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EVT 37-88

TRANSPORTABILITY TESTING OF THE ARMY TACTICAL MISSILE SYSTEM (ATACMS)

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EVALUATION DIVISION
SAVANNA, ILLINOIS 61074-9639

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The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been tasked by the U.S. Army Missile Command (MICOM), AMCPM-AT-T, Redstone Arsenal, AL to test the Army Tactical Missile System (ATACMS) in various shipping configurations and modes. Shipping configurations consisted of: six equivalent mass missiles blocked and braced in a boxcar; four mass equivalent missiles in a Military Van (MILVAN) secured to a load and roll pallet (LRP) with commercial web straps; four inert missiles secured to a flatrack with metal strap; and four secured to a military M871 semitrailer with nuclear straps. Containerized modes of transportation were subjected to rail, road, and Shipboard Transportation Simulator (STS) tests. Accelerometer data was recorded for all rail impact tests, the road hazard course, and the washboard course.

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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
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REPORT NO. EVT 37-88

TRANSPORTABILITY TESTING OF THE

ARMY TACTICAL MISSILE SYSTEM (ATACMS)

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been tasked by the U.S. Army Missile Command (MICOM), AMCPM-AT-T, Redstone Arsenal, AL to test the Army Tactical Missile System (ATACMS) in various shipping configurations and modes. Shipping configurations consisted of: six equivalent mass missiles blocked and braced in a boxcar; four mass equivalent missiles in a Military Van (MILVAN) secured to a load and roll pallet (LRP) with commercial web straps; four inert missiles secured to a flatrack with metal strap; and four secured to a military M871 semitrailer with nuclear straps. Containerized modes of transportation were subjected to rail, road, and Shipboard Transportation Simulator (STS) tests. Accelerometer data was recorded for all rail impact tests, the road hazard course, and the washboard course.

B. AUTHORITY. This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to determine if the outloading procedures developed for the ATACMS provided suitable protection in a road, rail, and ship transportation environment. The tests performed on different ATACMS shipping configurations were: Rail Impact Test, Road Hazard Course, Road Trip, and Washboard Course.

D. CONCLUSIONS. All test configurations (boxcar, MILVAN, flatrack, and M871 semitrailer) passed the rail, road (hazard, trip, and washboard), and STS tests.

E. RECOMMENDATIONS. It is recommended that all outloading procedures be adopted for shipping ATACMS as follows: in a boxcar; LRP stowed inside a MILVAN for transportation on Trailer-on-flatcar (TOFC), semitrailer and ship; on a flatrack for transportation on TOFC, semitrailer and ship; and on an M871 tactical trailer secured with web straps. The outloading test procedures contained in this report were used for testing purposes and are not the final approved outloading procedures. They are not to be used for outloading.

PART 2

ATTENDEES

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PART 3

TEST PROCEDURES

A. RAIL IMPACT TEST. The test load or vehicle should be positioned in/on a railcar. For containers, the loaded container shall be positioned on a container chassis and securely locked in place using the twist locks at each corner. The container chassis shall be secured to a railcar. Equipment needed to perform the test includes the specimen (hammer) car, five empty railroad cars connected together to serve as the anvil, and a railroad locomotive. These anvil cars are positioned on a level section of track with air and hand brakes set and with the draft gear compressed. The locomotive unit pulls the specimen car several hundred yards away from the anvil cars, then pushes the specimen car toward the anvil at a predetermined speed, disconnects from the specimen car about 50 yards away from the anvil cars, and allows the specimen car to roll freely along the track until it strikes the anvil. This constitutes an impact. Impacting is accomplished at speeds of 4, 6, and 8 miles per hour (mph) in one direction and at a speed of 8 mph in the opposite direction. The 4 and 6 mph impact speeds are approximate; the 8 mph speed is a minimum. Impact speeds are to be determined by using an electronic counter to measure the time required for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars.

B. HAZARD COURSE. The specimen being tested will be subjected to the road hazard course. Using a suitable truck/tractor or tactical vehicle, the vehicle/specimen of test method No. 1 shall be towed/driven over a hazard course two times at a speed of approximately 5 mph. The speed may be increased or decreased, as appropriate, to produce the most violent load response.

C. ROAD TRIP. Using a suitable truck/tractor and trailer, or tactical

vehicle, the tactical vehicle/specimen load shall be driven/towed for a total distance of at least 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. Test route shall include curves, corners, railroad crossings, cattle guards, stops, and starts. The test vehicle shall travel at the maximum speed suitable for the particular road being traversed, except as limited by legal restrictions. This step provides for the tactical vehicle/specimen load to be subjected to three full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph, while the stop in the reverse direction is of approximately 5 mph.

D. WASHBOARD COURSE. Using a suitable truck/tractor, and/or tactical vehicle, the specimen shall be driven/towed over the washboard course at a speed which produces the most violent response in the particular test load (as indicated by the resonant frequency of the suspension system beneath the load).

E. SHIPBOARD TRANSPORTATION SIMULATOR. The test load (specimen) shall be positioned on the STS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instruction, the STS shall be started oscillating at an amplitude of 30 degrees plus or minus 2 degrees, either side of center and a frequency of 2 cycles-per-minute (30 seconds plus 2 seconds total roll period). This frequency shall be observed for apparent defects that could cause a safety hazard. The frequency of oscillation shall then be increased to 4 cycles-per-minute (15 seconds plus 1 second roll period), and the apparatus operated for two hours. If an inspection of the load does not indicate an impending failure, the frequency of oscillation shall be further increased to 5 cycles-per-minute (12 second plus 1 second cycle time), and the apparatus operated for four hours. The operation does not necessarily have to be continuous; however, no

change or adjustments to the load or load restraints shall be permitted at any time during the test. After once being set in place, the test load (specimen) shall not be removed from the apparatus until the test has been completed or is terminated.

PART 4

TEST RESULTS

RAIL IMPACT TEST

TEST NO. 1 DATE: 30 MAY 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 channels of instrumentation.

TEST CAR NO: RBOX 40247	LT. WT.	63,100	POUNDS
LADING AND DUNNAGE	WT.	32,000	POUNDS
TOTAL SPECIMEN	WT.	95,100	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	3.96	Impact end moved 3/16 inch. Middle rack moved 3/4 inch. Far end moved 1 inch.
2	Forward	6.45	Impact end moved 9/16 inch which broke the 2 x 6 vertical support at the end of the rubber skid. Center pods moved 2-5/8 inches and completely broke off the 2 x 6 vertical supports on the impact end of the center pods. Rear end of load shifted 2-5/8 inch. LOAD FAILED.

RAIL IMPACT TEST

TEST NO. 2 DATE: 31 May 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 channels of instrumentation and with doubled 2 x 6 vertical supports.

TEST CAR NO: RBOX 40247	LT. WT.	63,100	POUNDS
LADING AND DUNNAGE	WT.	32,000	POUNDS
TOTAL SPECIMEN	WT.	95,100	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.65	Impact end moved [illegible] inch. Middle pod moved 1-1/4 inches. Gap at forward end 1-1/2 inches. At impact end and at first gate, the steel under the rubber skids cut into the 2 x 6 verticals. The end gate at the impact end resulted in the steel cutting and fracturing the first 2 x 6 it contacted. FAILURE.
2	Forward	4.50	Impact end moved 3/4 inch. Middle moved 1 inch. End moved two inches. Second impact increased penetration of the steel on rubber skid into the wood. FAILURE.

RAIL IMPACT TEST

TEST NO: 3 DATE: 07 JUNE 1989

TEST SPECIMEN: ATACMS in a boxcar with 12 instrumentation channels. Braced load with triangle piece of plywood at steel angle.

TEST CAR NO: RBOX 40247	LT. WT.	63,100	POUNDS
LADING AND DUNNAGE	WT.	32,000	POUNDS
TOTAL SPECIMEN	WT.	95,100	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.26	Load moved one inch breaking through triangle piece of plywood. Cut 3/8 inch into plywood.
2	Forward	6.41	Rear pod moved 3/4 inch. Angle cut into plywood. FAILED.

RAIL IMPACT TEST

TEST NO: 4 DATE: 13 JUNE 1989

TEST SPECIMEN: ATACMS in a boxcar with dunnage full height of 2 layers and has a hardwood piece of dunnage against the rubber skids and steel angles.

TEST CAR NO: RBOX 40247	LT. WT.	63,100	POUNDS
LADING AND DUNNAGE	WT.	32,000	POUNDS
TOTAL SPECIMEN	WT.	95,100	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.41	Middle moved 3/8 inch. Impact end moved 1/8 inch. Tended hardwood dunnage approx 1/32 inch.
2	Forward	6.43	Middle moved 1/8 inch. Impact end dented hardwood 1/16 inch.
3	Forward	8.52	No Change.
4	Reverse	8.33	Moved 3/4 inch at center. Moved one inch at impact end. Measured 1/16 inch into hard wood at end impacted at 4, 6, and 8 mph.

RESULTS FROM THE RAIL IMPACT TEST OF THE ATACMS
DATE: 13 JUNE 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-1.99	71.93	.0830
IMPACT 2	6.43	-2.10	57.07	.0789
IMPACT 3	8.52	-3.12	48.25	.1095
IMPACT 4 (REVERSE)	8.33	-6.00	24.21	.0842

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.16	18.73	.0018
IMPACT 2	6.43	-.15	15.04	.0015
IMPACT 3	8.52	-.17	21.51	.0019
IMPACT 4 (REVERSE)	8.33	-.92	20.64	.0151

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.56	17.63	.0054
IMPACT 2	6.43	.70	14.83	.0048
IMPACT 3	8.52	1.27	17.09	.0052
IMPACT 4 (REVERSE)	8.33	-3.25	29.15	.0587

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-2.08	61.08	.0809
IMPACT 2	6.43	-2.28	60.58	.0888
IMPACT 3	8.52	-3.23	47.42	.1104
IMPACT 4 (REVERSE)	8.33	3.66	36.02	.0920

TAPE CHANNEL 5 : LATERAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	*****	*****	*****
IMPACT 2	6.43	-.02	28.92	.0004
IMPACT 3	8.52	-.02	26.91	.0002
IMPACT 4 (REVERSE)	8.33	.55	37.32	.0128

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.41	152293.45	65.45	6651.00
IMPACT 2	6.43	210357.91	54.41	7095.99
IMPACT 3	8.52	256711.25	55.83	9281.65
IMPACT 4 (REVERSE)	8.33	211641.78	48.95	8617.17

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON CENTER BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.59	24.85	.0116
IMPACT 2	6.43	-.15	34.56	.0031
IMPACT 3	8.52	-.10	27.84	.0015
IMPACT 4 (REVERSE)	8.33	-.08	23.96	.0014

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-1.99	62.24	.0786
IMPACT 2	6.43	-2.17	57.29	.0847
IMPACT 3	8.52	-3.15	46.49	.1112
IMPACT 4 (REVERSE)	8.33	3.23	40.67	.0939

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	.14	32.38	.0029
IMPACT 2	6.43	.14	28.12	.0022
IMPACT 3	8.52	-7.30	107.21	.2398
IMPACT 4 (REVERSE)	8.33	-8.37	95.15	.3773

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.20	17.48	.0016
IMPACT 2	6.43	.38	15.70	.0031
IMPACT 3	8.52	.77	16.79	.0055
IMPACT 4 (REVERSE)	8.33	.79	15.36	.0043

TAPE CHANNEL 11 : LONGITUDINAL ACCELERATION ON CAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.94	70.40	.0335
IMPACT 2	6.43	-1.22	38.69	.0272
IMPACT 3	8.52	*****	*****	*****
IMPACT 4 (REVERSE)	8.33	*****	*****	*****

TAPE CHANNEL 12 : LATERAL ACCELERATION ON CAR FLOOR

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.04	14.29	.0002
IMPACT 2	6.43	.07	22.47	.0009
IMPACT 3	8.52	-.16	33.44	.0036
IMPACT 4 (REVERSE)	8.33	-8.21	140.55	.7489

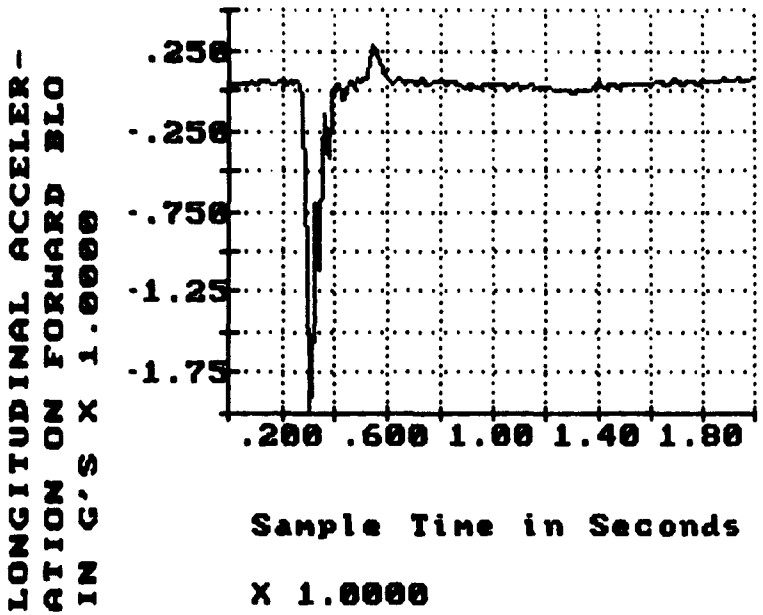
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON CAR FLOOR

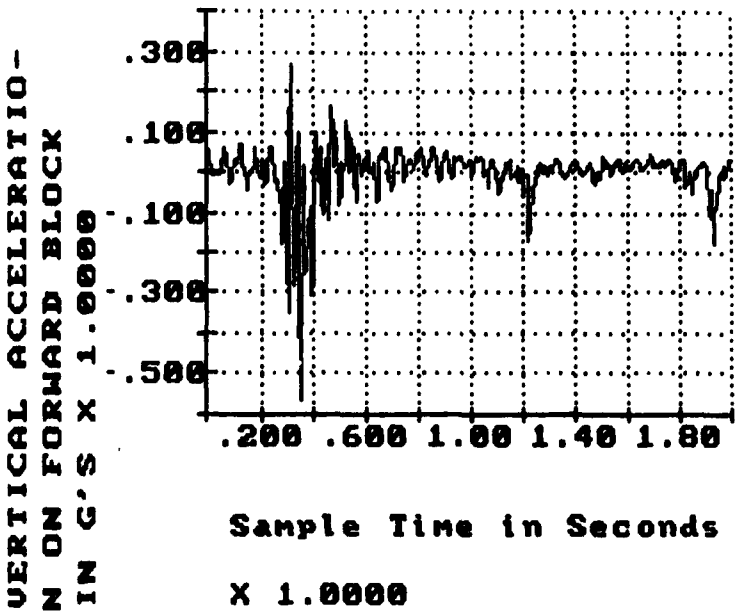
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.41	-.29	18.60	.0031
IMPACT 2	6.43	-.32	12.01	.0018
IMPACT 3	8.52	-2.86	22.20	.0407
IMPACT 4 (REVERSE)	8.33	-3.05	97.65	.1653

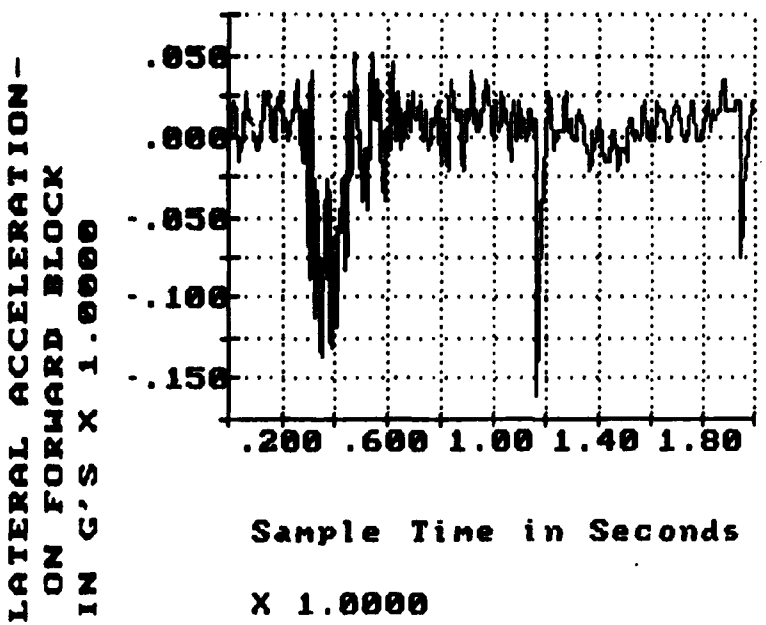
NOTES:

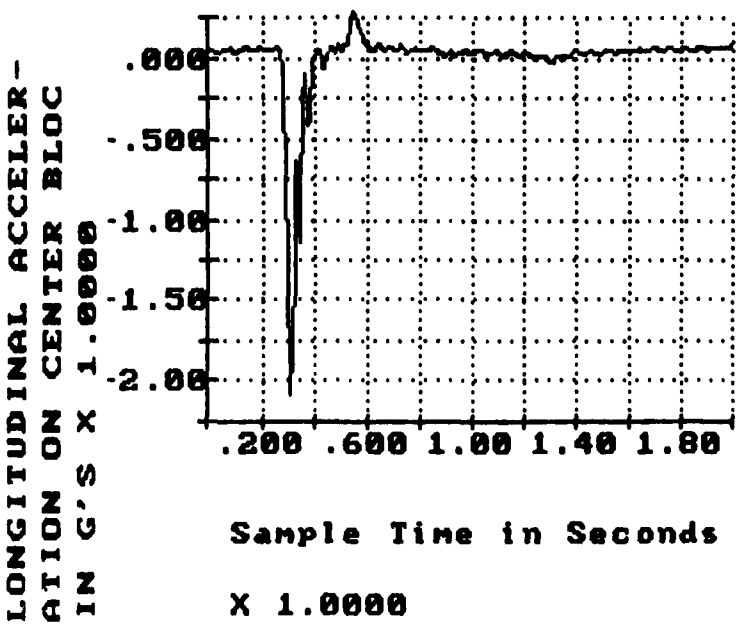
*****: DATA NOT AVAILABLE.

RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 4.41 MPH









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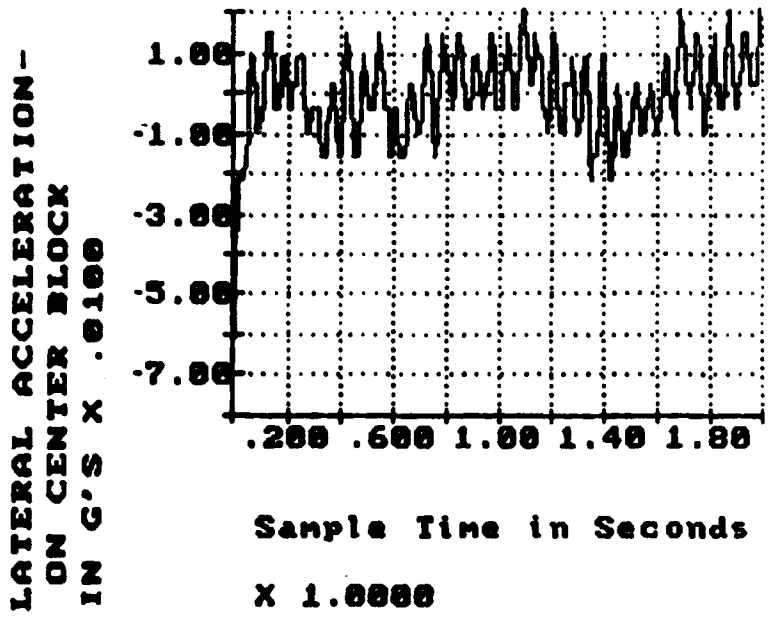

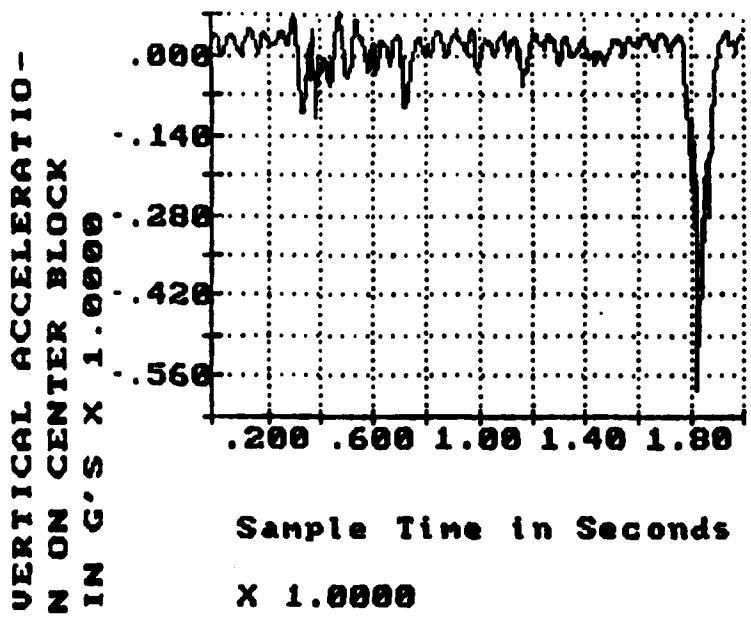

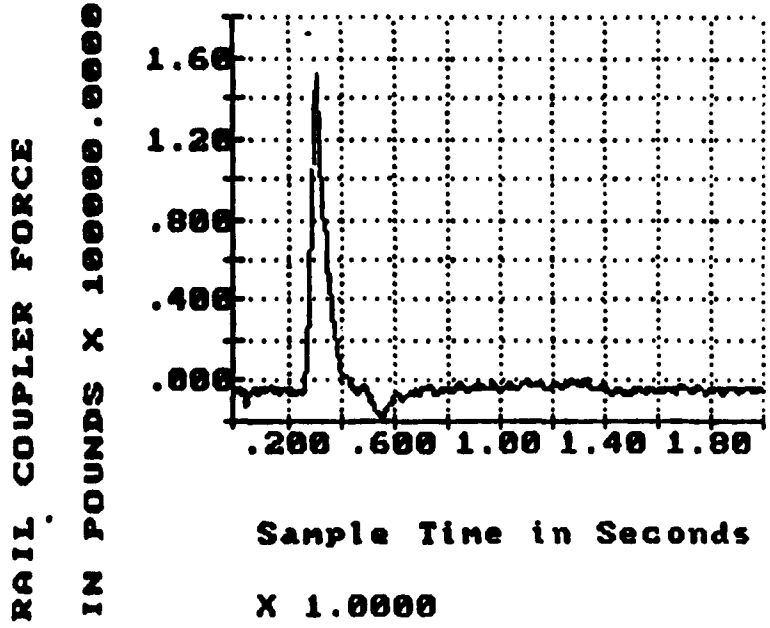

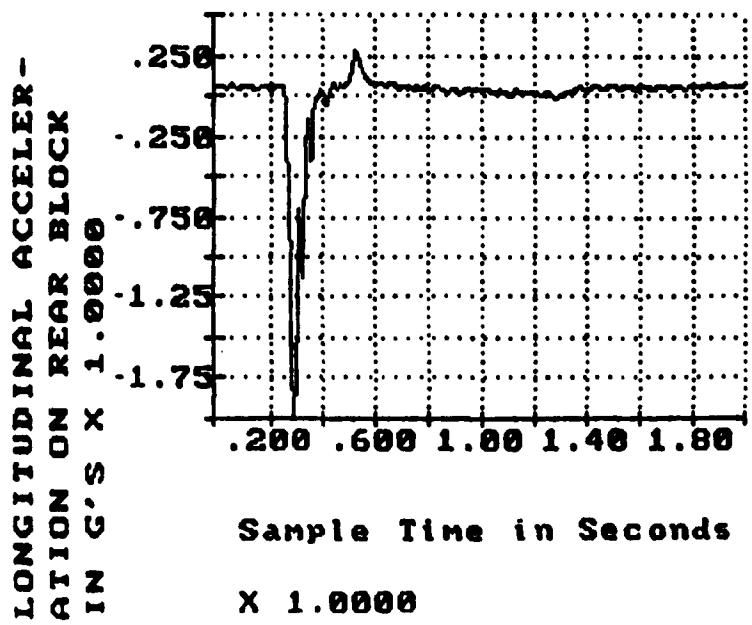

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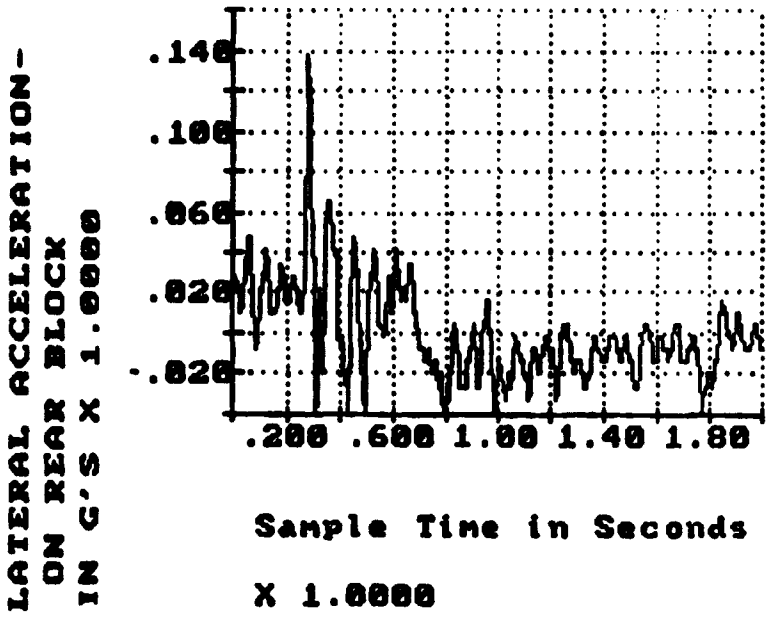

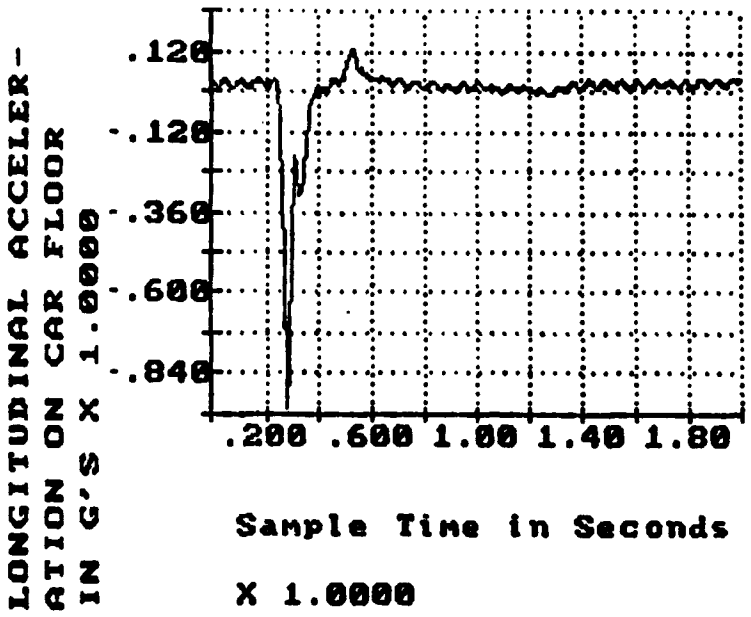

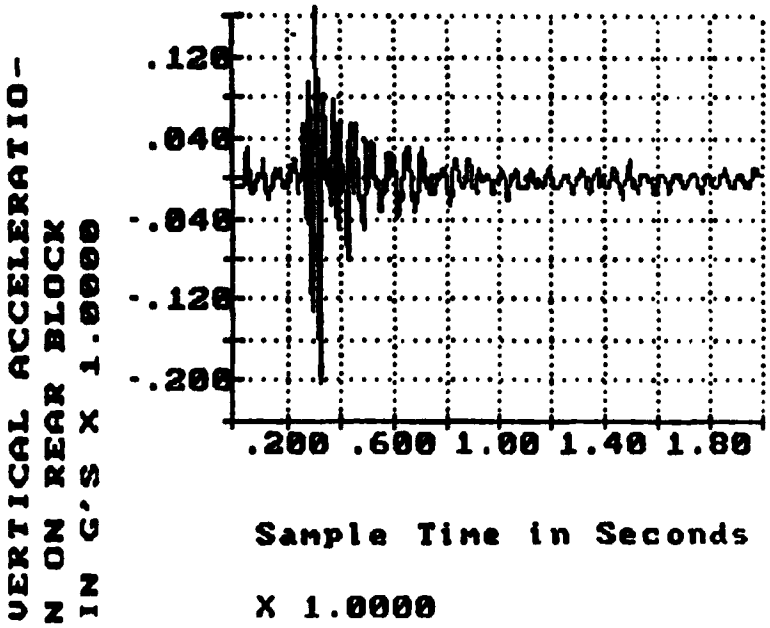

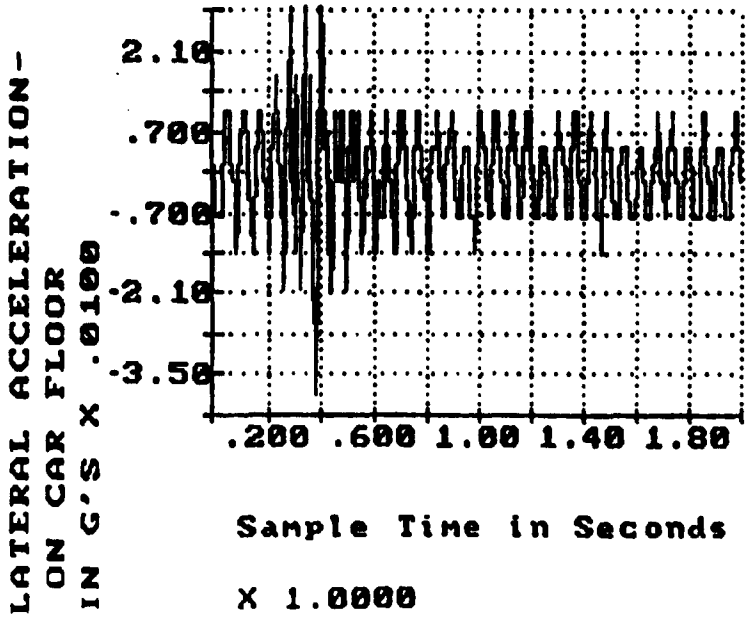

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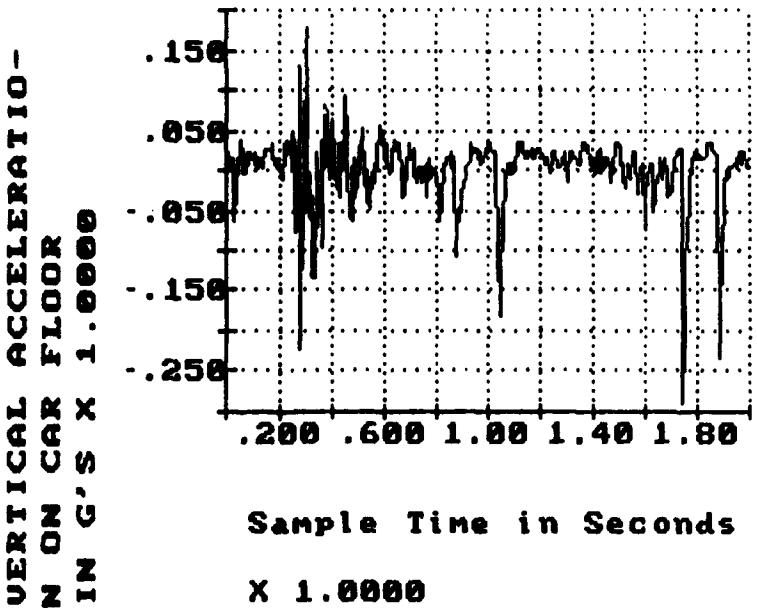
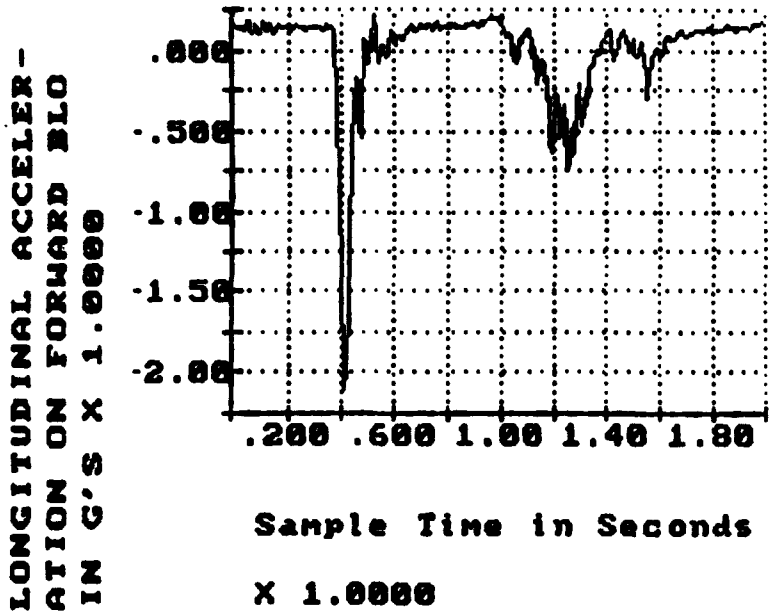
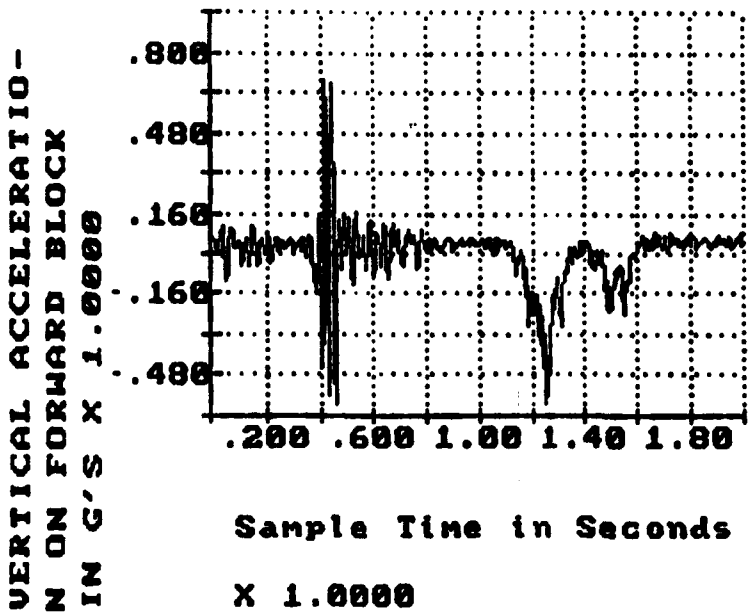
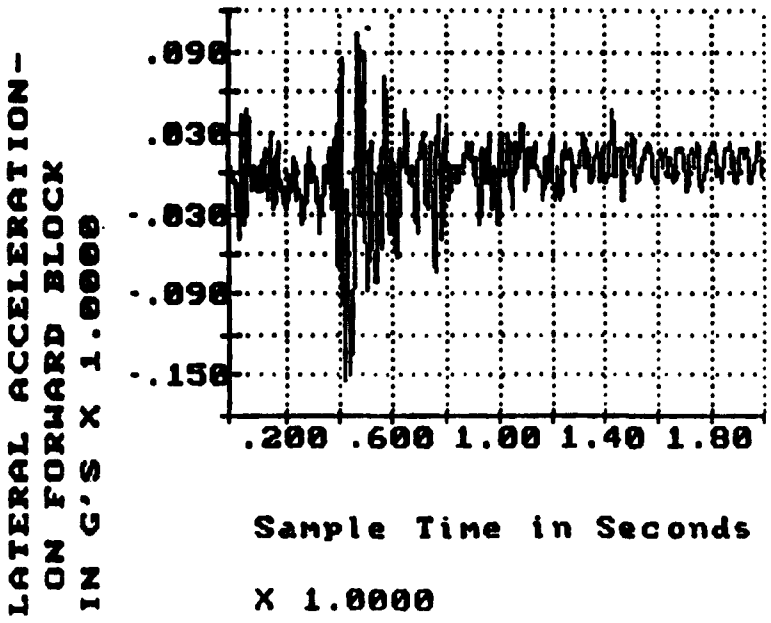
DATE: 13 JUNE 1989
SPEED: 4.41 MPH

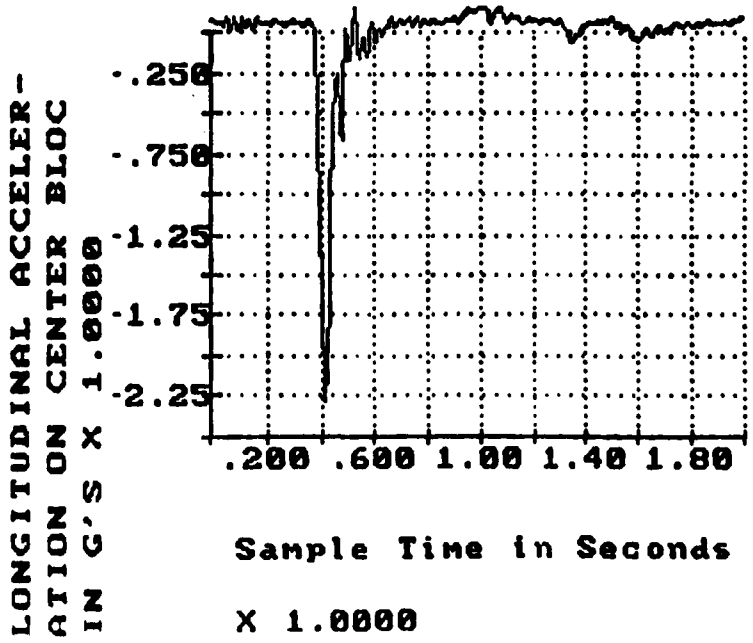


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 6.43 MPH

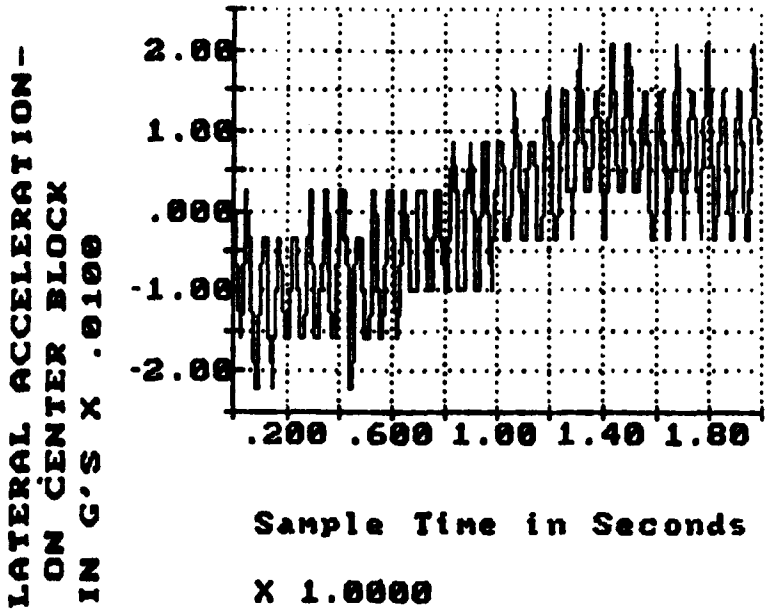


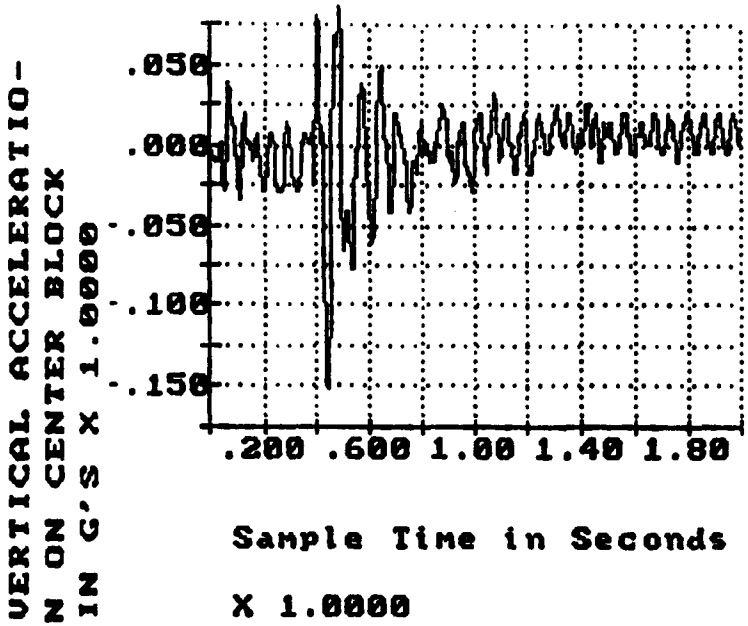


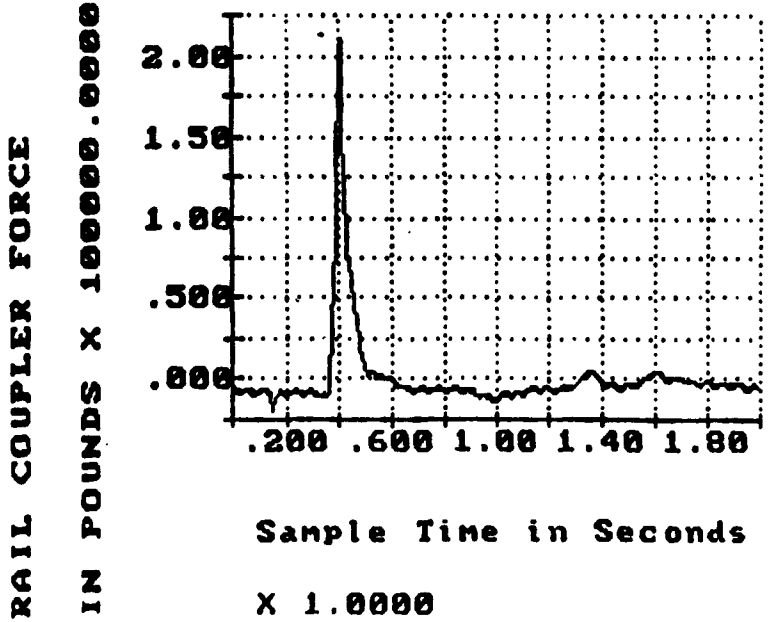


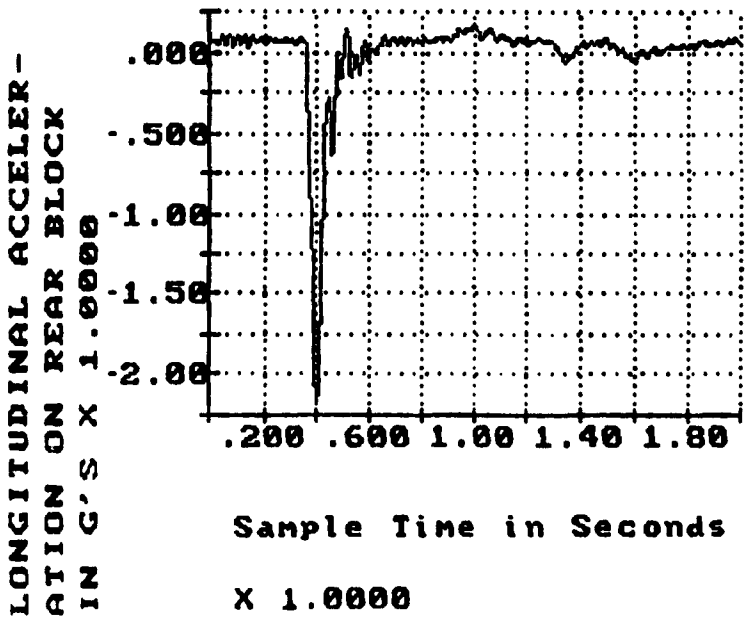


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 6.43 MPH

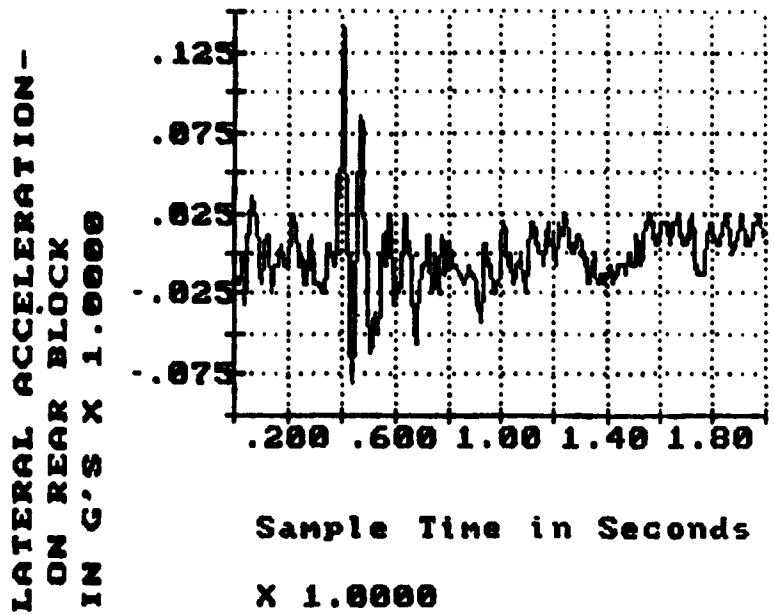


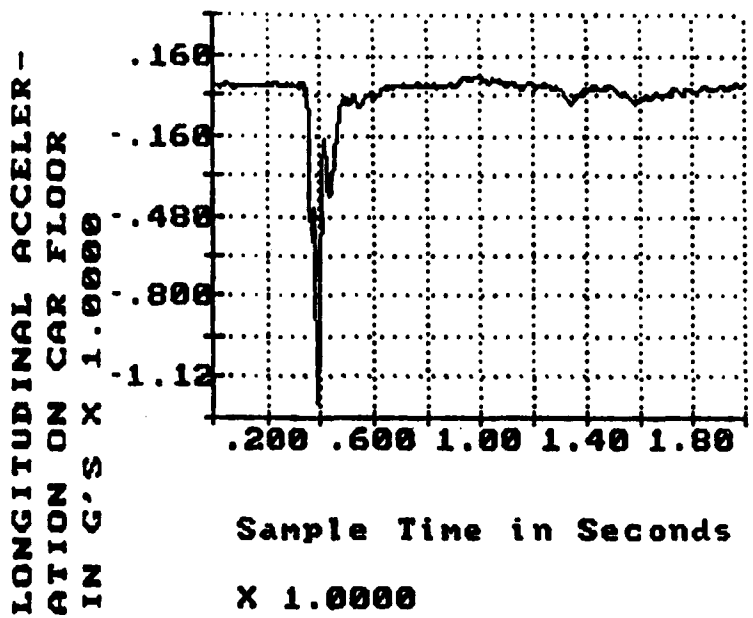


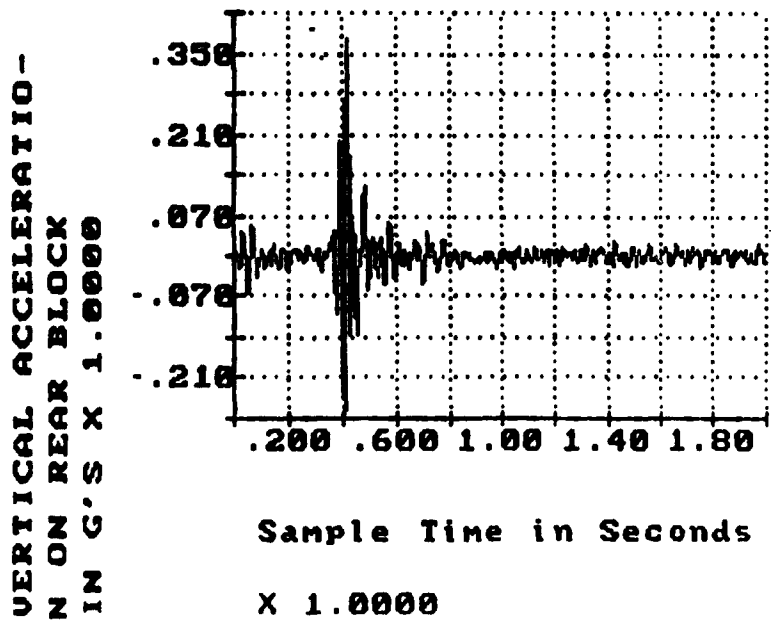


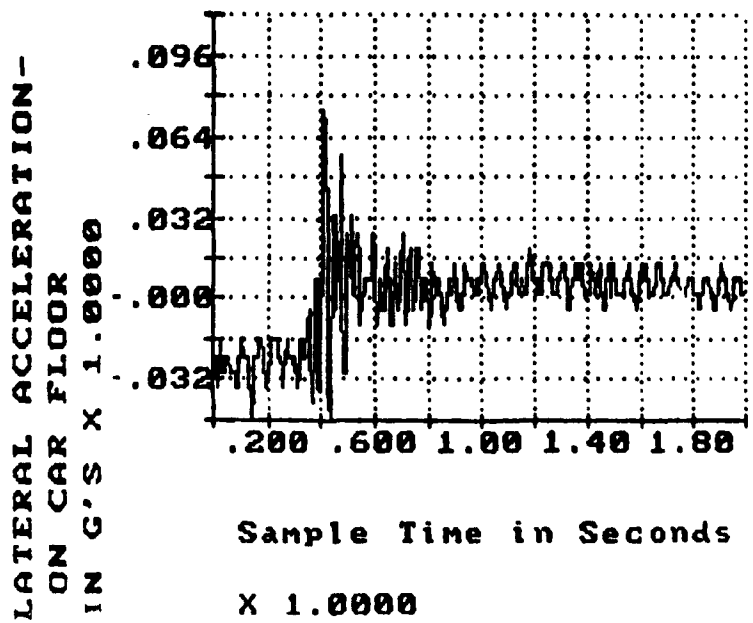


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 6.43 MPH

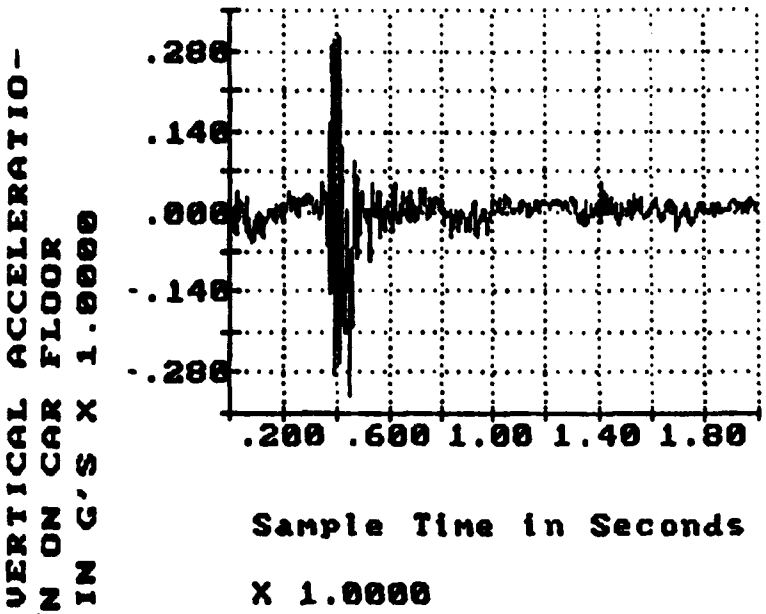




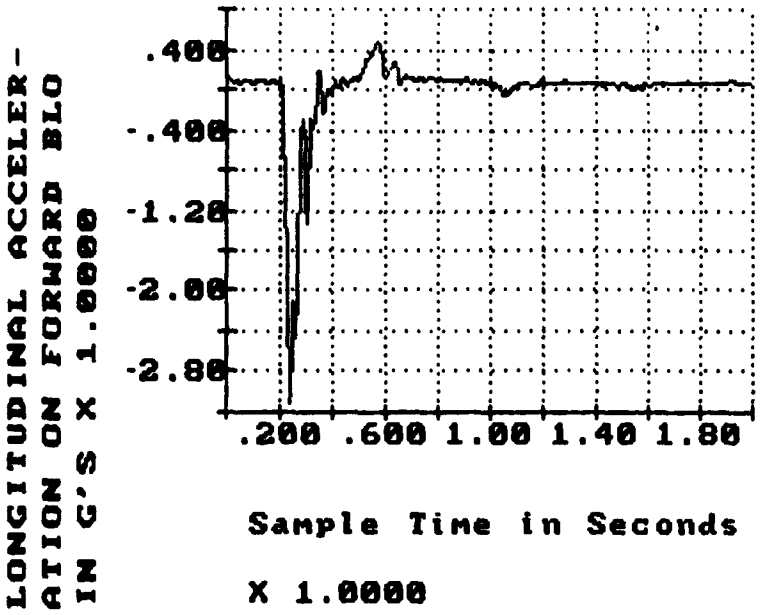


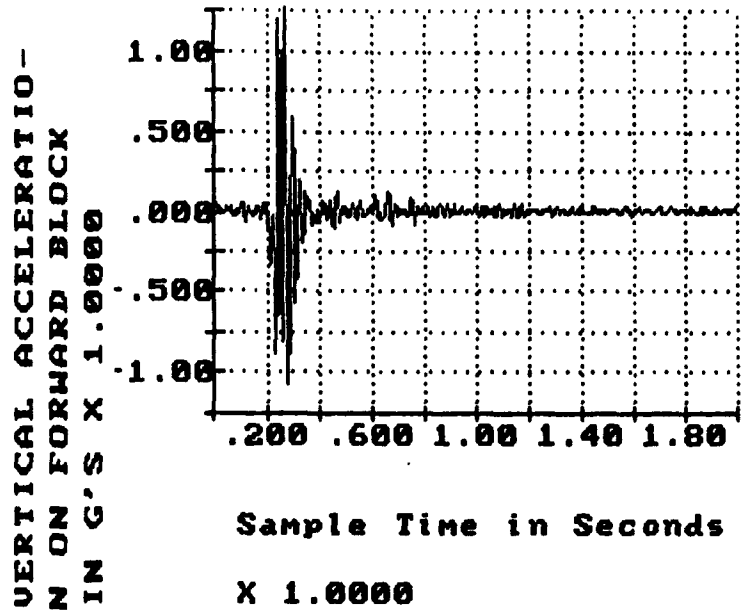


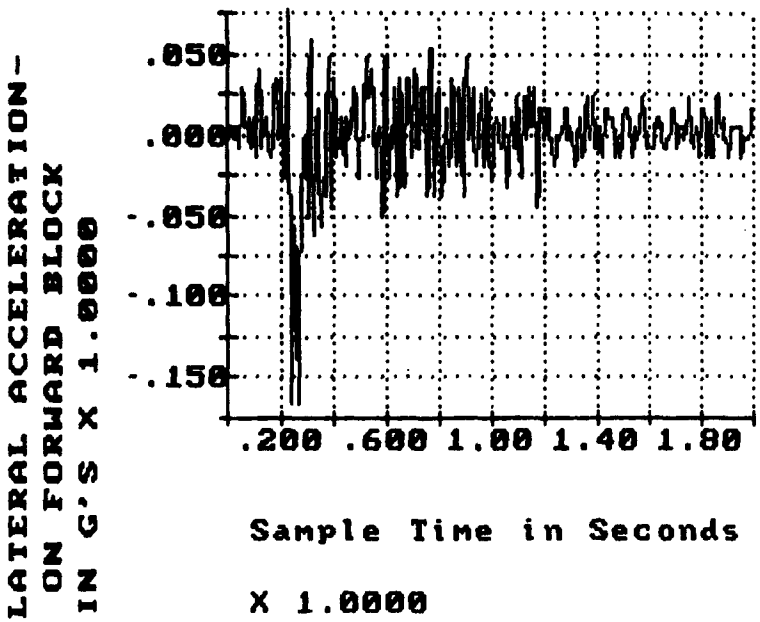
RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 6.43 MPH

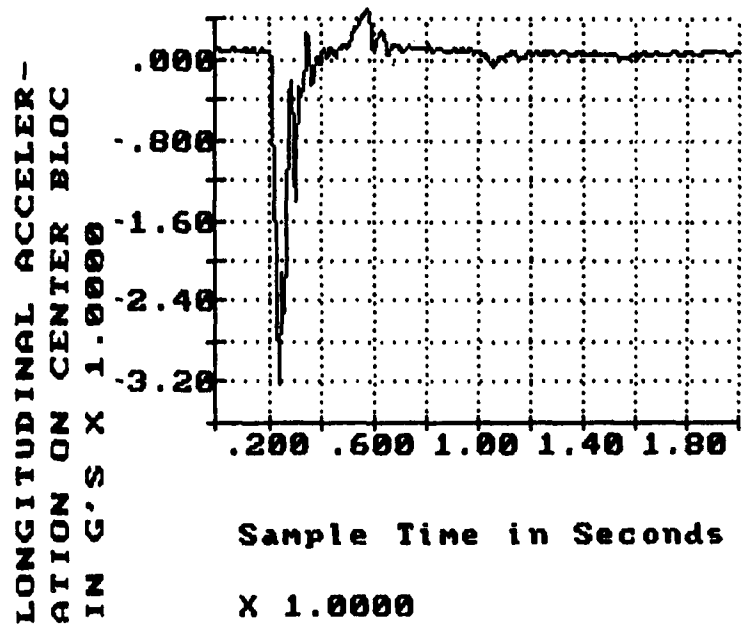


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 8.52 MPH

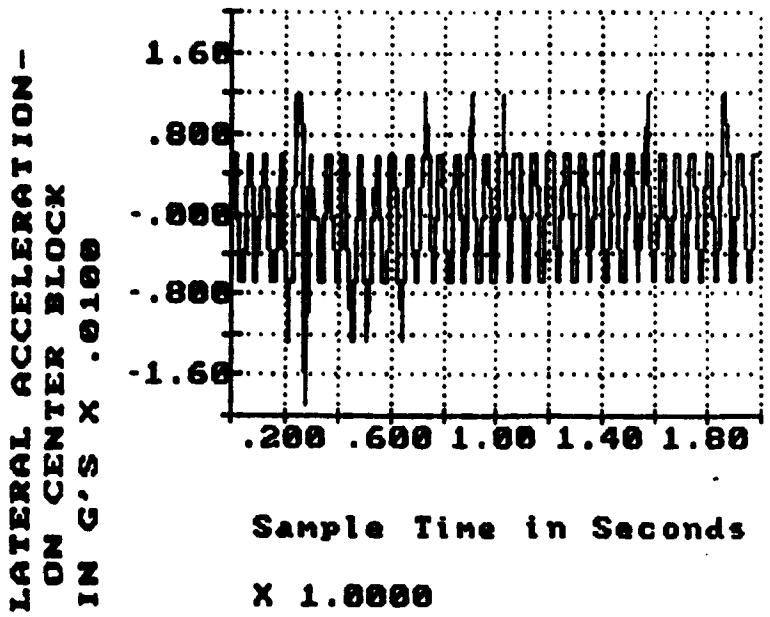


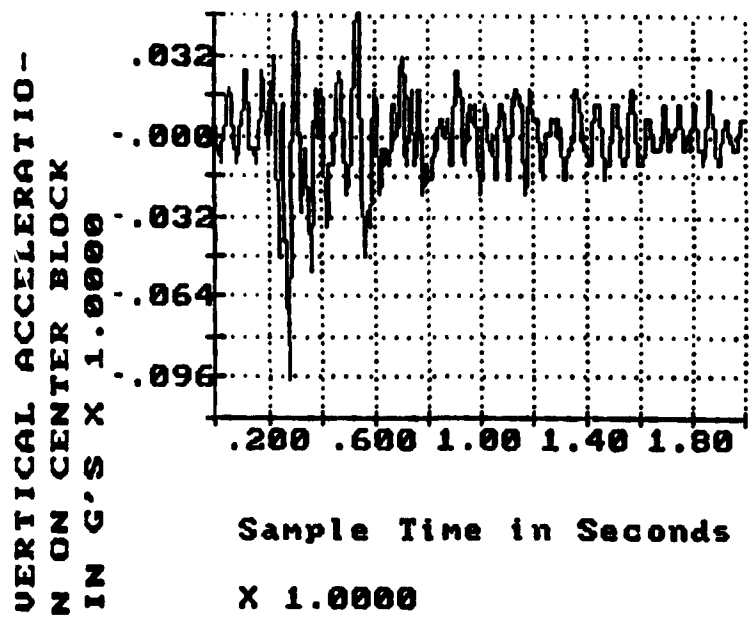


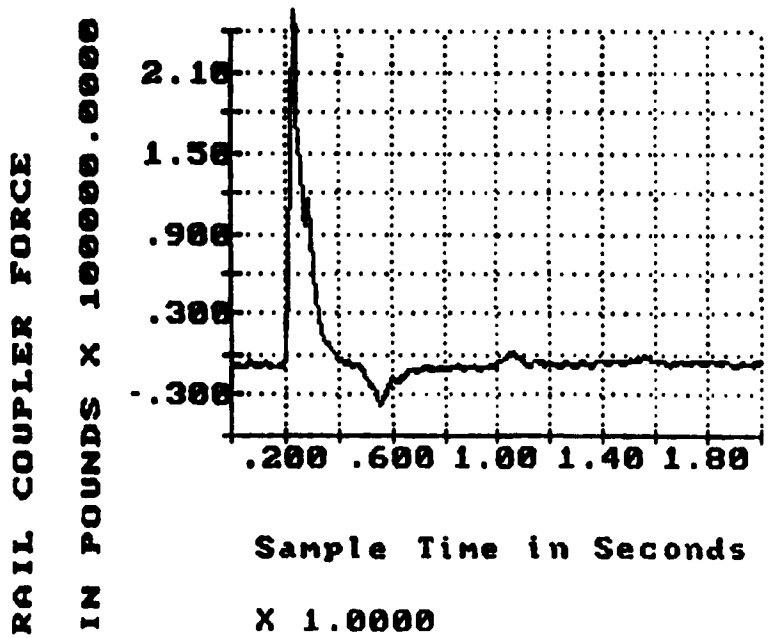


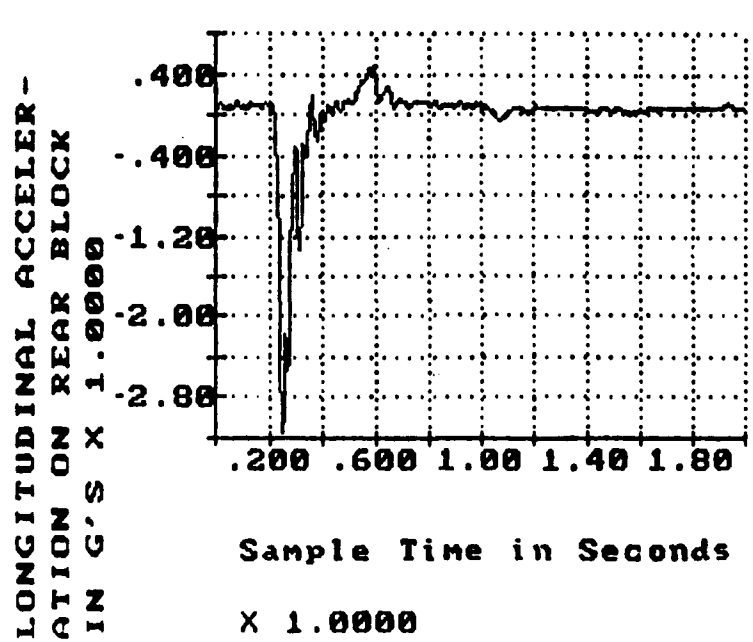


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 8.52 MPH

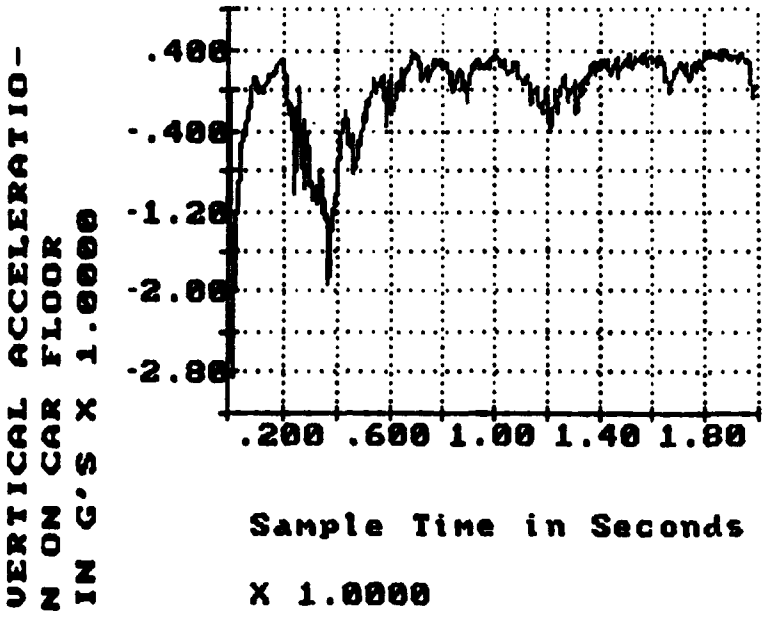








RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 8.52 MPH



RAIL IMPACT TEST OF ATACMS
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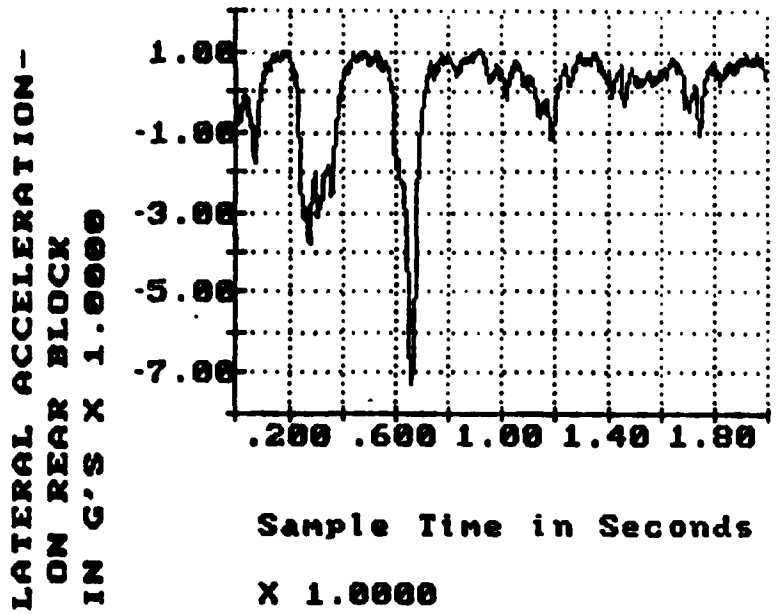
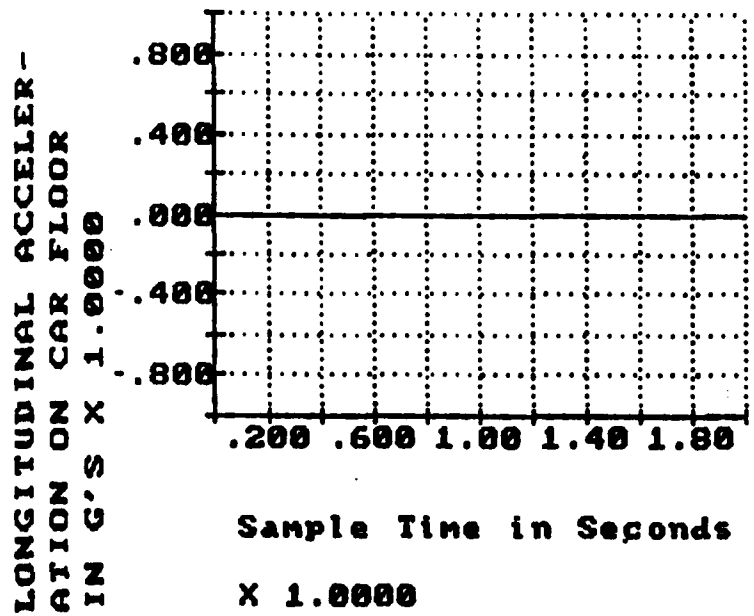
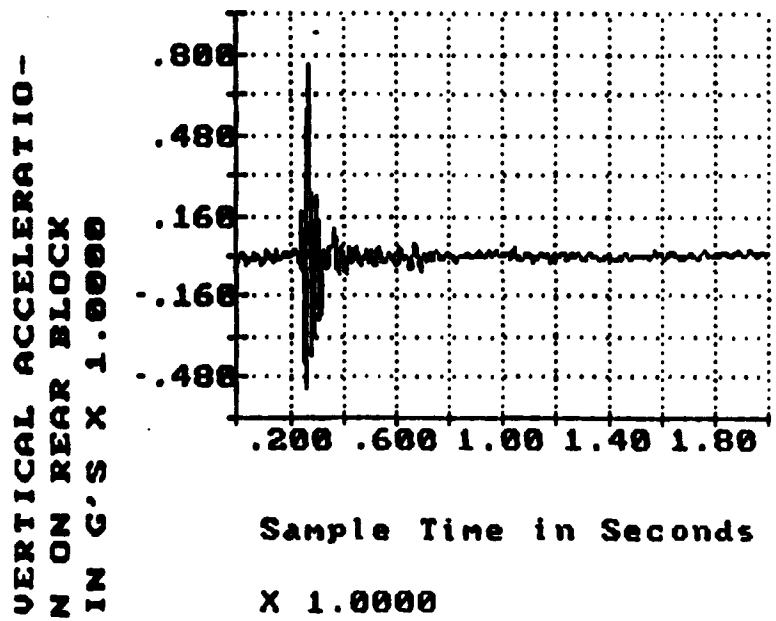
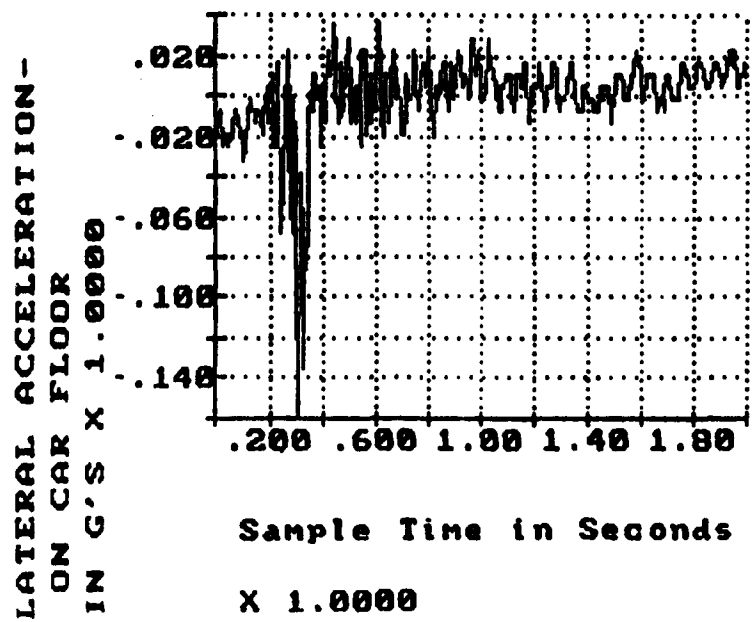
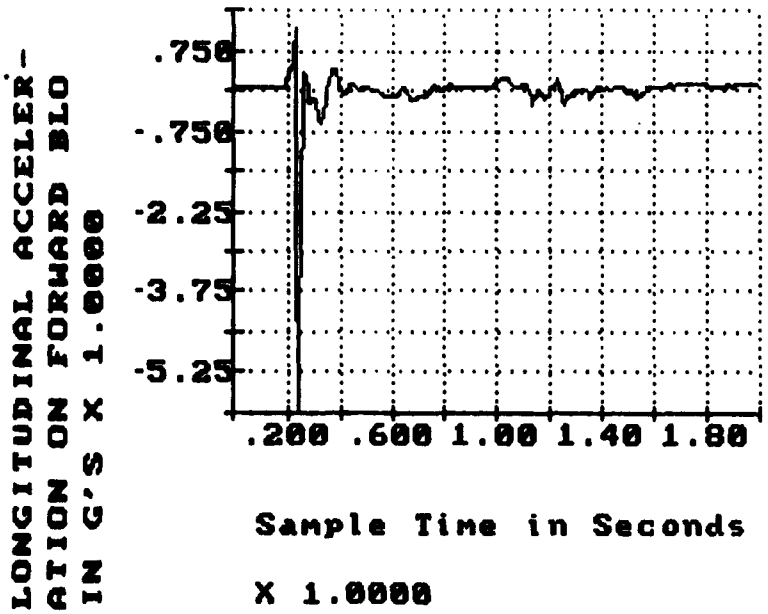


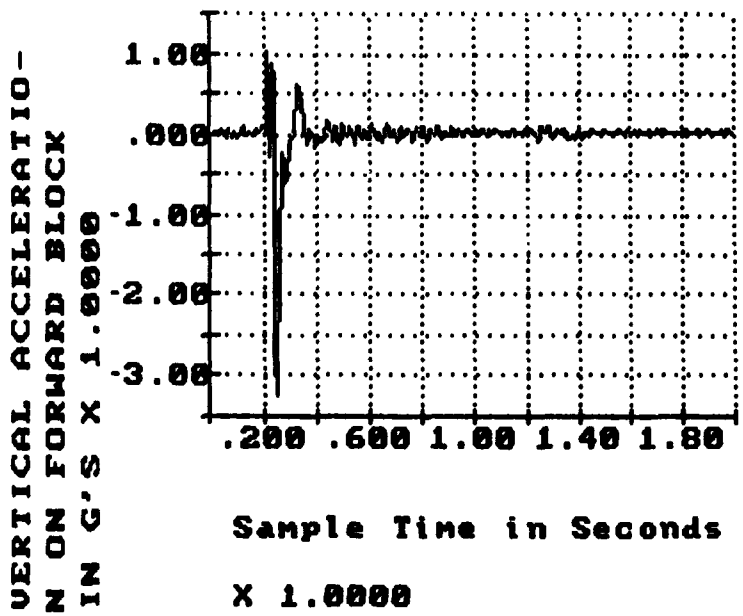


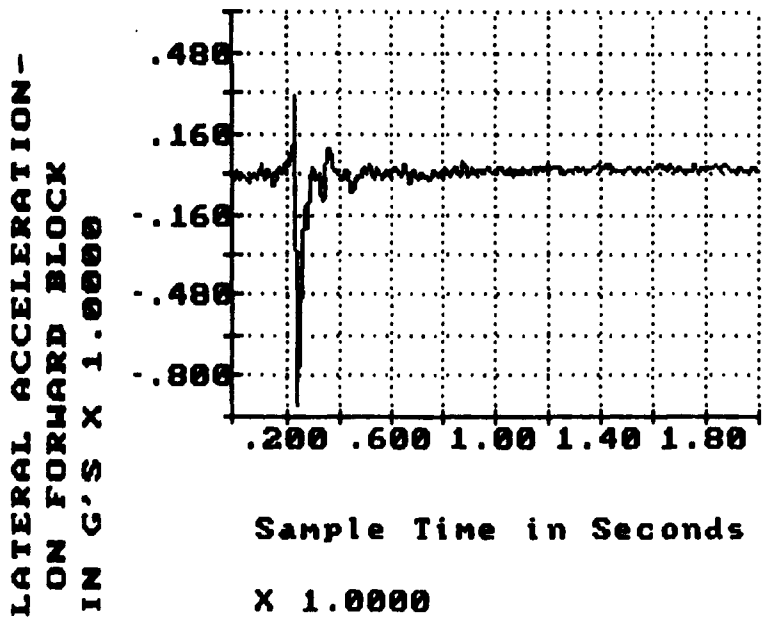


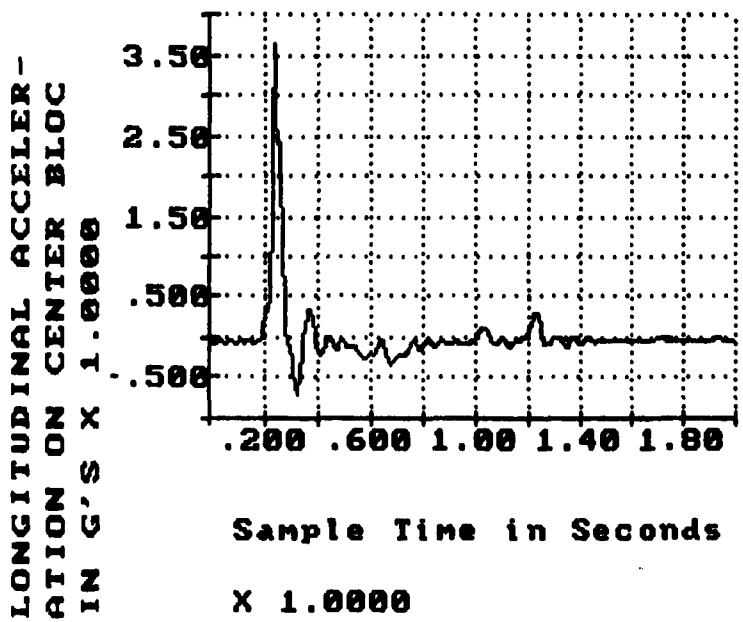


RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 8.33 MPH (REVERSE)









RAIL IMPACT TEST OF ATACMS
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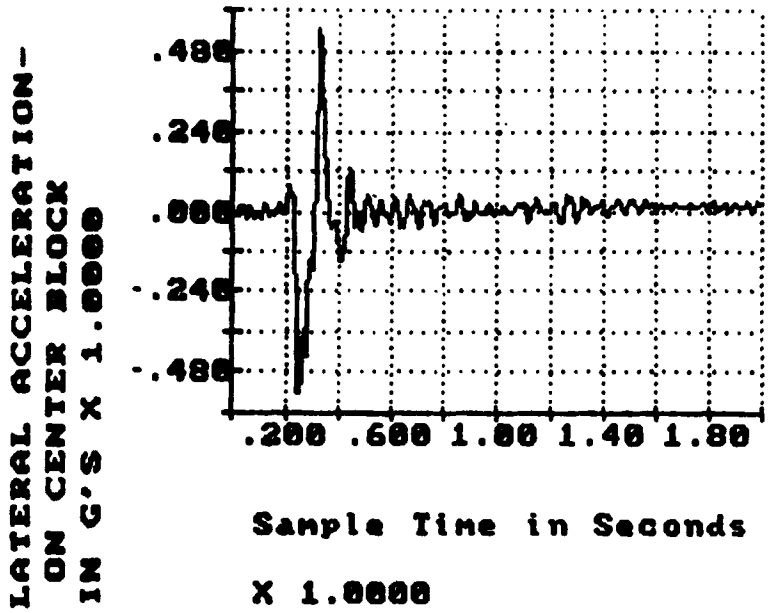

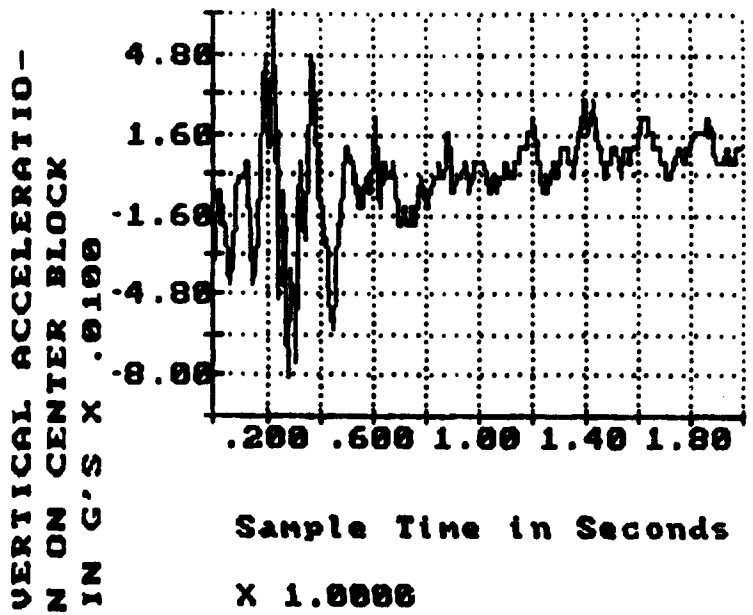

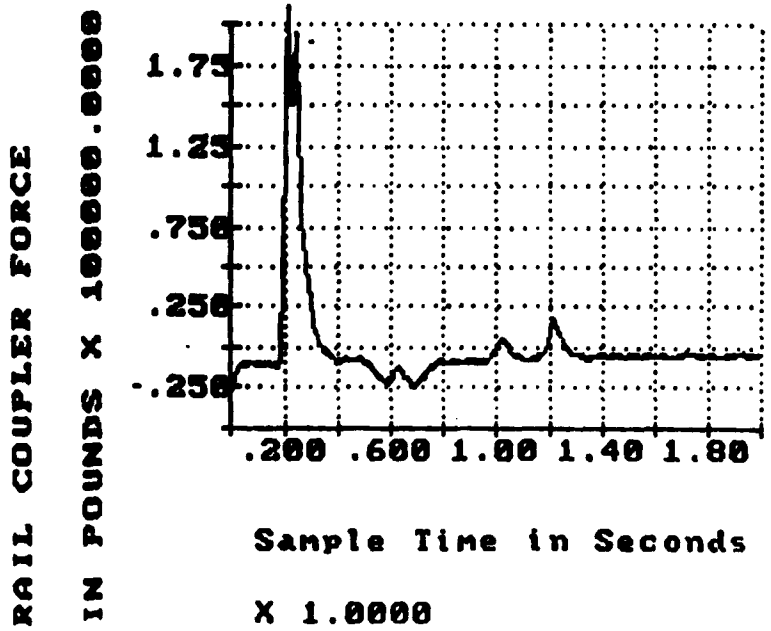

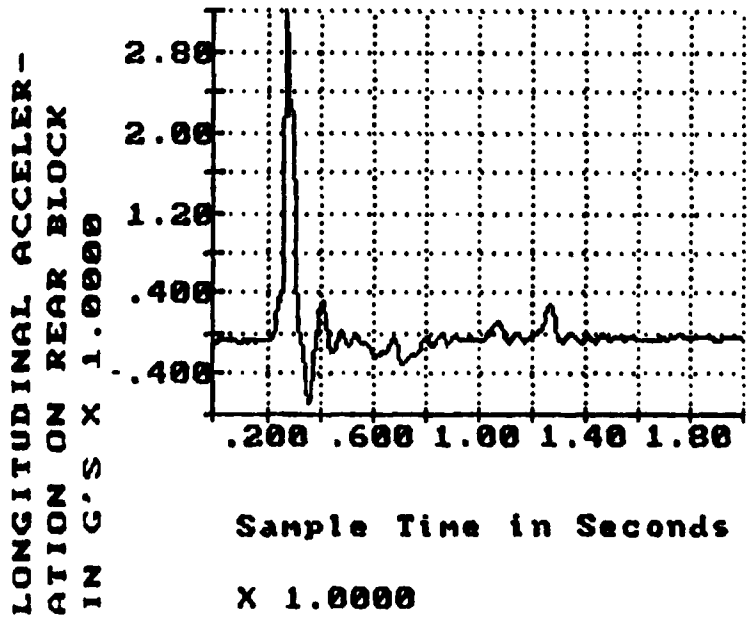

RAIL IMPACT TEST OF ATACMS
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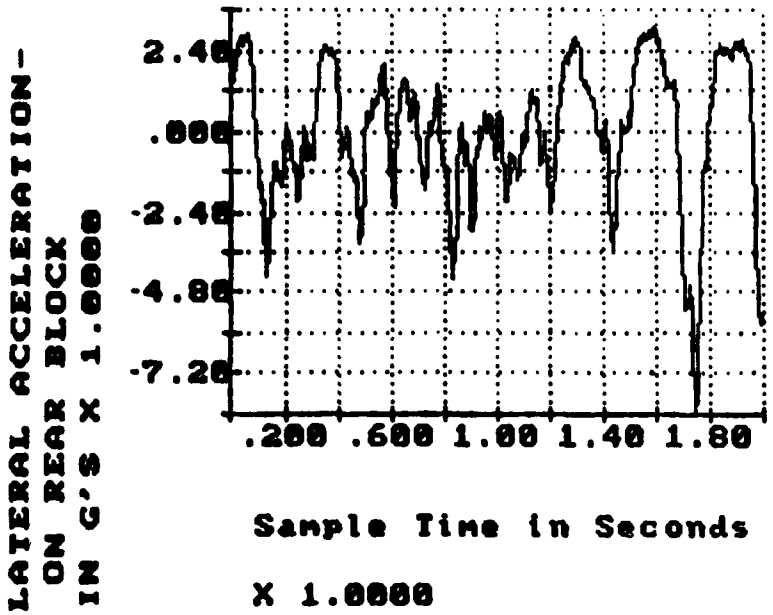
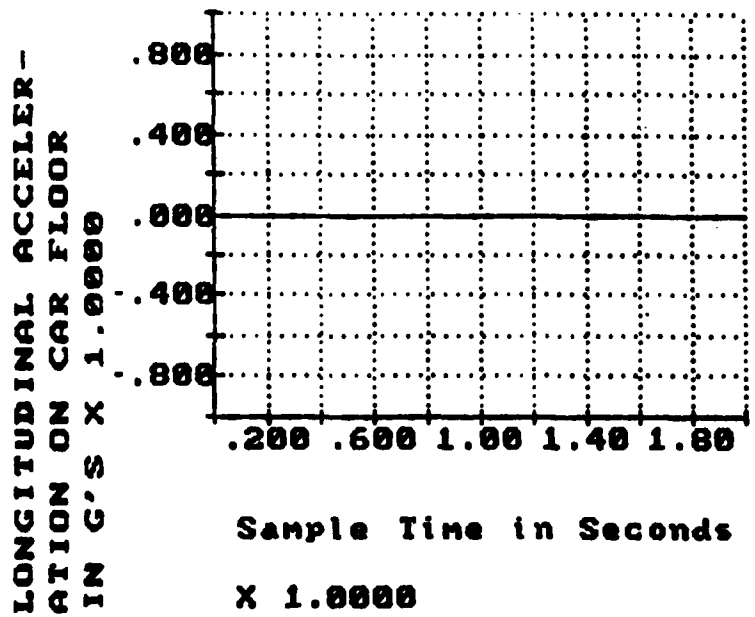
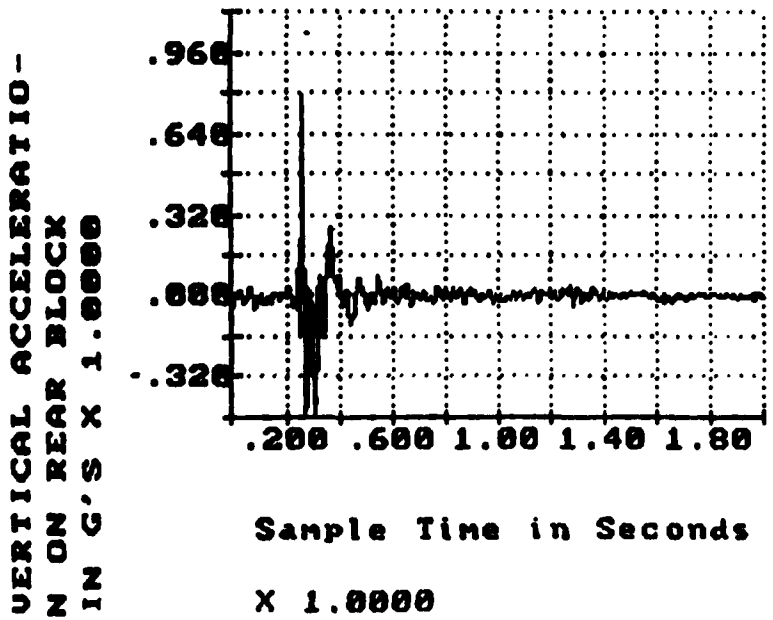
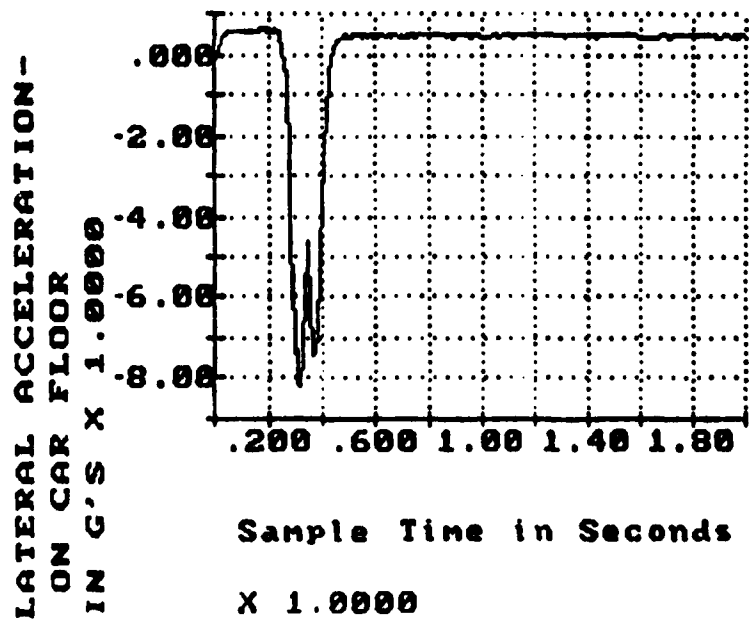
SPEED: 8.33 MPH (REVERSE)

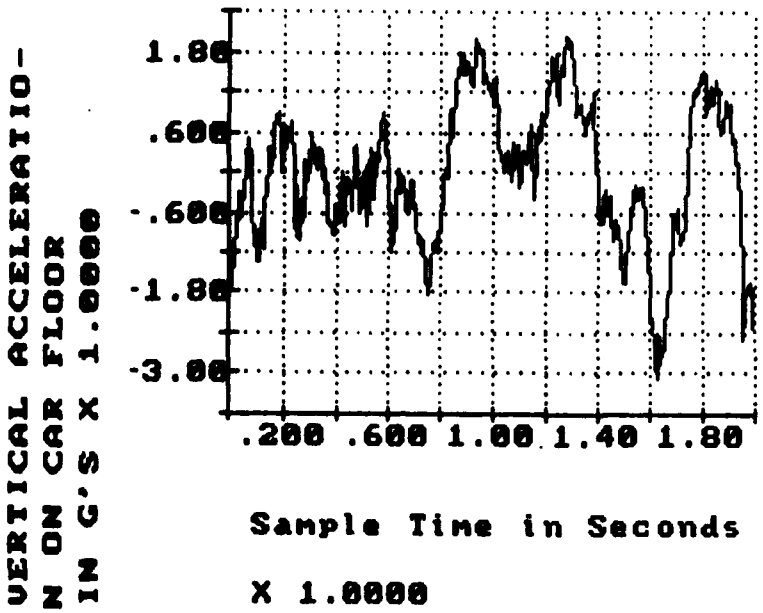








RAIL IMPACT TEST OF ATACMS
DATE: 13 JUNE 1989
SPEED: 8.33 MPH (REVERSE)



RAIL IMPACT TEST

TEST NO. 5 DATE: 11 JULY 1989

TEST SPECIMEN: ATACMS in Boxcar

TEST CAR NO. RBOX 40247 LT. WT. 63,100 POUNDS

LADING AND DUNNAGE WT. 32,000 POUNDS

TOTAL SPECIMEN WT. 95,100 POUNDS

BUFFER CAR (5 CARS) WT. 250,000 POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.49	Middle moved forward 1/4 inch.
2	Forward	6.29	Gap at forward end 1/2 inch.
3	Forward	8.33	Second strut was dislodged. Put in wrong position during loading.
4	Reverse	8.19	No damage.

