

Dynamic Science Report No. 8321-79-13A

Contract DOT-HS-8-01933

TEST REPORT 2 - SIDE IMPACTOR-
TO-FIXED BARRIER AND CAR
TESTS 8321-4.02 AND 8321-4.2

(162)
DOT

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TEST REPORT
April 1979

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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Washington, D.C. 20590

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TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract A series of seven full-scale Side Impactor-to-car crash tests will be conducted as required under Task 4 of DOT-HS-8-01933, "Test Device and Test Procedure to Assess Side Structures." This program is sponsored by the National Highway Traffic Safety Administration. This test report presents the results of Test No. 8321-4.2, a 60° Side Impactor-to-car collision. The bullet vehicle was the NHTSA Side Impactor, the target vehicle was a 1976 VW Rabbit 2-door sedan. Also included in this report are the results of Test 8321-4.02, a crash test of the Side Impactor to a fixed barrier at 30°. The object of these tests was to gather and provide data necessary to design a frontal honeycomb face representative of the characteristics of a 50th percentile 1978 automobile when involved in 60° and 90° front-to-side impact crashes with other vehicles.			
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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

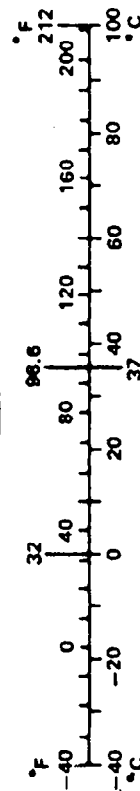


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1.0 INTRODUCTION

A series of seven full-scale Side Impactor-to-car crash tests is to be conducted as required under Task 4 of DOT-HS-8-01933, "Test Device and Test Procedure to Assess Side Structures." This program is sponsored by the National Highway Traffic Safety Administration. This test report presents the results of Test No. 8321-4.2, a 60-degree, Side Impactor-to-car side collision. The bullet vehicle was the NHTSA Side Impactor. The target vehicle was a 1976 V.W. Rabbit two-door sedan. Also included in this report are the results of Test 8321-4.02, a crash test of the Side Impactor into a fixed barrier at 30 degrees (Figure 1-1). The DSL 1172-4 honeycomb face was used in Test 4.02, and DSL 1172-5, in Test 4.2.

1.1 SIDE IMPACTOR-TO-FIXED BARRIER CHECKOUT TEST 8321-4.02

1.1.1 Test Objective

The objective of this test was to evaluate the performance of the selected Energy-Absorbing honeycomb configuration. Data obtained was evaluated and compared with the required data/deflection characteristic.

1.1.2 Test Scope

Dynamic crash evaluation of the side impact Test Device provided data to determine force/deflection characteristics for the Energy-Absorbing honeycomb. For the conduct of this test, the Side Impactor was instrumented with accelerometers mounted at the locations indicated in Figure 1-2. A summary of test conditions for the Side Impactor-to-fixed barrier checkout is shown in Table 1-1.

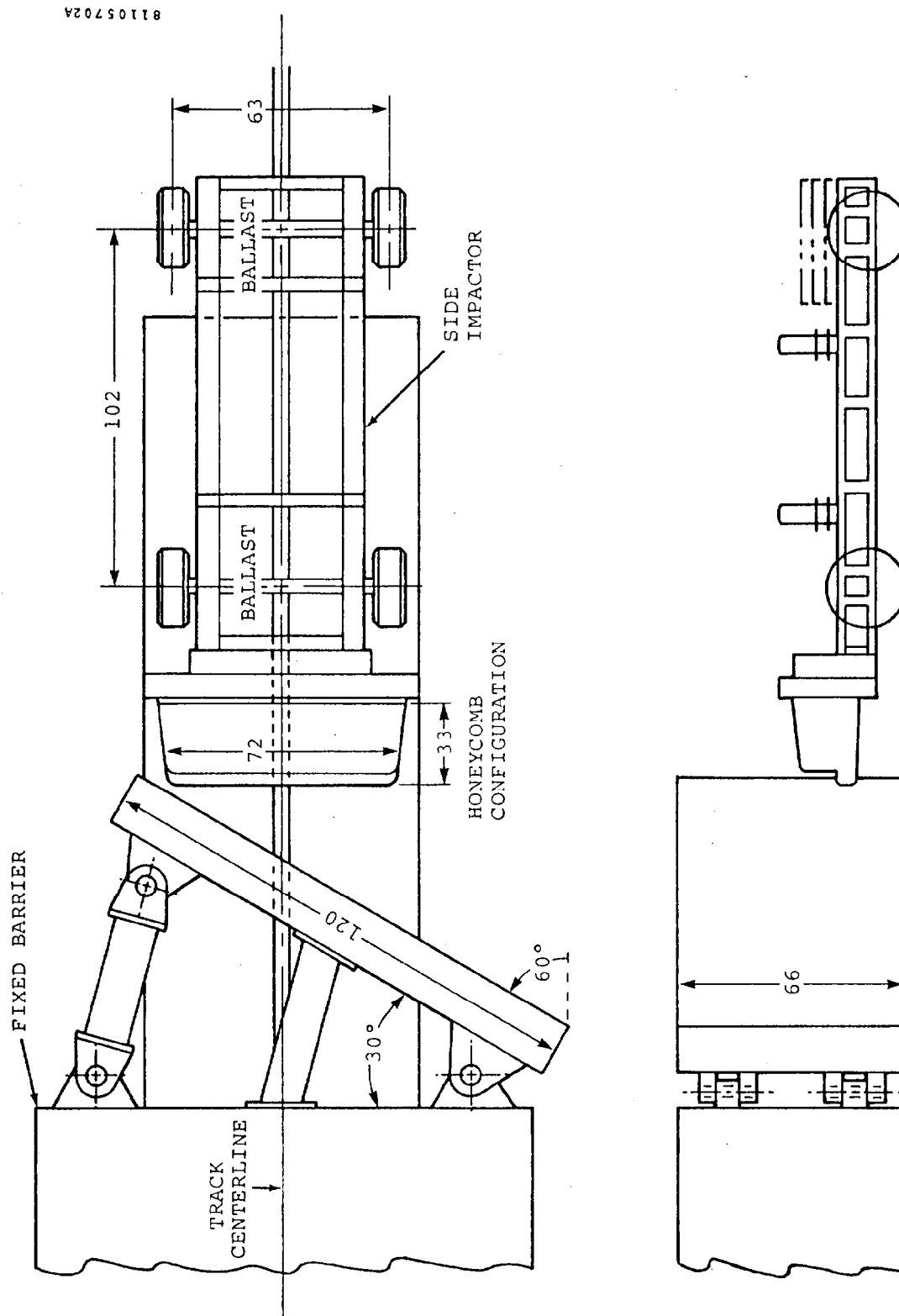


Figure 1-1. Side Impactor-to-Angled Barrier Checkout Configuration Test 4.02 - (60° Right Side).

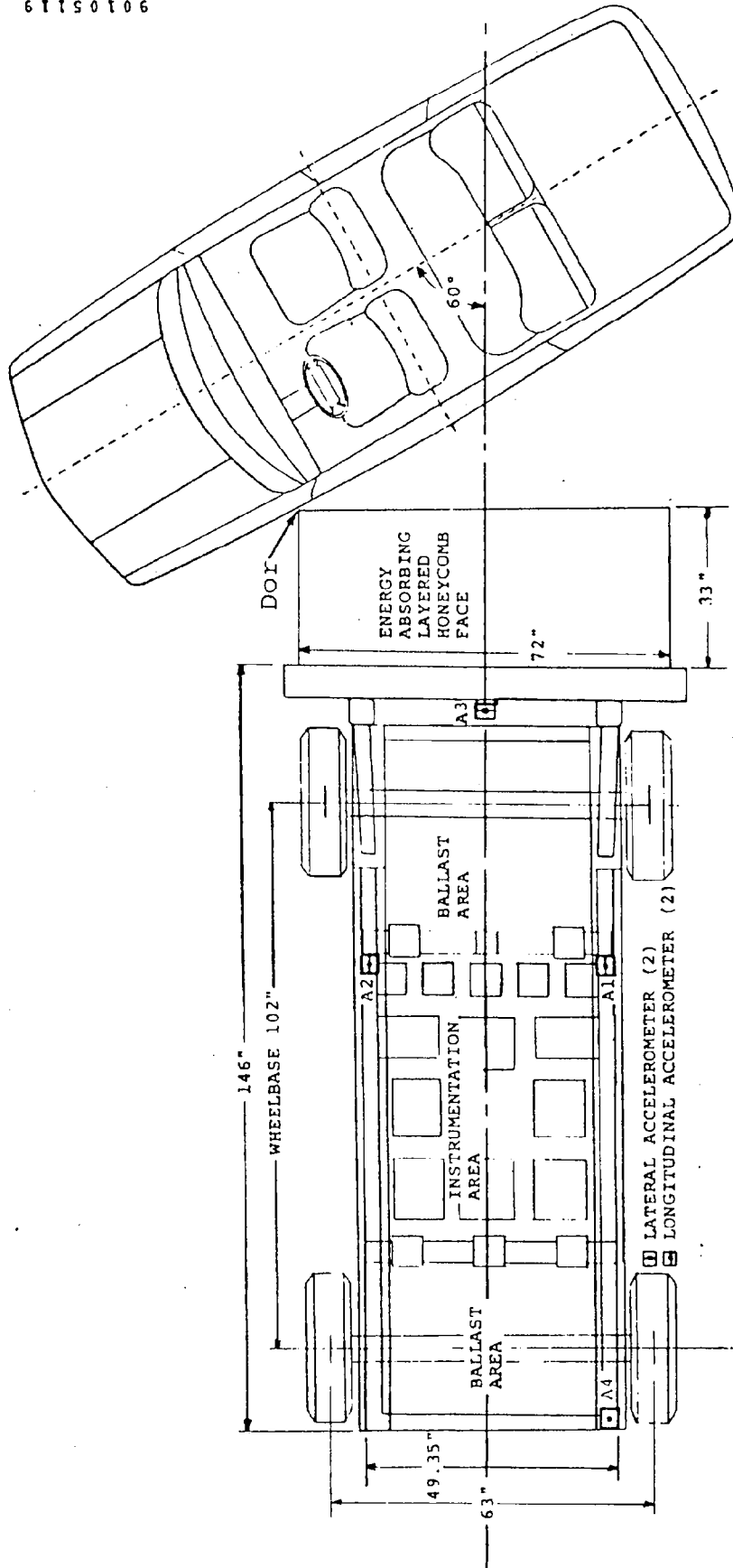


Figure 1-2. Side Impactor-to-Car at 60°.

TABLE 1-1. SUMMARY OF SIDE IMPACTOR-TO-FIXED BARRIER
TEST CONDITIONS - 8321

Test No.	Date	Test Conditions	Test Weight (lb)	Closing Velocity (mph)
4.01	11/29/78	30° right side impact with DSL 1172-2 Honey- comb E/A Face	3,817	20.54
4.02	12/22/78	30° right side impact with DSL 1172-4 E/A Face	3,630	19.69

1.2 SIDE IMPACTOR-TO-RABBIT TEST 8321-4.2

1.2.1 Test Objective

The objective of this test was to gather and provide the necessary data to evaluate the Energy-Absorbing Face characteristics of the Side Impactor in an actual car side crash. The primary purpose was to evaluate the frontal geometric shape and load/deflection characteristics which were selected to be representative of the crash characteristics of a generic 50th percentile 1978 automobile when involved in a 60-degree, front-to-side impact with the NHTSA-selected vehicle (1976 VW Rabbit).

The positioning of the test vehicle and the Side Impactor for the 60-degree impact is shown in Figure 1-2, where initial impact is at the Door Opening Reference Point (see SAE J972a).

1.2.2 Test Scope

Dynamic crush evaluation of the Side Impactor provided data to evaluate the Energy-Absorbing Face configuration and force/deflection characteristics. Two instrumented Part 572 Alderson anthropomorphic dummies were in the two left seating positions (one in front and one in the rear) of the target vehicle. Each occupant was unrestrained. The seat tracks were welded in their midrange position to prevent breakaway from the seat tracks. The test matrix and a summary of test conditions for the moving (frontal) Side Impactor-to-side of stationary car collisions planned for Phase I are shown in Table 1-2.

1.3 E/A FACE SPECIFICATIONS

The honeycomb crushing strength specifications and the fabrication details for the Side Impactor energy-absorbing faces are presented in Appendices C and D for Tests 4.02 and 4.2, respectively.

TABLE 1-2. TASK 4 SIDE IMPACTOR-TO-SIDE OF CAR TESTS (8321)

Test Number	Test Date	Test Configuration	Target Car Model	Car Test Weight (lb)	Impactor Weight (lb)	Closing Velocity (mph)
4.1	Dec. 05, 1978	Side Impactor A-to-1976 Volare 60° side impact	1976 Volare 4-door sedan	4009	3640	35.56
4.2	Jan. 02, 1979	Side Impactor A-to-1976 VW Rabbit 60° side impact	1976 VW Rabbit	2401	3628	30.34
4.3	Jan. 1979	Side Impactor A-to-1976 Volare Angle TBD	1976 Volare	TBD	3600	TBD
4.4	Feb. 1979	Side Impactor B-to-1977 Volare 60° side impact	1977 Volare 4-door sedan	TBD	3600	35
4.5	Mar. 1979	Side Impactor B-to-1978 VW Rabbit 60° side impact	1978 VW Rabbit	TBD	3600	30
4.6	Mar. 1979	Side Impactor B-to-1975 VW Rabbit Angle TBD	1975 VW Rabbit	TBD	3600	TBD
4.7	Apr. 1979	Side Impactor C-to-Modified Volare, Angle TBD	Impala (year, model TBD)	TBD	3600	TBD
4.8*	Apr. 1979	Side Impactor C-to-1976 Volare 90° side impact	1976 Volare	TBD	3600	35

*Optional test.

12/13/78

2.0 PRESENTATION OF RESULTS - TEST NO. 8321-4.02

This section of the report presents the results of Test No. 8321-4.02, a 30-degree angular frontal impact between the NHTSA Side Impactor and fixed angled barrier.

This section presents all test results for Test 8321-4.02 without analysis or discussion. Included in this document are: still photographs, film chronologies, tabulated pre- and post-test dimensions, accelerometer location identification, and summaries of electronic data. High-speed motion pictures were also obtained for this test and have been submitted to the CTM. Appendix A contains Calcomp plots of all electronic data for this test.

Figures 2-4, 2-5, and 2-6 show pre-test and post-test Side Impactor configurations.

Figures 2-7 and 2-8 present a comparison of string potentiometer data and the residual crush.

Figure 2-9 shows the force/crush curve for the 4.02 test, calculated from accelerometer data. Also included is the corresponding curve calculated by the methodology described in Test Report No. 1 (8321).

TABLE 2-1. CRASH TEST SUMMARY (TEST 8321-4.02)

TEST NO. 8321-4.02 CONTRACT: DOT-HS-8-01933
 TEST DATE: December 22, 1978 TIME: 1352 TEMPERATURE: 59 °F
 TEST CONFIGURATION: 30° Angular Frontal Impact
 VEHICLE NO. 1: NHTSA Side Impactor (DSL 1172-4 face)
 VEHICLE NO. 2: Fixed Barrier at 60° Right*

VEHICLE DATA	VEHICLE NO. 1	VEHICLE NO. 2
Overall Length/Width (in.)	184.5/78.3	N/A
Test Weight by Wheel (lb)	LF 1055 RF 1168 LR 695 RR 712	N/A N/A
Total Weight (lb)	3630	>>100,000
Wheelbase (in.)	102.0	N/A
Longitudinal C.G. (From of Front Axle) (in.)	38.5	N/A
Impact Angle (deg)*	0	60°
Offset Distance (in.)	0	0
Car Speed (mph)	19.7	N/A
Final Speed (mph @ msec)	-0.7 @ 175	N/A
Velocity Change (mph)	20.4	N/A
Maximum Compartment Acceleration (g @ msec)	-13.3 @ 97	N/A
Maximum Engine Acceleration (g @ msec)	N/A	N/A
Side Impactor Maximum Dynamic Displacement (Film Data) (in.)	27.5	N/A
Maximum Static Crush		
• Level F (28.4 in. from ground)	17.5	
• Level E (24.5 in. from ground)	17.4	N/A
• Level A (13.1 in. from ground)	23.7	
Maximum Post-test Intrusion (in.)	N/A	N/A
INSTRUMENTATION		
Number of Data Channels	14	0
Number of Cameras		6

*With respect to tow track centerline.

TABLE 2-2. INSTRUMENTATION SUMMARY
(TEST 8321-4.02)

VEHICLE: NHTSA Side Impactor with DSL
1172-4 E/A Face

<u>Required Number of Channels</u>	<u>Channel Function</u>
4	Accelerometers
8	String Potentiometers
2	Impact Switches
<u> </u>	
14	

14 Channels Available (1 RSCM)

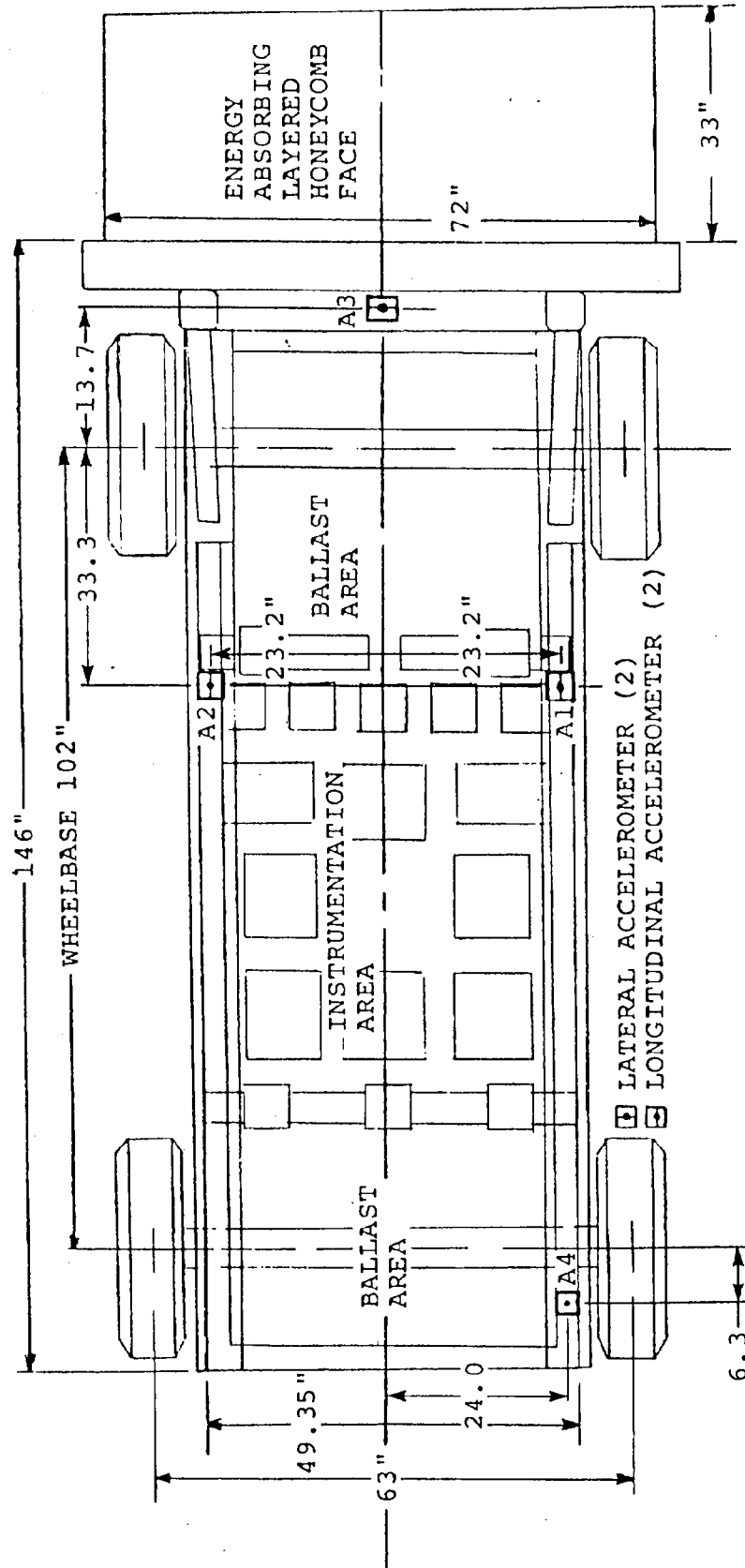


Figure 2-1. Side Impactor Accelerometer Location (Test 8321-4.02).

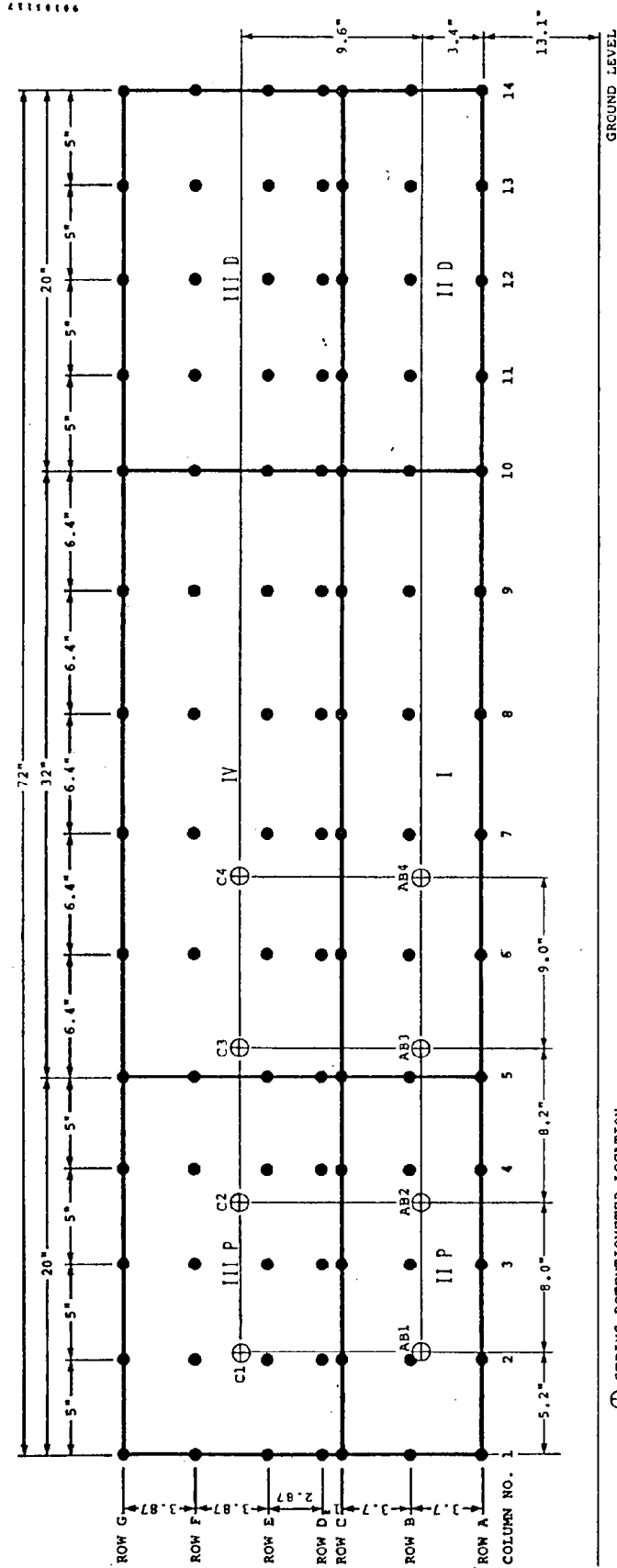


Figure 2-2. String Potentiometer Locations for Test 8321-4.02.

Test No: 8321-4.02 Test Date: 12/22/78

Test Type: Moving Side Impactor-to-60° Fixed Barrier

Vehicle A: Side Impactor

Vehicle B: Angled Fixed Barrier

Comments:

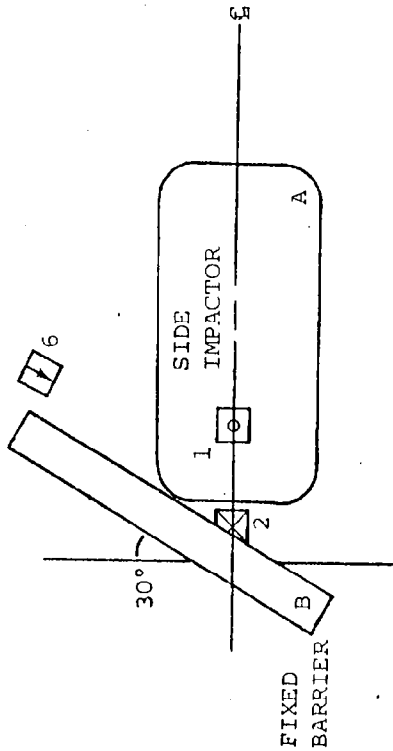
CAMERA SYMBOLS FRAME RATE

1. 1000 fr/sec
2. 200 fr/sec
3. Other 24 fr/sec
4. 400 fr/sec
5. 500 fr/sec

- ☐ PIT
☐ GROUND
☐ BARRIER
☒ OVERHEAD
☐ ON-BOARD

PANNING

CAMERA	YES
STILLS	X
SLIDES	X
MOVIE	X
POLAROID	
VIDEO	

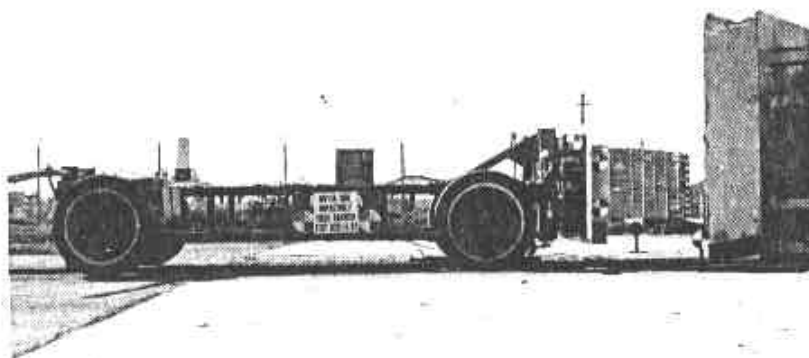


Loc. No.	Location	Field of View	* Lens Size	Frm Rate	Ser No	Impact Dist-X	C.L. Dist-Y	CAM Hght-Z
1	Pit	Views understructure		1	10			
2	Overhead	Views impact zone		1	12			
3	Ground Based	Left side view of impact zone (parallel to barrier)		1	1			
4	Ground Based	Left side view of impact zone (perpendicular to side impactor)		1	2			
5	Ground Based	Left side view of impact zone (perpendicular to side impactor)		5	M3			
6	Ground Based	Right side view of impact zone (parallel to barrier)		5	M9			
7	Ground Based	Panning overall test		3				

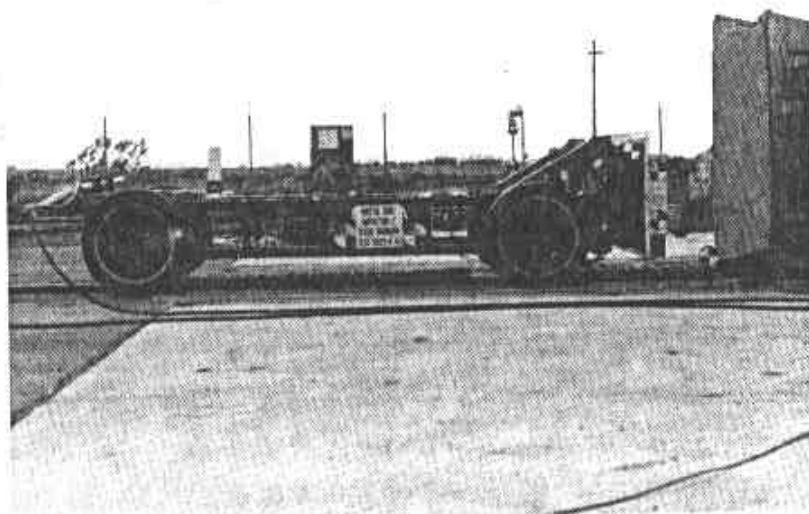
DSI FORM NO. TSO 125

Figure 2-3. Camera Locations.

*Not Recorded

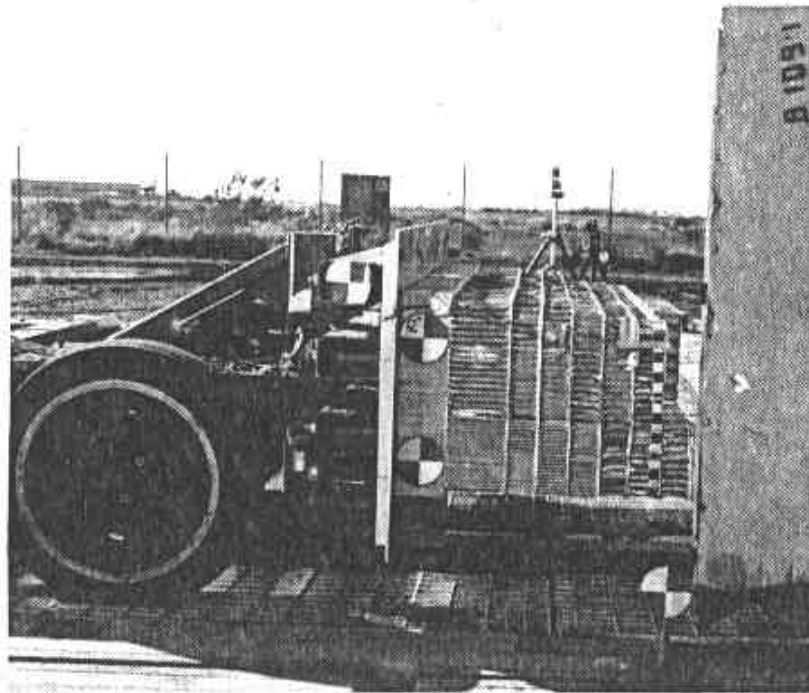


a) Pre-test

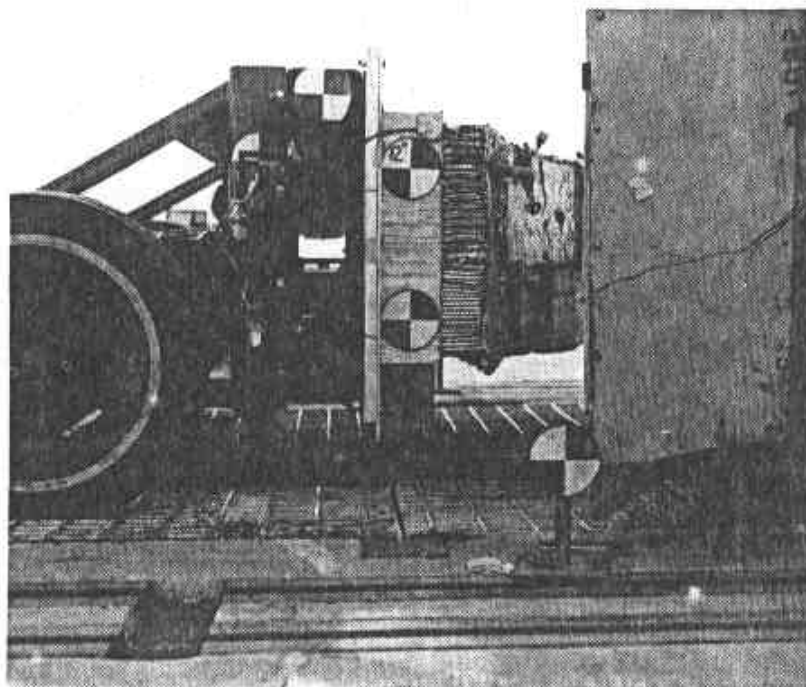


b) Post-test

Figure 2-4. Pre- and Post-test Side Impactor Configuration (Test 8321-4.02).

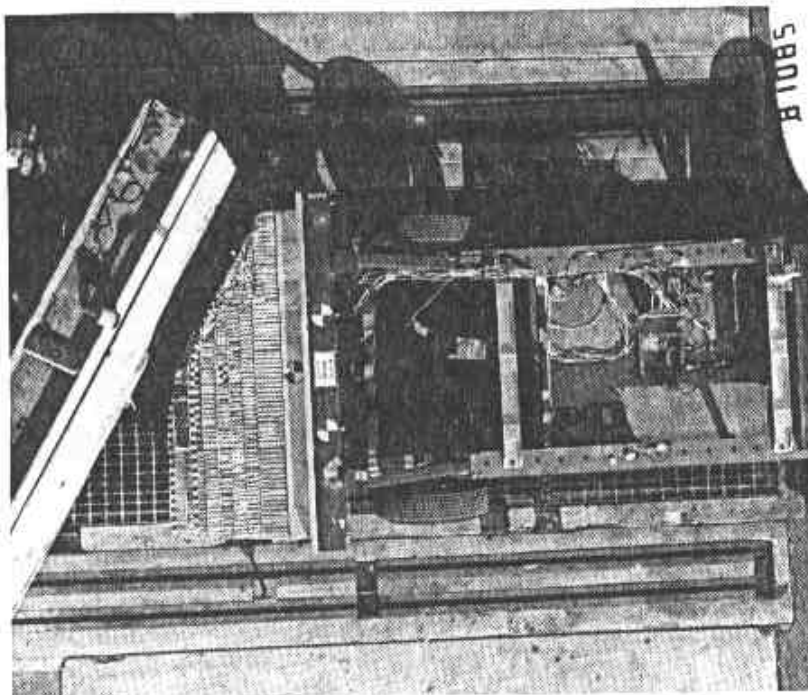


a) Pre-test

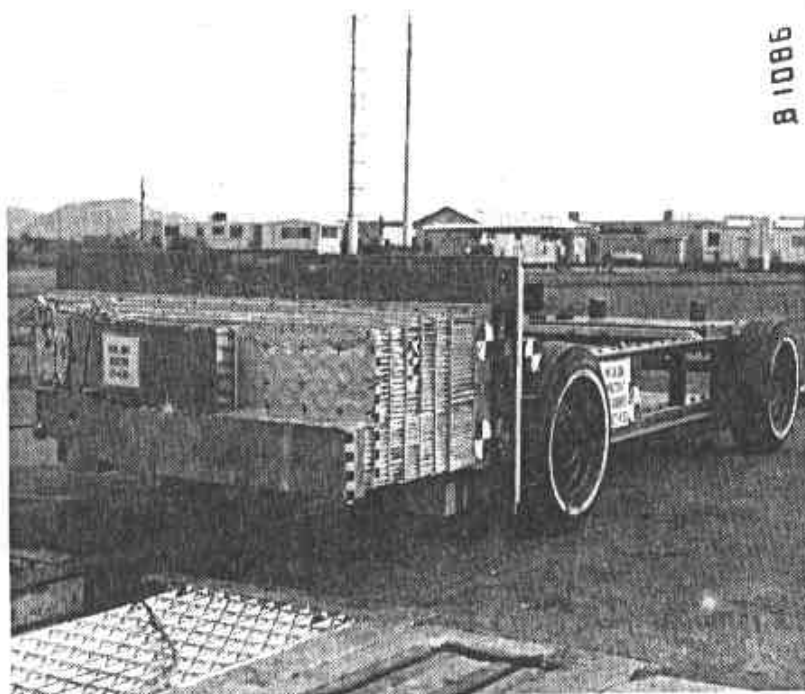


b) Post-test

Figure 2-5. Pre- and Post-test Closeup of Honeycomb Face (Test 8321-4.02).



a) Overhead View



b) Front View

Figure 2-6. Post-test Configuration of Side Impactor (Test 8321-4.02).

TABLE 2-3. CHRONOLOGY OF CRASH EVENTS (TEST 8321-4.02)

VEHICLE: NHTSA Side Impactor with DSL 1172-4 E/A Face

<u>Time (msec)</u>	<u>Fixed Barrier Crash Event</u>
0	Impact at bumper (Layer 11).
3	Layer 10 starts to crush.
17	Layer 9 starts to crush.
26	Layer 8 starts to crush.
37	Layer 7 starts to crush.
45	Layer 6 starts to crush.
55	Layer 5 starts to crush.
76	Layers 4 and 3 start to crush.
112	Side Impactor maximum dynamic displacement.
229	Separation of barrier and honeycomb face.
321	Recontact of barrier and honeycomb face.
529	Final separation of barrier and honeycomb face.

TABLE 2-4. TEST DEVICE HONEYCOMB POST-TEST CRUSH PROFILE (TEST 8321-4.02)

Crush Location*	Height Above Ground (in.)	Column Designations*													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Row G	32.1	2.2	0.5	0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Row F	28.2	17.5	15.3	11.9	9.0	7.2	3.6	1.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Row E	24.4	17.4	15.3	12.0	8.9	7.2	3.4	1.5	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Row D	21.5	17.4	15.2	11.9	8.9	7.3	3.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Row C	20.5	23.5	21.6	18.3	15.3	12.5	8.8	5.2	1.7	0.1	0.1	0.0	0.0	0.0	-0.1
Row B	16.8	23.5	21.6	18.3	15.3	12.5	8.8	5.2	1.7	0.1	0.1	0.0	0.0	0.0	-0.1
Row A	13.1	23.7	21.5	18.2	15.4	12.4	8.7	5.2	1.7	0.2	0.1	0.0	0.0	0.0	-0.1

*See Figure 2-2.

TABLE 2-5. SUMMARY OF SIDE IMPACTOR ACCELEROMETER DATA

Accelerometer Number*	Maximum Acceleration		Minimum Velocity		Maximum Displacement	
	A (G)	Time (msec)	V (mph)	Time (msec)	S (in.)	Time (msec)
1X	-12.6	92	-0.3	200	27.2	165
2X	-14.8	104	-1.5	138	25.9	110
3Y	-3.7	105	-3.8	114	-6.4	200
4Y	-2.3	105	-3.6	126	-8.0	200
Average of 1X and 2X	-13.3	97	-0.7	175	26.4	116

*For accelerometer locations, see Figure 2-1.

TABLE 2-6. SUMMARY OF SIDE IMPACTOR STRING POTENTIOMETER DATA

Displacement Potentiometer		Maximum Dynamic Displacement		Residual Static Displacement (in.) (post-test)
No.	Location*	D (in.)	Time (msec)	
1	AB1**	-	-	17.8
2	AB2	12.8	127	13.8
3	AB3	10.4	191	9.7
4	AB4	6.5	200	5.2
5	C1	12.2	117	12.1
6	C2	7.7	200	8.4
7	C3	5.8	197	6.4
8	C4	2.1	197	2.0

*For string potentiometer location, see Figure 2-2.

**String potentiometer malfunction.

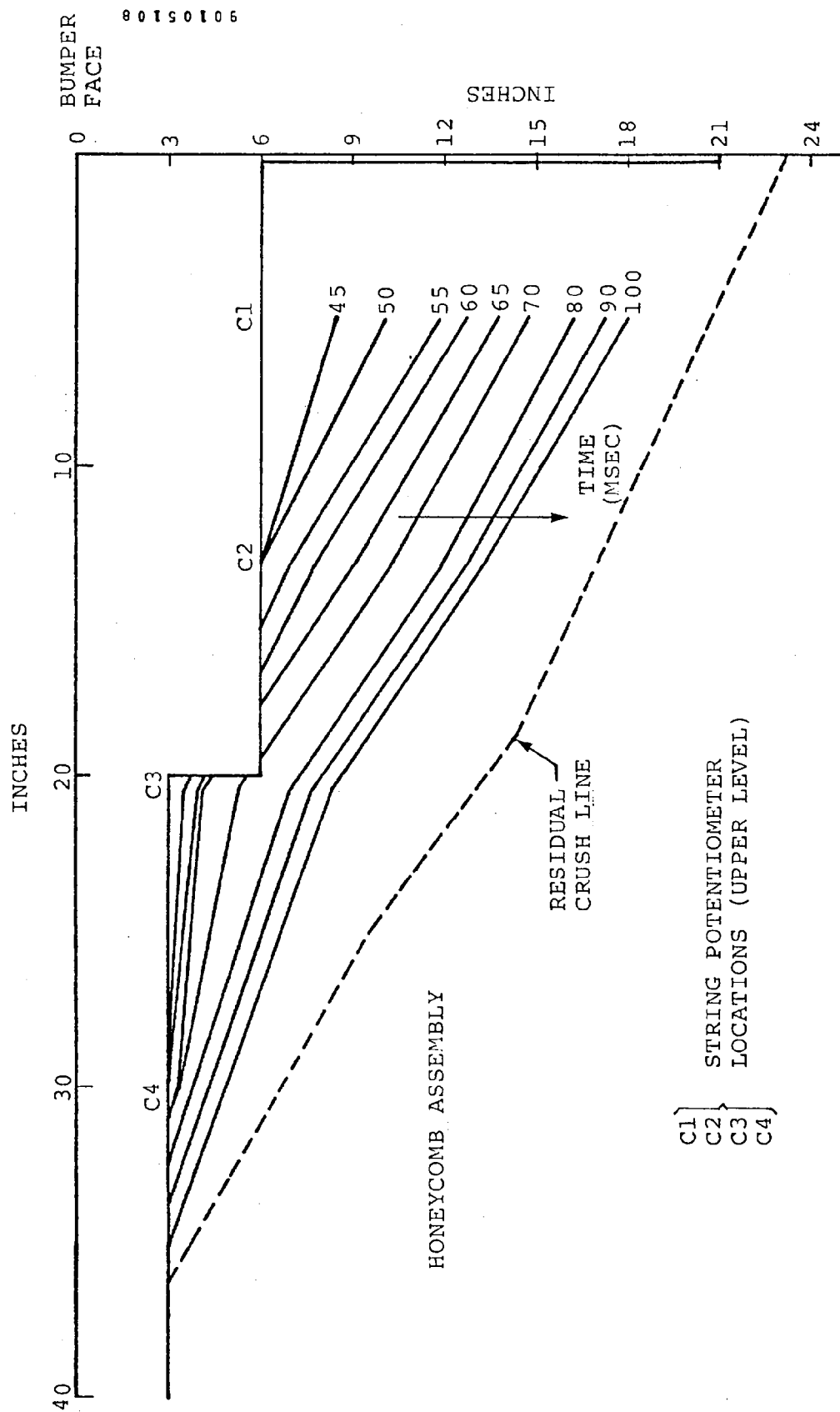


Figure 2-7. Crushing Face Versus Time, Superimposed on Honeycomb Assembly Geometry - String Potentiometer Data for Test 8321-4.02.

