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DOT HS 807 045
Test Report

June 1986

Dynamic Testing for Side Crush MRB-TO-CAR Side Impact Test of a 90° Moving Rigid Barrier to a 1980 Chevrolet Citation

Test No. 1 18.5 mph

Test No. 2 46.6 mph

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Technical Report Documentation Page

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DYNAMIC TESTING FOR SIDE CRUSH MRB-To-Car Side Impact Test of A 90° Moving Rigid Barrier To A 1980 Chevrolet Citation Test #1 18.5 mph, Test #2 46.6 mph	JUNE 1986
	6. Performing Organization Code
7. Author(s) N. A. El-Habash, Project Engineer, TRCO	8. Performing Organization Report No. 860326
9. Performing Organization Name and Address Vehicle Research and Test Center St. Rt. 33, Logan County East Liberty, Ohio 43319	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. DTNH22-85-C-08123
	13. Type of Report and Period Covered TEST REPORT March-June 1986
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

This test was conducted as part of VRTC Project No. SRL 46 Side Impact Protection In Production Vehicles

16. Abstract

This test report documents two of a series of nine crash tests to measure side crush in various vehicle models. Testing was conducted on a 1980 Chevrolet Citation 4-Door Hatchback at the TRCO Crash Test Facility, East Liberty, Ohio. The test vehicle was impacted on the left and right side perpendicular by a Moving Rigid Barrier (MRB). The test date was March 26, 1986.

Test #1 Vehicle was impacted perpendicular on the left side at 18.5 mph, the ambient temperature was 64°F and the time was 1002.

Test #2 Vehicle was impacted perpendicular on the right side at 46.6 mph, the ambient temperature was 70°F and the time was 1313.

17. Key Words	18. Distribution Statement
Occupant Response Moving Barrier Crash Testing	Available from: National Technical Information Service Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	88	

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SECTION 1.0

PURPOSE AND INTRODUCTION

PURPOSE

The main purpose of this test was to obtain side crush measurements for improvement of computer simulation models in one of a fleet of vehicles. The vehicle was tested using conditions not currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A stationary 1980 Chevrolet Citation 4-Door Hatchback was impacted on the left and right side by a Moving Rigid Barrier (MRB) on March 26, 1986.

Test #1: The MRB was to be towed into the stationary Chevrolet Citation at 18.5 mph, and the intended contact point of the MRB longitudinal centerline was to be -8.1 inches (rearward) from the center of gravity of the Chevrolet Citation. The angle of the MRB was 90° counter clockwise with respect to the longitudinal axis of the struck vehicle. The actual test speed was 18.6 mph and the actual contact point was -8.6 inches (rearward) from the center of gravity of the Chevrolet Citation.

Test #2: The MRB was to be towed into the stationary Chevrolet Citation at 46.5 mph, and the intended contact point of the MRB longitudinal centerline was to be -8.1 inches (rearward) from the center of gravity of the Chevrolet Citation. The angle of the MRB was 90° clockwise with respect to the longitudinal axis of the struck vehicle. The actual speed was 46.6 mph and the actual contact point was -8.1 inches (rearward) from the center of gravity of the Chevrolet Citation.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A & B contains pre-test and post-test vehicle photographs. Appendix C & D contains Data Plots.

SECTION 2.0
GENERAL TEST AND VEHICLE PARAMETER DATA

The following data sheets describe the General Test and Vehicle Parameter Data.

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: General Motors Corp.

MAKE/MODEL: Chevrolet Citation VIN: 1X687AT279044

BODY STYLE: 4-Door Hatchback MODEL YEAR: 1980

NHTSA NO.: R & D COLOR: Light Blue

ENGINE DATA: TYPE: Transverse CYLINDERS: 6 DISPLACEMENT: 2800cc

TRANSMISSION DATA: 3 Speed Automatic

DATE VEHICLE RECEIVED: 3/18/86 ODOMETER READING: 29914

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	Yes	AUTOMATIC TRANSMISSION	Yes
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	Yes	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes
OTHER			

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: General Motors Corp.

DATE OF MANUFACTURE: 03/80

GVWR: 3650 LBS.,

GAWR: FRONT 2035 LBS., REAR 1615 LBS.

VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 26 psi; REAR 26 psi

TIRES ON VEHICLE (MFGR. & LINE, SIZE): NA

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 3

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS):

RIGHT FRONT	851	LBS.	RIGHT REAR	479	LBS.
LEFT FRONT	895	LBS.	LEFT REAR	497	LBS.
TOTAL FRONT WEIGHT	1746	LBS.	(64.1 % OF TOTAL VEHICLE WEIGHT)		
TOTAL REAR WEIGHT	976	LBS.	(35.9 % OF TOTAL VEHICLE WEIGHT)		
TOTAL DELIVERED WEIGHT	2722	LBS.			

WEIGHT OF TEST VEHICLE AFTER PREPARATION:

RIGHT FRONT	849	LBS.	RIGHT REAR	540	LBS.
LEFT FRONT	876	LBS.	LEFT REAR	519	LBS.
TOTAL FRONT WEIGHT	1725	LBS.	(62.0 % OF TOTAL VEHICLE WEIGHT)		
TOTAL REAR WEIGHT	1059	LBS.	(38.0 % OF TOTAL VEHICLE WEIGHT)		
TOTAL TEST WEIGHT	2784	LBS.			

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

TEST FLUID DATA

TEST FLUID TYPE: PURPLE STODDARD SOLVENT 2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: NA GALLONS ACTUAL

TEST VOLUME: 0.0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): NA GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: DNA FUEL INJECTION: DNA

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? DNA

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 26 psi; REAR 26 psi

RECOMMENDED TIRE SIZE: P/85/80R13 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Front - Bench
Rear - Bench

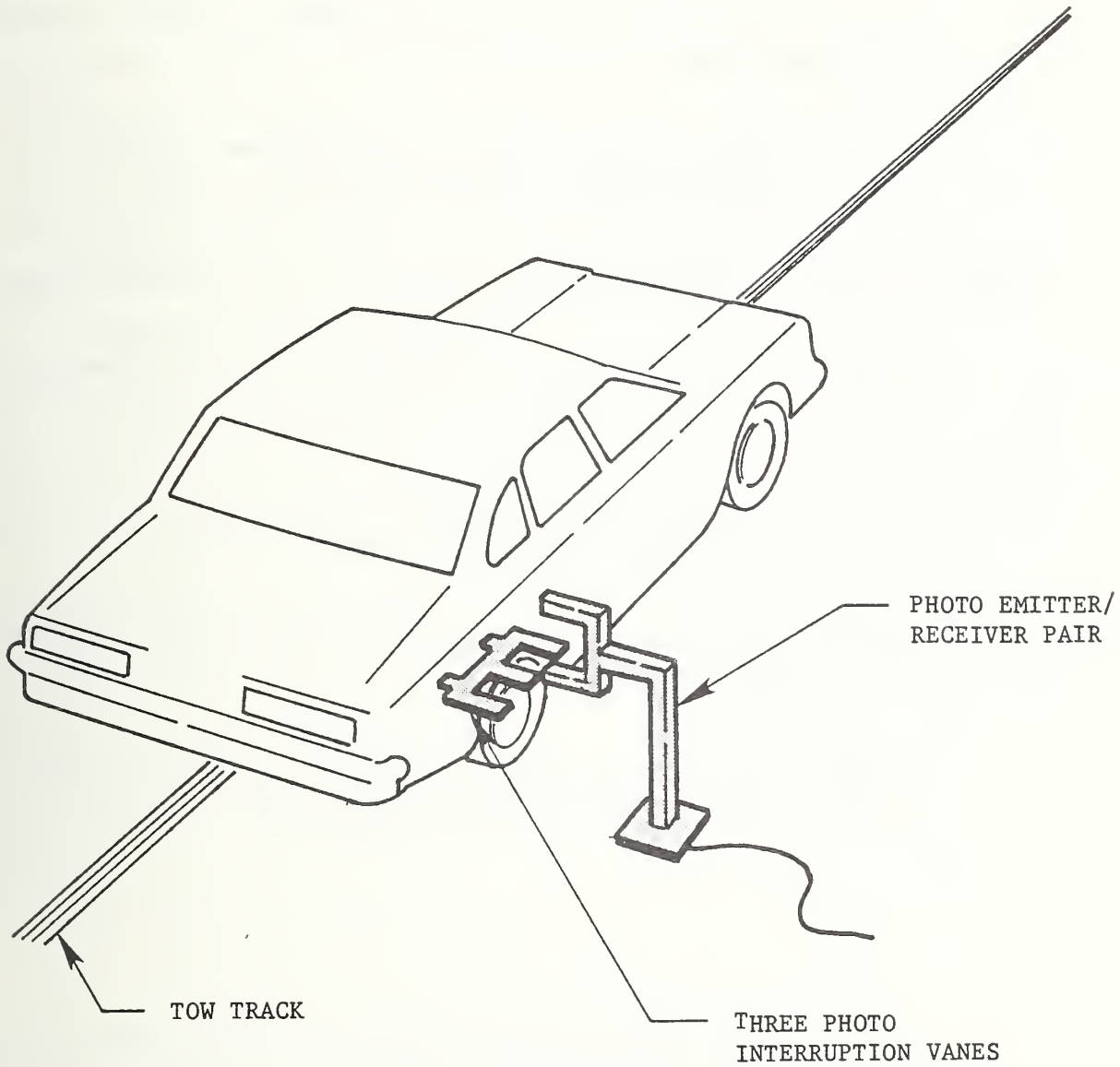
NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
3 REAR
5 TOTAL

CARGO LOAD DNA LBS.

TOTAL DNA LBS.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

TEST ANOMALIES

Test #1 vehicle was impacted perpendicular on the left side low speed.

1. The following data channels did not return to baseline following the crash pulse.

   VCGYG Vehicle Center of Gravity Acceleration Y Axis.
   VCGZG Vehicle Center of Gravity Acceleration Z Axis.

Test #2 vehicle was impacted perpendiculer on the right side high speed.

1. VCGXG Data loss between approximately 84 msec and 87 msec due to a pinched cable during impact.

2. VCGZG Data loss between approximately 76 msec and 84 msec due to a pinched cable during impact.

3. The following data channel did not return to baseline following the crash pulse.

   BCGYG Moving Barrier Center of Gravity Acceleration Y Axis.
   VCGYG Vehicle Center of Gravity Acceleration Y Axis.

Y TRCO is investigating the zero-shift phenomenon of accelerometer data during the crash pulse in conjunction with Metraplex Corporation and Endevco Representatives. There is no definite resolutions of the date of this report.

SECTION 3.0

DATA REQUIRED BY R&D TEST #1

The following pages are included in this section:

Test #1 vehicle was impacted perpendicular on the left side low speed.

1. Vehicle crush data
2. Vehicle accelerometer location and data summary
3. High speed camera information
4. Transducer information

TEST #1 VEHICLE WAS IMPACTED PERPENDICULAR ON LEFT SIDE LOW SPEED

Test Condition

Test Number: 860326 Date of Test = March 26, 1986

Wind Velocity 15 - 20/216S Time of Test = 10:02

Ambient Temperature at Impact Area: 64°F

Subject Vehicle Data	Actual	Intended
Vehicle Test Weight (Lbs.)	2784	2784
MRB Test Weight (Lbs.)	3229	3229
MRB Velocity (MPH)*	18.5	18.5
Impact Point (Inches)**	-8.6	-8.1

Vehicle Attitude (All dimensions in inches):

Delivered Attitude:	RF 27 1/8	;LF 27 5/16	;RR 25 9/16	;LR 25 5/8
Pre-Test Attitude:	RF 27	;LF 27 1/4	;RR 24 5/8	;LR 24 7/8
Post-Test Attitude:	RF 26 5/8	;LF 26 3/4	;RR 24 3/4	;LR 24 3/8

Vehicle dimension (All in inches):

***Center of Gravity	= 39.9	, wheel base	= 104 3/4
Width Car	= 68 5/8	, length car	= 176 3/4
Width Roof	= 48 11/16	, track width	= 57 1/2
Front overhang	= 35 3/8	, rear overhang	= 36 7/16

* As measured over final one foot of travel.

** As measured + is forward of the center of gravity of the test vehicles.
As measured - is rearward of the center of gravity of the test vehicles.

*** Rearward of front wheel centerline.

National Accident Sampling System — Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

NCI

Complete When Applicable	
End Damage	**Side Damage**
Undeformed end width _____	Bowing: B1 _____ X1 _____
Corner shift: A1 _____	B2 _____ X2 _____
A2 _____	Bowing constant
End shift at frame (CDC) (check one)	$\frac{X1 + X2}{2}$ = _____
<4 inches X	
≥4 inches _____	

Note: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts–
Rear to Front in Side impacts.

Specific Impact Number	Plane* of C-Measurements	Direct Damage		Field L**	C_1	C_2	C_3	C_4	C_5	C_6	±D
		Width** (CDC)	Max*** Crush								
Bumper Crush				78	0	9.1	8.6	8.7	8.3	0	-11.1
Hood Crush					0	5.6	6.5	5.1	4.4	0	

*Identify the plane at which the C-measurements are taken (e.g., at bumper, above bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

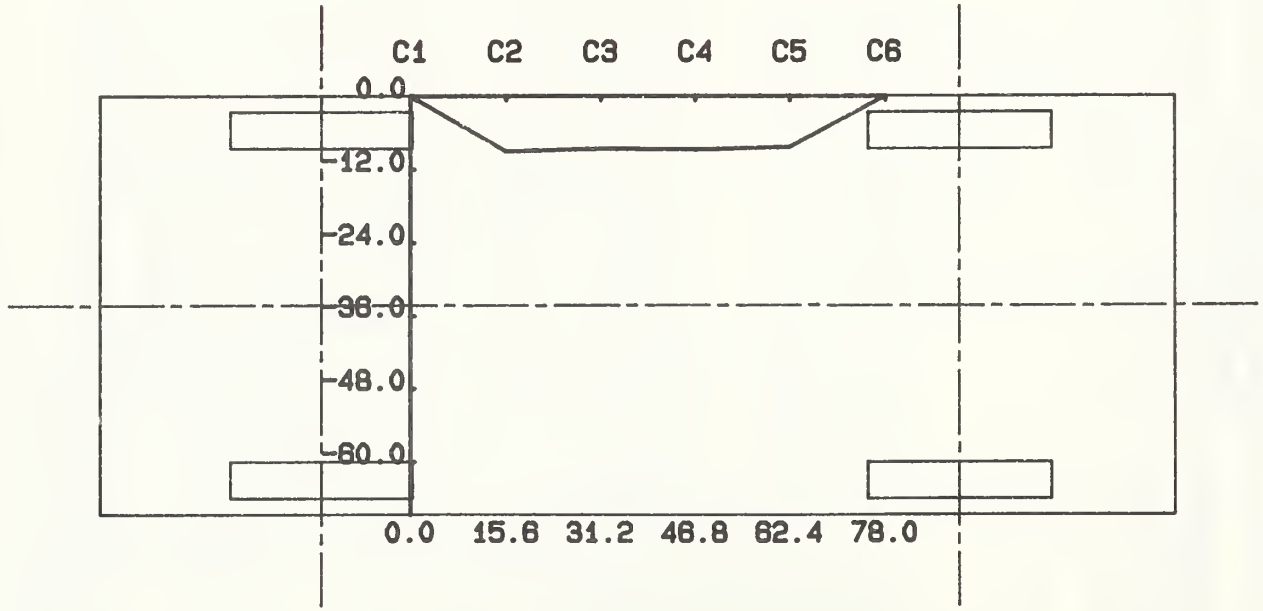
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

***Measure and document on the vehicle diagram the location of the maximum crush.

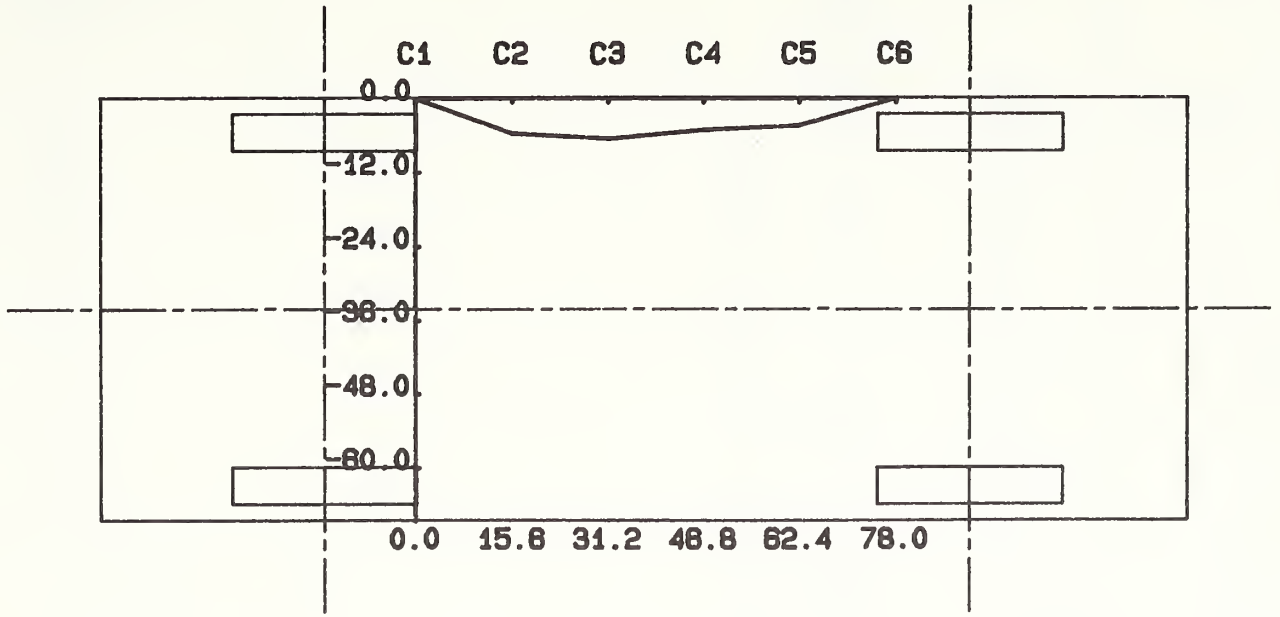
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS -11.1" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS HOOD EDGE HEIGHT WHICH IS 29.0 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS -11.1" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

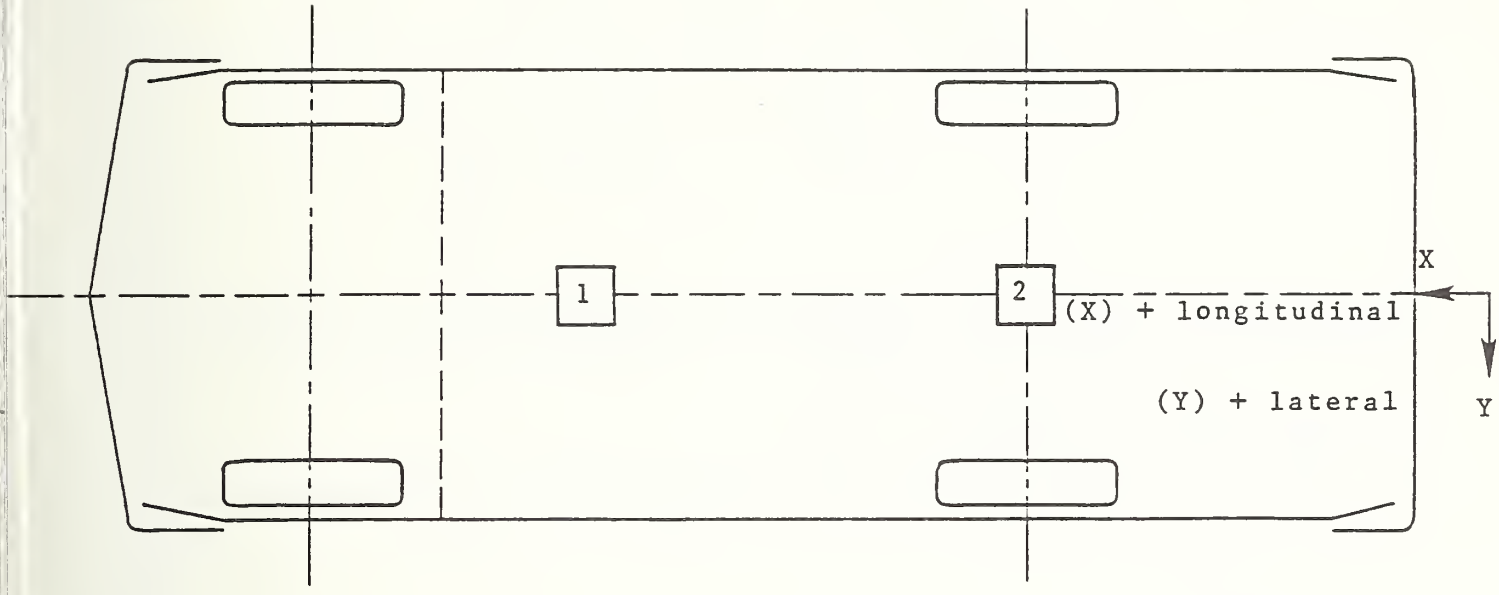
NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	-40.0	0.0	14.4				
	(LONGITUDINAL)				3.71	57.38	4.92	13.38
	(LATERAL)	Δ V = --- mph @ --- msec ϒ			---	---ϒ	---	---ϒ
	(VERTICAL)				---	---ϒ	---	---ϒ
	(RESULTANT)					--- @	---ϒ	
2	REAR DECK OVER AXLE	-99.0	0.5	27.1				
	(LONGITUDINAL)				7.25	42.63	4.10	55.75
	(LATERAL)	Δ V = -10.8 mph @ 101.5 msec			2.90	21.00	13.41	11.25
	(VERTICAL)							
	(RESULTANT)							

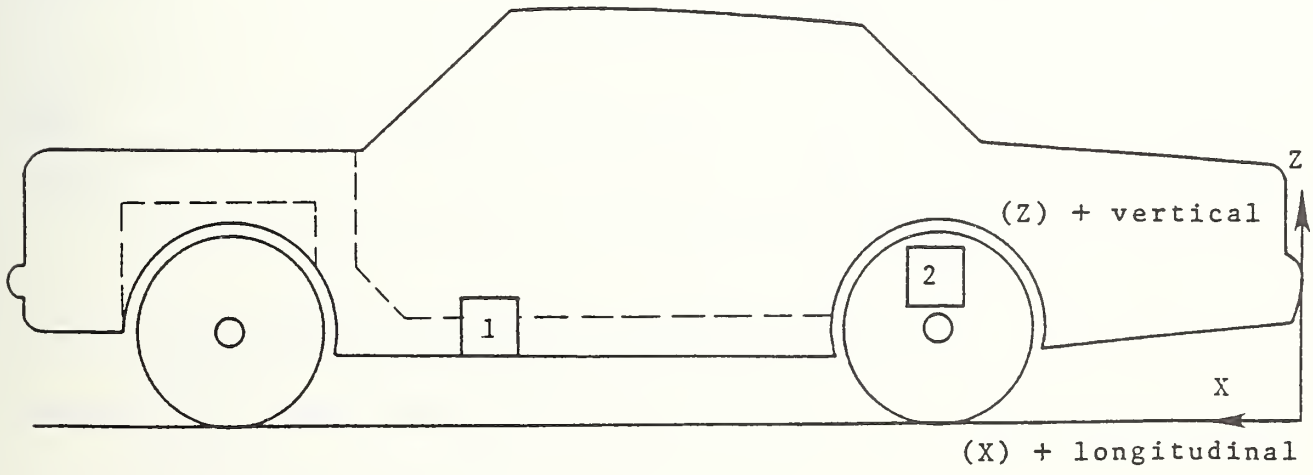
* Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Left), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

ϒ See TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS





YAW RATE GYRO LOCATION AND DATA SUMMARY

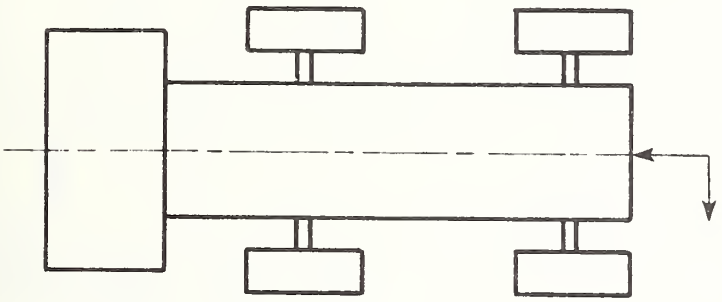
LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (deg/sec)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (deg/sec)	NEGATIVE DIRECTION TIME (msec)
YAW RATE GYRO	-99.6	0.0	28.0	60.16	53.38	39.30	94.33

*Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Left), Z - Ground Level (+ Up)

All measurements of rate gyro in inches.

Yaw rotation is positive when measured counterclockwise as viewed from above.

