



U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA-RD-99-028



PB99-137515

FULL-SCALE CRASH EVALUATION OF SIDEWALK-MOUNTED STEEL BRIDGE RAILING

**NCHRP TEST 4-10
SwRI TEST NO. NETC-1**

REPRODUCED BY: **NTIS**
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

Research, Development, and Technology
Turner-Fairbank Highway Research Center
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1. Report No. FHWA-RD-99-028	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle FULL-SCALE CRASH EVALUATION OF SIDEWALK-MOUNTED STEEL BRIDGE RAILING, NCHRP TEST 4-10, SWRI TEST NO. NETC-1		5. Report Date	
		6. Performing Organization Code	
7. Author(s) Kimball, C.E., Mayer, J.B.		8. Performing Organization Report No. 18-8518	
9. Performing Organization Name and Address Southwest Research Institute 6220 Culebra Road San Antonio, Texas 78238-5166		10. Work Unit No.(TRAIS)	
		11. Contract or Grant No. DTFH61-96-C-00088	
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Contracts and Procurement 6300 Georgetown Pike McLean, Virginia 22101-2296		13. Type of Report and Period Covered Test Report September 1996 - May 1998	
		14. Sponsoring Agency Code	
15. Supplementary Notes Contracting Officer's Technical Representative (COTR) - C. F. McDevitt, HSR-20			
16. Abstract This report presents the results of a NCHRP Report 350 type 4-10 crash test conducted on a sidewalk-mounted steel bridge railing designed by the New England Transportation Consortium (NETC). The test utilized a 920 kg (gross weight including dummy) small car impacting at 100 km/h and a 20° angle to evaluate the length of need of the barrier section in general, and the occupant risk in particular. The performance of the barrier was judged to pass all evaluation criteria of NCHRP Report 350, and no barrier damage, other than scuffing, was noted.			
17. Key Words Crash test, bridge railing, length of need, occupant risk, small car		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 56	22. Price

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH								
in	inches	25.4	millimeters	mm	millimeters	0.039	inches	in
ft	feet	0.305	meters	m	meters	3.28	feet	ft
yd	yards	0.914	meters	m	meters	1.09	yards	yd
mi	miles	1.61	kilometers	km	kilometers	0.621	miles	mi
AREA								
in ²	square inches	645.2	square millimeters	mm ²	square millimeters	0.0016	square inches	in ²
ft ²	square feet	0.093	square meters	m ²	square meters	10.764	square feet	ft ²
yd ²	square yards	0.836	square meters	m ²	square meters	1.195	square yards	ac
ac	acres	0.405	hectares	ha	hectares	2.47	acres	mi ²
mi ²	square miles	2.59	square kilometers	km ²	square kilometers	0.386	square miles	
VOLUME								
fl oz	fluid ounces	29.57	milliliters	ml	milliliters	0.034	fluid ounces	fl oz
gal	gallons	3.785	liters	l	liters	0.264	gallons	gal
ft ³	cubic feet	0.028	cubic meters	m ³	cubic meters	35.71	cubic feet	ft ³
yd ³	cubic yards	0.765	cubic meters	m ³	cubic meters	1.307	cubic yards	yd ³
NOTE: Volumes greater than 1000 l shall be shown in m ³ .								
MASS								
oz	ounces	28.35	grams	g	grams	0.035	ounces	oz
lb	pounds	0.454	kilograms	kg	kilograms	2.202	pounds	lb
T	short tons (2000 lb)	0.907	megagrams	Mg	megagrams	1.103	short tons (2000 lb)	T
TEMPERATURE (exact)								
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	°C	Celsius temperature	1.8C + 32	Fahrenheit temperature	°F
ILLUMINATION								
fc	foot-candles	10.76	lux	lx	lux	0.0929	foot-candles	fc
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS								
lbf	poundforce	4.45	newtons	N	newtons	0.225	poundforce	lbf
psi	poundforce per square inch	6.89	kilopascals	kPa	kilopascals	0.145	poundforce per square inch	psi

* SI is the symbol for the International System of Units. Appropriate rounding should be made in conformance with Section 4 of ASTM E-290.

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INTRODUCTION

The purpose of this test was to evaluate the performance of the New England Transportation Consortium (NETC) 4-bar, sidewalk-mounted steel bridge railing. To accomplish this, a test designated as type 4-10 in NCHRP Report 350⁽¹⁾ was performed. Test 4-10 utilizes an 820-kg small car impacting at 100 km/h and a 20° impact angle to evaluate the length of need as well as the occupant risk. The text in the following sections describe the test installation, vehicle, sequence, and resulting damage to both the installation and vehicle. In addition, conclusions regarding barrier performance will be offered. Following the text, figures and tables which further describe the test setup, procedures, and results will be presented.

TEST INSTALLATION

Facility

This test was performed along and adjacent to the inactive East Runway at Brooks Air Force Base, San Antonio, Texas. As shown in figure 1, a concrete approach and 34.1-m-long sidewalk were constructed at an angle to the runway and a 32.9-m-long bridge rail test article erected on the sidewalk.

Test Article

Drawings showing an elevation and cross section of the test installation are shown in figures 2 and 3, respectively. Briefly, the steel-reinforced, concrete sidewalk was 2.0 m wide by 203 mm high on the traffic side which sloped upward to a level 229 mm high where the bridge rail was mounted. The bridge rail utilized W6 x 25 steel posts welded to 25-mm x 254-mm x 356-mm base-

plates which were attached to the concrete with 25-mm anchor bolts. Post spacing was 2.44 m. Four longitudinal rails fabricated from steel structural tubing were attached to the posts with 19.1-mm diameter studs; rail heights, measured from the concrete sidewalk to the top of the rails, were 229 mm, 475 mm, 813 mm, and 1168 mm. Further details of the installation and its components are shown in the drawing of Appendix A.

Photographs of details of the barrier installation are shown in figure 4. Table 1 summarizes the beam and post materials used in the installation and also lists dimensions of the key components of the system.

TEST VEHICLE, CONTROLS, AND DATA SYSTEMS

Vehicle and Dummy

The vehicle used for this test was a 1991 Ford Festiva. An uninstrumented dummy was placed in the driver's seat of the vehicle and restrained with lap and shoulder belts. Gross test weight, including the dummy and vehicle instrumentation, was 902 kg. Pre-test photographs of the vehicle are shown in figure 5.

Vehicle Controls

Target impact point of the vehicle was the centerline of post 6. It was guided to that location using a 6.4-mm diameter x 457.2-m-long steel cable which passed through a guide tube/bracket attached to the left front wheel spindle. The cable was pretensioned and located alongside the run-up strip where it would not interfere with post-impact vehicle trajectory. Just prior to impact, the guide tube/bracket was sheared off allowing the vehicle free trajectory.

Braking of the test vehicle was accomplished by use of an air cylinder attached to its brake pedal. The air cylinder was activated by a gas-charged accumulator through an intermediate solenoid valve. The solenoid valve was remotely controlled by the test conductor.

¹Ross, H.E., Jr., Sicking, D.L., Zimmer, R.A., and Michie, J.D., "Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances," *NCHRP Report 350*, Washington, D.C., 1993.

The test vehicle was towed into the barrier using a cable/pulley system for reverse towing, i.e., the tow vehicle moved away from the barrier as the test vehicle moved toward it. The tow cable was attached to the underside of the test vehicle and released just prior to impact. Vehicle impact speed control was achieved by means of an automatic controller attached to the engine distributor of the tow vehicle. After the tow vehicle accelerated to its predetermined test speed, the controller pulsed the ignition, maintaining the tow vehicle at that speed.

Electronic Data Acquisition

The vehicle was instrumented with eleven accelerometers and one rate gyro; the location of each of these transducers in the vehicle is shown in table 2. The accelerometers were oriented to obtain data in directions parallel to the longitudinal, lateral, or vertical axes of the vehicle, and the rate gyro was oriented to measure the yaw angular rate change the vehicle experienced during the impact sequence. The transducer data was recorded by a Pacific Instruments Model 5600 Data Acquisition System (DAS) which contained signal conditioners, amplifiers, appropriate SAEJ211 filters and digitizers with on-board memory for up to 32 data channels at programmable sample rates to 100 kilohertz per channel. Digitized data was recorded in solid state non-volatile memory with a capacity of 65,000 data points per channel. For this test, twelve channels were used to measure and record X, Y, and Z accelerations as well as yaw rate of the vehicle.

In addition to the above, two accelerometers were mounted on the back flange of post 7 of the barrier installation. These were located 51 mm and 533 mm below the top of the post and were oriented to obtain data in a lateral direction to the barrier. These two transducers were connected to a signal conditioning unit for power, calibration and balancing, and their signals recorded by digital computer at a rate of 1 kilohertz.

Film Data Acquisition

In addition to the electronic data, high-speed film coverage of the event included a camera onboard the vehicle as well as cameras adjacent to and overhead of the barrier installation.

Data Processing

Vehicle transducer data were downloaded to a personal computer after the test and processed through an Institute-developed computer program. The program utilizes accelerometer and rate gyro data to determine vehicle acceleration (in longitudinal, lateral, and vertical directions), heading angle, velocity, and displacement as a function of time during the event. In addition, from this data the program calculates the highest 50-millisecond average accelerations for the vehicle as well as occupant risk data, including impact velocities (with the interior of the vehicle) and 10-millisecond average ridedown accelerations. The output of this data is provided in either tabular or graphical form.

Data from the two accelerometers mounted on post 7 were transferred to a floppy disk and then imported to a Microsoft Excel spreadsheet. These data were then converted to standard engineering units (g's) and output in both tabular and graphical form.

TEST DESCRIPTION

Ambient temperature at test time was 10°C. Actual impact conditions were 100.0 km/h and a 20° impact angle. As shown in the test summary diagram of figure 6, the vehicle traversed the sidewalk and impacted the barrier 610 mm downstream of post 6, maintaining contact with the longitudinal rails for 1.83 m as it was redirected, exiting the installation at a 6.6° angle (calculated from measured tire marks). Figures 7 and 8 show the redirection sequence of the vehicle from overhead as well as behind the barrier viewpoints. The post-impact trajectory of the vehicle was

such that it traveled in a relatively straight line after loss of contact, coming to a stop 77 m downstream of initial impact point (brakes had been applied immediately after loss of contact with the barrier). Two of the vehicle accelerometers, the lateral accelerometer at the c.g. and the longitudinal accelerometer mounted on the instrument panel, malfunctioned at impact, resulting in no data on those channels. Data from film analysis indicated maximum 50 msec average accelerations of -3.4 g's in the longitudinal direction and 6.9 g's in the lateral direction. Occupant risk values showed that the dummy did not travel the required hypothetical distance in the longitudinal direction, and a value of 1.4 m/sec occupant impact velocity is reported at the maximum displacement of 0.2 m. Lateral impact velocity is calculated from film analysis as 6.4 m/sec. Maximum ridedown acceleration was 6.4 g's, lateral. Figures 9 through 20 contain plots of the functional transducer data recorded during the event, and tabular printouts of the transducer data are shown in Appendices B and C. There was no measurable dynamic or permanent deflection of the barrier.

BARRIER DAMAGE

Damage to the barrier, as shown in figure 21, consisted of scuffing of the longitudinal rails which only required repainting prior to further testing. As described previously, no permanent barrier deflection was noted.

VEHICLE DAMAGE

As shown in figure 22, the test vehicle sustained damage to the left front fender and along the left side, as well as damage to the headlight/grill area. The left side of the front bumper was deformed rearward, and the left front suspension/wheel/tire displaced rearward. All tires except the right rear were either blown out or deflated as a result of the impact. The exterior vehicle damage scale was estimated to be 11-FL-2 using the VDS

system and 11FLEE2 using the CDC system. The interior deformation of the occupant compartment was LF0000000 using the OCDI system. There was no deformation or intrusion into the occupant compartment.

EVALUATION OF TEST RESULTS

Performance evaluation is based on the criteria shown in table 5.1 titled "Safety Evaluation Guidelines," of NCHRP Report 350. The specific requirements applicable for a Test Type 4-10 are shown in table 3 together with the test NETC-1 results. Although the data loss of the vehicle lateral accelerometer precluded any occupant risk calculations from transducer data, film analysis provided those data necessary for evaluation. Barrier performance compared with recommended criteria indicates it passed in all categories.

CONCLUSIONS

From the evaluation described in the preceding section, the NETC 4-bar, sidewalk-mounted steel bridge railing, as described in the section on "Test Article," appears to meet the requirements for a longitudinal barrier as applicable to a Test Type 4-10.

Table 1. Installation bill of material - Test NETC-1.

Bill of Material	
Item	Quantity
TS 4 x 4 x 1/4 - 7.31 M long Rail	12
TS 8 x 4 x 5/16 - 7.31 M long Rail	4
TS 4 x 4 x 1/4 - 3.66 M long Rail	3
TS 8 x 4 x 5/16 - 3.66 M long Rail	1
W6 x 25 - 1.05 M high Post	14

Table 2. Vehicle data transducer locations - Test NETC-1.

Type	Location	Orientation
Accelerometer	Center of gravity	Longitudinal axis
Accelerometer	Center of gravity	Lateral axis
Accelerometer	Center of gravity	Vertical axis
Rate Gyro	Center of gravity	Longitudinal axis
Accelerometer	Over rear axle	Longitudinal axis
Accelerometer	Over rear axle	Lateral axis
Accelerometer	Over rear axle	Vertical axis
Accelerometer	Top engine block	Longitudinal axis
Accelerometer	Bottom of engine block	Longitudinal axis
Accelerometer	Right front disc brake caliper	Longitudinal axis
Accelerometer	Left front disc brake caliper	Longitudinal axis
Accelerometer	Center of instrument panel	Longitudinal axis

Table 3. Test assessment summary - NCHRP Report 350 test designation 4-10 - SwRI test number NETC-1.

Designation	Factor	Description	Test Results	Assessment	
C	Structural Adequacy	Test article should contain and redirect the vehicle; the vehicle should not penetrate, underide, or override the installation although controlled lateral deflection of the test article is acceptable.	Vehicle contained and redirected.	PASS	
D	Occupant Risk	Detached elements, fragments, or other debris from the test article shall not penetrate or show potential for penetrating the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformation of, or intrusions into, the occupant compartment that could cause serious injuries shall not be permitted.	This article and its elements did not penetrate the occupant compartment or present undue hazard to adjacent traffic or others. There was no deformation or intrusion into the occupant compartment.	PASS	
F	Occupant Risk	The vehicle should remain upright during and after collision although moderate roll, pitching, and yawing are acceptable.	Vehicle remained upright during and after the collision.	PASS	
H	Occupant Risk	Occupant impact velocities should satisfy the following: Occupant Impact Velocity Limits (m/s)			
			Component	Preferred	Maximum
			Longitudinal	9	12
		Lateral	9	12	
I	Occupant Risk	Occupant ridedown accelerations should satisfy the following: Occupant Ridedown Acceleration Limits (G's)			
			Component	Preferred	Maximum
			Longitudinal	15	20
		Lateral	15	20	
K	Vehicle Trajectory	After collision, it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes.	Vehicle did not intrude into adjacent traffic lanes.	PASS	
M	Vehicle Trajectory	The exit angle from the test article preferably should be less than 60 percent of test impact angle, measured at time of vehicle loss of contact with test device.	Vehicle exit angle was 6.6 degrees.	PASS	



Figure 1. Barrier installation - Test NETC-1.

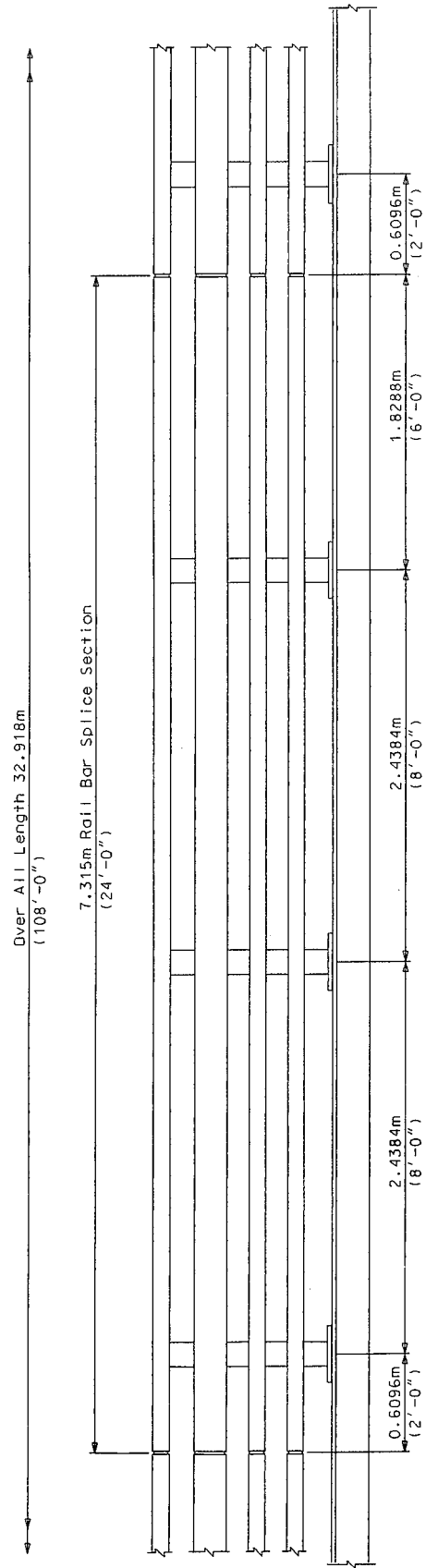


Figure 2. Barrier elevation drawing - Test NETC-1.