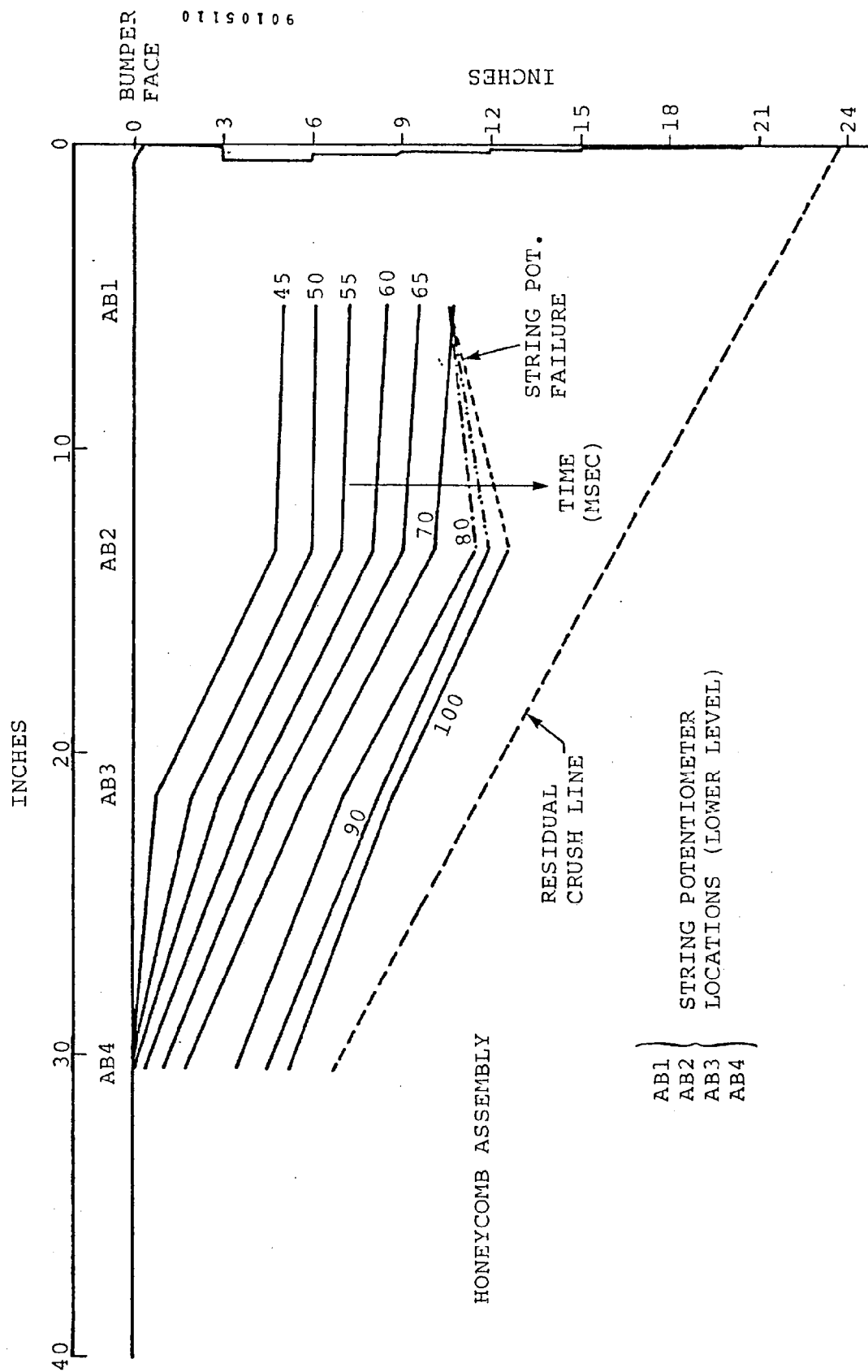


Figure 2-8. Crushing Face Versus Time, Superimposed on Honeycomb Assembly Geometry - String Potentiometer Data for Test 8321-4.02.

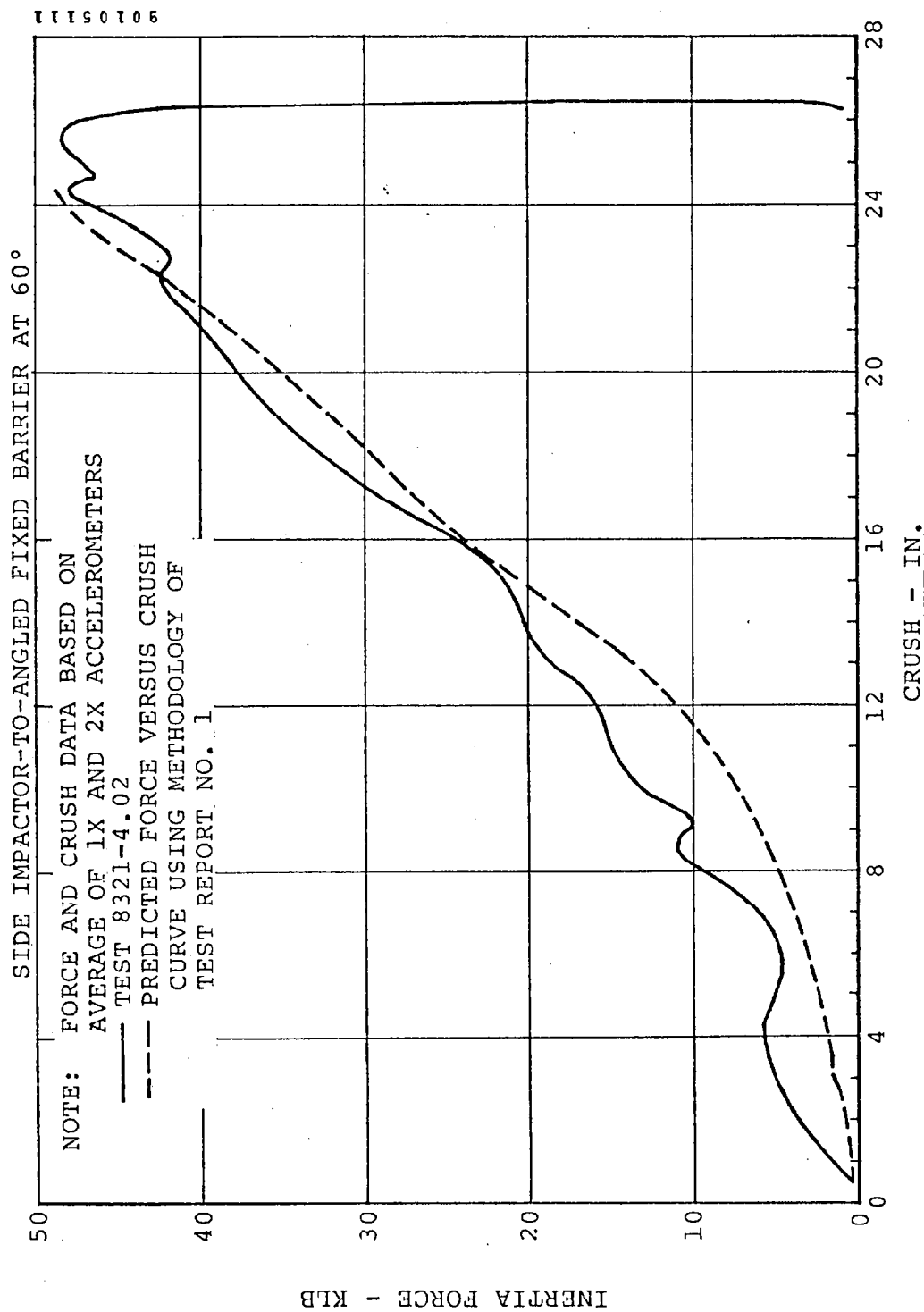
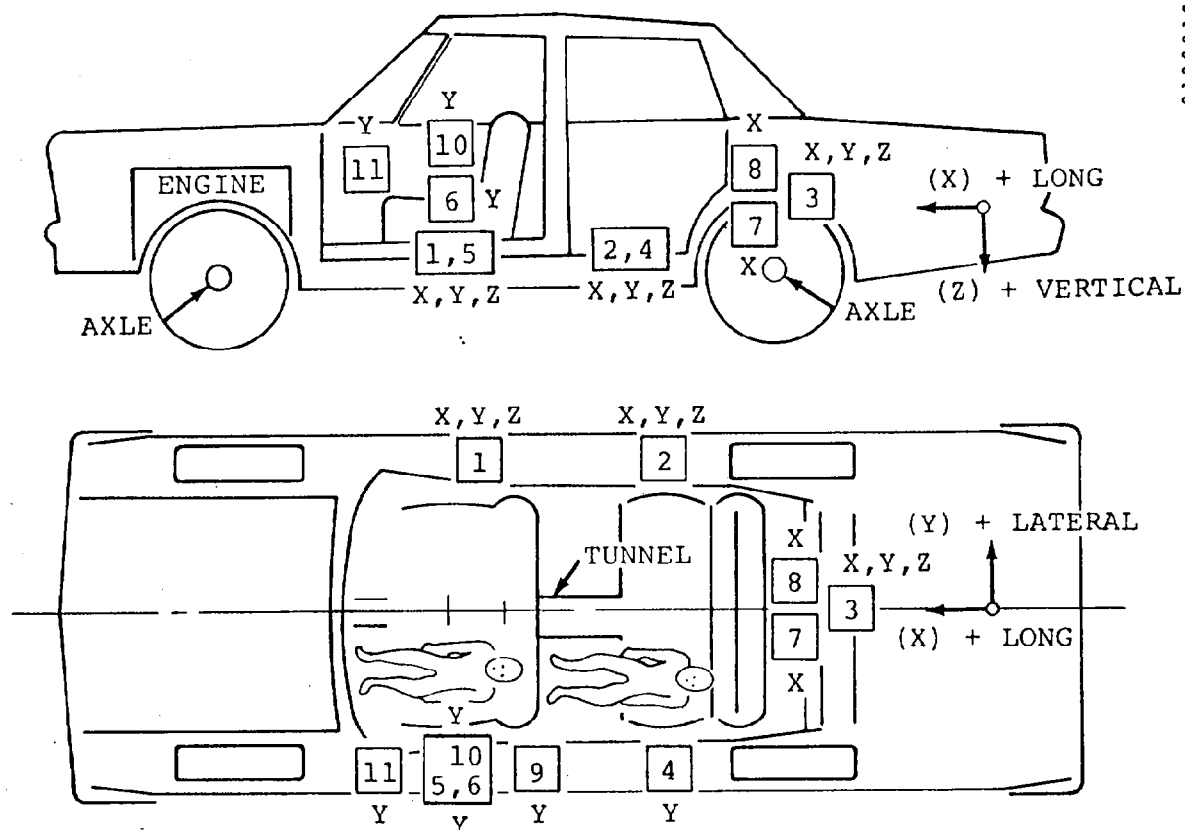


Figure 2-9. Inertia Force Versus Honeycomb Crush From Side Impactor Accelerometer Data (Left and Right Average) for Test 8321-4.02.

3.0 PRESENTATION OF RESULTS - TEST NO. 8321-4.2

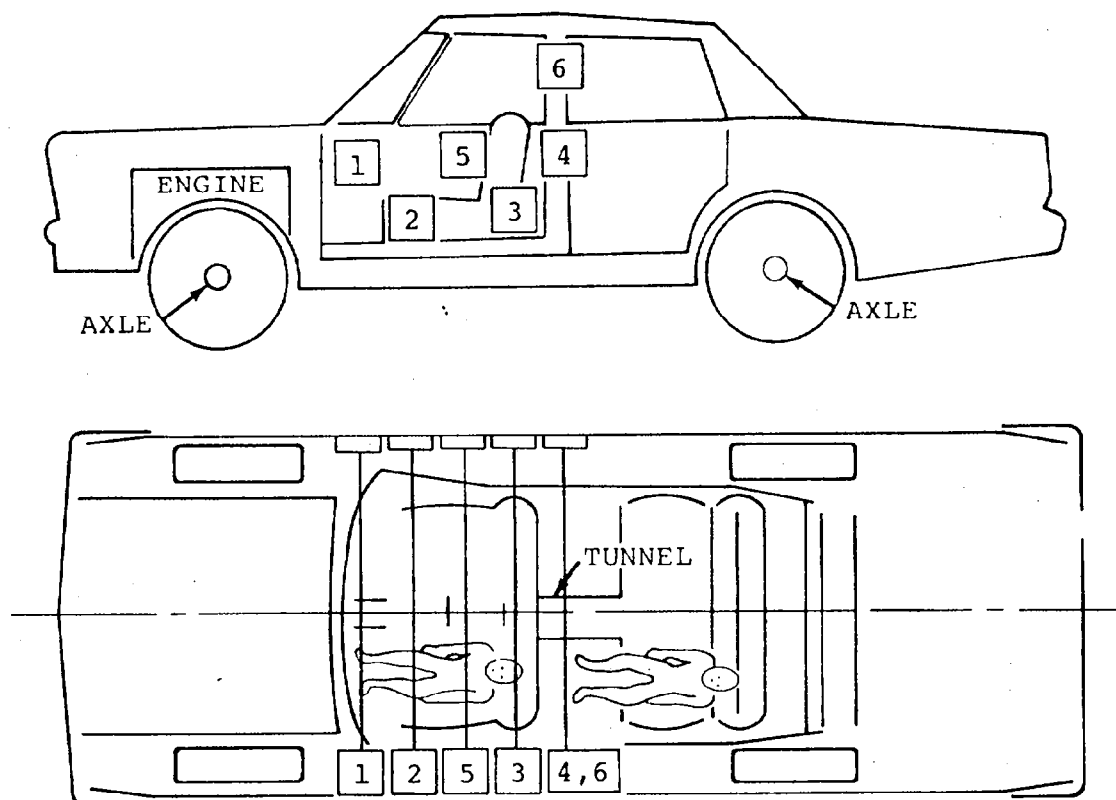
This section of the report presents the results of Test No. 8321-4.2, a 60-degree side impact crash test between the NHTSA Side Impactor (bullet vehicle) and a 1976 VW Rabbit two-door sedan (target vehicle).

This section presents all test results for Test 8321-4.2 without analysis or discussion. Included in this document are: still photographs, film chronologies, vehicle damage sketches and tabulated pre- and post-test dimensions, accelerometer location identification, summaries of electronic data, and summaries of the simulated occupant data, including injury criteria values. High-speed motion pictures were also obtained for this test and have been submitted to the CTM. Appendix B contains Calcomp plots of all electronic data for this test. Section 4 provides comparisons of vehicle data with a previous Rabbit baseline test.



TEST VEHICLE ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES					MAXIMUM EXPECTED READINGS		
No.	DESCRIPTION OF LOCATION	X	Y	Z	LONG	LAT	VERT
1	Right sill next to front seat	83	25	14	20	50	10
2	Right sill next to rear seat	59	25	14	20	50	10
3	Deck over rear axle	36	0	17	20	50	10
4	Left sill next to rear seat	59	-25	14		100	
5	Left sill next to front seat	83	-25	14		200	
6	Left front door centerline	84	-27	20		300	
7	Left rear compartment	36	-14	17	20		
8	Right rear compartment	36	14	17	20		
9	Midrear of left front door	66	-27	23		200	
10	Upper left front door centerline	84	-27	23		200	
11	Midfront of left front door	99	-27	23		300	
12	Front door centerline	80	-27	23		300	
13	DOR point	102	-30	17		300	

Figure 3-1. Test Vehicle Accelerometer Locations.



VEHICLE STRING POTENTIOMETER
LOCATIONS AND PHYSICAL COORDINATES

No.	DESCRIPTION OF LOCATION	HEIGHT ABOVE GROUND	DISTANCE FROM B-PILLAR	MAXIMUM EXPECTED READINGS
1	Midfront of left front door and just above driver knees	31 in.	32 in.	25 in.
2	Sill just ahead of front seat and behind driver feet	18 in.	32 in.	20 in.
3	Sill just behind front seat and in front of passenger feet	12 in.	9 in.	15 in.
4	Left B-pillar just below window sill	34 in.	0 in.	10 in.
5	Left front door centerline just below window sill	34 in.	27 in.	15 in.
6	Left B-pillar at window top height	52 in.	0 in.	10 in.

Figure 3-2. Test Vehicle String Potentiometer Locations.

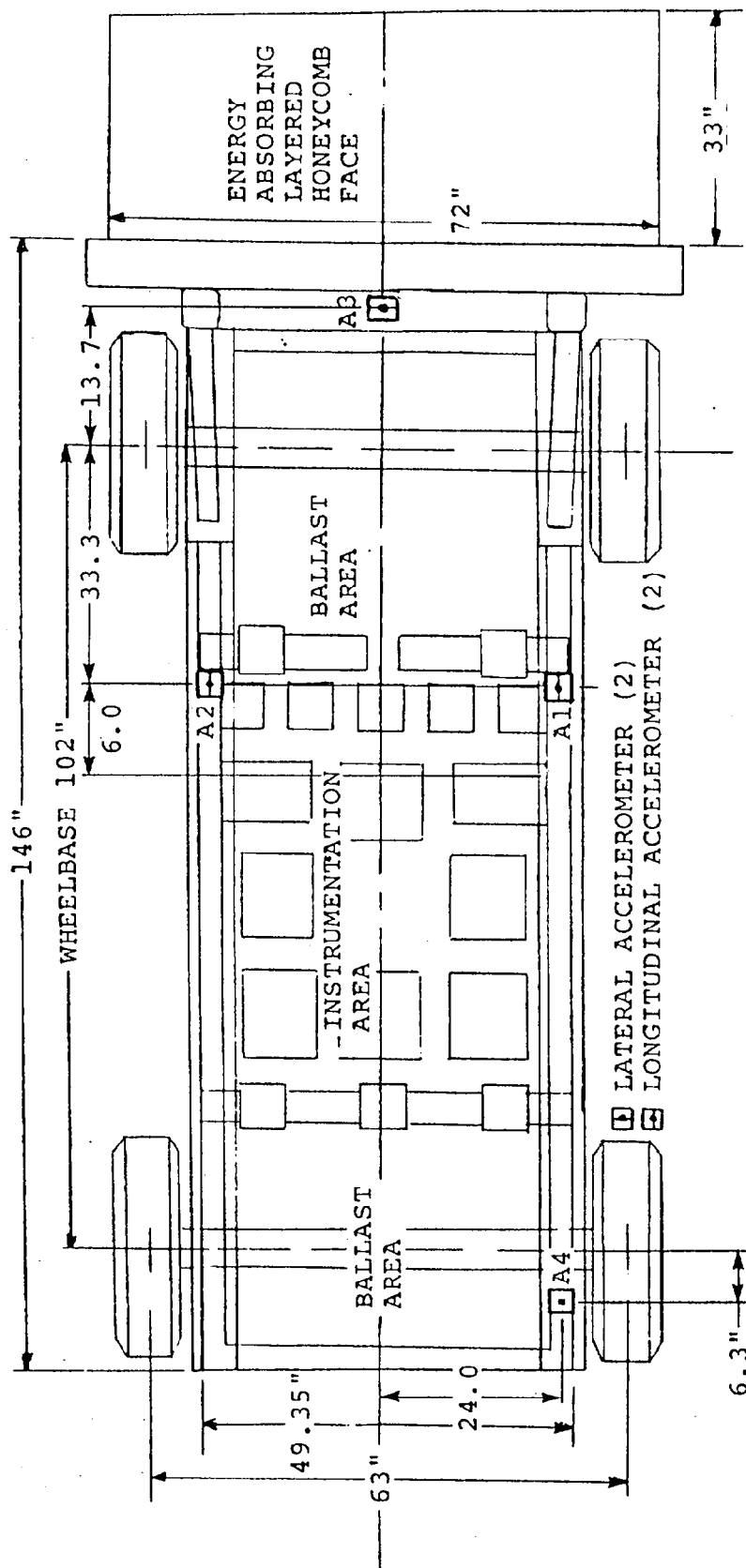


TABLE 3-1. CRASH TEST SUMMARY (TEST 8321-4.2)

TEST NO. 8321-4.2 CONTRACT: DOT-HS-8-01933
 TEST DATE: January 2, 1979 TIME: 1448 TEMPERATURE 55 °F
 TEST CONFIGURATION: 60° Side Impactor
 VEHICLE NO. 1: NHTSA Side Impactor with DSL 1172-5 Face
 VEHICLE NO. 2: 1976 VW Rabbit 4-door sedan

VEHICLE DATA	VEHICLE NO. 1	VEHICLE NO. 2
Overall Length/Width (in.)	184.5/78.3	155.3/63.4
Test Weight by Wheel (lb)	LF 1077 RF 1160 LR 657 RR 734	LF 643 RF 655 LR 534 RR 659
Total Weight (lb)	3628	2401
Wheelbase (in.)	102.0	95.2
Longitudinal C.G. (From Center of Front Axle) (in.)	39.1	51.5
Impact Angle (deg)*	0	60
Offset Distance (in.)**	0	0
Car Speed (mph)	30.3	0
Final Speed (mph @ msec)	15.1 @ 200	16.6 @ 132
Velocity Change (mph)	15.2	16.6
Maximum Compartment Acceleration (g @ msec)	-11.4 @ 82	19.6 @ 88
Maximum Door Acceleration*** (g @ msec)	N/A	167.9 @ 60
Maximum Mutual Dynamic Crush (Film Data) (in.)		35.1
Maximum Static Crush		
• Window Top Level	N/A	5.9
• Windowsill Level	7.3	23.6
• Door Center Level	5.8	14.9
• Axle Level	7.8	2.3
Maximum Post-test Intrusion (in.)	N/A	18.8
<u>OCCUPANTS</u>		
Type	N/A	Alderson Part 572
Location	N/A	LF-Driver RF-Passenger
Restraints	N/A	Unrestrained
<u>INSTRUMENTATION</u>		
Number of Data Channels	13	37
Number of Cameras		9

*With respect to tow track centerline.

**Extreme left edge of honeycomb struck VW Rabbit DOR point 102.0 in. from rear bumper centerline.

***At Location 9.

N/A: Not Applicable.

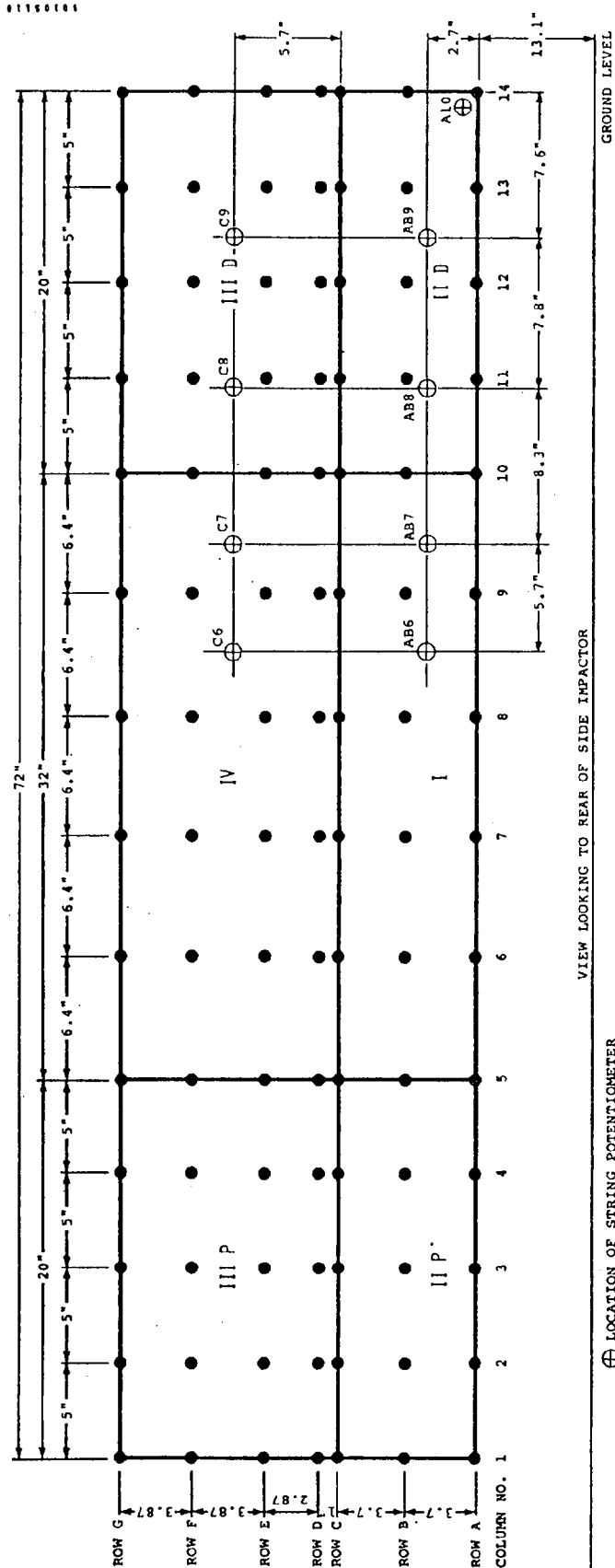


Figure 3-4. Front View of Side Impactor Face (Looking Aft) Showing String Potentiometer Locations (Test 8321-4.2).

TABLE 3-2. RECEIVING INSPECTION OF VEHICLES (TEST 8321-4.2)

Contractor: Dynamic Science, Inc. Contract No.: DOT-HS-8-01933
 VIN NO.: 176316802 Make: Volkswagen
 NHTSA No.: R & D
 Year: 1976 Color: Blue Model: Rabbit
 Auto Trans: yes ☐ no ☒ Pwr Steering: yes ☐ no ☒ Seats: Bench: _____
 Pwr Brakes: yes ☒ no ☐ Auto Speed Cont: yes ☐ no ☒ (front) Bucket: X
 Pwr Seats: yes ☐ no ☒ Anti Skid Brake: yes ☐ no ☒ Split
 Pwr Windows: yes ☐ no ☒ Air Conditioning: yes ☐ no ☒ Bench: _____
 Tinted Glass: yes ☐ no ☒ Rear Window Def.: yes ☒ no ☐ Split
 Radio: yes ☒ no ☐ Brakes: drum: _____ disc: _____ Back
 Clock: yes ☐ no ☒ Bench: _____
 Tire Size: 155SR-13 Ply Rating: _____ Mfg. & Line: Continental
 Bias Ply: _____ Belted: _____ Radial X / Eng. _____ Total 97
 Type: _____ Cylinders: 4 Displ: CID
 Trans, # Fwd. Speeds: 4 Shipping Weight: _____ Odometer: 26104
 Dealer (name, address, and phone number)
Demas Volkswagen
3230 North Scottsdale Road
Scottsdale, Az. 85251
 Remarks (list additional accessories not listed above)

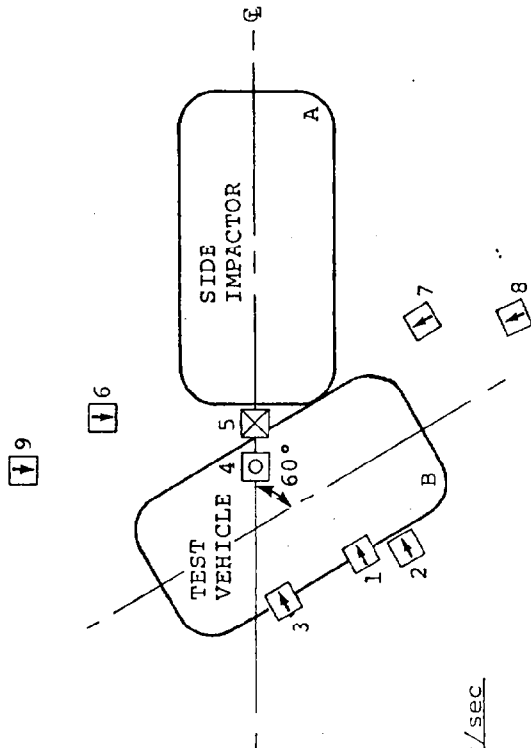
 Date of Manufacture: 1-76 Dynamic Science No.: 766 Date Received: 11-1-78
 Tilting Steering Wheel: yes ☐ no ☒ Telescoping Steering Wheel: yes ☐ no ☒
 Fuel Capacity: _____ "Space Saver" Spare Tire yes ☐ no ☒
 (from owner's manual)
 Restraint System: _____
 1. Is the vehicle stock throughout? Describe: Mirrors, spare tire, jack,
wipers, and right rear window removed.
 2. Does vehicle show evidence of prior accident history? Describe: None
 3. Does vehicle show any significant corrosion? Describe: None
 4. Check condition of the front bumper and frame: No bumper guards.

TABLE 3-3. INSTRUMENTATION SUMMARY (TEST 8321-4.2)

Test Vehicle		Side Impactor	
Required Number of Channels	Channel Function	Required Number of Channels	Channel Function
17	Accelerometers	4	Accelerometers
6	String Potentiometers	9	String Potentiometers
2	Impact Switches		
12	Dummy Accelerometers		
<u>37</u>		<u>13</u>	
42 channels available (3 RSCMs)		28 channels available (2 RSCMs)	

Test No: 8321-4.2 Test Date: January 2, 1979
 Moving Side Impactor-to-Stationary Test
 Test Type: Vehicle Positioned at 60° Clockwise

Vehicle A: Side Impactor
 Vehicle B: Stationary 1976 V.W. Rabbit
 Comments:



CAMERA SYMBOLS

- FRAME RATE
- 1. 1000 fr/sec
 - 2. 200 fr/sec
 - 3. Other 24 fr/sec
 - 4. 400 fr/sec
 - 5. 500 fr/sec

- TIMING LIGHT SPEED
- 1. 100 Hz (10 msec/light)
 - 2. 200 Hz (5 msec/light)
 - 3. Other

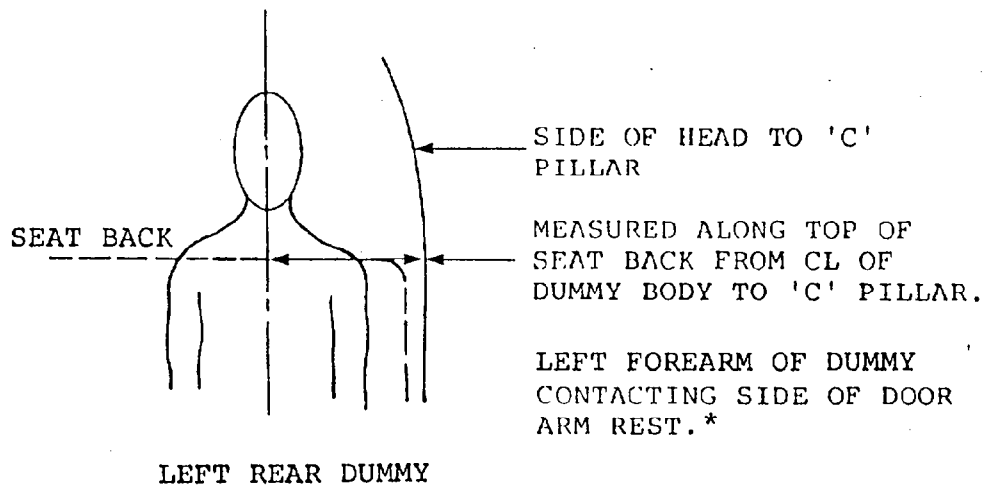
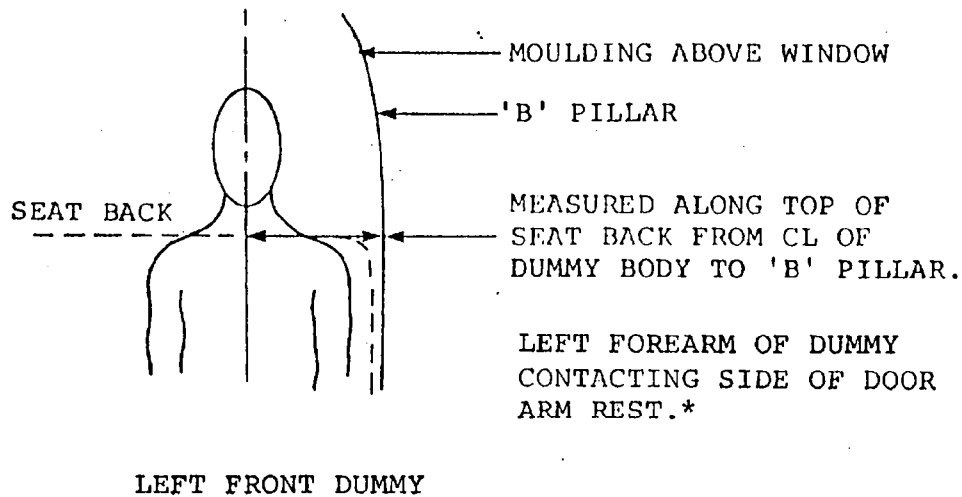
CAMERA	YES
STILLS	X
SLIDES	X
MOVIE	X
POLAROID	

Loc. No.	Location	Field of View	Lens Size	Frm Rate	Trng Spd	Ser No	Impact Dist-X	C.L. Dist-Y	CAM Hght-Z
1	On-Board	Cut hole in roof, views dummies		1	1				
2	On-Board	Look through window, views dummies		5	1				
3	On-Board	Looks along interior side wall, views dummies in interaction with side.		1	1				
4	Pit	Views understructure		1	1				
5	Overhead	Views impact zone		1	1				
6	Ground Based	Right side view of impact zone (perpendicular to side impactor A)		1	1				
7	Ground Based	Left side view of impact zone (parallel to test vehicle B)		1	1				
8	Ground Based	Left side view of impact zone (parallel to test vehicle B)		5	1				
9	Ground Based	Right side view of impact zone (perpendicular to side impactor A)		5	1				
10	Ground Based	Panning overall test		3	-				

Figure 3-5. Camera Locations - Impact Test 8321-4.2.

TABLE 3-4. DUMMY PRE-TEST POSITIONS RELATIVE TO SIDE OF CAR.

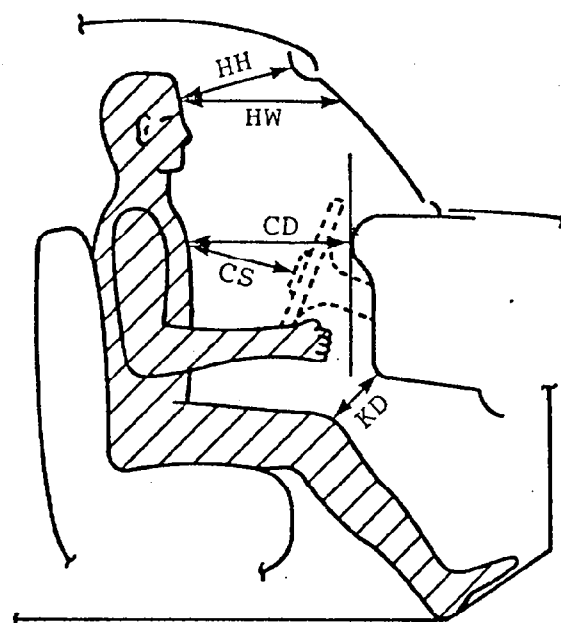
VEHICLE 1976 VW Rabbit TEST DATE January 2, 1979
 TEST NUMBER 8321-4.2



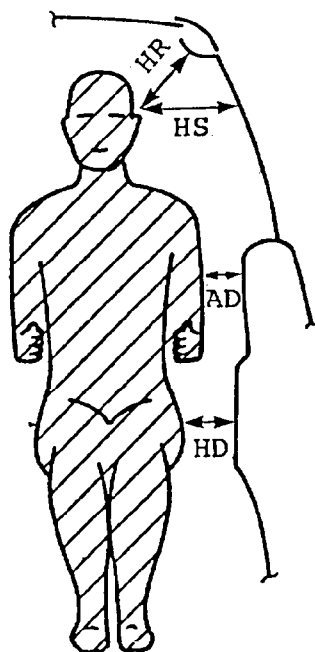
PRE-TEST
<u>6.8</u>
<u>7.9</u>
<u>12.2</u>
<u>2.5</u>
<u>7.9</u>
<u>13.1</u>
<u>2.5</u>

*No arm rest. Use door panel.

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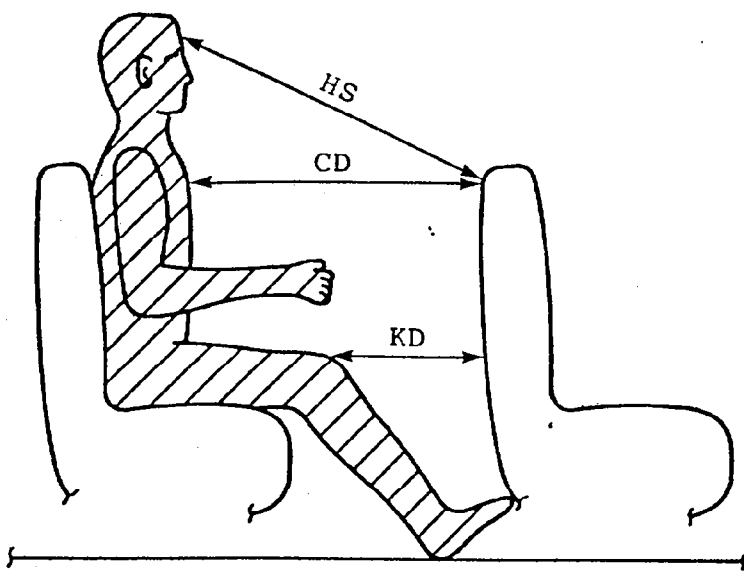
HH = 17.5 IN.
 HW = 23.7 IN.
 CD = 21.9 IN.
 CS = 13.5 IN.
 KD = 7.8 IN./7.8 IN.



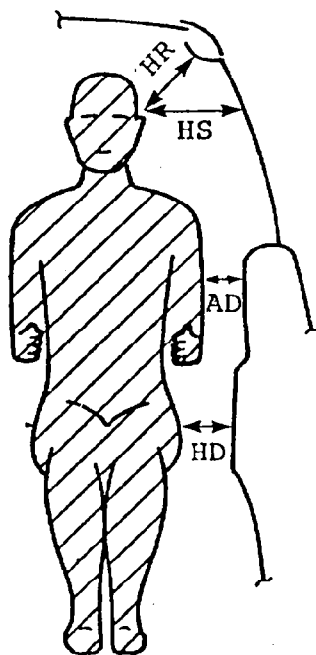
HR = 7.3 IN.
 HS = 7.5 IN.
 AD = 3.2 IN.
 HD = 5.9 IN.

Figure 3-6. Driver Pre-test Position (Test 8321-4.2).

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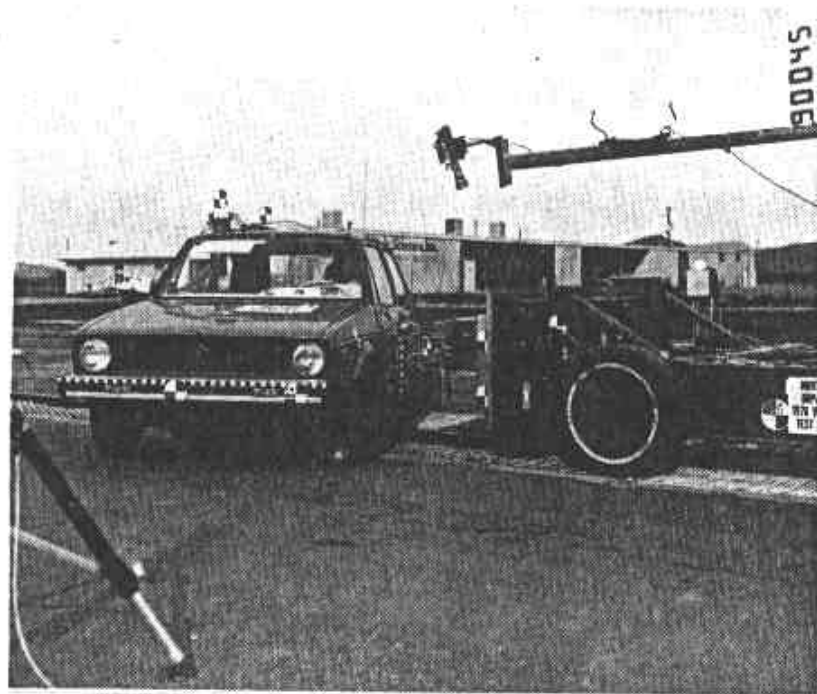


HS = 23.5 IN.
CD = 19.0 IN.
KD = 3.5 IN./3.5 IN.

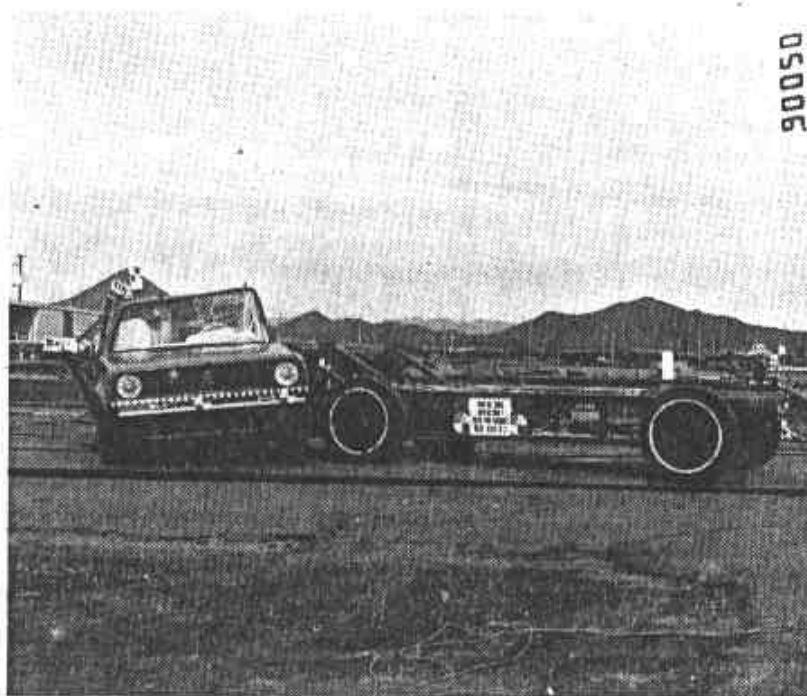


HR = 6.8 IN.
HS = 7.9 IN.
AD = 2.5 IN.
HD = 5.0 IN.

Figure 3-7. Rear Passenger Pre-test Position (Test 8321-4.2).



a) Pre-test

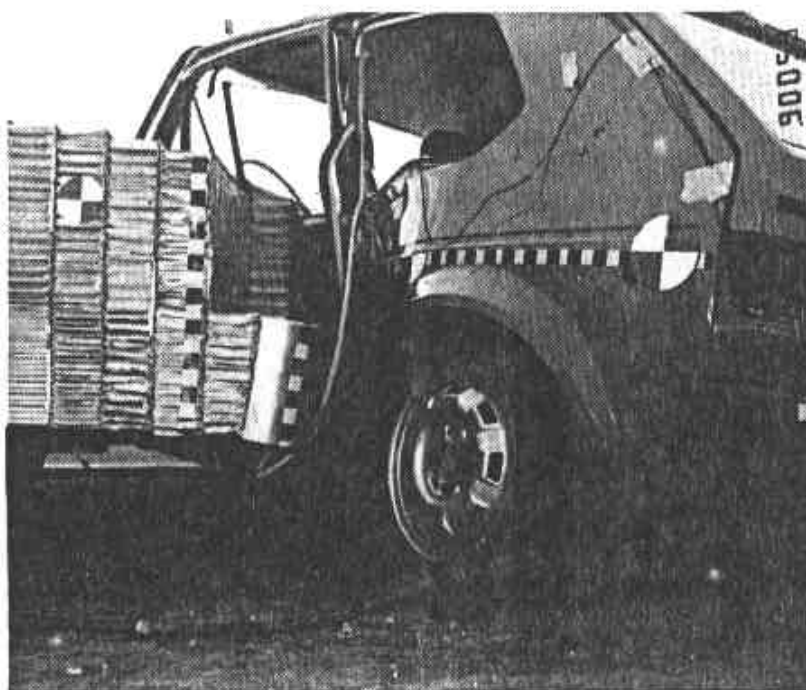


b) Post-test

Figure 3-8. Pre- and Post-test Vehicle Configuration
(Test 8321-4.2).



a) Pre-test

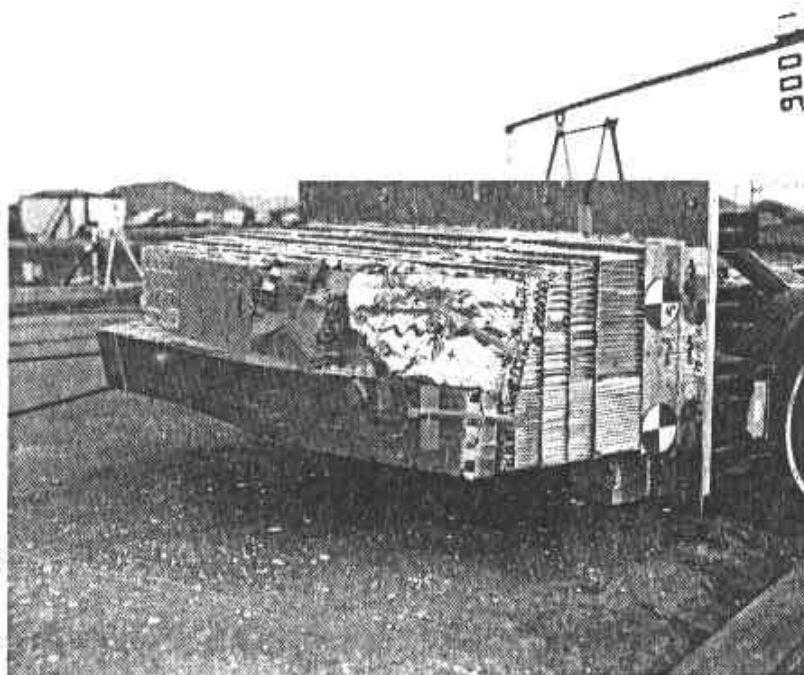


b) Post-test

Figure 3-9. Closeup of Impact Area
(Test 8321-4.2).



a) Post-test V.W. Rabbit



b) Post-test Side Impactor

Figure 3-10. Post-test View of Vehicles
(Test 8321-4.2).

