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**National Highway
Traffic Safety
Administration**

NHTSA
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DOT HS 808 397

October 1995

Final Report

Final Report of a Non-Deformable Crabbed Impactor into a 1992 Chevrolet Caprice 4-Door Sedan in Support of CRASH3 Damage Algorithm Reformulation

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16. Abstract

This test was conducted for research and development in support of the CRASH III damage algorithm reformulation. This test was conducted on a 1992 Chevrolet Caprice 4-door sedan, VIN 1G1BL537XNW148868, at Transportation Research Center Inc. on October 11, 1995. The impact speed was 53.9 kph.

Maximum Crush:

At Vehicle Sill Height:	581 mm
At Vehicle Maximum Crush	1032 mm
At Vehicle Window Bottom	774 mm

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

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

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

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

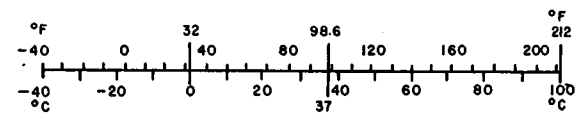


Table of Contents

Section	Title	Page
1.0	Purpose and Test Procedure	1-1
2.0	Vehicle and Test Data	2-1
3.0	Test Summary	3-1
Appendix A	Photographs	A-1
Appendix B	Data Plots	B-1
Appendix C	Miscellaneous Test Information	C-1

List of Tables

Number	Description	Page
1	Test Vehicle Information	2-2
2	Impactor Information	2-5
3	Crush Measurements	2-6
4	Vehicle Accelerometer Locations and Data Summary	2-11
5	Crabbed Impactor Accelerometer Locations and Data Summary	2-13
6	Camera Information	2-15
7	Test Conditions	3-2
8	Vehicle Crush at Sill Height	3-3
9	Vehicle Maximum Crush	3-5
10	Vehicle Window Bottom	3-7

List of Figures

Number	Description	Page
1	Vehicle Accelerometer Placement	2-10
2	Crabbed Impactor Accelerometer Placement	2-12
3	Camera Positions	2-14
4	Vehicle Crush Profile at Sill Height	3-4
5	Vehicle Maximum Crush Profile	3-6
6	Vehicle Crush Profile at Window Bottom	3-8

List of Photographs

Title	Figure
Pre-Test Front View	A-1
Post-Test Front View	A-2
Pre-Test Left Front View	A-3
Post-Test Left Front View	A-4
Pre-Test Left Side View	A-5
Post-Test Left Side View	A-6
Pre-Test Left Rear View	A-7
Post-Test Left Rear View	A-8
Pre-Test Rear View	A-9
Post-Test Rear View	A-10
Pre-Test Right Side View	A-11
Post-Test Right Side View	A-12
Pre-Test Overhead Impact Aligment View	A-13

Section 1.0

Purpose and Test Procedure

Purpose and Test Procedure

The purpose of this non-deformable crabbed impactor side impact test was for research and development in support of the CRASH3 damage algorithm reformulation.

The 1992 Chevrolet Caprice was equipped with a 5.7-liter, 8-cylinder, longitudinal, gasoline engine with a 4-speed automatic transmission. The test weight of the vehicle was 1787 killograms.

The vehicle was instrumented with nine (9) accelerometers to measure vehicle X-axis, Y-axis, and Z-axis accelerations.

The impactor was crabbed 27° counterclockwise from the direction of forward motion. The test weight of the impactor was 1369 kg.

The impactor was instrumented to record data from three (3) accelerometers to measure X-axis, Y-axis, and Z-axis acceleration.

The crash test event was recorded by one (1) real-time panning camera and three (3) high-speed motion picture cameras operating at approximately 1000 frames per second.

Section 2.0

Vehicle and Test Data

Table 1 Test Vehicle Information

Vehicle Manufacturer:	General Motors Corporation		Model Year: 1992
Make/Model:	Chevrolet/Caprice		VIN: 1G1BL537XNW148868
Body Style:	4-door sedan		Color: White/Blue
Engine Data:	Type:	Inline	
	Cylinders:	8	
	Displacement:	5.7-liter	

Transmission Data: 4 Speed, __ Manual, X Automatic, __ Fwd, X Rwd, __4wd

Date Vehicle Received: 10/06/95 Odometer Reading: 104,325.7

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	Yes
Power Windows	Yes	Telescoping Steering Wheel	No
Tinted Glass	Yes	Air Conditioning	Yes
Radio	Yes	Anti-Skid Brake	Yes
Clock	Yes	Rear Window Defroster	Yes
Other	None		

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

Certification Data From Vehicle's Label:

Vehicle Manufactured by:		General Motors Corporation
Date of Manufacture:		05/92
VIN:		1G1BL537XNW148868
GVWR:		2380 kg
GAWR:	Front:	1159 kg
	Rear:	1221 kg

Table 1 Test Vehicle Information, Cont'd.

Tires On Vehicle (Mfr., Line, Size): Goodyear, Eagle ST, P225/70R15

Tire Pressure With Maximum Capacity Vehicle Load: Front: 240 kPa

Rear: 240 kPa

Spare Tire (Mfr., Line, Size): NA

Type of Seats: Front: Bucket

Rear: Bench

Type of Front Seat Backs: Manually adjustable

Maximum Width: 1940 mm

Wheelbase: 2940 mm

Location of Label Stating Tire Data: The label was located on the driver's door.

Tire & Capacity Data From Vehicle's Label:

Recommended Tire Size: P235/70R15

Recommended Cold Tire Pressure: Front: 240 kPa; Rear: 240 kPa

Designated Seating Capacity: 3 Front 3 Rear 6 Total

Vehicle Capacity Weight: 1100 lbs.

Test Vehicle Attitude (All measurements are in millimeters.):

Delivered Attitude:	LF 753;	RF 749;	LR 555;	RR 547
Pre-Test Attitude:	LF 715;	RF 711;	LR 545;	RR 528
Post-Test Attitude:	LF 700;	RF 703;	LR 568;	RR 488

Table 1 Vehicle Information, Cont'd.

Weight of Test Vehicle as Received (With Maximum Fluids):

Right Front	527	kg	Right Rear	392	kg
Left Front	504	kg	Left Rear	399	kg
Total Front Weight	1031	kg	(56.6% of total vehicle weight)		
Total Rear Weight	791	kg	(43.4% of total vehicle weight)		
Total Delivered Weight	1822	kg			

Weight of Test Vehicle:

Right Front	518	kg	Right Rear	385	kg
Left Front	495	kg	Left Rear	389	kg
Total Front Weight	1013	kg	(56.7% of total vehicle weight)		
Total Rear Weight	774	kg	(43.3% of total vehicle weight)		
Total Test Weight	1787	kg			

Weight of ballast secured in vehicle cargo area: 0 kg

Components removed to meet target test weight: None

CG rearward of front wheel centerline: 1274 mm

Table 2 Impactor Information

Impactor Type:	FMVSS 214 with rigid face					
Crabbed Angle[1]:	27°					
Test Weight of Impactor:	RF	373	kg;	RR	170	kg
	LF	514	kg;	LR	312	kg
Total Front Weight:	887	kg				
Total Rear Weight:	482	kg				
Total Test Weight:	1369	kg				

[1] As measured counterclockwise from the line of forward motion to the impactor's front longitudinal centerline.

Table 3 Crush Measurements

Test No. 951011

LOCATION	0		1		2		3		4		5		6		7	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Window Bot Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Pre	164	1345	161	1271	168	1199	175	1123	184	1049	191	976	202	900	213	825
Max Post	179	1325	180	1252	193	1179	210	1101	210	1026	217	952	236	880	257	805
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

LOCATION	8		9		10		11		12		13		14		15	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Window Bot Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Pre	226	751	247	680	274	610	315	552	378	506	450	487	523	473	597	457
Max Post	272	731	293	663	320	595	362	532	430	493	492	475	566	460	640	453
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

LOCATION	16		17		18		19		20		21		22		23	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	NA	NA	NA	NA	NA	NA	892	492	966	484	1045	471	1118	466	1193	456
Window Bot Post	NA	NA	NA	NA	NA	NA	950	509	1024	509	1098	501	1173	500	1246	498
Max Pre	672	451	747	444	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Post	717	450	792	444	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All measurements are in millimeters. Column readings are 75 millimeters apart starting at the front of the vehicle.

All X-axis measurements taken from a reference plane 1370 millimeters from and parallel to the rear bumper.

All Y-axis measurements taken from a reference plane 1200 millimeters from and parallel to the vehicle's longitudinal centerline.

Sill Height = 267 Max Crush Height = 445 Window Bottom = 867

Table 3 Crush Measurements, Cont'd.

Test No. 951011

LOCATION	24		25		26		27		28		29		30		31	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	1262	444	1333	443	1406	437	1478	433	1550	428	1629	425	1704	420	1780	412
Window Bot Post	1321	484	1397	491	1470	490	1529	488	1620	478	1698	475	1772	510	1921	490
Max Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1647	394	1722	390	1800	389
Max Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1691	478	1762	508	1917	685
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1636	543	1712	535	1787	534
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1710	643	1768	646	1850	636

LOCATION	32		33		34		35		36		37		38		39	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	1855	411	1934	405	2014	409	2092	411	NA	NA	2230	410	2311	406	2390	405
Window Bot Post	1960	535	2025	545	2127	565	2180	555	NA	NA	2330	556	2392	570	2455	562
Max Pre	1874	384	1950	383	2030	383	2105	384	2182	381	2257	383	2333	382	2410	385
Max Post	1960	733	2044	744	2107	750	2190	750	2260	745	2336	750	2418	760	2489	753
Sill Pre	1862	533	1937	532	2012	531	2087	531	2162	531	2237	532	2312	530	2387	530
Sill Post	1955	630	2008	645	2078	670	2161	665	2241	680	2317	676	2395	695	2464	695

LOCATION	40		41		42		43		44		45		46		47	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	2465	400	2541	399	2619	395	2698	393	2773	390	2845	392	2923	385	3000	383
Window Bot Post	2520	570	2600	588	2679	585	2747	600	2842	612	2932	628	2986	646	3040	712
Max Pre	2484	382	2557	380	2634	383	2707	383	2782	385	2856	385	2931	383	3006	383
Max Post	2565	755	2635	770	2714	766	2786	768	2859	773	2942	768	3010	772	3082	787
Sill Pre	2462	528	2537	525	2612	525	2687	526	2762	528	2837	530	2912	530	2987	535
Sill Post	2548	700	2612	712	2673	712	2740	731	2823	740	2903	753	2980	772	3042	783

All measurements are in millimeters. Column readings are 75 millimeters apart starting at the front of the vehicle.

All X-axis measurements taken from a reference plane 1370 millimeters from and parallel to the rear bumper.

All Y-axis measurements taken from a reference plane 1200 millimeters from and parallel to the vehicle's longitudinal centerline.

Sill Height = 267 Max Crush Height = 445 Window Bottom = 867

Table 3 Crush Measurements, Cont'd.

Test No. 951011

LOCATION	48		49		50		51		52		53		54		55	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	3077	398	3152	396	3228	402	3303	399	3377	402	3245	405	3529	411	3600	411
Window Bot Post	3090	710	3185	703	3242	705	3320	704	3457	708	3530	700	3587	667	3625	615
Max Pre	3081	384	3158	385	3232	388	3306	388	3381	392	3456	396	3532	393	3605	393
Max Post	3162	791	3239	795	3312	808	3387	807	3467	810	3555	816	3596	773	3621	703
Sill Pre	3062	528	3137	531	3212	530	3287	532	3362	534	3437	536	3512	541	3587	536
Sill Post	3120	764	3193	763	3285	759	3341	757	3415	755	3490	754	3560	751	3636	752

LOCATION	56		57		58		59		60		61		62		63	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	3675	410	3754	413	3829	420	3904	417	3982	427	4055	425	4149	456	4224	440
Window Bot Post	3684	563	3740	524	3819	506	3894	501	3957	514	4041	512	4108	510	4185	495
Max Pre	3684	394	3757	395	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Post	3661	636	3759	587	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Pre	3662	543	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	3700	753	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

LOCATION	64		65		66		67		68		69		70		71	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	4245	445	4375	446	4452	471	4529	466	4603	475	4378	484	4748	487	4820	500
Window Bot Post	4258	491	4336	491	4407	490	4490	493	4566	487	4642	496	4717	495	4794	478
Max Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4770	442	4847	460	4923	460
Max Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4775	441	4847	446	4916	455
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All measurements are in millimeters. Column readings are 75 millimeters apart starting at the front of the vehicle.

All X-axis measurements taken from a reference plane 1370 millimeters from and parallel to the rear bumper.

All Y-axis measurements taken from a reference plane 1200 millimeters from and parallel to the vehicle's longitudinal centerline.

Sill Height = 267 Max Crush Height = 445 Window Bottom = 867

Table 3 Crush Measurements, Cont'd.

Test No. 951011

LOCATION	72		73		74		75		76		77		78		79	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	4907	510	4978	514	5052	526	5123	537	5193	554	5263	577	5313	625	5351	969
Window Bot Post	4859	504	4938	495	5018	518	5094	530	5167	544	5239	567	5281	610	5307	690
Max Pre	4997	463	5073	477	5140	488	5222	491	5296	515	5377	530	5444	548	5506	584
Max Post	5000	447	5075	447	5151	458	5225	472	5305	482	5381	503	5448	520	5500	562
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

LOCATION	80		81		82		83		84		85		86		87	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	5372	767	5384	841	5384	911	5394	999	5407	1062	5412	1142	5408	1215	5417	1290
Window Bot Post	5344	764	5355	835	5376	917	5389	980	5397	1055	5390	1128	5397	1198	5407	1275
Max Pre	5561	637	5591	709	5598	782	5615	860	5625	933	5630	1009	5640	1084	5645	1156
Max Post	5573	615	5590	685	5615	760	5623	832	5642	915	5637	988	5653	1062	5652	1134
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

LOCATION	88		89		90		91		92		93		94		95	
	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
Window Bot Pre	5424	1367	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Window Bot Post	5408	1352	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Pre	5645	1231	5649	1305	5650	1582	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Max Post	5655	1202	5663	1278	5665	1355	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Pre	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sill Post	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

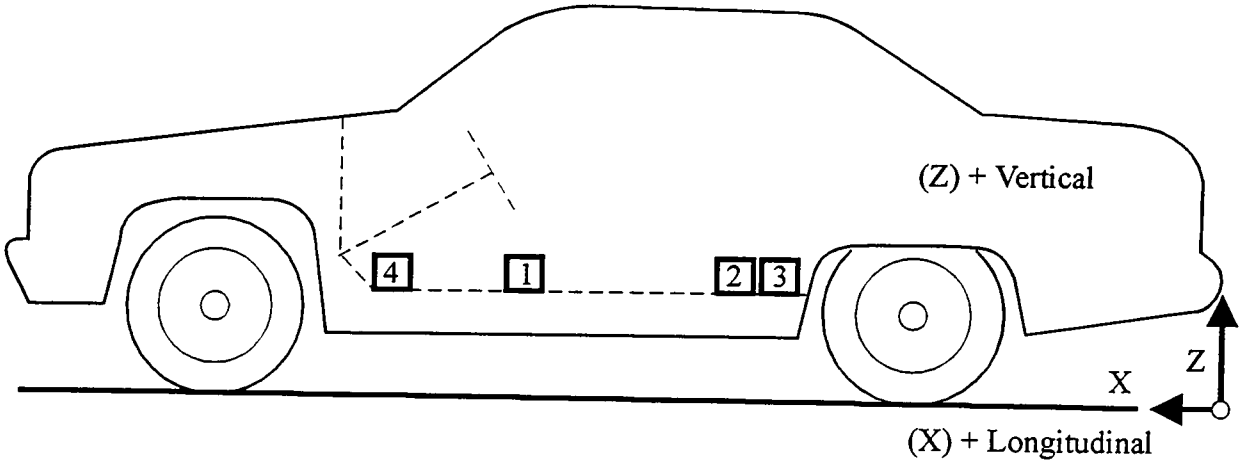
All measurements are in millimeters. Column readings are 75 millimeters apart starting at the front of the vehicle.

All X-axis measurements taken from a reference plane 1370 millimeters from and parallel to the rear bumper.

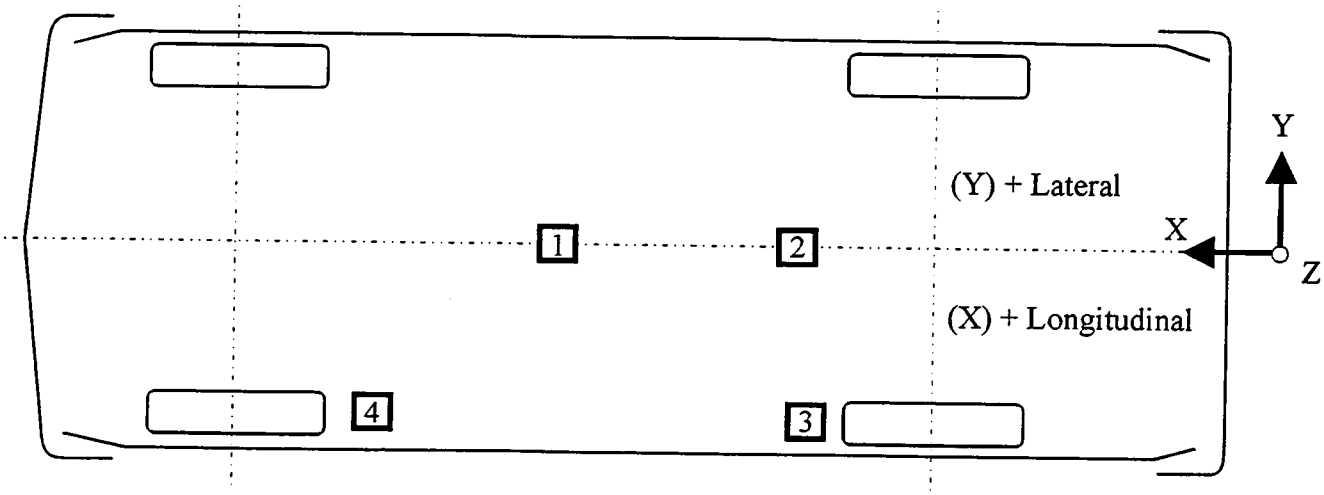
All Y-axis measurements taken from a reference plane 1200 millimeters from and parallel to the vehicle's longitudinal centerline.

Sill Height = 267 Max Crush Height = 445 Window Bottom = 867

Figure 1 Vehicle Accelerometer Placement



Side view



Bottom view

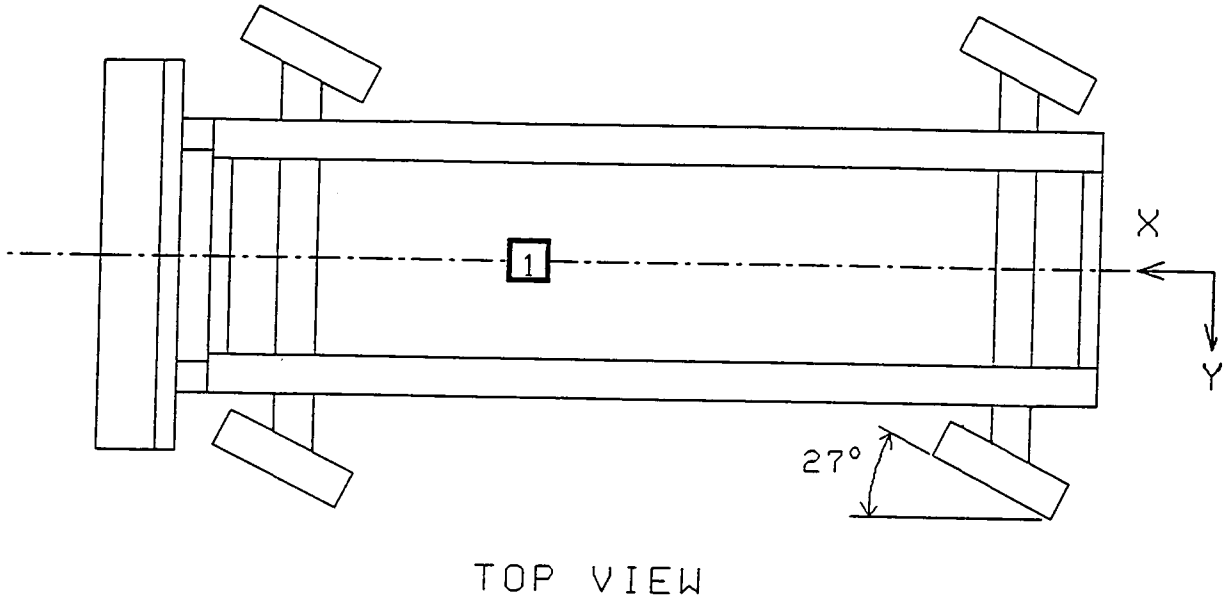
Table 4 Vehicle Accelerometer Locations and Data Summary

Test No. 951011

TEST NUMBER: 951011 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1 VEHICLE CENTER OF GRAVITY	3201 mm	-20 mm	361 mm				
LONGITUDINAL				23.2 g	@ 24.6 ms	14.5 g	@ 6.6 ms
LATERAL				16.7 g	@ 43.0 ms	33.6 g	@ 27.8 ms
VERTICAL				29.1 g	@ 19.4 ms	18.9 g	@ 27.9 ms
RESULTANT				41.6 g	@ 19.8 ms		
2 REAR SEAT CROSSMEMBER	2113 mm	-24 mm	449 mm				
LONGITUDINAL				24.3 g	@ 22.3 ms	18.0 g	@ 49.8 ms
LATERAL				13.7 g	@ 51.0 ms	102.3 g	@ 34.1 ms
3 RIGHT REAR SILL	2158 mm	-621 mm	388 mm				
LONGITUDINAL				4.7 g	@ 23.9 ms	9.4 g	@ 49.8 ms
LATERAL				2.6 g	@ 148.7 ms	25.6 g	@ 33.6 ms
4 RIGHT FRONT SILL	3201 mm	-667 mm	361 mm				
LONGITUDINAL				4.7 g	@ 28.9 ms	9.2 g	@ 8.5 ms
LATERAL				2.3 g	@ 150.4 ms	25.2 g	@ 42.5 ms

REFERENCE: X: + FORWARD FROM VEHICLE'S REAR BUMPER
Y: + LEFTWARD FROM VEHICLE'S LONGITUDINAL CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

Figure 2 Crabbed Impactor Accelerometer Placement



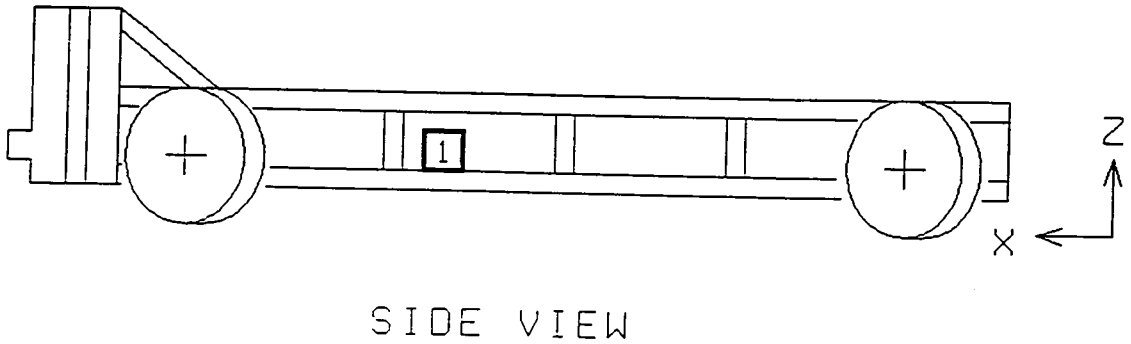


Table 5 Crabbed Impactor Accelerometer Locations and Data Summary

Test No. 951011

TEST NUMBER: 951011 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1 MOVING BARRIER	1880 mm	0 mm	305 mm				
CENTER OF GRAVITY							
LONGITUDINAL[1]				14.1 g	@ 57.9 ms	15.4 g	@ 18.3 ms
LATERAL[1]				38.2 g	@ 58.1 ms	1.6 g	@ 33.9 ms
VERTICAL[1]				14.7 g	@ 38.6 ms	10.0 g	@ 49.4 ms
RESULTANT[1]				40.7 g	@ 58.1 ms		

REFERENCE: X: + FORWARD FROM BARRIER'S REAR SURFACE
Y: + LEFTWARD FROM BARRIER'S LONGITUDINAL CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

[1] See DATA ACQUISITION EXPLANATIONS

Figure 3 Camera Positions

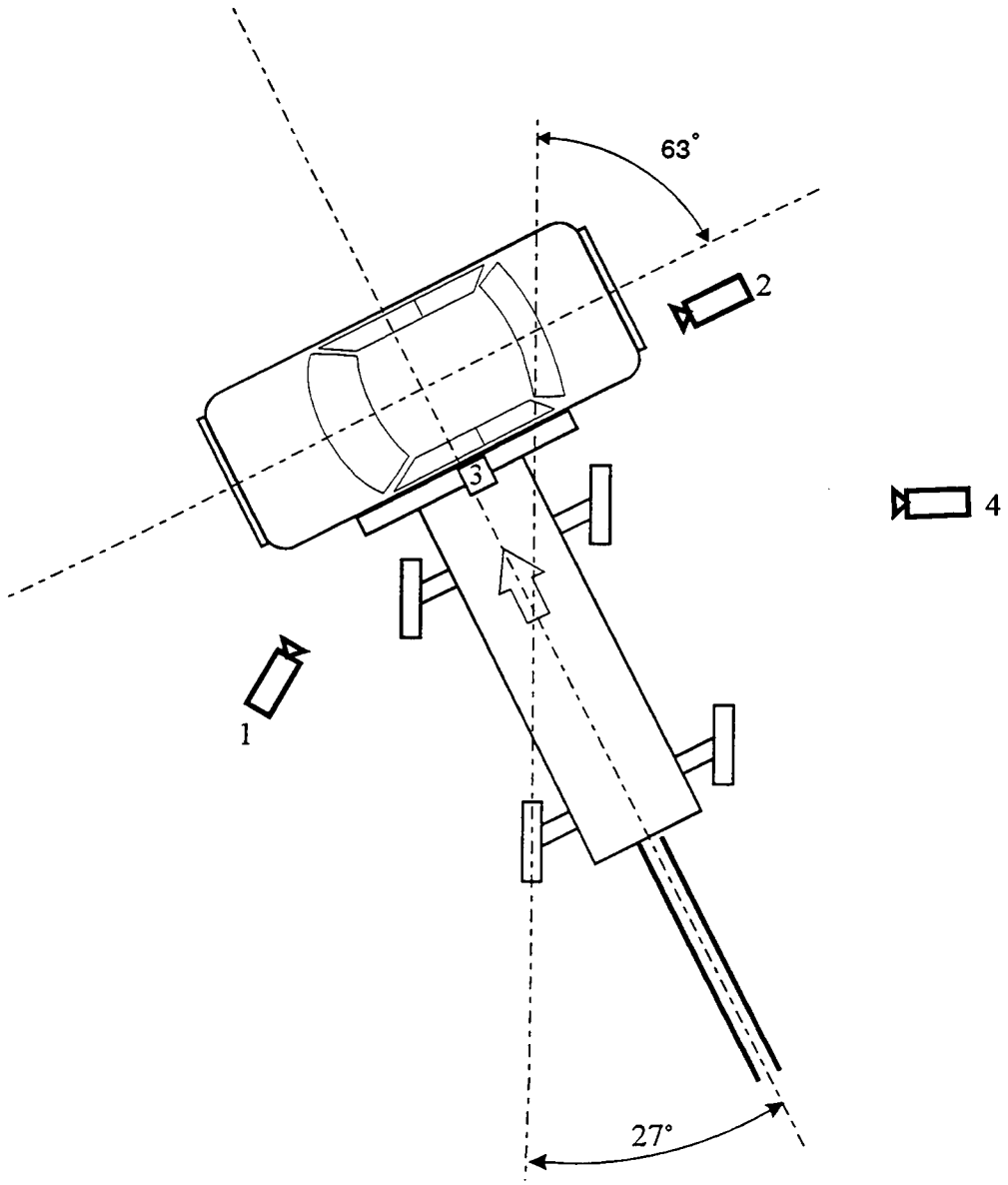


Table 6 Camera Information

Test No. 951011

Camera Number	Location	Type	Lens (mm)	Speed (fps)	Purpose of Camera Data
1	Left wide	Photosonic	25	1002	Impact overall
2	Right wide	Photosonic	25	995	Impact overall
3	Overhead	Photosonic	13	1005	Impact overall
4	Panning	Bolex	16	24	Vehicle dynamics

Section 3.0

Test Summary

Table 7 Test Conditions

Test No. 951011

Date of Test: 10/11/95

Time of Test: 1349

Ambient Temperature at Impact Area: 23° C

Intended Impact Velocity: 53.9 kph

Actual Impact Velocity:	Primary	=	53.9	kph
	Secondary	=	53.9	kph

Subject Vehicle Data

Maximum Crush

At Vehicle Sill Height:	346	mm
At Vehicle Maximum Crush:	615	mm
At Vehicle Window Bottom:	461	mm

All distance measurements are in millimeters.

