DOT4960+961

DYNAMIC TESTING FOR SIDE CRUSH

MRB-TO-CAR SIDE IMPACT TEST OF A 90° MOVING RIGID BARRIER TO A 1983 FORD ESCORT

TEST #1 16.1 MPH

TEST #2 32.2 MPH

PREPARED BY:

VEHICLE RESEARCH AND TEST CENTER

ST. RT. 33 LOGAN COUNTY

EAST LIBERTY, OHIO 43319

TEST REPORT

JUNE 1986

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

400 SEVENTH STREET, S.W.

WASHINGTON, D.C. 20590

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Technical Report Documentation Page

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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 1983 Ford Escort 2-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 May 16, 1986.

Test #1 Vehicle was impacted perpendicular on the left side at 16.1 mph, the ambient temperature was 76°F and the time was 1333.

Test #2 Vehicle was impacted perpendicular on the right side at 32.2 mph, the ambient temperature was 82°F and the time was 1436.

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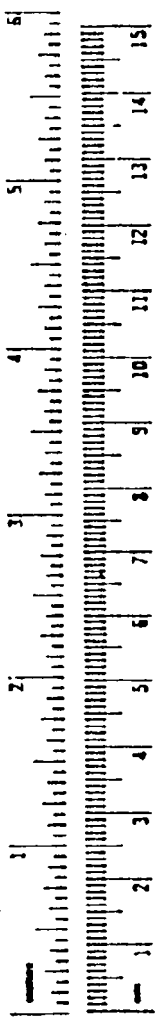
METRIC CONVERSION FACTORS

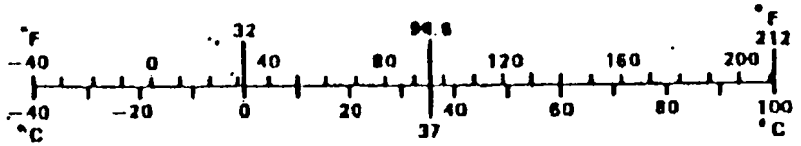
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric ton	t
	VOLUME			
tsp	teaspoons	5	milliliters	mL
Tbsp	tablespoons	15	milliliters	mL
in^3	cubic inches	16	milliliters	mL
fl oz	fluid ounces	30	milliliters	mL
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10 000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton (1000 kg)	1.1	short tons	
	VOLUME			
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in^3
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F





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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 Ford Escort 2-Door Hatchback was impacted on the left and right side by a Moving Rigid Barrier (MRB) on May 16, 1986.

Test #1: The MRB was to be towed into the stationary Ford Escort at 16.1 mph, and the intended contact point of the MRB longitudinal centerline was to be -9.8 inches (rearward) from the center of gravity of the Ford Escort. The angle of the MRB was 90° counter clockwise with respect to the longitudinal axis of the struck vehicle. The actual test speed was 16.1 mph and the actual contact point was -9.5 inches (rearward) from the center of gravity of the Ford Escort.

Test #2: The MRB was to be towed into the stationary Ford Escort at 32.3 mph, and the intended contact point of the MRB longitudinal centerline was to be -9.8 inches (rearward) from the center of gravity of the Ford Escort. The angle of the MRB was 90° clockwise with respect to the longitudinal axis of the struck vehicle. The actual speed was 32.2 mph and the actual contact point was -9.9 inches (rearward) from the center of gravity of the Ford Escort.

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: Ford Motor Co.

MAKE/MODEL: Ford Escort VIN: 1X687AT279044

BODY STYLE: 2-Door Hatchback MODEL YEAR: 1983

NHTSA NO.: R & D COLOR: red

ENGINE DATA: TYPE: Inline CYLINDERS: 4 DISPLACEMENT: 1600cc

TRANSMISSION DATA: 4 speed manual

DATE VEHICLE RECEIVED: 5/12/86 ODOMETER READING: 58,977

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	Yes	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	Yes	AIR CONDITIONING	No
RADIO	Yes	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	No
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: Ford Motor Co.

DATE OF MANUFACTURE: 09/82

GVWR: 3030 LBS.,

GAWR: FRONT 1705 LBS., REAR 1424 LBS.

VEHICLE TIRE DATA

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

TIRES ON VEHICLE (MFGR. & LINE, SIZE): Sport & Radial (LRR) 165SR13M/S

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

WEIGHT OF TEST VEHICLE AFTER PREPARATION:

RIGHT FRONT	593	LBS.	RIGHT REAR	372	LBS.
LEFT FRONT	641	LBS.	LEFT REAR	379	LBS.
TOTAL FRONT WEIGHT	1234	LBS. (62.2 % OF TOTAL VEHICLE WEIGHT)			
TOTAL REAR WEIGHT	751	LBS. (37.8 % OF TOTAL VEHICLE WEIGHT)			
TOTAL TEST WEIGHT	1985	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): 26 psi; REAR 26 psi

RECOMMENDED TIRE SIZE: P165/80R13 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Front - Bucket

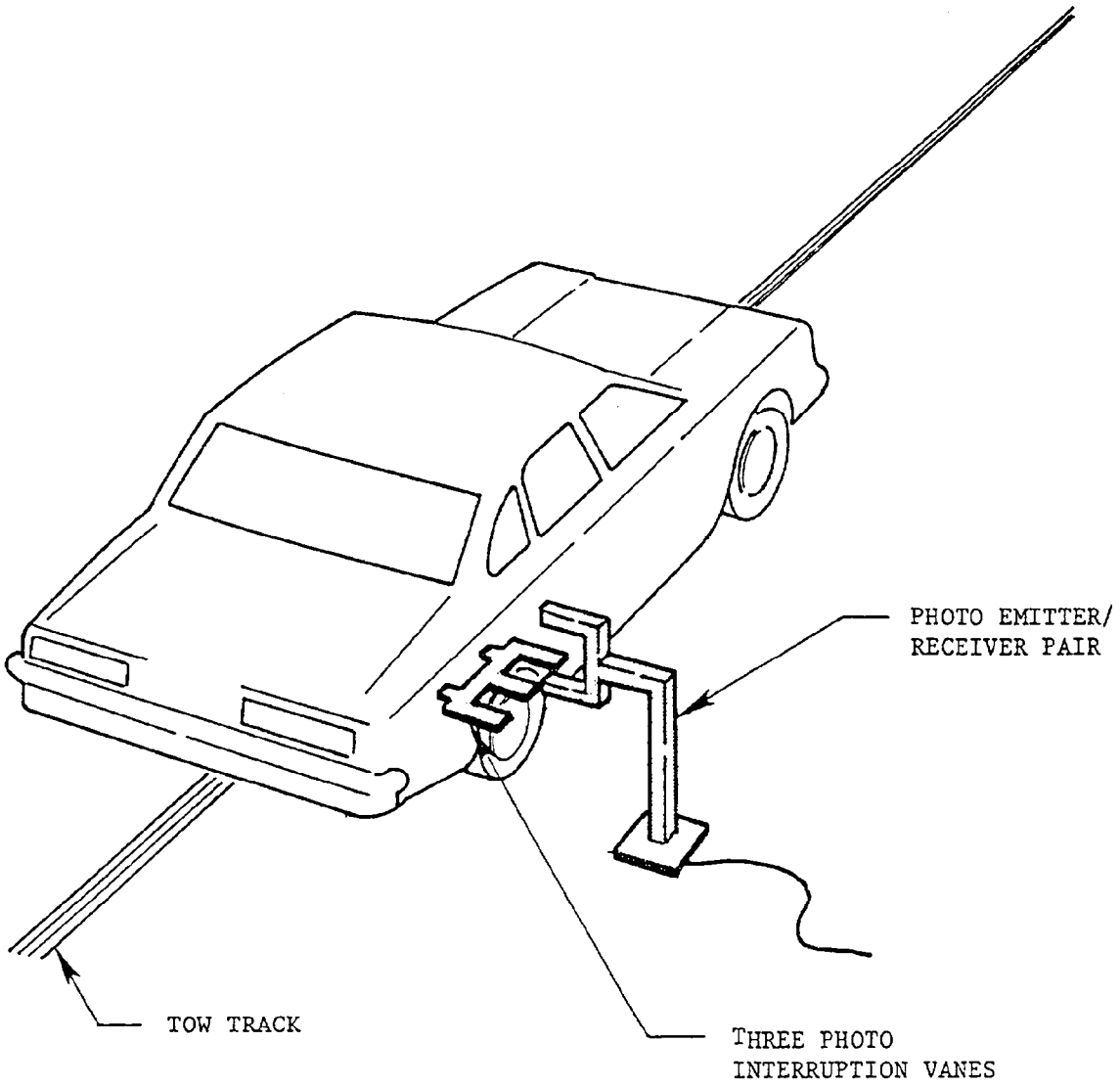
NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
2 REAR
4 TOTAL

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 at the left side low speed.

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

   BCGZG Moving Barrier Center of Gravity Acceleration Z Axis.

γ TRC0 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 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: 860516 Date of Test = May 16, 1986

Wind Velocity 9 - 18/218S Time of Test = 13:33

Ambient Temperature at Impact Area: 76°F

Subject Vehicle Data	Actual	Intended
Vehicle Test Weight (lbs.)	1985	1985
MRB Test Weight (lbs.)	3229	3229
MRB Velocity (mph)*	16.1	16.1
Impact Point (in.)**	-9.5	-9.8

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 25 3/8	;LF 25 3/8	;RR 24 7/16	;LR 24 1/2
Post-Test Attitude:	RF 26 1/8	;LF 25 3/16	;RR 25 1/16	;LR 24 5/16

Vehicle dimension (All in inches):

***Center of Gravity	= 35 11/16	, wheel base	= 94 1/4
Width Car	= 66 3/4	, length car	= 164 5/16
Width Roof	= 45 3/8	, track width	= 54 7/8
Front overhang	= 33 3/8	, rear overhang	= 36 3/4

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

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	5.3	5.2	5.6	5.2	0	
	Door free space				0	0	0	0	0	0	
	Net bumper crush			75	0	5.3	5.2	5.6	5.2	0	-13.1
	Sill crush				-	4.2	4.1	4.5	4.7	-	
	Sill free space				-	1.5	1.5	1.5	1.5	-	
	Net sill crush				-	2.7	2.6	3.0	3.2	-	

*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).

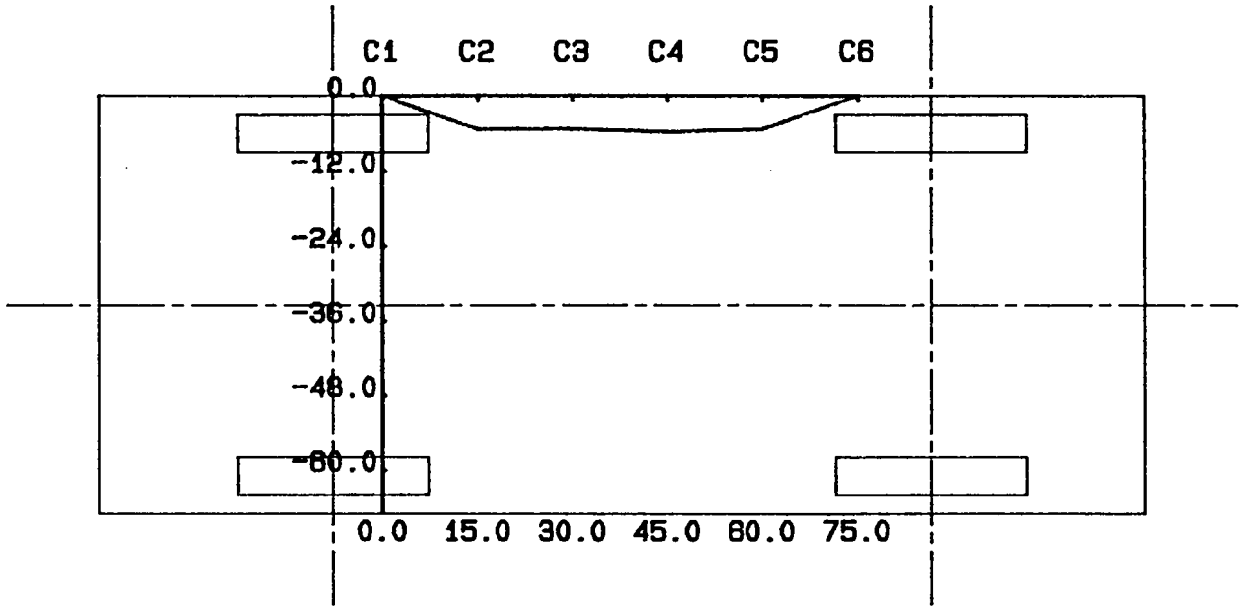
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**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.

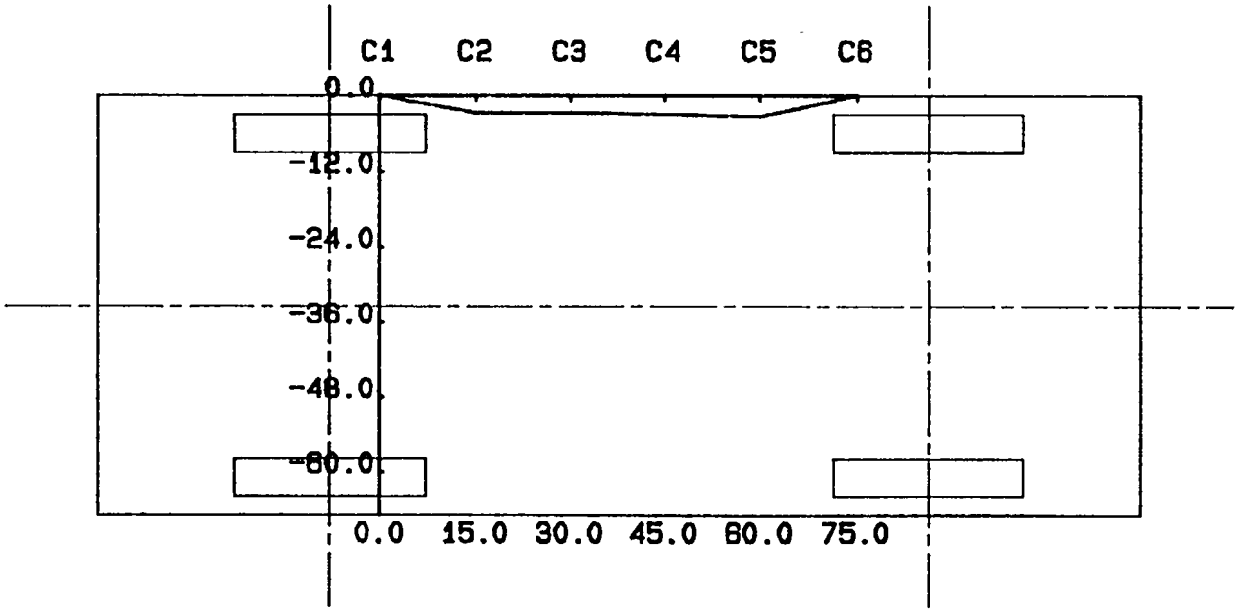
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS -13.1" 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 -13.1" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

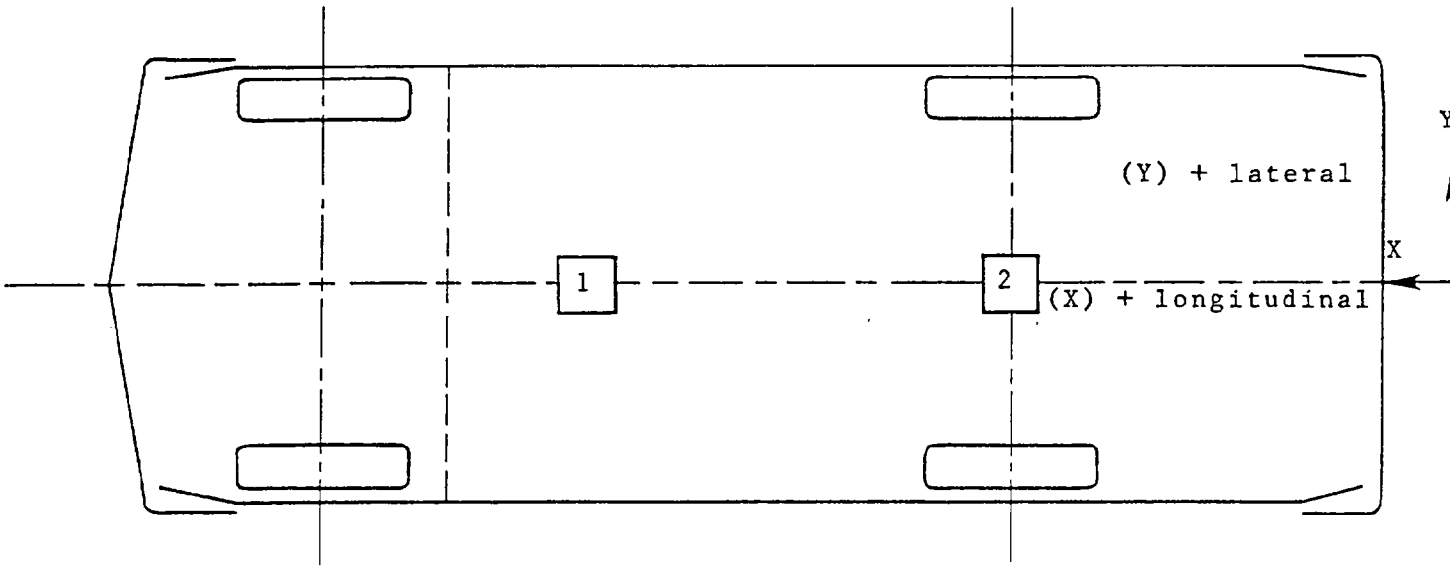
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

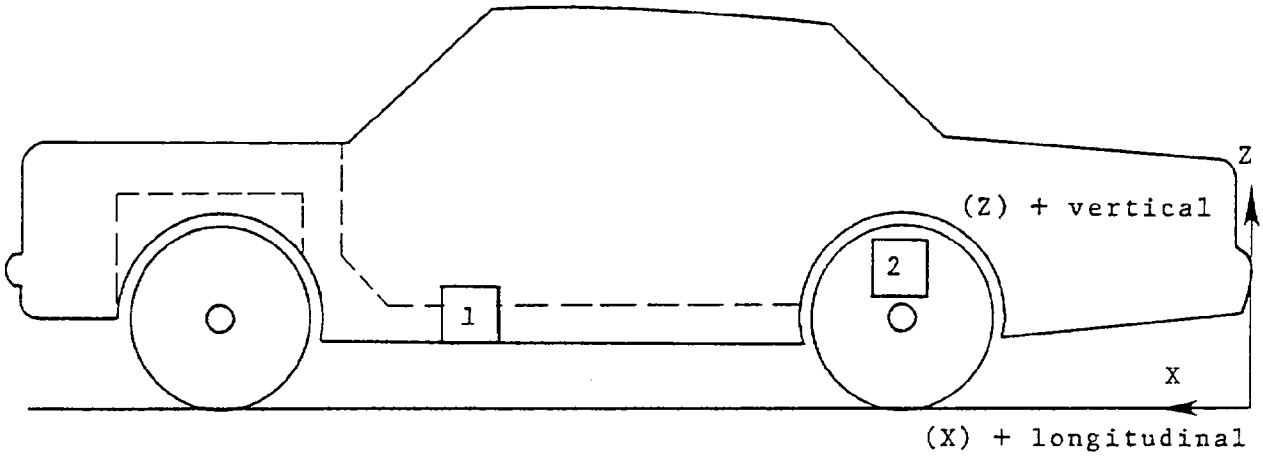
NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	-35.7	0.0	13.4				
	(LONGITUDINAL)				2.88	51.25	3.48	15.88
	(LATERAL)	Δ V = -12.0 mph @ 100.00 msec			2.18	141.00	14.31	41.38
	(VERTICAL)				12.49	66.25	10.32	37.00
	(RESULTANT)					15.27 @ 49.13		
2	REAR DECK OVER AXLE	-93.1	0.0	19.3				
	(LONGITUDINAL)				4.13	24.50	7.93	31.38
	(LATERAL)	Δ V = -14.2 mph @ 100.00 msec			1.01	103.88	15.79	49.13
	(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 MAX (deg/sec)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (deg/sec)	NEGATIVE DIRECTION TIME (msec)
YAW RATE GYRO	-100.2	11.5	24.6	---	---ϒ	---	---ϒ

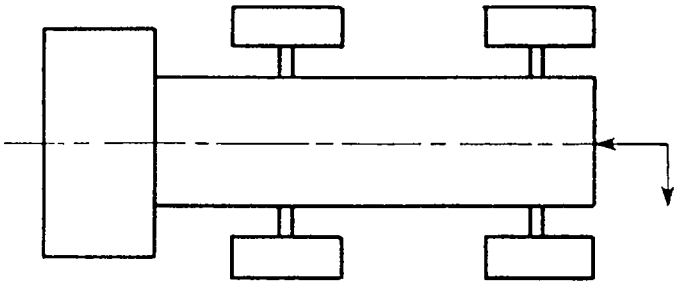
*Reference: X - Front Axle (+ Forward), Y - Vehicle Centerline (+ To Left), Z - Ground Level (+ Up)

All measurements of rate gyro in inches.

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

ϒSee TEST ANOMALIES

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	61.5	0.0	12.0				
	LONGITUDINAL	ΔV = -7.7 mph @ 100.00 msec			0.21	198.25	6.92	41.63
	(LATERAL)				1.71	63.75	2.56	52.63
	(VERTICAL)				3.10	47.38	1.69	41.63
	(RESULTANT)					7.24 @ 41.50		
2	REAR FRAME MEMBER	22.0	20.3	13.6				
	(LONGITUDINAL)	ΔV = -7.9 mph @ 100.00 msec			0.30	108.13	7.39	40.63
	(LATERAL)				0.82	169.50	1.41	11.00

*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	1008	Vehicle Dynamics
3	Overhead tight	Photosonic 1B	25	1000	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)
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: 860516 Date of Test = May 16, 1986

Wind Velocity 9 - 18/243 S.W. Time of Test = 14:36

Ambient Temperature at Impact Area: 82°F

Subject Vehicle Data	Actual	Intended
Vehicle Test Weight (lbs.)	1985	1985
MRB Test Weight (lbs.)	3229	3229
MRB Velocity (mph)*	32.2	32.3
Impact Point (in.)**	-9.9	-9.8

Vehicle Attitude (All dimensions in inches):

Delivered Attitude:	RF		;LF		;RR		;LR	
Pre-Test Attitude:	RF	26 1/8	;LF	25 3/16	;RR	25 1/16	;LR	24 5/16
Post-Test Attitude:	RF	23 1/16	;LF	24 1/16	;RR	22 3/4	;LR	23 5/16

Vehicle dimension (All in inches):

***Center of Gravity	= 35 11/16	, wheel base	= 94 1/4
Width Car	= 66 3/4	, length car	= 164 5/16
Width Roof	= 45 3/8	, track width	= 54 7/8
Front overhang	= 33 3/8	, rear overhang	= 36 3/4

* 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 _____ Corner shift: A1 _____ A2 _____ End shift at frame (CDC) (check one) <4 inches _____ ≥4 inches X	Bowing: B1 _____ X1 5 B2 _____ X2 7 Bowing constant $\frac{X1 + X2}{2}$ = 6

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	14.1	14.1	15	15.8	0	
	Door free space				0	1	1	1	1	0	
	Net bumper crush				0	13.1	13.1	14	14.8	0	
	Bowing				6	6	6	6	6	6	
	Net crush			88.5	6	19.1	19.1	20	20.8	6	-14.6
	Sill crush				-	11	12	13.5	14	-	
	Sill free space				-	2.5	2.5	2.5	2.5	-	
	Net sill crush				-	8.5	9.5	11	11.5	-	

*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).

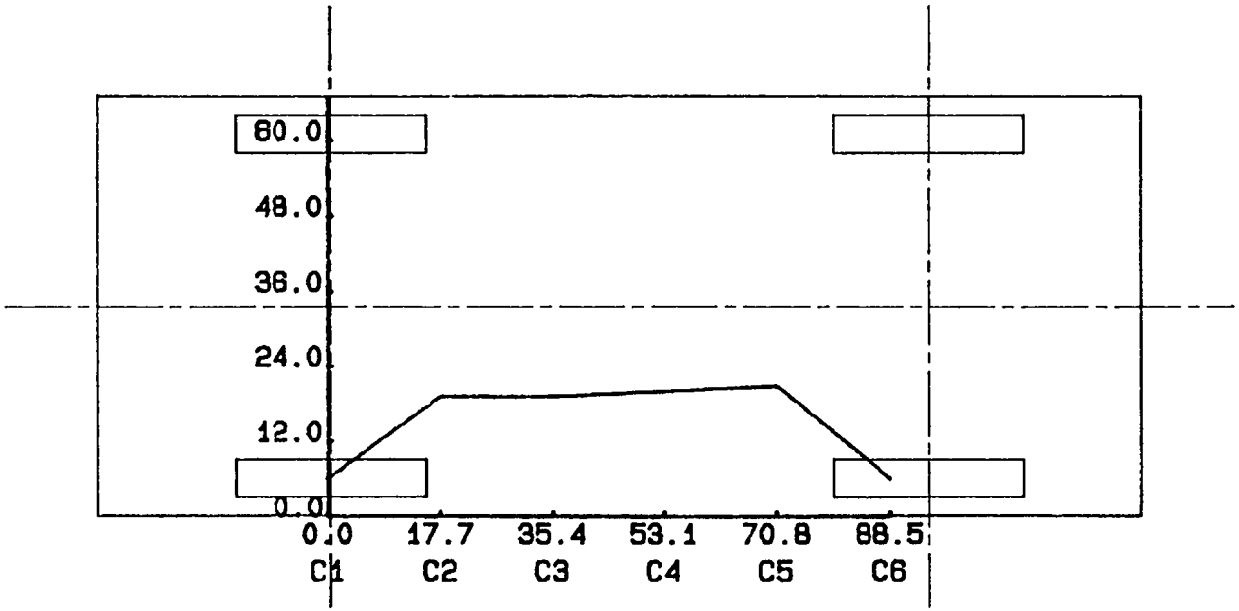
Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

**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.

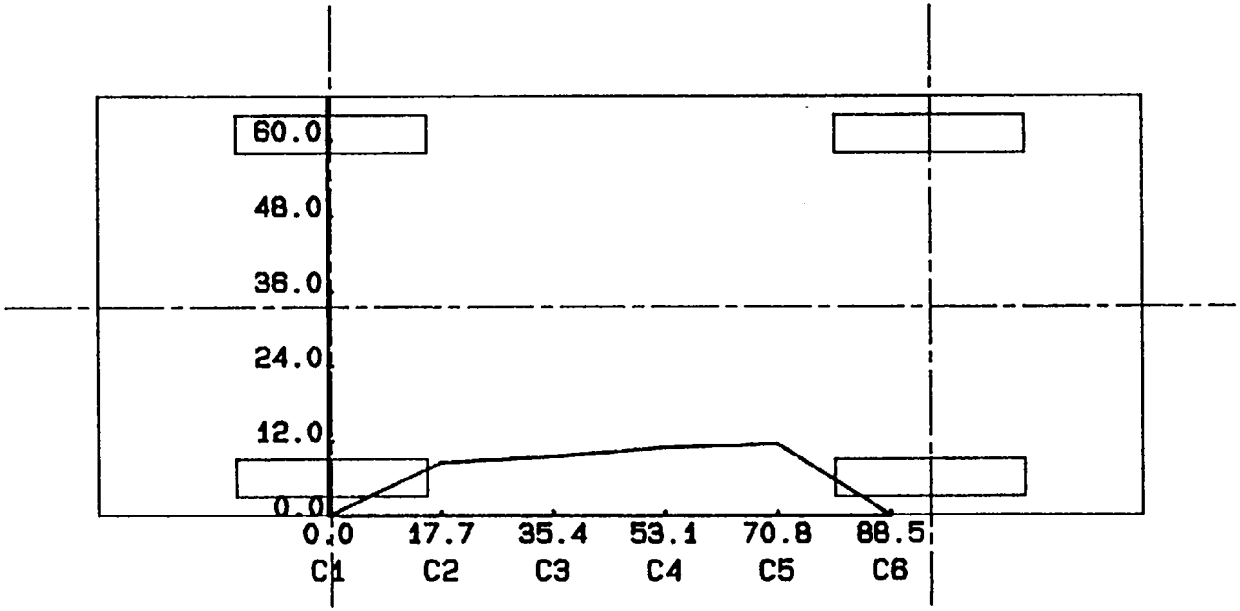
Note: Use as many lines/columns as necessary to describe each damage profile.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