TABLE 3-5. CHRONOLOGY OF CRASH EVENTS (TEST 8321-4.2)

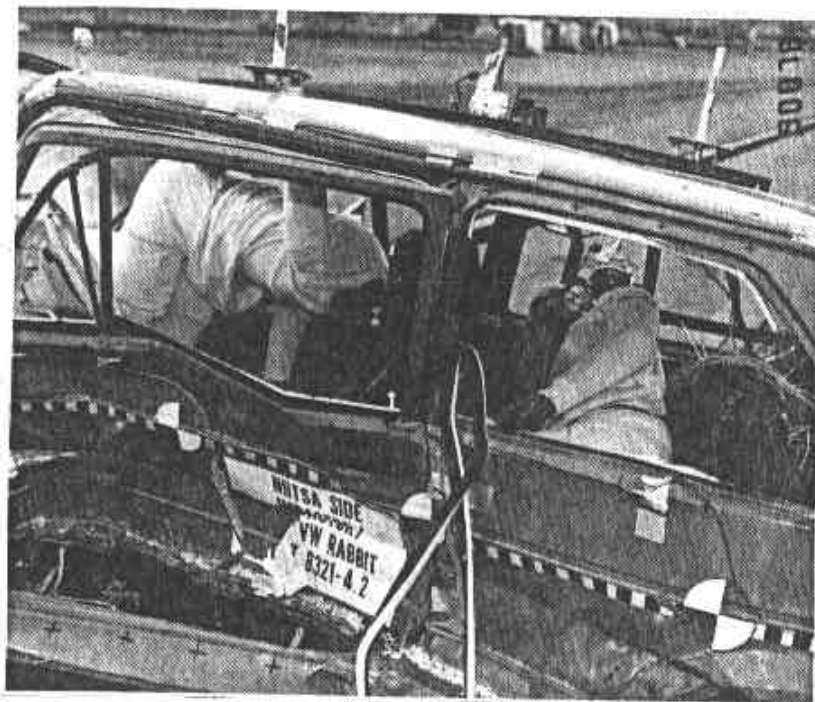
Time (msec)	1976 VW Rabbit Crash Event
0	Impact.
21	Intrusion of front compartment begins.
38	Hinges on front door break off.
51	B-pillar and rear panel intrusion begins.
57	Driver dummy and seat begin to move to the right.
60	Steering wheel and driver dummy knees are struck by door. Front of Rabbit begins to move down track.
70	Left front side window shatters. Rear of Rabbit begins to move down track.
75	Side Impactor penetrates Rabbit to honeycomb faceplate and strikes rear wheel well. Rear panel strikes passenger dummy shoulder.
78	Roof buckles. Rear panel strikes passenger dummy knees.
86	Rear passenger head begins to move towards left side of vehicle. Front windshield cracks and begins to pull out of moulding.
102	Left rear side window shatters.
124	Maximum mutual dynamic crush, (35.1 in.). Passenger dummy head strikes side of vehicle above top window sill.
174	Passenger dummy head begins rebound.
281	Driver dummy strikes right side of vehicle.
319	Maximum Rabbit inclination, (10.5°).



a) Pre-test Driver



b) Pre-test Passenger



c) Post-test Driver and Passenger

Figure 3-11. 1976 V.W. Rabbit Dummy Configuration (Test 8321-4.2).

TABLE 3-6. SUMMARY OF POST-TEST OBSERVATIONS (TEST No. 8321-4.2)

VEHICLE: 1976 VW Rabbit

Dummy Contact Points:	Left Front	Left Rear
Head-----	Window header	None
Shoulder-----	Windowsill	Windowsill
Hips -----	Door panel	Door panel

Glazing: 100% shattered. 50% retained in center.

Doors: Unlocked prior to test. Right side doors opened easily. Left side doors would not open. Left front door hinges sheared off.

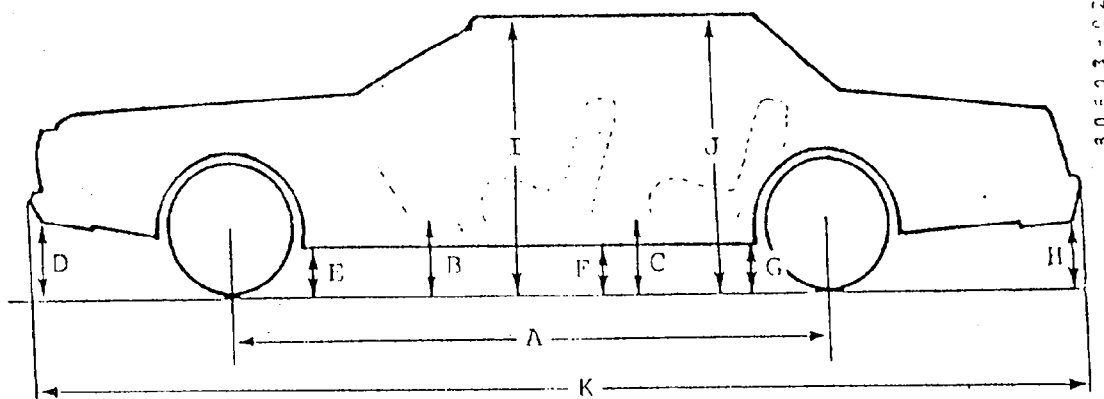
Seat Belt Anchorages and Restraints: Dummies unrestrained. Left driver seat anchorage sheared off.

Vehicle Centerline to Barrier Centerline: Side Impactor: Front: 93 in. right. Rear: 39 in. right.

Fuel Leakage: None

General Observations: Front dummy interference with string potentiometers 1, 2, and 5. Left side windows broken. VW Rabbit DOR 37 ft from impact. Side Impactor rebounded 3 in.

TABLE 3-7. TEST VEHICLE STRUCTURAL PRE- AND POST-TEST DIMENSIONS



VEHICLE: 1976 VW Rabbit 2-door sedan

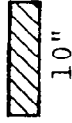
Test 4.2						
	Pre-test		Post-test		Difference	
	LS	RS	LS	RS	LS	RS
A	95.2	95.2	93.4	95.5	1.8	-0.3
B	13.0	12.8	15.1	11.9	-2.1	0.9
C	13.2	13.0	15.3	11.6	2.1	1.4
D	15.6	15.7	19.3	15.6	3.7	0.1
E	9.9	9.8	12.0	9.5	-2.1	0.3
F	10.8	10.6	13.7	9.3	2.9	1.3
G	11.0	10.6	12.0	9.1	-1.0	1.5
H	15.9	15.6	15.0	13.7	0.9	1.9
I	52.6	52.3	55.1	51.6	-2.5	0.7
J	52.7	52.4	52.4	50.9	0.3	1.5
K	155.9	156.1	151.6	154.7	4.3	1.4

TABLE 3-8. TEST VEHICLE EXTERIOR PROFILES AND STATIC CRUSH (TEST 8321-4.2)

Location		R.P.* Height (in.) (in.)	Zero Point at DOR - Distance (in.)																			
			DOR																			
		24	18	12	6	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84		
		PRE-TEST PROFILE (IN.)																				
Axle Height		75	10.9				9.9	10.1	10.1	10.2	10.3	10.4	10.3	10.6	10.7	10.8	10.9	11.1				
Door Center		75	18.3				8.0	8.0	8.1	8.1	8.1	8.2	8.3	8.4	8.4	8.5	8.7	8.9				
Windowsill		75	34.6	10.1	10.0	10.0	9.8	9.4	9.4	9.4	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.3	10.5	10.8	11.3
Window Top		75	49.6								15.8	15.9	16.1	16.1	16.3	16.3	16.4	16.5	16.6	16.7	16.8	
		POST-TEST PROFILE (IN.)																				
Axle Height		75	13.0				12.5	15.6	15.8	15.8	16.2	16.2	16.3	16.5	17.5	13.2	12.8	11.6				
Door Center		75	19.5				13.1	27.0	30.9	31.7	30.4	28.2	27.7	25.9	23.3	19.8	16.9	13.9				
Windowsill		75	35.3	11.5	12.2	12.9	13.9	22.5	23.7	24.2	24.5	22.3	20.0	18.7	19.4	18.4	16.0	13.8	11.9	11.2	11.3	11.3
Window Top		75	52.6								18.1	15.9	15.7	15.7	15.7	18.3	18.1	18.1	18.1	18.1		
		POST-TEST STATIC CRUSH (IN.)																				
Axle Height		2.1					2.6	5.5	5.7	5.6	5.9	5.8	5.8	5.9	6.8	2.4	2.0	0.5				
Door Center		1.2					5.1	19.0	22.8	23.6	22.3	20.0	19.4	17.5	14.9	11.3	8.2	5.0				
Windowsill		0.7	1.4	2.2	2.9	4.1	13.1	14.1	14.9	15.1	12.8	10.5	9.0	9.6	8.5	6.0	3.7	1.6	0.7	0.5	0.5	
Window Top		3.0									2.3	0.0	-0.4	-0.4	-0.6	1.9	1.6	1.3	1.4	1.3		
*Zero plane is 6 inches to the right of the vehicle right wheel hubs. This plane is 8.6 inches to the right of the vehicle at axle height.																						

*Zero plane is 6 inches to the right of the vehicle right wheel hubs. This plane is 8.6 inches to the right of the vehicle at axle height.

AXLE LEVEL - 10.9 IN. ABOVE GROUND
 1976 V.W. RABBIT
 SCALE: .06" = 1"



10"

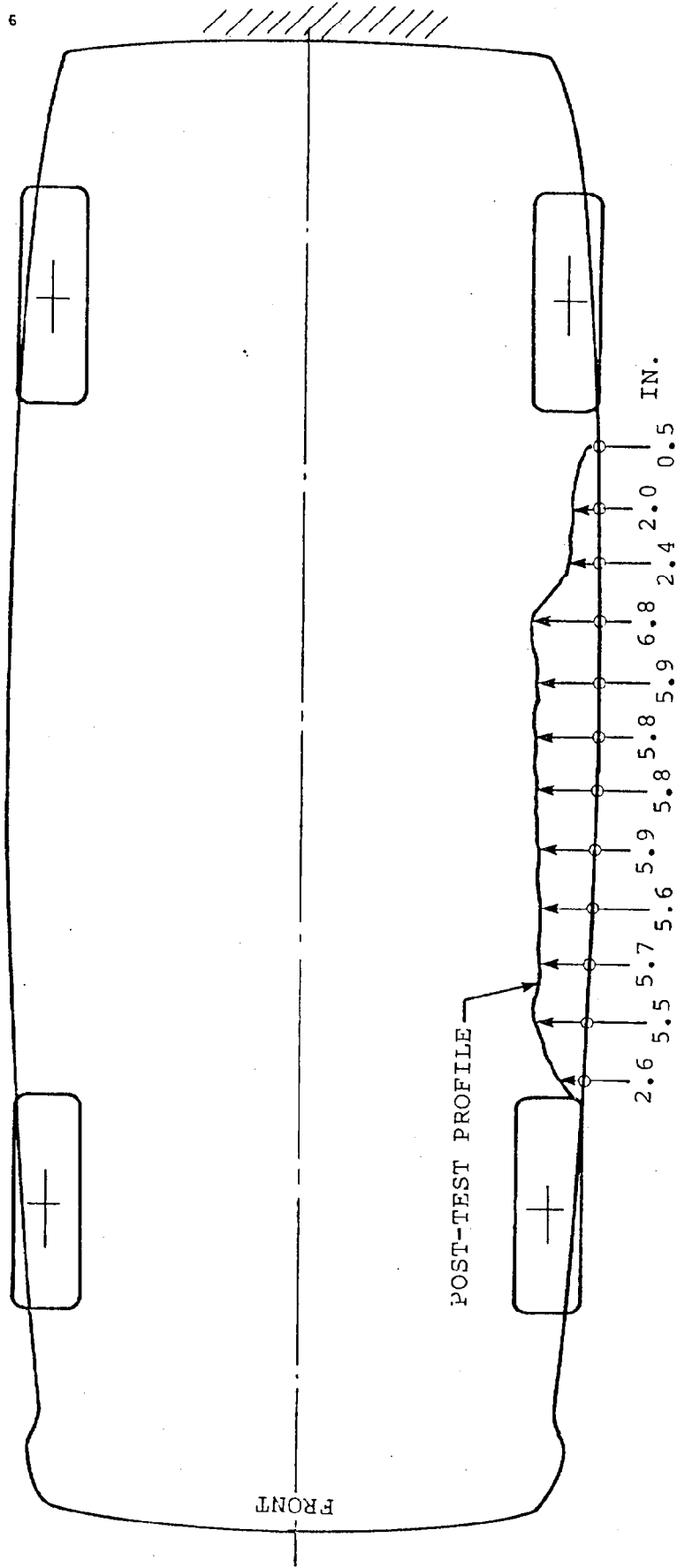
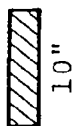


Figure 3-12. Exterior Vehicle Profile and Static Crush (in.) for Test 8321-4.2
 (Data From Table 3-8).

WINDOW SILL LEVEL - 34.6 IN. ABOVE GROUND

1976 V.W. RABBIT

SCALE: .06" = 1"



10"

90150106

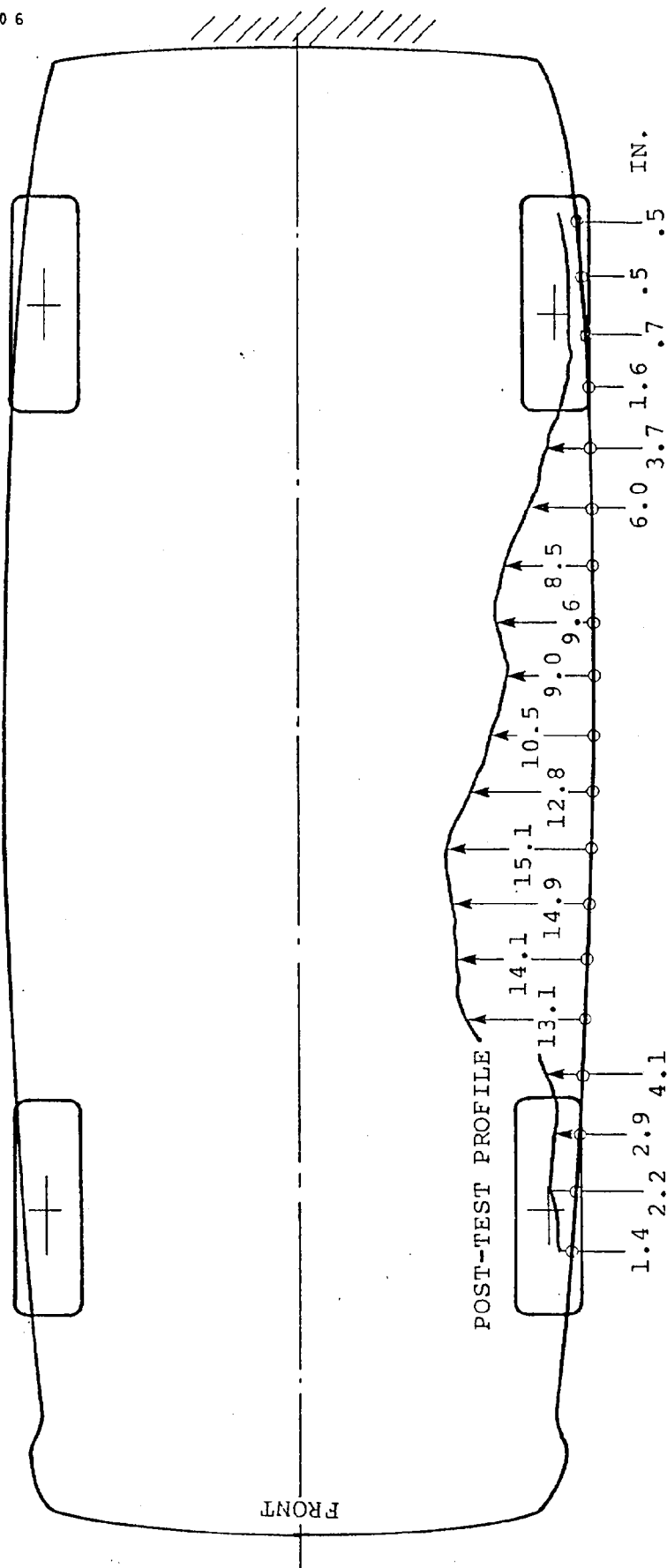


Figure 3-13. Exterior Vehicle Profile and Static Crush (in.) for Test 8321-4.2 (Data From Table 3-8).

DOOR CENTER LEVEL - 18.3 IN. ABOVE GROUND
 1976 V.W. RABBIT
 SCALE: .06" = 1"

10"

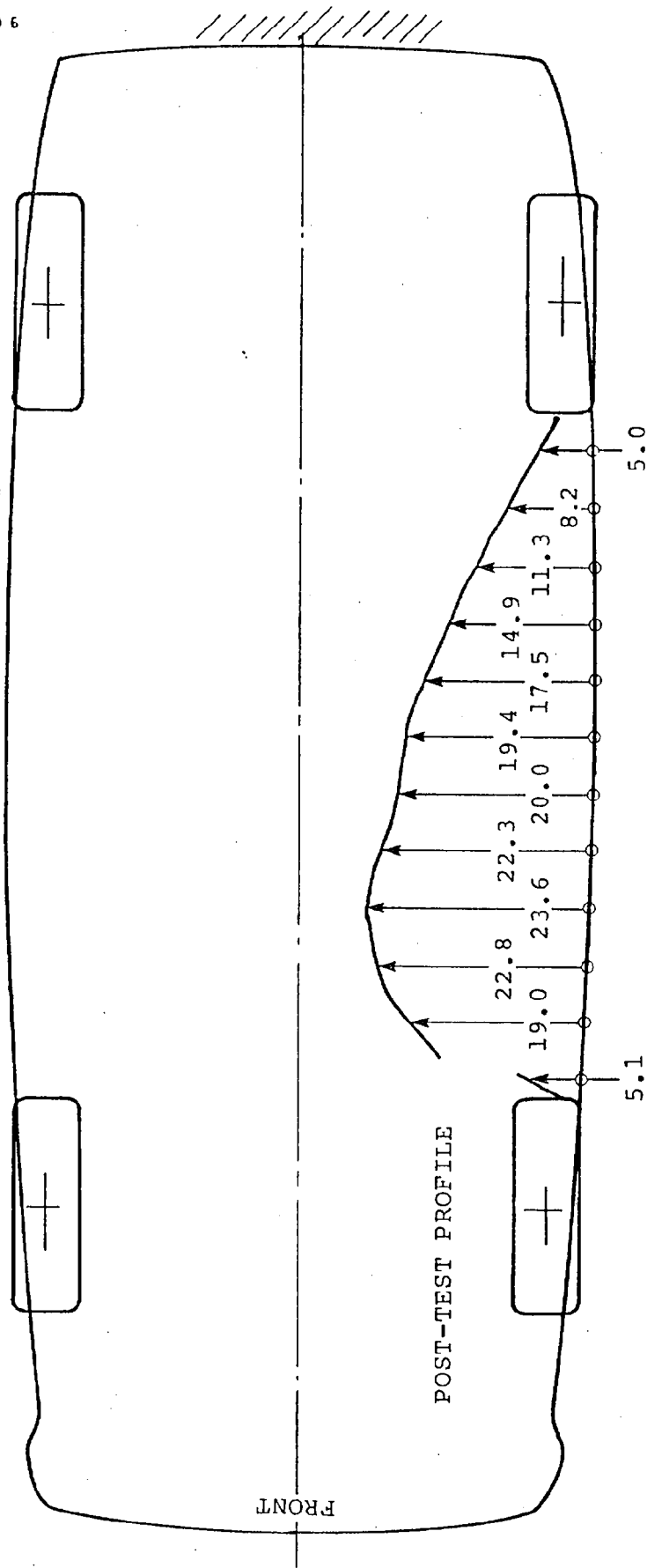


Figure 3-14. Exterior Vehicle Profile and Static Crush (in.) for Test 8321-4.2
 (Data From Table 3-8).

WINDOW TOP LEVEL - 49.6 IN. ABOVE GROUND
 1976 V.W. RABBIT
 SCALE: .06" = 1"



90105104

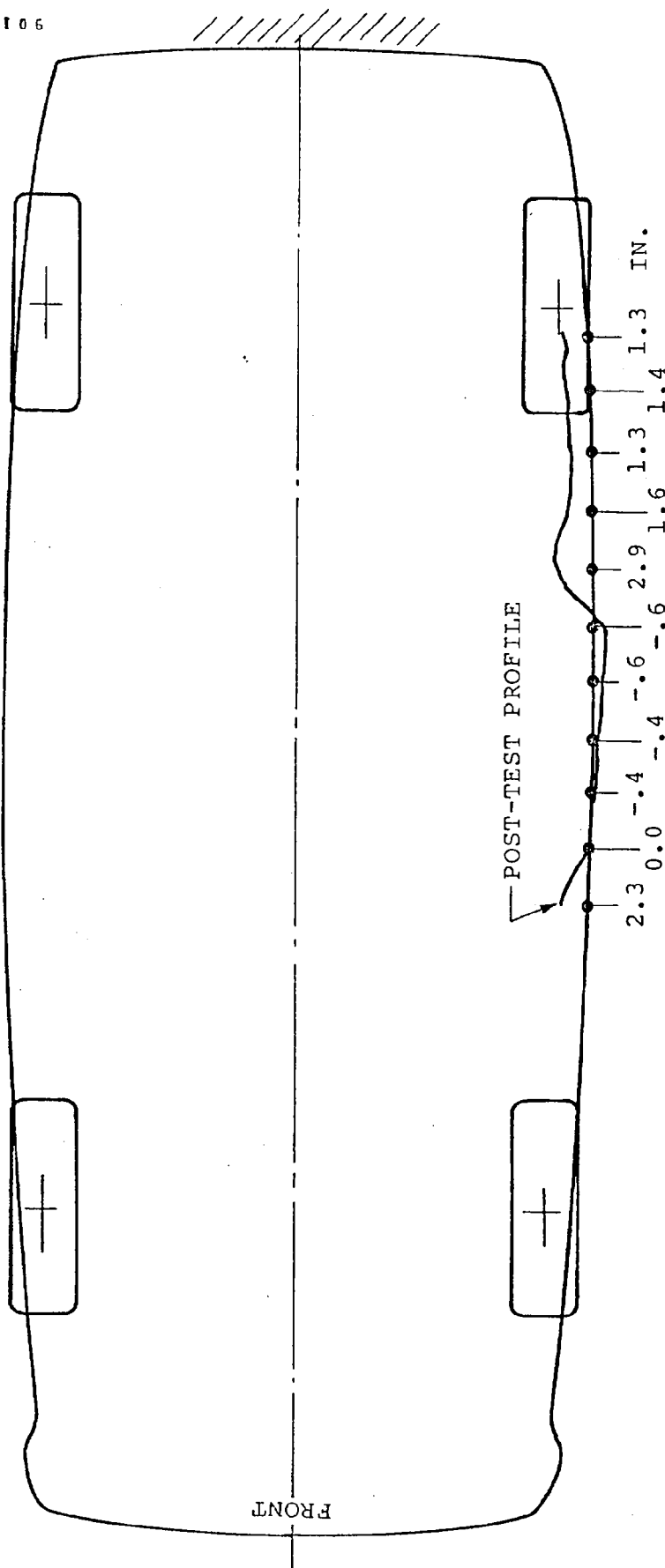


Figure 3-15. Exterior Vehicle Profile and Static Crush (in.) for Test 8321-4.2
 (Data From Table 3-8).

TABLE 3-9. VEHICLE INTERIOR INTRUSION

Location	Height (in.)	DISTANCE FROM REARMOST EDGE OF REAR DOOR PANEL (IN.)											
		0	6	12	18	24	30	36	42	48	54	60	66
<u>PRE-TEST WIDTH (IN.)</u>													
3/4 Door Level	29.5	50.0	50.5	50.9	50.8	50.7	51.7	51.7	51.7	51.1	52.1	51.9	51.7
Door Beam Level	24.6	-	50.5	51.0	51.0	50.7	51.8	51.8	51.7	51.8	51.9	51.8	51.7
1/4 Door Level	18.3	-	50.5	51.0	51.0	50.9	51.8	51.7	51.7	51.8	51.9	51.9	52.0
<u>POST-TEST WIDTH (IN.)</u>													
3/4 Door Level	29.5	49.8	49.9	47.0	43.8	40.3	39.3	38.8	38.5	37.1	36.5	35.8	33.0
Door Beam Level	24.6	-	48.6	47.0	44.8	39.0	39.3	37.0	36.4	34.8	34.4	34.1	32.9
1/4 Door Level	18.3	-	48.4	47.3	45.0	38.4	39.5	36.3	35.0	33.2	32.6	32.0	31.7
<u>STATIC INTRUSION (IN.)</u>													
3/4 Door Level		0.2	0.6	3.9	7.0	10.4	12.4	12.9	13.2	14.0	15.6	16.1	18.7
Door Beam Level		-	1.9	4.0	6.2	11.7	12.5	14.8	15.3	17.0	17.5	17.7	18.8
1/4 Door Level		-	2.1	3.7	6.0	12.5	12.3	15.4	16.7	18.6	19.3	19.9	20.3

ONE-QUARTER DOOR LEVEL

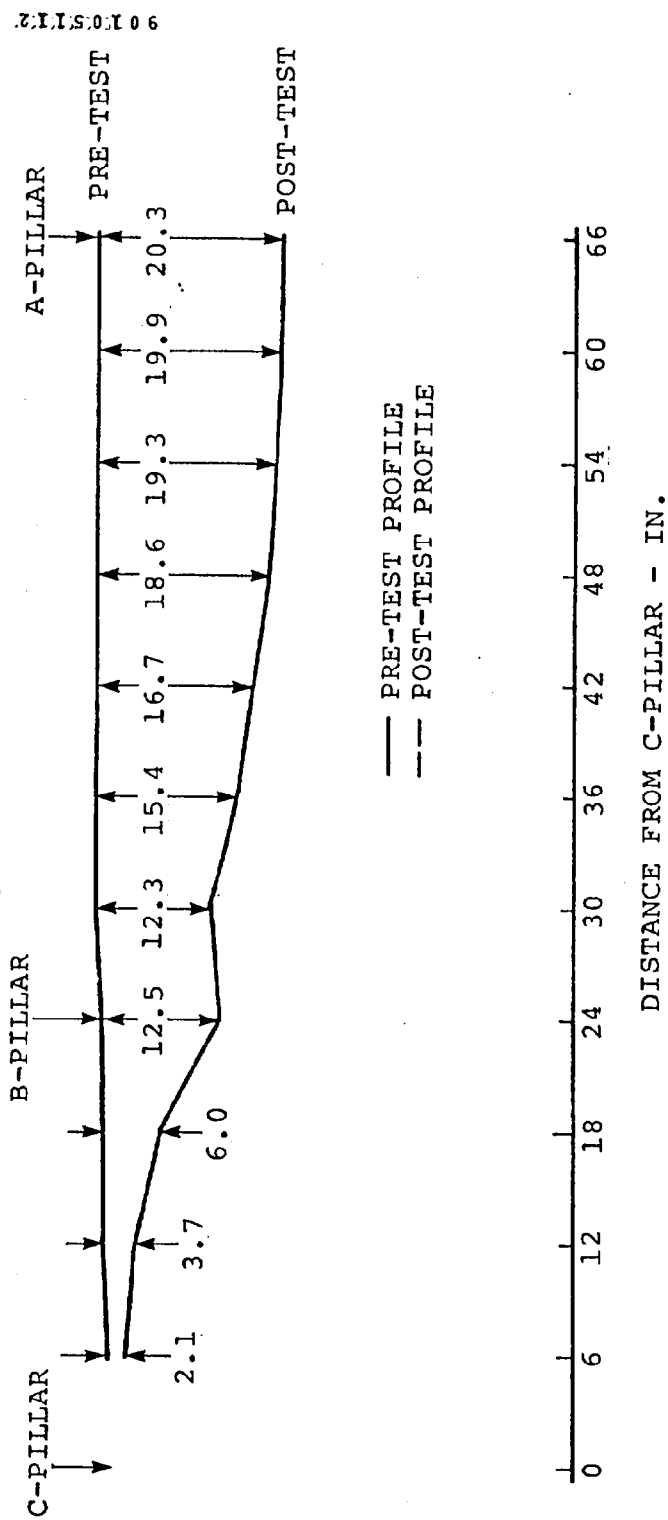
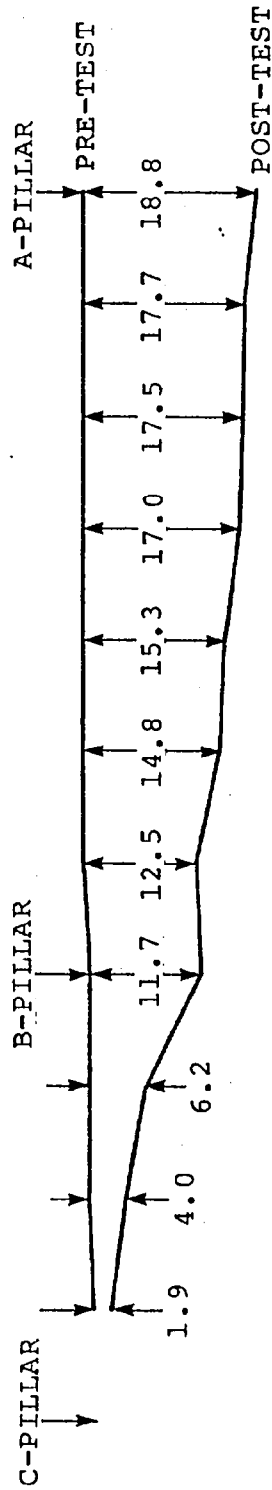


Figure 3-16. Interior Profile and Intrusion at One-Quarter Door Level for 1976
V.W. Rabbit Test 8321-4.2.

DOOR BEAM LEVEL

61150106



— PRE-TEST PROFILE
 -- POST-TEST PROFILE

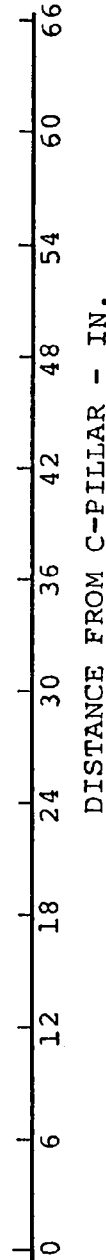


Figure 3-17. Interior Profile and Intrusion at Door Beam Level for 1976
 V.W. Rabbit Test 8321-4.2.

THREE-QUARTER DOOR LEVEL

41150106

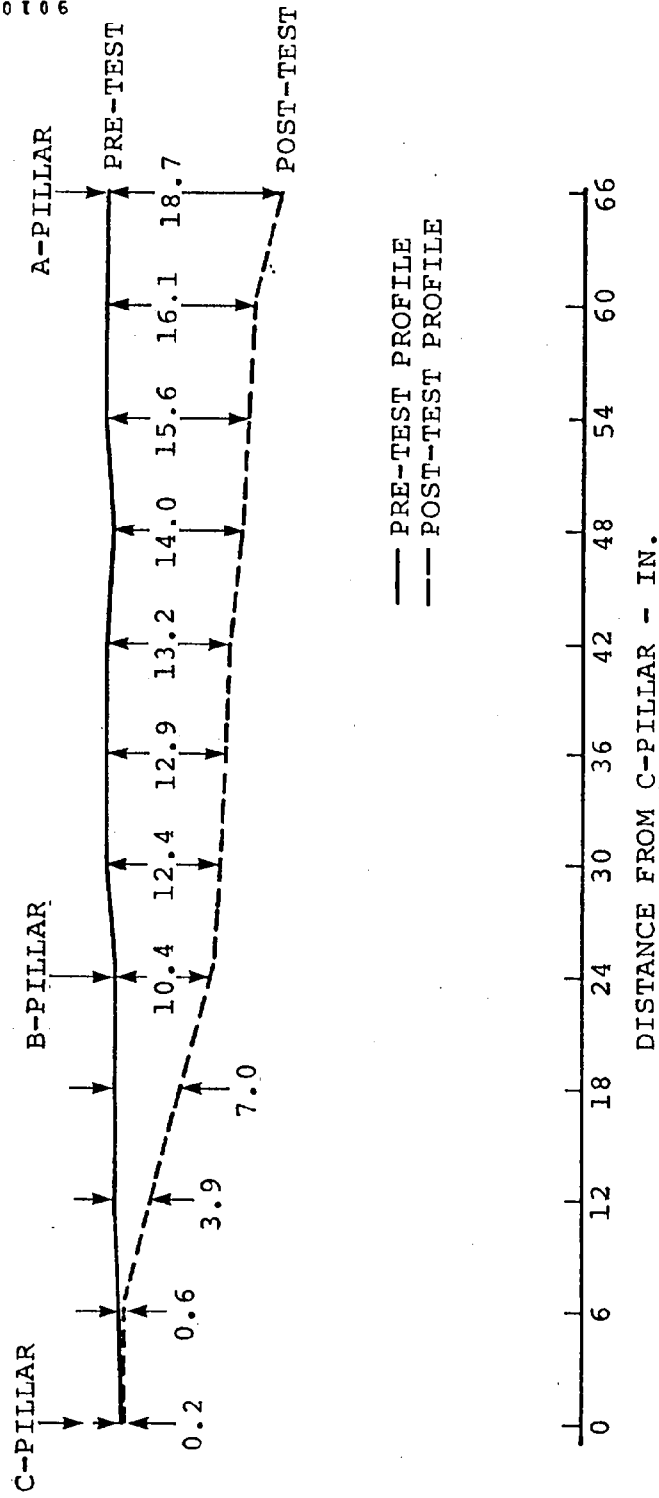


Figure 3-18. Interior Profile and Intrusion at Three-Quarter Door Level for 1976 V.W. Rabbit Test 8321-4.2.

TABLE 3-10. 1976 VOLKSWAGEN RABBIT STEERING WHEEL MEASUREMENTS
AND DISPLACEMENT VALUES FOR TEST 8321-4.2

Wheel Location	Pre-test (in.)			Post-test (in.)			Displacement (in.)		
	X*	Y*	Z*	X	Y	Z	X	Y	Z
Top	91.0	-12.2	41.4	94.9	-4.3	43.3	-3.9	7.9	7.2
Hub	87.7	-12.2	34.6	90.9	-7.3	36.8	-3.2	4.9	4.4
Bottom	83.9	-12.2	28.5	85.2	-9.8	33.0	1.3	2.4	2.4

*Reference for X, Y, Z measurements are rear bumper, vehicle centerline and ground level, respectively.

TABLE 3-11. SUMMARY OF TEST CAR ACCELEROMETER DATA*

Accelerometer Number	Maximum Acceleration		Maximum Velocity		Maximum Displacement (to 200 msec)	
	A (G)	Time (msec)	V (mph)	Time (msec)	S (in.)	Time (msec)
1X	-6.6	92	-6.3	169	-12.8	200
1Y	22.3	88	15.4	144	33.5	200
1Z	27.4	82	-1.7	96	-0.8	139
2X	-5.8	41	-4.6	170	-9.2	200
2Y	20.6	93	17.8	131	38.0	200
2Z	-9.0	85	2.9	190	3.8	200
3X	-15.6	74	-8.9	200	-17.2	200
3Y	23.0	91	20.3	125	42.6	200
3Z	18.0	73	1.6	76	0.6	105
4Y	58.6	62	15.4	101	32.8	200
5Y	-74.6	9	11.5	32	18.2	200
6Y	92.2	30	22.2	74	53.0	200
7X	-16.8	75	-10.3	167	-20.2	200
8X	-11.7	80	-5.8	167	-11.9	200
9Y	167.9	60	41.7	65	97.1	200
10Y	54.9	62	23.3	73	54.4	200
11Y	-87.8	42	23.9	81	48.2	200

*See Figure 3-1 for accelerometer locations.

TABLE 3-12. SUMMARY OF TEST CAR ACCELEROMETER DATA*
(TEST 8321-4.2)

Accelerometer Number	Maximum Acceleration		Maximum Velocity		Maximum Displacement	
	A (G)	Time (msec)	V (mph)	Time (msec)	S (in.)	Time (msec)
Resultant 1	27.4	82	16.6	145	34.8	200
Resultant 2	21.1	93	18.3	132	39.4	200
Resultant 3	29.3	92	21.8	140	46.0	200

*See Figure 3-1 for accelerometer locations.

TABLE 3-13. SUMMARY OF CAR STRING POTENTIOMETER DATA

No.	Displacement Potentiometer Location*	Maximum Dynamic Displacement		Static Displacement (in.)
		D (in.)	Time (msec)	
1	Midfront door	19.4	125	15.2
2	Sill just ahead of front seat	20.1	177	19.4
3	Sill just behind front seat	6.0	104	5.0
4	B-pillar just below windowsill	10.1	112	8.7
5	Midtop door	15.4	99	12.6
6	B-pillar at top of window	0.9	178	1.0

*See Figure 3-2 for string potentiometer locations.

TABLE 3-14. DUMMY INJURY CRITERIA VALUES
(TEST 8321-4.2)

Dummy Position	Maximum Acceleration (G) (No 3 msec clip)							
	Head				Chest			
	X	Y	Z	R	X	Y	Z	R
Dummy (1)	-16.5	28.0	41.5	48.3	-27.6	50.8	-27.2	55.6
Time (msec)	63	73	81	83	62	71	61	60
Dummy (4)	-30.7	41.2	75.1	87.9	-21.3	30.2	18.9	37.2
Time (msec)	96	92	94	94	110	110	103	110

Dummy Position	Injury Criteria*			
	HIC	Chest Acceleration**	Severity Index	
			Head	Chest
Dummy (1)	217	54.3	287	342
Time (msec)	61 - 122	68	200	200
Dummy (4)	402	35.3	550	141
Time (msec)	91 - 102	108	200	200

*As defined in FMVSS No. 208.

**3 msec clip.

TABLE 3-15. SUMMARY OF TIME OF IMPACTS

Impact Switch No.	Location of Switch	Time of Impact of Specific Switch
1 - Test Car	Initial point of impact (102.0) *	0
2 - Test Car	B-pillar (79.5)	29
3 - Test Car	C-pillar (57.0)	52

*Number in parenthesis indicates switch distance from rear bumper.

TABLE 3-16. SUMMARY OF SIDE IMPACTOR ACCELEROMETER DATA*
(TEST 8321-4.2)

Accelerometer Number	Maximum Acceleration		Maximum Velocity		Maximum Displacement	
	A (G)	Time (msec)	V (mph)	Time (msec)	S (in.)	Time (msec)
1X	-8.7	94	17.3	159	79.0	200
2X	-11.4	82	15.1	200	75.4	200
3Y	4.5	110	-0.8	97	1.6	200
4Y	3.6	82	0.0	0	7.6	200

*For location of accelerometers, see Figure 3-3.

TABLE 3-17. TEST DEVICE HONEYCOMB POST-TEST CRUSH PROFILE (TEST 8321-4.2)

Crush Location*	Height Above Ground (in.)	Column Designations*													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Row G	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Row F	0.6	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	2.6	1.2	1.3	2.8	4.5	7.3
Row E	0.7	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.3	0.4	0.8	0.2	1.4	3.4	5.8
Row D	0.7	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.5	1.8	4.6
Row C	0.9	0.0	0.2	0.4	0.6	0.7	0.7	0.6	0.6	0.9	2.1	3.5	5.0	6.6	8.3
Row B	0.7	0.5	0.7	0.8	1.0	1.2	1.2	1.0	0.7	0.8	1.9	3.2	4.8	6.1	7.8
Row A	0.6	1.0	1.2	1.4	1.7	1.9	2.0	1.7	1.2	0.8	1.8	3.0	4.4	5.8	7.3

*See Figure 3-13.

TABLE 3-18. SUMMARY OF SIDE IMPACTOR STRING
POTENTIOMETER DATA

<u>Displacement Potentiometer</u>		<u>Maximum Dynamic Displacement</u>		<u>Residual Static Displacement (in.)</u>
<u>No.</u>	<u>Location*</u>	<u>D (in.)**</u>	<u>Time (msec)</u>	
1	AB6	0.8	117	0.9
2	AB7	1.1	73	1.0
3	AB8	3.5	75	2.9
4	AB9	5.6	117	5.2
5	A10	6.4	127	17.7
6	C6	0.3	22	0.0
7	C7	0.7	145	0.8
8	C8	0.7	103	0.3
9	C9	3.4	103	3.1

*For string potentiometer location, see Figure 3-13.

**Values indicate that string potentiometers AB8 and C6 did not function during complete crash.

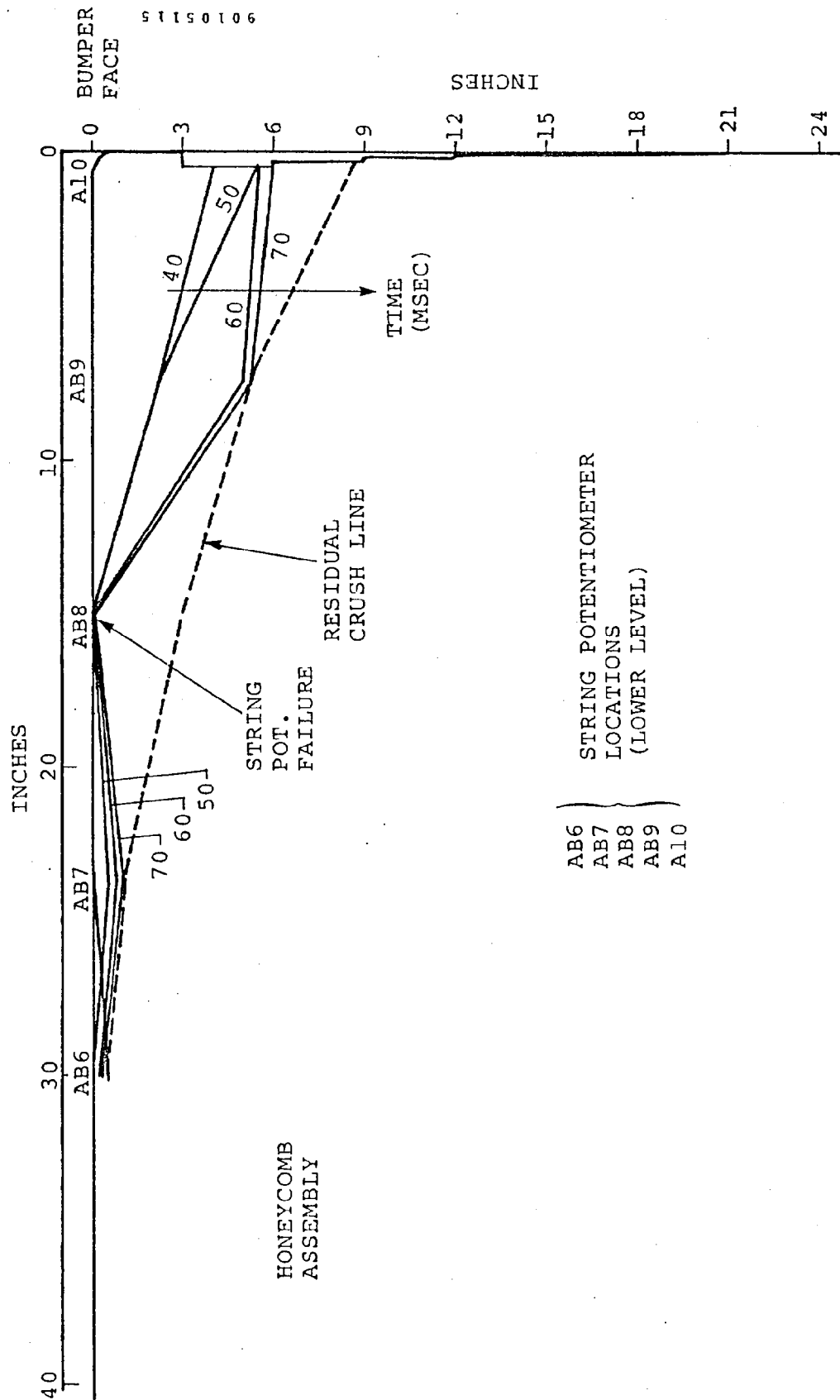


Figure 3-19. Crushing Face Versus Time, Superimposed on Honeycomb Assembly Geometry - String Potentiometer Data for Test 8321-4.2.

