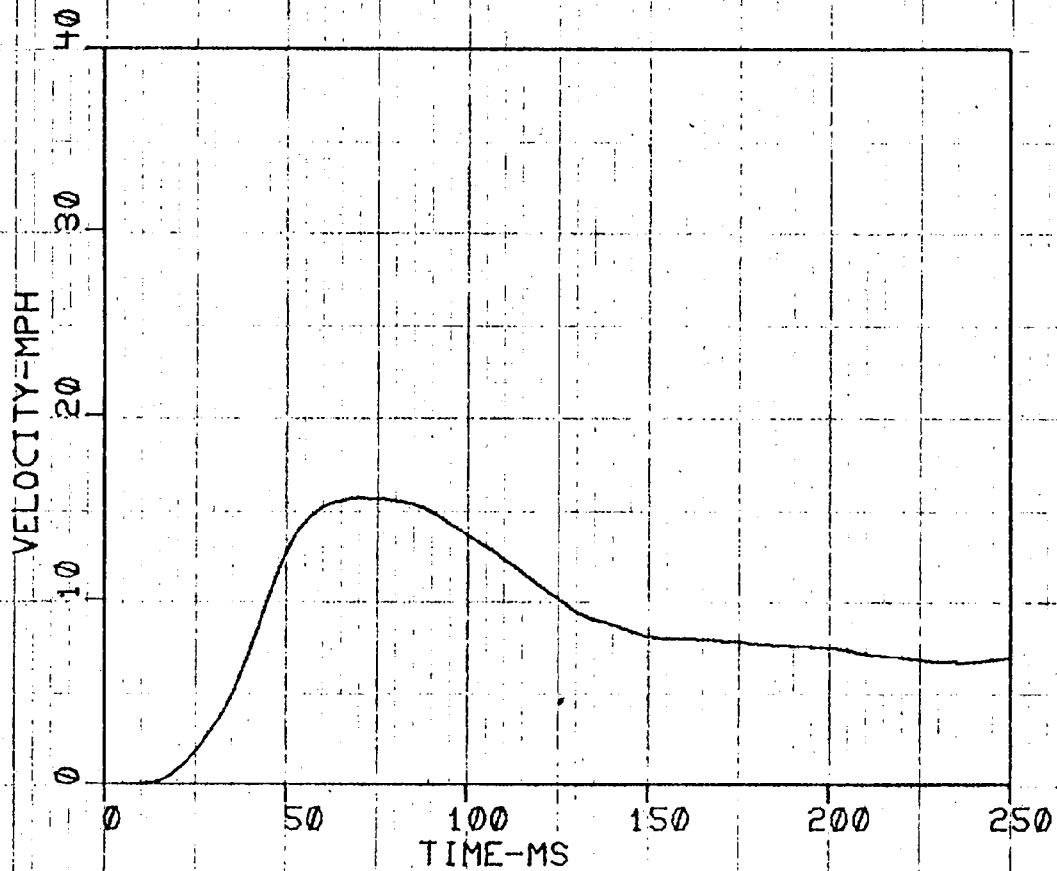


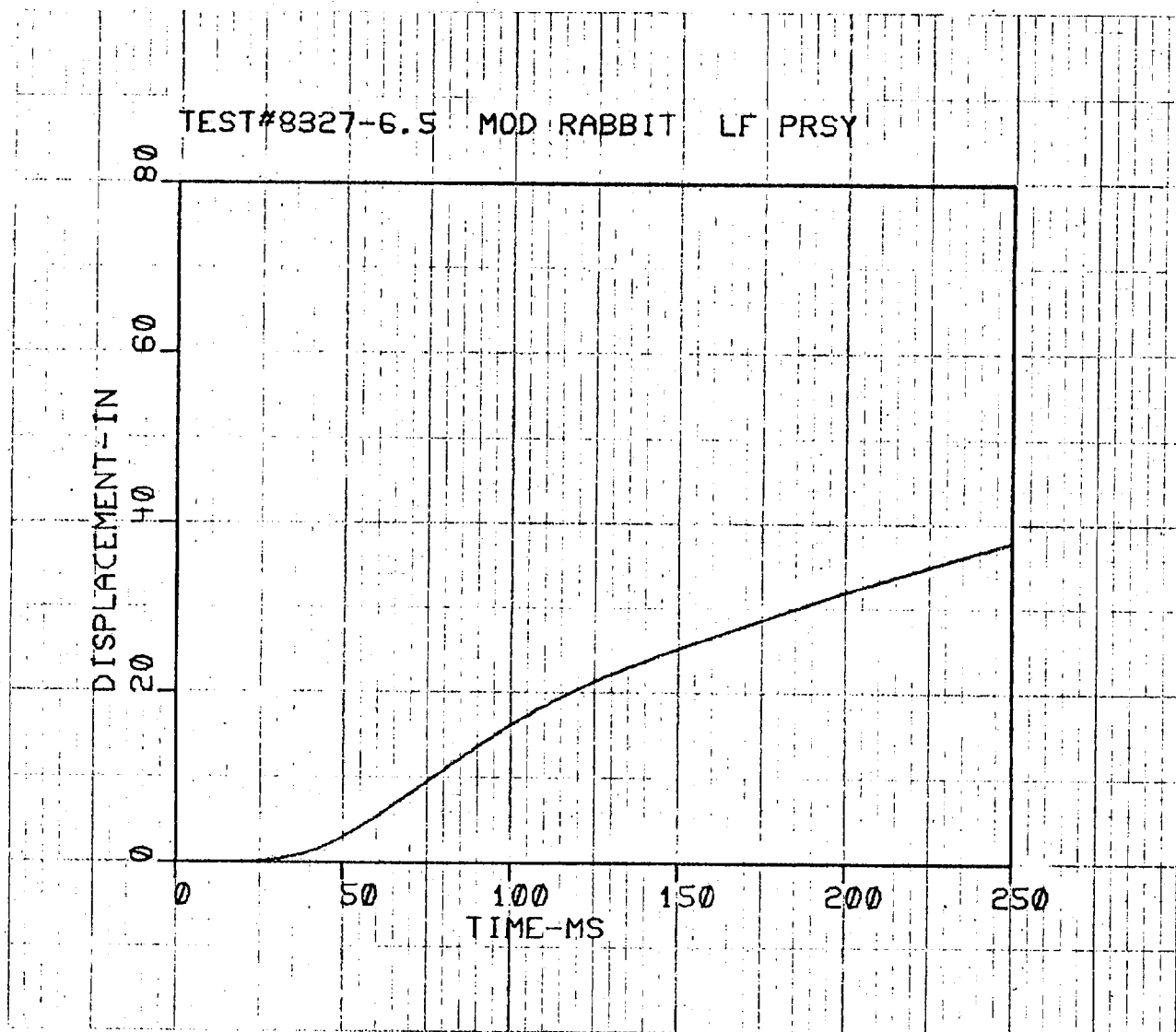


TEST#8327-6.5 MOD RABBIT LF PRGY

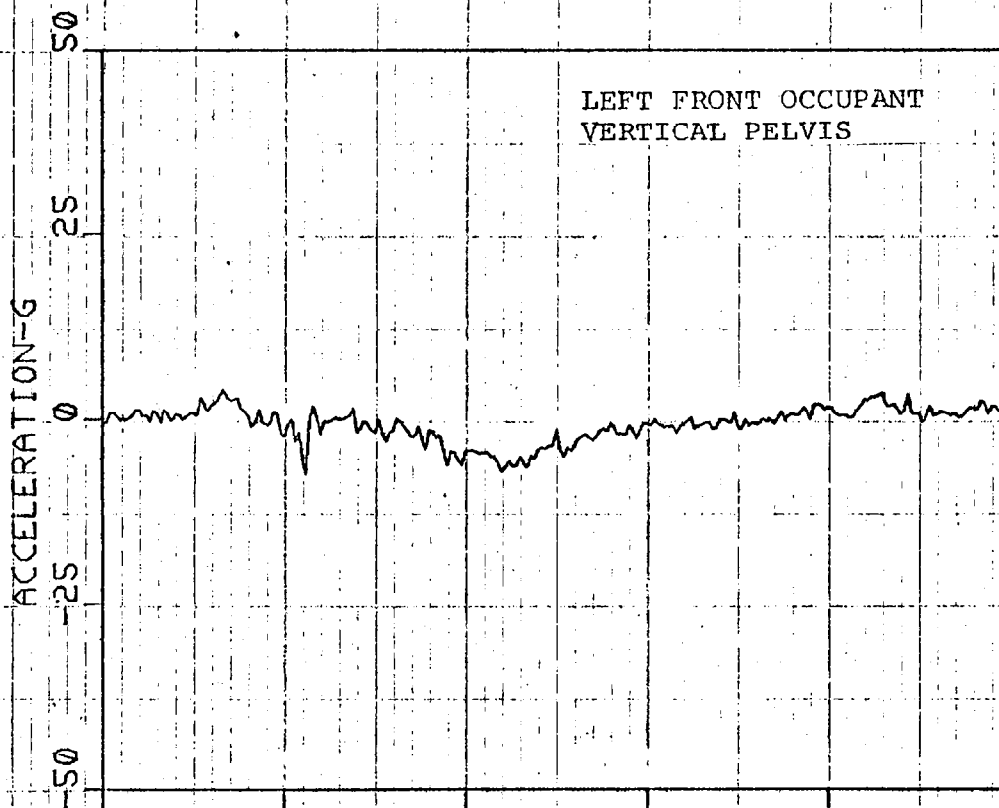


TEST#8327-6.5 MOD RABBIT LF PRVY

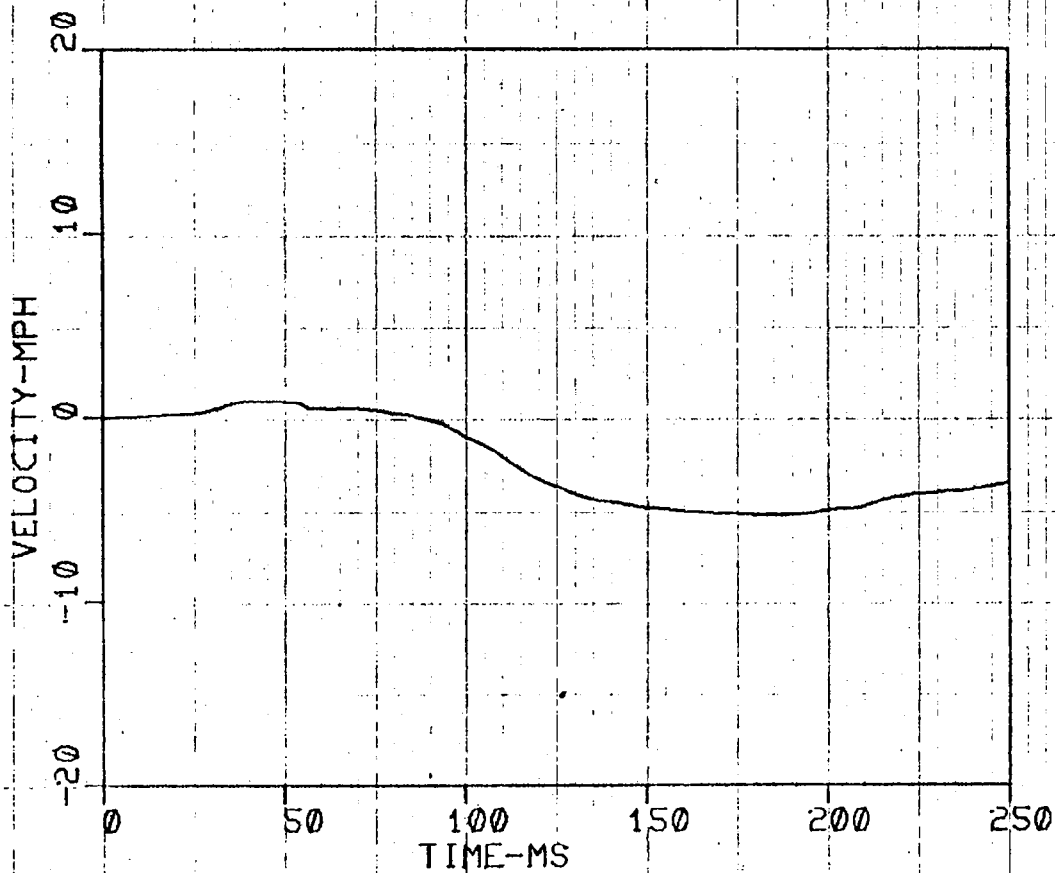


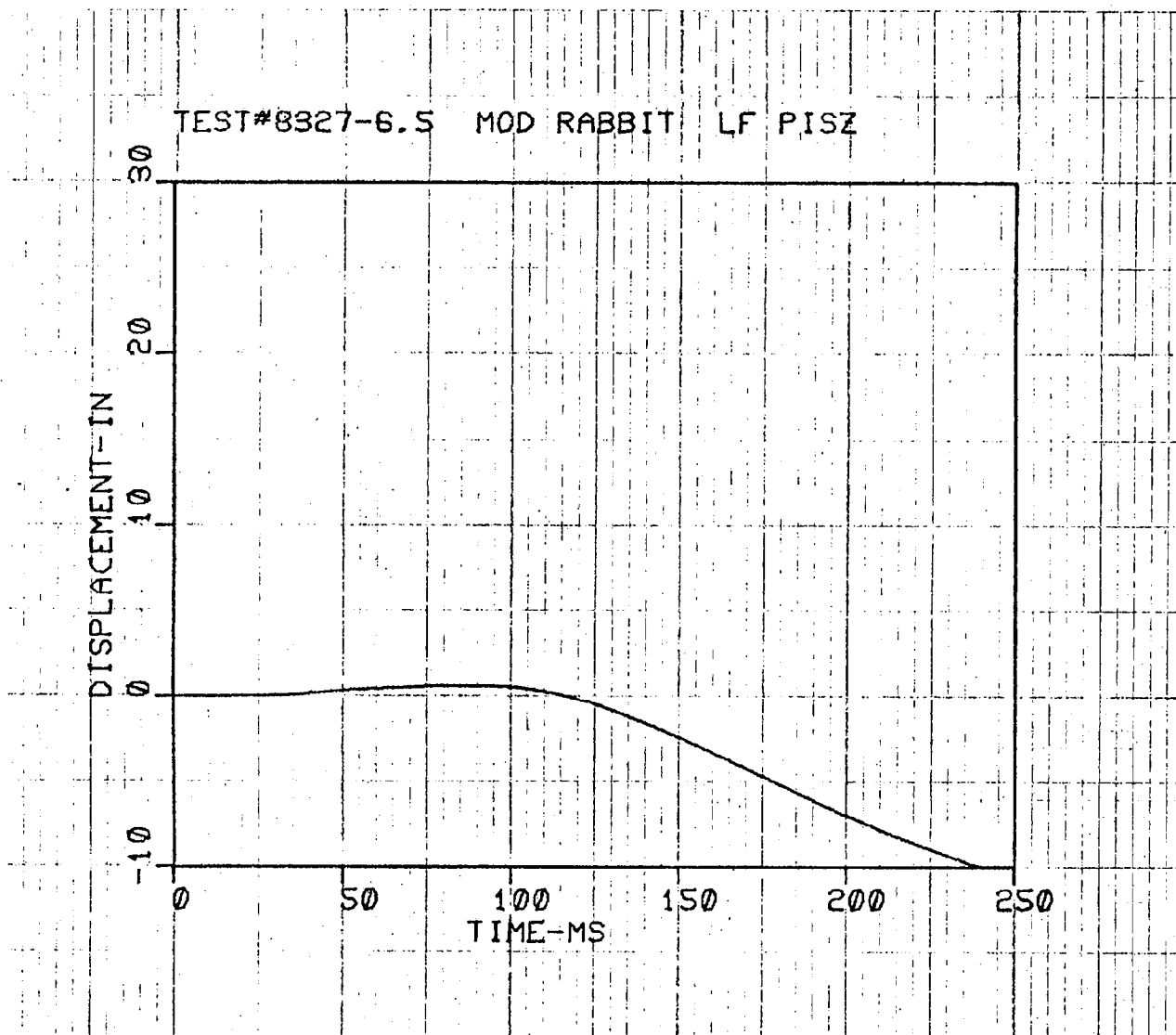


TEST#8327-6.5 MOD RABBIT LF PIGZ

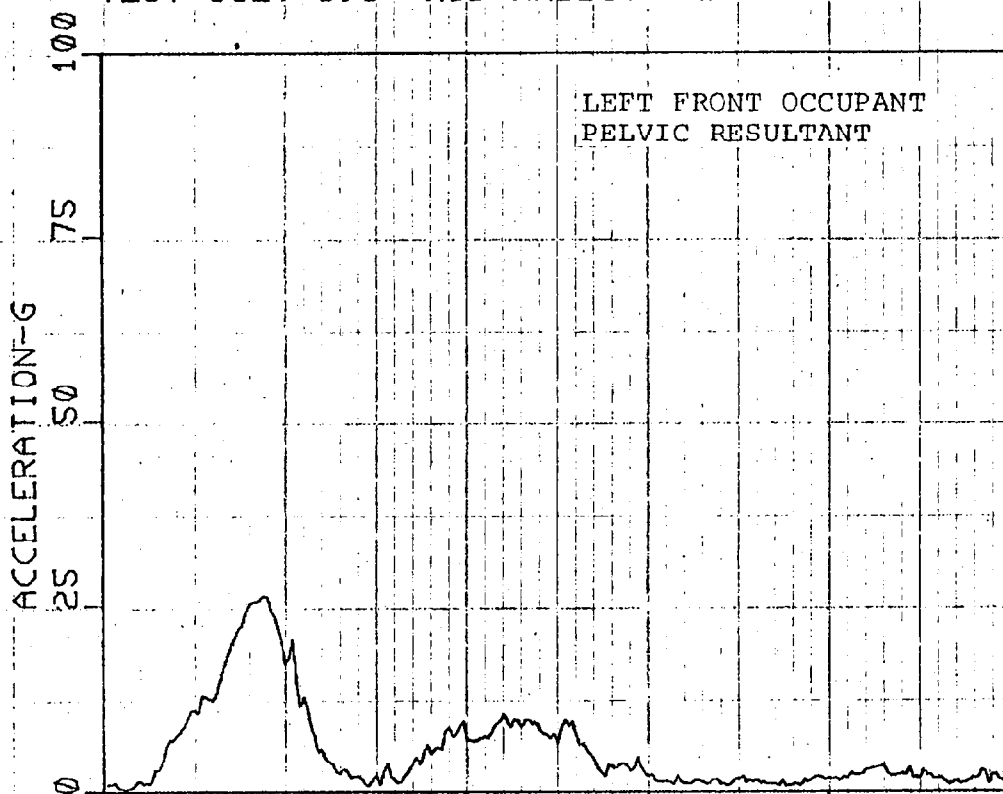


TEST#8327-6.5 MOD RABBIT LF PIVZ

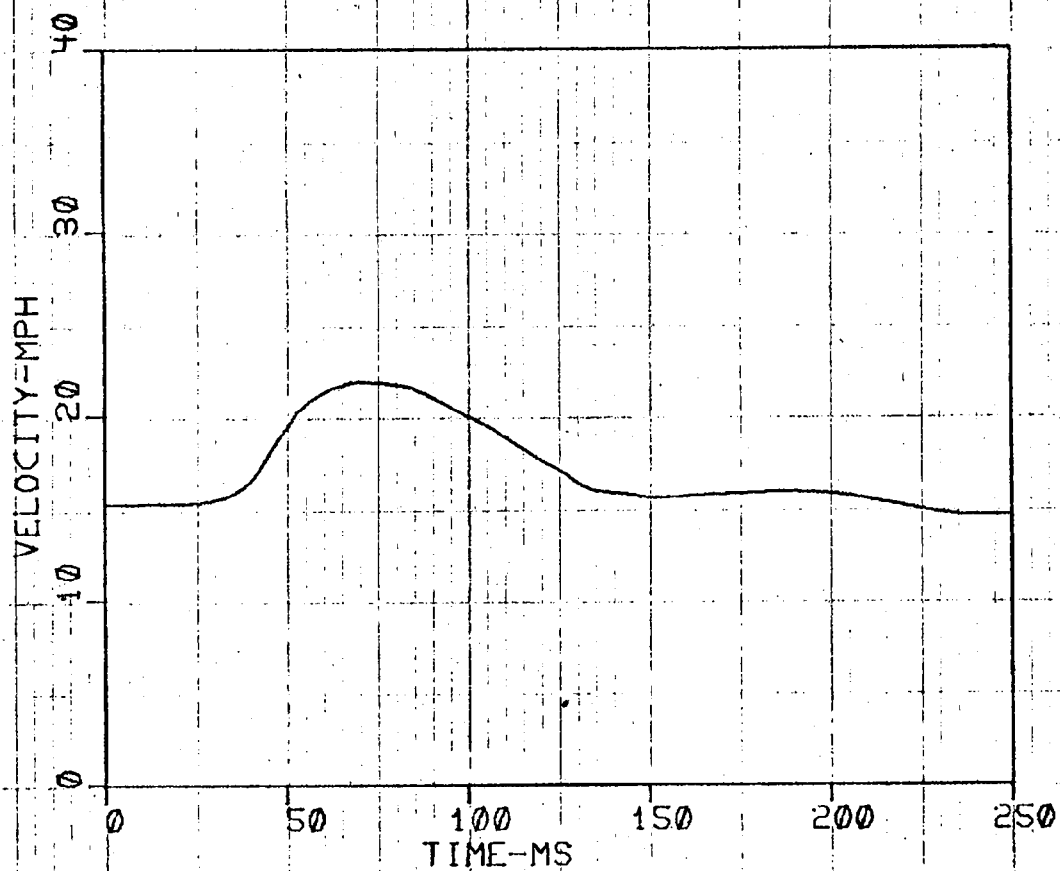


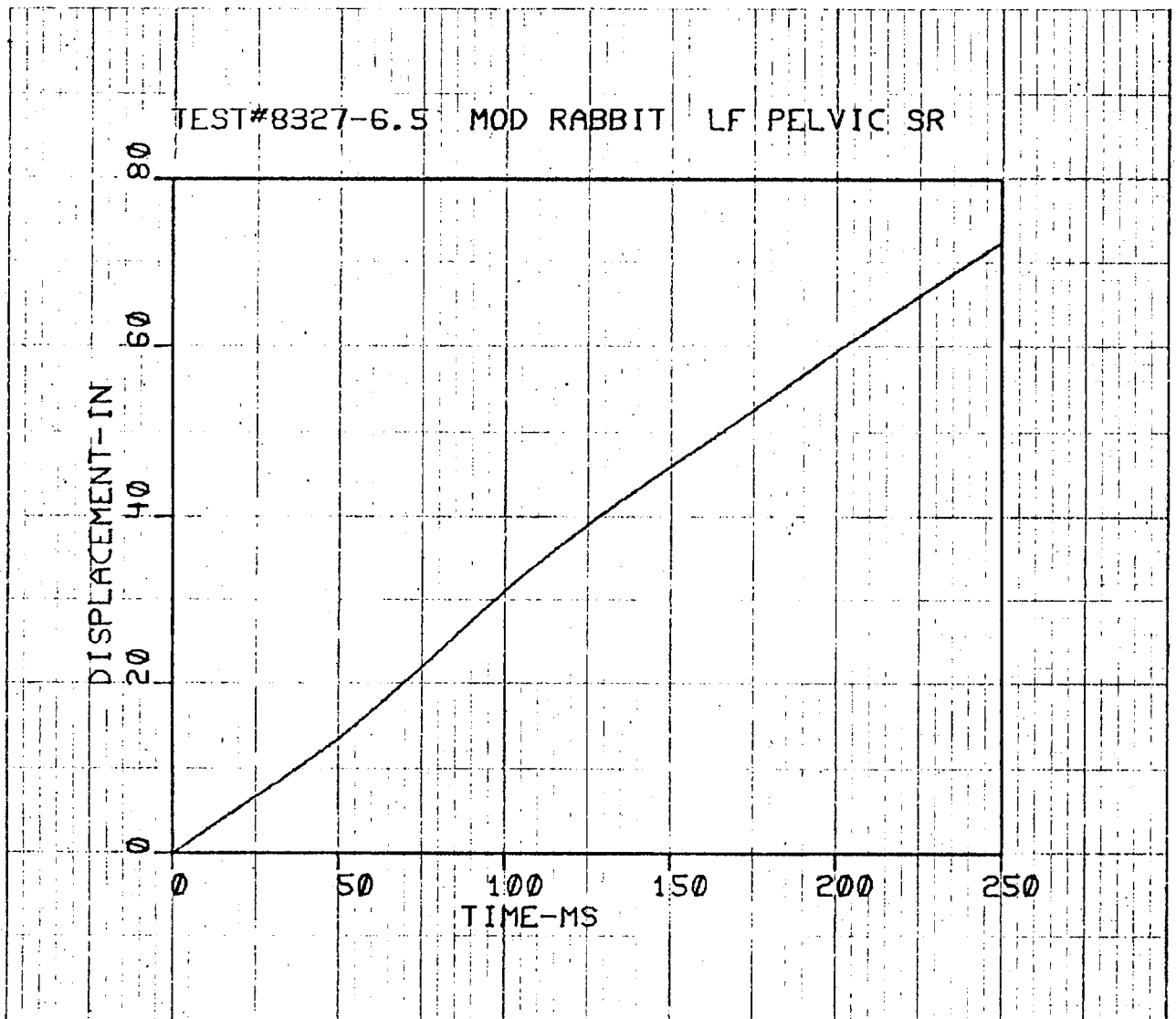


TEST#8327-6.5 MOD RABBIT LF PELVIC AR

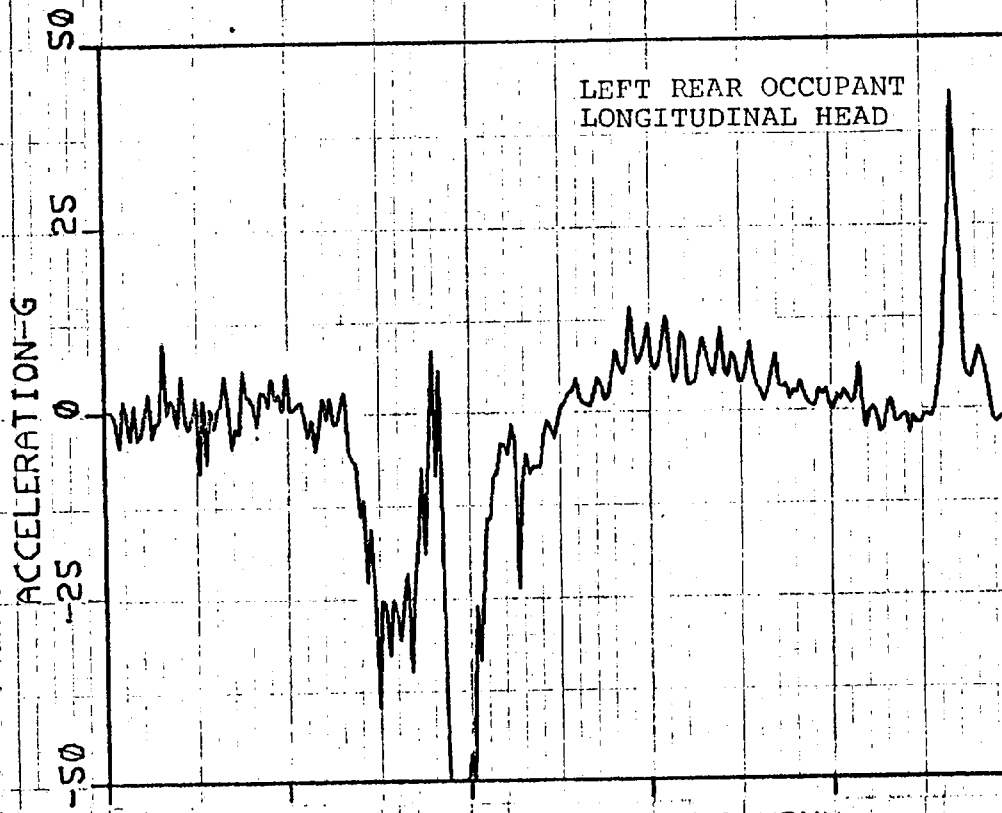


TEST#8327-6.5 MOD RABBIT LF PELVIC VR

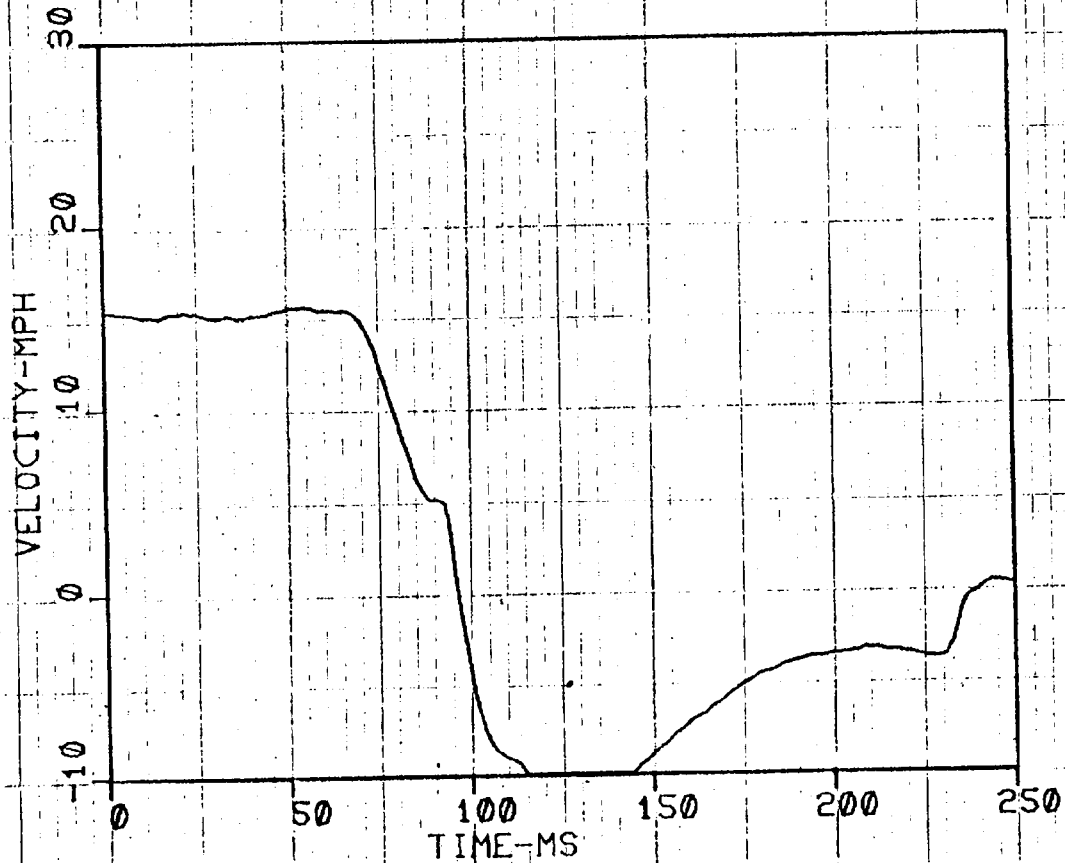


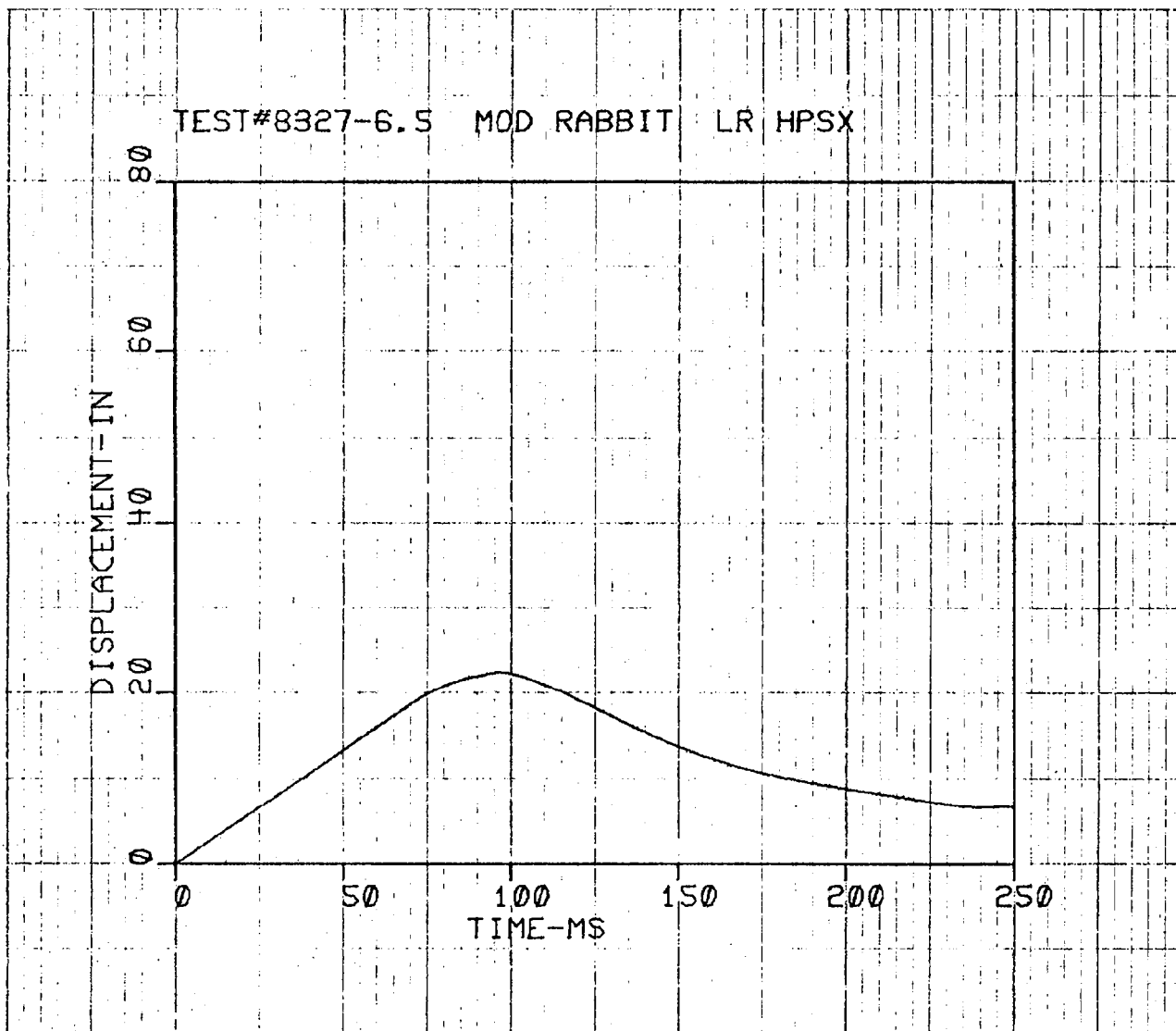


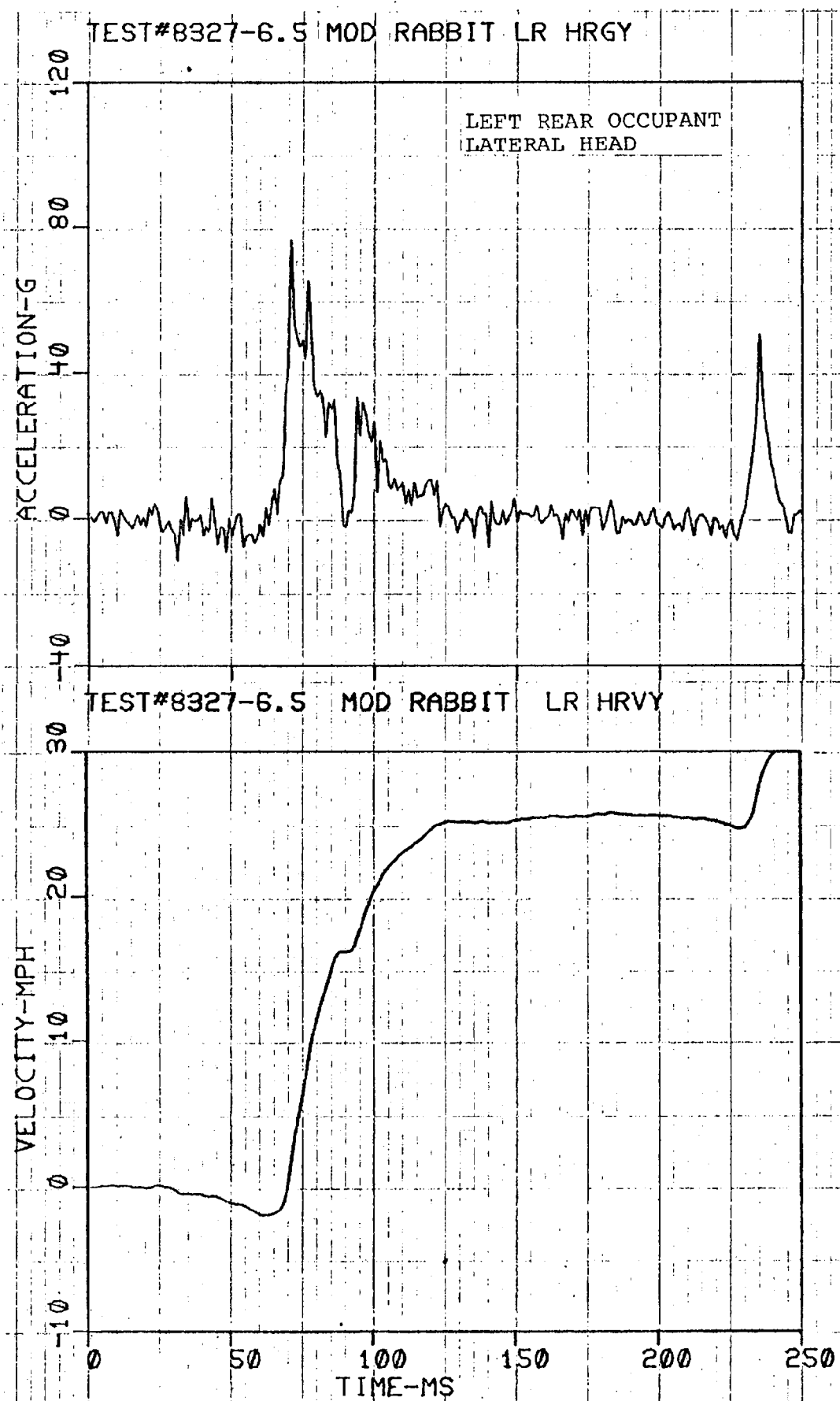
TEST#8327-6.5 MOD RABBIT LR HPGX

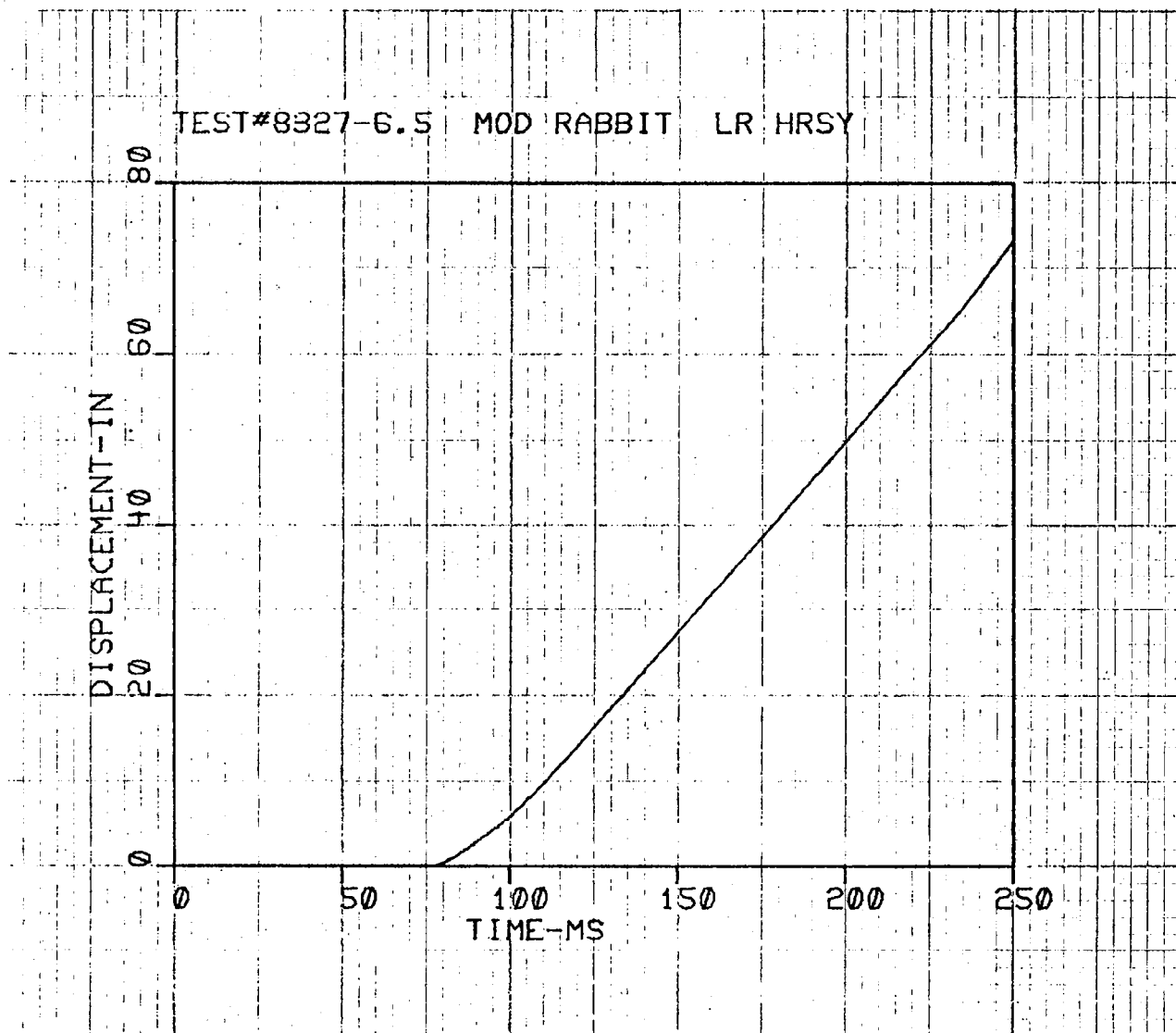


TEST#8327-6.5 MOD RABBIT LR HPVX

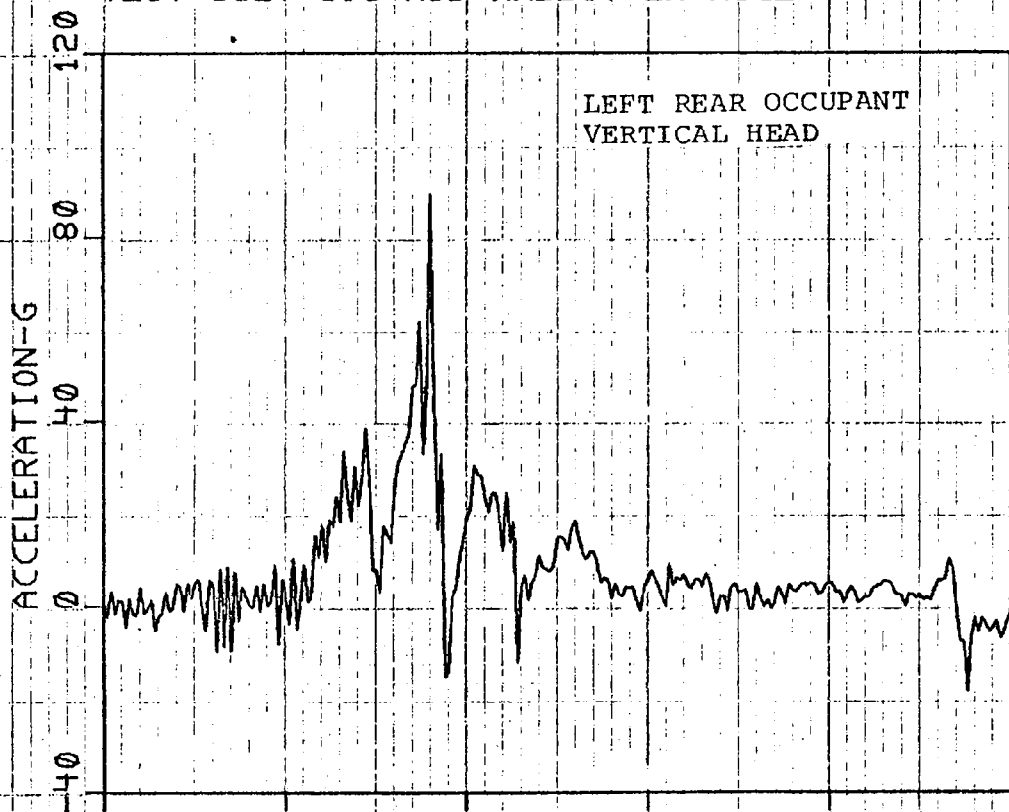




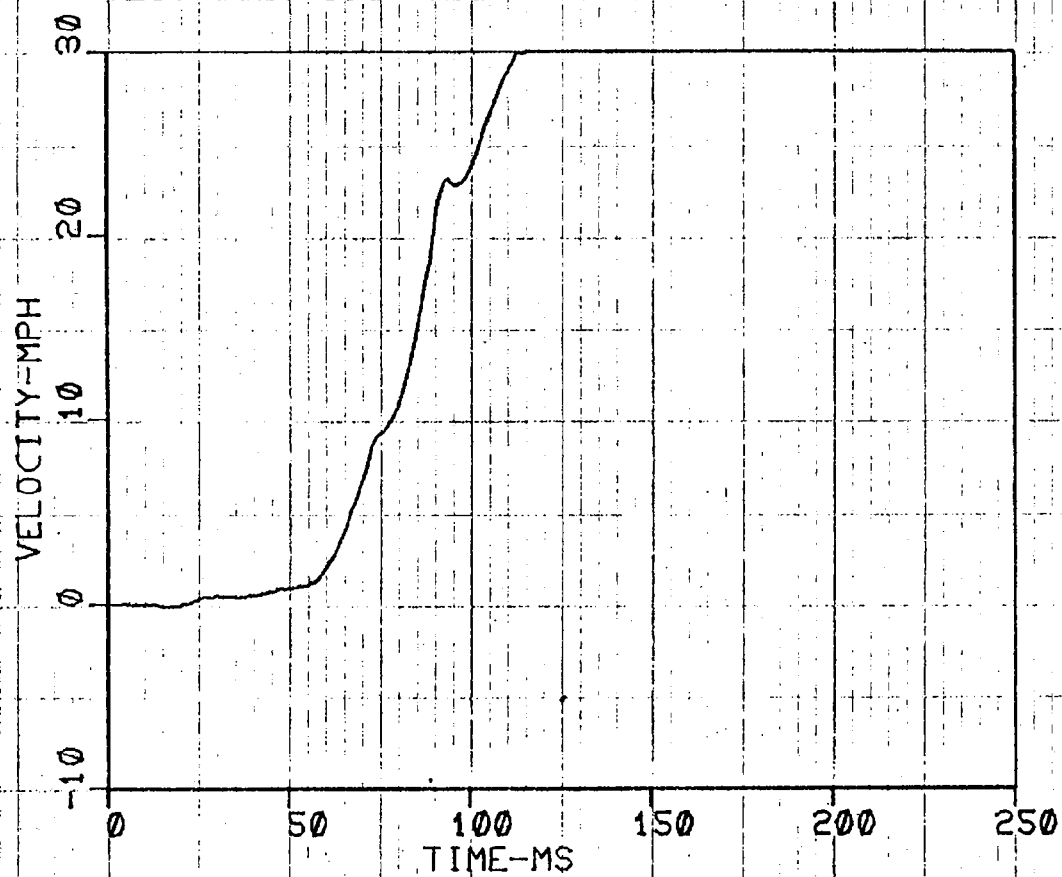


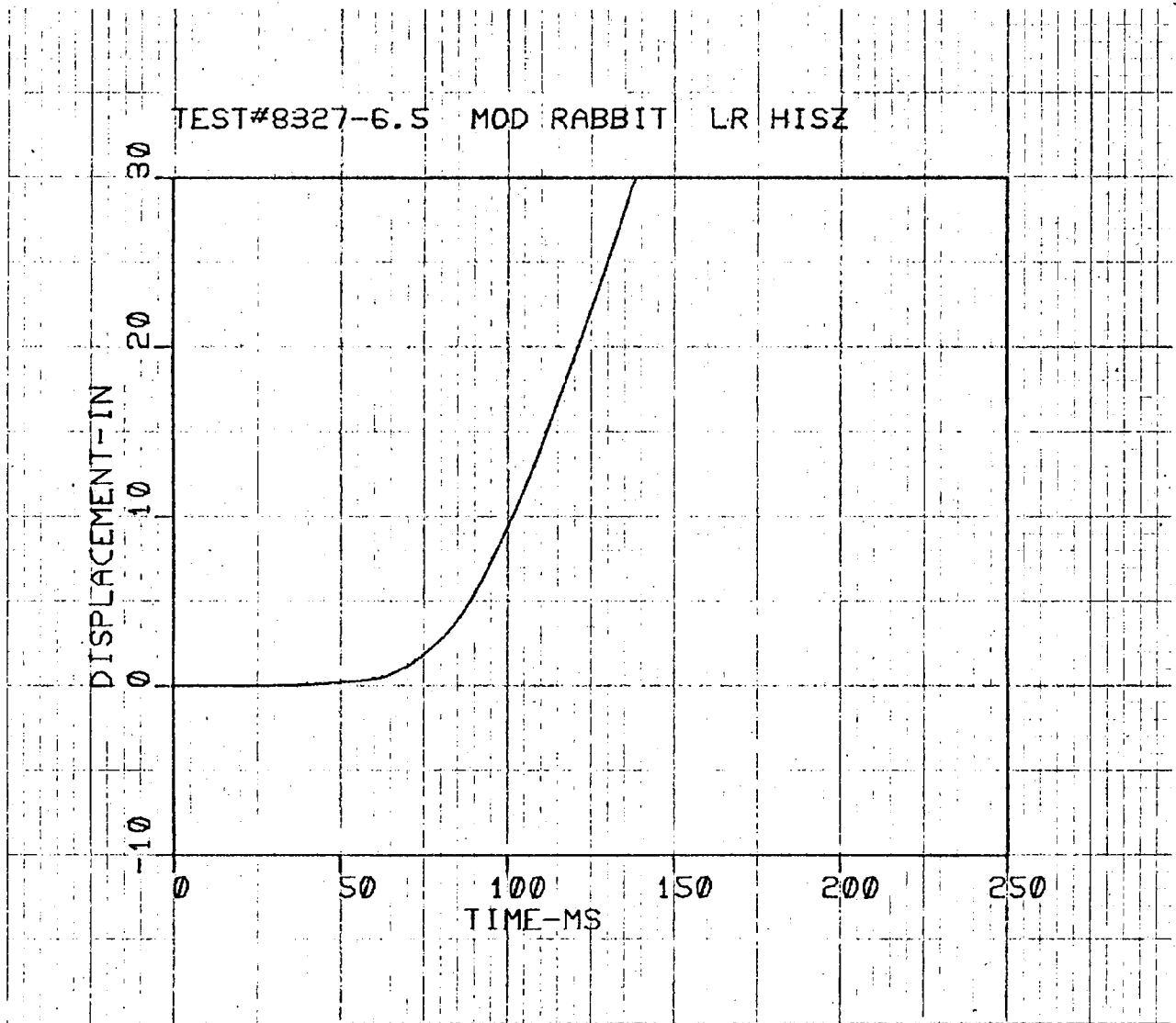


TEST#8327-6.5 MOD RABBIT LR HIGZ

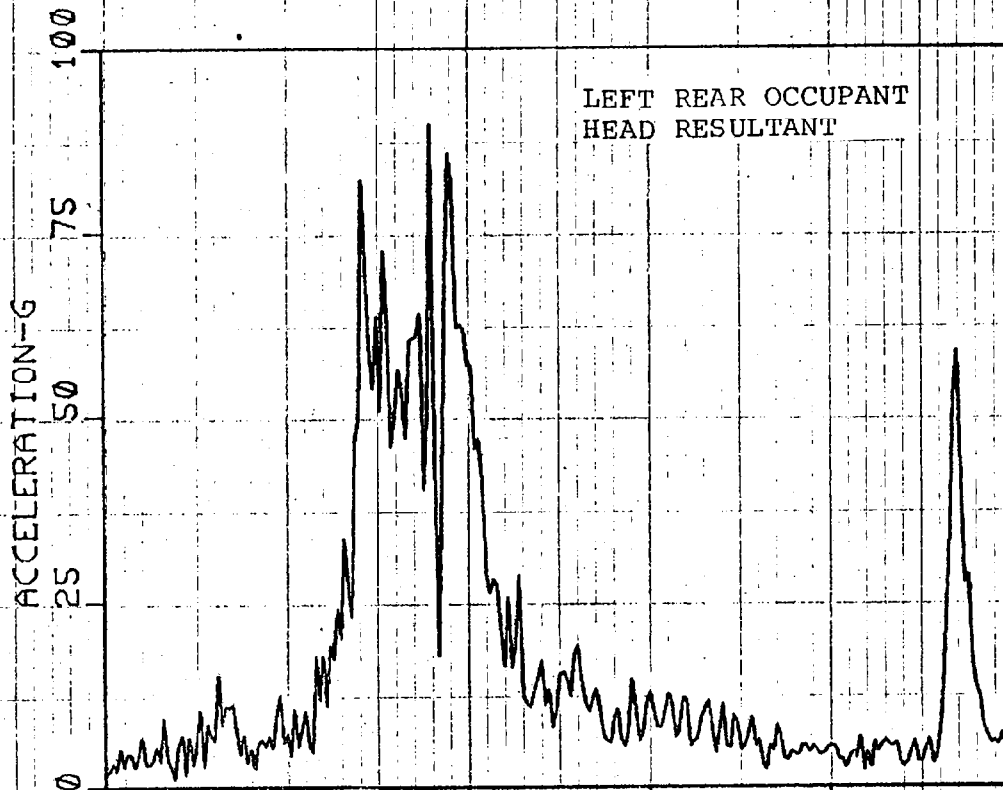


TEST#8327-6.5 MOD RABBIT LR HIVZ

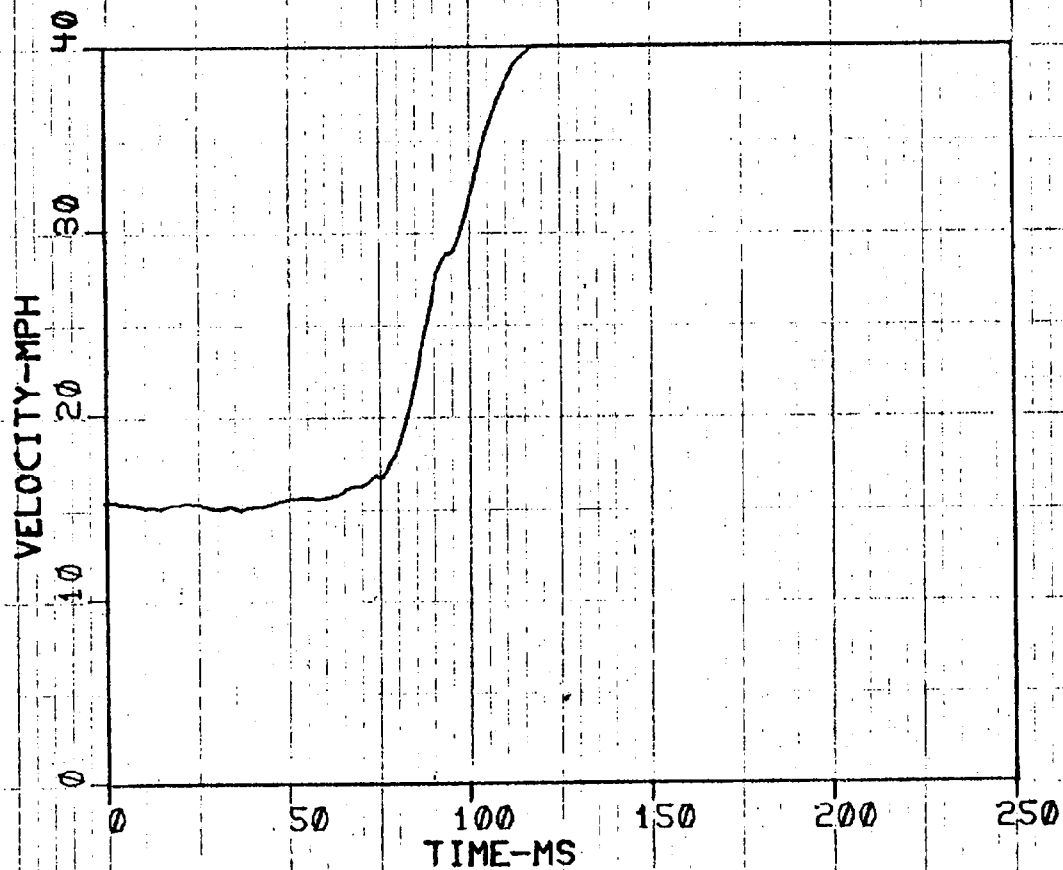


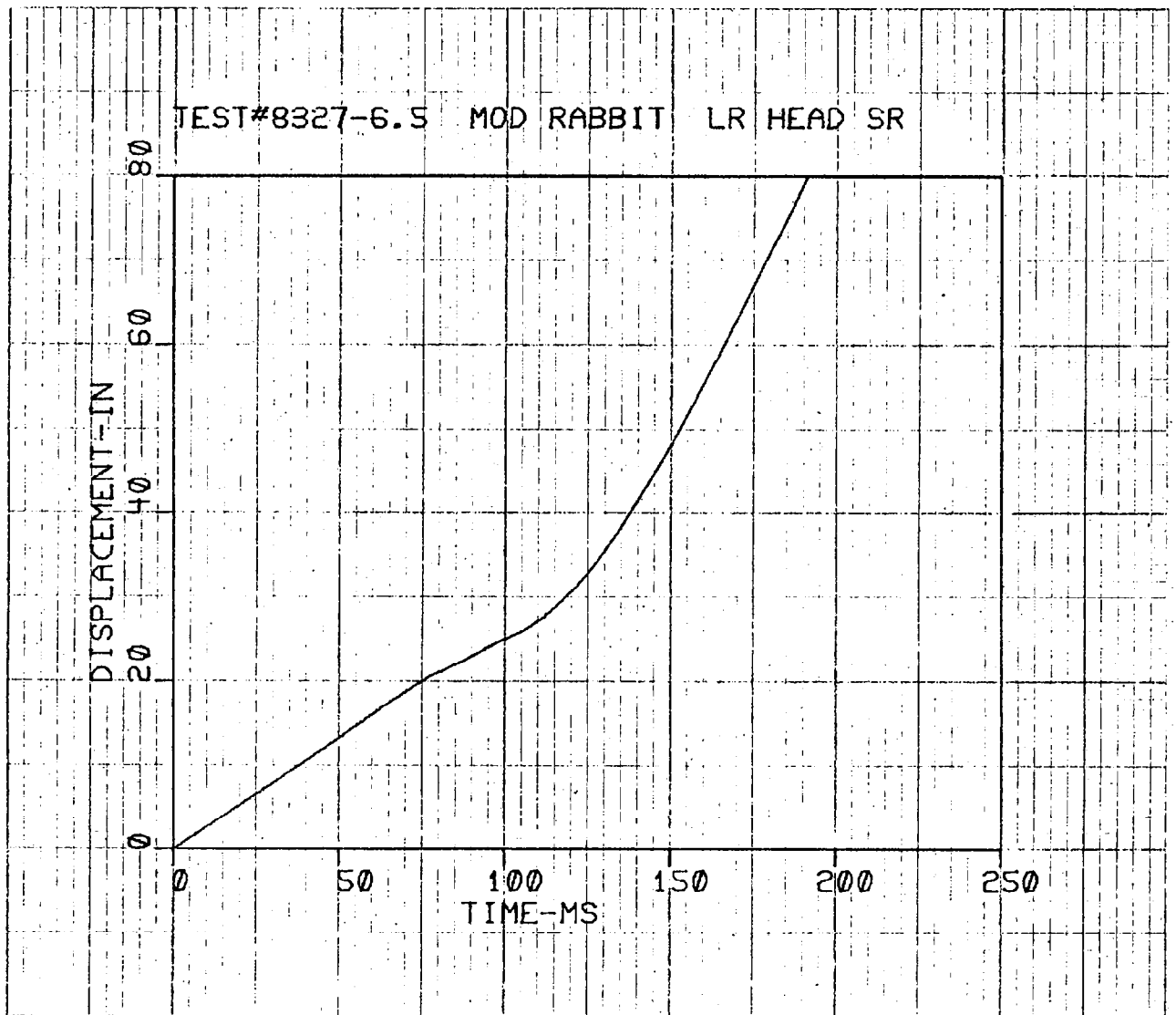


TEST#8327-6.5 MOD RABBIT LR HEAD AR

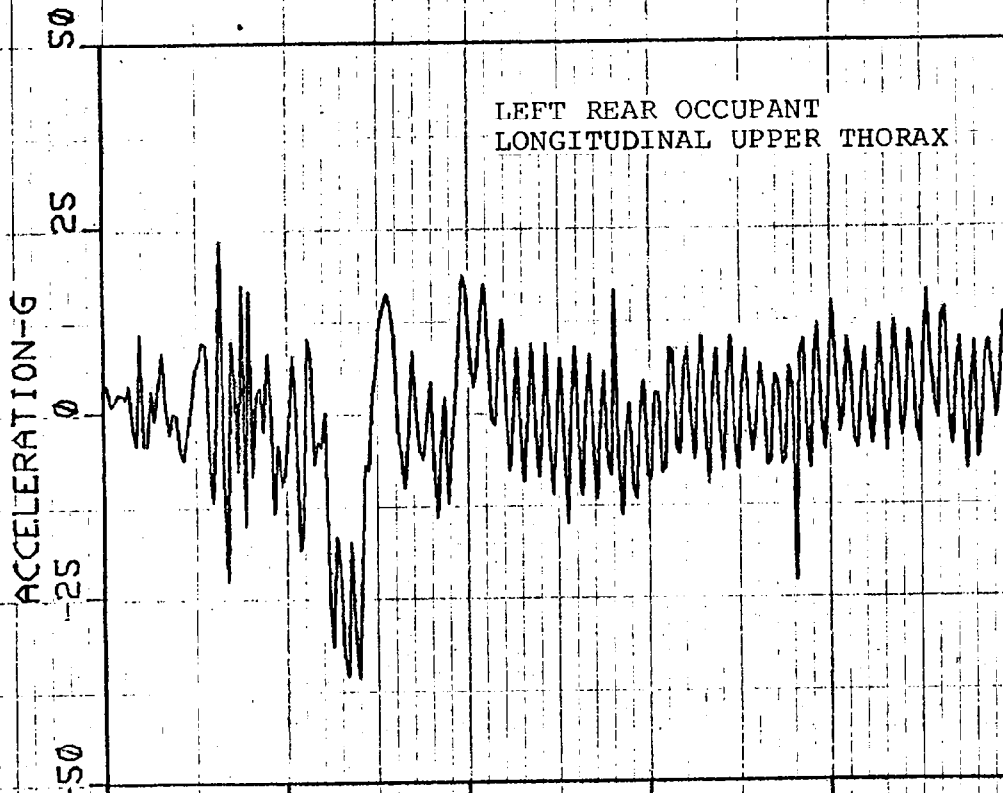


TEST#8327-6.5 MOD RABBIT LR HEAD VR

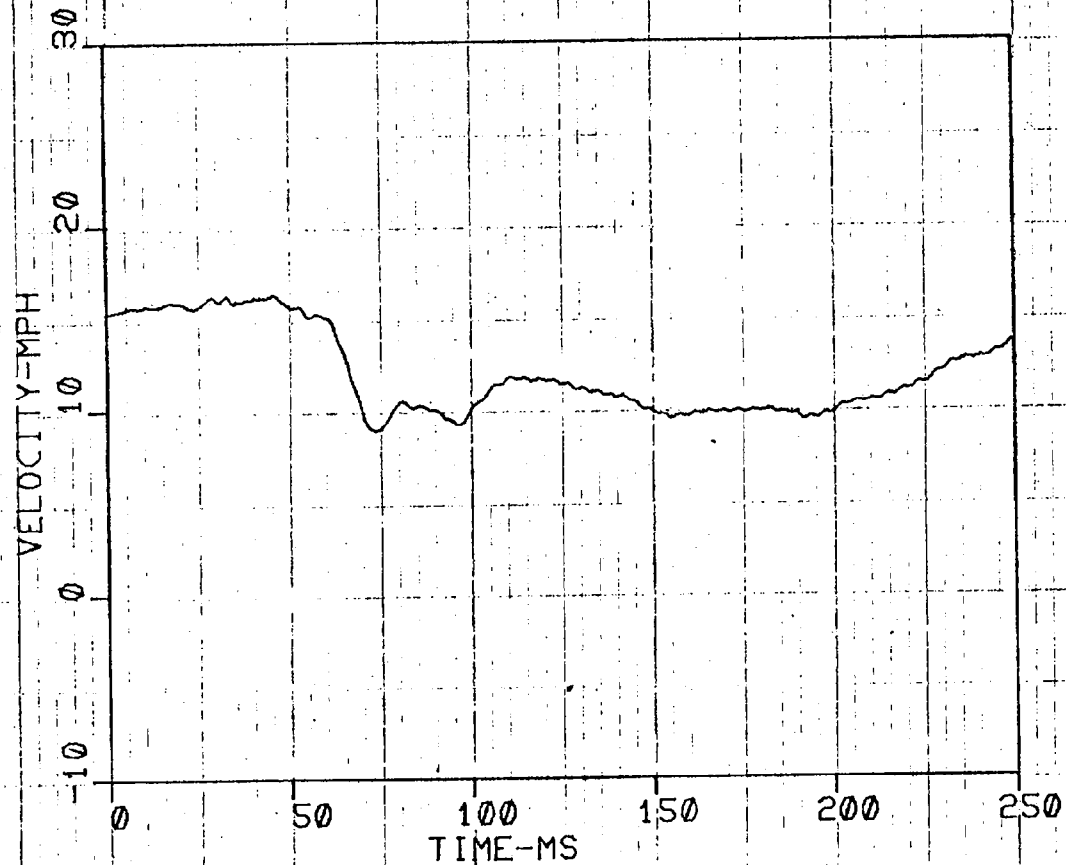


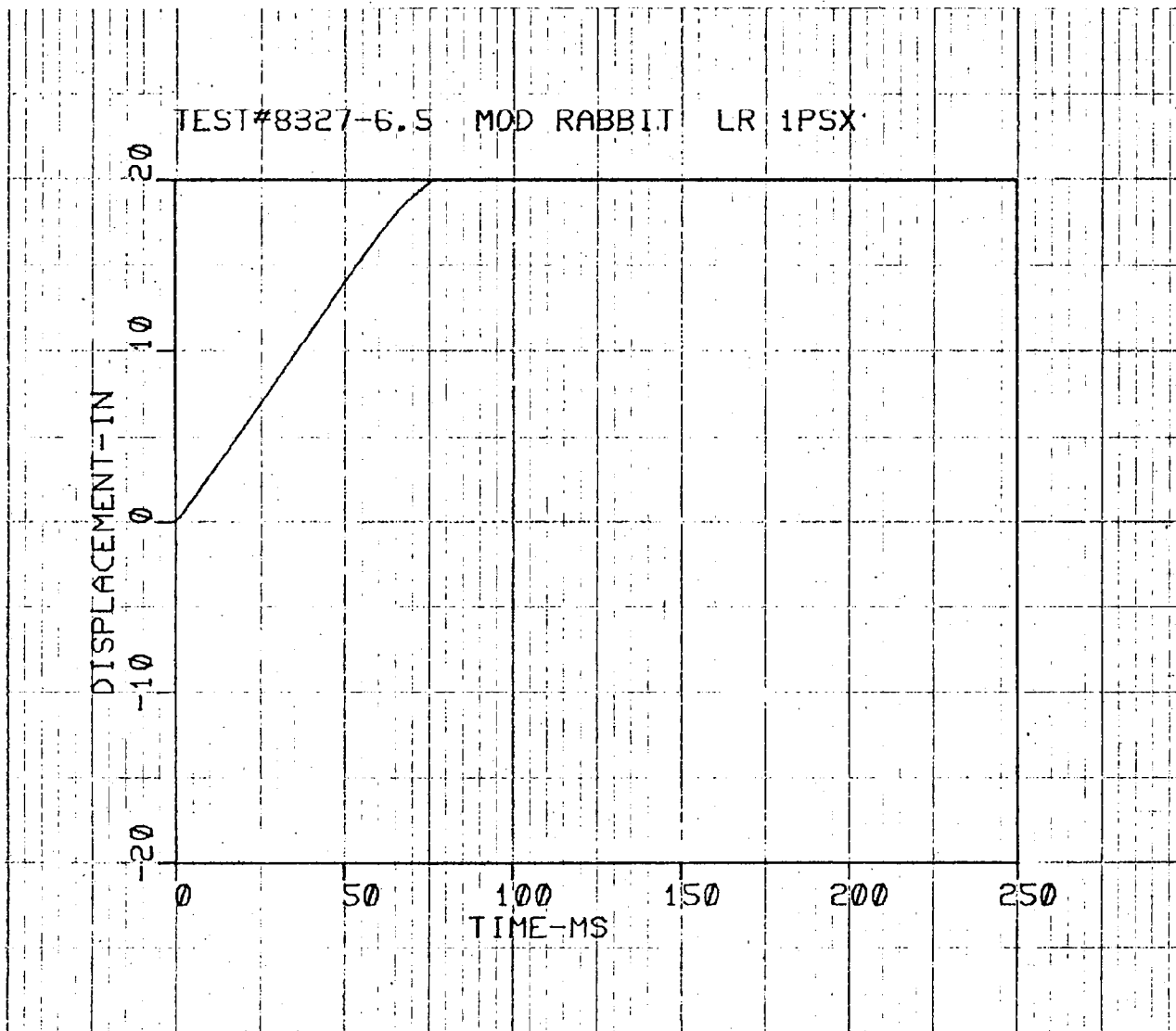


TEST#8327-6.5 MOD RABBIT LR 1PGX

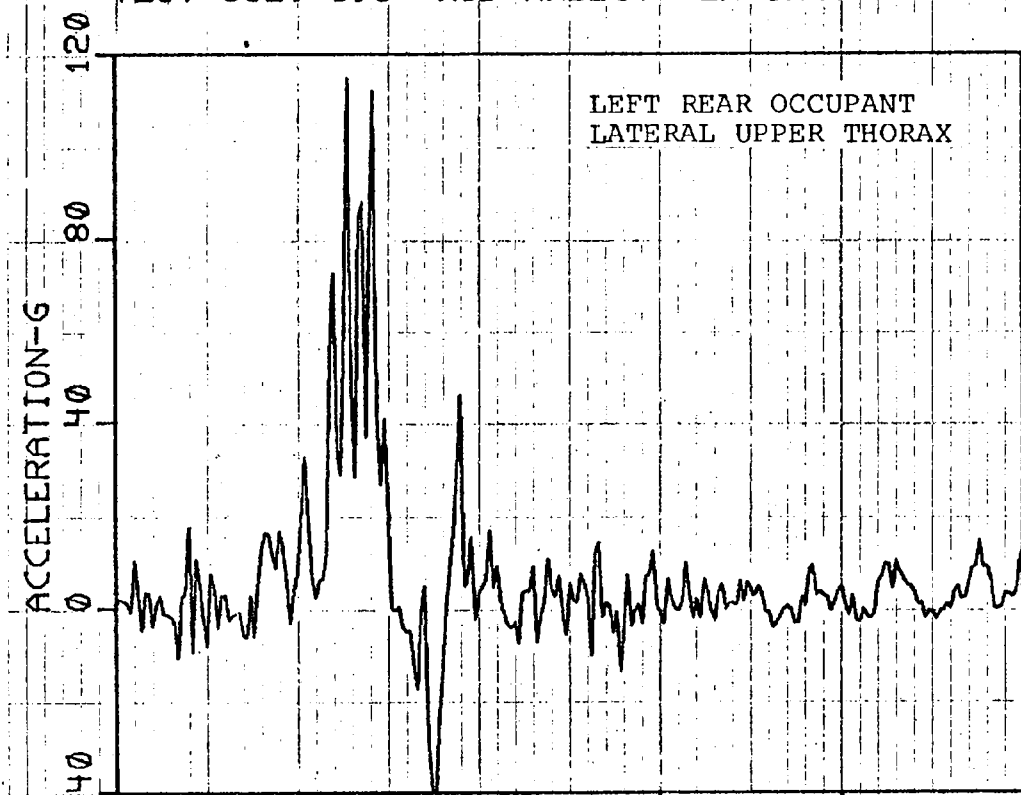


TEST#8327-6.5 MOD RABBIT LR 1PVX

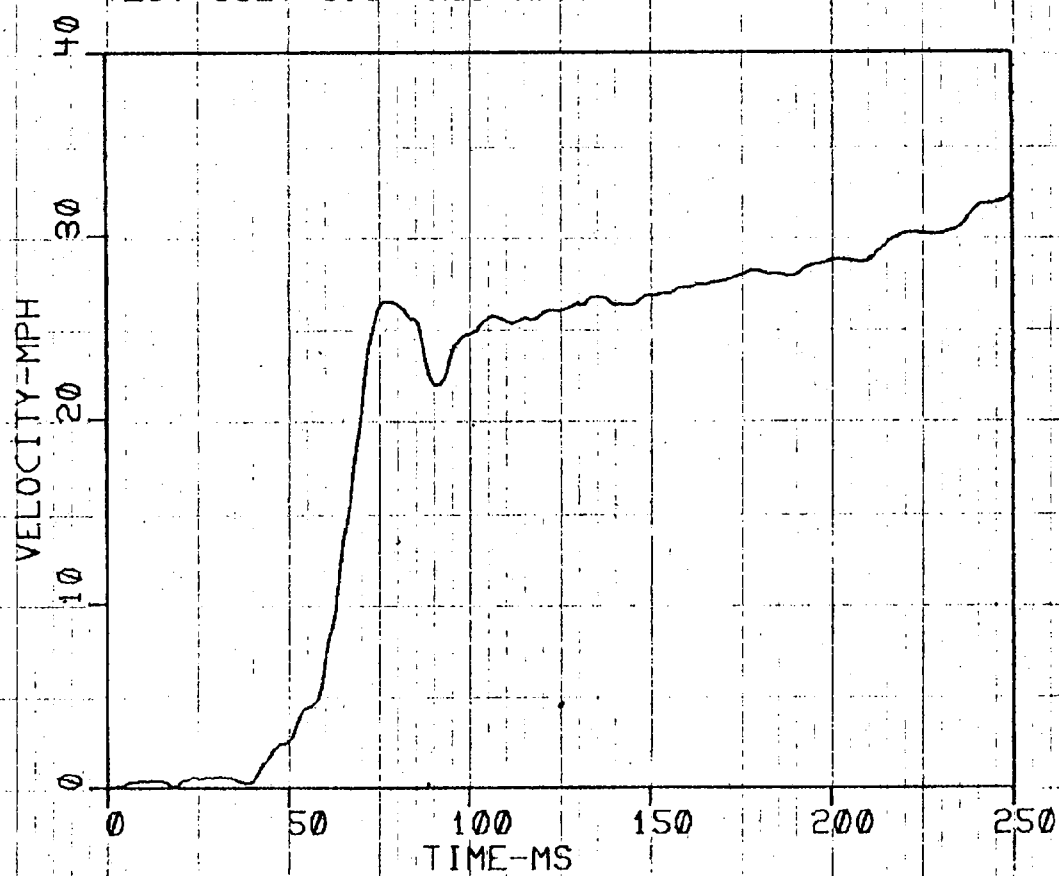


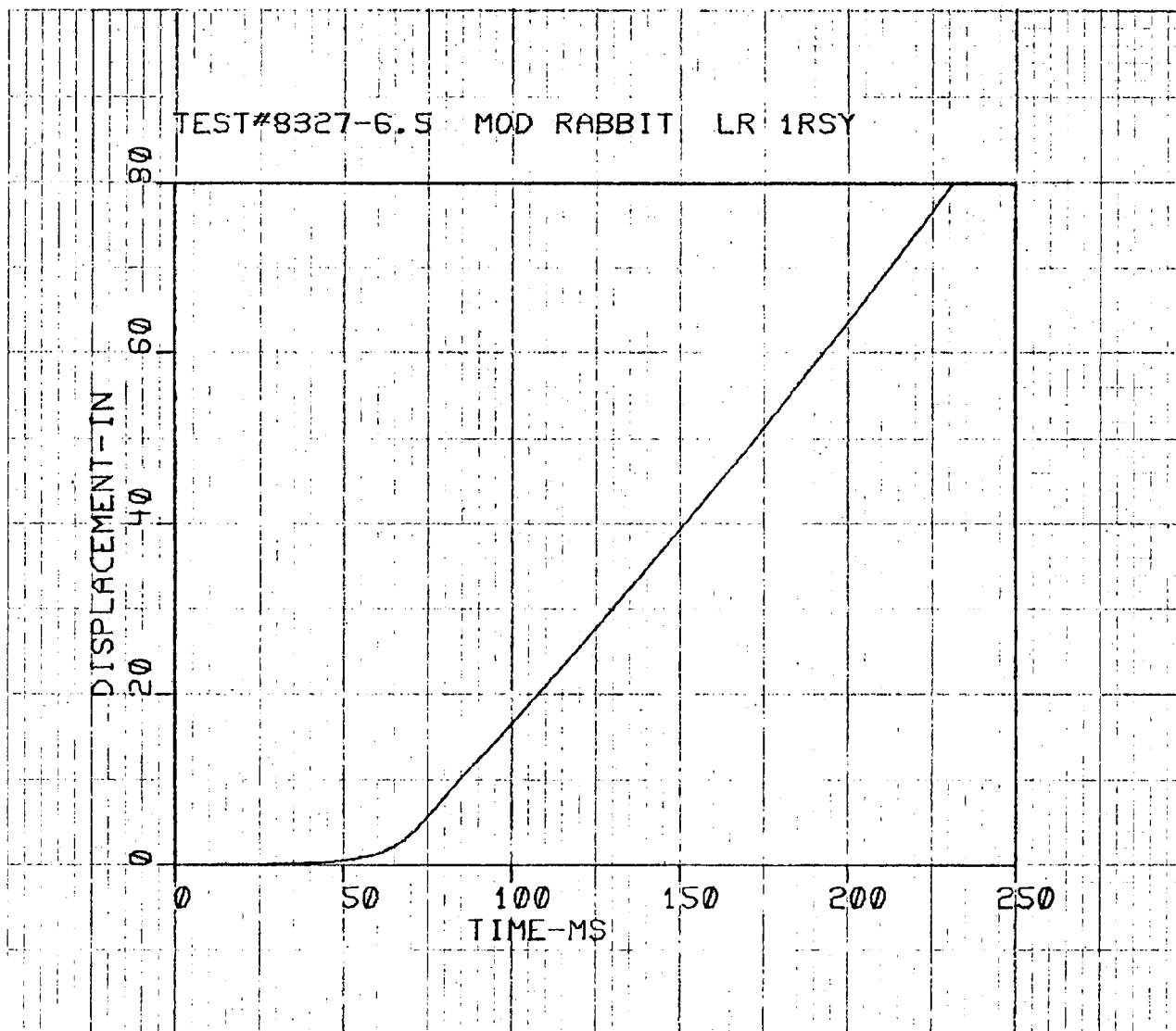


TEST#8327-6.5 MOD RABBIT LR 1RGY

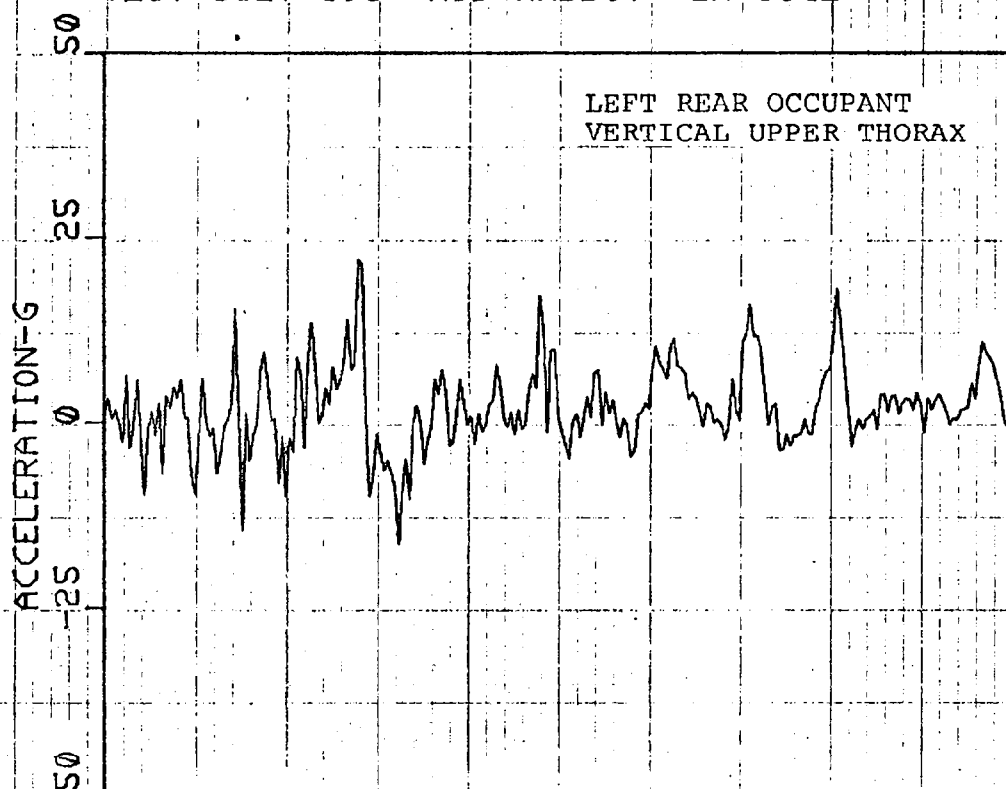


TEST#8327-6.5 MOD RABBIT LR 1RVY

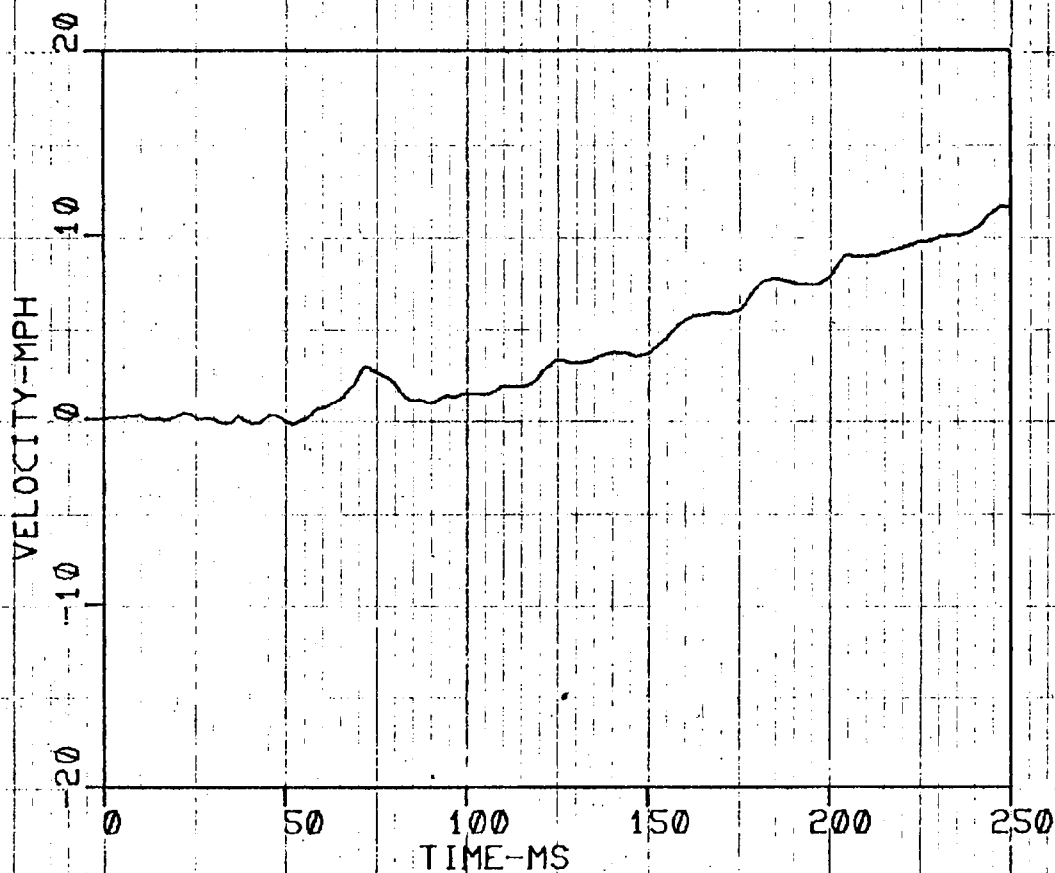


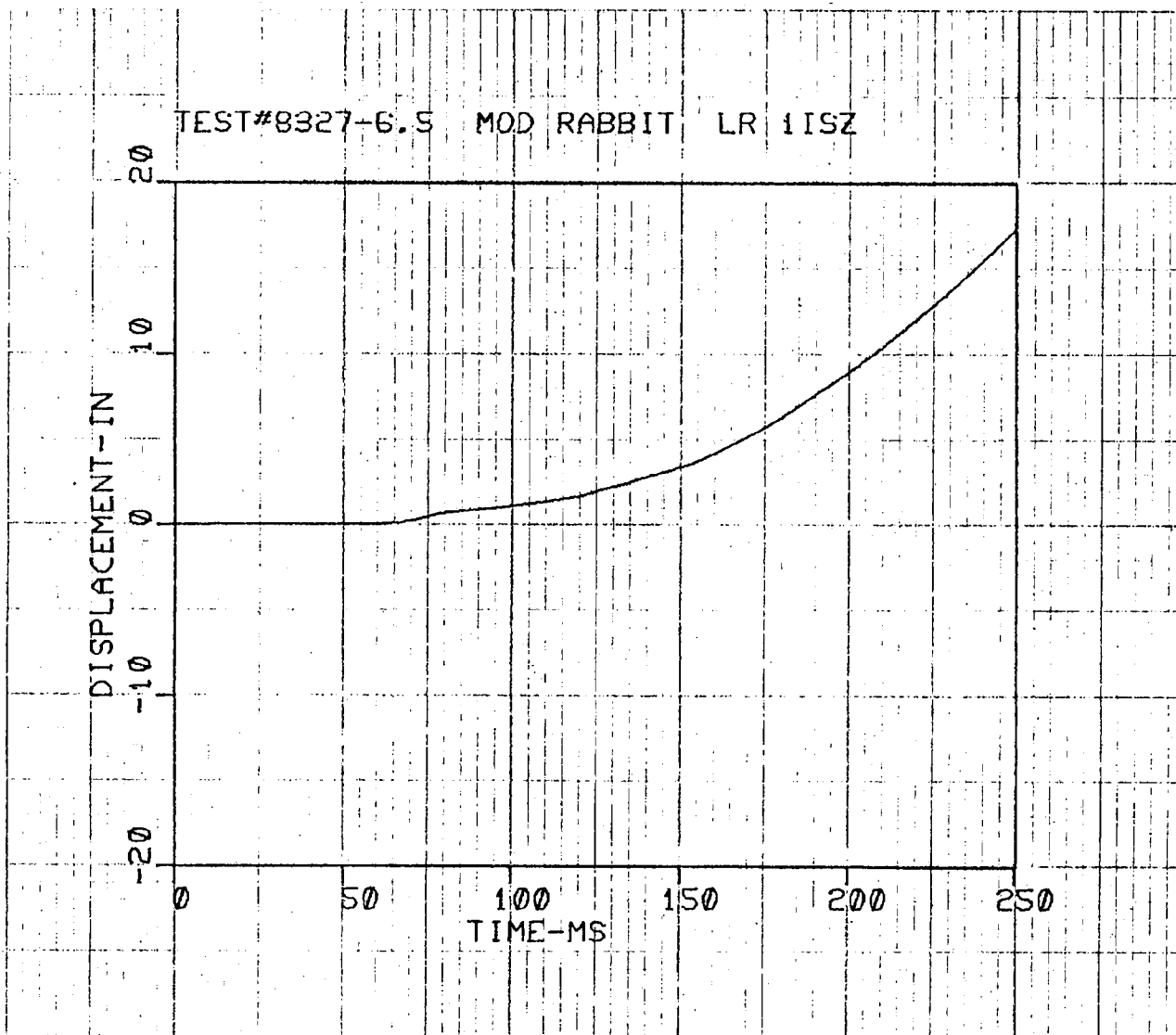


TEST#8327-6.5 MOD RABBIT LR 1IGZ

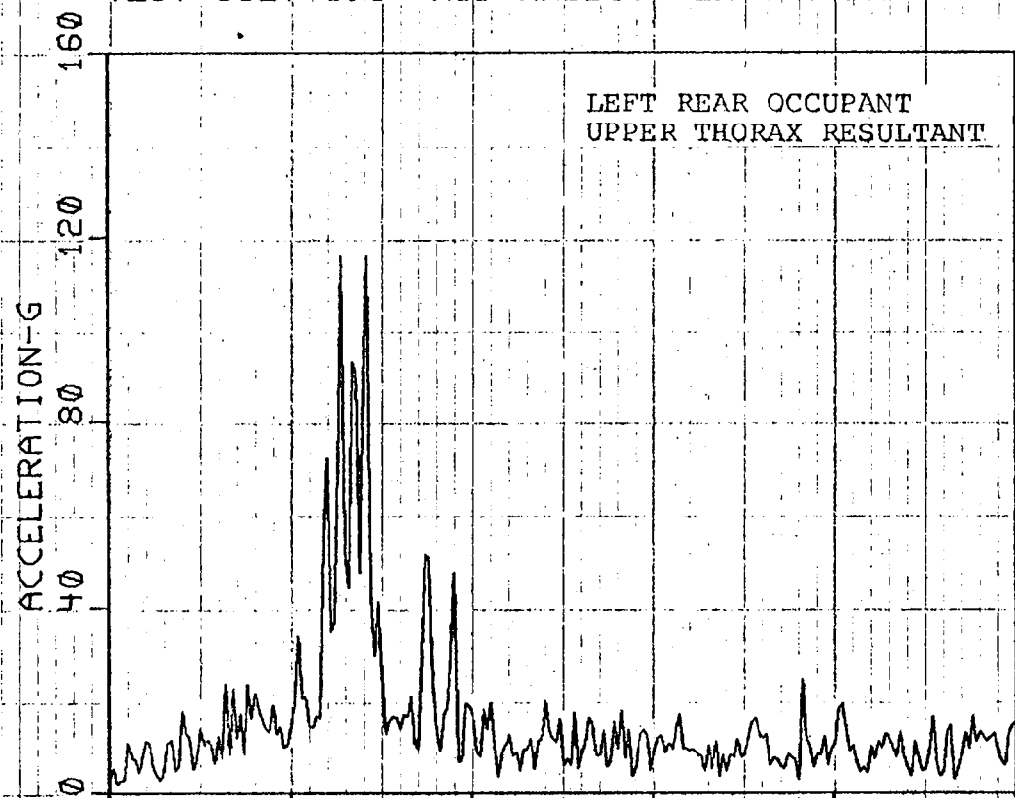


TEST#8327-6.5 MOD RABBIT LR 1IVZ

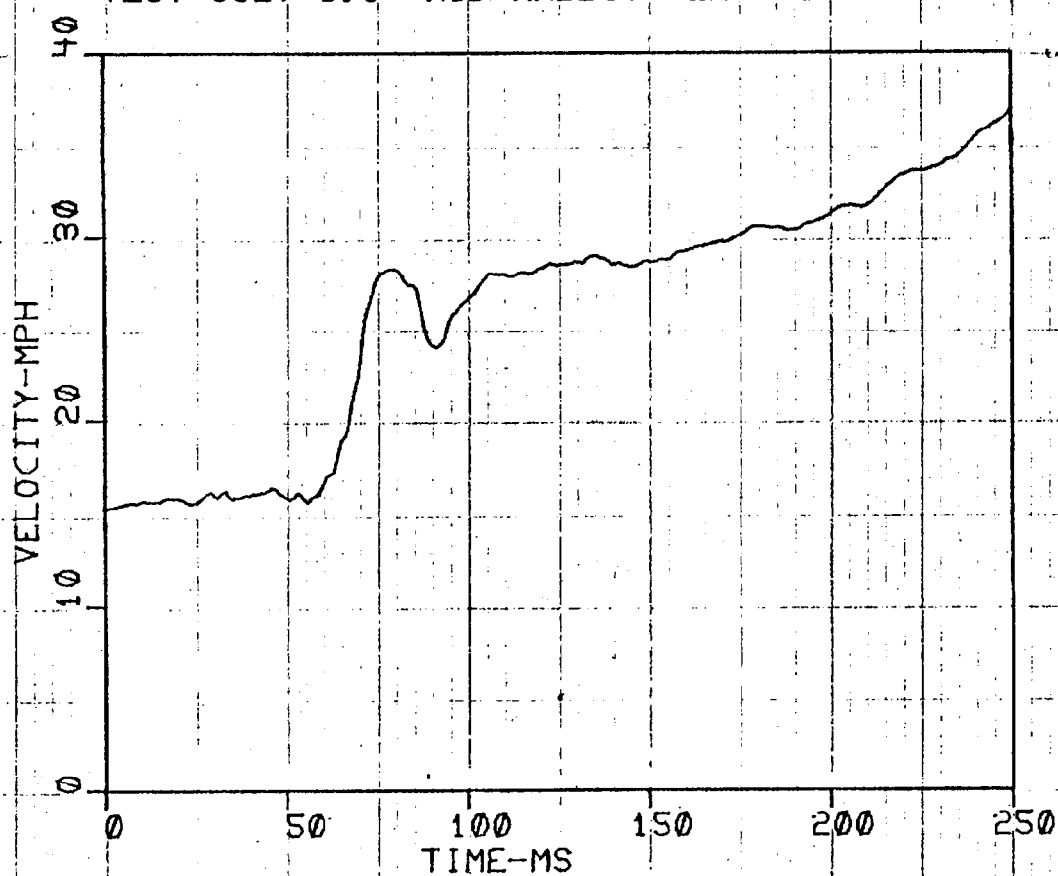


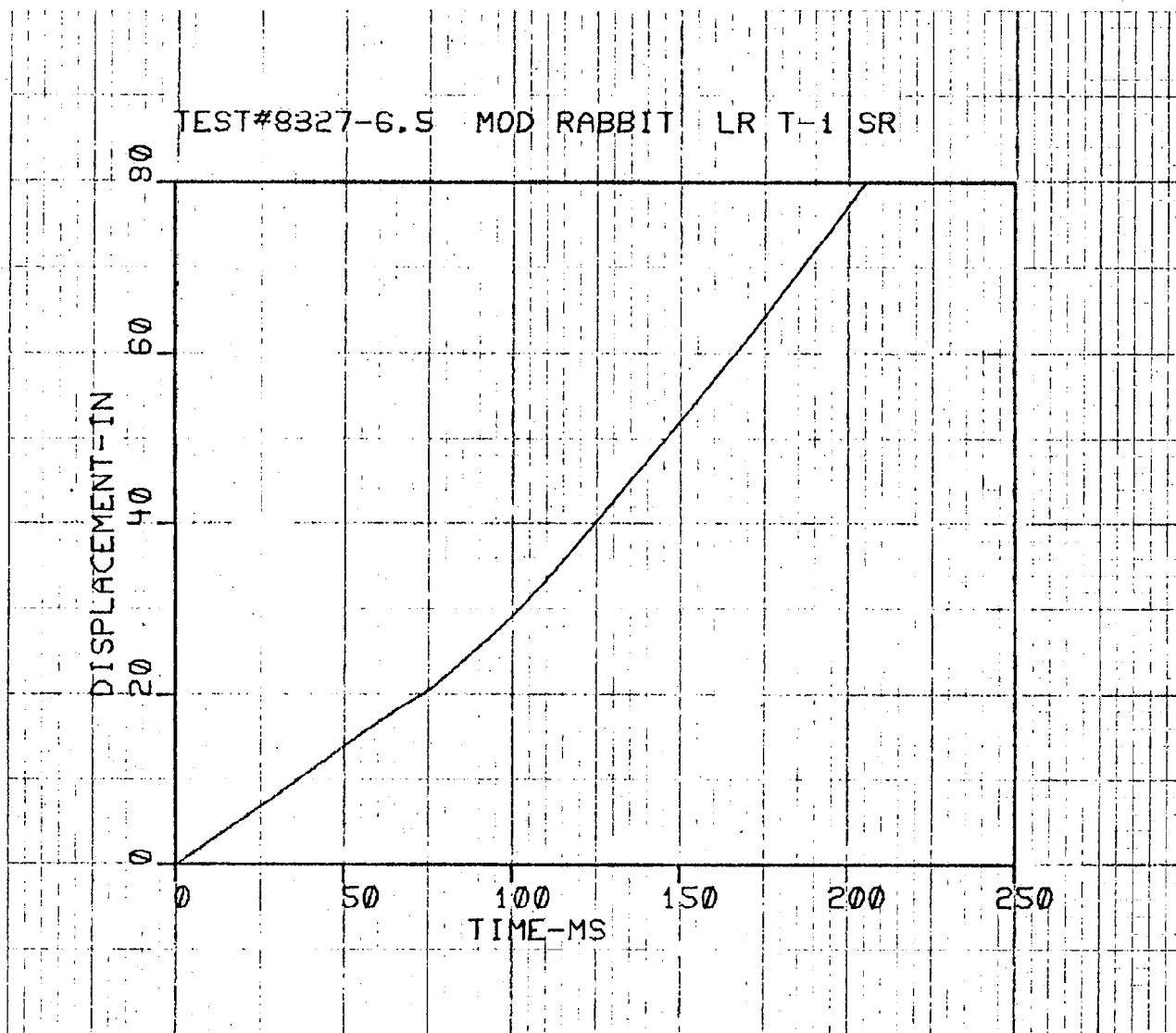


TEST#8327-6.5 MOD RABBIT LR T-1 AR

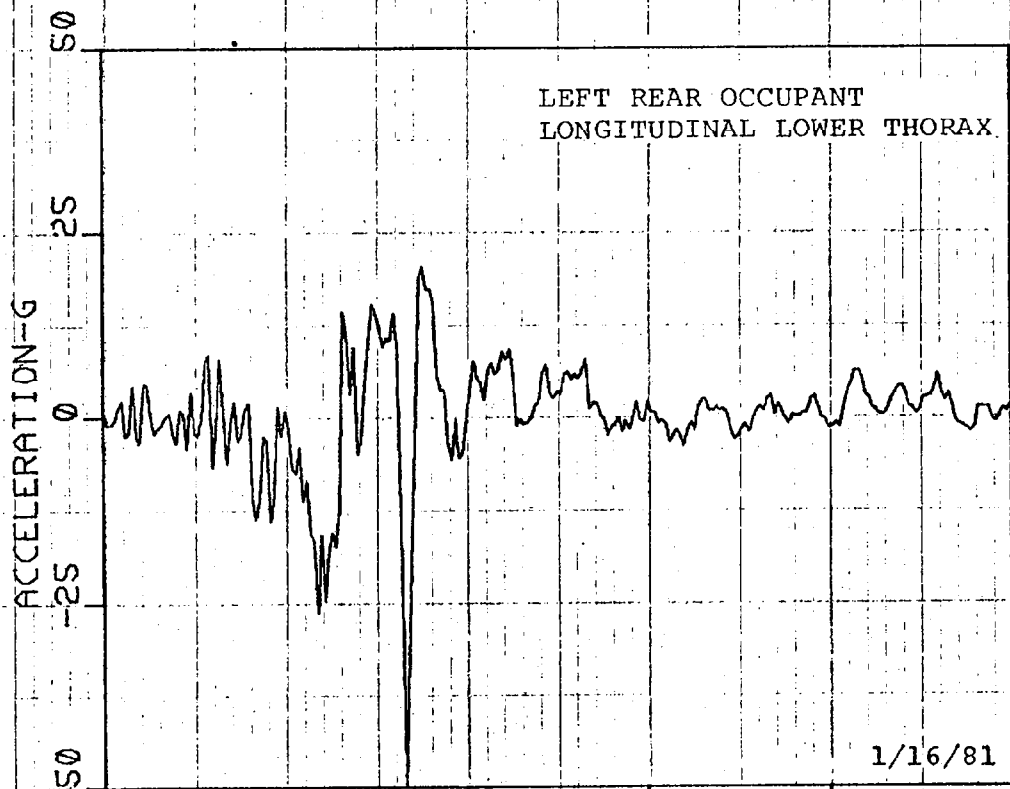


TEST#8327-6.5 MOD RABBIT LR T-1 VR

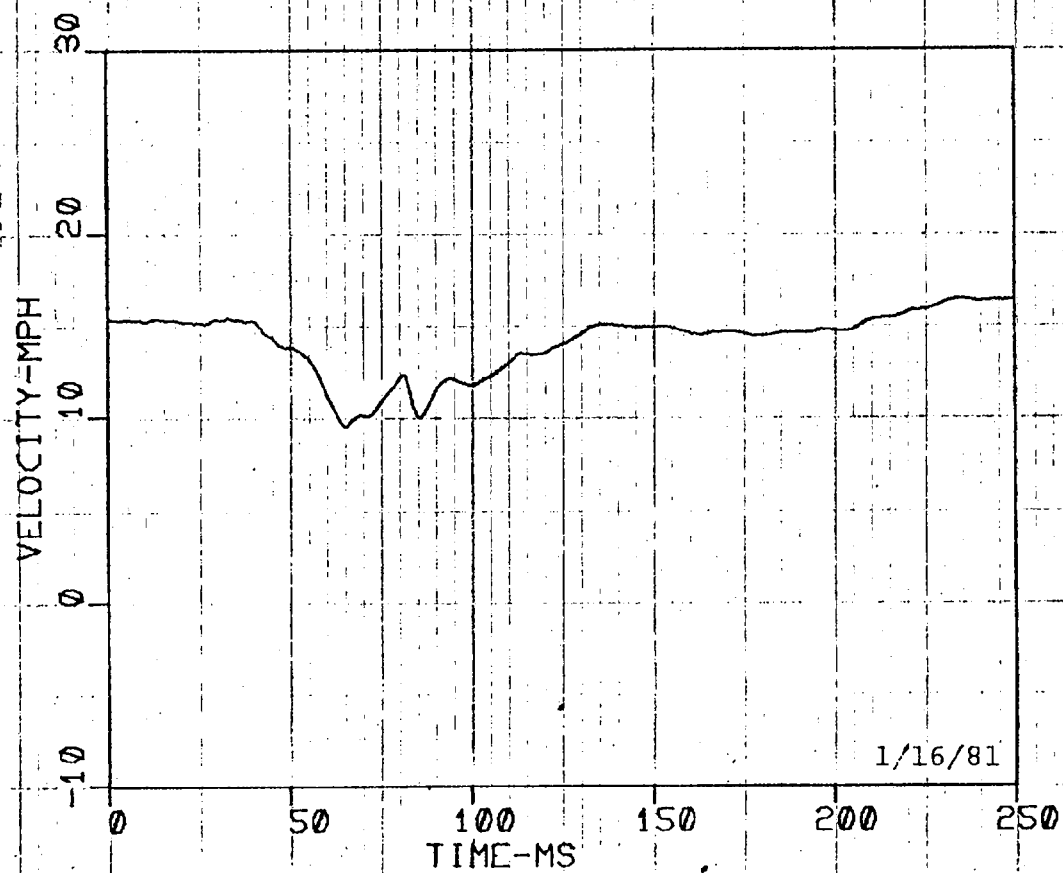


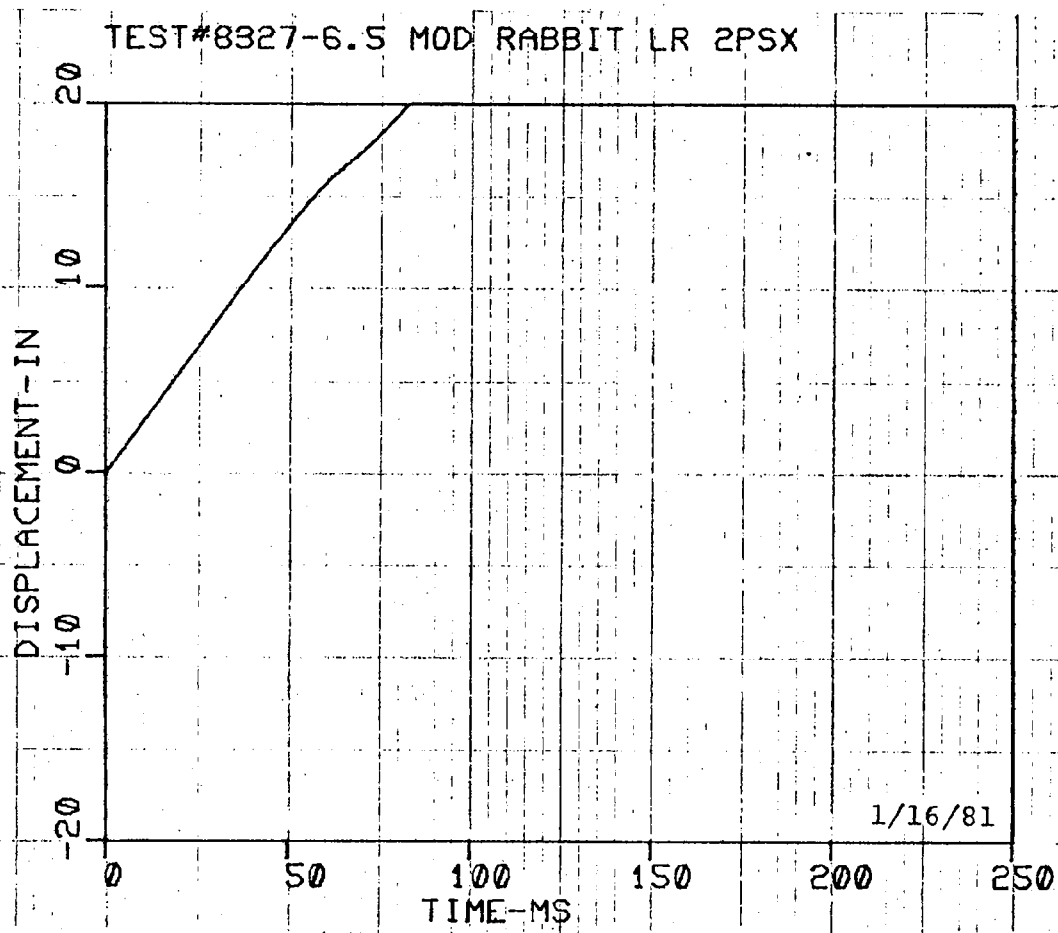


TEST#8327-6.5 MOD RABBIT LR 2PGX

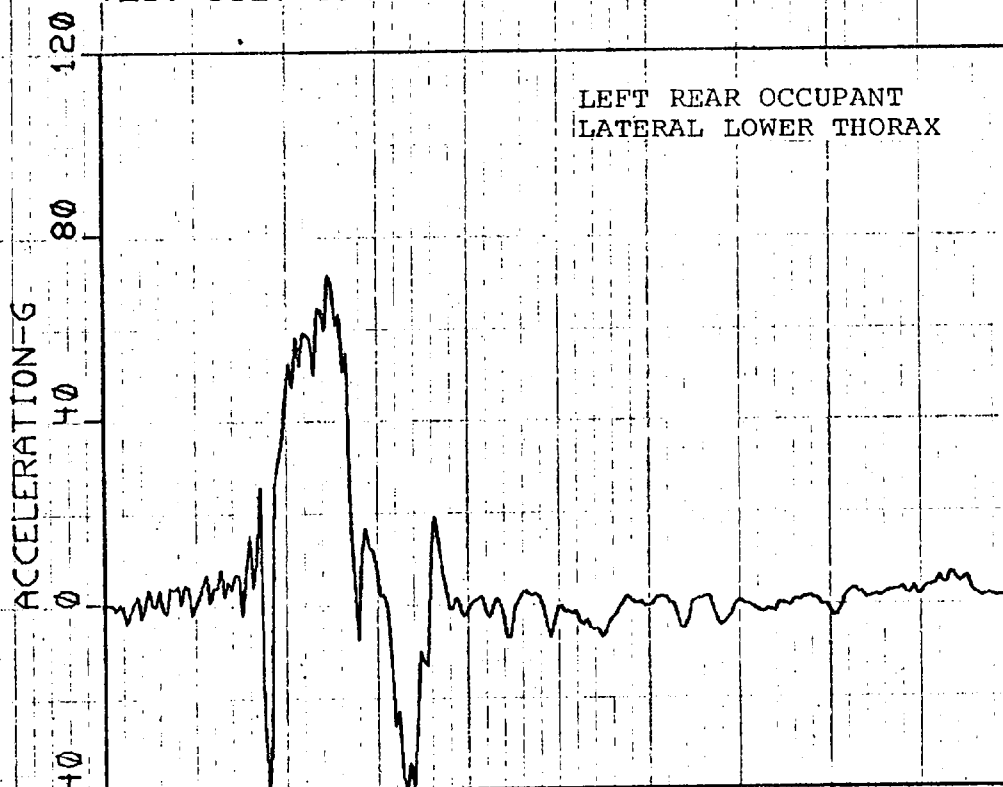


TEST#8327-6.5 MOD RABBIT LR 2PVX

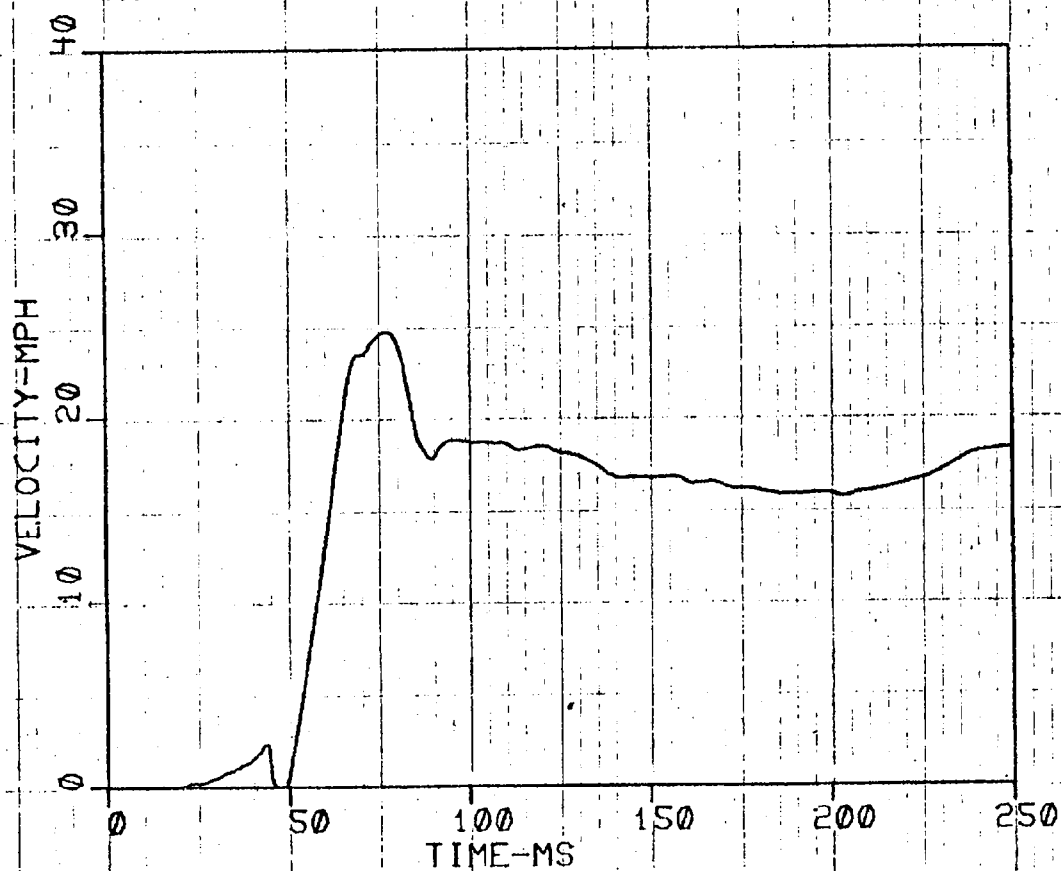


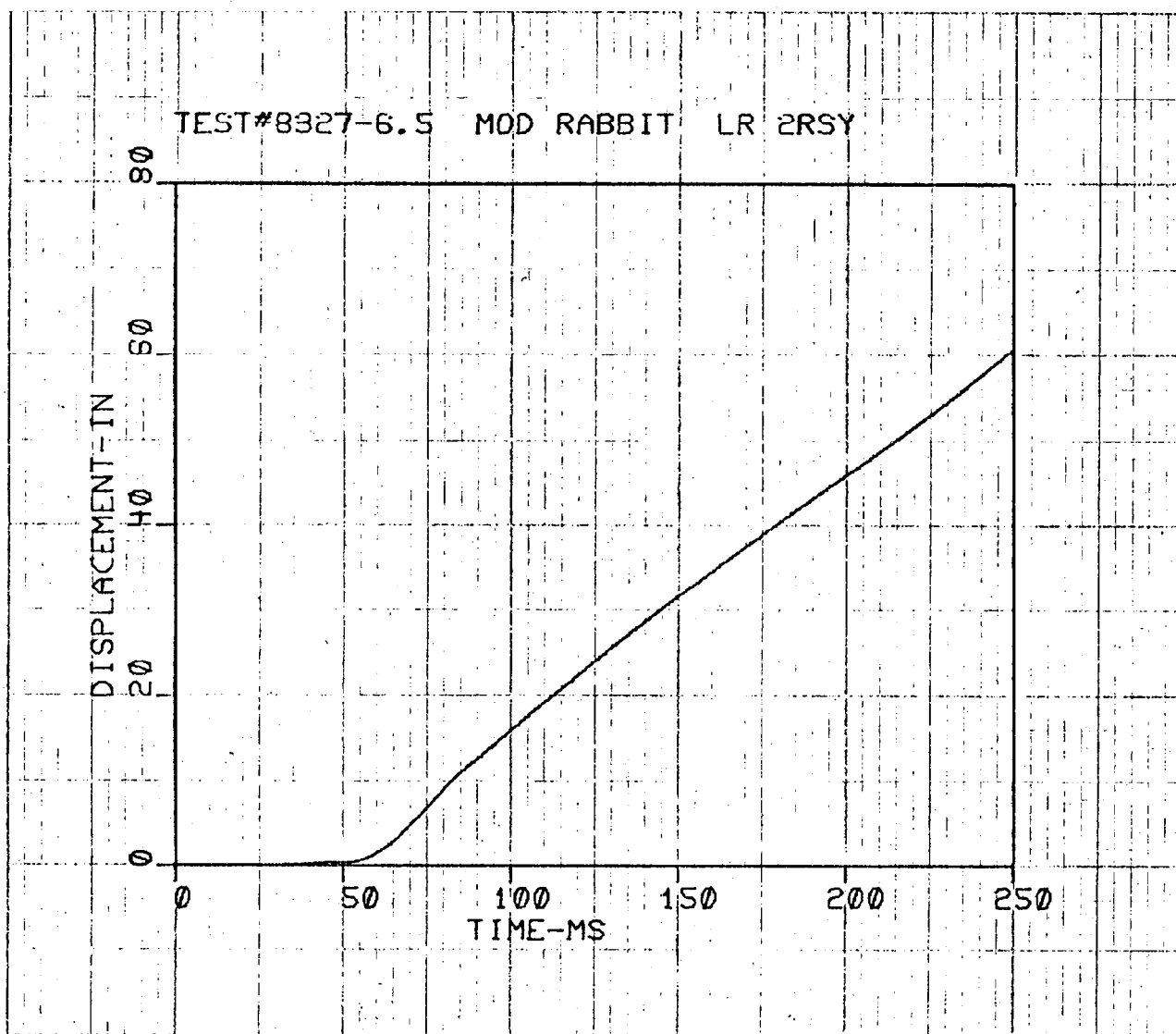


TEST#8327-6.5 MOD RABBIT LR 2RGY

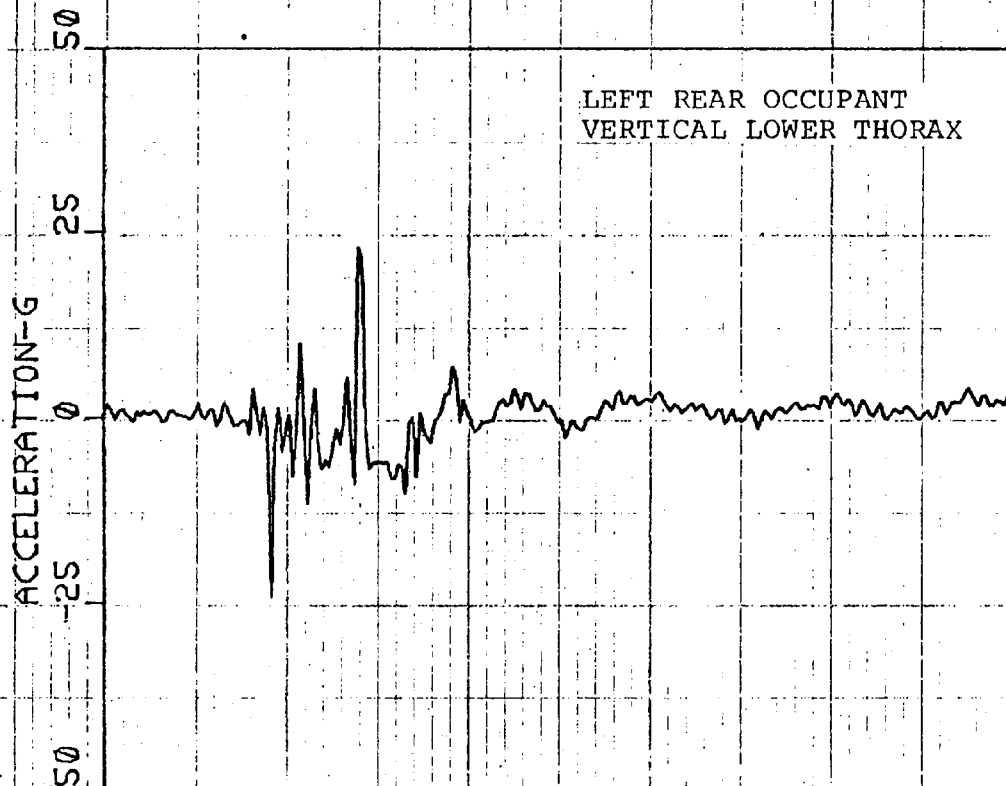


TEST#8327-6.5 MOD RABBIT LR 2RVY

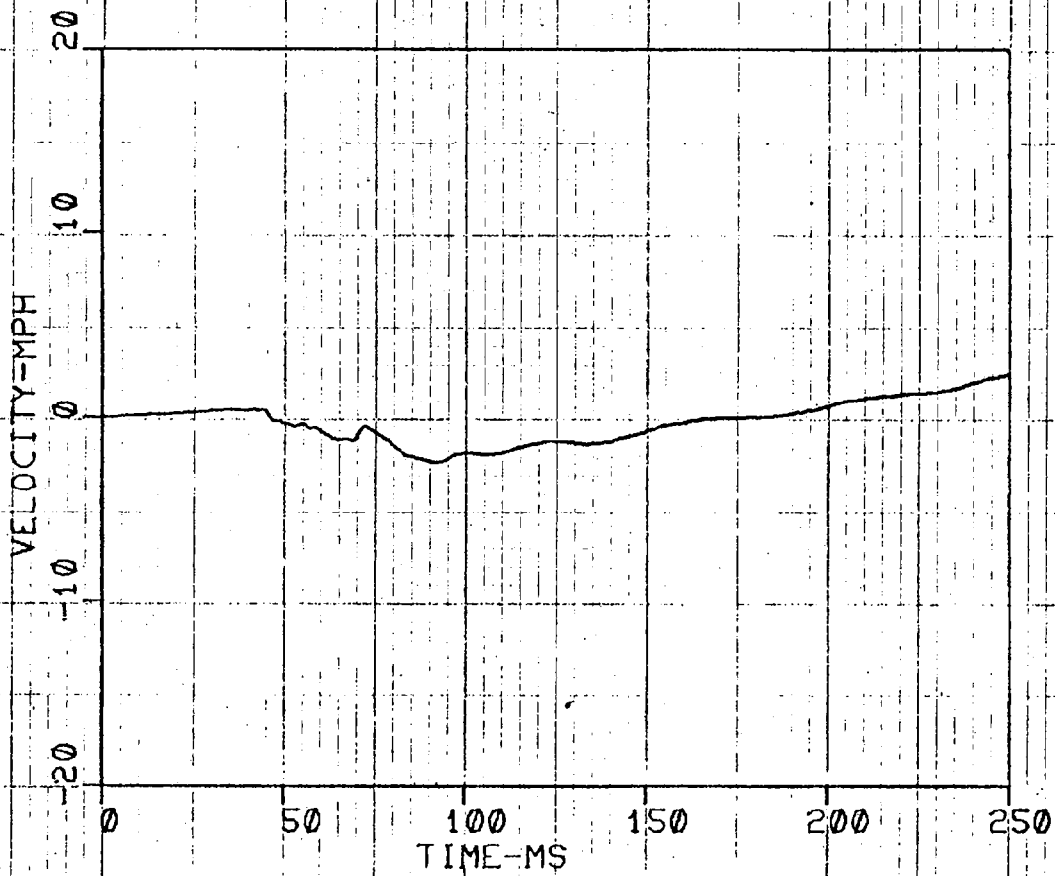


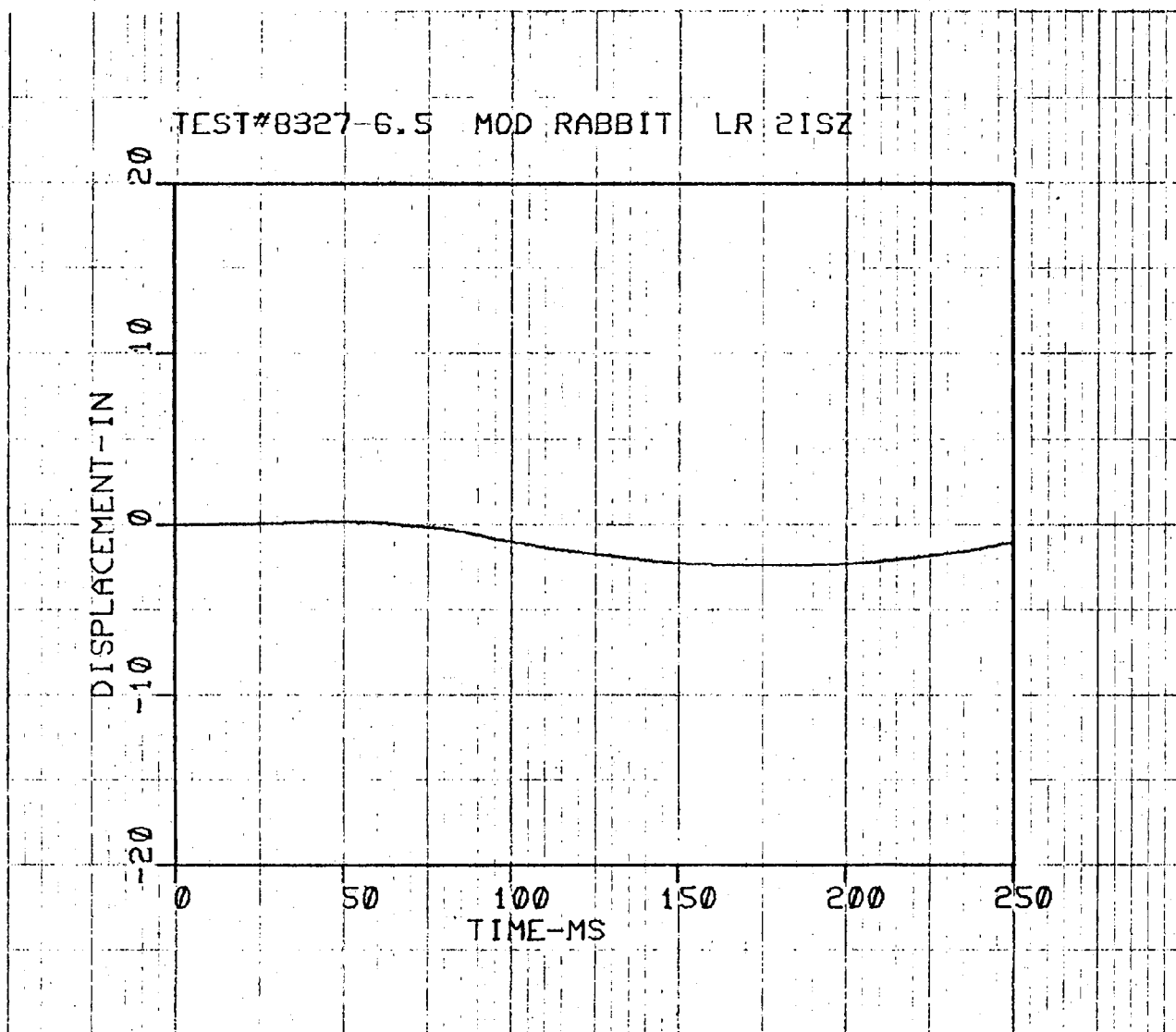


TEST#8327-6.5 MOD RABBIT LR 2IGZ

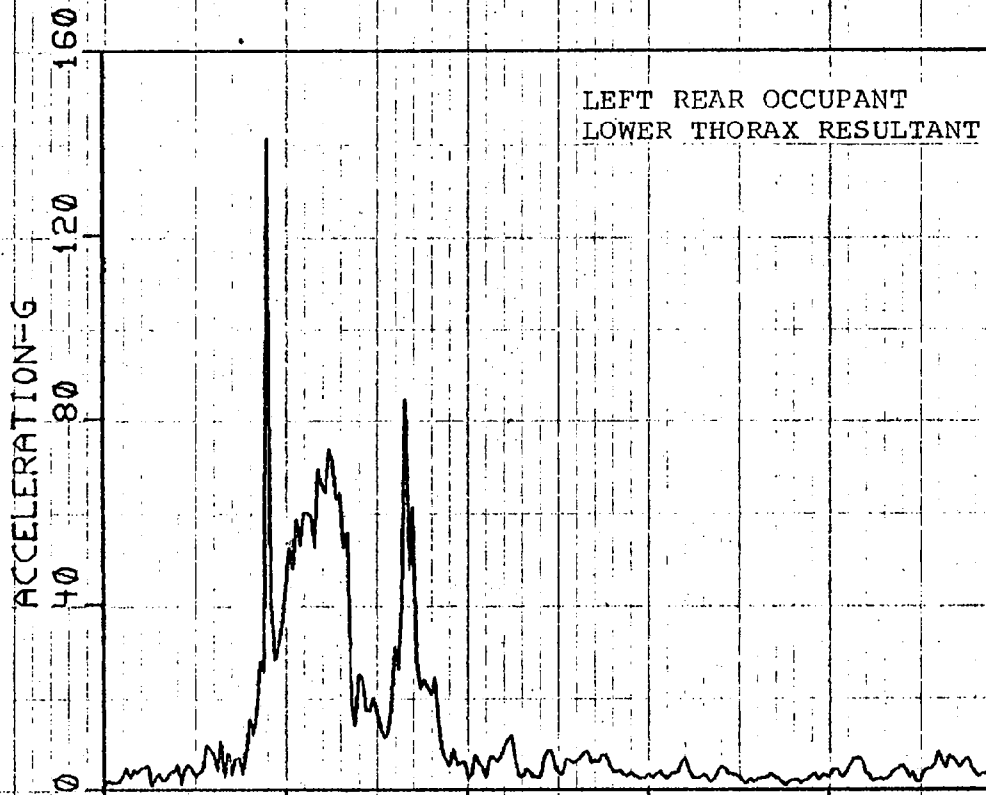


TEST#8327-6.5 MOD RABBIT LR 2IVZ

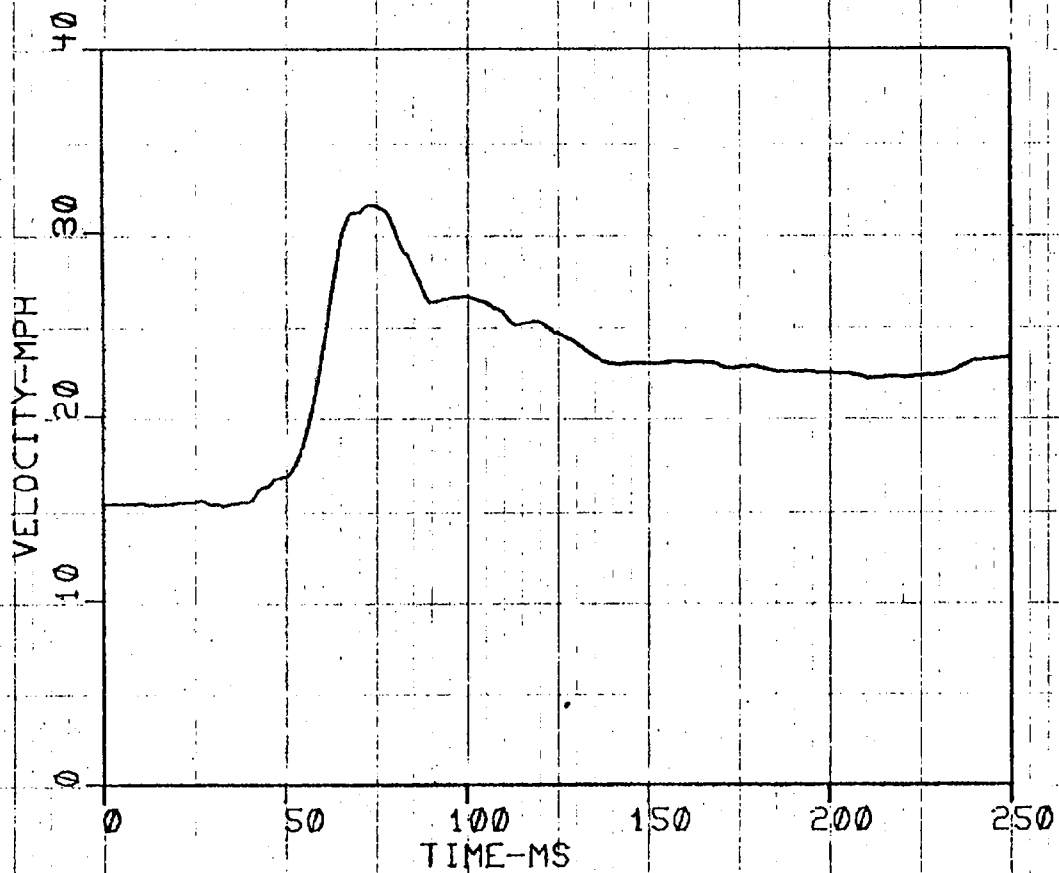


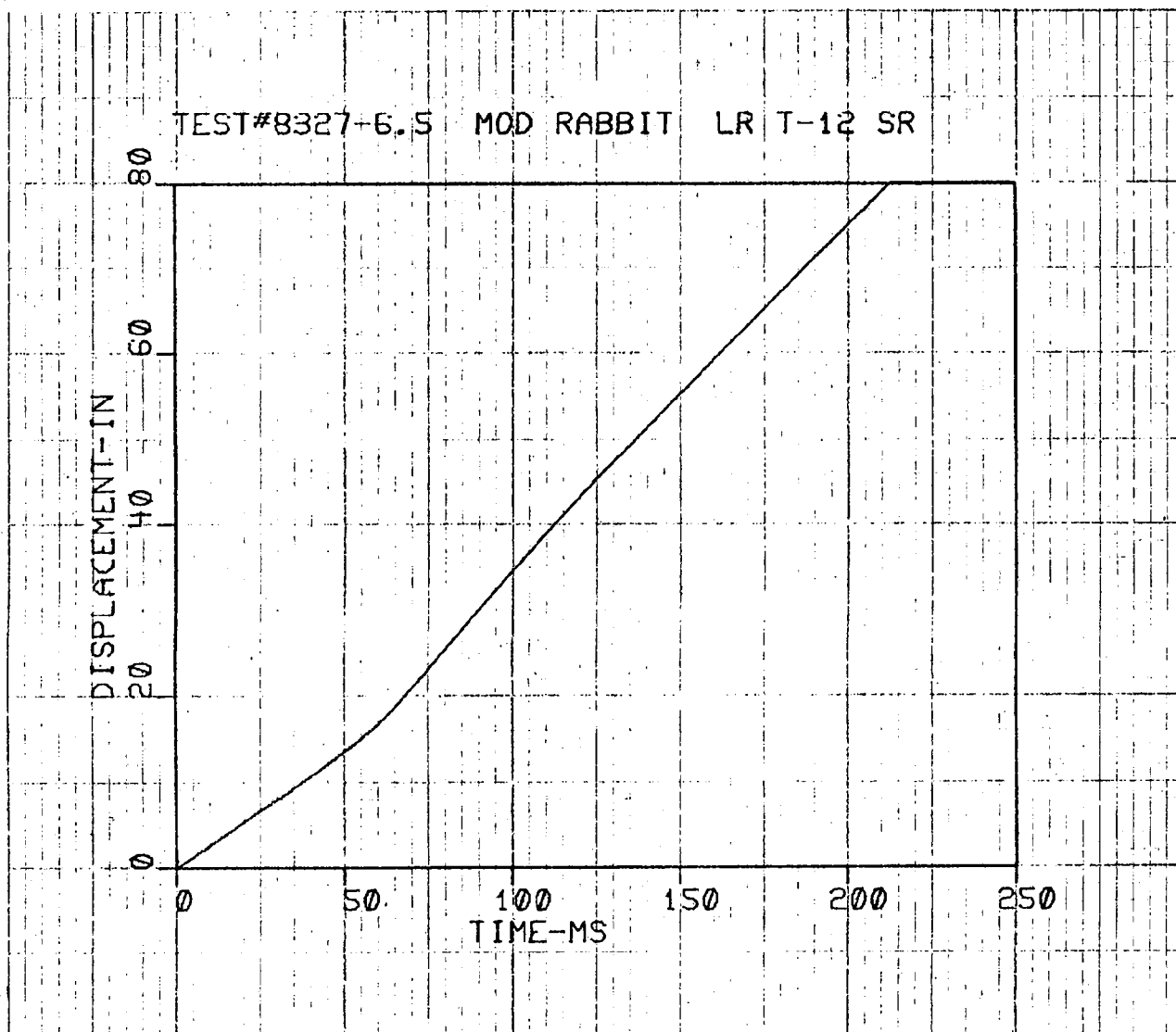


TEST#8327-6.5 MOD RABBIT LR T-12 AR

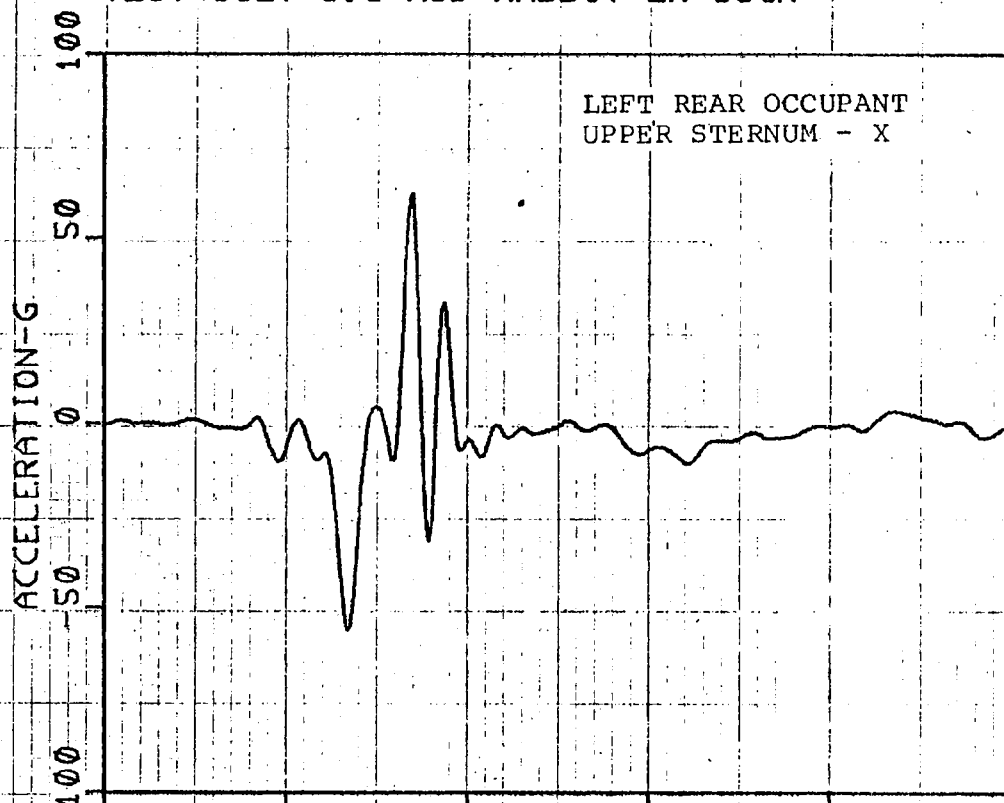


TEST#8327-6.5 MOD RABBIT LR T-12 VR

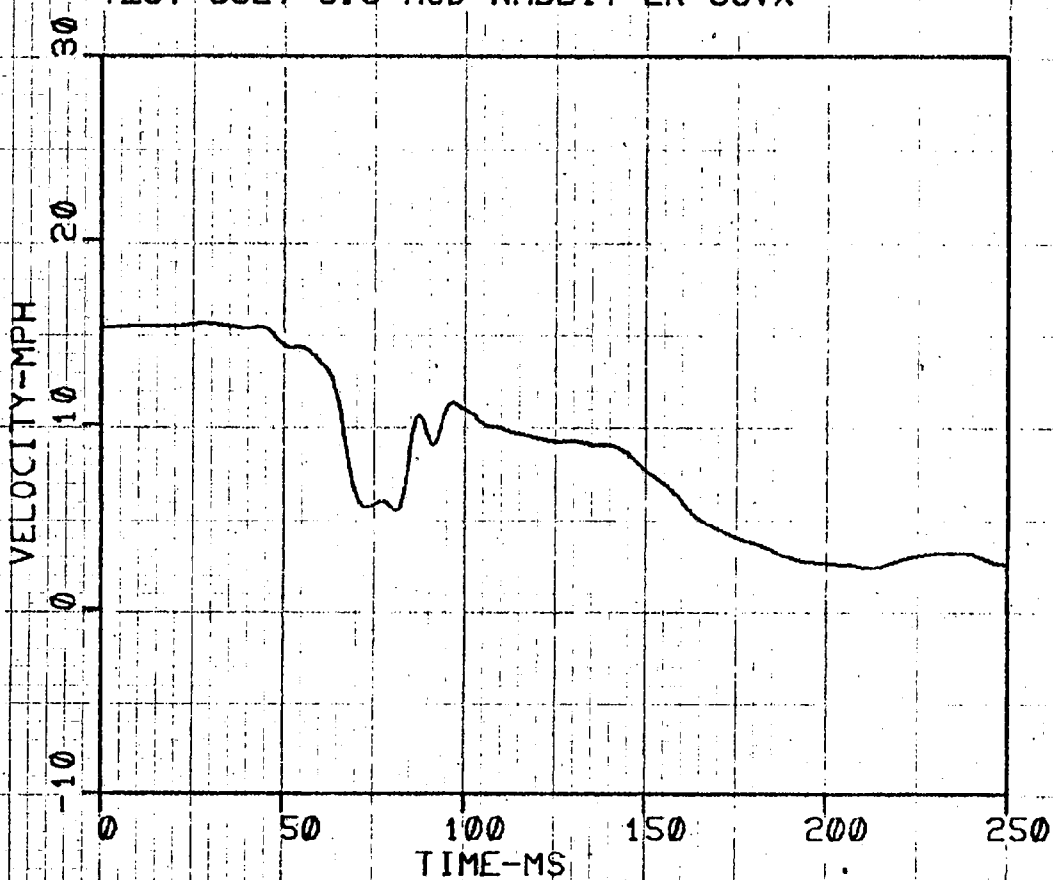


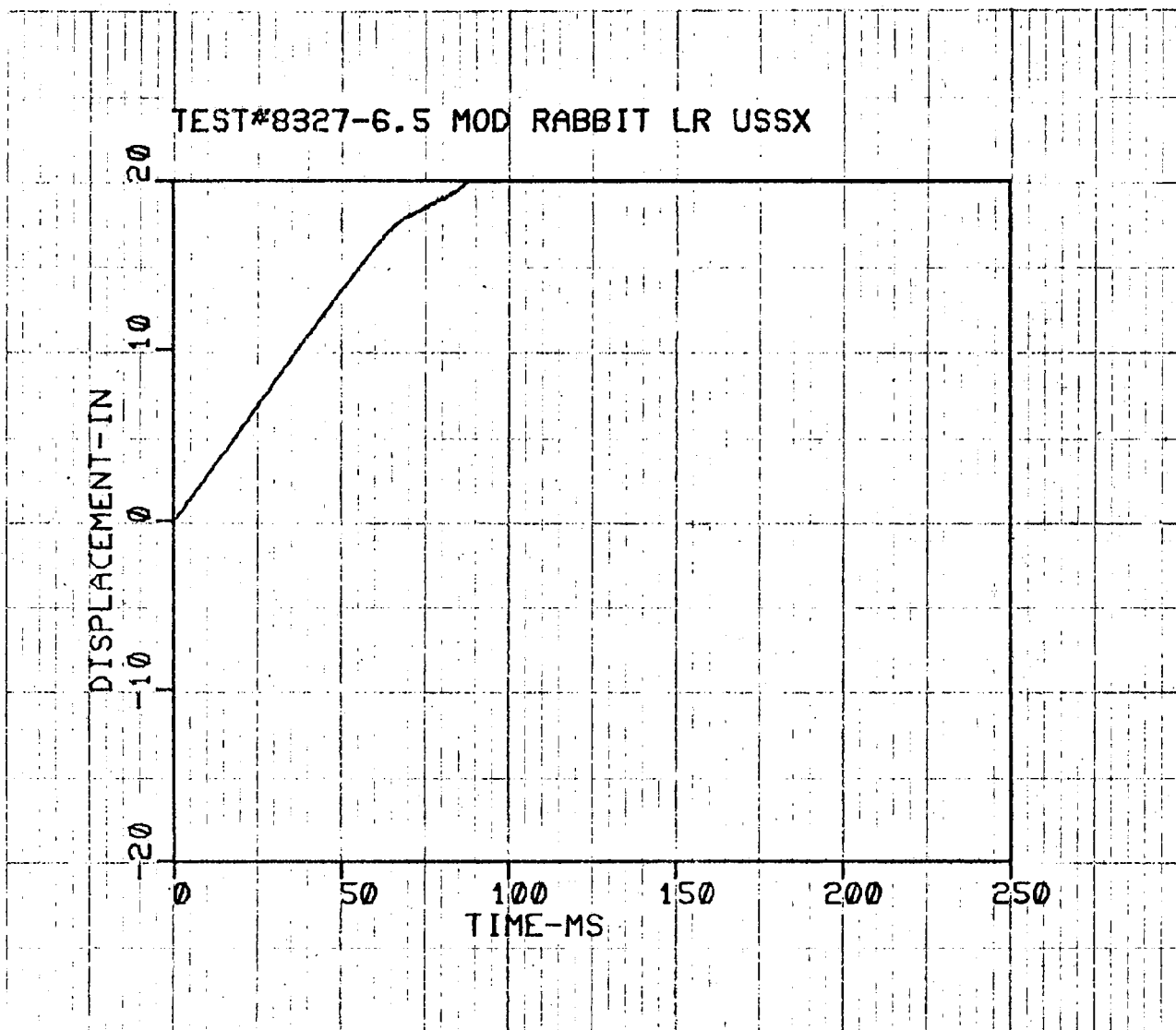


TEST#8327-6.5 MOD RABBIT LR USGX

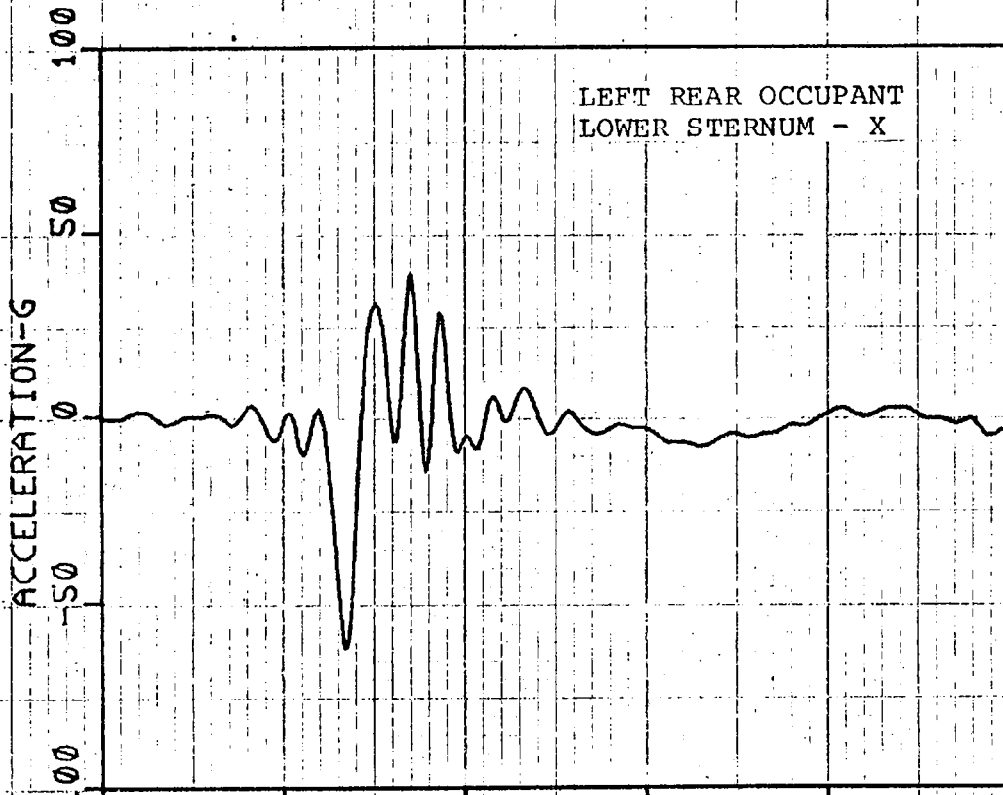


TEST#8327-6.5 MOD RABBIT LR USVX

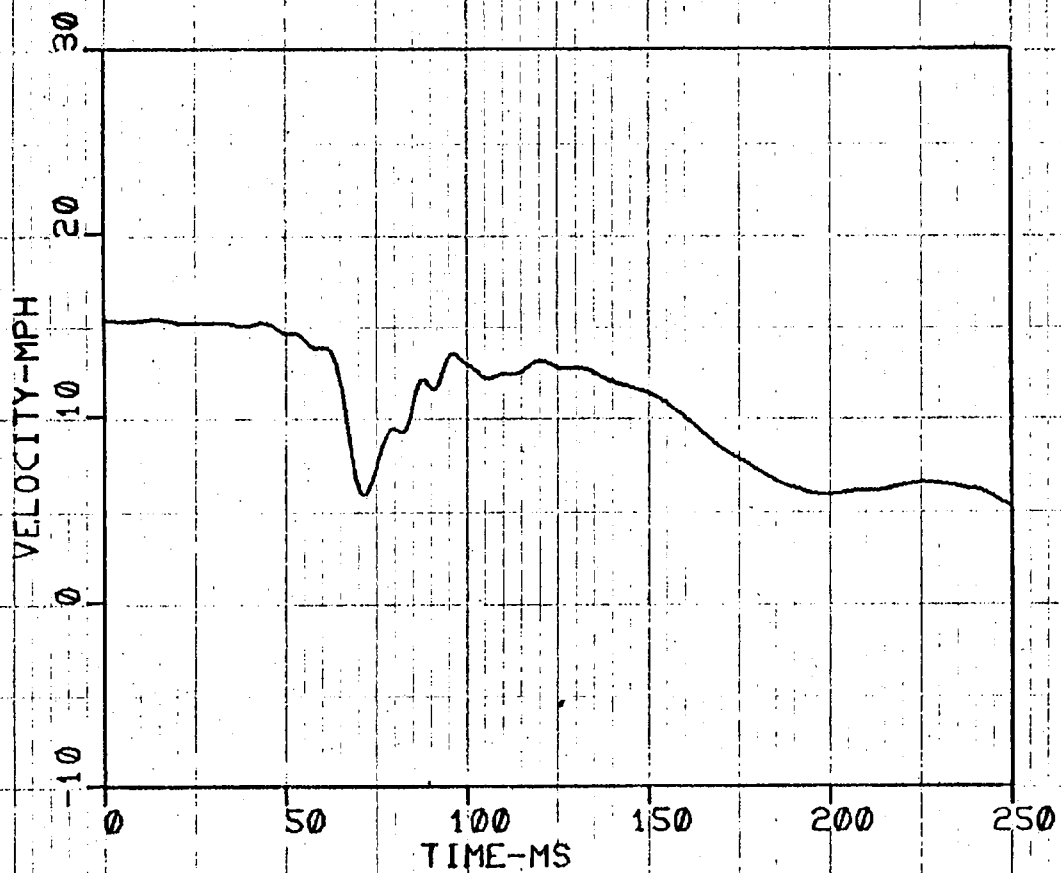


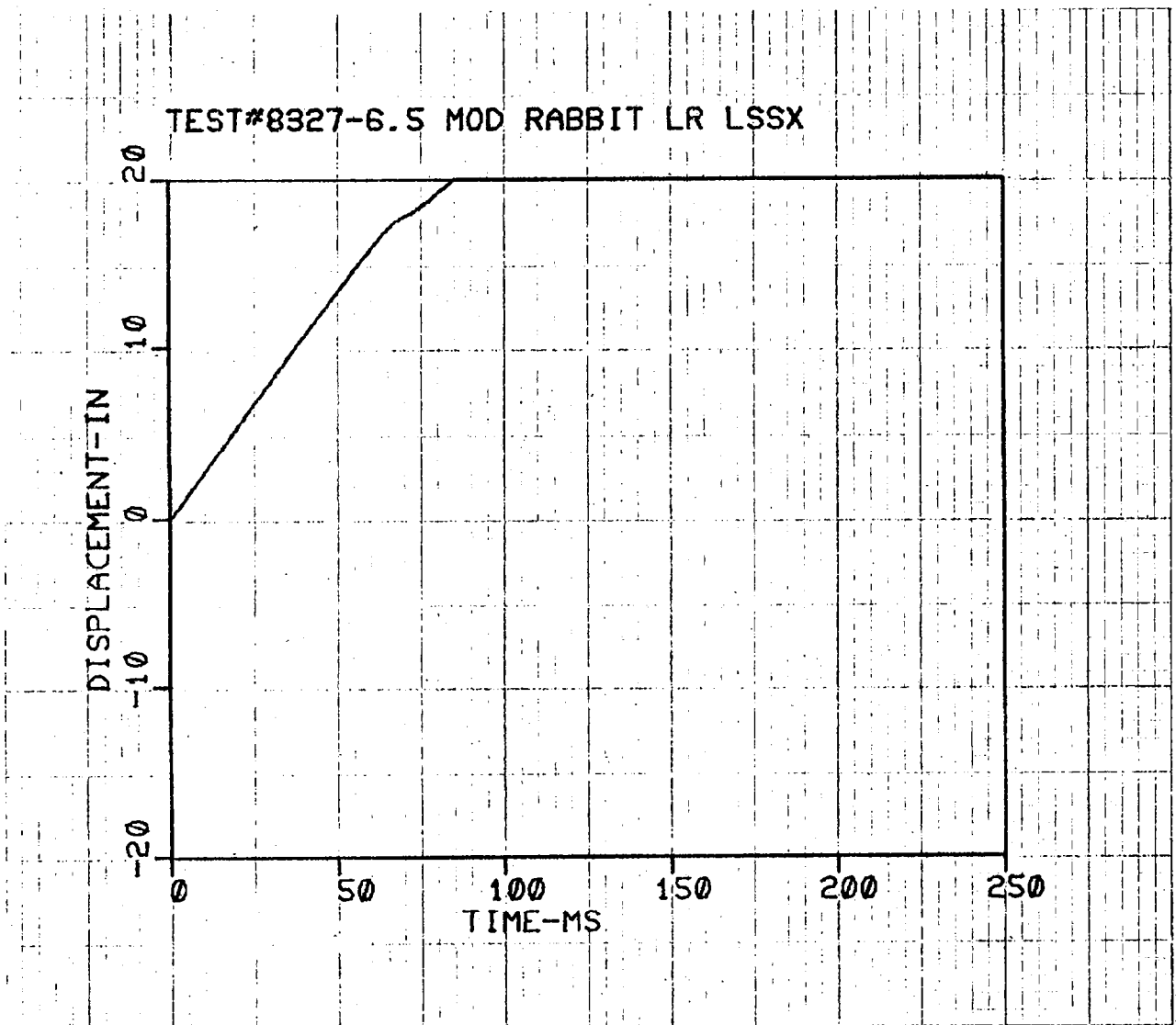


TEST#8327-6.5 MOD RABBIT LR LSGX

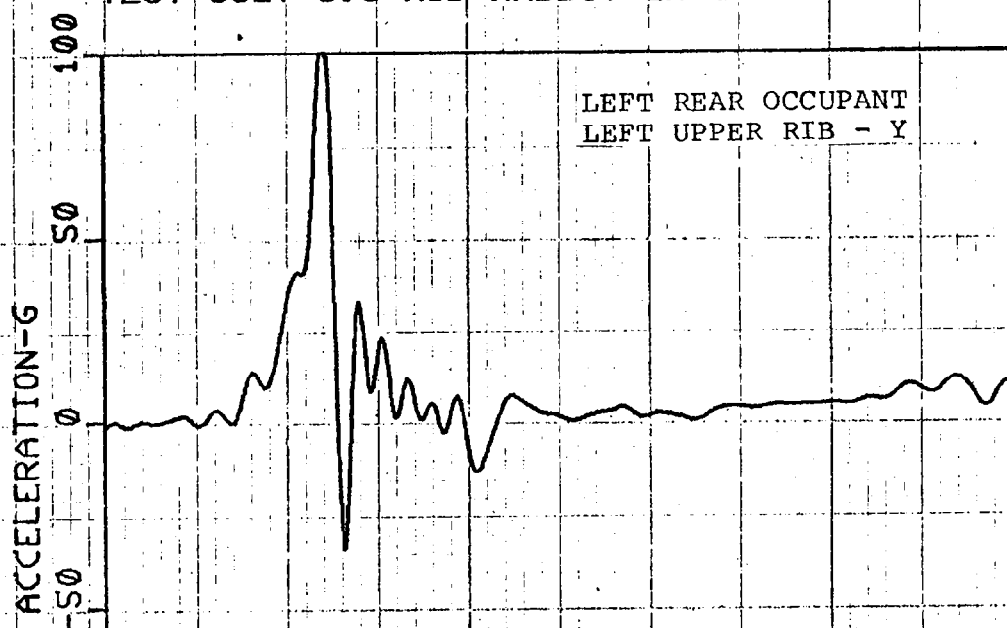


TEST#8327-6.5 MOD RABBIT LR LSVX

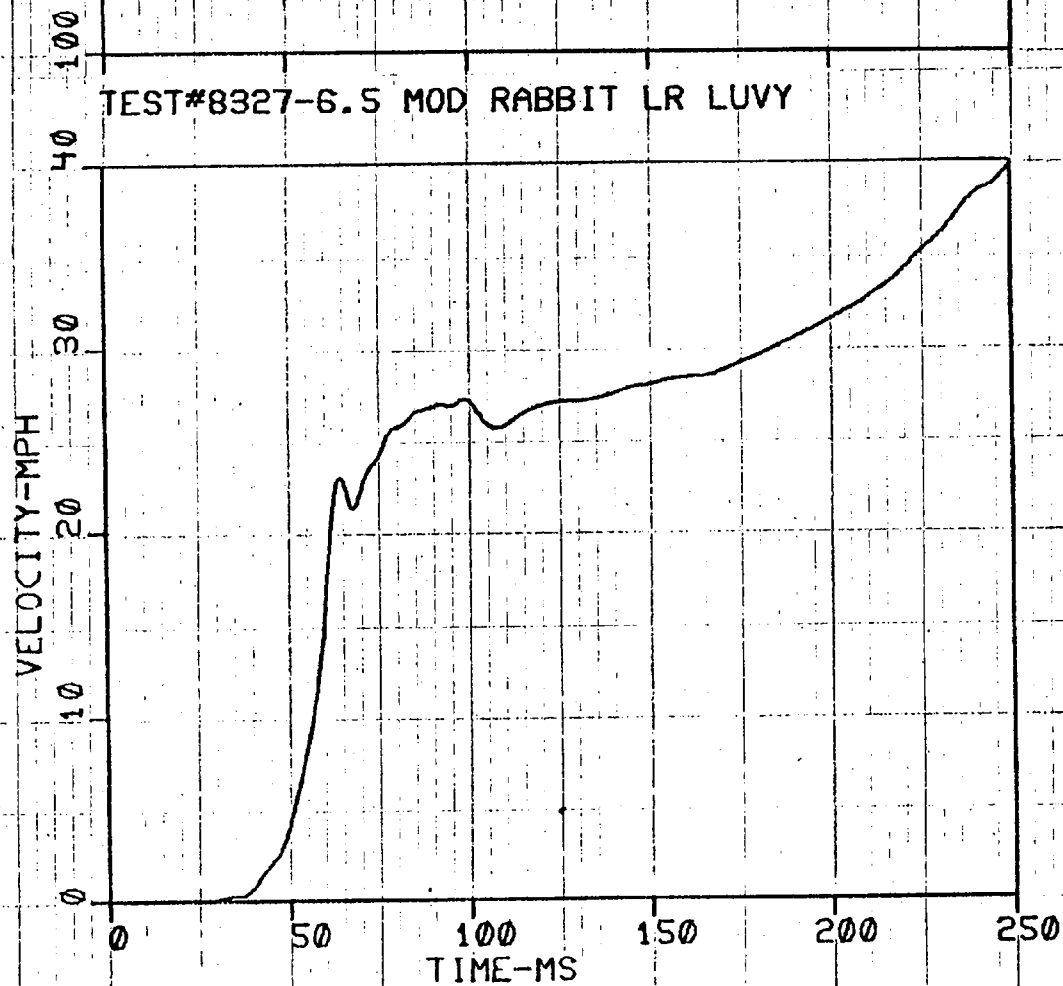


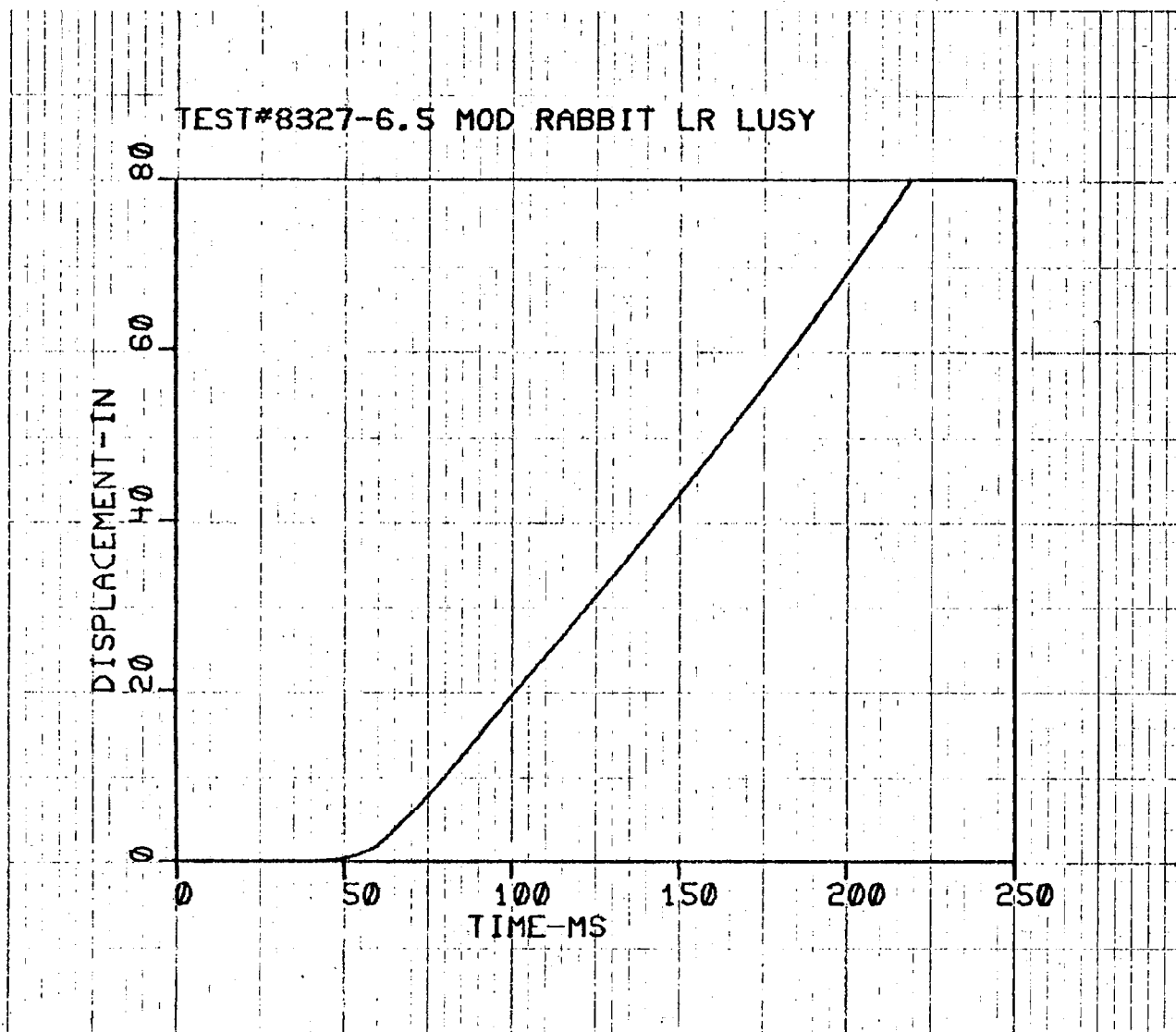


TEST#8327-6.5 MOD RABBIT LR LUGY

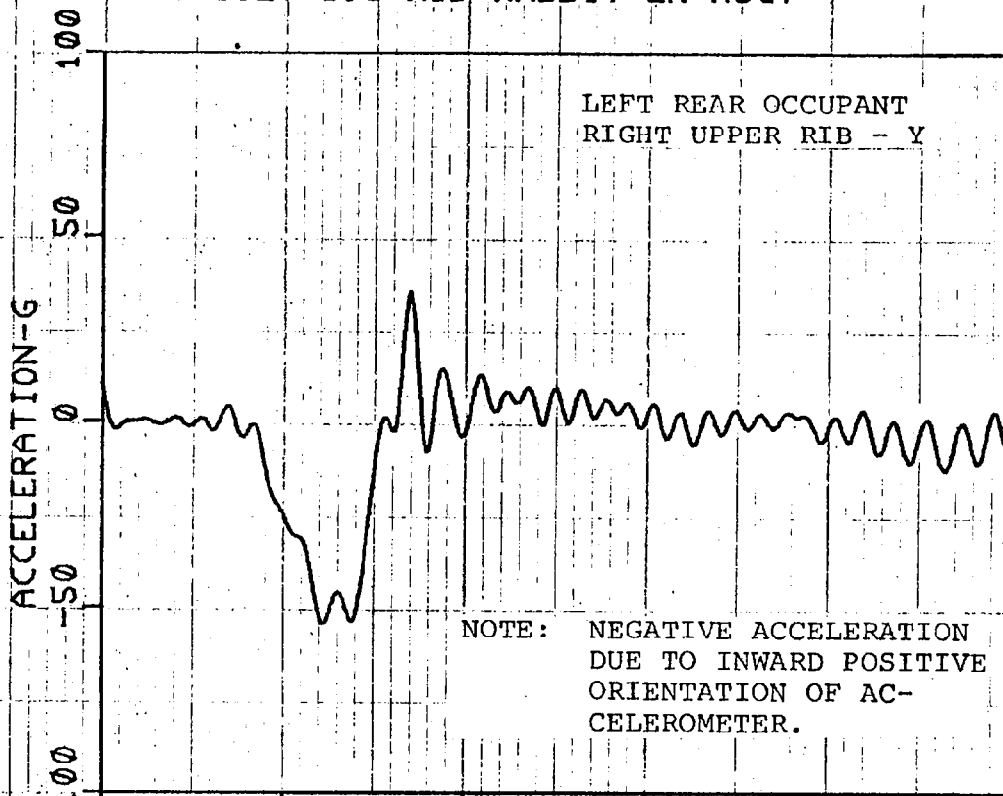


TEST#8327-6.5 MOD RABBIT LR LUVY

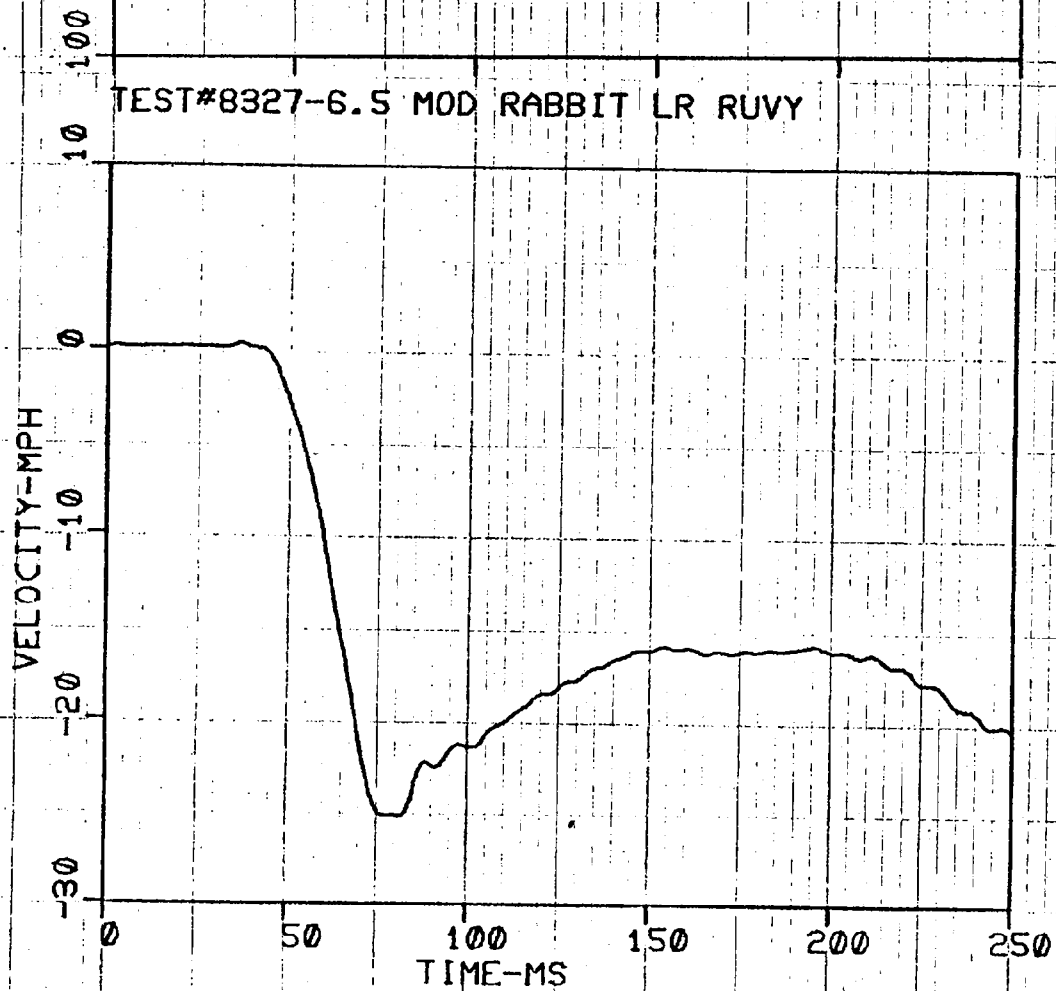


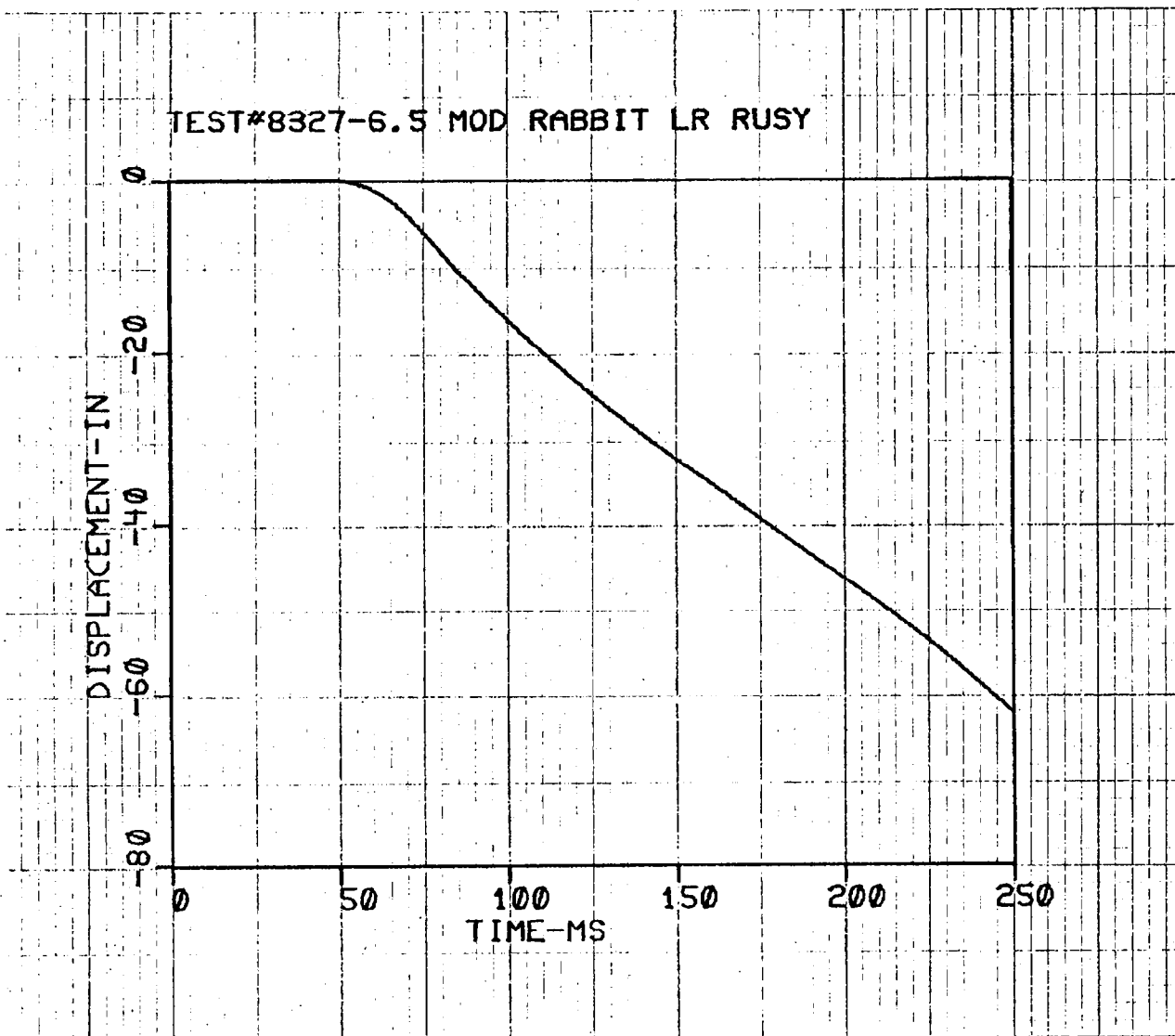


TEST#8327-6.5 MOD RABBIT LR RUGY

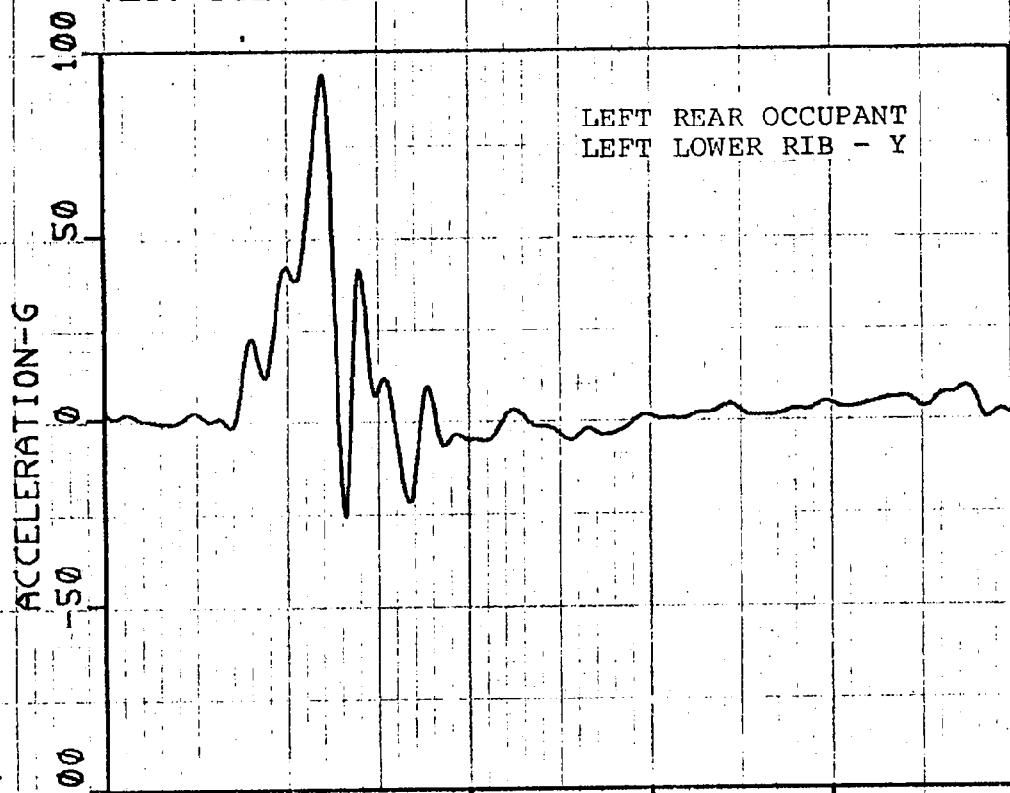


TEST#8327-6.5 MOD RABBIT LR RUVY

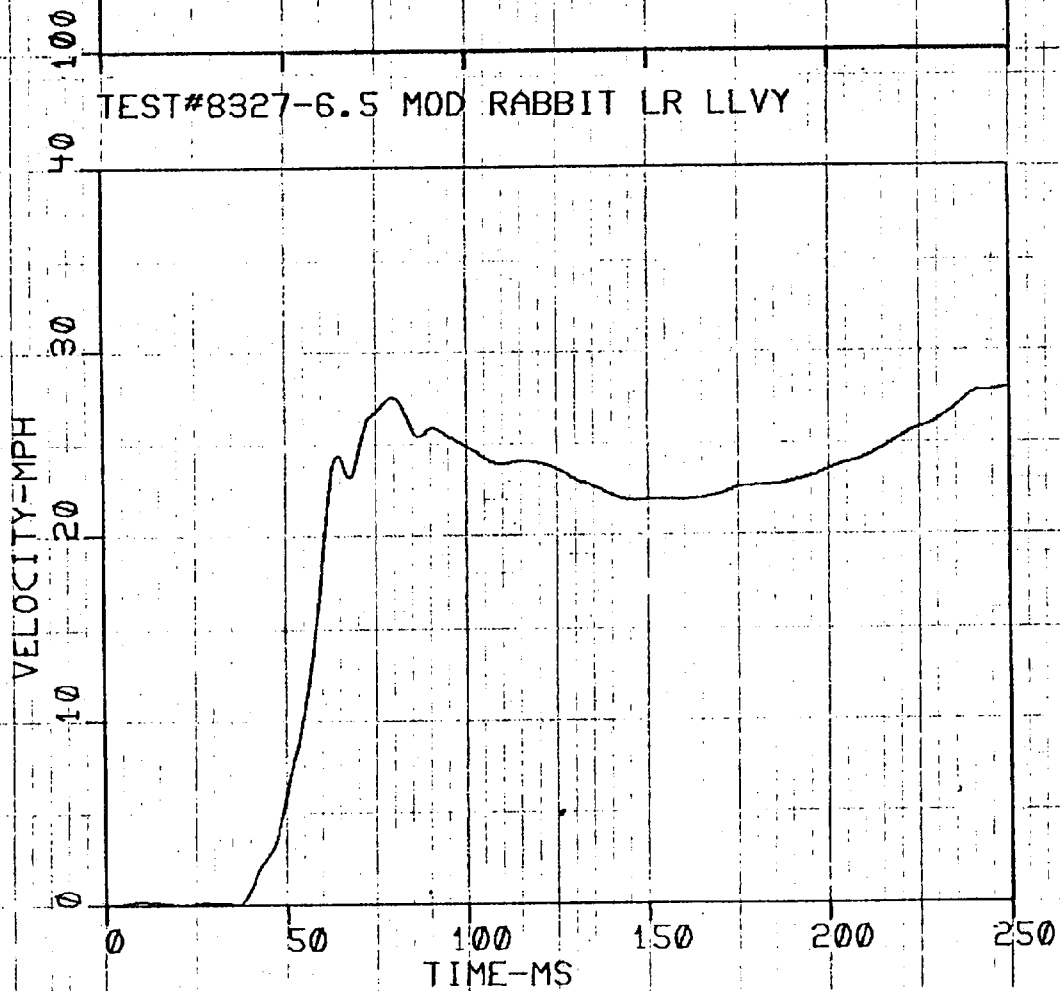


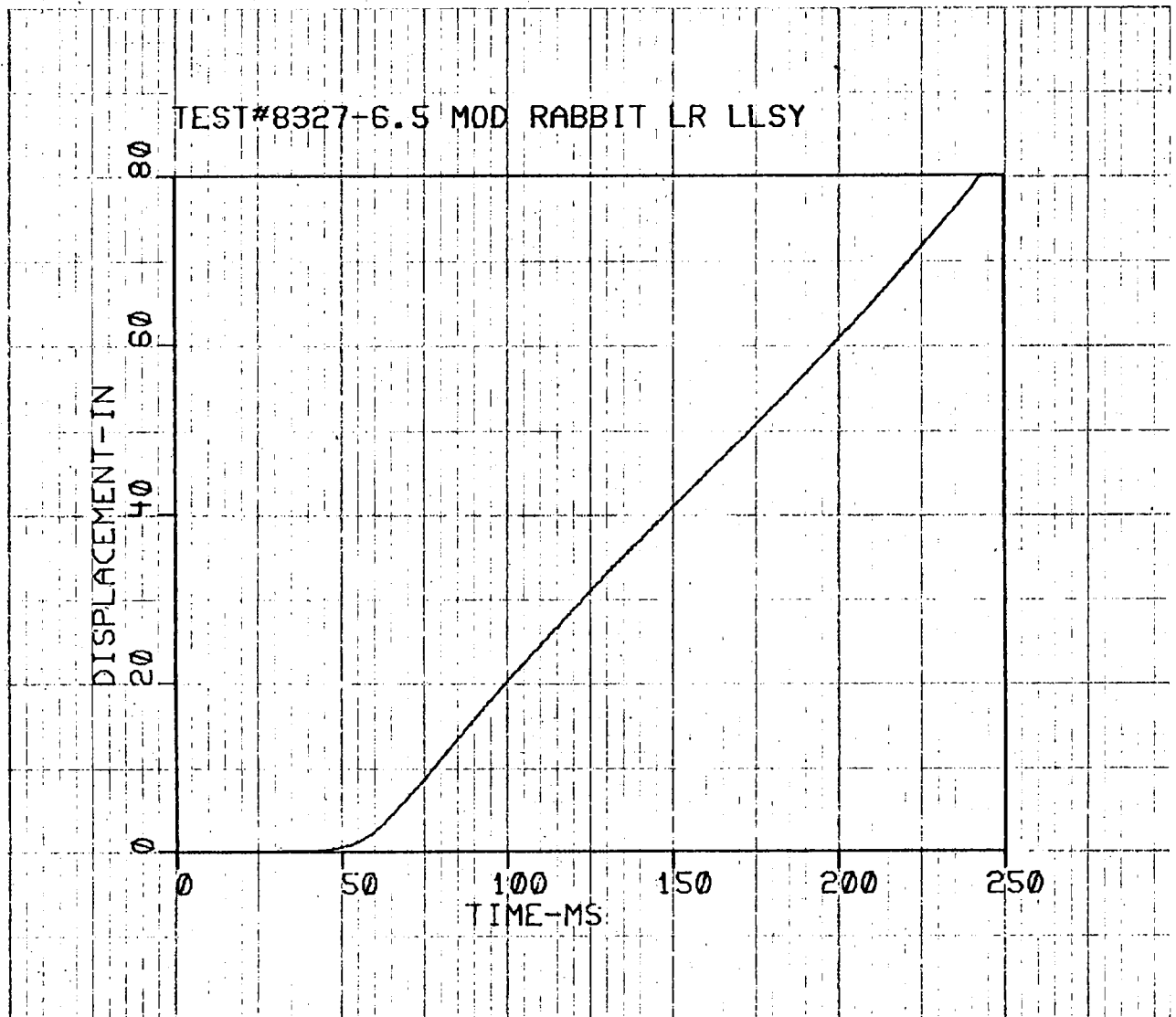


TEST#8327-6.5 MOD RABBIT LR LLGY

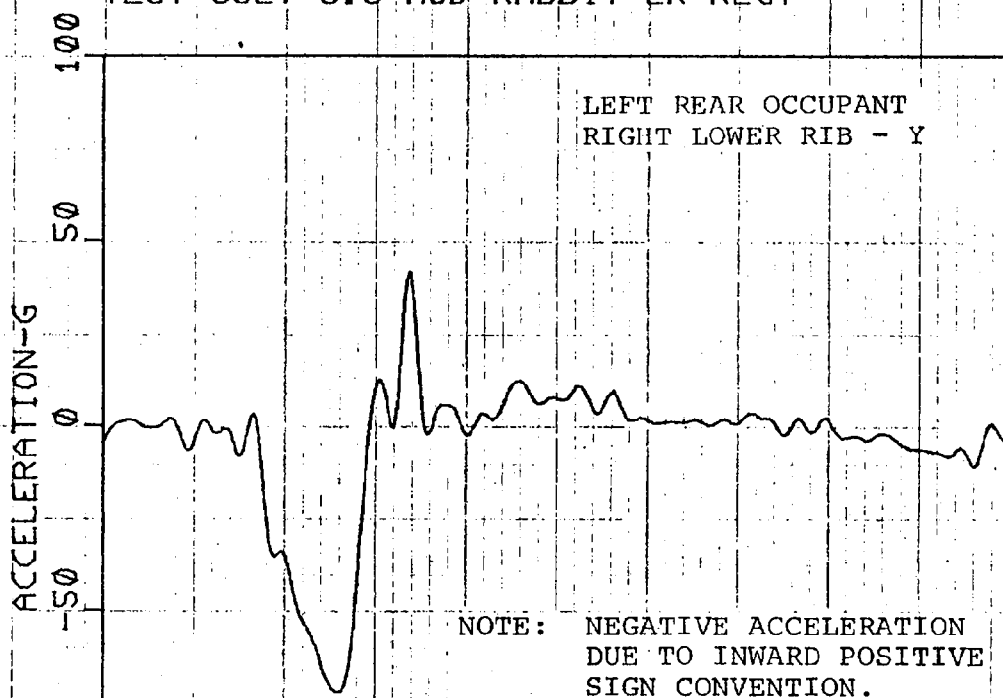


TEST#8327-6.5 MOD RABBIT LR LLVY

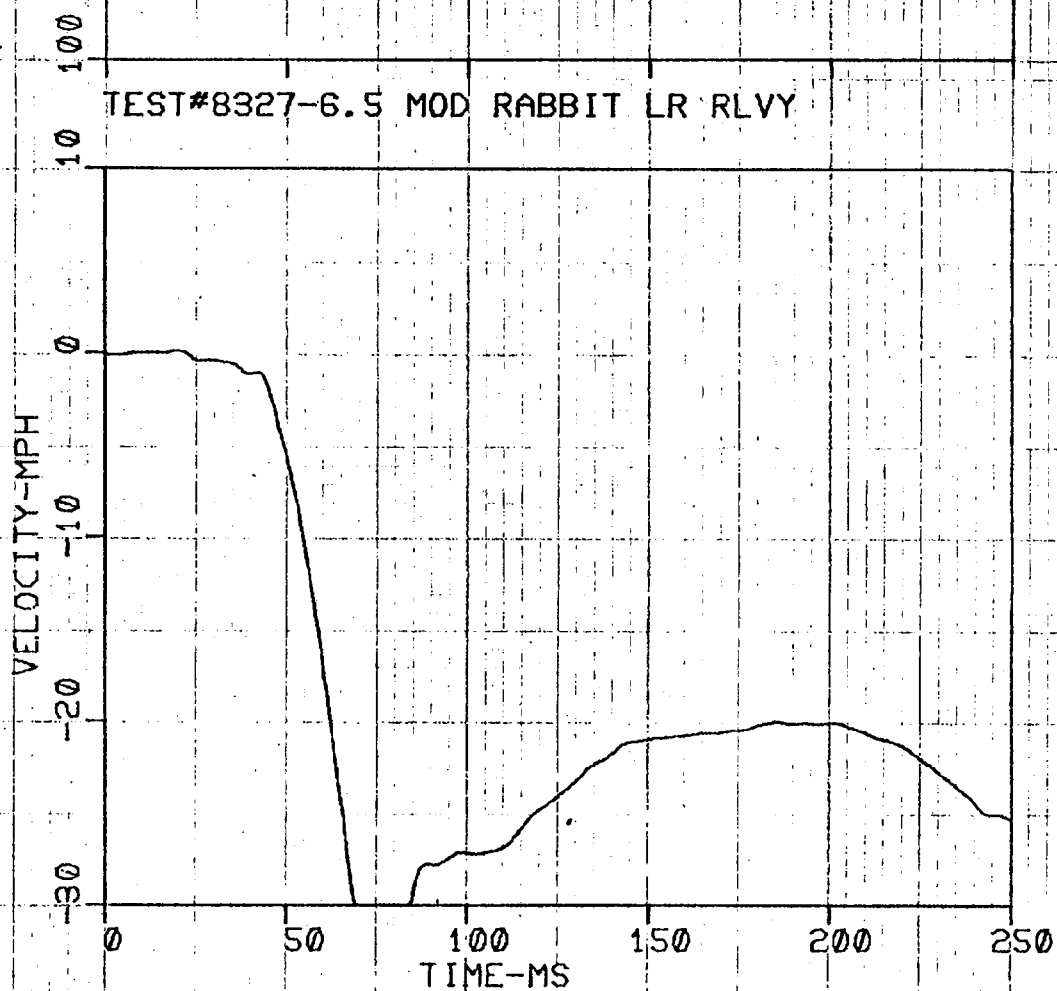


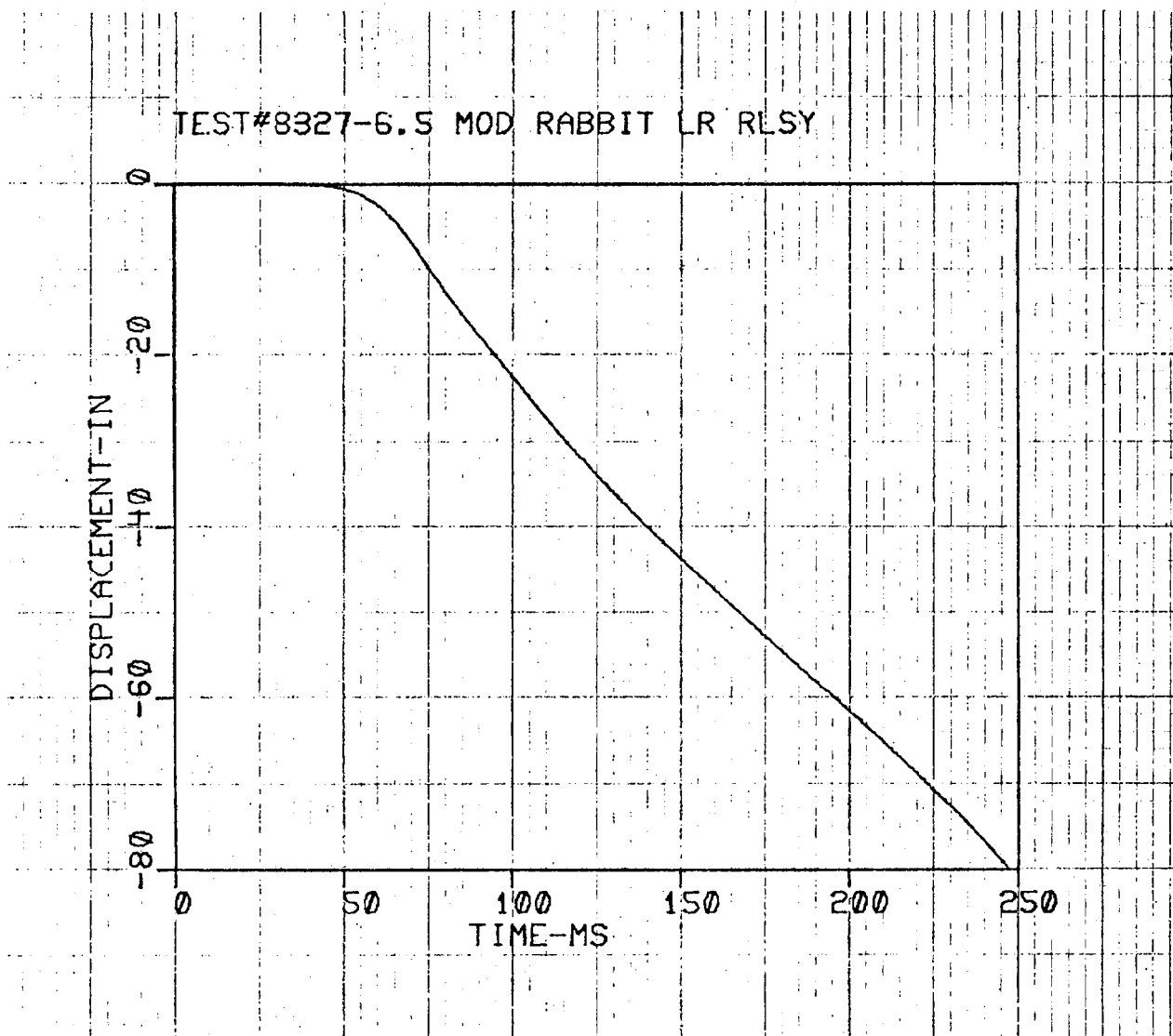


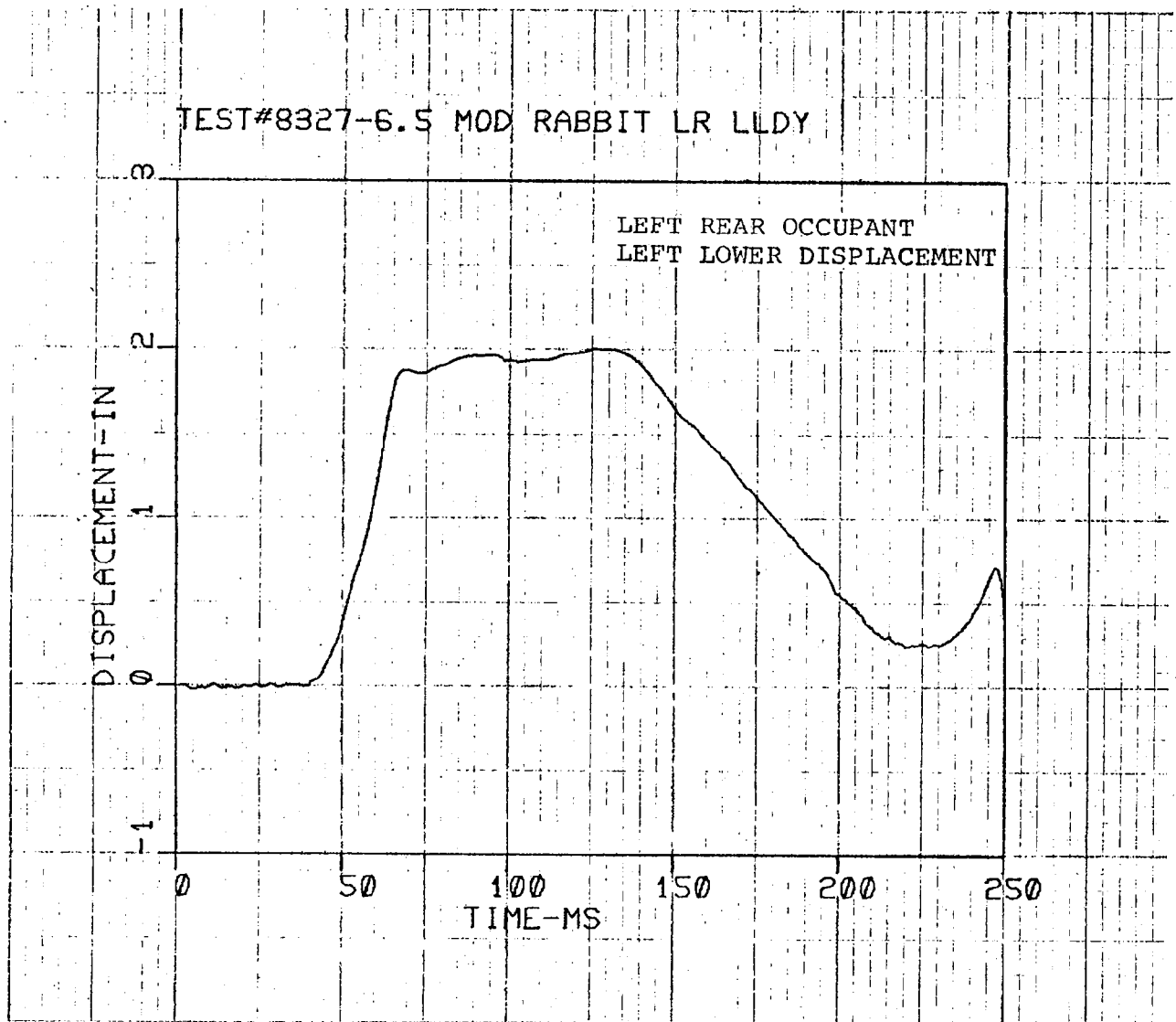
TEST#8327-6.5 MOD RABBIT LR RLG



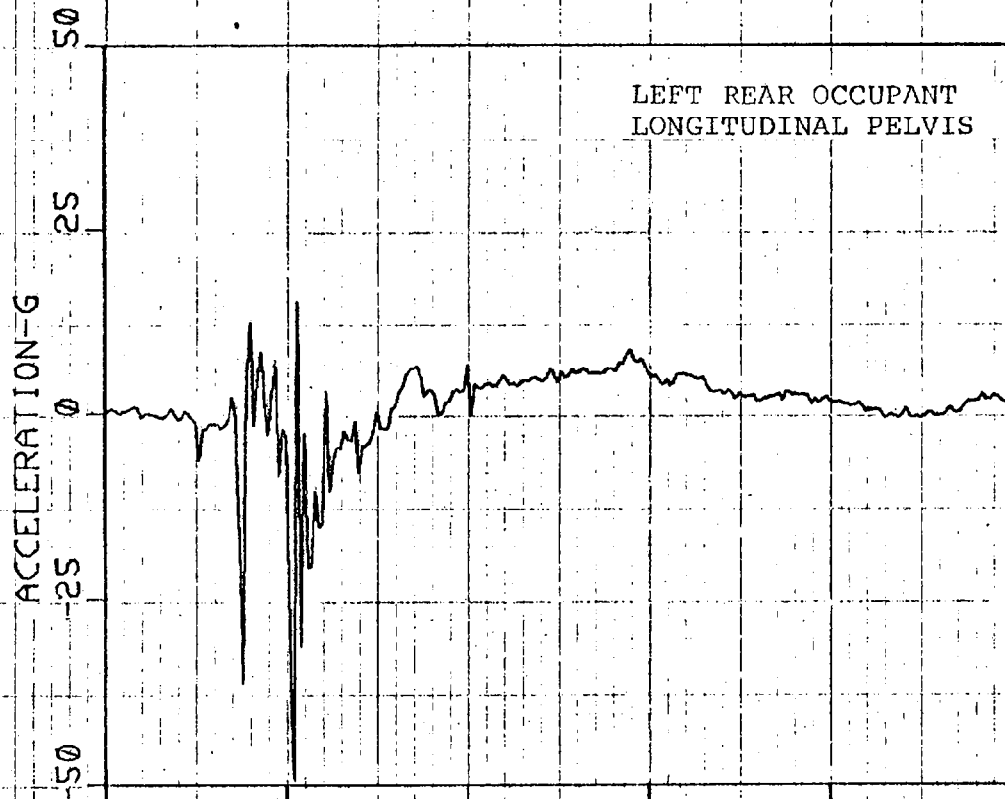
TEST#8327-6.5 MOD RABBIT LR RLV



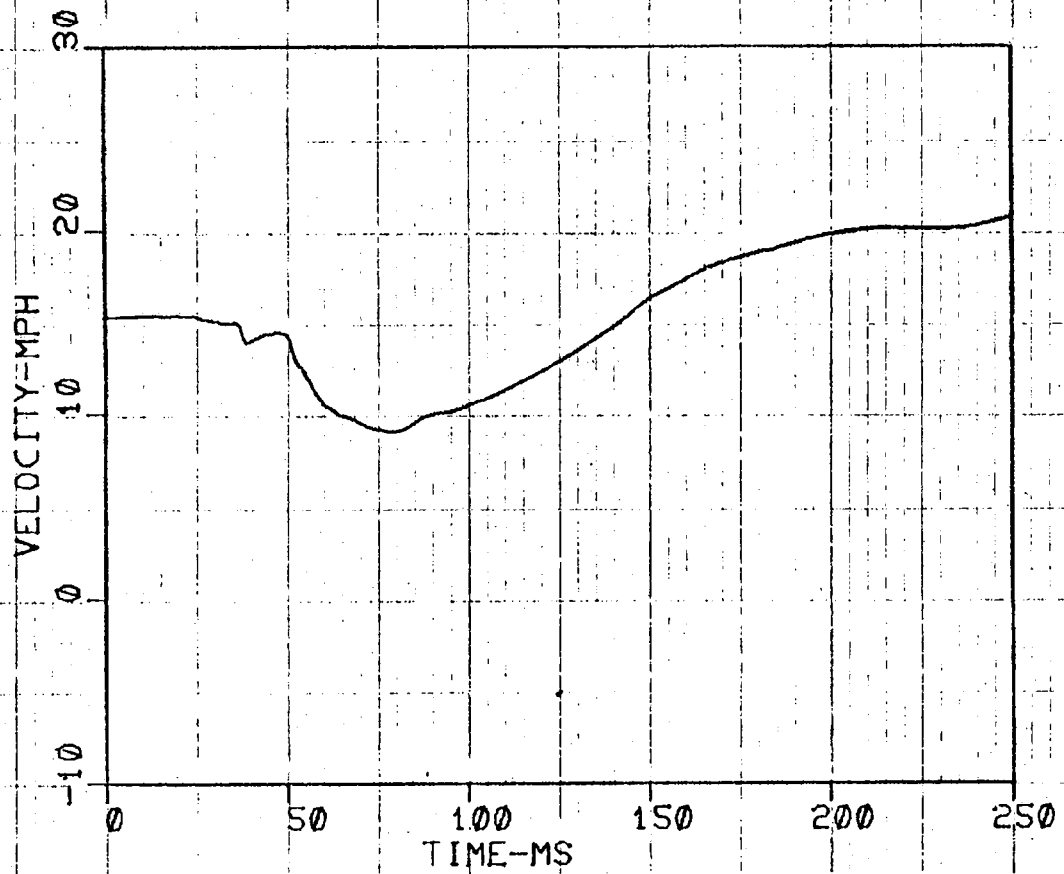


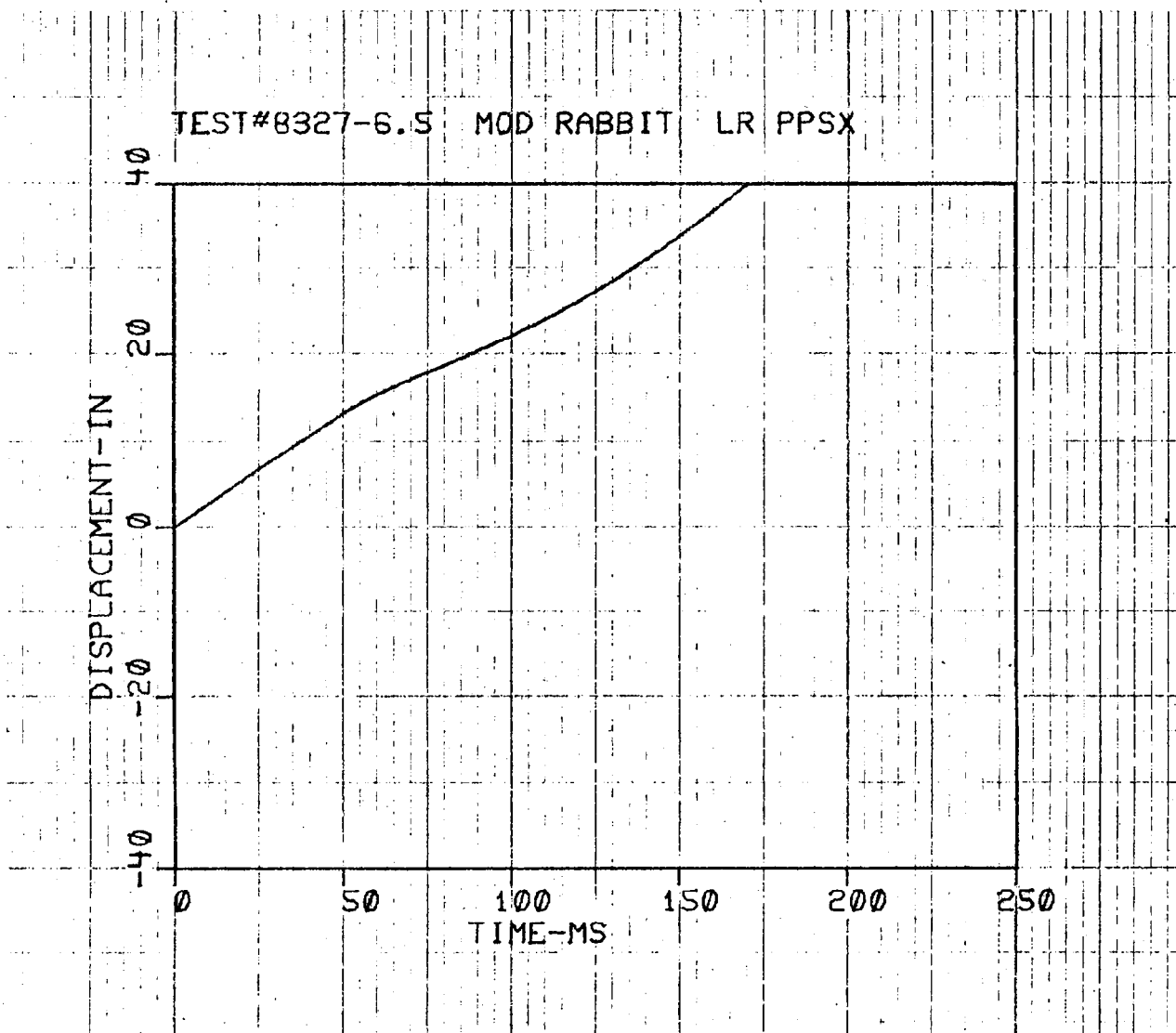


TEST#8327-6.5 MOD RABBIT LR PPGX

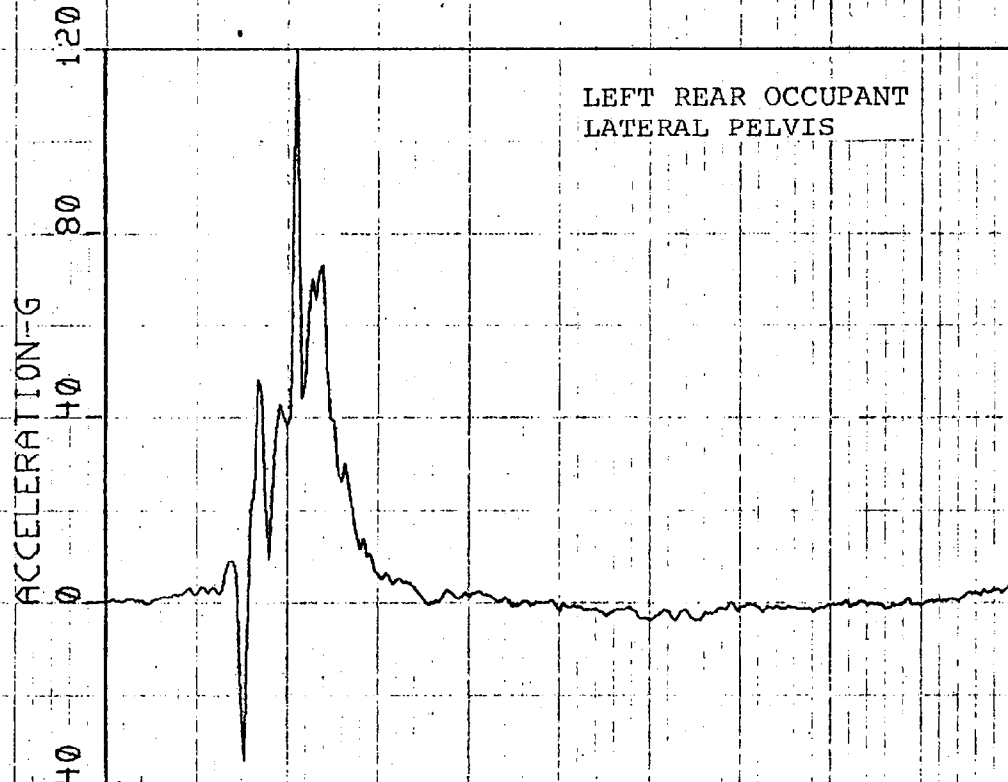


TEST#8327-6.5 MOD RABBIT LR PPVX

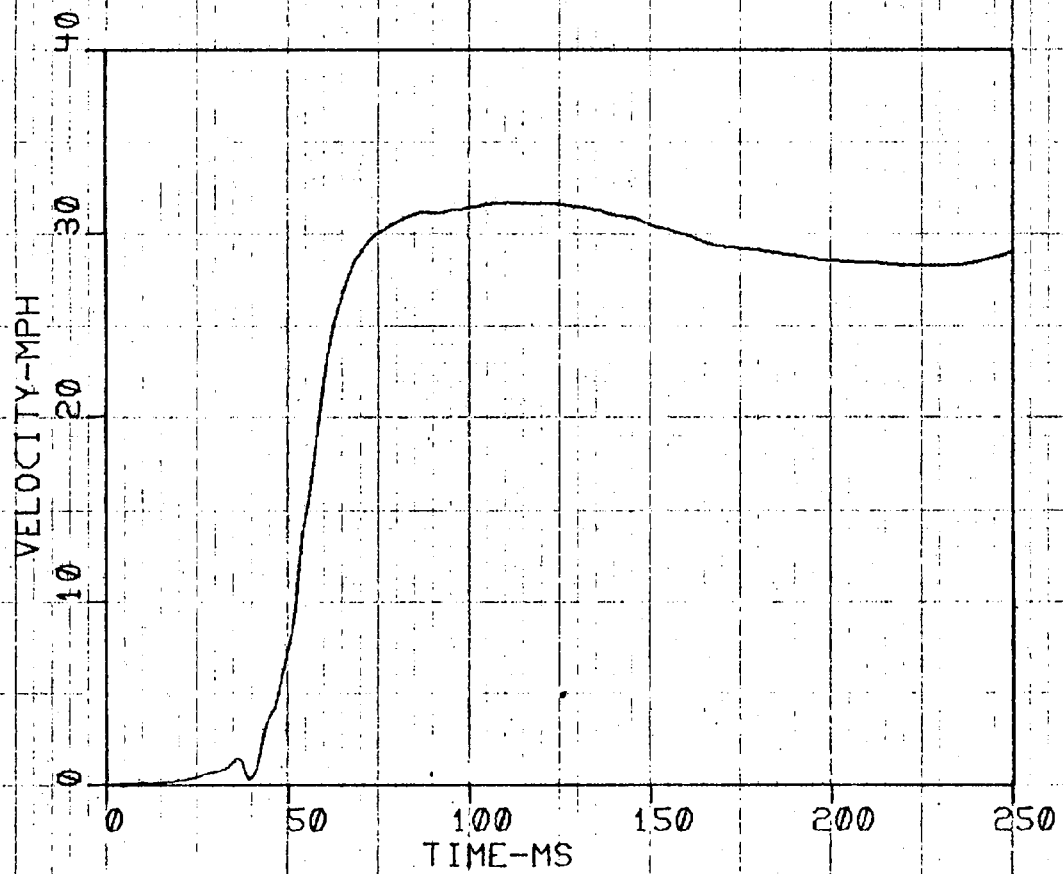


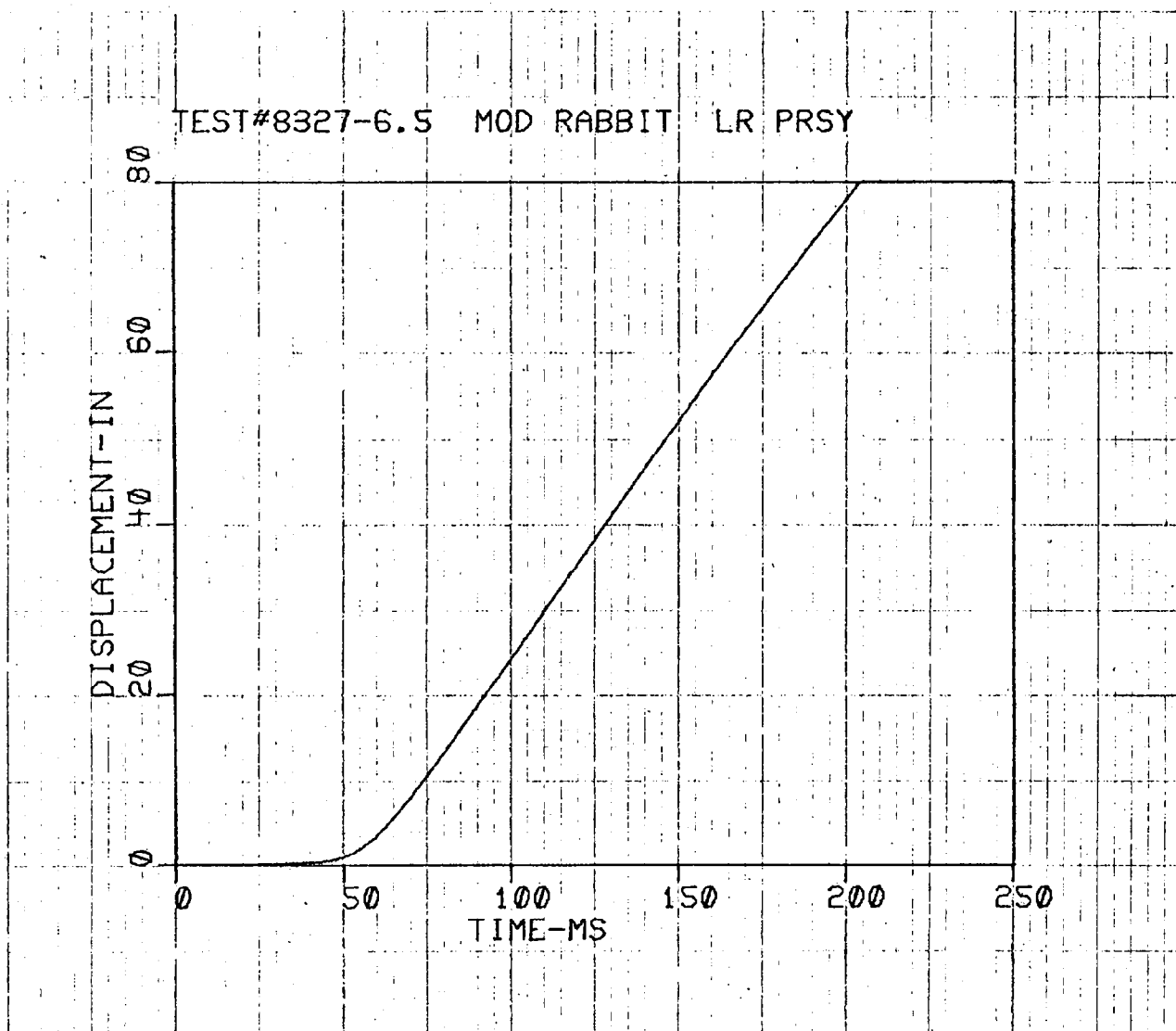


TEST#8327-6.5 MOD RABBIT LR PRGY

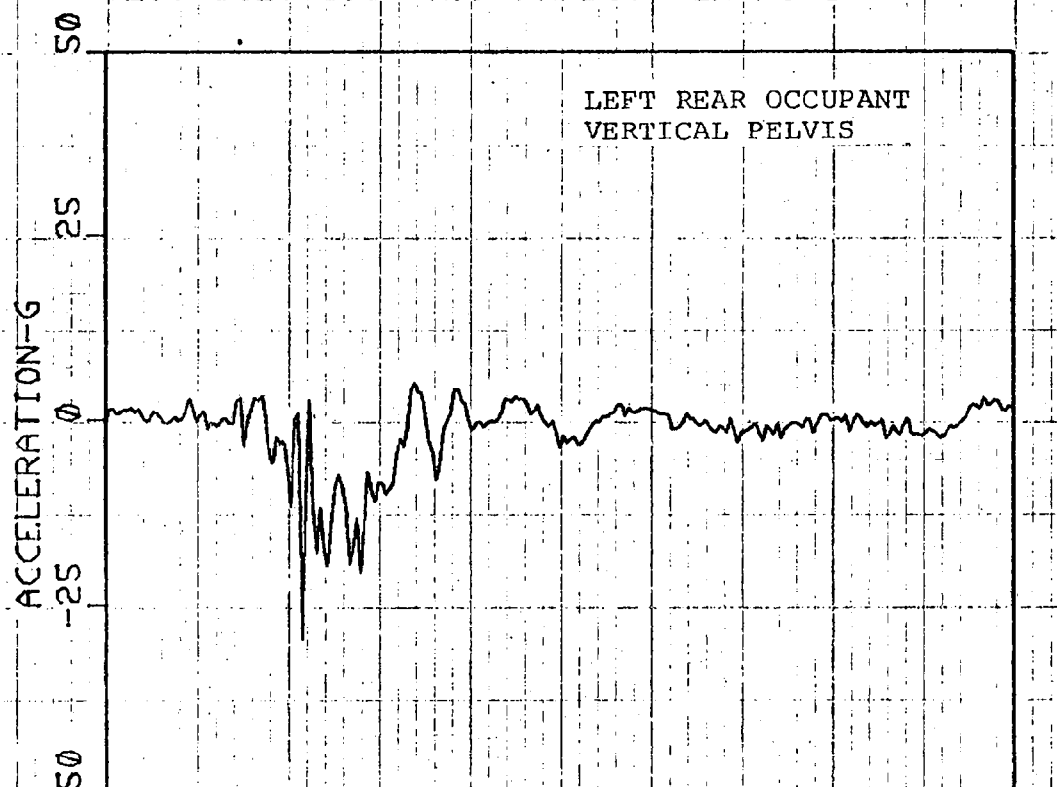


TEST#8327-6.5 MOD RABBIT LR PRVY

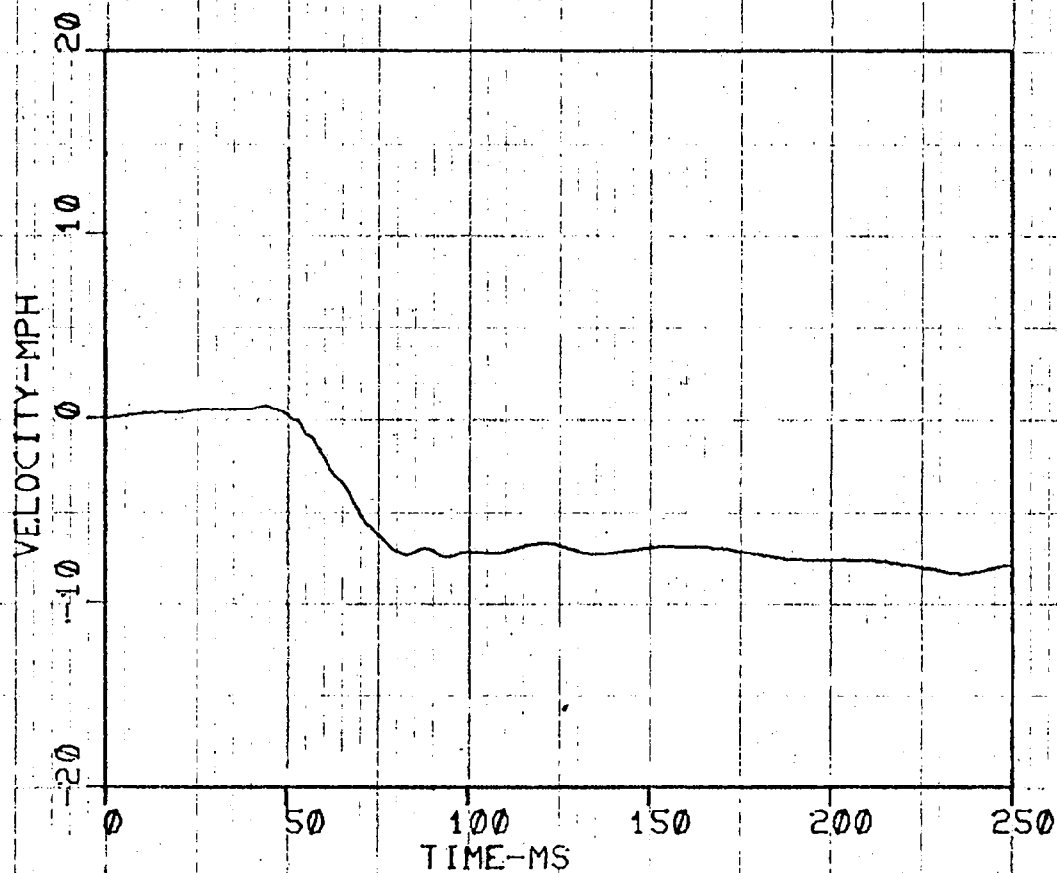


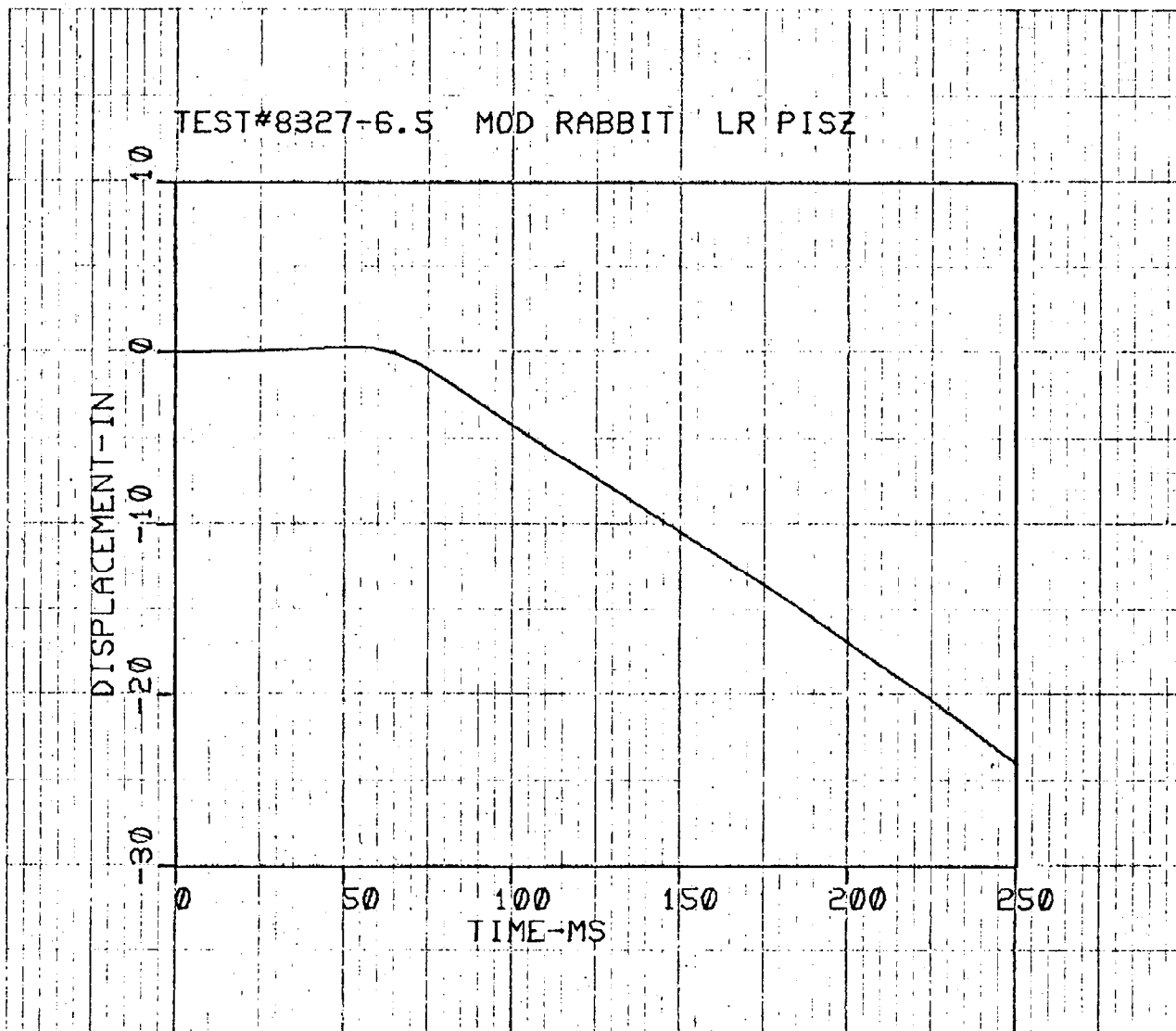


TEST#8327-6.S MOD RABBIT LR PIGZ

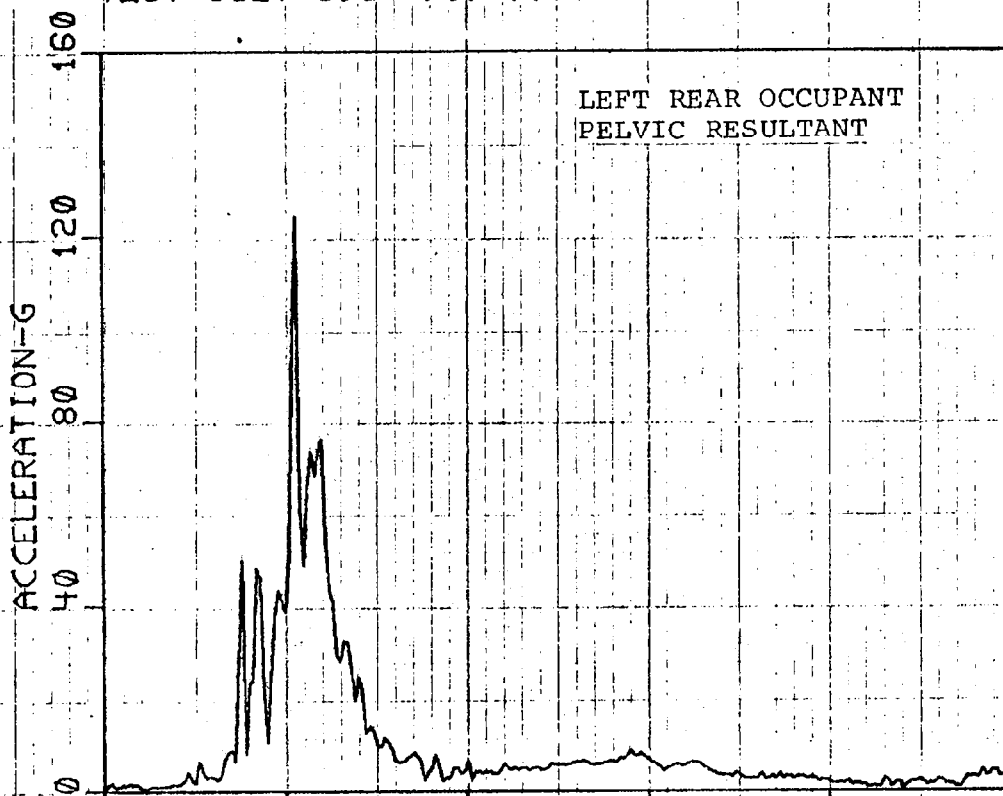


TEST#8327-6.S MOD RABBIT LR 2IVZ

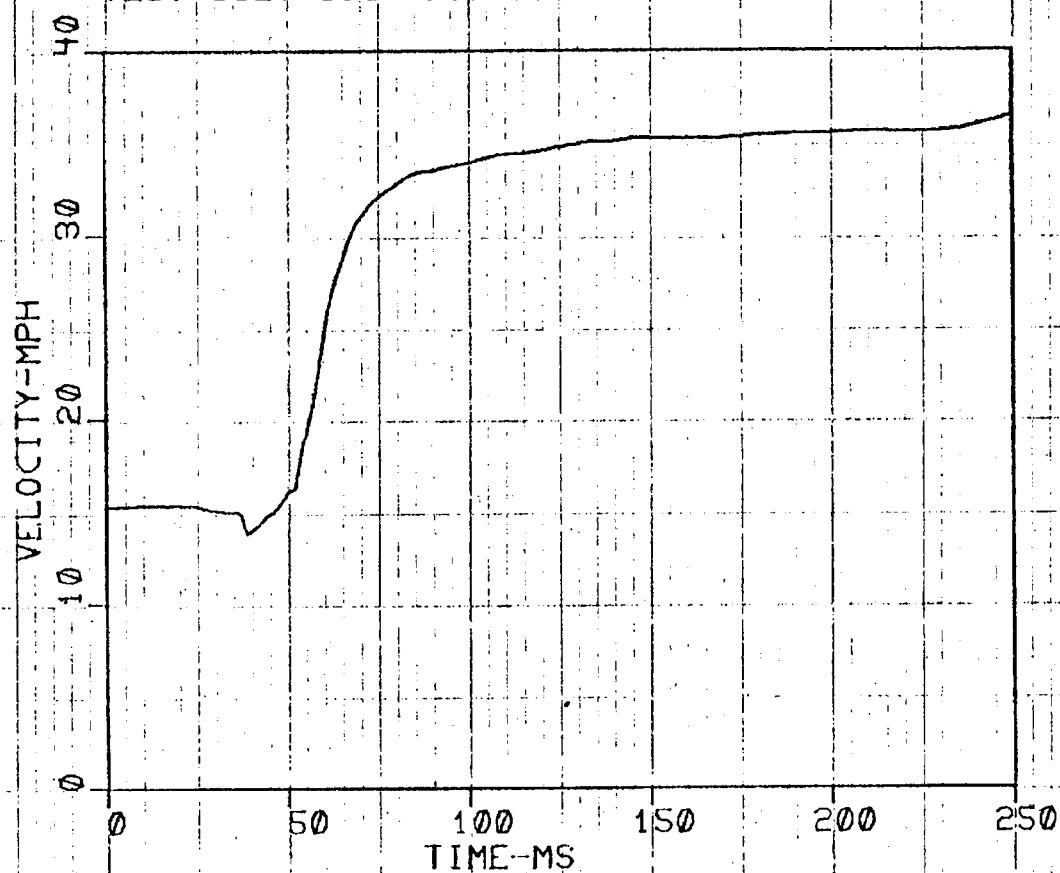


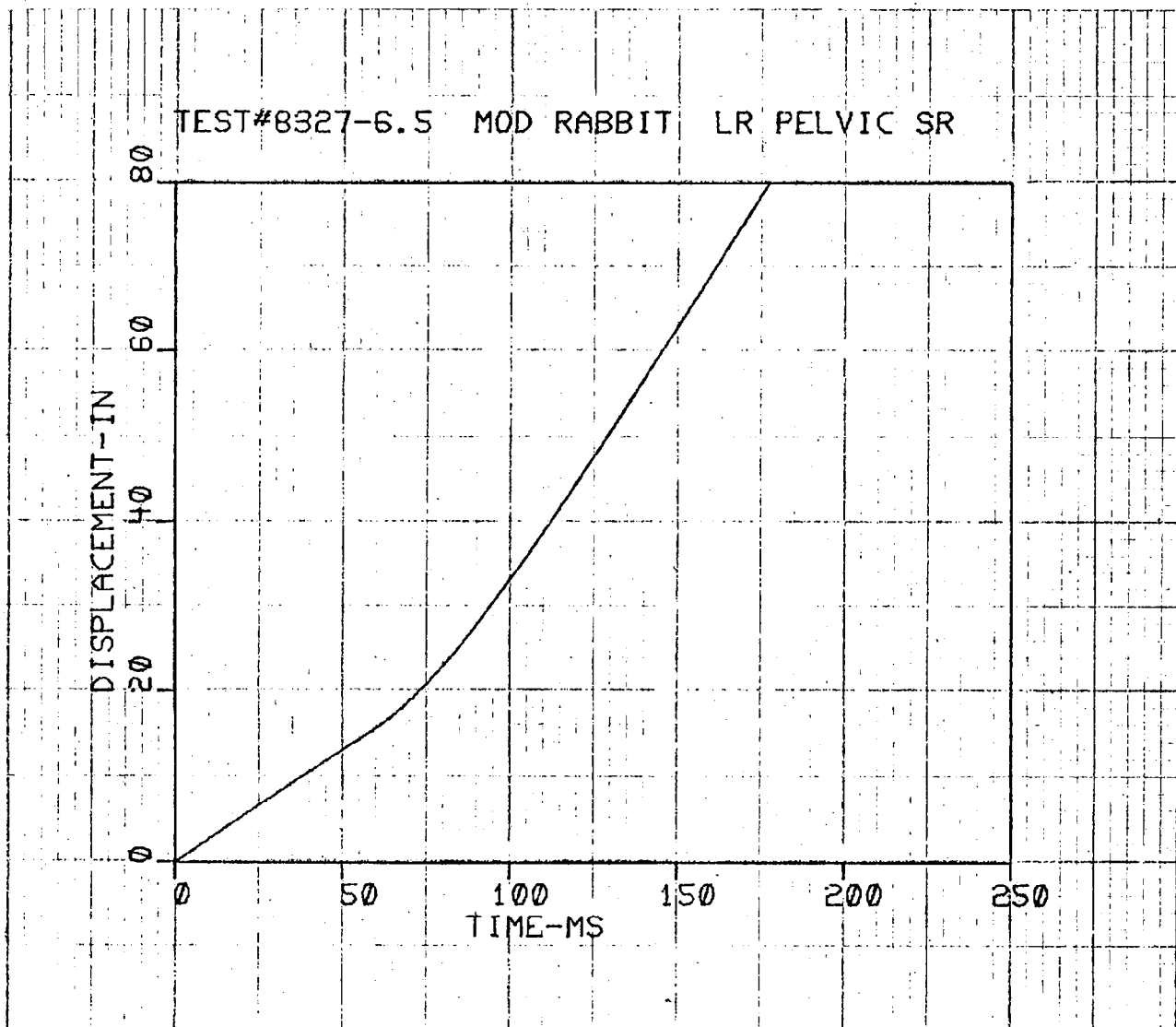


TEST#8327-6.5 MOD RABBIT LR PELVIC AR



TEST#8327-6.5 MOD RABBIT LR PELVIC VR



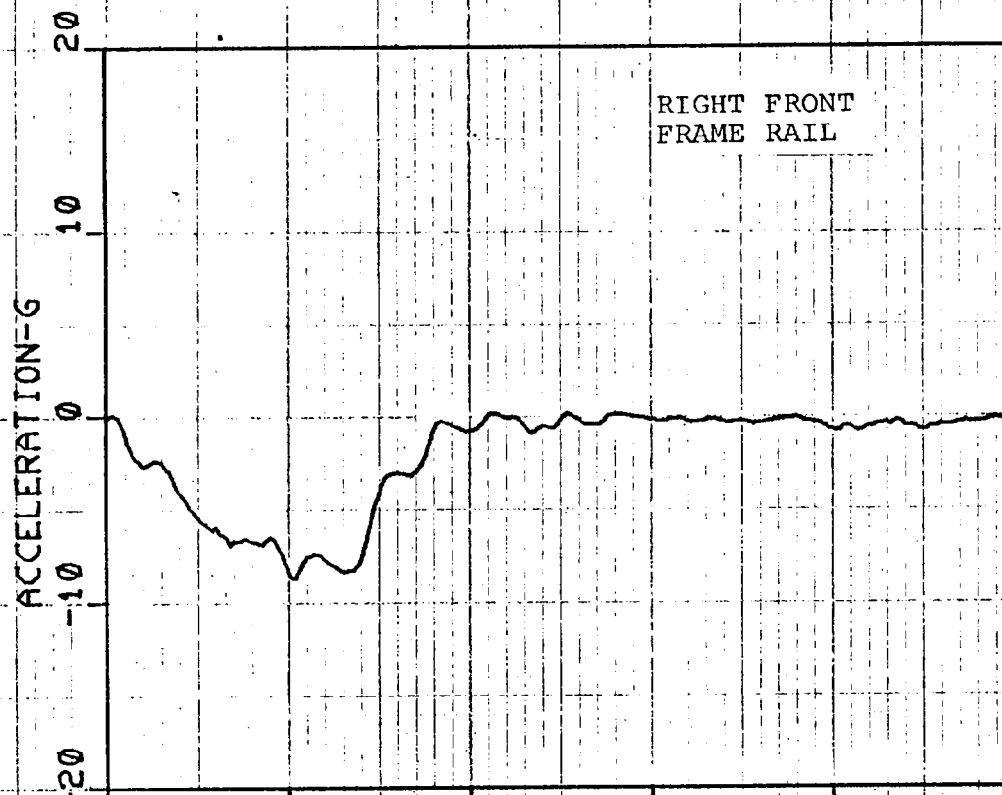


APPENDIX C

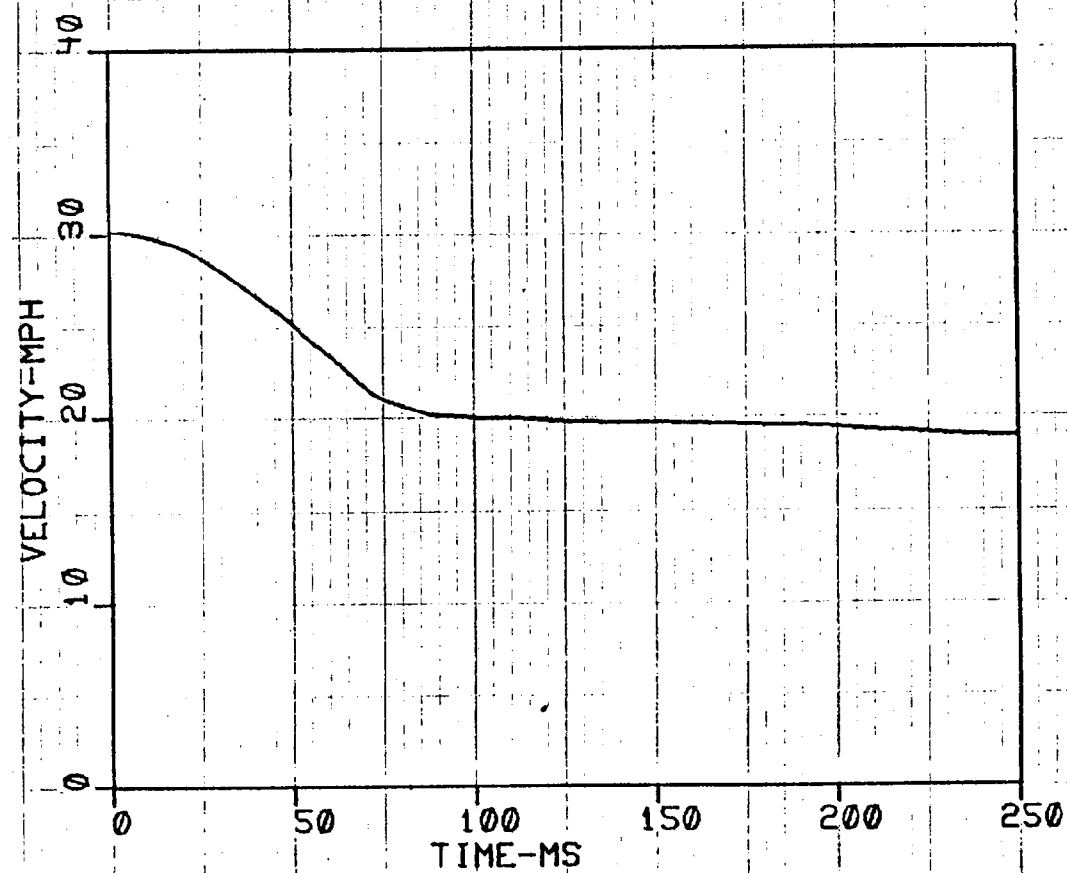
CALCOMP PLOTS
FOR TEST 8327-6.6

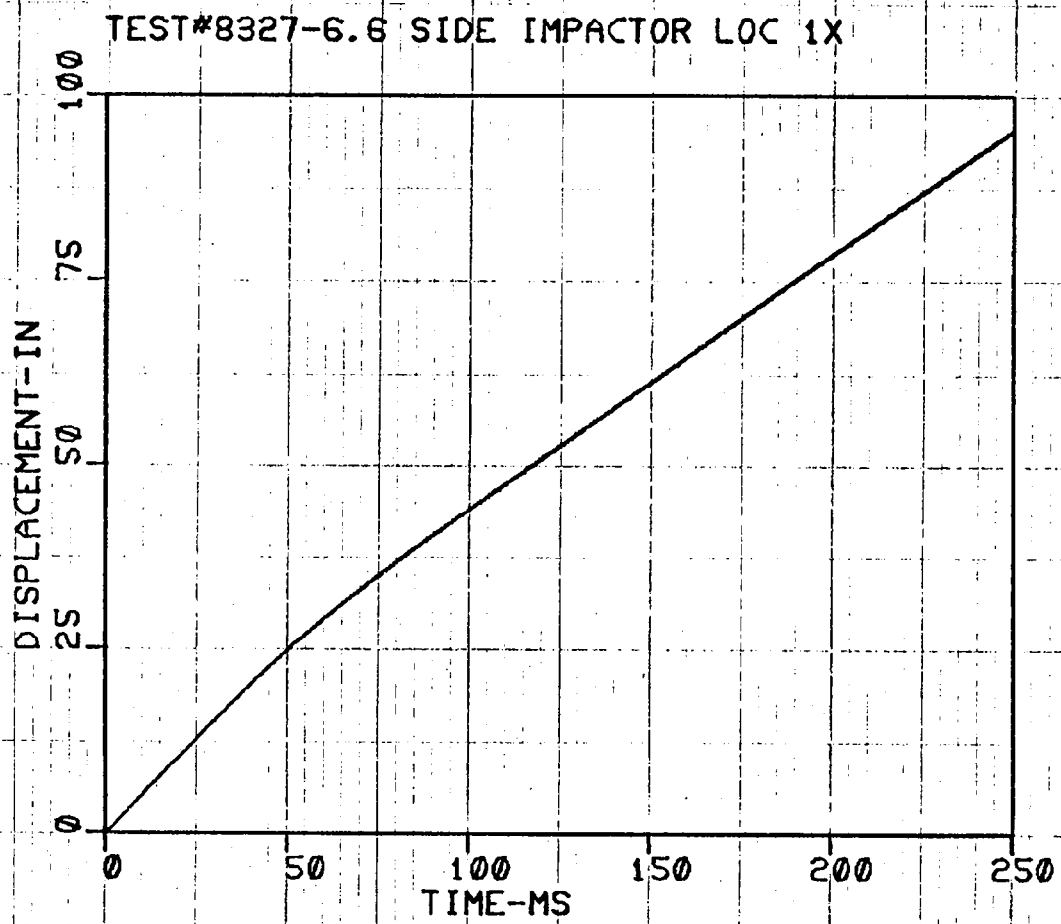
STRAIGHT SIDE IMPACTOR-INTO
MODIFIED VW RABBIT AT 60°
(BOTH VEHICLES MOVING)
(FRONT: APR REAR: SID)