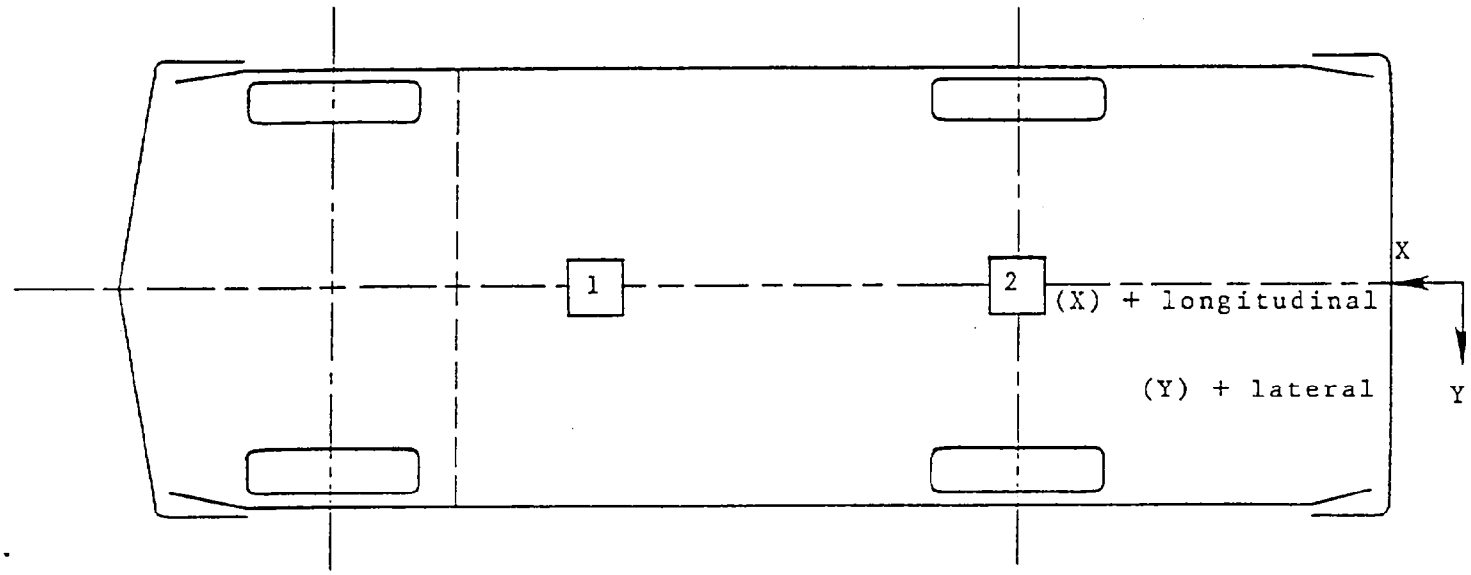
PROFILE LEVEL EQUALS MID-BUMPER HEIGHT WHICH IS 17.0 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS -14.6" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

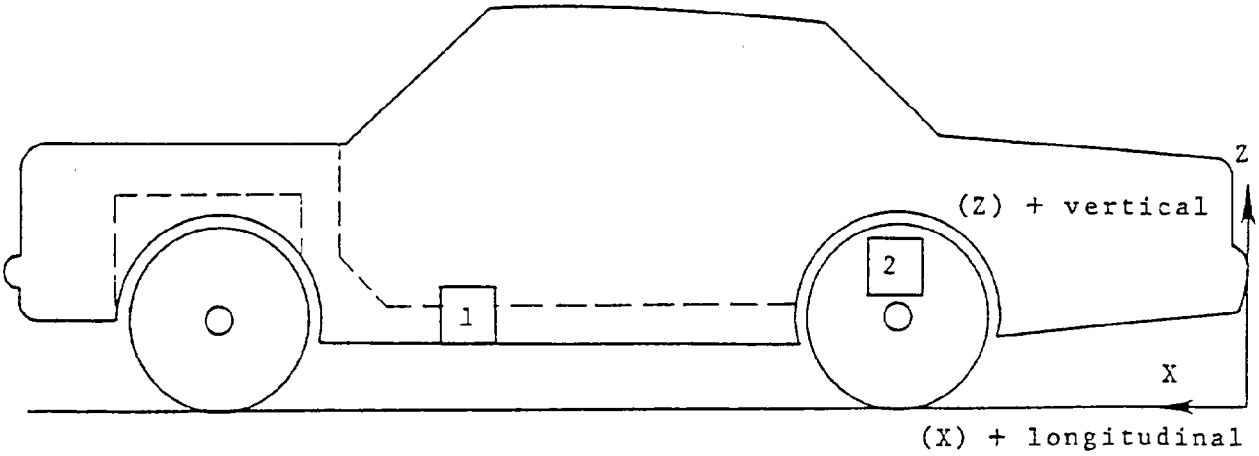
VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS SILL EDGE HEIGHT WHICH IS 12.3 " ABOVE GROUND LEVEL
THE CENTER OF THE CRUSH IS −14.6" FROM THE CENTER OF GRAVITY
SCALE FACTOR EQUALS 0.034

VEHICLE ACCELEROMETER LOCATIONS





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	-35.7	0.0	13.4				
	(LONGITUDINAL)				16.85	74.63	9.66	25.75
	(LATERAL)	ΔV = 18.0 mph @ 129.0 msec			34.29	41.00	5.55	81.38
	(VERTICAL)				26.64	50.38	31.77	42.63
	(RESULTANT)					45.72 @ 42.00		
2	REAR DECK OVER AXLE	-93.1	0.0	19.3				
	(LONGITUDINAL)				8.98	40.25	7.12	83.75
	(LATERAL)	ΔV = 21.4 mph @ 129.00 msec			22.31	35.25	3.89	127.38
	(VERTICAL)							
	(RESULTANT							

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

All measurements of accelerometer locations in inches.

YAW RATE GYRO LOCATION AND DATA SUMMARY

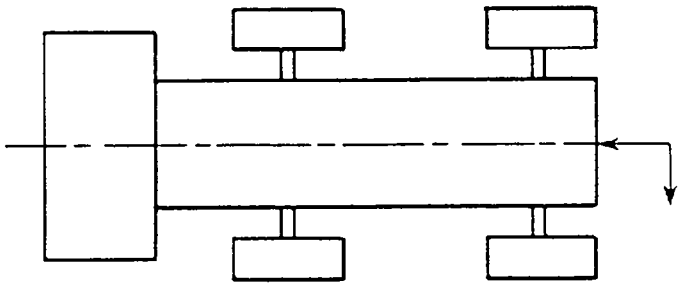
LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (deg/sec)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (deg/sec)	NEGATIVE DIRECTION TIME (msec)
YAW RATE GYRO	-100.2	11.5	24.6	133.42	55.88	80.43	108.75

*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	62.5	0.0	12.0				
	LONGITUDINAL	ΔV = -14.0 mph @ 129.00 msec			0.37	210.00	10.79	25.00
	(LATERAL)				3.33	73.00	2.67	46.63
	(VERTICAL)				---	---γ	---	---γ
	(RESULTANT)					--- @	---γ	
2	REAR FRAME MEMBER	22.0	20.3	13.6				
	(LONGITUDINAL)	ΔV = -13.9 mph @ 129.00 msec			0.52	180.13	9.81	24.13
	(LATERAL)				3.25	38.88	1.91	44.88

*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	Right panning	Kodak	25	24	Real time panning
2	Overhead wide	Photosonic 1B	8	1000	Vehicle dynamics
3	Overhead tight	Photosonic 1B	25	1000	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)
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		Page
A-1.	PRE-TEST FRONT VIEW	A-2
A-2.	POST-TEST FRONT VIEW	A-2
A-3.	PRE-TEST PASSENGER SIDE VIEW	A-3
A-4.	POST-TEST PASSENGER SIDE VIEW	A-3
A-5.	PRE-TEST REAR VIEW	A-4
A-6.	POST-TEST REAR VIEW	A-4
A-7.	PRE-TEST DRIVER SIDE VIEW	A-5
A-8.	POST-TEST DRIVER SIDE VIEW	A-5
A-9.	PRE-TEST DRIVER FRONT THREE-QUARTER VIEW	A-6
A-10.	POST-TEST DRIVER FRONT THREE-QUARTER VIEW	A-6
A-11.	PRE-TEST DRIVER REAR THREE-QUARTER VIEW	A-7
A-12.	POST-TEST DRIVER REAR THREE-QUARTER VIEW	A-7
A-13.	PRE-TEST OVERHEAD VIEW	A-8
A-14.	POST-TEST OVERHEAD VIEW	A-8
A-15.	POST-TEST FRONT DRIVER DOOR VIEW	A-9