Table 8 Vehicle Crush at Sill Height

Test No. 951011

FL =	2984
C1 =	317
C2 =	336
C3 =	346
C4 =	269
C5 =	192
C6 =	163

NOTE: FL is the post-test length of the damaged surface.

Measurements C1 - C6 were spaced equally apart over the post-impact length of the damaged surface. This distance is defined as length "FL" on the vehicle crush profile plot.

All measurements are in millimeters.

Figure 4 Vehicle Crush Profile at Sill Height

Test No. 951011

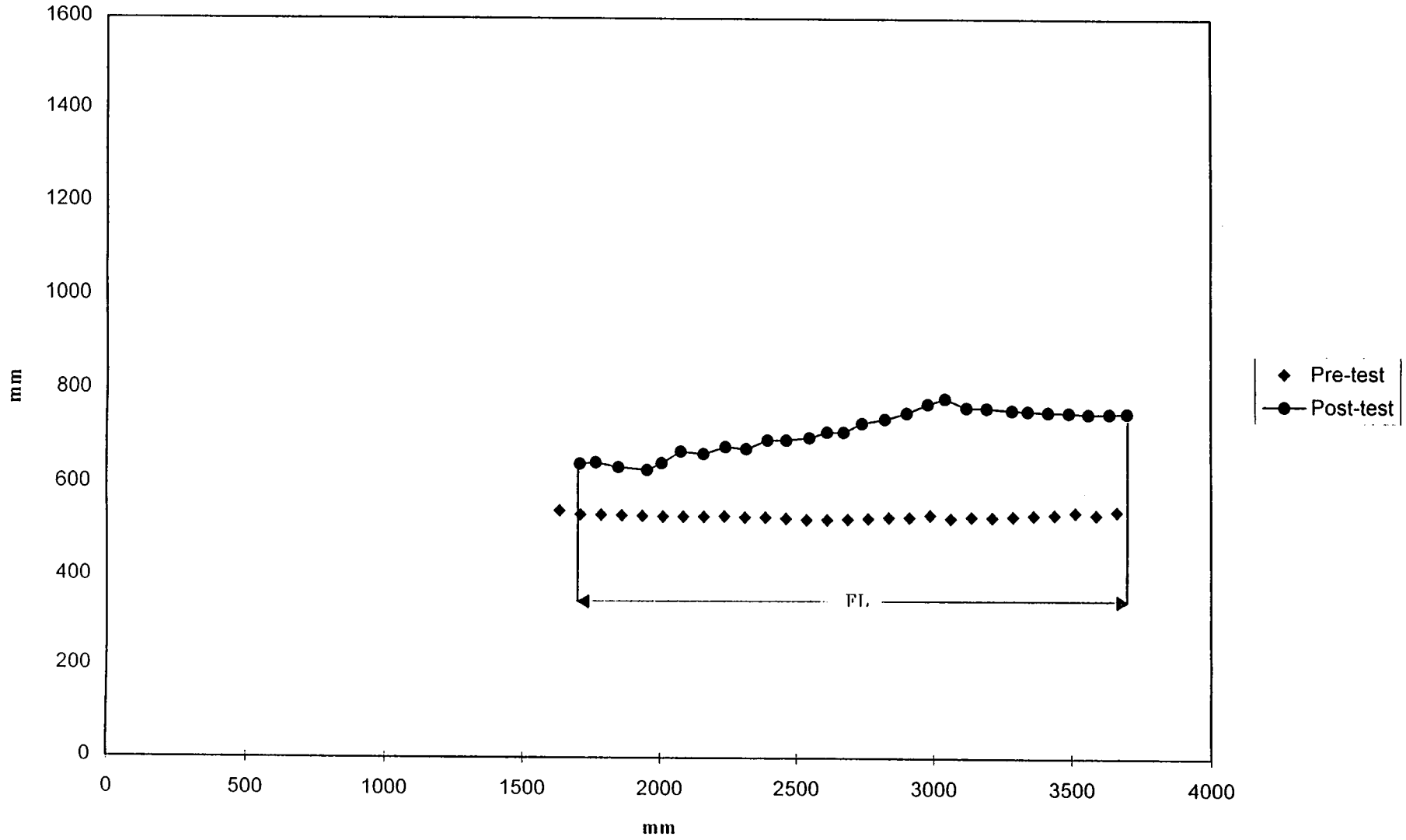


Table 9 Vehicle Maximum Crush

Test No. 951011

FL =	2032
C1 =	307
C2 =	615
C3 =	576
C4 =	567
C5 =	557
C6 =	133

NOTE: FL is the post-test length of the damaged surface.

Measurements C1 - C6 were spaced equally apart over the post-impact length of the damaged surface. This distance is defined as length "FL" on the vehicle crush profile plot.

All measurements are in millimeters.

Figure 5 Vehicle Maximum Crush Profile

Test No. 951011

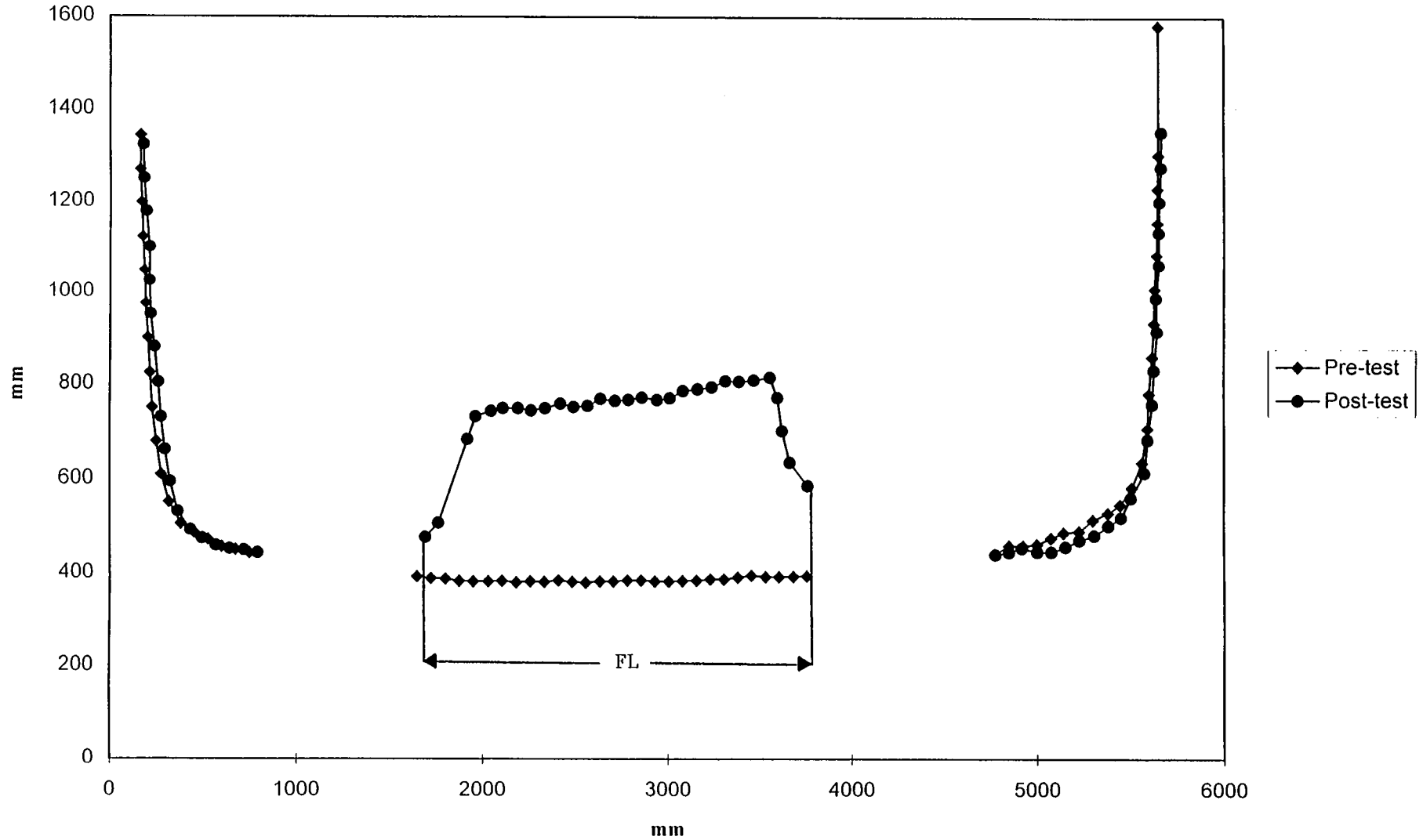


Table 10 Vehicle Window Bottom

Test No. 951011

FL =	3645
C1 =	0
C2 =	135
C3 =	461
C4 =	230
C5 =	77
C6 =	0

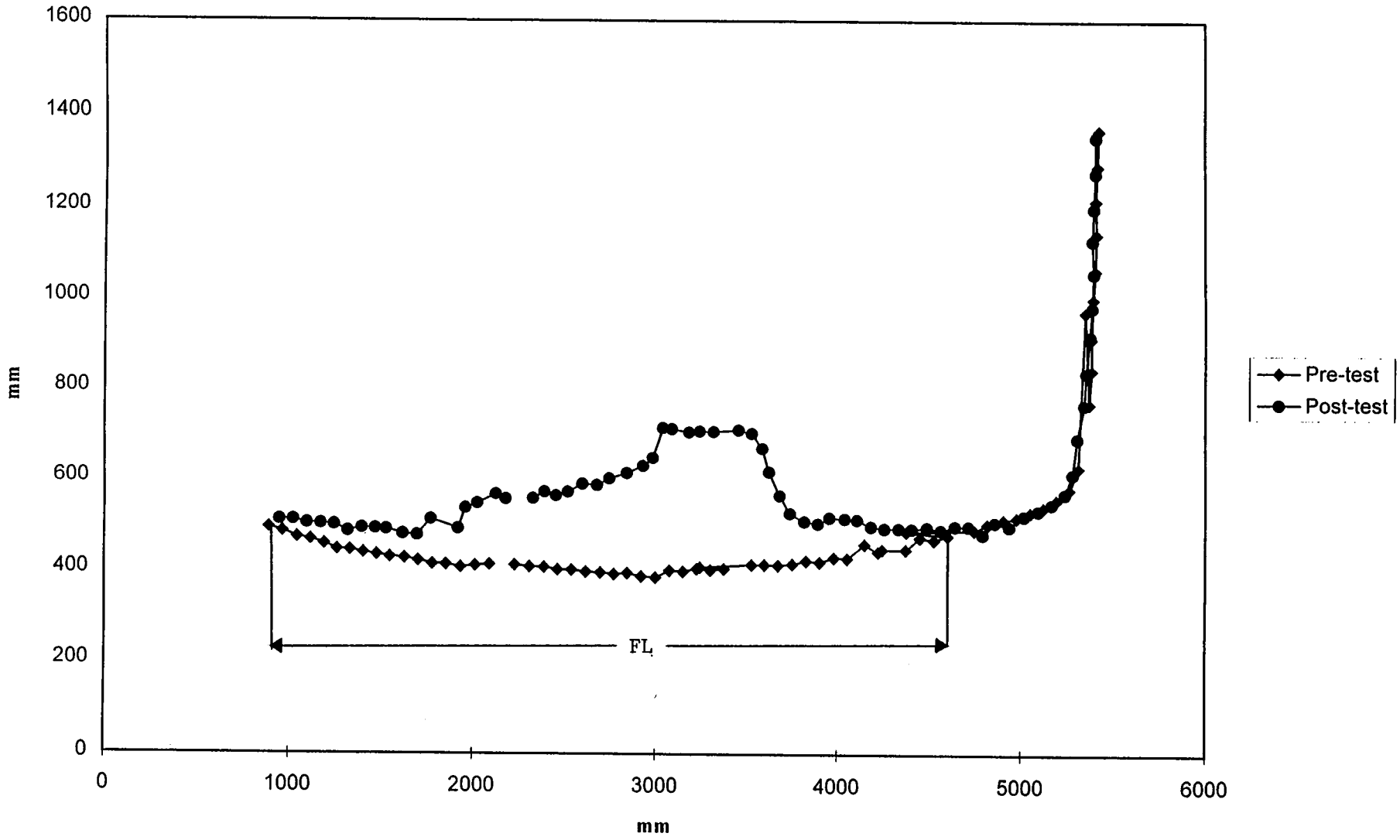
NOTE: FL is the post-test length of the damaged surface.

Measurements C1 - C6 were spaced equally apart over the post-impact length of the damaged surface. This distance is defined as length "FL" on the vehicle crush profile plot.

All measurements are in millimeters.