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY



NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	61.2	0.0	11.8				
	(LONGITUDINAL)	Δ V = -10.00 mph @ 101.50 msec			0.25	176.00	8.97	30.88
	(LATERAL)				2.02	28.38	2.01	64.00
	(VERTICAL)				3.53	36.75	3.96	51.50
	(RESULTANT)					9.26 @ 36.13		
2	REAR FRAME MEMBER	22.0	+18.4	11.9				
	(LONGITUDINAL)	Δ V = -7.9 mph @ 101.50 msec			1.24	125.50	8.40	28.63
	(LATERAL)				1.29	102.38	2.44	19.75

* Reference: X - Rear Most Point of Frame (+ Forward), Y - Barrier Centerline (+ To Left), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	R. Panning	Kodak	25	24	Real Time Panning
2	Overhead wide	Photosonic 1B	8	990	Vehicle Dynamics
3	Overhead tight	Photosonic 1B	25	1007	Close-up of Impact Point
4	Onboard MRB	Photosonic 1B	13	1000	Close-up of Impact Point
5	Onboard roof	Photosonic 1B	8	1001	Door/Driver Contact Velocity

NON-GOVERNMENT FURNISHED TRANSDUCER INFORMATION

PARAMETER BEING MEASURED	TYPE OF TRANSDUCER	MODEL NUMBER	SERIAL NUMBER	MFGR.	DATE OF LAST CALIBRATION	SENSITIVITY	DESIRED FULL SCALE (ENGR. UNITS)
BCGXG	Accel	4-202-0001	18849	Bell Howell	3/25/86	.2225	100 G
BCGYG	Accel	4-202-0001	18859	Bell Howell	3/25/86	.2115	100 G
BCGZG	Accel	4-202-0001	18235	Bell Howell	3/25/86	.2381	100 G
BRCYG	Accel	4-202-0001	19022	Bell Howell	3/25/86	.2211	100 G
BRCXG	Accel	4-202-0001	18851	Bell Howell	3/25/86	.2488	100 G

All struck vehicle accelerometers were Government Furnished Equipment and were Endevco 2264 and 7264 Accelerometers.

SECTION 4.0
DATA REQUIRED BY R&D TEST #2

The following pages are included in this section:

Test #2 vehicle was impacted perpendicular on the right side high speed.

1. Vehicle crush data

2. Vehicle accelerometer location and data summary

3. High speed camera information

4. Transducer information

TEST #2 VEHICLE WAS IMPACTED PERPENDICULAR ON RIGHT SIDE HIGH SPEED

Test Condition

Test Number: 860326 Date of Test = March 26, 1986

Wind Velocity 20-25/225 S.W. Time of Test = 13:13

Ambient Temperature at Impact Area: 70°F

Subject Vehicle Data	Actual	Intended
Vehicle Test Weight (Lbs.)	2784	2784
MRB Test Weight (Lbs.)	3229	3229
MRB Velocity (MPH)*	46.6	46.5
Impact Point (Inches)**	-8.1	-8.1

Vehicle Attitude (All dimensions in inches):

Delivered Attitude: RF 27 1/8 ;LF 25 5/16 ;RR 25 9/16 ;LR 25 5/8

Pre-Test Attitude: RF 26 15/16 ;LF 27 1/4 ;RR 24 1/4 ;LR 24 3/8

Post-Test Attitude: RF 23 1/4 ;LF 23 7/16 ;RR 23 1/2 ;LR 24 3/4

Vehicle dimension (All in inches):

***Center of Gravity	= 39 15/16	, wheel base	= 104 3/4
Width Car	= 68 5/8	, length car	= 176 3/4
Width Roof	= 48 11/16	, track width	= 57 1/2
Front overhang	= 35 3/8	, rear overhang	= 36 7/16

* As measured over final one foot of travel.

** As measured + is forward of the center of gravity of the test vehicles.
As measured - is rearward of the center of gravity of the test vehicles.

*** Rearward of front wheel centerline.

National Accident Sampling System — Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

Complete When Applicable	
End Damage	**Side Damage**
Undeformed end width _____	Bowing: B1 3 X1 2.5
Corner shift: A1 _____	B2 12 X2 11.5
A2 _____	Bowing constant
End shift at frame (CDC) (check one)	$\frac{X1 + X2}{2} = \frac{14}{2} = 7$
<4 inches _____	
≥4 inches X	

Note: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts–
Rear to Front in Side impacts.

Specific Impact Number	Plane* of C-Measurements	Direct Damage		Field L**	C_1	C_2	C_3	C_4	C_5	C_6	±D
		Width** (CDC)	Max*** Crush								
1	Maximum Door Crush				0	4.5	35.8	33	30	0	
2	Door Freespace				–	0.8	0.8	0.8	0.8	–	
3	Door Crush				0	3.7	35	32.2	29.2	0	
4	Maximum Sill Crush				–	–	14.2	14.5	16.5	–	
5	Sill Freespace				–	–	3.5	3.5	3.5	–	
6	Sill Crush				–	–	10.7	11.0	13.0	–	
7	Bowing				7	7	7	7	7	7	
	$\frac{\text{lines } 3+6}{2} + 7$			97.0	7.0	10.7	29.9	28.6	28.1	7.0	-13.6

*Identify the plane at which the C-measurements are taken (e.g., at bumper, above bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

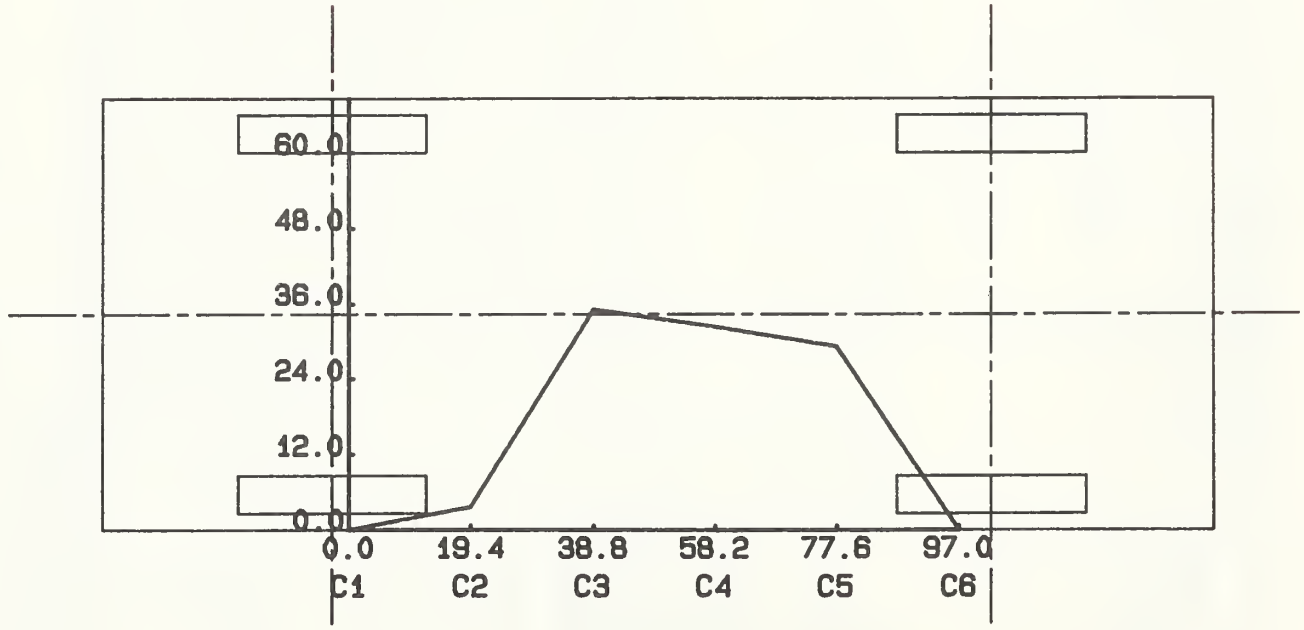
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

***Measure and document on the vehicle diagram the location of the maximum crush.

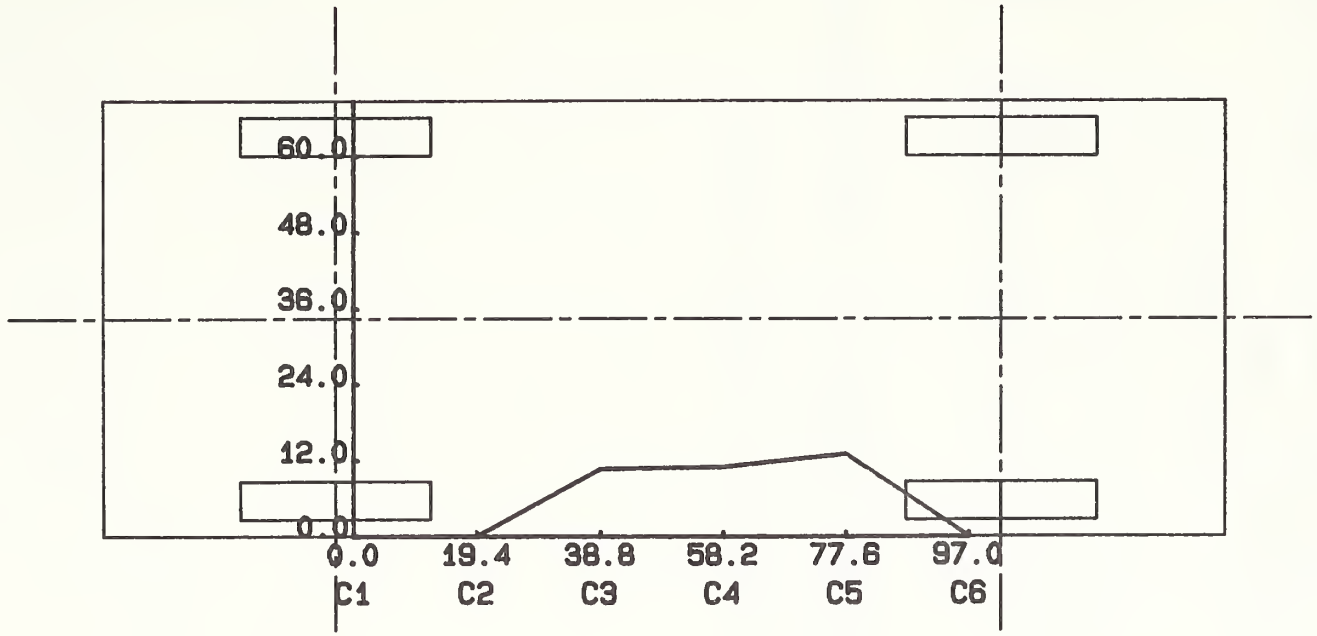
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS -13.6" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS SILL EDGE HEIGHT WHICH IS 12.3 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS −13.6" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

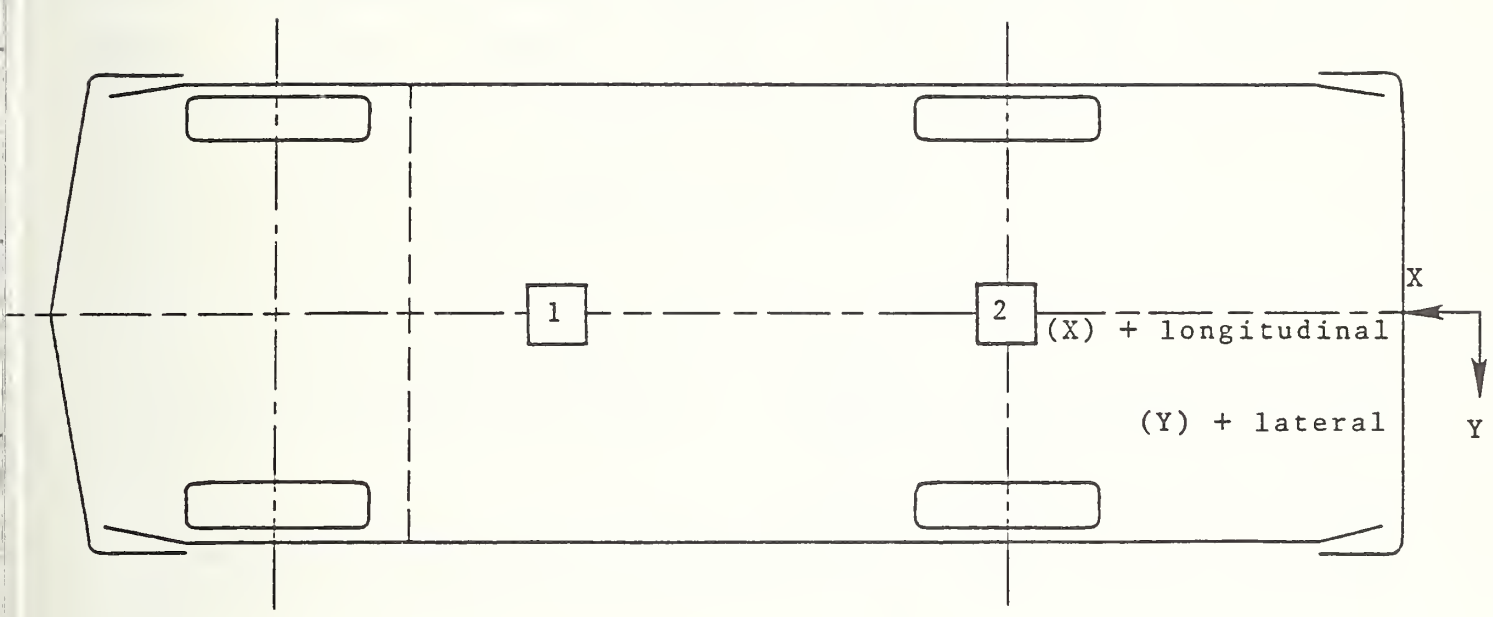
NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	-40.0	0.0	25.1				
	(LONGITUDINAL)				---	---γ	---	---γ
	(LATERAL)	Δ V = --- mph @ --- msec γ			---	---γ	---	---γ
	(VERTICAL)				---	---γ	---	---γ
	(RESULTANT)					--- @	---γ	
2	REAR DECK OVER AXLE	-99.0	0.5	27.1				
	(LONGITUDINAL)				19.31	38.63	16.40	92.50
	(LATERAL)	Δ V = 30.0 mph @ 190.63 msec			26.68	105.00	9.91	31.00
	(VERTICAL)							
	(RESULTANT)							

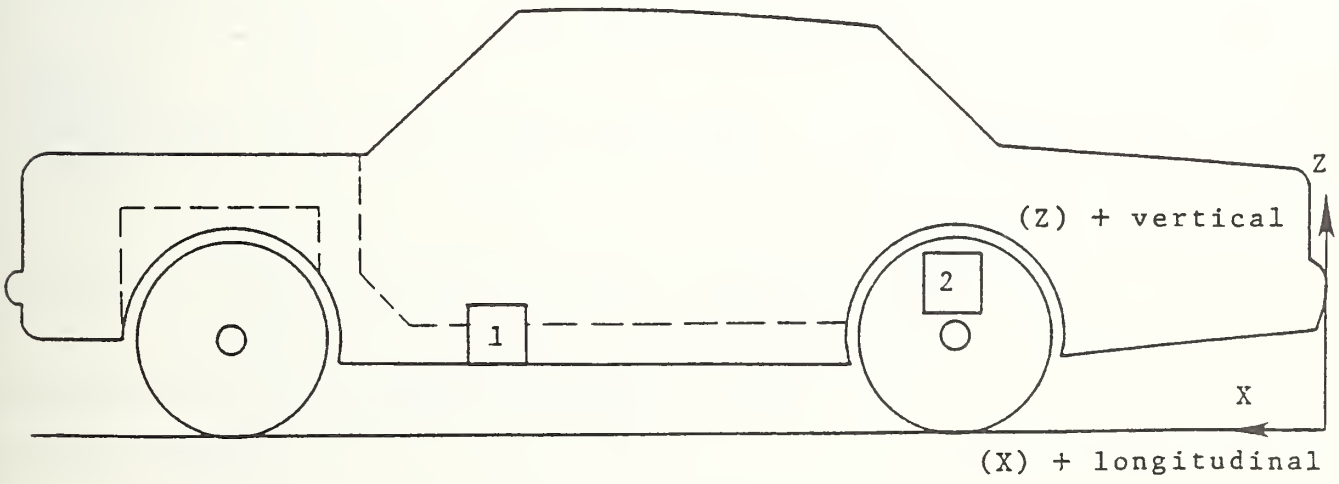
* Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Right), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

γ See TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS





YAW RATE GYRO LOCATION AND DATA SUMMARY

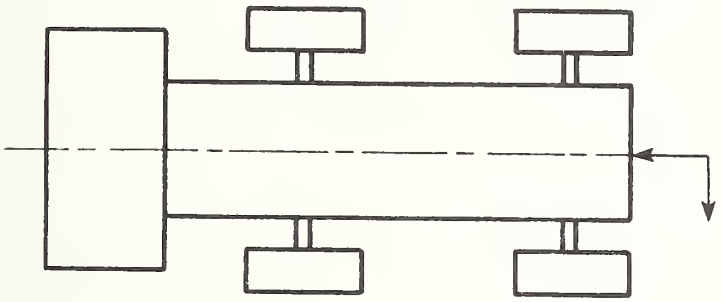
LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (deg/sec)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (deg/sec)	NEGATIVE DIRECTION TIME (msec)
YAW RATE GYRO	-99.6	0.0	28.6	75.40	178.50	181.15	66.63

*Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Right), Z - Ground Level (+ Up)

All measurements of rate gyro in inches.

Yaw rotation is positive when measured counterclockwise as viewed from above.

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY



NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	61.2	0.0	11.8				
	(LONGITUDINAL)	ΔV = -28.2 mph @ 190.63 msec			0.30	311.13	15.93	17.63
	(LATERAL)				---	---γ	---	---γ
	(VERTICAL)				7.13	29.00	7.23	37.13
	(RESULTANT)					--- @	---γ	
2	REAR FRAME MEMBER	22.0	+18.4	11.9				
	(LONGITUDINAL)	ΔV = -18.0 mph @ 190.63 msec			7.62	234.50	11.06	8.50
	(LATERAL)				3.87	21.38	4.08	101.88

* Reference: X - Rear Most Point of Frame (+ Forward), Y - Barrier Centerline (+ To Left), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

γ See TEST ANOMALIES

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	R. Panning	Kodak	25	24	Real Time Panning
2	Overhead wide	Photosonic 1B	8	998	Vehicle Dynamics
3	Onboard tight	Photosonic 1B	25	1002	Close-up of Impact Point
4	Onboard MRB	Photosonic 1B	13	1000	Close-up of Impact Point
5	Onboard Roof	Photosonic 1B	8	1001	Door/Passenger Contact Velocity

NON-GOVERNMENT FURNISHED TRANSDUCER INFORMATION

PARAMETER BEING MEASURED	TYPE OF TRANSDUCER	MODEL NUMBER	SERIAL NUMBER	MFGR.	DATE OF LAST CALIBRATION	SENSITIVITY	DESIRED FULL SCALE (ENGR. UNITS)
BCGXG	Accel	4-202-0001	18849	Bell Howell	3/25/86	.2225	100 G
BCGYG	Accel	4-202-0001	18859	Bell Howell	3/25/86	.2115	100 G
BCGZG	Accel	4-202-0001	18235	Bell Howell	3/25/86	.2381	100 G
BRCYG	Accel	4-202-0001	19022	Bell Howell	3/25/86	.2211	100 G
BRCXG	Accel	4-202-0001	18851	Bell Howell	3/25/86	.2488	100 G

All struck vehicle accelerometers were Government Furnished Equipment and were Endevco 2264 and 7264 Accelerometers.

APPENDIX A

PHOTOGRAPHS

TEST #1 VEHICLE WAS IMPACTED PERPENDICULAR ON THE LEFT SIDE LOW SPEED.