Figure A-1. PRE-TEST FRONT VIEW

Figure A-2. POST-TEST FRONT VIEW

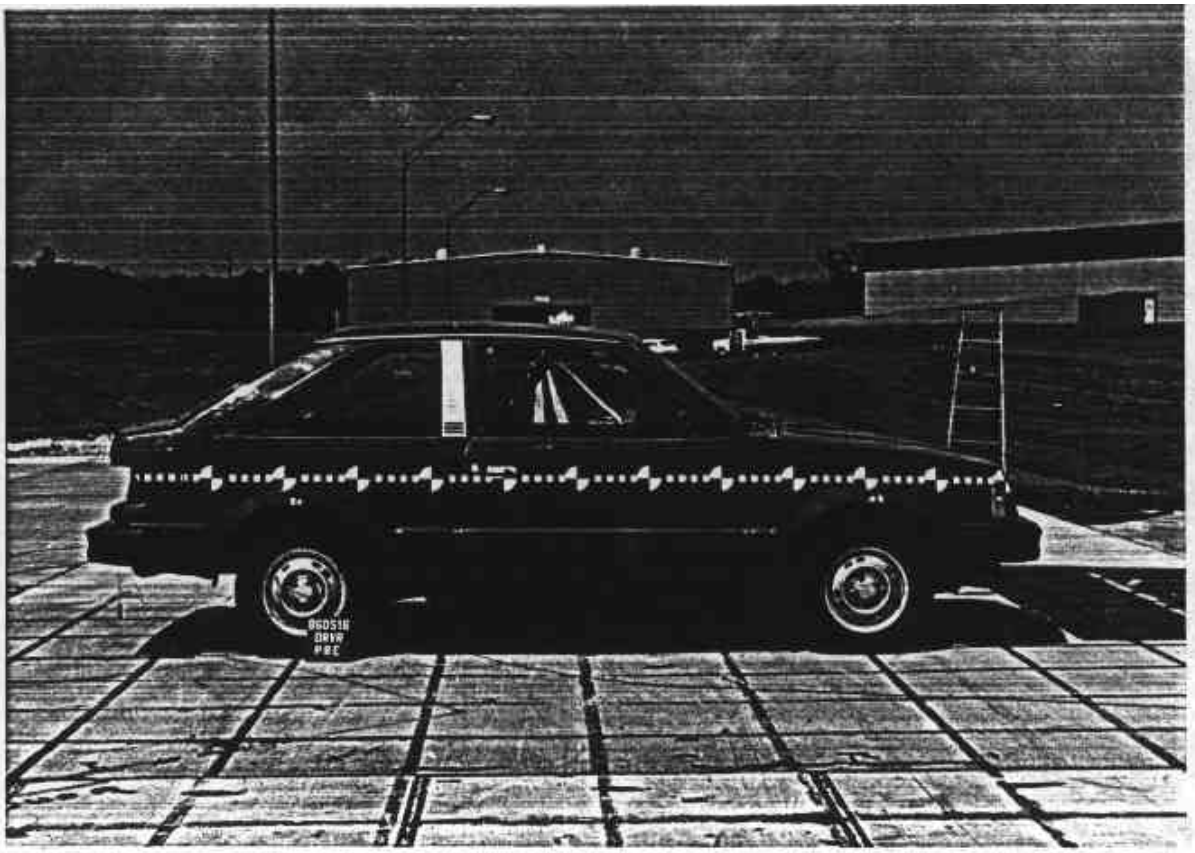


Figure A-3. PRE-TEST PASSENGER SIDE VIEW

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

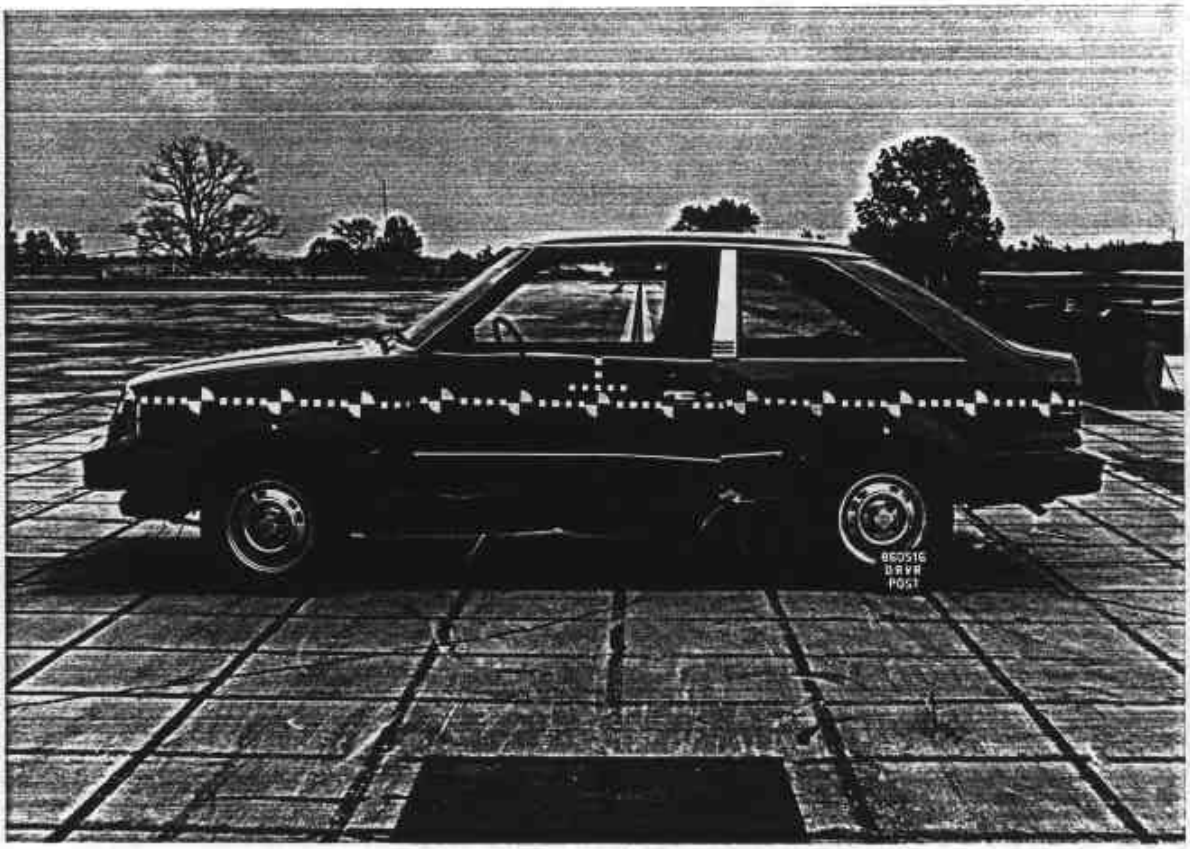


Figure A-8. POST-TEST DRIVER SIDE VIEW

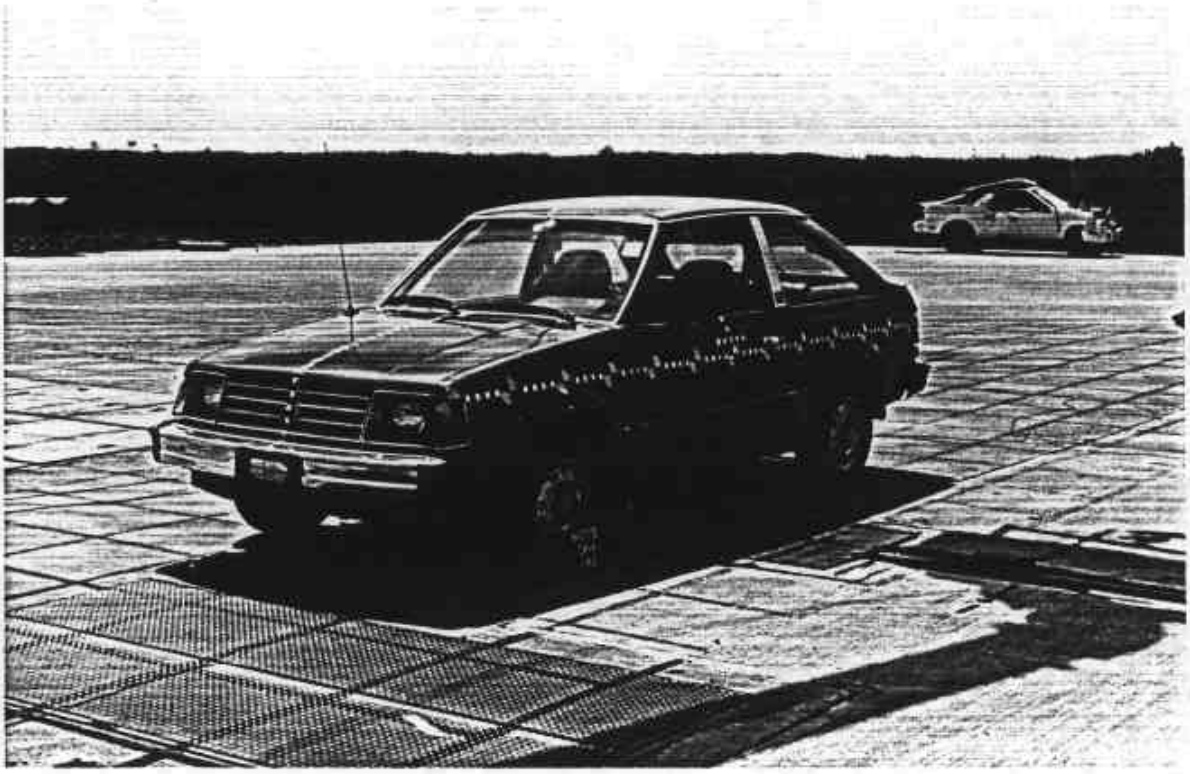


Figure A-9. PRE-TEST DRIVER FRONT THREE-QUARTER VIEW

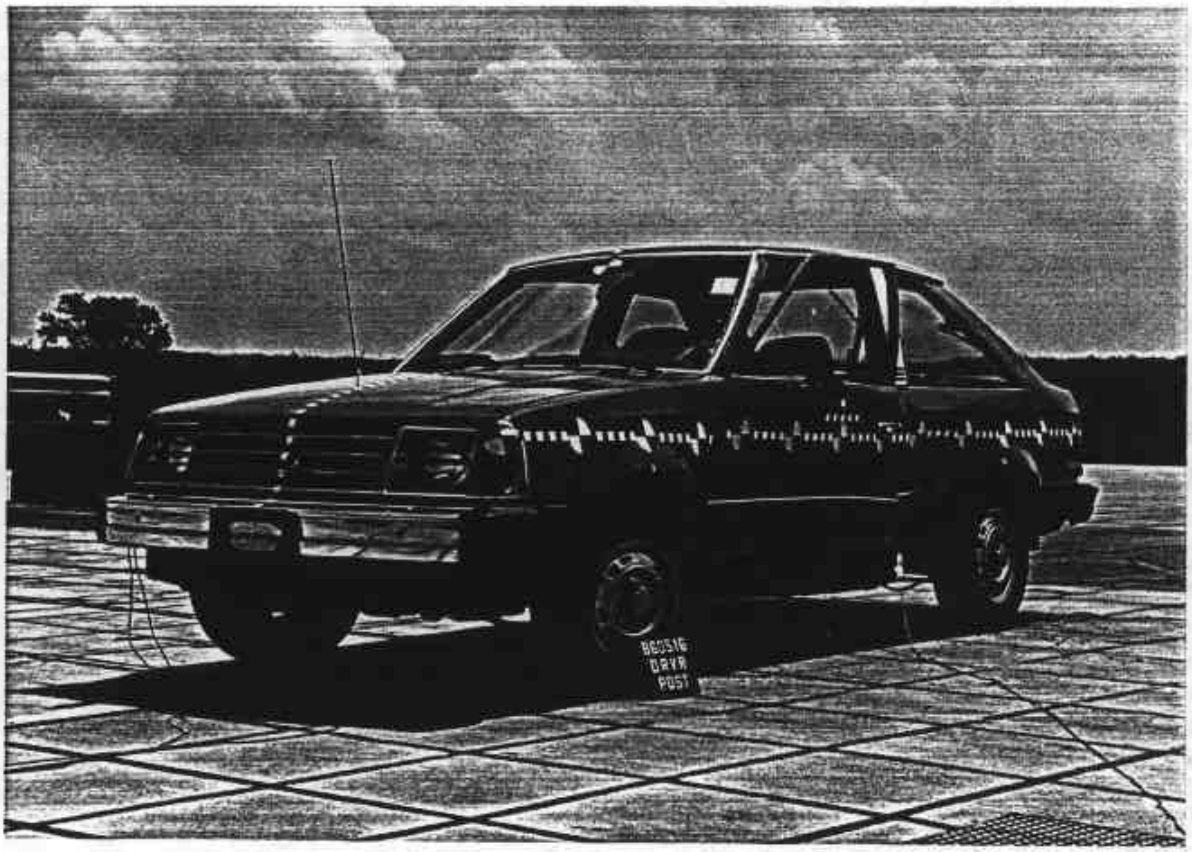


Figure A-10. POST-TEST DRIVER FRONT THREE-QUARTER VIEW

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

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

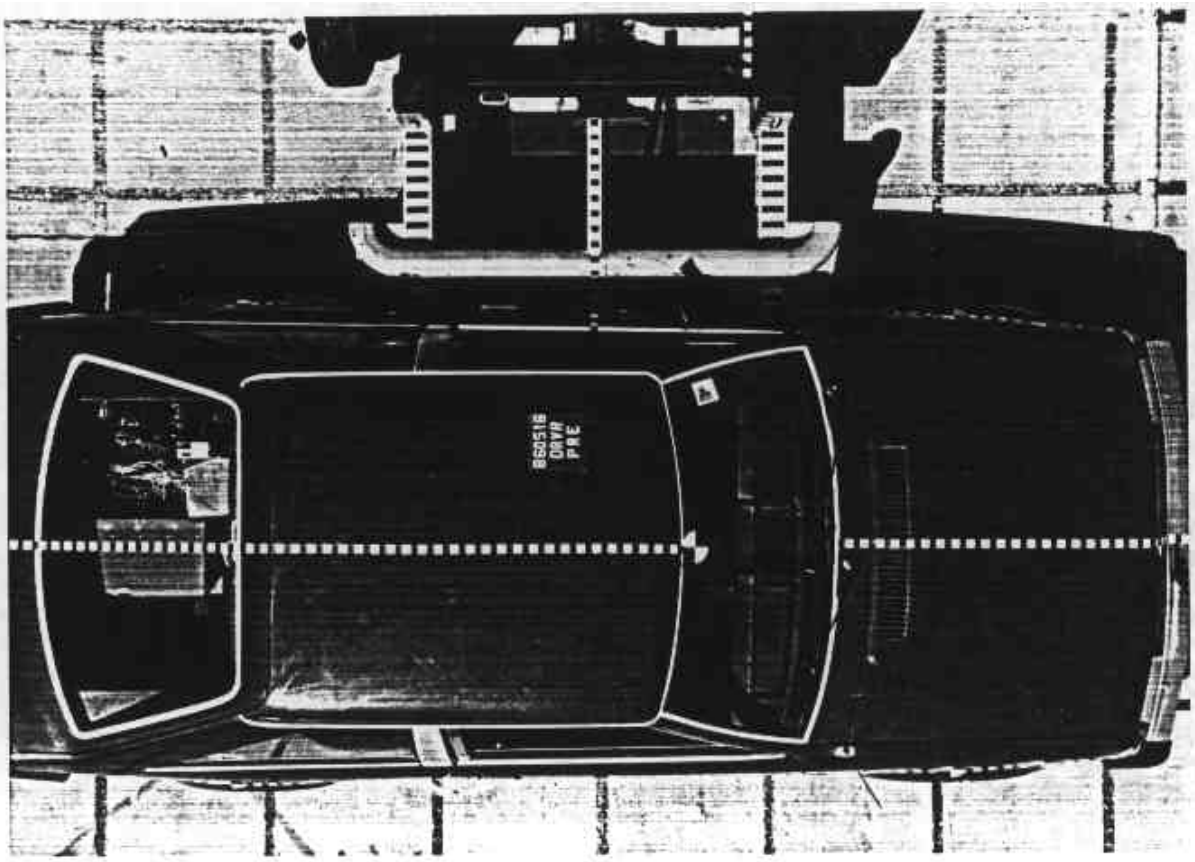


Figure A-13. PRE-TEST OVERHEAD VIEW

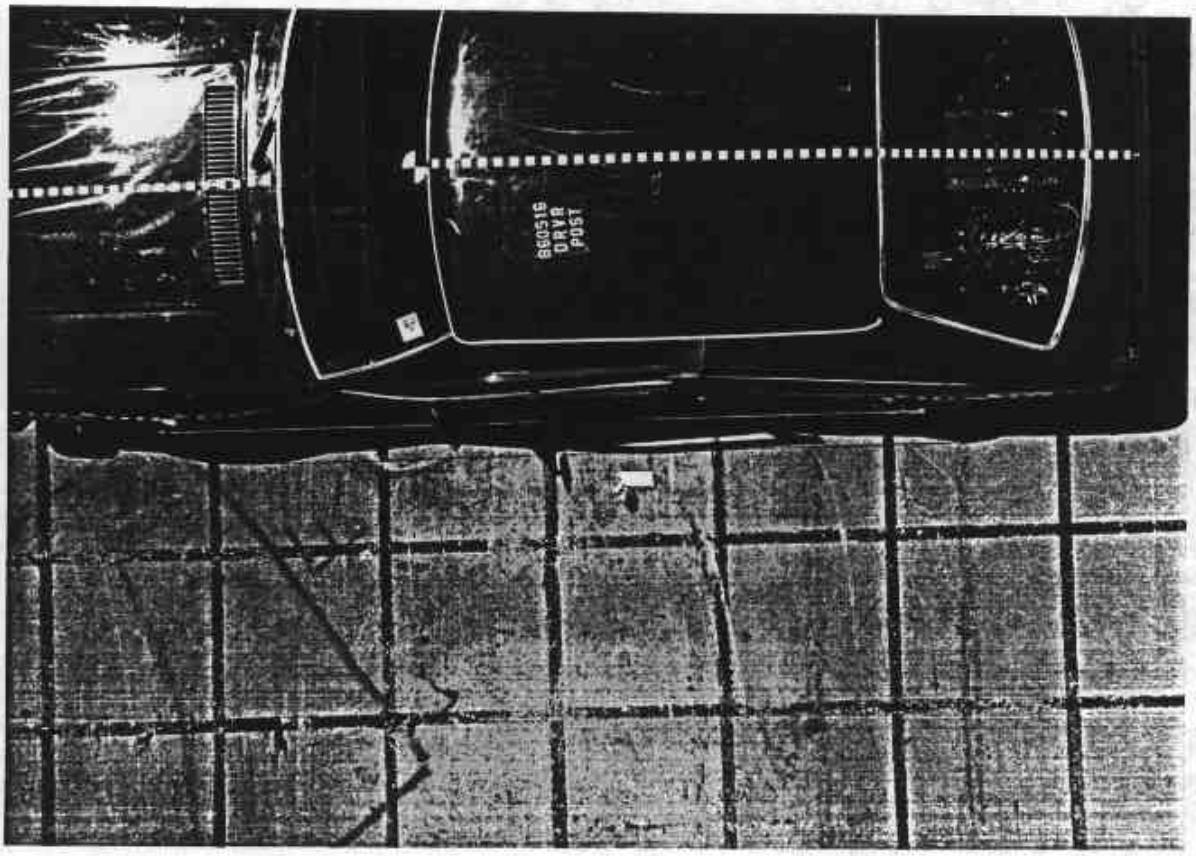


Figure A-14. POST-TEST OVERHEAD VIEW

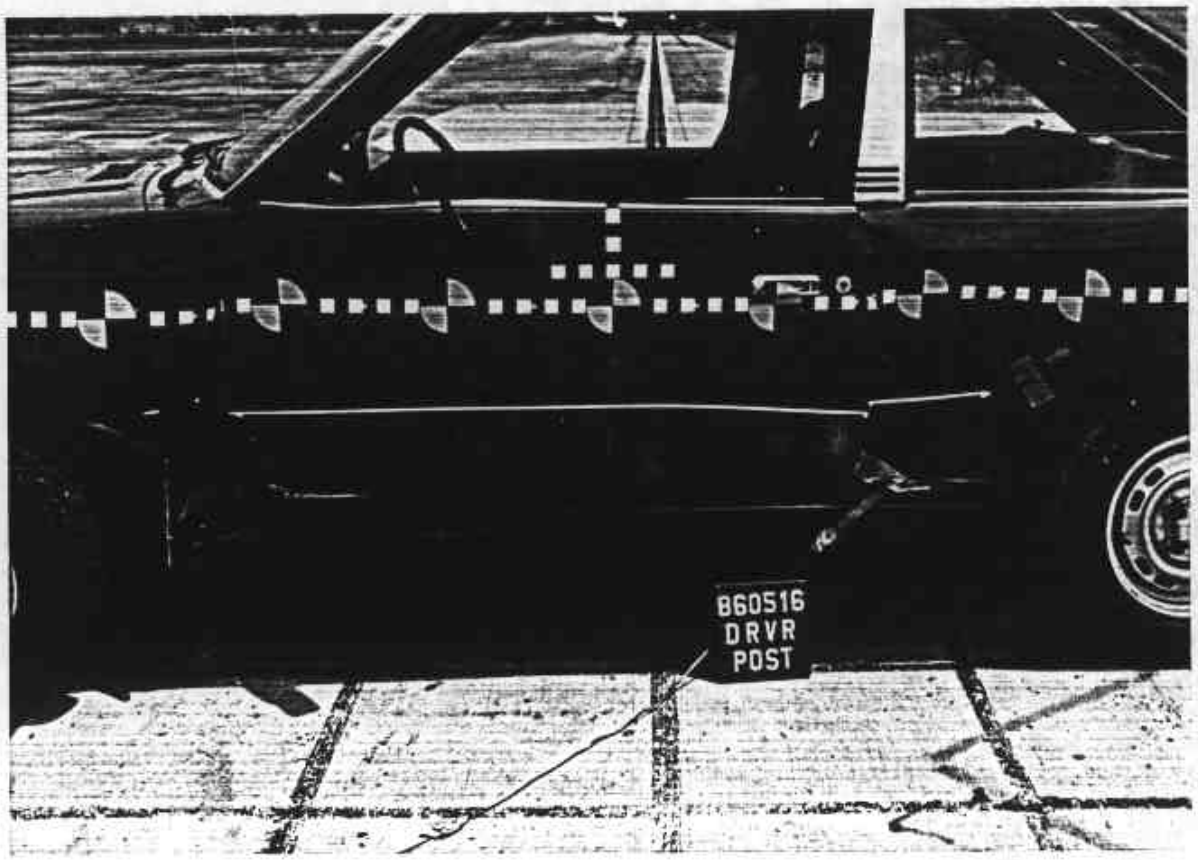


Figure A-15. POST-TEST FRONT DRIVER DOOR VIEW

APPENDIX B

PHOTOGRAPHS

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

Figure		Page
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 DRIVER FRONT THREE-QUARTER VIEW	B-6
B-10.	POST-TEST DRIVER FRONT THREE-QUARTER VIEW	B-6
B-11.	PRE-TEST DRIVER REAR THREE-QUARTER VIEW	B-7
B-12.	POST-TEST DRIVER REAR THREE-QUARTER VIEW	B-7
B-13.	PRE-TEST OVERHEAD VIEW	B-8
B-14.	POST-TEST OVERHEAD VIEW	B-8
B-15.	POST-TEST OVERALL VIEW	B-9
B-16.	POST-TEST FRONT PASSENGER SIDE VIEW	B-9