RESULTS FROM RAIL IMPACT TESTING
OF ATACMS IN BOXCAR
DATE: 11 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.74	47.38	.0538
IMPACT 2	6.29	-2.13	84.65	.0994
IMPACT 3	8.33	-3.35	46.90	.0941
IMPACT 4 (REVERSE)	8.19	5.69	39.48	.1230

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.20	24.51	.0029
IMPACT 2	6.29	-.25	32.26	.0029
IMPACT 3	8.33	-.29	37.20	.0056
IMPACT 4 (REVERSE)	8.19	-1.33	13.74	.0128

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.31	13.25	.0024
IMPACT 2	6.29	.59	15.31	.0051
IMPACT 3	8.33	1.33	13.94	.0103
IMPACT 4 (REVERSE)	8.19	-3.08	17.30	.0382

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.84	47.04	.0563
IMPACT 2	6.29	-2.23	75.80	.0979
IMPACT 3	8.33	-3.51	41.19	.0966
IMPACT 4 (REVERSE)	8.19	4.23	31.18	.0824

TAPE CHANNEL 5 : LATERAL ACCELERATION MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.15	55.22	.0042
IMPACT 2	6.29	.08	12.16	.0006
IMPACT 3	8.33	-.10	15.84	.0010
IMPACT 4 (REVERSE)	8.19	.75	18.96	.0077

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.49	127587.32	107.27	6223.30
IMPACT 2	6.29	195302.97	58.09	7045.33
IMPACT 3	8.33	254527.34	46.22	7959.51
IMPACT 4 (REVERSE)	8.19	211995.84	43.35	6945.94

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.23	53.70	.0071
IMPACT 2	6.29	-.26	45.08	.0059
IMPACT 3	8.33	-.38	73.52	.0039
IMPACT 4 (REVERSE)	8.19	-.11	36.36	.0019

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-1.74	48.34	.0558
IMPACT 2	6.29	-2.14	81.59	.0994
IMPACT 3	8.33	-3.37	40.77	.0946
IMPACT 4 (REVERSE)	8.19	6.04	30.39	.1120

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.18	75.01	.0004
IMPACT 2	6.29	-7.41	67.59	.2884
IMPACT 3	8.33	.31	31.61	.0051
IMPACT 4 (REVERSE)	8.19	-.20	33.05	.0040

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	.14	13.64	.0011
IMPACT 2	6.29	-.15	12.87	.0012
IMPACT 3	8.33	.47	13.50	.0037
IMPACT 4 (REVERSE)	8.19	.76	15.13	.0065

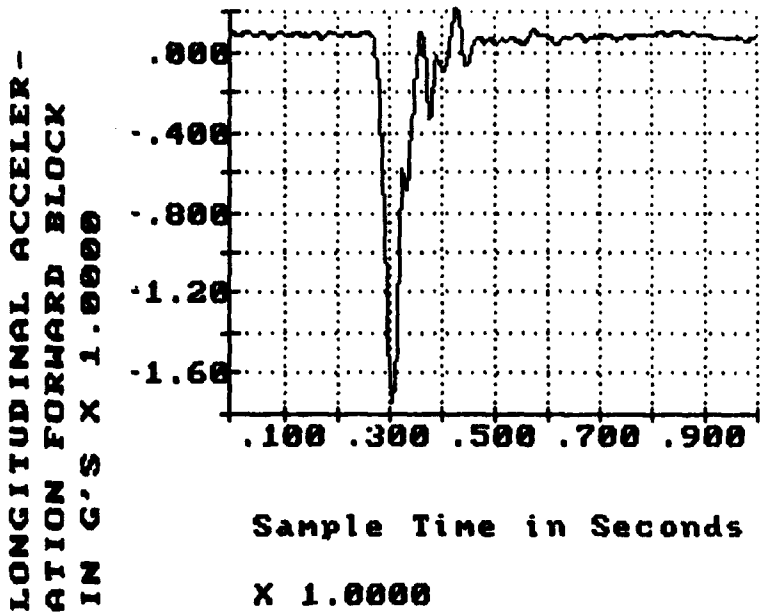
TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON BOXCAR FLOOR

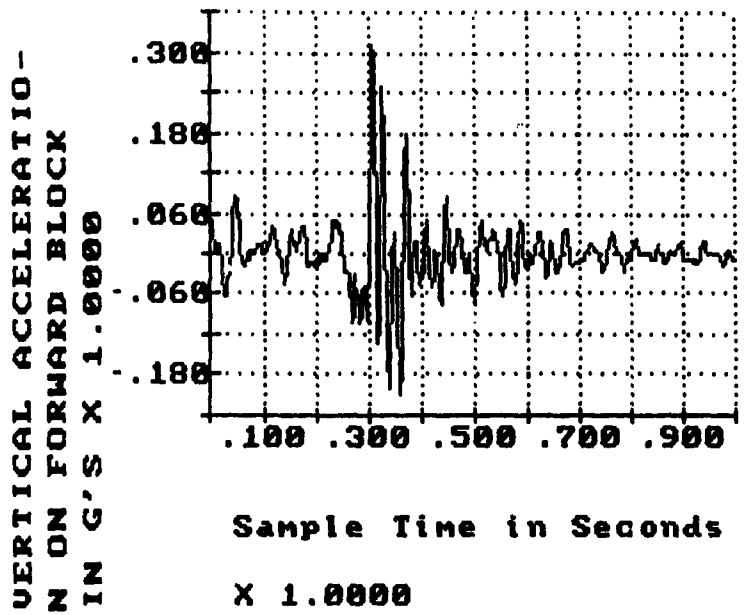
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.78	48.68	.0252
IMPACT 2	6.29	-3.16	24.83	.0491
IMPACT 3	8.33	-4.38	22.67	.0698
IMPACT 4 (REVERSE)	8.19	-4.33	37.67	.0921

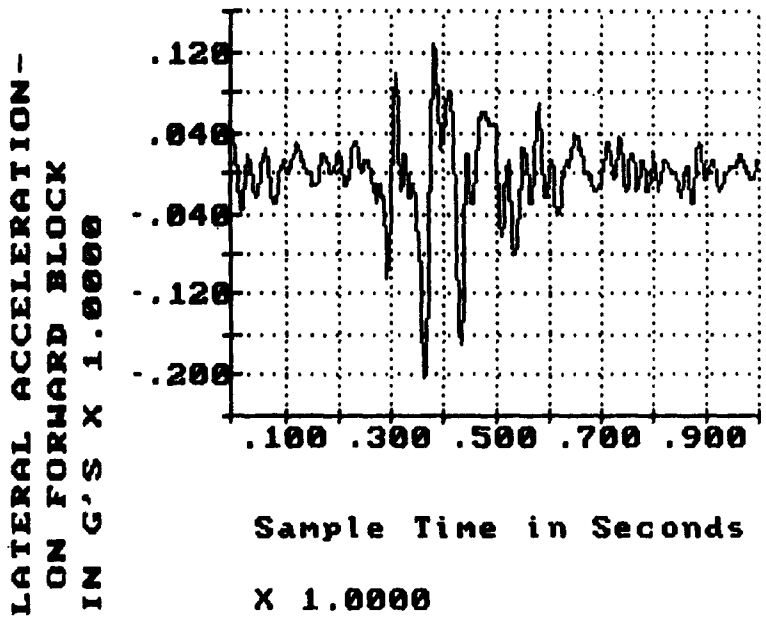
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON BOXCAR FLOOR

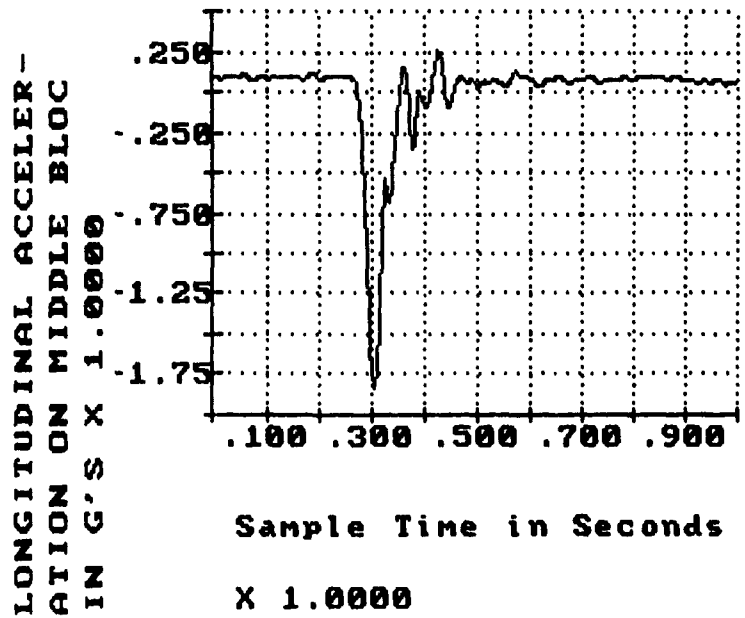
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.49	-.21	12.06	.0000
IMPACT 2	6.29	-.63	23.06	.0007
IMPACT 3	8.33	.87	5.12	.0011
IMPACT 4 (REVERSE)	8.19	1.55	6.82	.0053

RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 4.49 MPH

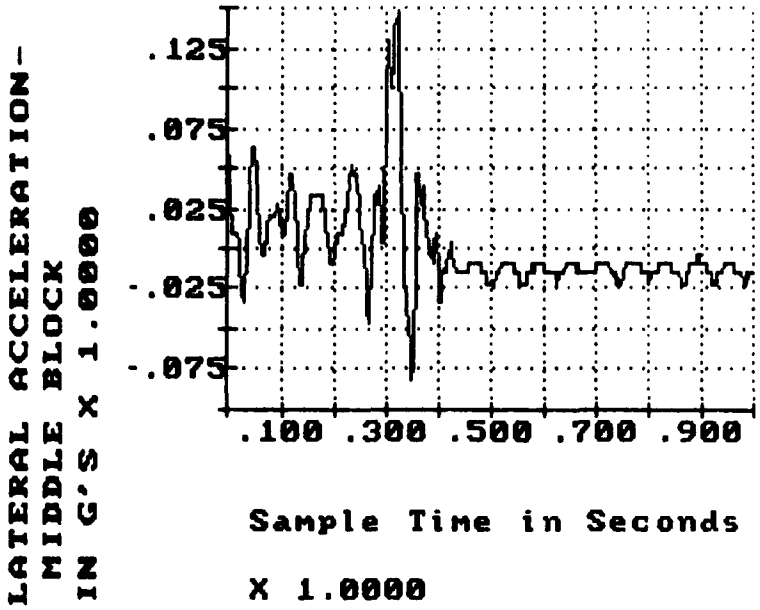


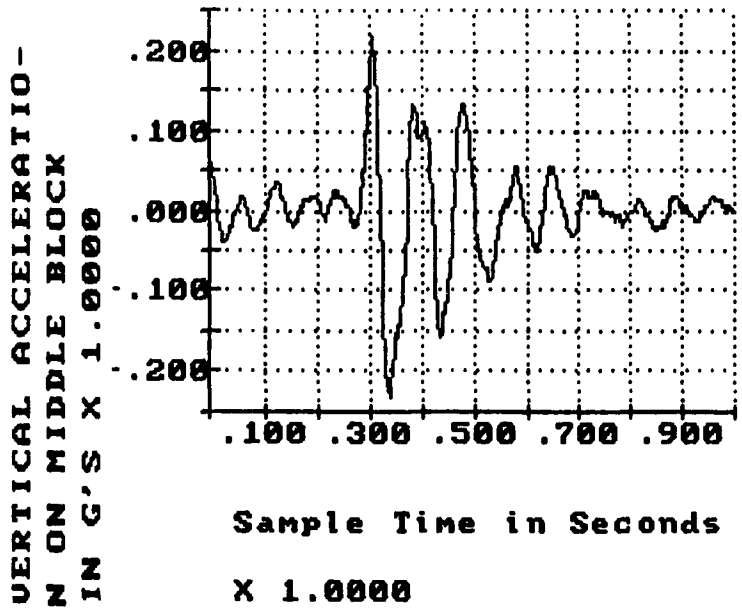


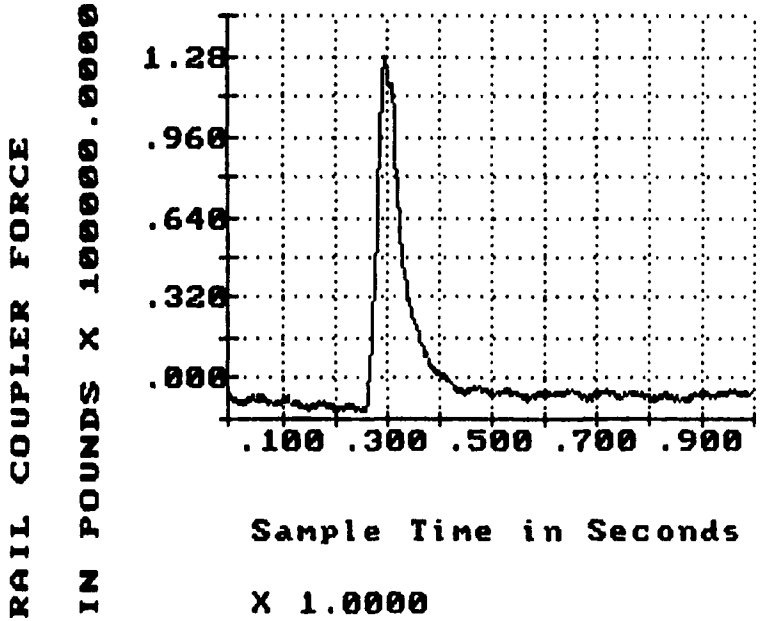


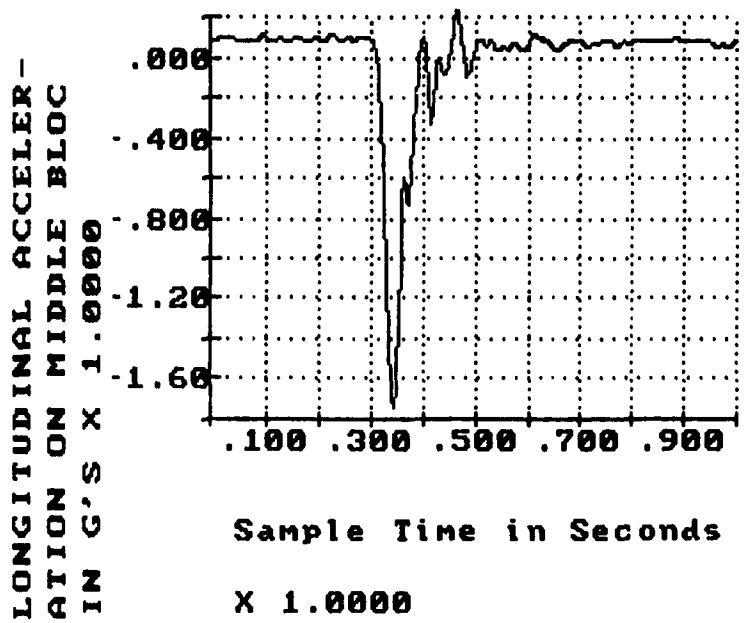


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 4.49 MPH

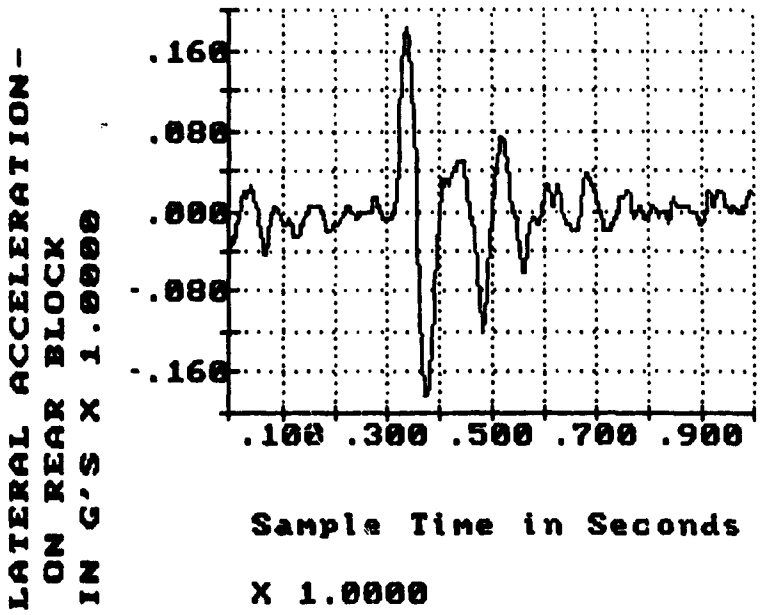


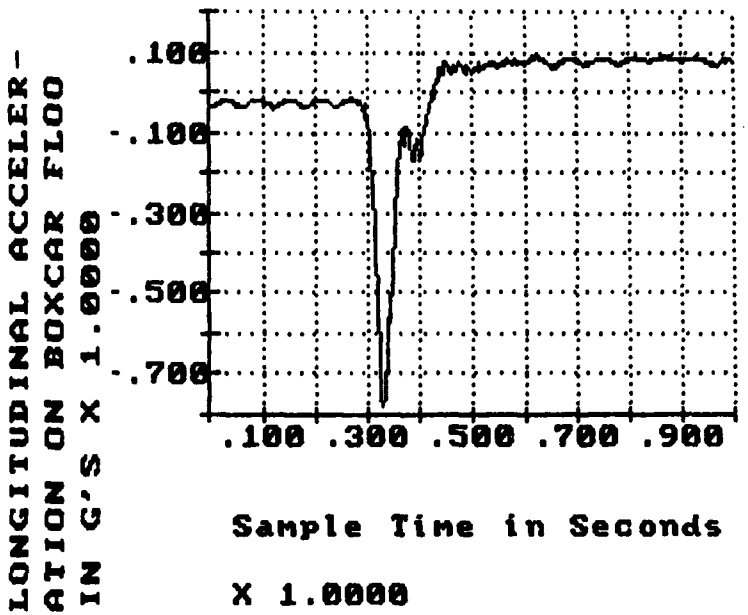


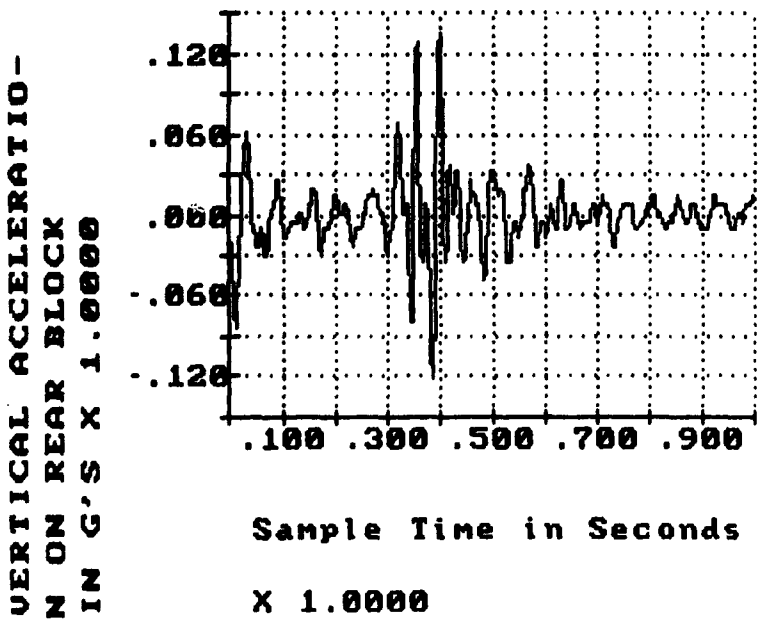


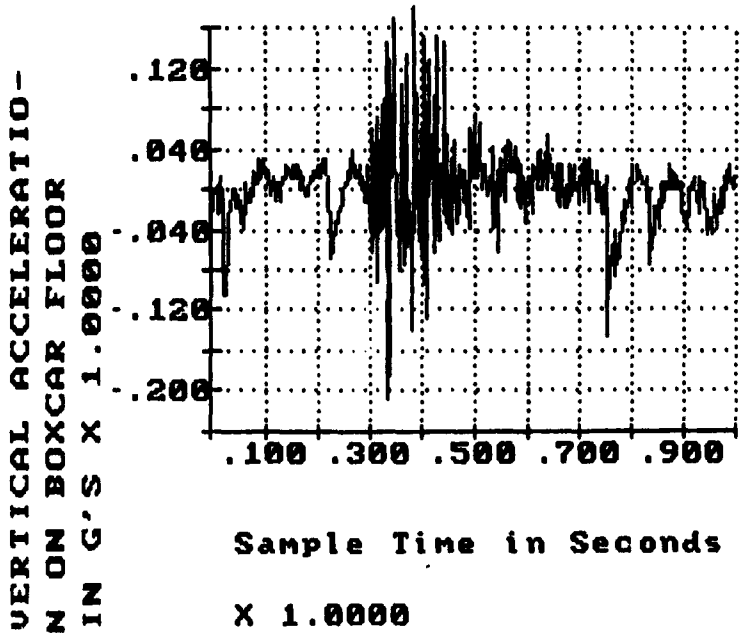


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 4.49 MPH

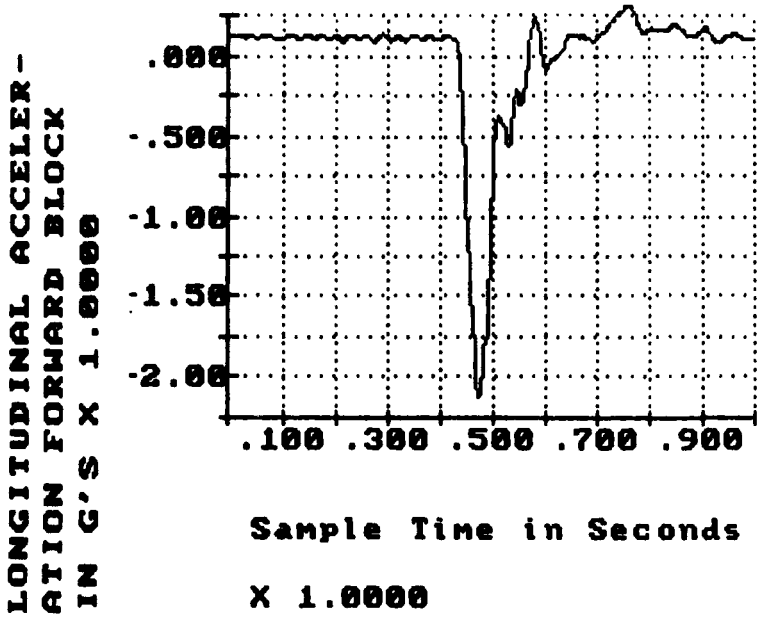


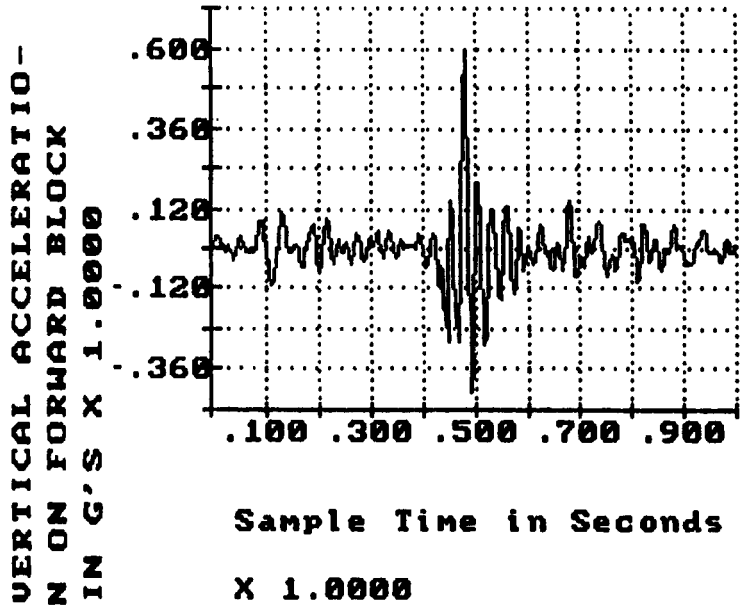


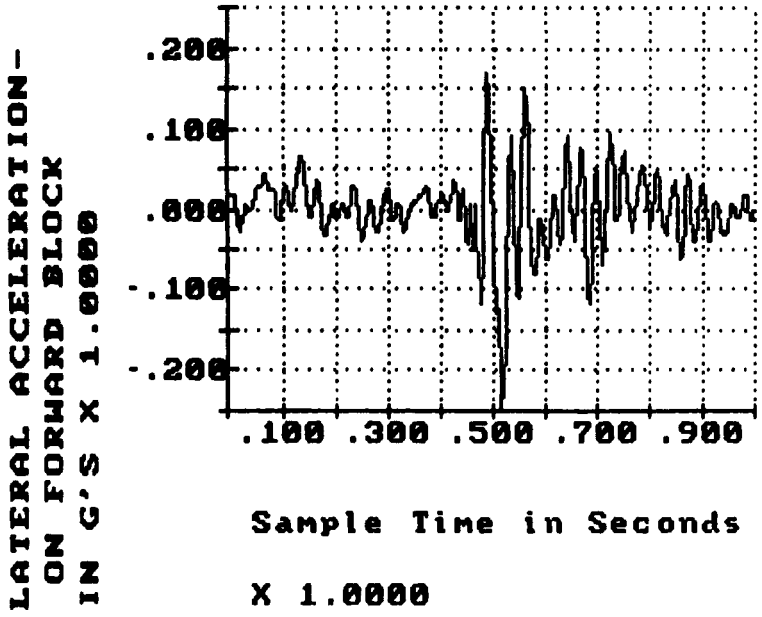


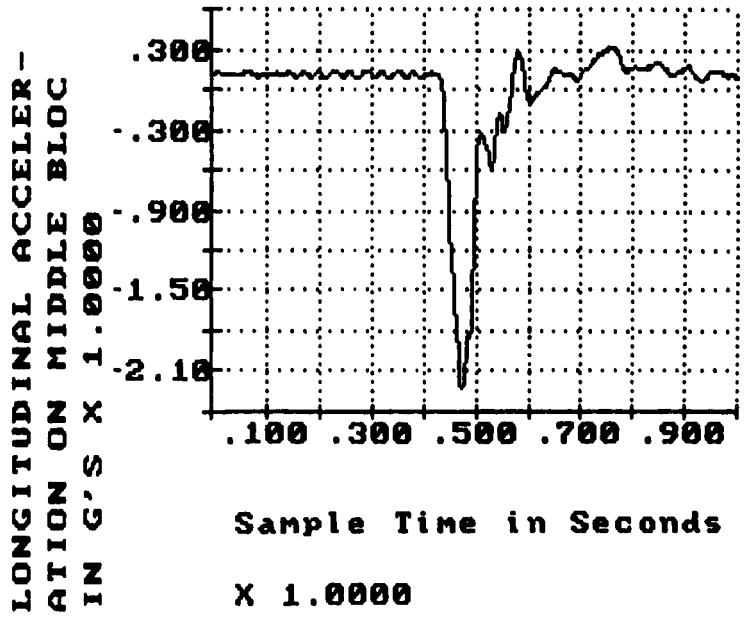


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

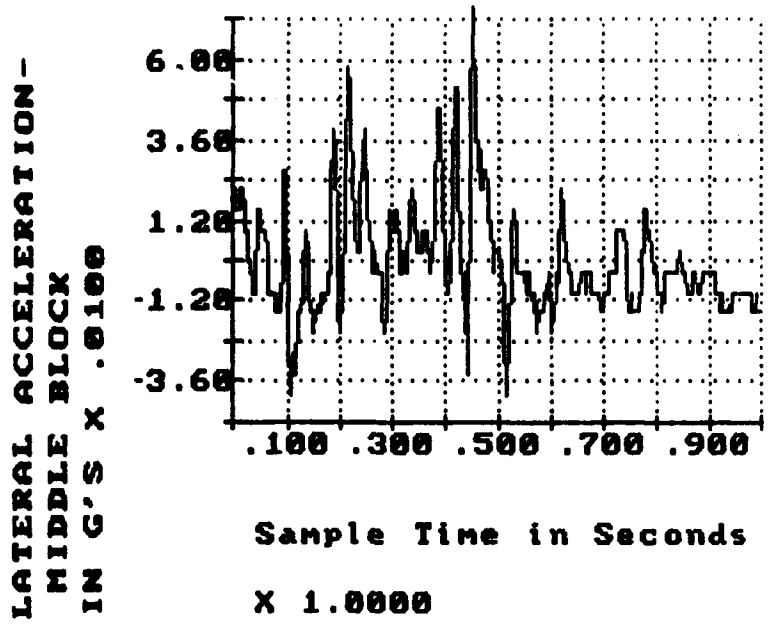


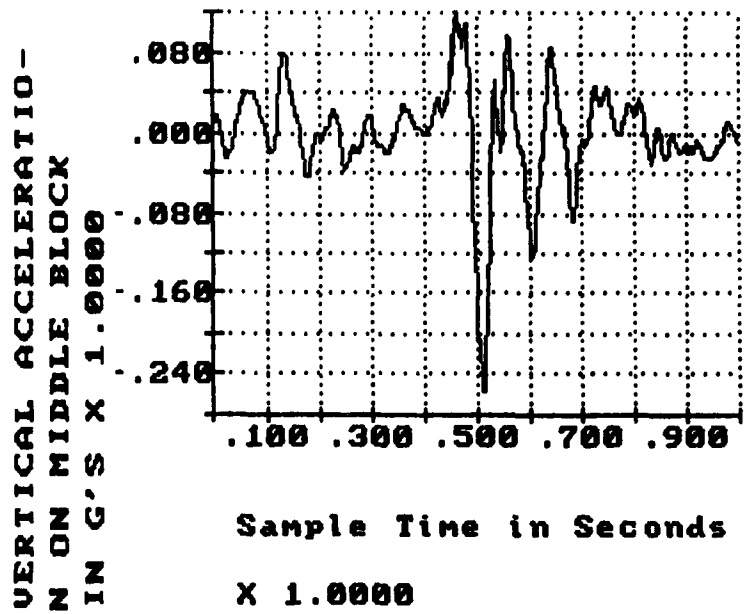


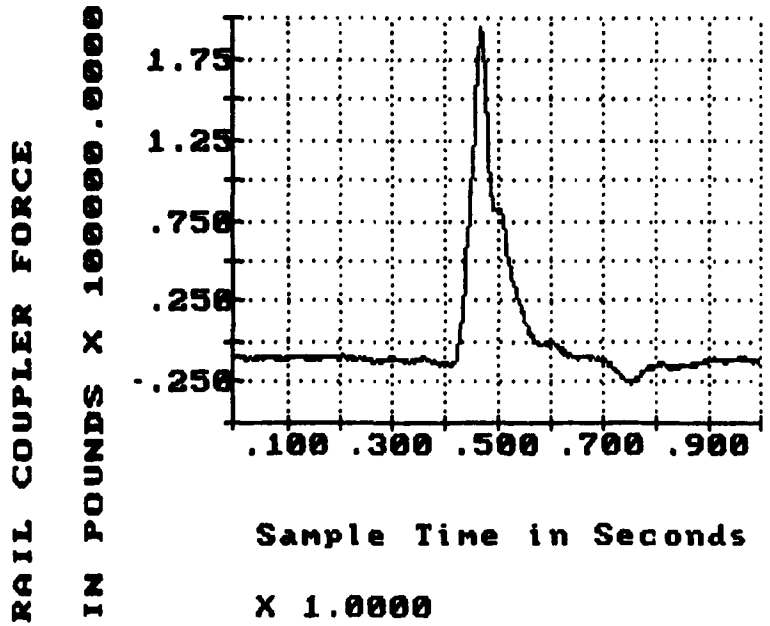


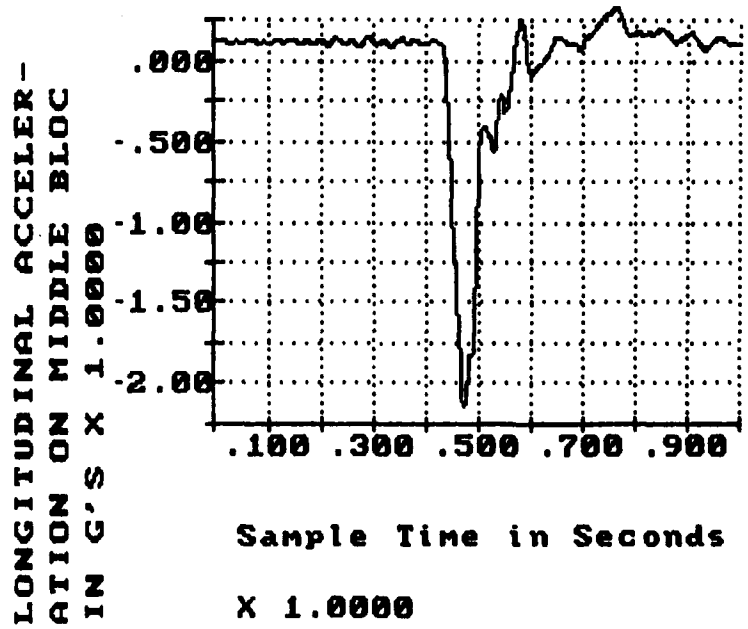


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

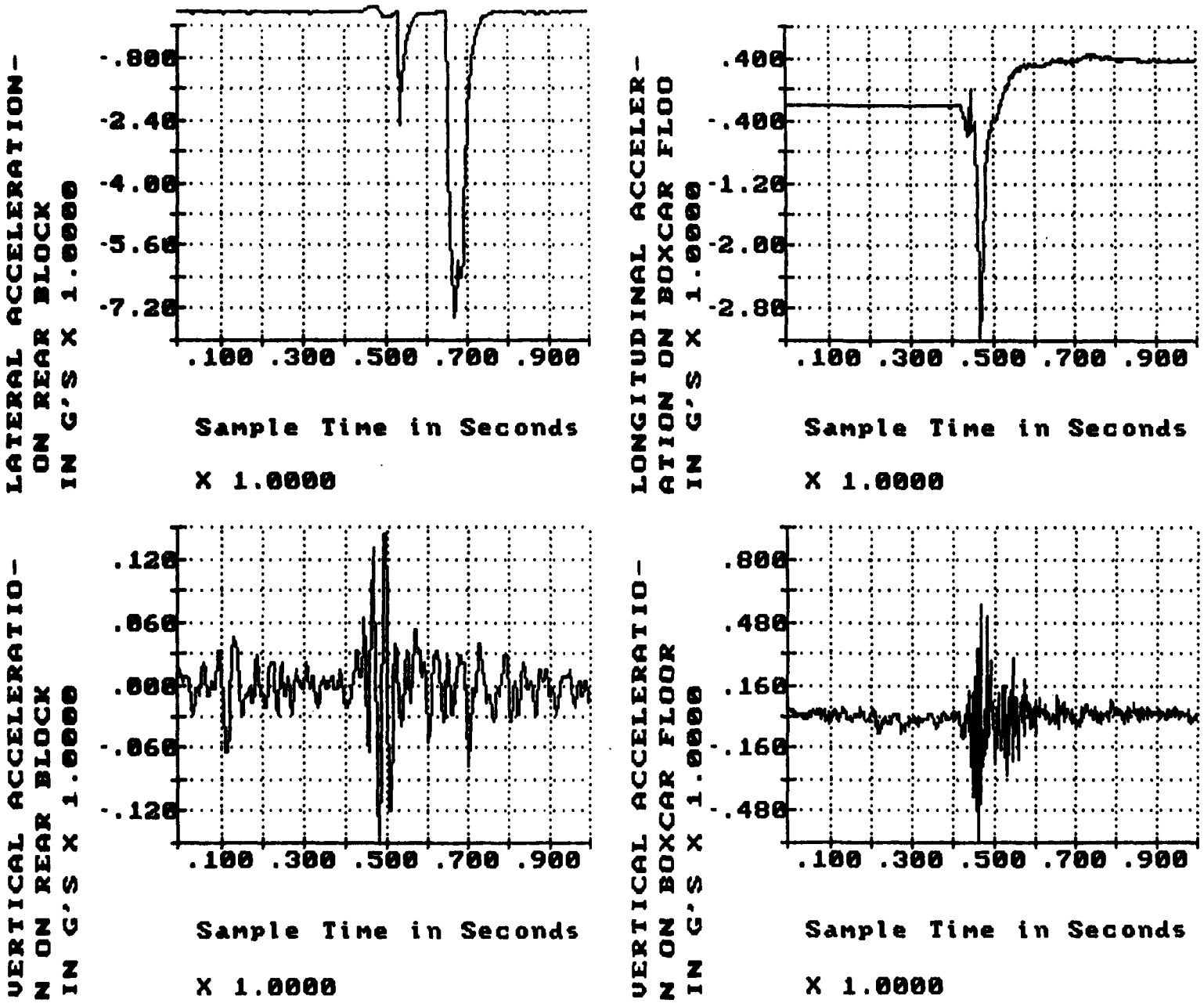




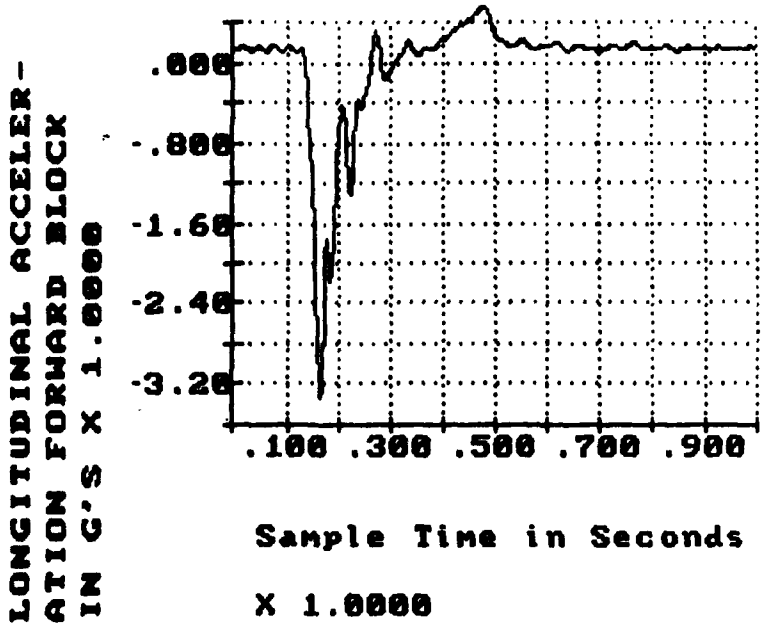


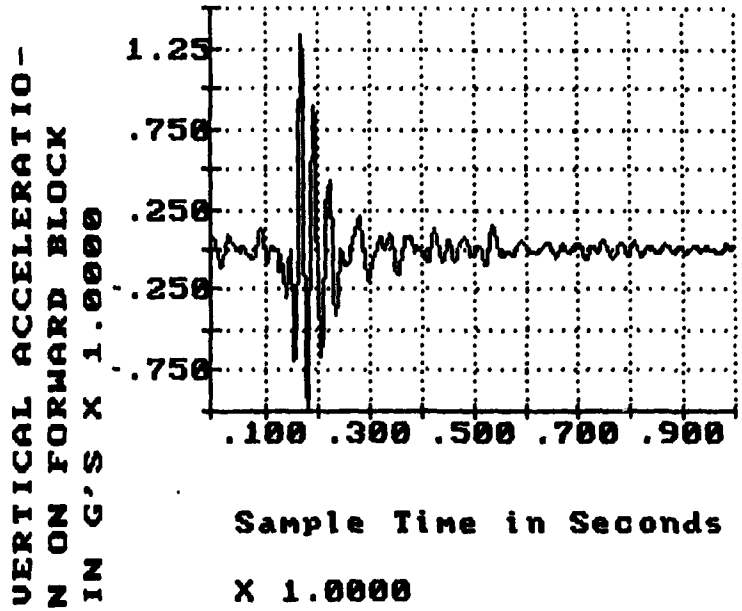


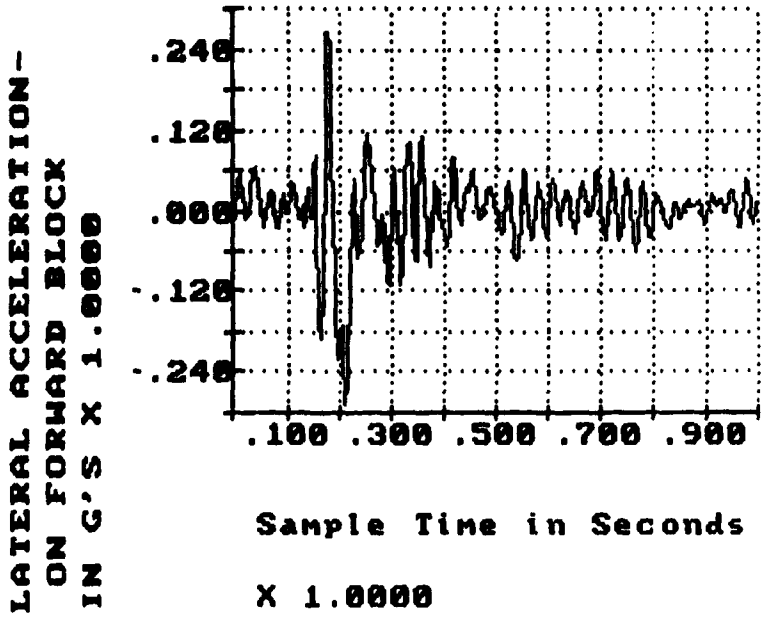
RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

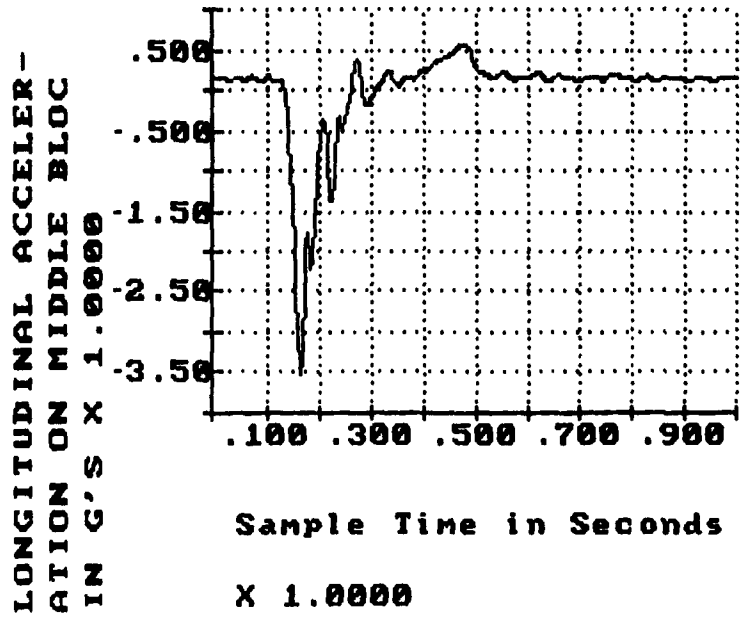


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

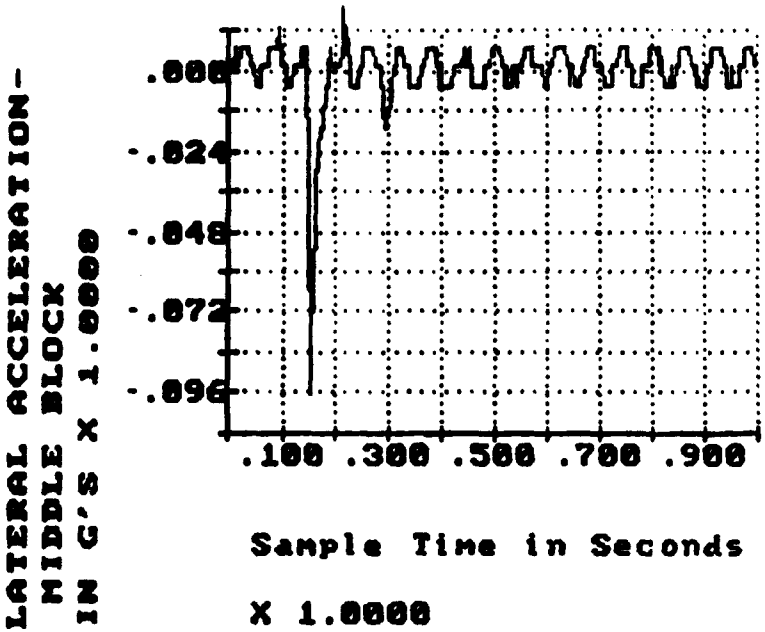


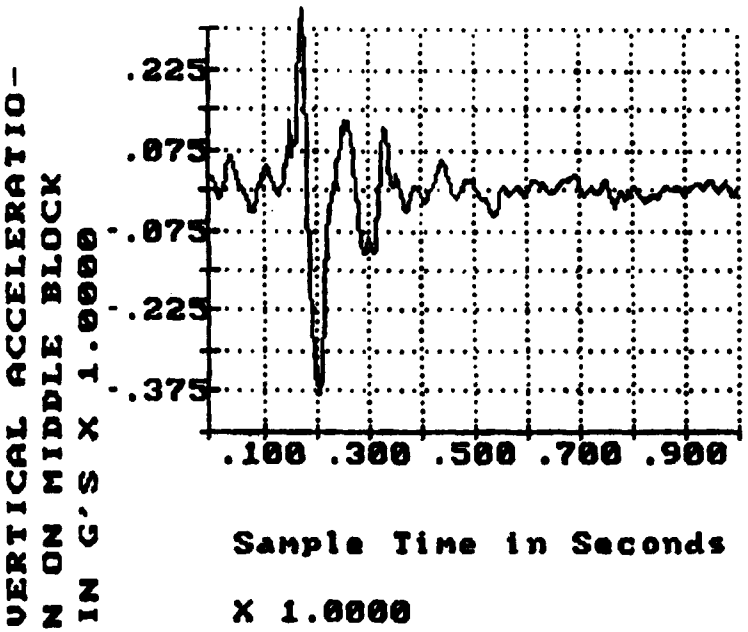


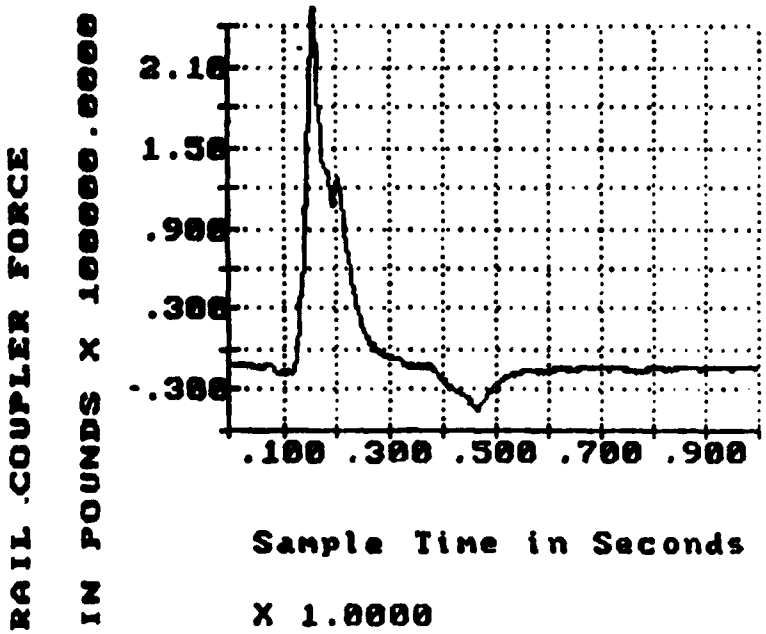


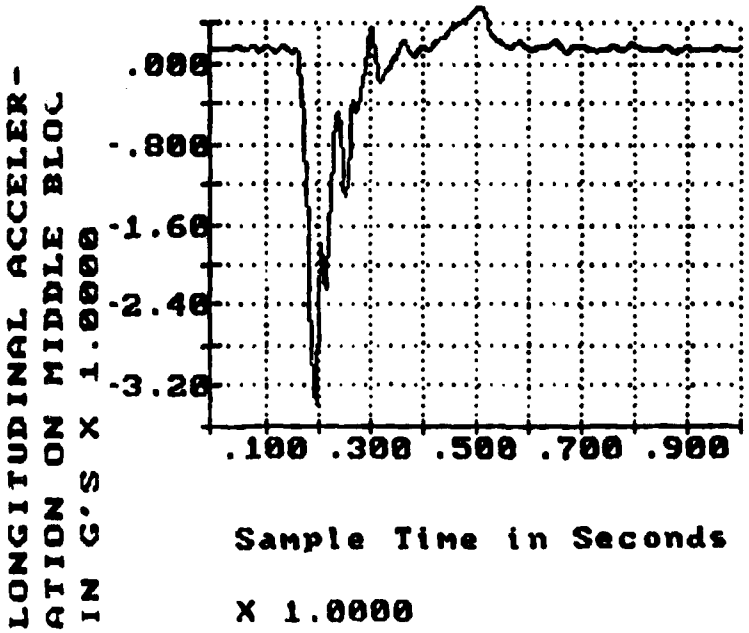


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

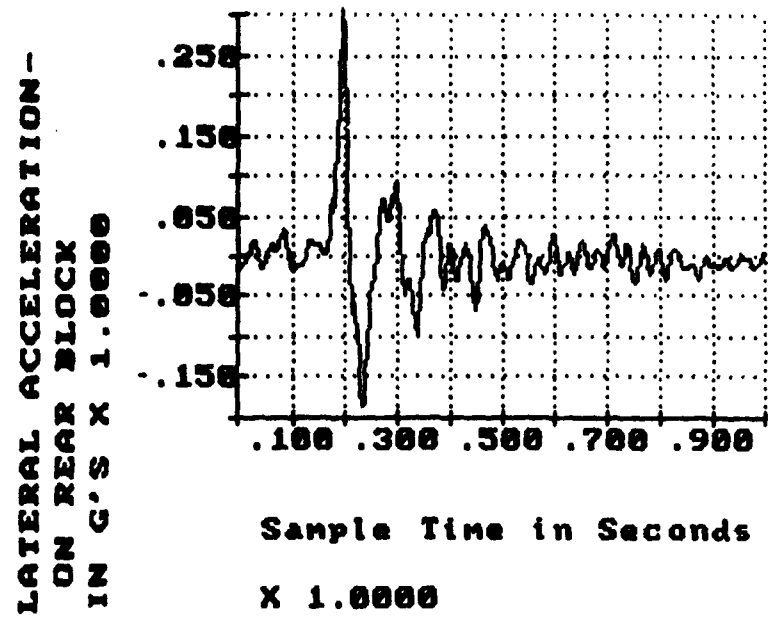


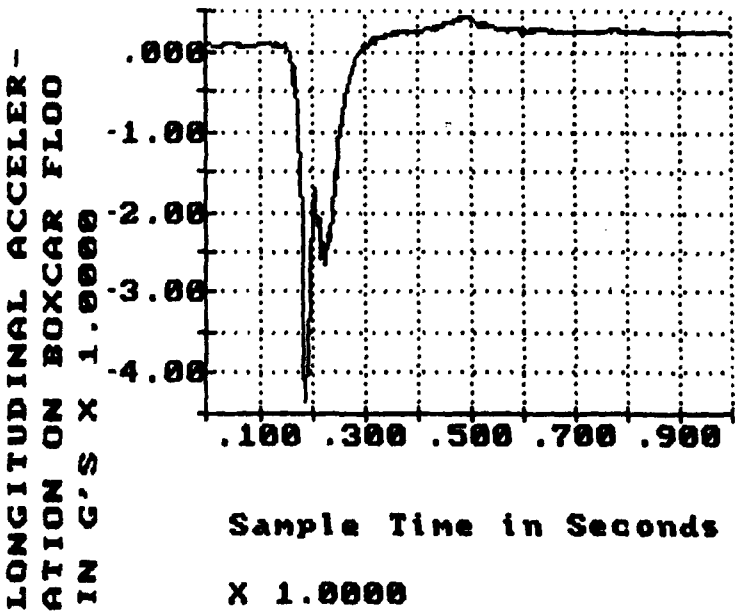


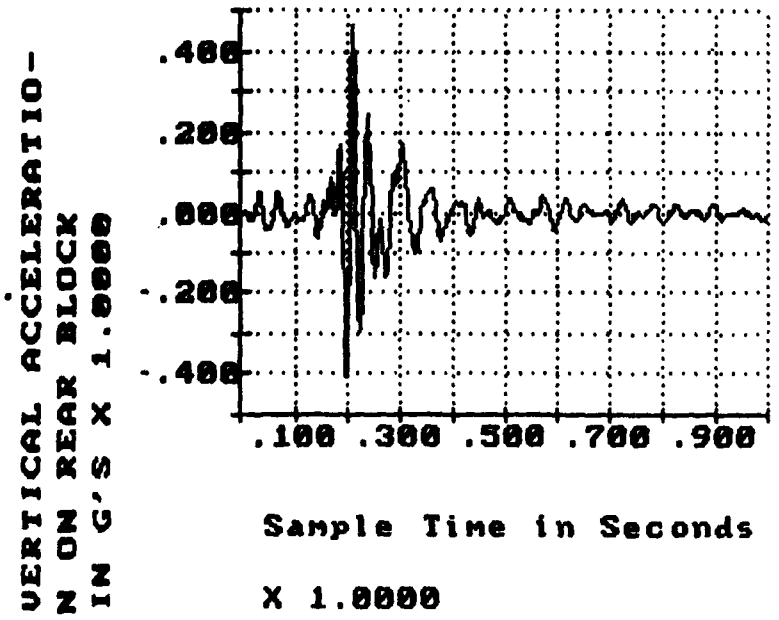


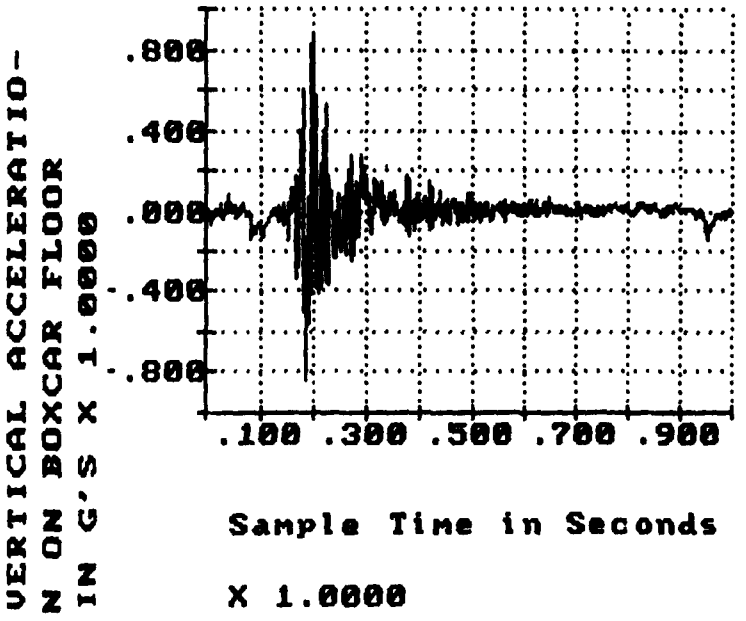


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.33 MPH

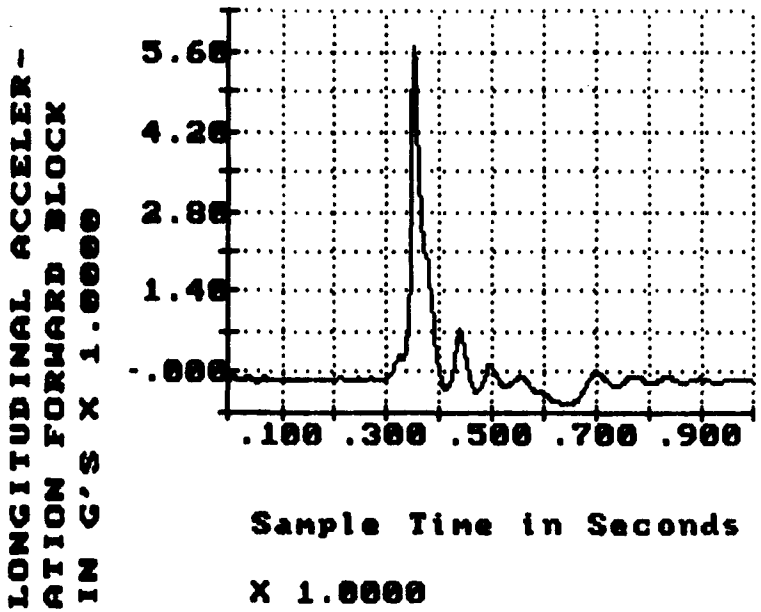


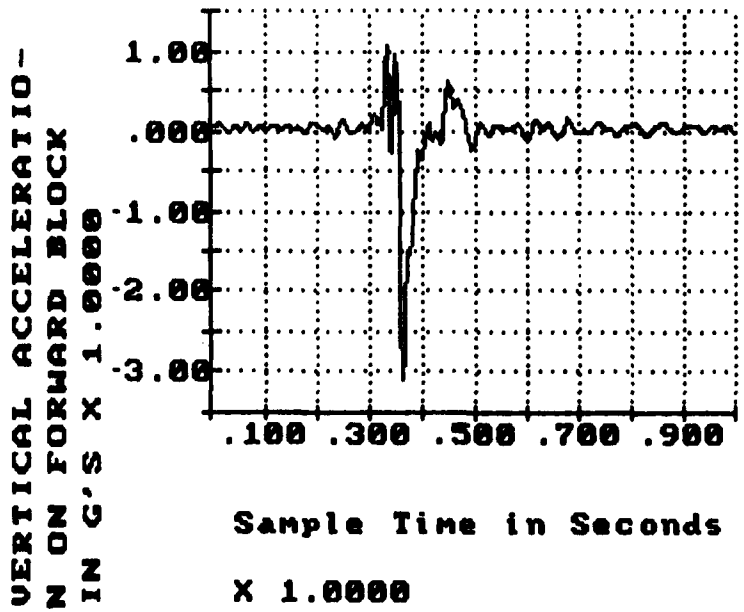


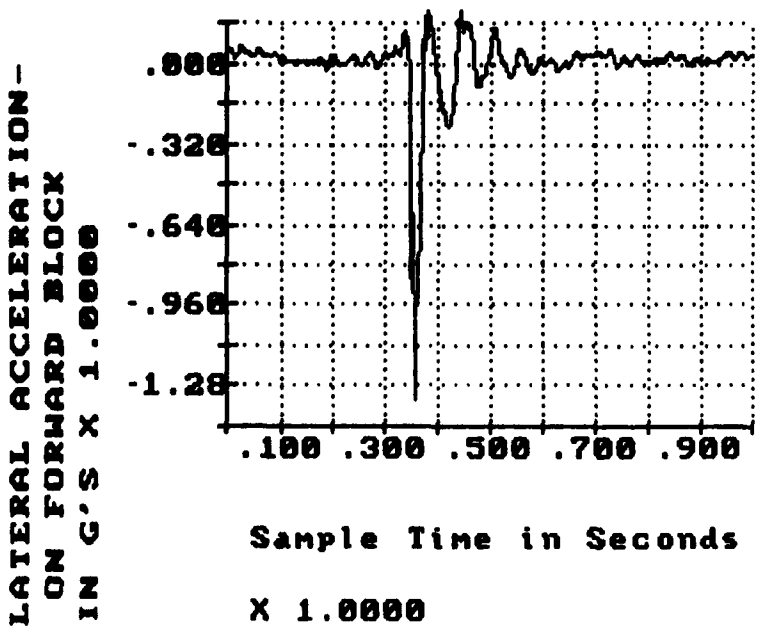


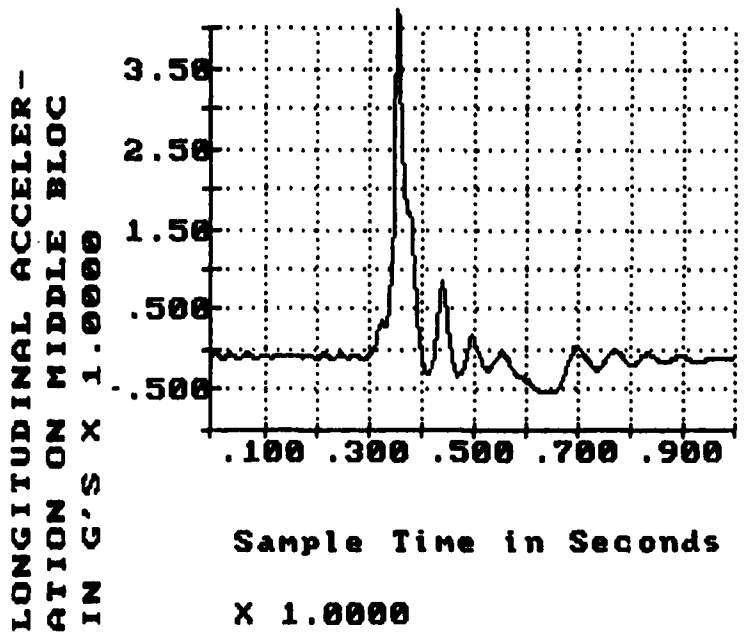


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.19 MPH (REVERSE)

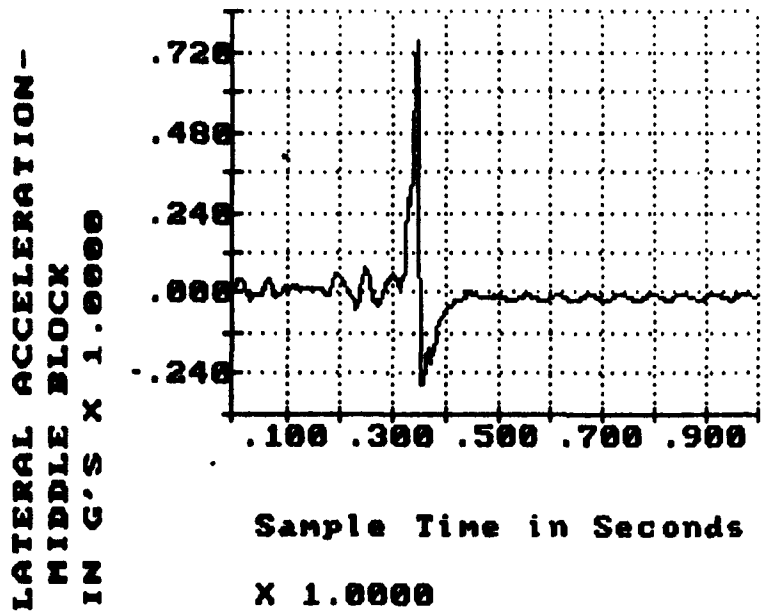


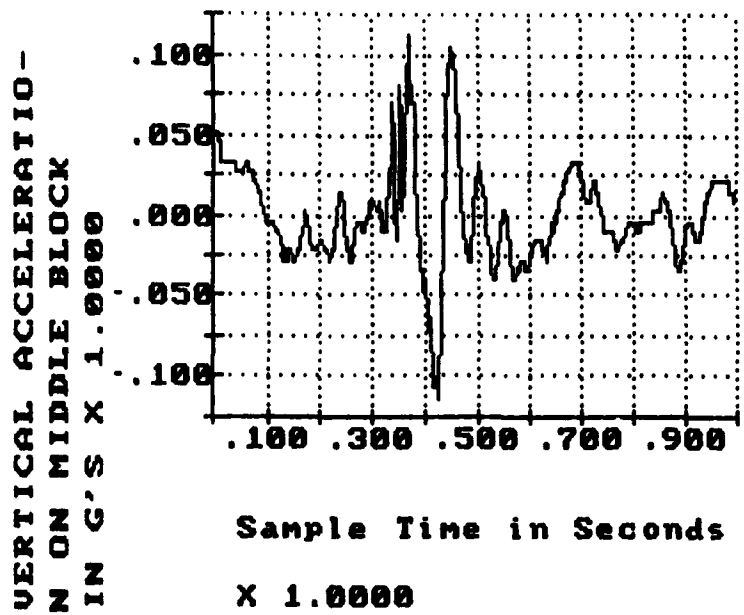


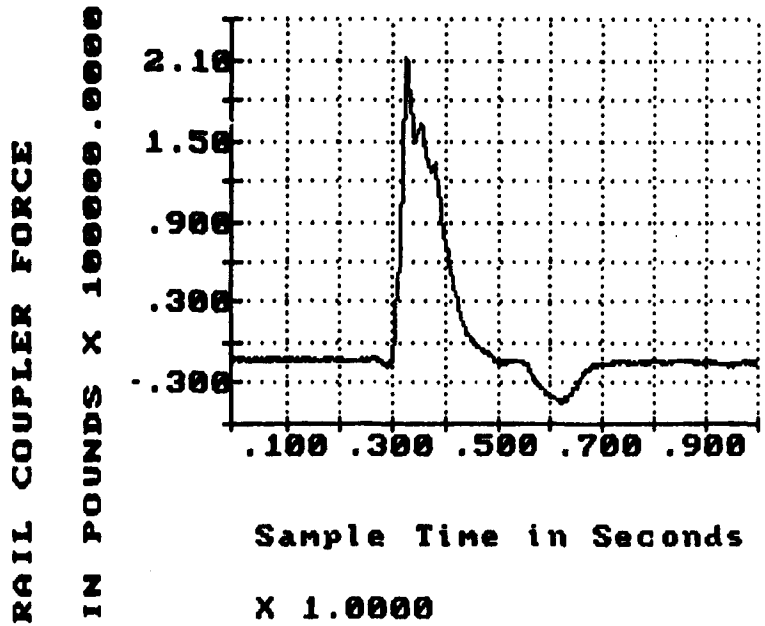


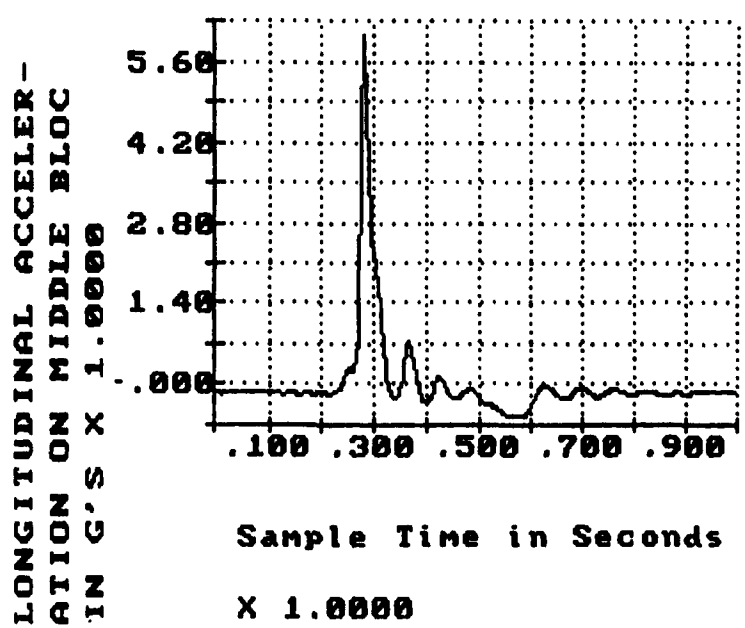


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.19 MPH (REVERSE)

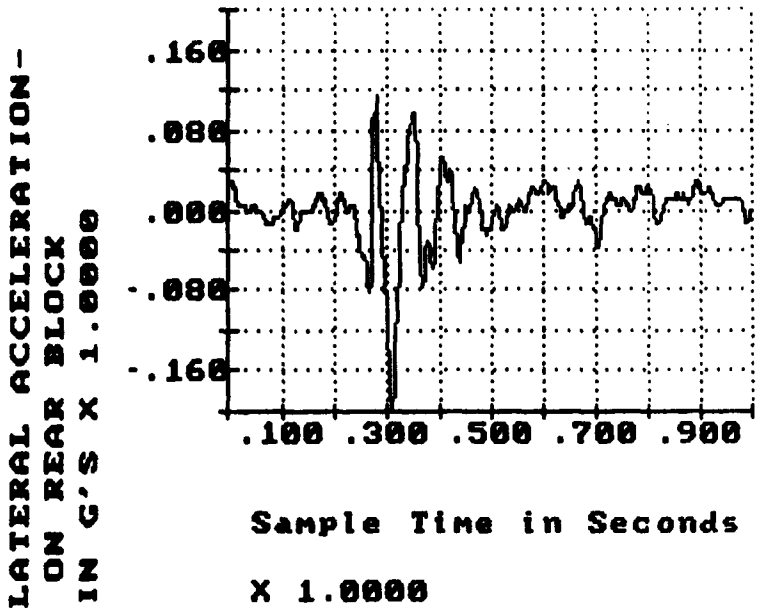


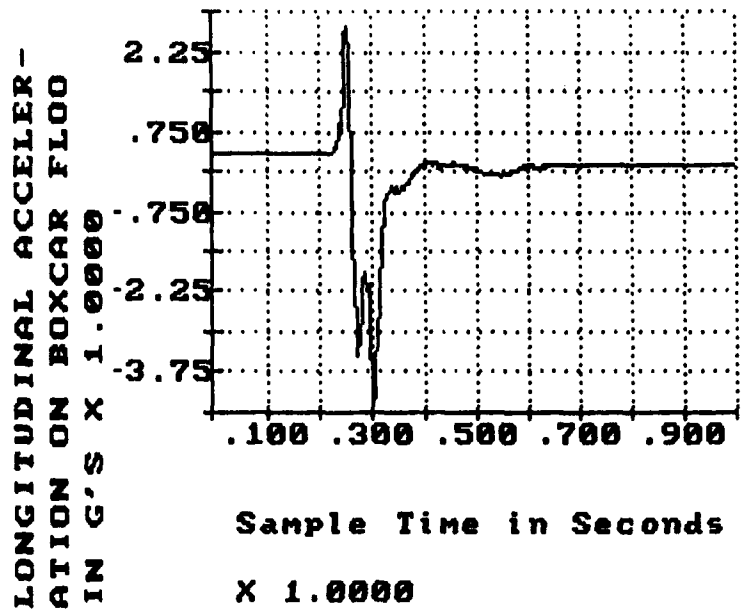


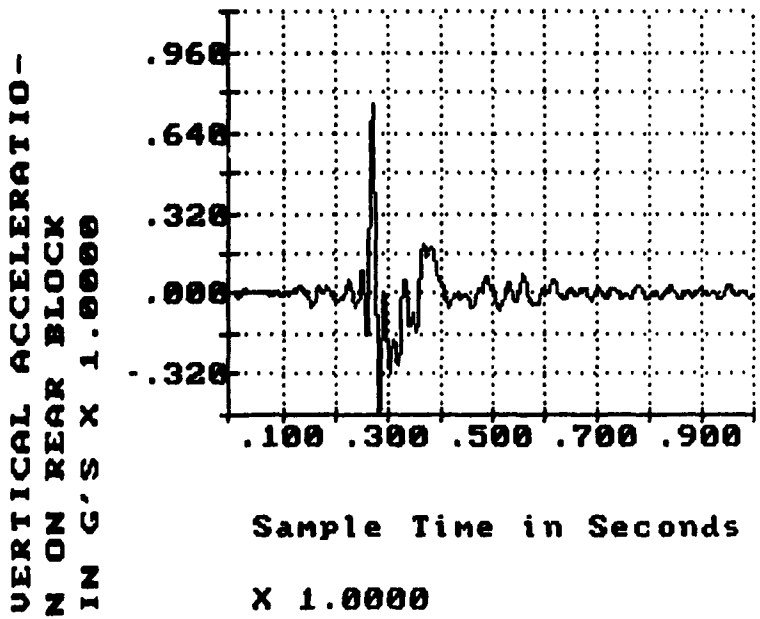


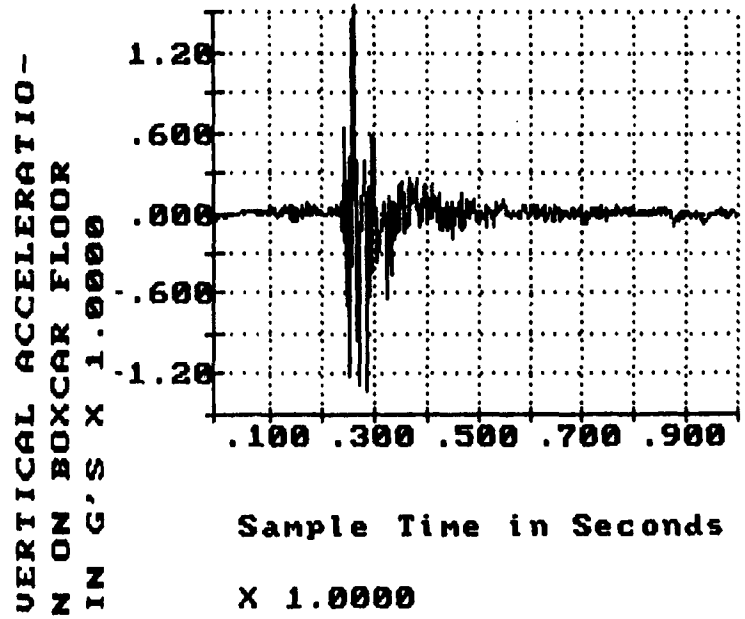


RAIL IMPACT TEST OF ATACMS IN BOXCAR
DATE: 11 JULY 1989
SPEED: 8.19 MPH (REVERSE)









RAIL IMPACT TEST

TEST NO. 6 DATE: 12 JULY 1989

TEST SPECIMEN: ATACMS on LRP in MILVAN on TOFC.

