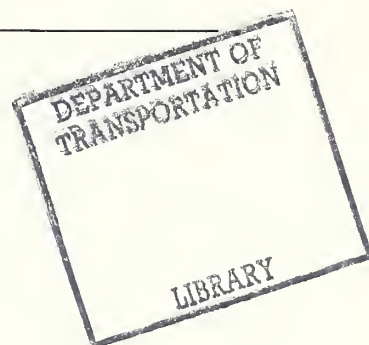


**DOT HS 807 044
Test Report**

June 1986



Crash III Model Improvements MRB-TO-CAR Side Impact Test of a 90° Moving Rigid Barrier to a 1983 Mitsubishi Tredia

Test No. 1 16.7 mph

Test No. 2 33.5 mph

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear only because they are considered essential to the object of this report.

1. Report No. DOT HS 807 044	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle CRASH III MODEL IMPROVEMENTS/ MRB-To-Car Side Impact Test of A 90° Moving Rigid Barrier To A 1983 Mitsubishi Tredia Test #1 16.7 mph, Test #2 33.5 mph		5. Report Date JUNE 1986	
		6. Performing Organization Code	
		8. Performing Organization Report No. 860523	
7. Author(s) N. A. El-Habash, Project Engineer, TRCO		10. Work Unit No. (TRIS)	
9. Performing Organization Name and Address Vehicle Research and Test Center St. Rt. 33, Logan County East Liberty, Ohio 43319		11. Contract or Grant No. DTNH22-85-C-08123	
		13. Type of Report and Period Covered TEST REPORT May-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. 85-0001 Side Impact Protection In Production Vehicles			
16. Abstract This test report documents two of a series of four crash tests to measure side crush in various vehicle models. Testing was conducted on a 1983 Mitsubishi Tredia 4-Door Sedan 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 May 23, 1986. Test #1 Vehicle was impacted perpendicular on the left side at 16.7 mph, the ambient temperature was 62°F and the time was 1054. Test #2 Vehicle was impacted perpendicular on the right side at 33.5 mph, the ambient temperature was 62°F and the time was 1218.			
17. Key Words Occupant Response Moving Barrier Crash Testing		18. Distribution Statement Available from: National Technical Information Service Springfield, Virginia 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 87	22. Price

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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 1983 Mitsubishi Tredia 4-Door Sedan was impacted on the left and right side by a Moving Rigid Barrier (MRB) on May 23, 1986.

Test #1: The MRB was to be towed into the stationary Mitsubishi Tredia at 16.6 mph, and the intended contact point of the MRB longitudinal centerline was to be -10.9 inch (rearward) from the center of gravity of the Mitsubishi Tredia. The angle of the MRB was 90° counter clockwise with respect to the longitudinal axis of the struck vehicle. The actual test speed was 16.7 mph and the actual contact point was -11.0 inch (rearward) from the center of gravity of the Mitsubishi Tredia.

Test #2: The MRB was to be towed into the stationary Mitsubishi Tredia at 33.3 mph, and the intended contact point of the MRB longitudinal centerline was to be -10.9 inch (rearward) from the center of gravity of the Mitsubishi Tredia. The angle of the MRB was 90° clockwise with respect to the longitudinal axis of the struck vehicle. The actual speed was 33.5 mph and the actual contact point was -10.4 inches (rearward) from the center of gravity of the Mitsubishi Tredia.

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: Mitsubishi Motor Sales of America, Inc.

MAKE/MODEL: Mitsubishi Tredia

VIN: JA3BF3646DZ450934

BODY STYLE: 4-Door Sedan

MODEL YEAR: 1983

NHTSA NO.: R & D

COLOR: Blue

ENGINE DATA: TYPE: Transverse

CYLINDERS: 4

DISPLACEMENT: 1795cc

TRANSMISSION DATA: 5 Speed Manual

DATE VEHICLE RECEIVED: 5/20/86

ODOMETER READING: 2303

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	No	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	Yes	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: Mitsubishi Motor Sales of America, Inc.

DATE OF MANUFACTURE: 09/82

GVWR: 3250 LBS.,

GAWR: FRONT 1765 LBS., REAR 1485 LBS.

VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 29 psi; REAR 29 psi

TIRES ON VEHICLE (MFGR. & LINE, SIZE): P165/80R13

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 4

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	NA	LBS.	RIGHT REAR	NA	LBS.
LEFT FRONT	NA	LBS.	LEFT REAR	NA	LBS.
TOTAL FRONT WEIGHT	NA		LBS.	(0.0 % OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	NA		LBS.	(0.0 % OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	NA		LBS.		

WEIGHT OF TEST VEHICLE AFTER PREPARATION:

RIGHT FRONT	677	LBS.	RIGHT REAR	399	LBS.
LEFT FRONT	662	LBS.	LEFT REAR	423	LBS.
TOTAL FRONT WEIGHT	1339		LBS.	(61.9 % OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	822		LBS.	(38.1 % OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2161		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 29 psi; REAR 29 psi

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

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

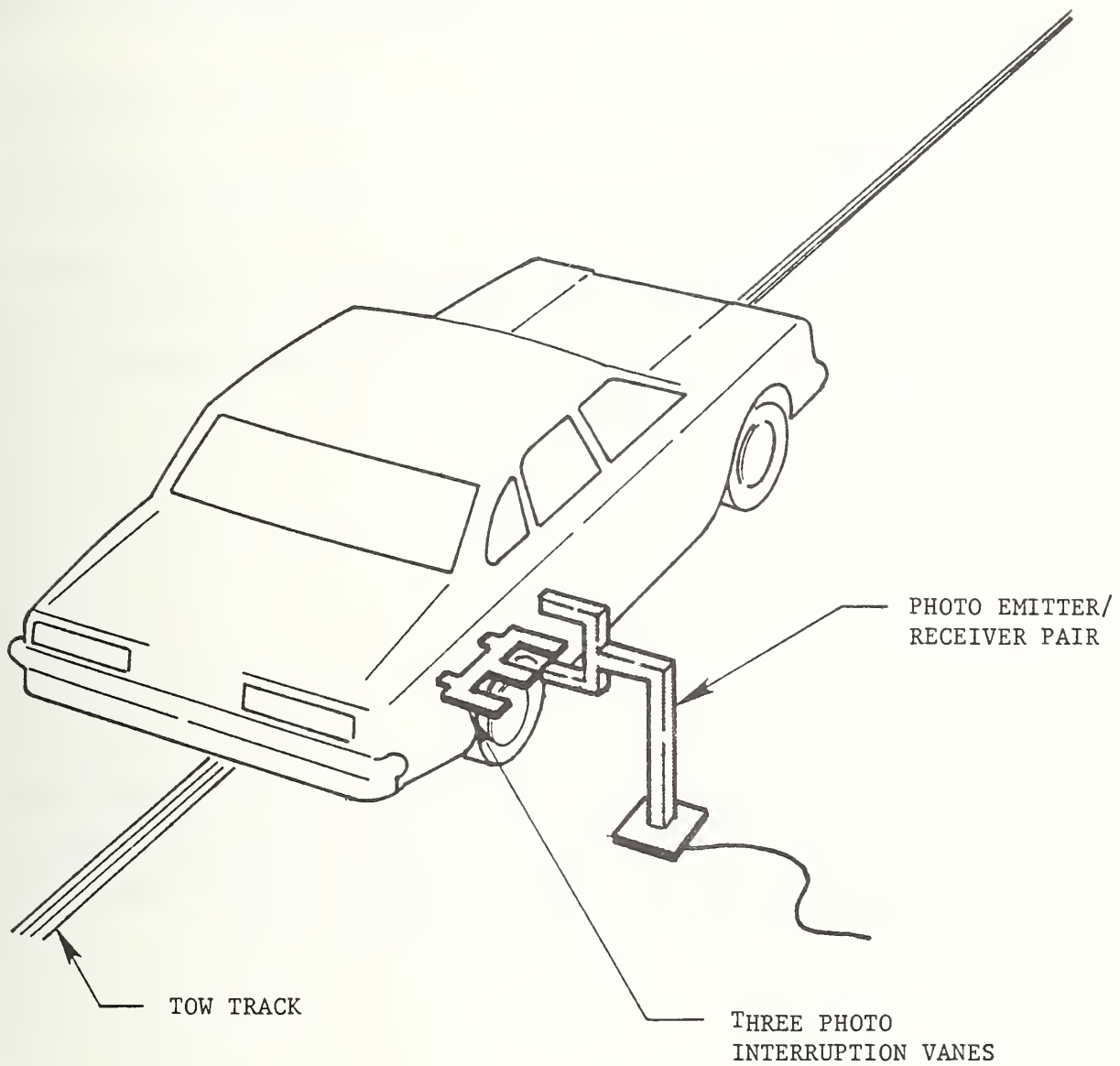
NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT

CARGO LOAD DNA LBS. 3 REAR
5 TOTAL

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.

RDKZV Vehicle Rear Deck Rate Gyro

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

1. BCGYG Data loss after approximately 240 msec due to a pinched cable during impact.

γ TRCO is investigating the zero-shift phenomenon of accelerometer and rate gyro data during the crash pulse in conjunction with Metraplex Corporation and Endevco Representatives. There is no definite resolutions as 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: 860523

Date of Test = May 23, 1986

Wind Velocity 3 - 6/342NW

Time of Test = 10:54

Ambient Temperature at Impact Area: 62°F

Subject Vehicle Data

Actual

Intended

Vehicle Test Weight (Lbs.)

2161

2161

MRB Test Weight (Lbs.)

3237

3237

MRB Velocity (MPH)*

16.7

16.6

Impact Point (Inches)**

-11.0

-10.9

Vehicle Attitude (All dimensions in inches):

Delivered Attitude: RF 26 1/8 ;LF 26 1/16 ;RR 21 5/8 ;LR 21 3/8

Pre-Test Attitude: RF 26 1/8 ;LF 26 1/16 ;RR 21 5/8 ;LR 21 3/8

Post-Test Attitude: RF 26 3/16 ;LF 25 15/16 ;RR 21 1/16 ;LR 20 9/16

Vehicle dimension (All in inches):

***Center of Gravity = 36.5 , wheel base = 96 1/4

Width Car = 64 3/4 , length car = 172 1/2

Width Roof = 39 1/4 , track width = 54 1/4

Front overhang = 37 1/2 , rear overhang = 38 11/16

* 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

8605231 - 86-0001 - 0100 - Tredia

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

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				0	5	5	5.8	6.3	0	
	Door Freespace				--	0.8	0.8	0.8	0.8	--	
	Net Bumper Crush			80	0	4.2	4.2	5.	5.5	0	-14.8
	Sill Crush				--	3	3.5	3.7	4	--	
	Sill Freespace				--	3	3	3	3	--	
	Net Sill Crush				--	0	0.5	0.7	1	--	

*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).

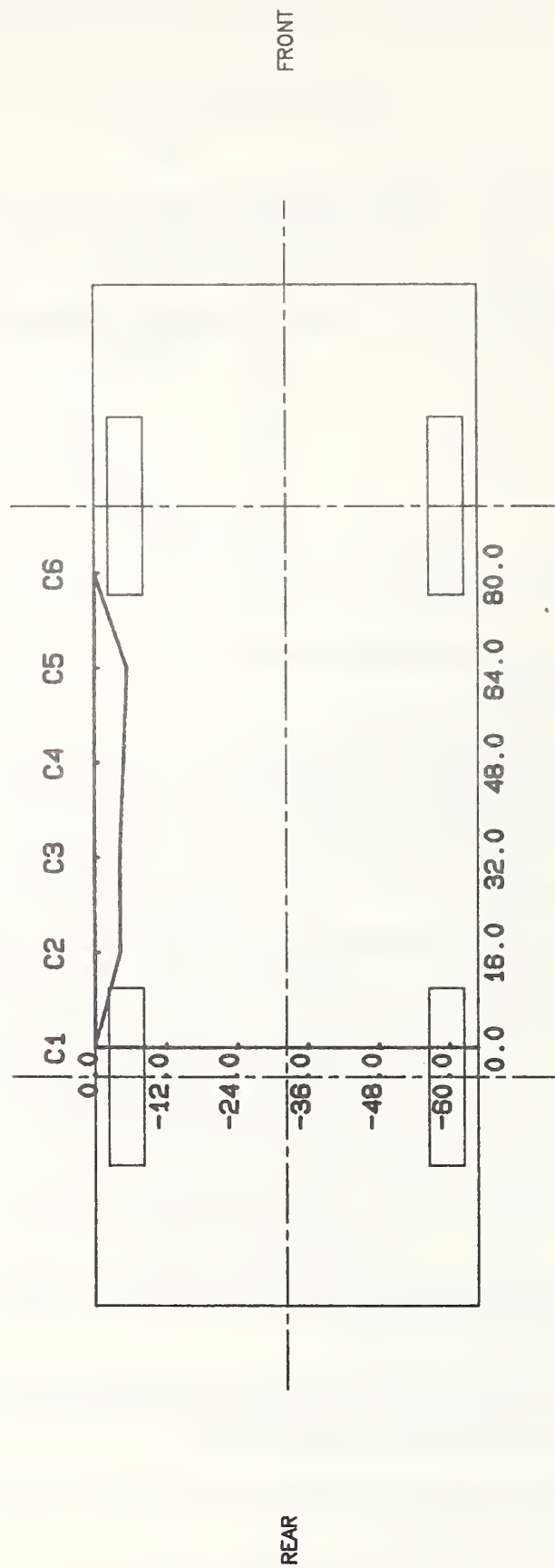
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**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.

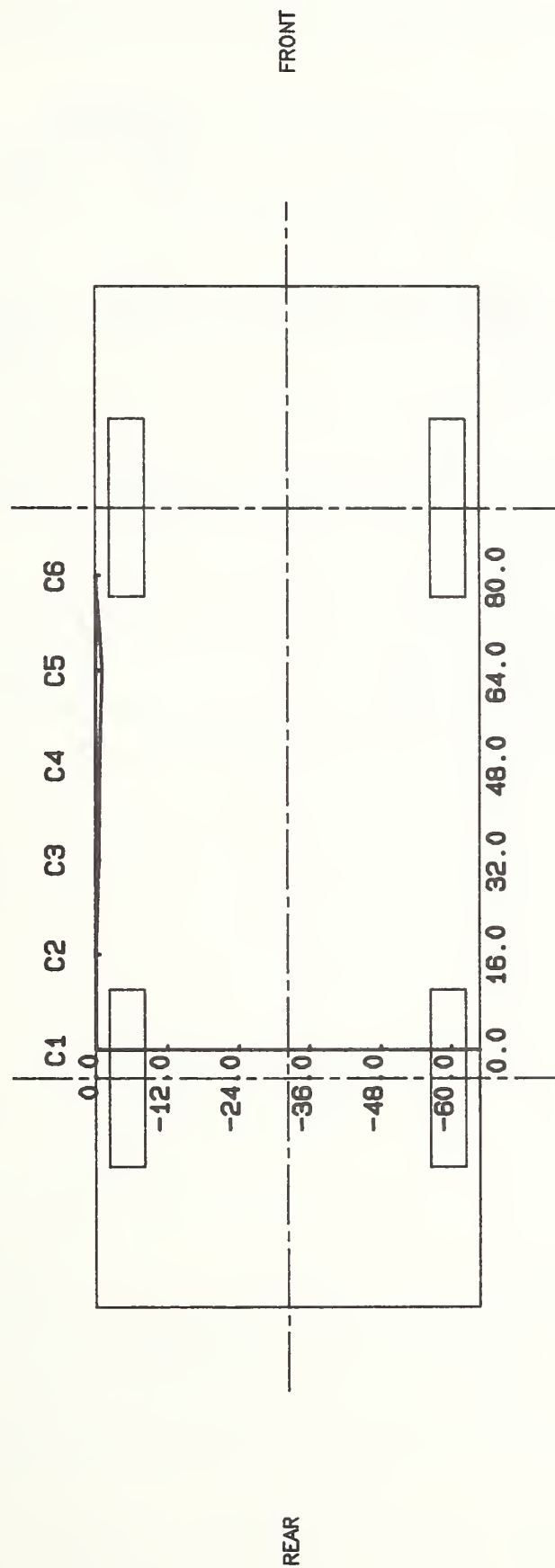
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0" ABOVE GROUND LEVEL
 THE CENTER OF THE CRUSH IS -14.8" FROM THE CENTER OF GRAVITY
 SCALE FACTOR EQUALS 0.036

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS SILL EDGE HEIGHT WHICH IS 12.3" ABOVE GROUND LEVEL
 THE CENTER OF THE CRUSH IS -14.8" FROM THE CENTER OF GRAVITY
 SCALE FACTOR EQUALS 0.036

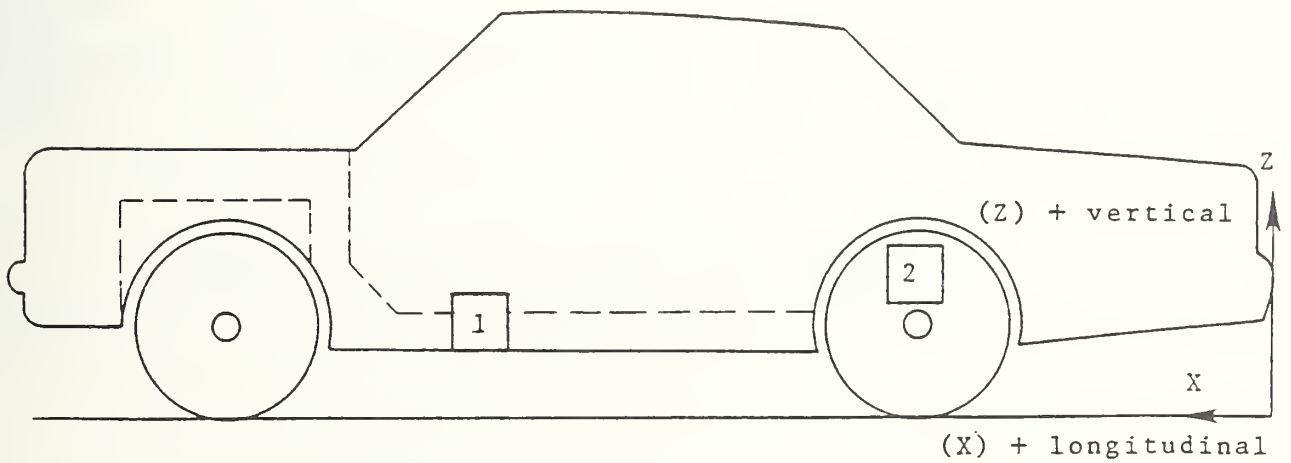
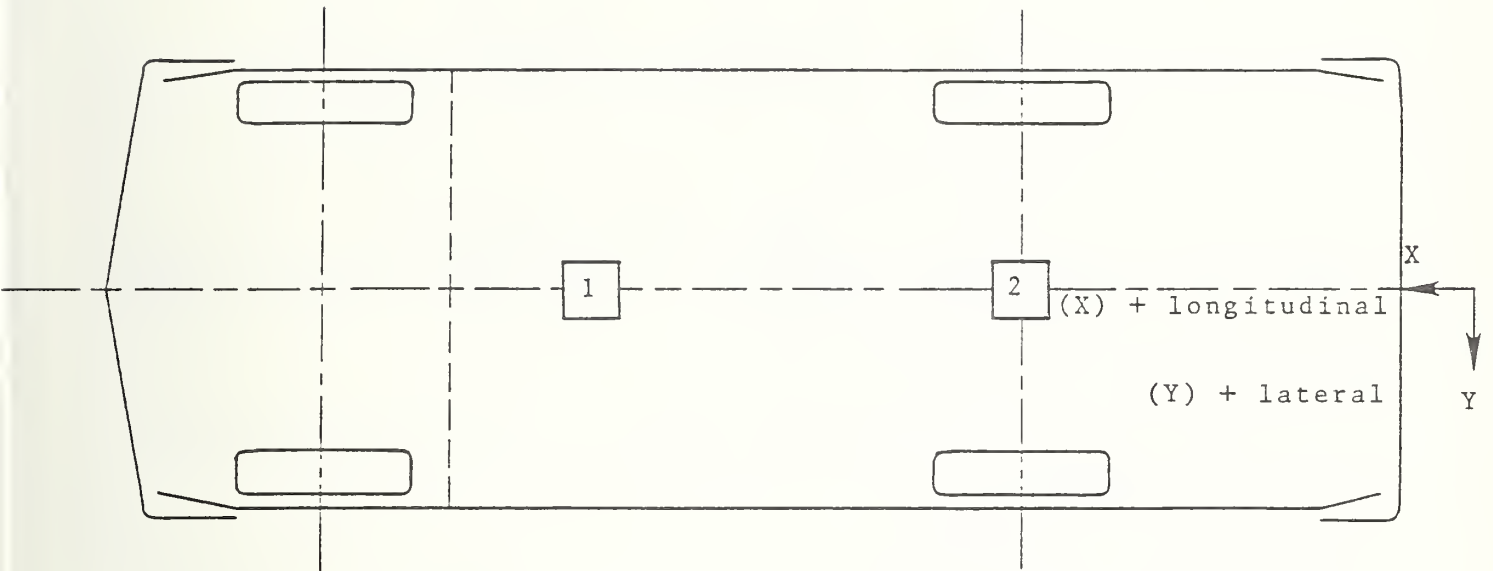
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	CENTER OF GRAVITY	-38.0	-0.2	14.5				
	(LONGITUDINAL)				3.49	8.00	4.11	15.50
	(LATERAL)	$\Delta V = -9.6 \text{ mph @ } 100.00 \text{ msec}$			2.77	121.75	15.00	27.50
	(VERTICAL)				11.74	30.38	9.95	37.13
	(RESULTANT)					17.24 @ 29.50		
2	REAR DECK OVER AXLE	-116.4	0.0	14.5				
	(LONGITUDINAL)				5.15	39.25	2.61	25.63
	(LATERAL)	$\Delta V = -13.5 \text{ mph @ } 100.00 \text{ msec}$			3.39	94.88	19.13	31.63
	(VERTICAL)							
	(RESULTANT)							

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

All measurements of accelerometer locations in inches.

VEHICLE ACCELEROMETER LOCATIONS



YAW RATE GYRO LOCATION AND DATA SUMMARY

LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX (deg/sec)	TIME (msec)	MAX (deg/sec)	TIME (msec)
YAW RATE GYRO	-115.2	+20.9	26.5	---	---Y	---	---Y

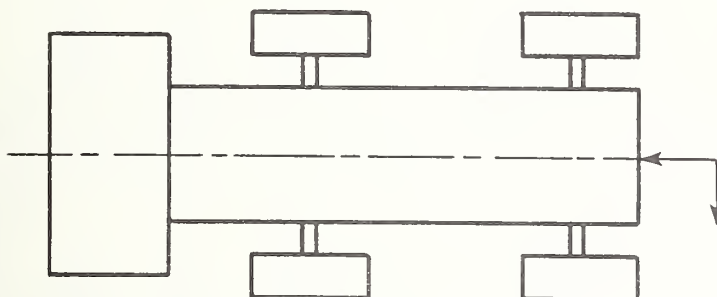
*Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Left),
Z - Ground Level (+ Up)

All measurements of rate gyro in inches.