Figure 6 Vehicle Window Bottom Profile

Test No. 951011



Appendix A

Photographs

Figure A-1 Pre-Test Front View

Figure A-2 Post-Test Front View

Figure A-3 Pre-Test Left Front View

Figure A-4 Post-Test Left Front View

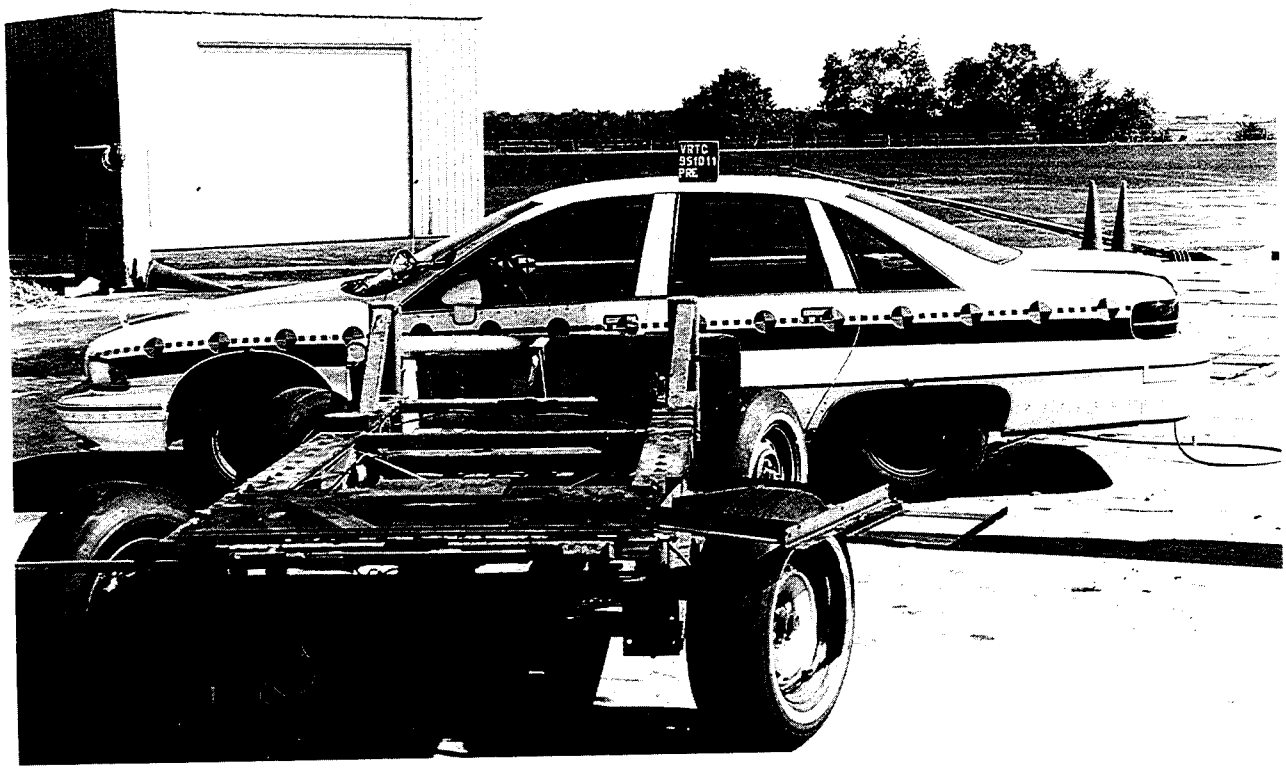


Figure A-5 Pre-Test Left Side View

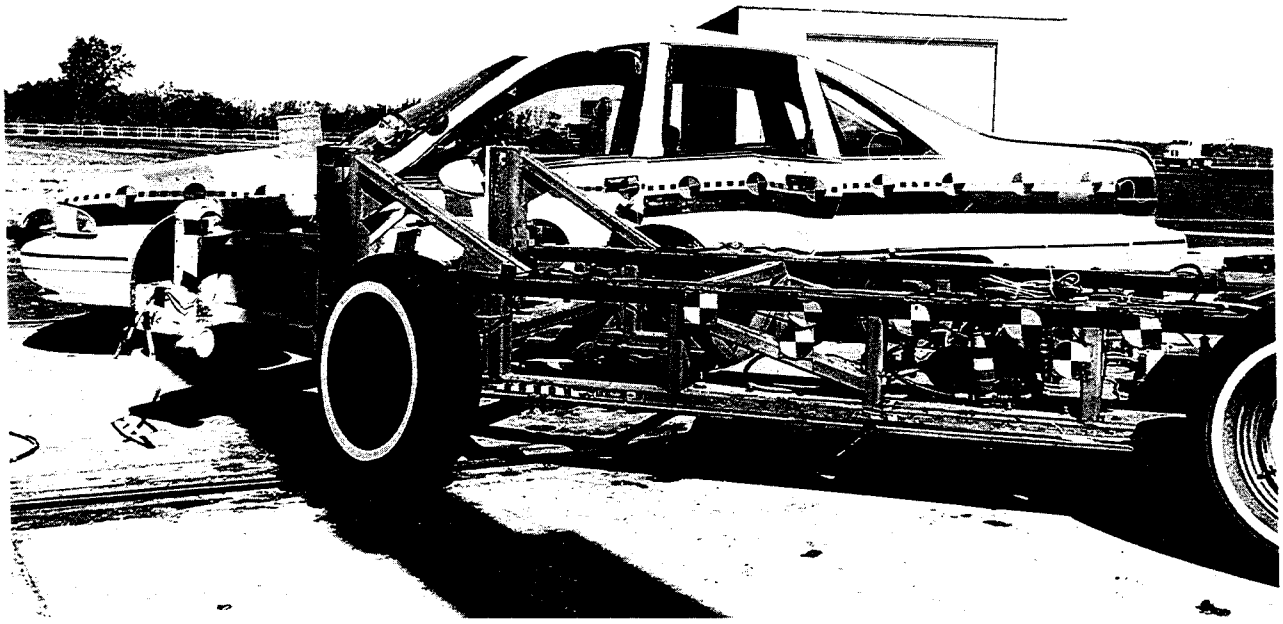


Figure A-6 Post-Test Left Side View

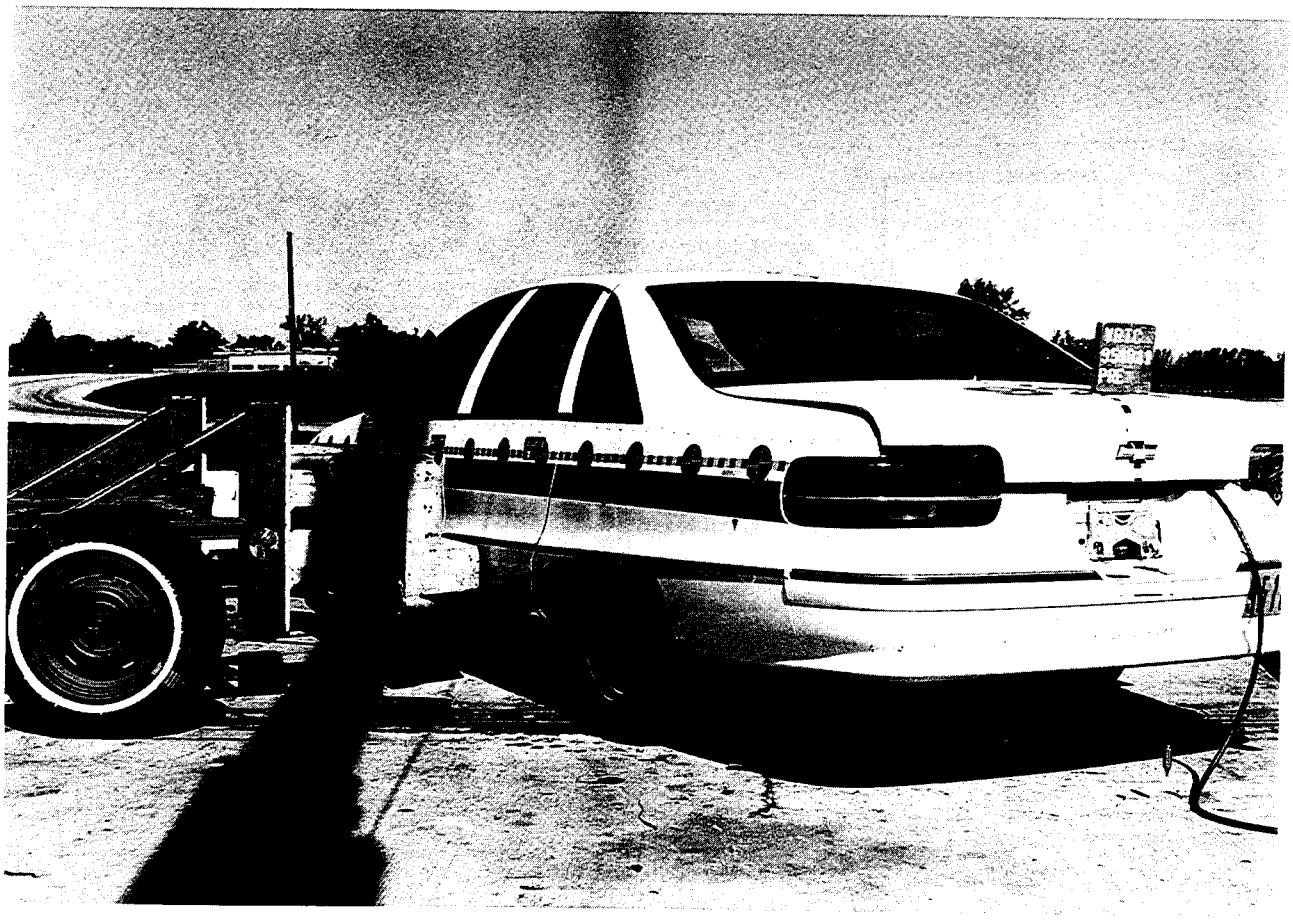


Figure A-7 Pre-Test Left Rear View

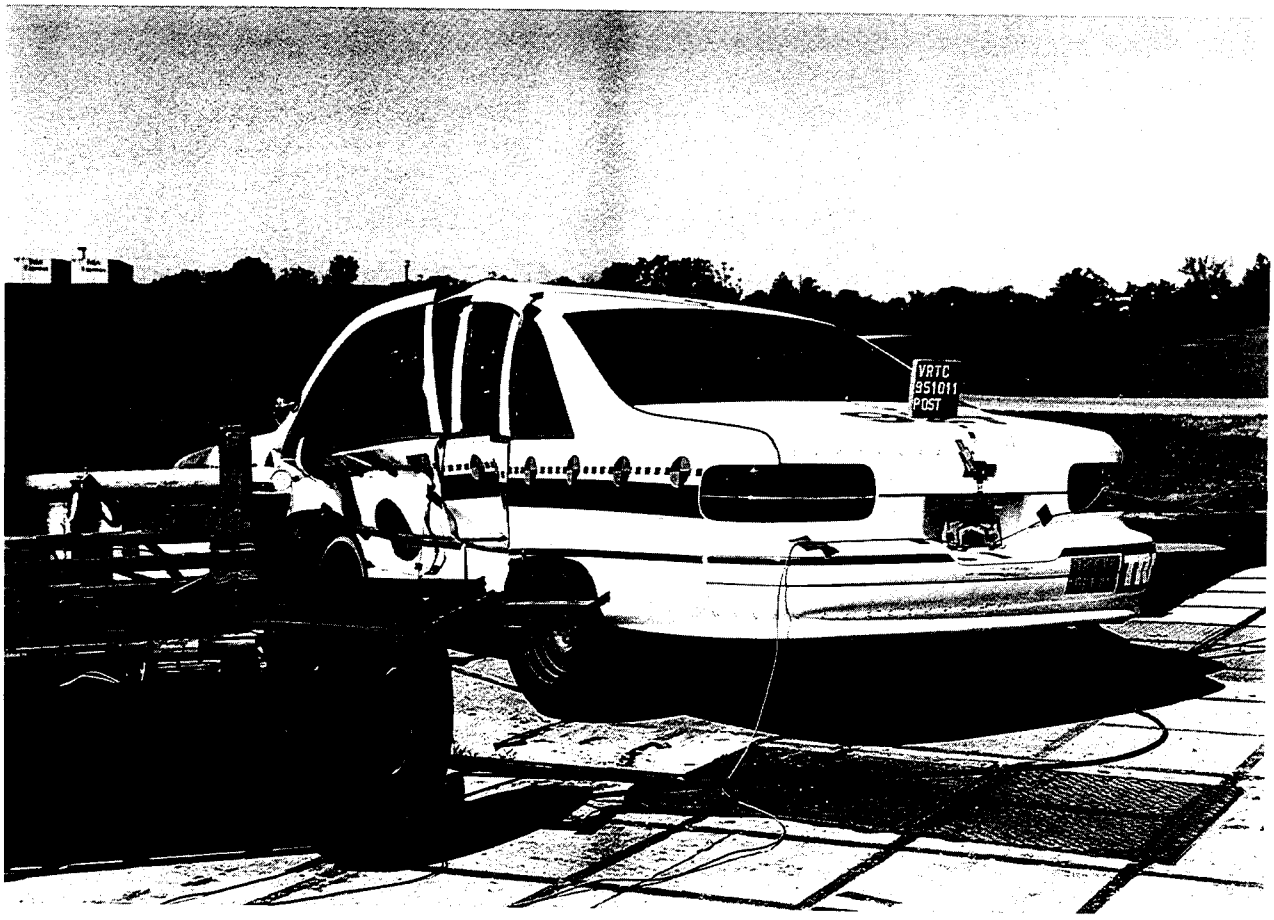


Figure A-8 Post-Test Left Rear View

Figure A-9 Pre-Test Rear View

Figure A-10 Post-Test Rear View

Figure A-11 Pre-Test Right Side View

Figure A-12 Post-Test Right Side View

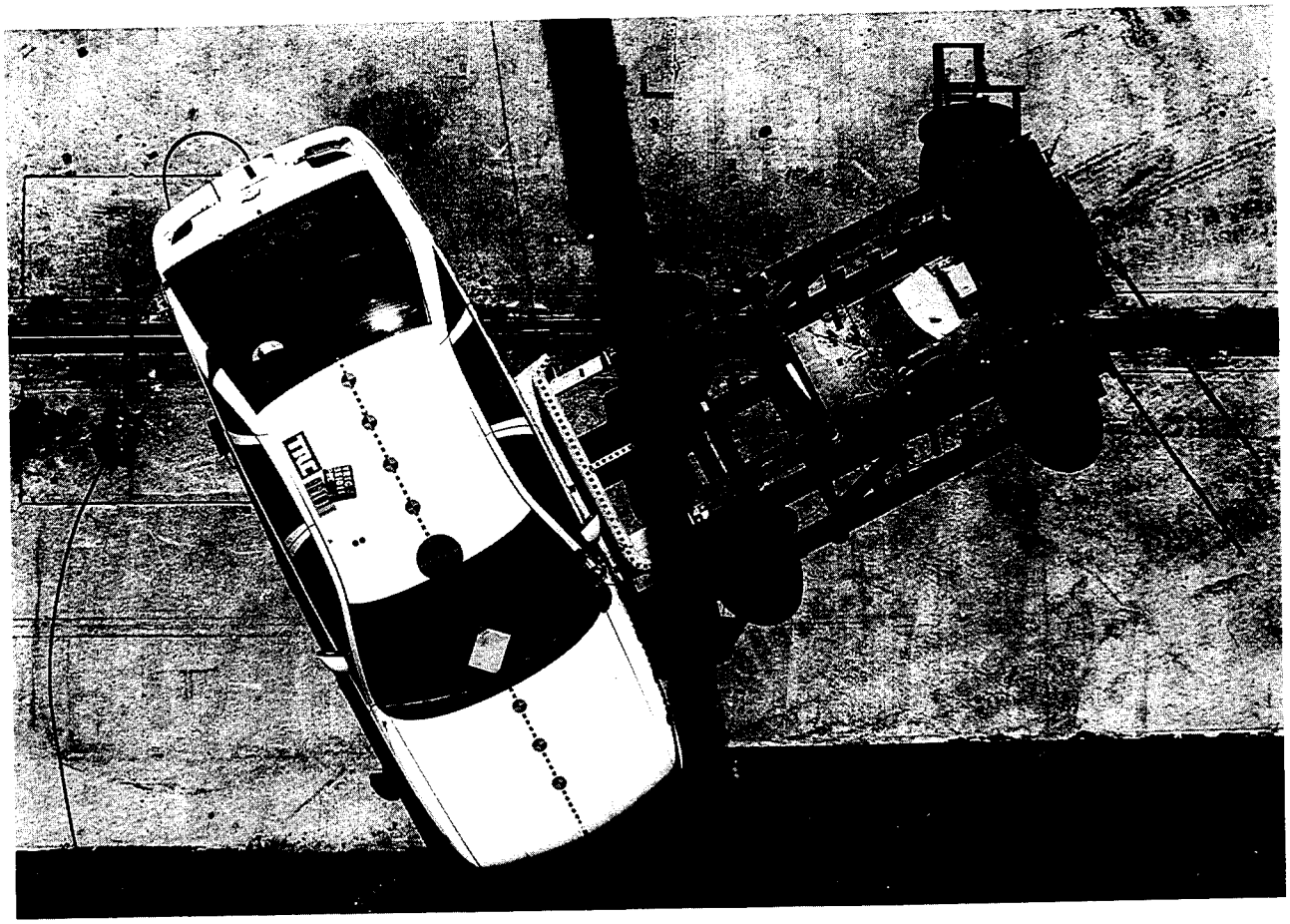
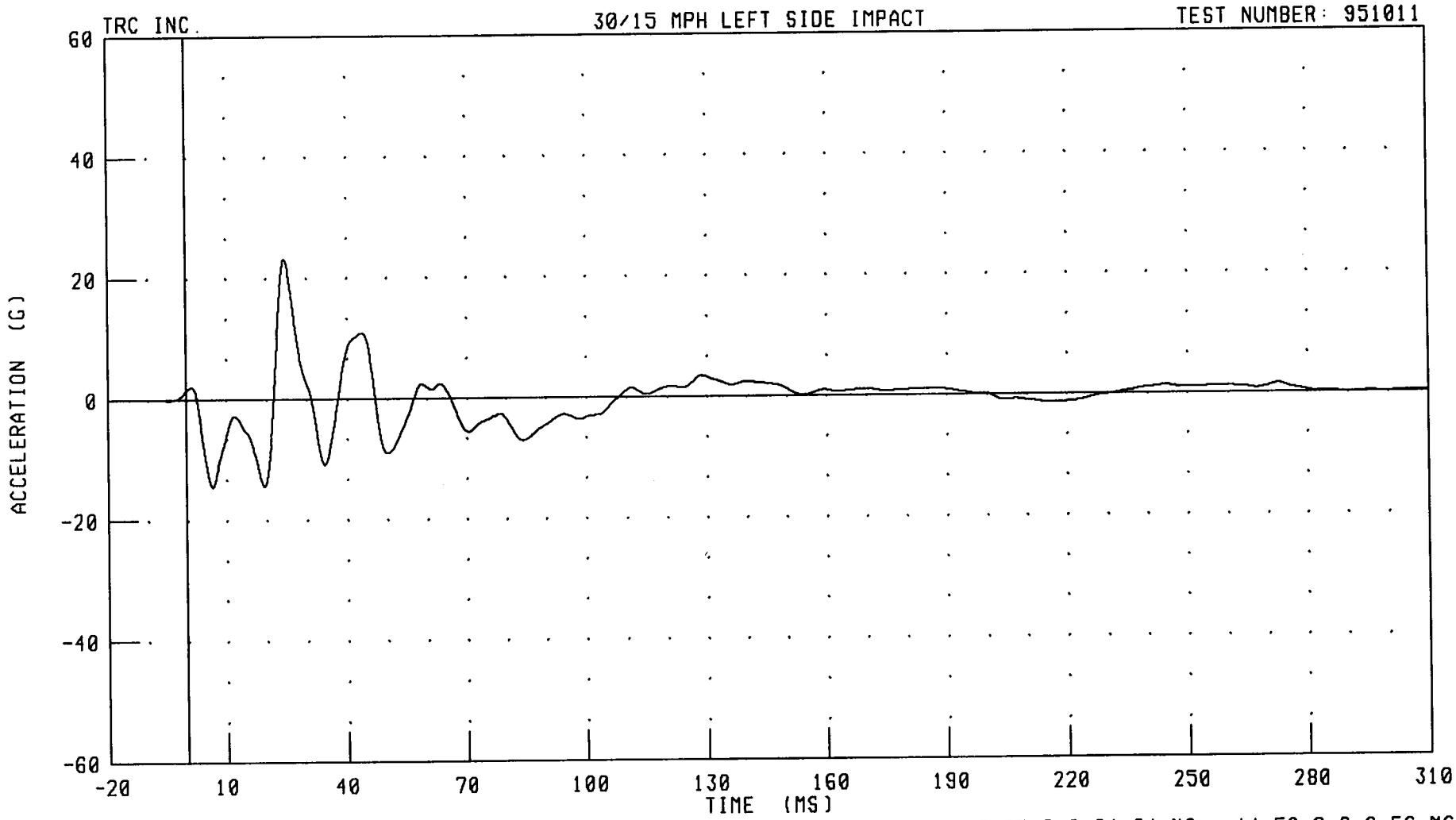


Figure A-13 Pre-Test Overhead Impact Alignment View

Appendix B

Data Plots

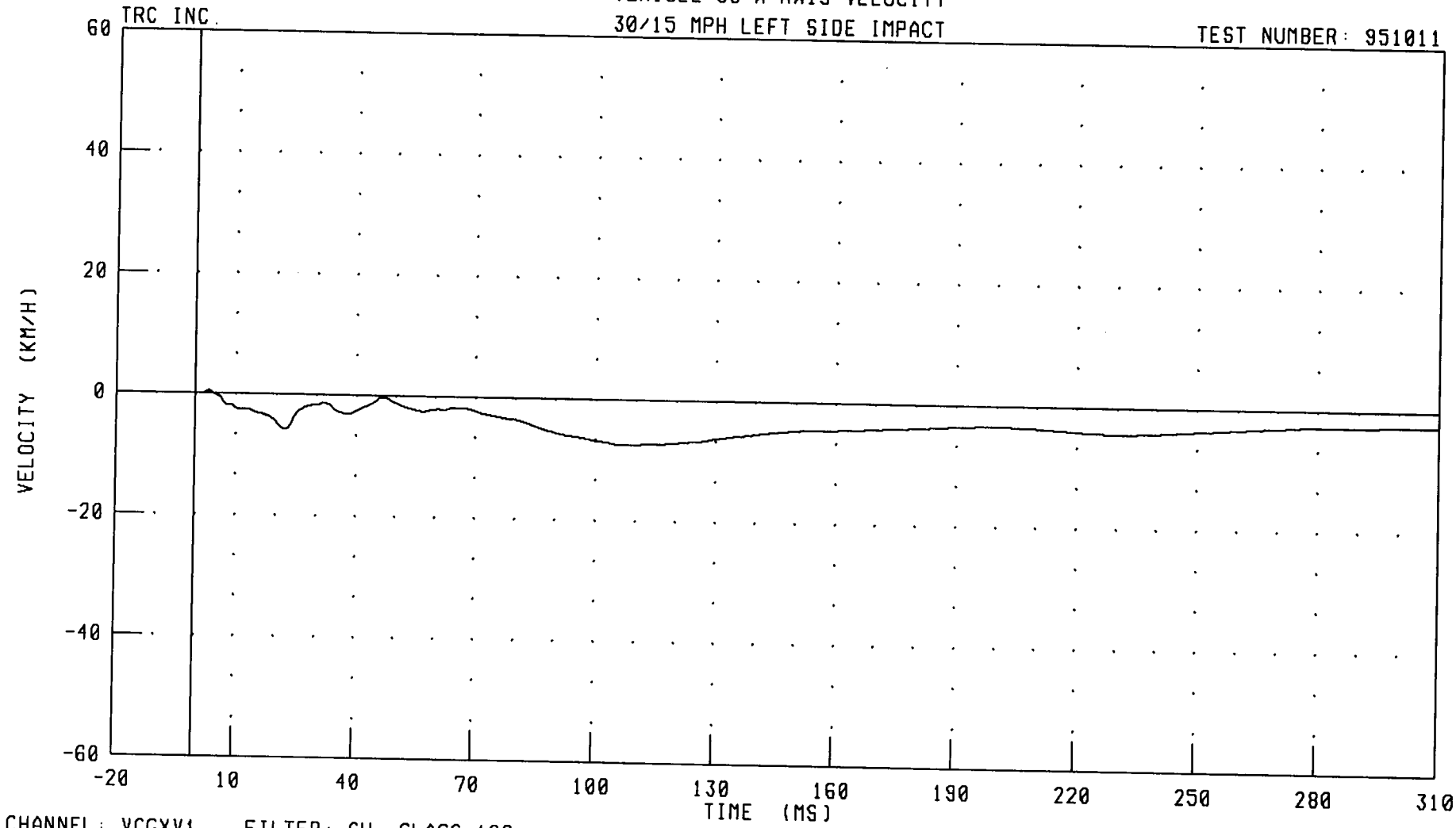
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG X-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT



CHANNEL: VCGXG1 FILTER: CH. CLASS 60

PEAK DATA: 23.25 G @ 24.64 MS; -14.52 G @ 6.56 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG X-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



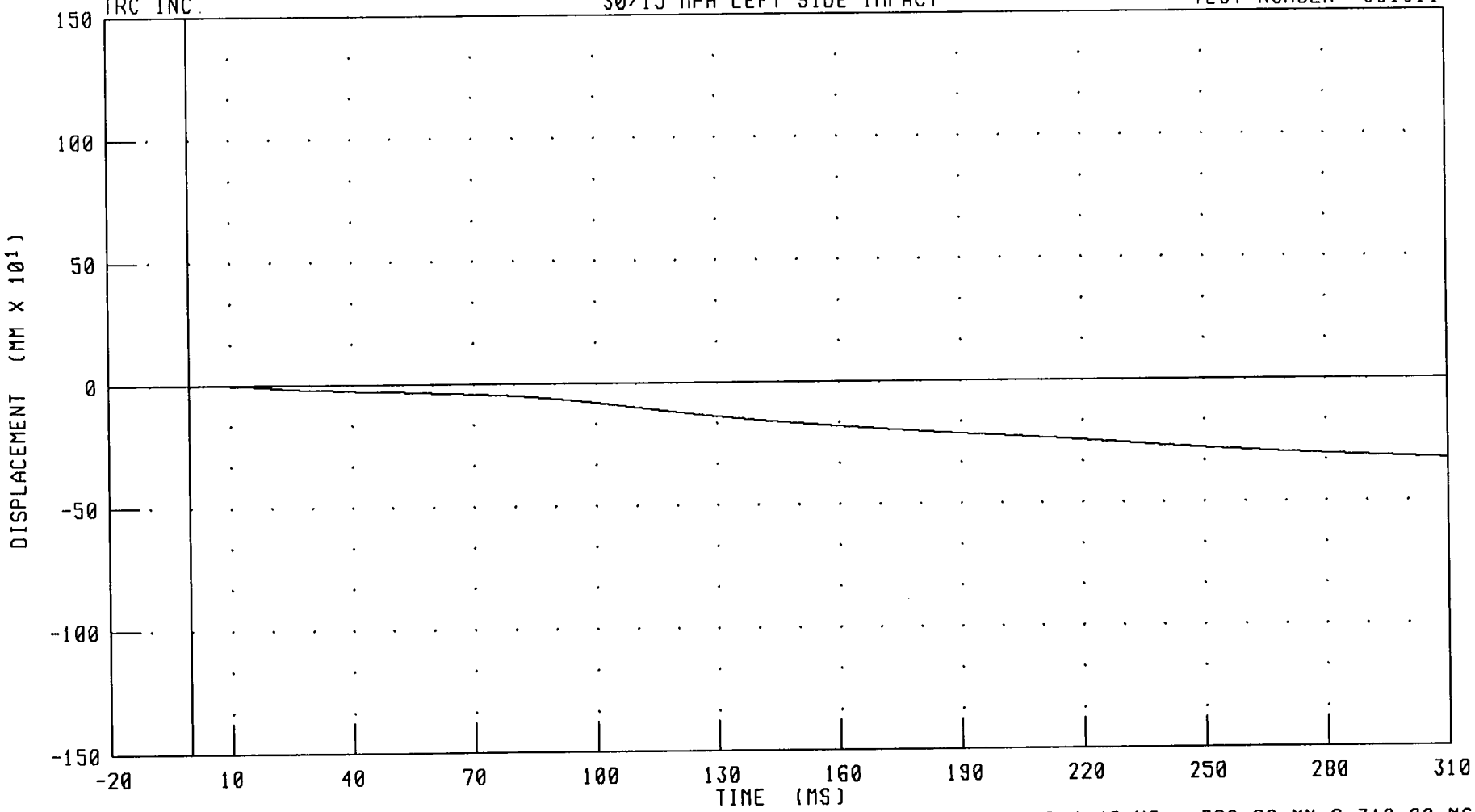
CHANNEL: VCGXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.43 KM/H @ 3.28 MS; -7.47 KM/H @ 108.32 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG X-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

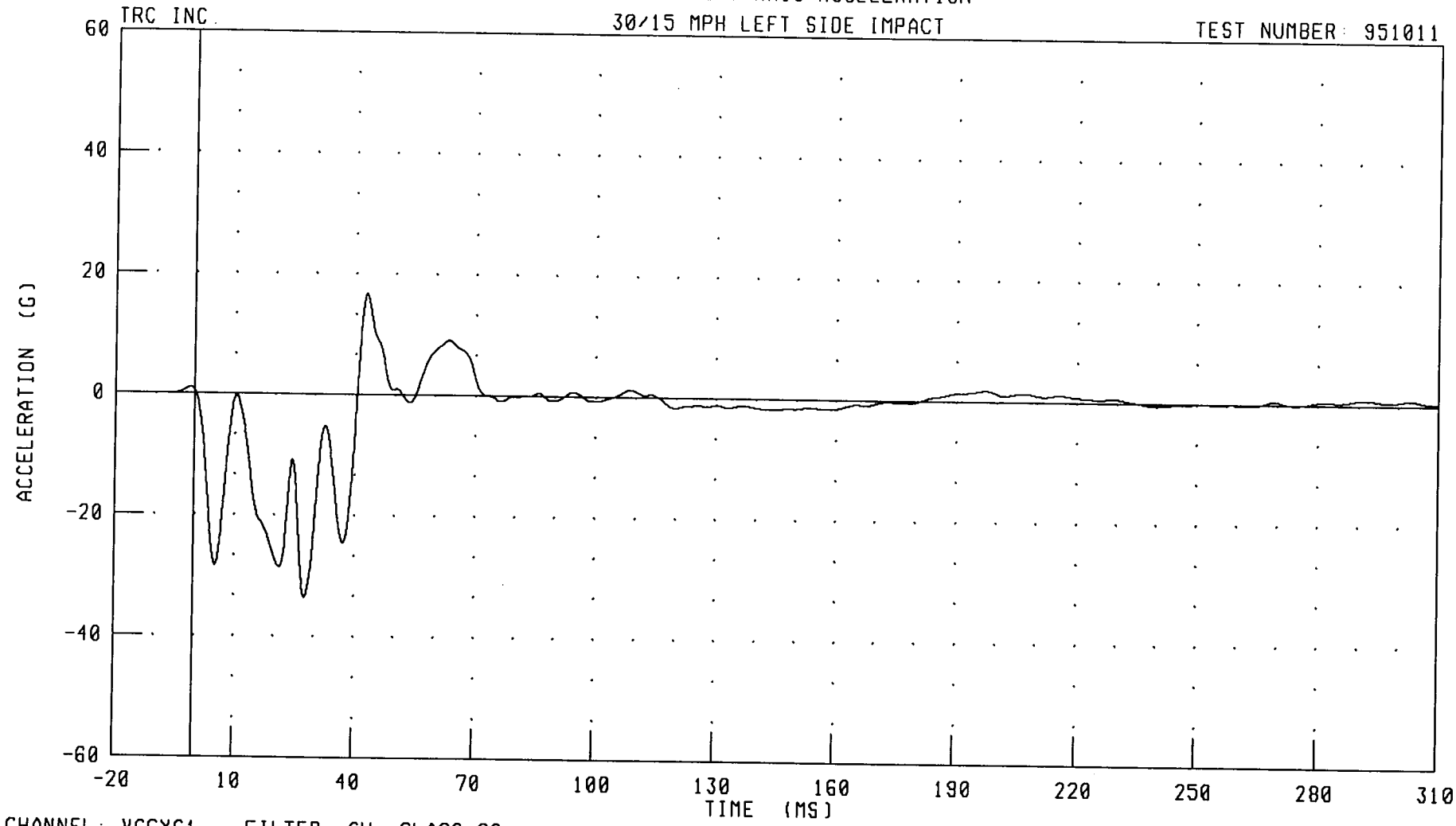
TEST NUMBER: 951011



CHANNEL: VCGXD1 FILTER: CH. CLASS 180

PEAK DATA: 0.20 MM @ 4.48 MS; -329.06 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Y-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT



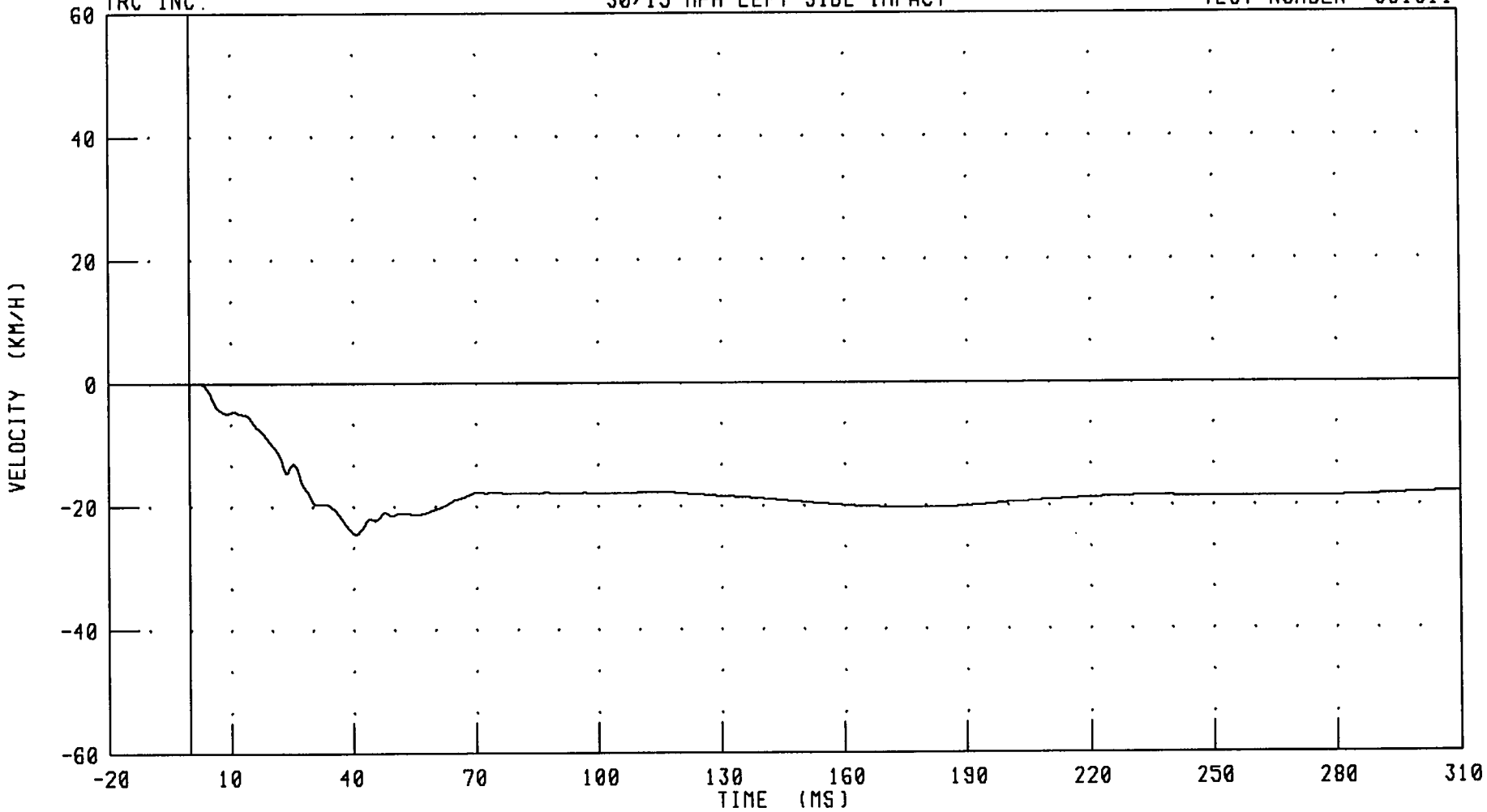
CHANNEL: VCGYG1 FILTER: CH. CLASS 60

PEAK DATA: 16.71 G @ 42.96 MS; -33.61 G @ 27.76 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Y-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT

TRC INC.

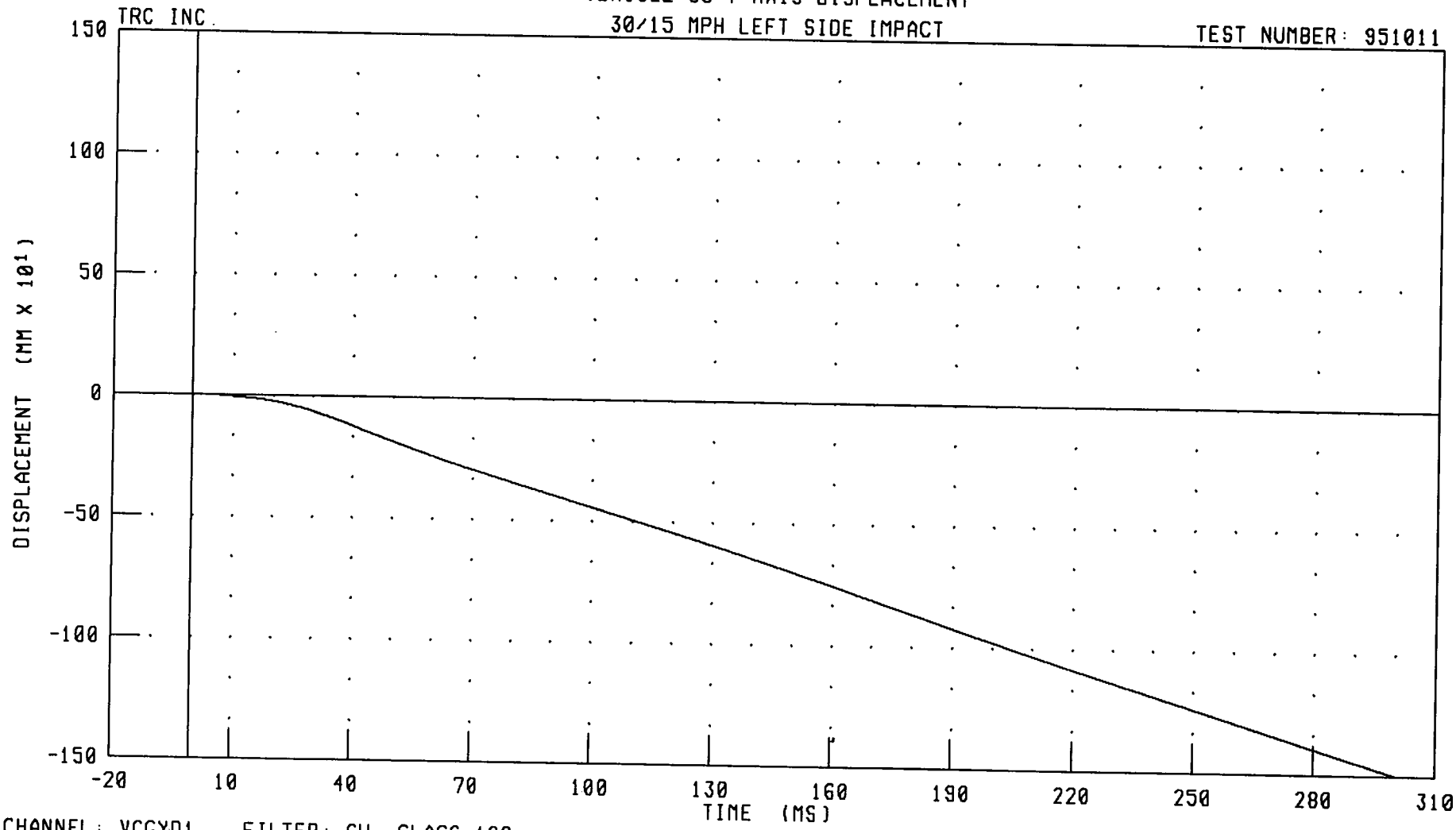
TEST NUMBER: 951011



CHANNEL: VCGYV1 FILTER: CH. CLASS 180

PEAK DATA: 0.01 KM/H @ 1.84 MS; -24.50 KM/H @ 40.72 MS

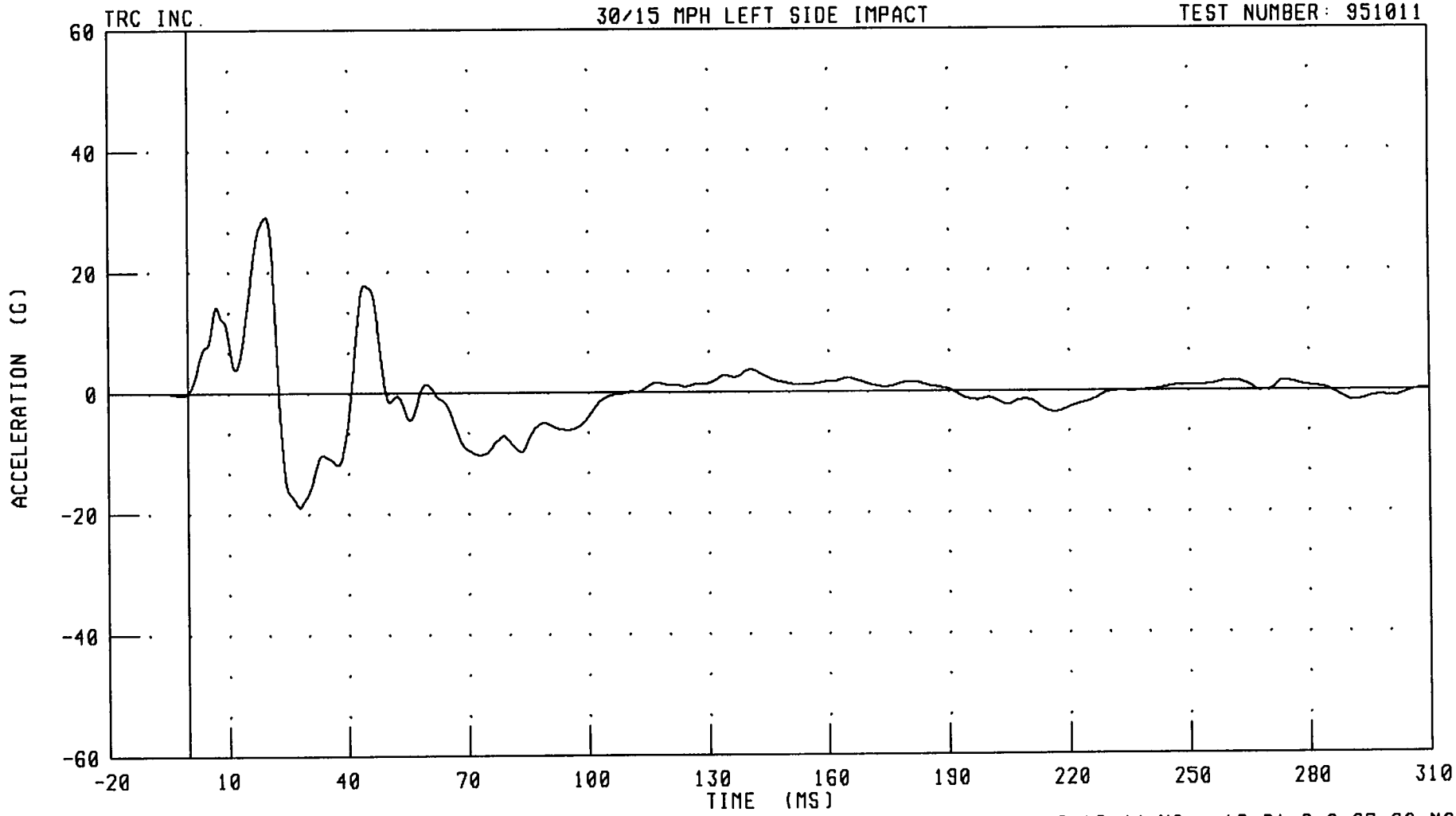
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Y-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT



CHANNEL: VCGYD1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 MM @ 2.24 MS; -1545.77 MM @ 310.00 MS

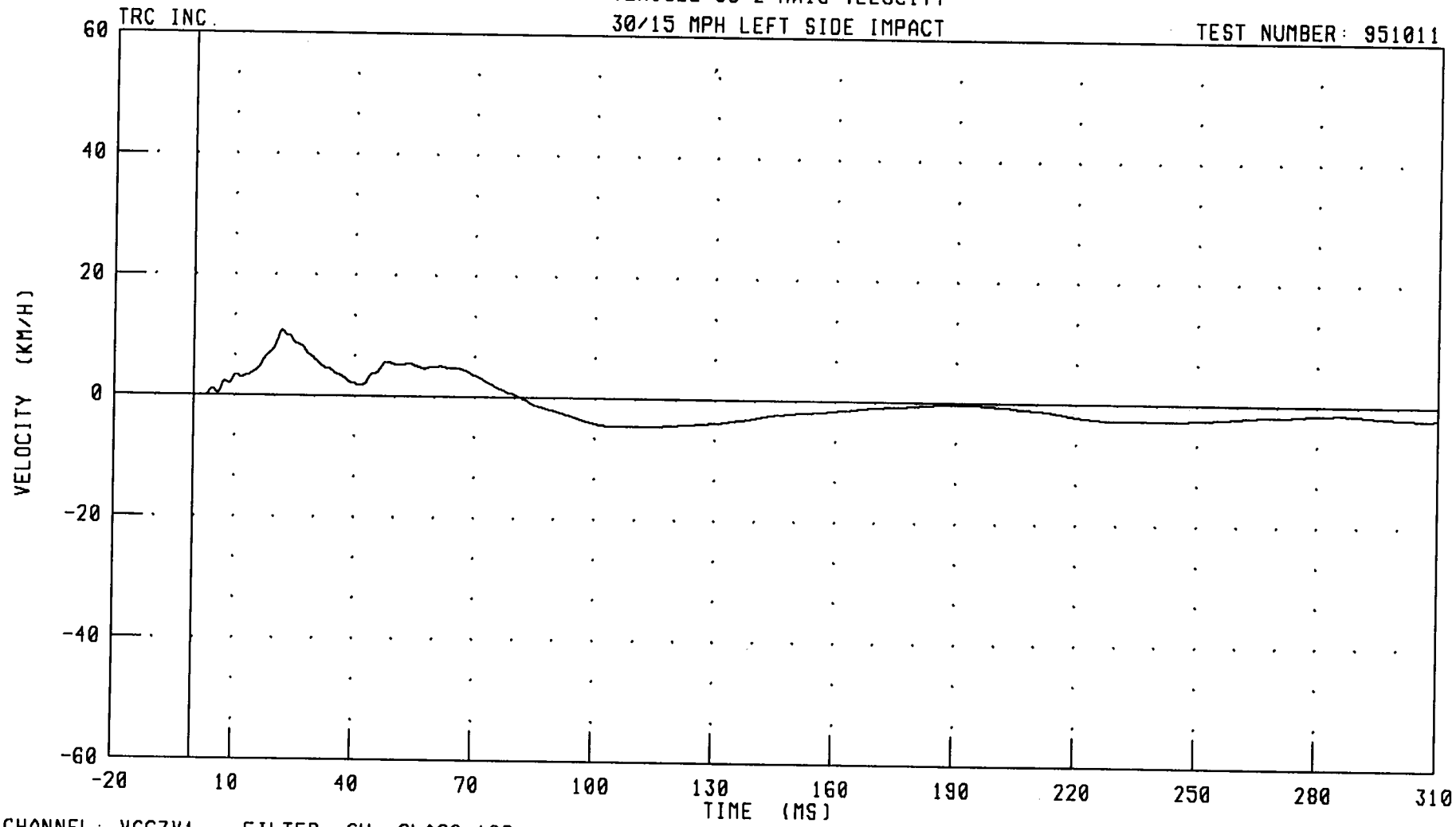
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Z-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT



CHANNEL: VCGZG1 FILTER: CH. CLASS 60

PEAK DATA: 29.08 G @ 19.44 MS; -18.91 G @ 27.92 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Z-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



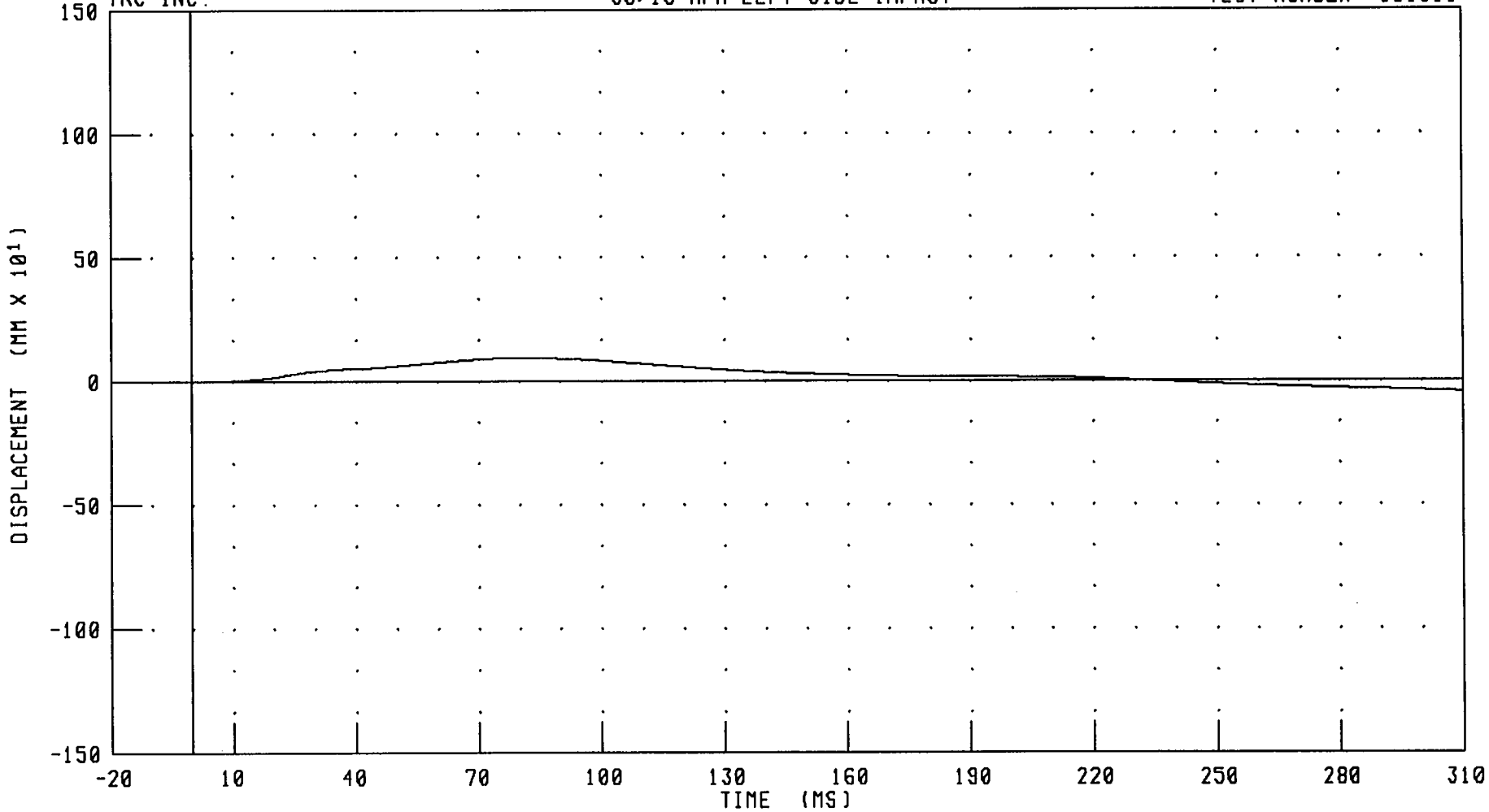
CHANNEL: VCGZV1 FILTER: CH. CLASS 180

PEAK DATA: 10.78 KM/H @ 21.92 MS; -4.64 KM/H @ 110.08 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG Z-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

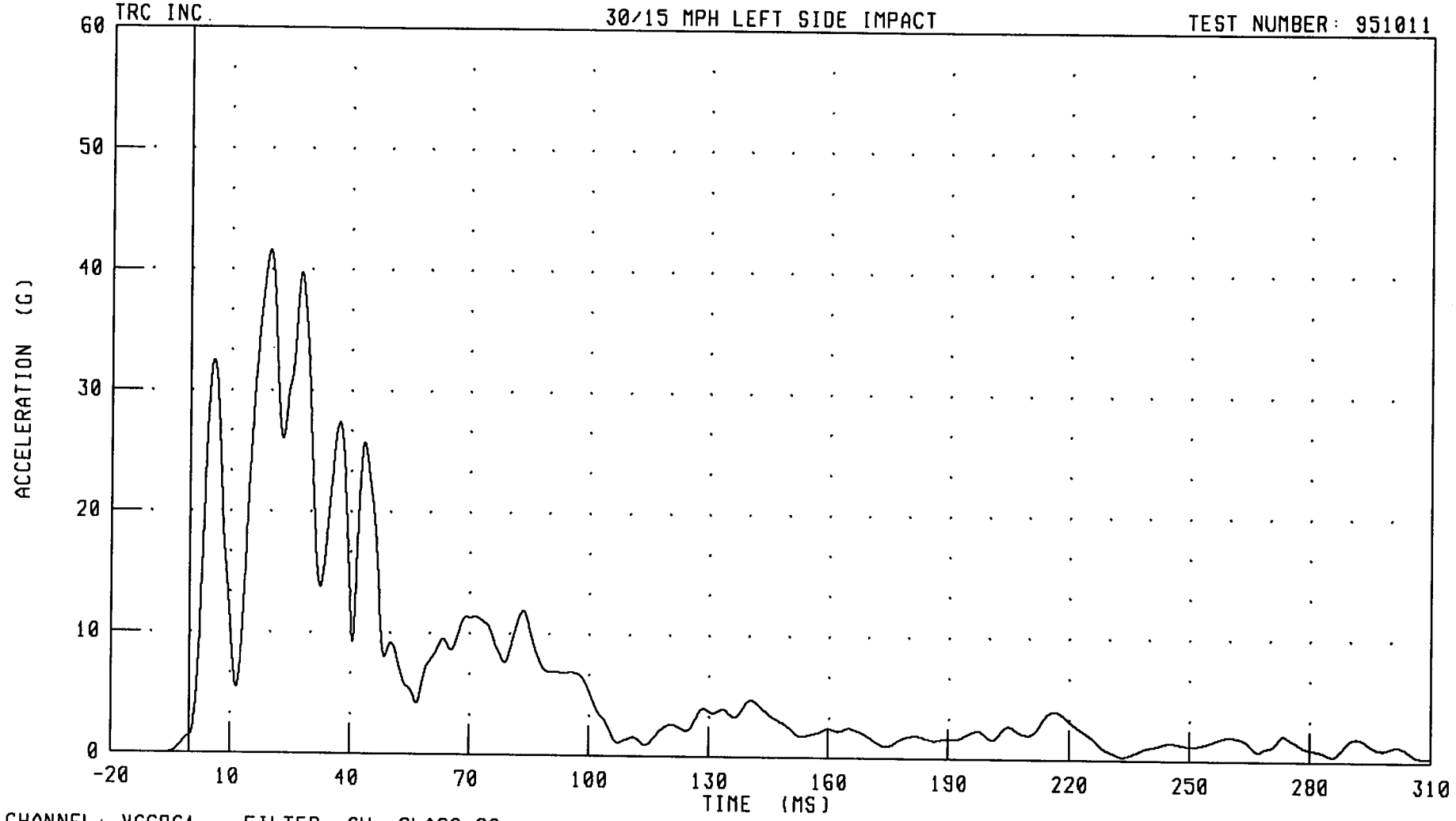
TEST NUMBER: 951011



CHANNEL: VCGZD1 FILTER: CH. CLASS 180

PEAK DATA: 93.92 MM @ 81.52 MS; -45.30 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG RESULTANT ACCELERATION
30/15 MPH LEFT SIDE IMPACT



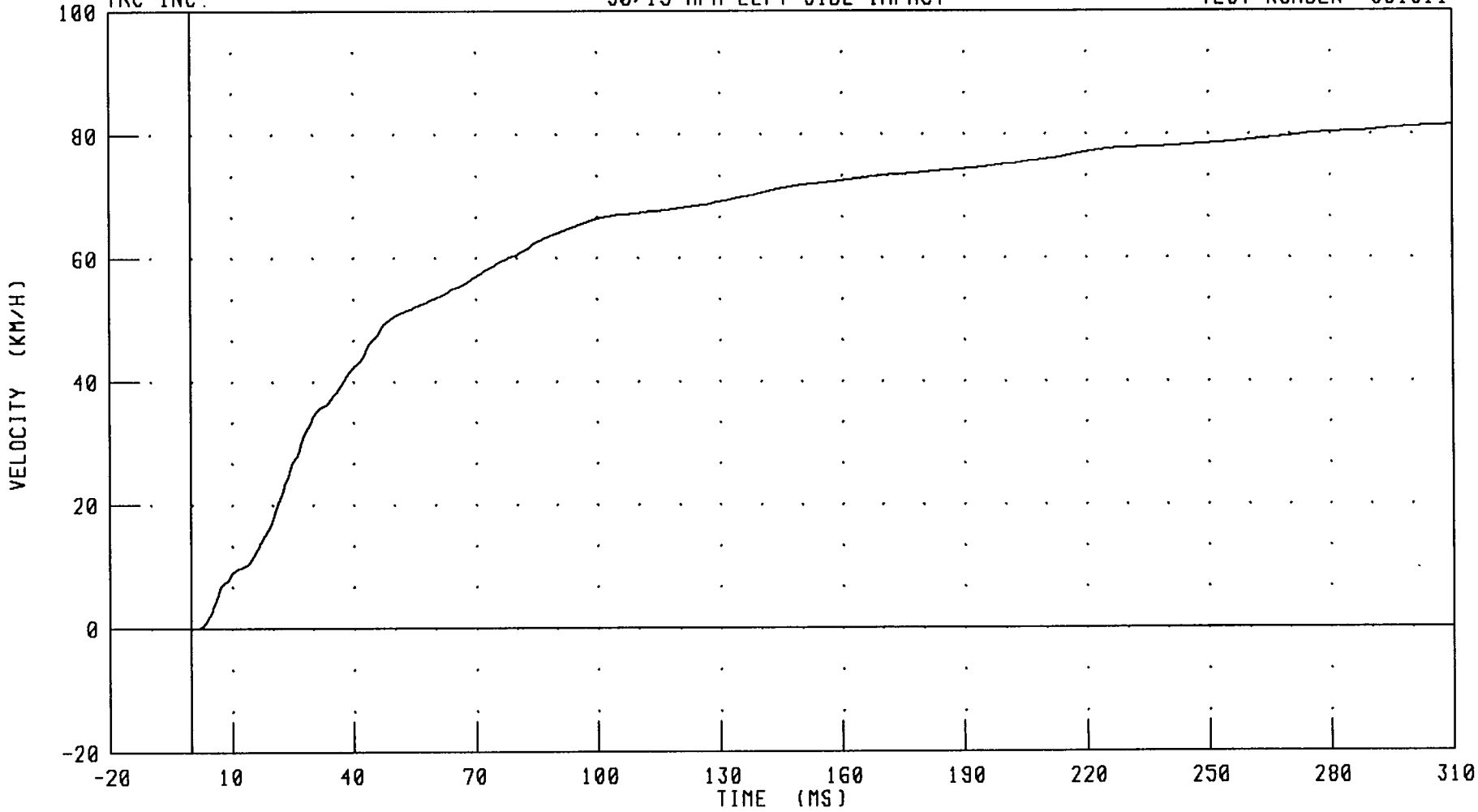
CHANNEL: VCGRG1 FILTER: CH. CLASS 60

PEAK DATA: 41.63 G @ 19.76 MS; 0.00 G @ -9.76 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG RESULTANT VELOCITY
30/15 MPH LEFT SIDE IMPACT

TRC INC.

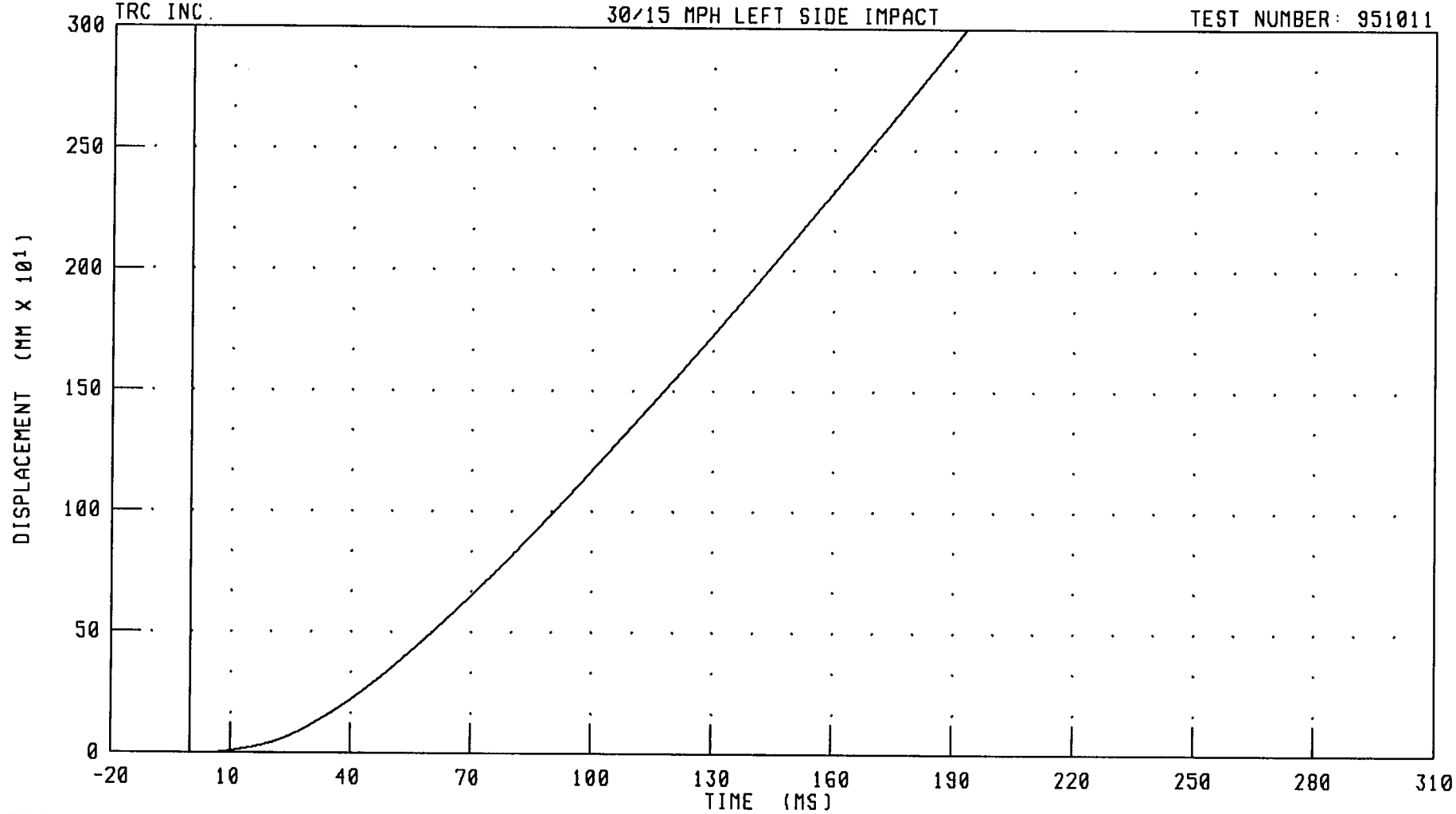
TEST NUMBER: 951011



CHANNEL: VCGRV1 FILTER: CH. CLASS 180

PEAK DATA: 81.44 KM/H @ 310.00 MS; 0.00 KM/H @ 0.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
VEHICLE CG RESULTANT DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT



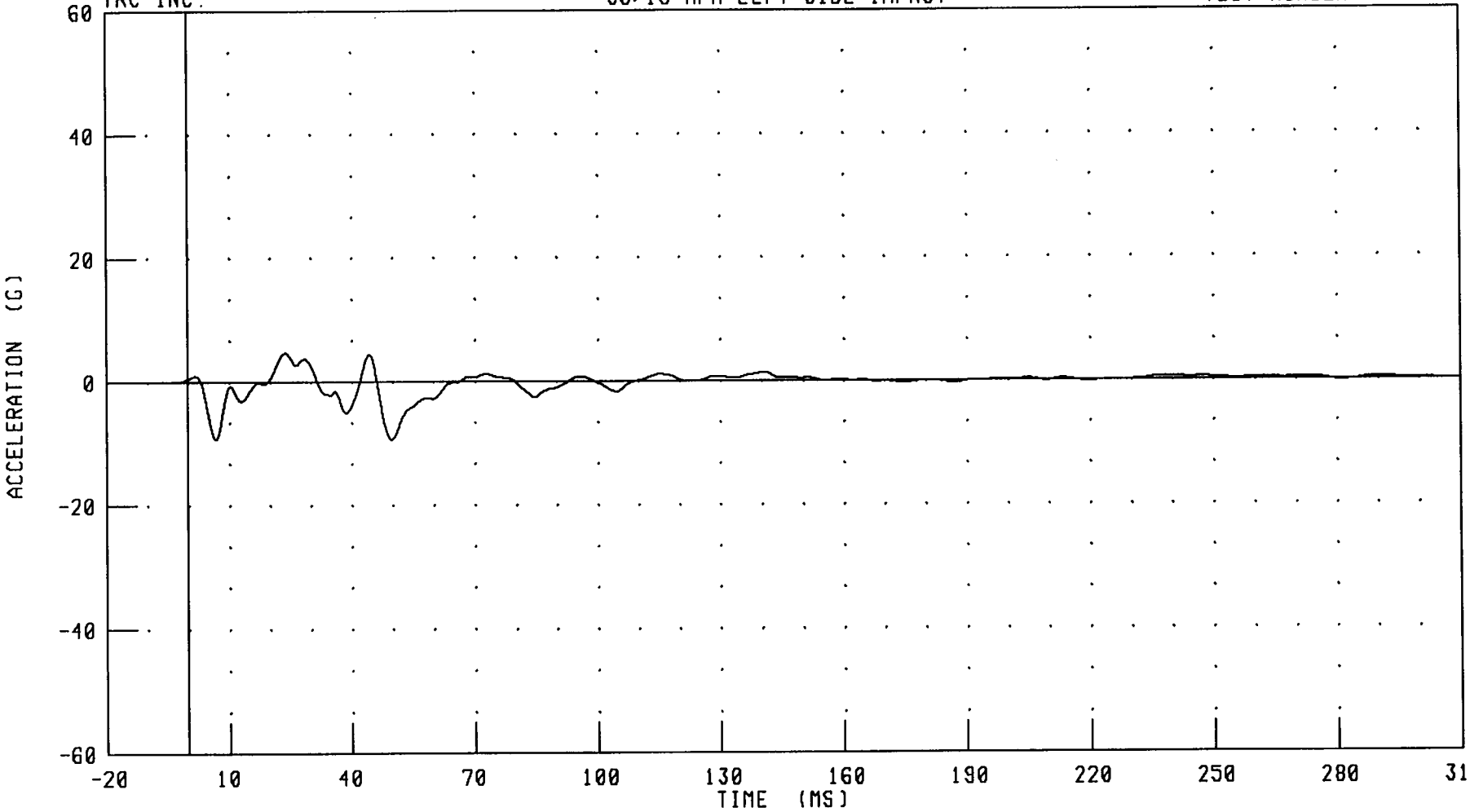
CHANNEL: VCGRD1 FILTER: CH. CLASS 180

PEAK DATA: 5551.18 MM @ 310.00 MS; 0.00 MM @ 0.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL X-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

TRC INC.