TEST#8327-6.6 SIDE IMPACTOR LOC 1X

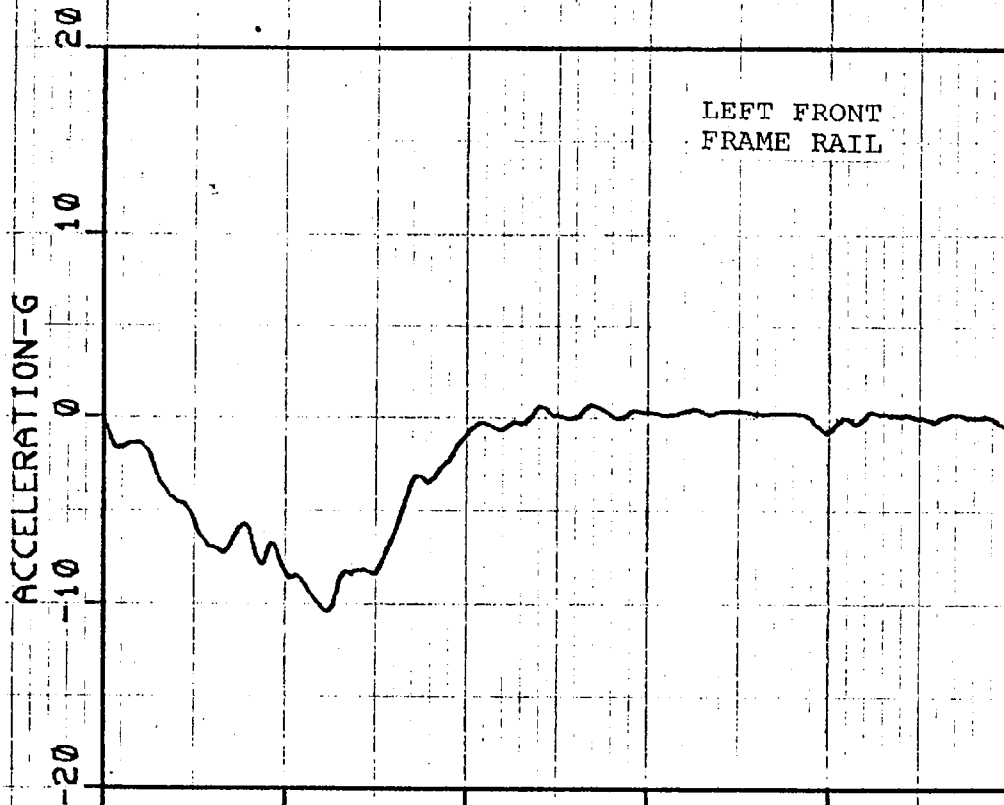


TEST#8327-6.6 SIDE IMPACTOR LOC 1X

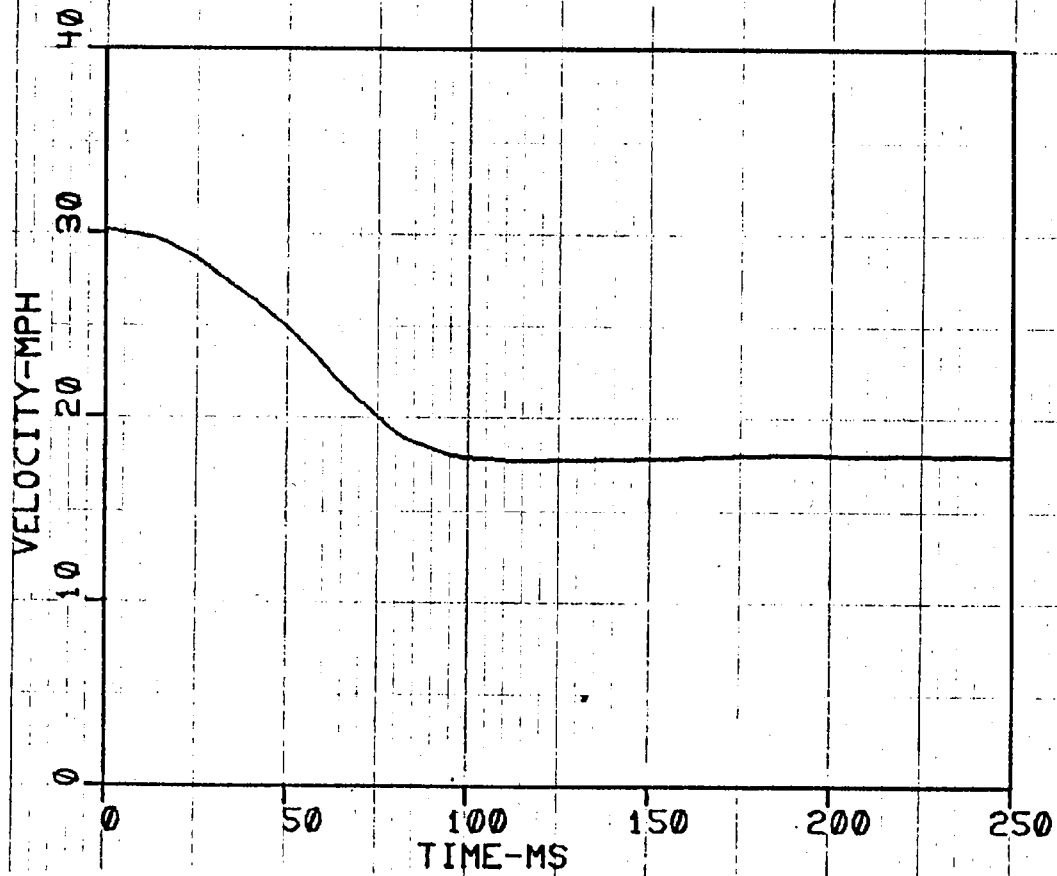


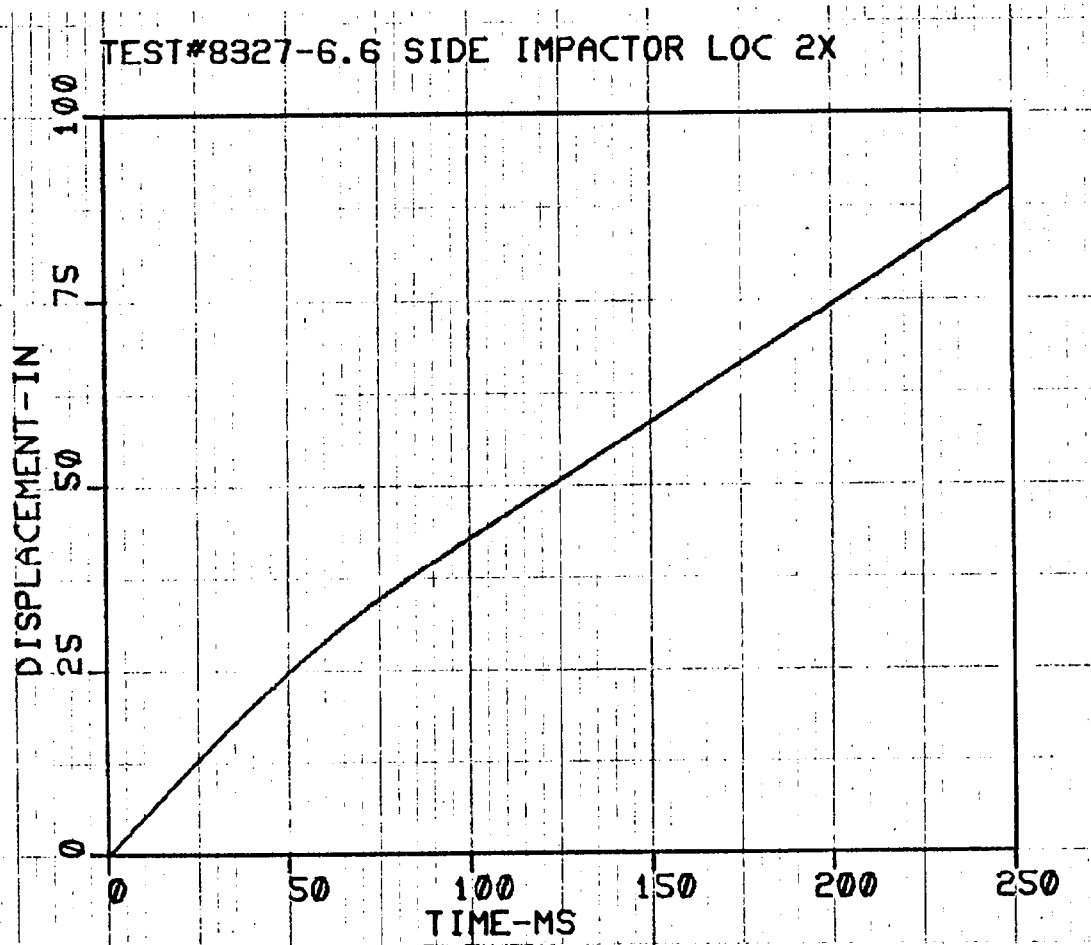


TEST#8327-6.6 SIDE IMPACTOR LOC 2X

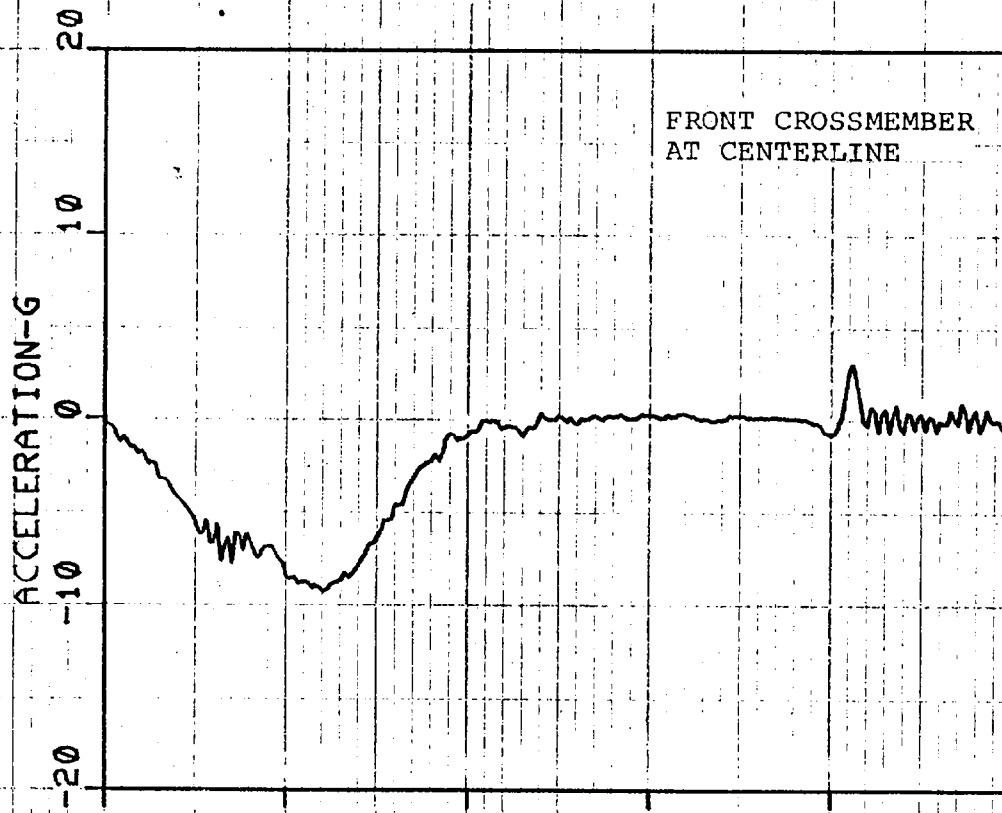


TEST#8327-6.6 SIDE IMPACTOR LOC 2X

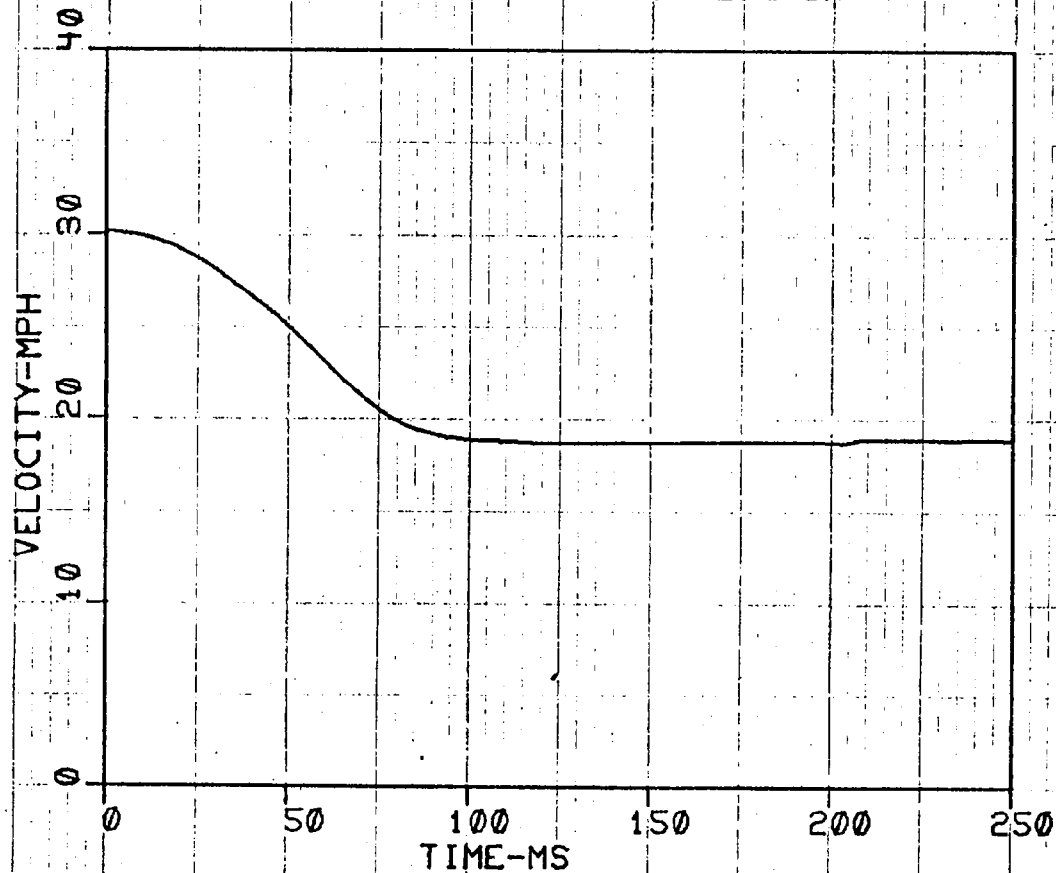


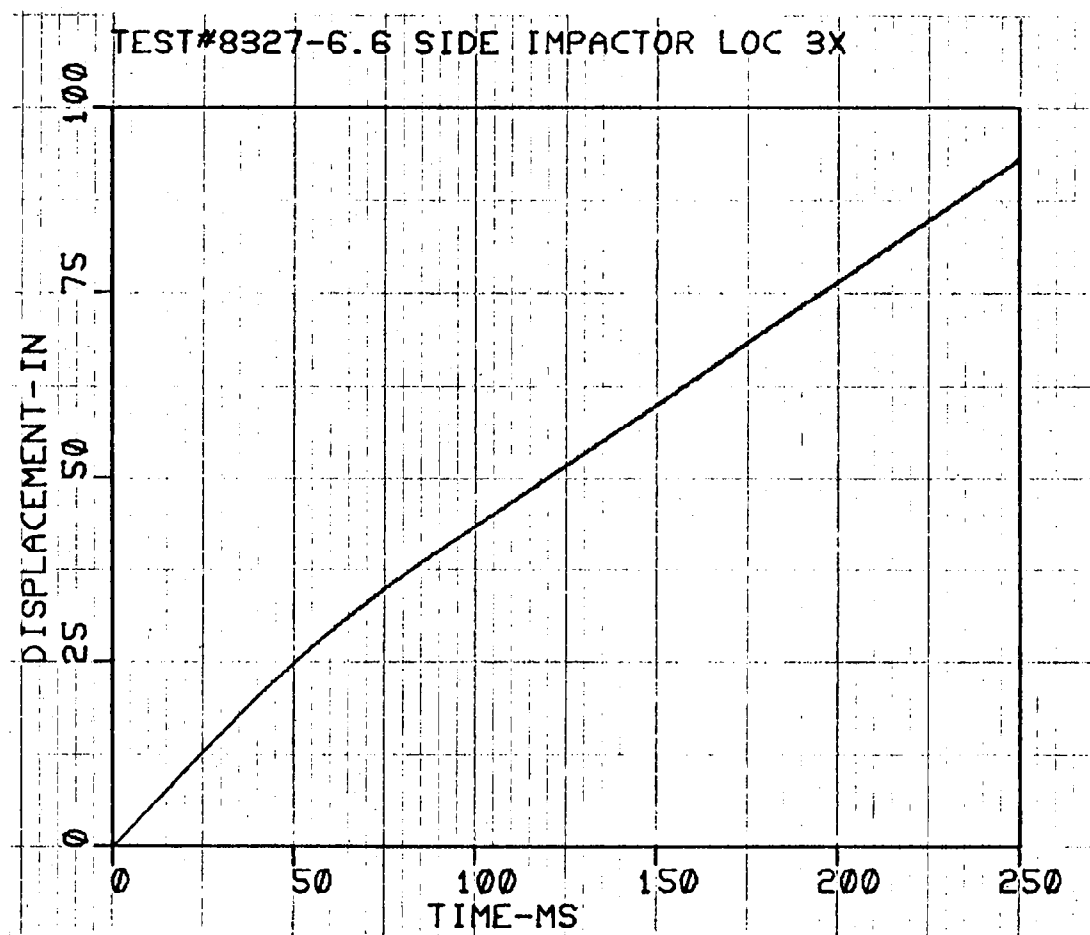


TEST#8327-6.6 SIDE IMPACTOR LOC 3X

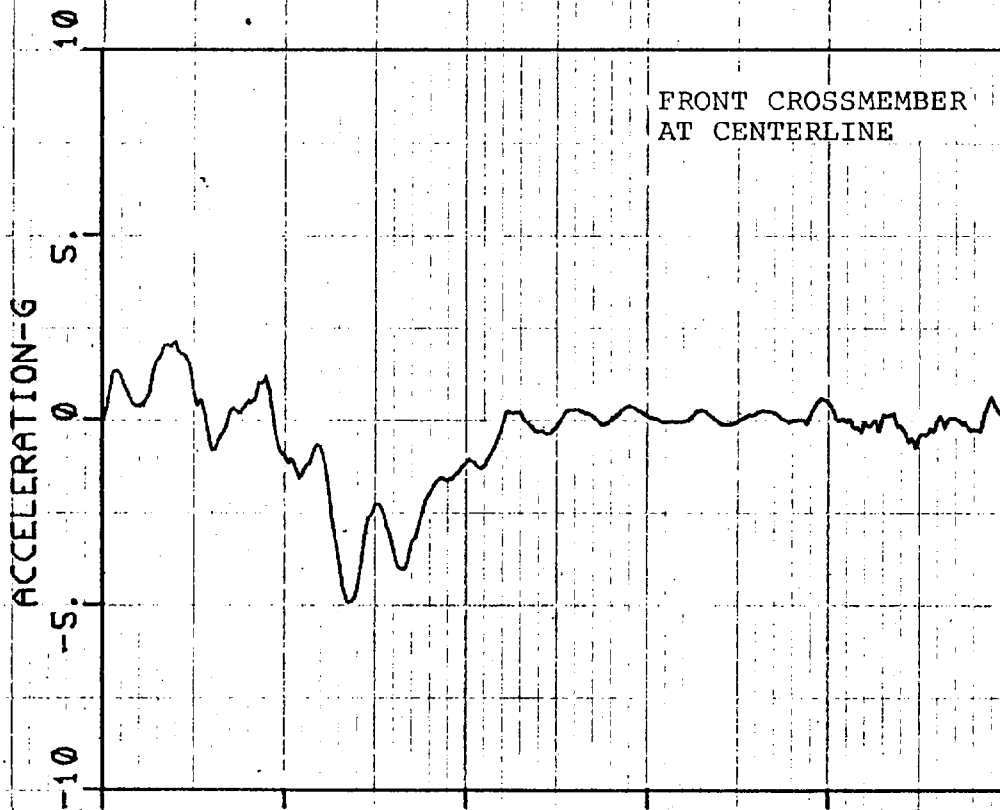


TEST#8327-6.6 SIDE IMPACTOR LOC 3X

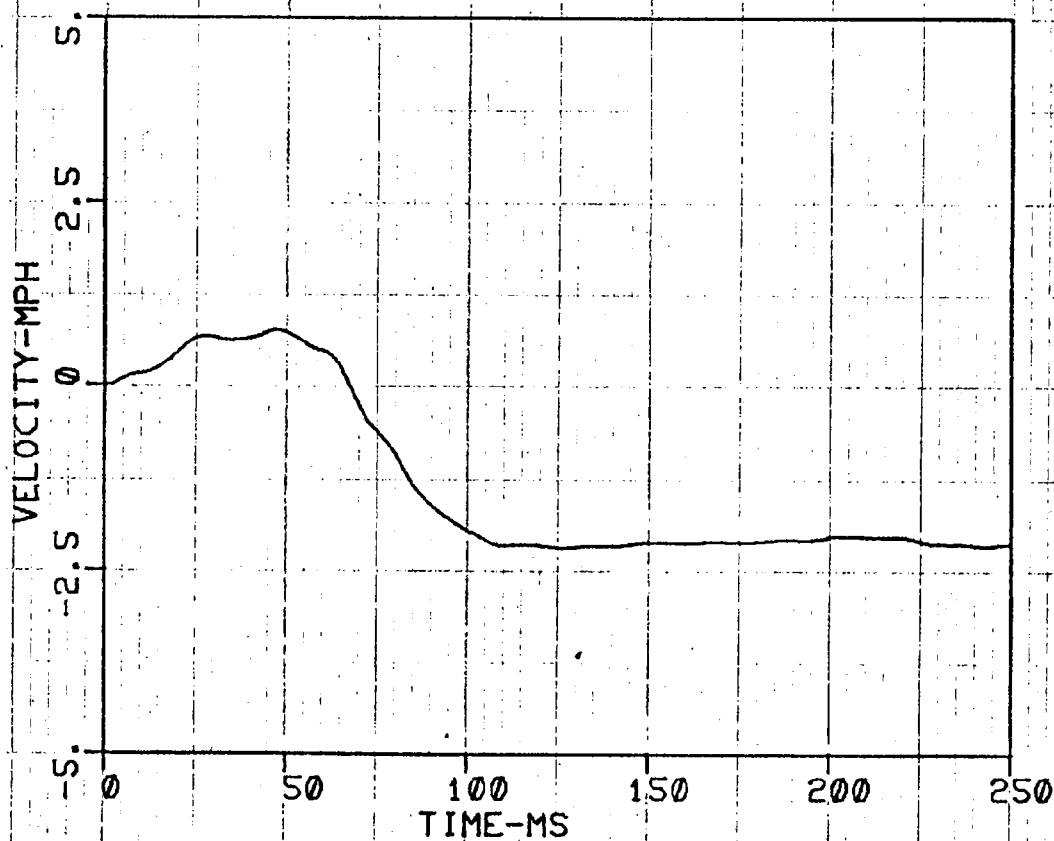


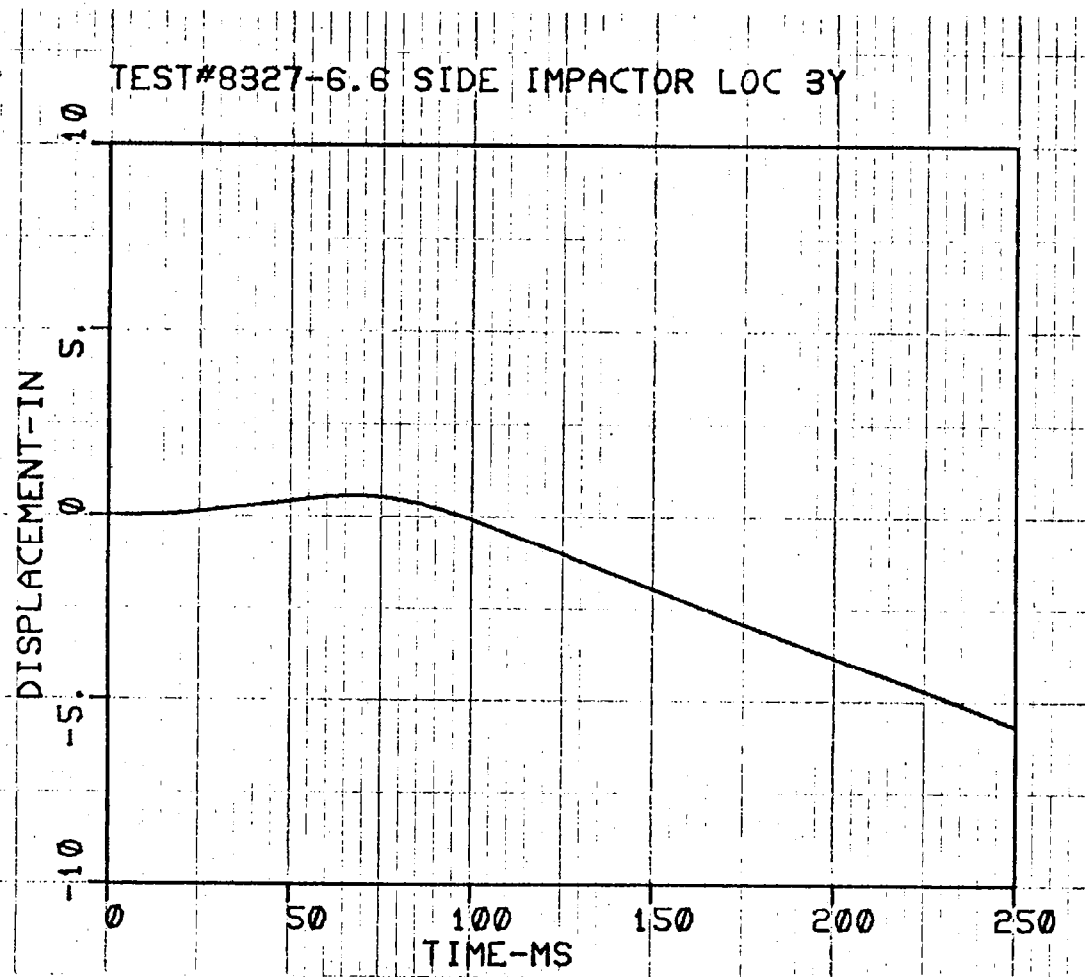


TEST#8327-6.6 SIDE IMPACTOR LOC 3Y

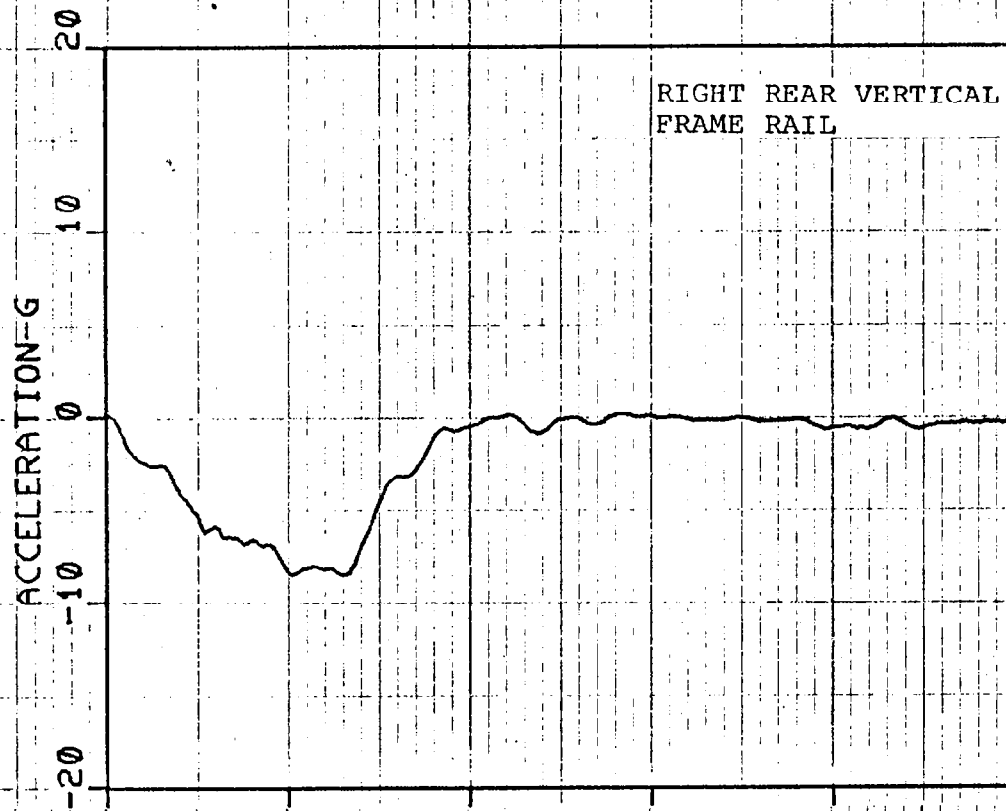


TEST#8327-6.6 SIDE IMPACTOR LOC 3Y

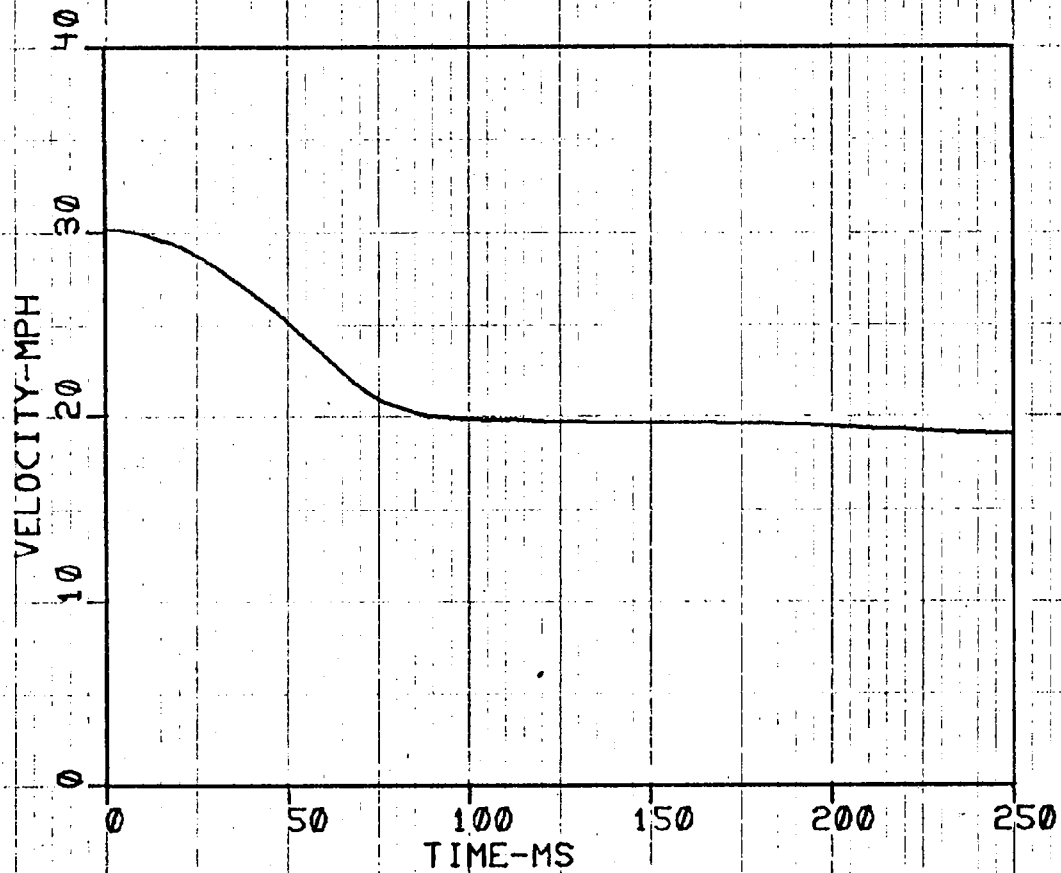


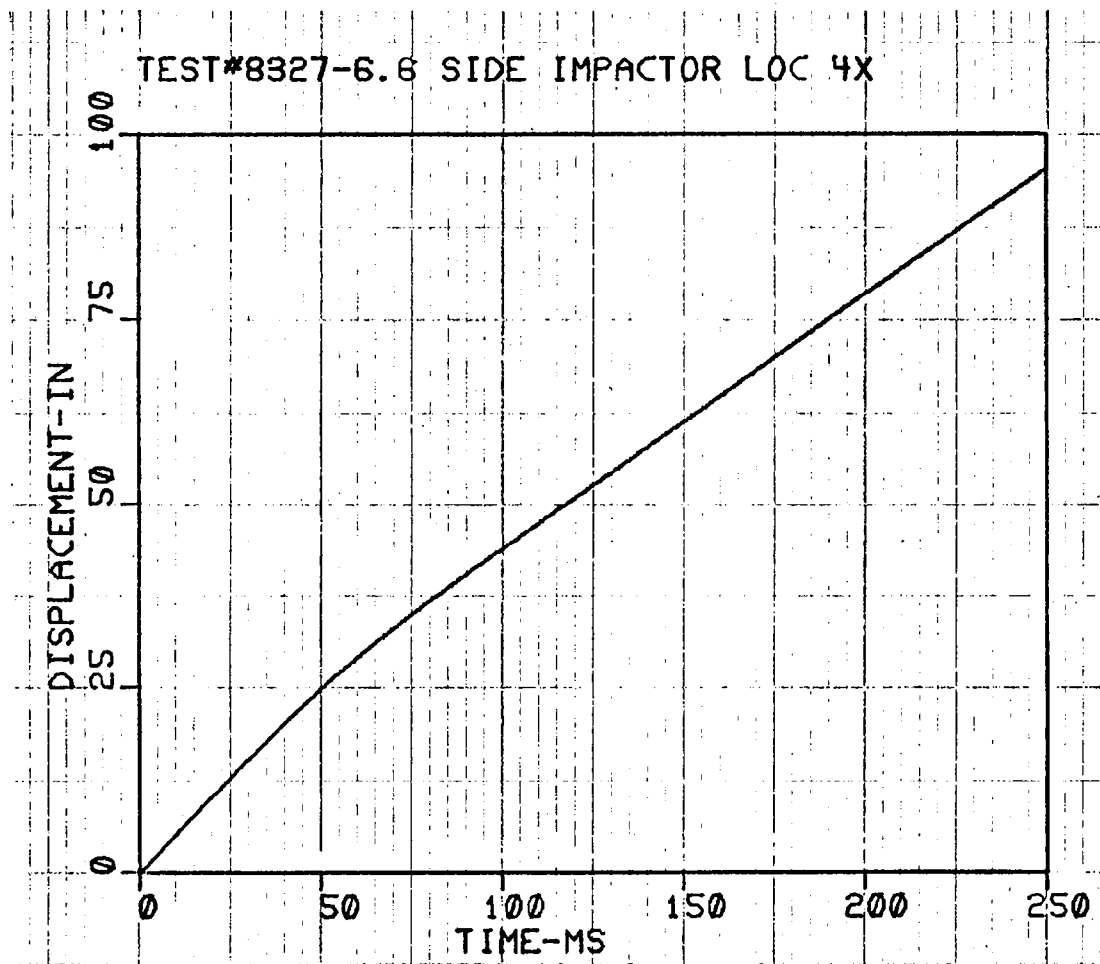


TEST#8327-6.6 SIDE IMPACTOR LOC 4X

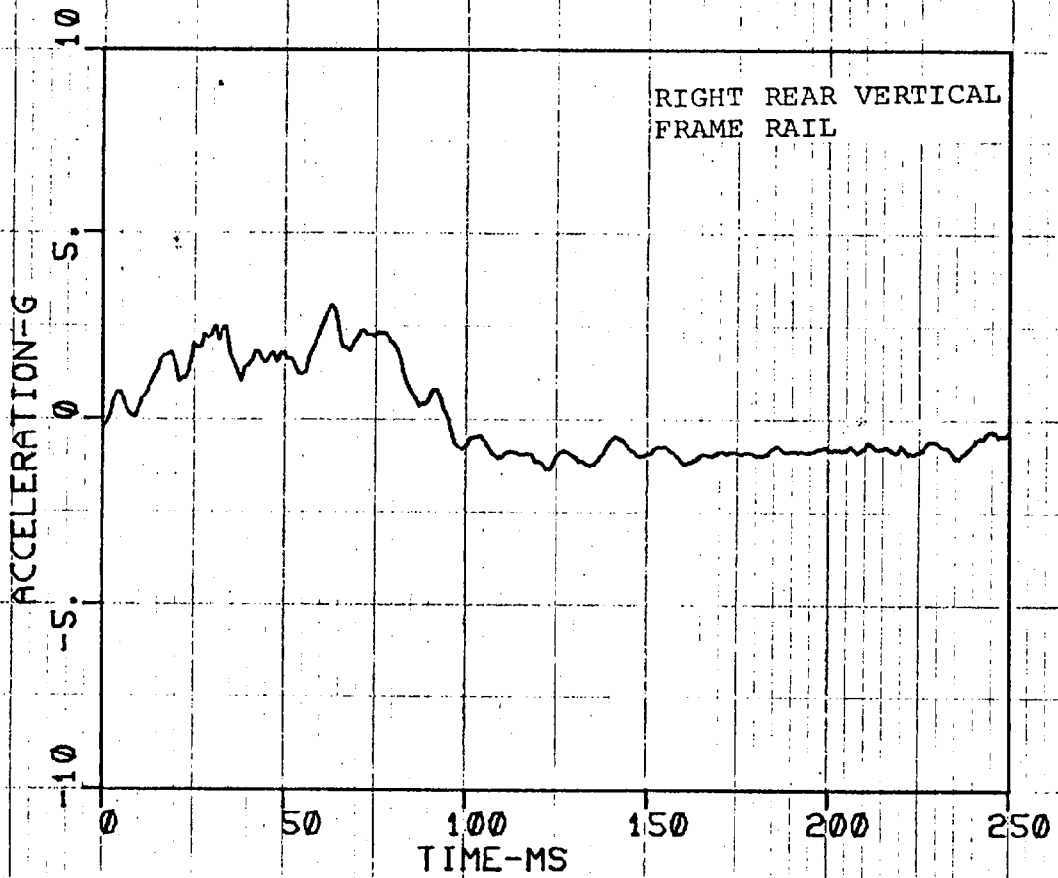


TEST#8327-6.6 SIDE IMPACTOR LOC 4X

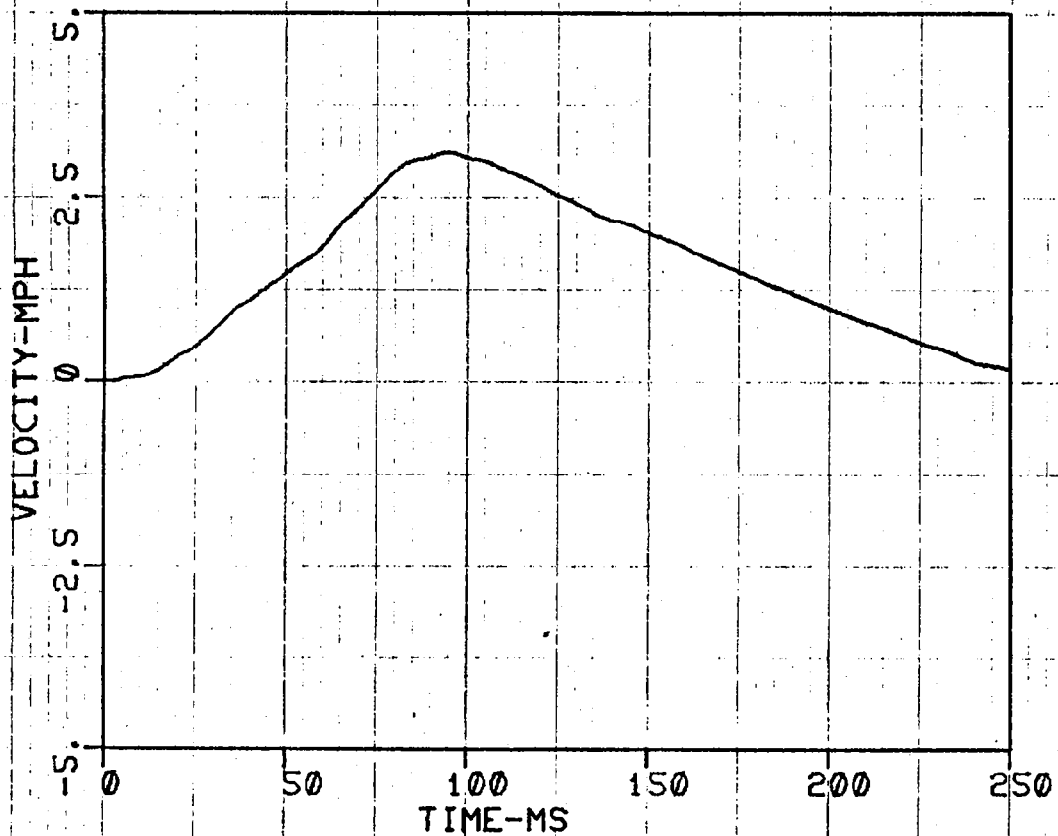


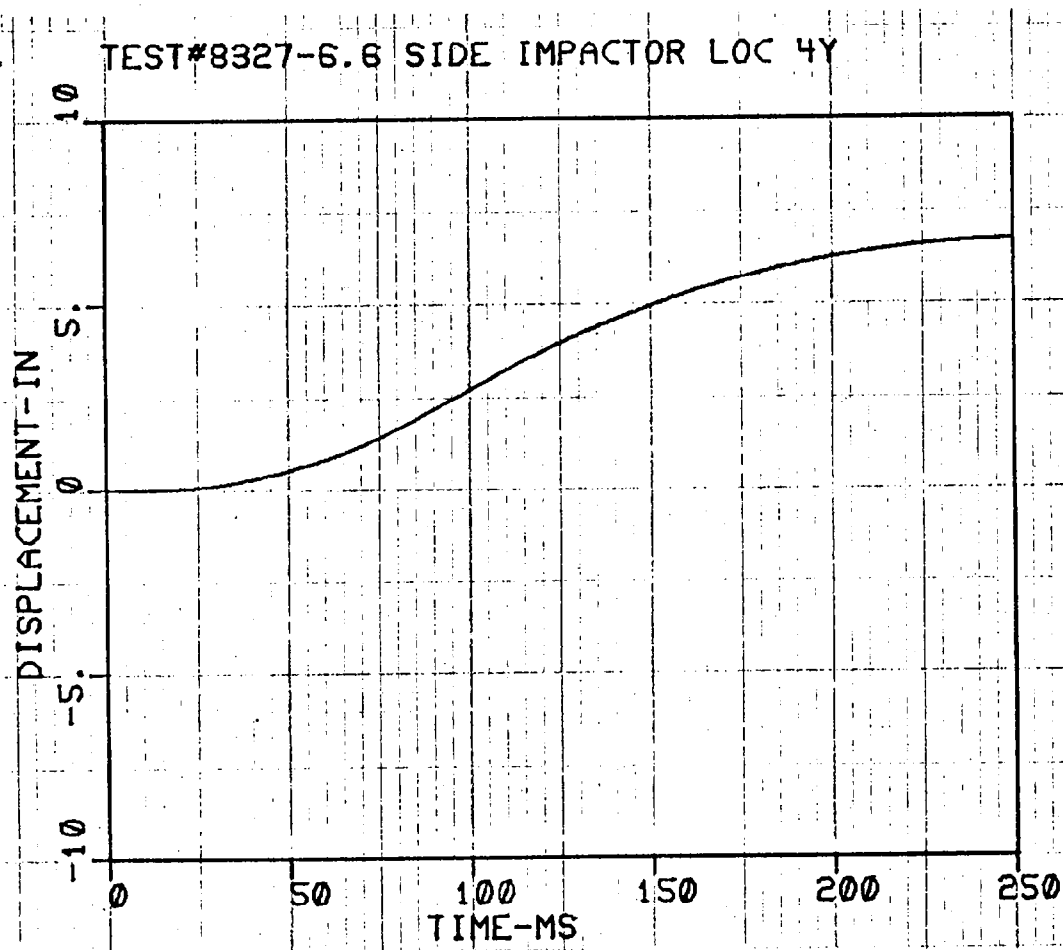


TEST#8327-6.6 SIDE IMPACTOR LOC 4Y

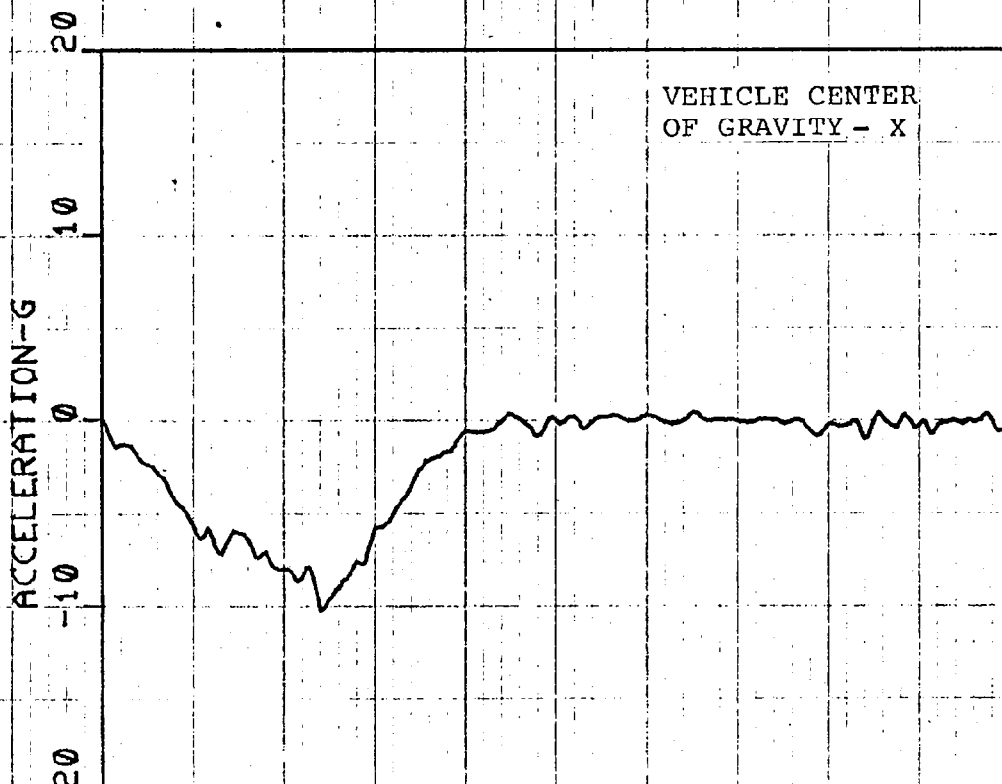


TEST#8327-6.6 SIDE IMPACTOR LOC 4Y

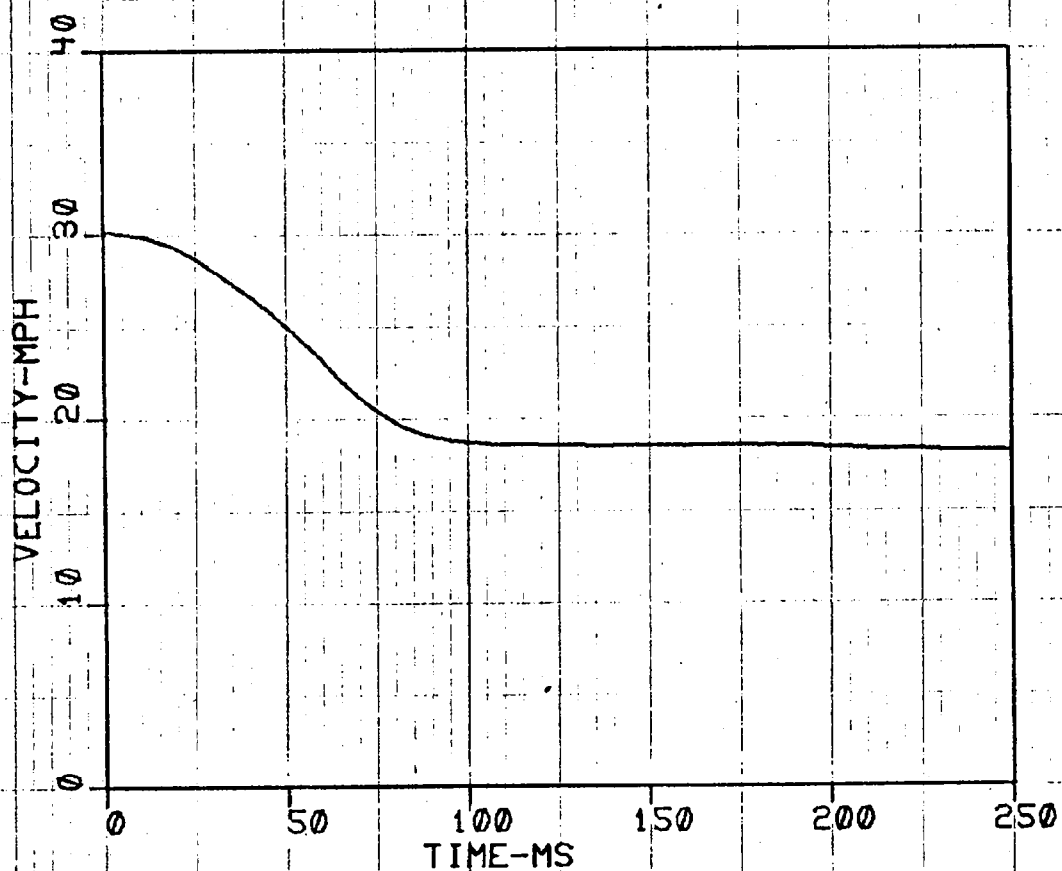


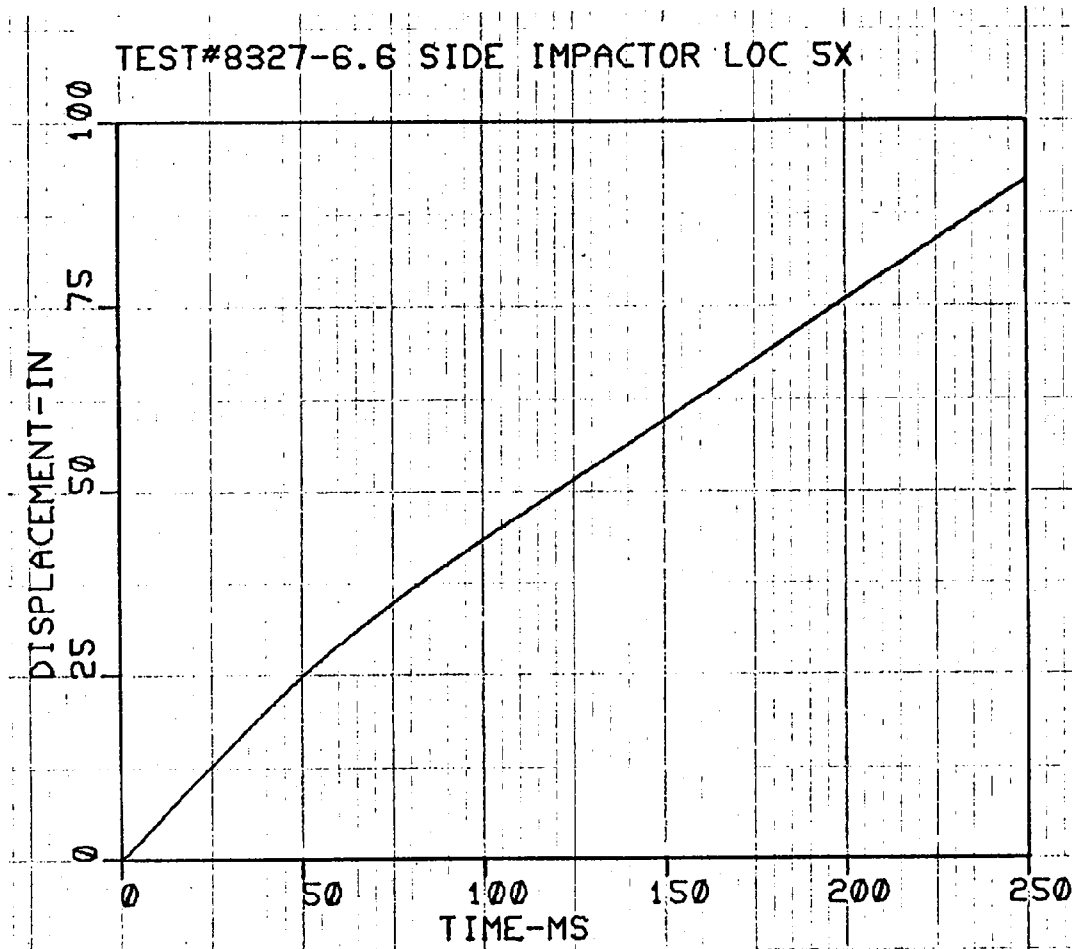


TEST#8327-6.6 SIDE IMPACTOR LOC 5X

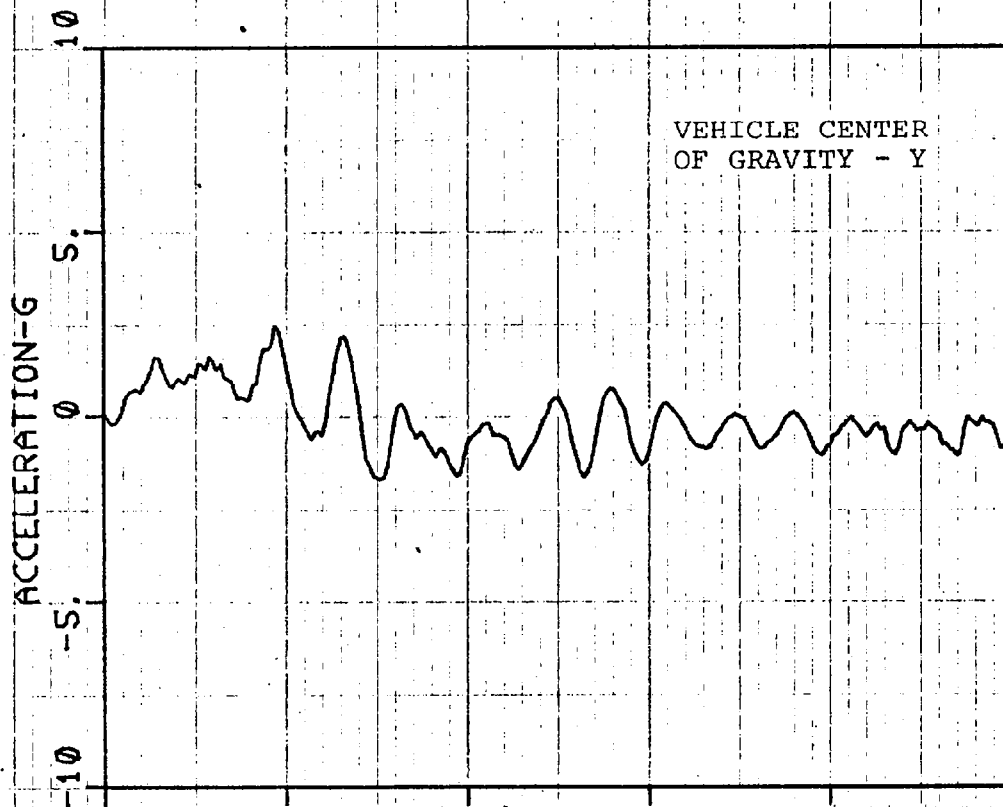


TEST#8327-6.6 SIDE IMPACTOR LOC 5X

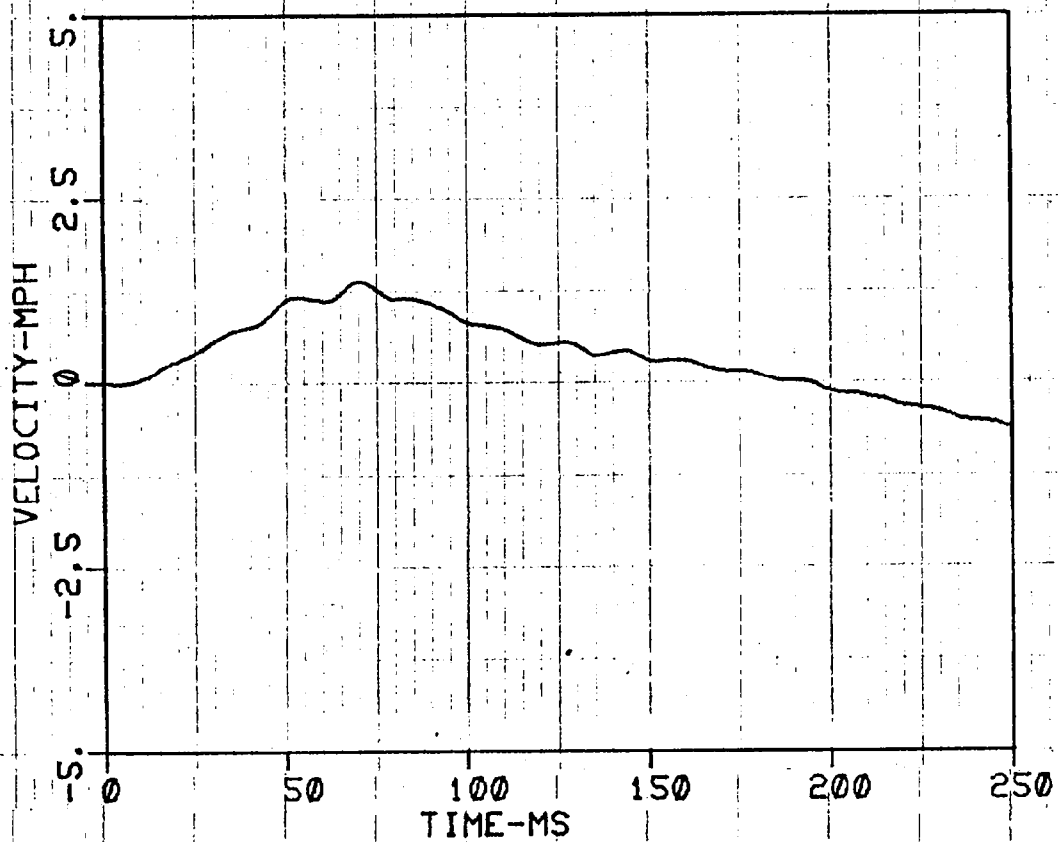


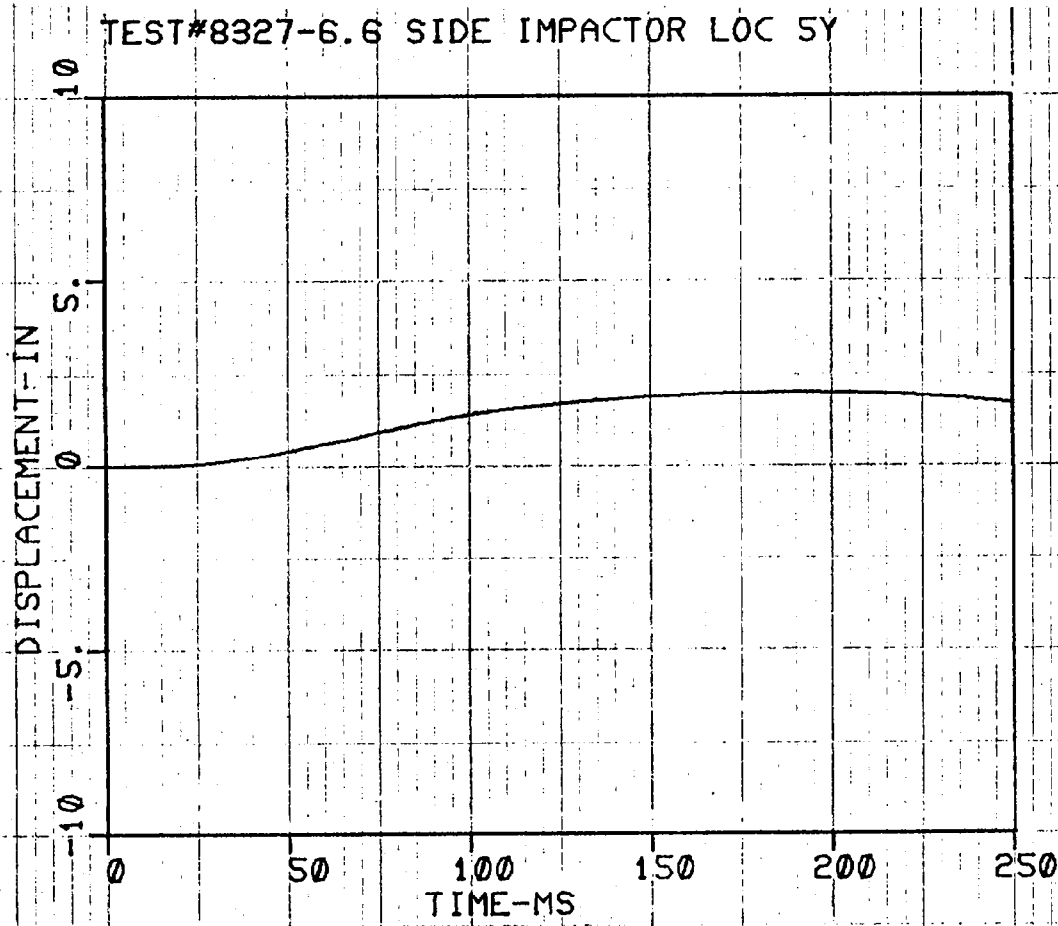


TEST#8327-6.6 SIDE IMPACTOR LOC 5Y

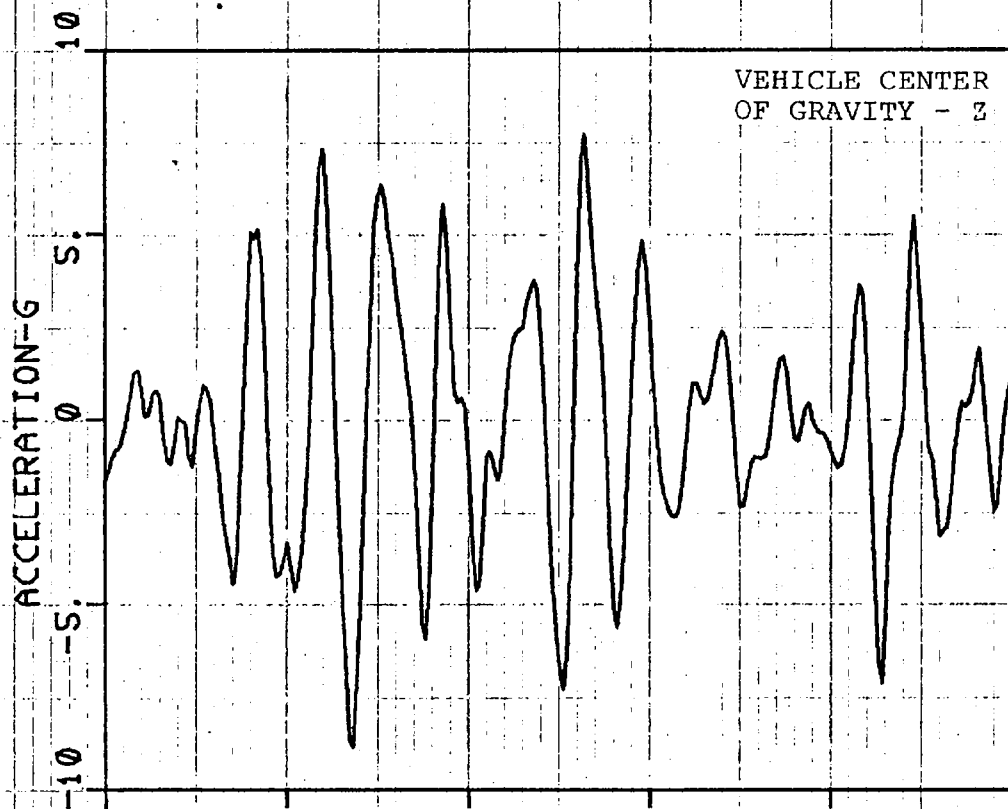


TEST#8327-6.6 SIDE IMPACTOR LOC 5Y

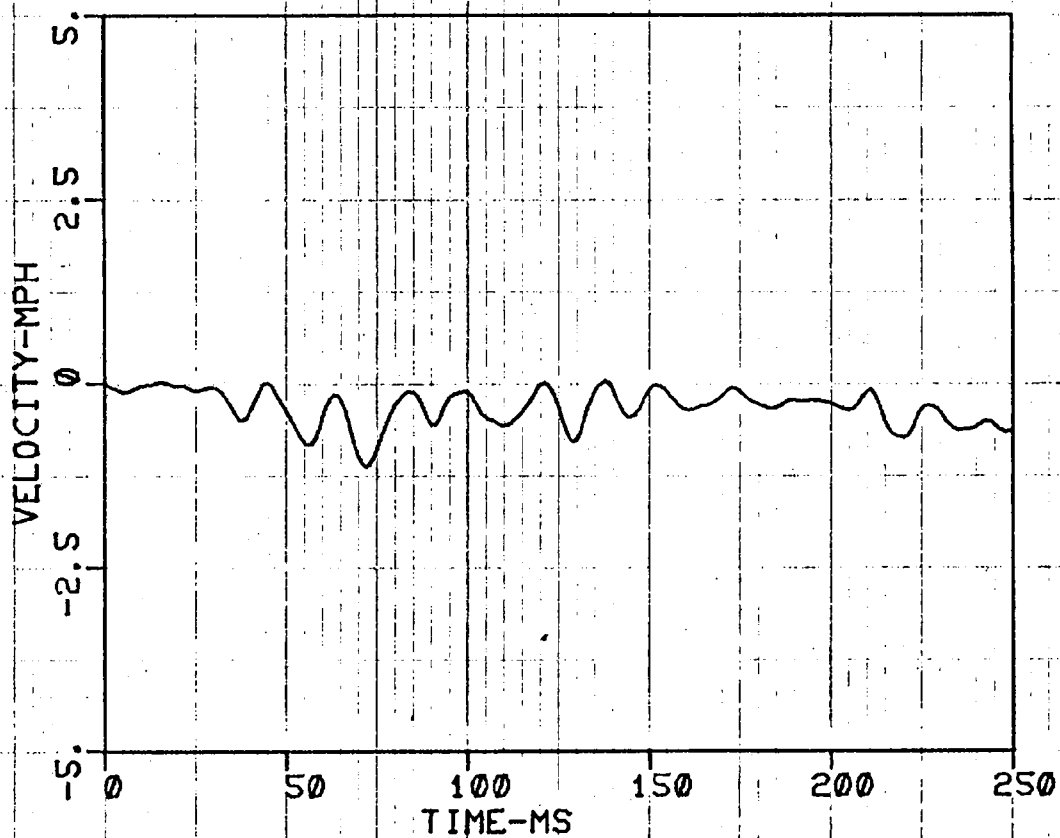


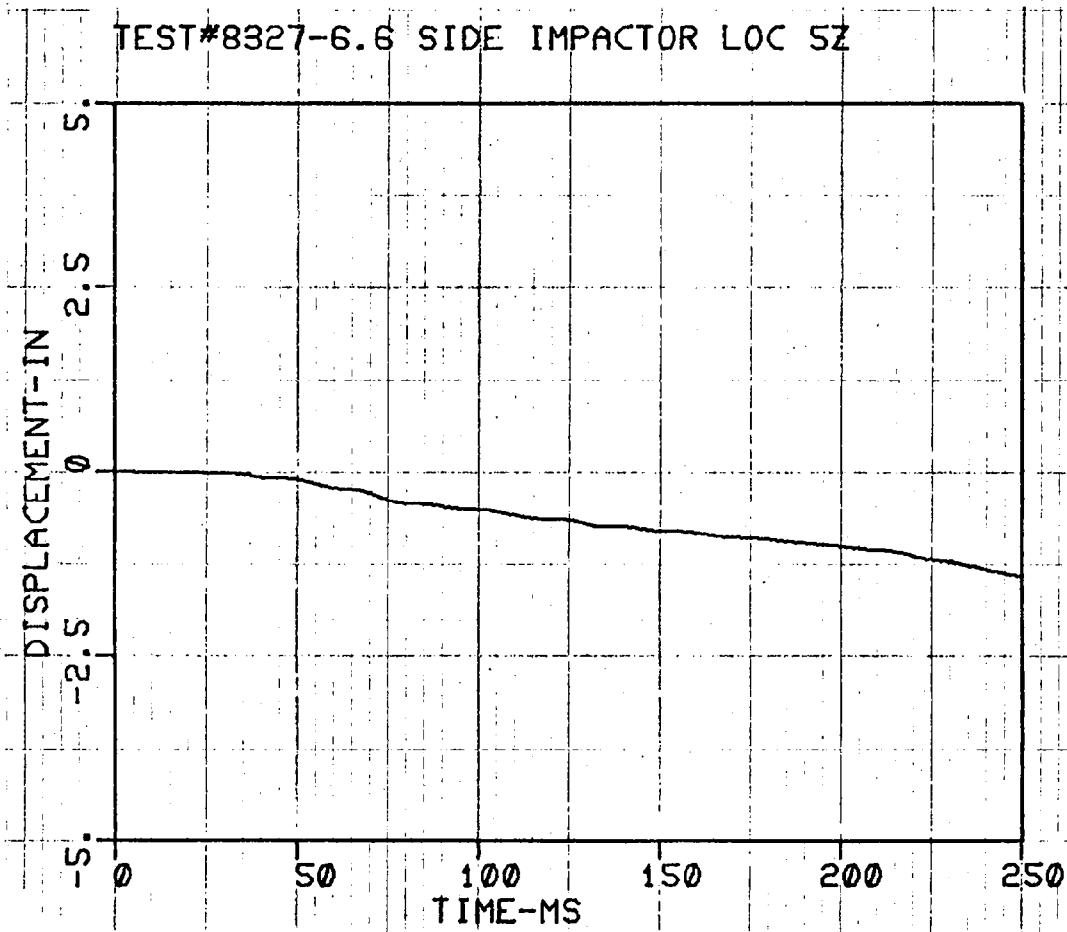


TEST#8327-6.6 SIDE IMPACTOR LOC 5Z

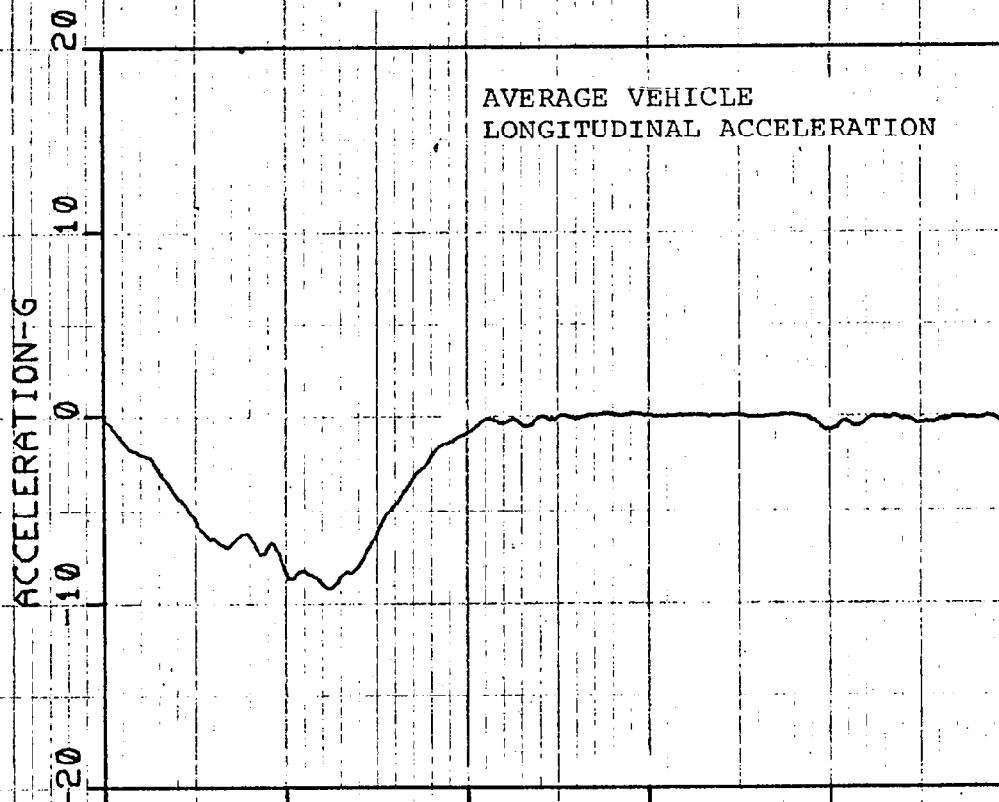


TEST#8327-6.6 SIDE IMPACTOR LOC 5Z

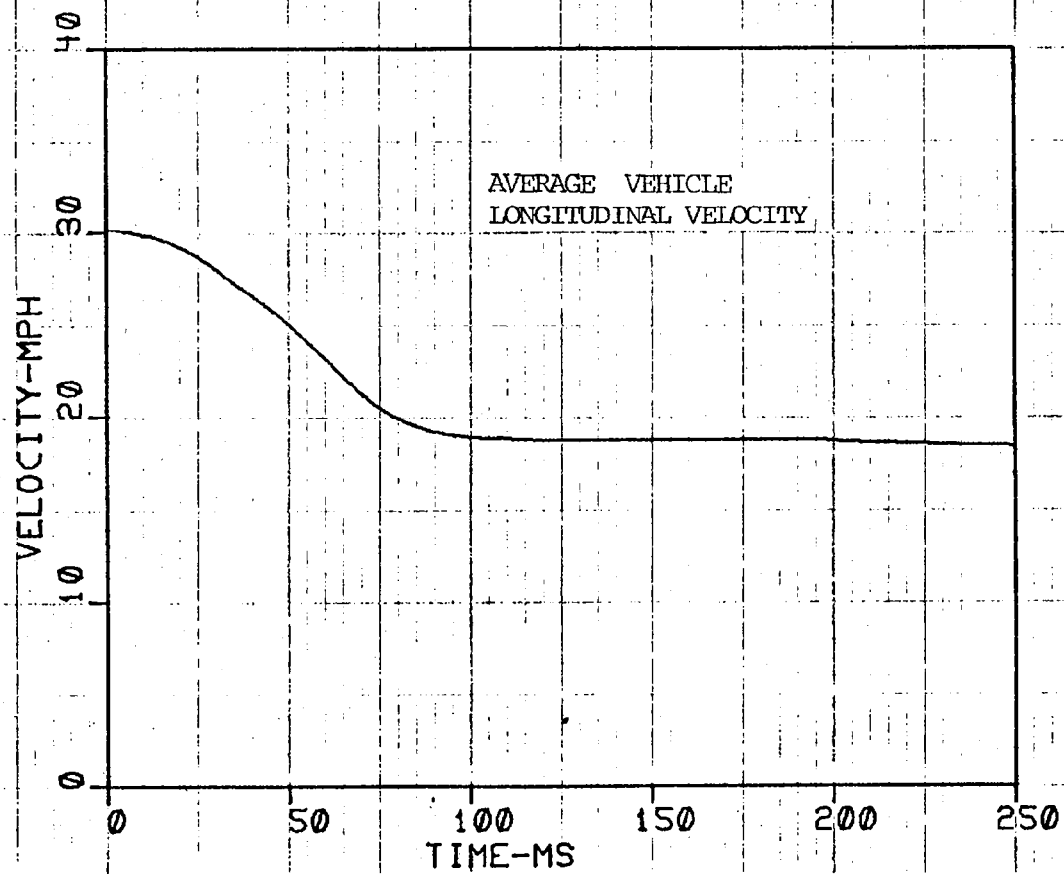


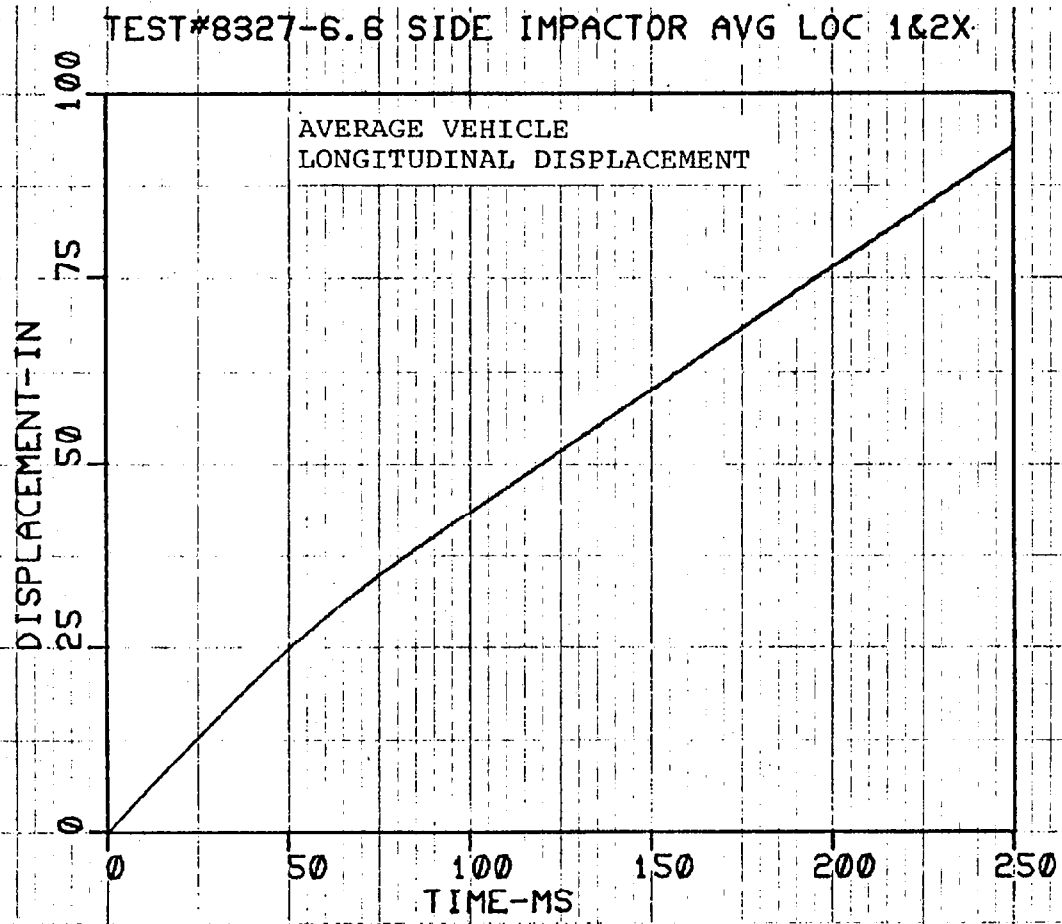


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 1&2X

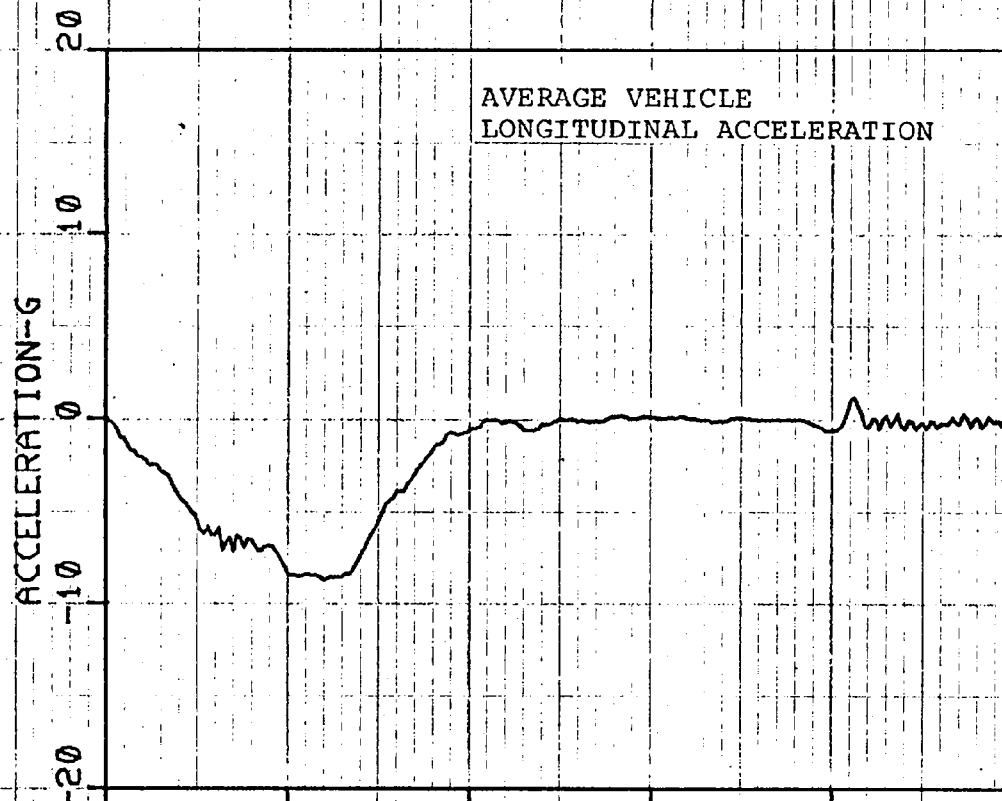


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 1&2X

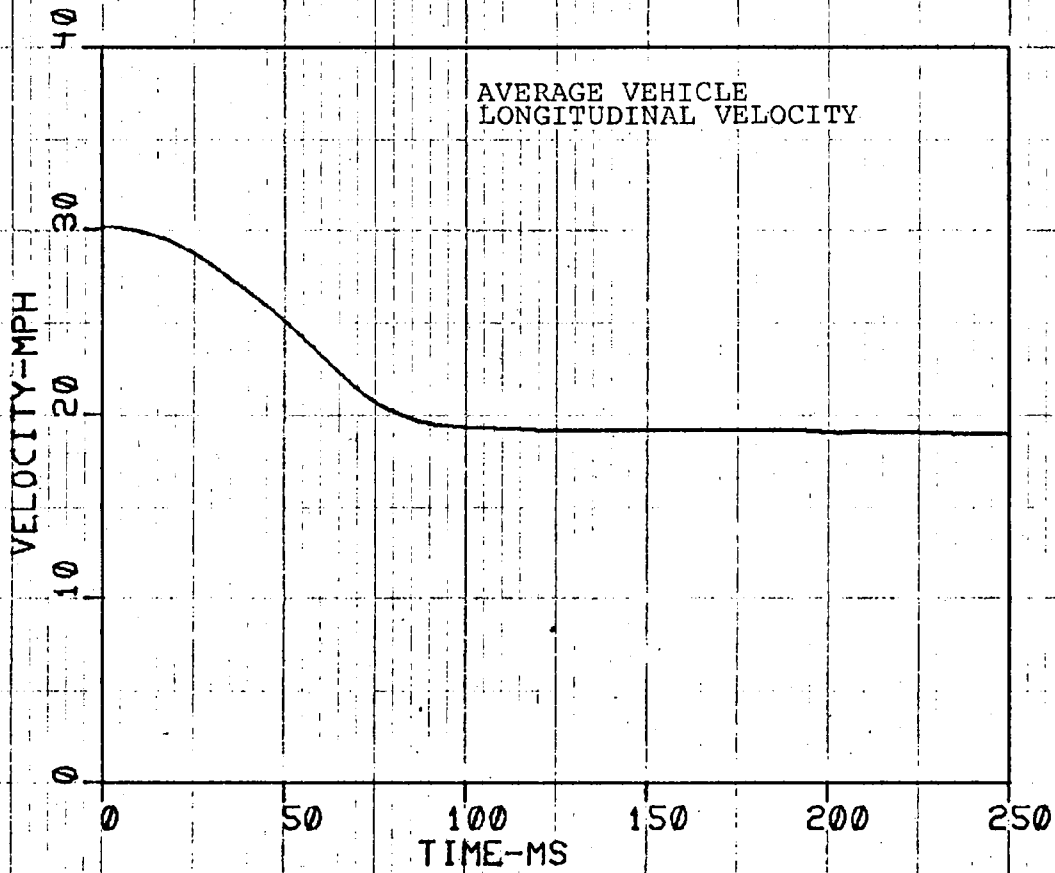


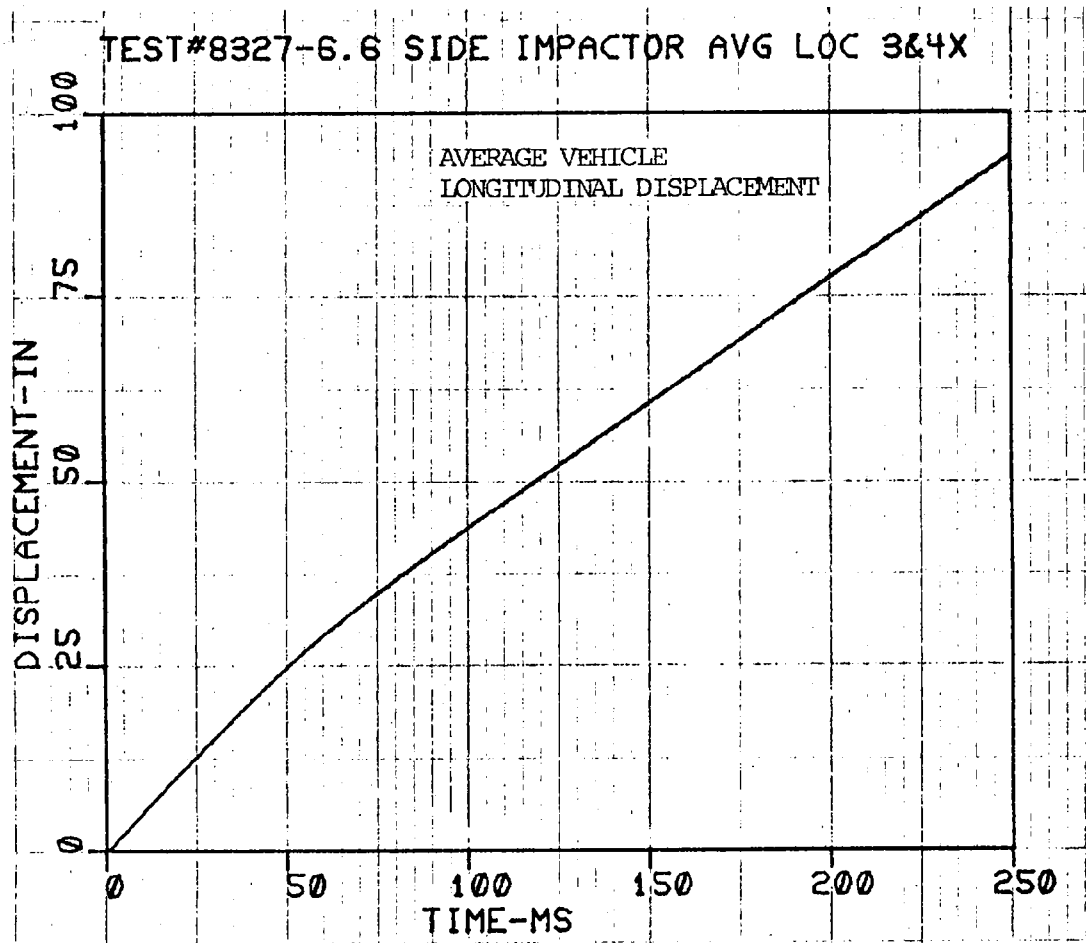


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 3&4X

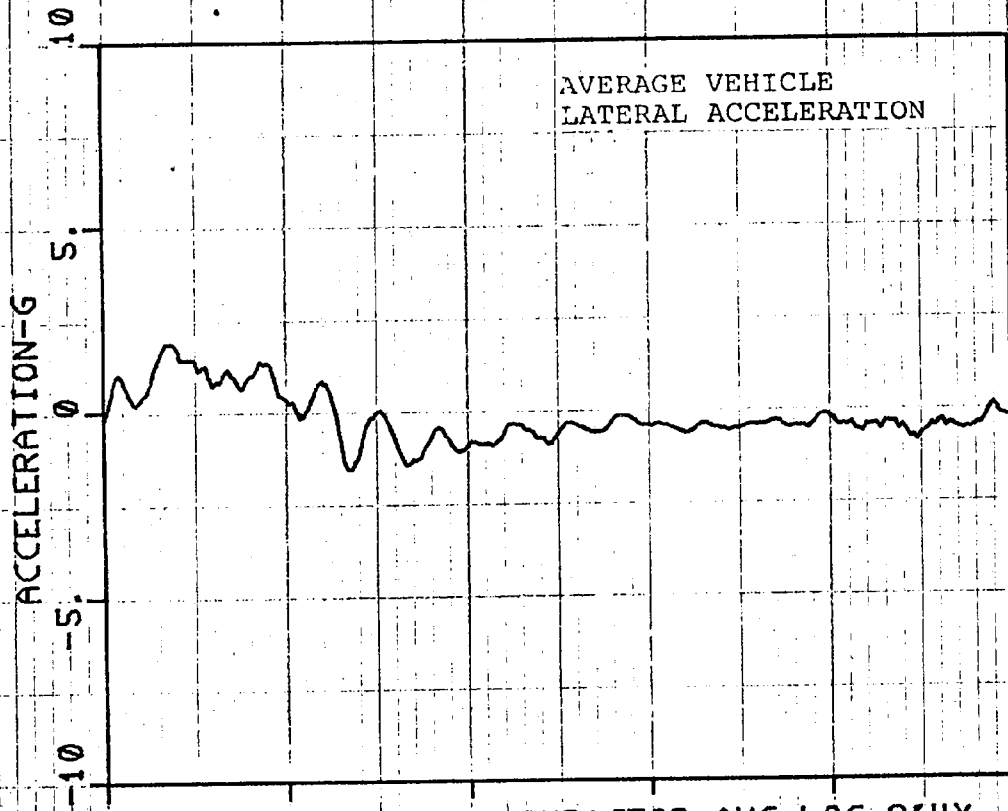


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 3&4X

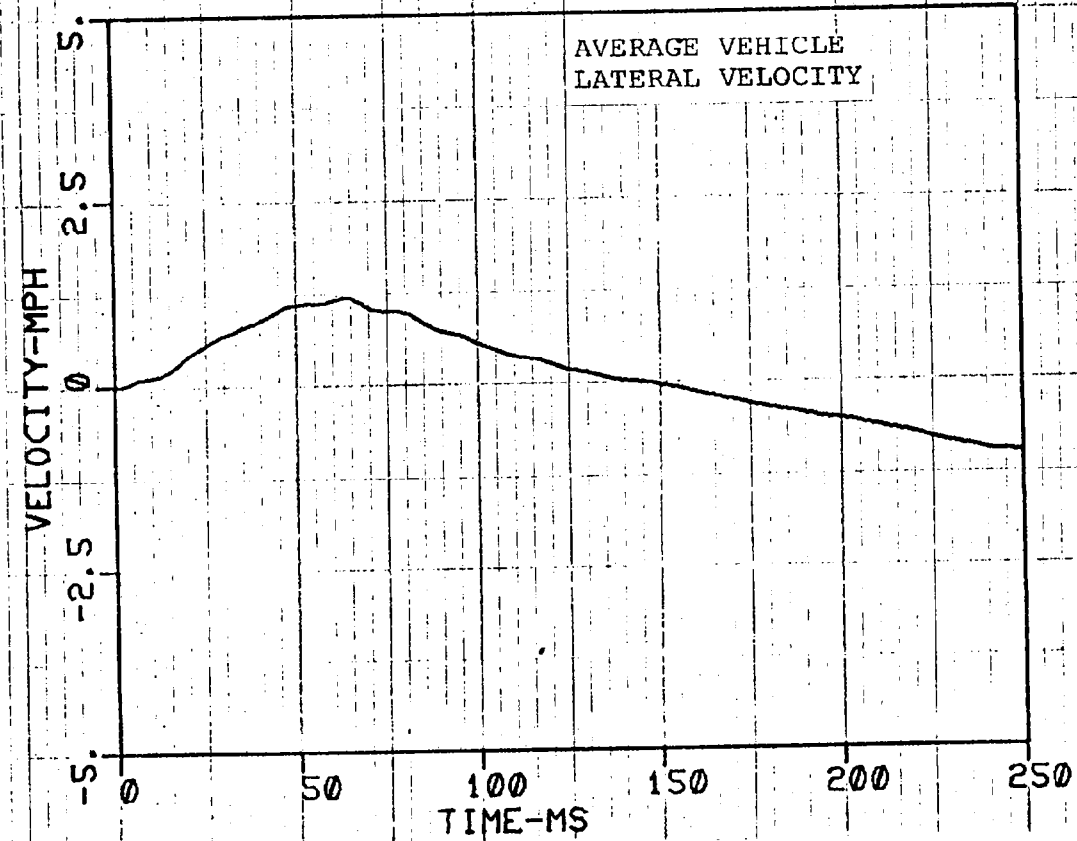


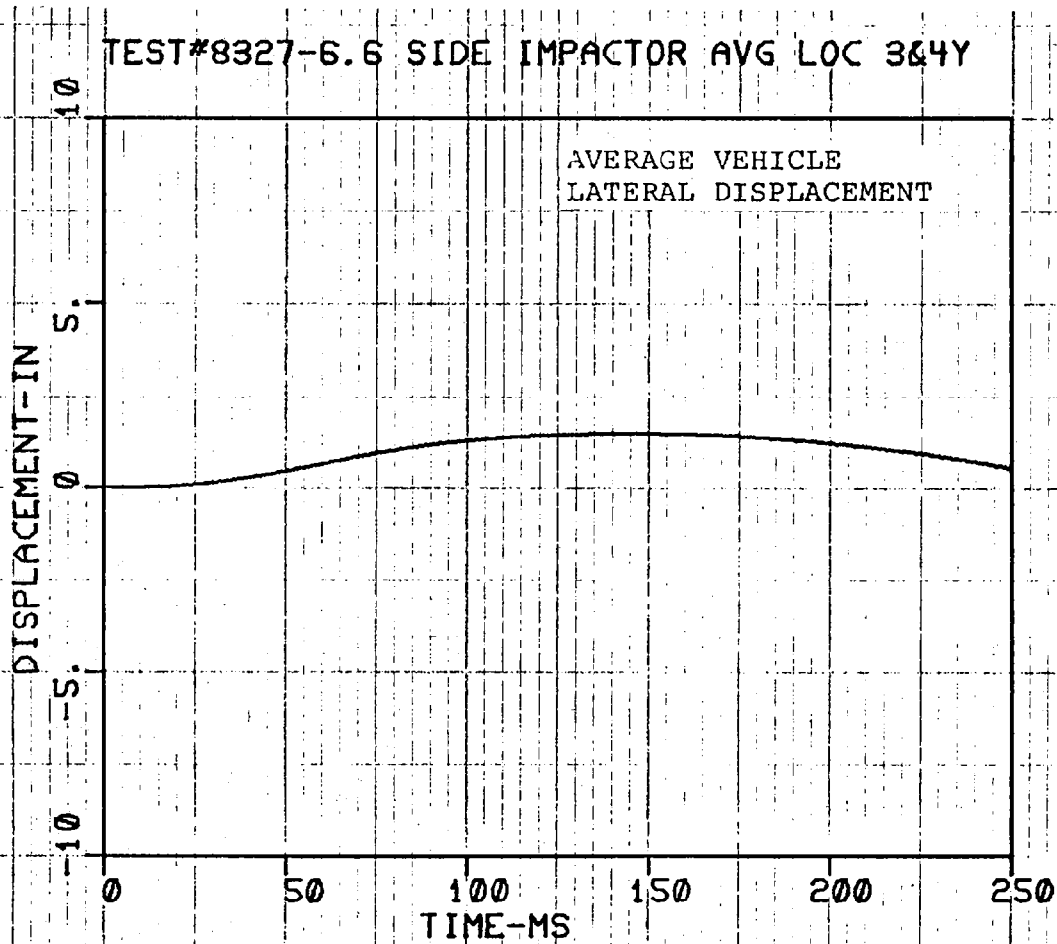


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 3&4Y

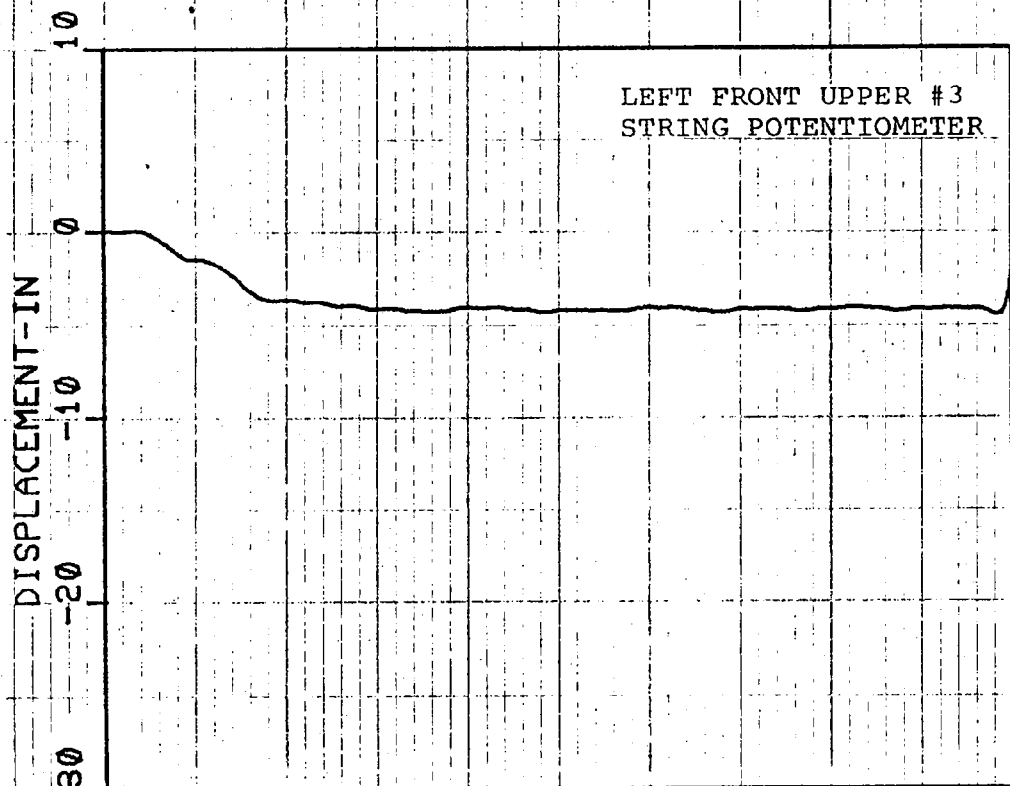


TEST#8327-6.6 SIDE IMPACTOR AVG LOC 3&4Y

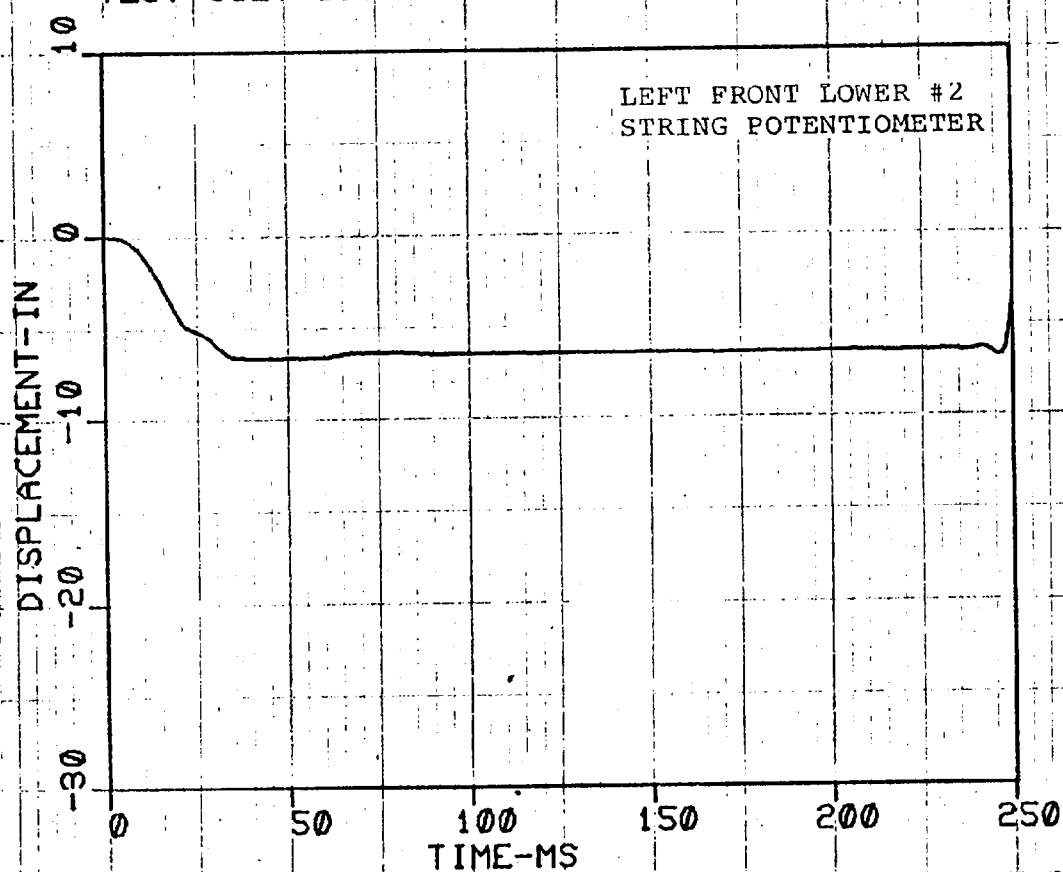


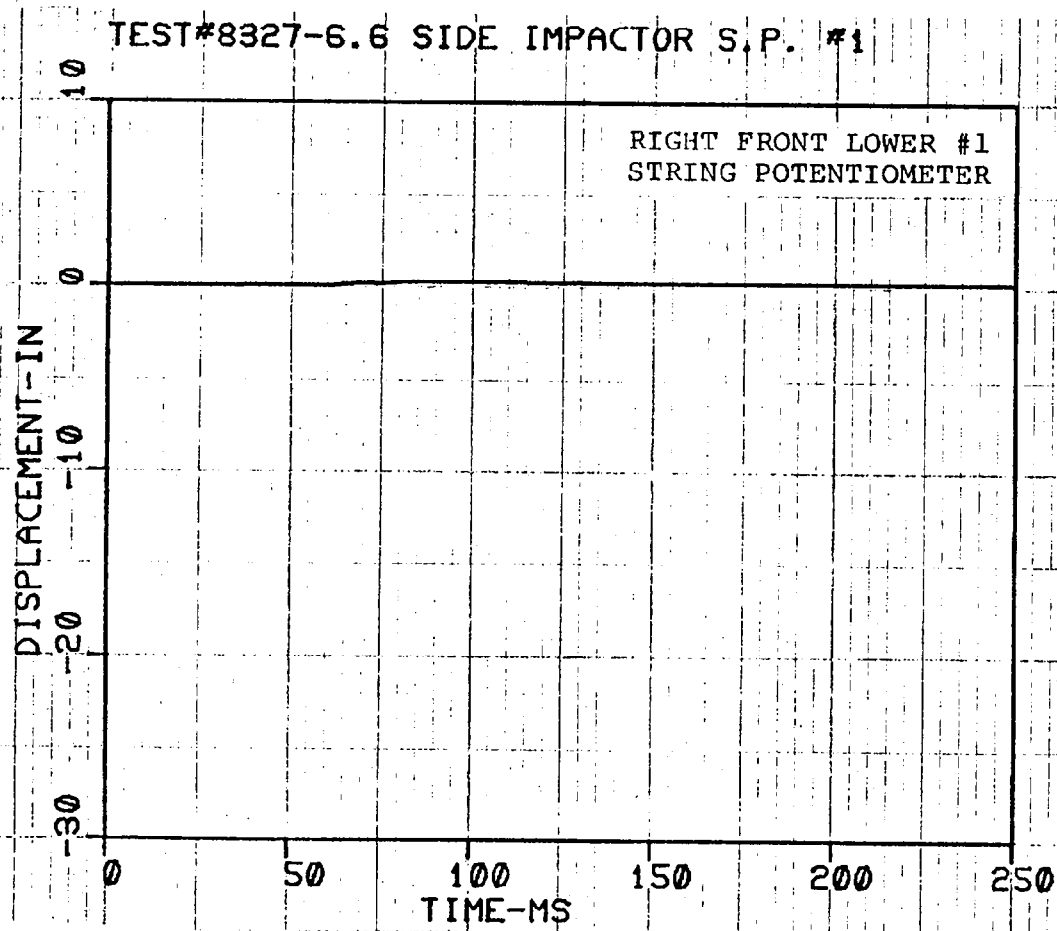


TEST#8327-6.6 SIDE IMPACTOR S.P. #3

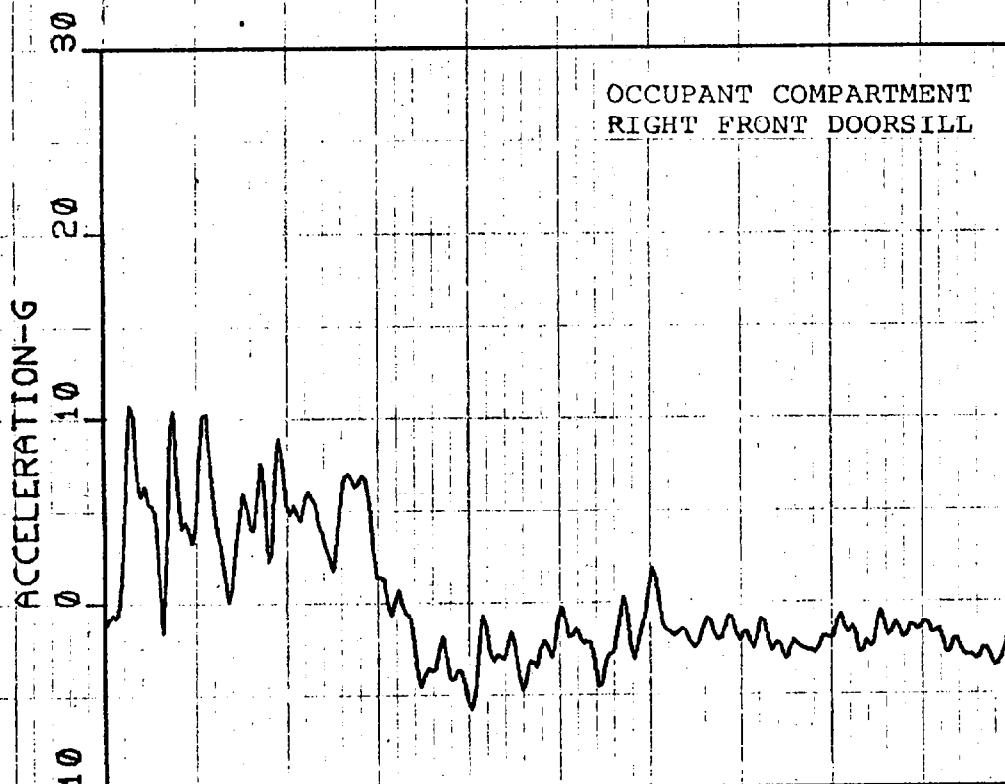


TEST#8327-6.6 SIDE IMPACTOR S.P. #2

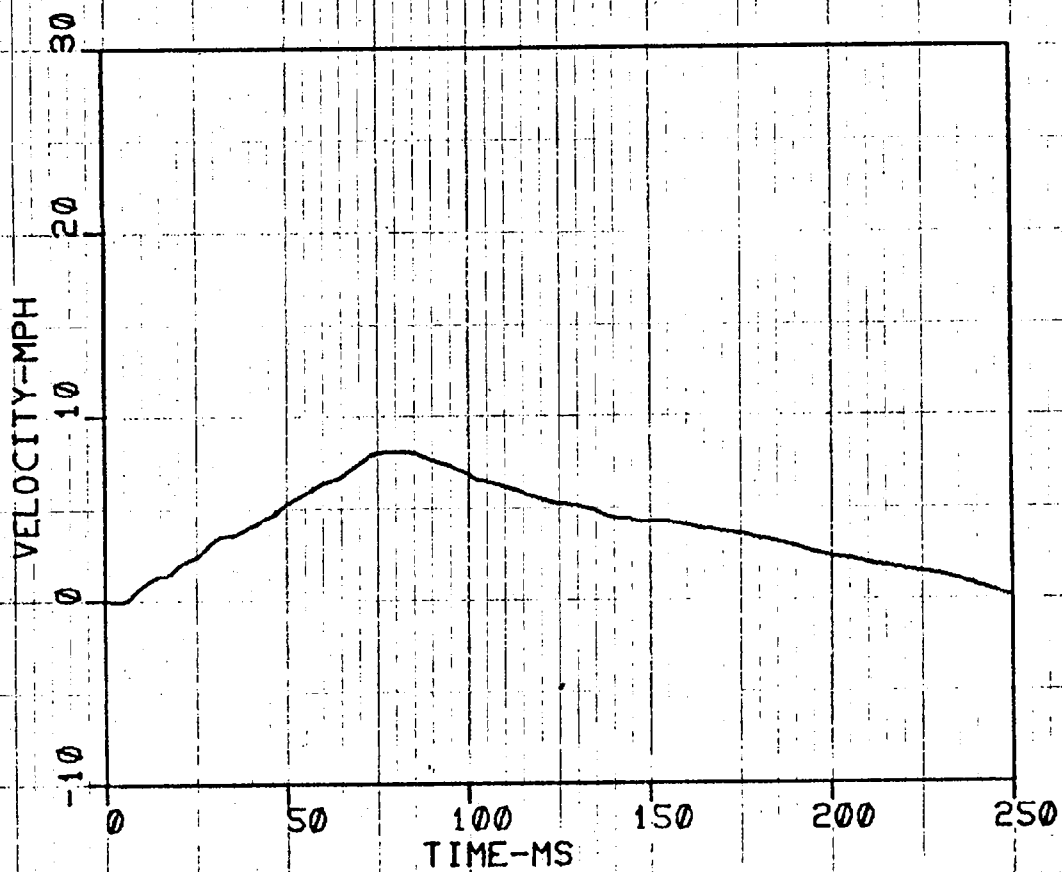


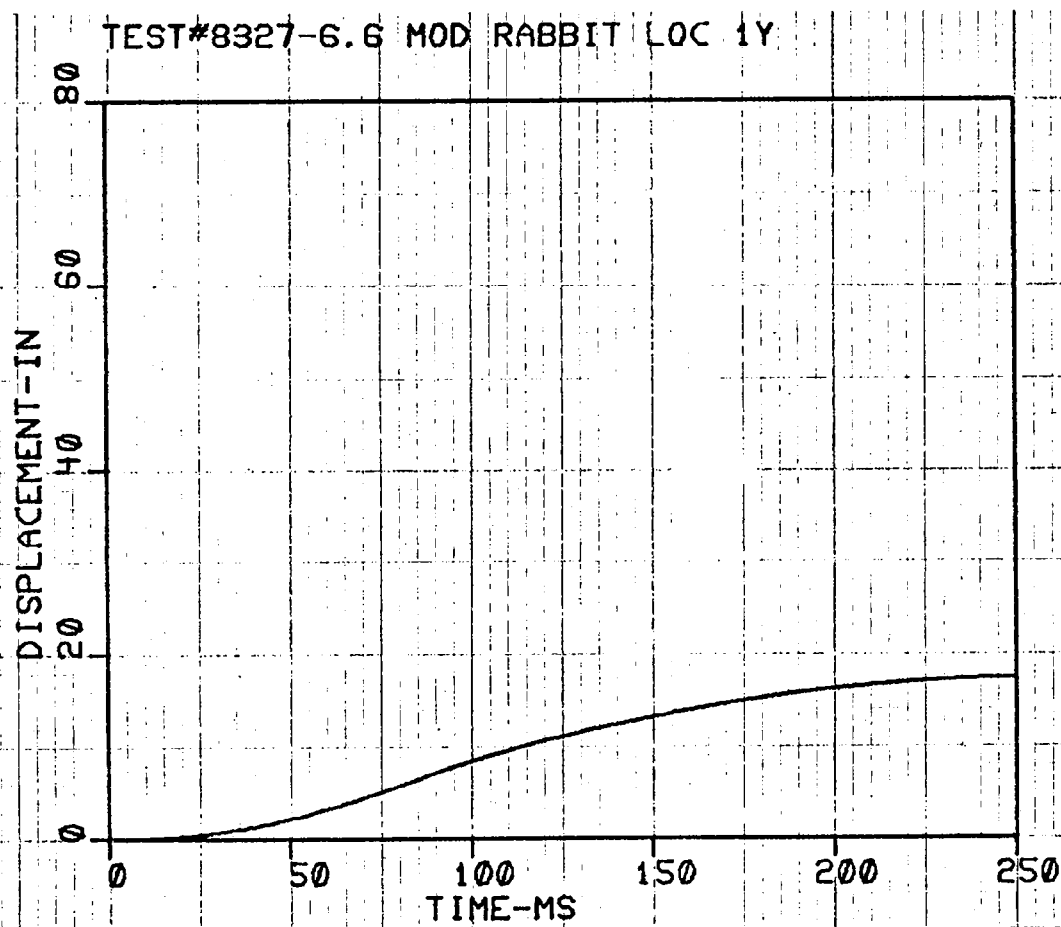


TEST#8327-6.6 MOD RABBIT LOC 1Y

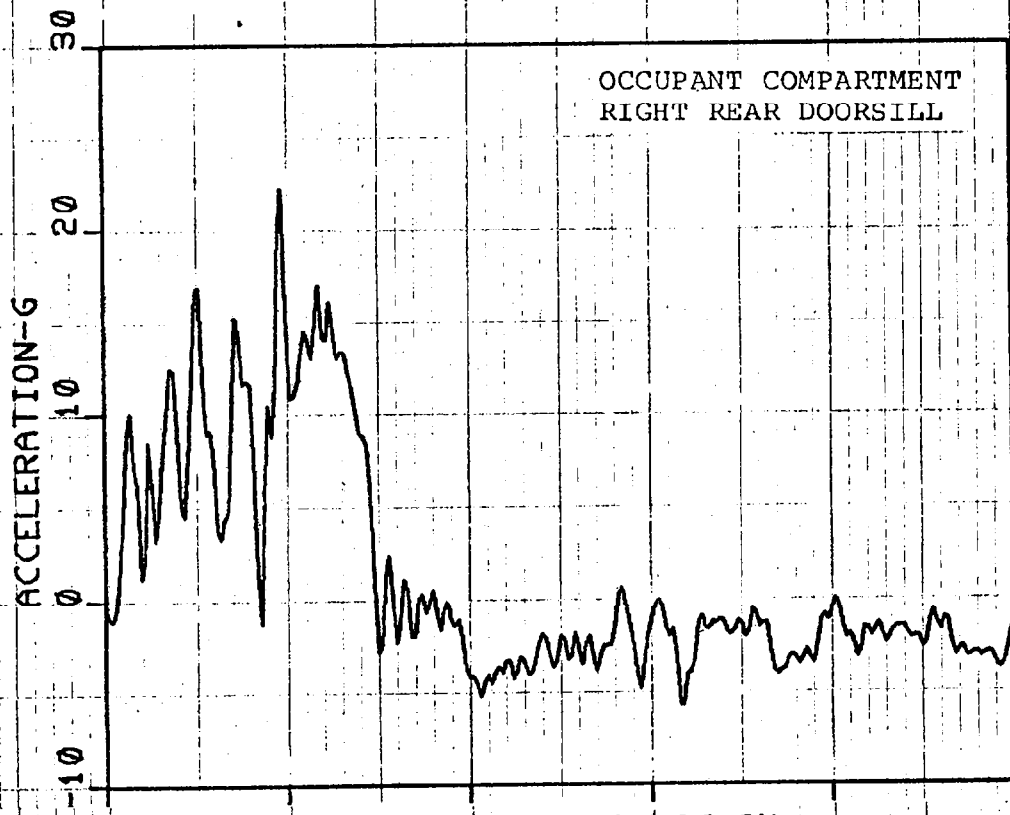


TEST#8327-6.6 MOD RABBIT LOC 1Y

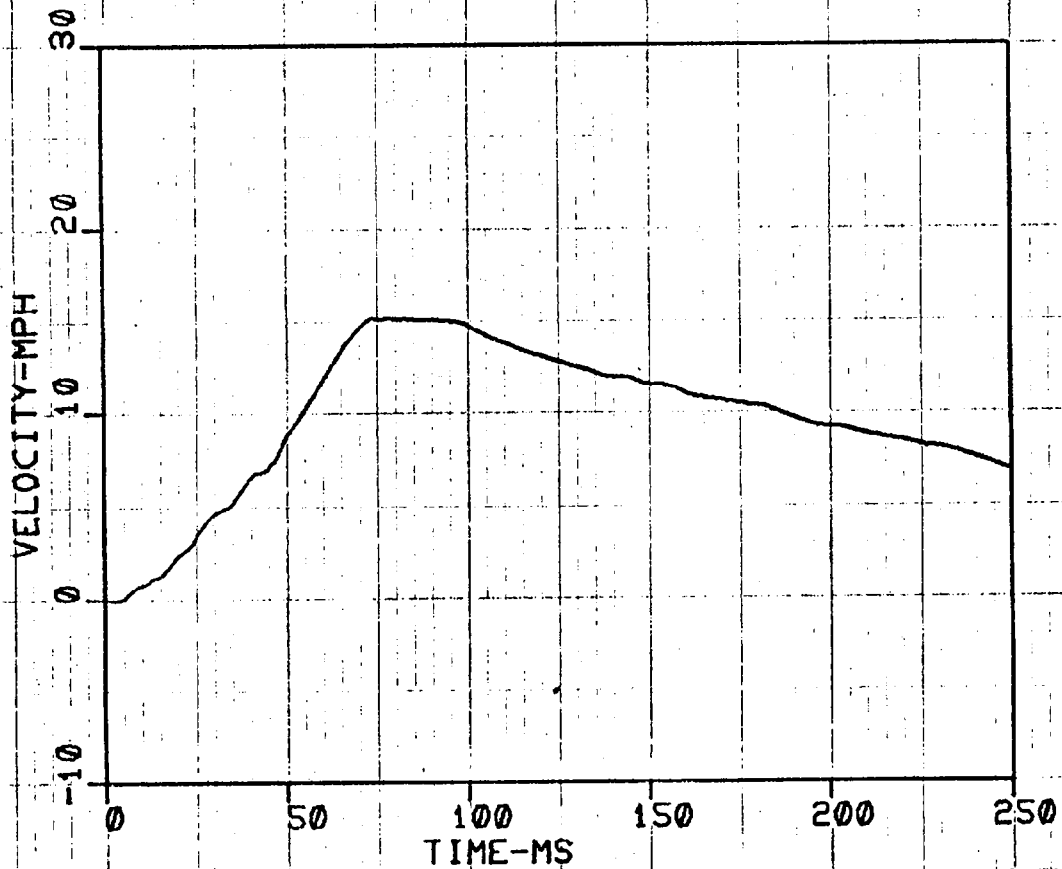


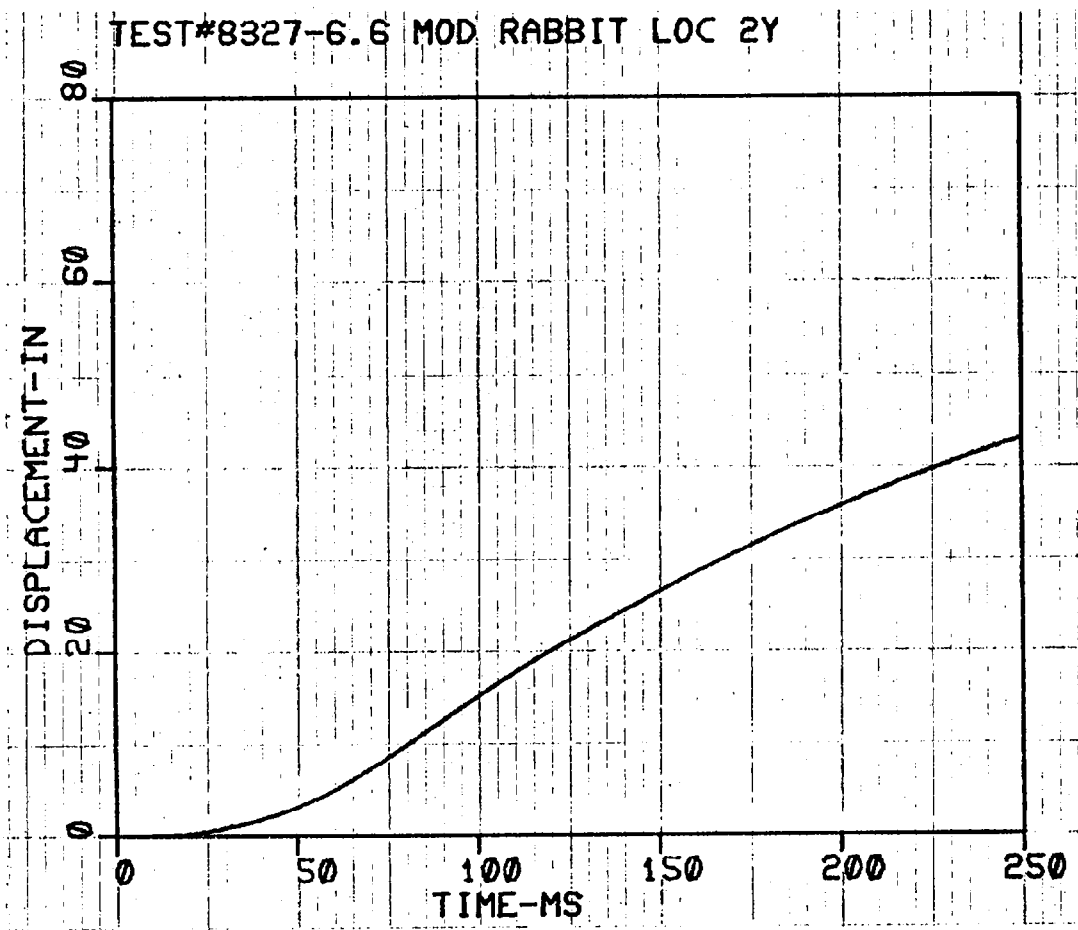


TEST#8327-6.6 MOD RABBIT LOC 2Y

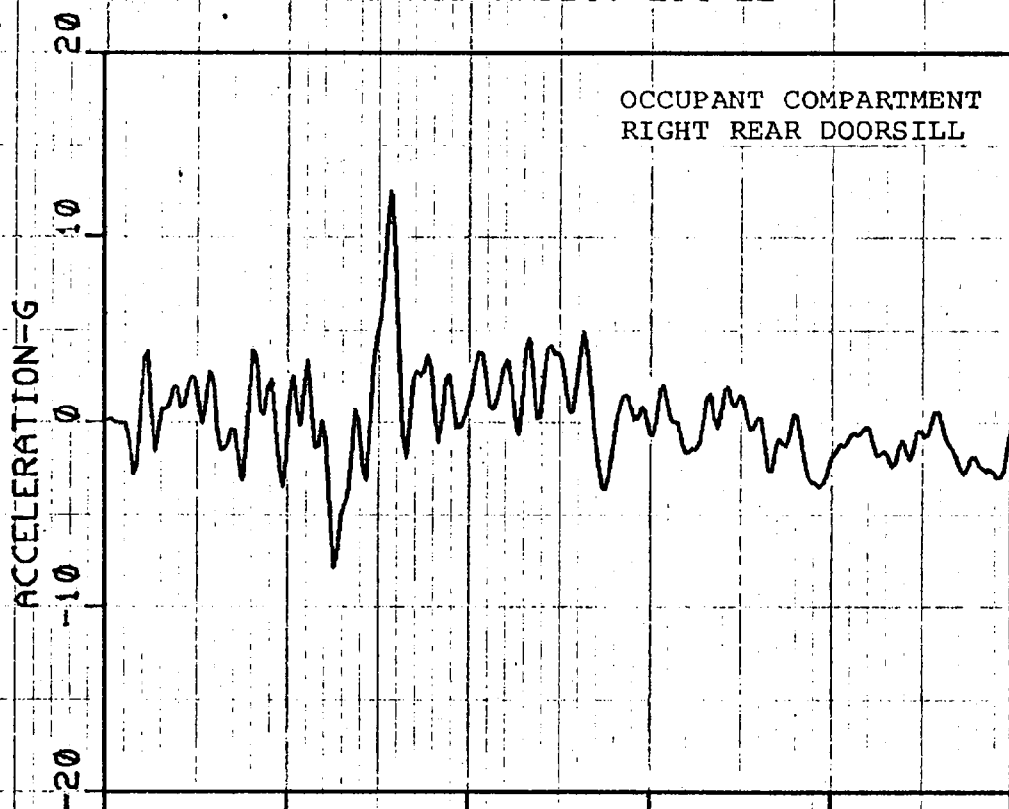


TEST#8327-6.6 MOD RABBIT LOC 2Y

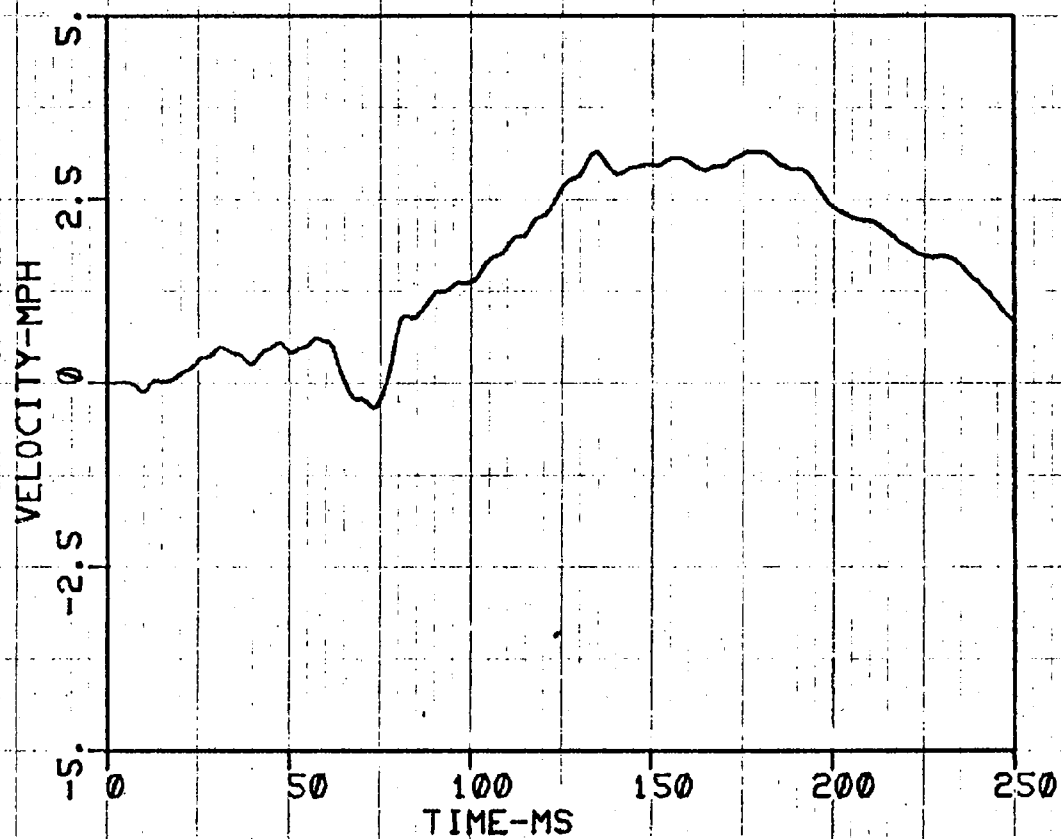




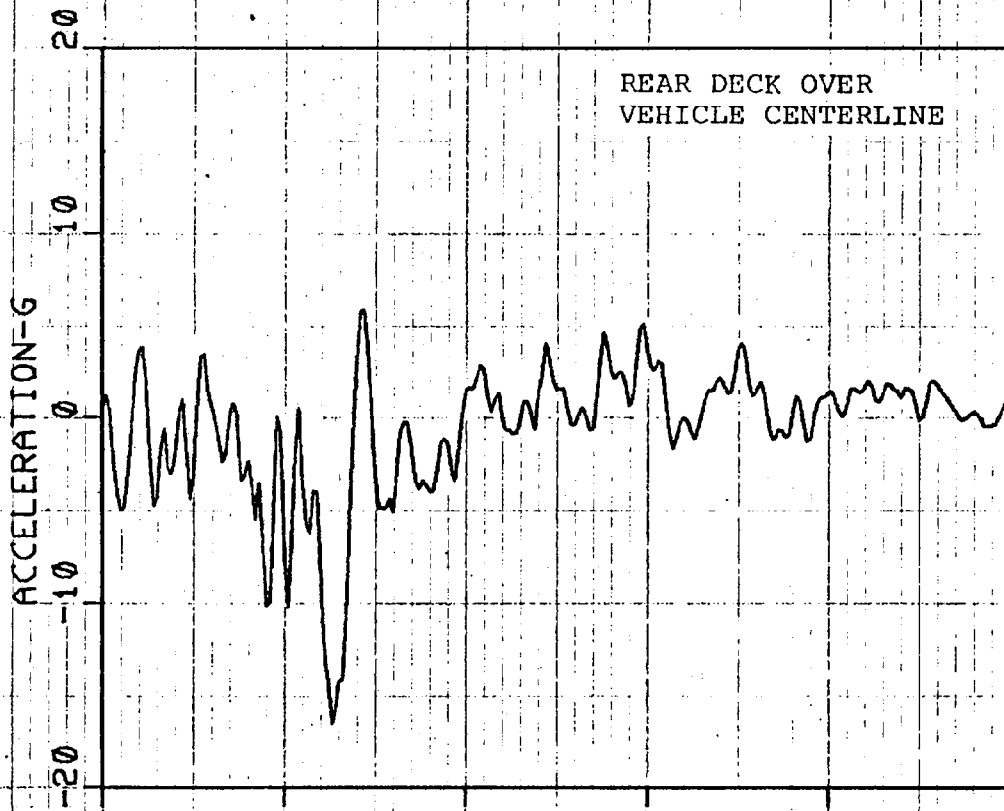
TEST#8327-6.6 MOD RABBIT LOC 2Z



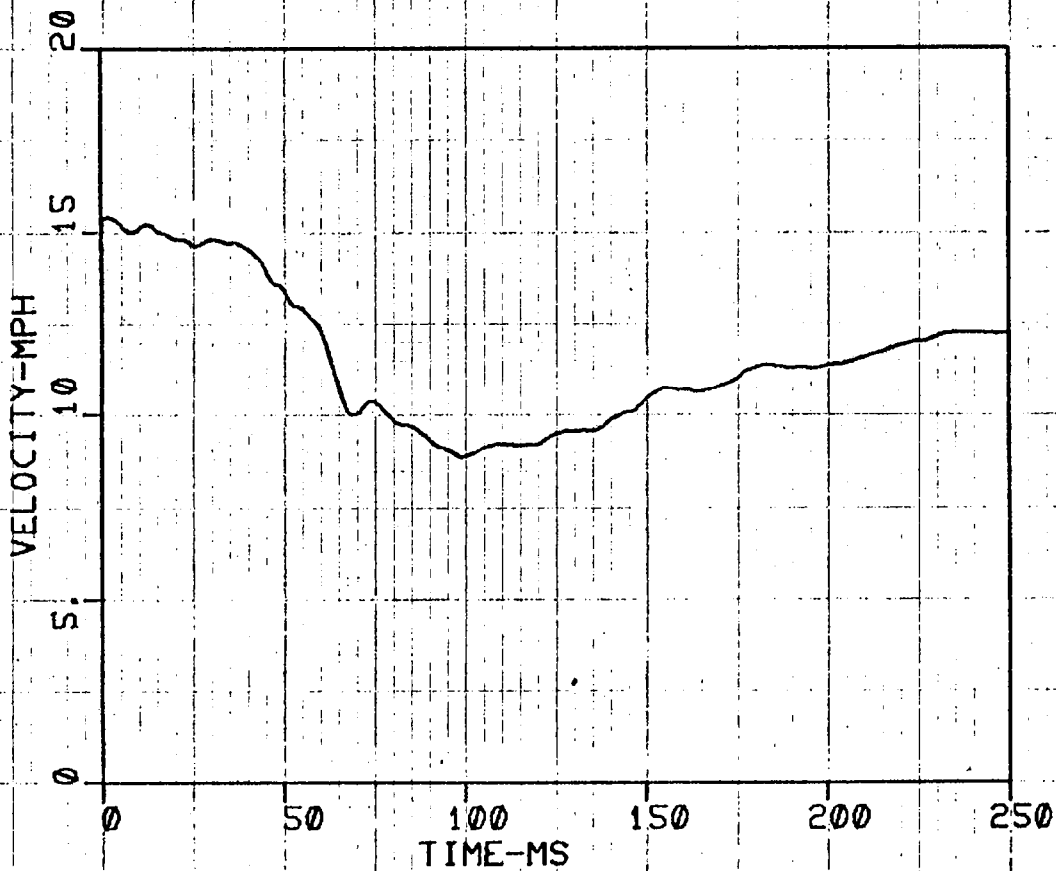
TEST#8327-6.6 MOD RABBIT LOC 2Z

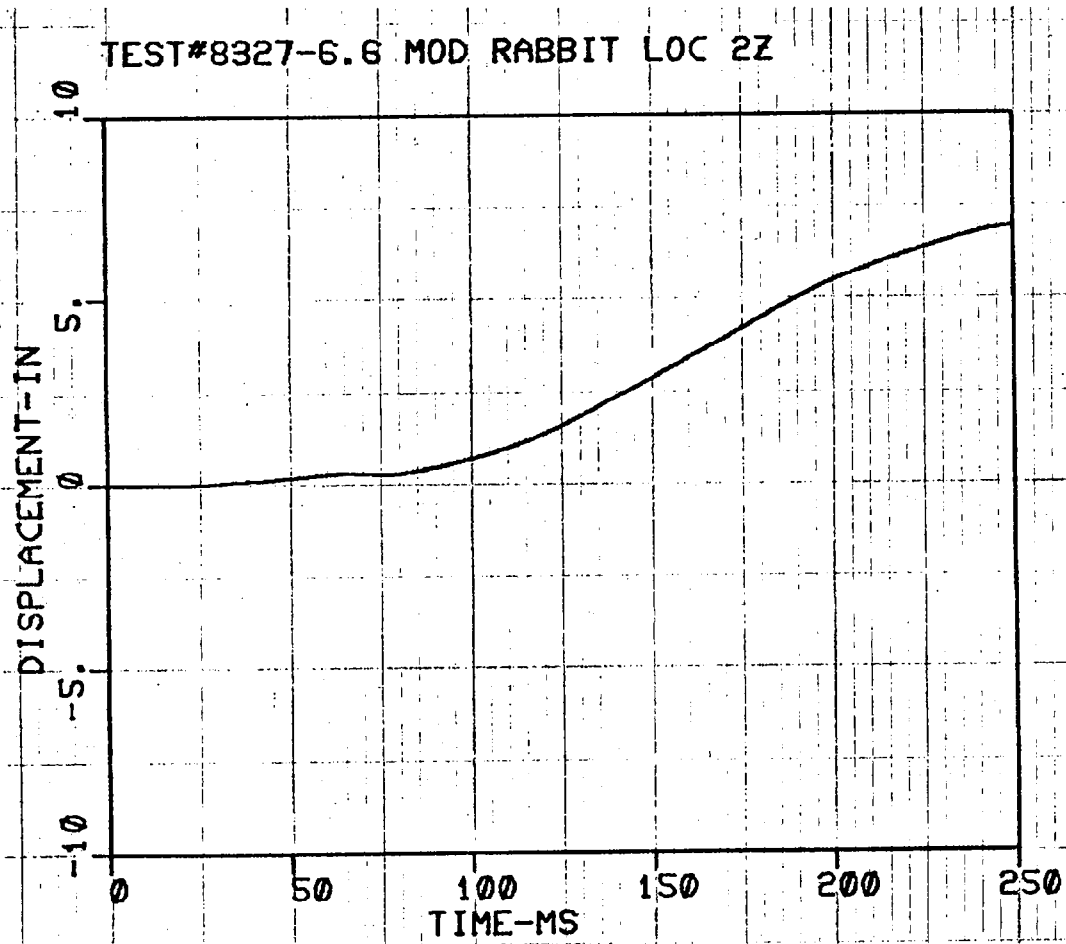


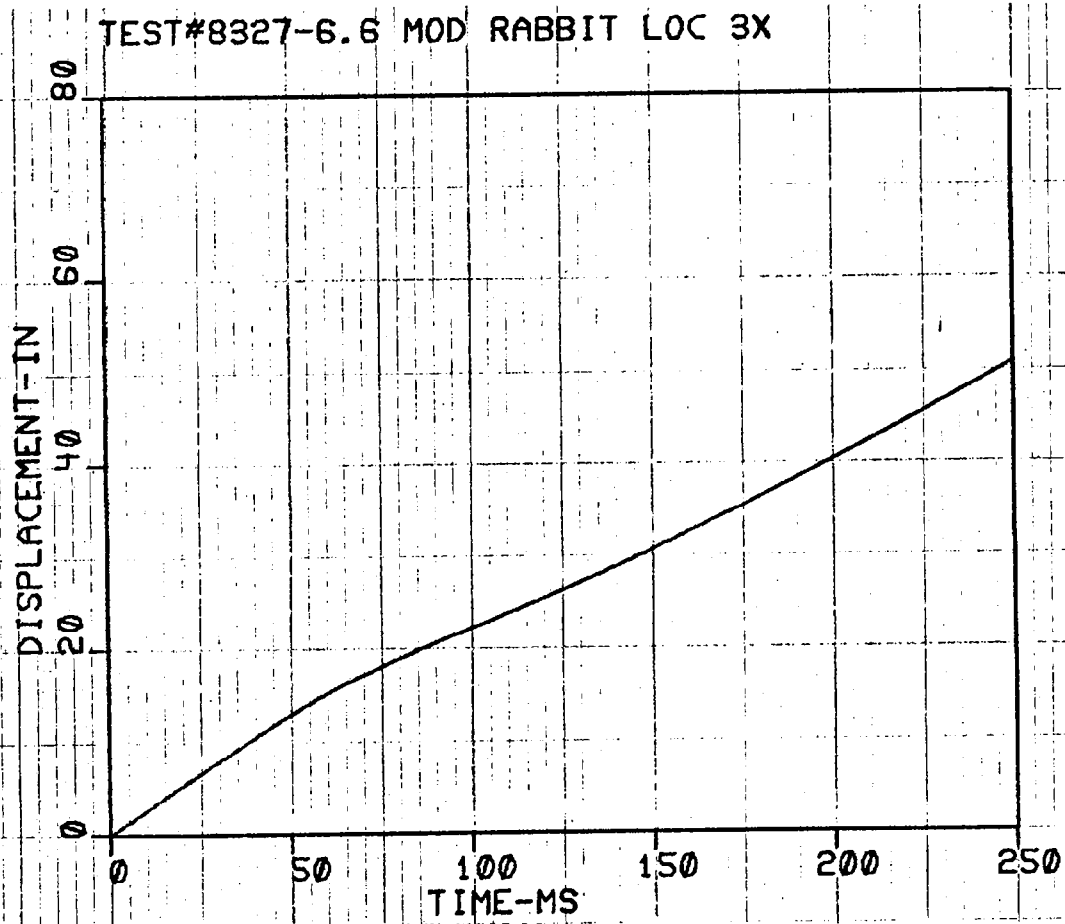
TEST#8327-6.6 MOD RABBIT LOC 3X



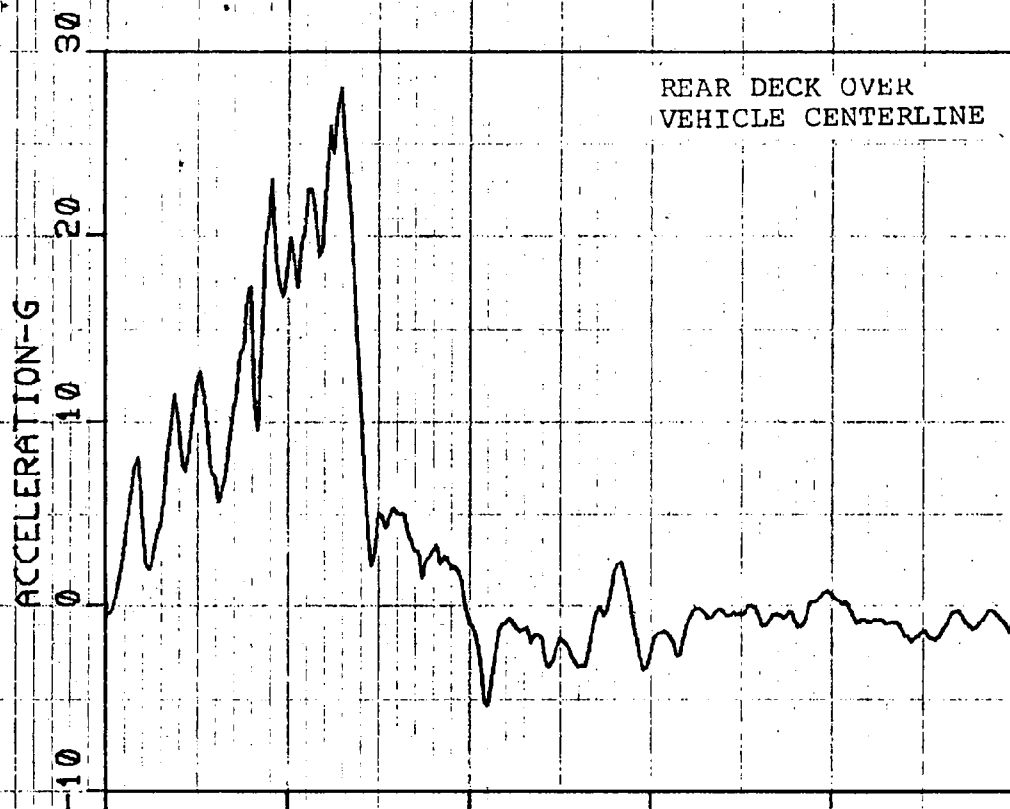
TEST#8327-6.6 MOD RABBIT LOC 3X



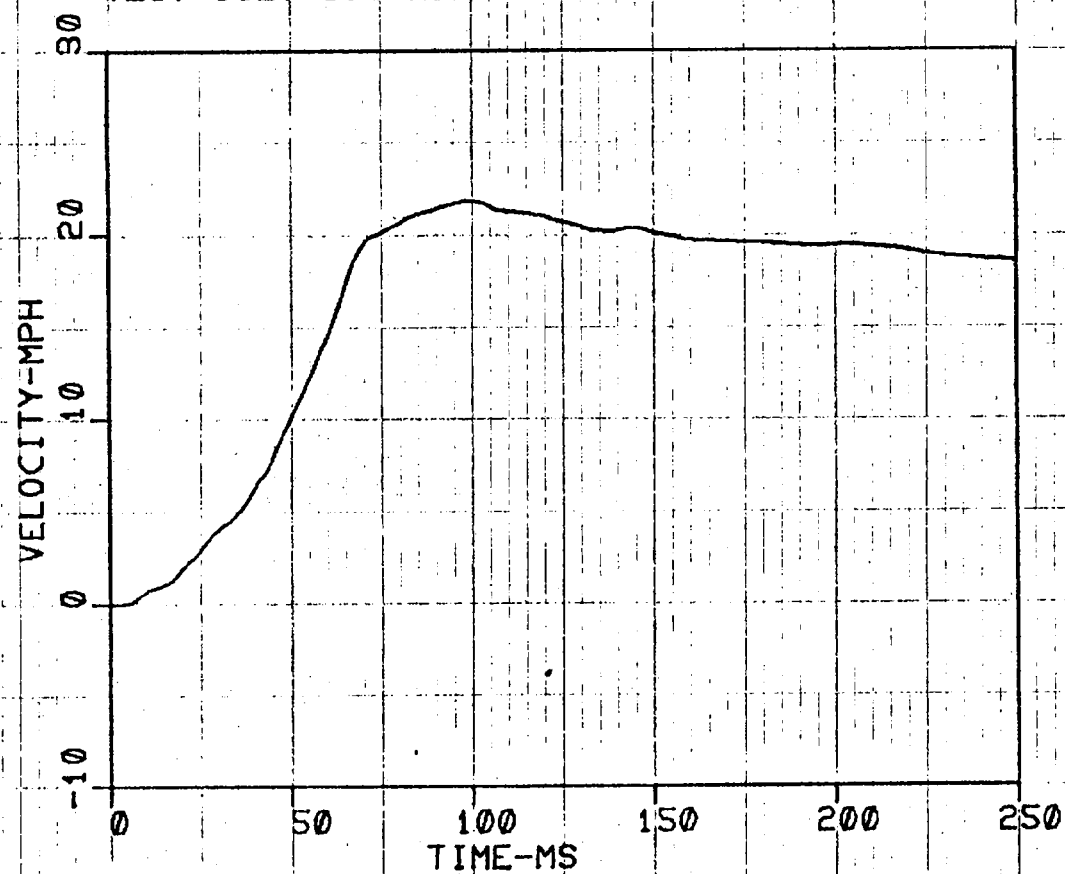


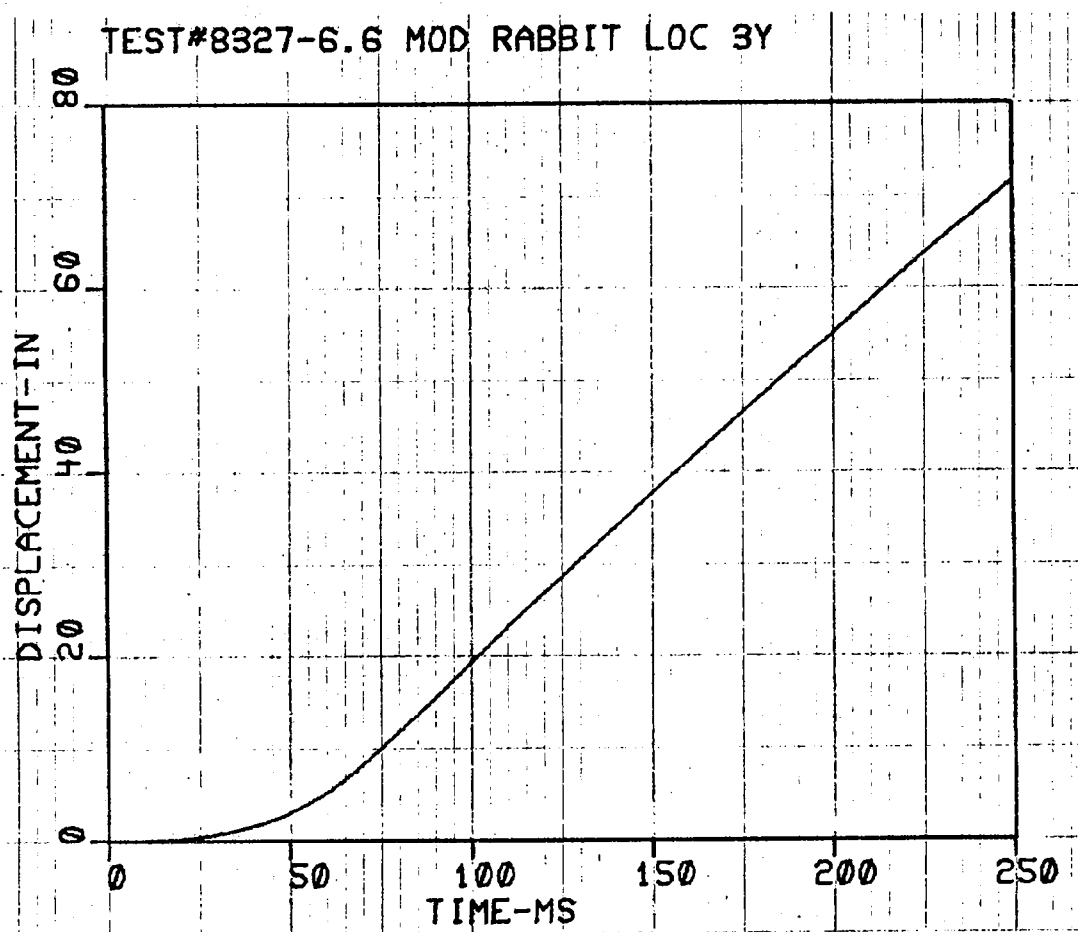


TEST#8327-6.6 MOD RABBIT LOC 3Y

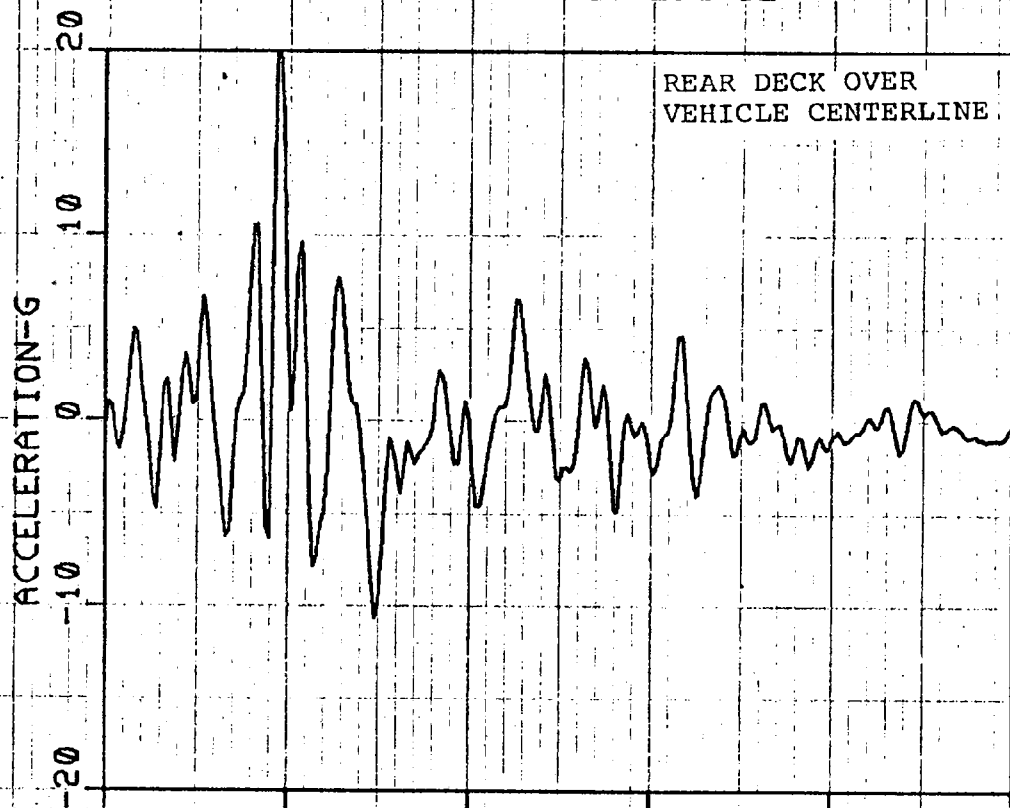


TEST#8327-6.6 MOD RABBIT LOC 3Y

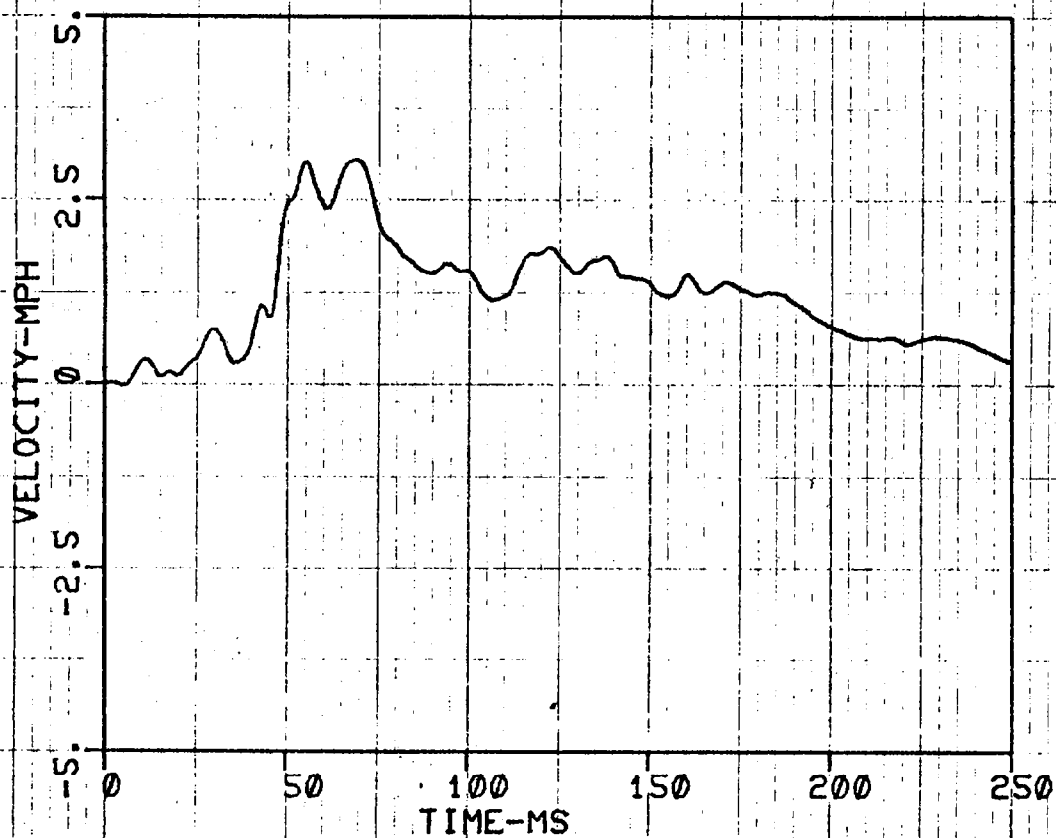


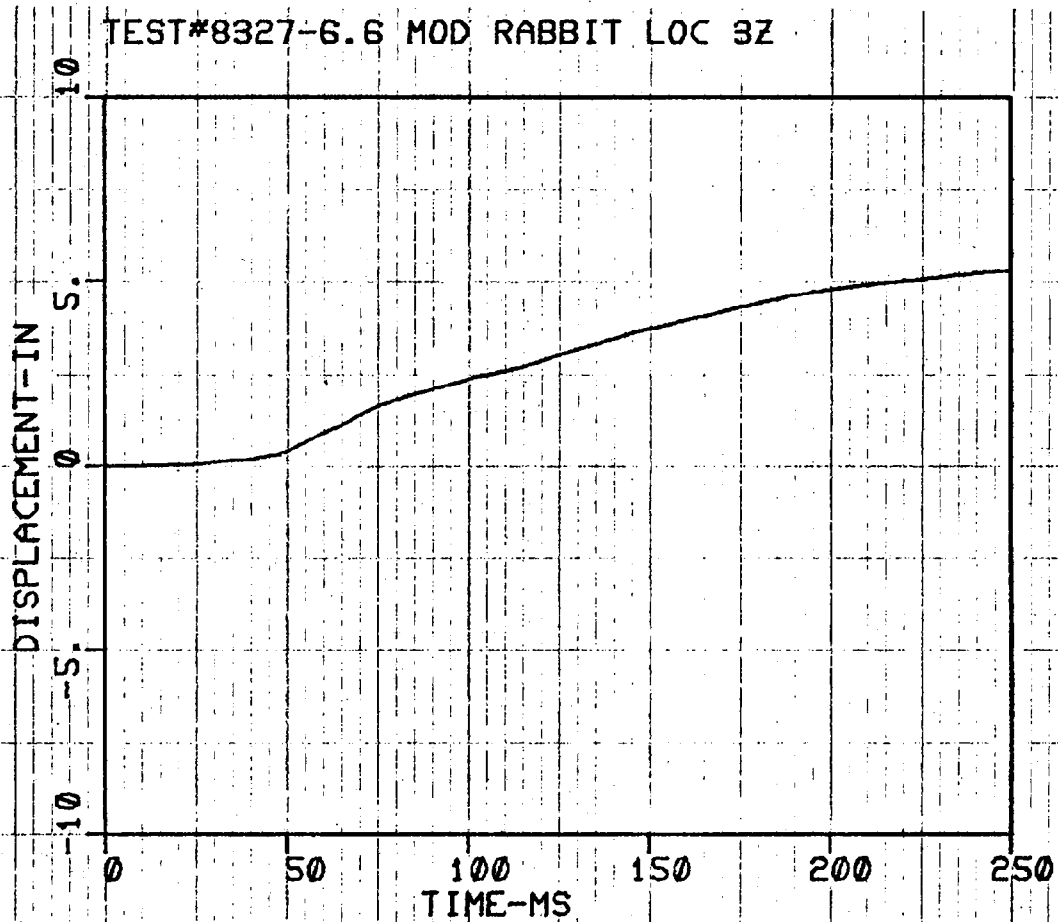


TEST#8327-6.6 MOD RABBIT LOC 3Z

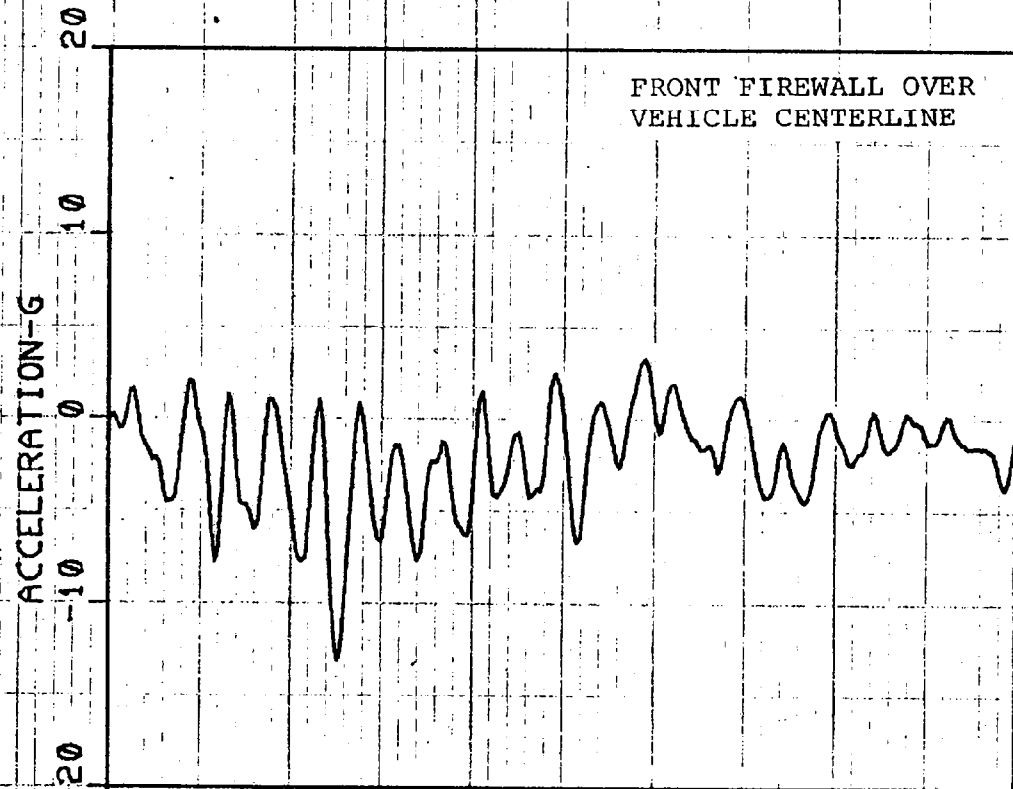


TEST#8327-6.6 MOD RABBIT LOC 3Z

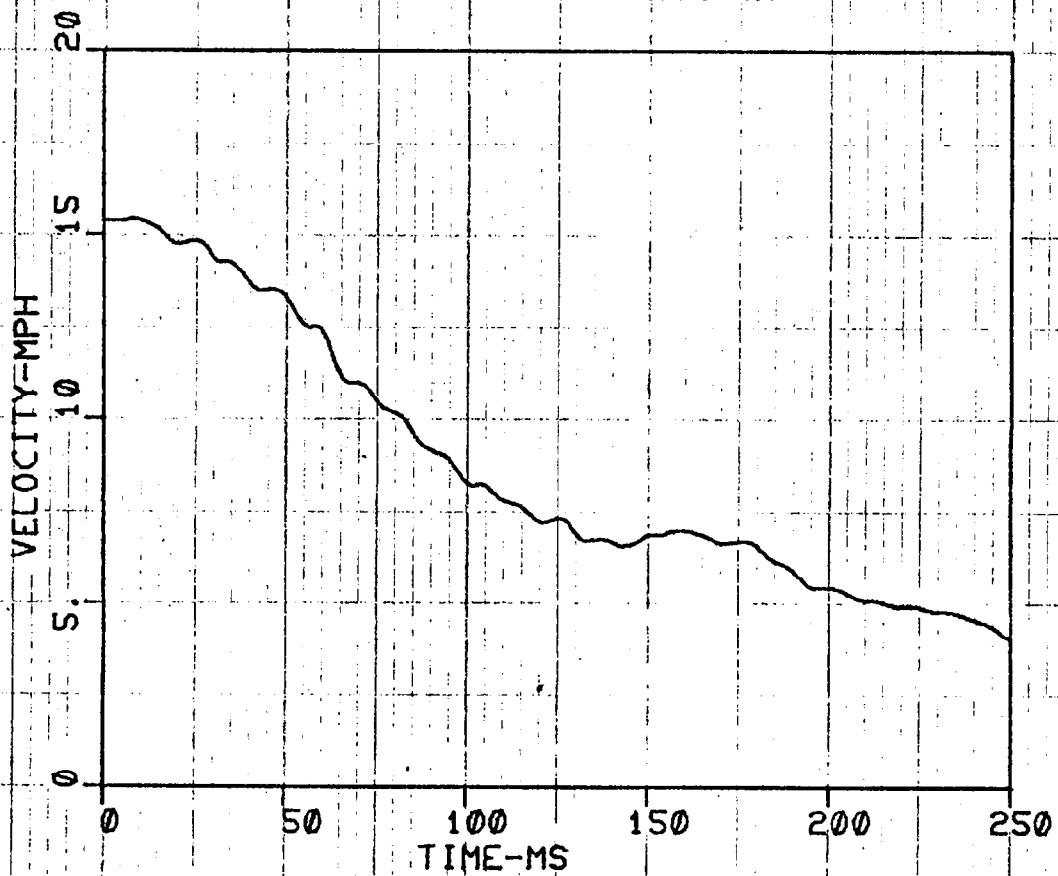


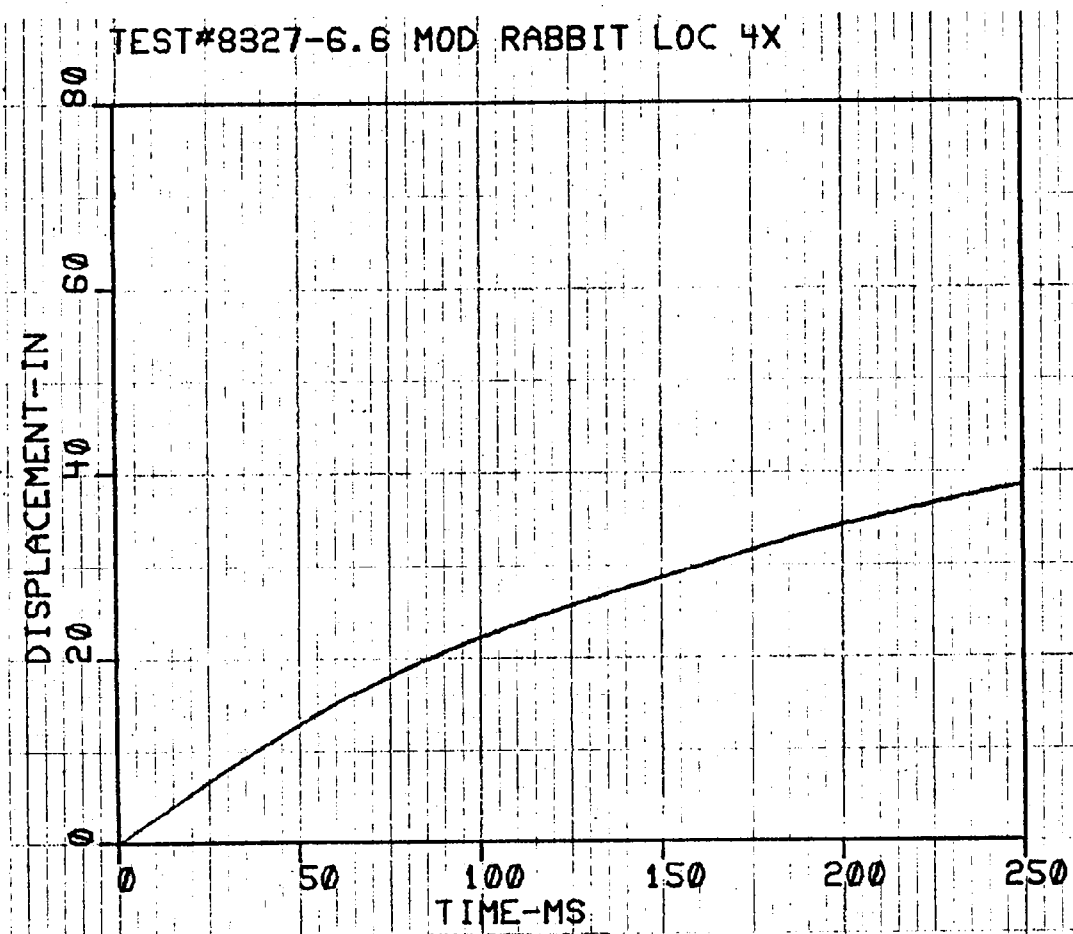


TEST#8327-6.6 MOD RABBIT LOC 4X

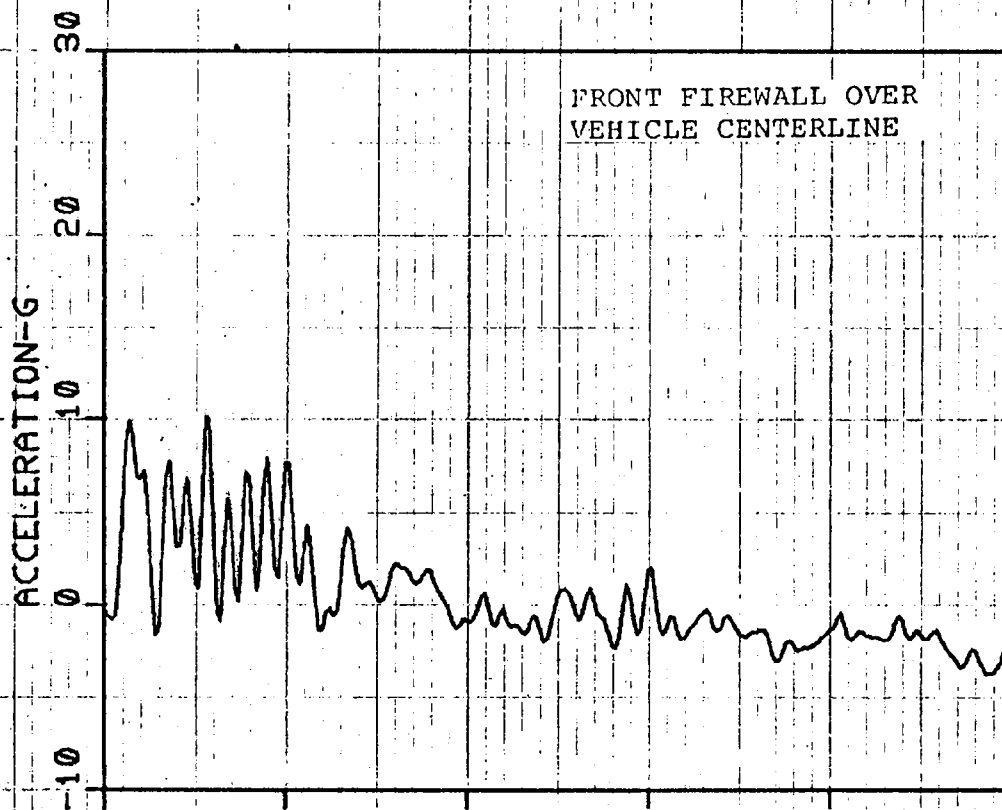


TEST#8327-6.6 MOD RABBIT LOC 4X

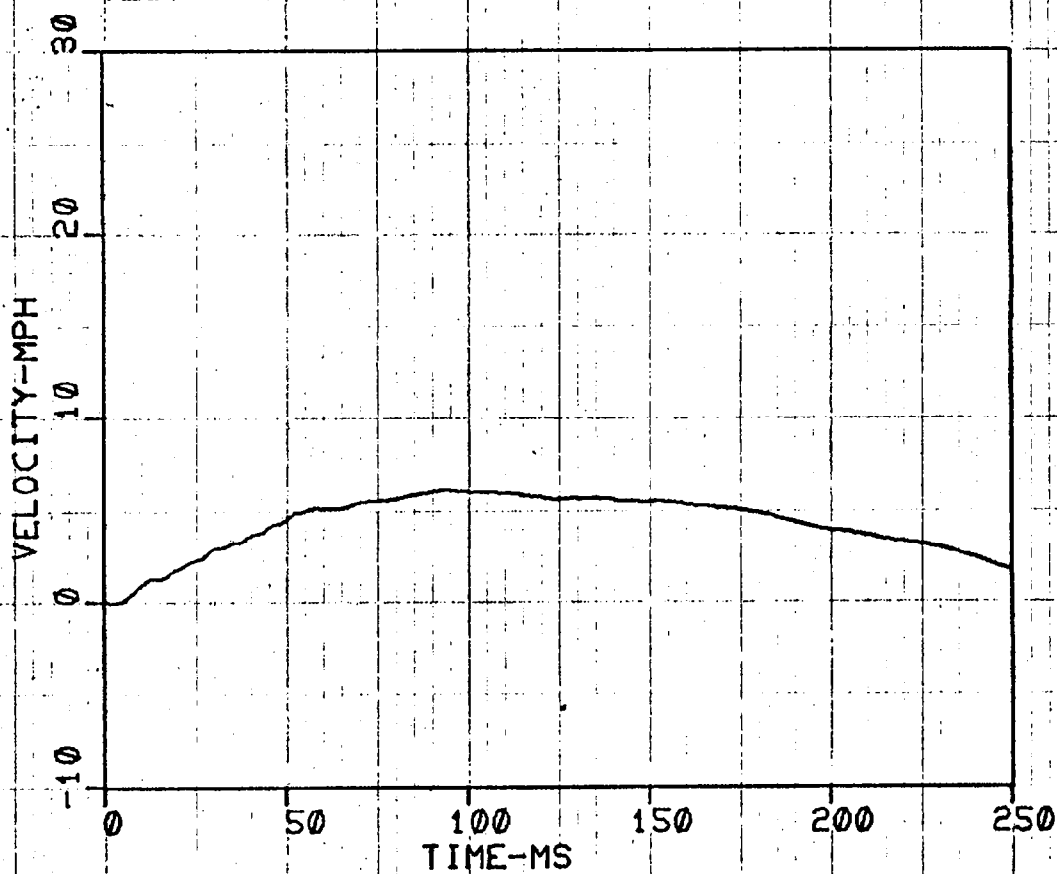


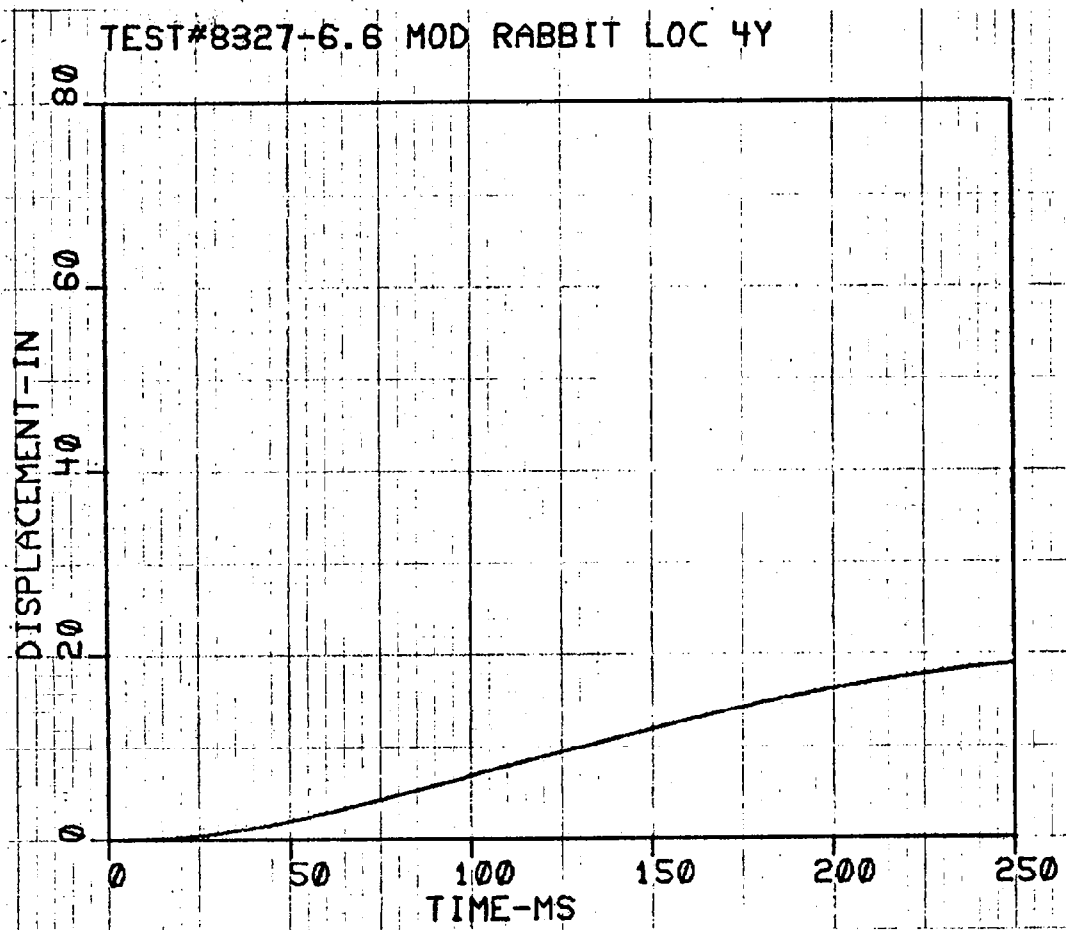


TEST#8327-6.6 MOD RABBIT LOC 4Y

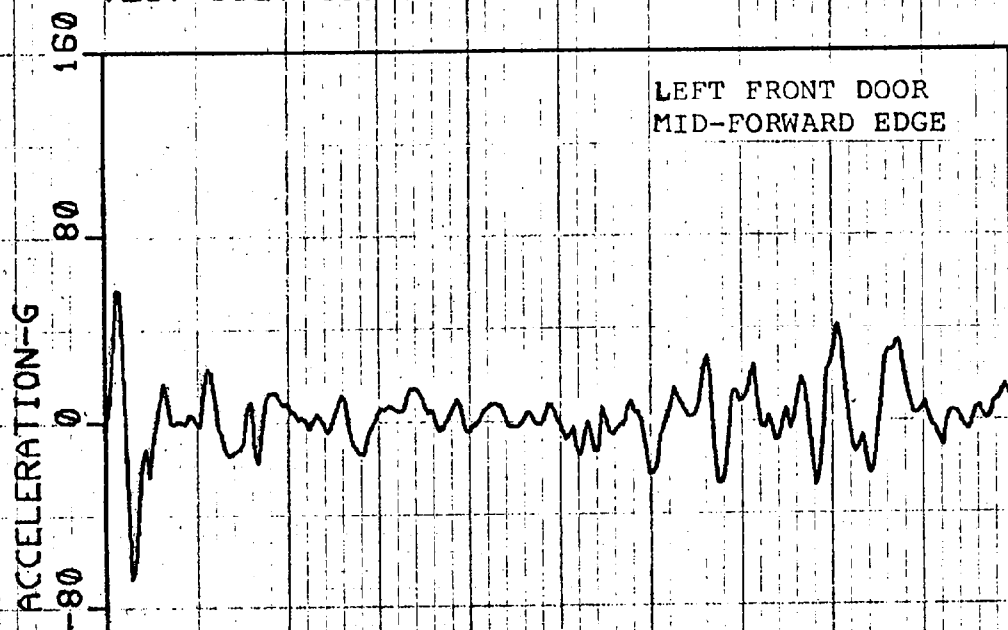


TEST#8427-6.6 MOD RABBIT LOC 4Y

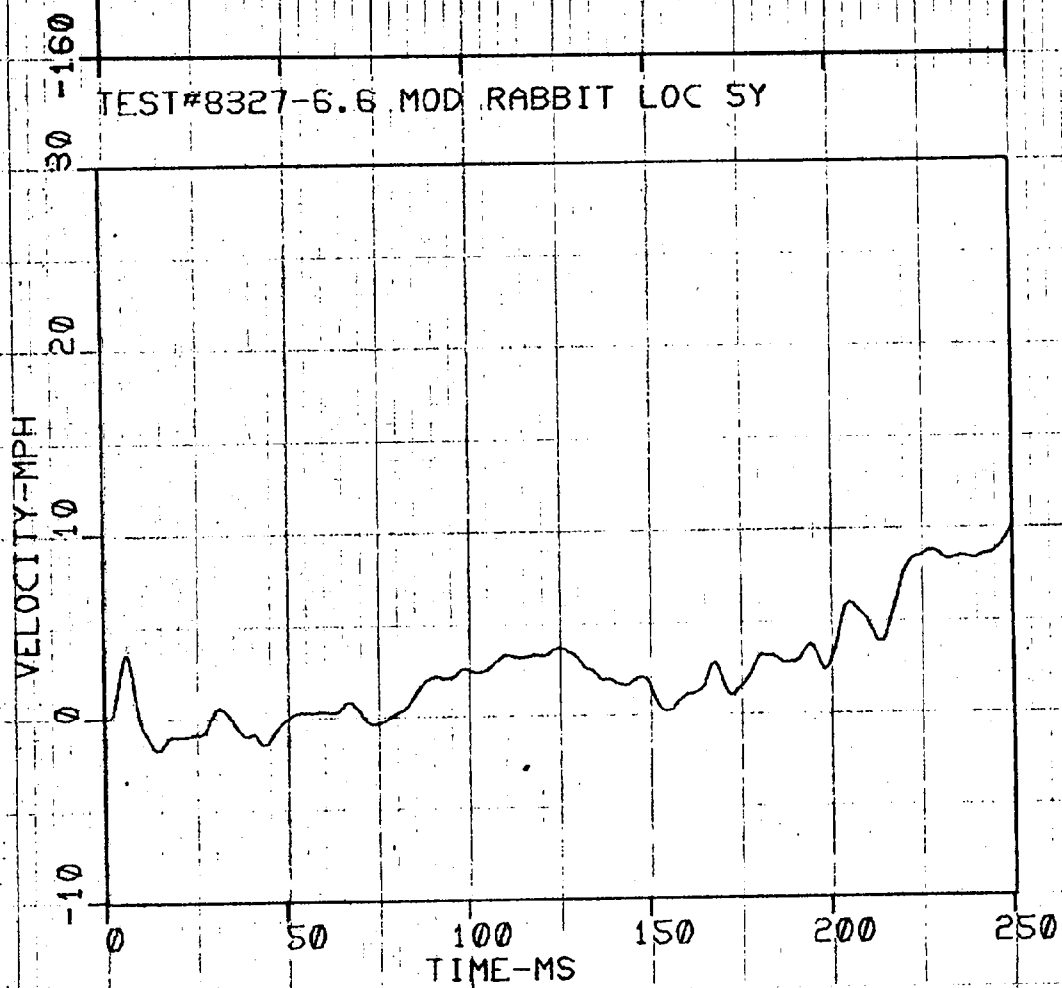


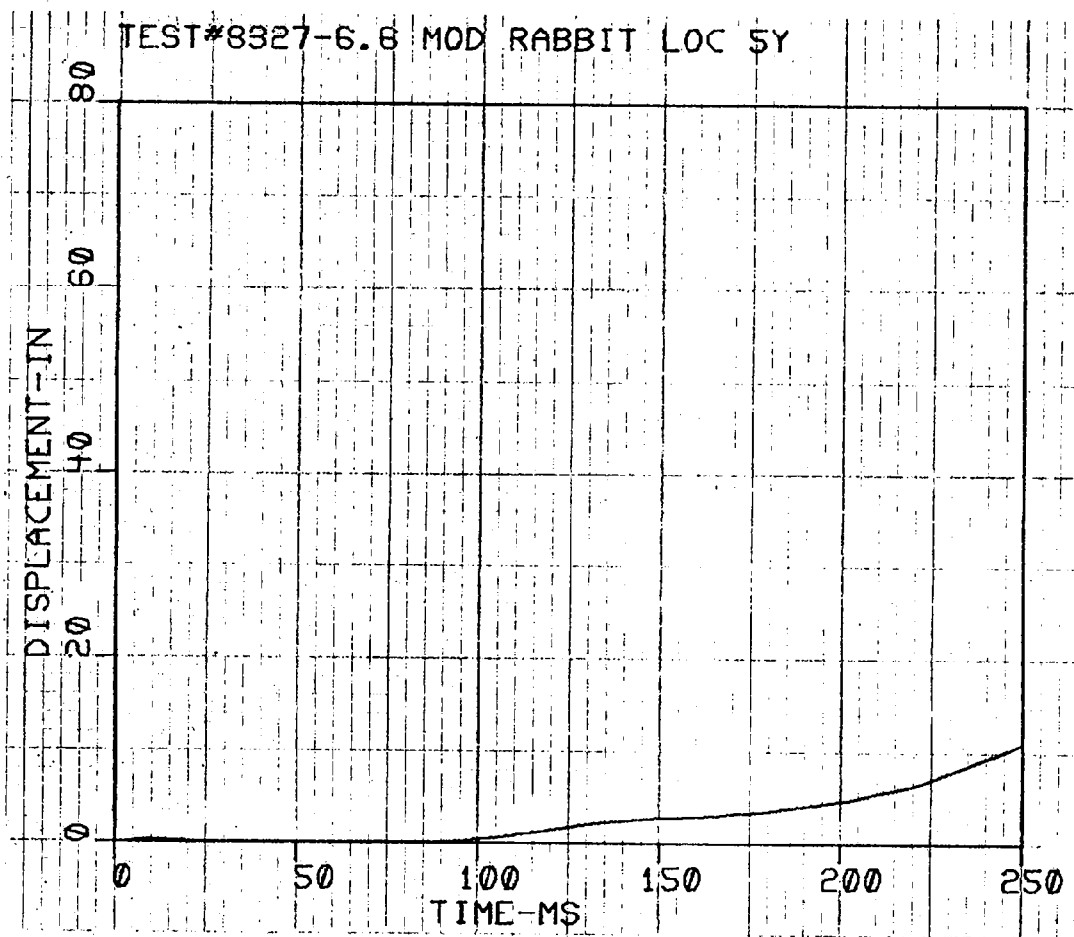


TEST#8327-6.6 MOD RABBIT LOC 5Y

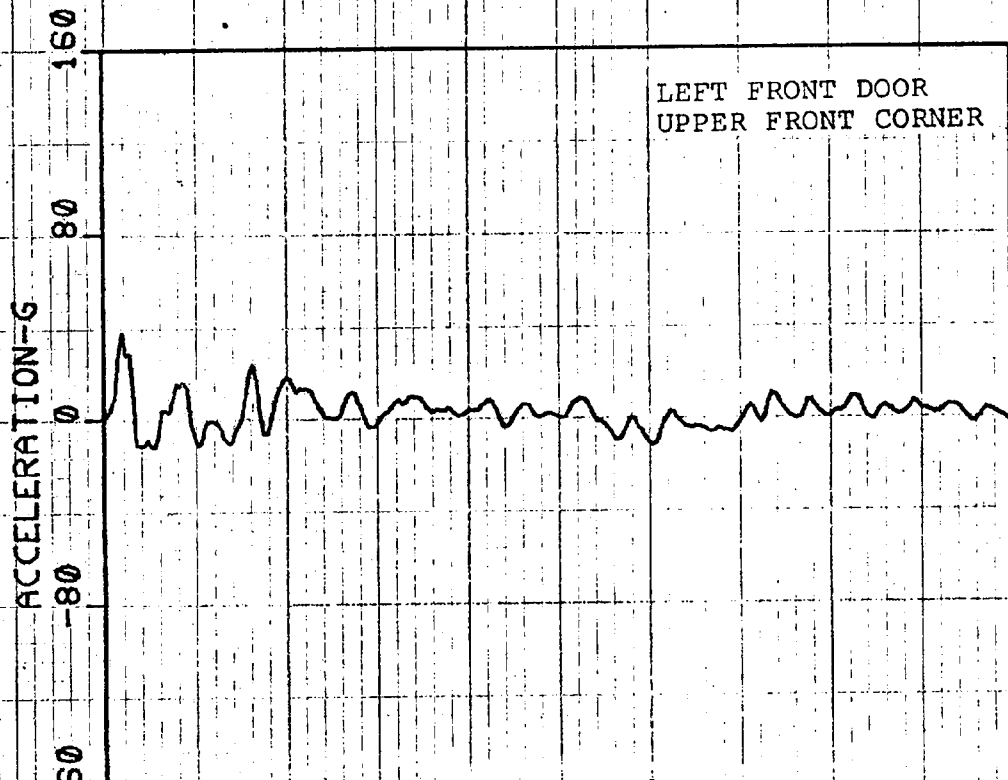


TEST#8327-6.6 MOD RABBIT LOC 5Y

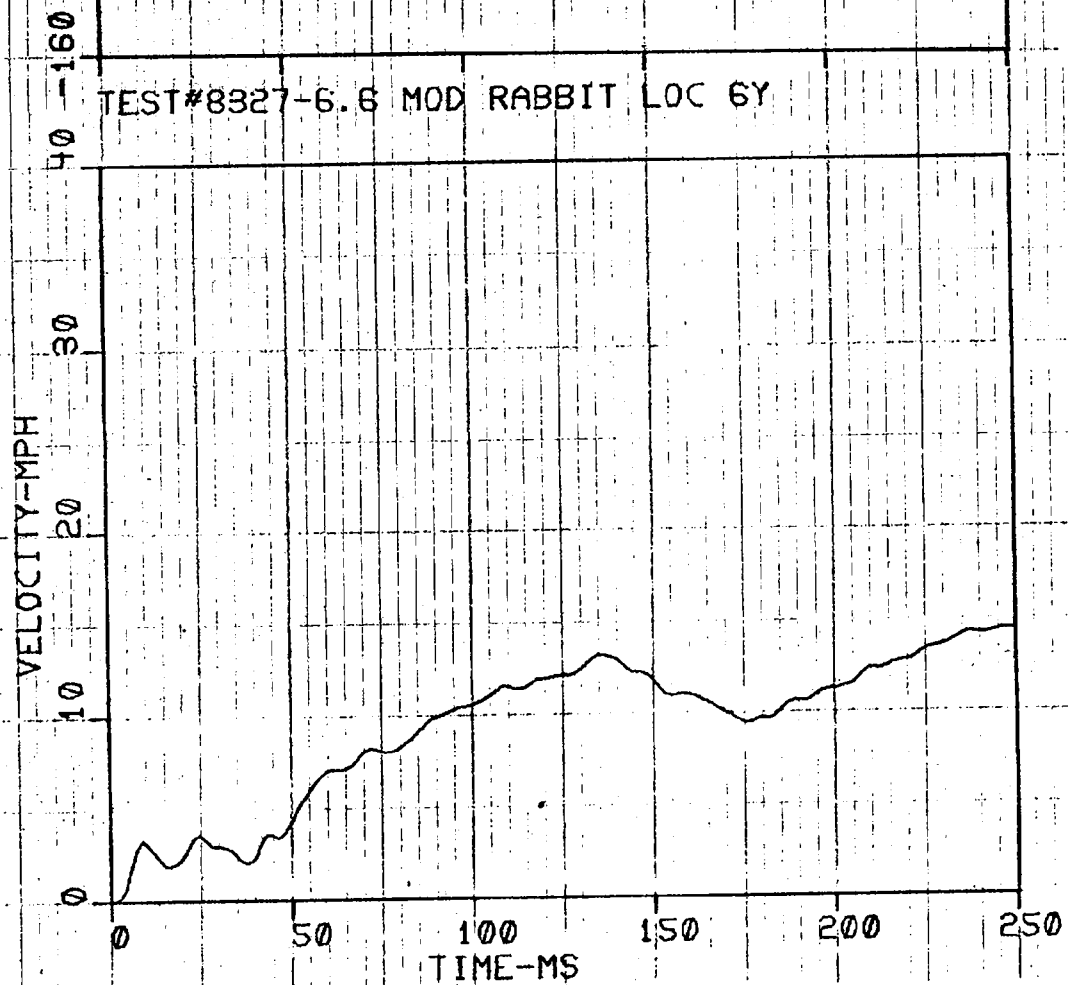


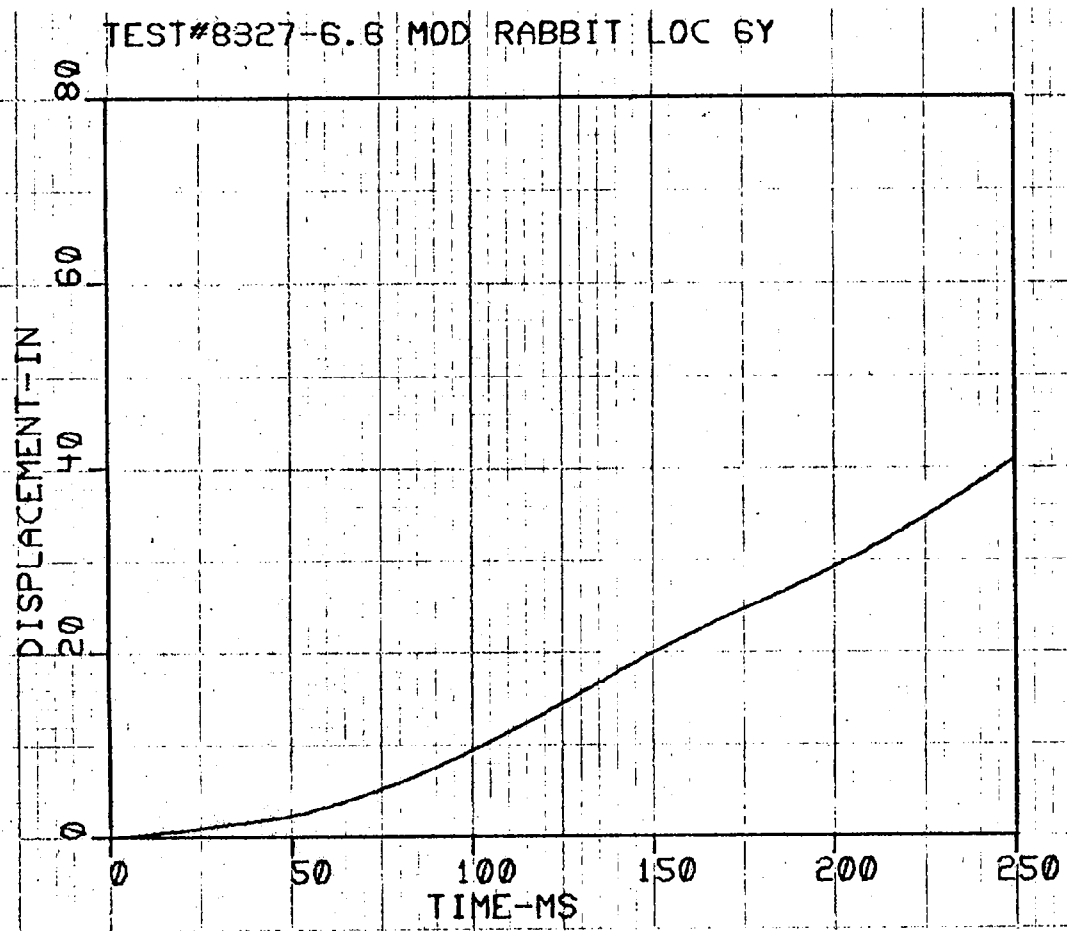


TEST#8327-6.6 MOD RABBIT LOC 6Y

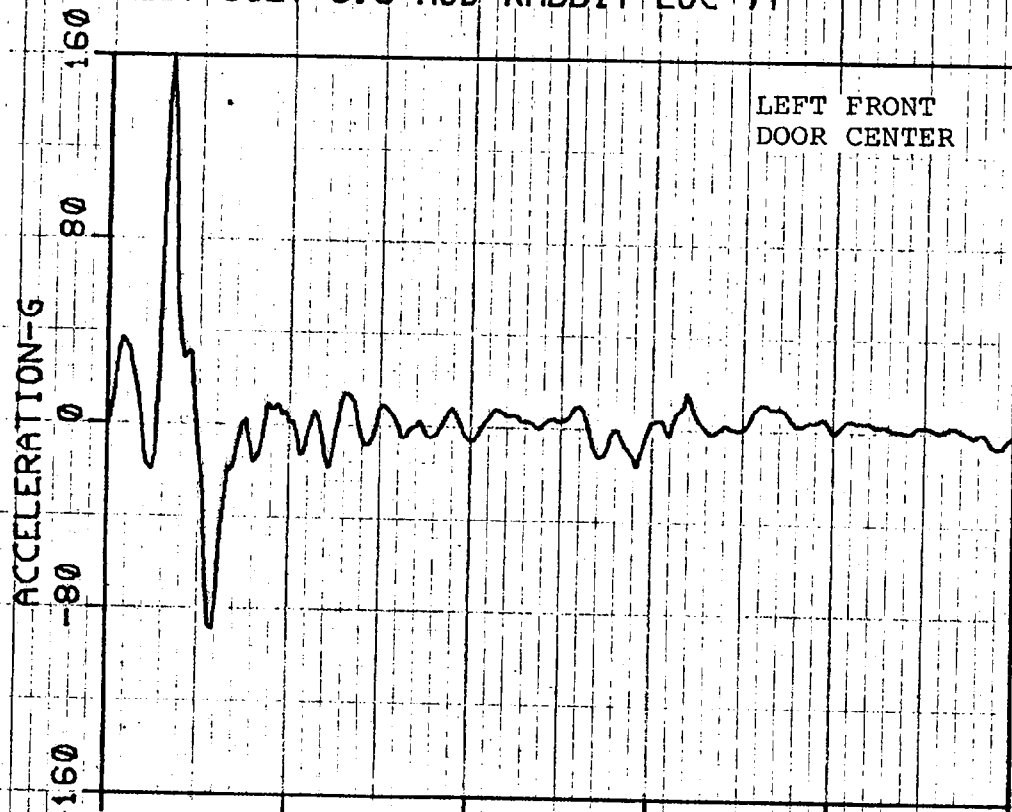


TEST#8327-6.6 MOD RABBIT LOC 6Y

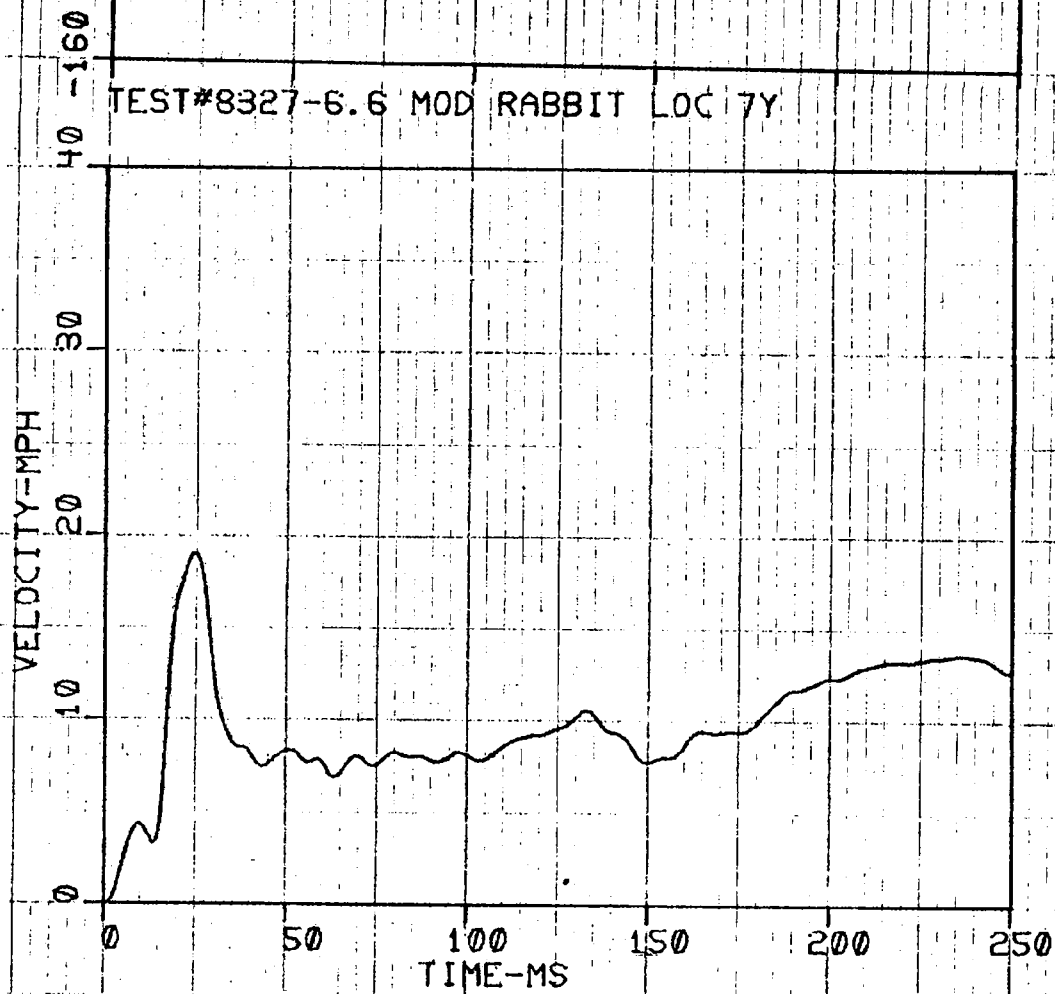


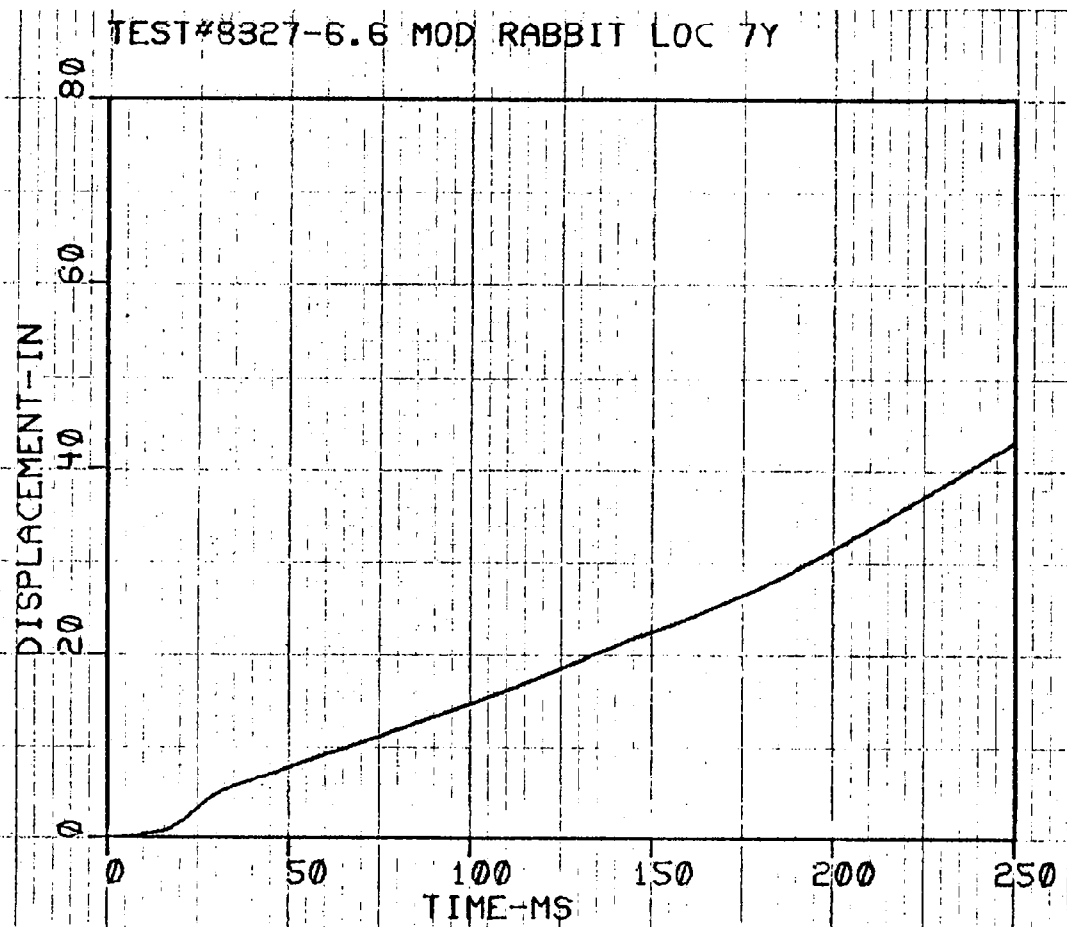


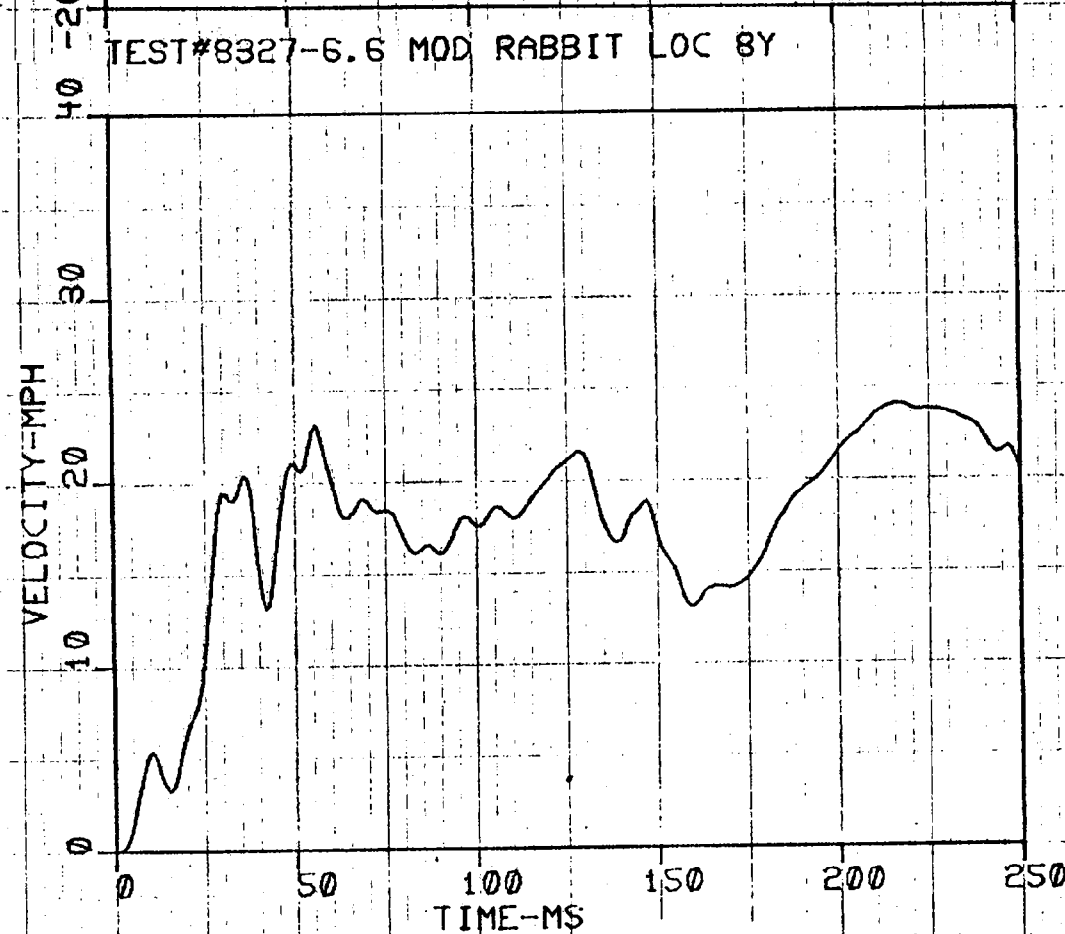
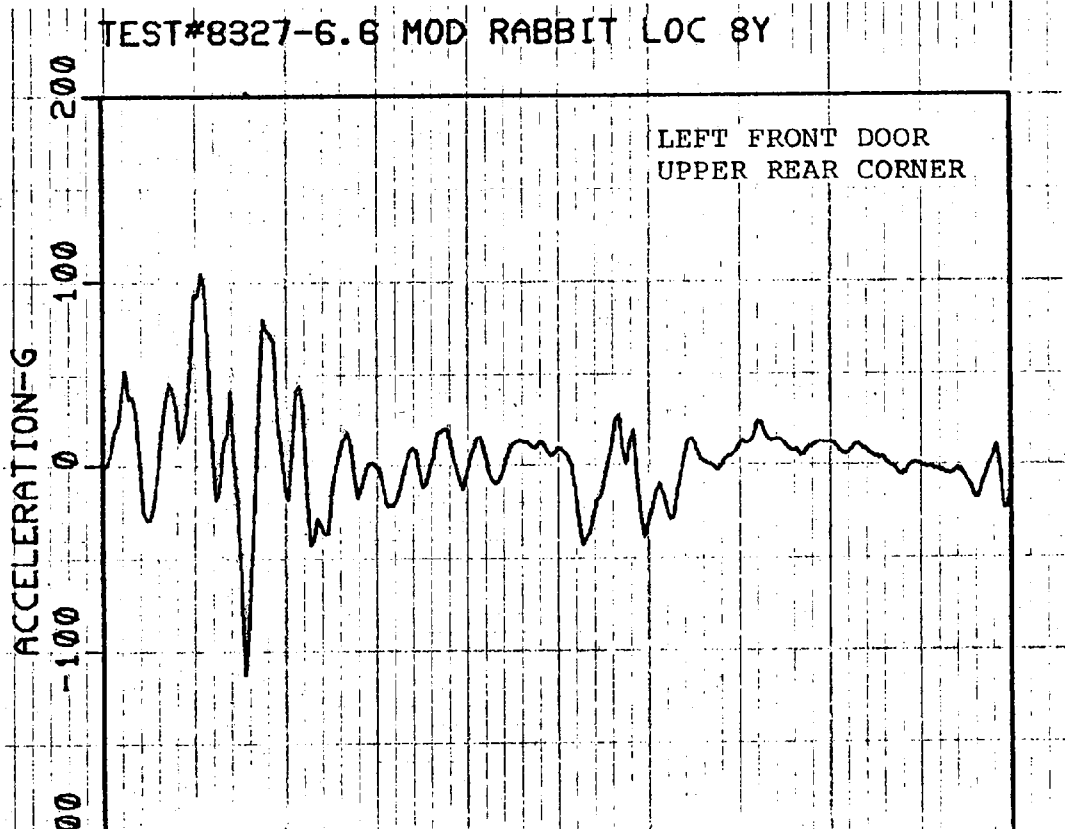
TEST#8327-6.6 MOD RABBIT LOC 7Y