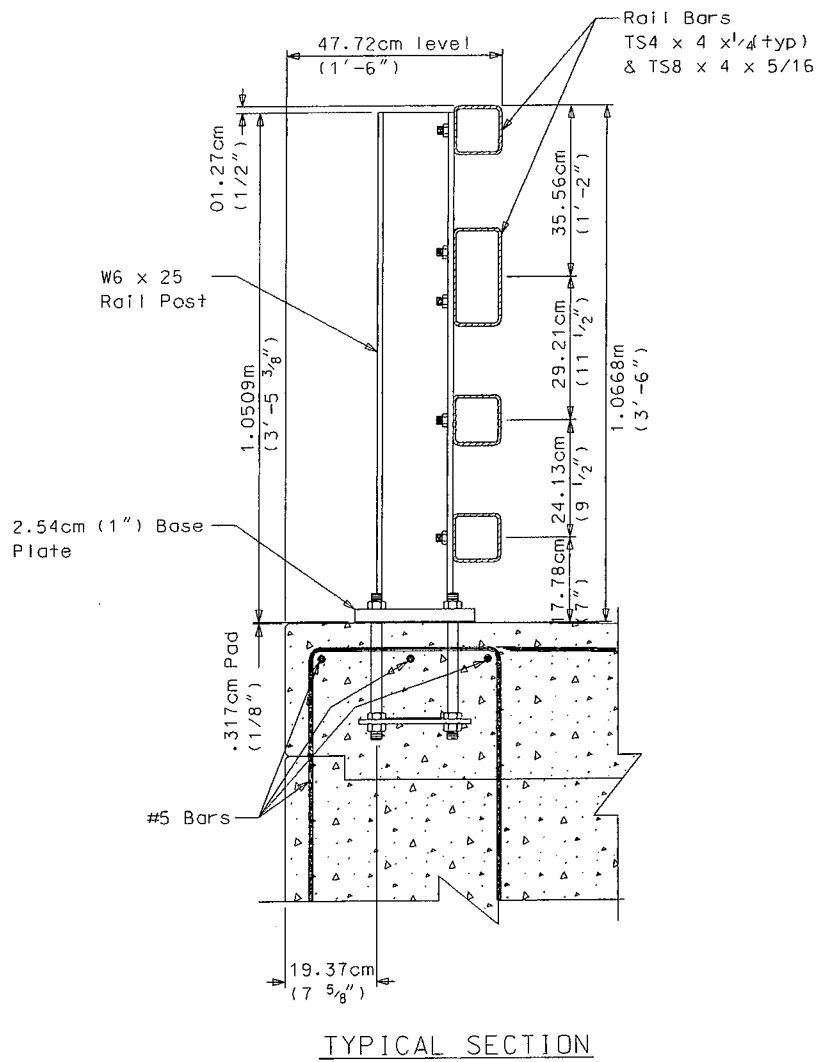


Figure 3. Barrier cross-section drawing - Test NETC-1.



Figure 4. Barrier photographs - Test NETC-1.

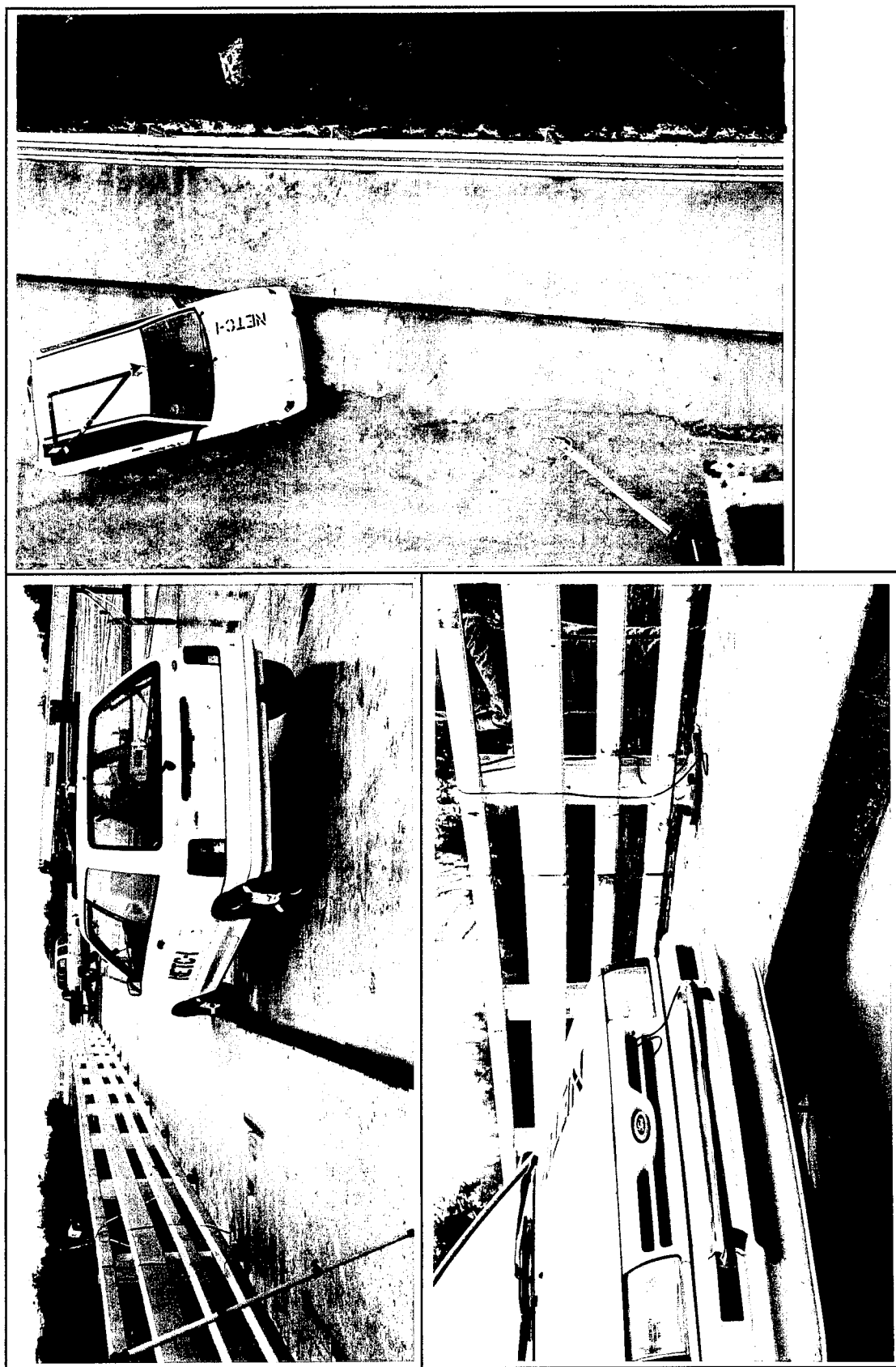


Figure 5. Vehicle photographs - Test NETC-1.

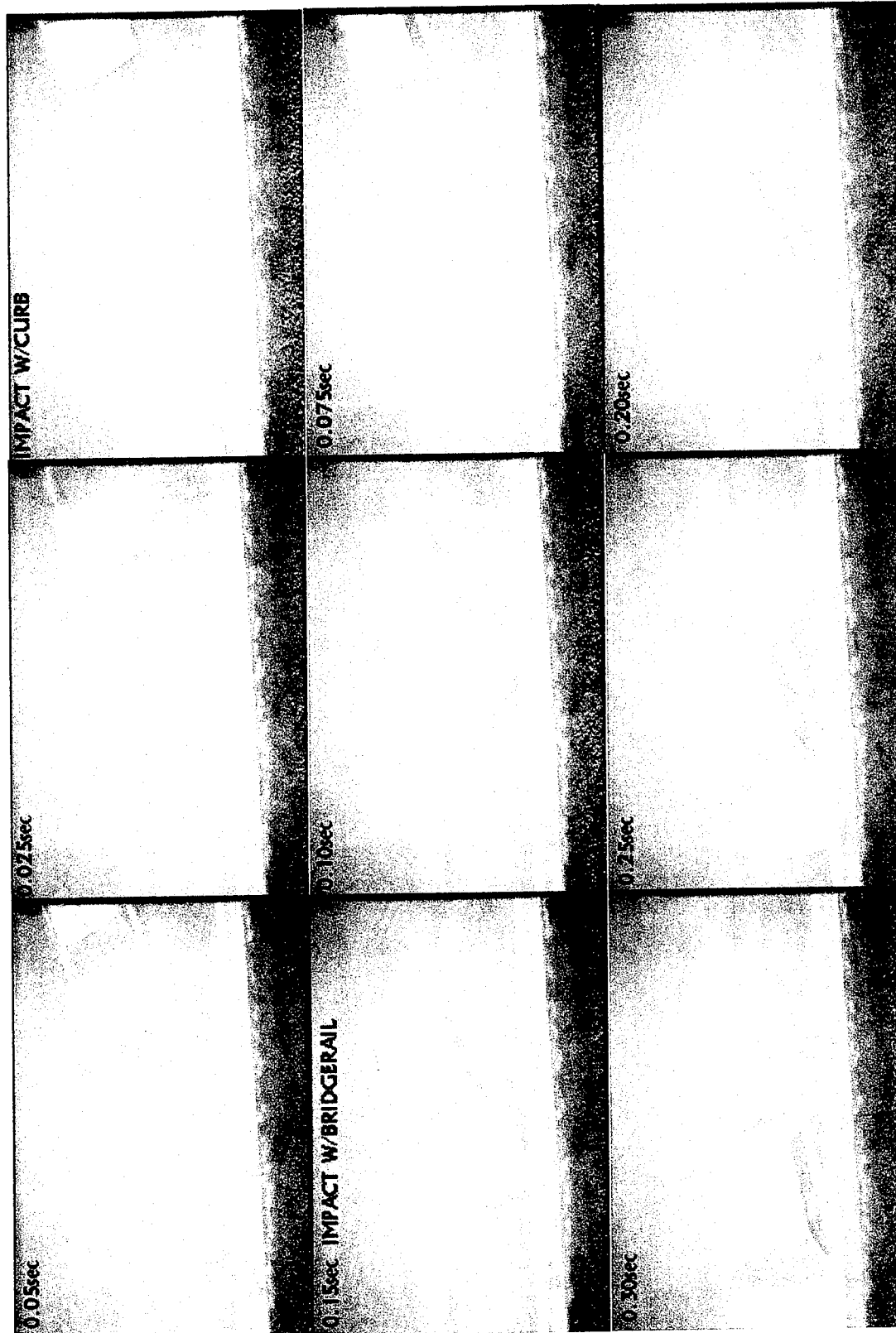


Figure 7. Overhead sequential photographs - Test NETC-1.

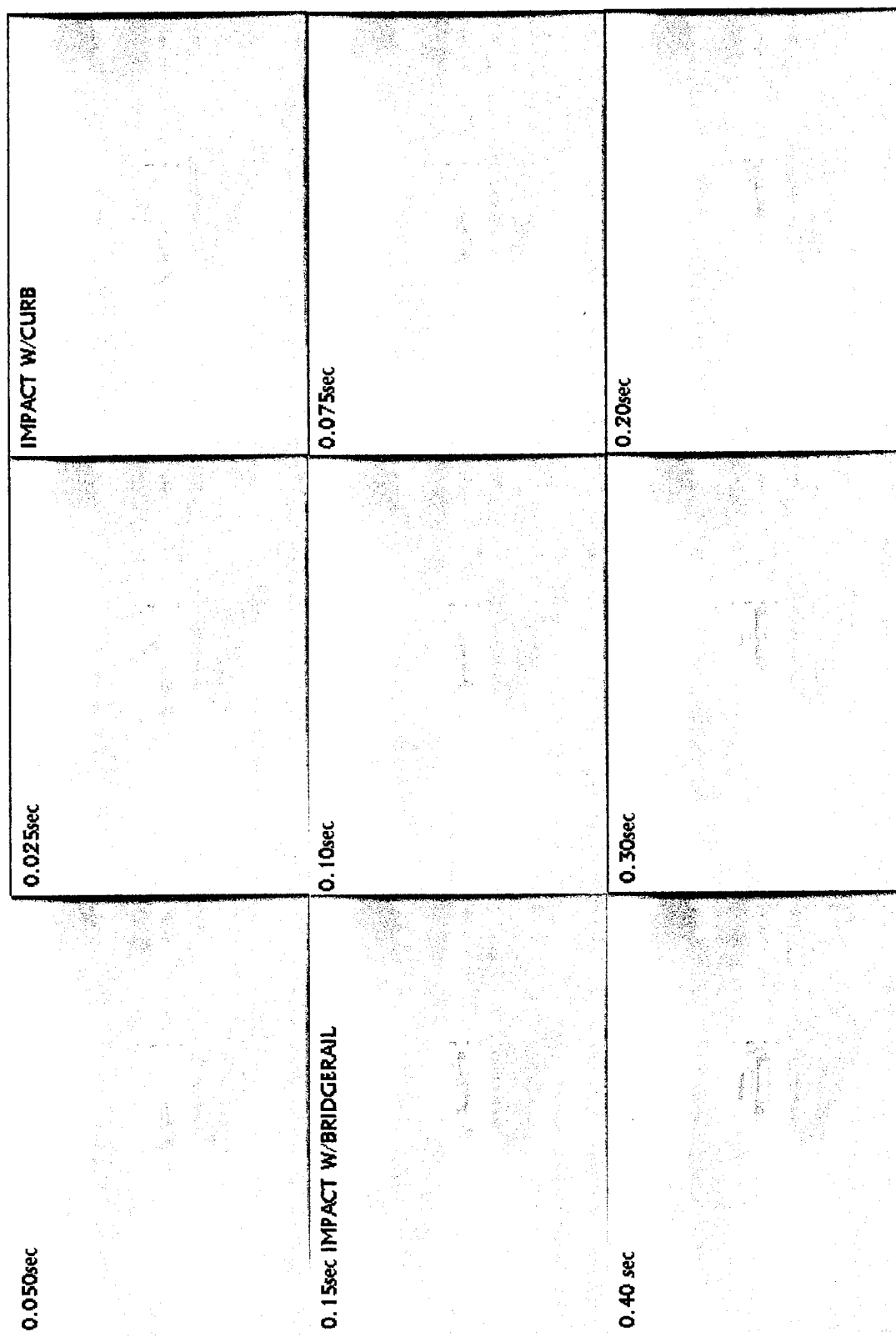


Figure 8. Sequential photographs - Test NETC-1.