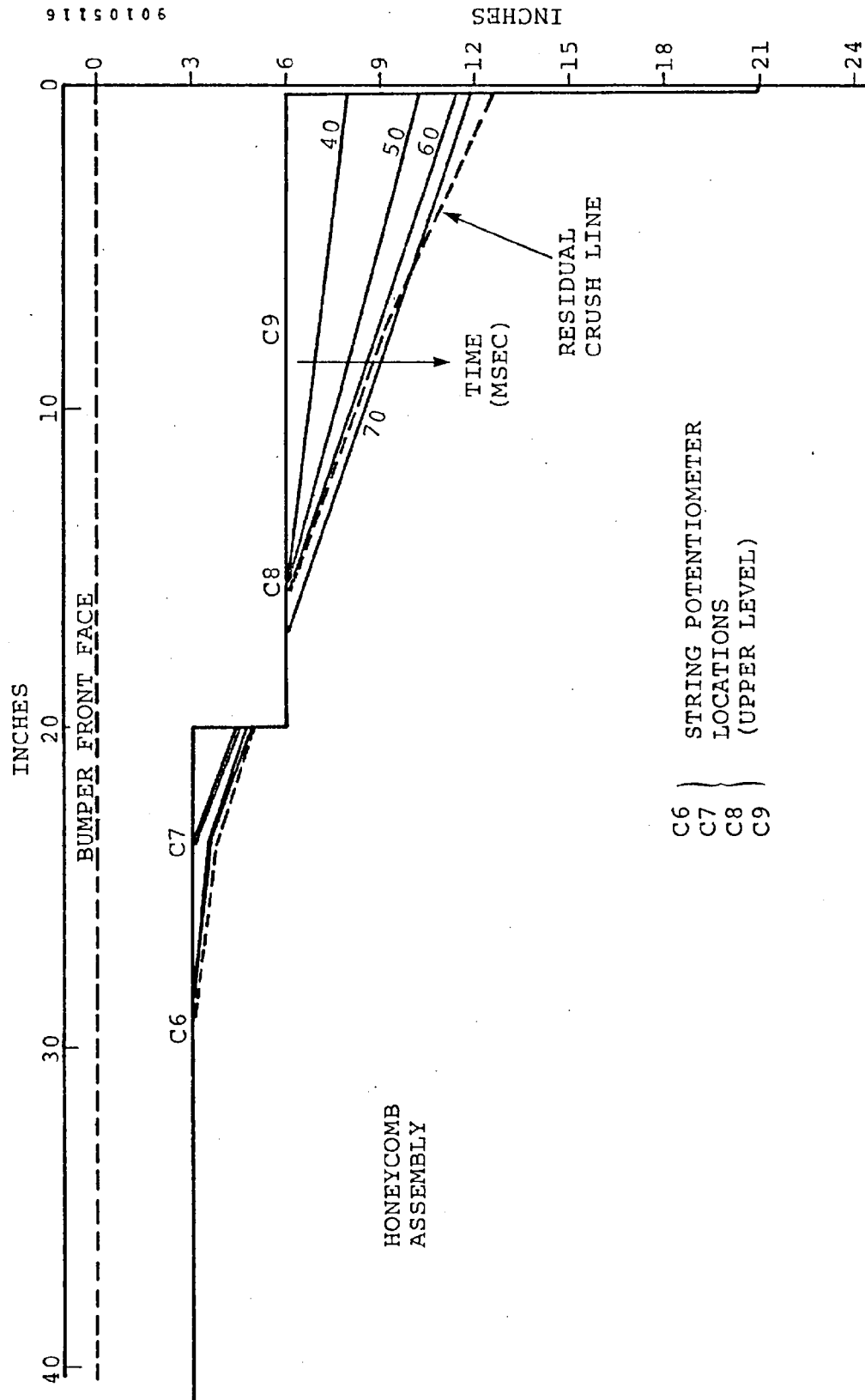


Figure 3-20. Crushing Face Versus Time, Superimposed on Honeycomb Assembly Geometry - String Potentiometer Data for Test 8321-4.2.

4.0 COMPARISON OF RESULTS WITH PREVIOUS TEST

Results from Dynamic Science Test 8321-4.2 were compared to the Calspan Baseline Test No. 4. Table 4-1 presents a comparison of relevant data from these two tests. Figures 4-1 through 4-4 show the comparison of exterior crush profiles at several levels. Figure 4-5 presents a comparison of front compartment lateral acceleration for Test 8321-4.2 and Calspan Baseline Test No. 4.

The impact speed for Test 8321-4.2 was 30.3 mph; for Calspan Test No. 4 the impact speed was 29.1 mph. Thus, we would expect somewhat greater crush for Test 8321-4.2, since the impact speed was 4.1 percent higher. This speed difference is probably more significant than the bullet vehicle test weight difference of 242 pounds (-6.2%).

TABLE 4-1. COMPARISON OF TEST 4.2 TO BASELINE TEST

	Dynamic Science Test 8321-4.2	Calspan Baseline Test No. 4*	Percent Difference
Target Vehicle	1976 VW Rabbit	1976 VW Rabbit	
Bullet Vehicle	NHTSA Side Impactor	1978 Chevrolet Impala	
Target Test Weight (lb)	2401	2380	+8.8
Bullet Test Weight (lb)	3628	3870	-6.3
Target Vehicle Maximum Side Exterior Crush (in.)	23.6	21.0	+12.4
Target Vehicle Maximum Acceleration (g)			
Impacted Door (upper door)	+54.9 ± 32	+100 ± 43	-45.1
Impacted Rocker Panel	-74.6 ± 9	+11.7 ± 82	-737.6
Bullet Vehicle Maximum Acceleration (g)			
Impacted Side	-11.4 ± 32	-7.3 ± 70	+46.2
Non-impacted Side	-3.7 ± 94	-7.2 ± 64	+20.8
Dummy Maximum Acceleration (g)**		(Approx. Times - from graphs)	
Driver Head			
X	-12.5 ± 67-69 msec	-12 ± 94 msec	+4.2
Y	14.3 ± 72-74 msec	19 ± 70 msec	-24.7
Z	34.2 ± 79-81 msec	35 ± 77 msec	-2.3
R	35.3 ± 79-81 msec	19 ± 77 msec	-9.5
Driver Chest			
X	-22.3 ± 67-69 msec	16 ± 91 msec	-242.5
Y	46.3 ± 69-71 msec	38 ± 56 msec	-20.2
Z	-21.1 ± 60-62 msec	-20 ± 50 msec	+9.0
R	52.3 ± 67-69 msec	58 ± 56 msec	-9.8
Driver HIC	217 ± 61 - 122 msec	111 ± 59 - 139 msec	+95.5
Severity Index			
Driver Head	287	160	+79.4
Driver Chest	342	310	+10.3

*Calspan Report No. 6225-V-3, 2 Feb 1978.

**Dummy accelerations are taken not to exceed a 3-msec consecutive duration. Calspan passenger was placed in front seat so passenger data will not be compared.

AXLE LEVEL - 10.9 IN. ABOVE GROUND
 1976 V.W. RABBIT
 SCALE: .06" = 1"
 10"

90105123

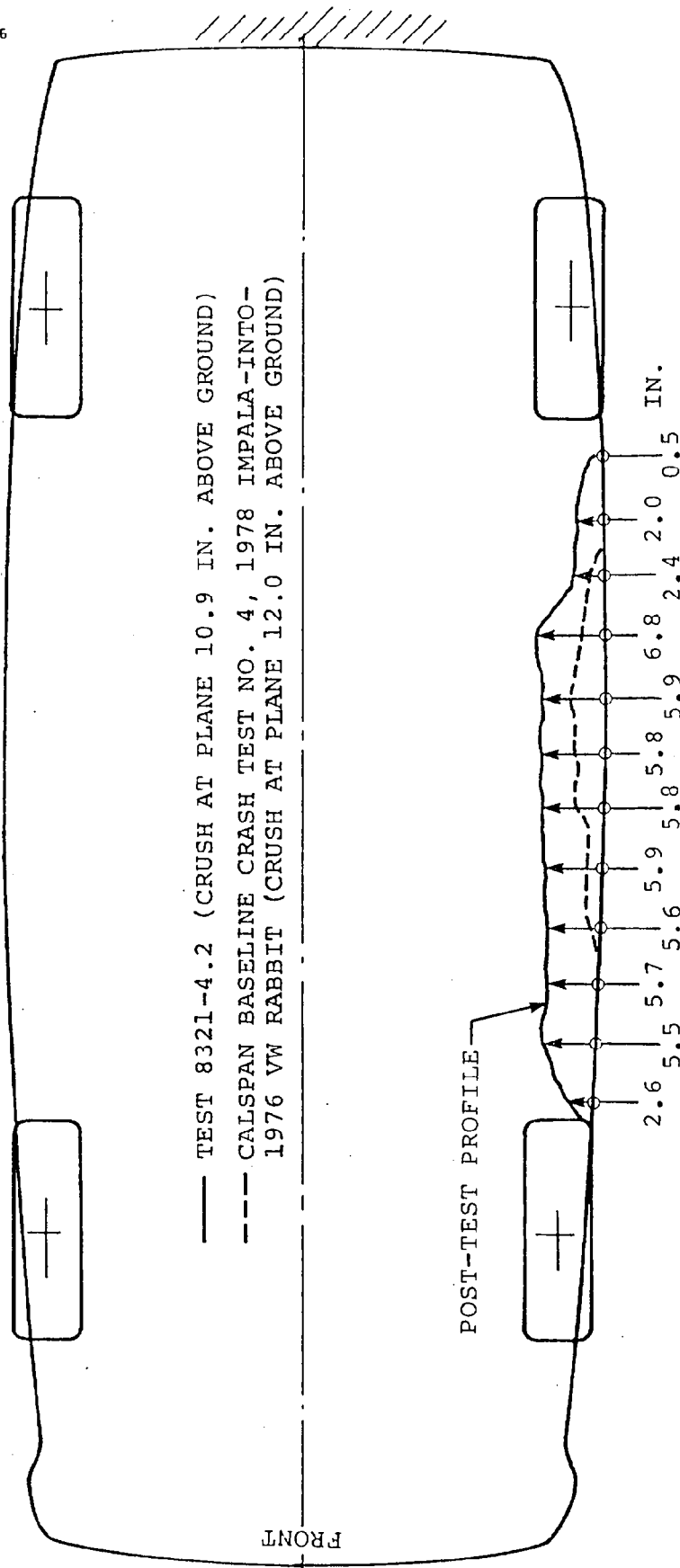


Figure 4-1. Comparison of Exterior Crush Profiles - 1976 VW Rabbit (Test 8321-4.2 and Calspan Baseline Test No. 4).

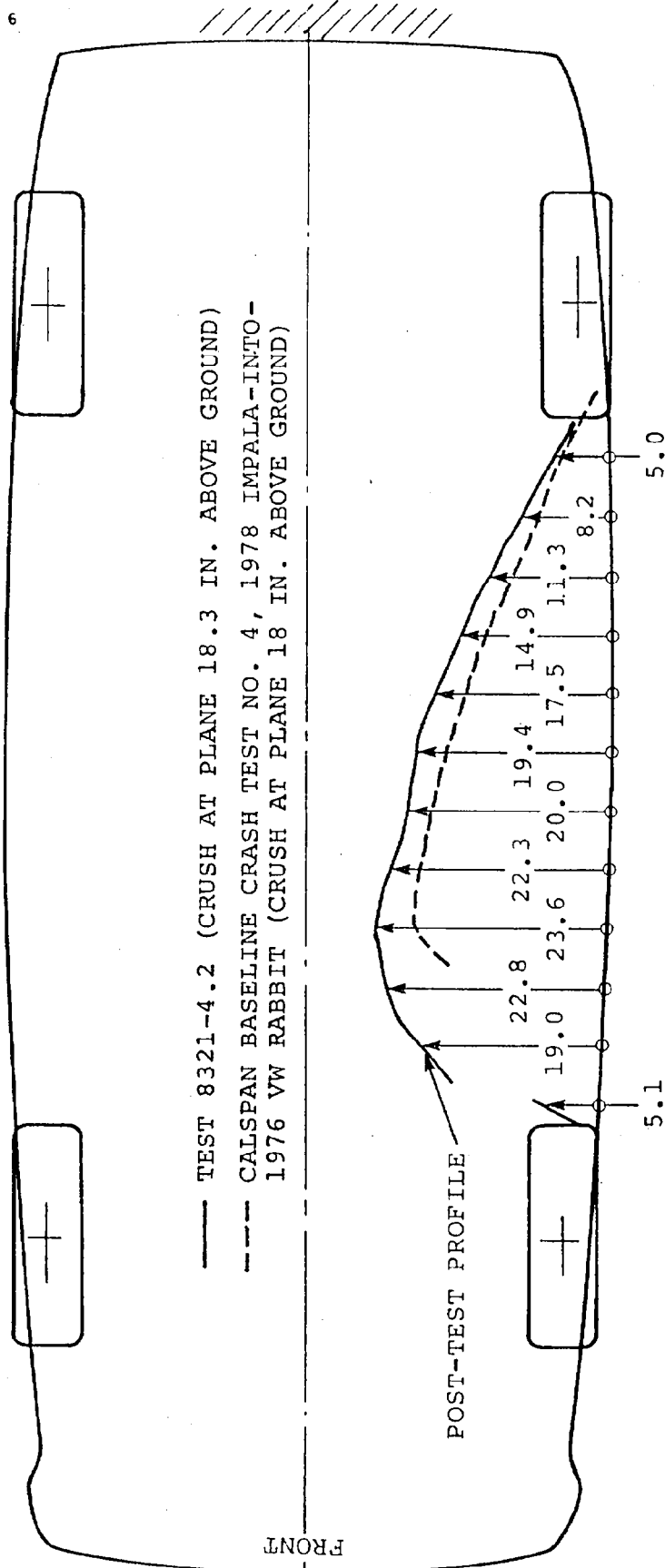
DOOR CENTER LEVEL - 18.3 IN. ABOVE GROUND

1976 V.W. RABBIT

SCALE: .06" = 1"



10"



— TEST 8321-4.2 (CRUSH AT PLANE 18.3 IN. ABOVE GROUND)

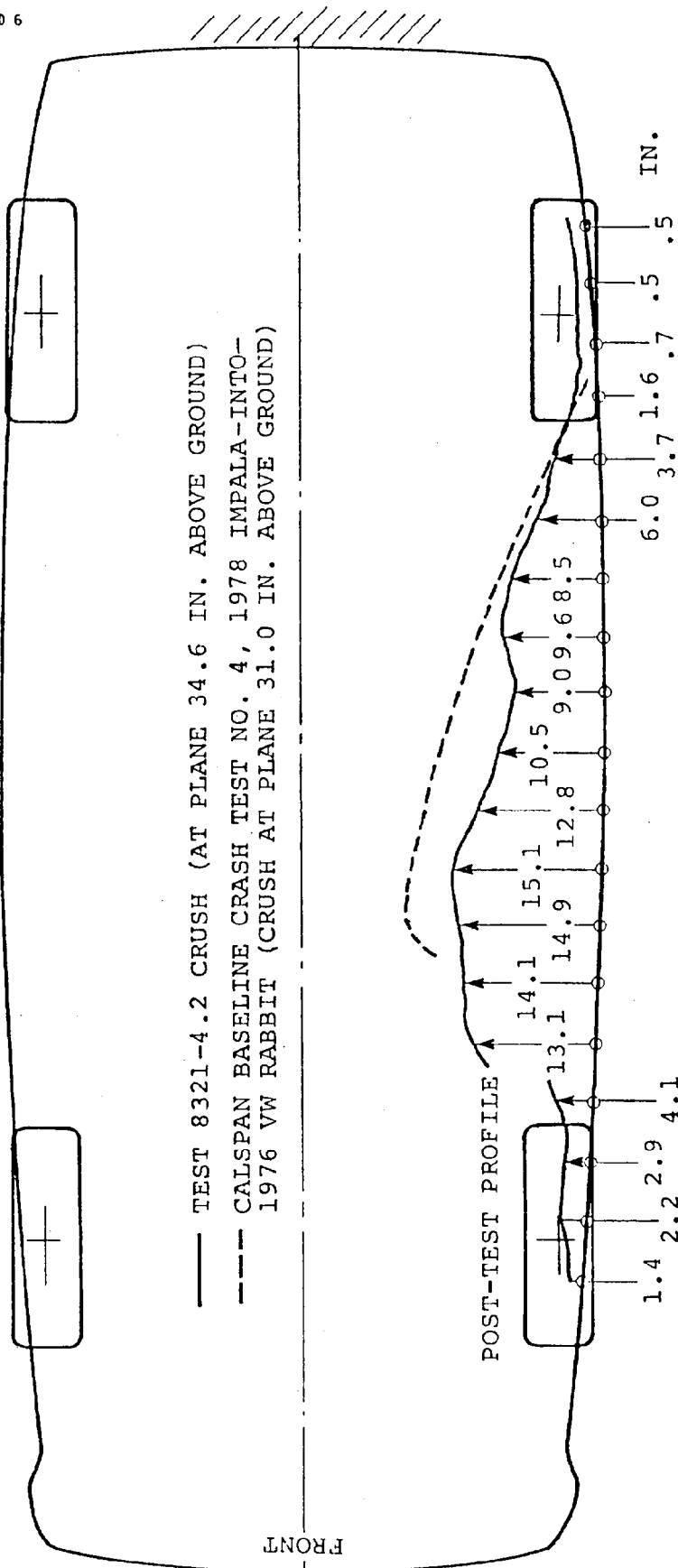
- - - CALSPAN BASELINE CRASH TEST NO. 4, 1978 IMPALA-INTO-1976 VW RABBIT (CRUSH AT PLANE 18 IN. ABOVE GROUND)

Figure 4-2. Comparison of Maximum Exterior Crush Profiles - 1976 V.W. Rabbit (Test 8321-4.2 and Calspan Baseline Test No. 4).

WINDOW SILL LEVEL - 34.6 IN. ABOVE GROUND

1976 V.W. RABBIT

SCALE: .06" = 1"



— TEST 8321-4.2 CRUSH (AT PLANE 34.6 IN. ABOVE GROUND)

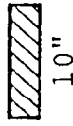
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Figure 4-3. Comparison of Exterior Crush Profiles - 1976 VW Rabbit (Test 8321-4.2 and Calspan Baseline Test No. 4).

WINDOW TOP LEVEL - 49.6 IN. ABOVE GROUND

1976 V.W. RABBIT

SCALE: .06" = 1"



10"

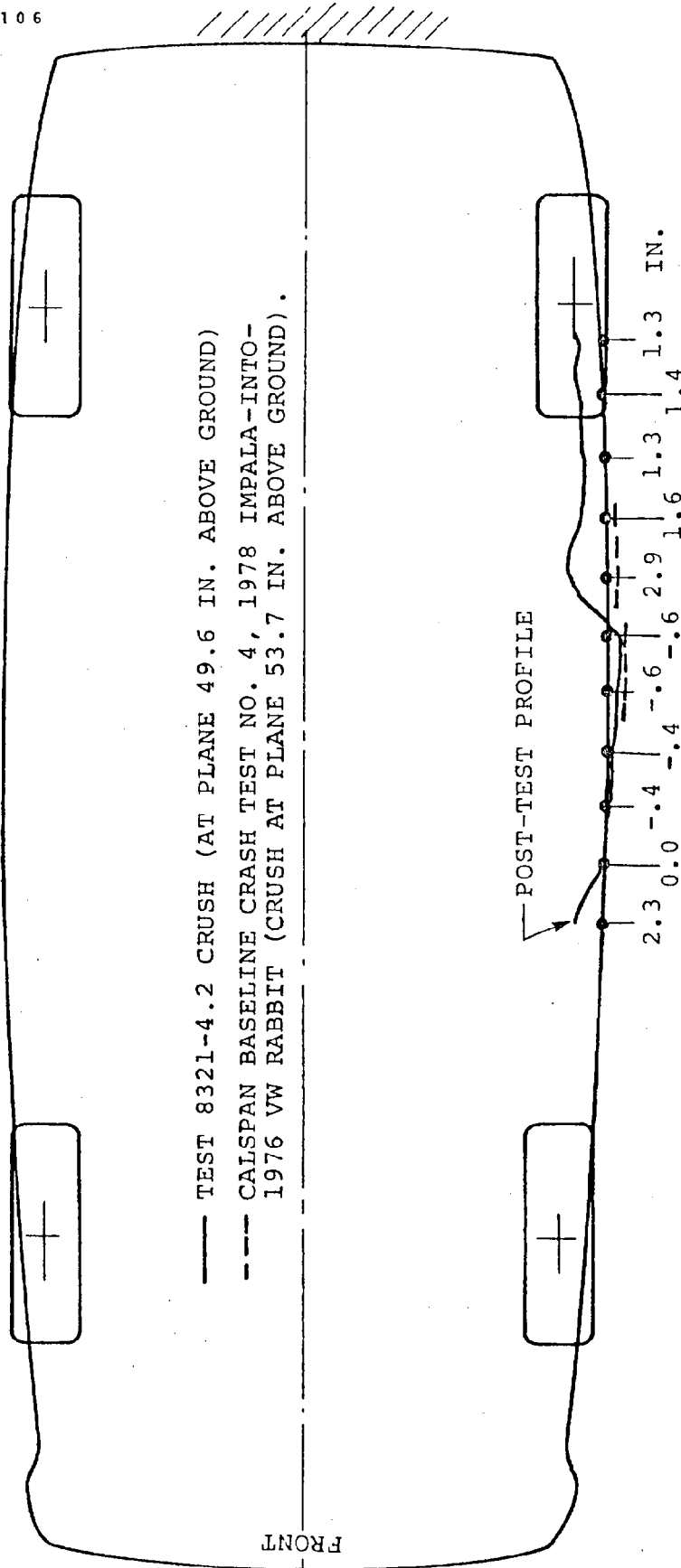


Figure 4-4. Comparison of Exterior Crush Profiles - 1976 VW Rabbit (Test 8321-4.2 and Calspan Baseline Test No. 4).

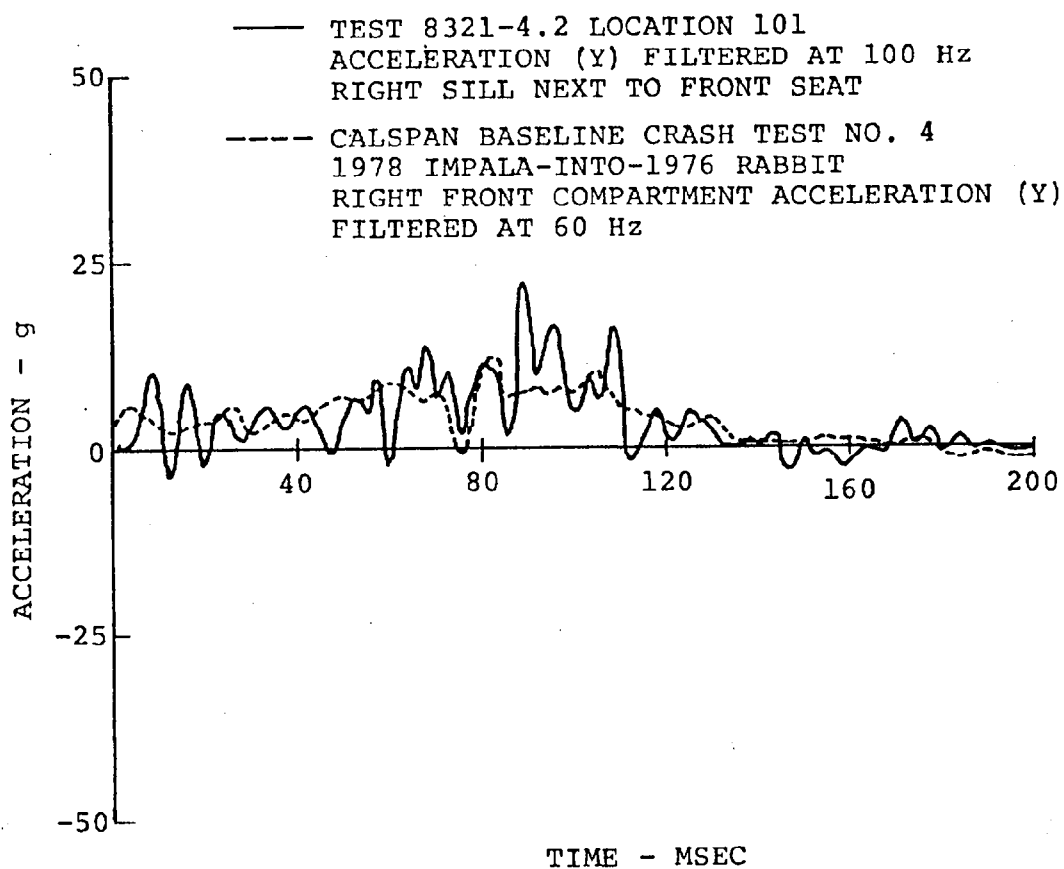


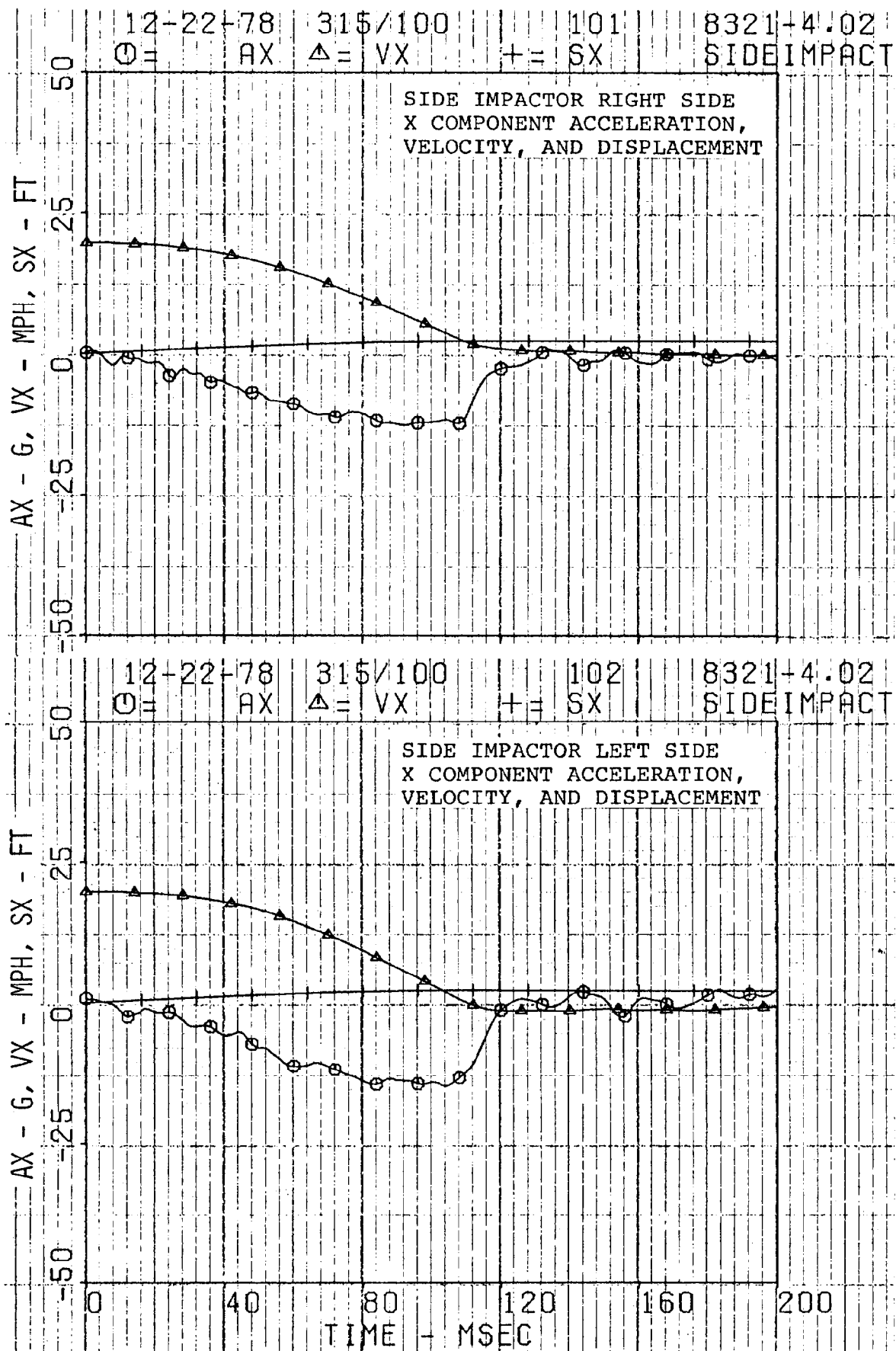
Figure 4-5. Comparison of Front Compartment Acceleration for Test 8321-4.2 and Calspan Baseline Test No. 4.

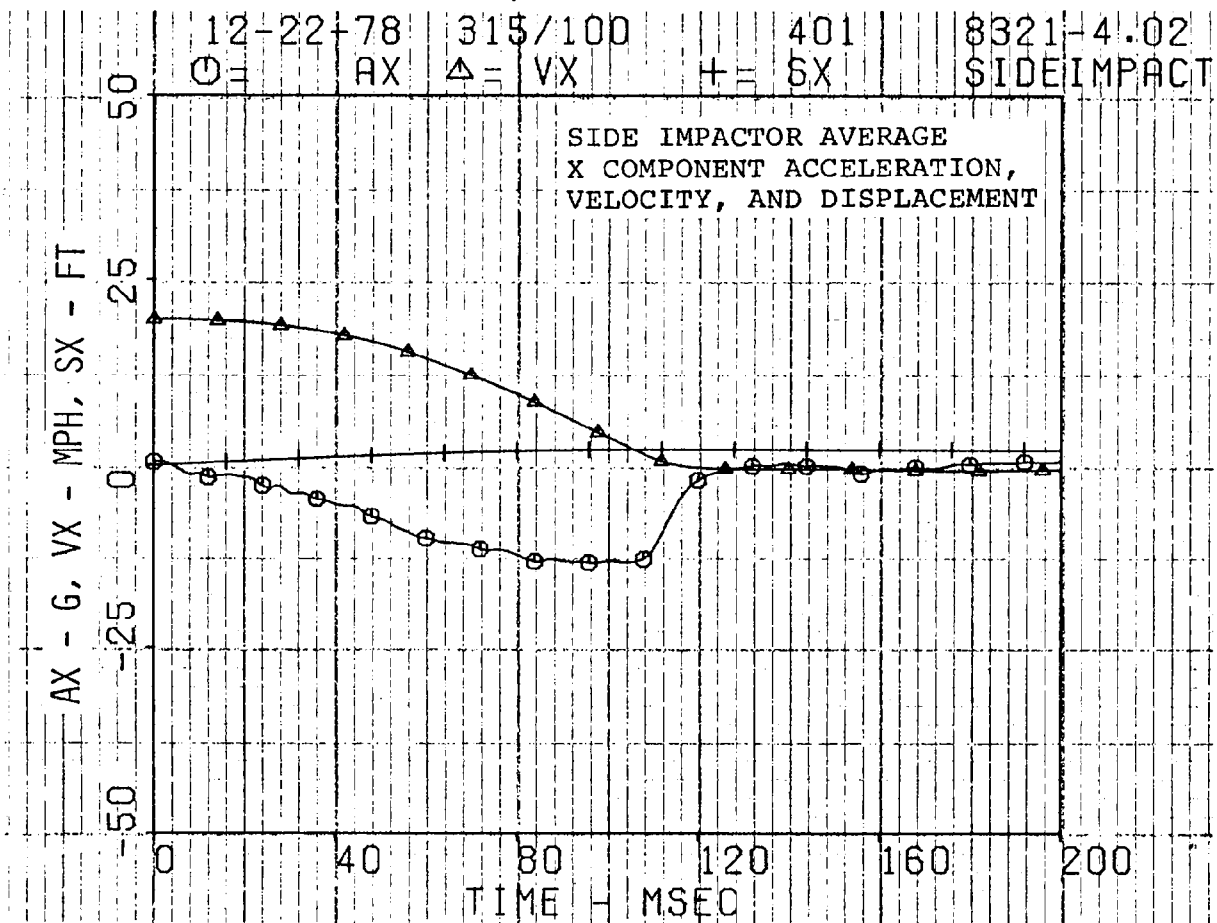
APPENDIX A

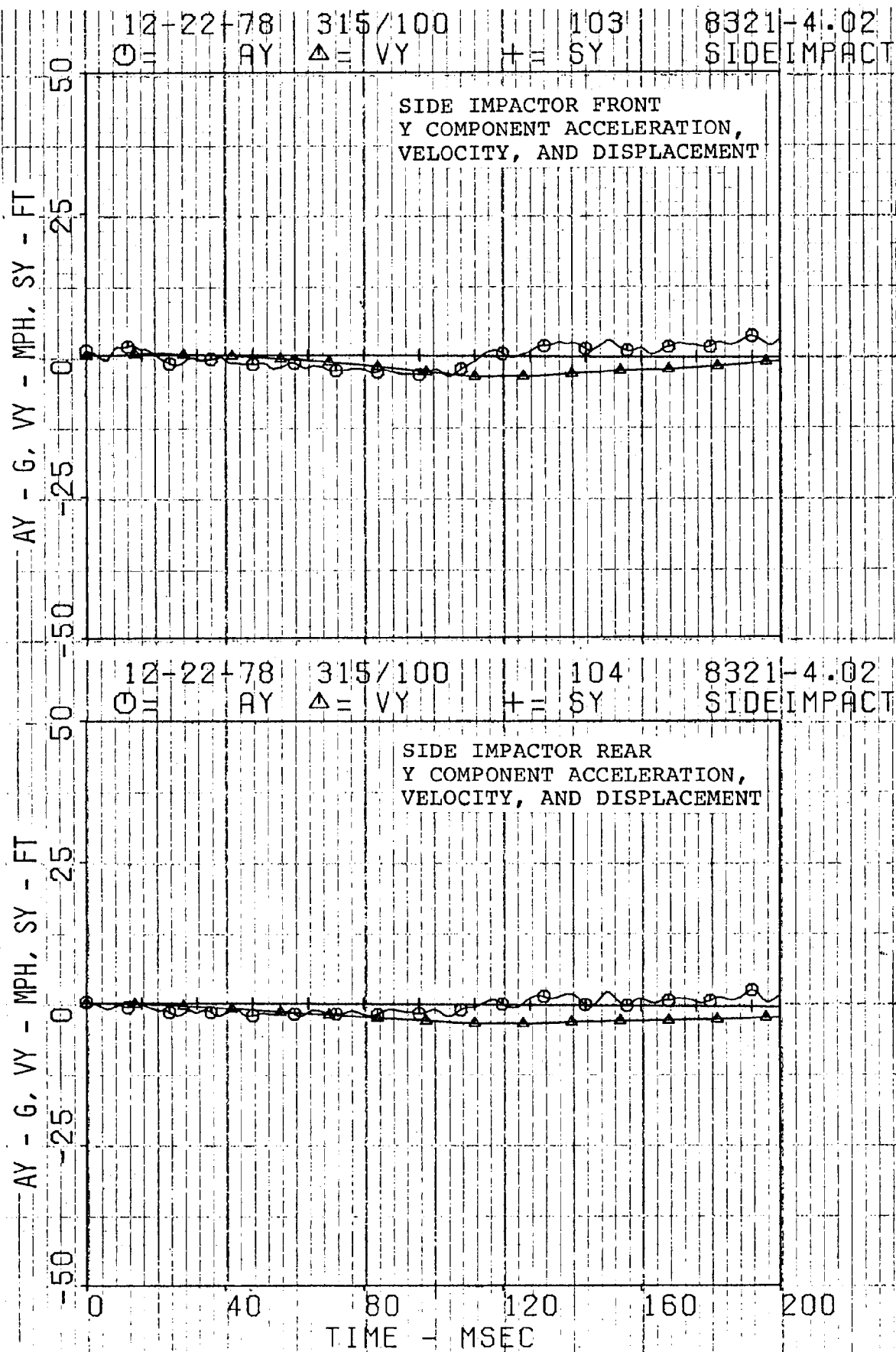
CALCOMP PLOTS FOR ANGLED

FIXED BARRIER CRASH

TEST 8321-4.02





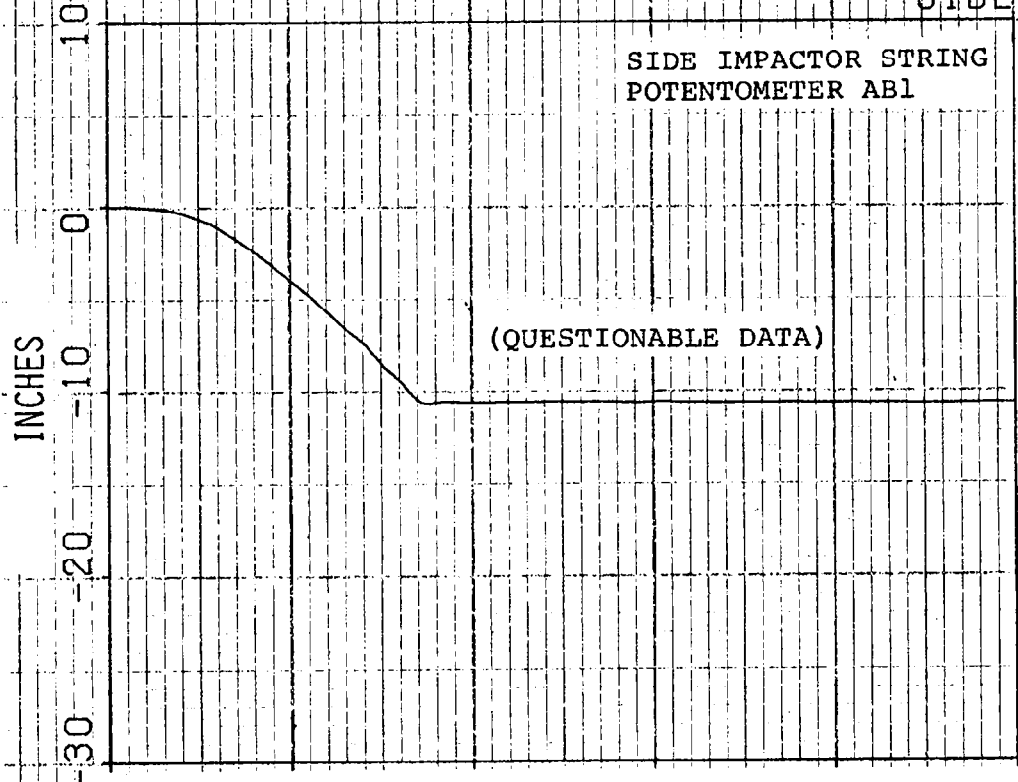


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LOCATION
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TEST NO
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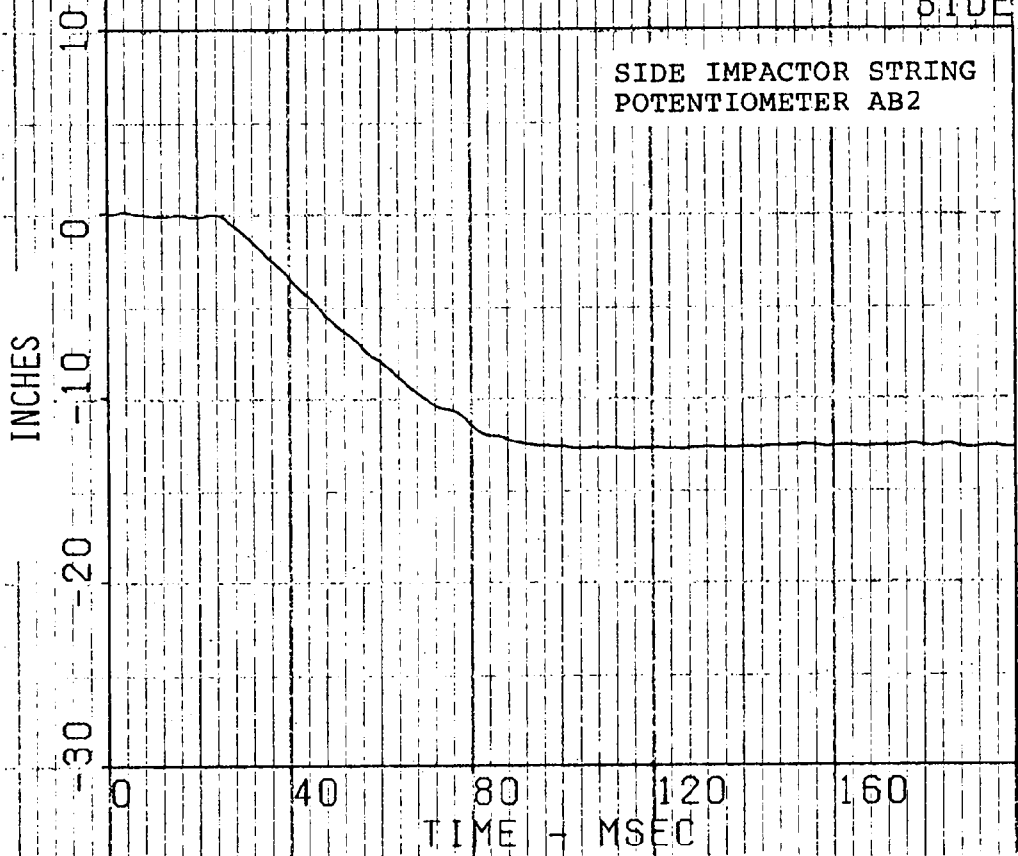


