Heavy Truck into Left Side of
1995 Blue Bird Bus
TRC Test Number: 990525

Prepared by:
Transportation Research Center Inc.
10820 State Route 347
East Liberty, OH 43319

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Prepared For:
Vehicle Research and Test Center
P. O. Box 37
East Liberty, OH 43319

TRC TEST NUMBER: 990525

Report Prepared by:

Allison E. Louden Date: 7/1/99

Allison E. Louden
Project Engineer

Report Approved by:

Jeffery W. Sankey Date: 7/2/99

Jeffery W. Sankey
Manager, Project Operations
Transportation Research Center Inc.

Final Report Accepted by:

Lisa K. Sullivan Date: 7/15/99

Lisa Sullivan
Project Engineer
Vehicle Research & Test Center

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Section 1.0

Purpose and Test Summary

Purpose and Test Summary

This 45 mph heavy truck into bus impact test was conducted to investigate both vehicle and occupant dynamics during a side impact test.

This test was conducted with a 1995 Blue Bird Bus that was impacted by a 25,265-pound heavy truck. The target vehicle contained two instrumented Hybrid III 50th percentile adult male SID dummies; two instrumented Hybrid III 5th percentile adult female dummies; two instrumented 6-year-old child dummies; one 50th percentile abult male ballast dummy with head accelerometers; one uninstrumented 50th percentile adult male ballast dummy; and two uninstrumented 6-year-old child ballast dummies.

Section 2.0

Side Impact Test Summary

Test Procedure

This test was conducted per VRTC personnel's instructions.

The target vehicle was instrumented with eleven (11) accelerometers to measure longitudinal, lateral, and vertical axis accelerations. The target vehicle was impacted by a 25,265-pound heavy truck behind the left front wheel well.

The bullet vehicle was instrumented with two (2) accelerometers to measure longitudinal axis accelerations; one (1) accelerometer to measure lateral axis accelerations; and one (1) accelerometer to measure vertical axis accelerations. The vehicle's specified impact velocity range was 70.8 km/h to 74.0 km/h

The test vehicle contained seven (7) instrumented anthropomorphic test devices (dummies) and three (3) uninstrumented anthropomorphic test devices (dummies). The dummies were positioned according to Figure 1.

The SID dummies were instrumented with head accelerometers to measure longitudinal, lateral, and vertical accelerations; upper and lower ribs, lower spine and pelvis accelerometers to measure lateral accelerations; chest deflection potentiometers; and upper neck load cells to measure forces and moments.

The 6-year-old and 5th female dummies were instrumented with head, chest, and pelvis accelerometers to measure longitudinal, lateral, and vertical accelerations; chest deflection potentiometers; left and right femur load cells to measure axial forces; and upper neck load cells to measure forces and moments.

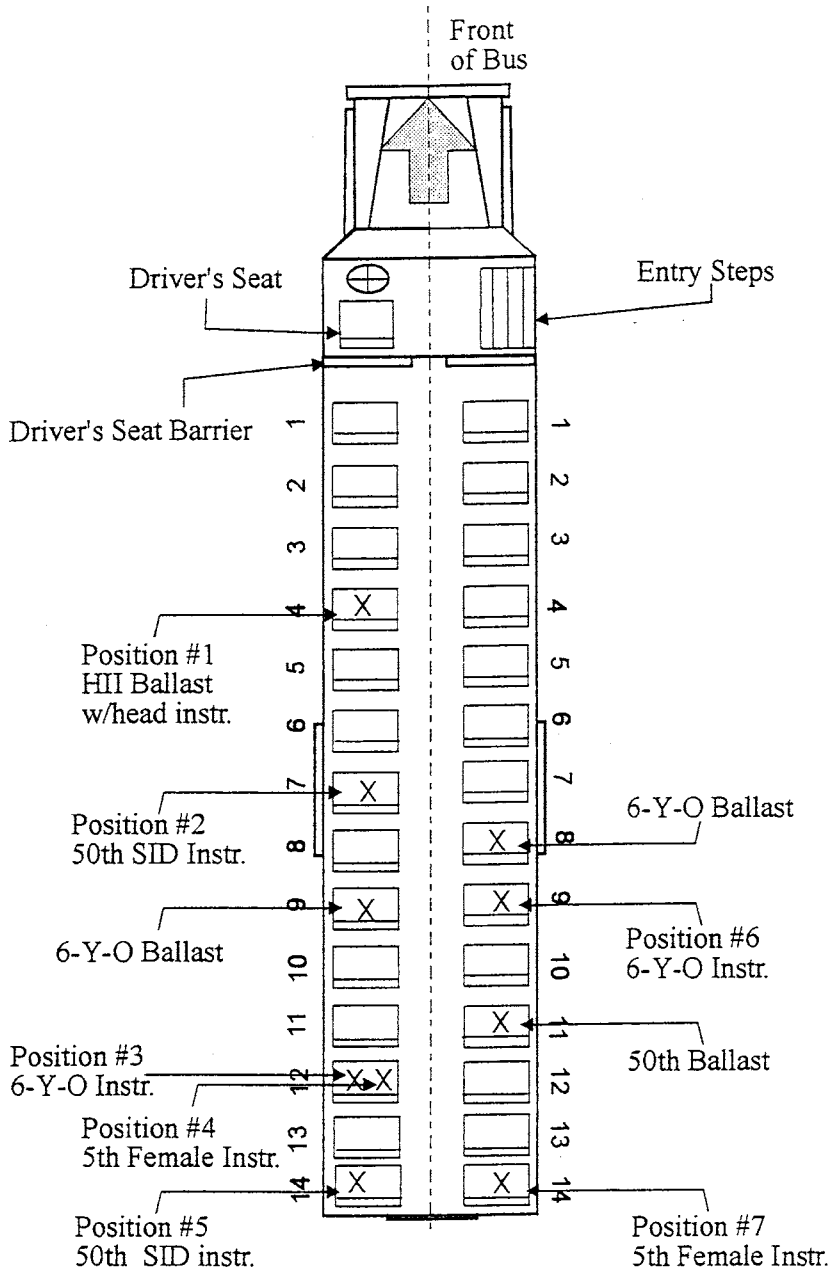
One ballast dummy was instrumented with a head accelerometer to measure longitudinal, lateral, and vertical accelerations.

The one-hundred-forty-five (145) data channels were digitally sampled at 12,500 samples per second and processed per Sections 11.13 through 11.15 of the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time panning motion picture camera and ten (10) high-speed motion picture cameras. The pre-test and post-test conditions were recorded by one (1) real-time motion picture camera.

The vehicle and occupant data are summarized in Section 2.0. The FMVSS 208 and FMVSS 214 data are presented in Section 3.0. The vehicle, occupant, and camera measurements are presented in Section 4.0. Appendix A contains the still photographic prints. Appendix B contains the dummy and vehicle data plots. Appendix C contains the dummy calibration information.

Figure 1 Dummy Positioning Data



Test Results Summary

This side impact crash test was conducted at TRC on May 25, 1999.

The target vehicle was a 1995 Blue Bird Bus. The target vehicle's test weight was 9,965.5 kg. The vehicle's maximum static crush was 1705 millimeters at the bottom of the window sill.

The bullet vehicle was a Peterbilt heavy truck. The bullet vehicle's test weight was 11,460.1 kg. The vehicle's impact speed was 75.3 km/h. The vehicle's maximum static crush was 775 mm.

The Position #1 dummy's 36-millisecond Head Injury Criteria (HIC) was 2164.

The Position #2 dummy's 36-millisecond HIC was 277. The Position #2 dummy's TTI was 54.7. The Position #2 dummy's maximum lateral axis acceleration was 61.4 g.

The Position #3 dummy's 36-millisecond HIC was 85. The Position #3 dummy's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 27.7 g. The Position #3 dummy's chest deflection was 3 mm. The Position #3 dummy's left and right femur maximum compressive forces were 189 N and 170 N, respectively.

The Position #4 dummy's 36-millisecond HIC was 124. The Position #4 dummy's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 11.1 g. The Position #4 dummy's chest deflection was 1 mm. The Position #4 dummy's left and right femur maximum compressive forces were 199 N and 318 N, respectively.

The Position #5 dummy's 36-millisecond HIC was 133. The Position #5 dummy's TTI was 7.1 g. The Position #5 dummy's maximum lateral axis acceleration was -5.5 g.

The Position #6 dummy's 36-millisecond HIC was 54. The Position #6 dummy's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 22.7 g. The Position #6 dummy's chest deflection was 2 mm. The Position #6 dummy's left and right femur maximum compressive forces were 489 N and 48 N, respectively.

The position #7 dummy's 36-millisecond HIC was 1. The position #7 dummy's chest maximum resultant acceleration with 3 milliseconds minimum duration was 7.4 g. The position #7 dummy's chest deflection was 1 mm. The position #7 dummy's left and right femur maximum compressive forces were 193 N and 224 N, respectively.

Data Acquisition Explanations

The Position #2 dummy's lower spine Y-axis acceleration redundant channel, T12YR2, recorded questionable data throughout the impact.

The target vehicle's right frame at center of gravity X-, Y- and Z-axis data channels, FRTXG1, FRTYG1, and FRTZG1, lost data after approximately 188 milliseconds. This affected the resultant calculation.

The target vehicle's impact side left wall at Y-axis data channel, IMPYG1, recorded questionable data after approximately 68 milliseconds. This affected the resultant calculation.

Table 1 Crash Test Summary

Test type:	Heavy Truck into Left Side of School Bus
Test date:	05/25/99
Test time:	1837
Ambient temperature at impact area:	17° C
Target vehicle year/make/ model/body style:	1995 Blue Bird Bus
Target vehicle test weight:	9,965.5 kg
Bullet vehicle year/make/ Model/body style:	1995 Peterbilt/Cabover
Bullet vehicle test weight:	11,460.1 kg
Impact angle[1]:	270°
Impact velocity[2]:	
Primary:	75.3 km/h
Secondary:	75.3 km/h
Target Vehicle Maximum static crush:	1705 mm
Bullet Vehicle Maximum static crush:	775 mm
Number of cameras:	
Real-time:	1
High-speed:	10

[1] With respect to tow track centerline.
[2] Speed trap measurement (± .08 km/h accuracy)

Table 2 Target Vehicle Information

Vehicle year/make/ model/body style:	1995/Blue Bird/Bus			
Color:	Yellow			
VIN:	1BABMBBA8SF064683			
Engine data:				
Placement:	In-line			
Cylinders:	6			
Displacement:	6.6 liters			
Transmission data:	_4_speed,	___manual,	_X_automatic,	___overdrive
Final drive:	___fwd,	_X_rwd,	___4wd	
Date vehicle received:	05/20/99			
Odometer reading:	616			
Dealer's name and address:	N/A			

Accessories:

Power steering	Yes	Automatic transmission	Yes
Air brakes	Yes	Automatic speed control	No
Power seats	No	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	No
Tinted glass	No	Air conditioning	No
Radio	No	Anti-skid brake	No
Clock	Yes	Rear window defroster	No
Power door locks	No	Other:	None

Certification data from vehicle's label:

Vehicle manufactured by:		Blue Bird Body Company
Date of manufacture:		02/95
VIN:		1BABMBBA8SF064683
GVWR:		36,200 lbs
GAWR:	Front:	13,220 lbs
	Rear:	23,000 lbs

Table 2 Target Vehicle Information, Cont'd.

Size of tires on vehicle:	11R x 22.5
Spare tire:	N/A
Type of front seats:	Bucket

Tire & capacity data from vehicle's label:

Recommended tire size:	11R X 22.5
Recommended cold tire pressure:	
Front:	115 psi
Rear:	110 psi
Designated Seating Capacity:	
Front	N/A
Rear	N/A
Total	N/A
Vehicle Cargo Weight:	N/A

Vehicle Attitudes:

Pre-Test:	LF 1200	RF 1127	LR 1230	RR 1169
Post-Test: [1]	LF N/A	RF 718	LR 1198	RR 1143

[1] The vehicle came off its front axle.

Table 2 Target Vehicle Information, Cont'd.

Weight of test vehicle as received (with maximum fluids):

Right front	N/A	Right rear	N/A
Left front	N/A	Left rear	N/A
Total front weight	N/A	(N/A% of total vehicle weight)	
Total rear weight	N/A	(N/A% of total vehicle weight)	
Total delivered weight	N/A		

Calculation of test vehicle's target test weight:

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight

DSC[1] = Designated Seating Capacity

RCLW[2] = N/A

Target test weight = UDW + RCLW + (number of Hybrid III Dummies x 75.7 kg per dummy)

Target test weight[3] = N/A

Weight of test vehicle with required dummies:

Front	3,397.4 kg	(7,490 lbs.)
Rear	6,568.1 kg	(14,480 lbs.)
Total	9,965.5 kg	(21,970 lbs.)

Weight of ballast secured in vehicle: None

Components removed to meet target test weight: None

CG rearward of front wheel centerline: 10,469 mm (412.2 in)

Vehicle Wheelbase: 6,900 mm (271.7 in)

[1] The designated seating capacity is determined by counting the number of seat belts installed in the vehicle.

[2] From vehicle's tire label.

[3] There was no target test weight provided.

Table 3 Bullet Vehicle Information

Vehicle year/make/ model/body style:	Peterbilt/Cabover			
Color:	White			
VIN:				
Engine data:				
Placement:	N/A			
Cylinders:	N/A			
Displacement:	N/A			
Transmission data:	___speed,	_X_manual,	___automatic,	___overdrive
Final drive:	___fwd,	_X_rwd,	___4wd	
Date vehicle received:	05/20/99			
Odometer reading:	N/A			
Dealer's name and address:	N/A			

Accessories:

Power steering	N/A	Automatic transmission	N/A
Air brakes	N/A	Automatic speed control	N/A
Power seats	N/A	Tilting steering wheel	N/A
Power windows	N/A	Telescoping steering wheel	N/A
Tinted glass	N/A	Air conditioning	N/A
Radio	N/A	Anti-skid brake	N/A
Clock	N/A	Rear window defroster	N/A
Power door locks	N/A	Other:	N/A

Certification data from vehicle's label: [1]

Vehicle manufactured by:		N/A
Date of manufacture:		N/A
VIN:		N/A
GVWR:		N/A
GAWR:	Front:	N/A
	Rear:	N/A

[1] The vehicle did not contain a certification or tire load label. The vehicle had been previously crashed.

Table 3 Bullet Vehicle Information, Cont'd.

Size of tires on vehicle:	Front: 10 X 20 Rear: 11R X 22.5
Spare tire:	N/A
Type of front seats:	N/A

Tire & capacity data from vehicle's label: [1]

Recommended tire size:	
Recommended cold tire pressure:	
Front:	N/A
Rear:	N/A
Designated Seating Capacity:	
Front	N/A
Rear	N/A
Total	N/A
Vehicle Cargo Weight:	N/A

Vehicle Attitudes:

Pre-Test:	LF 1151	RF 1153	LR 1131	RR 1115
Post-Test: [2]	LF N/A	RF N/A	LR 1119	RR 1134

[1] The vehicle did not have a tire load label.

[2] The vehicle came off of its front axle.

Table 3 Bullet Vehicle Information, Cont'd.

Weight of test vehicle as received (with maximum fluids):

Right front	N/A	Right rear	N/A
Left front	N/A	Left rear	N/A
Total front weight	N/A	(N/A% of total vehicle weight)	
Total rear weight	N/A	(N/A% of total vehicle weight)	
Total delivered weight	N/A		

Calculation of test vehicle's target test weight:

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight

DSC[1] = Designated Seating Capacity

RCLW[2] = N/A

Target test weight = UDW + RCLW + (number of Hybrid III Dummies x 75.7 kg per dummy)

Target test weight[3] = N/A

Weight of test vehicle with required dummies:

Front	3,352.1 kg	(7,390 lbs.)
Rear	8,108.0 kg	(17,875 lbs.)
Total	11,460.1 kg	(25,265 lbs.)

Weight of ballast secured in vehicle: None

Components removed to meet target test weight: None

CG rearward of front wheel centerline: 2,805.2 mm (110.4 in)

Vehicle Wheelbase: 3,965 mm (156.1 in)

[1] The designated seating capacity is determined by counting the number of seat belts installed in the vehicle.

[2] From vehicle's tire label.

[3] There was no target test weight provided.