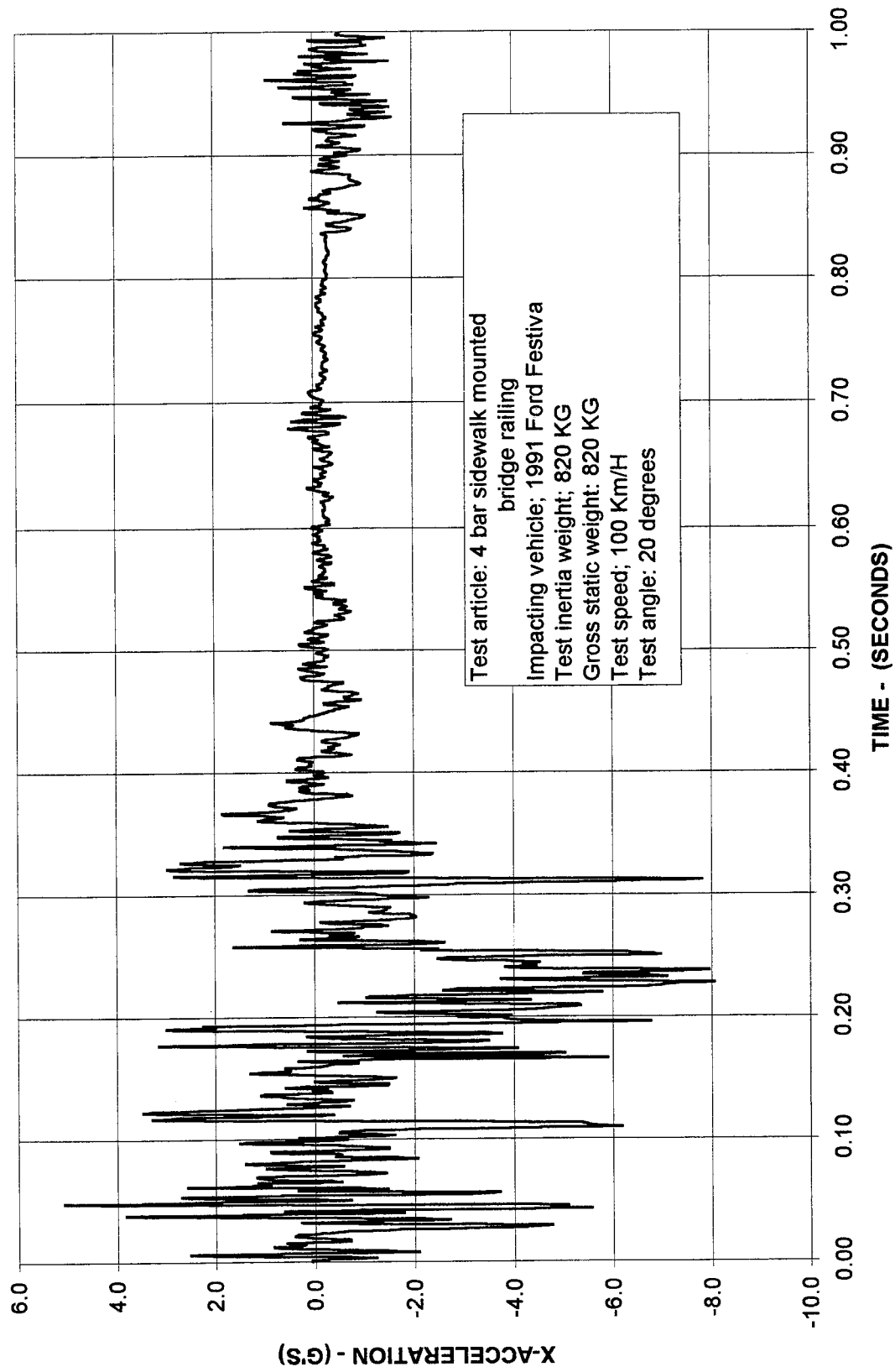


Figure 9. Vehicle C.G. longitudinal accelerometer plot - Test NETC-1.

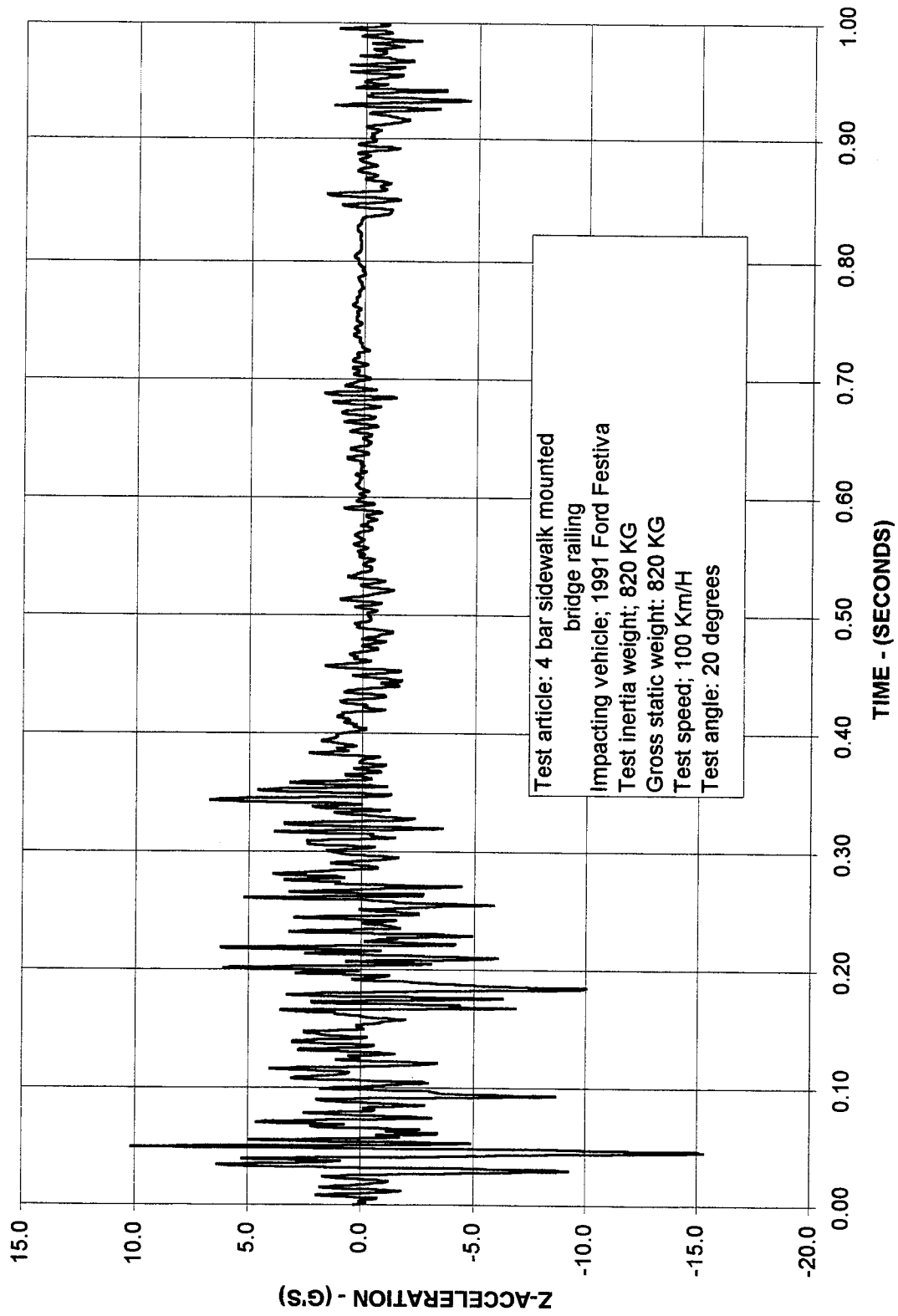


Figure 10. Vehicle C.G. vertical accelerometer plot - Test NETC-1.

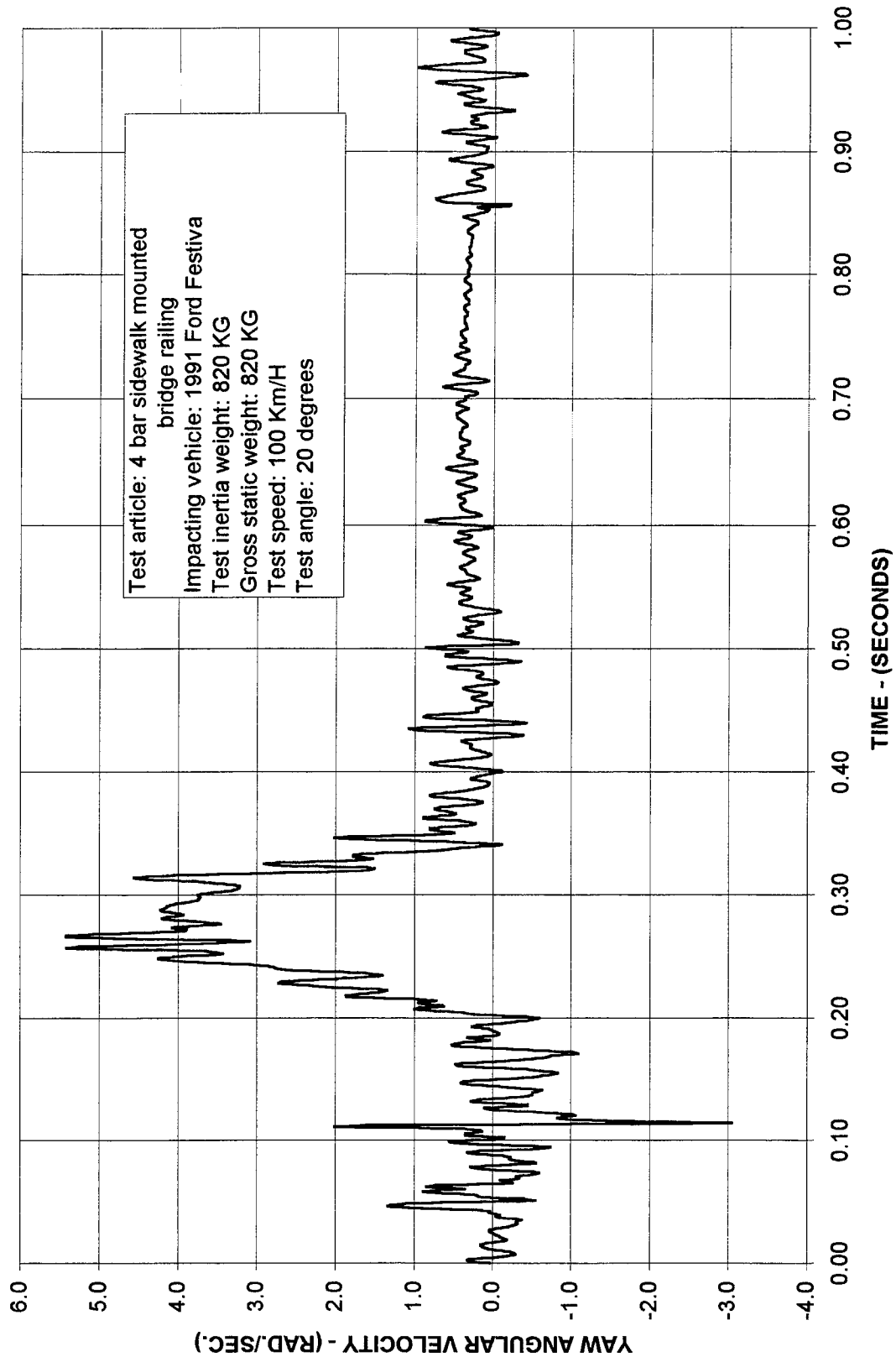


Figure 11. Rate gyro plot - Test NETC-1.

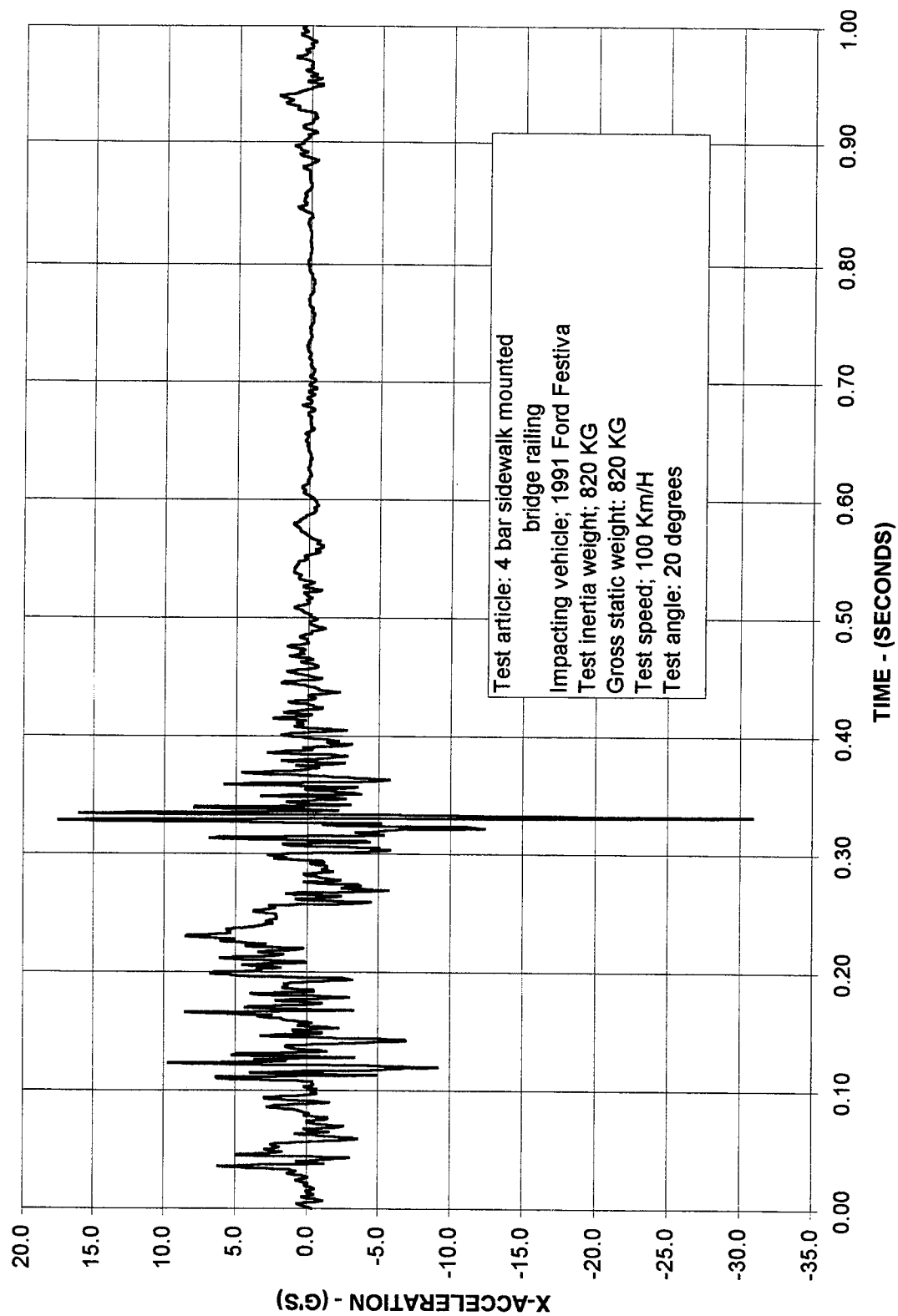


Figure 12. Rear axle longitudinal accelerometer plot - Test NETC-1.

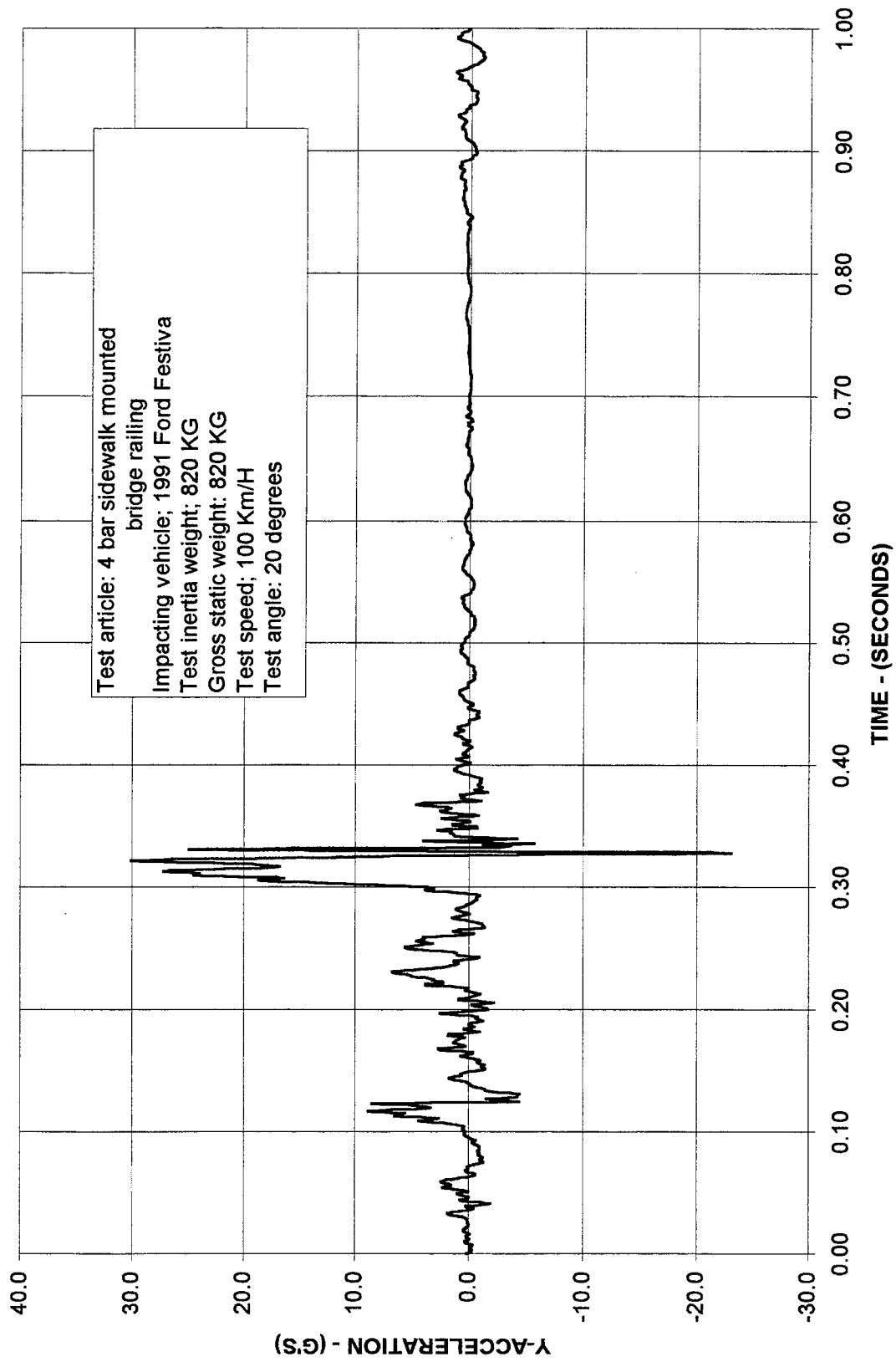


Figure 13. Rear axle lateral accelerometer plot - Test NETC-1.