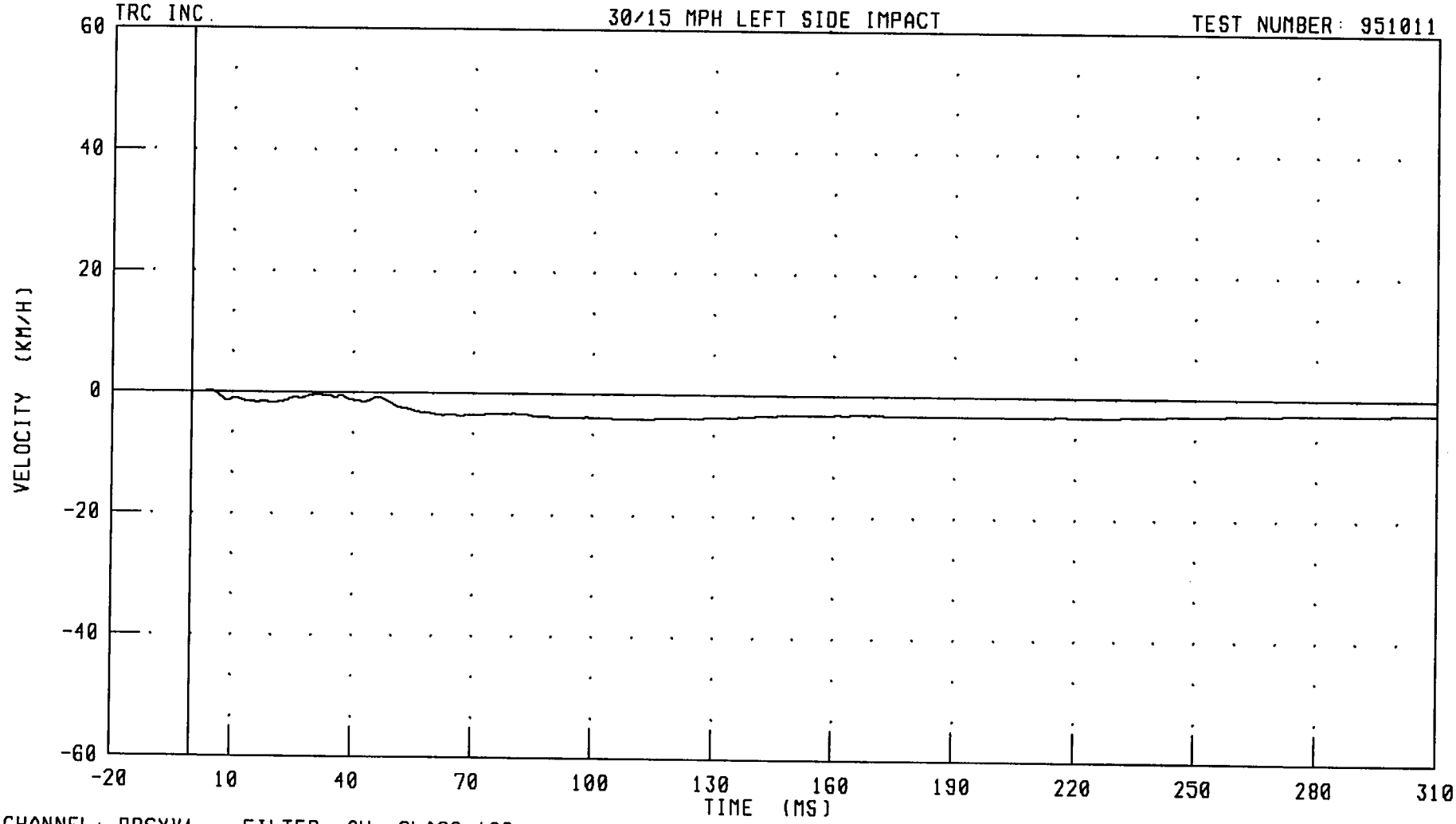
TEST NUMBER: 951011



CHANNEL: RRSXG1 FILTER: CH. CLASS 60

PEAK DATA: 4.67 G @ 23.92 MS; -9.39 G @ 49.76 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL X-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



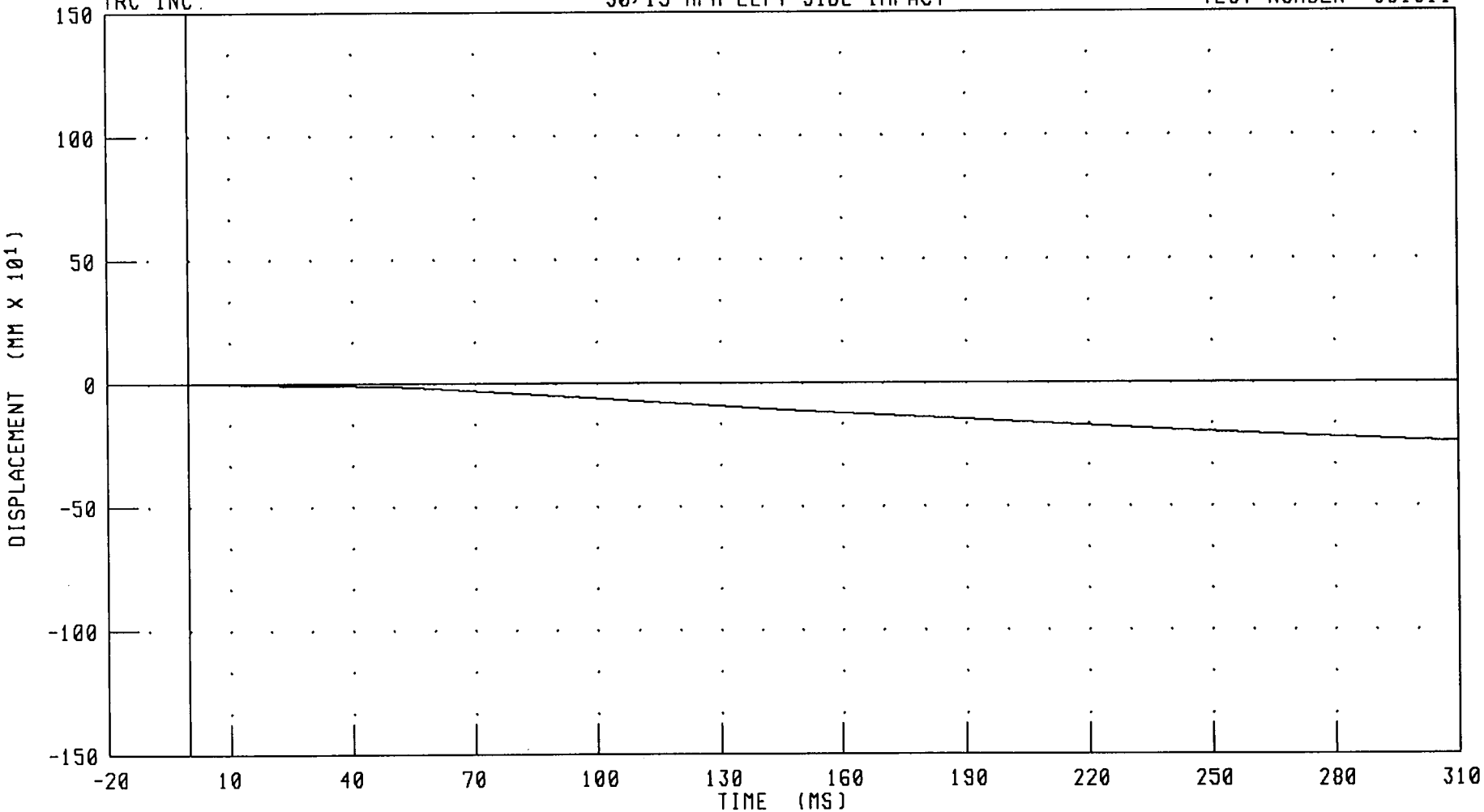
CHANNEL: RRSXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.19 KM/H @ 4.32 MS; -4.10 KM/H @ 111.84 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL X-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

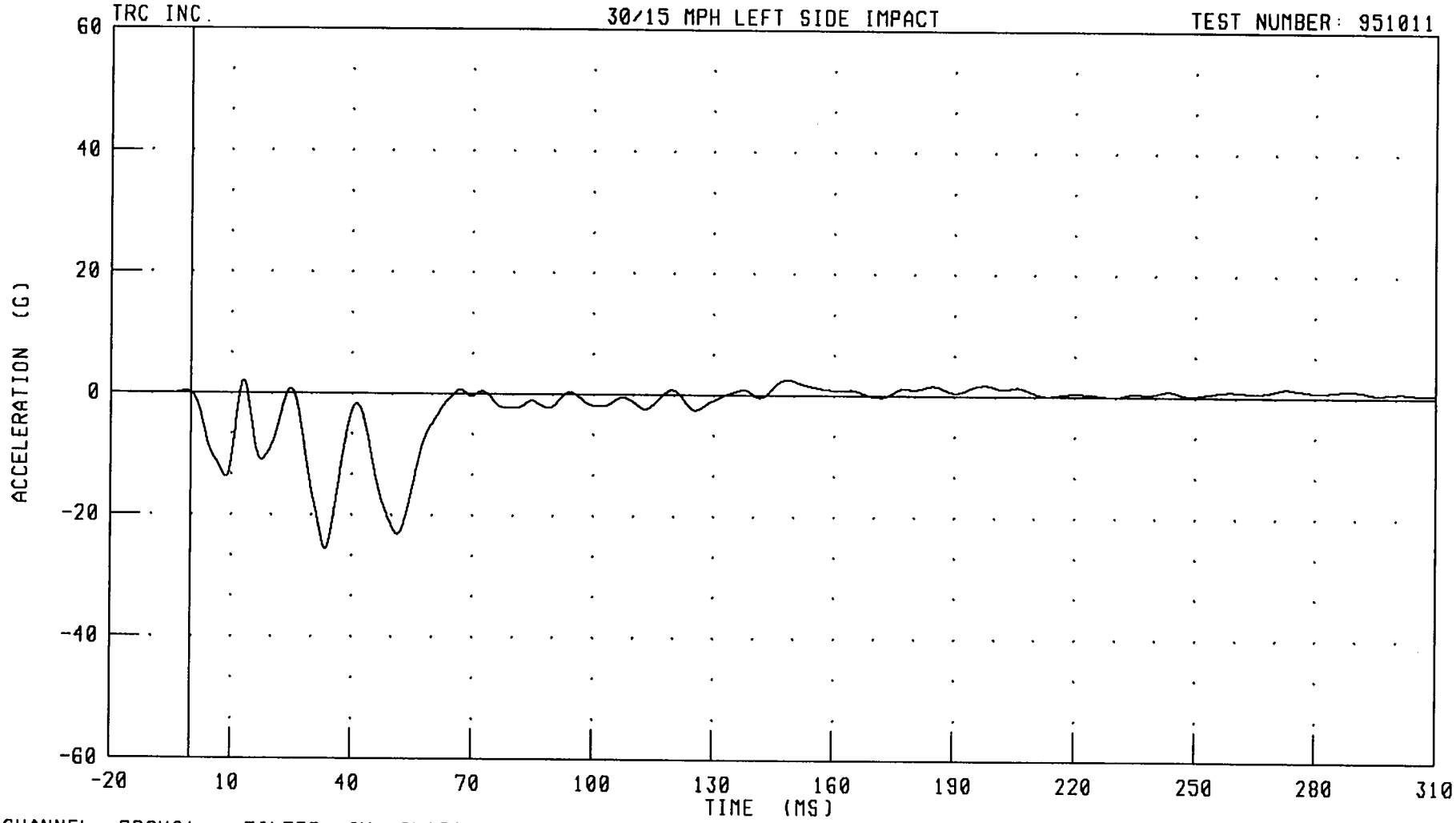
TEST NUMBER: 951011



CHANNEL: RRSXD1 FILTER: CH. CLASS 180

PEAK DATA: 0.09 MM @ 5.44 MS; -243.25 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL Y-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

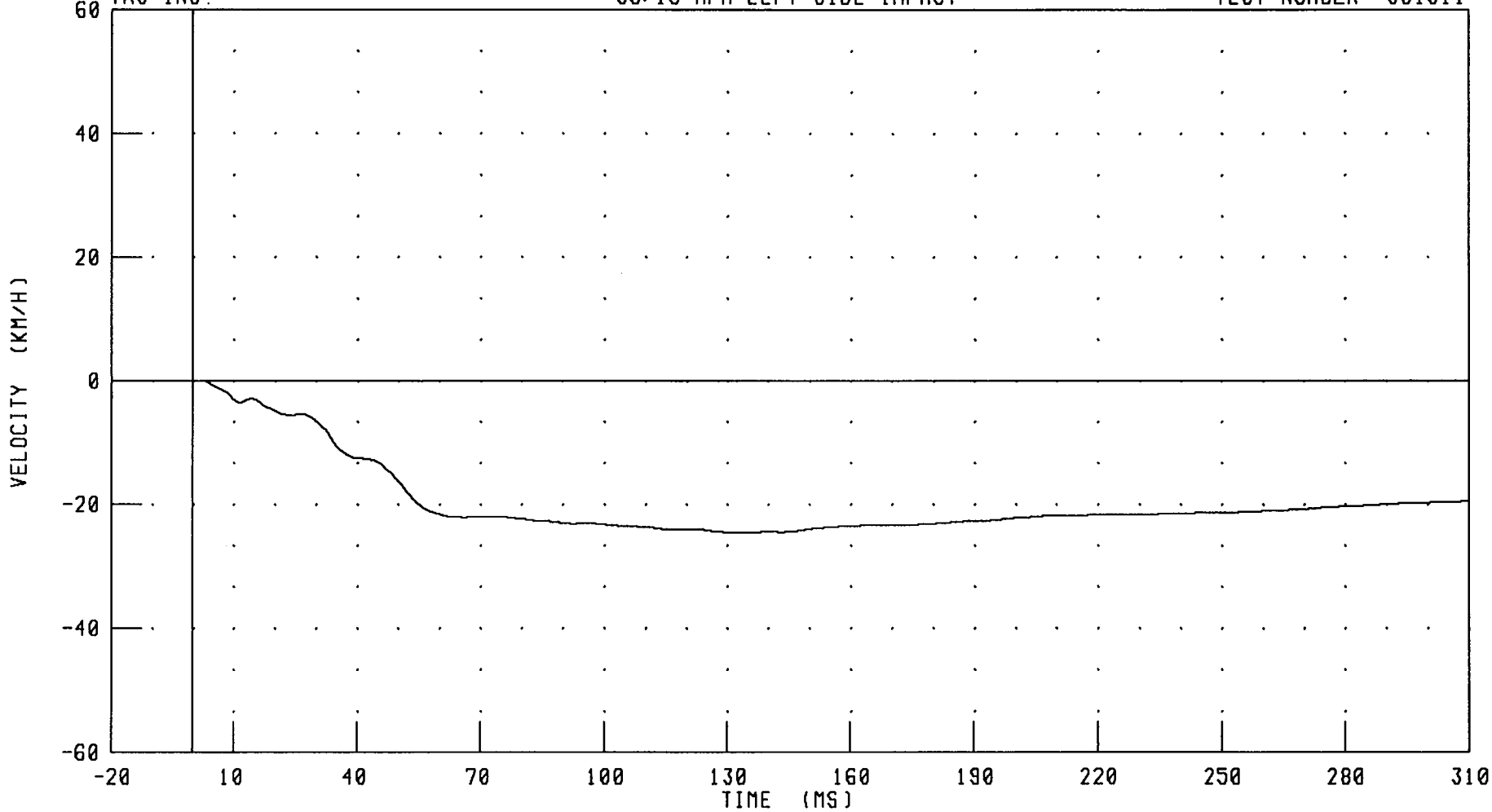


CHANNEL: RRSYG1 FILTER: CH. CLASS 60

PEAK DATA: 2.58 G @ 148.72 MS; -25.59 G @ 33.60 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL Y-AXIS VELOCITY

TRC INC. 30/15 MPH LEFT SIDE IMPACT TEST NUMBER: 951011

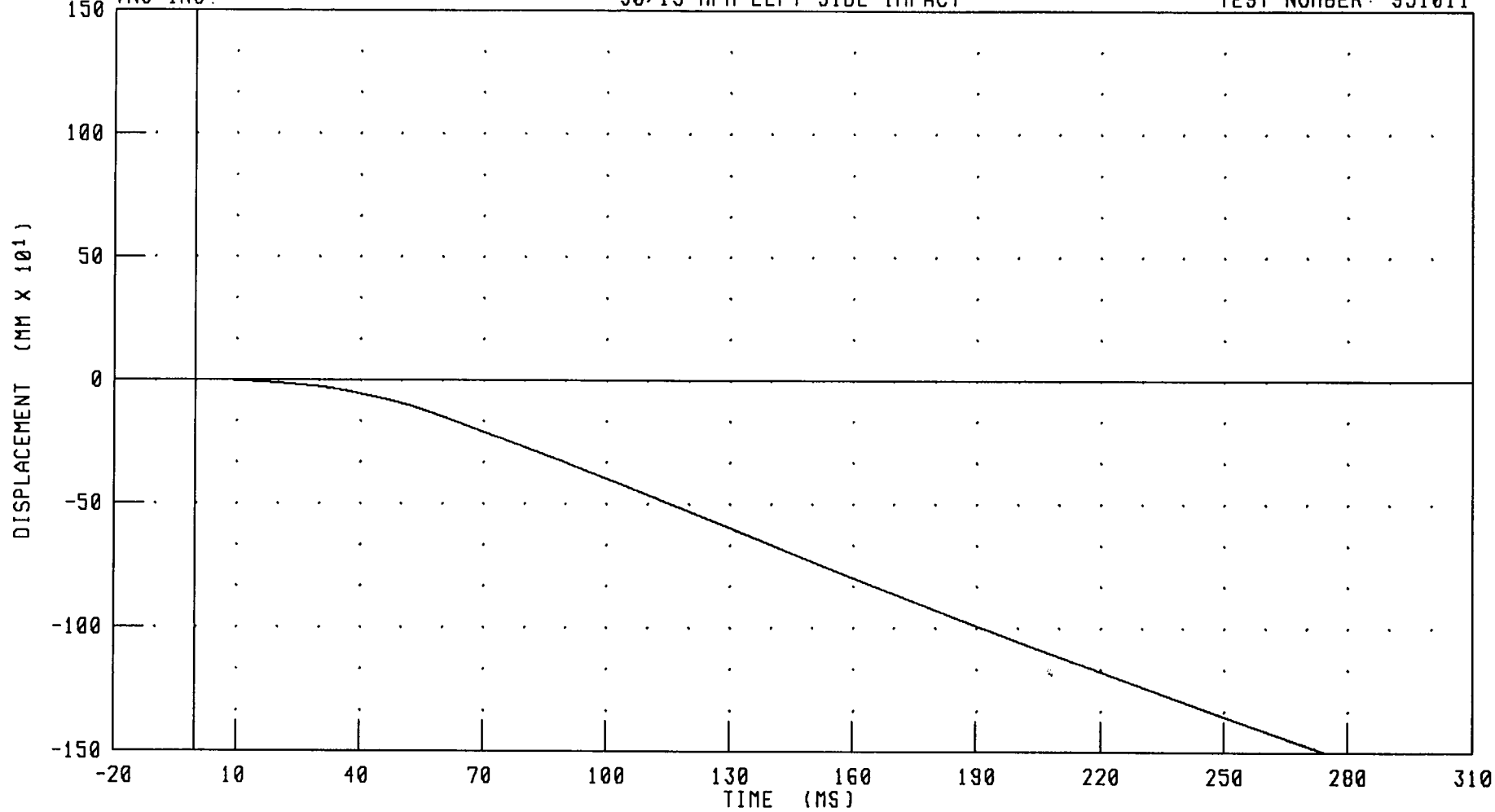


CHANNEL: RRSYV1 FILTER: CH. CLASS 180 PEAK DATA: 0.01 KM/H @ 2.00 MS; -24.56 KM/H @ 132.56 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT REAR SILL Y-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

TEST NUMBER: 951011

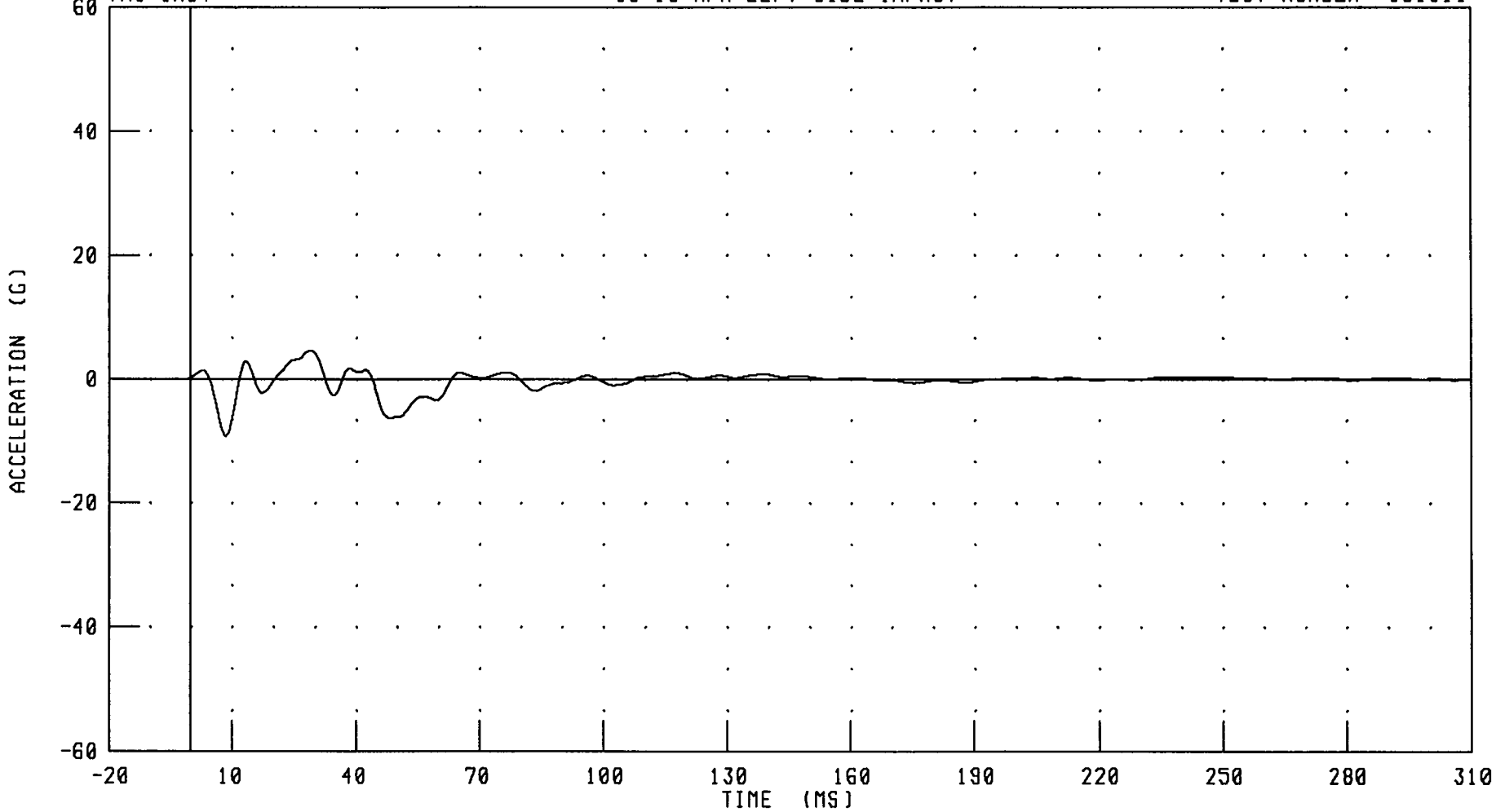


CHANNEL: RRSYD1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 MM @ 2.48 MS; -1694.69 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL X-AXIS ACCELERATION

TRC INC. 30/15 MPH LEFT SIDE IMPACT TEST NUMBER: 951011

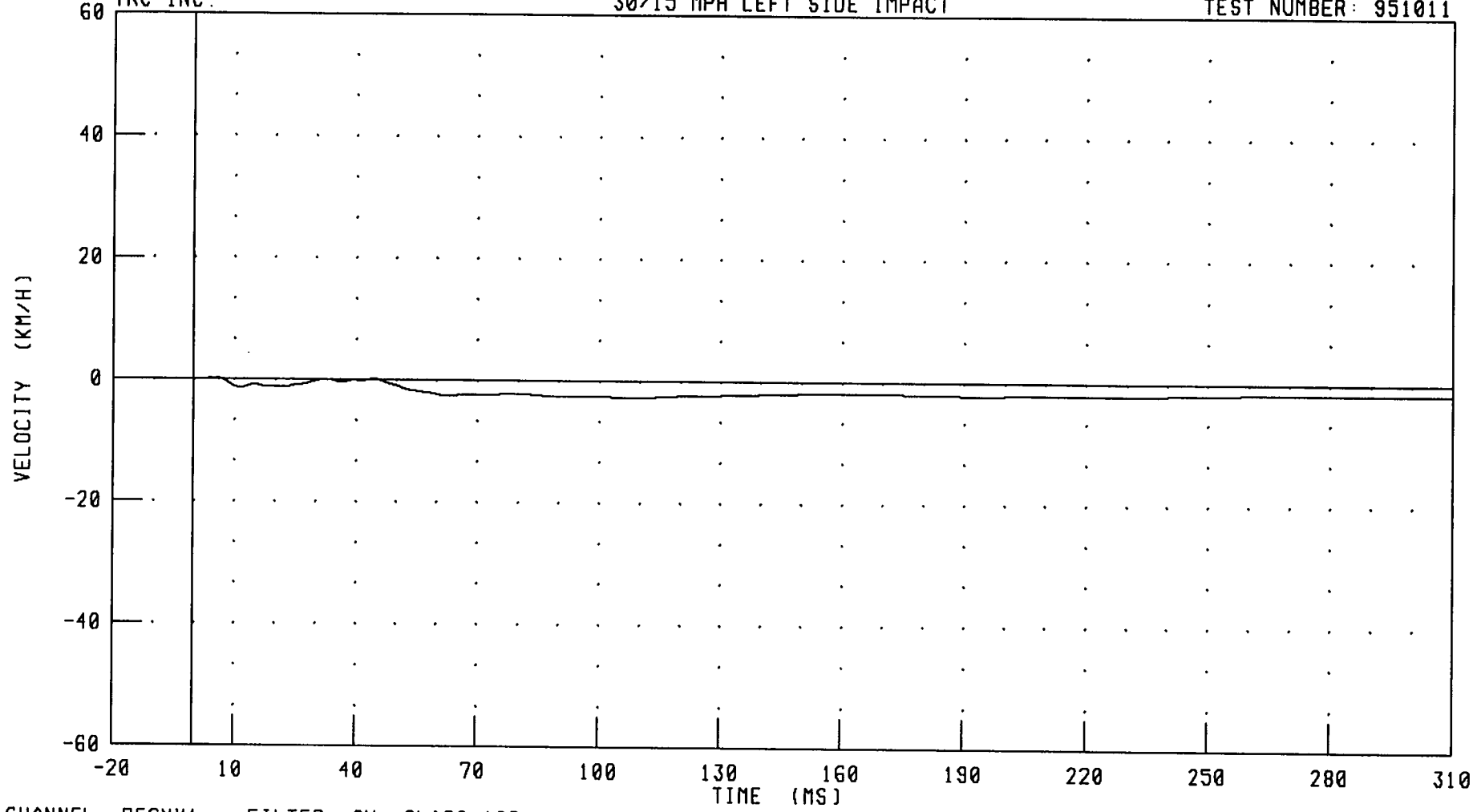


CHANNEL: RFSXG1 FILTER: CH. CLASS 60 PEAK DATA: 4.66 G @ 28.88 MS; -9.22 G @ 8.48 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL X-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT

TRC INC.