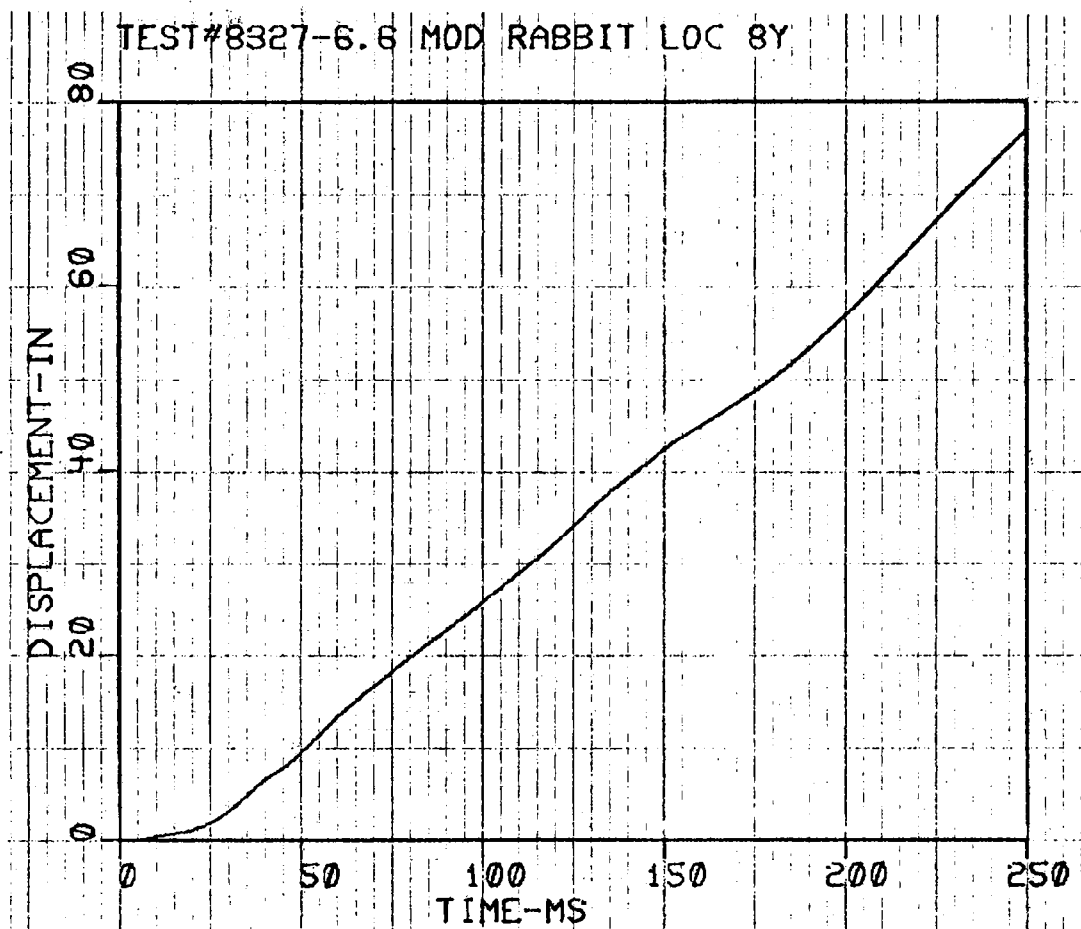


TEST#8327-6.6 MOD RABBIT LOC 7Y

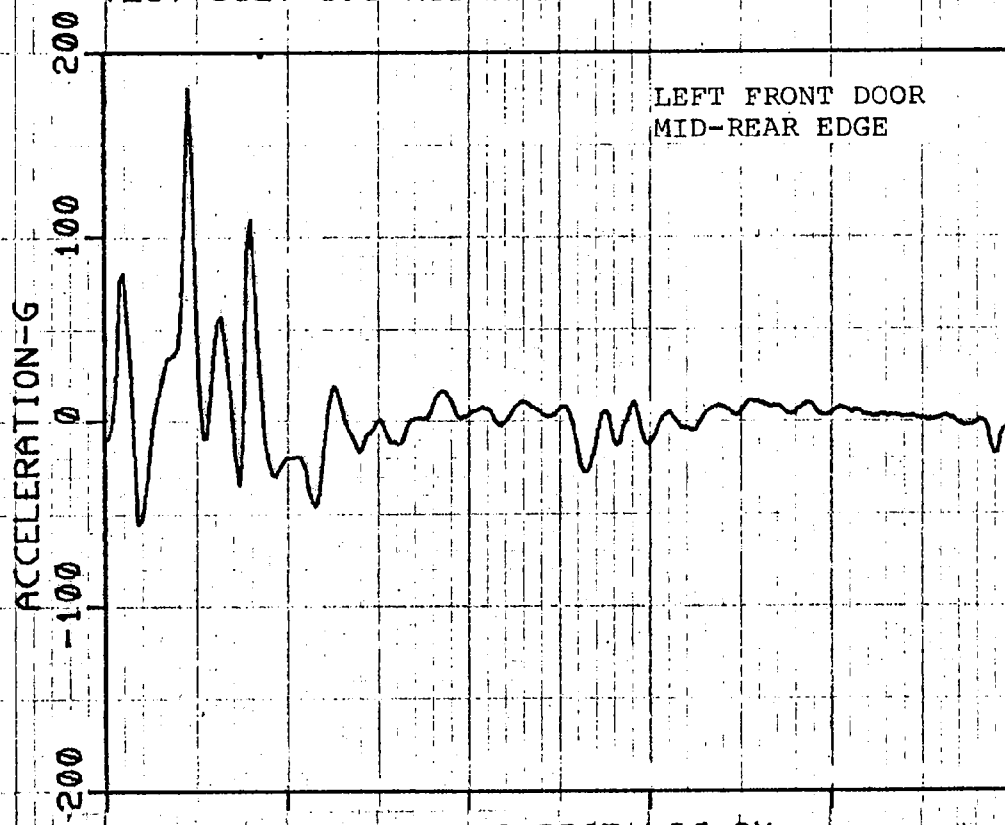




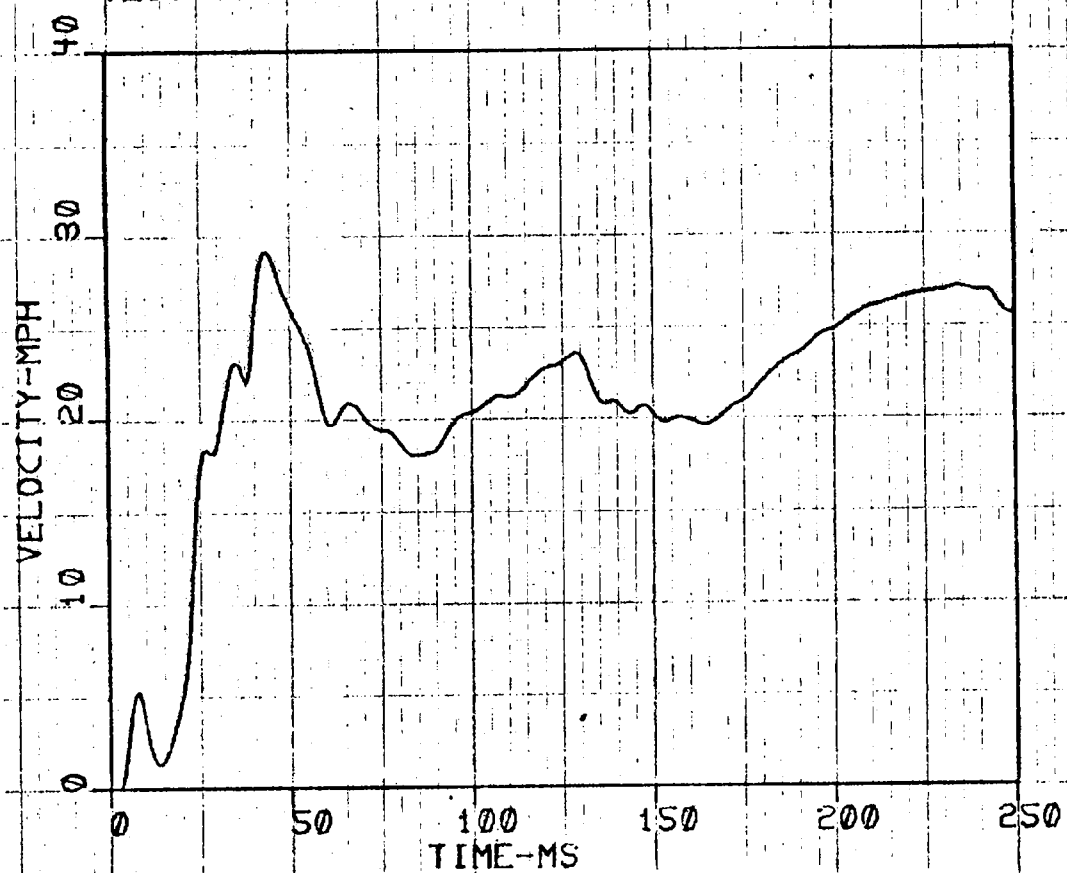


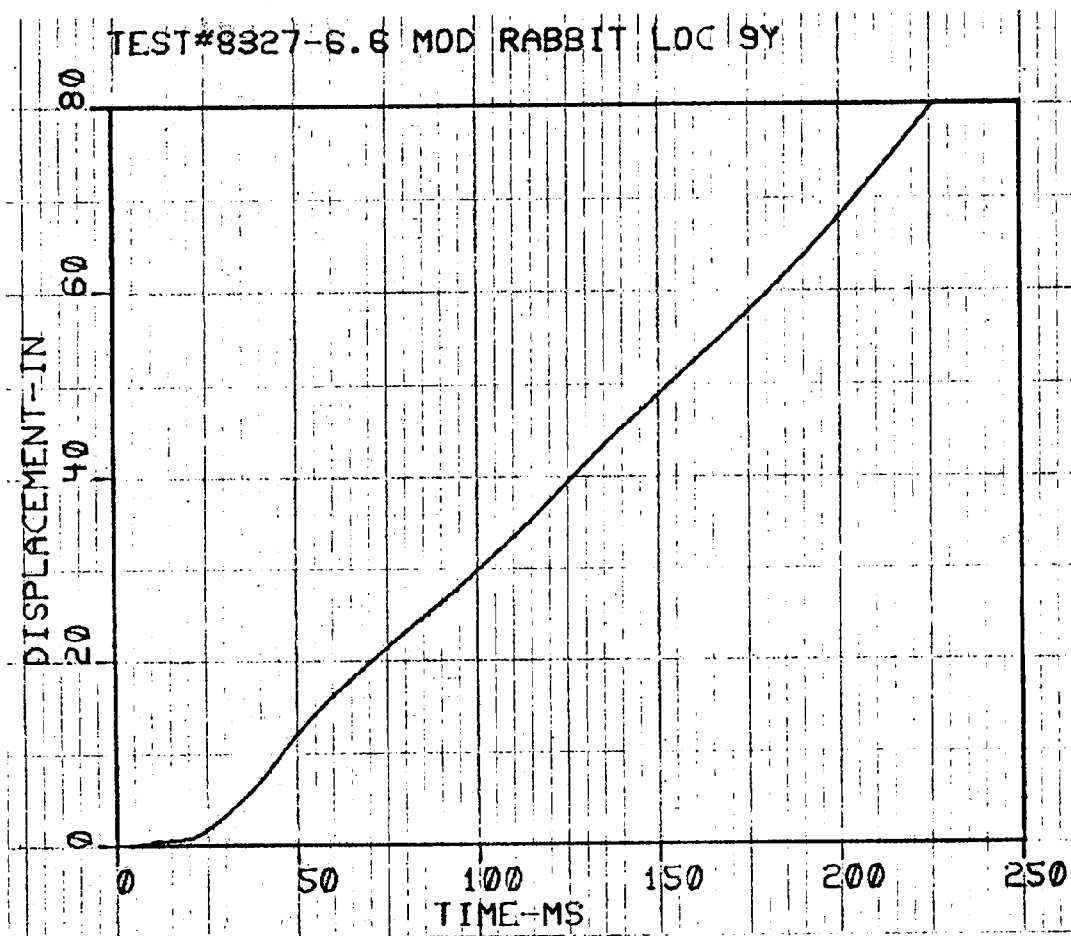


TEST#8327-6.6 MOD RABBIT LOC 9Y

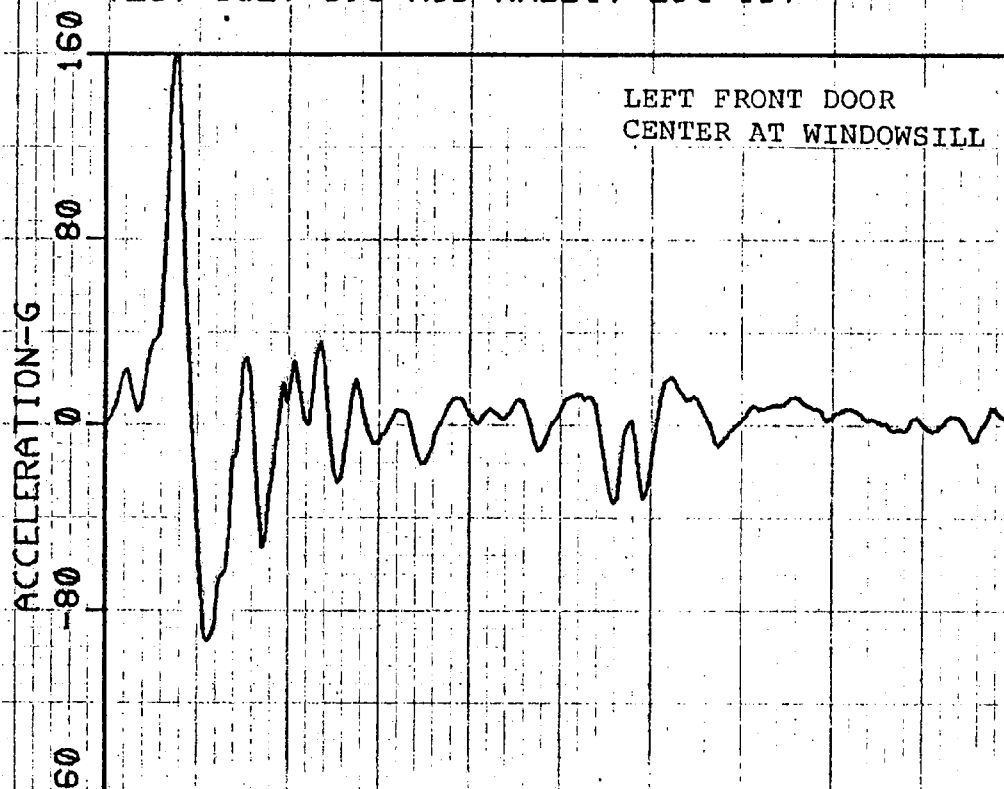


TEST#8327-6.6 MOD RABBIT LOC 9Y

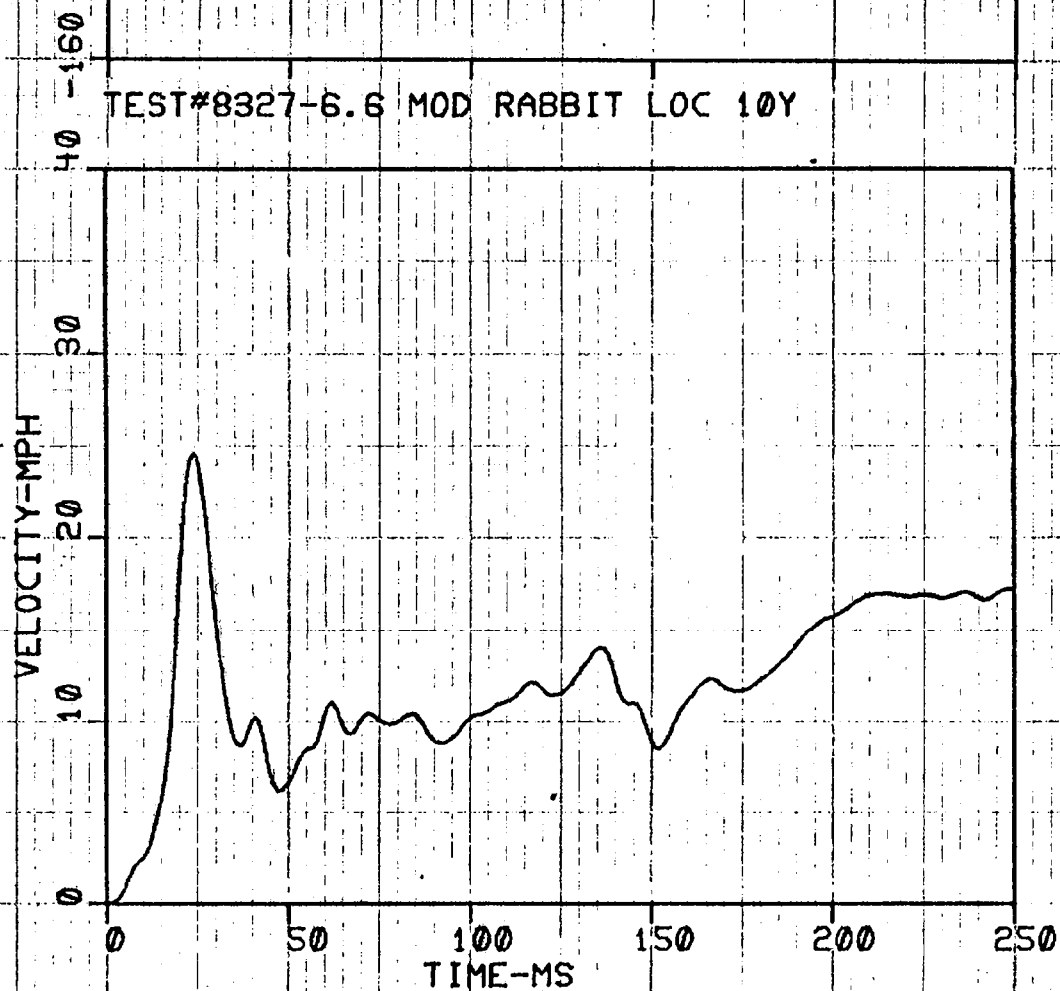


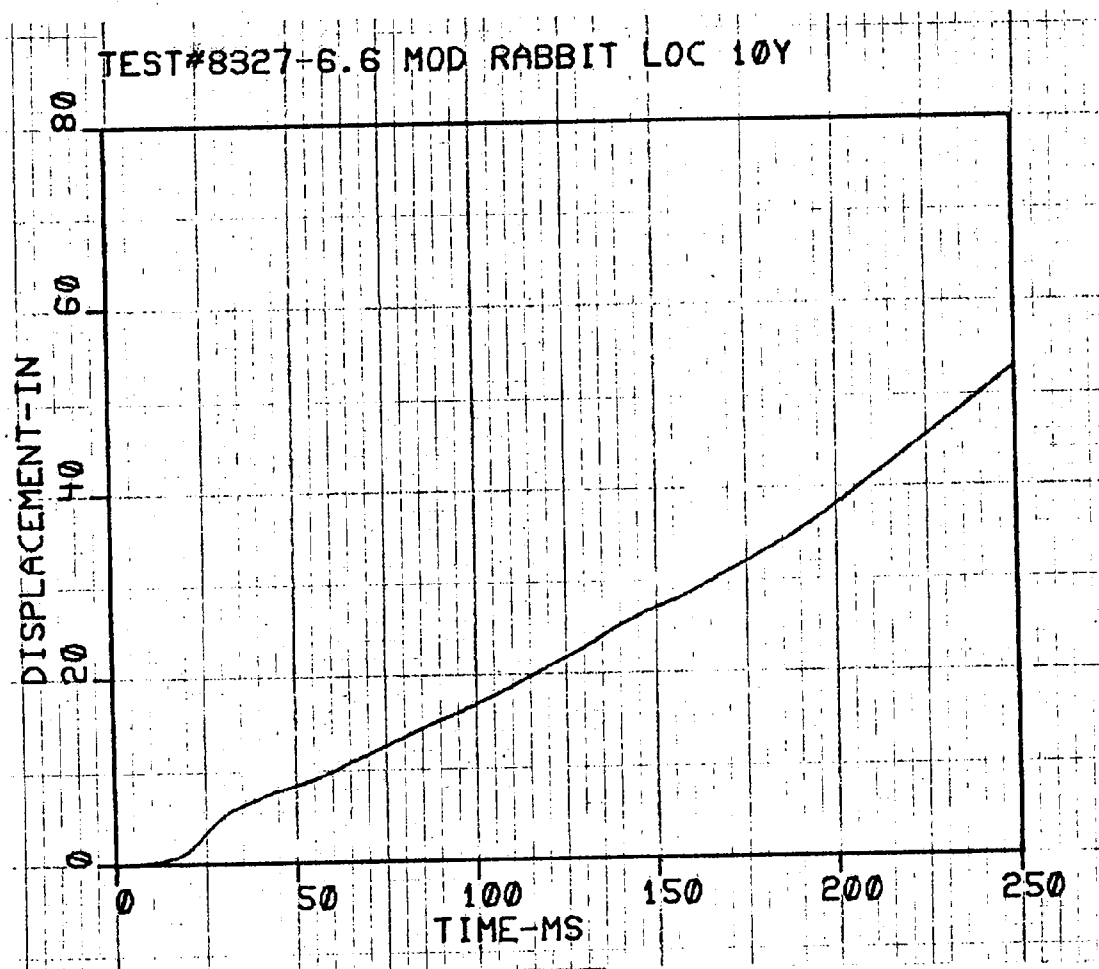


TEST#8327-6.6 MOD RABBIT LOC 10Y

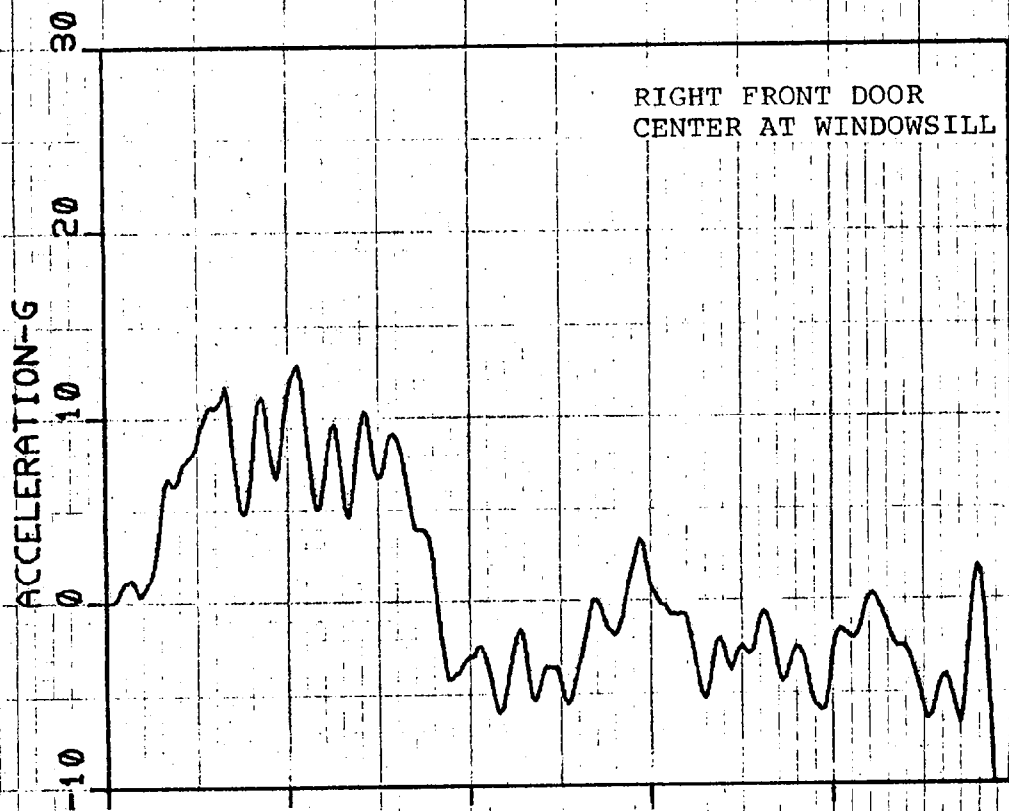


TEST#8327-6.6 MOD RABBIT LOC 10Y

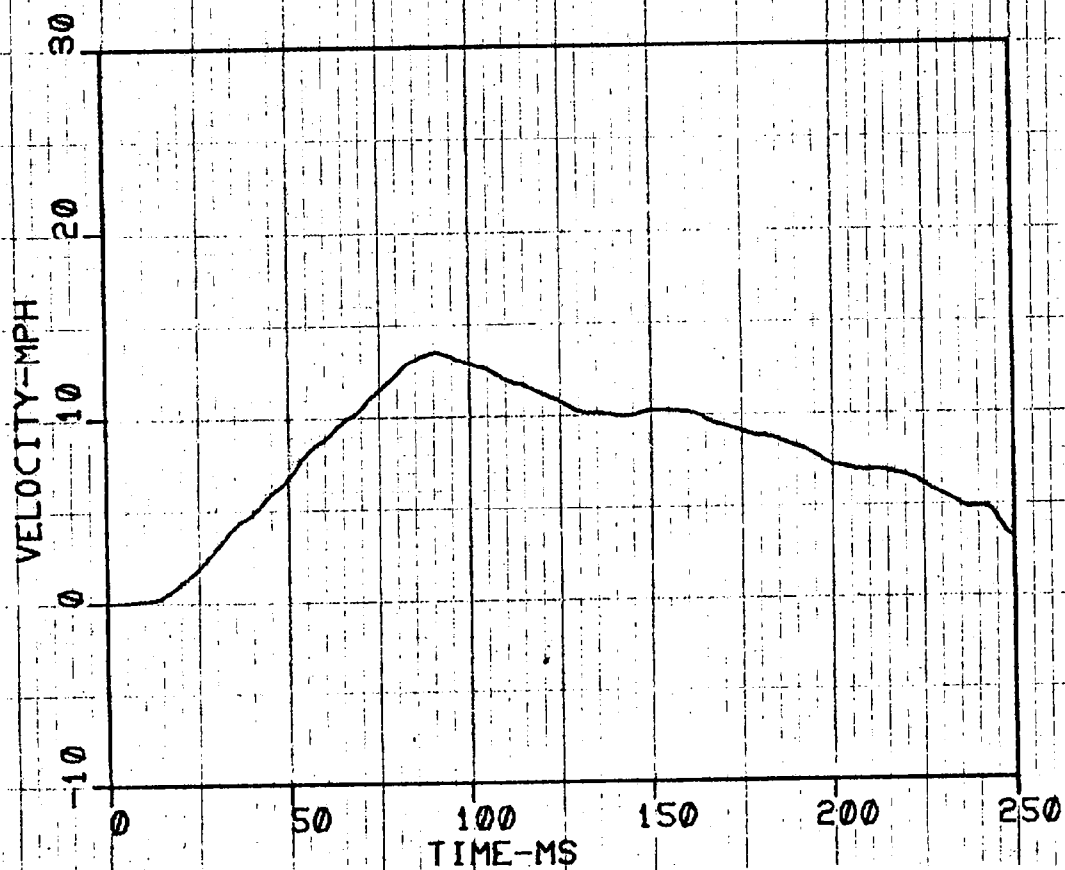


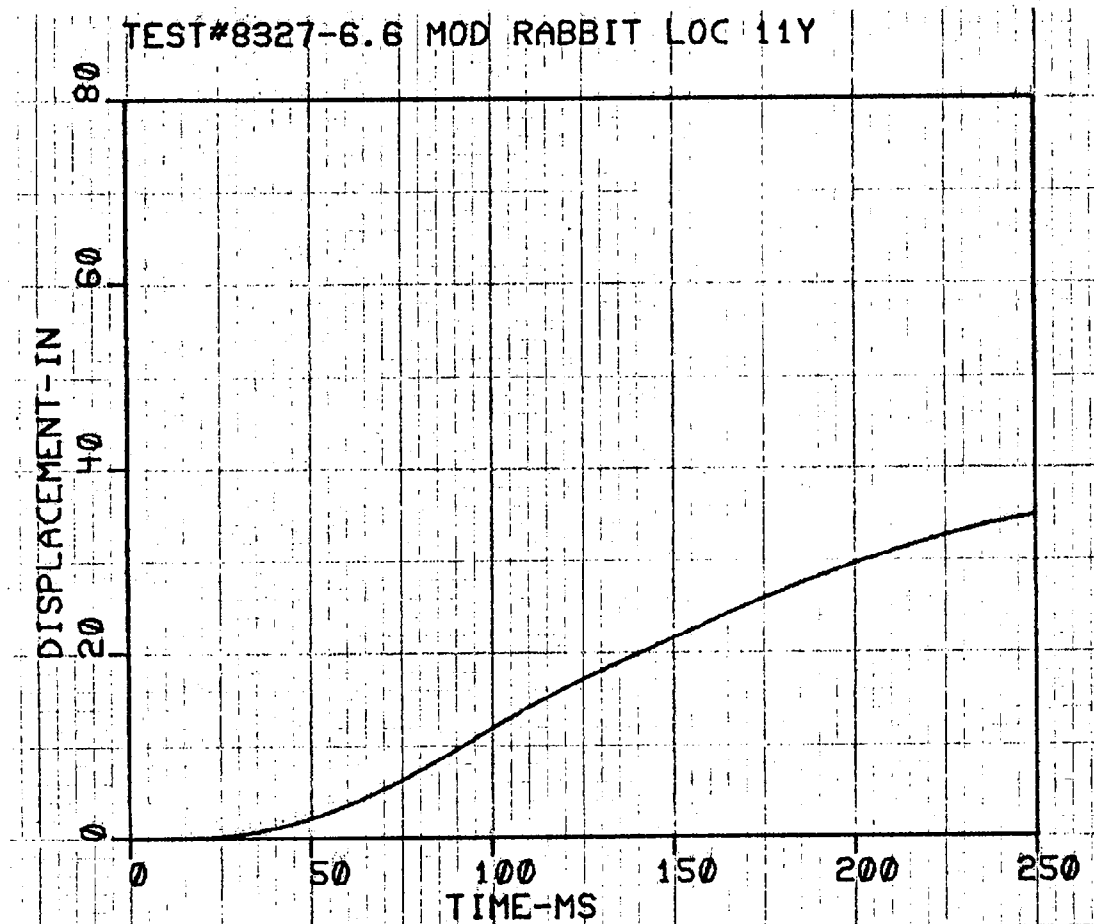


TEST#8327-6.6 MOD RABBIT LOC 11Y

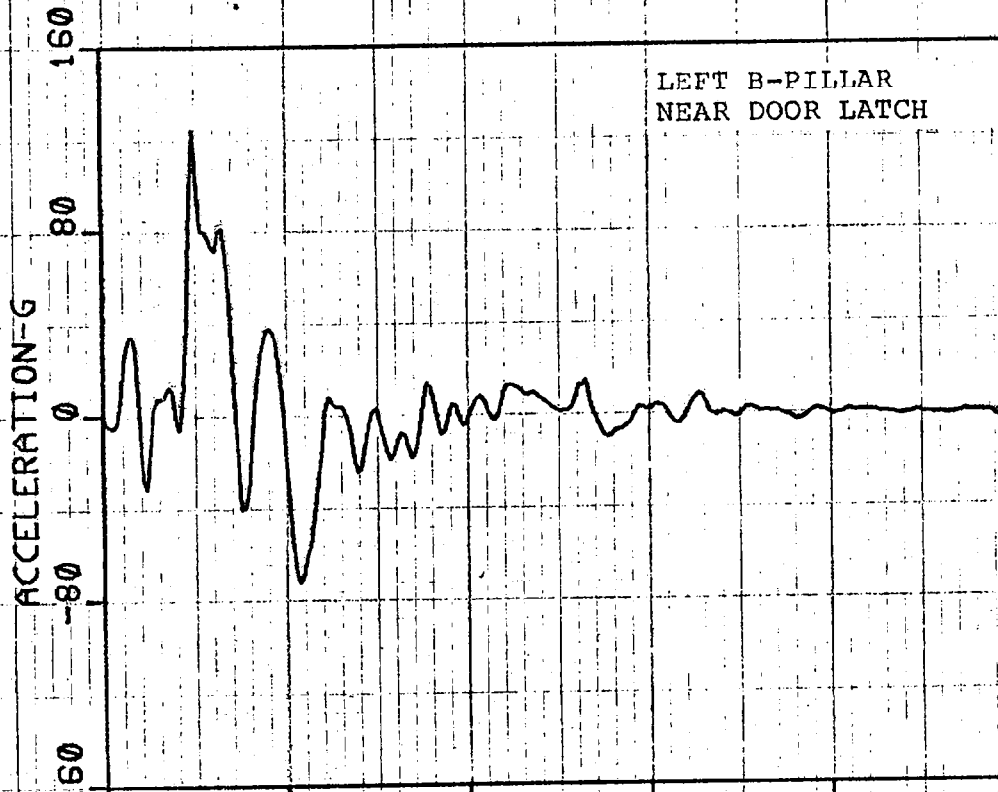


TEST#8327-6.6 MOD RABBIT LOC 11Y

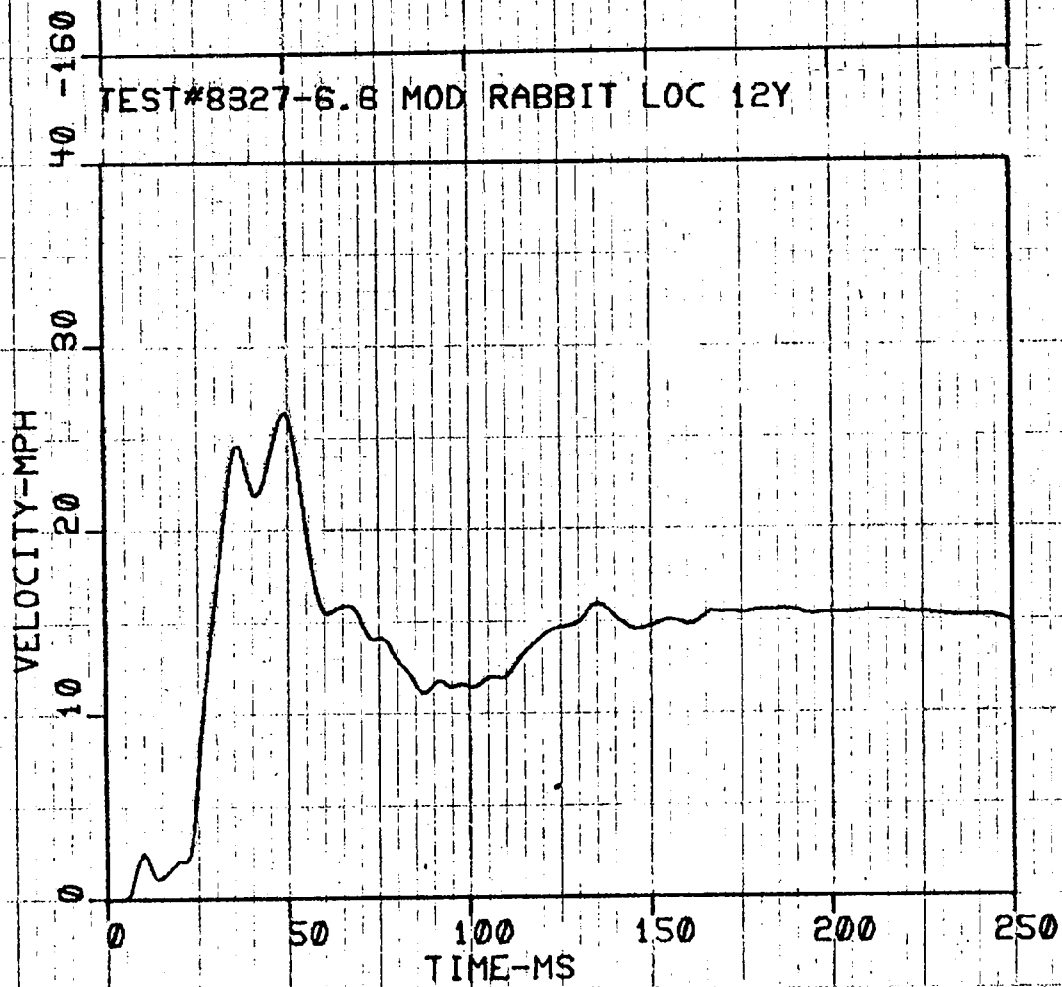


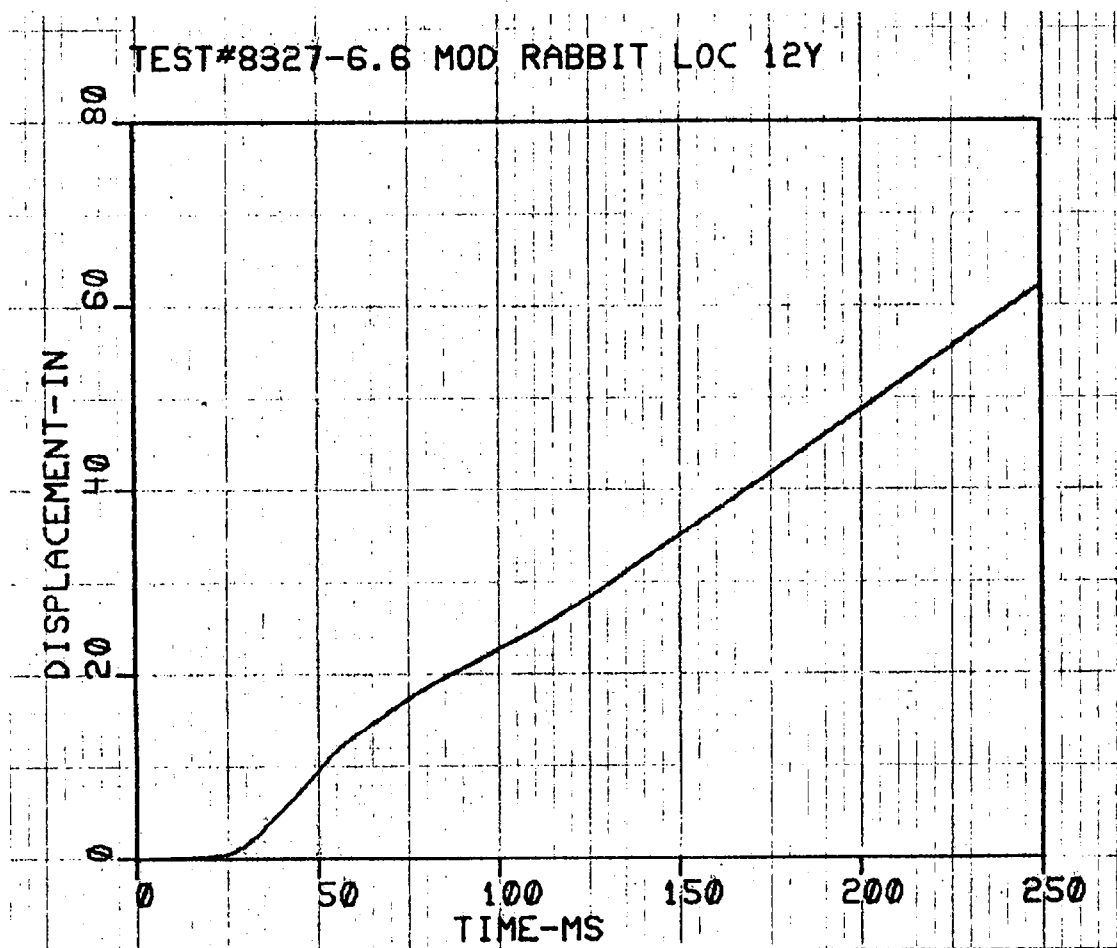


TEST#8327-6.6 MOD RABBIT LOC 12Y

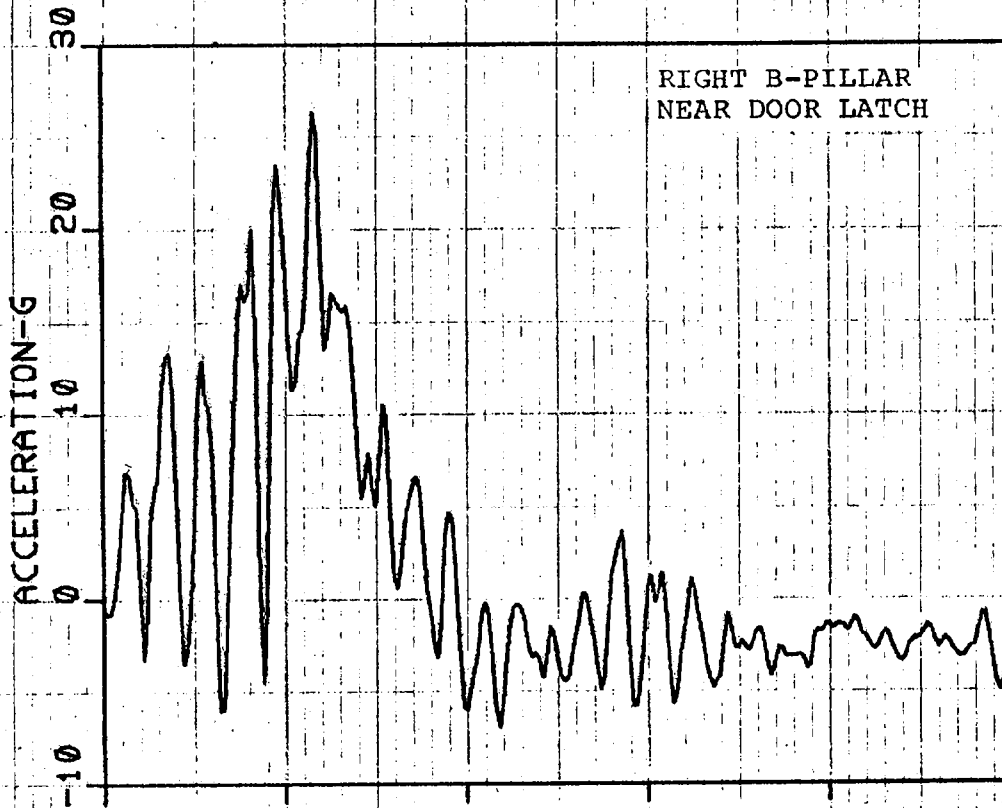


TEST#8327-6.6 MOD RABBIT LOC 12Y

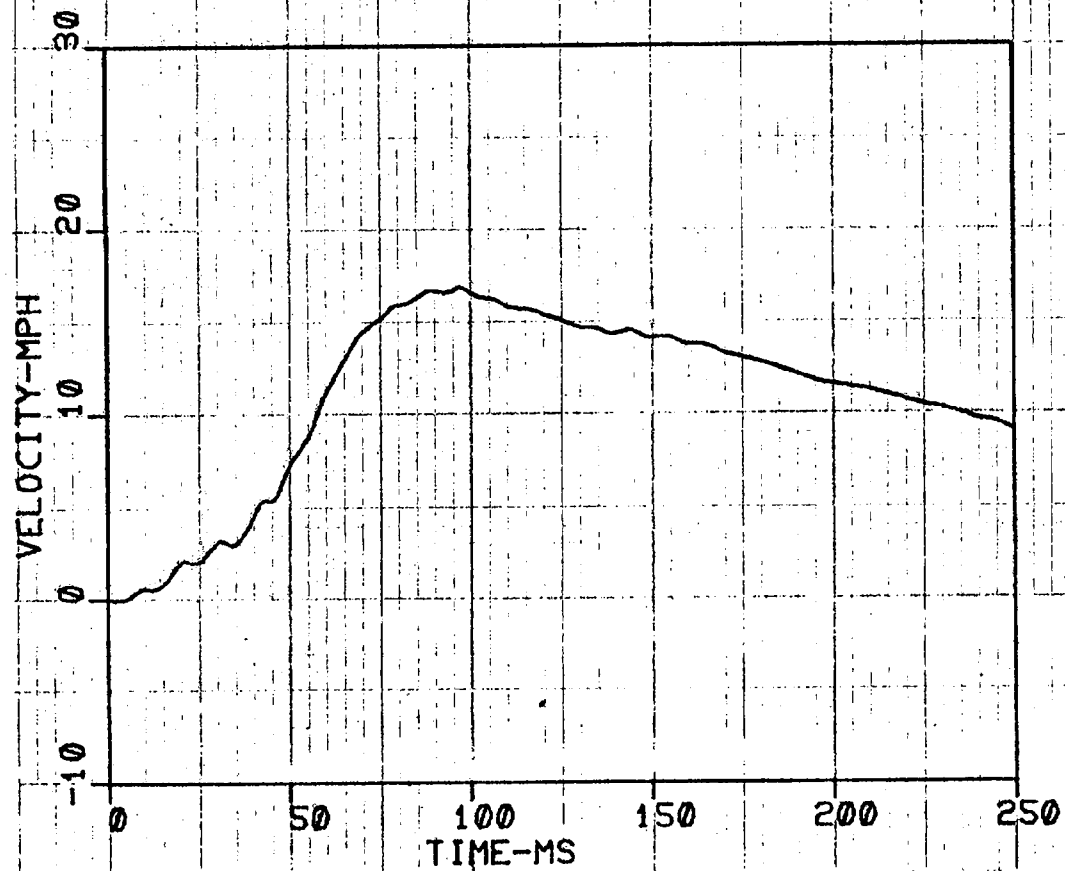


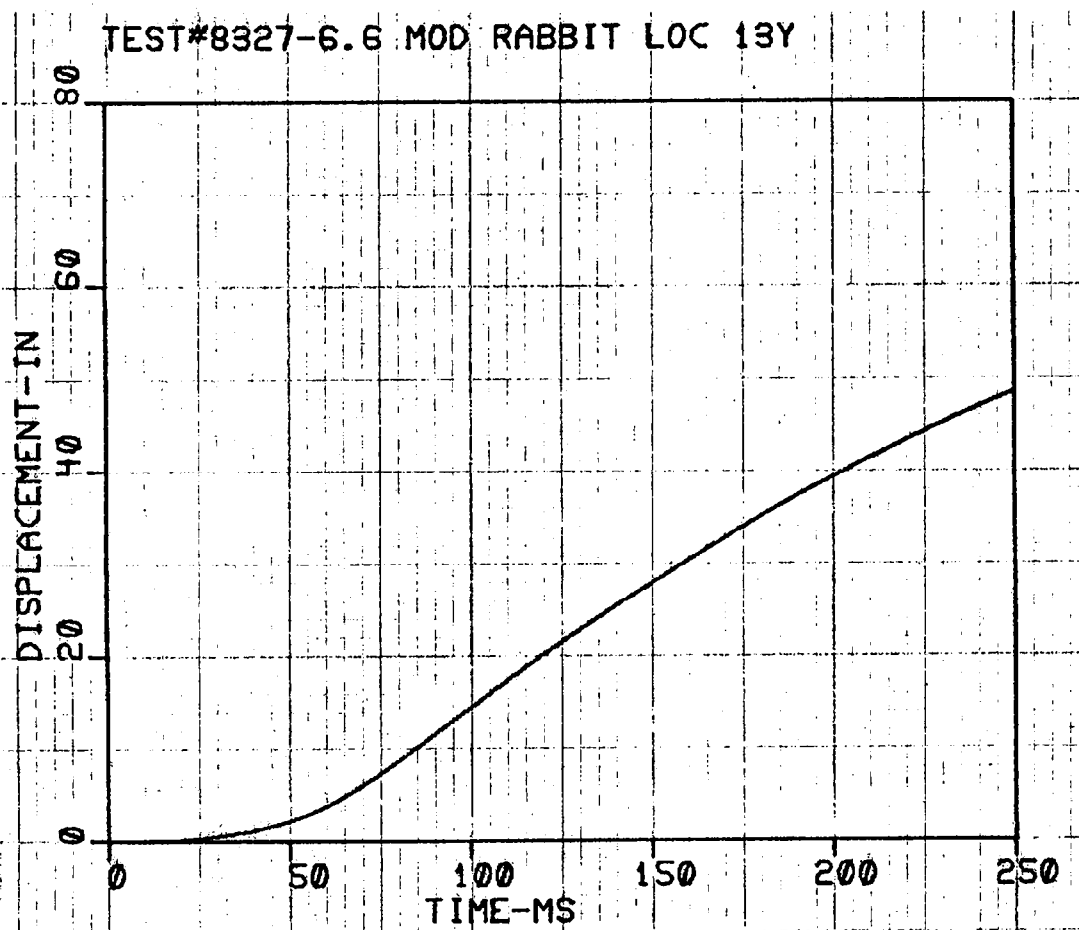


TEST#8327-6.6 MOD RABBIT LOC 13Y

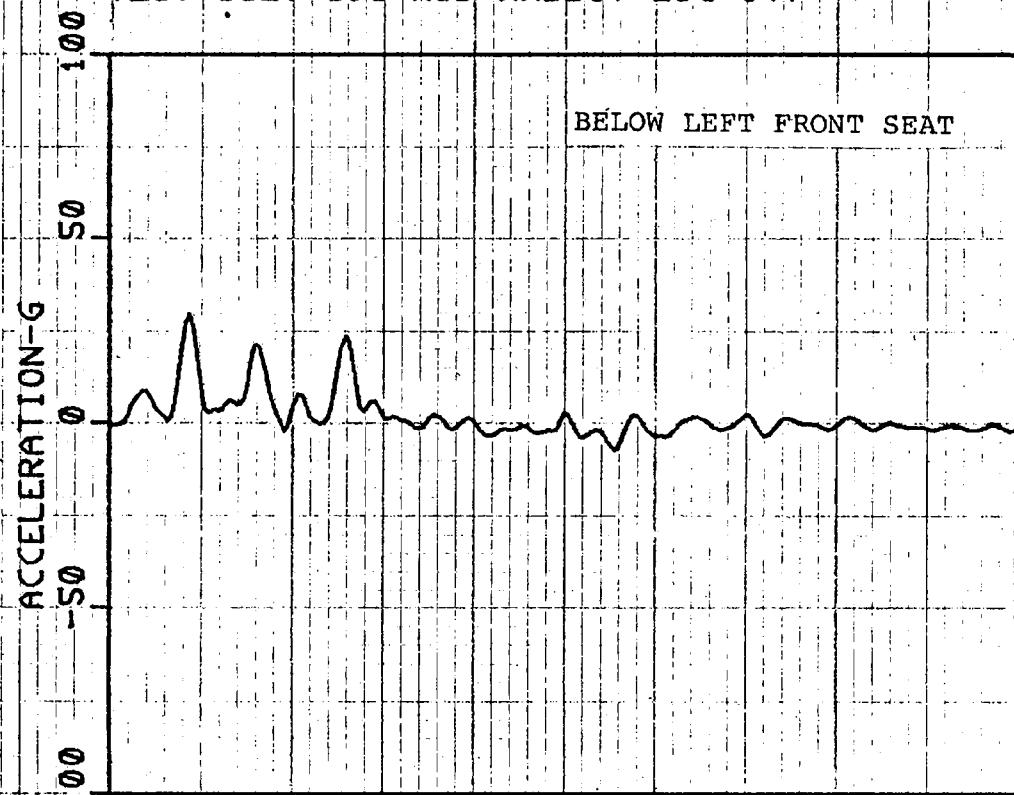


TEST#8327-6.6 MOD RABBIT LOC 13Y

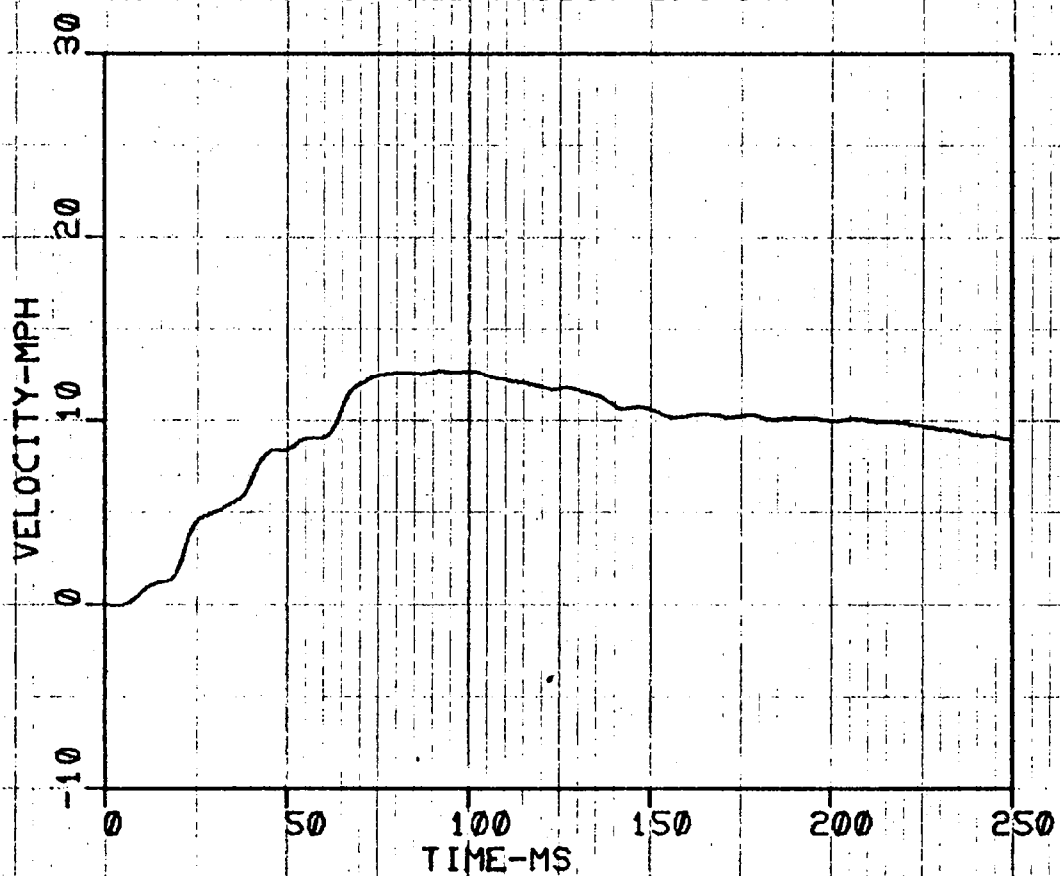


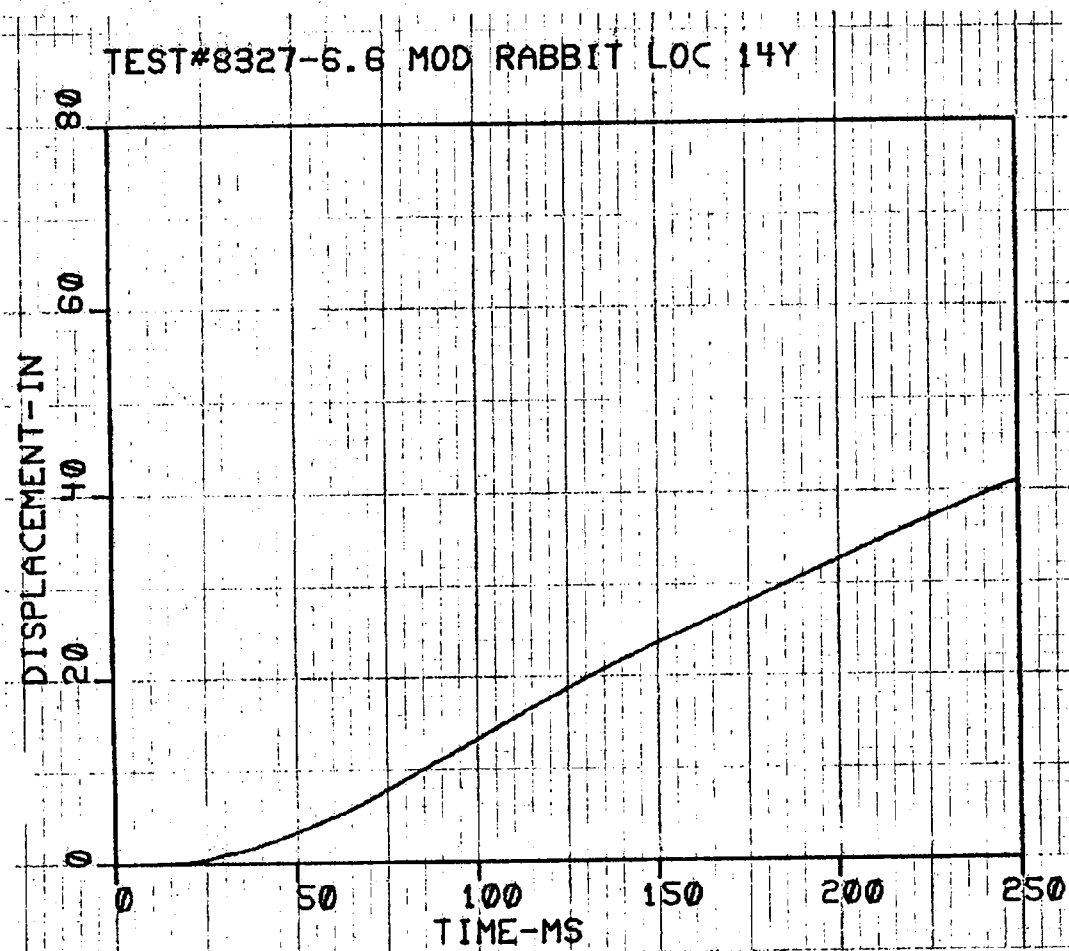


TEST#8327-6.6 MOD RABBIT LOC 14Y

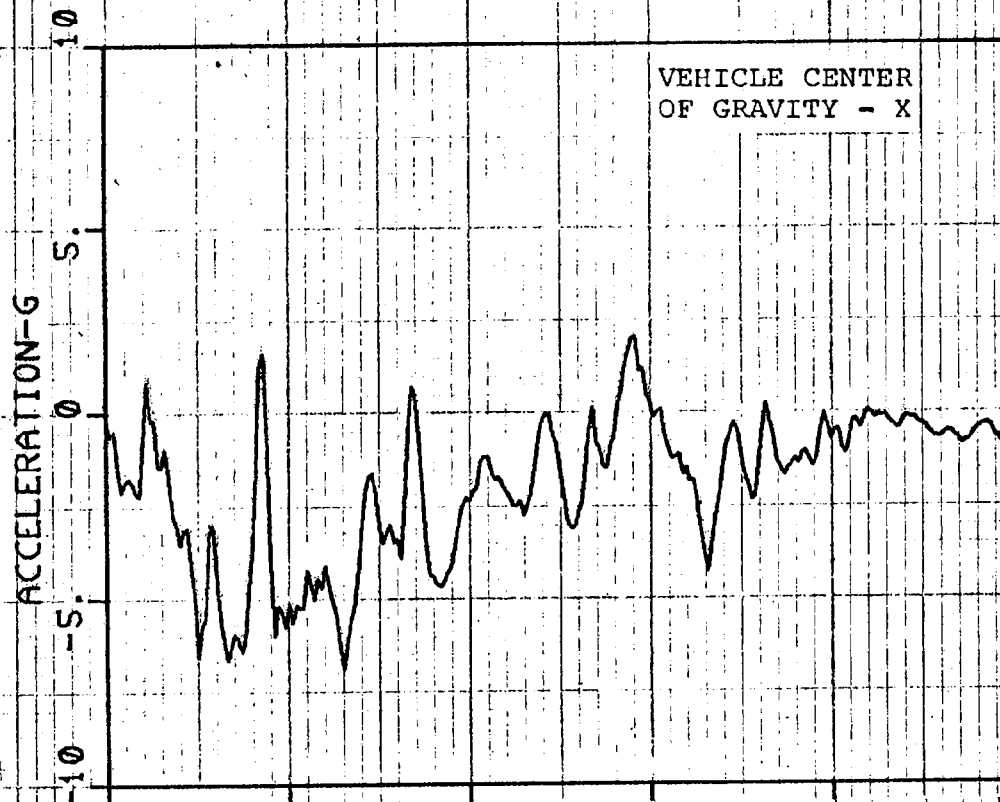


TEST#8327-6.6 MOD RABBIT LOC 14Y

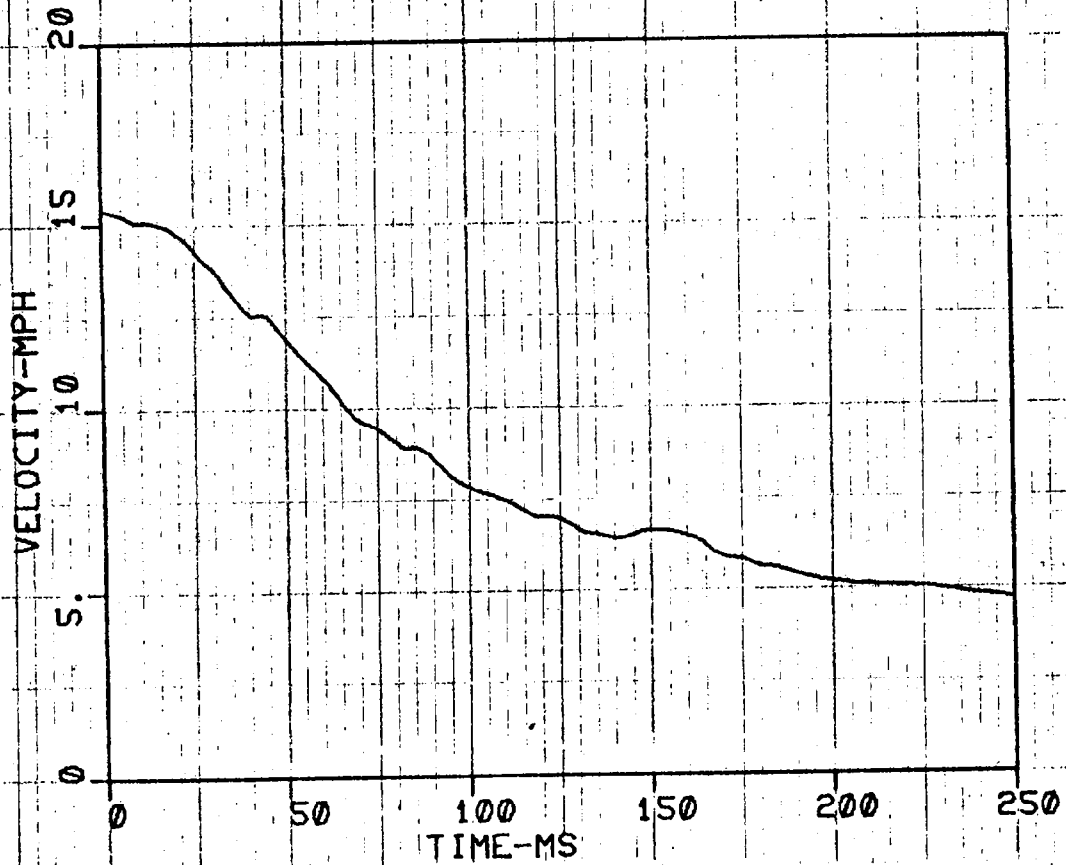


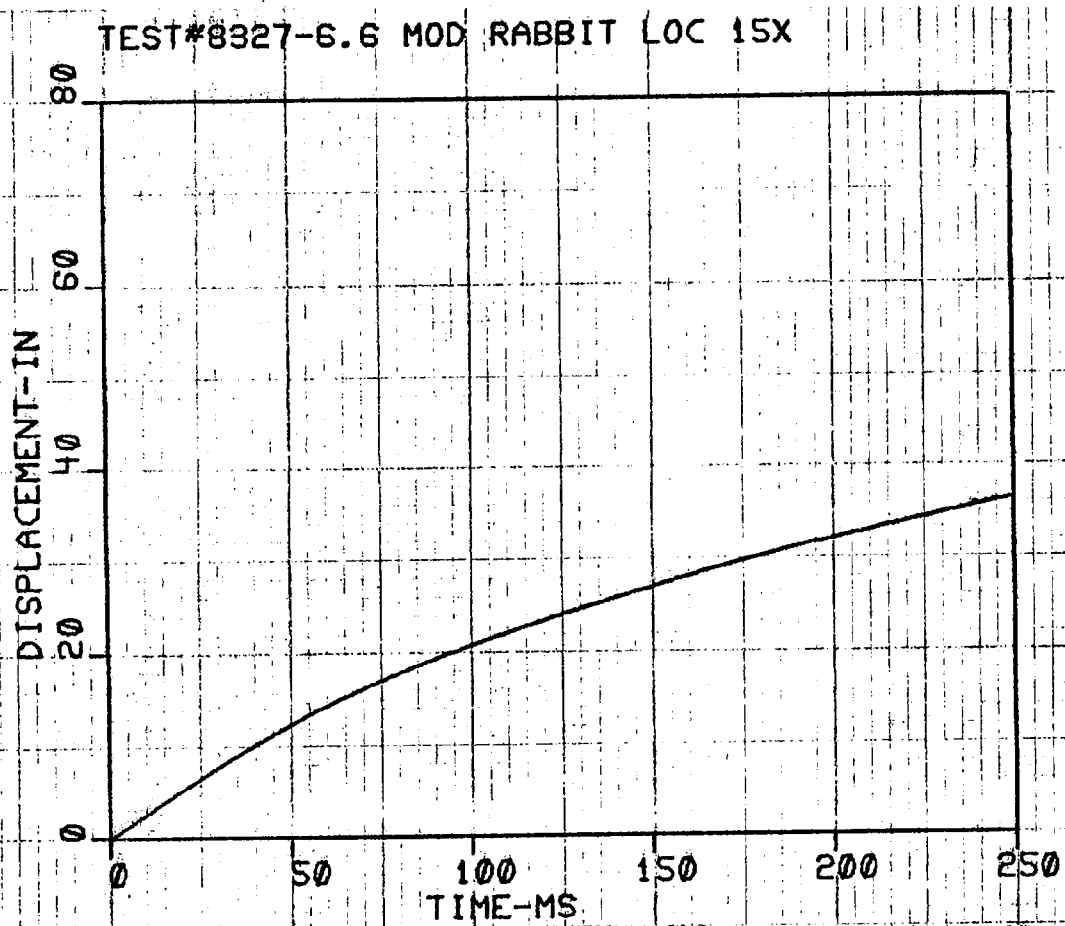


TEST#8327-6.6 MOD RABBIT LOC 15X

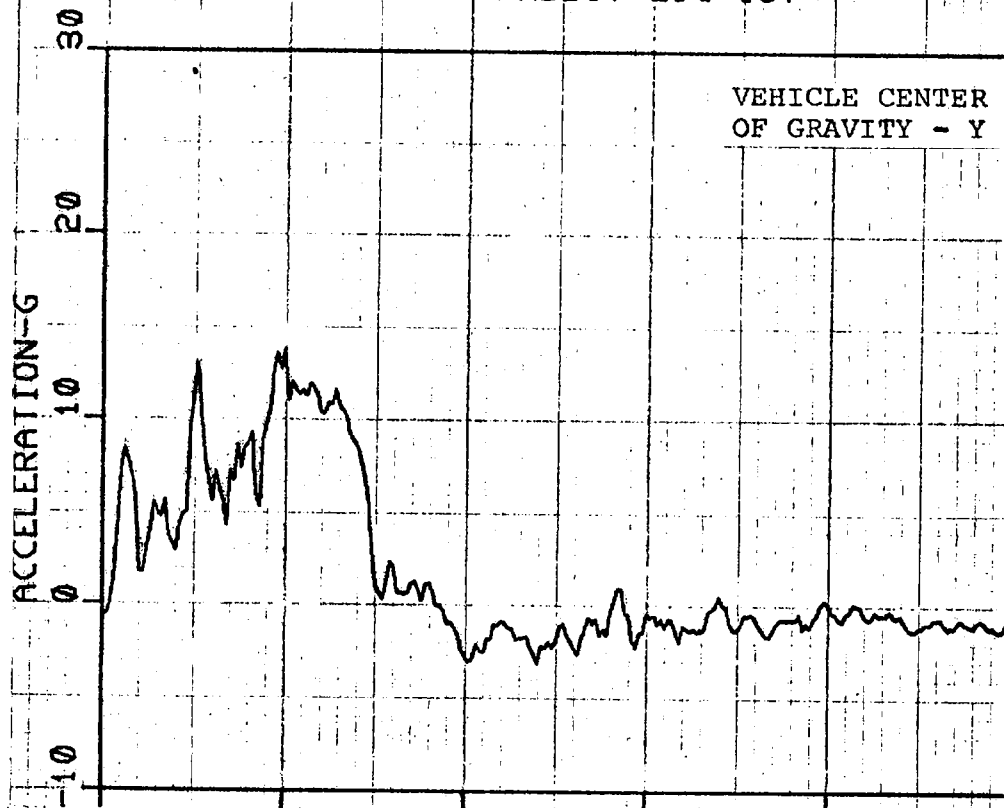


TEST#8327-6.6 MOD RABBIT LOC 15X

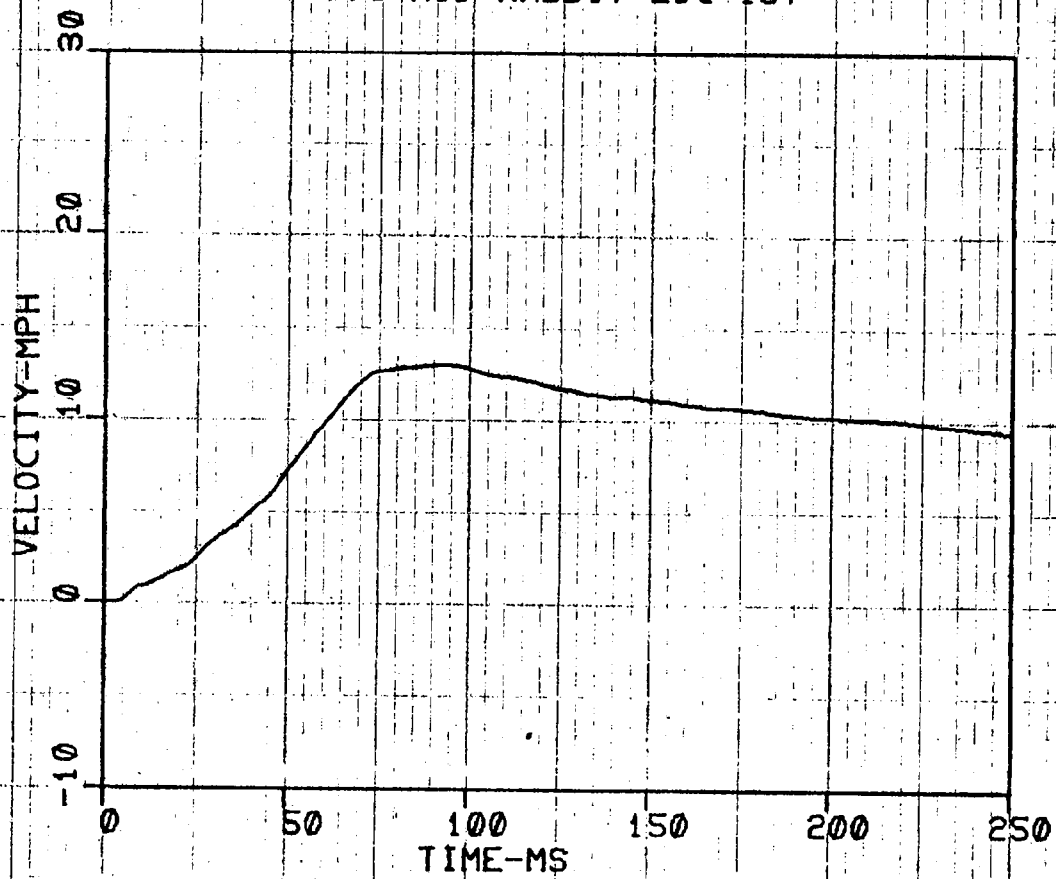


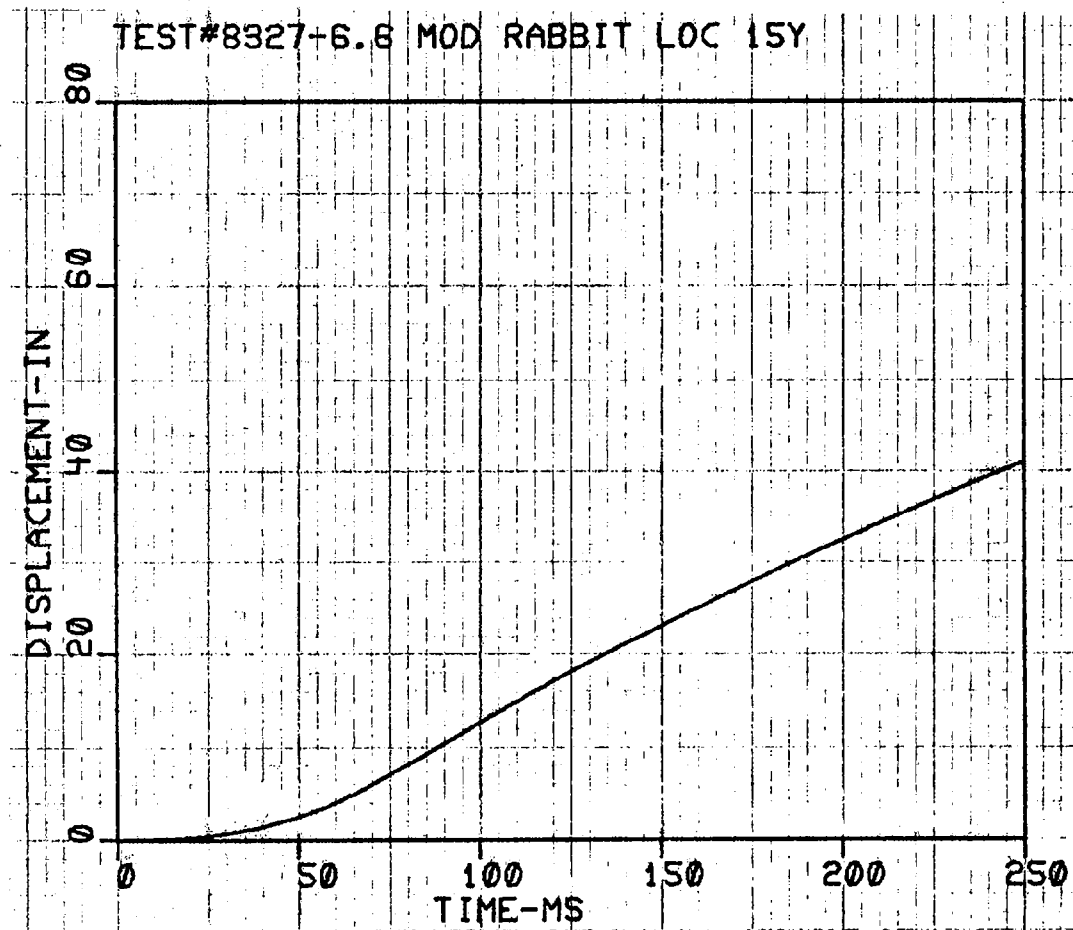


TEST#8327-6.6 MOD RABBIT LOC 15Y

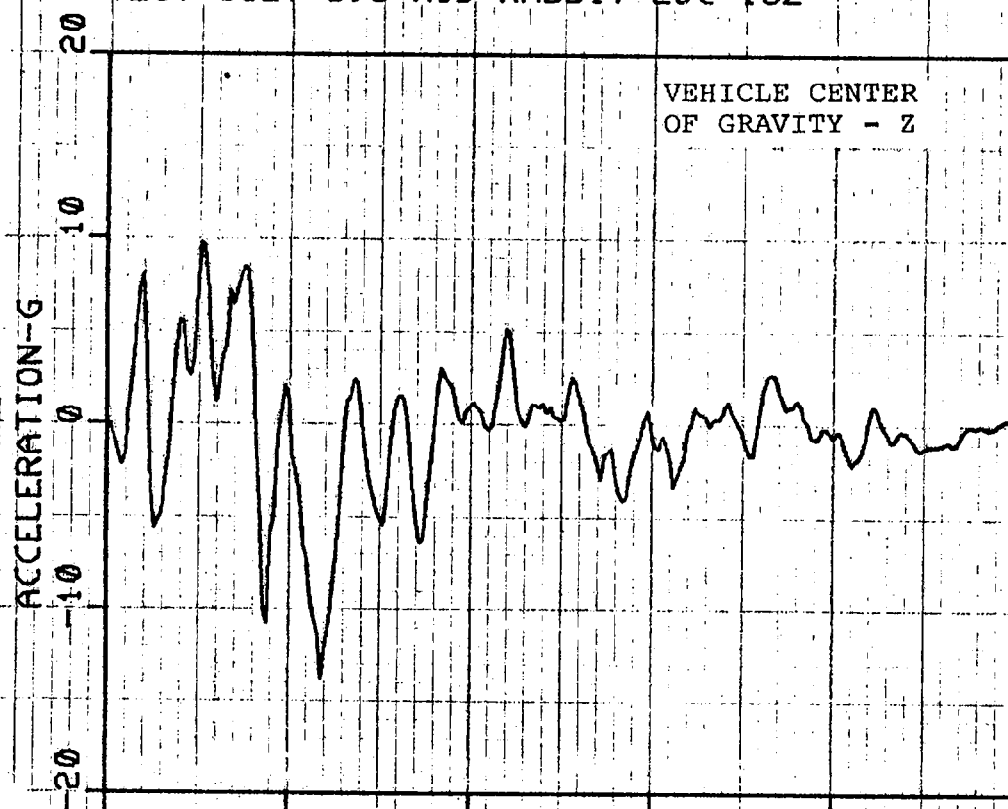


TEST#8327-6.6 MOD RABBIT LOC 15Y

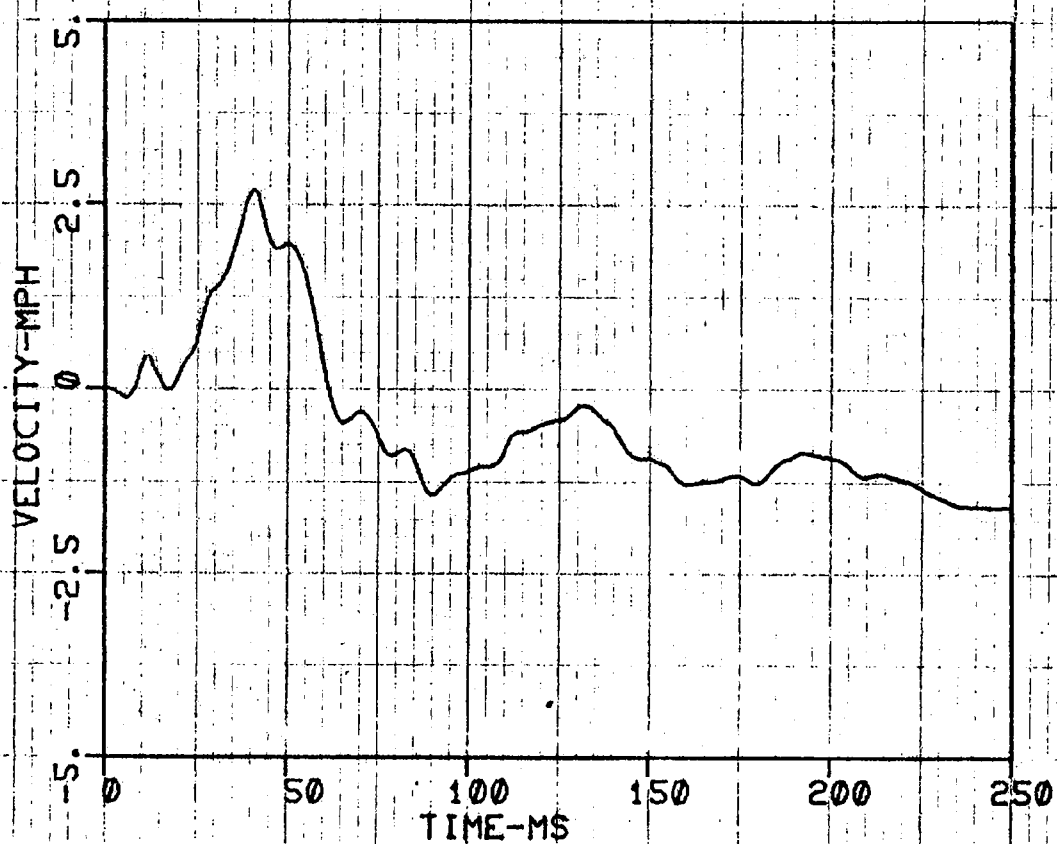


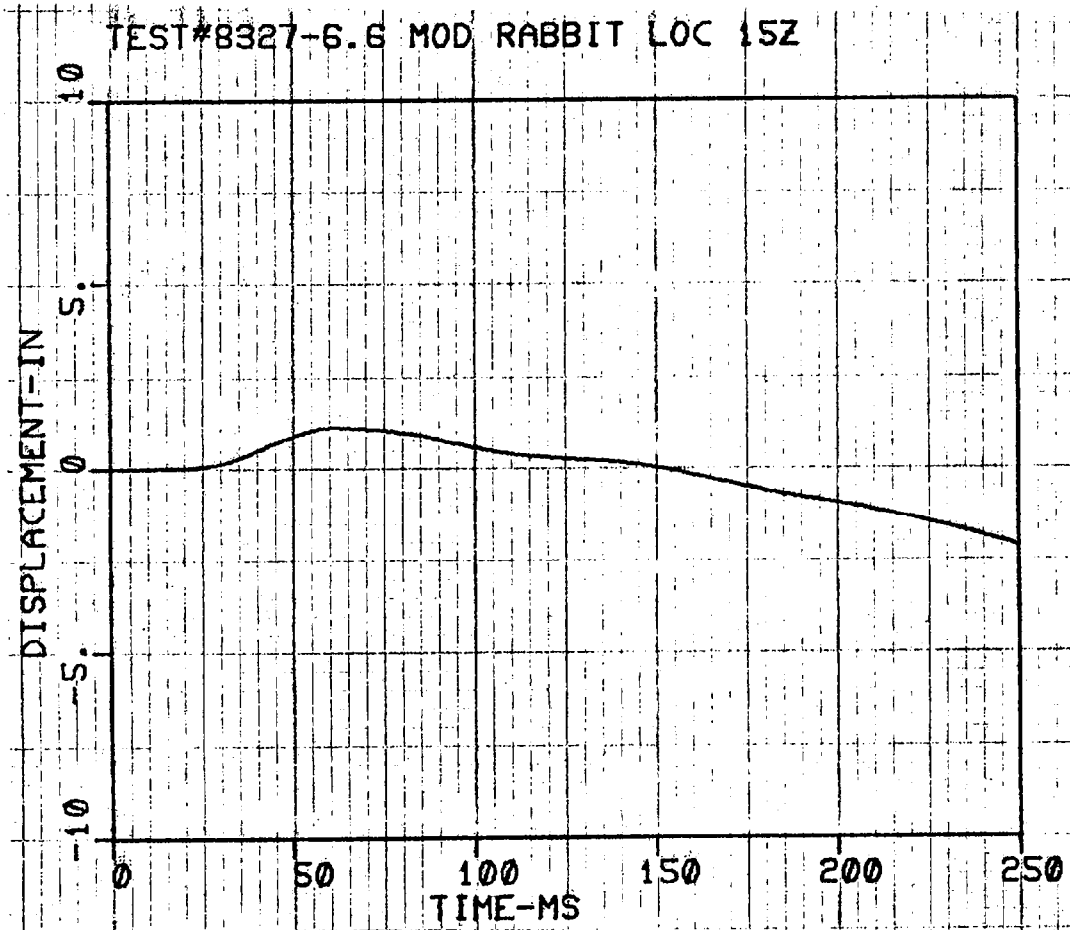


TEST#8327-6.6 MOD RABBIT LOC 15Z

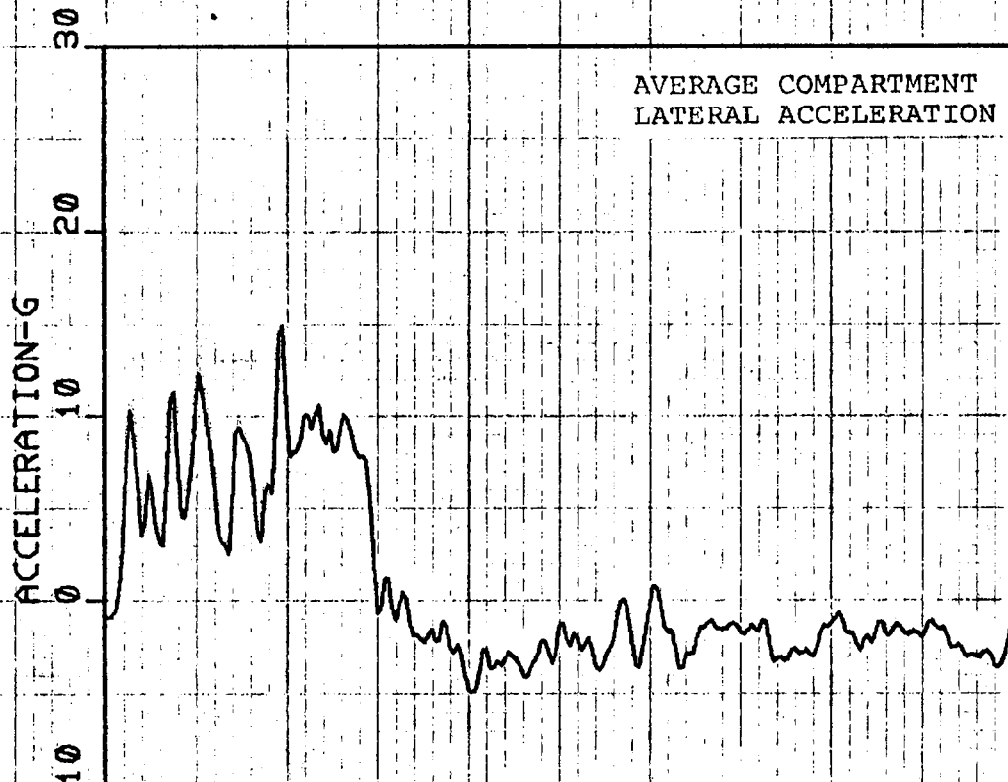


TEST#8327-6.6 MOD RABBIT LOC 15Z

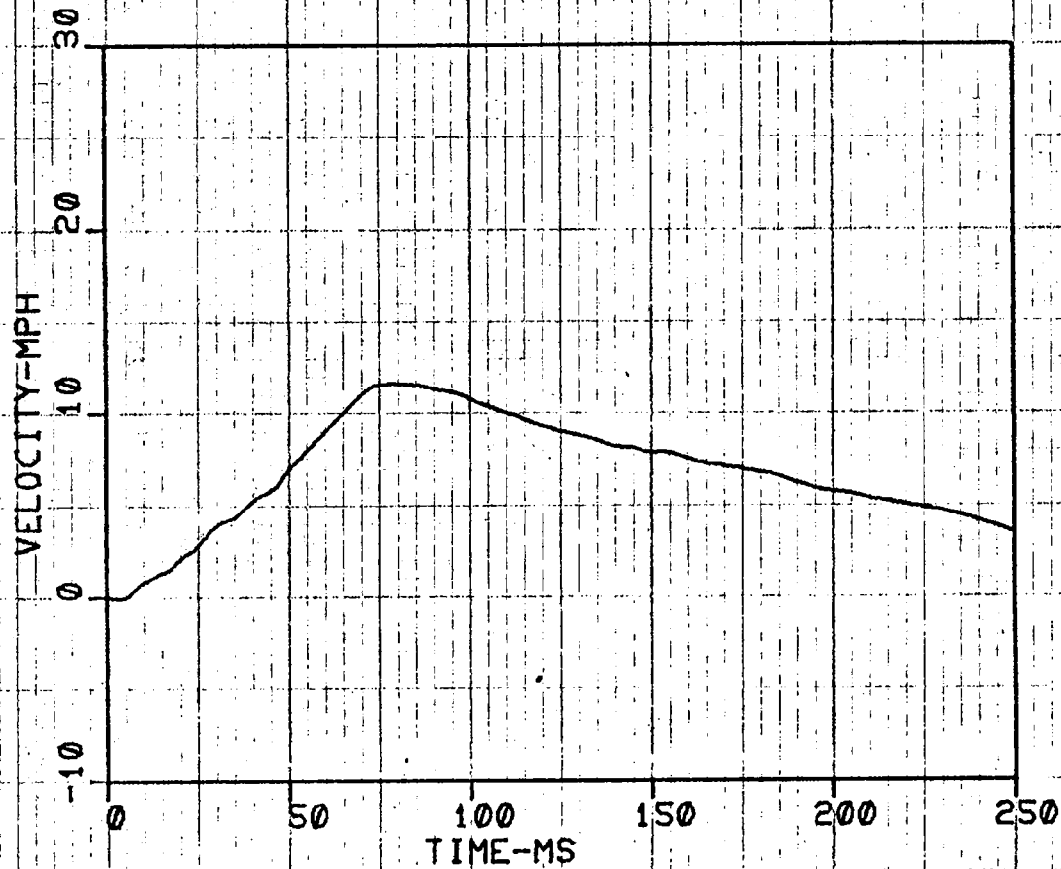


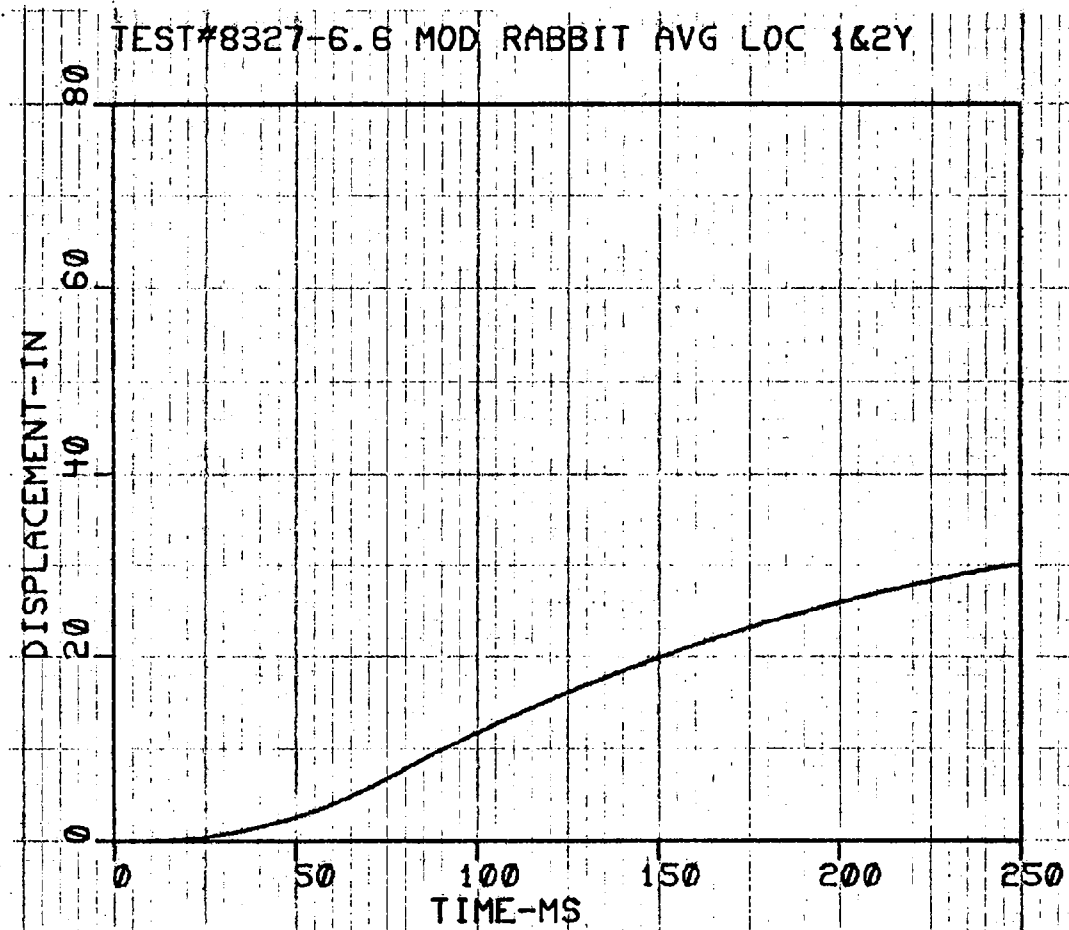


TEST#8327-6.8 MOD RABBIT AVG LOC 1&2Y

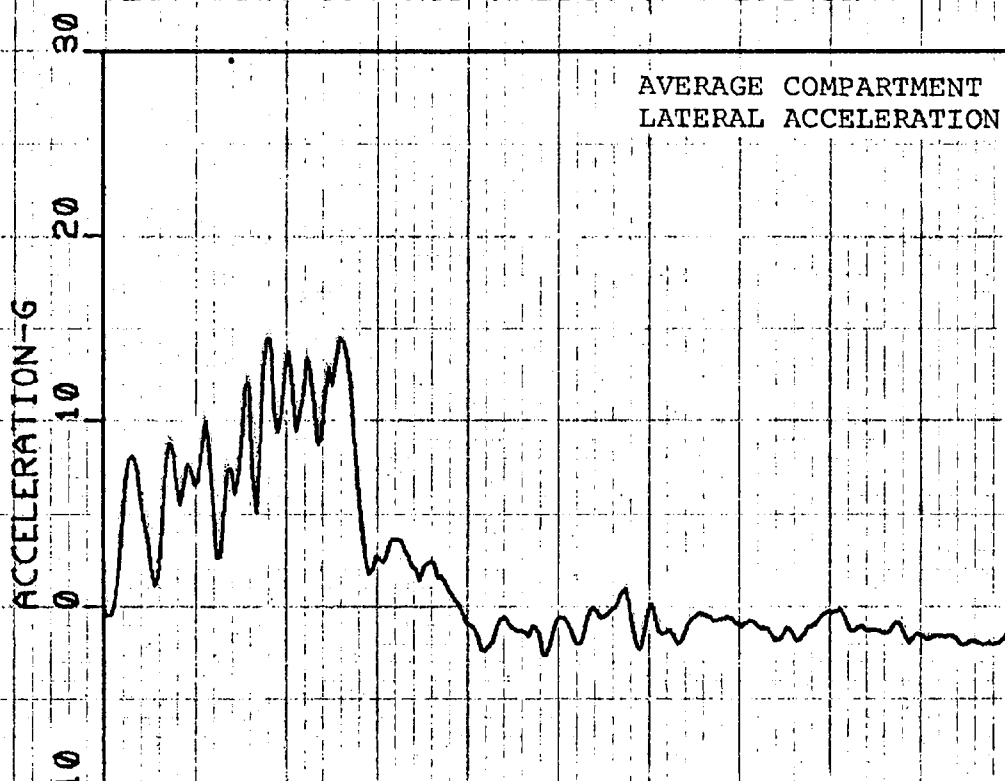


TEST#8327-6.8 MOD RABBIT AVG LOC 1&2Y

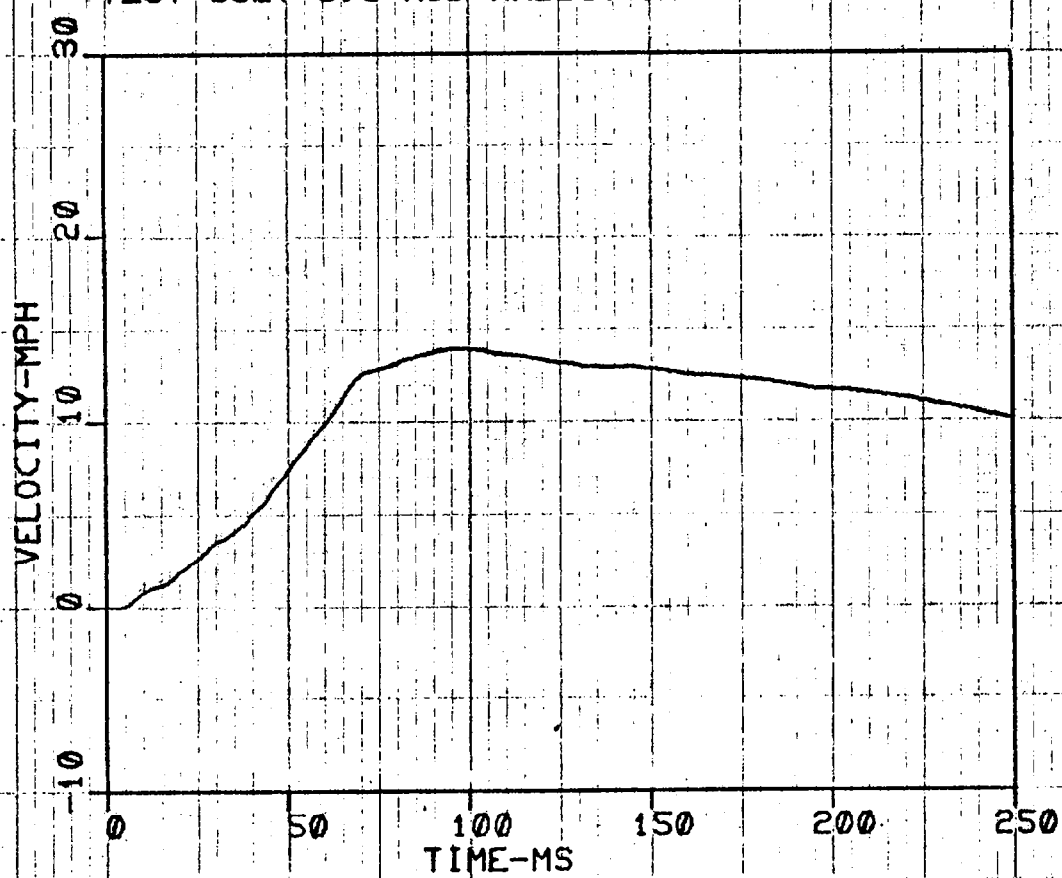


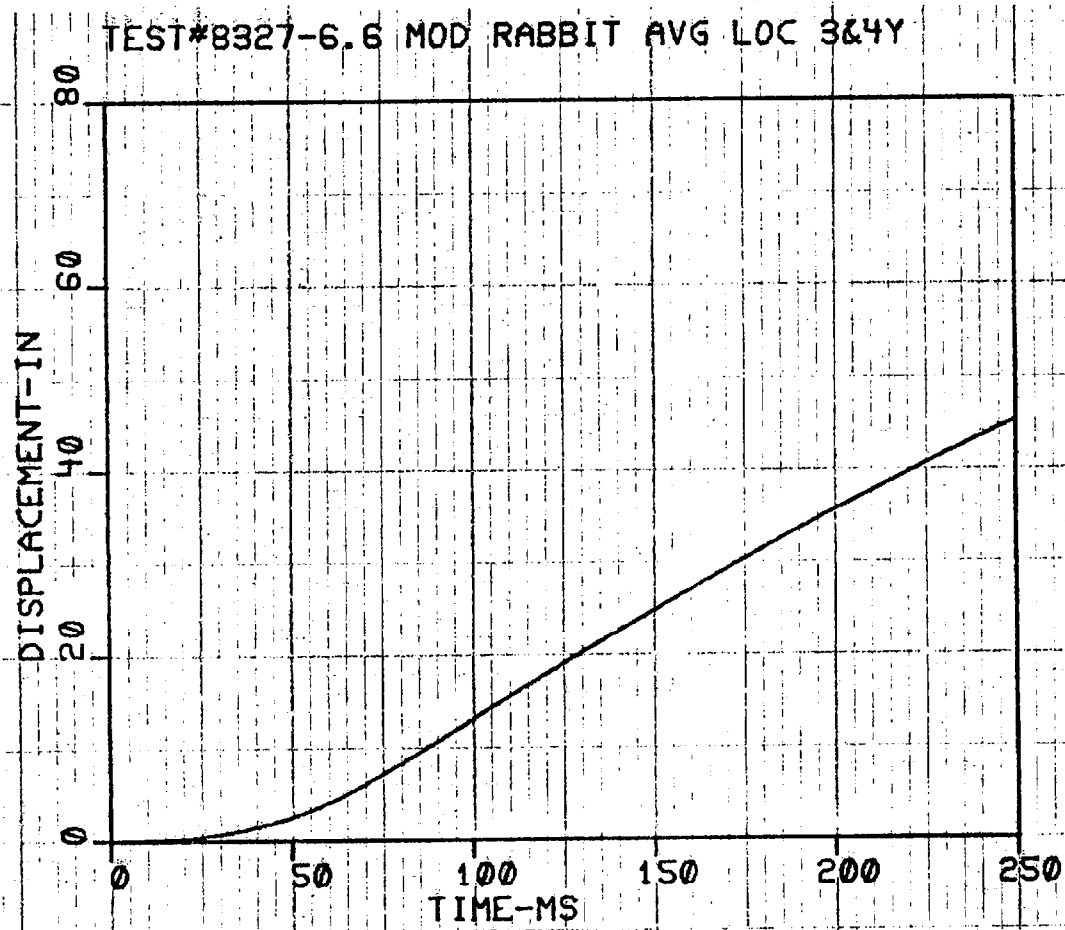


TEST#8327-6.6 MOD RABBIT AVG LOC 3&4Y

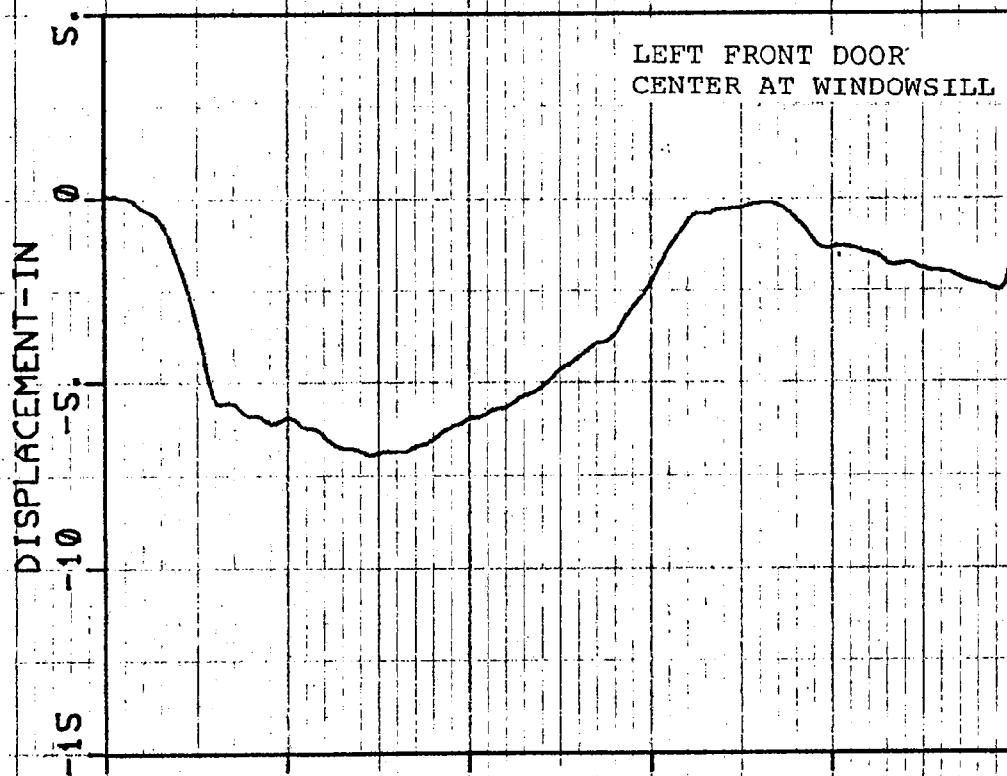


TEST#8327-6.6 MOD RABBIT AVG LOC 3&4Y

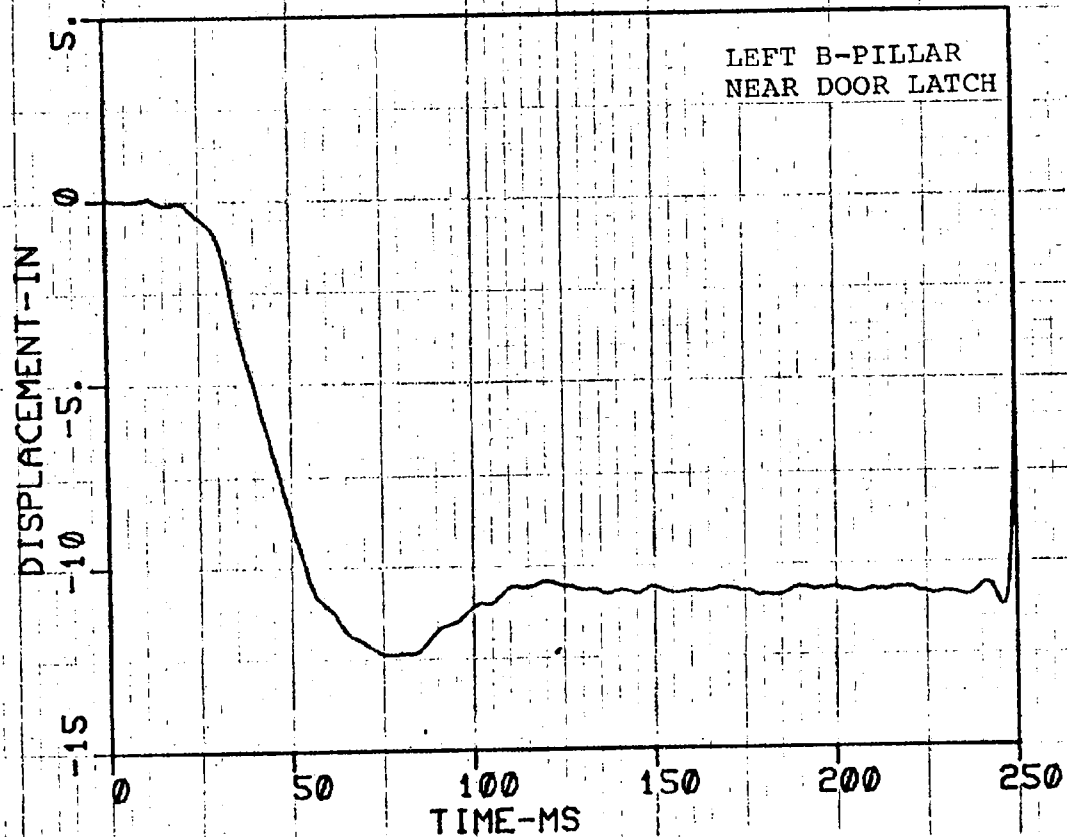




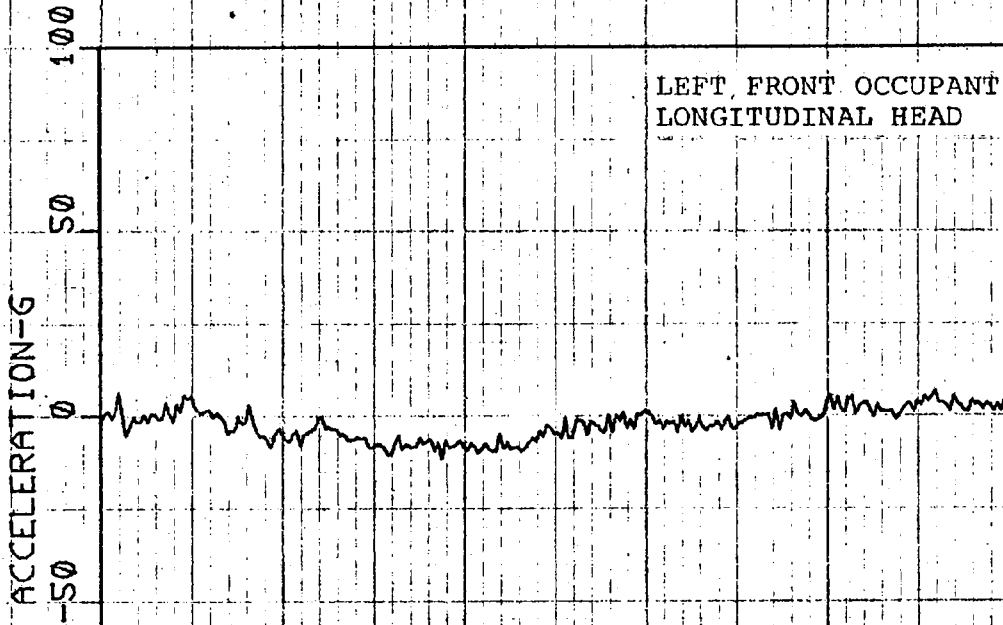
TEST#8327-6.6 MOD RABBIT S.P. #1



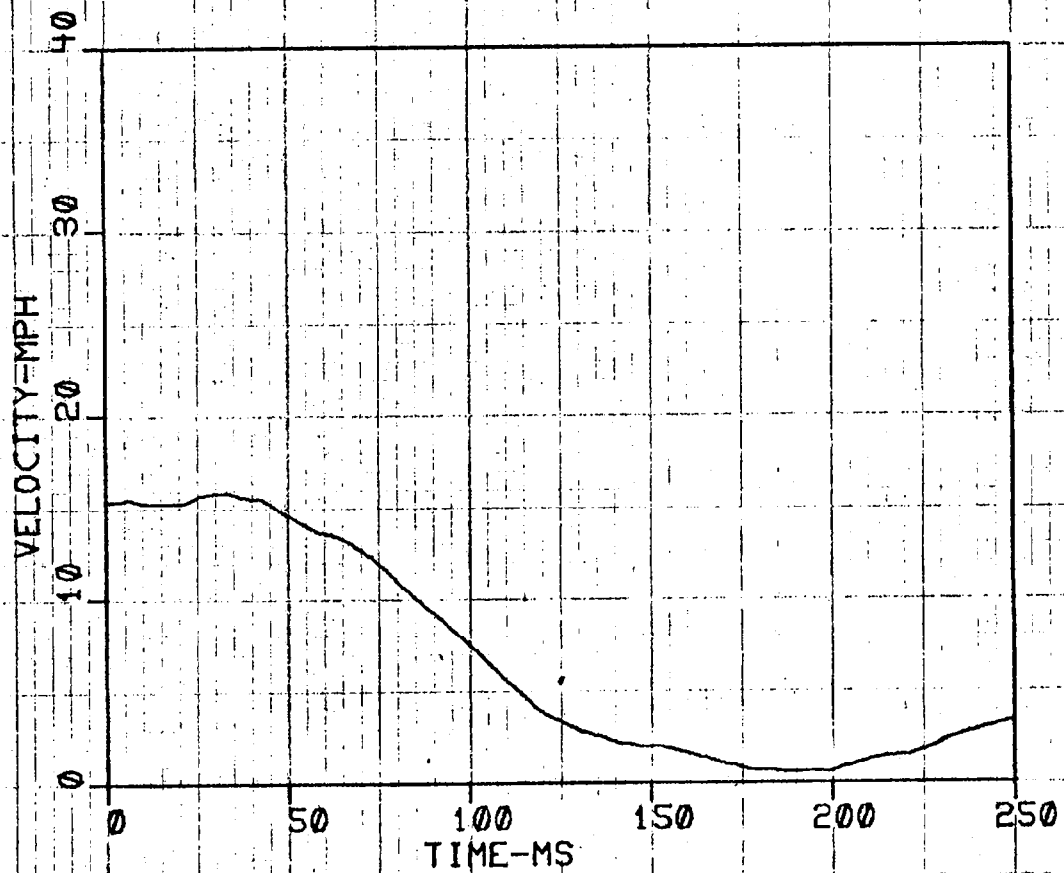
TEST#8327-6.6 MOD RABBIT D.T. #2

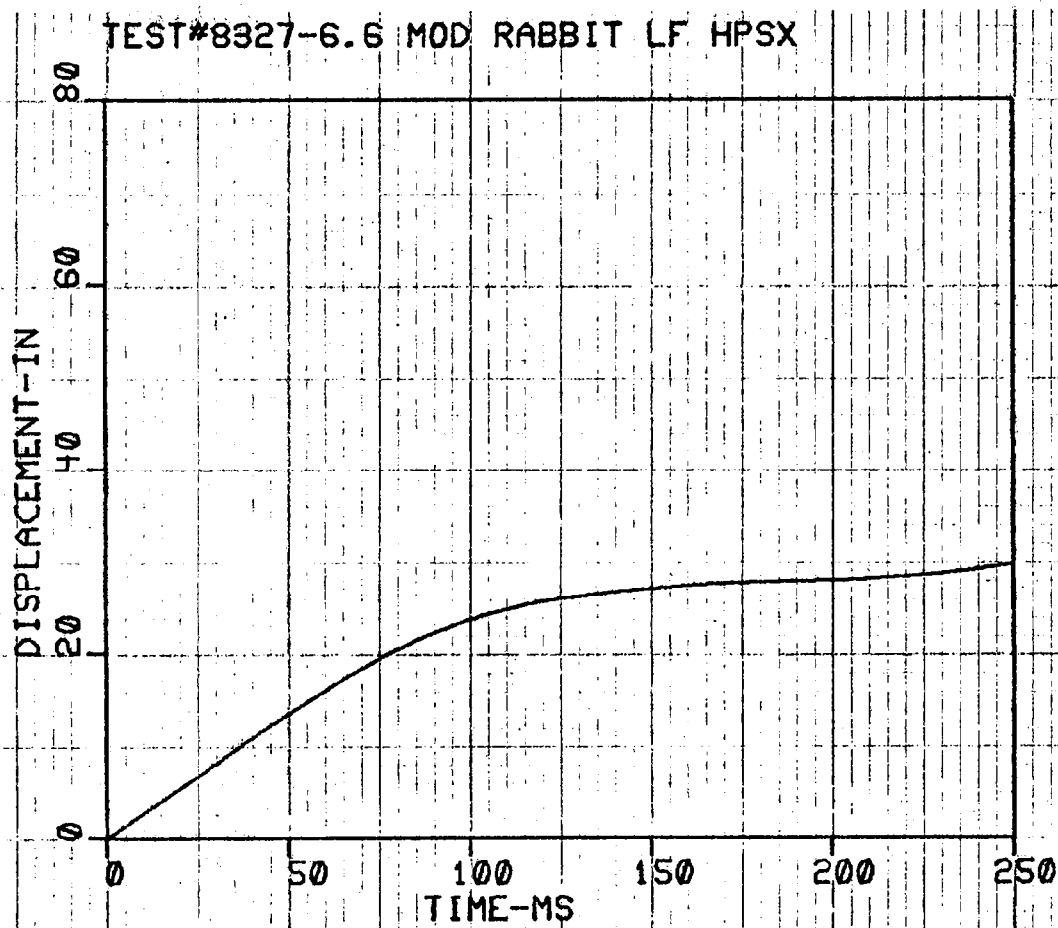


TEST#8327-6.6 MOD RABBIT LF HPGX

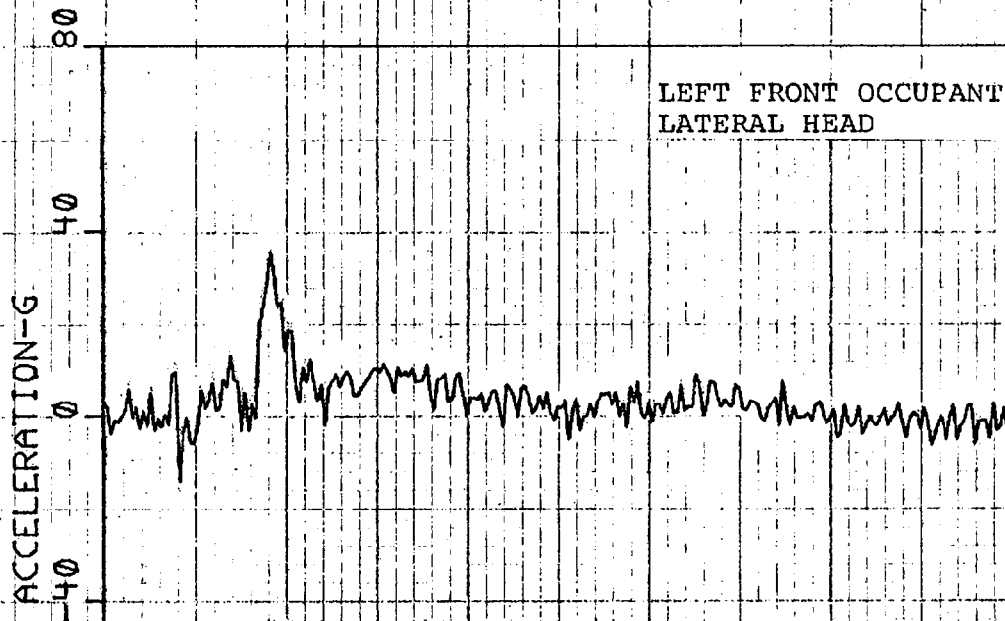


TEST#8327-6.6 MOD RABBIT LF HPVX

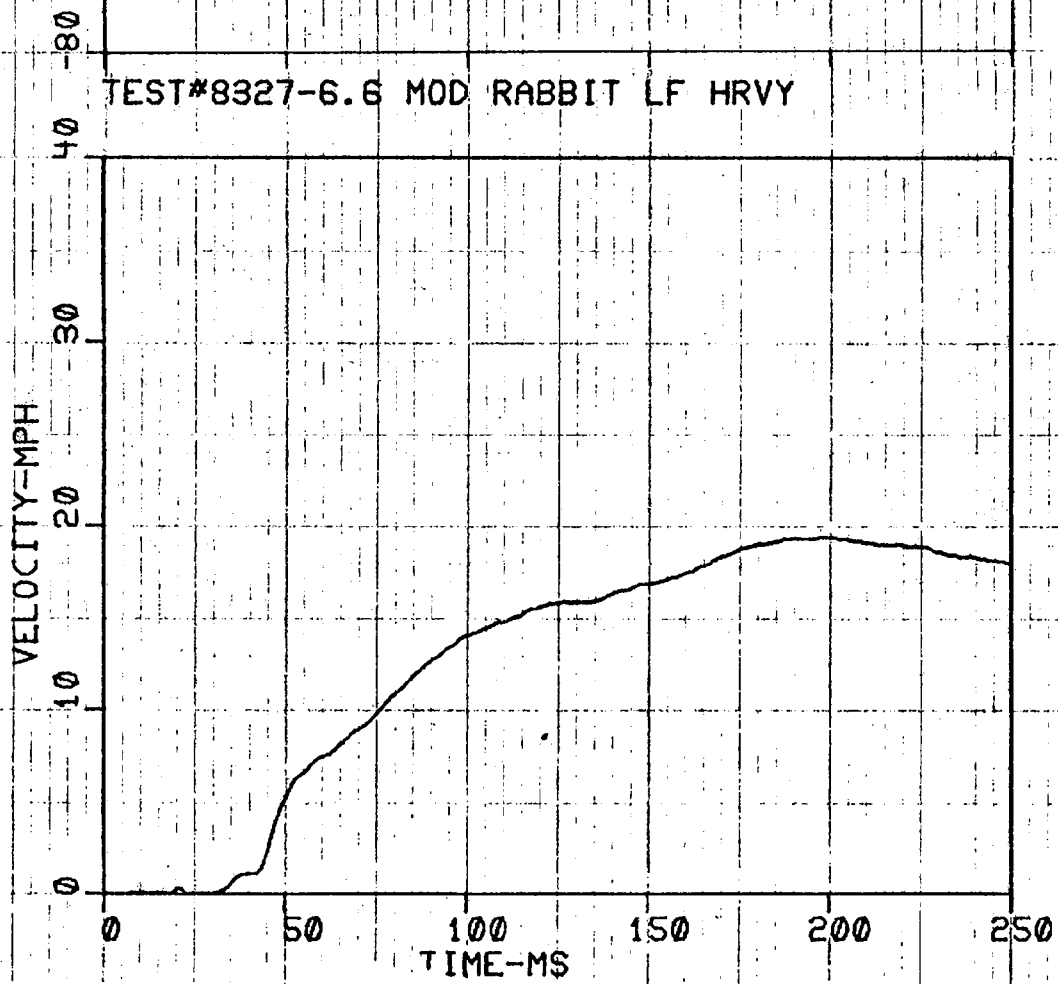


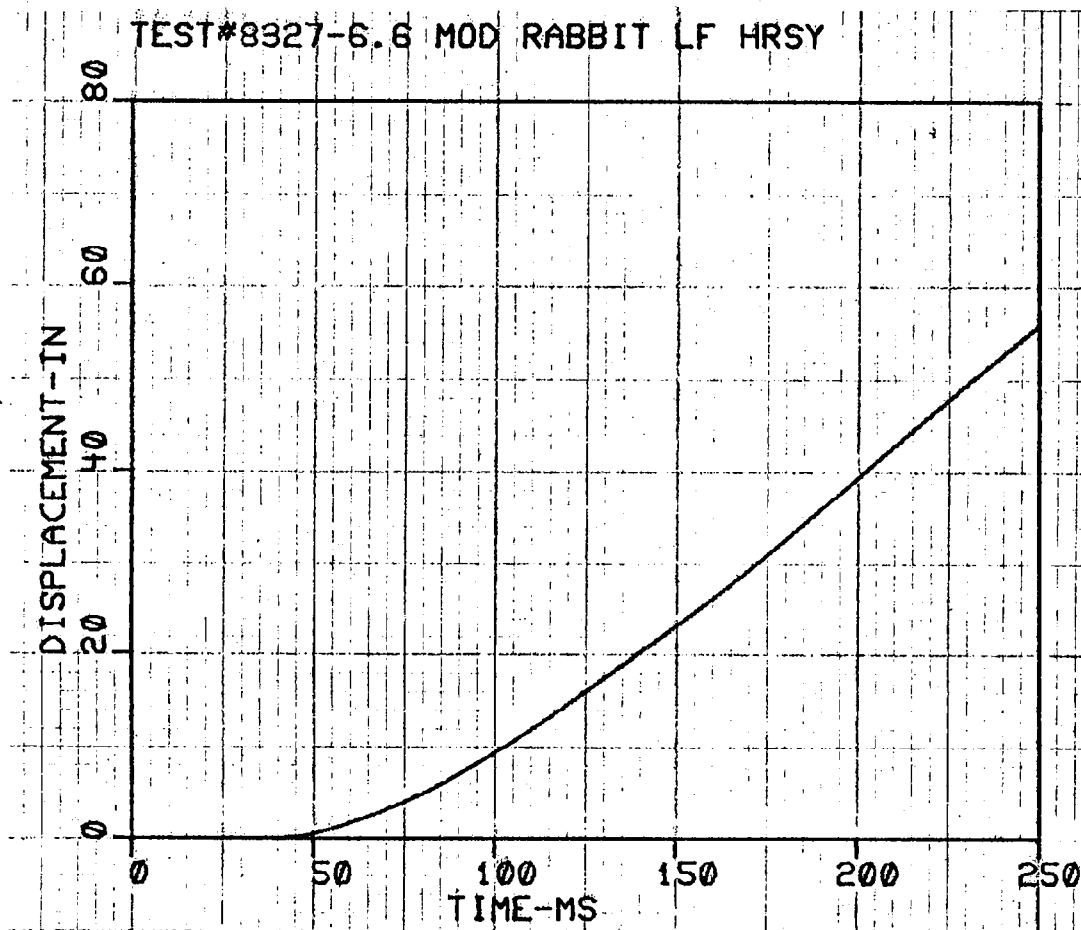


TEST#8327-6.6 MOD RABBIT LF HRGY

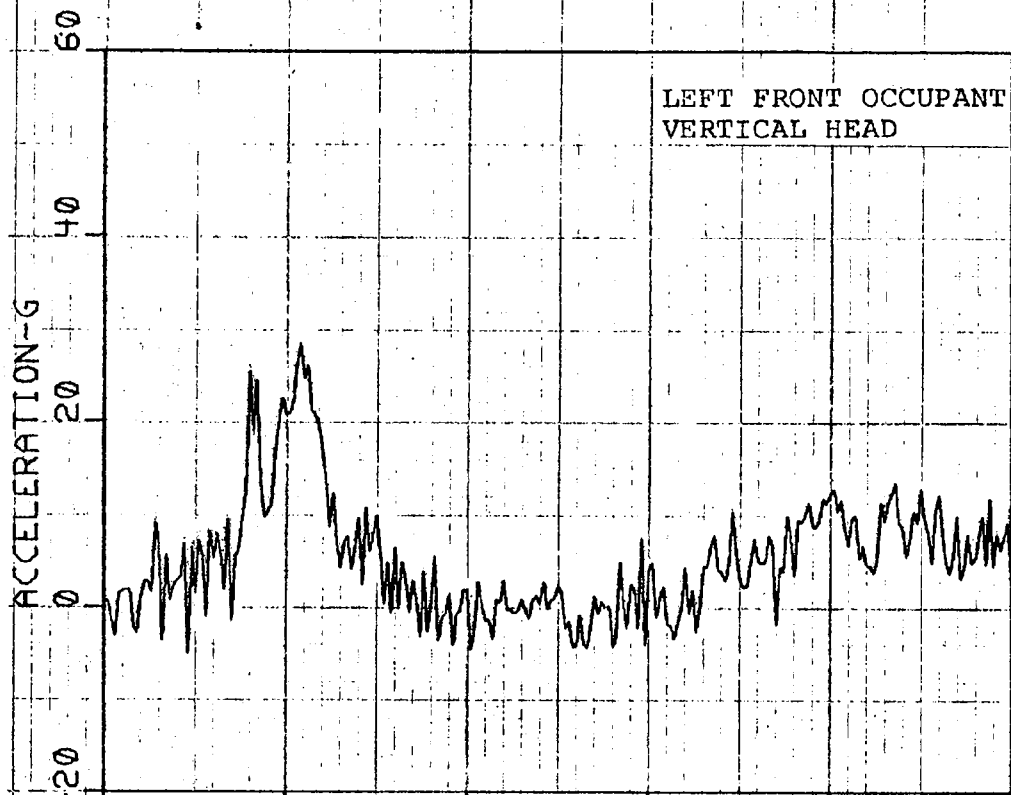


TEST#8327-6.6 MOD RABBIT LF HRVY

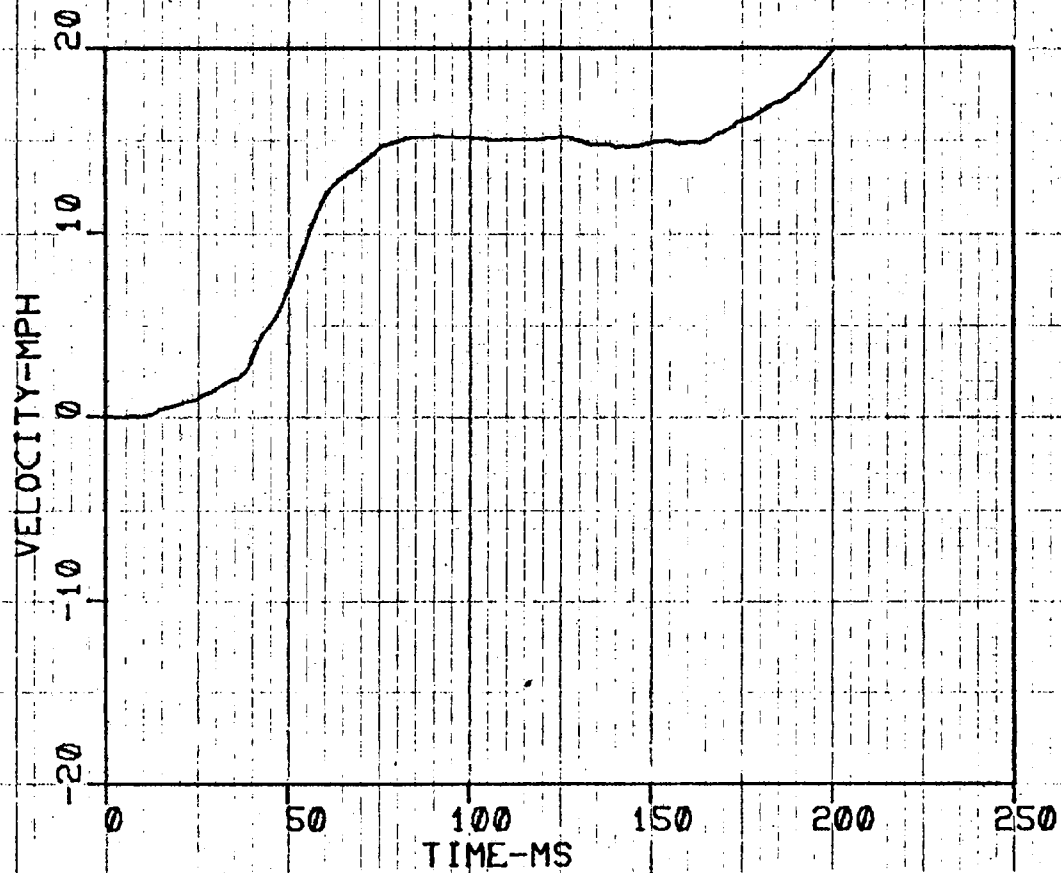


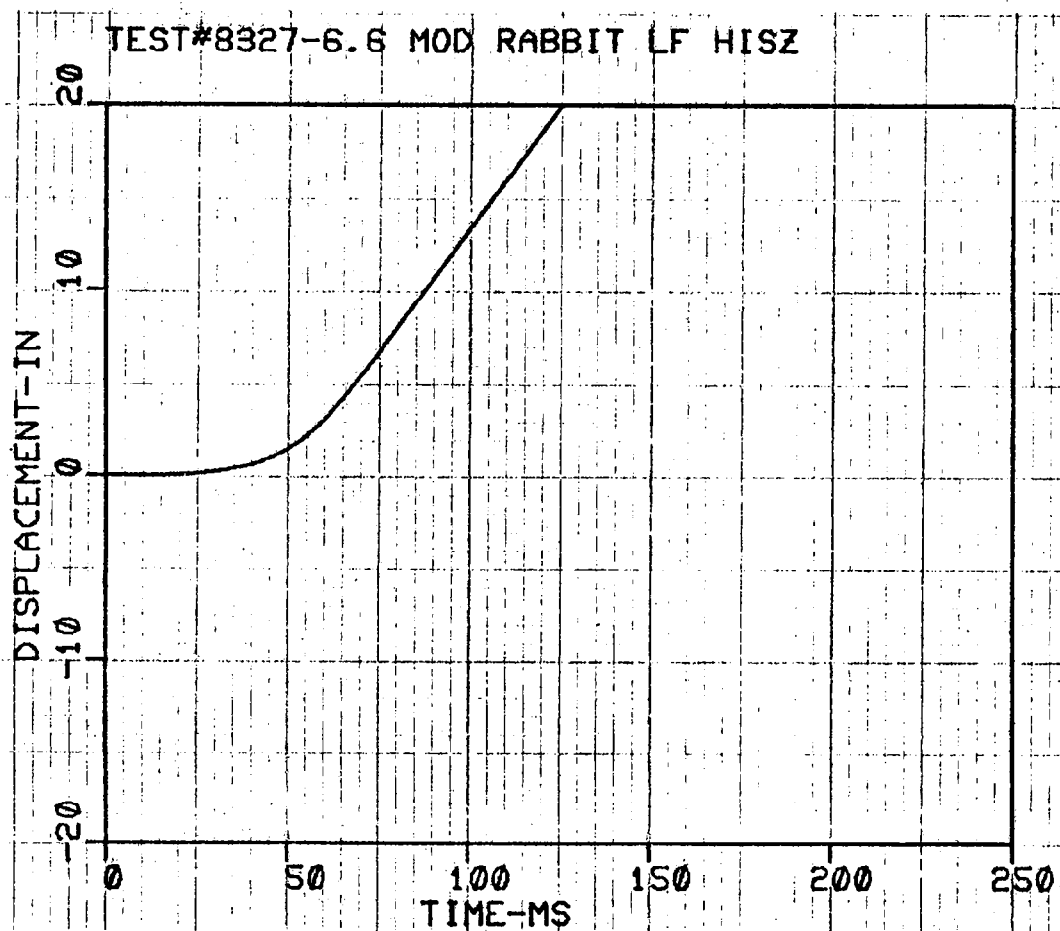


TEST#8327-6.6 MOD RABBIT LF HIGZ

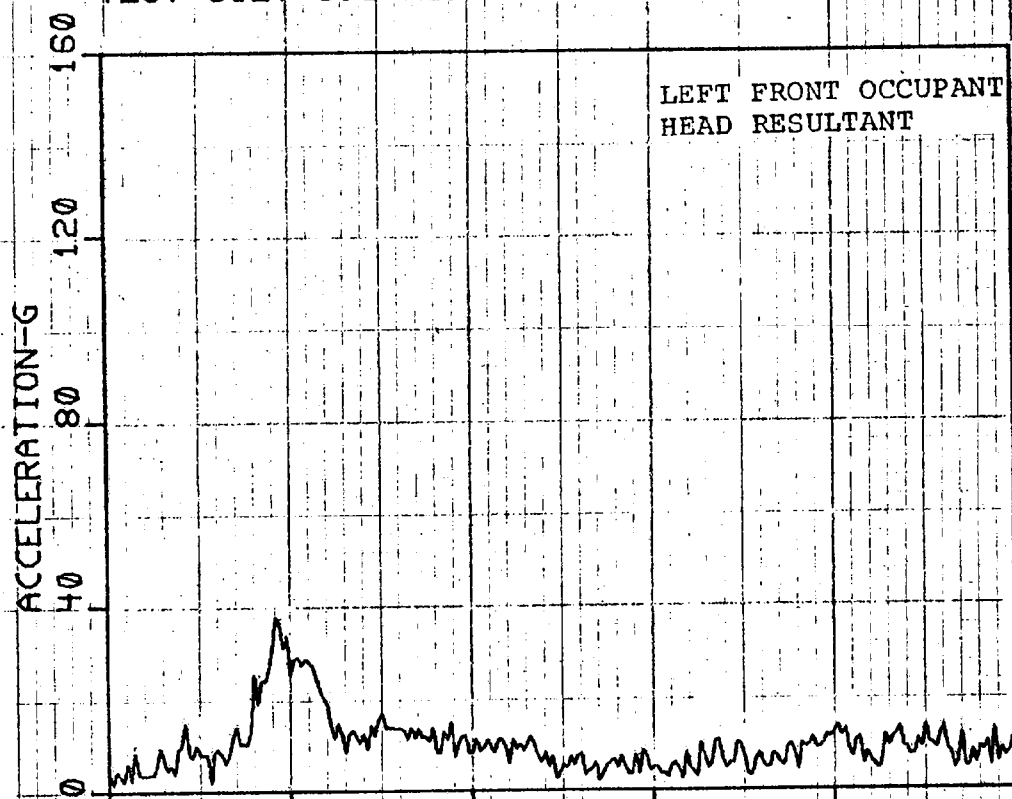


TEST#8327-6.6 MOD RABBIT LF HIVZ

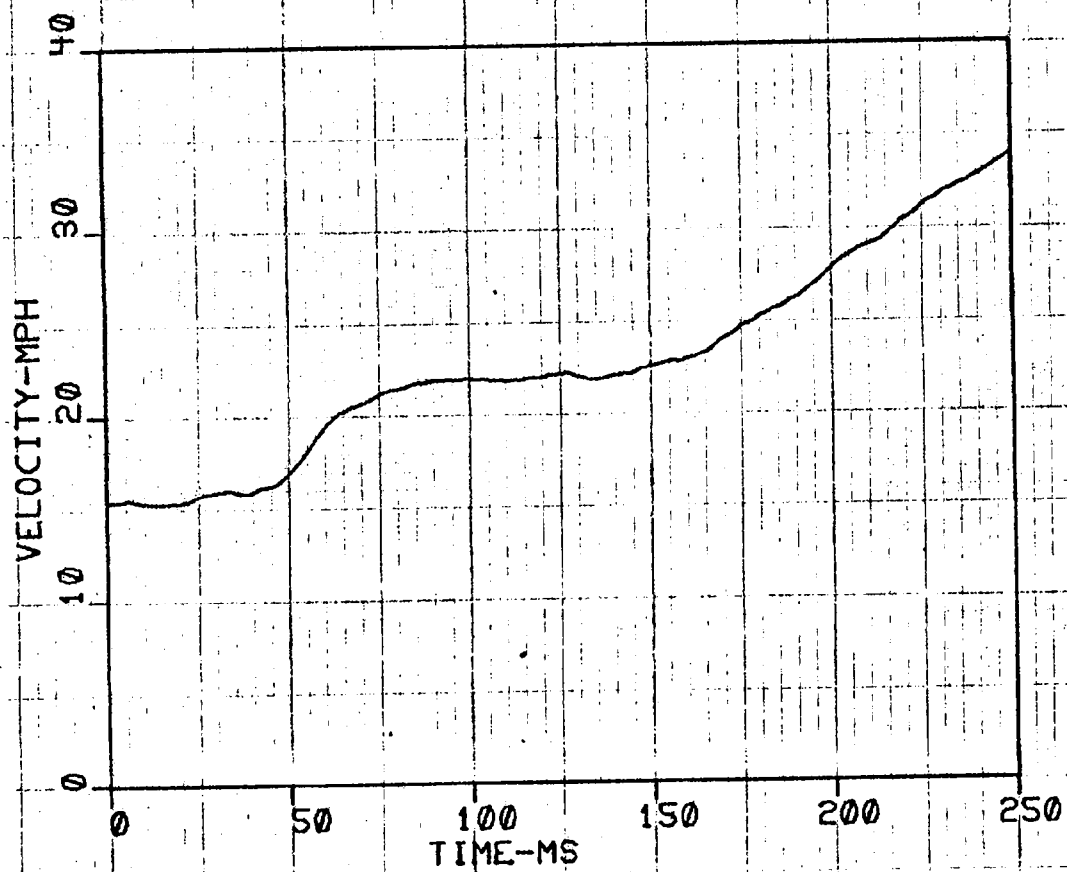


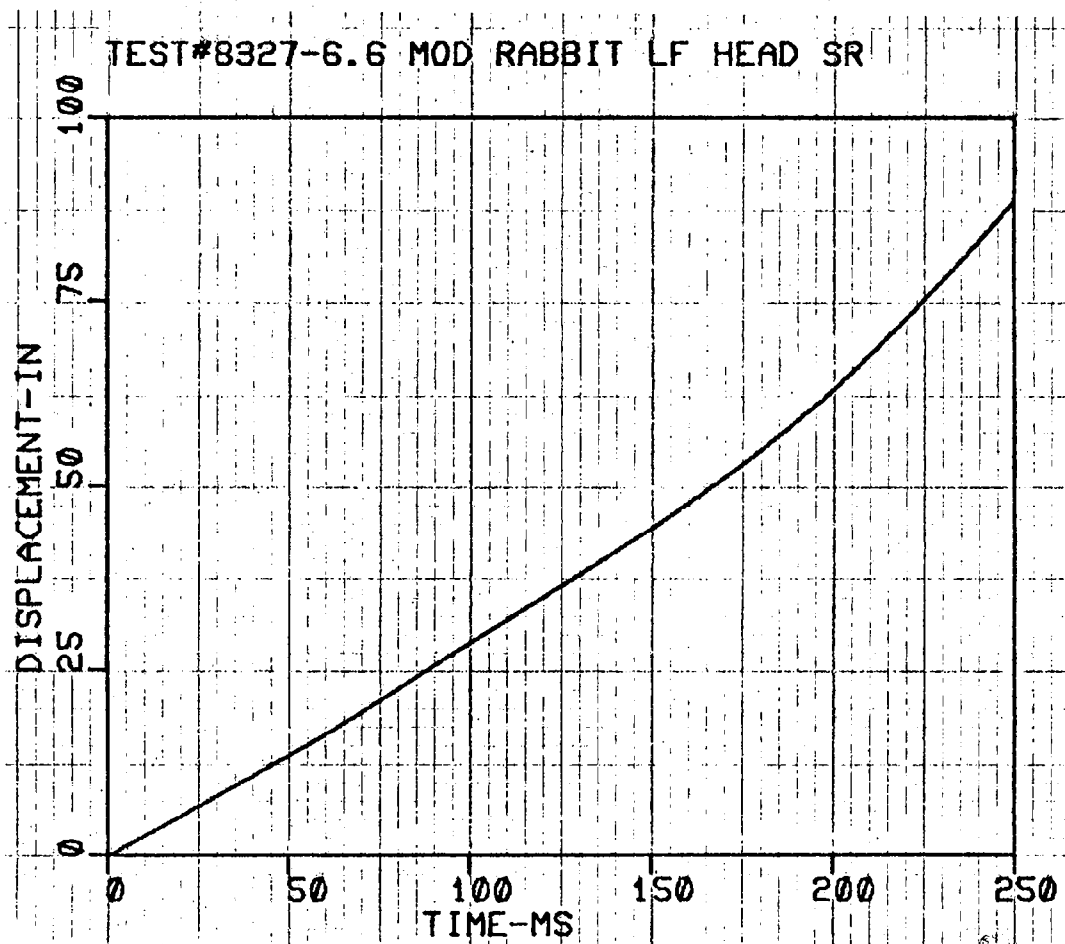


TEST#8327-6.6 MOD RABBIT LF HEAD AR

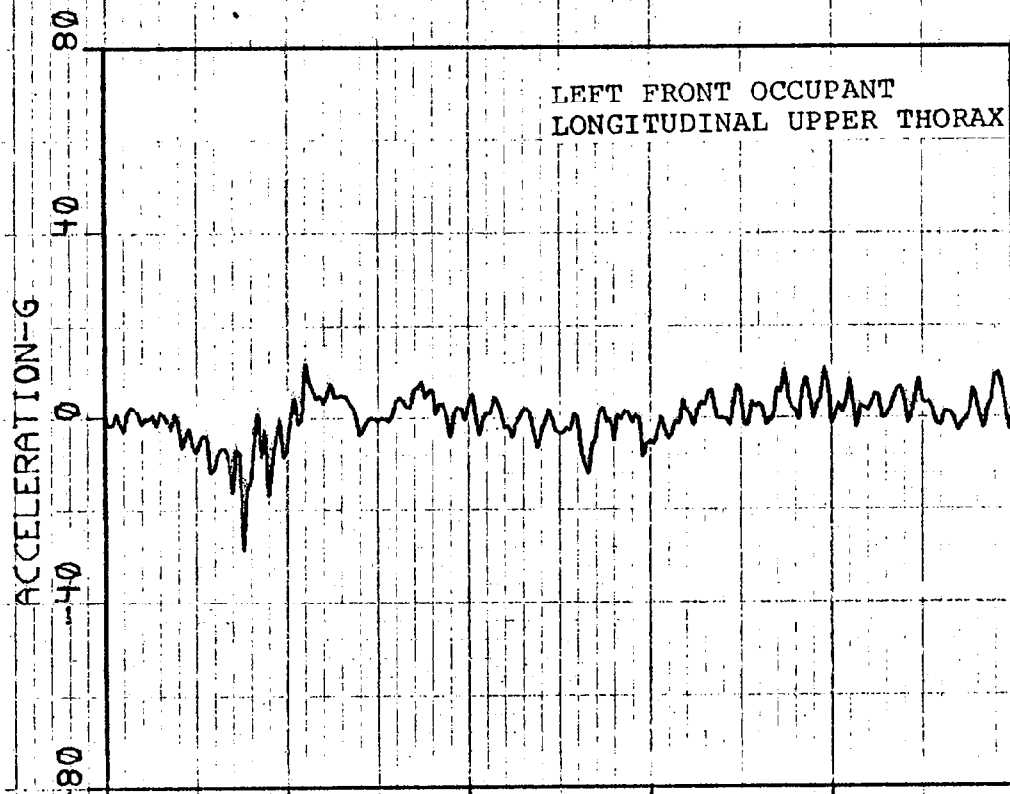


TEST#8327-6.6 MOD RABBIT LF HEAD VR

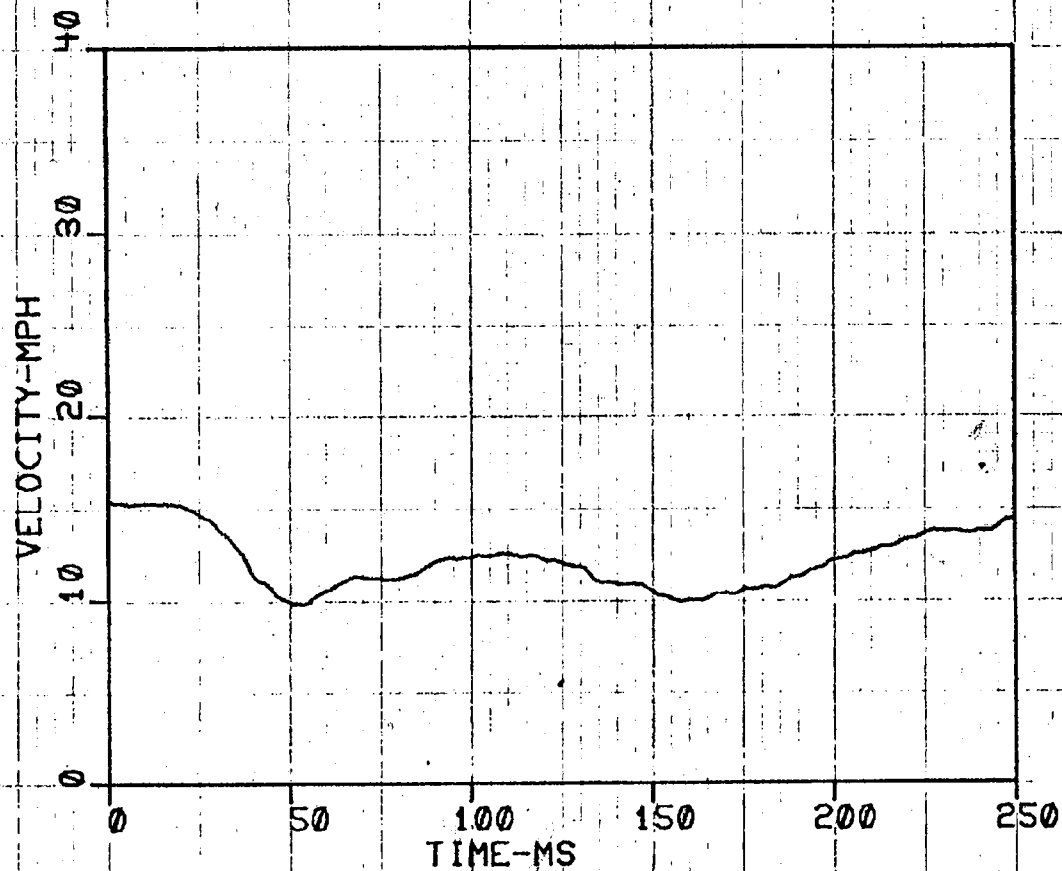


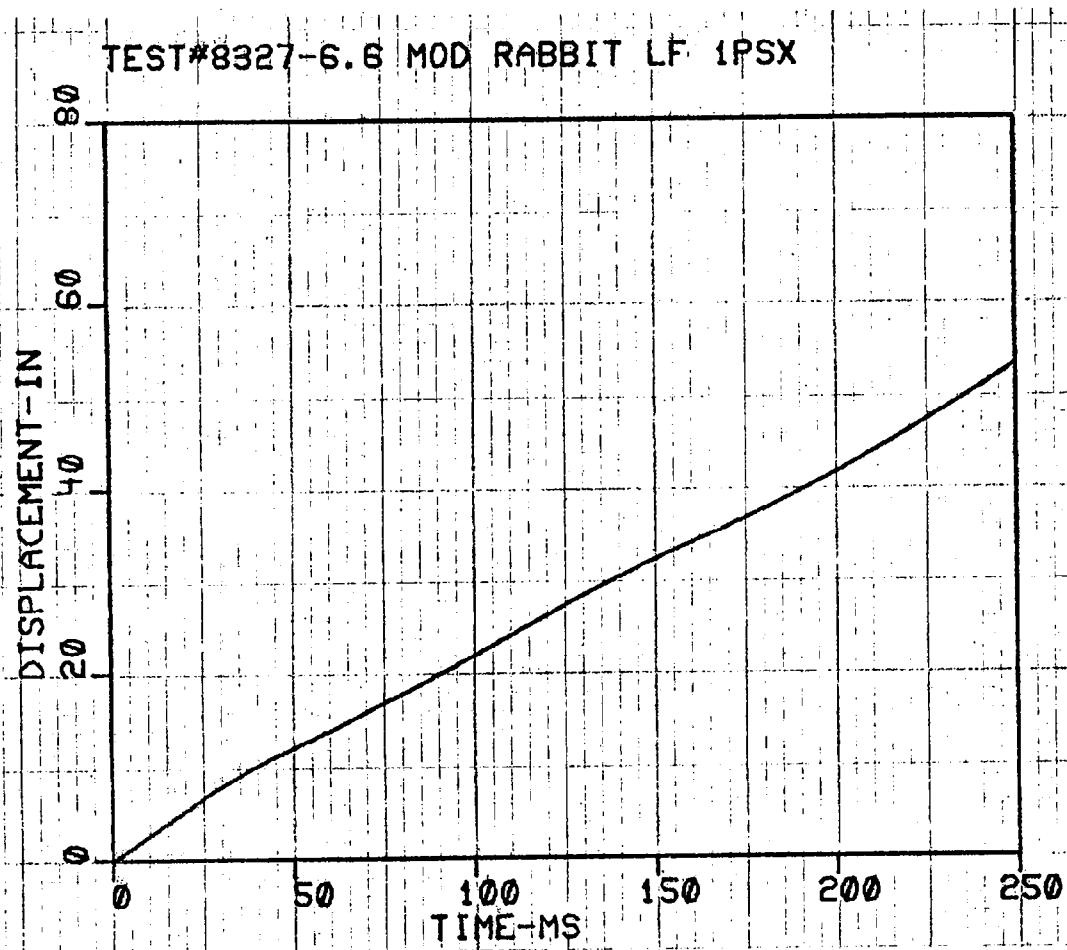


TEST#8327-6.6 MOD RABBIT LF 1PGX

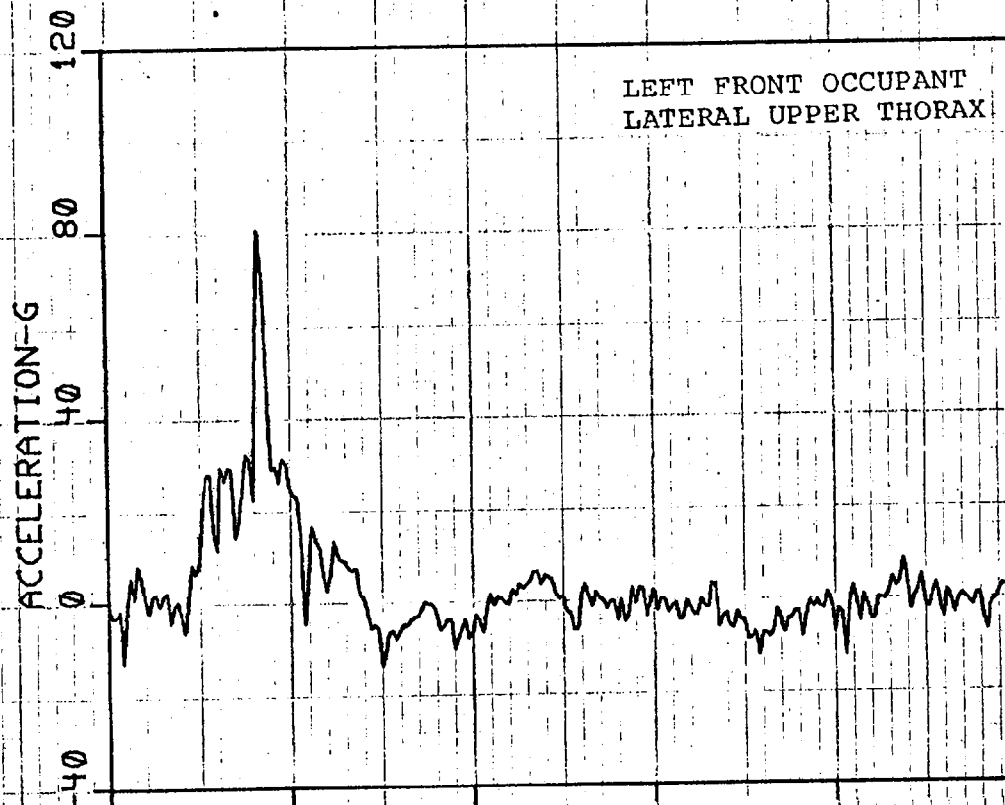


TEST#8327-6.6 MOD RABBIT LF 1PVX

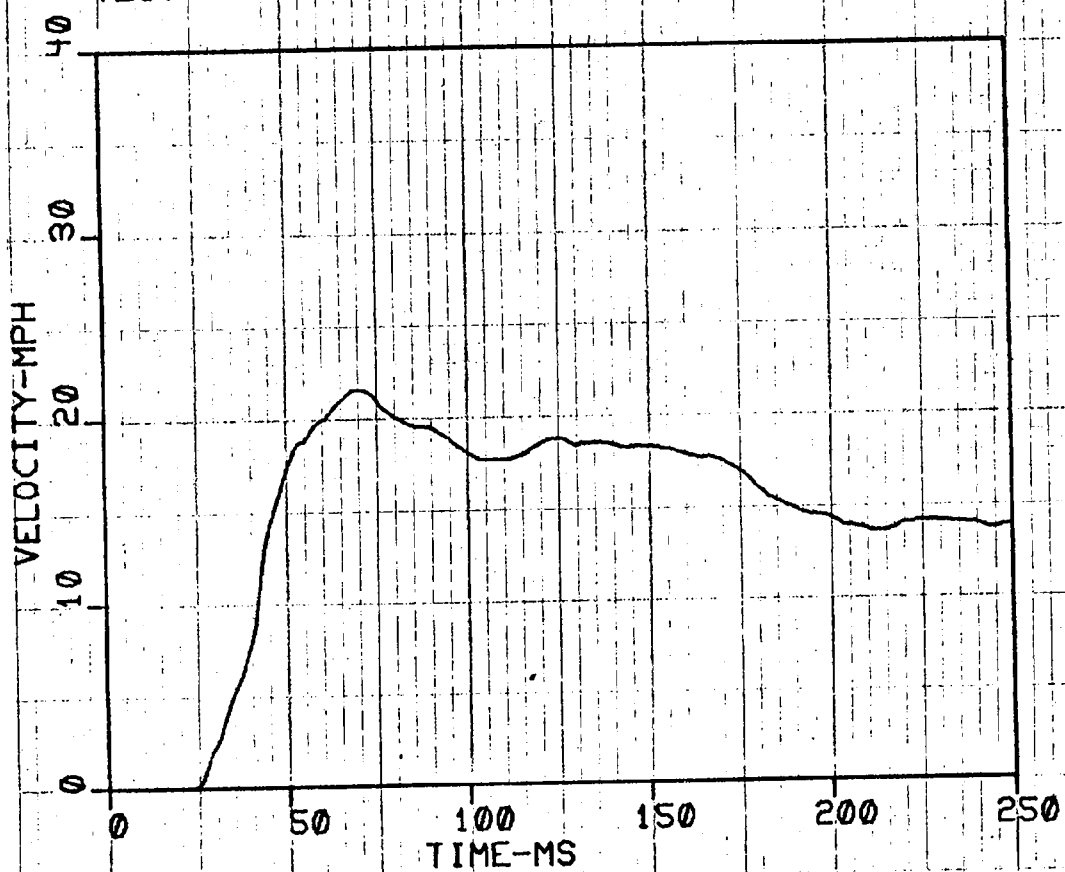


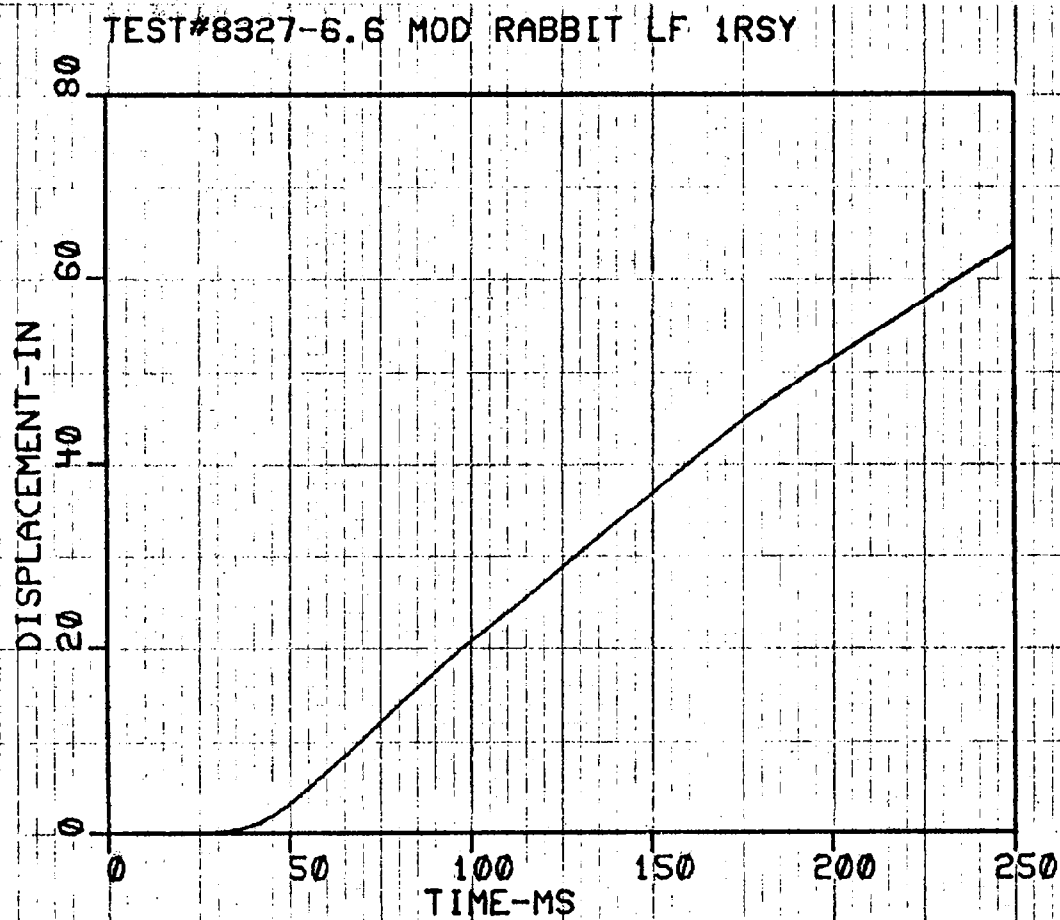


TEST#8327-6.6 MOD RABBIT LF 1RGY

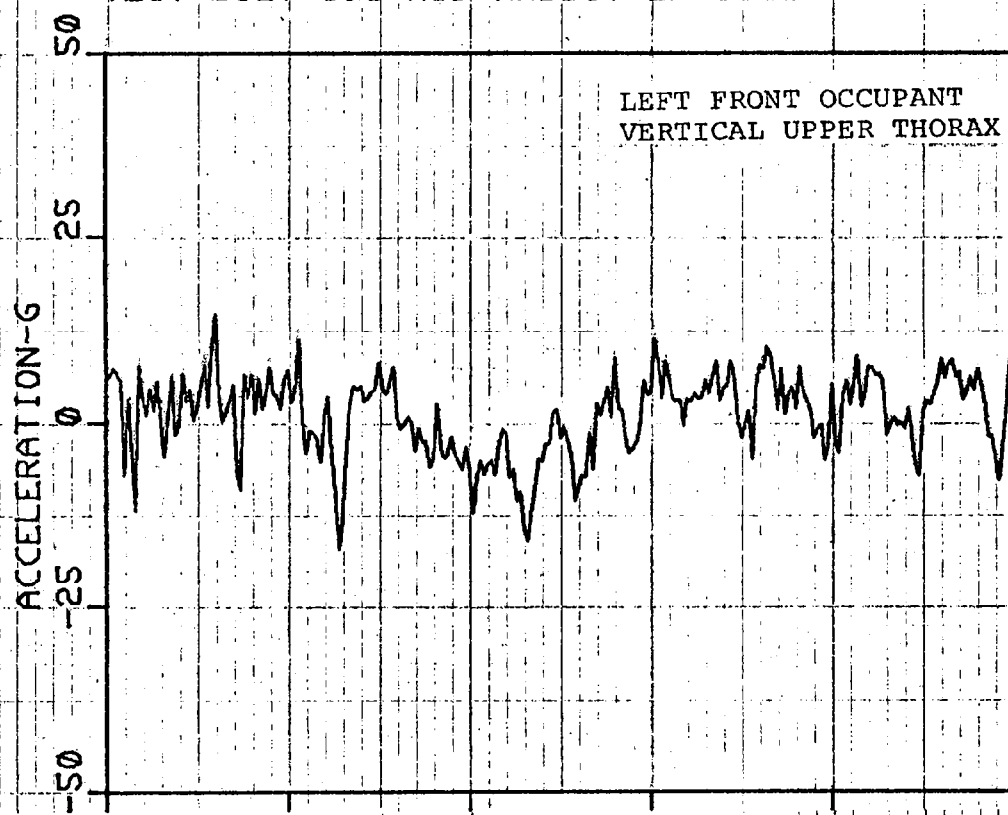


TEST#8327-6.6 MOD RABBIT LF 1RVY

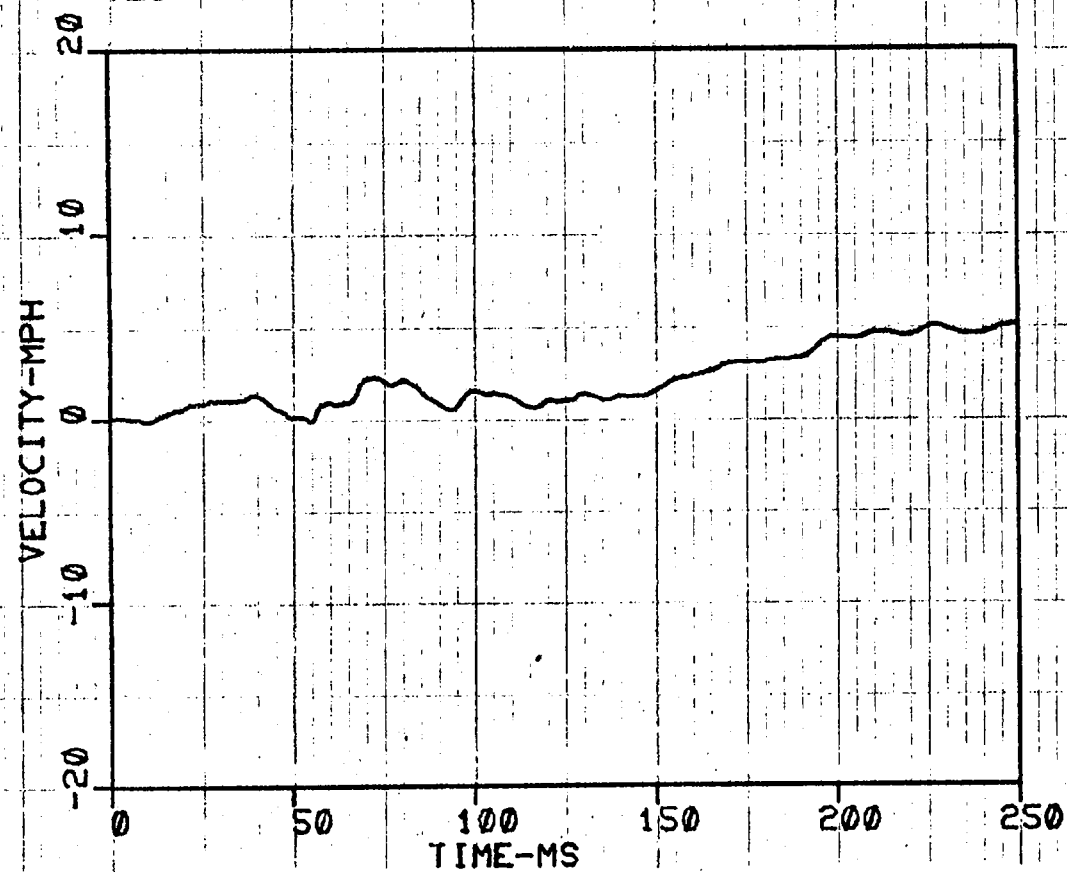


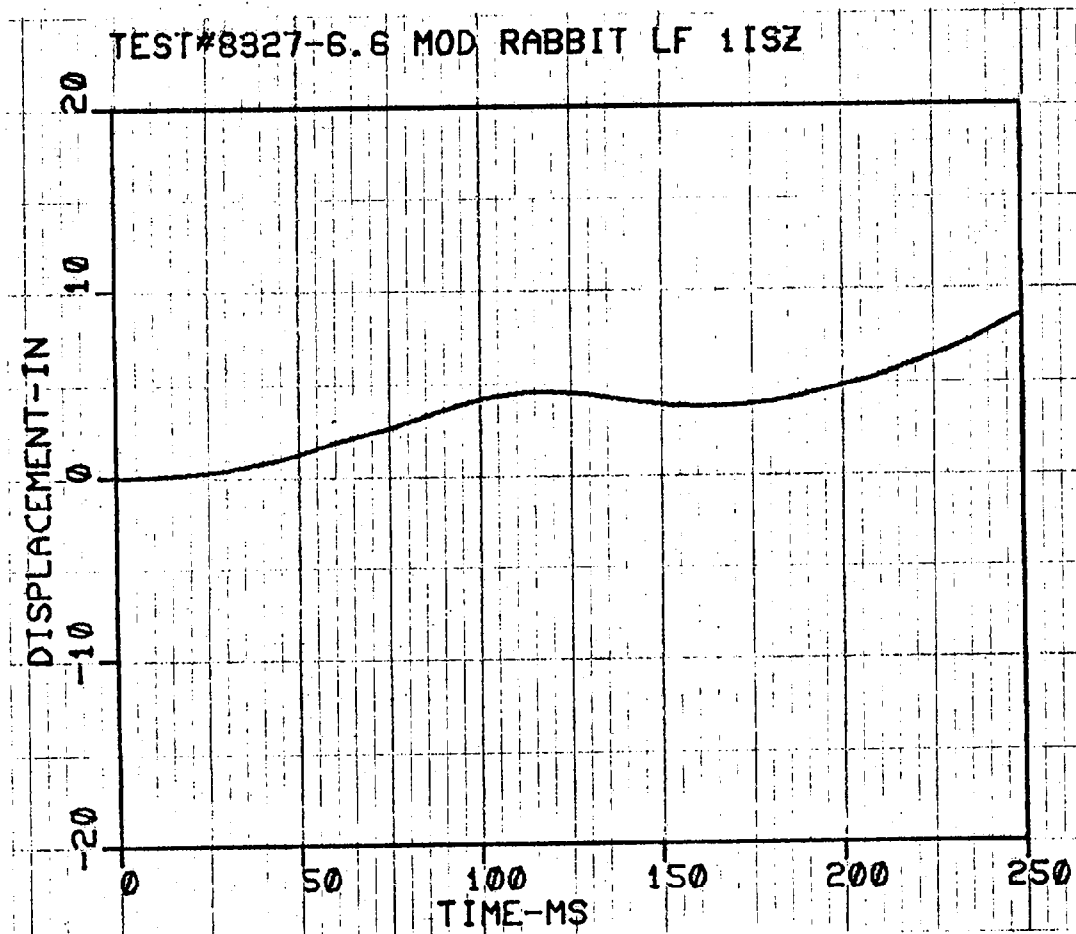


TEST#8327-6.6 MOD RABBIT LF 1IGZ

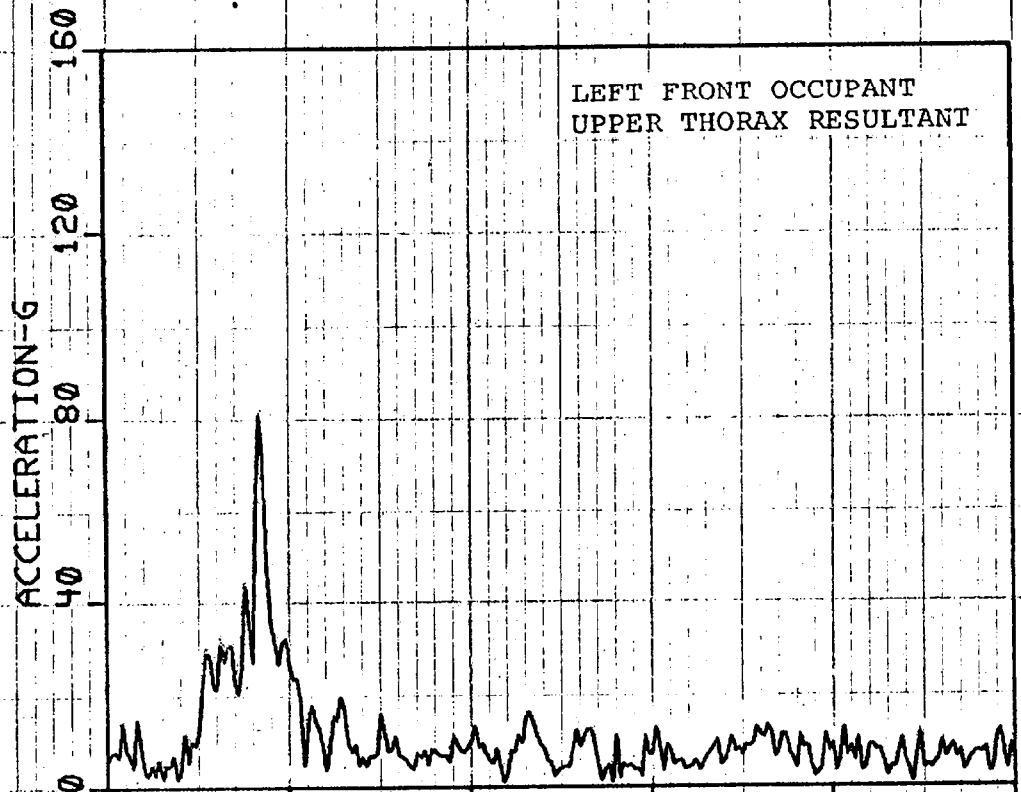


TEST#8327-6.6 MOD RABBIT LR 1IVZ

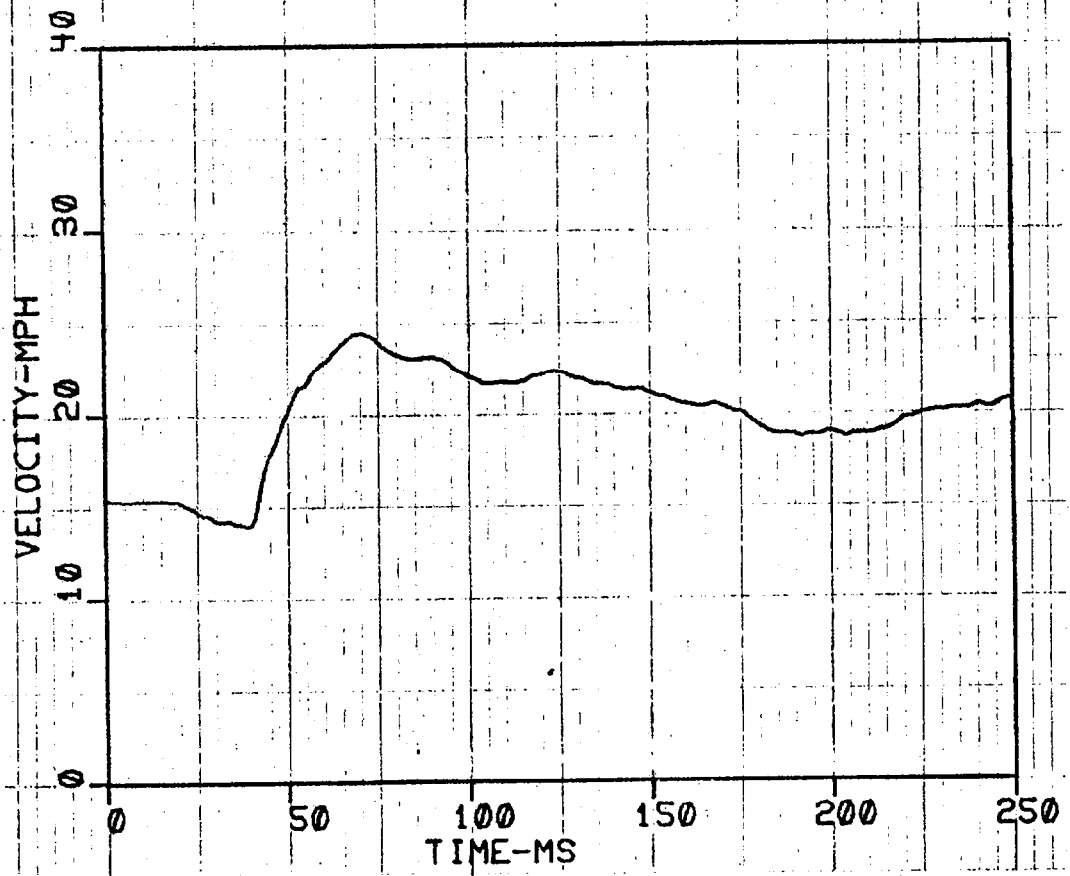


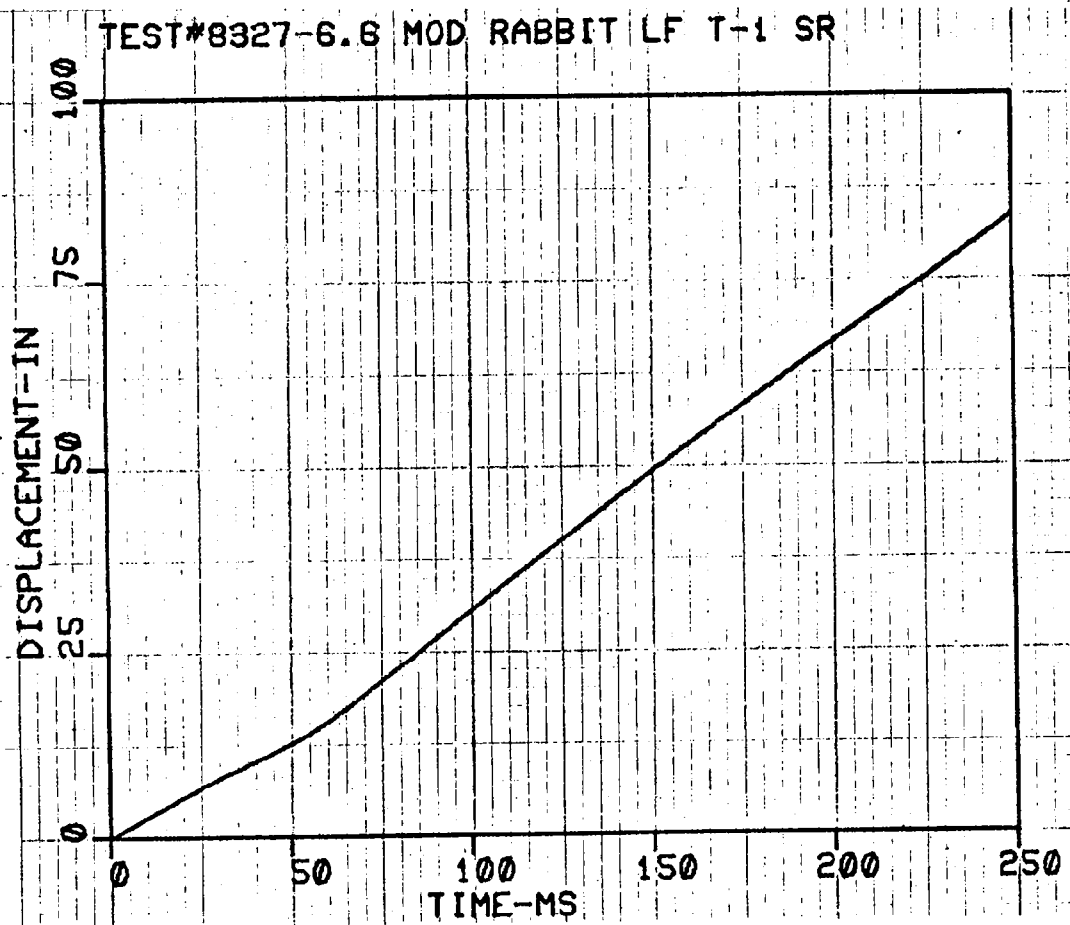


TEST#8327-6.6 MOD RABBIT LF T-1 AR

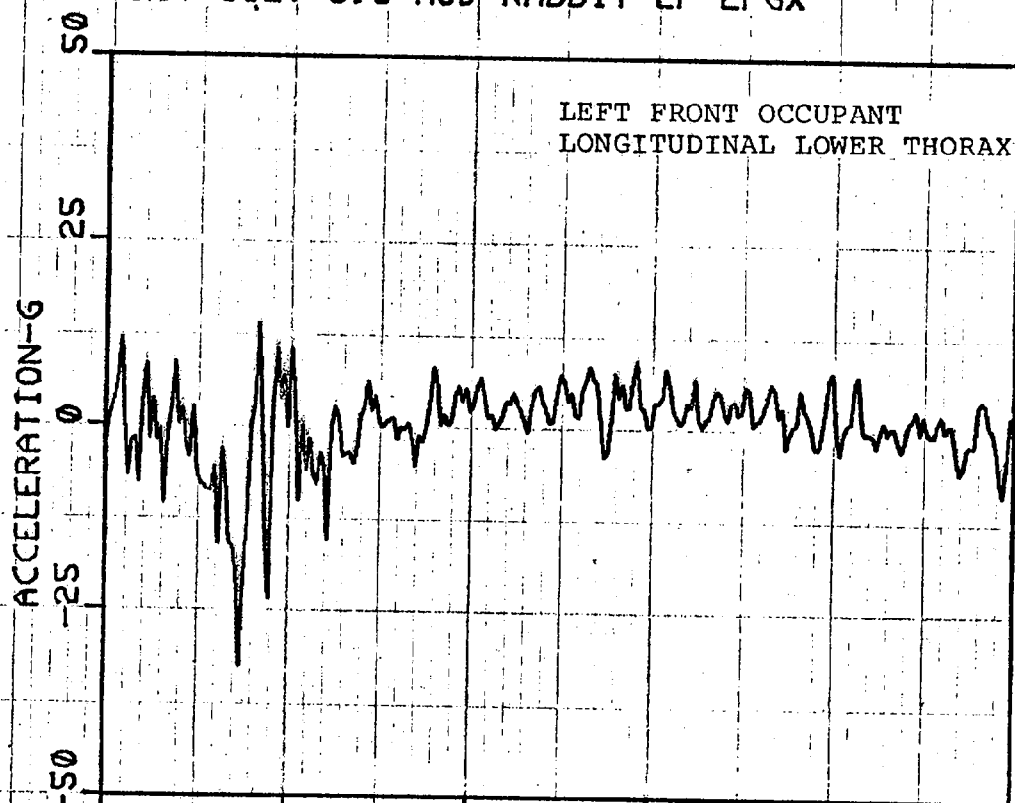


TEST#8327-6.6 MOD RABBIT LF T-1 VR

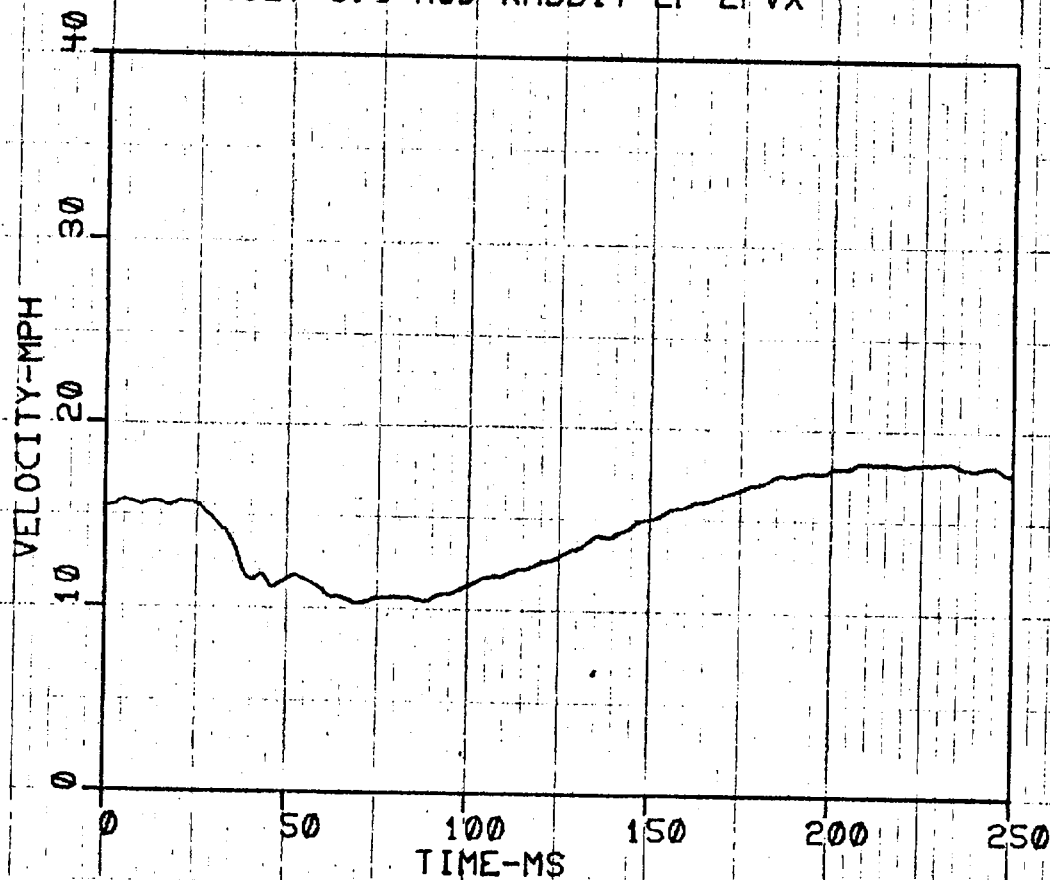


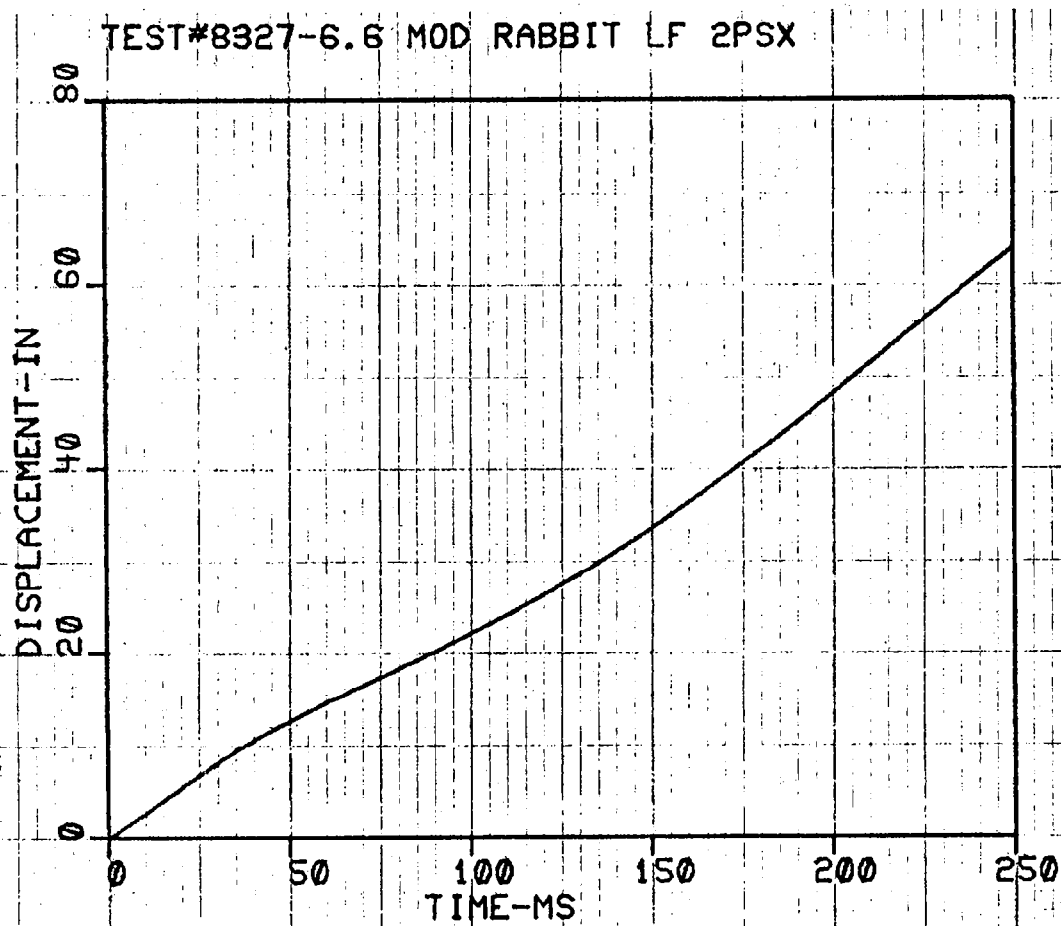


TEST#8327-6.6 MOD RABBIT LF 2PGX

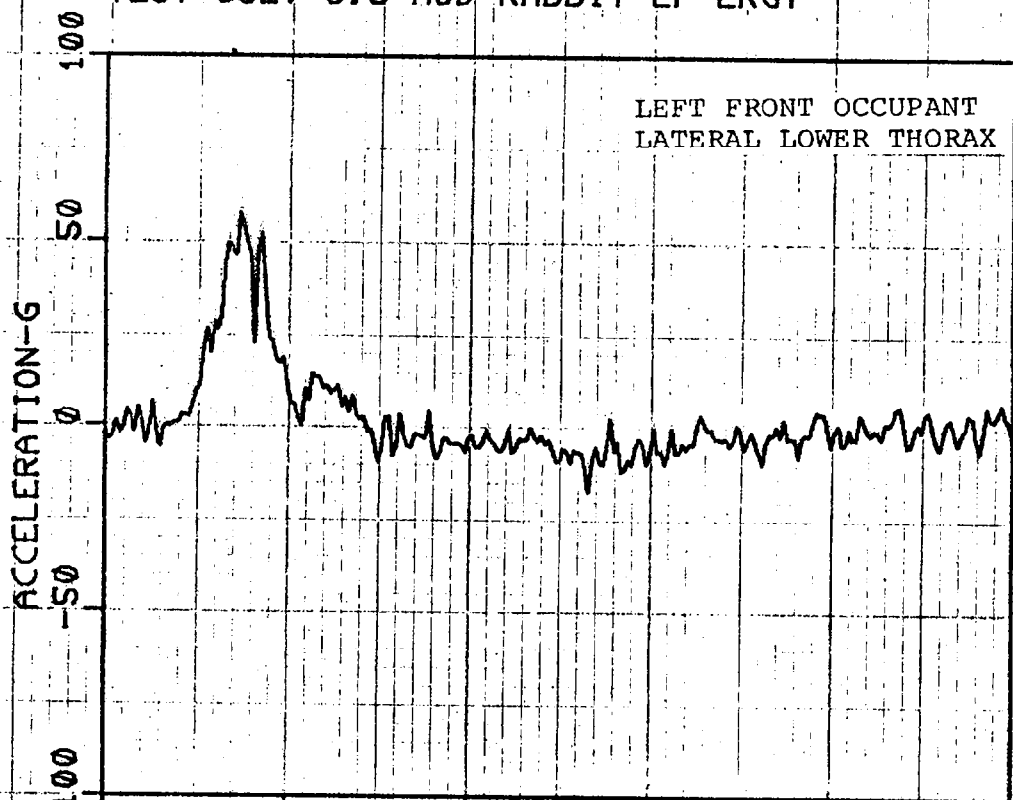


TEST#8327-6.6 MOD RABBIT LF 2PVX

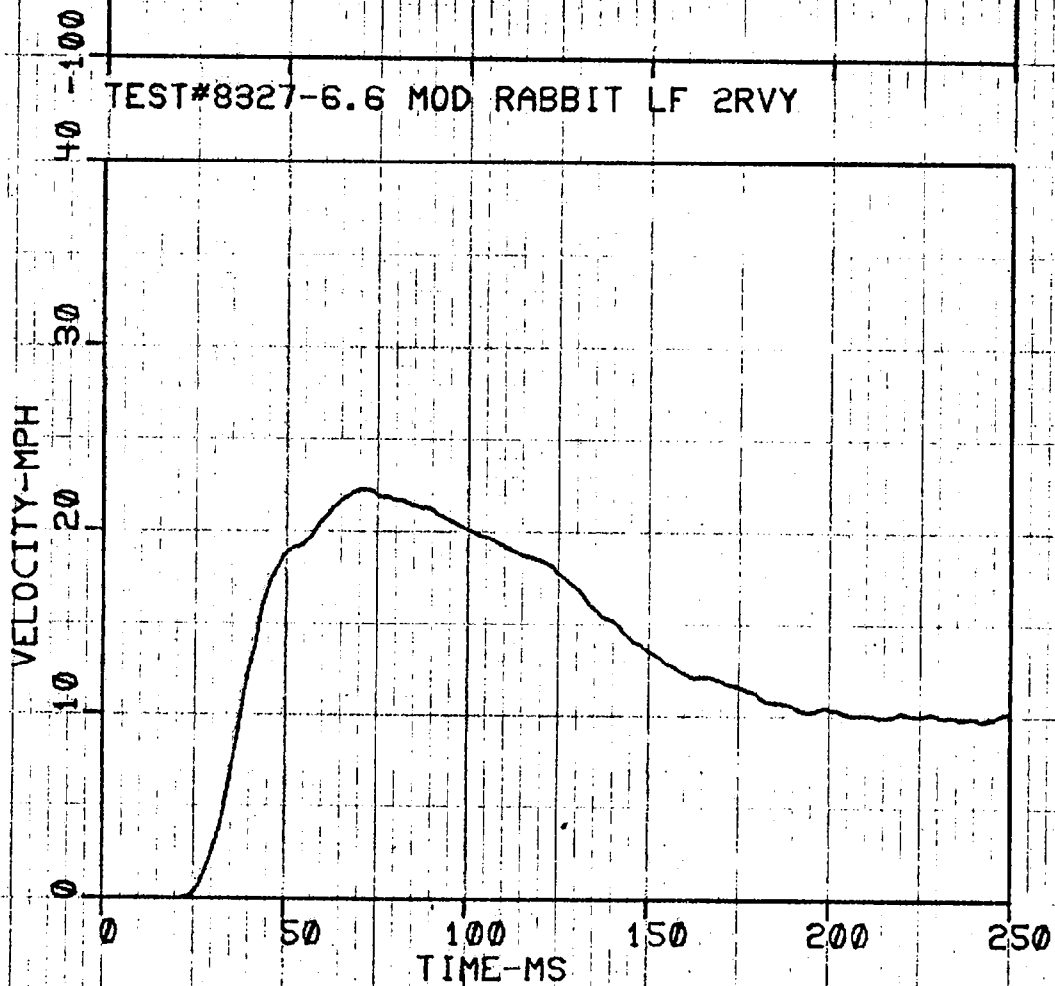


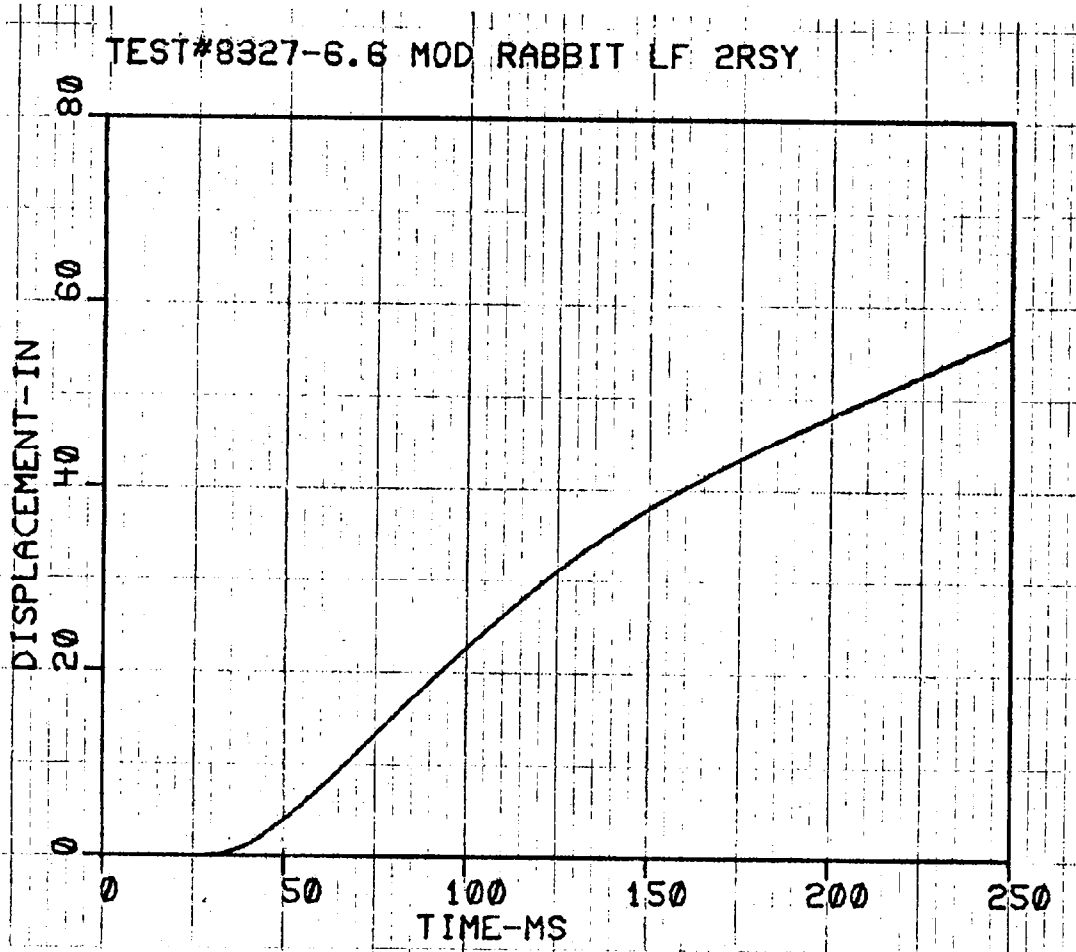


TEST#8327-6.6 MOD RABBIT LF 2RGY

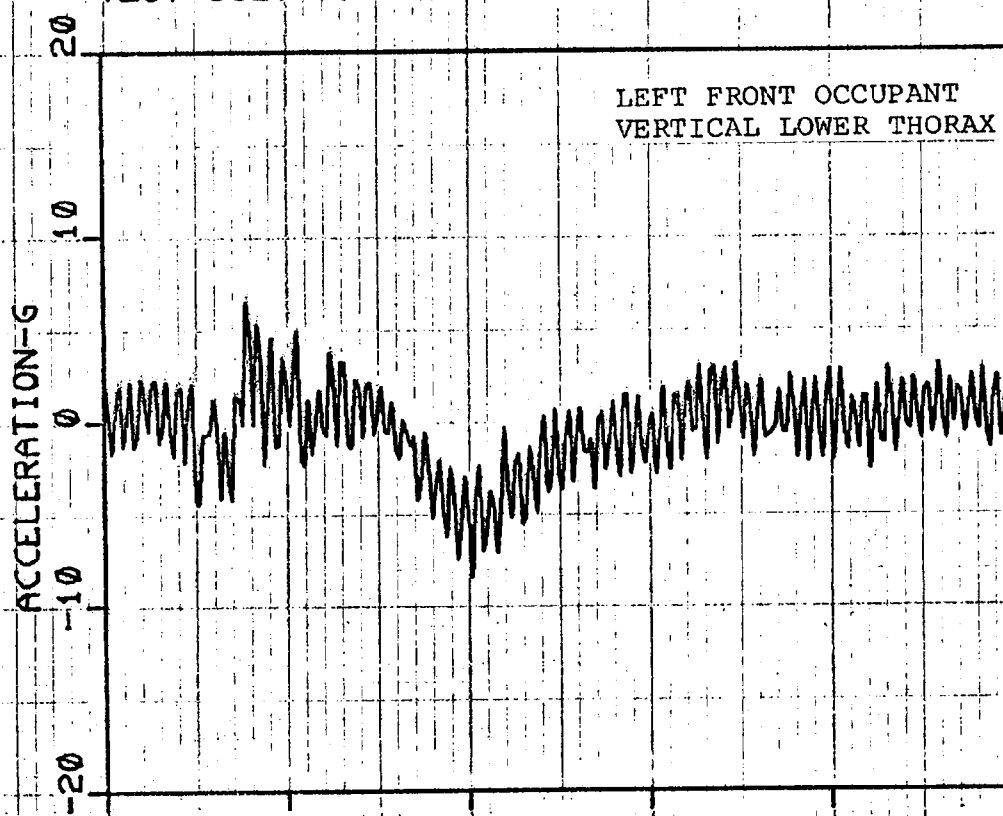


TEST#8327-6.6 MOD RABBIT LF 2RVY

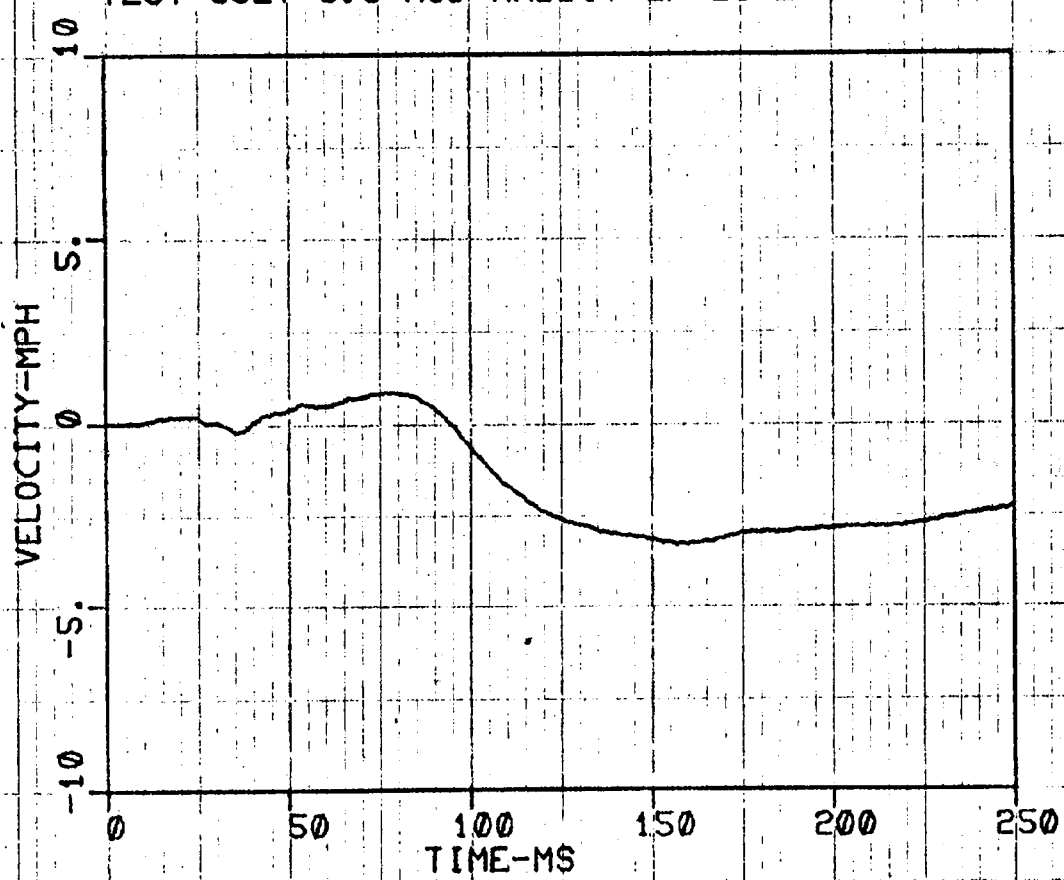


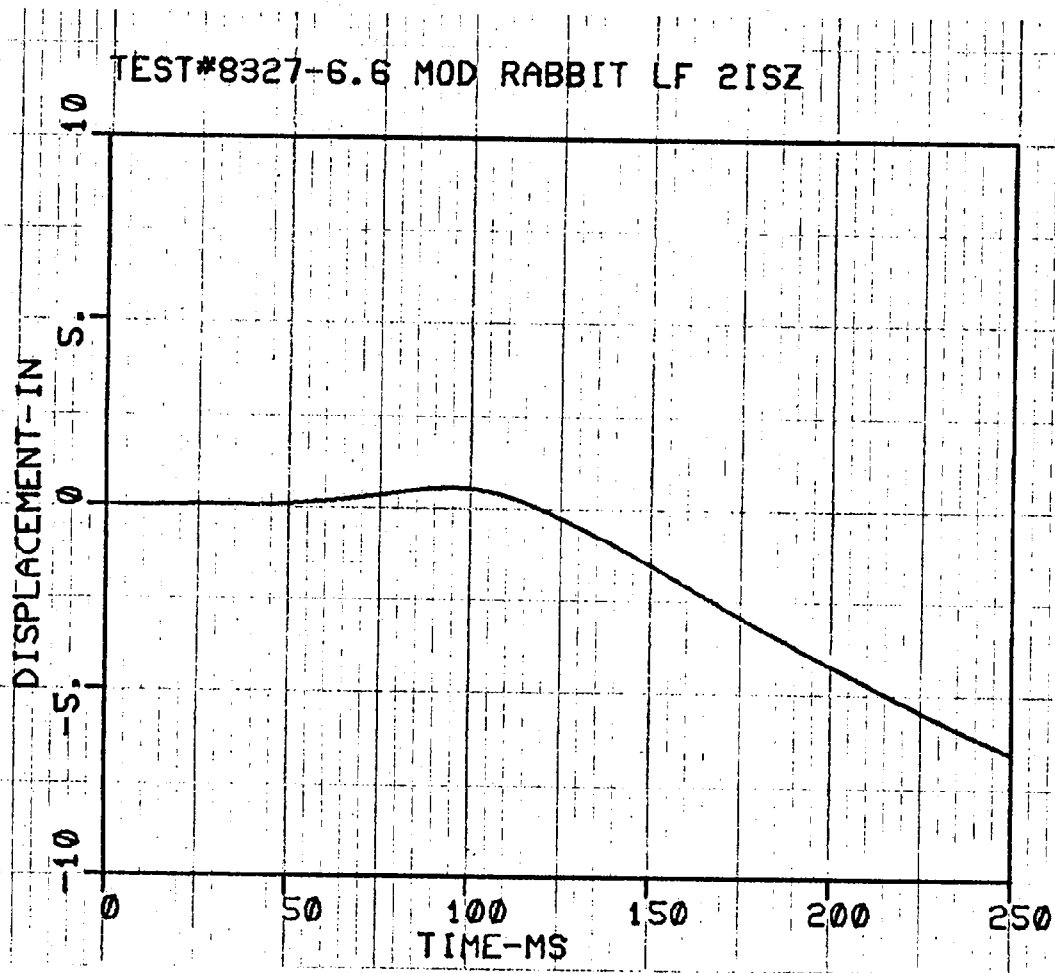


TEST#8327-6.6 MOD RABBIT LF 2IGZ

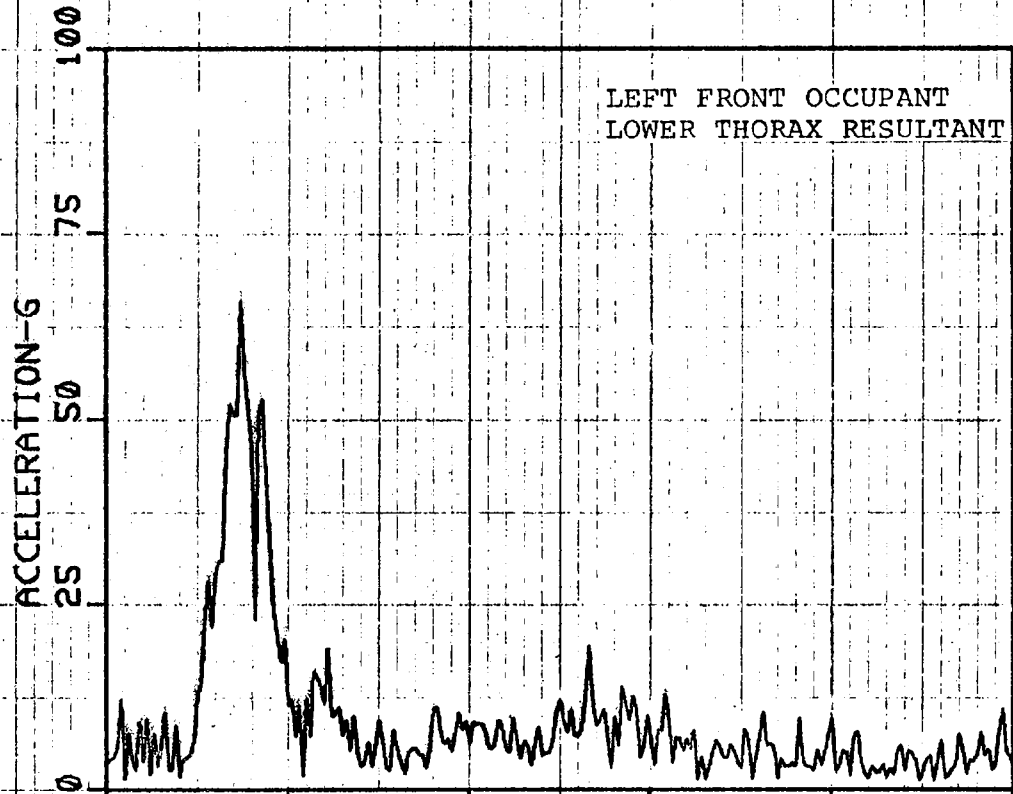


TEST#8327-6.6 MOD RABBIT LF 2IVZ

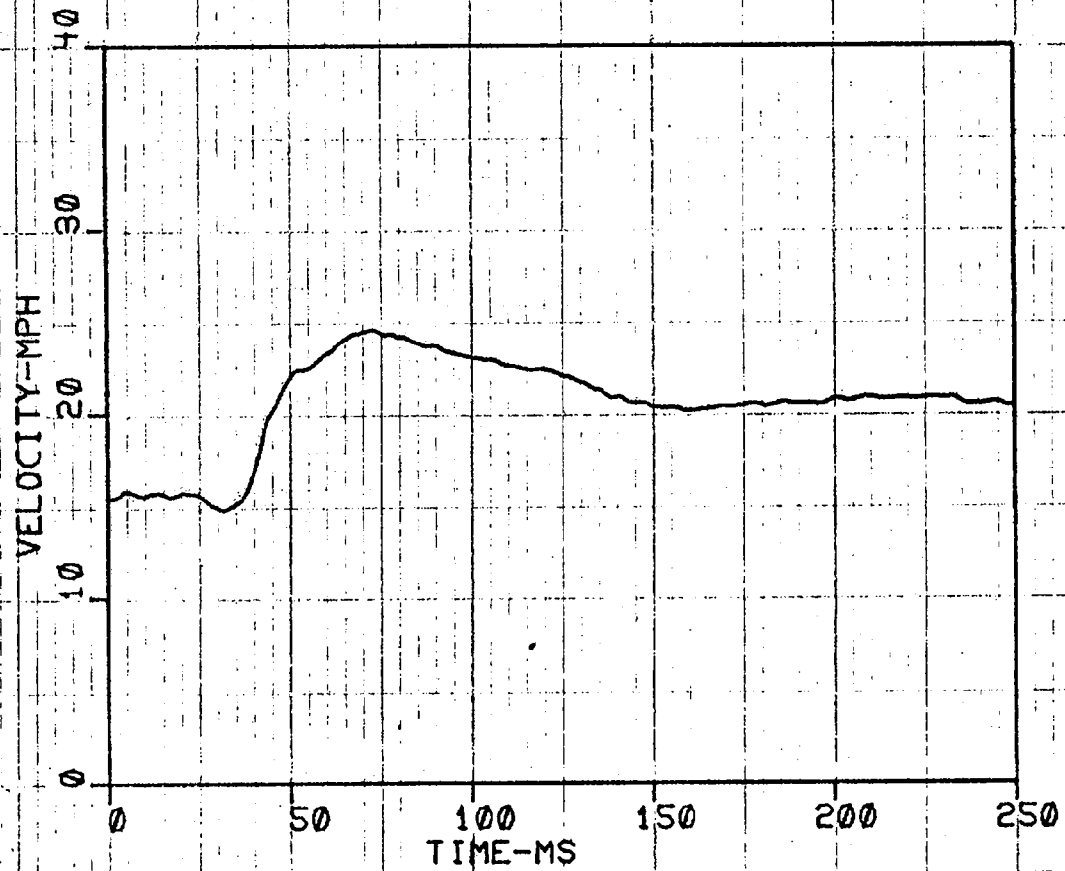


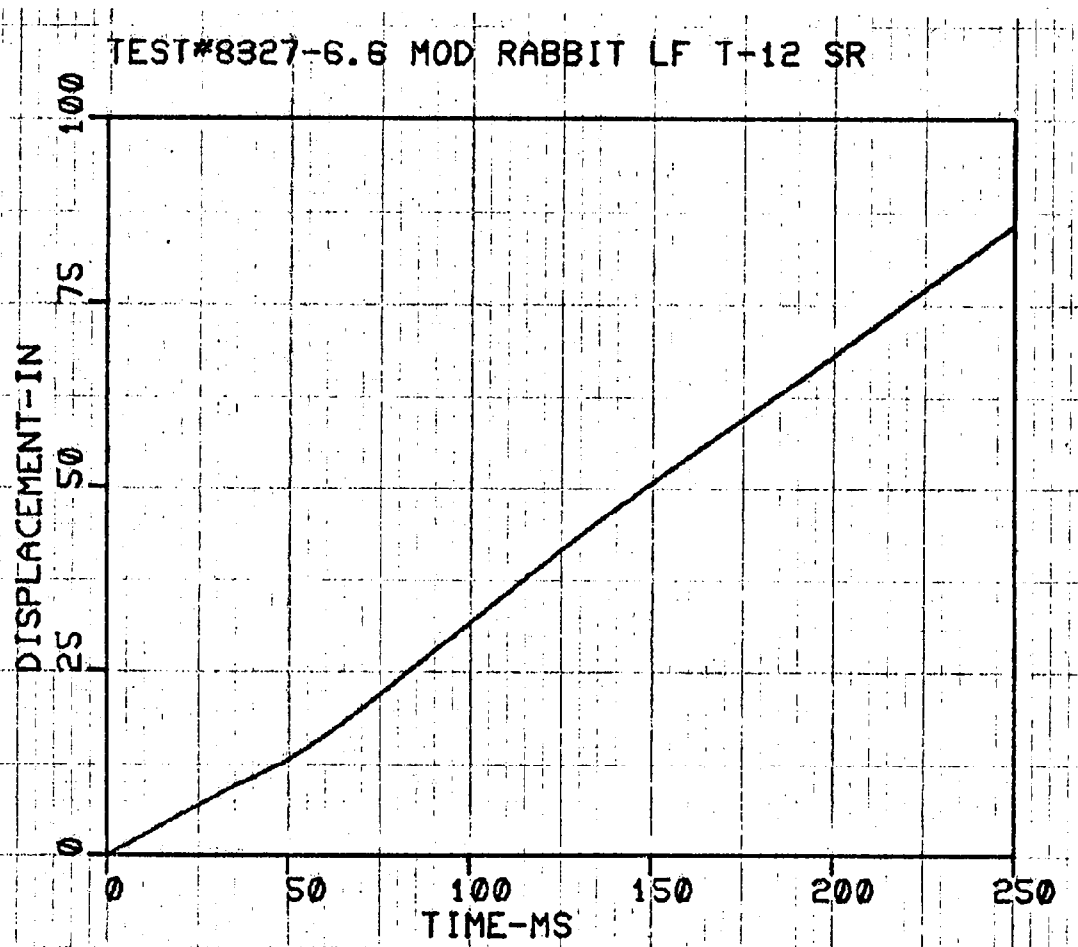


TEST#8327-6.6 MOD RABBIT LF T-12 AR

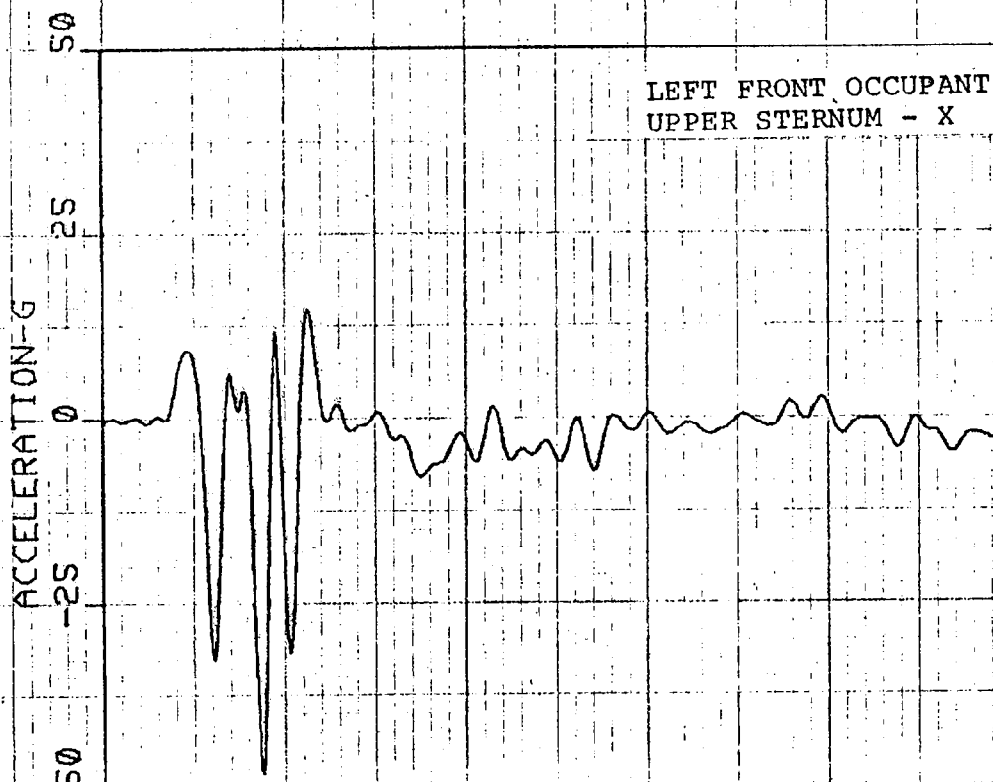


TEST#8327-6.6 MOD RABBIT LF T-12 VR

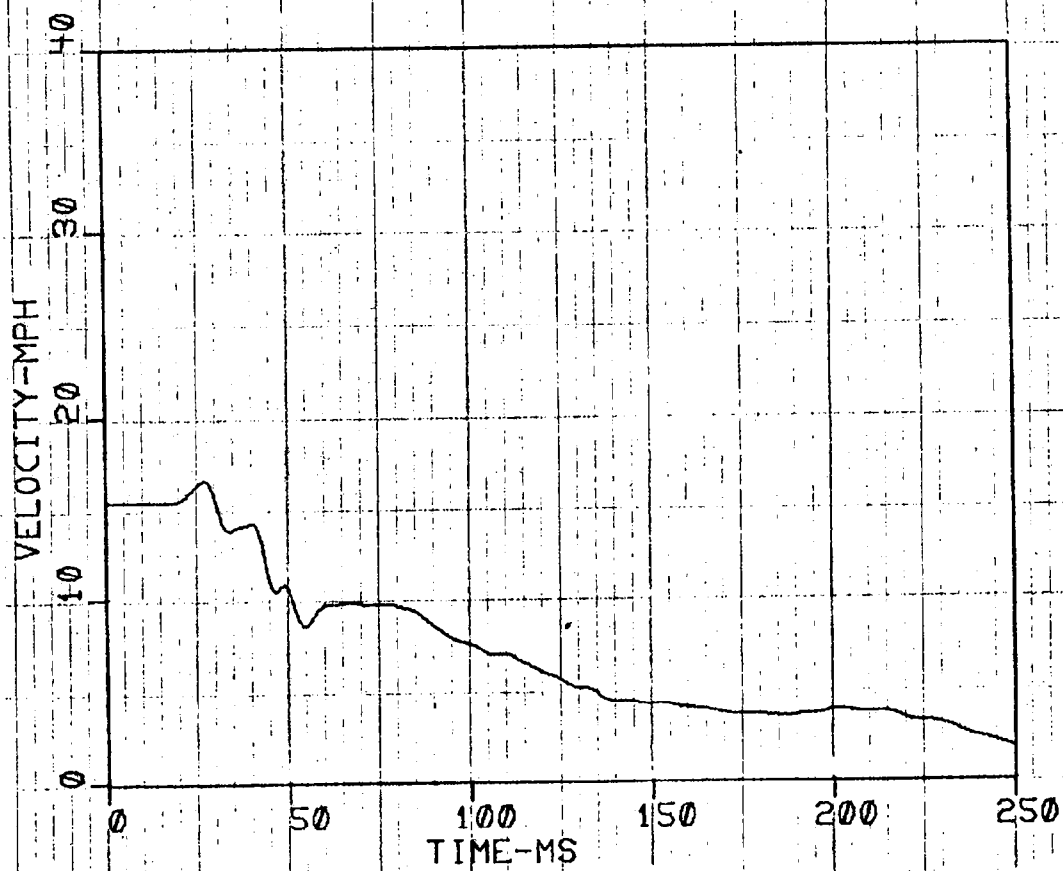


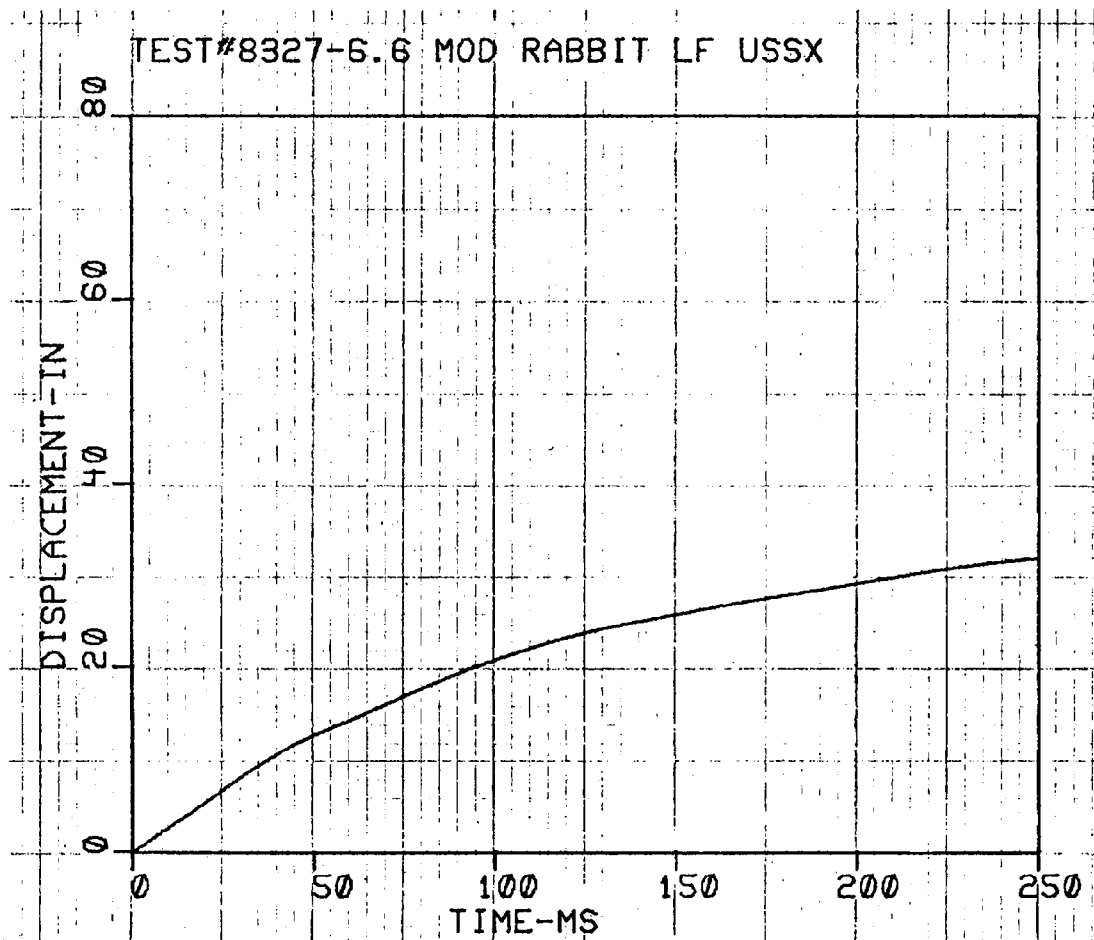


TEST#8327-6.6 MOD RABBIT LF USGX

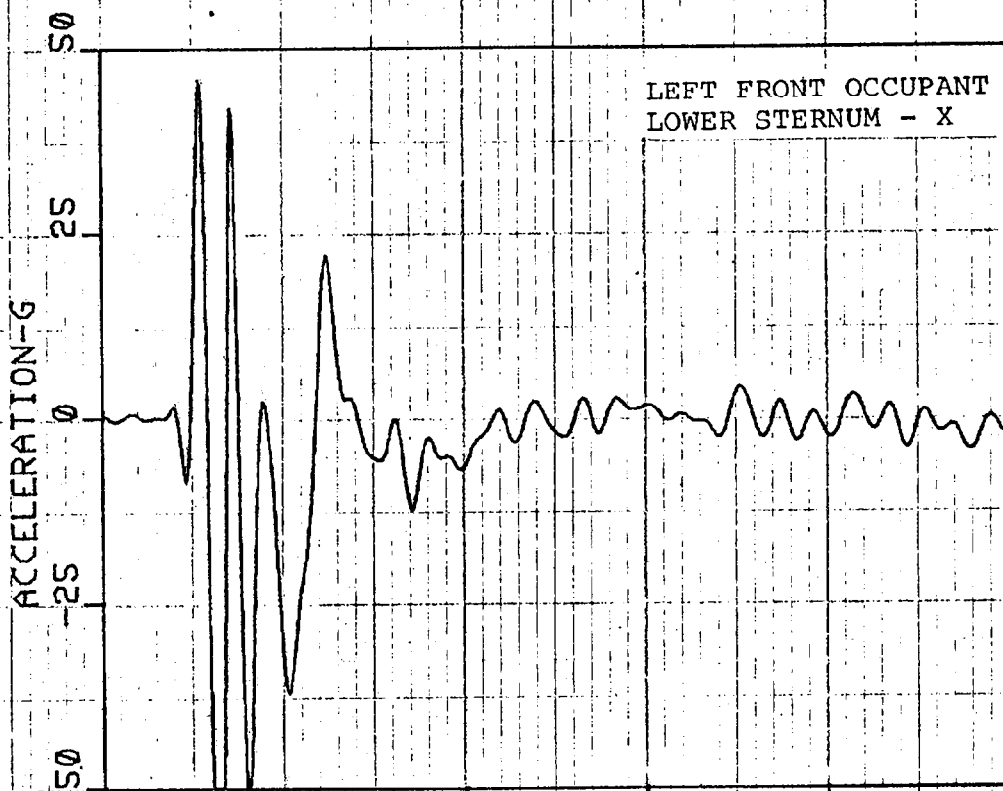


TEST#8327-6.6 MOD RABBIT LF USVX

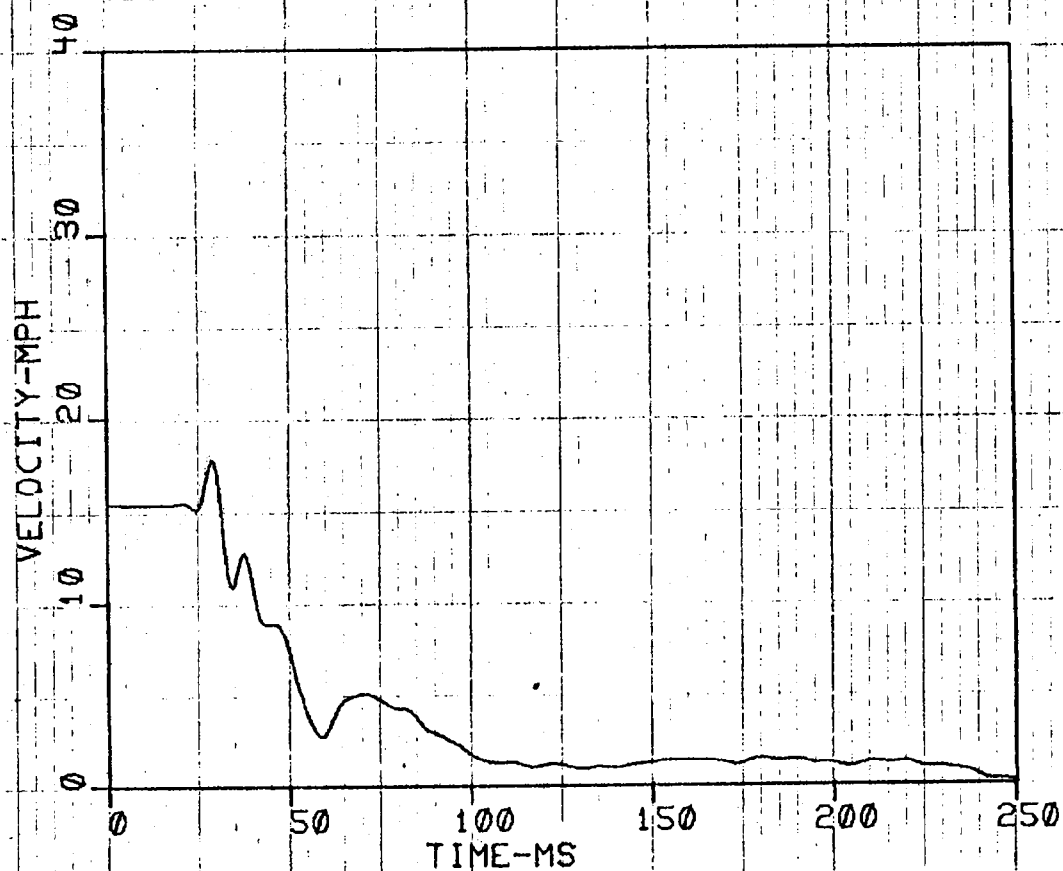


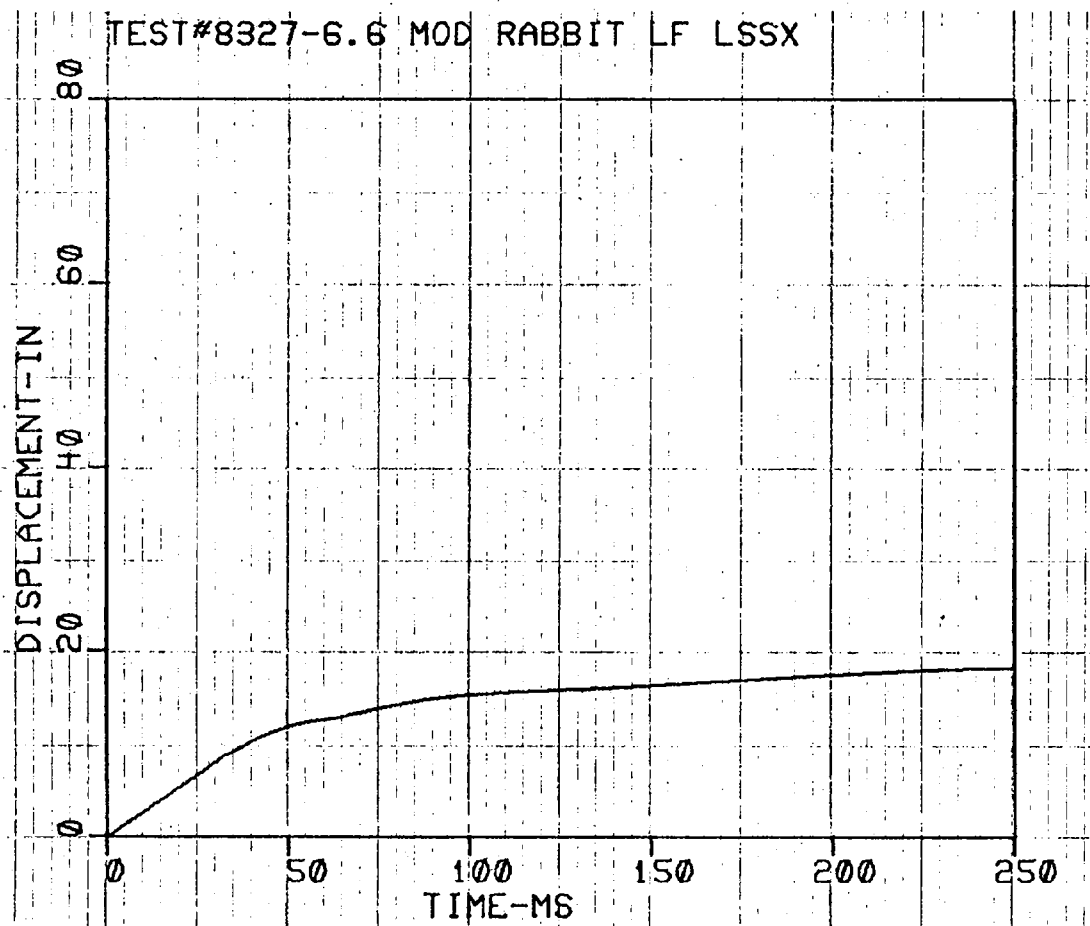


TEST#8327-6.6 MOD RABBIT LF LSGX

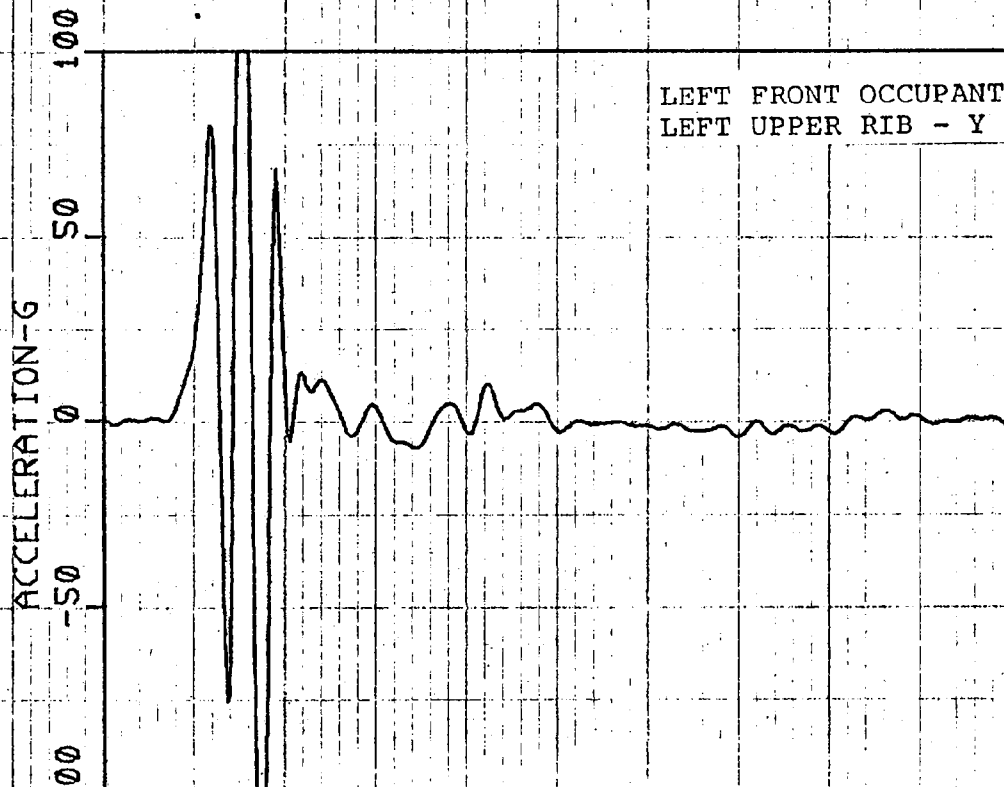


TEST#8327-6.6 MOD RABBIT LF LSVX

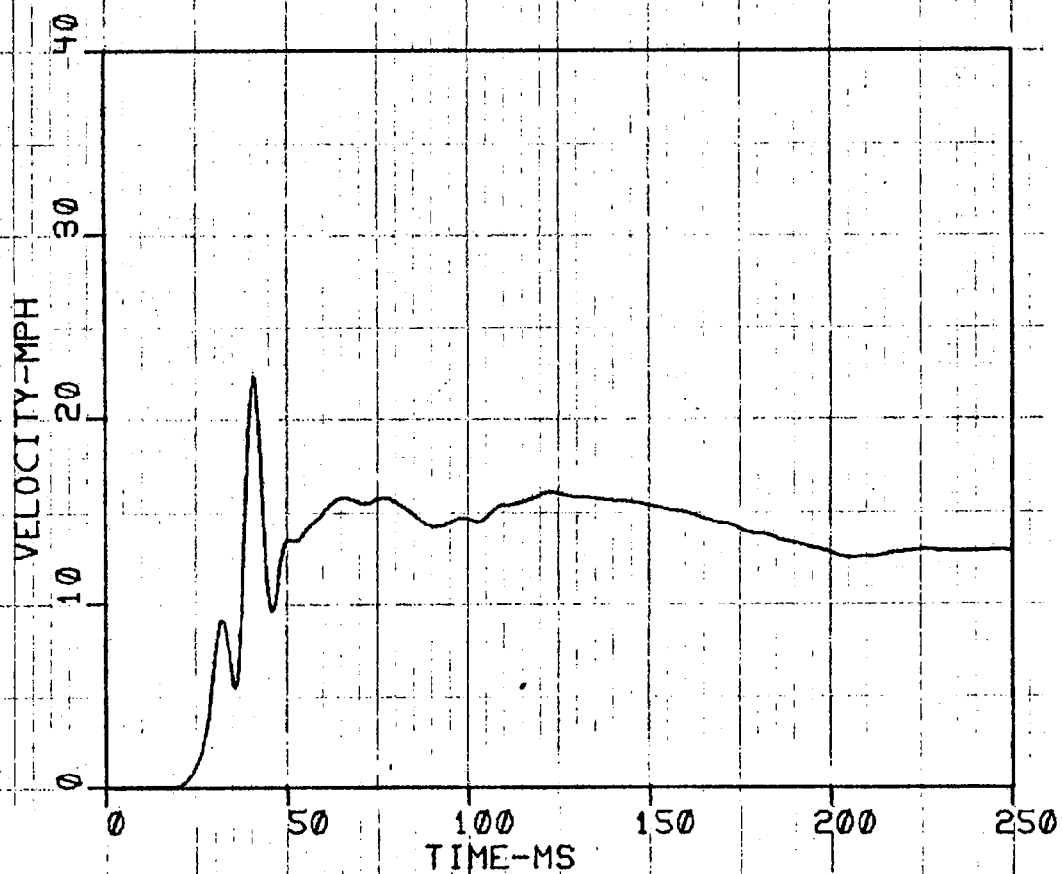


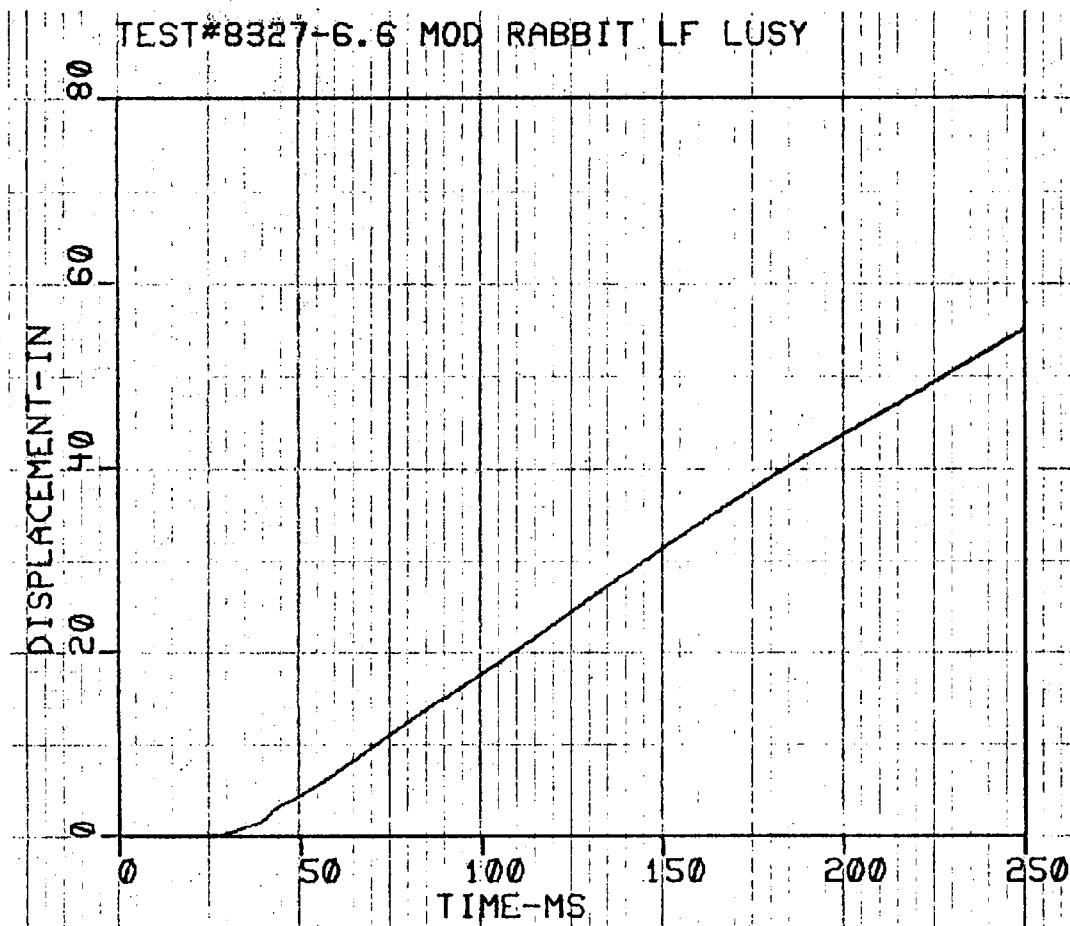


TEST#8327-6.6 MOD RABBIT LF LUGY



TEST#8327-6.6 MOD RABBIT LF LUVY





TEST#8327-6.6 MOD RABBIT LF RUGY

LEFT FRONT OCCUPANT
RIGHT UPPER RIB - Y

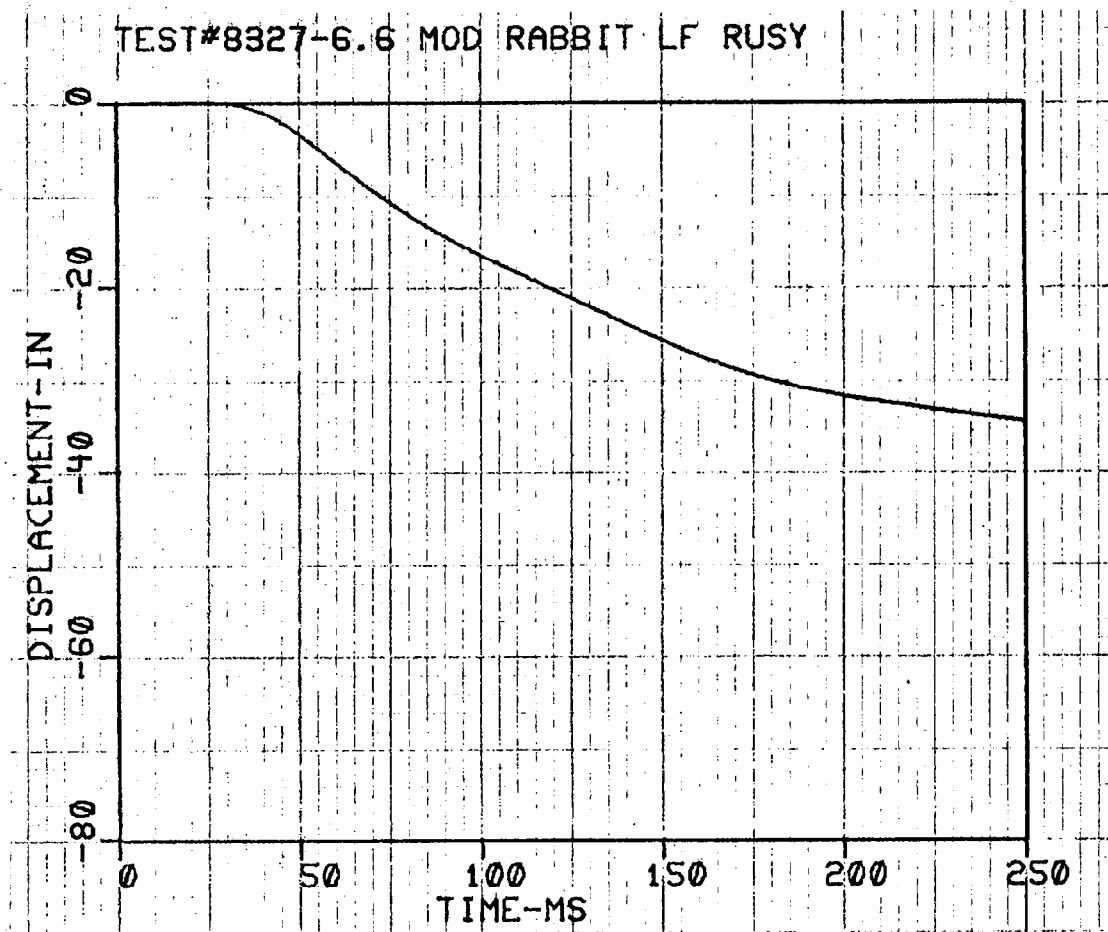
ACCELERATION-G

NOTE: NEGATIVE ACCELERATION
DUE TO INWARD POSITIVE
ORIENTATION OF AC-
CELEROMETER.