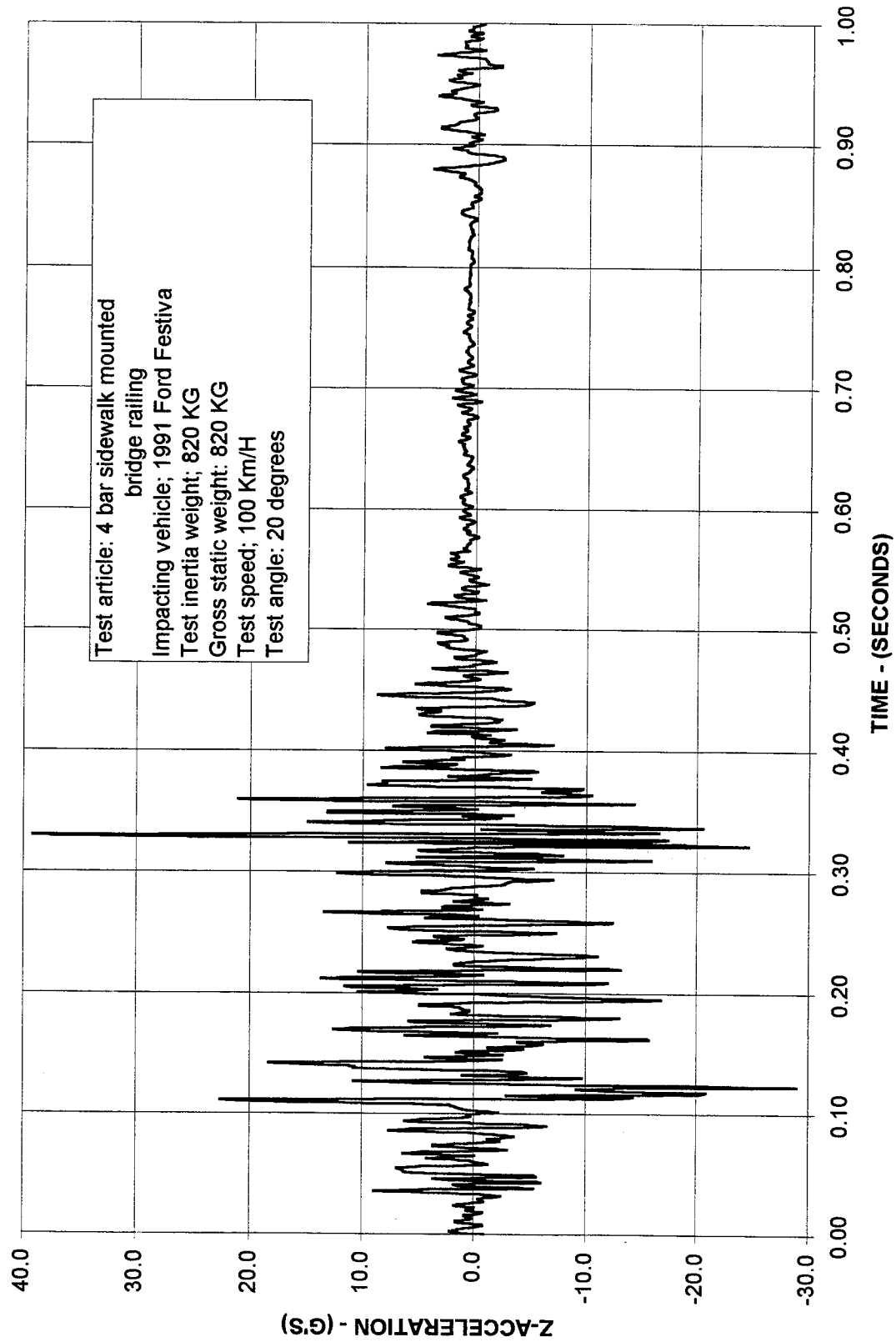


Figure 14. Rear axle vertical accelerometer plot - Test NETC-1.

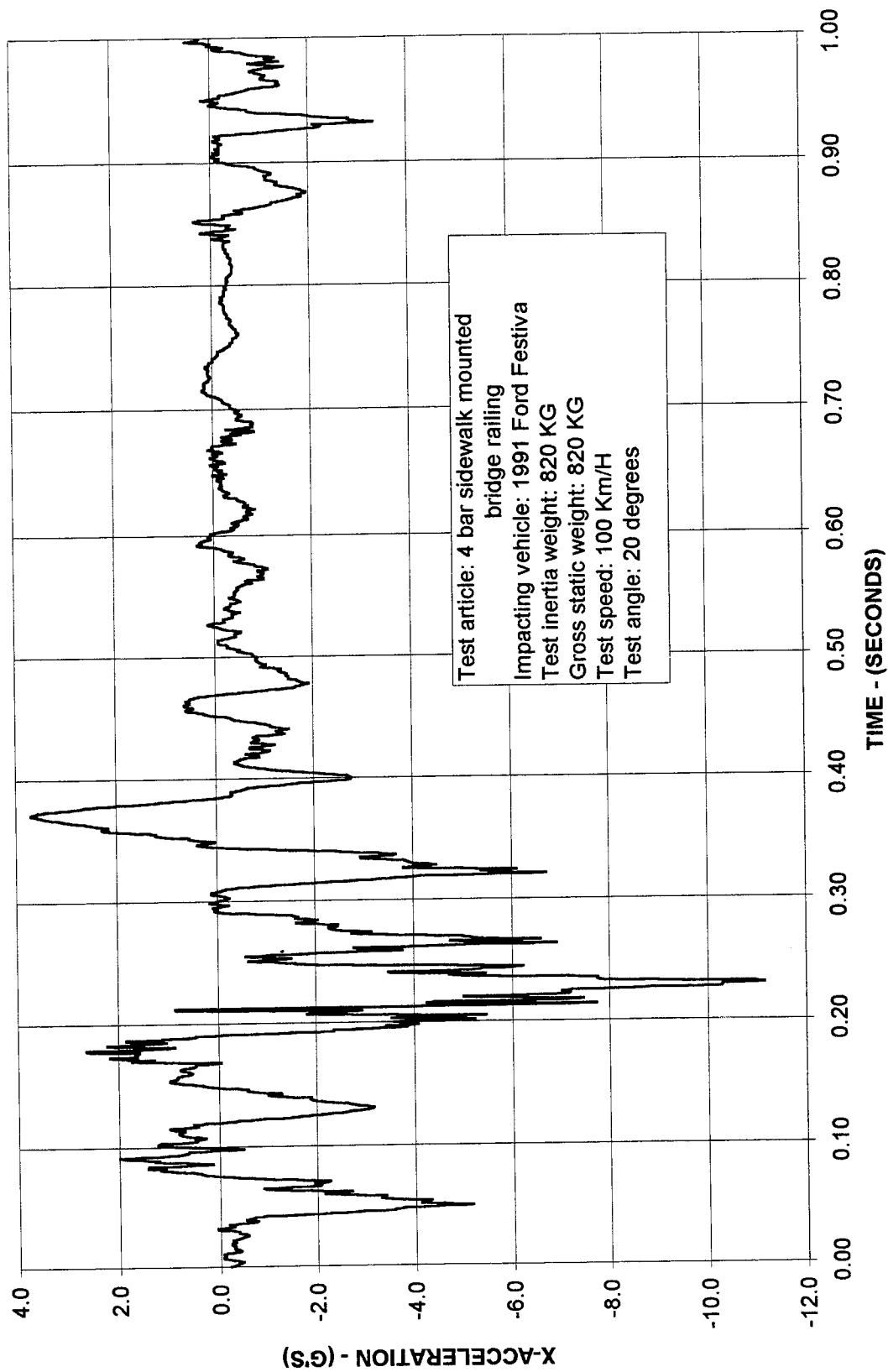


Figure 15. Top of engine longitudinal accelerometer plot - Test NETC-1.

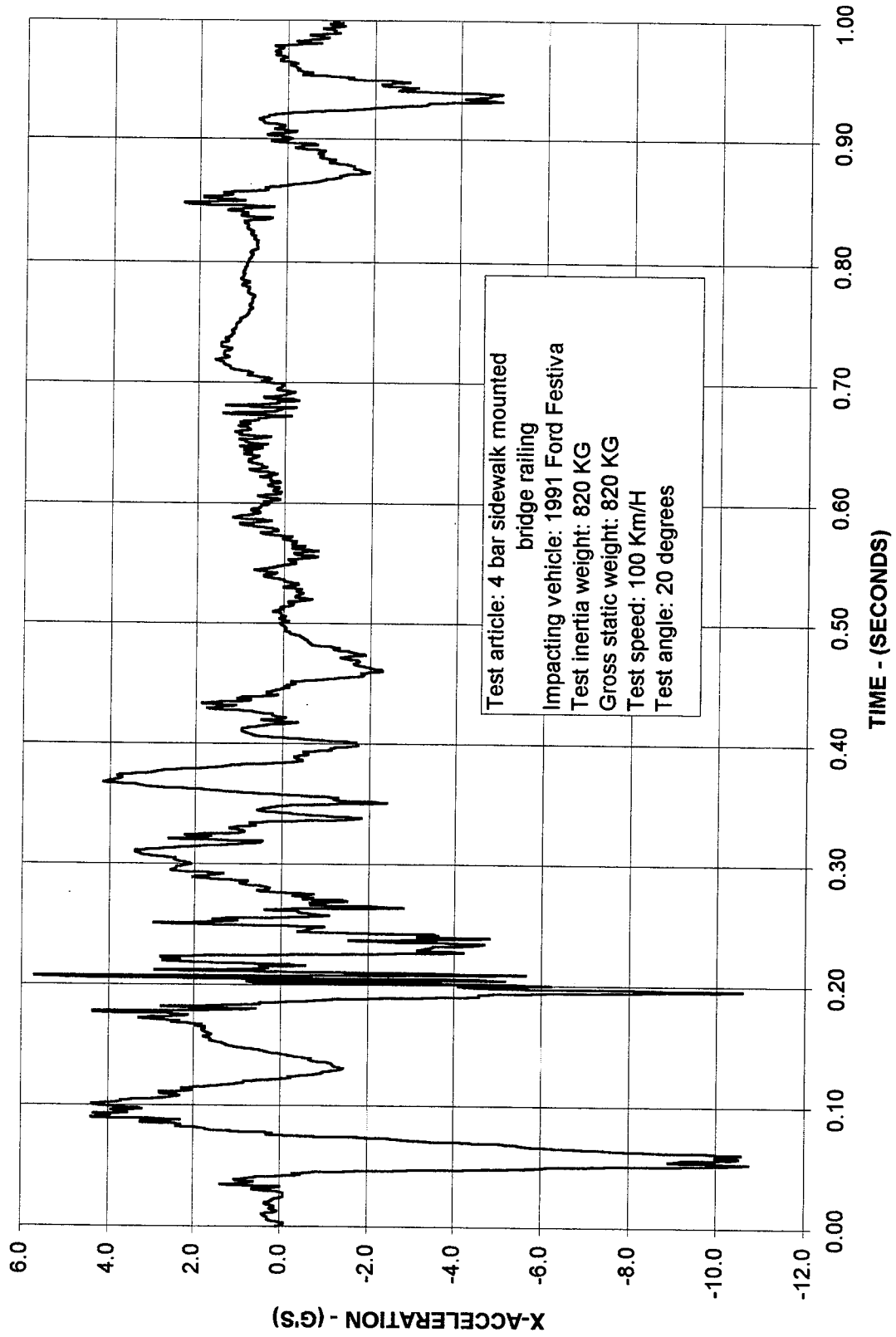


Figure 16. Bottom of engine longitudinal accelerometer plot - Test NETC-1.

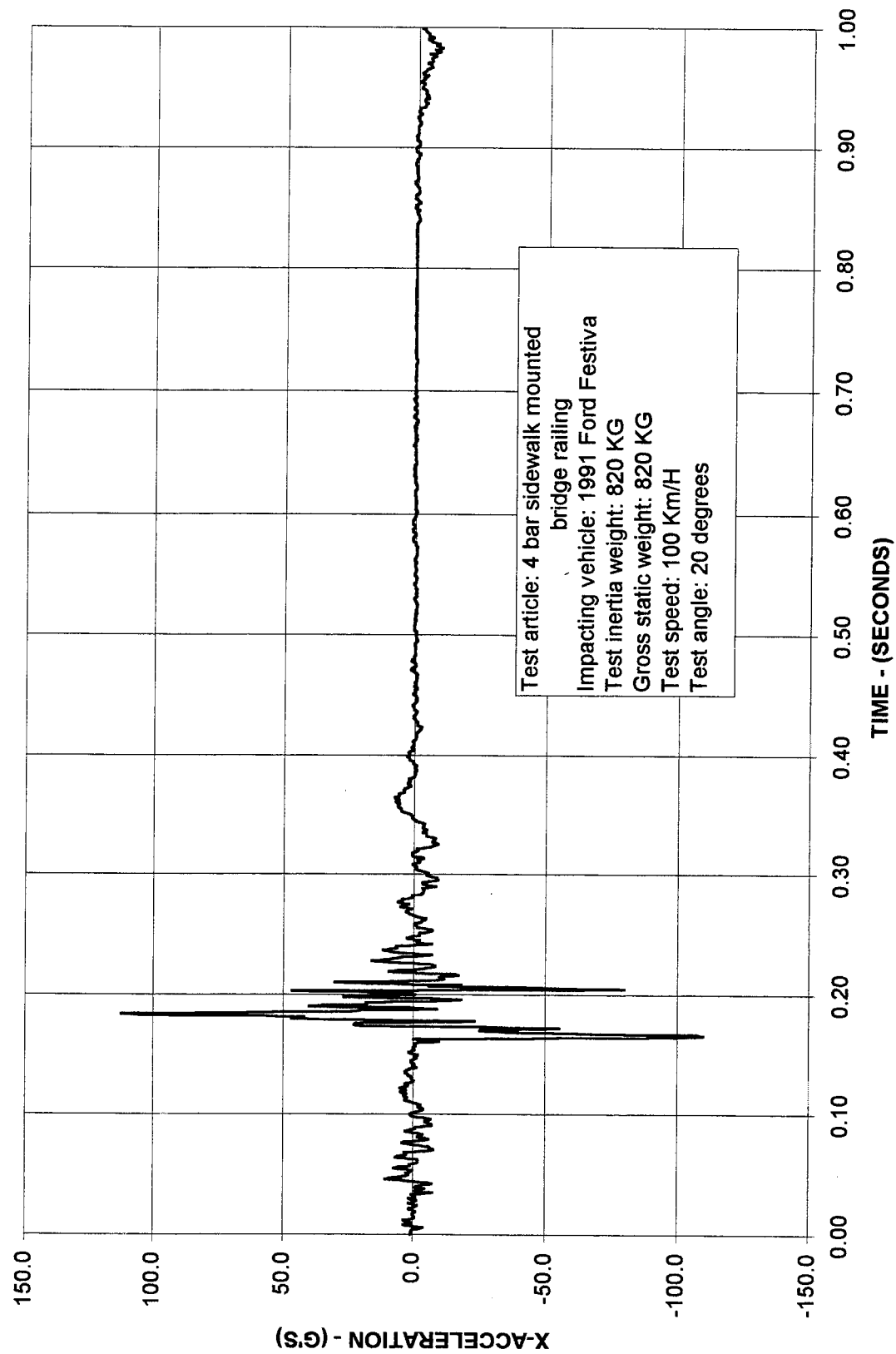


Figure 17. Right front disc brake longitudinal accelerometer plot - Test NETC-1.