TEST CAR NO: TTX 252005	LT. WT.	74,900	POUNDS
MILVAN CHASSIS NO. 5394	LT. WT.	6,040	POUNDS
MILVAN NO. 1058	LT. WT.	5,900	POUNDS
LOAD AND ROLL PALLET NO.	LT. WT.	4,100	POUNDS
LADING AND DUNNAGE	WT.	21,800	POUNDS
TOTAL SPECIMEN	WT.	112,740	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.09	End of pallet shifted 5/8 inch. Pallet rocked up about one inch.
2	Forward	6.37	Additional 1/4-inch movement.
3	Forward	8.23	Securing blocks tight.
4	Reverse	8.54	No damage or shifting.

RESULTS FROM RAIL IMPACT TESTING OF
ATACMS IN TOFC
DATE: 12 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.41	80.79	.0786
IMPACT 2	6.37	2.00	98.41	.1199
IMPACT 3	8.23	2.81	183.99	.1928
IMPACT 4 (REVERSE)	8.54	-3.45	106.72	.2326

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.18	35.55	.0033
IMPACT 2	6.37	.19	24.90	.0030
IMPACT 3	8.23	.25	17.79	.0025
IMPACT 4 (REVERSE)	8.54	-.35	25.02	.0050

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.96	56.23	.0352
IMPACT 2	6.37	1.15	26.26	.0191
IMPACT 3	8.23	1.66	151.43	.0925
IMPACT 4 (REVERSE)	8.54	-1.56	60.24	.0323

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.44	81.64	.0802
IMPACT 2	6.37	2.11	87.76	.1175
IMPACT 3	8.23	2.96	129.99	.1981
IMPACT 4 (REVERSE)	8.54	-3.31	110.56	.2323

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.57	51.27	.0196
IMPACT 2	6.37	.38	30.91	.0078
IMPACT 3	8.23	.04	26.09	.0009
IMPACT 4 (REVERSE)	8.54	.03	16.78	.0004

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.09	121160.75	76.81	5496.80
IMPACT 2	6.37	169545.41	48.85	5707.44
IMPACT 3	8.23	232486.73	42.93	6658.96
IMPACT 4 (REVERSE)	8.54	207655.44	44.05	6140.35

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-.14	42.40	.0039
IMPACT 2	6.37	.22	36.00	.0052
IMPACT 3	8.23	.23	86.93	.0114
IMPACT 4 (REVERSE)	8.54	.24	26.72	.0047

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	1.39	83.03	.0791
IMPACT 2	6.37	2.02	102.76	.1212
IMPACT 3	8.23	2.86	137.24	.1968
IMPACT 4 (REVERSE)	8.54	-3.45	109.06	.2335

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-.11	26.65	.0019
IMPACT 2	6.37	.16	79.76	.0046
IMPACT 3	8.23	-11.93	38.24	.2926
IMPACT 4 (REVERSE)	8.54	.20	26.08	.0031

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.37	61.37	.0091
IMPACT 2	6.37	.62	37.45	.0141
IMPACT 3	8.23	.72	28.24	.0146
IMPACT 4 (REVERSE)	8.54	1.60	26.02	.0259

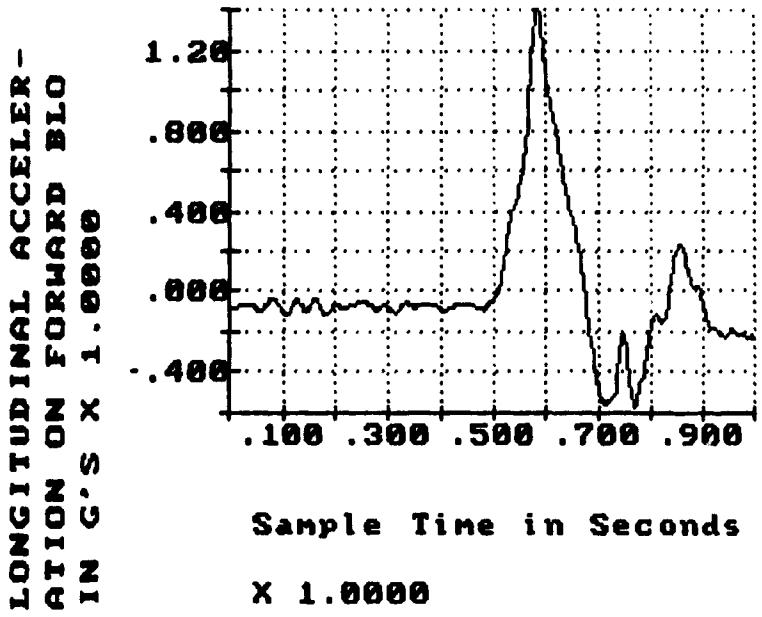
TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON BOXCAR FLOOR

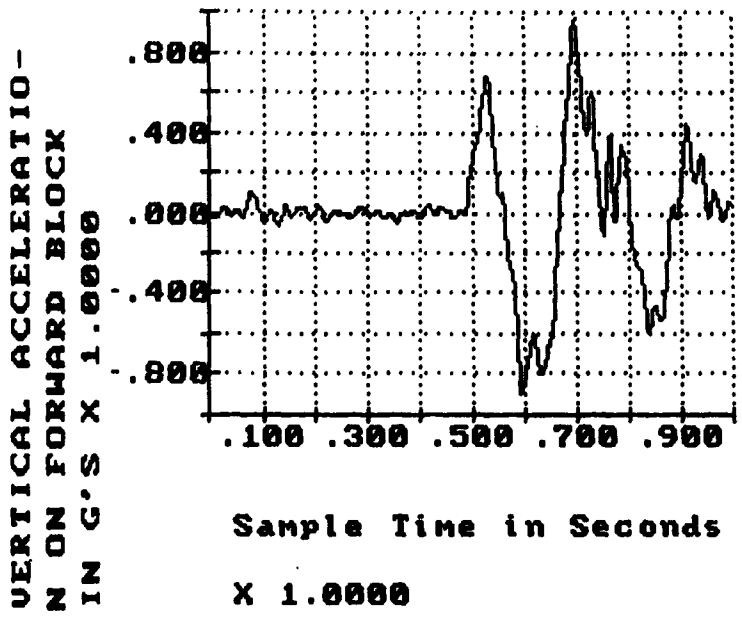
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	-1.47	126.23	.0732
IMPACT 2	6.37	-4.10	60.39	.1100
IMPACT 3	8.23	-2.20	37.11	.0485
IMPACT 4 (REVERSE)	8.54	1.36	23.09	.0180

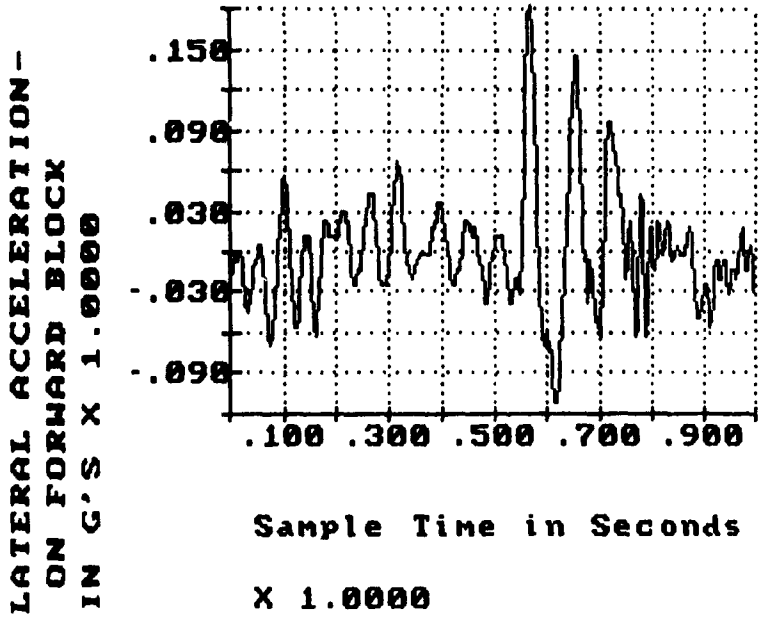
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON BOXCAR FLOOR

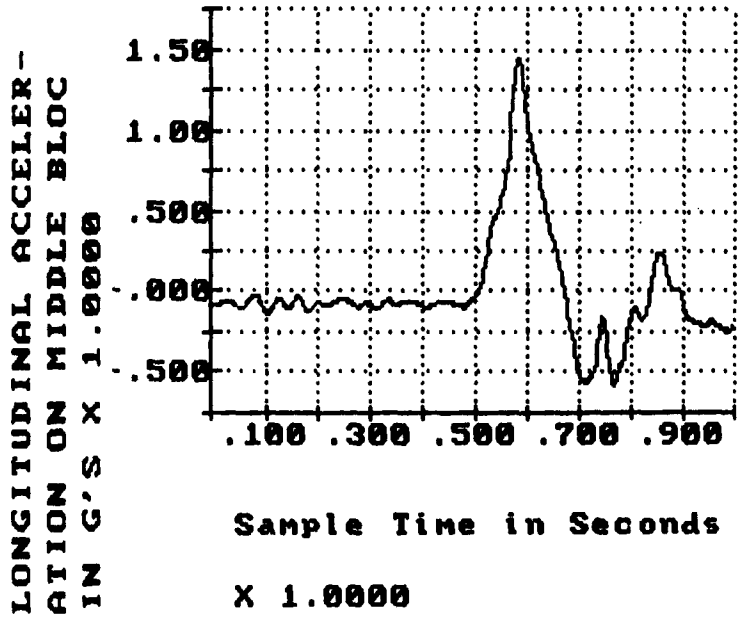
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.09	.33	12.76	.0035
IMPACT 2	6.37	.57	30.37	.0125
IMPACT 3	8.23	-3.07	25.54	.0455
IMPACT 4 (REVERSE)	8.54	-1.01	9.24	.0054

RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 4.09 MPH

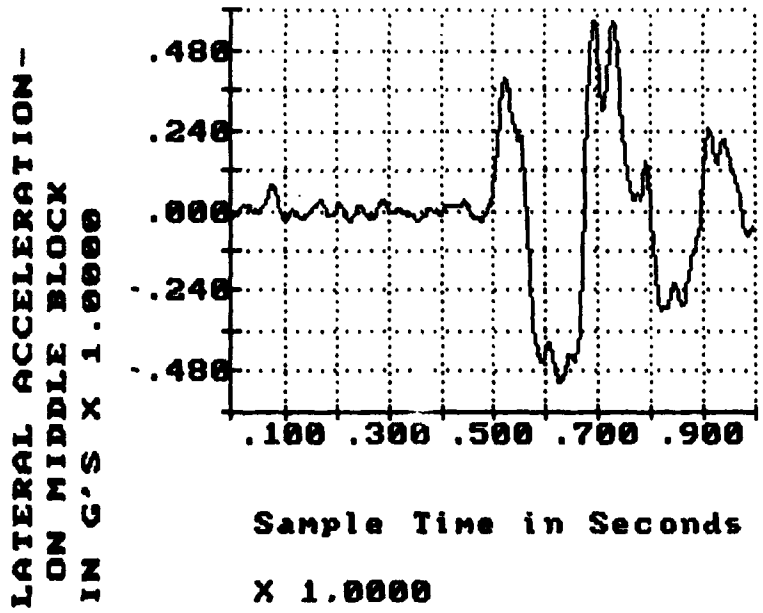


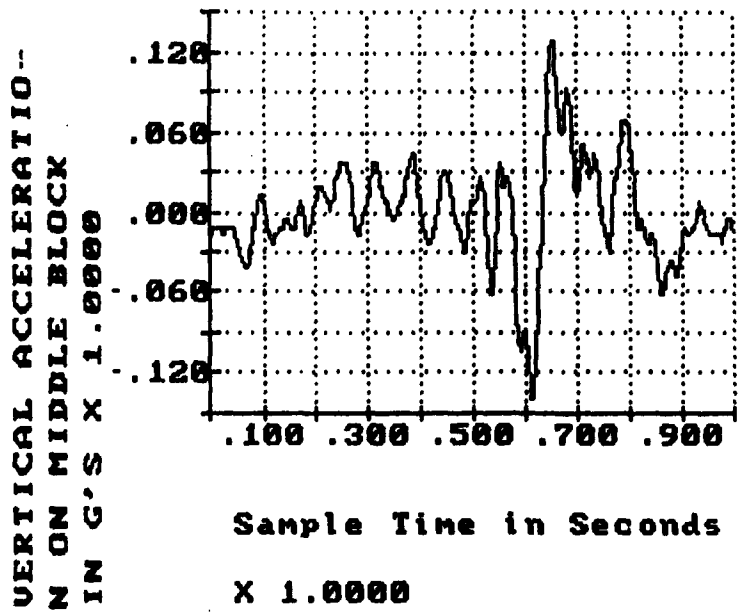


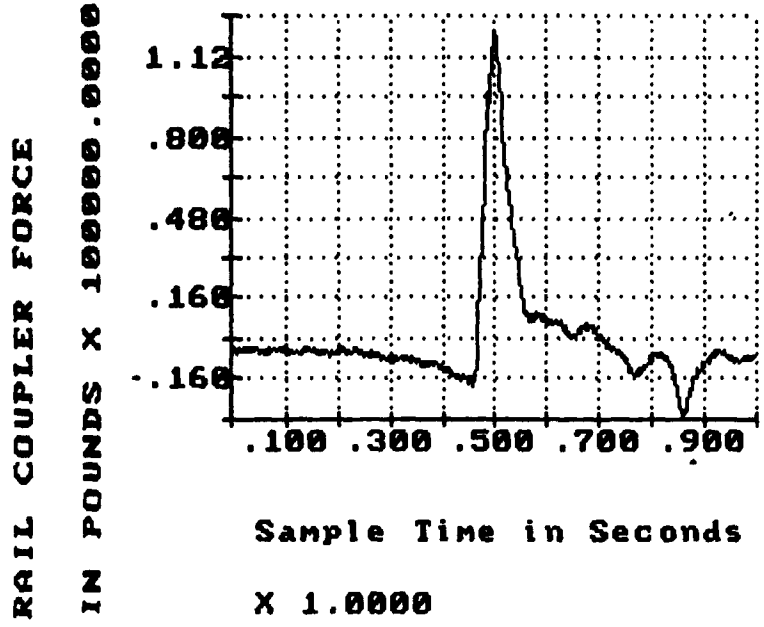


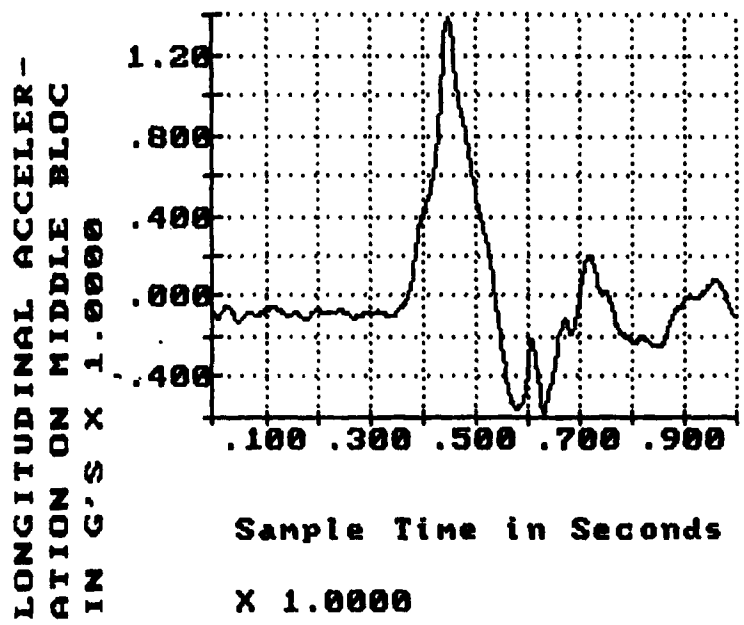


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 4.09 MPH

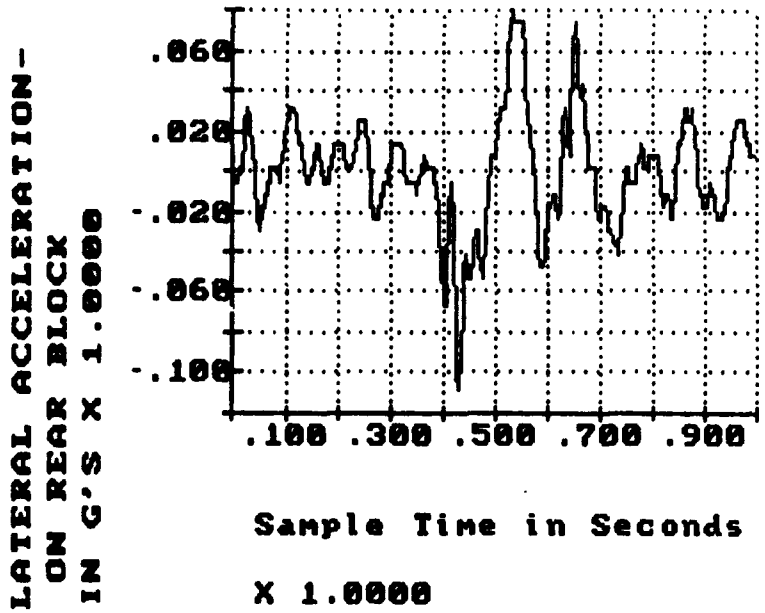


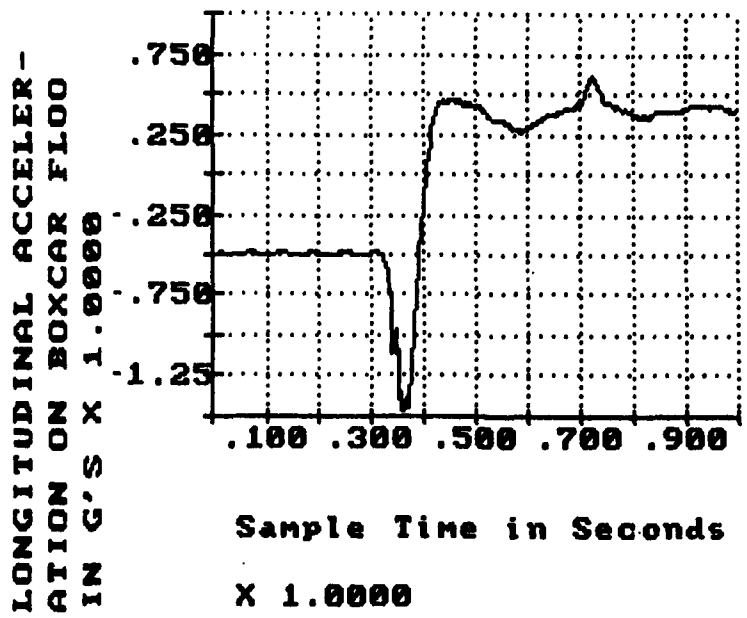


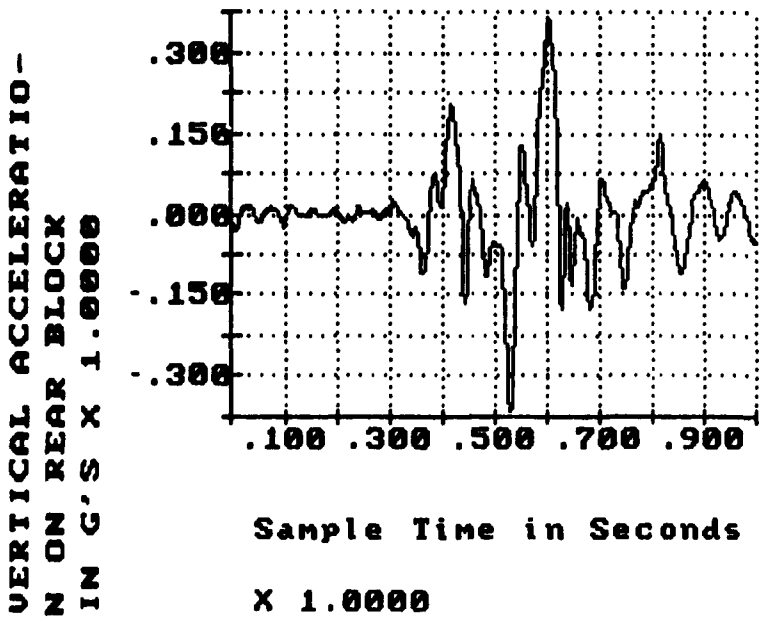


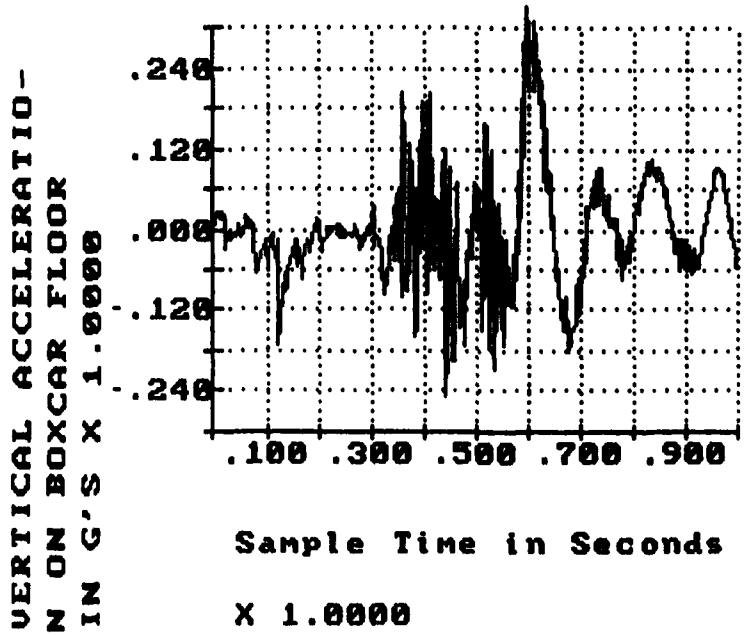


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 4.09 MPH

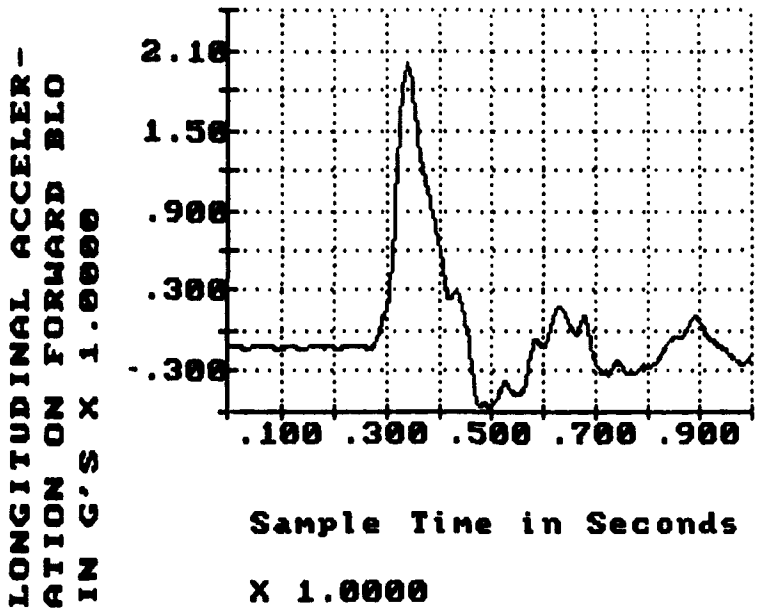


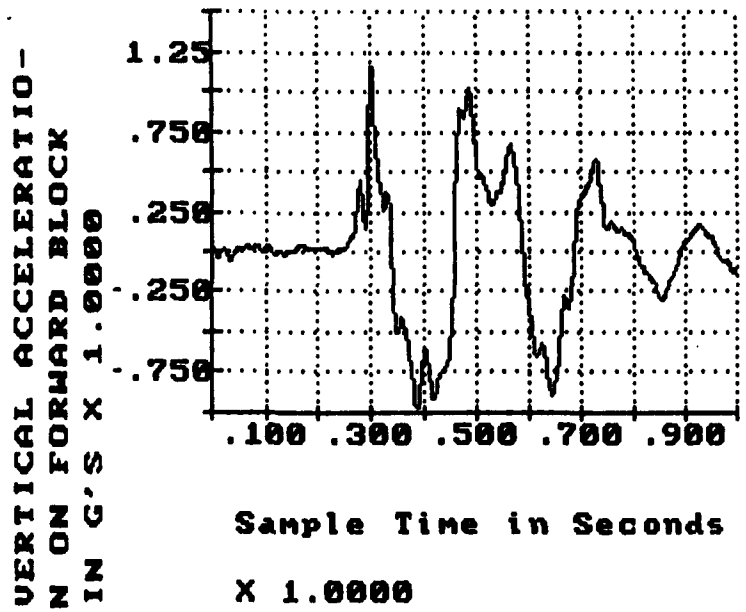


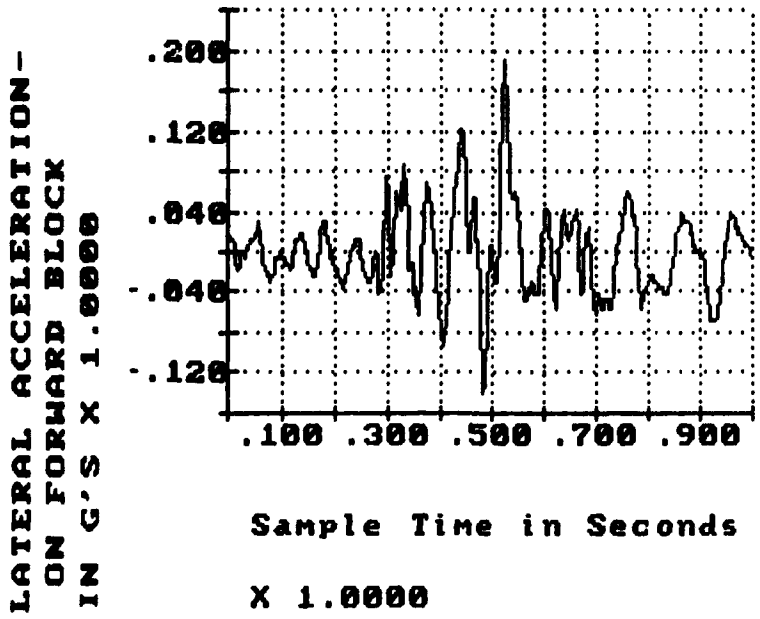


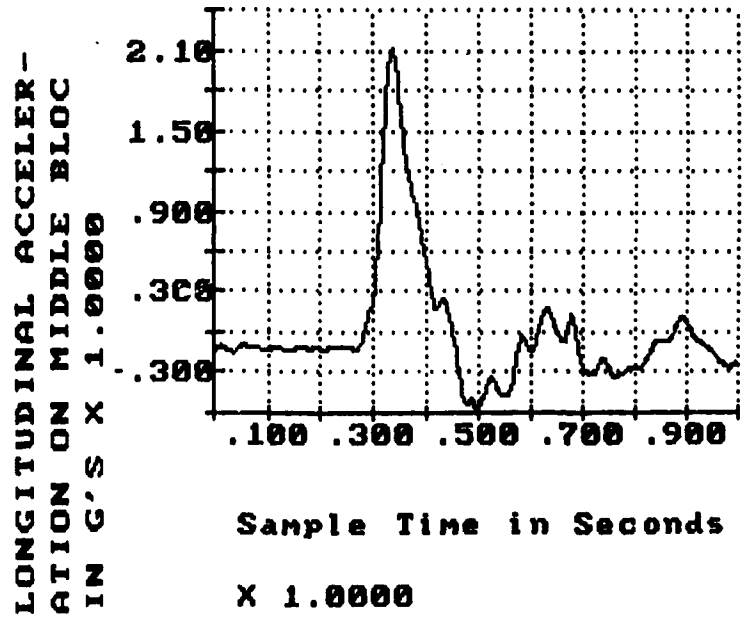


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 6.37 MPH

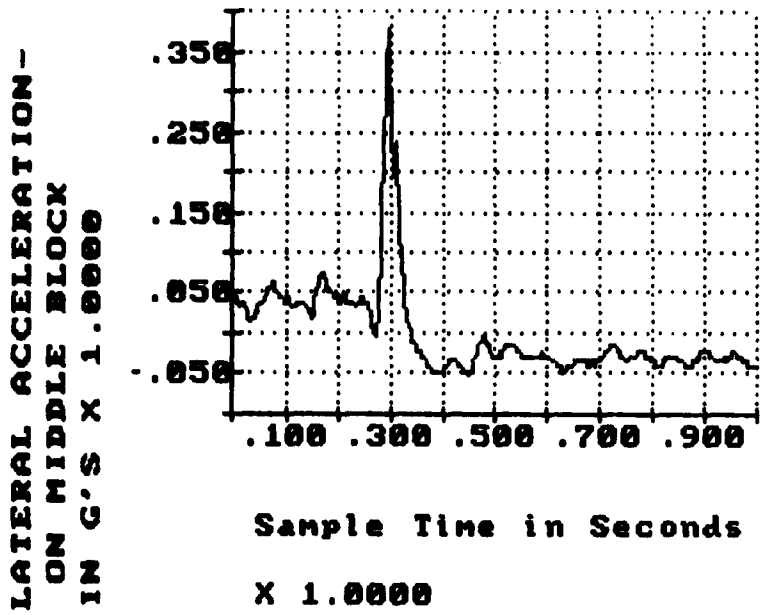


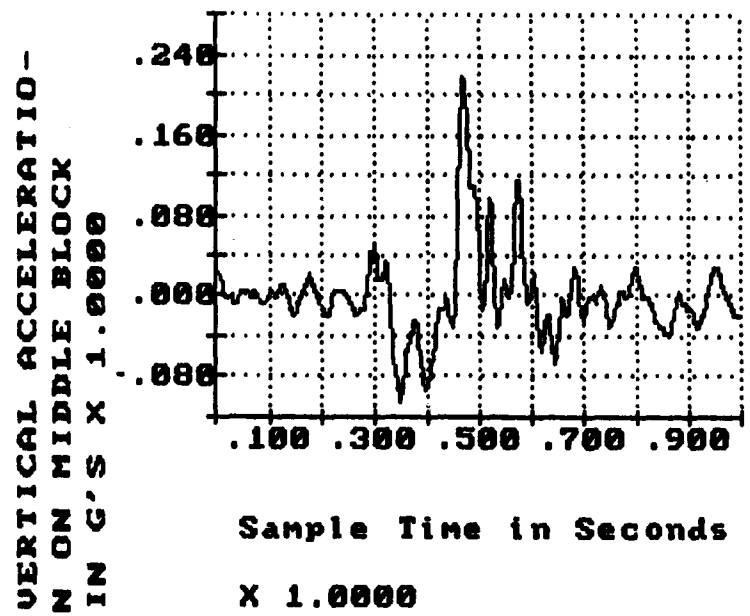


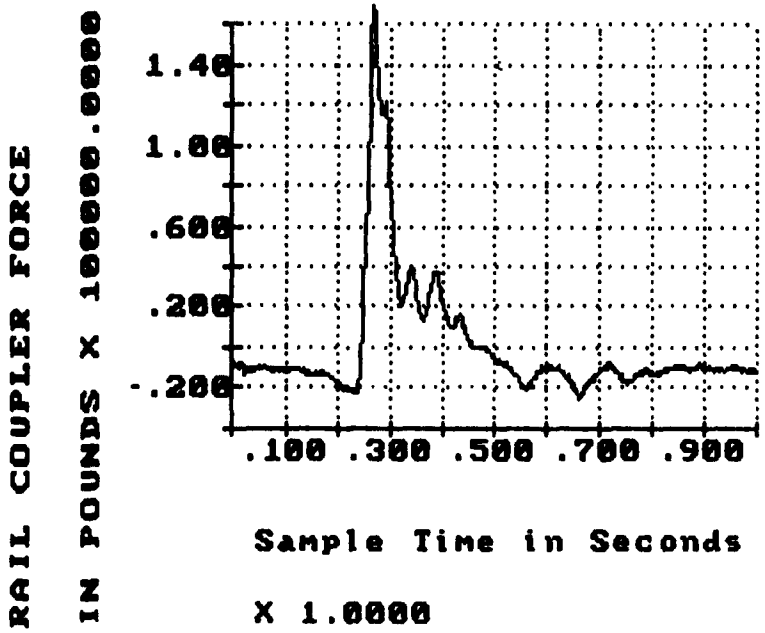


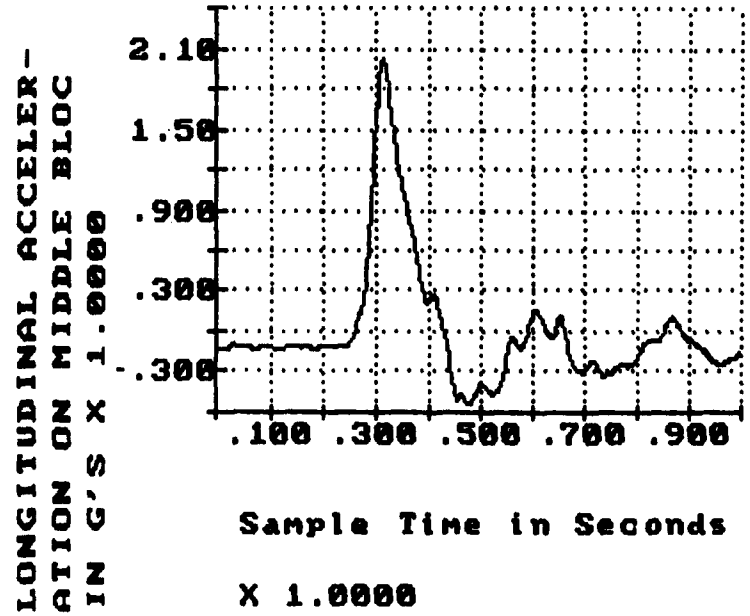


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 6.37 MPH

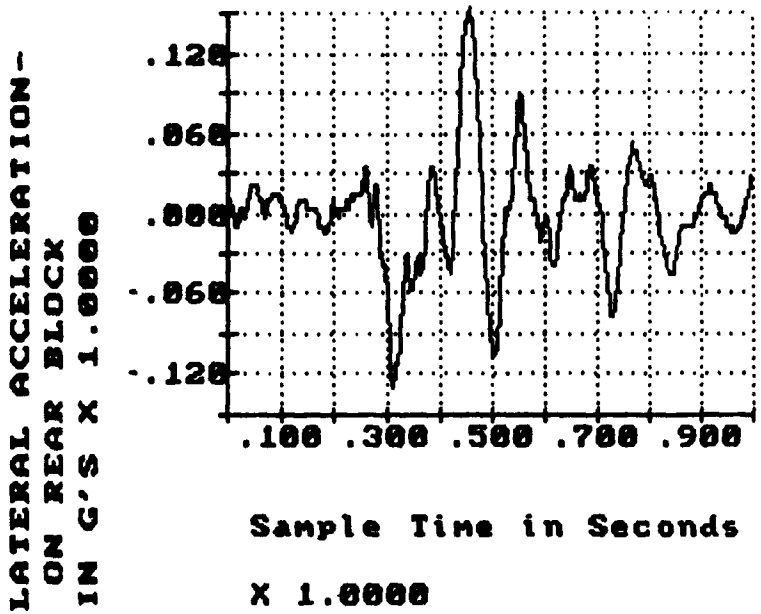


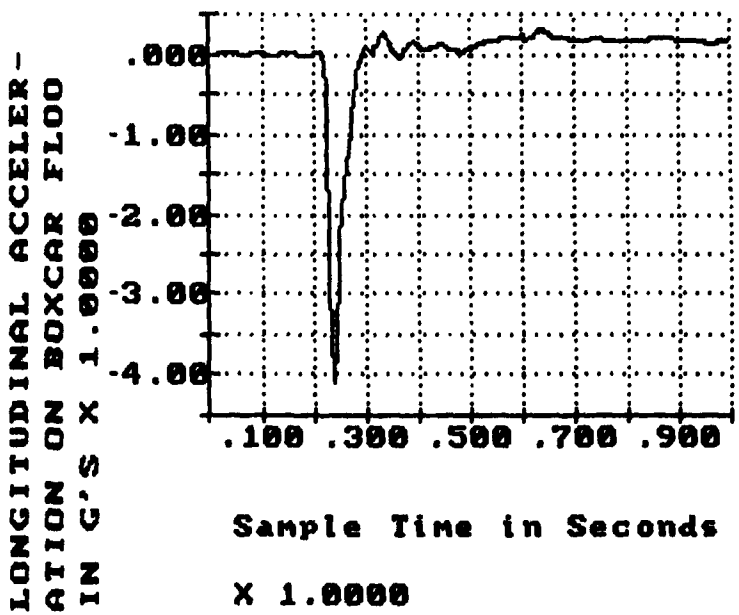


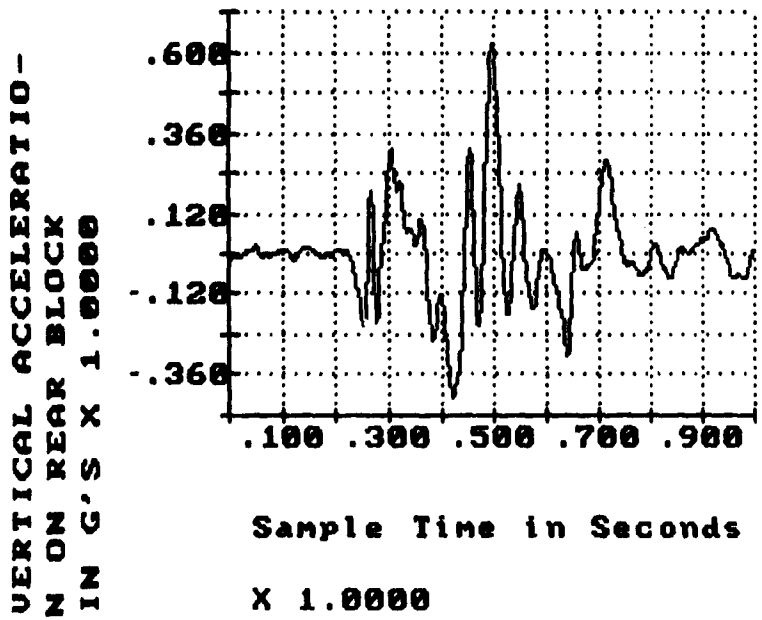


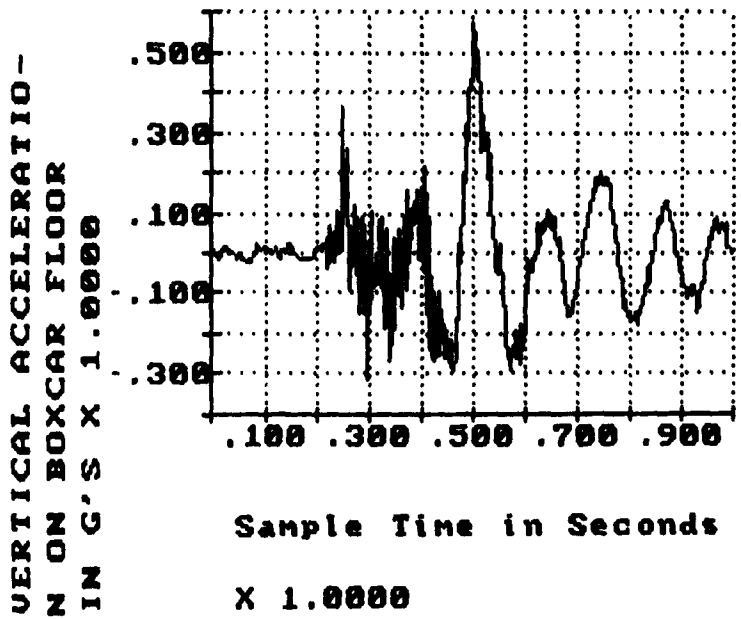


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 6.37 MPH

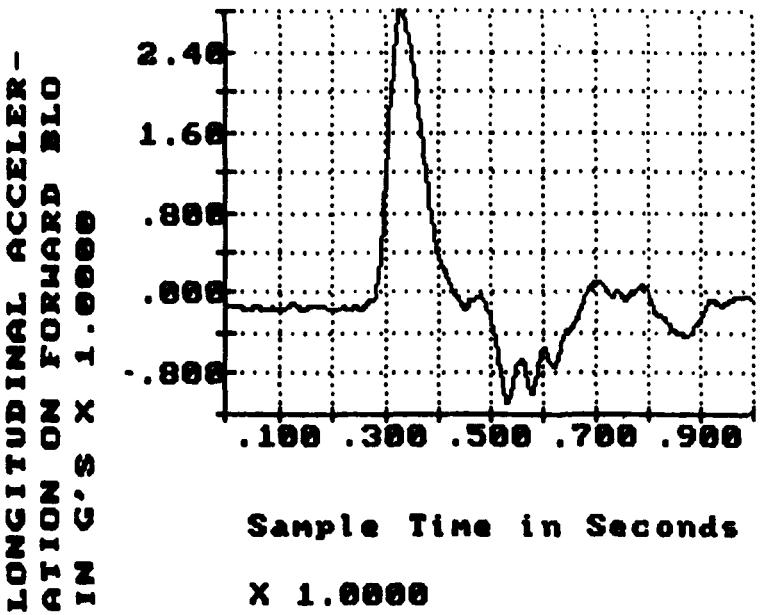


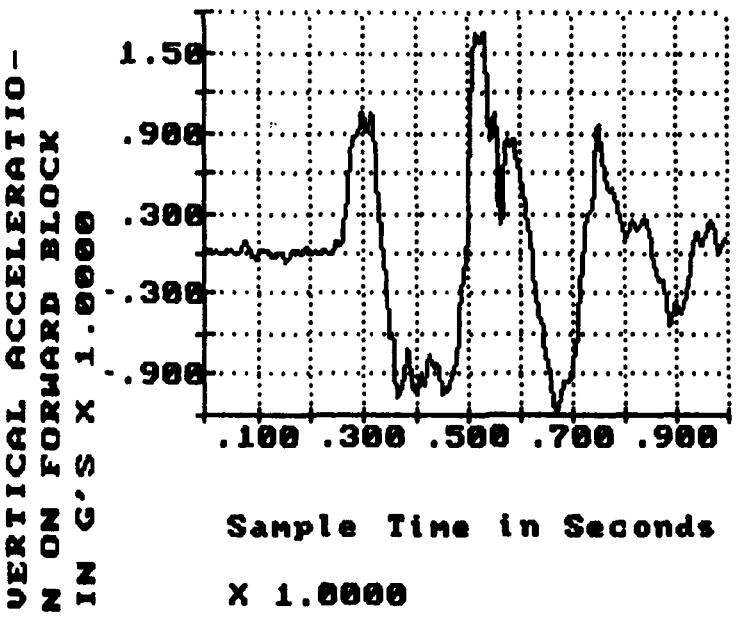


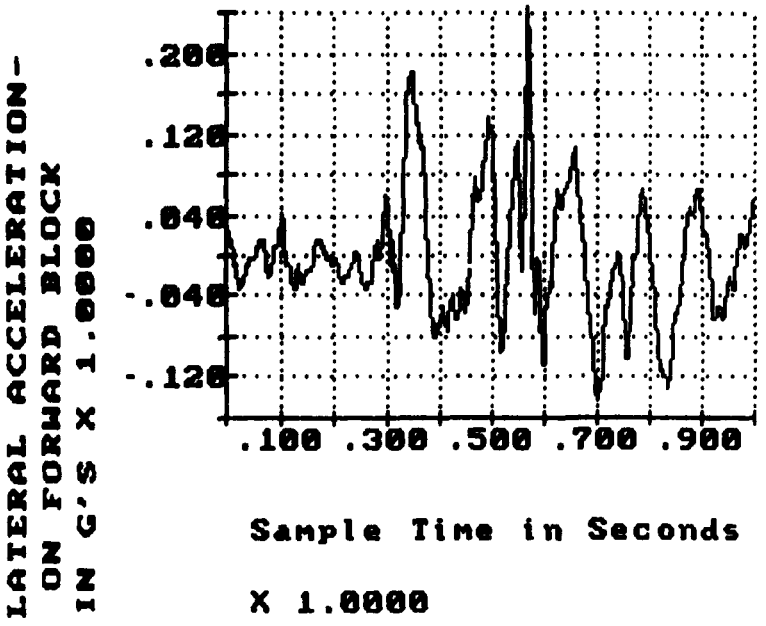


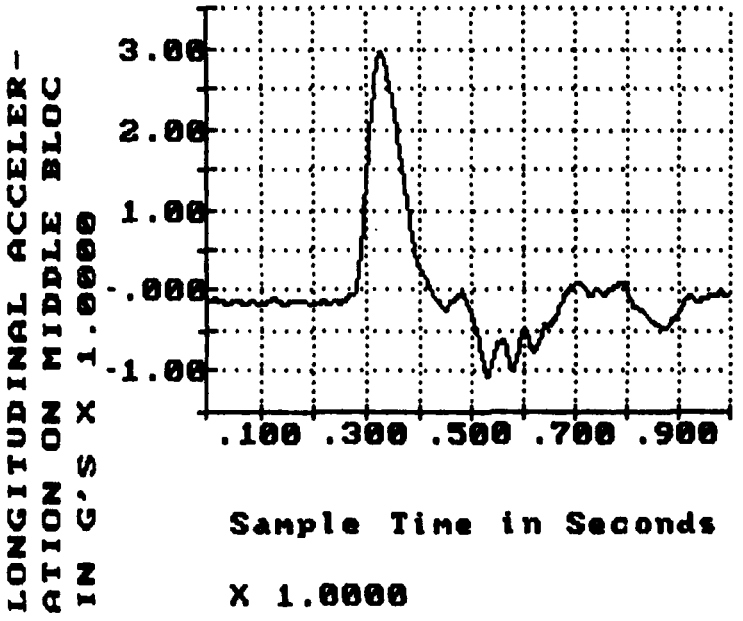


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.23 MPH

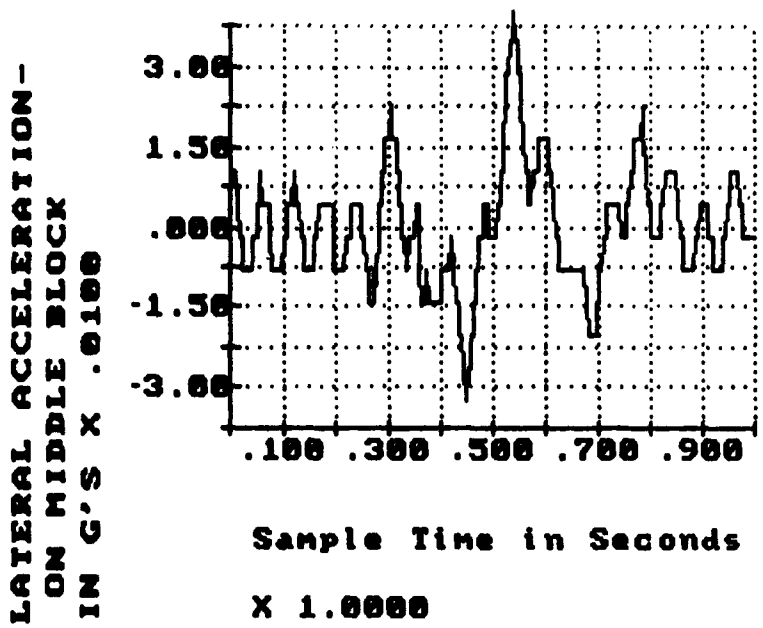


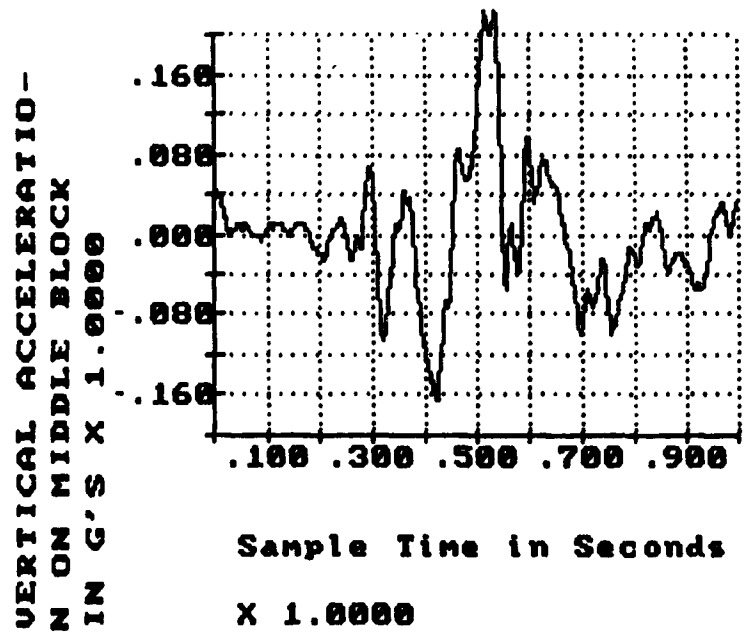


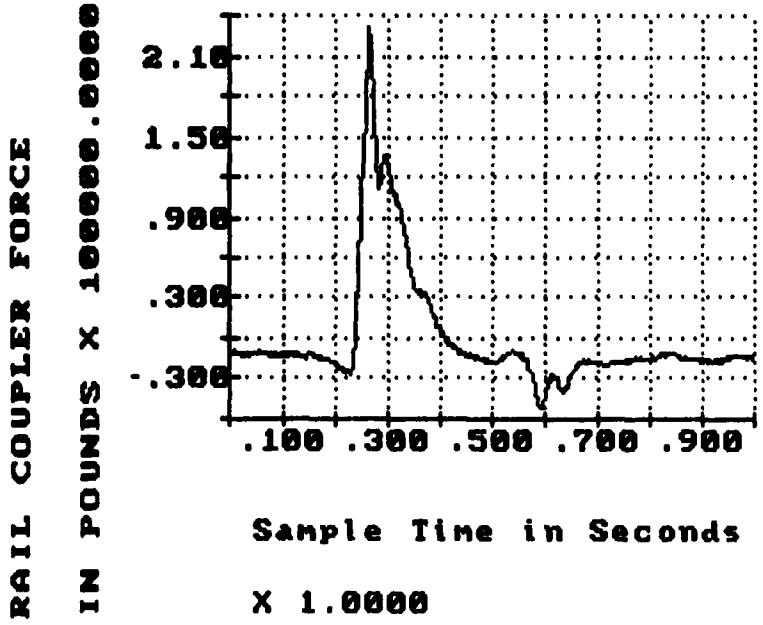


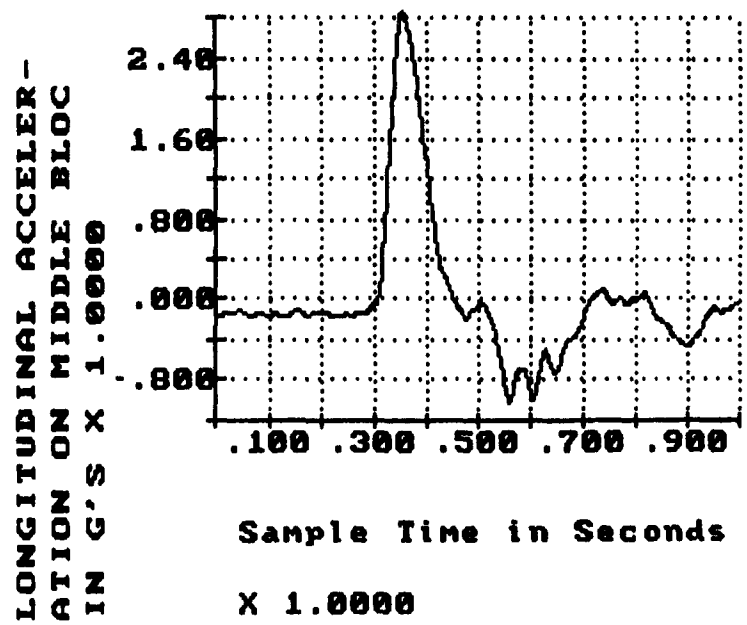


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.23 MPH

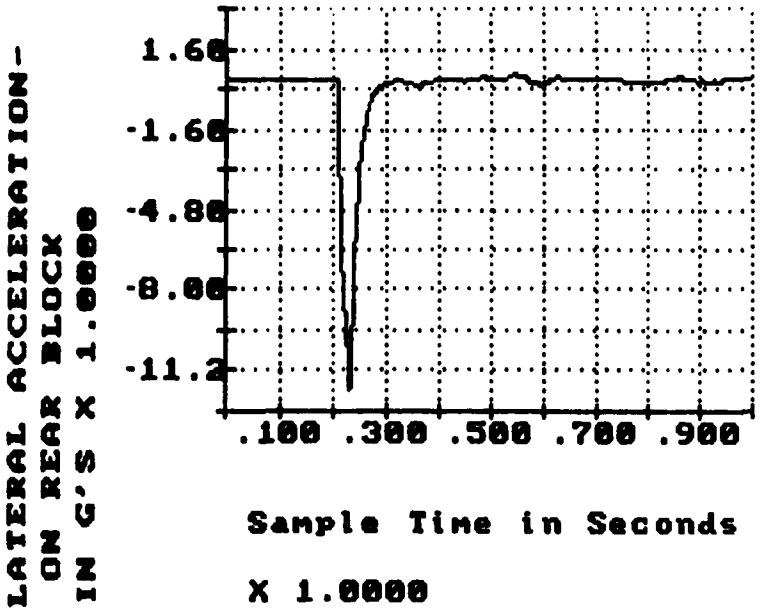


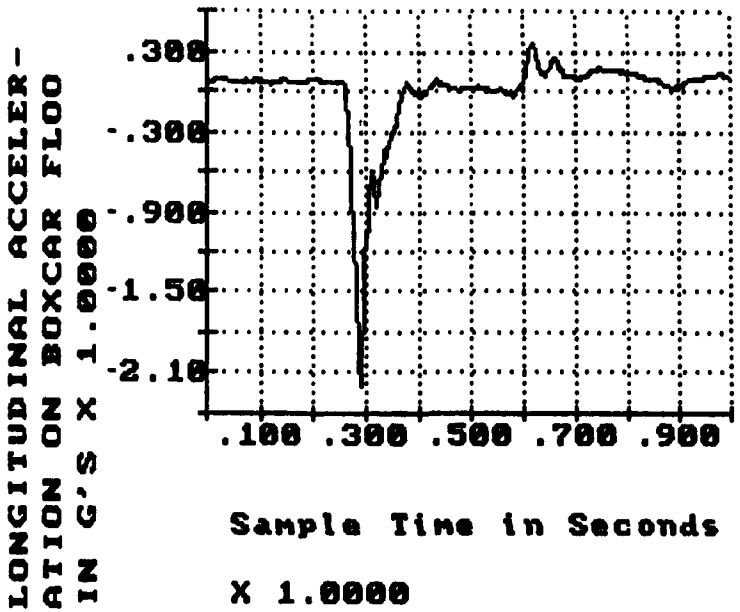


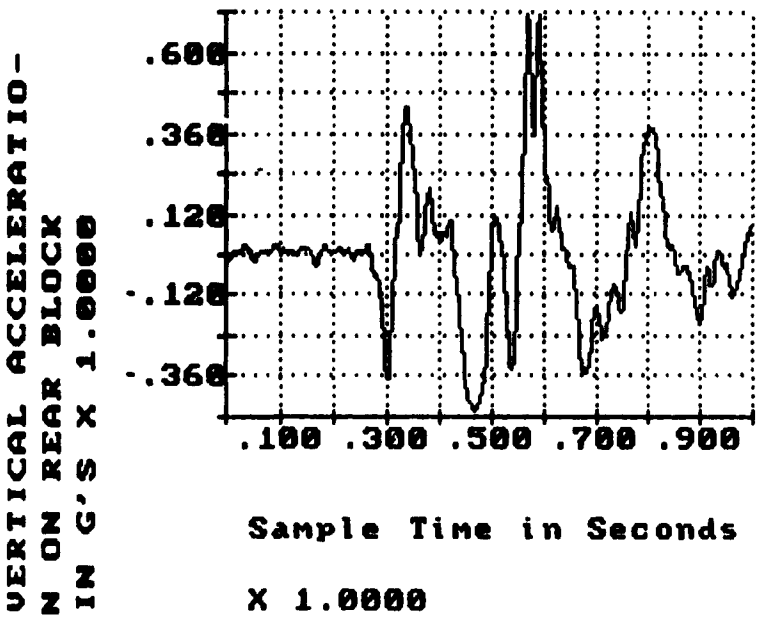


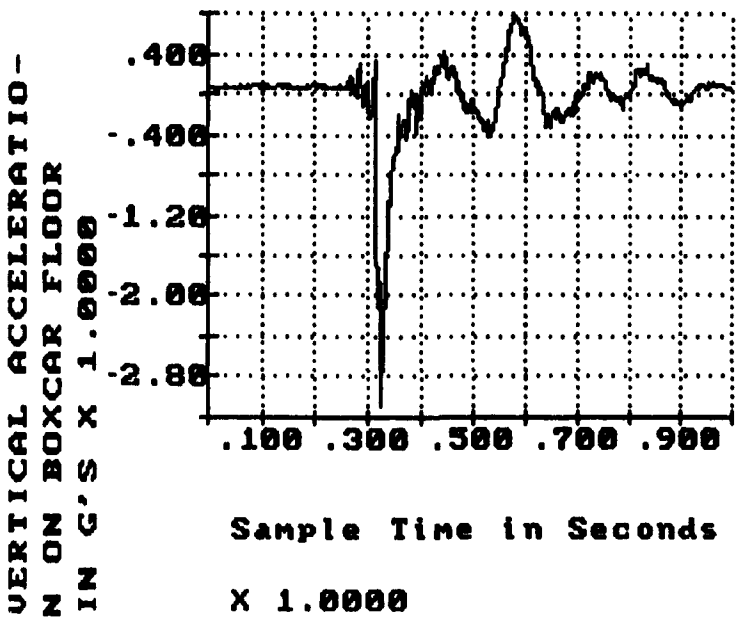


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.23 MPH

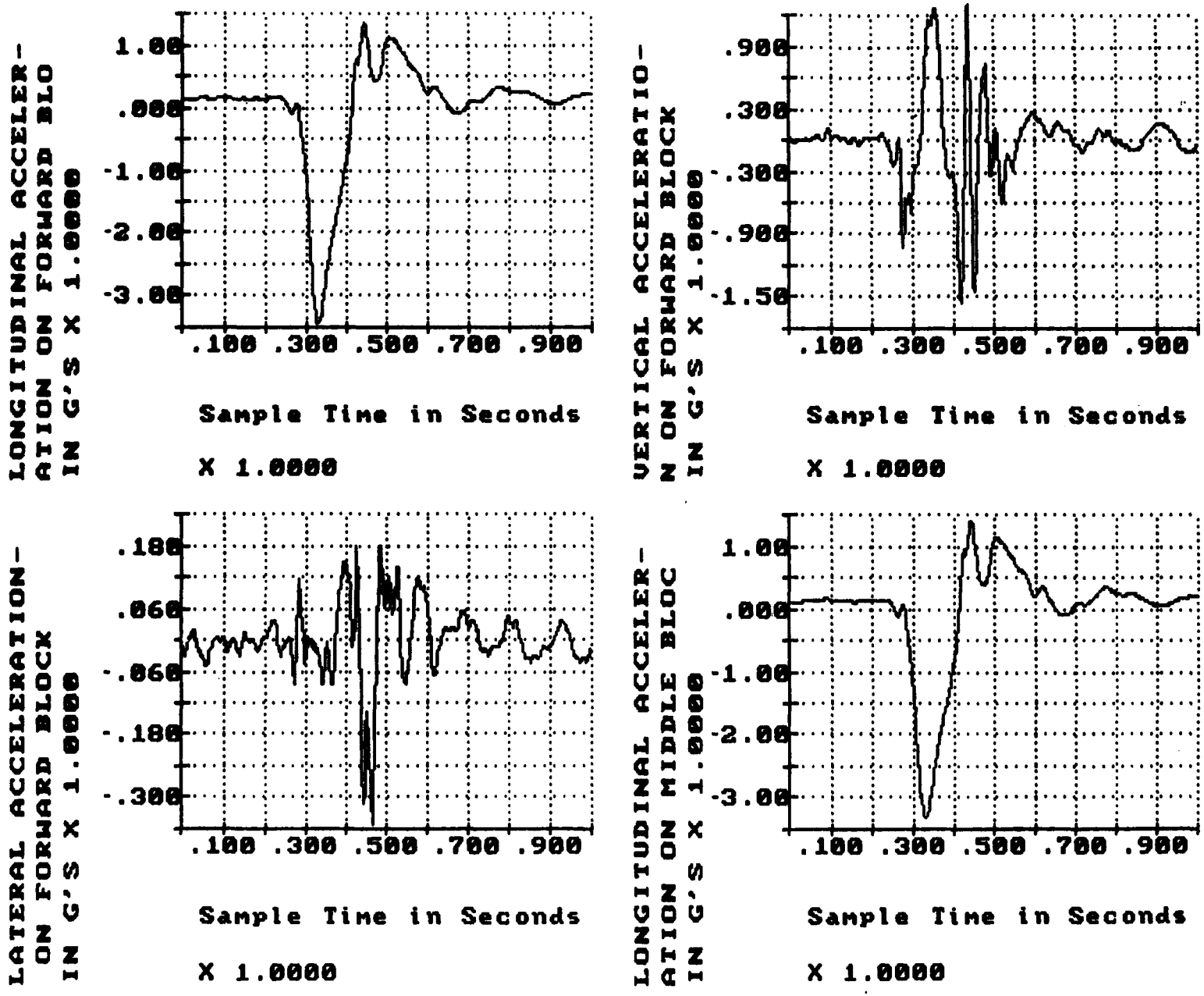




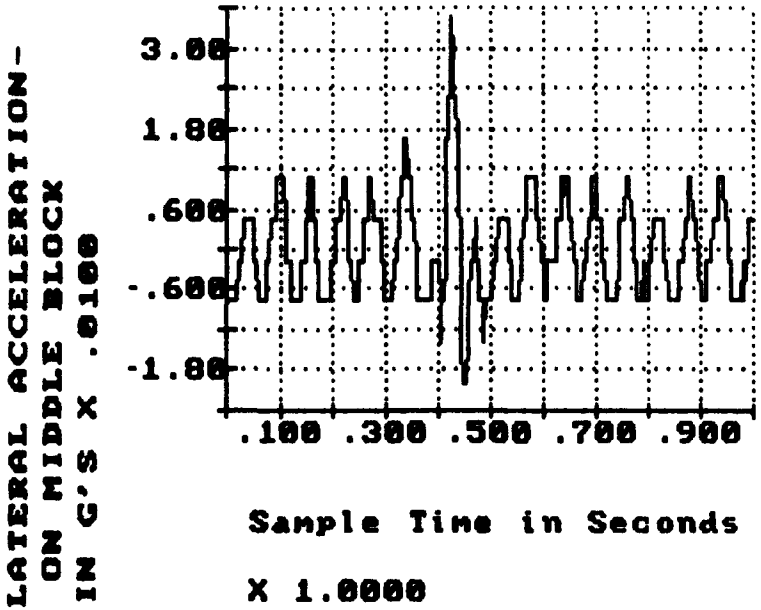


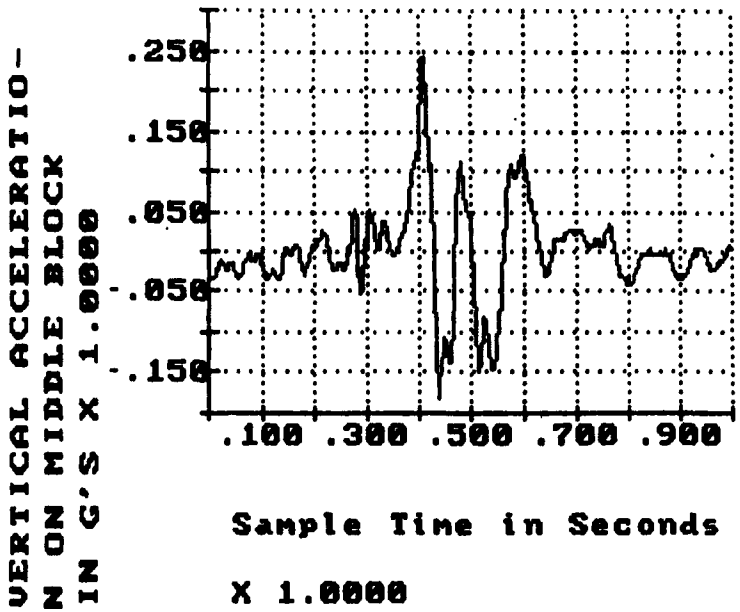


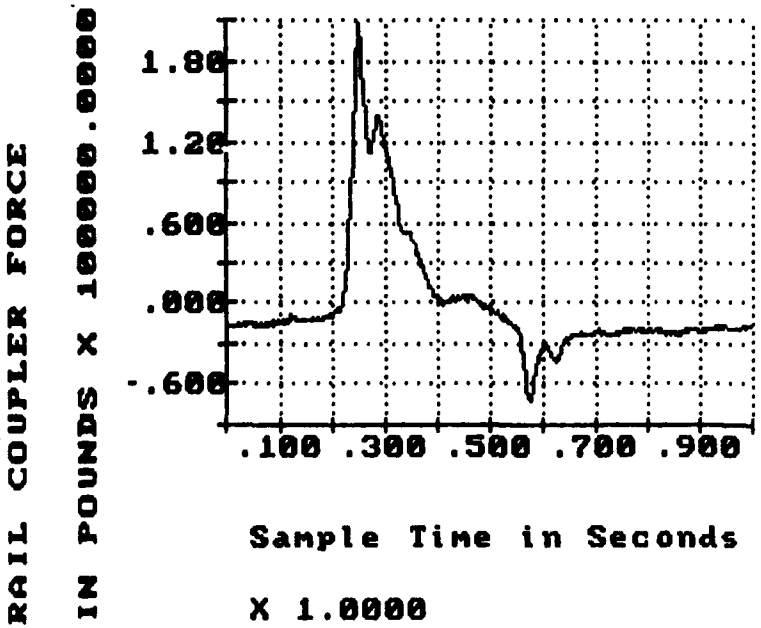
RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.54 MPH (REVERSE)

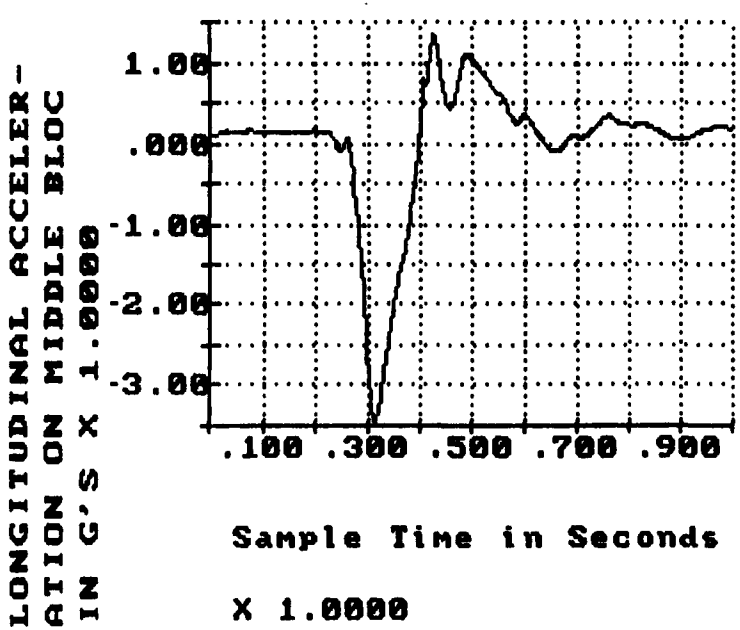


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.54 MPH (REVERSE)

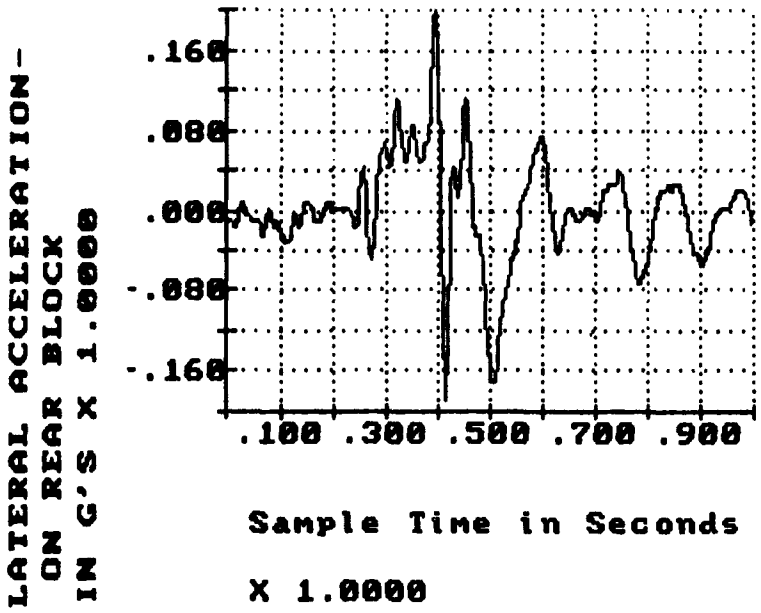


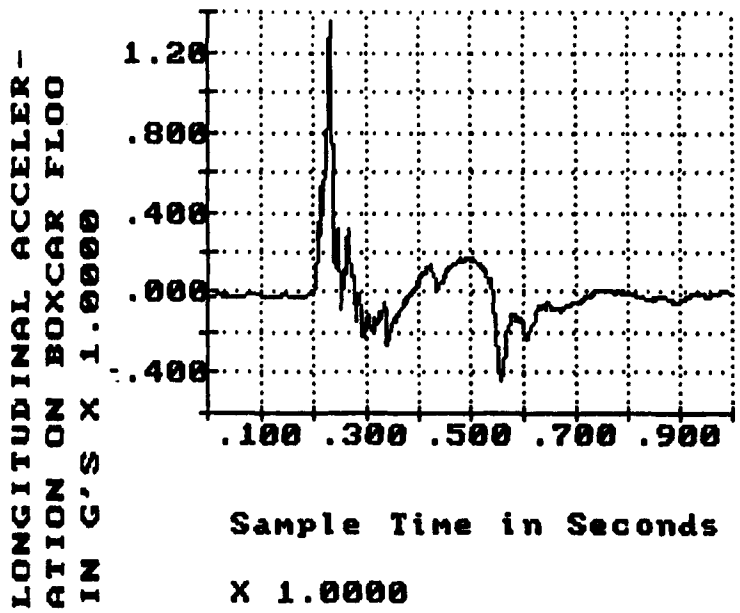


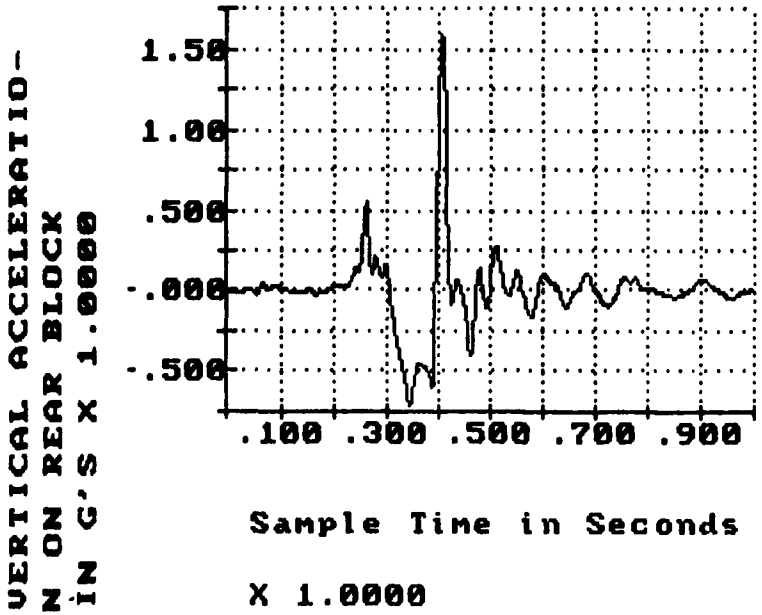


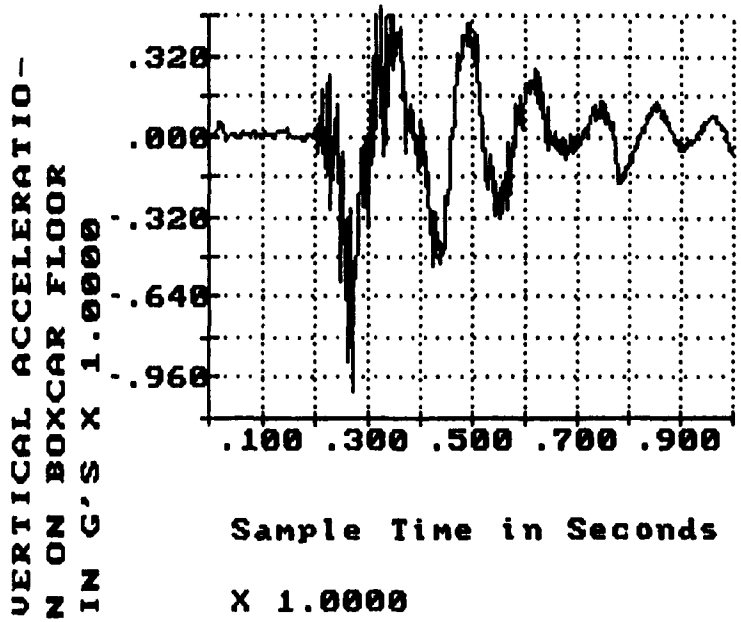


RAIL IMPACT TEST OF ATACMS ON TOFC
DATE: 12 JULY 1989
SPEED: 8.54 MPH (REVERSE)









ROAD TEST DATA

TEST NO: 7 DATE: 12 JULY 1989

TEST SPECIMEN: ATACMS on LRP in a MILVAN and chassis.

PASS 1-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 1-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No visible damage to load.

PASS 2-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 2-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.58	MPH

REMARKS: Rear chock came out of position on left side. Repositioned and sent on 30 mile road trip.

30 MILE ROAD TEST: No visible damage.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 3-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No visible damage.

PASS 4-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 4-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No visible damage to load.

WASHBOARD COURSE: No visible damage.

RESULTS FROM ROAD HAZARD TESTING OF
ATACMS ON LRP
DATE: 12 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.22	149.77	.0506
PASS 1, COURSE B	8.00	-1.21	74.53	.0569
PASS 2, COURSE A	8.00	-1.19	135.55	.0527
PASS 2, COURSE B	8.00	-1.20	76.35	.0584
WASHBOARD COURSE	8.00	-.46	39.78	.0105

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.18	102.44	.0814
PASS 1, COURSE B	8.00	-1.21	107.31	.0840
PASS 2, COURSE A	8.00	-1.10	98.73	.0721
PASS 2, COURSE B	8.00	-1.14	74.15	.0621
WASHBOARD COURSE	8.00	-.20	16.06	.0013

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	2.93	44.56	.0927
PASS 1, COURSE B	8.00	2.93	51.83	.1077
PASS 2, COURSE A	8.00	3.00	35.69	.0800
PASS 2, COURSE B	8.00	2.90	55.30	.1198
WASHBOARD COURSE	8.00	1.16	29.76	.0199

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.21	121.68	.0542
PASS 1, COURSE B	8.00	-1.17	75.73	.0554
PASS 2, COURSE A	8.00	-1.16	131.58	.0515
PASS 2, COURSE B	8.00	-1.17	76.25	.0544
WASHBOARD COURSE	8.00	-.47	40.33	.0108

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.81	78.06	.0871
PASS 1, COURSE B	8.00	1.97	70.79	.1029
PASS 2, COURSE A	8.00	1.82	215.33	.0287
PASS 2, COURSE B	8.00	1.83	150.49	.0745
WASHBOARD COURSE	8.00	.73	54.44	.0208

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.05	80.15	.0600
PASS 1, COURSE B	8.00	-1.29	120.02	.1048
PASS 2, COURSE A	8.00	1.07	102.32	.0718
PASS 2, COURSE B	8.00	-1.26	137.19	.1158
WASHBOARD COURSE	8.00	-.14	38.60	.0035

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.14	139.90	.0462
PASS 1, COURSE B	8.00	-1.12	74.75	.0504
PASS 2, COURSE A	8.00	-1.10	78.26	.0556
PASS 2, COURSE B	8.00	-1.11	87.15	.0448
WASHBOARD COURSE	8.00	-.45	40.11	.0103

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.62	88.08	.0367
PASS 1, COURSE B	8.00	-.69	111.87	.0520
PASS 2, COURSE A	8.00	-.60	125.16	.0376
PASS 2, COURSE B	8.00	-.70	113.46	.0517
WASHBOARD COURSE	8.00	-.15	21.04	.0017

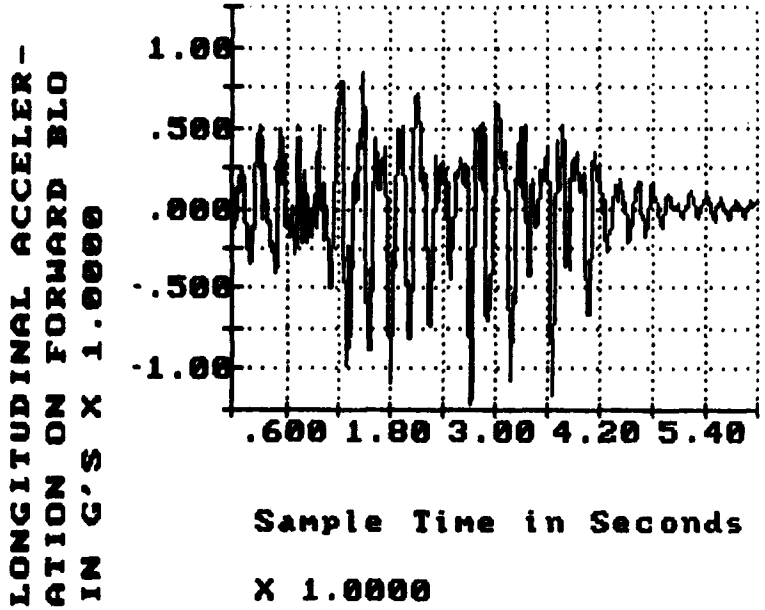
TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

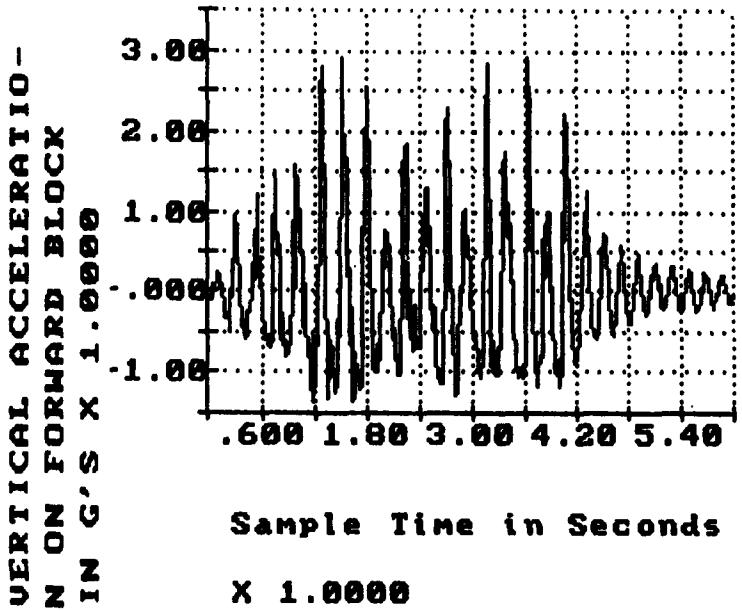
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.89	26.05	.0130
PASS 1, COURSE B	8.00	.93	44.08	.0313
PASS 2, COURSE A	8.00	.86	28.06	.0137
PASS 2, COURSE B	8.00	.94	67.32	.0485
WASHBOARD COURSE	8.00	-.59	*****	*****

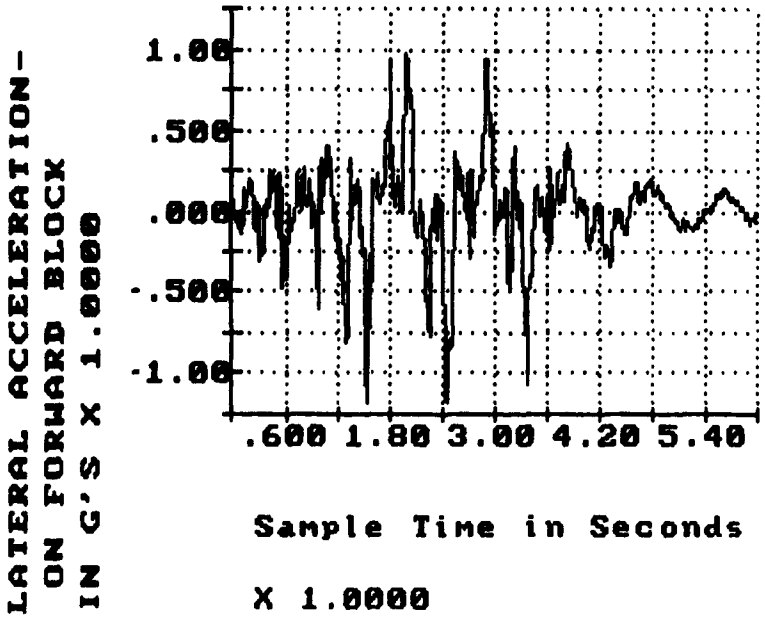
NOTES:

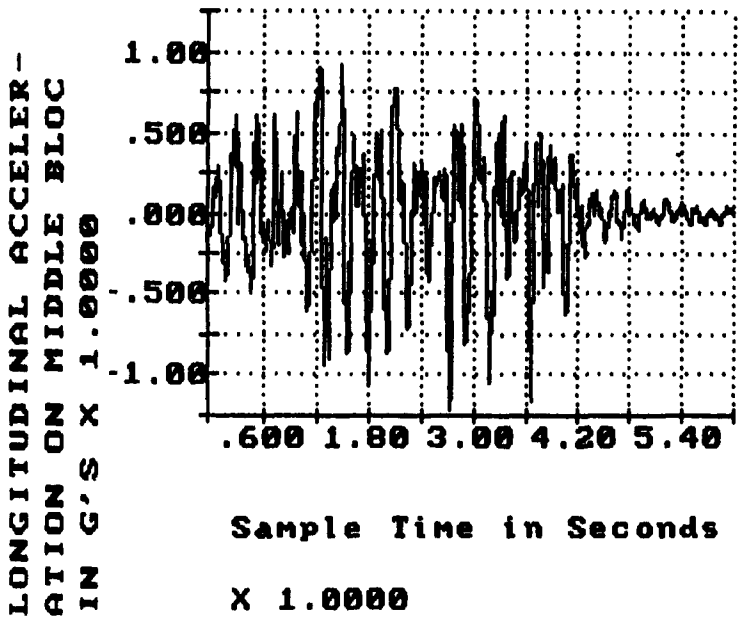
*****: DATA NOT AVAILABLE.

ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE A

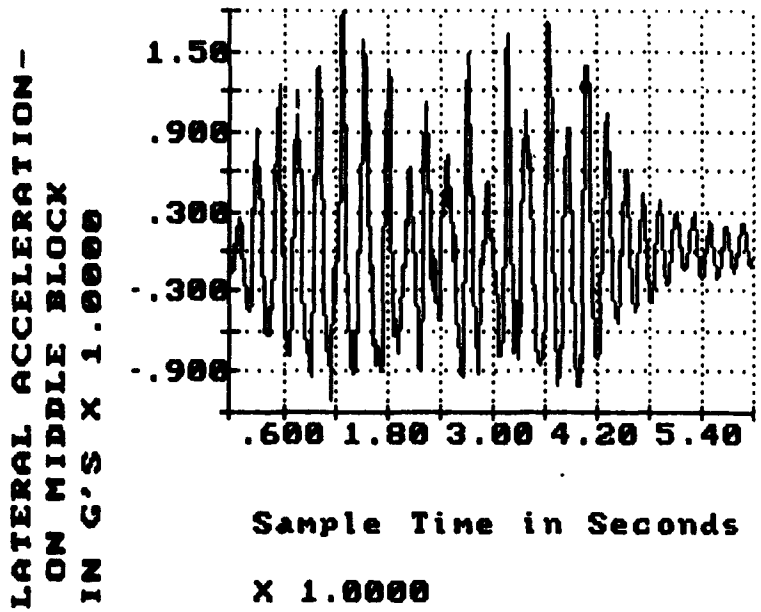


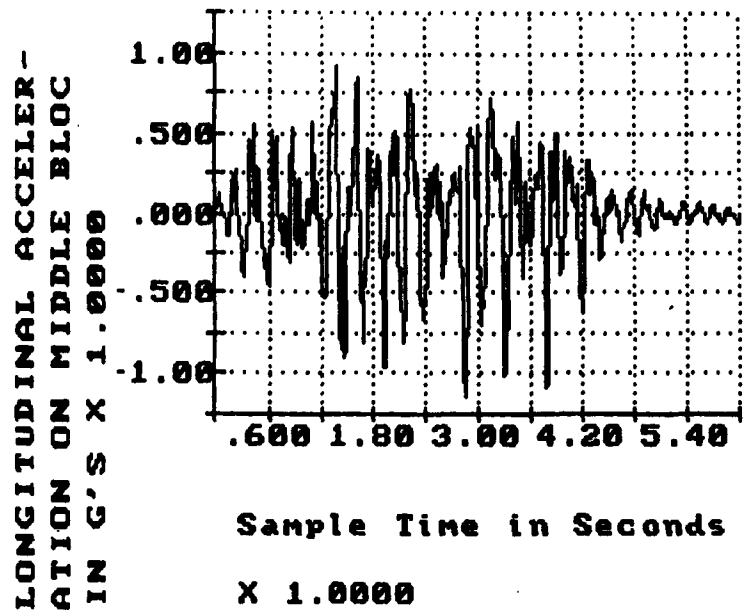


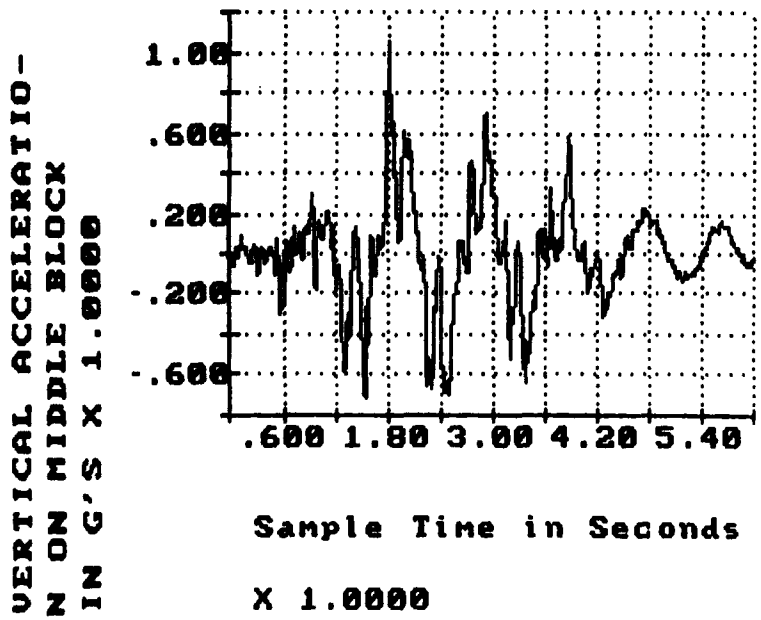


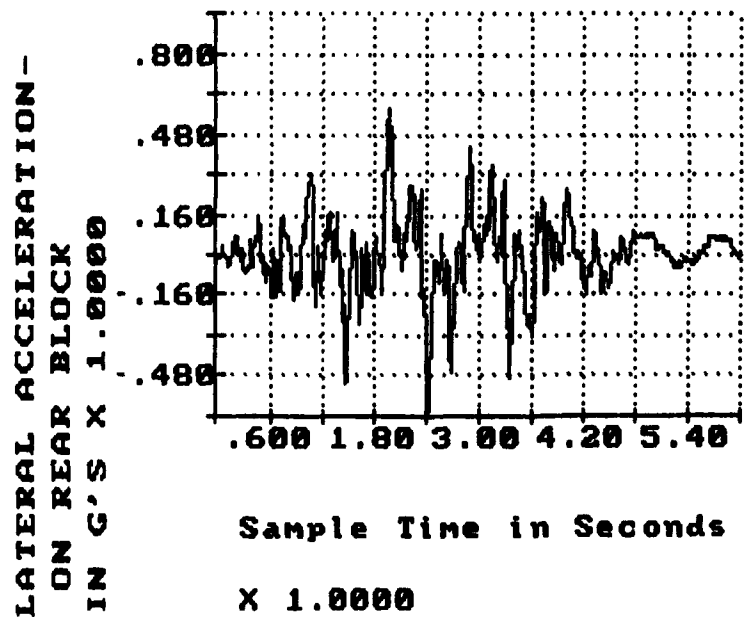


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE A

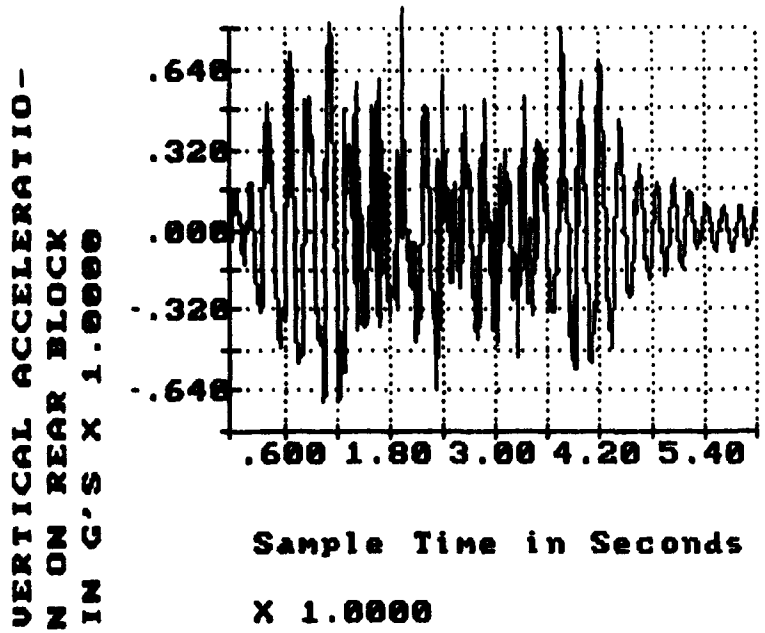




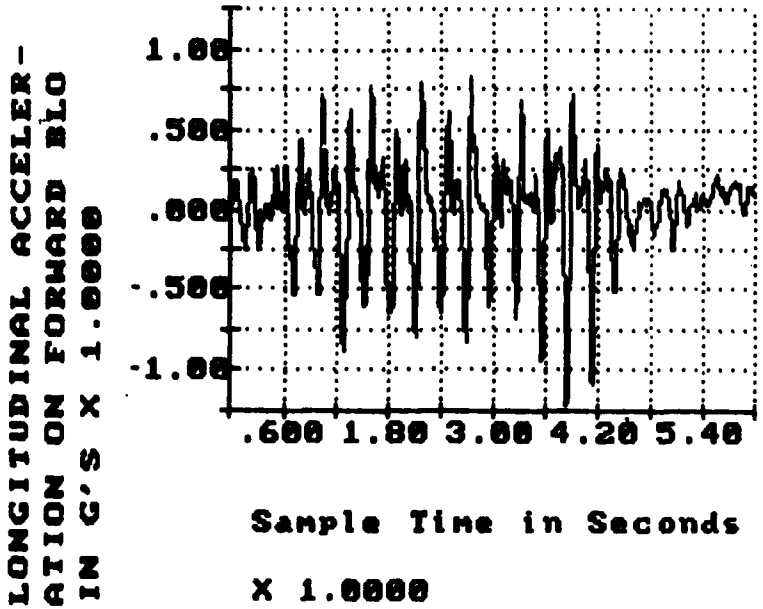


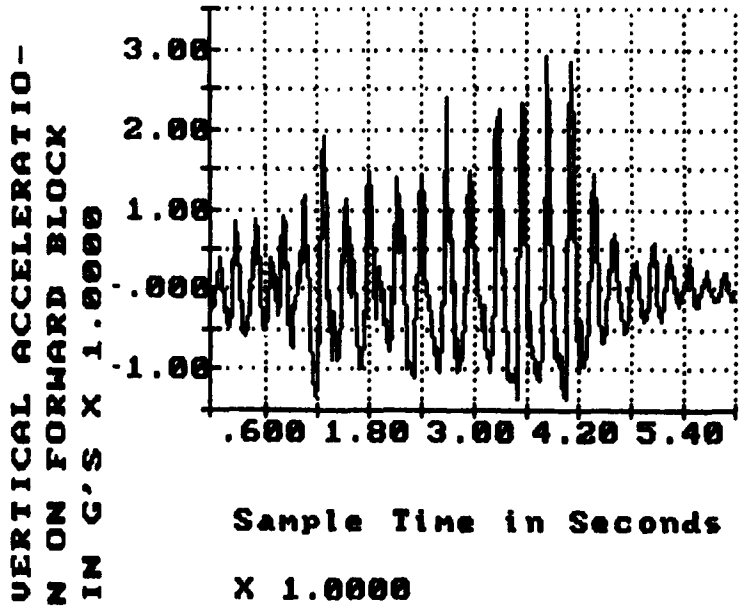


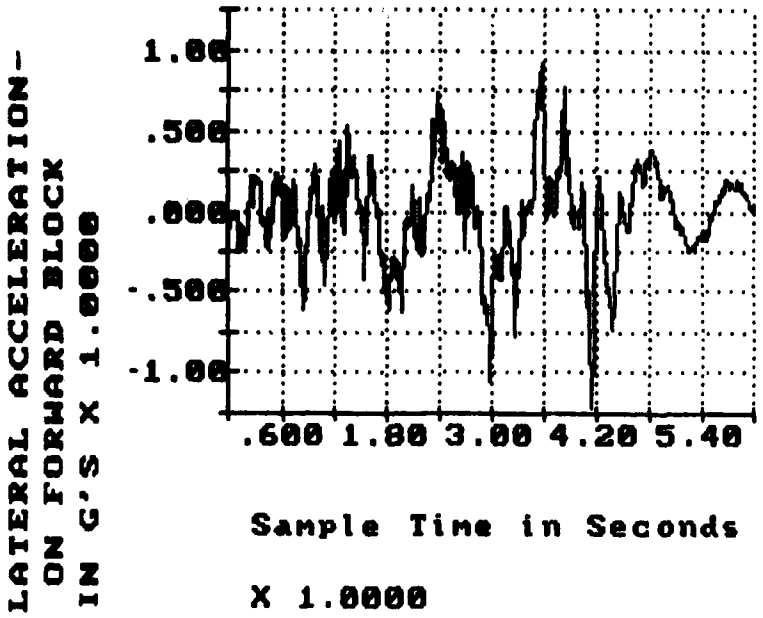
ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE A

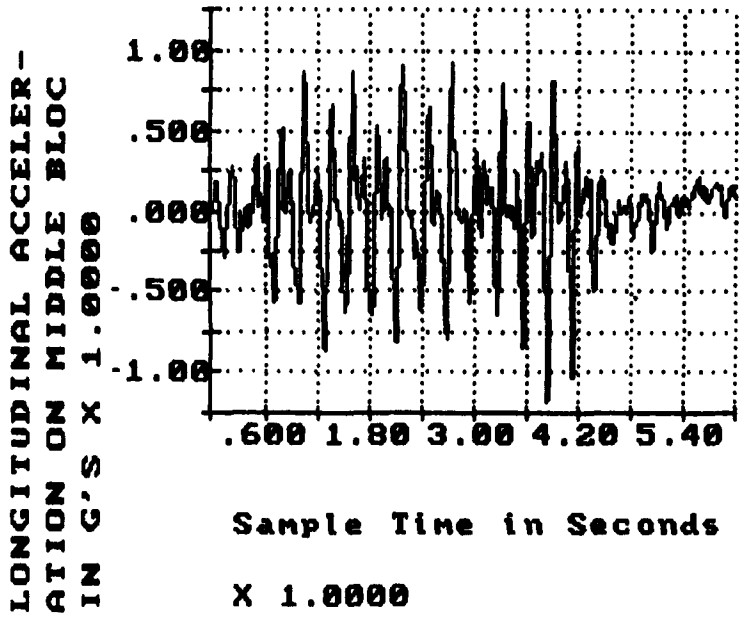


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE B

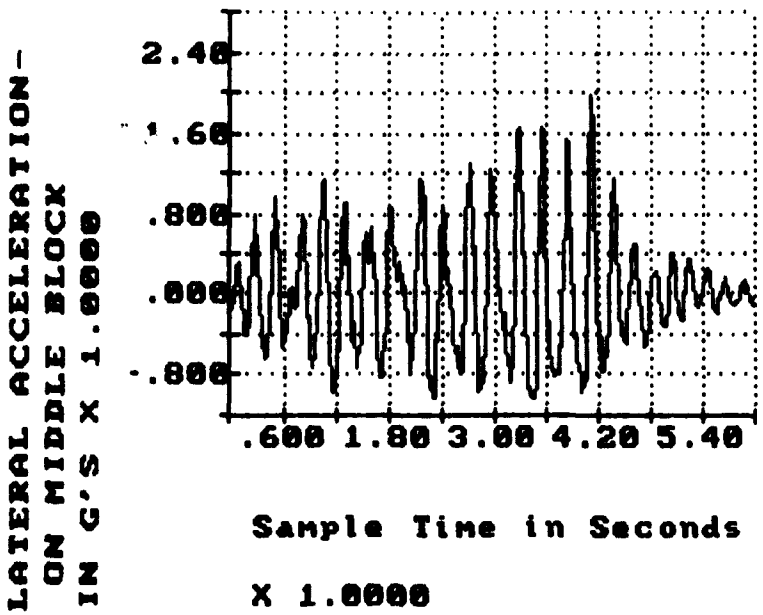


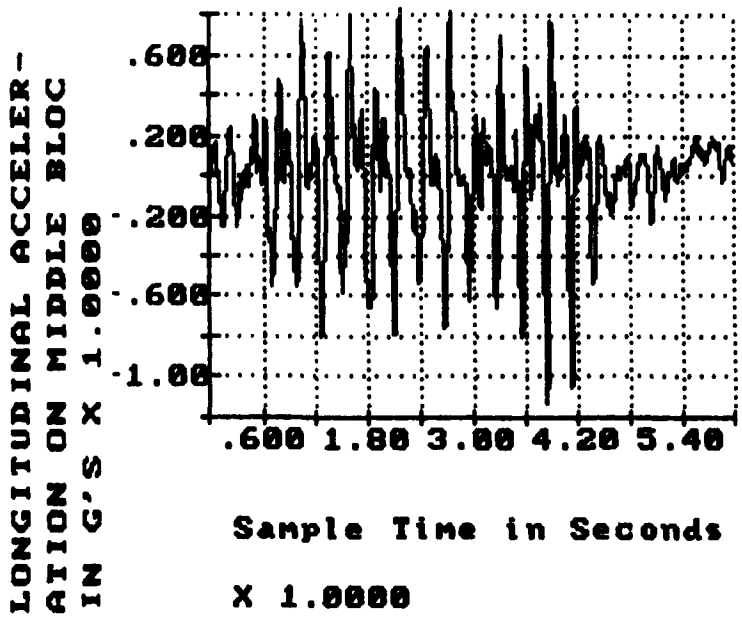


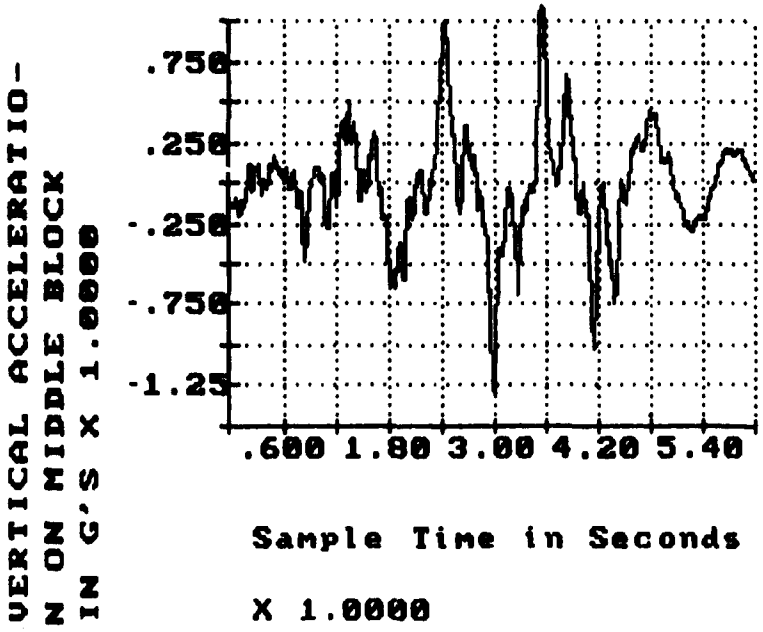


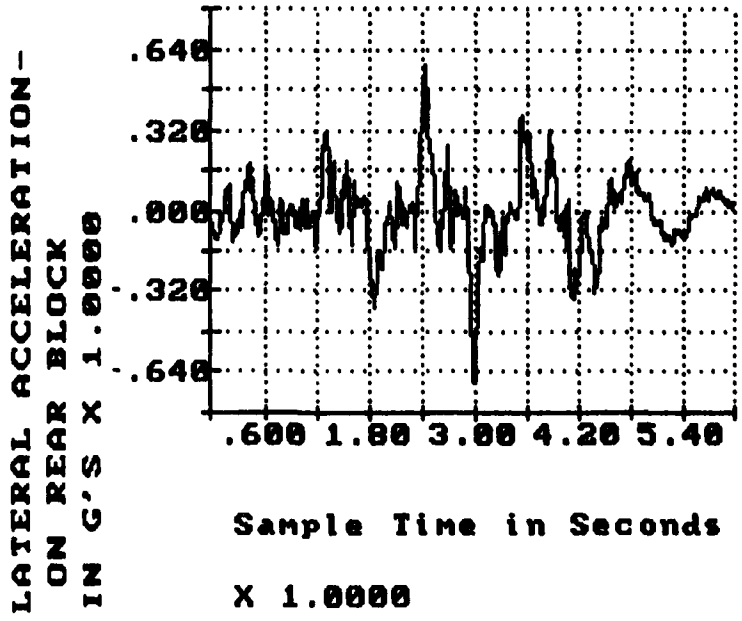


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE B

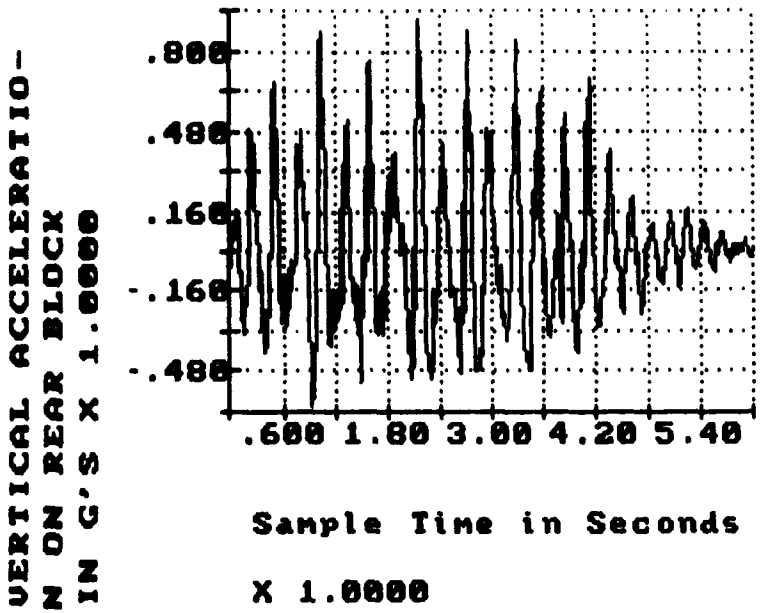








ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 1, COURSE B



ROAD HAZARD TEST OF ATACMS ON LRP
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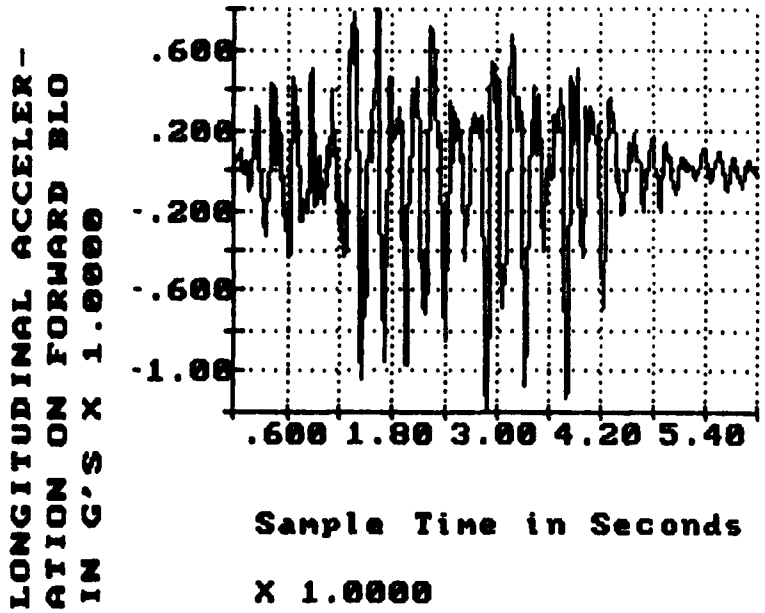
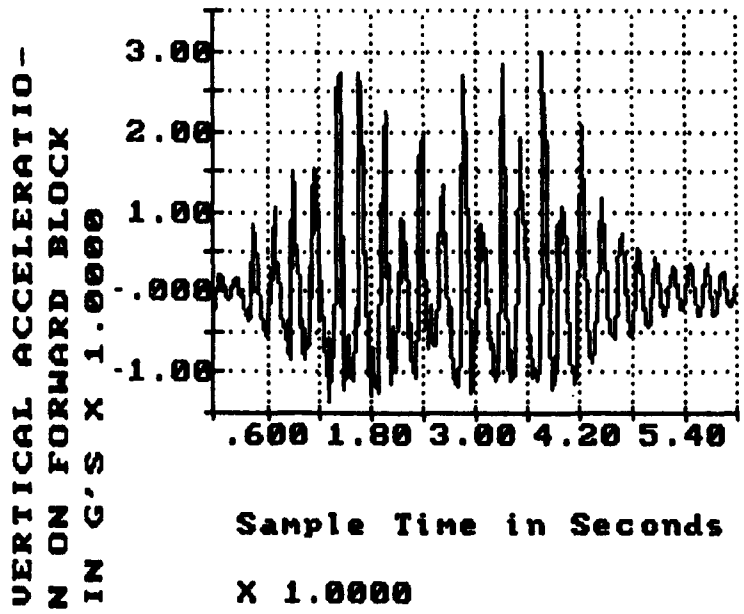
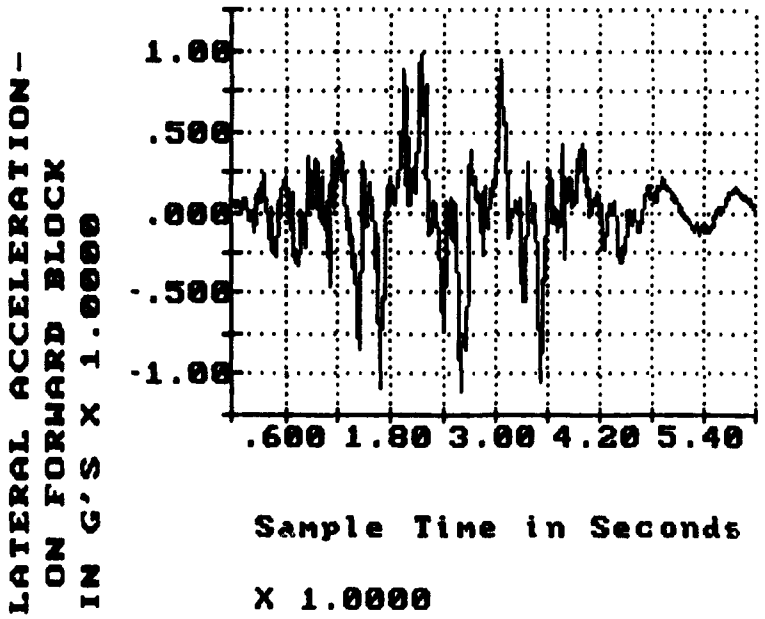
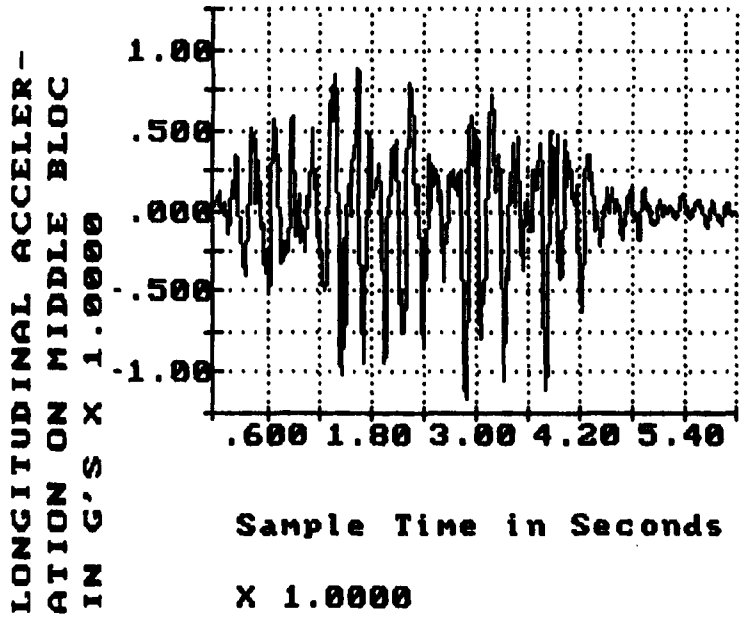
PASS 2, COURSE A

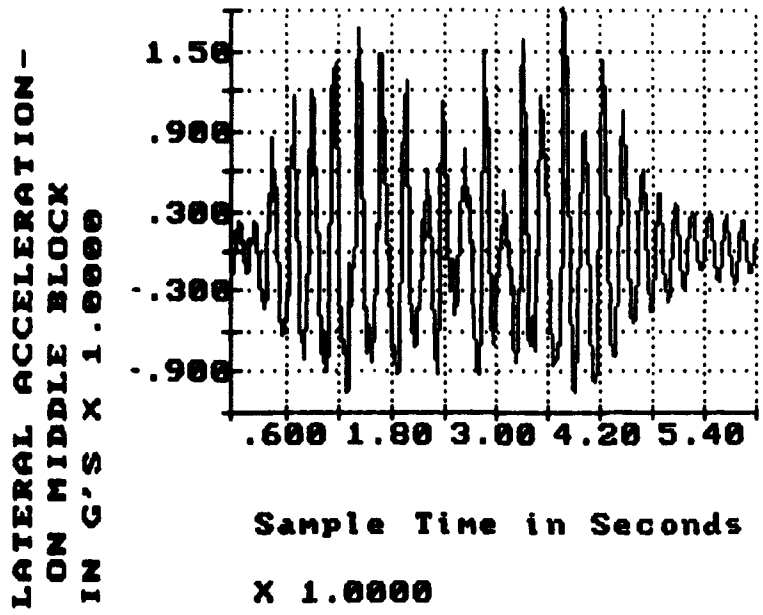


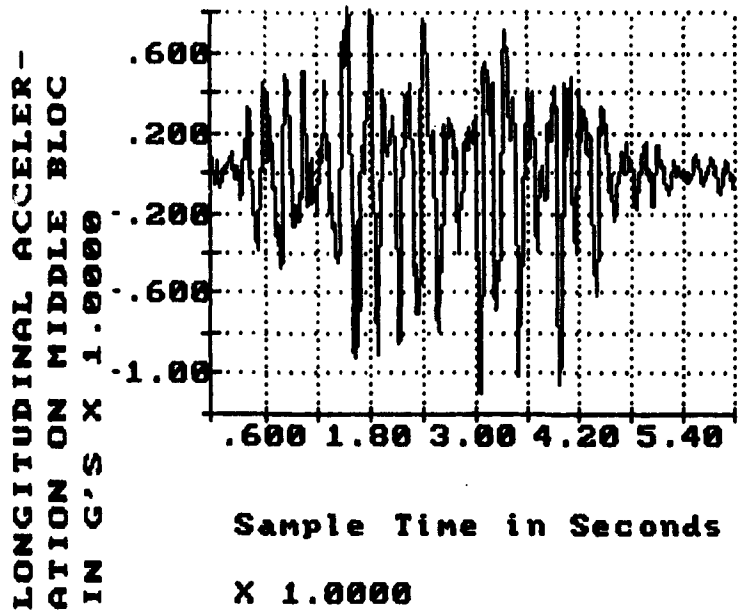


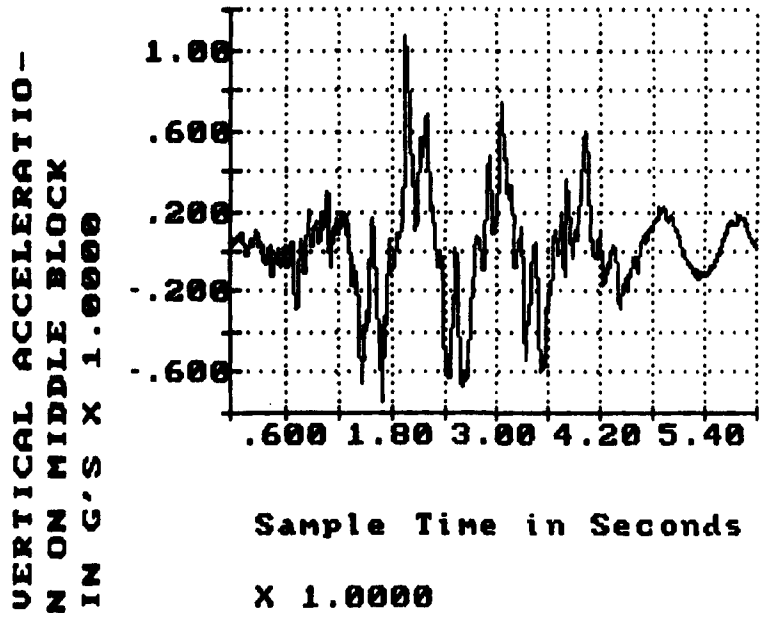


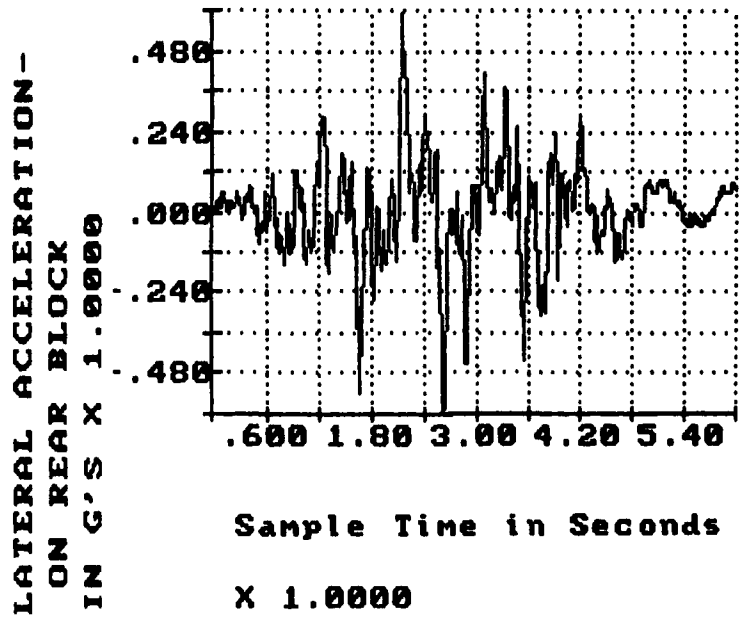


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 2, COURSE A

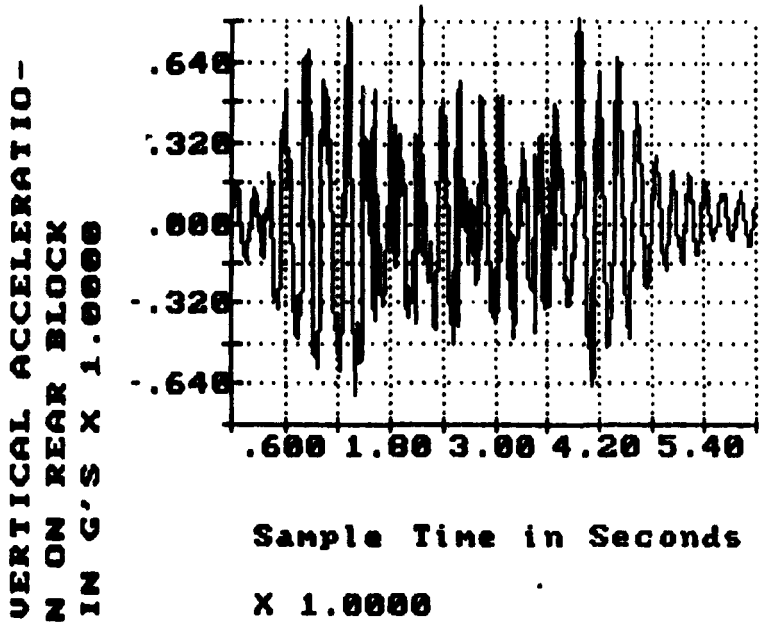




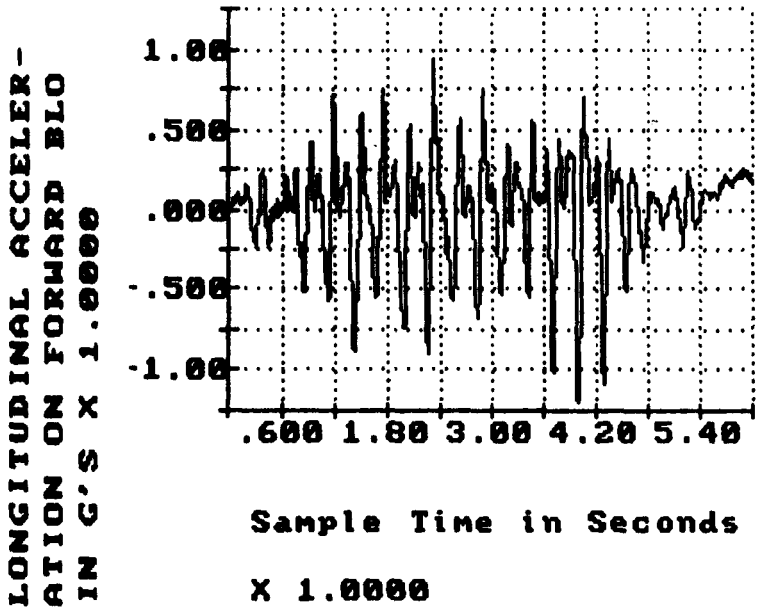


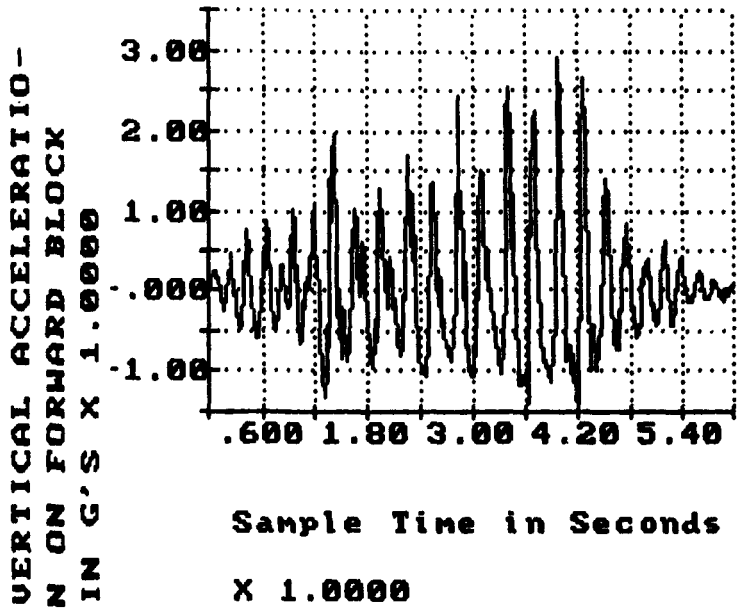


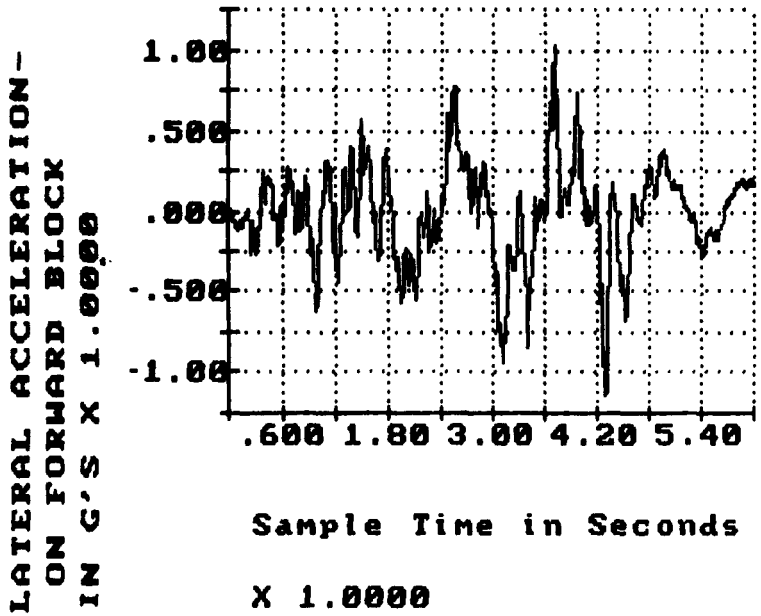
ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 2, COURSE A

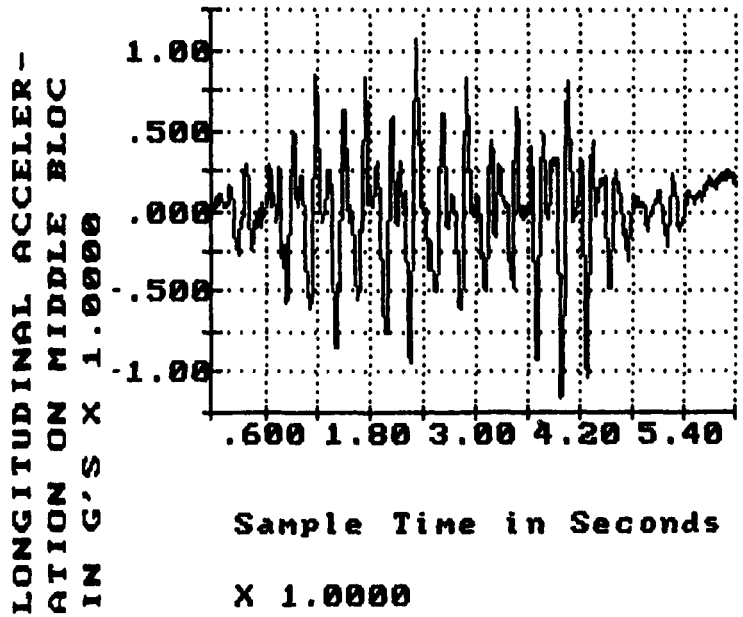


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 2, COURSE B

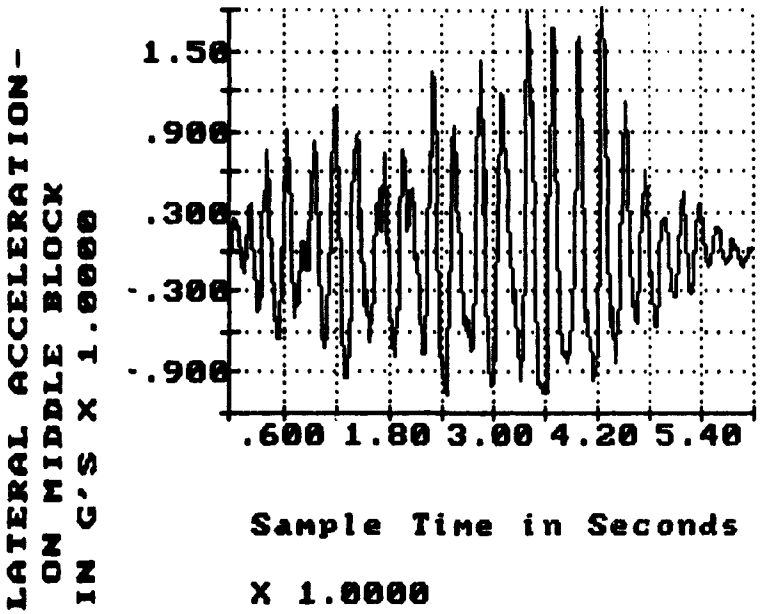


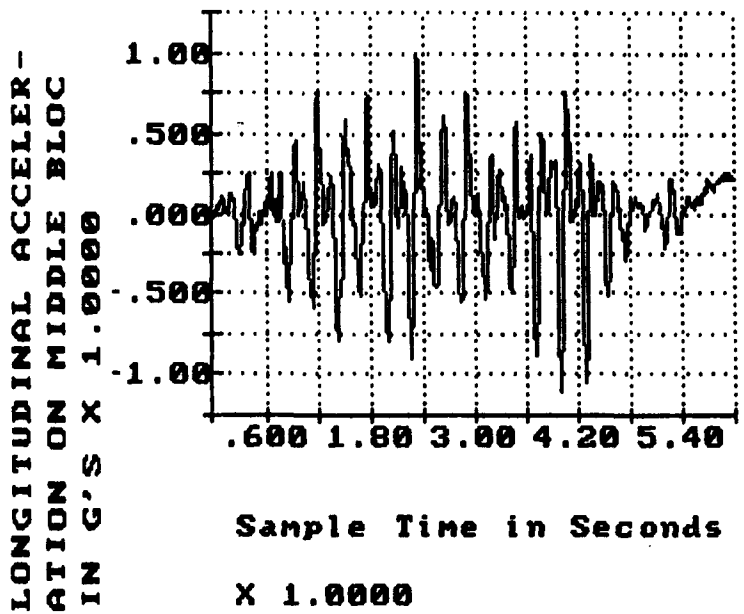


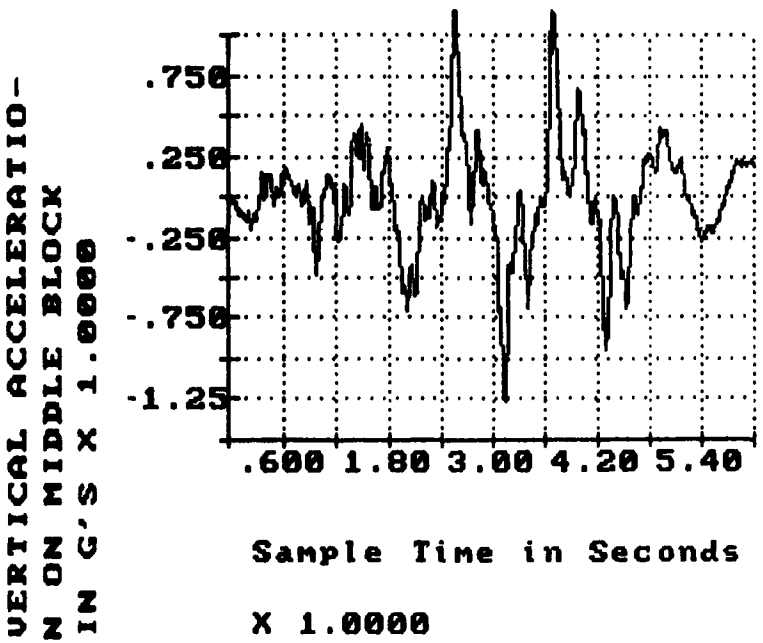


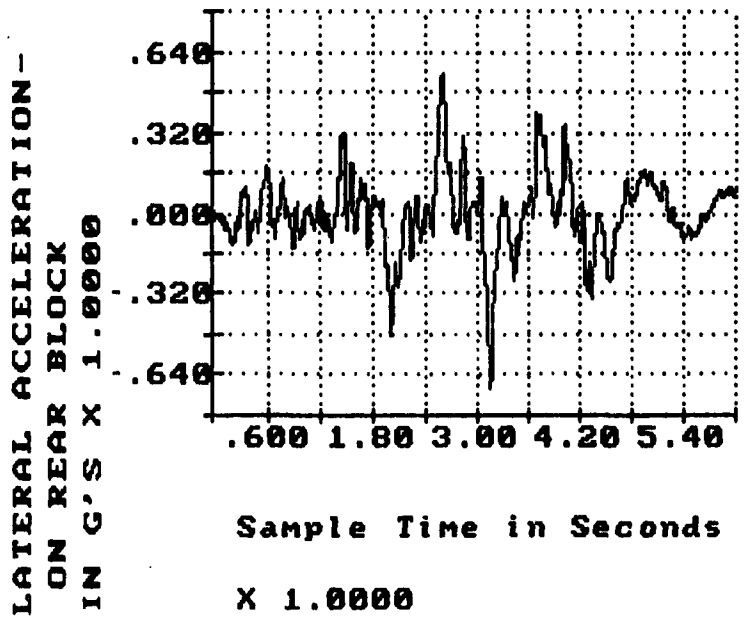


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 2, COURSE B

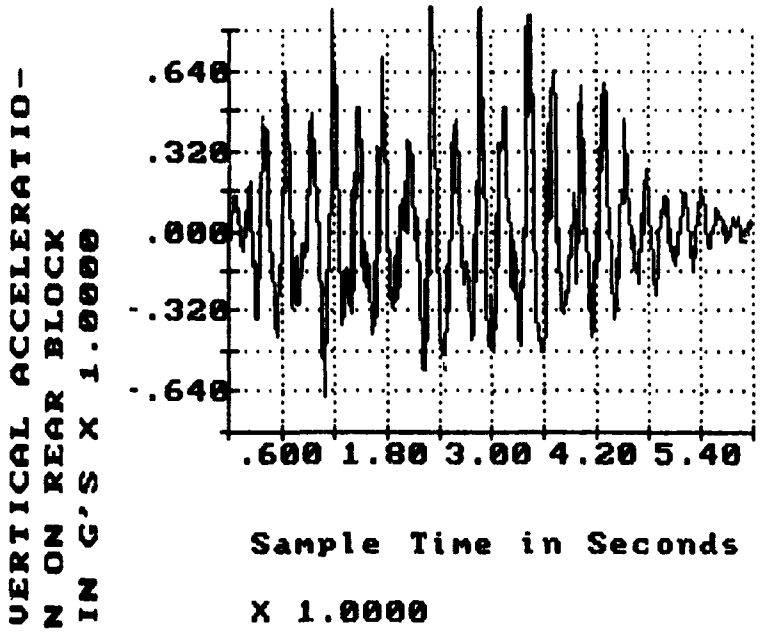




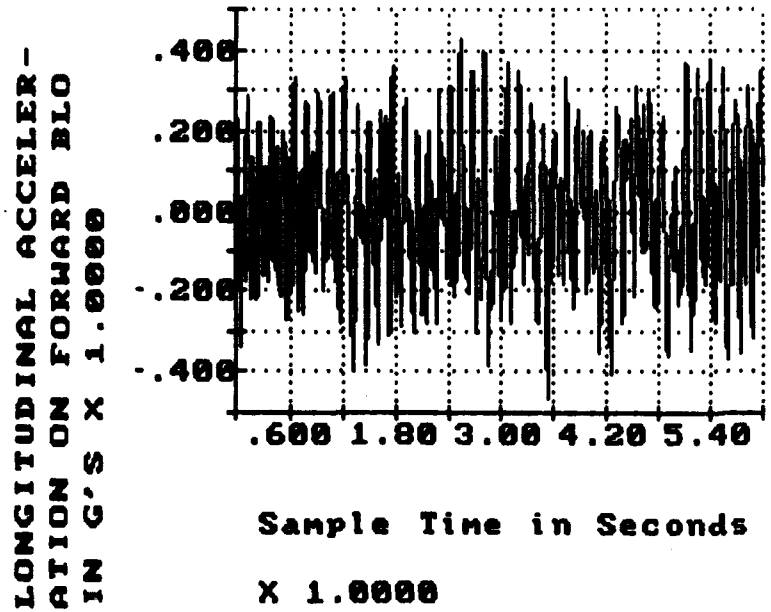


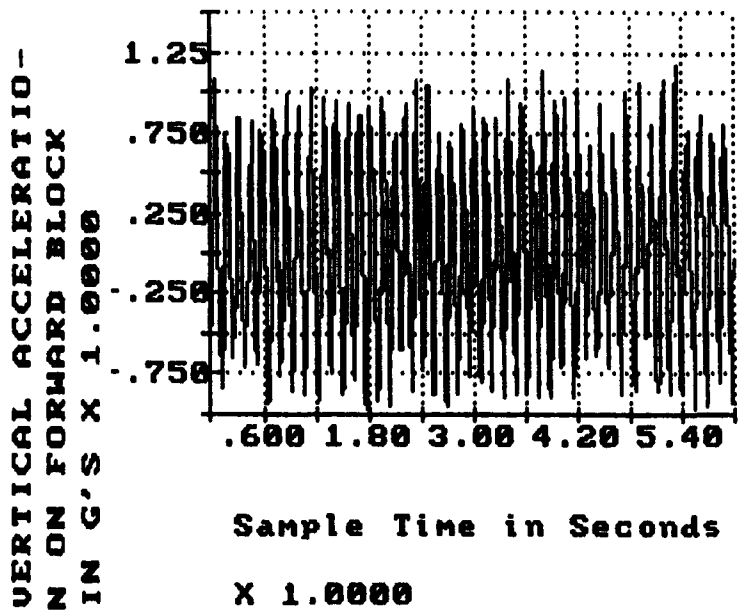


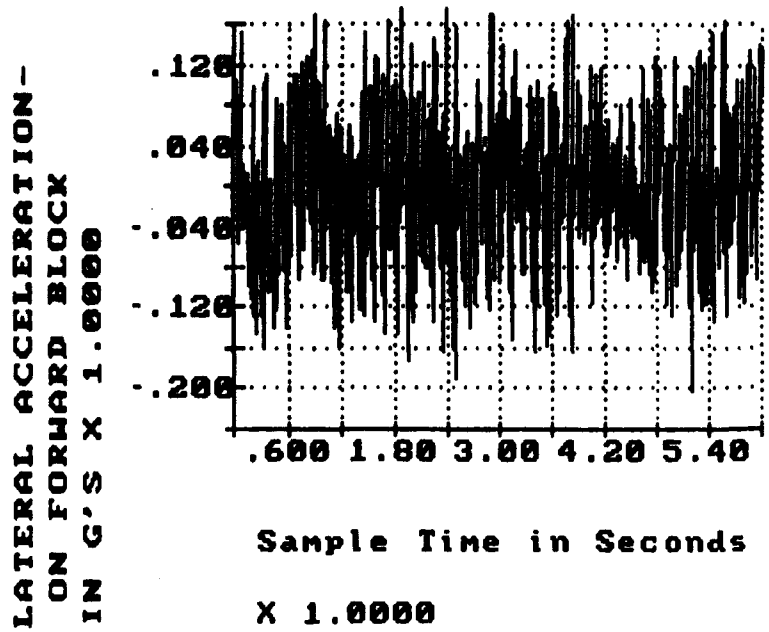
ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
PASS 2, COURSE B

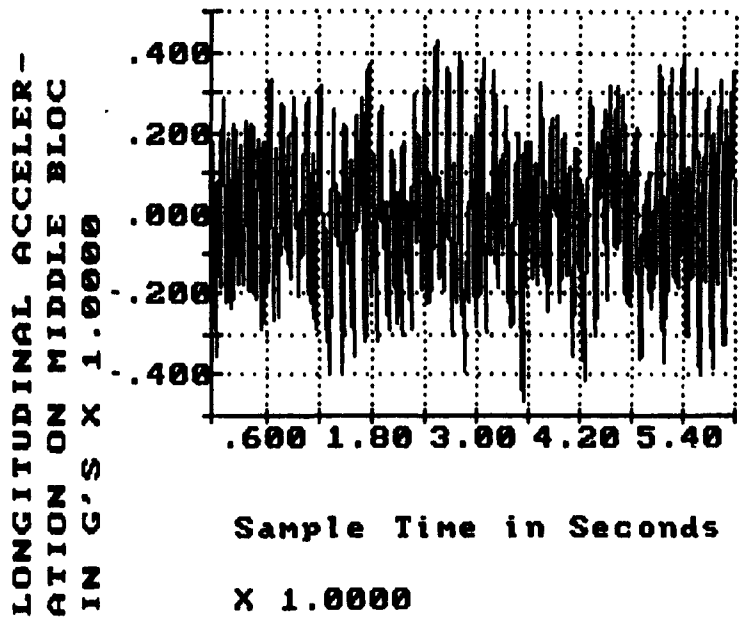


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
WASHBOARD COURSE

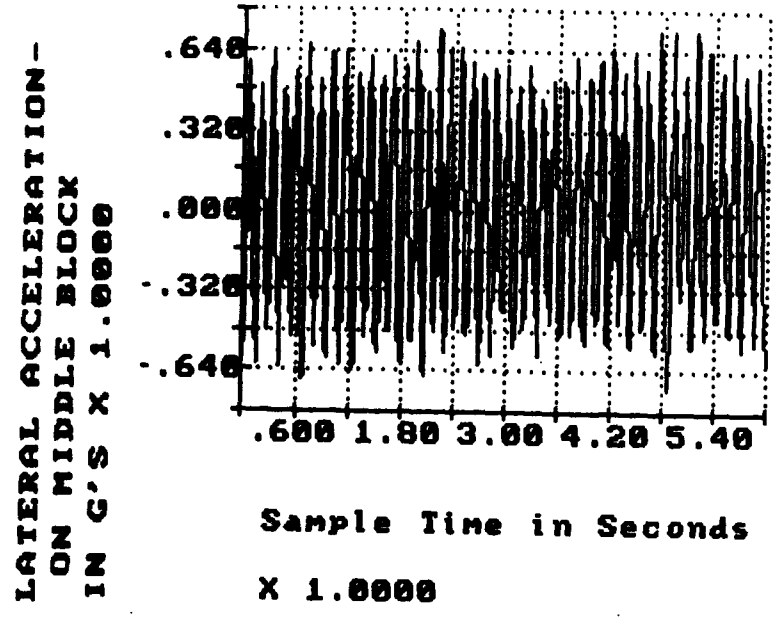


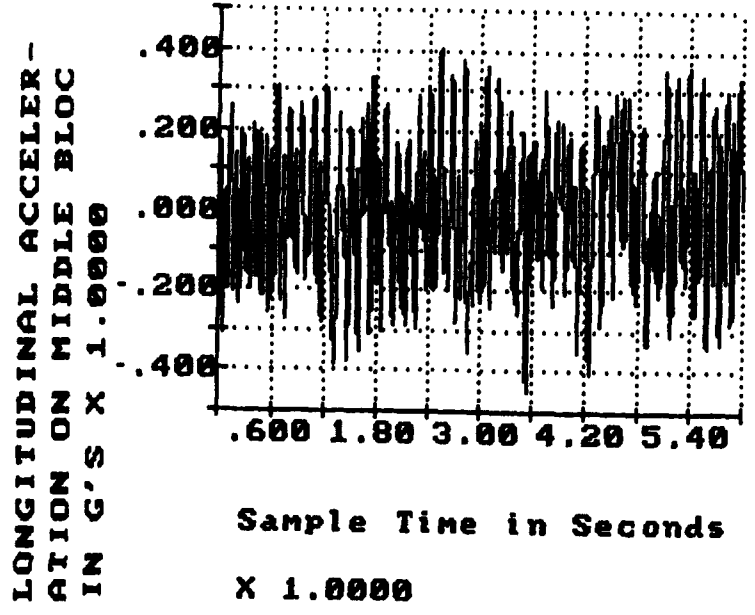


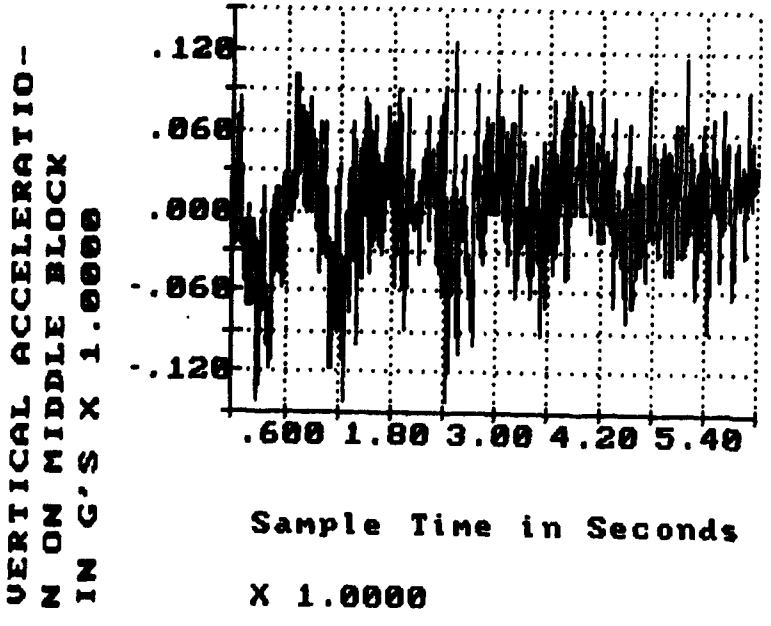


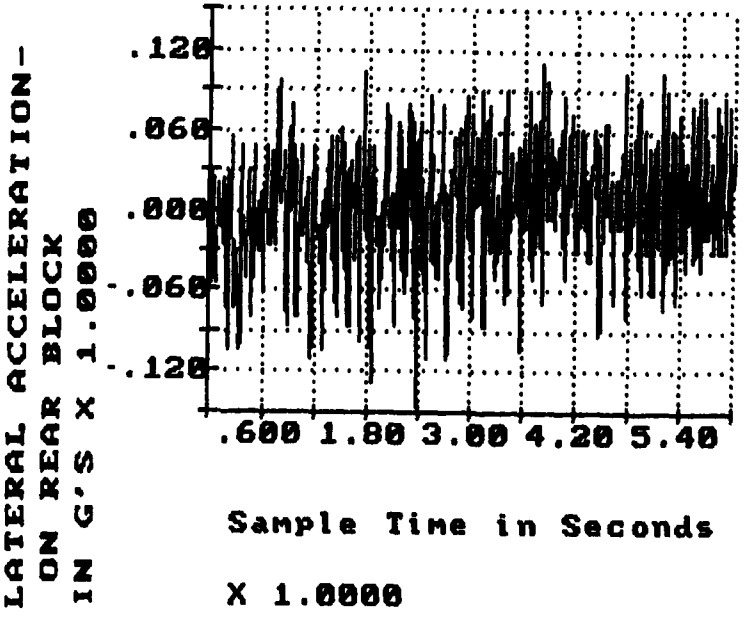


ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
WASHBOARD COURSE

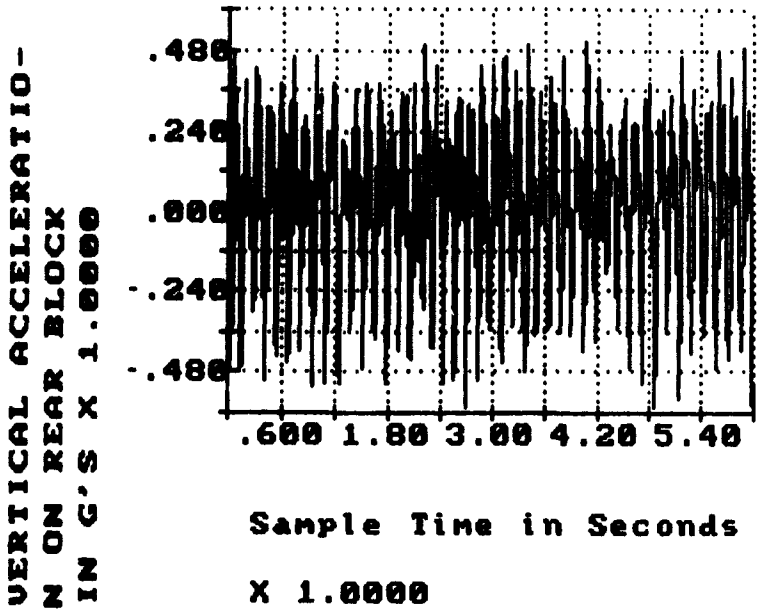








ROAD HAZARD TEST OF ATACMS ON LRP
DATE: 12 JULY 1989
WASHBOARD COURSE



RAIL IMPACT TEST

TEST NO: 8 DATE: 13 JULY 1989

TEST SPECIMEN: ATACMS (four pods) on a flatrack.

TEST CAR NO: TTX 252005	LT. WT.	74,900	POUNDS
CHASSIS NO: 5394	LT. WT.	6,040	POUNDS
FLAT RACK NO:	LT. WT.	5,000	POUNDS
LADING AND DUNNAGE	WT.	21,000	POUNDS
TOTAL SPECIMEN	WT.	106,940	POUNDS
BUFFER CAR (5 CARS)	WT.	250,000	POUNDS

IMPACT NO.	END STRUCK	VELOCITY (MPH)	REMARKS
1	Forward	4.29	No shifting or damage.
2	Forward	6.38	No shifting or damage.
3	Forward	8.43	No shifting or damage.
4	Reverse	8.19	No shifting or damage.

RESULTS FROM RAIL IMPACT TESTING OF
ATACMS ON FLATRACK
DATE: 13 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.57	126.32	.1099
IMPACT 2	6.38	-1.95	125.89	.1416
IMPACT 3	8.43	-3.15	187.83	.2058
IMPACT 4 (REVERSE)	8.19	3.46	87.05	.1815

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.20	13.83	.0015
IMPACT 2	6.38	.18	14.58	.0013
IMPACT 3	8.43	-.19	13.46	.0016
IMPACT 4 (REVERSE)	8.19	.23	20.84	.0028

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.66	23.56	.0089
IMPACT 2	6.38	.73	48.33	.0180
IMPACT 3	8.43	1.28	37.96	.0314
IMPACT 4 (REVERSE)	8.19	1.88	42.35	.0466

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.64	125.79	.1133
IMPACT 2	6.38	-2.03	115.82	.1444
IMPACT 3	8.43	-3.29	173.40	.2129
IMPACT 4 (REVERSE)	8.19	3.66	84.28	.1838

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.08	10.52	.0005
IMPACT 2	6.38	-.07	46.92	.0024
IMPACT 3	8.43	-.09	37.18	.0020
IMPACT 4 (REVERSE)	8.19	.75	40.43	.0201

TAPE CHANNEL 6 : RAIL COUPLER FORCE

TEST	SPEED MPH	PEAK VALUE POUNDS	DURATION MILLISECONDS	AREA POUNDS-SECONDS
IMPACT 1	4.29	129536.39	80.62	5895.41
IMPACT 2	6.38	178244.11	76.46	6461.98
IMPACT 3	8.43	220524.08	46.62	6709.13
IMPACT 4 (REVERSE)	8.19	229603.06	44.76	6902.23

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.15	34.03	.0026
IMPACT 2	6.38	.11	18.19	.0006
IMPACT 3	8.43	-.20	21.53	.0026
IMPACT 4 (REVERSE)	8.19	.34	35.52	.0079

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-1.59	136.09	.1124
IMPACT 2	6.38	-1.94	276.52	.1280
IMPACT 3	8.43	-3.16	170.00	.2091
IMPACT 4 (REVERSE)	8.19	3.54	88.08	.1841

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.13	19.83	.0016
IMPACT 2	6.38	.13	30.27	.0021
IMPACT 3	8.43	.21	27.19	.0038
IMPACT 4 (REVERSE)	8.19	-.28	34.49	.0062

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-.42	31.19	.0086
IMPACT 2	6.38	-.66	63.25	.0207
IMPACT 3	8.43	-1.20	48.54	.0370
IMPACT 4 (REVERSE)	8.19	.61	56.24	.0213

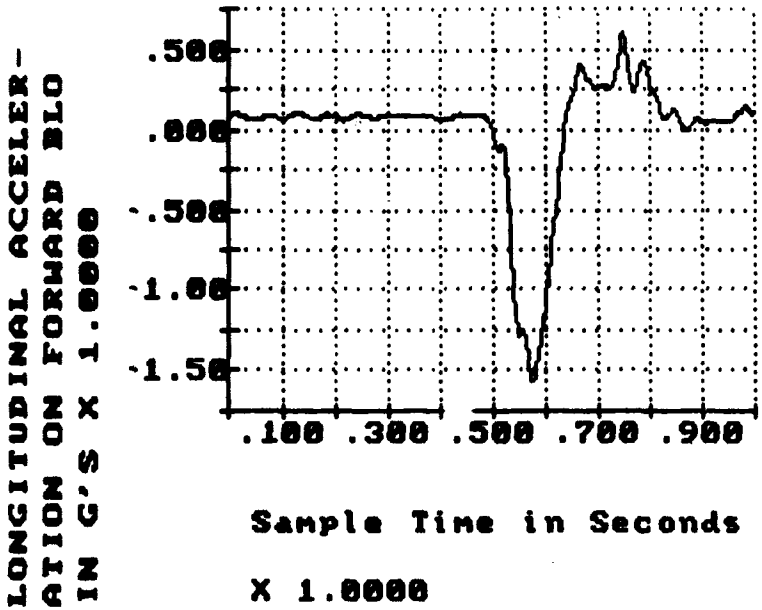
TAPE CHANNEL 12 : LONGITUDINAL ACCELERATION ON RAILCAR FLOOR

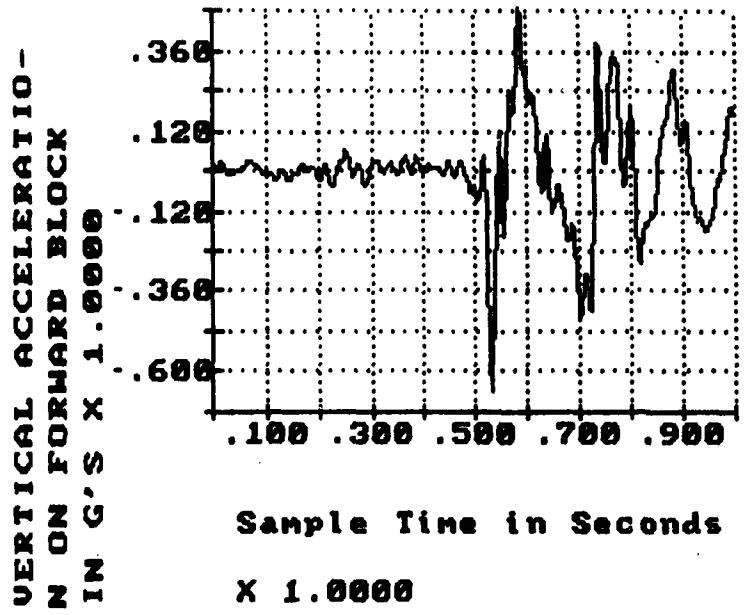
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	-11.17	53.95	.4308
IMPACT 2	6.38	-4.25	21.23	.0555
IMPACT 3	8.43	.93	33.13	.0148
IMPACT 4 (REVERSE)	8.19	-2.64	38.87	.0668

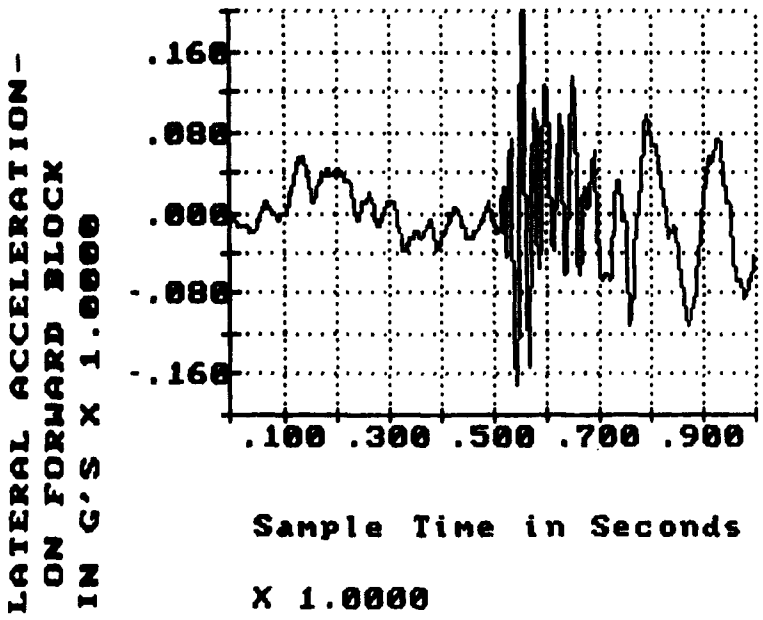
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON RAILCAR FLOOR

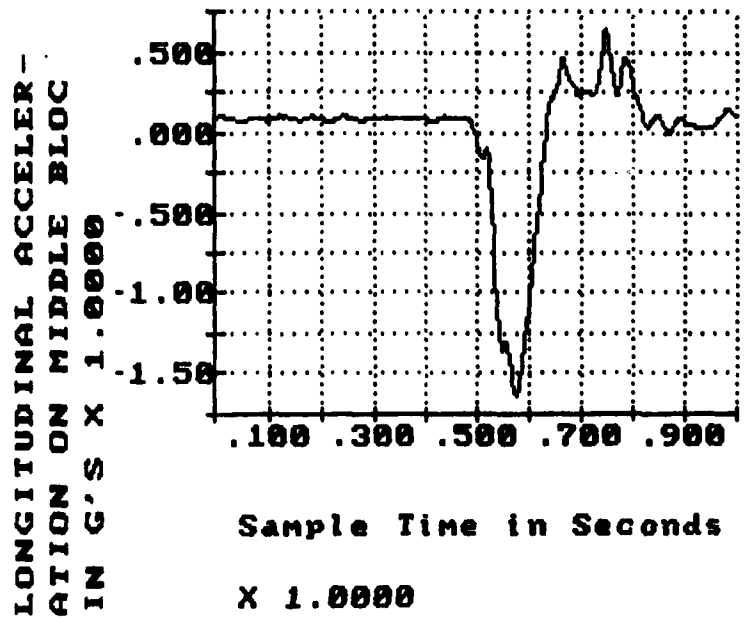
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
IMPACT 1	4.29	.57	8.84	.0038
IMPACT 2	6.38	-1.74	8.43	.0096
IMPACT 3	8.43	-4.03	17.11	.0519
IMPACT 4 (REVERSE)	8.19	-3.00	16.48	.0351

RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 4.29 MPH

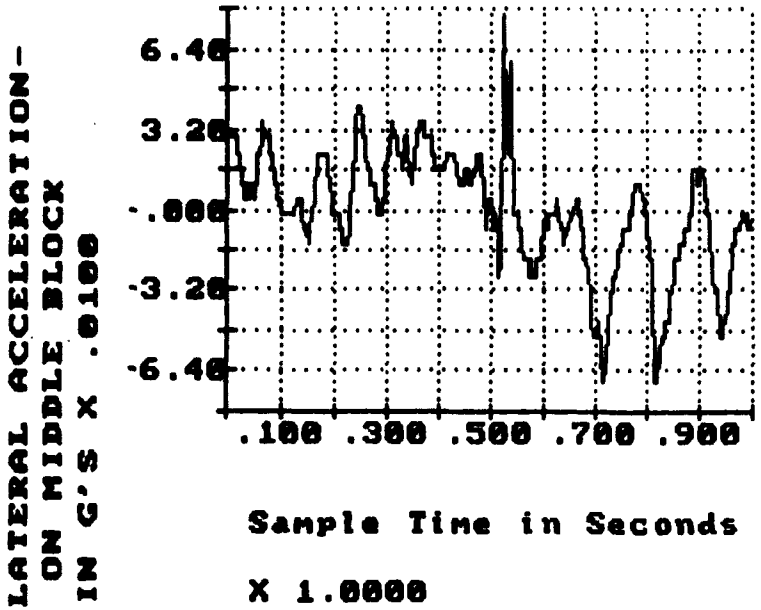


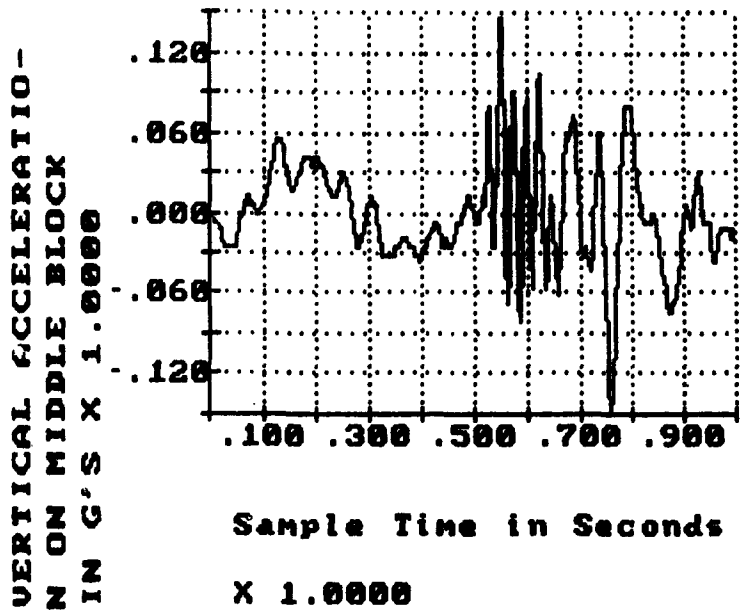


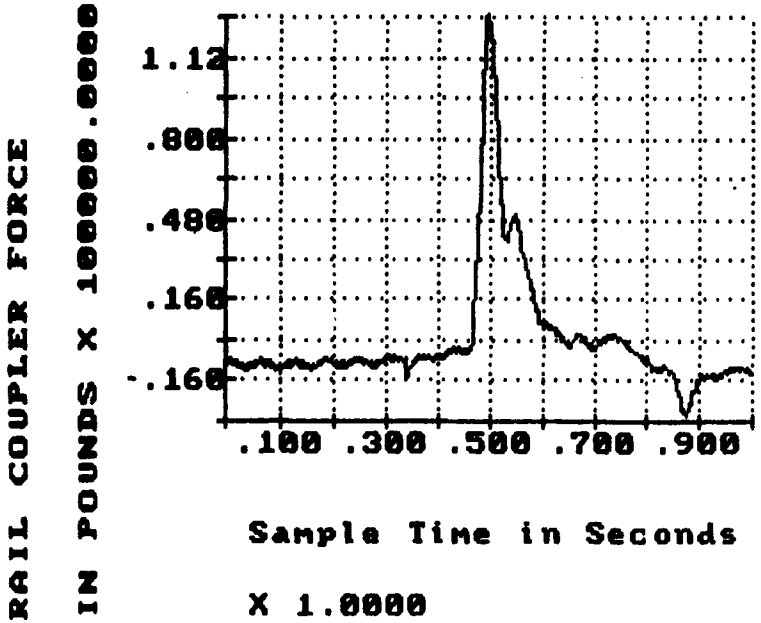


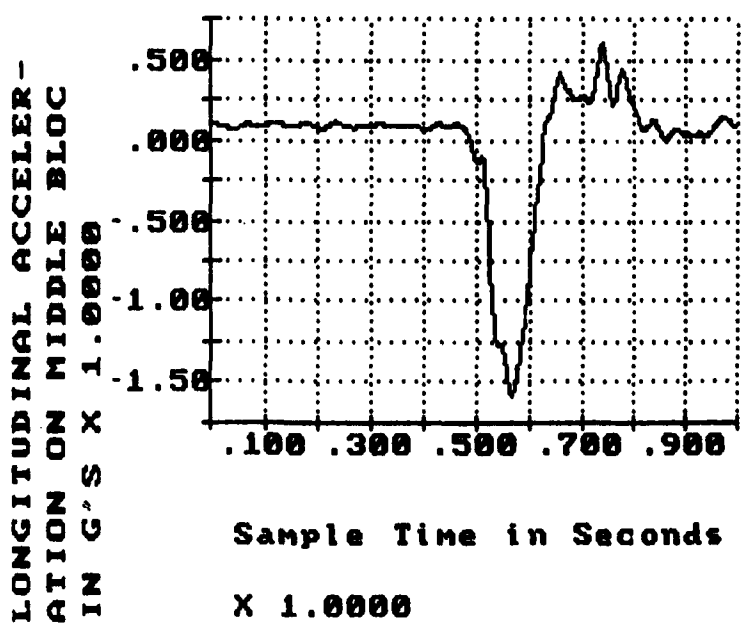


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 4.29 MPH

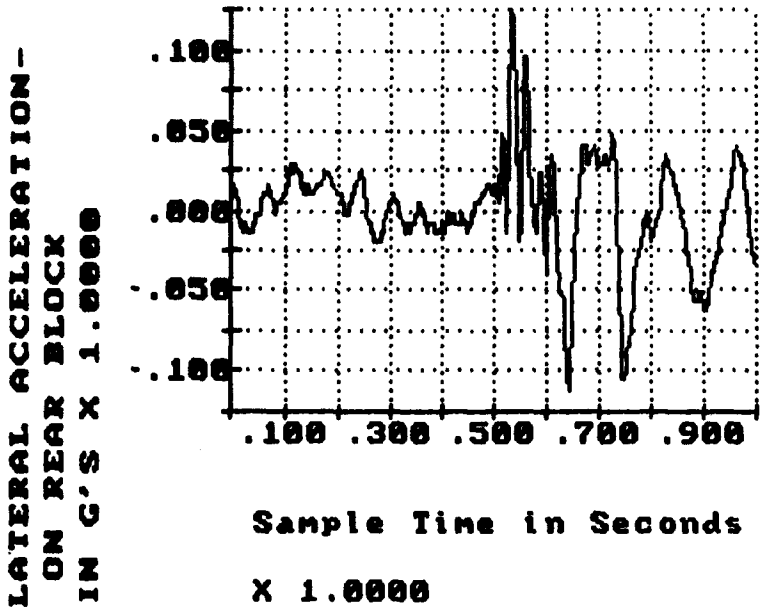


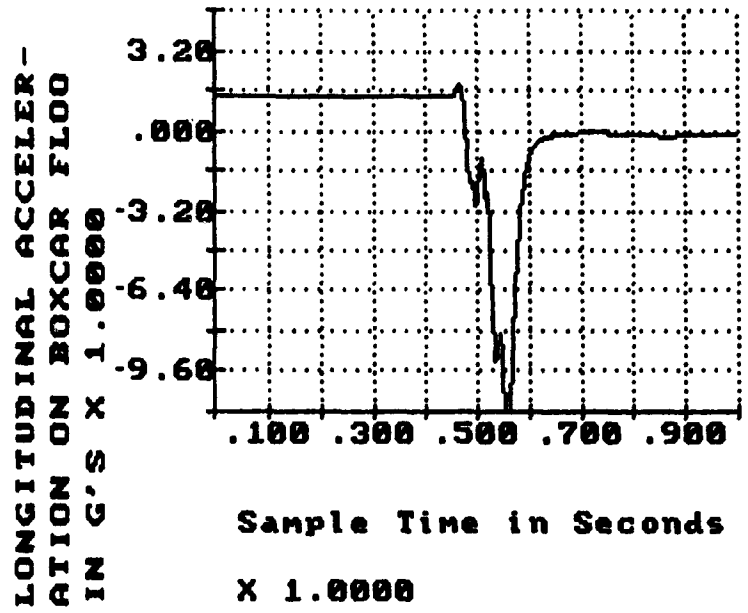


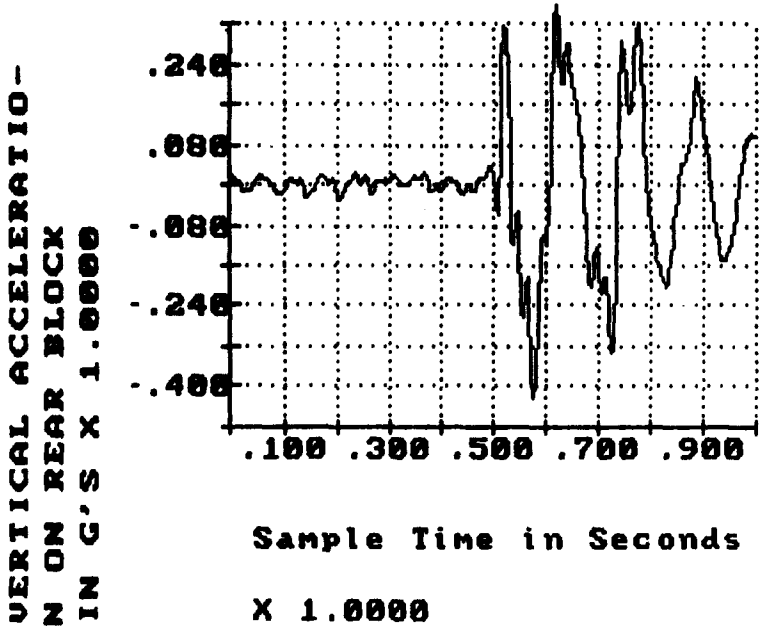


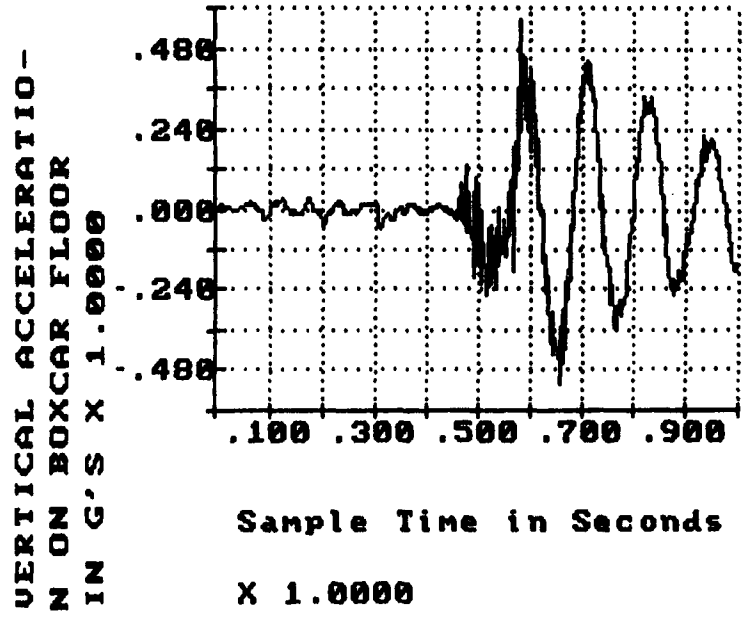


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 4.29 MPH

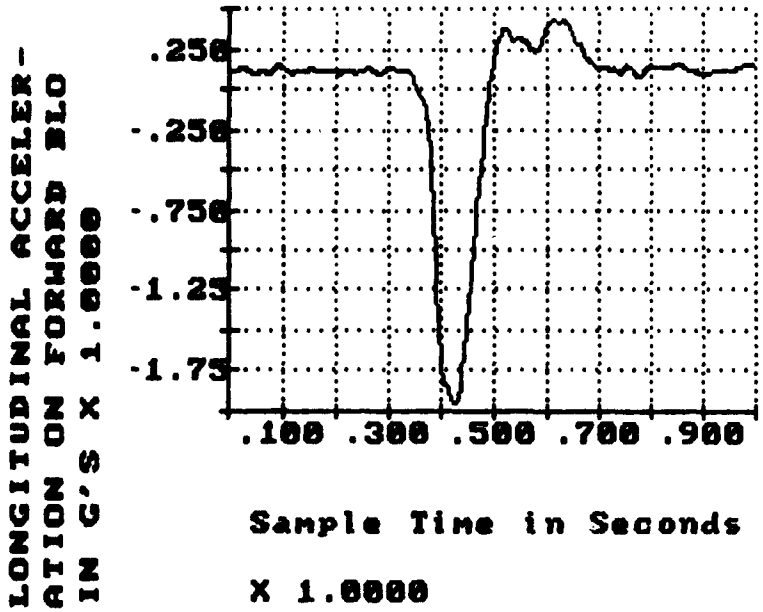


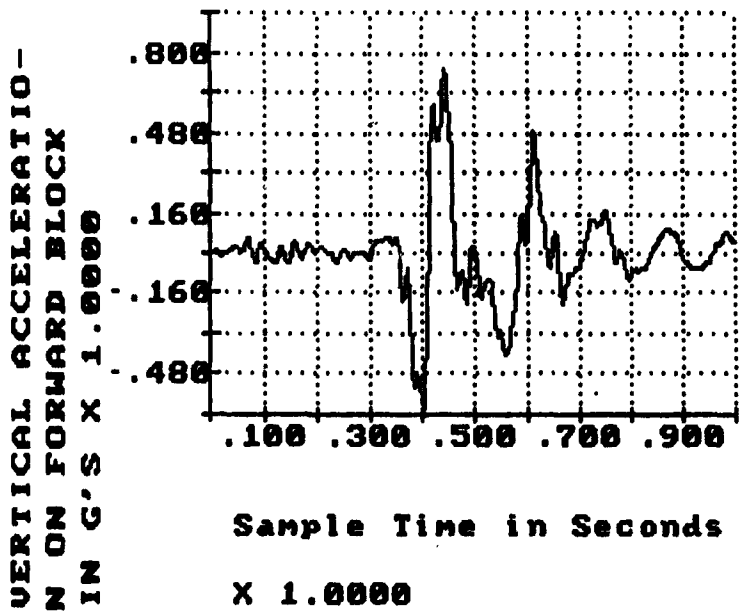


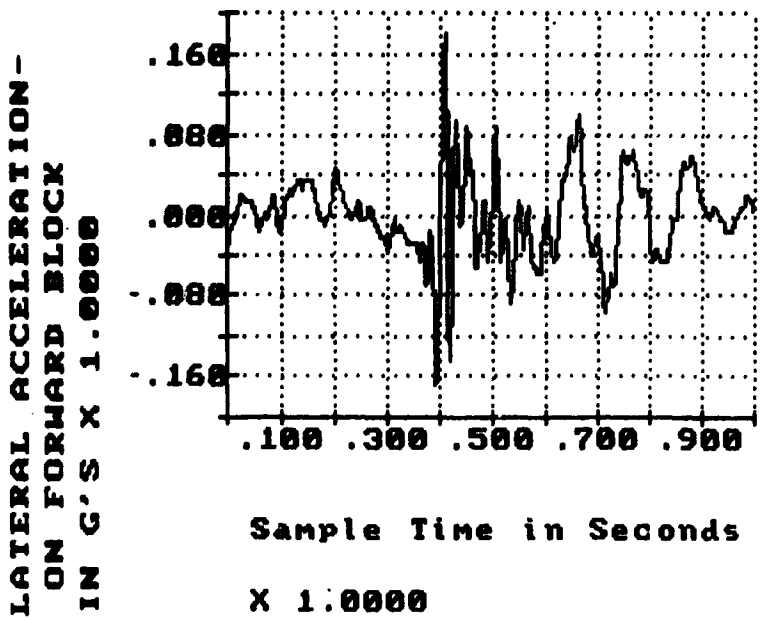


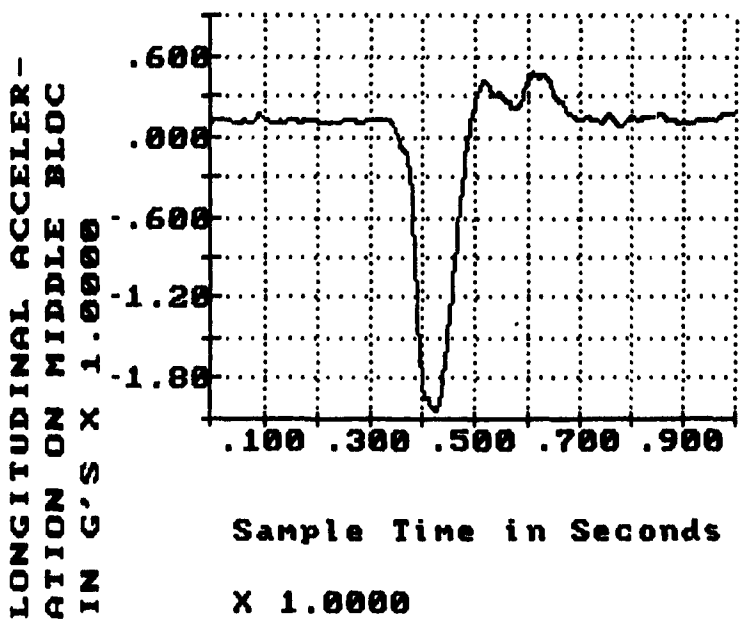


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 6.38 MPH

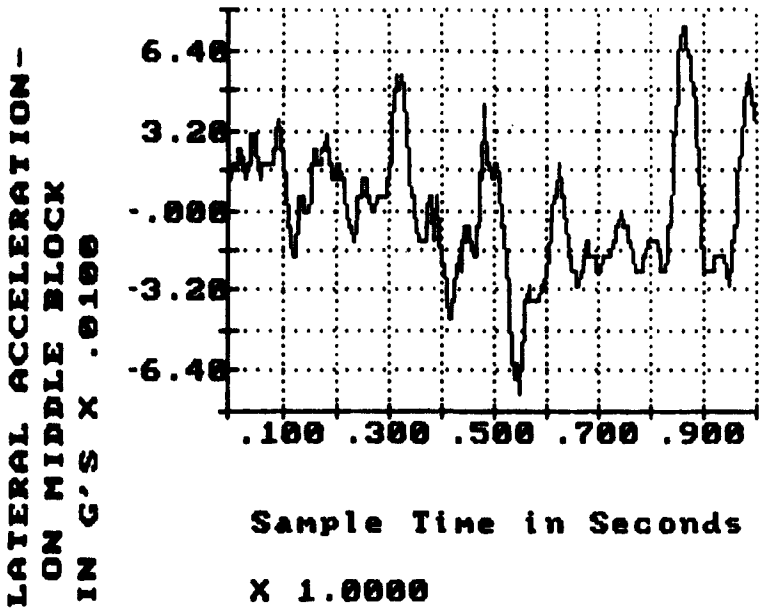


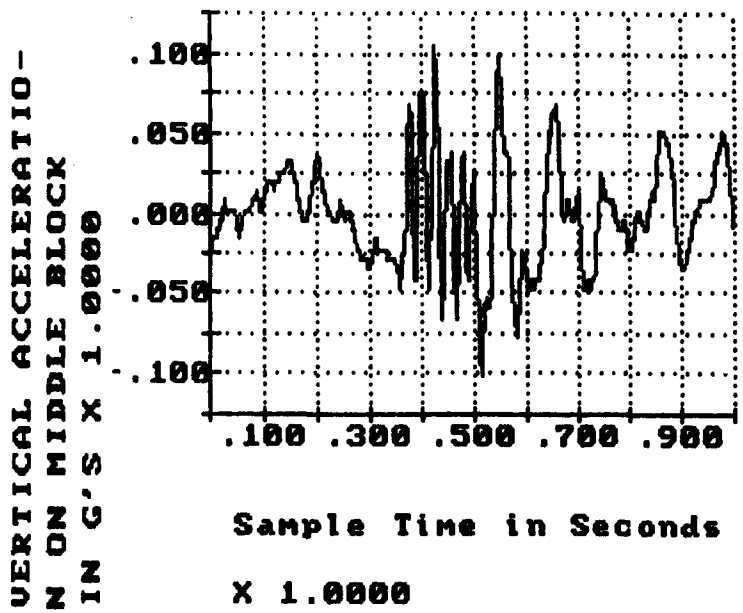


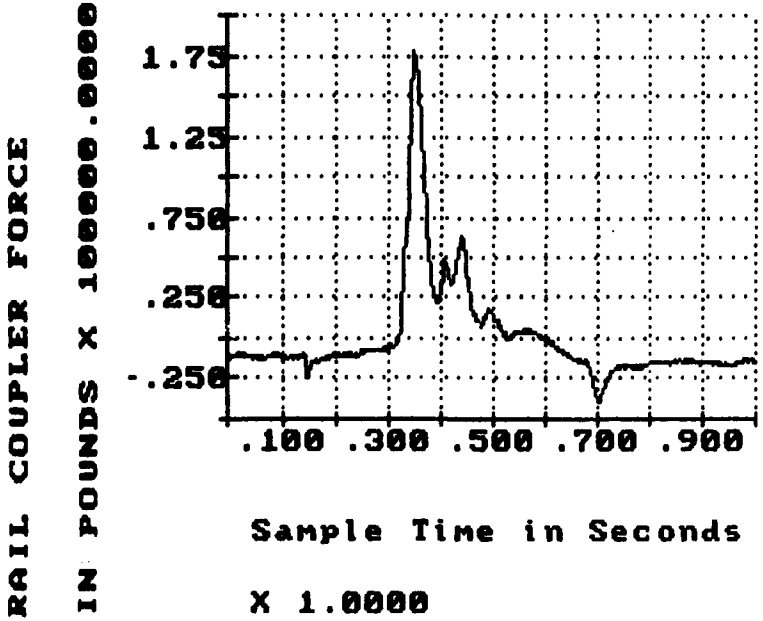


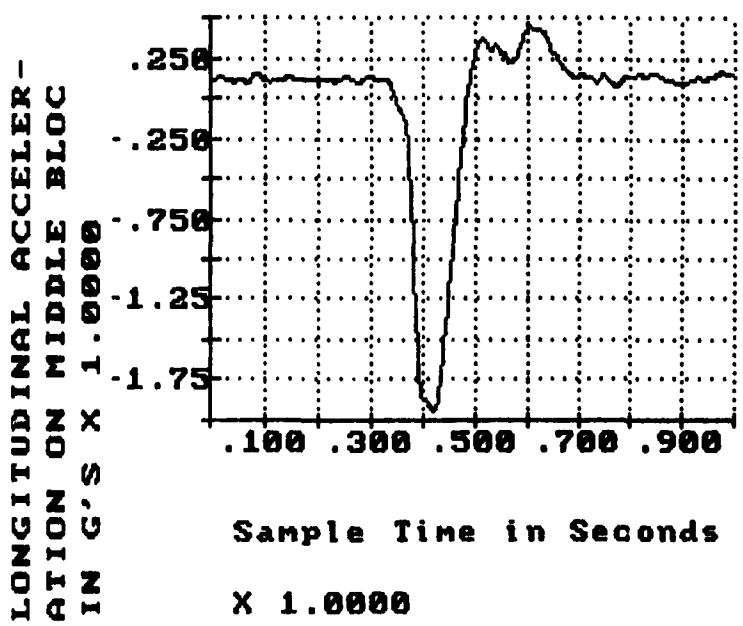


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 6.38 MPH

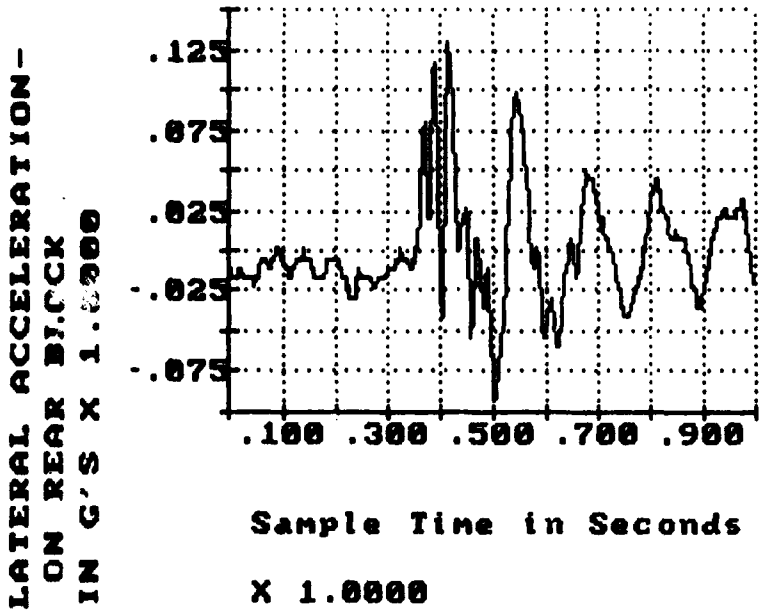


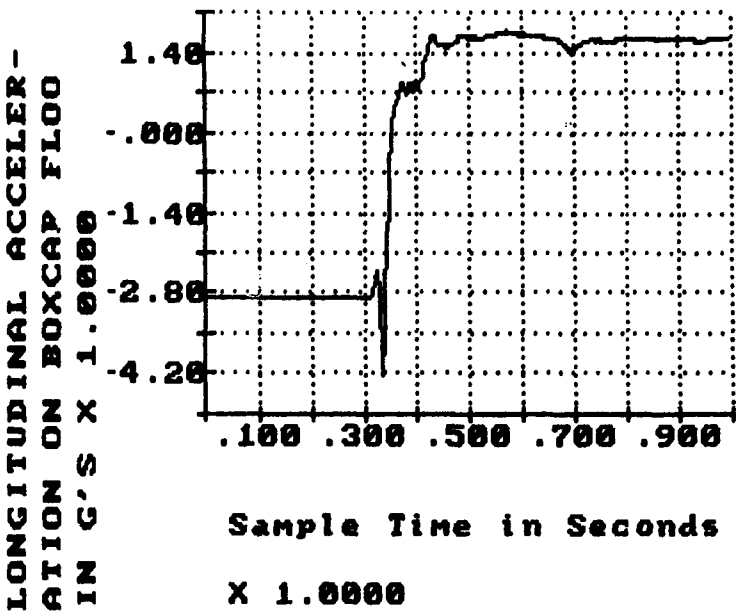


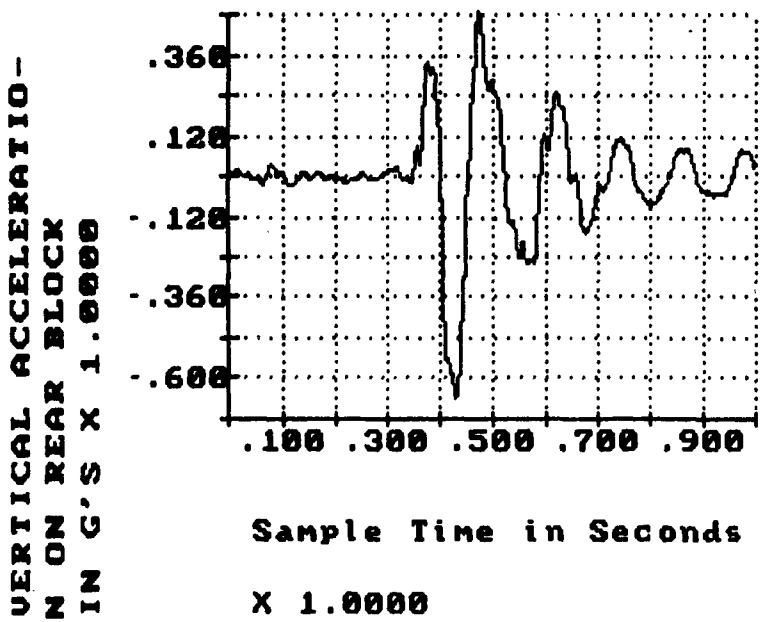


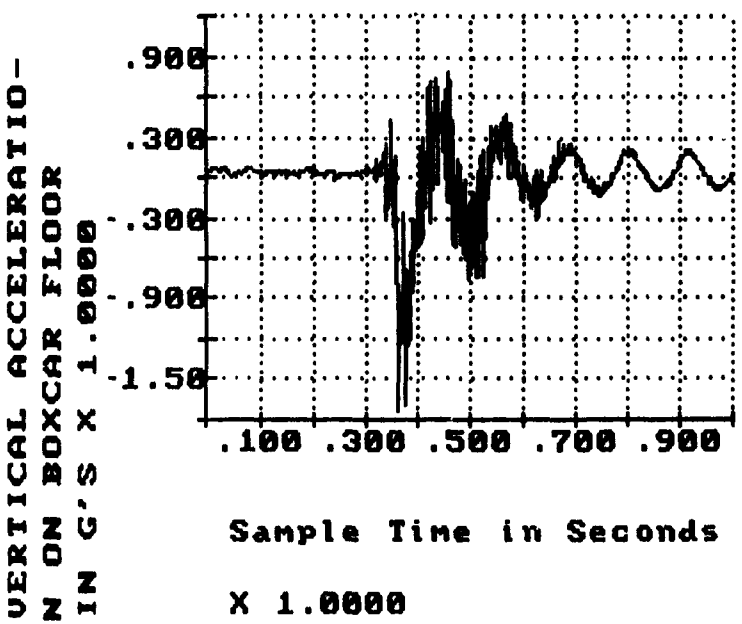


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 6.38 MPH

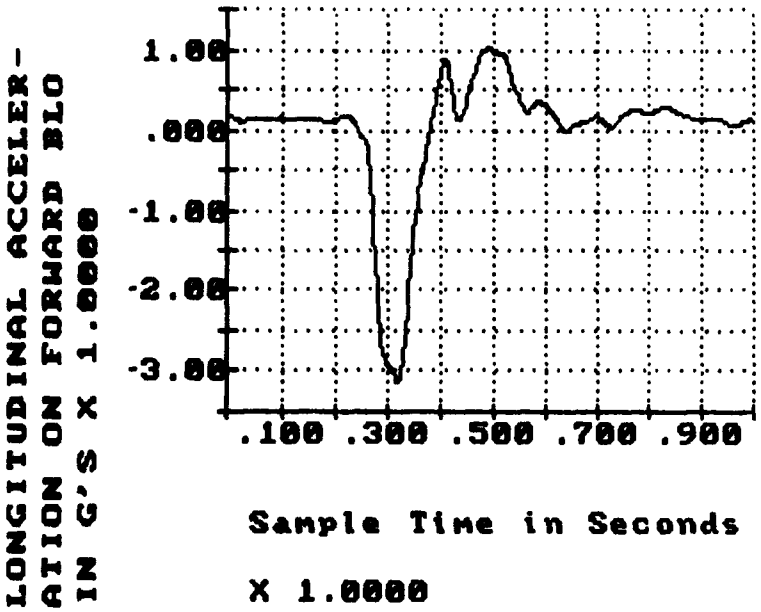


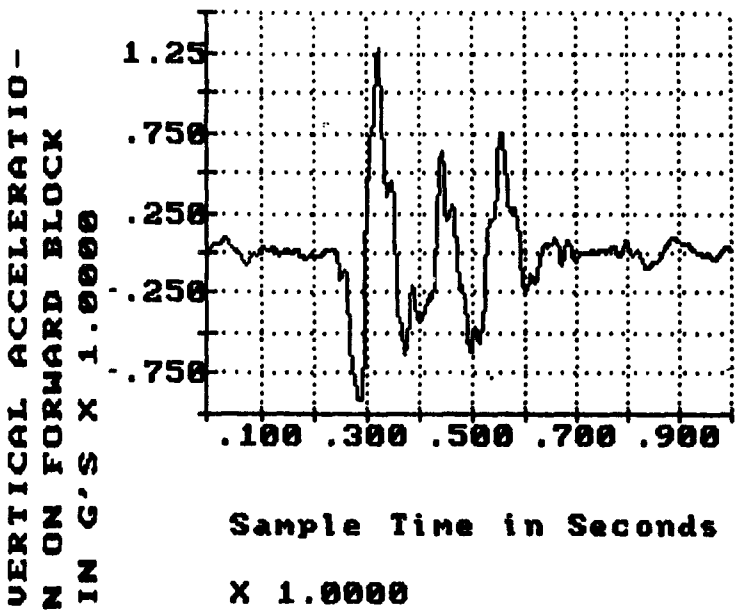


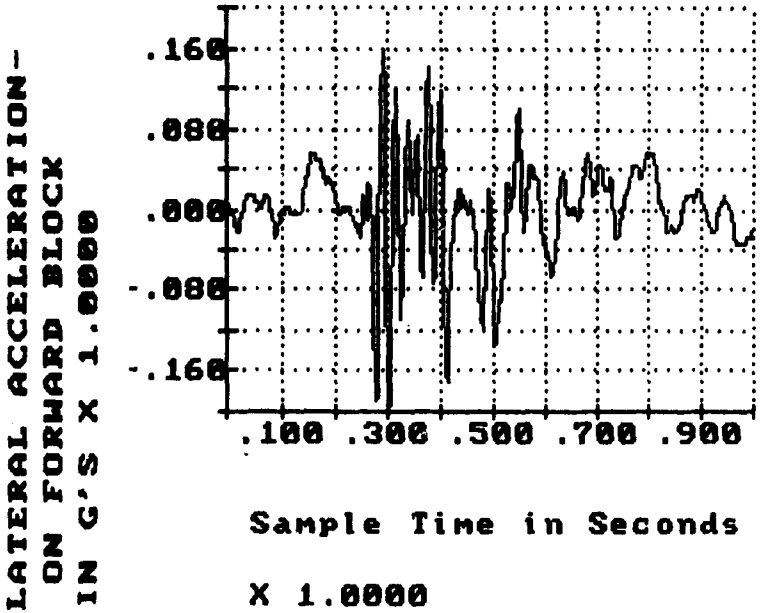


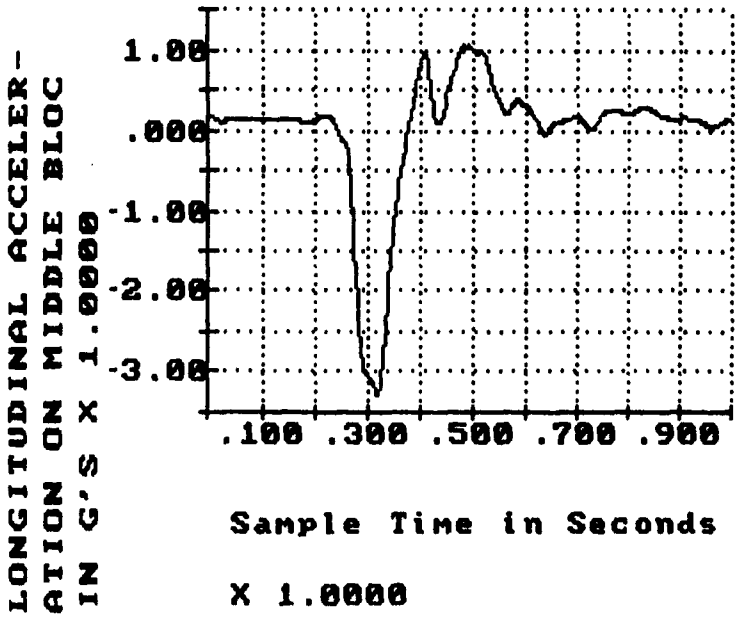


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.43 MPH

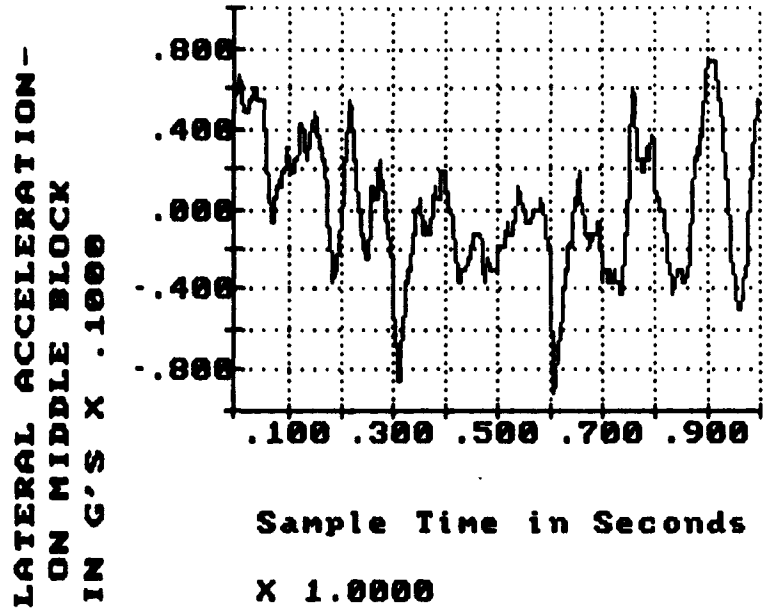


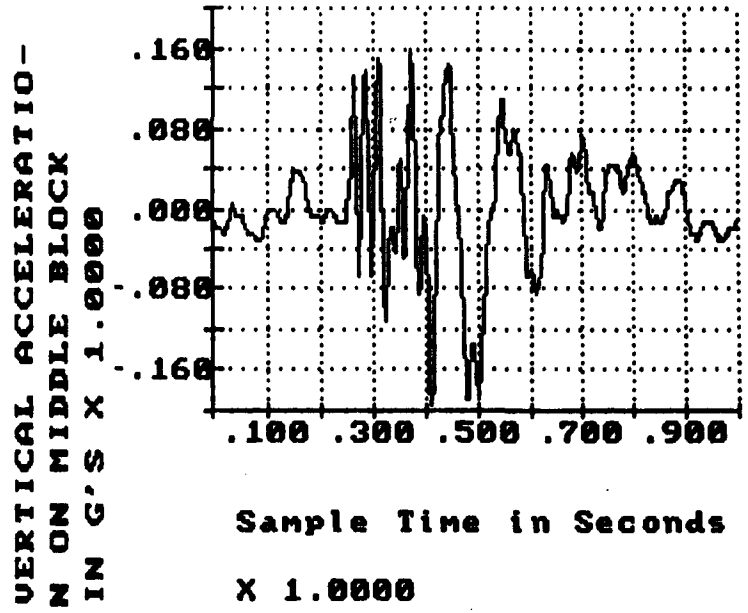


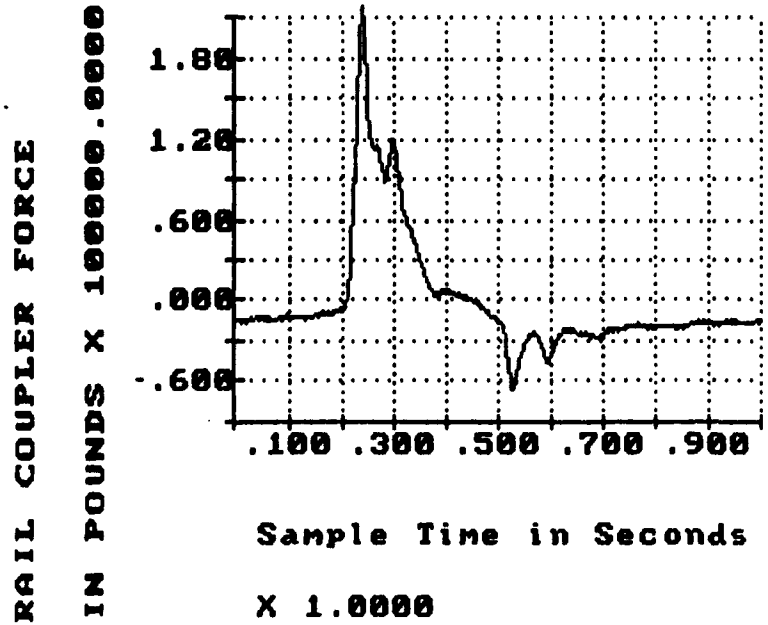


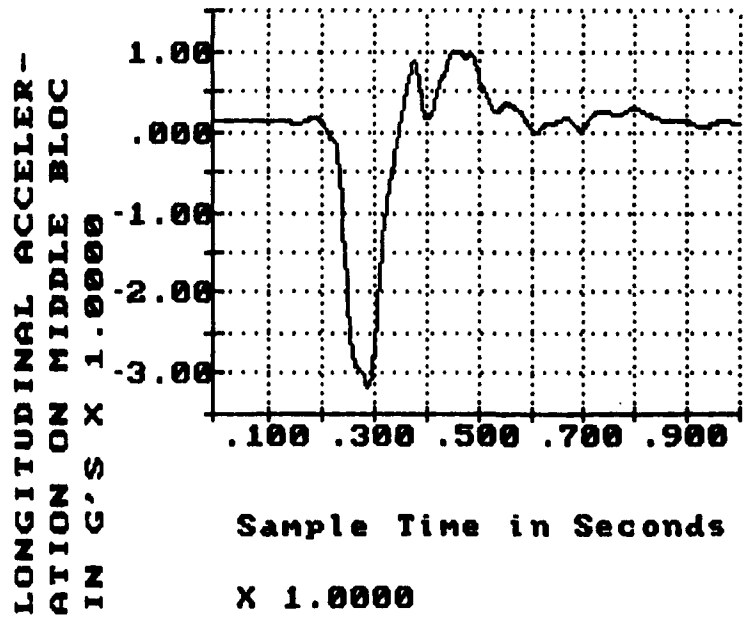


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.43 MPH

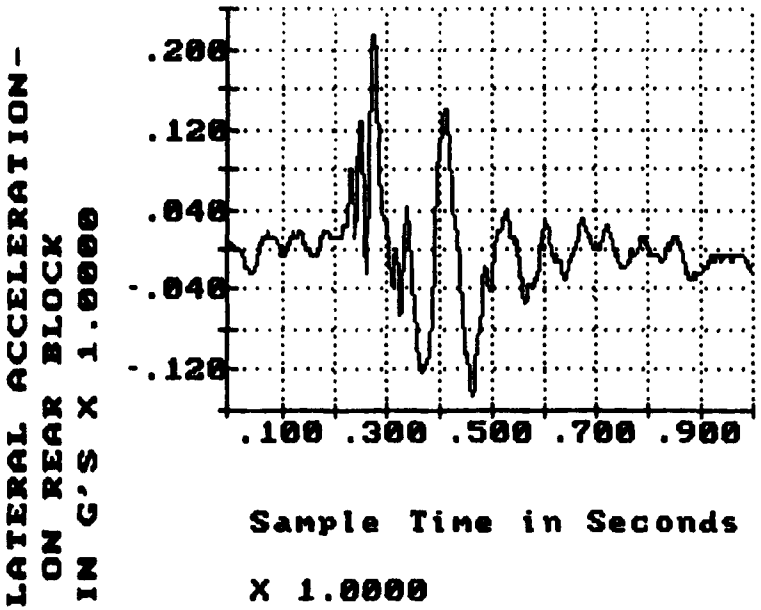


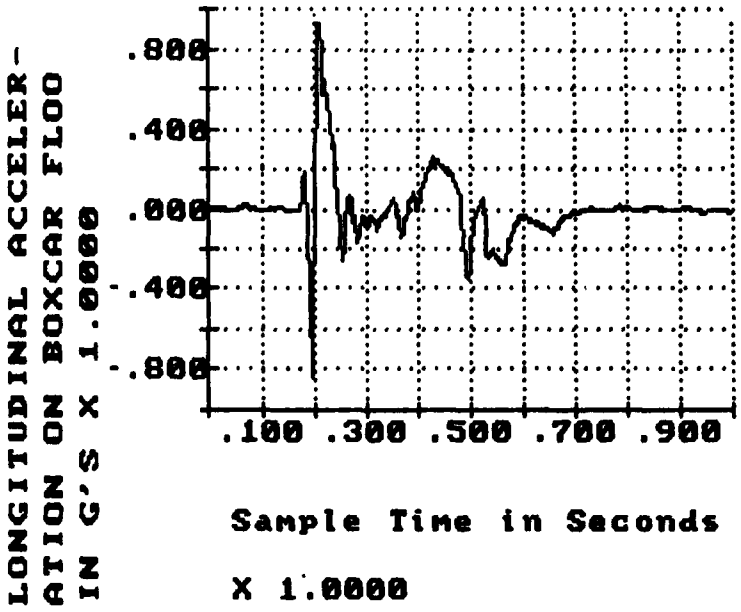


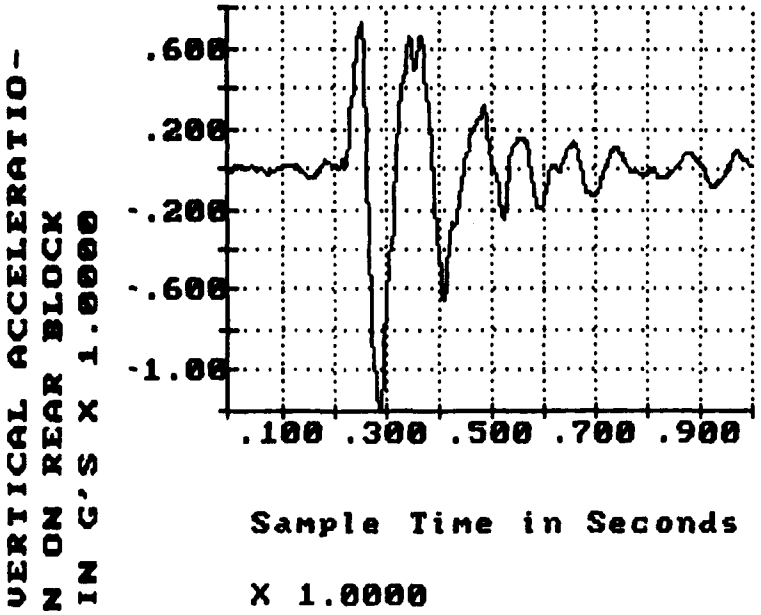


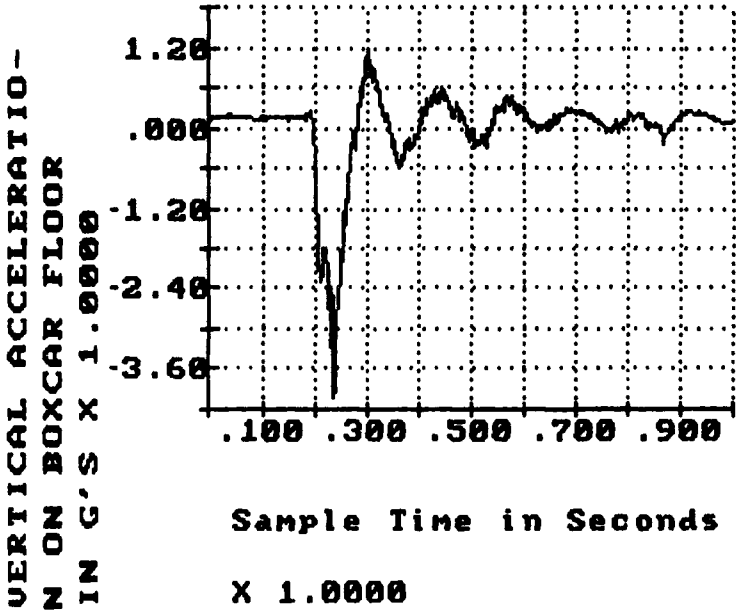


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.43 MPH

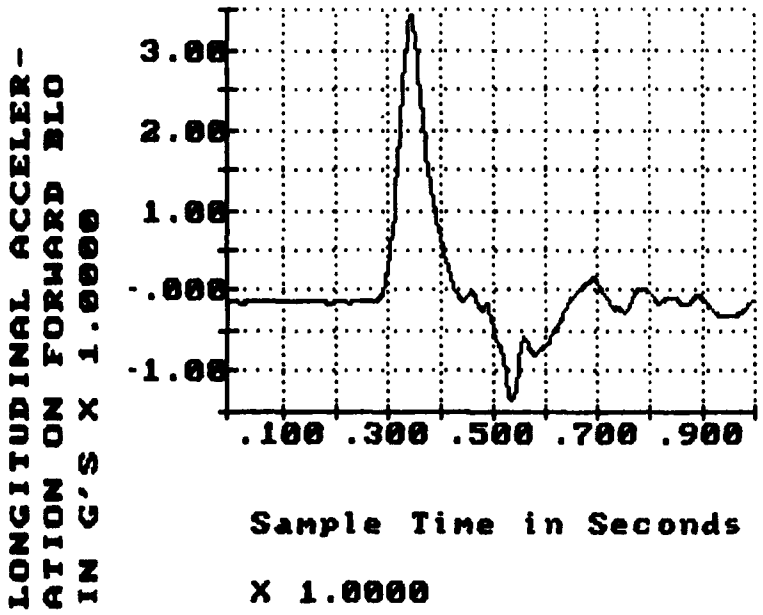


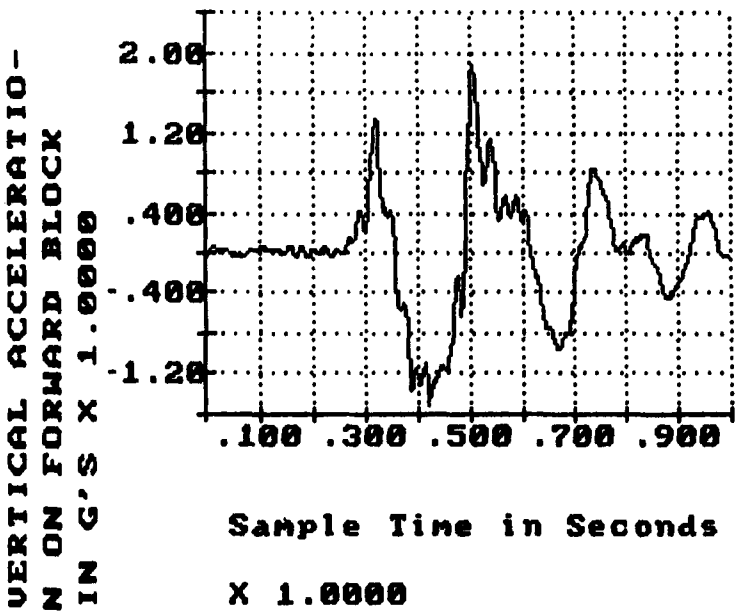


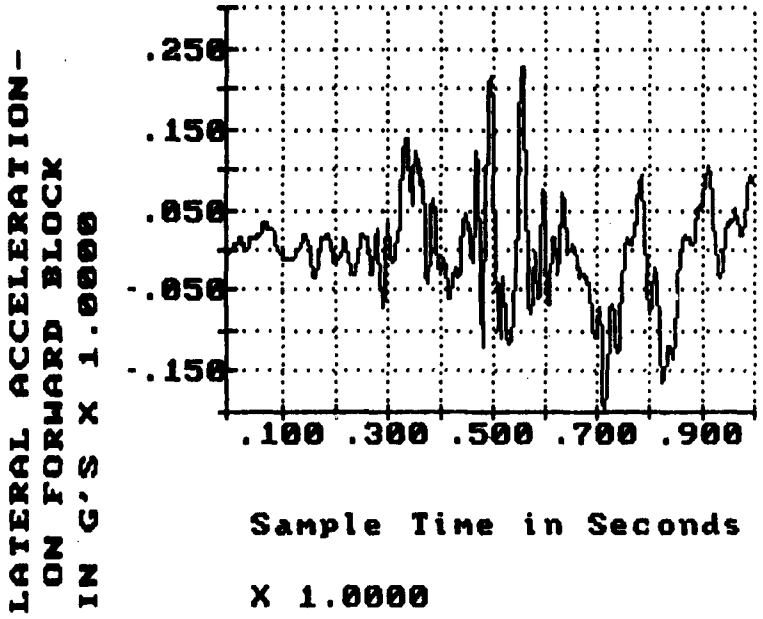


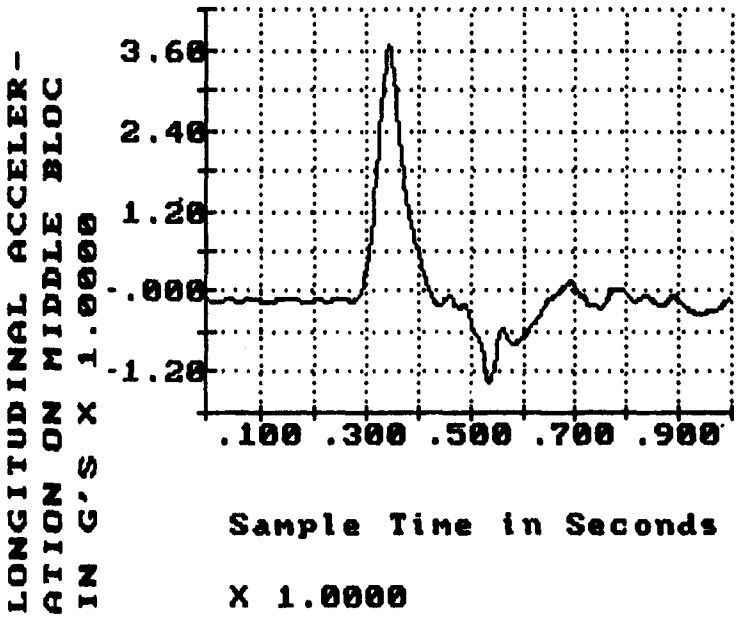


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.19 MPH (REVERSE)

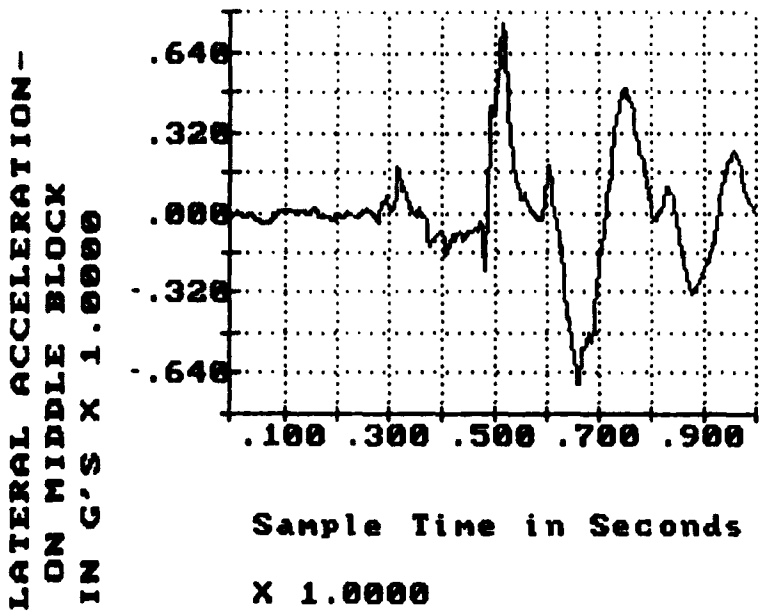


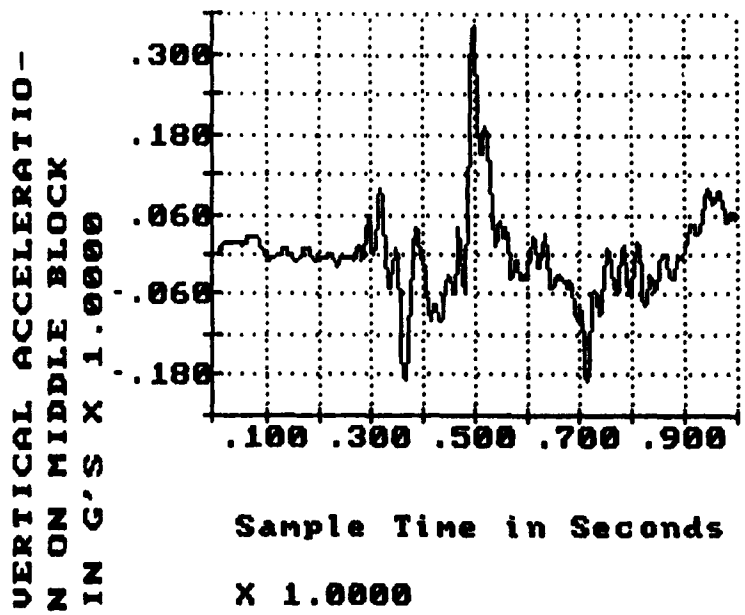


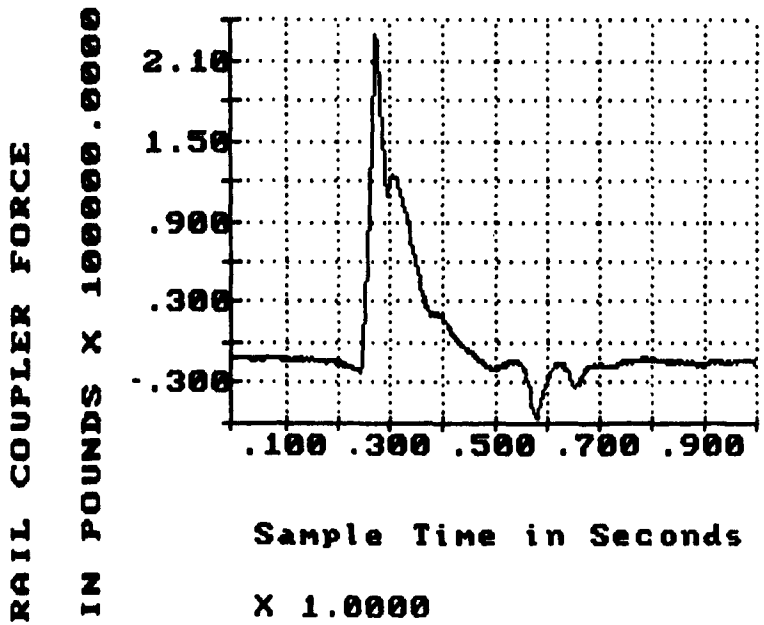


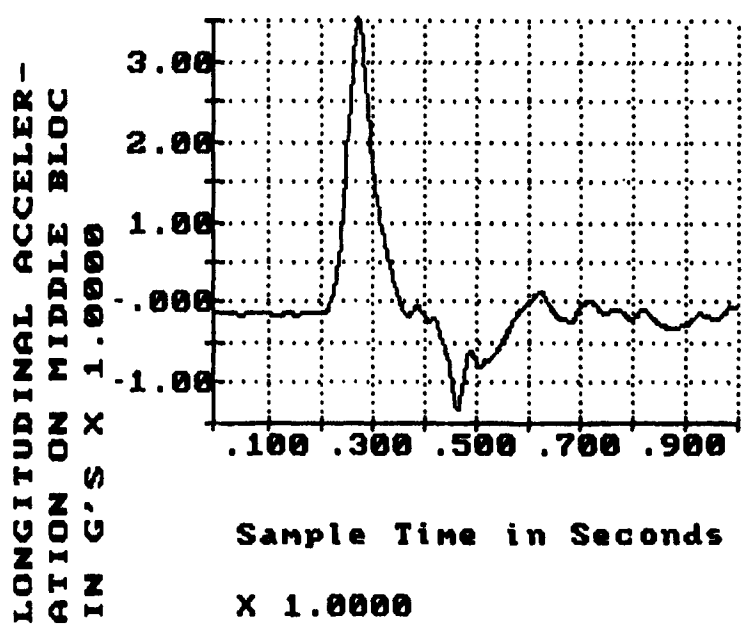


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.19 MPH (REVERSE)

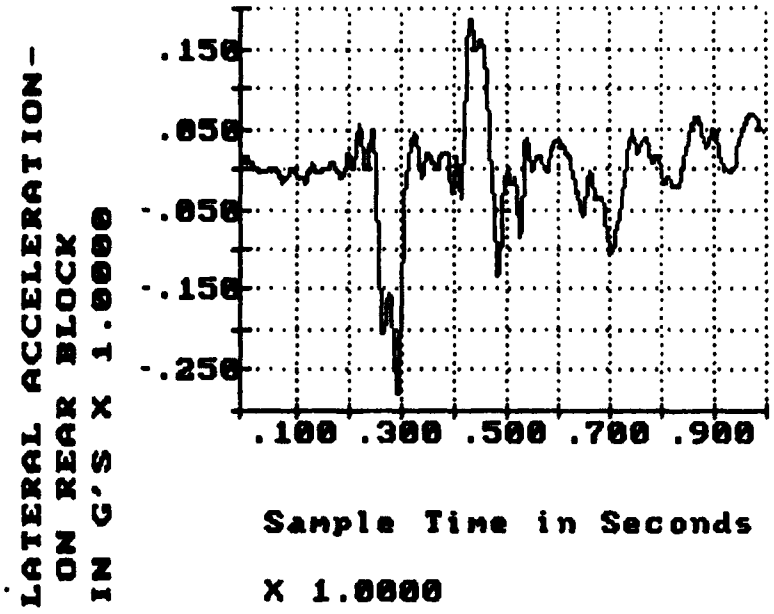


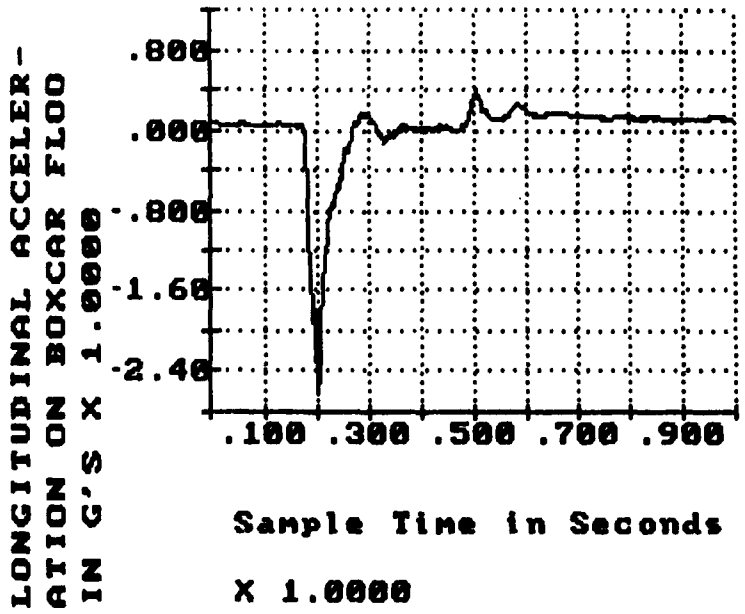


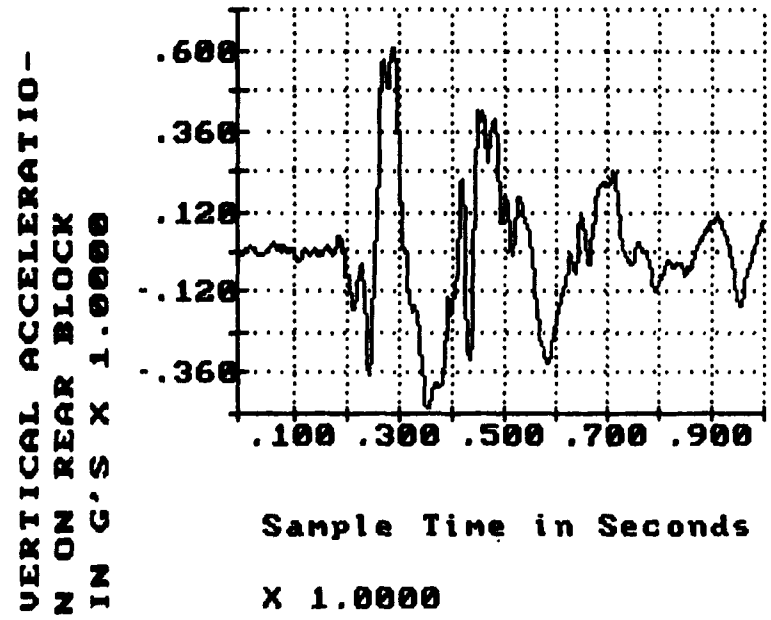


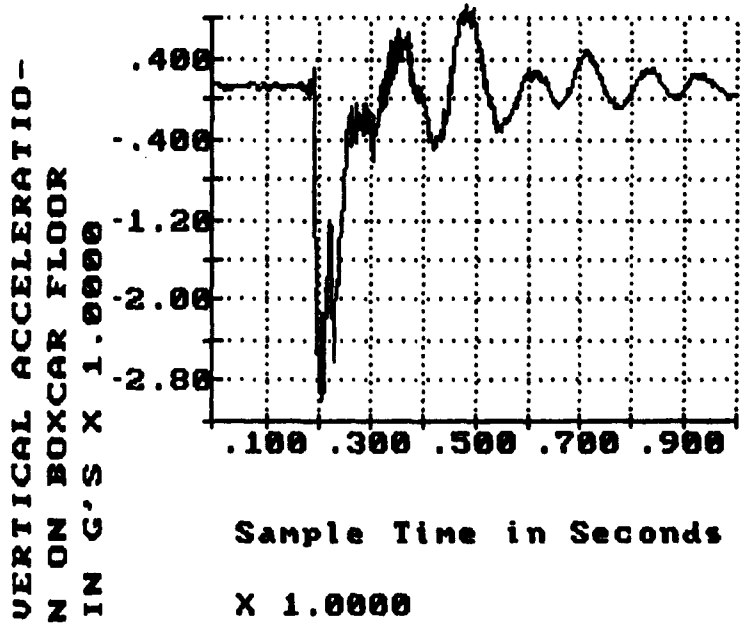


RAIL IMPACT TEST OF ATACMS ON FLATRACK
DATE: 13 JULY 1989
SPEED: 8.19 MPH (REVERSE)









ROAD TEST DATA

TEST NO: 9 DATE: 14 JULY 1989

TEST SPECIMEN: ATACMS on a Flatrack

PASS 1-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 1-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

PASS 2-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 2-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

30 MILE ROAD TEST: No shifting or damage to load.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 3-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

PASS 4-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 4-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

WASHBOARD COURSE: Two passes, load intact without damage.

RESULTS FROM ROAD HAZARD TESTING OF
ATACMS ON FLATRACK
DATE: 14 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.54	65.74	.0655
PASS 1, COURSE B	8.00	-1.08	64.58	.0482
PASS 2, COURSE A	8.00	-.97	70.71	.0432
PASS 2, COURSE B	8.00	-1.03	64.60	.0474
PASS 3, COURSE A	8.00	-1.33	77.30	.0496
PASS 3, COURSE B	8.00	-1.00	70.17	.0430
PASS 4, COURSE A	8.00	-1.38	66.41	.0545
PASS 4, COURSE B	8.00	-1.04	70.54	.0527
WASHBOARD COURSE	8.00	.92	61.69	.0383

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.55	110.08	.1155
PASS 1, COURSE B	8.00	-.79	81.61	.0484
PASS 2, COURSE A	8.00	-1.36	40.96	.0333
PASS 2, COURSE B	8.00	-.79	48.84	.0270
PASS 3, COURSE A	8.00	-1.58	115.43	.1173
PASS 3, COURSE B	8.00	.91	95.68	.0597
PASS 4, COURSE A	8.00	-1.66	136.37	.1299
PASS 4, COURSE B	8.00	.85	131.83	.0808
WASHBOARD COURSE	8.00	-.40	20.72	.0036

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	3.42	46.43	.1075
PASS 1, COURSE B	8.00	1.79	63.14	.0641
PASS 2, COURSE A	8.00	3.14	46.16	.1004
PASS 2, COURSE B	8.00	1.82	75.25	.0932
PASS 3, COURSE A	8.00	3.39	51.17	.1212
PASS 3, COURSE B	8.00	1.83	59.96	.0770
PASS 4, COURSE A	8.00	3.42	47.39	.1092
PASS 4, COURSE B	8.00	1.93	57.36	.0764
WASHBOARD COURSE	8.00	2.55	34.23	.0494

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.49	64.09	.0604
PASS 1, COURSE B	8.00	-1.04	61.24	.0445
PASS 2, COURSE A	8.00	-.93	64.89	.0395
PASS 2, COURSE B	8.00	.99	55.68	.0354
PASS 3, COURSE A	8.00	-1.29	69.68	.0484
PASS 3, COURSE B	8.00	-1.05	70.23	.0435
PASS 4, COURSE A	8.00	-1.36	63.54	.0498
PASS 4, COURSE B	8.00	-1.07	60.40	.0456
WASHBOARD COURSE	8.00	1.08	64.84	.0452

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.74	78.88	.0895
PASS 1, COURSE B	8.00	.03	43.40	.0008
PASS 2, COURSE A	8.00	.09	46.68	.0031
PASS 2, COURSE B	8.00	-.04	47.60	.0013
PASS 3, COURSE A	8.00	2.01	63.69	.0943
PASS 3, COURSE B	8.00	1.10	134.72	.0475
PASS 4, COURSE A	8.00	1.99	65.43	.0920
PASS 4, COURSE B	8.00	1.13	106.85	.0688
WASHBOARD COURSE	8.00	1.76	81.55	.0908

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.38	153.50	.1317
PASS 1, COURSE B	8.00	.95	215.78	.1271
PASS 2, COURSE A	8.00	1.37	149.01	.1051
PASS 2, COURSE B	8.00	1.01	190.84	.1291
PASS 3, COURSE A	8.00	-1.41	138.92	.1239
PASS 3, COURSE B	8.00	1.04	723.07	.0684
PASS 4, COURSE A	8.00	-1.48	108.11	.1048
PASS 4, COURSE B	8.00	1.05	171.67	.1121
WASHBOARD COURSE	8.00	.32	20.72	.0030

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-1.46	63.38	.0598
PASS 1, COURSE B	8.00	-.98	61.12	.0412
PASS 2, COURSE A	8.00	-.90	66.54	.0396
PASS 2, COURSE B	8.00	-.92	72.22	.0393
PASS 3, COURSE A	8.00	-1.25	70.45	.0470
PASS 3, COURSE B	8.00	-.98	69.14	.0408
PASS 4, COURSE A	8.00	-1.32	70.83	.0483
PASS 4, COURSE B	8.00	-1.00	59.60	.0426
WASHBOARD COURSE	8.00	.96	67.23	.0419

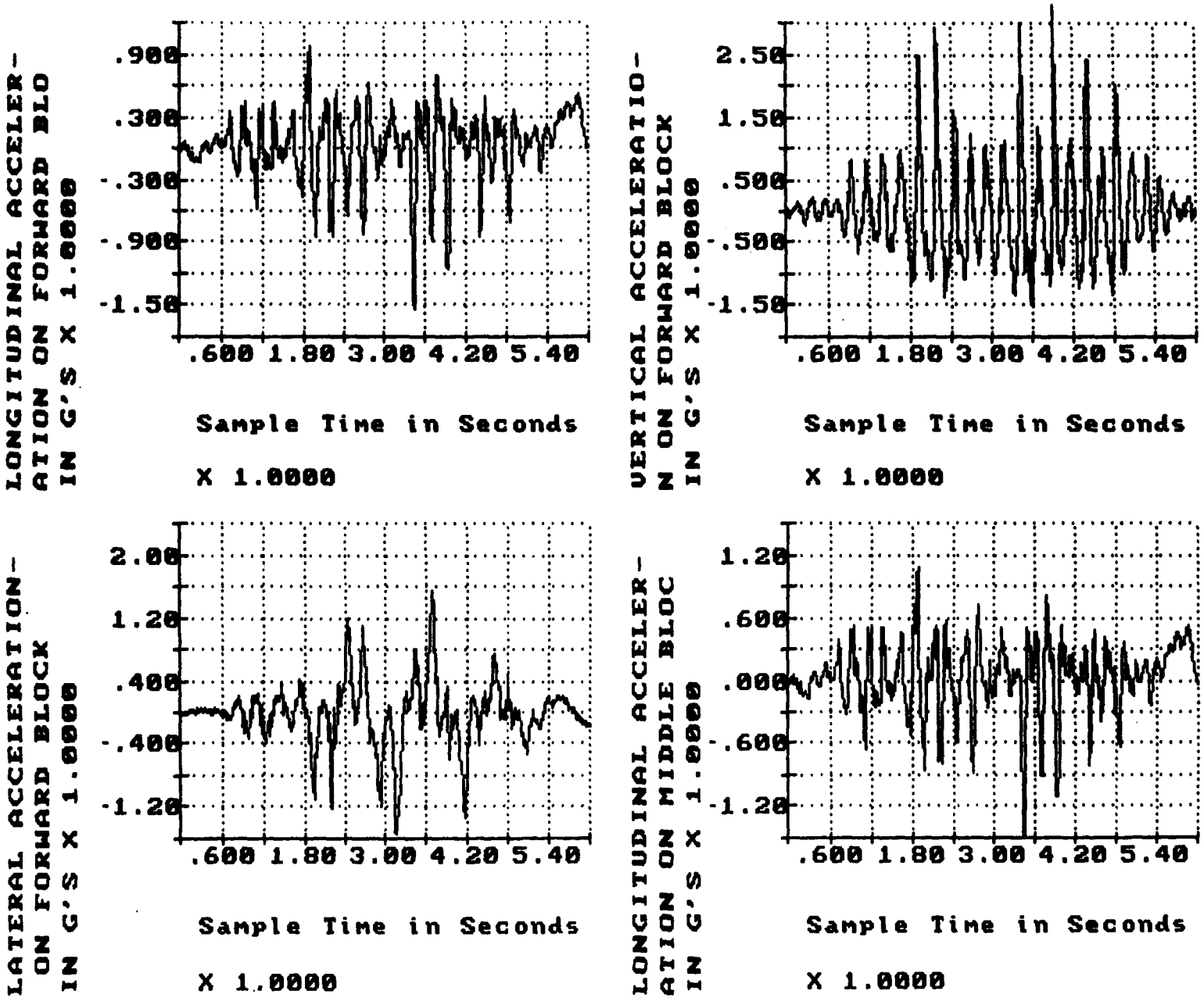
TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.76	135.88	.0657
PASS 1, COURSE B	8.00	.49	134.18	.0452
PASS 2, COURSE A	8.00	.50	83.54	.0301
PASS 2, COURSE B	8.00	.50	139.08	.0492
PASS 3, COURSE A	8.00	.71	111.19	.0569
PASS 3, COURSE B	8.00	.50	156.71	.0510
PASS 4, COURSE A	8.00	.80	85.82	.0495
PASS 4, COURSE B	8.00	.55	104.14	.0400
WASHBOARD COURSE	8.00	-.18	73.37	.0080

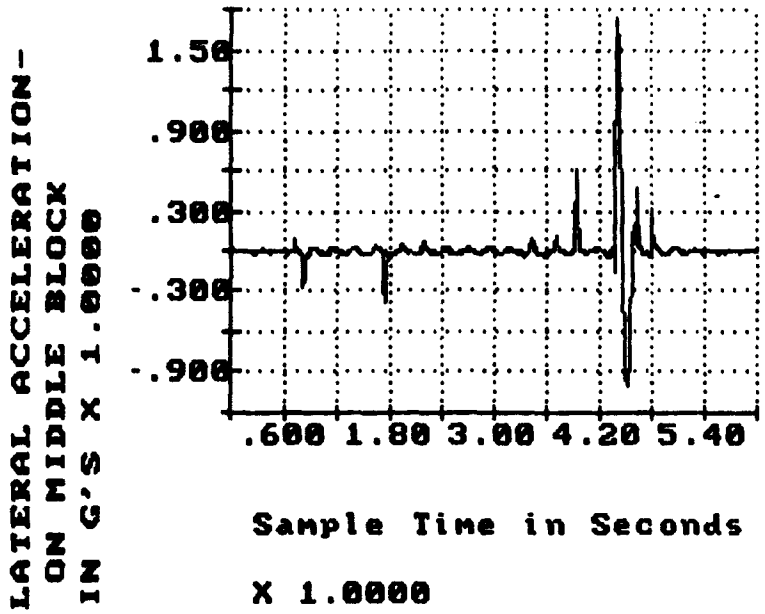
TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

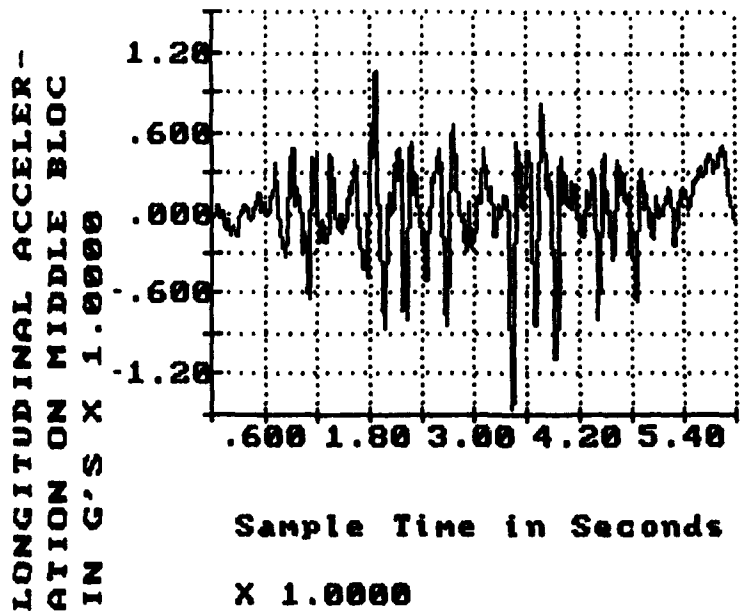
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.81	83.82	.0446
PASS 1, COURSE B	8.00	.89	61.32	.0393
PASS 2, COURSE A	8.00	.81	128.00	.0471
PASS 2, COURSE B	8.00	.96	52.35	.0339
PASS 3, COURSE A	8.00	.85	117.55	.0484
PASS 3, COURSE B	8.00	.93	52.40	.0330
PASS 4, COURSE A	8.00	.89	233.64	.0074
PASS 4, COURSE B	8.00	.90	83.54	.0470
WASHBOARD COURSE	8.00	1.25	50.53	.0405

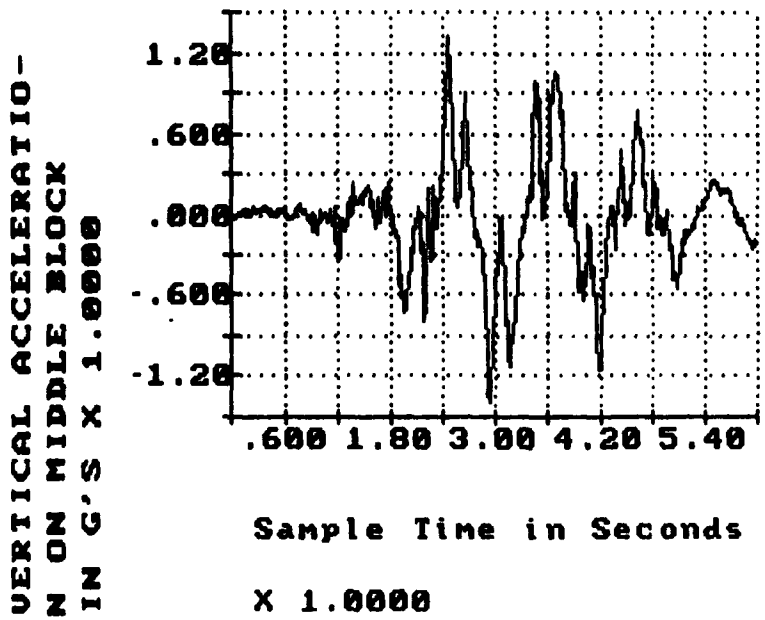
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 1, COURSE A

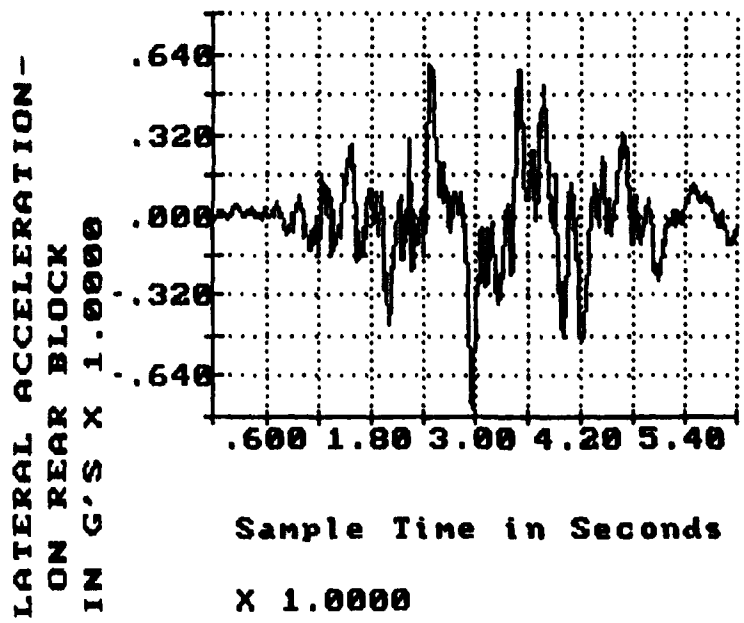


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 1, COURSE A









ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
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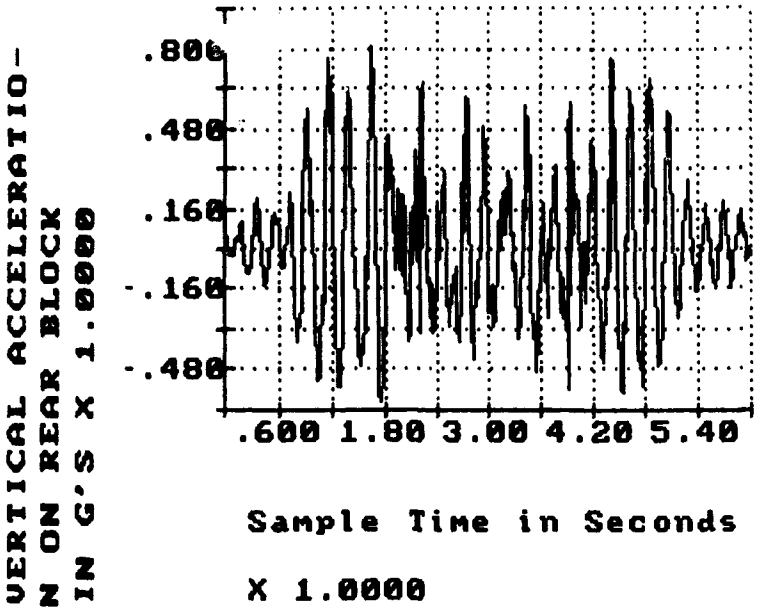

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DATE: 14 JULY 1989
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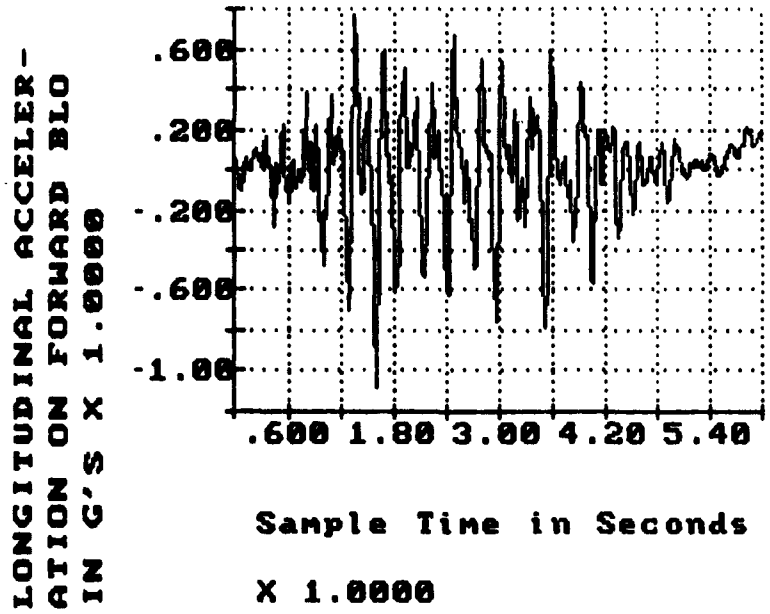

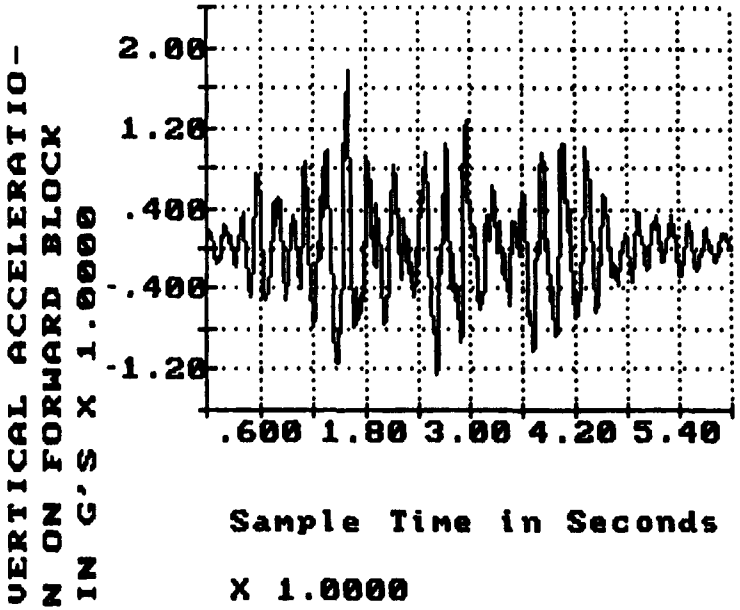

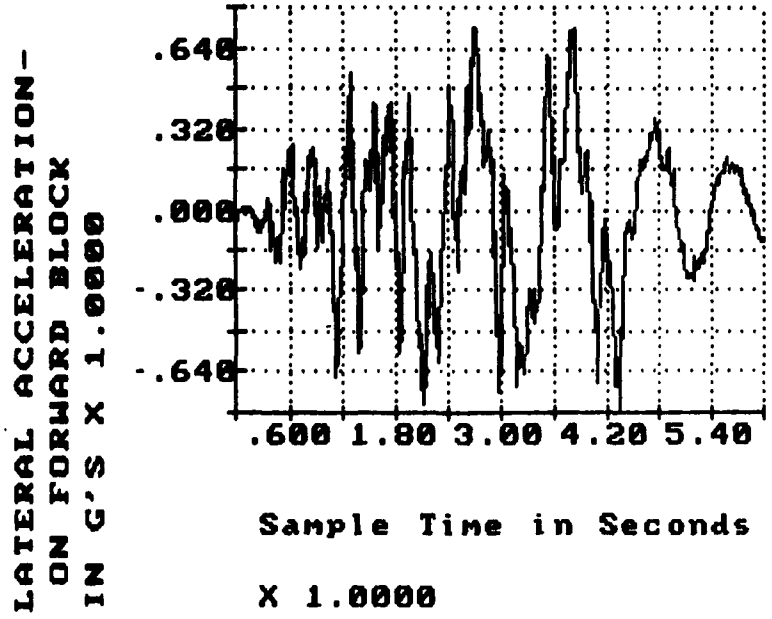

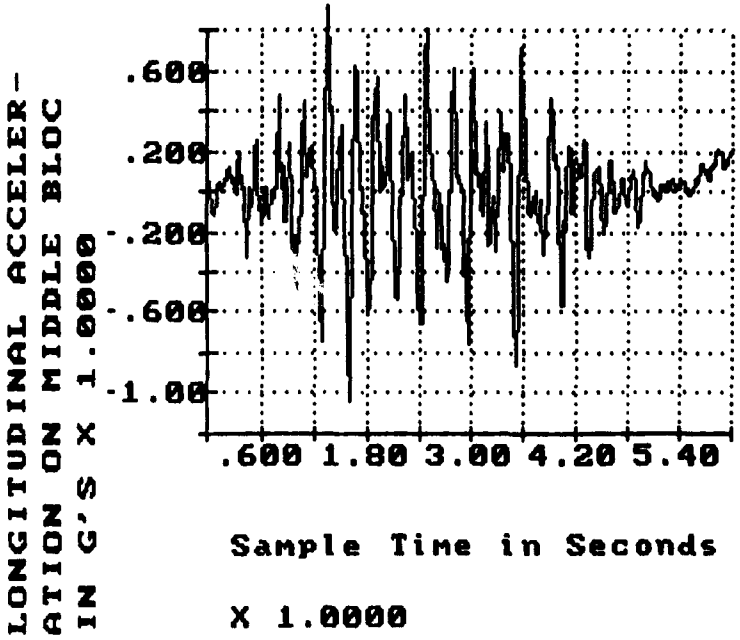

ROAD HAZARD TEST OF ATACMS ON FLATRACK
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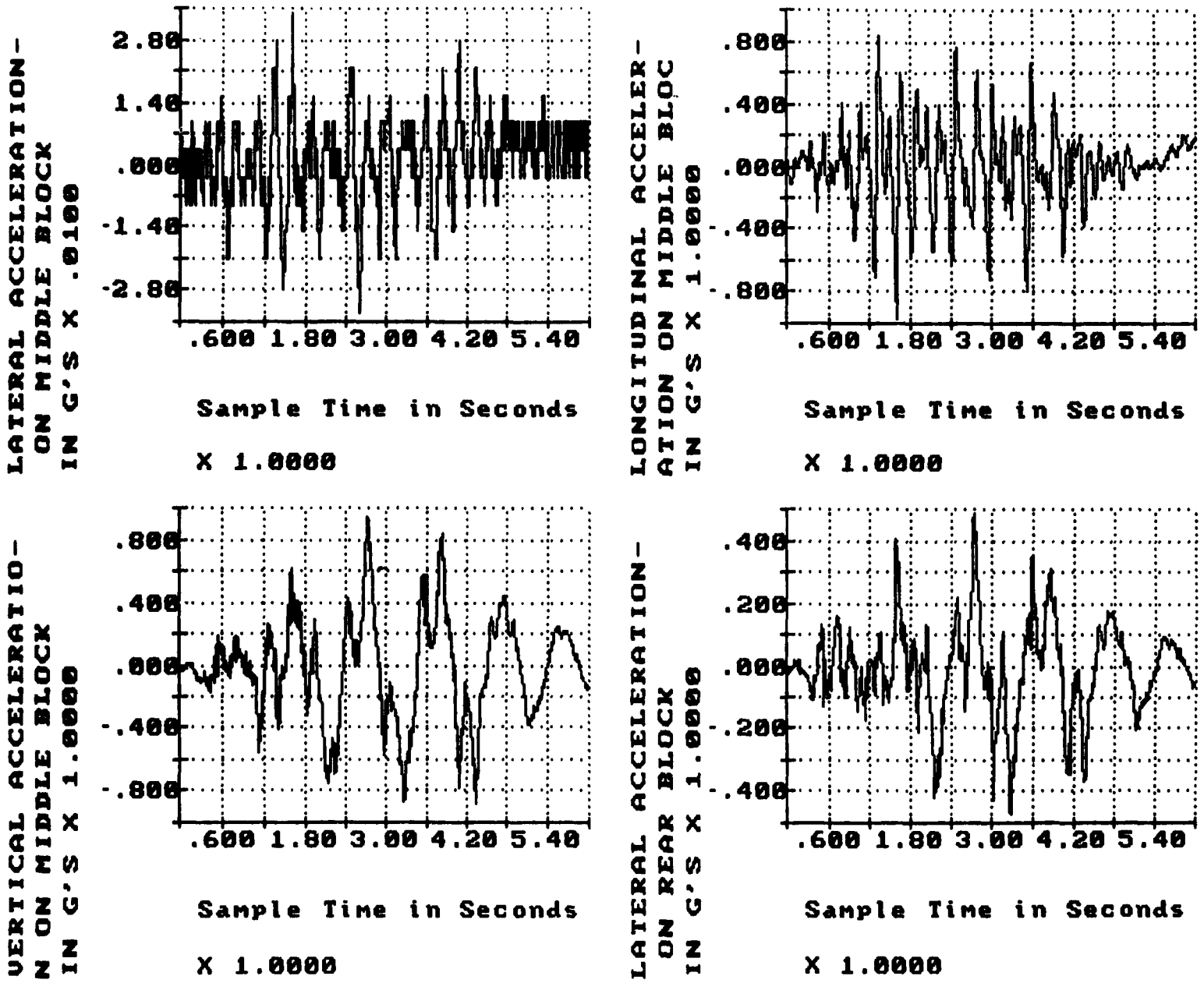
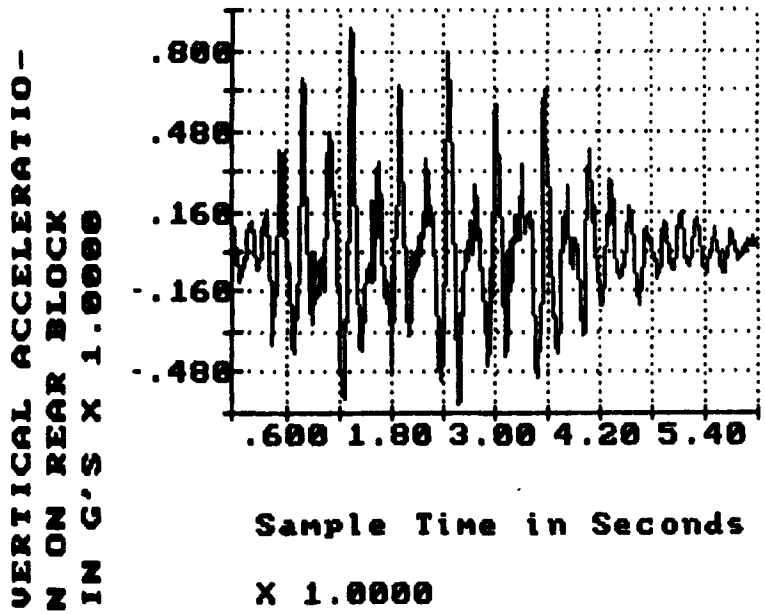
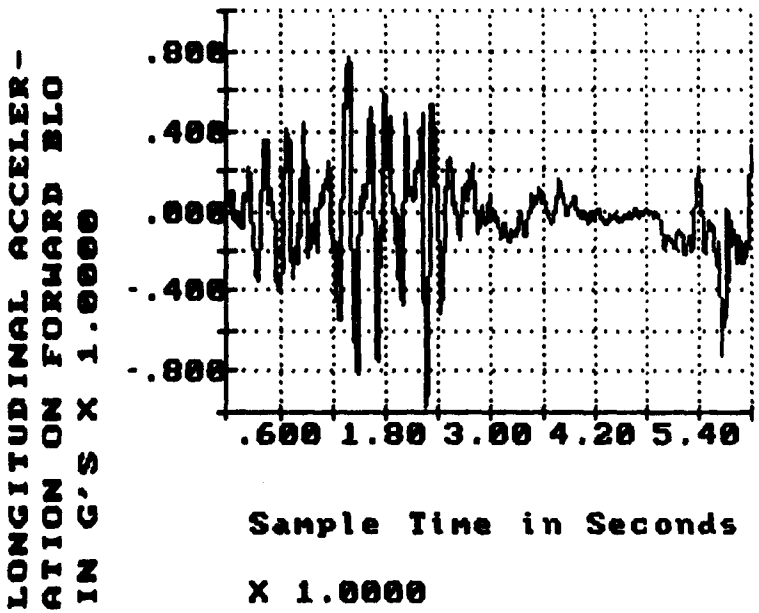
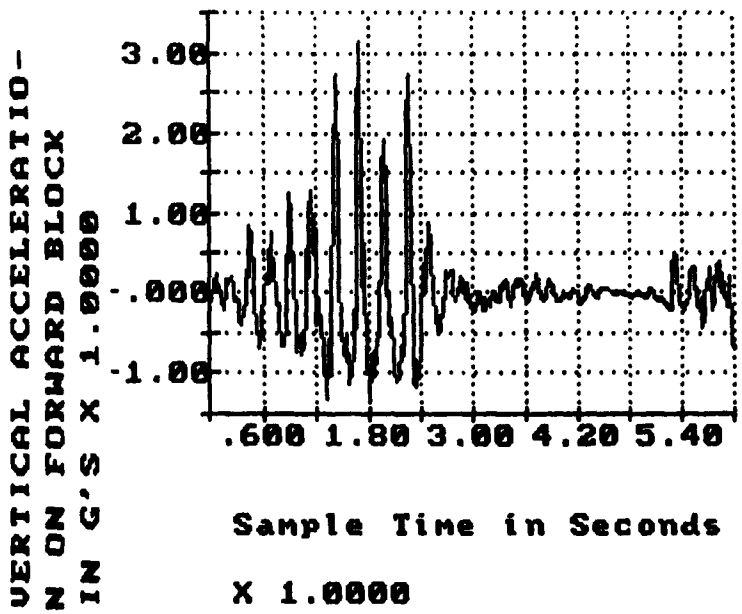