Table 4 Post-Impact Data

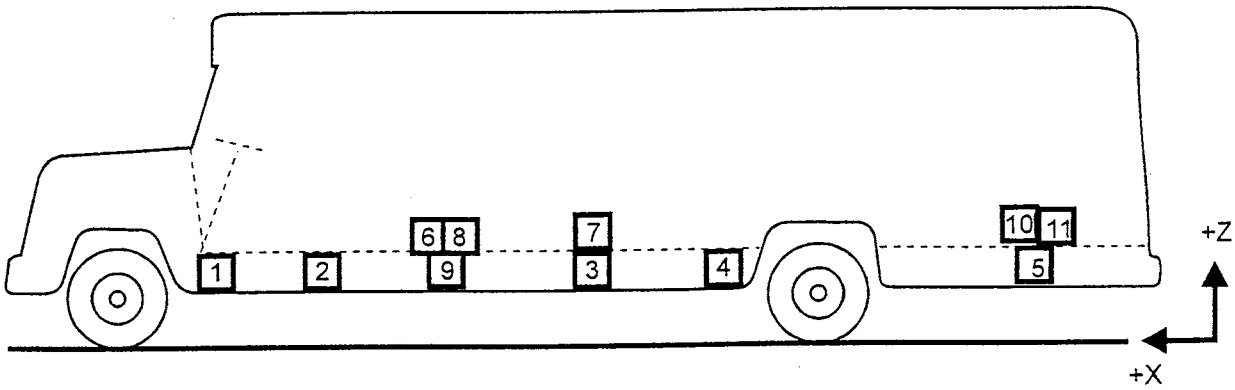
Test number:	990525
Test date:	05/25/99
Test time:	1837
Test type:	Heavy Truck into Left Side of School Bus
Impact angle:	0°
Ambient temperature at impact area:	17° C
Temperature in occupant compartment:	18° C
Impact velocity:	
Primary:	75.3 km/h
Secondary:	75.3 km/h
Specified Range:	(70.8 to 74.0 km/h)

Bullet vehicle static crush:

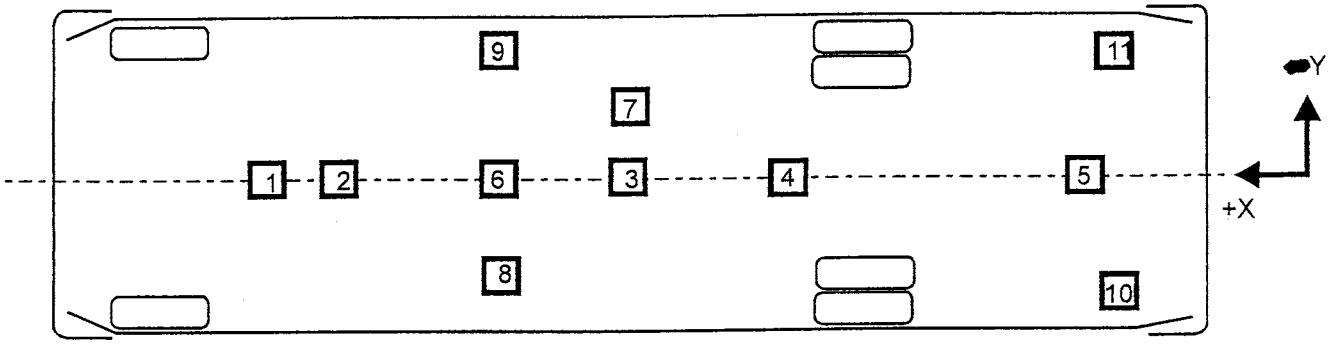
Overall length of test vehicle:

Pre-test:	L: 7800 mm	C: 7775 mm	R: 7825 mm
Post-test:	L: 7369 mm	C: 7802 mm	R: 8600 mm
Total crush:	L: 431 mm	C -27 mm	R: -775 mm
Average crush:	-123.7 mm		

Figure 2 Target Vehicle Accelerometer Placement



Side View



Top View

Table 5 Target Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: 990525 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1 FRONT FLOOR TUNNEL	10215 mm	0 mm	1067 mm				
LONGITUDINAL				17.0 g	@ 90.5 ms	35.6 g	@ 55.8 ms
LATERAL				35.4 g	@ 49.2 ms	24.9 g	@ 25.5 ms
VERTICAL				16.8 g	@ 98.6 ms	30.2 g	@ 77.8 ms
RESULTANT				43.4 g	@ 56.2 ms		
2 IMPACT FLOOR TUNNEL	7750 mm	0 mm	1069 mm				
LONGITUDINAL				40.4 g	@ 16.4 ms	28.0 g	@ 11.4 ms
LATERAL				71.9 g	@ 5.3 ms	8.5 g	@ 125.5 ms
VERTICAL				50.2 g	@ 12.2 ms	47.4 g	@ 16.5 ms
RESULTANT				74.8 g	@ 5.4 ms		
3 VEHICLE CENTER OF GRAVITY	5360 mm	0 mm	1077 mm				
LONGITUDINAL				12.9 g	@ 4.7 ms	7.3 g	@ 90.6 ms
LATERAL				44.3 g	@ 7.4 ms	7.9 g	@ 78.6 ms
VERTICAL				16.1 g	@ 96.9 ms	20.0 g	@ 26.4 ms
RESULTANT				45.2 g	@ 7.3 ms		
4 FLOOR TUNNEL ROW 11	3170 mm	0 mm	1082 mm				
LONGITUDINAL				4.0 g	@ 99.4 ms	11.0 g	@ 9.2 ms
LATERAL				27.4 g	@ 9.0 ms	3.6 g	@ 79.9 ms
VERTICAL				9.5 g	@ 107.0 ms	12.8 g	@ 93.6 ms
RESULTANT				29.6 g	@ 9.0 ms		

Table 5 Target Vehicle Accelerometer Locations and Data Summary, Cont'd.

TEST NUMBER: 990525 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
5 REAR FLOOR TUNNEL	1200 mm	0 mm	1082 mm				
LONGITUDINAL				11.5 g	@ 9.9 ms	14.9 g	@ 105.6 ms
LATERAL				5.3 g	@ 19.3 ms	4.0 g	@ 109.8 ms
VERTICAL				30.3 g	@ 111.3 ms	25.8 g	@ 103.6 ms
RESULTANT				31.4 g	@ 111.3 ms		
6 FLOOR TUNNEL ROW 7	6200 mm	0 mm	1077 mm				
LONGITUDINAL				15.3 g	@ 5.0 ms	7.1 g	@ 89.6 ms
LATERAL				50.6 g	@ 6.2 ms	6.1 g	@ 78.6 ms
VERTICAL				18.2 g	@ 94.1 ms	16.1 g	@ 12.3 ms
RESULTANT				52.5 g	@ 5.8 ms		
7 RIGHT FRAME AT CENTER OF GRAVITY	5360 mm	-413 mm	850 mm				
LONGITUDINAL[1]				155.4 g	@ 121.5 ms	46.7 g	@ 190.0 ms
LATERAL[1]				49.2 g	@ 190.0 ms	30.7 g	@ 187.8 ms
VERTICAL[1]				41.7 g	@ 190.0 ms	26.2 g	@ 187.8 ms
RESULTANT[1]				156.6 g	@ 121.5 ms		
8 IMPACT LEFT WALL	5770 mm	1143 mm	1380 mm				
LONGITUDINAL				32.2 g	@ 3.8 ms	6.8 g	@ 101.4 ms
LATERAL[1]				80.4 g	@ 11.8 ms	21.4 g	@ 41.5 ms
VERTICAL				15.4 g	@ 17.7 ms	12.2 g	@ 10.5 ms
RESULTANT[1]				81.5 g	@ 11.8 ms		

Table 5 Target Vehicle Accelerometer Locations and Data Summary, Cont'd.

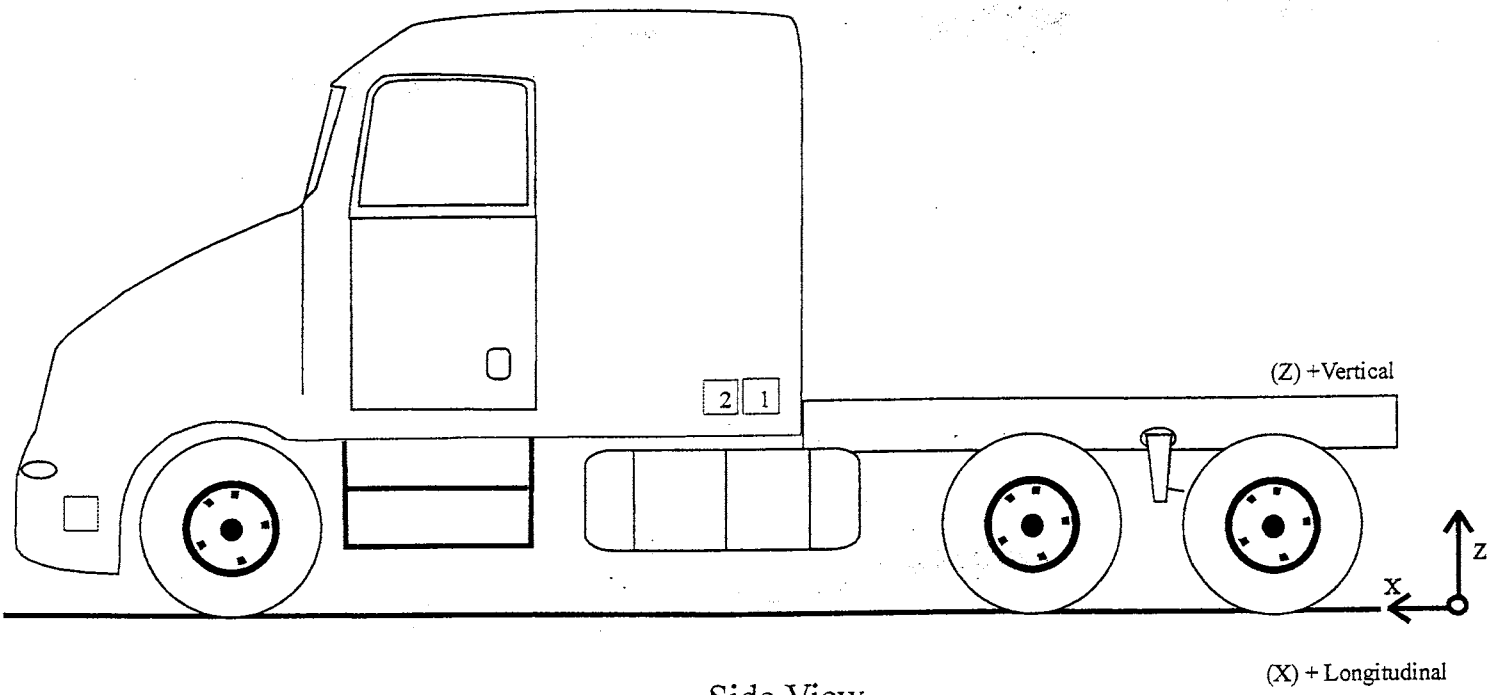
TEST NUMBER: 990525

No.	LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
9	IMPACT RIGHT WALL	6280 mm	-1093 mm	1302 mm				
	LONGITUDINAL				1.0 g	@ 106.2 ms	11.5 g	@ 28.3 ms
	LATERAL				46.3 g	@ 9.6 ms	12.3 g	@ 75.1 ms
	VERTICAL				12.2 g	@ 7.4 ms	12.8 g	@ 274.7 ms
	RESULTANT				46.5 g	@ 9.5 ms		
10	LEFT REAR WALL	565 mm	1115 mm	1837 mm				
	LONGITUDINAL				3.6 g	@ 79.6 ms	18.5 g	@ 6.8 ms
	LATERAL				6.7 g	@ 20.6 ms	12.6 g	@ 8.2 ms
	VERTICAL				14.3 g	@ 10.6 ms	12.3 g	@ 104.4 ms
	RESULTANT				25.2 g	@ 9.4 ms		
11	RIGHT REAR WALL	600 mm	-840 mm	1812 mm				
	LONGITUDINAL				4.1 g	@ 23.5 ms	6.6 g	@ 30.8 ms
	LATERAL				3.8 g	@ 80.1 ms	13.0 g	@ 8.9 ms
	VERTICAL				5.1 g	@ 111.7 ms	8.8 g	@ 37.0 ms
	RESULTANT				13.1 g	@ 9.0 ms		

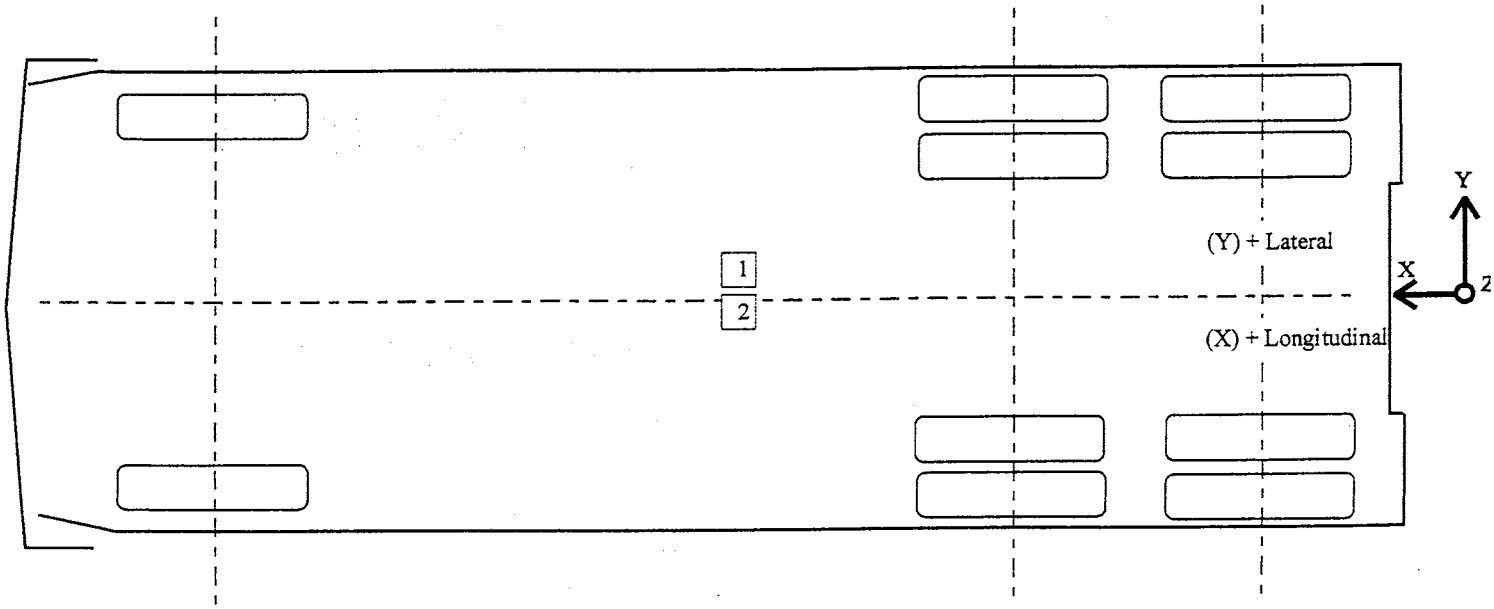
REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

[1]See DATA ACQUISITION EXPLANATIONS

Figure 3 Bullet Vehicle Accelerometer Placement



Side View



Bottom View

Table 6 Bullet Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: 990525

No.	LOCATION		X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1	VEHICLE CENTER OF GRAVITY	PRE	2500 mm	-47 mm	985 mm				
	LONGITUDINAL					13.3 g	@ 14.2 ms	16.5 g	@ 32.7 ms
	LATERAL					8.2 g	@ 38.5 ms	5.7 g	@ 247.8 ms
	VERTICAL					16.3 g	@ 42.0 ms	15.6 g	@ 53.4 ms
	RESULTANT					18.1 g	@ 33.8 ms		
2	VEHICLE CENTER OF GRAVITY REDUNDANT	POST	2500 mm	51 mm	985 mm				
	LONGITUDINAL					12.9 g	@ 4.7 ms	7.3 g	@ 90.6 ms

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

Section 3.0

Data Results

Table 7 Dummy Injury Criteria

Maximum Acceleration

	Head			
	X	Y	Z	R
Position #1 Dummy	150.2 g	205.0 g	136.3 g	231.7 g

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #1 Dummy	2164	15.4 ms	28.7 ms

[1] As defined in FMVSS No. 208

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head			
	X	Y	Z	R
Position #2 Dummy	-59.7 g	78.2 g	36.6 g	84.4 g

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #2 Dummy	277	60.0 ms	80.160 ms

Maximum Rib Accelerations

	Upper	Lower
Position #2 Dummy	52.9 g	65.2 g

Maximum Lateral Pelvis Acceleration[2]