Figure A-1. PRE-TEST FRONT VIEW

Figure A-2. POST-TEST FRONT VIEW

Figure A-3. PRE-TEST PASSENGER SIDE VIEW

Figure A-4. POST-TEST PASSENGER SIDE VIEW

Figure A-5. PRE-TEST REAR VIEW

Figure A-6. POST-TEST REAR VIEW

Figure A-7. PRE-TEST DRIVER SIDE VIEW

Figure A-8. POST-TEST DRIVER SIDE VIEW

Figure A-9. PRE-TEST DRIVER FRONT THREE-QUARTER VIEW

Figure A-10. POST-TEST DRIVER FRONT THREE-QUARTER VIEW

Figure A-11. PRE-TEST DRIVER REAR THREE-QUARTER VIEW

Figure A-12. POST-TEST DRIVER REAR THREE-QUARTER VIEW

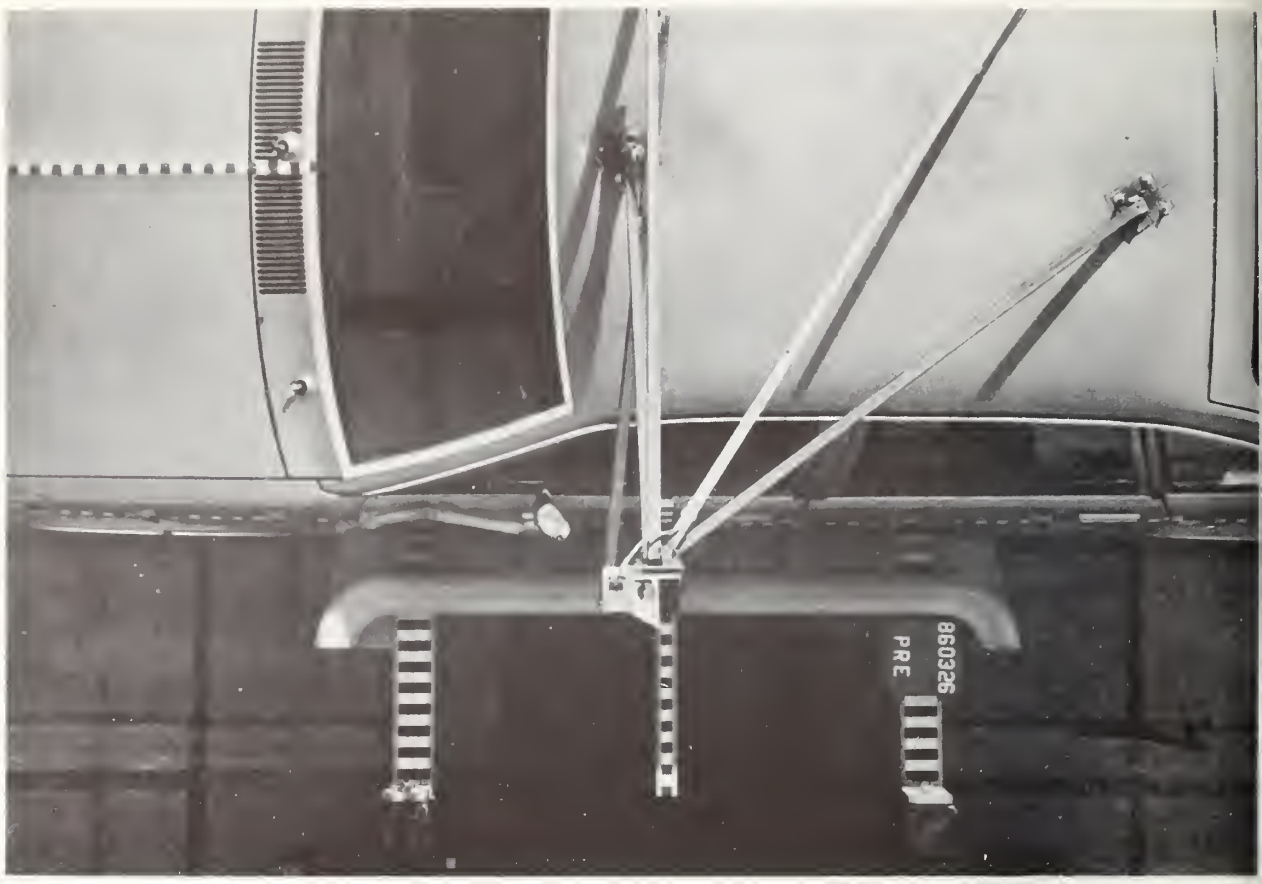


Figure A-13. PRE-TEST OVERHEAD VIEW

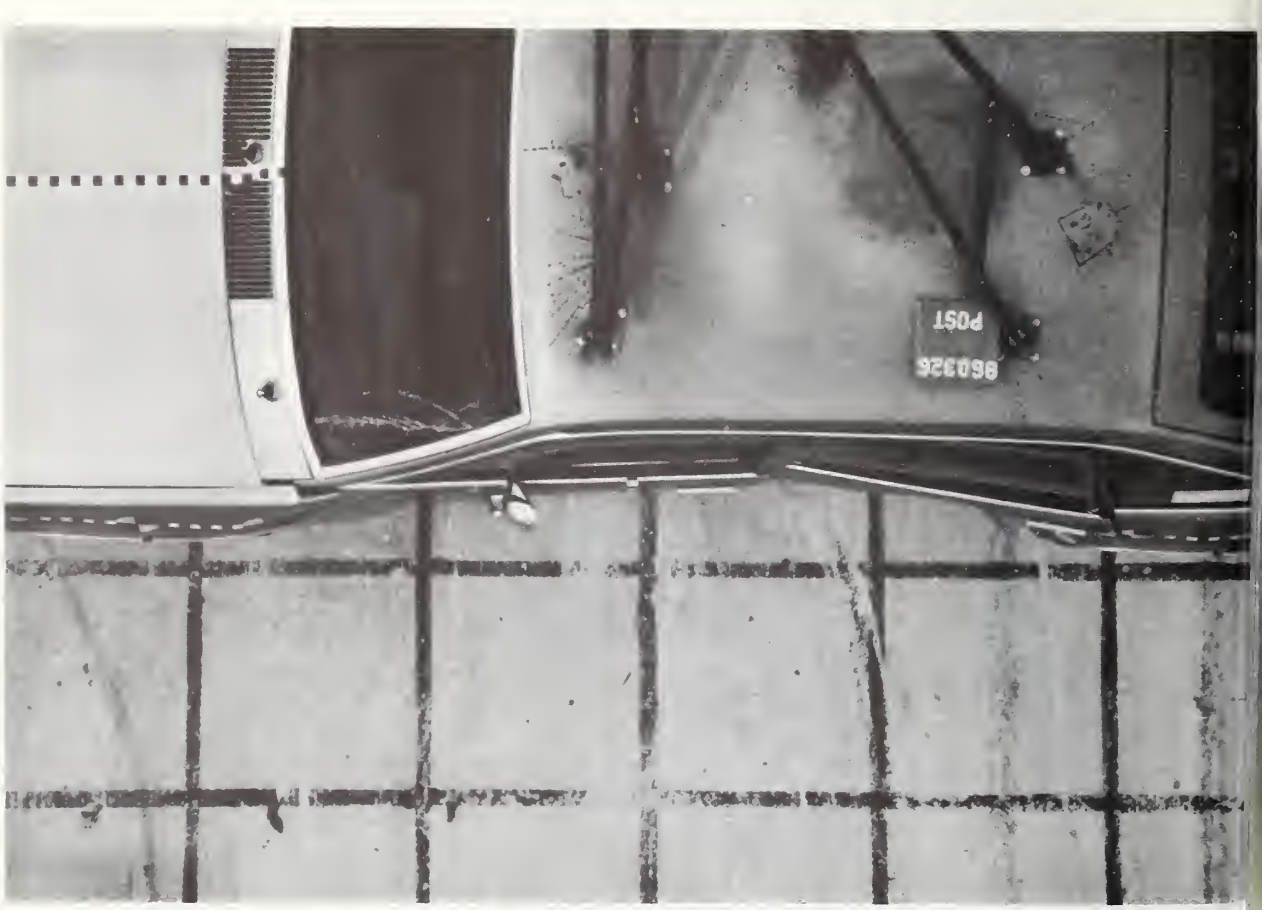


Figure A-14. POST-TEST OVERHEAD VIEW

Figure A-15. PRE-TEST OVERALL - VIEW 1

Figure A-16. PRE-TEST OVERALL - VIEW 2

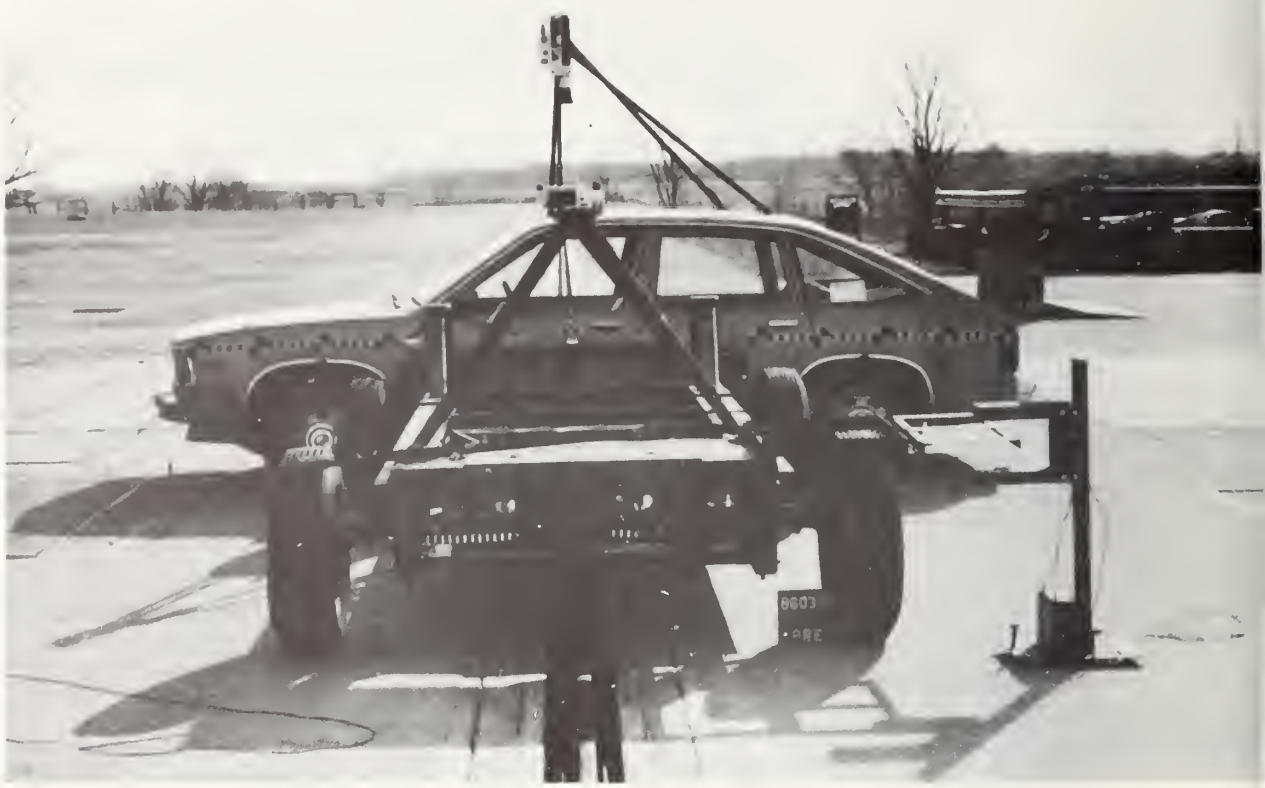


Figure A-17. PRE-TEST OVERALL - VIEW 3

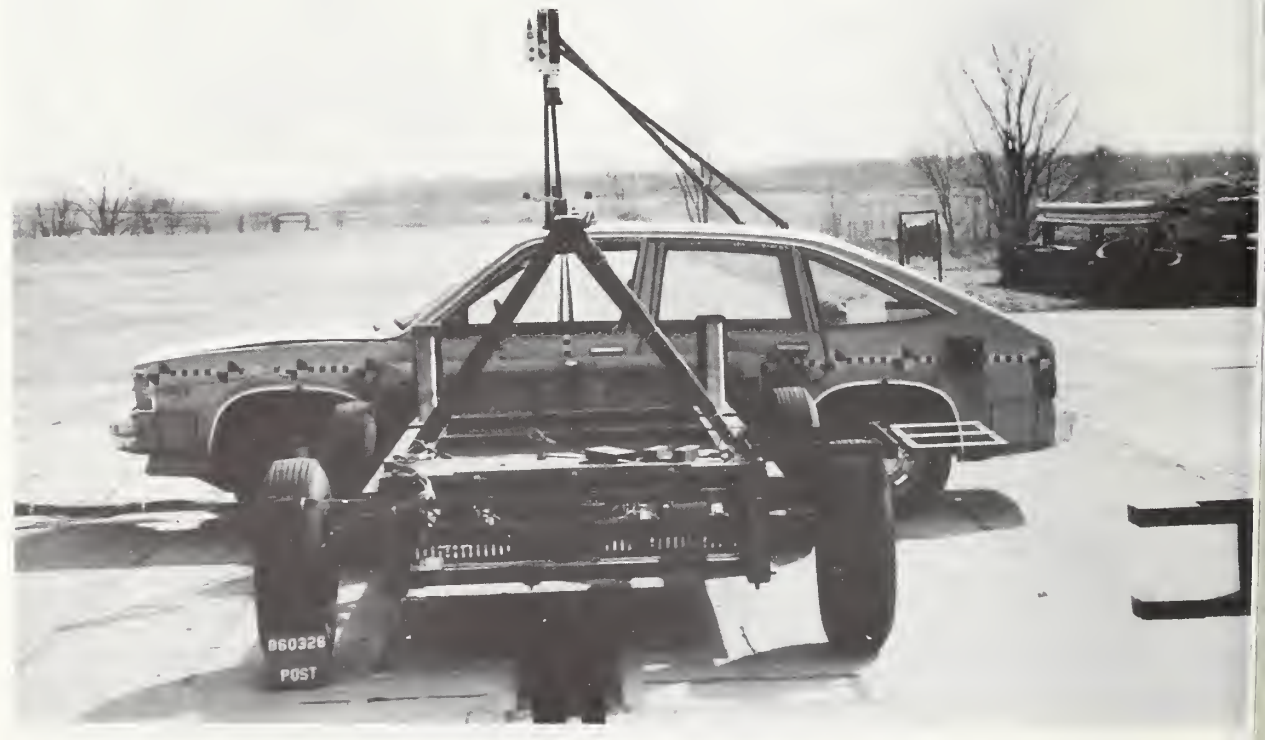


Figure A-18. POST-TEST OVERALL VIEW

Figure A-19. POST-TEST FRONT DRIVER DOOR VIEW

APPENDIX B

PHOTOGRAPHS

TEST #2 VEHICLE WAS IMPACTED PERPENDICULAR ON THE RIGHT SIDE HIGH SPEED.