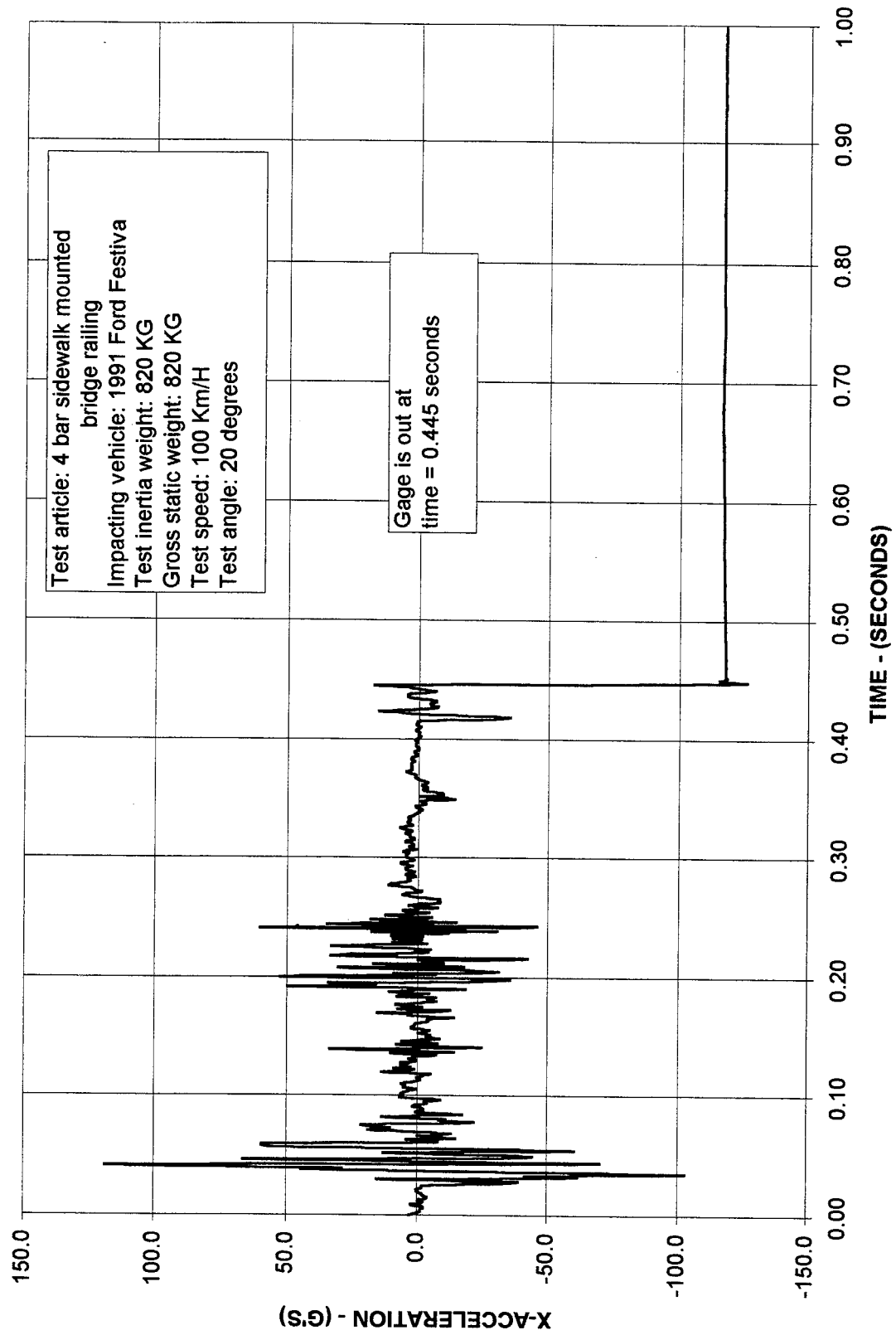


Figure 18. Left front disc brake longitudinal accelerometer plot - Test NETC-1.

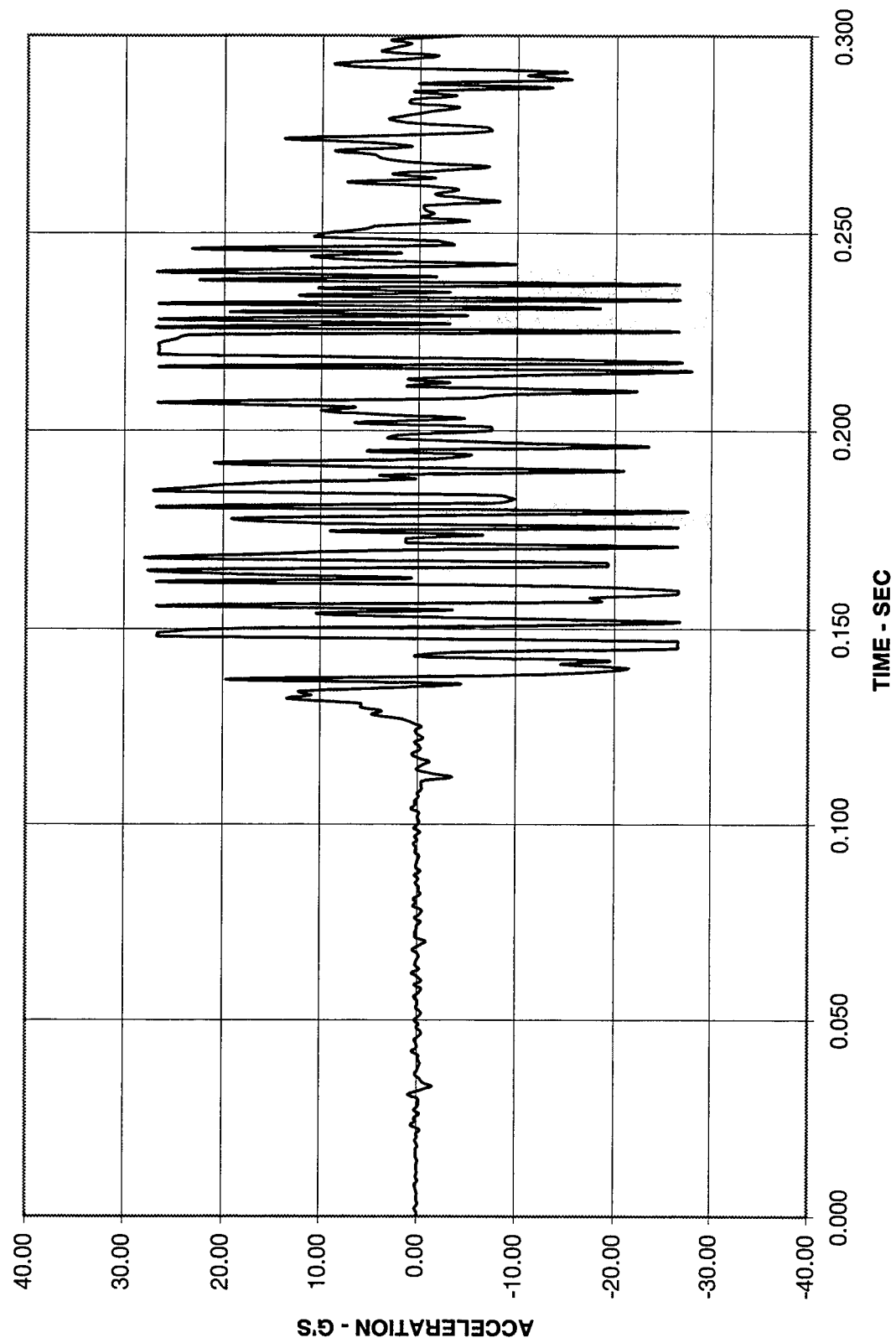


Figure 19. Top of post 7 lateral accelerometer plot - Test NETC-1.

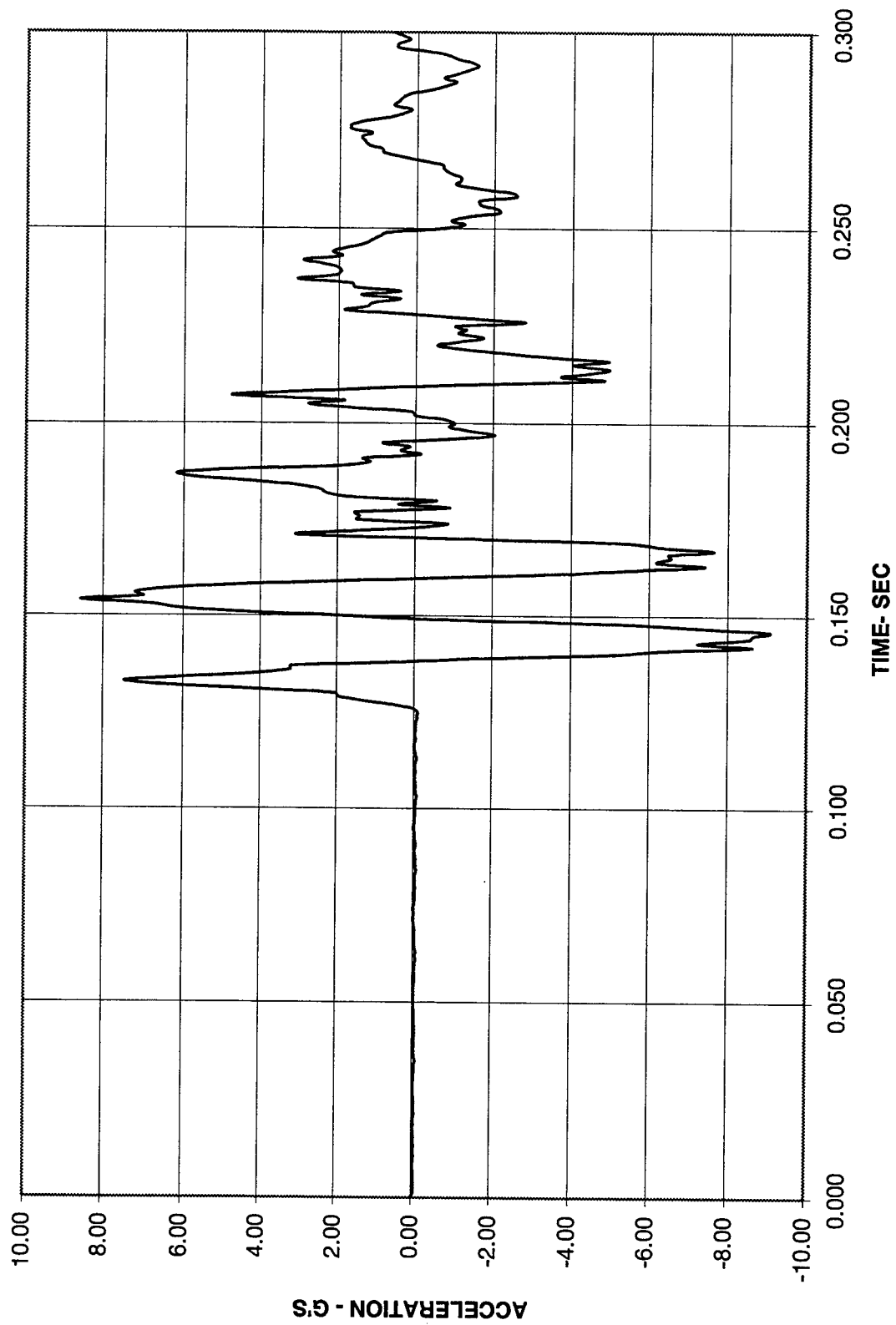


Figure 20. Bottom of post 7 lateral accelerometer plot - Test NETC-1.

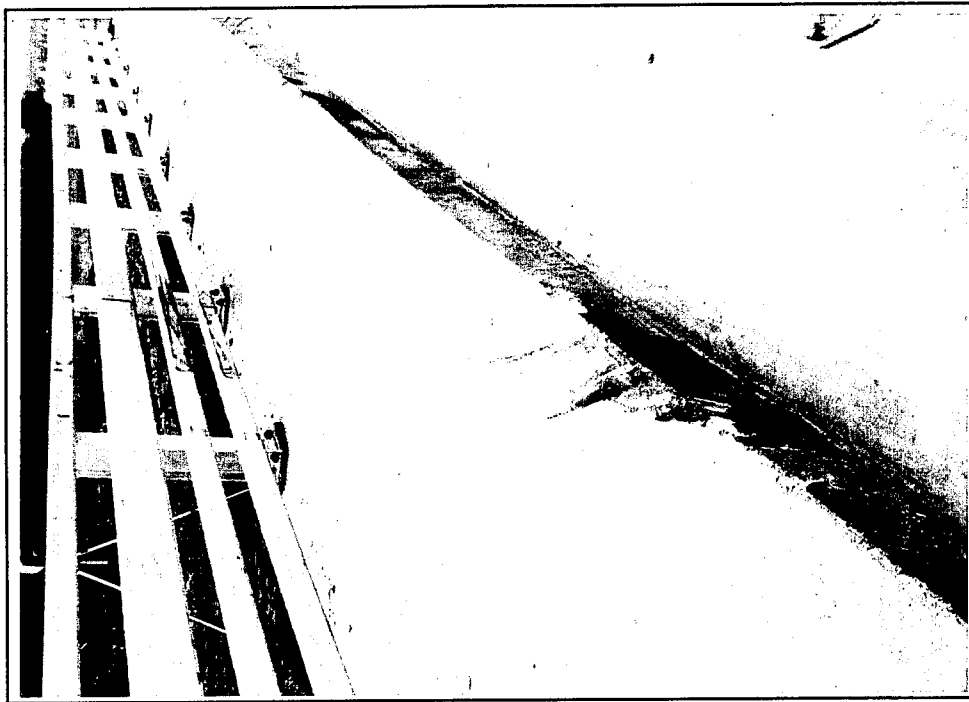


Figure 21. Barrier damage photographs - Test NETC-1.

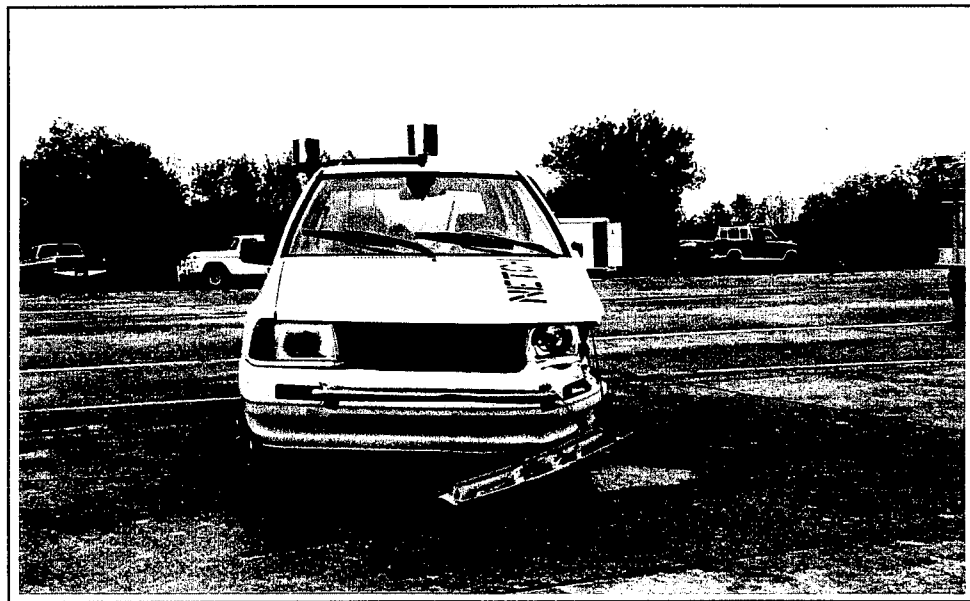
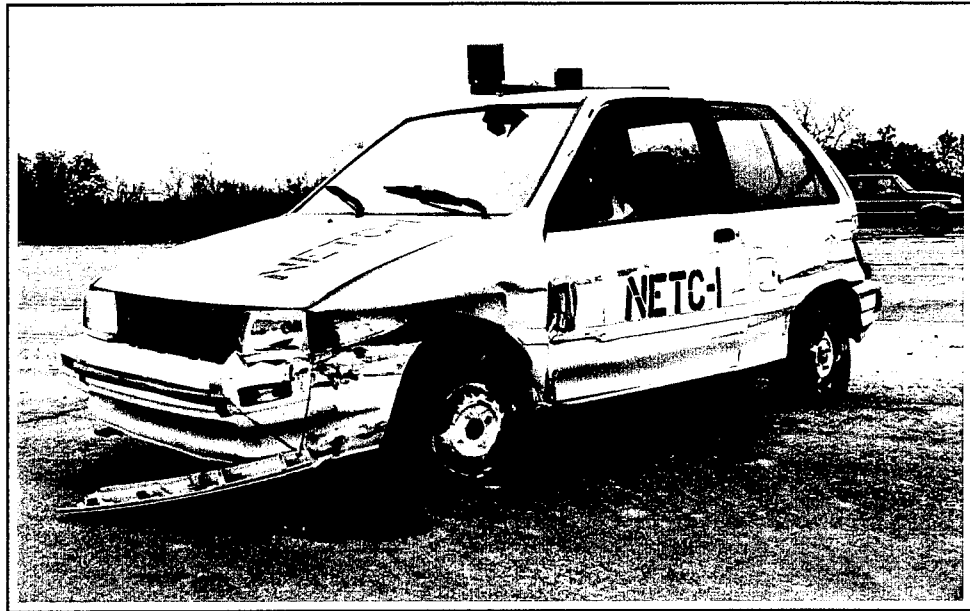


Figure 22. Vehicle damage photographs - Test NETC-1.