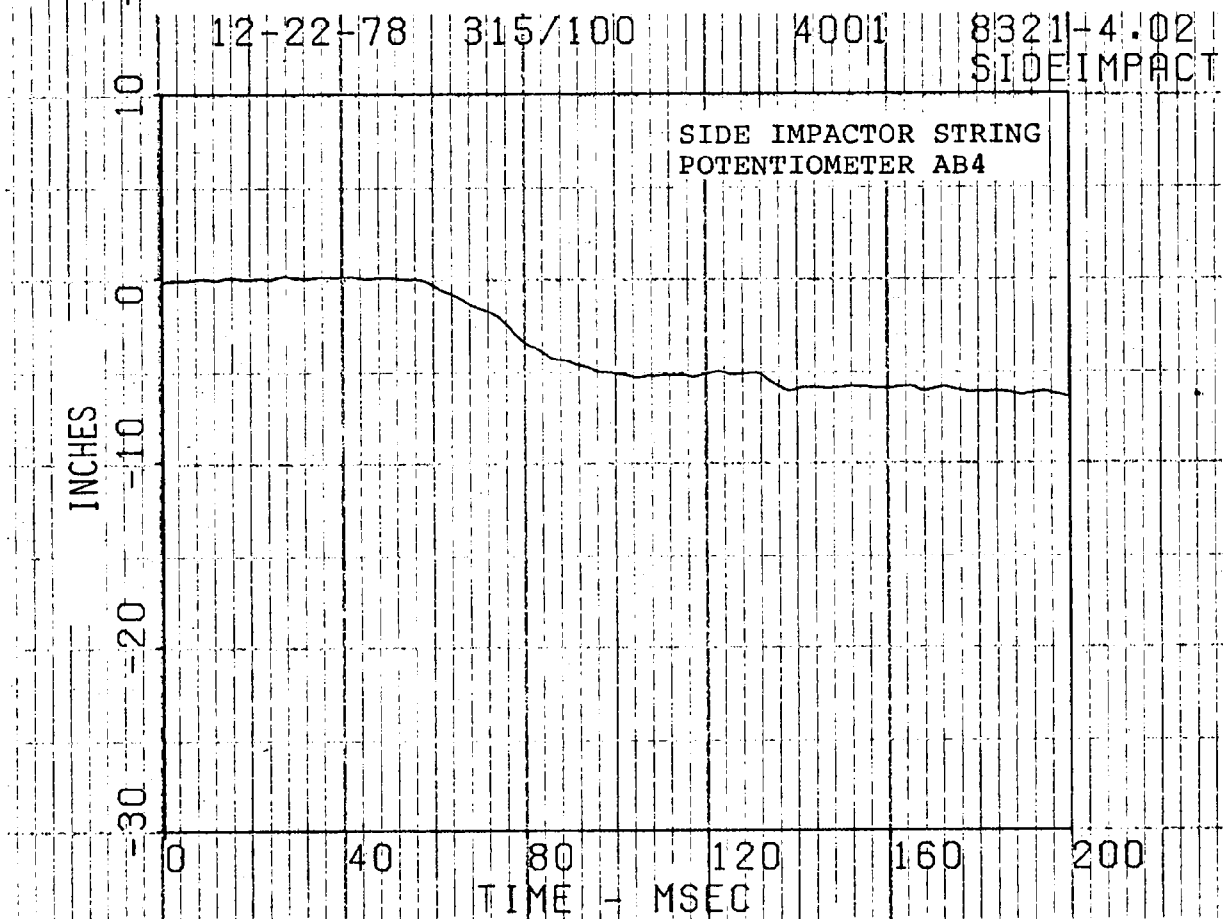
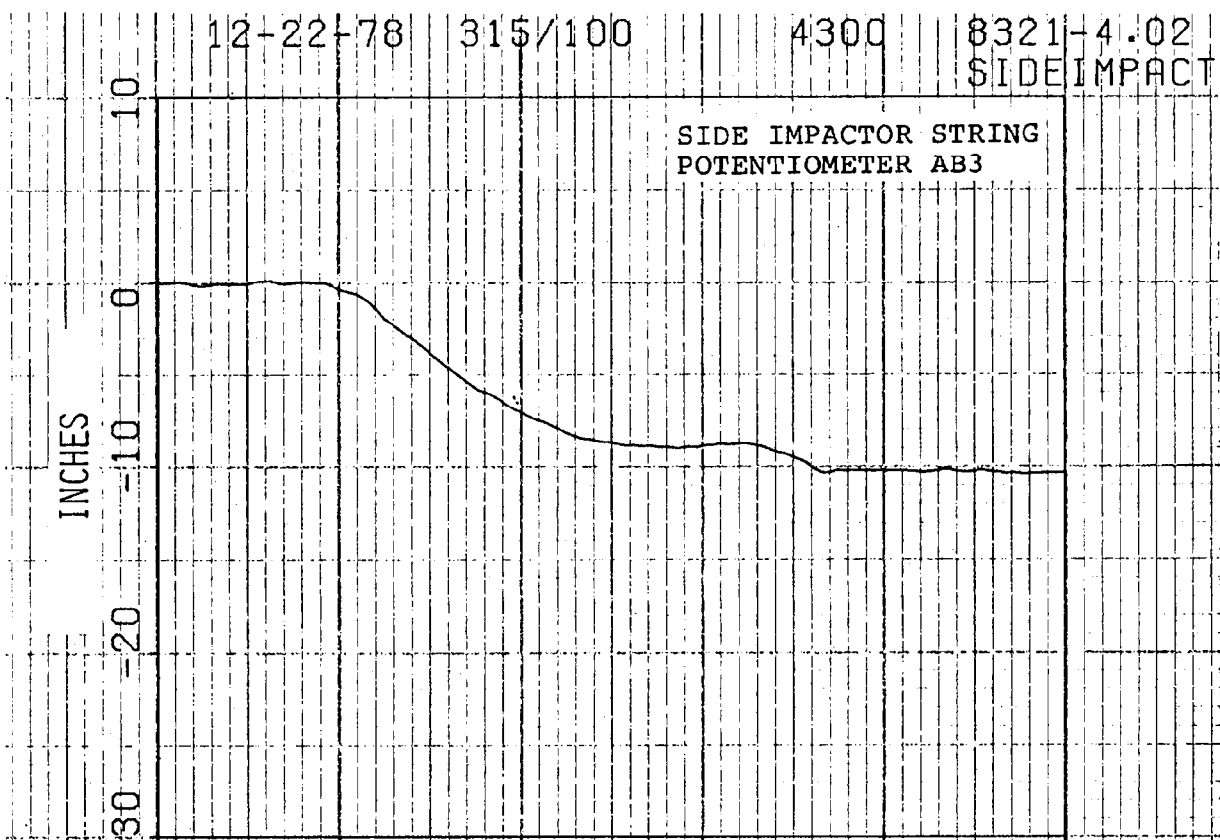
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315/100

4300

8321-4.02
SIDE IMPACT





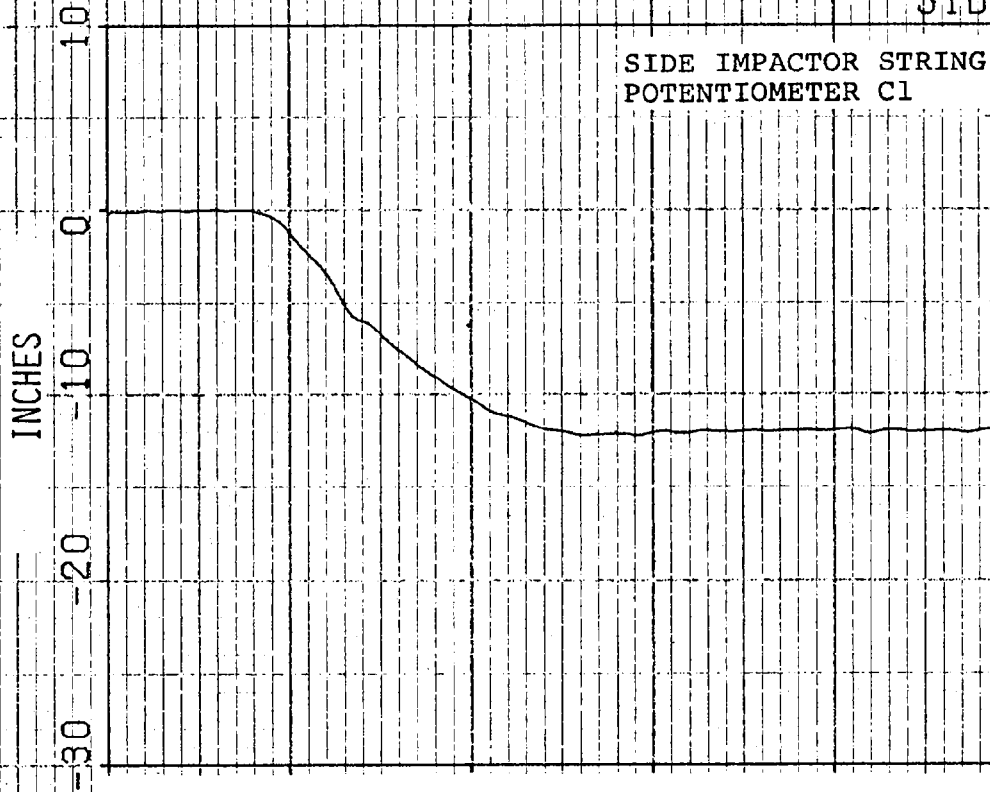
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315/100

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8321-4.02

SIDE IMPACT



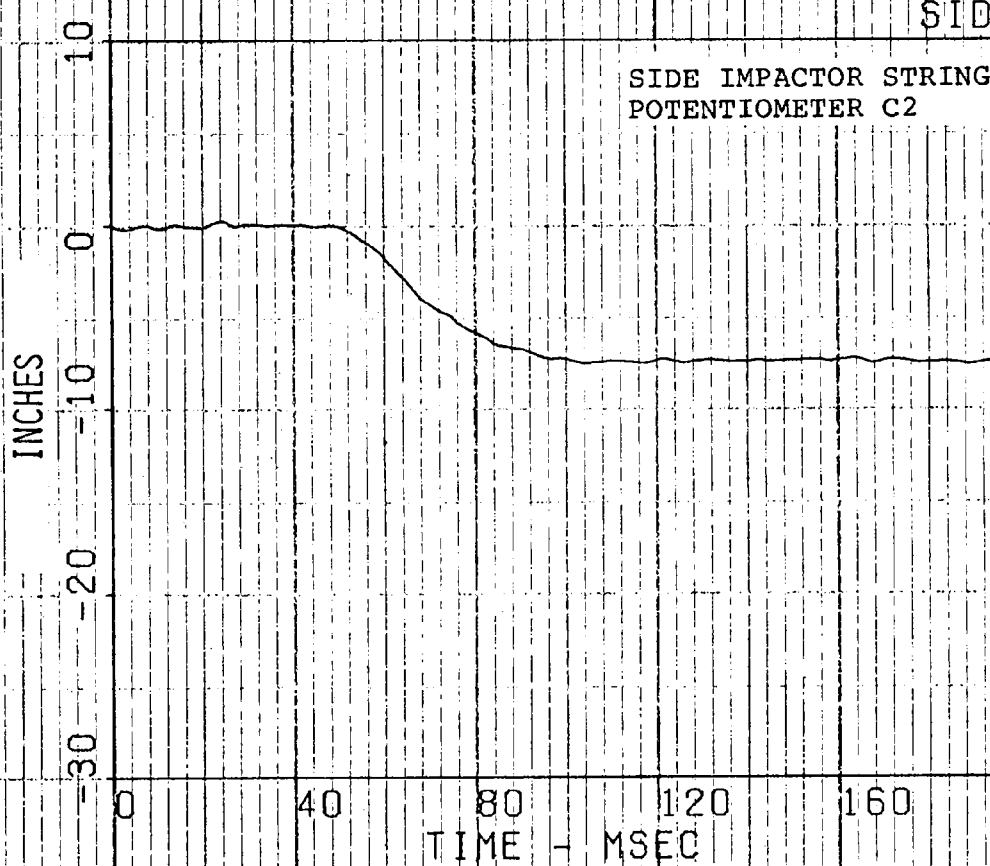
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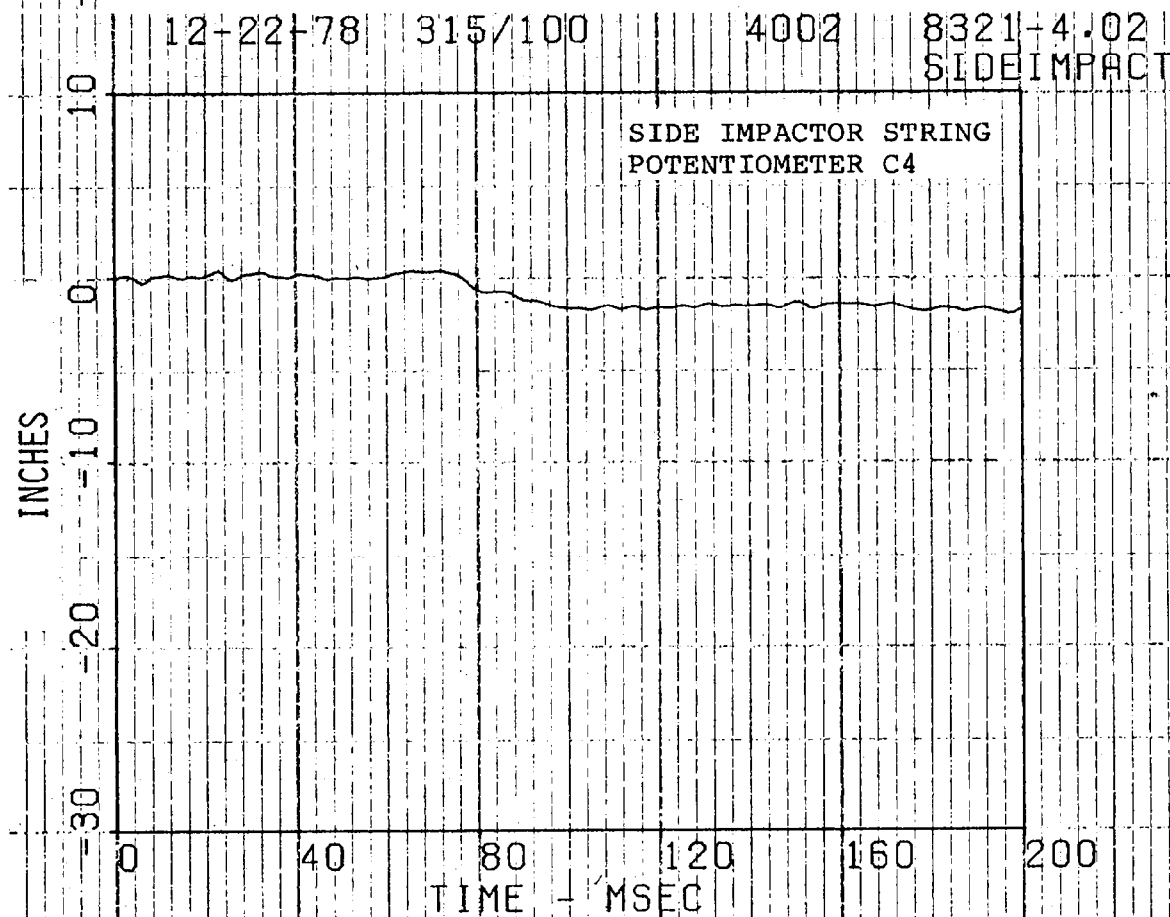
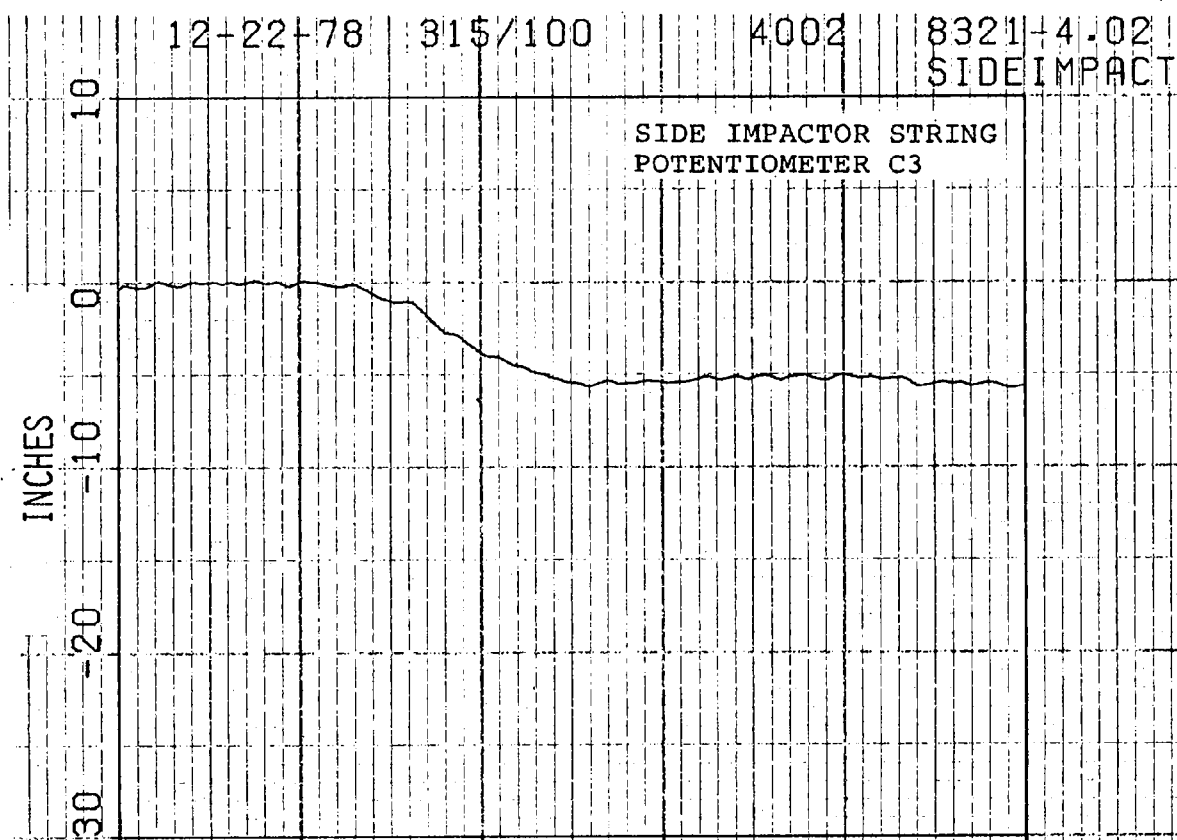
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4001

8321-4.02

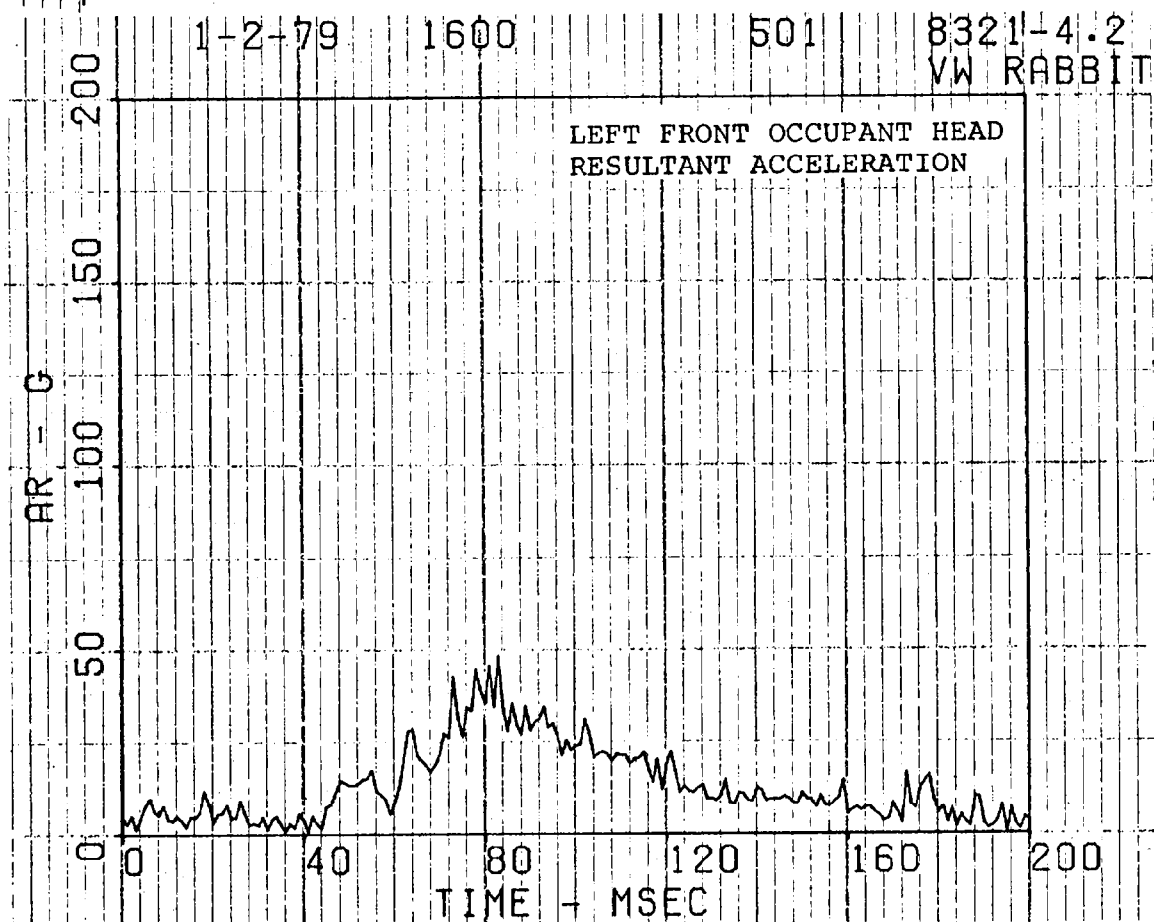
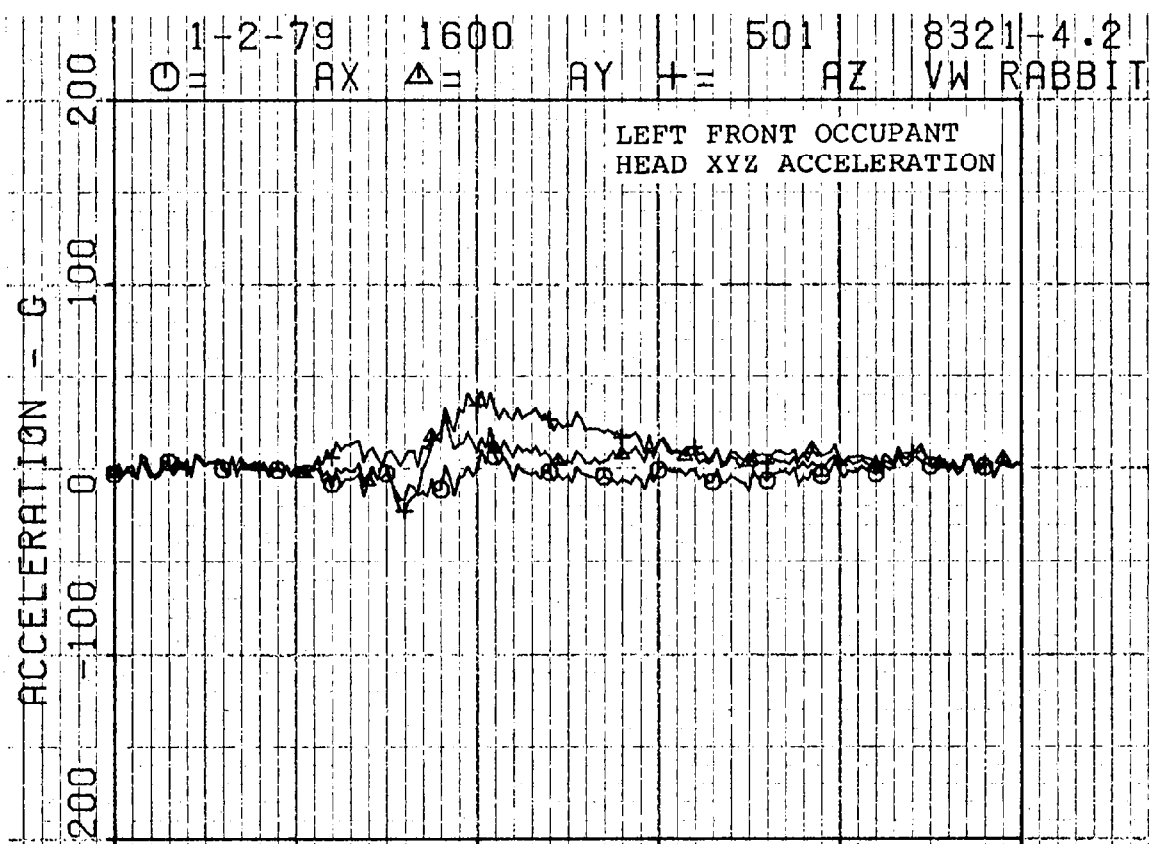
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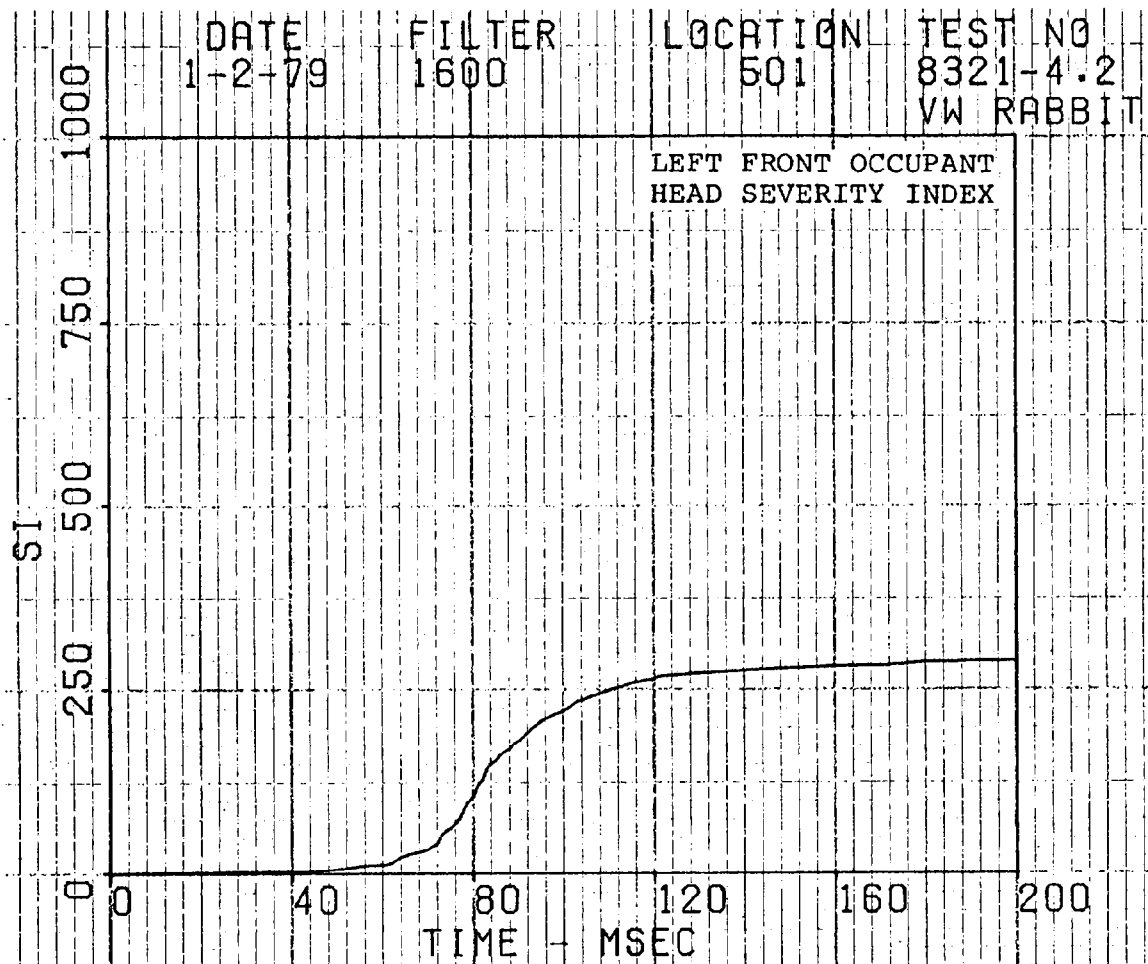


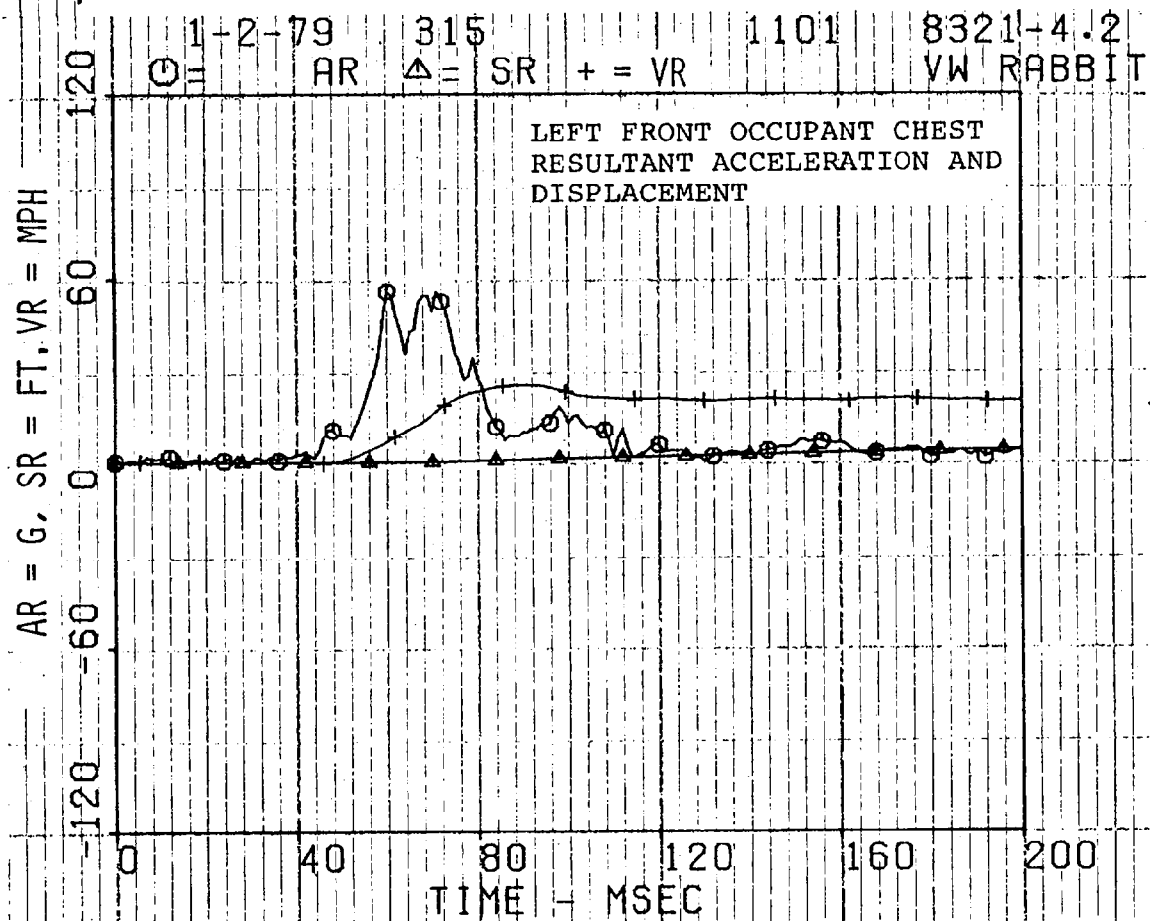
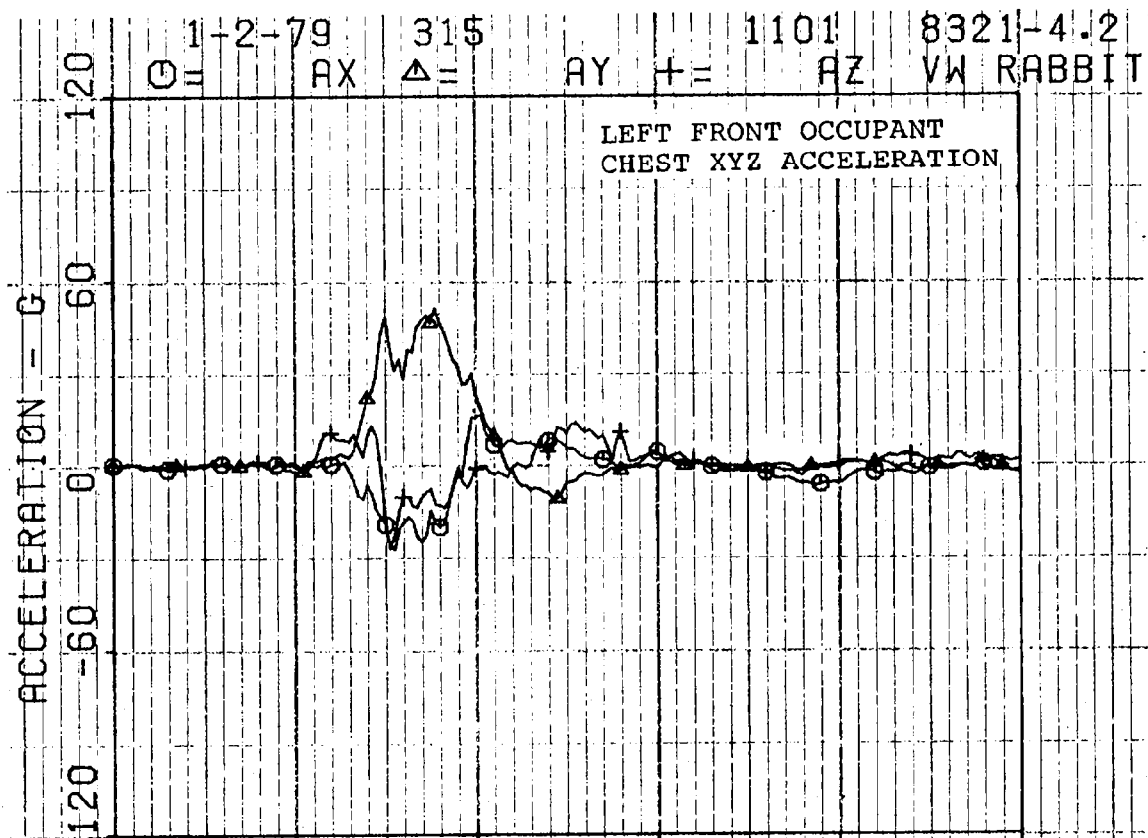


APPENDIX B

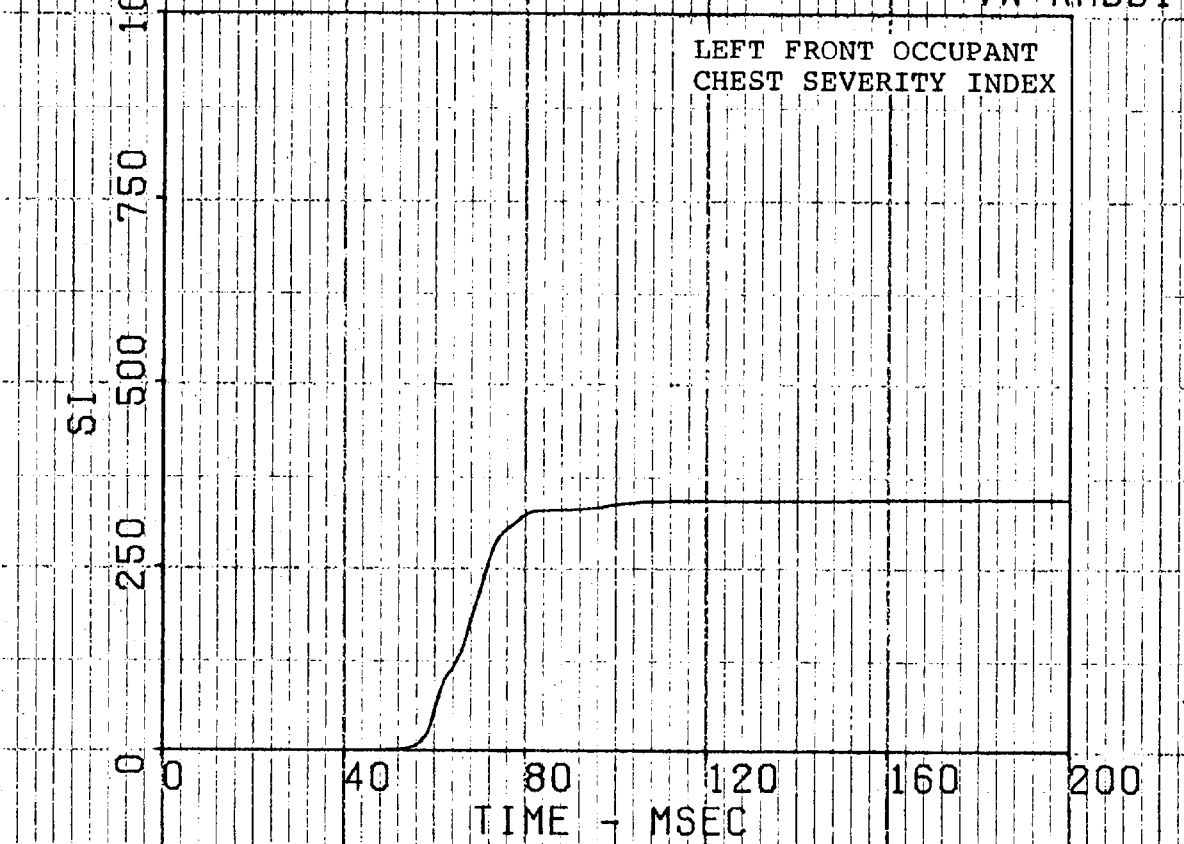
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VW RABBIT



011779

DATE

1-2-79

FILTER

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LOCATION

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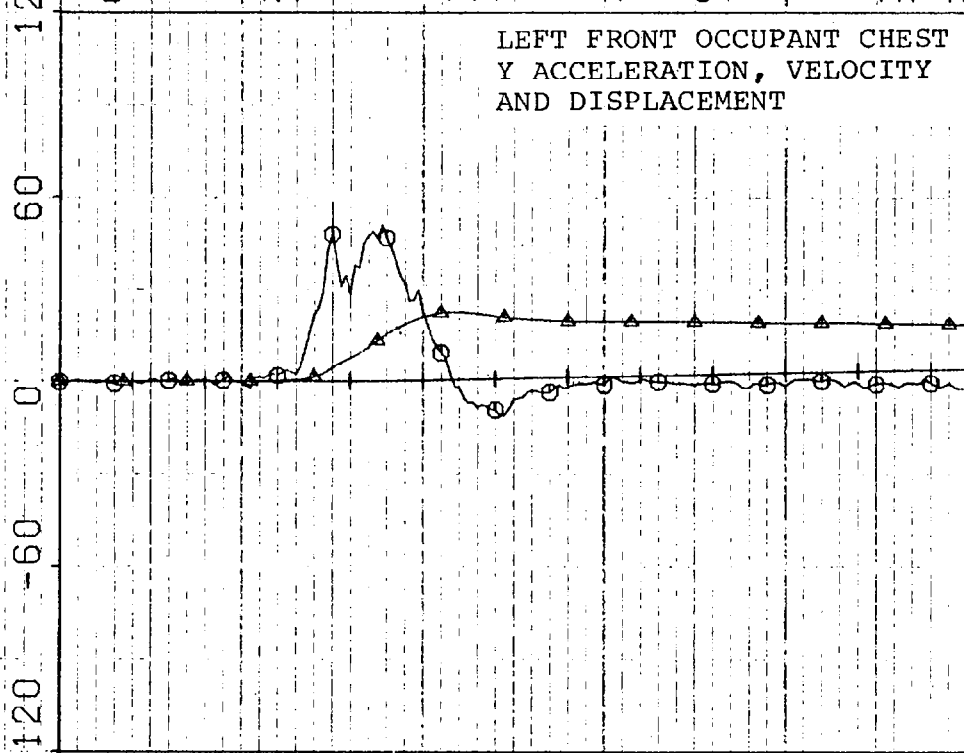
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+ = SY

VW RABBIT

AY = G, VY = MPH, SY = FT.



O =

1-2-79

AX

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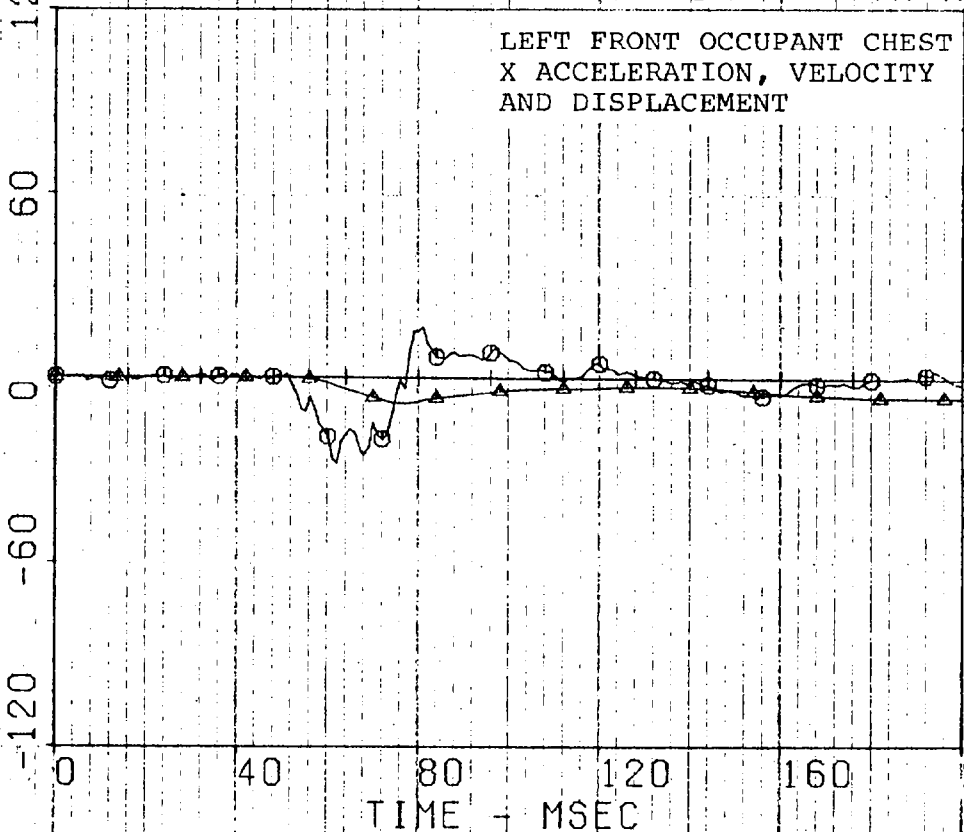
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+ = SX

8321-4.2

VW RABBIT

AX = G, VX = MPH, SX = FT.



011779

DATE

1-2-79

FILTER

315

LOCATION

1101

TEST NO.