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

Y See TEST ANOMALIES

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY



NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	CENTER OF GRAVITY	79.3	0.0	12.3				
	(LONGITUDINAL)	$\Delta V = -8.4 \text{ mph @ } 100.00 \text{ msec}$			0.18	168.38	8.77	39.25
	(LATERAL)				1.91	30.25	1.91	46.38
	(VERTICAL)				1.43	47.00	1.42	53.88
	(RESULTANT)					8.77 @ 39.00		
2	REAR FRAME MEMBER	21.5	+20.3	13.5				
	(LONGITUDINAL)	$\Delta V = -8.5 \text{ mph @ } 100.00 \text{ msec}$			0.35	116.25	8.76	32.38
	(LATERAL)				2.30	26.88	1.63	21.25

* 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	Right Time Panning	Kodak	25	24	Real Time Panning
2	Overhead Wide	Photosonic 1B	8	1003	Vehicle Dynamics
3	Overhead Tight	Photosonic 1B	25	1005	Close-up of Impact Point
4	Onboard MRB	Photosonic 1B	13	1003	Close-up of Impact Point

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)
BOGXG	Accel	4-202-0001	18849	Bell Howell	3/25/86	.2225	100 G
BOGYG	Accel	4-202-0001	18859	Bell Howell	3/25/86	.2115	100 G
BOGZG	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: 860523

Date of Test = May 23, 1986

Wind Velocity 4-9/360 N.

Time of Test = 12:18

Ambient Temperature at Impact Area: 62°F

<u>Subject Vehicle Data</u>	<u>Actual</u>	<u>Intended</u>
Vehicle Test Weight (Lbs.)	2161	2161
MRB Test Weight (Lbs.)	3237	3237
MRB Velocity (MPH)*	33.5	33.5
Impact Point (Inches)**	-10.4	-10.9

Vehicle Attitude (All dimensions in inches):

Delivered Attitude: RF 26 1/8 ;LF 26 1/16 ;RR 21 5/8 ;LR 21 3/8

Pre-Test Attitude: RF 26 3/16 ;LF 25 15/16 ;RR 21 1/16 ;LR 20 9/16

Post-Test Attitude: RF 24 1/4 ;LF 24 1/4 ;RR 18 1/8 ;LR 18 1/16

Vehicle dimension (All in inches):

***Center of Gravity = 39 1/2 , wheel base = 96 1/4

Width Car = 64 3/4 , length car = 172 1/2

Width Roof = 39 1/4 , track width = 54 1/4

Front overhang = 37 1/2 , rear overhang = 38 11/16

* 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

8605232 - 86-0001 - 0200 - Tredia

Complete When Applicable

End Damage	Side Damage
Undeformed end width _____	Bowing: B1 _____ X1 <u>0</u>
Corner shift: A1 _____	B2 _____ X2 <u>5.8</u>
A2 _____	Bowing constant
End shift at frame (CDC) (check one)	$\frac{X1 + X2}{2} = \underline{2.9}$
<4 inches _____	
≥4 inches <u>X</u>	

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				0	22.8	20	18.4	17.2	0	
	Door Freespace				--	0.8	0.8	0.8	0.8	--	
	Net Bumper Crush				0	22	19.2	17.6	16.4	0	
	Bowing				2.9	2.9	2.9	2.9	2.9	2.9	
	Net Crush			88	2.9	24.9	22.1	20.5	19.3	2.9	-18.8
	Sill Crush				--	--	11.5	15	13.4	--	
	Sill Freespace				--	--	3	3	3	--	
	Net Sill Freespace				--	--	8.5	12	10.4	--	

*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).

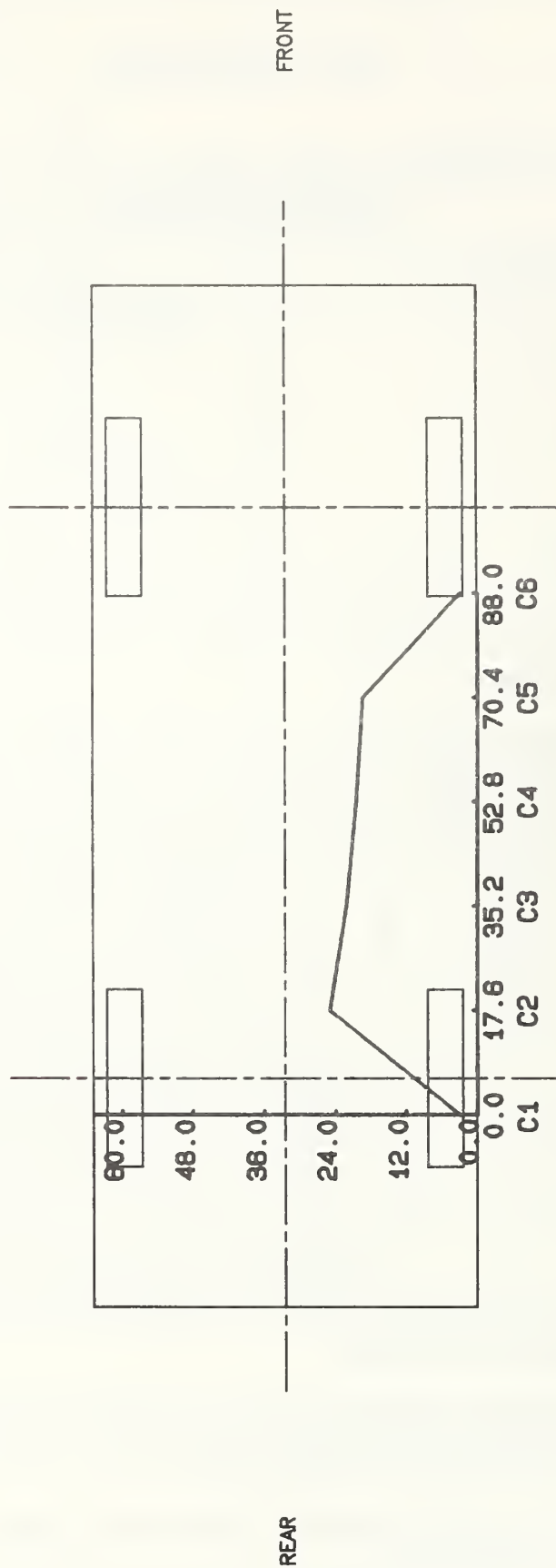
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**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.

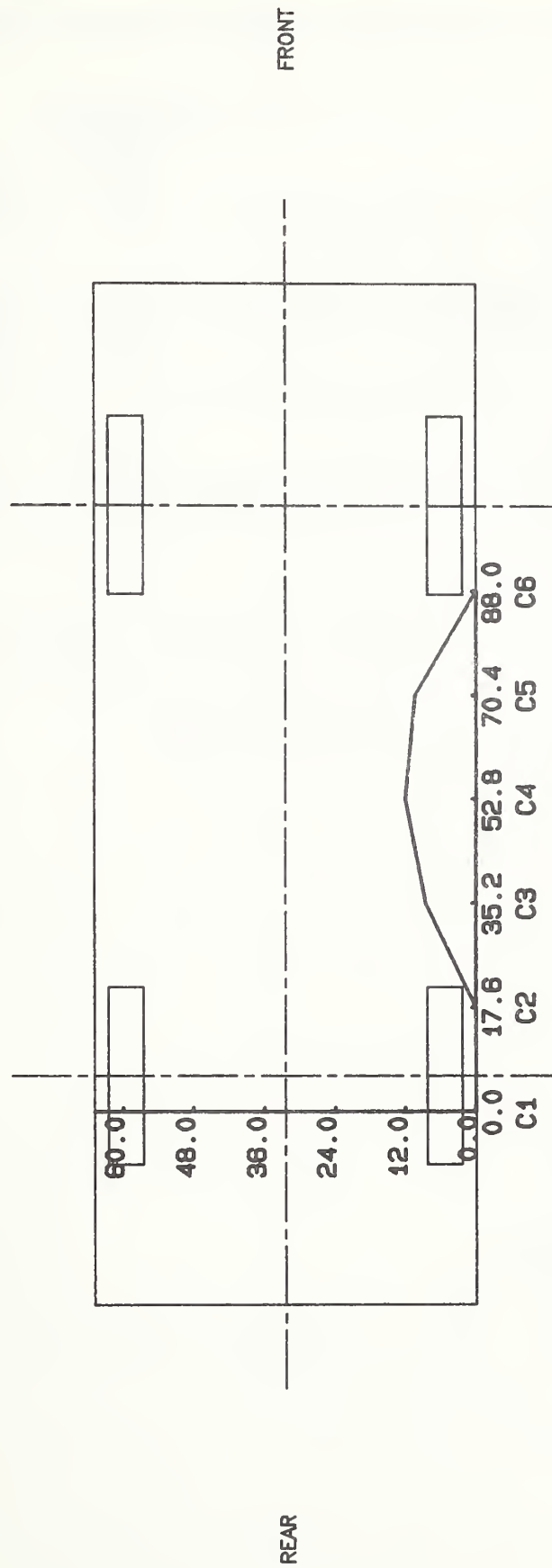
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0" ABOVE GROUND LEVEL
 THE CENTER OF THE CRUSH IS -18.8" FROM THE CENTER OF GRAVITY
 SCALE FACTOR EQUALS 0.036

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS SILL EDGE HEIGHT WHICH IS 12.3" ABOVE GROUND LEVEL
 THE CENTER OF THE CRUSH IS -18.8" FROM THE CENTER OF GRAVITY
 SCALE FACTOR EQUALS 0.036

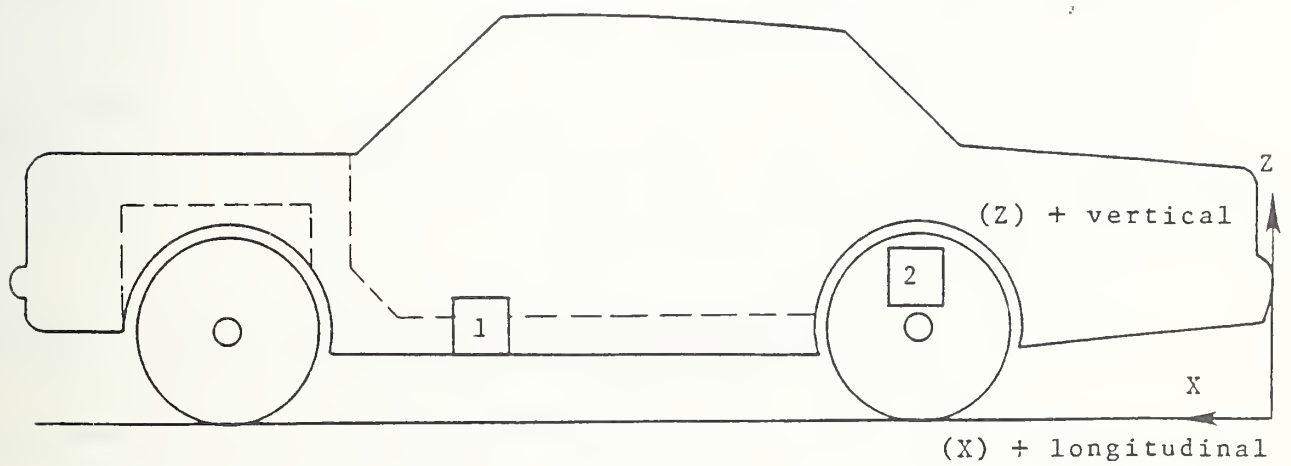
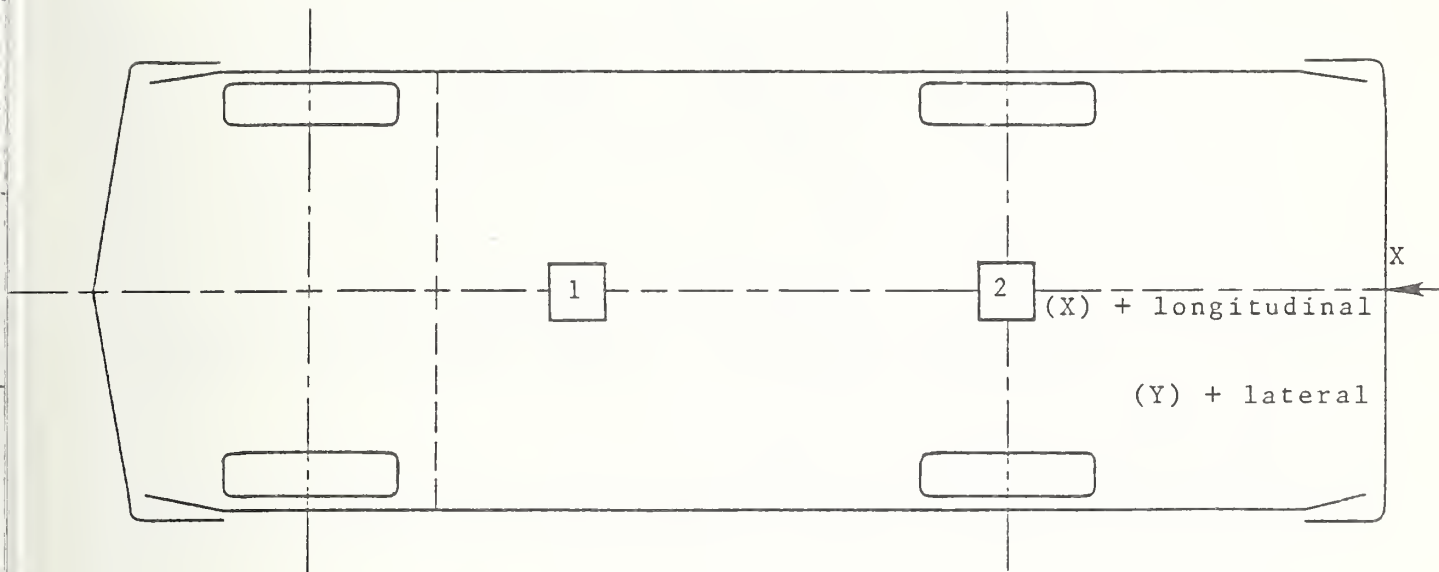
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X*	Y*	Z*	POSITIVE	TIME	NEGATIVE	TIME
					DIRECTION MAX (g)		DIRECTION MAX (g)	
1	CENTER OF GRAVITY (LONGITUDINAL)	-38.0	-0.2	14.5	6.81	21.63	17.27	31.25
	(LATERAL)	$\Delta V = 19.5 \text{ mph @ } 135.00 \text{ msec}$			25.75	35.63	1.62	118.00
	(VERTICAL)				15.52	92.63	26.55	36.38
	(RESULTANT)					37.18 @	36.13	
2	REAR DECK OVER AXLE (LONGITUDINAL)	-116.4	0.0	14.5	11.15	34.75	5.31	15.63
	(LATERAL)	$\Delta V = 20.0 \text{ mph @ } 135.00 \text{ msec}$			16.91	17.75	3.56	164.13
	(VERTICAL)							
	(RESULTANT)							

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

All measurements of accelerometer locations in inches.

VEHICLE ACCELEROMETER LOCATIONS



YAW RATE GYRO LOCATION AND DATA SUMMARY

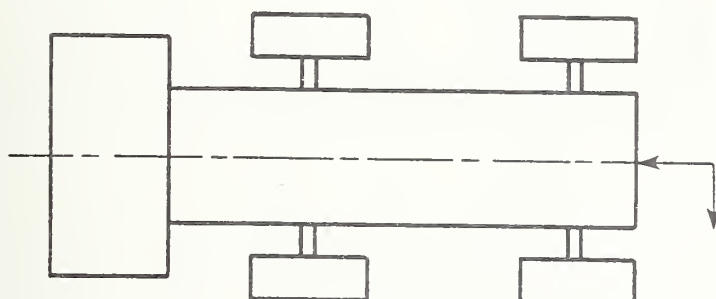
LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX (deg/sec)	TIME (msec)	MAX (deg/sec)	TIME (msec)
YAW RATE GYRO	-115.2	+20.9	26.5	78.92	32.25	42.34	25.63

*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		NEGATIVE DIRECTION	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	CENTER OF GRAVITY	79.3	0.0	12.3				
	(LONGITUDINAL)	$\Delta V = -14.0 \text{ mph @ } 135.00 \text{ msec}$			15.63	290.50	11.28	30.38
	(LATERAL)				6.45	32.63	5.50	23.00
	(VERTICAL)				12.73	240.38	3.90	19.88
	(RESULTANT)					13.33 @ 27.00		
2	REAR FRAME MEMBER	21.5	+20.3	13.5				
	(LONGITUDINAL)	$\Delta V = -13.5 \text{ mph @ } 135.00 \text{ msec}$			4.55	331.13	10.45	30.75
	(LATERAL)				11.19	331.13	1.89	337.38

* 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	Right Panning	Kodak	25	24	Real Time Panning
2	Overhead Wide	Photosonic 1B	8	1003	Vehicle Dynamics
3	Overhead Tight	Photosonic 1B	25	1003	Close-up of Impact Point
4	Onboard MRB	Photosonic 1B	13	1002	Close-up of Impact Point

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.



Figure A-1. PRE-TEST FRONT VIEW



Figure A-2. POST-TEST FRONT VIEW
A-2



Figure A-5. PRE-TEST REAR VIEW



Figure A-6. POST-TEST REAR VIEW
A-4



Figure A-7. PRE-TEST DRIVER SIDE VIEW



Figure A-8. POST-TEST DRIVER SIDE VIEW
A-5



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



Figure A-10. POST-TEST DRIVER FRONT THREE-QUARTER VIEW
A-6



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



Figure A-12. POST-TEST DRIVER REAR THREE-QUARTER VIEW
A-7



Figure A-13. PRE-TEST OVERHEAD VIEW



Figure A-14. POST-TEST OVERHEAD VIEW
A-8



Figure A-15. POST-TEST OVERALL VIEW



Figure A-16. POST-TEST DRIVER SIDE VIEW
A-9

APPENDIX B

PHOTOGRAPHS

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

<u>Figure</u>	<u>Page</u>
B-1. PRE-TEST FRONT VIEW	B-2
B-2. POST-TEST FRONT VIEW	B-2
B-3. PRE-TEST PASSENGER SIDE VIEW	B-3
B-4. POST-TEST PASSENGER SIDE VIEW	B-3
B-5. PRE-TEST REAR VIEW	B-4
B-6. POST-TEST REAR VIEW	B-4
B-7. PRE-TEST DRIVER SIDE VIEW	B-5
B-8. POST-TEST DRIVER SIDE VIEW	B-5
B-9. PRE-TEST PASSENGER THREE-QUARTER VIEW	B-6
B-10. POST-TEST PASSENGER THREE-QUARTER VIEW	B-6
B-11. PRE-TEST PASSENGER REAR THREE-QUARTER VIEW	B-7
B-12. POST-TEST PASSENGER REAR THREE-QUARTER VIEW	B-7
B-13. PRE-TEST OVERHEAD VIEW	B-8
B-14. POST-TEST OVERHEAD VIEW	B-8
B-15. PRE-TEST OVERALL VIEW	B-9
B-16. POST-TEST PASSENGER SIDE VIEW	B-9