Position #2 Dummy	61.4 g

TTI [2]

Position #2 Dummy	54.7

[1] As defined in FMVSS No. 208
[2] As defined in FMVSS No. 214

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Position #3 Dummy	-34.2 g	-89.1 g	18.5 g	93.1 g	22.1 g	21.3 g	5.8 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Position #3 Dummy	189 N	170 N

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #3 Dummy	85	272.2 ms	273.9 ms

Chest Maximum Resultant Acceleration[2]

	Acceleration	Time t_1	Time t_2
Position #3 Dummy	27.7 g	25.8 ms	28.8 ms

Maximum Chest Deflection

Position #3 Dummy	2.7 mm

[1] As defined in FMVSS No. 208
[2] Defined as equal to or exceeding 0.003 sec. duration

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Position #4 Dummy	-34.4 g	98.7 g	14.4 g	104.4 g	8.6 g	7.9 g	3.1 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Position #4 Dummy	199 N	318 N

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #4 Dummy	124	272.1 ms	274.2 ms

Chest Maximum Resultant Acceleration[2]

	Acceleration	Time t_1	Time t_2
Position #4 Dummy	11.1 g	68.7 ms	71.8 ms

Maximum Chest Deflection

Position #4 Dummy	1.4 mm

[1] As defined in FMVSS No. 208
[2] Defined as equal to or exceeding 0.003 sec. duration

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head			
	X	Y	Z	R
Position #5 Dummy	6.9 g	59.0 g	17.1 g	60.5 g

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #5 Dummy	133	238.7 ms	246.7 ms

Maximum Rib Accelerations

	Upper	Lower
Position #5 Dummy	-6.7 g	7.5 g

Maximum Lateral Pelvis Acceleration[2]

Position #5 Dummy	-5.5 g

TTI [2]

Position #5 Dummy	7.1

[1] As defined in FMVSS No. 208
[2] As defined in FMVSS No. 214

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Position #6 Dummy	-17.4 g	29.8 g	26.3 g	39.8 g	-8.1 g	7.2 g	21.7 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Position #6 Dummy	489 N	48 N

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #6 Dummy	54	215.7 ms	225.1 ms

Chest Maximum Resultant Acceleration[2]

	Acceleration	Time t_1	Time t_2
Position #6 Dummy	22.7 g	222.5 ms	225.5 ms

Maximum Chest Deflection

Position #6 Dummy	2.2 mm

[1] As defined in FMVSS No. 208
[2] Defined as equal to or exceeding 0.003 sec. duration

Table 7 Dummy Injury Criteria, Cont'd.

Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Position #7 Dummy	3.1 g	-4.2 g	-3.9 g	4.4 g	7.5 g	-5.6 g	-4.6 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Position #7 Dummy	193 N	224 N

36 millisecond Head Injury Criteria [1]

	HIC	Time t_1	Time t_2
Position #7 Dummy	1	60.6 ms	96.6 ms

Chest Maximum Resultant Acceleration[2]

	Acceleration	Time t_1	Time t_2
Position #7 Dummy	7.4 g	305.2 ms	308.2 ms

Maximum Chest Deflection

Position #7 Dummy	1.0 mm

[1] As defined in FMVSS No. 208
[2] Defined as equal to or exceeding 0.003 sec. duration

Section 4.0

Vehicle, Occupant, and Camera Measurements

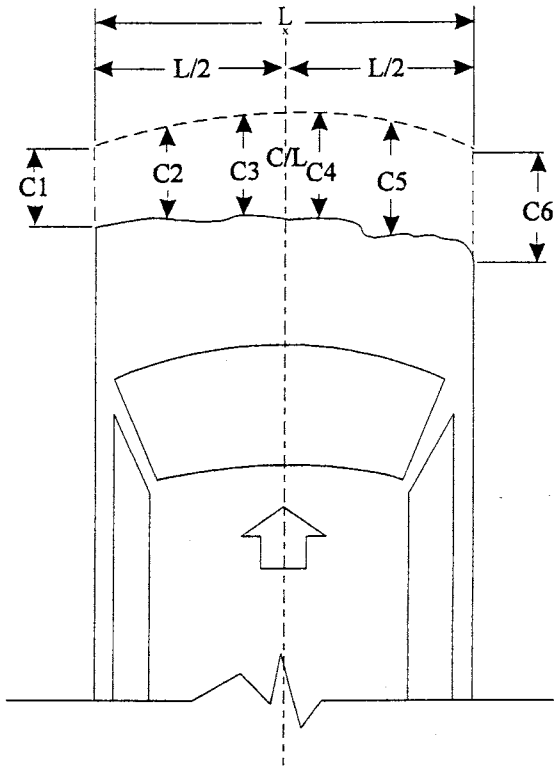
Table 8 Target Vehicle Crush Measurements

	Pre-Test profile (distance in MM from ref. plane)																	
LOCATION	**Height-**	**1200**	**1050**	**900**	**750**	**600**	**450**	**300**	**150**	**0**	**150**	**300**	**450**	**600**	**750**	**900**	**1050**	**1200**
Top of Window + 6in	2615	357	355	355	343	359	353	356	350	350	343	344	347	347	350	343	345	347
Top of Window	2460	350	343	344	335	343	343	343	340	337	328	334	338	340	342	335	340	333
Bottom of Window Sill	1830	330	325	330	320	334	328	327	320	326	315	326	320	320	327	323	324	315
H-PT. +6IN.	1690	329	325	327	321	332	324	328	320	325	314	328	320	320	325	320	322	313
H-PT.	1535	325	323	322	318	324	324	323	313	322	313	322	320	314	323	318	318	313
H-PT. -6IN.	1380	325	323	318	317	324	326	325	320	323	317	325	320	315	323	318	317	312
BUS FLOOR	1060	315	320	315	310	316	318	316	313	315	313	318	314	310	313	307	314	305
BUMPER	620	300	315	302	305	307	310	312	308	308	308	308	306	303	306	300	302	303
	Post-Test profile (distance MM from ref. plane)																	
LOCATION	**Height-**	**1200**	**1050**	**900**	**750**	**600**	**450**	**300**	**150**	**0**	**150**	**300**	**450**	**600**	**750**	**900**	**1050**	**1200**
Top of Window + 6in	2615	1860	1910	1960	1905	1885	1865	1892	1865	1870	1870	1874	1907	1925	1960	1935	1965	1980
Top of Window	2460	1897	1930	1940	1975	1920	1920	1920	1915	1920	1905	1910	1920	1940	1967	1955	1987	1879
Bottom of Window Sill	1830	1955	2030	2005	2010	1985	1980	1980	1953	1980	1975	1964	1974	1965	1935	1910	1892	1822
H-PT. +6IN.	1690	1900	1962	1980	1975	1970	1949	1960	1935	1940	1935	1970	1965	1925	1895	1859	1835	1780
H-PT.	1535	1910	1940	1940	1950	1932	1940	1915	1895	1895	1885	1923	1920	1880	1857	1805	1770	1733
H-PT. -6IN.	1380	1850	1917	1875	1910	1890	1925	1905	1880	1875	1858	1900	1885	1835	1800	1747	1712	1677
BUS FLOOR	1060	1640	1670	1675	1689	1783	1760	1710	1685	1697	1645	1675	1675	1606	1532	1510	1454	1485
BUMPER	620	1350	1342	1420	1605	1710	1900	1900	1930	1957	1983	1982	1955	1908	1800	1765	1707	1658
	Static Crush (MM)																	
LOCATION	**Height-**	**1200**	**1050**	**900**	**750**	**600**	**450**	**300**	**150**	**0**	**150**	**300**	**450**	**600**	**750**	**900**	**1050**	**1200**
Top of Window + 6in	2615	1503	1555	1605	1562	1526	1512	1536	1515	1520	1527	1530	1560	1578	1610	1592	1620	1633
Top of Window	2460	1547	1587	1596	1640	1577	1577	1577	1575	1583	1577	1576	1582	1600	1625	1620	1647	1546
Bottom of Window Sill	1830	1625	1705	1675	1690	1651	1652	1653	1633	1654	1660	1638	1654	1645	1608	1587	1568	1507
H-PT. +6IN.	1690	1571	1637	1653	1654	1638	1625	1632	1615	1615	1621	1642	1645	1605	1570	1539	1513	1467
H-PT.	1535	1585	1617	1618	1632	1608	1616	1592	1582	1573	1572	1601	1600	1566	1534	1487	1452	1420
H-PT. -6IN.	1380	1525	1594	1557	1593	1566	1599	1580	1560	1552	1541	1575	1565	1520	1477	1429	1395	1365
BUS FLOOR	1060	1325	1350	1360	1379	1467	1442	1394	1372	1382	1332	1357	1361	1296	1219	1203	1140	1180
BUMPER	620	1050	1027	1118	1300	1403	1590	1588	1622	1649	1675	1674	1649	1605	1494	1465	1405	1355

Column readings are left to right from front to rear of vehicle.

** Reference plane is parallel to and 48 inches from vehicle longitudinal centerline.

Figure 4 Bullet Vehicle Crush



NOTES: L is pre-test length of contact surface.
C1 through C6 are spaced equally apart.
CL is vehicle centerline.

Vehicle: Peterbilt Heavy Truck

	Pre-test	Post-test	Crush
L	2285 mm		
C1	7800 mm	7369 mm	431 mm
C2	7765 mm	7682 mm	83 mm
C3	7775 mm	7796 mm	-21 mm
C4	7777 mm	7785 mm	-8 mm
C5	7784 mm	7881 mm	-97 mm
C6	7825 mm	8600 mm	-775 mm
CL	7775 mm	7802 mm	-27 mm

[1] The vehicle came off of its front axle.

Table 9 Dummy Measurement Data For Bus Seat Occupants

All measurements are referenced to the front outboard seat-mounting bolt.

Placement of Left Side, Instrumented Hybrid II Dummy (Position #1):

Bus seat #4

Distance from bus seat floor bolt to head CG	x: 260	y: 560	z: 1158
Distance from bus seat floor bolt to H-point	x: 314	y: 455	z: 493
Distance from bus seat floor bolt to knee pivot	x: 115	y: 495	z: 538

Placement of Left Side, Instrumented SID-H3 50th male Dummy (Position #2):

Bus seat #7

Distance from bus seat floor bolt to head CG	x: 310	y: 549	z: 1162
Distance from bus seat floor bolt to H-point	x: 300	y: 485	z: 507
Distance from bus seat floor bolt to knee pivot	x: 143	y: 503	z: 528
Distance from front of head to front seatback	x: 391		
Distance from front of knee to front seatback	Left x: 0	Right x: 0	
*Distance from head to window	285		

Placement of Left Side, Ballast 6-Year-Old Dummy:

Bus seat #9

Distance from bus seat floor bolt to head CG	x: 173	y: 634	z: 936
Distance from bus seat floor bolt to H-point	x: 140	y: 628	z: 510
Distance from bus seat floor bolt to knee pivot	x: 160	y: 661	z: 531
Distance from front of head to front seatback	x: 490		
Distance from front of knee to front seatback	Left: x: 264	Right: x: 267	

Placement of Left Side, Instrumented 6-Year-Old Dummy (Position #3):

Bus seat #11

Distance from seat back hinge to head CG	x: 292	y: 650	z: 917
Distance from seat back hinge to H-point	x: 265	y: 627	z: 466
Distance from seat back hinge to knee pivot	x: 28	y: 655	z: 499
Distance from front of head to front seatback	x: 415		
Distance from front of knee to front seatback	Left: x: 199	Right: x: 200	

Placement of Left Side Instrumented HIII 5th Female Dummy (Position #4):

Bus seat #11

Distance from bus seat floor bolt to head CG	x: 210	y: 90	z: 1054
Distance from bus seat floor bolt to H-point	x: 275	y: -30	z: 502
Distance from bus seat floor bolt to knee pivot	x: 134	y: 40	z: 418
Distance from front of head to front seatback	x: 289		
Distance from front of knee to front seatback	Left: x: 109	Right: x: 95	

Table 9 Dummy Measurement Data For Bus Seat Occupants, Cont'd.

All measurements are referenced to the rear outboard seat-mounting bolt.

Placement of Left Side, Instrumented SID-H3 50th Male Dummy (Position #5):

Bus seat #14

Distance from bus seat floor bolt to head CG	x:	464	y:	820	z:	1160
Distance from bus seat floor bolt to H-point	x:	300	y:	690	z:	522
Distance from bus seat floor bolt to knee pivot	x:	170	y:	744	z:	530
Distance from front of head to front seatback	x:	520				
Distance from front of knee to front seatback	Left: x: 10		Right: x: 12			

* Measurements are referenced to rear accelerometer mount.

Placement of Right Side, Ballast 6-Yr.-Old Dummy:

Bus seat #24

Distance from bus seat floor bolt to head CG	x:	220	y:	690	z:	953
Distance from bus seat floor bolt to H-point	x:	83	y:	666	z:	453
Distance from bus seat floor bolt to knee pivot	x:	200	y:	703	z:	445
Distance from front of head to front seatback	x:	450				
Distance from front of knee to front seatback	Left: x: 227		Right: x: 233			

Placement of Right Side, Instrumented 6-Year-Old Dummy (Position #6):

Bus seat #9

Distance from bus seat floor bolt to head CG	x:	315	y:	757	z:	922
Distance from bus seat floor bolt to H-point	x:	298	y:	645	z:	449
Distance from bus seat floor bolt to knee pivot	x:	0	y:	660	z:	466
Distance from front of head to front seatback	x:	421				
Distance from front of knee to front seatback	Left: x: 243		Right: x: 240			

Placement of Right Side, Ballast HIII 50th Male Dummy:

Bus seat #11

Distance from bus seat floor bolt to head CG	x:	464	y:	201	z:	1172
Distance from bus seat floor bolt to H-point	x:	310	y:	61	z:	498
Distance from bus seat floor bolt to knee pivot	x:	140	y:	100	z:	421
Distance from front of head to front seatback	x:	452				
Distance from front of knee to front seatback	Left: x: 51		Right: x: 62			

Placement of Right Side, Instrumented HIII 5th Female Dummy (Position #7):

Bus seat #14

Distance from bus seat floor bolt to head CG	x:	345	y:	860	z:	1034
Distance from bus seat floor bolt to H-point	x:	355	y:	785	z:	519
Distance from bus seat floor bolt to knee pivot	x:	50	y:	792	z:	458
Distance from front of head to front seatback	x:	365				
Distance from front of knee to front seatback	Left: x: 110		Right: x: 100			

* Measurements are referenced to rear accelerometer mount.