8321-4.2

O =

AZ

Δ =

VZ

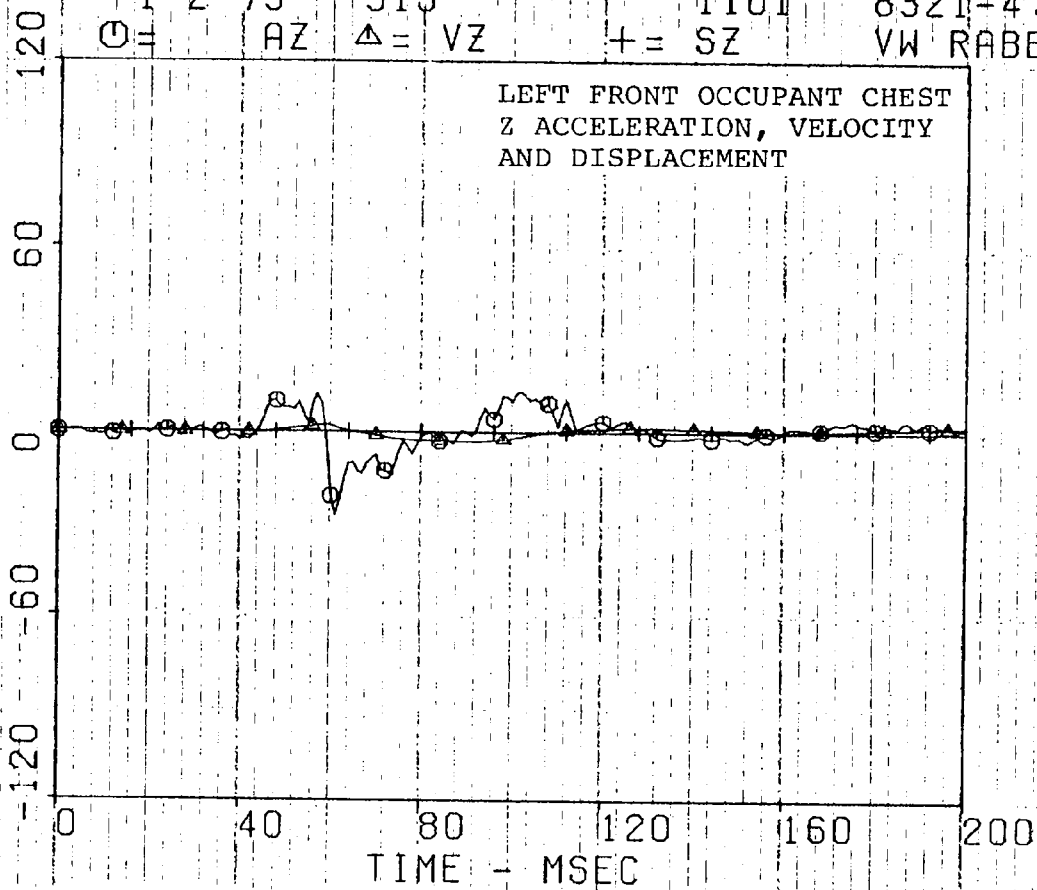
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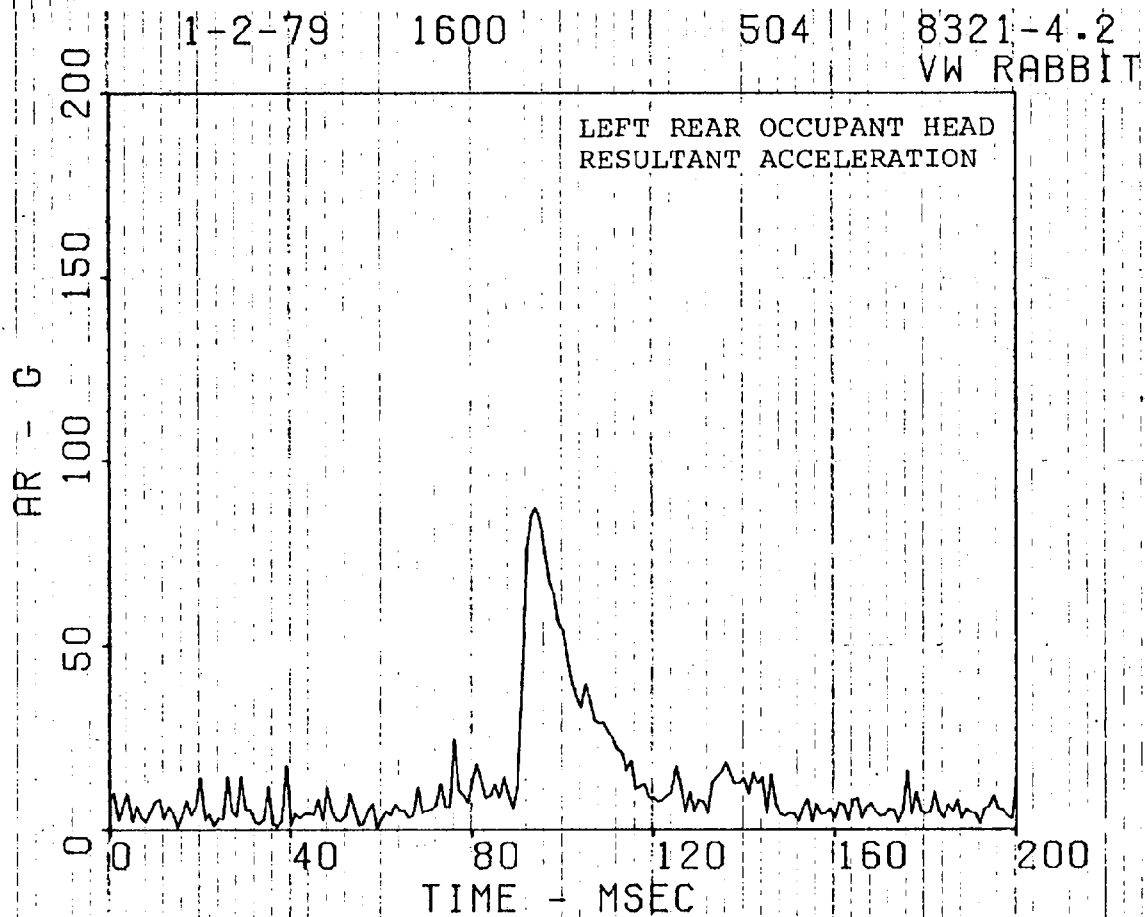
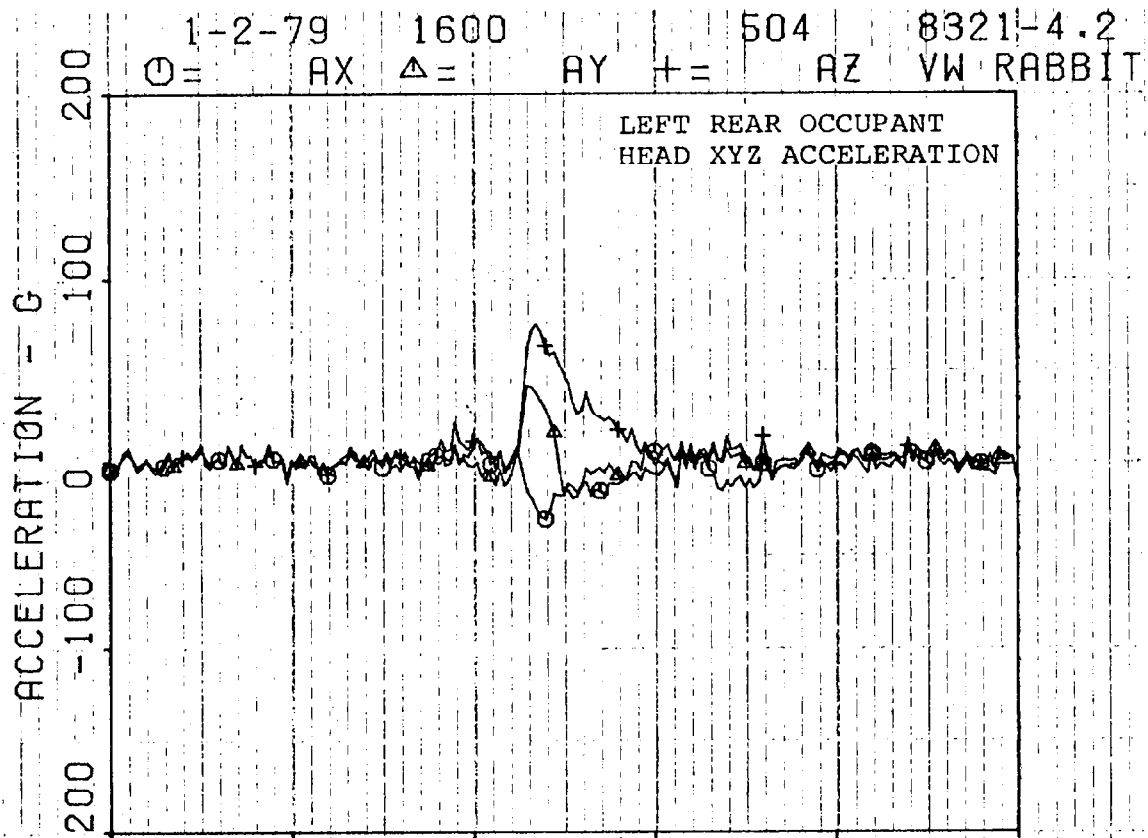
SZ

VW

RABBIT

— AZ = G, VZ = MPH, SZ = FT.





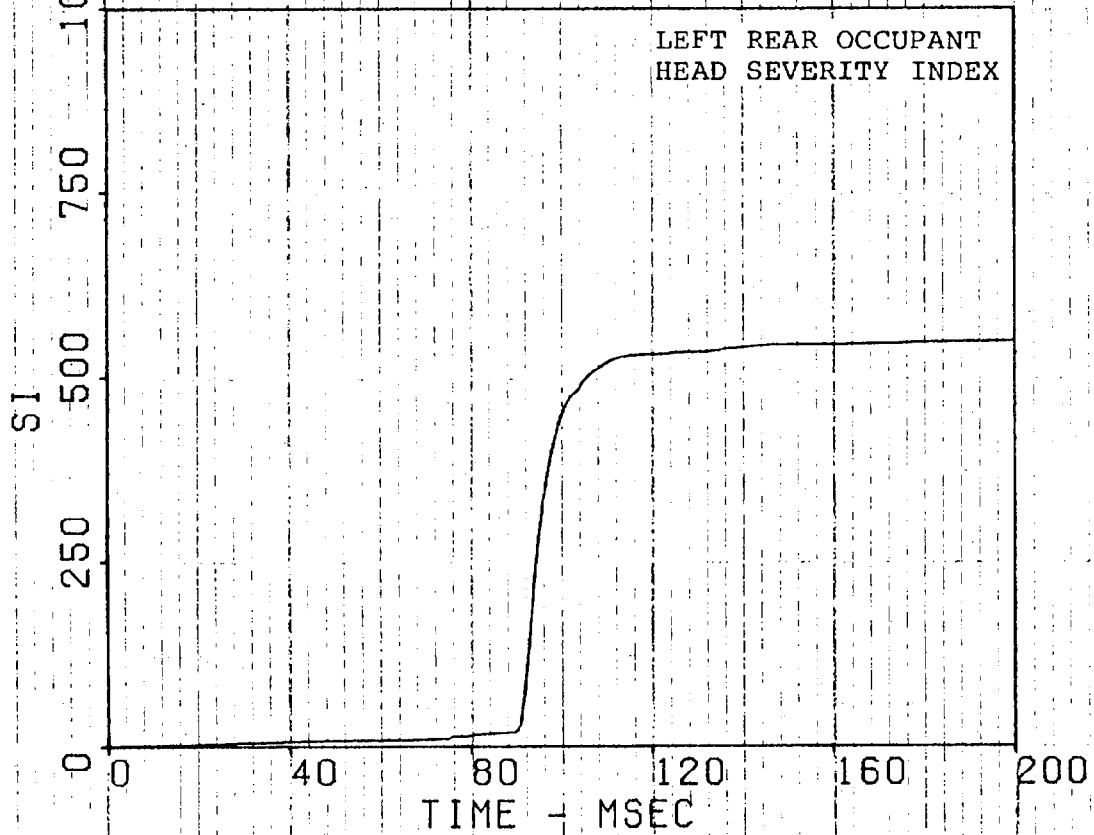
011079

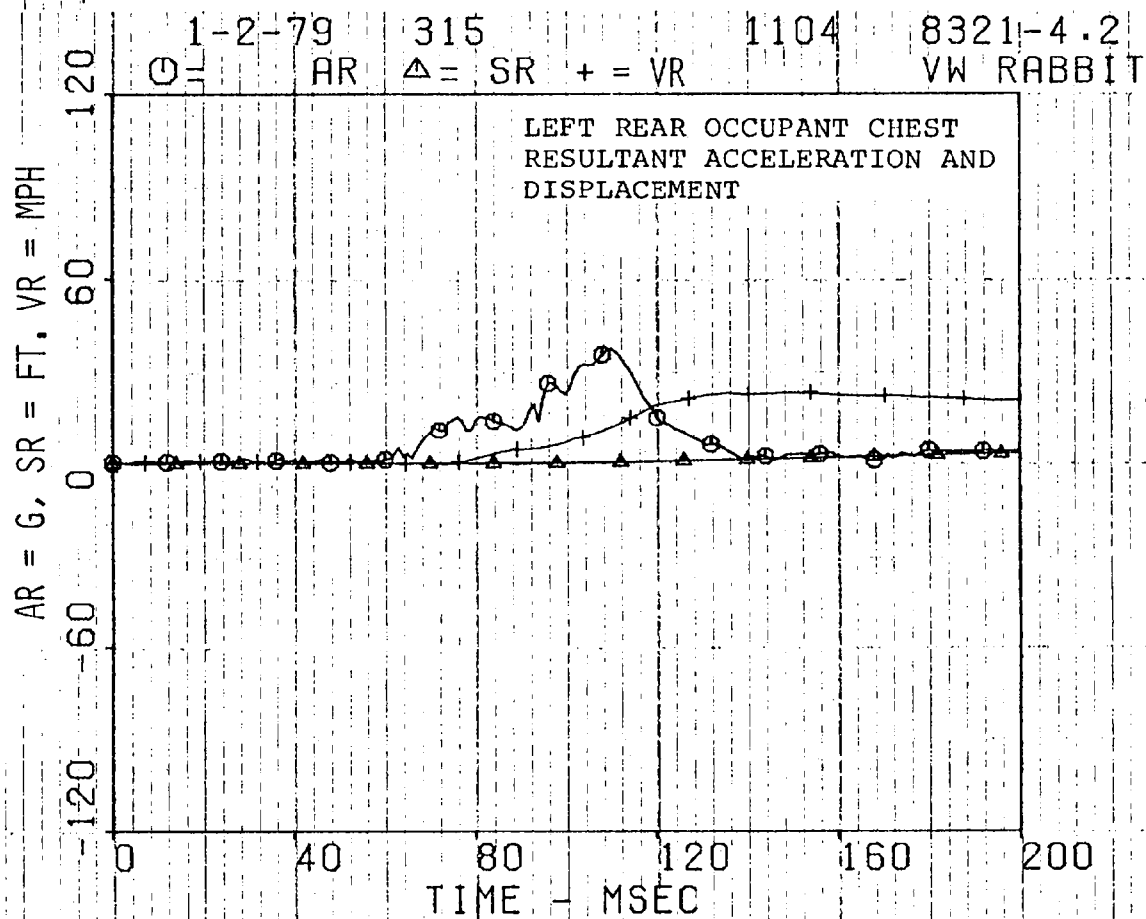
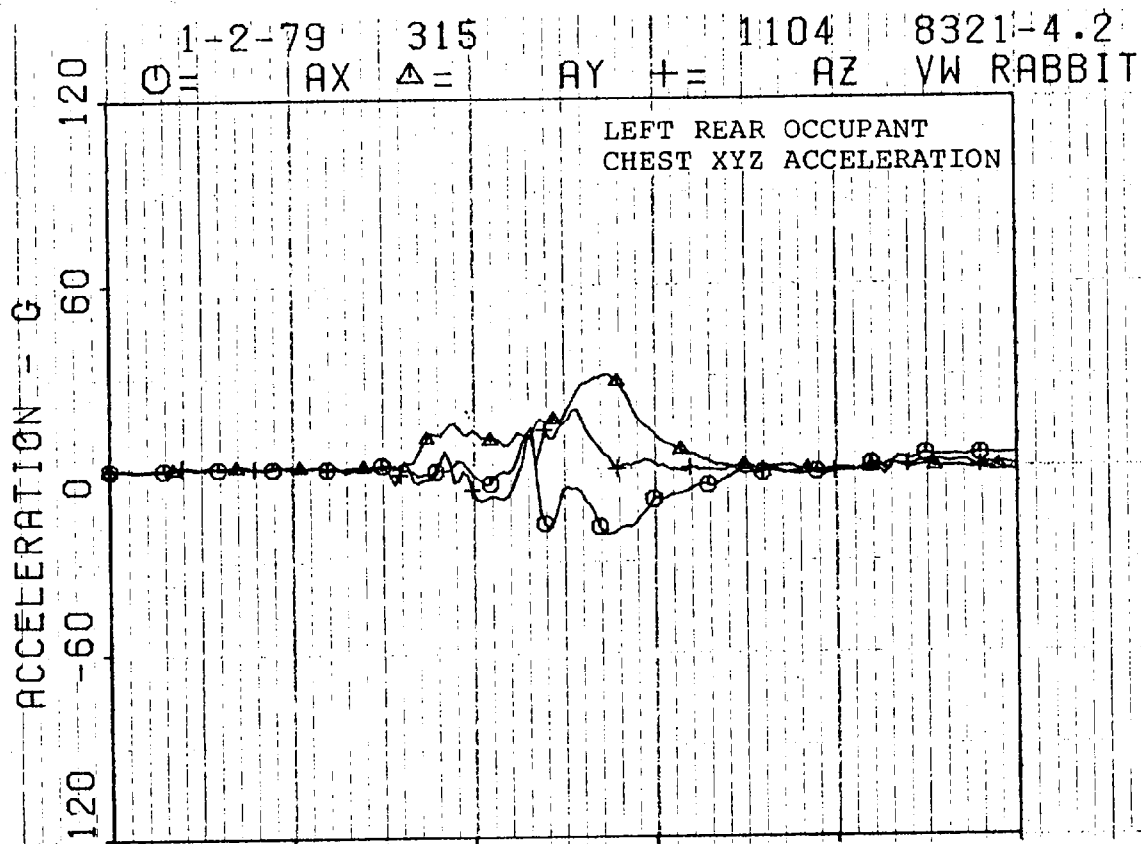
DATE
1-2-79

FILTER
1600

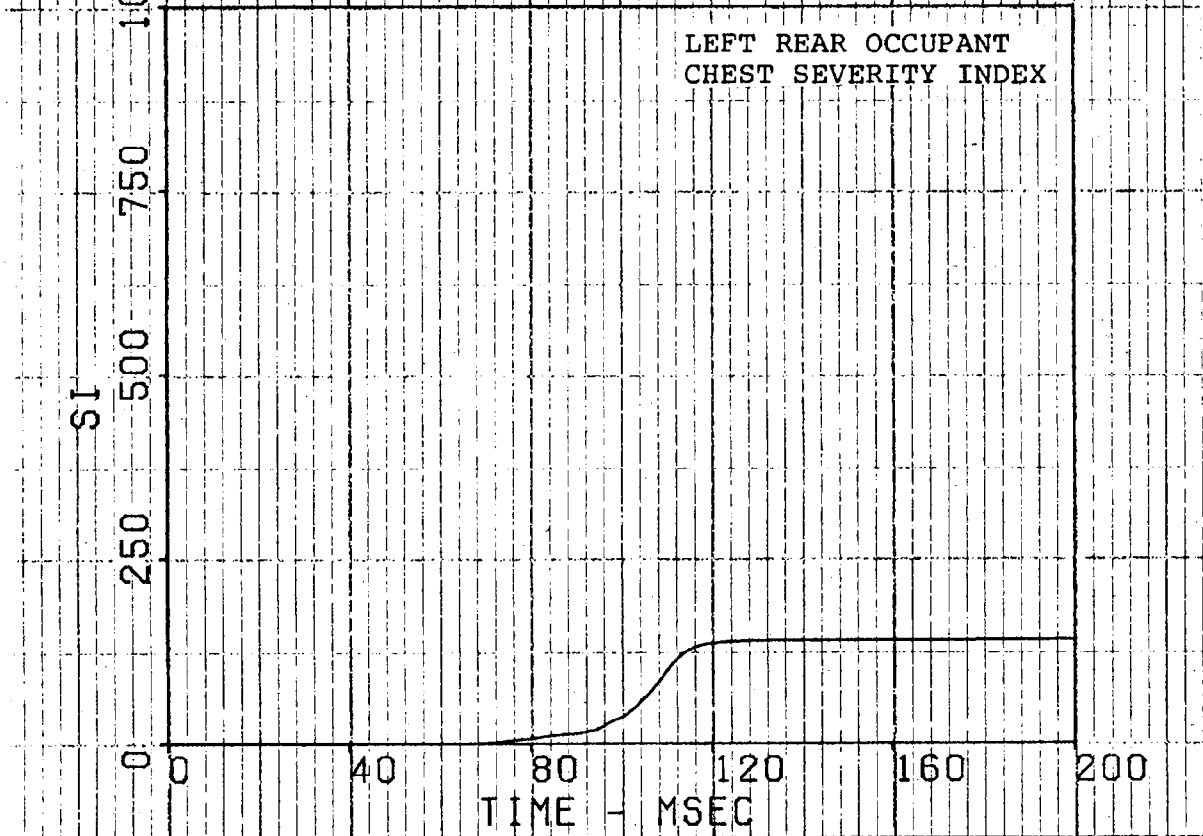
LOCATION
504

TEST NO
8321-4.2
VW RABBIT





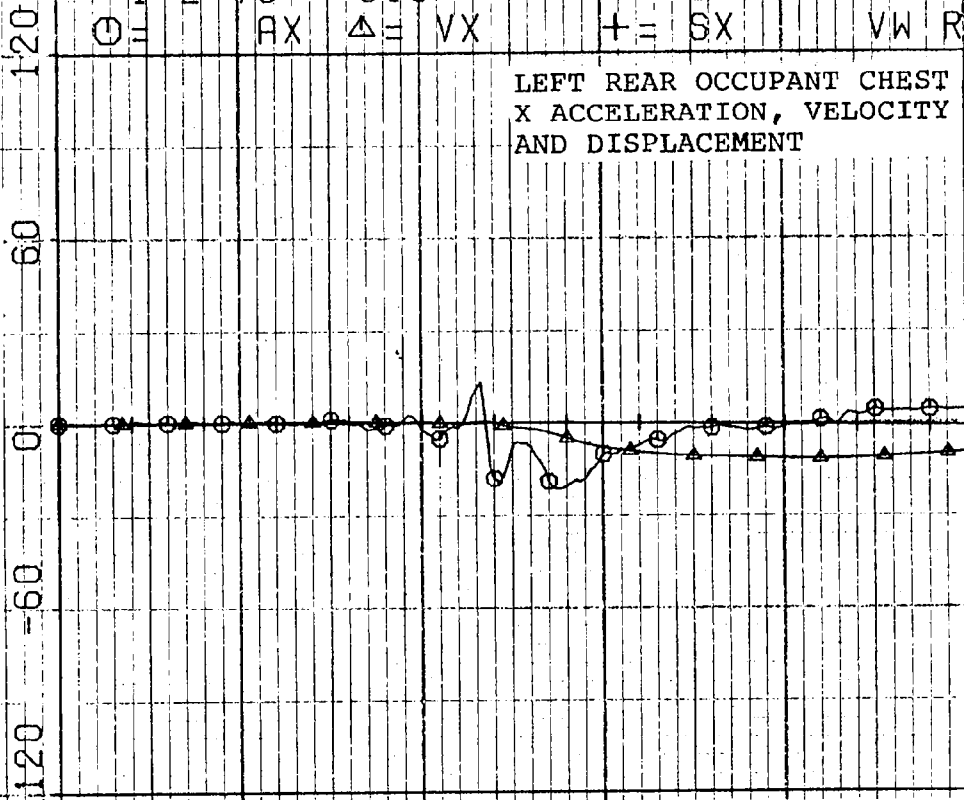
011079 DATE 1-2-79 FILTER 315 LOCATION 1104 TEST NO 8321-4.2
VW RABBIT



DATE 1-2-79 FILTER 315 LOCATION 1104 TEST NO 8321-4.2
 AX AX Δ= VX += SX VW RABBIT

LEFT REAR OCCUPANT CHEST
 X ACCELERATION, VELOCITY
 AND DISPLACEMENT

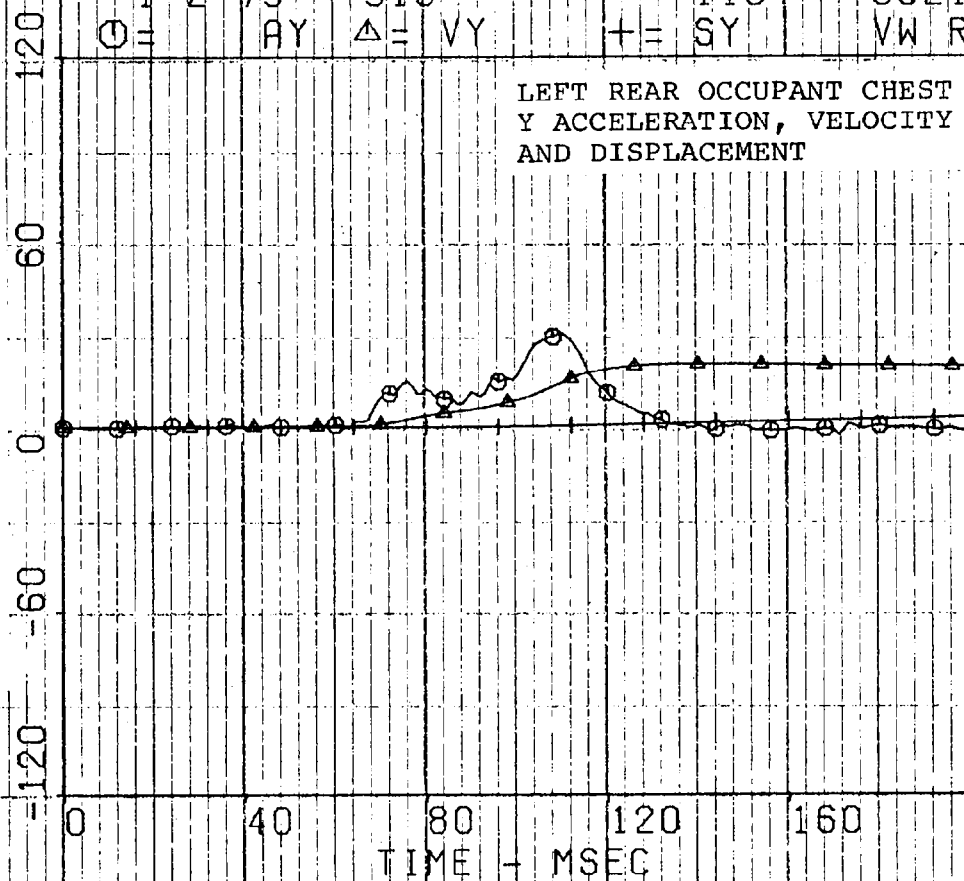
AX = G, VX = MPH, SX = FT

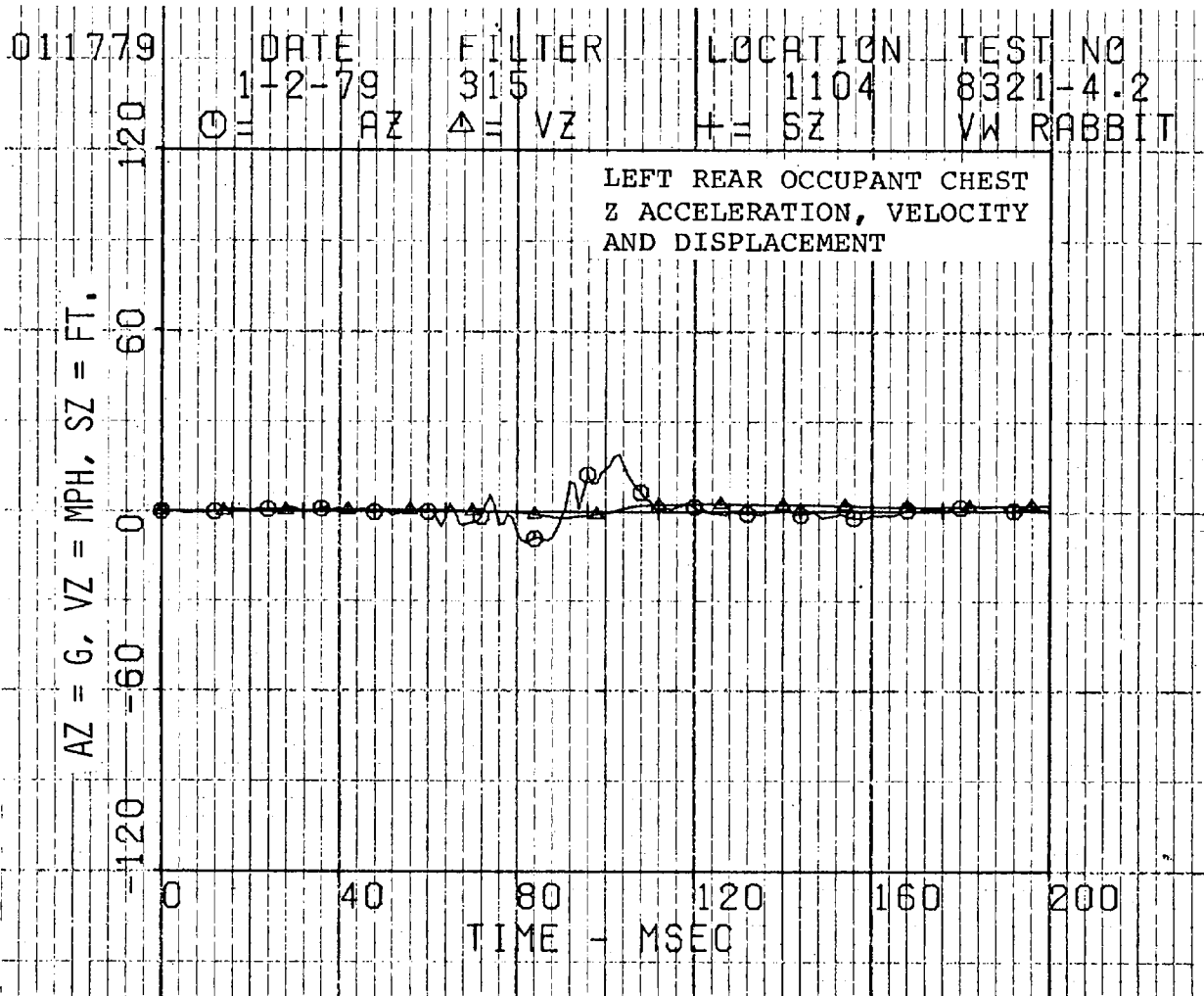


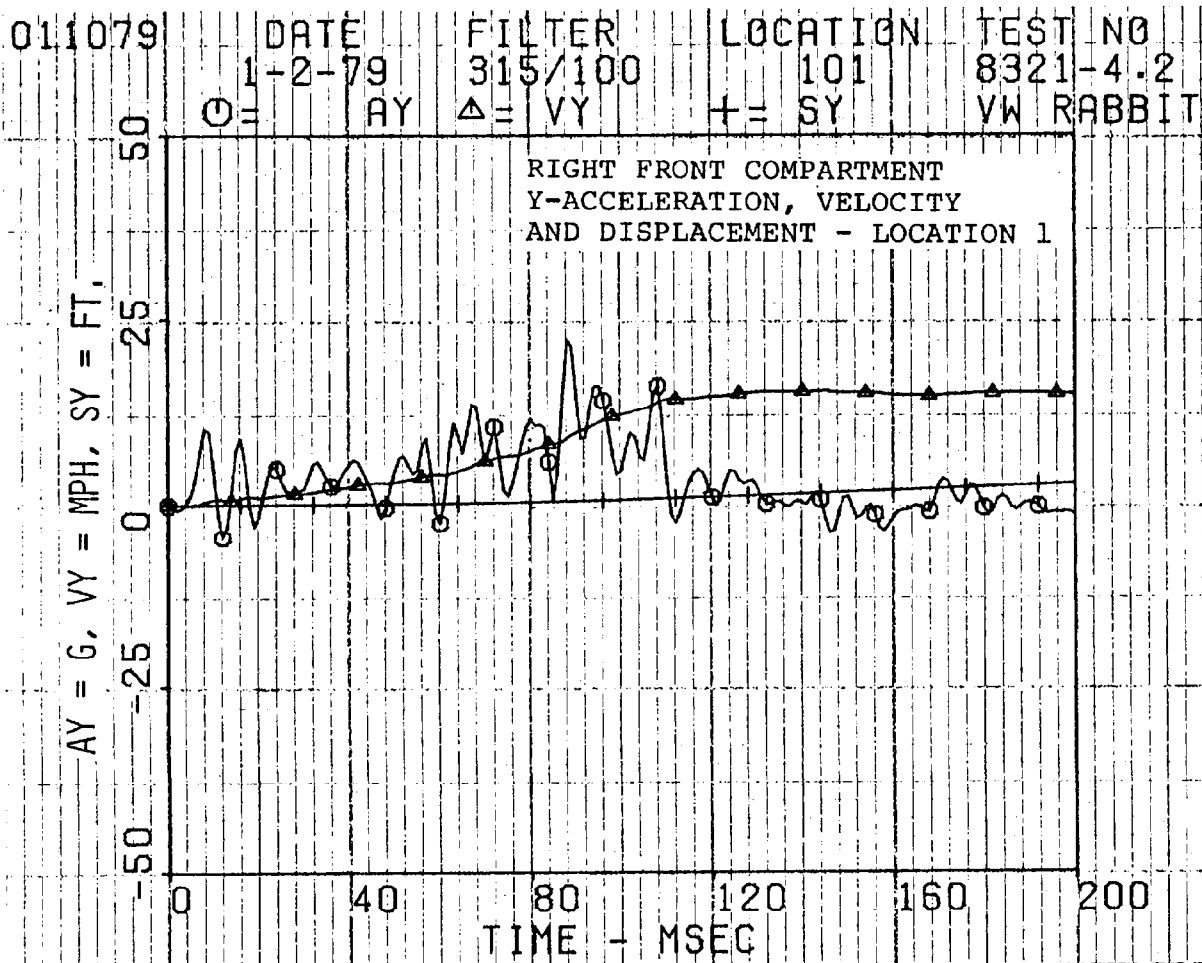
DATE 1-2-79 FILTER 315 LOCATION 1104 TEST NO 8321-4.2
 AY AY Δ= VY += SY VW RABBIT

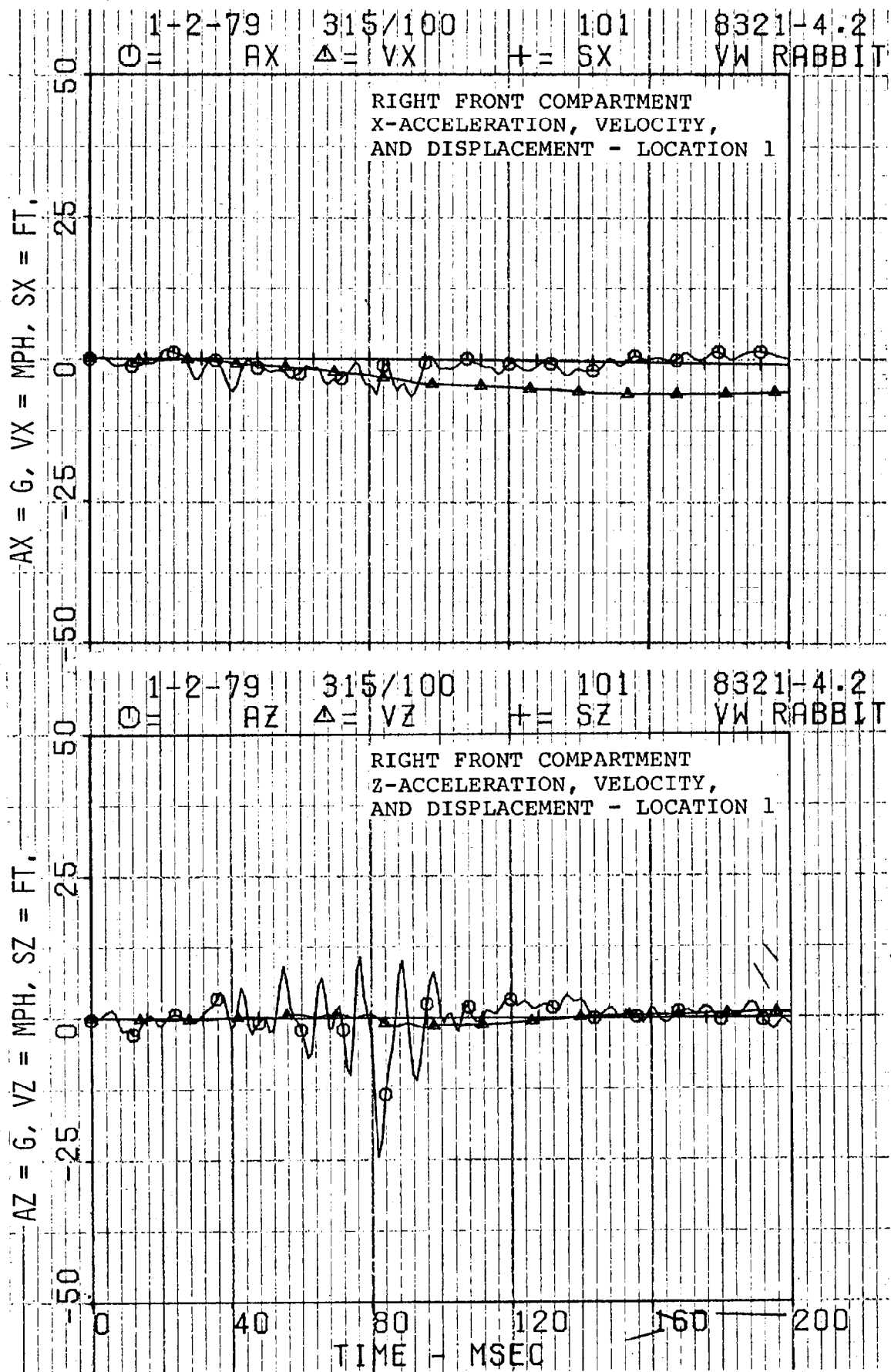
LEFT REAR OCCUPANT CHEST
 Y ACCELERATION, VELOCITY
 AND DISPLACEMENT

AY = G, VY = MPH, SY = FT

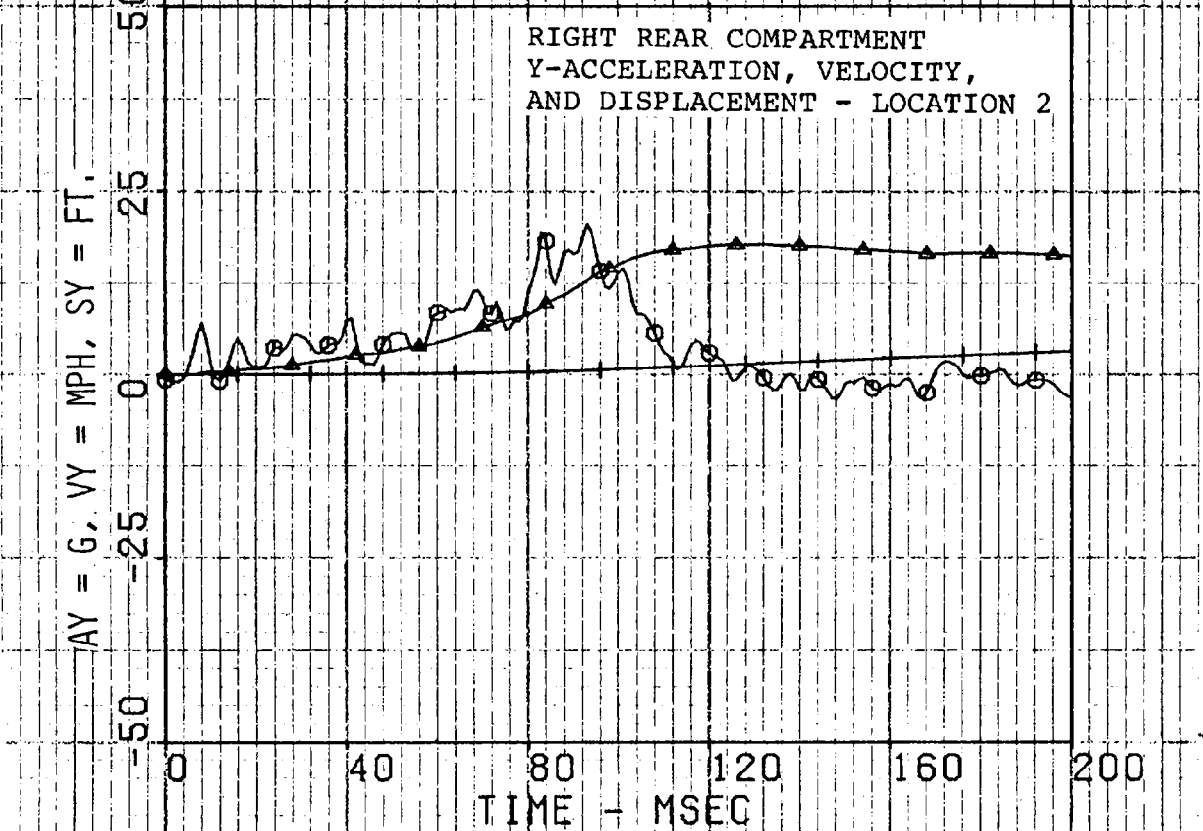


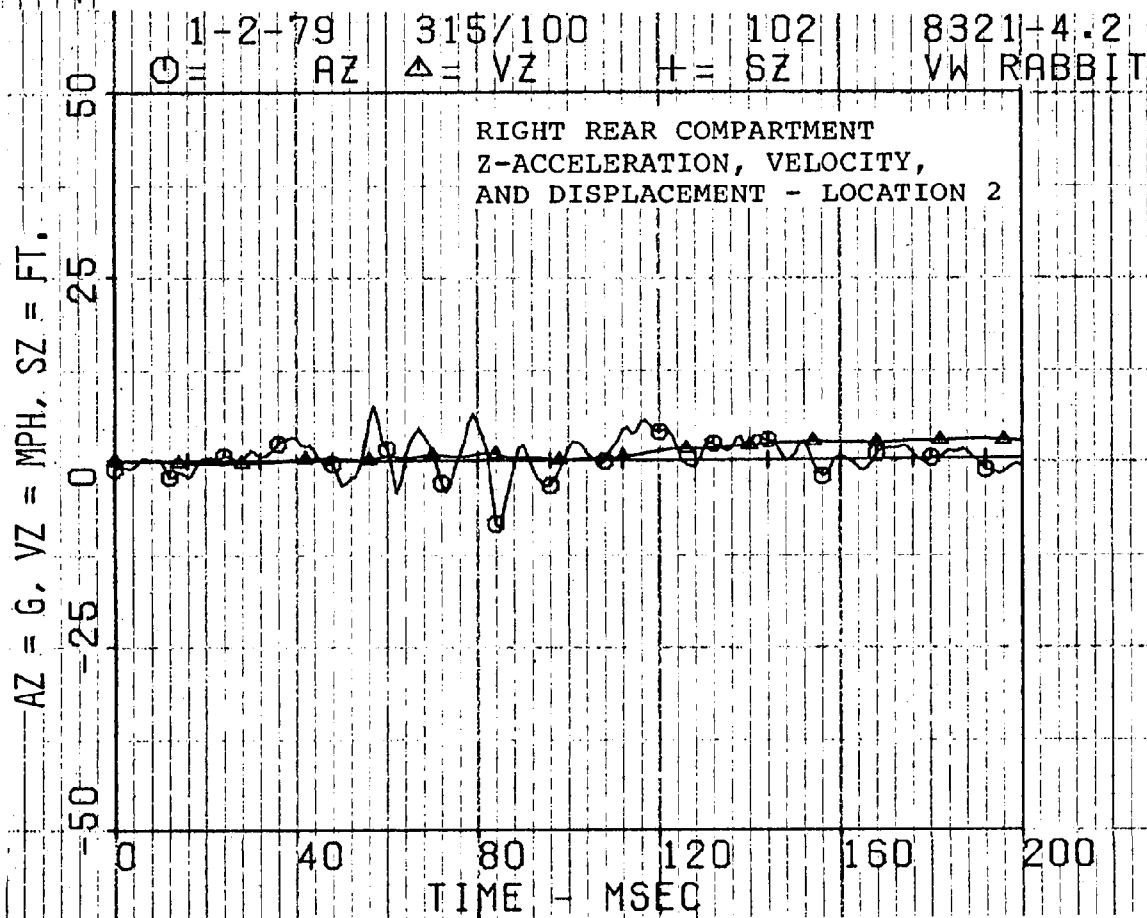
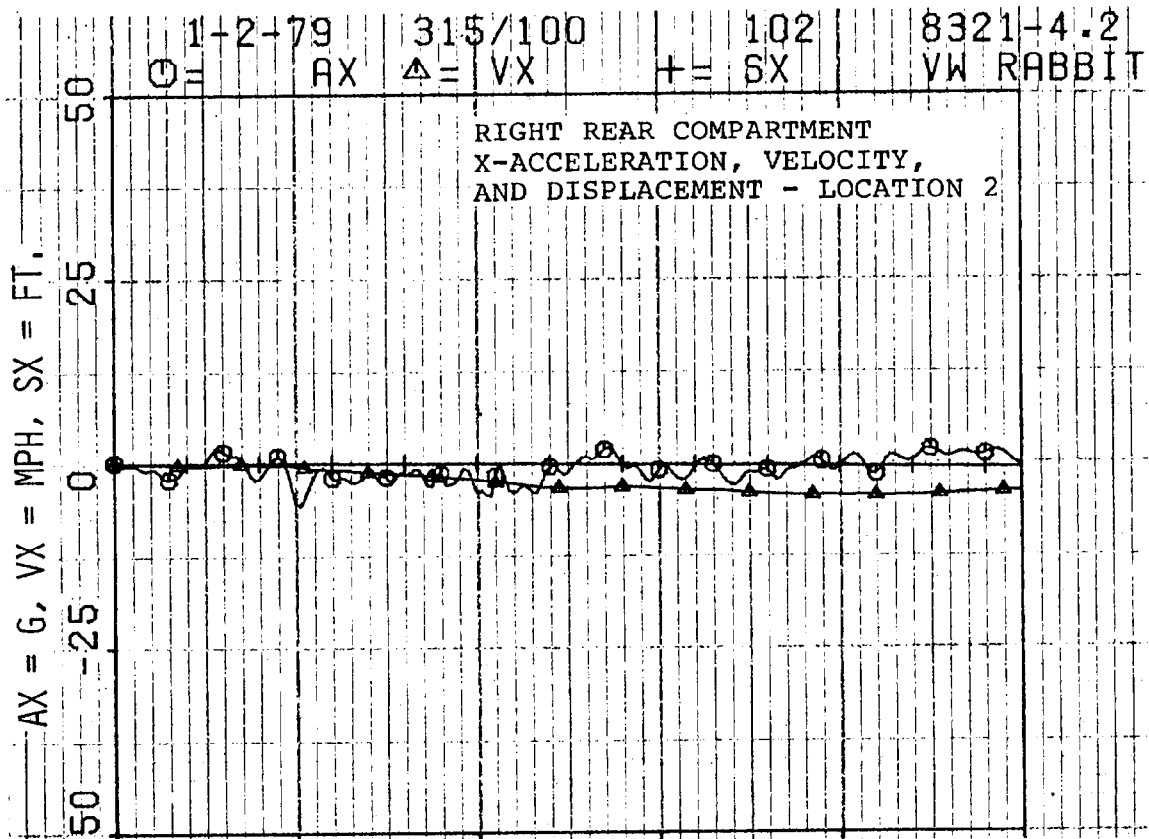