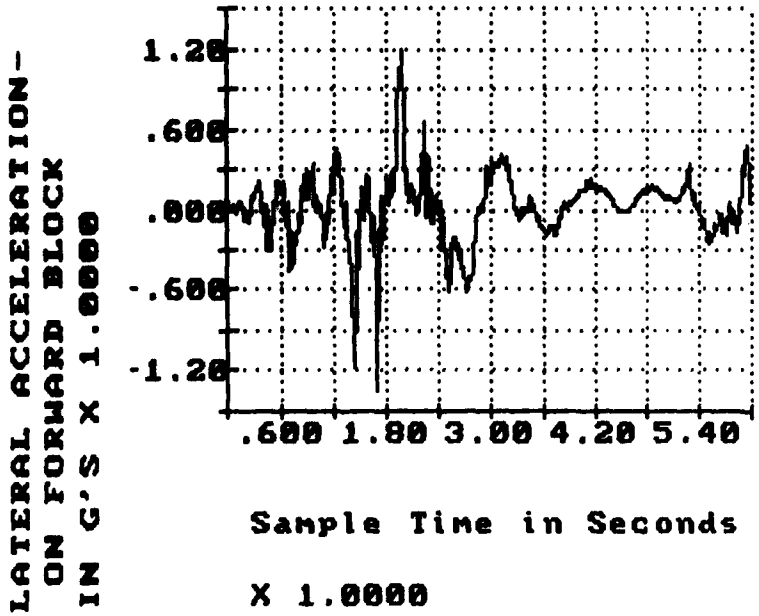
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 1, COURSE B

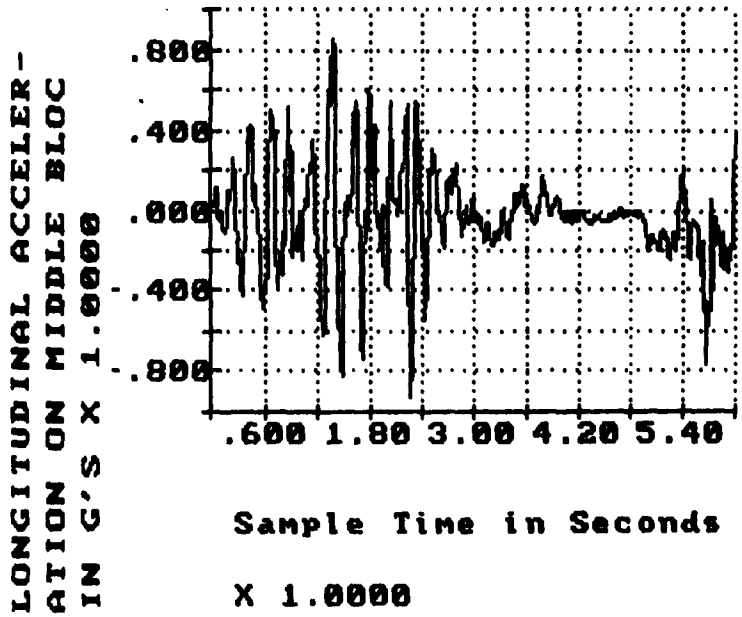


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 2, COURSE A

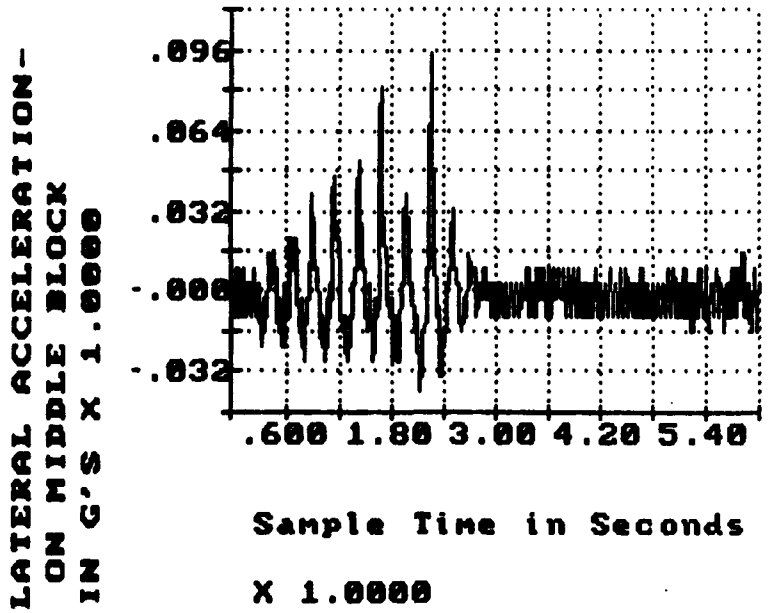


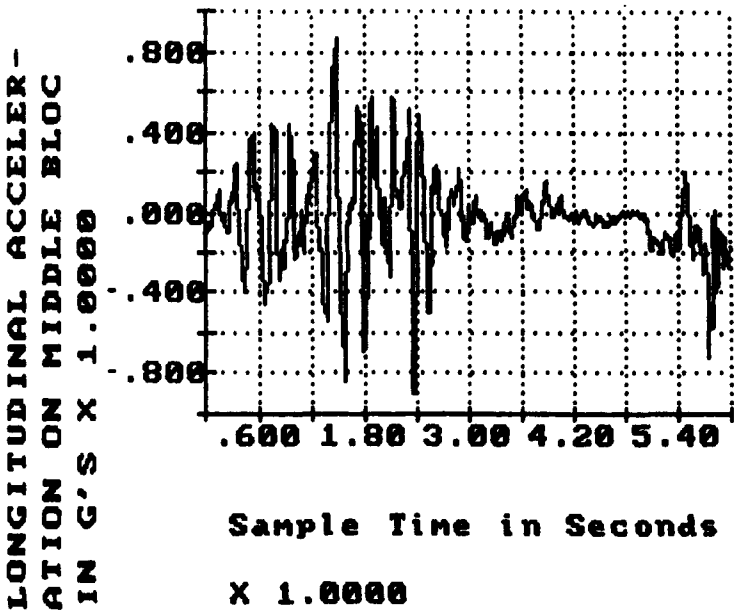


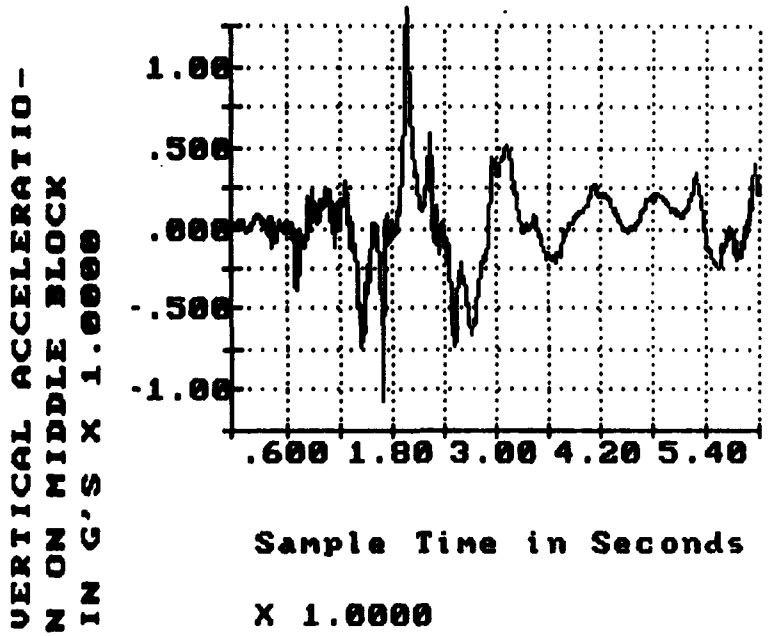


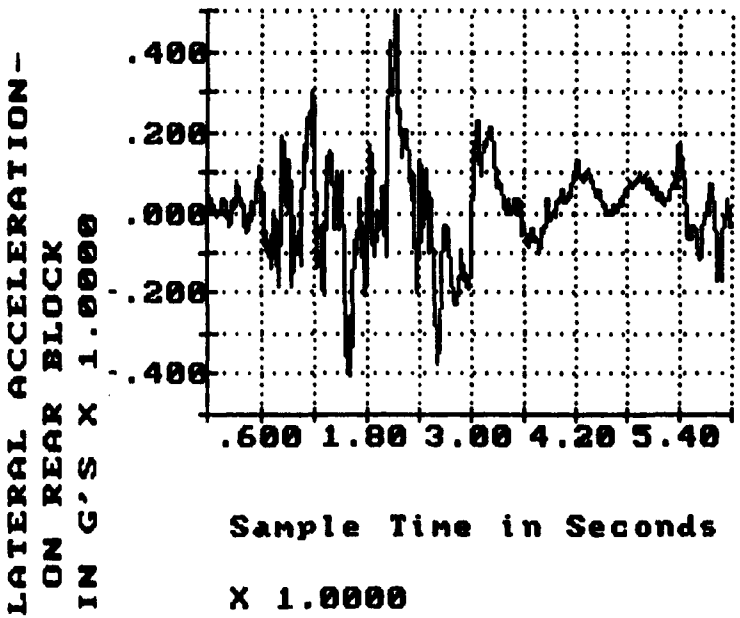


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 2, COURSE A

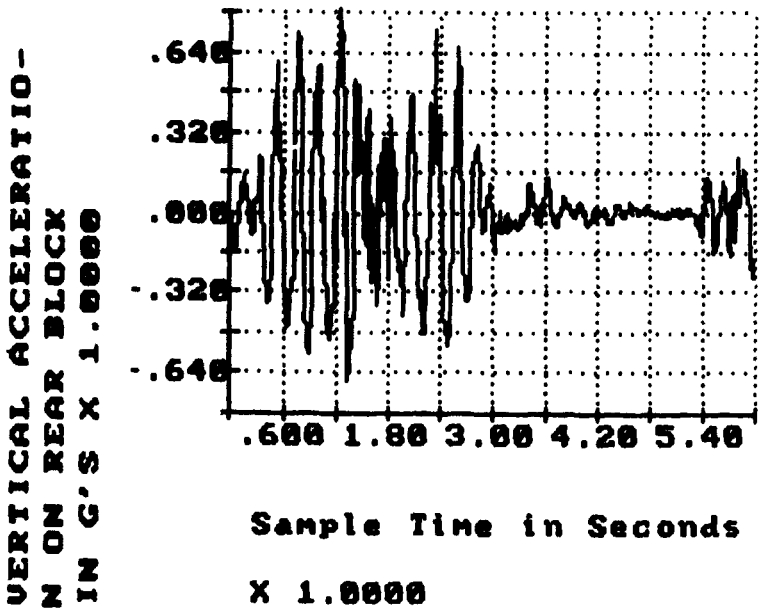








ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 2, COURSE A



ROAD HAZARD TEST OF ATACMS ON FLATRACK
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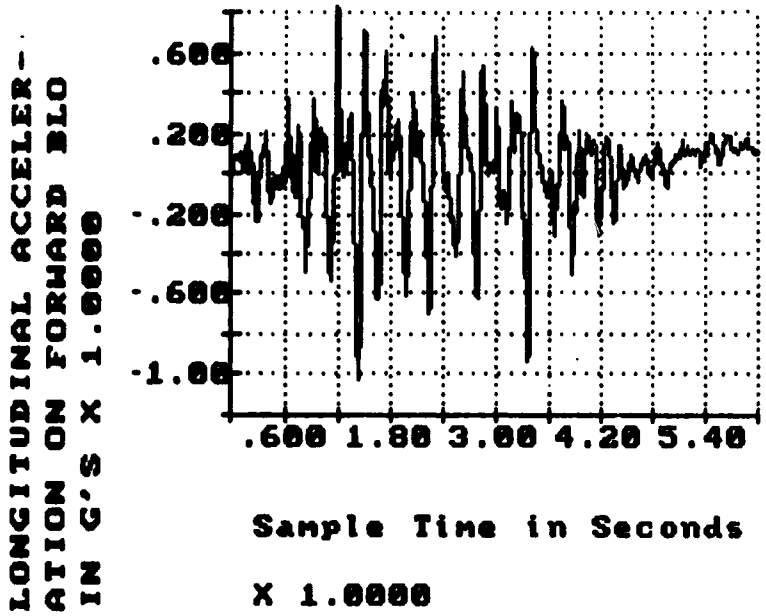
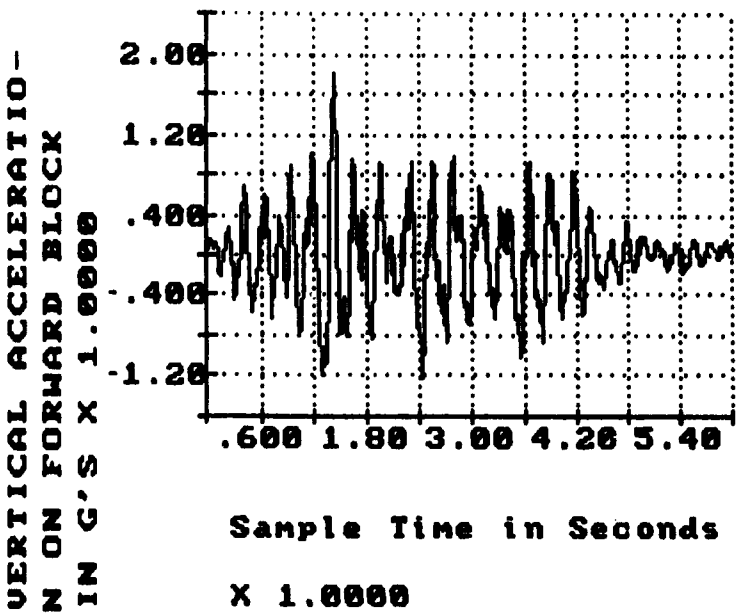
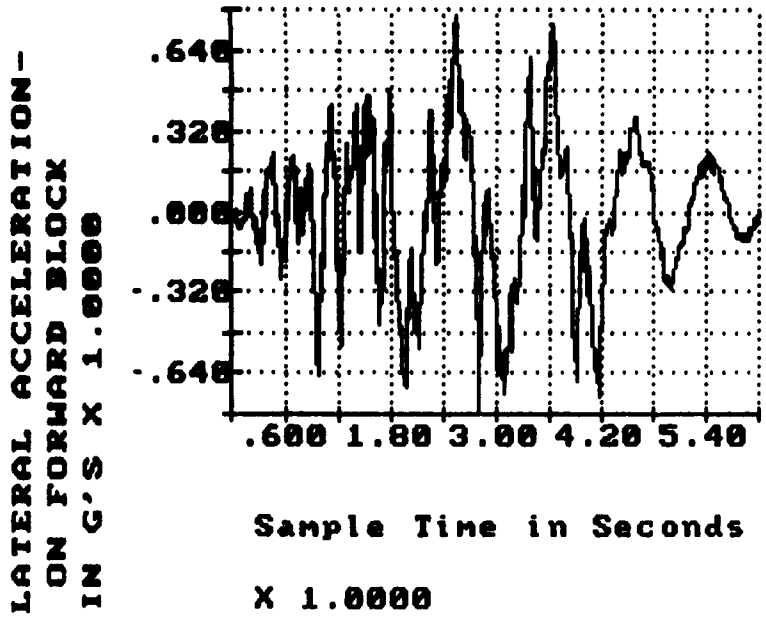
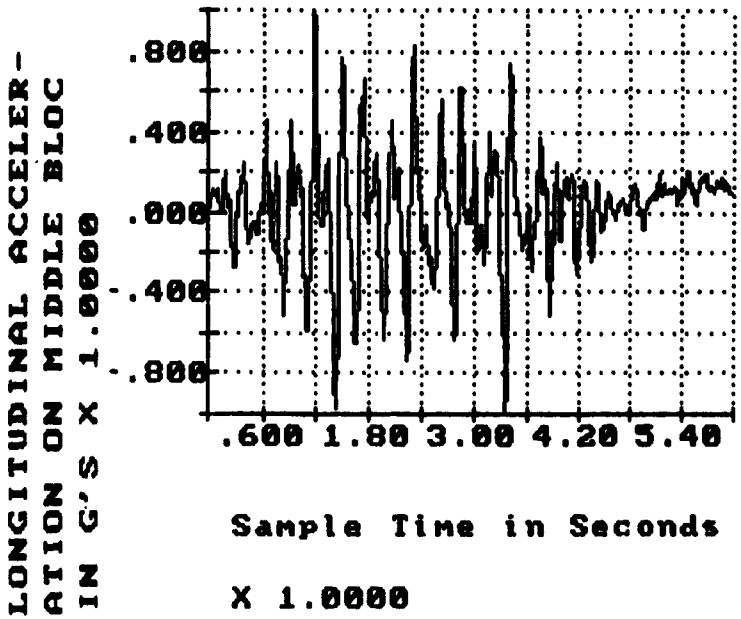
PASS 2, COURSE B

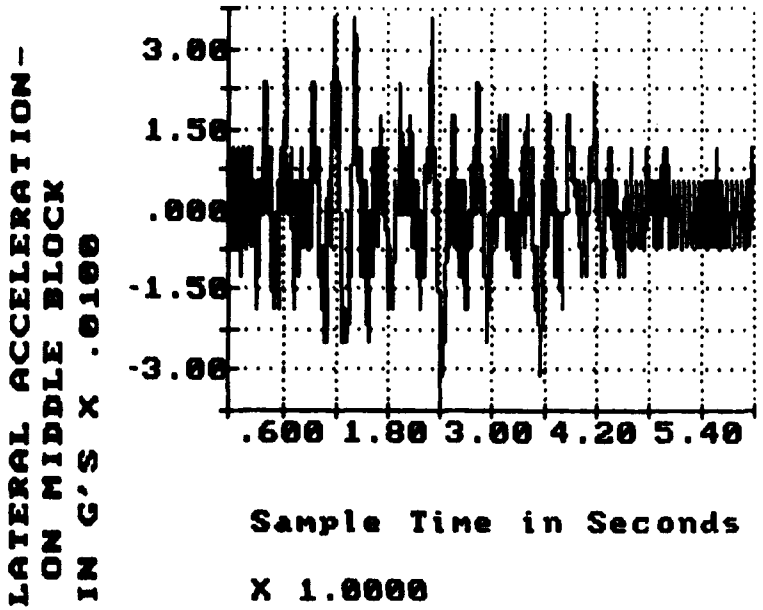


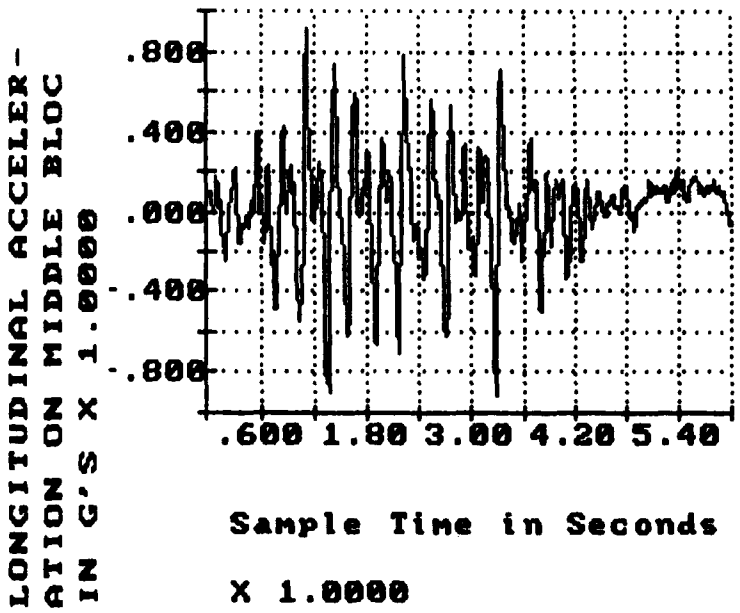


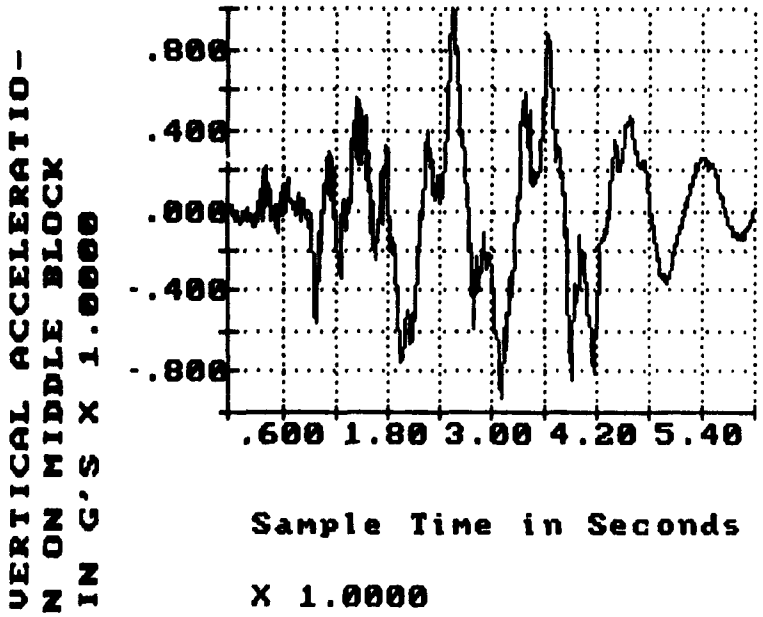


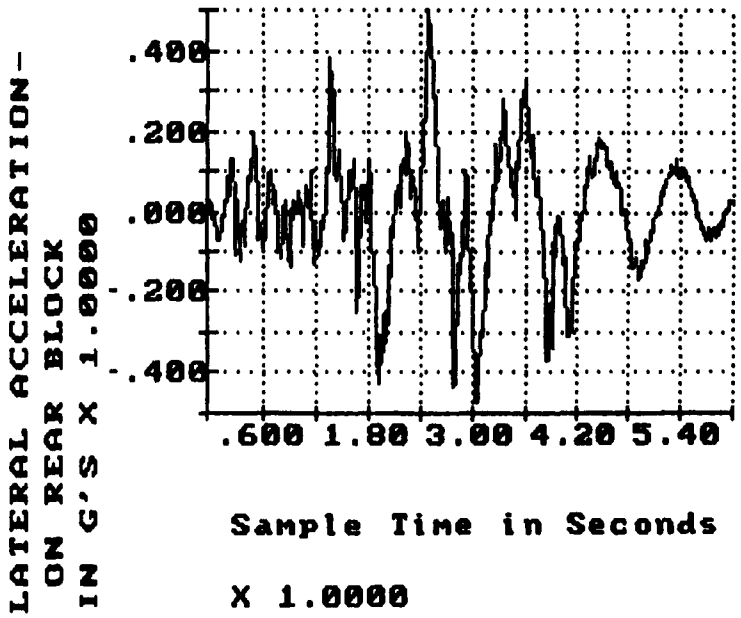


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 2, COURSE B

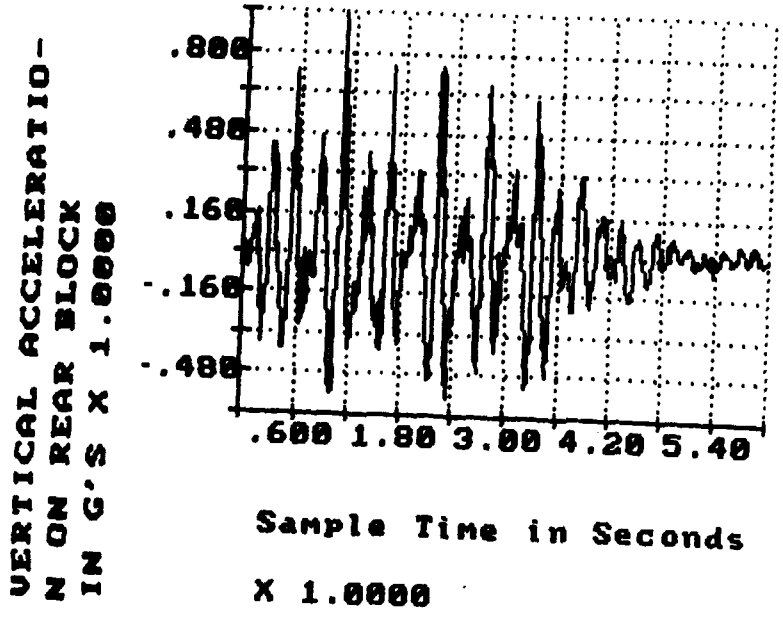




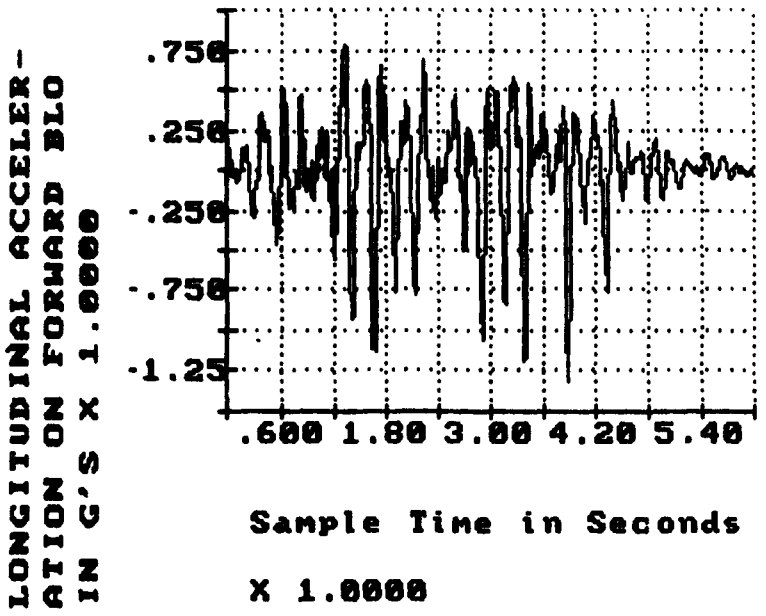


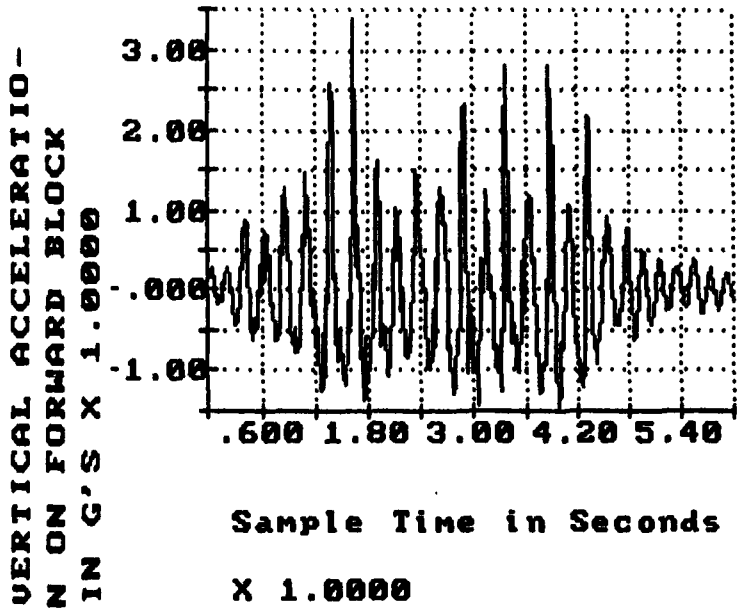


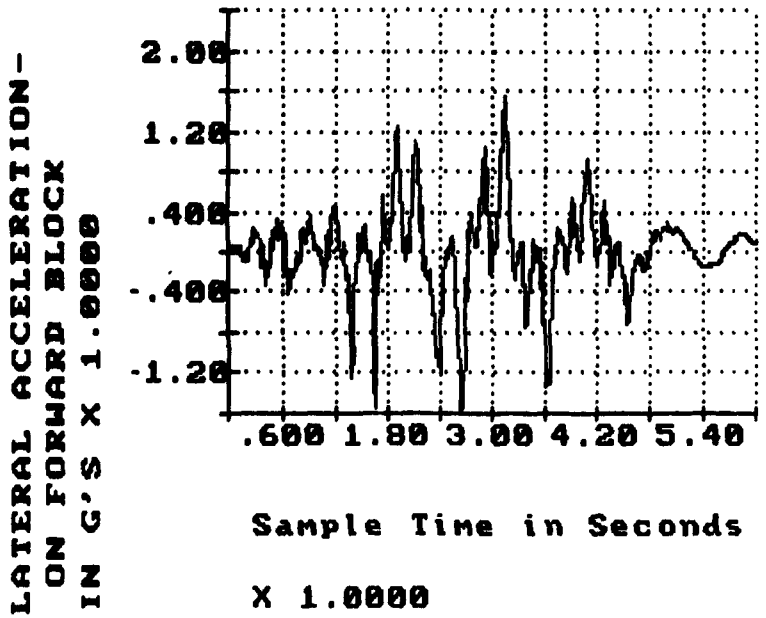
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 2, COURSE B

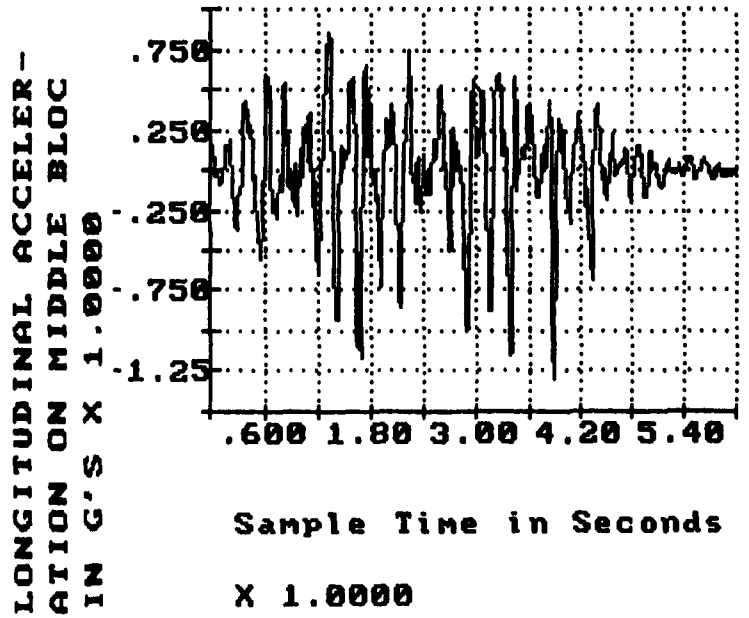


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE A

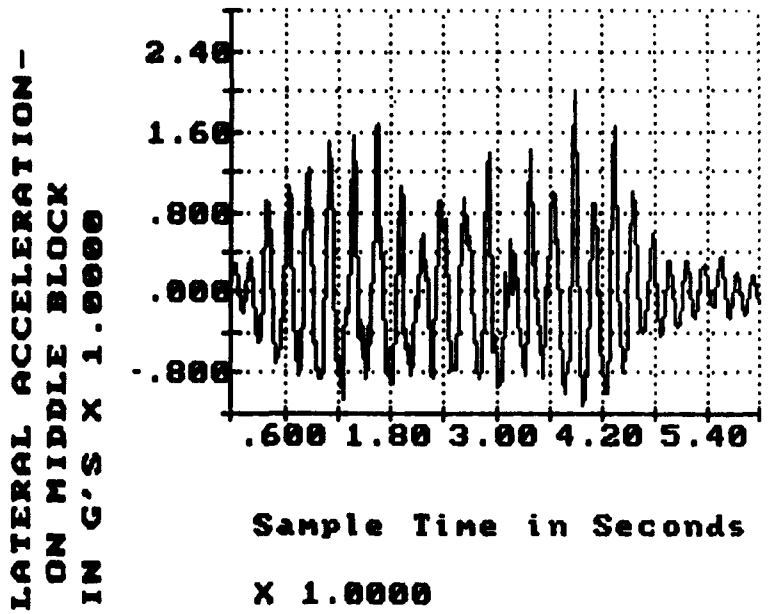


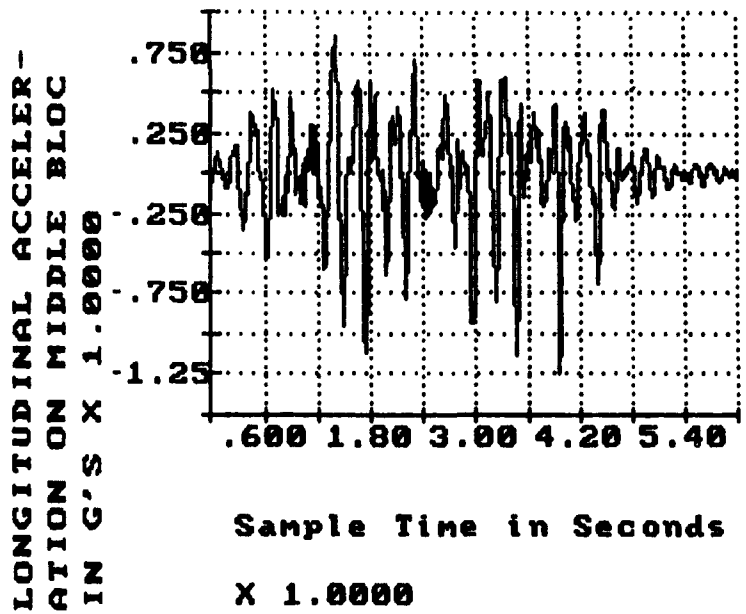


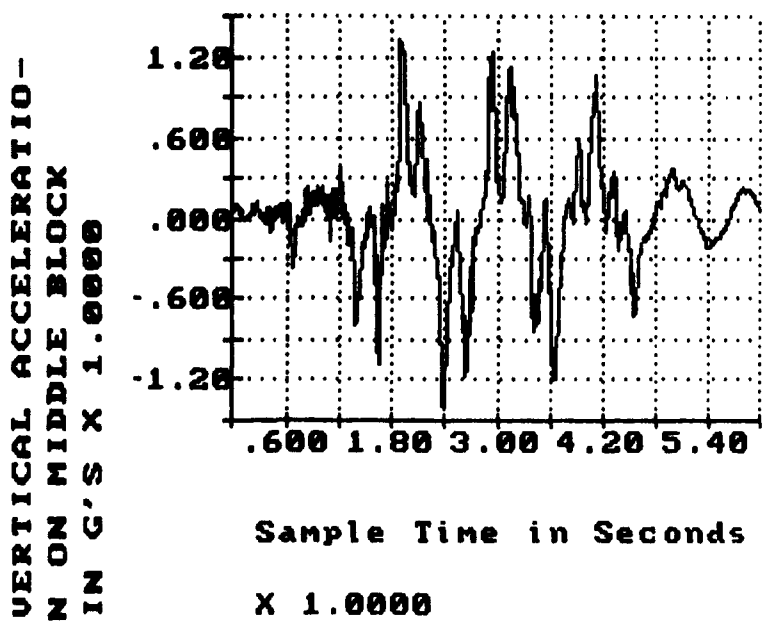


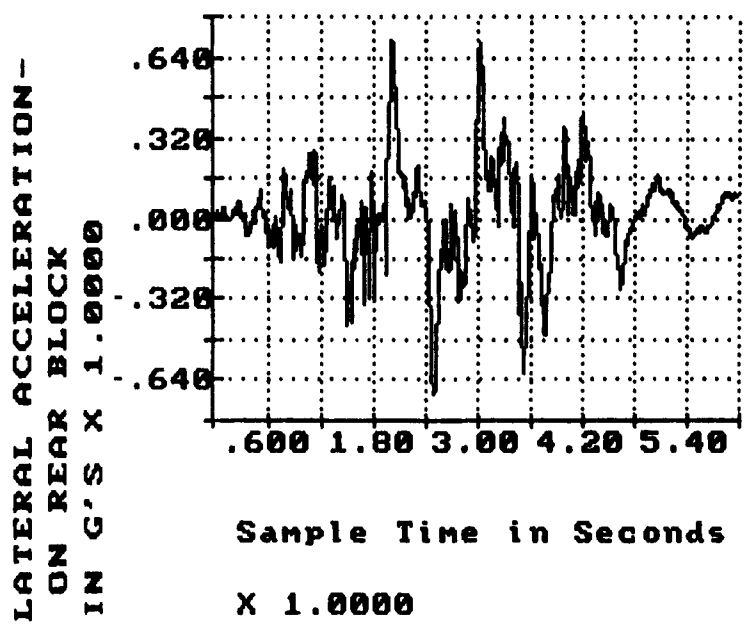


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE A

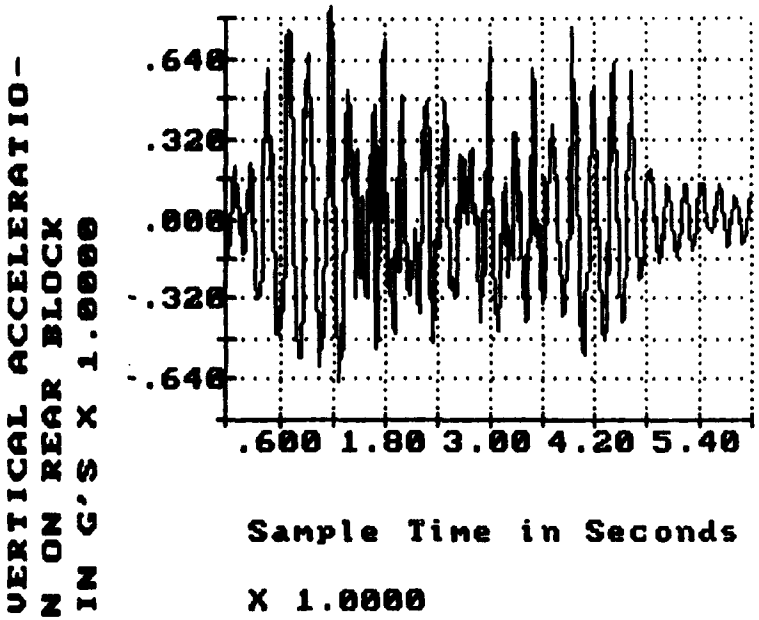




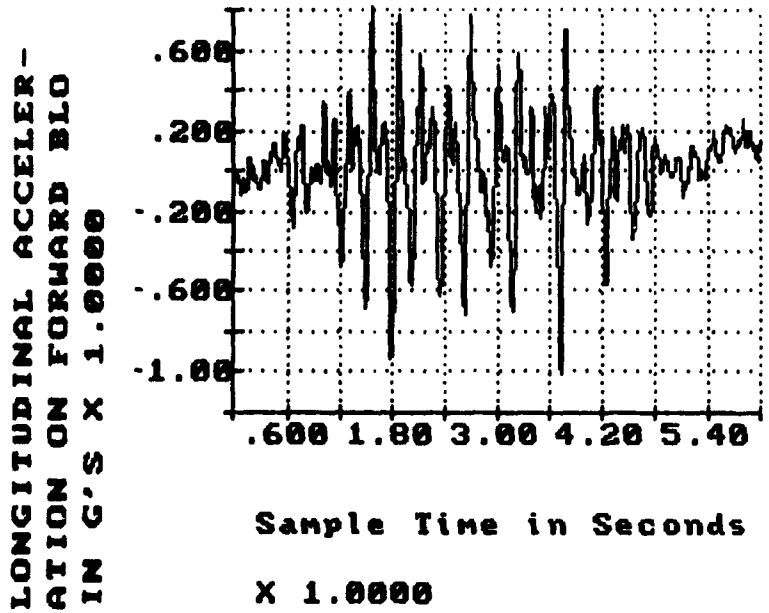


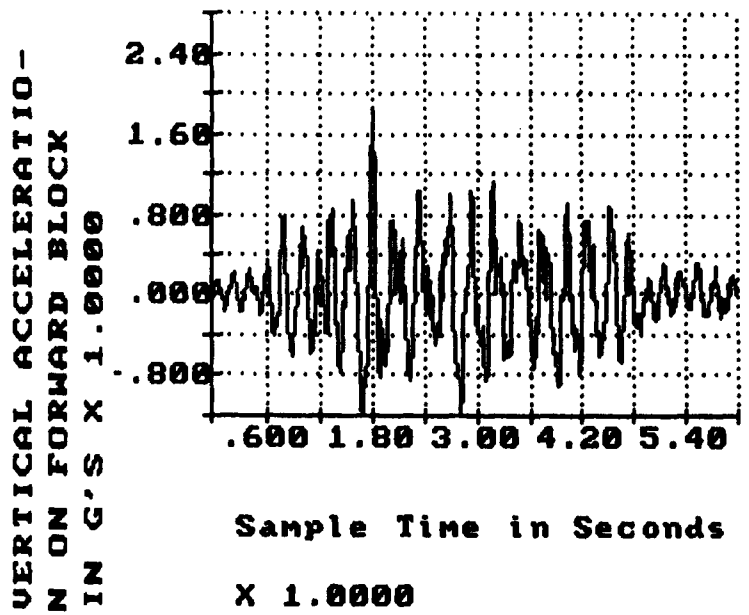


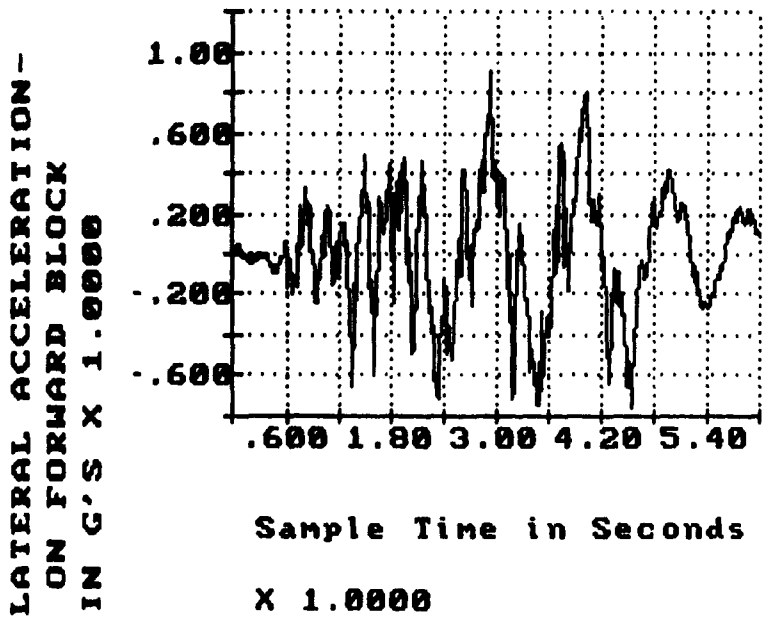
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE A

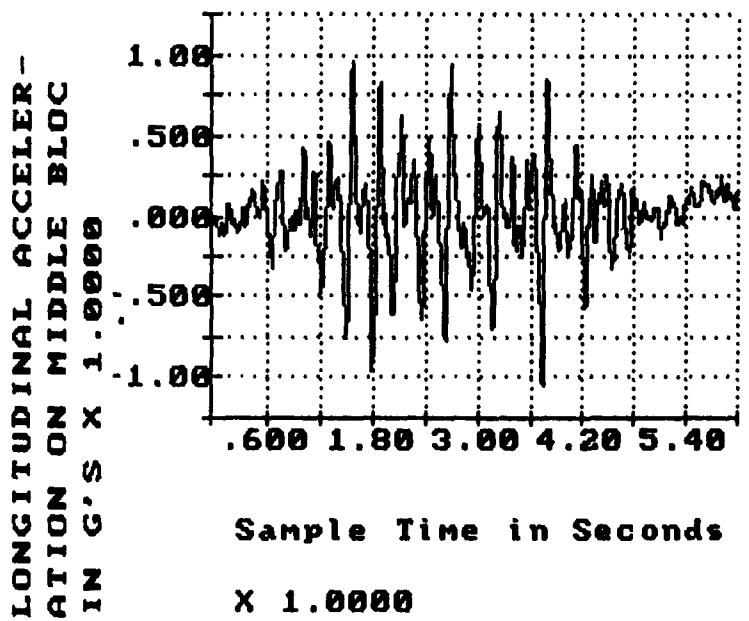


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE B

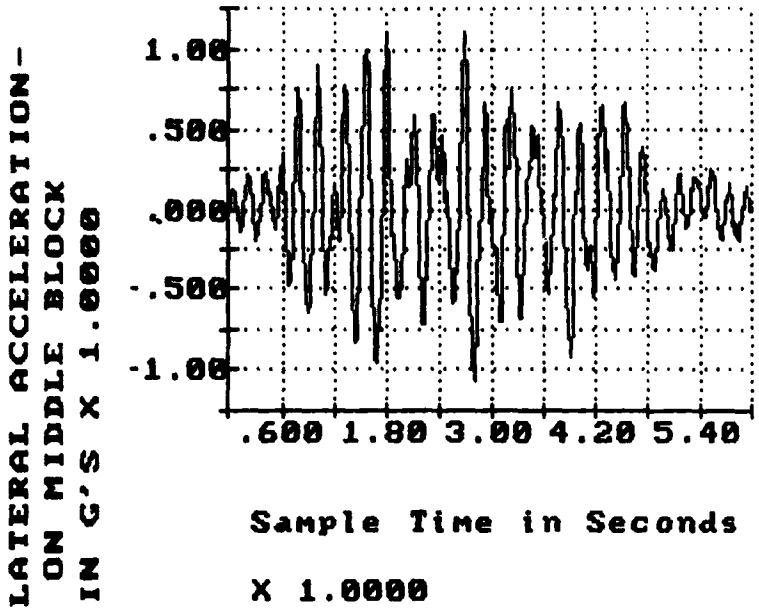


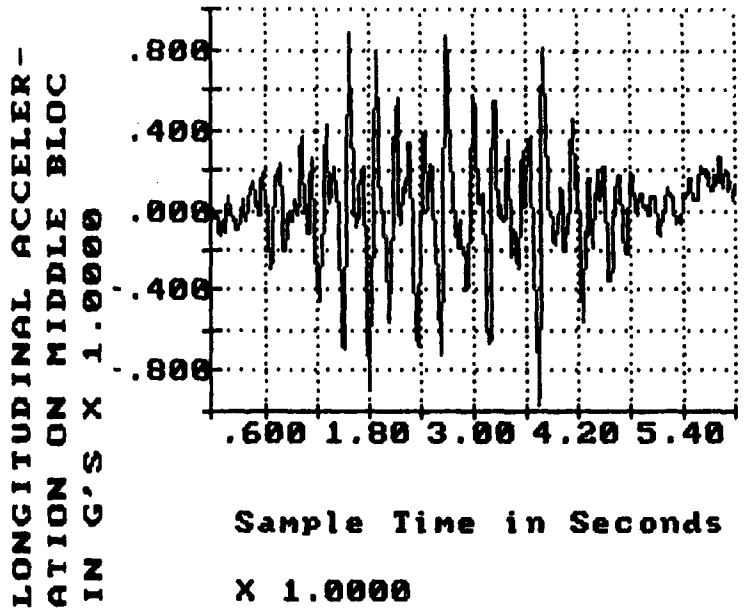


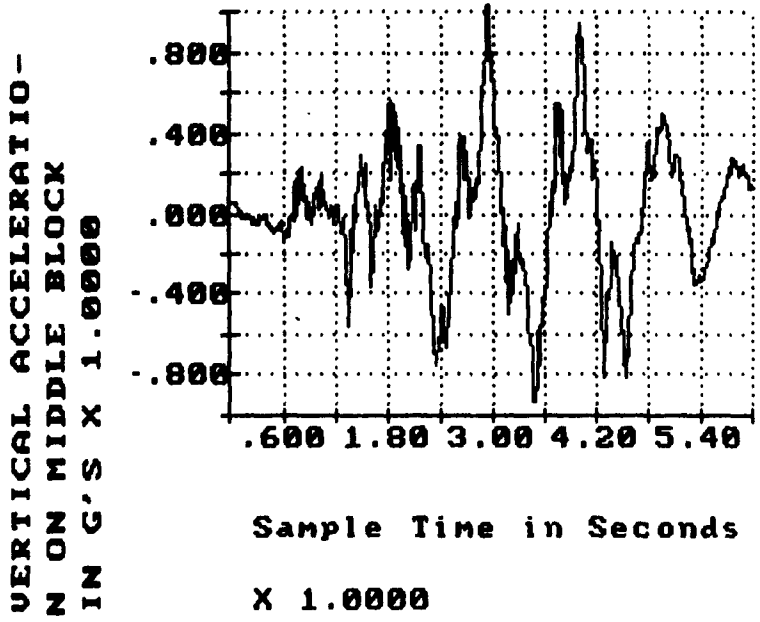


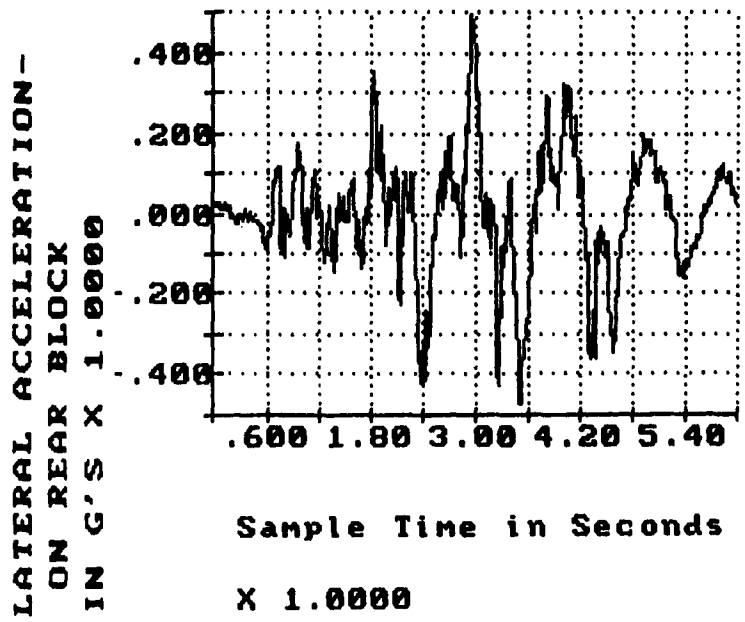


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE B

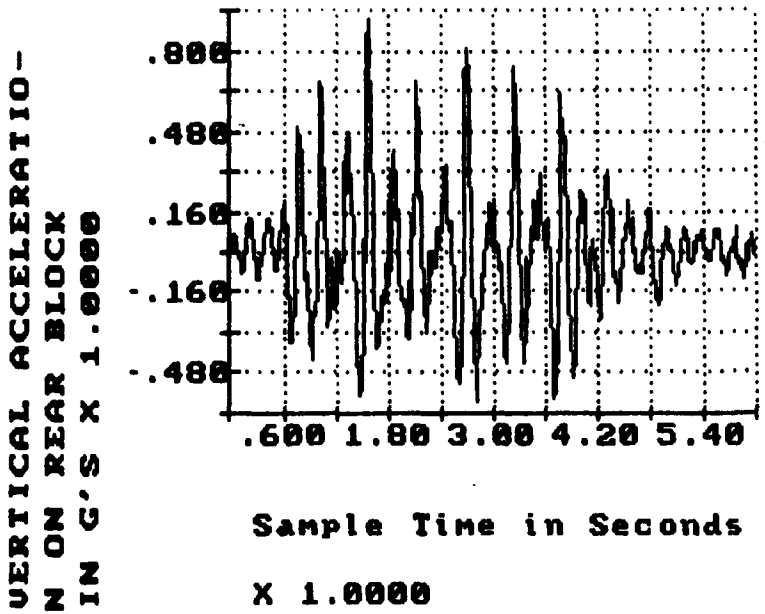




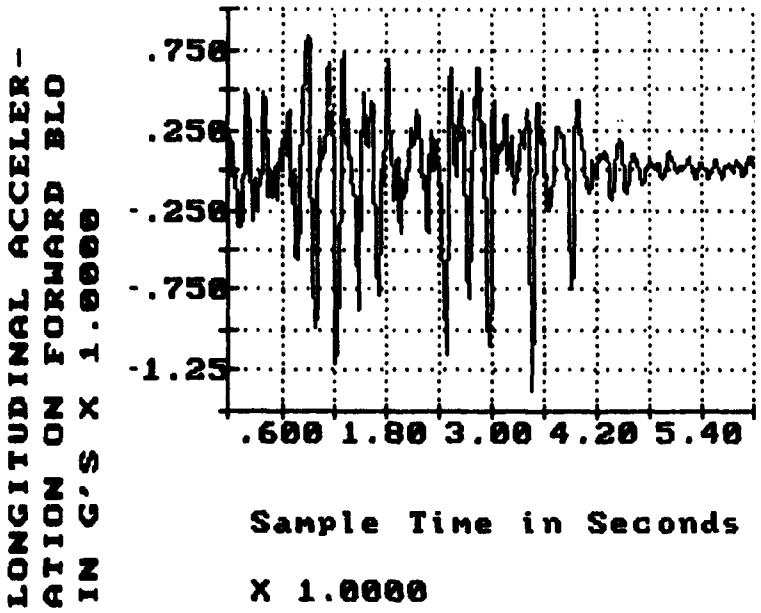


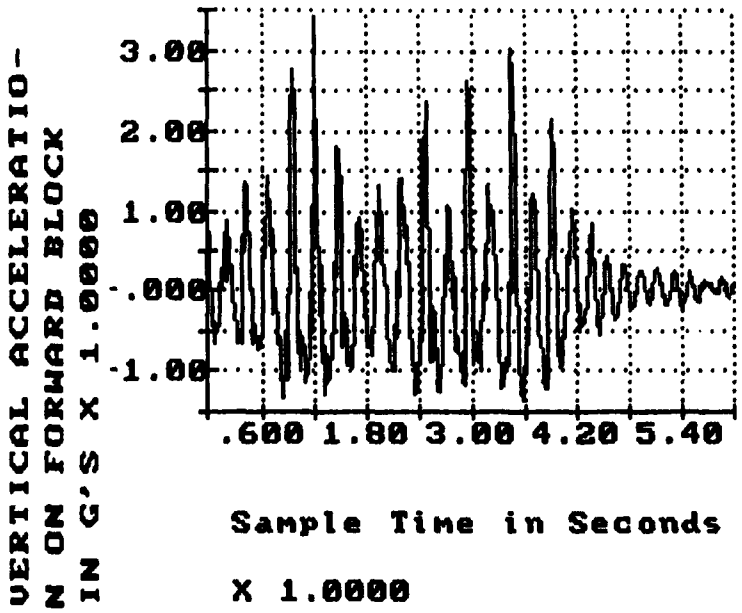


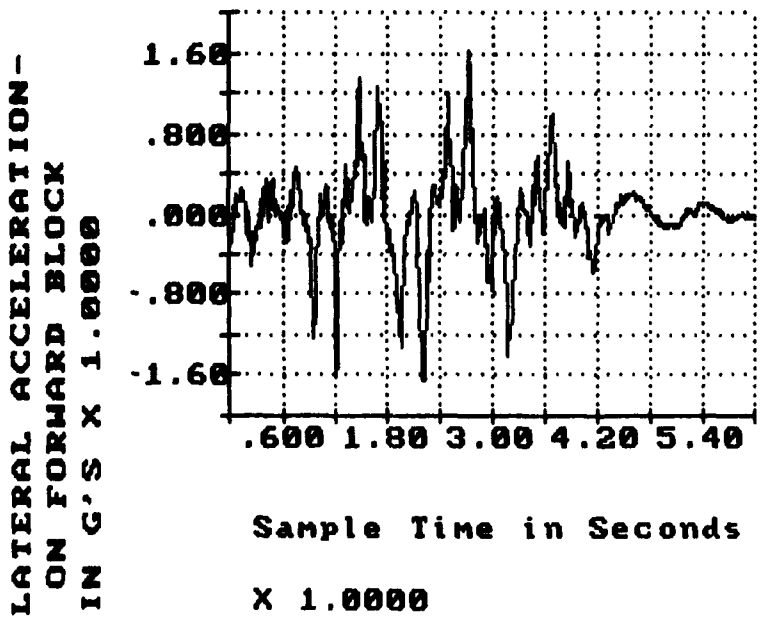
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 3, COURSE B

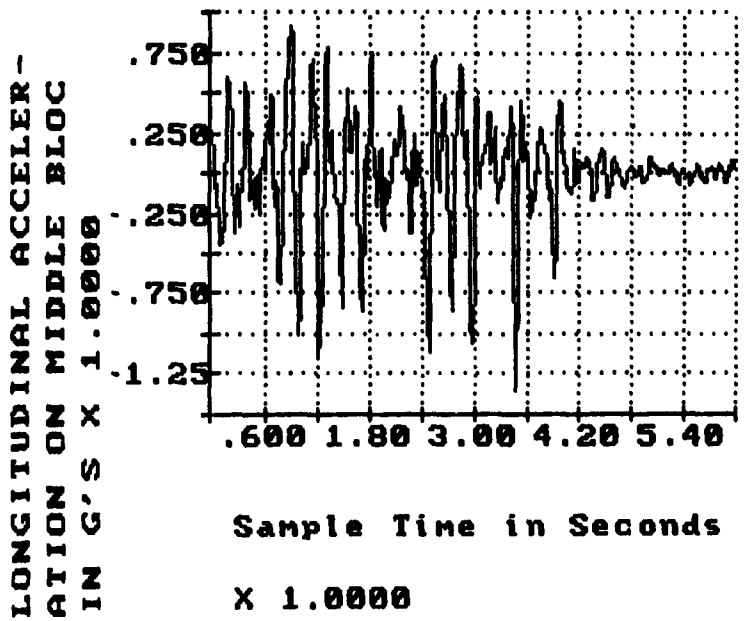


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 4, COURSE A

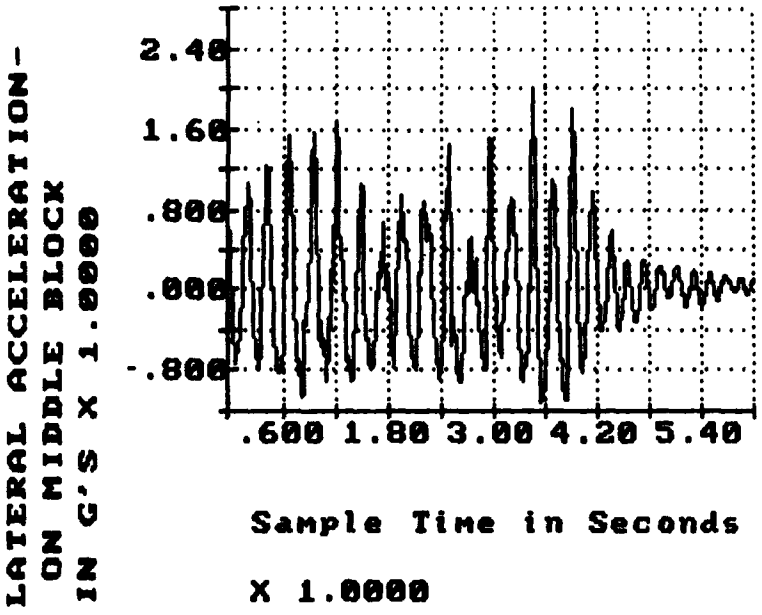


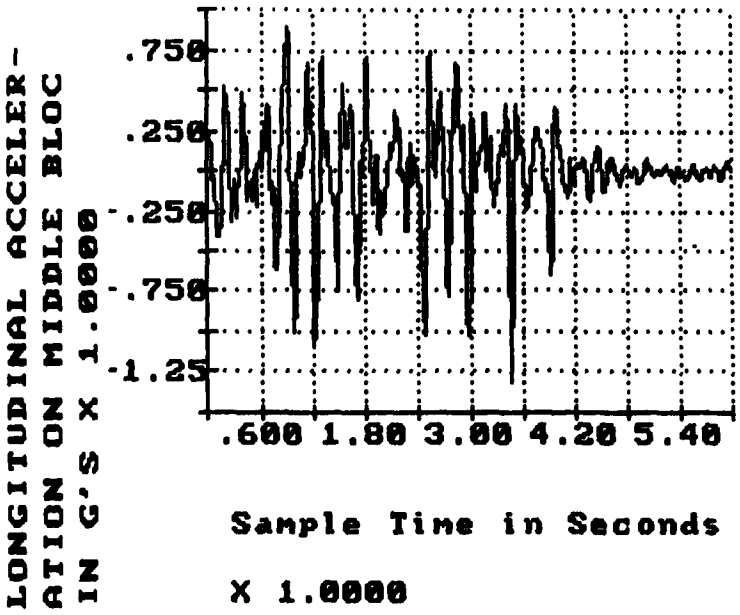


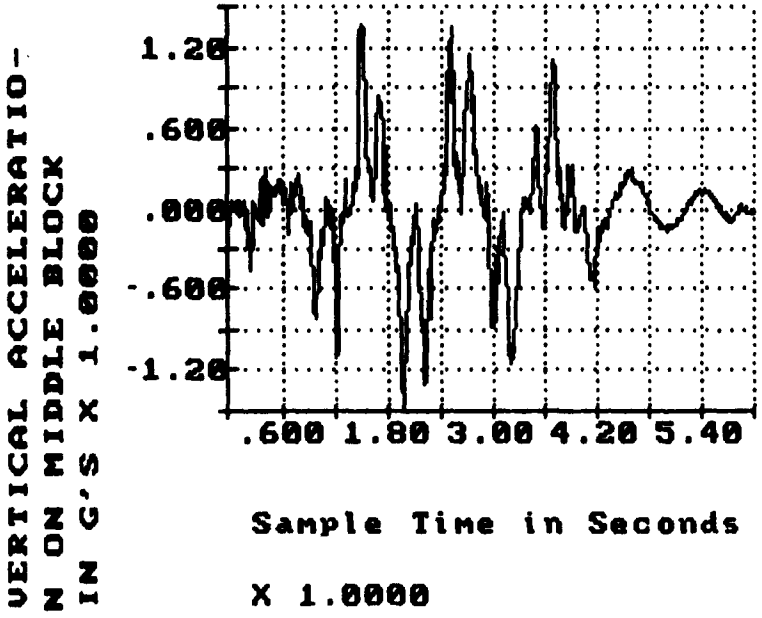


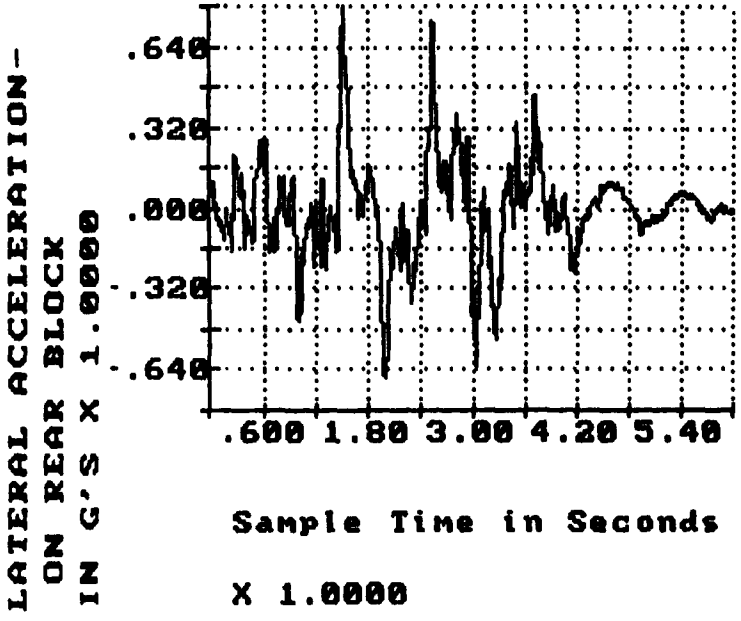


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 4, COURSE A

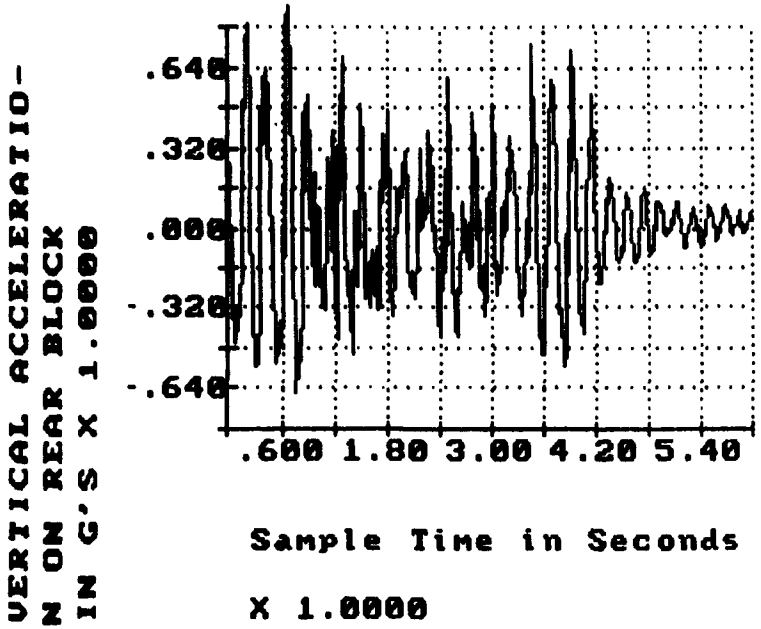








ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 4, COURSE A



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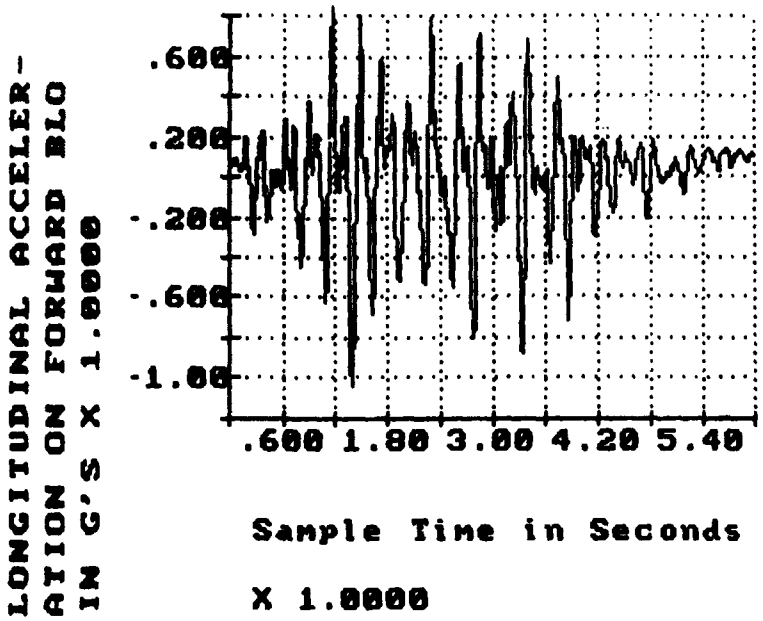
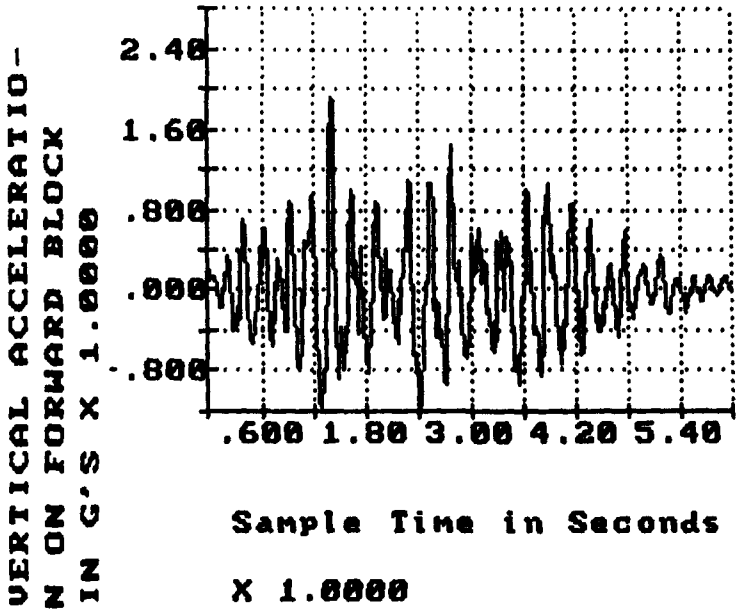
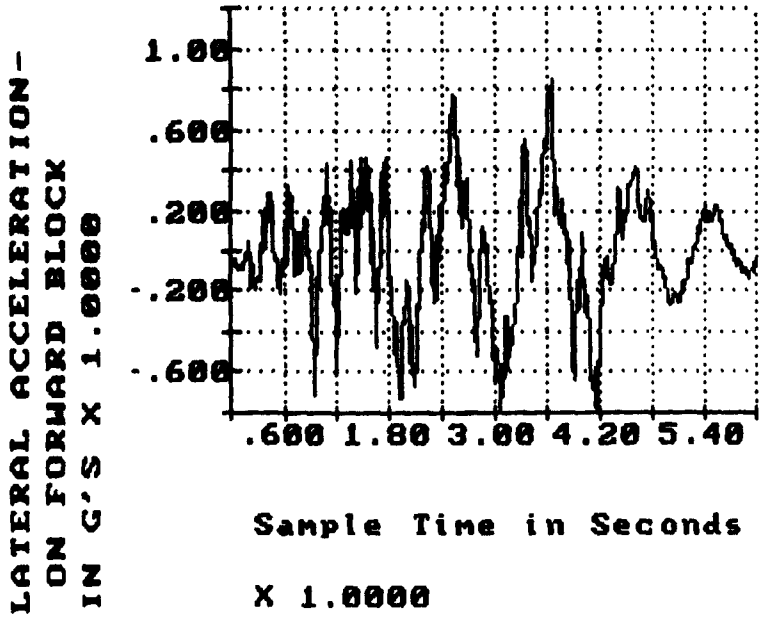
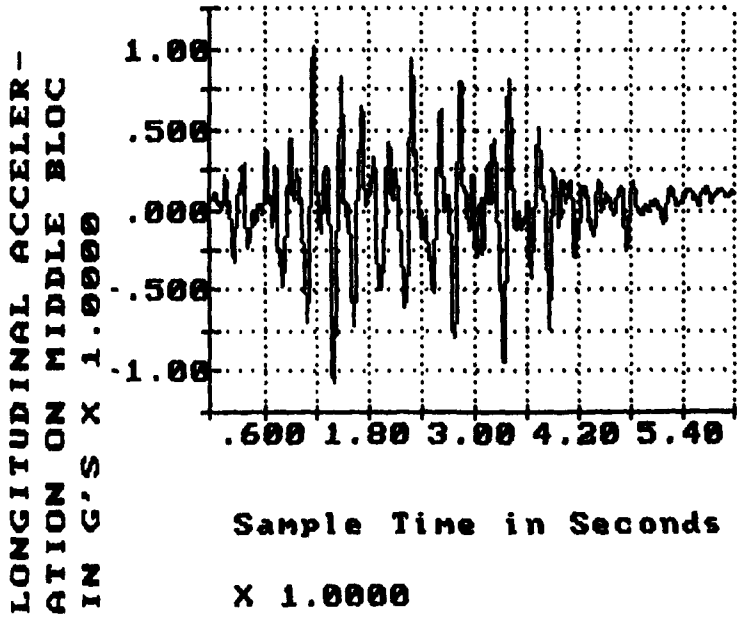
DATE: 14 JULY 1989
PASS 4, COURSE B

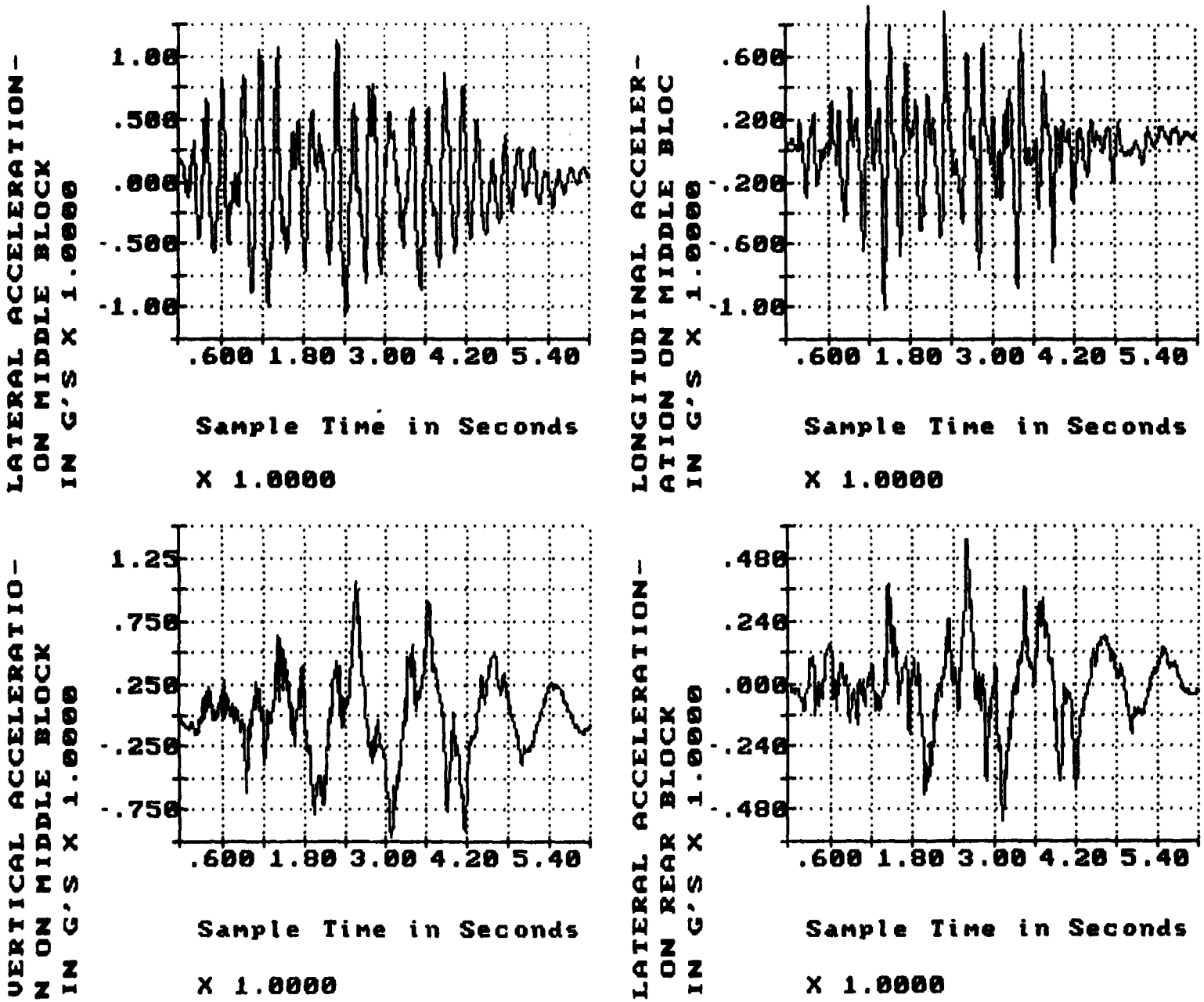




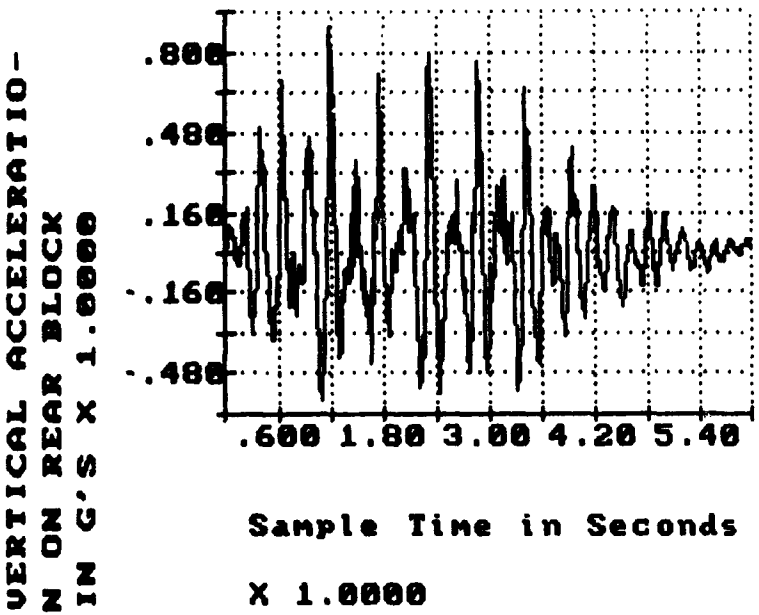




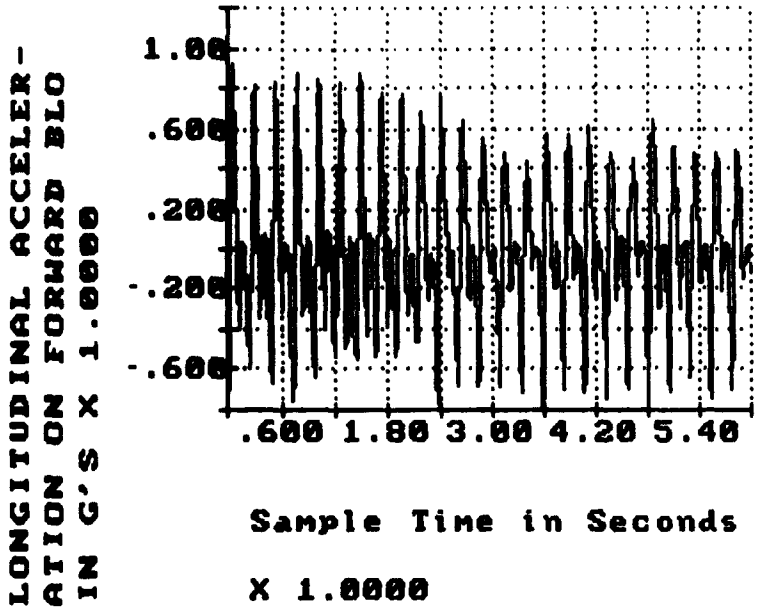
ROAD HAZARD TEST OF MTACHS ON FLATRACK
DATE: 14 JULY 1989
PASS 4, COURSE B

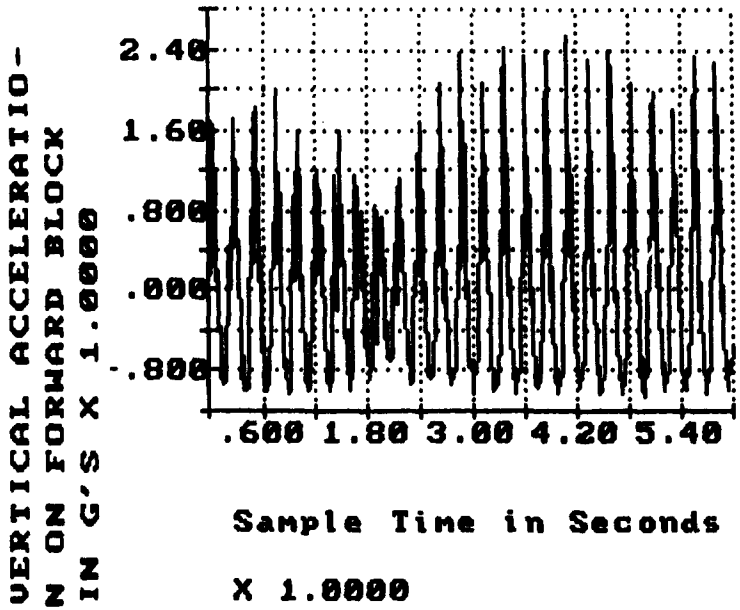


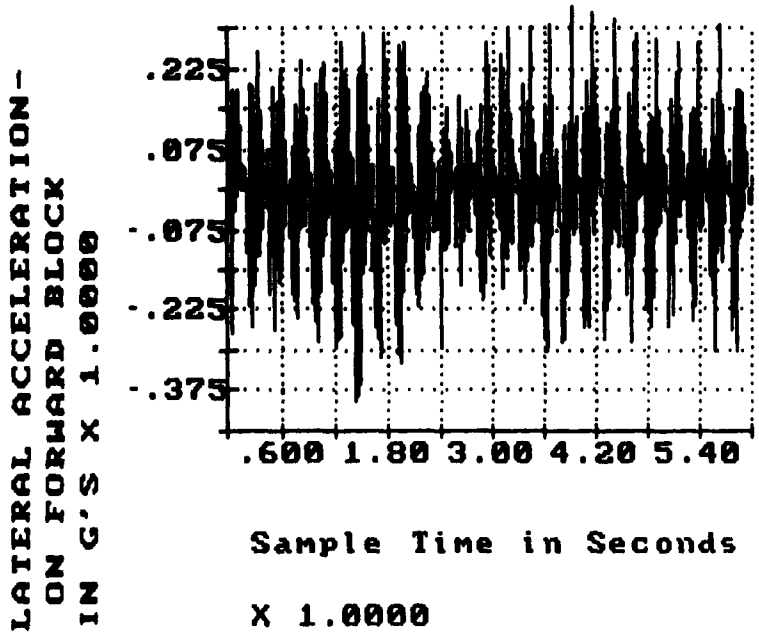
ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
PASS 4, COURSE B