Figure B-1. PRE-TEST FRONT VIEW



Figure B-2. POST-TEST FRONT VIEW
B-2



Figure B-3. PRE-TEST PASSENGER SIDE VIEW



Figure B-4. POST-TEST PASSENGER SIDE VIEW
B-3



Figure B-5. PRE-TEST REAR VIEW



Figure B-6. POST-TEST REAR VIEW
B-4



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



Figure B-10. POST-TEST PASSENGER THREE-QUARTER VIEW
B-6



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

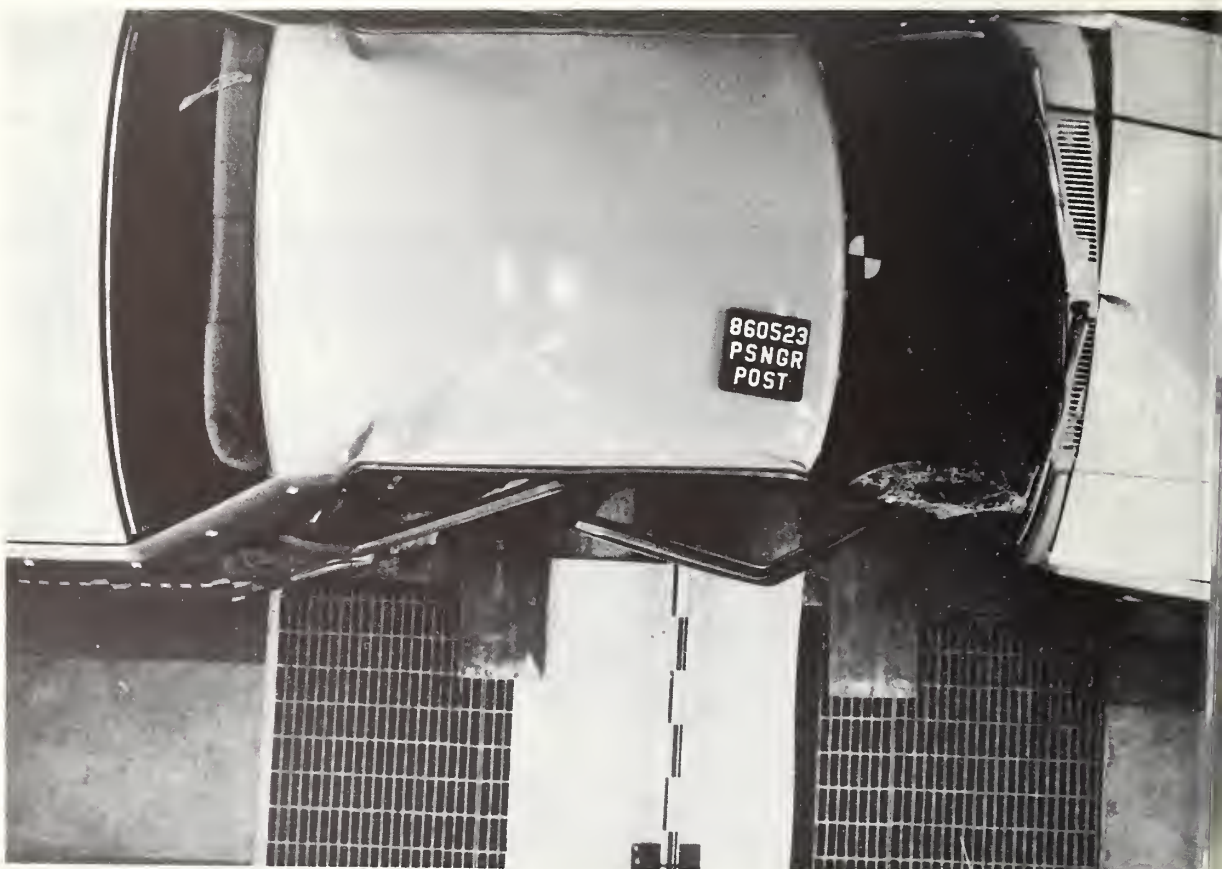


Figure B-14. POST-TEST OVERHEAD VIEW

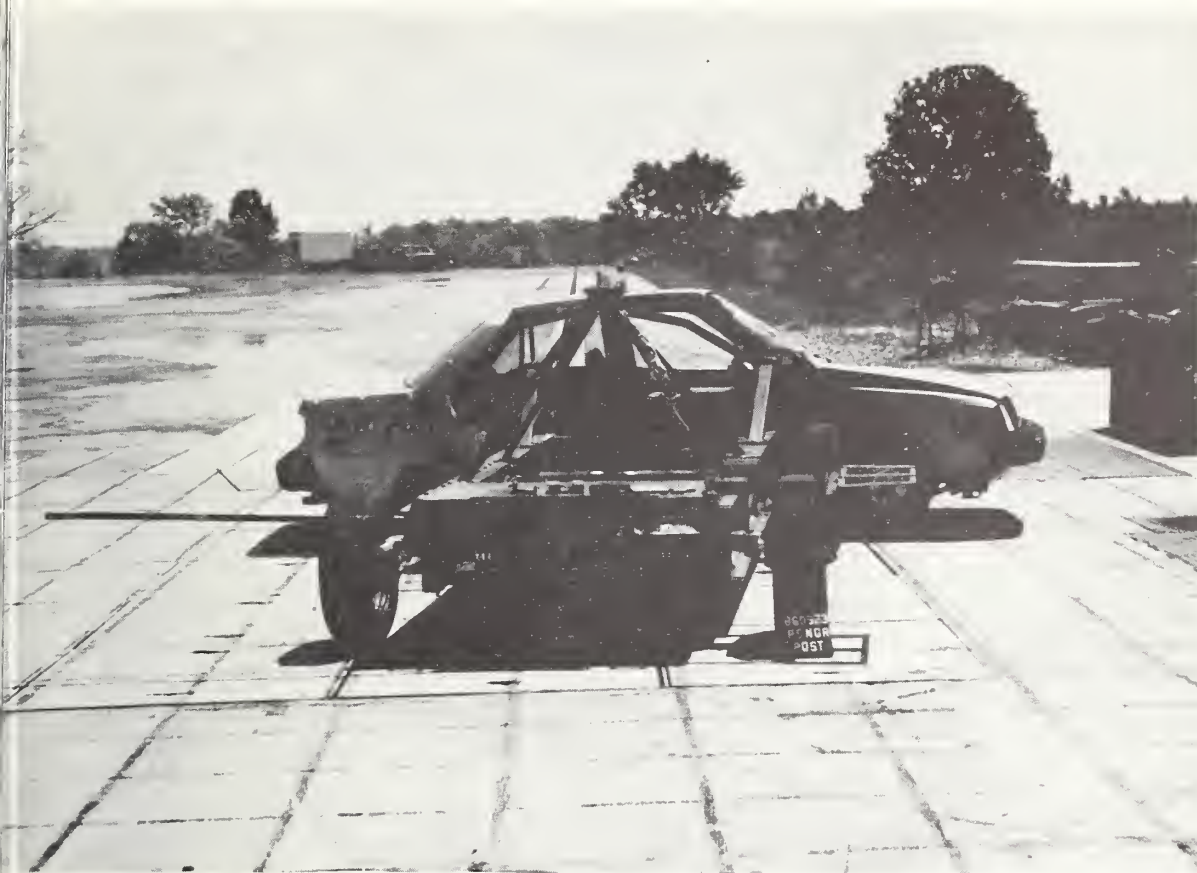


Figure B-15. POST-TEST OVERALL VIEW



Figure B-16. POST-TEST FRONT PASSENGER SIDE VIEW
B-9

APPENDIX C

DATA PLOT PRESENTATION

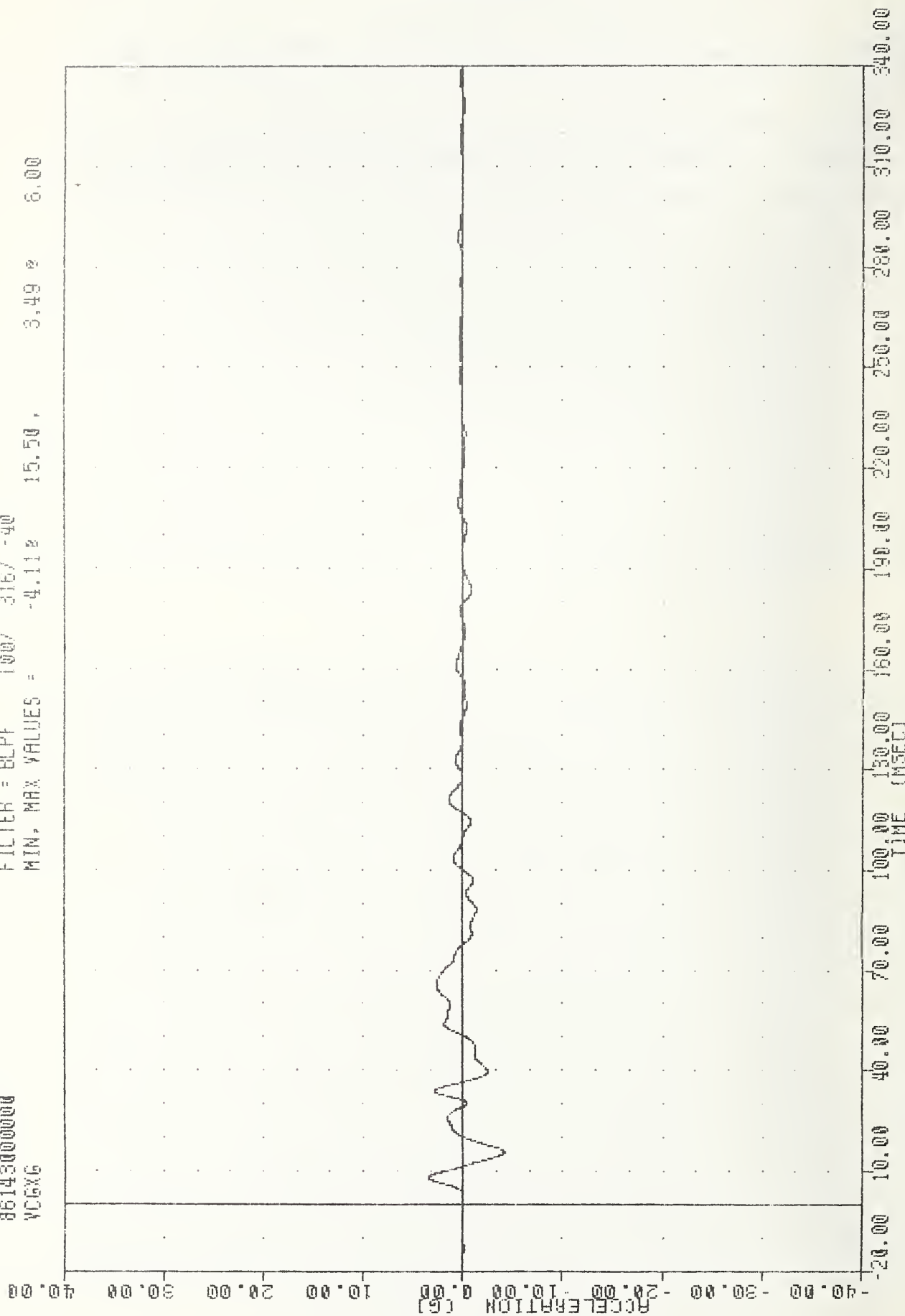
TEST #1 VEHICLE WAS IMPACTED PERPENDICULAR ON THE LEFT SIDE LOW SPEED.

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.

VRT
CRASH 3 MODEL IMPROVEMENTS
86143000000
VCGXG

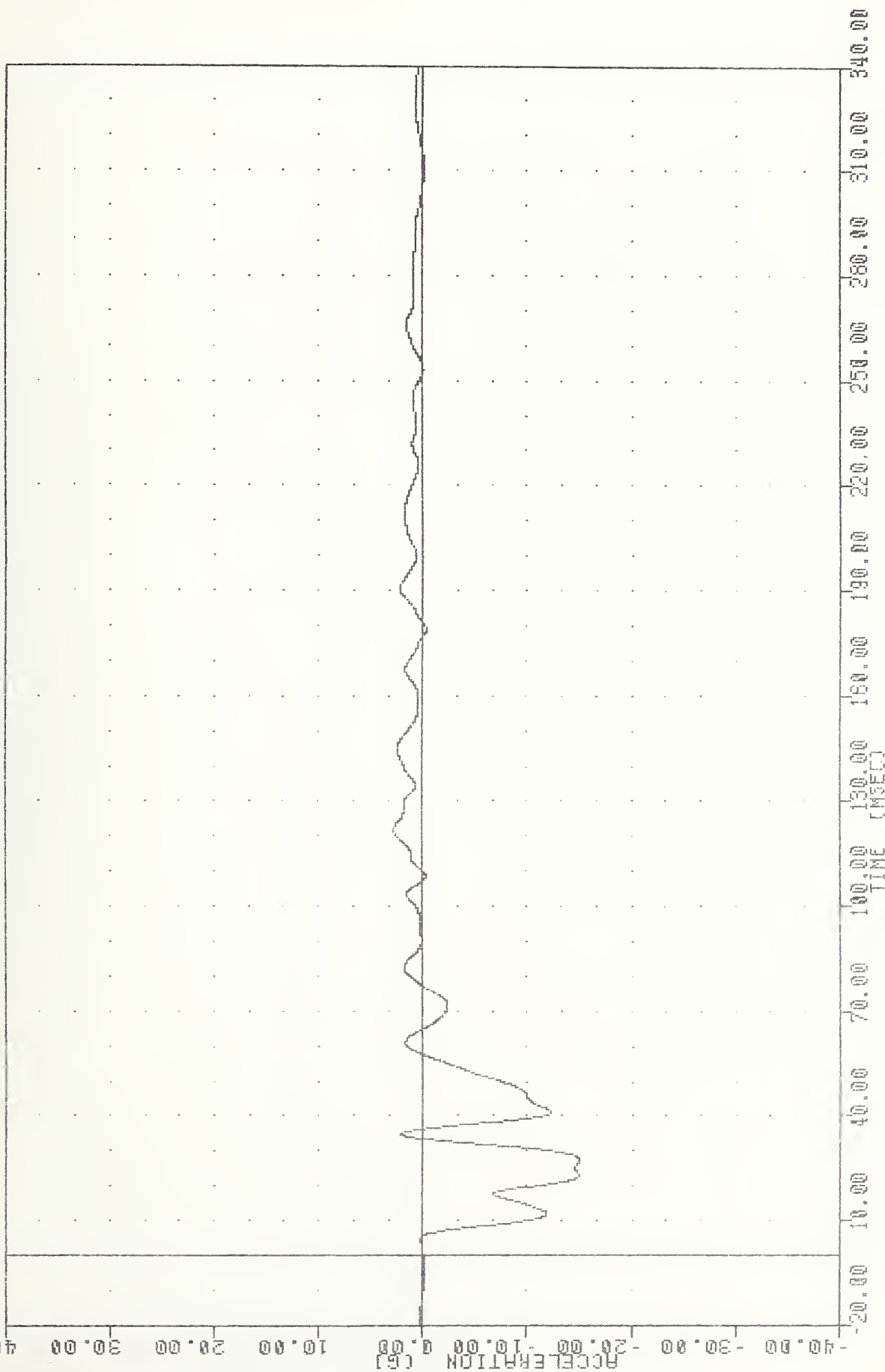
8605231

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -4.112 15.50 3.49 6.00



VRT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VCGYG

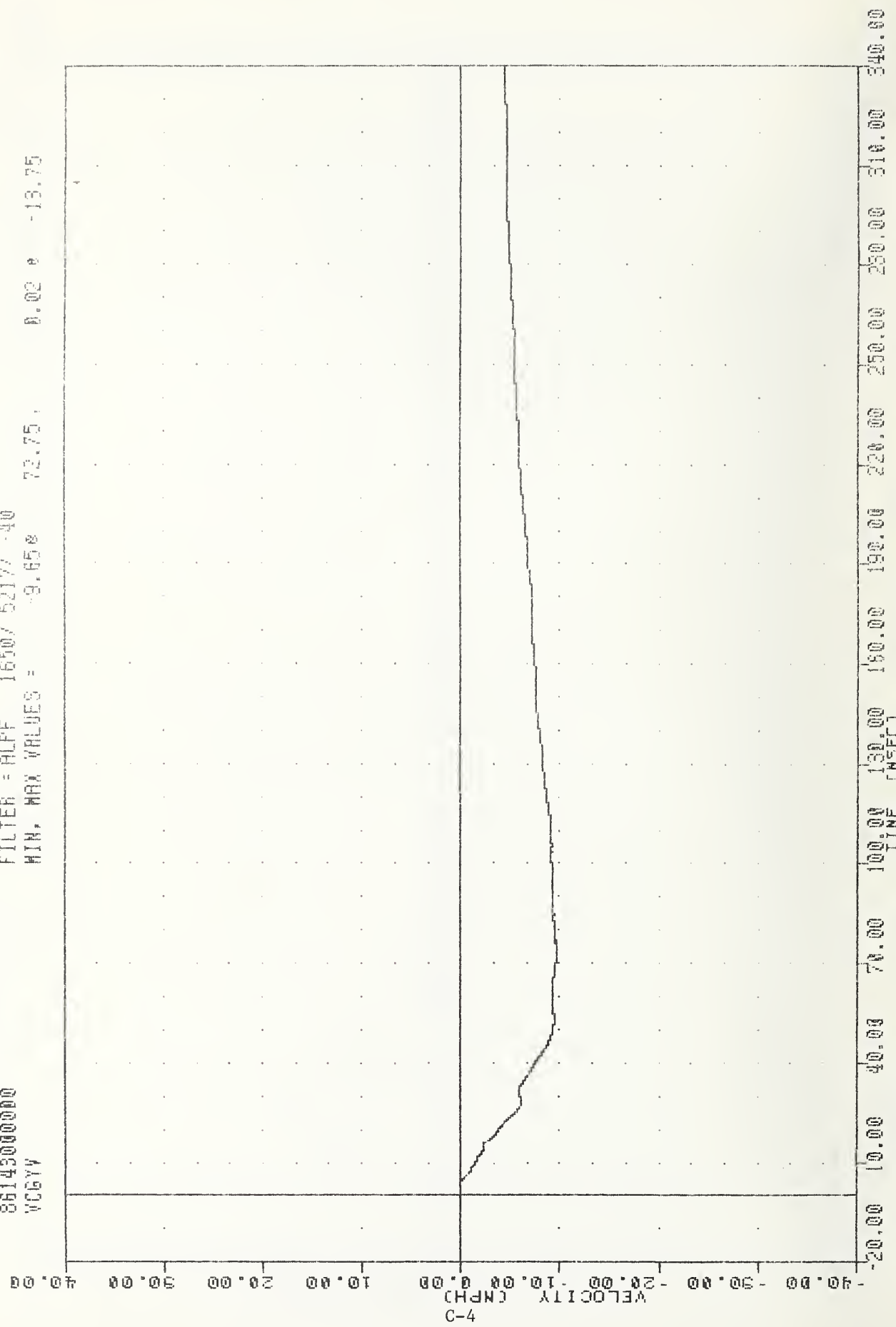
FILTER = 6LPF 100/ 316/ -40
 MIN, MAX VALUES = -15.000 27.50 , 2.77 121.75



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS

VRT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VCGYV

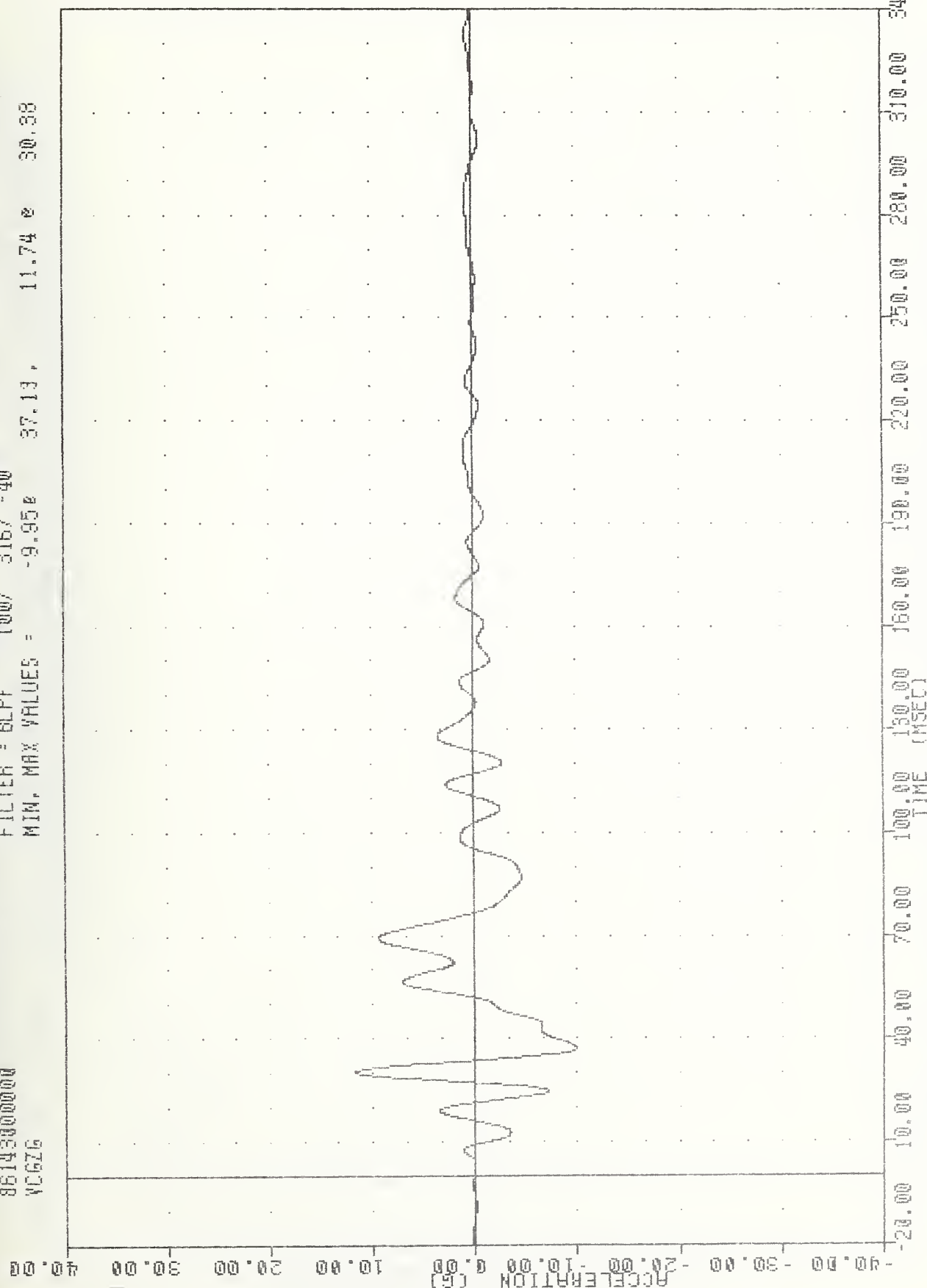
FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = -9.650 72.75, 0.02 0 -13.75



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 DELTA V USTING VCCYC

VRT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143800000
 WCGZG

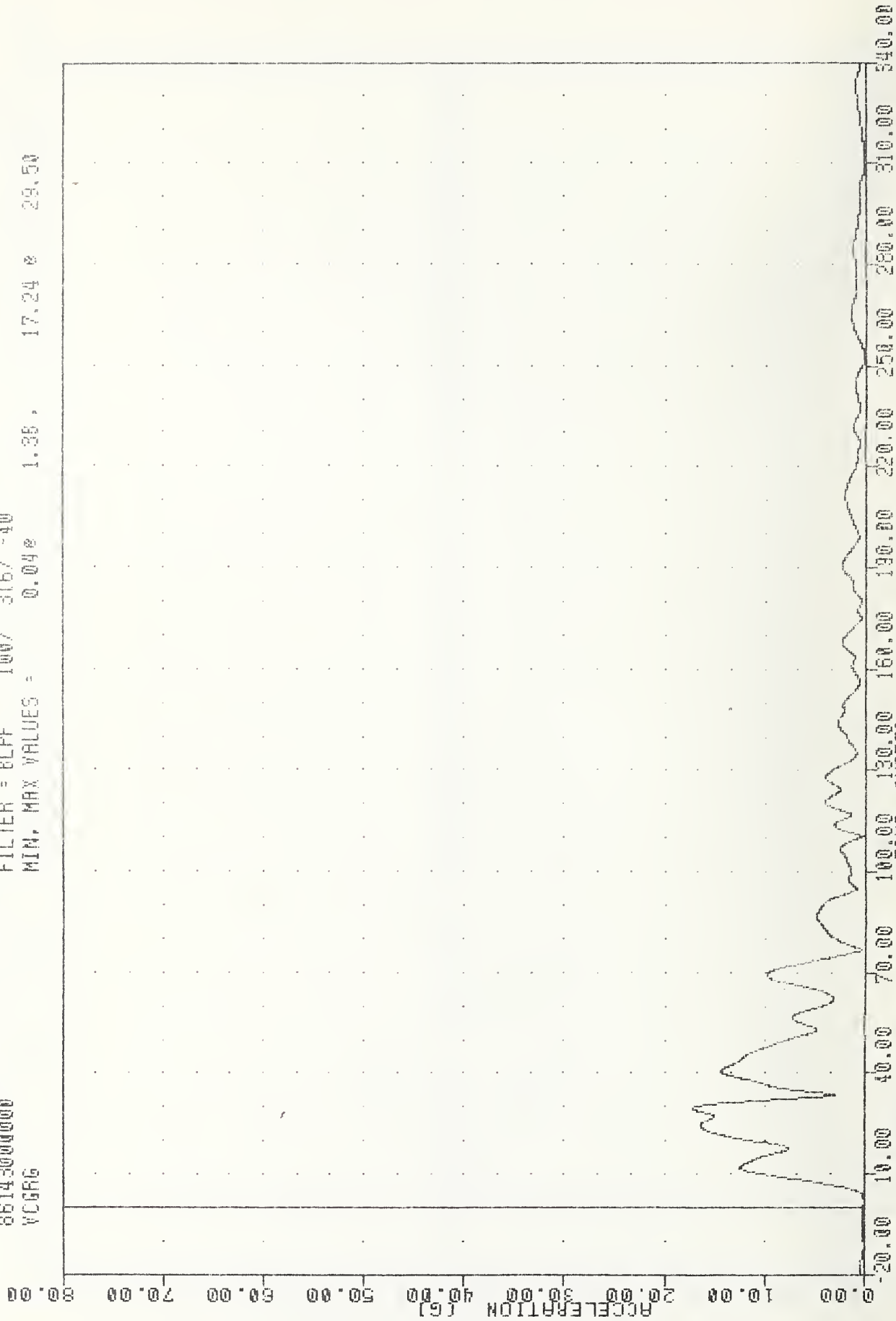
FILTER = BLPF 100/ 316/ -40
 MIN. MAX VALUES = -9.95e 37.13, 11.74 e 30.38