Figure 5 Camera Positions

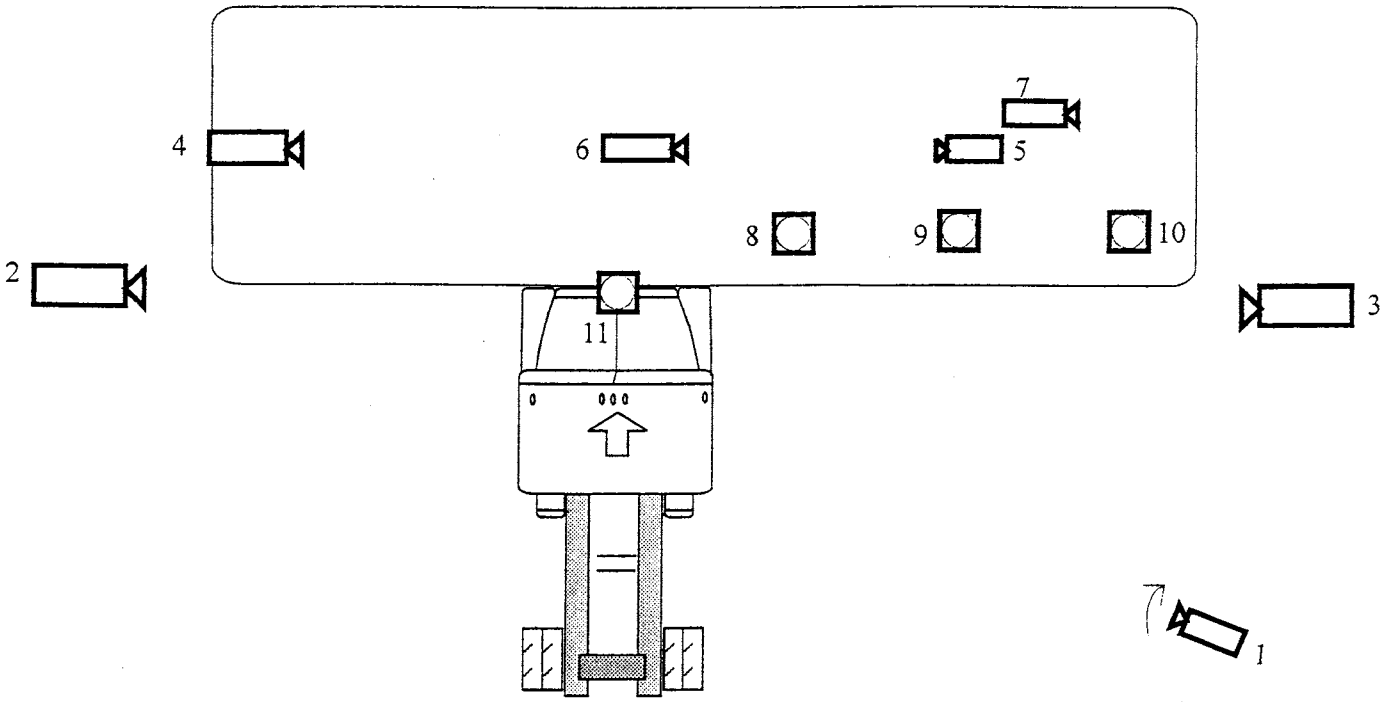


Table 10 Camera Information

Camera Number	Location	Type	Lens (mm)	Speed (fps)	Purpose of camera data
1	Panning/DOC	Bolex	16	24	Vehicle dynamics
2	Front wide	Photosonic	13	500	Dummy kinematics
3	Rear wide	Photosonic	13	485	Dummy kinematics
4	Onboard wide front	Photosonic	8	480	Dummy kinematics
5	Onboard wide rear	Photosonic	8	495	Dummy kinematics
6	Onboard wide mid	Photosonic	8	500	Dummy kinematics
7	Onboard tight rear	Photosonic	13	495	Dummy kinematics
8	Overhead Seat 7 View	Photosonic	8	500	Dummy kinematics
9	Overhead Seat 11 View	Photosonic	8	475	Dummy kinematics
10	Overhead Seat 14 View	Photosonic	8	490	Dummy kinematics
11	Overhead wide	Photosonic	8	450	Vehicle Dynamics

Appendix A

Photographs

Figure A-1 Pre-Test Front View

Figure A-2 Post-Test Front - View 1

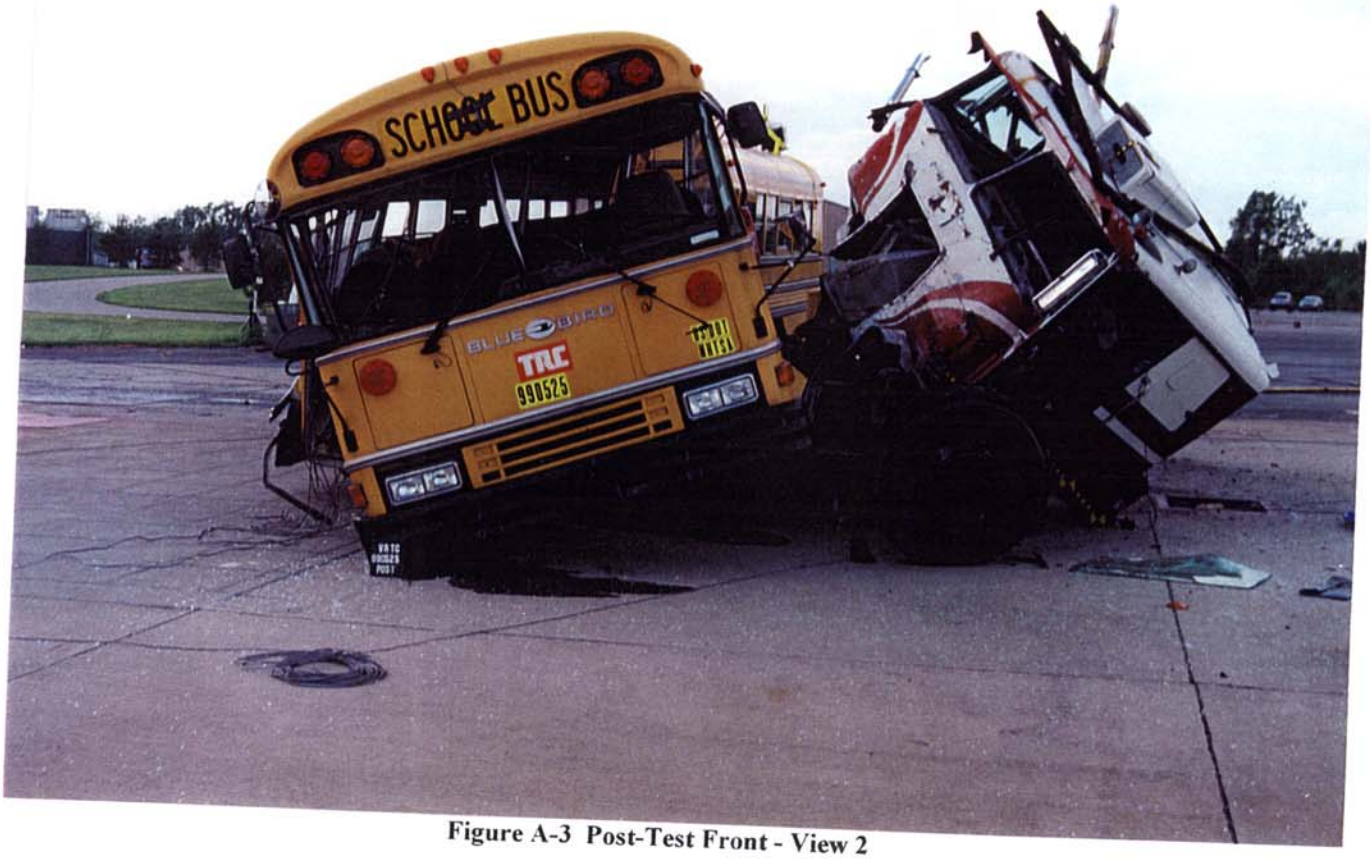


Figure A-3 Post-Test Front - View 2

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Figure A-4 Pre-Test Left Side View