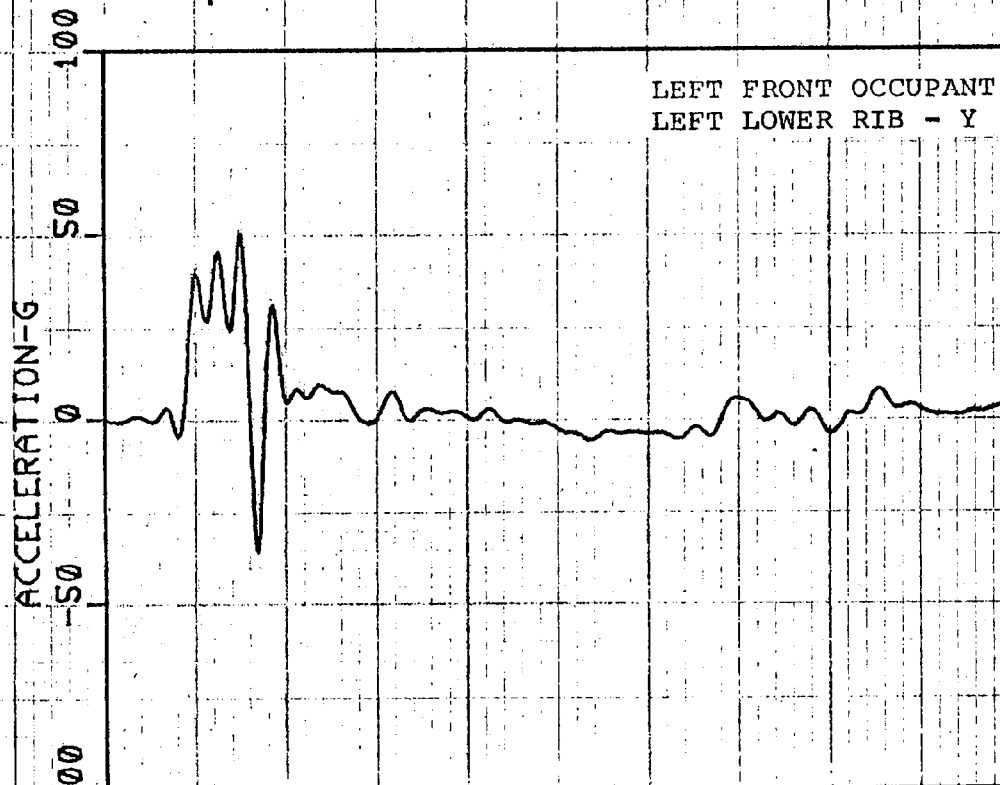
TEST#8327-6.6 MOD RABBIT LF RUVY

VELOCITY-MPH

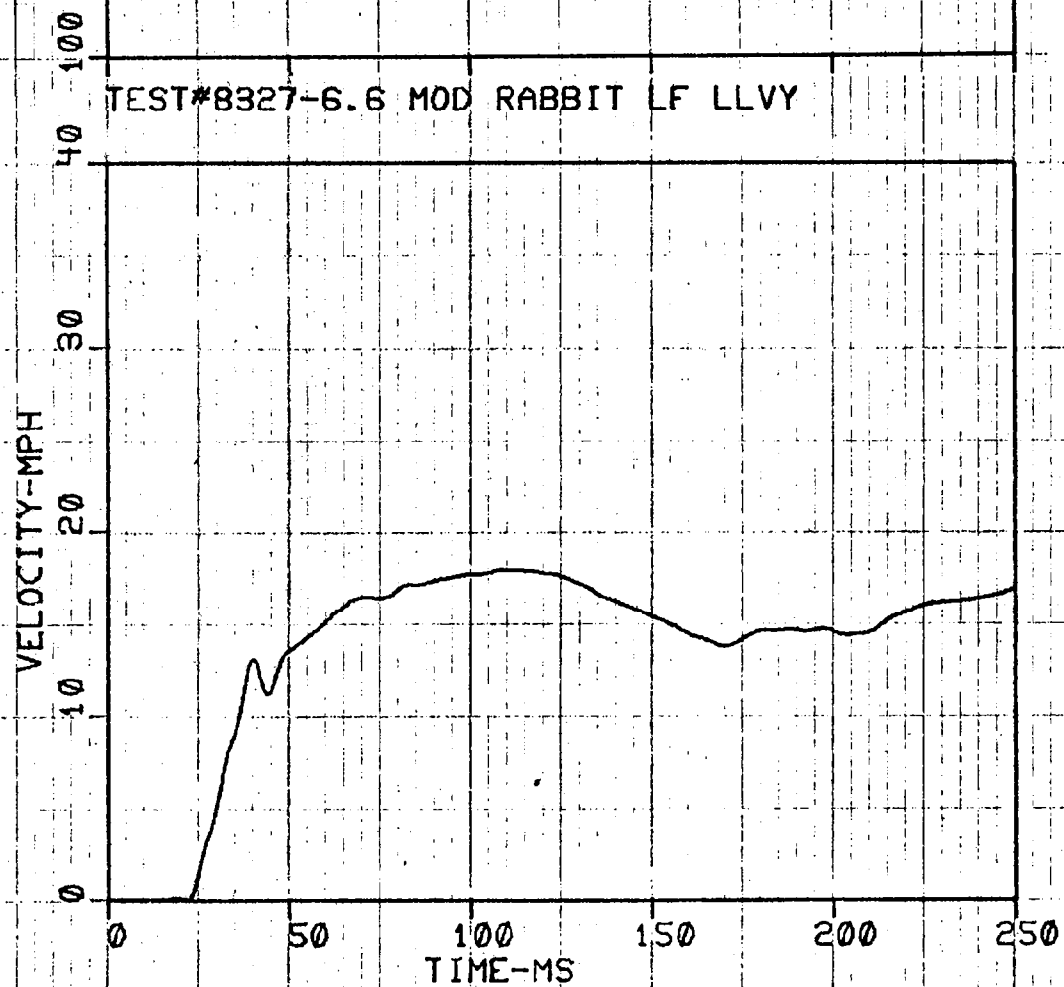
TIME-MS

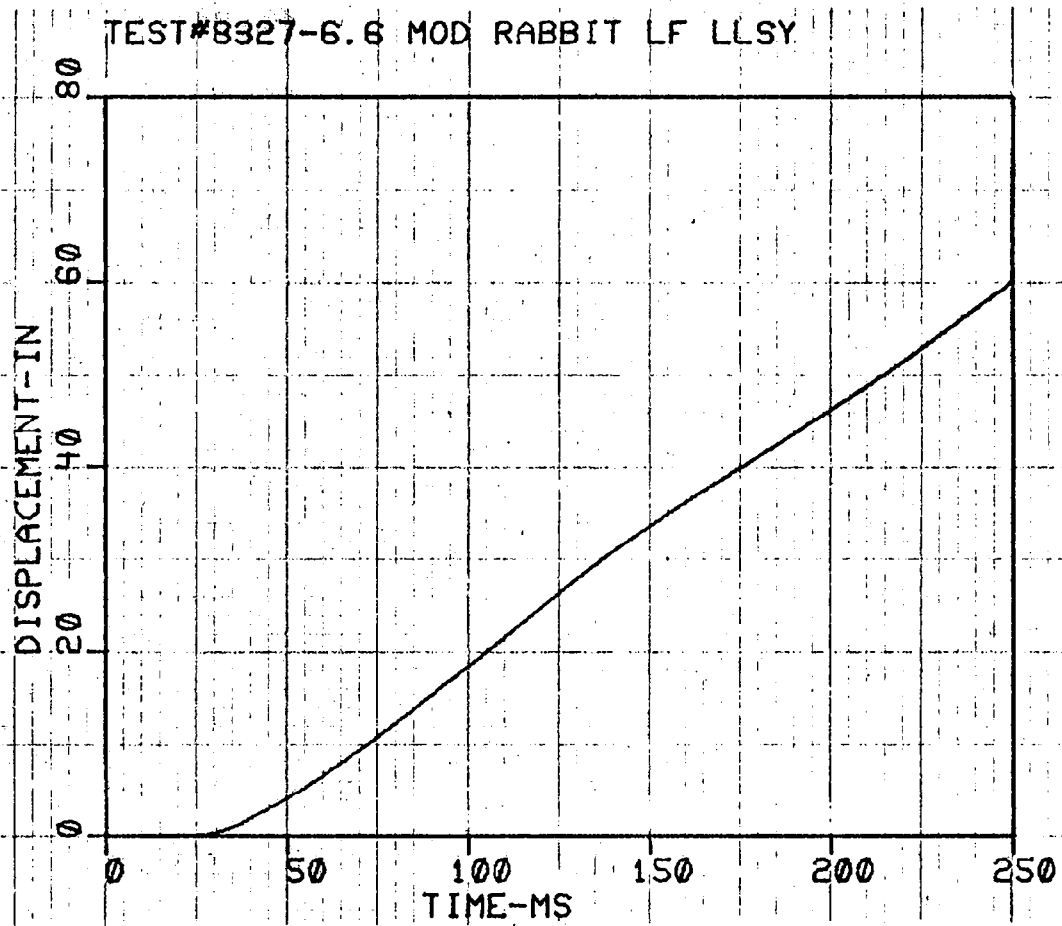


TEST#8327-6.6 MOD RABBIT LF LLGY

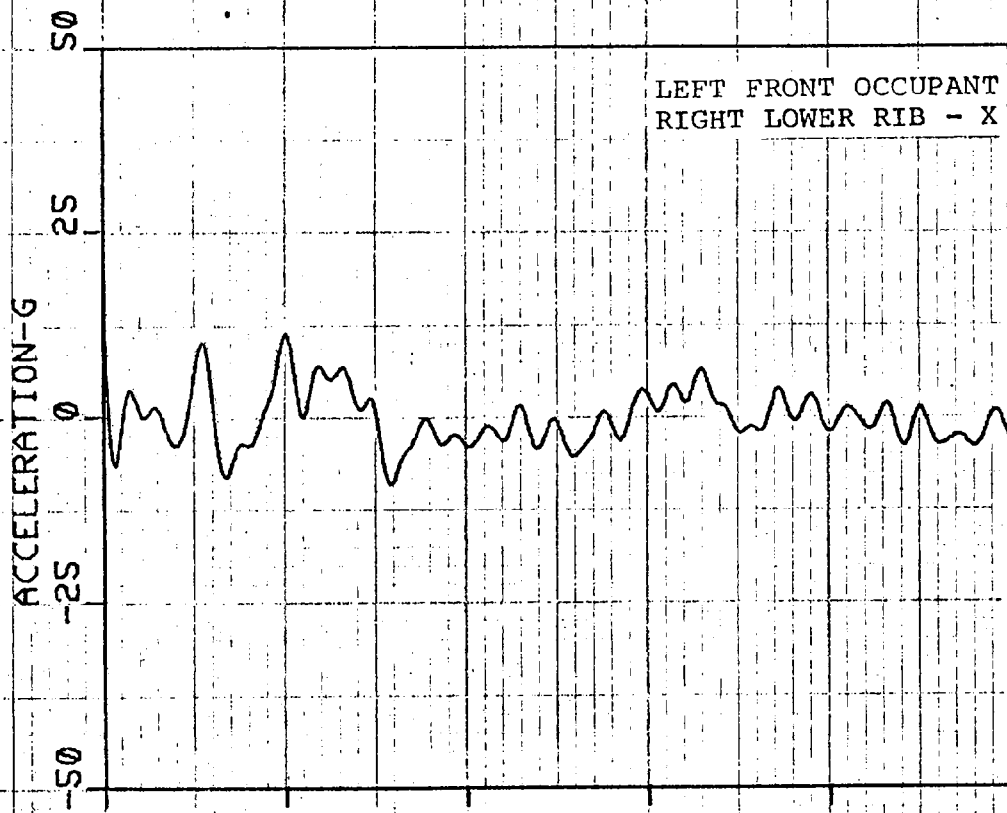


TEST#8327-6.6 MOD RABBIT LF LLVY

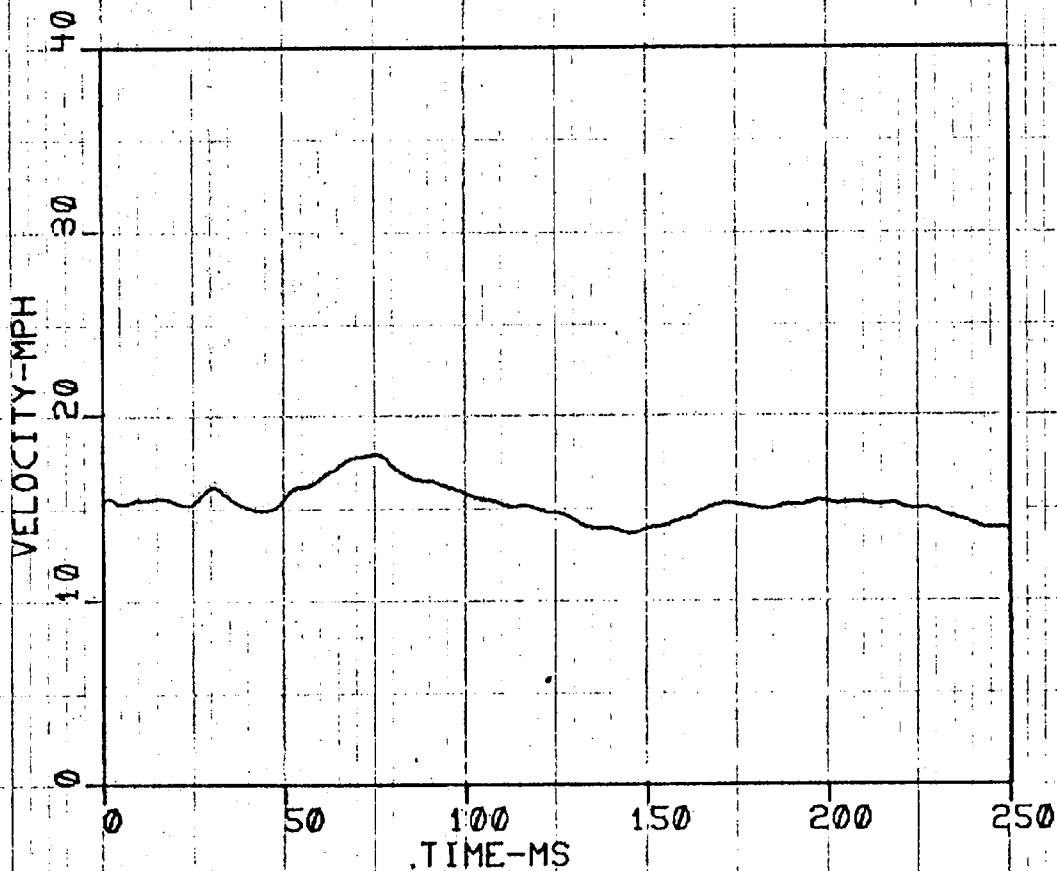


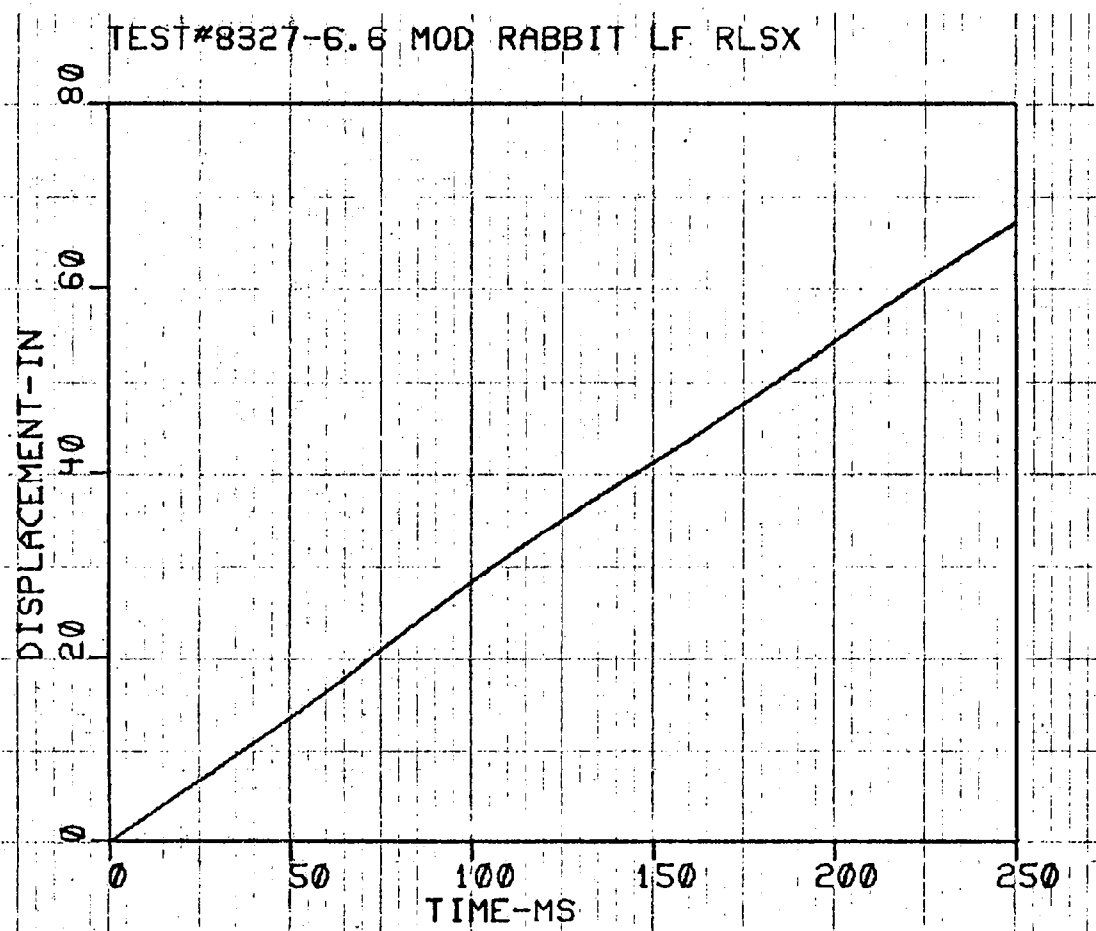


TEST#8327-6.6 MOD RABBIT LF RLGX

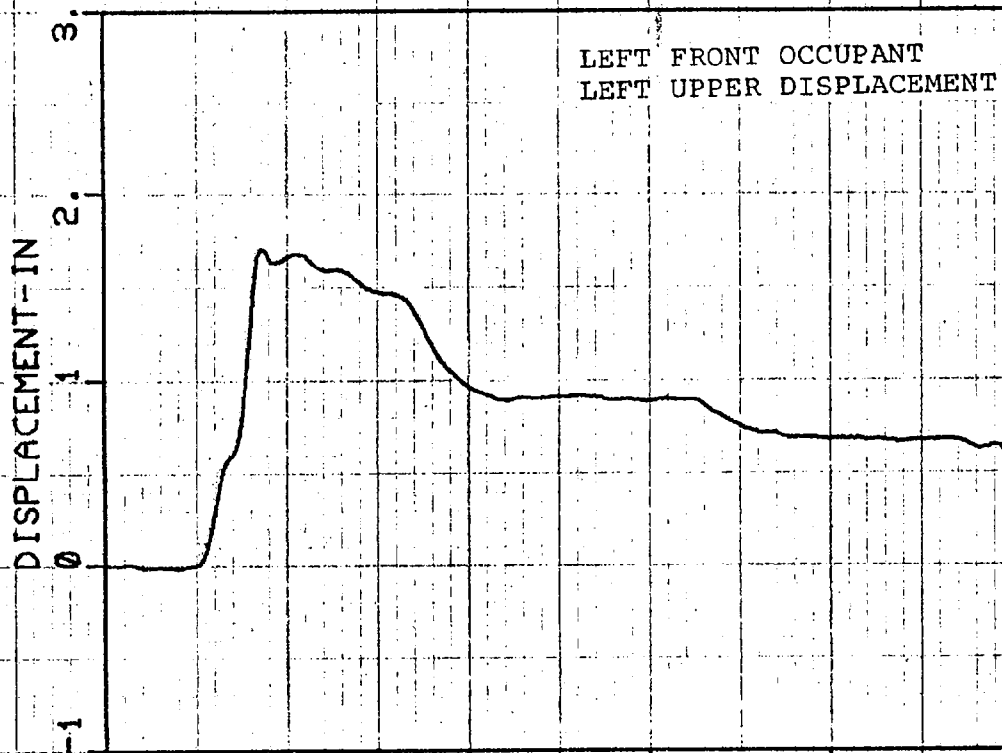


TEST#8327-6.6 MOD RABBIT LF RLVX

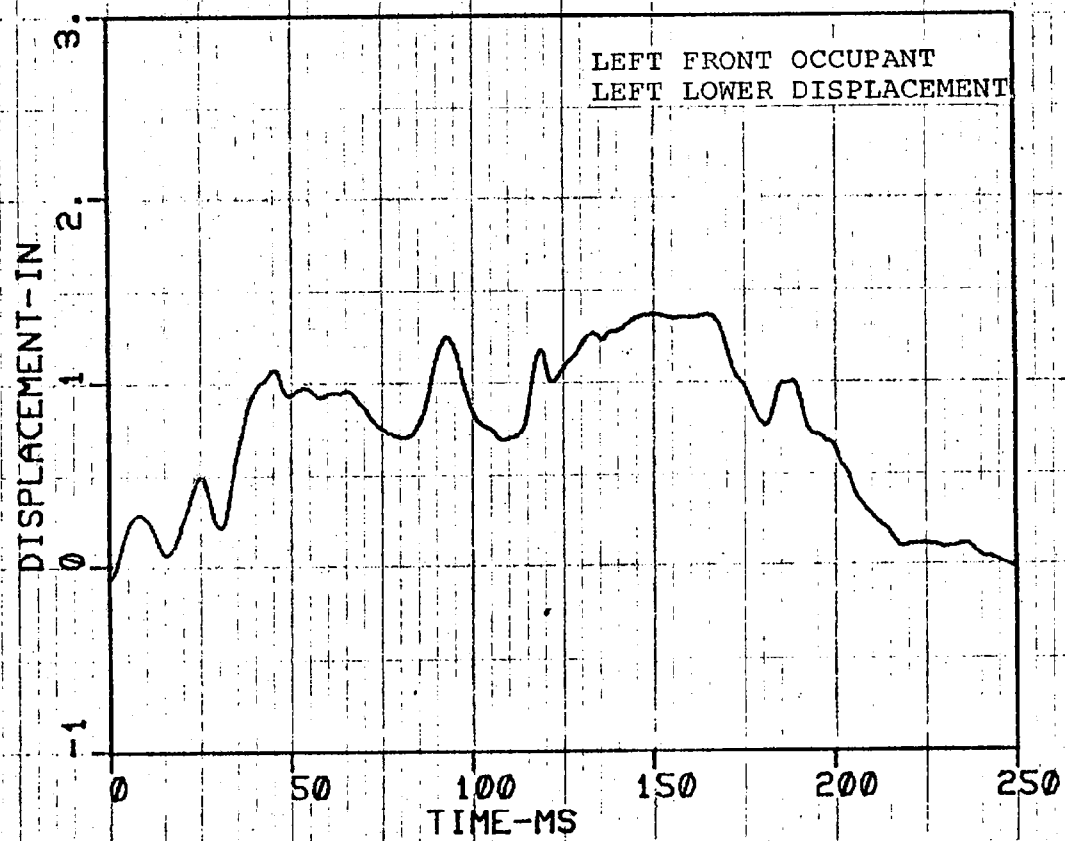




TEST#8327-6.6 MOD RABBIT LF LUDY



TEST#8327-6.6 MOD RABBIT LF LLDY



TEST#8327-6.6 MOD RABBIT LF PPGX

LEFT FRONT OCCUPANT
LONGITUDINAL PELVIS

ACCELERATION-G

80

40

0

-40

-80

TEST#8327-6.6 MOD RABBIT LF PPVX

VELOCITY-MPH

40

30

20

10

0

TIME-MS

0

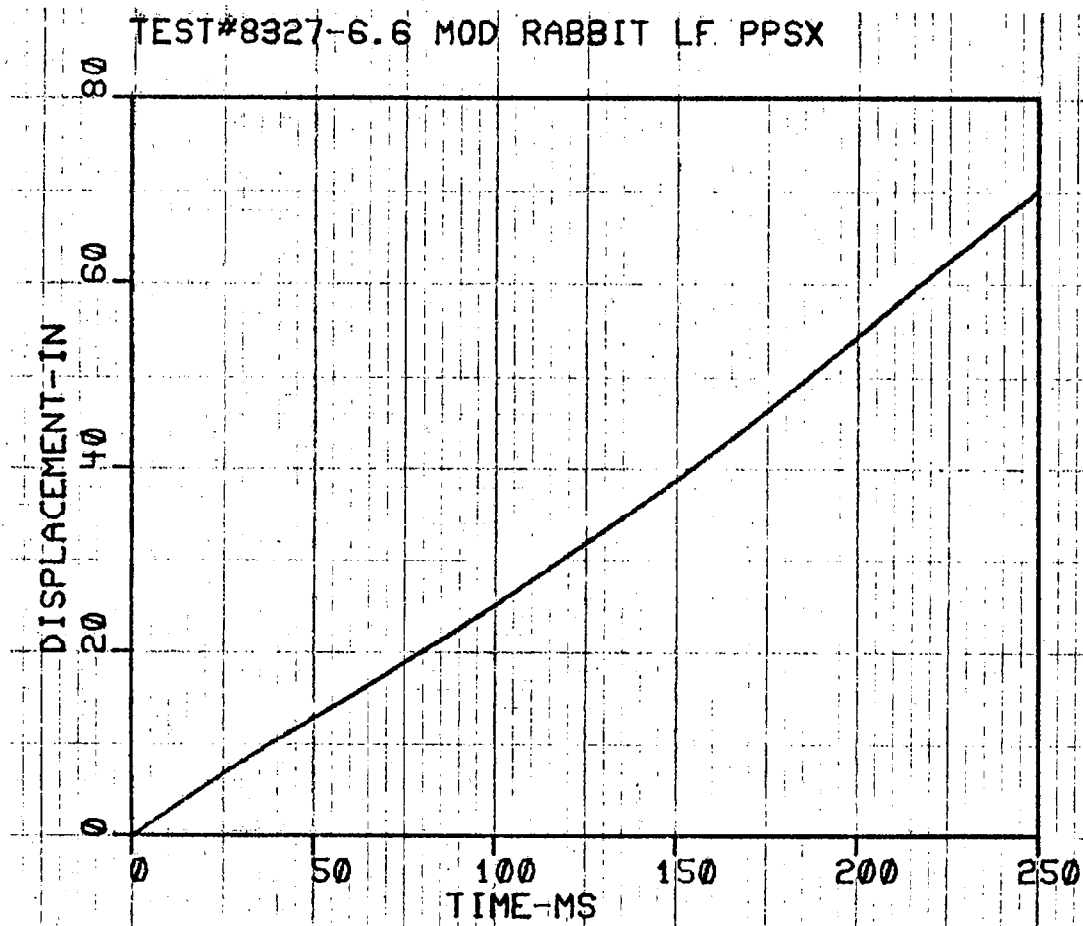
50

100

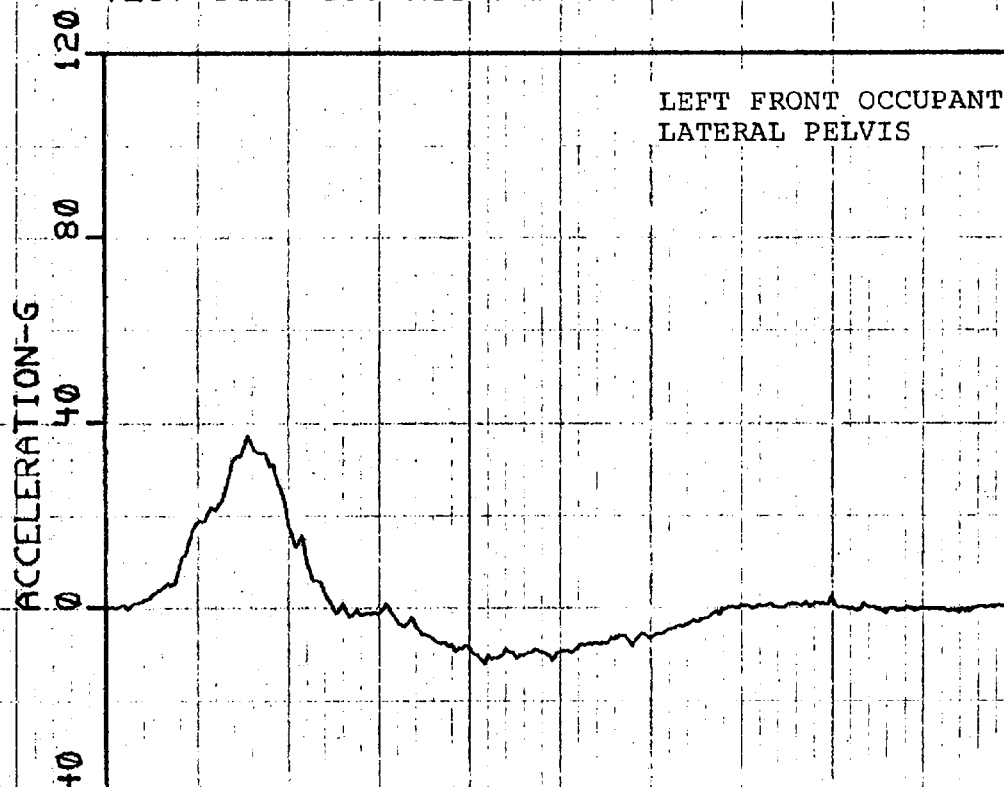
150

200

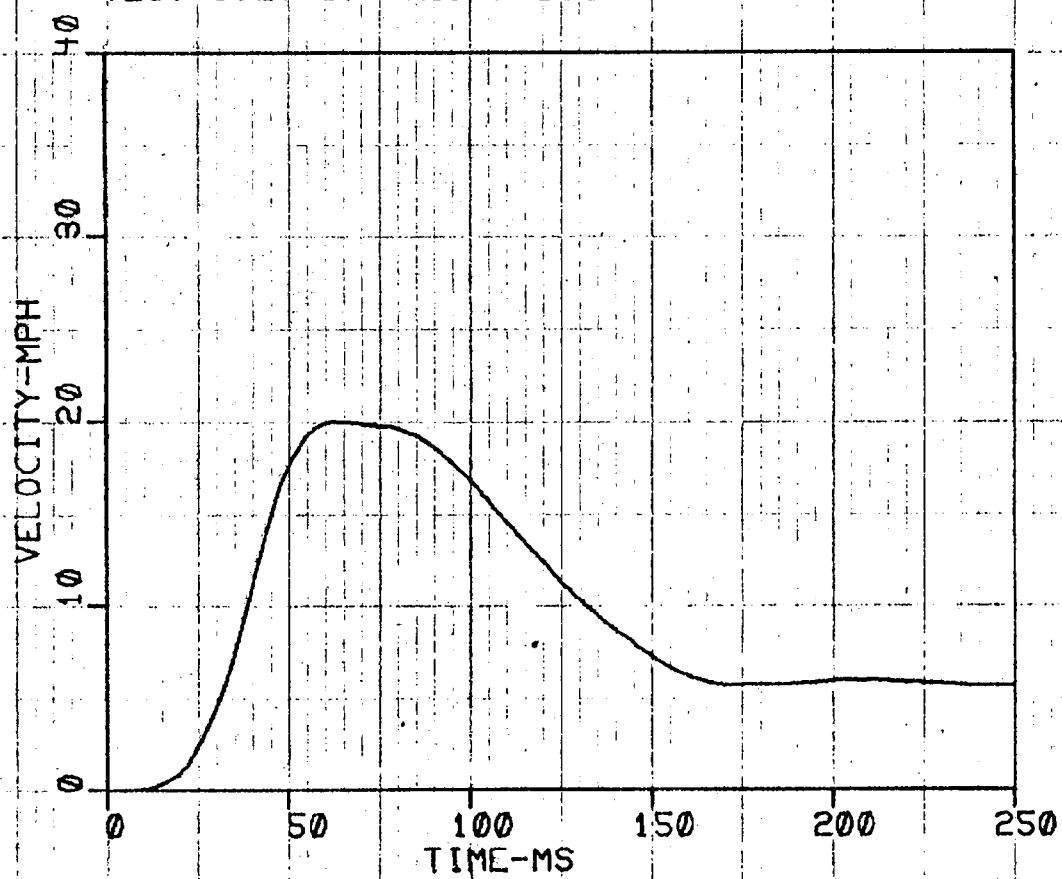
250

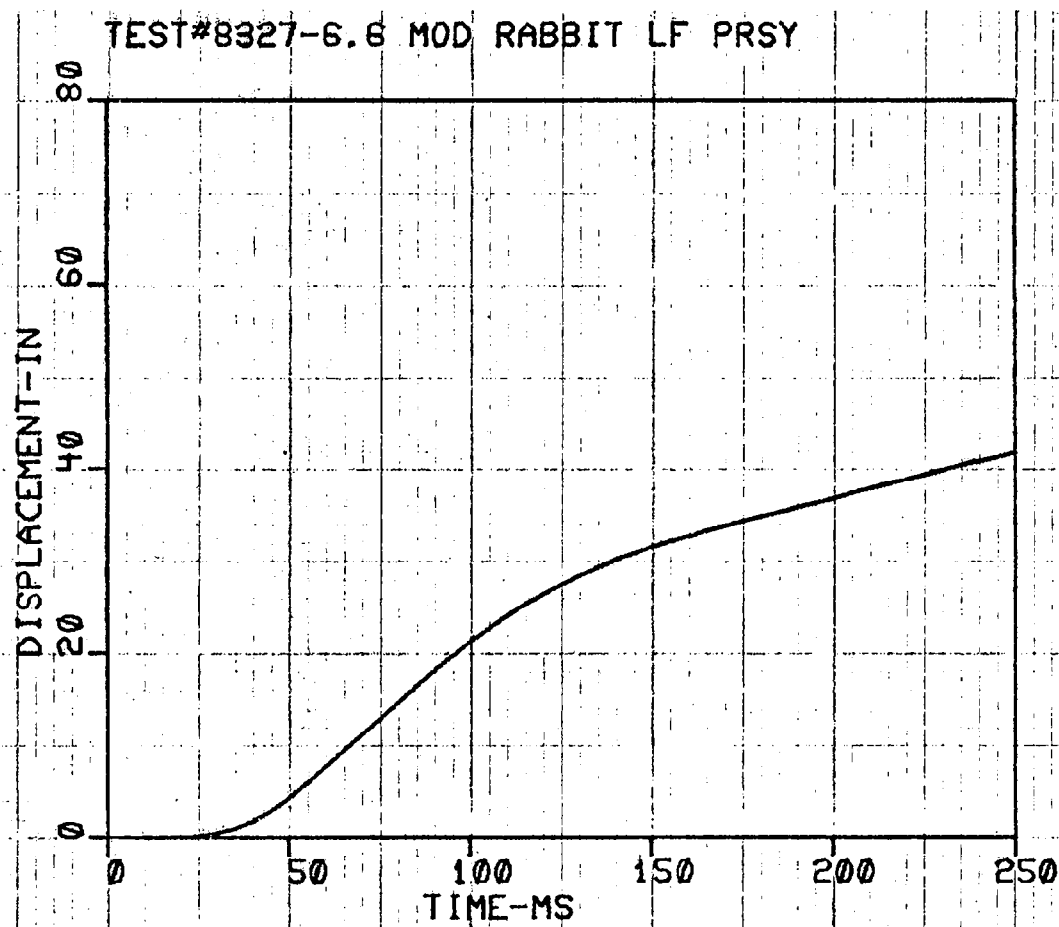


TEST#8327-6.6 MOD RABBIT LF PRGY

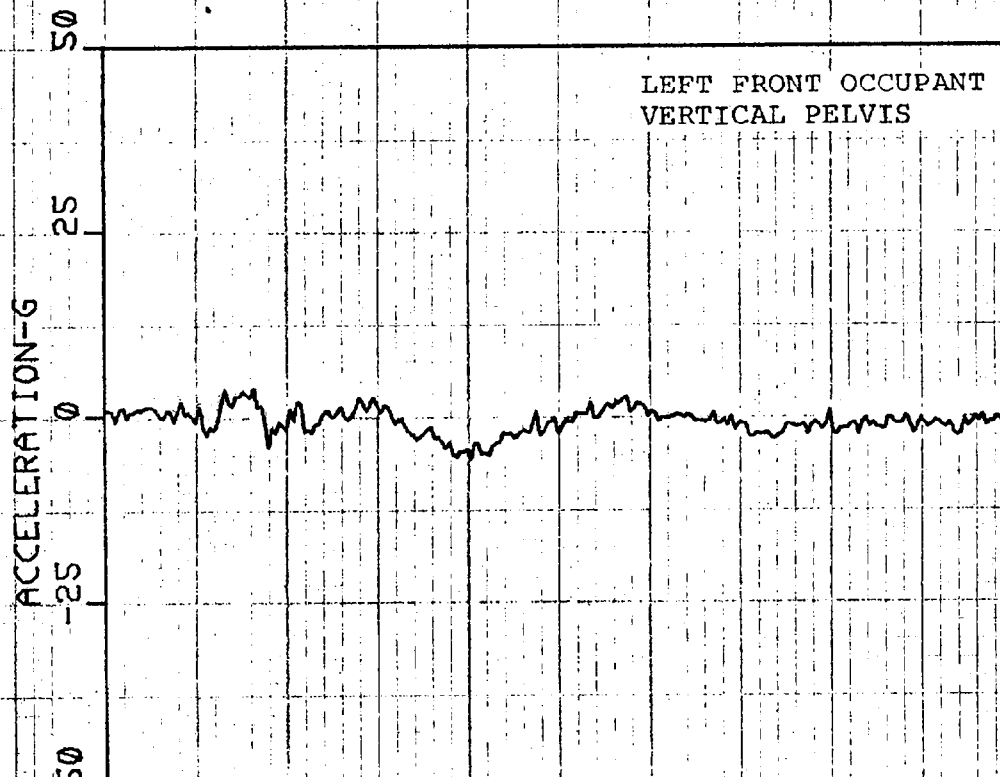


TEST#8327-6.6 MOD RABBIT LF PRVY

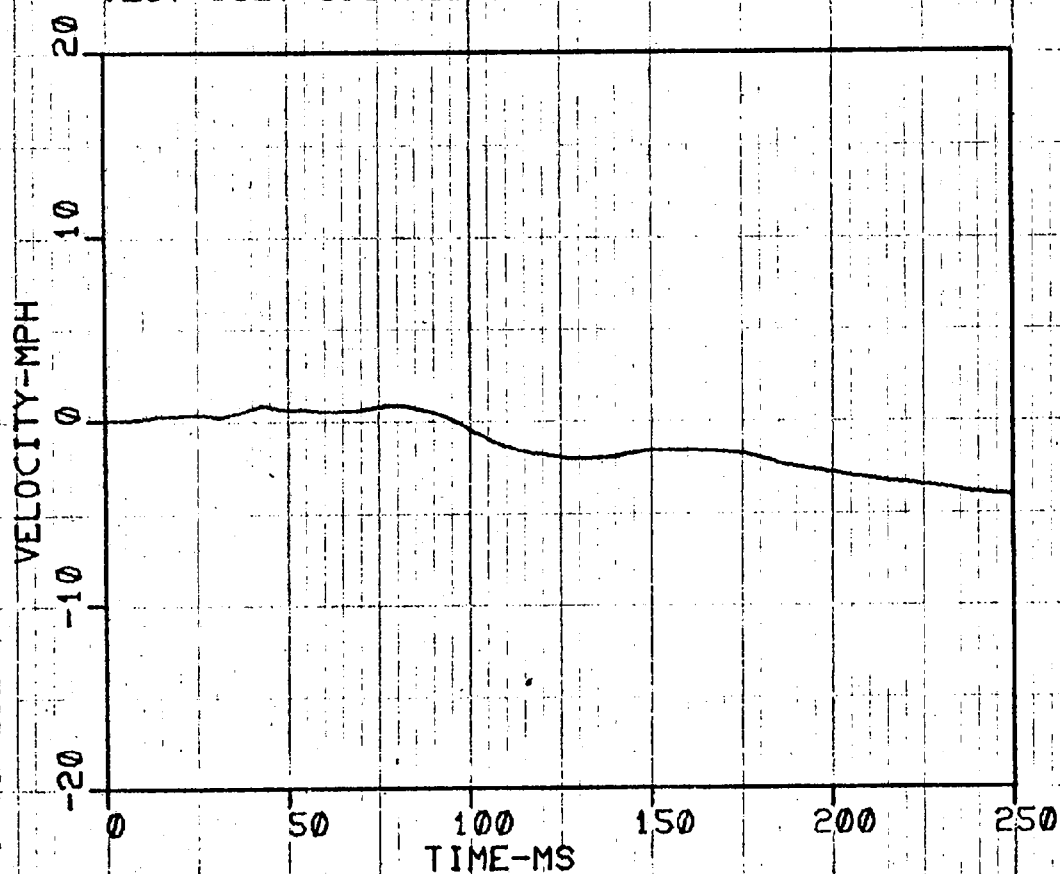


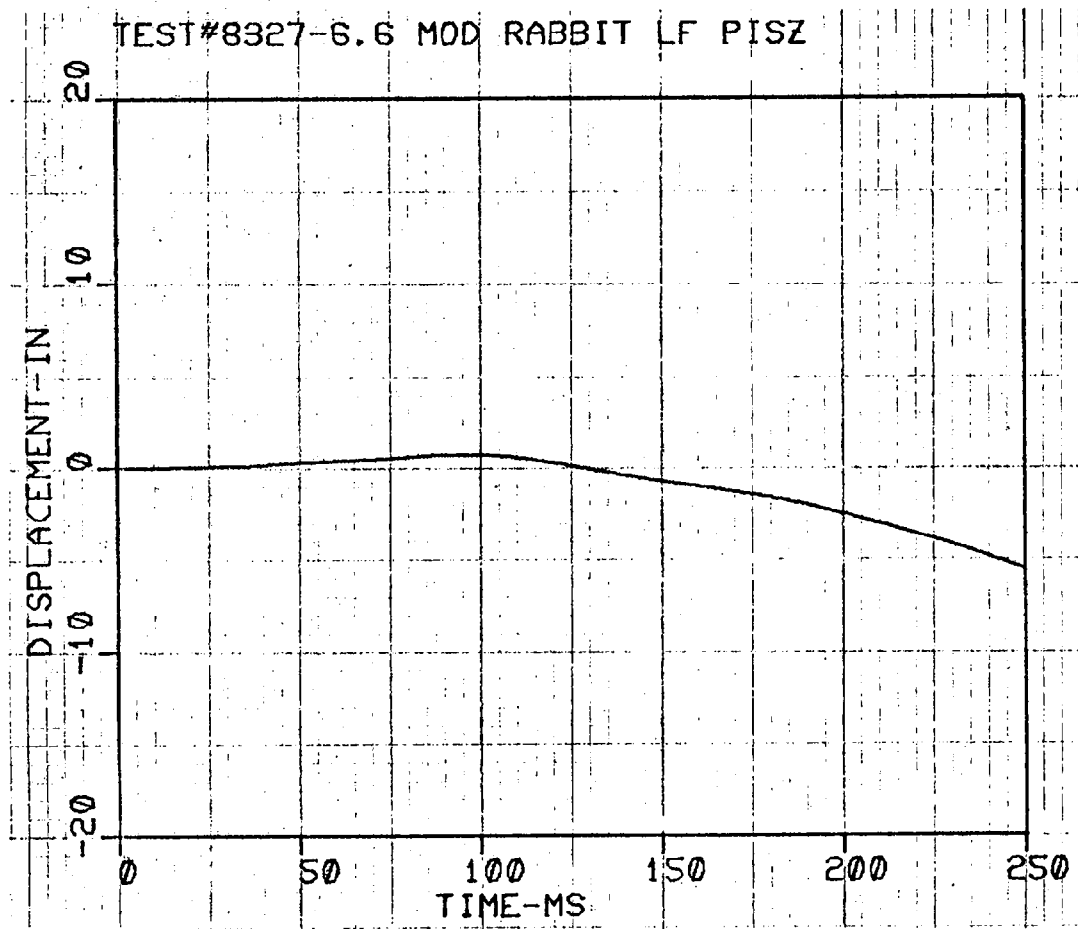


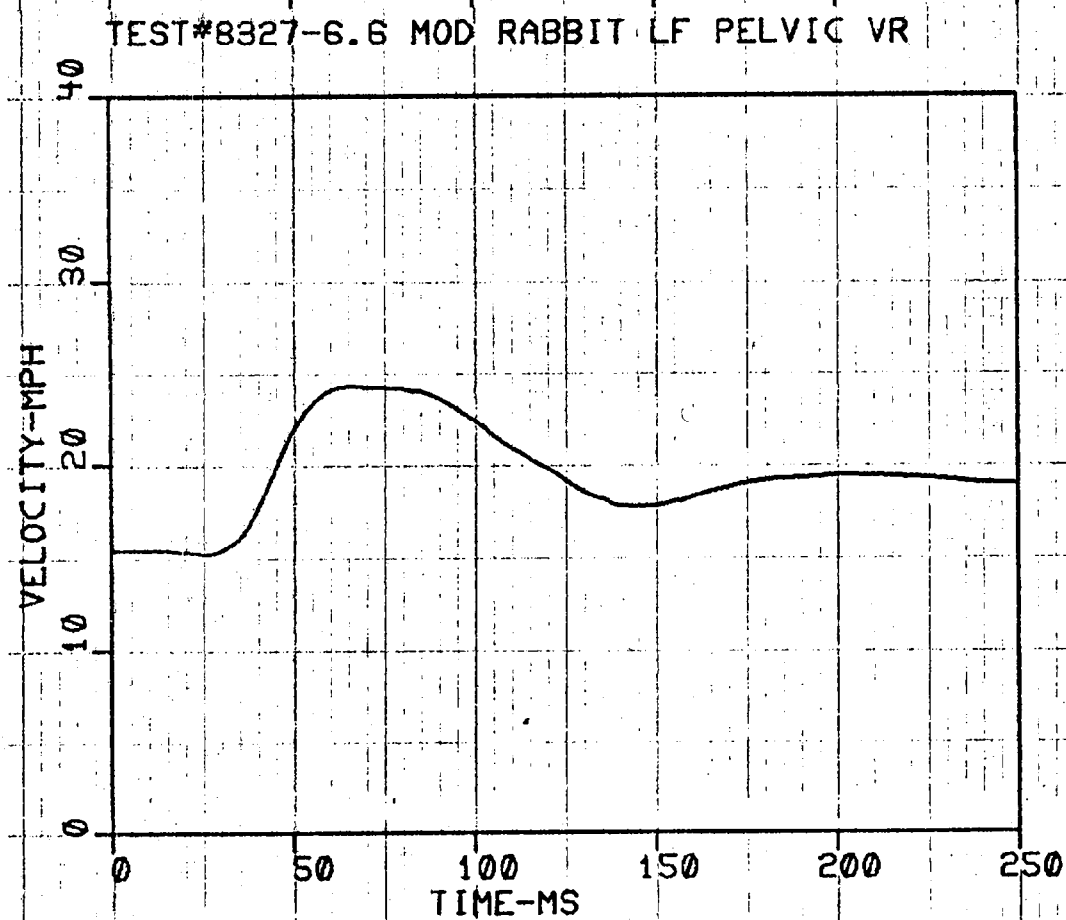
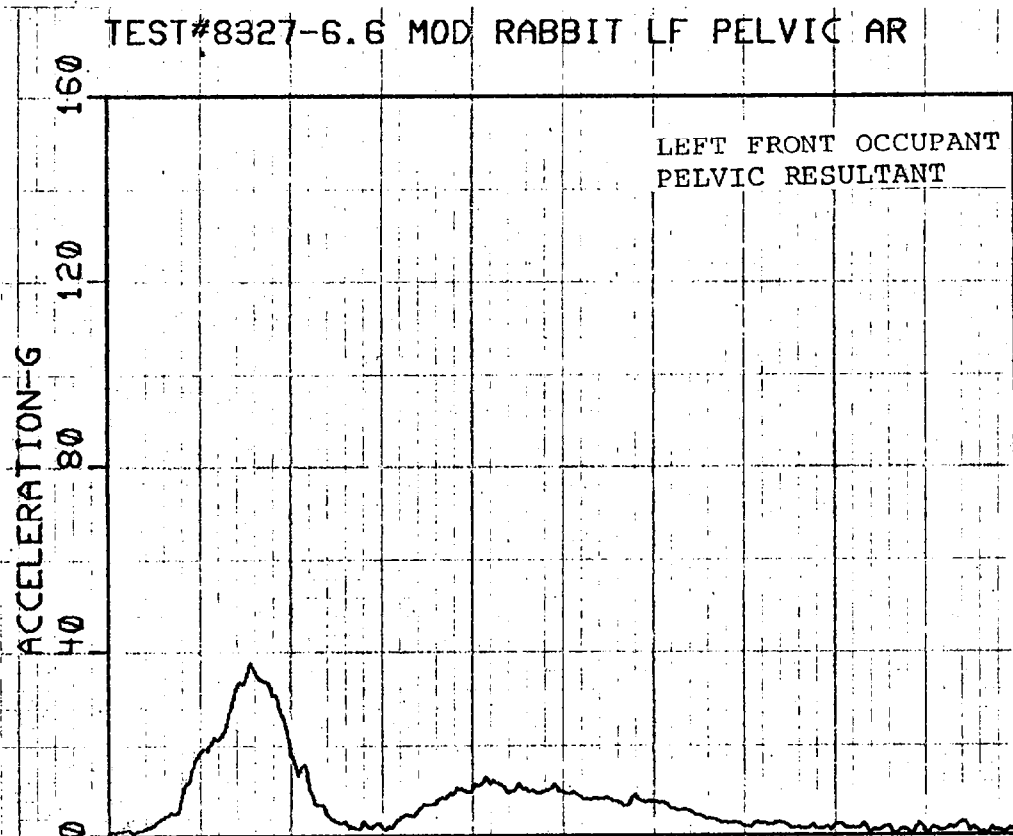
TEST#8327-6.6 MOD RABBIT LF PIGZ