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS

VRT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VCGRG

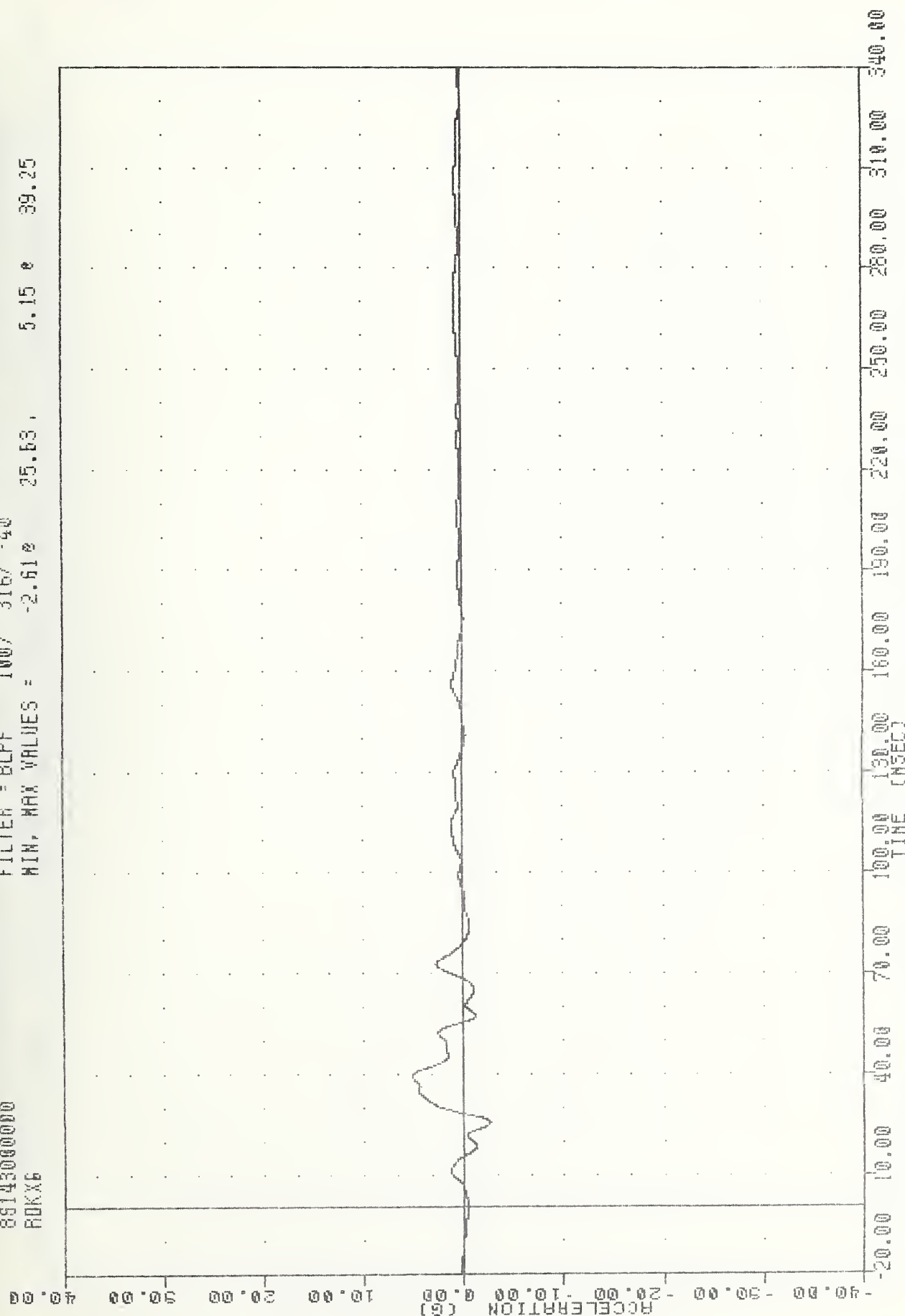
FILTER = 8LFF 100/ 316/ -40
 MIN. MAX VALUES = 0.04e 1.35, 17.24 e 29.50



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 VEHICLE CENTER OF GRAVITY ACCELERATION RESISTANT

WAT , 8605231
CRASH 3 MODEL IMPROVEMENTS
86143000000
ROKX6

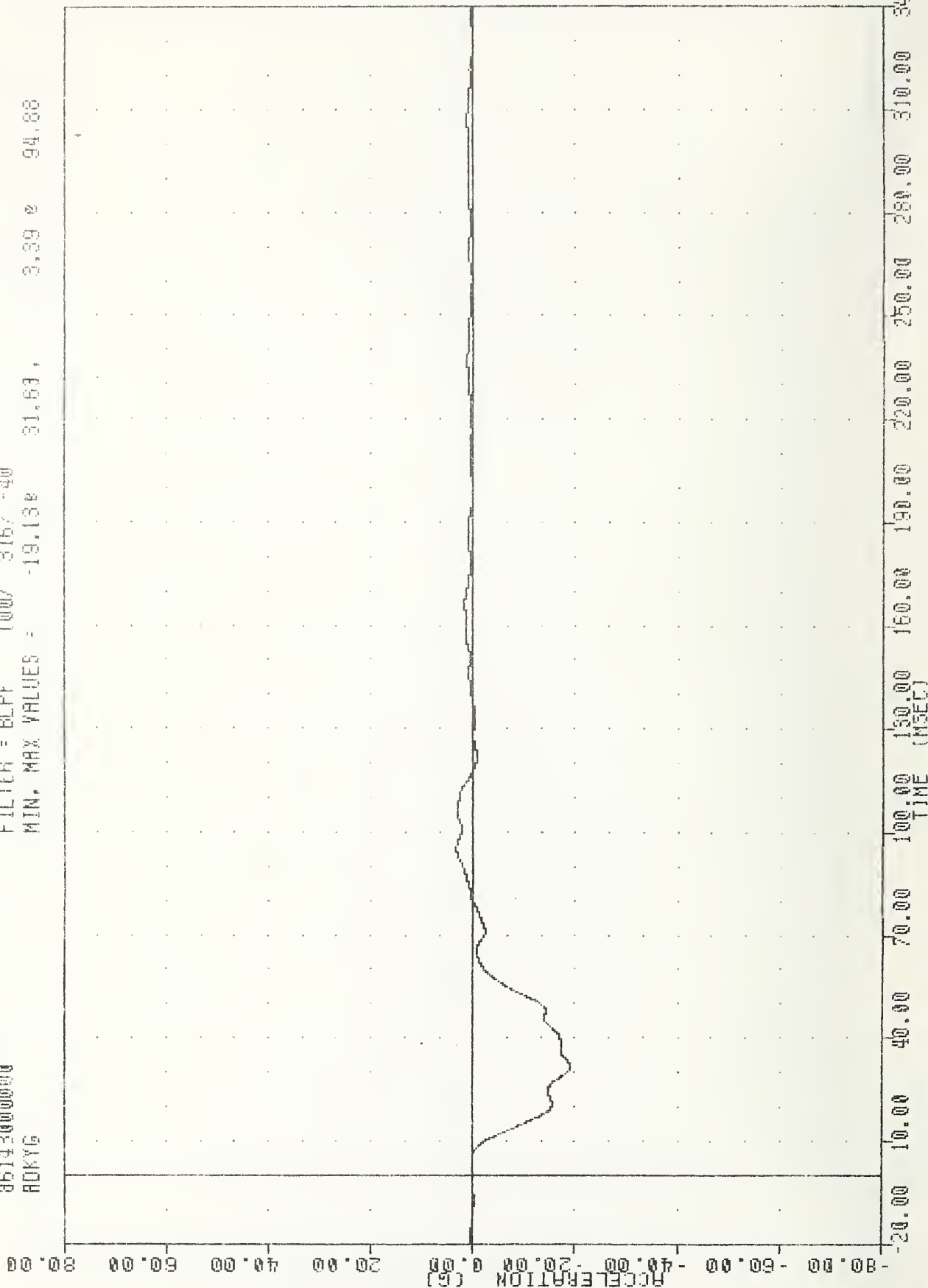
FILTER = BLPF 100/ 316/ -40
WIN, MAX VALUES = -2.61e 25.63 , 5.15 e 39.25



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
VEHICLE REAR DECK ACCELERATION X AXIS

VRT 860523J
 CRASH 3 MODEL IMPROVEMENTS
 86142000000
 ADKYG

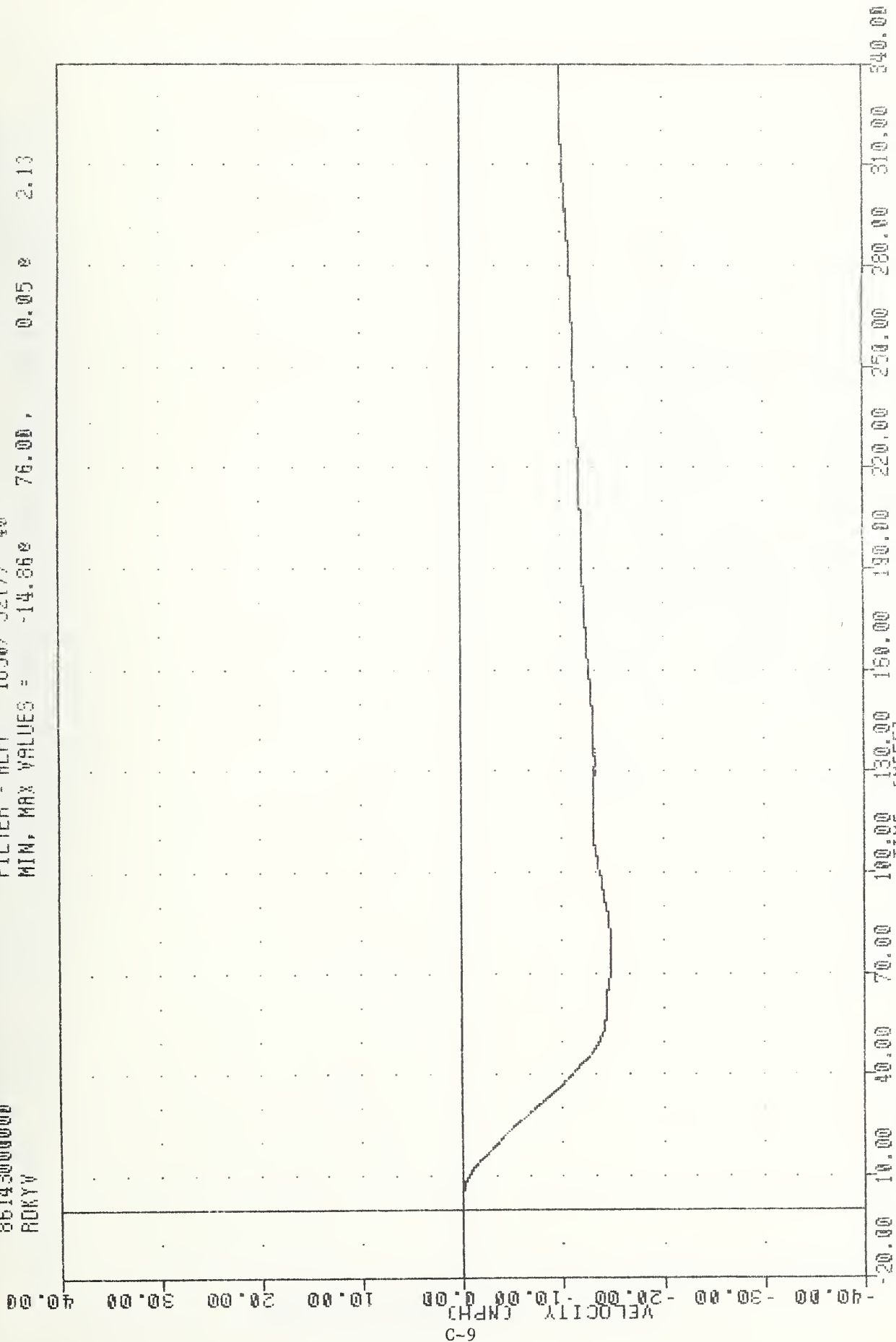
FILTER = BLPF 100/ 316/ -40
 MIN. MAX VALUES = -19.13e 31.63, 3.39 e 94.88



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 VEHICLE REAR DECK ACCELERATION Y AXIS

VAT , 8605231
CRASH 3 MODEL IMPROVEMENTS
86143000000
ROKYV

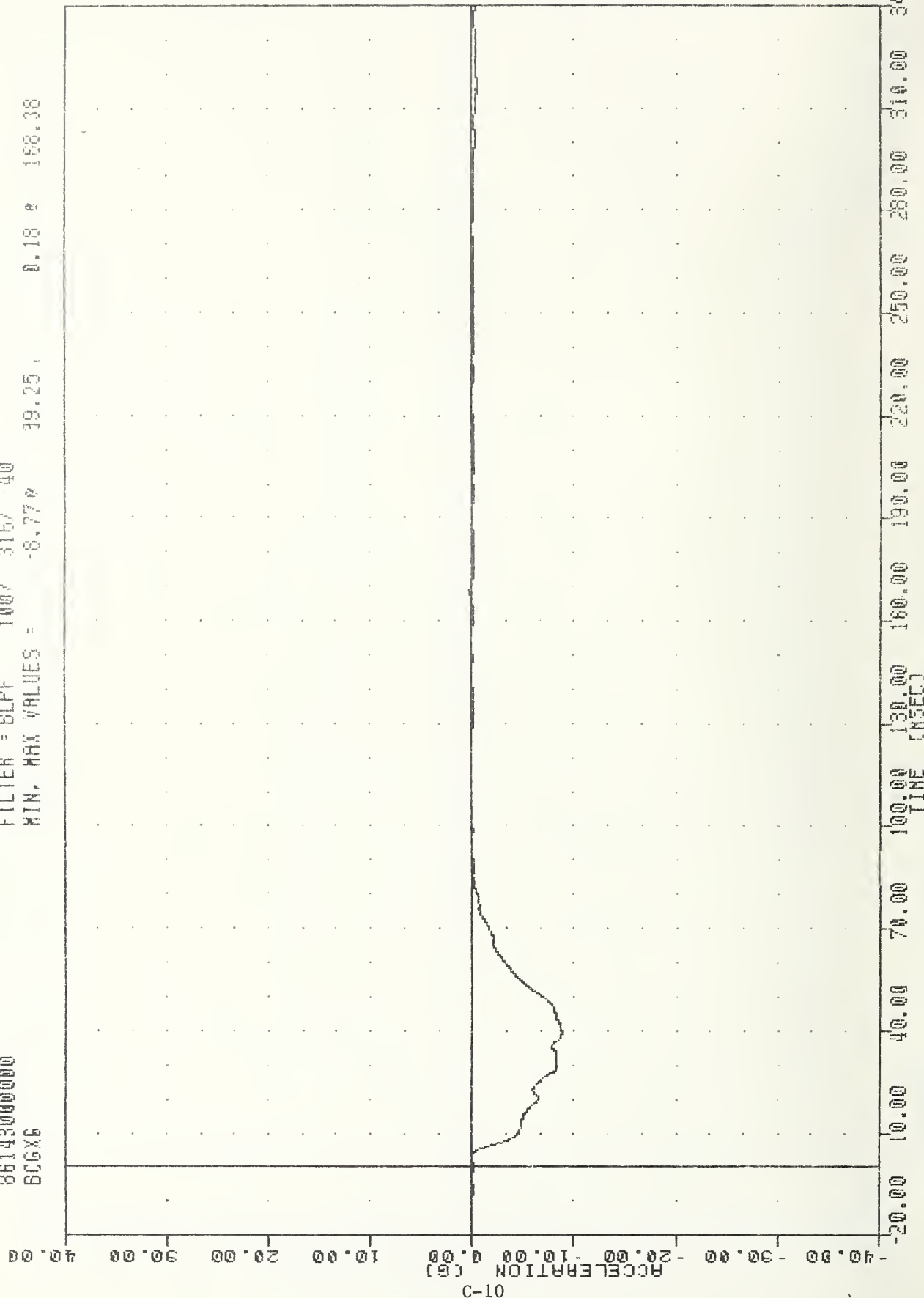
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -14.860 76.00, 0.05 2.13



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
DELTA V USING ROKY6

VAT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 8614300000
 BCGX6

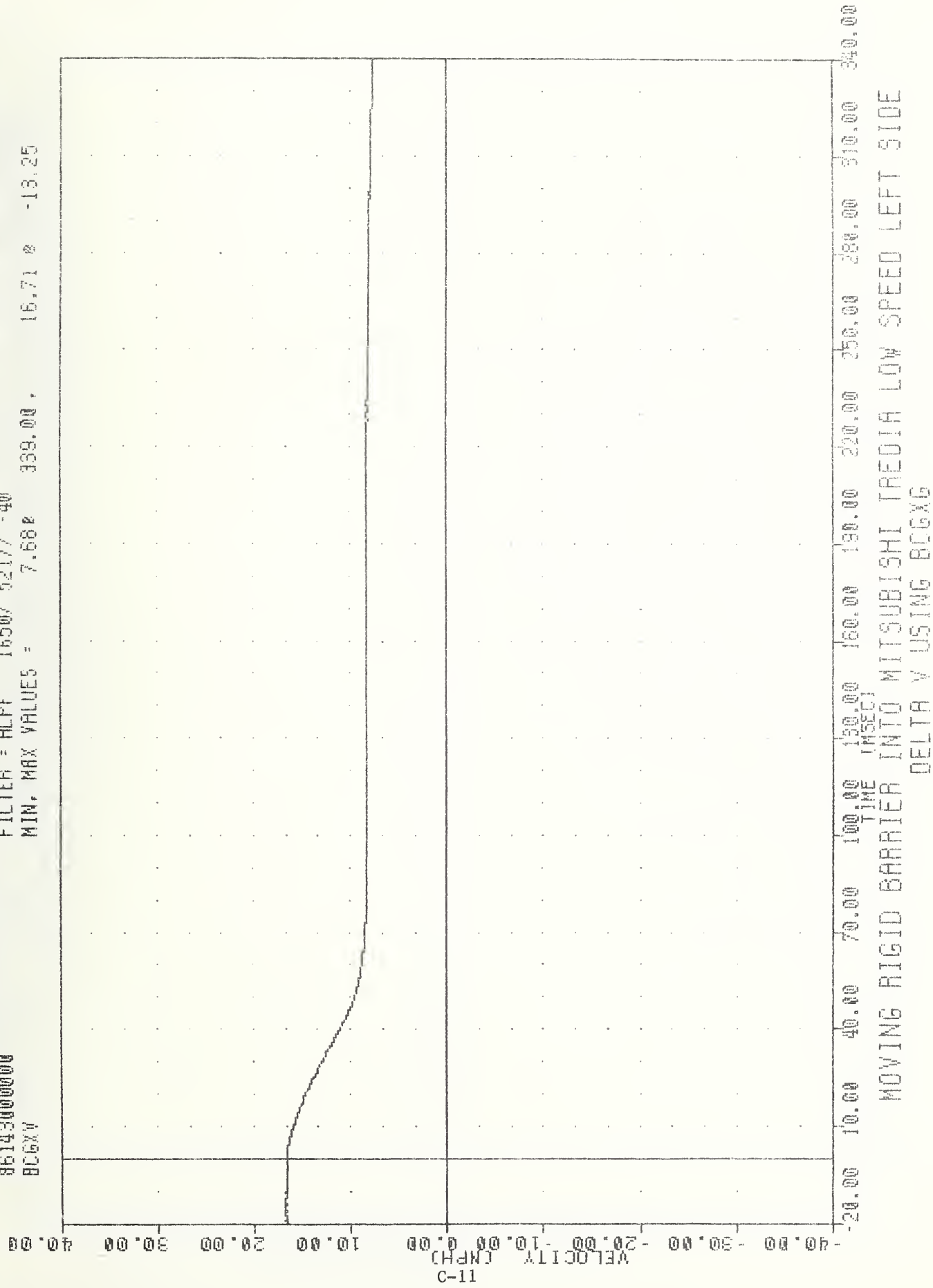
FILTER = BLPF 100/ 316/ 40
 MIN. MAX VALUES = -8.77% 39.25 , 0.18 e 158.38



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS

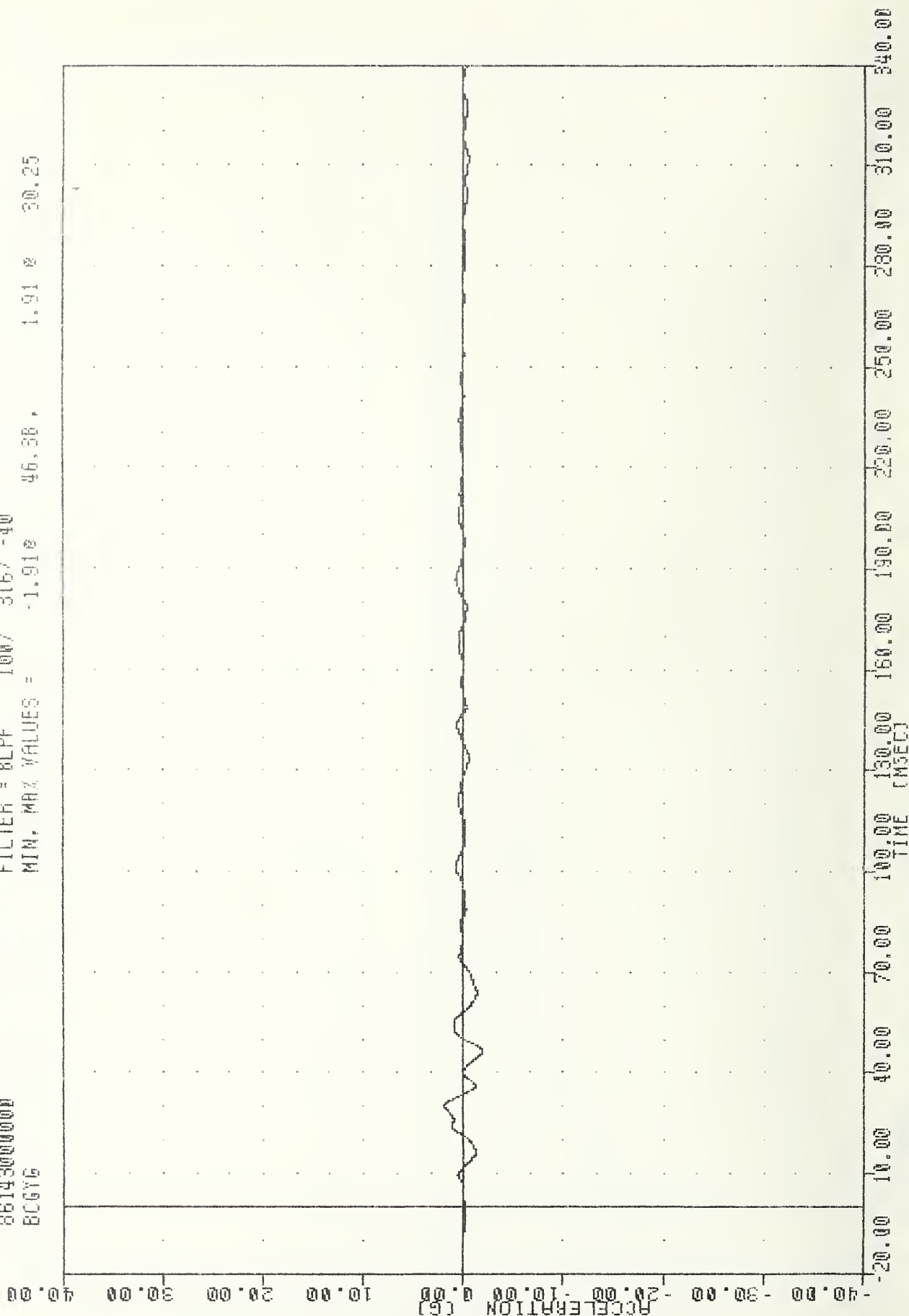
VRT 8605231
CRASH 3 MODEL IMPROVEMENTS
86143000000
BCGXV

FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = 7.68 339.00, 16.71 2 -13.25



VRT
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BCGTG

FILTER = BLPF 100/ 316/-40
 MIN. MAX VALUES = -1.91e 46.38, 1.91 e 30.25



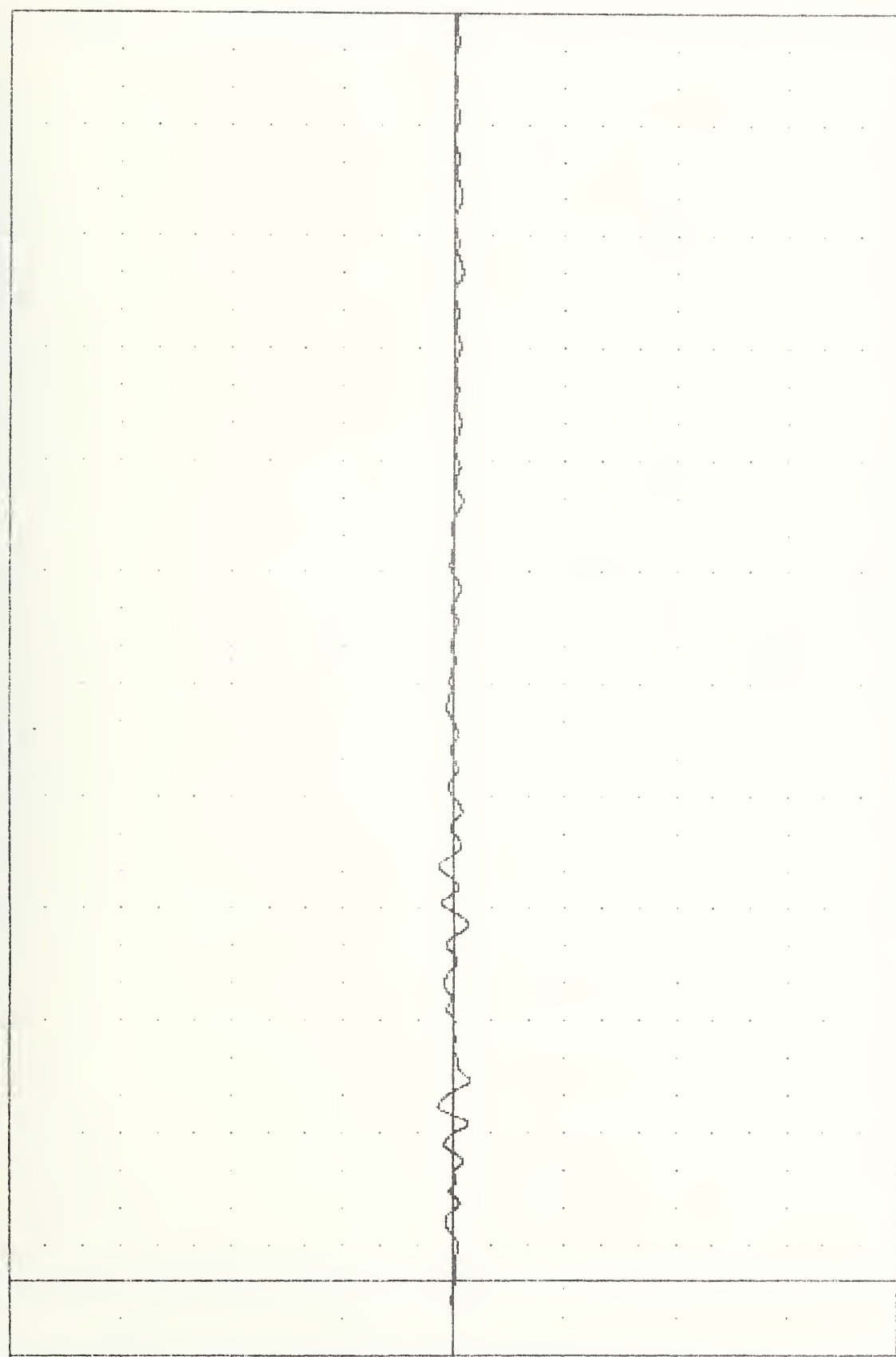
MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS

VR1 6605231

FILTER = BLPF 1407 3167 -40

MIN. MAX VALUES = -1.42# 53.88, 1.43 # 47.00

ACCELERATION (G)



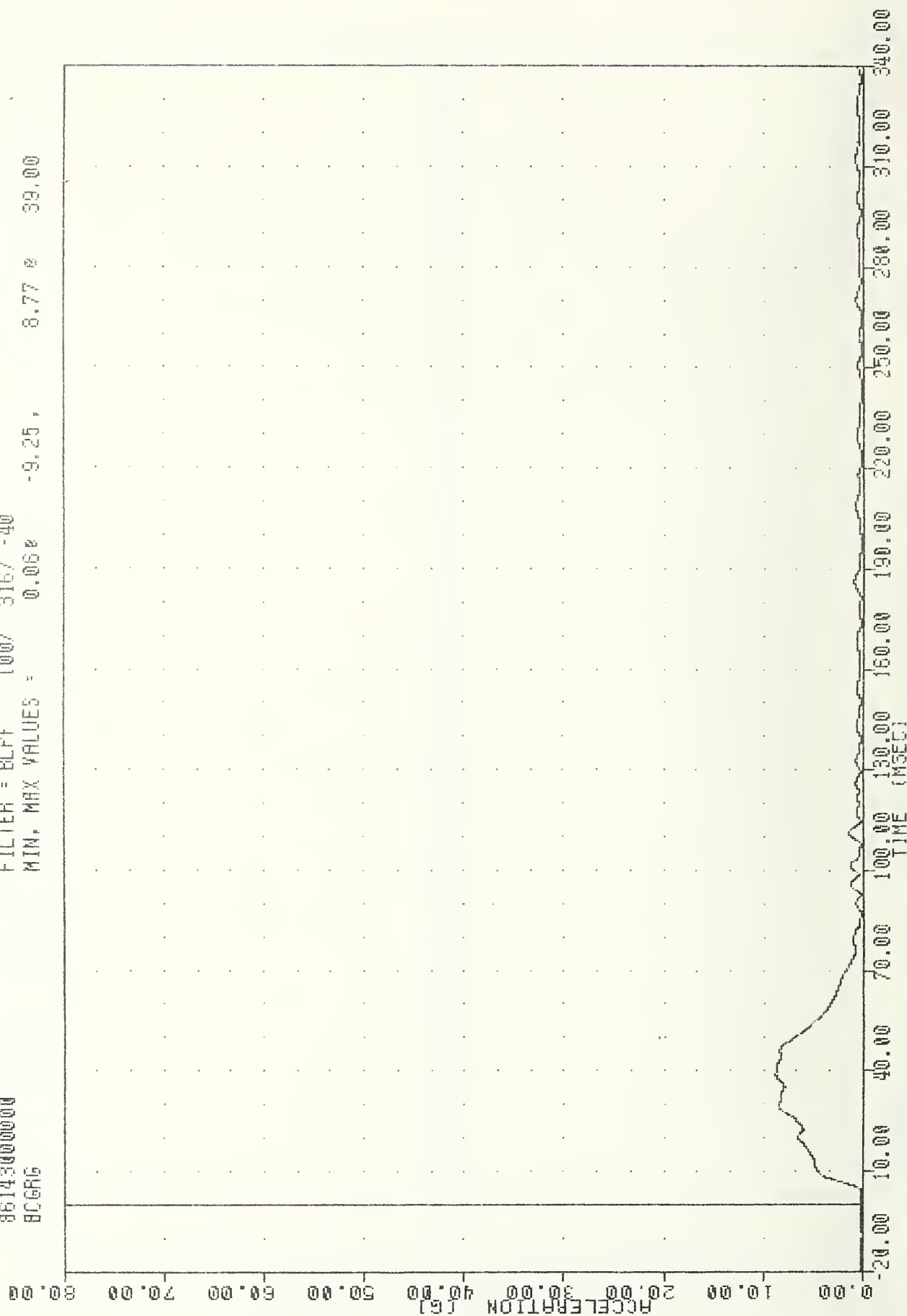
0.00 10.00 20.00 30.00 40.00 50.00 60.00 70.00 80.00 90.00 100.00 110.00 120.00 130.00 140.00 150.00 160.00 170.00 180.00 190.00 200.00 210.00 220.00 230.00 240.00 250.00 260.00 270.00 280.00 290.00 300.00 310.00 320.00 330.00 340.00

MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS

VRT
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BCGRG

* 8605231

FILTER = BLFF 100/ 316/ -40
 MIN, MAX VALUES = 0.060 -9.25, 8.77 @ 39.00



VRT 8805231

CRASH 3 MODEL IMPROVEMENTS

86143000000

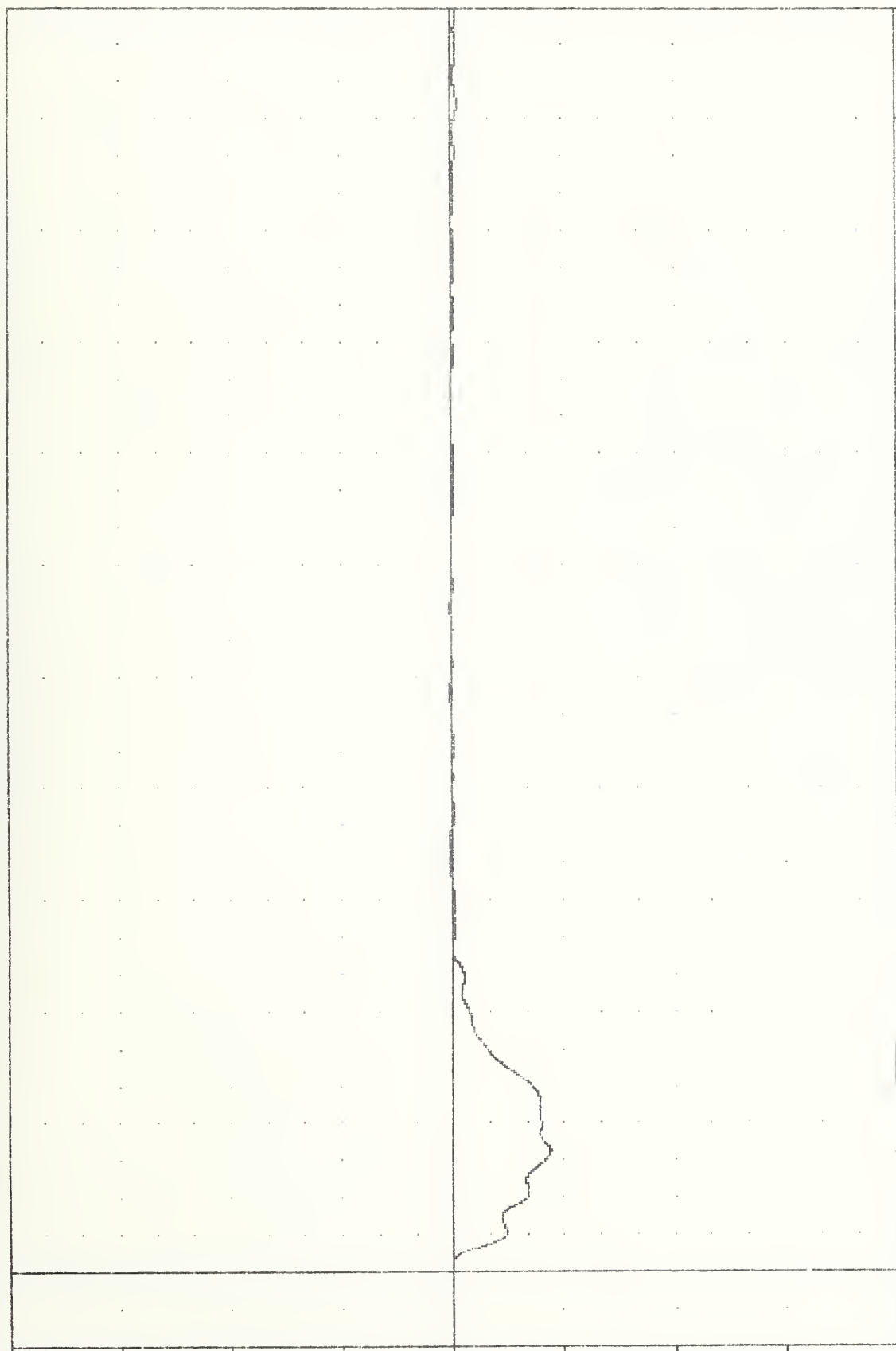
BRCXG

FILTER = 6LFF 100/ 316/ -40

MIN. MAX VALUES = -8.76e 32.36.

0.35 e 116.25

ACCELERATION (G)

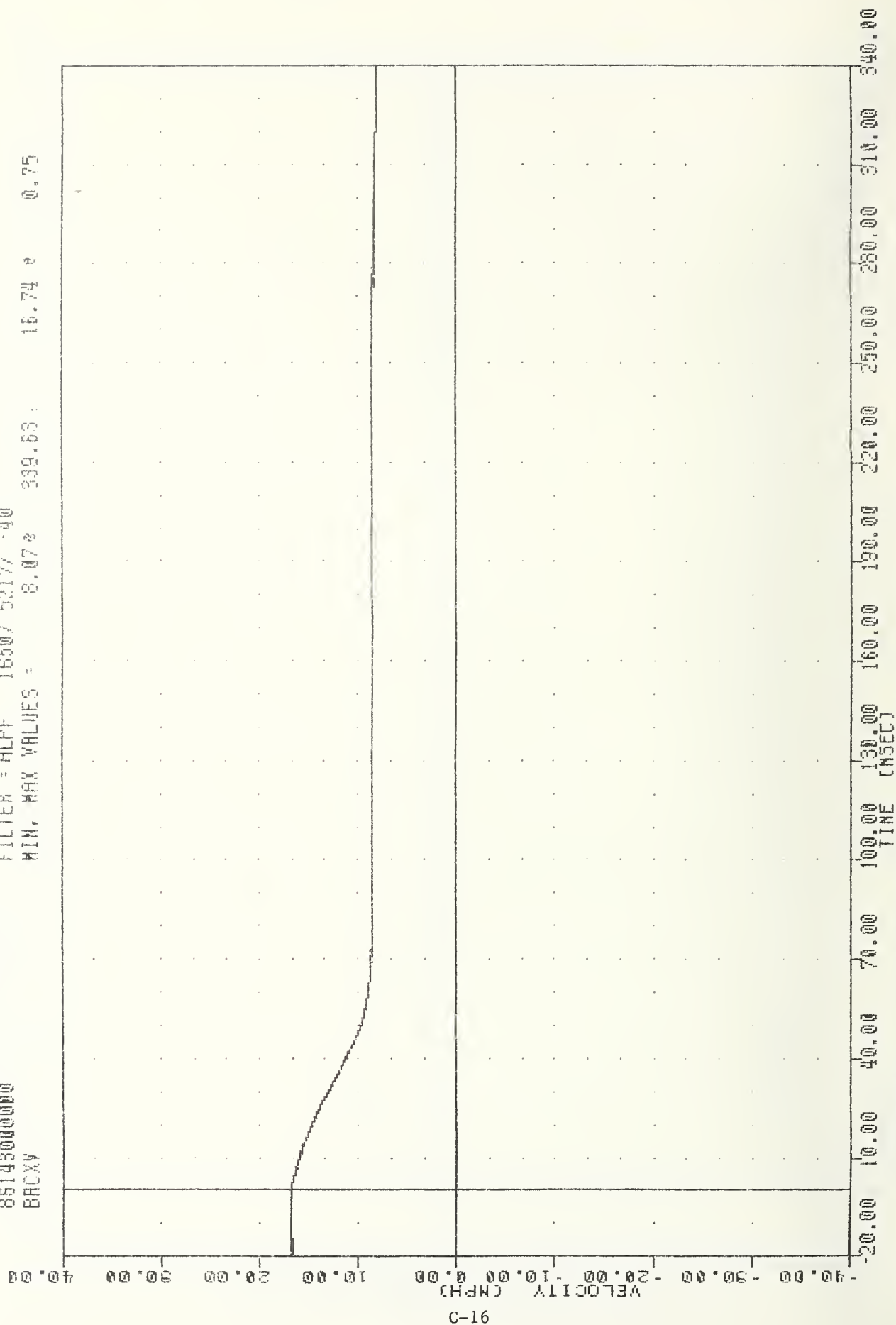


MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE

MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS

VAT , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BRXY

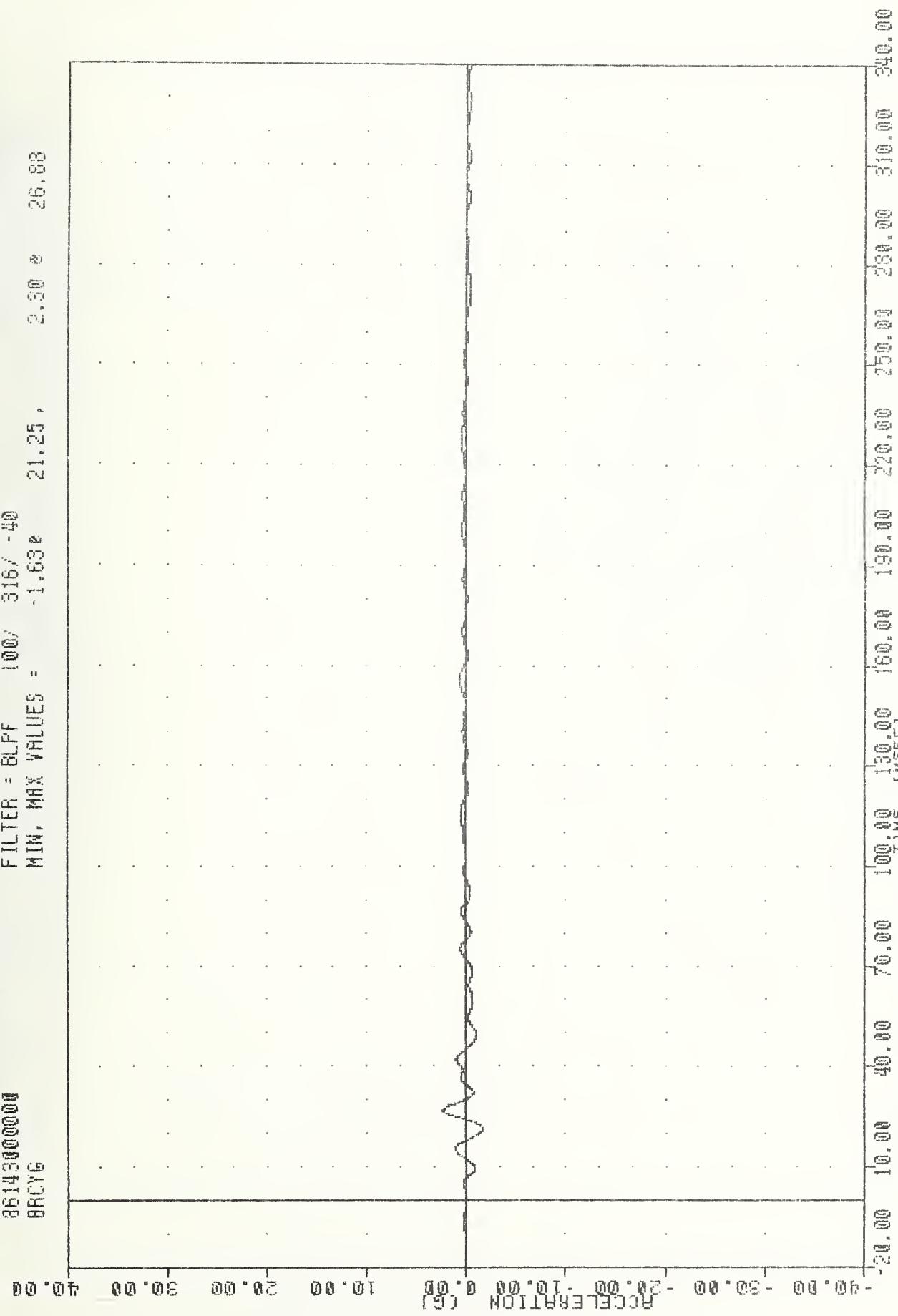
FILTER = ALPF 1650 / 5217 / -40
 MIN, MAX VALUES = 8.07e 339.63 16.74 0.75



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 DELTA V USING BRXYG

VRT 8605231
CRASH 3 MODEL IMPROVEMENTS
86143000000
BRCYG

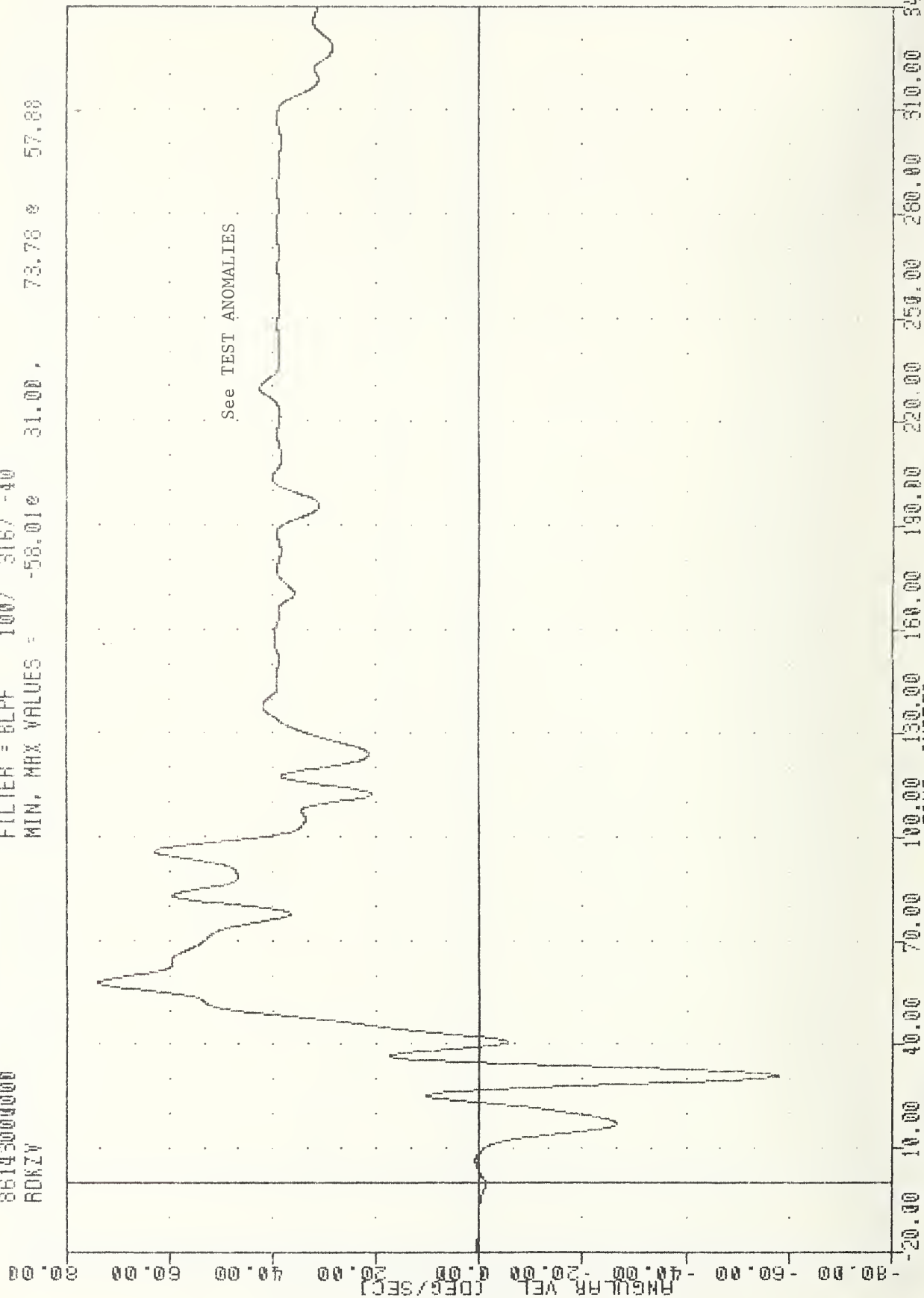
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -1.630 21.25, 2.30 26.88