Figure B-1. PRE-TEST FRONT VIEW

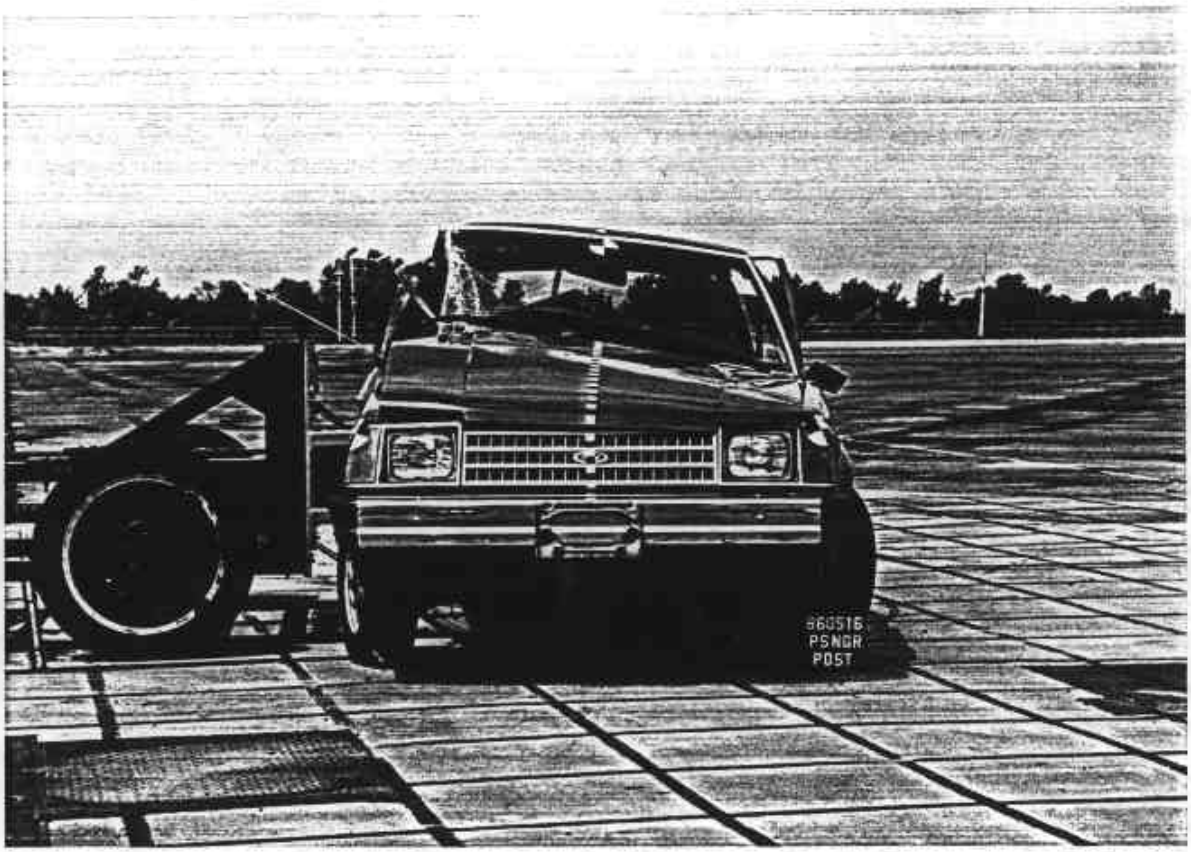


Figure B-2. POST-TEST FRONT VIEW

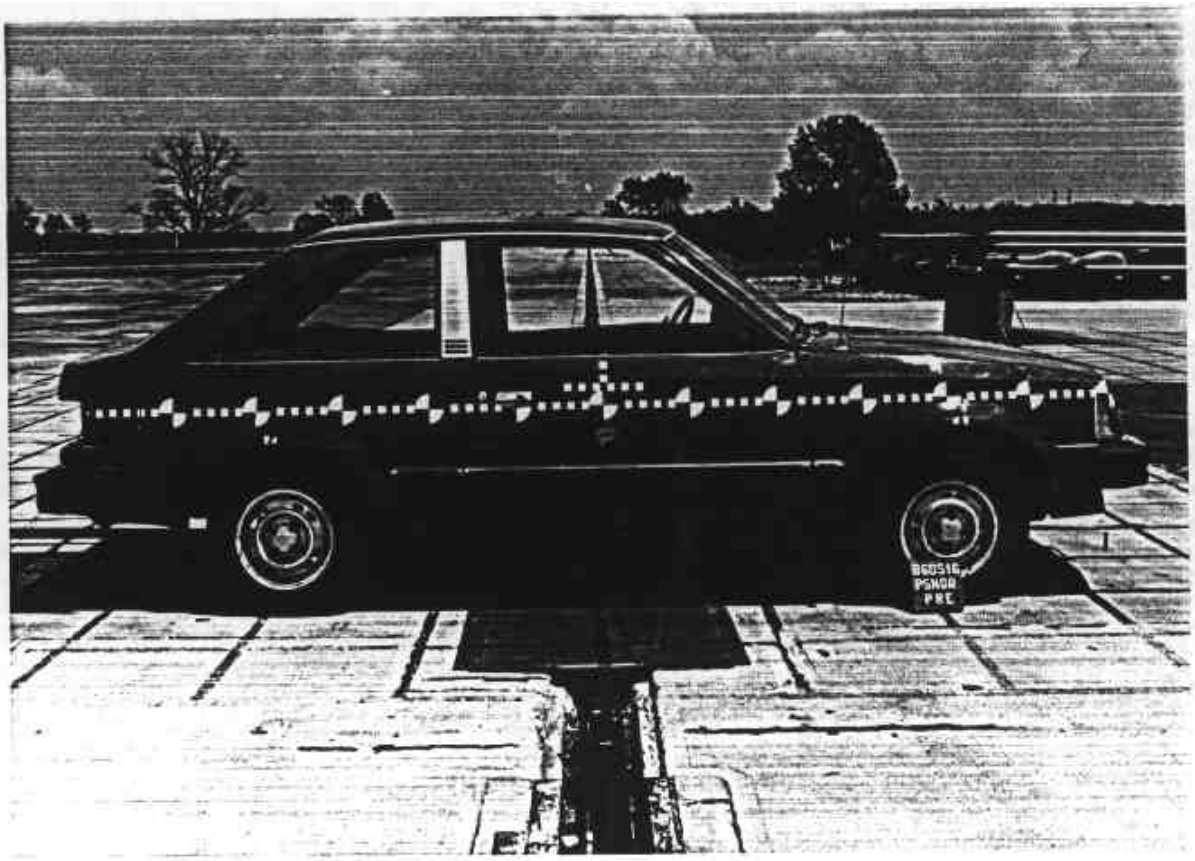


Figure B-3. PRE-TEST PASSENGER SIDE VIEW

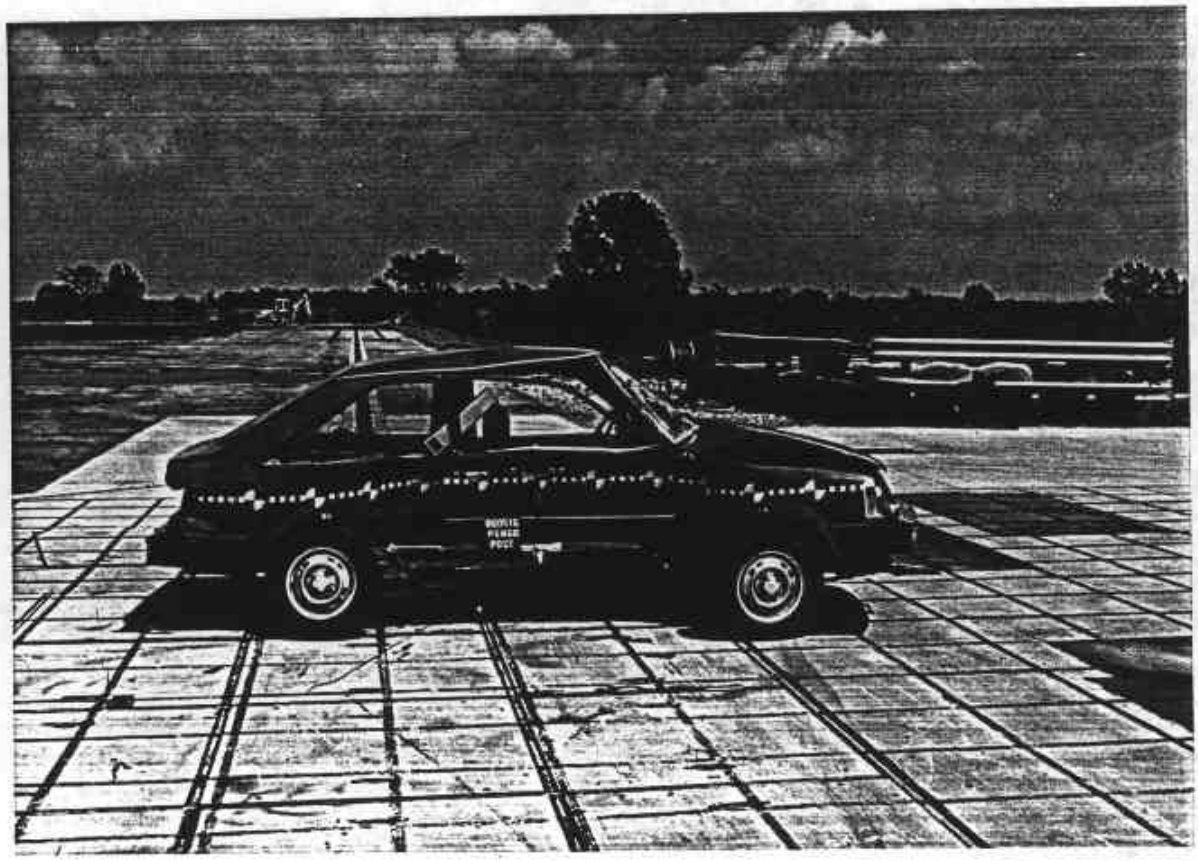


Figure B-4. POST-TEST PASSENGER SIDE VIEW

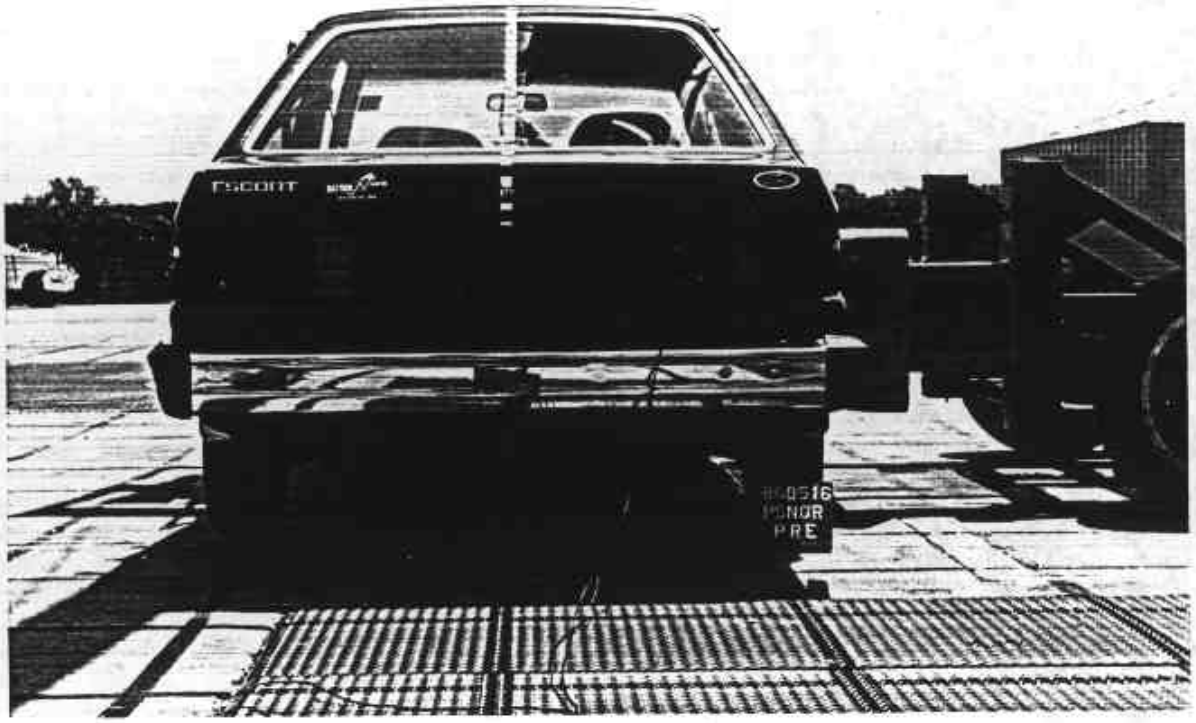


Figure B-5. PRE-TEST REAR VIEW

Figure B-6. POST-TEST REAR VIEW

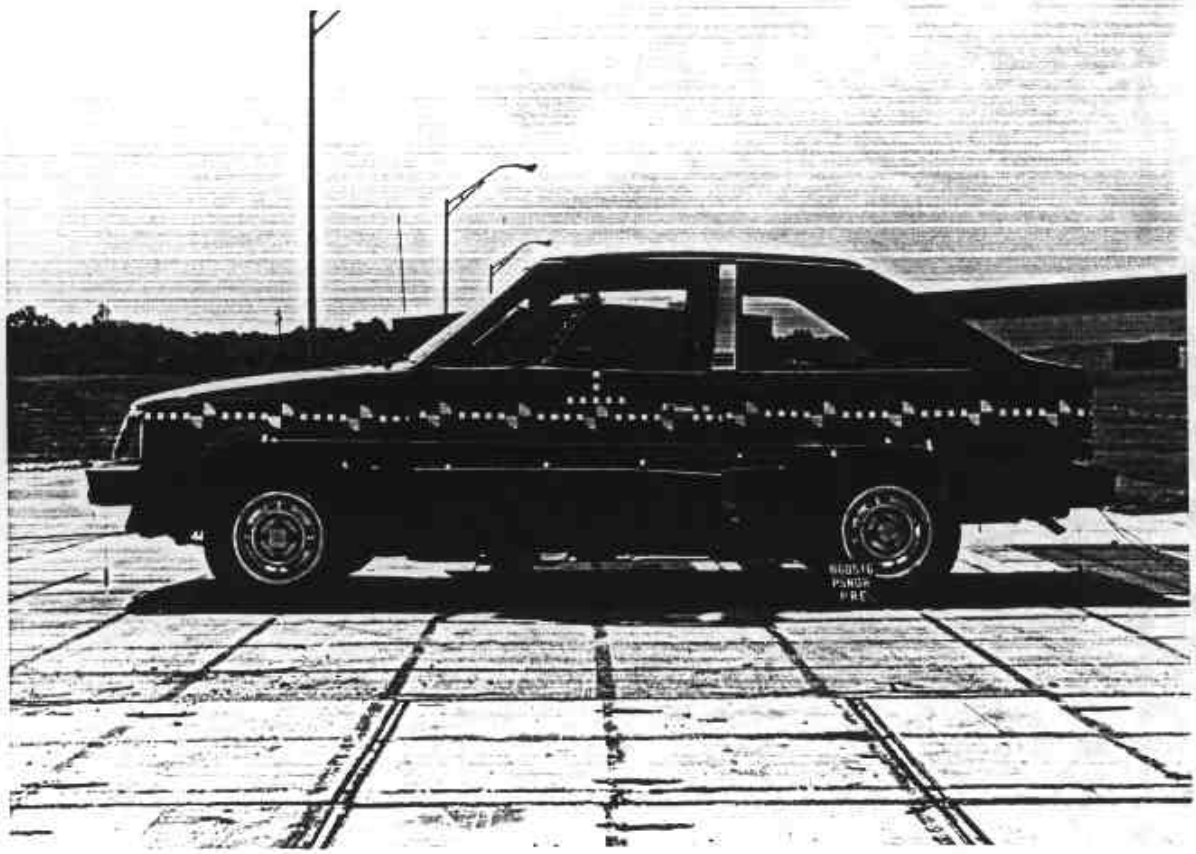


Figure B-7. PRE-TEST DRIVER SIDE VIEW

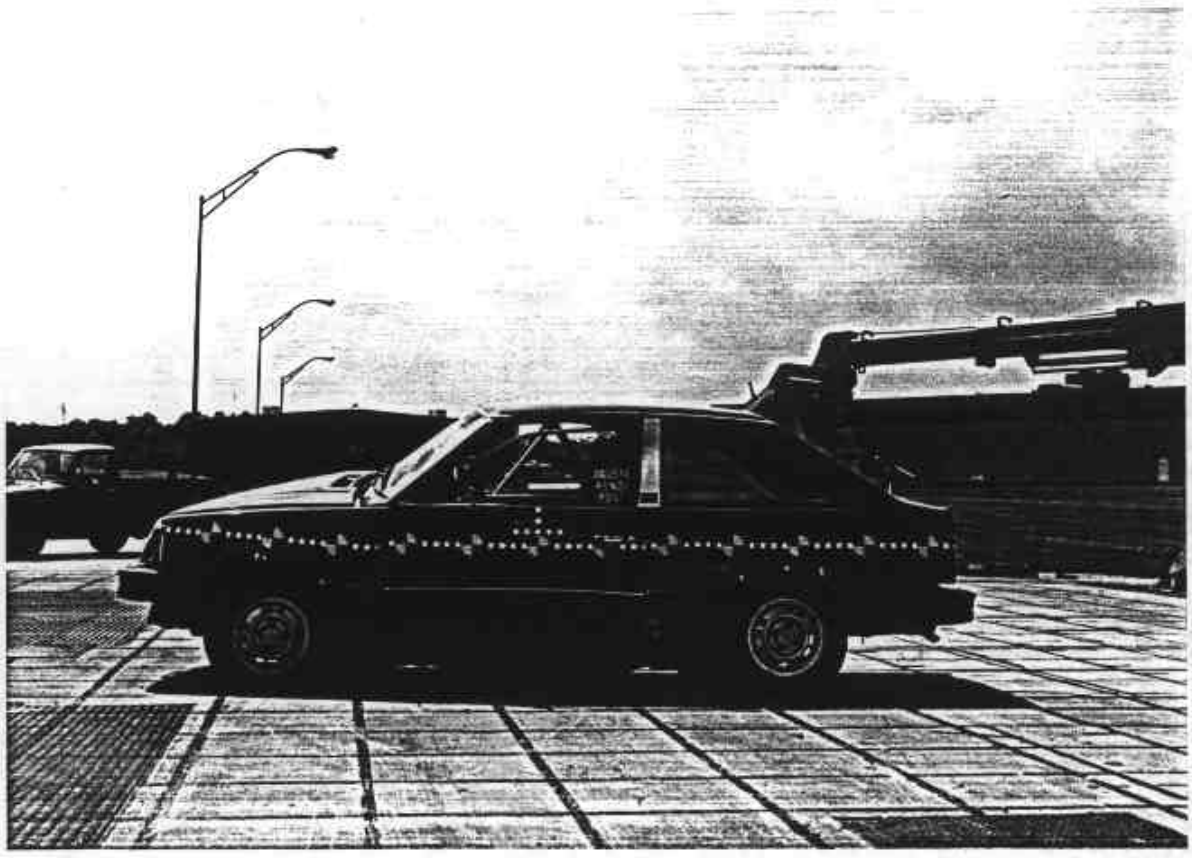


Figure B-8. POST-TEST DRIVER SIDE VIEW

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

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

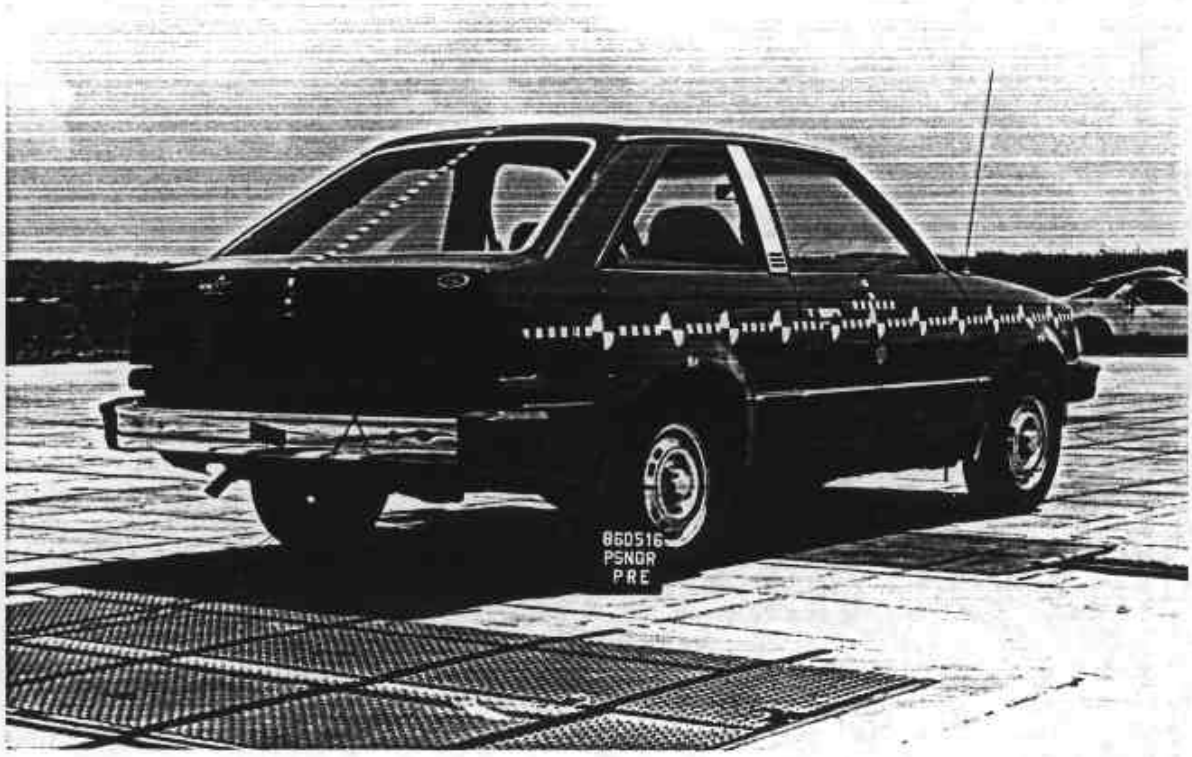


Figure B-11. PRE-TEST PASSENGER REAR THREE-QUARTER VIEW

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

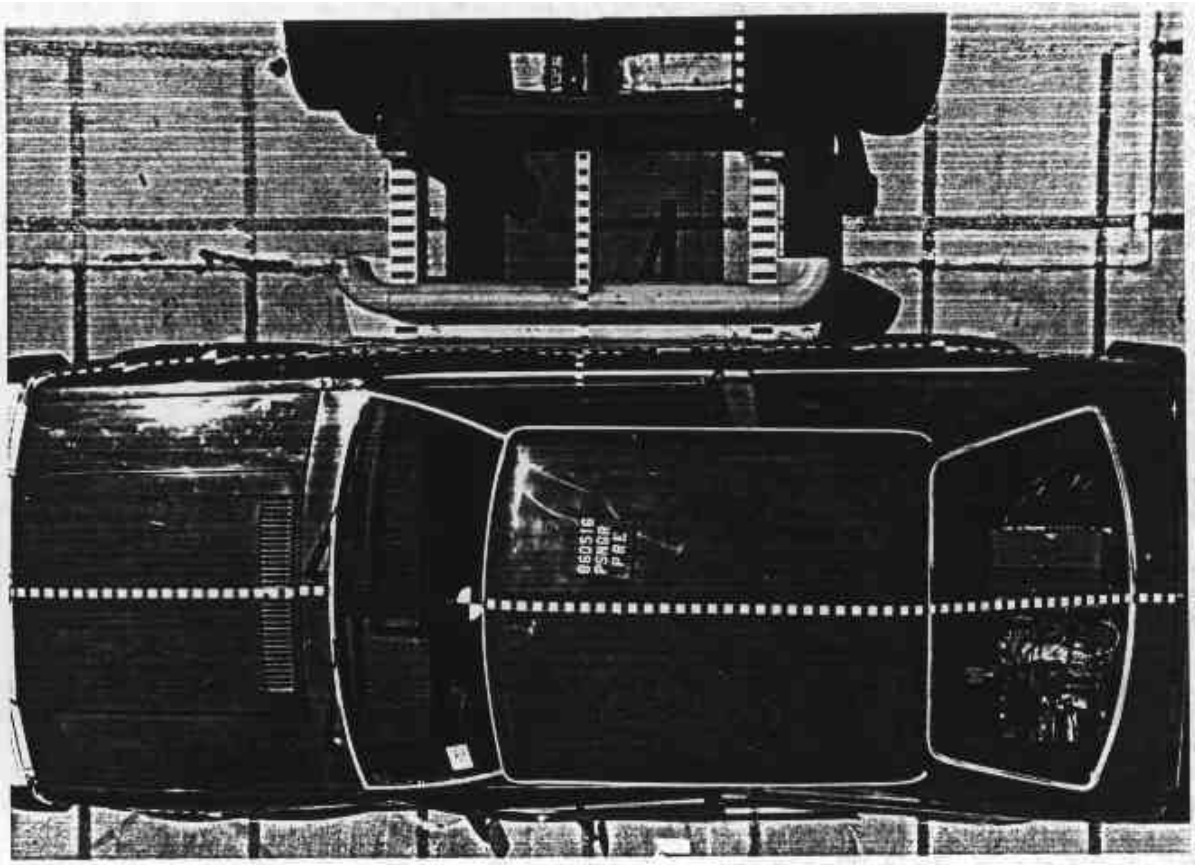


Figure B-13. PRE-TEST OVERHEAD VIEW

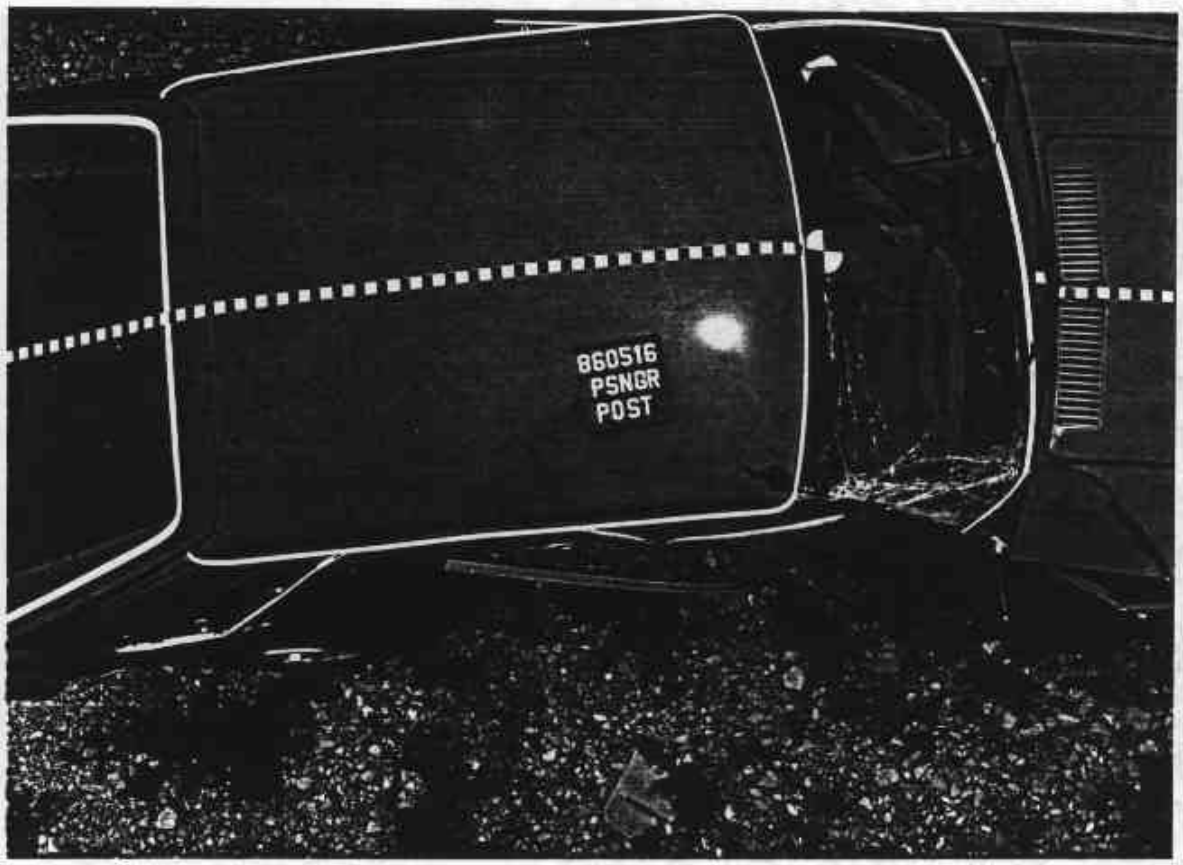


Figure B-14. POST-TEST OVERHEAD VIEW

Figure B-15. POST-TEST OVERALL VIEW

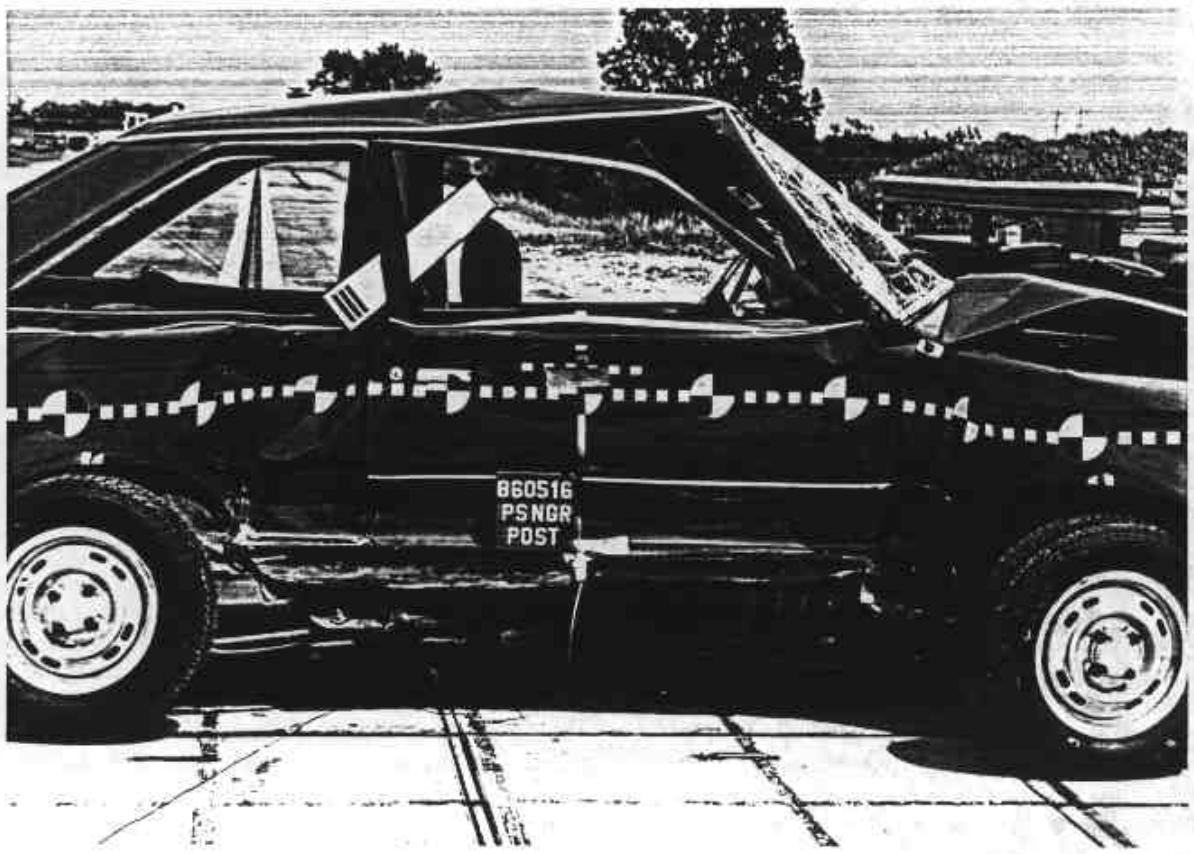


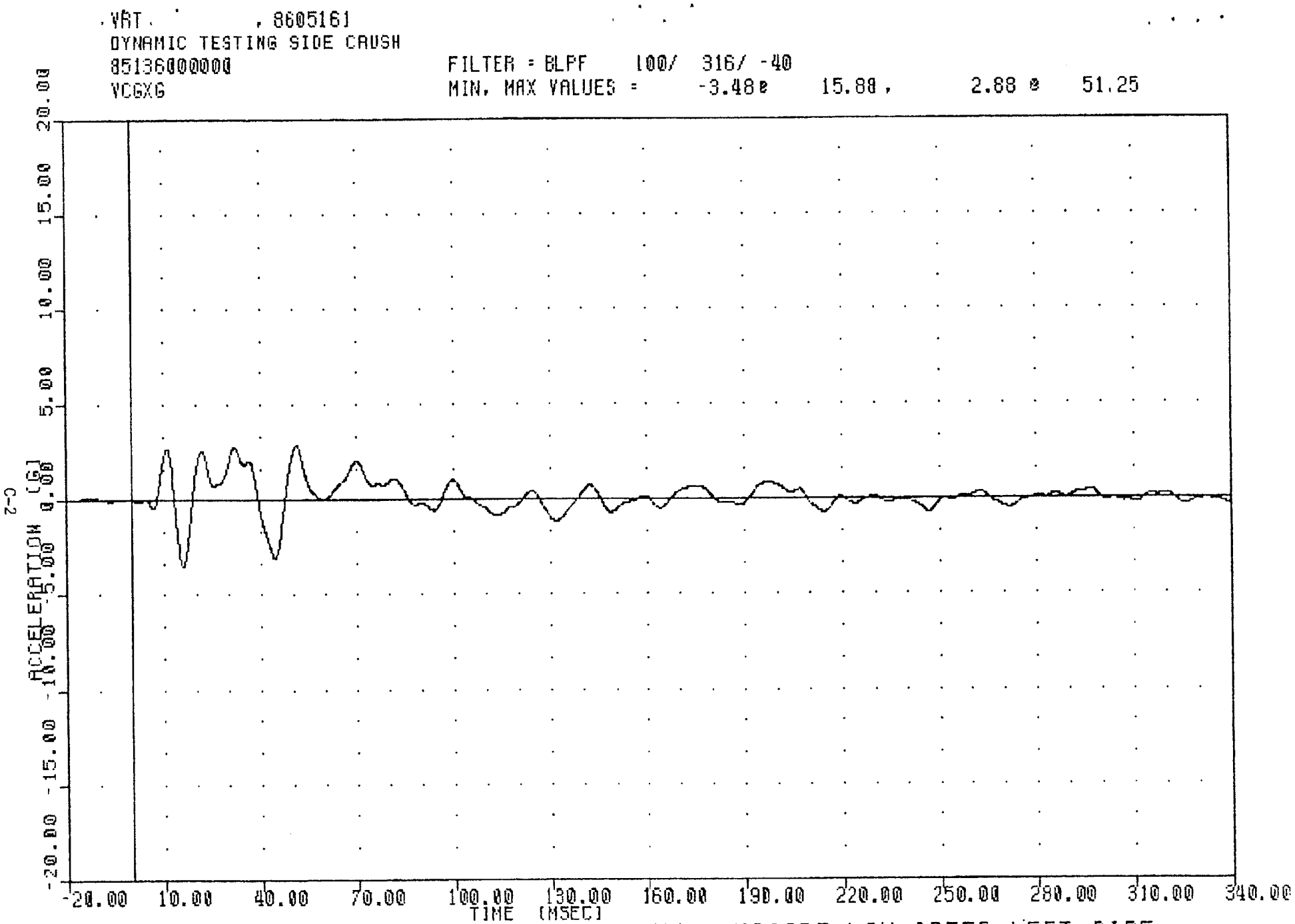
Figure B-16. POST-TEST PASSENGER SIDE VIEW

APPENDIX C

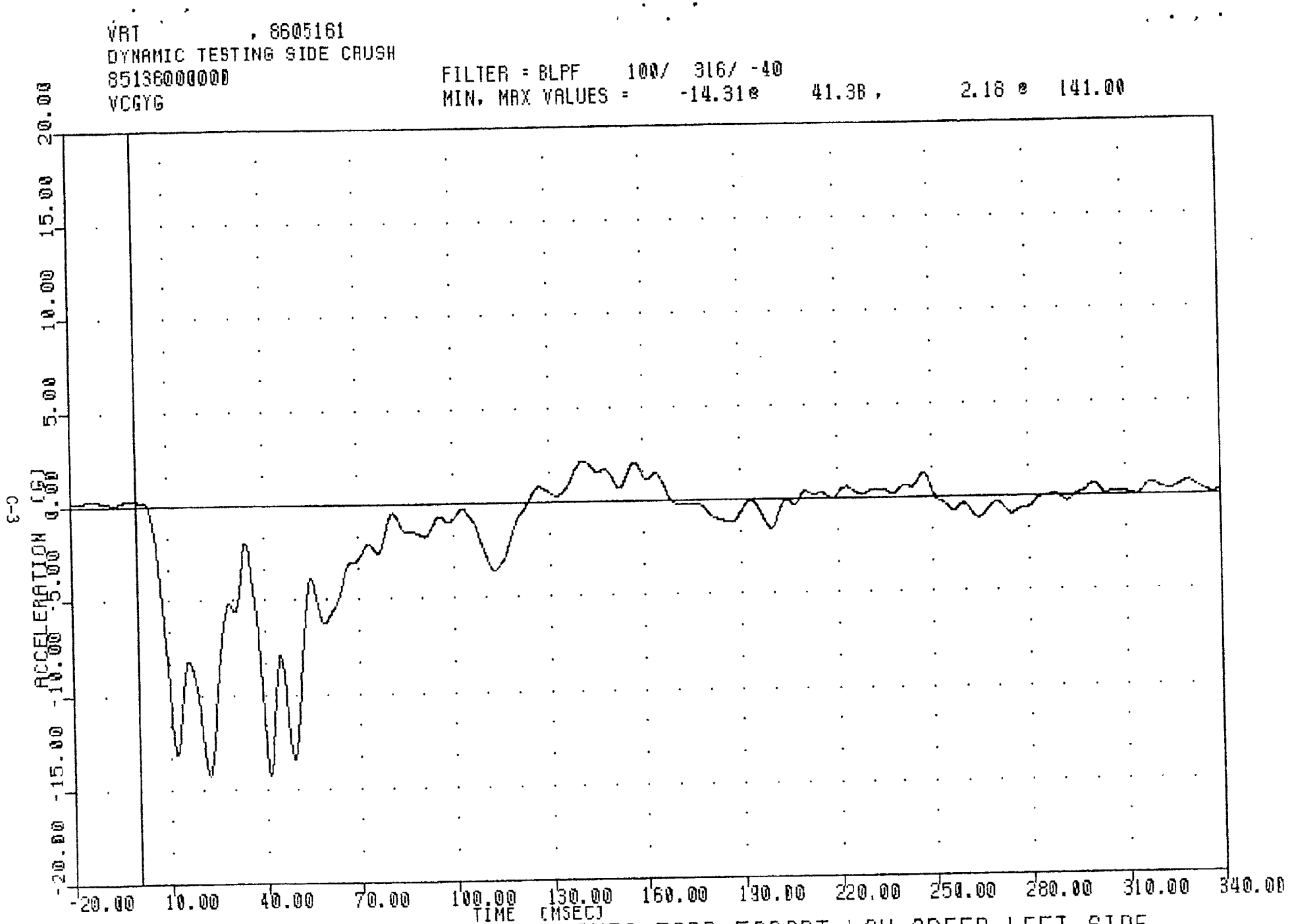
DATA PLOT PRESENTATION

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

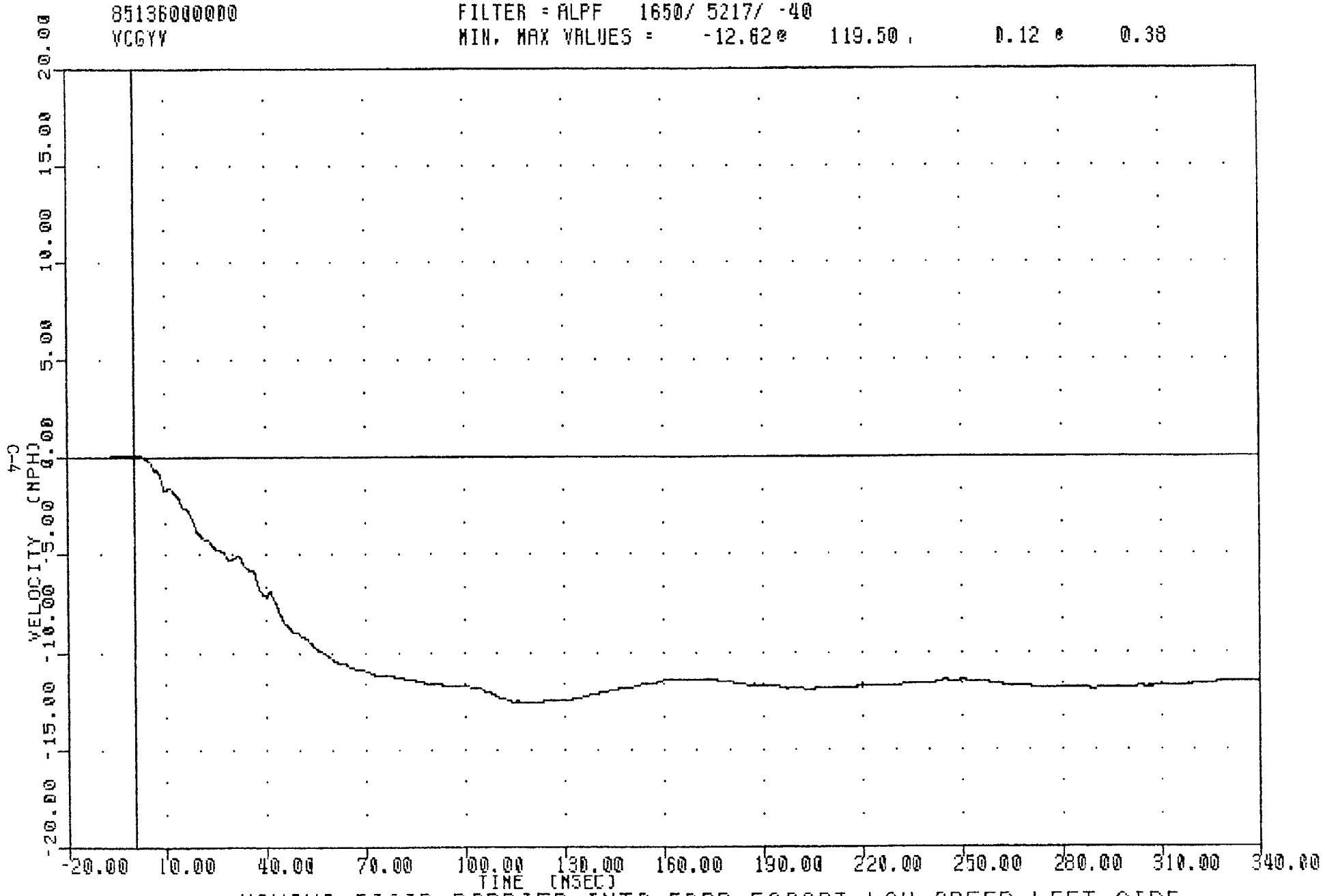
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211.



MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION X AXIS

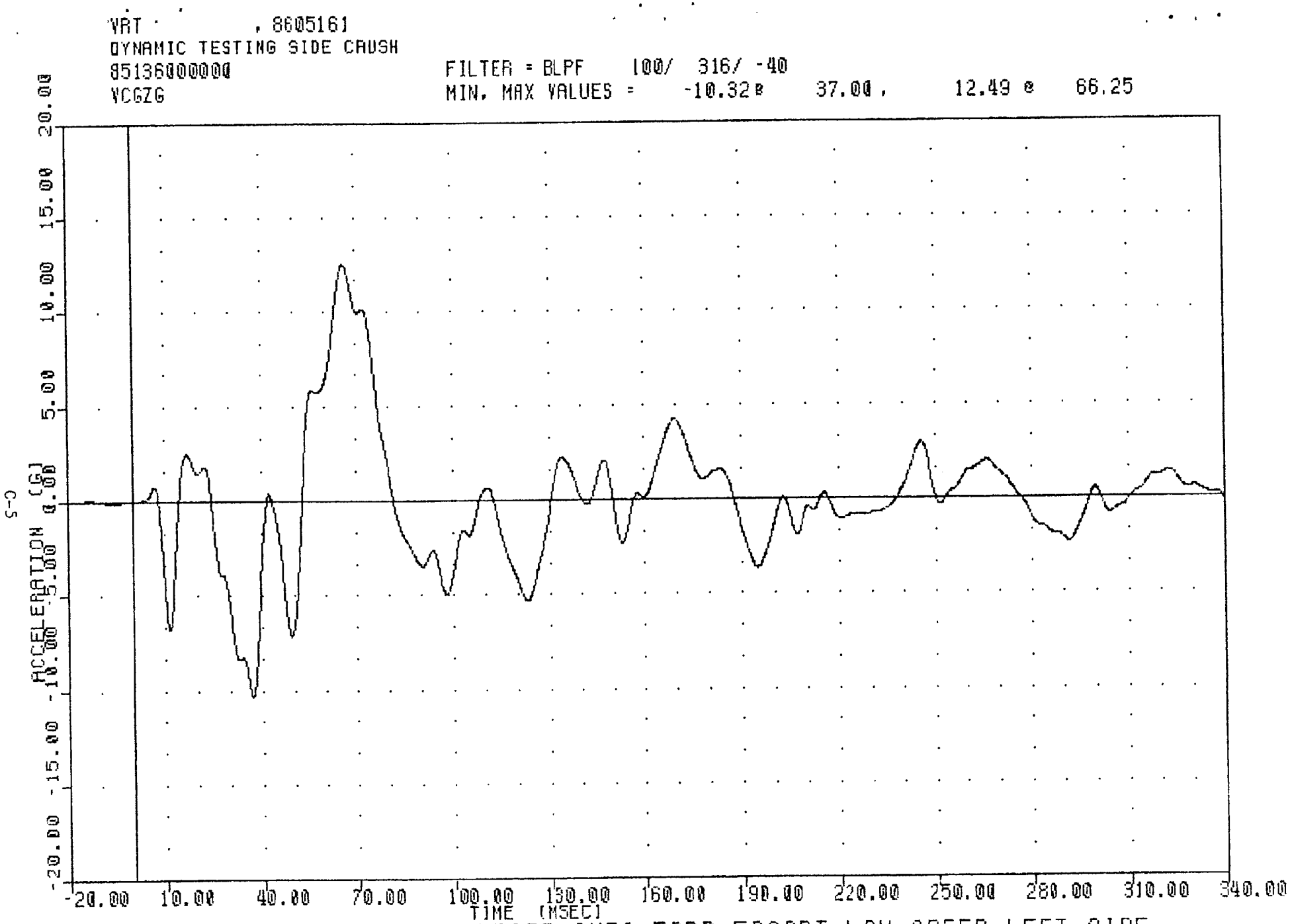


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS



C-4

MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
DELTA V USING VCGYG

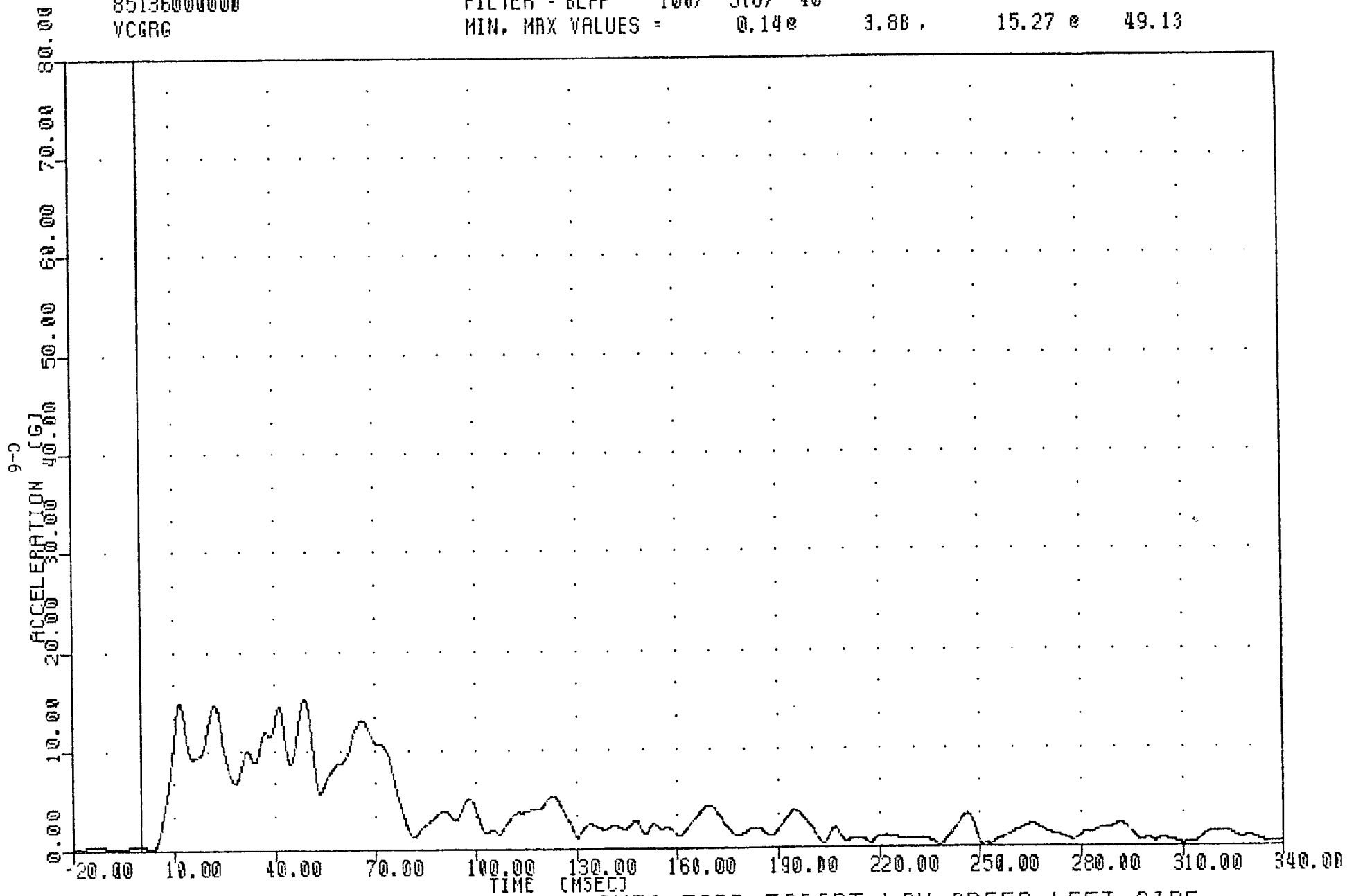


C-5

MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS

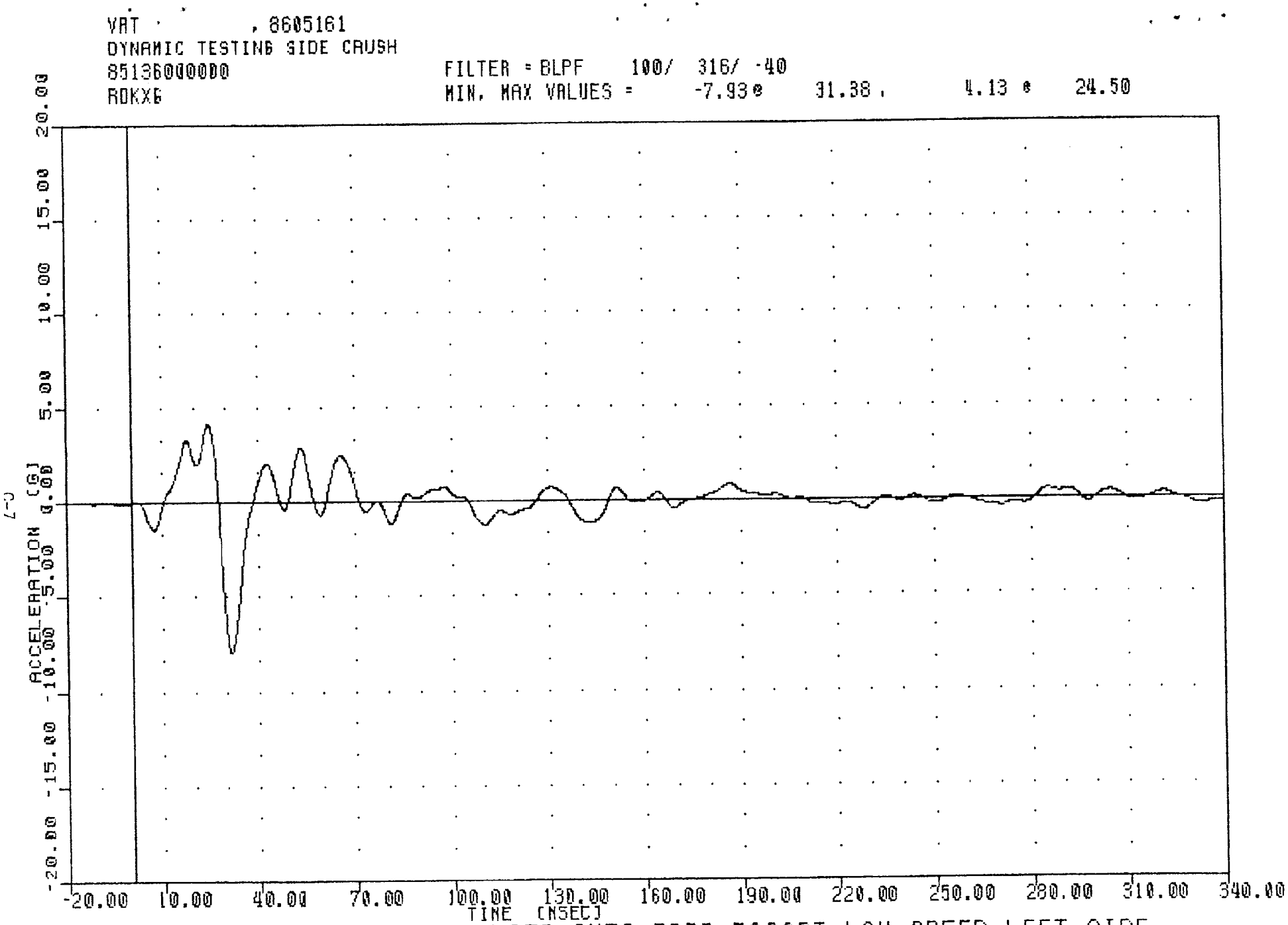
VRT , 8605161
DYNAMIC TESTING SIDE CRUSH
85136000000
VCGRG