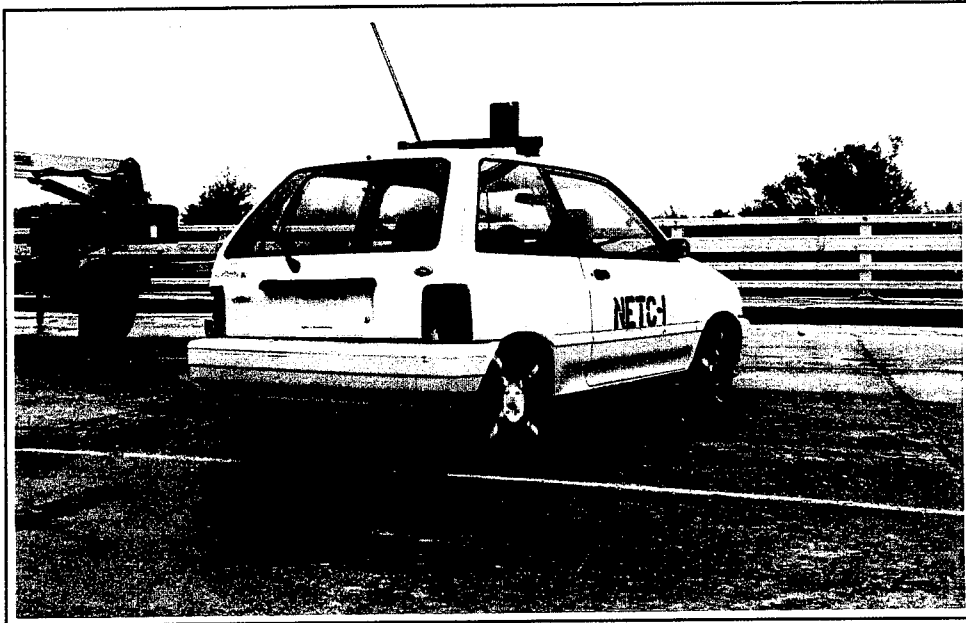
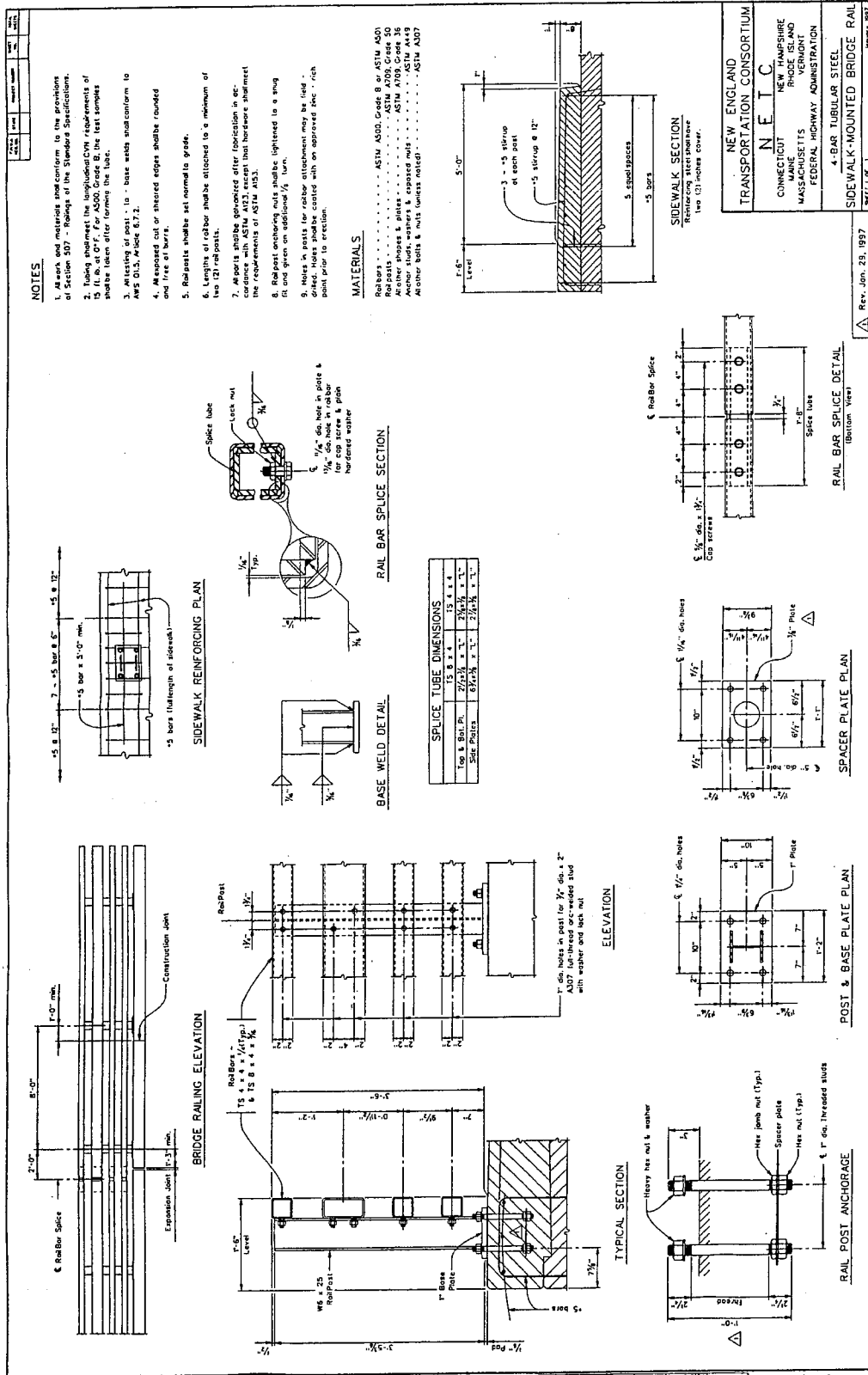


Figure 22. Vehicle damage photographs - Test NETC-1 (continued).

APPENDIX A - NETC CRASH TEST STEEL BRIDGE RAILING DRAWING



APPENDIX B - TRANSDUCER DATA WITH CALCULATED VEHICLE KINETICS AND OCCUPANT RISK SUMMARIES

Test ID — NETC -1
 Test Date — 11/18/97
 Vehicle Type — 820 C
 Occupant Risk Summary from Film Analysis

Time (S)	Vehicle Accel. (G'S)		Occup. Vel. (FPS)		Occup. Disp. (F)	
	LONG.	LAT.	LONG.	LAT.	LONG.	LAT.
0.000	-2.02	3.73	0.00	0.00	0.00	0.00
0.010	-2.61	4.32	0.33	-0.94	0.00	0.00
0.020	-3.05	4.92	0.80	-2.10	0.01	-0.02
0.030	-3.36	5.48	1.39	-3.51	0.02	-0.05
0.040	-3.54	5.97	2.06	-5.12	0.03	-0.09
0.050	-3.58	6.37	2.72	-7.01	0.04	-0.14
0.060	-3.51	6.68	3.39	-9.02	0.08	-0.22
0.070	-3.33	6.67	3.95	-11.26	0.11	-0.35
0.080	-3.07	6.87	4.45	-13.30	0.15	-0.46
0.090	-2.74	6.92	4.89	-16.61	0.17	-0.62
0.100	-2.37	6.80	5.10	-18.48	0.21	-0.80
0.110	-1.98	6.62	5.22	-20.95	0.22	-1.00
0.120	-1.58	6.37	5.20	-23.36	0.25	-1.23
0.130	-1.20	5.80	5.10	-25.65	0.26	-1.50
0.140	-0.86	5.35	4.84	-27.85	0.28	-1.75
0.150	-0.55	4.82	4.56	-29.85	0.27	-2.03
0.160	-0.29	4.23	4.21	-31.65	0.27	-2.35
0.170	-0.08	3.65	3.82	-33.35	0.26	-2.68
0.180	0.07	3.12	3.45	-34.70	0.25	-3.02
0.190	0.17	2.56	3.04	-35.95	0.23	-3.40
0.200	0.22	2.05	2.71	-36.96	0.20	-3.81
0.210	0.23	1.58	2.40	-37.80	0.19	-4.15
0.220	0.19	1.20	2.12	-38.52	0.18	-4.51
0.230	0.12	0.86	1.90	-39.05	0.15	-4.92
0.240	0.02	0.55	1.72	-39.42	0.14	-5.32
0.250	-0.10	0.37	1.62	-39.70	0.12	-5.70
0.260	-0.24	0.23	1.58	-39.92	0.09	-6.12
0.270	-0.39	0.16	1.58	-40.01	0.09	-6.46
0.280	-0.55	0.15	1.60	-40.15	0.07	-6.91
0.290	-0.72	0.16	1.65	-40.23	0.06	-7.25
0.300	-0.87	0.25	1.78	-40.25	0.05	-7.83
0.310	-1.02	0.35	2.00	-40.53	0.05	-8.12
0.320	-1.16	0.50	2.10	-40.54	0.04	-8.50
0.330	-1.28	0.65	2.30	-40.72	0.02	-8.87
0.340	-1.38	0.78	2.52	-40.92	0.00	-9.11
0.350	-1.45	0.93	2.71	-41.20	-0.02	-9.25
0.360	-1.49	1.07	2.96	-41.51	-0.04	-9.86
0.370	-1.51	1.15	3.20	-41.81	-0.07	-10.15
0.380	-1.50	1.21	3.35	-42.18	-0.09	-10.89
0.390	-1.47	1.20	3.54	-42.57	-0.10	-11.35
0.400	-1.41	1.22	3.70	-42.89	-0.13	-11.78
0.410	-1.33	1.13	3.87	-43.36	-0.16	-12.20
0.420	-1.24	0.98	4.05	-43.78	-0.19	-12.73
0.430	-1.13	0.85	4.15	-44.09	-0.24	-13.01
0.440	-1.02	0.63	4.23	-44.37	-0.27	-13.55
0.450	-0.90	0.40	4.35	-44.56	-0.32	-13.68
0.460	-0.80	0.15	4.38	-44.75	-0.39	-14.03
0.470	-0.70	-0.11	4.45	-44.81	-0.44	-14.53
0.480	-0.62	-0.32	4.46	-44.82	-0.46	-14.92
0.490	-0.57	-0.49	4.50	-44.72	-0.47	-15.40
0.500	-0.53	-0.65	4.55	-44.58	-0.50	-15.98

Occup. Risk Factors	Time (S)	Velocity (FPS)	Convert to M/S
Long. Vel. after 2.0 ft. Disp.	0.500	4.55*	1.39
Lat. Vel after 1.0 ft. Disp.	0.110	-20.95	6.39
Max. Accel. after Occup. Impact	Time (S)	ACC. (G's)	
Lat. Acceleration	0.120	6.37	

* Occup. did not travel req'd hypothetical distance

Test ID --- NETC-1
Test Date --- 11/18/97
Vehicle Type 820C

TIME (S)	Vehicle Accel. (G's)		Heading Angle (deg)	Veh. Vel. (M/S)		Veh. Disp (M)	
	LONG.	LAT.		LONG.	LAT.	x	y
0.000	-2.05	3.63	19.85	27.56	0.30	-1.69	-1.16
0.010	-2.63	4.35	19.19	27.33	0.38	-1.53	-1.08
0.020	-3.08	4.69	18.32	27.06	0.44	-1.30	-1.01
0.030	-3.36	5.43	17.30	26.75	0.46	-1.07	-0.93
0.040	-3.56	5.97	16.12	26.42	0.50	-0.77	-0.87
0.050	-3.58	6.37	15.08	26.09	0.48	-0.52	-0.81
0.060	-3.50	6.36	14.30	25.72	0.52	-0.27	-0.76
0.070	-3.21	6.67	12.56	25.43	0.52	-0.03	-0.71
0.080	-3.02	6.95	10.65	25.10	0.51	-0.01	-0.68
0.090	-2.81	6.90	9.20	24.88	0.51	0.00	-0.64
0.100	-2.35	6.81	7.53	24.62	0.50	0.46	-0.60
0.110	-1.97	5.33	5.62	24.42	0.48	0.71	-0.59
0.120	-1.59	4.80	3.25	24.26	0.46	0.94	-0.58
0.130	-1.21	4.24	2.36	24.14	0.43	1.17	-0.59
0.140	-0.86	3.65	1.11	24.04	0.40	1.42	-0.61
0.150	-0.55	3.12	0.06	24.02	0.34	1.65	-0.62
0.160	-0.29	2.65	0.03	23.95	0.29	1.89	-0.64
0.170	-0.12	5.03	-0.06	23.60	0.21	2.12	-0.65
0.180	-0.07	1.62	-0.13	23.64	0.14	2.36	-0.66
0.190	-0.02	1.20	-1.10	23.96	0.05	2.58	-0.67
0.200	0.12	0.86	-2.36	23.97	0.03	2.81	-0.68
0.210	0.22	0.56	-2.96	24.00	0.01	3.05	-0.70
0.220	0.23	0.39	-3.45	24.01	-0.01	3.27	-0.74
0.230	0.19	0.23	-3.98	24.03	-0.03	3.51	-0.76
0.240	0.12	0.15	-4.33	24.03	-0.31	3.74	-0.76
0.250	0.02	0.14	-5.79	24.02	-0.50	3.97	-0.81
0.260	0.09	0.18	-6.45	24.00	-0.62	4.21	-0.82
0.270	-0.05	0.25	-7.56	23.97	-0.61	4.43	-0.85
0.280	-0.20	0.35	-8.86	23.89	-0.75	4.74	-0.88
0.290	-0.53	0.52	-9.88	23.86	-0.83	4.83	-0.93
0.300	-0.86	0.63	-10.10	23.47	-0.90	4.97	-0.93
0.310	-1.02	0.82	-10.31	23.68	-0.95	5.36	-0.96
0.320	-1.15	0.93	-10.51	23.57	-1.02	5.59	-0.98
0.330	-1.25	1.03	-10.73	23.44	-1.11	5.82	-1.06
0.340	-1.32	1.15	-10.76	23.31	-1.13	6.04	-1.09
0.350	-1.45	1.18	-11.26	23.16	-1.15	6.27	-1.18
0.360	-1.49	1.23	-11.45	23.01	-1.17	6.54	-1.16
0.370	-1.51	1.22	-11.47	22.86	-1.18	6.72	-1.19
0.380	-1.50	1.15	-11.77	22.68	-1.18	6.93	-1.21
0.390	-1.49	1.20	-12.02	22.55	-1.21	7.16	-1.23
0.400	-1.41	1.19	-12.02	22.37	-1.20	7.46	-1.26
0.410	-1.33	1.12	-13.06	22.26	-1.21	7.59	-1.28
0.420	-1.23	1.00	-13.25	22.13	-1.23	7.80	-1.34

TIME (S)	Vehicle Accel. (G's)		Heading Angle (deg)	Veh. Vel. (M/S)		Veh. Disp (M)	
	LONG.	LAT.		LONG.	LAT.	x	y
0.430	-1.12	0.90	-13.49	22.00	-1.27	7.71	-1.37
0.440	-1.02	0.85	-14.01	21.89	-1.31	8.22	-1.46
0.450	-0.95	0.65	-14.23	21.81	-1.37	8.44	-1.51
0.460	-0.90	0.39	-14.56	21.79	-1.44	8.65	-1.53
0.470	-0.70	0.13	-14.87	21.70	-1.47	8.98	-1.57
0.480	-0.62	-0.01	-15.00	21.61	-1.53	9.07	-1.59
0.490	-0.55	-0.40	-14.98	21.54	-1.64	9.28	-1.66
0.500	-0.61	-0.61	-15.15	21.47	-1.91	9.43	-1.71
0.510	-0.65	-0.66	-15.35	21.41	-2.09	9.61	-1.76
0.520	-0.55	-0.65	-15.63	21.35	-2.21	9.88	-1.81
0.530	-0.60	-0.50	-15.82	21.29	-2.27	10.10	-1.83
0.540	-0.63	-0.07	-15.87	21.23	-2.45	10.30	-1.89
0.550	-0.77	0.09	-15.88	21.16	-2.60	10.45	-1.91
0.560	-0.75	0.54	-15.97	21.10	-2.65	10.68	-1.94
0.570	-0.96	1.09	-16.06	20.99	-2.67	10.91	-1.99
0.580	-1.01	1.63	-16.23	20.89	-2.16	11.10	-2.05
0.590	-1.06	2.08	-16.41	20.78	-2.08	11.31	-2.10
0.600	-1.03	2.23	-16.56	20.66	-2.06	11.71	-2.12
0.610	-0.97	2.41	-16.77	20.55	-1.90	11.91	-2.15
0.620	-0.69	1.93	-16.86	20.44	-1.86	12.17	-2.19

HIGHEST 50-MS AVG. ACCEL.