TEST NUMBER: 951011

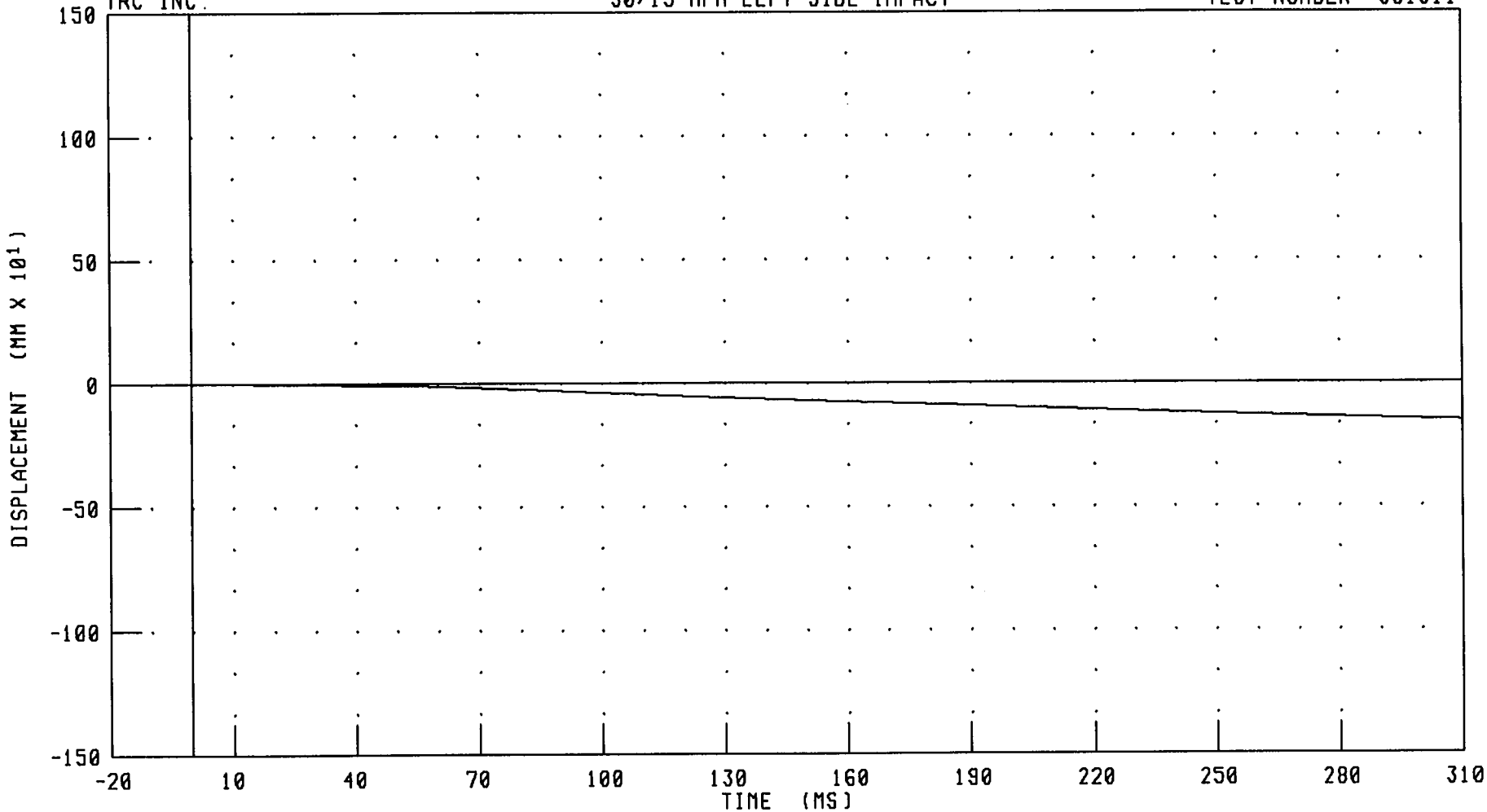


CHANNEL: RFSXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.18 KM/H @ 5.44 MS; -2.72 KM/H @ 107.28 MS

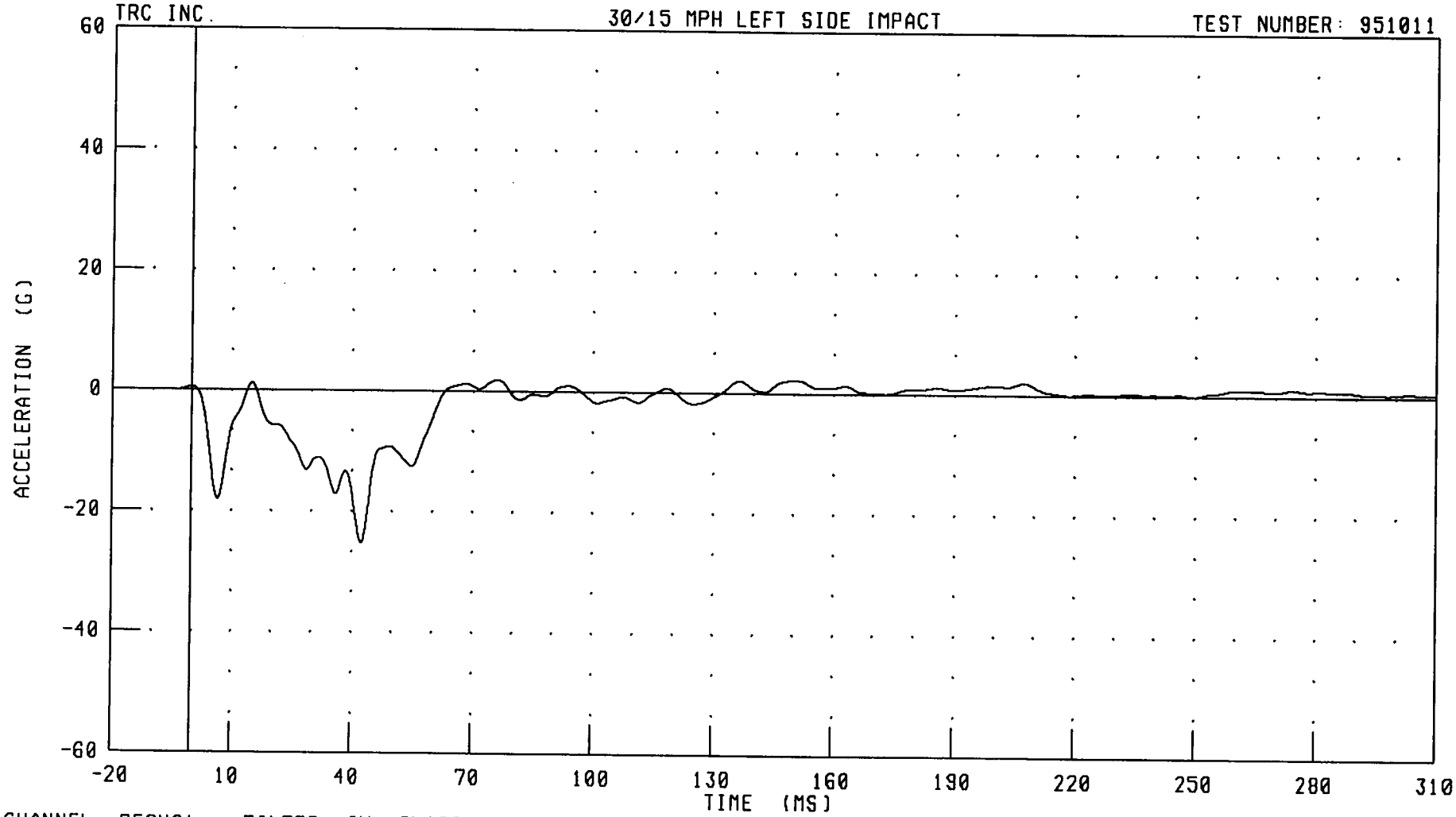
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL X-AXIS DISPLACEMENT

TRC INC. 30/15 MPH LEFT SIDE IMPACT TEST NUMBER: 951011



CHANNEL: RFSXD1 FILTER: CH. CLASS 180 PEAK DATA: 0.14 MM @ 6.96 MS; -154.58 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL Y-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT



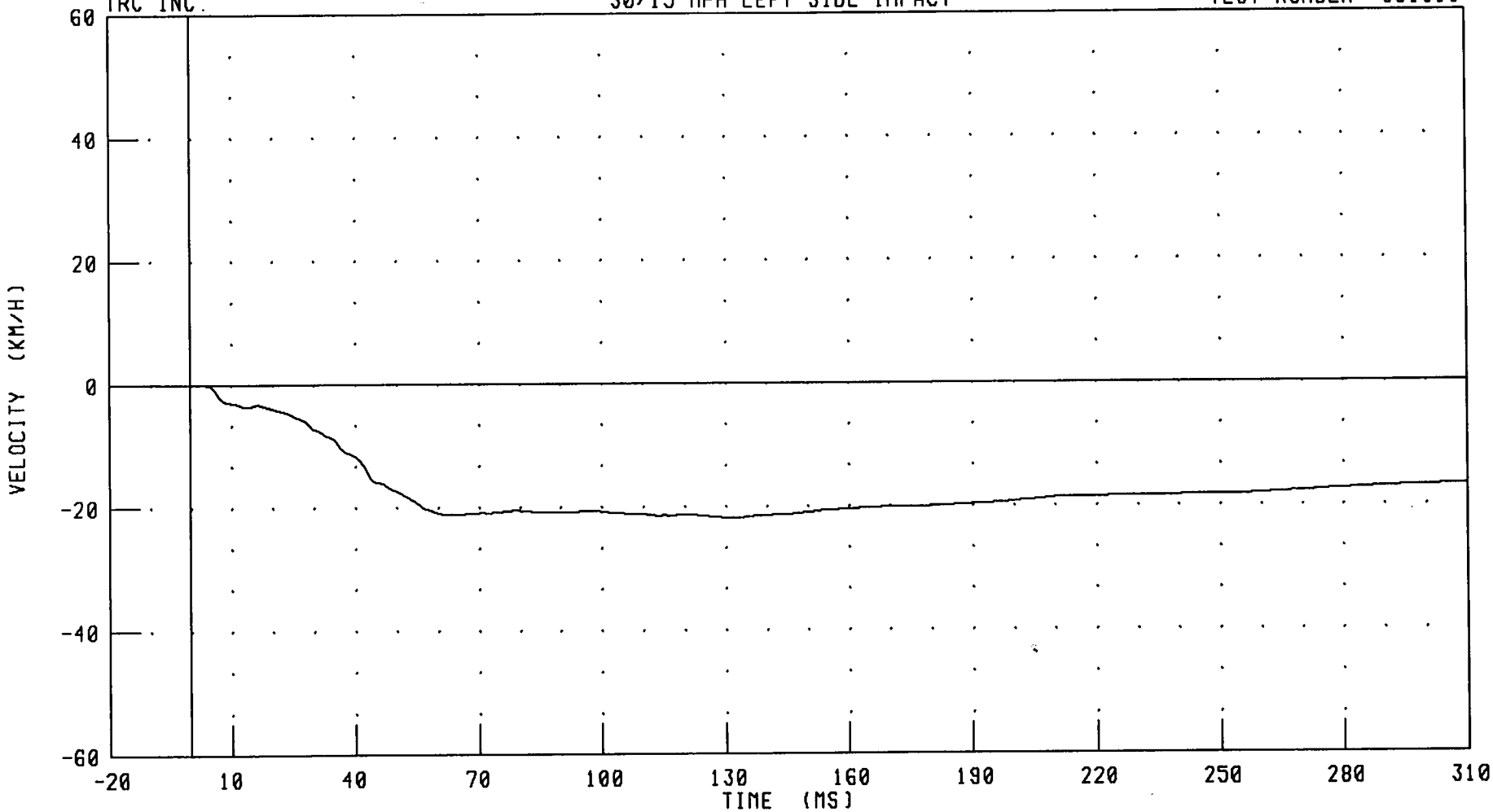
CHANNEL: RFSYG1 FILTER: CH. CLASS 60

PEAK DATA: 2.27 G @ 150.40 MS; -25.18 G @ 42.48 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL Y-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT

TRC INC.

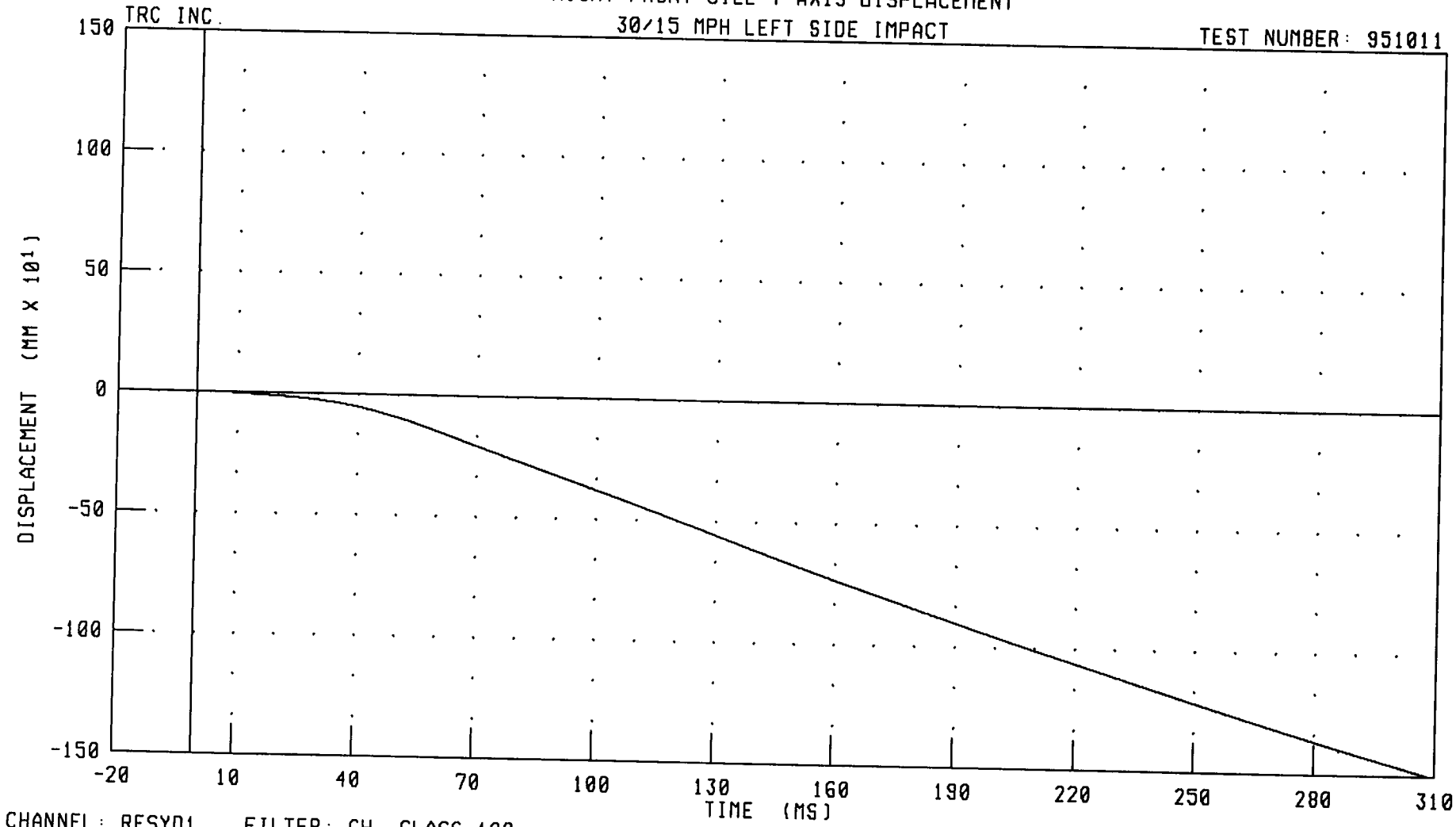
TEST NUMBER: 951011



CHANNEL: RFSYV1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 KM/H @ 1.44 MS; -21.81 KM/H @ 133.12 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
RIGHT FRONT SILL Y-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT



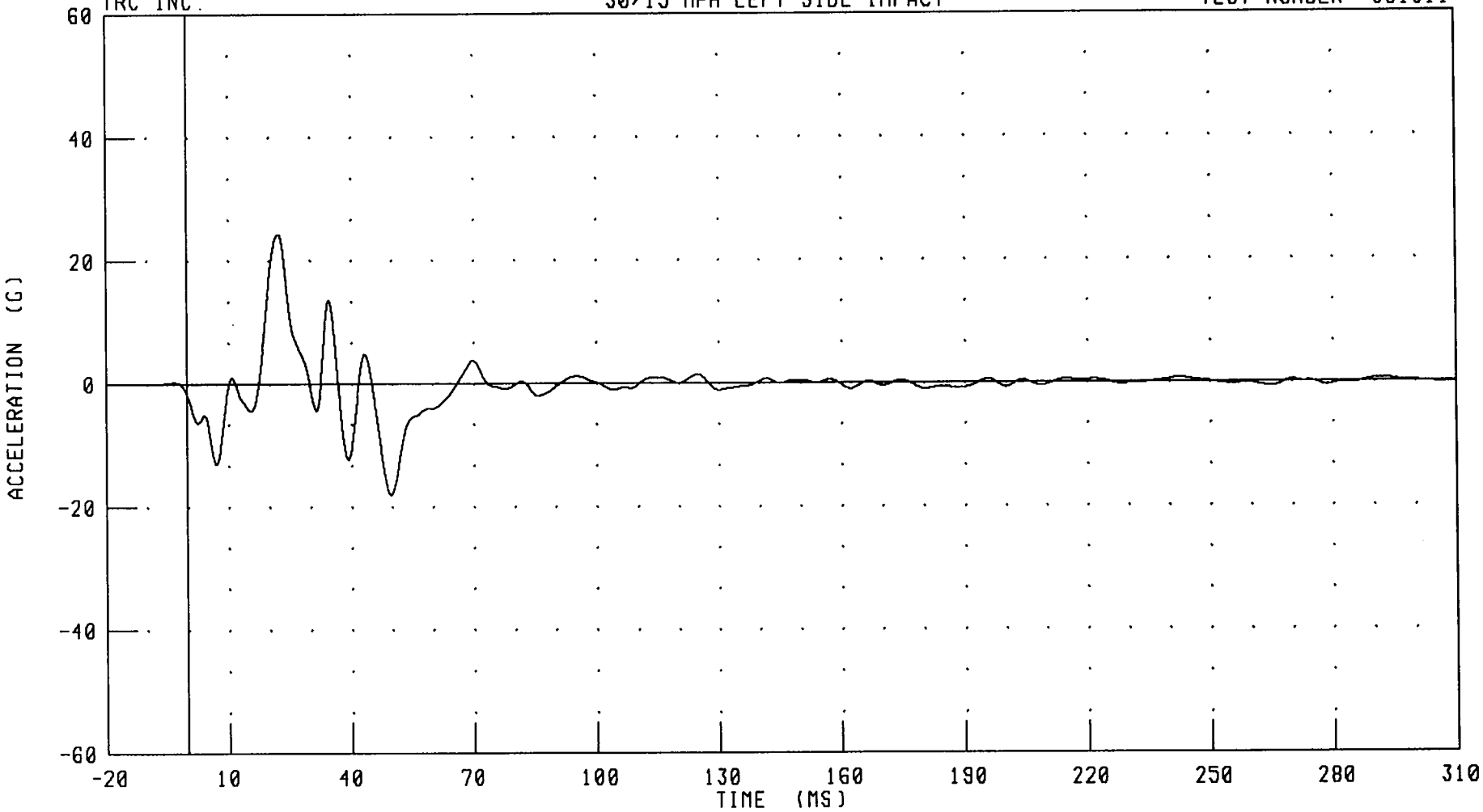
CHANNEL: RFSYD1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 MM @ 1.68 MS; -1505.36 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER X-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

TRC INC.

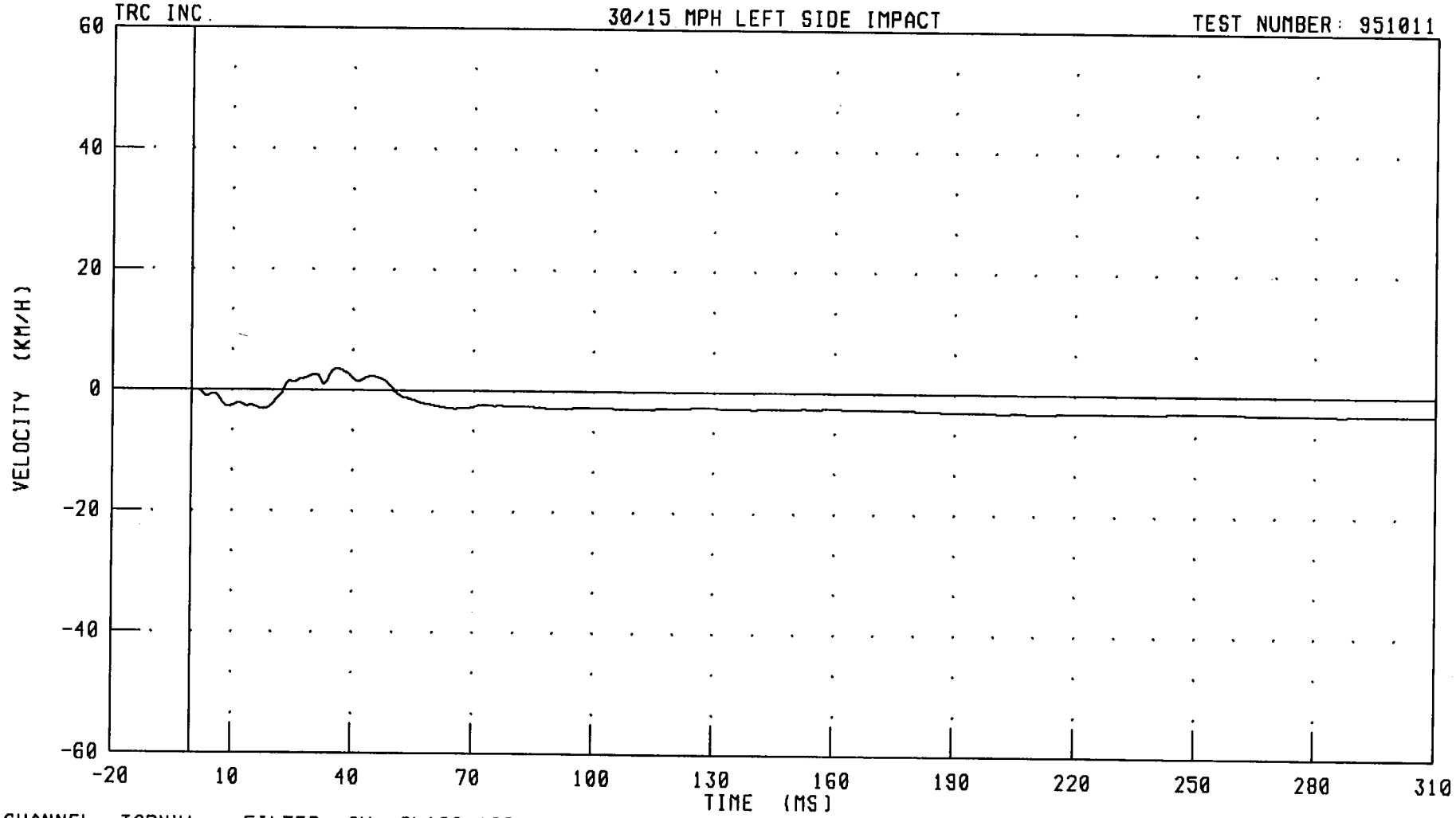
TEST NUMBER: 951011



CHANNEL: TCRXG1 FILTER: CH. CLASS 60

PEAK DATA: 24.31 G @ 22.32 MS; -18.03 G @ 49.76 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER X-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



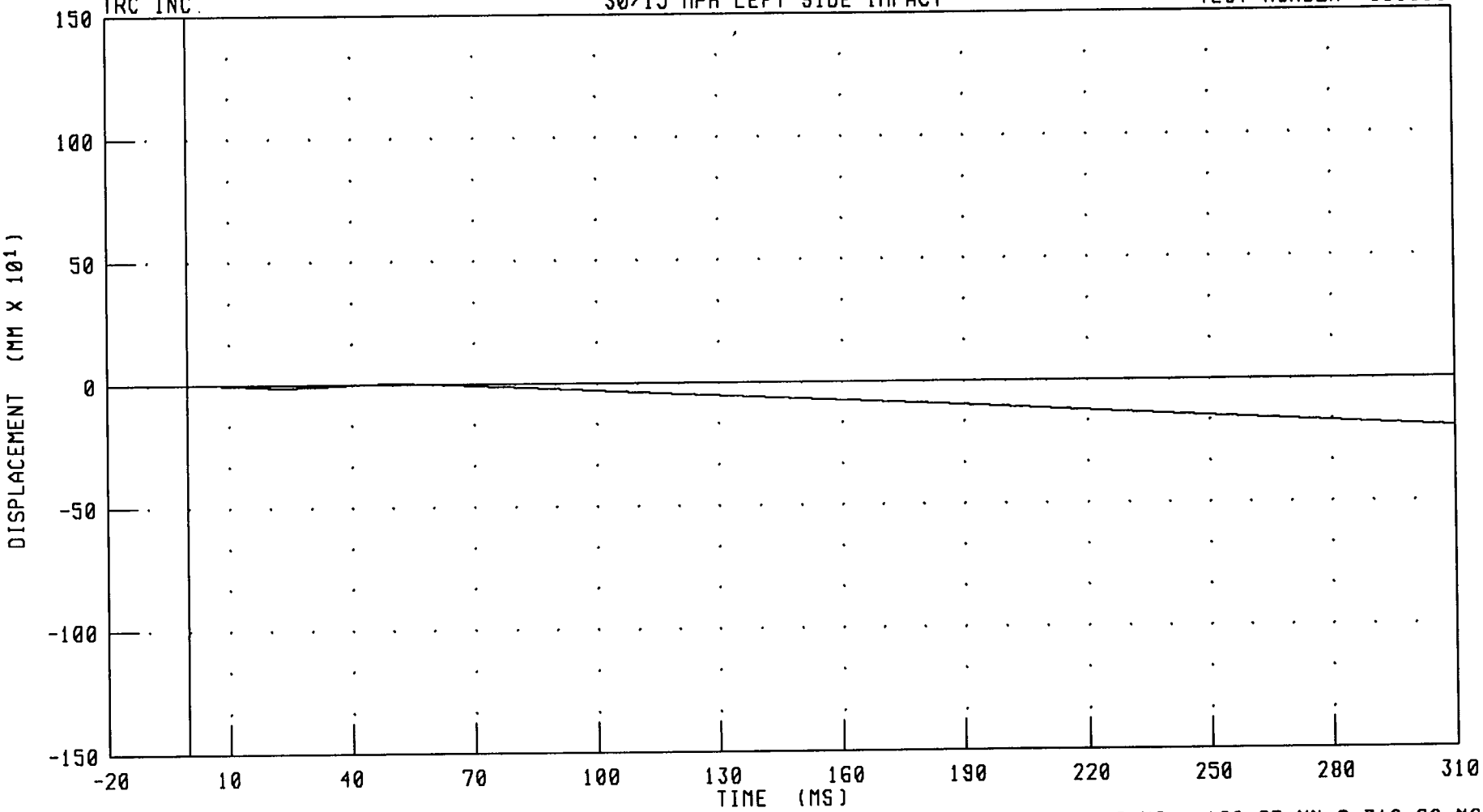
CHANNEL: TCRXV1 FILTER: CH. CLASS 180

PEAK DATA: 3.59 KM/H @ 36.24 MS; -3.19 KM/H @ 211.52 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER X-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

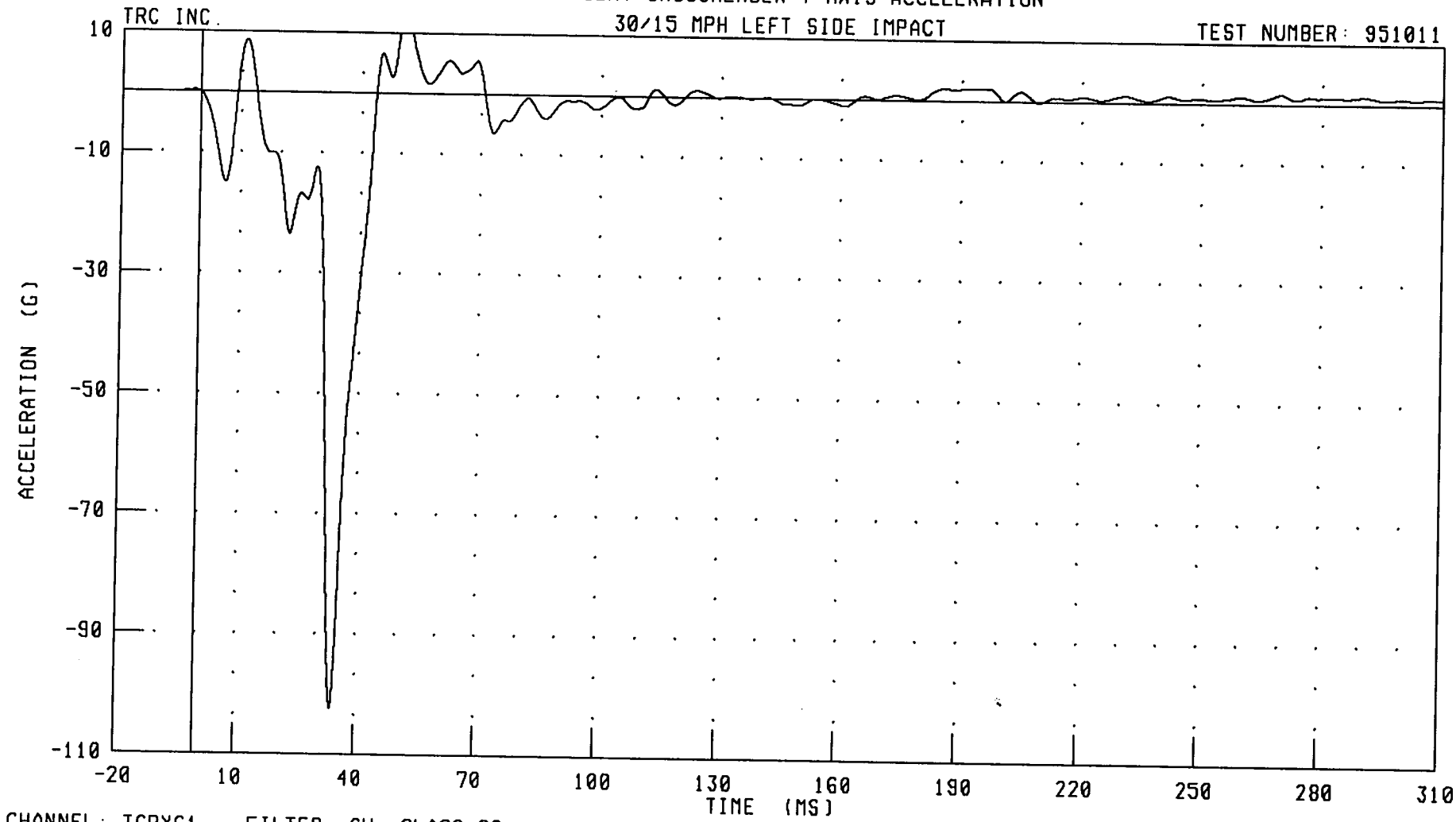
TEST NUMBER: 951011



CHANNEL: TCRXD1 FILTER: CH. CLASS 180

PEAK DATA: 3.82 MM @ 50.40 MS; -198.85 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER Y-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT



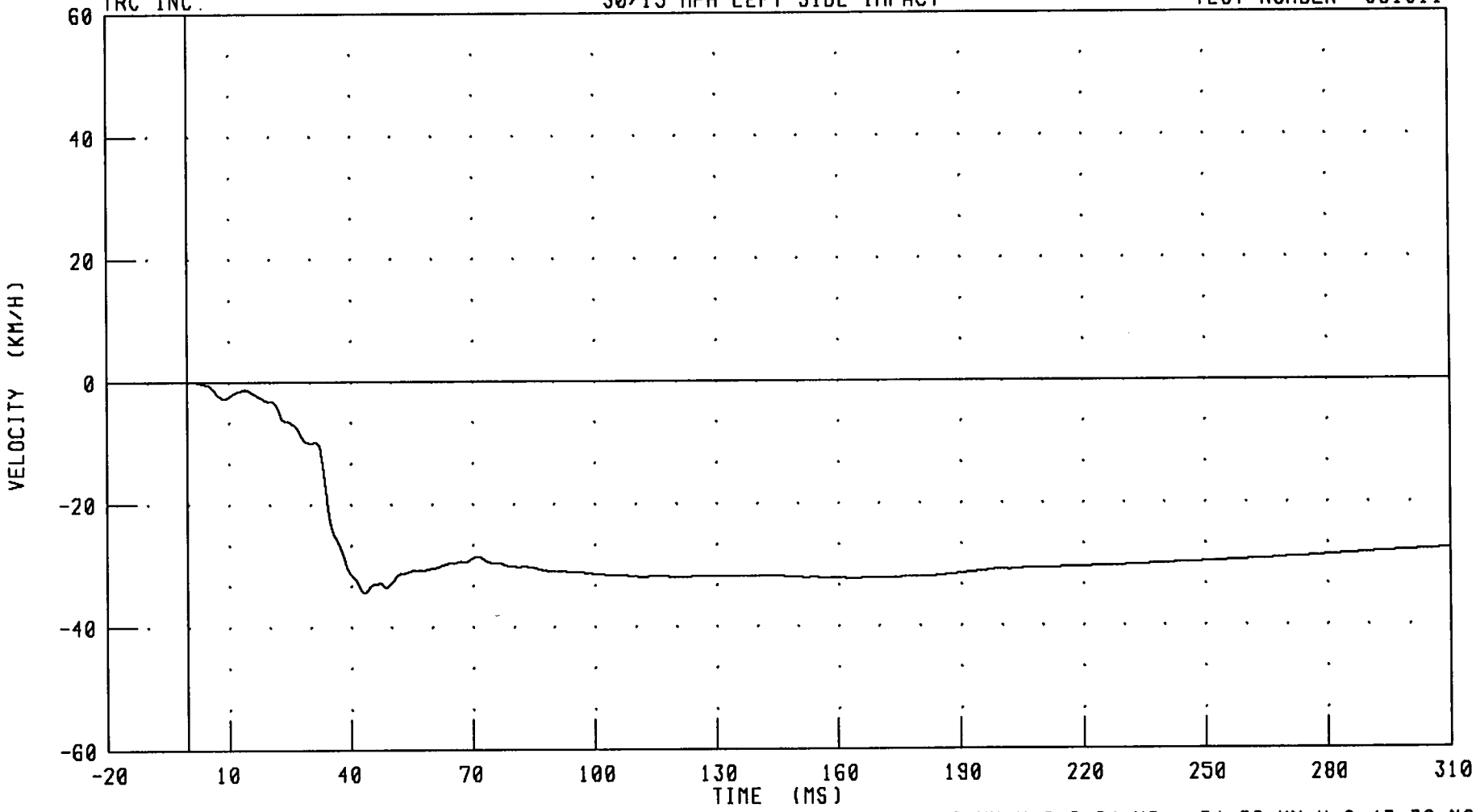
CHANNEL: TCRYG1 FILTER: CH. CLASS 60

PEAK DATA: 13.67 G @ 50.96 MS; -102.33 G @ 34.08 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER Y-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT

TRC INC.