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.14@ 3.88, 15.27 @ 49.13

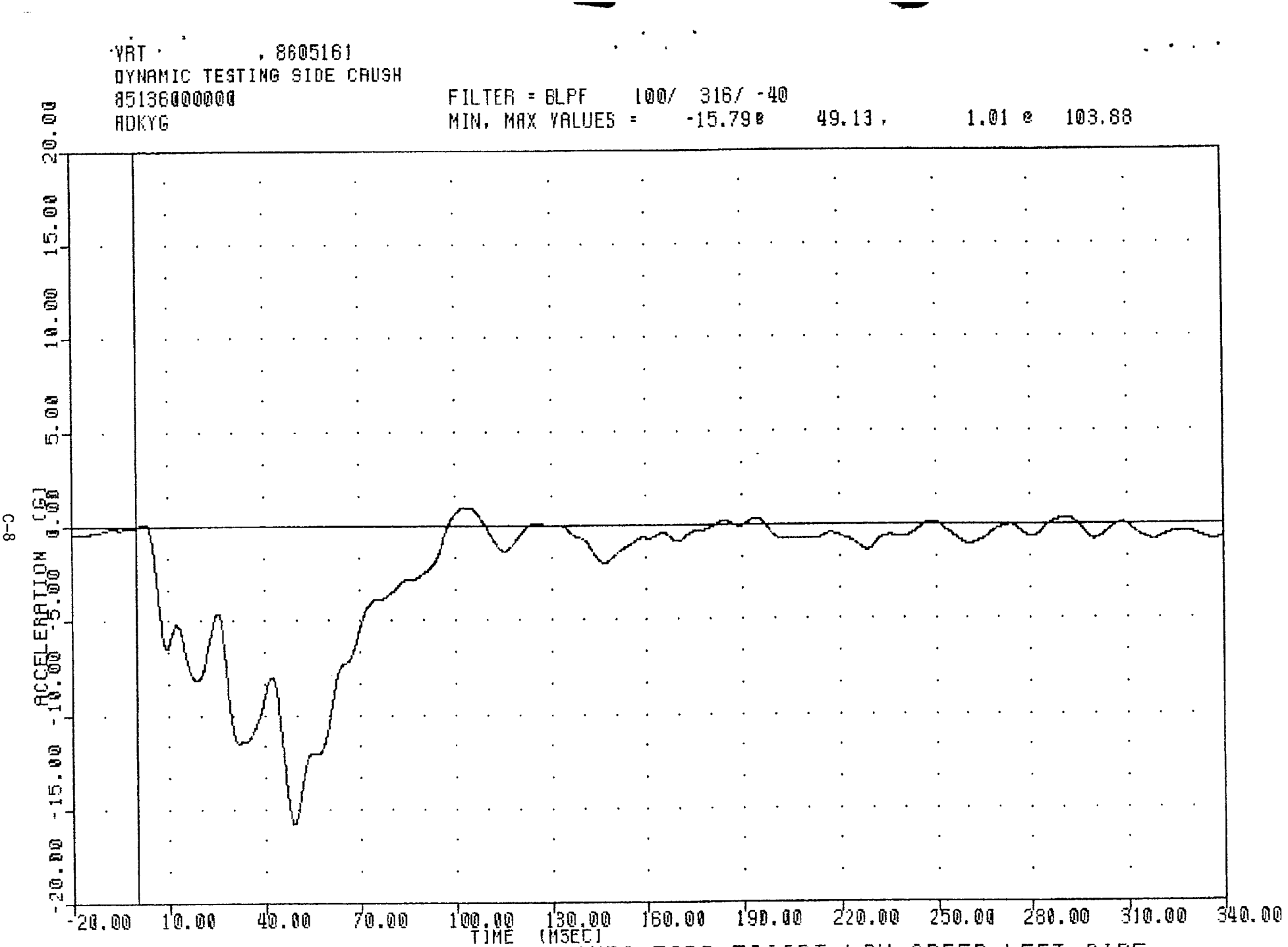


C-6

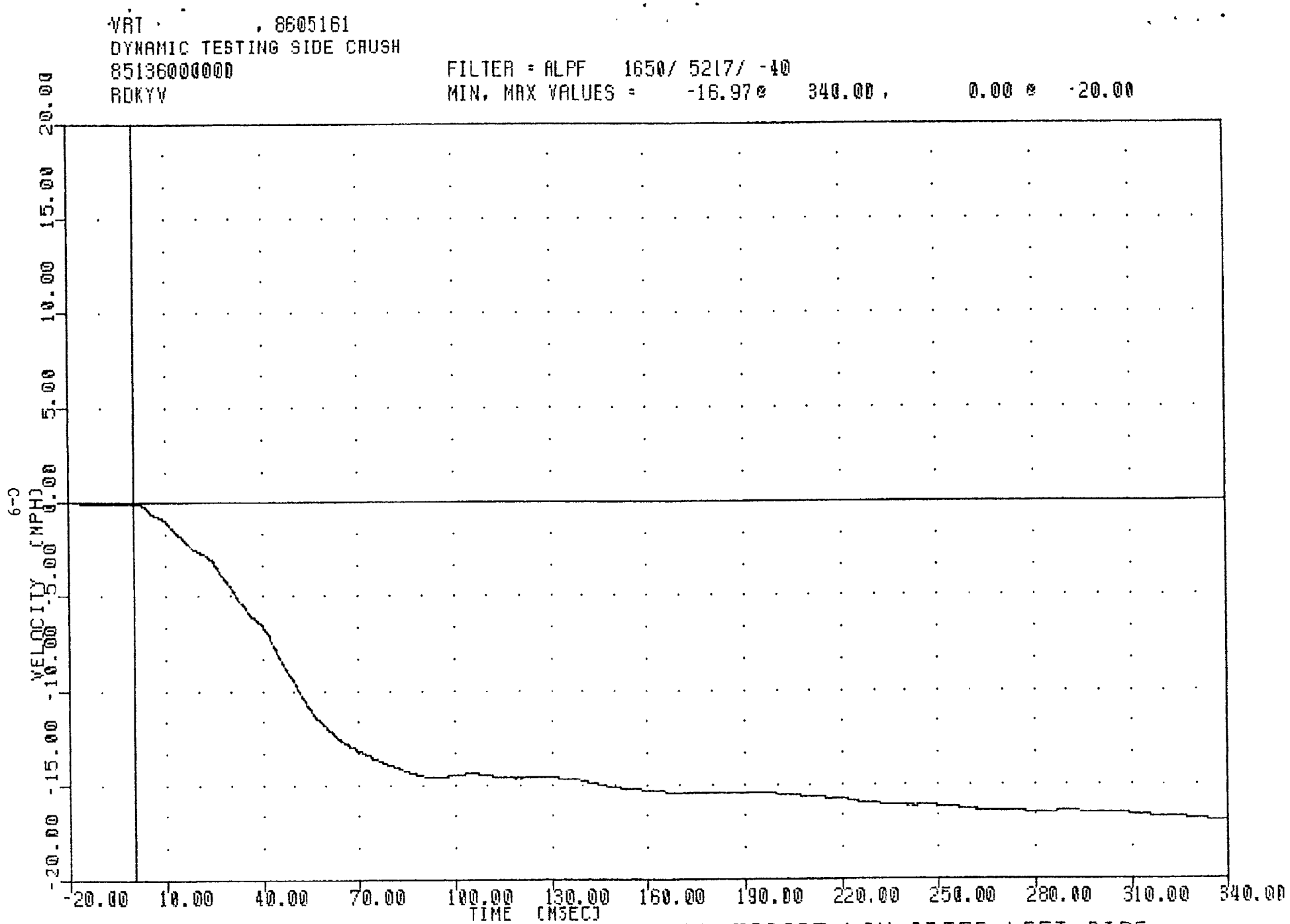
MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION RESULTANT



MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE REAR DECK ACCELERATION X AXIS

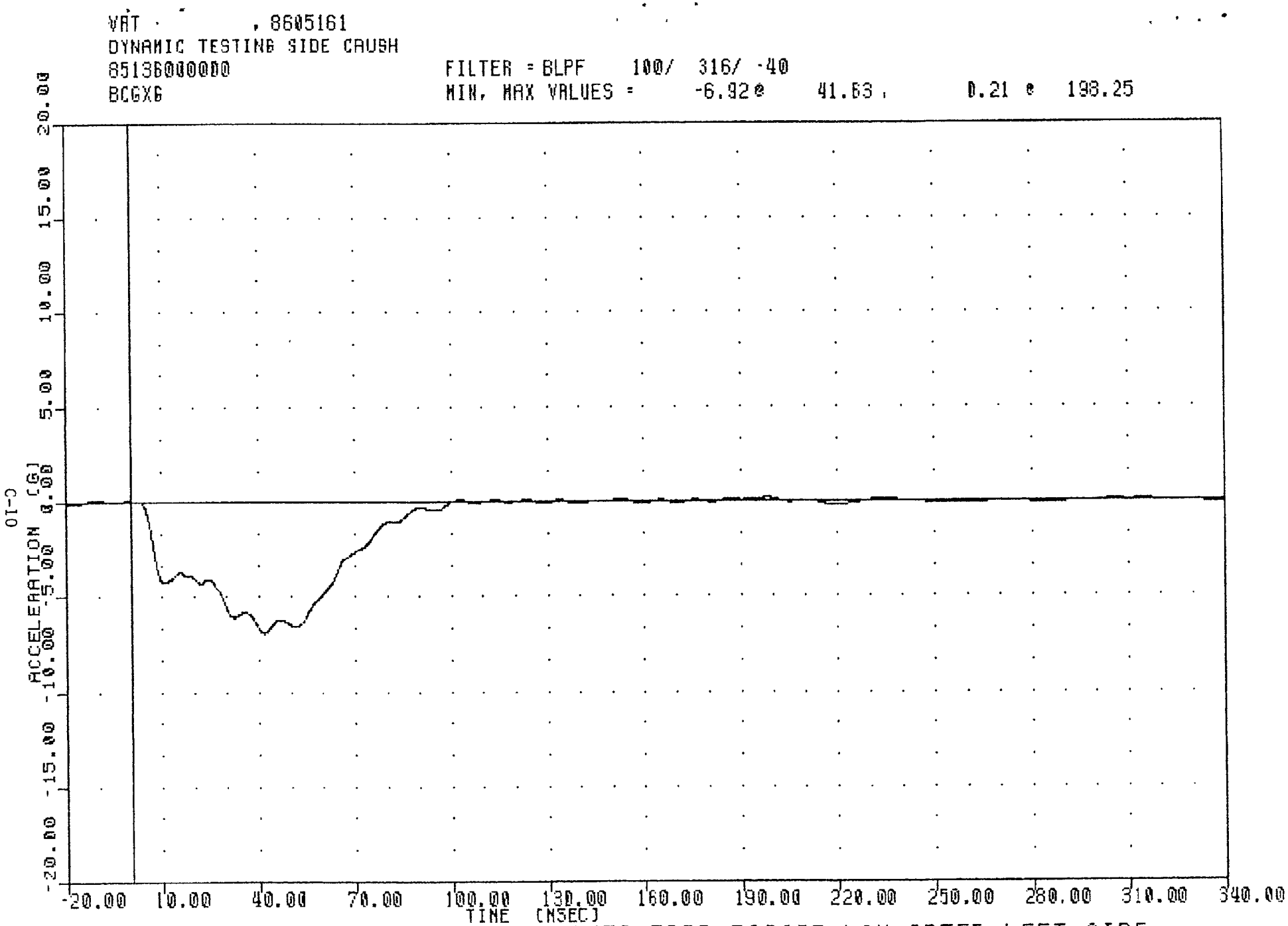


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE REAR DECK ACCELERATION Y AXIS



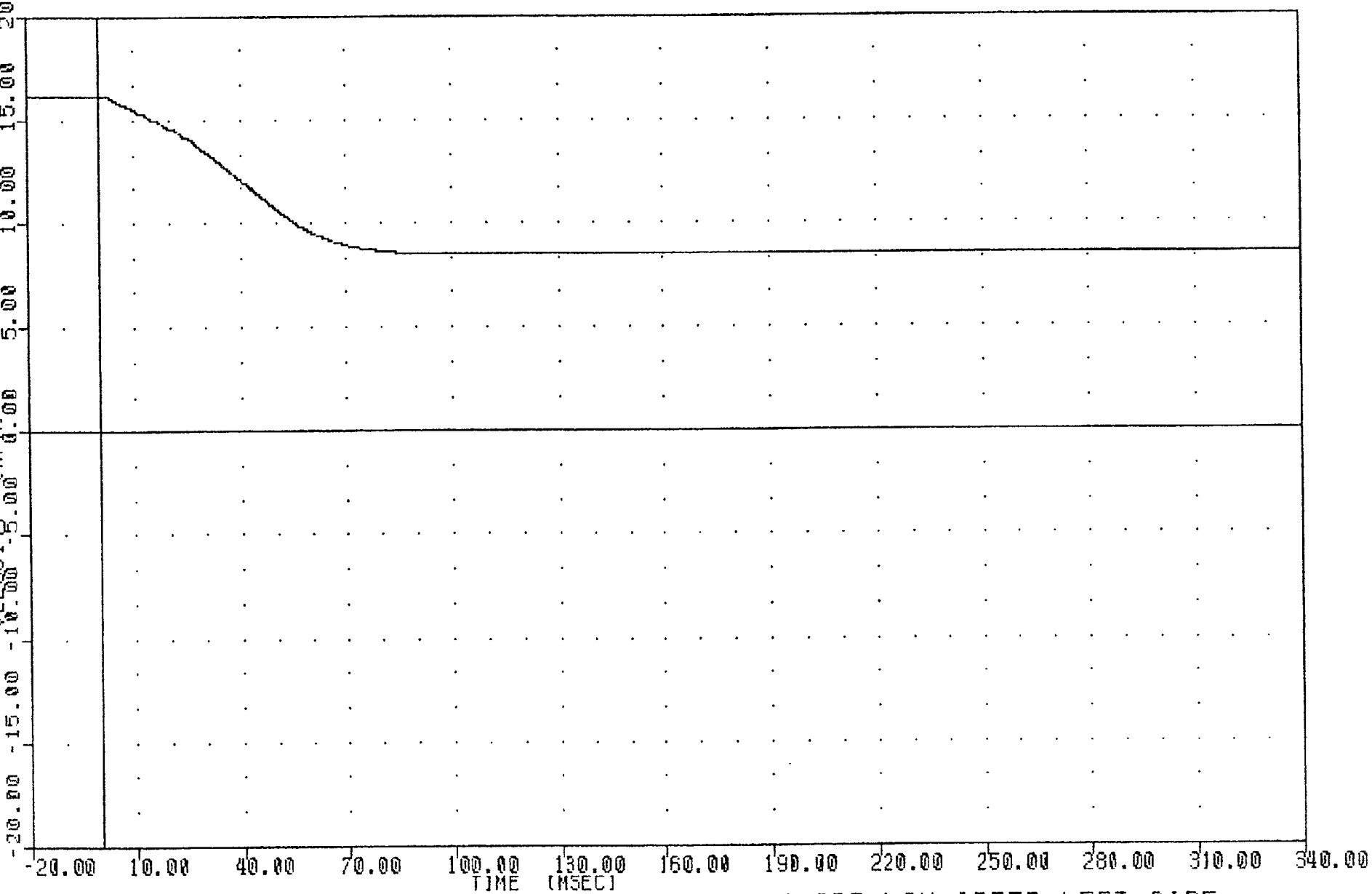
C-9

MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
DELTA V USING RDKYG

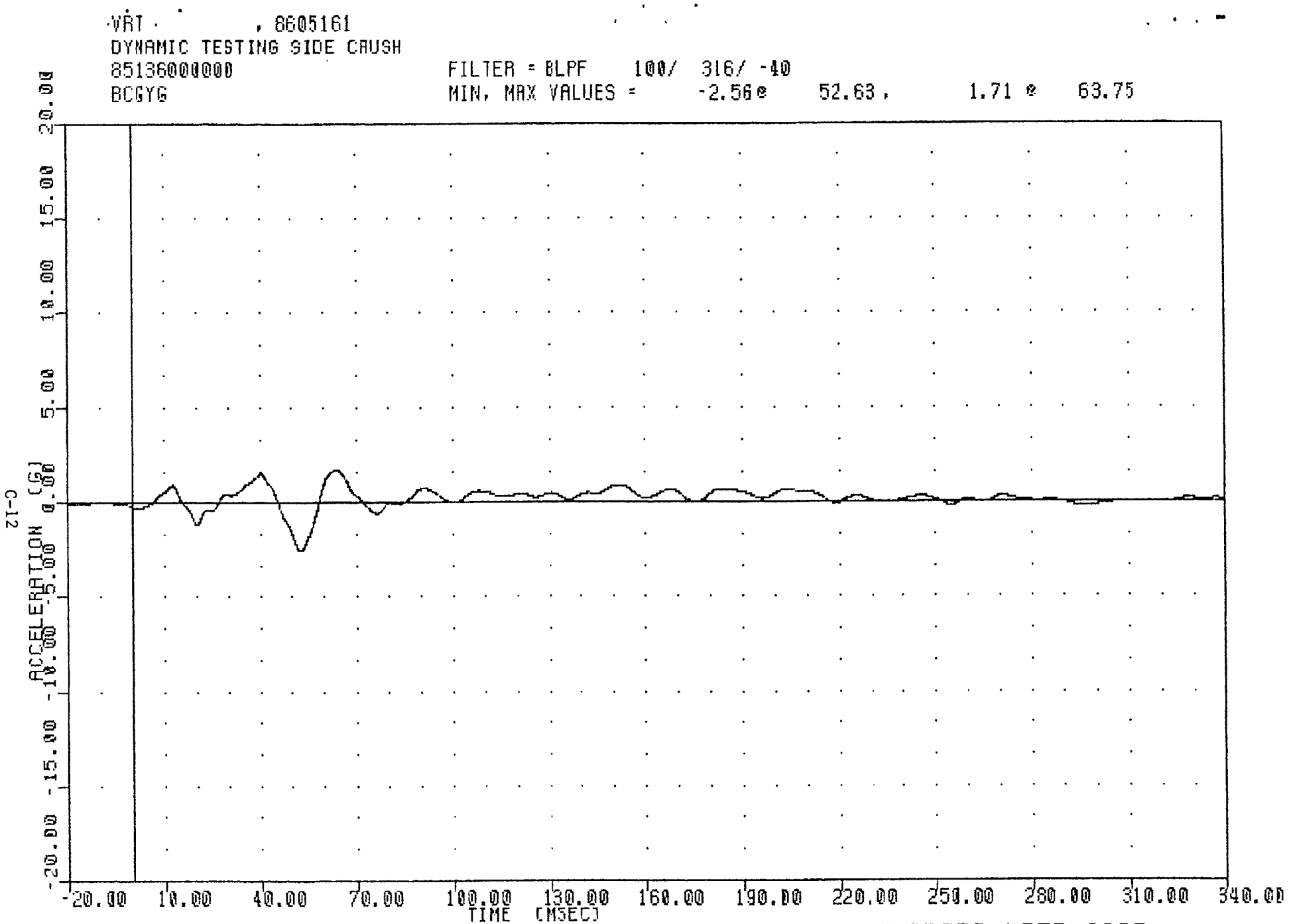


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS

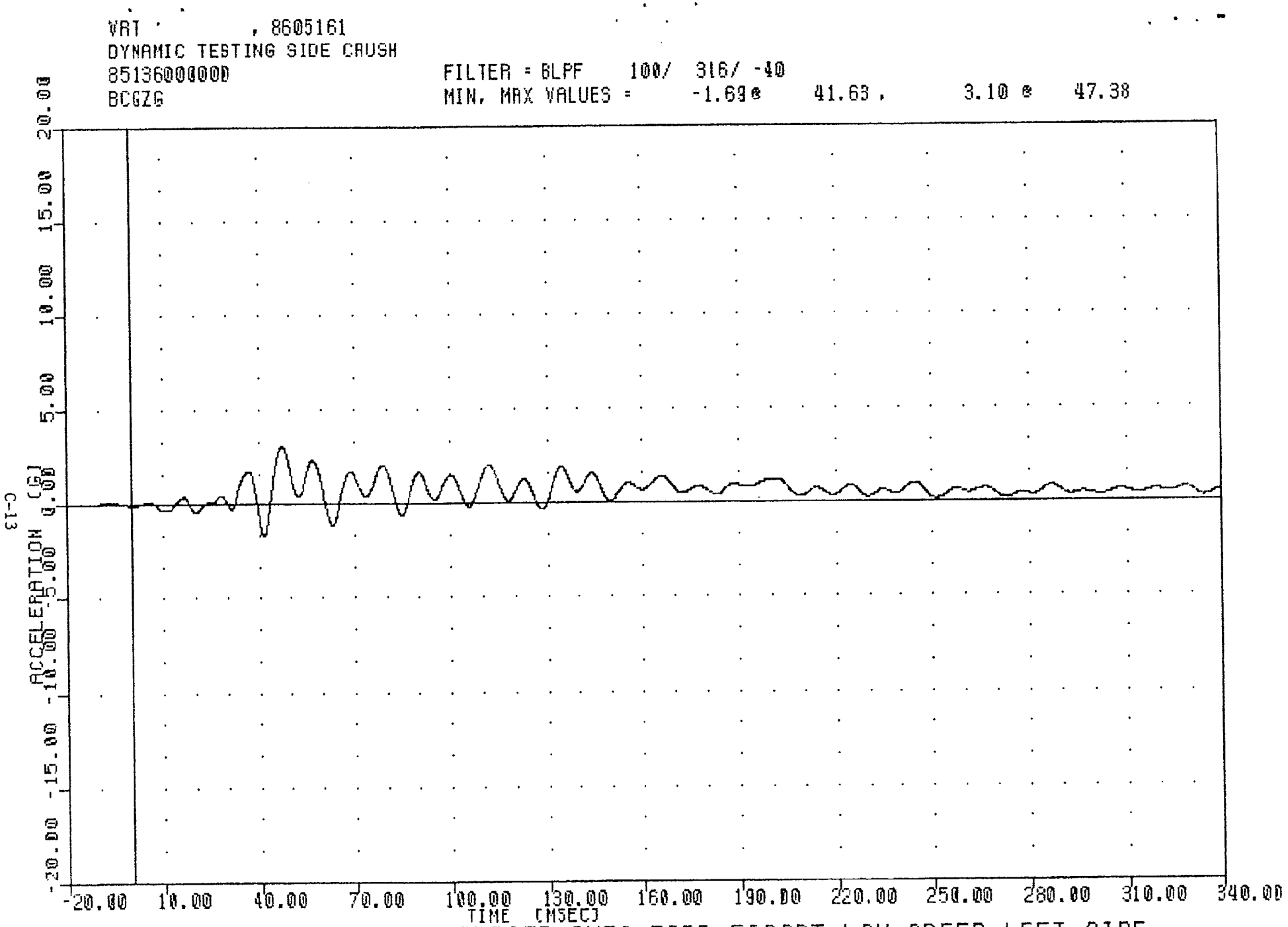
VRT , 8605161
DYNAMIC TESTING SIDE CRUSH
85136000000 FILTER = ALPF 1650/ 5217/ -40
BCGXV MIN, MAX VALUES = 8.47 @ 104.63 , 16.13 @ -0.63



MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
DELTA V USING BCGXG

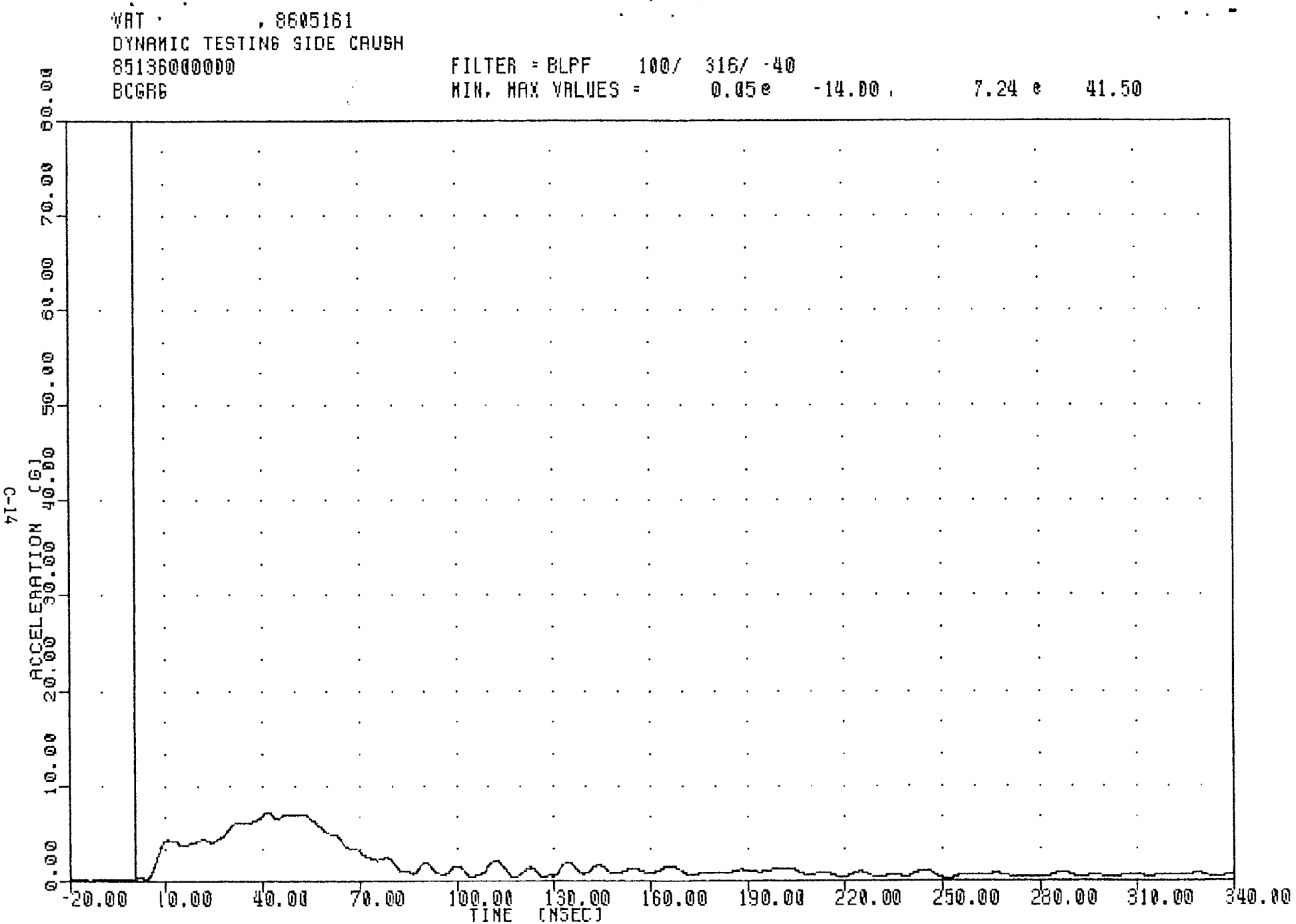


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS

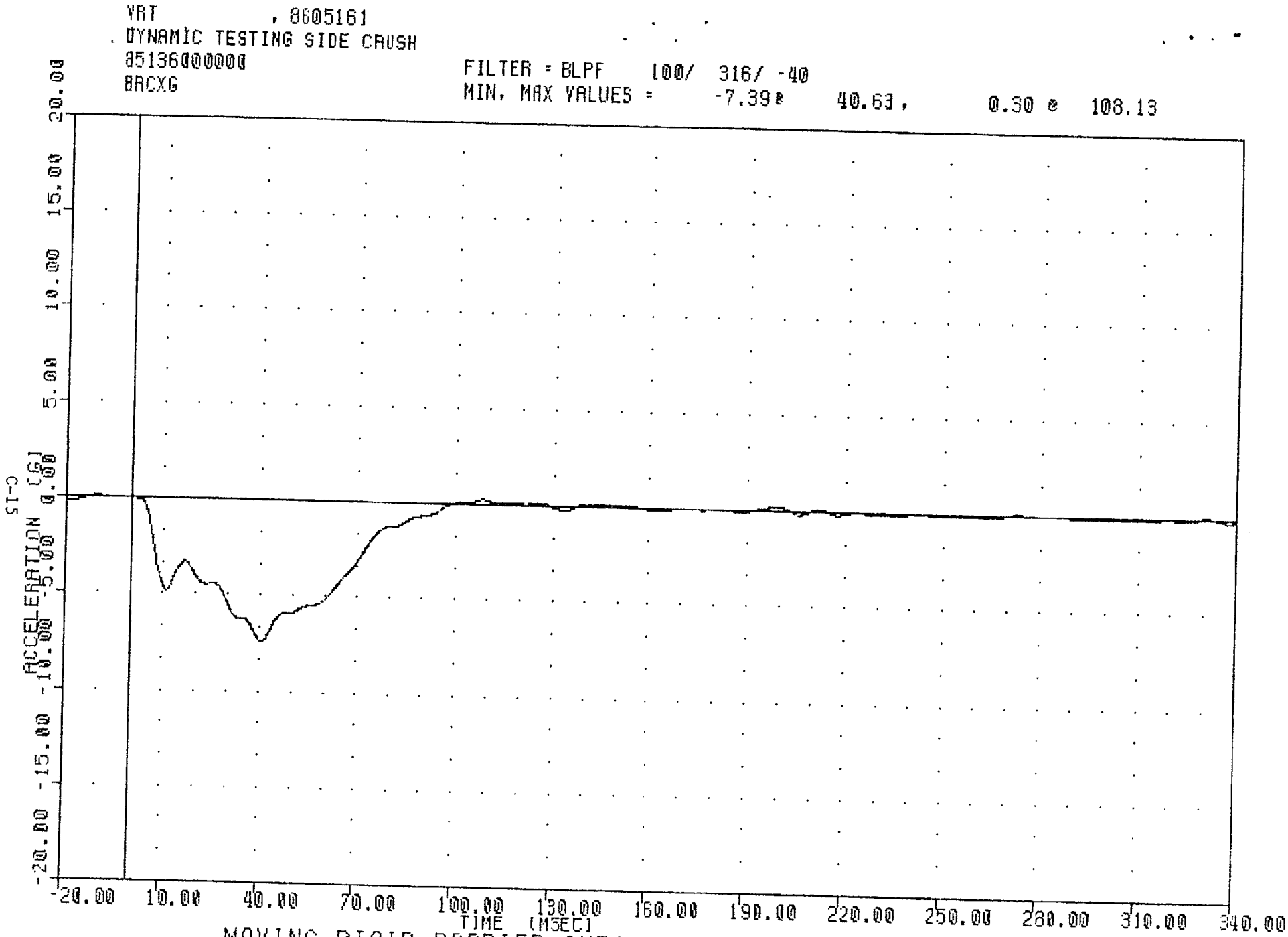


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE

MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS

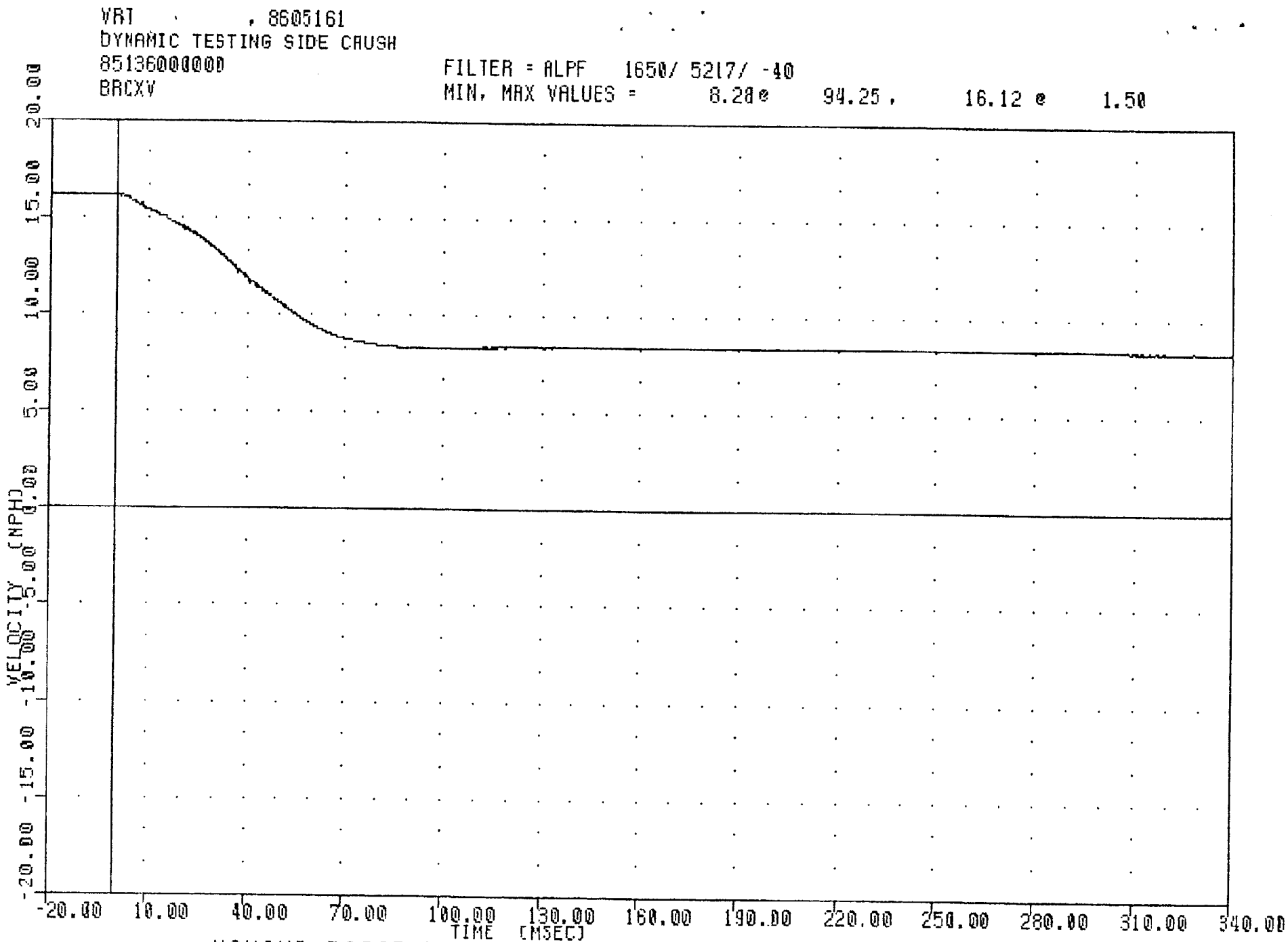


MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION RESULTANT



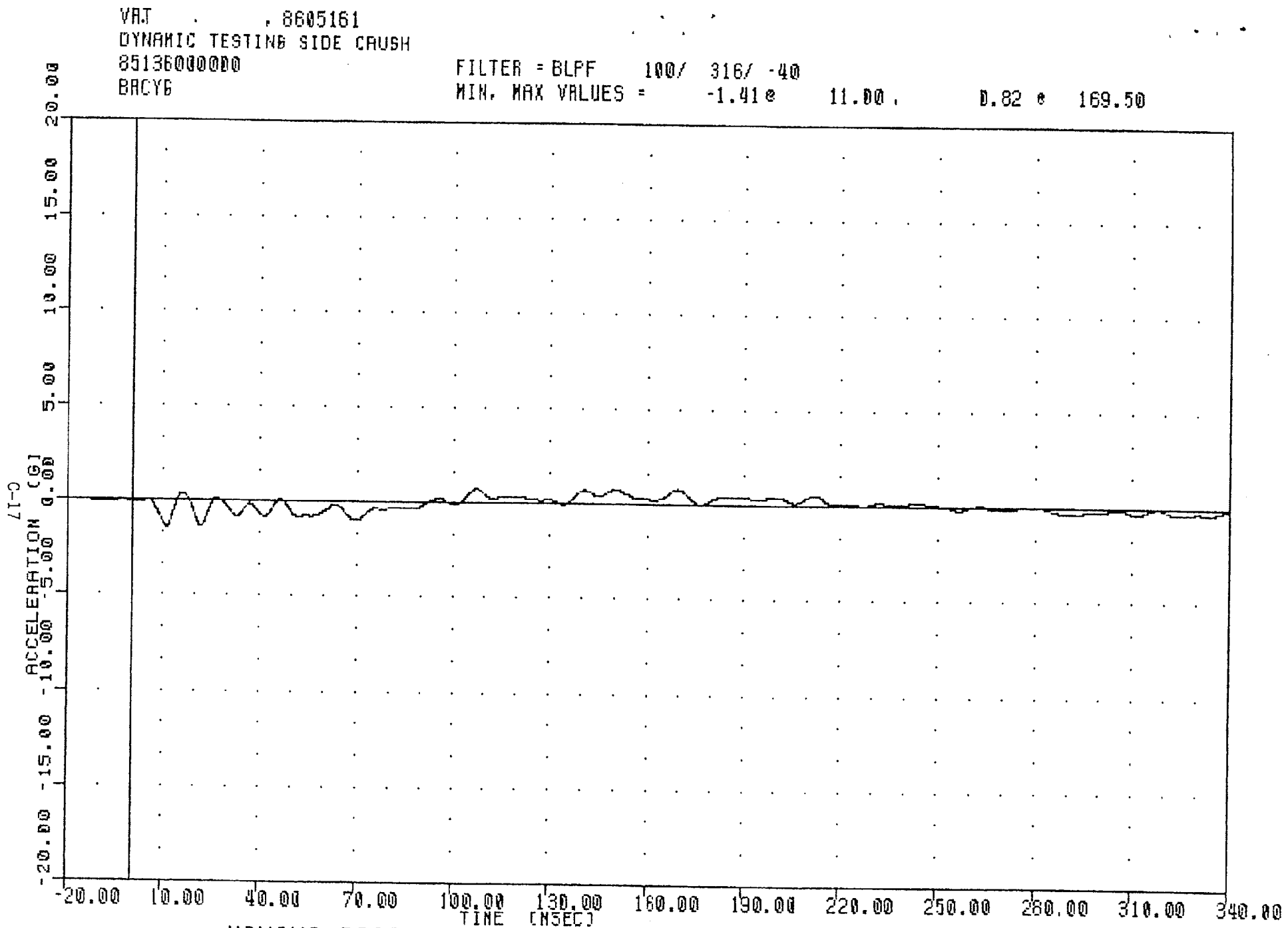
C-15

MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS

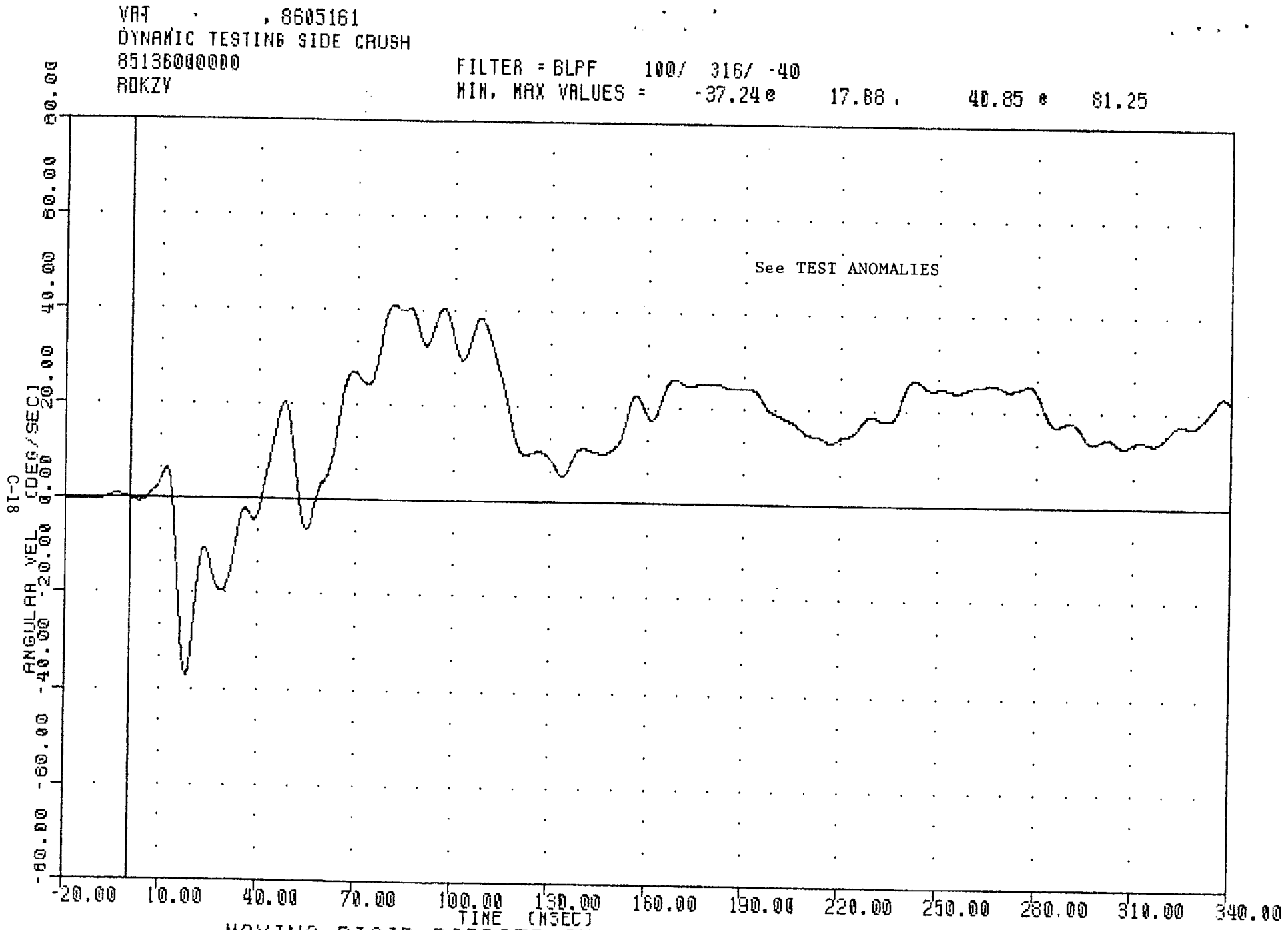


C-16

MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
DELTA V USING BRCXG



MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS



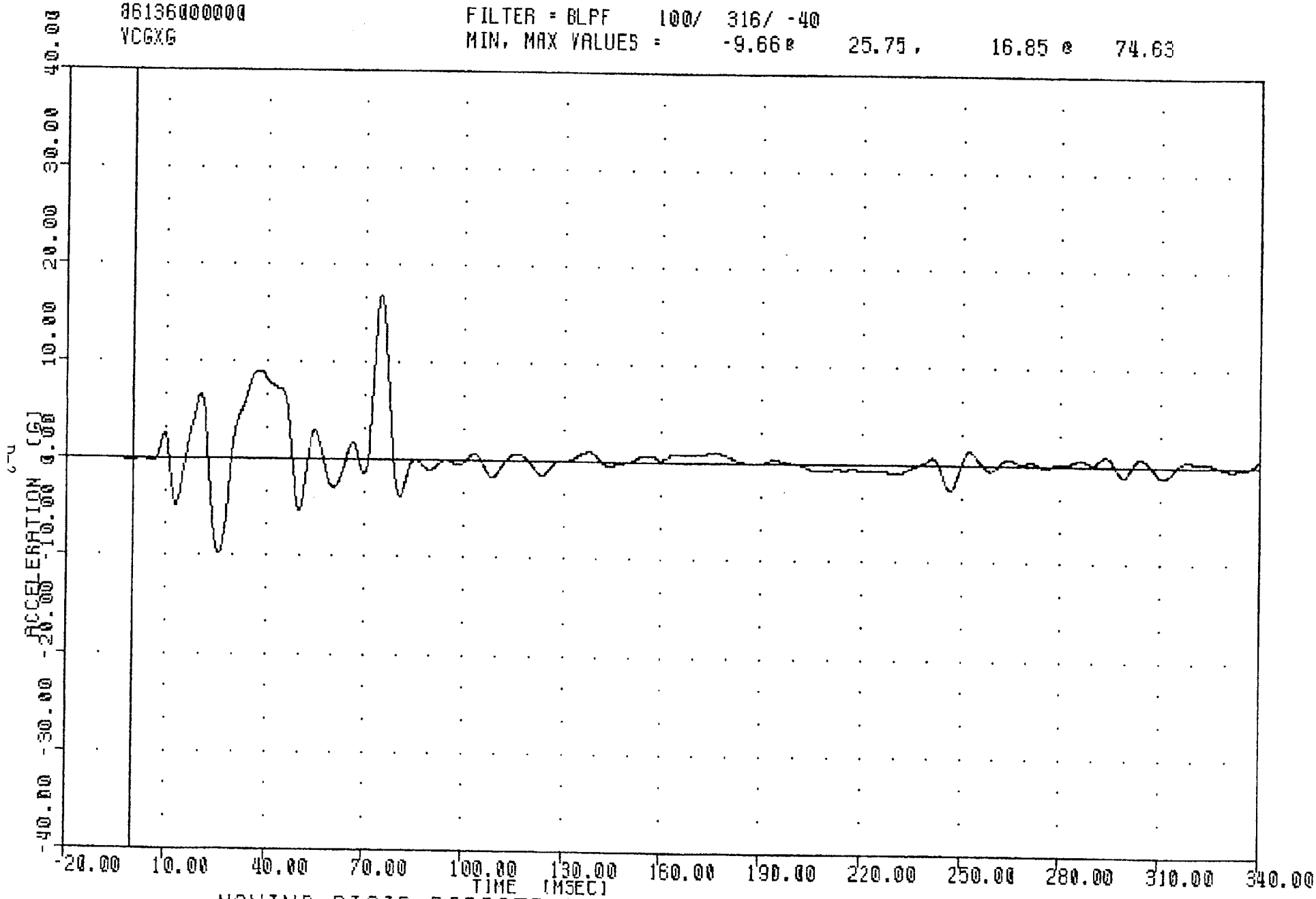
MOVING RIGID BARRIER INTO FORD ESCORT LOW SPEED LEFT SIDE
VEHICLE YAW RATE DEGREE/SECOND

APPENDIX D

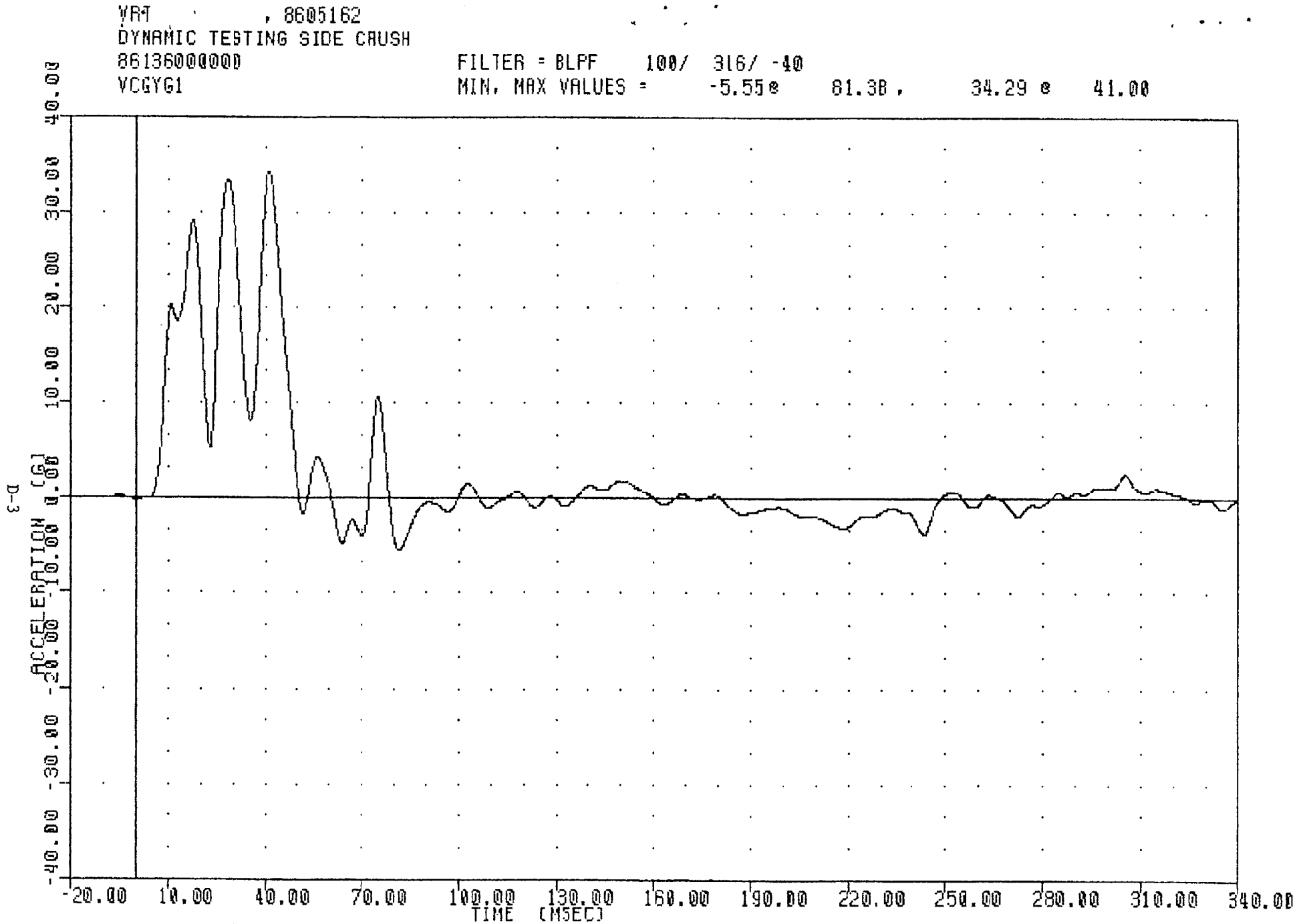
DATA PLOT PRESENTATION

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

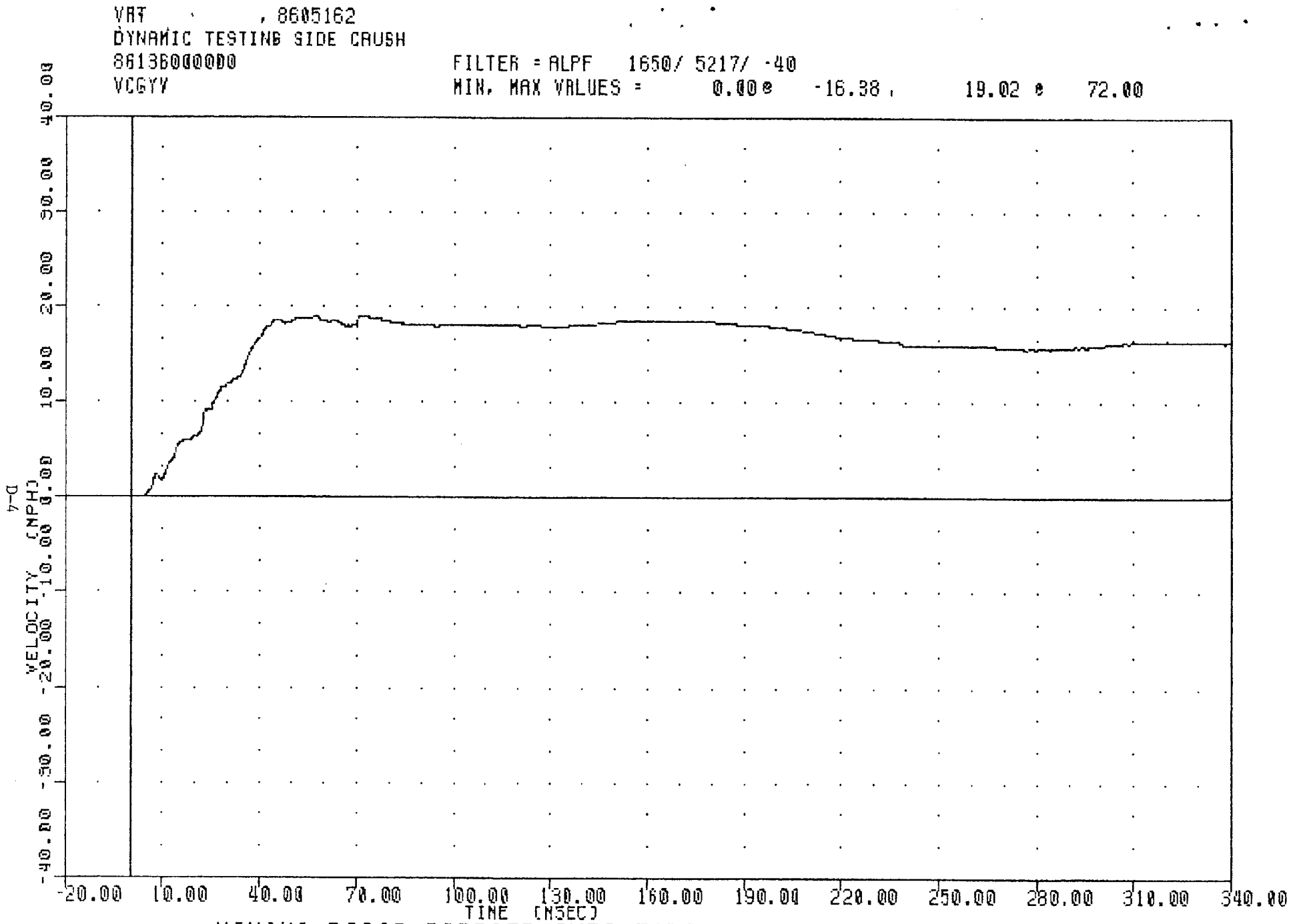
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211.