	G'S	TIME (SEC)	
		START	END
LONG.	-3.43	0.025	0.075
LAT.	6.94	0.065	0.115

TEST ID ----- NETA-1
 TEST DATE ----- 11-18-97
 VEHICLE CLASS - 820C
 IMPACT SPEED -- 27.78 M/S

TIME (SEC)	(--- VEL. CG ACCEL.-(G'S) ---)	(-- VEL. REAR ACCEL.-(G'S) --)
	X Y Z R	X Y Z R
.000	.1 .0 .3 .3	-.3 .2 -.9 1.0
.010	-.3 .0 -.4 .5	.3 .3 1.6 1.7
.020	.2 .0 -1.2 1.3	.2 .4 .6 .8
.030	-3.4 .0 -8.7 9.3	1.4 .5 -.9 1.7
.040	-1.8 .0 2.0 2.7	.7 -1.1 1.0 1.6
.050	-.7 .0 7.4 7.4	3.0 .6 .9 3.1
.060	-.9 .0 -3.3 3.5	-3.2 2.0 .1 3.8
.070	.6 .0 4.6 4.7	-2.6 .1 -3.0 4.0
.080	1.4 .0 -.5 1.5	-.2 -1.0 -2.7 2.9
.090	.9 .0 2.0 2.2	-1.6 -.5 -6.5 6.7
.100	-.6 .0 1.2 1.4	-.5 .3 -.6 .8
.110	-6.2 .0 1.9 6.5	6.2 3.5 19.8 21.1
.120	-.4 .0 -2.7 2.7	-9.2 3.3 -11.2 14.9
.130	-.1 .0 -.9 .9	5.2 -4.3 -9.7 11.8
.140	.1 .0 3.0 3.0	-2.3 .0 11.3 11.5
.150	-1.6 .0 -.1 1.6	.9 -.8 -1.0 1.6
.160	-.2 .0 -.3 .3	1.7 -.5 -3.9 4.3
.170	-5.0 .0 -4.4 6.6	4.3 .3 12.6 13.3
.180	-3.5 .0 1.8 3.9	-.4 1.7 -13.0 13.1
.190	2.5 .0 -2.0 3.2	1.6 -.9 4.9 5.2
.200	-2.9 .0 2.1 3.5	6.4 -1.7 6.2 9.1
.210	-5.3 .0 -6.1 8.1	3.0 .0 -3.8 4.8
.220	-5.8 .0 1.1 5.9	.3 3.8 -13.1 13.7
.230	-4.2 .0 -3.4 5.4	8.4 6.6 -9.8 14.5
.240	-4.1 .0 -.2 4.1	3.0 1.3 .2 3.3
.250	-4.5 .0 -.4 4.5	3.1 5.4 -7.3 9.6
.260	-1.9 .0 3.5 4.0	-1.8 2.4 -8.4 8.9
.270	.1 .0 -3.5 3.5	-4.2 -1.2 .1 4.3
.280	-1.6 .0 3.0 3.4	-.8 .7 .0 1.0
.290	-1.5 .0 1.4 2.0	-1.2 -.7 -2.8 3.1
.300	-1.3 .0 1.3 1.8	1.4 3.7 9.2 10.0
.310	-4.2 .0 1.5 4.4	-4.4 24.4 -15.8 29.4
.320	.7 .0 -3.6 3.6	-5.5 22.7 .1 23.3
.330	-.6 .0 -.7 .9	-.2 3.7 39.2 39.4
.340	1.8 .0 .0 1.8	7.8 -4.2 11.2 14.3
.350	-1.6 .0 1.9 2.5	1.3 -.6 13.2 13.3
.360	.8 .0 .6 1.0	4.0 -.5 21.1 21.5
.370	.5 .0 .4 .6	2.5 .9 -3.1 4.1
.380	-.4 .0 -.8 .9	.2 -.5 -.3 .6
.390	-.1 .0 .5 .5	.3 -.8 5.2 5.3
.400	-.2 .0 .9 .9	1.4 .6 2.1 2.6

TIME (SEC)	(--- VEL. CG ACCEL. - (G'S) ---)	(--- VEL. REAR ACCEL. - (G'S) ---)
	X Y Z R	X Y Z R
.410	.2 .0 .7 .8	.4 .5 -1.7 1.8
.420	-.4 .0 -1.0 1.1	1.7 -.1 3.9 4.2
.430	-.7 .0 -.7 1.0	.8 1.0 5.0 5.1
.440	.7 .0 -1.6 1.8	-.7 -.7 -5.2 5.3
.450	-.3 .0 -.1 .3	-.4 -.3 -2.0 2.1
.460	-.9 .0 .1 1.0	-.6 .9 -.1 1.1
.470	-.3 .0 -.3 .4	.3 -.4 .2 .6
.480	-.1 .0 .0 .1	.1 -.4 -.1 .4
.490	.1 .0 .3 .3	-.7 .4 2.3 2.5
.500	-.2 .0 -.2 .3	-.4 .5 .2 .7
.510	.1 .0 -.8 .8	.8 -.1 2.7 2.8
.520	-.2 .0 -1.1 1.2	.2 -.4 2.9 3.0
.530	-.6 .0 -.6 .8	-.3 .4 -.1 .6
.540	-.6 .0 -.4 .7	1.1 .1 .5 1.2
.550	-.1 .0 .2 .2	.1 -.3 -.4 .5
.560	-.3 .0 .4 .5	-1.0 .6 1.6 2.0
.570	-.2 .0 .2 .3	.2 .3 .8 .9
.580	.0 .0 -.4 .4	1.1 -.2 .8 1.4
.590	-.2 .0 .7 .7	-.4 .1 .3 .5
.600	.0 .0 .0 .0	-.3 .4 1.0 1.1
.610	-.2 .0 .3 .4	.5 .0 1.5 1.6
.620	-.2 .0 .3 .4	-.1 .0 .8 .8
.630	-.1 .0 .1 .1	.0 .4 .8 1.0
.640	-.2 .0 .4 .4	.0 -.1 .5 .5
.650	-.3 .0 .1 .3	.3 -.1 1.2 1.2
.660	-.4 .0 -.6 .7	-.3 .3 .7 .8
.670	-.1 .0 .4 .4	-.1 .1 .6 .7
.680	.3 .0 1.3 1.4	.5 -.2 1.4 1.5
.690	-.1 .0 .0 .1	-.1 .2 .2 .3
.700	-.2 .0 -.3 .3	-.3 .1 1.1 1.2
.710	-.1 .0 .5 .5	-.3 .0 .3 .4
.720	-.3 .0 .3 .4	.1 .0 .6 .6
.730	-.2 .0 .1 .2	.3 .1 1.0 1.1
.740	-.3 .0 .3 .4	.0 .2 .7 .7
.750	-.2 .0 .4 .4	-.1 .1 .7 .7
.760	-.1 .0 .2 .2	.0 .3 .9 .9
.770	-.2 .0 .3 .4	.2 .4 .7 .8
.780	-.1 .0 .2 .2	-.1 .1 .9 .9
.790	-.2 .0 .0 .2	-.1 .1 .8 .8
.800	-.3 .0 .3 .4	.2 .3 .7 .8
.810	-.3 .0 .2 .3	.0 .3 .5 .6
.820	-.3 .0 .3 .4	.1 .3 .8 .8
.830	-.3 .0 .3 .4	.1 .3 .5 .6
.840	-.8 .0 -1.1 1.4	.0 .2 .1 .2

TIME (SEC)	VEL. X	CG Y	ACCEL. Z	-(G'S) R	VEL. X	REAR Y	ACCEL. Z	-(G'S) R
.850	-1.0	.0	-1.5	1.9	.3	.4	.5	.7
.860	-.3	.0	-.7	.8	.3	.7	-.2	.8
.870	-.4	.0	-.5	.6	.2	.5	.3	.6
.880	-.8	.0	-.1	.8	.6	.8	4.0	4.1
.890	-.6	.0	-.5	.7	.8	.9	-2.1	2.4
.900	-.7	.0	-.3	.7	.6	-.4	.6	.9
.910	-.6	.0	.0	.6	.1	.4	1.1	1.2
.920	-.1	.0	-.5	.5	-.4	.8	.3	.9
.930	-1.5	.0	-1.1	1.8	1.0	.9	-.6	1.5
.940	-1.3	.0	-3.5	3.8	1.7	-.4	3.3	3.7
.950	-.6	.0	-.3	.7	-.2	.0	1.3	1.3
.960	.5	.0	-1.6	1.6	.3	1.0	1.9	2.1
.970	-.8	.0	-.3	.8	.3	-.2	-.5	.6
.980	.3	.0	-1.3	1.3	.2	-1.0	1.2	1.6
.990	-1.0	.0	-.6	1.2	.3	.6	.6	.9

MAXIMUM VALUES AND TIME OF OCCURANCE

	X----	SEC	Y----	SEC	Z----	SEC	R----	SEC
- VEL. CG ACCEL.-(G'S)	-8.1	.228	.0	1.000	-15.8	.046	16.8	.046
VEL. REAR ACCEL.-(G'S)	-32.1	.332	30.1	.322	41.1	.330	43.3	.329

TEST ID ----- NETC-1
 TEST DATE ----- 11-18-96
 VEHICLE CLASS - 820C
 IMPACT SPEED -- 27.78 M/S

TIME (S)	----- ACCELERATION- (G'S) -----				INSTRUMENT PANEL
	ENGINE TOP	BLOCK BOTTOM	DISK BRAKE CALIPERS RIGHT	DISK BRAKE CALIPERS LEFT	
.000	-.2	.1	1.1	3.0	.0
.010	-.1	.4	.4	-1.4	.0
.020	-.3	.3	.0	.1	.0
.030	-.3	.4	1.6	15.6	.0
.040	-.6	.8	-1.5	72.2	.0
.050	-5.2	-6.1	1.6	-38.7	.0
.060	-2.2	-10.2	-1.8	32.7	.0
.070	-2.2	-4.2	-7.8	8.3	.0
.080	.9	1.7	-4.5	-11.1	.0
.090	1.5	4.4	-4.2	-1.1	.0
.100	.6	4.3	1.1	5.6	.0
.110	.8	2.8	.5	6.3	.0
.120	-.2	.8	2.9	13.7	.0
.130	-3.1	-1.4	.8	.9	.0
.140	-1.4	-.5	-.6	-.6	.0
.150	.3	1.2	-1.5	-3.3	.0
.160	.5	1.7	-2.2	1.3	.0
.170	1.7	2.3	-25.2	15.5	.0
.180	1.3	.6	46.9	-7.3	.0
.190	.4	-3.6	40.1	-18.7	.0
.200	-3.6	-6.2	-.7	52.7	.0
.210	-2.9	-3.5	30.1	-2.9	.0
.220	-5.0	2.7	5.7	2.2	.0
.230	-11.1	-3.3	7.8	2.5	.0
.240	-3.6	-3.1	6.8	-5.5	.0
.250	-1.2	1.9	-2.0	-5.3	.0
.260	-3.2	-.4	-2.7	3.8	.0
.270	-5.0	-1.4	2.3	4.4	.0
.280	-2.5	.3	1.5	4.2	.0
.290	-.6	2.0	-8.3	4.7	.0
.300	.0	2.1	-5.5	4.6	.0
.310	-.2	3.4	-2.0	1.9	.0
.320	-5.6	1.5	-1.6	5.1	.0
.330	-4.0	1.2	-8.2	4.0	.0
.340	-2.4	-1.0	-3.5	-1.4	.0
.350	.4	-1.3	1.4	-10.8	.0

----- ACCELERATION- (G'S) -----					
TIME (S)	ENGIN TOP	BLOCK BOTTOM	DISK BRAKE CALIPERS		INSTRUMENT PANEL
			RIGHT	LEFT	
.360	2.2	1.0	6.6	-1.5	.0
.370	3.6	3.9	4.3	1.9	.0
.380	1.5	1.7	2.2	2.4	.0
.390	-.4	-.4	-.4	.7	.0
.400	-2.8	-1.7	2.2	.9	.0
.410	-.6	.9	.4	-.6	.0
.420	-.6	.5	-1.7	-14.5	.0
.430	-.7	1.8	.0	-4.3	.0
.440	-1.3	.3	.7	-6.5	.0
.450	-.3	-.3	.5	-115.4	.0
.460	.6	-2.0	.3	-117.7	.0
.470	-.2	-1.7	1.0	-117.7	.0
.480	-1.7	-1.3	.7	-117.6	.0
.490	-1.3	-.4	.1	-117.5	.0
.500	-.8	.1	-.1	-117.4	.0
.510	-.2	.3	.4	-117.2	.0
.520	-.5	-.6	-.1	-117.1	.0
.530	-.2	.0	.5	-117.1	.0
.540	-.2	.5	.2	-117.1	.0
.550	-.4	-.3	.6	-116.9	.0
.560	-.6	-.8	-.1	-116.8	.0
.570	-.9	.0	-.5	-116.8	.0
.580	-.5	.5	1.1	-116.8	.0
.590	.0	.8	.3	-116.8	.0
.600	.1	.5	.3	-116.7	.0
.610	-.4	.3	.3	-116.7	.0
.620	-.7	.3	.3	-116.6	.0
.630	-.5	.4	.2	-116.5	.0
.640	-.2	.8	.8	-116.5	.0
.650	-.2	.8	.6	-116.5	.0
.660	.0	1.0	.0	-116.2	.0
.670	.0	.6	.2	-116.2	.0
.680	-.6	.8	1.1	-116.3	.0
.690	-.8	.0	.5	-116.4	.0
.700	-.4	.4	.3	-116.4	.0
.710	.0	1.1	.6	-116.5	.0
.720	.2	1.5	.5	-116.6	.0
.730	.1	1.5	.7	-116.6	.0
.740	.0	1.2	.7	-116.7	.0
.750	-.3	1.1	.8	-116.8	.0
.760	-.5	.9	.7	-116.8	.0
.770	-.4	.8	.7	-116.7	.0
.780	-.2	.9	.8	-116.6	.0
.790	-.2	1.0	.5	-116.6	.0
.800	-.3	.9	.4	-116.6	.0

	----- ACCELERATION- (G'S) -----				
			DISK BRAKE		
TIME	ENGIN	BLOCK	CALIPERS		INSTRUMENT
(S)	TOP	BOTTOM	RIGHT	LEFT	PANEL
-----	-----	-----	-----	-----	-----
.810	-.4	.7	.6	-116.6	.0
.820	-.4	.7	.6	-116.6	.0
.830	-.3	.9	.8	-116.6	.0
.840	-.3	.9	-.6	-116.5	.0
.850	-.1	1.0	1.1	-116.6	.0
.860	-.6	.5	.9	-116.6	.0
.870	-1.6	-1.2	1.5	-116.6	.0
.880	-1.6	-1.1	.8	-116.6	.0
.890	-1.2	-.9	.7	-116.6	.0
.900	-.3	-.1	1.0	-116.6	.0
.910	-.2	.1	.6	-116.6	.0
.920	-.2	.3	-.6	-116.6	.0
.930	-2.1	-3.8	.2	-116.7	.0
.940	-.9	-2.5	-2.3	-116.7	.0
.950	.2	-1.4	-1.1	-116.7	.0
.960	-1.1	-.2	-3.3	-116.7	.0
.970	-1.1	.3	-3.1	-116.7	.0
.980	-1.0	-.8	-8.0	-116.7	.0
.990	-.1	-1.1	-3.4	-116.8	.0

APPENDIX C - POST NO. 7 ACCELEROMETER DATA

ACCELEROMETER DATA -TEST NETC-1			
		POST 7	POST 7
		TOP	BOTTOM
TIME	ACCEL	ACCEL	ACCEL
(SEC)	(G'S)	(G'S)	(G'S)
0.000	0.00	0.02	
0.001	-0.05	-0.05	
0.002	0.14	-0.06	
0.003	-0.10	-0.06	
0.004	-0.06	-0.06	
0.005	0.03	-0.05	
0.006	-0.05	-0.05	
0.007	0.04	-0.05	
0.008	0.17	-0.03	
0.009	-0.12	-0.05	
0.010	0.04	-0.05	
0.011	-0.06	-0.06	
0.012	-0.01	-0.05	
0.013	0.00	-0.06	
0.014	-0.12	-0.05	
0.015	0.04	-0.05	
0.016	0.05	-0.05	
0.017	0.04	-0.03	
0.018	-0.09	-0.03	
0.019	0.12	-0.05	
0.020	-0.06	-0.03	
0.021	-0.03	-0.06	
0.022	-0.35	-0.06	
0.023	0.53	-0.05	
0.024	0.16	-0.06	
0.025	0.22	-0.05	
0.026	-0.30	-0.05	
0.027	0.25	-0.03	
0.028	-0.18	-0.03	
0.029	-0.17	-0.03	
0.030	-0.10	-0.05	
0.031	0.80	-0.05	
0.032	-0.43	-0.06	
0.033	-1.54	-0.06	
0.034	-0.65	-0.06	
0.035	-0.35	-0.08	
0.036	0.16	-0.06	
0.037	-0.06	-0.05	
0.038	-0.14	-0.05	
0.039	-0.31	-0.05	
0.040	-0.12	-0.05	
0.041	-0.14	-0.06	
0.042	0.49	-0.06	