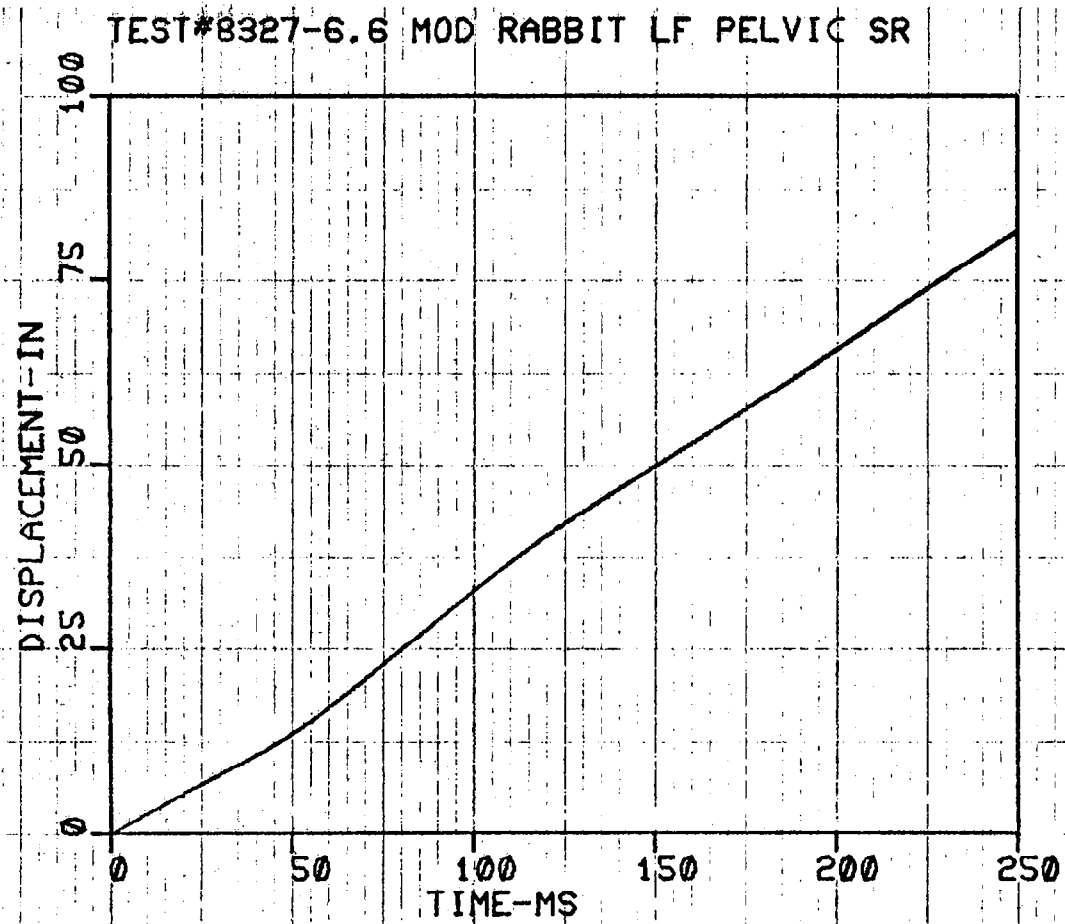


TEST#8327-6.6 MOD RABBIT LF PIVZ

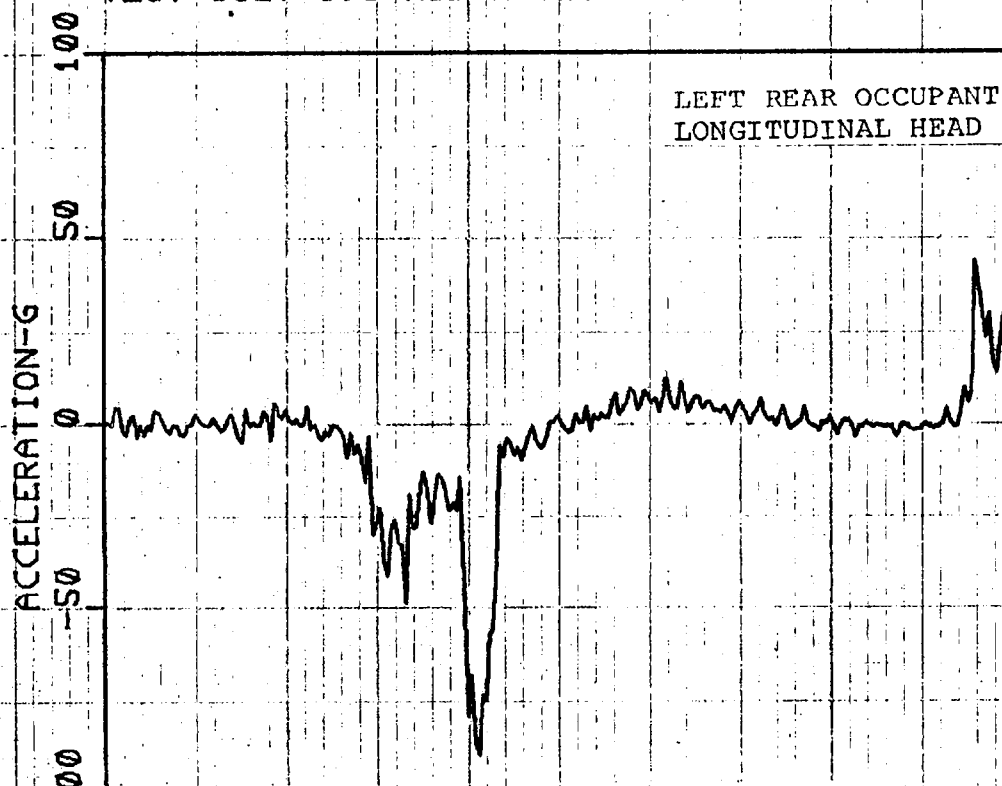




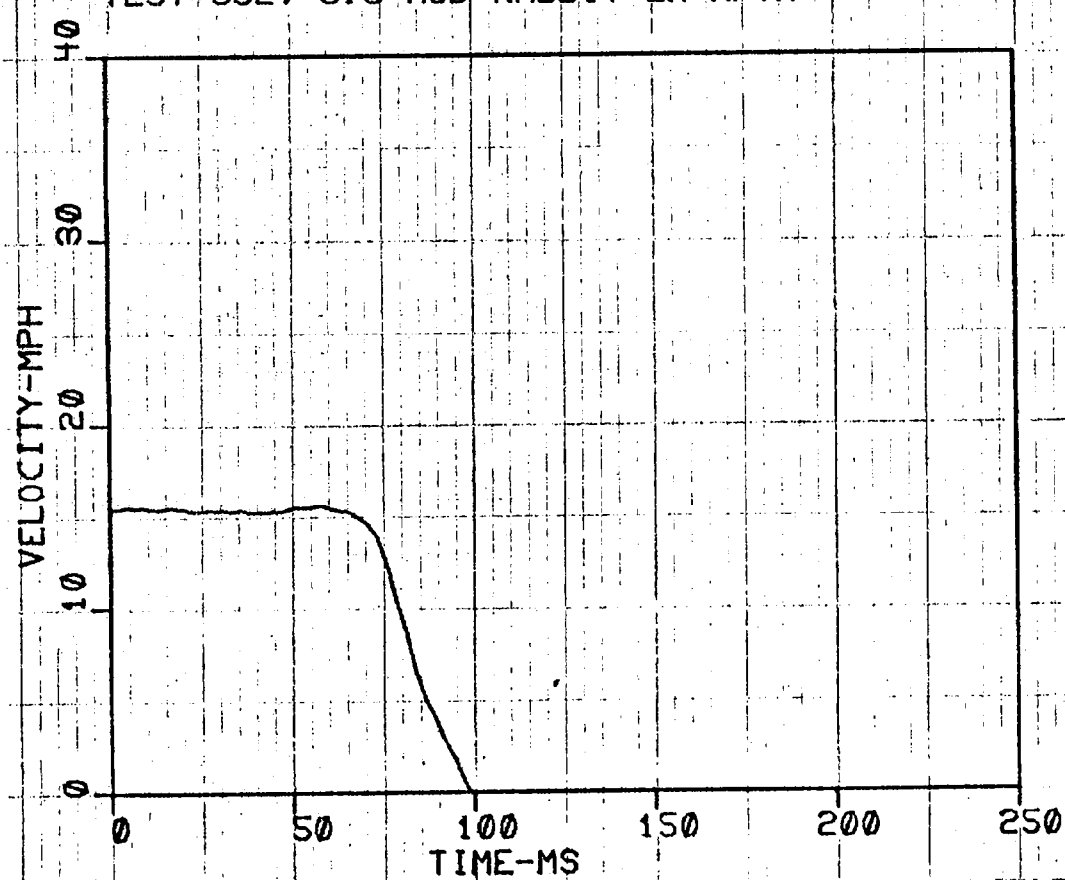


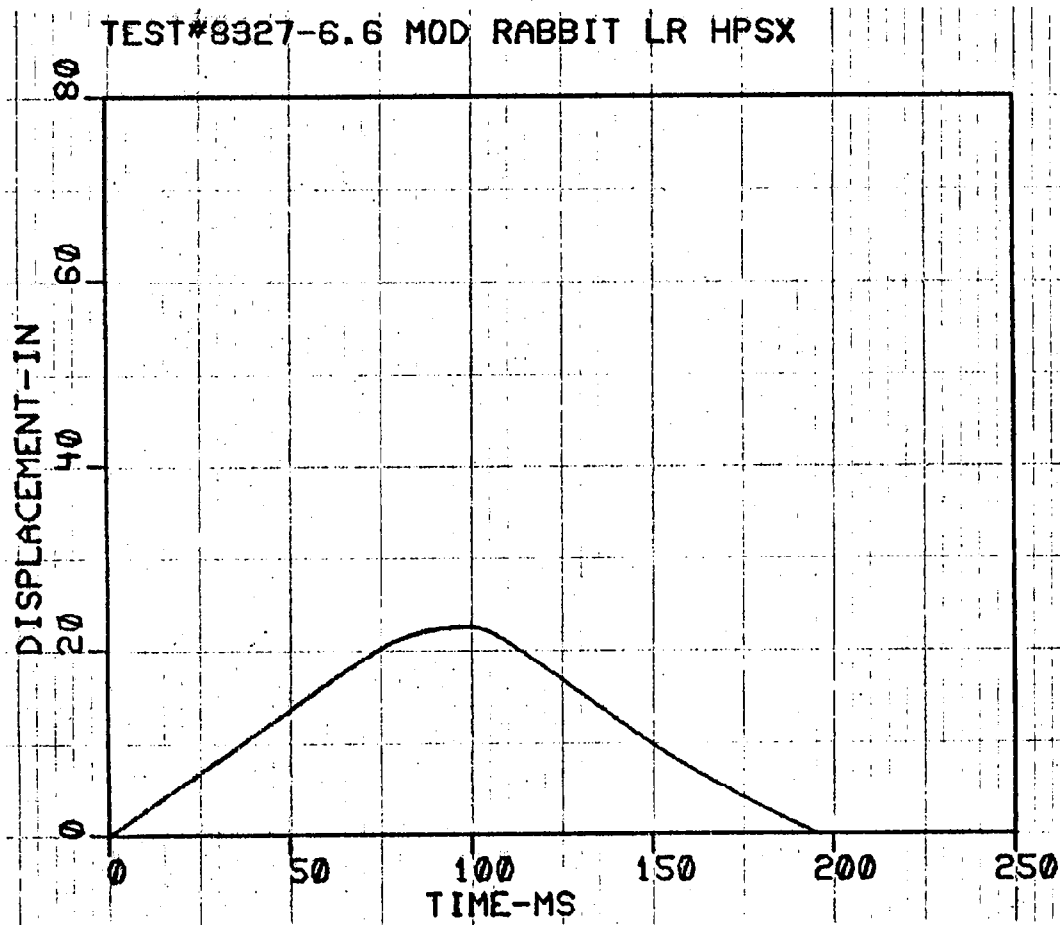


TEST#8327-6.6 MOD RABBIT LR HPGX

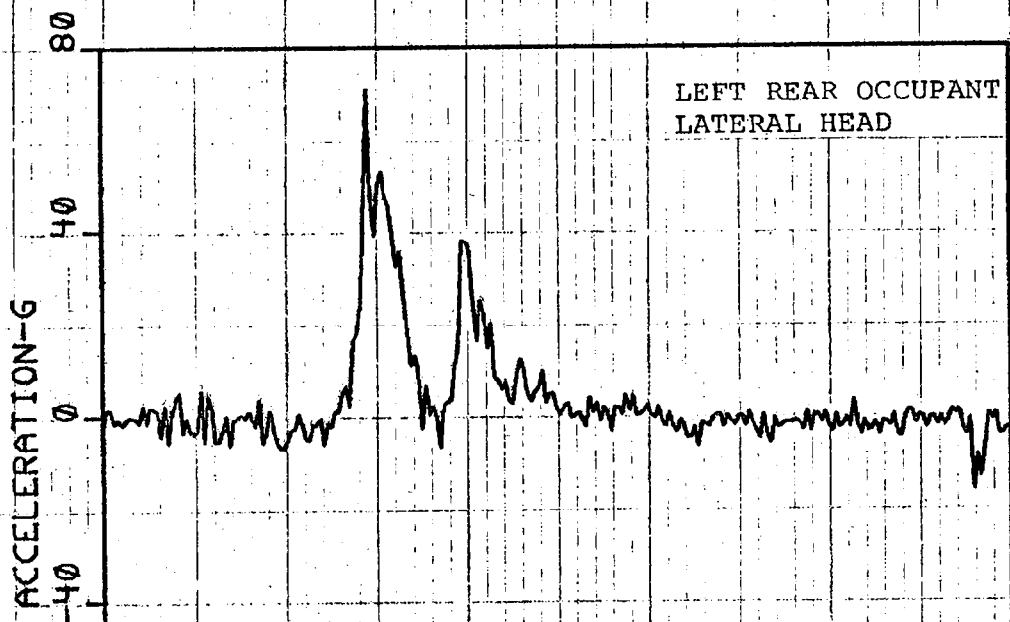


TEST#8327-6.6 MOD RABBIT LR HPVX

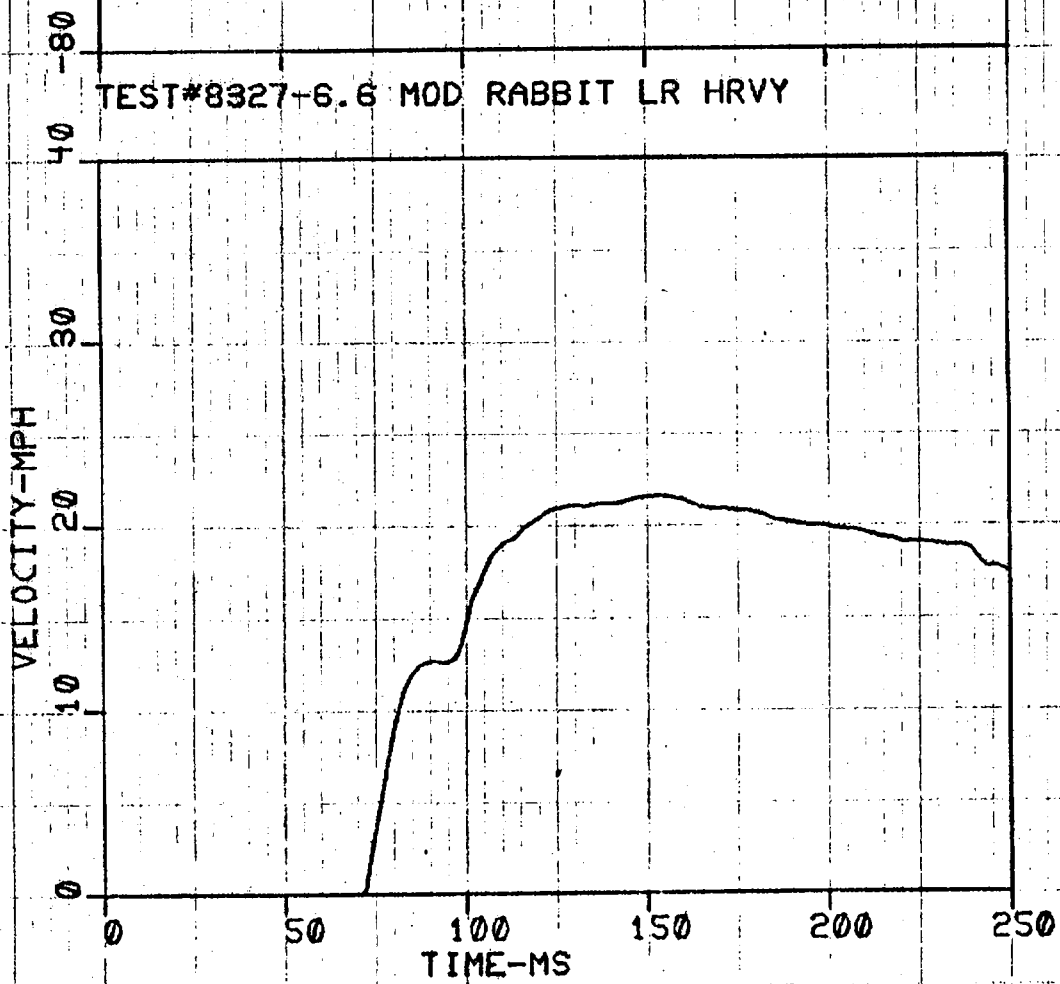


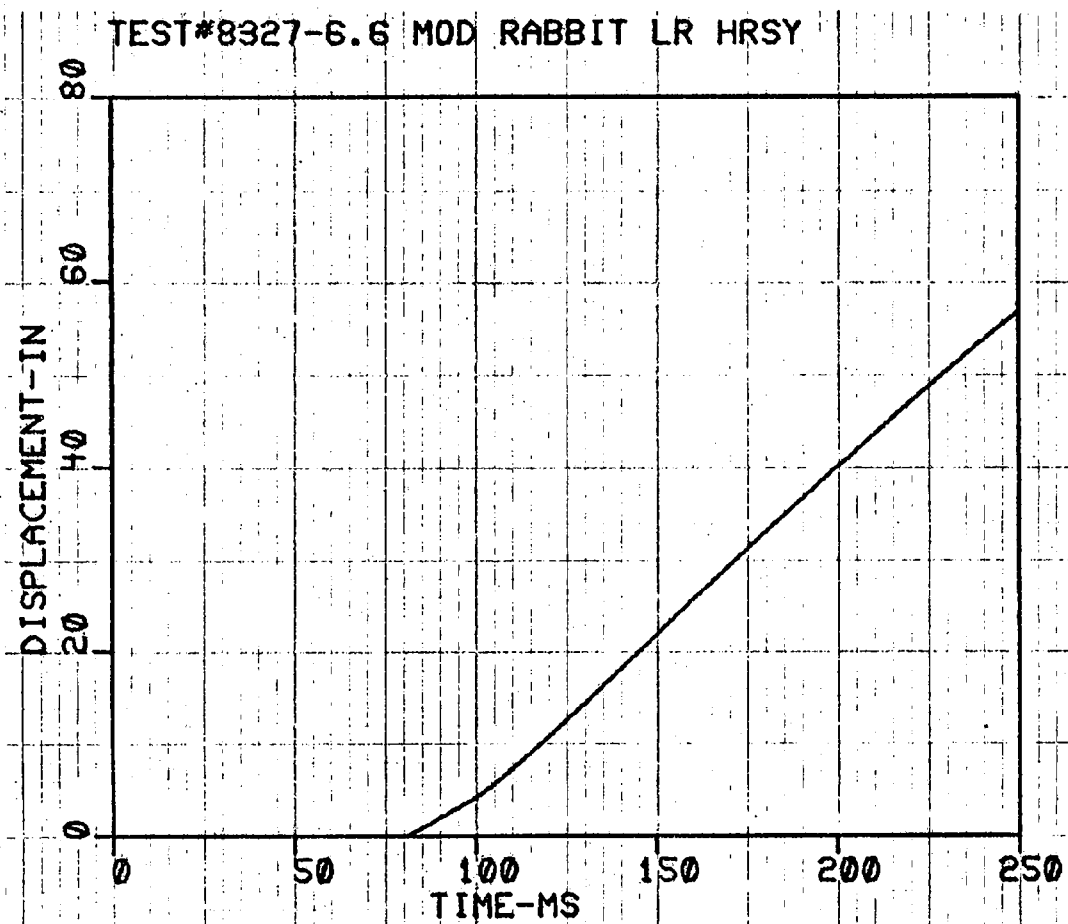


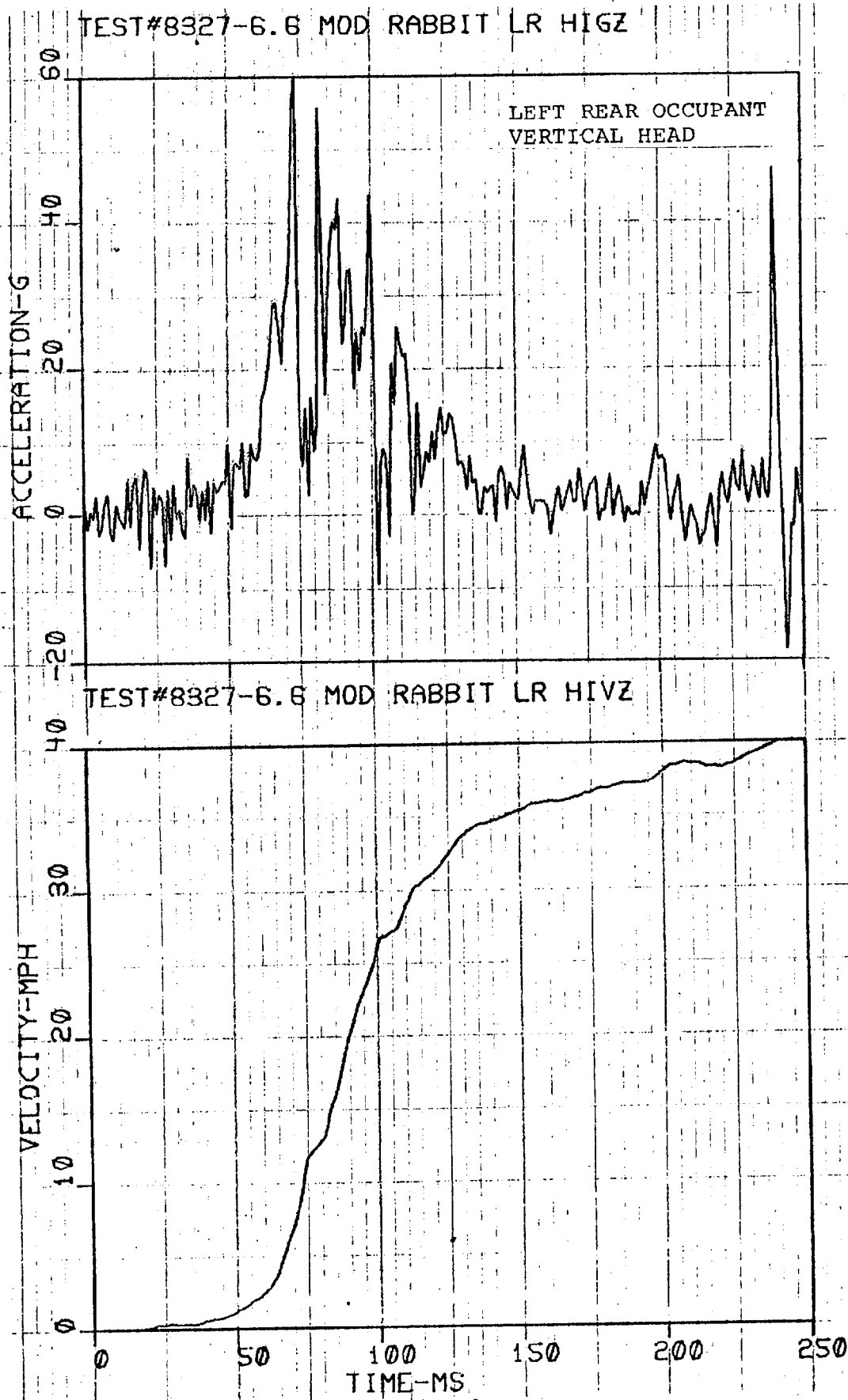
TEST#8327-6.6 MOD RABBIT LR HRGY

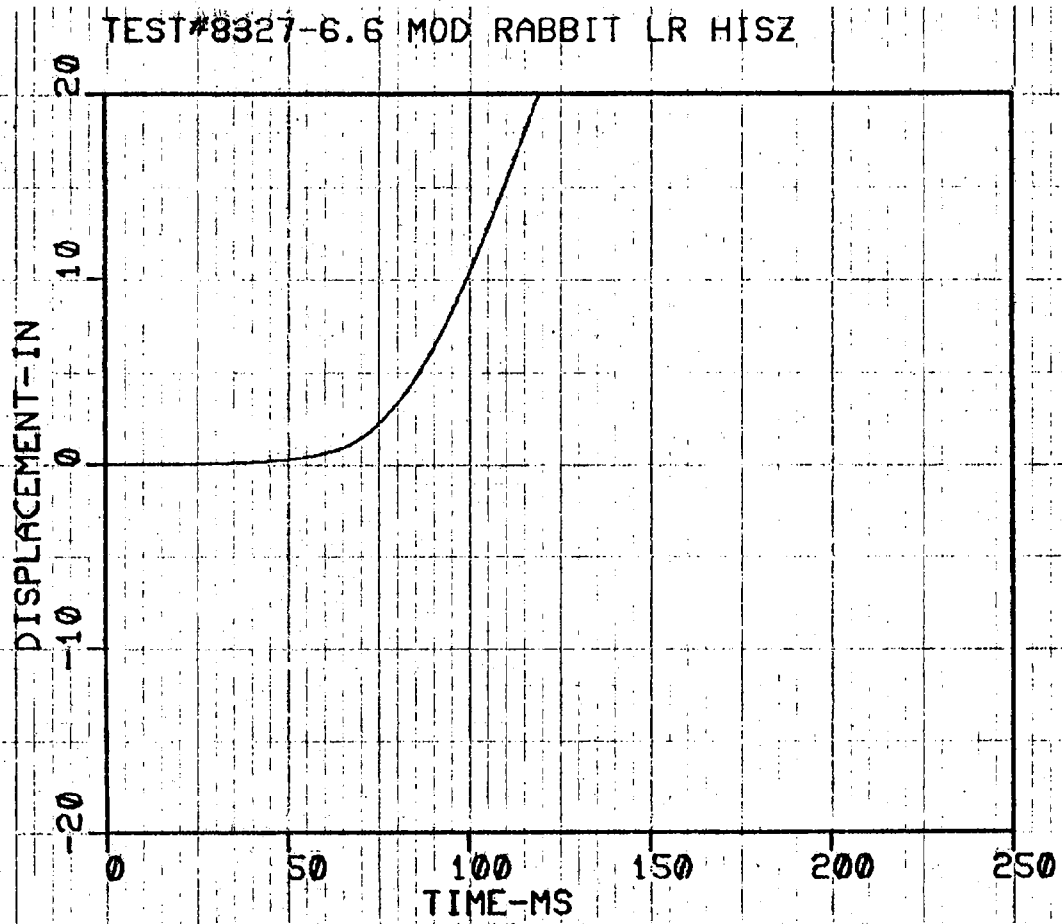


TEST#8327-6.6 MOD RABBIT LR HRVY

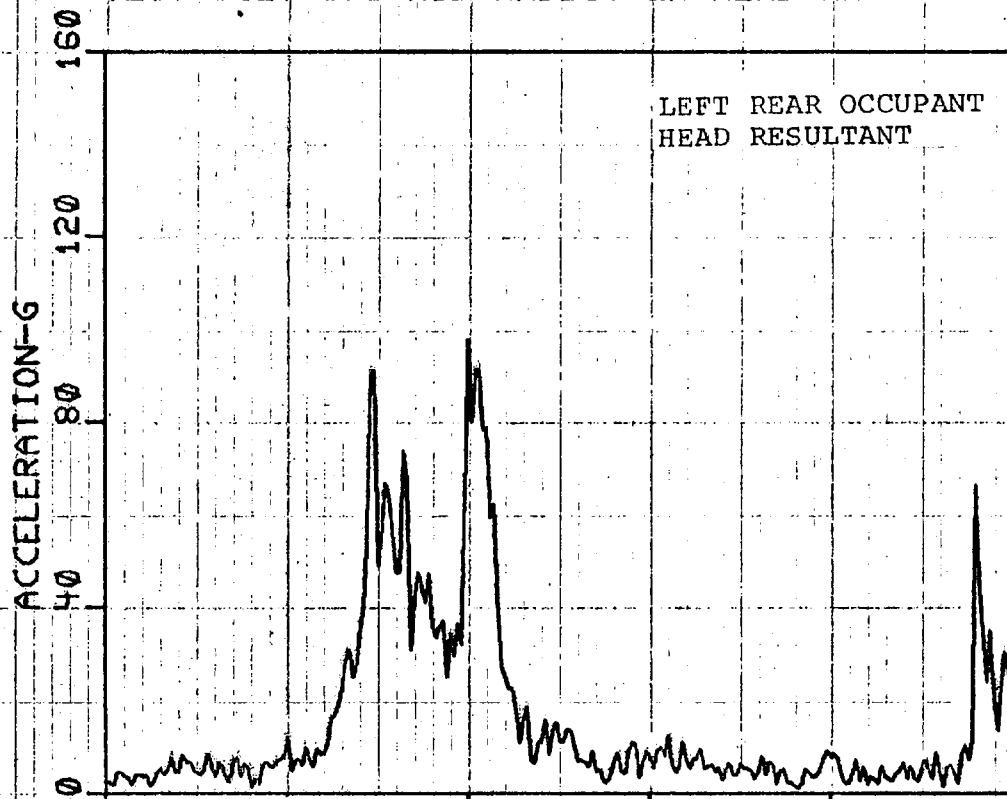




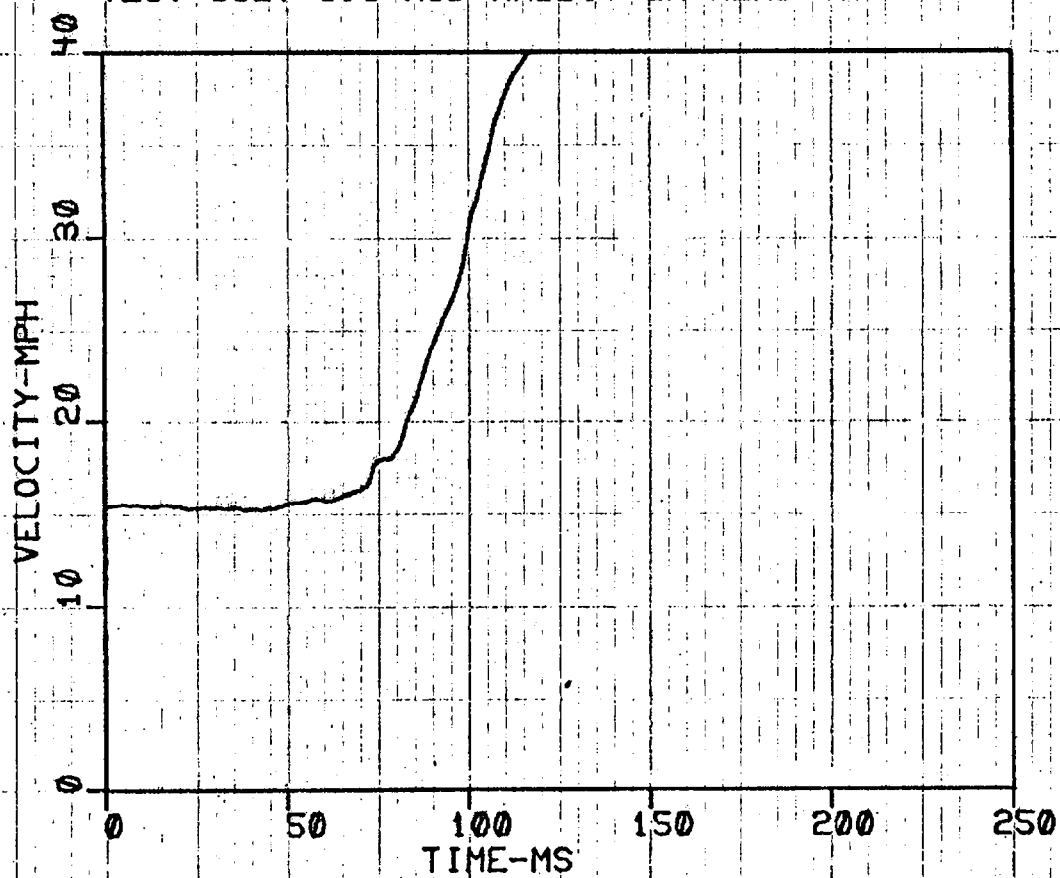


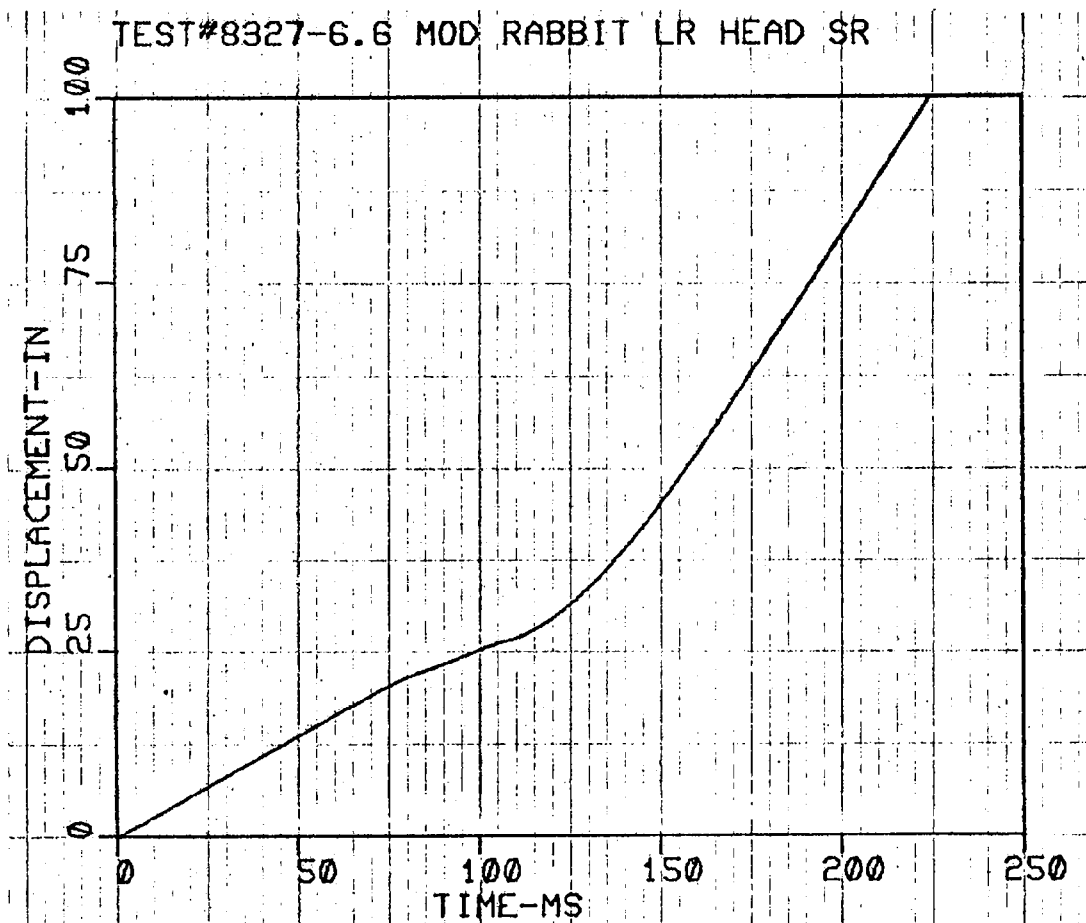


TEST#8327-6.6 MOD RABBIT LR HEAD AR

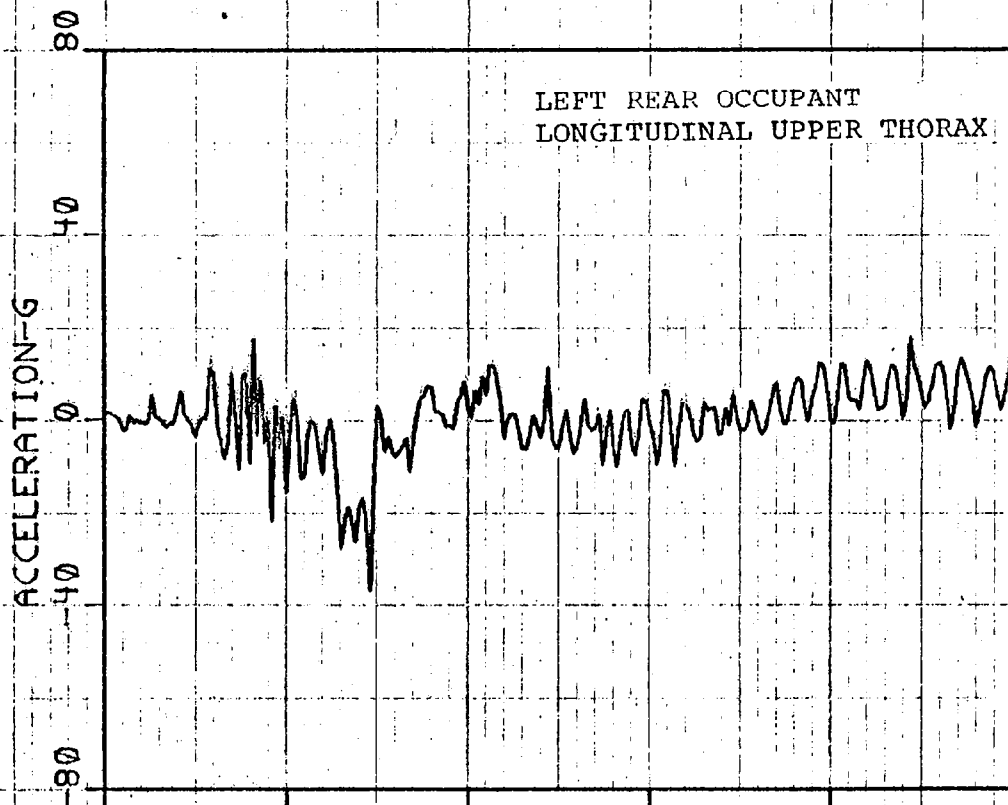


TEST#8327-6.6 MOD RABBIT LR HEAD VR

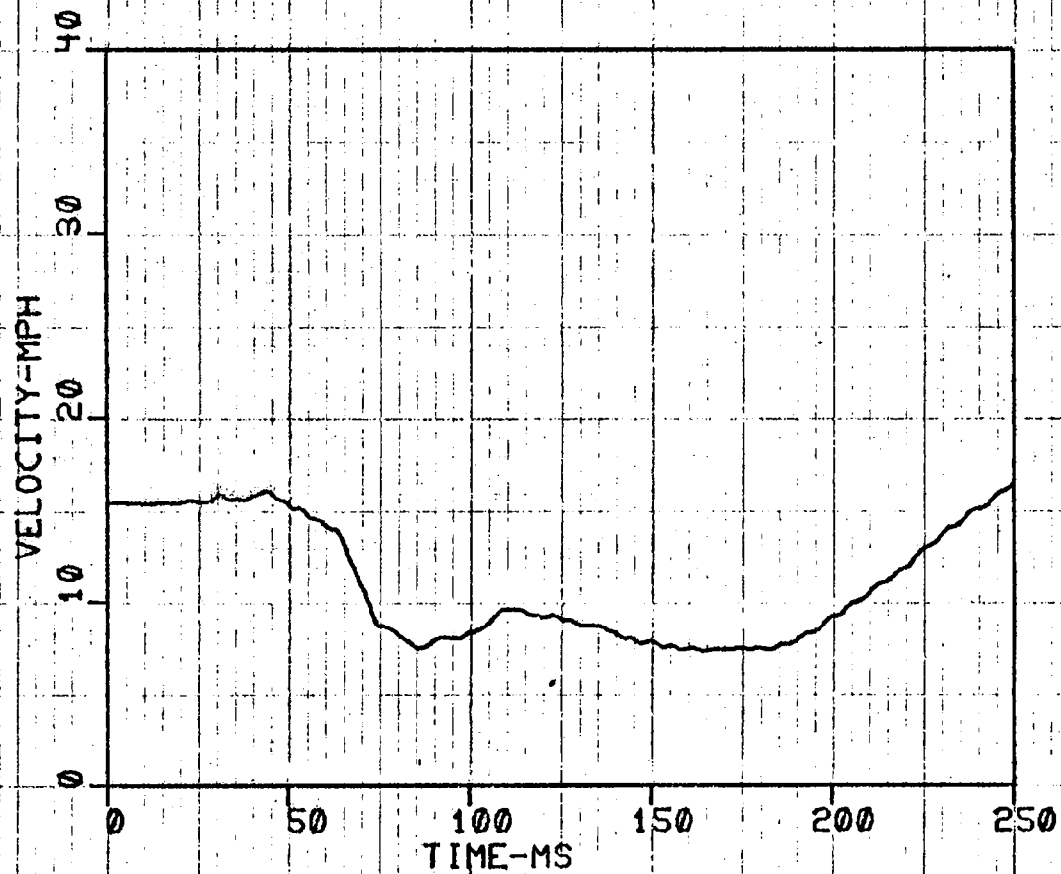


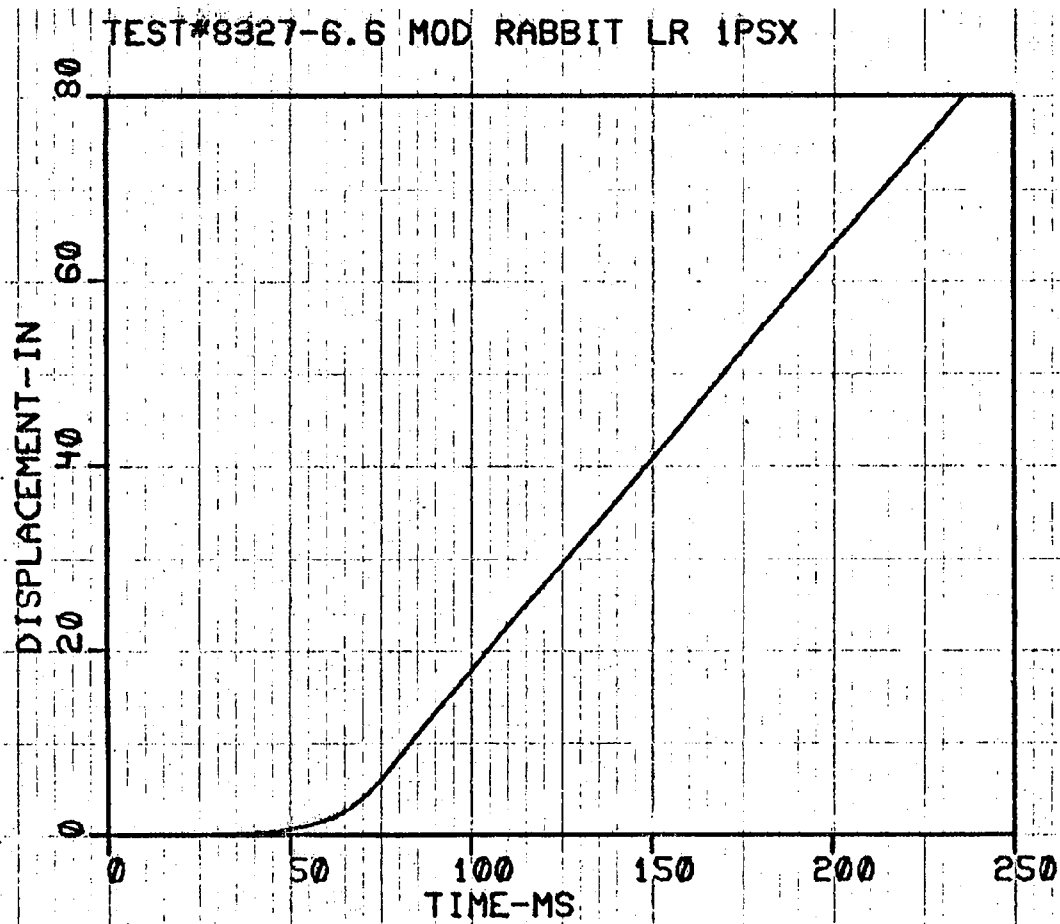


TEST#8327-6.6 MOD RABBIT LR 1PGX

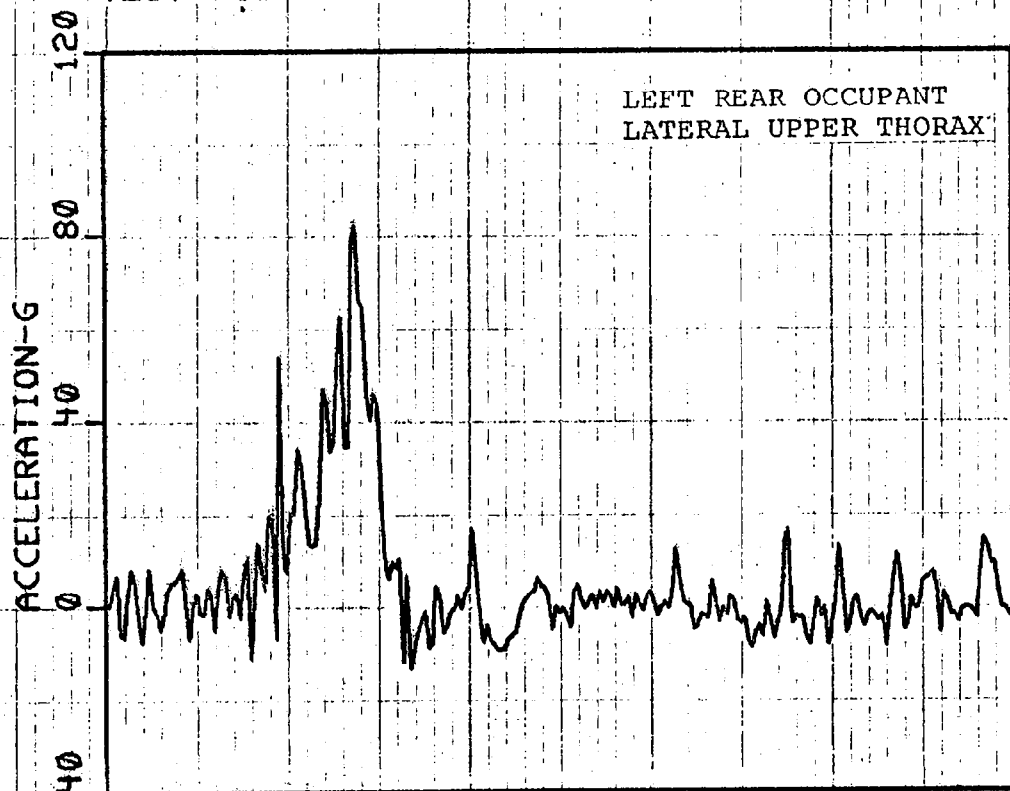


TEST#8327-6.6 MOD RABBIT LR 1PVX

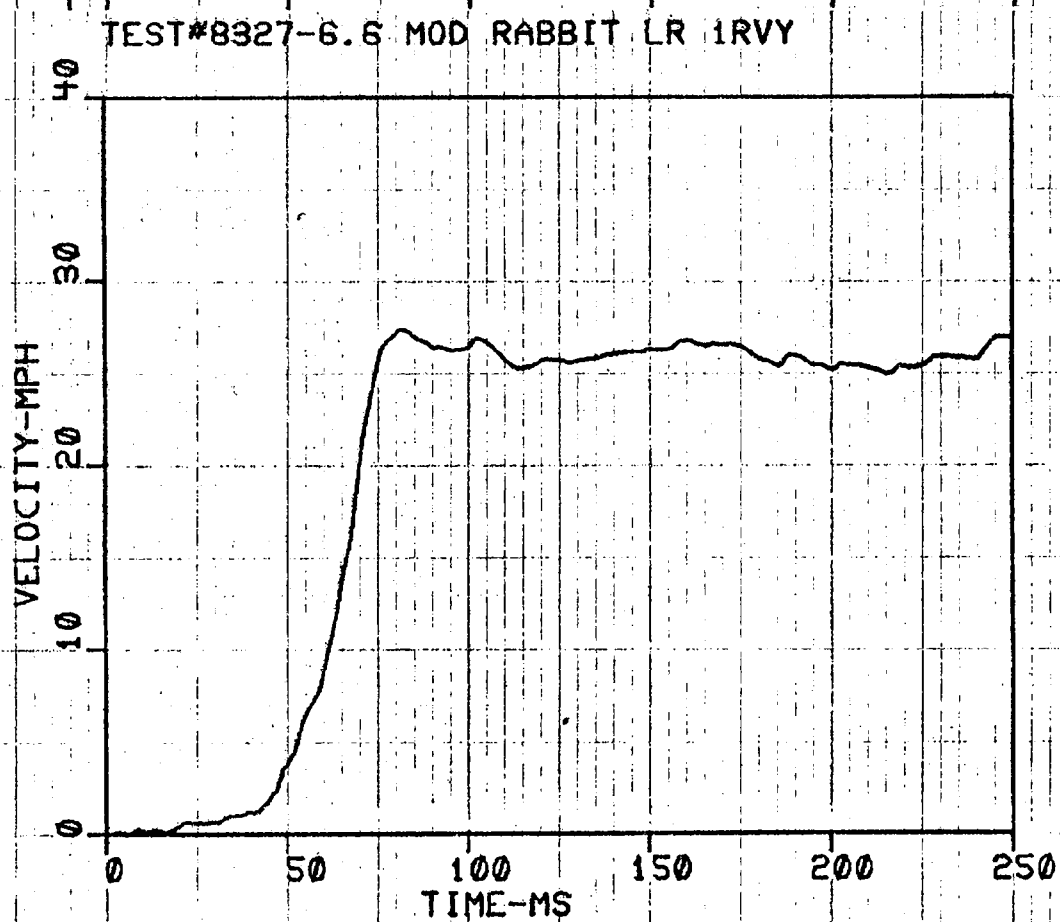


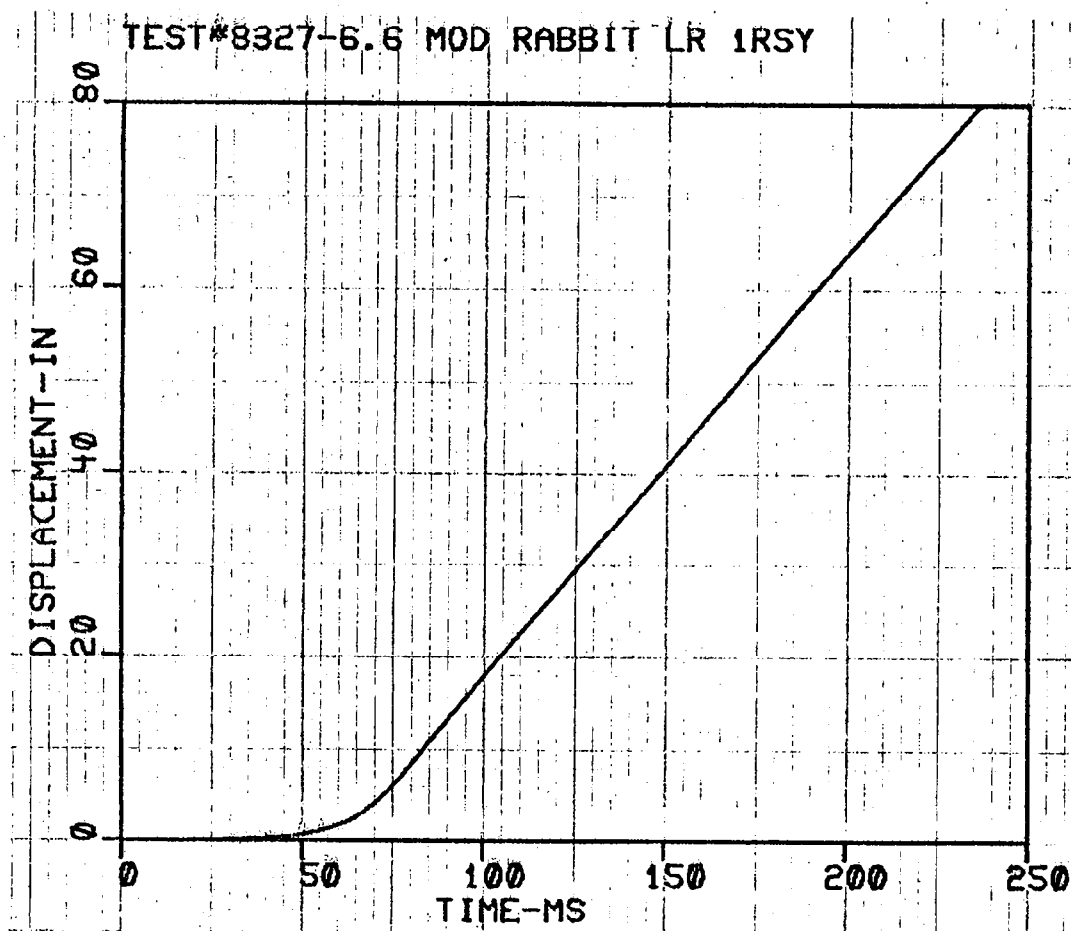


TEST#8327-6.6 MOD RABBIT LR 1RGY

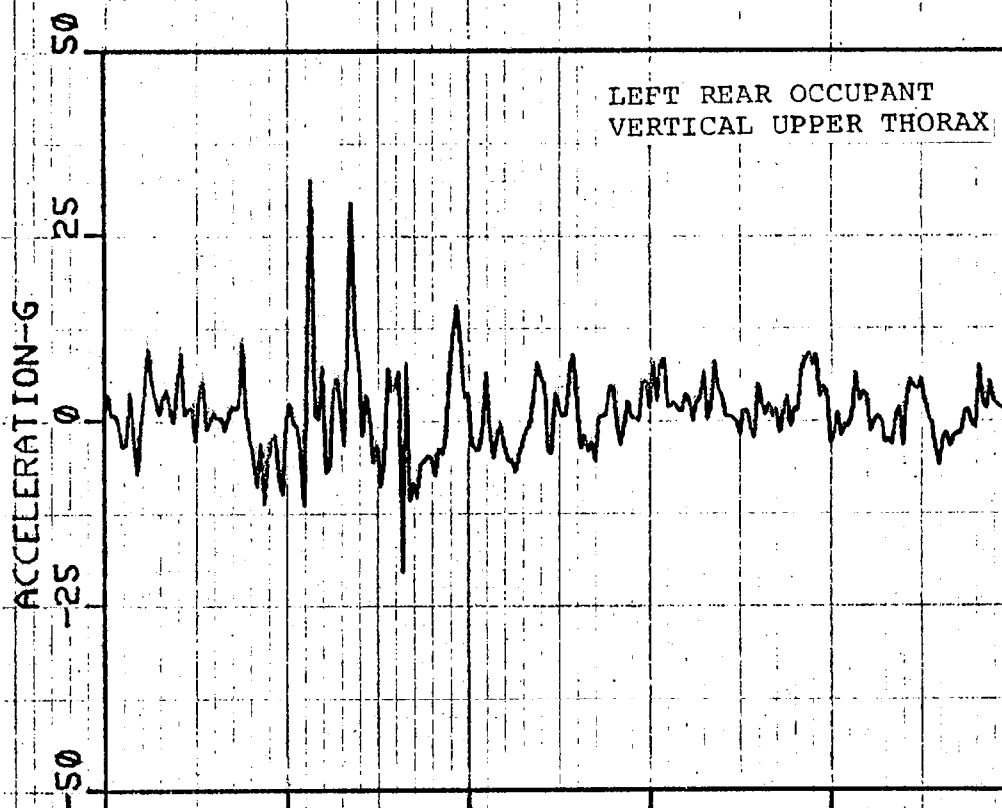


TEST#8327-6.6 MOD RABBIT LR 1RVY

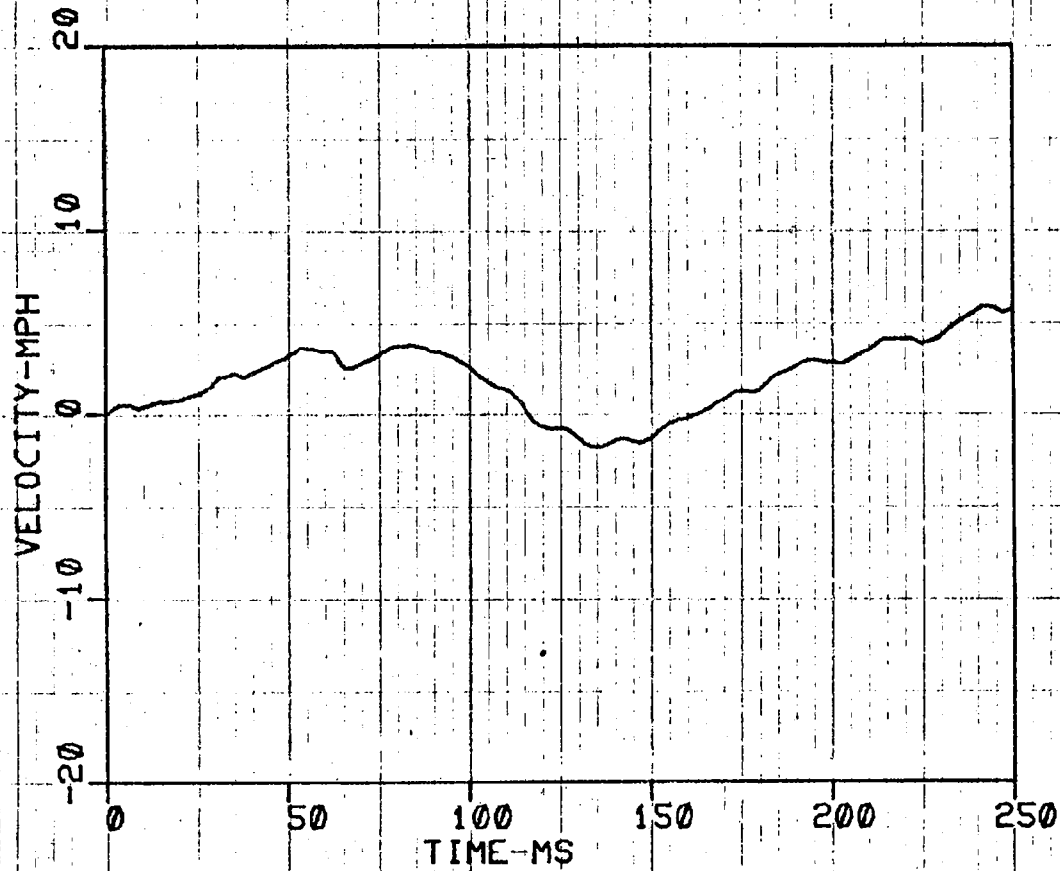


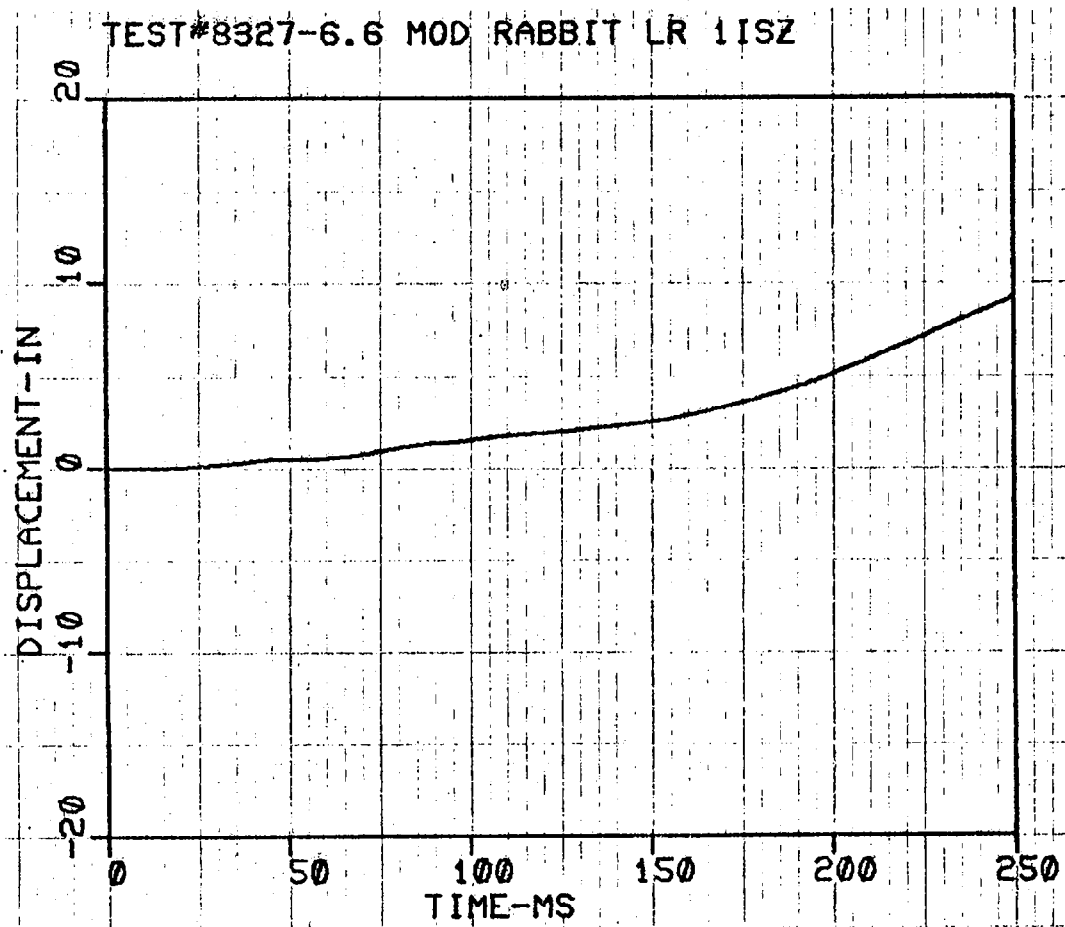


TEST#8327-6.6 MOD RABBIT LR 1IGZ

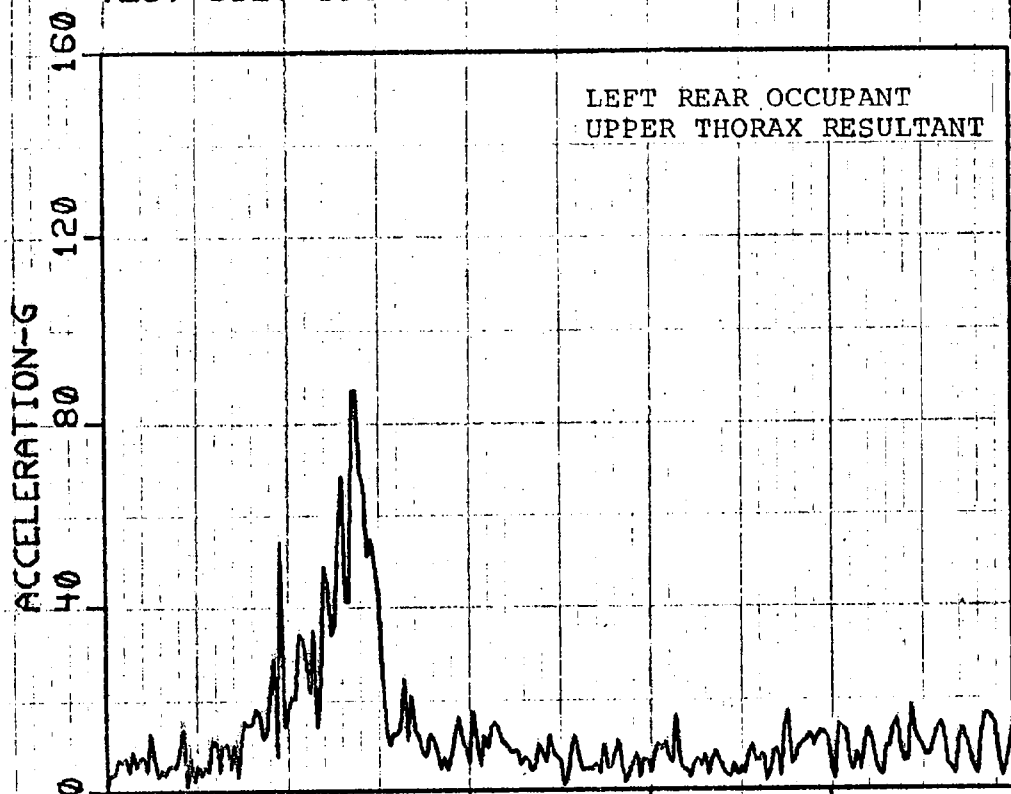


TEST#8327-6.6 MOD RABBIT LF 1IVZ

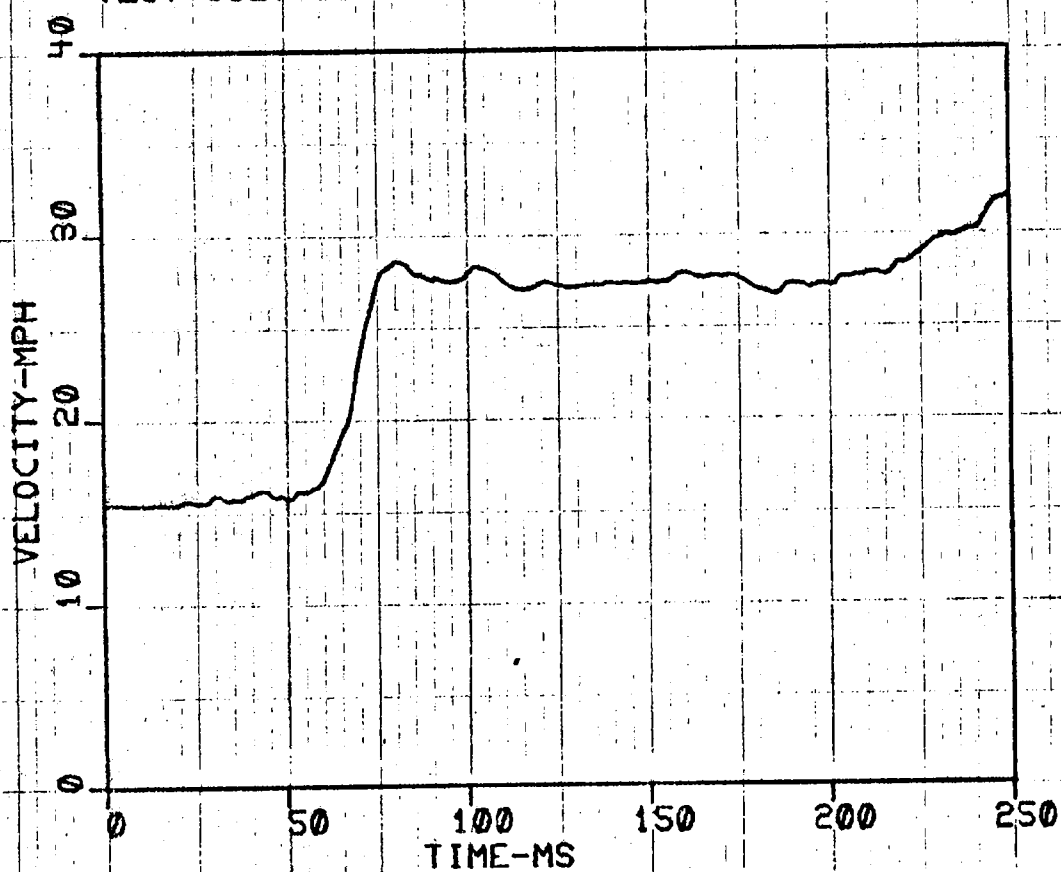


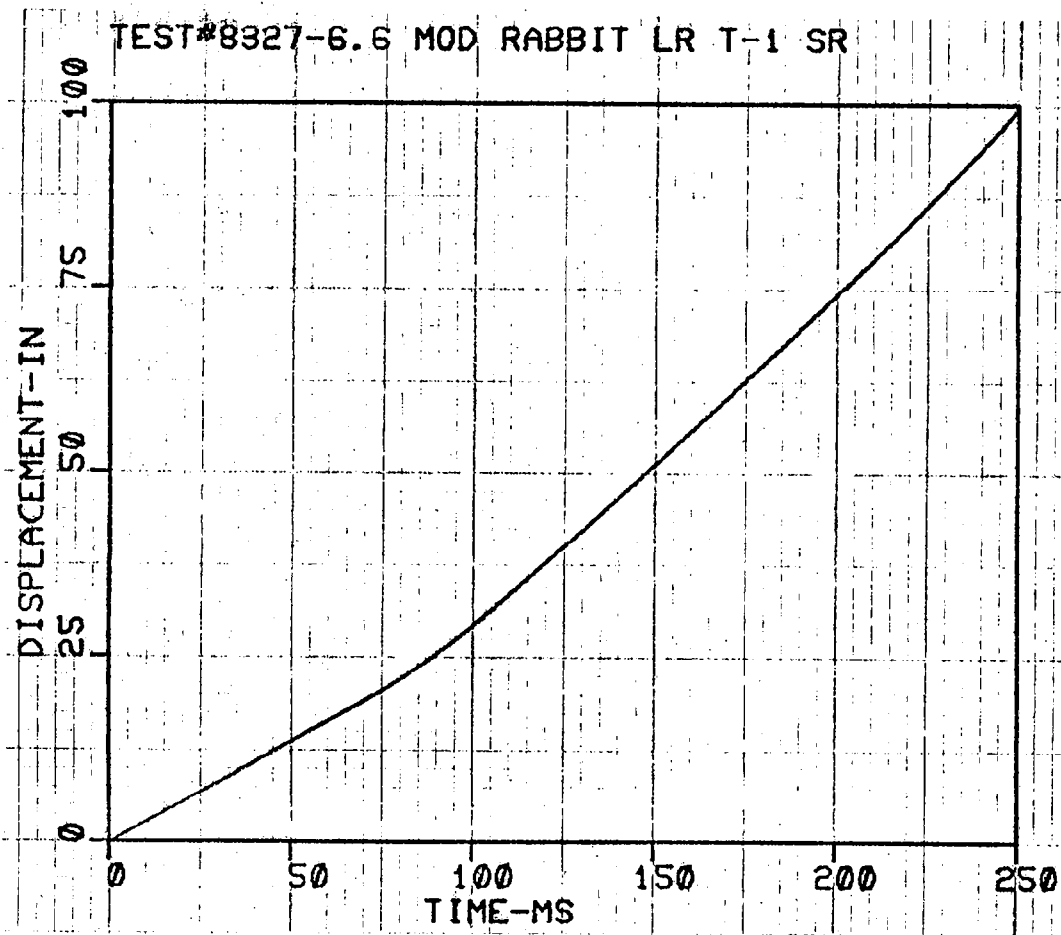


TEST#8327-6.6 MOD RABBIT LR T-1 AR

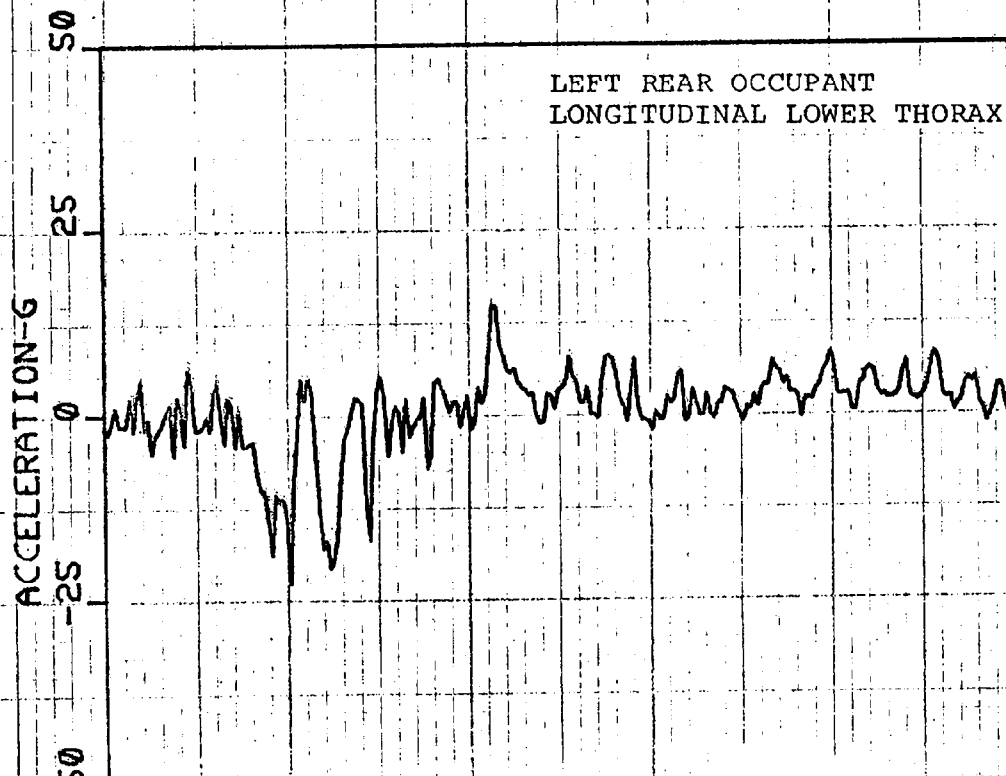


TEST#8327-6.6 MOD RABBIT LR T-1 VR

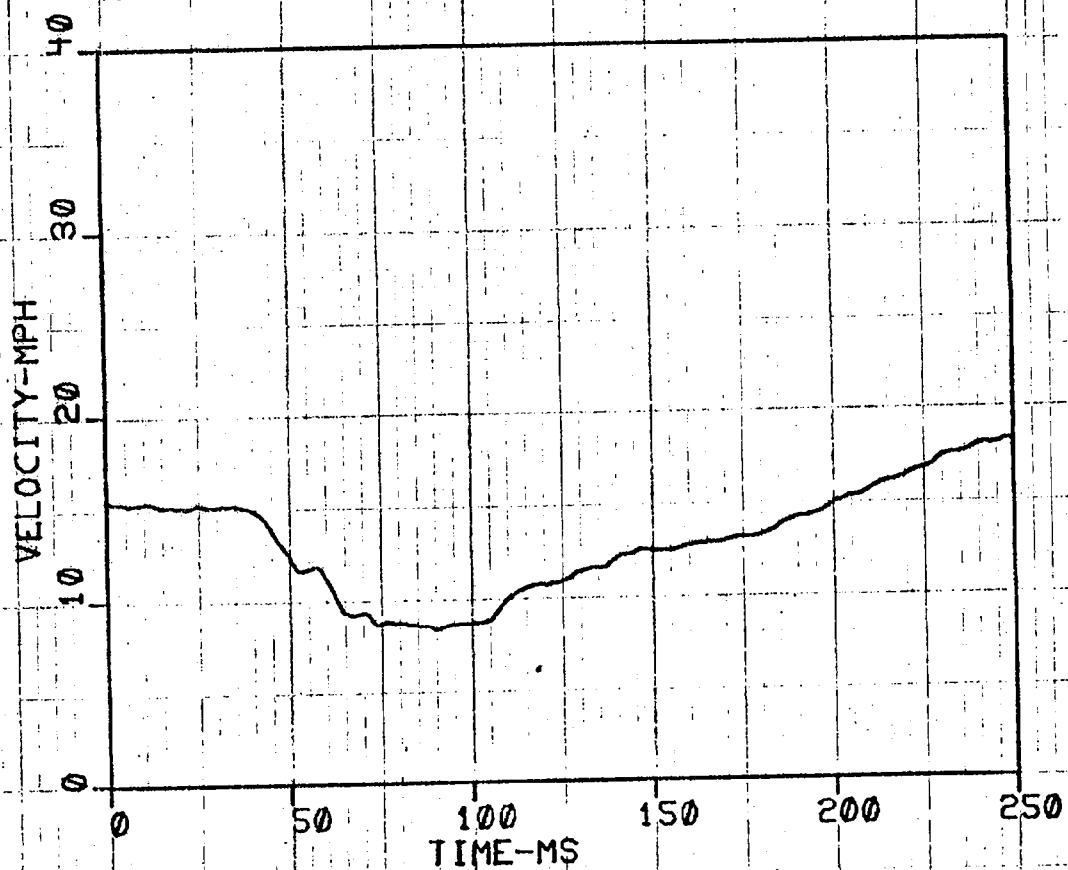


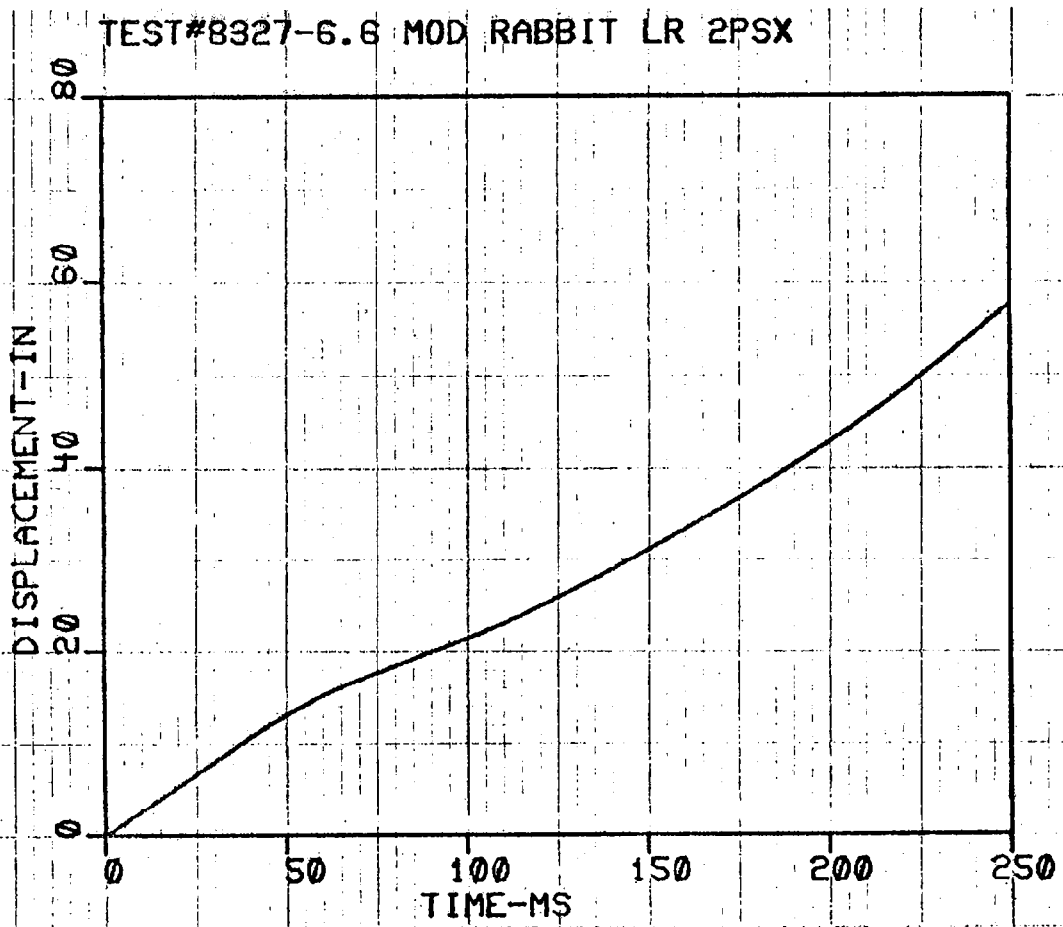


TEST#8327-6.6 MOD RABBIT LR 2PGX

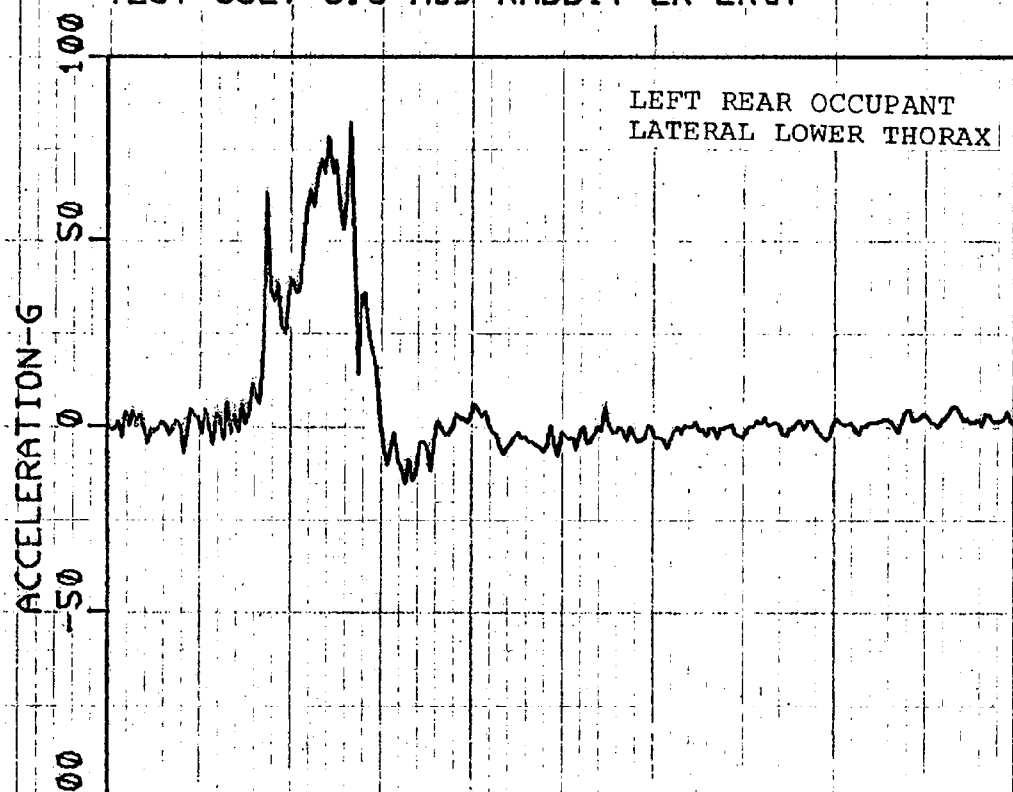


TEST#8327-6.6 MOD RABBIT LR 2PVX

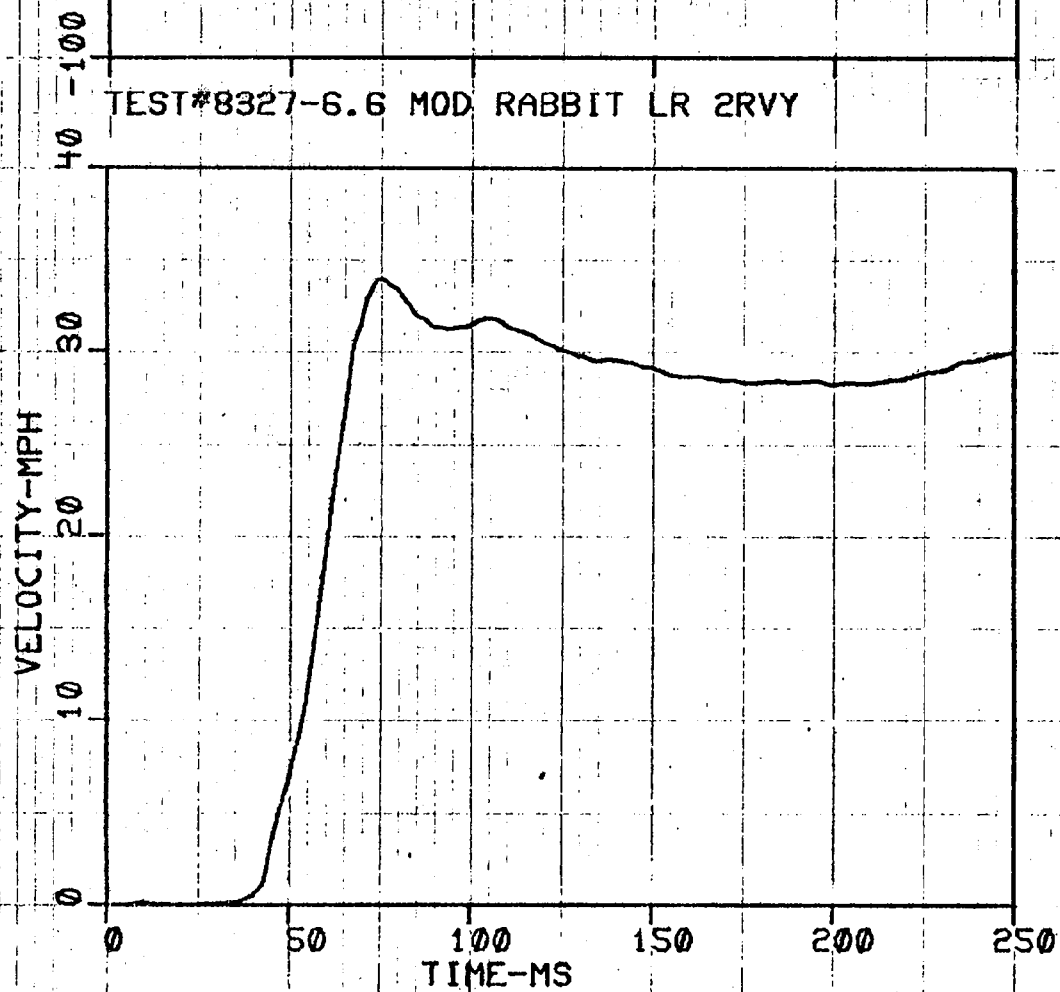


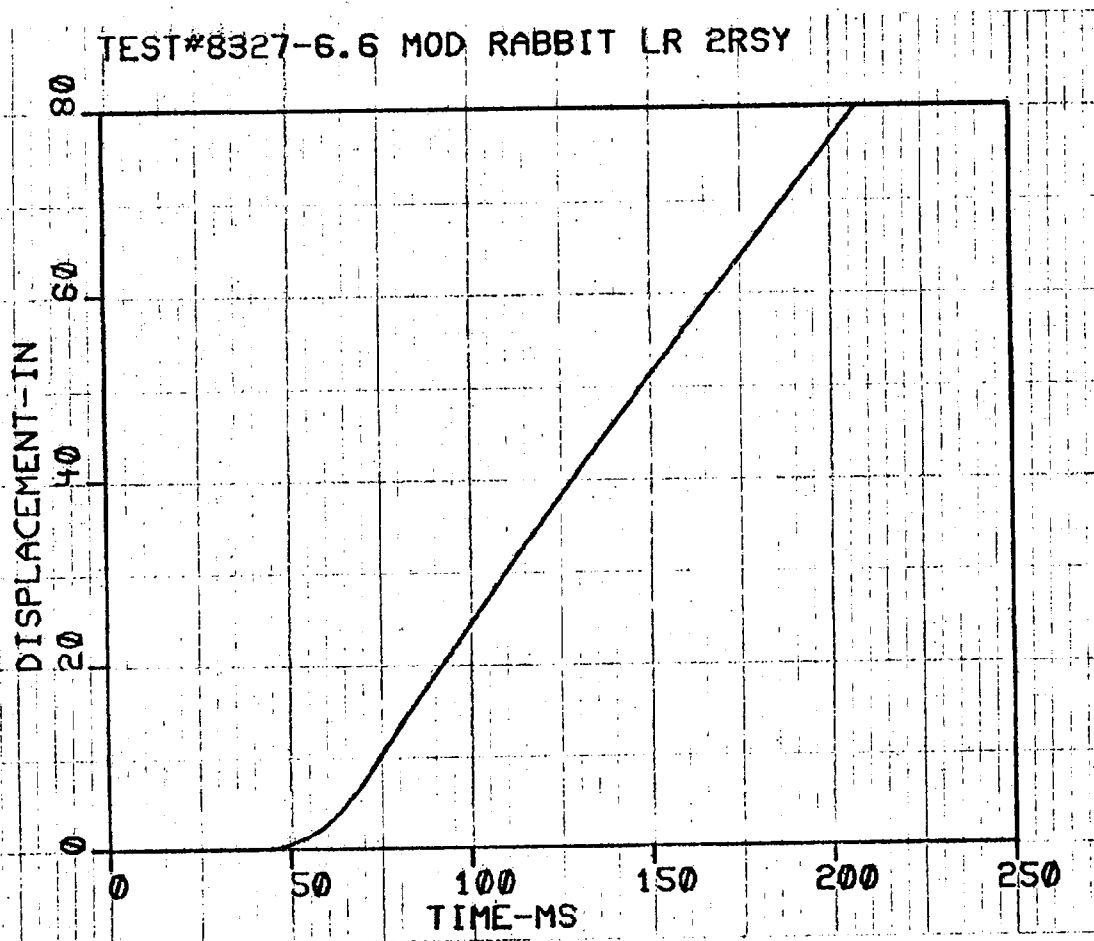


TEST#8327-6.6 MOD RABBIT LR 2RGY

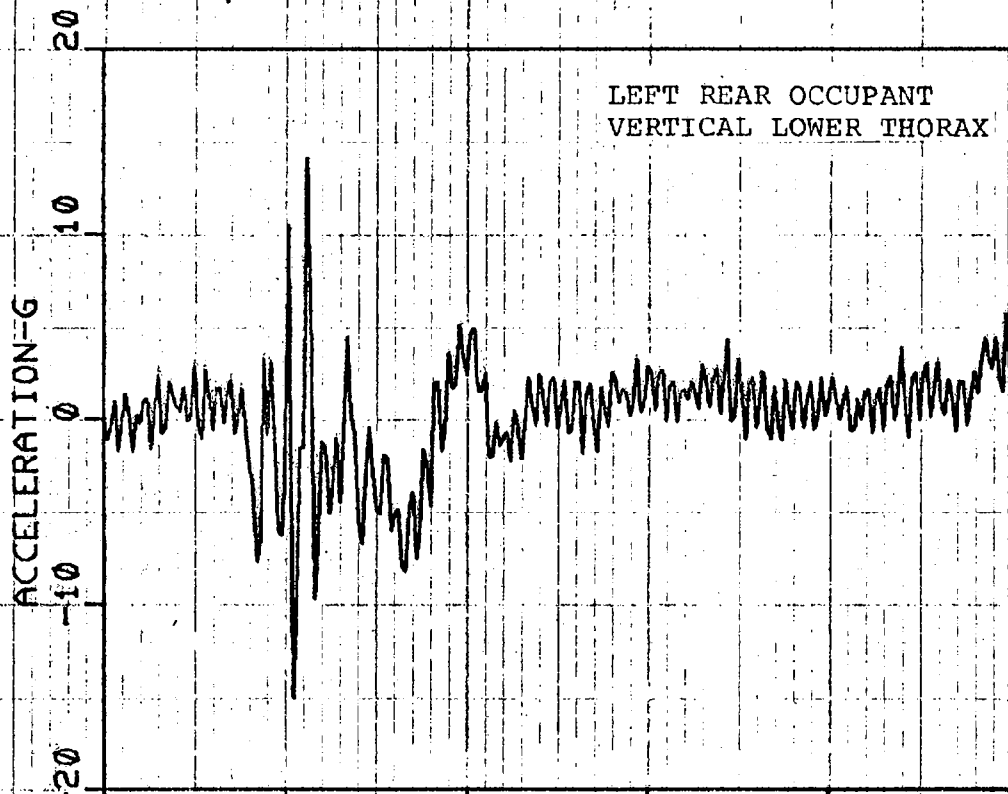


TEST#8327-6.6 MOD RABBIT LR 2RVY

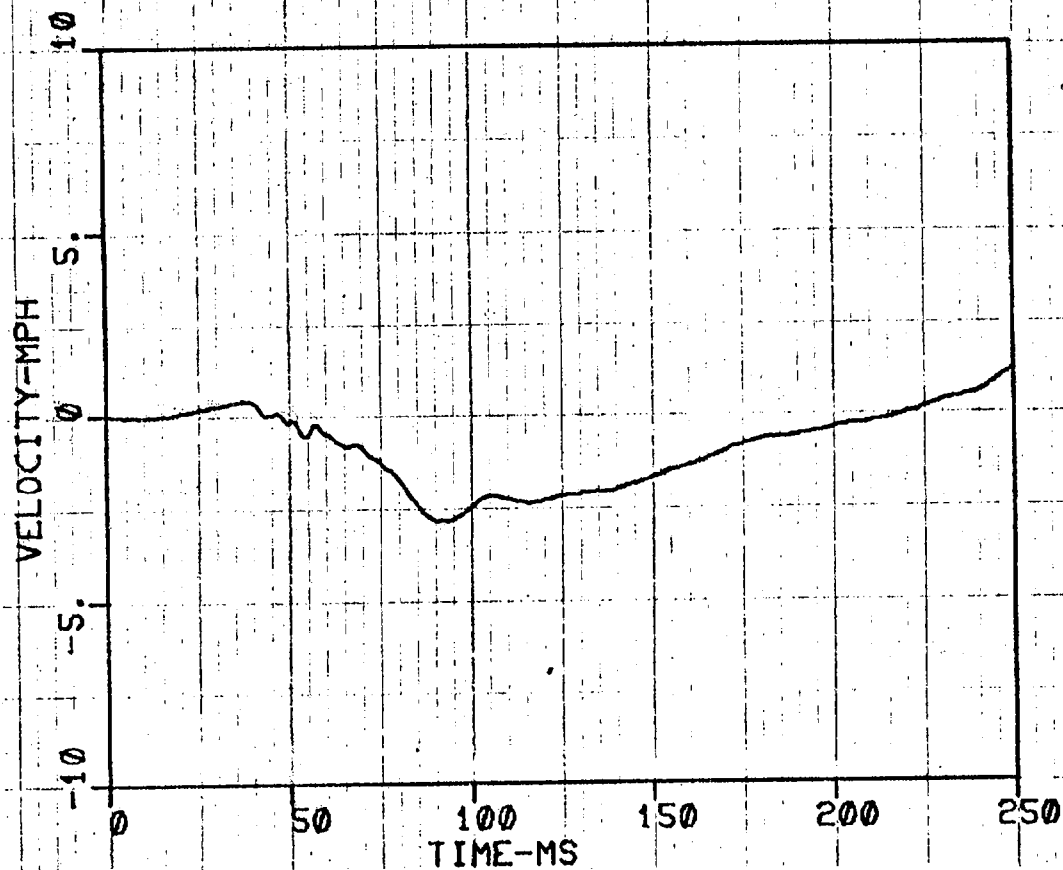


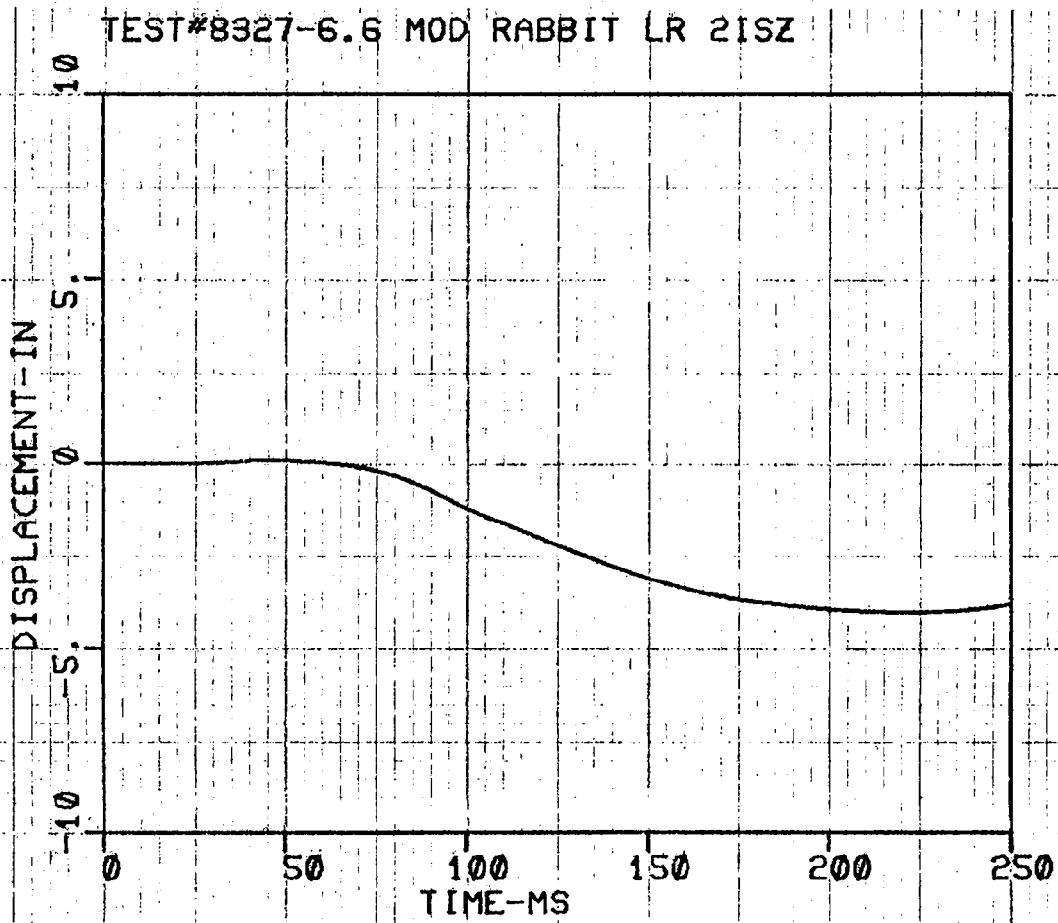


TEST#8327-6.6 MOD RABBIT LR 2IGZ

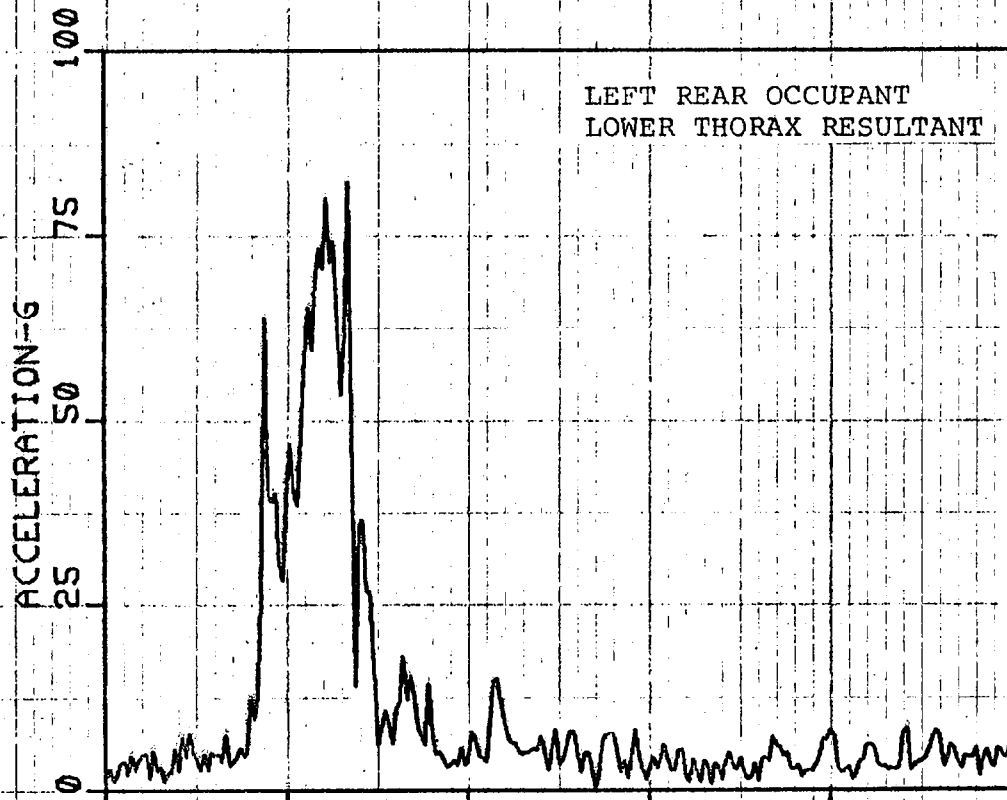


TEST#8327-6.6 MOD RABBIT LR 2IVZ

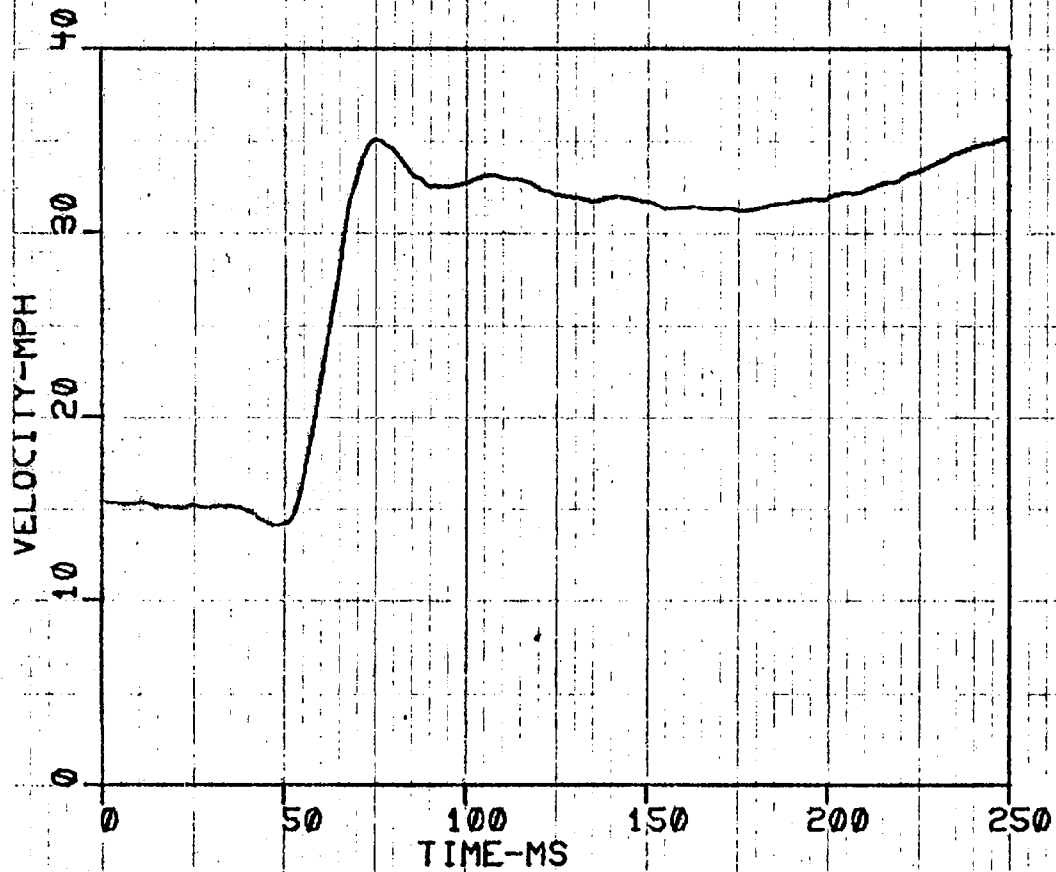


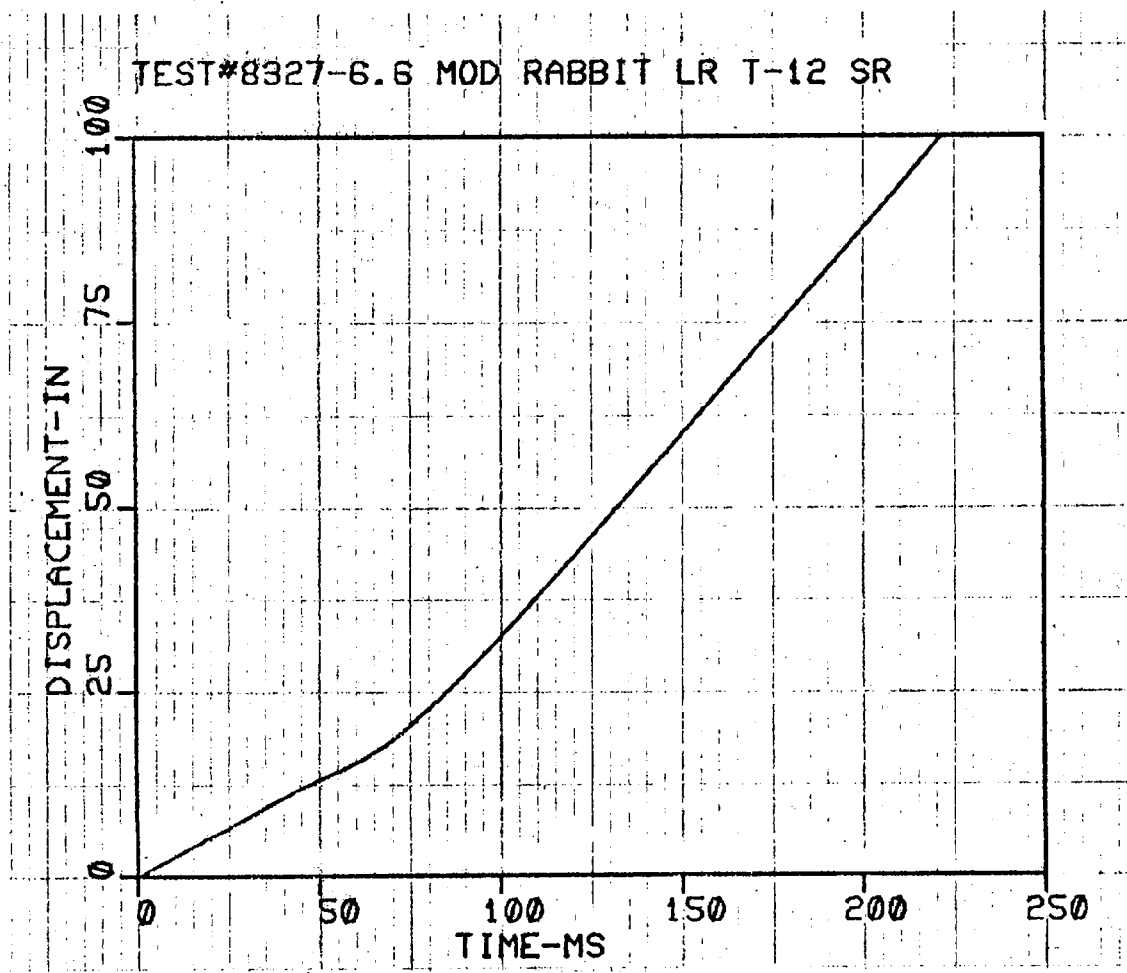


TEST#8327-6.6 MOD RABBIT LR T-12 AR

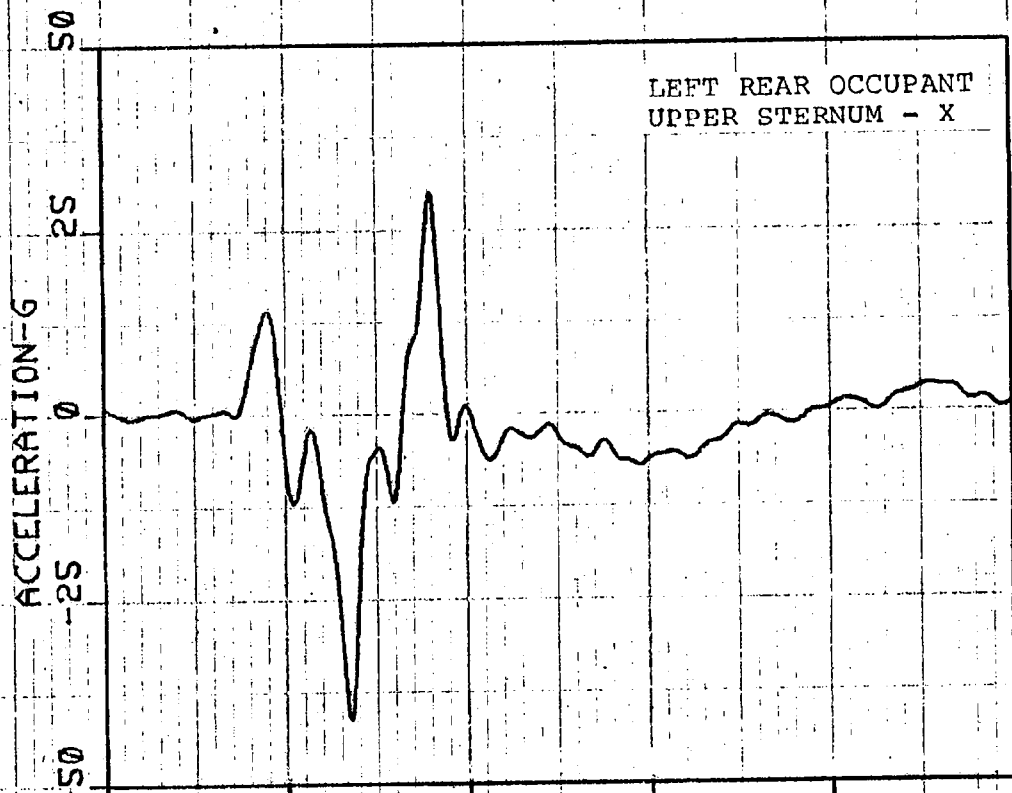


TEST#8327-6.6 MOD RABBIT LR T-12 VR

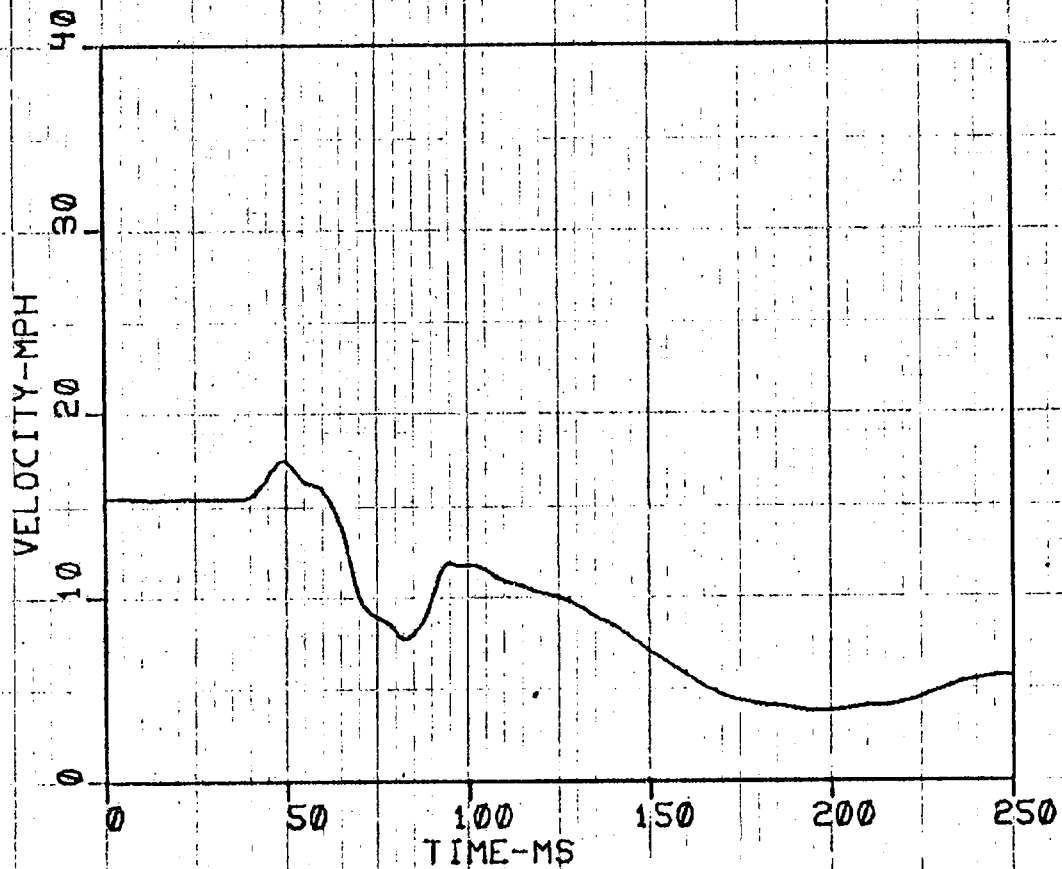


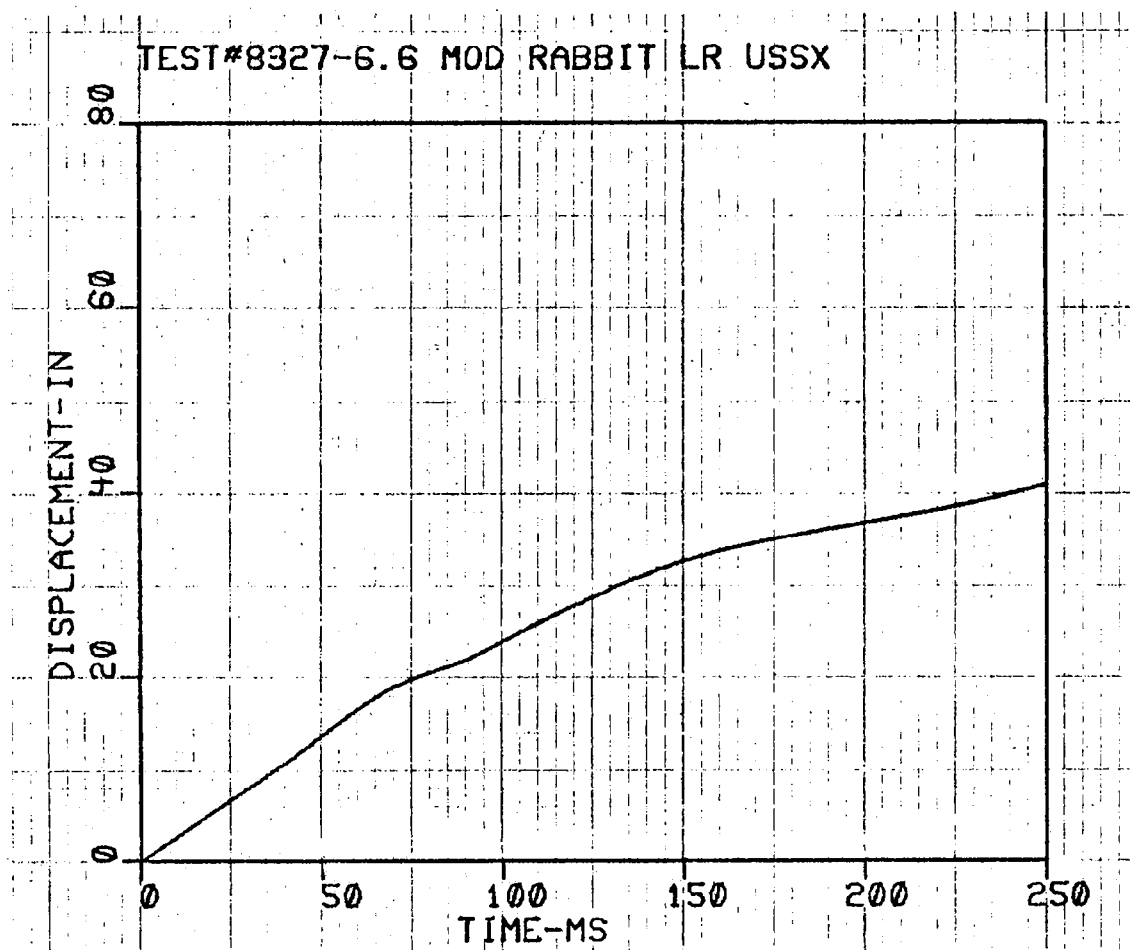


TEST#8327-6.6 MOD RABBIT LR USGX

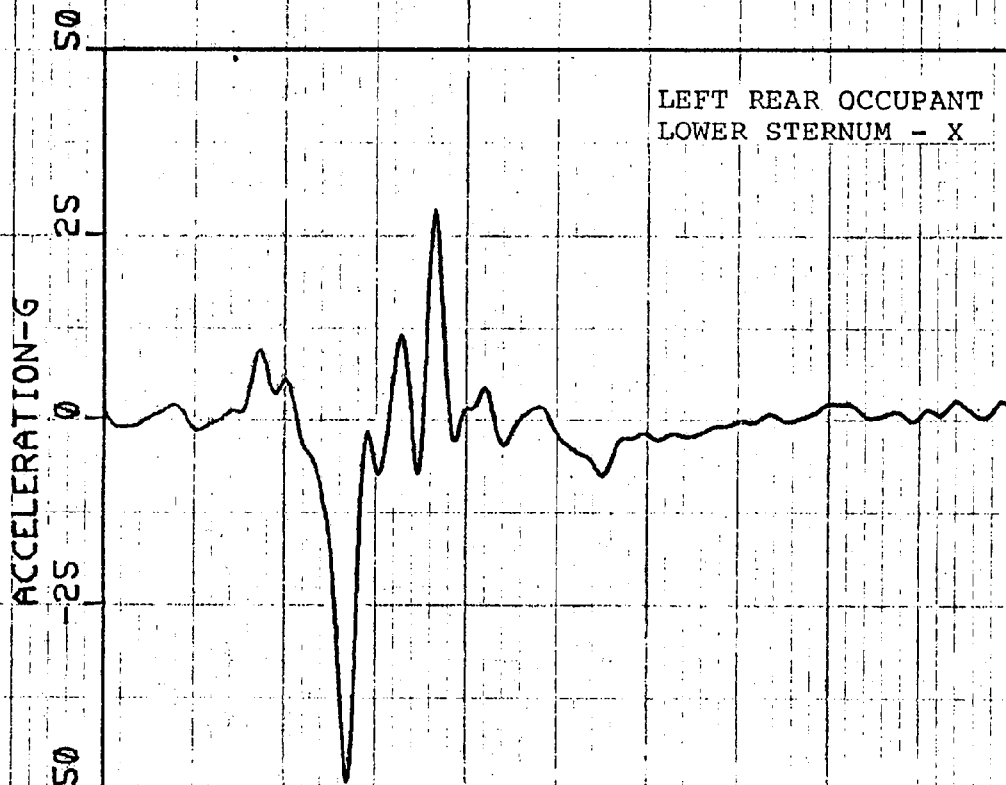


TEST#8327-6.6 MOD RABBIT LR USVX

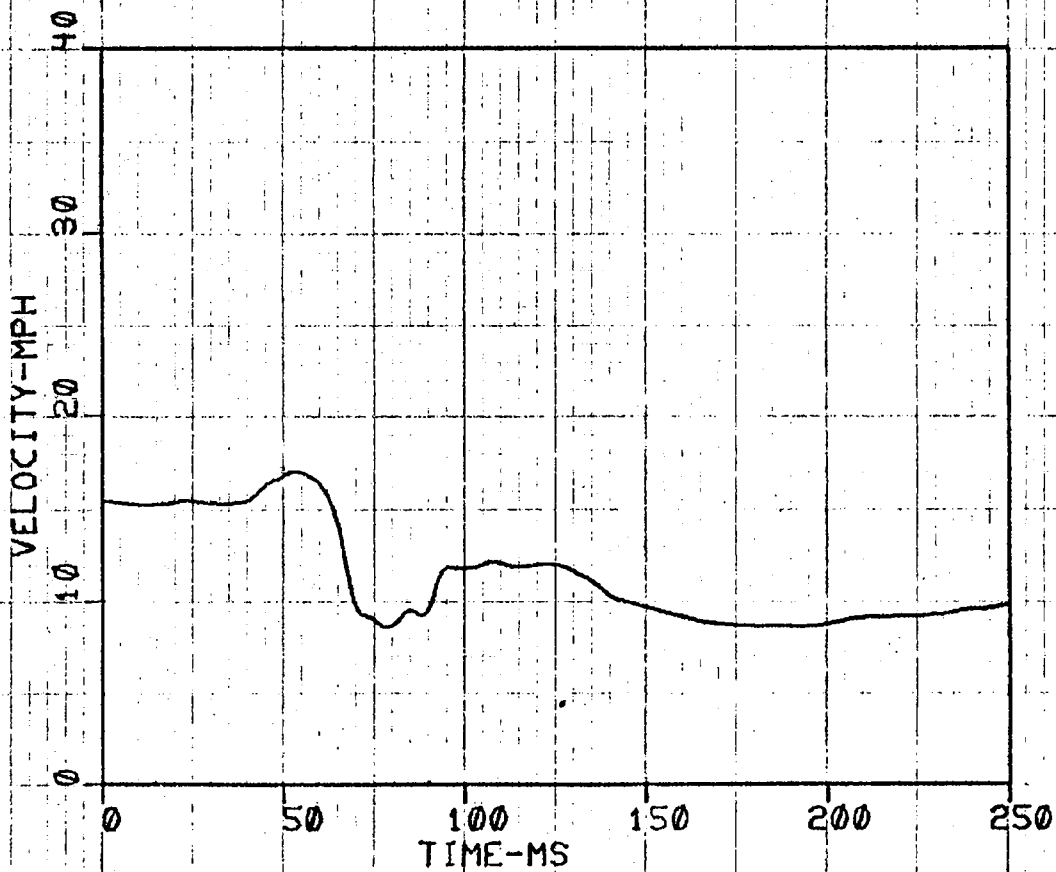


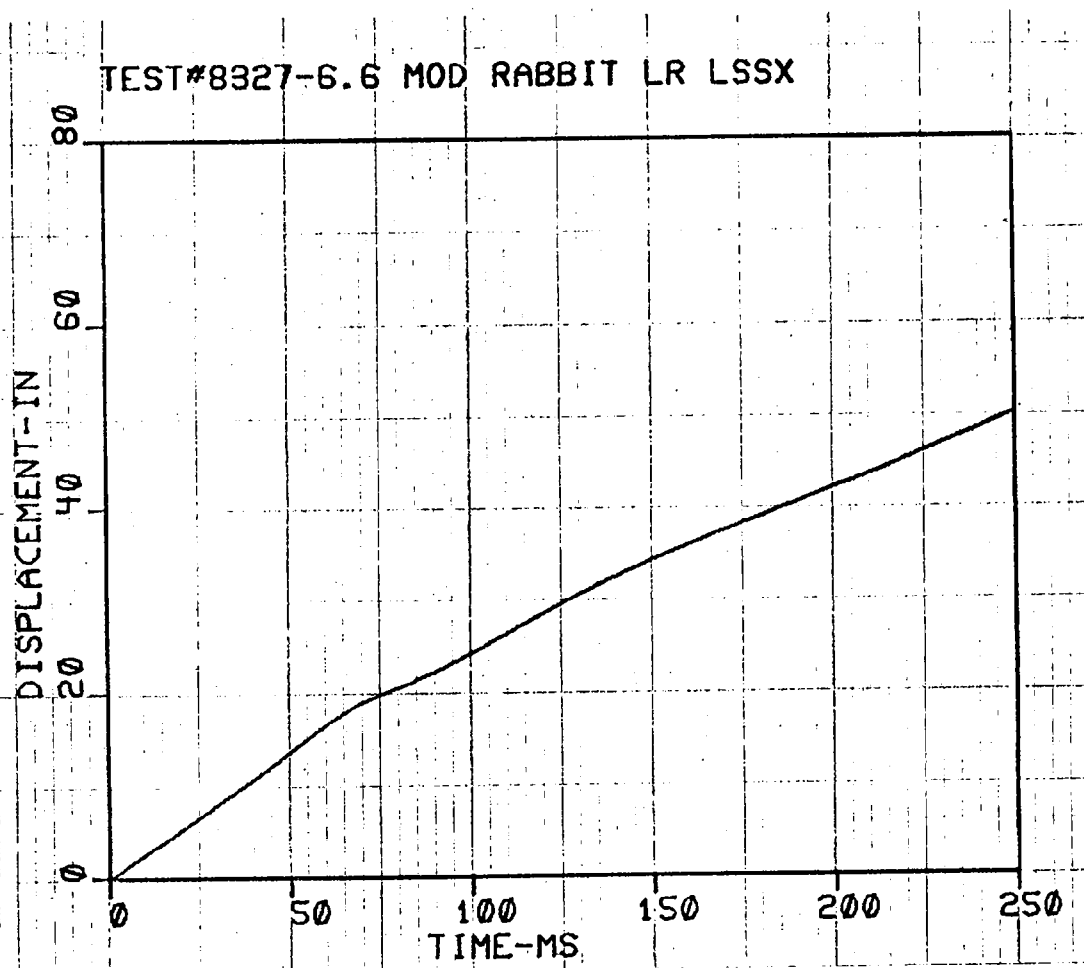


TEST#8327-6.6 MOD RABBIT LR LSGX

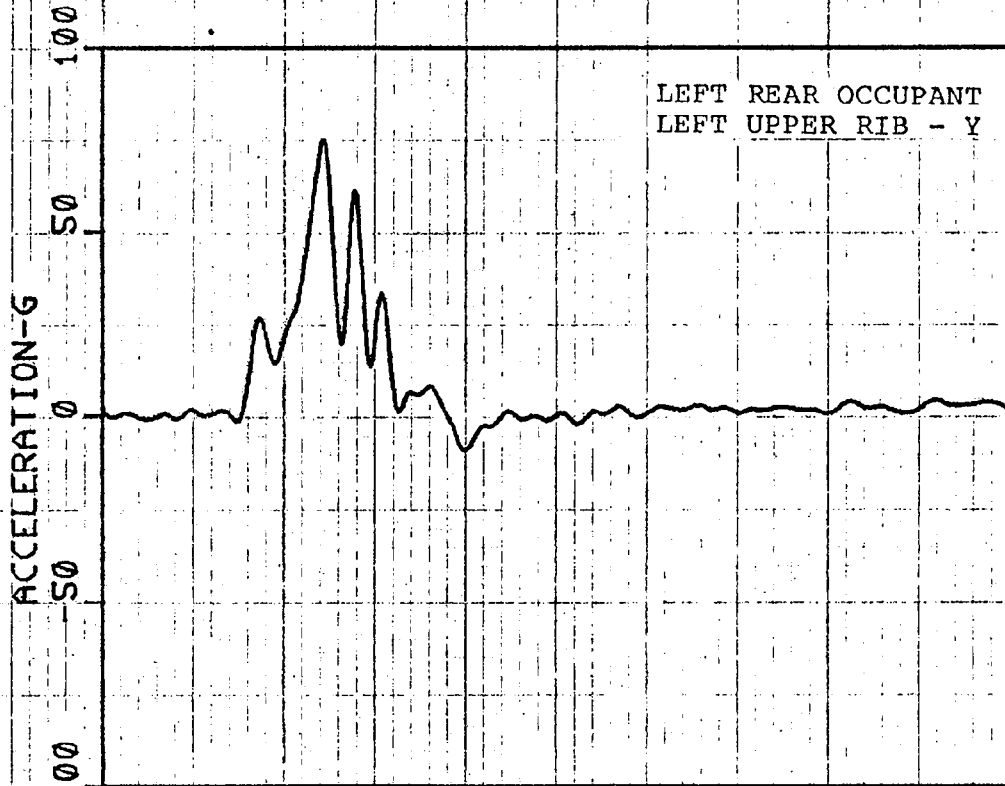


TEST#8327-6.6 MOD RABBIT LR LSVX

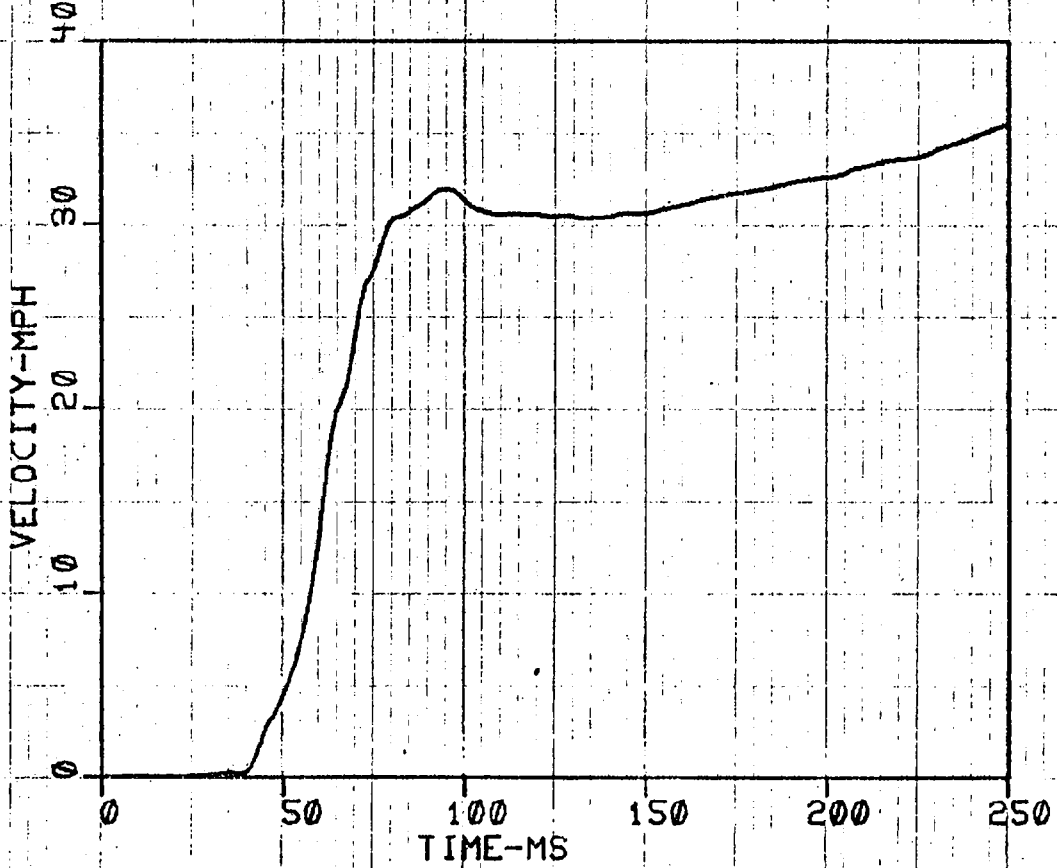


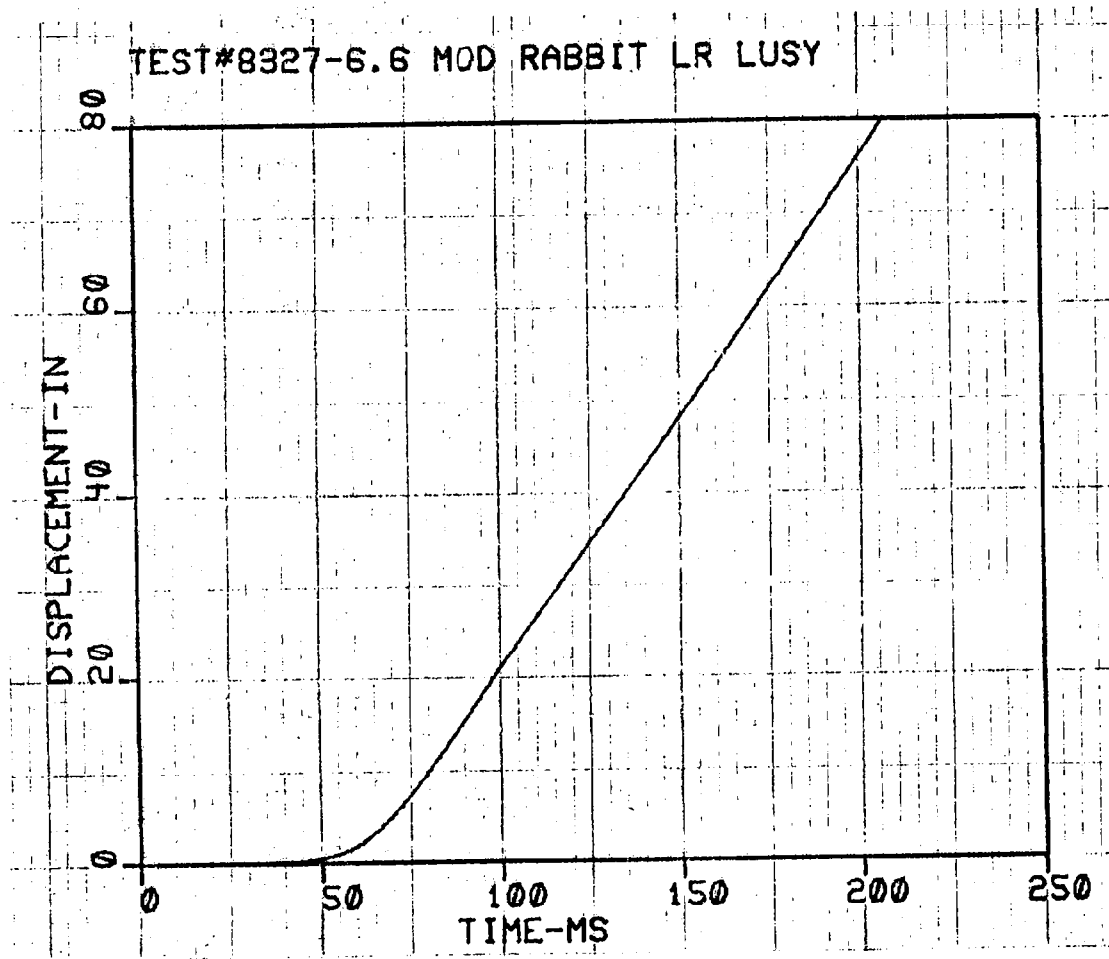


TEST#8327-6.6 MOD RABBIT LR LUGY

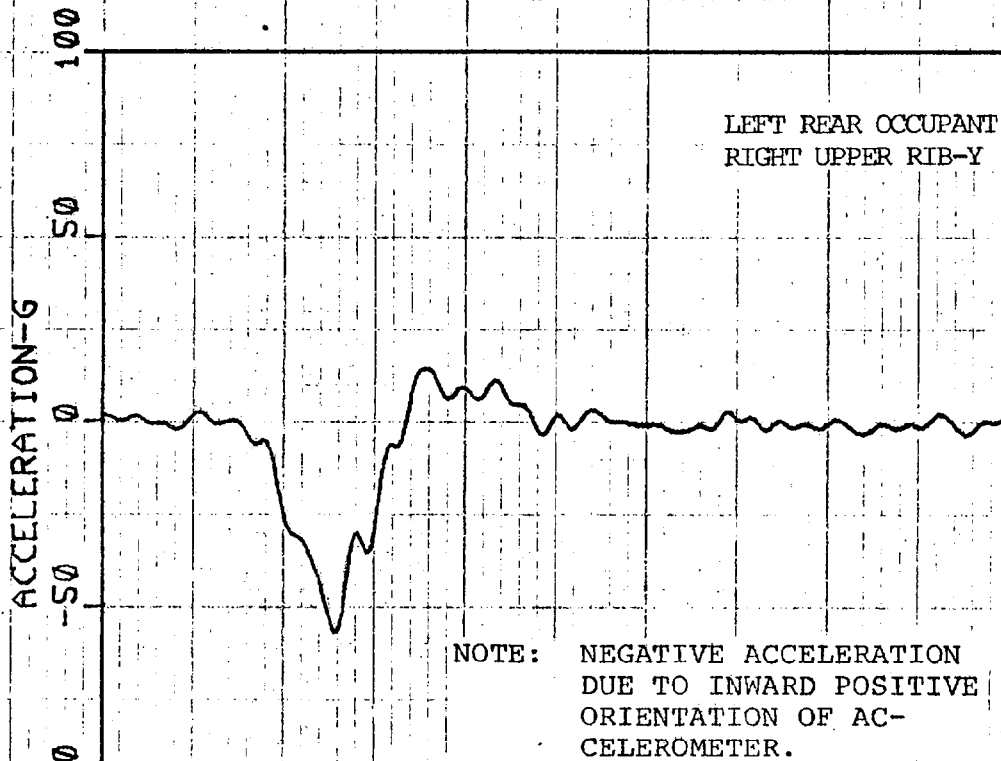


TEST#8327-6.6 MOD RABBIT LR LUVY

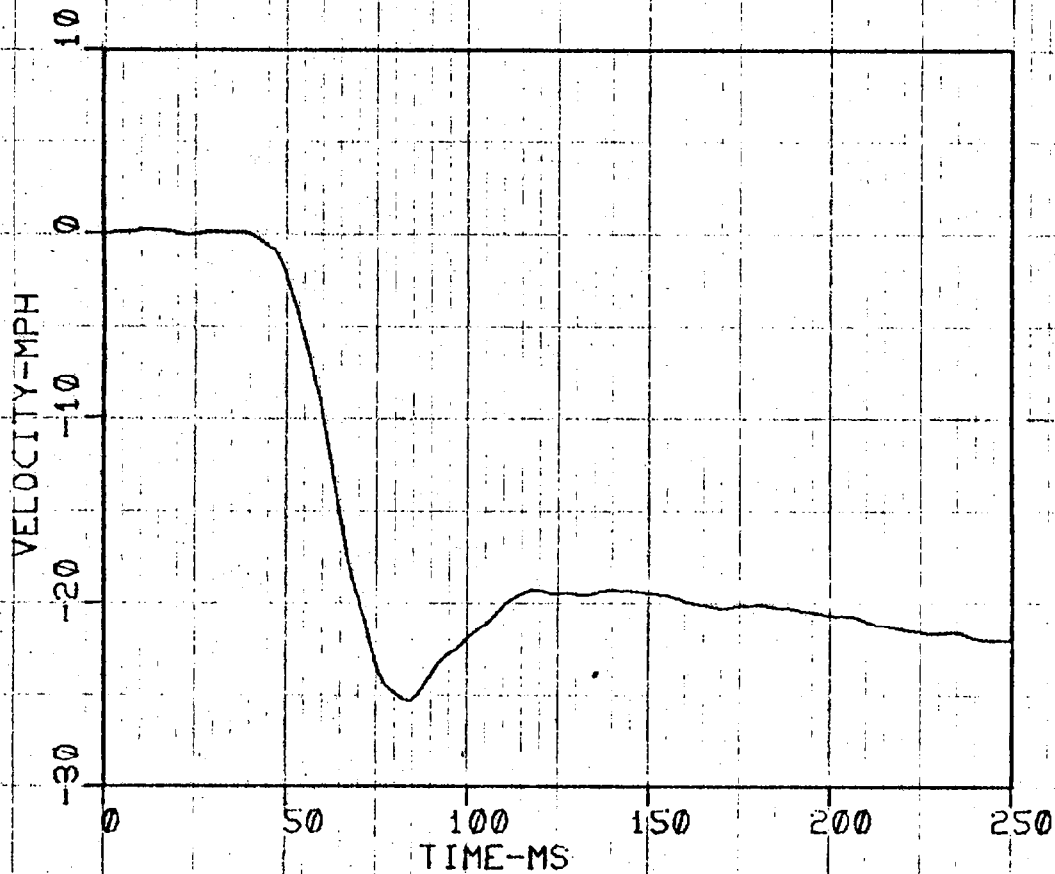


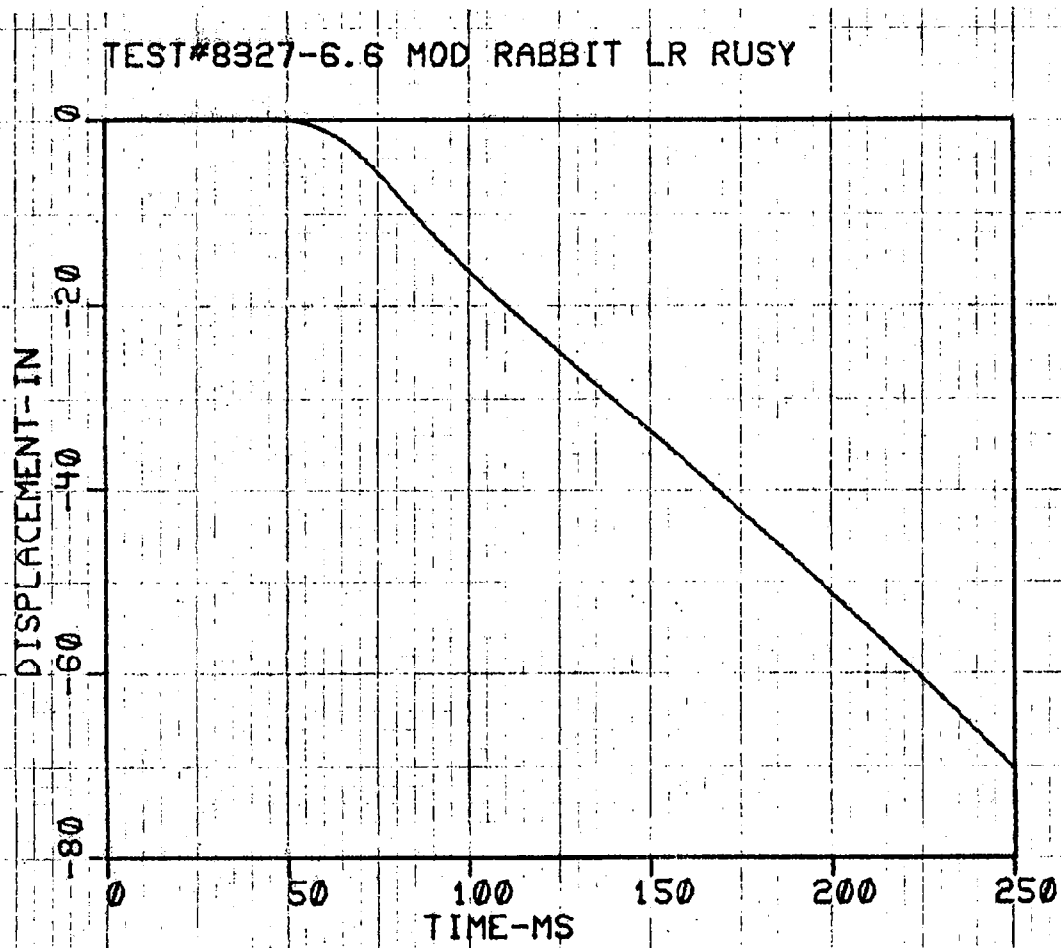


TEST#8327-6.6 MOD RABBIT LR RUGY

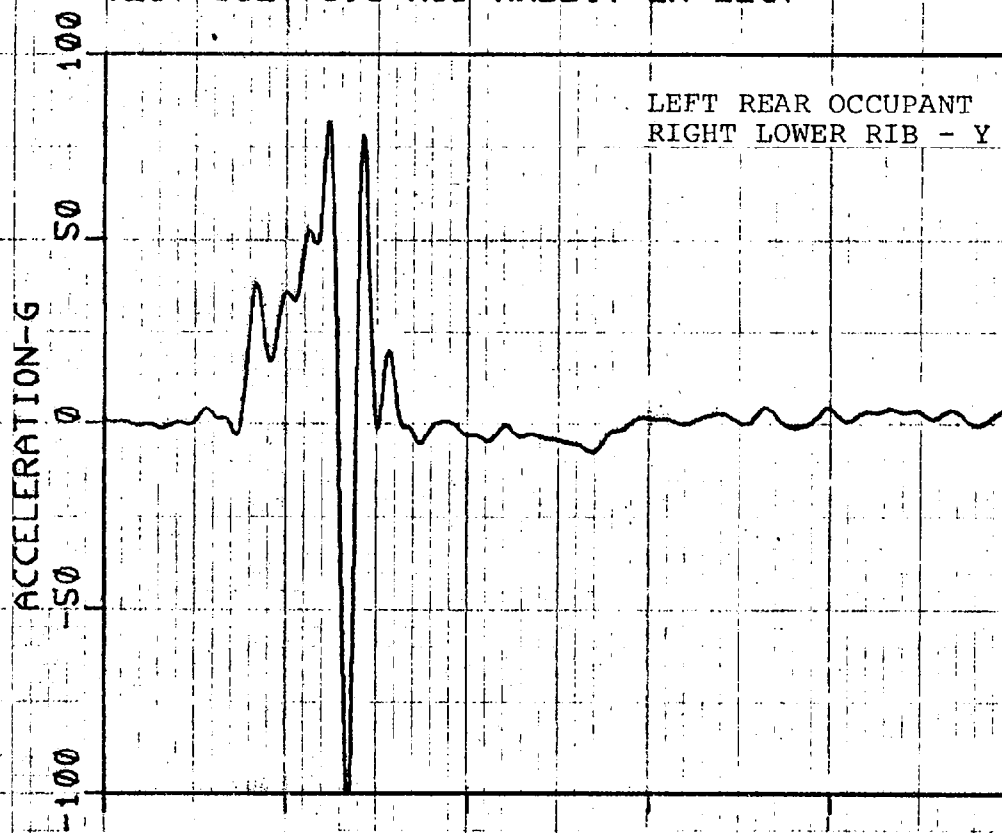


TEST#8327-6.6 MOD RABBIT LR RUVY

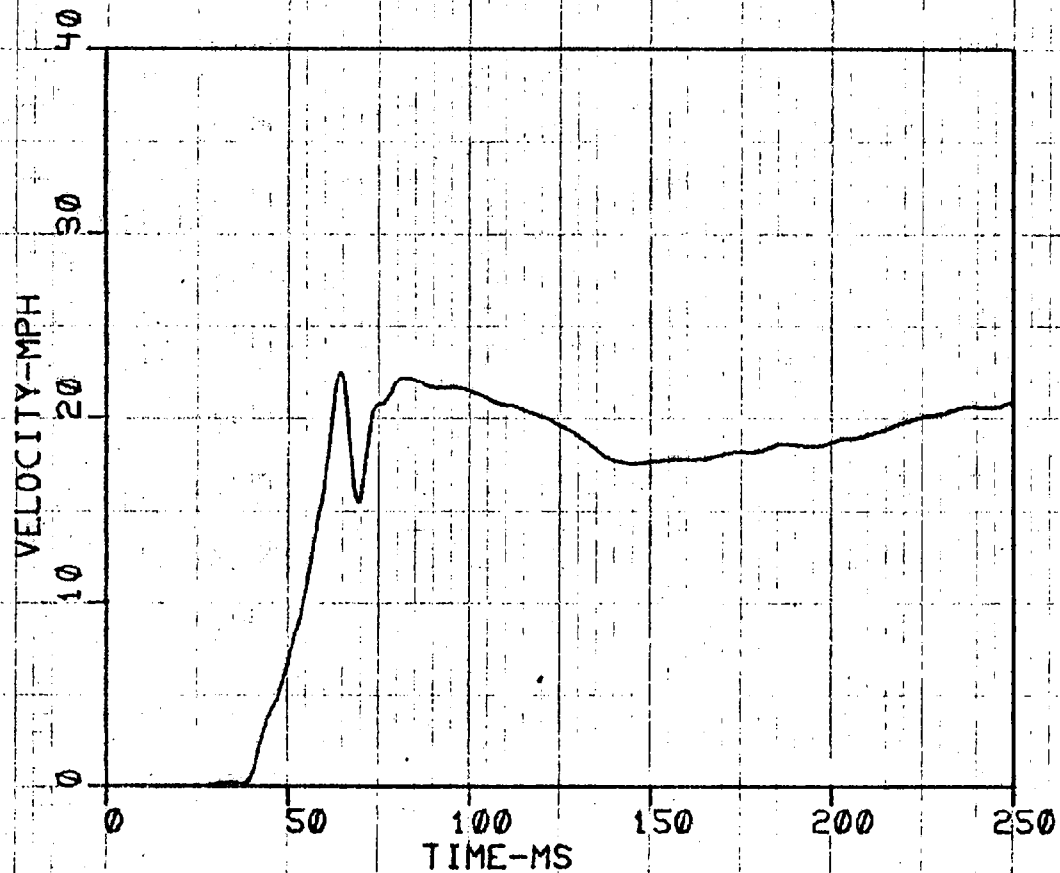


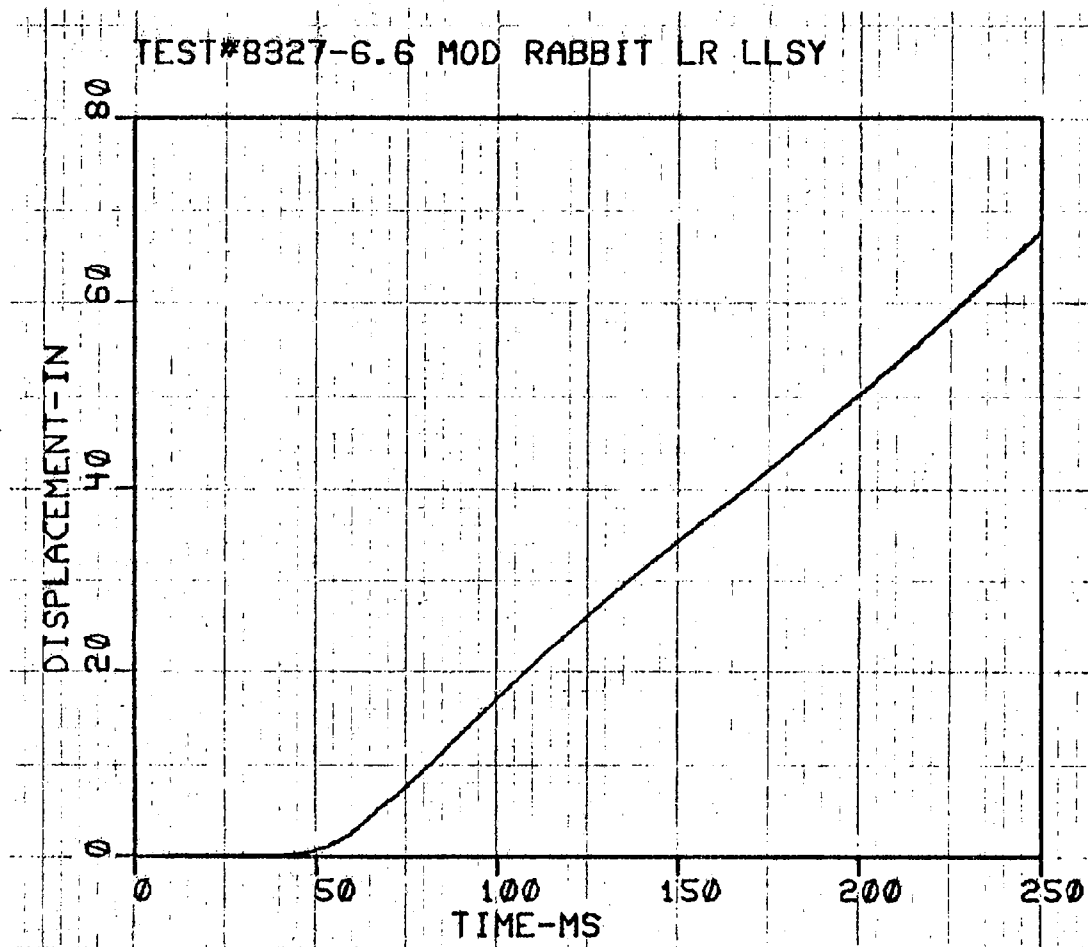


TEST#8327-6.6 MOD RABBIT LR LLGY

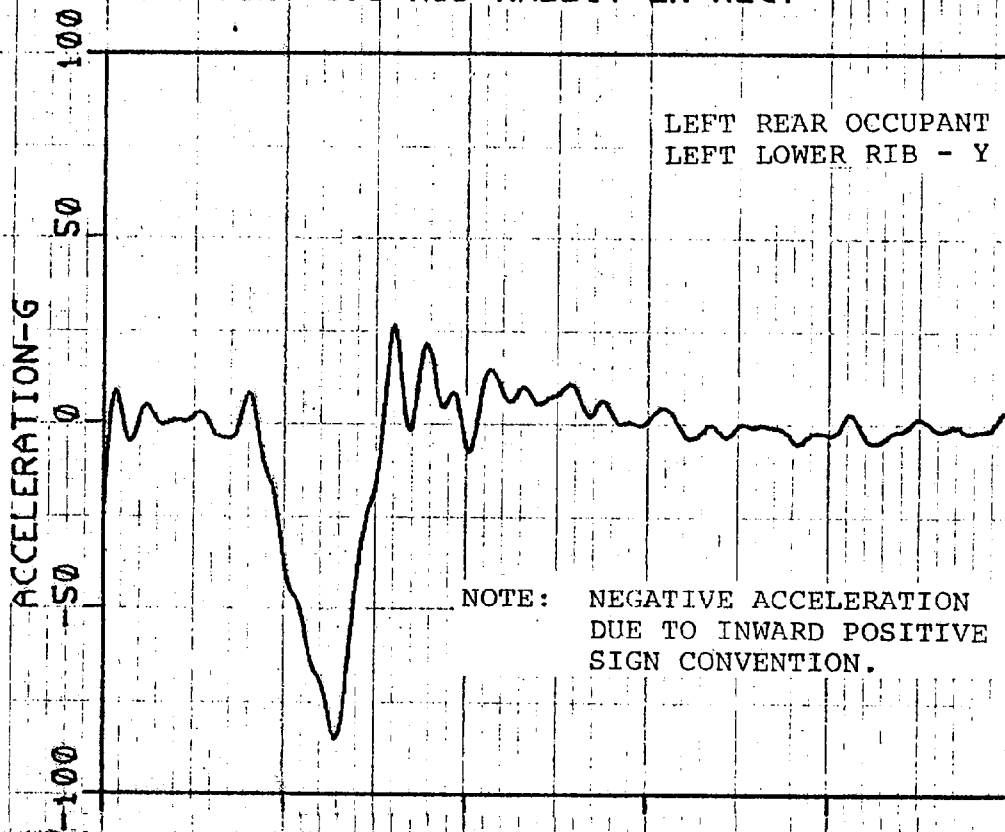


TEST#8327-6.6 MOD RABBIT LR LLVY

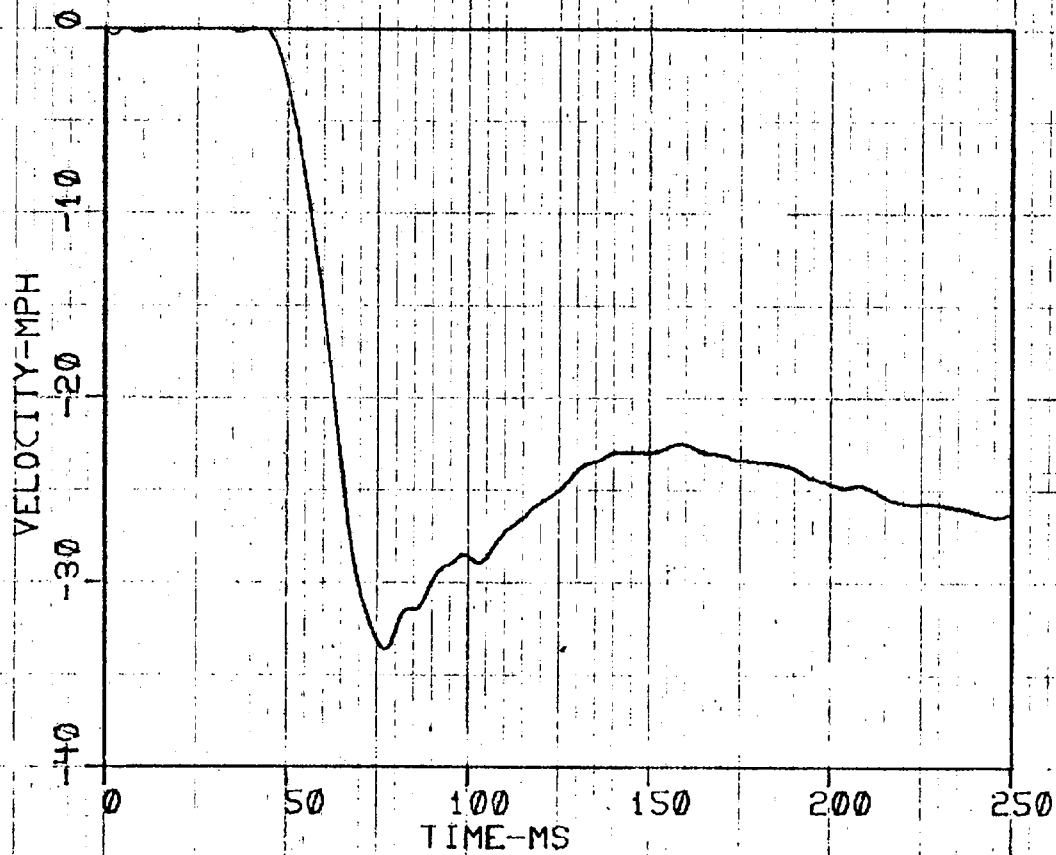