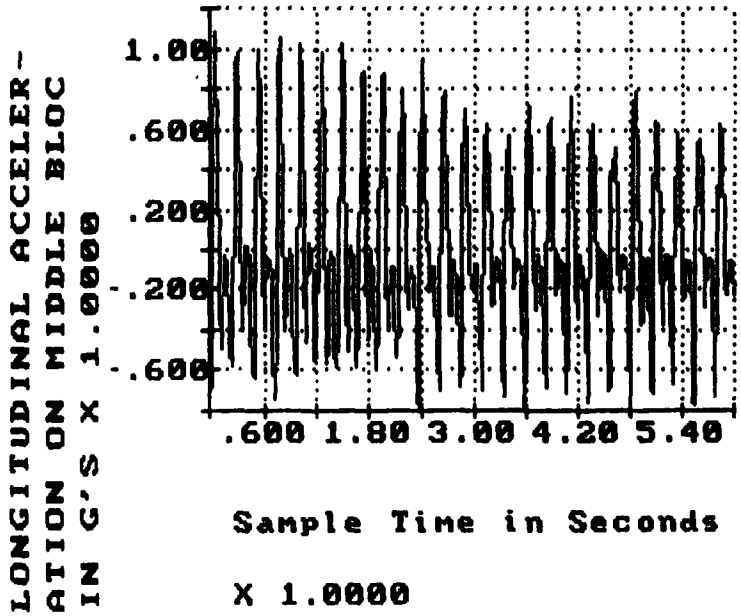


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
WASHBOARD COURSE

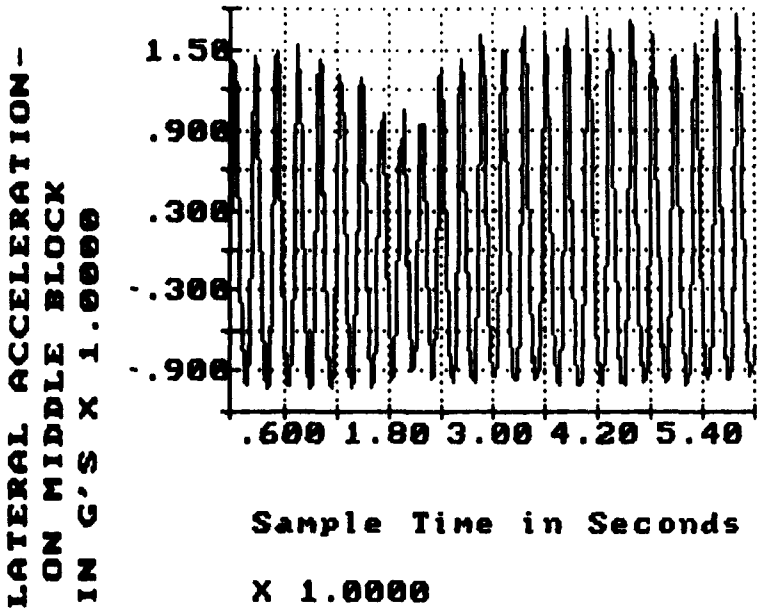


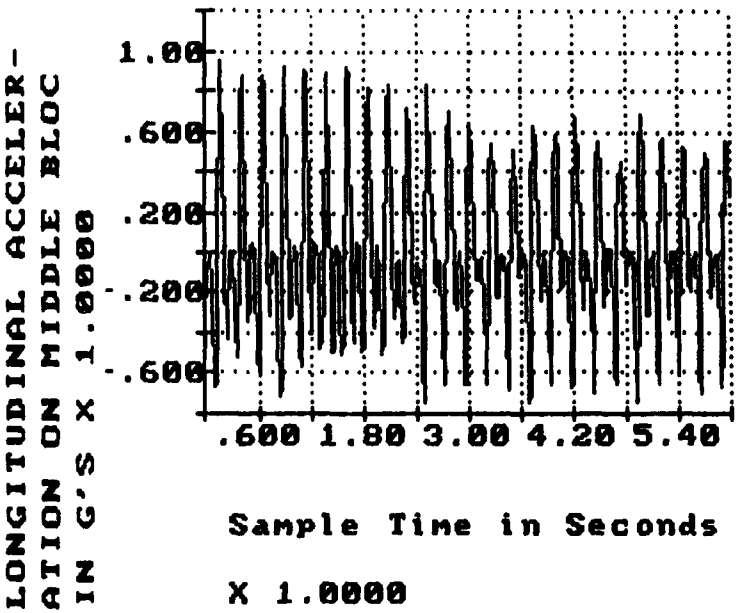


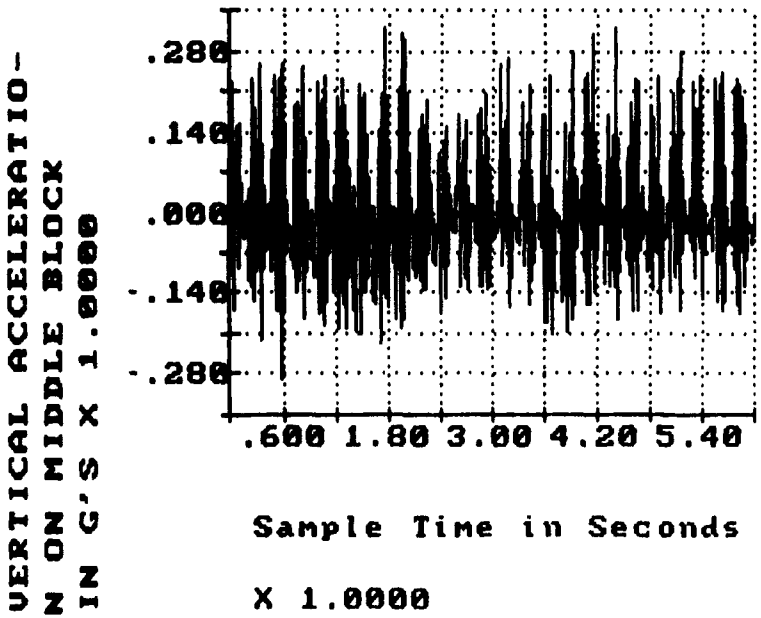


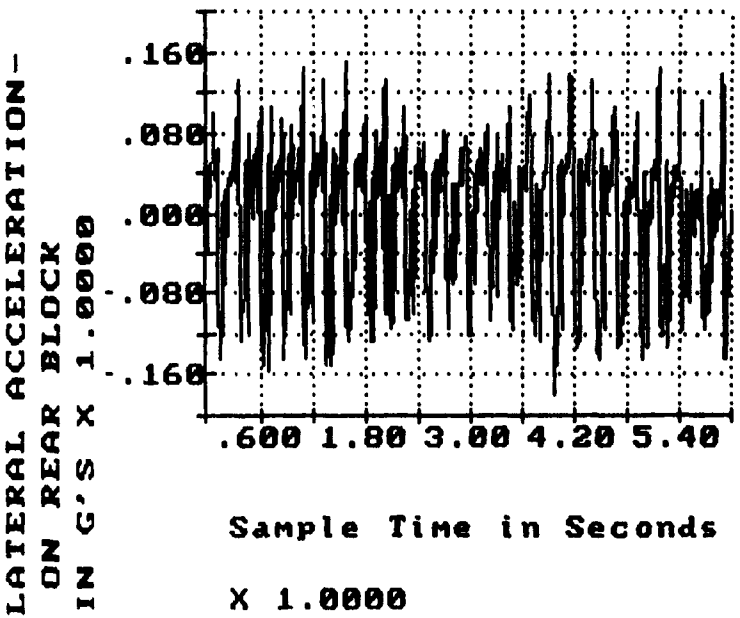


ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
WASHBOARD COURSE

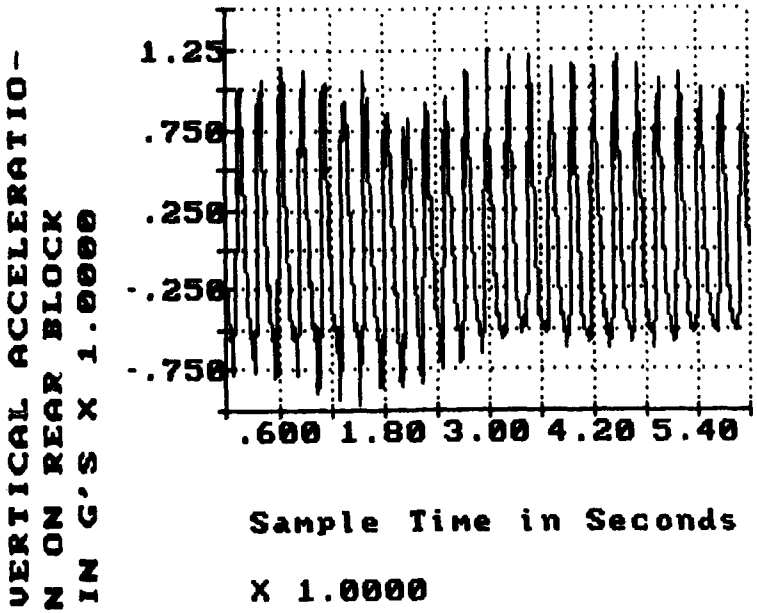








ROAD HAZARD TEST OF ATACMS ON FLATRACK
DATE: 14 JULY 1989
WASHBOARD COURSE



ROAD TEST DATA

TEST NO: 10 DATE: 20 JULY 1989

TEST SPECIMEN: ATACMS on M871 Semitrailer

PASS 1-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 1-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

PASS 2-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 2-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

30 MILE ROAD TEST: No shifting or damage to load.

PANIC STOP TEST: Not performed.

PASS 3-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 3-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

PASS 4-A OVER FIRST SERIES OF TIES:	0.10	MIN	5.68	MPH
PASS 4-B OVER SECOND SERIES OF TIES:	0.10	MIN	5.68	MPH

REMARKS: No damage.

WASHBOARD COURSE: Two passes, load intact without damage.

RESULTS FROM ROAD HAZARD TESTING OF
ATACMS IN M871 TRAILER
DATE: 20 JULY 1989

TAPE CHANNEL 1 : LONGITUDINAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.60	47.79	.0171
PASS 1, COURSE B	8.00	-.63	73.79	.0265
PASS 2, COURSE A	8.00	-.61	50.92	.0184
PASS 2, COURSE B	8.00	-.63	68.18	.0257
PASS 3, COURSE A	8.00	-.53	46.77	.0147
PASS 3, COURSE B	8.00	-.64	71.07	.0271
PASS 4, COURSE A	8.00	.51	53.34	.0165
PASS 4, COURSE B	8.00	-.62	63.10	.0240
WASHBOARD COURSE	8.00	-1.03	63.78	.0426

TAPE CHANNEL 2 : LATERAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.78	104.95	.0455
PASS 1, COURSE B	8.00	-.46	81.04	.0240
PASS 2, COURSE A	8.00	-.73	86.92	.0419
PASS 2, COURSE B	8.00	-.46	75.46	.0238
PASS 3, COURSE A	8.00	-.82	69.61	.0368
PASS 3, COURSE B	8.00	-.47	56.08	.0169
PASS 4, COURSE A	8.00	-.72	74.44	.0369
PASS 4, COURSE B	8.00	.47	72.65	.0229
WASHBOARD COURSE	8.00	.25	26.36	.0038

TAPE CHANNEL 3 : VERTICAL ACCELERATION ON FORWARD BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.55	69.60	.0810
PASS 1, COURSE B	8.00	1.20	191.08	.0227
PASS 2, COURSE A	8.00	1.52	58.53	.0509
PASS 2, COURSE B	8.00	1.35	81.82	.0749
PASS 3, COURSE A	8.00	1.53	60.26	.0659
PASS 3, COURSE B	8.00	1.25	75.96	.0668
PASS 4, COURSE A	8.00	1.49	47.35	.0460
PASS 4, COURSE B	8.00	1.29	96.85	.0799
WASHBOARD COURSE	8.00	2.27	43.19	.0625

TAPE CHANNEL 4 : LONGITUDINAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.66	79.75	.0351
PASS 1, COURSE B	8.00	-.69	72.41	.0287
PASS 2, COURSE A	8.00	.69	148.27	.0229
PASS 2, COURSE B	8.00	-.70	67.47	.0276
PASS 3, COURSE A	8.00	.67	78.06	.0341
PASS 3, COURSE B	8.00	-.69	67.75	.0299
PASS 4, COURSE A	8.00	.63	55.69	.0223
PASS 4, COURSE B	8.00	-.68	65.05	.0269
WASHBOARD COURSE	8.00	-1.13	61.57	.0461

TAPE CHANNEL 5 : LATERAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.72	179.54	.0632
PASS 1, COURSE B	8.00	1.36	142.29	.0657
PASS 2, COURSE A	8.00	1.34	99.31	.0869
PASS 2, COURSE B	8.00	1.21	105.02	.0719
PASS 3, COURSE A	8.00	1.78	269.65	.0031
PASS 3, COURSE B	8.00	1.42	103.44	.0882
PASS 4, COURSE A	8.00	1.65	414.93	.0073
PASS 4, COURSE B	8.00	1.46	105.01	.0918
WASHBOARD COURSE	8.00	1.57	86.01	.0852

TAPE CHANNEL 7 : VERTICAL ACCELERATION ON MIDDLE BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.91	107.20	.0614
PASS 1, COURSE B	8.00	.59	427.28	.0359
PASS 2, COURSE A	8.00	-.85	105.28	.0590
PASS 2, COURSE B	8.00	.56	409.11	.0445
PASS 3, COURSE A	8.00	.86	125.95	.0707
PASS 3, COURSE B	8.00	.59	116.11	.0480
PASS 4, COURSE A	8.00	.85	147.11	.0842
PASS 4, COURSE B	8.00	.66	113.88	.0496
WASHBOARD COURSE	8.00	.22	32.98	.0041

TAPE CHANNEL 8 : LONGITUDINAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	.62	234.44	.0246
PASS 1, COURSE B	8.00	-.63	71.36	.0260
PASS 2, COURSE A	8.00	.64	94.58	.0382
PASS 2, COURSE B	8.00	-.64	65.89	.0255
PASS 3, COURSE A	8.00	.63	86.69	.0345
PASS 3, COURSE B	8.00	-.63	85.46	.0295
PASS 4, COURSE A	8.00	.58	163.34	.0310
PASS 4, COURSE B	8.00	-.62	65.74	.0242
WASHBOARD COURSE	8.00	-1.02	63.00	.0426

TAPE CHANNEL 9 : LATERAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	-.45	87.45	.0263
PASS 1, COURSE B	8.00	-.41	107.90	.0286
PASS 2, COURSE A	8.00	-.46	96.01	.0309
PASS 2, COURSE B	8.00	-.40	101.08	.0263
PASS 3, COURSE A	8.00	-.52	75.62	.0278
PASS 3, COURSE B	8.00	-.39	109.06	.0283
PASS 4, COURSE A	8.00	-.48	82.21	.0261
PASS 4, COURSE B	8.00	-.41	106.07	.0283
WASHBOARD COURSE	8.00	-.20	60.06	.0069

TAPE CHANNEL 10 : VERTICAL ACCELERATION ON REAR BLOCK

TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.26	97.07	.0718
PASS 1, COURSE B	8.00	1.02	86.21	.0556
PASS 2, COURSE A	8.00	1.16	73.99	.0571
PASS 2, COURSE B	8.00	1.02	77.77	.0522
PASS 3, COURSE A	8.00	1.25	94.09	.0706
PASS 3, COURSE B	8.00	1.00	91.50	.0551
PASS 4, COURSE A	8.00	1.20	84.65	.0647
PASS 4, COURSE B	8.00	1.02	97.92	.0591
WASHBOARD COURSE	8.00	1.01	75.79	.0485

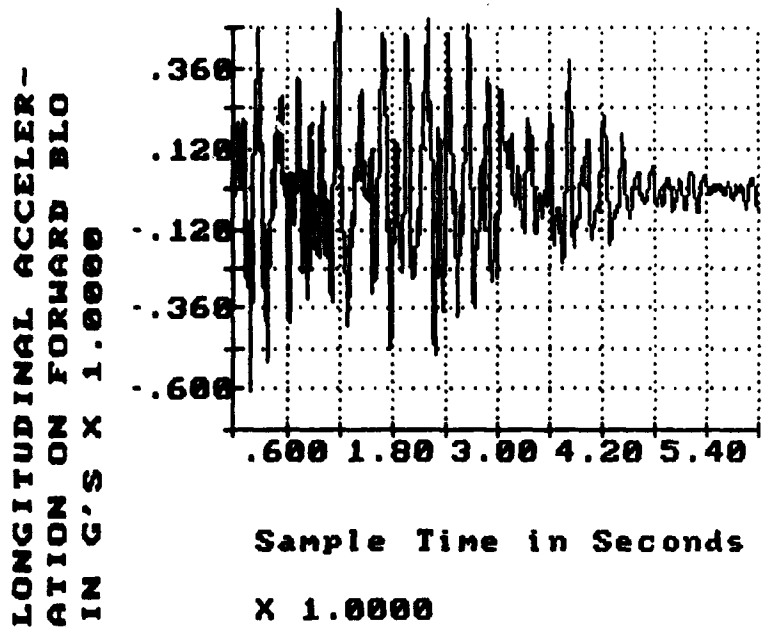
TAPE CHANNEL 14 : VERTICAL ACCELERATION ON TRAILER BED

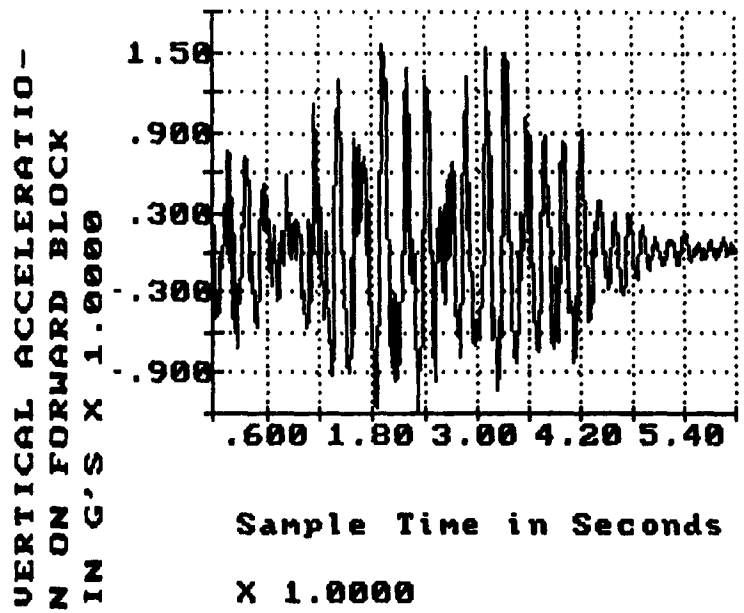
TEST	SPEED MPH	PEAK VALUE G'S	DURATION MILLISECONDS	AREA G'S-SECONDS
PASS 1, COURSE A	8.00	1.48	36.29	.0364
PASS 1, COURSE B	8.00	-1.38	20.75	.0155
PASS 2, COURSE A	8.00	1.46	42.36	.0438
PASS 2, COURSE B	8.00	-1.92	33.17	.0455
PASS 3, COURSE A	8.00	1.69	48.03	.0564
PASS 3, COURSE B	8.00	1.17	68.26	.0564
PASS 4, COURSE A	8.00	1.56	46.57	.0496
PASS 4, COURSE B	8.00	1.19	77.75	.0585
WASHBOARD COURSE	8.00	1.32	49.11	.0467

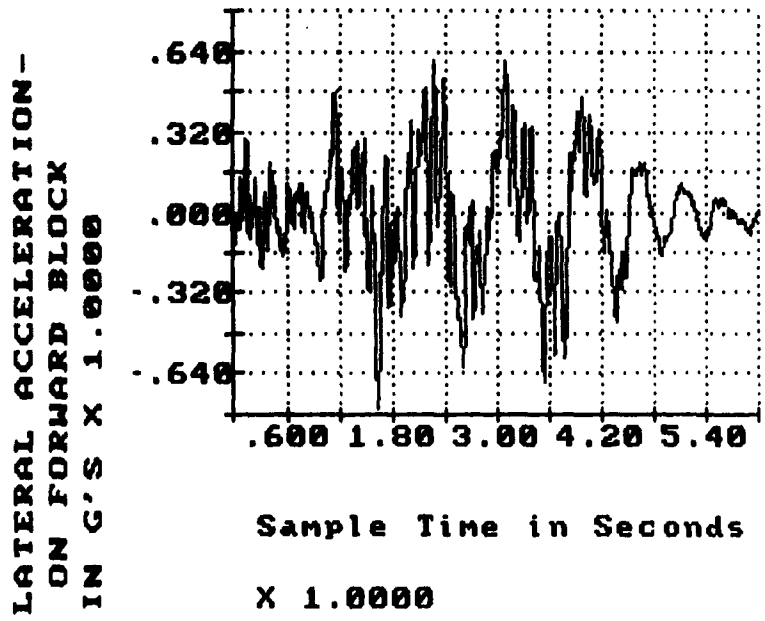
NOTES:

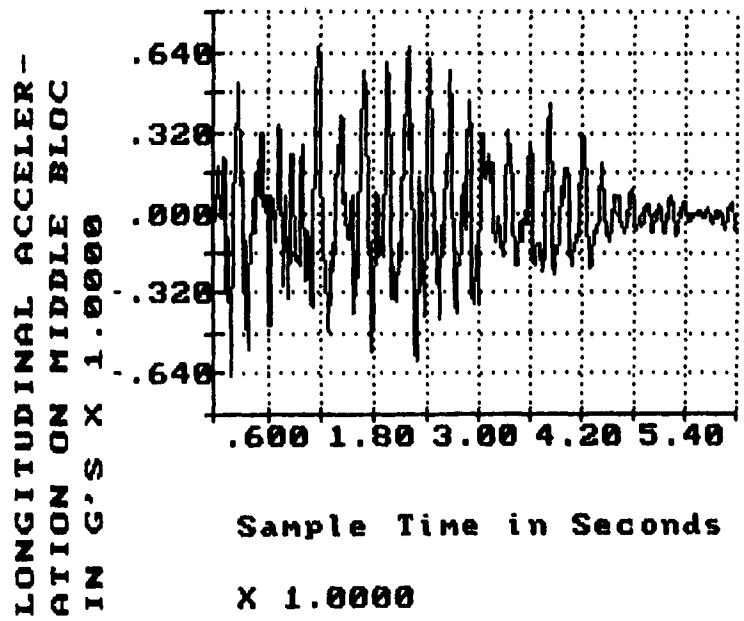
*****: DATA NOT AVAILABLE.

ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE A

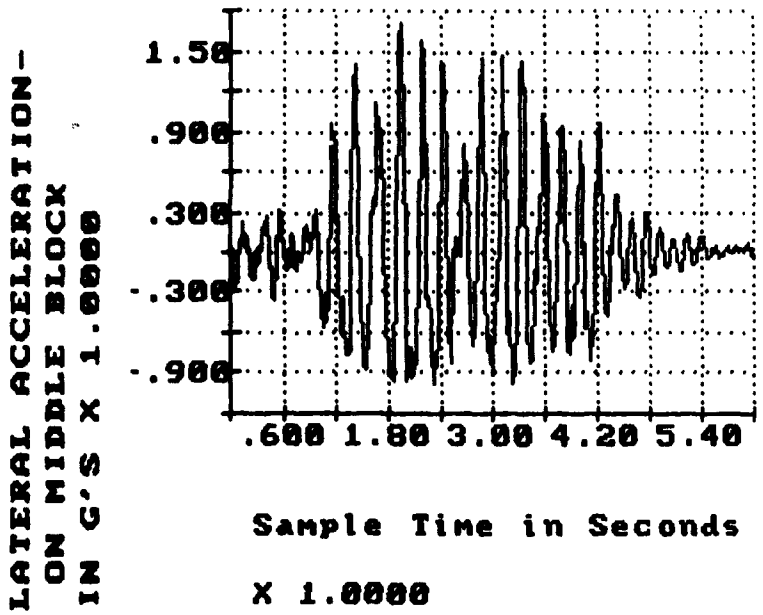


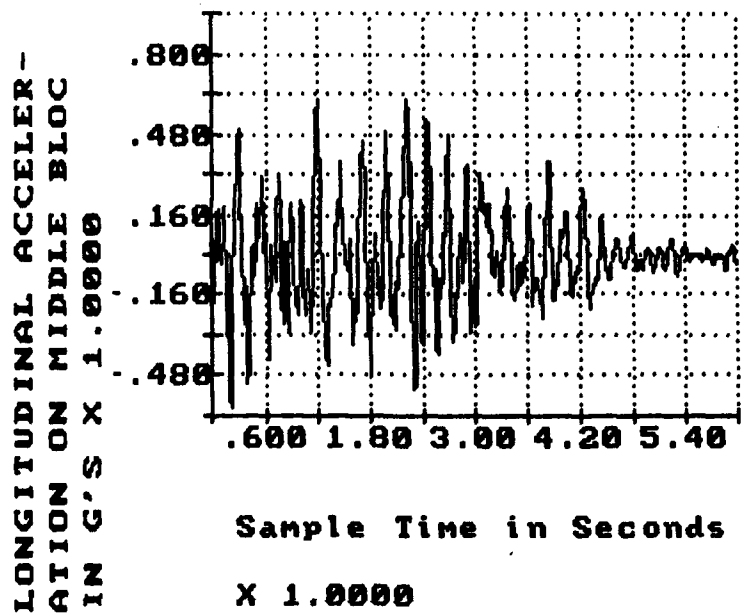


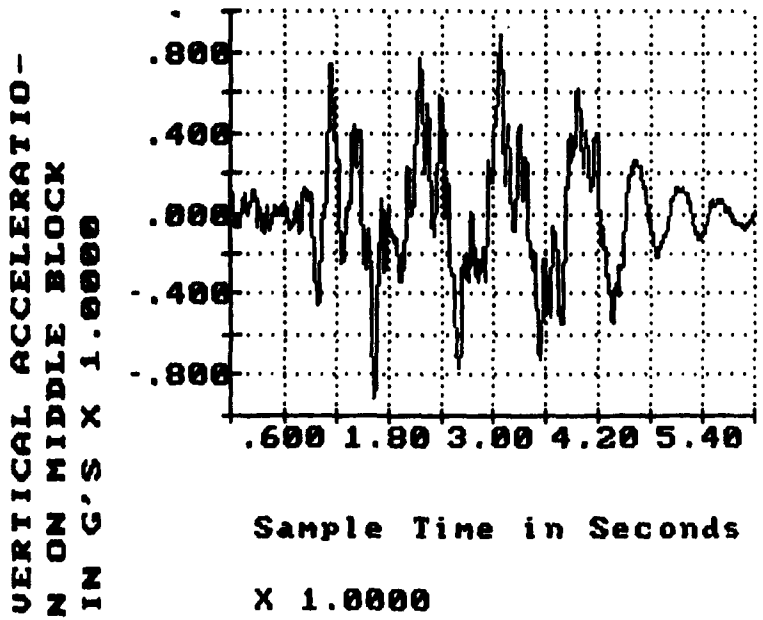


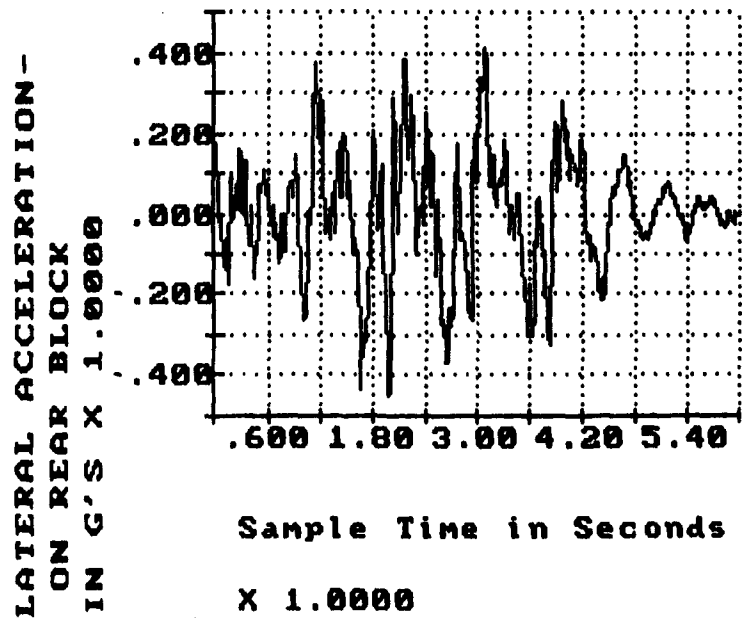


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE A

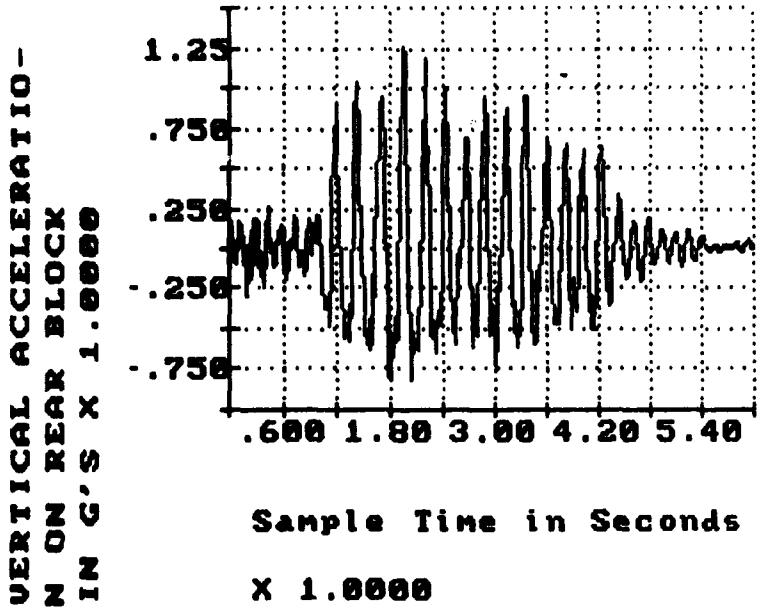


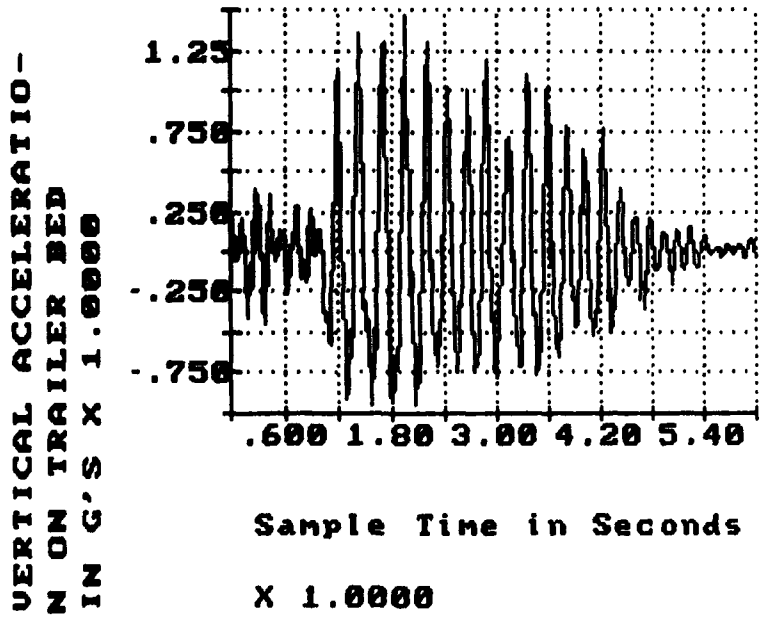




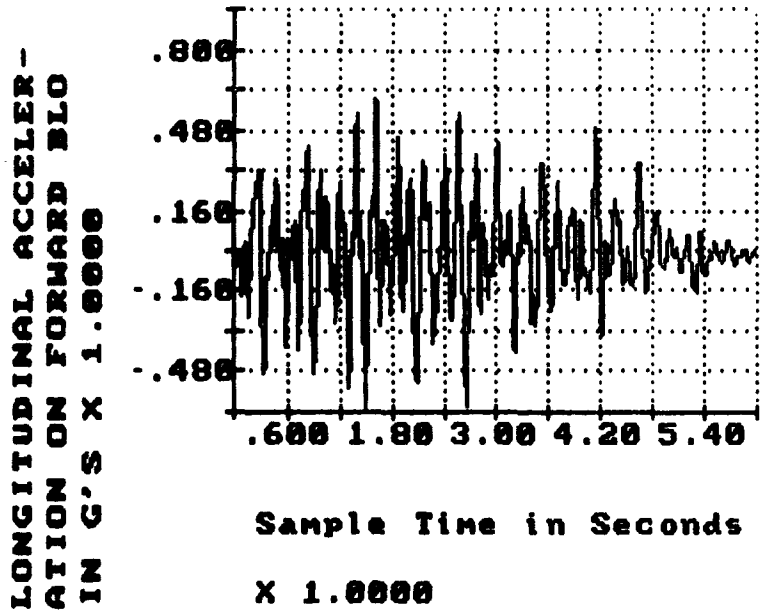


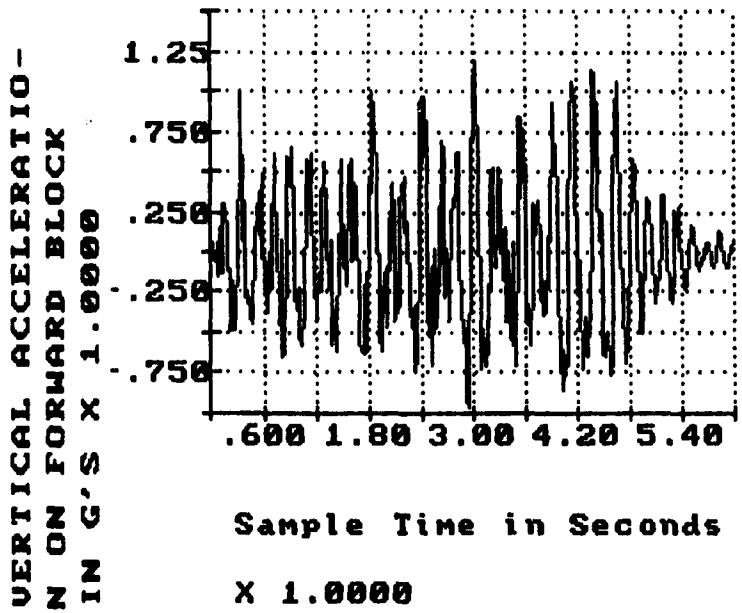
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE A

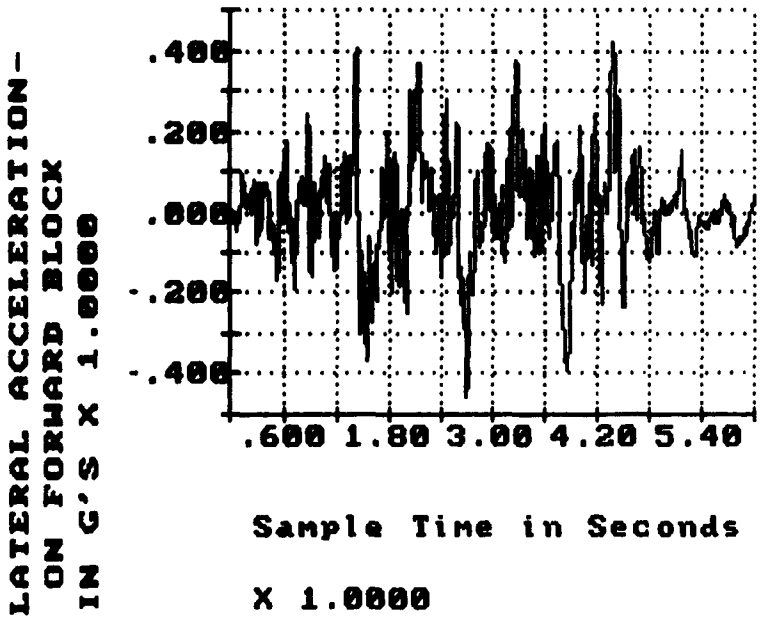


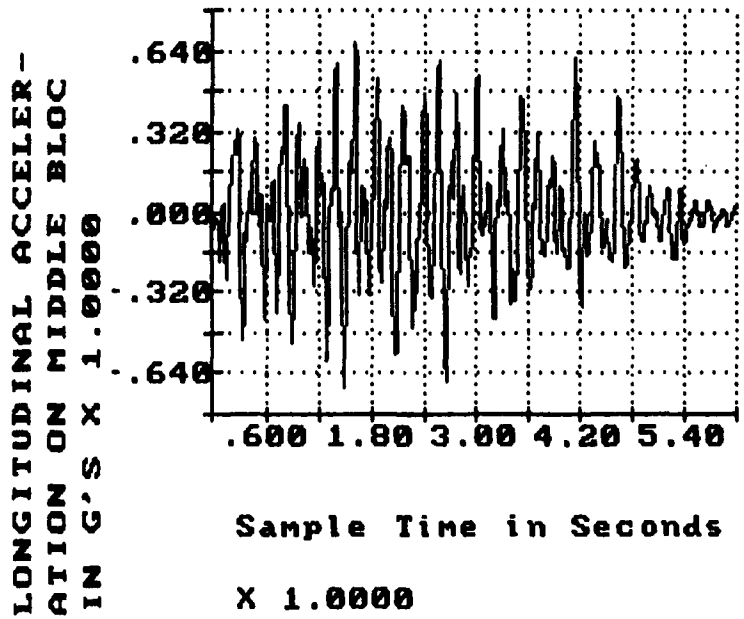


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE B

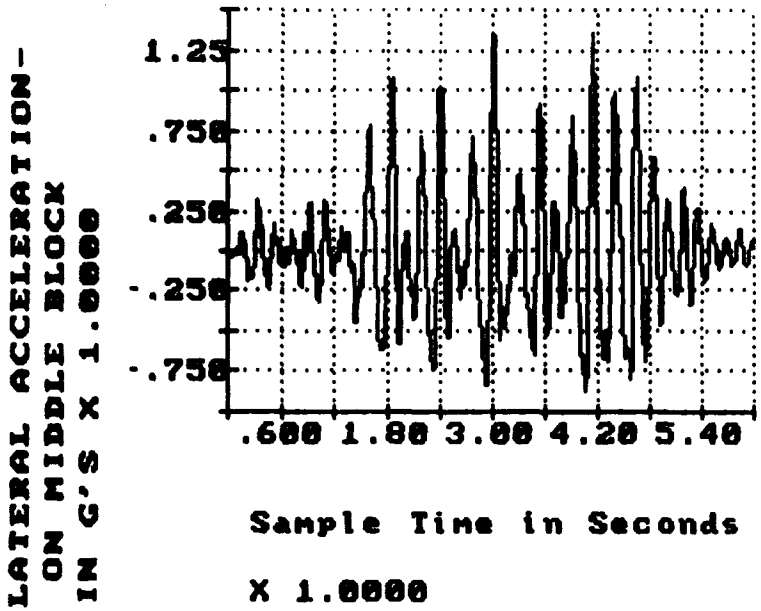


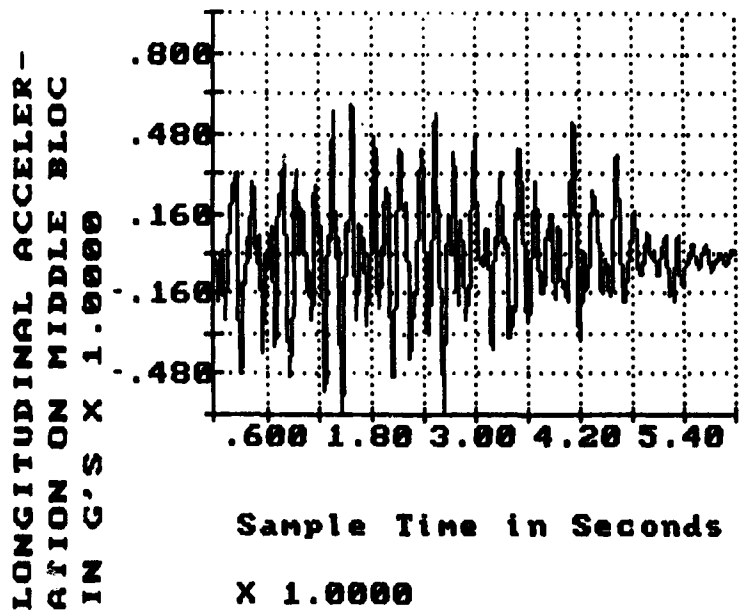


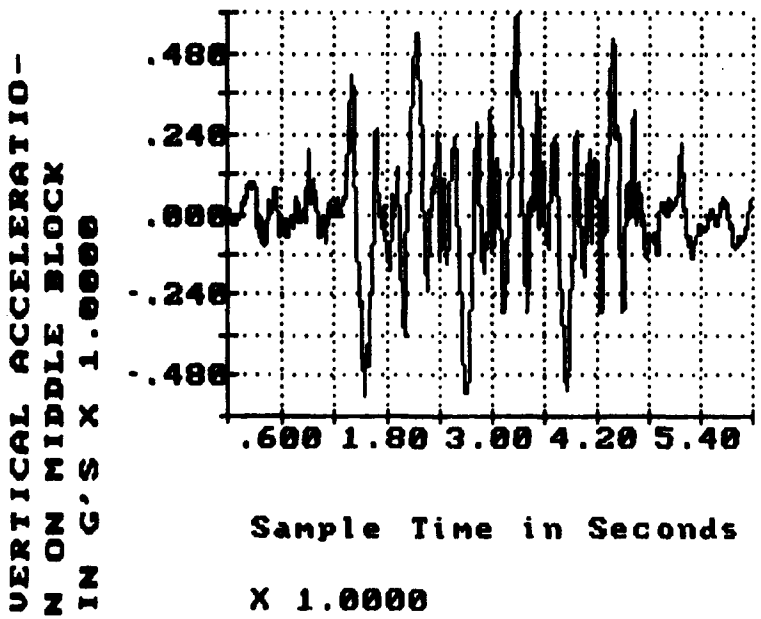


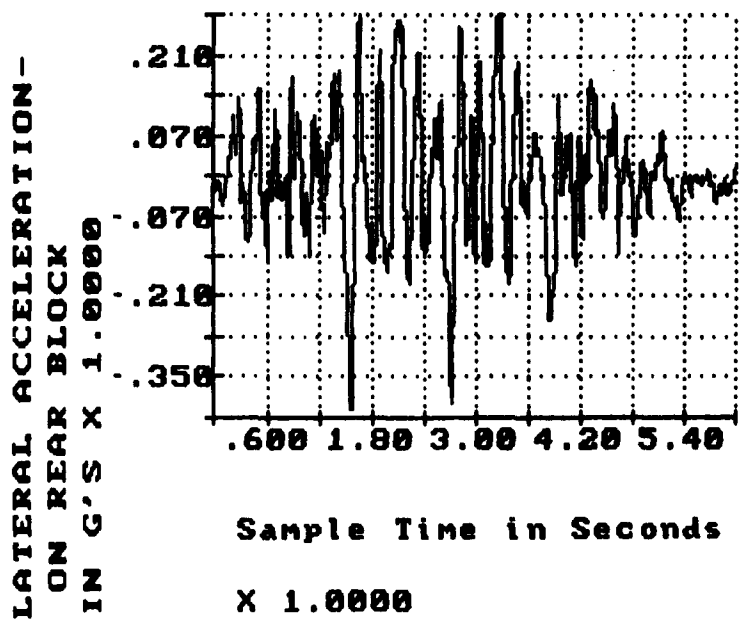


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE B

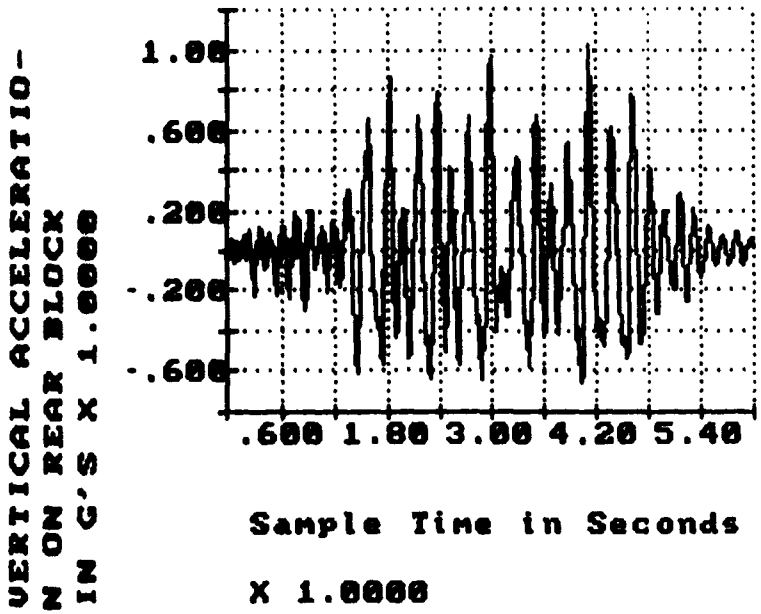


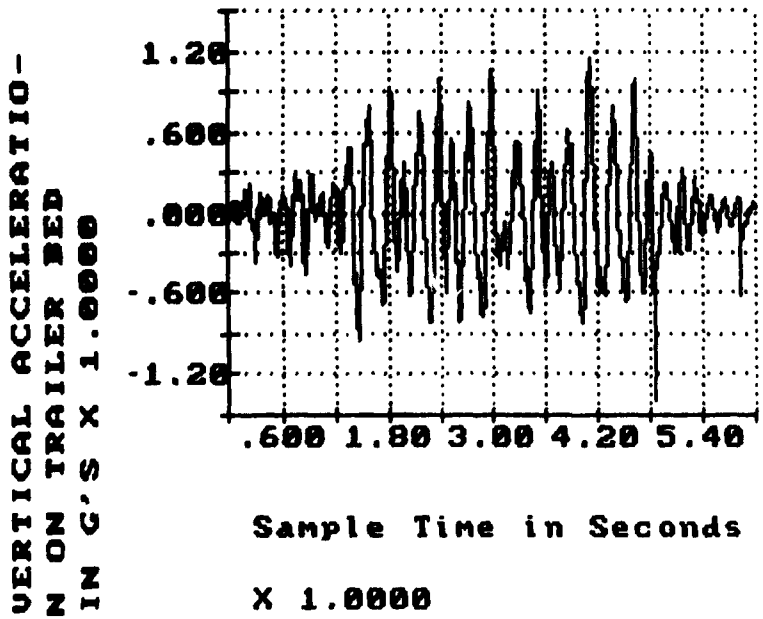




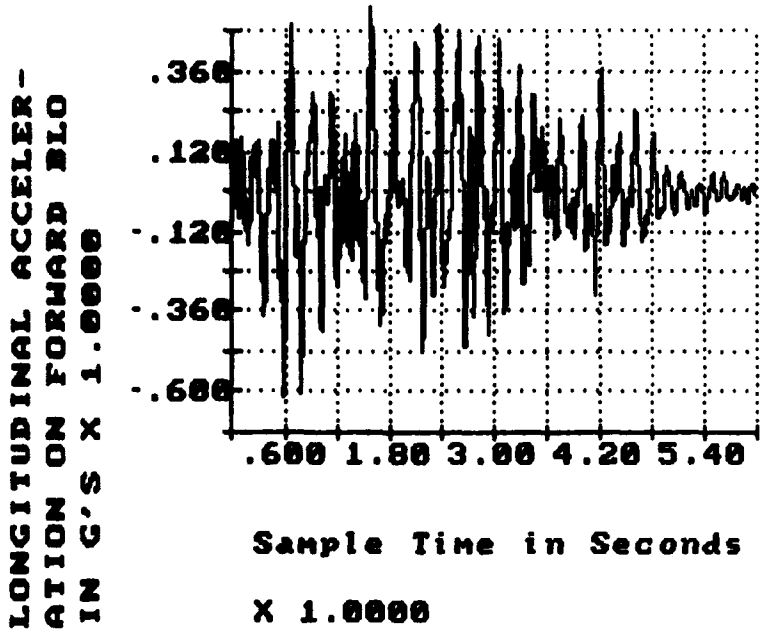


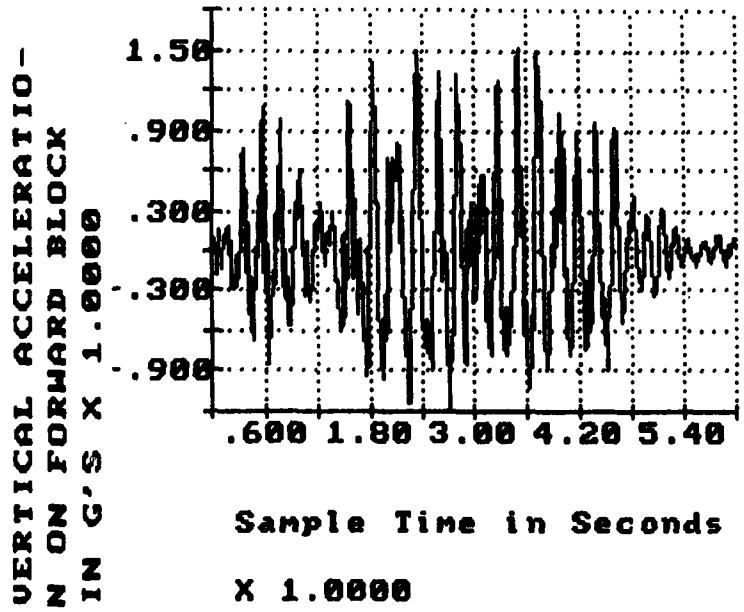
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 1, COURSE B

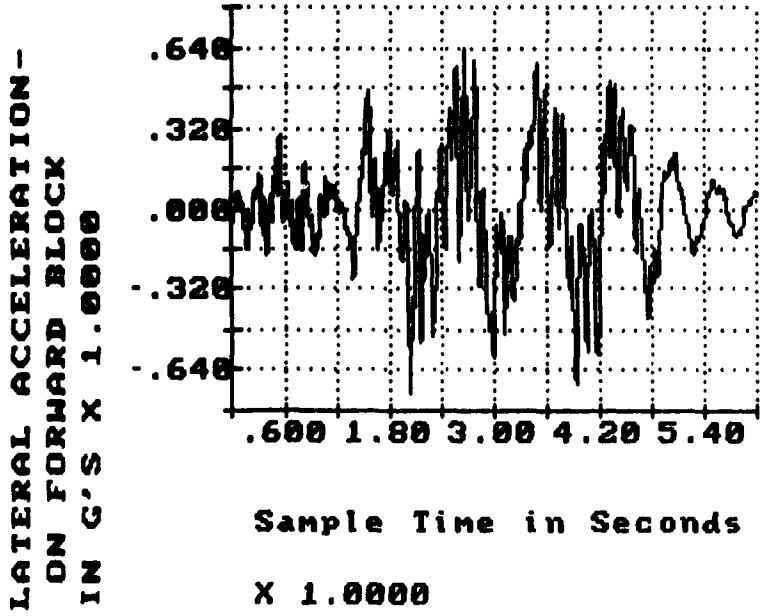


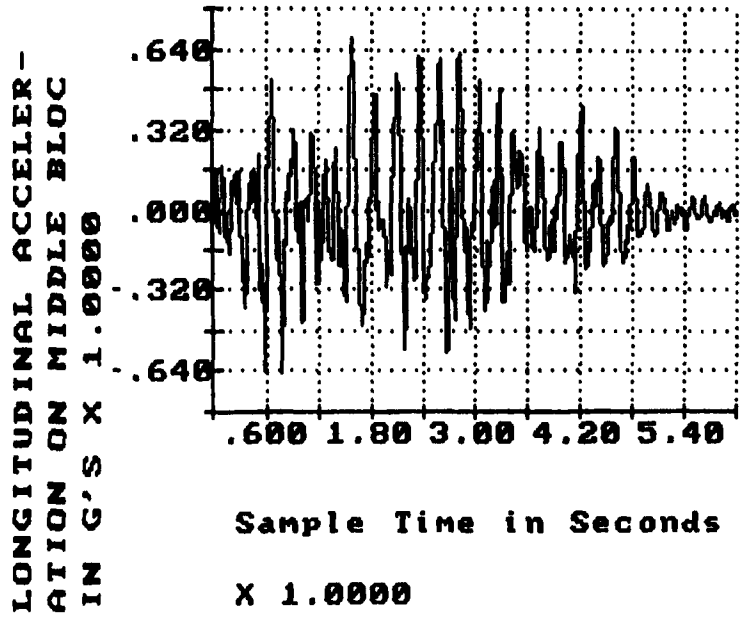


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 2, COURSE A









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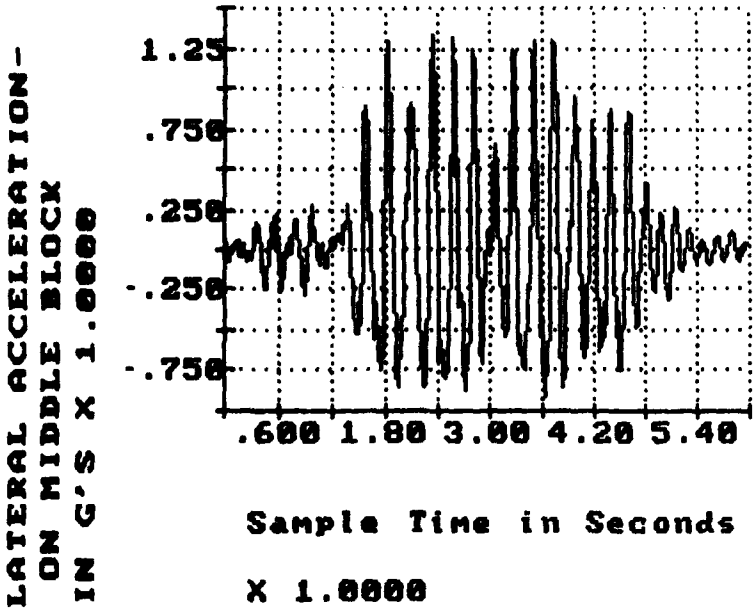
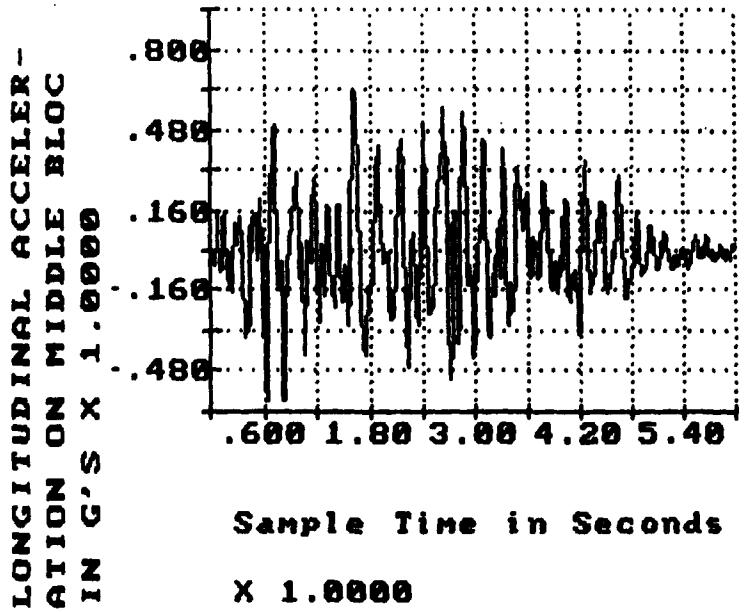
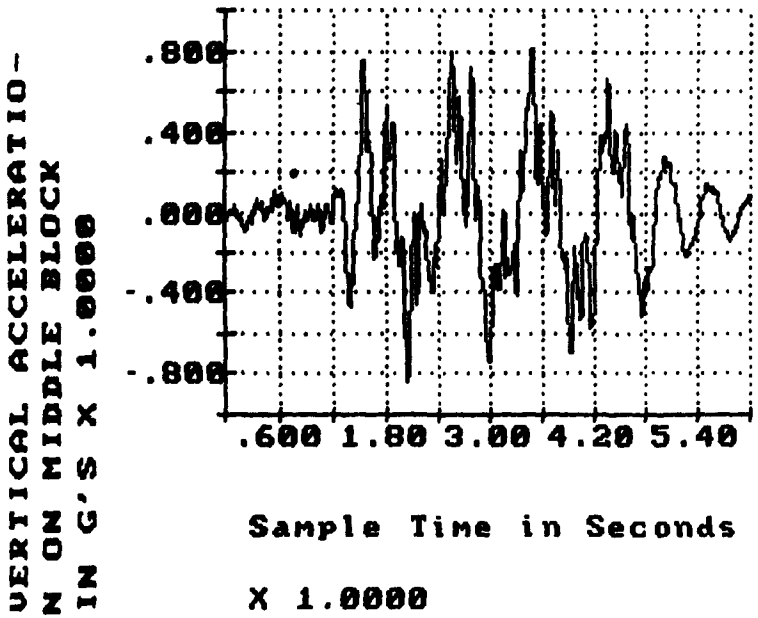
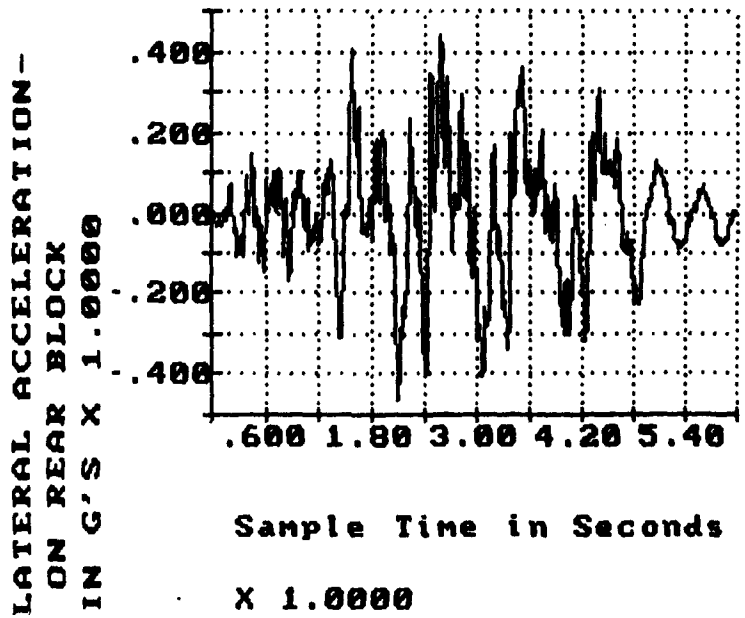
DATE: 20 & 21 JULY 1989
PASS 2, COURSE A

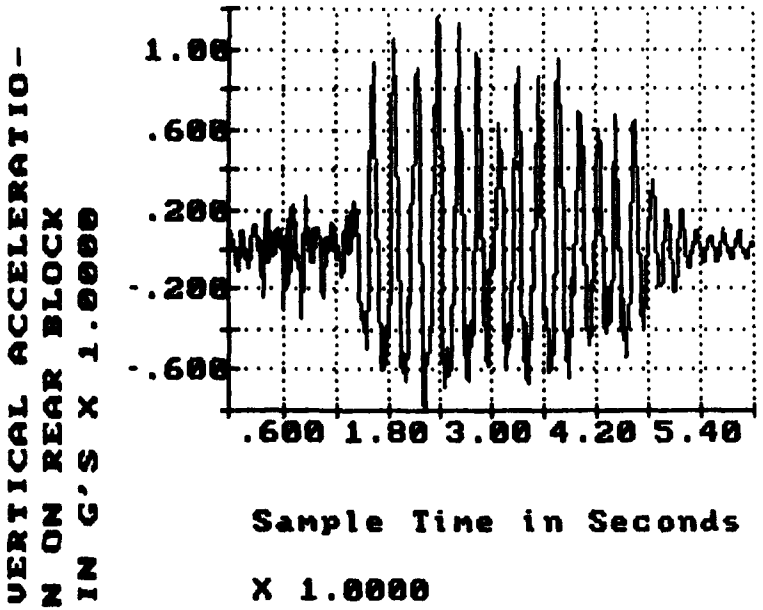


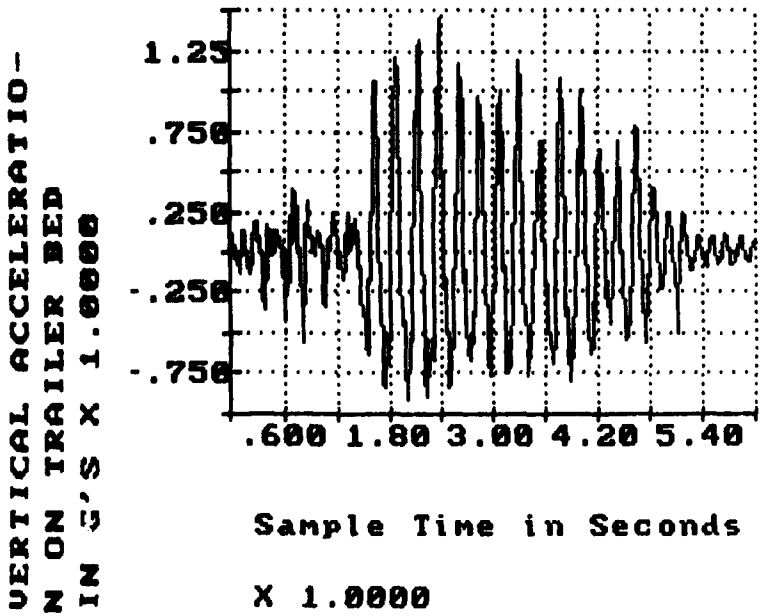




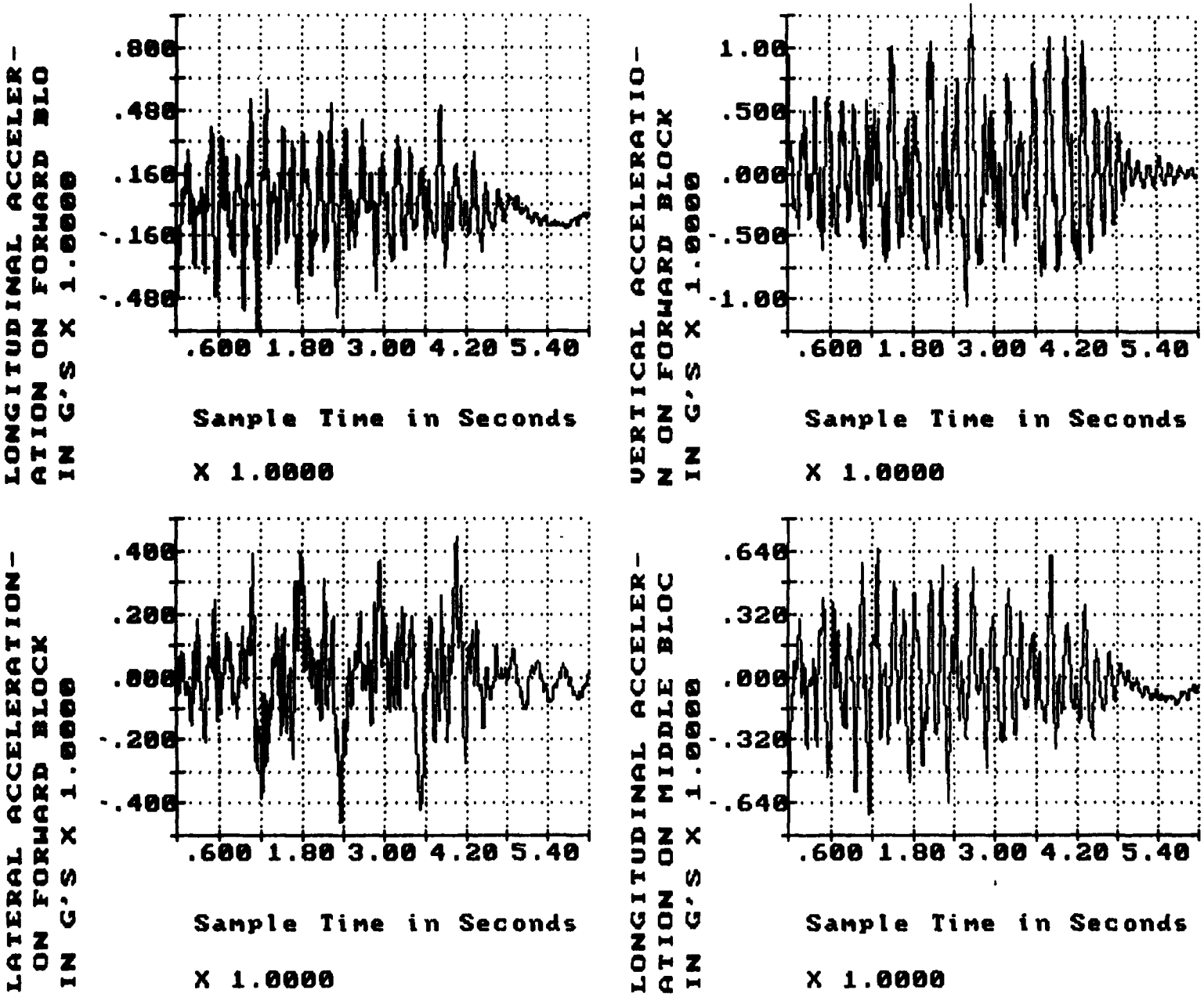


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 2, COURSE A

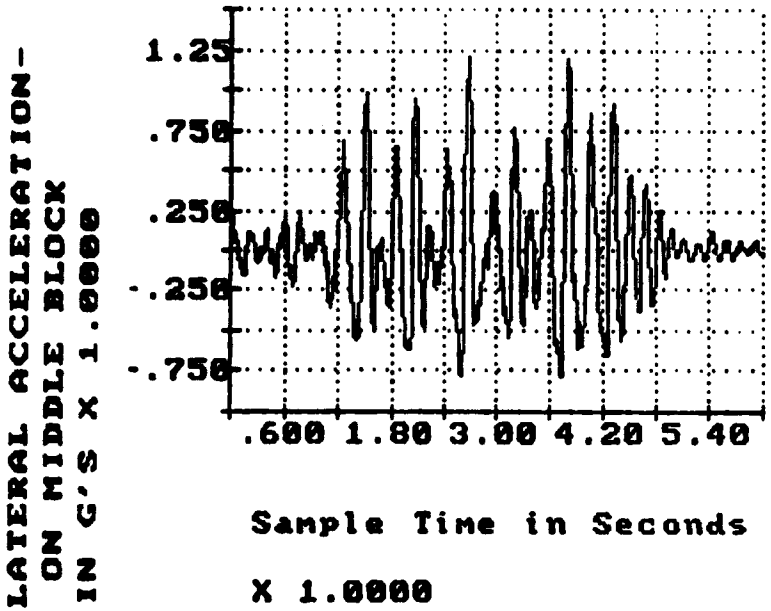


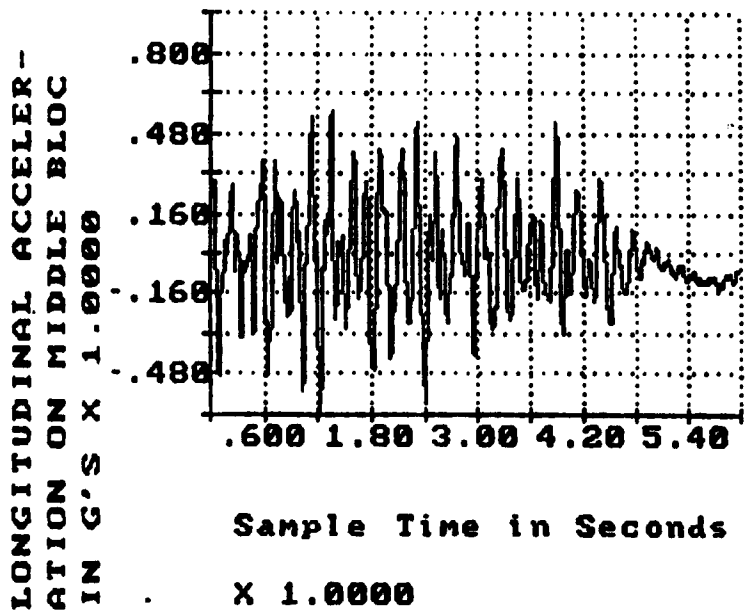


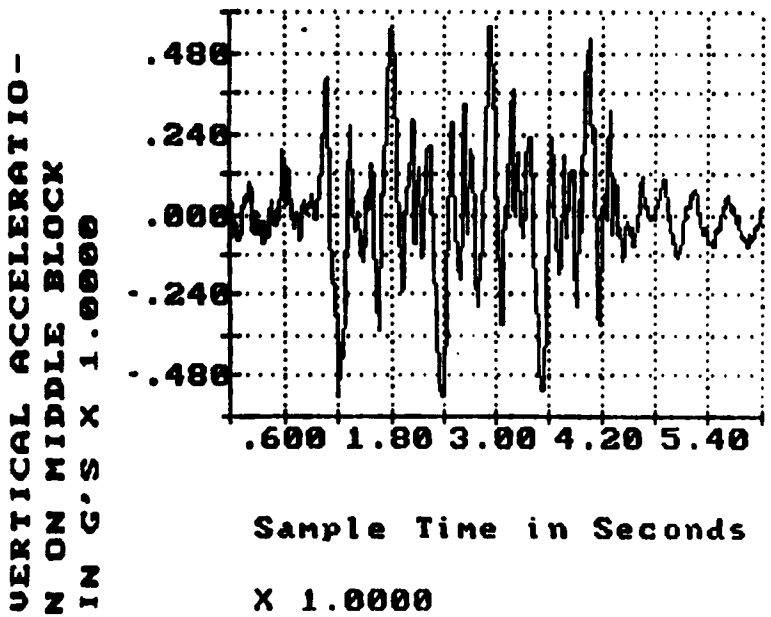
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 2, COURSE B

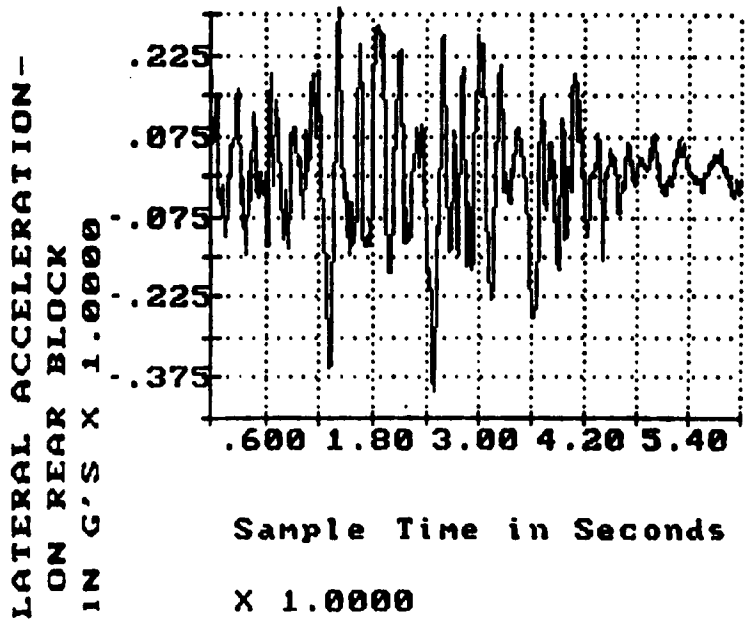


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 2, COURSE B

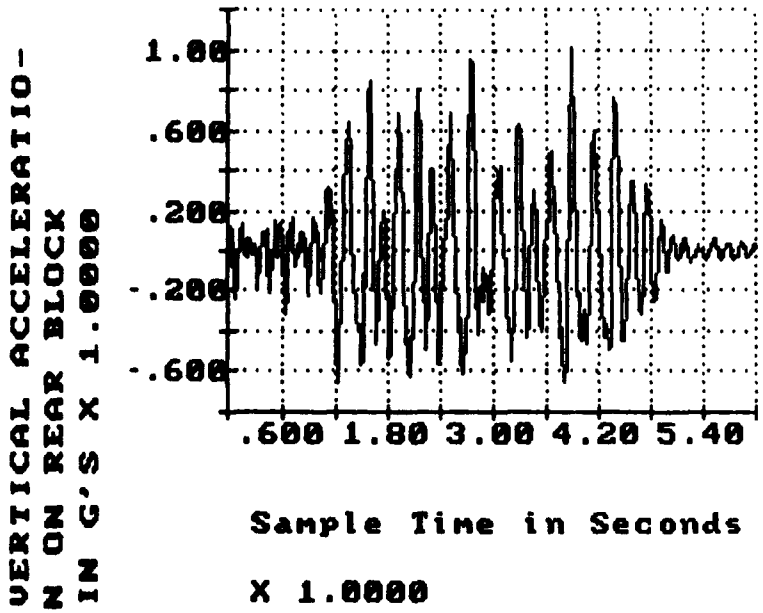


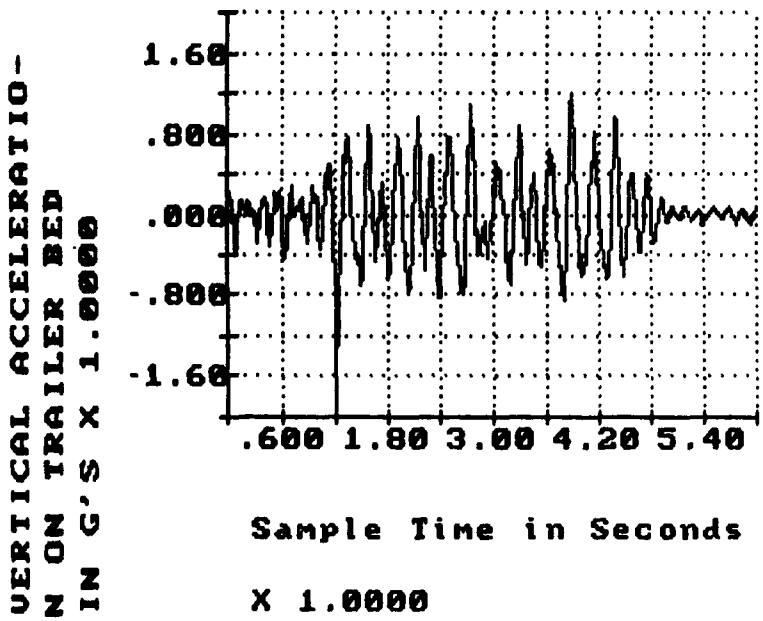




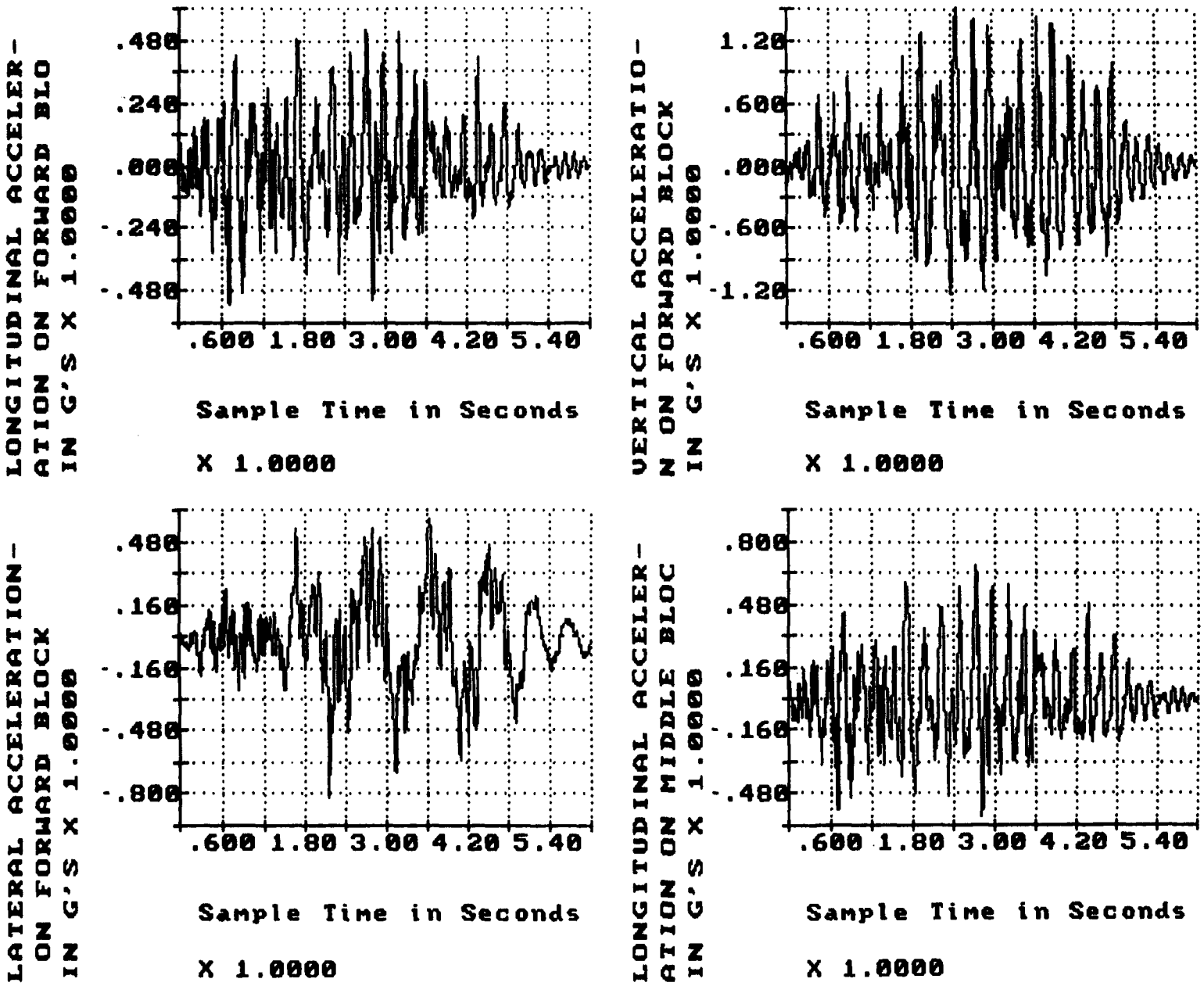


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 2, COURSE B

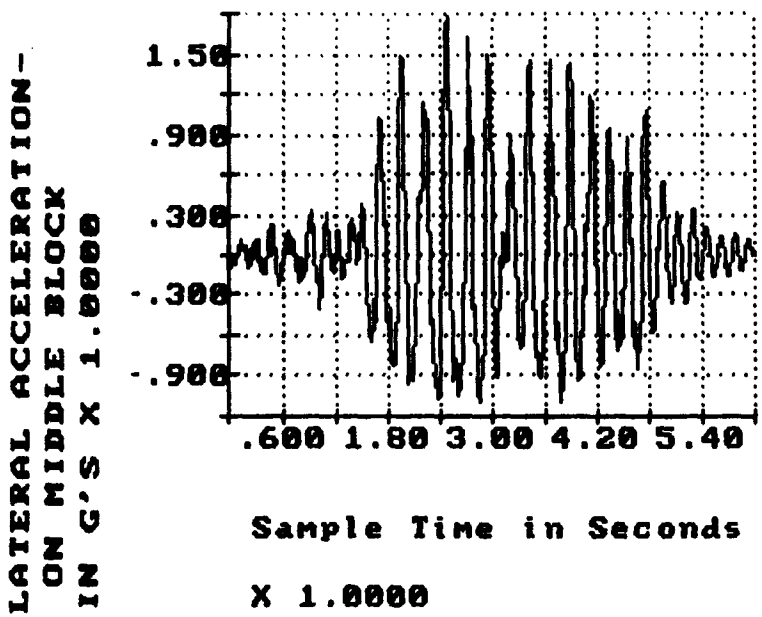


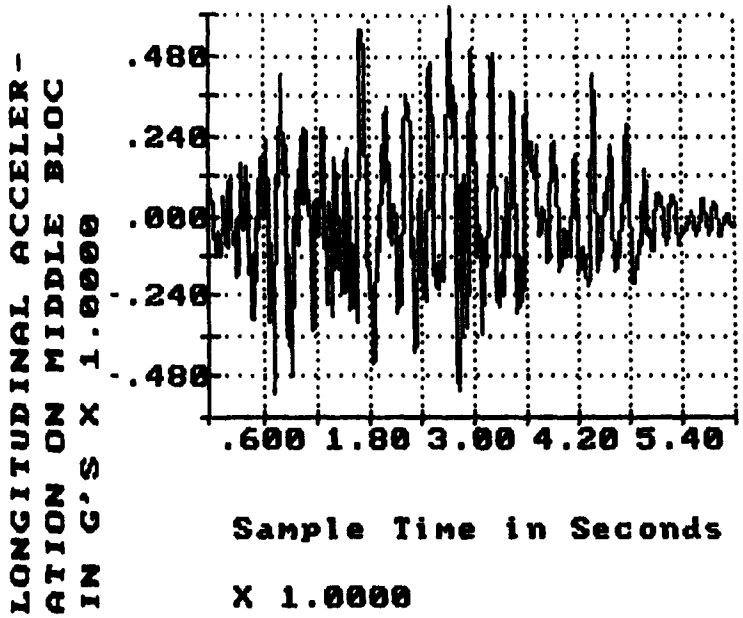


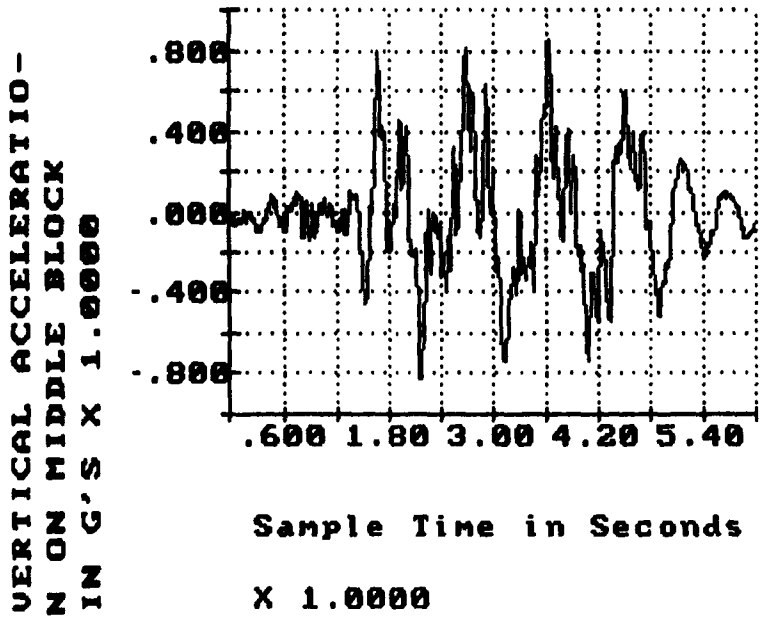
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE A