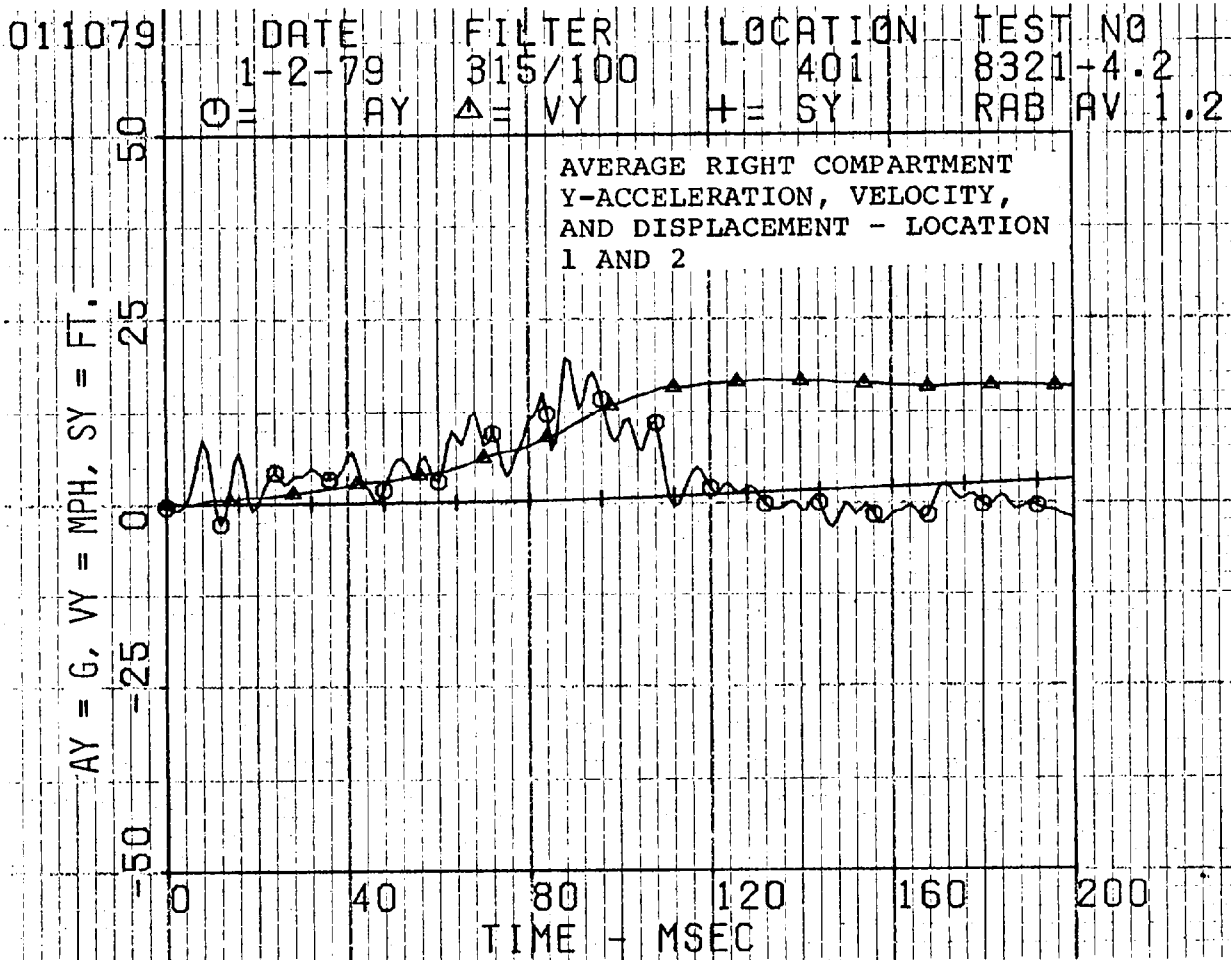


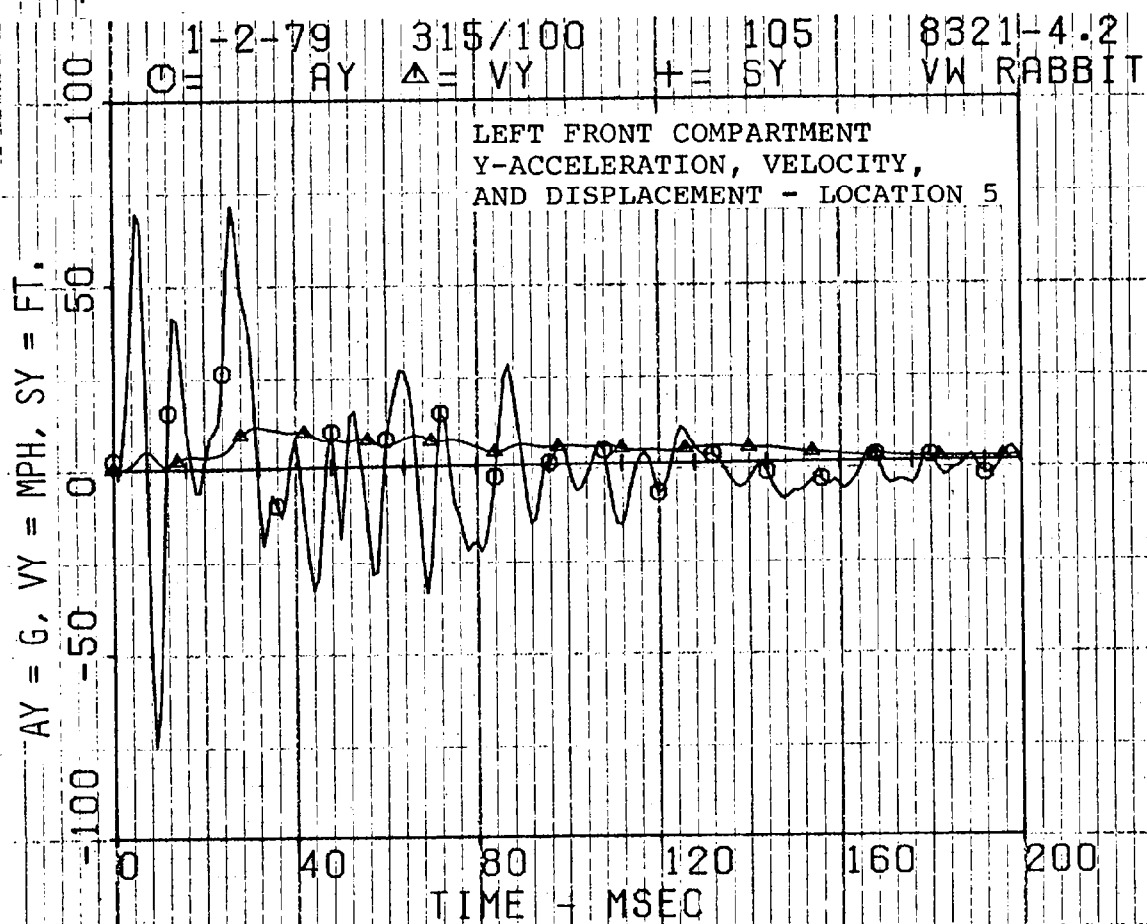
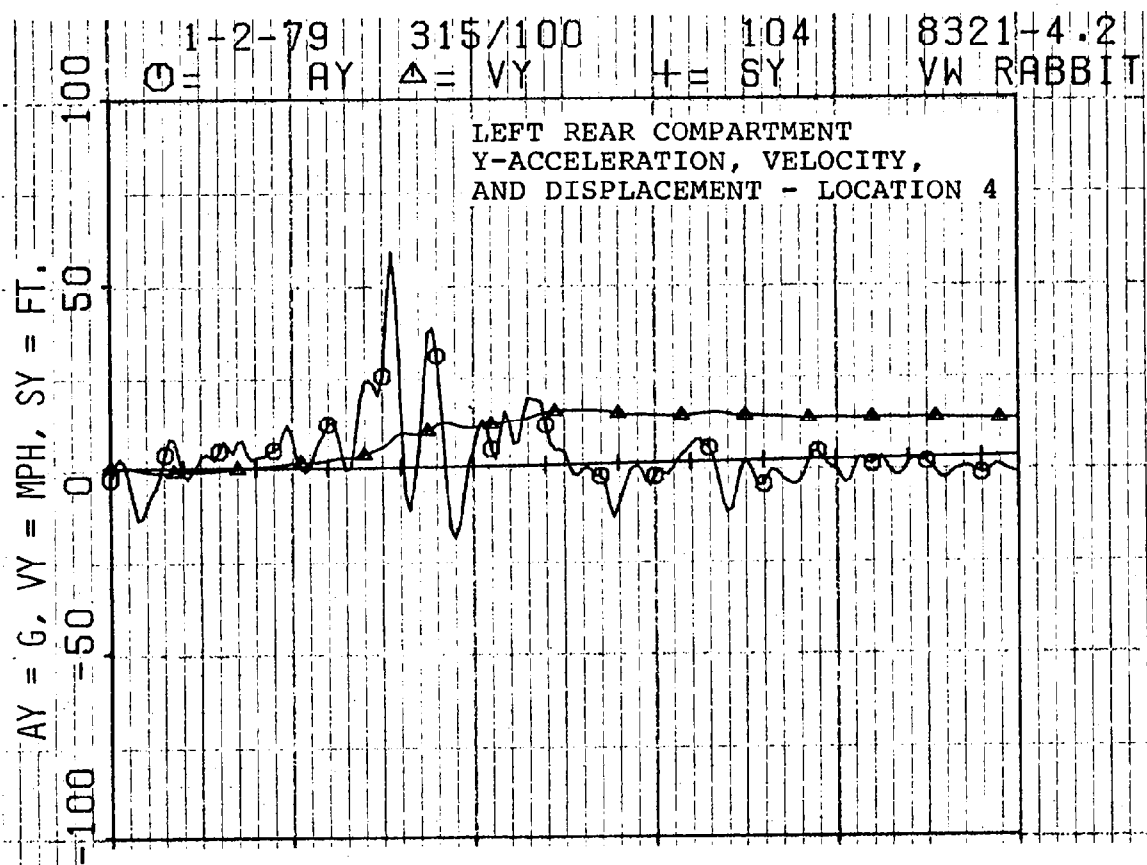


011079	DATE	FILTER	LOCATION	TEST NO
	1-2-79	315/100	102	8321-4.2
	AY	$\Delta = VY$	$+ = SY$	VW RABBIT

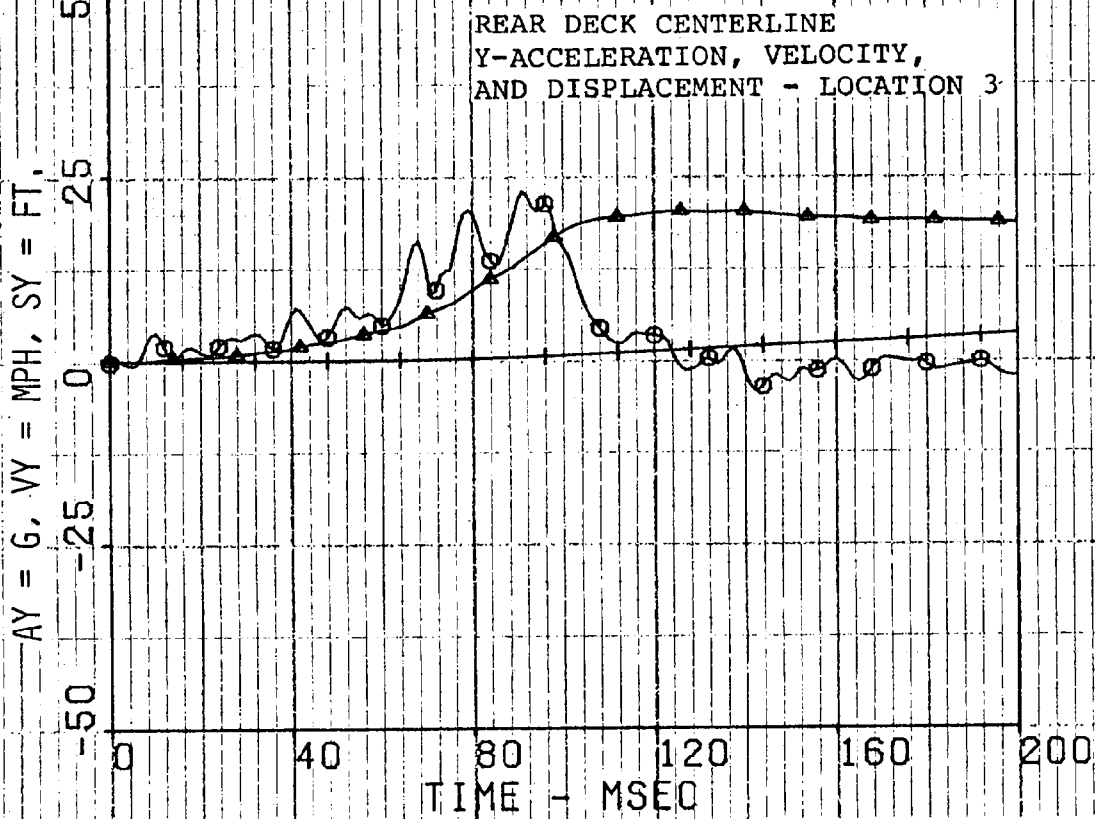


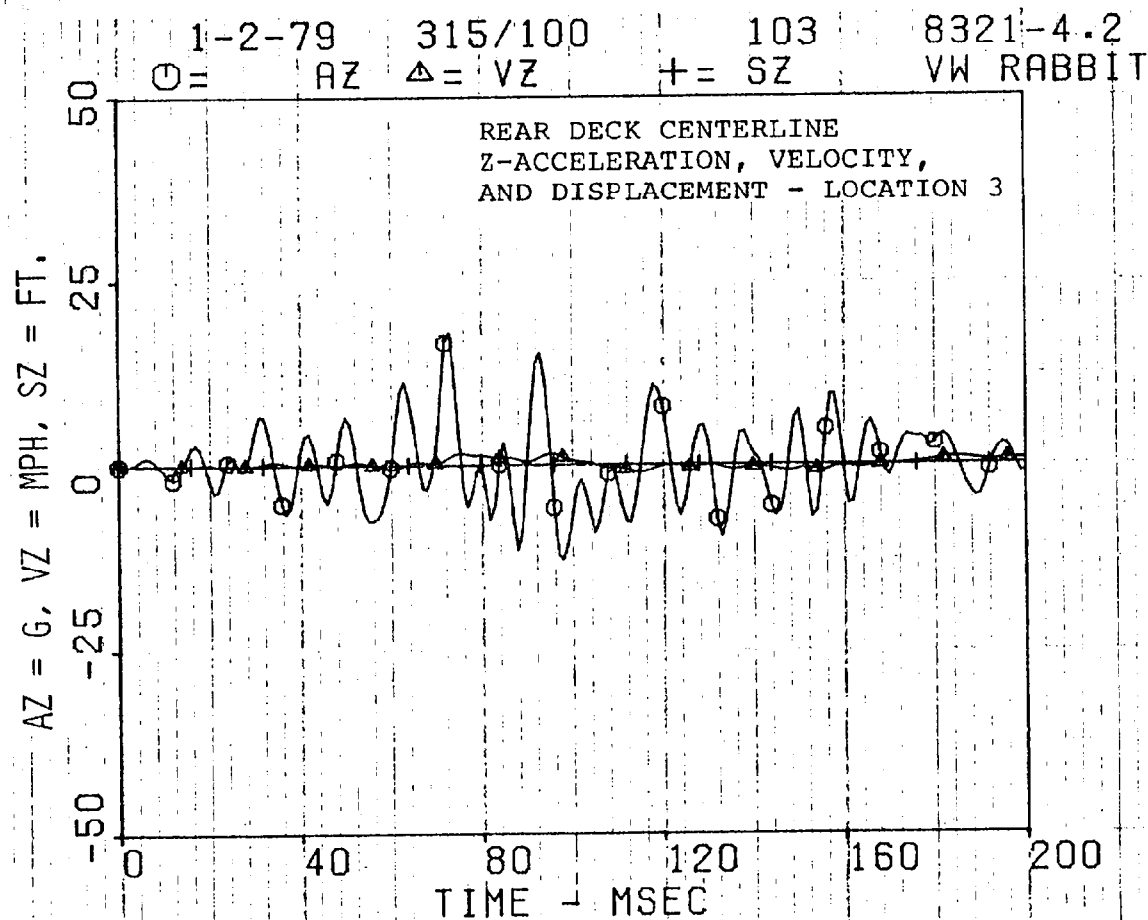
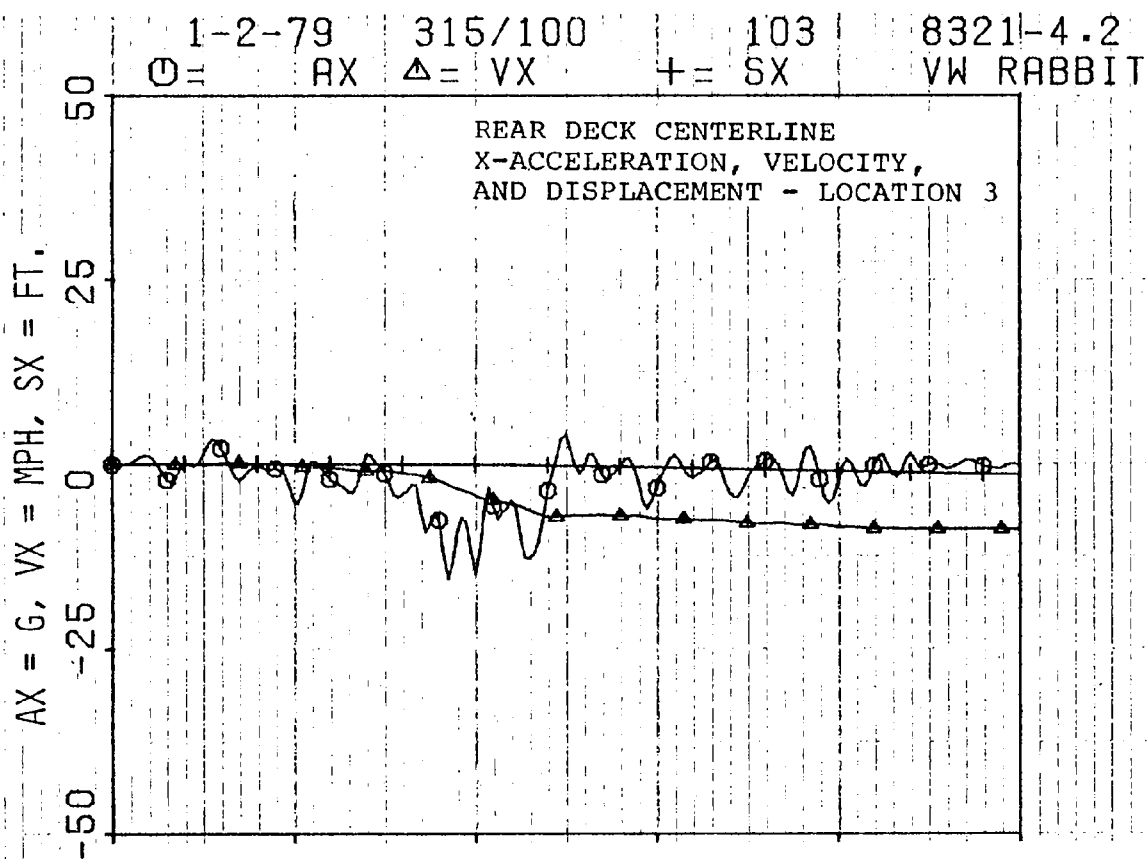


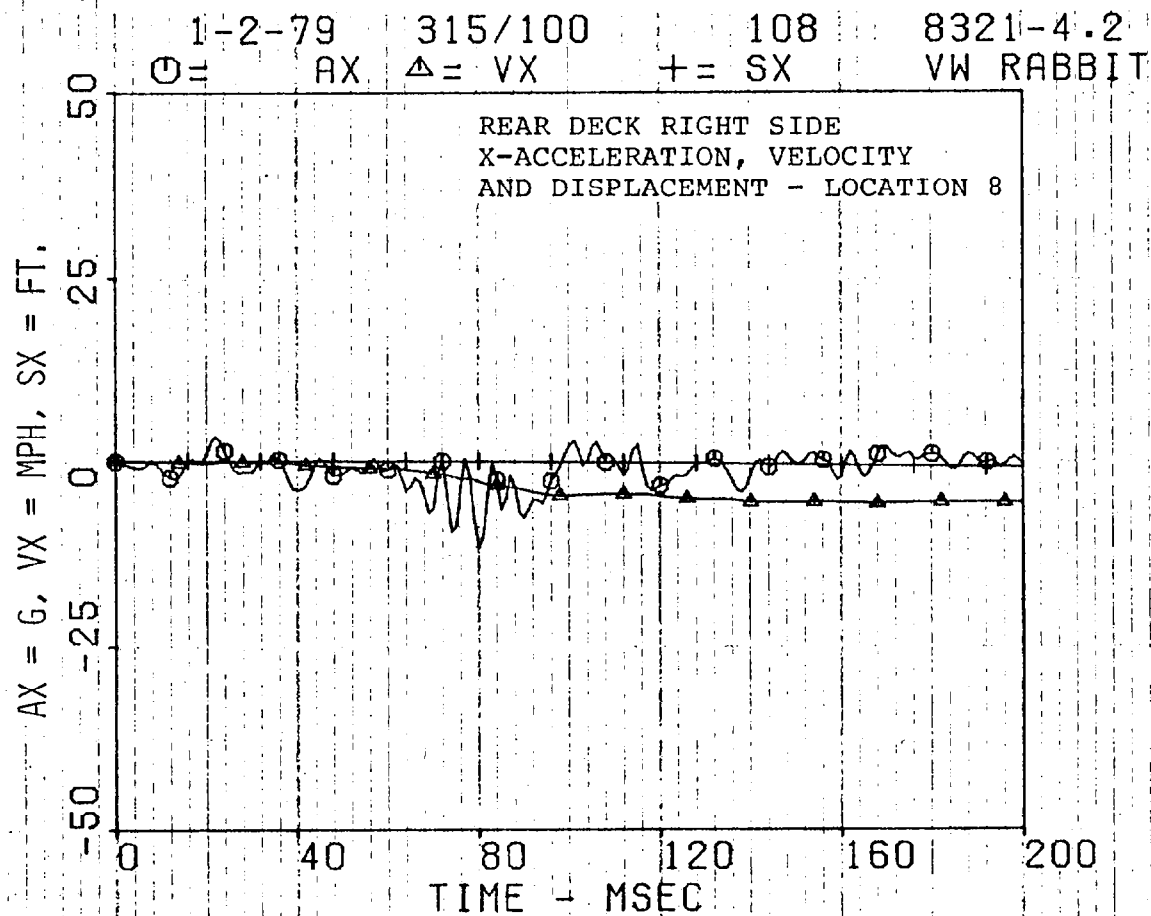
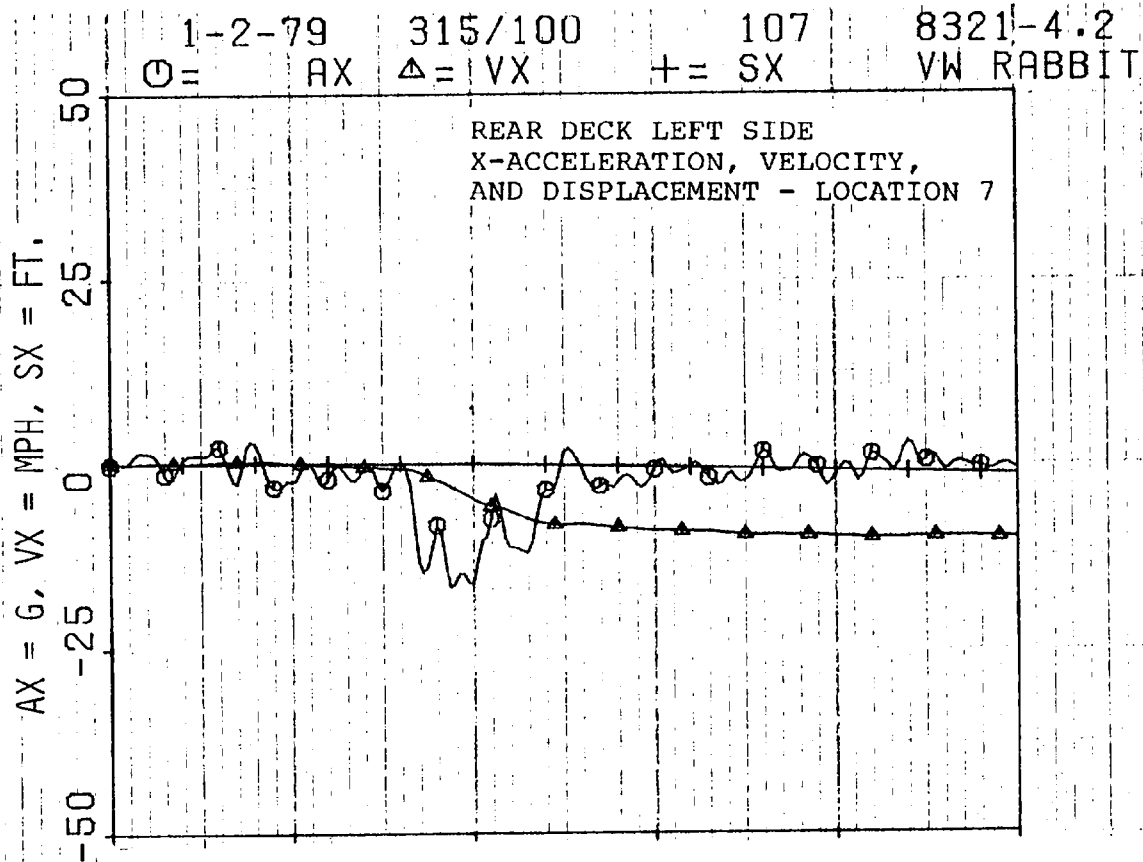


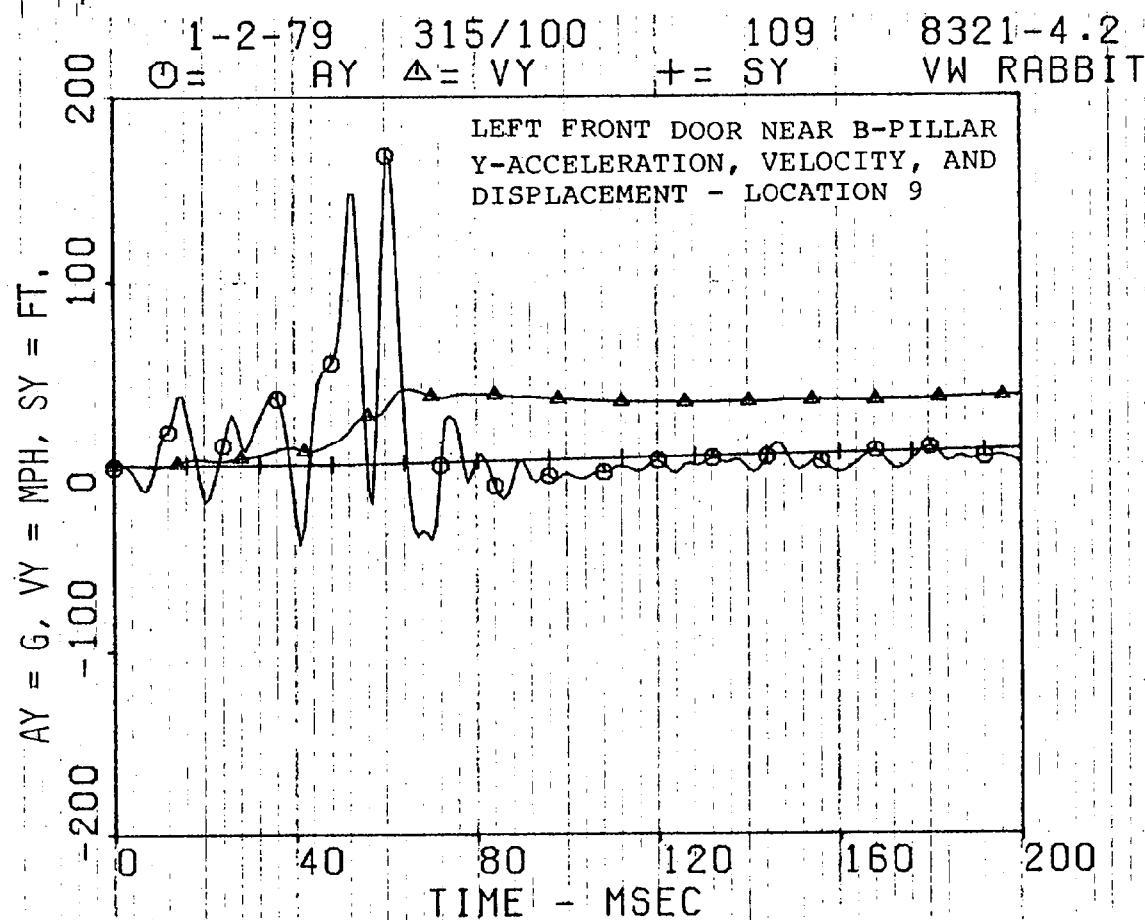
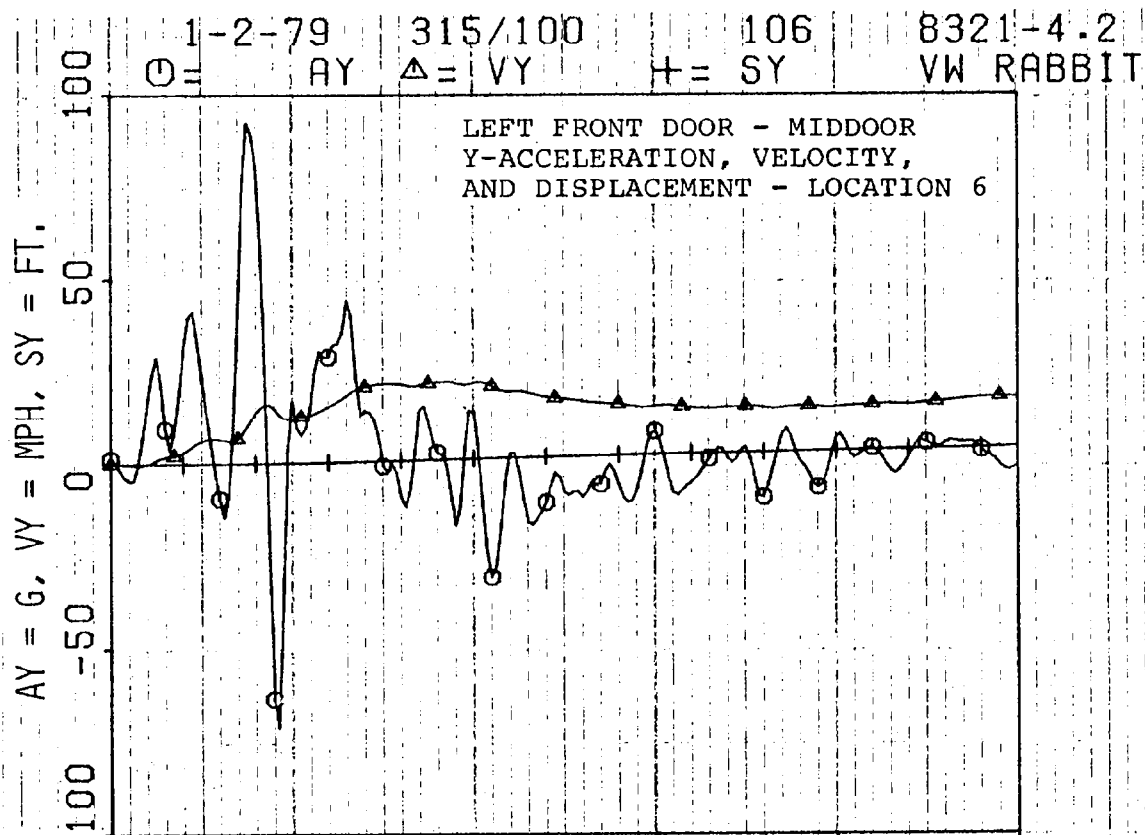


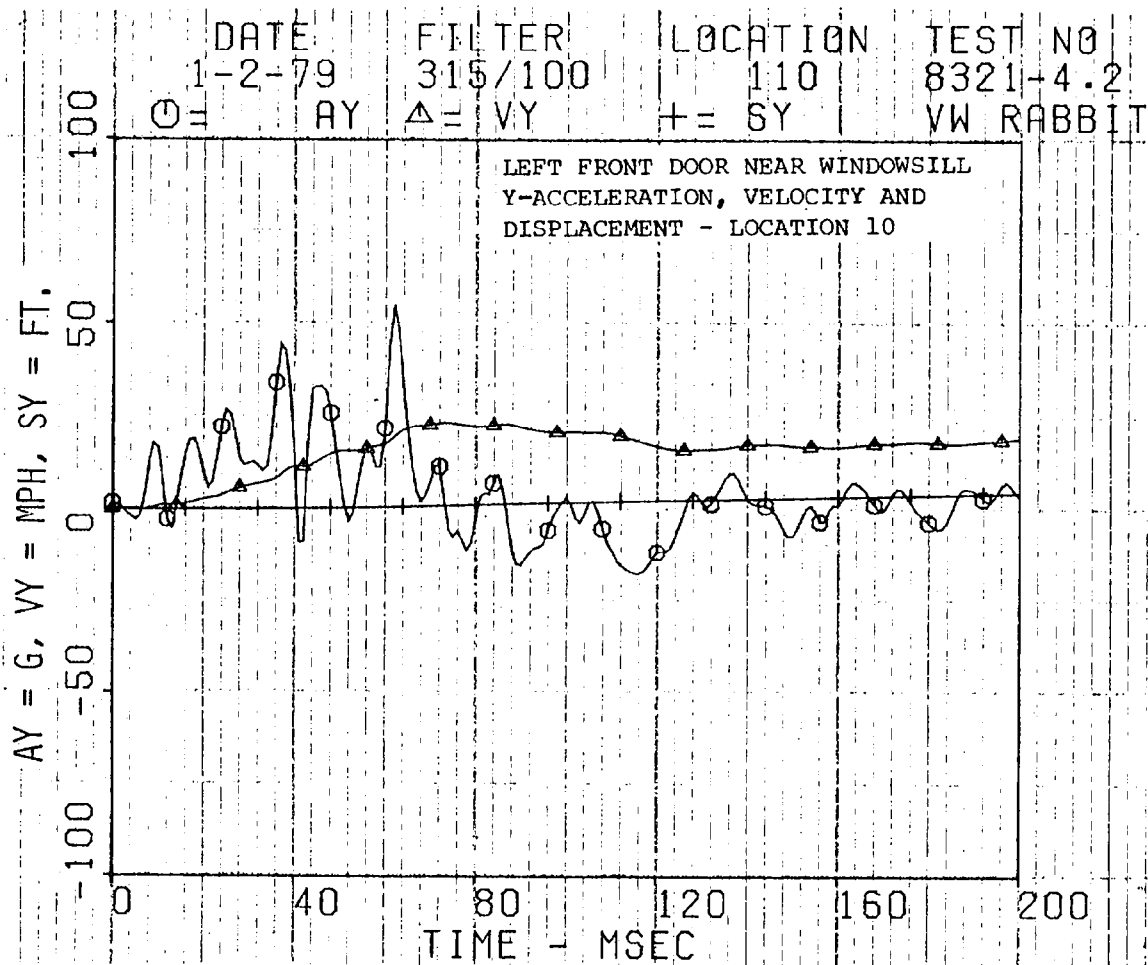
011079	DATE	FILTER	LOCATION	TEST NO
	1-2-79	315/100	103	8321-4.2
	AY	VY	SY	VW RABBIT

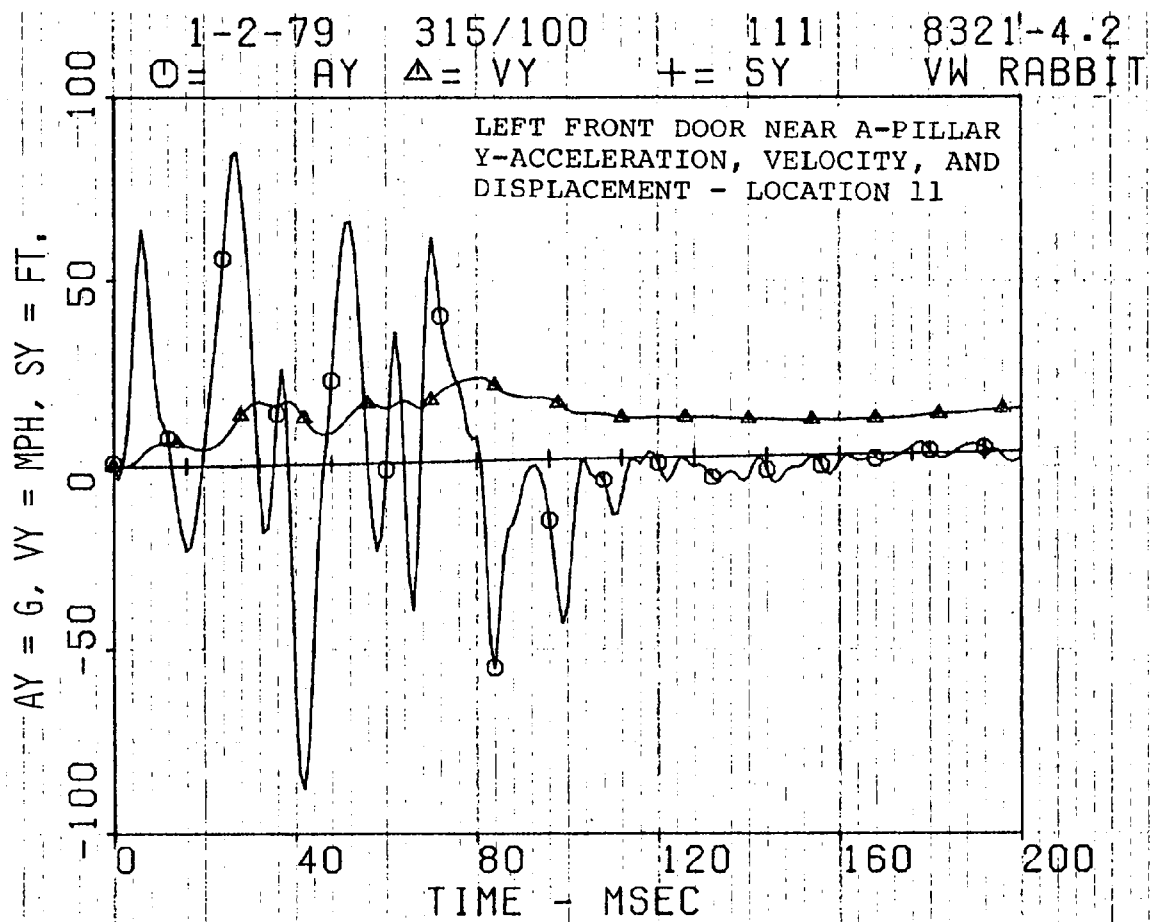


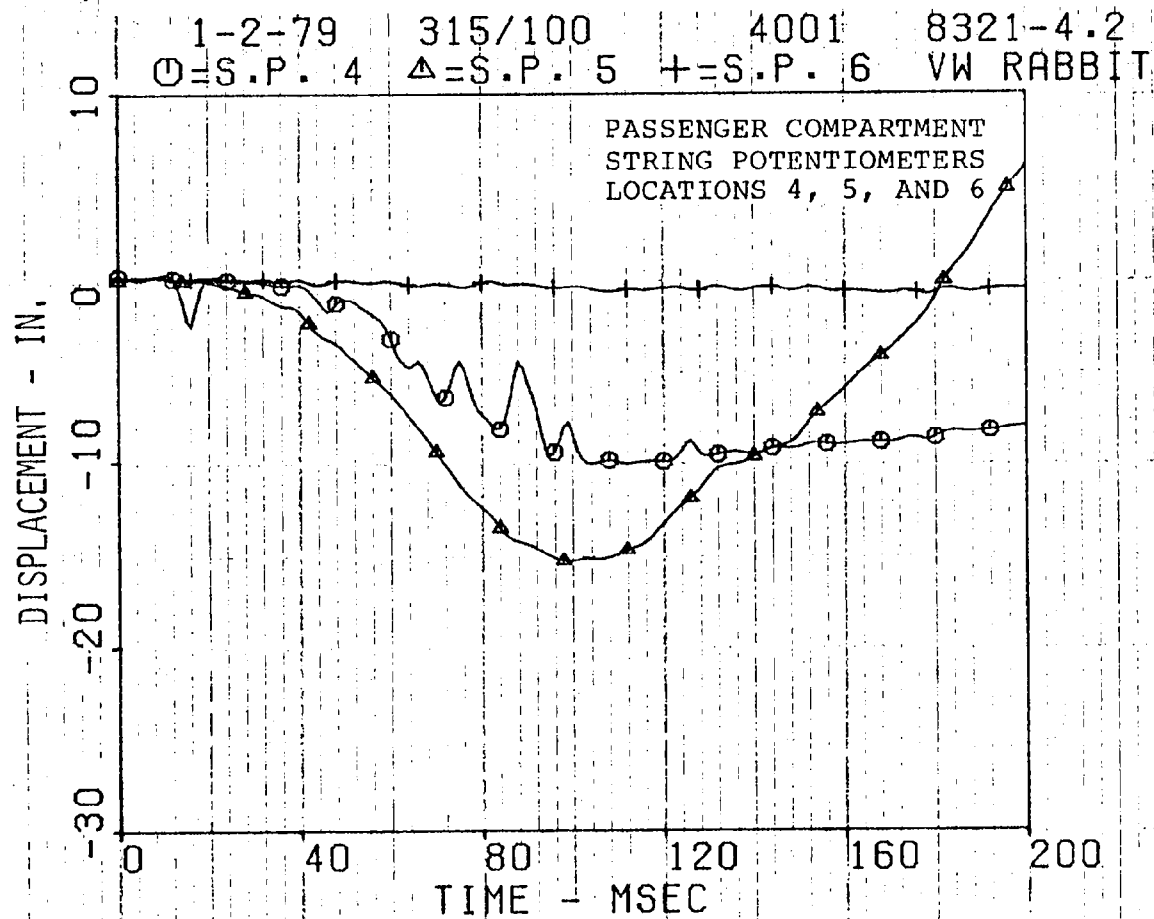
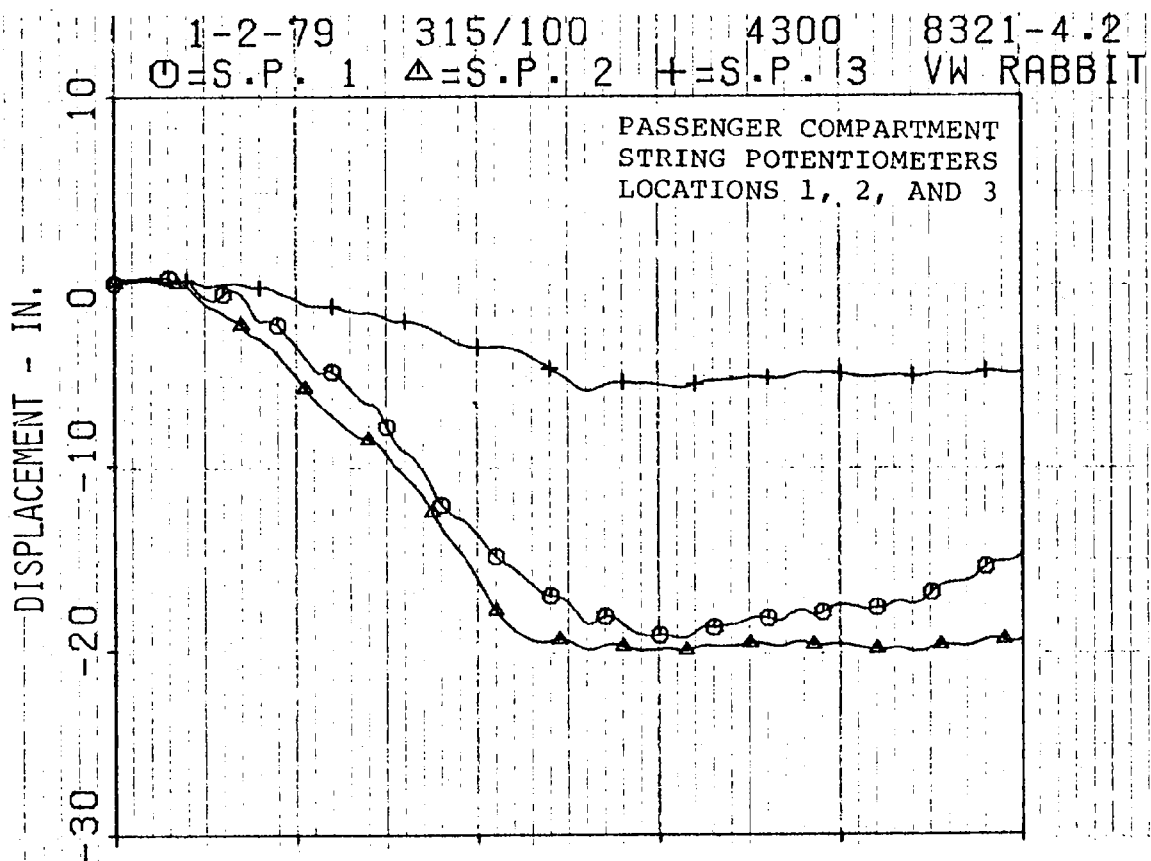