Figure A-5 Post-Test Left Side View

Figure A-6 Pre-Test Rear View

Figure A-7 Post-Test Rear View

Figure A-8 Pre-Test Right Side View

Figure A-9 Post-Test Right Side View

Figure A-24 Pre-Test Right Side Seat 9 Instrumented 6-year-old - View 1

Figure A-25 Pre-Test Right Side Seat 9 Instrumented 6-year-old - View 2

Figure A-10 Pre-Test Dummy Overall View

Figure A-11 Post-Test Dummy Overall View

Figure A-12 Pre-Test Left Side Seat 4 Ballast 50th - View 1

Figure A-13 Pre-Test Left Side Seat 4 Ballast 50th - View 2

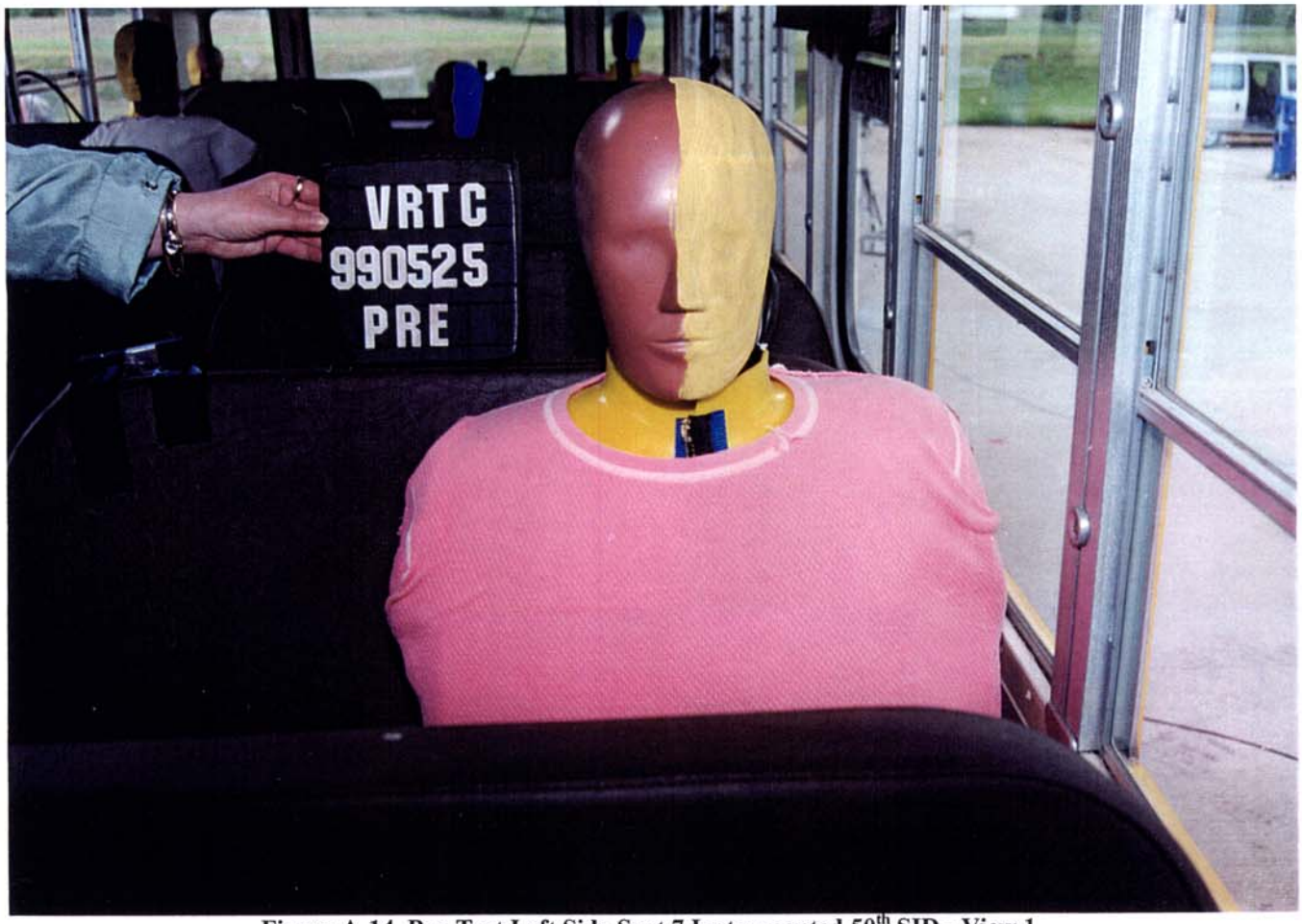

Figure A-14 Pre-Test Left Side Seat 7 Instrumented 50th SID - View 1

Figure A-15 Pre-Test Left Side Seat 7 Instrumented 50th SID - View 2

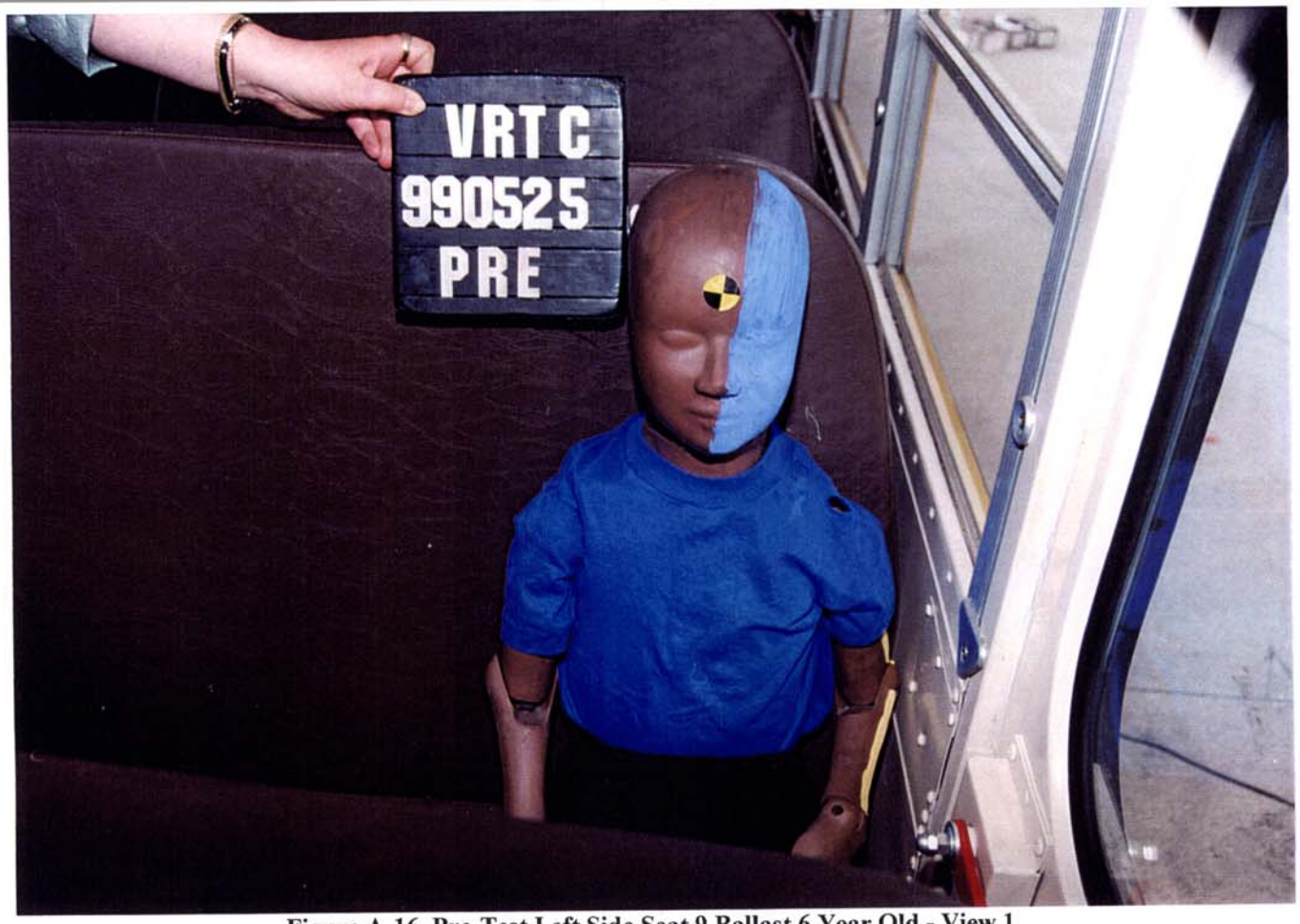

Figure A-16 Pre-Test Left Side Seat 9 Ballast 6 Year Old - View 1

Figure A-17 Pre-Test Left Side Seat 9 Ballast 6 Year Old - View 2

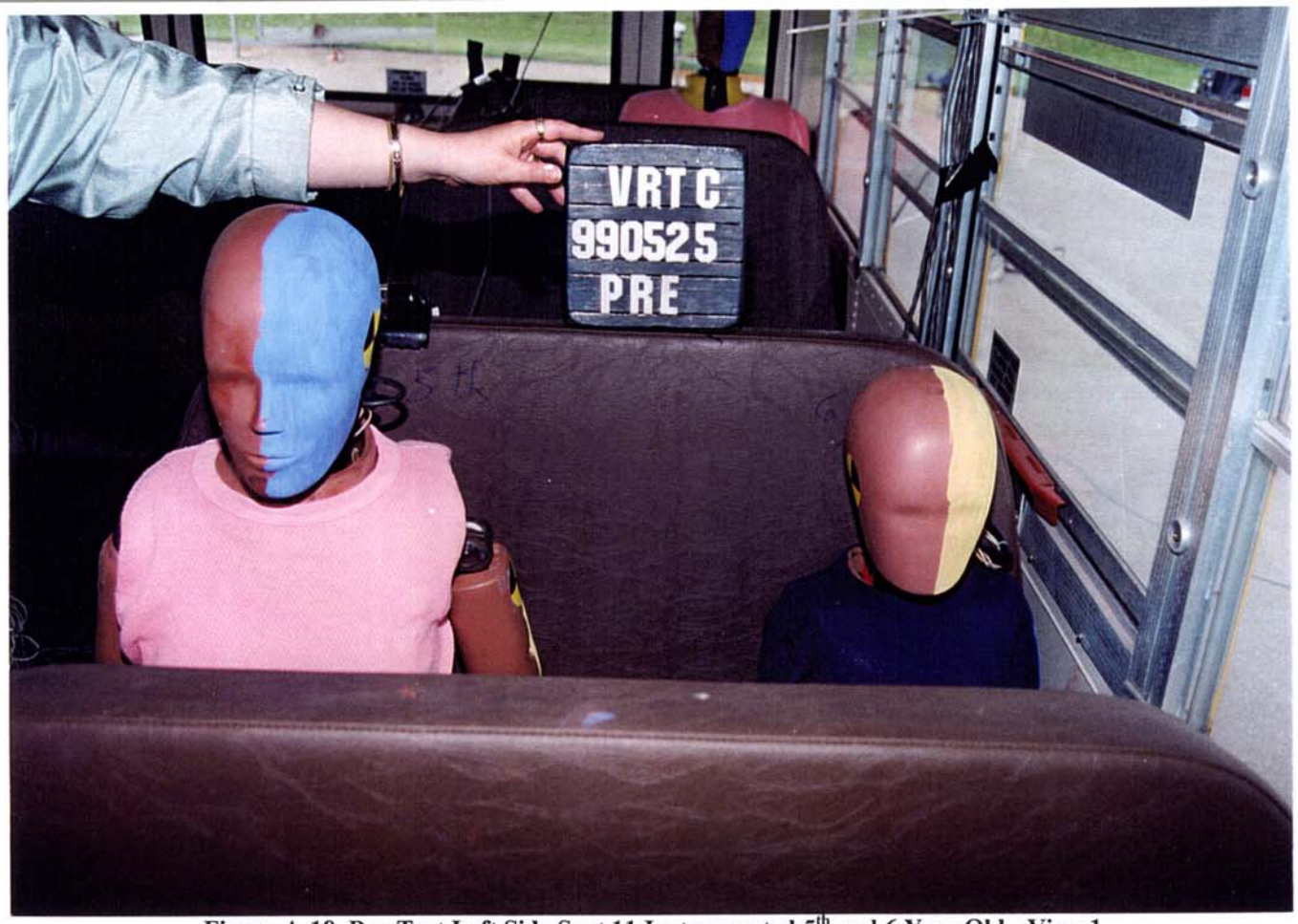

Figure A-18 Pre-Test Left Side Seat 11 Instrumented 5th and 6 Year Old - View 1

Figure A-19 Pre-Test Left Side Seat 11 Instrumented 5th and 6 Year Old - View 2

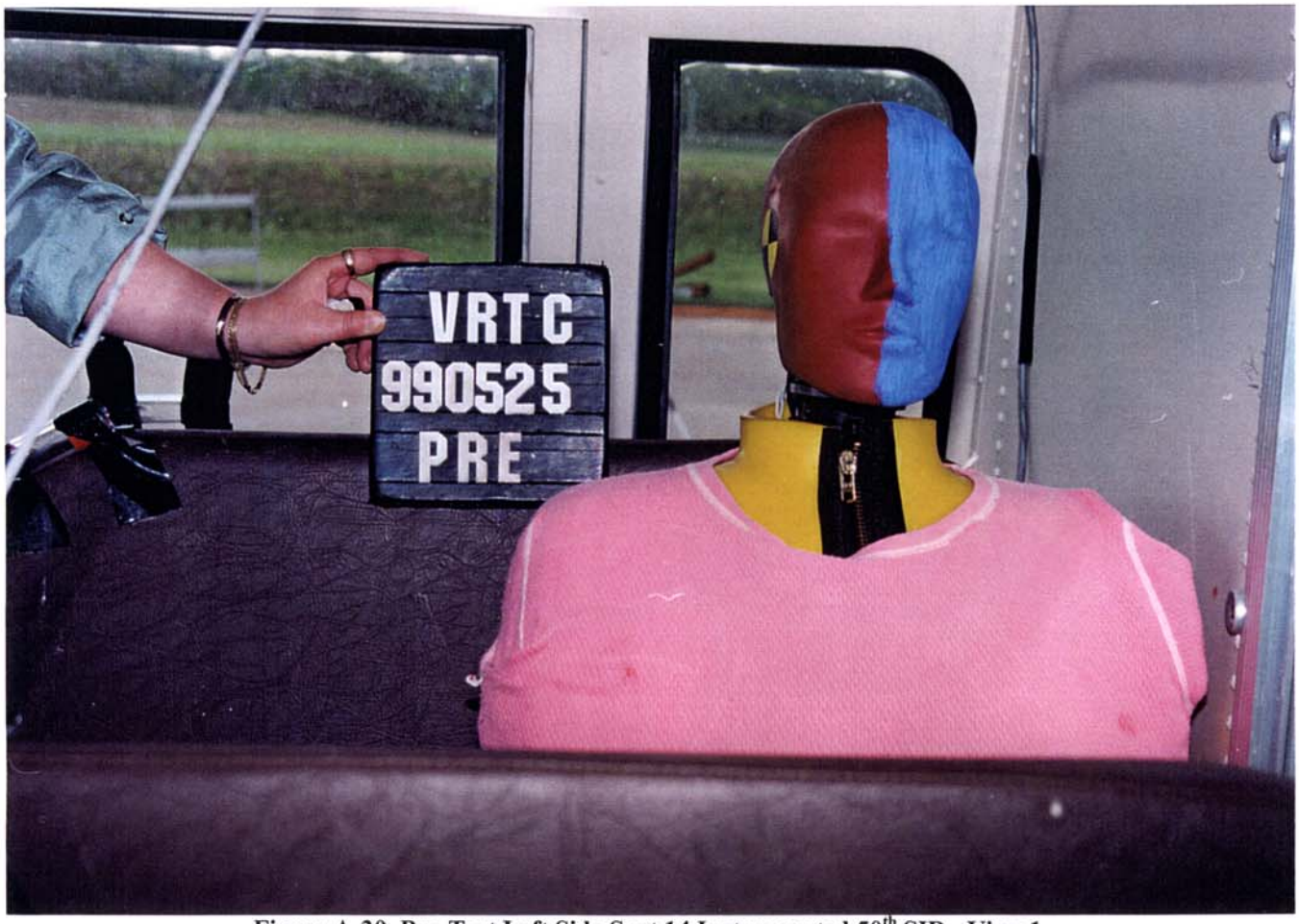

Figure A-20 Pre-Test Left Side Seat 14 Instrumented 50th SID - View 1

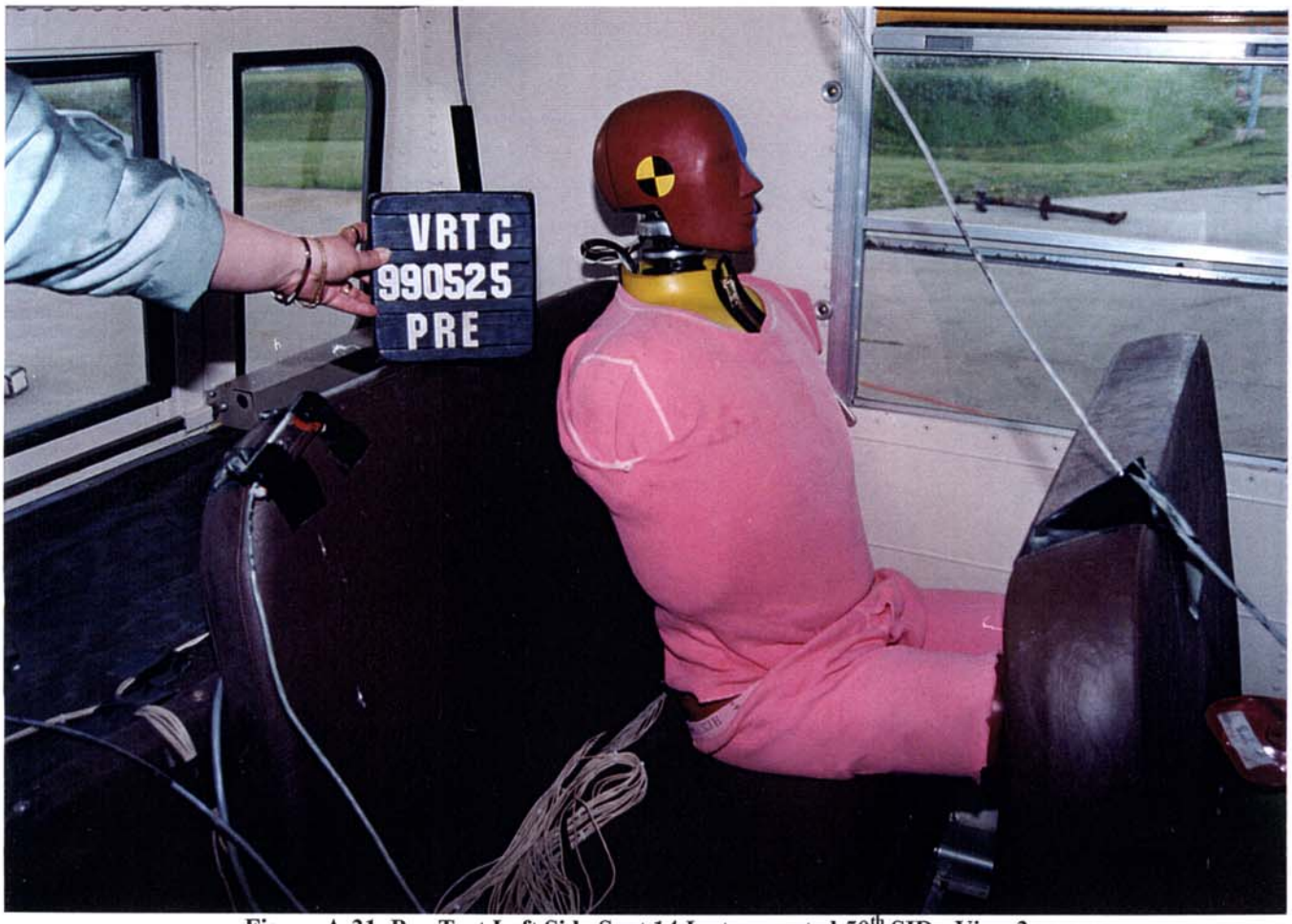

Figure A-21 Pre-Test Left Side Seat 14 Instrumented 50th SID - View 2

Figure A-22 Pre-Test Right Side Seat 8 Ballast 6-year-old - View 1

Figure A-23 Pre-Test Right Side Seat 8 Ballast 6-year-old - View 2

Figure A-37 Post-Test Left Side Seat 9 Ballast 6 Year Old - View 1

Figure A-38 Post-Test Left Side Seat 9 Ballast 6 Year Old - View 2

Figure A-39 Post-Test Right Side Seat 11 Instrumented 5th and 6 Year Old - View 1

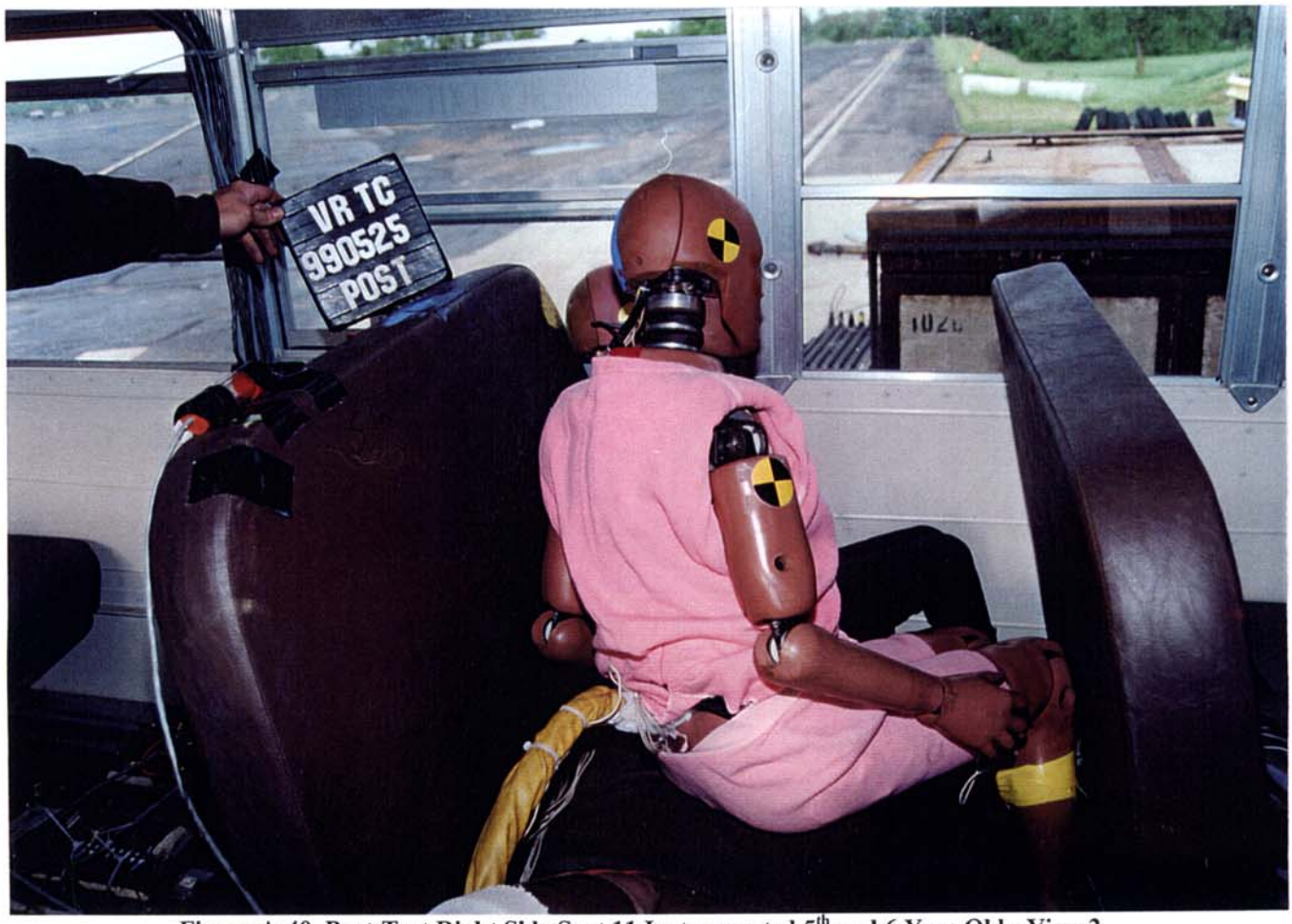

Figure A-40 Post-Test Right Side Seat 11 Instrumented 5th and 6 Year Old - View 2