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS

VR1 , 8605231
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 RDKZY

FILTER = 6LPF 100/ 316/ -40
 MIN. MAX VALUES = -58.01e 31.00, 73.78 e 57.80



C-18

MOVING RIGID BARRIER INTO MITSUBISHI TREDIA LOW SPEED LEFT SIDE
 VEHICLE YAW RATE DEGREE/SECOND

APPENDIX D

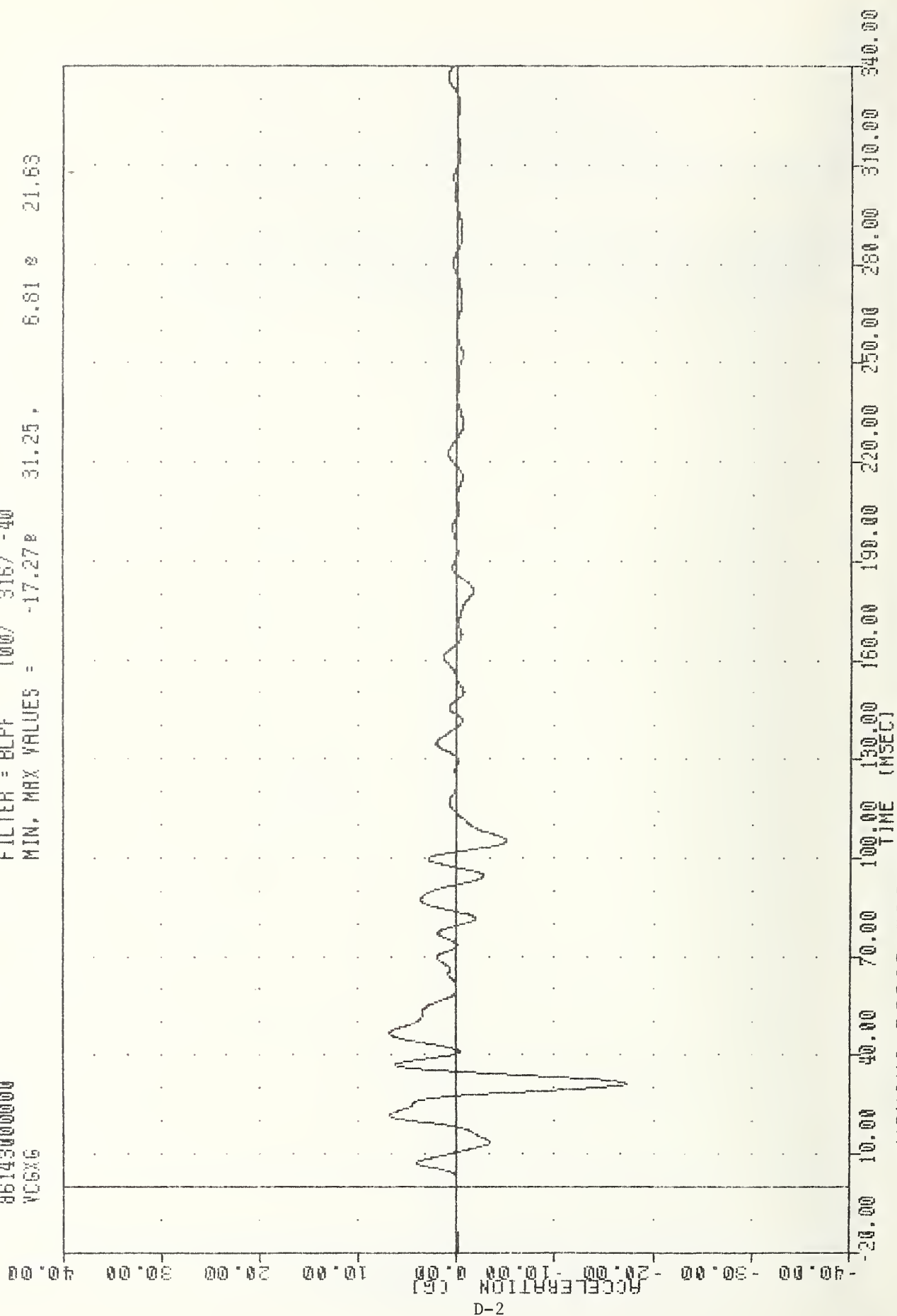
DATA PLOT PRESENTATION

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.

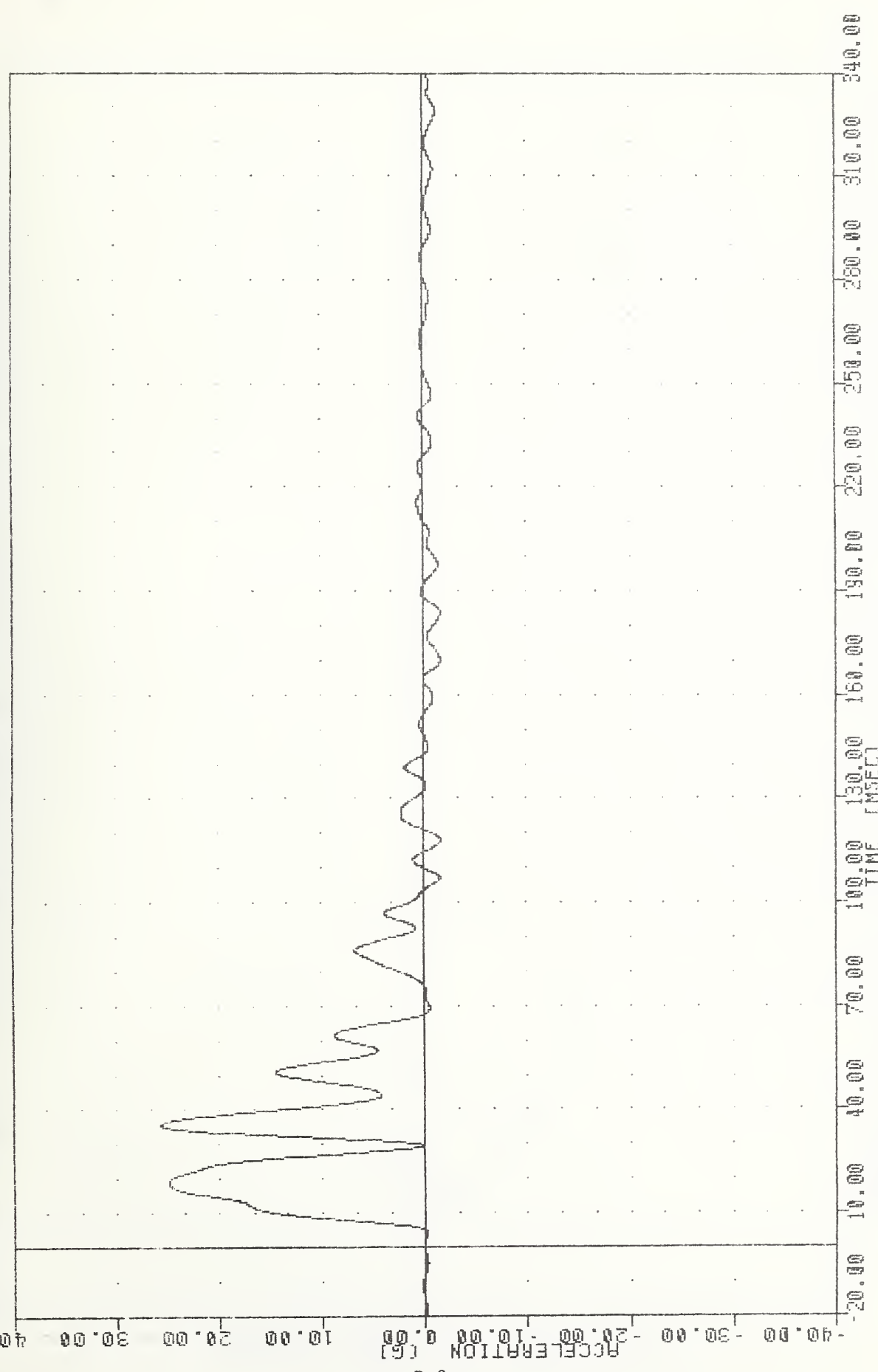
VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VC6X6

FILTER = BLPF 100/ 316/ -40
 MIN. MAX VALUES = -17.278 31.25, 6.81 21.63



VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 861430000000
 YCGY61

FILTER = 6LFF 100/ 316/ -40
 MIN. MAX VALUES = -1.620 118.00 25.75 0 35.63

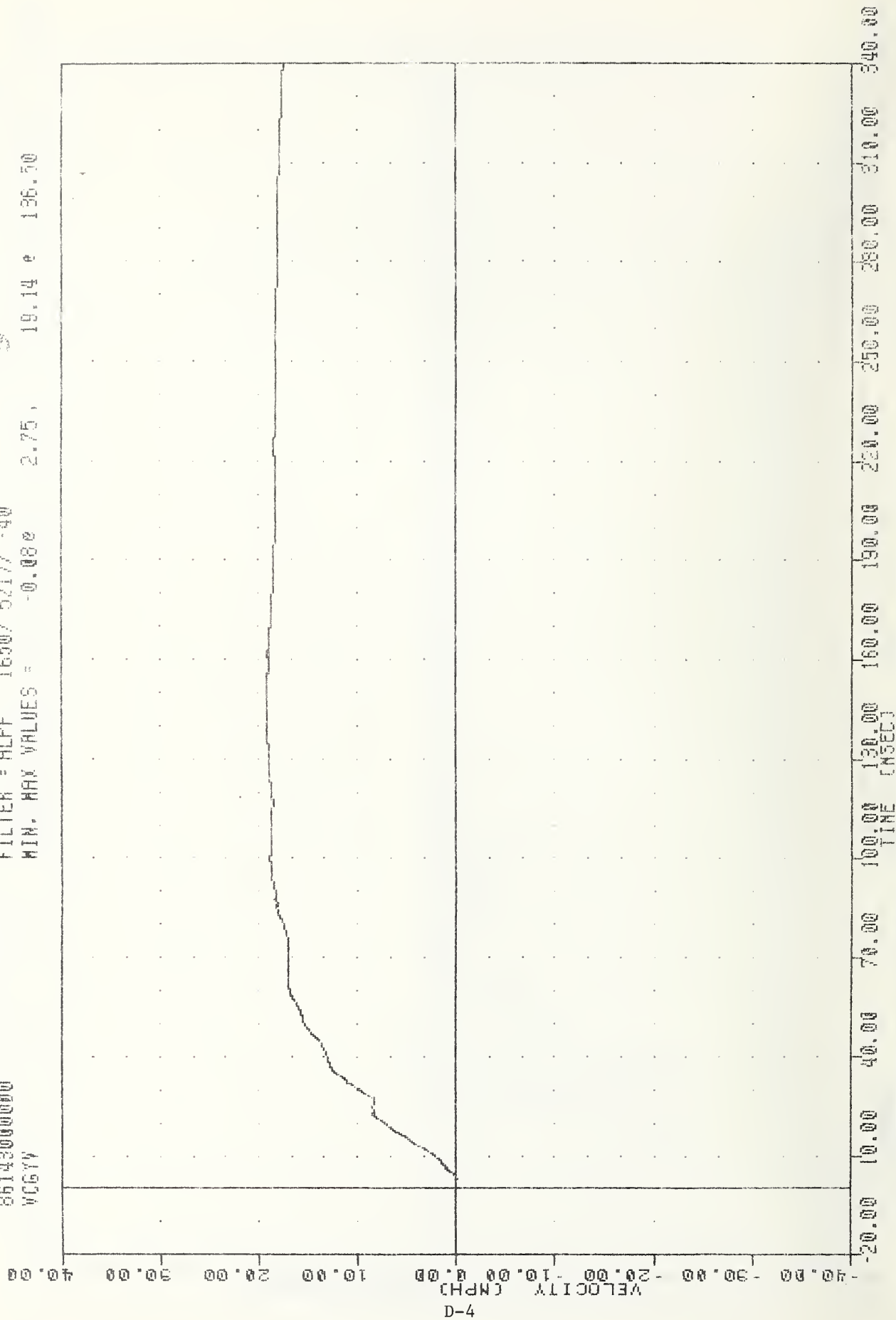


D-3

MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS REDUNDANT -1

VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VCGYV

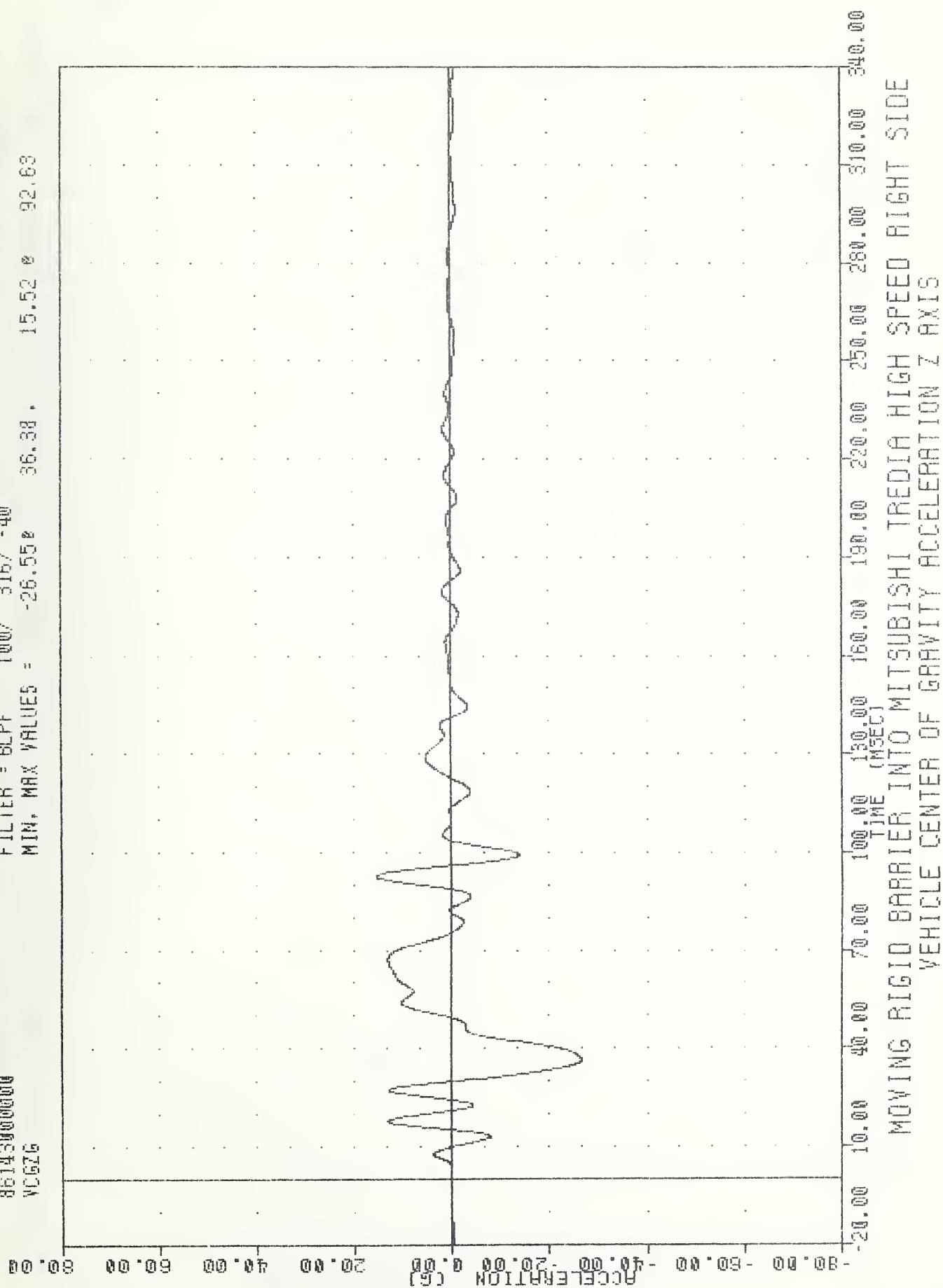
FILTER = ALFF 1650/ 5217/ -40
 MIN. MAX VALUES = -0.080 2.75, 19.14 e 136.50



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 DFITA V USING VCGYG

VRT , 8605232
CRASH 3 MODEL IMPROVEMENTS
86143000000
VCGIG

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -26.55% 36.38 . 15.52 % 92.63