TEST NUMBER: 951011



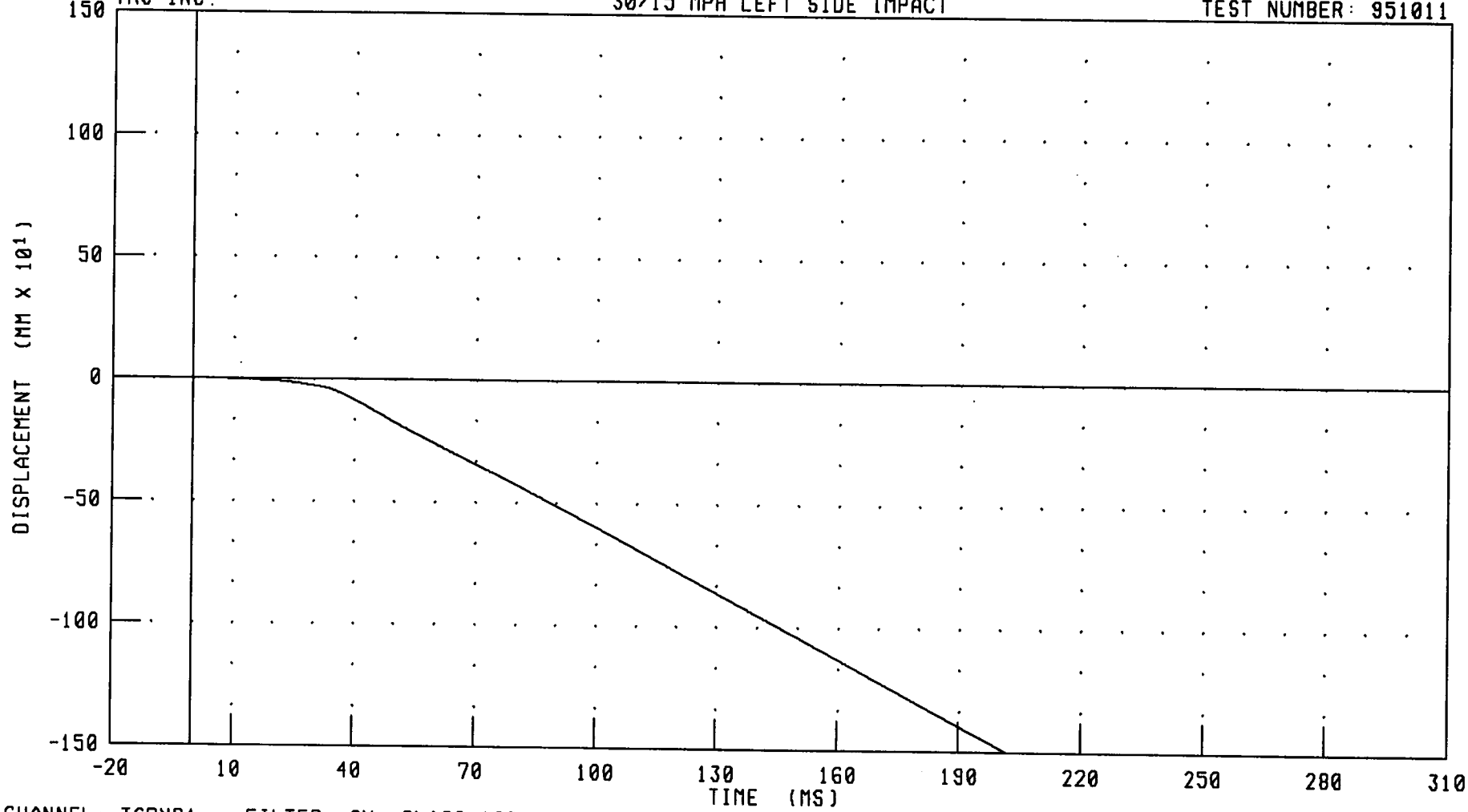
CHANNEL: TCRYV1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 KM/H @ 0.64 MS; -34.38 KM/H @ 43.36 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
REAR SEAT CROSSMEMBER Y-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

TEST NUMBER: 951011



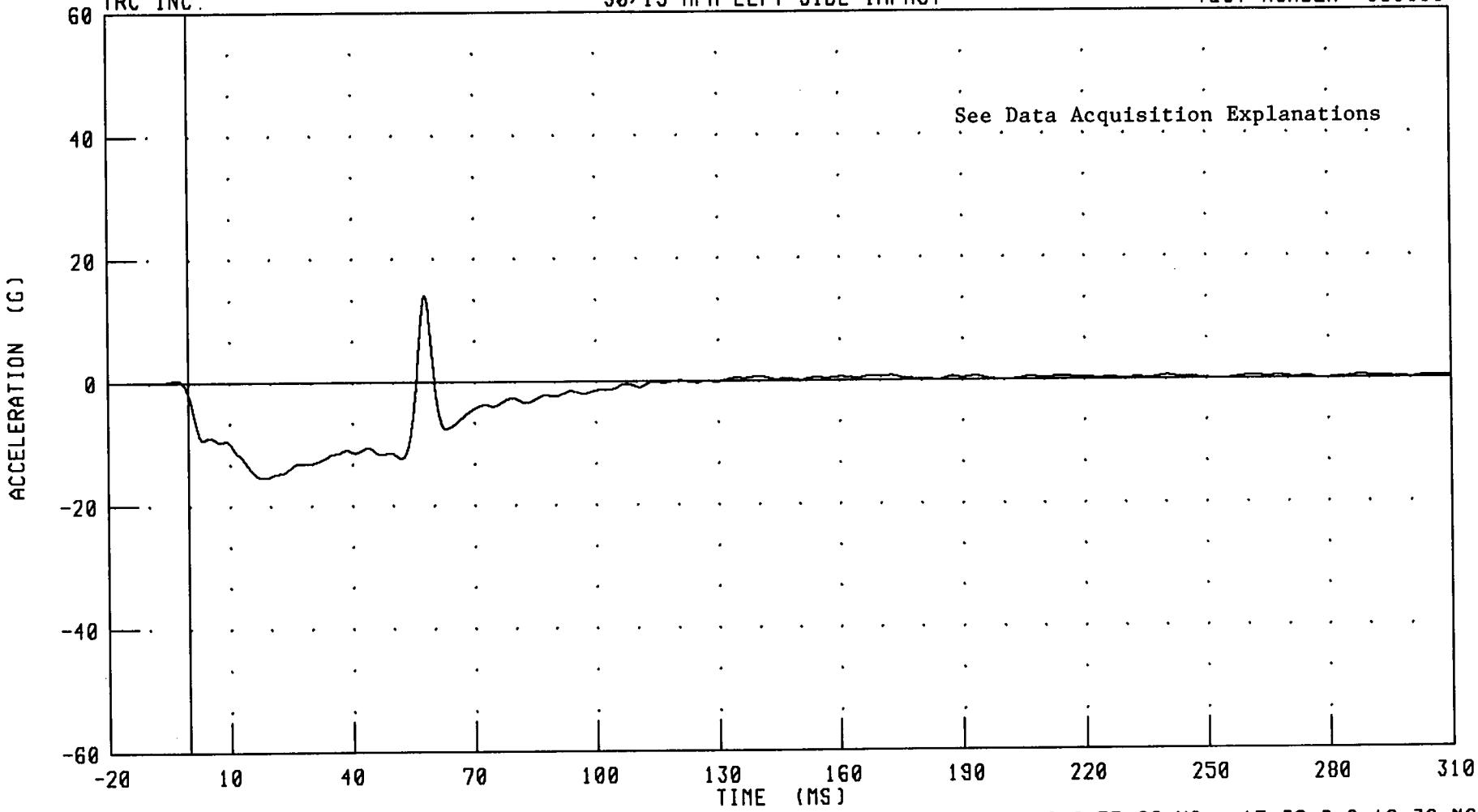
CHANNEL: TCRYD1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 MM @ 1.04 MS; -2381.25 MM @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY X-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

TRC INC.

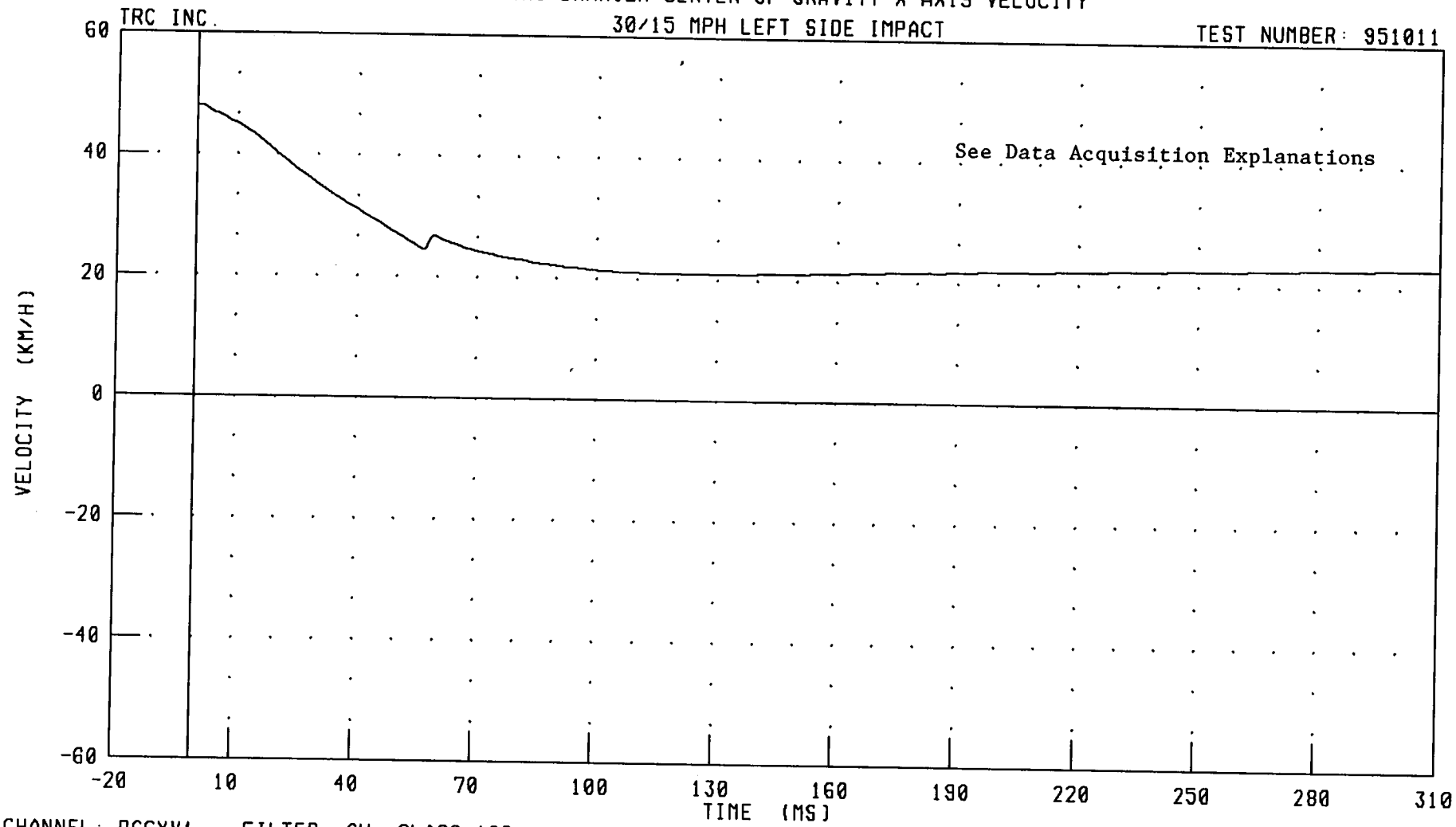
TEST NUMBER: 951011



CHANNEL: BCGXG1 FILTER: CH. CLASS 60

PEAK DATA: 14.07 G @ 57.92 MS; -15.39 G @ 18.32 MS

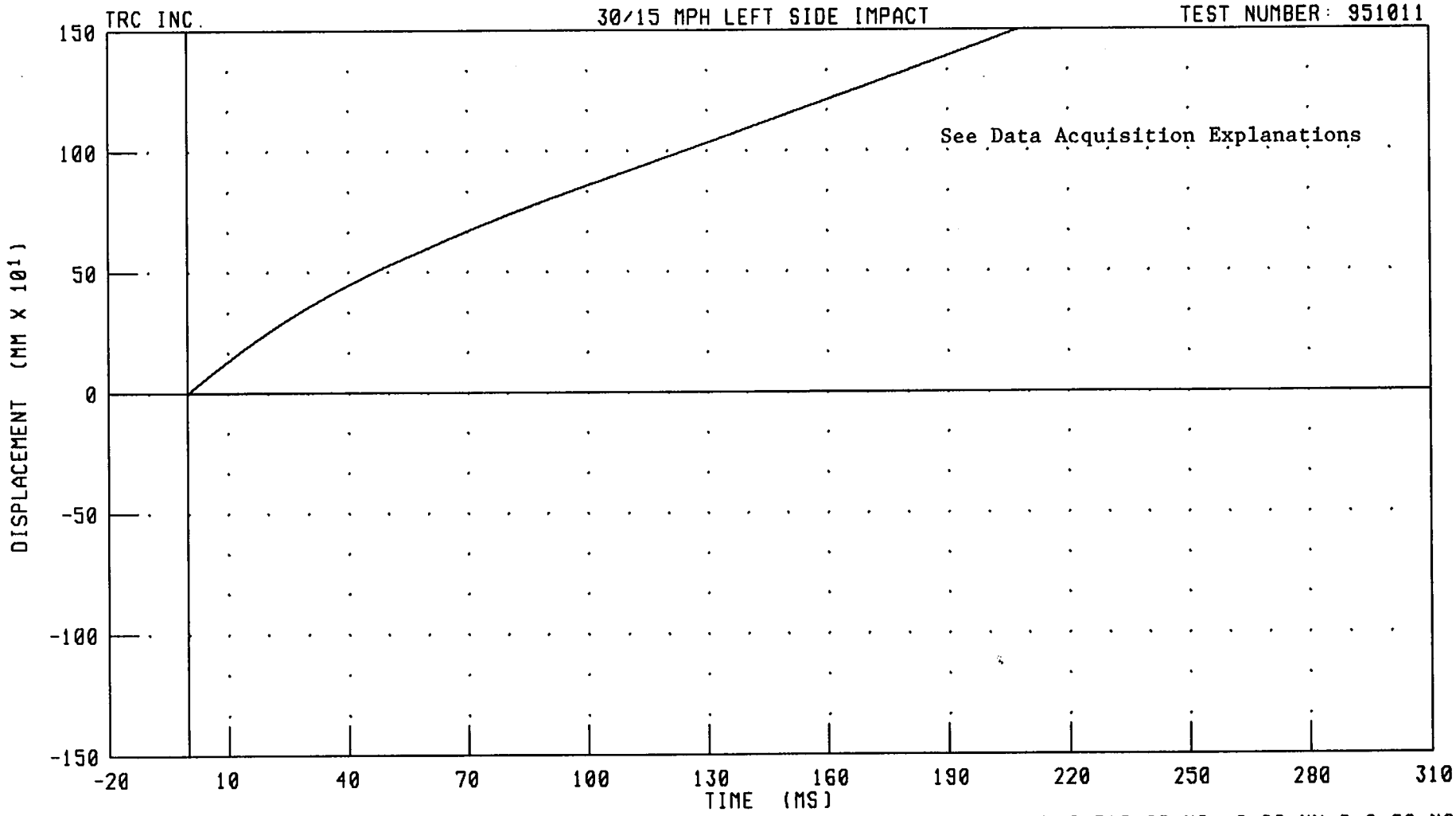
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY X-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



CHANNEL: BCGXV1 FILTER: CH. CLASS 180

PEAK DATA: 48.00 KM/H @ 0.32 MS; 20.94 KM/H @ 126.00 MS

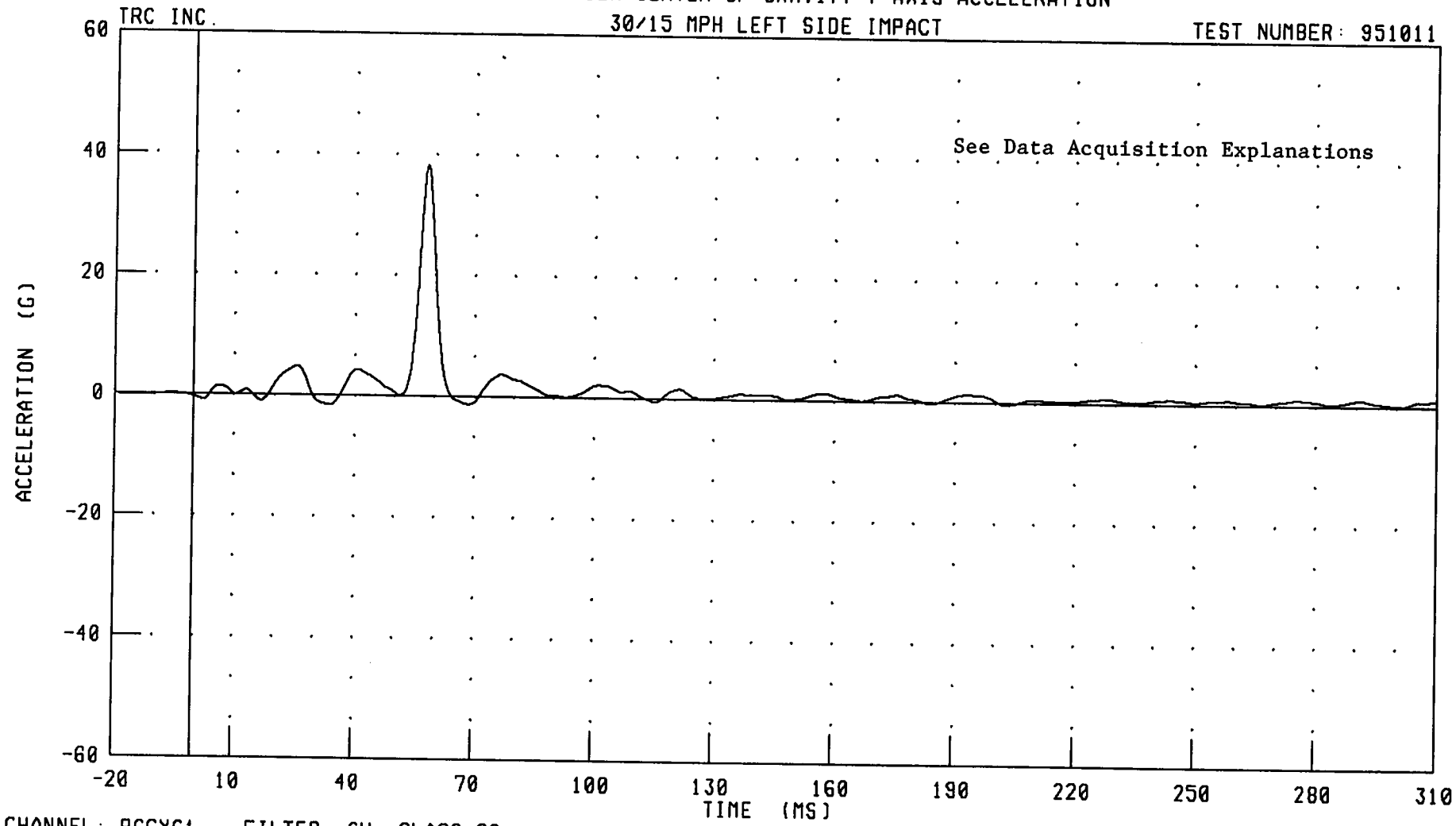
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY X-AXIS DISPLACEMENT



CHANNEL: BCGXD1 FILTER: CH. CLASS 180

PEAK DATA: 2139.27 MM @ 310.00 MS; 0.00 MM @ 0.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Y-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

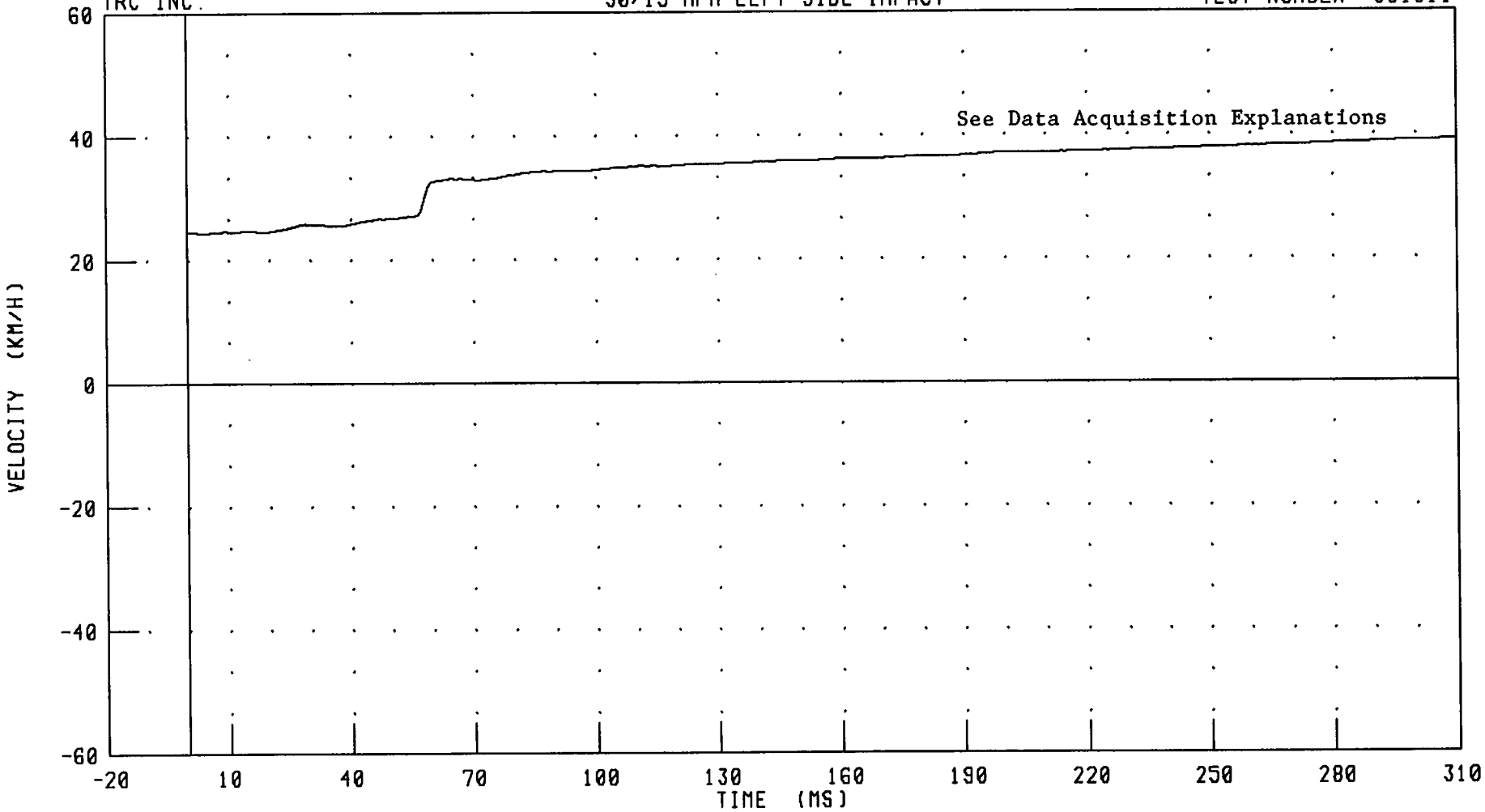


CHANNEL: BCGYG1 FILTER: CH. CLASS 60

PEAK DATA: 38.20 G @ 58.08 MS; -1.59 G @ 33.92 MS

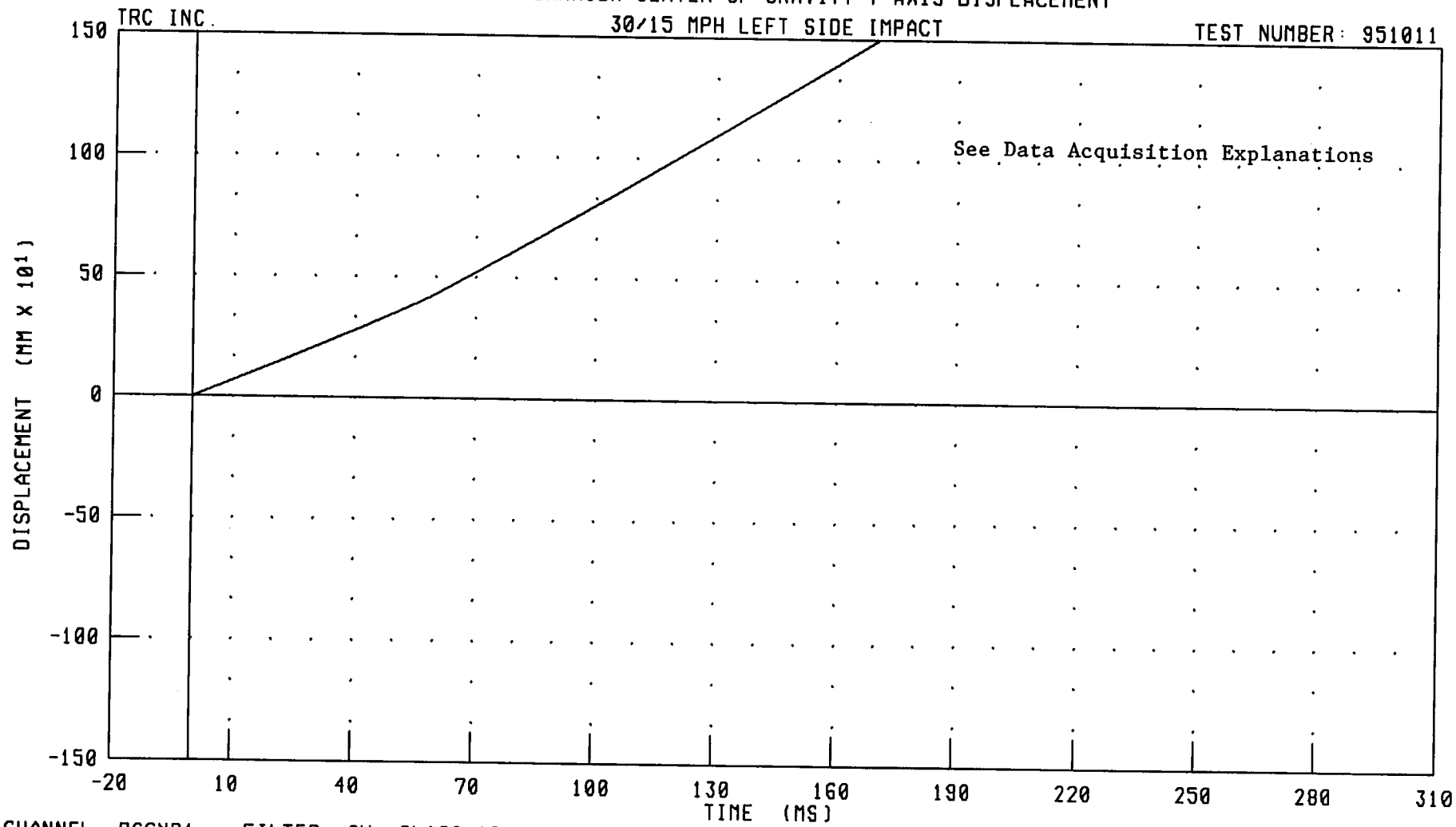
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Y-AXIS VELOCITY