Figure A-41 Post-Test Right Side Seat 14 Instrumented 50th SID - View 1

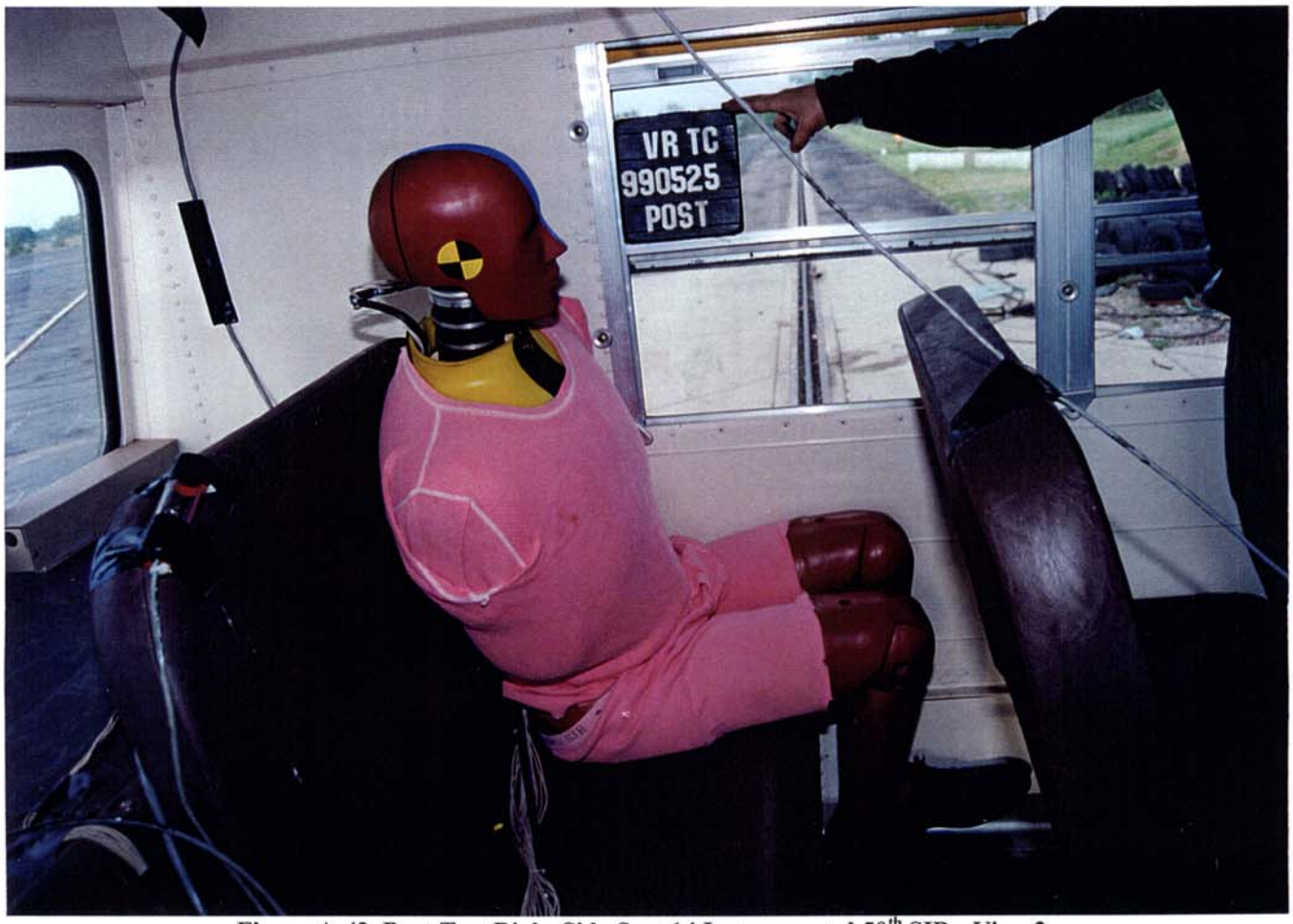

Figure A-42 Post-Test Right Side Seat 14 Instrumented 50th SID - View 2

Figure A-43 Post-Test Right Side Seat 8 Ballast 6-year-old - View 1

Figure A-44 Post-Test Right Side Seat 8 Ballast 6-year-old - View 2

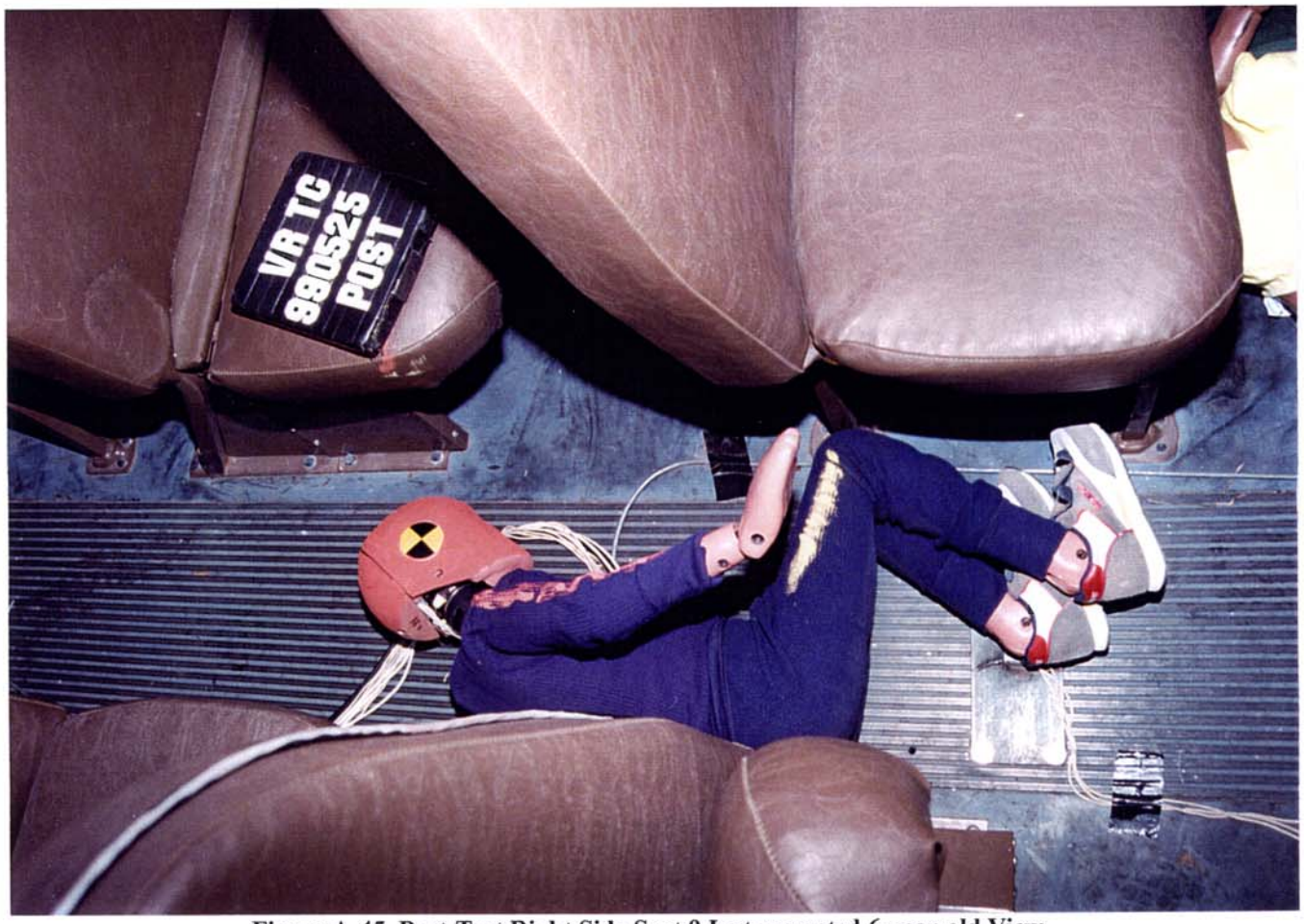

Figure A-45 Post-Test Right Side Seat 9 Instrumented 6-year-old View

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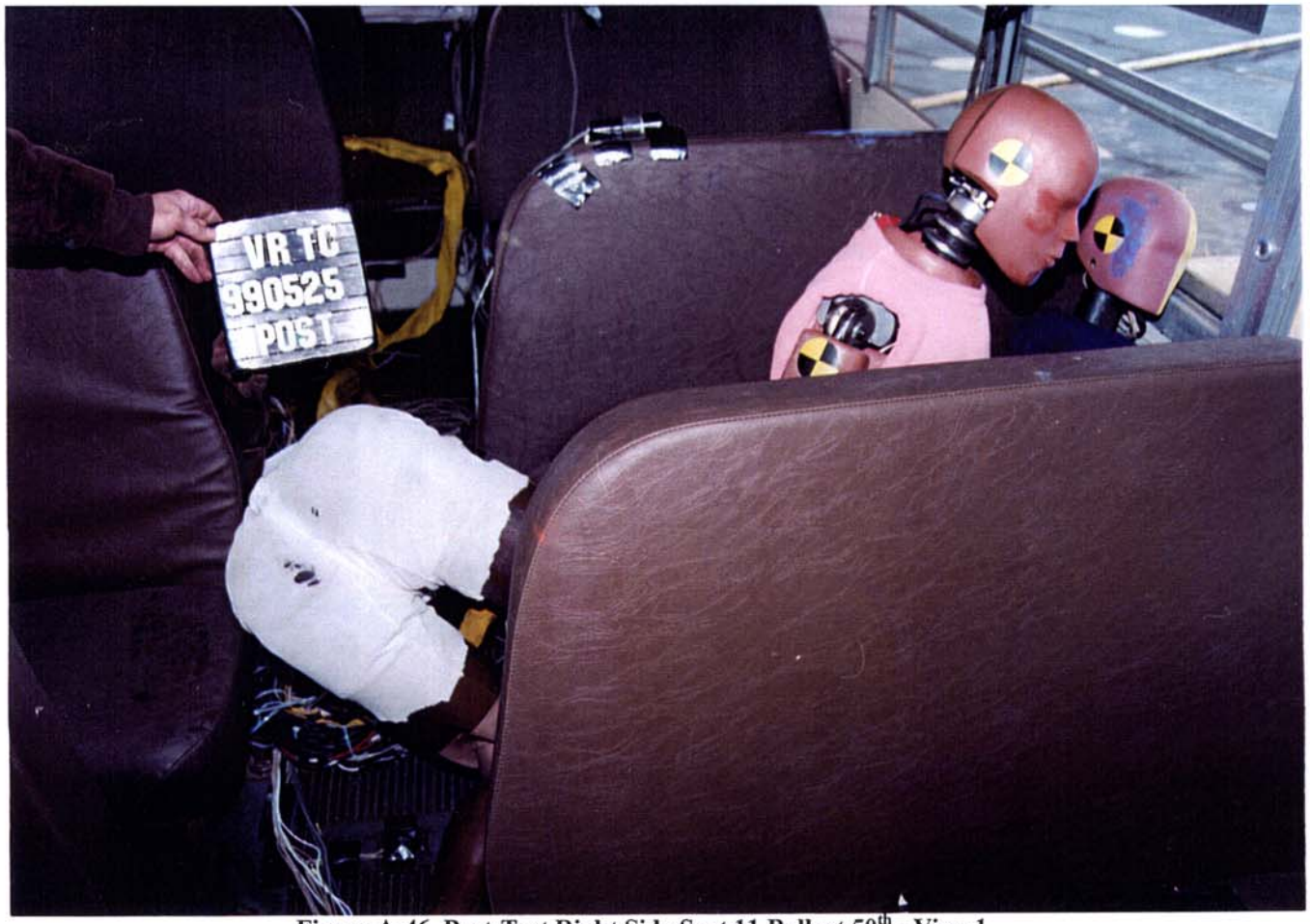

Figure A-46 Post-Test Right Side Seat 11 Ballast 50th - View 1

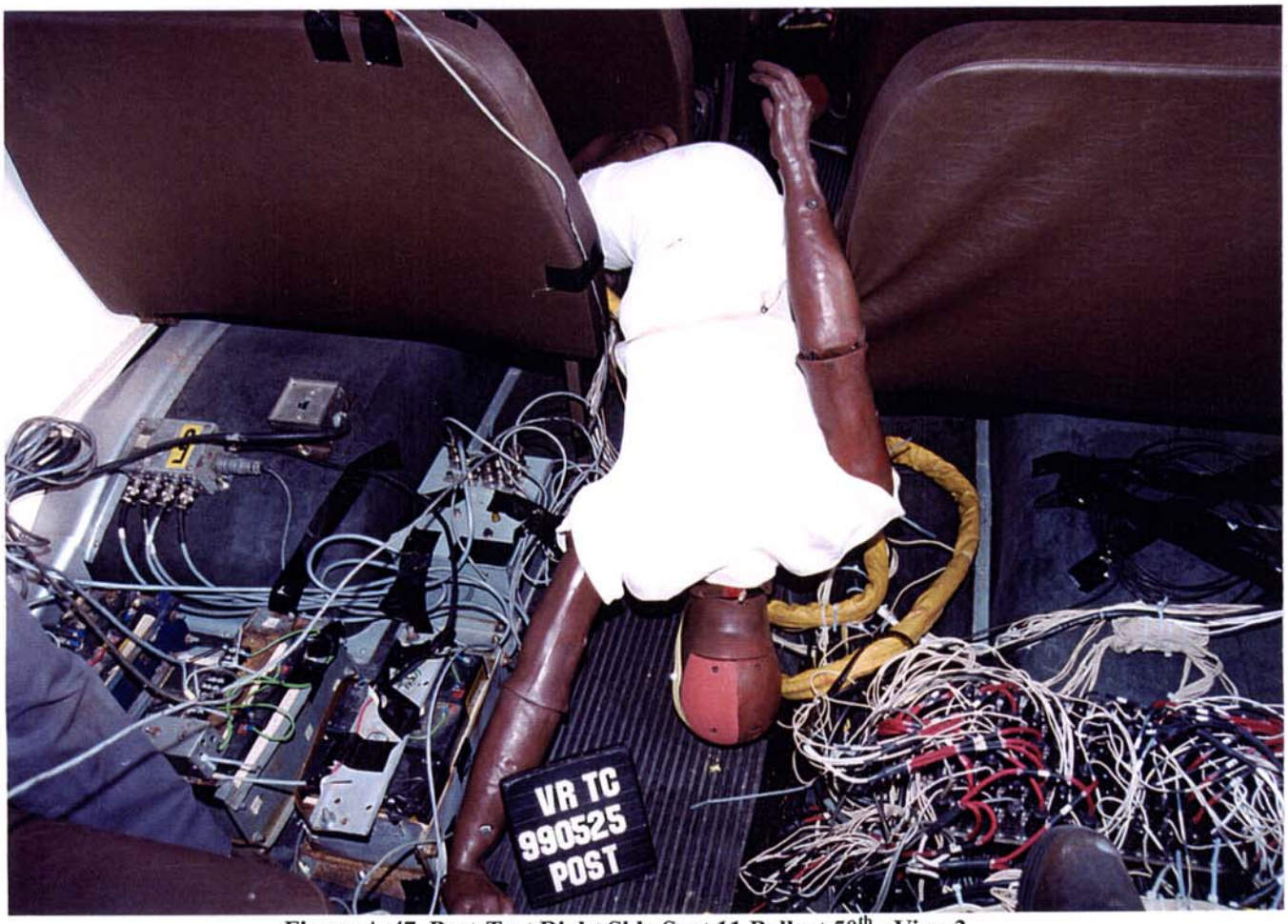

Figure A-47 Post-Test Right Side Seat 11 Ballast 50th - View 2

Figure A-48 Post-Test Right Side Seat 11 Ballast 50th - View 3

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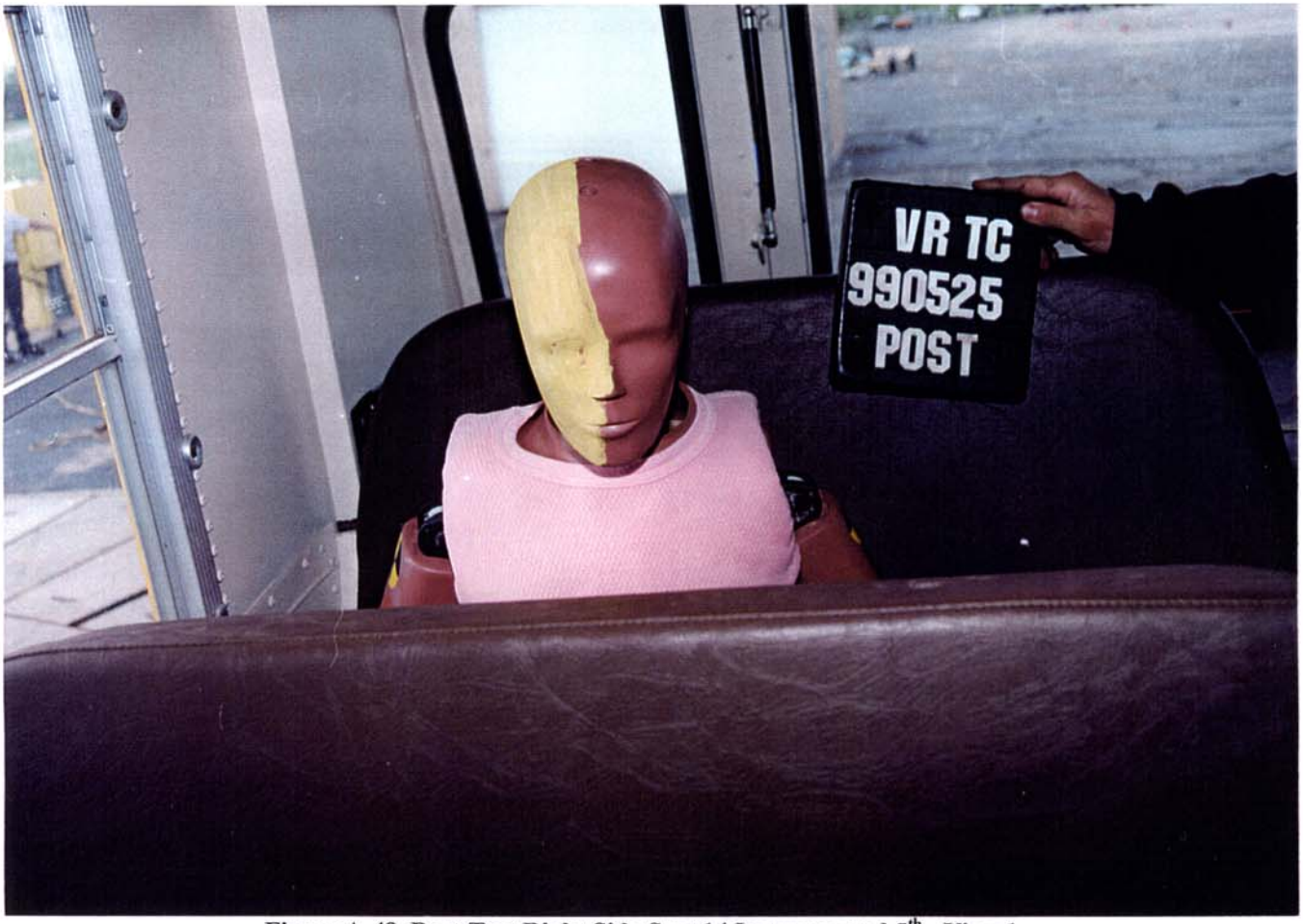