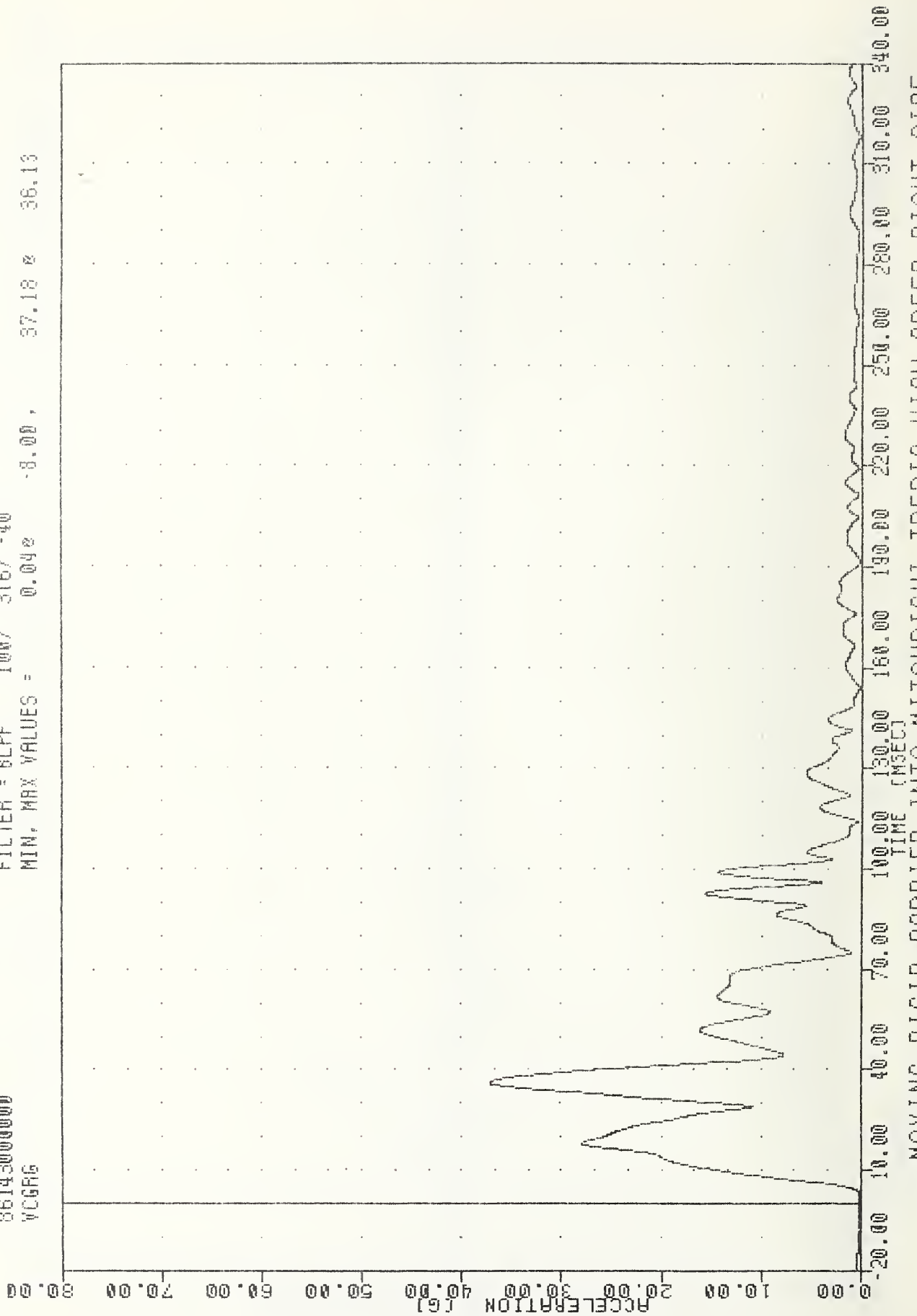


MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS

VRT
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 VCGRG

8605232

FILTER = 8LPF 100/ 316/ -40
 MIN, MAX VALUES = 0.042 -8.00, 37.13 & 36.13

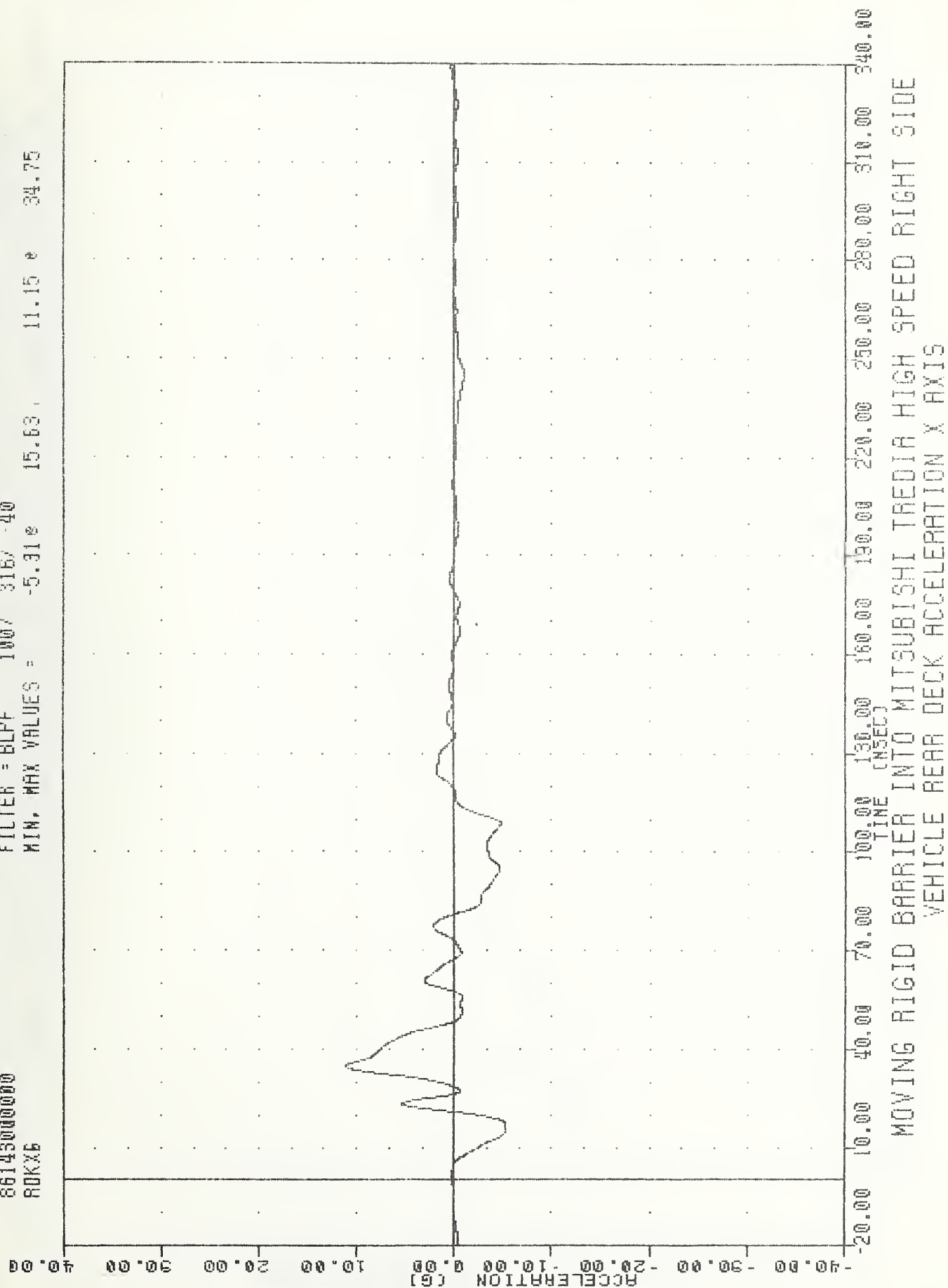


MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 VEHICLE CENTER OF GRAVITY ACCELERATION RESULTANT

VRT
 CRASH 3 MODEL IMPROVEMENTS
 8605232

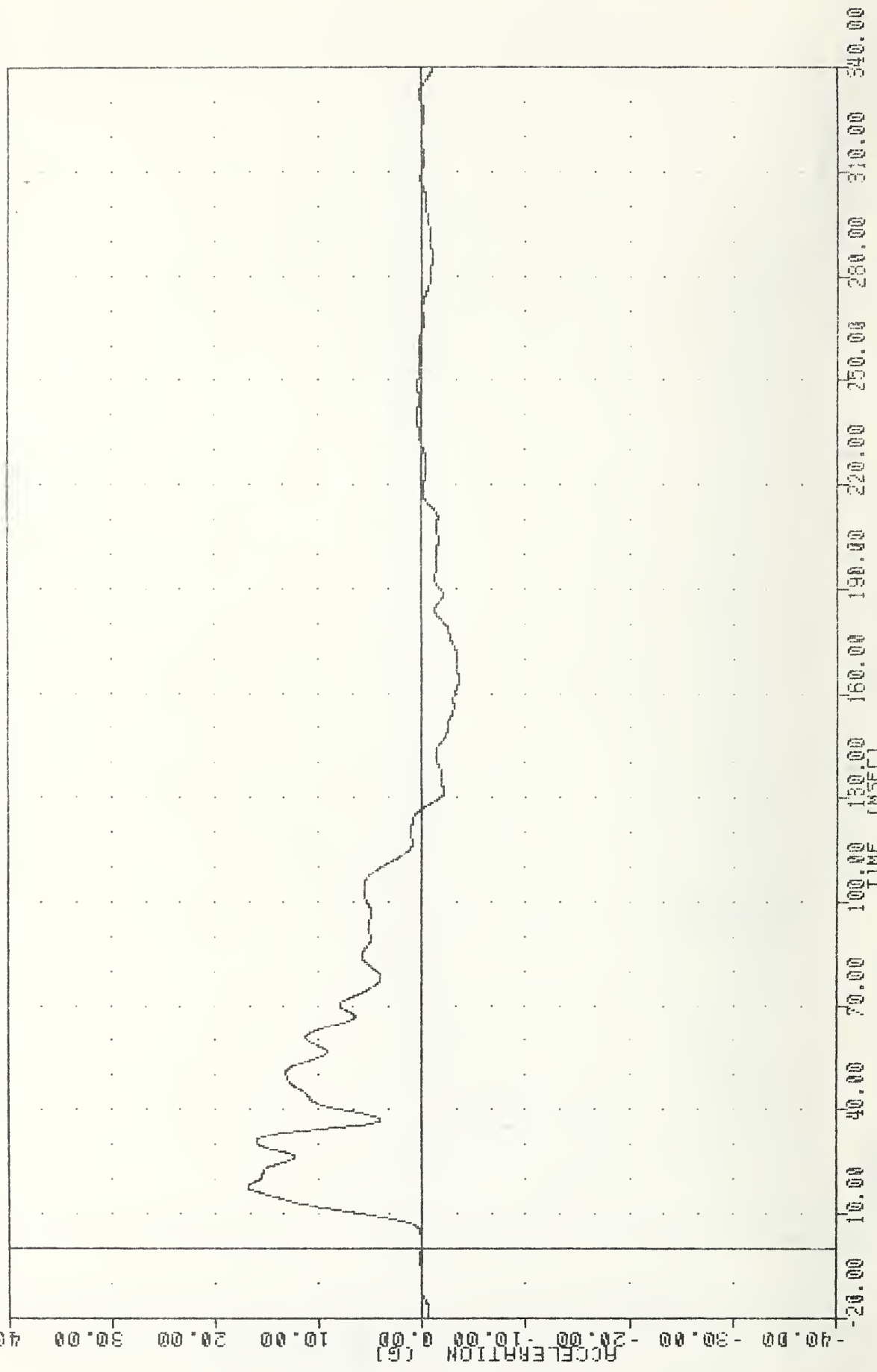
WAT 8605232
CRASH 3 MODEL IMPROVEMENTS
86143000000
RDKX6

FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -5.31* 11.15 * 34.75



VRT
 CRASH 3 MODEL IMPROVEMENTS
 861430000000
 ADKYG

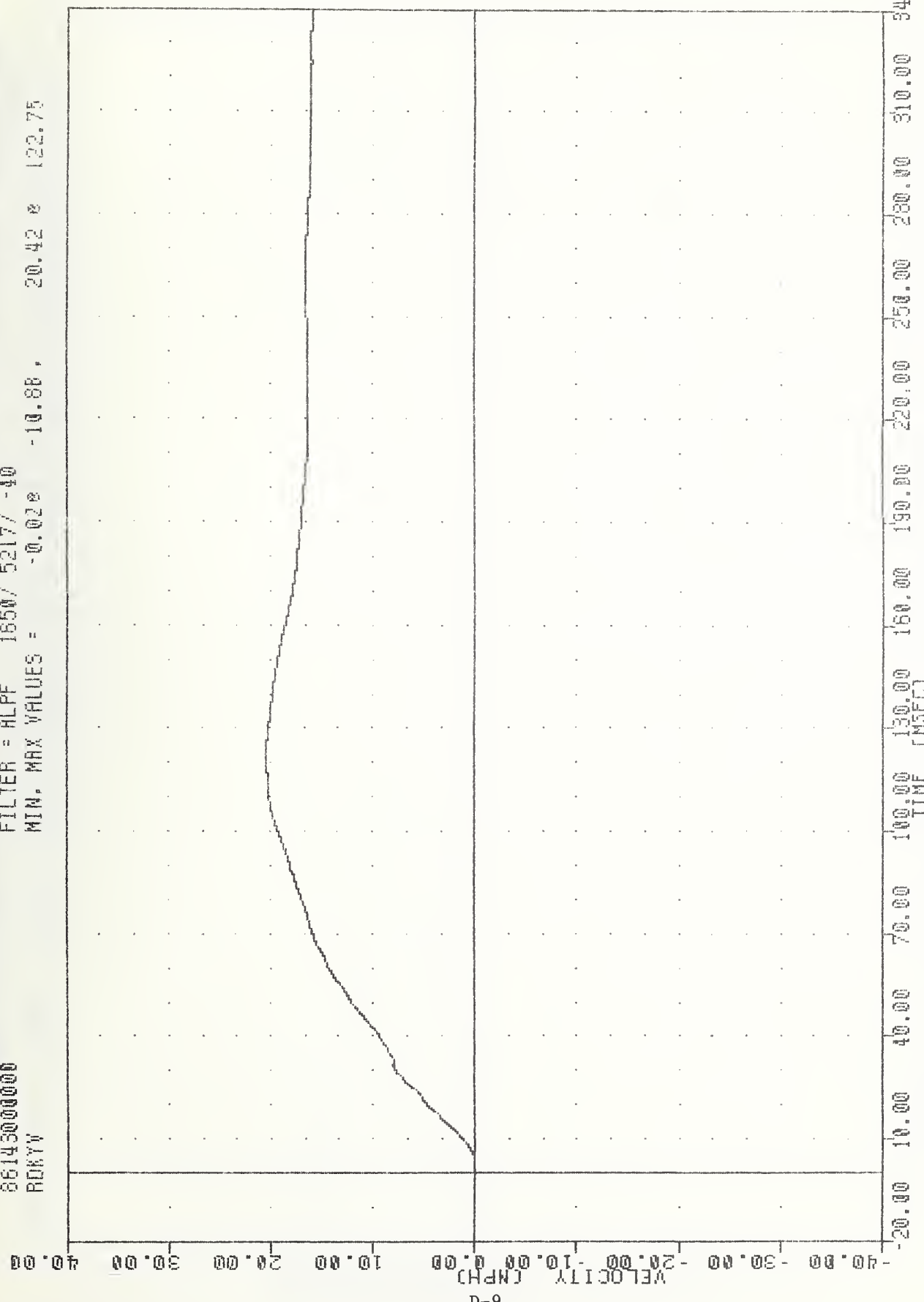
FILTER = 6LFF 100/ 316/ -40
 MIN. MAX VALUES = -3.56 164.13 16.91 17.75



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 VEHICLE REAR DECK ACCELERATION Y AXIS

VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 RDKYW

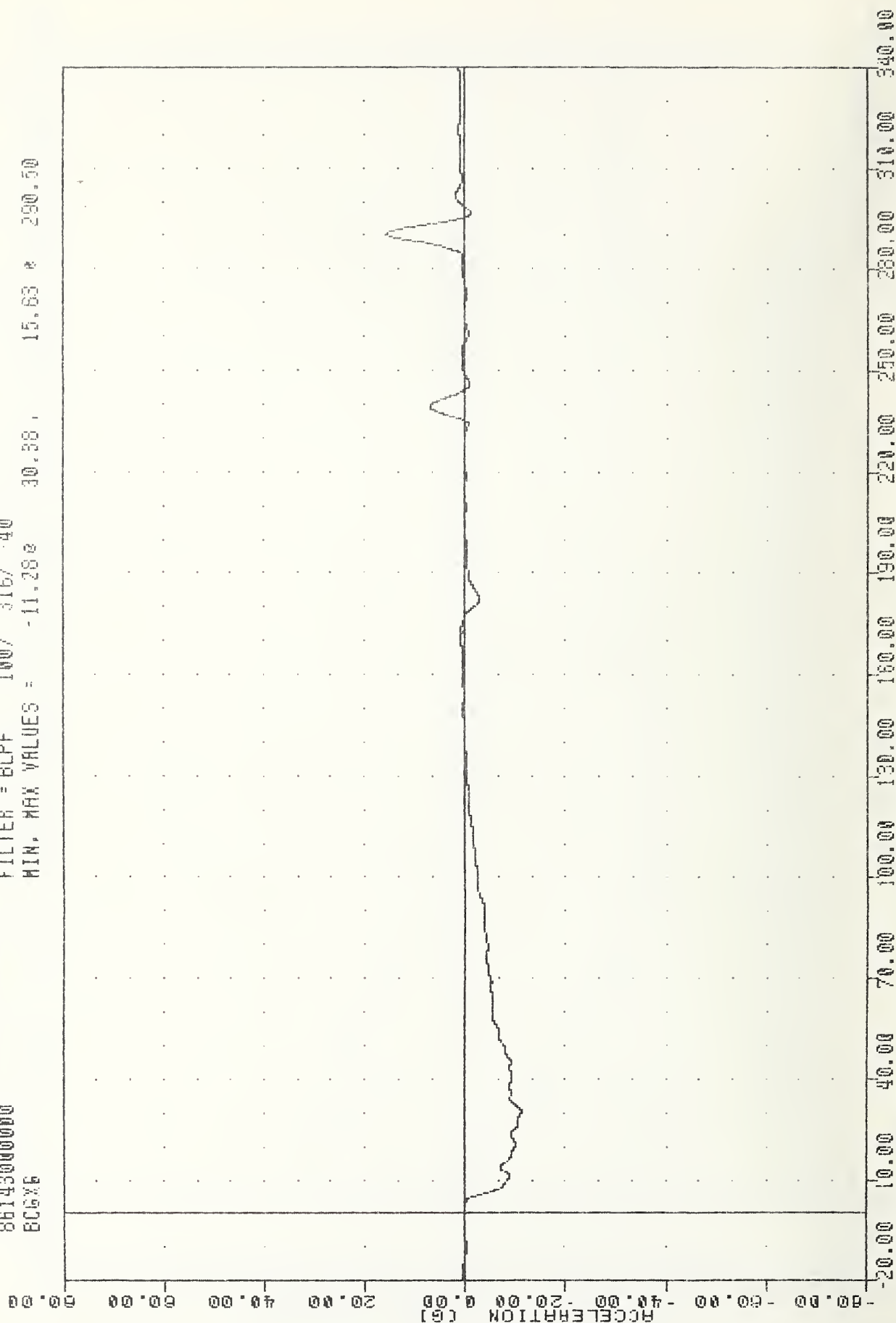
FILTER = ALPF 1850/ 5217/ -40
 MIN. MAX VALUES = -0.028 -10.88 , 20.42 & 122.75



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 DELTA V USING RDKYG

VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86145000000
 BCGXB

FILTER = BLPF 100/ 316/ 40
 MIN. MAX VALUES = -11.28 30.38 , 15.63 * 290.50



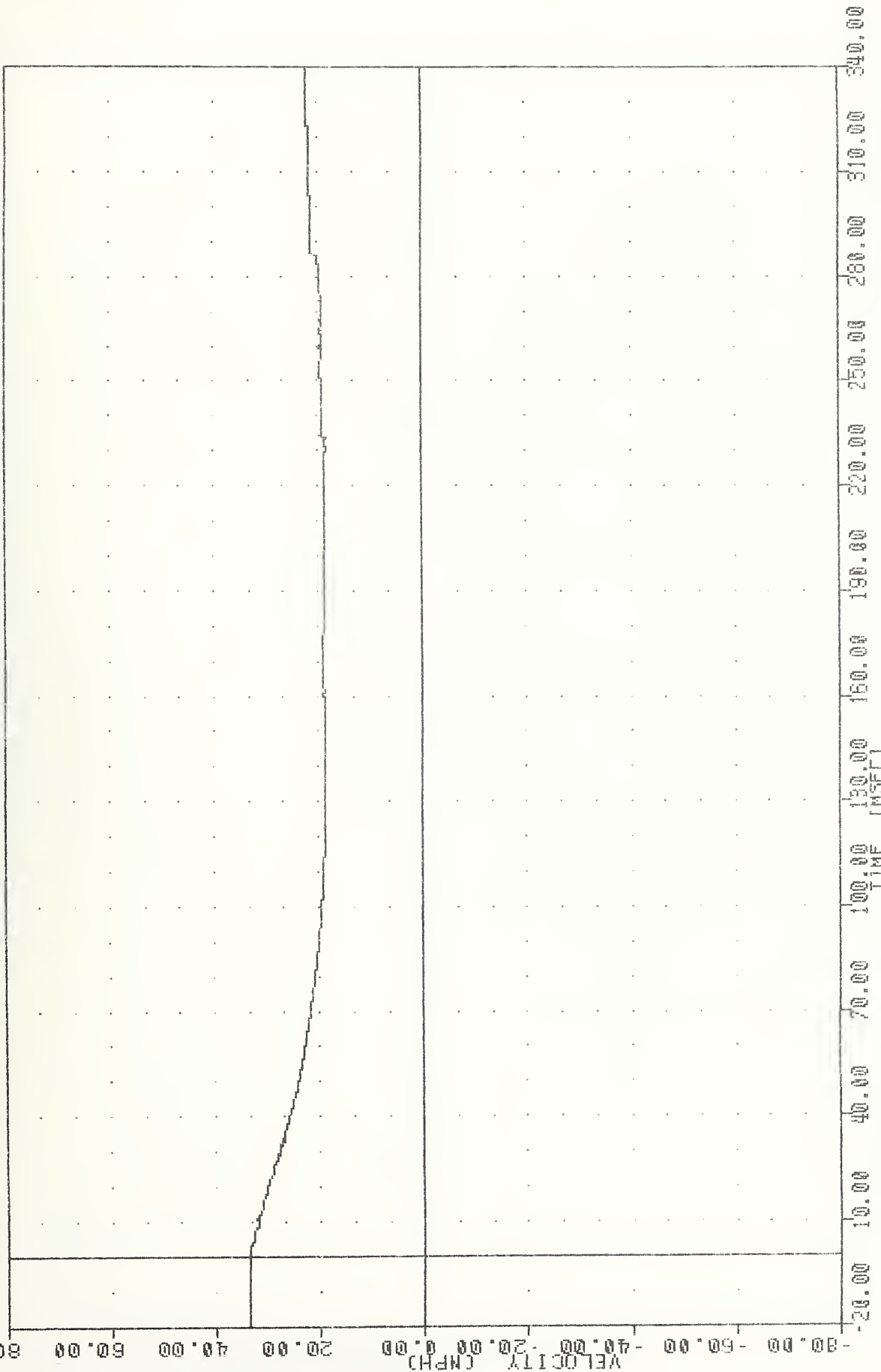
D-10

MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS

VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86145000000
 BCGXB

VRT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BCGXW

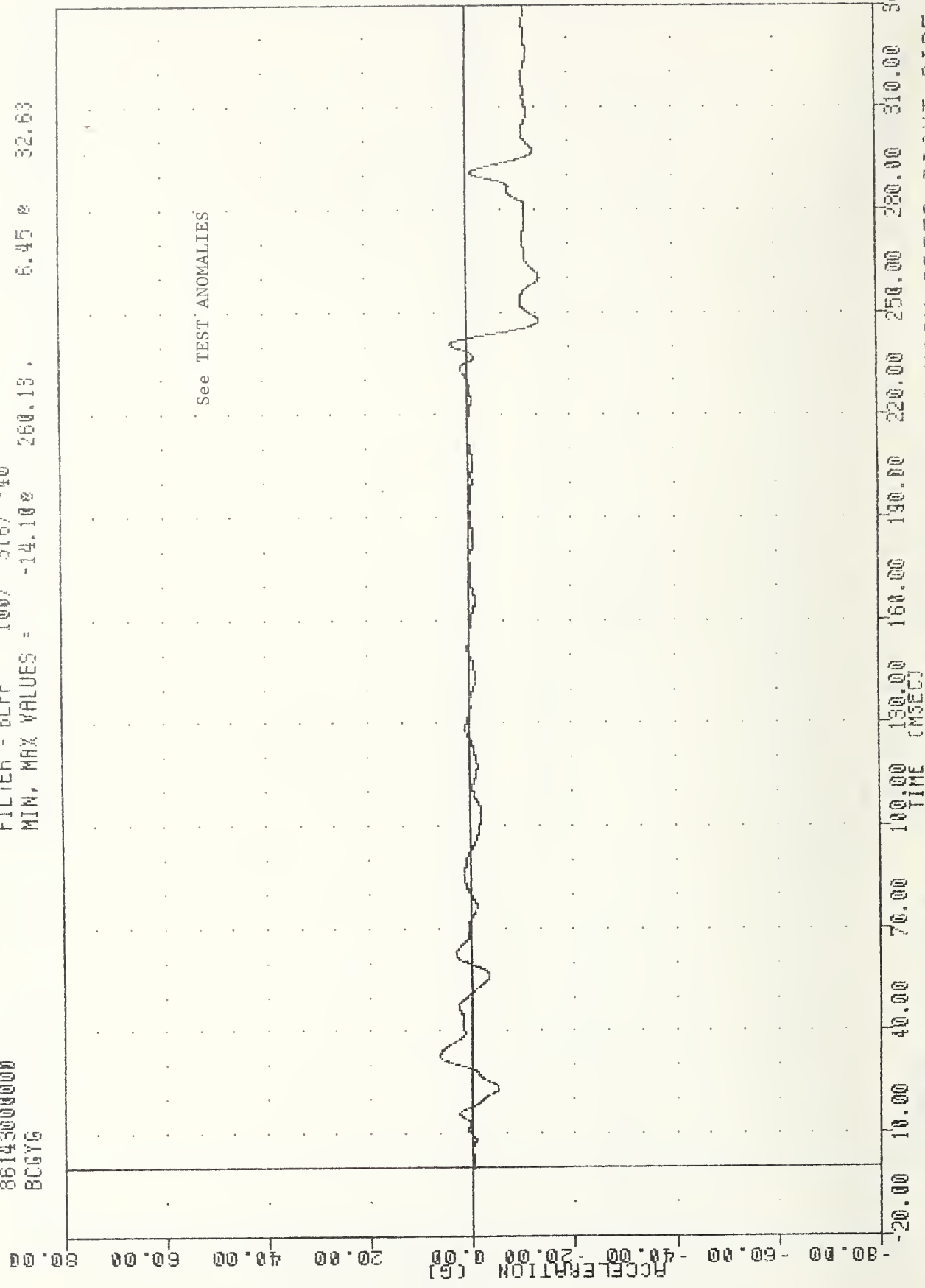
FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = 18.49e 33.52 e -15.38