TRC INC. 30/15 MPH LEFT SIDE IMPACT TEST NUMBER: 951011



CHANNEL: BCGYV1 FILTER: CH. CLASS 180 PEAK DATA: 39.17 KM/H @ 310.00 MS; 24.33 KM/H @ 3.92 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Y-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT



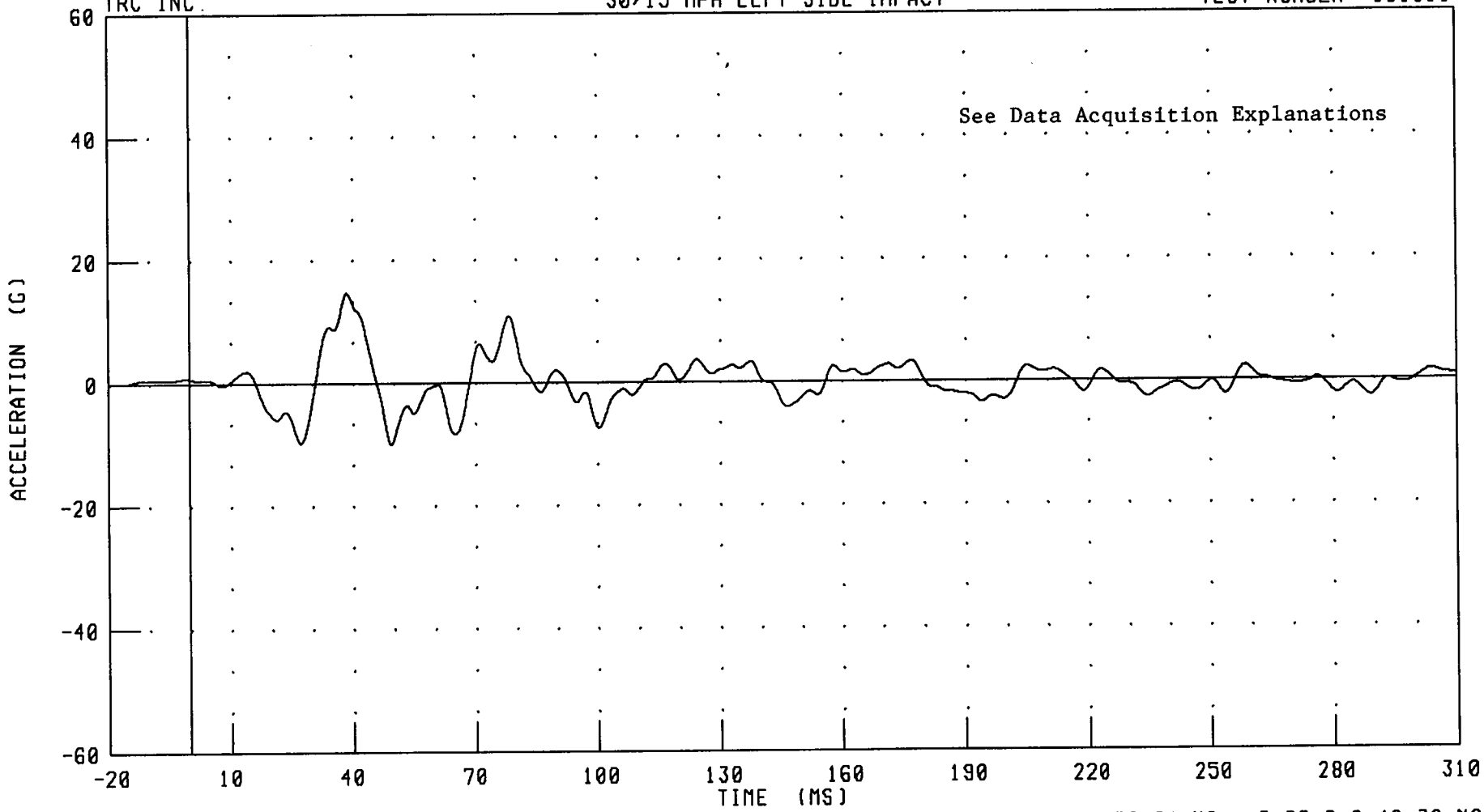
CHANNEL: BCGYD1 FILTER: CH. CLASS 180

PEAK DATA: 2962.36 MM @ 310.00 MS; 0.00 MM @ 0.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Z-AXIS ACCELERATION
30/15 MPH LEFT SIDE IMPACT

TRC INC.

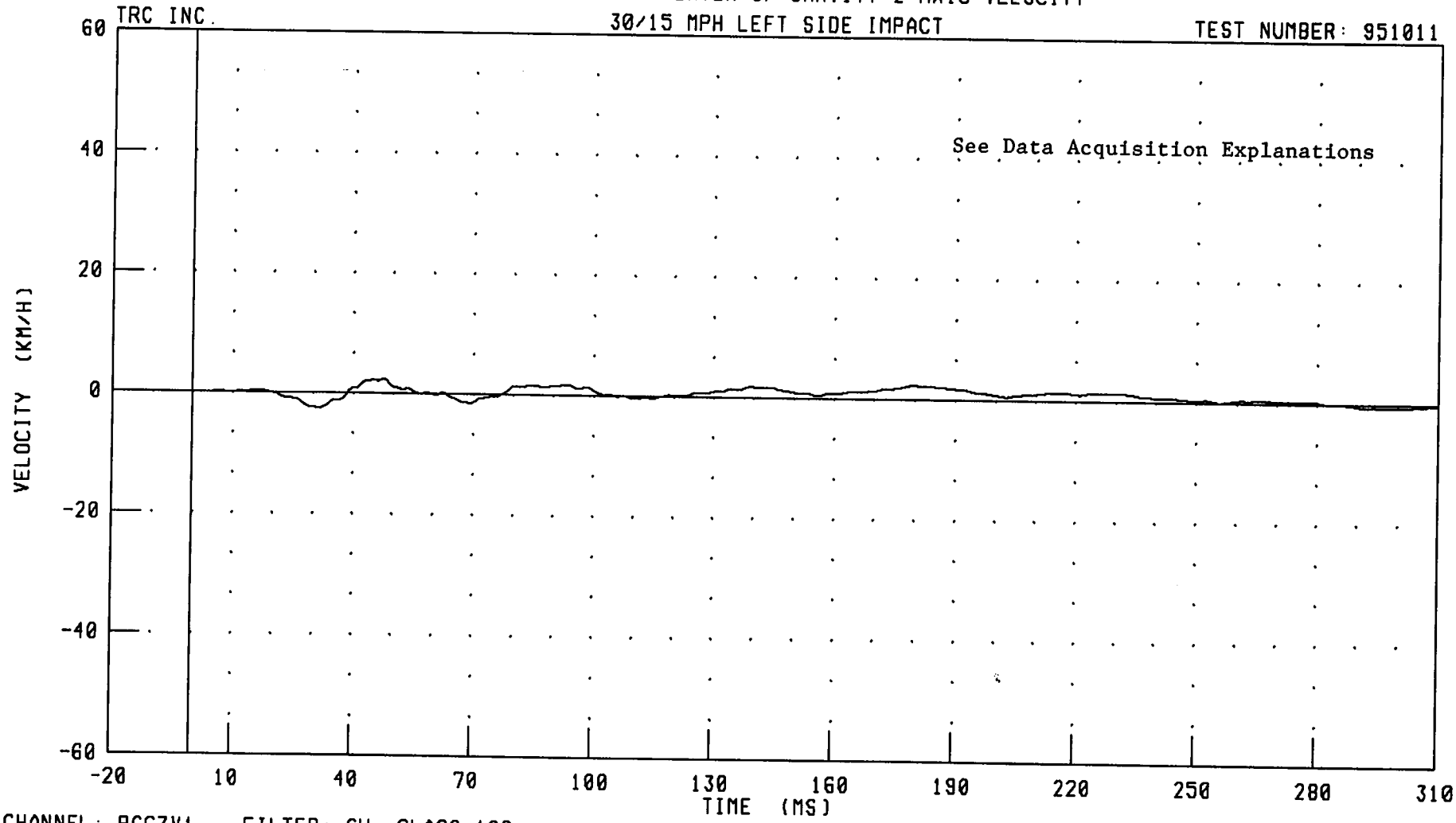
TEST NUMBER: 951011



CHANNEL: BCGZG1 FILTER: CH. CLASS 60

PEAK DATA: 14.70 G @ 38.64 MS; -9.96 G @ 49.36 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Z-AXIS VELOCITY
30/15 MPH LEFT SIDE IMPACT



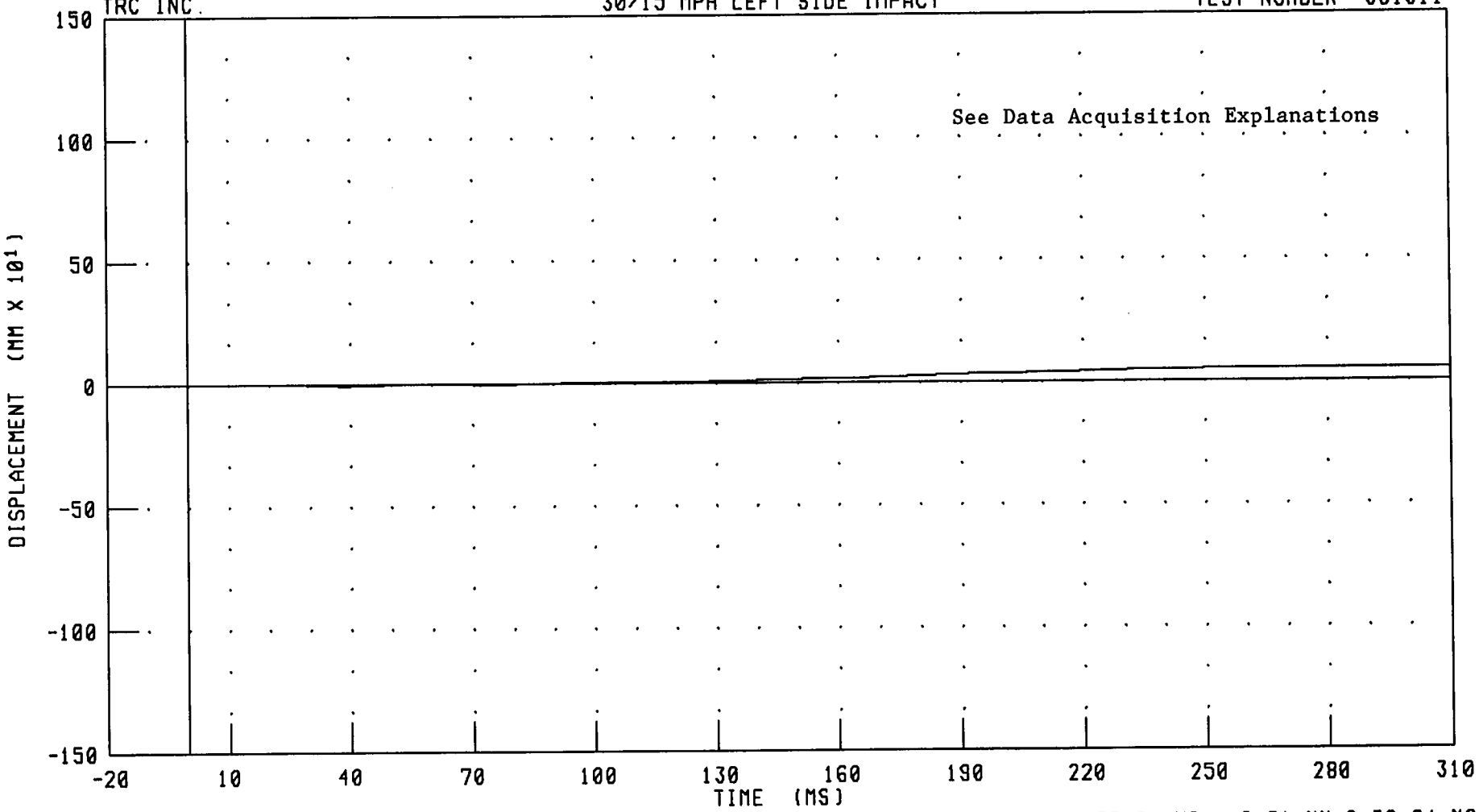
CHANNEL: BCGZV1 FILTER: CH. CLASS 180

PEAK DATA: 2.33 KM/H @ 179.60 MS; -2.52 KM/H @ 31.36 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY Z-AXIS DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT

TRC INC.

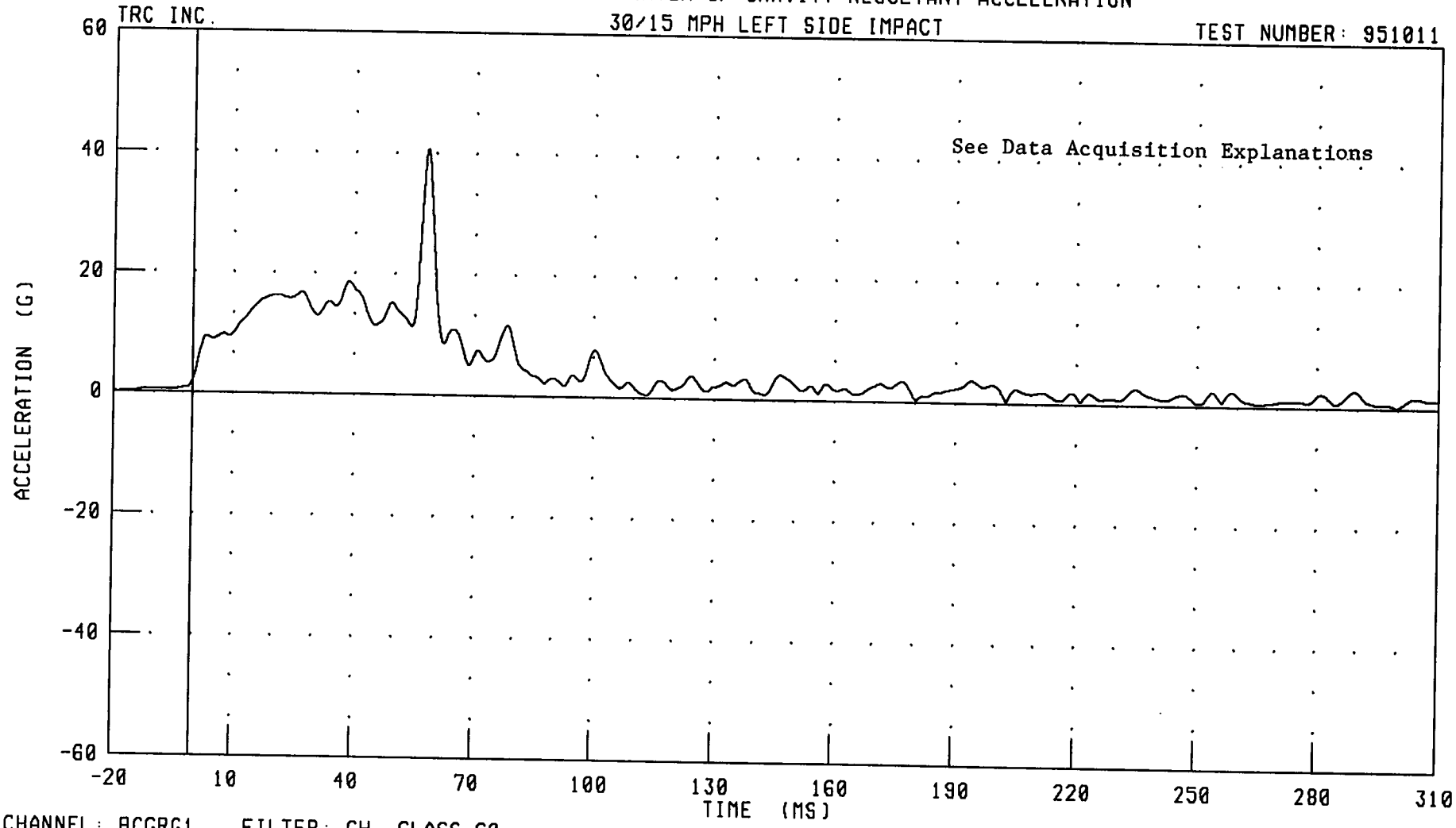
TEST NUMBER: 951011



CHANNEL: BCGZD1 FILTER: CH. CLASS 180

PEAK DATA: 51.86 MM @ 283.04 MS; -6.31 MM @ 38.64 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY RESULTANT ACCELERATION
30/15 MPH LEFT SIDE IMPACT

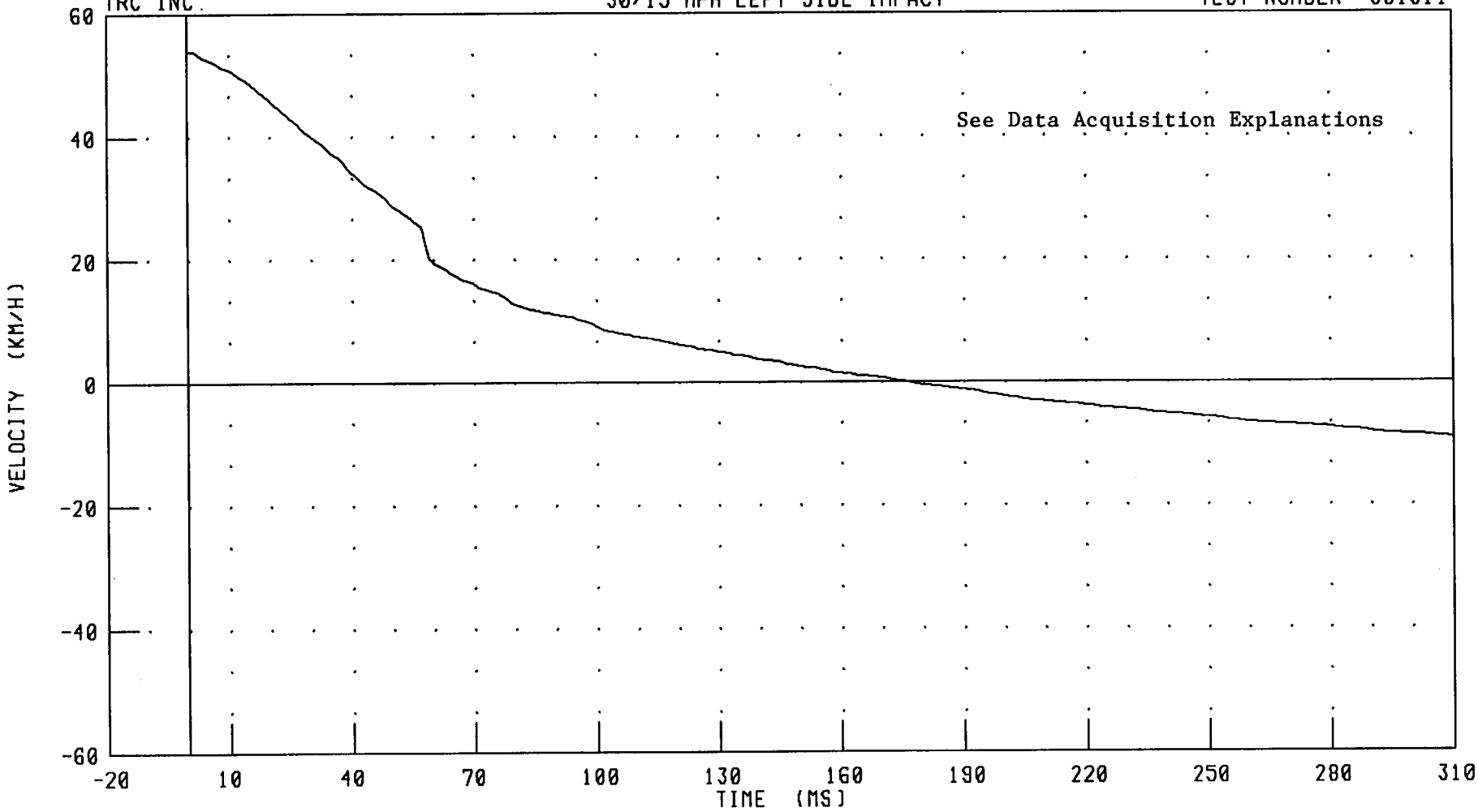


CHANNEL: BCGRG1 FILTER: CH. CLASS 60

PEAK DATA: 40.69 G @ 58.08 MS; 0.07 G @ -19.12 MS

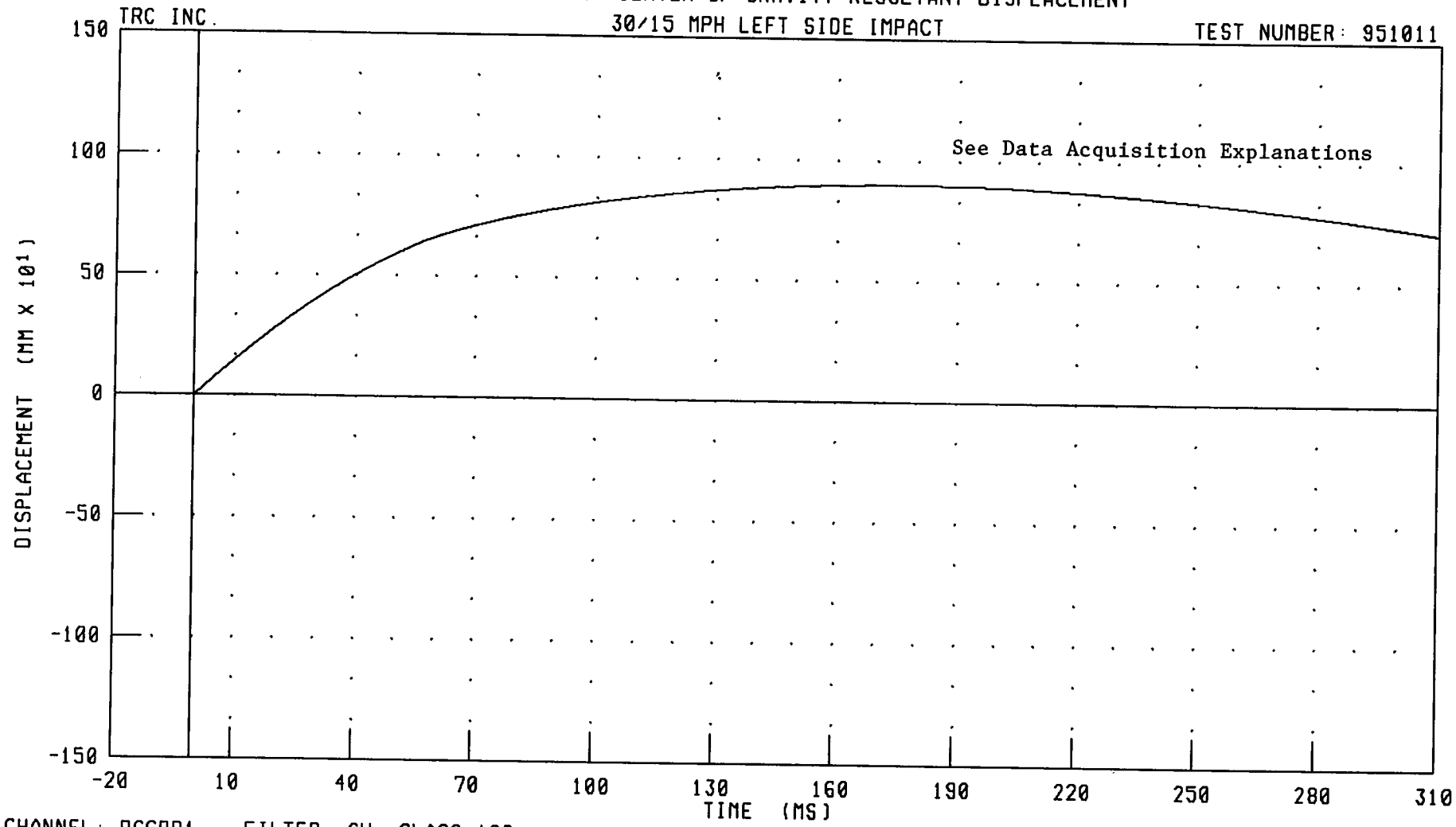
MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY RESULTANT VELOCITY

TRC INC. 30/15 MPH LEFT SIDE IMPACT TEST NUMBER: 951011



CHANNEL: BCGRV1 FILTER: CH. CLASS 180 PEAK DATA: 53.90 KM/H @ 0.00 MS; -9.10 KM/H @ 310.00 MS

MOVING CONTOURED BARRIER INTO LEFT SIDE OF 1992 CHEVROLET CAPRICE
MOVING BARRIER CENTER OF GRAVITY RESULTANT DISPLACEMENT
30/15 MPH LEFT SIDE IMPACT



CHANNEL: BCGRD1 FILTER: CH. CLASS 180

PEAK DATA: 901.17 MM @ 176.32 MS; 0.00 MM @ 0.00 MS

Appendix C

Miscellaneous Test Information

Vehicle Accelerometer Information

No.	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
1	Vehicle Center of Gravity	X	Endevco	7264	FG17J	Front
		Y	Endevco	7264	CW69H	Right
		Z	Endevco	7264	DR10JT	Up
2	Right Rear Seat	X	Endevco	7264	CH74H	Front
		Y	Endevco	7264	DW58JC	Left
3	Right Rear Sill	X	Endevco	7264	DA99H	Forward
		Y	Endevco	7264	CK01H	Left
4	Right Front Sill	X	Endevco	7264	CG13H	Front
		Y	Endevco	7264	AC8P6	Right

Crabbed Impactor Accelerometer Information

No.	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
1	Impactor Center of Gravity	X	Endevco	7264	ANA36	Front
		Y	Endevco	7264	CK25H	Left
		Z	Endevco	7264	CY78H	Up

Sign Convention

All Dummy, Barrier, And Vehicle Channels:

+X: Forward

+Y: Leftward

+Z: Upward

+Force: Tension