Figure A-49 Post-Test Right Side Seat 14 Instrumented 5th - View 1

Figure A-50 Post-Test Right Side Seat 14 Instrumented 5th - View 2

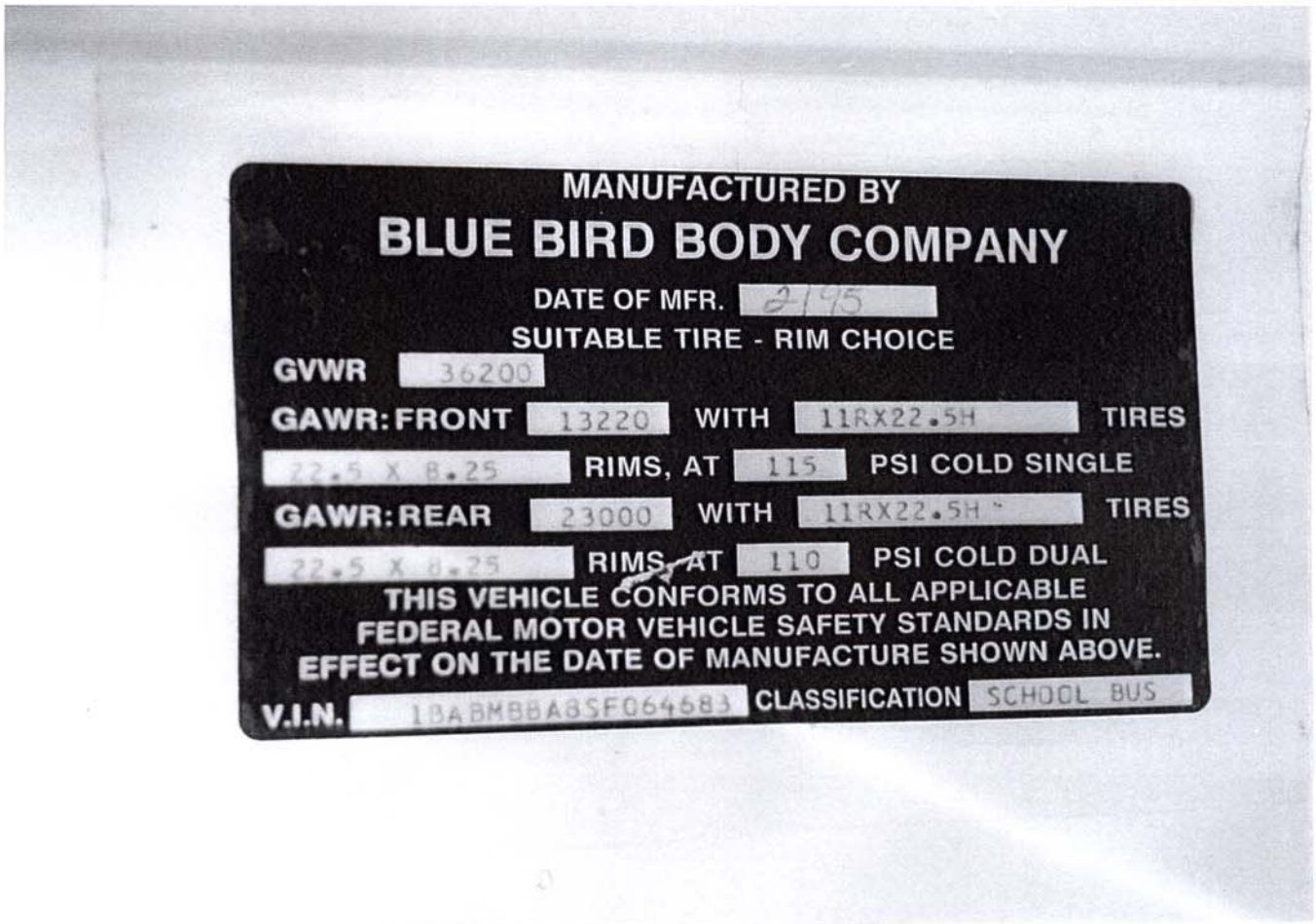


Figure A-51 Pre-Test Certification Label View

TRANSPORTATION RESEARCH CENTER INC.

LEFT KNEE IMPACT TEST

HYBRID III SMALL FEMALE 19-APR-99

TRC INC. TEST NO: 329C2LK1 S.FEMALE SN329 LEFT KNEE CAL2

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	21.1 DEG. C
RELATIVE HUMIDITY	10 - 70 %	33.0 %
PROBE VELOCITY	2.07 - 2.13 M/S	2.13 M/S
PEAK KNEE IMPACT FORCE 3.0 KG PENDULUM	3360 - 4080 N	4089.2 N *

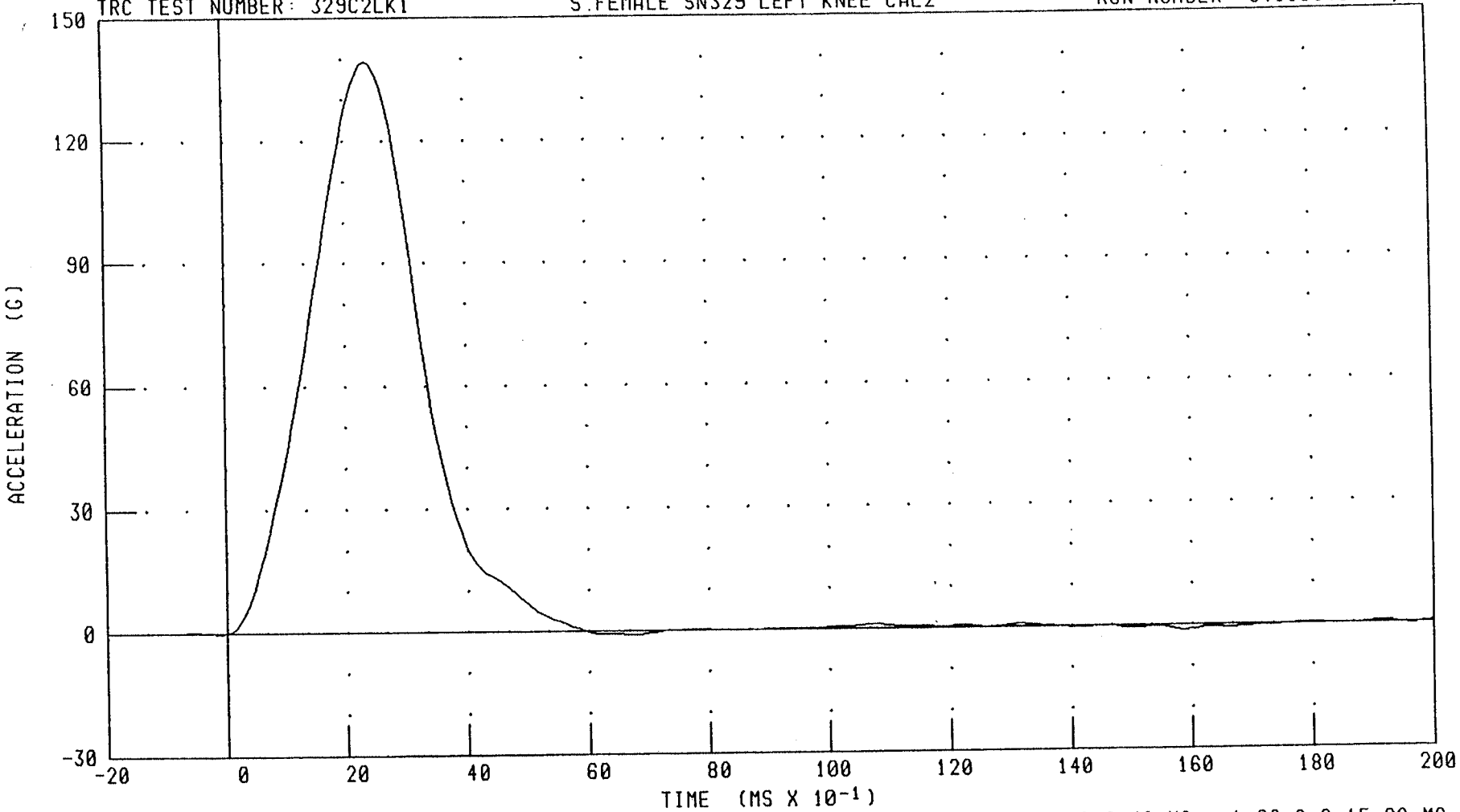
TEST DOES NOT MEET SPECIFICATIONS

TECHNICIAN _____ RUN NUMBER: 041999.1548;1

SMALL FEMALE HYBRID III LEFT KNEE CALIBRATION
PENDULUM DECELERATION (5 KG PEND.)
S.FEMALE SN329 LEFT KNEE CAL2

TRC TEST NUMBER: 329C2LK1

RUN NUMBER: 041999.1548;1



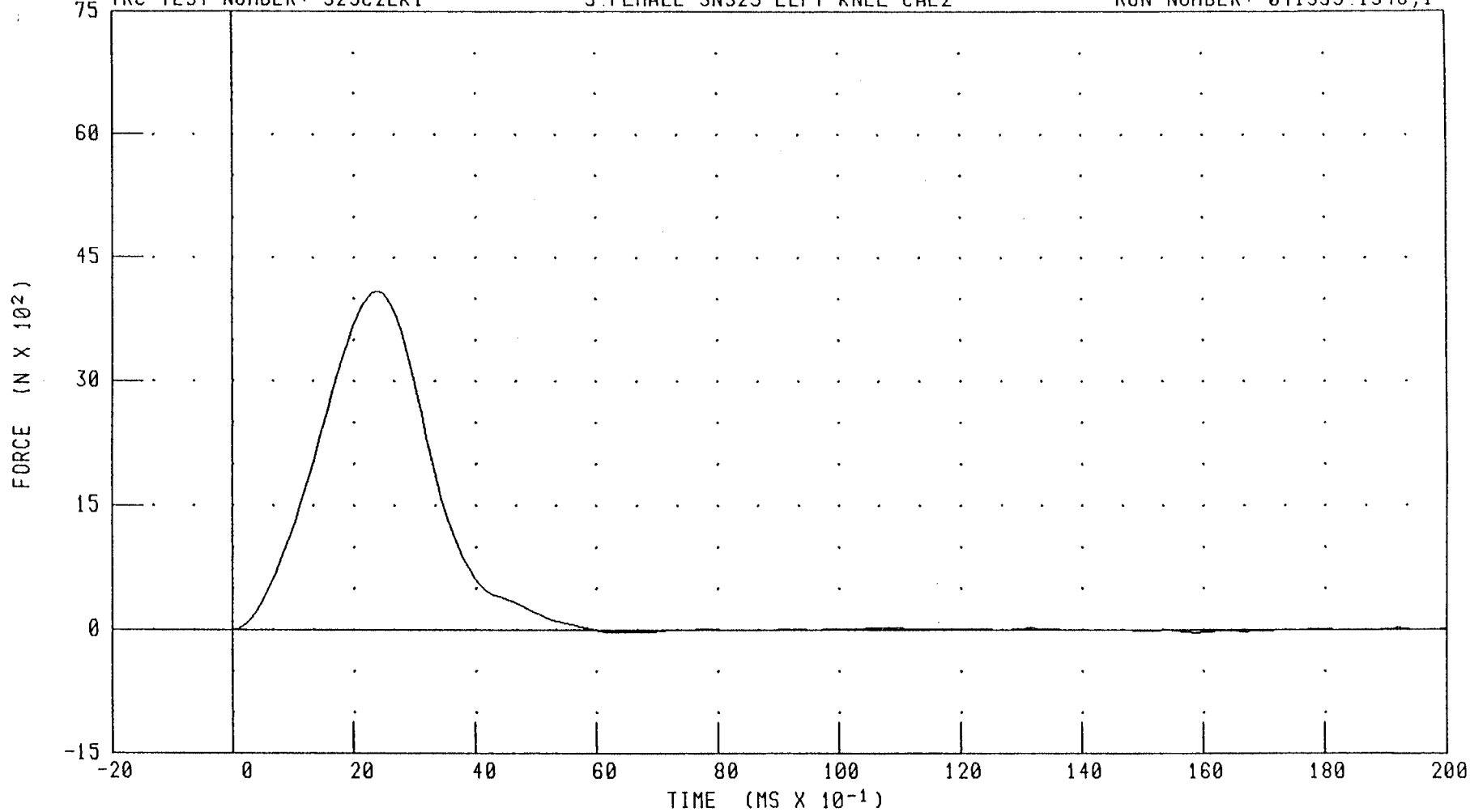
CHANNEL: PENXG FILTER: CH. CLASS 600

PEAK DATA: 139.30 G @ 2.40 MS; -1.26 G @ 15.92 MS

SMALL FEMALE HYBRID III LEFT KNEE CALIBRATION

PENDULUM FORCE (5 KG PEND.)

TRC TEST NUMBER: 329C2LK1 S.FEMALE SN329 LEFT KNEE CAL2 RUN NUMBER: 041999.1548;1



CHANNEL: PENXF FILTER: CH. CLASS 600 PEAK DATA: 4089.26 N @ 2.40 MS; -36.93 N @ 15.92 MS

Appendix D

Miscellaneous Test Information

Dummy Instrumentation Placement

Dummy Manufacturer and S/N: Humanetics/572

Seating position: Position #1 (50th)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG1	Head	X	Endevco	7264-2000T	J14675	Rear
HEDYG1	Head	Y	Endevco	7264-2000T	BE39J	Left
HEDZG1	Head	Z	Endevco	7264-2000T	ACC66	Up

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: ASTC/055

Seating position: Position #2 (SID)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG2	Head	X	Endevco	7264	FG33J	Rear
HEDYG2	Head	Y	Endevco	7264	ACCY2	Left
HEDZG2	Head	Z	Endevco	7264	J14674	Up
NEKXF2	Neck	X	Denton	1716A	452FX	Head forward
NEKYF2	Neck	Y	Denton	1716A	452FY	Head leftward
NEKZF2	Neck	Z	Denton	1716A	452FZ	Head upward (tension)
NEKXM2	Neck	X	Denton	1716A	452MX	Right ear to Right shoulder
NEKYM2	Neck	Y	Denton	1716A	452MY	Chin to chest
NEKZM2	Neck	Z	Denton	1716A	452MZ	Chin to left shoulder
LURYG2	Upper rib	Y	Endevco	7264	J18736	Right
LURYR2	Upper rib red.	Y	Endevco	7264	AJ5R0	Right
LLRYG2	Lower rib	Y	Endevco	7264	J19244	Right
LLRYR2	Lower rib red.	Y	Endevco	7264	J20054	Right
T12YG2	Lower spine	Y	Endevco	7264	J23943	Left
T12YR2	Lower spine red.	Y	Endevco	7264	J18724	Left
PEVYG2	Pelvis	Y	Endevco	7264	AJ7G1	Left

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: First Technologies/027

Seating position: Position #3 (6YO)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG3	Head	X	Endevco	7264-2000T	AJ4N7	Forward
HEDYG3	Head	Y	Endevco	7264-2000T	J22038	Right
HEDZG3	Head	Z	Endevco	7264-2000T	ALAB9	Up
NEKXF3	Neck	X	Denton	1716A	810FX	Head forward
NEKYF3	Neck	Y	Denton	1716A	810FY	Head leftward
NEKZF3	Neck	Z	Denton	1716A	810FZ	Head upward (tension)
NEKXM3	Neck	X	Denton	1716A	810MX	Right ear to Right shoulder
NEKYM3	Neck	Y	Denton	1716A	810MY	Chin to chest
NEKZM3	Neck	Z	Denton	1716A	810MZ	Chin to left shoulder
CSTXG3	Chest	X	Endevco	7264-2000T	J23941	Forward
CSTYG3	Chest	Y	Endevco	7264-2000T	J14190	Left
CSTZG3	Chest	Z	Endevco	7264-2000T	BD15J	Down
CSTXD3	Chest	X	Servo	14CB1-2897	027	Outward
PEVXG3	Pelvis	X	Endevco	7264-2000T	J23944	Forward
PEVYG3	Pelvis	Y	Endevco	7264-2000T	J20047	Left
PEVZG3	Pelvis	Z	Endevco	7264-2000T	J23805	Up
LFMZF3	Left femur	Z	Denton	T11654	005	Tension
RFMZF3	Right femur	Z	Denton	T11654	008	Tension