	0.043	-0.03	-0.06		
	0.044	0.06	-0.06		
	0.045	0.22	-0.05		
	0.046	-0.26	-0.05		
	0.047	-0.45	-0.05		
	0.048	0.03	-0.05		
	0.049	-0.18	-0.03		
	0.050	0.25	-0.03		
	0.051	-0.21	-0.03		
	0.052	-0.47	-0.03		
	0.053	0.08	-0.03		
	0.054	-0.04	-0.03		
	0.055	-0.04	-0.05		
	0.056	0.30	-0.05		
	0.057	-0.22	-0.06		
	0.058	-0.47	-0.05		
	0.059	0.21	-0.06		
	0.060	-0.44	-0.06		
	0.061	-0.05	-0.08		
	0.062	0.49	-0.06		
	0.063	-0.22	-0.08		
	0.064	0.14	-0.06		
	0.065	0.04	-0.05		
	0.066	-0.14	-0.05		
	0.067	-0.04	-0.05		
	0.068	0.45	-0.05		
	0.069	-0.35	-0.05		
	0.070	-0.91	-0.03		
	0.071	0.12	-0.02		
	0.072	0.22	-0.02		
	0.073	0.05	-0.03		
	0.074	0.00	-0.02		
	0.075	-0.36	-0.03		
	0.076	0.25	-0.05		
	0.077	-0.29	-0.05		
	0.078	-0.43	-0.05		
	0.079	0.36	-0.06		
	0.080	0.10	-0.06		
	0.081	0.32	-0.05		
	0.082	-0.31	-0.05		
	0.083	-0.09	-0.06		
	0.084	-0.17	-0.08		
	0.085	0.16	-0.06		
	0.086	-0.09	-0.06		
	0.087	0.27	-0.06		
	0.088	-0.31	-0.05		
	0.089	0.12	-0.03		
	0.090	0.04	-0.06		
	0.091	-0.08	-0.06		
	0.092	-0.18	-0.05		
	0.093	0.25	-0.03		

	0.094	0.10	-0.03		
	0.095	0.40	-0.02		
	0.096	0.00	-0.03		
	0.097	0.19	-0.03		
	0.098	-0.30	-0.05		
	0.099	0.31	-0.05		
	0.100	-0.08	-0.05		
	0.101	-0.16	-0.06		
	0.102	-0.01	-0.06		
	0.103	-0.14	-0.08		
	0.104	0.62	-0.06		
	0.105	0.25	-0.05		
	0.106	0.29	-0.05		
	0.107	-0.10	-0.05		
	0.108	0.00	-0.03		
	0.109	-0.43	-0.05		
	0.110	-0.40	-0.05		
	0.111	-0.52	-0.03		
	0.112	-3.46	-0.06		
	0.113	-1.44	-0.08		
	0.114	0.06	-0.06		
	0.115	-0.44	-0.03		
	0.116	-1.21	-0.02		
	0.117	-0.04	-0.03		
	0.118	0.54	-0.06		
	0.119	-0.30	-0.03		
	0.120	-0.18	-0.05		
	0.121	0.30	-0.05		
	0.122	-0.57	-0.05		
	0.123	0.06	-0.08		
	0.124	0.19	-0.08		
	0.125	-0.38	-0.09		
	0.126	0.60	0.03		
	0.127	1.59	0.54		
	0.128	4.61	1.39		
	0.129	3.68	1.94		
	0.130	5.82	2.05		
	0.131	5.81	4.21		
	0.132	13.19	6.63		
	0.133	10.89	7.45		
	0.134	12.08	6.01		
	0.135	3.10	4.26		
	0.136	-3.76	3.21		
	0.137	19.63	3.19		
	0.138	-5.53	0.45		
	0.139	-17.61	-1.62		
	0.140	-21.47	-5.15		
	0.141	-14.59	-6.28		
	0.142	-19.13	-8.62		
	0.143	0.09	-7.23		
	0.144	-3.72	-8.53		

	0.145	-26.54	-8.66		
	0.146	-26.54	-9.05		
	0.147	-26.54	-7.25		
	0.148	26.53	-5.01		
	0.149	26.53	-0.65		
	0.150	20.37	1.79		
	0.151	-14.14	4.56		
	0.152	-26.54	6.12		
	0.153	-0.89	6.83		
	0.154	10.39	8.57		
	0.155	-3.20	6.98		
	0.156	26.53	7.18		
	0.157	-18.62	6.35		
	0.158	-17.49	4.58		
	0.159	-26.54	1.99		
	0.160	-26.54	-0.76		
	0.161	-13.54	-3.92		
	0.162	26.53	-5.57		
	0.163	0.76	-7.42		
	0.164	17.83	-6.20		
	0.165	26.53	-6.55		
	0.166	-19.23	-6.49		
	0.167	-19.18	-7.65		
	0.168	26.53	-6.24		
	0.169	15.01	-5.44		
	0.170	3.52	-1.26		
	0.171	-26.54	2.98		
	0.172	1.17	1.74		
	0.173	1.21	-0.25		
	0.174	-6.44	-0.82		
	0.175	8.59	1.50		
	0.176	-26.54	1.43		
	0.177	10.55	1.54		
	0.178	18.88	-0.88		
	0.179	-6.62	0.43		
	0.180	-26.54	-0.52		
	0.181	26.53	1.74		
	0.182	-8.02	2.31		
	0.183	-9.84	2.48		
	0.184	-7.76	3.04		
	0.185	26.53	4.16		
	0.186	22.22	5.75		
	0.187	15.98	6.17		
	0.188	0.40	4.92		
	0.189	3.68	2.02		
	0.190	-20.90	1.17		
	0.191	6.58	1.34		
	0.192	20.76	-0.11		
	0.193	-1.65	0.37		
	0.194	-5.30	0.15		
	0.195	4.85	0.82		

	0.196	-23.14	-0.93		
	0.197	-9.60	-2.02		
	0.198	2.99	-1.37		
	0.199	1.36	-0.88		
	0.200	-7.44	-1.00		
	0.201	-7.33	-0.76		
	0.202	6.56	0.00		
	0.203	-4.63	0.12		
	0.204	3.72	1.70		
	0.205	10.02	2.78		
	0.206	6.82	1.88		
	0.207	26.53	4.75		
	0.208	-3.94	3.11		
	0.209	-8.53	1.11		
	0.210	-22.13	-1.33		
	0.211	0.83	-4.78		
	0.212	-3.16	-3.73		
	0.213	0.91	-4.50		
	0.214	-11.33	-4.95		
	0.215	-26.54	-4.02		
	0.216	26.53	-4.95		
	0.217	-25.63	-3.52		
	0.218	-10.44	-2.39		
	0.219	26.53	-1.19		
	0.220	26.53	-0.56		
	0.221	26.53	-1.14		
	0.222	26.53	-1.73		
	0.223	24.75	-1.09		
	0.224	23.42	-1.30		
	0.225	-26.54	-1.03		
	0.226	26.53	-2.81		
	0.227	-3.06	-1.40		
	0.228	26.53	0.19		
	0.229	-4.85	1.80		
	0.230	19.33	1.28		
	0.231	-18.45	1.13		
	0.232	26.53	0.42		
	0.233	-26.54	1.42		
	0.234	11.77	0.42		
	0.235	-3.14	1.59		
	0.236	9.80	1.67		
	0.237	-26.54	3.07		
	0.238	22.04	2.11		
	0.239	-1.70	1.94		
	0.240	26.53	2.02		
	0.241	10.00	2.42		
	0.242	-9.80	2.90		
	0.243	4.09	1.94		
	0.244	11.13	2.16		
	0.245	2.13	1.83		
	0.246	23.20	1.39		

	0.247	-3.27	1.19		
	0.248	-1.49	0.96		
	0.249	10.60	0.71		
	0.250	9.38	-0.68		
	0.251	5.88	-1.22		
	0.252	3.91	-0.89		
	0.253	-4.95	-1.36		
	0.254	-0.22	-2.13		
	0.255	-1.44	-2.05		
	0.256	-0.56	-1.63		
	0.257	-0.47	-1.62		
	0.258	-8.11	-2.56		
	0.259	-4.37	-2.45		
	0.260	-1.53	-1.67		
	0.261	-3.93	-1.02		
	0.262	-0.65	-1.13		
	0.263	7.43	-1.11		
	0.264	-1.46	-0.85		
	0.265	2.81	-0.69		
	0.266	-2.89	-0.65		
	0.267	-6.97	-0.17		
	0.268	0.53	0.35		
	0.269	3.90	0.85		
	0.270	4.78	0.91		
	0.271	8.63	1.26		
	0.272	0.95	1.34		
	0.273	5.26	1.43		
	0.274	13.81	1.17		
	0.275	0.45	1.70		
	0.276	-7.24	1.71		
	0.277	-6.74	1.37		
	0.278	1.21	0.68		
	0.279	3.20	0.32		
	0.280	1.21	0.17		
	0.281	-1.11	0.59		
	0.282	-3.90	0.46		
	0.283	1.00	0.37		
	0.284	0.89	0.19		
	0.285	-3.69	-0.37		
	0.286	0.40	-0.76		
	0.287	-13.49	-0.99		
	0.288	0.18	-0.69		
	0.289	-15.03	-0.99		
	0.290	-10.94	-1.33		
	0.291	-14.57	-1.56		
	0.292	4.39	-1.42		
	0.293	8.82	-1.03		
	0.294	1.72	-0.76		
	0.295	-1.76	-0.20		
	0.296	3.84	0.49		
	0.297	2.73	0.51		

0.298	0.92	0.20	
0.299	2.88	0.35	
0.300	-3.97	0.60	
0.301	-4.60	0.11	
0.302	-5.46	-0.93	
0.303	-1.70	-0.77	
0.304	-3.21	-0.03	
0.305	1.35	0.34	
0.306	1.96	0.28	
0.307	1.45	0.05	
0.308	-2.06	0.08	
0.309	3.58	0.31	
0.310	0.40	0.12	
0.311	4.68	0.25	
0.312	-2.40	0.60	
0.313	5.13	0.40	
0.314	-7.76	-0.19	
0.315	-1.67	-0.46	
0.316	-1.37	-0.54	
0.317	0.48	-0.29	
0.318	3.33	0.12	
0.319	7.52	0.57	
0.320	6.80	0.48	
0.321	1.23	0.09	
0.322	9.21	-0.23	
0.323	9.99	-0.15	
0.324	-0.84	-0.12	
0.325	-1.70	-0.05	
0.326	7.31	0.02	
0.327	-3.54	0.11	
0.328	7.92	0.09	
0.329	3.11	-0.12	
0.330	8.77	-0.12	
0.331	-2.48	0.09	
0.332	2.72	0.23	
0.333	2.86	-0.31	
0.334	-1.54	-0.63	
0.335	-0.66	-0.62	
0.336	0.44	-0.77	
0.337	-6.58	-1.00	
0.338	-4.35	-0.80	
0.339	-2.89	-0.56	
0.340	-2.77	-0.45	
0.341	0.41	0.08	
0.342	0.52	0.39	
0.343	-2.35	0.35	
0.344	3.76	0.39	
0.345	-2.24	0.60	
0.346	0.75	0.60	
0.347	1.78	0.66	
0.348	-0.67	0.66	

	0.349	-3.07	0.62		
	0.350	-0.05	0.35		
	0.351	0.12	0.11		
	0.352	1.39	-0.06		
	0.353	0.44	-0.34		
	0.354	2.53	-0.35		
	0.355	3.37	-0.23		
	0.356	-1.30	-0.08		
	0.357	-1.08	-0.12		
	0.358	-1.33	-0.28		
	0.359	0.73	-0.39		
	0.360	0.22	-0.45		
	0.361	1.44	-0.39		
	0.362	-0.26	-0.32		
	0.363	1.50	-0.32		
	0.364	0.78	-0.22		
	0.365	-1.45	-0.14		
	0.366	-0.16	-0.14		
	0.367	-0.12	0.00		
	0.368	1.35	-0.02		
	0.369	-1.19	-0.09		
	0.370	0.13	-0.06		
	0.371	0.87	-0.02		
	0.372	1.78	-0.05		
	0.373	2.28	-0.08		
	0.374	1.10	0.12		
	0.375	0.06	0.34		
	0.376	-1.04	0.14		
	0.377	-0.35	0.00		
	0.378	-0.04	0.03		
	0.379	0.18	0.14		
	0.380	1.75	0.31		
	0.381	-0.65	0.40		
	0.382	-2.58	0.32		
	0.383	1.35	0.20		
	0.384	-1.23	-0.03		
	0.385	1.74	-0.35		
	0.386	0.32	-0.39		
	0.387	1.06	-0.28		
	0.388	-0.76	-0.32		
	0.389	1.57	-0.40		
	0.390	-0.51	-0.25		
	0.391	1.26	-0.02		
	0.392	-2.05	-0.09		
	0.393	1.72	-0.17		
	0.394	1.50	-0.05		
	0.395	1.46	0.09		
	0.396	-1.33	0.06		
	0.397	-0.52	-0.06		
	0.398	-0.76	-0.15		
	0.399	-0.83	-0.11		

0.400	-0.75	-0.15	
0.401	-2.02	-0.22	
0.402	0.31	-0.17	
0.403	-0.58	-0.11	
0.404	1.89	0.02	
0.405	-0.93	0.15	
0.406	0.31	0.05	
0.407	0.26	-0.15	
0.408	-1.00	-0.19	
0.409	0.09	0.06	
0.410	1.30	0.31	
0.411	0.73	0.28	
0.412	1.13	0.22	
0.413	-0.65	0.20	
0.414	0.83	0.08	
0.415	0.17	-0.08	
0.416	1.02	-0.02	
0.417	-0.32	0.15	
0.418	1.01	0.11	
0.419	-1.63	-0.02	
0.420	0.12	-0.29	
0.421	-0.34	-0.52	
0.422	-0.86	-0.56	
0.423	-0.80	-0.48	
0.424	-1.14	-0.42	
0.425	1.65	-0.31	
0.426	1.49	-0.11	
0.427	-1.01	-0.06	
0.428	0.04	-0.02	
0.429	0.00	0.02	
0.430	1.83	0.11	
0.431	0.58	0.20	
0.432	-0.69	0.14	
0.433	-0.08	0.08	
0.434	0.26	0.05	
0.435	0.16	0.06	
0.436	-0.67	0.06	
0.437	-1.10	-0.02	
0.438	-0.66	-0.11	
0.439	0.87	-0.06	
0.440	0.66	0.02	
0.441	-0.54	0.06	
0.442	-0.60	0.06	
0.443	0.25	0.06	
0.444	-0.57	0.02	
0.445	-0.43	0.02	
0.446	-0.92	0.00	
0.447	0.58	0.03	
0.448	-0.41	0.00	
0.449	0.31	-0.14	
0.450	-0.08	-0.15	

	0.451	-2.01	-0.17		
	0.452	1.00	-0.25		
	0.453	-0.39	-0.26		
	0.454	-0.65	-0.20		
	0.455	-0.96	-0.17		
	0.456	-0.44	-0.29		
	0.457	0.45	-0.28		
	0.458	-0.84	-0.14		
	0.459	-0.36	-0.11		
	0.460	1.22	-0.05		
	0.461	-0.14	0.12		
	0.462	0.78	0.17		
	0.463	-0.01	0.14		
	0.464	0.19	0.17		
	0.465	0.06	0.17		
	0.466	0.96	0.09		
	0.467	0.21	0.14		
	0.468	-0.79	0.14		
	0.469	-0.62	-0.03		
	0.470	0.32	-0.22		
	0.471	0.48	-0.14		
	0.472	0.69	-0.02		
	0.473	-0.34	-0.08		
	0.474	-1.27	-0.11		
	0.475	0.25	-0.12		
	0.476	0.36	-0.06		
	0.477	0.03	0.12		
	0.478	0.19	0.15		
	0.479	1.31	0.02		
	0.480	0.05	-0.08		
	0.481	0.39	-0.08		
	0.482	-0.95	-0.20		
	0.483	-1.23	-0.37		
	0.484	-0.58	-0.35		
	0.485	1.02	-0.25		
	0.486	-0.69	-0.14		
	0.487	-0.41	-0.11		
	0.488	0.09	-0.11		
	0.489	0.45	-0.11		
	0.490	-1.13	-0.06		
	0.491	0.41	0.00		
	0.492	1.75	0.11		
	0.493	1.18	0.12		
	0.494	0.10	0.09		
	0.495	-1.21	0.15		
	0.496	1.09	0.25		
	0.497	-0.66	0.17		
	0.498	-0.21	0.03		
	0.499	-0.29	0.00		
	0.500	-0.75	0.03		