Figure B-1. PRE-TEST FRONT VIEW

Figure B-2. POST-TEST FRONT VIEW

Figure B-3. PRE-TEST PASSENGER SIDE VIEW

Figure B-4. POST-TEST PASSENGER SIDE VIEW

Figure B-5. PRE-TEST REAR VIEW

Figure B-6. POST-TEST REAR VIEW

Figure B-7. PRE-TEST DRIVER SIDE VIEW

Figure B-8. POST-TEST DRIVER SIDE VIEW

Figure B-9. PRE-TEST PASSENGER FRONT THREE-QUARTER VIEW

Figure B-10. POST-TEST PASSENGER FRONT THREE-QUARTER VIEW

Figure B-11. PRE-TEST PASSENGER REAR THREE-QUARTER VIEW

Figure B-12. POST-TEST PASSENGER REAR THREE-QUARTER VIEW

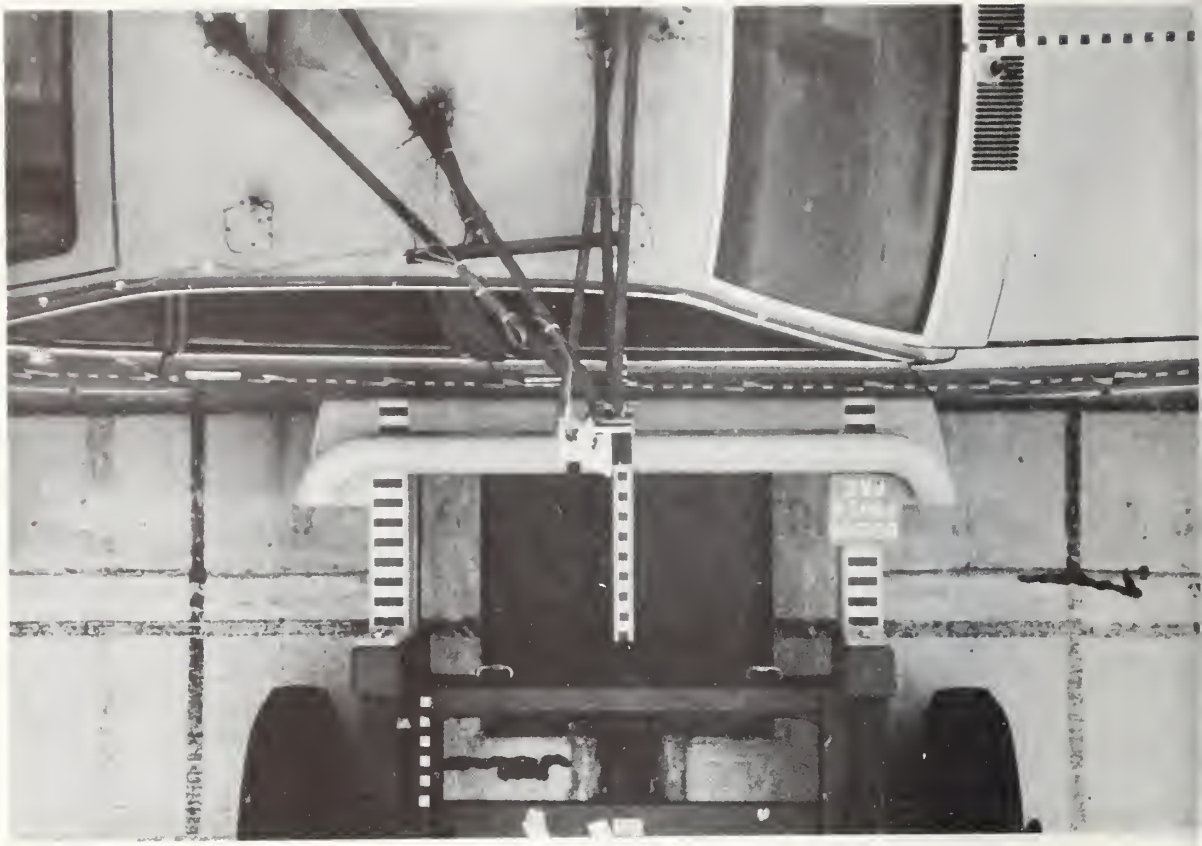


Figure B-13. PRE-TEST OVERHEAD VIEW

Figure B-14. POST-TEST OVERHEAD VIEW

Figure B-15. PRE-TEST OVERALL - VIEW 1

Figure B-16. PRE-TEST OVERALL - VIEW 2

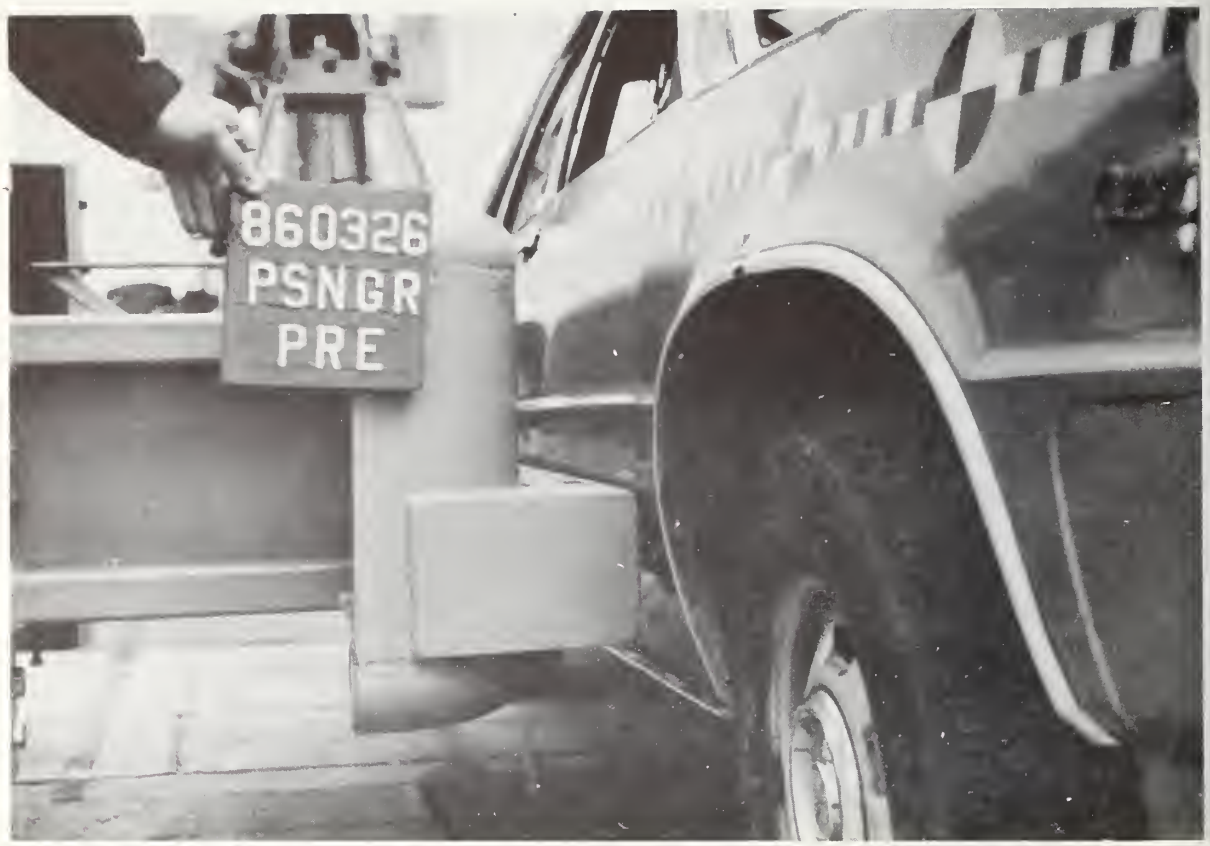


Figure B-17. PRE-TEST OVERALL - VIEW 3

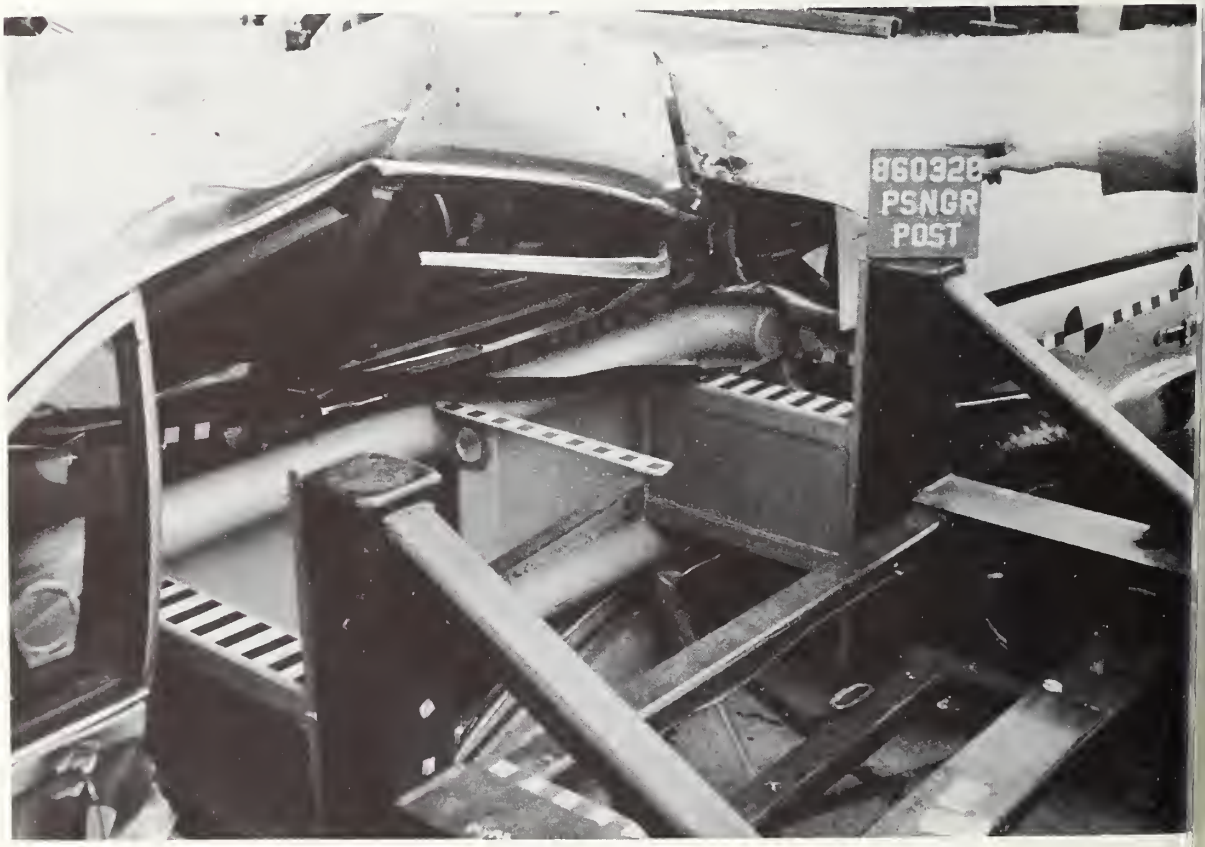


Figure B-18. POST-TEST OVERALL - VIEW 1

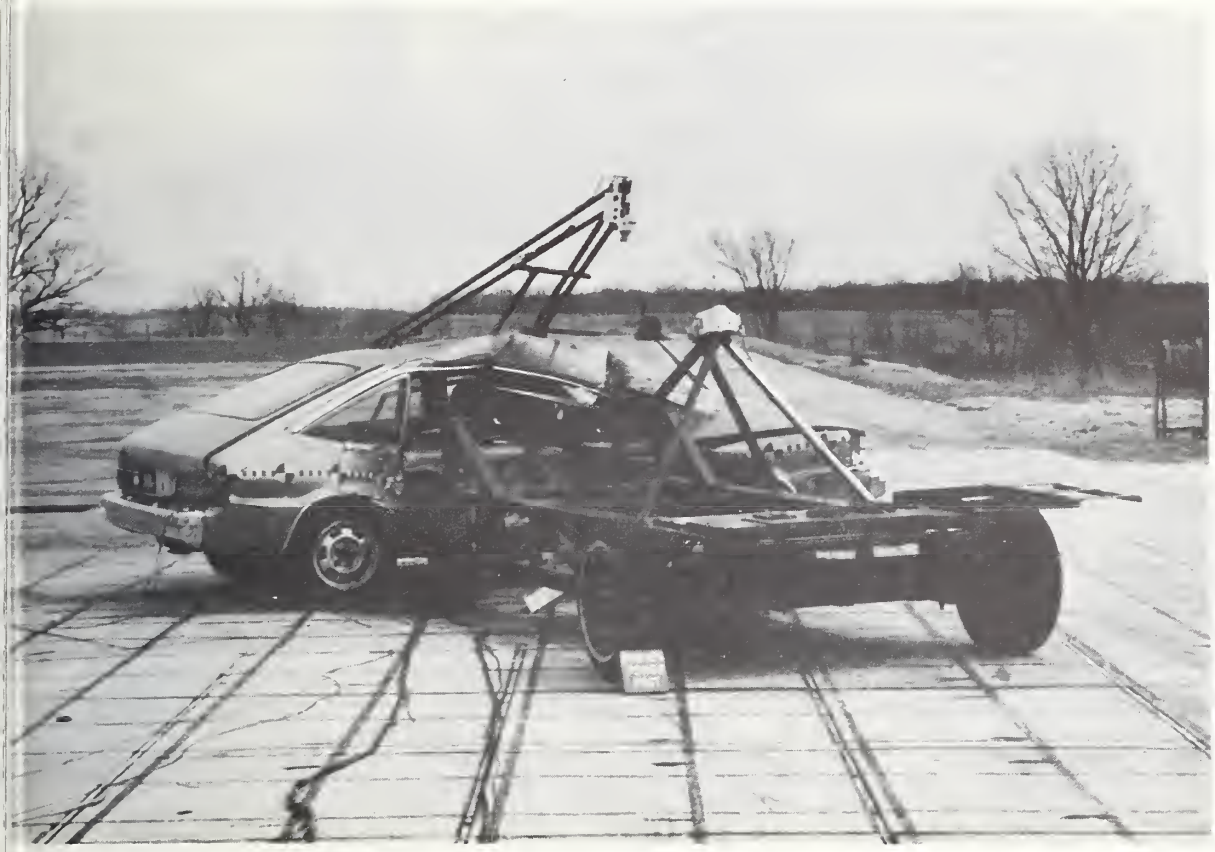


Figure B-19. POST-TEST OVERALL - VIEW 2

Figure B-20. POST-TEST OVERALL - VIEW 3

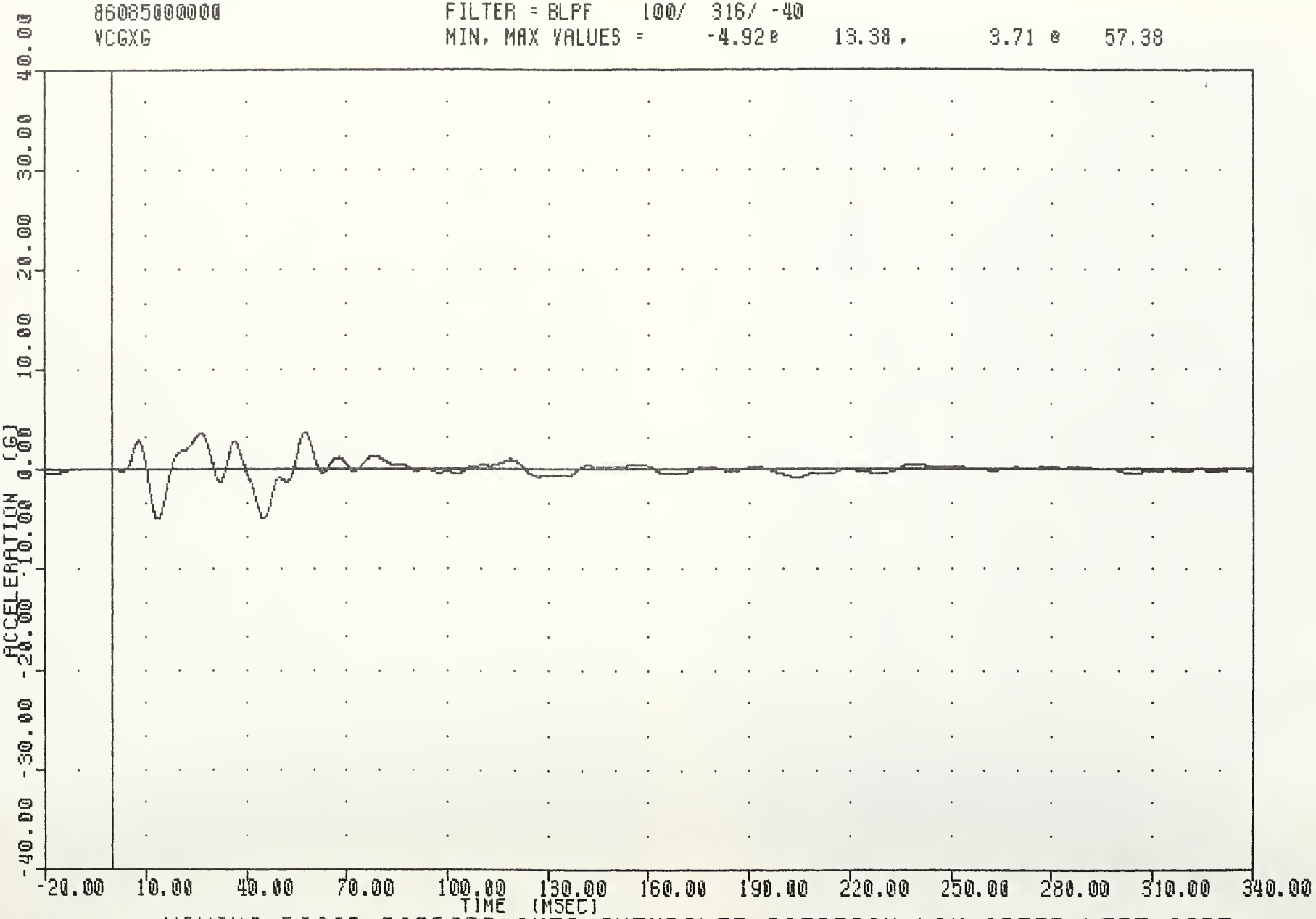
Figure B-21. POST-TEST OVERALL - VIEW 4

APPENDIX C

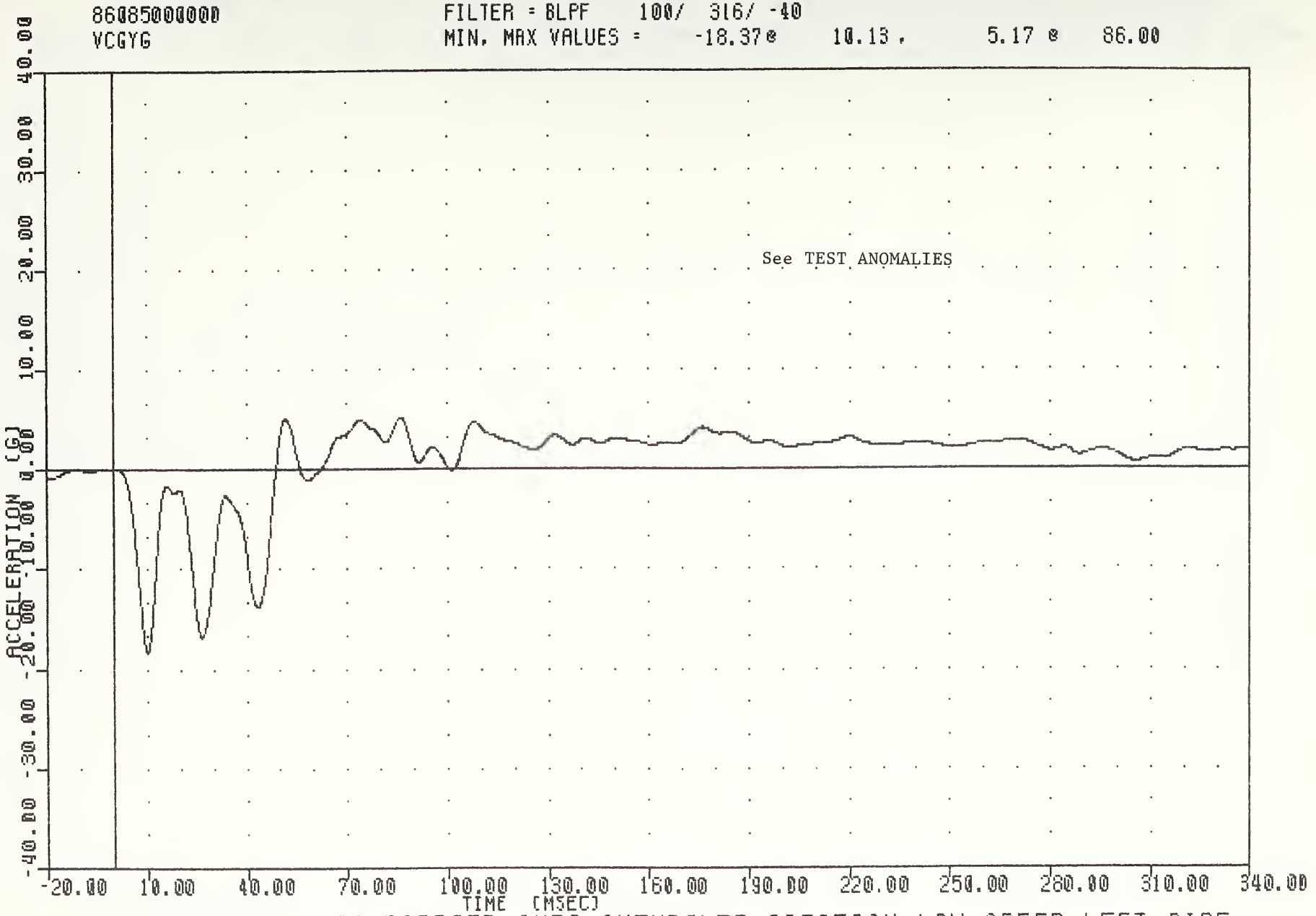
DATA PLOT PRESENTATION

TEST #1 VEHICLE WAS IMPACTED PERPENDICULAR ON THE LEFT SIDE LOW SPEED.

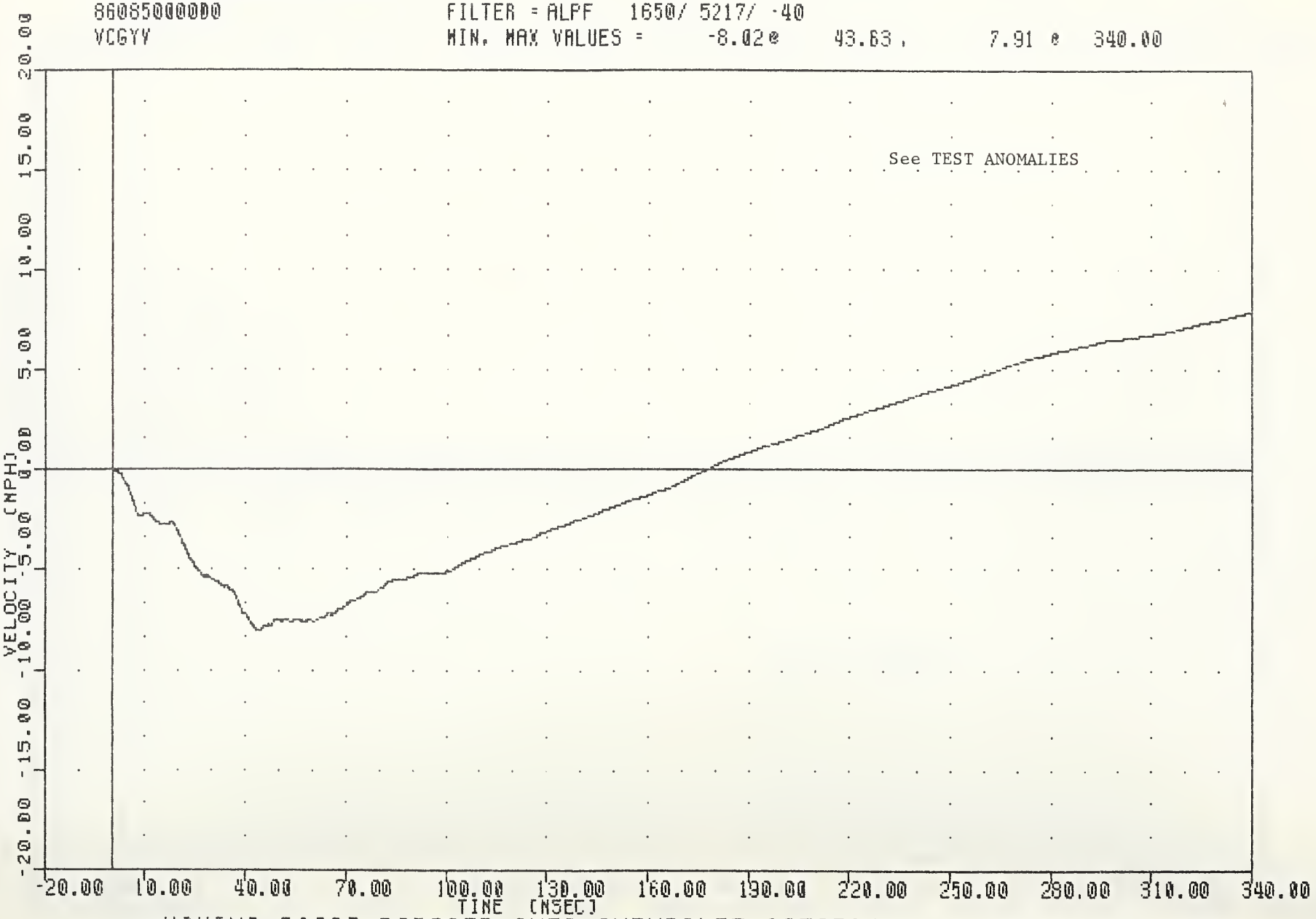
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211.



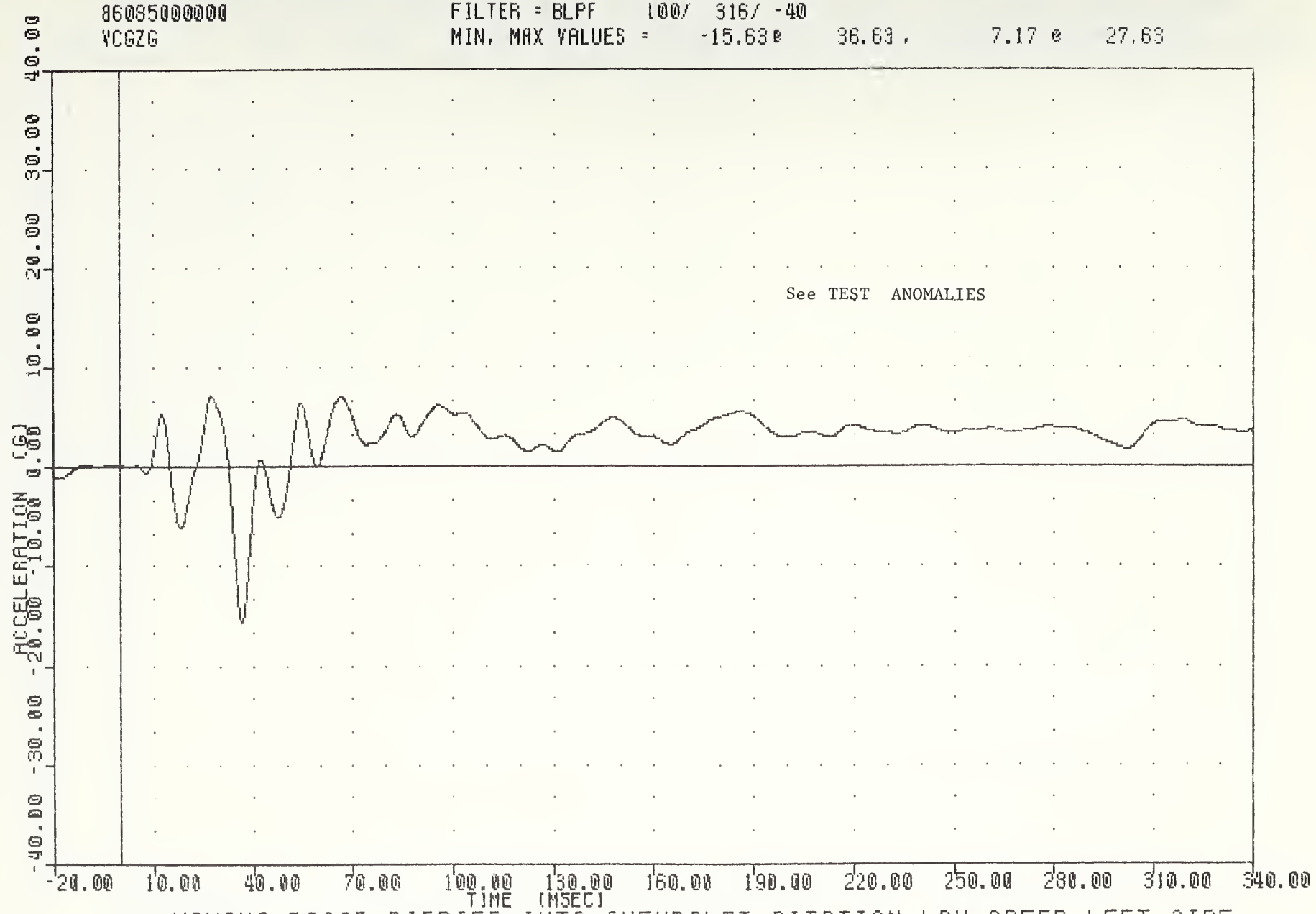
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION X AXIS



MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS

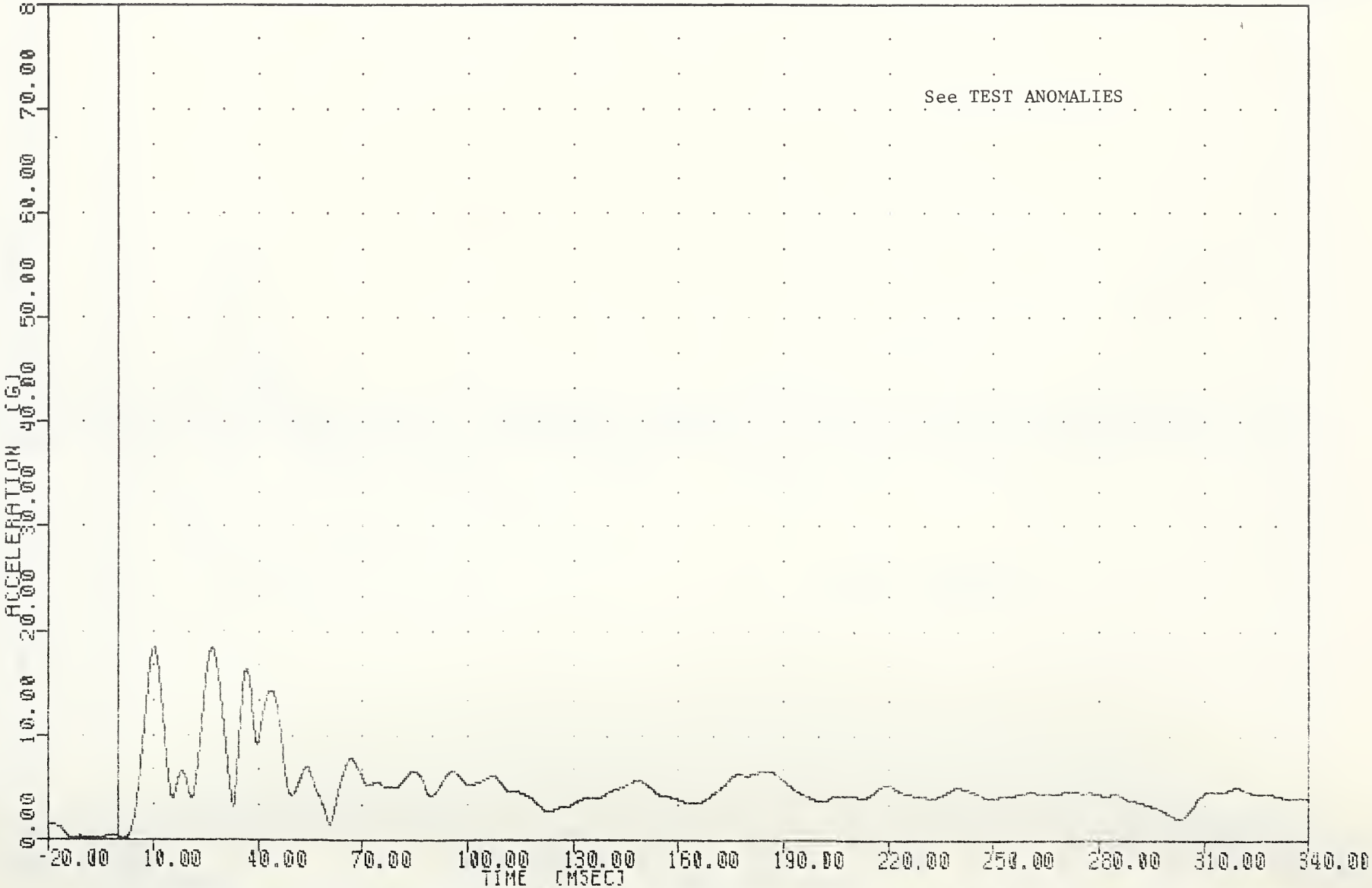


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
DELTA V USING VCGYG

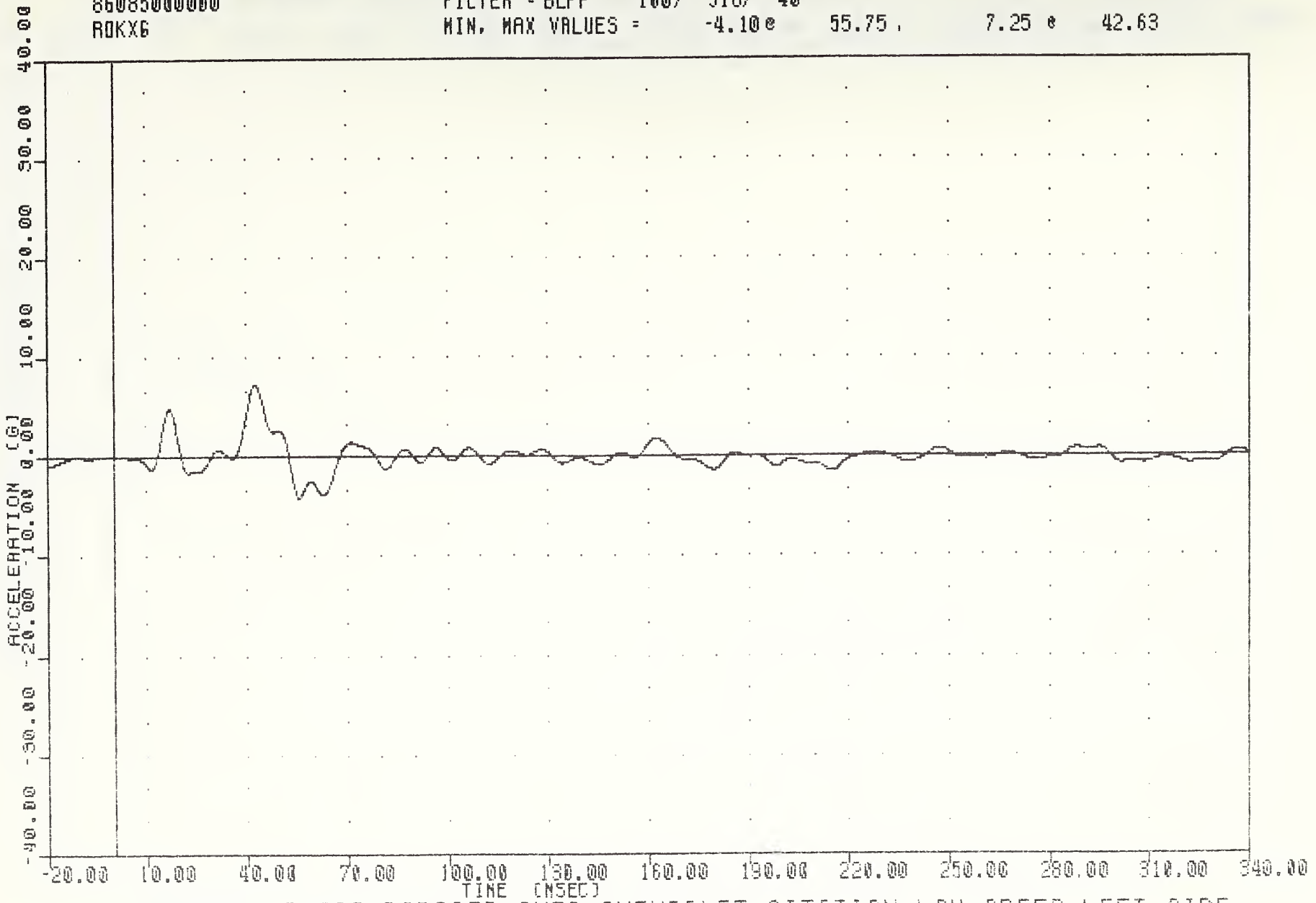


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS

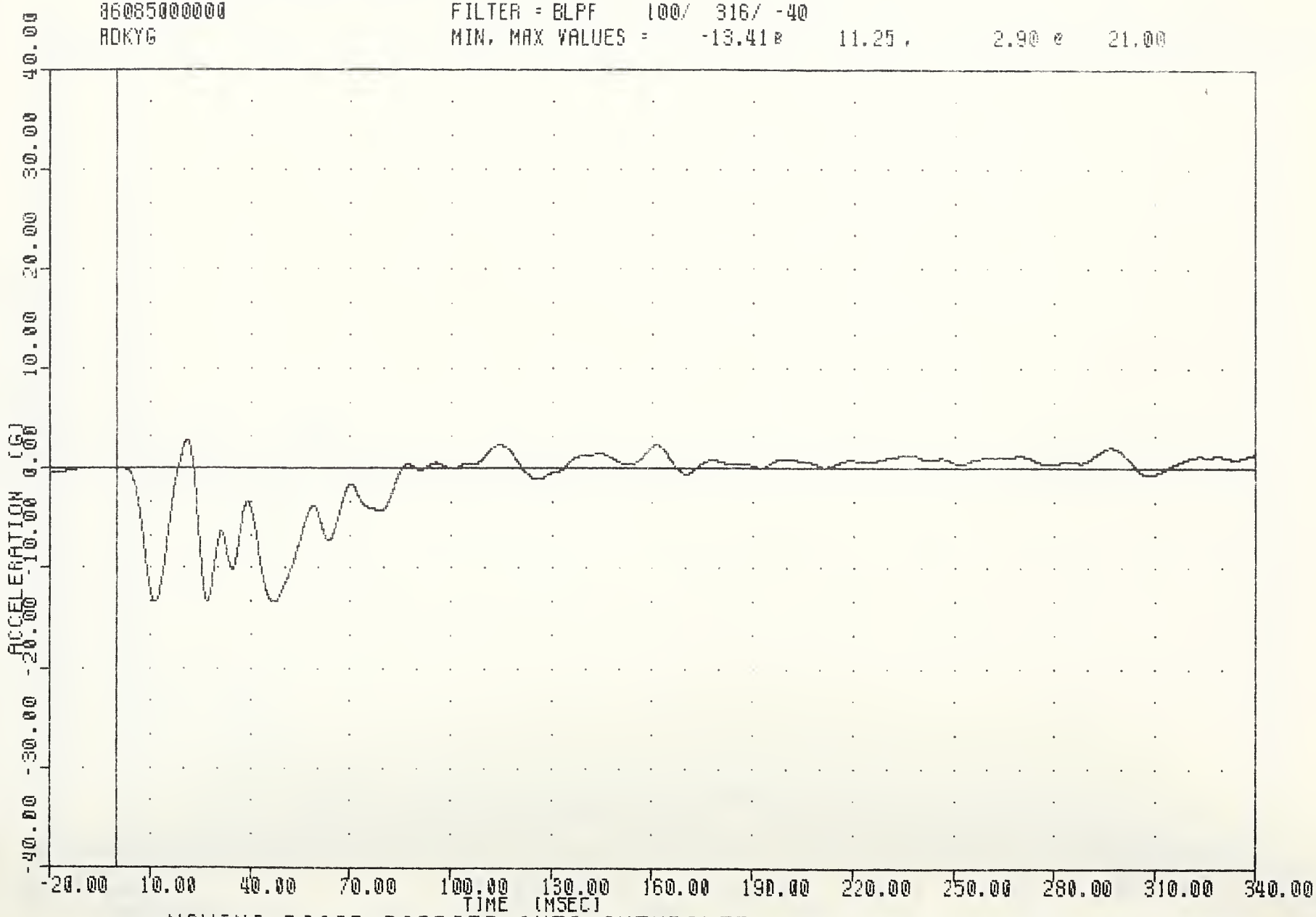
VRT , 8603261
DYNAMIC TESTING SIDE CRUSH
86085000000 FILTER = BLPF 100/ 316/ -40
VCGRG MIN, MAX VALUES = 0.06 @ -13.13 , 18.46 @ 10.13



MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION RESULTANT

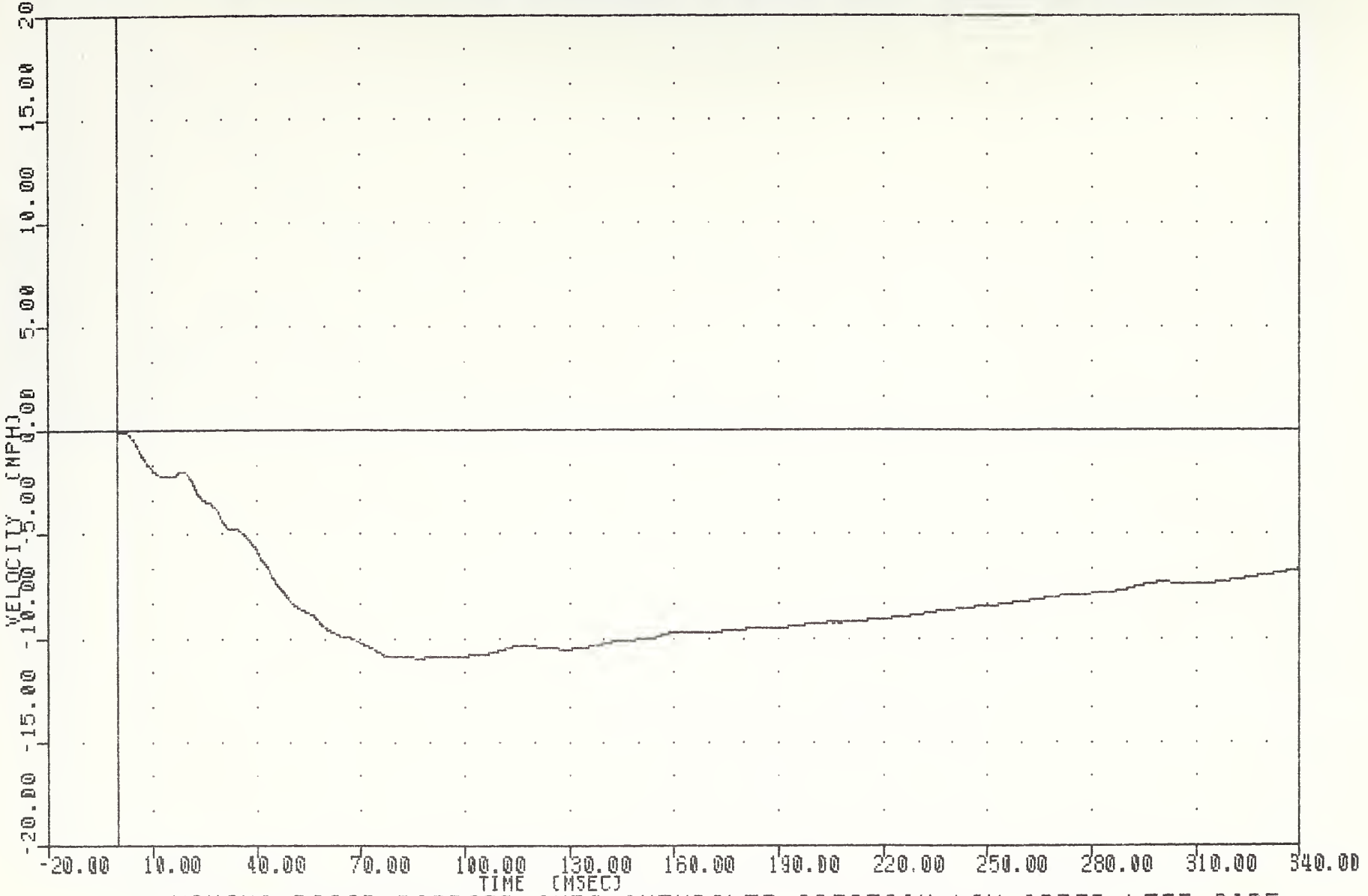


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE REAR DECK ACCELERATION X AXIS

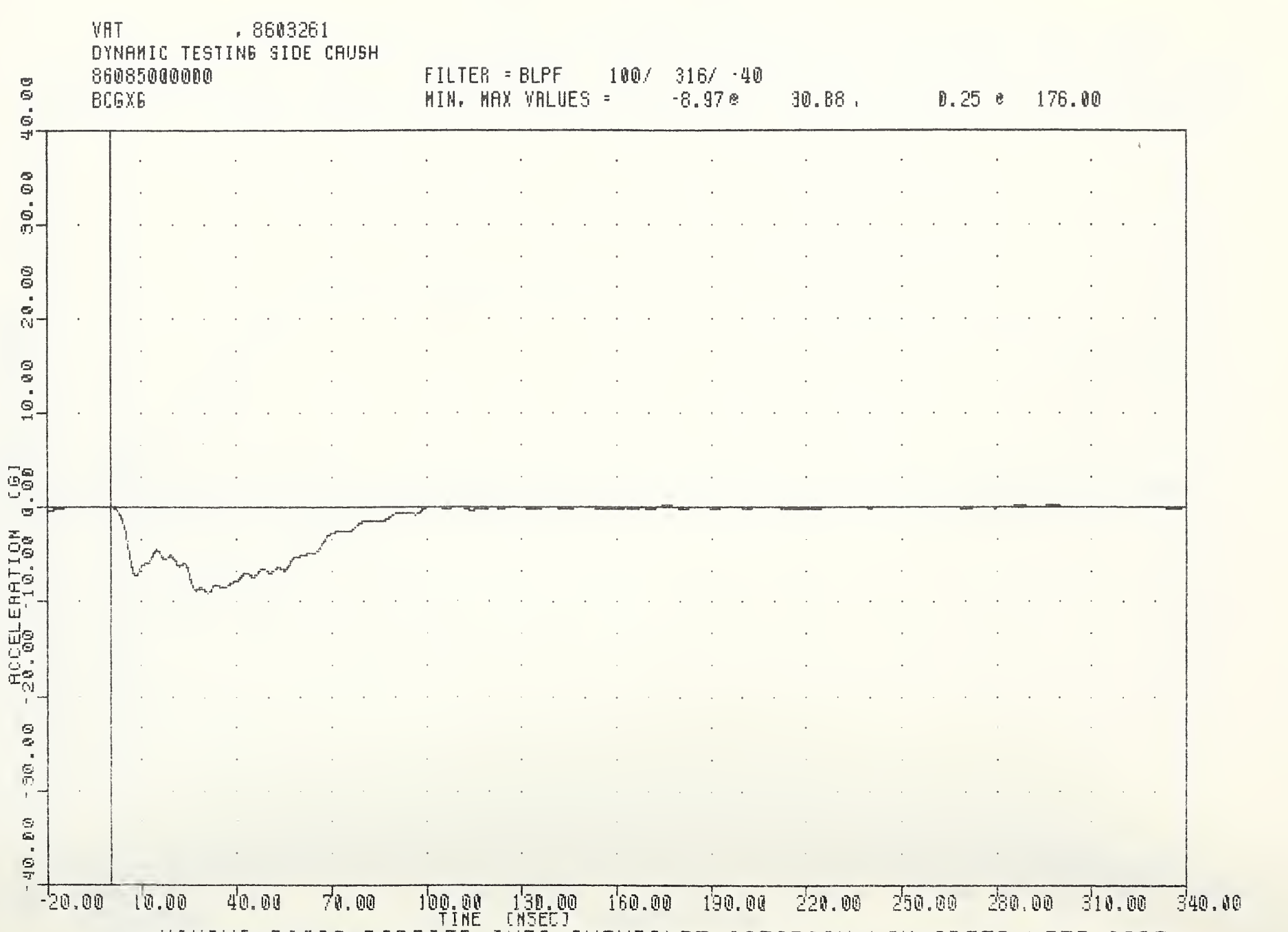


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE REAR DECK ACCELERATION Y AXIS

VRT , 8603261
DYNAMIC TESTING SIDE CRUSH
86085000000
RDKYV
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -10.96 @ 86.86 , 0.00 @ -17.50

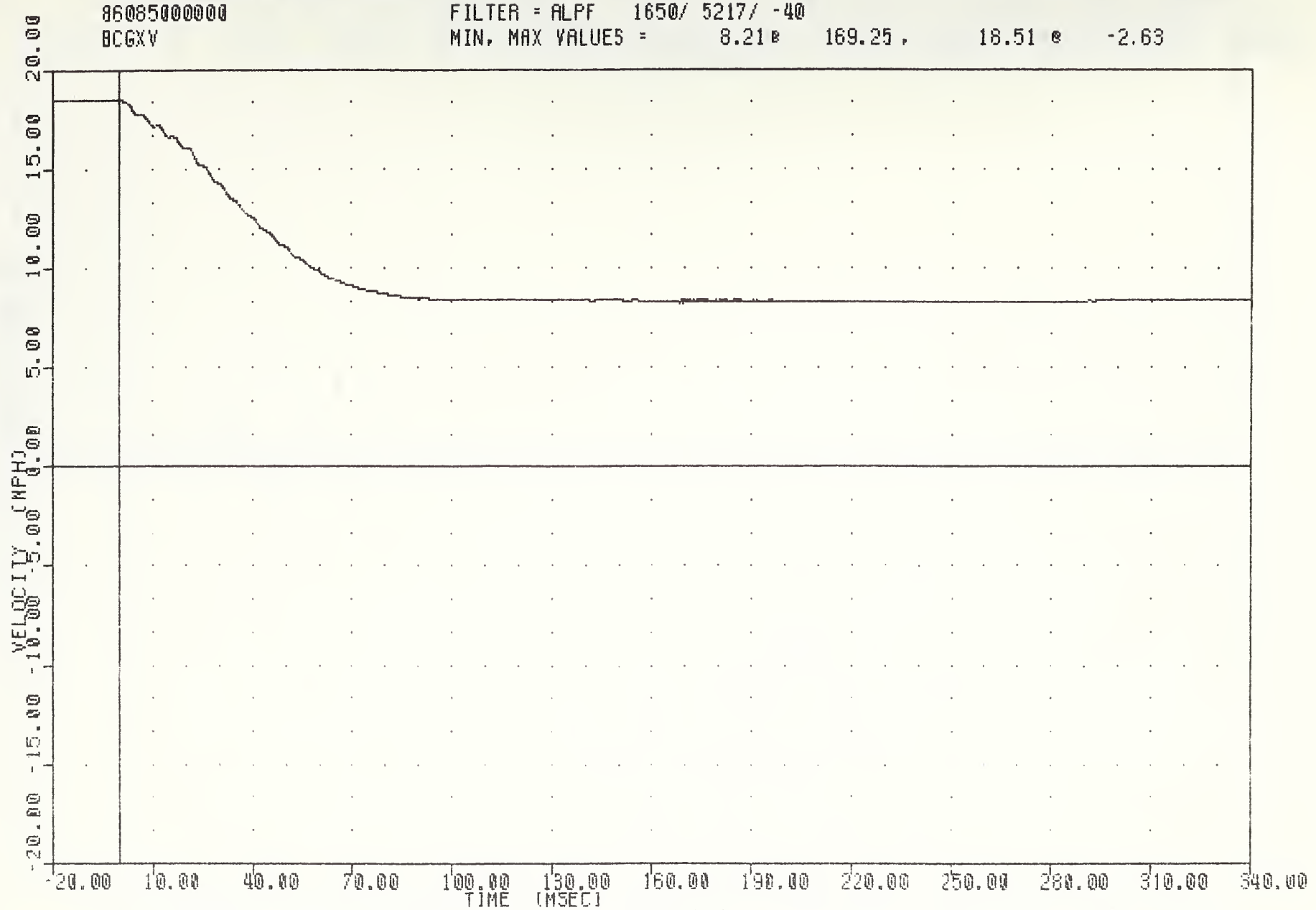


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
DELTA V USING RDKYG

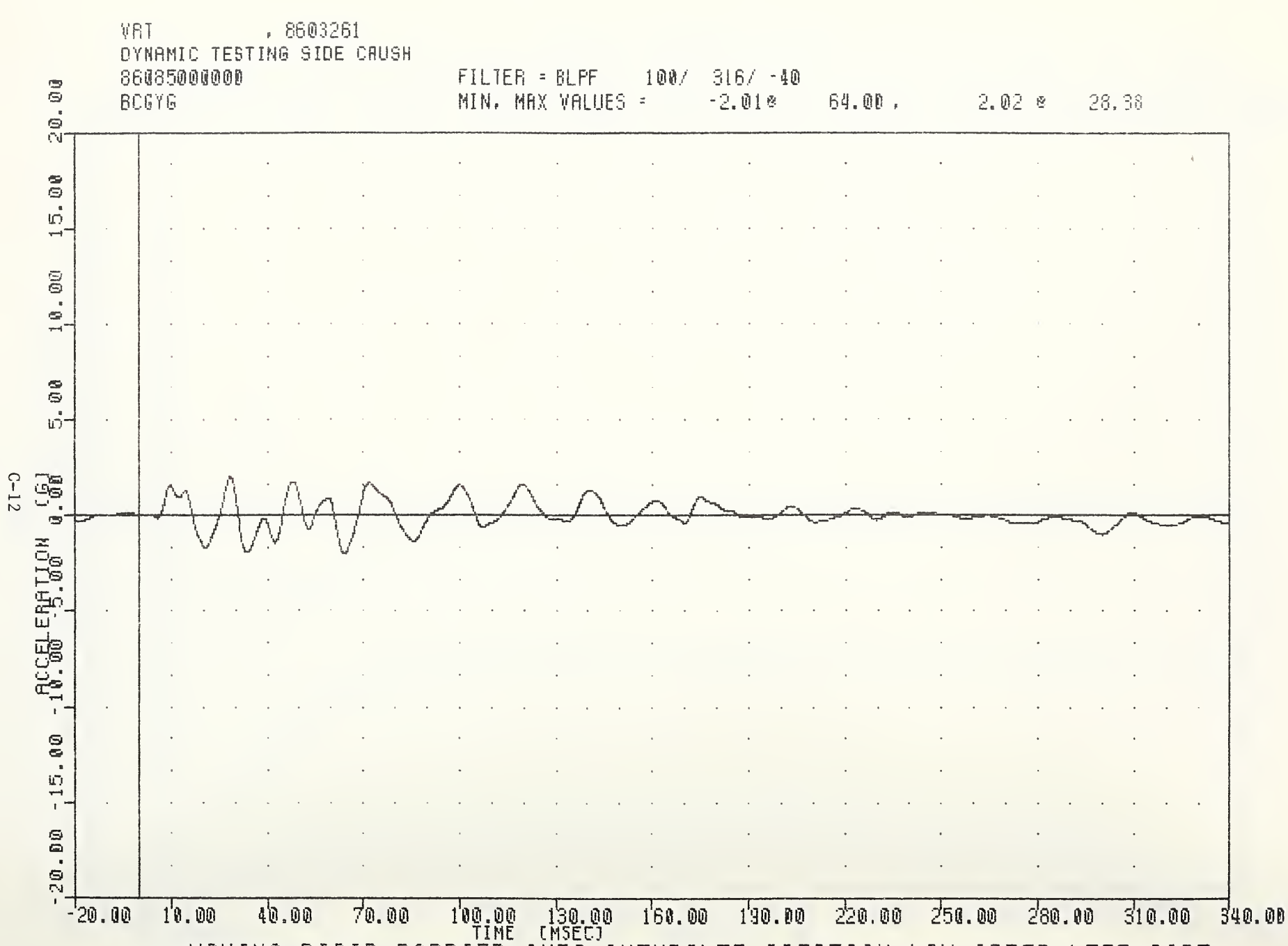


MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS

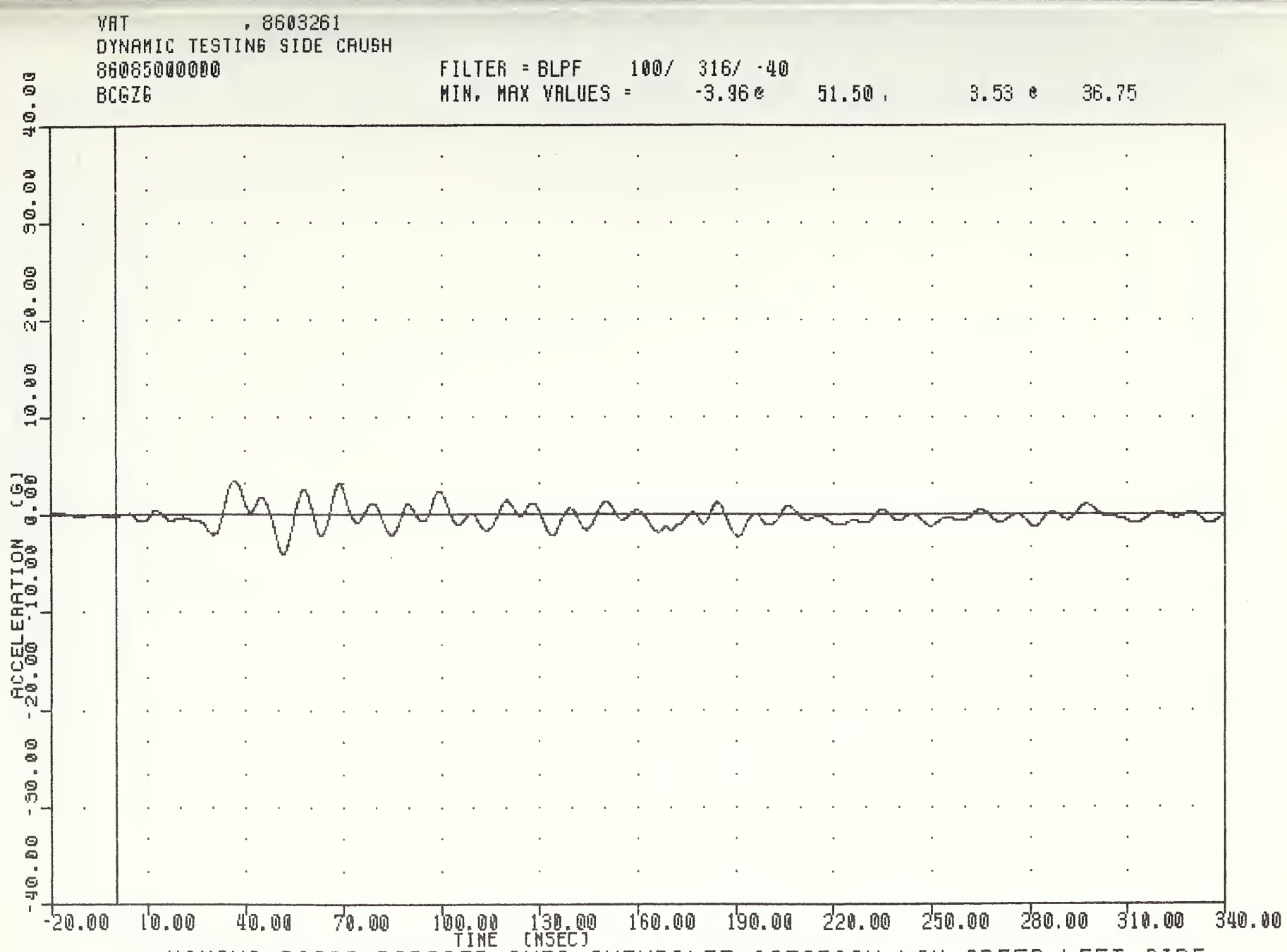
VRT , 8603261



MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
DELTA V USING BCGXG



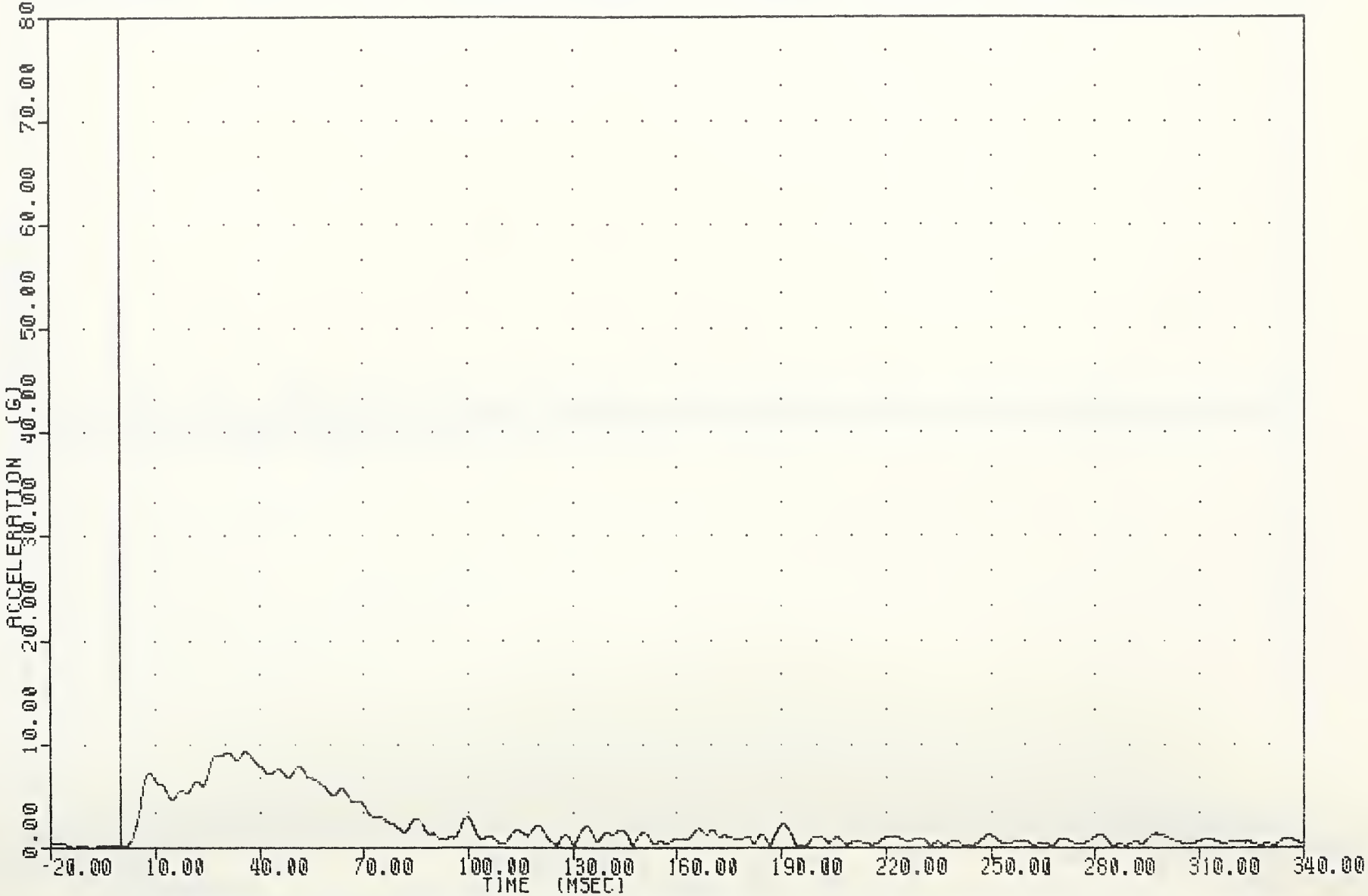
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS



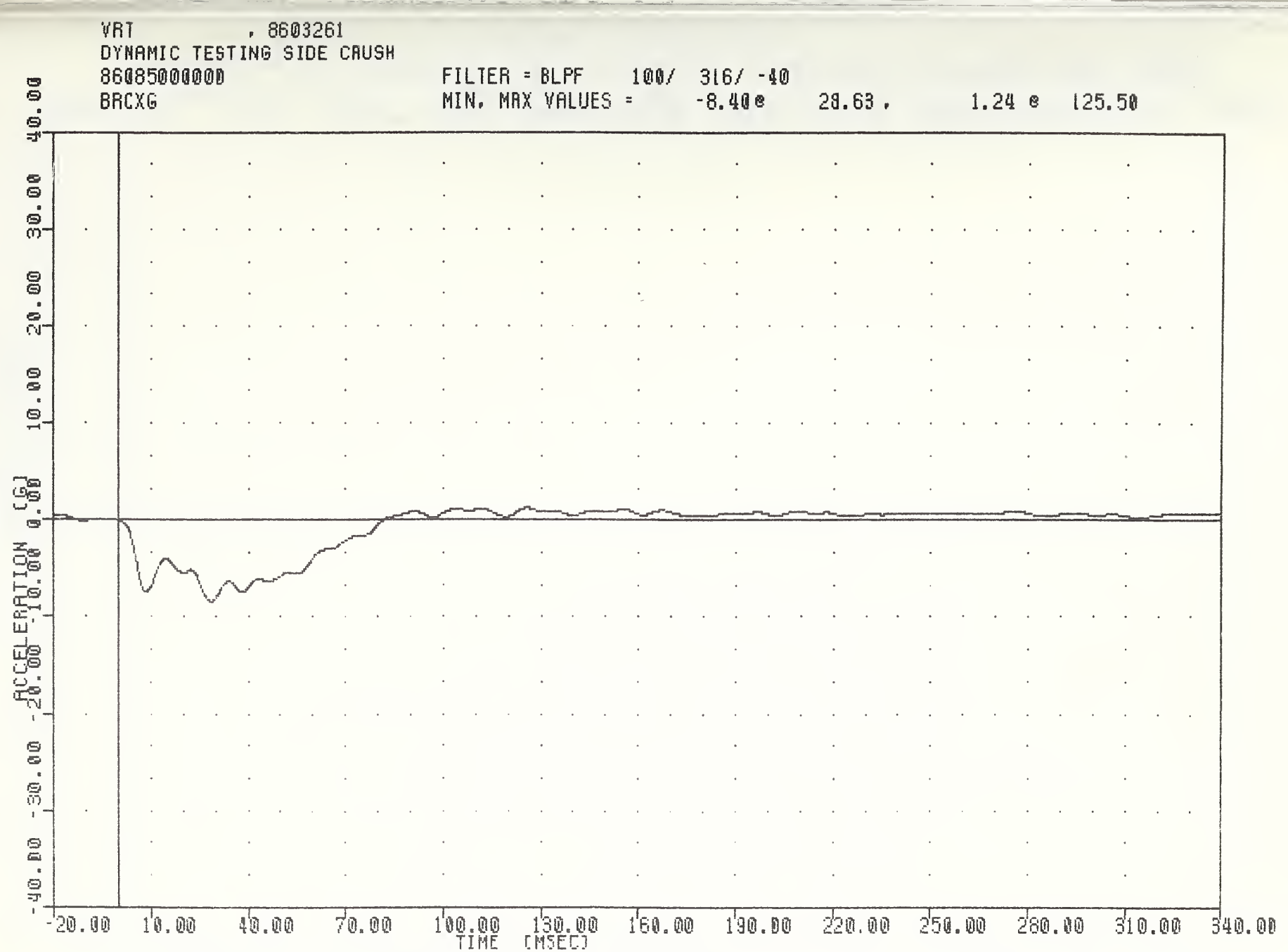
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS

VRT , 860326]
DYNAMIC TESTING SIDE CRUSH
86085000000
BCGRG

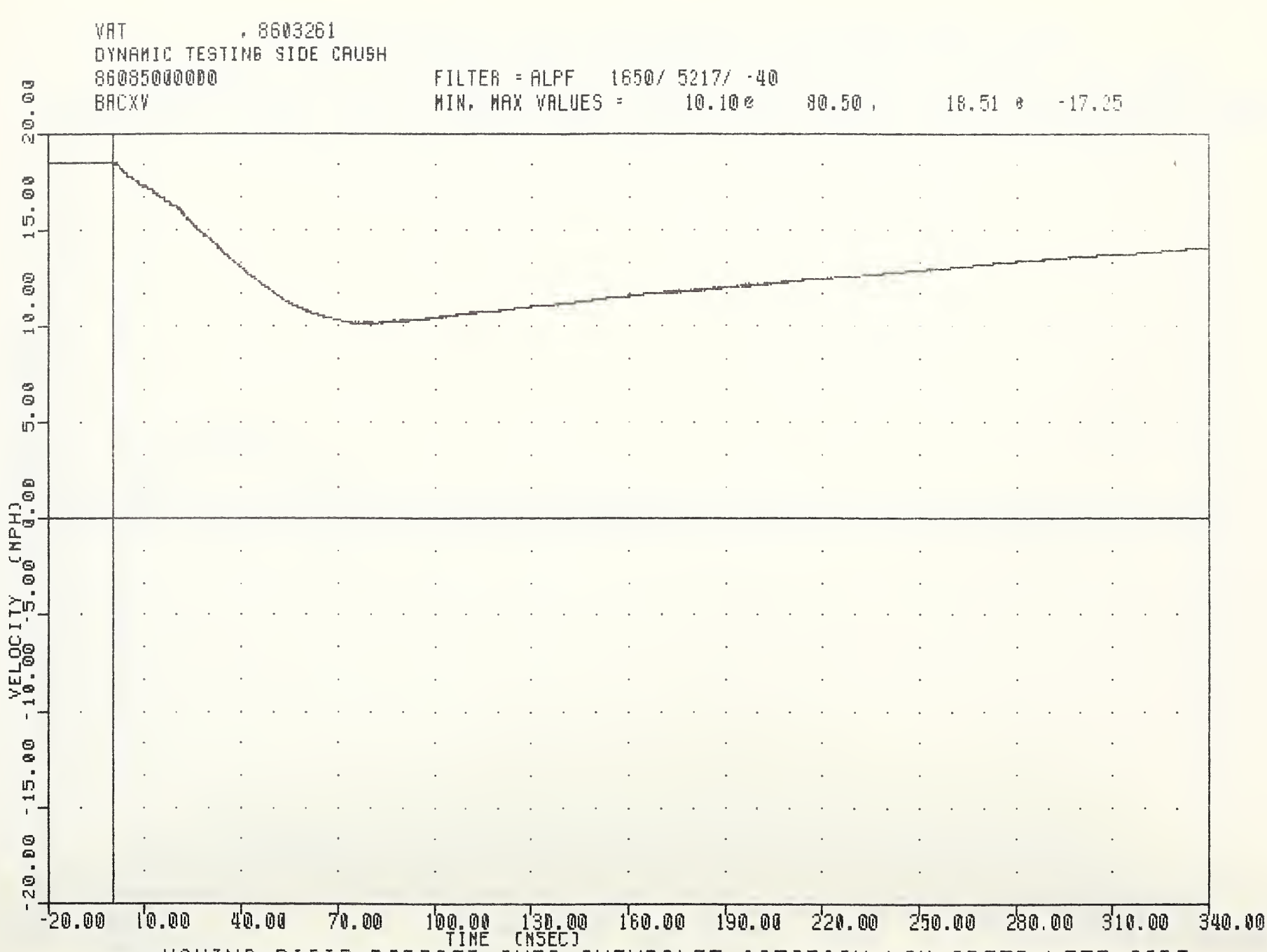
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.02@ -13.50 , 9.26 @ 36.13



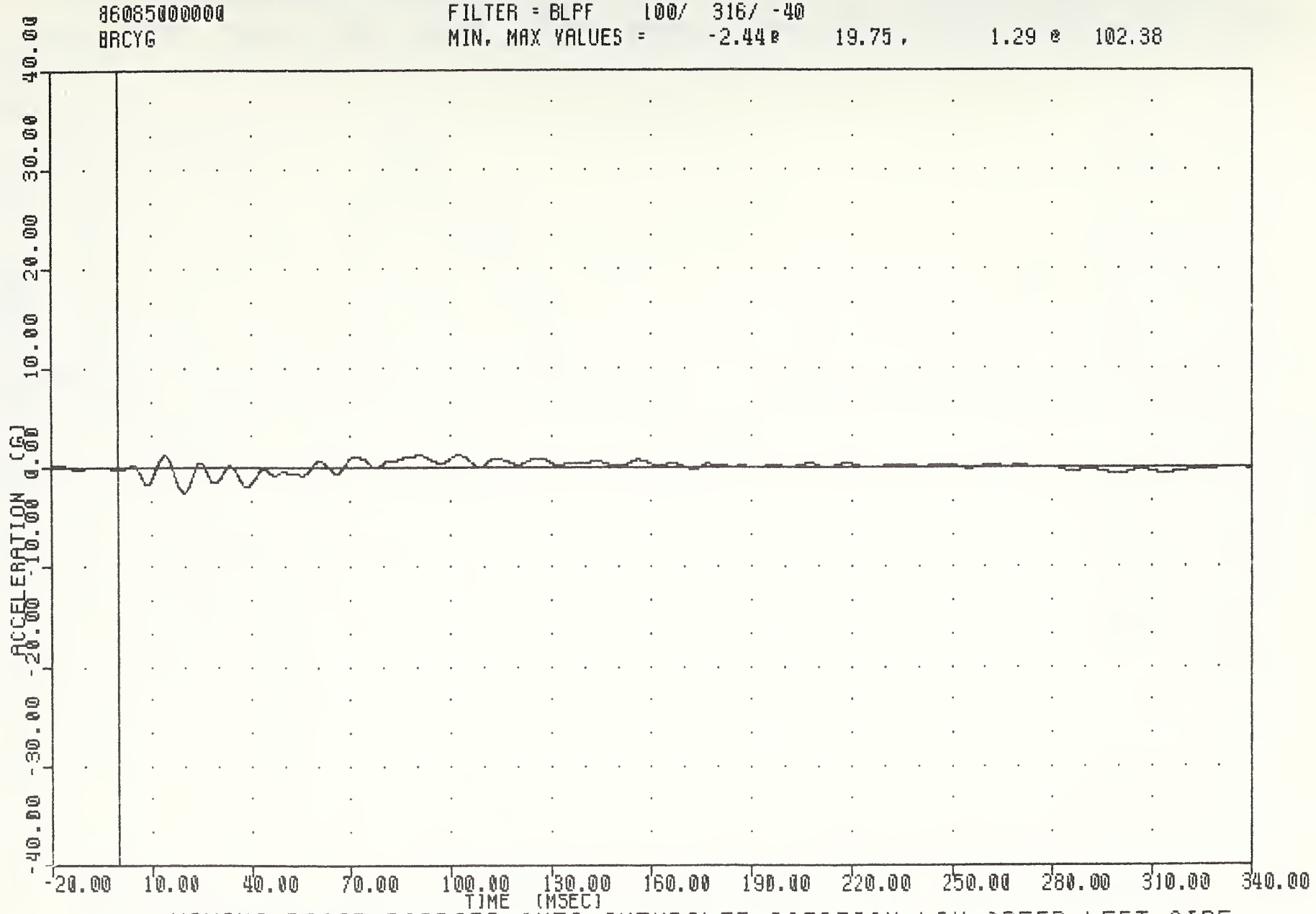
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION RESULTANT



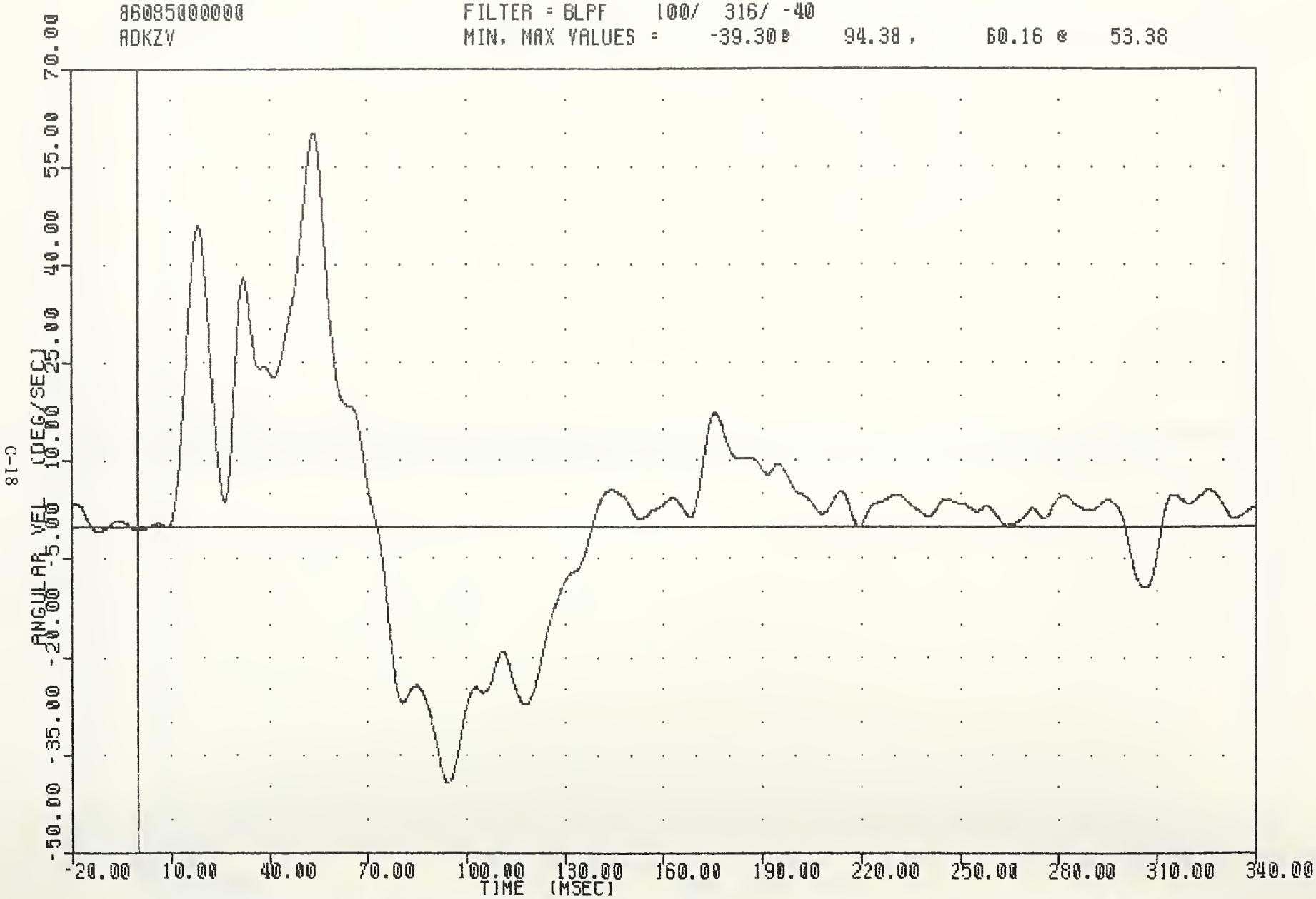
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS



MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
DELTA V USING BRCXG



MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS



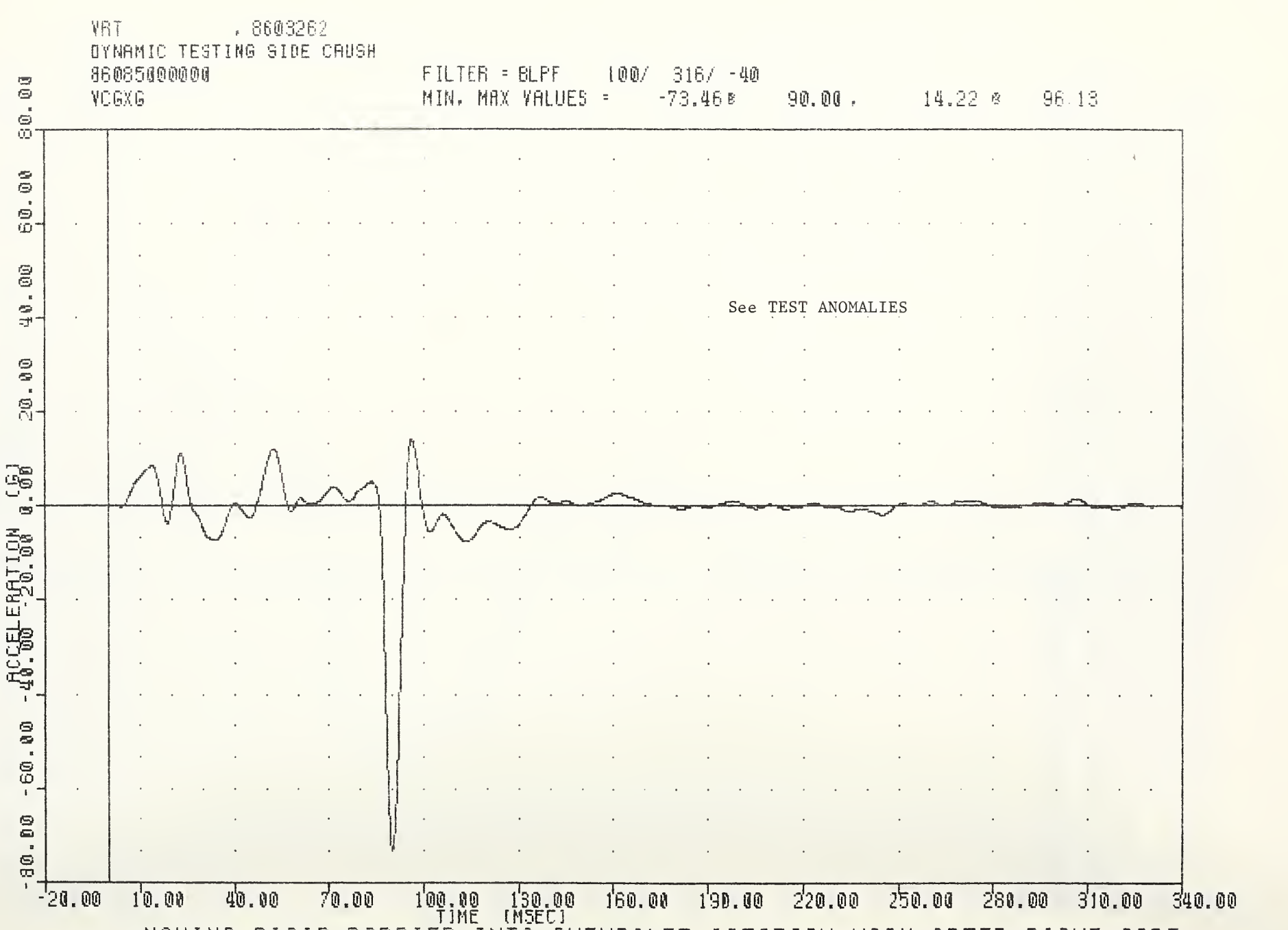
MOVING RIGID BARRIER INTO CHEVROLET CITATION LOW SPEED LEFT SIDE
VEHICLE YAW RATE DEGREE/SECOND

APPENDIX D

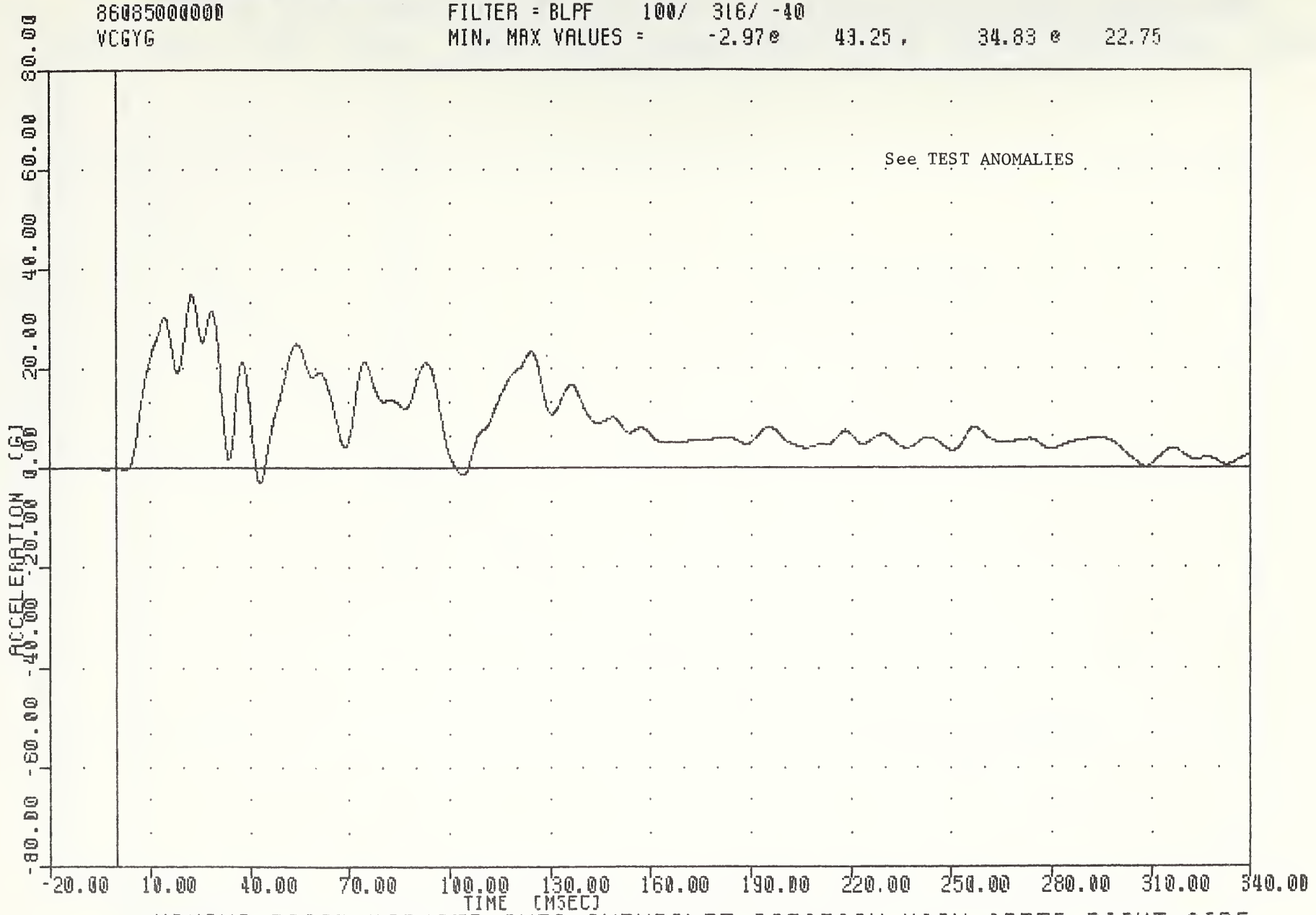
DATA PLOT PRESENTATION

TEST #2 VEHICLE WAS IMPACTED PERPENDICULAR ON THE RIGHT SIDE HIGH SPEED.

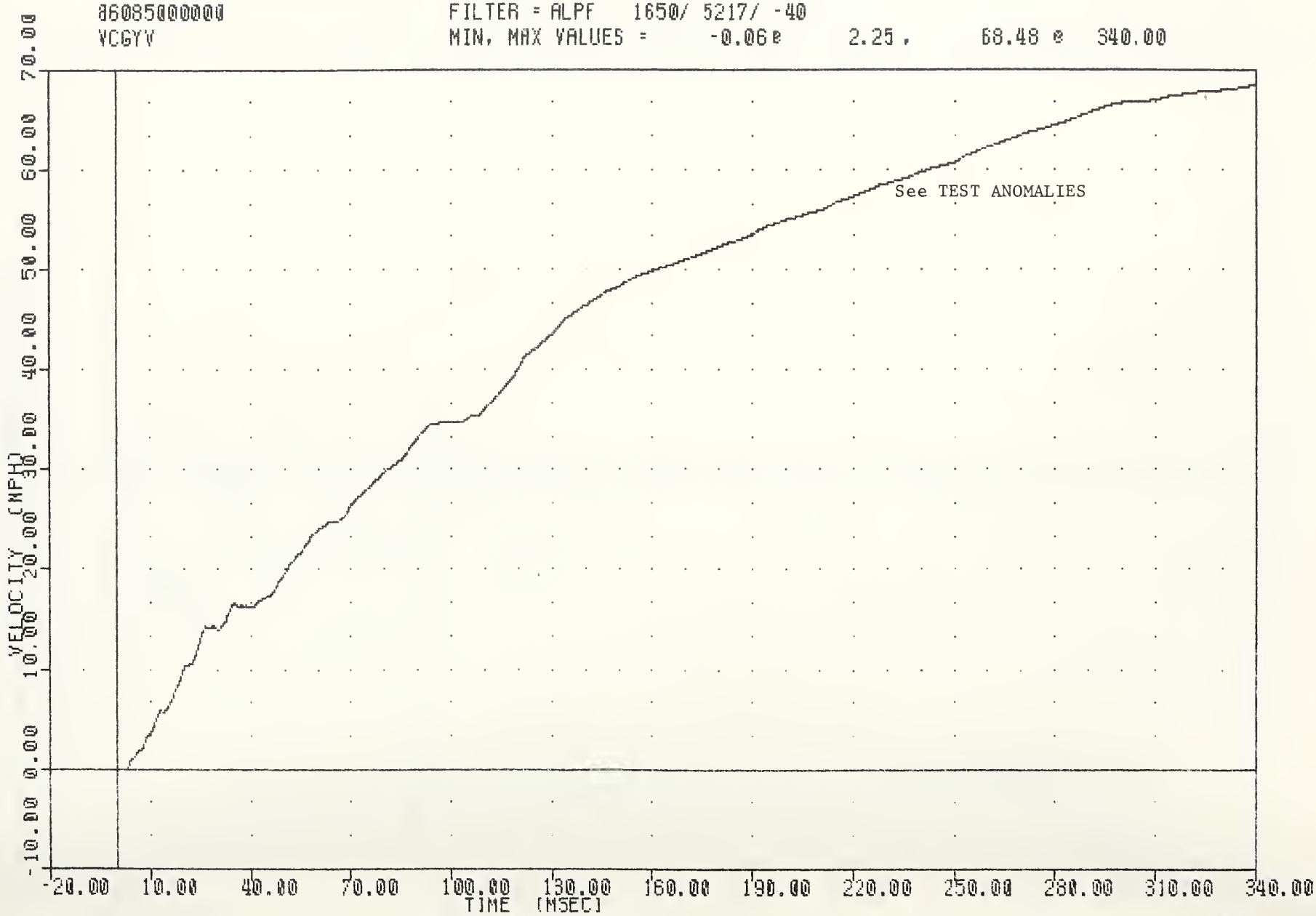
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211.