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: First Technologies/289

Seating position: Position #4 (5th)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG4	Head	X	Endevco	7264-2000T	J20165	Rearward
HEDYG4	Head	Y	Endevco	7264-2000T	J19865	Left
HEDZG4	Head	Z	Endevco	7264-2000T	J19934	Up
NEKXF4	Neck	X	Denton	1716	0425FX	Head forward
NEKYF4	Neck	Y	Denton	1716	0425FY	Head leftward
NEKZF4	Neck	Z	Denton	1716	0425FZ	Head upward (tension)
NEKXM4	Neck	X	Denton	1716	0425MX	Right ear to Right shoulder
NEKYM4	Neck	Y	Denton	1716	0425MY	Chin to chest
NEKZM4	Neck	Z	Denton	1716	0425MZ	Chin to left shoulder
CSTXG4	Chest	X	Endevco	7264-2000T	J20599	Forward
CSTYG4	Chest	Y	Endevco	7264-2000T	J20580	Left
CSTZG4	Chest	Z	Endevco	7264-2000T	EH88J	Up
CSTXD4	Chest	X	Servo	14CB1-2897	019	Outward
PEVXG4	Pelvis	X	Endevco	7264-2000T	CY06H	Rearward
PEVYG4	Pelvis	Y	Endevco	7264-2000T	AGAC4	Left
PEVZG4	Pelvis	Z	Endevco	7264-2000T	BF65J	Up
LFMZF4	Left femur	Z	Denton	1914	0259FZ	Tension
RFMZF4	Right femur	Z	Denton	1914	0257FZ	Tension

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: VRTC/904

Seating position: Position #5 (SID)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG5	Head	X	Endevco	7264	EJ59J	Rear
HEDYG5	Head	Y	Endevco	7264	J20083	Left
HEDZG5	Head	Z	Endevco	7264	BF28J	Up
NEKXF5	Neck	X	Denton	1716A	1037FX	Head forward
NEKYF5	Neck	Y	Denton	1716A	1037FY	Head leftward
NEKZF5	Neck	Z	Denton	1716A	1037FZ	Head upward (tension)
NEKXM5	Neck	X	Denton	1716A	1037MX	Right ear to Right shoulder
NEKYM5	Neck	Y	Denton	1716A	1037MY	Chin to chest
NEKZM5	Neck	Z	Denton	1716A	1037MZ	Chin to left shoulder
LURYG5	Upper rib	Y	Endevco	7264	AJ454	Right
LURYR5	Upper rib red.	Y	Endevco	7264	DJ61J	Right
LLRYG5	Lower rib	Y	Endevco	7264	CC92H	Right
LLRYR5	Lower rib red.	Y	Endevco	7264	J20093	Right
T12YG5	Lower spine	Y	Endevco	7264	J20084	Left
T12YR5	Lower spine red.	Y	Endevco	7264	AJ4W2	Left
PEVYG5	Pelvis	Y	Endevco	7264	J19440	Left

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: First Technologies/088

Seating position: Position #6 (6YO)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG6	Head	X	Endevco	7264-2000T	J23803	Forward
HEDYG6	Head	Y	Endevco	7264-2000T	J23947	Right
HEDZG6	Head	Z	Endevco	7264-2000T	AJ451	Up
NEKXF6	Neck	X	Denton	1716A	798FX	Head forward
NEKYF6	Neck	Y	Denton	1716A	798FY	Head leftward
NEKZF6	Neck	Z	Denton	1716A	798FZ	Head upward (tension)
NEKXM6	Neck	X	Denton	1716A	798MX	Right ear to Right shoulder
NEKYM6	Neck	Y	Denton	1716A	798MY	Chin to chest
NEKZM6	Neck	Z	Denton	1716A	798MZ	Chin to left shoulder
CSTXG6	Chest	X	Endevco	7264-2000T	ACC65	Forward
CSTYG6	Chest	Y	Endevco	7264-2000T	DW83J	Left
CSTZG6	Chest	Z	Endevco	7264-2000T	AJ4L3	Down
CSTXD6	Chest	X	Servo	14CB1-2897	088	Outward
PEVXG6	Pelvis	X	Endevco	7264-2000T	J23998	Forward
PEVYG6	Pelvis	Y	Endevco	7264-2000T	J23832	Left
PEVZG6	Pelvis	Z	Endevco	7264-2000T	AJ4J6	Up
LFMZF6	Left femur	Z	Denton	2090	125	Tension
RFMZF6	Right femur	Z	Denton	2090	126	Tension

Dummy Instrumentation Placement, Cont'd.

Dummy Manufacturer and S/N: First Technologies/329

Seating position: Position #7 (5th)

Mnemonic	Location	Axis	Manufacturer	Model	Serial Number	Orientation (+ Sensing)
HEDXG7	Head	X	Entran	EGE-73BQ-2000B	98H10-F16	Rear
HEDYG7	Head	Y	Entran	EGE-73BQ-2000B	98H14-K2	Left
HEDZG7	Head	Z	Entran	EGE-73BQ-2000B	98H13-F04	Up
NEKXF7	Neck	X	Denton	1716A	1039FX	Head forward
NEKYF7	Neck	Y	Denton	1716A	1039FY	Head leftward
NEKZF7	Neck	Z	Denton	1716A	1039FZ	Head upward (tension)
NEKXM7	Neck	X	Denton	1716A	1039MX	Right ear to Right shoulder
NEKYM7	Neck	Y	Denton	1716A	1039MY	Chin to chest
NEKZM7	Neck	Z	Denton	1716A	1039MZ	Chin to left shoulder
CSTXG7	Chest	X	Entran	EGE-73BQ-2000B	98H13-F05	Forward
CSTYG7	Chest	Y	Entran	EGE-73BQ-2000B	98H13-F07	Left
CSTZG7	Chest	Z	Entran	EGE-73BQ-2000B	98H10-F10	Down
CSTXD7	Chest	X	Servo	14CB1-2897	329F	Outward
PEVXG7	Pelvis	X	Entran	EGE-73BQ-2000B	98H10-F19	Rearward
PEVYG7	Pelvis	Y	Entran	EGE-73BQ-2000B	98H10-F12	Left
PEVZG7	Pelvis	Z	Entran	EGE-73BQ-2000B	98H13-F01	Up
LFMZF7	Left femur	Z	Denton	1914A	376FZ	Tension
RFMZF7	Right femur	Z	Denton	1914A	383FZ	Tension

Target Vehicle Instrumentation Placement

Test Number 990525

Number	Location	Axis	Manufacturer	Model	S/N	Orientation (+ Sensing)
1	Front Floor Tunnel	X	Endevco	7264-2000TZ	J26955	Rearward
		Y	Endevco	7264-2000TZ	J28466	Left
		Z	Endevco	7264-2000TZ	J26943	Up
2	Impact Floor Tunnel	X	Endevco	7264-2000TZ	J27879	Rearward
		Y	Endevco	7264-2000TZ	J27347	Left
		Z	Endevco	7264-2000TZ	J27940	Up
3	Vehicle Center of Gravity	X	Endevco	7264-2000TZ	J27328	Rearward
		Y	Endevco	7264-2000TZ	J27370	Left
		Z	Endevco	7264-2000TZ	J27921	Up
4	Floor Tunnel Row 11	X	Endevco	7264-2000TZ	J27850	Rearward
		Y	Endevco	7264-2000TZ	J27659	Left
		Z	Endevco	7264-2000TZ	J27657	Up
5	Rear Floor Tunnel	X	Endevco	7264-2000TZ	J27947	Rear
		Y	Endevco	7264-2000TZ	J28468	Right
		Z	Endevco	7264-2000TZ	J22740	Up
6	Floor Tunnel Row 7	X	Endevco	7264-2000TZ	J27799	Rearward
		Y	Endevco	7264-2000TZ	J26551	Right
		Z	Endevco	7264-2000TZ	J25527	Up
7	Right Frame at CG	X	Endevco	7264-2000TZ	J27892	Forward
		Y	Endevco	7264-2000TZ	J27800	Left
		Z	Endevco	7264-2000TZ	J21532	Up
8	Impact Left Wall	X	Endevco	7264-2000TZ	J27369	Rearward
		Y	Endevco	7264-2000TZ	J27938	Left
		Z	Endevco	7264-2000TZ	J27361	Up
9	Impact Right Wall	X	Endevco	7264-2000TZ	J27305	Rear
		Y	Endevco	7264-2000TZ	J27303	Left
		Z	Endevco	7264-2000TZ	J27329	Up

Target Vehicle Instrumentation Placement, Cont'd.

Test Number 990525

Number	Location	Axis	Manufacturer	Model	S/N	Orientation (+ Sensing)
10	Left Rear Wall	X	Endevco	7264-2000TZ	J26493	Rearward
		Y	Endevco	7264-2000TZ	J27678	Left
		Z	Endevco	7264-2000TZ	J21764	Up
11	Right Rear Wall	X	Endevco	7264-2000TZ	J22660	Forward
		Y	Endevco	7264-2000TZ	J21533	Right
		Z	Endevco	7264-2000TZ	J27365	Up

Bullet Vehicle Instrumentation Placement

Test Number 990525

Number	Location	Axis	Manufacturer	Model	S/N	Orientation (+ Sensing)
1	Center of Gravity	X	Endevco	7264-2000T	DP32J	Forward
		Y	Endevco	7264-2000T	J18037	Left
		Z	Endevco	7264-2000T	DC20J	Up
2	Center of Gravity Redundant	X	Endevco	7264-2000T	EH78J	Forward

Report Sign Convention and NHTSA Data Tape Reference Guide

Accelerometers:	+X: Forward	
	+Y: Leftward	
	+Z: Upward	
Potentiometers:	+Chest longitudinal deflection:	Outward
	+Chest lateral deflection:	Leftward
	+Seat belt displacement:	Outward
	+Seat belt extension:	Elongation
	+Knee slider displacement:	Distance between femur and tibia increased (in relation to a seated dummy)
Load cells:	+Femur force:	Tension
Neck load cells:	+X force:	Head pushed rearward, chest forward
	+Y force:	Head pushed leftward, chest rightward
	+Z force:	Head pulled upward (tension on neck)
	+X moment:	Left ear rotating toward left shoulder
	+Y moment:	Chin rotating toward chest
	+Z moment:	Chin rotating toward left shoulder

Description Of Timing Marks On TRC High-Speed Film

All TRC high-speed cameras are equipped with red LED's, which put timing, marks on the right edge of the film. TRC uses a single timing generator to generate the timing for all cameras. This allows the timing marks to be common to all cameras. The timing marks can be used to measure camera speed (frames per second) or to locate a point in time before or after the time-zero event.

The timing marks appear on the film as small red marks on the right edge of the film. Round marks are left by the Photo-Sonics and Stalex cameras while horizontal bars are left by the Hycam, Locam, and Fastax II cameras.

The timing generator puts out a pulse for every millisecond plus it generates additional pulses for hundredths and tenths of seconds. To explain this further, we can use an example of a camera running at 1000 frames per second.

1. Every frame will have **one** LED appear in it. This indicates a *millisecond* pulse.

2. Every ten frames will have **two** LEDs appear in it. These indicate a *millisecond* pulse plus a *hundredth of a second* pulse.

3. Every one hundred frames will have **three** LEDs appear in it. These indicate a *millisecond* pulse, a *hundredth of a second* pulse, and a *tenth of a second* pulse.

Filtering Data

J211 MAR95

Vehicle Structural Accelerations Class 60

Occupant

Head Accelerometer Class 1000

Neck Class 60

Chest Accelerometer Class 180

Chest Deflection Class 180

Femur Force Class 600

Pelvis Class 1000

Upper Rib FIR100

Lower Rib FIR100

Lower Spine FIR100

Pelivs (SID) FIR100

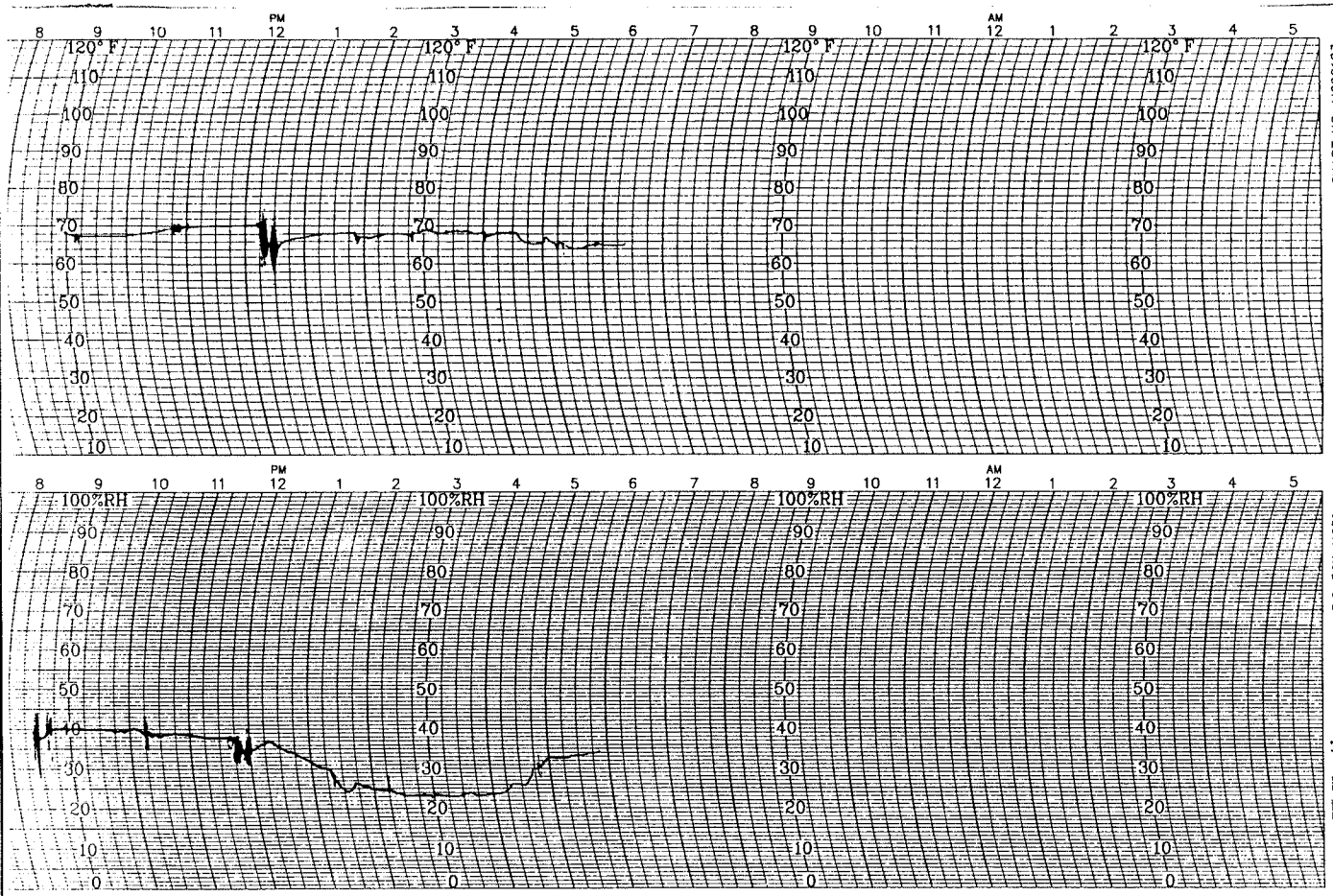


CHART NO. M699123
C311-D-HF
ECN 2717
6-9-87

HYGROTHERMOGRAPH
1 DAY

Weatherjeasure
WEATHERtronics
Division of QUALIMETRICS, Inc.
P.O. BOX 41039
SACRAMENTO, CA 95841
PHONE: (916) 923-0055

STATION _____ DATE ON 5/25 DATE OFF _____