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 DELTA V USING BCGXG

WRT 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BCGYS

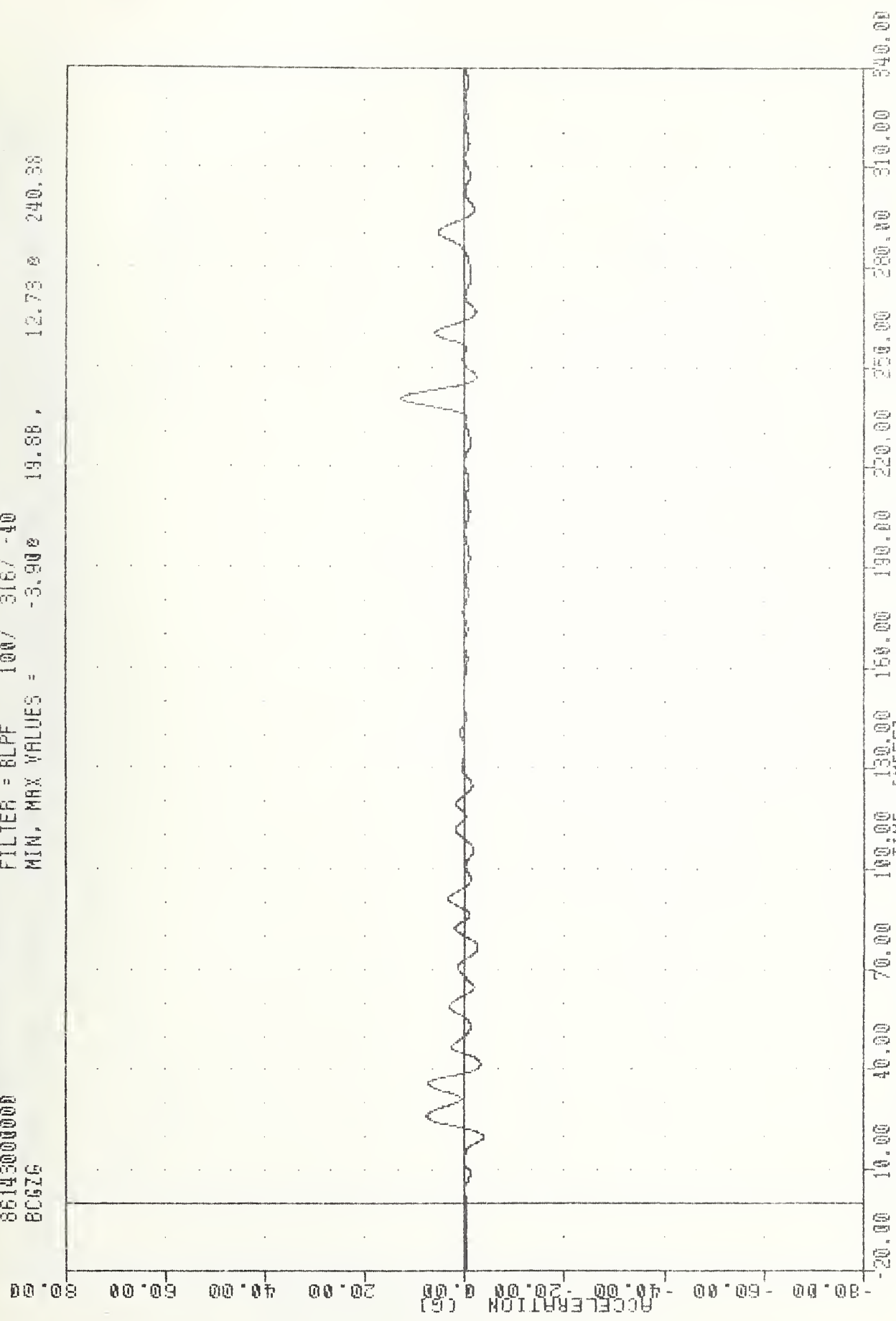
FILTER = BLPF 100/ 316/ -40
 MIN, MAX VALUES = -14.10% 260.13, 6.45% 32.63



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS

VRT , 8505282
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BC6Z6

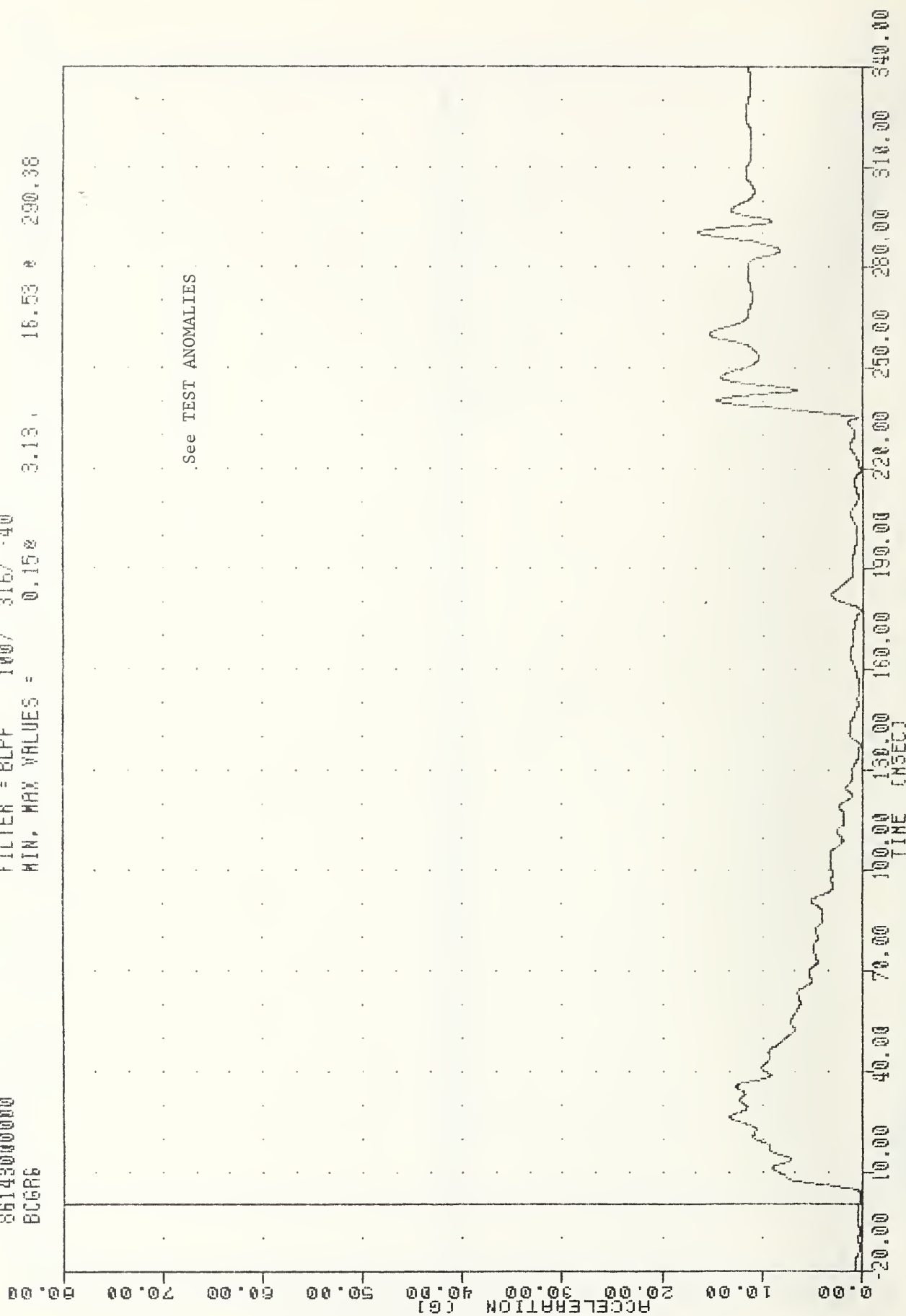
FILTER = 8LPF 100/ 316/ -40
 MIN, MAX VALUES = -3.900 19.88 , 12.73 0 240.38



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS

VAT , 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BCGR6

FILTER = BLPF 100/ 315/ -40
 MIN. MAX VALUES = 0.15 3.13 16.53 290.36

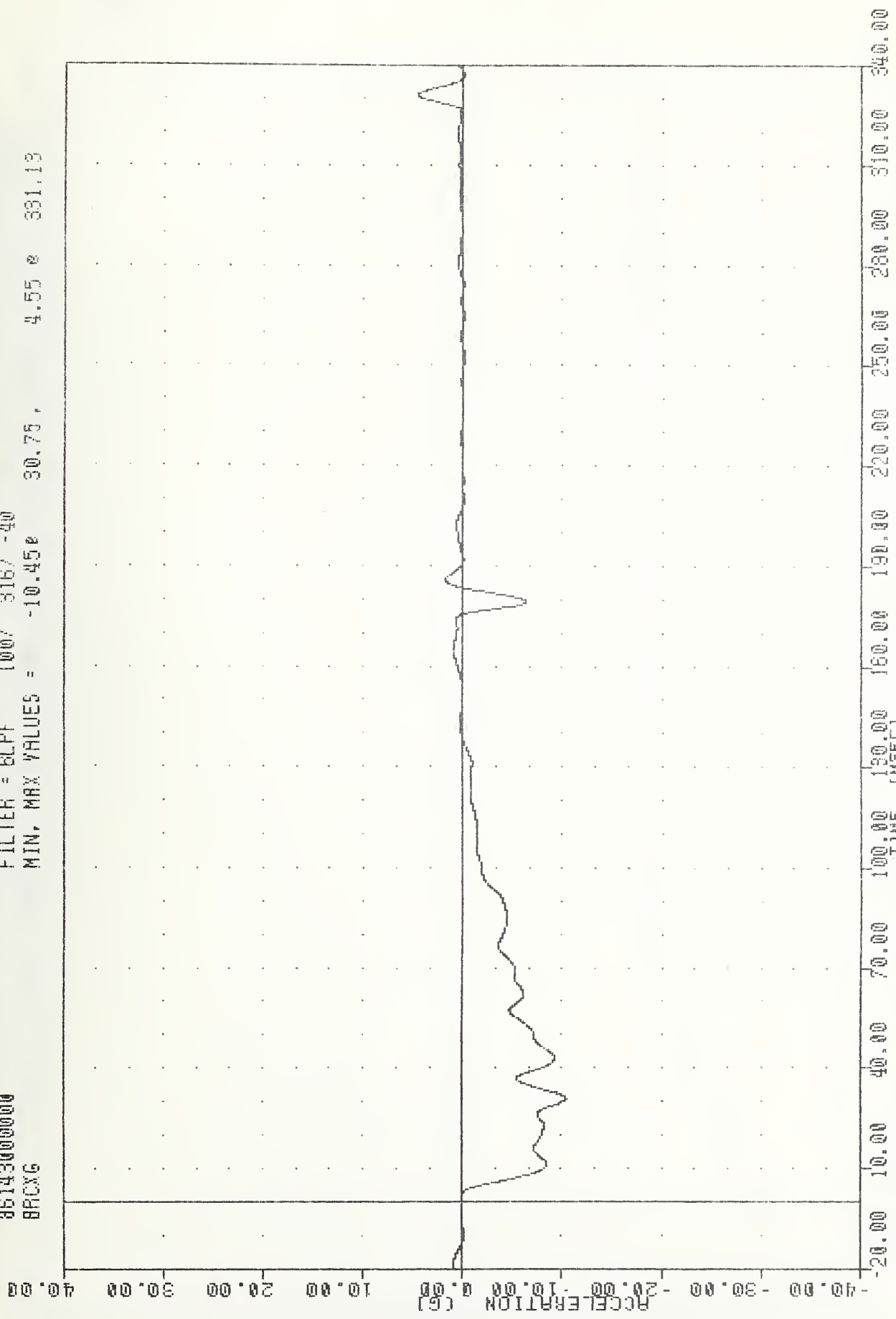


MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 MOVING BARRIER CENTER OF GRAVITY ACCELERATION RESULTANT

MOVING BARRIER ENTER CRASH SITE AT 30.75 SECONDS

VRT 8605232
CRASH 3 MODEL IMPROVEMENTS
86143000000
BRCX6

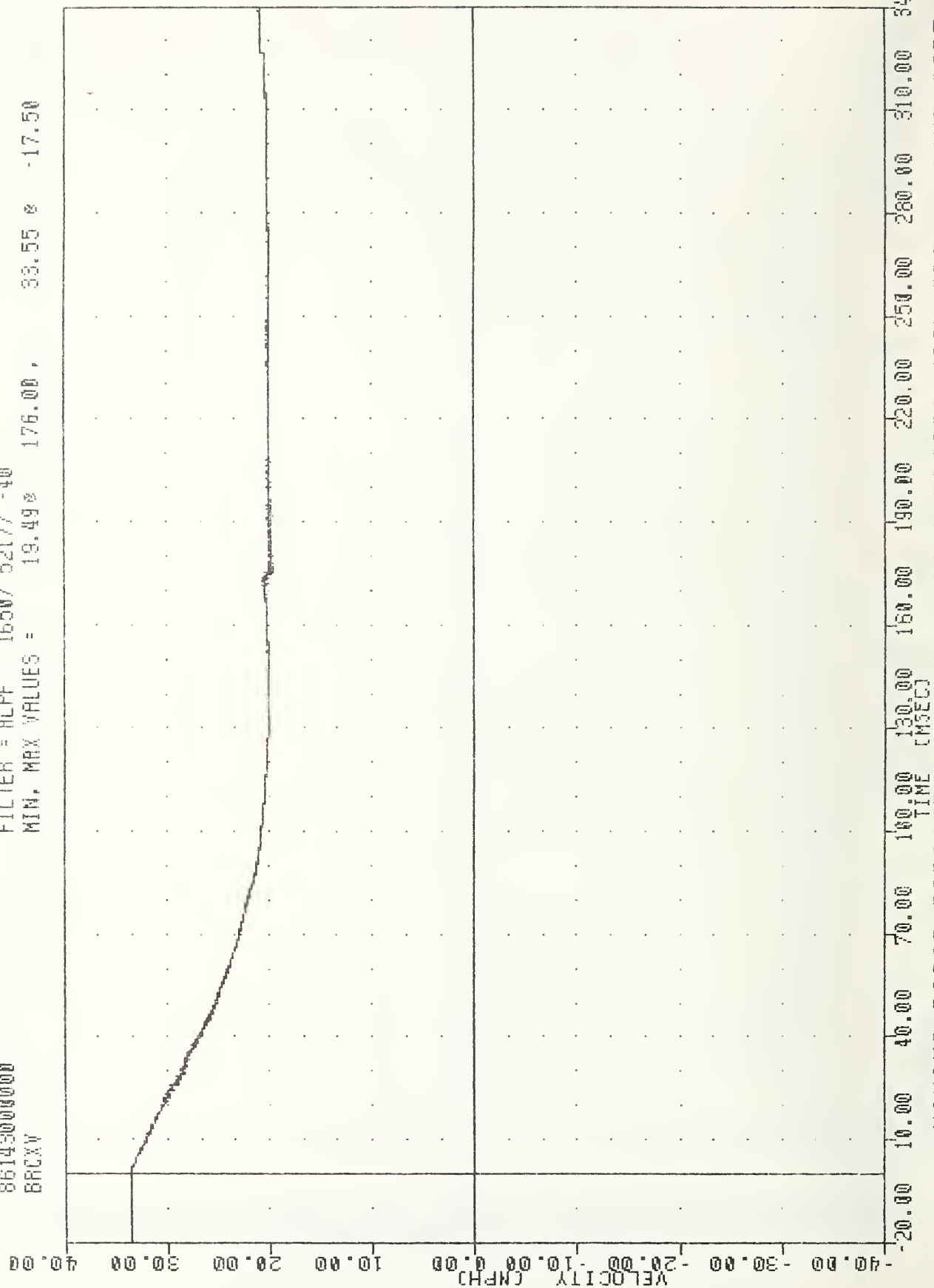
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -10.450 30.75, 4.55 @ 331.13



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS

VRT
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BRXV

FILTER = ALPF 1650/ 5217/ -40
 MIN. MAX VALUES = 19.49% 33.55% -17.50

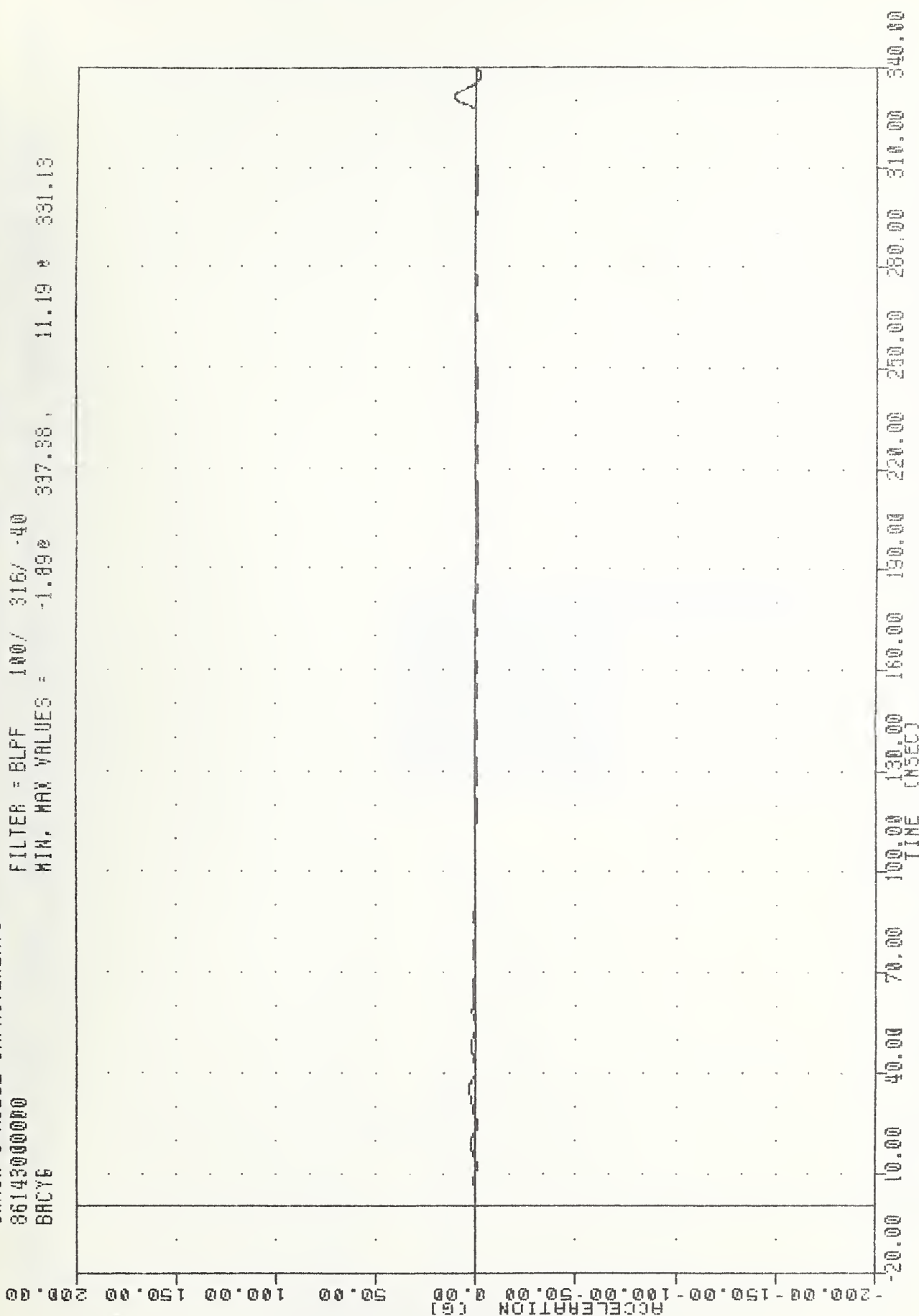


MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE

DELTA V USING BRXG

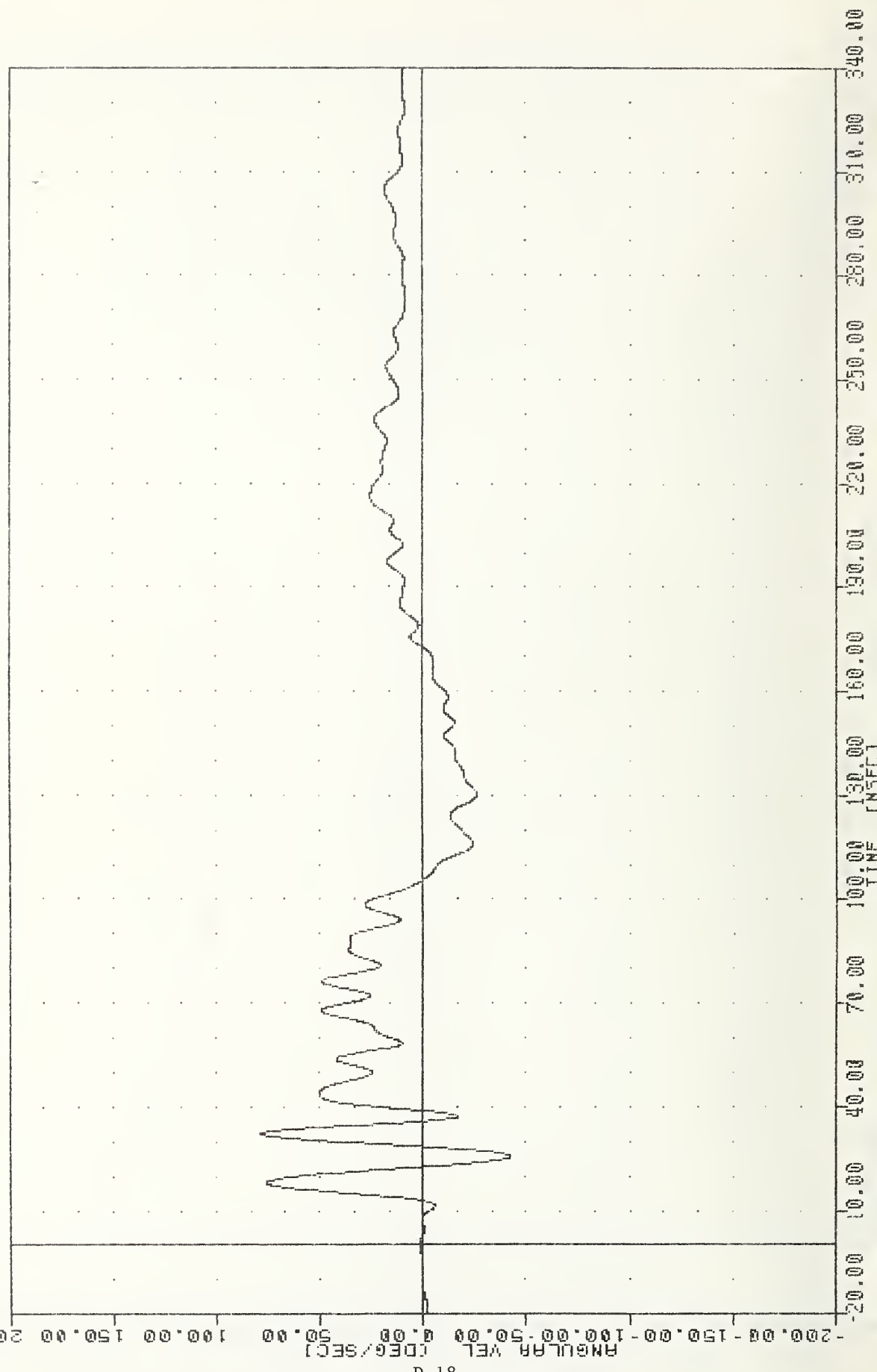
VAT # 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 BRCT6

FILTER = BLPF 100/ 316/ -40
 MIN. MAX VALUES = -1.89e 337.88 , 11.19 * 331.13



VRT 8605232
 CRASH 3 MODEL IMPROVEMENTS
 86143000000
 ROKZY

FILTER = BLPF 100/ 316/ -40
 MIN. MAX VALUES = -42.34 25.83 78.92 32.25



MOVING RIGID BARRIER INTO MITSUBISHI TREDIA HIGH SPEED RIGHT SIDE
 VEHICLE YAW RATE DEGREE/SECOND

776 002 0000

PLANNING

111 0000

Form DOT F 172
FORMERLY FORM D