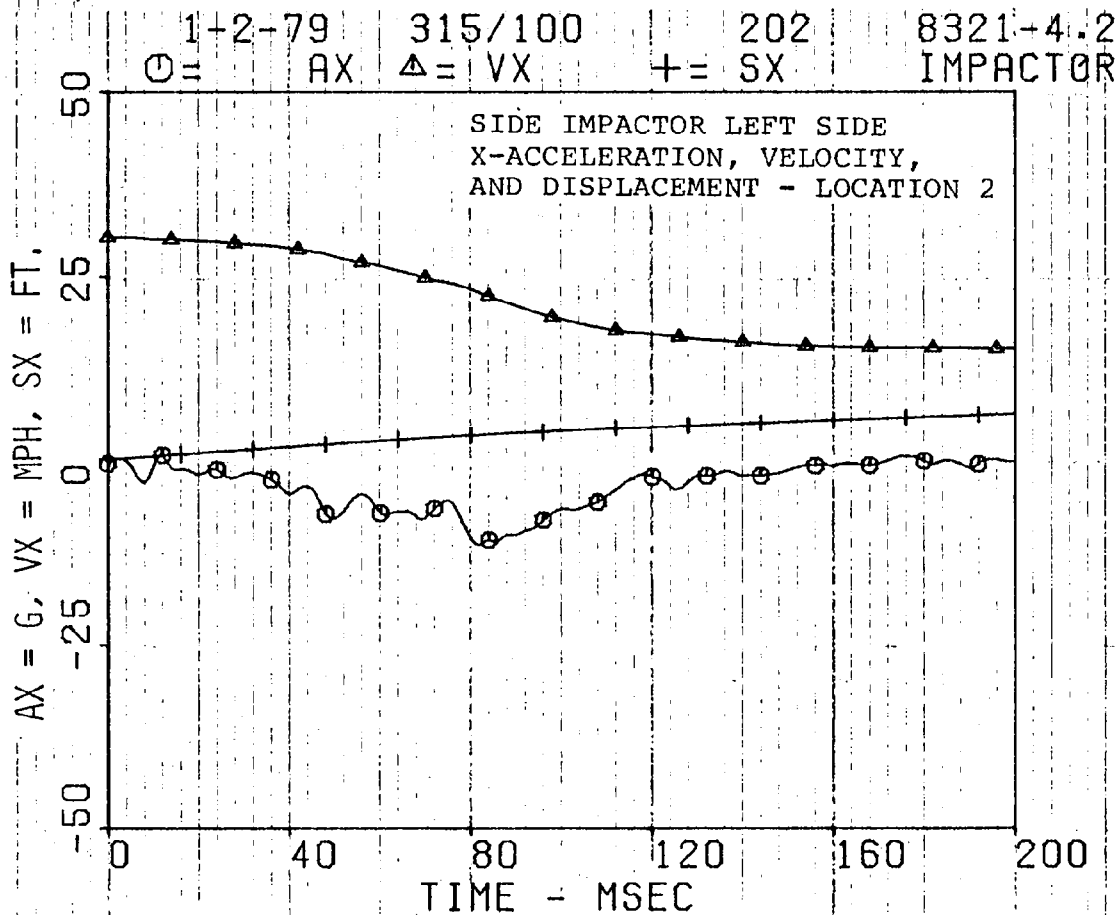
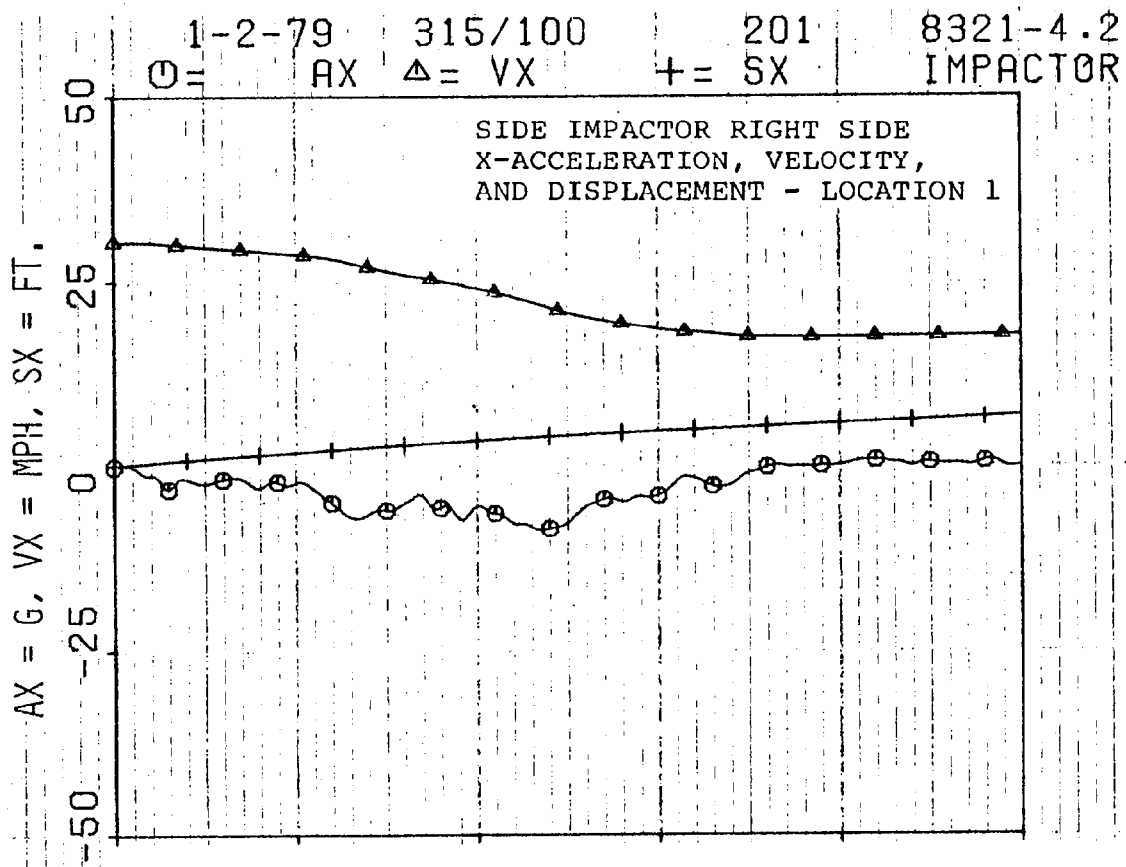


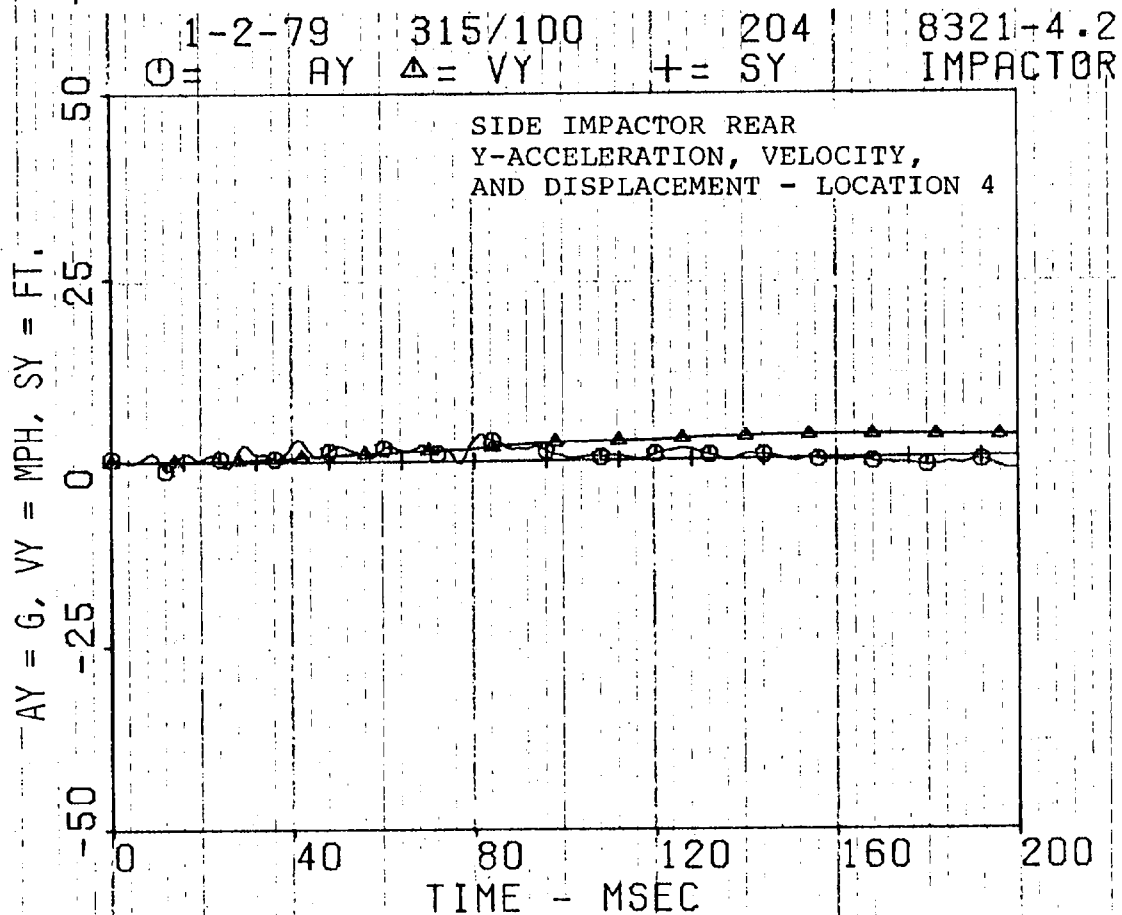
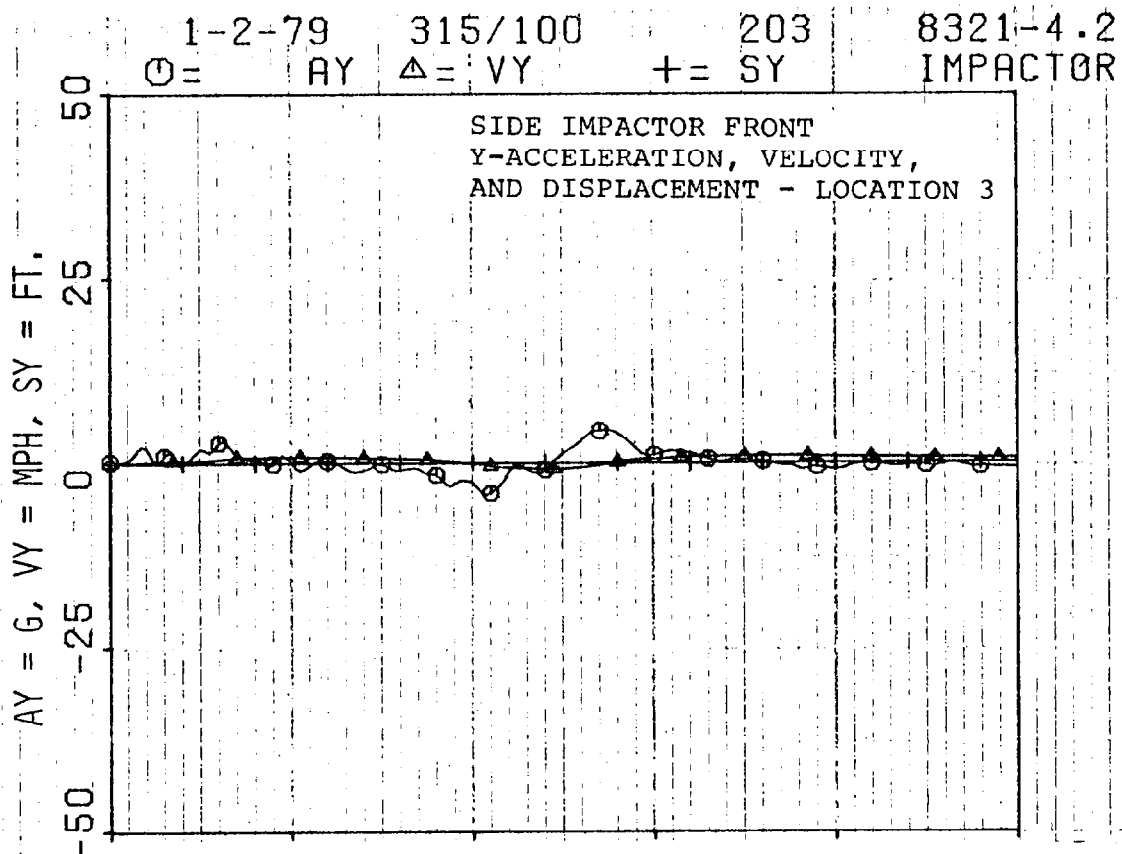


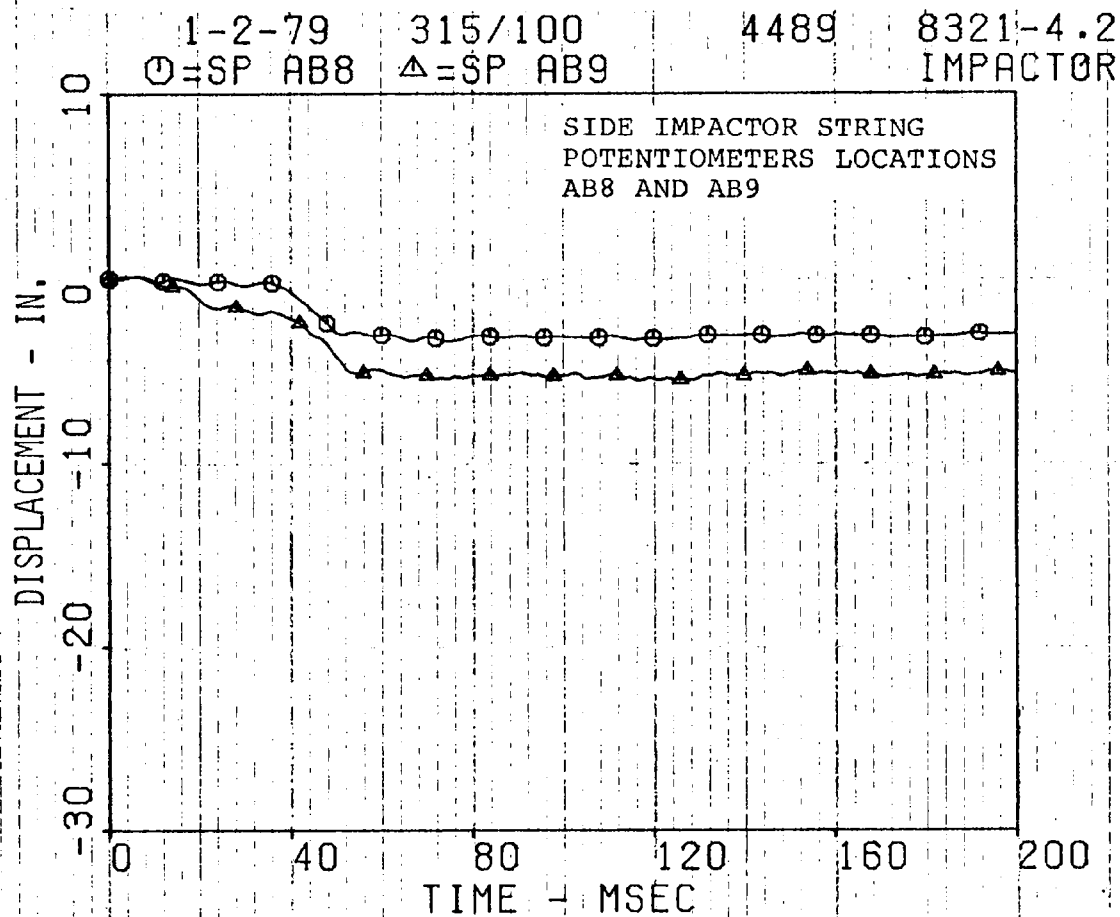
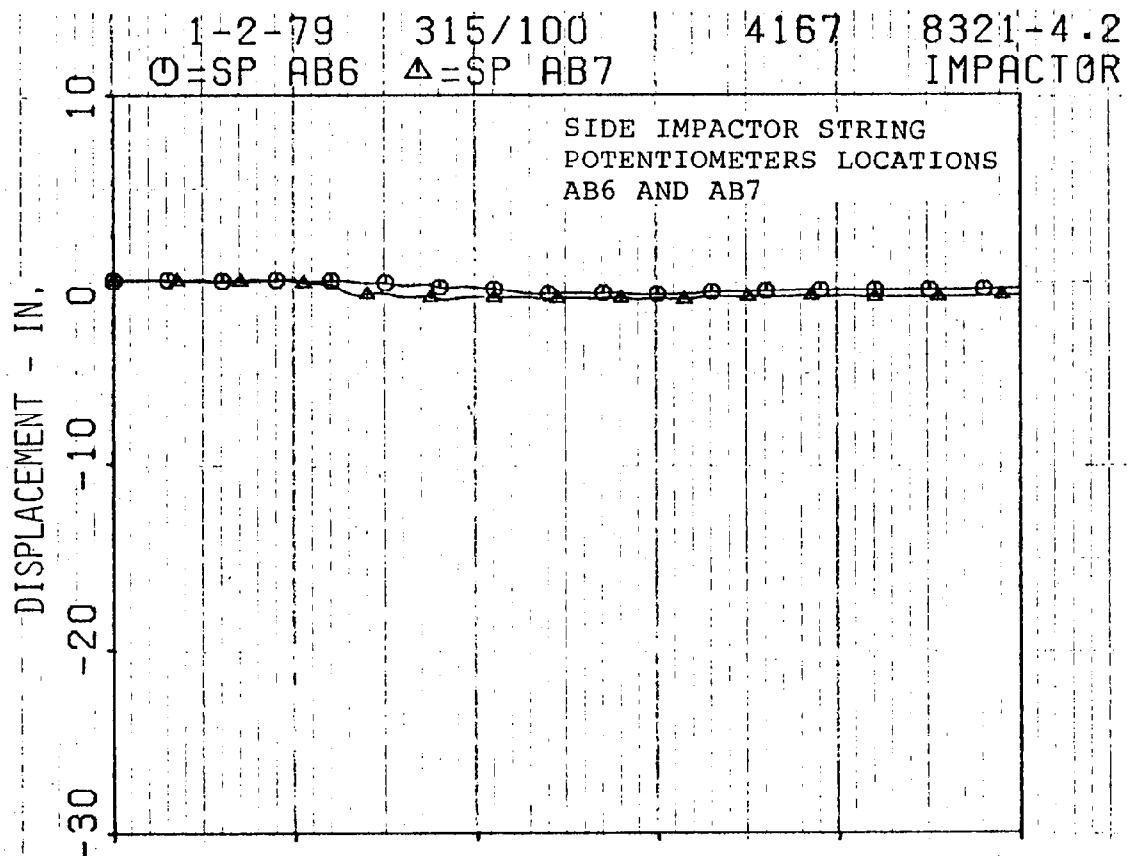












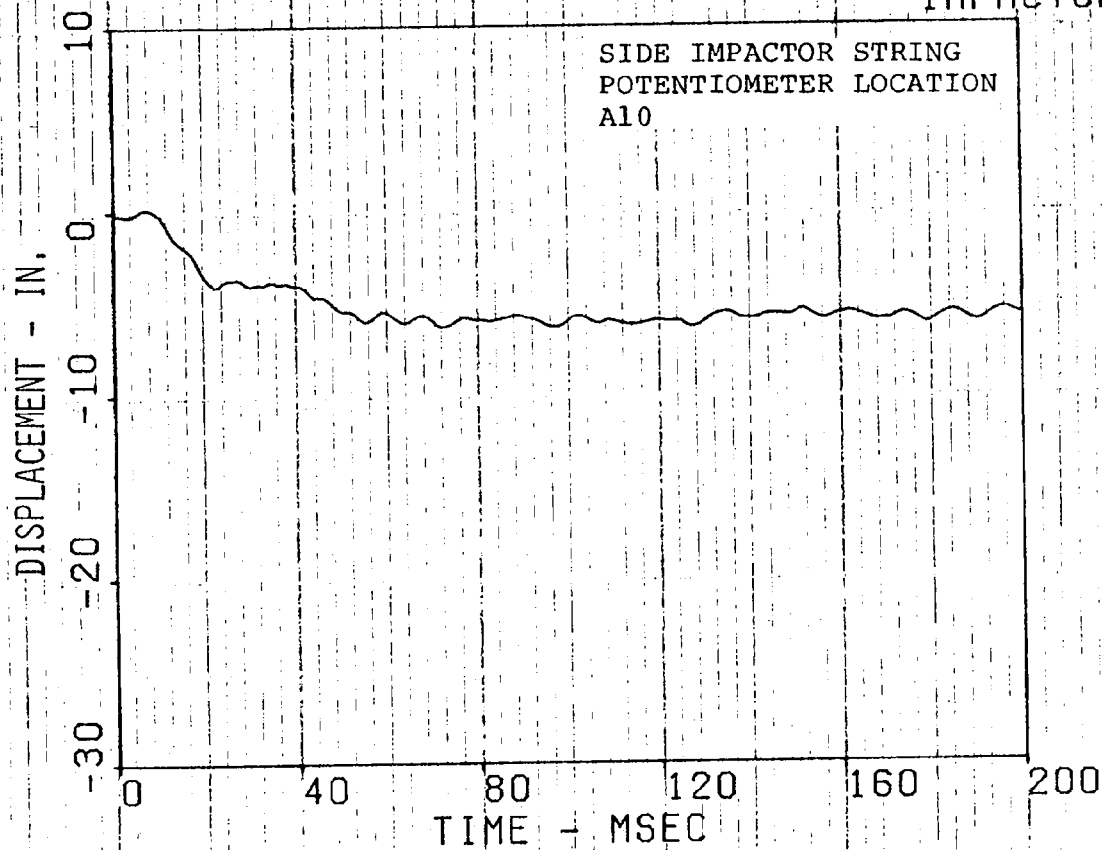
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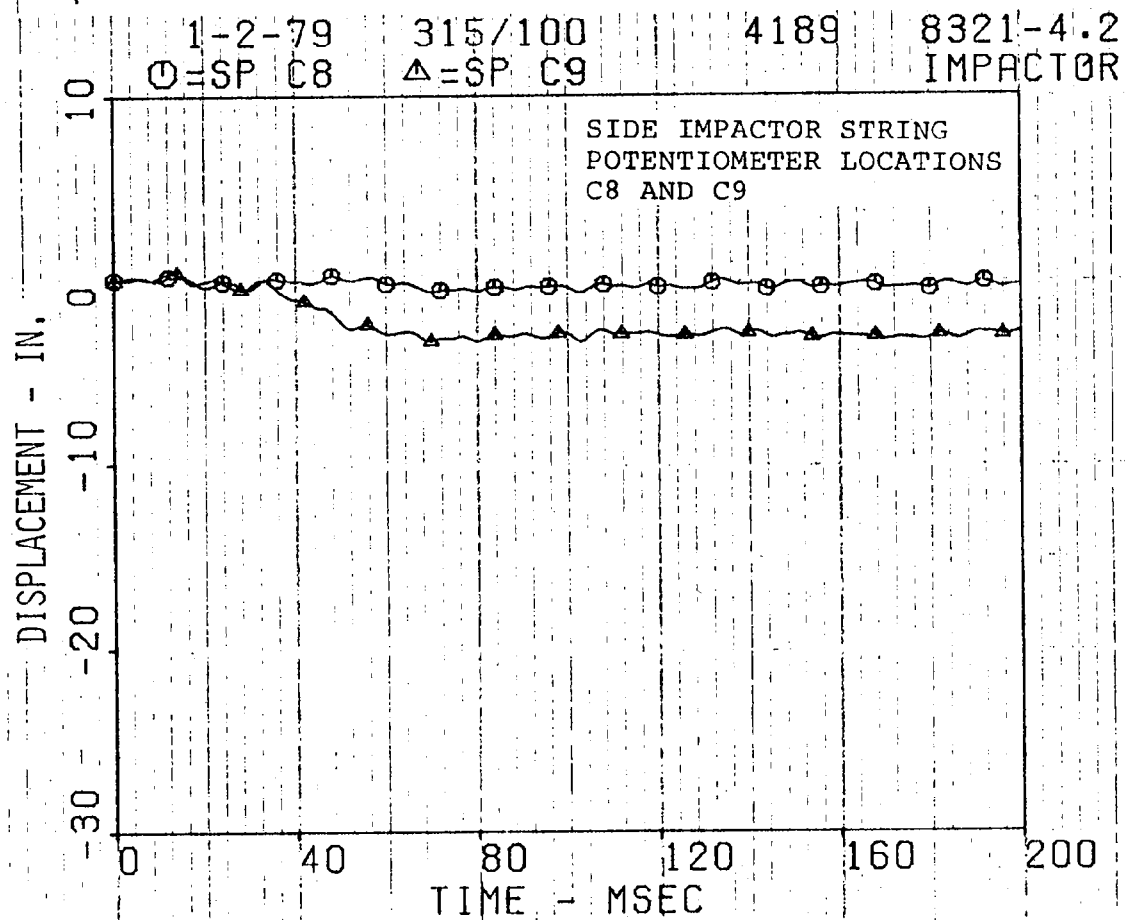
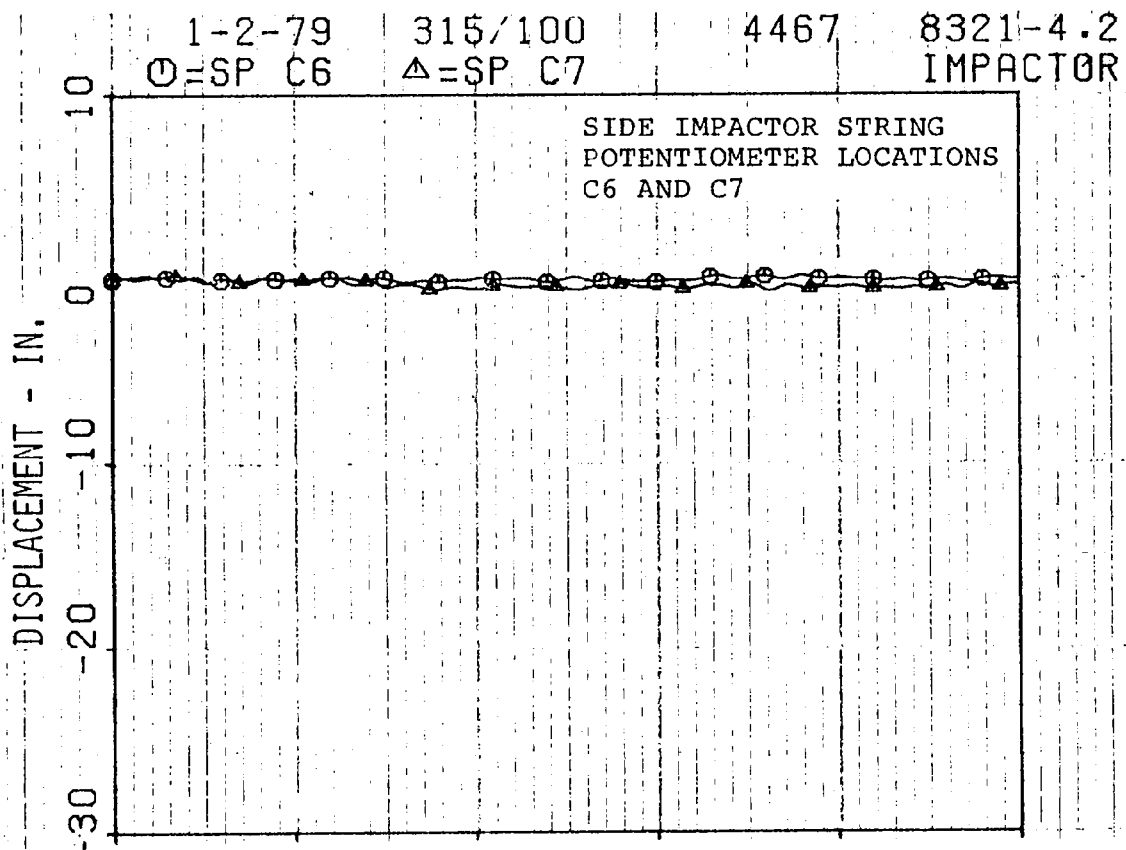
DATE
1-2-79

FILTER
315/100

LOCATION
4110

TEST NO
8321-4.2
IMPACTOR





APPENDIX C

ENERGY-ABSORBING FACE

SPECIFICATIONS FOR TEST 8321-4.02

TABLE (-) COMPONENT FABRICATION SPECIFICATION - ITEM 4 (TEST 8321-4.02)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, β, Δ) (deg)	
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (%)	Contour Engineering Drawing		
Plate A 6061-T6 AL														
1	I	ACG SPEC 1	NO/NO	NO/NO	750A	5	72	20	0		100			
	II _D	(CS = 750 PSI)				(TWO PIECES 5 X 72 X 10)								
	II _P													
	III _D													
	III _P													
IV														
Plate B 6061-T6 AL														
Plate B 6061-T6 AL														
2	I					.025	72	20						
	II _D					(SKIP THIS LAYER)								
	II _P													
	III _D													
	III _P													
IV														
Plate C														
NO PLATE														

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE C-1 COMPONENT FABRICATION SPECIFICATION - ITEM 4 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, β, δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (%)	Contour Engineering Drawing	
3	I	ACG- $\frac{3}{8}$ -0.003	445/495	no/no	150AA	6	32	7.4	0		100	DSL- NONE	
	II _D	↓	↓	↓	↓	6	20.0	7.4	14	F-1.75	77		
	II _P	↓	↓	↓	↓	6	20.0	7.4	14		77		
	III _D	ACG- $\frac{3}{4}$ -0.003	↓	↓	50AA	6	20.0	11.6	21		78		
	III _P	↓	↓	↓	↓	6	20.0	11.6	15		84		
	IV	↓	↓	↓	↓	6	32	11.6	34	↓	78		
	Plate D	REYNOLDS 67ND	—	.001	—	ALUM. FOIL	72	19	—				
4	I												
	II _D												
	II _P												
	III _D												
	III _P												
	IV												
	Plate E												

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE C-1 COMPONENT FABRICATION SPECIFICATION - ITEM 4 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, 8, 4) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left	Contour Engineering Drawing	
5	I	ACG- $\frac{3}{8}$ -003	445/445	20/20	150A	3	32	7.4	10	F-1.75	88		
	II _D	↓				3	19.8	7.4	14		77		
	II _P	↓				3	19.8	7.4	14		77		
	III _D	ACG- $\frac{3}{8}$ -003			38A	3	19.8	11.1	8		92		
	III _P	↓				3	19.8	11.1	0		100		
	IV	↓				3	32	11.1	34		78		
	Plate F	REYNOLDS END	—	.001	—	ALUM. FORC.	71.6	18.5	—				
6	I	ACG- $\frac{3}{8}$ -003	445/445	20/20	150A	3	32	7.4	18	F-1.75	79		
	II _D	↓				3	19.7	7.4	14		77		
	II _P	↓				3	19.7	7.4	14		77		
	III _D	ACG- $\frac{3}{8}$ -003			38A	3	19.7	10.8	8		92		
	III _P	↓				3	19.7	10.8	0		100		
	IV	↓				3	32	10.8	34		78		
	Plate G	REYNOLDS END		.001		ALUM. FORC.	71.4	18.2	—				

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE C-1 COMPONENT FABRICATION SPECIFICATION - ITEM 4 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, 8°) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left	Contour Engineering Drawing	
7	I	ACG- $\frac{3}{8}$ -0.003	405/405	m0/m0	150A	3	32	7.4	24	F-1.75	76	DSL- NCM-8	
	II _D	↓	↓	↓	↓	3	19.6	7.4	14	↓	77		
	II _P	↓	↓	↓	↓	3	19.6	7.4	14	↓	77		
	III _D	ACG- $\frac{3}{4}$ -0.003	↓	↓	38A	3	19.6	10.6	8	↓	78		
	III _P	↓	↓	↓	↓	3	19.6	10.6	5	↓	95		
	IV	↓	↓	↓	↓	3	32	10.6	34	↓	78		
	Plate H	6061-T6 AL	—	—		.025	71.2	18.0	—				
8	I	ACG- $\frac{3}{8}$ -0.003	405/405	m0/m0	150A	3	32	7.4	24	F-1.75	76		
	II _D	ACG- $\frac{3}{4}$ -0.003	↓	↓	50A	3	19.5	7.4	0		100		
	II _P	↓	↓	↓	"	3	19.5	7.4	0		100		
	III _D	↓	↓	↓	38A	3	19.5	10.3	11	F-1.75	89		
	III _P	↓	↓	↓	↓	3	19.5	10.3	20	↓	79		
	IV	↓	↓	↓	↓	3	32	10.3	34	↓	78		
	Plate I	6061-T6 AL	—	.001		ALUM Foil	71.0	17.7	—				

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE C-1 COMPONENT FABRICATION SPECIFICATION - ITEM 4 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, β, δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern DSL-1177 (8)	Uncored Area Left DSL-NONE	Contour Engineering Drawing	
9	I	ACG- $\frac{3}{8}$ -003	495/495	no/no	150A	3	32	7.4	24	F-1.75	76		
	II _D	ACG- $\frac{3}{8}$ -003			38A	3	19.4	7.4	0		100		
	II _P					3	19.4	7.4	0		100		
	III _D					3	19.4	10.0	24	F-1.75	76		
	III _P					3	19.4	10.0	21	"	79		
	IV	KP-1 $\frac{1}{2}$ -80(0)		495/495	14A	3	32	10.0	0		100		
Plate J		REYNOLDS 545D	—	.001		Actual (Top) 32	10.0		one more		50.6	7.4	
						Per (Bot) 70.8	7.4				70.8	7.4	
10	I	ACG- $\frac{3}{8}$ -003	495/495	no/no	150A	3	32	7.4	24	F-1.75	76		
	II _D	ACG- $\frac{3}{8}$ -003			38A	3	19.3	7.4	16		74		
	II _P	"			"	3	19.3	7.4	8		87		
	III _D	VOID											
	III _P	VOID											
	IV	KP-1 $\frac{1}{2}$ -80(0)	495/495	495/495	14A	3	32	9.7	0		100		
Plate K		REYNOLDS 545D	—	.001		Actual (Top) 32	10.0				70.6	7.4	
						Per (Bot) 70.6	7.4				70.6	7.4	

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE C-1 COMPONENT FABRICATION SPECIFICATION - ITEM 4 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, 8 Δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (\$)	Contour Engineering Drawing	
II	I	AC6-8 -- 003	445/405	40/40	150A	FABRICATE TO ATTACHING TO DWG. DSL-1189 CONCEPT A			0	DSL-NONE	100	DSL-NONE	
	II _D												
	II _P												
	III _D	VOID											
	III _P	VOID											
	IV	VOID											
	Plate L	6061-T6 AL	-	-		.25	(DSL-1189 - CONCEPT A)						
	I												
	II _D												
	II _P												
	III _D												
	III _P												
	IV												
	Plate I												

*Refer to Detail A for definition of honeycomb core orientation (of grain).

APPENDIX D

ENERGY-ABSORBING FACE

SPECIFICATIONS FOR TEST 8321-4.2

TABLE D-1 COMPONENT FABRICATION SPECIFICATION - ITEM 5 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, 8, δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (%)	Contour Engineering Drawing	
3	I	ACG-3-8--003	405/405	no/no	150AA	6	32	7.4	0		100	DSL- NONE	
	II _D	↓				6	20.0	7.4	14	F-1.75	77		
	II _P					6	20.0	7.4	14		77		
	III _D	ACG-3-4--003			50AA	6	20.0	11.6	21		78		
	III _P	↓				6	20.0	11.6	15		84		
	IV	↓				6	32	11.6	34	↓	78		
	Plate D	REYNOLDS EHD	—	.001	—	ALUM. FOIL	72	19	—	—			
4	I												
	II _D												
	II _P												
	III _D												
	III _P												
	IV												
	Plate E									NO PLATE			

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE D-1 COMPONENT FABRICATION SPECIFICATION - ITEM 5 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, β, Δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (%)	Contour Engineering Drawing	
5	I	ACG- $\frac{3}{8}$ - .003	445/445	10/100	150A	3	32	7.4	0	-	100	None	
	II _D	↓				3	19.8	7.4	14	F-1.75	77		
	II _P	↓				3	19.8	7.4	14		77		
	III _D	ACG- $\frac{3}{4}$ - .003			38A	3	19.8	11.1	8		92		
	III _P	↓				3	19.8	11.1	0		100		
	IV	↓				3	32	11.1	34	↓	78		
	Plate F	REYNOLDS 54D	—	.001		ALUM. FOIL	71.6	18.5	—				
6	I	ACG- $\frac{3}{8}$ - .003	445/445	10/100	150A	3	32	7.4	18	F-1.75	79		
	II _D	↓				3	19.7	7.4	14		77		
	II _P	↓				3	19.7	7.4	14		77		
	III _D	ACG- $\frac{3}{4}$ - .003			38A	3	19.7	10.8	8		92		
	III _P	↓				3	19.7	10.8	0		100		
	IV	↓				3	32	10.8	34	↓	78		
	Plate G	REYNOLDS 54D	—	.001		ALUM. FOIL	71.4	18.2	—				

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE D-1 COMPONENT FABRICATION SPECIFICATION - ITEM 5 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (α, β, Δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern	Uncored Area Left (%)	Contour Engineering Drawing	
7	I	ACG- $\frac{3}{8}$ -.003	495/405	40/40	121A	3	32	7.4	0		100	DSL- none	
	II _D	↓			↓	3	19.6	7.4	14	F-1.75	77		
	II _P	↓			↓	3	19.6	7.4	14		77		
	III _D	ACG- $\frac{3}{8}$ -.003			38A	3	19.6	10.6	8		78		
	III _P	↓			↓	3	19.6	10.6	5		95		
	IV	↓	↓	↓	↓	3	32	10.6	34	↓	78		
	Plate H	6061-T6 AL	—	—		.025	71.2	18.0	—				
8	I	ACG- $\frac{3}{8}$ -.003	495/403	40/40	121A	3	32	7.4	19	F-1.75	81		
	II _D	ACG- $\frac{3}{8}$ -.003			50A	3	19.5	7.4	0		100		
	II _P	↓			50A	3	19.5	7.4	0		100		
	III _D	↓			38A	3	19.5	10.3	11	F-1.75	89		
	III _P	↓			↓	3	19.5	10.3	20		79		
	IV	↓	↓	↓	↓	3	32	10.3	34	↓	78		
	Plate I	REYNOLDS 67HD	—	.001		ALUM. FOL	71.0	17.7	—				

*Refer to Detail A for definition of honeycomb core orientation (of grain).

TABLE D-1 COMPONENT FABRICATION SPECIFICATION - ITEM 5 (CONTD)

Layer Number	Load Panel	Material	Precrush (T/B)	Face Skin Thickness (T/B) (in.)	Mat'l Code	Dimensions*			Coring Characteristics				Tapered Angle (a, δ , Δ) (deg)
						T (in.)	L (in.)	W (in.)	Number of Holes	Hole Pattern DSL-	Uncored Area Left (%)	Contour Engineering Drawing DSL-	
9	I	ACG- $\frac{3}{8}$ -.003	445/405	20/100	12/A	3	32	7.4	19	F-1.75	81		
	II _D	ACG- $\frac{3}{8}$ -.003			38/A	3	19.4	7.4	0		100		
	II _P					3	19.4	7.4	0		100		
	III _D					3	19.4	10.0	24	F-1.75	76		
	III _P					3	19.4	10.0	21	"	79		
	IV	KP-1 $\frac{1}{2}$ -80(0)		445/405	14/A	3	32	10.0	0		100		
	Plate J	REYNOLDS END	—	.001		ALUM. (TOP) 32 10.0 F-1.75 (BOT) 70.8 7.4			ONE PIECE	F-1.75 7.4			
10	I	ACG- $\frac{3}{8}$ -.003	445/405	20/100	12/A	3	32	7.4	19	F-1.75	81		
	II _D	ACG- $\frac{3}{8}$ -.003			38/A	3	19.3	7.4	16		74		
	II _P	"			38/A	3	19.3	7.4	8		87		
	III _D	VOID											
	III _P	VOID											
	IV	KP-1 $\frac{1}{2}$ -80(0)		445/405	14/A	3	32	9.7	0		100		
	Plate K	REYNOLDS END		.001		ALUM. (TOP) 0 0 F-1.75 (BOT) 70.6 7.4					70.6 70.6 7.4		

*Refer to Detail A for definition of honeycomb core orientation (of grain).

April 27, 1979

Mr. Carl Ragland
Contract Technical Manager
National Highway Traffic Safety
Administration
2100 Second Street, S.W.
Washington, D.C. 20590

Subject: Transmittal of:

Reproducible Test Report 1 - Side Impactor-to-Fixed
Barrier and Car Tests 8321-4.01 and 8321-4.1

Reproducible Test Report 2 - Side Impactor-to-Fixed
Barrier and Car Tests 8321-4.02 and 8321-4.2

Reference: Contract No. DOT-HS-8-01933

Dear Carl:

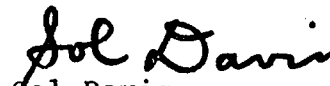
I am forwarding the reproducible and eight copies of Test Report 1 - Side Impactor-to-Fixed Barrier and Car Tests 8321-4.01 and 8321-4.1 which covers the following tests:

- Test No. 8321-4.01 - NHTSA Side Impactor-to-Fixed Barrier, 30° Angular Impact ($V_0 = 20.54$ mph)
- Test No. 8321-4.1 - NHTSA Side Impactor-to-1976 Plymouth Volare, 60° Angular Side Impact ($V_0 = 30.56$ mph)

and Test Report 2 - Side Impactor-to-Fixed Barrier and Car Tests 8321-4.02 and 8321-4.2 which covers the following tests:

- Test No. 8321-4.02 - NHTSA Side Impactor-to-Fixed Barrier, 30° Angular Impact ($V_0 = 19.69$ mph)
- Test No. 8321-4.2 - NHTSA Side Impactor-to-1976 VW Rabbit, 60° Angular Side Impact ($V_0 = 30.34$ mph).

Sincerely,


Sol Davis

Manager, Special
Projects Department

SD:bmV

Enclosures