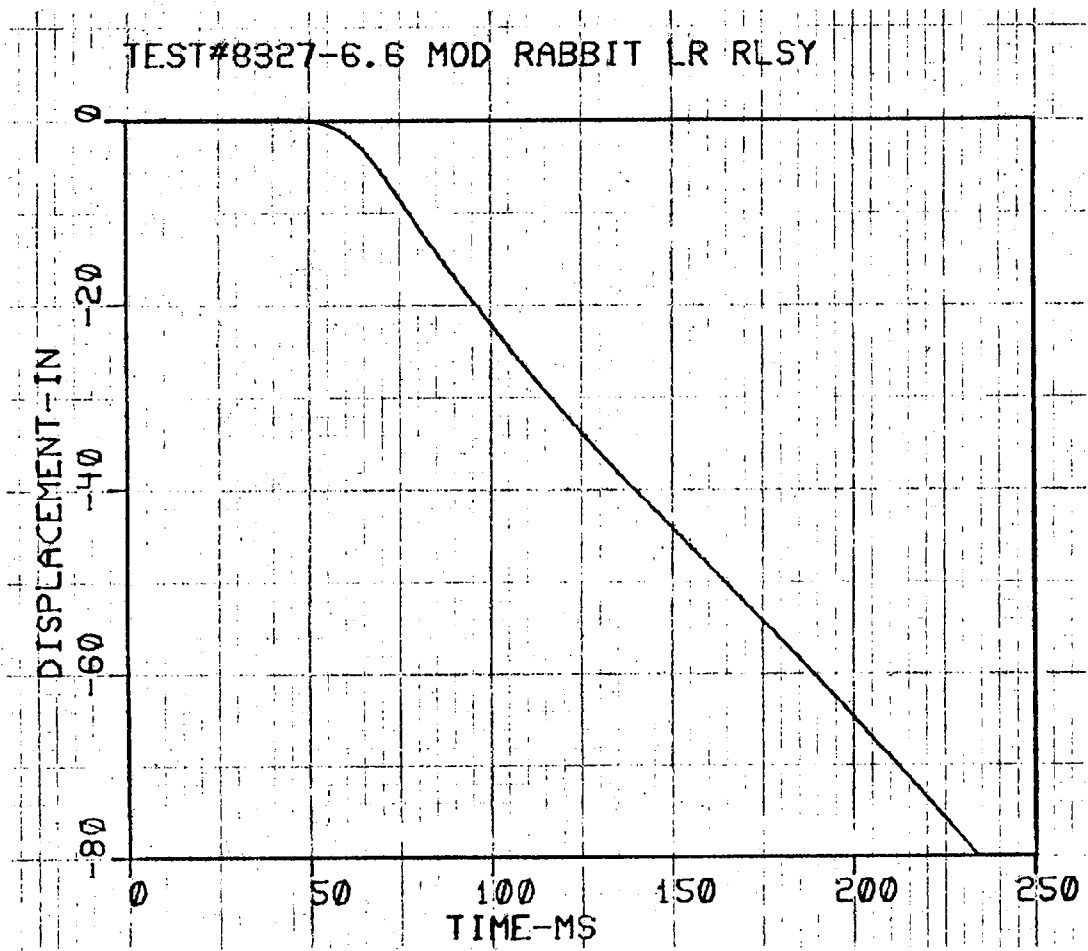


TEST#8327-6.6 MOD RABBIT LR RLGY

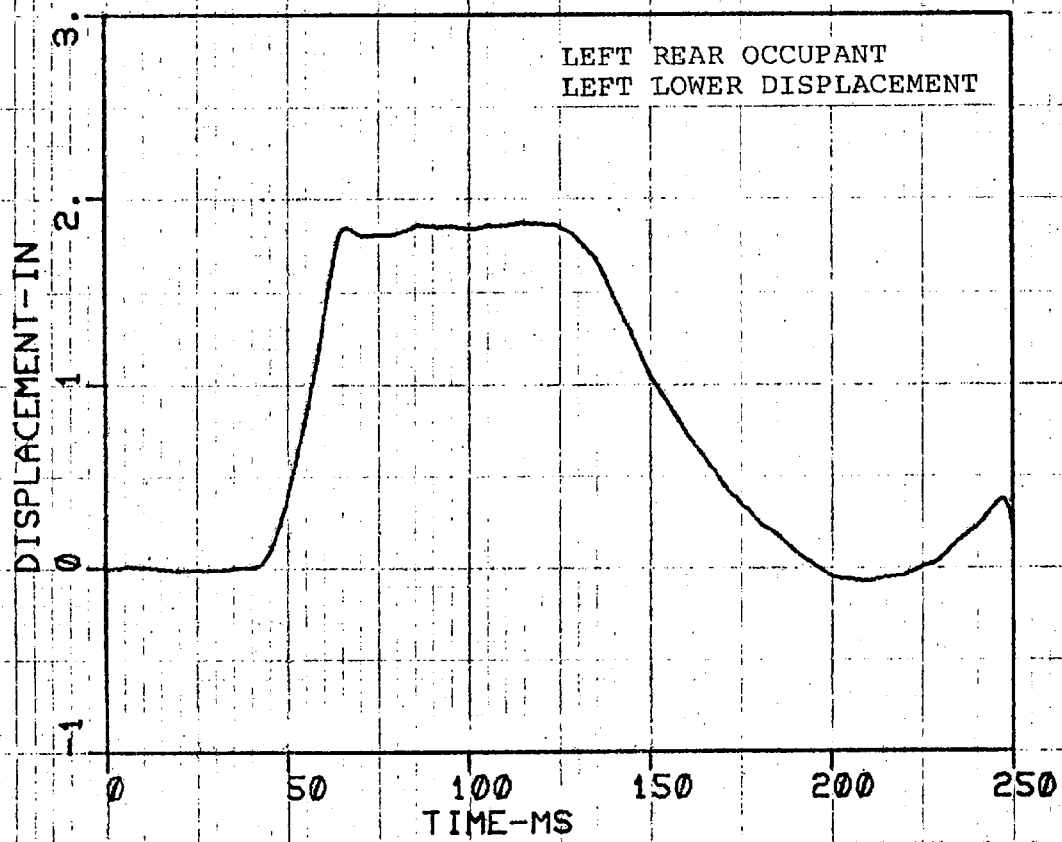


TEST#8327-6.6 MOD RABBIT LR RLGY

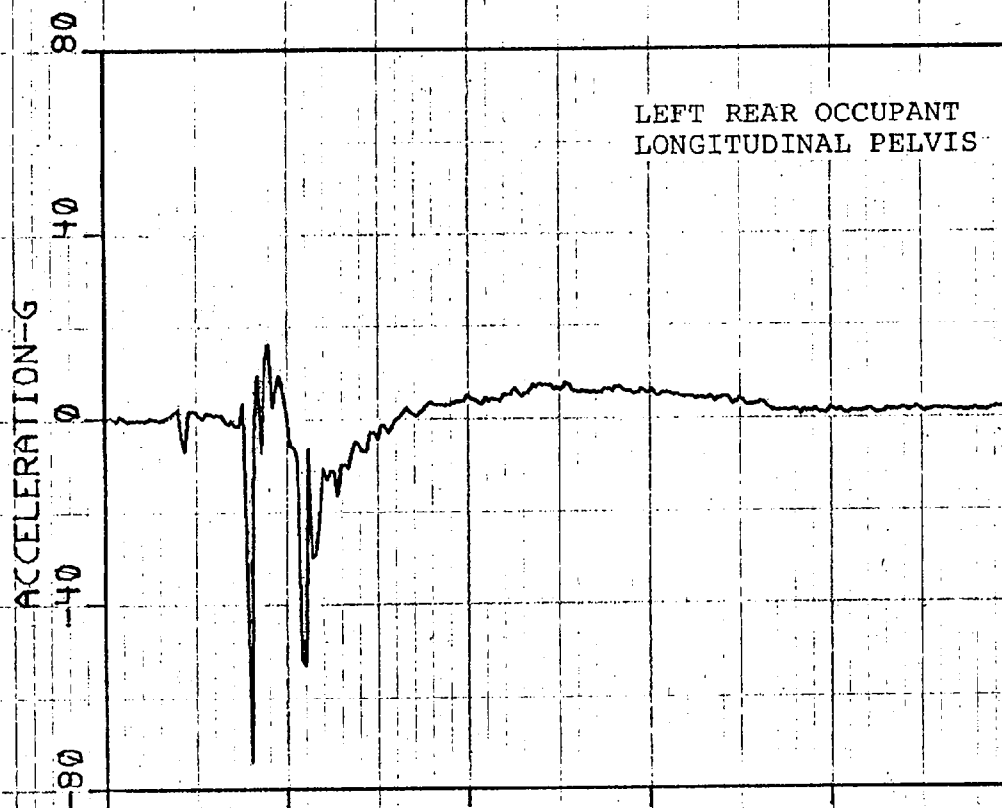




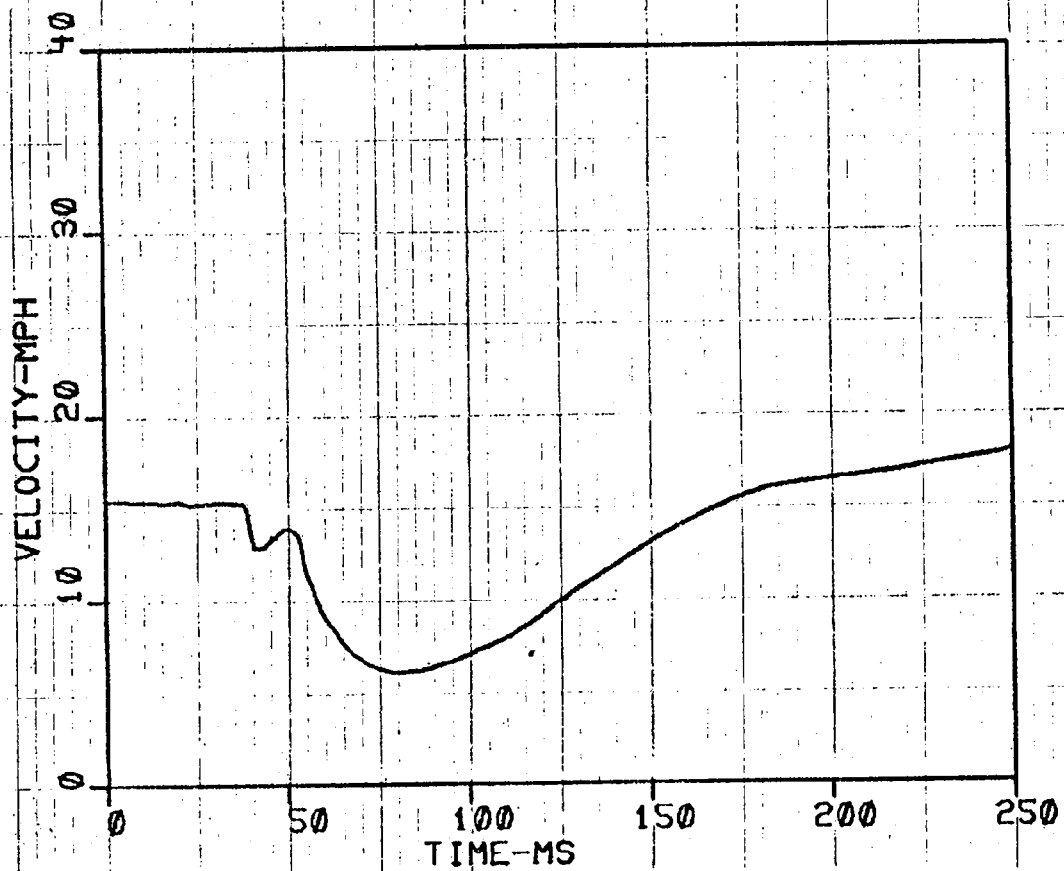
TEST#8327-6.6 MOD RABBIT LR LLDY

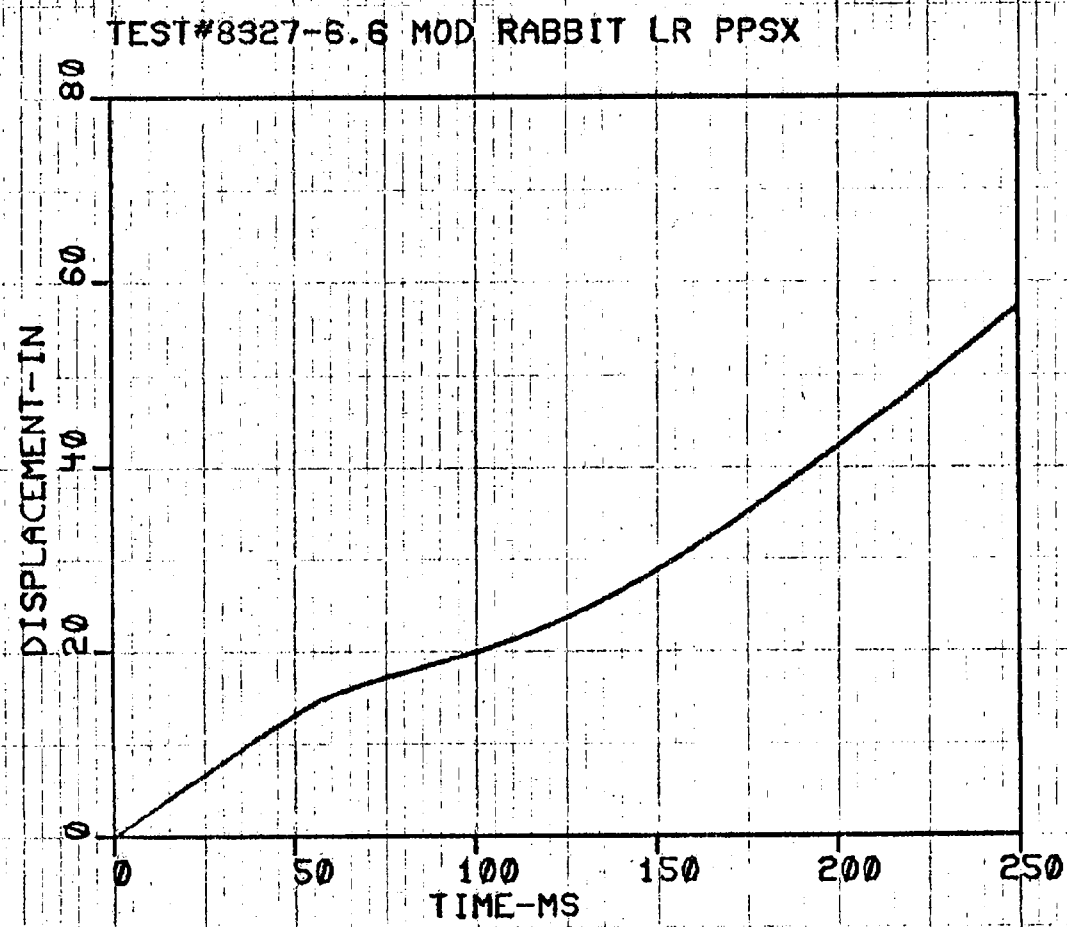


TEST#8327-6.6 MOD RABBIT LR PPGX

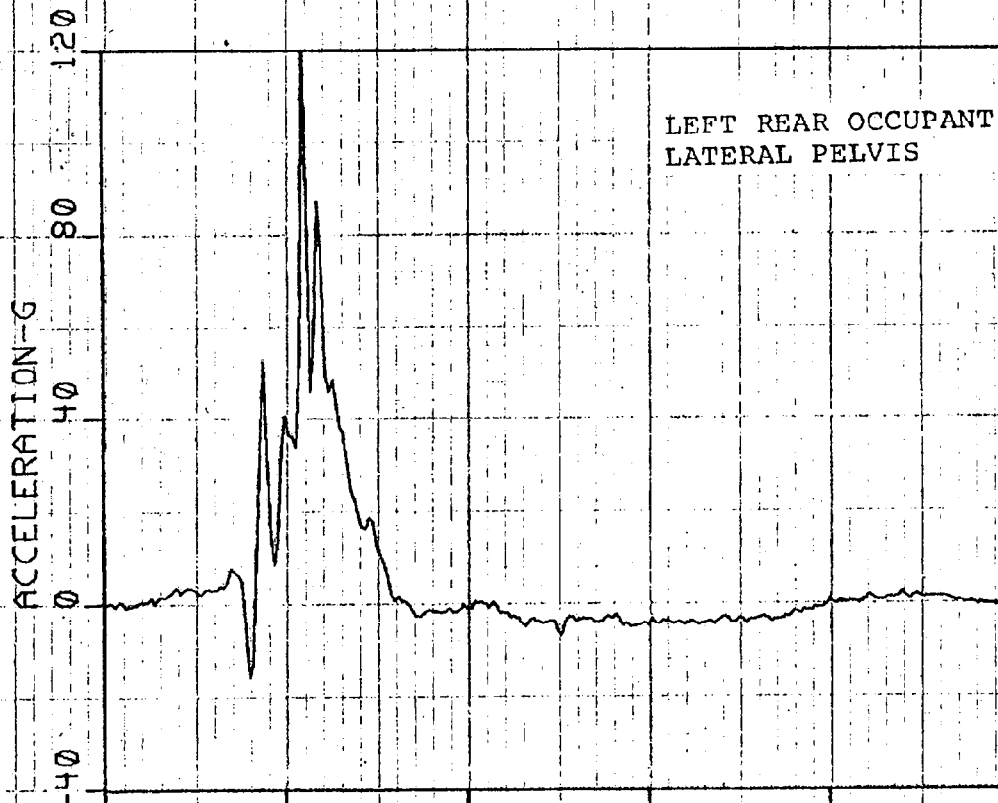


TEST#8327-6.6 MOD RABBIT LR PPVX

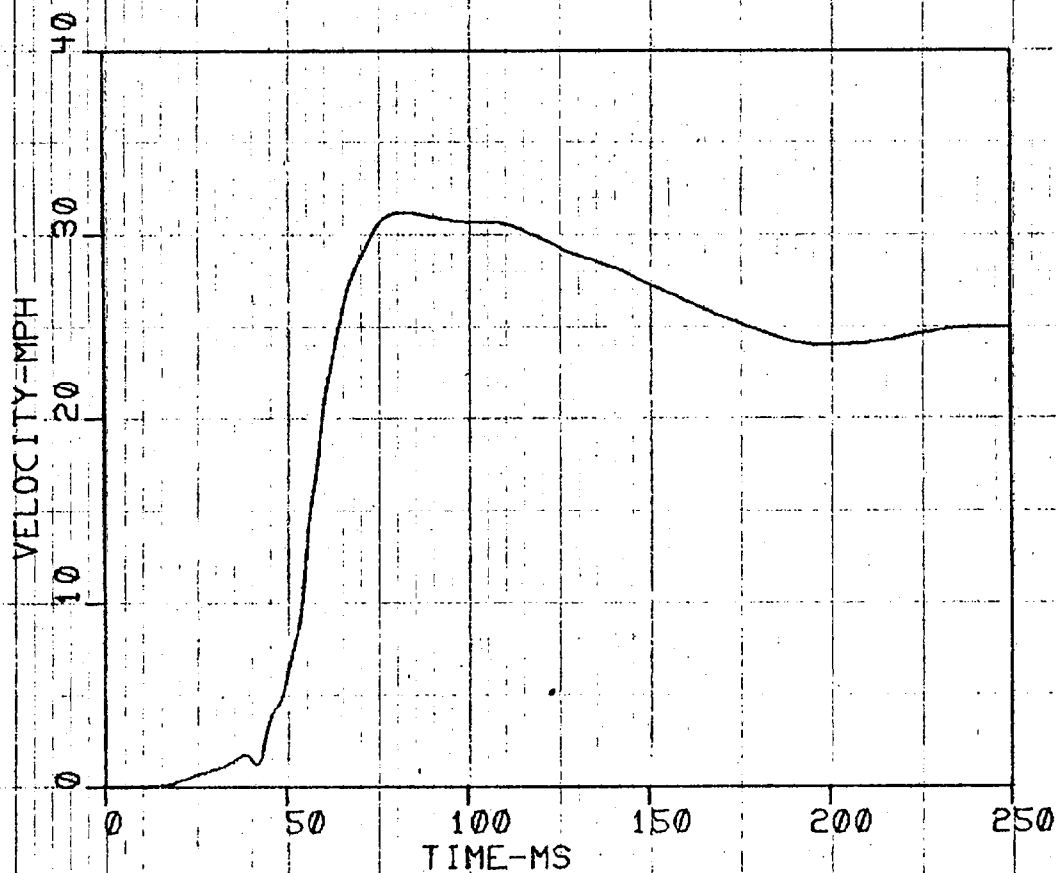


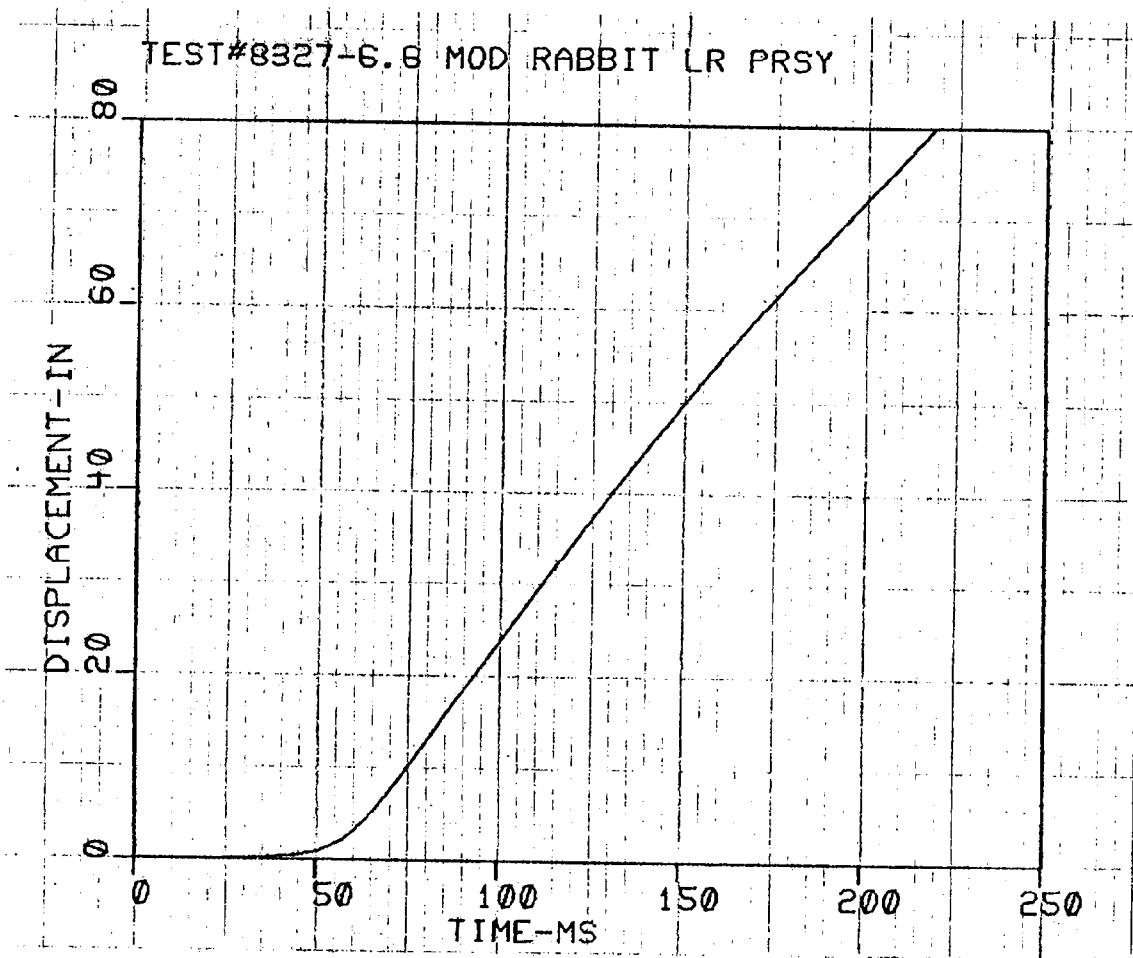


TEST#8327-6.6 MOD RABBIT LR PRGY

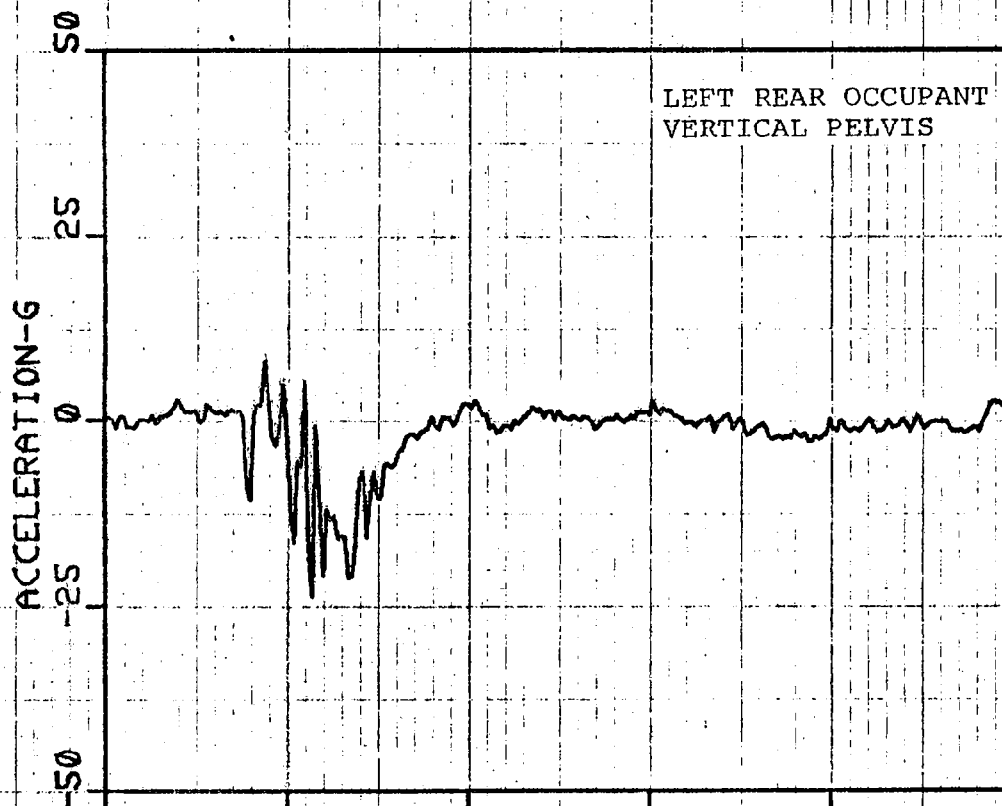


TEST#8327-6.6 MOD RABBIT LR PRVY

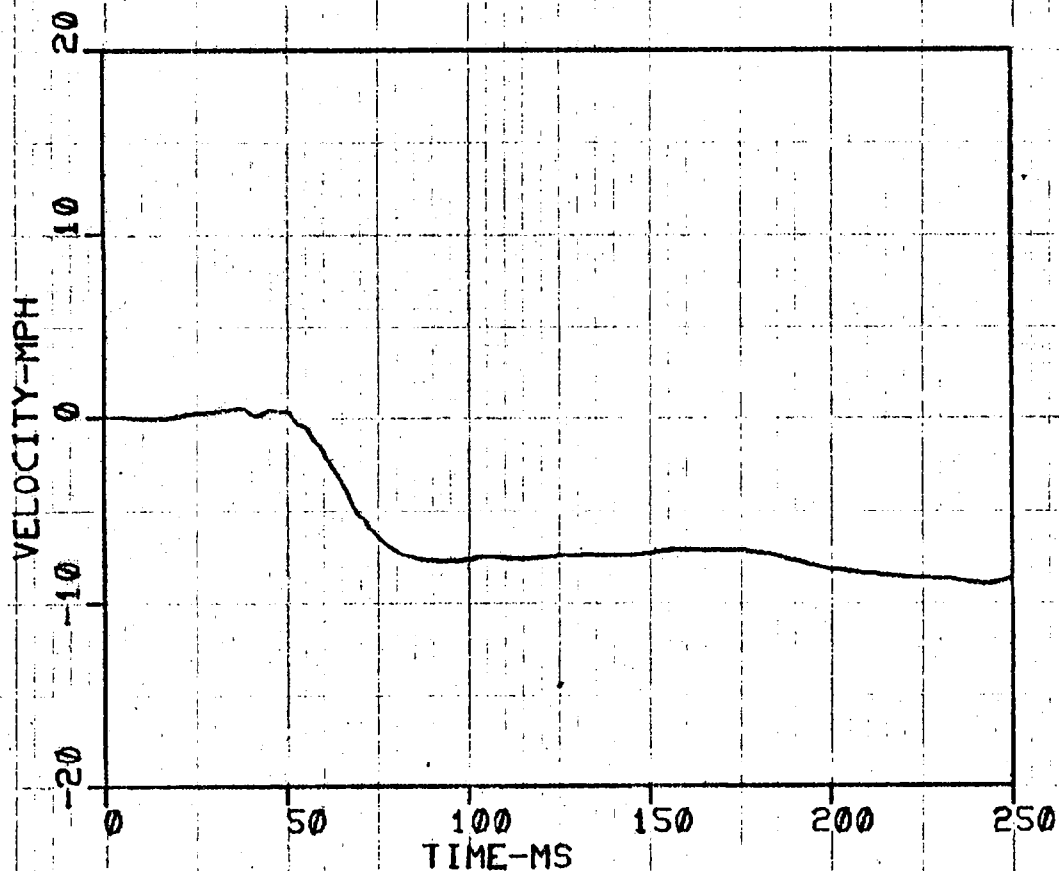


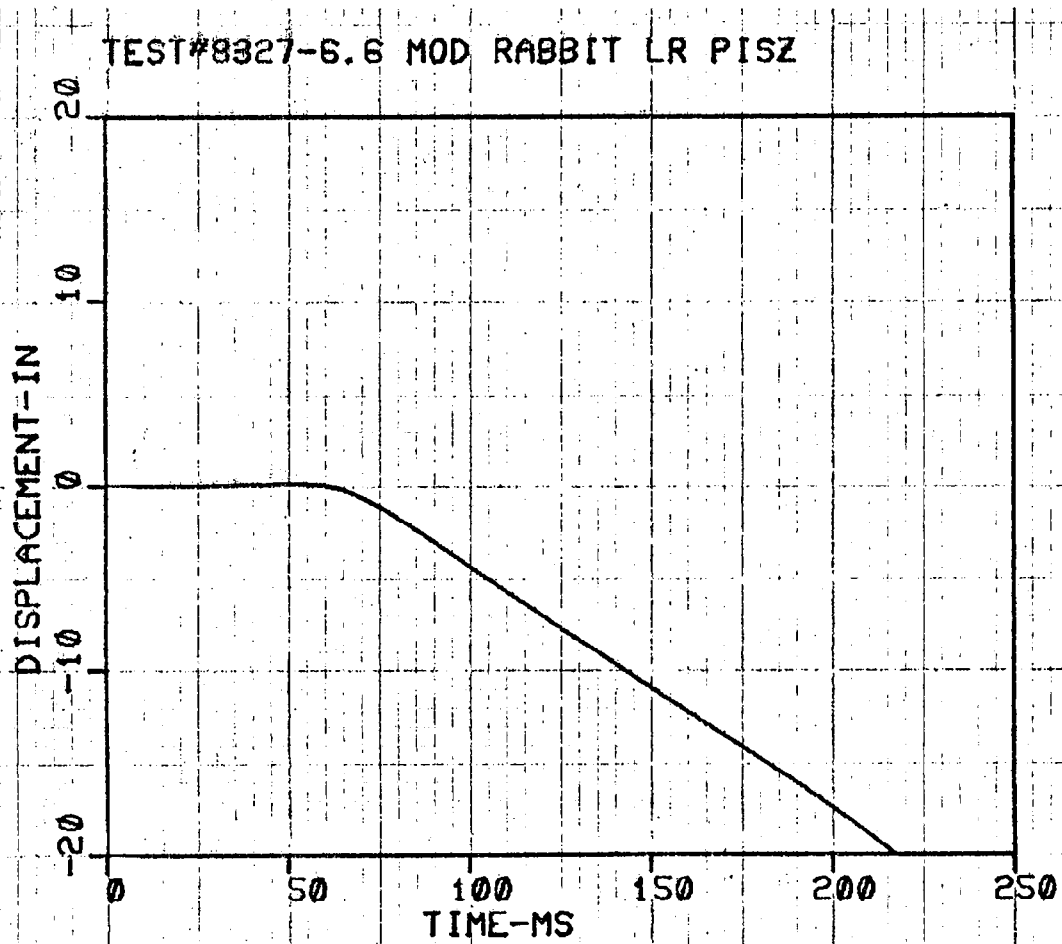


TEST#8327-6.6 MOD RABBIT LR PIGZ

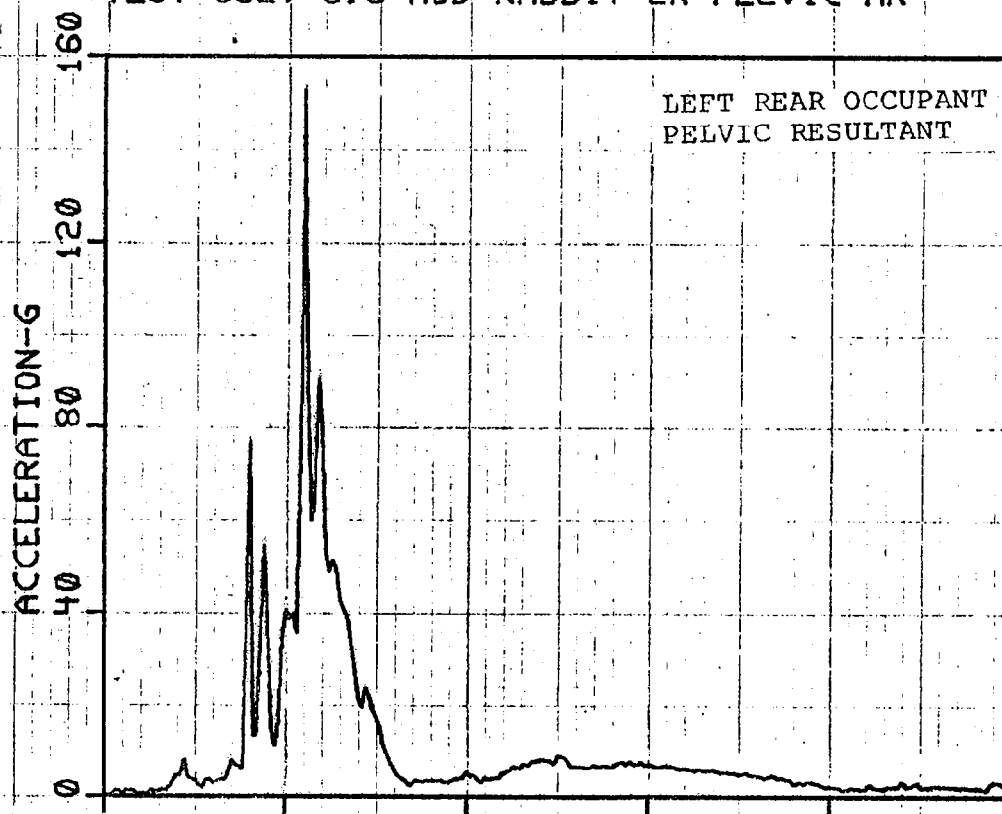


TEST#8327-6.6 MOD RABBIT LR PIVZ

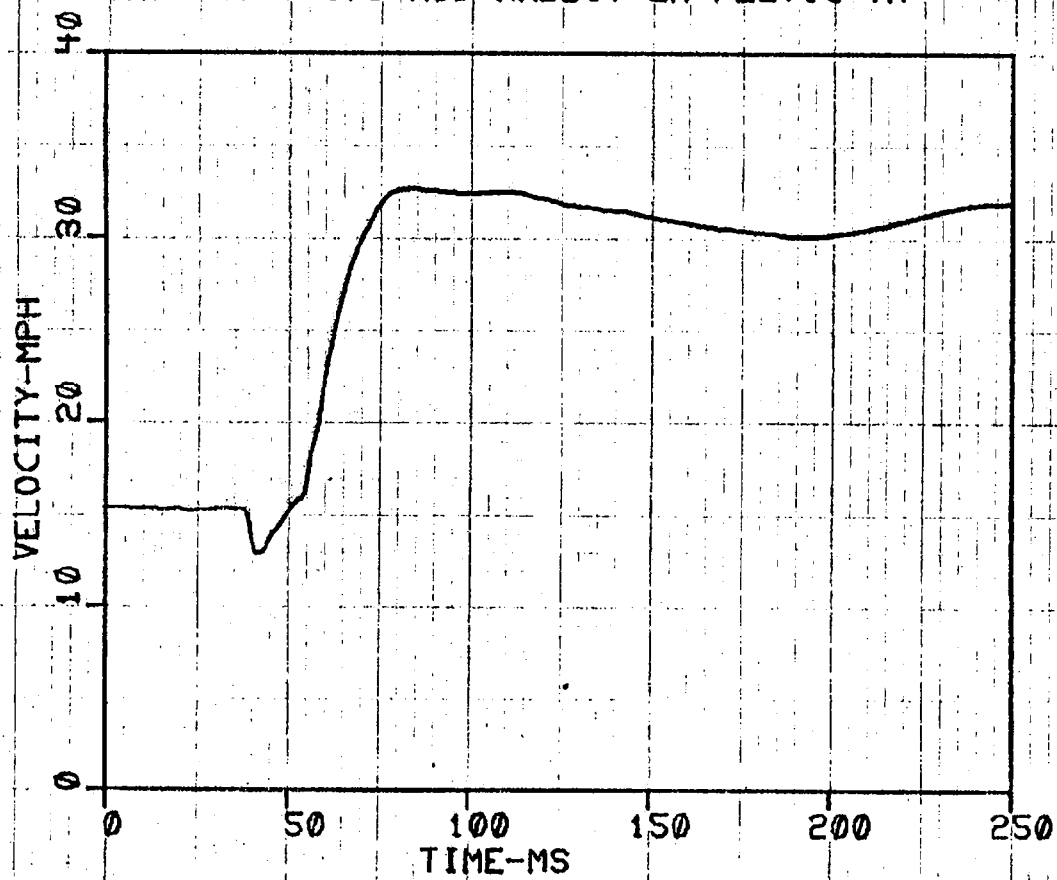


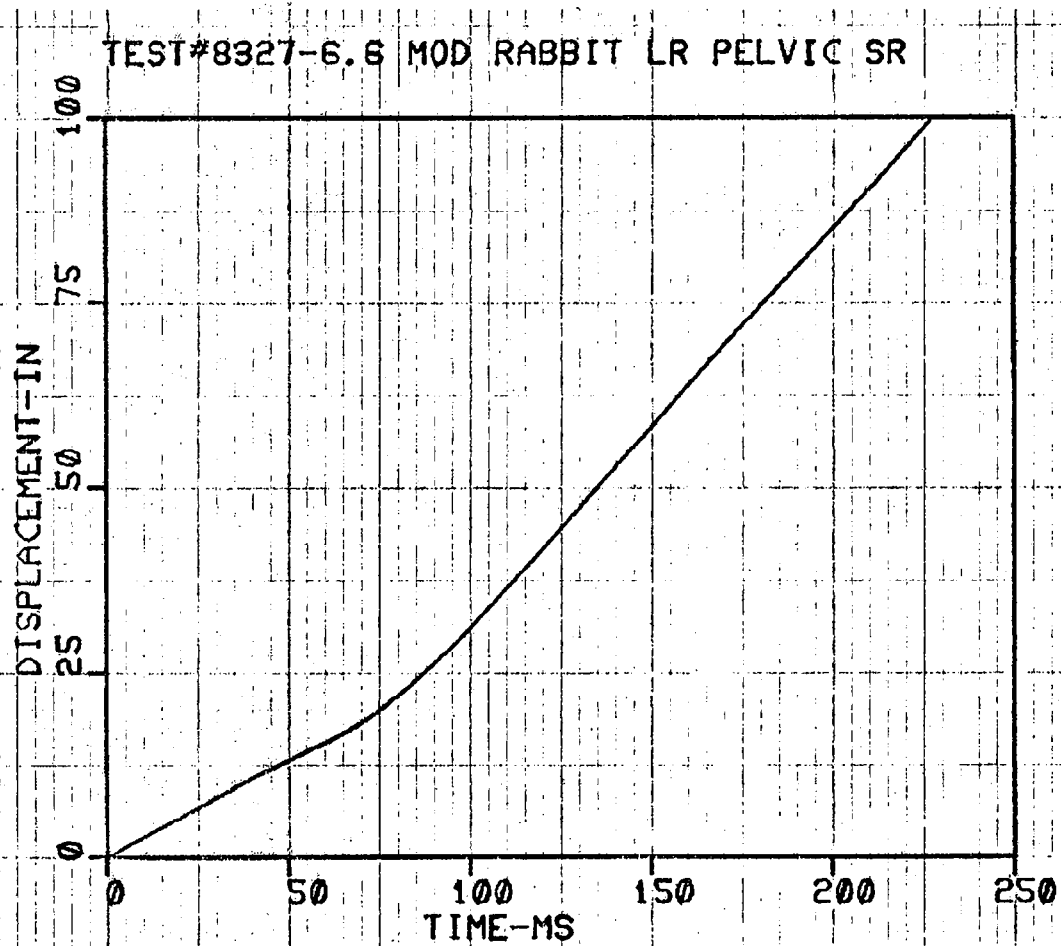


TEST#8327-6.6 MOD RABBIT LR PELVIC AR



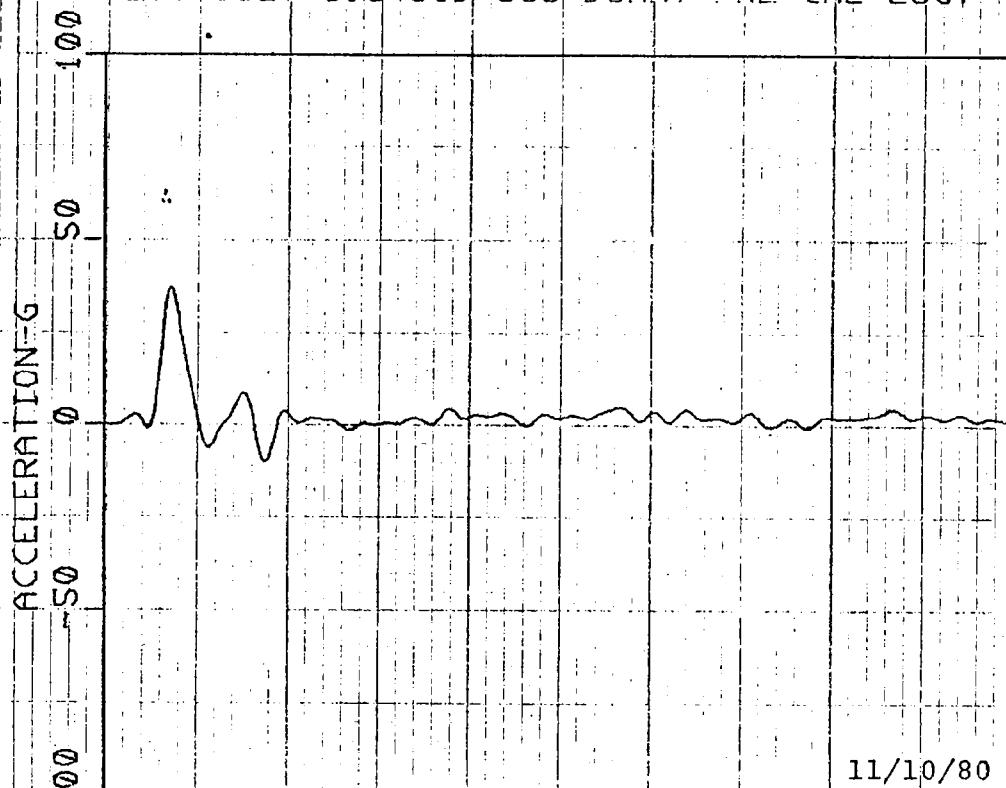
TEST#8327-6.6 MOD RABBIT LR PELVIC VR



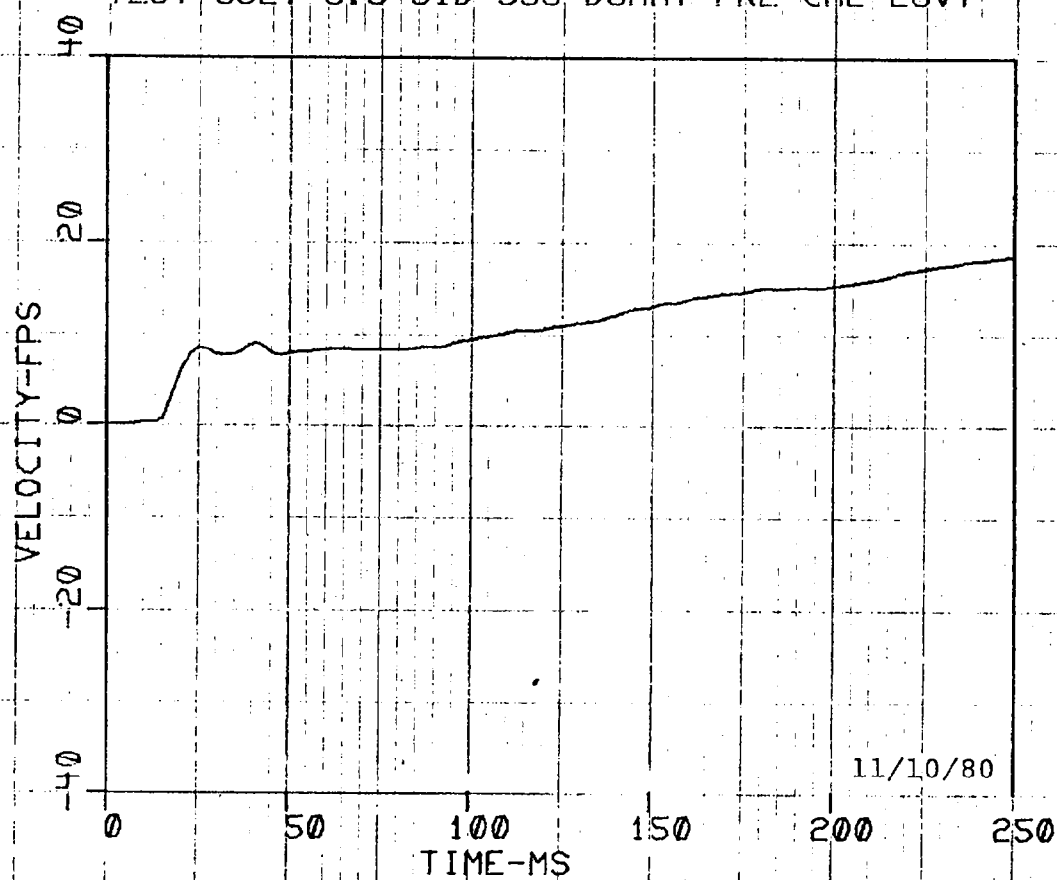


APPENDIX D
DUMMY PRE-TEST
CALIBRATION DATA -
TEST 6.5

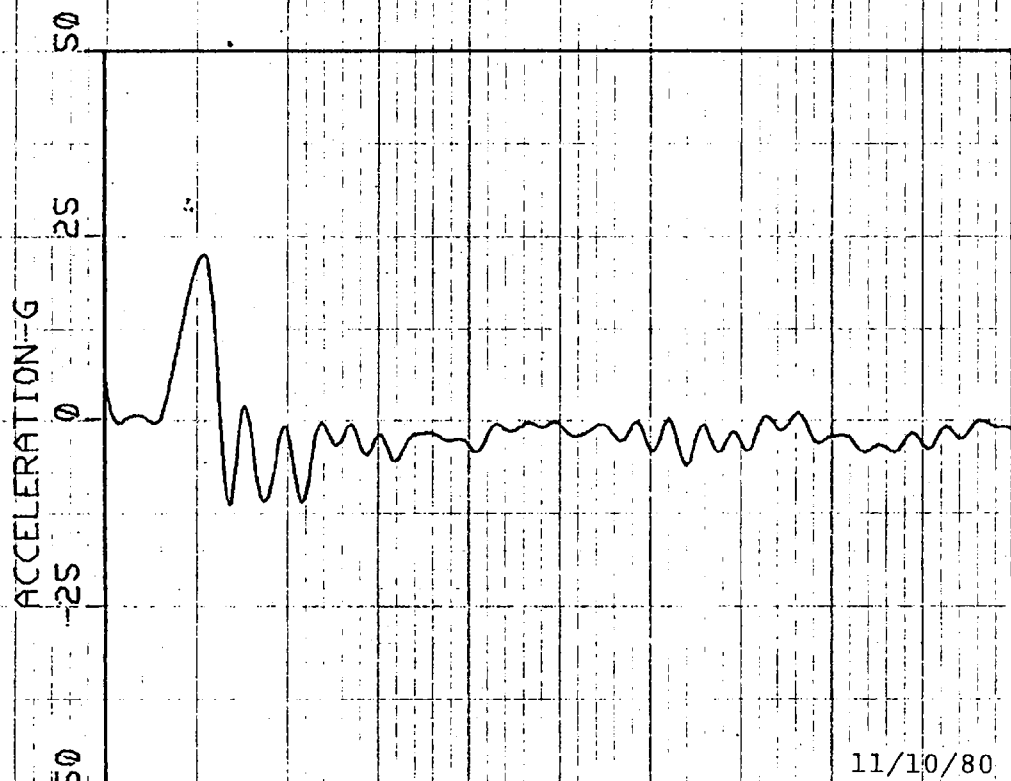
TEST#8327-6.5 SID 386 DUMMY PRE-CAL LUGY



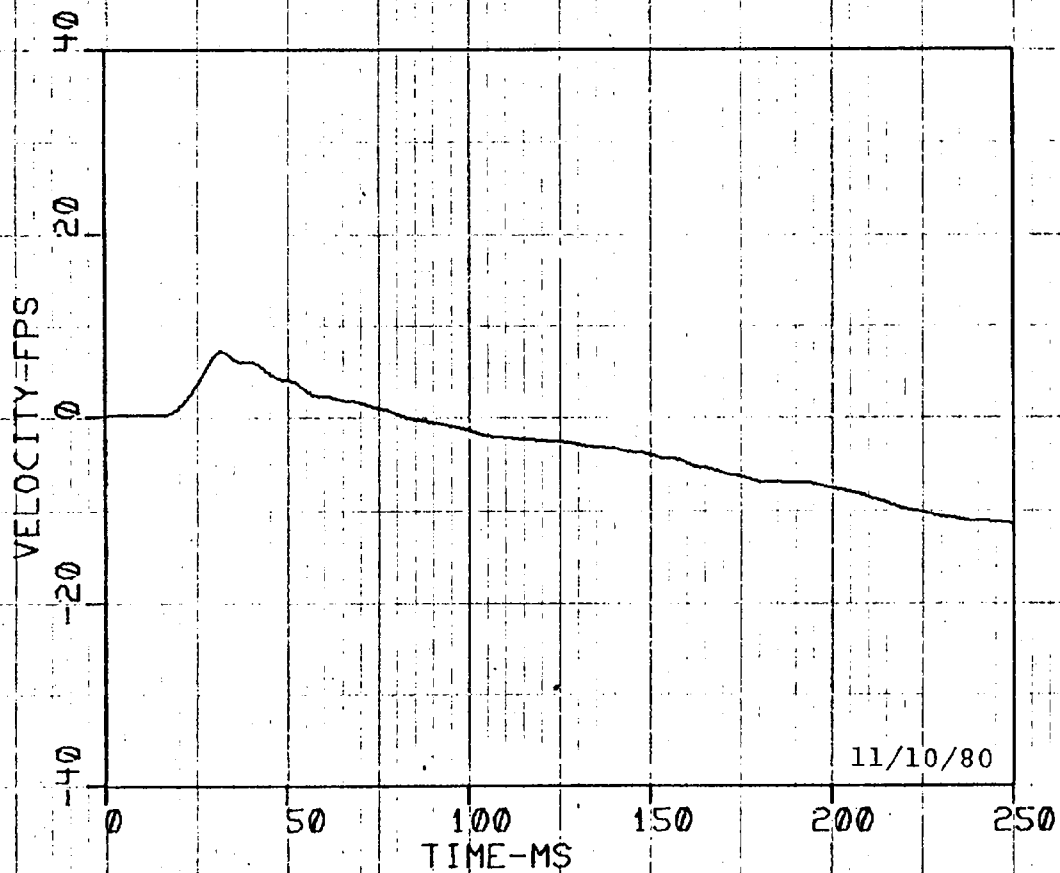
TEST#8327-6.5 SID 386 DUMMY PRE-CAL LUGY



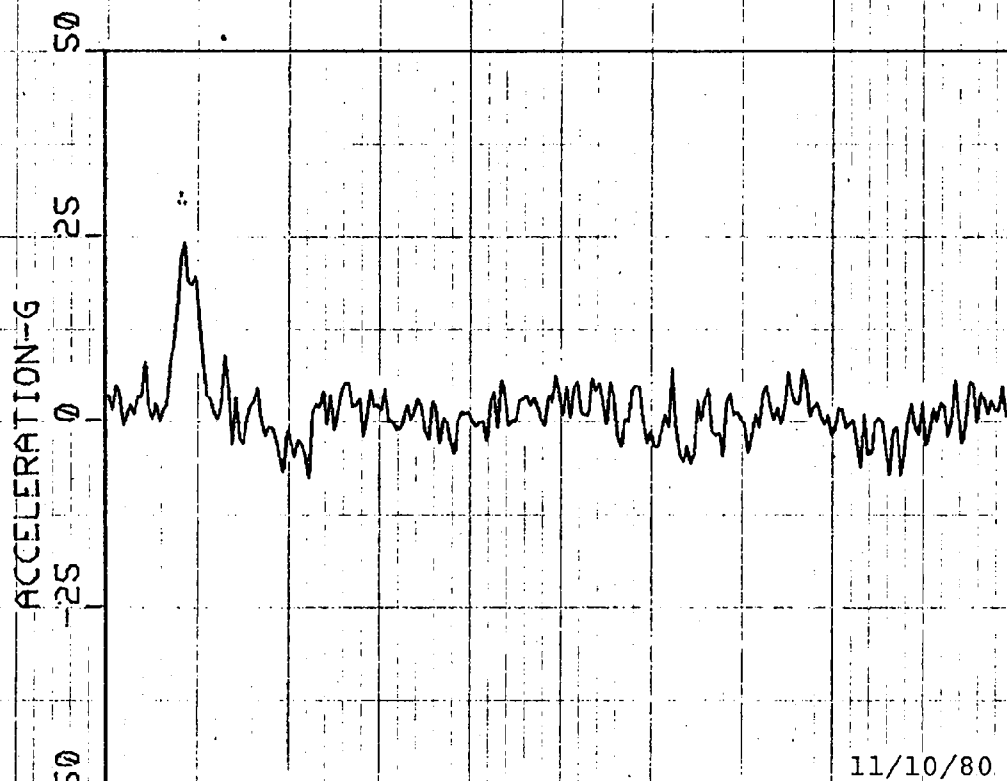
TEST#8327-6.5 SID 386 DUMMY PRE-CAL RUGY



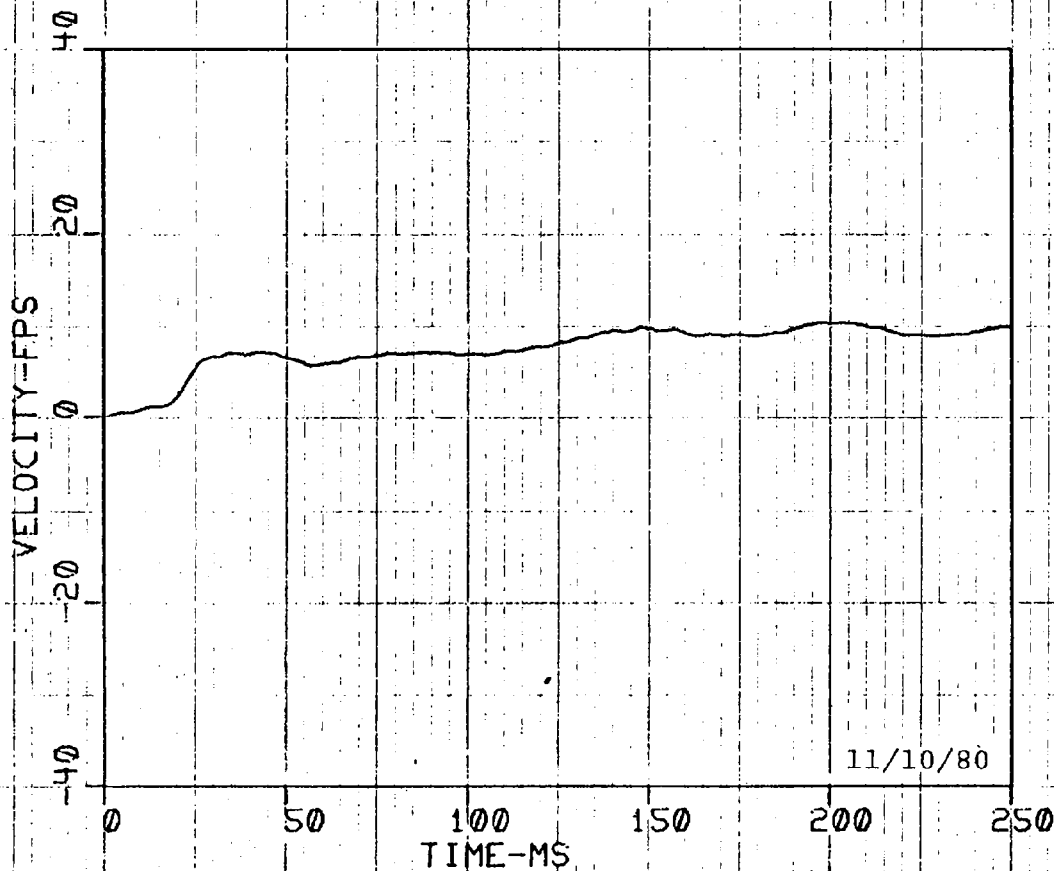
TEST#8327-6.5 SID 386 DUMMY PRE-CAL RUVY



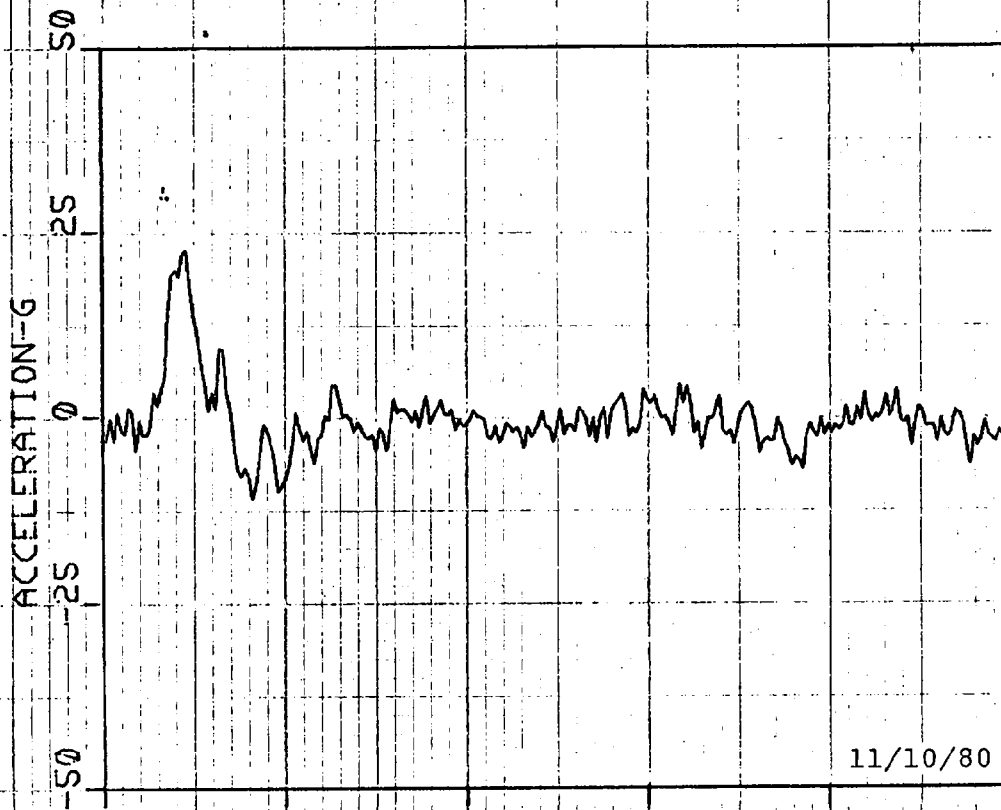
TEST#8327-6.5 SID 386 DUMMY PRE-CAL 1RGY



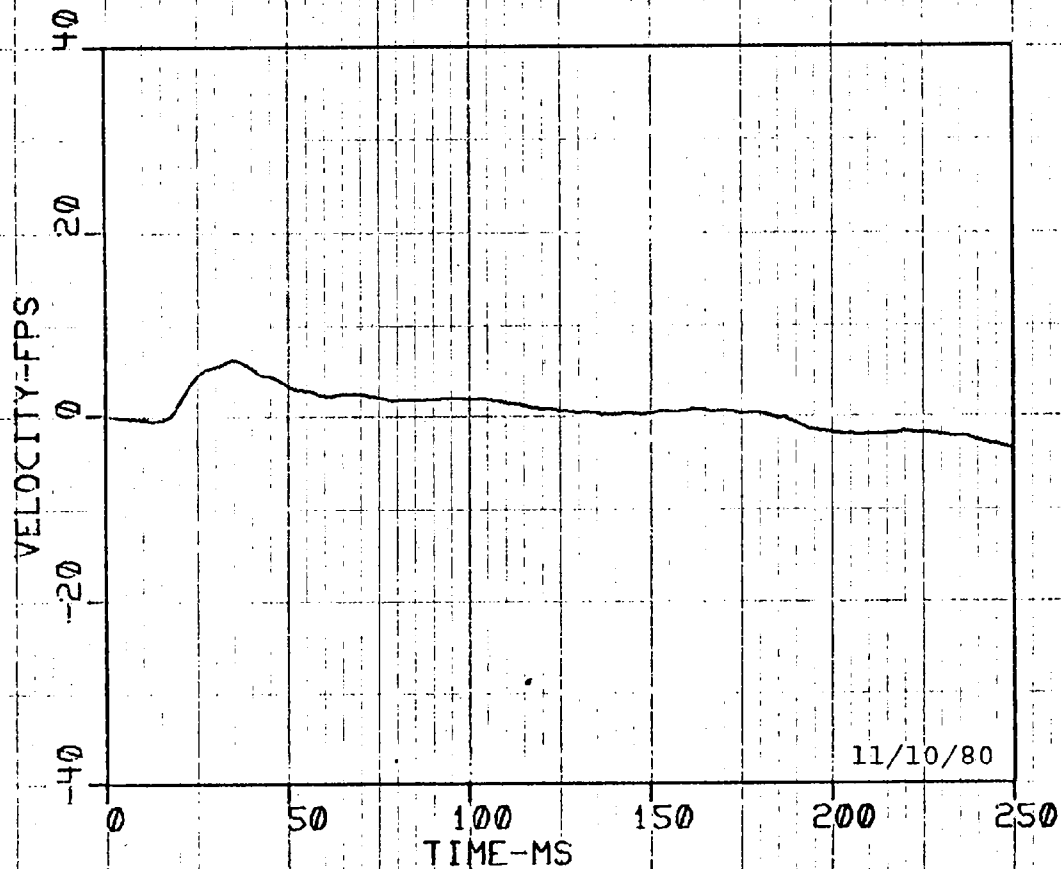
TEST#8327-6.5 SID 386 DUMMY PRE-CAL 1RVY



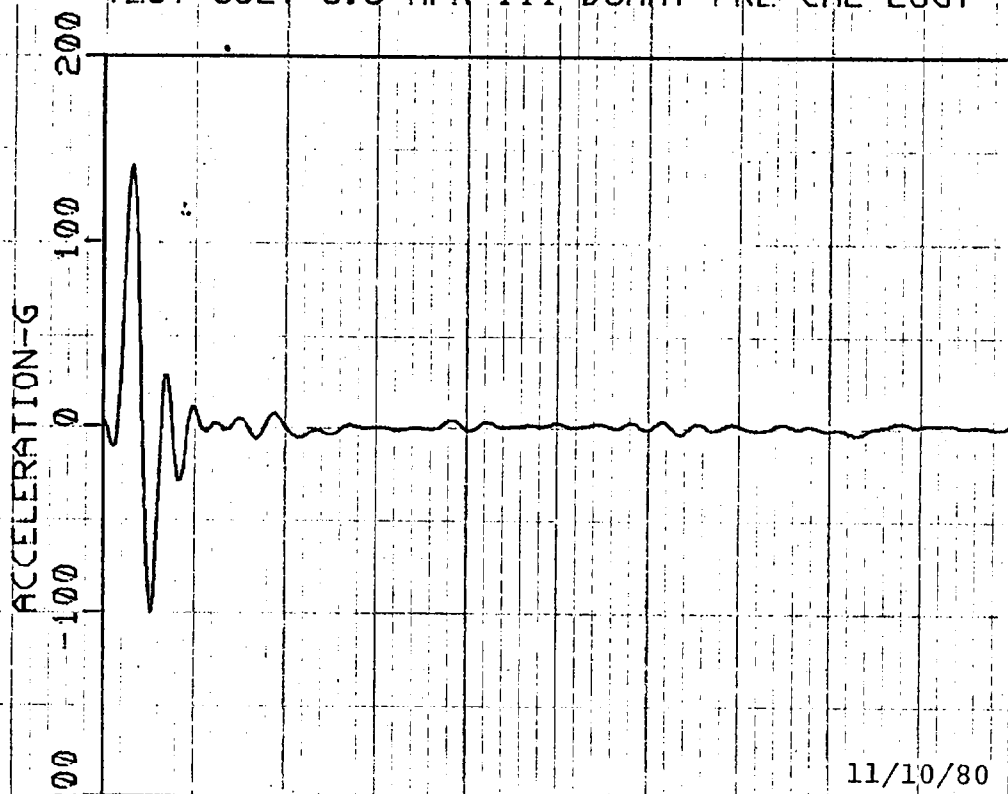
TEST#8327-6.5 SID 386 DUMMY PRE-CAL 2RGY



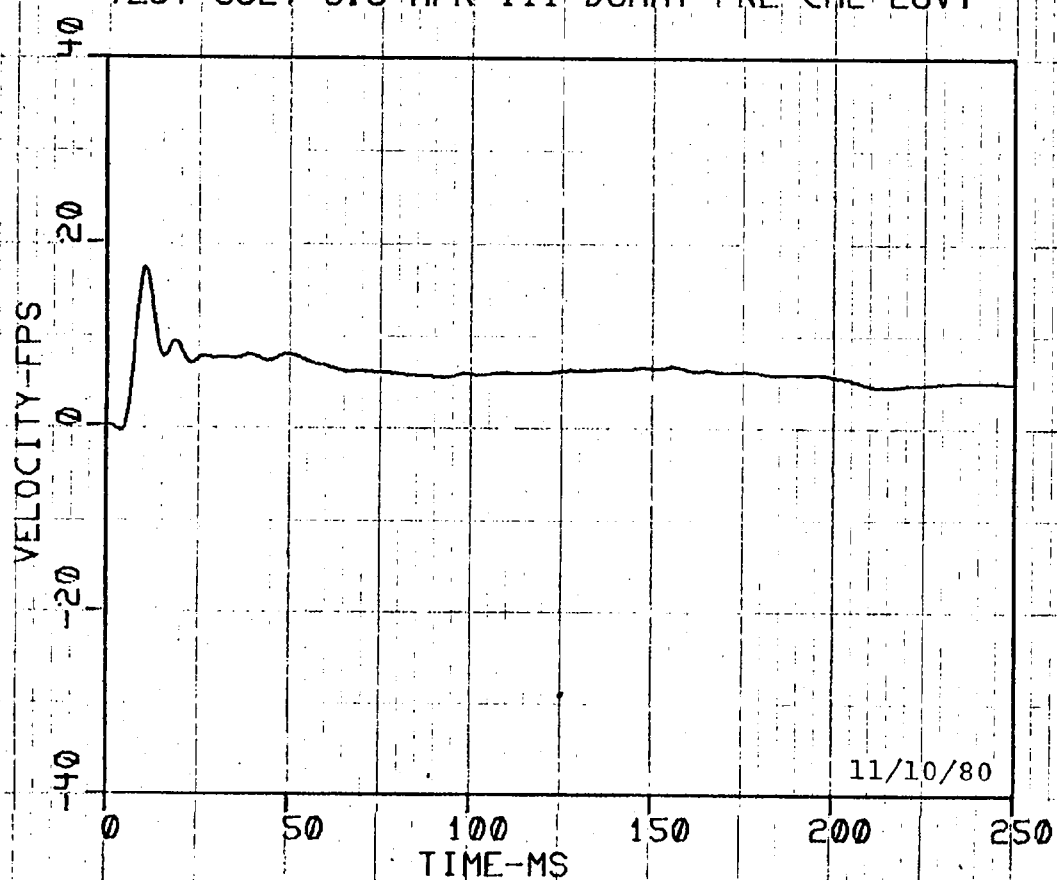
TEST#8327-6.5 SID 386 DUMMY PRE-CAL 2RVY



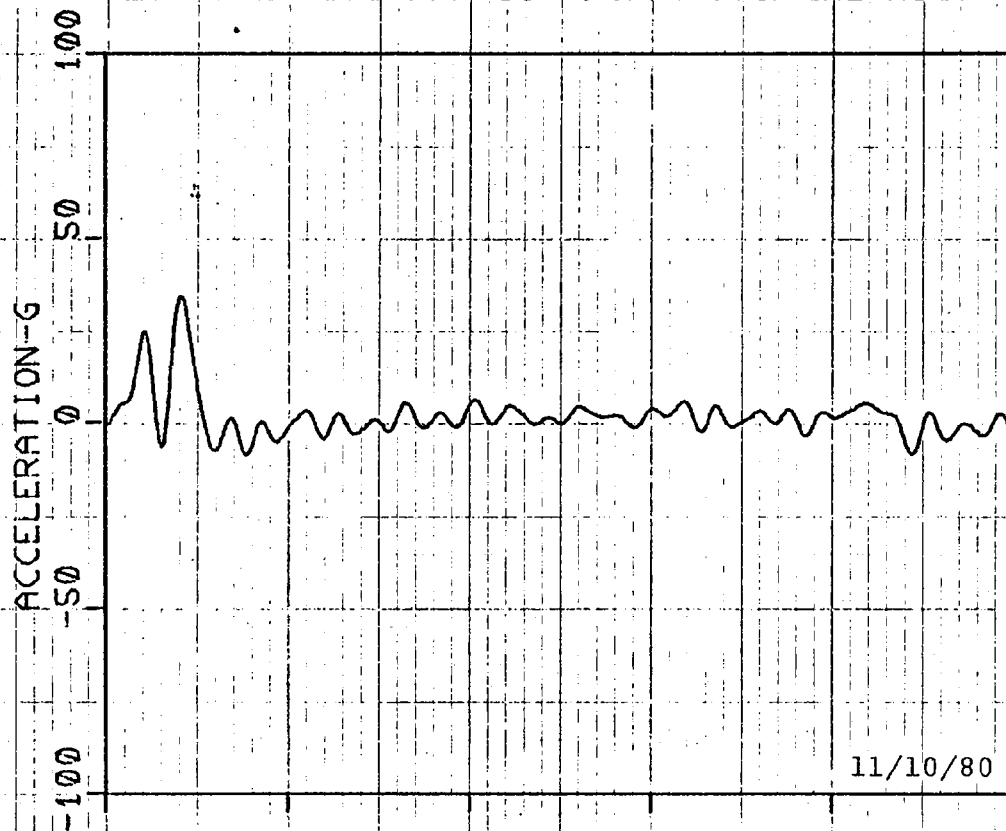
TEST#8327-6.5 APR III DUMMY PRE-CAL LUGY



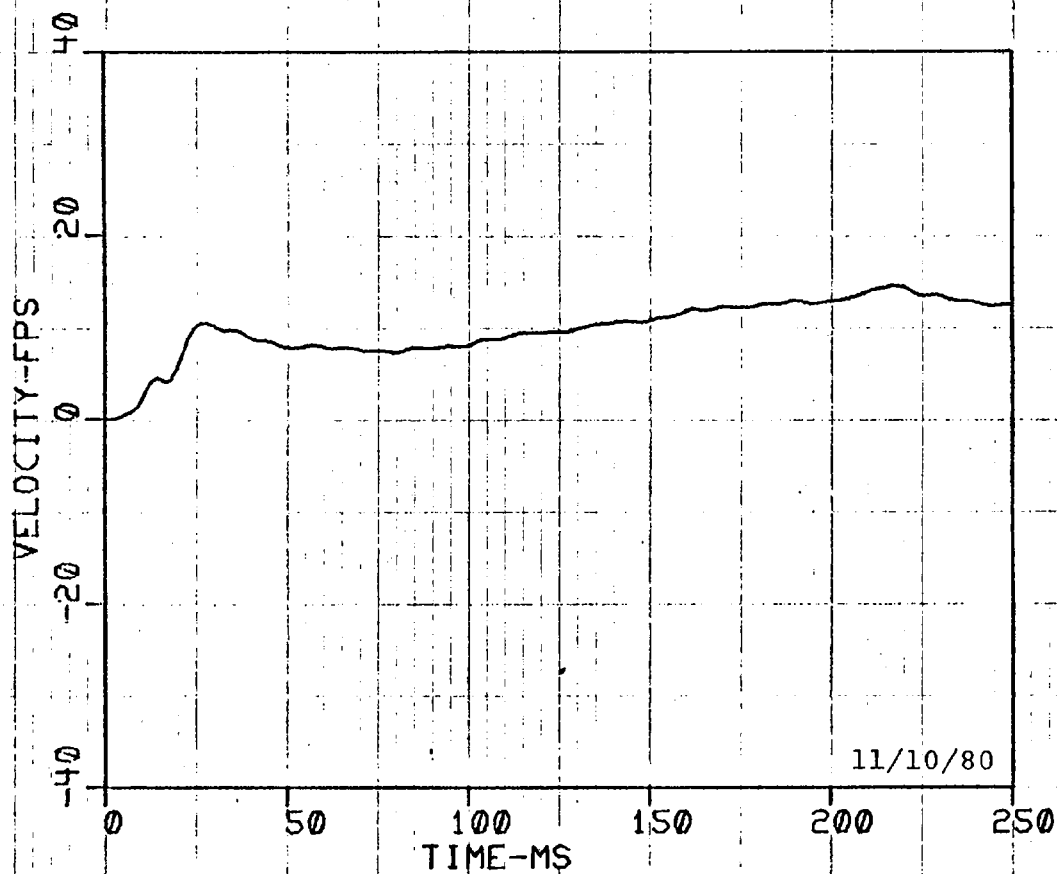
TEST#8327-6.5 APR III DUMMY PRE-CAL LUGY



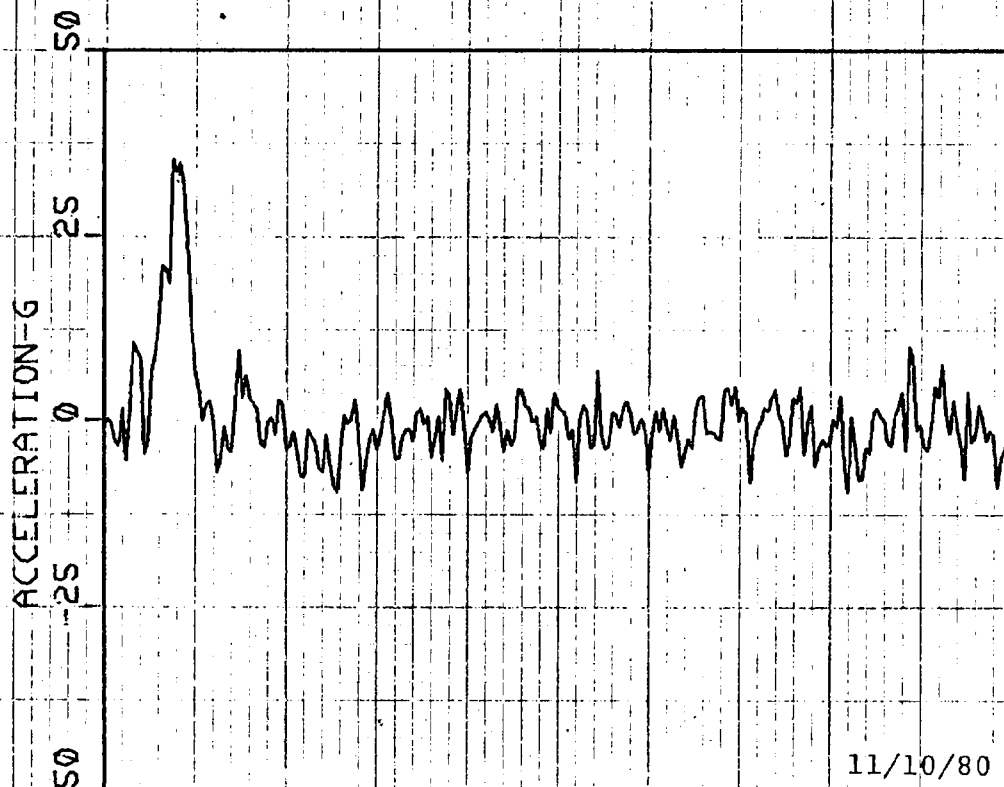
TEST#8327-6.5 APR III DUMMY PRE-CAL RUGY



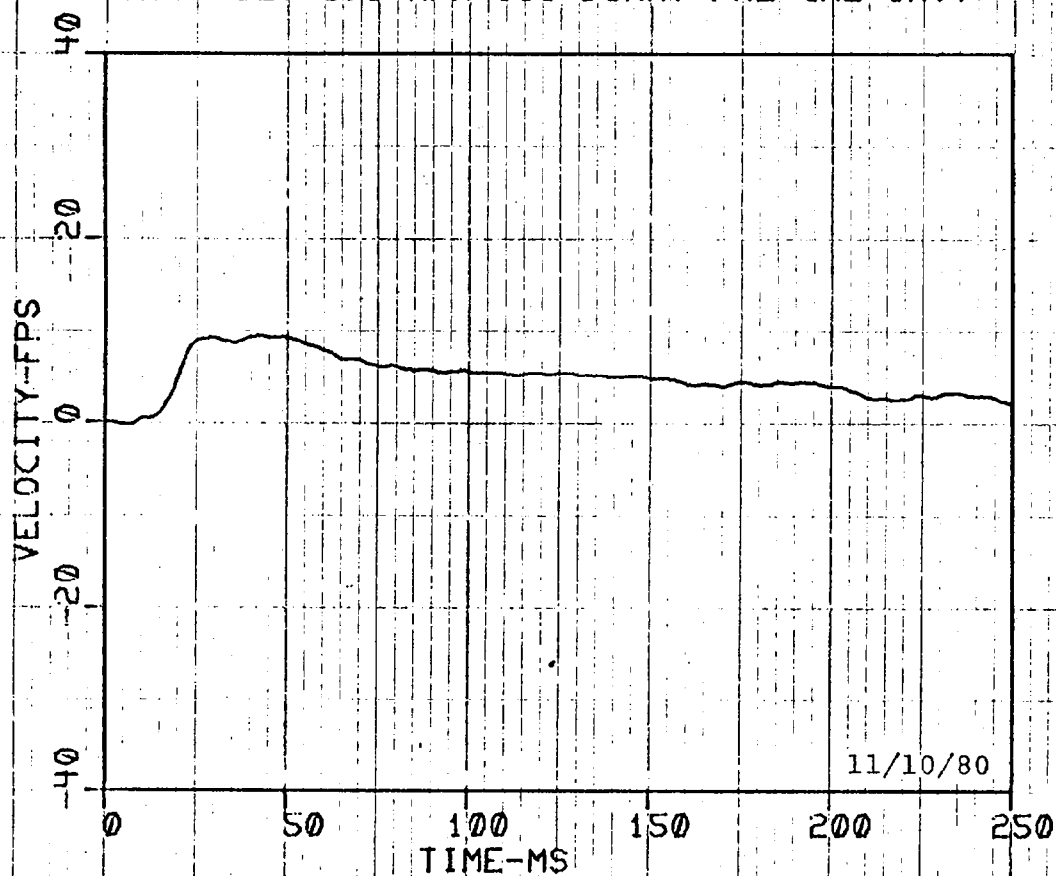
TEST#8327-6.5 APR III DUMMY PRE-CAL RUGY



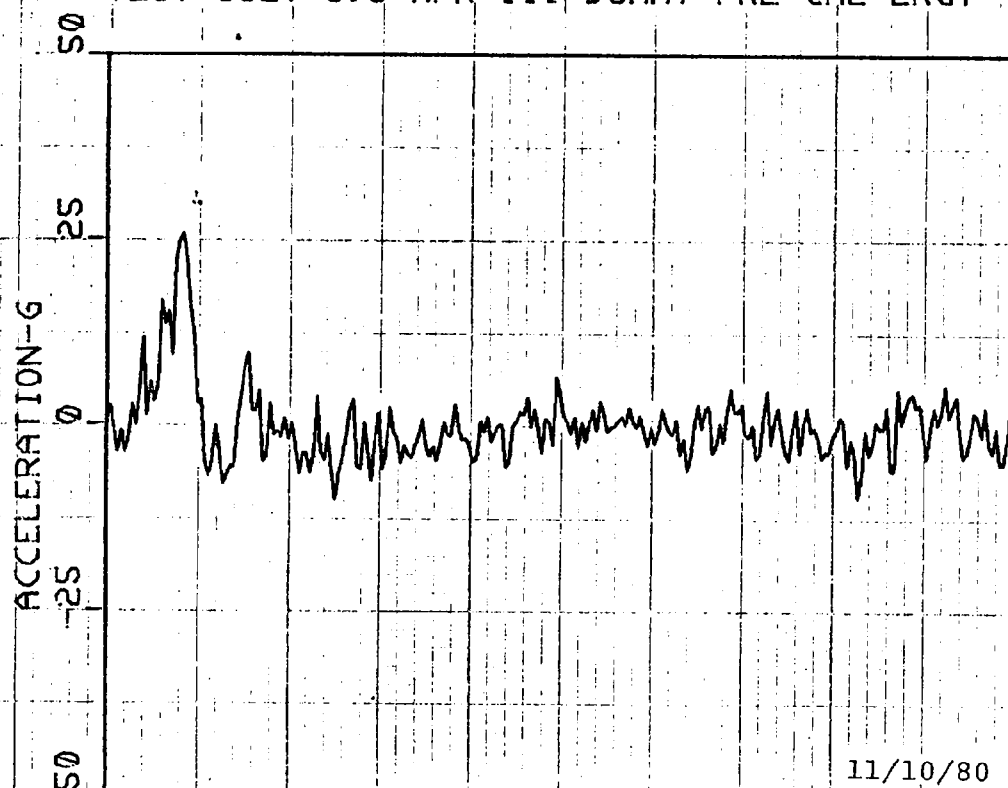
TEST#8327-6.5 APR III DUMMY PRE-CAL 1RGY



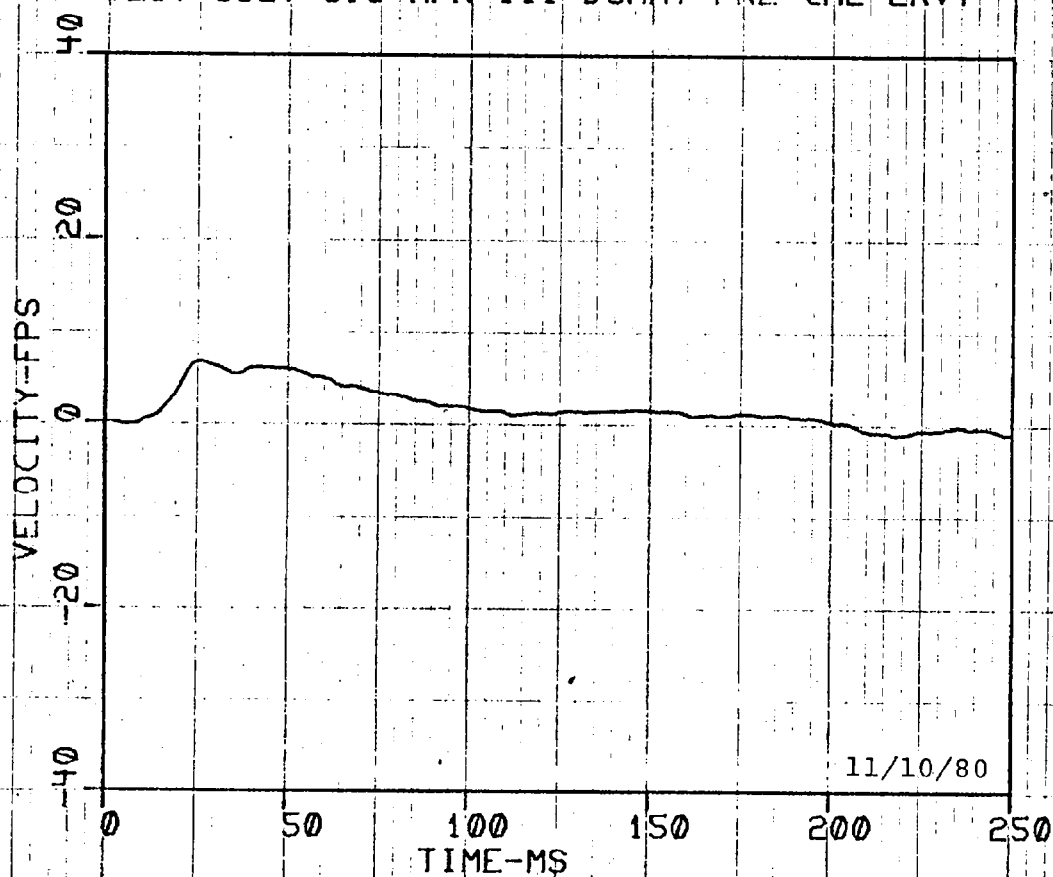
TEST#8327-6.5 APR III DUMMY PRE-CAL 1RVY



TEST#8327-6.5 APR III DUMMY PRE-CAL 2RGY

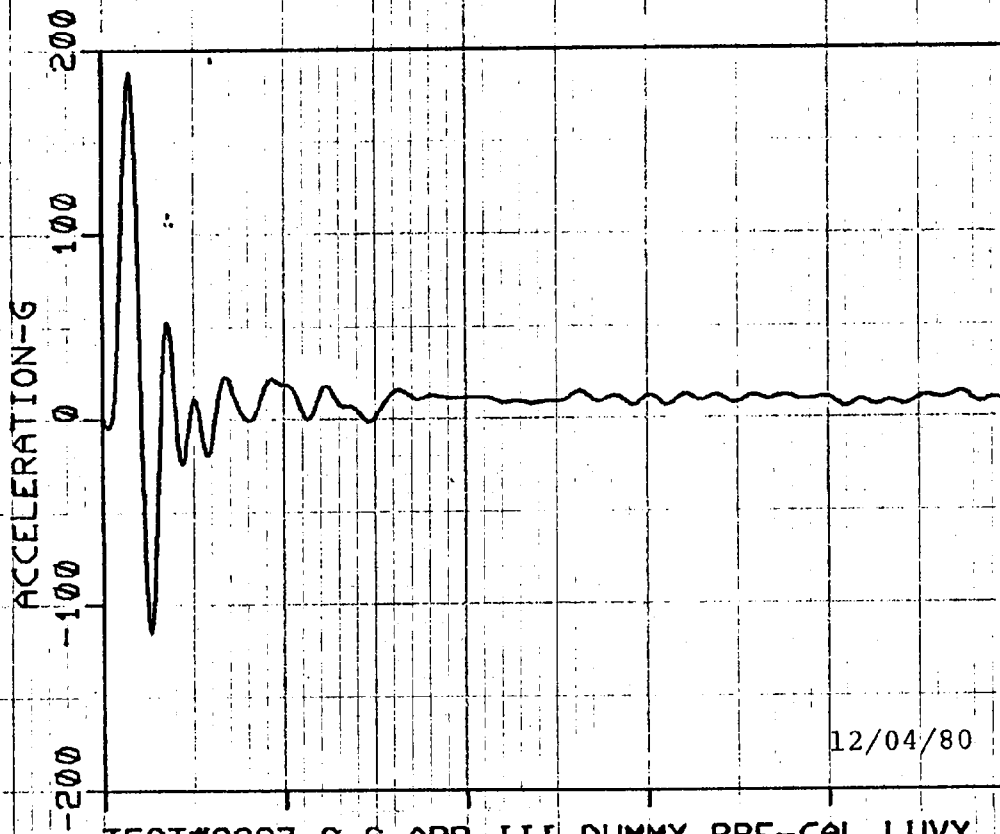


TEST#8327-6.5 APR III DUMMY PRE-CAL 2RVY

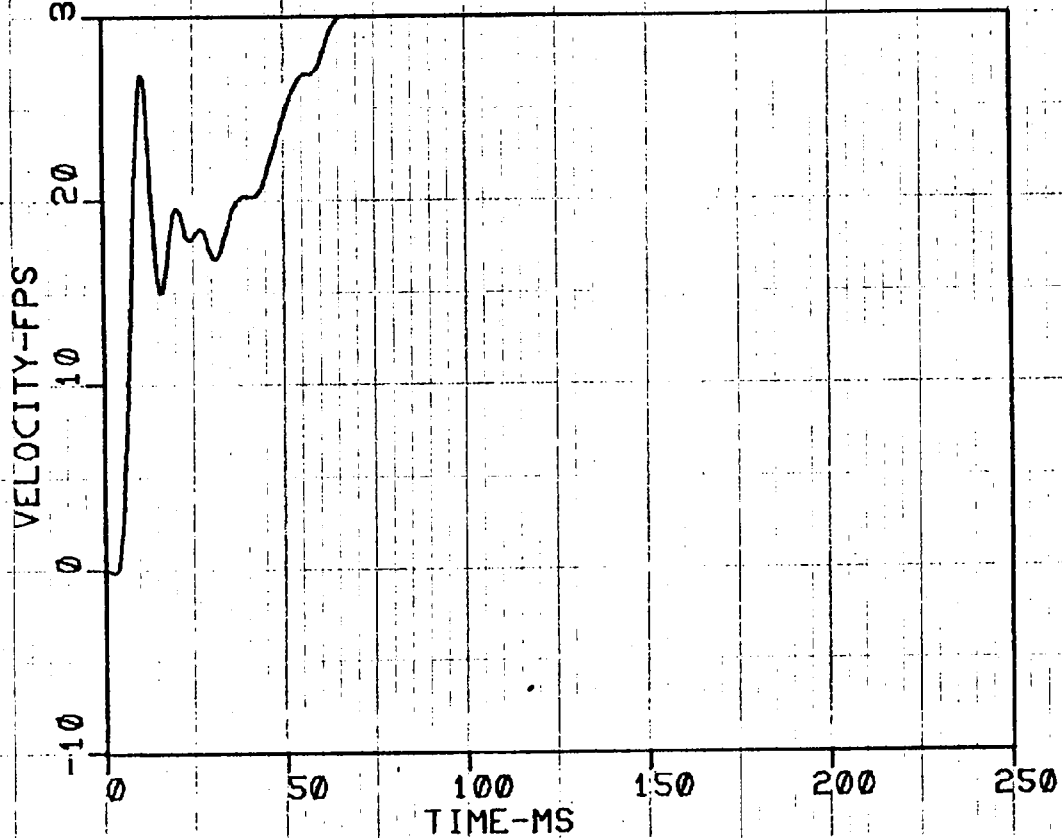


APPENDIX E
DUMMY PRE-TEST
CALIBRATION DATA -
TEST 6.6

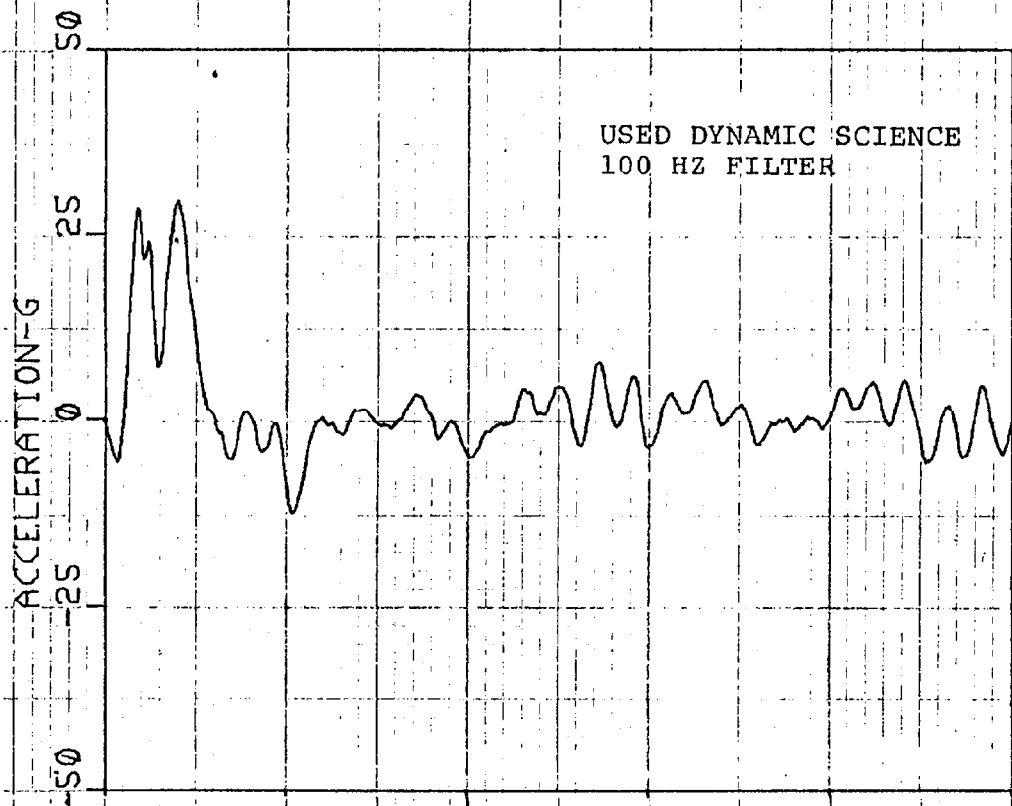
TEST#8327-6.6 APR III DUMMY PRE-CAL LUGY



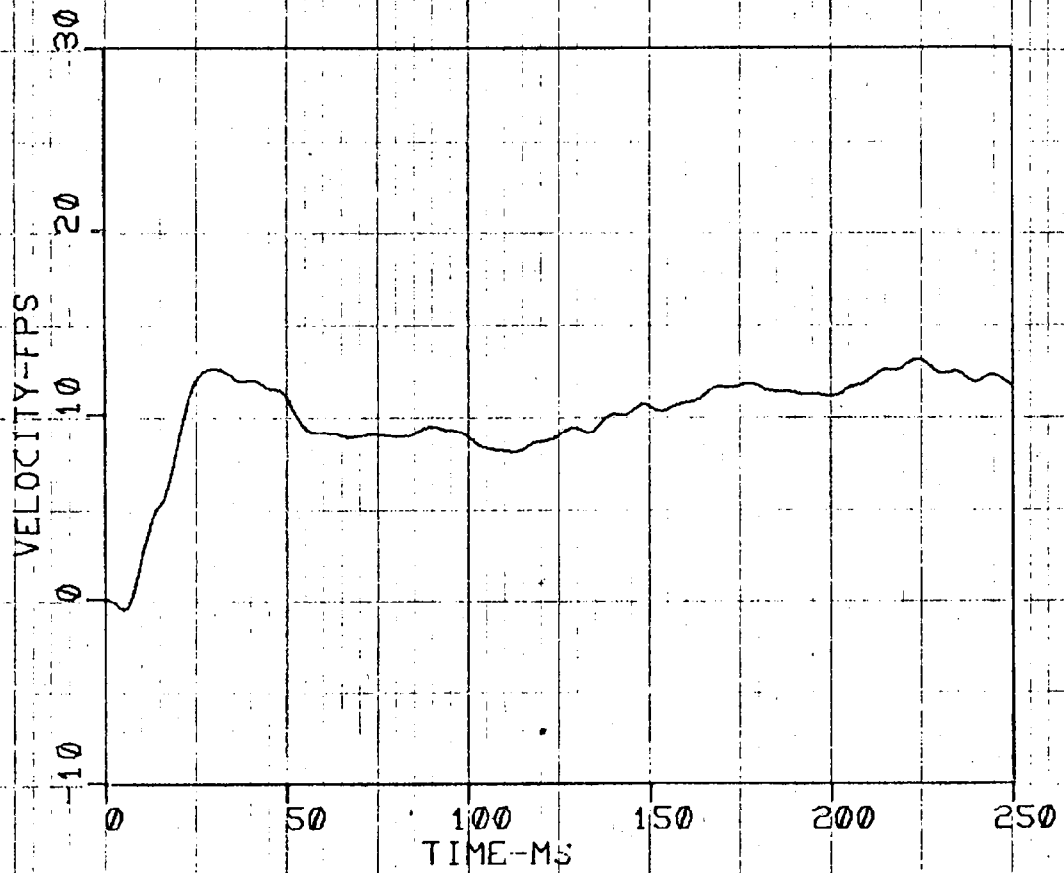
TEST#8327-6.6 APR III DUMMY PRE-CAL LUGY



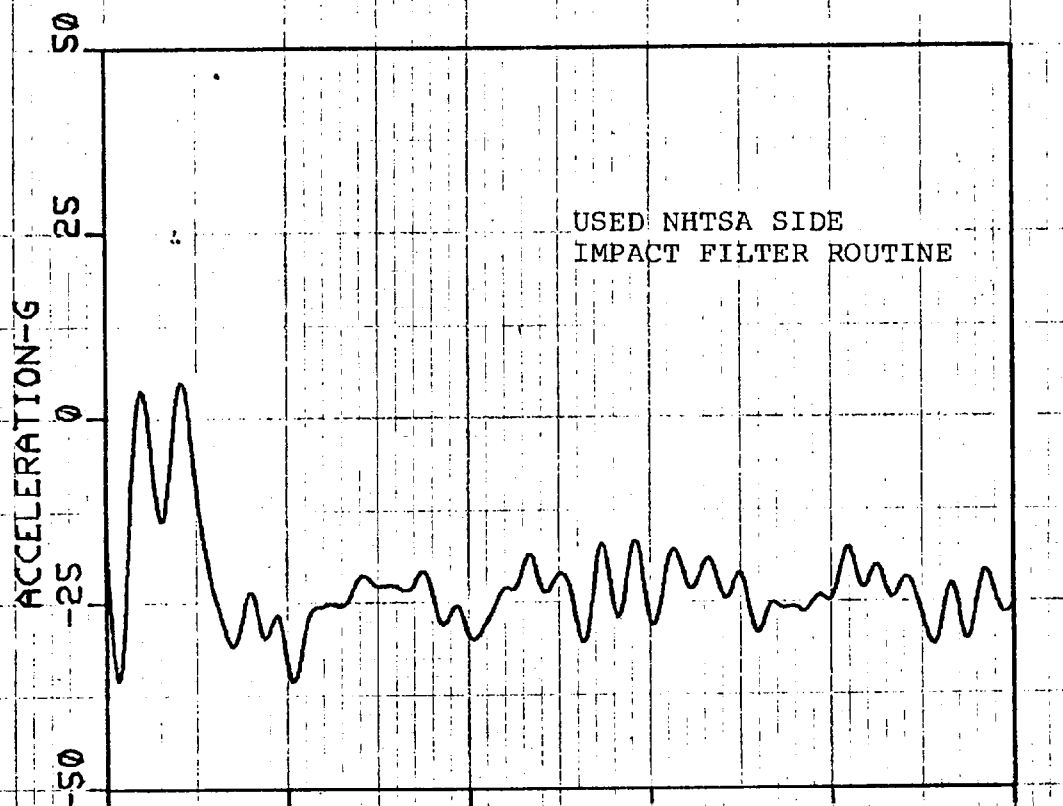
TEST#8327-6.6 APR III DUMMY PRE-CAL RUGY



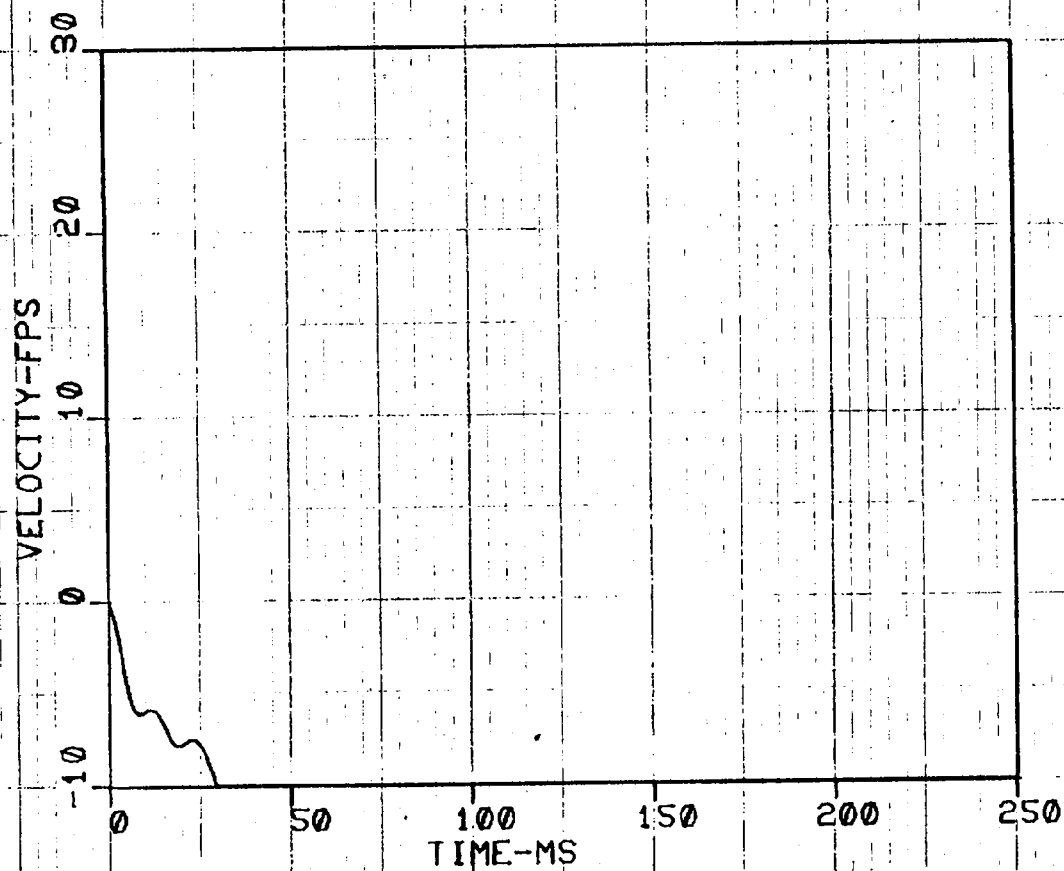
TEST#8327-6.6 APR III DUMMY PRE-CAL RUGY



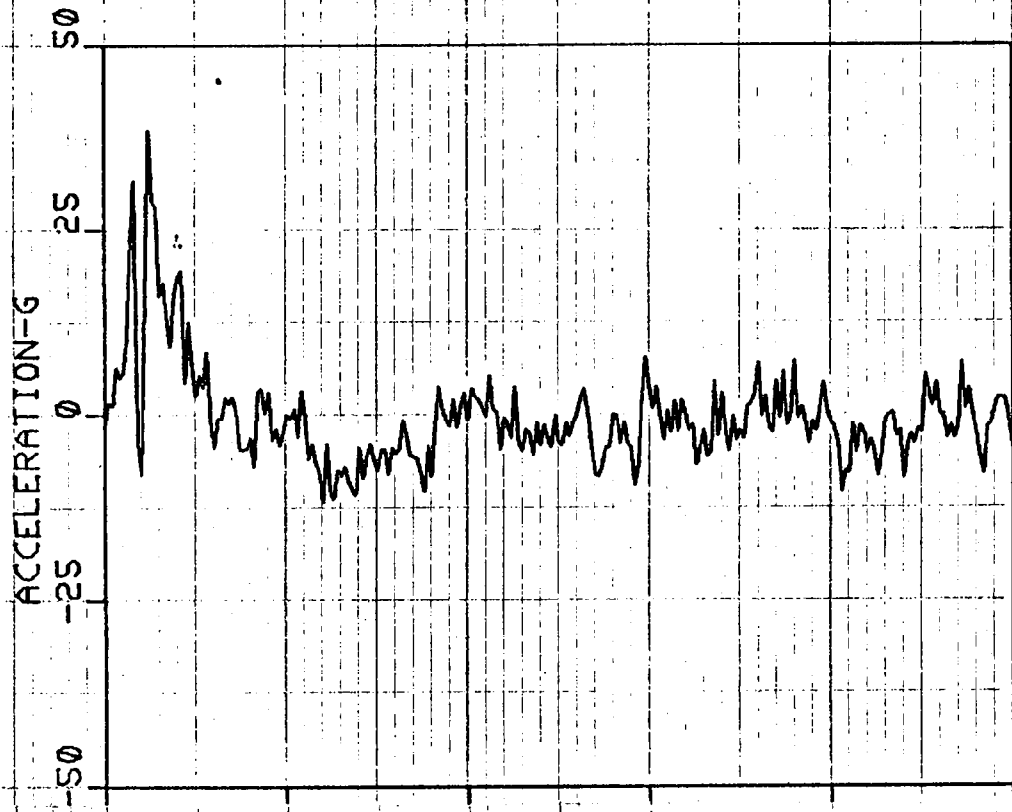
TEST#8327-6.6 APR III DUMMY PRE-CAL RUGY



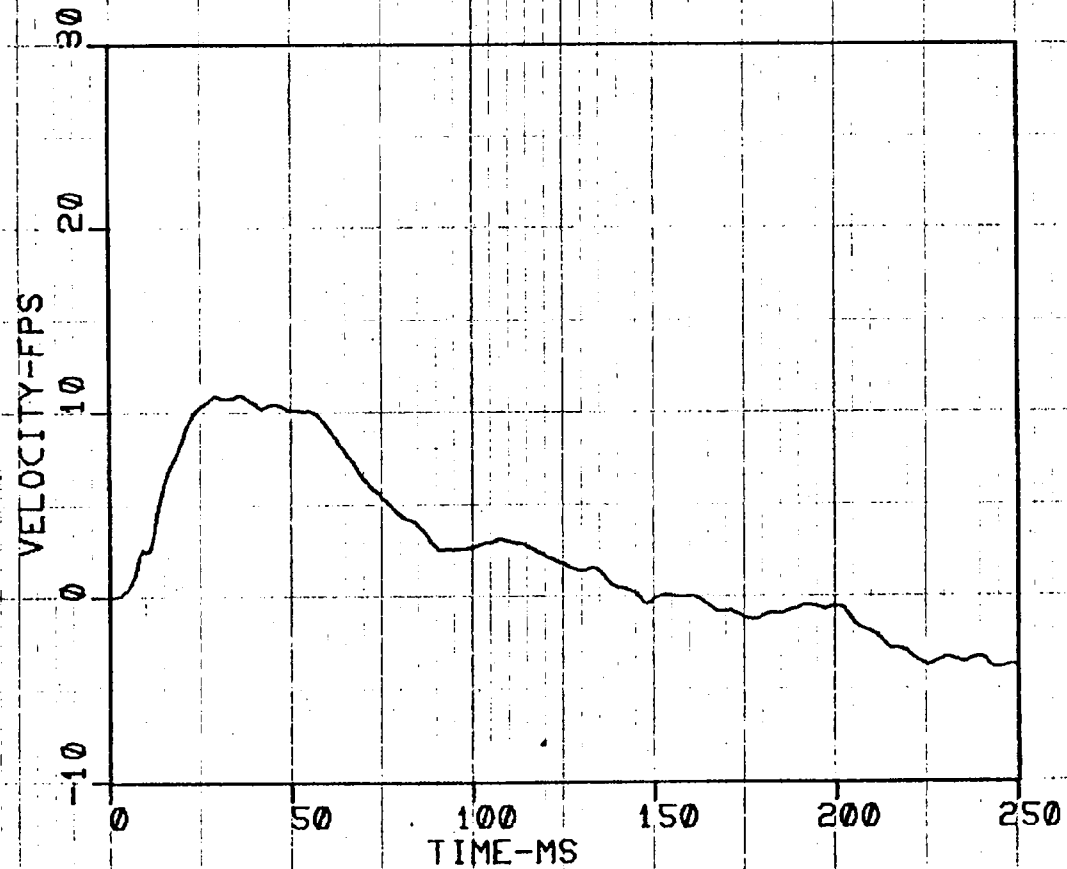
TEST#8327-6.6 APR III DUMMY PRE-CAL RUGY



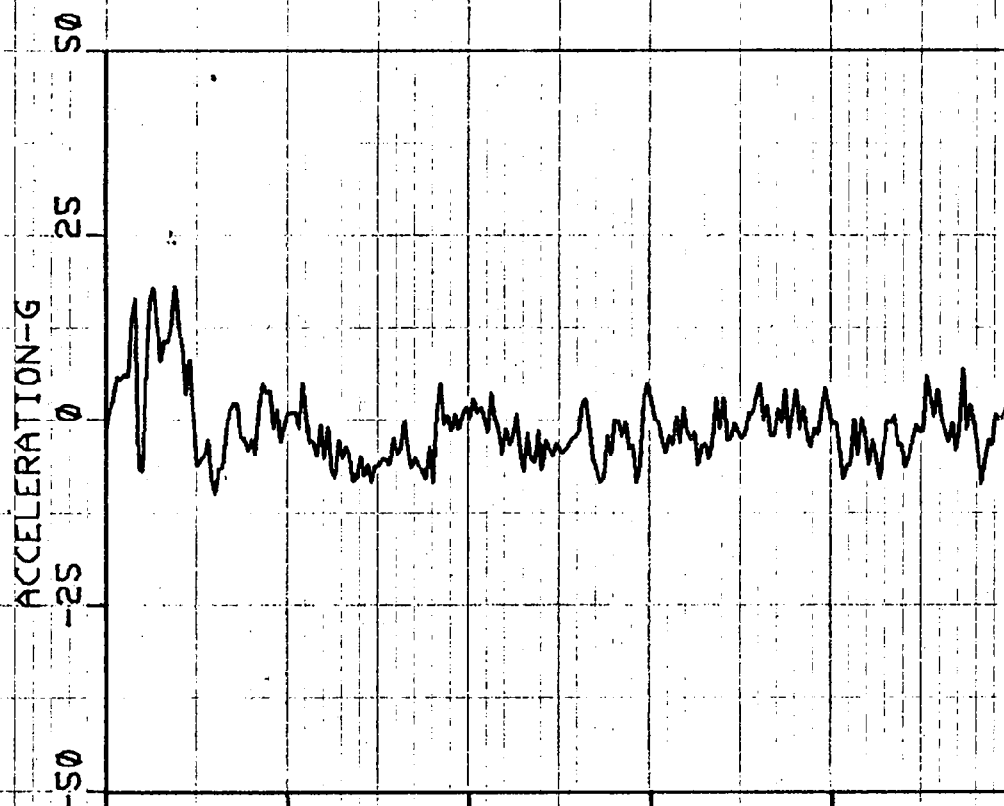
TEST#8327-6.6 APR III DUMMY PRE-CAL 1RGY



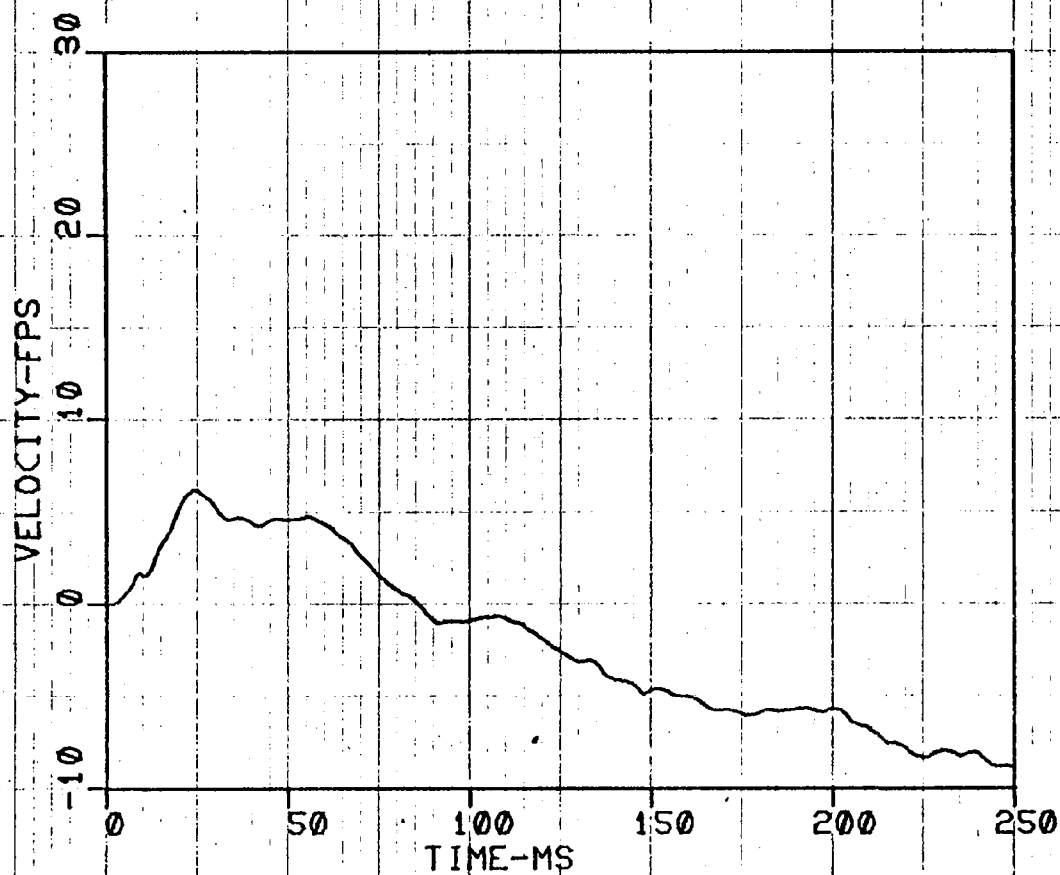
TEST#8327-6.6 APR III DUMMY PRE-CAL 1RVY



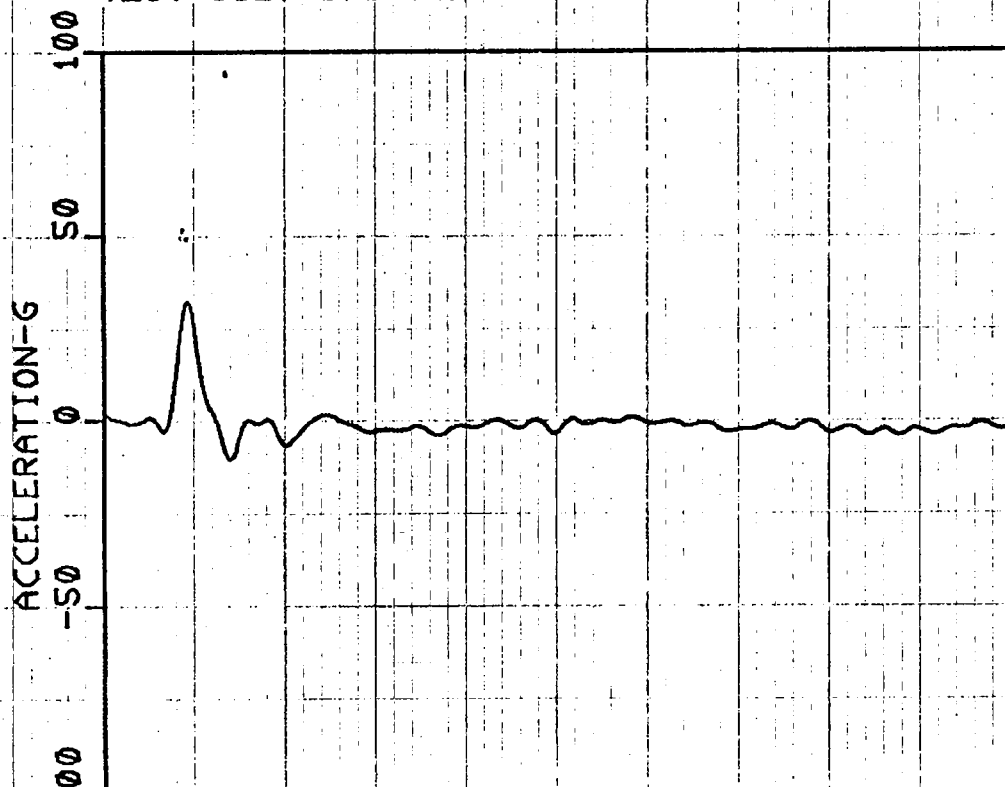
TEST#8327-6.6 APR III DUMMY PRE-CAL 2RGY



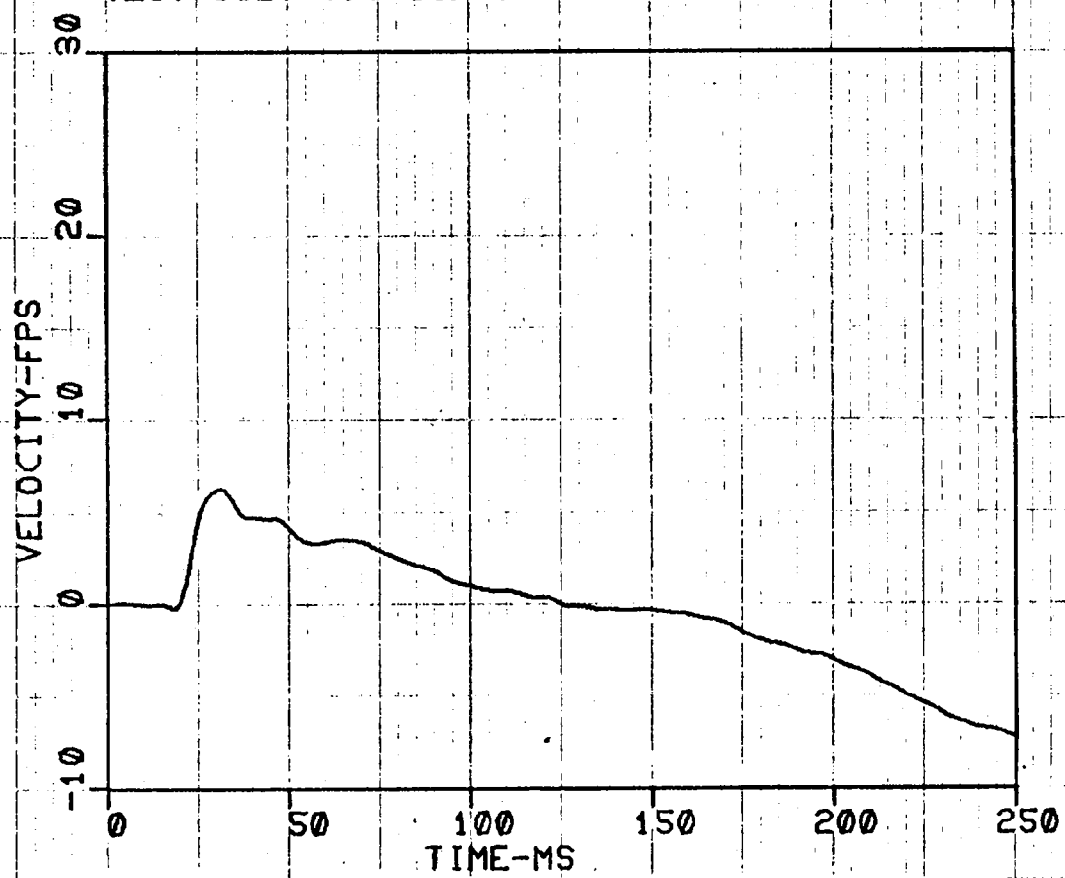
TEST#8327-6.6 APR III DUMMY PRE-CAL 2RVY