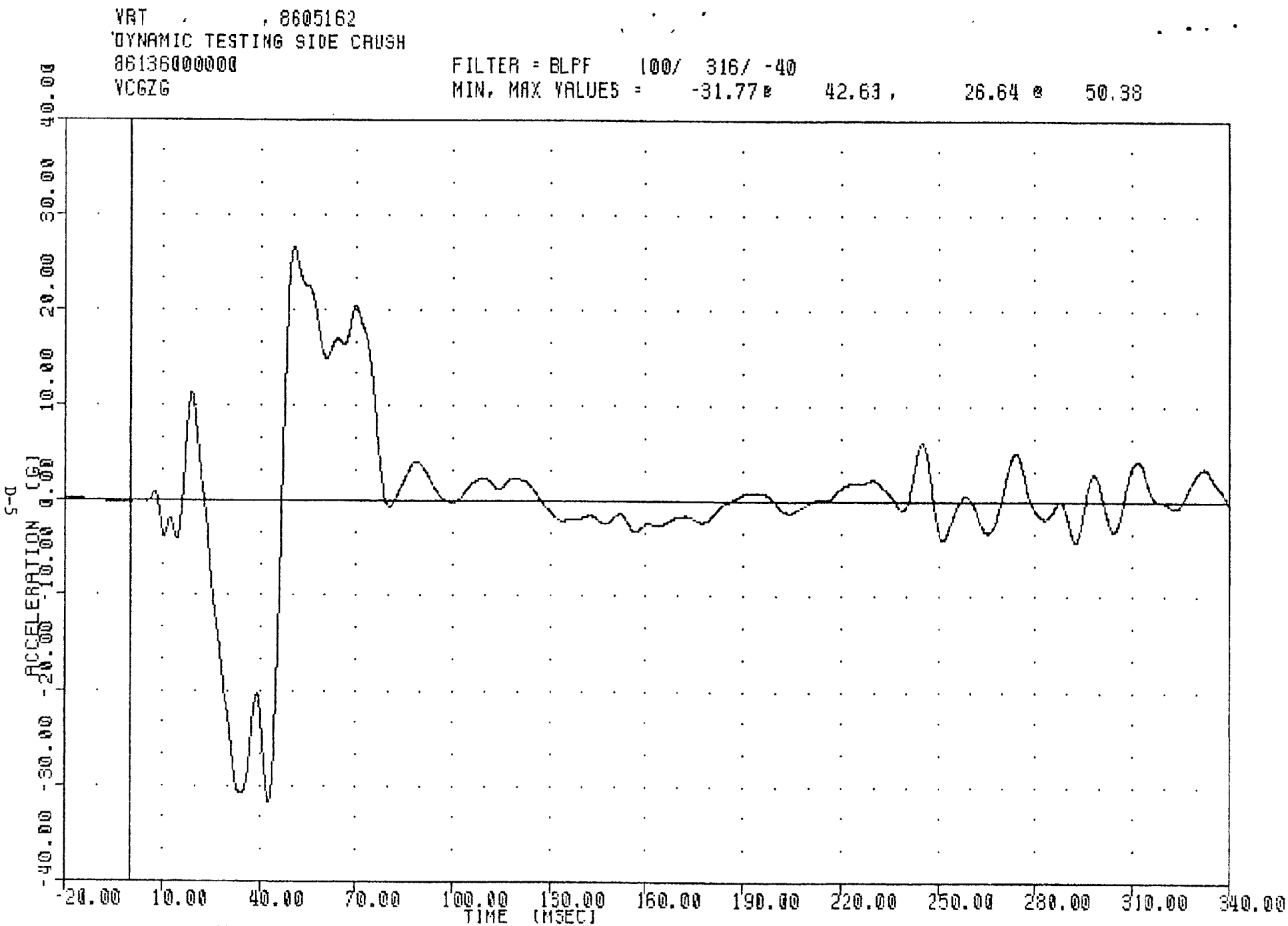
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION X AXIS



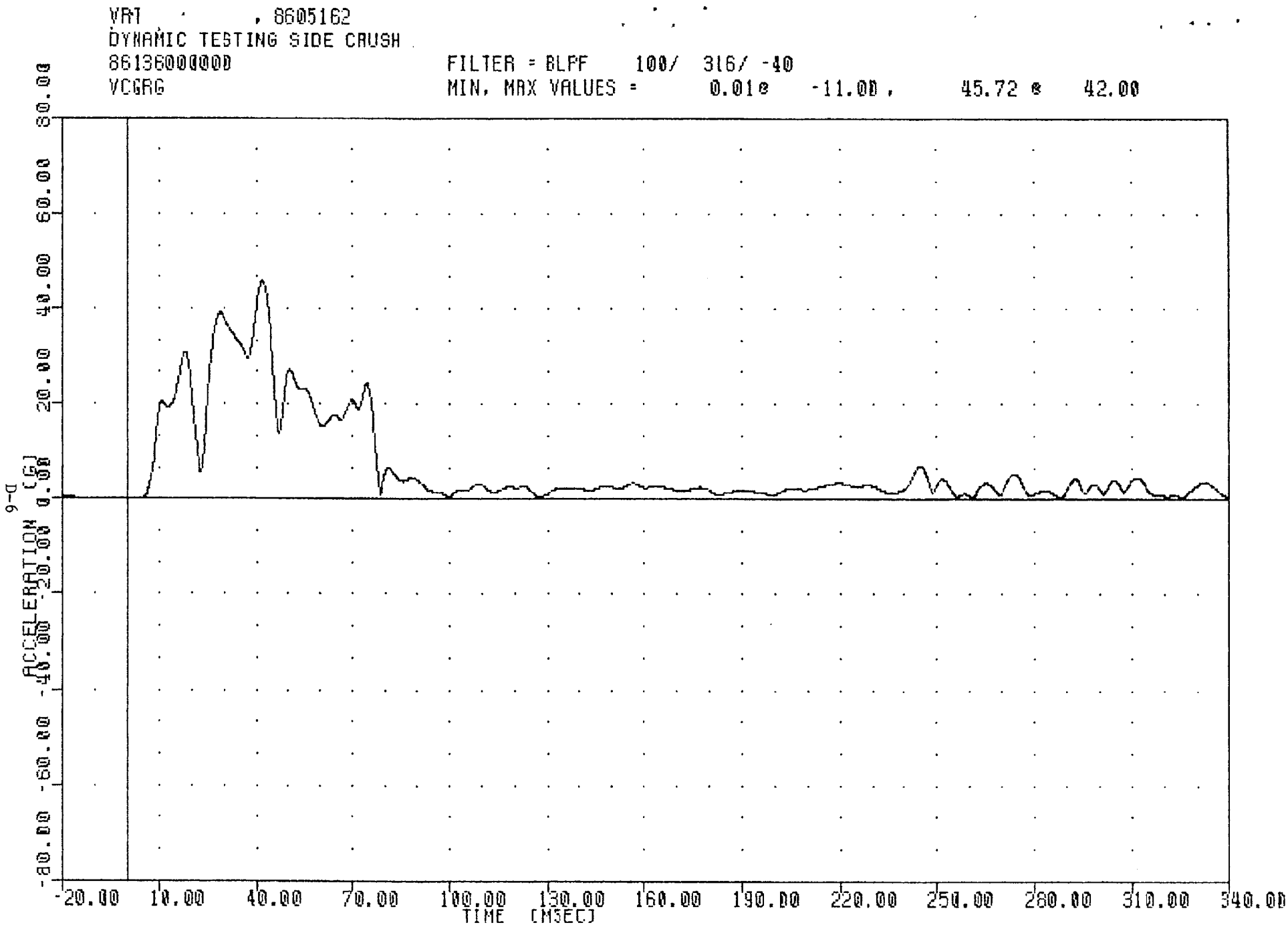
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS REDUNDANT -1



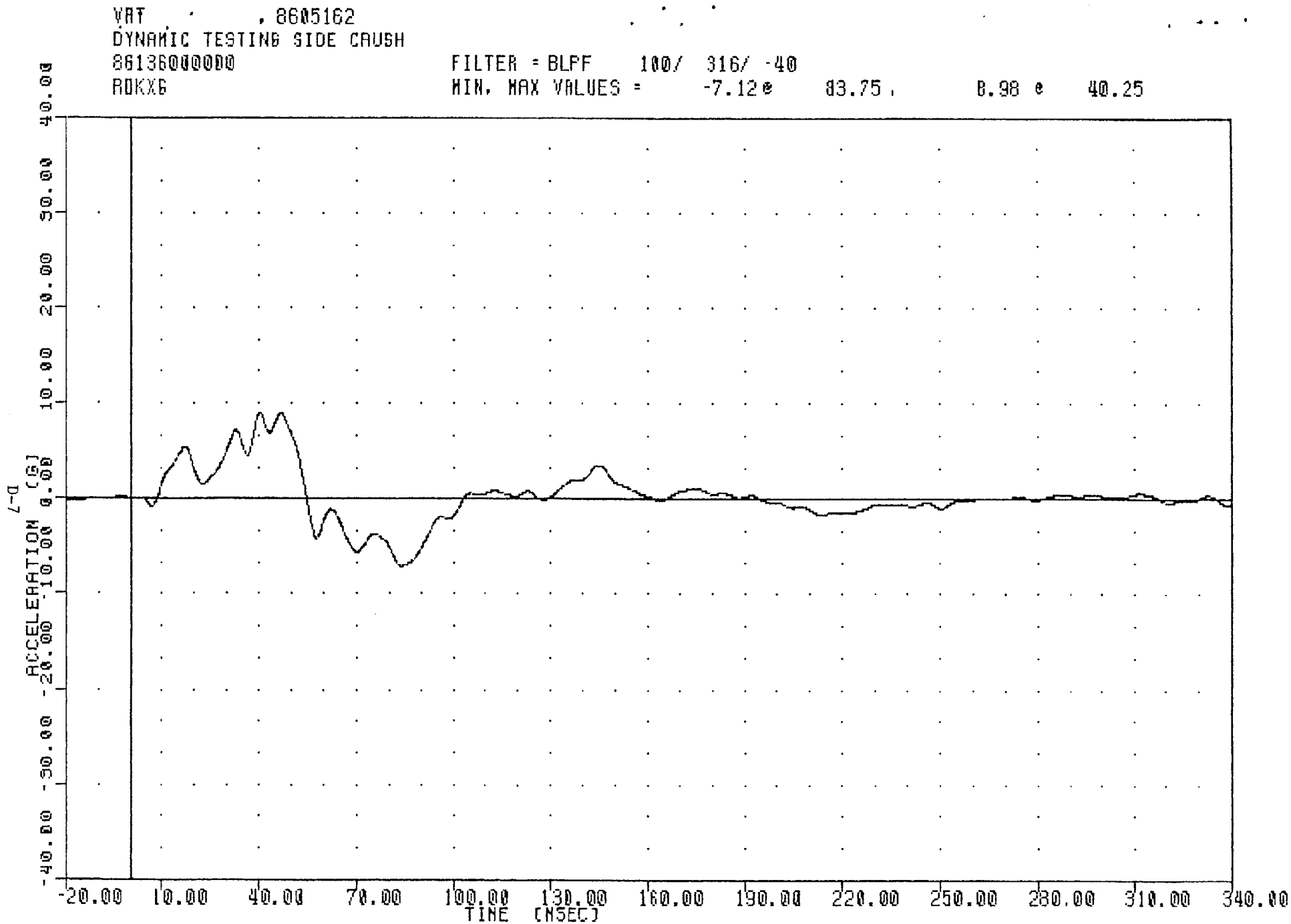
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
DELTA V USING VCGYG1



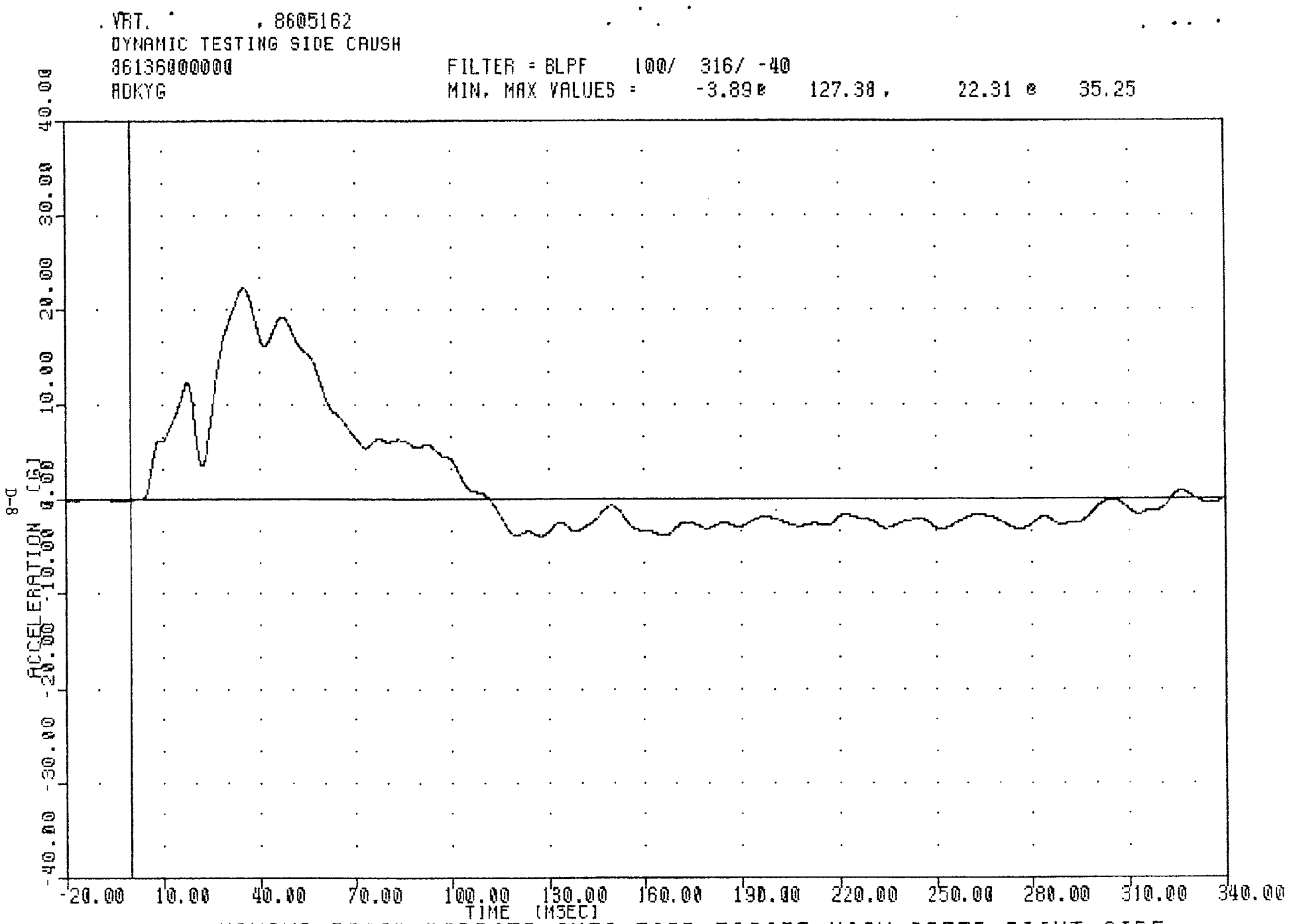
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS



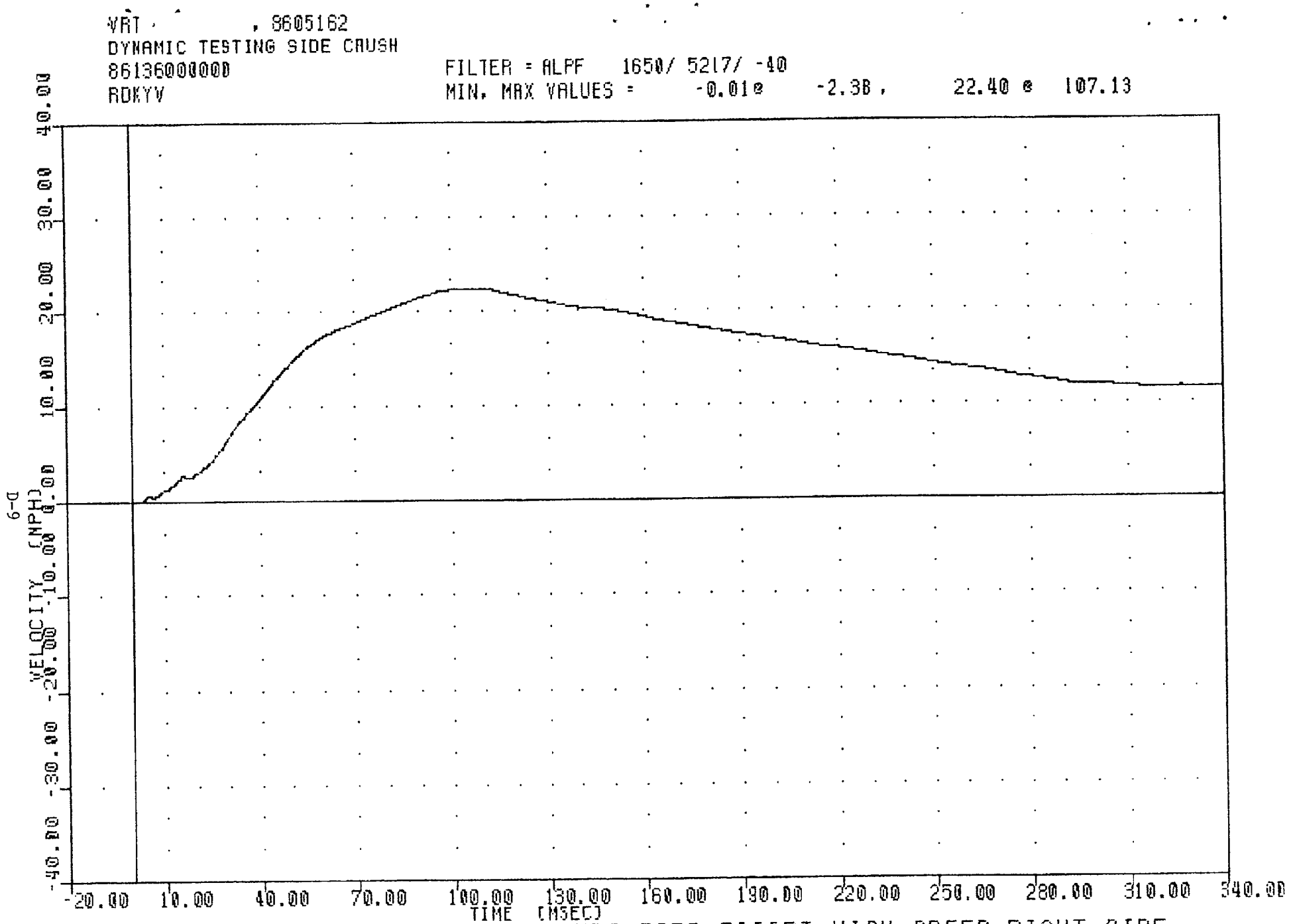
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE CENTER OF GRAVITY ACCELERATION RESULTANT



MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE REAR DECK ACCELERATION X AXIS



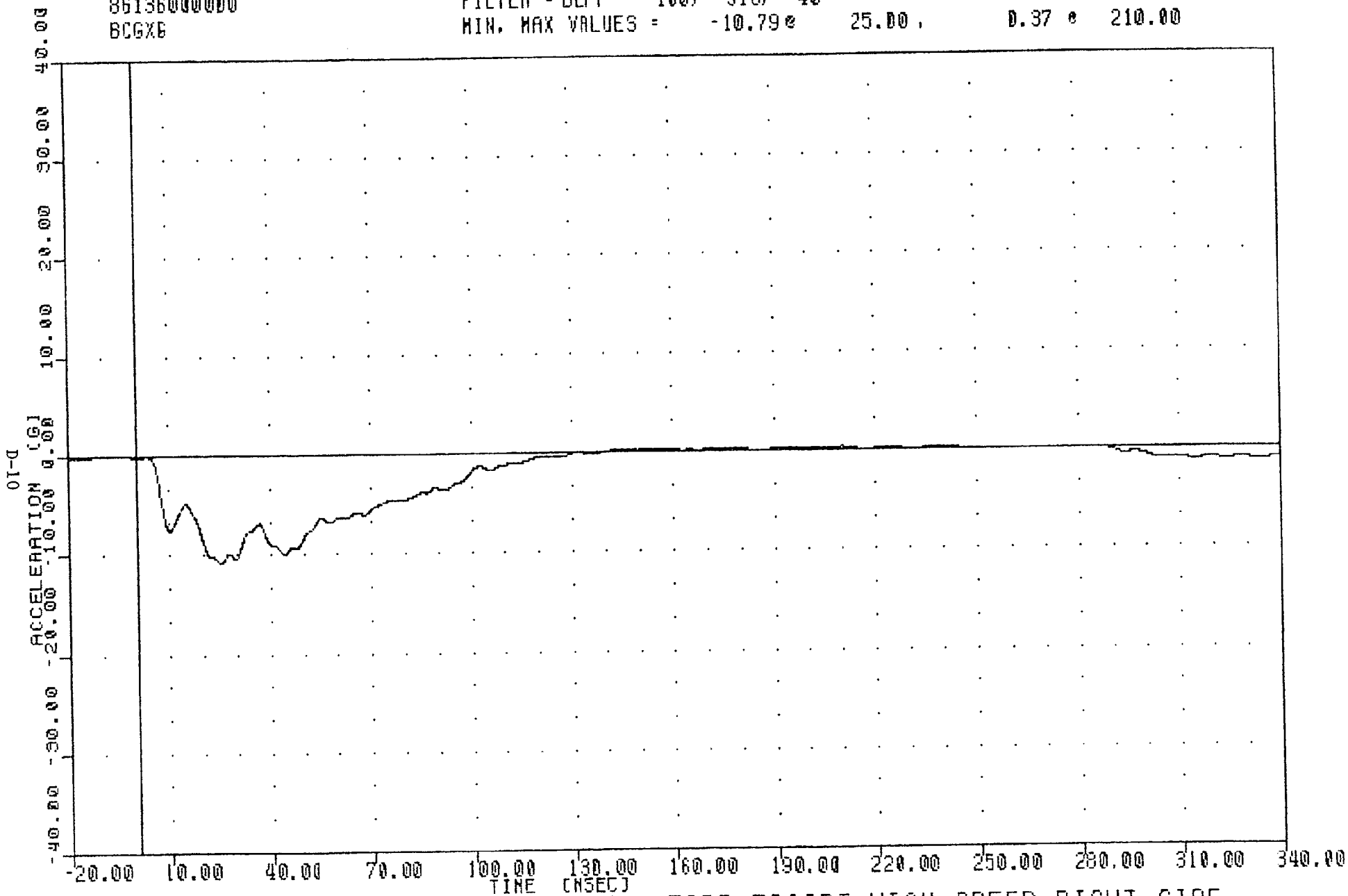
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE REAR DECK ACCELERATION Y AXIS



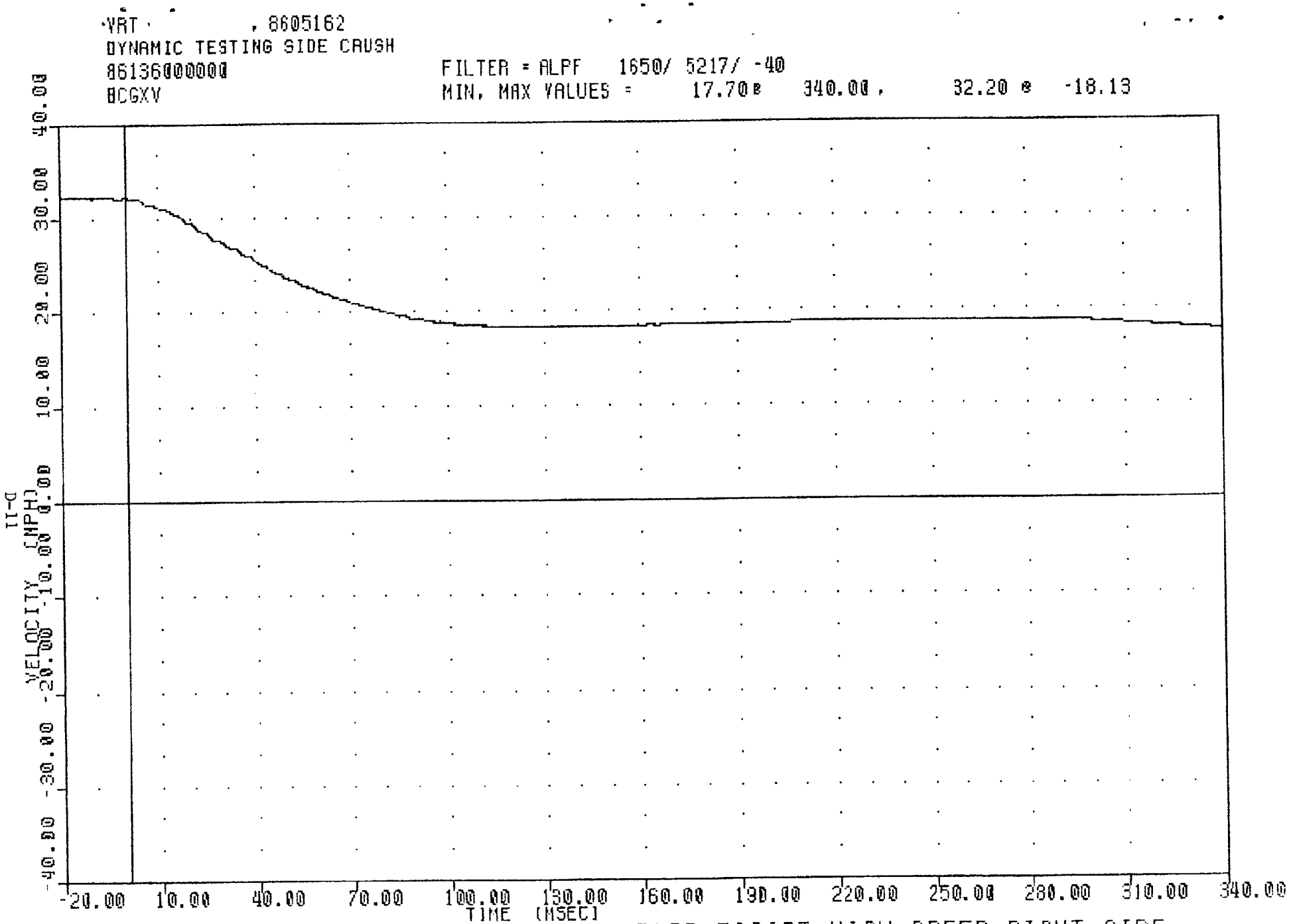
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
DELTA V USING RDKYG