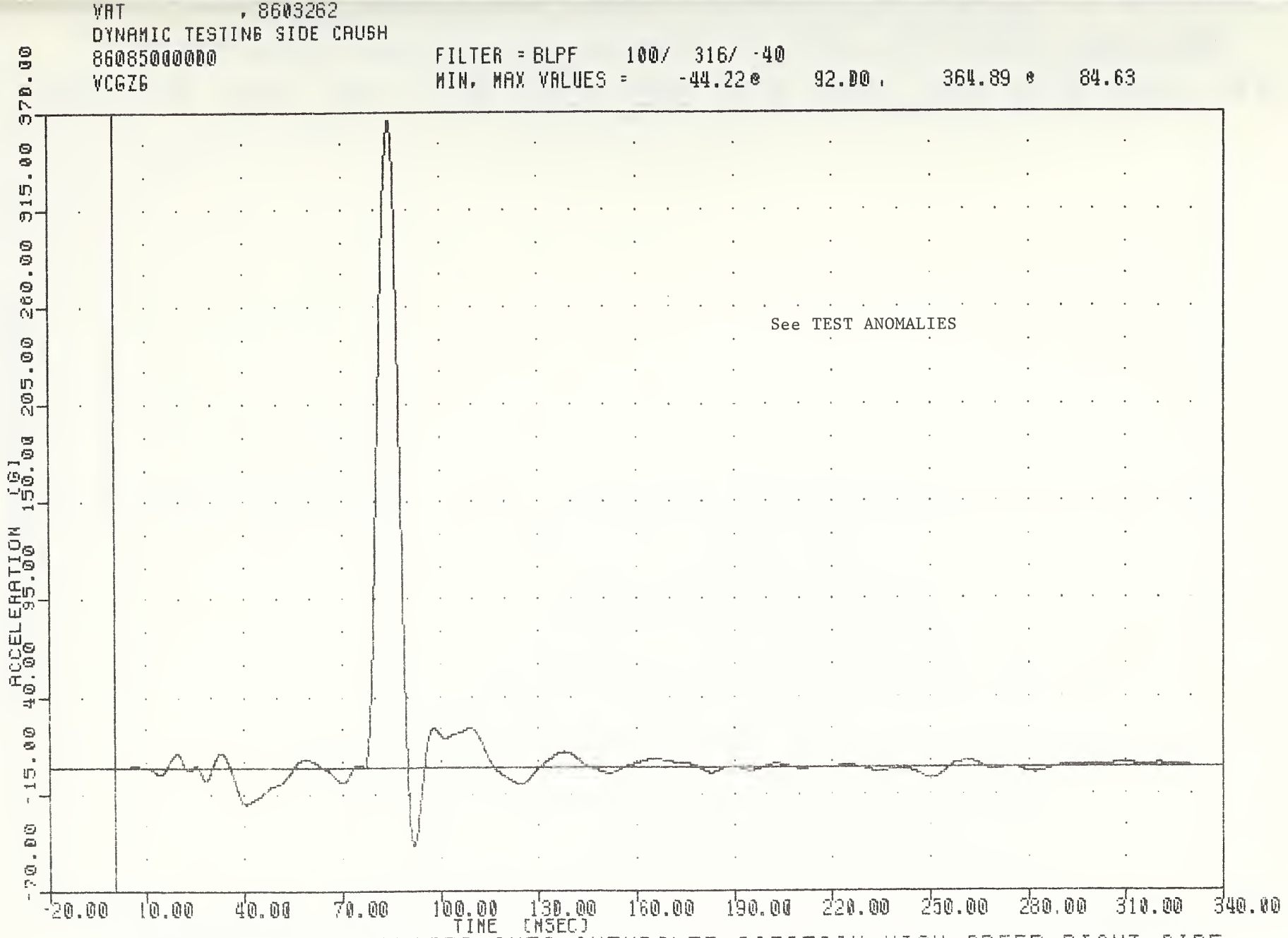
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION X AXIS



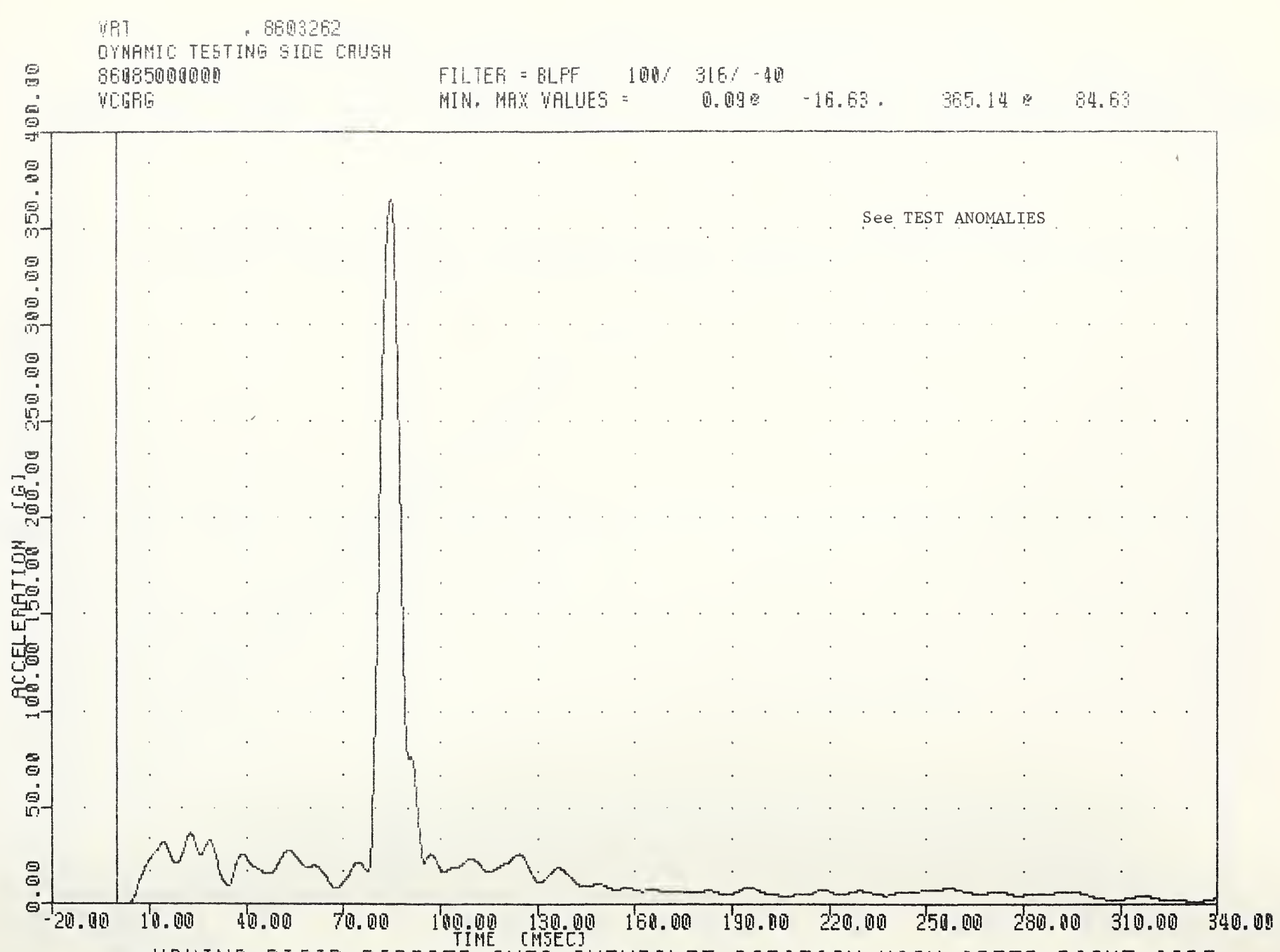
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS



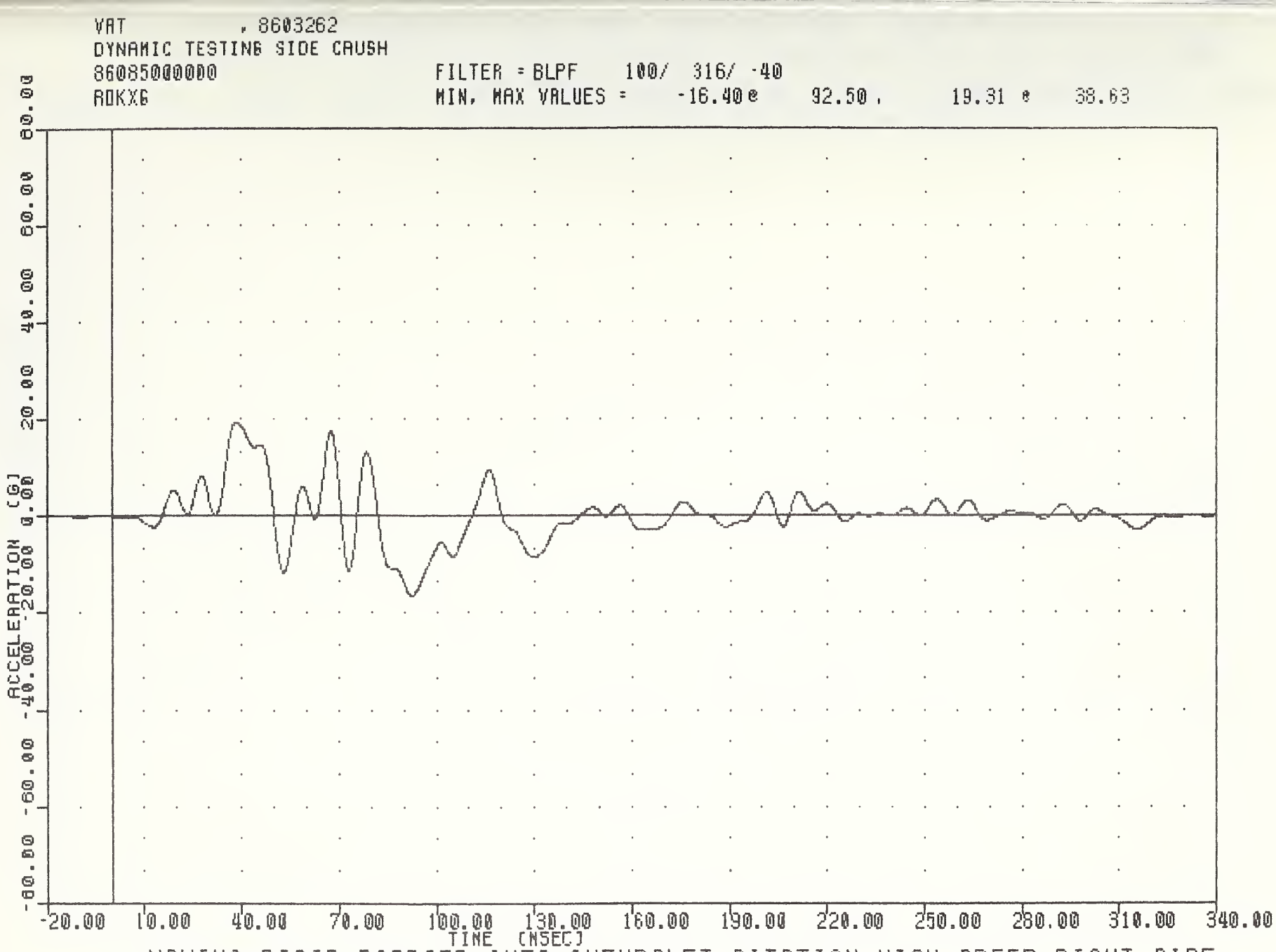
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
DELTA V USING VCGYG



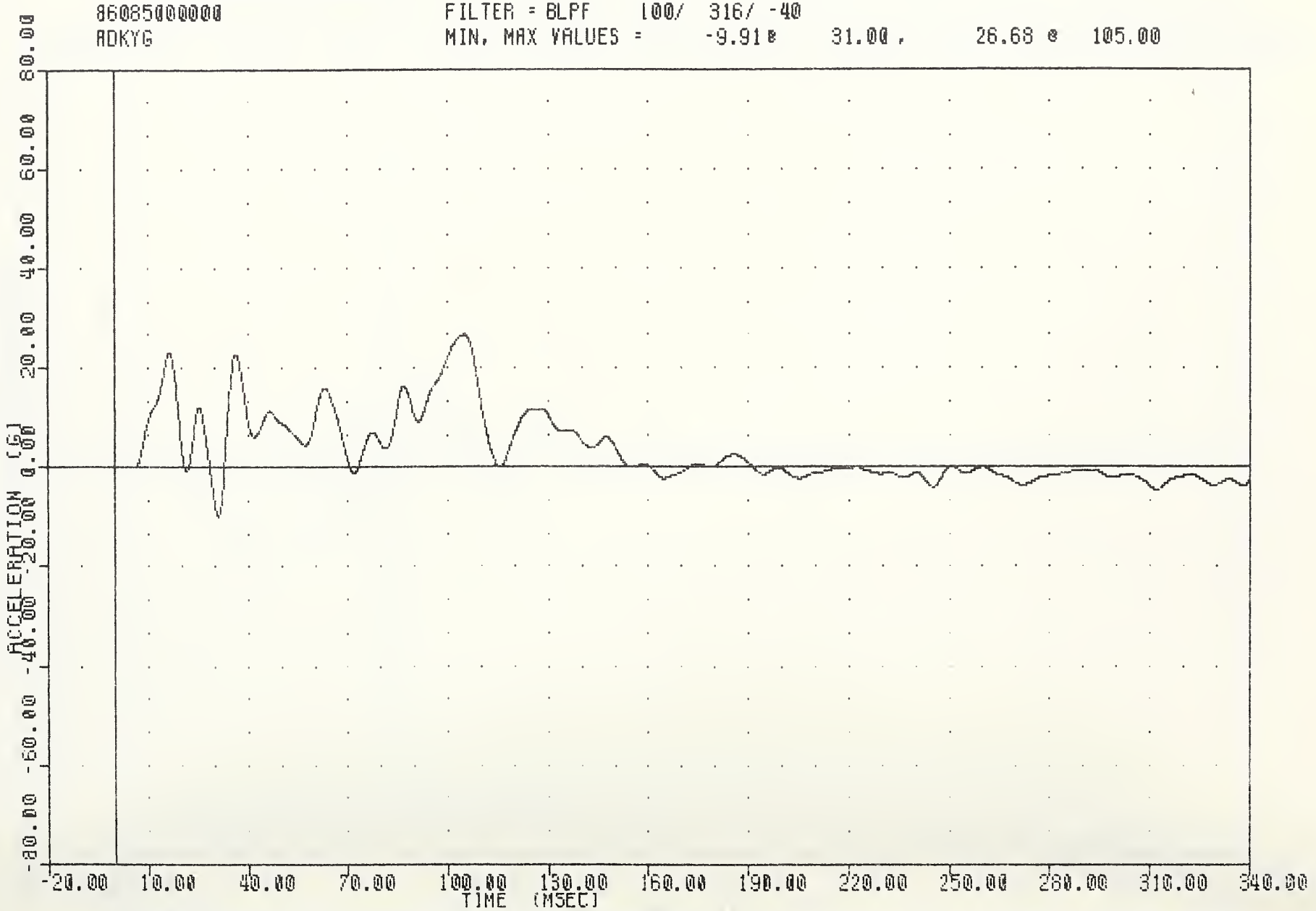
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS



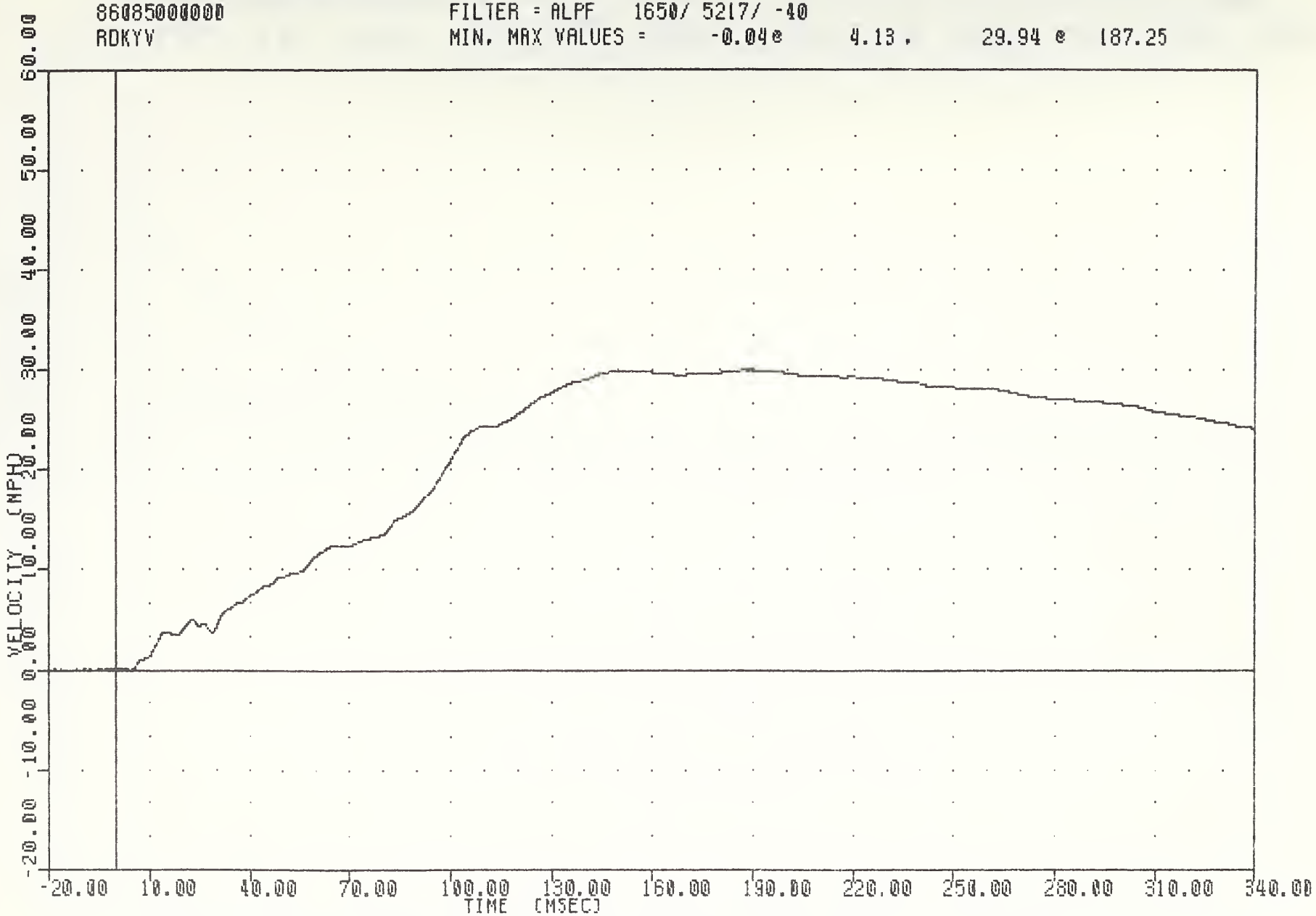
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION RESULTANT



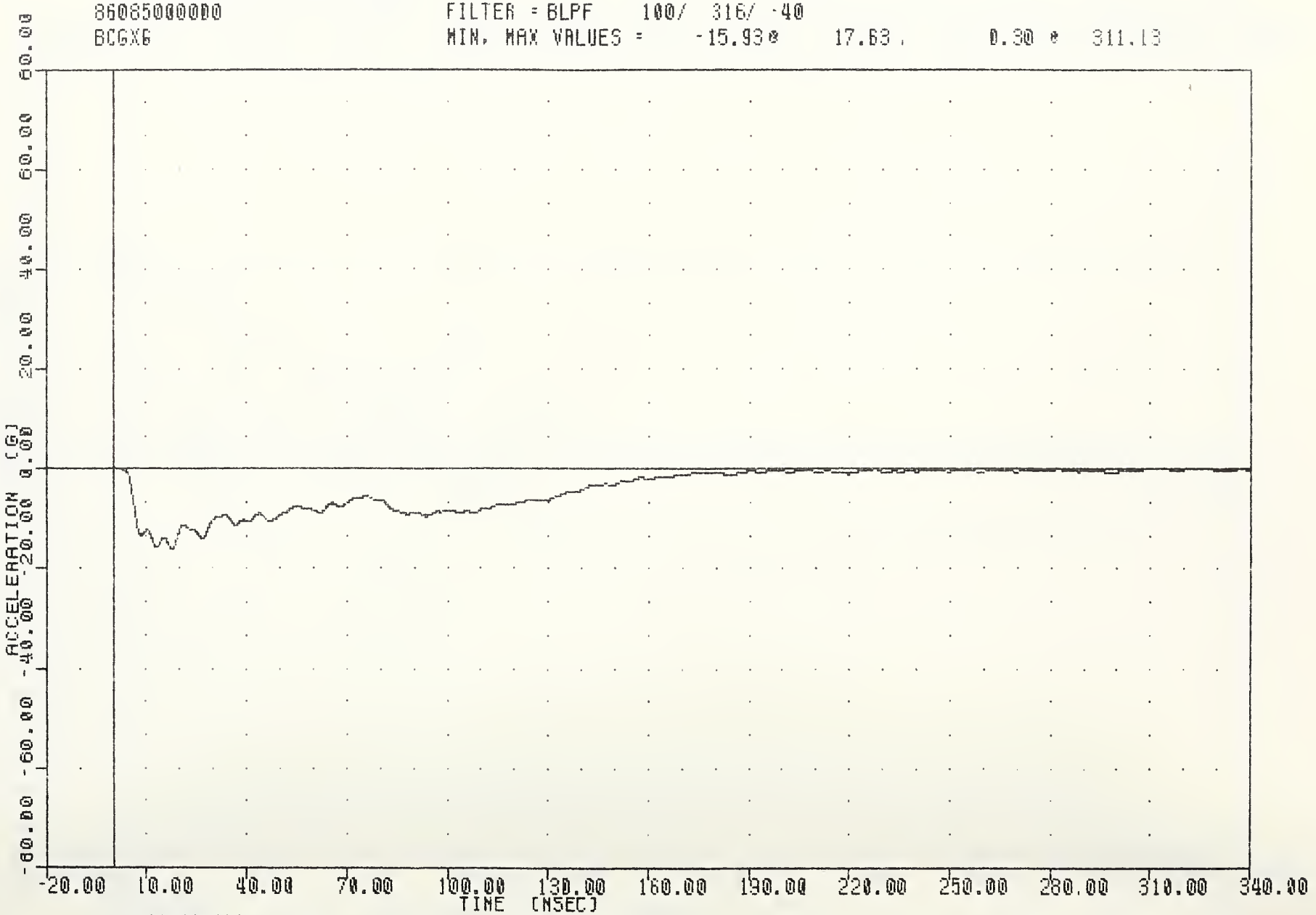
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE REAR DECK ACCELERATION X AXIS



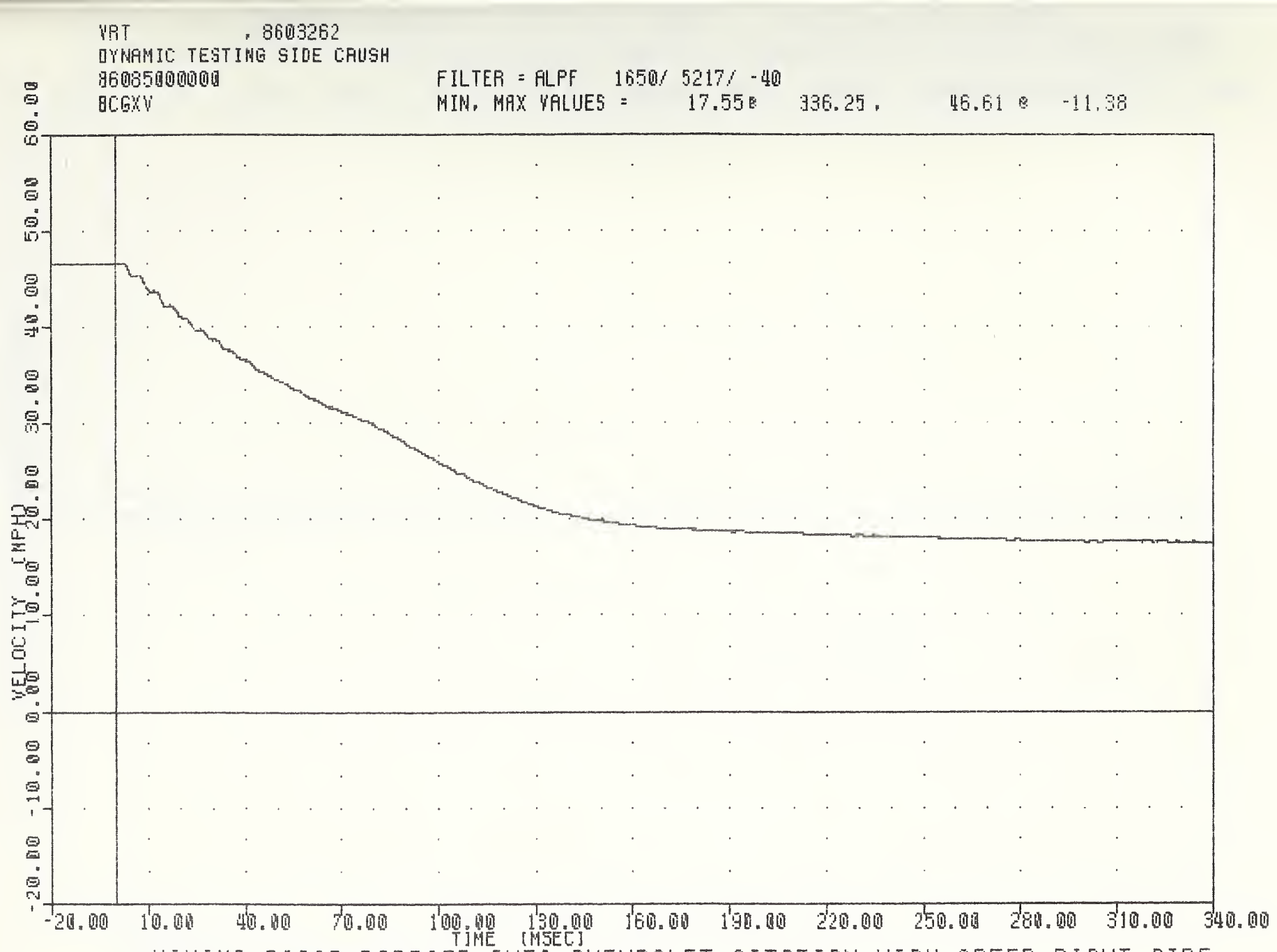
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE REAR DECK ACCELERATION Y AXIS