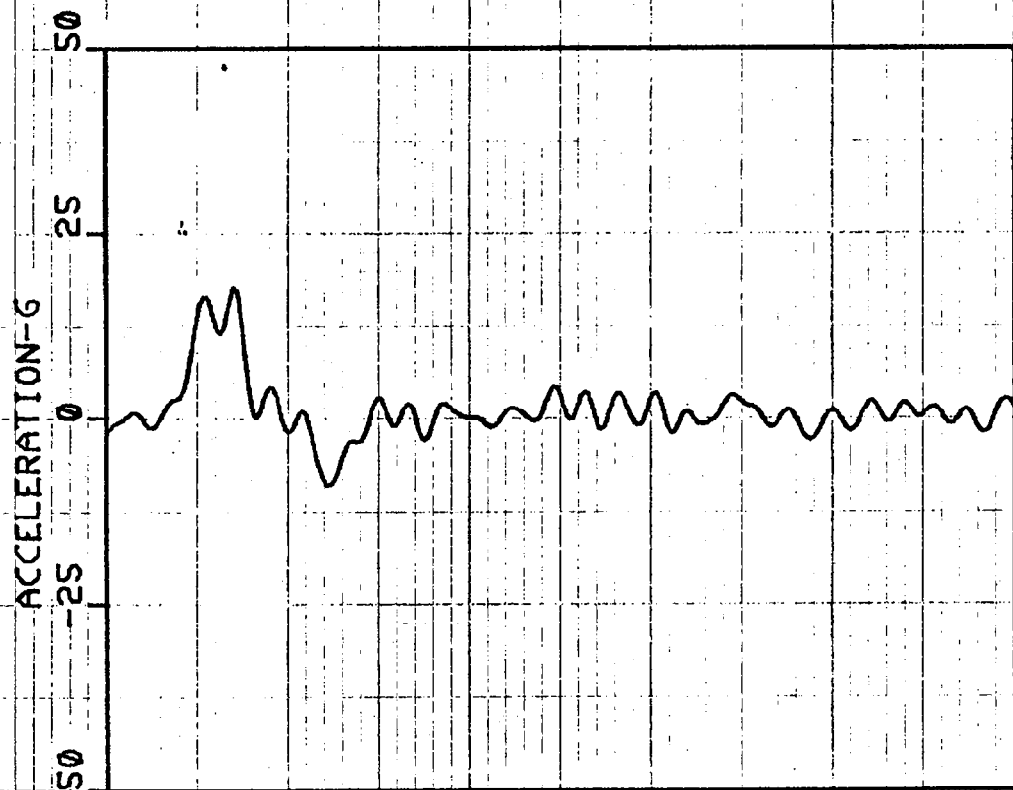
TEST#8327-6.6 SID 386 DUMMY PRE-CAL LUGY



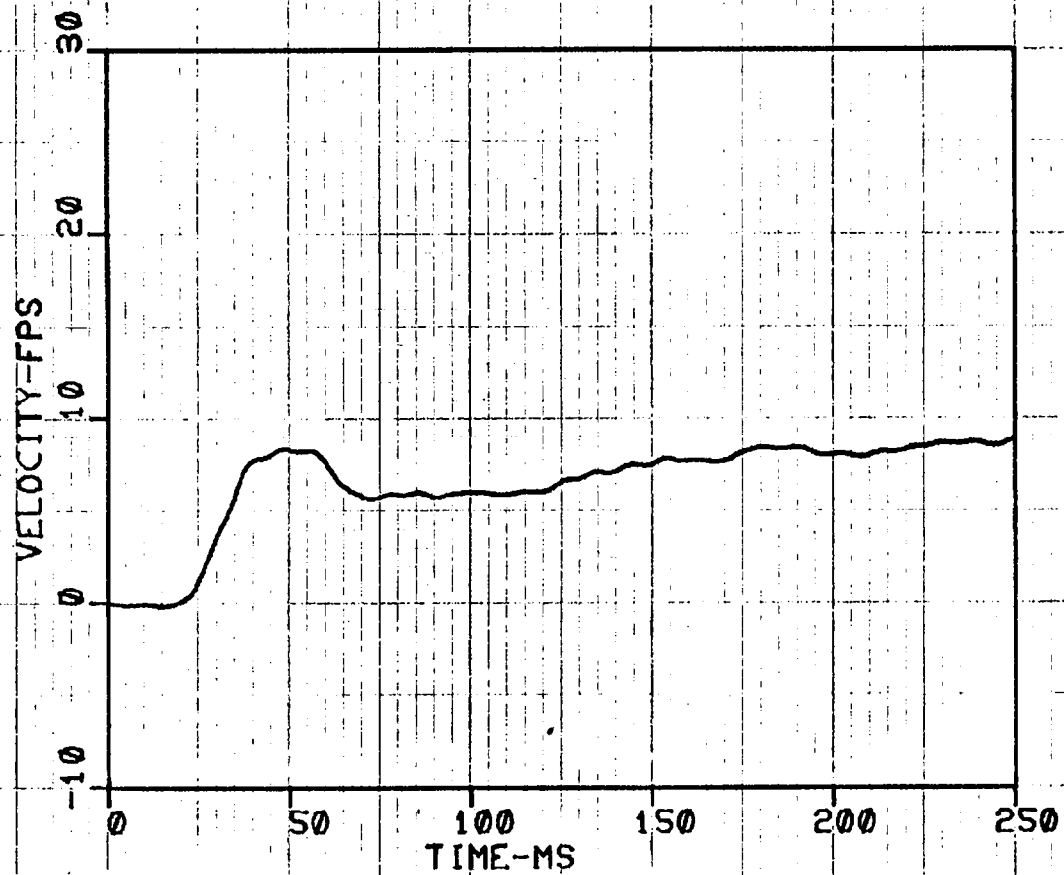
TEST#8327-6.6 SID 386 DUMMY PRE-CAL LUGY



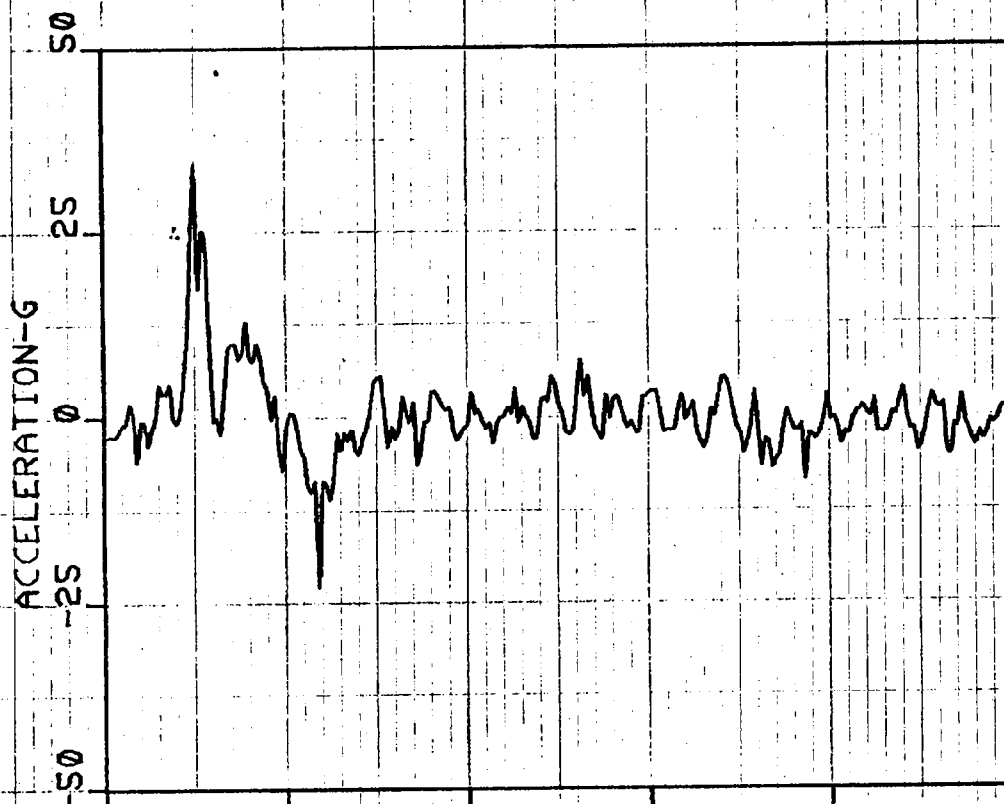
TEST#8327-6.6 SID 386 DUMMY PRE-CAL RUGY



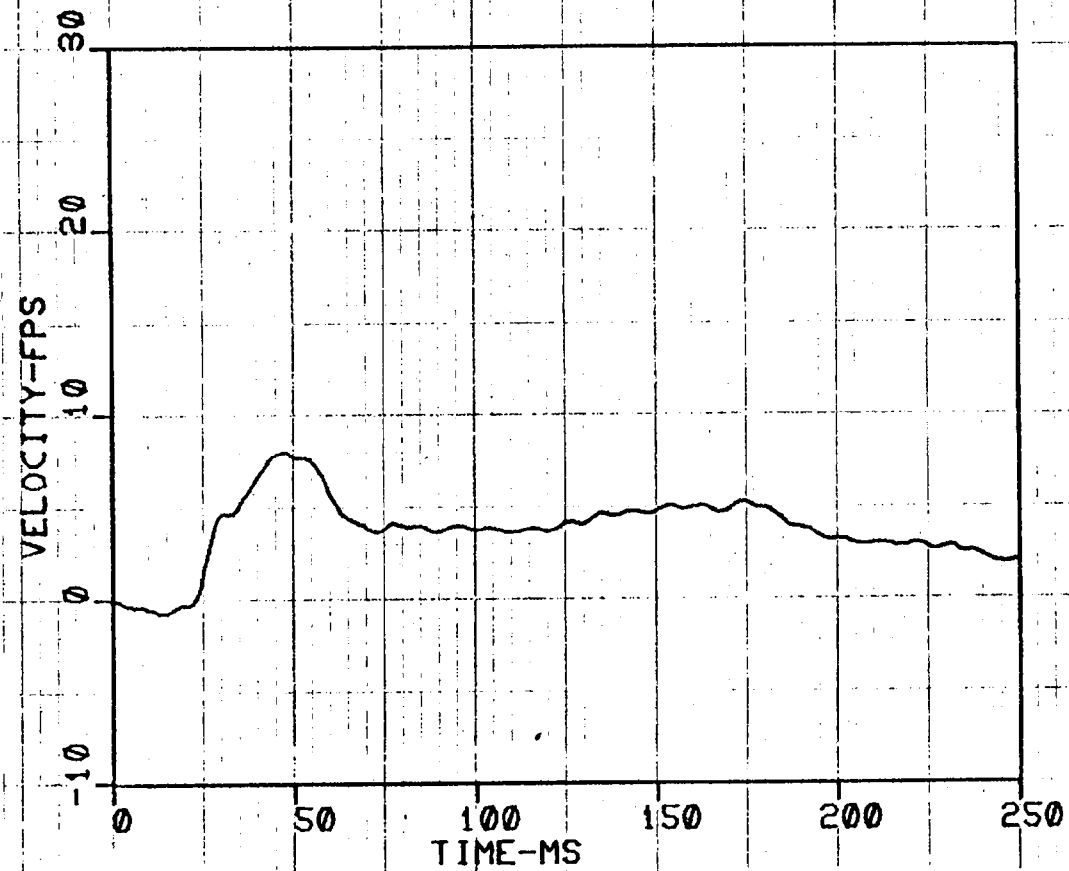
TEST#8327-6.6 SID 386 DUMMY PRE-CAL RUVY



TEST#8327-6.6 SID 386 DUMMY PRE-CAL 1RGY

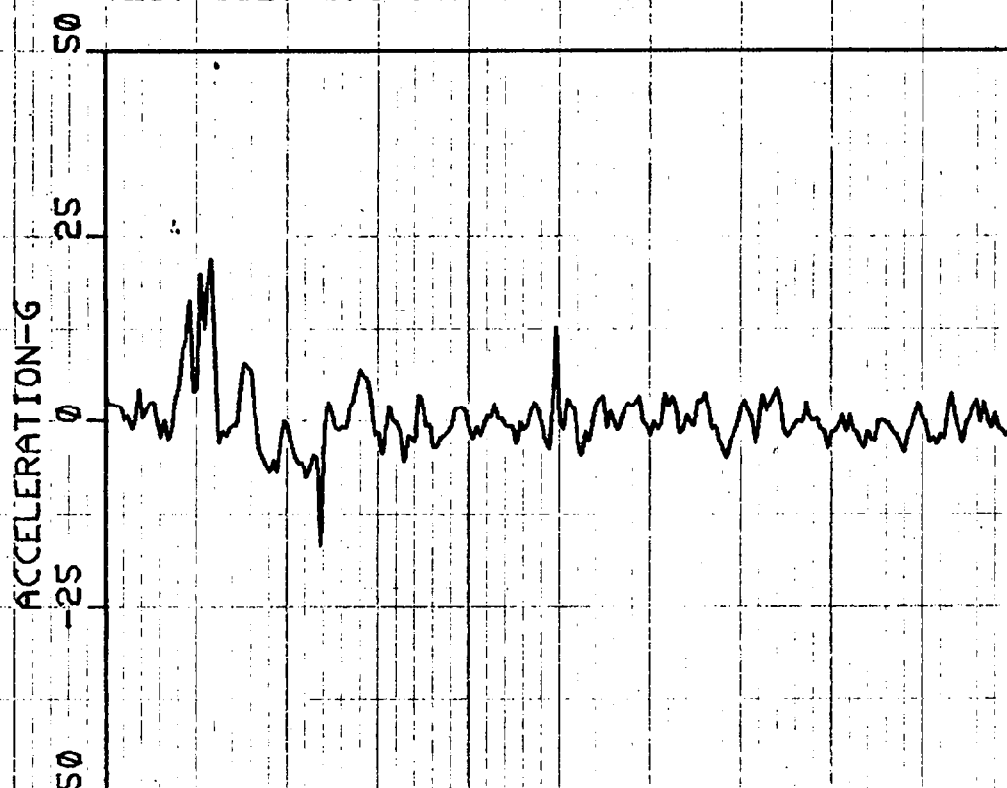


TEST#8327-6.6 SID 386 DUMMY PRE-CAL 1RVY

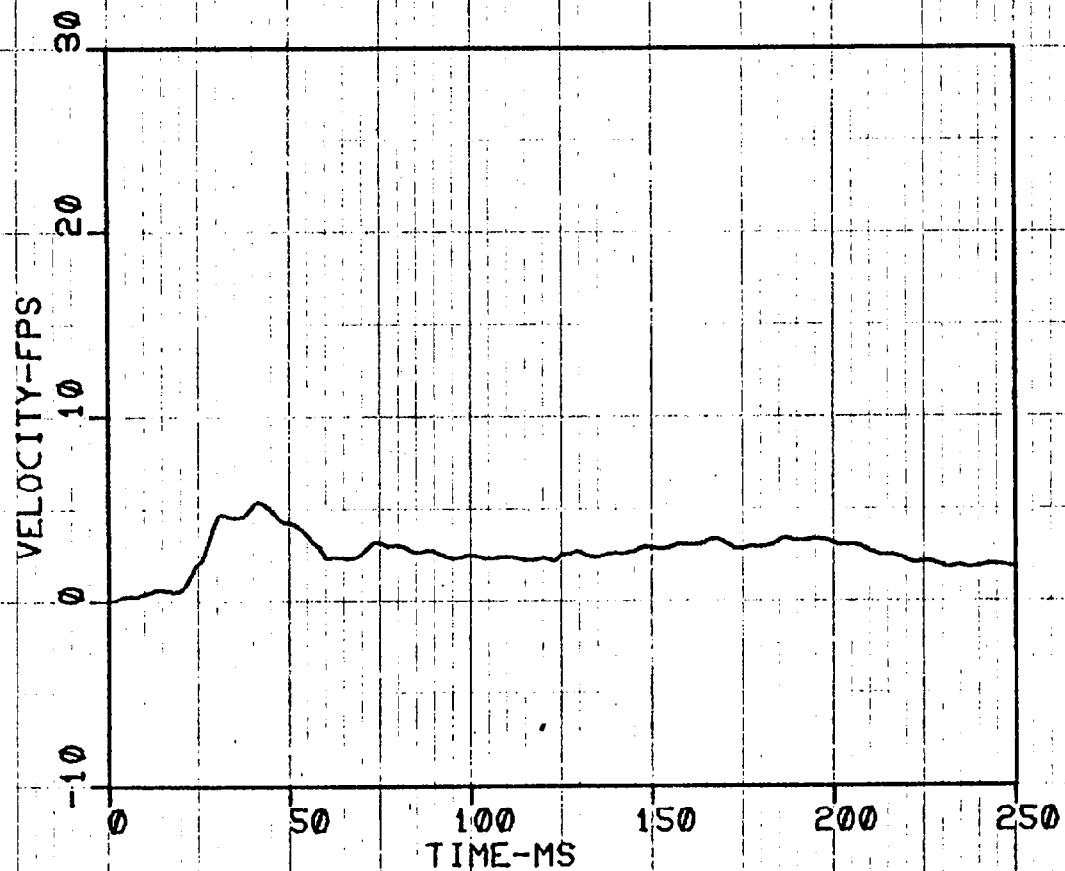


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TEST#8327-6.6 SID 386 DUMMY PRE-CAL 2RGY

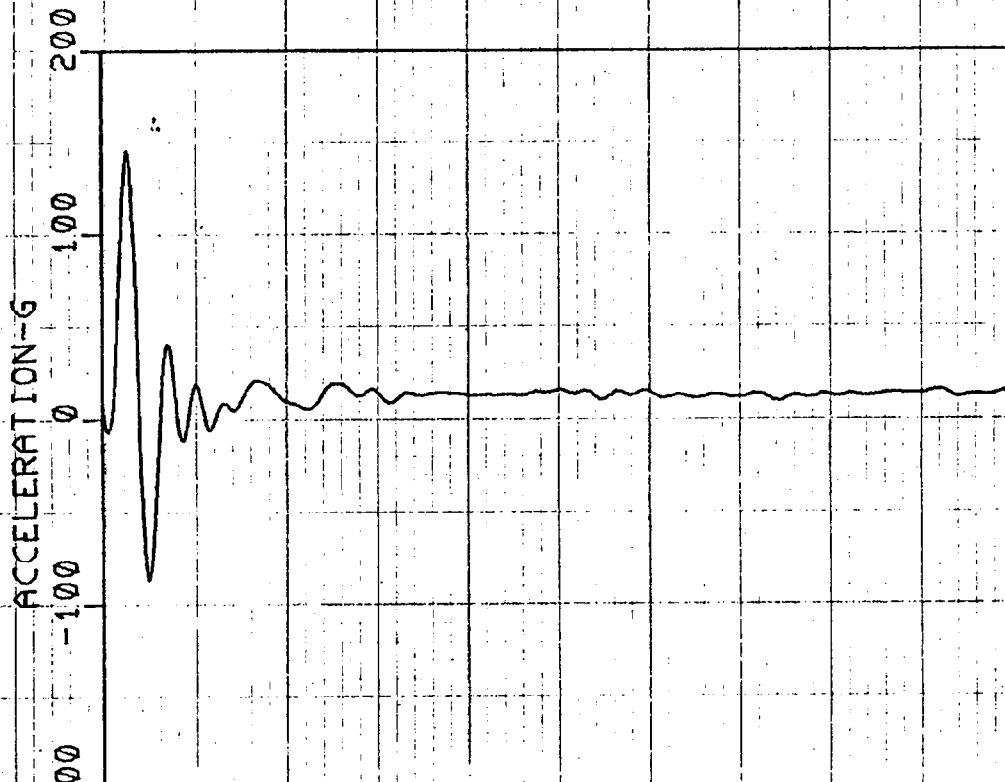


TEST#8327-6.6 SID 386 DUMMY PRE-CAL 2RVY

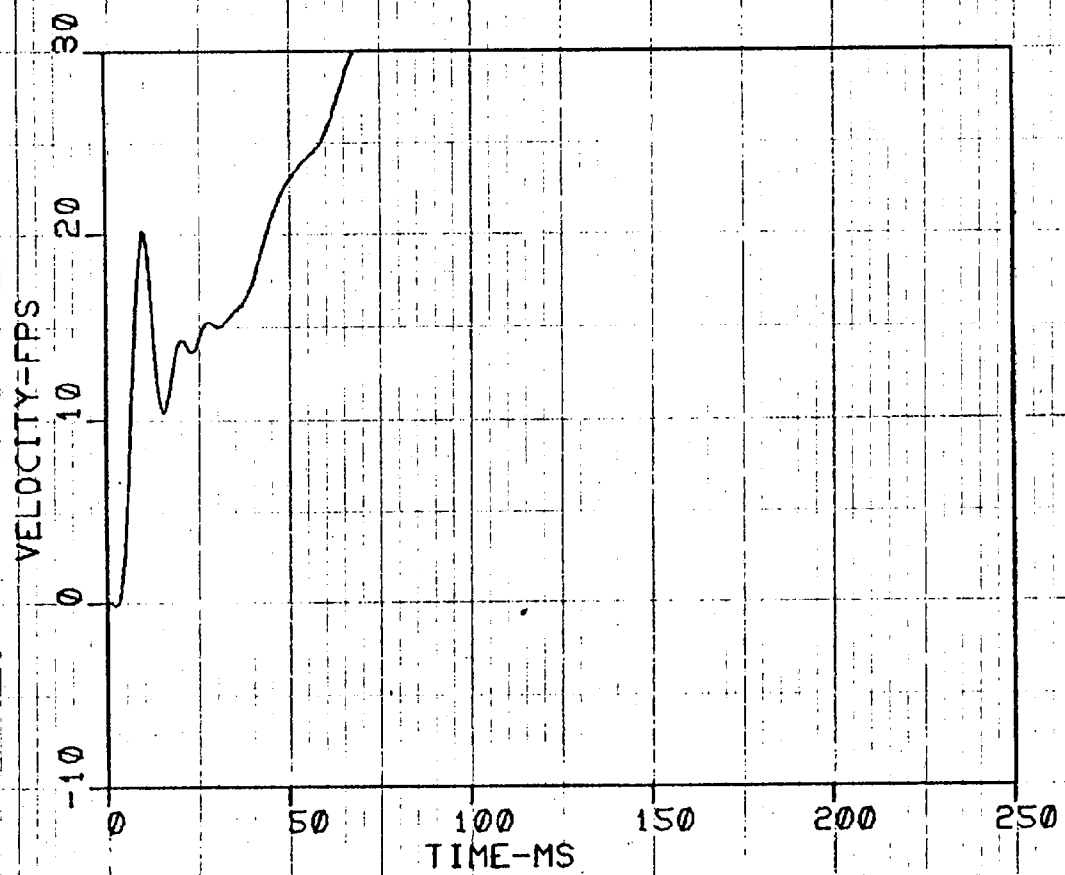


APPENDIX F
DUMMY POST-TEST
CALIBRATION DATA -
TEST 6.6

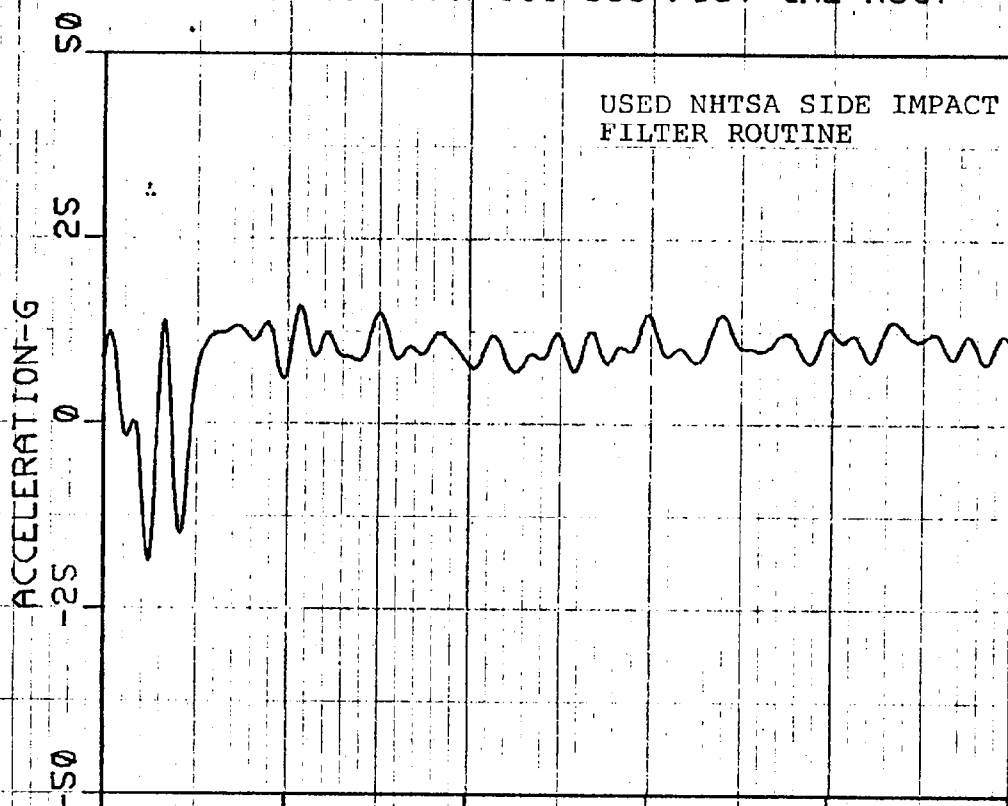
TEST#8327-6.6 APR III 869 POST CAL LUGY



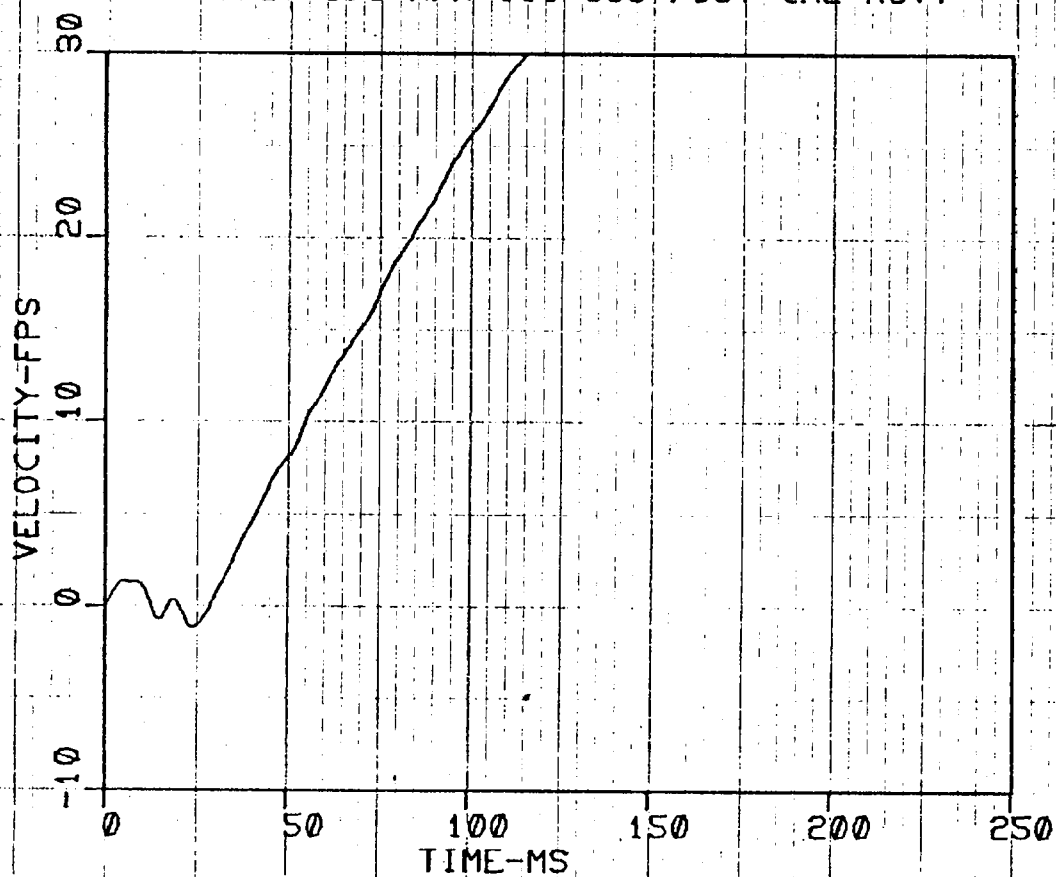
TEST#8327-6.6 APR III 869 POST CAL LUVY



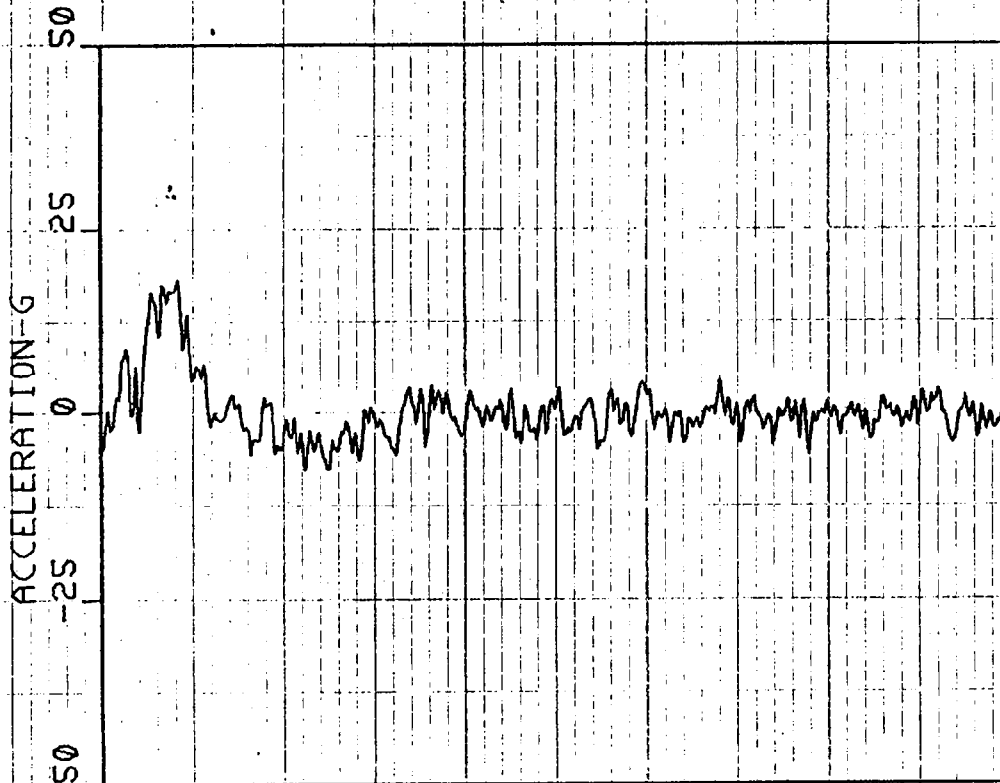
TEST#8327-6.6 APR III 869 POST CAL RUGY



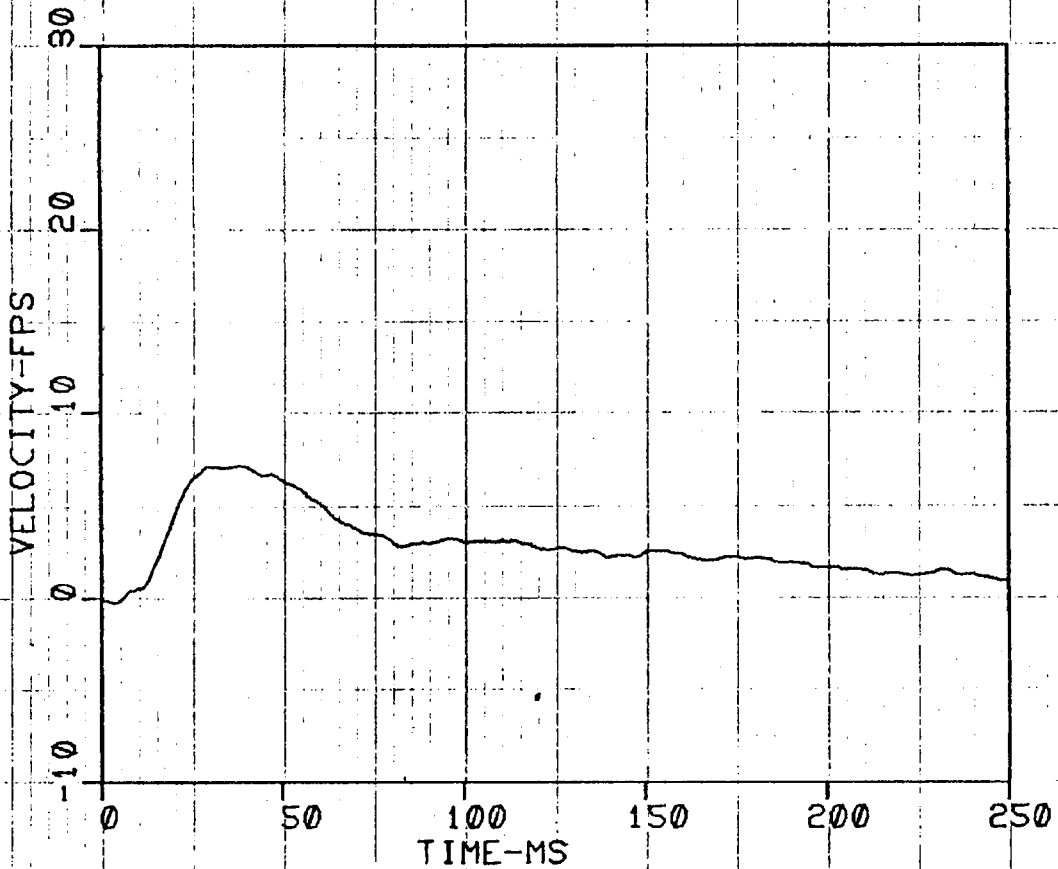
TEST#8327-6.6 APR III 869 POST CAL RUVY



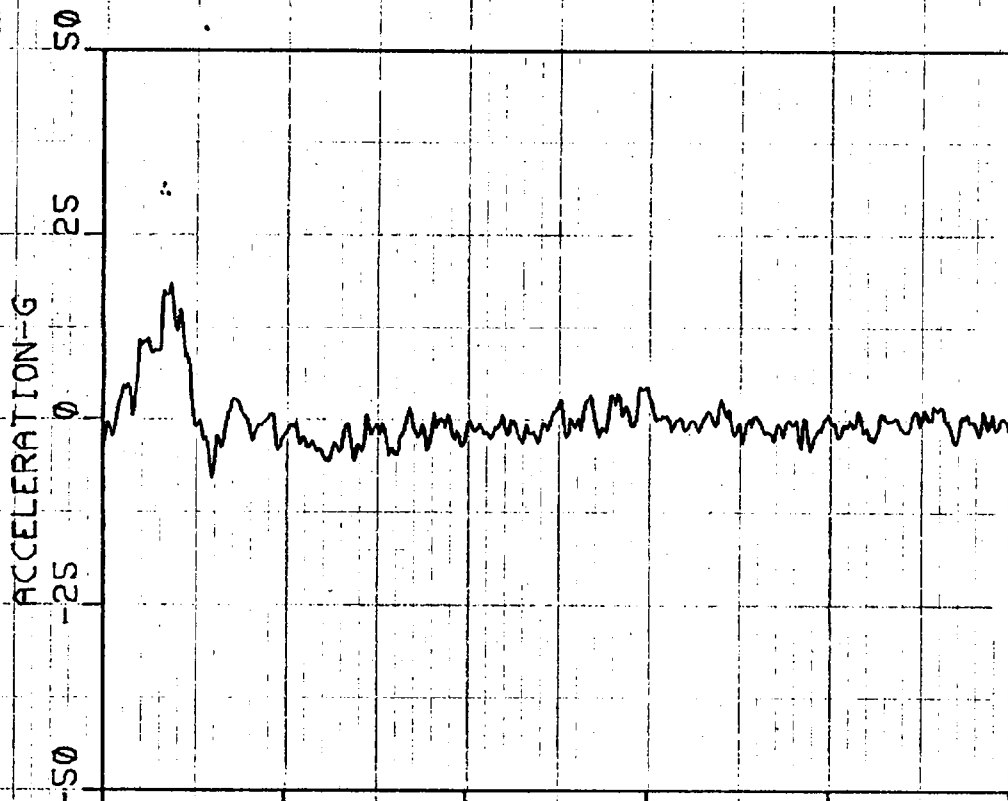
TEST#8327-6.6 APR III 869 POST CAL 1RGY



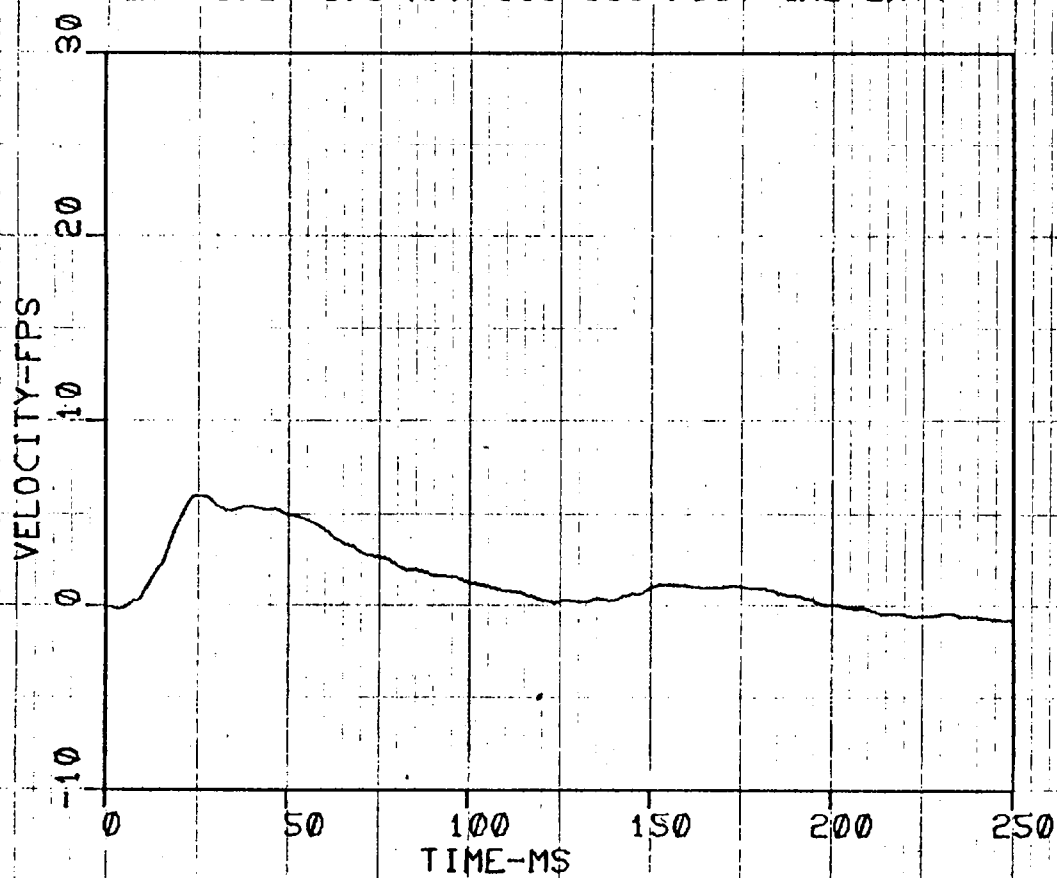
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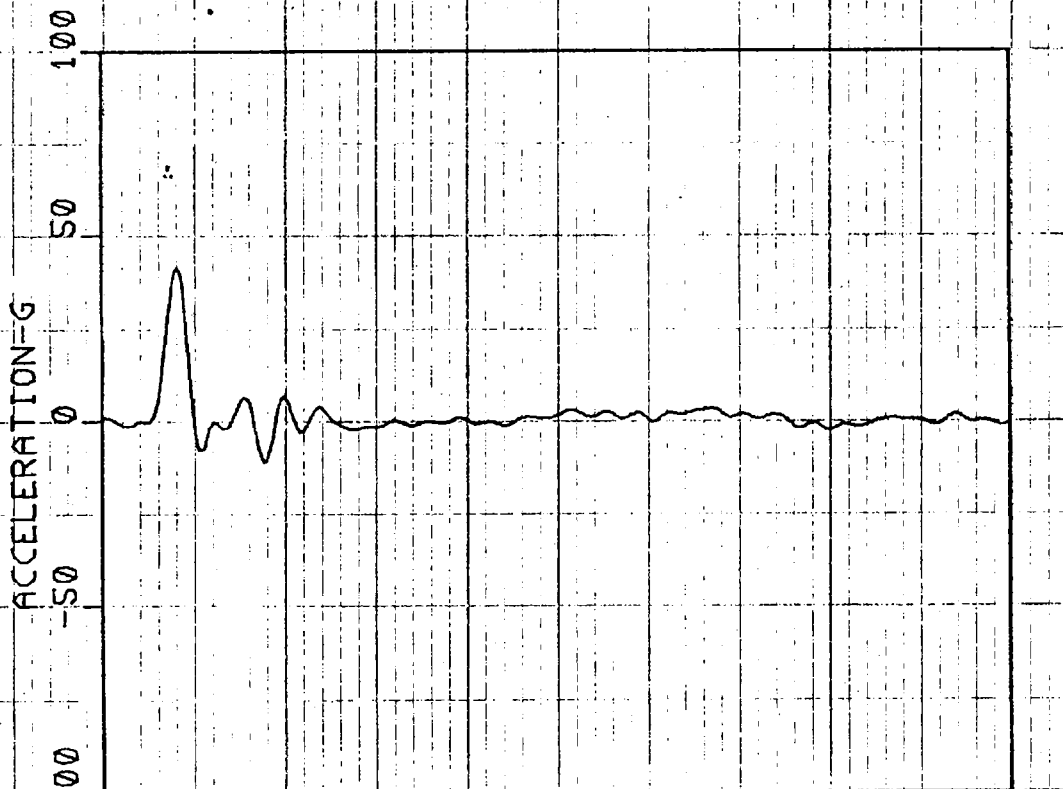
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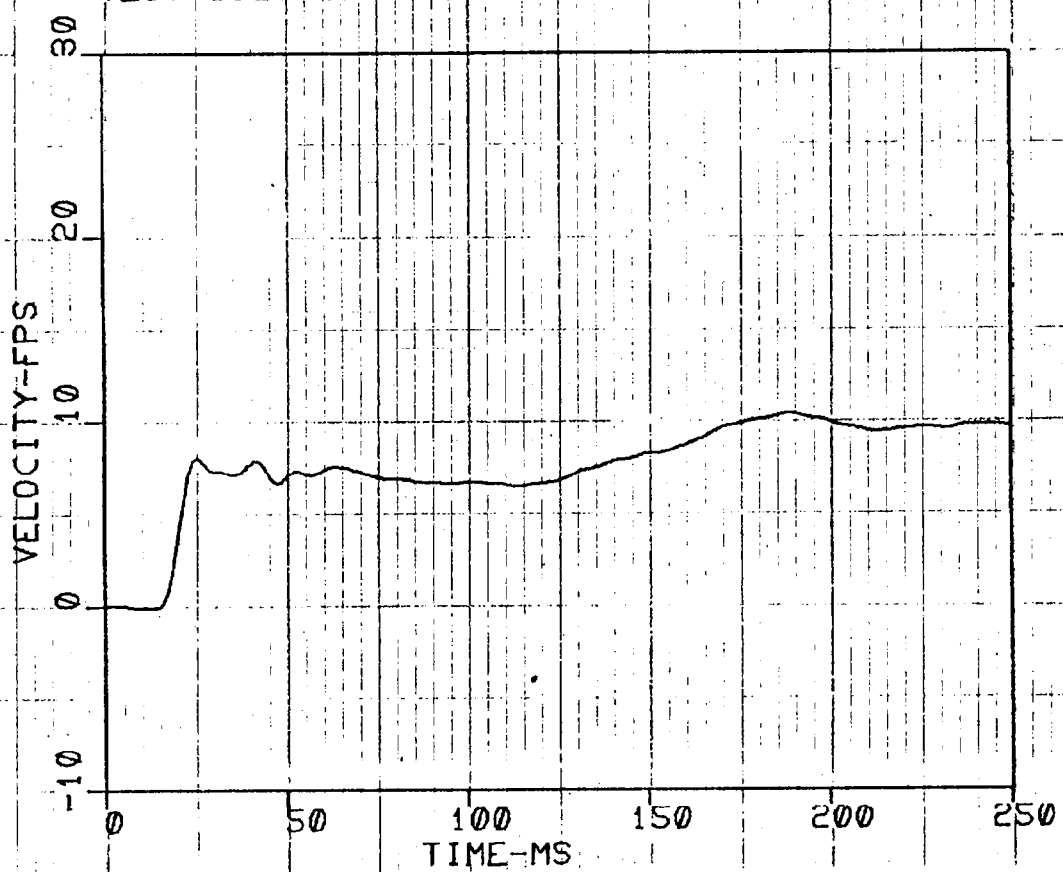
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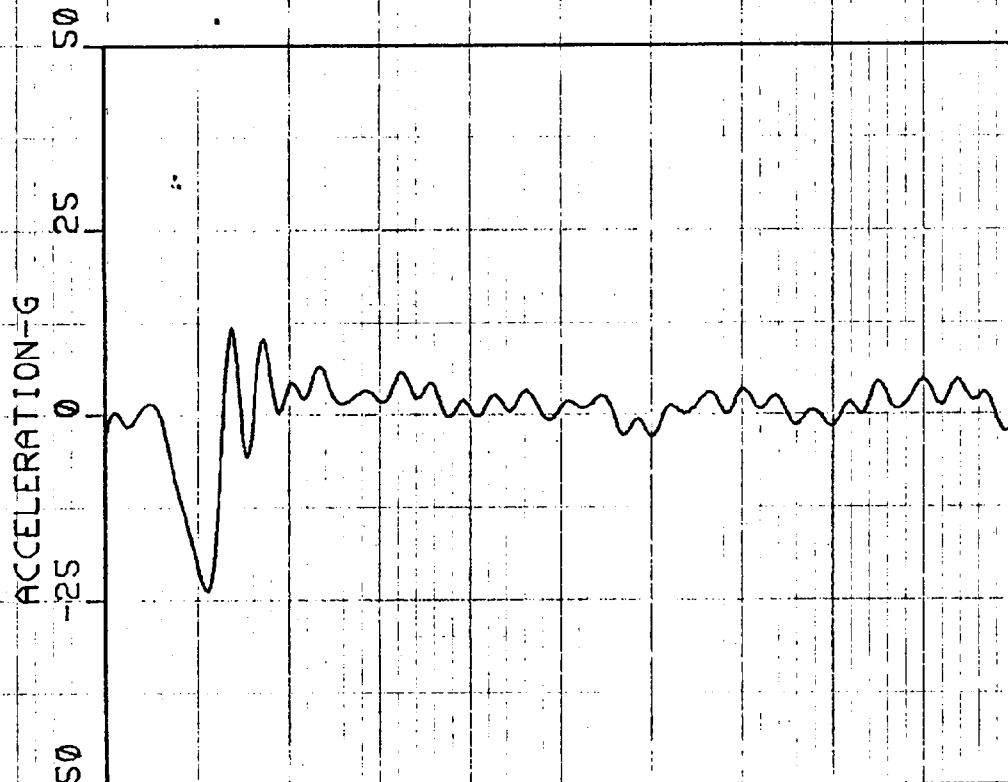
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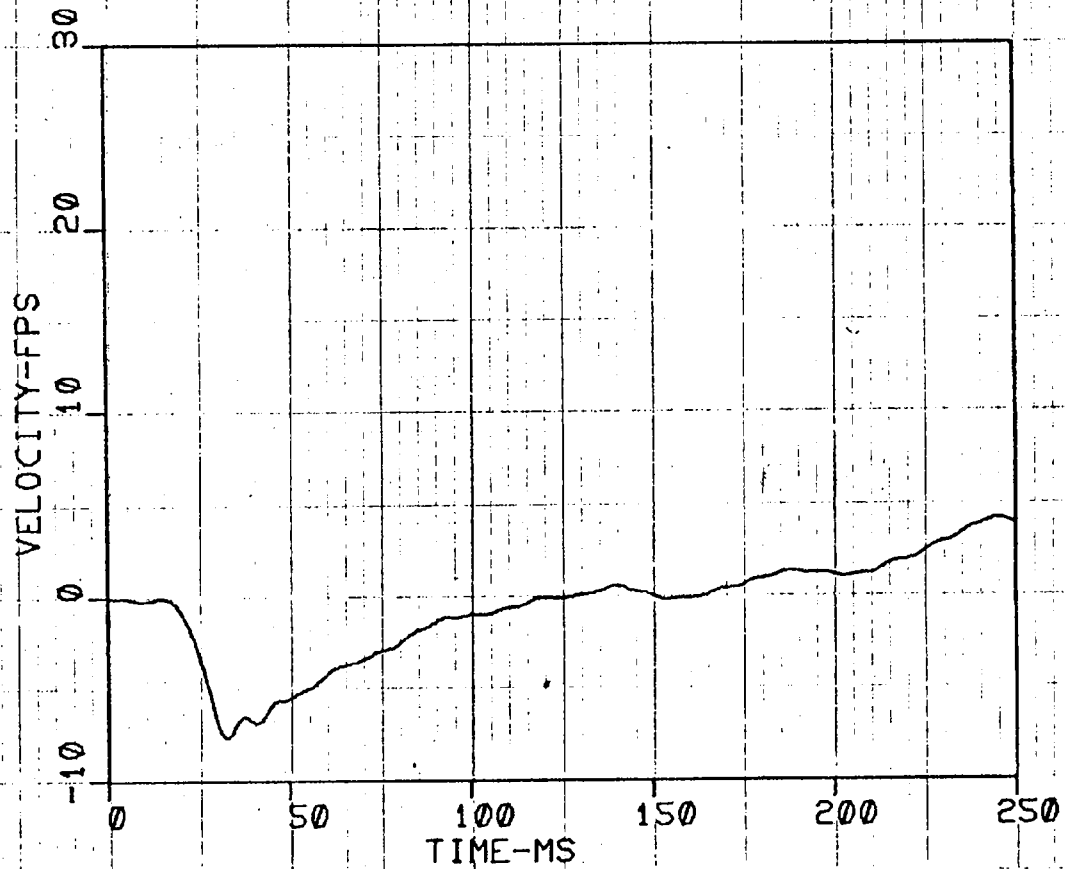
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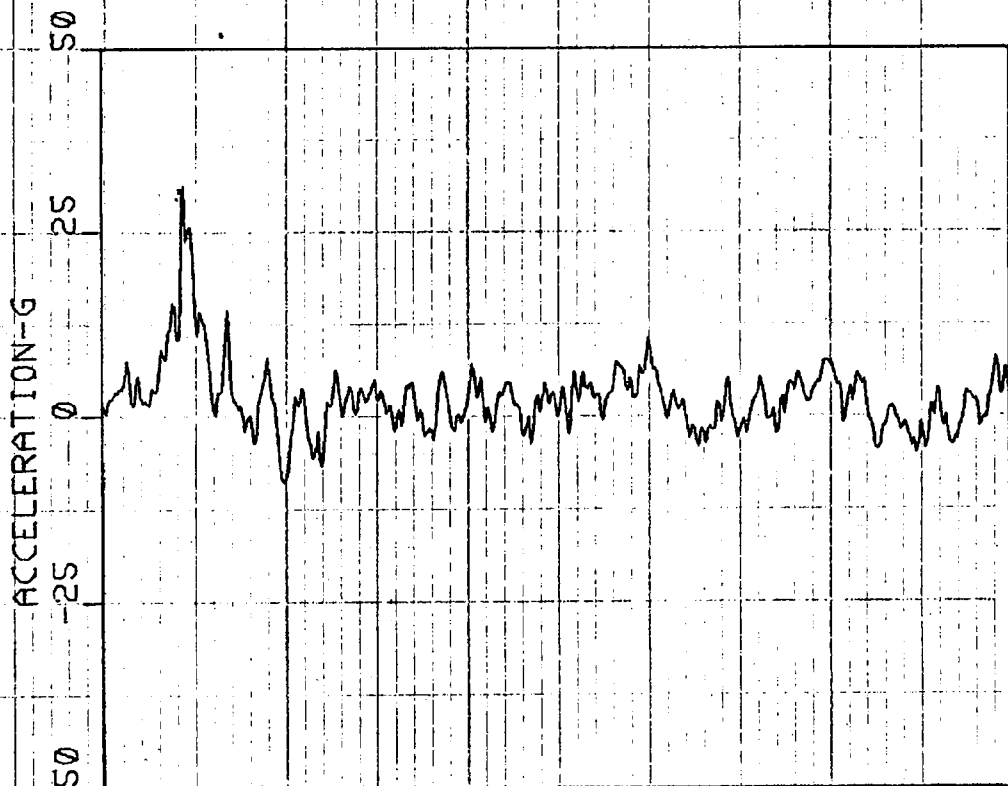
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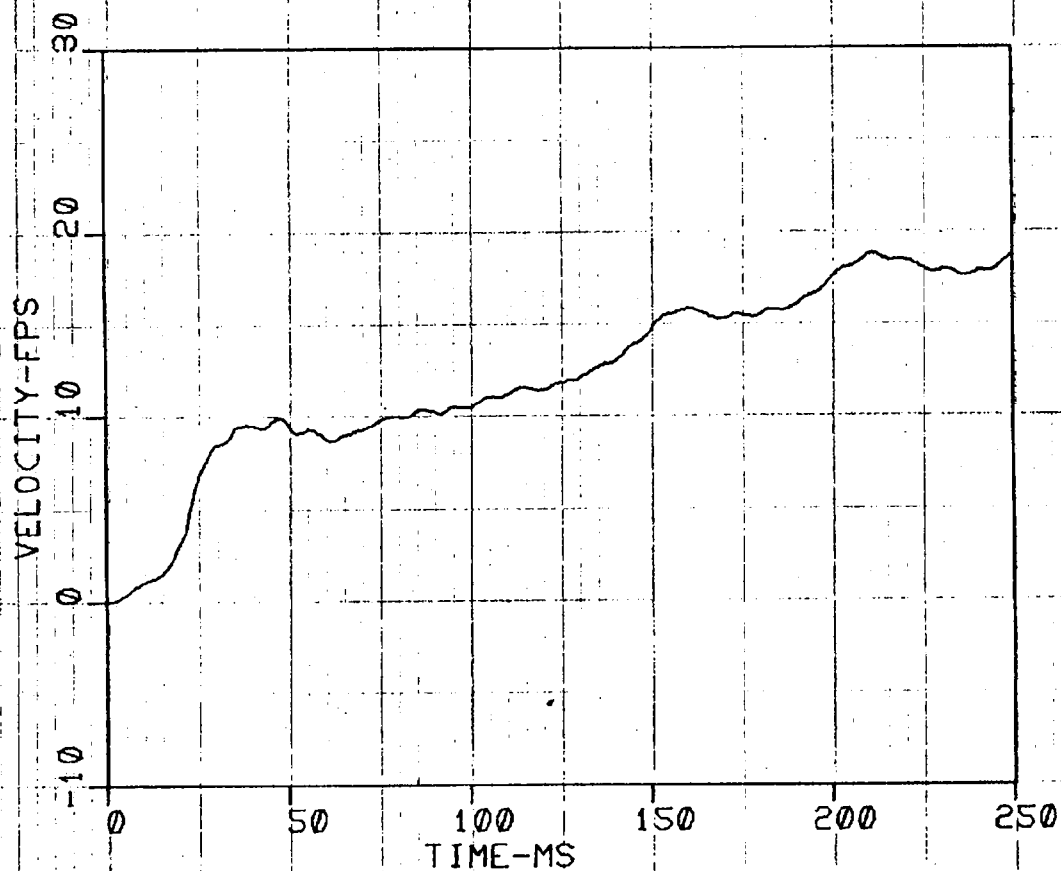
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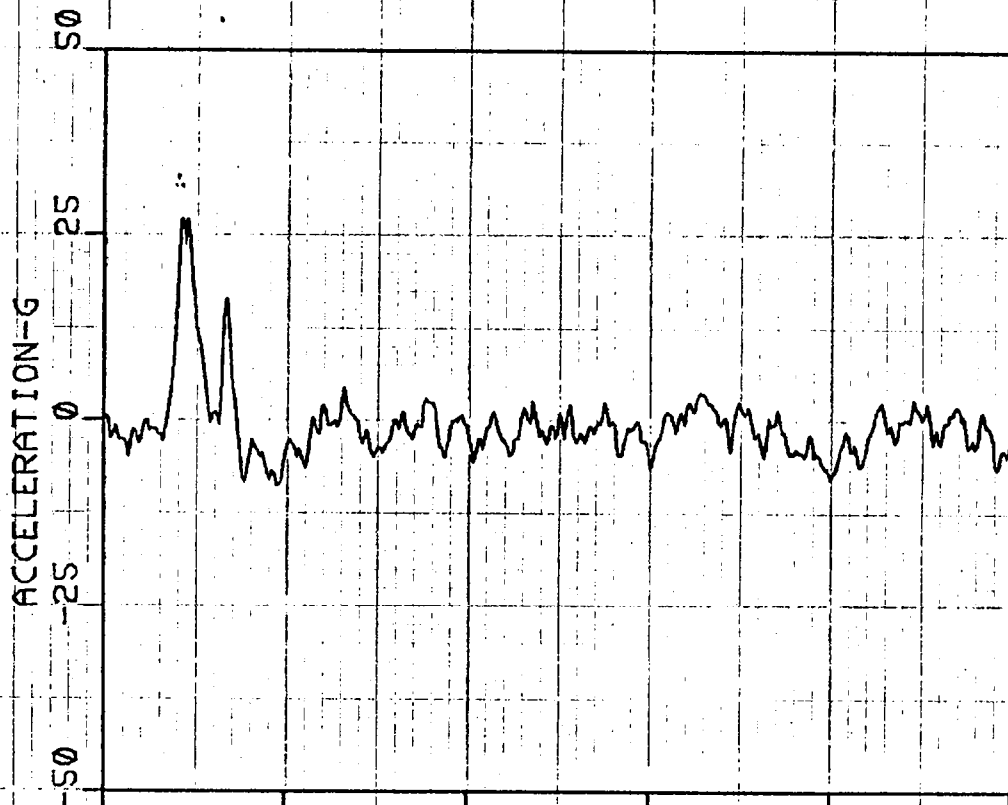
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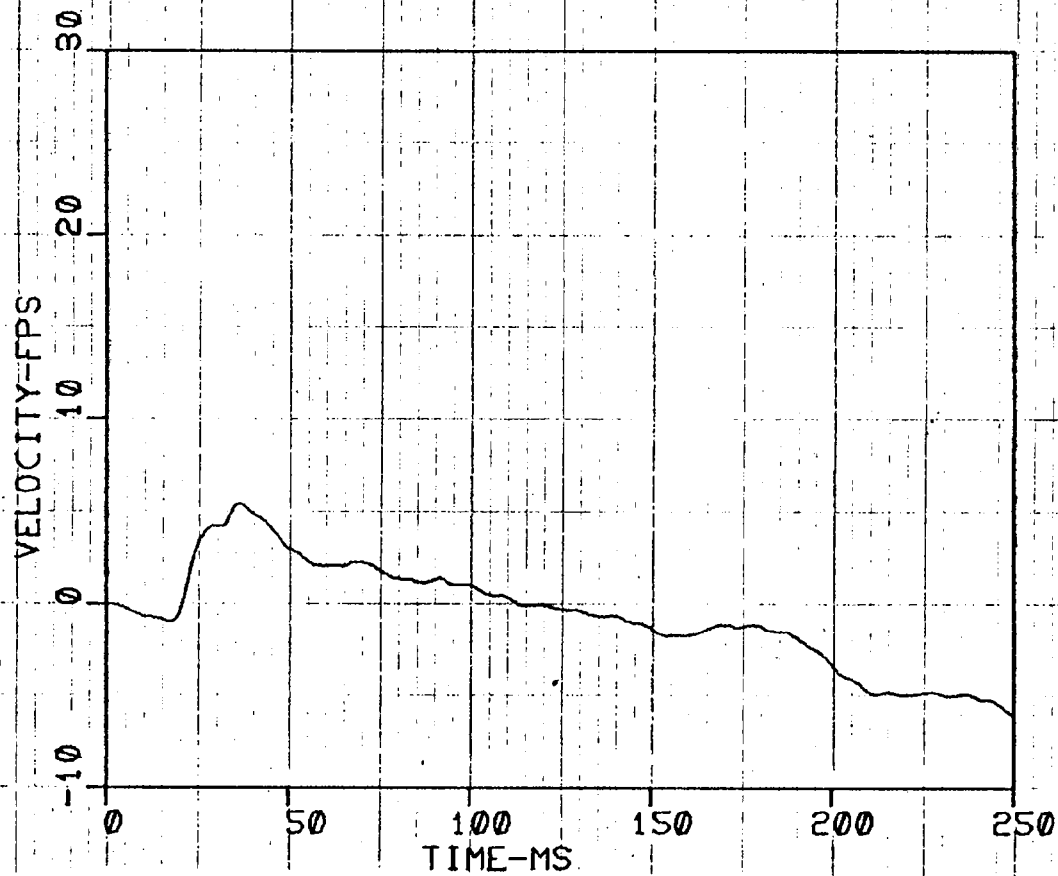
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TEST#8327-6.6 SID 386 POST CAL 2RVY



#417
Report No. (to be assigned by NHTSA)

TEST REPORT NO. 2
STRAIGHT SIDE IMPACTOR-TO-
MODIFIED VW RABBIT
FRONT-TO-SIDE TESTS @ 60°

TESTS 8327-6.5 and 8327-6.6

CONTRACT NO. DOT-HS-8-01933 (II)

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February 1981

TEST REPORT

Document is available to the public through the
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

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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	0.9	metric ton	t
	(2000 lb)			

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	2.5	acres	
	(10 000 m ²)			

MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton	1.1	short tons	
	(1000 kg)			

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

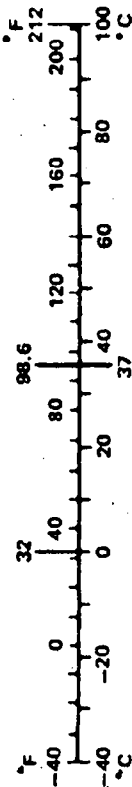


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THIS INFORMATION BELONGS TO TEST #417

1.0 INTRODUCTION

This report presents the results of Tests 8327-6.5 and 8327-6.6, Side Impactor-to-Modified VW Rabbit, front-to-side impacts at 60 degrees, with both vehicles moving. These tests were performed under Task 6 of Phase II of the "Test Device and Test Procedure to Assess Side Structure" program. This program is sponsored by the Department of Transportation, National Highway Traffic Safety Administration, under contract No. DOT-HS-8-01933.

Table 1-1 presents the currently defined test matrix for Task 6. The results of the first four tests in this series are discussed in a separate test report (Reference 1). The results of Tests 6.5 and 6.6 are presented in the main body of this report. Calcomp plots for these tests are contained in Appendices B and C.

1.1 TEST OBJECTIVE

The primary objective of the Task 6 tests is to develop the Side Impactor design and methodology for eventual use as a compliance test device. The methodology is based on the NHTSA procedure for simulating two vehicles moving by using a stationary target car and "crabbed" bullet car. Current production vehicles and "future" (modified current) production vehicles will be used as target cars to obtain comparison data representing a range of vehicle models.

The specific objective of Tests 8327-6.5 and 6.6 was to obtain response data for the modified production vehicles in a

TABLE 1-1. TASK 6 TEST MATRIX (SIDE IMPACTOR-TO-SIDE OF TARGET CAR)

Test No.	Test Date	Bullet Vehicle*	Target Vehicle	Dummy (F/R)	Bullet Vehicle Speed (mph)	Target Vehicle Speed (mph)	Impact Angle (deg)
6.1**	8/1/80	CRABBED* Side Impactor (Task 5 Face)	1980 Subcompact VW Rabbit (#17A0835905)	APR III/SID	39.25 (See Note)	0	60°
6.2	8/15/80	CRABBED* Side Impactor (Task 5 Face)	Modified VW Rabbit With APR Padding (#1763031960)	APR III/SID	39.75 (See Note)	0	60°
6.3	8/25/80	CRABBED* Side Impactor (Task 5 Face)	Modified VW Rabbit With APR Padding (#1763091024)	SID/APR III	39.12 (See Note)	0	60°
6.4	9/17/80	CRABBED* Side Impactor (Task 5 Face)	1980 Subcompact VW Rabbit (#17A0953454)	SID/Part 572 (Uninstrumented)	40.05 (See Note)	0	60°
• 6.5	11/12/80	Side Impactor* (Task 5 Face)	Modified VW Rabbit With APR Padding (#1763401019)	APR III/SID	29.96	15.29	60°
• 6.6	12/19/80	Side Impactor (Task 5 Face)	Modified VW Rabbit With APR Padding (#176328118)	APR III/SID	30.1	15.4	60°
6.7**		CRABBED*** Side Impactor (Task 5A Face)	1980 Truck Chevrolet C-10 (#CCD14AF36'380)	APR III/SID	(39.7) (See Note)	0	60°
6.8**		CRABBED*** Side Impactor (Task 5A Face)	1980 Sports Car Fiat X1/9 With APR Padding ()	APR III/SID	(39.7) (See Note)	0	60°
6.9		CRABBED*** Side Impactor (Task 7 Face)	Modified Plymouth Volare ()	APR III/SID	(39.7) (See Note)	0	60°
6.10		Chevrolet Citation	Modified Plymouth Volare ()	APR III/SID	(39.7) (See Note)	0	60°
6.11(a)		CRABBED Side Impactor (Task 7 Face)	TBD	TBD	(39.7) (See Note)	0	60°
6.12(a)		CRABBED Side Impactor (Task 7 Face)	TBD	TBD	(39.7) (See Note)	0	60°

• Test results contained in this report.

* Final design impactor as used in Task 5. Bullet test weight - 3600 pounds.

** Accident Investigation research to be conducted on these tests.

*** Bullet test weight - 3400 pounds.

(a) These are optional tests.

NOTE: Crash test simulates a 60° two-car moving condition where $V_B = 30$ mph and $V_T = 15$ mph.

12/31/80

two-vehicle-moving side impact, and compare the data with simulation Tests 8327-6.2 and 6.3 which used the "Crabbed" Side Impactor and stationary modified VW Rabbit target vehicles. A second objective was to obtain data on the crash performance of two new side impact dummies (APR III and SID) to assist NHTSA in selecting a dummy for future compliance testing requirements.

2.0 TEST METHODOLOGY

2.1 CRASH TEST CONFIGURATION

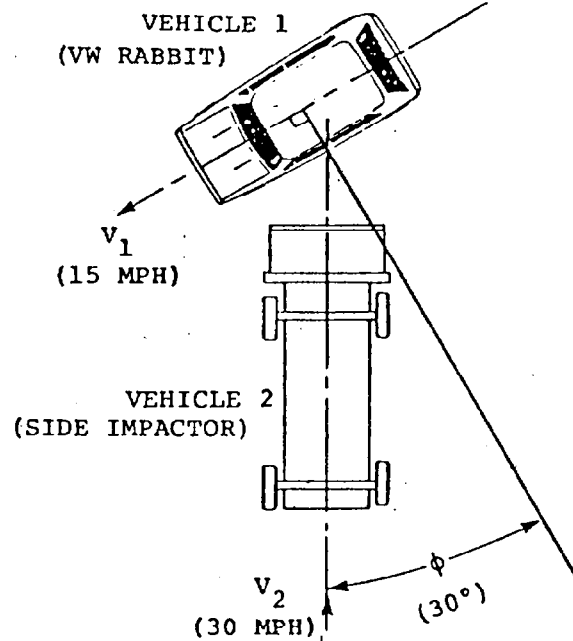
All testing was conducted at the Dynamic Science Side Impact Facility. VW Rabbits modified by the Budd Company were used as moving target vehicles. These were towed on the side impact spur at an angle of 60-degrees relative to the main tow track axis. The NHTSA Side Impactor was towed with straight axles on the main tow track. Figures 2-1 and 2-2 present sketches of the actual test configuration for Tests 6.5 and 6.6, and the simulated test condition used in Test 6.2. Figures 2-3 and 2-4 present typical pre-test photographs of the test configuration.

The APR III side impact dummy was placed in the driver's position of the VW Rabbit. The SID dummy was placed in the left rear passenger's position. Both dummies were unrestrained.

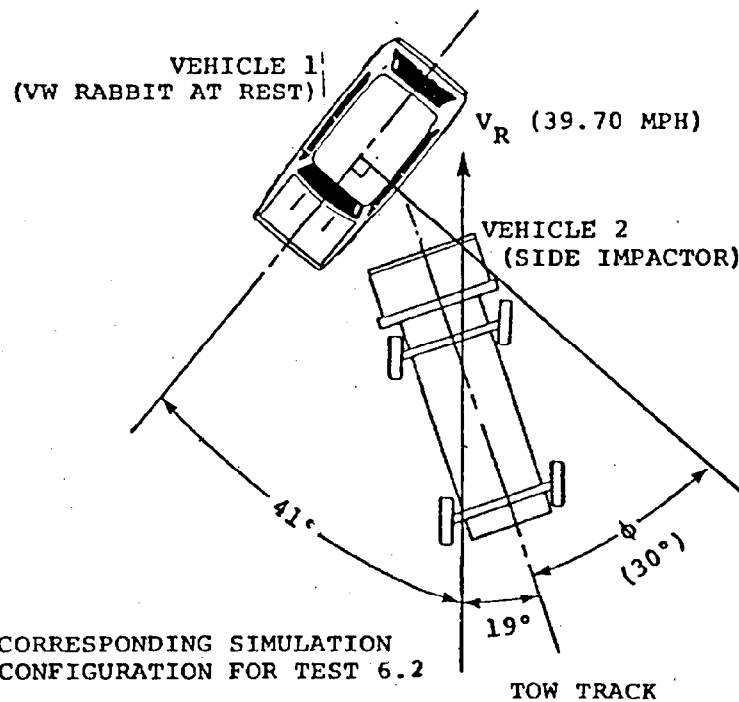
Crash test documentation was obtained through vehicle-mounted accelerometers, high-speed motion pictures, still photographs, and pre- and post-test dimensional measurements. Appendix A contains the instrumentation summaries for each vehicle, along with the camera location matrix.

2.2 ENERGY-ABSORBING SIDE IMPACTOR FACE

The energy-absorbing honeycomb faces used in Tests 6.5 and 6.6 were constructed in accordance with Dynamic Science Drawing No. DSL-1266. Pre-test views of the honeycomb face are shown in Figures 2-3 and 2-4.



A. COLLISION CONFIGURATION FOR TESTS 6.5 AND 6.6



B. CORRESPONDING SIMULATION
CONFIGURATION FOR TEST 6.2

FIGURE 2-1. SIDE IMPACTOR-TO-CAR 60° IMPACT CONFIGURATION AND
CORRESPONDING "CRABBED" SIDE IMPACTOR SIMULATION
CONFIGURATION.

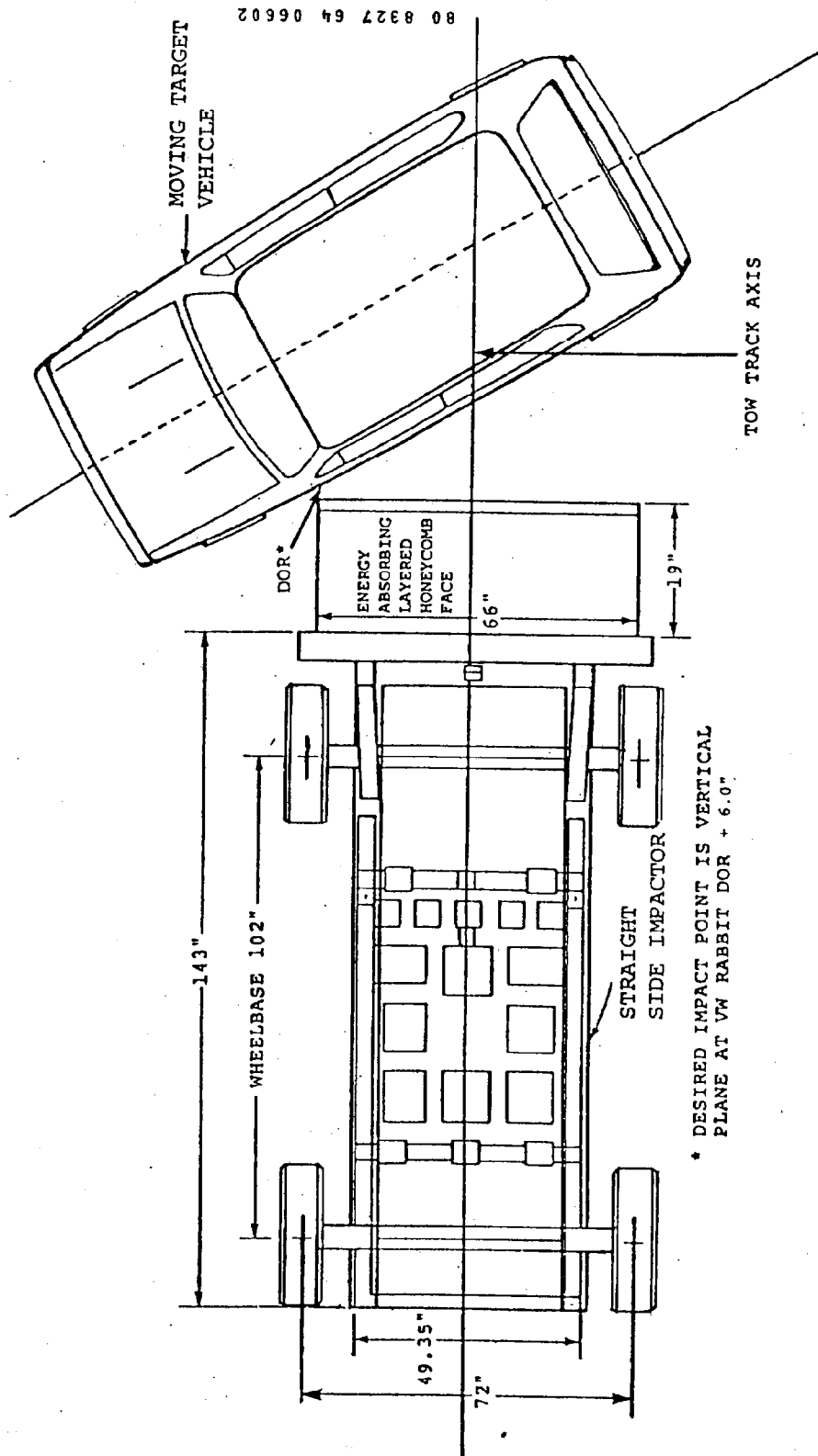


FIGURE 2-2. TEST CONFIGURATION FOR TESTS 6.5 AND 6.6.

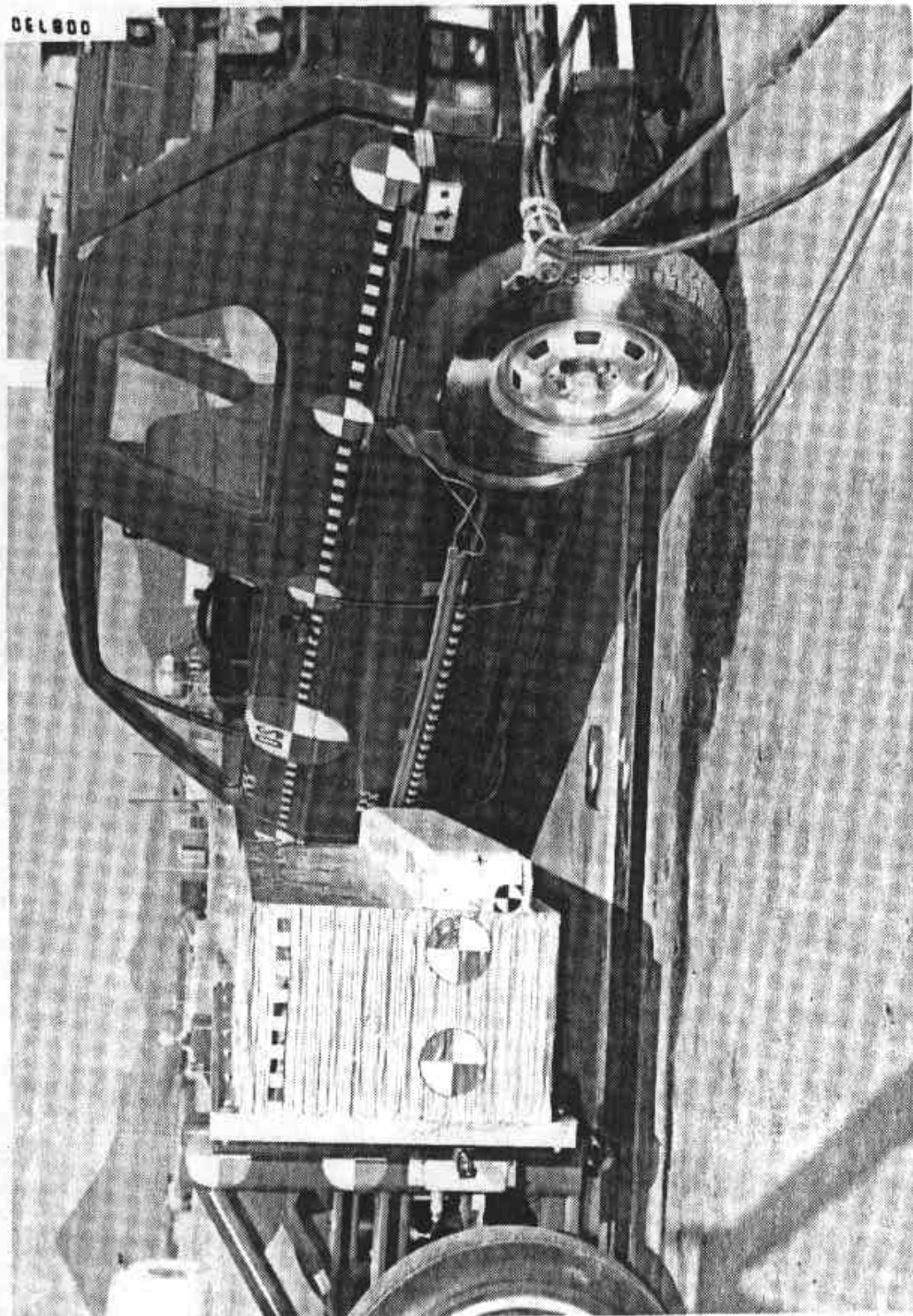


FIGURE 2-3. PRE-TEST VEHICLE CONFIGURATION.

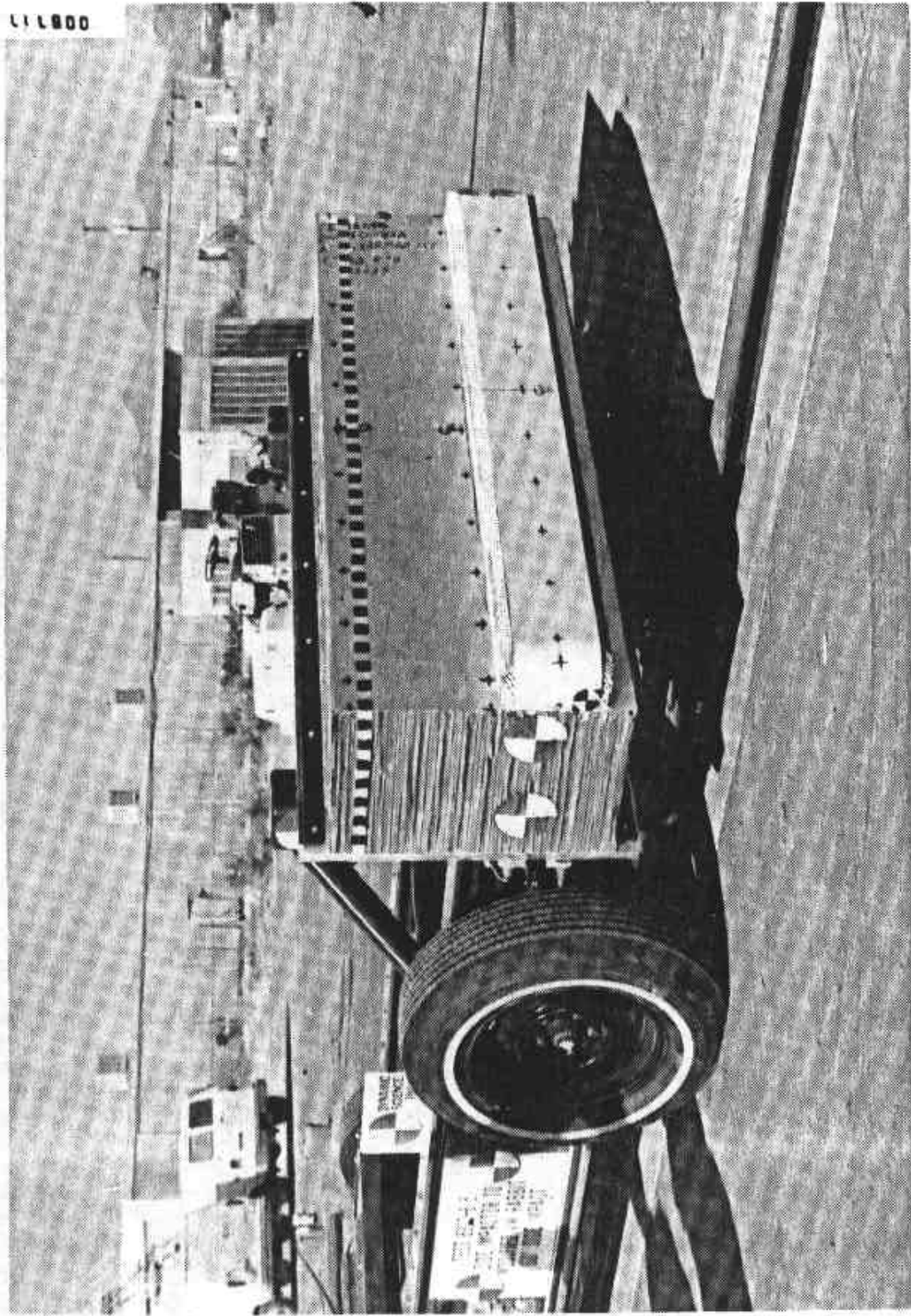


FIGURE 2-4. PRE-TEST VIEW OF "STRAIGHT" SIDE IMPACTOR FACE.

4.0 TEST 6.6 (1976 MODIFIED VW RABBIT WITH APR III/SID)

This section of the report presents the results of Test 8327-6.6. Included in this section are still photographs, vehicle damage profiles, tabulated pre- and post-test dimensional measurements, summaries of electronic data, and summaries of the side impact dummy data. High-speed motion pictures have been previously submitted to the CTM.

Appendix C contains Calcomp plots of all electronic data for this test. Appendix C1 contains the Side Impactor (bullet vehicle) data. Appendix C2 contains the VW Rabbit (target vehicle) data. Appendix C3 contains the Driver (APR III) dummy data. Appendix C4 contains the Rear Passenger (SID) dummy data.

Appendix E contains data for the side impact dummy pre-test pendulum impacts. Post-test pendulum impact data is included in Appendix F.

TABLE 4-1. RECEIVING INSPECTION OF VEHICLES.

Contractor: Dynamic Science, Inc. Contract No.: DOT-HS-8-01933 (II)
 VIN NO.: 1763298118 Make: Volkswagen
 NHTSA No.: R & D
 Year: 1976 Color: Brown Model: Modified Rabbit 2-door
 Auto Trans: yes ☐ no ☒ Pwr Steering: yes ☐ no ☒ Seats: Bench: _____
 Pwr Brakes: yes ☐ no ☒ Auto Speed Cont: yes ☐ no ☒ (front) Bucket: X
 Pwr Seats: yes ☐ no ☒ Anti Skid Brake: yes ☐ no ☒ Split
 Pwr Windows: yes ☐ no ☒ Air Conditioning: yes ☐ no ☒ Bench: _____
 Tinted Glass: yes ☐ no ☒ Rear Window Def.: yes ☒ no ☐ Split
 Radio: yes ☒ no ☐ Brakes: drum: R disc: F Back
 Clock: yes ☐ no ☒ Bench: _____
 Tire Size: 155SR-13 Ply Rating: 4 Mfg. & Line: Pirelli Cinturato
 Bias Ply: _____ Belted: _____ Steel Radial X /Eng. Type: OHC Cylinders: 4 Total Displ: 97 CID
 Trans. & Fwd. Speeds: 4 Shipping Weight: _____ Odometer: 27,102.1
 Dealer (name, address, and phone number)
Budd Co. Via: Cooper Mfg. Co.
Whittain Township, Pa. 115 Main Street
Salunga, Pa. 17538

Remarks (list additional accessories not listed above)

Date of Manufacture: 4-76 Dynamic Science No.: 1057 Date Received: 3-22-80
 Tilting Steering Wheel: yes ☐ no ☒ Telescoping Steering Wheel: yes ☐ no ☒
 Fuel Capacity: 10 Gallons "Space Saver" Spare Tire yes ☐ no ☒
 (from owner's manual)
 Restraint System: Three-point safety belts

1. Is the vehicle stock throughout? Describe: No. Vehicle left side door and roof structure modified by the Budd Company.
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: Satisfactory

TABLE 4-2. TARGET VEHICLE PRE-TEST CONDITION

Test No: <u>8327-6.6</u>	Vehicle: <u>Modified VW Rabbit</u>	LF <u>703</u> RF <u>720</u>
Test Date: <u>12/19/80</u>	Total Test Wt: <u>2603 lb</u>	LR <u>600</u> RR <u>580</u>

HEAD RESTS - up down other none
 FRONT SEAT - forward midpoint rearward latched welded
 FRONT SEAT TILT - forward midpoint back other 23° none
 REAR SEAT - in place removed
 STEERING WHEEL - up midpoint down not adjustable
 SUN VISORS - up down removed
 GLOVE COMPARTMENT - locked closed none
 SEAT BELTS - fastened unfastened removed none
 SHOULDER HARNESSSES - fastened unfastened removed
 VENT WINDOWS - closed open removed none stationary
 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 _____
 TRANSMISSION - neutral other _____ removed
 DRIVESHAFT - in place removed
 PARKING BRAKE - off on disconnected enough to provide drag
 FRONT BUMPER - in place removed none
 REAR BUMPER - in place removed none
 HOOD - in place removed
 WINDSHIELD WIPERS - in place removed
 FUEL TANK - 95 Percent full empty other _____
 RADIATOR - full empty none removed
 BATTERY - in place removed drained
 SPARE TIRE - in place removed none

TABLE 4-2. TARGET VEHICLE PRE-TEST CONDITION (CONTD)

Test No: 8327-6.6 Vehicle: Modified VW Rabbit LF 703 RF 720
Test Date: 12/19/80 Total Test Wt: 2603 lb LR 600 RR 580

JACK - in place removed none

WHEEL COVERS - in place removed none

BALLAST - none lbs @

AIR BAG CHECK TIME - sec no air bags

DUMMY LOCATIONS - LF CF RF LR CR RR none

DUMMY POSITIONING CRITERIA - FMVSS 208 Other side impact
criteria

12 INCH TARGET REFERENCE DIMENSION - 75.6 inches aft of front
bumper G (at vehicle C.G.)

TABLE 4-3. CRASH TEST SUMMARY FOR BULLET VEHICLE

VEHICLE DATA		TEST 8327-6.6
Test Vehicle		NHTSA Side Impactor
Overall Length/Width (in.)		158/72
Test Weight by Axle (lb)		F 1841 R 1762
Total Weight (lb)		3603
Wheelbase (in.)		102.0
Longitudinal C.G. (from Center of Front Axle) (in.)		51.0
Impact Angle (deg)*		60°
Impact Speed (mph)		30.1
Maximum C.G. Resultant Velocity Change (mph @ msec)		11.7 mph @ 127 ms
Maximum C.G. Average Resultant Compartment Acceleration (G @ msec)		12.7 G @ 60 ms
Maximum Static Crush (in.)		
• Row C (Top of Stack Level)		5.7
• Row B (Mid-Stack Level)		7.1
• Row A (Bumper Level)		10.0
<u>OCCUPANTS</u>		
Type		N/A
Location		N/A
Restraints		N/A
<u>INSTRUMENTATION</u>		
Number of Data Channels		15
Number of Cameras (Ground Based)		8
*With respect to target vehicle.		
N/A - Not Applicable.		

TABLE 4-4. CRASH TEST SUMMARY FOR TARGET VEHICLE

VEHICLE DATA		TEST 8327-6.6	
Test Vehicle		Modified VW Rabbit	
Overall Length/Width (in.)		154.0/63.5	
Test Weight by Wheel (lb)		LF 703	RF 720
		LR 600	RR 580
Total Weight (lb)		2603	
Wheelbase (in.)		94.8	
Longitudinal C.G. (from Center of Front Axle) (in.)		43.0	
Impact Angle (deg)*		60°	
Impact Speed (mph)		15.4	
Maximum C.G. Resultant Velocity Change (mph @ msec)		14.9 mph @ 97 ms	
Maximum C.G. Resultant Acceleration (G @ msec)		17.3 G @ 26 ms	
Maximum Door Acceleration (G @ msec)**		180.6 G @ 23 ms	
Maximum Exterior Static Crush (in.)			
• Level 4 (32.0")		12.2	
• Level 3 (26.0")		11.0	
• Level 2 (20.0")		10.3	
• Level 1 (12.0")		4.9	
Maximum Post-test Intrusion (in.)		11.7	
<u>OCCUPANTS</u>			
Type		APR III	SID IV
Location		Driver	Left Rear Pass.
Restraints		None	None
<u>INSTRUMENTATION</u>			
Number of Data Channels		41	
Number of Cameras (On Board)		3	

*With respect to bullet vehicle.

**At mid rear edge of left front door (location 9).

TABLE 4-5. SUMMARY OF POST-TEST OBSERVATIONS (TEST 6.6)

VEHICLE: 1976 Volkswagen Rabbit (Modified) VIN 1763298118

Dummy Contact Points:	Left Front	Left Rear
		Top of Side
Head	No Contact	Impactor Face
Shoulder	Upper Door Panel	Upper Seat Side
	Padding	Panel Padding
Hip	Lower Door Panel	Lower Seat Side
	Padding	Panel Padding

Glazing: Windshield cracked along left side, especially upper left corner. Left side door window shattered. Left rear window forced out of frame. All other glass remained retained and unbroken.

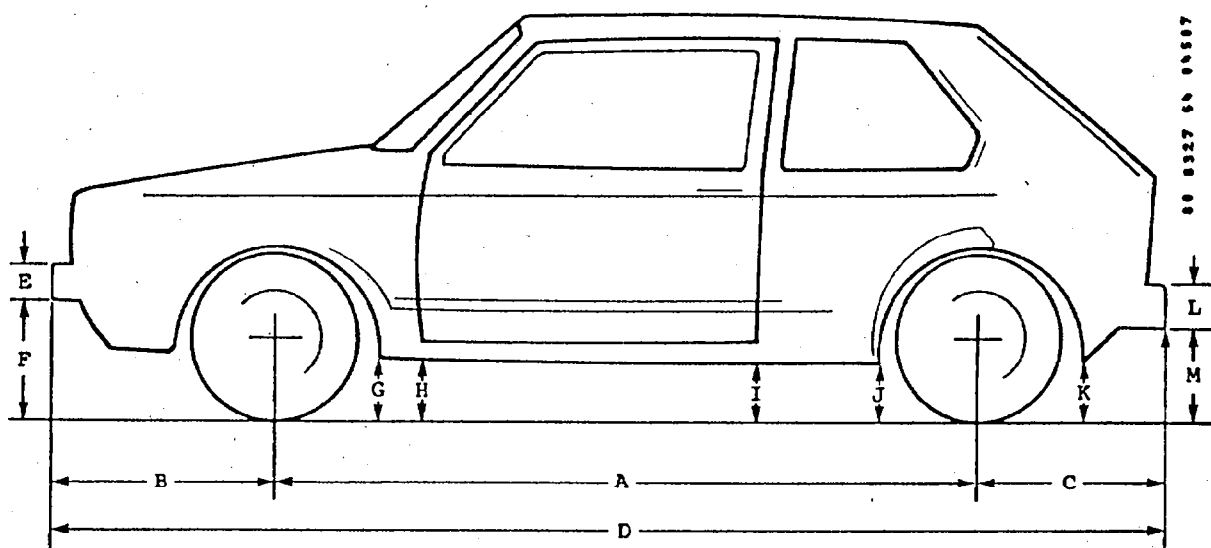
Doors: Left side door and "B" pillar severely damaged; door partly open post-test. Right side door operated normally.

Seat Anchorages and Restraints: Driver's seat leaning inward; seatback buckled severely and leaning inboard due to contact with door and padding. Right front seat undamaged. Restraints not in use.

Fuel Leakage: None - fuel deleted.

General Observations: Impact point 13.9 inches aft of DOR (target point 6.0 inches aft of DOR). Buckle in roof over left side B-pillar. 5 inches of left rear wheel rim bent outwards - tire flat. All interior padding and backing sheets remained intact and in place. Steering wheel was not pinned by door metal; remained operational.

TABLE 4-6. PRE-TEST AND POST-TEST DIMENSION MEASUREMENTS
(TEST 6.6)



VEHICLE: 1976 VW Rabbit 2-door, VIN 1763298118

Measurement	Pre-test (in.)	Post-test (in.)	Change (in.)*
A	94.8	95.0	-0.2
B	32.4	31.6	0.8
C	26.7	25.4	1.3
D	153.9	153.2	0.7
E	4.1	4.1	0.0
F	15.8	14.4	1.1
G	9.8	7.5	2.3
H	9.5	7.4	2.1
I	9.8	7.3	2.5
J	10.0	6.9	3.1
K	10.8	5.4	5.4
L	4.3	4.3	0.0
M	15.0	9.8	5.2

* Left rear tire flat post-test

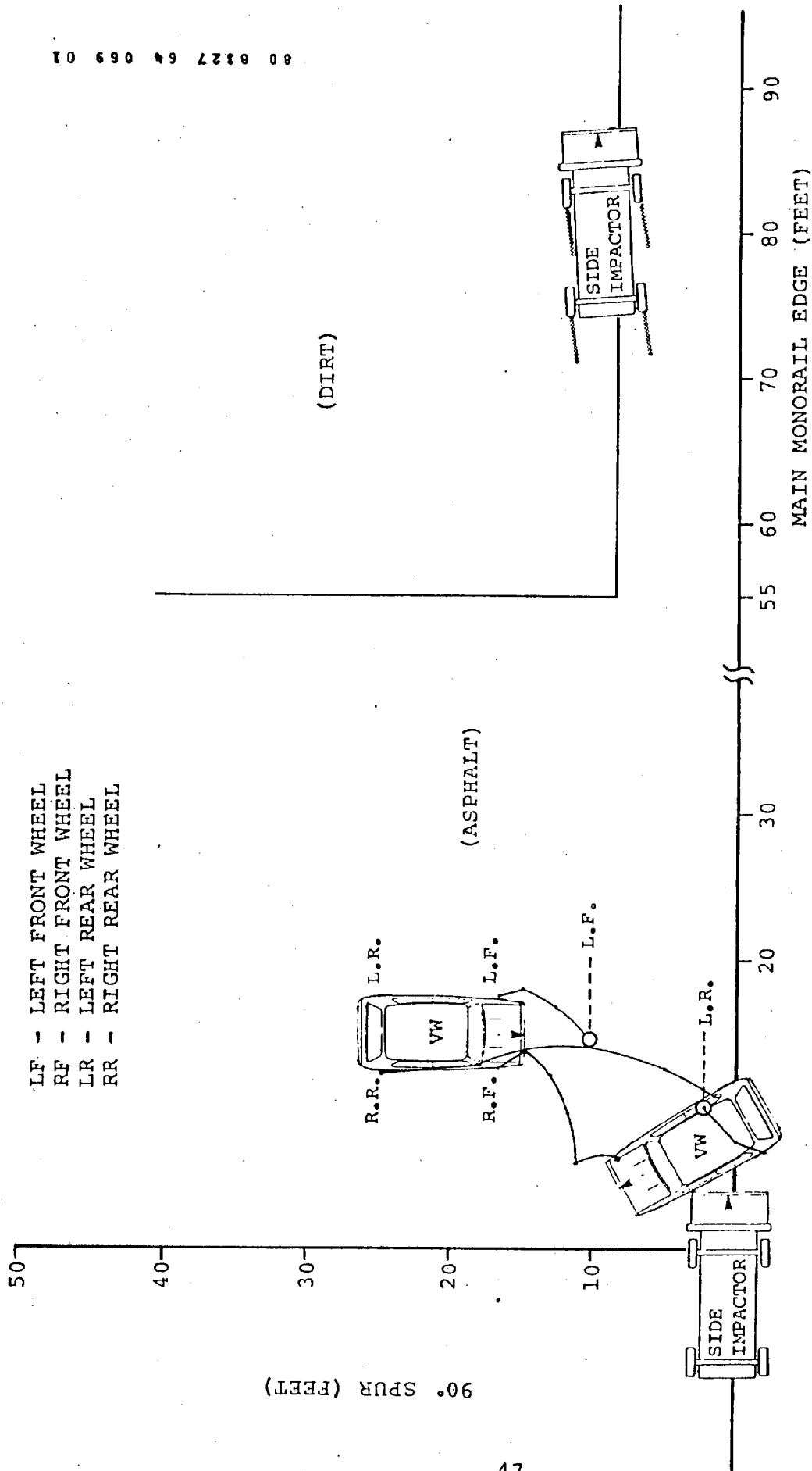
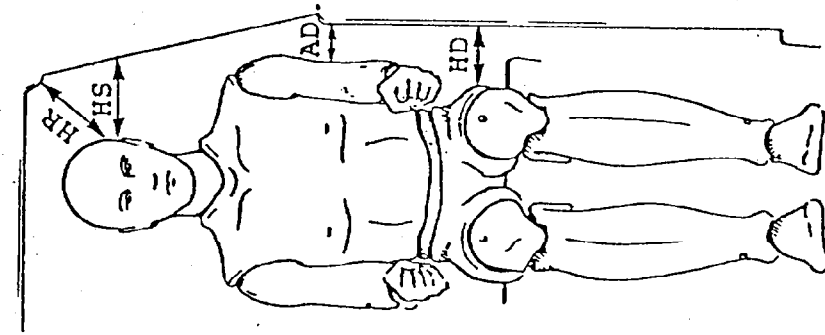


FIGURE 4-1. VEHICLE PRE- AND POST-TEST POSITIONS (TEST 6.6)

80 8327 069 02



(HEAD REFERENCE: NOSE)

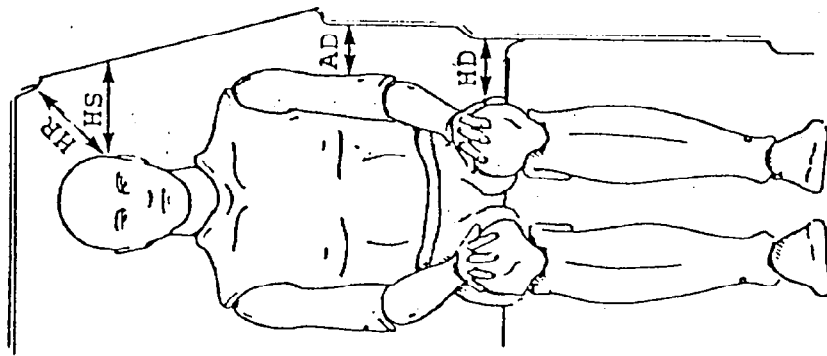
HH = 17.0
HW = 24.0
CD = 21.5
CS = 13.5
KD = 8.0/7.5

HR = 9.0
HS = 12.5
AD = 4.0 (CONTACTING PAD)
HD = 6.0 (0.5 FROM PAD)

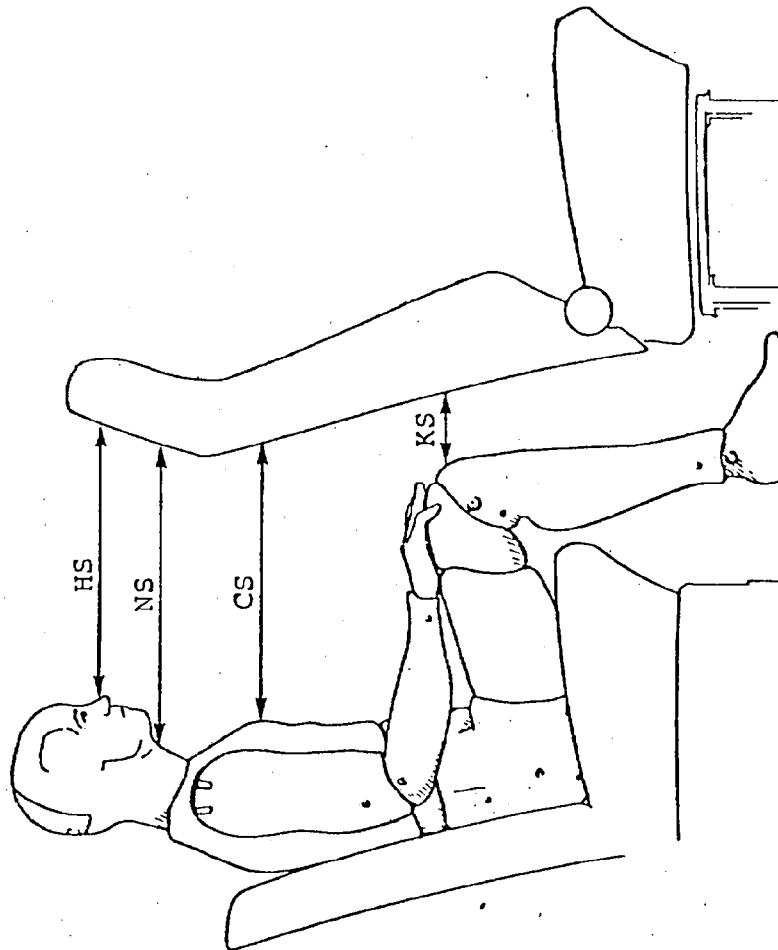
(ALL DIMENSIONS IN INCHES)

FIGURE 4-2. DRIVER PRE-TEST POSITION, APR III SIDE IMPACT DUMMY (TEST 6.6).

80 8327 64 069 03



HR = 11.0
 HS = 12.0
 AD = 4.0 (CONTACTING PAD)
 HD = 6.0 (0.5 FROM PAD)



(HEAD REFERENCE: NOSE)

HS = 22.0
 NS = 21.0
 CS = 18.0
 KS = 3.5/4.0

(ALL DIMENSIONS IN INCHES)

FIGURE 4-3. REAR PASSENGER PRE-TEST POSITION, SID IV SIDE IMPACT DUMMY (TEST 6.6).

TABLE 4-7. EXTERIOR STATIC CRUSH FOR VW RABBIT (TEST 6.6)

Location*	Height (in.)**	(Front)						Zero Distance Located at DDR (in.)										(Rear)						
		42	36	30	24	18	12	6	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
Level 4	32.0	0.1	0.1	0.4	0.4	0.6	0.6	0.7	1.0	1.5	4.1	6.5	8.2	9.6	9.9	9.0	12.2	10.4	8.2	5.2	3.5	1.7	0.5	-0.1
Level 3	26.0	0.2	0.5	0.6	0.7	0.8	0.9	0.8	1.1	3.2	4.9	6.7	8.4	9.3	9.5	8.9	11.0	10.4	8.9	5.5	3.0	2.0	0.9	-0.2
Level 2	20.0	0.4	0.6	NA	NA	NA	NA	1.0	1.6	3.7	5.2	6.6	7.7	8.8	9.1	9.1	10.3	9.6	8.3	NA	NA	NA	NA	0.6
Level 1	12.0	NA	0.8	NA	NA	NA	NA	1.3	1.5	2.0	2.2	2.6	3.1	3.6	4.8	4.9	4.3	3.9	2.9	NA	NA	NA	NA	1.9

*Location Description:

Level 4 = Window sill height

Level 3 = Bullet vehicle hood height

Level 2 = Mid-door height

Level 1 = Rocker sill height

**All heights measured above ground level.

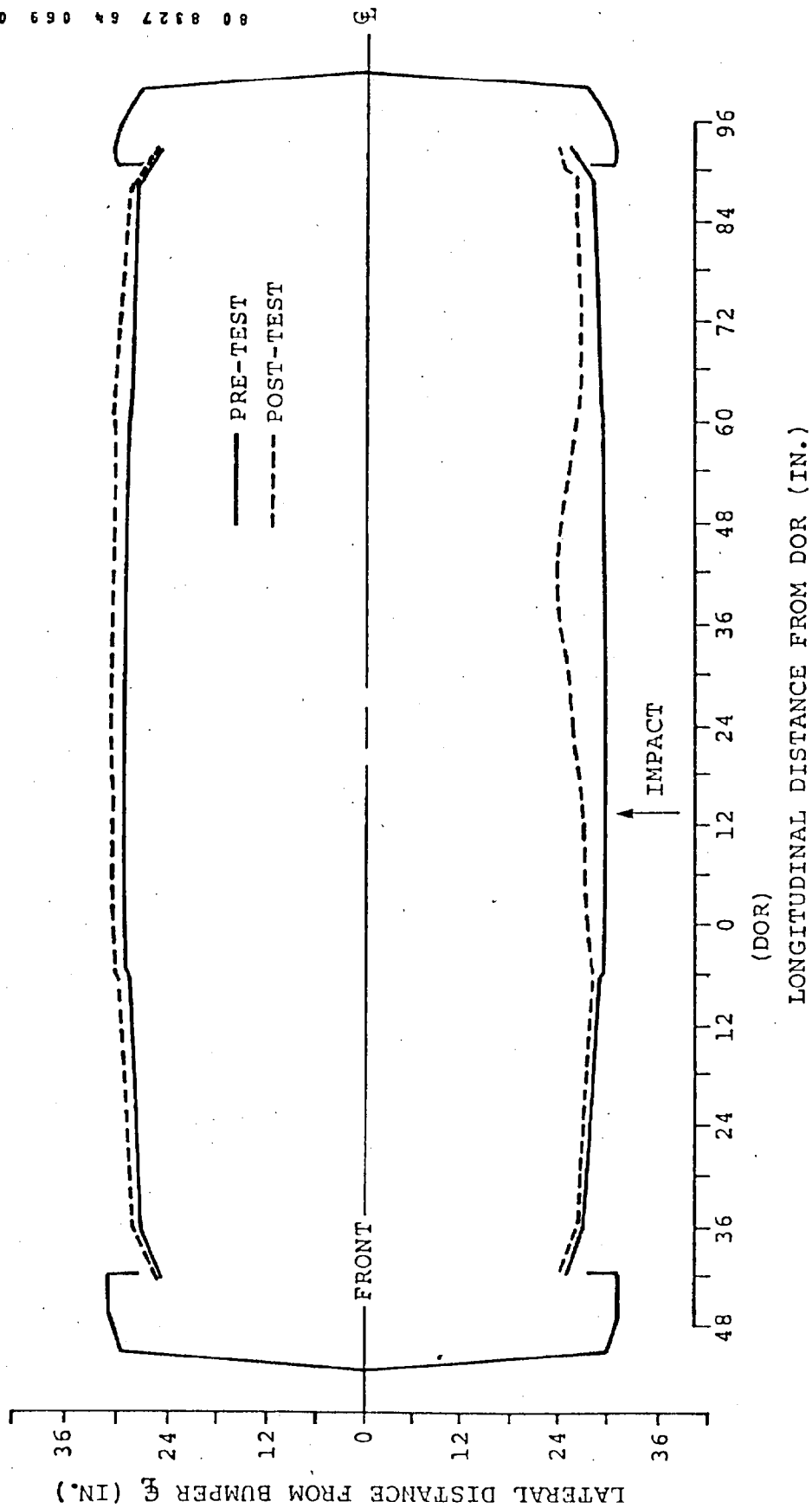


FIGURE 4-4. PRE- AND POST-TEST EXTERIOR PROFILES AT 12.0" ABOVE GROUND LEVEL FOR VW RABBIT (TEST 6.6).

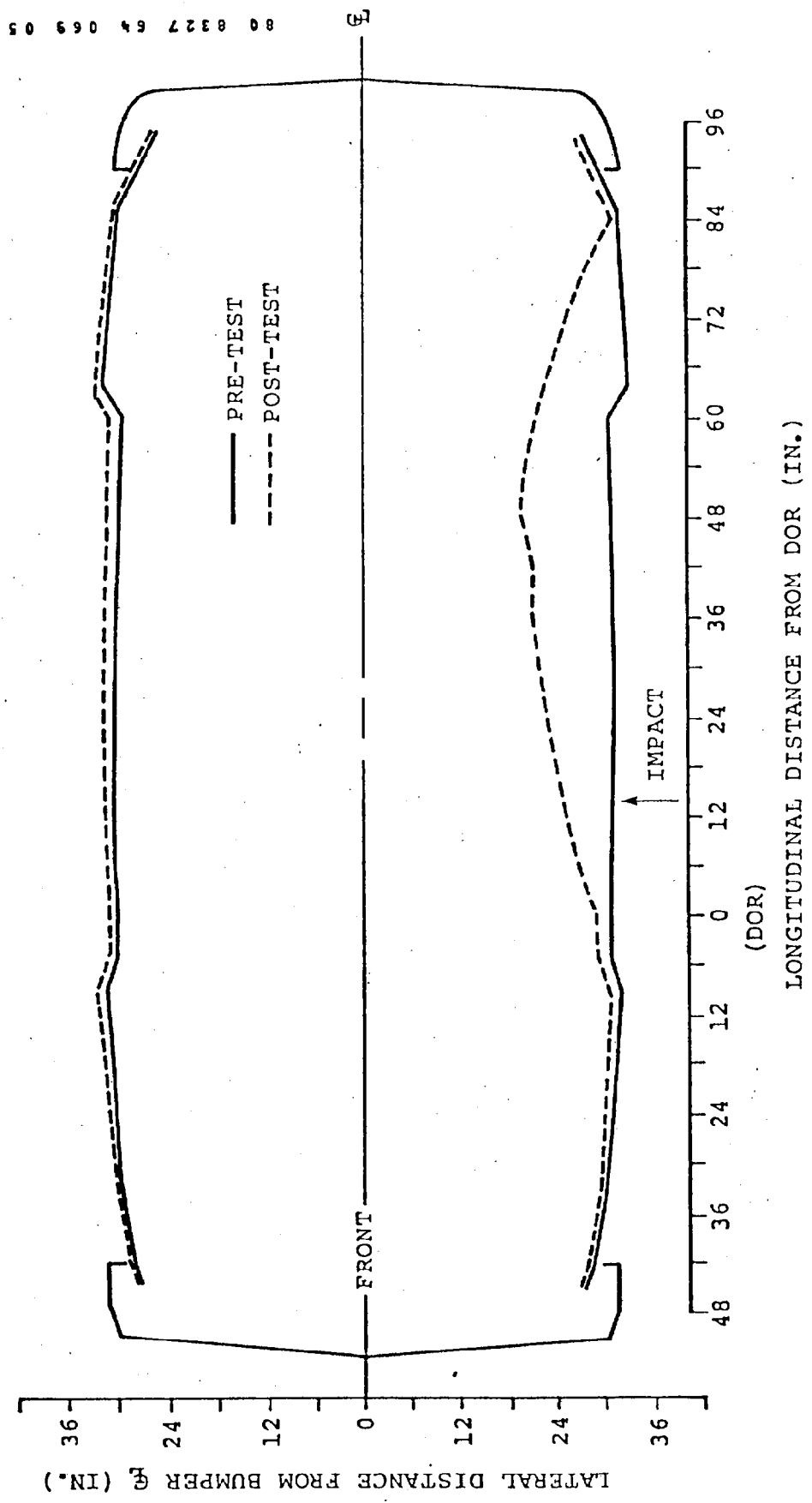


FIGURE 4-5. PRE- AND POST-TEST EXTERIOR PROFILES AT 20.0" ABOVE GROUND LEVEL FOR VW RABBIT (TEST 6.6).

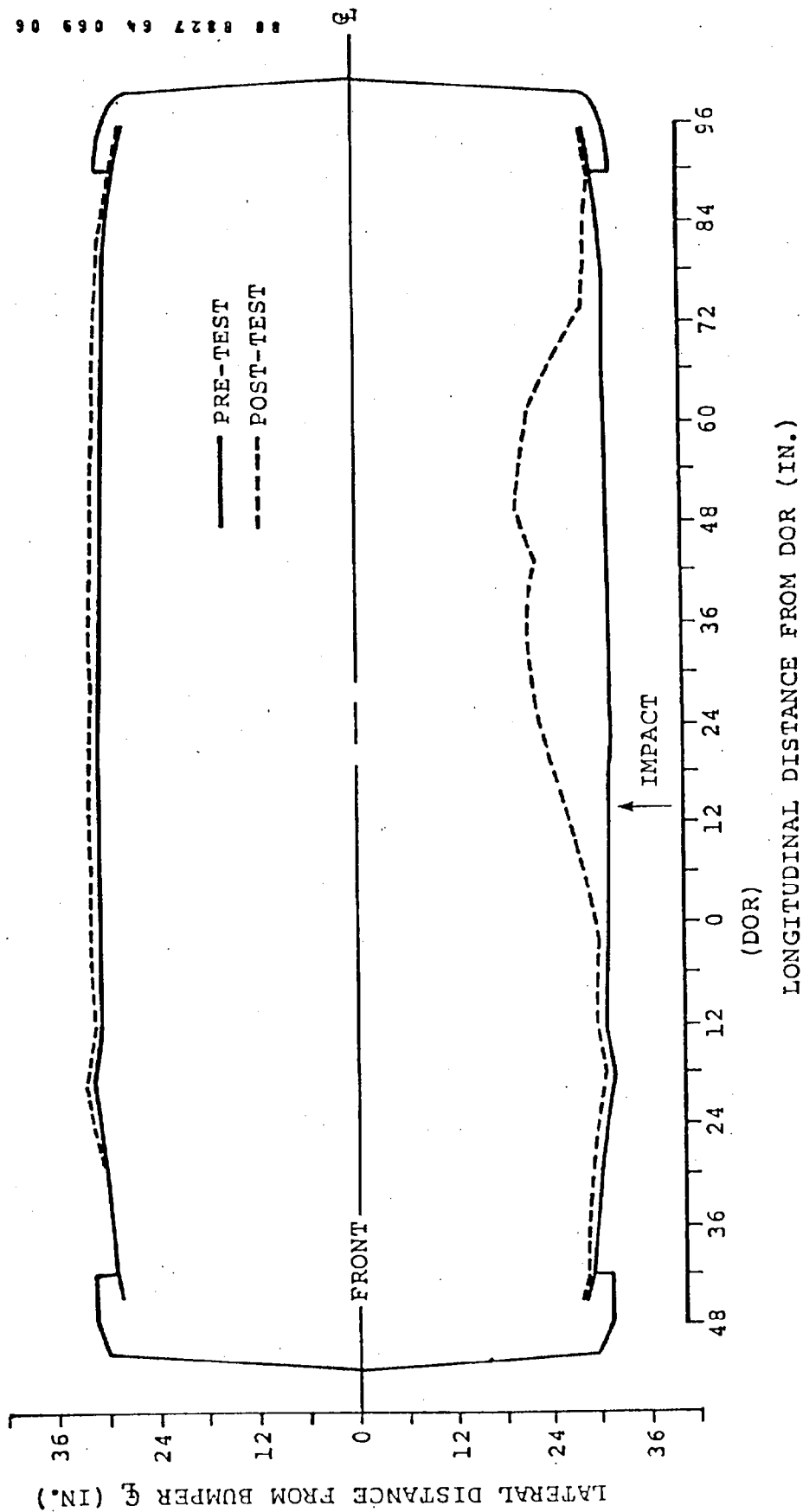


FIGURE 4-6. PRE- AND POST-TEST EXTERIOR PROFILES AT 26.0" ABOVE GROUND LEVEL FOR VW RABBIT (TEST 6.6).

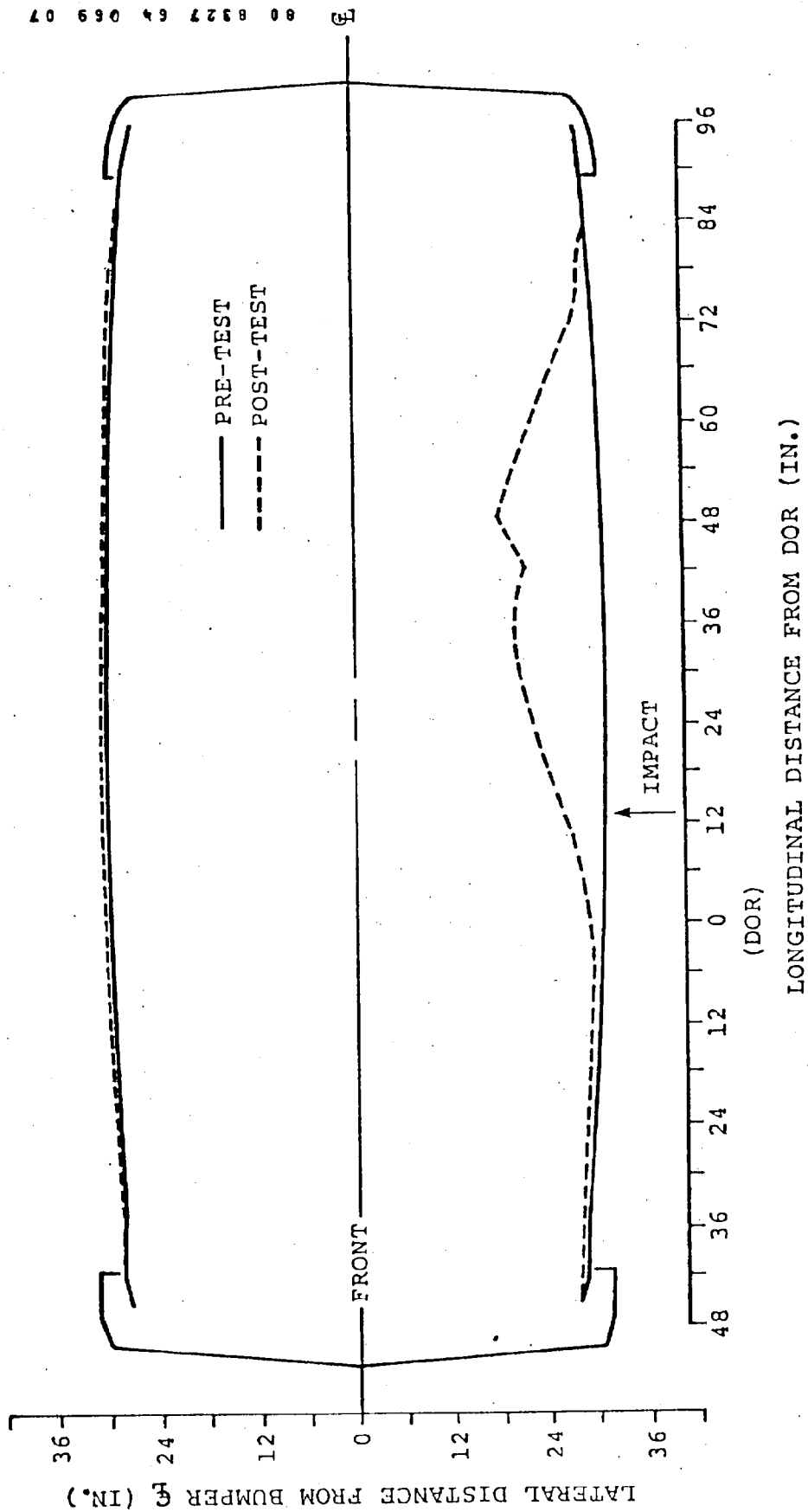


FIGURE 4-7. PRE-AND POST-TEST EXTERIOR PROFILES AT 32.0" ABOVE GROUND LEVEL FOR VW RABBIT (TEST 6.6).

TABLE 4-8. INTERIOR STATIC INTRUSION FOR VW RABBIT (TEST 6.6)

Location	Height* @ DOR (in.)	Zero Distances Starting at DOR (in.)										
		0	6	12	18	24	30	36	42	48	54	60
Windowsill Level	34.5	NA	2.0	3.5	5.2	6.4	7.2	7.8	11.7	10.0	7.4	4.5
Mid-door Level	24.0	NA	2.5	3.8	5.1	6.3	7.3	8.0	10.0	9.6	NA	NA
Bullet Vehicle Bumper Level	17.0	NA	2.1	3.0	3.9	4.6	5.1	5.7	7.4	5.2	5.0	NA
Doorsill Level	12.5	1.5	1.5	2.0	2.3	3.0	3.3	3.9	3.1	NA	NA	NA

*Heights measured above ground level.

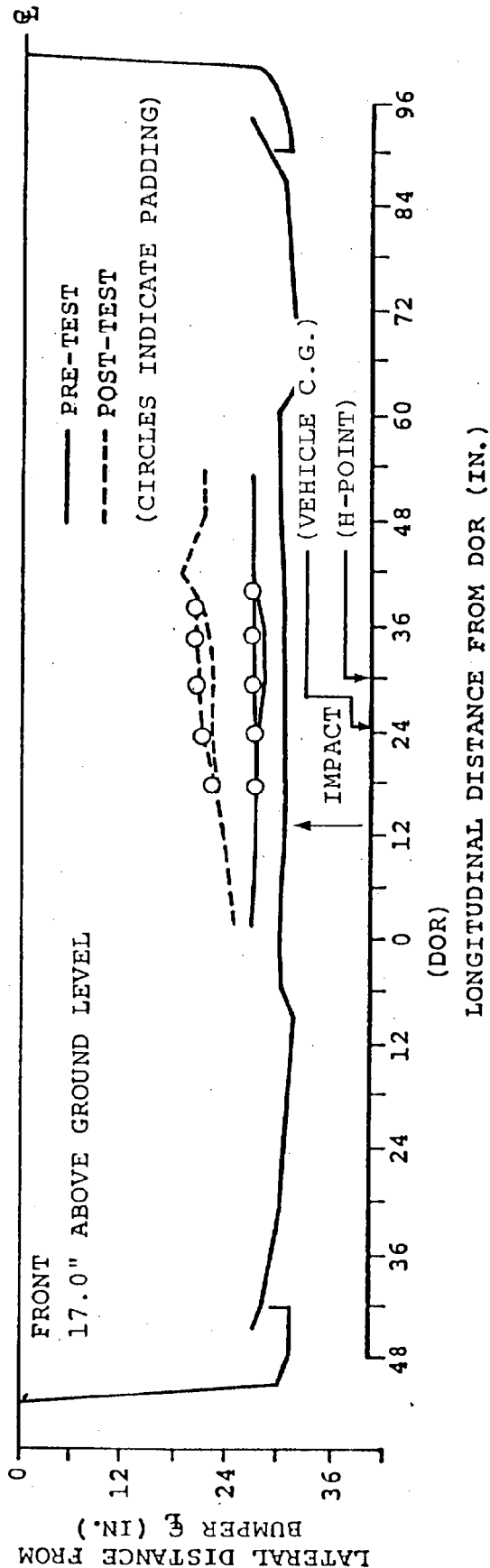
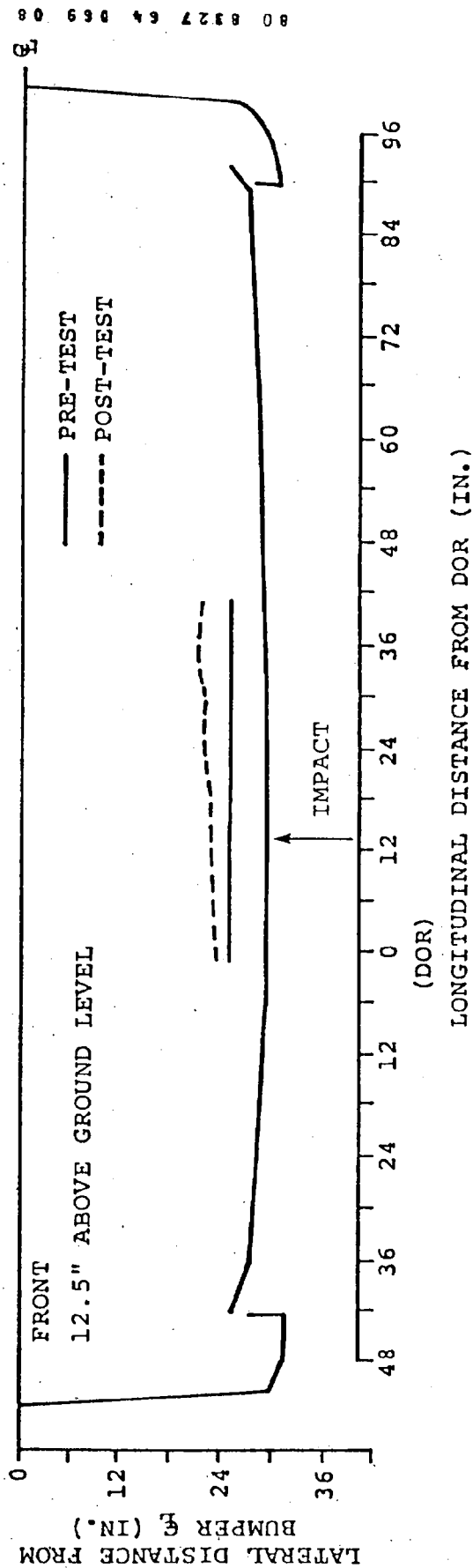


FIGURE 4-8. PRE- AND POST-TEST INTERIOR PROFILES FOR VW RABBIT (TEST 6.6).

88 83227 64 069 03

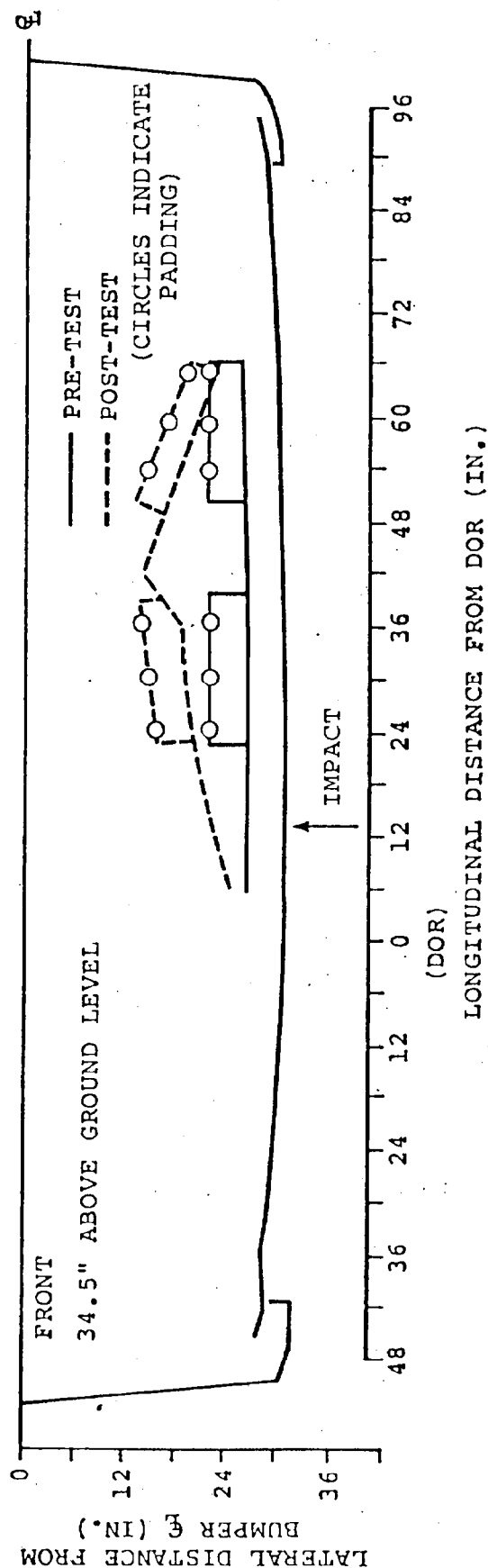
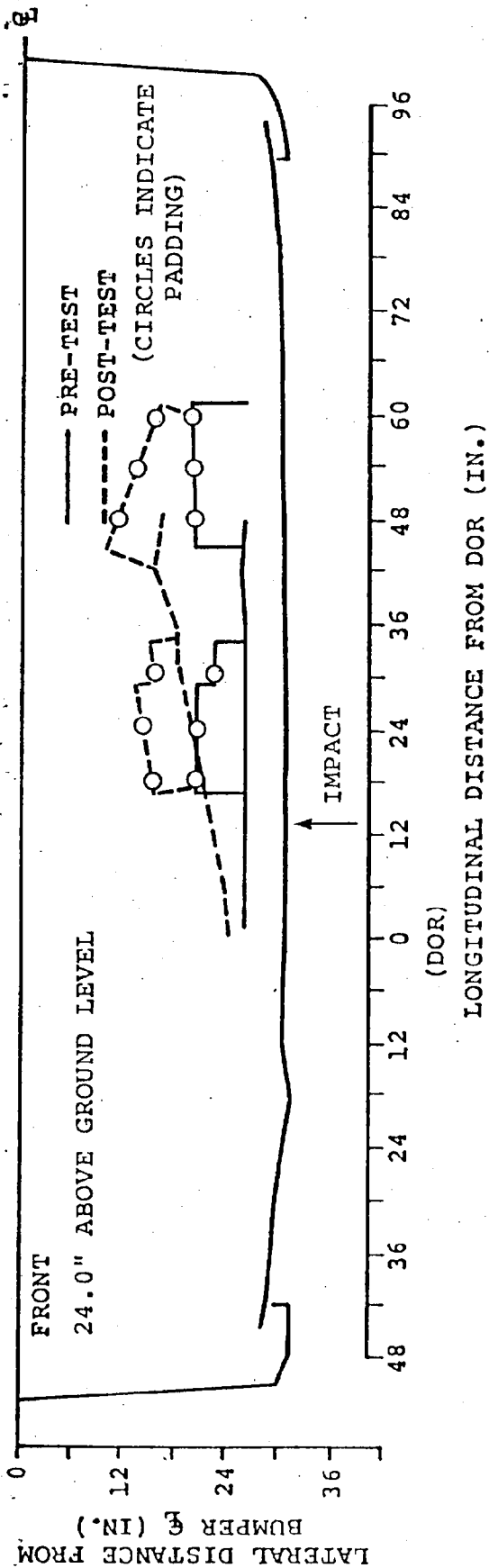
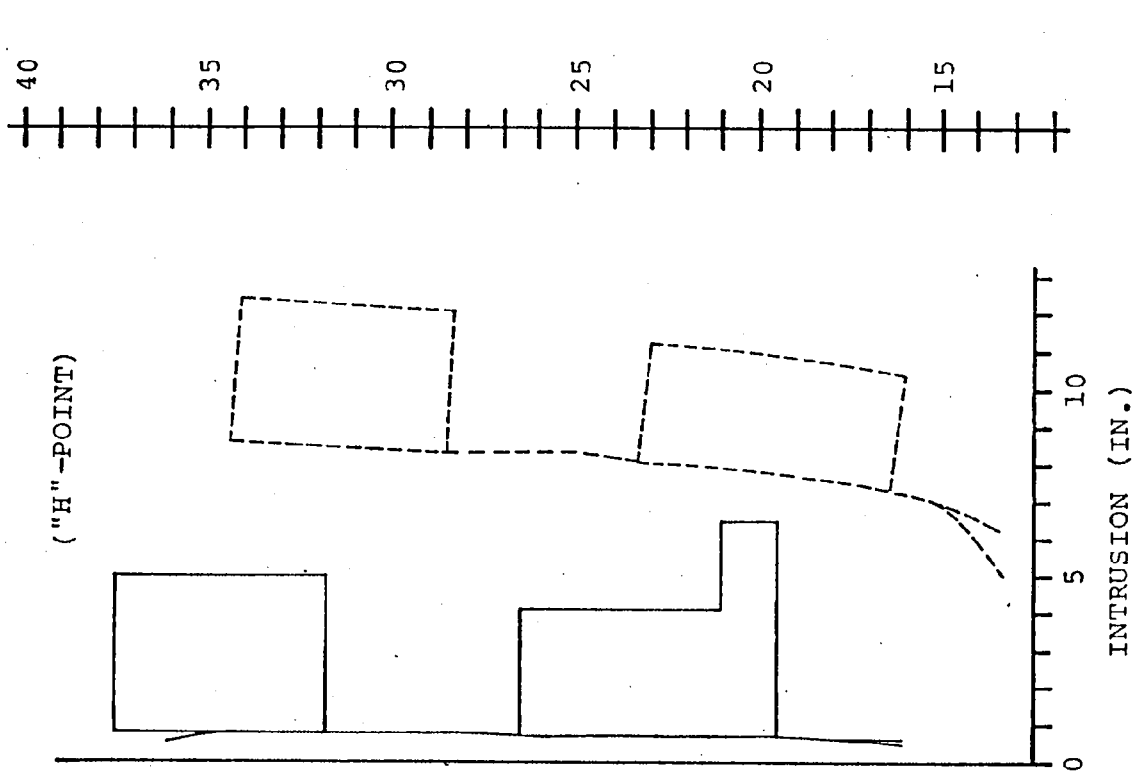
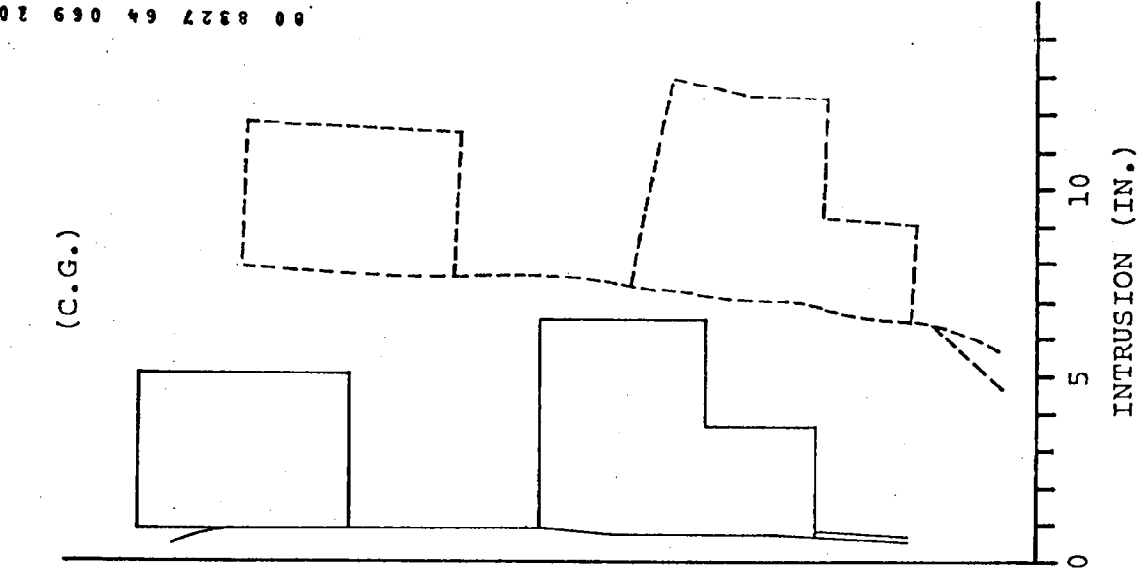


FIGURE 4-9. PRE- AND POST-TEST INTERIOR PROFILES FOR VW RABBIT (TEST 6.6).

00 8827 64 069 20A



PRE-TEST —
POST-TEST - - -

FIGURE 4-10. PRE- AND POST-TEST INTERIOR PROFILES AT LATERAL PLANES THROUGH "H"-POINT AND CENTER OF GRAVITY (TEST 6.6).

TABLE 4-9. EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR (TEST 6.6)

Location	Height at G_L (in.)*	Distance Right of Center (in.)					Distance Left of Center (in.)**							
		33	30	24	18	12	6	0	6	12	18	24	30	33
Top of Stack Level	32.0	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3	-0.0	0.9	2.5	4.8	5.7
Mid-Stack Level	21.8	-0.3	-0.3	-0.3	-0.2	-0.1	0.0	0.0	0.1	0.4	1.7	3.8	6.1	7.1
Bumper Level	17.0	-0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	1.0	4.1	6.7	9.5	10.0

*Heights measured above ground level.

**Impact side.

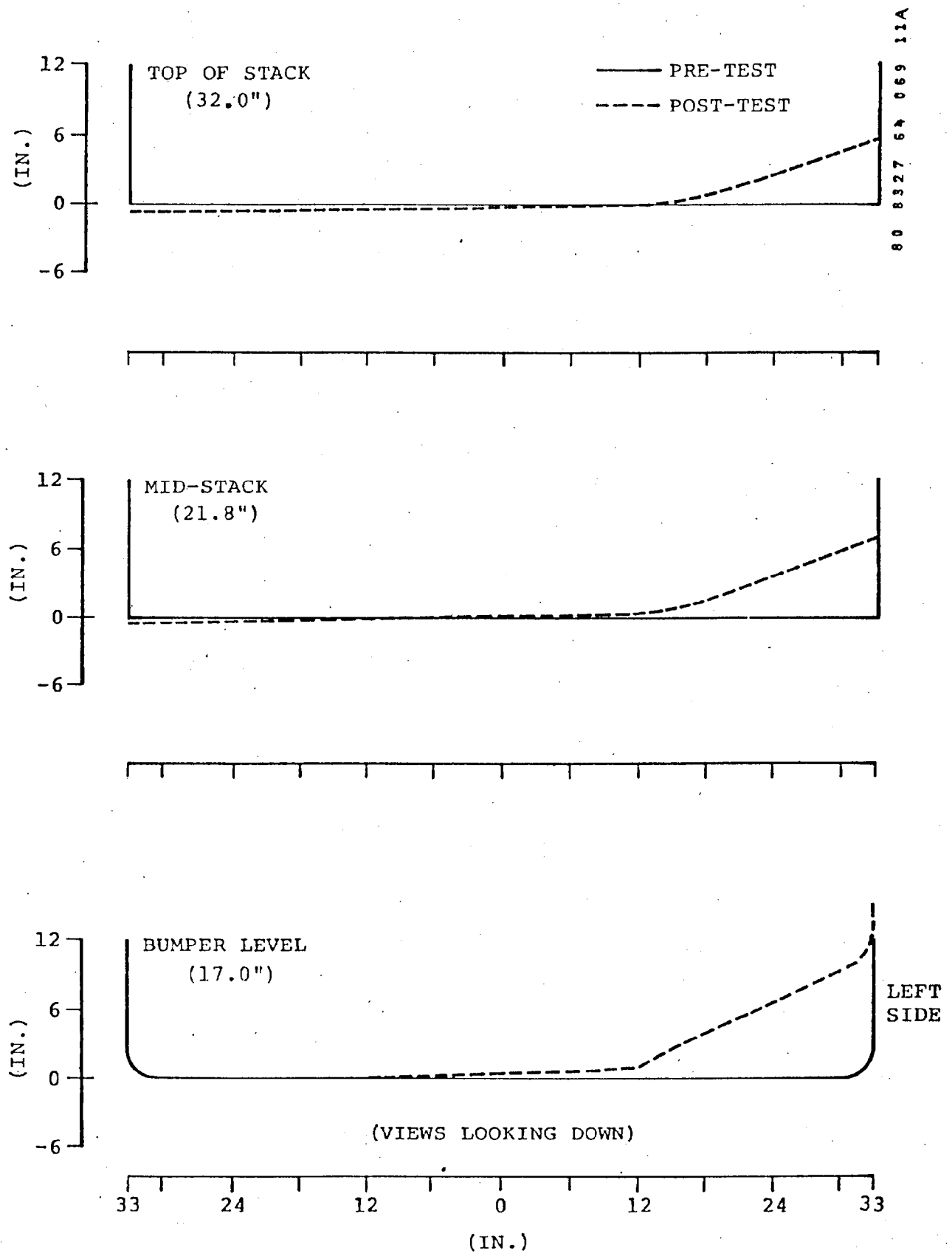


FIGURE 4-11. PRE- AND POST-TEST FRONTAL PROFILES FOR SIDE IMPACTOR (TEST 6.6).

TABLE 4-10. SIDE IMPACT DUMMY TEST RESPONSE SUMMARY

TEST NO. 8327-6.6 (Driver) TEST DATE 12/19/80

TEST CONFIGURATION:

Target Vehicle	<u>Modified VW Rabbit</u>	Speed	<u>15.4 mph</u>
Bullet Vehicle	<u>NHTSA Straight Side Impactor</u>	Speed	<u>30.1 mph</u>
Impact Location	<u>DOR + 13.9"</u>	Angle	<u>60°</u>

HEAD RESPONSE:

Peak A _R	<u>38.0 G @ 46 ms</u>	Impacted Object	<u>None</u>
HIC	<u>80.3</u>	Time	<u>13-250</u> ms

CHEST RESPONSE:

Location	Pk A (G)	3ms Clip (G)	SI	ΔV _y (MPH)	Impact Time (MS)
Upper Sternum (X)	48.2	31.9	NA	NA	27
Lower Sternum (X)	98.5	55.7	NA	NA	21
LUR (Y)	237.3	125.7	3586	22.3	21
LLR (Y)	50.8	40.3	169	17.9	21
RUR (Y)	66.7	54.0	210	17.9	22
RLR (X)	11.4	9.9	NA	NA	24

CHEST DEFLECTION (IN.):

LUDY 1.7 LLDY 1.4

COMPUTED COEFFICIENTS:

Lower Sternum - Long

B = 6.78 Q = -300.85 V₁₅ = 0.00125 V₁₉ = 0.01000 RVS = 8.00

Left Upper Rib - Lat

B = 7.51 Q = 595.89 V₁₅ = 0.00125 V₁₉ = 0.00250 RVS = 2.00

Right Upper Rib - Lat

B = 6.56 Q = -800.56 V₁₅ = 0.01313 V₁₉ = 0.02063 RVS = 1.57

AIS = 3.01 AIS (BLUR) = 4.36 MAIS = 4.31

NA = Not Applicable

TABLE 4-10. SIDE IMPACT DUMMY TEST RESPONSE SUMMARY (TEST 6.6)
(CONTD)

THORAX RESPONSE:

Location	Pk Ay (G)	Pk AR (G)	3ms Clip (G)	SI	ΔV_y (MPH)	Impact Time (MS)
Upper Thorax (T-1)	80.6	80.8	57.8	296	21.6	21
Lower Thorax (T-12)	57.4	66.0	51.9	292	22.3	24

PELVIS RESPONSE:

Peak A_R 37.7 G 3ms Clip (G) 35.1 Impact Time = 21 ms
SI = 143 ΔV_y = 20.0 mph

COMMENTS:

Listed below is the damage sustained by the driver (APR III, S/N 869) in Test 8327-6.6:

1. Upper and lower rib dampers jammed.
2. Leather breast plate cut along lower edge, in area adjacent to bottom edge of lower rib.
3. Vertical cut in leather breast plate on right side between second and fourth ribs.
4. Rib cage suffered deformation as noted below:
 - Significant deformation - 4R, 5R, 5L
 - Noticeable deformation - 1R, 3R, 1L, 3L, 4L
 - No apparent deformation - 2R, 6R, 2L, 6L

Figure 4-12 presents a sketch showing rib 5R in original condition and post-test 6.6 condition.

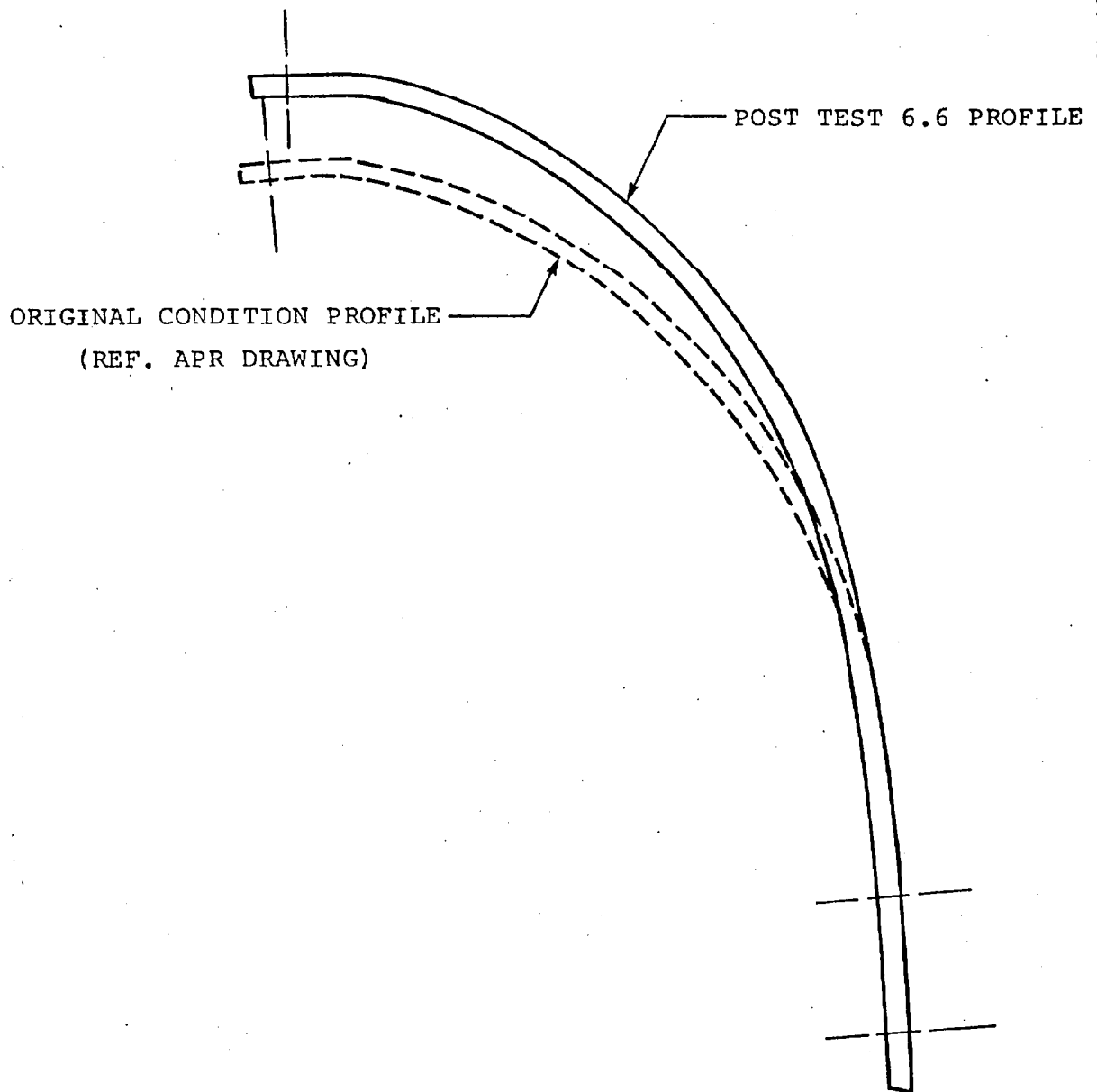


FIGURE 4-12. PRE- AND POST-TEST PROFILES SHOWING SIGNIFICANT DEFORMATION OF RIB 5R.

TABLE 4-11. SIDE IMPACT DUMMY TEST RESPONSE SUMMARY

TEST NO. 8327-6.6 (left rear passenger) TEST DATE 12/19/80

TEST CONFIGURATION:

Target Vehicle Modified VW Rabbit Speed 15.4 mph
 Bullet Vehicle NHTSA Straight Side Impactor Speed 30.1 mph
 Impact Location DOR + 13.9" Angle 60°

HEAD RESPONSE:

Peak A_R 91.4 G @ 103 ms Impacted Object Side Impactor Face
 HIC 866.6 Time 70-109 ms

CHEST RESPONSE:

Location	Pk A (G)	3ms Clip (G)	SI	ΔV _y (MPH)	Impact Time (MS)
Upper Sternum (X)	41.2	34.6	NA	NA	39
Lower Sternum (X)	49.1	43.0	NA	NA	39
LUR (Y)	75.1	69.0	430	31.9	39
LLR (Y)	108.1	78.5	731	22.5	39
RUR (Y)	56.9	53.8	279	25.3	39
RLR (X)	85.2	81.3	753	33.7	39

CHEST DEFLECTION (IN.):

LUDY NA LLDY 1.9

COMPUTED COEFFICIENTS:

Lower Sternum - Long
 B = 6.20 Q = -367.1 V₁₅ = 0.00500 V₁₉ = 0.00937 RVS = 1.88
 Left Upper Rib - Lat
 B = 6.90 Q = 1358.7 V₁₅ = 0.01500 V₁₉ = 0.02875 RVS = 1.92
 Right Upper Rib - Lat
 B = 6.66 Q = -1135.3 V₁₅ = 0.01188 V₁₉ = 0.02313 RVS = 1.95
 AIS = 4.31 AIS (BLUR) = 3.40 MAIS = 3.09

NA = Not Applicable

TABLE 4-11. SIDE IMPACT DUMMY TEST RESPONSE SUMMARY (TEST 6.6)
(CONTD)

THORAX RESPONSE:

Location	Pk A _y (G)	Pk A _R (G)	3ms Clip (G)	SI	ΔV_y (MPH)	Impact Time (MS)
Upper Thorax (T-1)	82.1	87.0	68.9	548	27.3	29
Lower Thorax (T-12)	82.3	82.4	71.4	705	31.8	33

PELVIS RESPONSE:

Peak A_R 152.7 G 3ms Clip (G) 75.4 Impact Time = 34 ms
SI = 897 ΔV_y = 31.2 mph

COMMENTS:

Listed below is the damage sustained by the left rear passenger
(SID IV dummy, S/N 386) in Test 8327-6.6:

1. 100 cs rib damper leaking oil badly. Probable lost seal
or cracked/broken reservoir.



FIGURE 4-13. POST-TEST VW RABBIT FRONT THREE-QUARTER VIEW (TEST 6.6).



FIGURE 4-14. POST-TEST VW RABBIT REAR THREE-QUARTER VIEW (TEST 6.6).

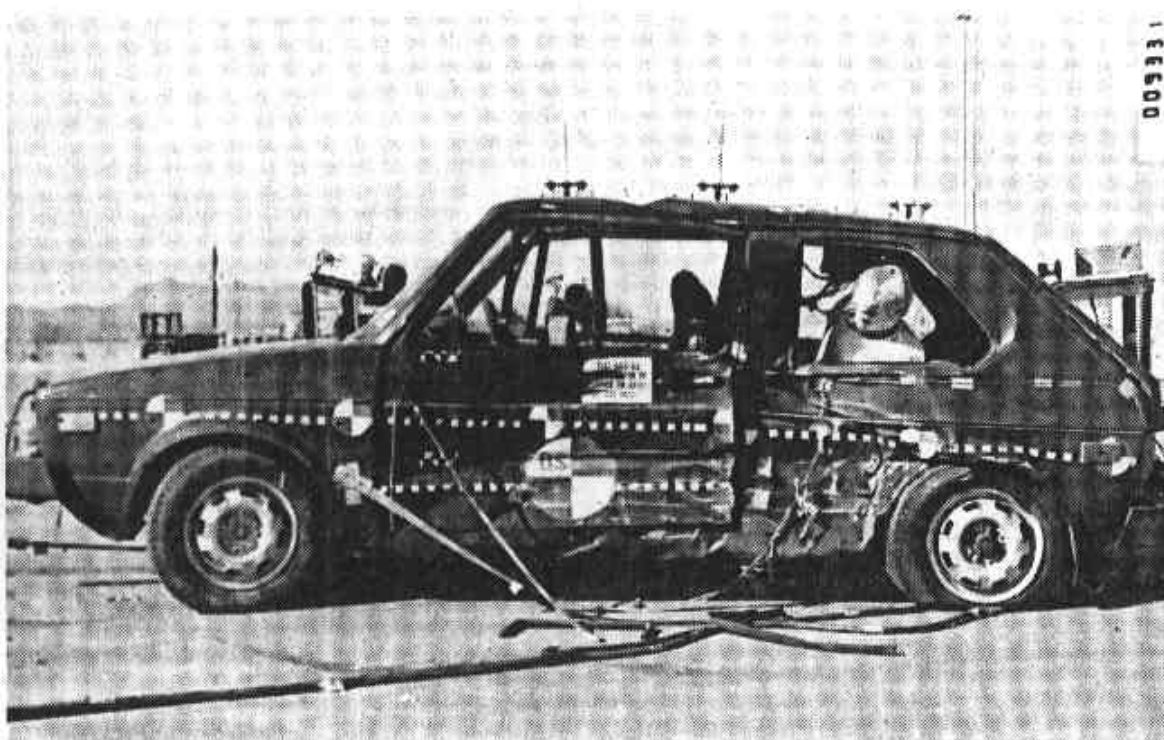


FIGURE 4-15. POST-TEST VW RABBIT LEFT SIDE VIEW (TEST 6.6).

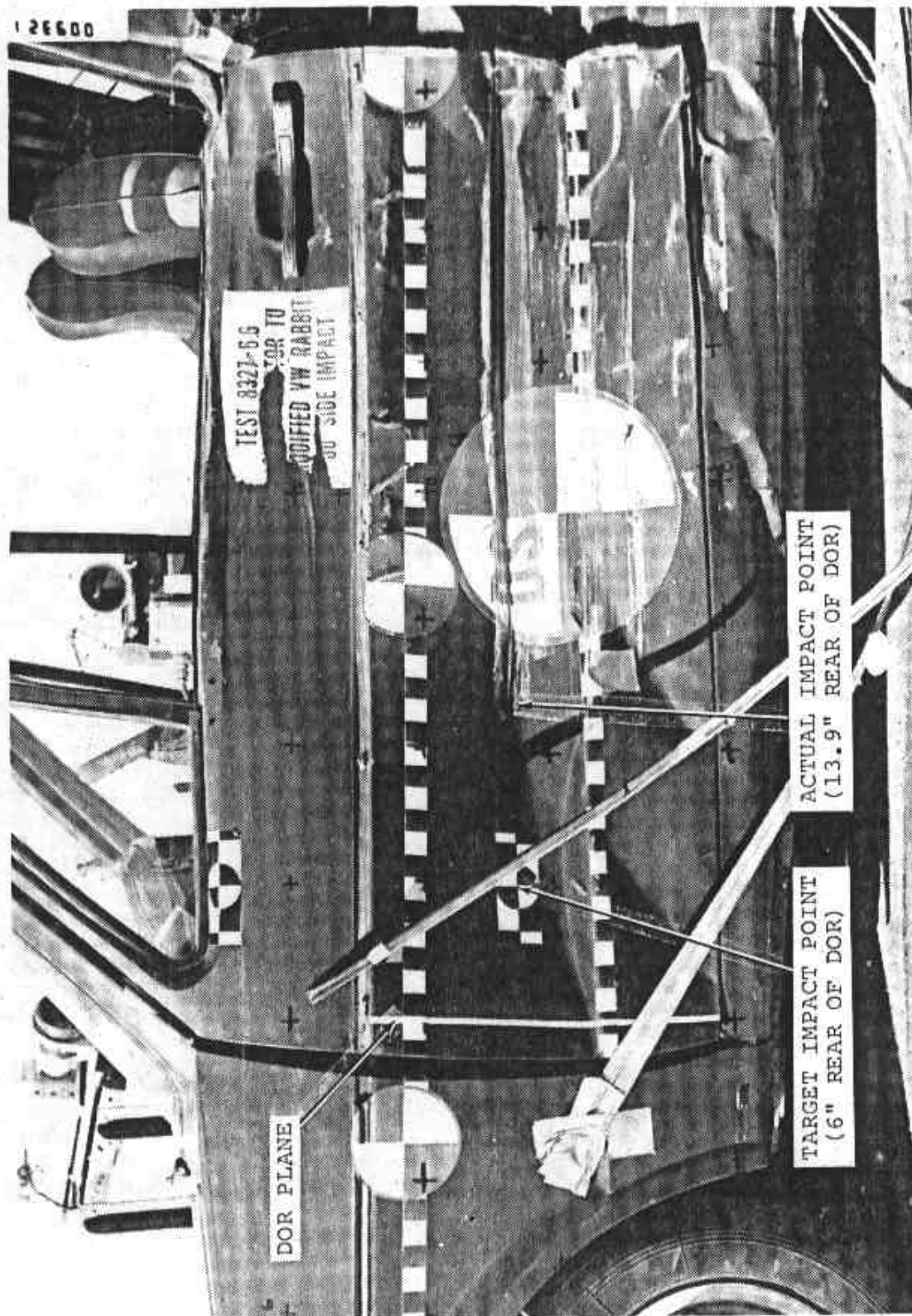


FIGURE 4-16. SIDE VIEW OF VW RABBIT SHOWING TARGET IMPACT POINT AND ACTUAL IMPACT POINT (TEST 5.5).

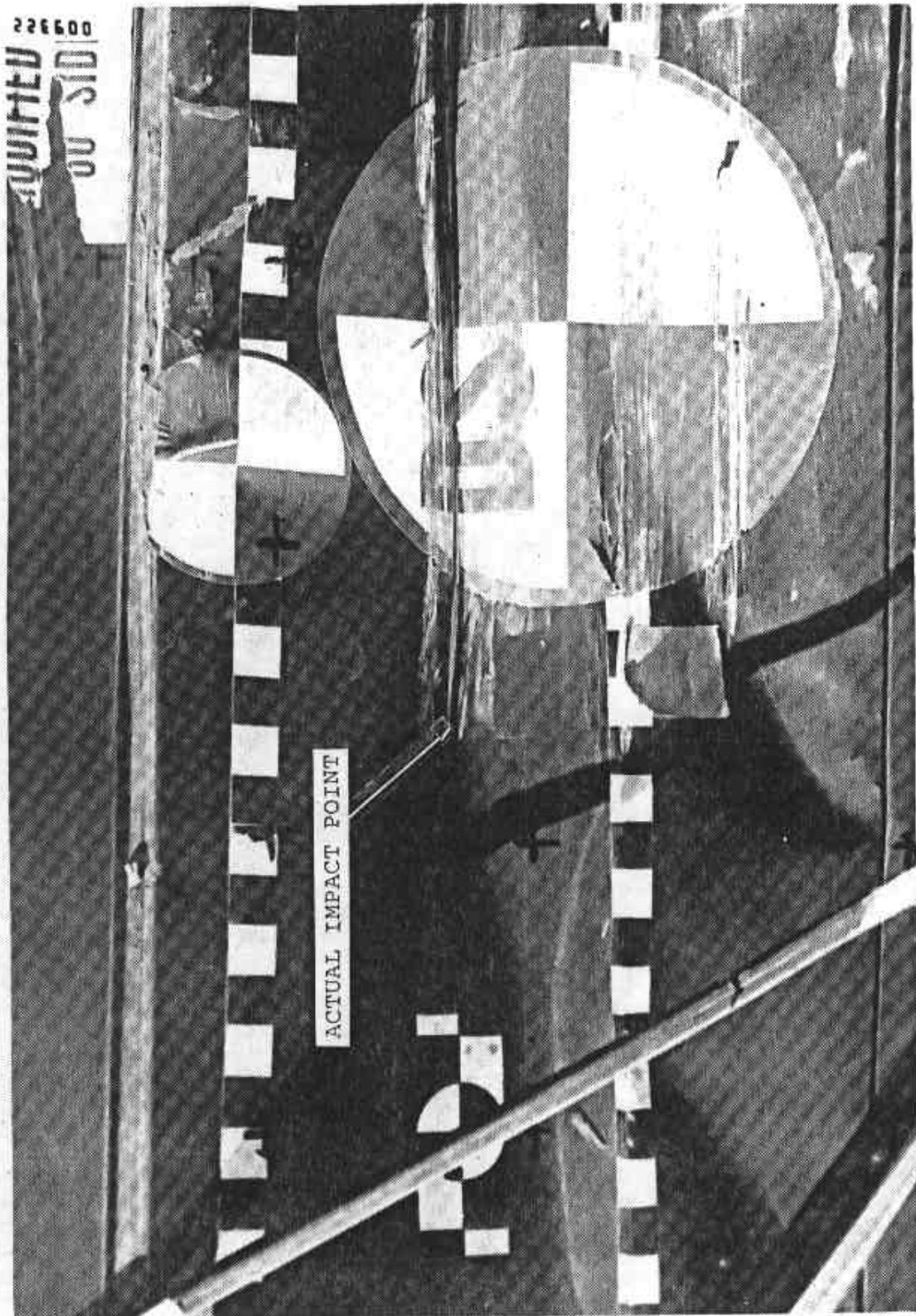


FIGURE 4-17. CLOSE-UP VIEW OF ACTUAL IMPACT POINT ON VW RABBIT (TEST 6.6).

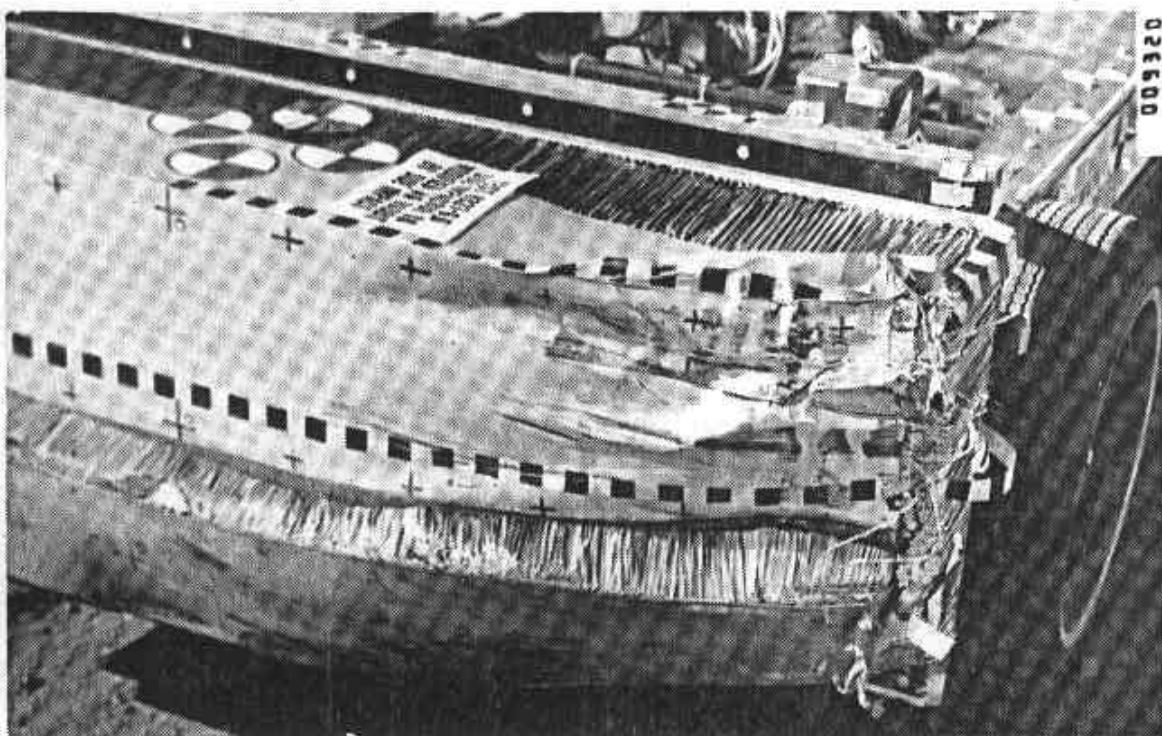


FIGURE 4-18. POST-TEST SIDE IMPACTOR FACE (TEST 6.6).

5.0 ANALYSES OF TEST RESULTS

The primary objectives of the Task 6 development testing were to evaluate the "crabbed" bullet vehicle simulation and to evaluate the performance of the Side Impactor. Tests 8327-6.5 and 6.6 have provided data for two-vehicles-moving crash tests utilizing the Task 5 Face. It is therefore now possible to directly compare the results of "crabbed" Side Impactor Tests with the results of two-vehicle-moving tests, Section 5.1, and to compare the results of tests utilizing the Task 5 face with the results of previous tests utilizing the Phase I face or actual bullet cars, Section 5.2. In addition, an assessment of the Side Impact dummies as compliance test devices is presented in Section 5.3.

5.1 EVALUATION OF THE "CRABBED" BULLET VEHICLE SIMULATION TECHNIQUE

The fundamental requirements of the "crabbed" bullet vehicle simulation technique are that the principal directions of force with respect to the bullet and target vehicles be unchanged, and that the magnitude and direction of the relative velocity of the two vehicles remain the same as in the two-vehicles-moving case. The test configuration utilized in Tests 6.1 through 6.4 meets these criteria at initial impact. However, there is some concern regarding the validity of the simulation after t_0 , since the velocity of the target vehicle is being compensated for by increasing the velocity of the bullet vehicle. In these tests, the mass of the bullet vehicle is greater than the mass of the target

vehicle, which affects energy and momentum change.

Section 5.1 provides a comparison of a two-vehicles-moving test, 8327-6.6, with "crabbed" bullet vehicle tests 8327-6.2 and 6.3 (Reference 1) to assess the validity of the simulation technique.

Figures 5-1, 5-2, and 5-3 compare longitudinal, lateral, and resultant velocity changes at the target vehicle C.G. for Modified Rabbit Tests 6.2, 6.3 and 6.6. These curves indicate that the overall vehicle ΔV 's in both the two-vehicles-moving test and the crabbed bullet simulations are quite similar. There does seem to be some difference in the individual X and Y velocity components late in the event, which could be due to variable factors such as different tire/ground interaction, different rate of rotation due to location of impact point, etc. However, the resultant ΔV 's correspond reasonably well as was expected.

It must be pointed out that all the velocities do not correspond equally as well; compare Figures 5-4 and 5-5. These figures compare Y-axis velocities longitudinally along the target vehicle (location 4Y forwardmost, location 3Y rearmost) and indicate that the lateral velocity components were uniformly higher in the simulation test.

The data in Figure 5-6 and corresponding high-speed films indicate that the target vehicle in the two-vehicles-moving test undergoes a greater Z-axis change earlier in the event (similar response has been observed in previous tests). With the target

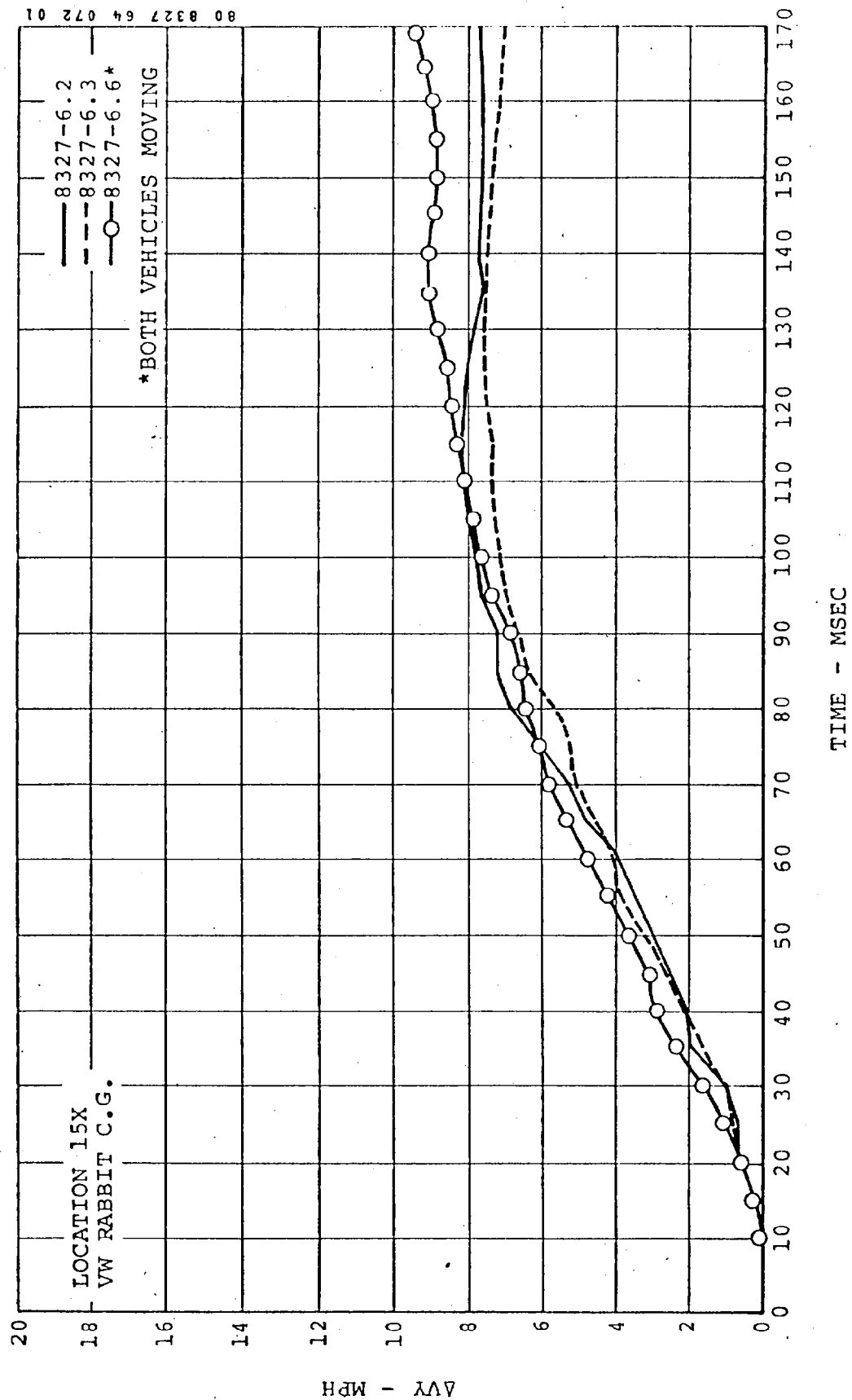


FIGURE 5-1. COMPARISON OF TARGET VEHICLE LONGITUDINAL VELOCITY CHANGE (TESTS 6.2, 6.3, AND 6.6).