VAT , 8605162
DYNAMIC TESTING SIDE CRUSH
861360000D0
BCGX6

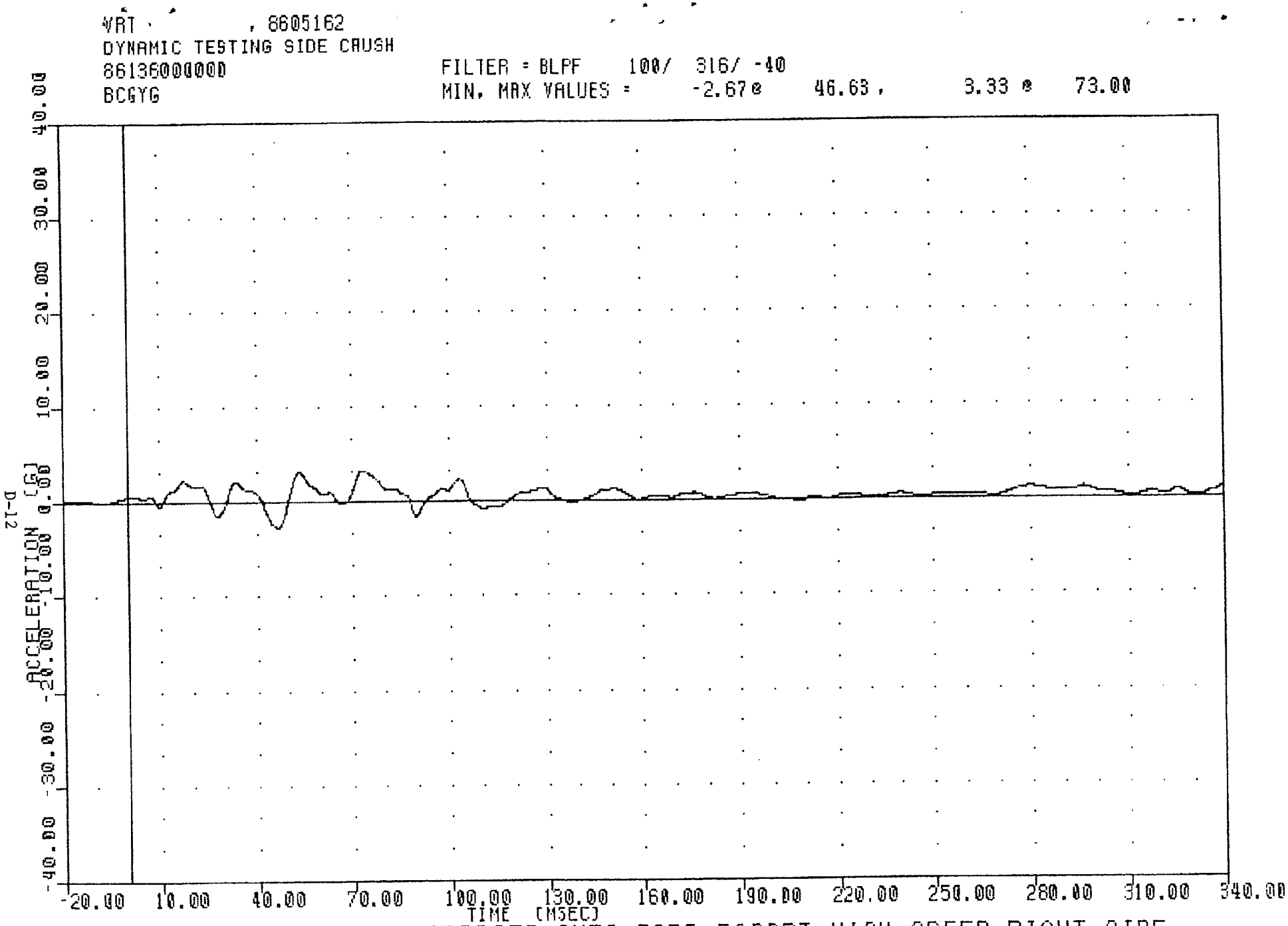
FILTER = BLPF 100/ 316/ -40
MIN. MAX VALUES = -10.79 @ 25.00 , 0.37 @ 210.00



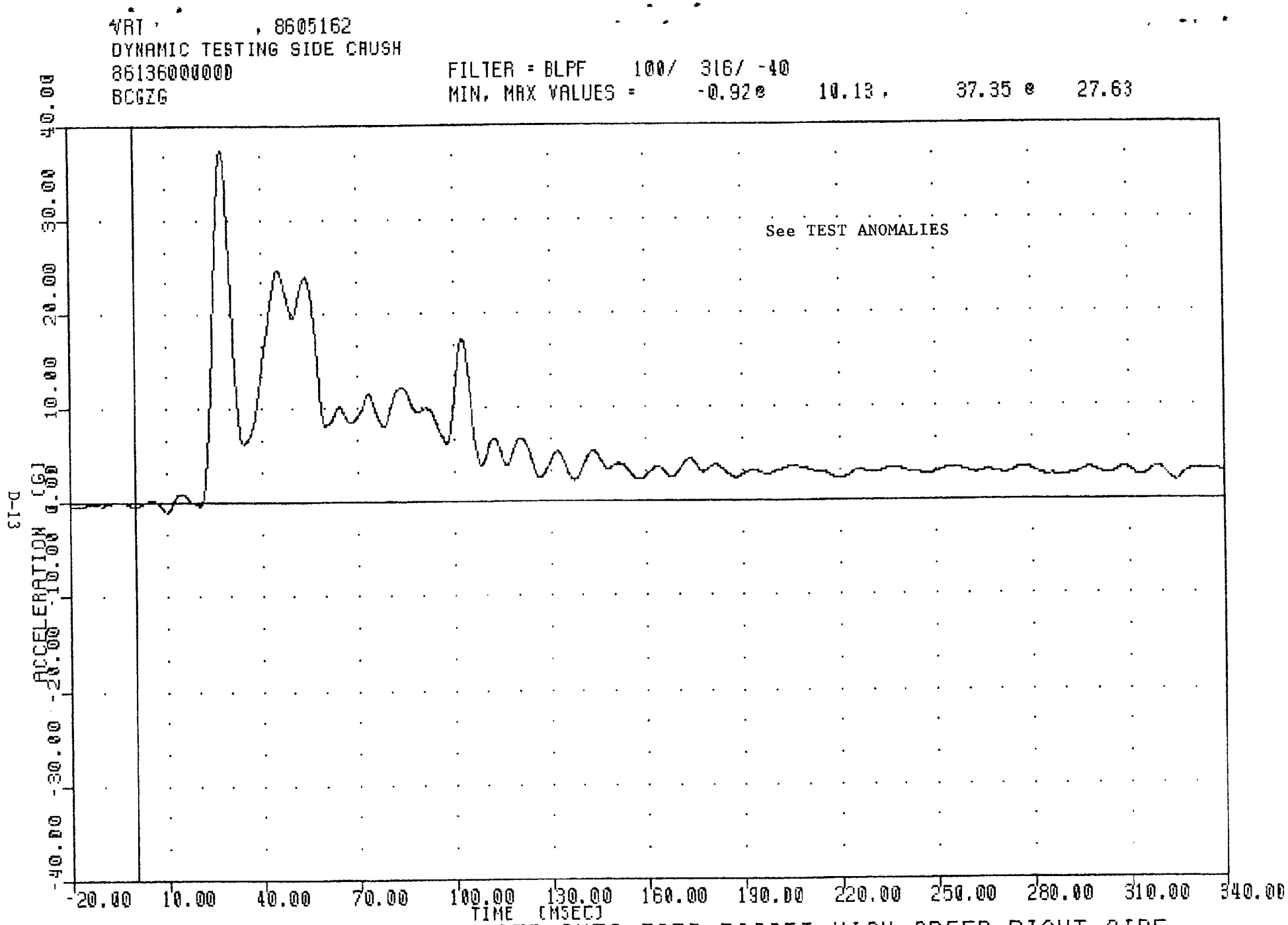
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION X AXIS



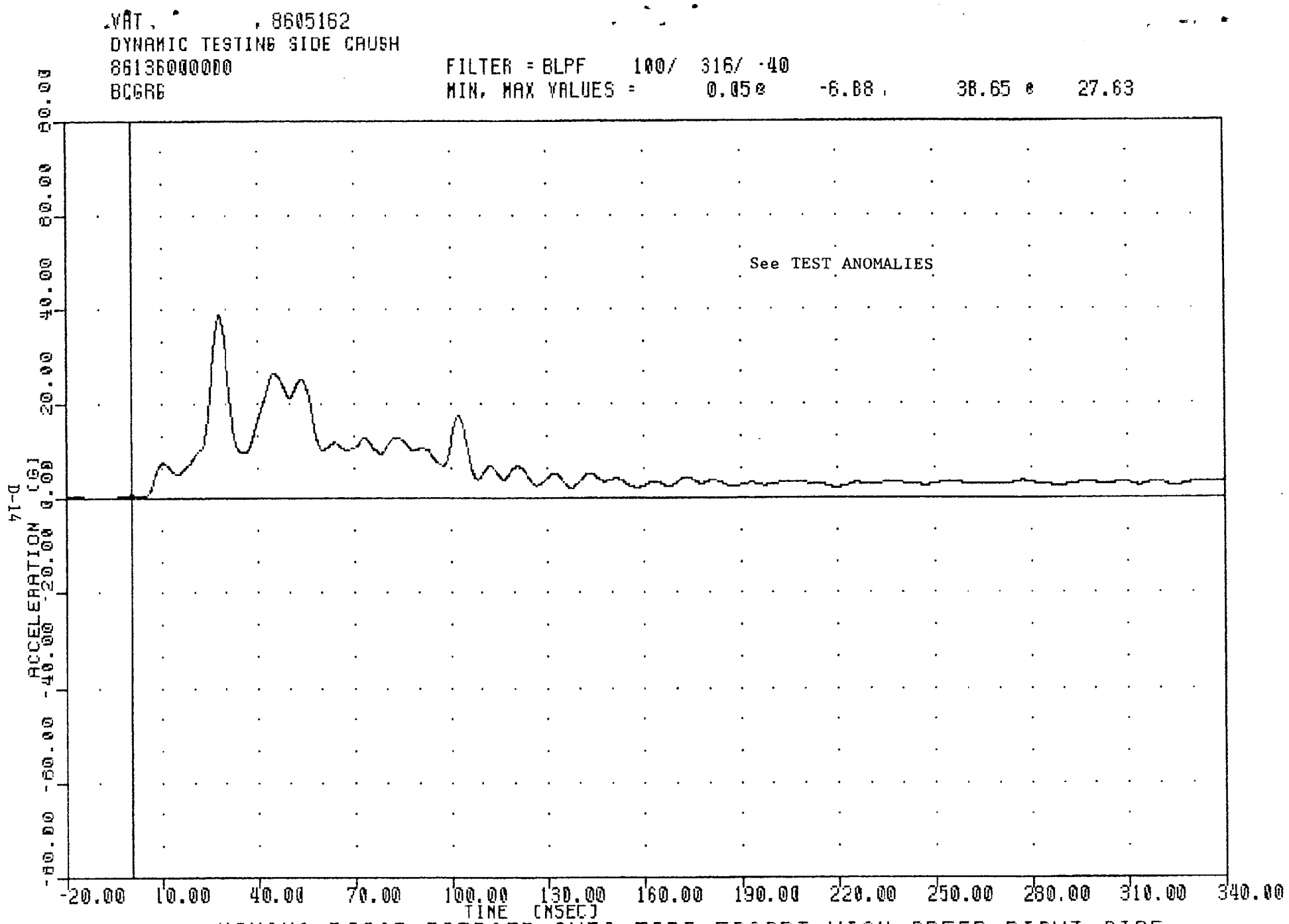
MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
DELTA V USING BCGXG



MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Y AXIS

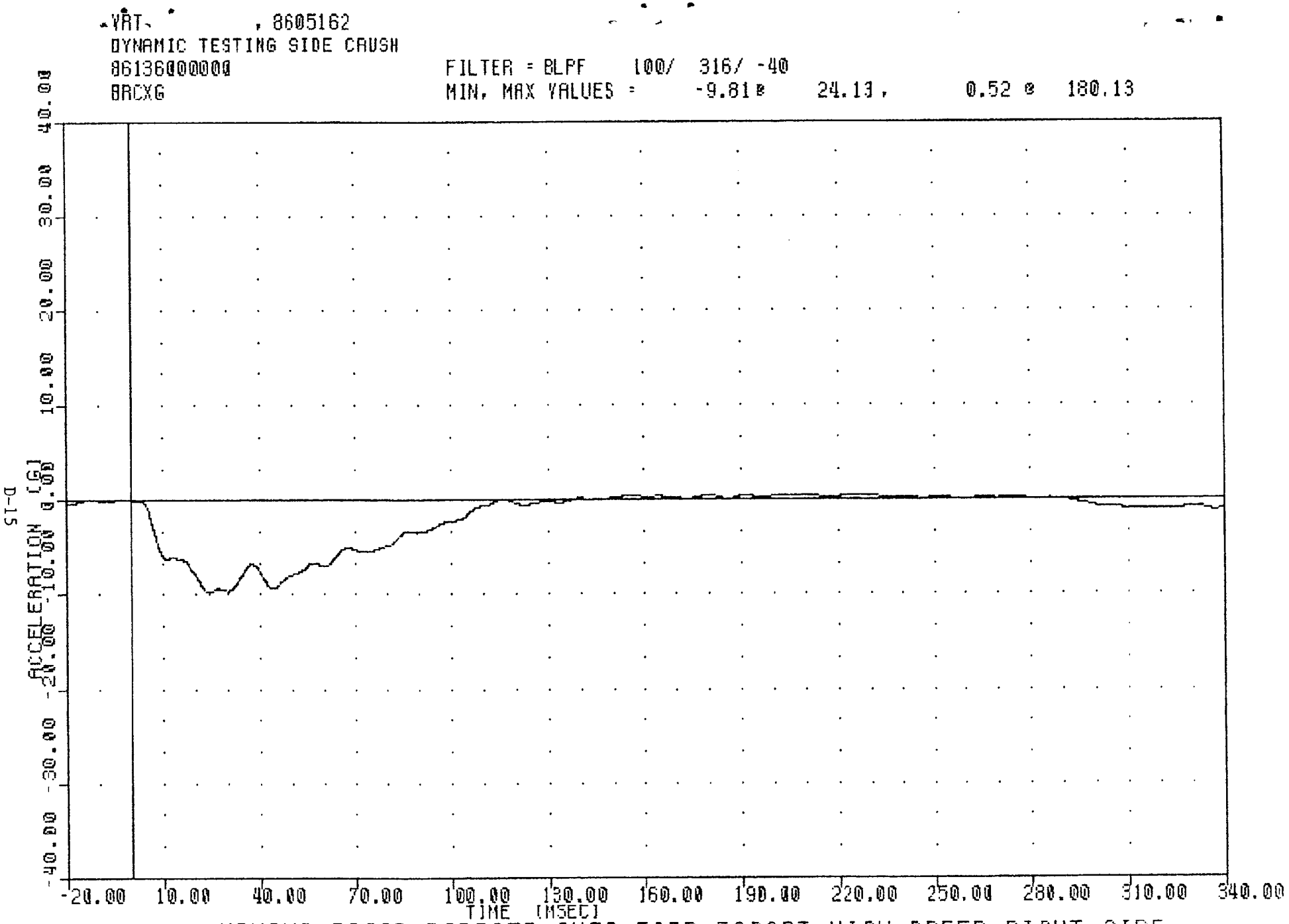


MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION Z AXIS



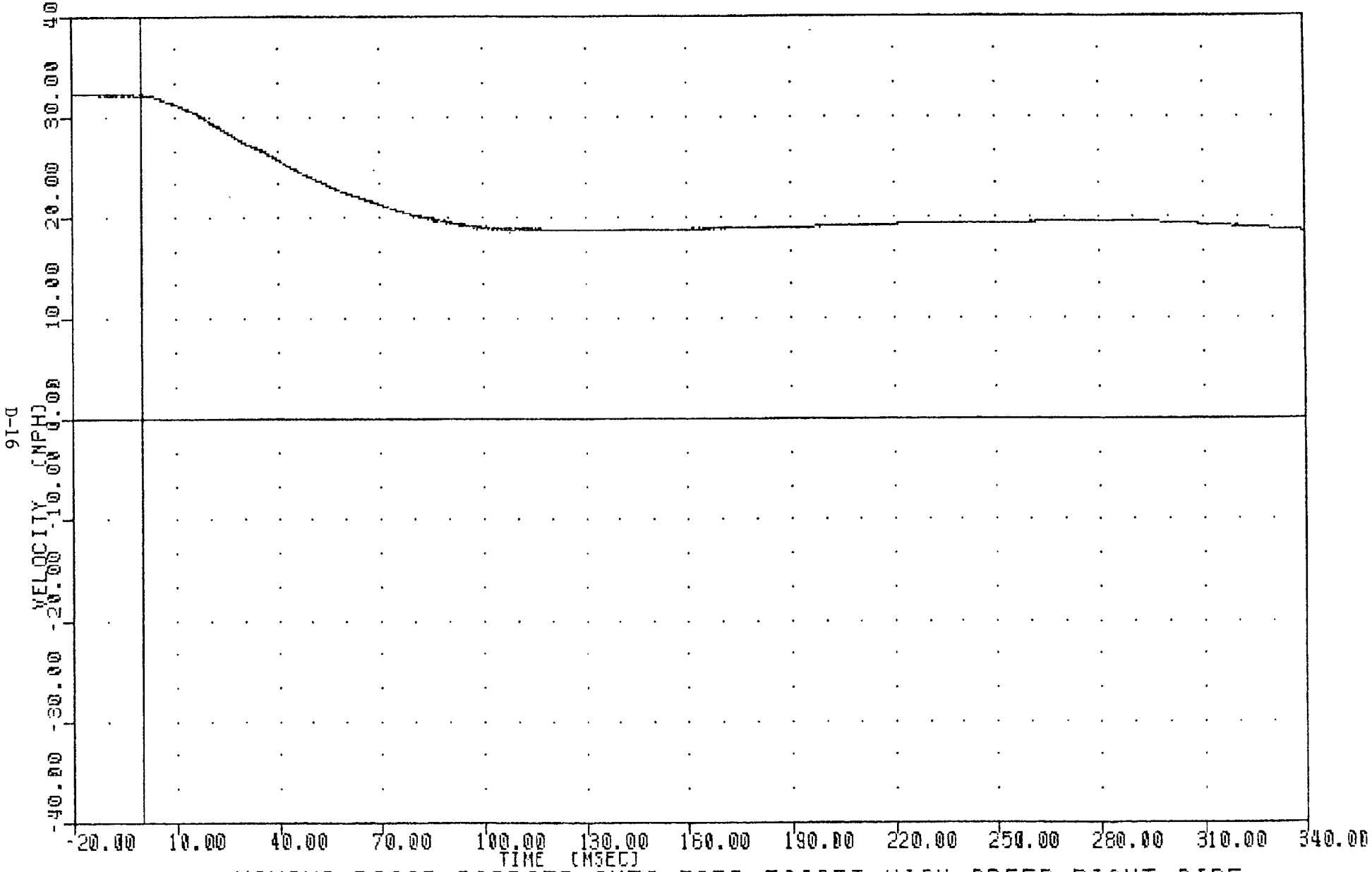
D-14

MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER CENTER OF GRAVITY ACCELERATION RESULTANT

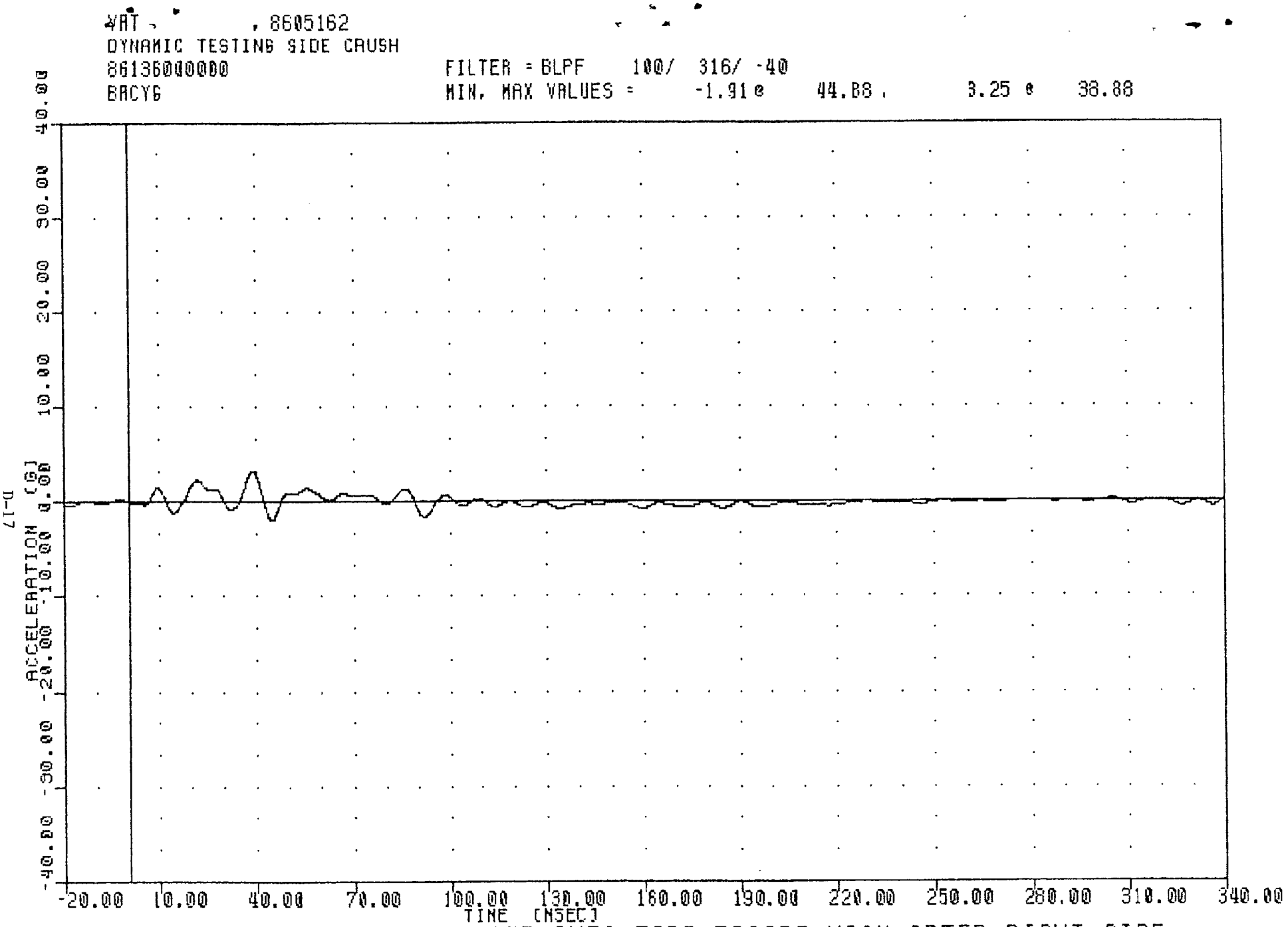


MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION X AXIS

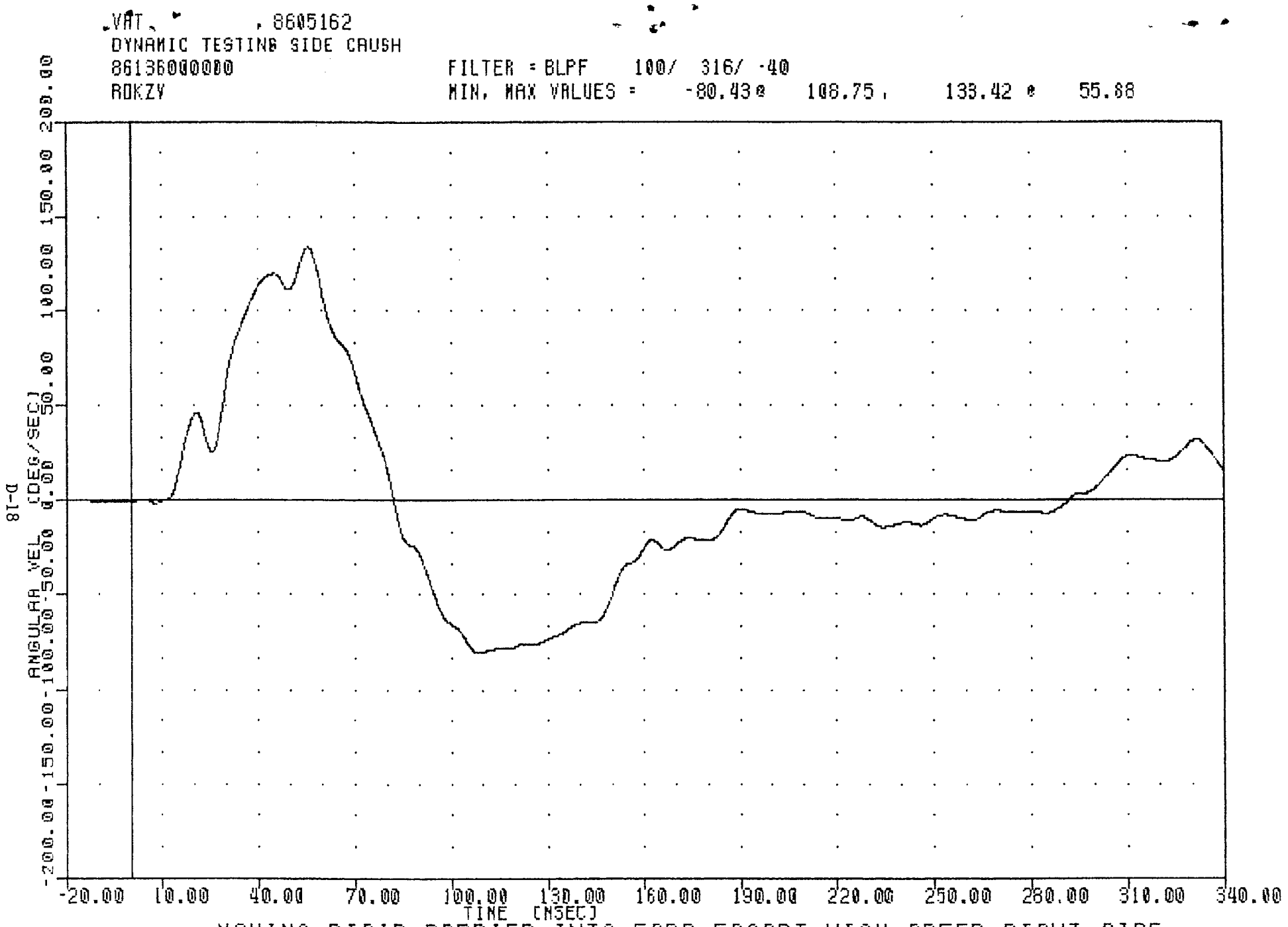
WRT , 8605162
DYNAMIC TESTING SIDE CRUSH
8613600@000
BRCXV
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = 18.59@ 107.88, 32.21 @ -18.38



MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
DELTA V USING BRCXG



MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
MOVING BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS



MOVING RIGID BARRIER INTO FORD ESCORT HIGH SPEED RIGHT SIDE
VEHICLE YAW RATE DEGREE/SECOND