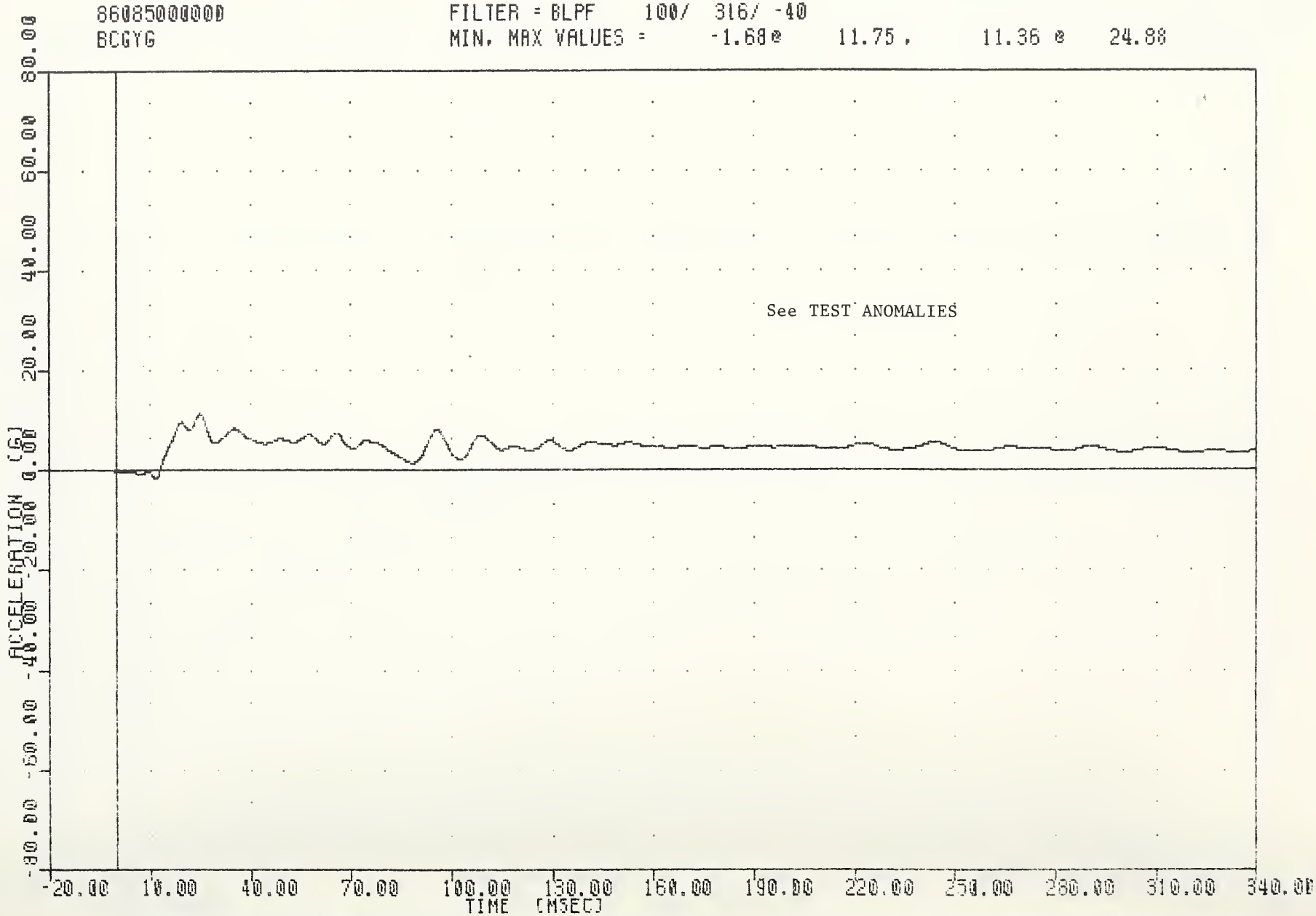
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
DELTA V USING RDKYG



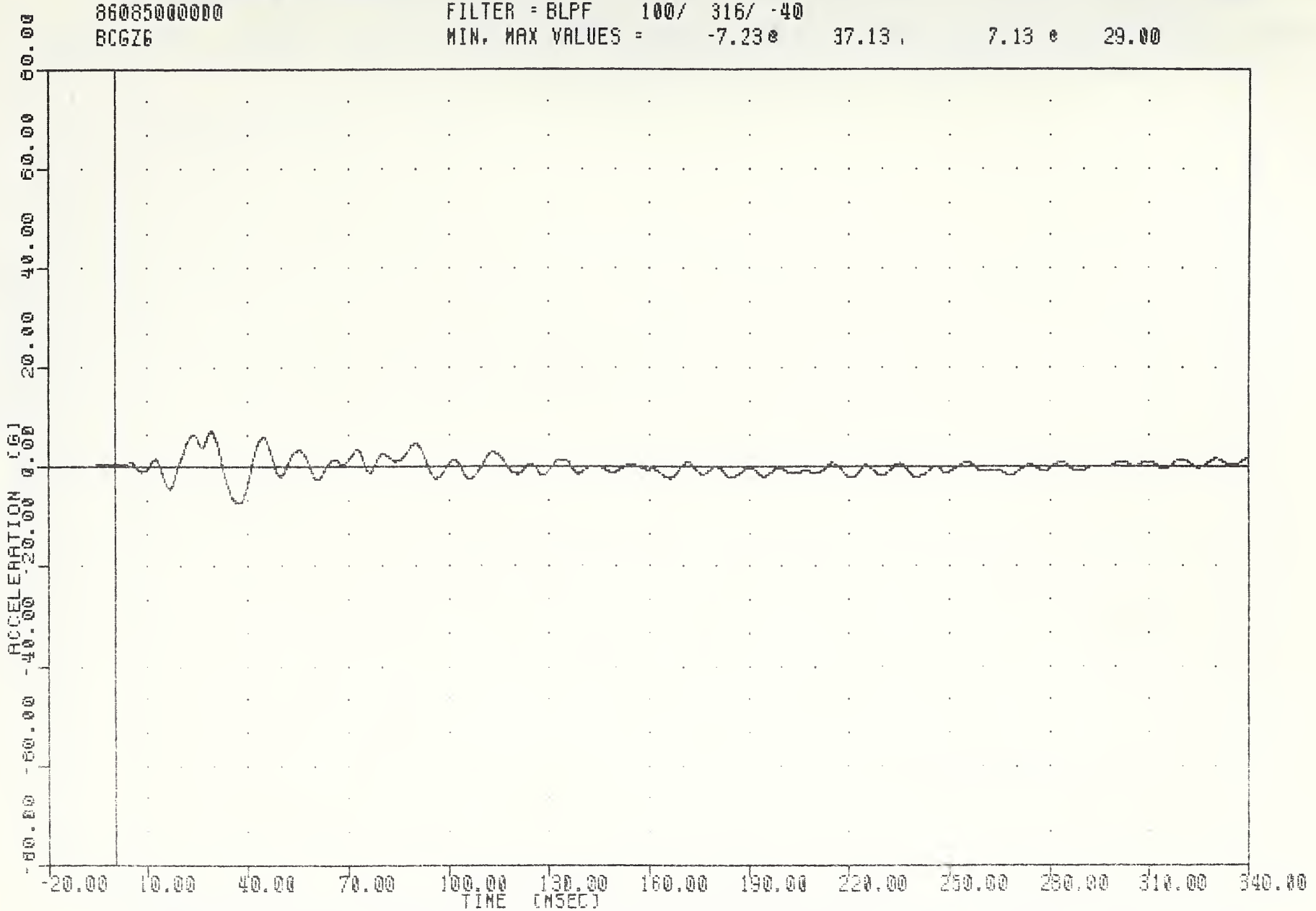
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS



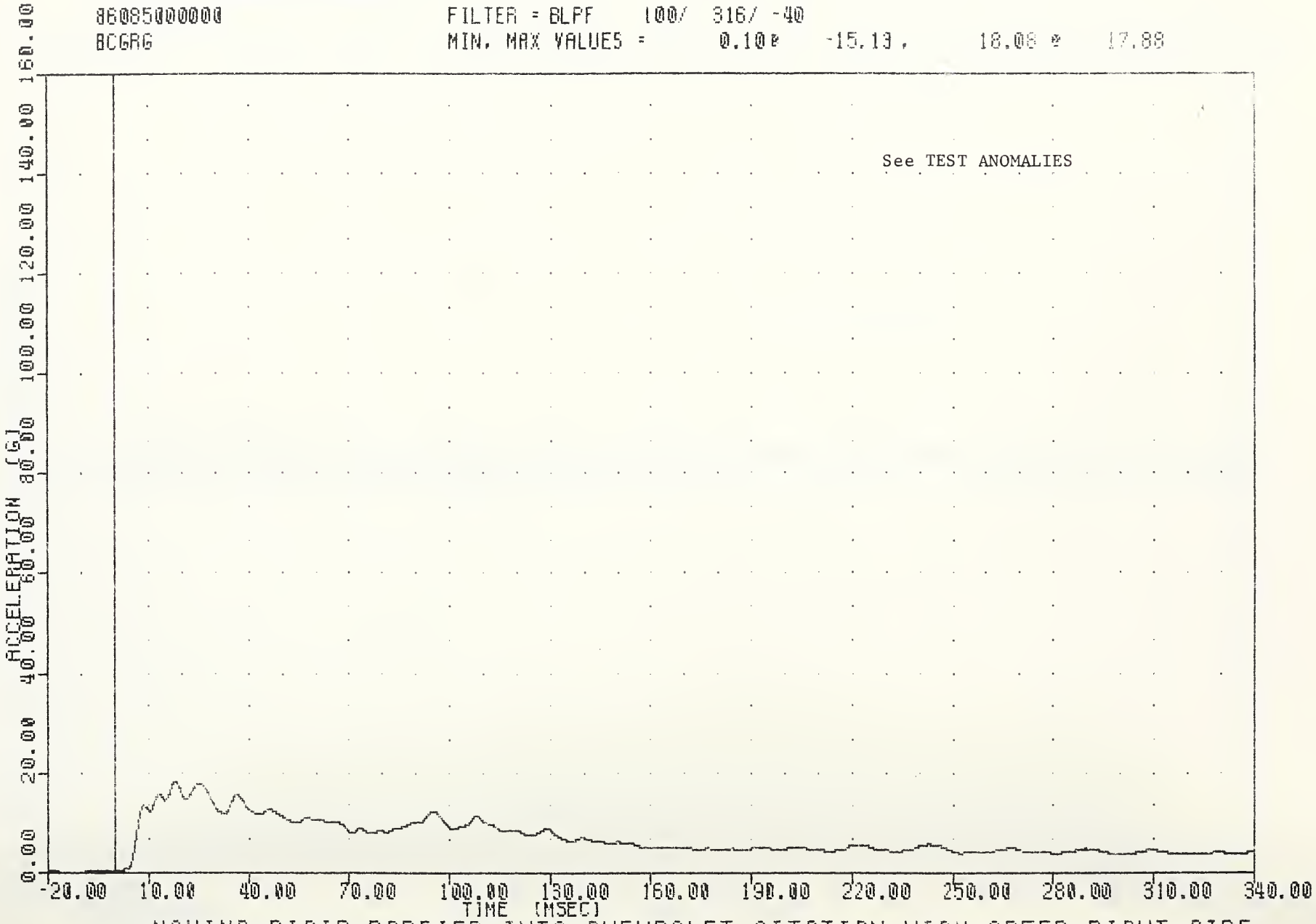
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
DELTA V USING BCGXG



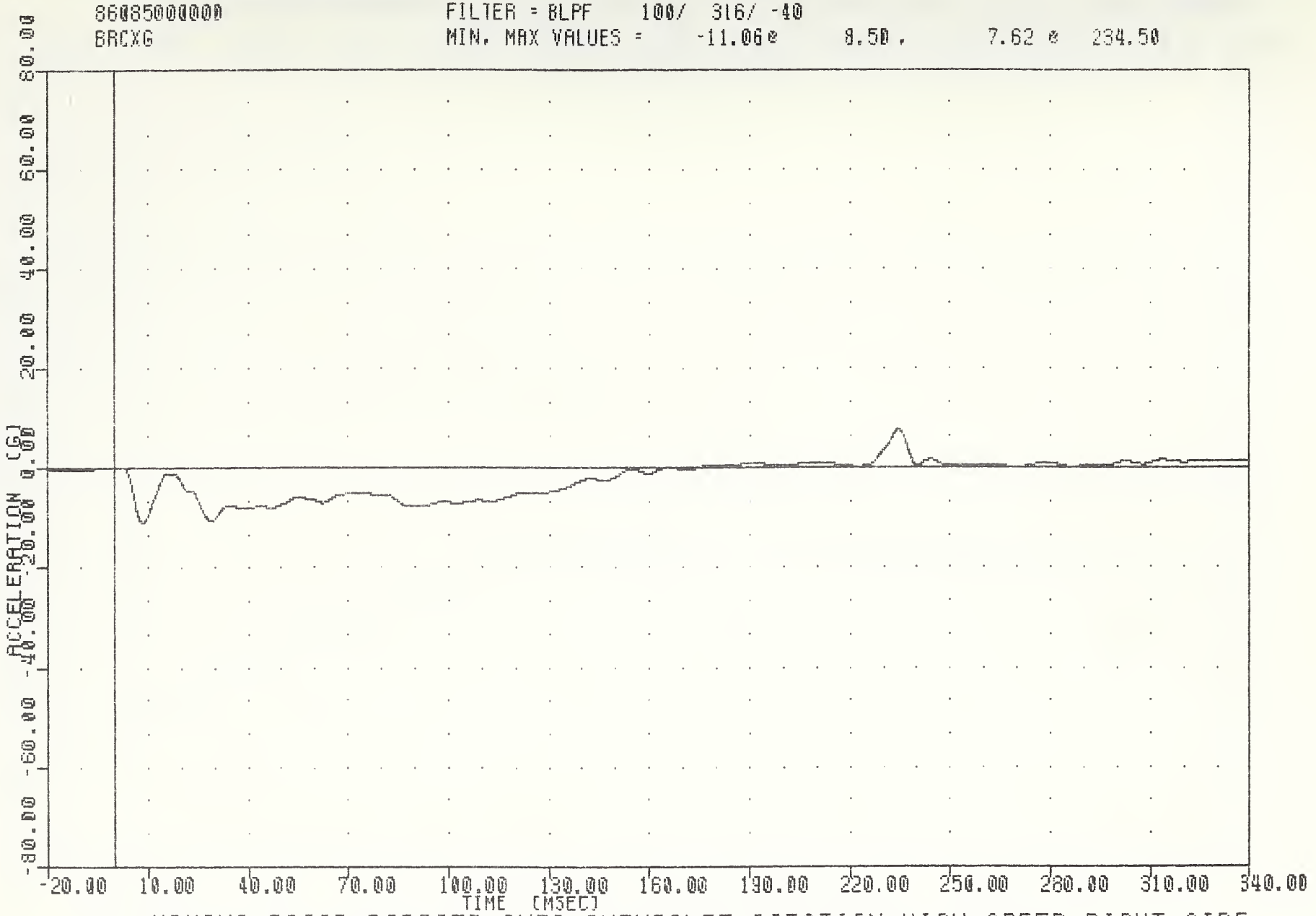
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS



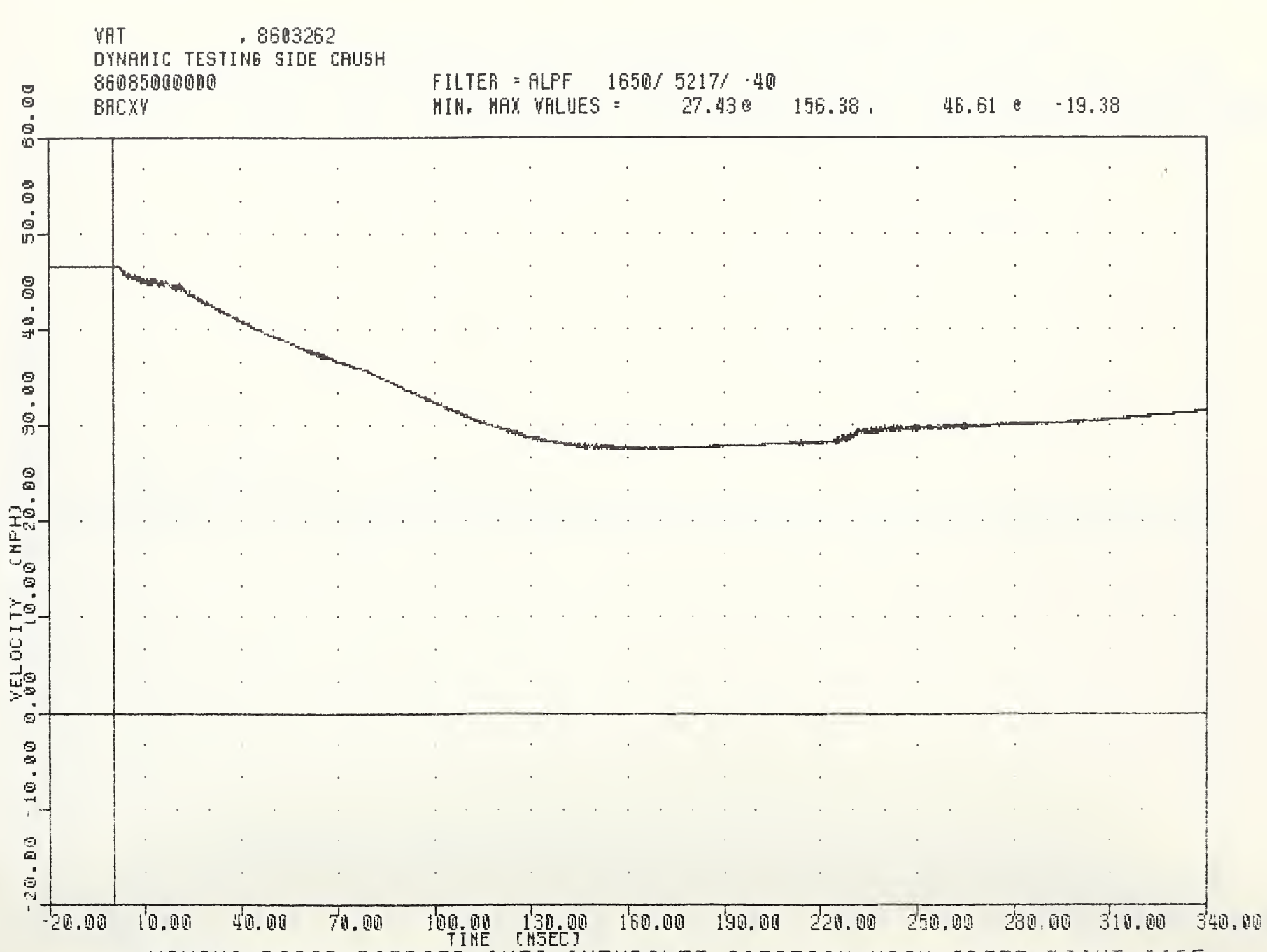
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS



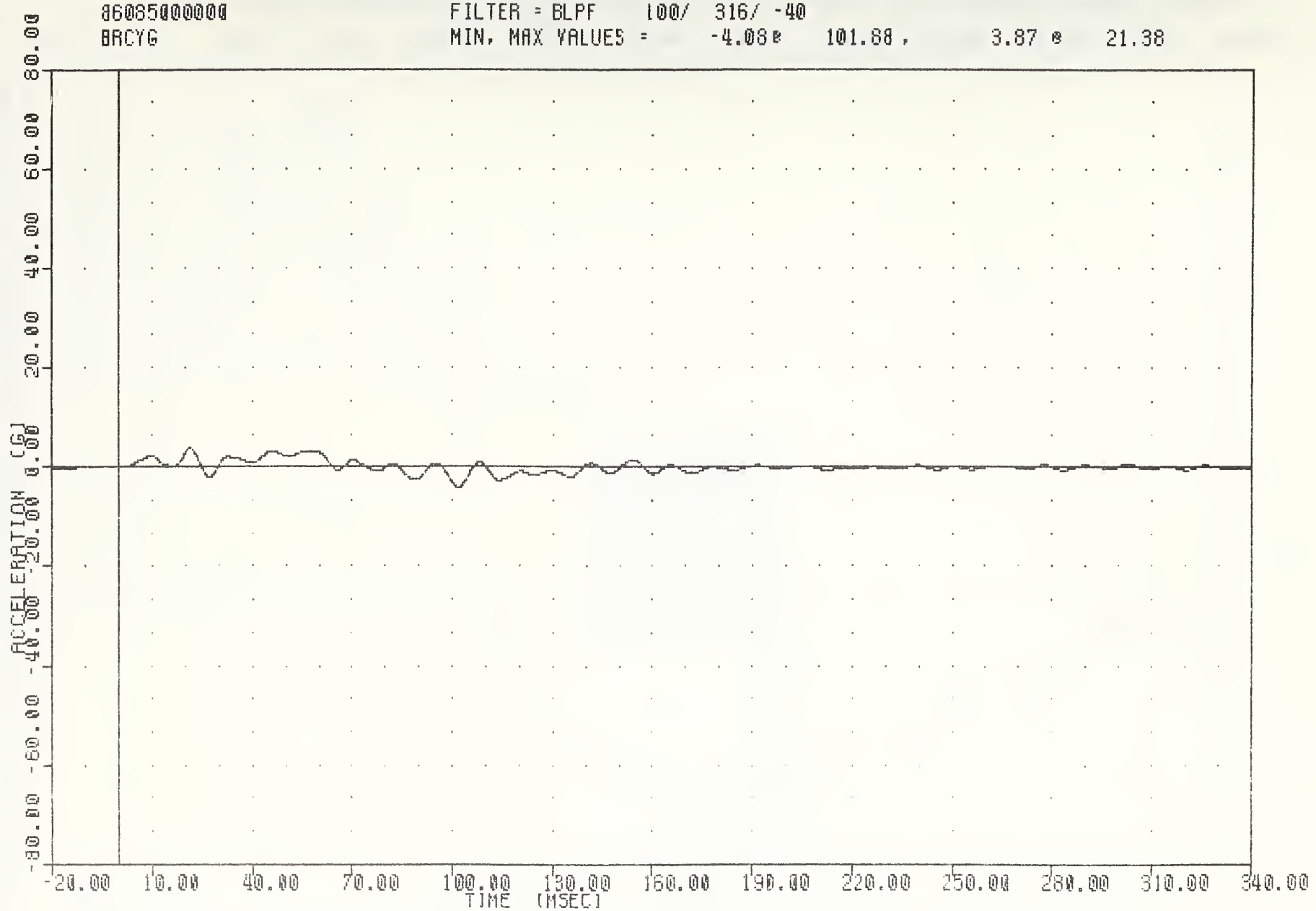
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION RESULTANT



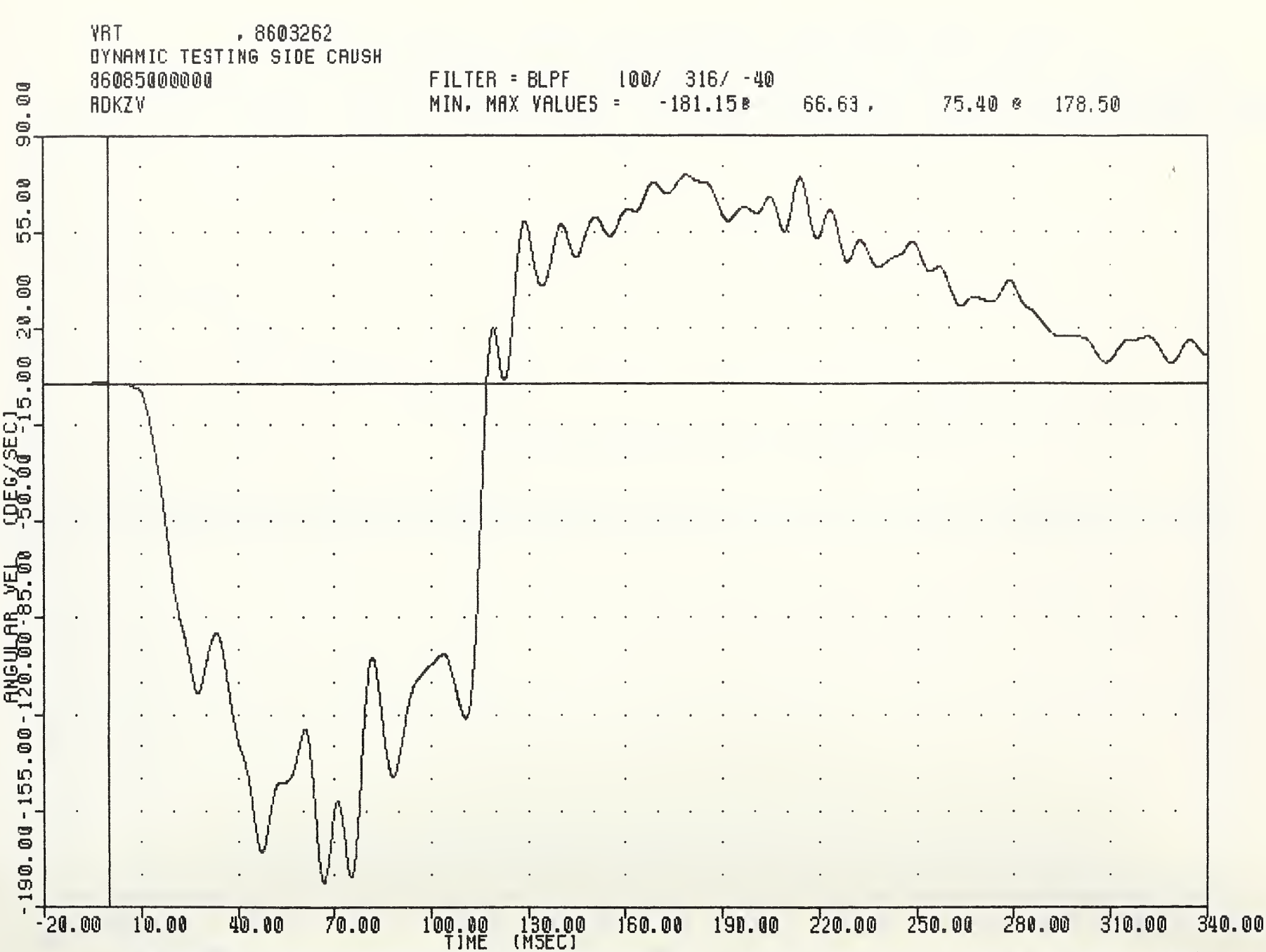
MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS



MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
DELTA V USING BRCXG



MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS



MOVING RIGID BARRIER INTO CHEVROLET CITATION HIGH SPEED RIGHT SIDE
VEHICLE YAW RATE DEGREE/SECOND