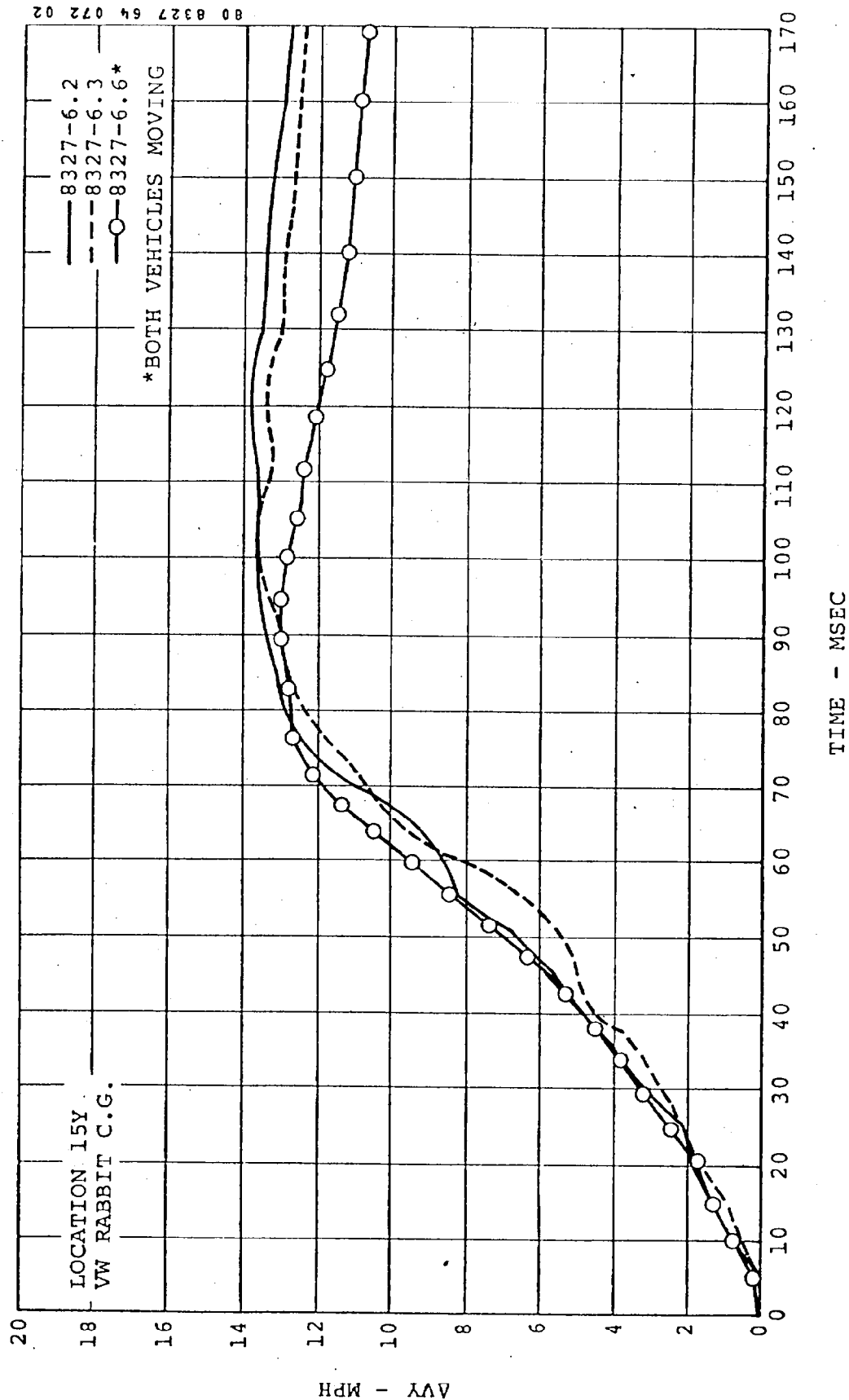


FIGURE 5-2. COMPARISON OF TARGET VEHICLE LATERAL VELOCITY CHANGE (TESTS 6.2, 6.3, AND 6.6).

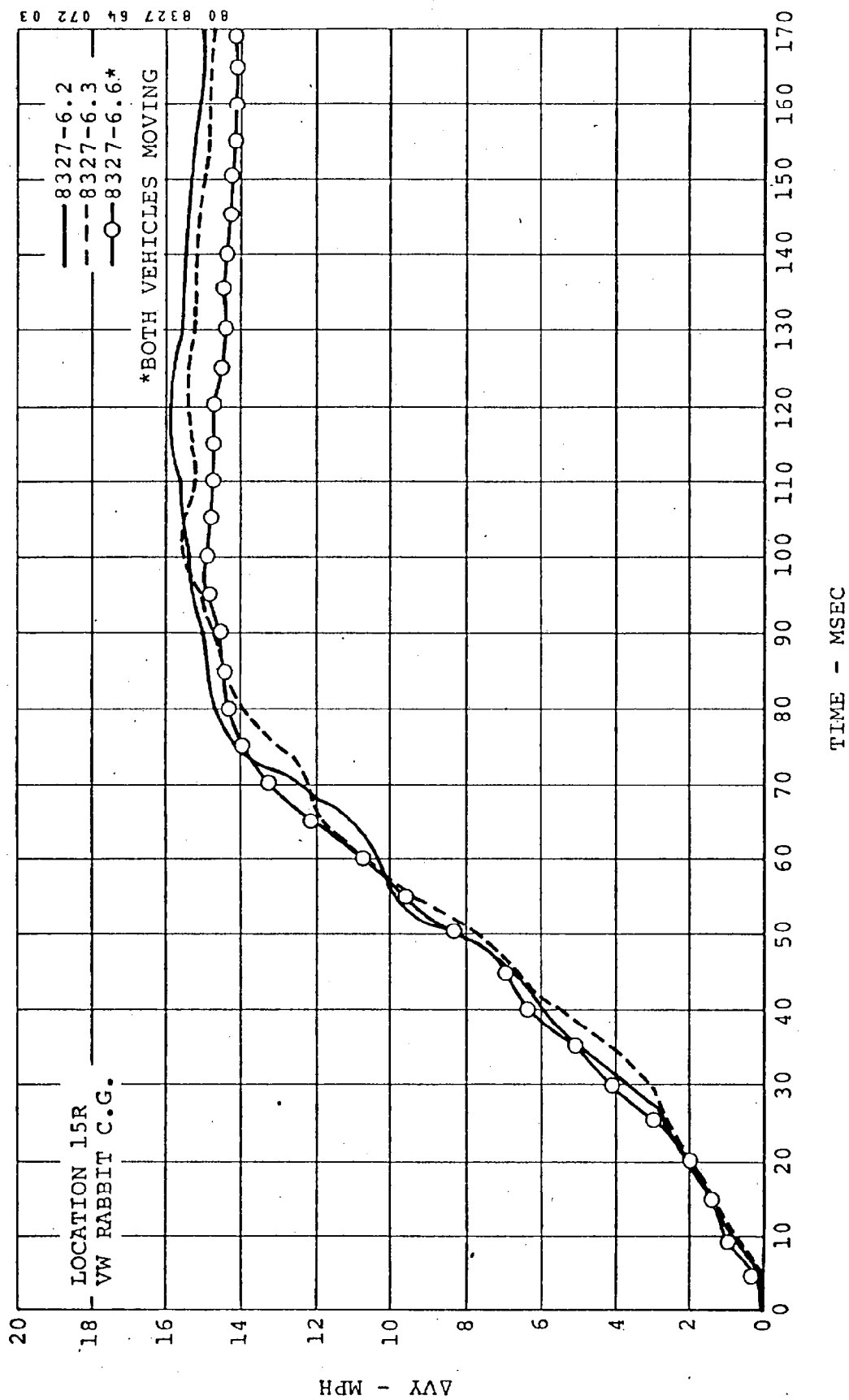


FIGURE 5-3. COMPARISON OF TARGET VEHICLE RESULTANT VELOCITY CHANGE
(TESTS 6.2, 6.3, AND 6.6).

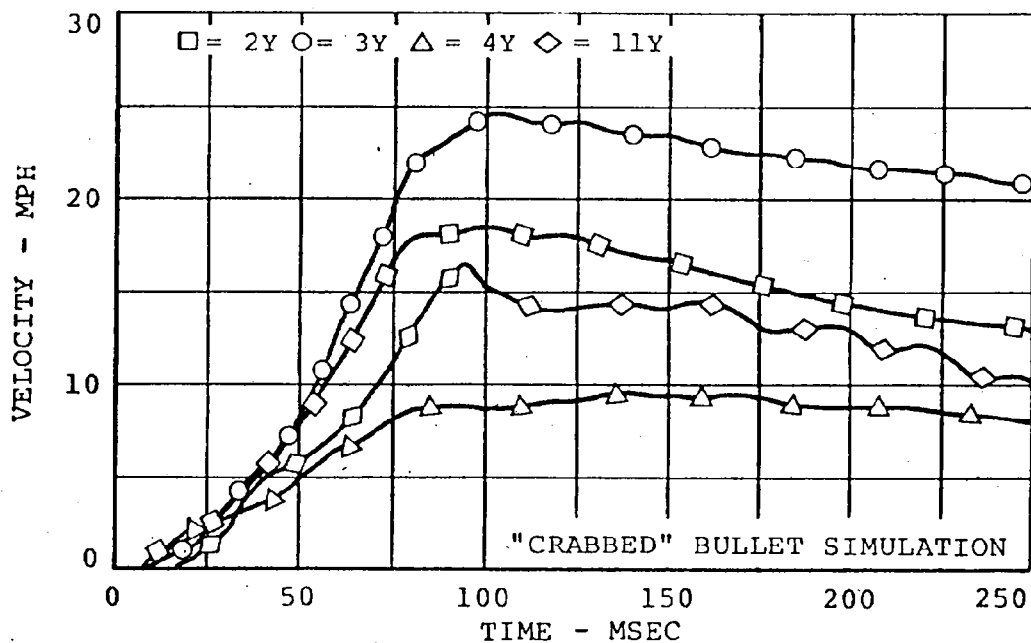


FIGURE 5-4. COMPARISON OF LATERAL COMPARTMENT VELOCITIES, TEST 6.2.

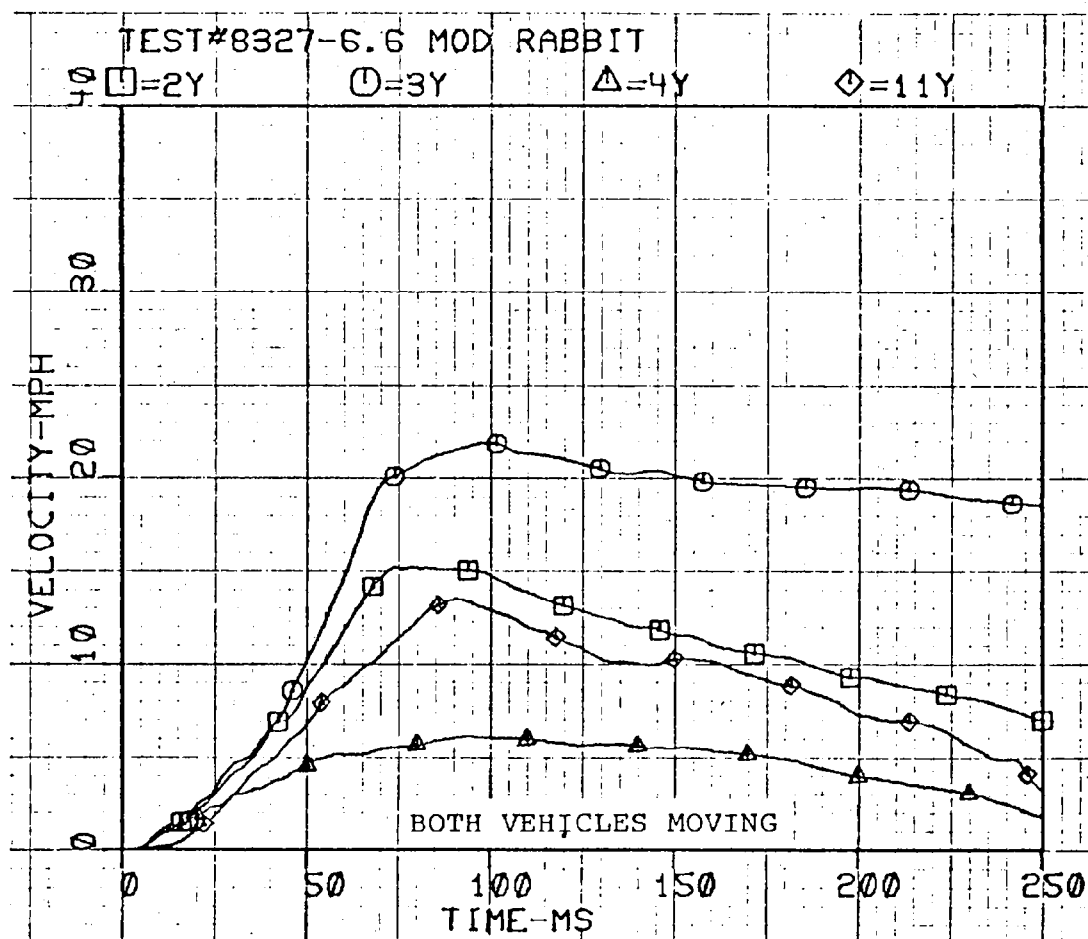
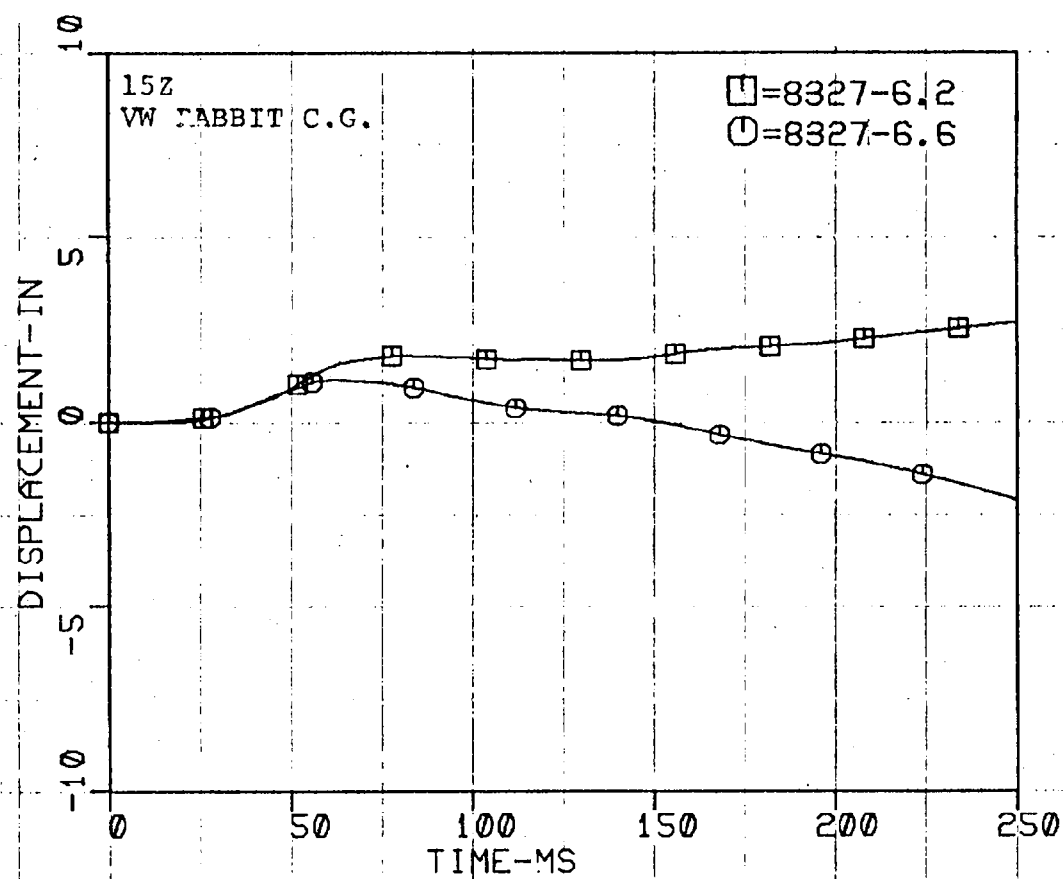


FIGURE 5-5. COMPARISON OF LATERAL COMPARTMENT VELOCITIES, TEST 6.6.



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FIGURE 5-6. VERTICAL VW COMPARTMENT DISPLACEMENT
(TESTS 6.2 AND 6.6).

vehicle pitched up more, the Y-axis accelerometers would be expected to lose more of the actual Y-axis response, which could account for some of the lower velocities in Test 6.6. This difference in Z-axis response is a major dissimilarity between the two-vehicles-moving test and the simulation. However, the most severe target vehicle pitching occurs after the crash event so that the effects on the crash environment, if any, are not significant, except with regard to trajectory.

Figures 5-7 and 5-8 compare longitudinal and lateral velocity changes for the bullet vehicle. In Figure 5-7 it is apparent that the longitudinal velocity changes are very similar. However, in Figure 5-8, the bullet vehicle in the two-vehicles-moving test exhibits a somewhat different lateral response than in the simulation. To be specific, the bullet vehicle in the two-vehicles-moving test is apparently less susceptible to the counterclockwise rotation caused by the dragging friction force of the crash. This difference in lateral response for the bullet vehicle may also be partly responsible for the difference in longitudinal responses noted for the target vehicles.

Given that the overall vehicle responses were fairly similar for both the two-vehicles-moving test and the simulations, it was expected that crush, door responses, and dummy responses would also be similar. However, two factors have combined to make these comparisons difficult. First, in the two-vehicles-moving test, the impact point was somewhat rearward of the impact point in the simulations, as shown in Table 5-1. The difference in impact point causes less crash energy to be absorbed forward on the target vehicle in the two-vehicles-moving test than in the

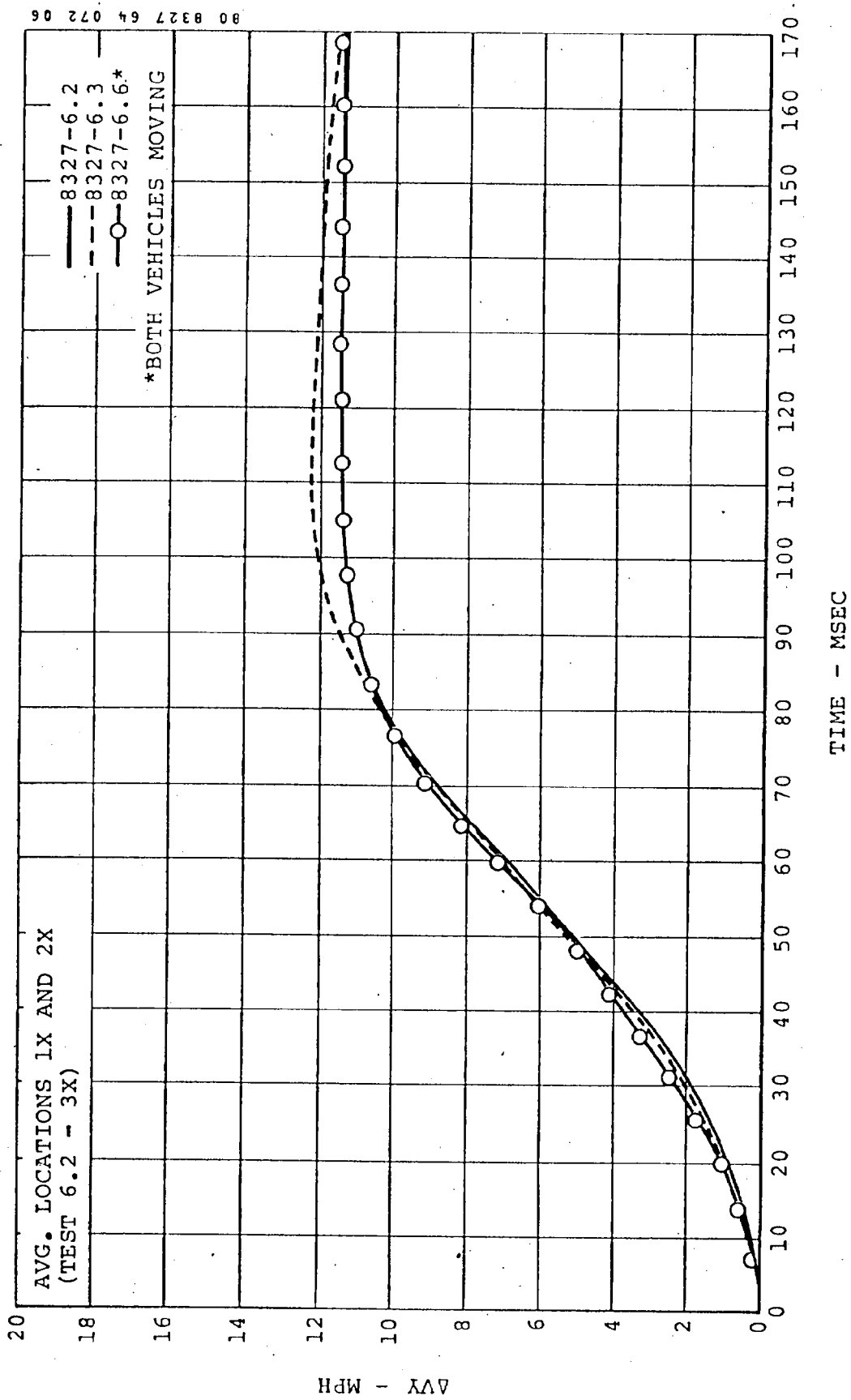


FIGURE 5-7. COMPARISON OF BULLET VEHICLE LONGITUDINAL VELOCITY CHANGE
(TESTS 6.2, 6.3, AND 6.6).

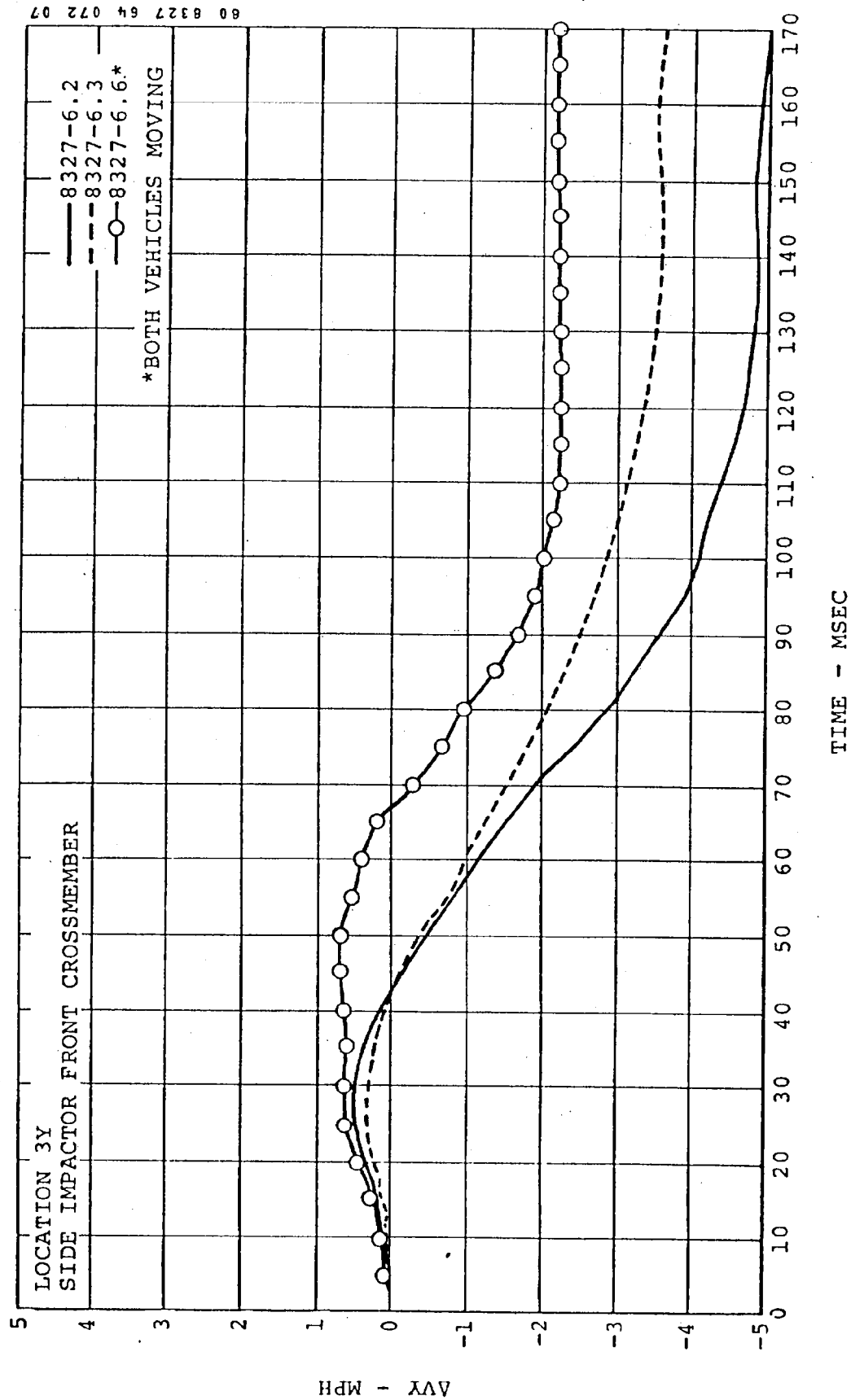


FIGURE 5-8. COMPARISON OF BULLET VEHICLE FRONT LATERAL VELOCITY CHANGE
(TESTS 6.2, 6.3, AND 6.6).

See Revised
Reproduce. -15"

TABLE 5-1. TARGET AND ACTUAL IMPACT POINTS FOR TESTS 6.1 - 6.6

Test No.	Target Point	Actual Impact Point	(Inches)	Comment
8327-6.1	DOR	DOR + 4.2"	+4.2"	Crabbed Side Impactor
8327-6.2	DOR	DOR + 6.0"	+6.0"	
8327-6.3	DOR	DOR + 4.4"	+4.4"	
8327-6.4	DOR	DOR + 2.8"	+2.8"	
8327-6.5	DOR + 6.0"	DOR + 21.5"*	+15.5"	Targeted to hit same actual impact point as in Test 8327-6.2.
8327-6.6	DOR + 6.0"	DOR + 13.9"	+7.9"	Targeted to hit same actual impact point as in Test 8327-6.2.

*Target vehicle wandered laterally during tow.

corresponding area of the target vehicle in the simulations. As a result, the front seat occupant in the two-vehicles-moving test (6.6) might experience a less severe crash environment, while the rear seat occupant would experience a more severe one. The second factor was the fact that the door in Test 6.6 ended up partially open (see Figures 4-13 and 4-14) which tended to substantially alter the post-test profiles. Early door velocities and occupant response would be expected to be independent of this factor, however.

In Figures 5-9 and 5-10 it can be seen that the post-test crush profile in Test 6.6 is indeed more severe further rearward than in Tests 6.2 and 6.3.

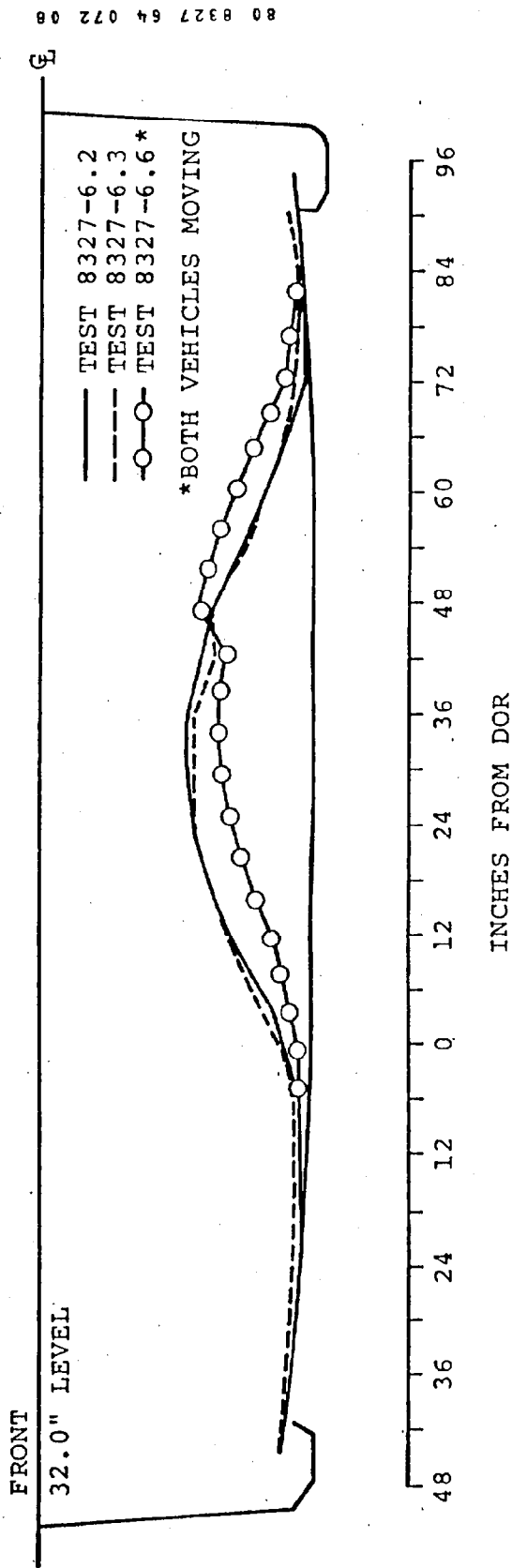


FIGURE 5-9. POST-TEST VW CRUSH AT 32" LEVEL (TESTS 6.2, 6.3, AND 6.6).

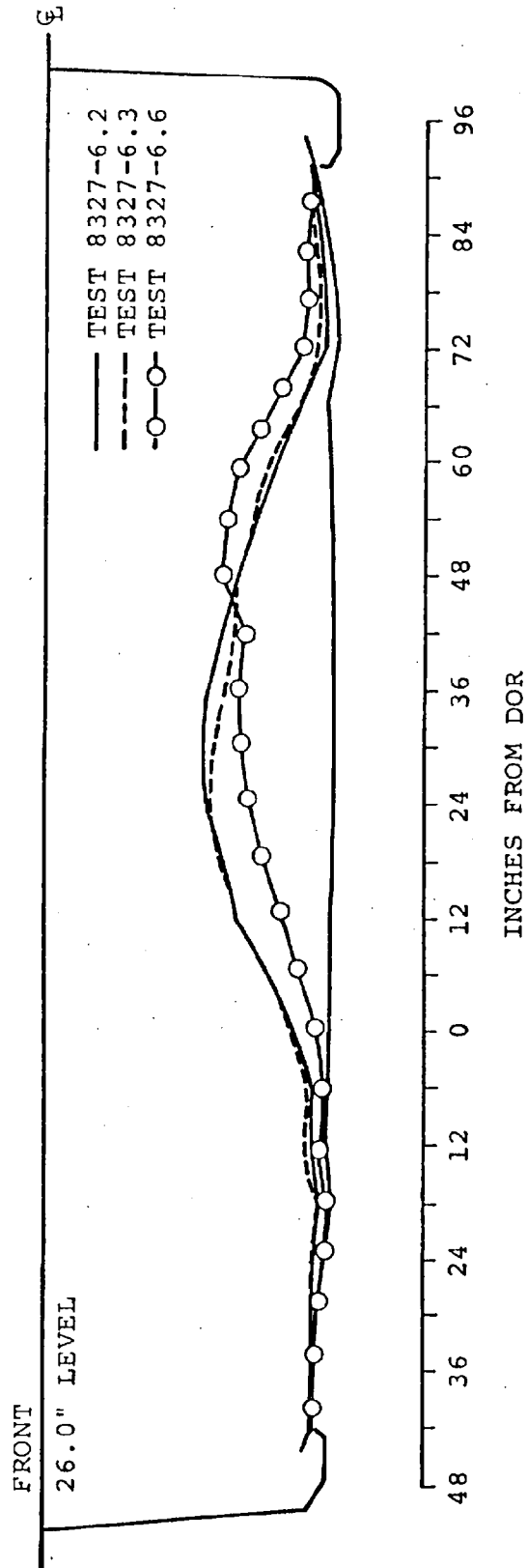


FIGURE 5-10. POST-TEST VW CRUSH AT 26" LEVEL (TESTS 6.2, 6.3, AND 6.6).

Figures 5-11 and 5-12 compare velocities at mid-door. The Test 6.6 traces indicate less intrusion at these locations (lower velocity at location 7, shorter duration at location 10) which was expected considering that less crash energy was dissipated so far forward on the car when compared with Tests 6.2 and 6.3.

Figures 5-13 and 5-14 compare velocities at the rear of the target vehicle door. At these locations, it is apparent that the target vehicle is still absorbing substantially more energy (and crushing more) in the simulations than in the two-vehicles-moving test.

Since the door velocities (and inward displacement) were less in Test 6.6, it was expected that the driver occupant velocity responses would be less. In Figures 5-15 and 5-16 it is apparent that the driver occupant in Test 6.2 did indeed undergo a greater lateral velocity change.

Due to the greater rear area post-test crush for Test 6.6, exhibited in Figures 5-9 and 5-10, it was expected that vehicle dynamic response and rear seat dummy response in this area would be greater in Test 6.6. In Figure 5-17, velocities at the B-Pillar are compared. The Test 6.6 velocity does not appear to be of greater magnitude or duration than in Tests 6.2 and 6.3. However, Figure 5-18 compares intrusion at the B-pillar, (same as Location 12) as measured by the scratch tube, and these curves do indicate that Test 6.6 produced somewhat more intrusion further rearward.

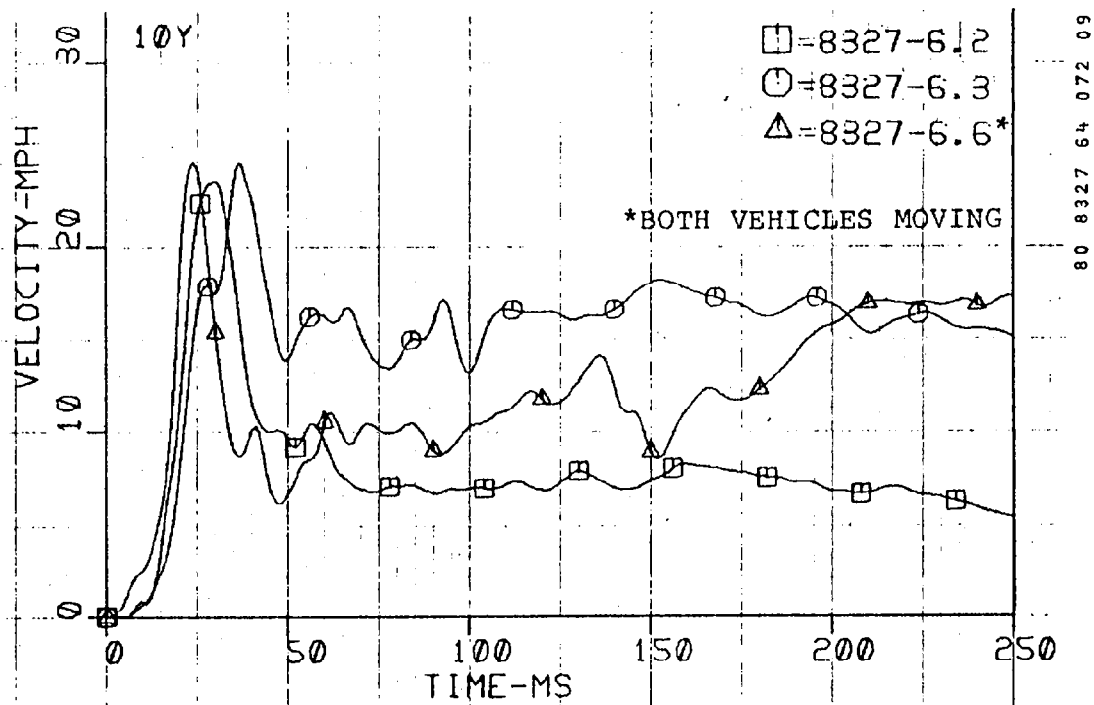


FIGURE 5-11. LATERAL VELOCITY AT MID-DOOR - WINDOWSILL LEVEL (TESTS 6.2, 6.3, AND 6.6).

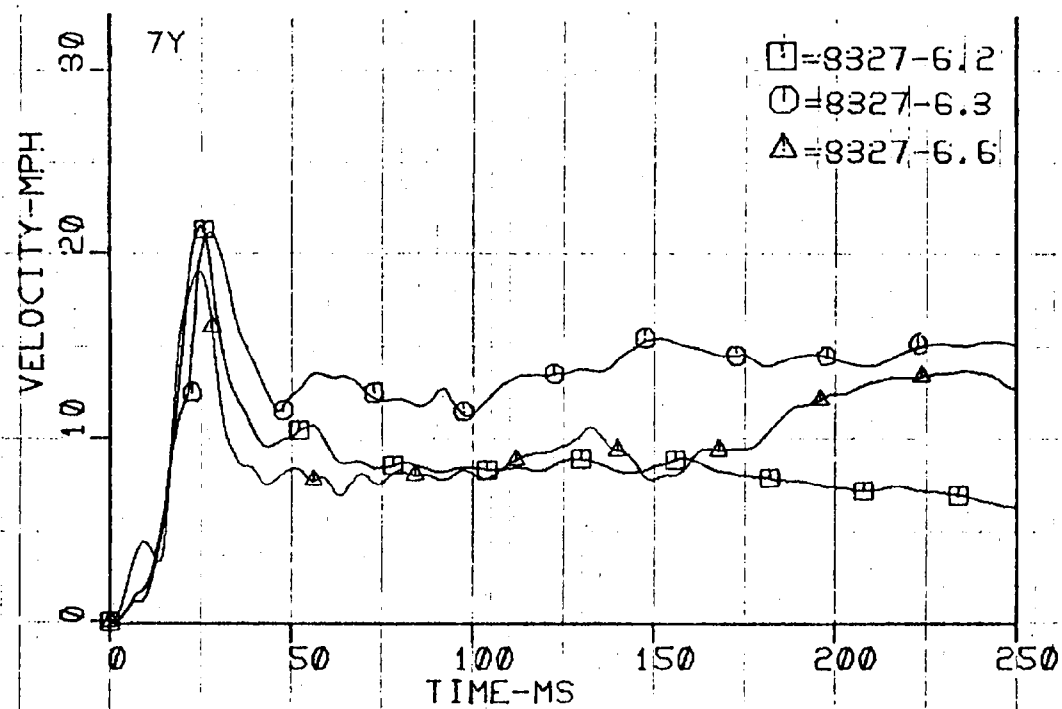


FIGURE 5-12. LATERAL VELOCITY AT MID-DOOR - MID-DOOR LEVEL (TESTS 6.2, 6.3, AND 6.6).

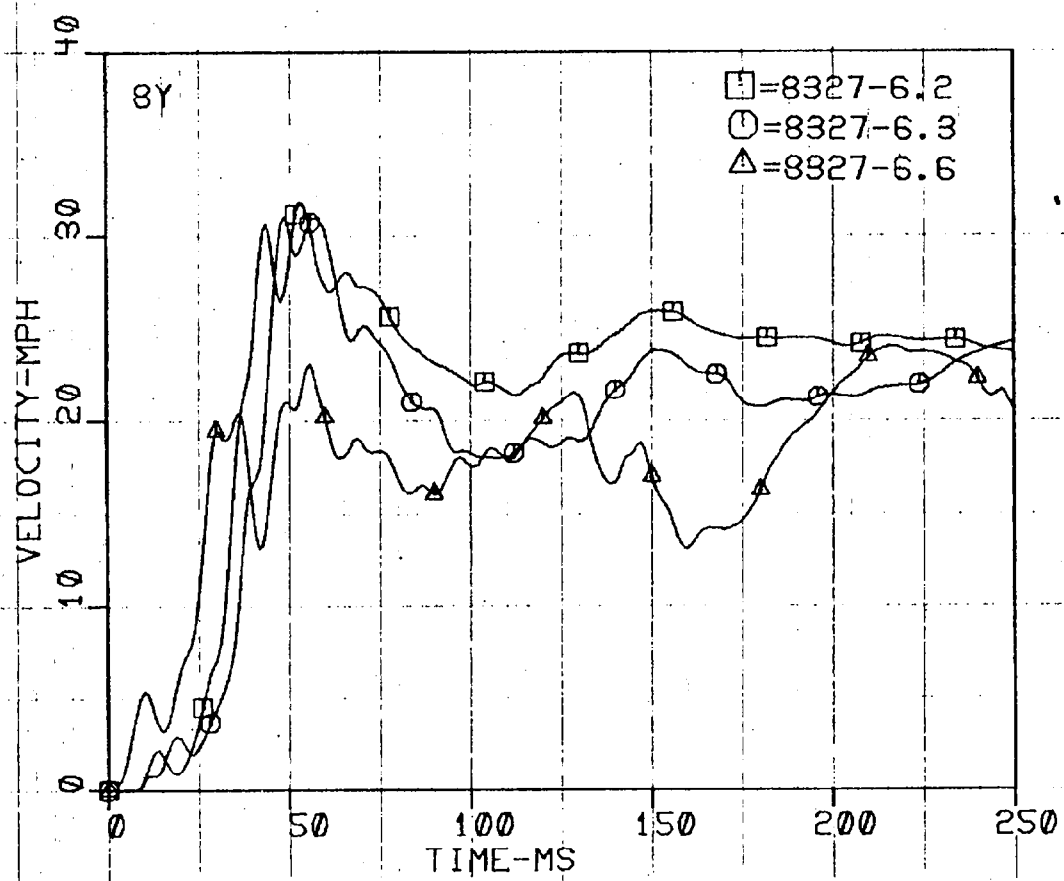
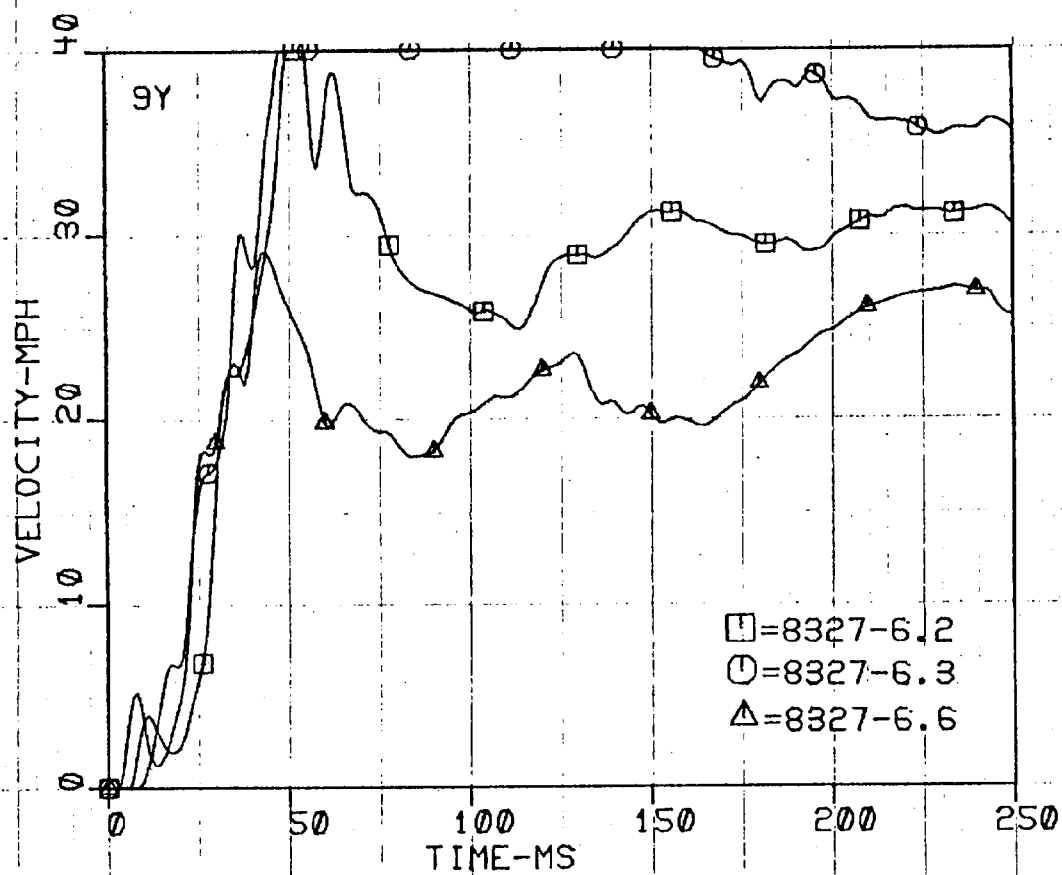


FIGURE 5-13. LATERAL VELOCITY AT UPPER REAR CORNER OF DOOR (TESTS 6.2, 6.3, AND 6.6).



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FIGURE 5-14. LATERAL VELOCITY AT REAR OF DOOR - MID-DOOR LEVEL (TESTS 6.2, 6.3, AND 6.6).

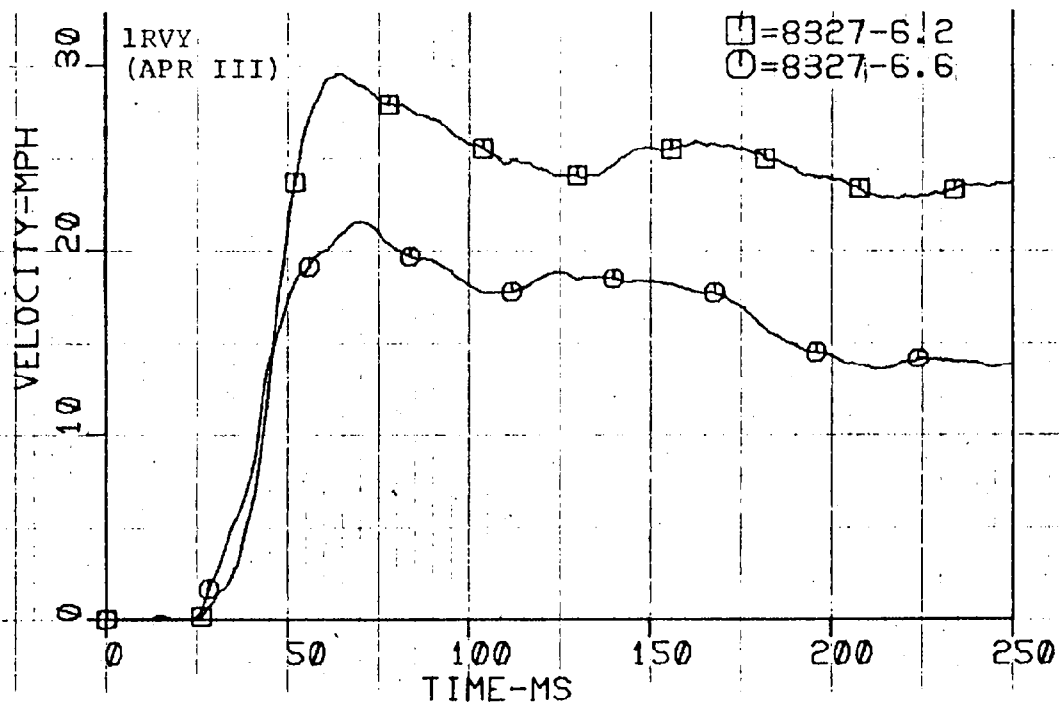


FIGURE 5-15. DRIVER DUMMY LATERAL UPPER THORAX VELOCITY (TESTS 6.2 AND 6.6).

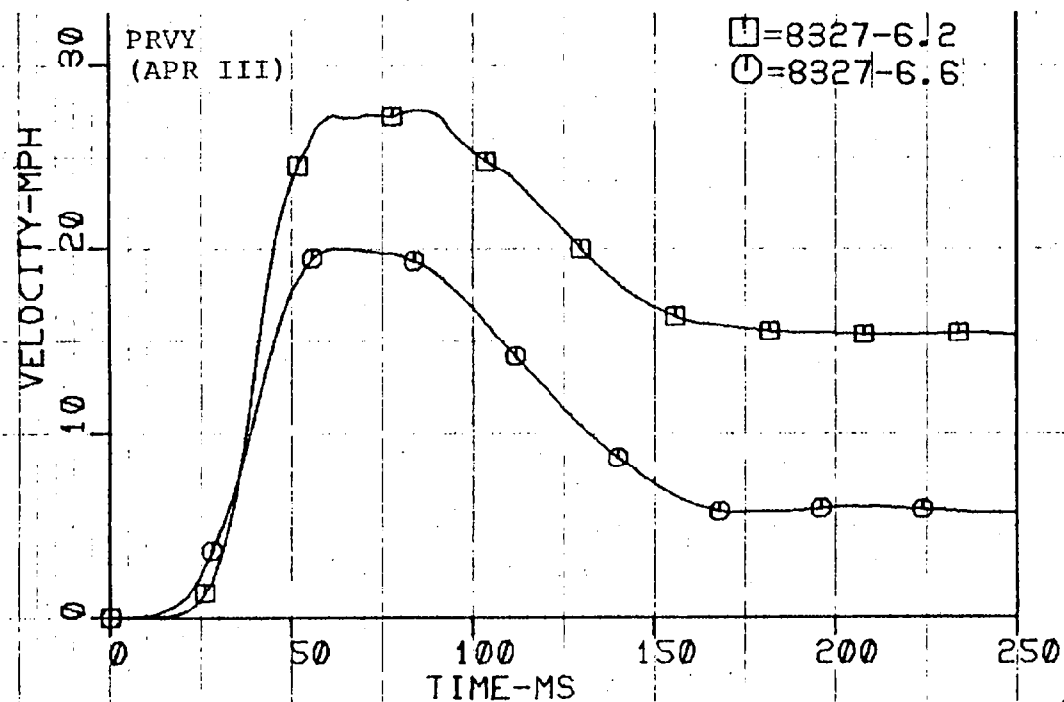


FIGURE 5-16. DRIVER DUMMY LATERAL PELVIS VELOCITY (TESTS 6.2 AND 6.6).

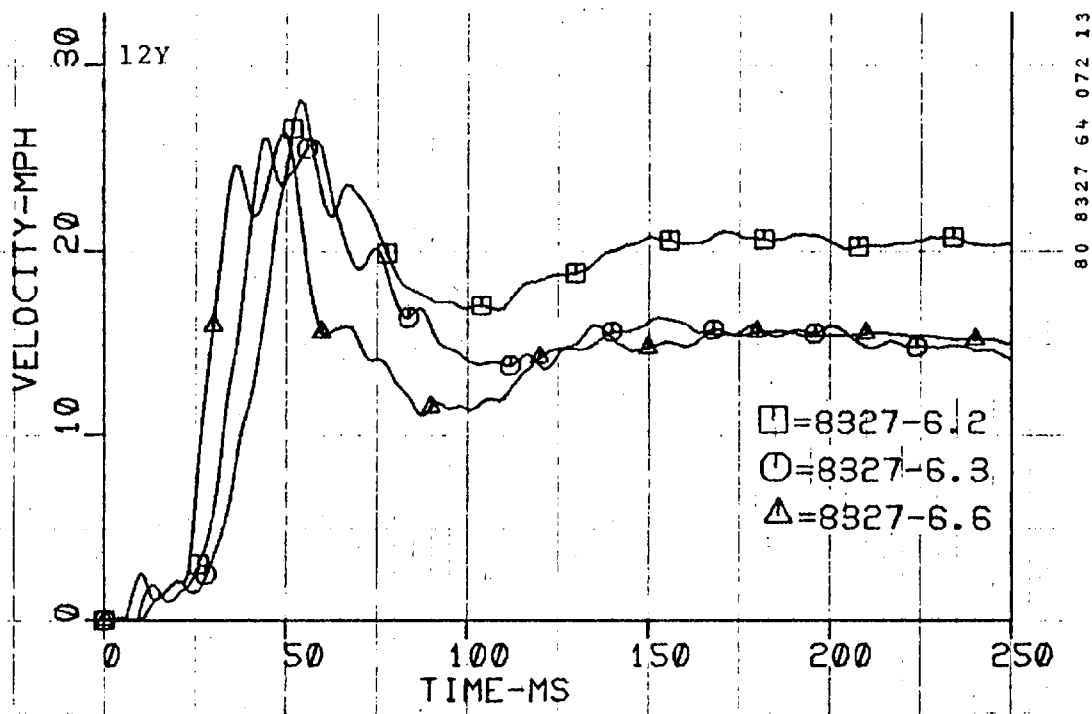


FIGURE 5-17. LATERAL VELOCITY AT B-PILLAR
(TESTS 6.2, 6.3, AND 6.6).

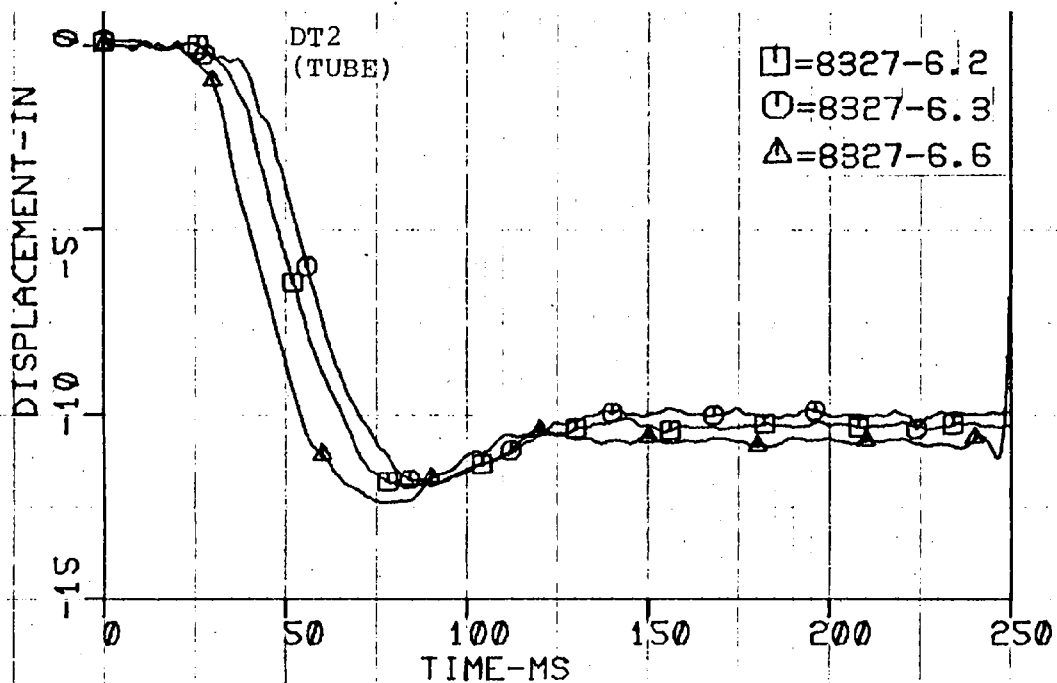


FIGURE 5-18. INTRUSION AT VW B-PILLAR
(TESTS 6.2, 6.3, AND 6.6).

Close examination of Figures 5-9 and 5-10 indicates that even at the B-Pillar (DOR + 48"), the difference in crush is not substantial, and it is only rear of the B-Pillar that the greater deformation in Test 6.6 becomes apparent. If there were any structural accelerometers aft of the B-Pillar, it would be expected that they would also exhibit a greater response.

The rear seat passenger dummy (SID) was seated aft of the B-Pillar. As exhibited in Figures 5-19 and 5-20, the rear seat dummy in Test 6.6 experienced a more severe crash environment than in Test 6.2.

In Figure 5-21, several normalized dummy injury criteria are compared for Tests 6.2 and 6.6. This figure further illustrates the results discussed above, namely that in Test 6.6 with the impact point further rearward, the driver dummy suffers less severe injuries and the rear passenger dummy suffers more severe injuries.

It was expected that, in Test 6.5, in which the impact point was even further rearward, the same pattern would be repeated, namely less severe response toward the front of the target vehicle and more toward the rear. Figures 5-22 and 5-23 compare post-test crush in Tests 6.5 and 6.6. In Test 6.5, as in Test 6.6, the door ended up partly open, distorting the crush profiles, but there is enough difference from DOR to DOR + 48" to justify the conclusion.

Figures 5-24 and 5-25 compare driver dummy velocities. It is obvious that in Test 6.5 the responses are again lower, which is to be expected when comparing the door velocities in Figure 5-26.

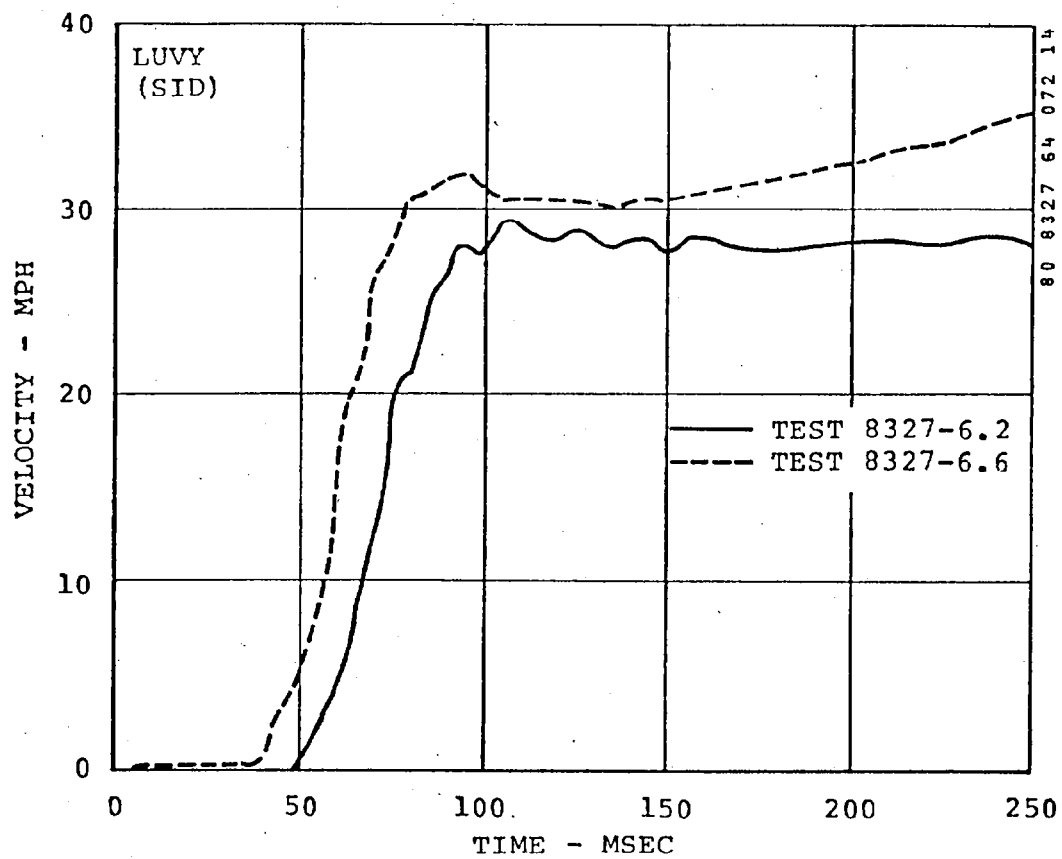


FIGURE 5-19. LEFT REAR OCCUPANT LATERAL LEFT UPPER RIB VELOCITY (TESTS 6.2 AND 6.6).

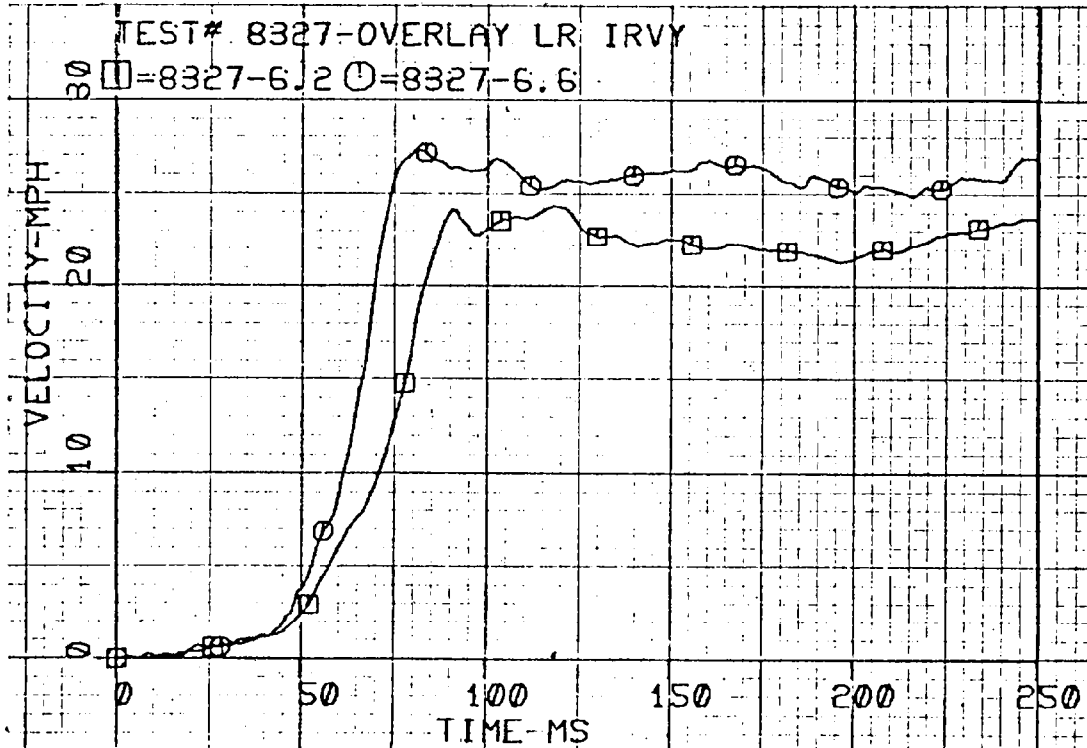
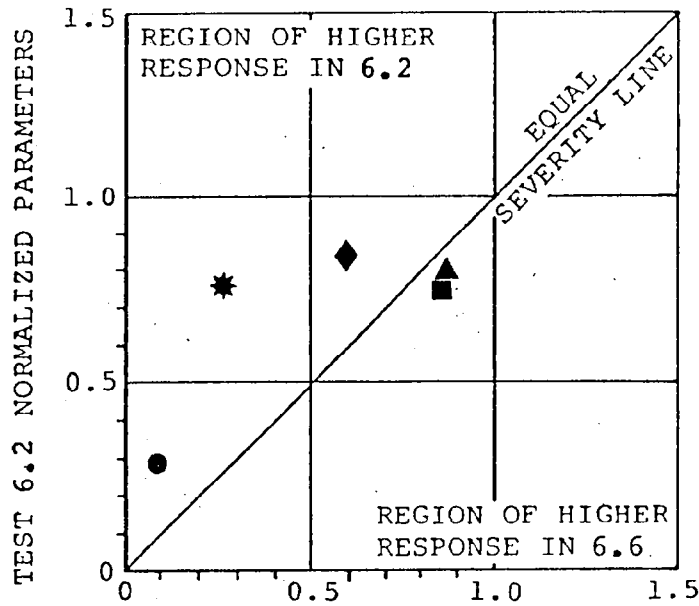


FIGURE 5-20. LEFT REAR OCCUPANT LATERAL UPPER THORAX VELOCITY (TESTS 6.2 AND 6.6).



A) DRIVER DUMMY (APR III)

LEGEND

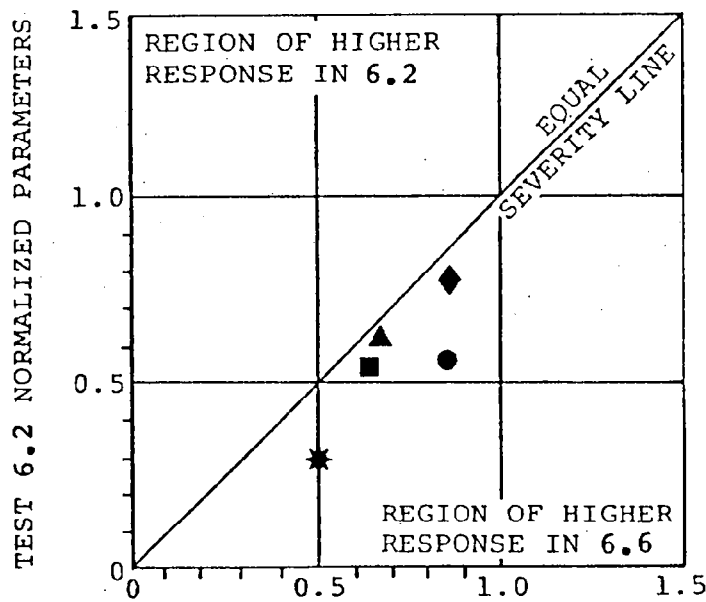
$\frac{HIC}{1000}$

$\frac{UPPER THORAX SI}{1000}$

$\frac{AIS}{5}$

$\frac{AIS (BLUR)}{5}$

$\frac{MAIS}{5}$



B) LEFT REAR PASSENGER DUMMY (HSRI SID)

FIGURE 5-21. COMPARISON OF NORMALIZED DUMMY PARAMETERS FROM TESTS 6.2 AND 6.6.

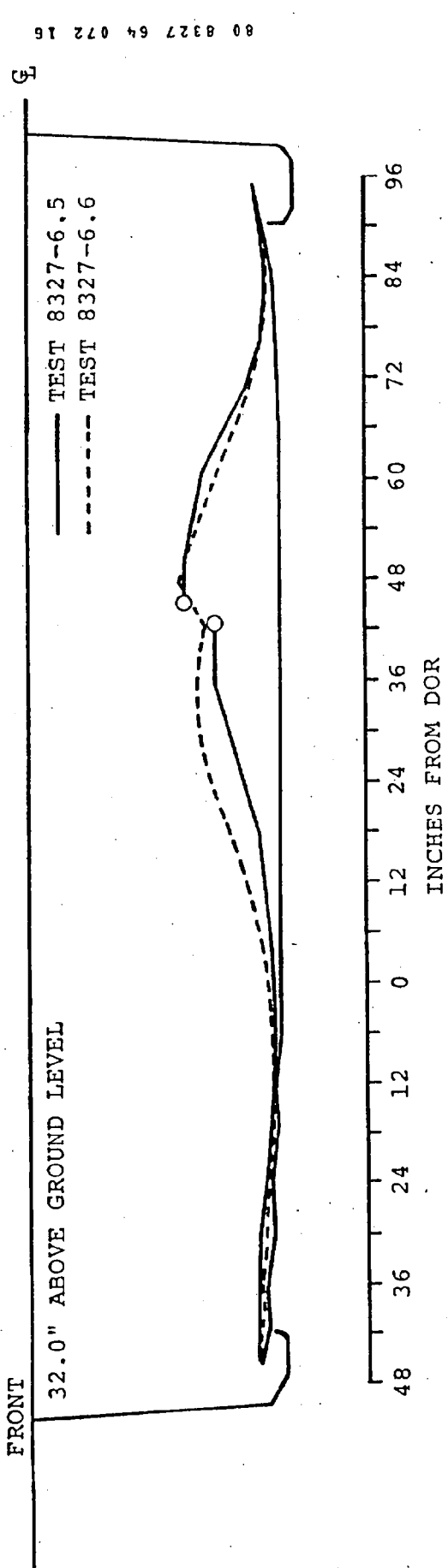


FIGURE 5-22. POST-TEST VW SIDE CRUSH AT 32" LEVEL (TESTS 6.5 AND 6.6).

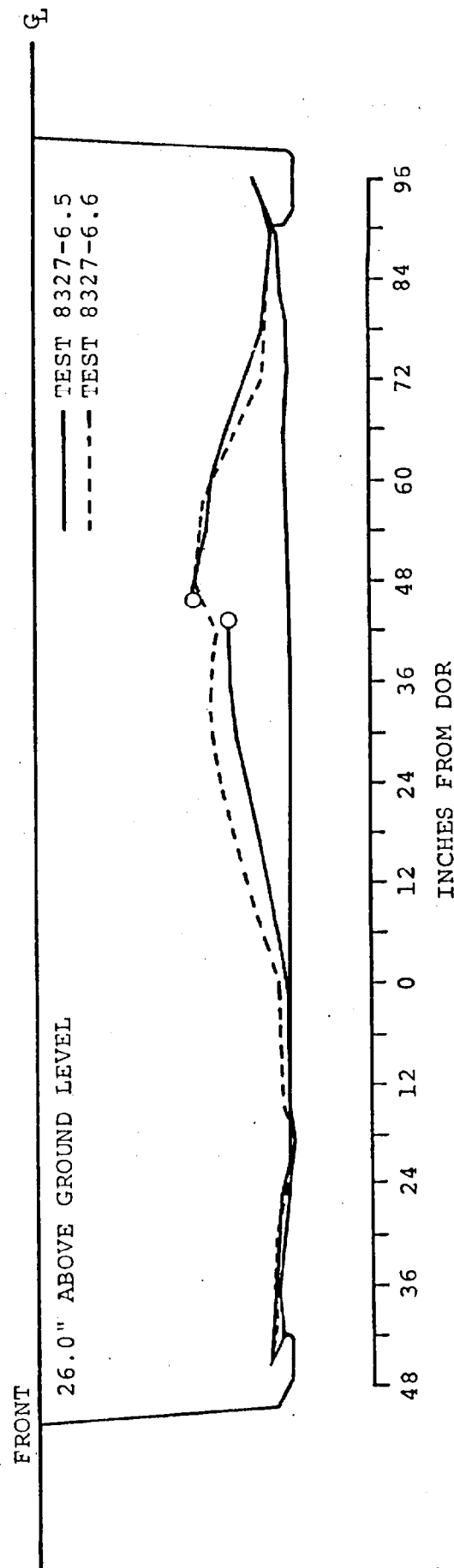


FIGURE 5-23. POST-TEST VW SIDE CRUSH AT 26" LEVEL (TESTS 6.5 AND 6.6).

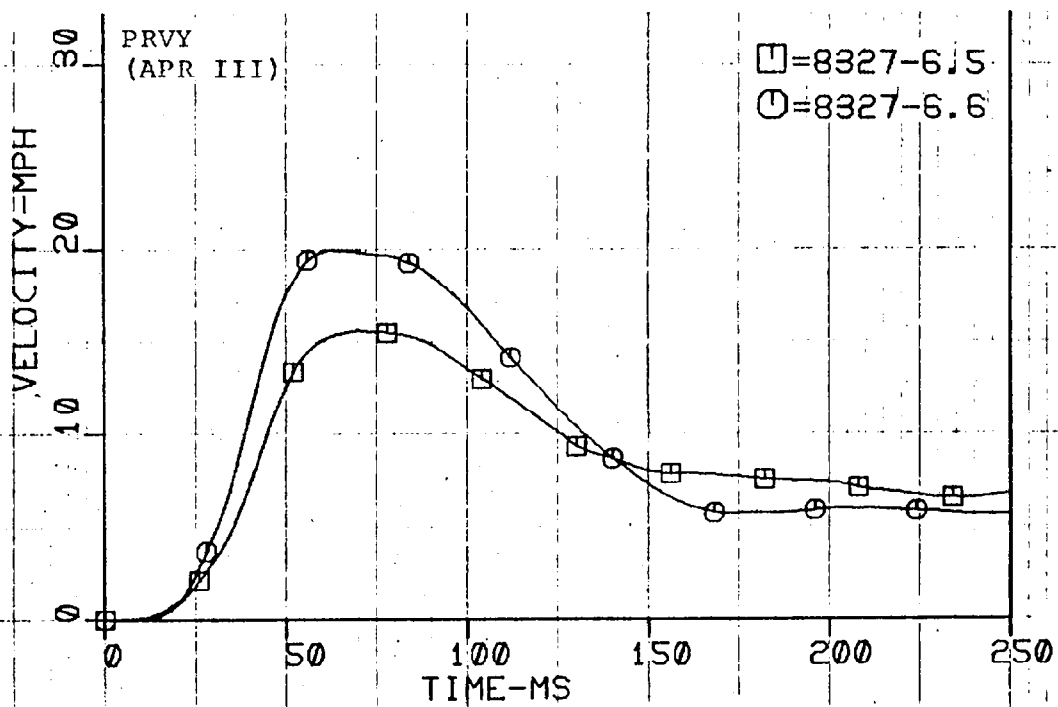


FIGURE 5-24. DRIVER DUMMY LATERAL PELVIS VELOCITY (TESTS 6.5 AND 6.6)

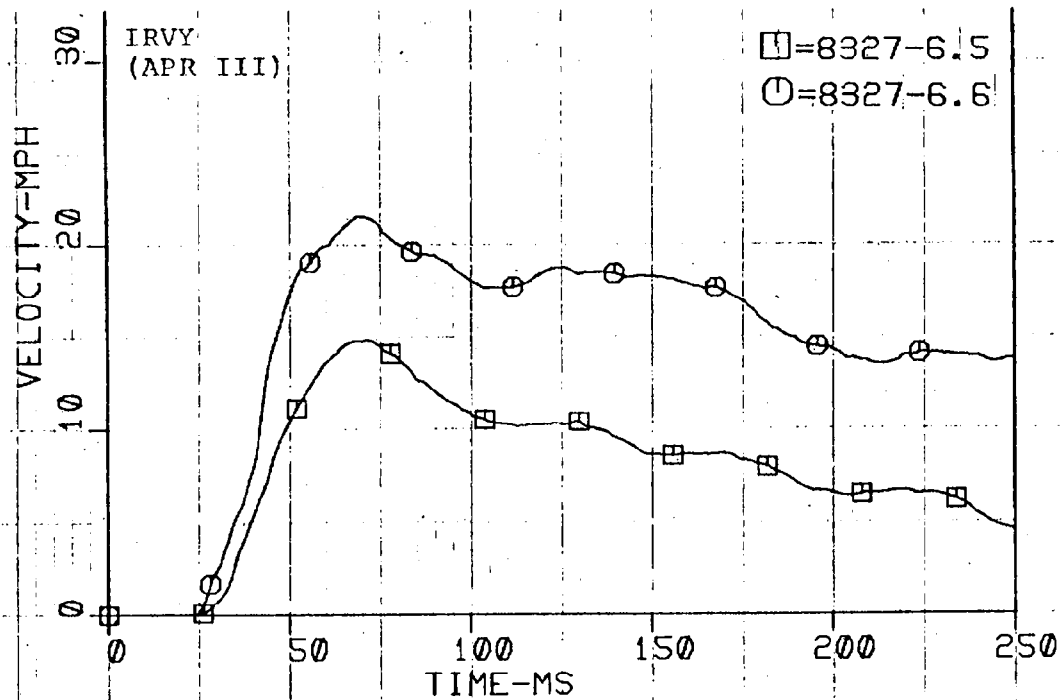


FIGURE 5-25. DRIVER DUMMY LATERAL UPPER THORAX VELOCITY (TESTS 6.5 AND 6.6).

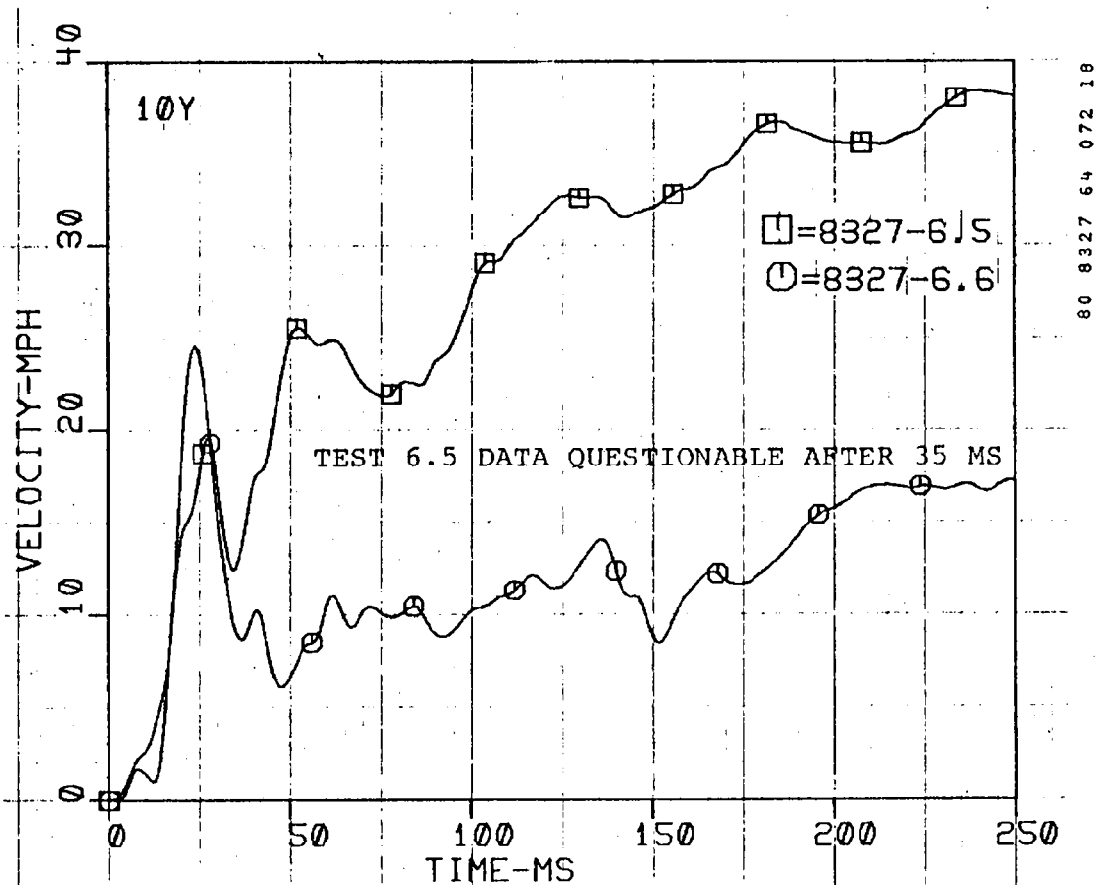


FIGURE 5-26. LATERAL VELOCITY AT UPPER MID-DOOR (TESTS 6.5 AND 6.6).

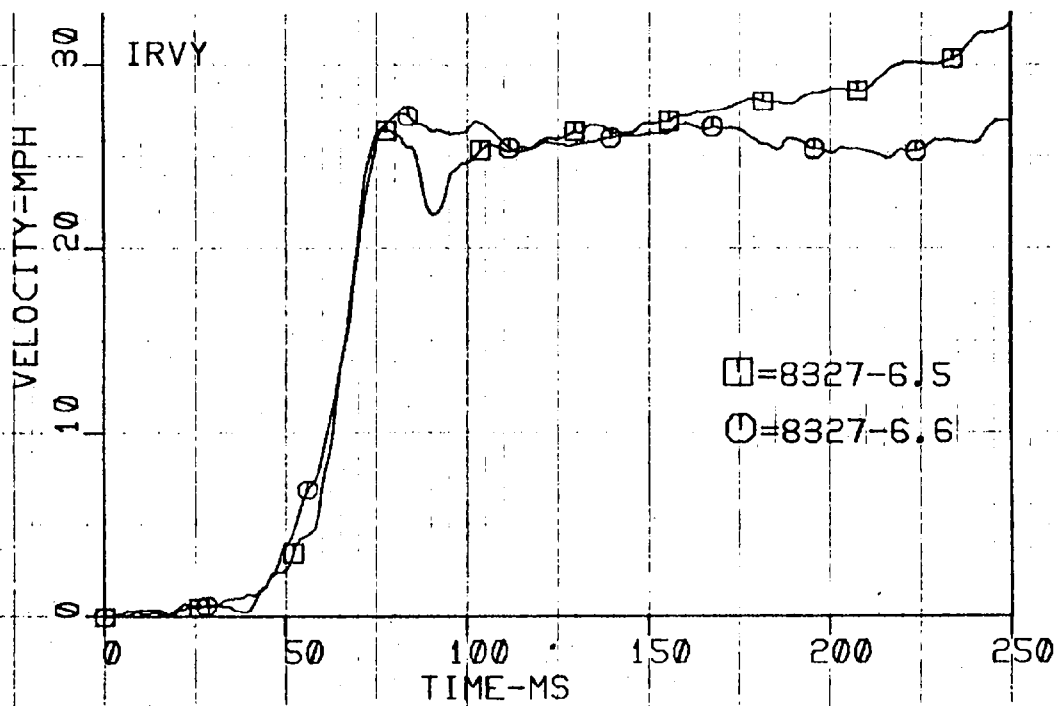


FIGURE 5-27. LEFT REAR OCCUPANT LATERAL UPPER THORAX VELOCITY (TESTS 6.5 AND 6.6).

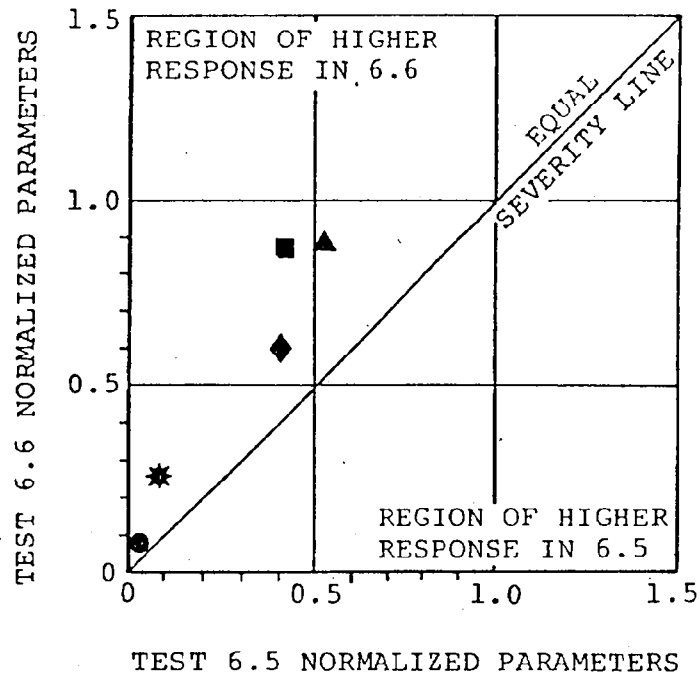
Figure 5-27 compares rear passenger response. Test 6.5 corresponds well with Test 6.6, and the crush patterns indicate that both VW Rabbits crushed similarly in the rear seat area. This is contrary to what might be expected from the previous discussion, but the rear wheel and tire of the VW Rabbit sets a natural limit to the amount of crush that can occur in this area.

Figure 5-28 compares normalized dummy injury criteria parameters for Tests 6.5 and 6.6. As expected from the preceding discussion, the driver in Test 6.6 suffered more severe injuries than in Test 6.5, and, except for chest SI, the rear passengers in the two tests exhibited very similar responses.

The final result of this discussion is that the "crabbed" bullet vehicle simulation reproduces two-vehicles-moving overall vehicle dynamic responses fairly well, but due to differences in the impact points, side structure and dummy responses were not exactly reproduced.

5.2 EVALUATION OF SIDE IMPACTOR PERFORMANCE

Following Phase I testing and the comparison test run in Task 4 of Phase II of this program (Reference 2), it was determined that there was room for improvement in the design of the Side Impactor Energy Absorbing Face, primarily in two areas.



A) DRIVER DUMMY (APR III)

LEGEND

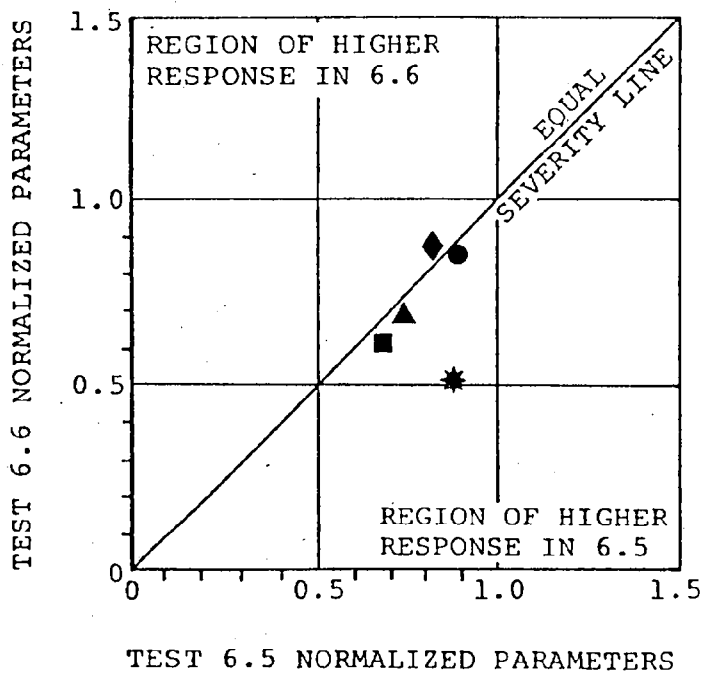
$\frac{HIC}{1000}$

$\frac{UPPER\ THORAX\ SI}{1000}$

$\frac{AIS}{5}$

$\frac{AIS\ (BLUR)}{5}$

$\frac{MAIS}{5}$



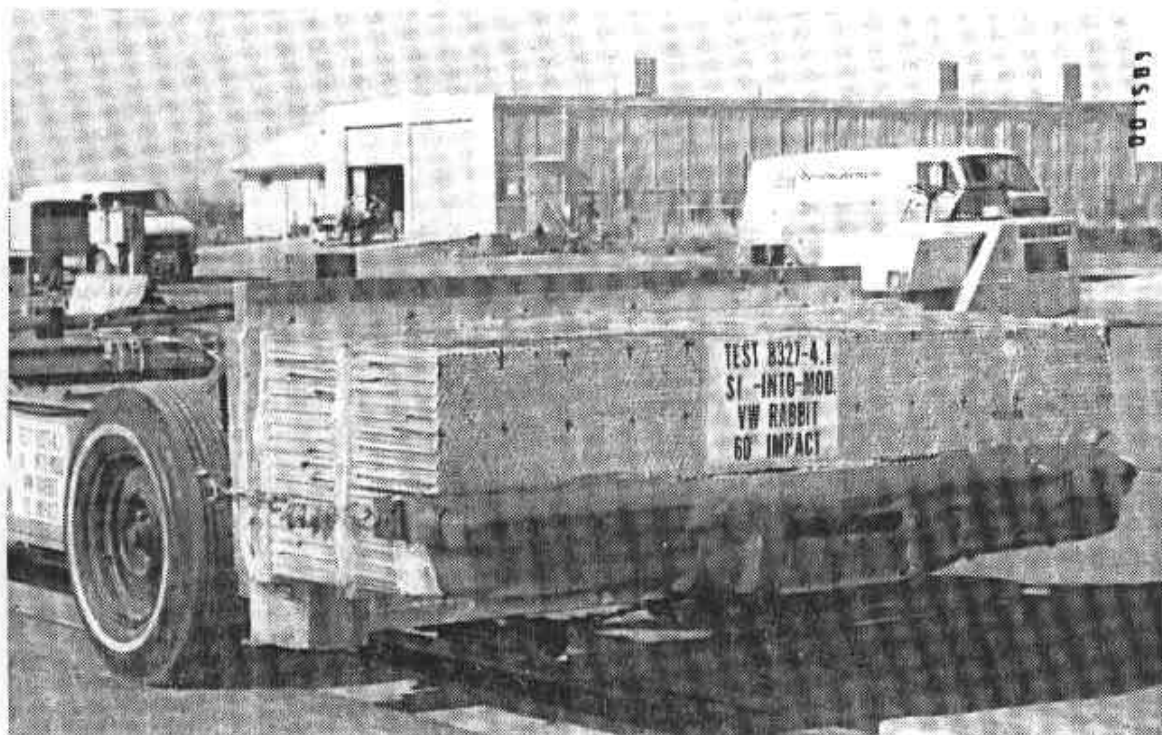
B) LEFT REAR PASSENGER DUMMY (HSRI SID)

FIGURE 5-28. COMPARISON OF NORMALIZED DUMMY PARAMETERS FROM TESTS 6.5 AND 6.6.

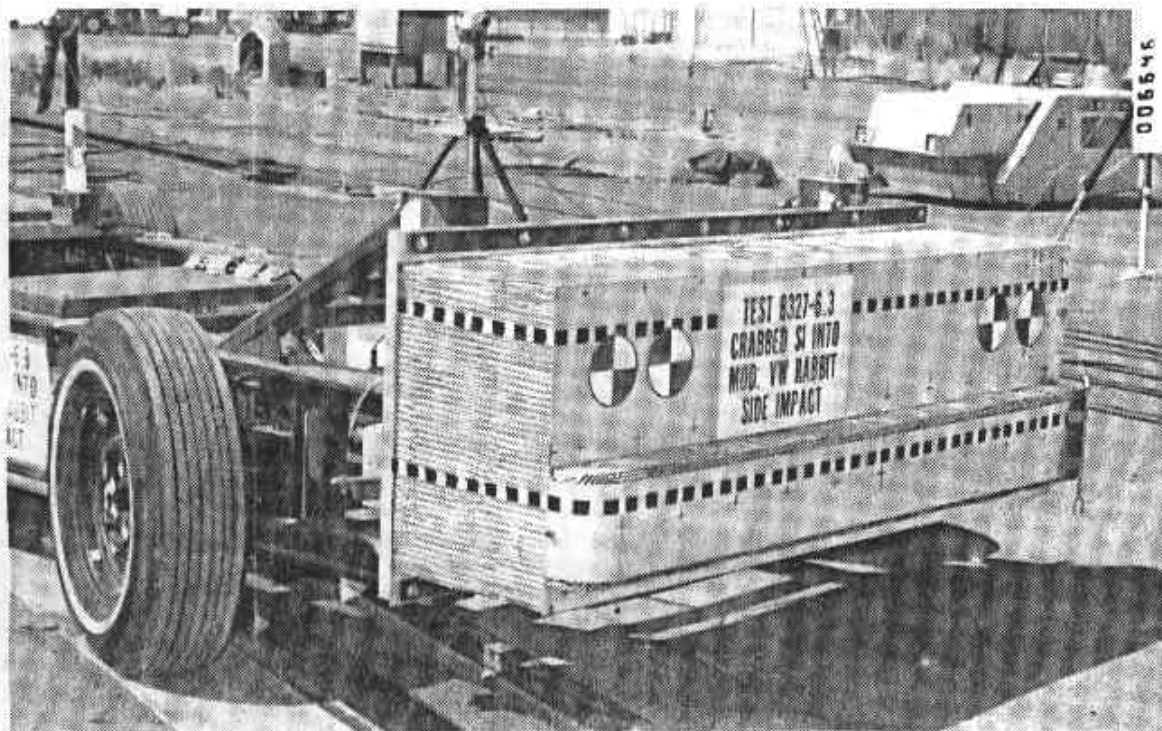
First, the Phase I face was rather weak in the 30 degree crush direction. Second, the presence of a hood on automobiles proved to be a major factor in side impacts, and the Side Impactor had no such structure. Therefore, in Task 5 of Phase II, the Energy Absorbing Face underwent design changes to correct these deficiencies. First, an aluminum sheet was bonded over the entire Energy Absorbing Face to spread the loading, both longitudinal and lateral, over more of the honeycomb structure, thereby stiffening the face. Second, the height of the face was increased and a simulated "hood surface" was incorporated, theoretically presenting a surface for the target vehicle dummy to strike its head on, as was observed in some tests involving two actual cars. Figure 5-29 shows the Phase I face and the Task 5 face.

The design changes involving stiffening the structure were made with the goal of simulating the Force/Crush characteristics of a Chevrolet Citation, which was judged to be more representative of a mid-1980's car than an Oldsmobile Cutlass. Figure 5-30 presents Force/Crush Curves. Therefore, this analysis concentrates on a determination of whether or not the Task 5 design changes have yielded the desired results. It was expected that the Task 6 tests would produce results characteristic of a stiffer bullet vehicle face structure, and that the target vehicle dummies might strike their heads on the Side Impactor Face surface.

The second expected result is very simple to verify and will be examined first. In Tests 6.1 through 6.6, post-test examination revealed a total of four head strikes on the Side Impactor Face, one by driver dummies and three by passenger dummies. These head strikes appear to be primarily due to the increased height of the



A) PHASE I FACE.



B) PHASE II, TASK 5 FACE.

FIGURE 5-29. SIDE IMPACTOR FACE.

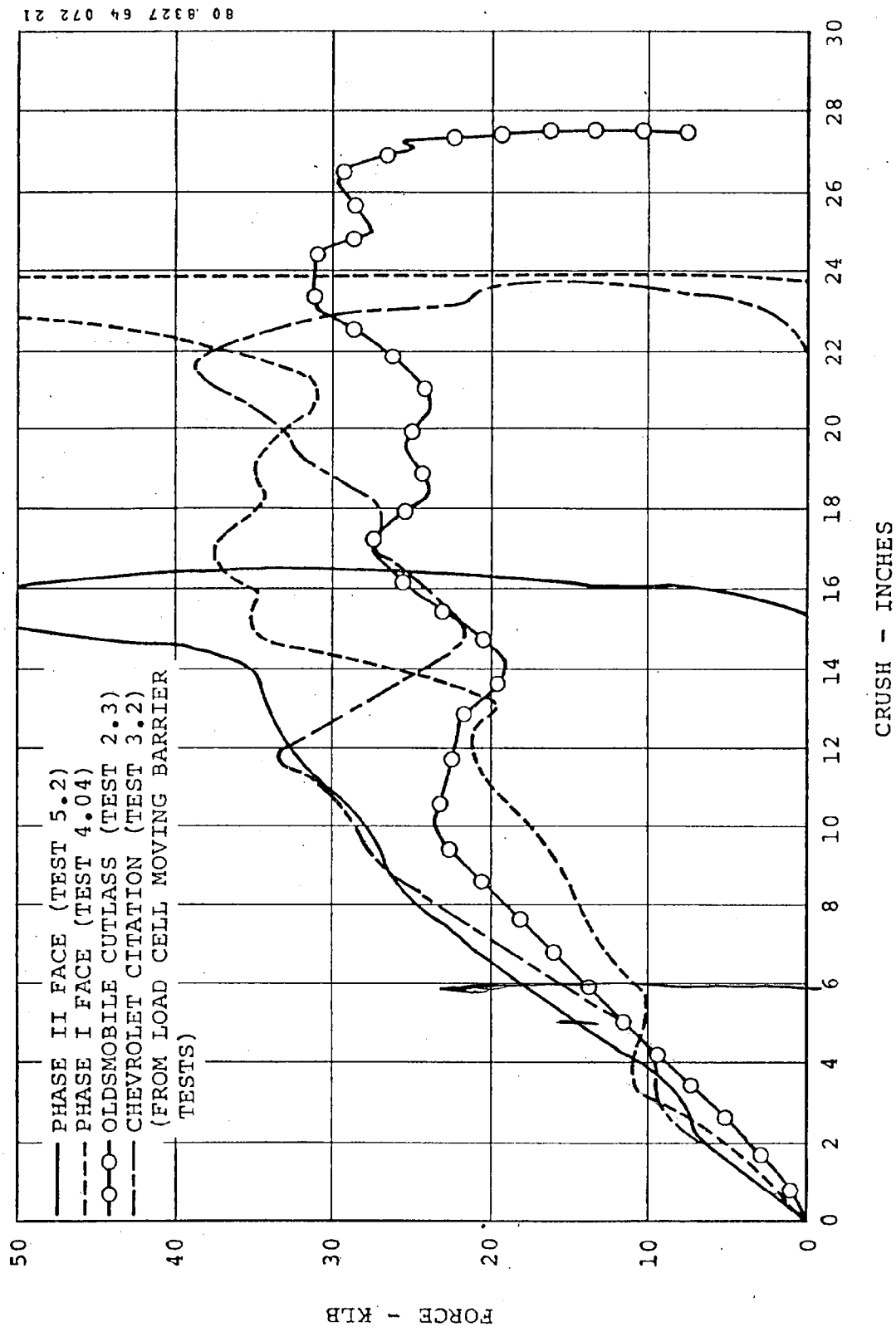
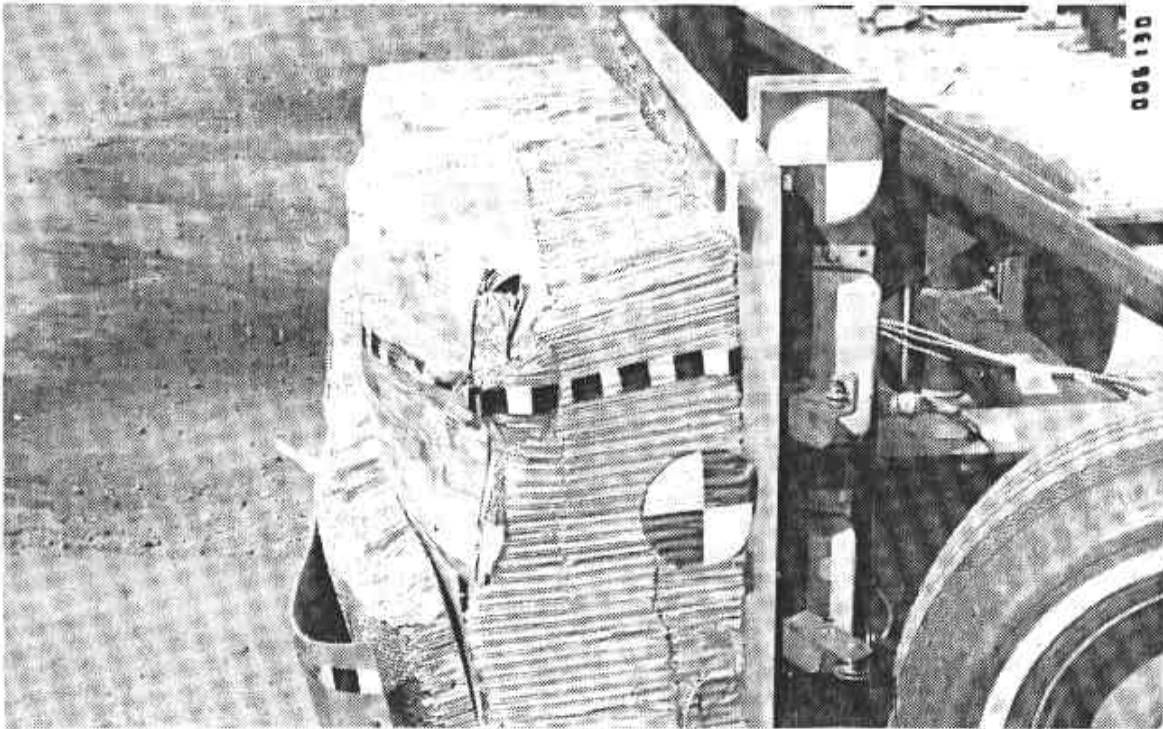


FIGURE 5-30. COMPARISON OF FORCE/CRUSH CHARACTERISTICS FOR PHASE II TASK 5 FACE, PHASE I FACE, OLDSMOBILE CUTLASS, AND CHEVROLET CITATION IN 30° CRUSH DIRECTION.

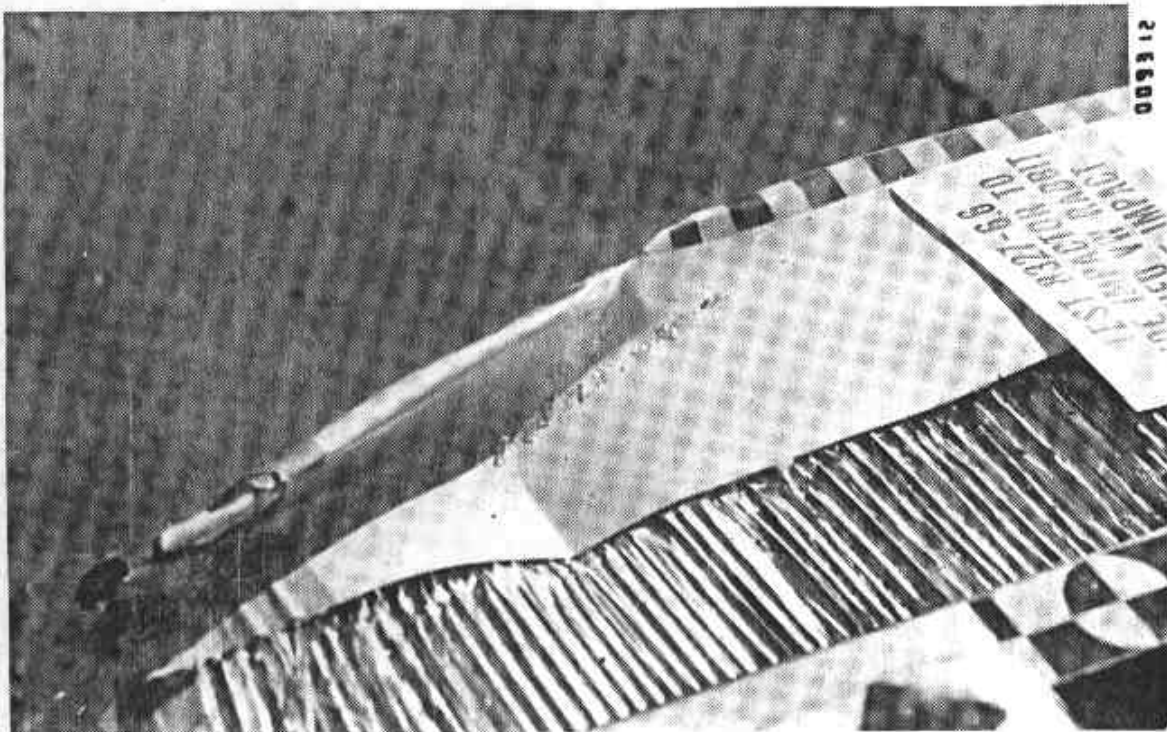
Side Impactor Face because, in all six tests, the "hood" surface buckled and bent instead of bowing up, as was noted in the Task 5 component testing (Reference 3). This has resulted in the surface becoming a series of very stiff ridges of sheet aluminum, as shown in Figure 5-31, by the time a head strike occurs, and could result in a somewhat stiffer surface than was originally designed for when the aluminum was intended to bow up.

Regarding the results expected of a stiffer face, the first characteristic that should be noticeable is a higher but shorter duration acceleration pulse for the Side Impactor vehicle, given that all Modified Rabbits have essentially the same side structure stiffness. Figure 5-32 compares overall vehicle acceleration pulses from Test 8327-4.1 (Phase I face) with those from Tests 8327-6.2 and 6.6 (Phase II Task 5 Face). This figure indicates that the expected result has been achieved.

A stiffer Side Impactor Face was also expected to cause more deformation of the VW side structure. Figures 5-33 and 5-34 compare exterior VW crush. In Figure 5-33 (32.0 inch level) it is apparent that the Side Impactor in Test 6.2 (Task 5 face) has created a deeper deformation than the Phase I face (Test 4.1), at least ahead of the B-Pillar. The Test 6.6 profile is distorted by the partially open door and is therefore rather misleading, but it does show the additional deformation rear of the B-Pillar mentioned in the previous section. Figure 5-34 (26.0 inch level) shows that the Task 5 face has caused more deformation at the B-Pillar than did the Phase I face. From an overall standpoint, these two figures show the increased performance of the Task 5 face because it reproduces the deformation of the VW side caused by the Cutlass



A) TEST 8327-6.1.



B) TEST 8327-6.6.

FIGURE 5-31. SIDE IMPACTOR "HOOD" SURFACE DEFORMATION (TESTS 6.1 AND 6.6).

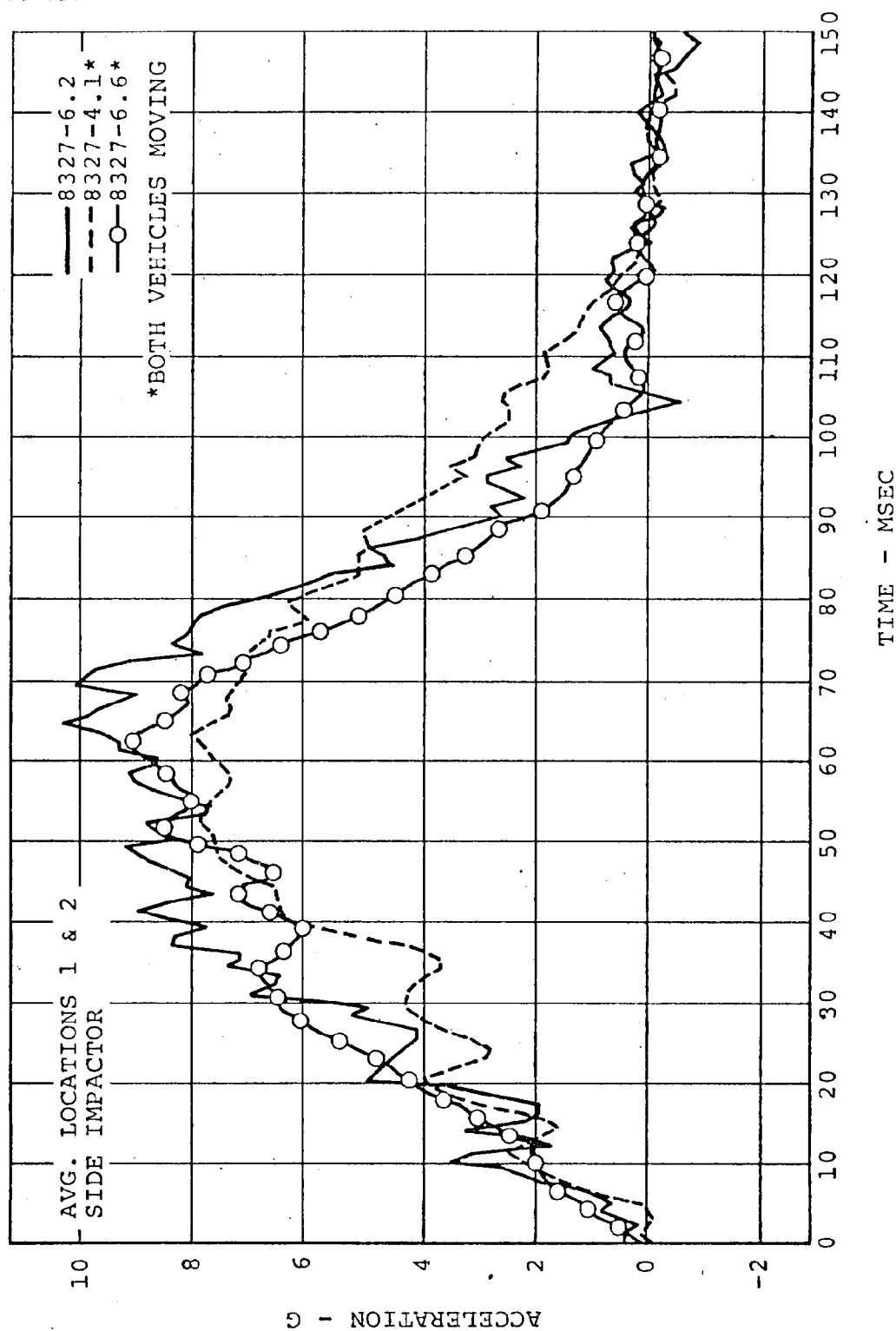


FIGURE 5-32. COMPARISON OF LONGITUDINAL ACCELERATIONS FOR BULLET VEHICLES
(TESTS 4.1, 6.2 AND 6.6).

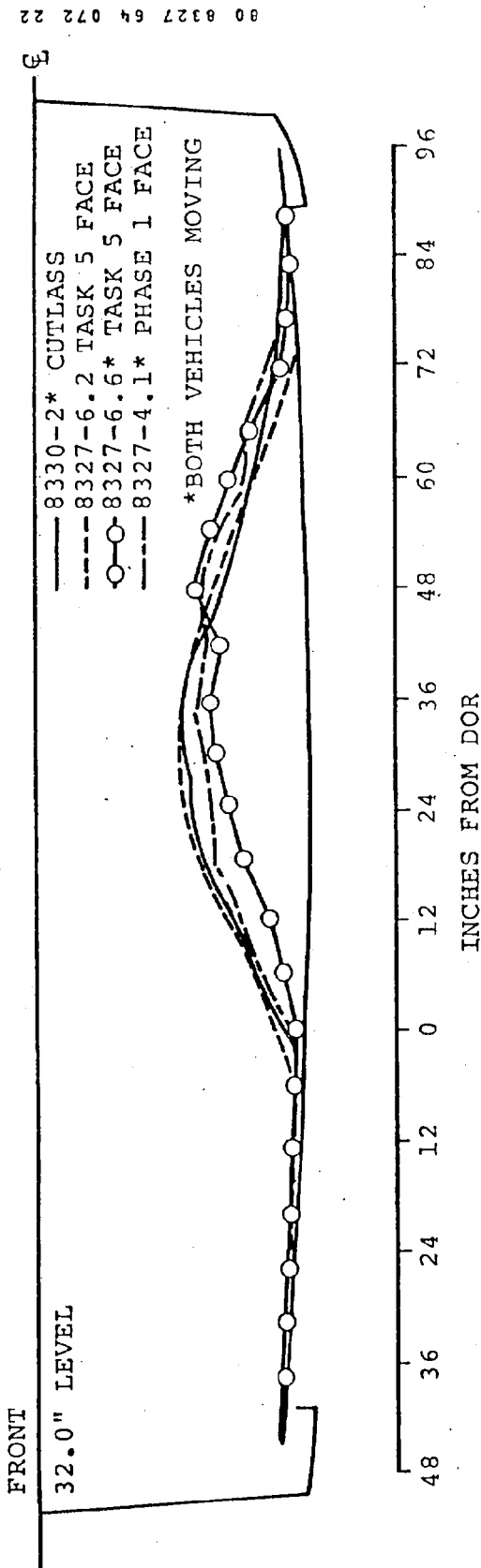


FIGURE 5-33. COMPARISON OF MODIFIED VW RABBIT EXTERIOR CRUSH AT 32" LEVEL.

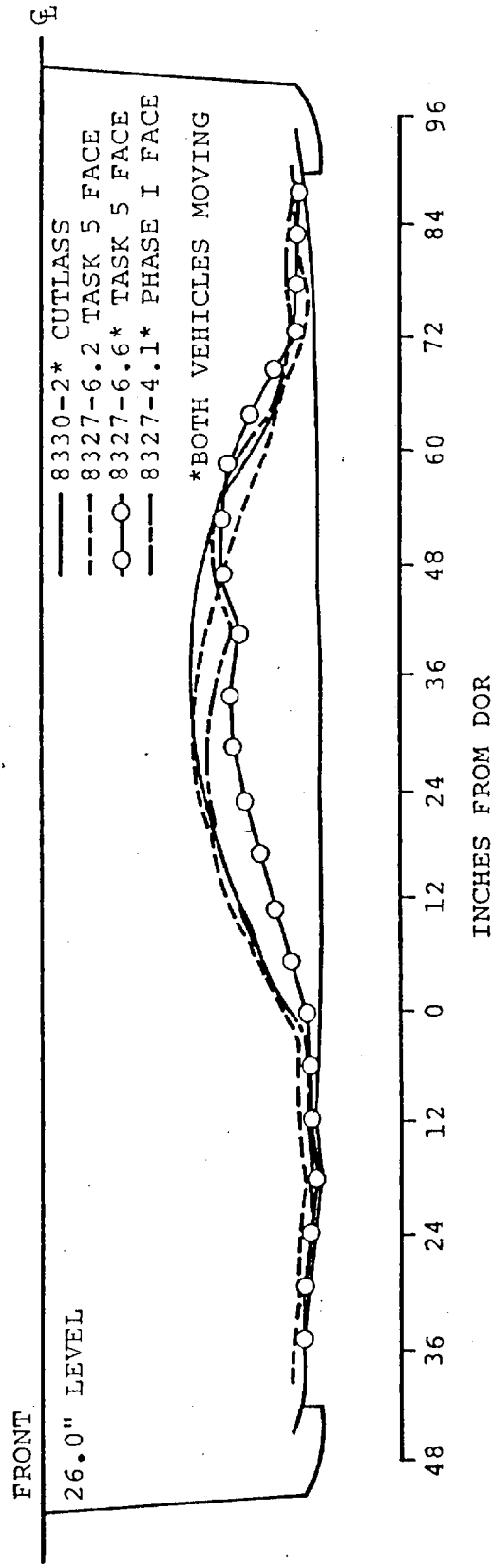


FIGURE 5-34. COMPARISON OF MODIFIED VW RABBIT EXTERIOR CRUSH AT 26" LEVEL.

bullet car better than the Phase I face. However, it is somewhat surprising that the Task 5 face did not create somewhat deeper deformation than the Oldsmobile Cutlass, given the difference in stiffness displayed in Figure 5-30.

Figures 5-35 and 5-36 compare door velocities at the mid-door locations (7Y and 10Y). Figure 5-35 shows that the Task 5 face produces the same velocity profile as did the Phase I face and the Oldsmobile Cutlass. The peak velocities for Tests 8327-4.1 and 8330-2 are somewhat higher than in the Task 6 tests and occur somewhat later. However, following the discussion in Section 5.1, this result would be expected because the impact point in Test 8327-4.1 and 8330-2 was farther forward than in Tests 6.2 and 6.3. In Figure 5-36 the same pattern is apparent, except that the Oldsmobile Cutlass trace has a noticeably different profile, which was a result of the rather unique crushing pattern of the Oldsmobile Cutlass (Reference 2).

Figures 5-37 and 5-38 continue the comparison of velocities at struck side accelerometer locations, with the same results as just discussed. In these figures, the peak velocities are very comparable except for Test 6.6, location 8Y. The duration of high velocity in the Tests utilizing the Task 5 face is greater than in Test 4.1, which indicates greater intrusion as expected. These figures also more clearly point out the unique crushing pattern caused by the Cutlass.

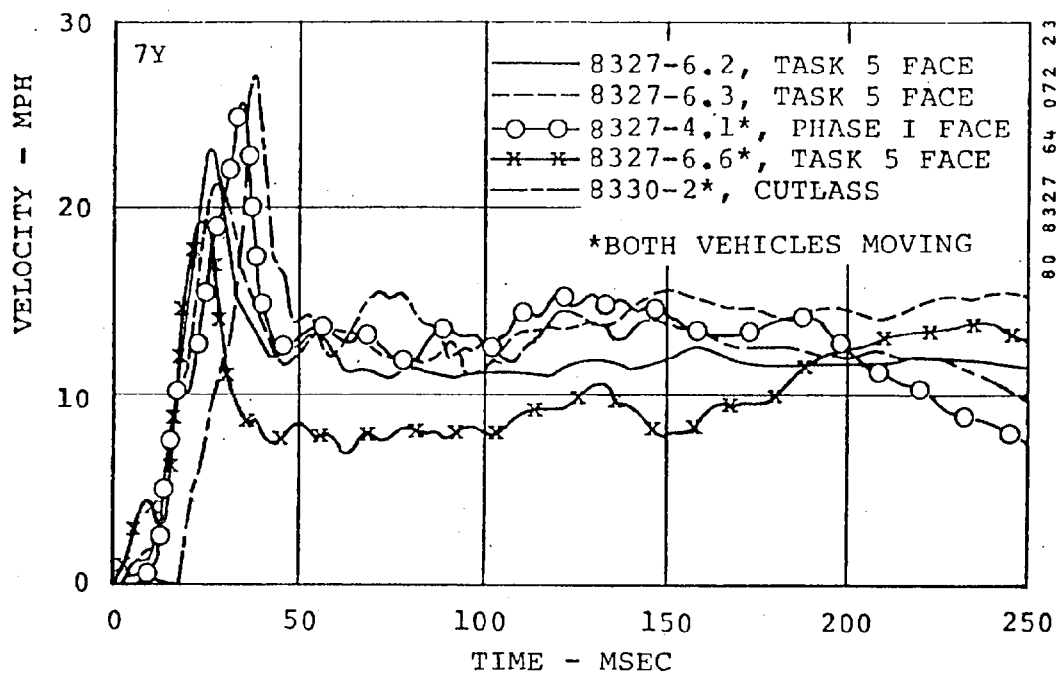


FIGURE 5-35. COMPARISON OF LATERAL VELOCITY AT MODIFIED VW RABBIT DOOR CENTER.

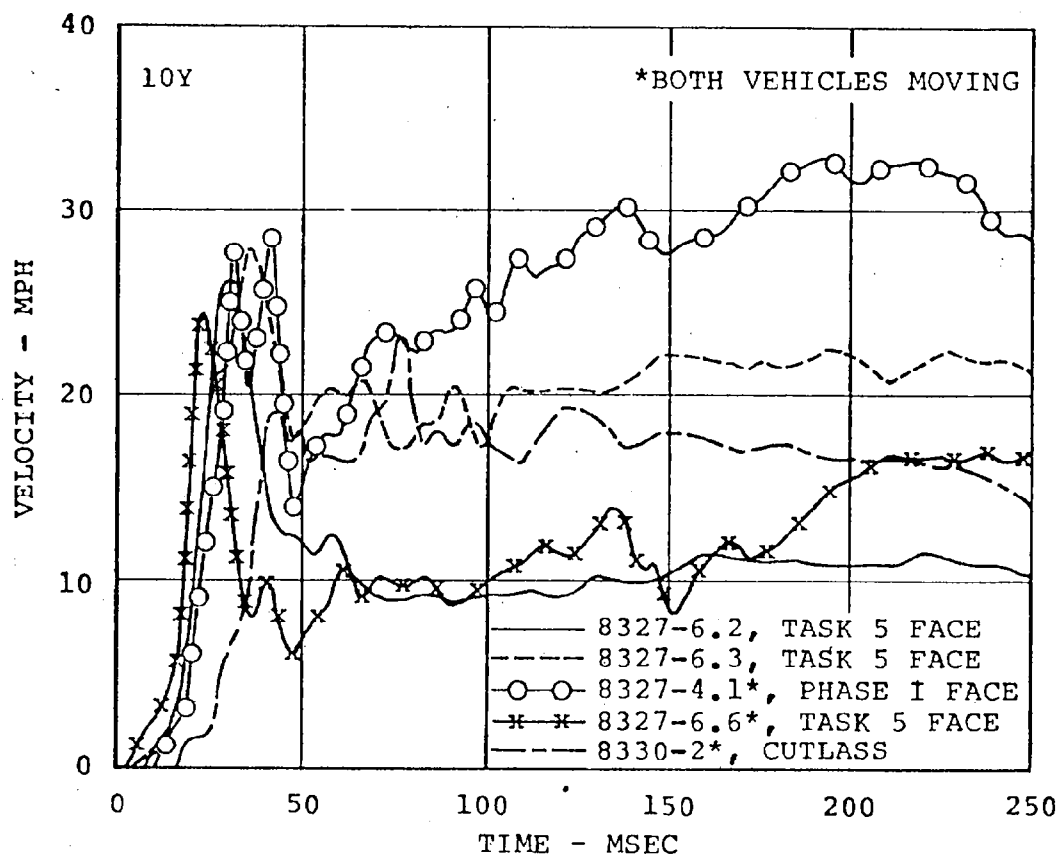


FIGURE 5-36. COMPARISON OF LATERAL VELOCITY AT MID-DOOR, WINDOWSILL LEVEL OF MODIFIED VW RABBIT.

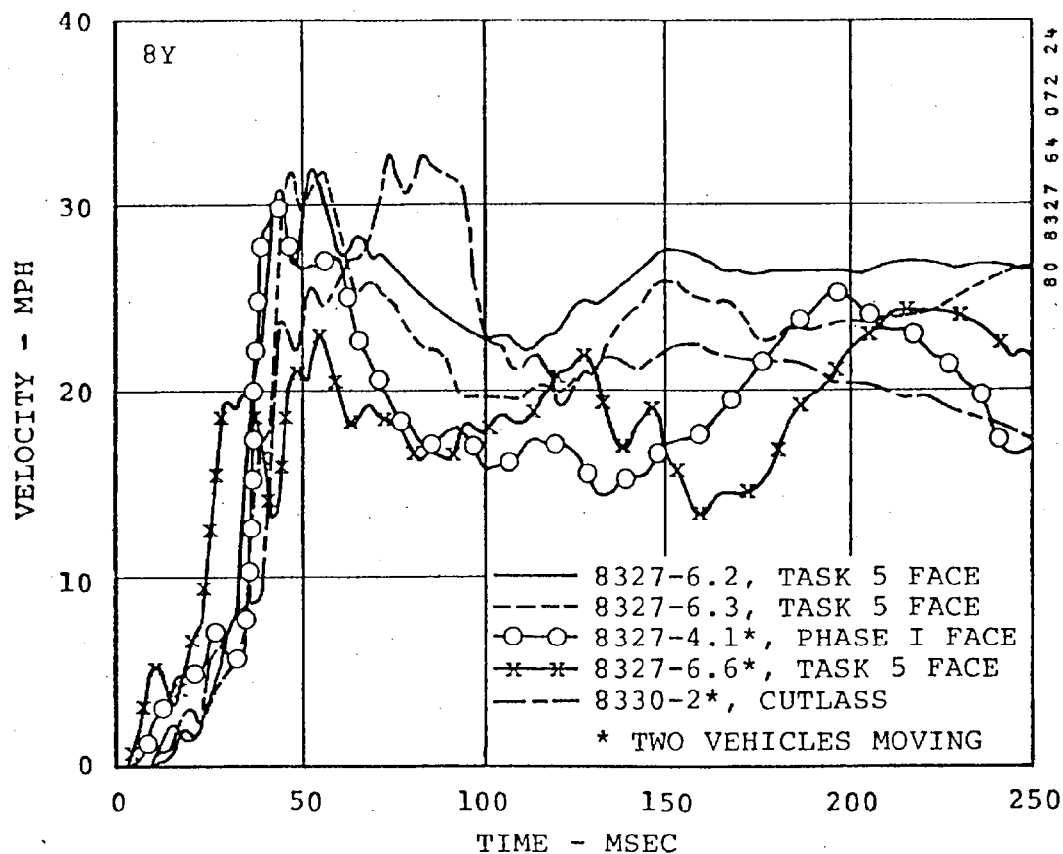


FIGURE 5-37. COMPARISON OF LATERAL VELOCITY AT UPPER REAR CORNER OF MODIFIED VW RABBIT DOOR.

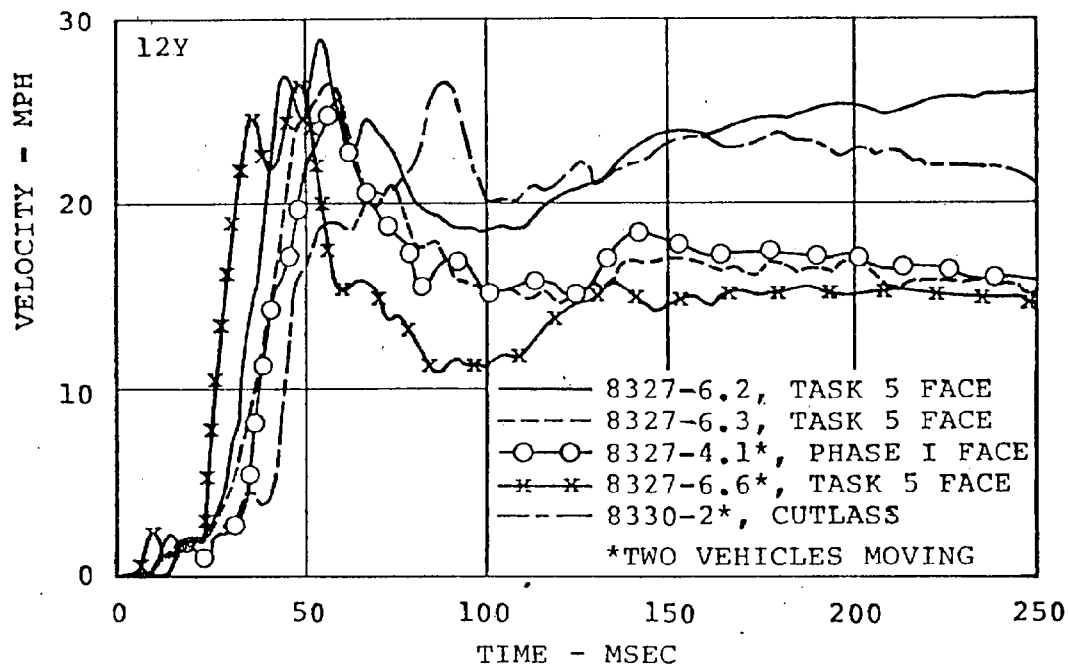


FIGURE 5-38. COMPARISON OF LATERAL VELOCITY AT B-PILLAR OF MODIFIED VW RABBIT.

In Figure 5-39, intrusion at the B-Pillar, as measured by the scratch tube, is compared. It is obvious that the Task 5 face created a greater intrusion at the B-Pillar location than did the Phase I face.

Tables 5-2 and 5-3 summarize target vehicle and bullet vehicle responses for the six Task 6 tests, Test 8327-4.1, and two tests from the "Countermeasures for Side Impact" program (Tests 8330-2 and 8330-4).

Tables 5-4 and 5-5 summarize target vehicle post-test exterior crush and intrusion for these tests, and Table 5-6 summarizes frontal post-test crush for the bullet vehicles in these tests.

These tables indicate overall trends supporting the previous discussions in this section, namely: (1) due to the increased stiffness of the Task 5 face, both target and bullet vehicles experience greater, earlier dynamic responses, and (2) the Task 5 Face causes greater damage to the target vehicles and less crush to the bullet vehicles.

5.3 EVALUATION OF THE APR III AND HSRI SID SIDE IMPACT DUMMIES AS POSSIBLE COMPLIANCE TEST DEVICES

A comparison of the response patterns of these two side impact dummies was presented in the report covering the first four tests in Task 6 (Reference 1). The purpose of this section is to report the experience of Dynamic Science regarding the use of these two dummies as test devices in Tests 6.1 through 6.6.

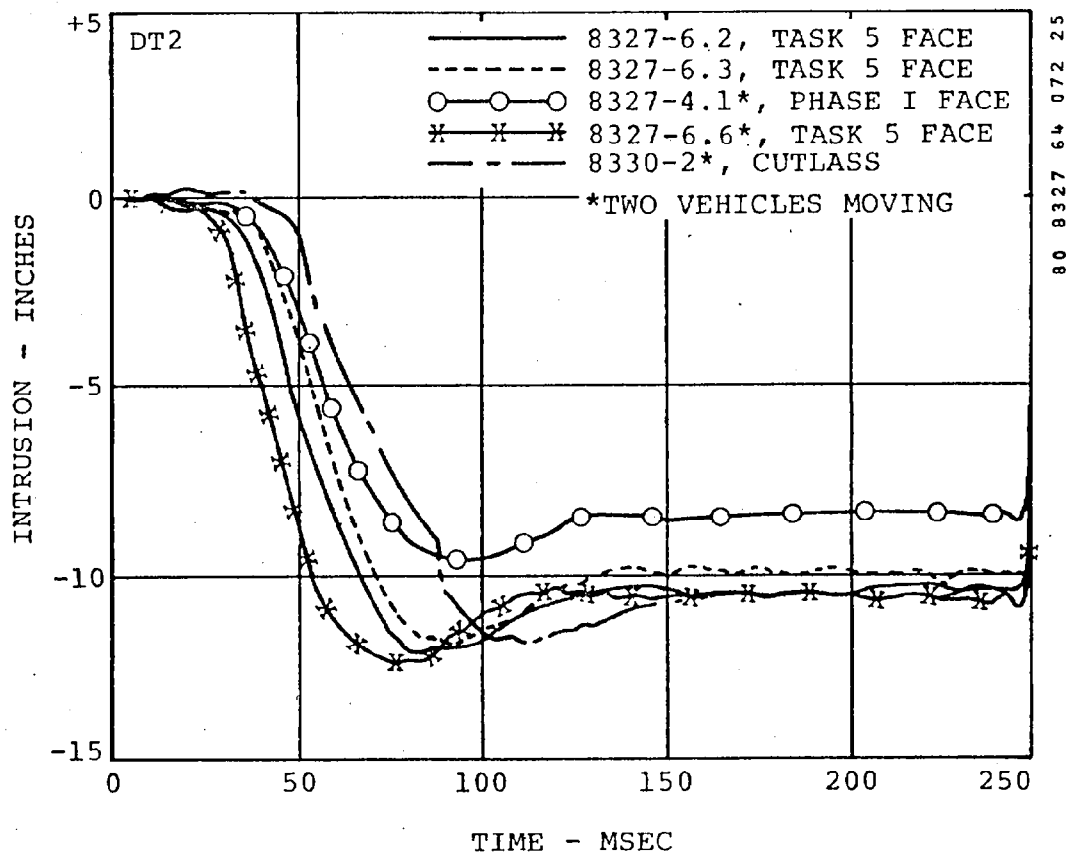


FIGURE 5-39. COMPARISON OF INTRUSION AT MODIFIED VW RABBIT B-PILLAR.

TABLE 5-2. TARGET VEHICLE RESPONSE SUMMARY

		Test Number					
Modified VW Rabbit		8330-2	8327-4.1	8327-6.2	8327-6.3	8327-6.5	8327-6.6
		Impact Point (Referenced to DOR - in.)					
		-2.5	+1.5	+6.0	+4.4	+21.5	+13.9
		Impact Velocity**					
Acc. Location	Curve**	15.2	15.5	Stationary	Stationary	15.3	15.4
1. Right Front	A _y @ ms	9.5 @ 47	8.3 @ 36	13.2 @ 52	+14.3 @ 56	+13.4 @ 9	+10.7 @ 7
Doorsill	ΔV _y @ ms	8.0 @ 111	7.5 @ 89	10.7 @ 93	10.8 @ 93	5.9 @ 74	8.1 @ 78
2. Right Rear	A _y @ ms	+14.6 @ 46	+15.1 @ 79	+20.9 @ 66	+22.3 @ 53	+19.9 @ 8	+22.3 @ 49
Doorsill	ΔV _y @ ms	15.0 @ 130	16.4 @ 106	18.1 @ 102	17.9 @ 101	13.7 @ 84	15.2 @ 79
3. Rear Deck	A _x @ ms	-9.8 @ 76	-7.4 @ 71	-13.1 @ 74	-11.9 @ 53	-11.1 @ 60	-16.5 @ 63
Over Vehicle	ΔV _x @ ms	5.2 @ 118	5.8 @ 108	8.2 @ 105	7.0 @ 98	6.1 @ 95	6.5 @ 99
Centerline	A _x @ ms	+18.0 @ 91	+23.3 @ 79	+27.0 @ 56	+25.3 @ 53	+24.2 @ 58	+28.1 @ 65
	ΔV _x @ ms	21.4 @ 138	21.9 @ 114	24.5 @ 103	23.5 @ 106	19.7 @ 91	21.9 @ 99
4. Front Fire-	A _x @ ms	-8.7 @ 51	-9.6 @ 68	-12.0 @ 31	-11.2 @ 51	-11.1 @ 67	-13.1 @ 63
Wall Over	ΔV _x @ ms	9.4 @ 148	7.2 @ 113	8.4 @ 121	8.4 @ 134	6.5 @ 114	8.2 @ 122
Vehicle	A _y @ ms	+12.6 @ 14	+10.9 @ 12	+12.1 @ 48	+11.7 @ 68	+10.7 @ 9	+10.3 @ 28
Centerline	ΔV _y @ ms	6.6 @ 117	7.8 @ 112	8.9 @ 123	8.6 @ 119	5.1 @ 97	6.1 @ 93
5. Left Front	A _y @ ms	+105.0 @ 9	+66.6 @ 9	+63.8 @ 4	+107.6 @ 41	+118.3 @ 7	+57.1 @ 3
Door Mid-	ΔV _y @ ms	8.3 @ 21	9.4 @ 12	6.7 @ 26	10.2 @ 33*	9.6 @ 12*	3.5 @ 6*
Fore Edge							
6. Left Front	A _y @ ms	-102.9 @ 19	-73.8 @ 39	-43.6 @ 27	-69.3 @ 36	+43.0 @ 37	+38.2 @ 5
Door Upper	ΔV _y @ ms	11.2 @ 26	7.2 @ 23	8.1 @ 25	8.7 @ 33	17.2 @ 29	13.1 @ 135
Front Corner							
7. Left Front	A _y @ ms	+152.2 @ 36	+119.9 @ 15	+105.3 @ 20	+72.0 @ 24	+100.0 @ 15	+163.5 @ 17
Door Middle	ΔV _y @ ms	27.2 @ 38	25.6 @ 35	21.6 @ 25	21.4 @ 28	15.2 @ 19	19.1 @ 24
8. Left Front	A _y @ ms	+162.0 @ 42	+238.4 @ 37	+120.0 @ 33	+127.1 @ 45	+199.2 @ 23	+104.4 @ 27
Door Upper	ΔV _y @ ms	32.4 @ 85	30.1 @ 44	30.7 @ 44	31.1 @ 57	41.0 @ 35	23.1 @ 56
Rear Corner							
9. Left Front	A _y @ ms	+347.6 @ 40*	+175.0 @ 33	+158.4 @ 30	+160.8 @ 35	+143.9 @ 19	+180.6 @ 23
Door Mid-	ΔV _y @ ms	57.1 @ 69*	24.8 @ 56	45.4 @ 52*	65.9 @ 68*	24.8 @ 31	27.6 @ 47
Rear Edge							
10. Left Front	A _y @ ms	+74.7 @ 40	+155.6 @ 29	+110.0 @ 23	+92.5 @ 22	+135.9 @ 16	+163.1 @ 20
Door Middle	ΔV _y @ ms	19.3 @ 42	29.1 @ 42	23.6 @ 30	24.5 @ 37	19.6 @ 27	24.6 @ 24
of Windowsill							
11. Right Front	A _y @ ms	+13.7 @ 92	+12.8 @ 88	+15.3 @ 83	+15.2 @ 32	13.1 @ 46	+12.9 @ 53
Door Middle	ΔV _y @ ms	13.3 @ 118	14.9 @ 126	16.9 @ 94	15.8 @ 102	11.0 @ 100	13.5 @ 91
of Windowsill							
12. Left B-	A _y @ ms	+137.7 @ 43	+119.5 @ 35	+87.9 @ 32	+74.2 @ 46	+85.5 @ 27	+124.2 @ 25
Pillar Near	ΔV _y @ ms	30.3 @ 87	28.4 @ 58	26.0 @ 44	25.9 @ 59	23.1 @ 34	26.3 @ 50
Door Latch							
13. Right B-	A _y @ ms	+32.1 @ 56	+26.4 @ 47	+29.2 @ 67	+36.7 @ 53	+16.8 @ 53	+26.4 @ 58
Pillar Near	ΔV _y @ ms	18.6 @ 121	20.3 @ 106	18.7 @ 103	19.2 @ 118	15.5 @ 93	16.8 @ 97
Door Latch							
14. Underneath	A _y @ ms	+40.0 @ 50	+43.0 @ 33	+77.3 @ 33	+64.2 @ 32	+27.4 @ 32	+29.4 @ 22
Left Front	ΔV _y @ ms	12.6 @ 118	15.4 @ 90	14.0 @ 85	14.3 @ 98	19.7 @ 84	12.7 @ 92
Seat							
15. Vehicle	A _x @ ms	-7.0 @ 49	-6.5 @ 58	-10.1 @ 56	-9.9 @ 36	-7.5 @ 34	-6.6 @ 25
Center of	ΔV _x @ ms	8.3 @ 145	5.9 @ 136	7.9 @ 116	7.9 @ 131	4.7 @ 108	8.4 @ 121
Gravity	A _y @ ms	+9.1 @ 48	+15.7 @ 67	+24.3 @ 52	+19.8 @ 61	+12.1 @ 9	+13.8 @ 50
	ΔV _y @ ms	11.9 @ 131	17.6 @ 108	13.9 @ 118	13.7 @ 100	10.8 @ 82	13.0 @ 92
Displacement							
String Potentiometer		-10.3 @ 91	-16.2 @ 55*	N/A	-11.1 @ 85	-4.3 @ 63	-6.9 @ 73
Displacement Transducer		-11.8 @ 110	-9.8 @ 96	-11.9 @ 90	-11.8 @ 91	-10.6 @ 78	-12.4 @ 76

N/A - Not Available *Data Questionable. **All Velocities in miles per hour. All accelerations in G's.

TABLE 5-2. TARGET VEHICLE RESPONSE SUMMARY (CONTO)

Unmodified VW Rabbit		Test Number		
		8330-4	8327-6.1	8327-6.4
		Impact Point (Referenced to DOR - in.)		
		+5.7	+4.2	+2.8
		Impact Velocity**		
Acc. Location	Curve**	15.4	Stationary	Stationary
1. Right Front	A _y @ ms	11.2 @ 47	9.7 @ 48	11.4 @ 68
Doorsill	ΔV _y @ ms	8.1 @ 105	8.3 @ 103	8.5 @ 111
2. Right Rear	A _y @ ms	21.6 @ 46	+26.0 @ 60	+18.2 @ 58
Doorsill	ΔV _y @ ms	15.9 @ 124	17.2 @ 96	15.7 @ 116
3. Rear Deck	A _x @ ms	-17.6 @ 52	-26.6 @ 73	-18.5 @ 72
Over Vehicle	ΔV _x @ ms	10.2 @ 134	10.4 @ 113	11.6 @ 108
Centerline	A _y @ ms	24.8 @ 67	+27.8 @ 67	+32.8 @ 71
	ΔV _y @ ms	23.2 @ 124	23.2 @ 127	22.3 @ 119
4. Front Fire-	A _x @ ms	-10.7 @ 75	-13.0 @ 70	-27.5 @ 55
Wall Over	ΔV _x @ ms	10.7 @ 125	11.3 @ 128	13.5 @ 136
Vehicle	A _y @ ms	8.5 @ 57	13.1 @ 49	+9.4 @ 50
Centerline	ΔV _y @ ms	6.5 @ 136	6.9 @ 116	7.6 @ 112
5. Left Front	A _y @ ms	+85.0 @ 5	+65.5 @ 3	+57.4 @ 4
Door Mid-	ΔV _y @ ms	9.9 @ 47	10.4 @ 15	12.8 @ 18
Fore Edge				
6. Left Front	A _y @ ms	-176.0 @ 53	-45.5 @ 51	-91.1 @ 36
Door Upper	ΔV _y @ ms	8.1 @ 35	10.4 @ 25	13.2 @ 33
Front Corner				
7. Left Front	A _y @ ms	+118.5 @ 13	+112.8 @ 12	+136.7 @ 14
Door Middle	ΔV _y @ ms	24.5 @ 43*	22.9 @ 23	26.9 @ 40
8. Left Front	A _y @ ms	+112.8 @ 36	+118.7 @ 47	+97.8 @ 39
Door Upper	ΔV _y @ ms	19.1 @ 47	20.8 @ 50	19.2 @ 53
Rear Corner				
9. Left Front	A _y @ ms	+147.0 @ 34	+157.2 @ 46*	+235.7 @ 60
Door Mid-	ΔV _y @ ms	27.5 @ 46	27.9 @ 62	23.9 @ 52
Rear Edge				
10. Left Front	A _y @ ms	+171.5 @ 38	-141.4 @ 30	+126.6 @ 38
Door Middle	ΔV _y @ ms	23.8 @ 41	27.2 @ 32	31.1 @ 41
of Windowsill				
11. Right Front	A _y @ ms	+12.9 @ 60	+16.4 @ 65	+16.9 @ 71
Door Middle	ΔV _y @ ms	12.7 @ 121	14.2 @ 114	14.1 @ 113
of Windowsill				
12. Left B-	A _y @ ms	+92.9 @ 35	+187.0 @ 37	+193.6 @ 37
Pillar Near	ΔV _y @ ms	27.7 @ 64	27.8 @ 41	34.3 @ 50
Door Latch				
13. Right B-	A _y @ ms	+29.9 @ 83	+29.2 @ 67	+71.0 @ 57
Pillar Near	ΔV _y @ ms	18.7 @ 119	18.7 @ 99	20.0 @ 111
Door Latch				
14. Underneath	A _y @ ms	+111.5 @ 31	+148.2 @ 23	+125.3 @ 25
Left Front	ΔV _y @ ms	18.0 @ 46	18.7 @ 105	17.6 @ 103
Seat				
15. Vehicle	A _x @ ms	-12.4 @ 48	-17.1 @ 66	-15.4 @ 52
Center of	ΔV _x @ ms	9.0 @ 153	11.8 @ 150	15.7 @ 125*
Gravity	A _y @ ms	+16.2 @ 65	+58.8 @ 45	+26.9 @ 45
	ΔV _y @ ms	17.1 @ 124	10.1 @ 97	8.8 @ 111
Displacement				
String Potentiometer		-11.4 @ 93	-18.1 @ 56*	-14.1 @ 102
Displacement Transducer		-17.7 @ 91	-16.3 @ 95	-18.8 @ 99

*Data Questionable. **All Velocities in miles per hour. All accelerations in G's.

TABLE 5-3. BULLET VEHICLE RESPONSE SUMMARY

Test Number	8330-2	8330-4	8327-4.1	8327-6.1	8327-6.2	8327-6.3	8327-6.4	8327-6.5	8327-6.6
Bullet Vehicle	Cutlass	Cutlass	Side Impactor	Crabbed S.I.	Crabbed S.I.	Crabbed S.I.	Crabbed S.I.	Side Impactor	Side Impactor
Impact Velocity*	29.7	30.2	30.3	37.1	39.8	37.0	40.1	30.0	31.1
Acc. Location	Curve*								
1. Right Frame Rail	A _x @ ms	-11.1 @ 73	-8.2 @ 55	-9.5 @ 61	-9.6 @ 67	-8.7 @ 44	-9.9 @ 62	-7.6 @ 47	-8.7 @ 51
	ΔV _x @ ms	10.6 @ 184	10.7 @ 143	10.8 @ 169	11.4 @ 118	10.6 @ 105	11.6 @ 164	9.5 @ 136	10.3 @ 104
2. Left Frame Rail	A _x @ ms	-13.0 @ 71	-8.3 @ 62	-13.5 @ 64	-35.4 @ 33 ¹	-10.4 @ 64	-13.0 @ 62	-8.8 @ 56	-10.4 @ 61
	ΔV _x @ ms	11.3 @ 165	11.8 @ 124	15.7 @ 126	28.8 @ 110 ¹	13.9 @ 111	15.4 @ 128	11.3 @ 115	12.5 @ 117
3. Front Cross-member at Centerline ³	A _x @ ms	-10.2 @ 85	N/A	-10.7 @ 62	-10.2 @ 64	-10.2 @ 40	-10.9 @ 63	-8.6 @ 47	-9.3 @ 60
	ΔV _x @ ms	11.6 @ 125	N/A	13.6 @ 140	12.7 @ 133	13.8 @ 159	12.9 @ 156	10.6 @ 129	2.2 @ 125
	A _y @ ms	-5.0 @ 67	-3.1 @ 90	-7.8 @ 90	-5.0 @ 73	-3.3 @ 49	-8.2 @ 63	-3.6 @ 67	-4.9 @ 68
	ΔV _y @ ms	-2.4 @ 70	1.5 @ 250	8.9 @ 120	4.8 @ 134	3.6 @ 140	9.4 @ 117	2.3 @ 133	11.5 @ 119
4. Right Rear Vertical Frame Rail	A _x @ ms	-8.4 @ 73	N/A	-11.5 @ 61	-8.6 @ 66	-9.1 @ 69	-13.8 @ 64	-7.5 @ 49	-8.5 @ 51
	ΔV _x @ ms	12.2 @ 173	N/A	22.9 @ 196 ¹	12.1 @ 182	11.9 @ 142	17.7 @ 164	9.5 @ 148	10.4 @ 104
	A _y @ ms	+3.7 @ 81	+2.4 @ 58	+3.3 @ 47	+4.1 @ 66	+3.9 @ 43	+4.2 @ 61	+2.7 @ 48	+3.1 @ 63
	ΔV _y @ ms	2.1 @ 125	3.1 @ 113	4.2 @ 110	4.9 @ 112	4.0 @ 108	4.3 @ 121	3.1 @ 98	3.1 @ 94
Displacement									
Left Upper S.P.	3	N/A	N/A	-3.2 @ 82	-13.9 @ 43 ²	-5.5 @ 100	+0.2 @ 82 ¹	-4.2 @ 100	-4.4 @ 120
Left Lower S.P.	2	N/A	N/A	-5.7 @ 51	-5.8 @ 101	-9.5 @ 98	-4.5 @ 105 ²	-18.0 @ 81	-6.6 @ 43
Right Lower S.P.	1	+3.5 @ 68	-0.3 @ 63	+2.3 @ 114 ²	+3.1 @ 69	+3.3 @ 65	+0.7 @ 102	+0.4 @ 89	+0.3 @ 84

*All velocities in miles per hour. All accelerations in G's.

¹Data questionable²String broken post-test.³Front firewall of Oldsmobile Cutlass.

N/A = Not Available.

TABLE 5-4. EXTERIOR STATIC CRUSH SUMMARY FOR TARGET VEHICLE

	Inches aft of DOR								
	6	12	18	24	30	36	42	48	54
Unmodified Rabbits									
Level 1									
8330-4	5.2	5.4	5.8	6.0	6.4	7.3	8.1	5.2	4.4
8327-6.1	7.8	8.3	8.6	9.3	10.0	9.6	9.8	8.5	6.6
8327-6.4	5.3	6.9	8.4	9.9	9.6	8.5	8.1	6.5	4.3
Level 2									
8330-4	12.1	15.9	17.3	18.2	18.5	19.2	15.5	13.9	11.8
8327-6.1	11.5	15.3	17.2	20.0	20.5	19.8	17.7	14.5	12.0
8327-6.4	13.8	18.1	21.0	22.4	23.1	22.8	20.9	15.1	12.7
Level 3									
8330-4	8.2	10.7	12.7	14.2	15.6	16.6	18.6	17.3	14.9
8327-6.1	11.0	14.3	16.6	17.8	18.4	17.8	16.5	15.5	11.8
8327-6.4	11.7	16.1	18.4	19.9	21.1	21.5	20.0	18.4	15.0
Level 4									
8330-4	6.8	9.7	12.0	13.7	15.3	15.8	16.3	14.9	13.5
8327-6.1	9.4	12.8	15.5	17.0	18.0	17.9	15.9	13.6	10.9
8327-6.4	10.5	14.4	17.6	19.4	20.3	20.2	17.7	15.9	12.4
Modified Rabbits									
Level 1									
8330-2	1.2	1.8	2.2	2.8	3.3	4.0	4.7	3.6	0.9
8327-4.1	3.7	4.1	4.6	4.7	4.9	5.1	5.6	4.8	4.1
8327-6.2	4.4	4.9	5.4	5.9	6.1	5.8	5.6	5.0	3.9
8327-6.3	4.1	5.1	5.5	5.6	5.8	5.8	5.9	4.2	3.4
8327-6.5	1.4	1.9	2.4	2.6	3.1	3.5	4.0	3.9	3.8
8327-6.6	2.0	2.2	2.6	3.1	3.6	4.8	4.9	4.3	3.9
Level 2									
8330-2	6.1	8.4	10.5	11.9	12.9	13.6	13.5	11.5	9.5
8327-4.1	8.5	10.4	10.9	11.0	11.2	10.4	9.0	10.6	9.6
8327-6.2	7.2	10.4	11.9	12.7	13.2	12.7	11.9	10.1	8.6
8327-6.3	7.6	11.0	11.3	12.7	12.5	11.7	10.3	9.3	8.0
8327-6.5	2.5	3.7	5.1	6.3	7.2	7.5	7.1	9.3	9.5
8327-6.6	3.7	5.2	6.6	7.7	8.8	9.1	9.1	10.3	9.6
Level 3									
8330-2	5.6	8.3	10.9	12.6	13.5	13.9	13.9	13.0	10.6
8327-4.1	6.6	8.9	11.0	12.1	12.3	11.5	10.0	11.7	11.1
8327-6.2	6.6	9.7	11.4	13.5	13.8	13.3	11.8	10.3	7.9
8327-6.3	6.5	9.4	11.8	12.9	12.5	11.5	10.0	9.5	7.9
8327-6.5	1.4	2.5	3.7	5.1	6.4	7.2	7.2	11.3	9.6
8327-6.6	3.2	4.9	6.7	8.4	9.3	9.5	8.9	11.0	10.4
Level 4									
8330-2	5.0	8.1	11.1	12.7	13.5	14.9	12.8	9.7	7.5
8327-4.1	5.1	7.2	9.6	10.5	11.3	12.9	11.2	11.9	9.8
8327-6.2	5.3	8.7	11.0	12.8	13.6	13.4	12.2	10.7	7.7
8327-6.3	6.1	9.4	11.6	13.1	13.2	12.8	10.6	11.0	7.5
8327-6.5	0.9	1.7	2.6	4.6	6.7	8.0	7.5	11.5	10.5
8327-6.6	1.5	4.1	6.5	8.2	9.6	9.9	9.0	12.2	10.4

Level 1: Doorsill Height - 12.0; Level 2: Mid-Door Height - 20.0;

Level 3: Bullet Vehicle Hood Height - 26.0; Level 4: Windowsill Height - 32.0

All heights measured above ground in inches.

TABLE 5-5. INTERIOR STATIC INTRUSION SUMMARY FOR TARGET VEHICLE

	Inches aft of DOR								
	6	12	18	24	30	36	42	48	54
Unmodified Rabbits									
Level 1									
8330-4	4.2	4.2	4.8	4.9	5.1	6.3	7.2	N/A	N/A
8327-6.1	3.8	5.0	5.6	5.7	6.0	6.6	5.7	N/A	N/A
8327-6.4	3.6	3.8	4.6	5.3	7.7	5.9	4.8	N/A	N/A
Level 2									
8330-4	11.3	13.3	13.8	14.8	16.9	17.0	15.0	13.0	12.0
8327-6.1	8.8	12.4	14.7	16.4	17.2	15.6	11.8	7.0	6.8
8327-6.4	11.8	14.2	15.1	17.5	19.0	17.7	12.5	9.0	6.9
Level 3									
8330-4	9.9	11.7	11.8	14.3	N/A	15.3	17.0	14.5	12.5
8327-6.1	8.6	12.4	14.4	15.8	16.0	15.6	17.1	9.9	6.2
8327-6.4	11.0	13.7	14.9	16.4	18.0	19.2	19.6	13.0	10.0
Level 4									
8330-4	7.5	8.5	11.0	12.5	13.5	14.5	17.3	14.3	12.0
8327-6.1	7.4	10.4	12.8	13.8	13.6	14.0	13.6	11.8	9.3
8327-6.4	8.4	11.0	14.0	16.2	17.1	17.4	16.7	13.9	10.0
Modified Rabbits									
Level 1									
8330-2	1.1	0.9	1.7	3.3	3.1	2.6	2.0	N/A	N/A
8327-4.1	0.4	2.5	2.6	3.0	2.6	2.9	3.4	N/A	N/A
8327-6.2	2.9	3.6	3.7	4.0	4.1	3.9	3.4	N/A	N/A
8327-6.3	2.0	3.1	2.4	2.9	3.9	3.7	2.6	N/A	N/A
8327-6.5	0.7	1.1	1.5	1.9	1.8	2.3	2.2	N/A	N/A
8327-6.6	1.5	2.0	2.3	3.0	3.3	3.9	3.1	N/A	N/A
Level 2									
8330-2	2.9	5.4	7.4	9.1	10.1	10.8	10.5	8.4	5.0
8327-4.1	5.5	6.8	7.3	7.1	6.3	6.5	6.2	4.8	1.4
8327-6.2	4.8	6.6	7.4	8.7	8.5	7.9	7.9	5.9	3.1
8327-6.3	5.4	6.3	6.7	7.0	6.9	6.6	6.8	4.7	3.1
8327-6.5	1.3	2.0	2.3	3.1	4.1	3.8	5.6	4.4	4.3
8327-6.6	2.1	3.0	3.9	4.6	5.1	5.7	7.4	5.2	5.0
Level 3									
8330-2	3.6	6.4	9.0	10.3	10.8	11.5	10.7	8.3	5.6
8327-4.1	6.0	7.6	8.5	8.4	7.7	8.4	9.7	7.0	3.5
8327-6.2	5.5	7.5	8.8	10.3	9.9	9.5	10.6	8.6	4.9
8327-6.3	5.5	7.0	8.5	10.3	10.0	9.0	11.4	7.8	4.2
8327-6.5	1.1	2.1	2.9	4.0	4.7	5.7	8.8	8.4	N/A
8327-6.6	2.5	3.8	5.1	6.3	7.3	8.0	10.0	9.6	N/A
Level 4									
8330-2	2.9	5.3	8.1	10.4	10.8	11.3	11.0	9.9	6.8
8327-4.1	5.2	7.2	9.0	9.6	9.5	9.4	12.0	10.0	7.9
8327-6.2	4.6	7.1	9.5	11.0	11.2	11.3	10.7	9.2	5.7
8327-6.3	4.9	7.6	9.8	11.0	11.0	10.7	9.9	8.6	5.7
8327-6.5	1.0	1.8	2.7	3.7	4.3	5.6	10.1	9.0	7.0
8327-6.6	2.0	3.5	5.2	6.4	7.2	7.8	11.7	10.0	7.4

Level 1: Doorsill Height - 12.5; Level 2: Bullet Vehicle Bumper Height - 17.0;

Level 3: Mid-Door Height - 24.0; Level 4: Windowsill Height - 34.5

All heights measured above ground in inches.

TABLE 5-6. EXTERIOR STATIC CRUSH SUMMARY FOR BULLET VEHICLE

Test Number	Vehicle Type	Distance Left of Center							
		6	0	6	12	18	24	30	33
Level 1									
8330-2	Cutlass	2.3	2.4	4.3	5.1	5.8	7.8	9.8	13.6
8330-4	Cutlass	1.6	1.5	3.0	3.3	3.6	5.3	6.1	7.2
8327-4.1	Side Impactor	2.4	3.5	4.6	5.9	7.3	8.8	10.3	11.1
8327-6.1	Crabbed S.I.	1.2	1.7	2.2	2.5	2.9	3.5	5.0	N/A
8327-6.2	Crabbed S.I.	0.2	1.0	2.2	4.0	5.6	7.3	9.3	N/A
8327-6.3	Crabbed S.I.	0.3	0.9	2.3	3.9	5.2	6.8	9.3	N/A
8327-6.4	Crabbed S.I.	0.6	0.7	1.0	0.9	0.8	1.3	2.8	N/A
8327-6.5	Side Impactor	0.1	0.3	0.8	1.4	3.3	6.3	9.2	9.6
8327-6.6	Side Impactor	0.1	0.3	0.5	1.0	4.1	6.7	9.5	10.0
Level 2									
8330-2	Cutlass	0.8	2.4	1.4	1.8	1.4	3.9	5.1	N/A
8330-4	Cutlass	1.9	3.0	2.1	2.7	0.3	3.5	6.9	N/A
8327-4.1	Side Impactor	0.1	0.0	0.1	0.4	2.1	3.4	6.1	7.5
8327-6.1	Crabbed S.I.	0.0	0.1	0.3	0.6	1.1	2.1	3.9	5.7
8327-6.2	Crabbed S.I.	-0.1	0.1	0.4	1.6	2.6	4.0	5.5	6.6
8327-6.3	Crabbed S.I.	-0.3	0.0	0.6	1.7	2.8	4.8	5.8	6.9
8327-6.4	Crabbed S.I.	0.2	0.4	0.5	0.4	0.4	1.2	3.0	4.6
8327-6.5	Side Impactor	0.0	0.0	0.0	0.2	0.9	3.5	6.2	6.8
8327-6.6	Side Impactor	0.0	0.0	0.1	0.4	1.7	3.8	6.1	7.1
Level 3									
8330-2	Cutlass	1.1	1.4	1.8	2.0	2.2	2.7	3.5	N/A
8330-4	Cutlass	0.8	1.1	1.2	1.3	1.0	1.3	5.9	N/A
8327-4.1	Side Impactor	0.0	0.0	0.0	0.4	1.1	2.3	5.1	6.9
8327-6.1	Crabbed S.I.	-0.7	-0.2	0.0	-0.3	0.6	2.1	4.5	6.3
8327-6.2	Crabbed S.I.	-0.7	-0.5	-0.2	0.0	0.6	1.8	3.3	5.0
8327-6.3	Crabbed S.I.	-0.7	-0.5	-0.1	0.3	0.7	1.8	3.9	5.3
8327-6.4	Crabbed S.I.	1.0	0.7	0.5	0.6	0.6	1.2	3.1	5.0
8327-6.5	Side Impactor	-0.2	-0.1	-0.1	0.1	0.7	2.7	5.2	6.2
8327-6.6	Side Impactor	-0.3	-0.3	-0.3	0.0	0.9	2.5	4.8	5.7

Level 1: Bumper Height - 17.0 (20.0)

Level 2: Mid-stack (Grille) Height - 21.8 (26.0)

Level 3: Top of Stack (Hood) Height - 32.0 (32.0)

All heights measured above ground in inches. Heights in parentheses pertain to Oldsmobile Cutlass.

N/A = Not Available.

The only real area of concern regarding these dummies as test devices is the damage sustained by the dummies during testing, which far exceeds usual damage sustained by the Part 572 dummies utilized in frontal impact testing. Table 5-7 presents a summary of dummy damage (and necessary repairs) for each dummy after Tests 6.1 through 6.6. The following sections outline recurrent damage and repair problems for the two dummies.

5.3.1 Recurrent Problem Areas of Side Impact Dummies

5.3.1.1 HSRI SID Dummy

- Viscous damper (100 cs) - two occurrences
 - First occurrence - Ram casing split on impact.
 - Second occurrence - Severe loss of fluid, with resulting loss of dampening.
- Displacement Transducer - Three occurrences
 - Shaft bends between mounting point on ribs and the potentiometer.
 - End cap of potentiometer is forced off of potentiometer case.

5.3.1.2 APR III Dummy

- Rib Deformation - Two occurrences
 - Individual spring steel ribs show post-test permanent deformation.
- Displacement potentiometer - Two occurrences
 - Shaft bends between rib mounting point and potentiometer.
 - Mounting brackets bend.
- LVDT - Two occurrences
 - Shaft bends at mounting point on ribs.
 - Mounting brackets bend.

TABLE 5-7. SUMMARY OF DUMMY DAMAGES (TESTS 6.1 - 6.6)

Test Number	Vehicle Type	Position	Dummy Type	Dummy Damage	Repairs Required
8327-6.1	Unmodified VW Rabbit	Driver	APR III	1) Lower three ribs on left side bent. 2) LVDT shaft bent. 3) Shaft brackets for LVDT and displacement potentiometer bent. 4) Lower left rib piston damaged - does not respond. 5) Lower right rib piston - probable damage - post-test response questionable. 6) Input shaft bent on left side clavicle position piston.	Entire chest replaced.
		Left Rear	HSRI SID	1) Rib displacement potentiometer shaft bent and rear cap broken. 2) Lateral rib damper piston (100 cs viscosity) broken.	Replaced. Replaced.
8327-6.2	Modified VW Rabbit	Driver	APR III	1) Rib pistons do not respond post-test. 2) Left arm broken above elbow, failure in thin brazed section.	Pistons disassembled and realigned. Arm replaced.
		Left Rear	HSRI SID	1) Three lacerations on right rear of head, from one to three inches in length, completely through skin to skull.	Repaired with hot iron
8327-6.3	Modified VW Rabbit	Driver	HSRI SID	1) Severe laceration on right side of head. 2) Foam shelf on lower right side of jacket torn completely off.	Repaired with hot iron. Not repaired.
		Left Rear	APR III	1) Severe laceration on right side of head. 2) Lower left rib piston will not return to center. 3) Sleeve insert ears bent on left side pistons.	Repaired with hot iron. Piston disassembled and realigned. Bent up areas ground off.
8327-6.4	Unmodified VW Rabbit	Driver	HSRI SID	1) Displacement potentiometer shaft bent. 2) Jacket collar cut on left side. 3) Left knee assembly broken.	Replaced. Not repaired. Replaced.
		Left Rear	Part 572	1) Left ankle broken.	Replaced.
8327-6.5	Modified VW Rabbit	Driver	APR III	1) Laceration on right rear side of head. 2) Upper and lower rib dampers jammed, rubber washers severely fatigued. 3) LVDT shaft bent. 4) Potentiometer mounting bracket bent.	Repaired with hot iron. Pistons disassembled and realigned, left upper piston shaft deburred. Washers not replaced due to lack of replacements. Straightened. Straightened.

TABLE 5-7. SUMMARY OF DUMMY DAMAGES (TEST 6.1 - 6.6) (CONTD)

Test Number	Vehicle Type	Position	Dummy Type	Dummy Damage	Repairs Required
8327-6.6	Modified VW Rabbit	Driver	APR III	Left Rear HSRI SID 1) Chest padding around ribs torn.	Remounted with duct tape.
				2) Displacement potentiometer shaft bent.	Straightened.
				3) Possible viscous damper damage.	No action.
				4) Hose clamp on damper bent.	Replaced.
				5) Lacerations on left upper cheek and on right rear of skull.	Repaired with hot iron.
8327-6.6	Modified VW Rabbit	Driver	APR III	1) Eight of twelve ribs bent.	Entire chest should be replaced.
				2) Upper and lower rib dampers jammed.	
				3) Leather breast plate cut along lower right edge and between second and fourth ribs on right.	
		Left Rear	HSRI SID	1) 100 cs rib damper leaking oil.	Will require replacement.

NOTE: The HSRI SID used in these tests is SN 386. Test 6.1 used APR III SN 869. Tests 6.2 - 6.6 used APR III SN 869 with SN 880 chest.

- Clavicle - Two occurrences
 - Prior to Test 6.1, broke twice during normal handling.
- Upper and lower rib damper pistons - Five occurrences
 - Pistons jam.
 - a. Washers become non-symmetrical within enclosure.
 - b. Piston face not securely attached to piston.
 - c. Piston shaft susceptible to gouging, causing binding.

5.3.2 Dummy Damage Repair Problems

5.3.2.1 Spare Parts Availability

- There is no large stock of spare parts immediately available.
- Acquisition of spare parts is a relatively long lead time proposition.

5.3.2.2 Repair Time (Assuming Parts Availability)

- HSRI SID Dummy
 - Remove and replace damper = two hours.
 - Remove and replace potentiometer = one and one-half hours.
 - a. Includes calibration of potentiometer.
- APR III Dummy
 - Remove and replace chest (rib deformation) = three to four hours.
 - a. Includes checkout of all accelerometers.
 - b. Includes removal and replacement of all accelerometers.
 - Remove and replace displacement potentiometer = one and one-half hours.
 - a. Includes calibration of potentiometer.
 - Remove and replace or repair LVDT = one and one-half hours.
 - a. Includes calibration.

- Remove and replace clavicle = one hour.
- Repair jammed rib pistons = three hours.
 - a. Requires disassembly of ribs from pistons, disassembly of potentiometer and LVDT brackets, removal of piston, removal of washer column, and realignment of washers and foam.

5.3.3 Dummy Calibration

As of this writing, there are no calibration standards for either of these dummies. The only checkouts currently being made are pre- and post-test pendulum "bump" tests wherein the accelerometer response signatures are examined. However, the magnitude of the responses in the bump tests has varied widely from test to test; whether these differences in response magnitude are due to undetected damage sustained during the actual crash tests or are simply a repeatability problem with the dummies themselves has not been adequately investigated.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 TEST PROCEDURE

Based on the results indicated by the curves of Figures 5-1 through 5-3, it appears that the "crabbed" bullet vehicle simulation technique reproduces the overall target vehicle C.G. velocity changes of the two-vehicles-moving condition quite well. The velocity profiles of struck-side target vehicle locations and the various occupant locations were adequately reproduced, although the velocity magnitudes at these locations were not adequately reproduced because of the difference in impact point location.

Even though the C.G. velocity changes were well reproduced, the differences observed between the other lateral compartment velocities would suggest that further consideration be given to the importance of conservation of energy and momentum between the two-vehicles-moving case and the "crabbed" bullet simulation.

From the comparisons presented in Section 5.1, it is concluded that impact point location is critical. It was previously reported (Reference 2) that a small variation in impact point location was not critical so long as the impact point was well forward of the driver occupant. However, it may be concluded that impact point location becomes more critical as impact approaches the H-Point. It is therefore recommended that, for maximum severity of driver occupant crash environment in a one occupant compliance condition, the impact point should be as close to the A-Pillar as possible. In compliance testing, impact point location should be rigidly controlled.

From the discussion presented in Section 5.1, it is apparent that moving the impact point rearward increases rear seat occupant response. If a two occupant compliance test condition is decided upon, an impact point location should be chosen such that both occupants' crash environments are severe, even if the driver environment is not maximized.

From Table 5-1, it may be concluded that the "crabbed" bullet vehicle simulation technique allows for more consistent control over impact point location. It is currently unclear what caused the impact point deviation in the one-vehicle-moving tests. Several factors such as weight distribution, angular adjustment of the tow and guidance system, and wheel and axle alignment are under consideration. It is believed that the problem may be solved through manipulation of these factors; however, the NHTSA may wish to consider a suspended carriage, as opposed to the current rigid carriage, which would effectively reduce the criticality of one or more of the above parameters.

6.2 SIDE IMPACTOR FACE

From the analysis presented in Section 5.2, it may be concluded that the Task 5 design changes have resulted in increased face stiffness as was desired. However, in Tests 6.1 through 6.6, the "hood" surface did not bow up in the desired manner. It is recommended that the "hood" surface be extended all the way back to the two inch aluminum mounting plate in order to provide more material between the front face sheet and the rear anchor point. This change should produce bending characteristics closer to that desired.

6.3 SIDE IMPACT DUMMIES

Both of the Side Impact dummies have experienced breakage or damage in these tests, with the APR III exhibiting a greater tendency toward damage than the HSRI SID. It is recommended that, whichever dummy is selected as a compliance test device, the NHTSA should be prepared to provide the various testing laboratories with an ample supply of spare parts to keep the dummies in good repair. Additionally, while the degree of reproduction of cadaver responses should be the primary determinant for selection of a compliance testing dummy, consideration should also be given to the costs of dummy repair and down time due to dummy damage. Because the failure of a dummy during the test casts doubts on the reliability of the data, design changes should be considered to minimize damage. For instance, it is felt that the APR III rib damper binding problem could be resolved by replacing the rubber washer column with a single rubber cylinder.

Side impact dummy calibration procedures must be defined in terms of response magnitudes. A reproduction of response signatures would not be appropriate for compliance testing because, as discussed in Section 5.1 concerning vehicle response, it is possible to reproduce response signatures but not magnitudes, with substantially different results. It is recommended that a testing program (i.e. sled or pendulum testing) be instituted to establish dummy acceptance standards.

6.4 MISCELLANEOUS

There are several locations currently being instrumented that consistently produce data that is questionable or of little use. It is recommended that those locations be eliminated and the data channel capability be otherwise utilized. For instance, target vehicle accelerometer locations 5 and 6 (front of door) consistently produce data of questionable validity. The data channel capability would be better utilized by instrumenting the target vehicle side structure aft of the B-Pillar. Additionally, String Potentiometers 1 and 2 on the Side Impactor could be eliminated because the strings invariably get snagged in the honeycomb, producing questionable data. Finally, String Pot #1 in the target vehicle often produces questionable data because the driver dummy fouls the string. Although some of these locations would probably not be instrumented in a compliance test, the data channel availability could be better utilized for the remainder of the research testing.

Contrary to what was previously believed (Reference 2), the test conditions utilized in Task 6 (bullet vehicle = 30 mph, target vehicle = 15 mph) do not produce a target vehicle ΔV of 25 mph (see Figure 5-3). This was determined to be a test parameter from the NCSS and MDAI data (Reference 4). Further NHTSA consideration concerning the criticality of this unmatched parameter is advised.

The close data correlation from Tests 6.2 and 6.3, appearing throughout Section 5, indicates acceptable test repeatability, in the area of vehicle response, when impact points are similar.

7.0 REFERENCES

1. Garn, R., et al, "Test Report No. 1, Crabbed Side Impactor-Into-VW Rabbit, Front-to-Side Tests @ 60°, Tests 8327-6.1 through 8327-6.4," Dynamic Science Report No. 8327-80-167A, Contract No. DOT-HS-01933(II), January 1981.
2. Bjork, T., et al, "60-Degree Two Vehicles Moving Front-to-Side Impact Tests Using Modified VW Rabbits as Target Vehicles (Tests 8327-4.1 and 8330-2, Phase II, Task 4)," Dynamic Science Report No. 8327-80-010A, Contract No. DOT-HS-8-01933(II), December 1980.
3. Baczynski, R., et al, "Task 5 Static Component and Subsystem Test Report," Dynamic Science Report No. 8327-80-006, Contract No. DOT-HS-8-01933(II), November 1980.
4. Burgett, A. and Hackney, J., "Status of the National Highway Traffic Safety Administration's Research and Rulemaking Activities for Upgrading Side Impact Protection," Proceeding of the Seventh International Technical Conference on Experimental Safety Vehicles, Paris, France, June 1979.