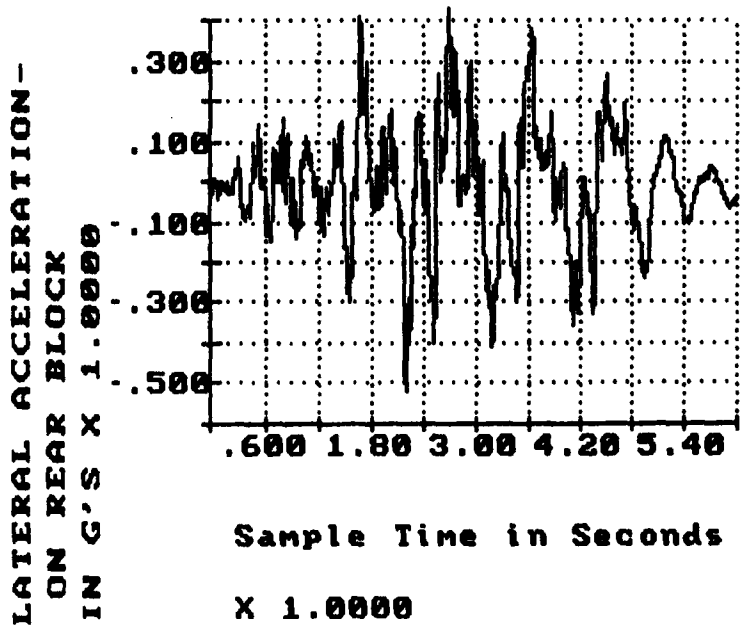


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE A

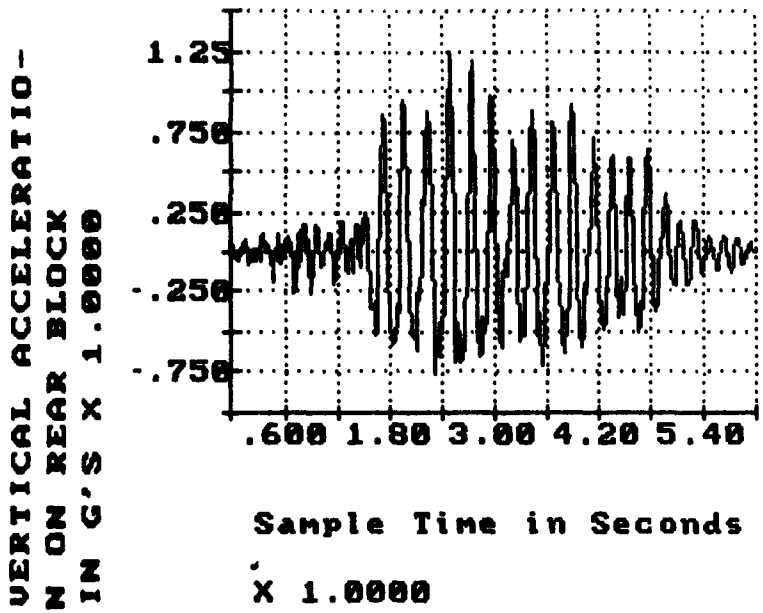


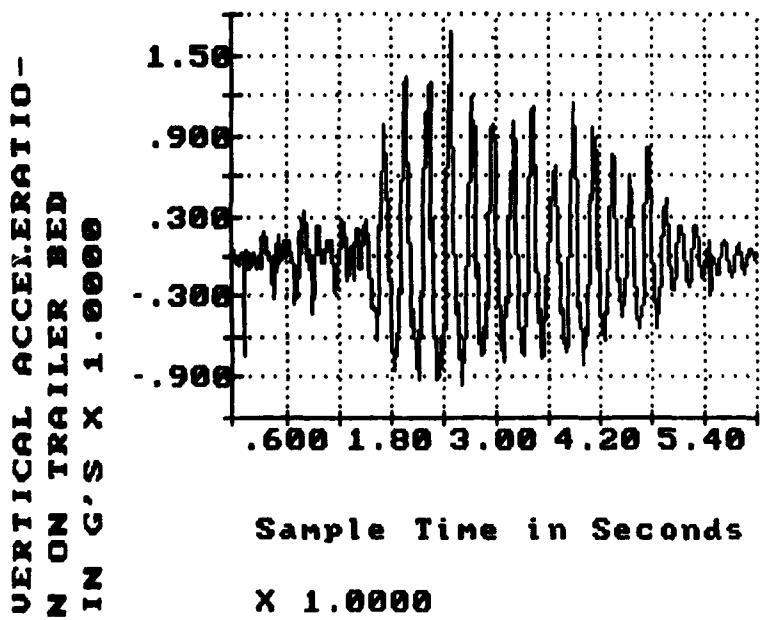




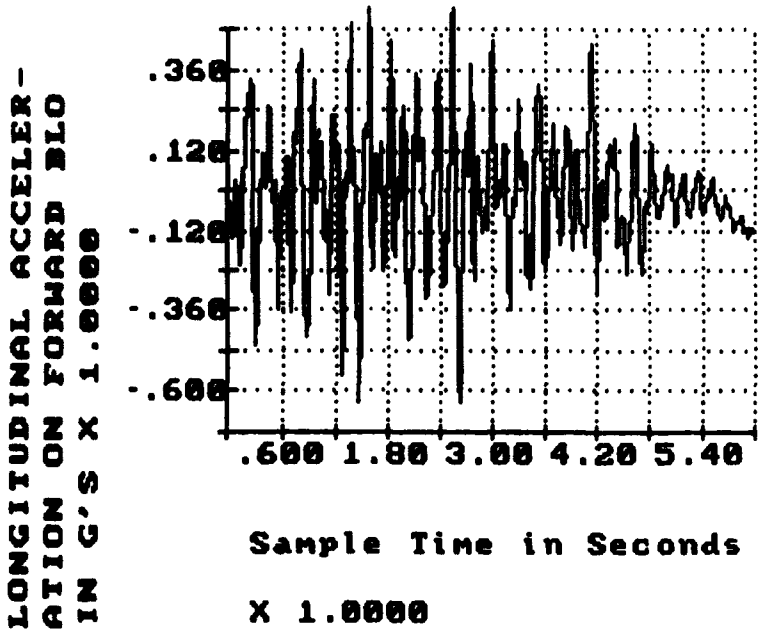


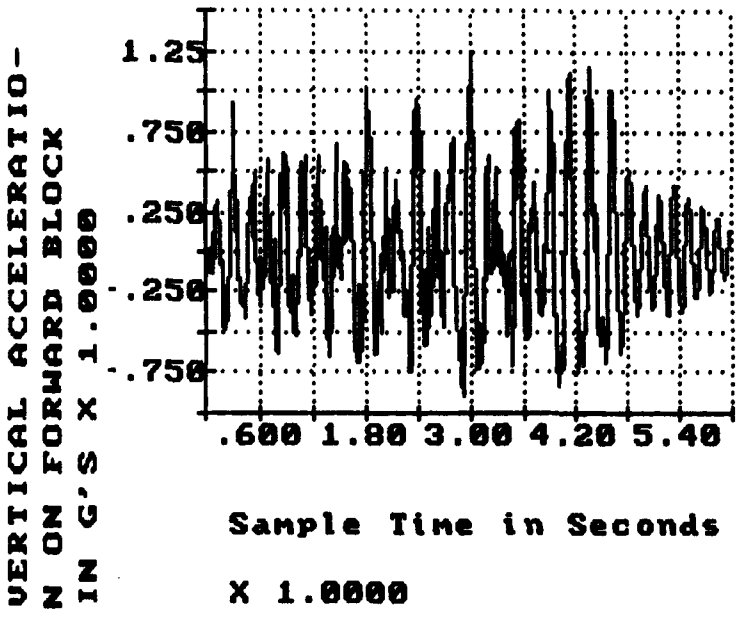
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE A

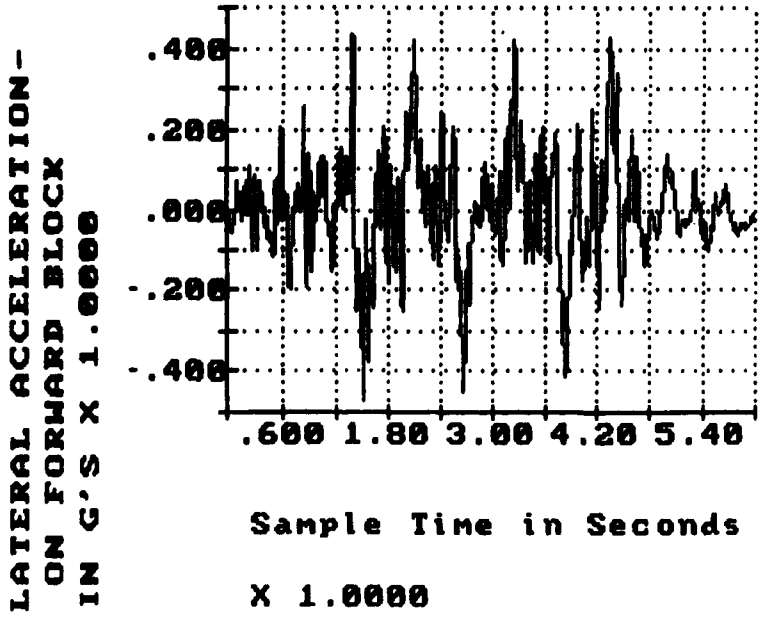


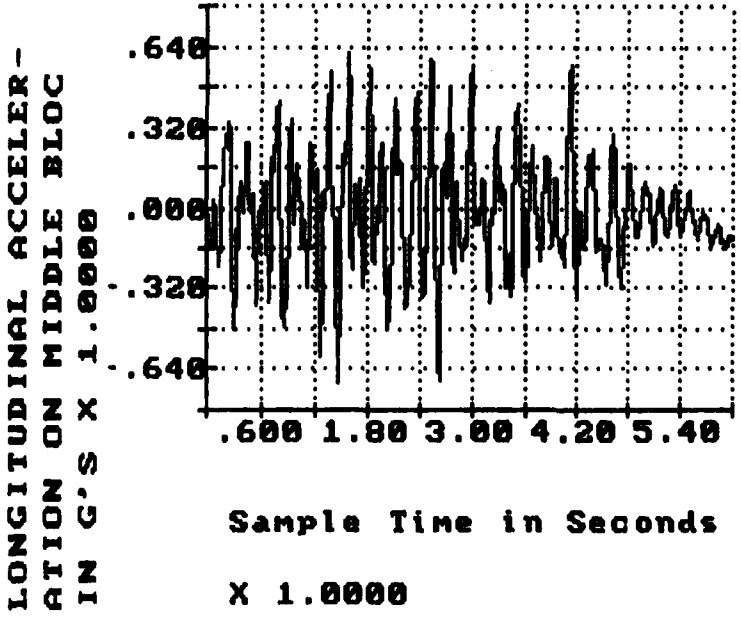


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE B

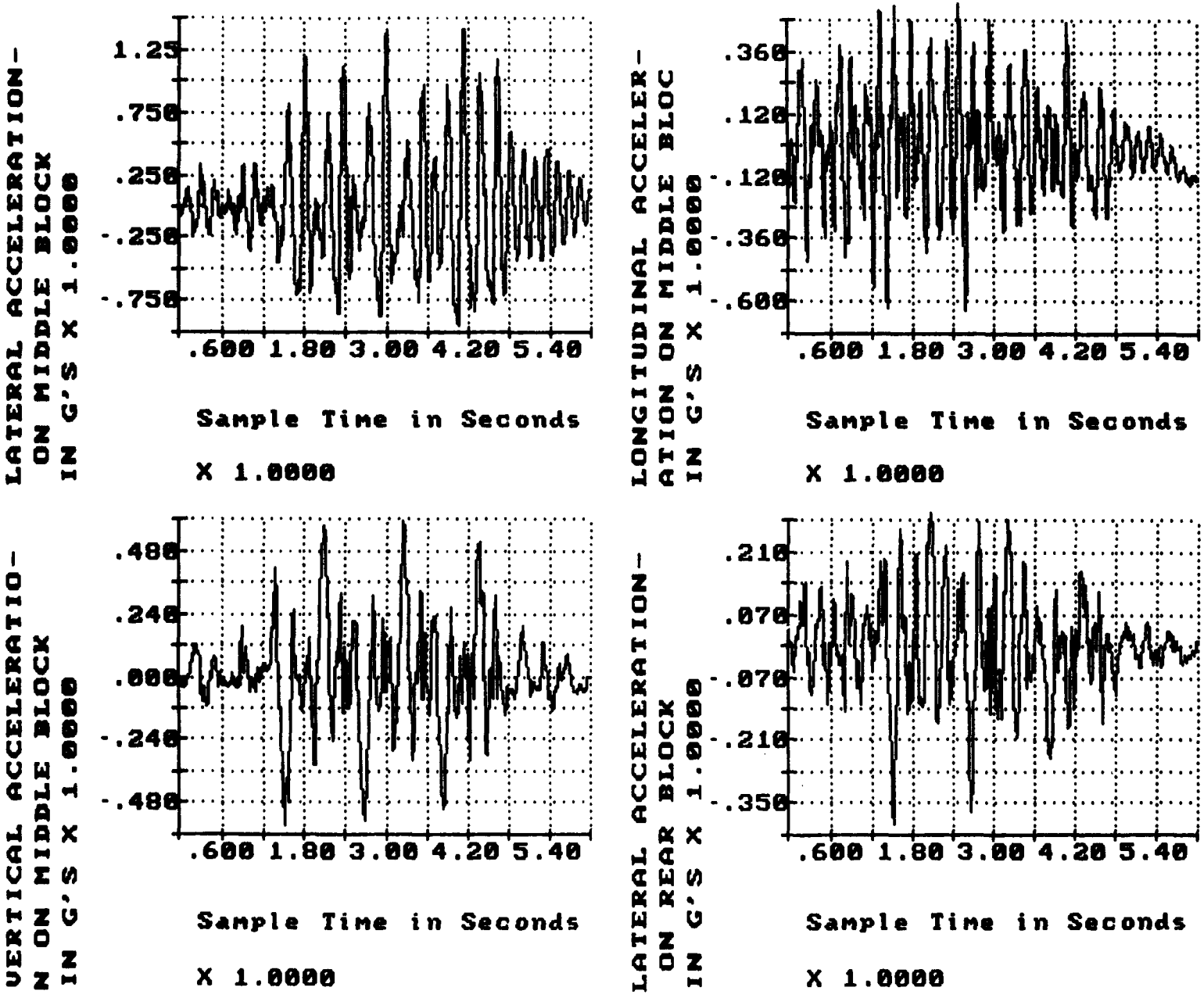




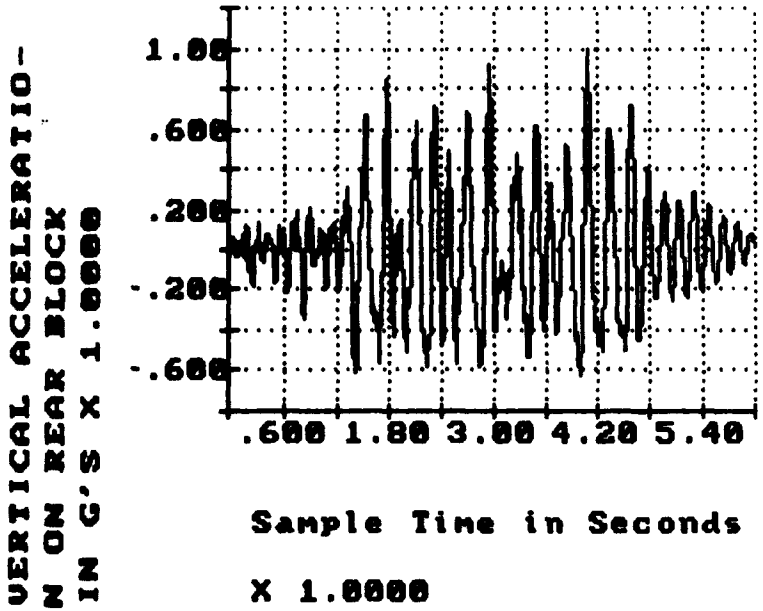


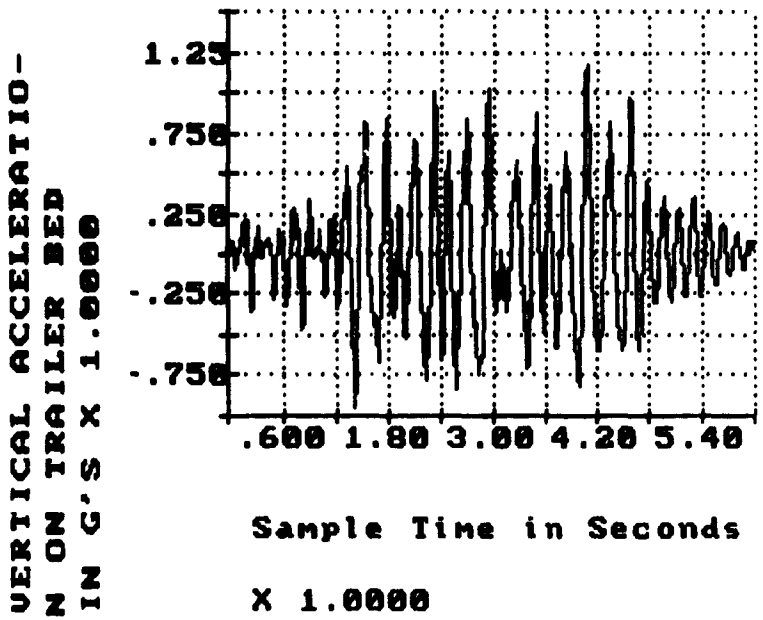


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE B

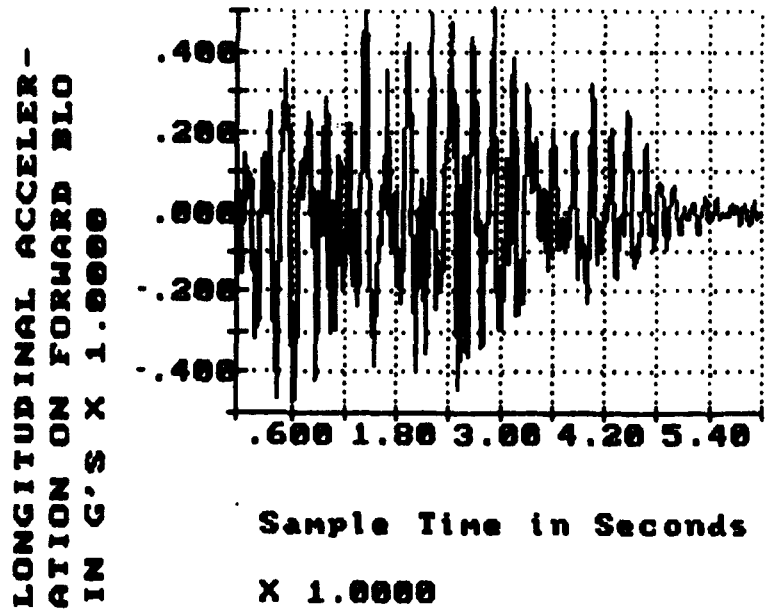


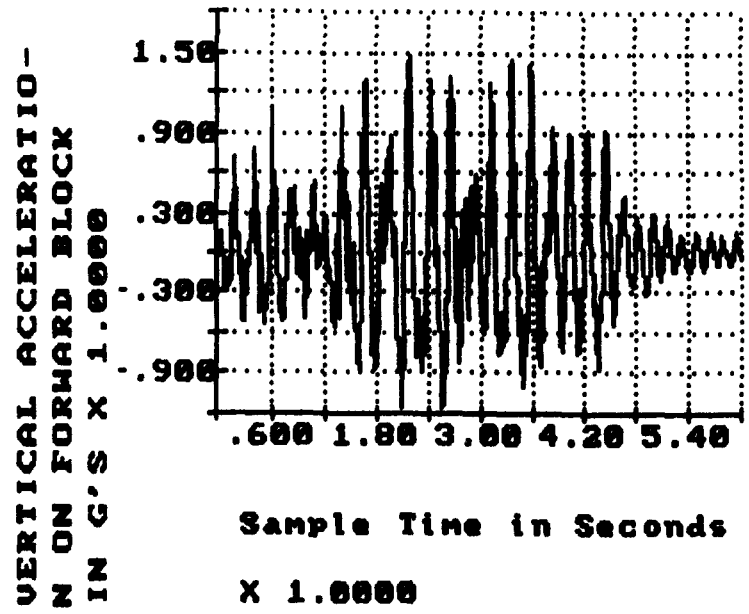
ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 3, COURSE B

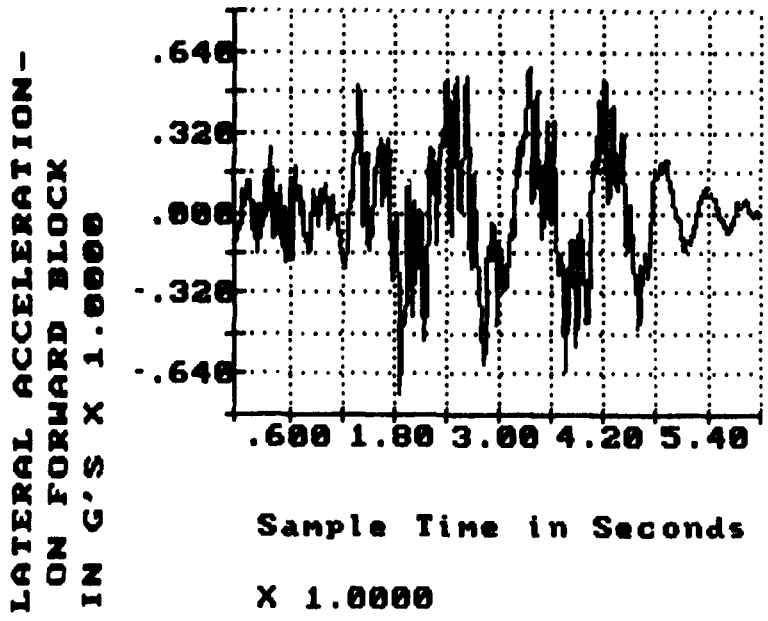


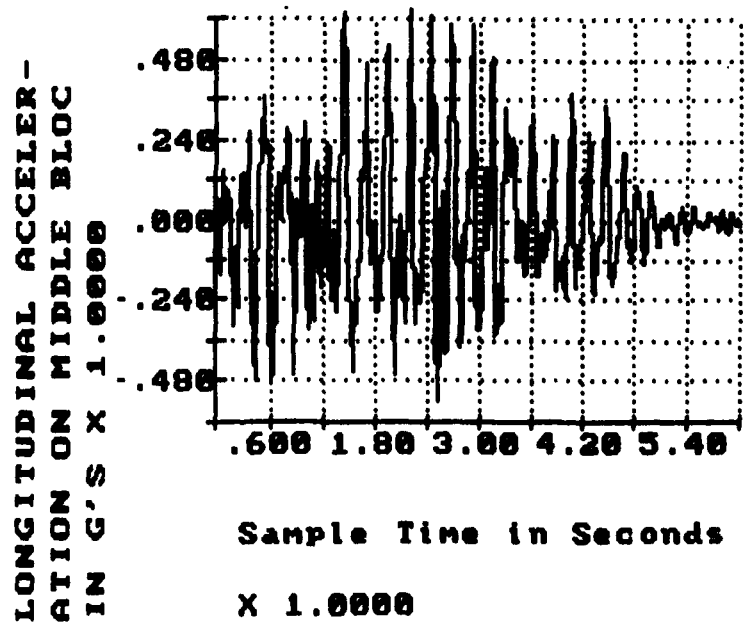


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 4, COURSE A









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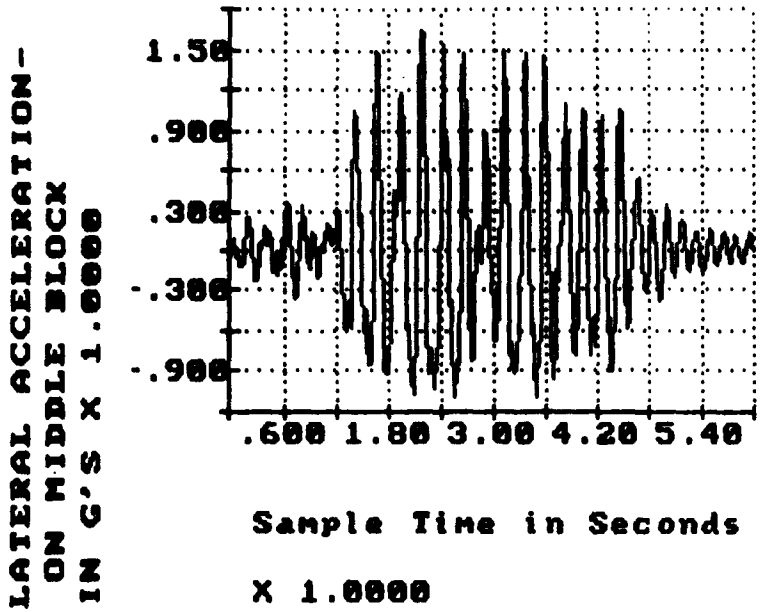
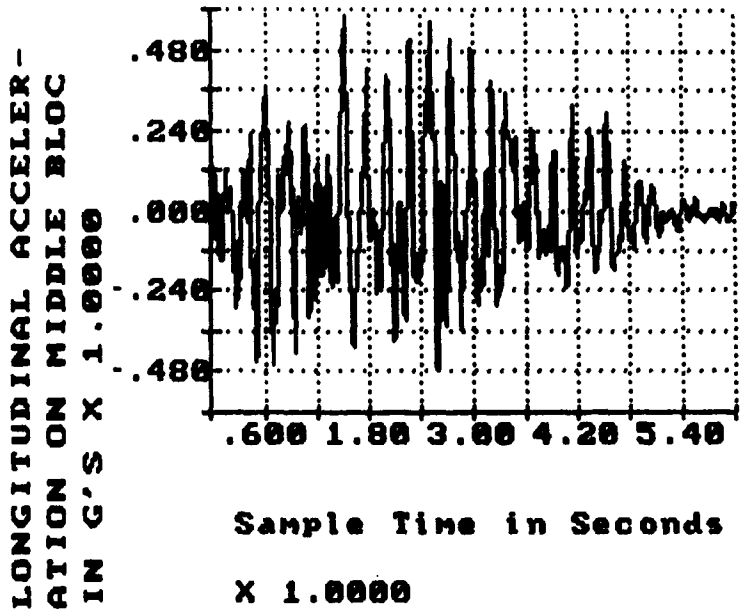
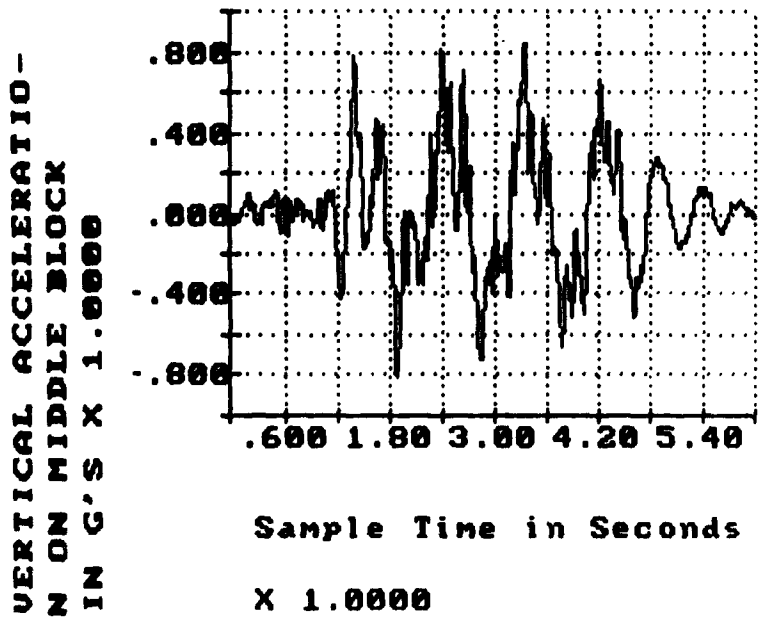
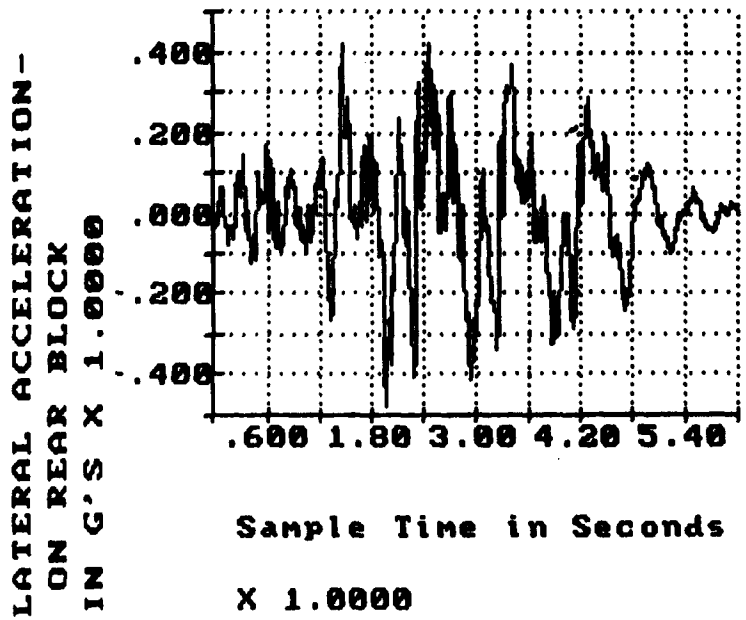
PASS 4, COURSE A









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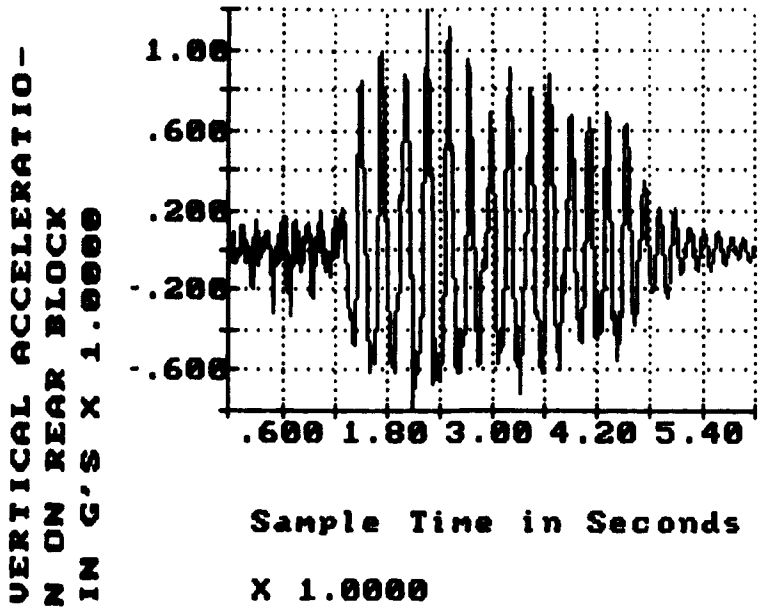
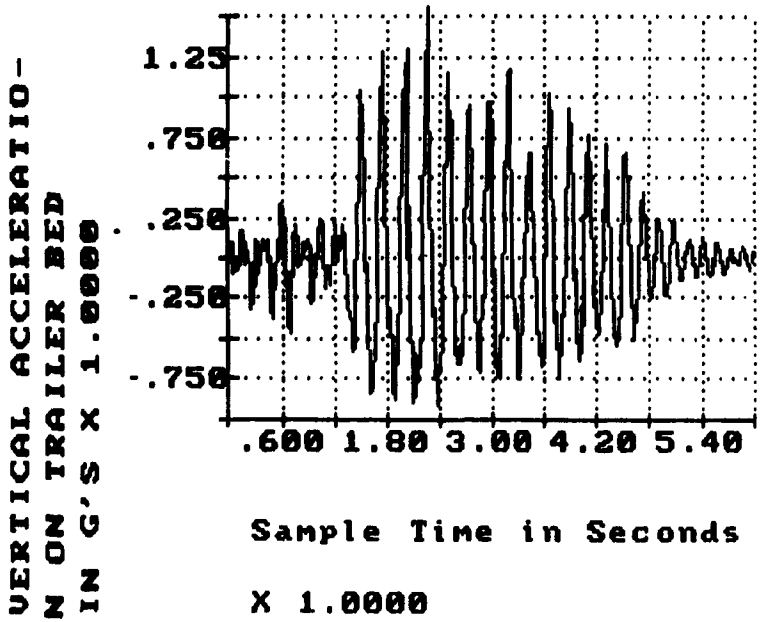
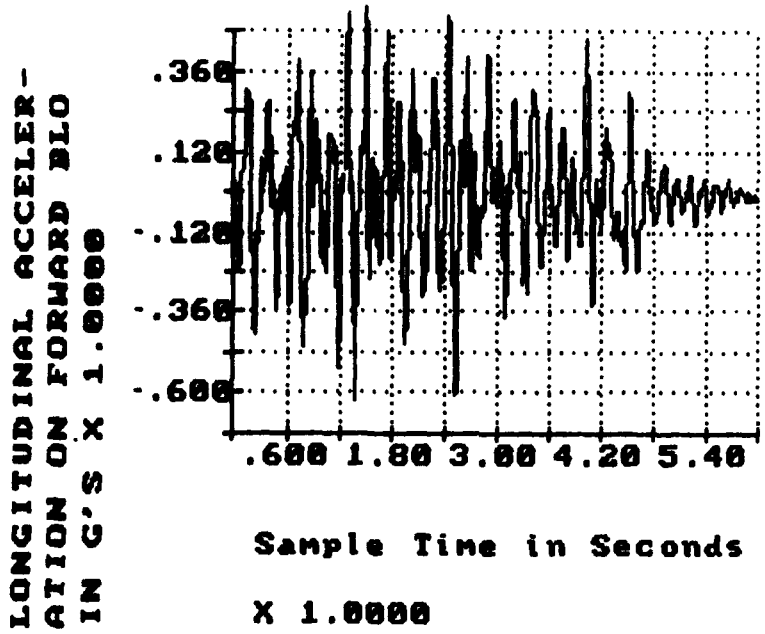
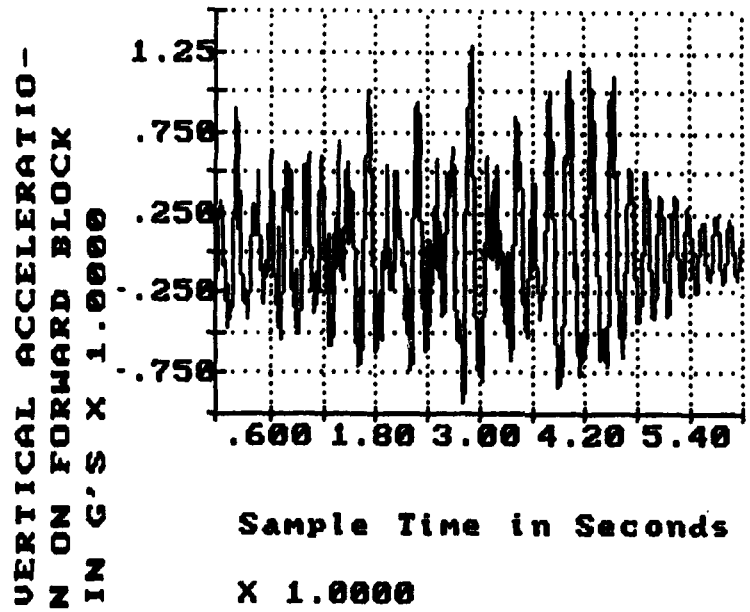
PASS 4, COURSE A

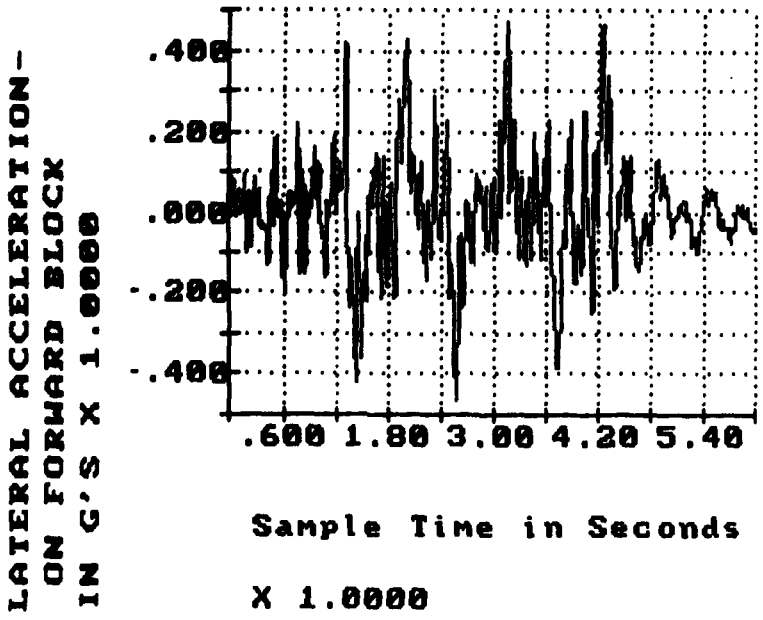


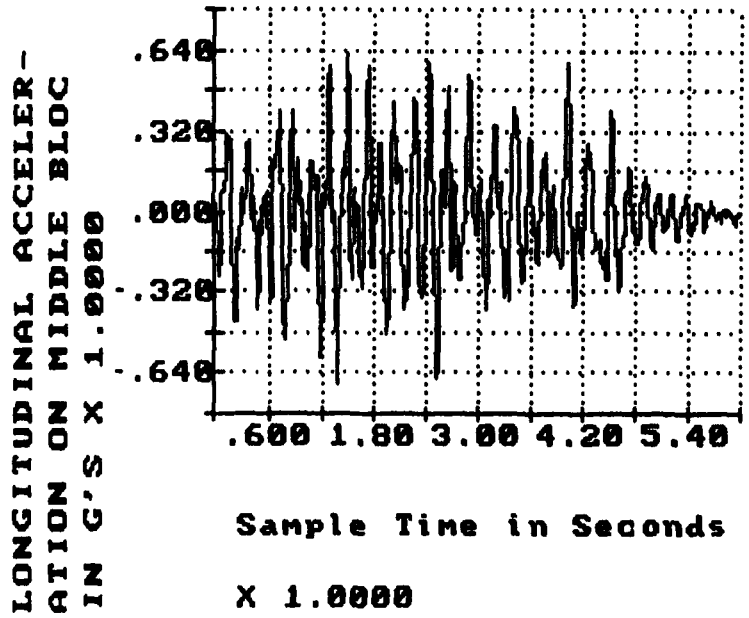


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 4, COURSE B

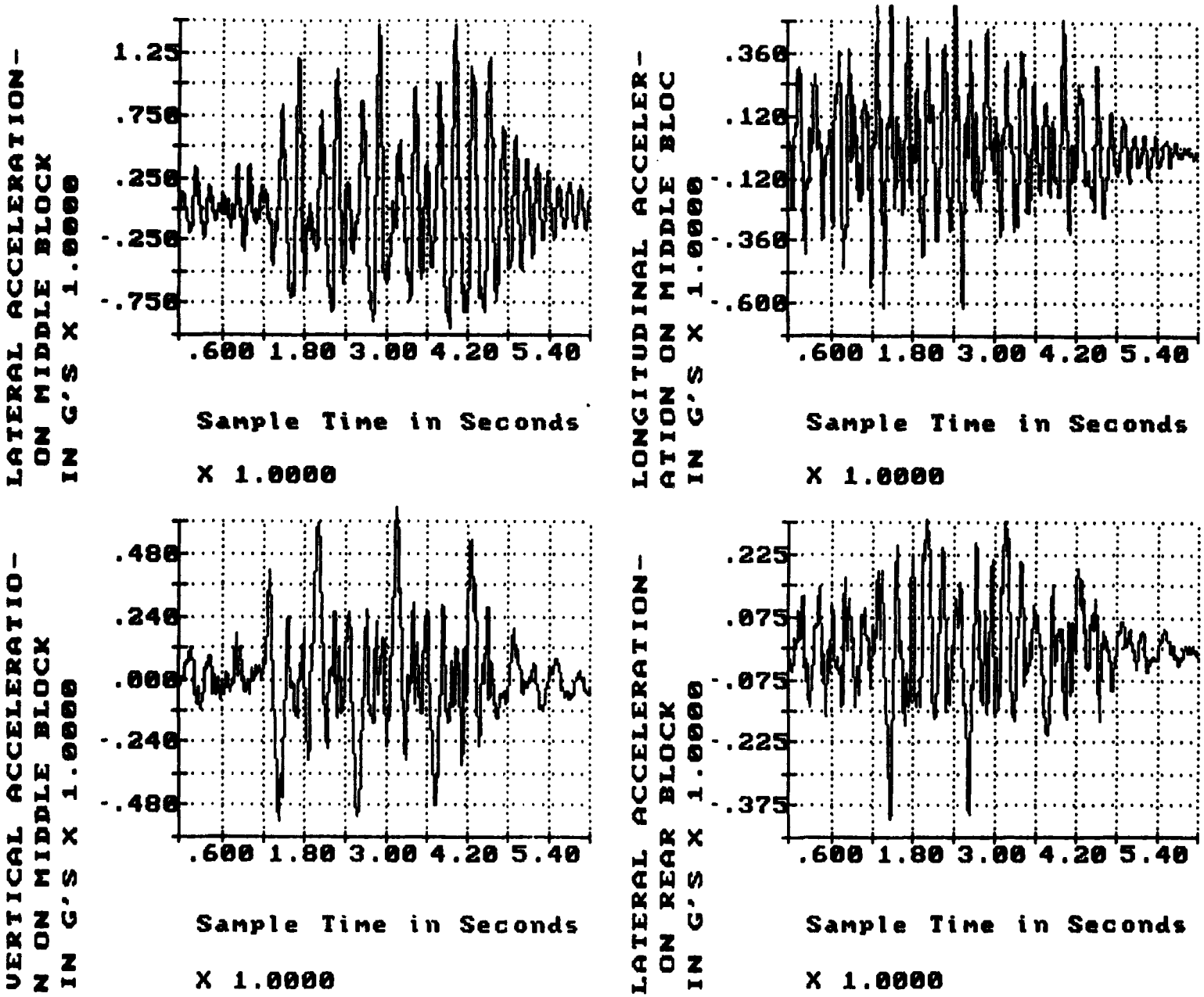








ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
PASS 4, COURSE B



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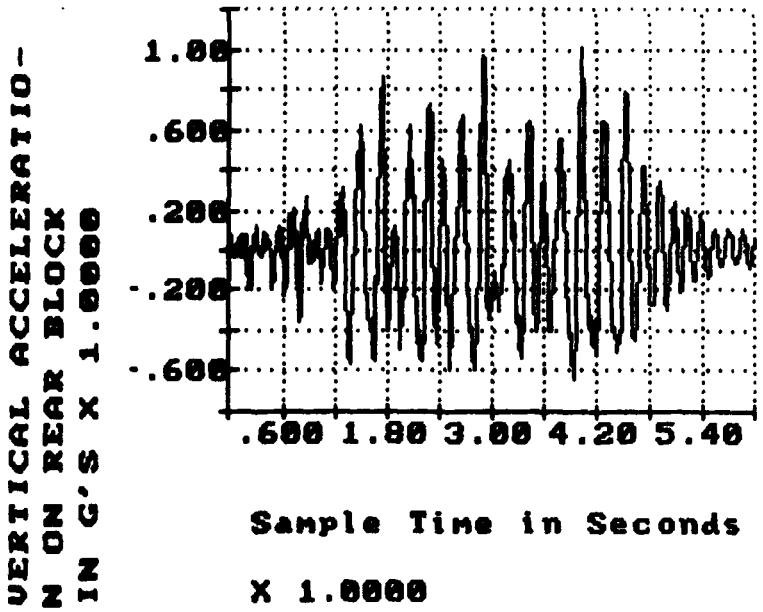
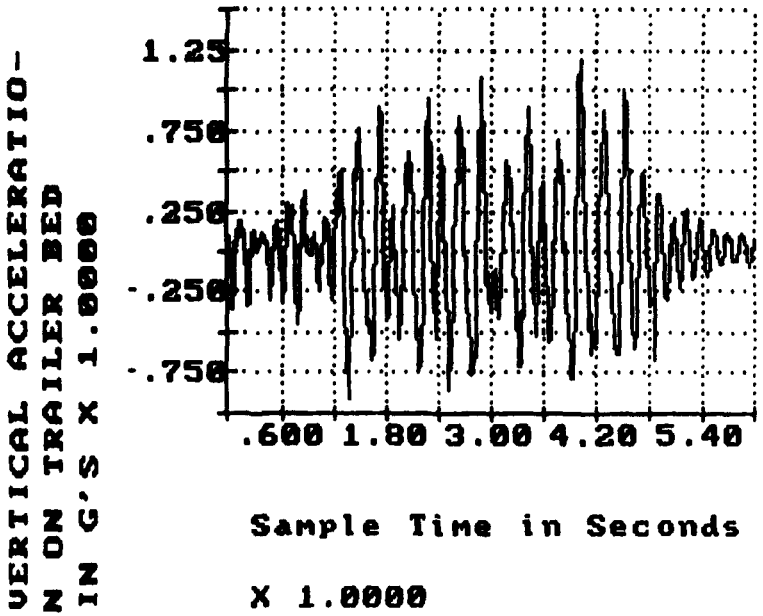
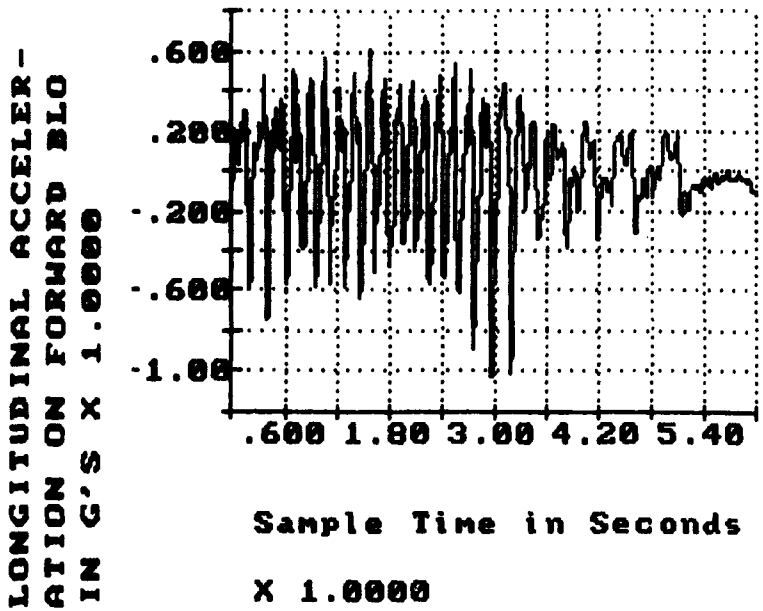
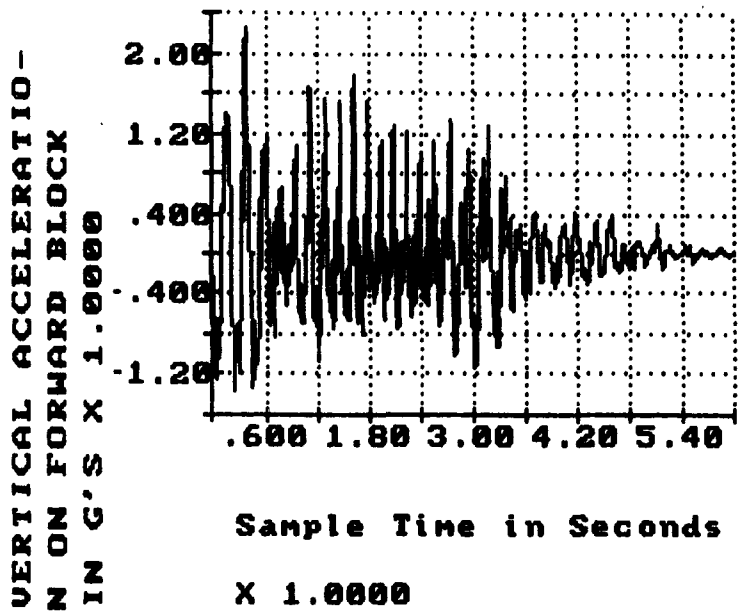
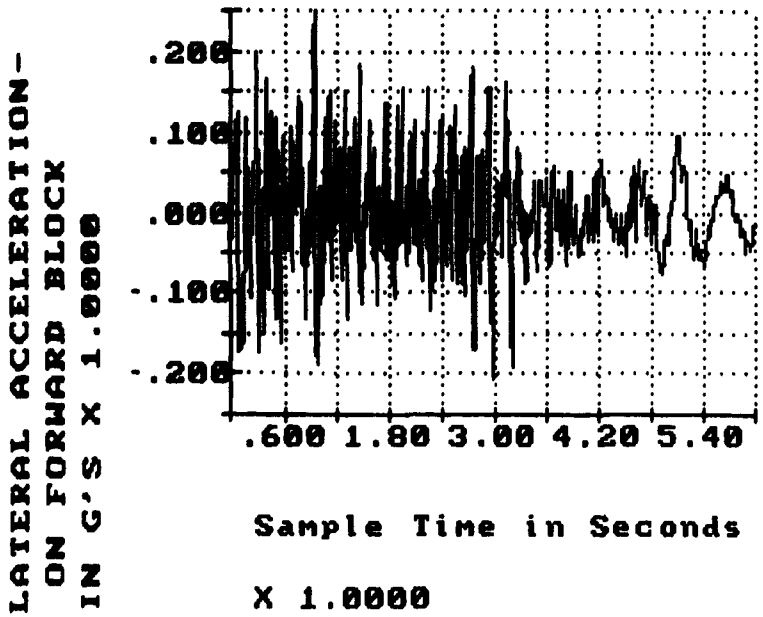


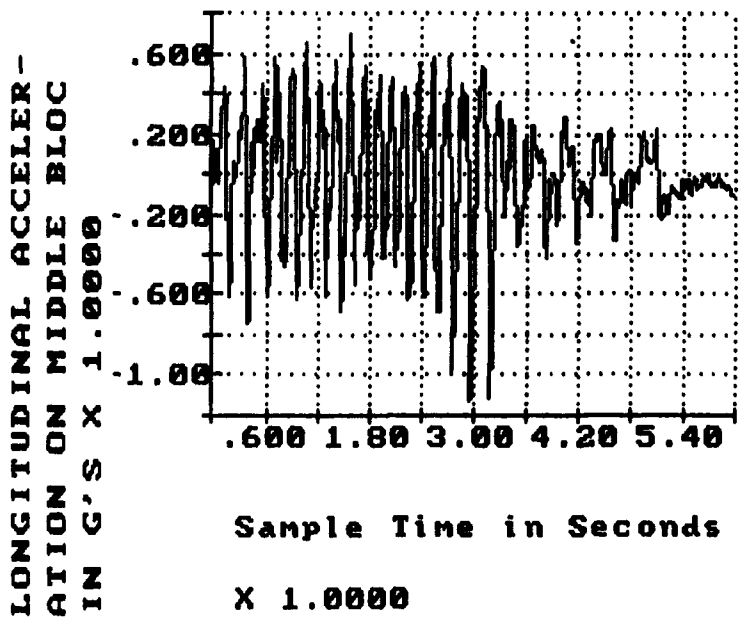


ROAD HAZARD TEST OF ATACMS ON M871 TRAILER
DATE: 20 & 21 JULY 1989
WASHBOARD COURSE









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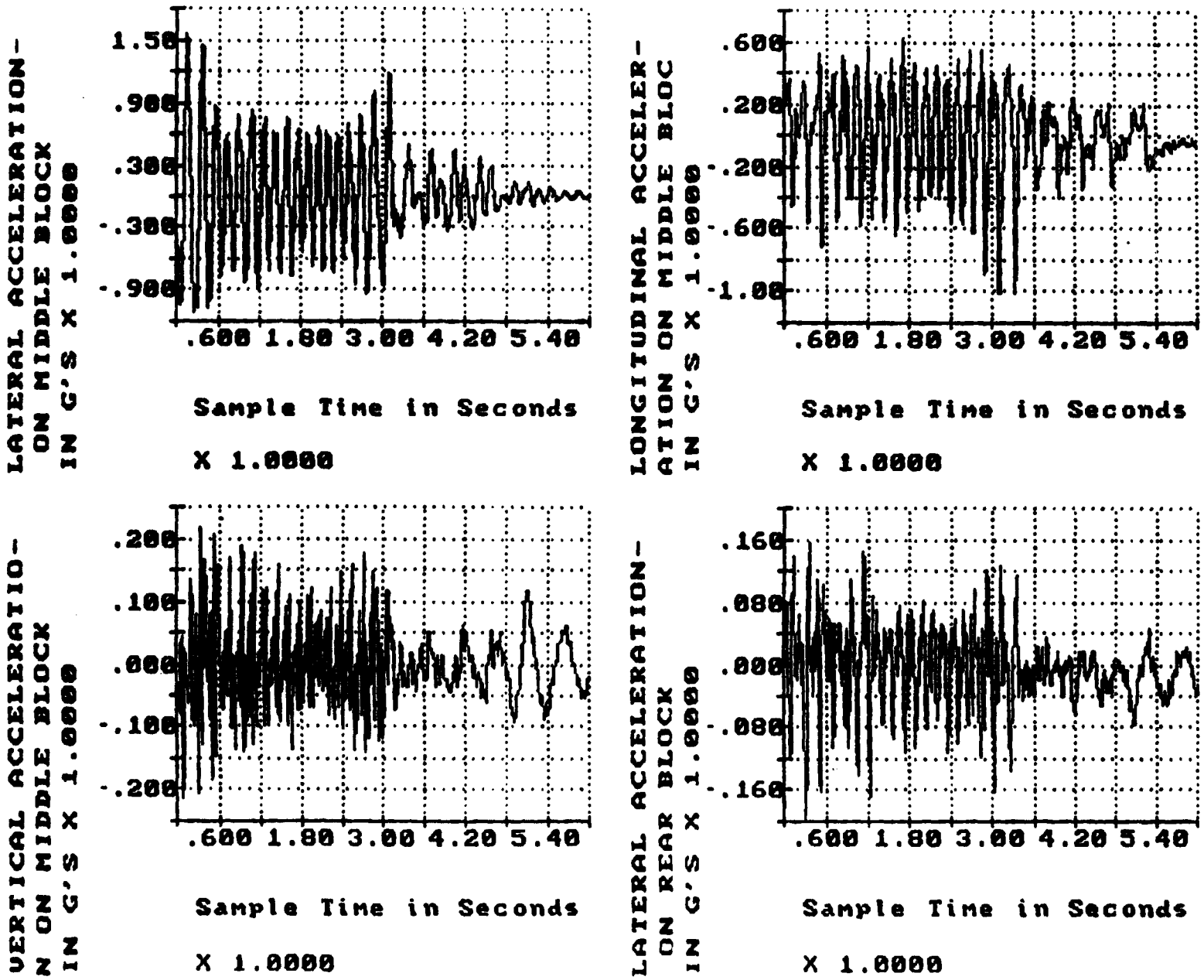

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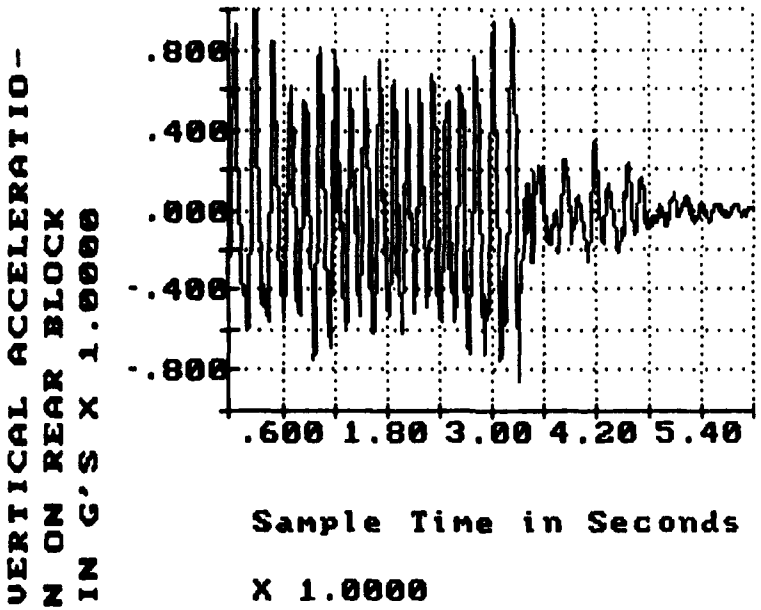

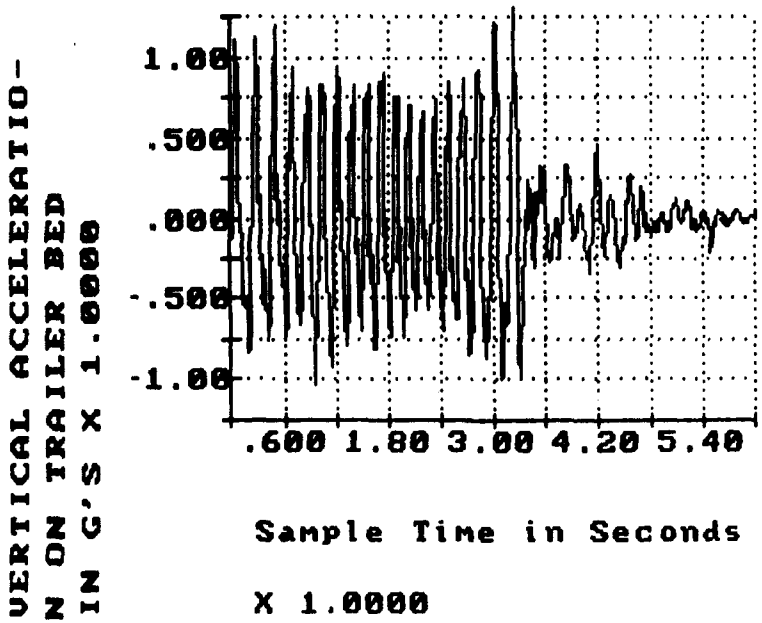

PART 5

BLOCKING AND BRACING PROCEDURES

MLRS

LOADING, TIEDOWN, AND UNLOADING PROCEDURES FOR THE LAUNCH POD/CONTAINER (LP/C) FOR THE MULTIPLE LAUNCH ROCKET SYSTEM IN/ON TACTICAL VEHICLES

INDEX

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SPECIAL TIEDOWN PROCEDURES FOR LOADING ONE THROUGH FOUR CONTAINERS IN/ON A TRUCK, HEAVY EXPANDED MOBILITY, 10 TON, M985 AND/OR A TRAILER, HEAVY EXPANDED MOBILITY, 11 TON, M989, EQUIPPED WITH A "CARGO TIEDOWN KIT"	11-22

REVISIONS			
1	JAN 84	DIW	

U.S. ARMY DARCOM DRAWING

FEBRUARY 1982

CLASS	DIVISION	DRAWING	FILE
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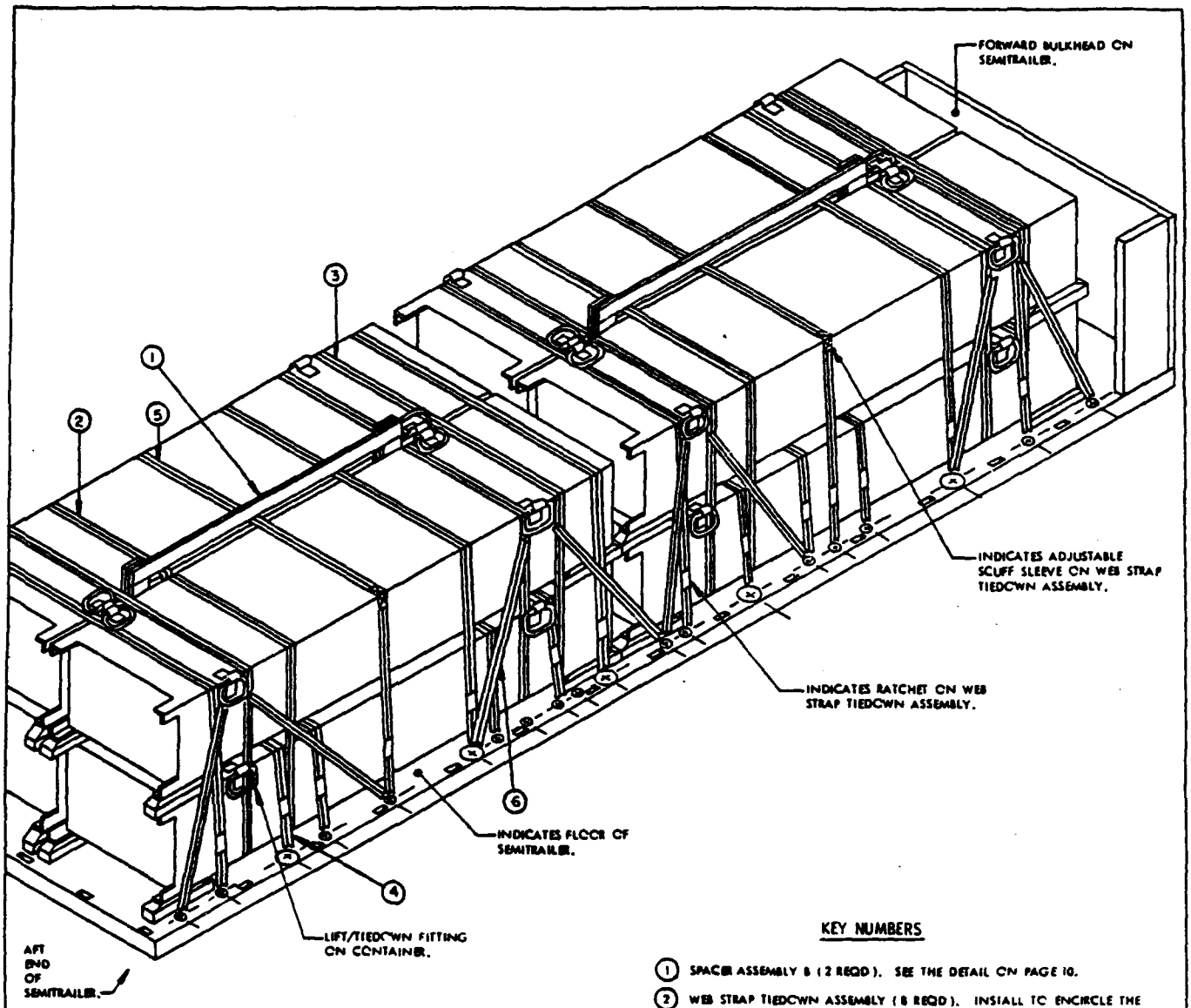
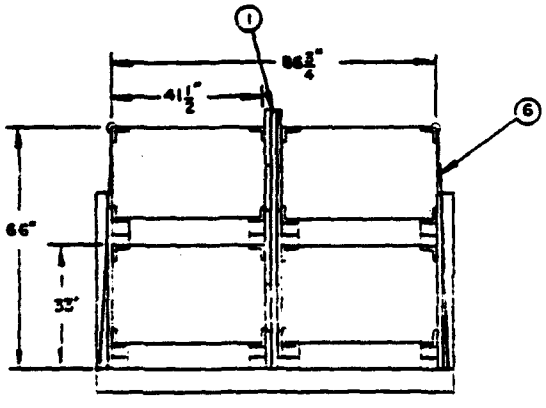
DO NOT SCALE



ISOMETRIC VIEW



REAR VIEW

KEY NUMBERS ②, ③, ④, AND ⑤ HAVE BEEN OMITTED FOR CLARITY.

KEY NUMBERS

1. SPACER ASSEMBLY B (2 REQD). SEE THE DETAIL ON PAGE 10.
2. WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO ENCIRCLE THE TWO (2) CONTAINERS IN THE TWO-HIGH STACKS AS SHOWN.
3. WEB STRAP TIEDOWN ASSEMBLY (4 REQD). (EACH ASSEMBLY WILL CONSIST OF TWO WEB STRAPS HOOKED TOGETHER). INSTALL EACH ASSEMBLY TO ENCIRCLE FOUR CONTAINERS, AS SHOWN. SEE GENERAL NOTE "K" ON PAGE 2.
4. WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO EXTEND FROM A TIEDOWN FITTING ON SIDE OF THE SEMITRAILER, OVER THE BOTTOM CONTAINERS, TO A TIEDOWN FITTING ON THE OPPOSITE SIDE OF THE SEMITRAILER. NOTE: POSITION THESE STRAPS WITH THE STRAP RATCHETS ON THE SAME SIDE OF THE SEMITRAILER. SEE GENERAL NOTE "N" ON PAGE 2.
5. WEB STRAP TIEDOWN ASSEMBLY (8 REQD). INSTALL TO EXTEND FROM A TIEDOWN FITTING ON SIDE OF THE SEMITRAILER, OVER THE CONTAINERS TO A TIEDOWN FITTING ON THE OPPOSITE SIDE OF THE SEMITRAILER. NOTE: POSITION THESE STRAPS WITH THE STRAP RATCHET ON THE SAME SIDE OF THE SEMITRAILER. SEE GENERAL NOTES "M" AND "N" ON PAGE 2.
6. WEB STRAP TIEDOWN ASSEMBLY (16 REQD). INSTALL AT ANGLE SHOWN, TO EXTEND FROM A TIEDOWN FITTING ON THE TOP CONTAINER TO A TIEDOWN FITTING ON THE SIDE OF THE SEMITRAILER. SEE GENERAL NOTE "M" ON PAGE 2.

PAGE 8

EIGHT CONTAINERS

GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1.

B. THIS DRAWING COVERS PROCEDURES APPLICABLE TO THE TRANSPORT OF THE LAUNCH POD/CONTAINERS (LP/C) FOR MULTIPLE LAUNCH ROCKET SYSTEM (MLRS), IN/ON TACTICAL TYPE VEHICLES. IF OTHER TYPES OF CARGO ITEMS ARE TRANSPORTED WITH THAT SHOWN, THE TOTAL LOAD MUST BE COMPATIBLE AND THE ADDED ITEMS MUST BE SECURED WITH WEB STRAP ASSEMBLIES, AS REQUIRED TO PREVENT DISPLACEMENT DURING TRANSPORTATION.

C. DEPICTED PROCEDURES APPLY TO THE VEHICLES DESIGNATED HEREIN, MODIFIED TO INCLUDE THE UNIVERSALLY APPLICABLE "TIE DOWN KIT" WHICH CONSISTS OF THE TIE DOWN FITTINGS OR ANCHOR DEVICES, FOR INSTALLATION IN/ON CARGO BEDS, AND WEB STRAP TIE DOWN ASSEMBLIES, OR MODIFIED TO INCLUDE A SPECIAL "CARGO TIEDOWN KIT" AND WEB STRAP TIEDOWN ASSEMBLIES.

D. AS APPLICABLE TO THE PROCEDURES SHOWN ON PAGES 4 THROUGH 10, WHENEVER POSSIBLE, A LOAD SHOULD BE CENTERED LATERALLY IN/ON CARRYING VEHICLE TO PROVIDE FOR EQUAL ANGLE HOLD DOWN BY THE SECURING WEB STRAP ASSEMBLIES. WHENEVER POSSIBLE, LADING SHOULD BE POSITIONED AGAINST THE FRONT WALL OF THE VEHICLE OR CENTERED LONGITUDINALLY IN/ON THE CARRYING VEHICLE BETWEEN THE SELECTED TIE DOWN FITTINGS TO BE USED. HOWEVER, DUE TO LADING WEIGHT, LADING LENGTH, LADING CONFIGURATION AND/OR LOCATION AND QUANTITY OF TIEDOWN ANCHORS WITHIN THE CARRYING VEHICLE IT MAY BE NECESSARY TO LOCATE THE LADING LONGITUDINALLY IN/ON A VEHICLE AS SHOWN WITHIN THIS DRAWING TO PROVIDE FOR PROPER TIEDOWN AND TO ACHIEVE A MAXIMUM LOAD.

E. WEB STRAP TIEDOWN ASSEMBLIES MUST BE SECURELY HOOKED INTO ANCHORING DEVICES ON THE TRANSPORTING VEHICLE AND FIRMLY TENSIONED. ALSO, WHEN ONE ITEM IS UNITIZED TO ANOTHER, THE HOOKS ON A STRAP MUST BE SECURELY ENGAGED AND THE STRAP FIRMLY TENSIONED. EXERCISE CARE DURING STRAP APPLICATION; AVOID TWISTS IN STRAP TO THE EXTENT POSSIBLE (IF TIME PERMITS) BUT INSURE THERE ARE NO KNOTS IN STRAP. ON THE TAKE-UP SPOOL OF RATCHET, INSURE STRAIGHT LAY OF STRAP WHEN TENSIONING. THE TENSIONED STRAP MUST FORM AT LEAST ONE AND ONE-HALF COMPLETE WRAPS ON THE TAKE-UP SPOOL OF THE TENSIONING RATCHET. TIE BACK THE LOOSE END OF STRAP AFTER TENSIONING IS COMPLETED (LOOSE END MAY BE FOLDED AND TAPED OR TIED TO THE TENSION STRAP IF TIME PERMITS).

F. ADJUSTABLE SCUFF SLEEVES PROVIDED ON WEB STRAP ASSEMBLIES WILL BE LOCATED TO PROVIDE A PAD WHERE STRAPS PASS OVER SHARP EDGES OR RATCHETS AND HOOKS ON PREVIOUSLY INSTALLED WEB STRAP TIEDOWN ASSEMBLIES. METAL PARTS OF A STRAP ASSEMBLY SHOULD BE LOCATED SO AS TO AVOID CONTACT WITH THE CARGO. IF CONTACT CANNOT BE AVOIDED, A SUITABLE ANTI-CHAFING MATERIAL, AS LISTED UNDER THE MATERIAL SPECIFICATIONS BELOW, MUST BE POSITIONED BETWEEN THE METAL PARTS OF A STRAP ASSEMBLY AND THE CARGO AND IF NECESSARY, TAPED OR TIED IN POSITION. IF THE WEB STRAP TIEDOWN ASSEMBLIES BEING USED ARE NOT EQUIPPED WITH ADJUSTABLE SCUFF SLEEVES A SUITABLE ANTI-CHAFING MATERIAL, AS LISTED IN THE MATERIAL SPECIFICATIONS BELOW, MUST BE POSITIONED BETWEEN THE STRAP AND ALL SHARP EDGES AND IF NECESSARY, TAPED OR TIED IN POSITION.

G. CONTAINER DETAIL:

DIMENSIONS: ——— 13'-10" LONG BY 41-1/2" WIDE BY 33" HIGH.
GROSS WEIGHT: ——— 5,078 POUNDS (APPROX).

H. IF THE SIDE RACKS FOR A SEMITRAILER ARE TO BE TRANSPORTED ON THE LOADED TRAILER, THEY WILL BE STACKED ON THE TRAILER AND SECURED WITH A SUFFICIENT QUANTITY OF WEB STRAP TIE DOWN ASSEMBLIES TO PREVENT LOSS DURING TRANSPORT. SIDE RACKS FOR THE M871 AND M872 SEMITRAILERS MAY BE POSITIONED AGAINST THE FORWARD BULKHEAD AND SECURED WITH WEB STRAP TIEDOWN ASSEMBLIES, OR INSTALLED ON THE TRAILERS IN THE APPROVED MANNER.

J. ITEM LOCATION AND QUANTITIES OF THE DESIGNATED ITEM MAY BE VARIED TO SATISFY OPERATIONAL REQUIREMENTS, PROVIDED LOADING AND TIEDOWN PRINCIPLES SPECIFIED HEREIN ARE RETAINED AND A VEHICLE IS NOT OVERLOADED. CAUTION: CONTAINERS MUST NOT BE STACKED MORE THAN TWO HIGH.

K. WHEN ONE WEB STRAP TIEDOWN ASSEMBLY IS NOT LONG ENOUGH TO SPAN THE DISTANCE REQUIRED, TWO ASSEMBLIES MAY BE HOOKED TOGETHER TO GAIN THE NECESSARY LENGTH.

(CONTINUED AT RIGHT)

(GENERAL NOTES CONTINUED)

L. ONLY THE CARGO BODIES OR BEDS OF THE TACTICAL VEHICLES HAVE BEEN SHOWN HEREIN, TO PREVENT DISTRACTION FROM THE DELINEATED LOADING AND TIEDOWN PROCEDURES, AND ARE SHOWN IN ISOMETRIC FORM WITH THE STRUCTURAL PORTIONS OMITTED AS NECESSARY TO IMPROVE THE CLARITY OF THE DEPICTED PROCEDURES.

M. SOME TIEDOWN METHODS WITHIN THIS DRAWING SHOW TWO OR MORE TIEDOWN STRAPS CONNECTED TO ONE VEHICLE TIEDOWN FITTING. THIS IS AUTHORIZED AS SPECIFIED HEREIN. THE APPLIED FORCES WILL NOT EXCEED THE DESIGN STRENGTH OF THE FITTING.

N. WHEN POSSIBLE, ALL OF THE HOLD-DOWN WEB STRAP ASSEMBLIES SHOULD BE POSITIONED WITH THE STRAP RATCHETS LOCATED ON THE SAME SIDE OF THE LOAD. THIS METHOD WILL AID IN REDUCING THE TIME REQUIRED TO LOAD AND UNLOAD A VEHICLE.

O. THE LOADS ON PAGES 6, 7, AND 8 SHOW A "SPACER ASSEMBLY" POSITIONED BETWEEN LATERALLY ADJACENT CONTAINERS. THE SPACER ASSEMBLY IS REQUIRED TO PROVIDE A SPACE BETWEEN THE CONTAINERS FOR THE LIFT/TIEDOWN FITTING BRACKET, WHICH PROJECTS 3/4" OUT FROM SIDE OF CONTAINER. NOTE: THE "SPACER ASSEMBLY" MAY BE OMITTED FOR "EMERGENCY LOGISTIC MOVEMENT" AND THE CONTAINERS MAY BE OFF-SET SO THE LIFT/TIEDOWN-FITTING BRACKETS ARE NOT LATERALLY ADJACENT TO EACH OTHER.

P. THE LOADING AND TIEDOWN PROCEDURES FOR THE M985 10 TON TRUCK AND THE M989 11 TON TRAILER, AS DELINEATED ON PAGES 11 THRU 22, ARE SPECIFICALLY APPLICABLE TO WEAPON SUPPORT/RESUPPLY OPERATIONS. PROCEDURES, AS SPECIFIED FOR BOTH OF THESE VEHICLES, DEPEND ON THE USE OF A SPECIAL CARGO SECUREMENT KIT (FLOOR-MOUNTED DEVICES) THAT HAS BEEN IMPLEMENTED TO SPECIFICALLY ENHANCE WEAPON SUPPORT/RESUPPLY OPERATIONS. ALTHOUGH THE PROCEDURES SPECIFIED ARE SPECIFICALLY APPLICABLE TO WEAPON SUPPORT/RESUPPLY OPERATIONS THEY CAN ALSO BE USED WITHIN OTHER SEGMENTS OF MLRS LP/C SUPPLY TRAINS IF CARGO SECUREMENT KITS ARE INSTALLED ON THE M985 AND/OR M989 VEHICLES USED IN THESE TRAINS.

Q. CAUTION: EXTRA CARE MUST BE TAKEN BY THE VEHICLE OPERATOR (DRIVER) WHEN MOVING A LOADED VEHICLE AND A LOAD UNIT (STACK) ON THE VEHICLE CONTAINS THREE MLRS PODS, AS SHOWN ON PAGES 7, 13 AND 17. A 3-POD LOAD UNIT CAUSES THE TRANSPORTING VEHICLE TO BE HEAVIER ON ONE SIDE AND, THUSLY, MORE UNSTABLE REGARDING VEHICLE TIP OVER. THE REQUIRED EXTRA CARE IS ESPECIALLY APPLICABLE TO THE LOADS DELINEATED ON PAGES 13 AND 17.

MATERIAL SPECIFICATIONS *

STRAP ——— : WEBBING, UNIVERSAL TIE DOWN, NSN 5340-01-089-4997, PN 11669580.

ANTI-CHAFING MATERIAL ——— : CANVAS, BURLAP, TAPE OR ANY OTHER SUITABLE MATERIAL.

LUMBER ——— : BM 745-200-1 (DUNNAGE LUMBER), FED SPEC MM-L-751.

NAILS ——— : FED SPEC FF-N-105; COMMON.

* ADDITIONAL SPECIFICATIONS THAT ARE APPLICABLE TO A SPECIAL "CARGO TIEDOWN KIT" ARE REFLECTED ON PAGE 10.

REVISIONS

REVISION NO [illegible], DATED JANUARY 198[illegible], CONSISTS OF:

1. ADDING SPECIAL TIEDOWN PROCEDURES FOR THE MLRS LP/C IN/ON THE TRUCK, HEAVY EXPANDED MOBILITY, 10 TON M985, AND THE TRAILER, HEAVY EXPANDED MOBILITY, 11 TON, M989.

2. UPDATED GENERAL NOTES, MATERIAL SPECIFICATIONS, AND DRAWINGS FORMAT.

SPECIAL NOTES: (FOR LOADS/VEHICLES SHOWN ON PAGES 4 THROUGH 10)

1. ONLY MAXIMUM LOADS ARE SHOWN FOR THE VEHICLES AND/OR TRAILERS LISTED IN THE CHART AT THE RIGHT. THE MAXIMUM QUANTITY OF CONTAINERS IN A LOAD IS BASED ON THE WEIGHT LIMIT OF THE VEHICLE AND/OR ON THE SIZE OF THE VEHICLE. SEE THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" ON PAGE 9.

2. PAGES 4 THROUGH 8 SHOW METHODS OF LOADING ONE THROUGH EIGHT CONTAINERS. DUE TO THE SIZE OF THE CONTAINER, EIGHT CONTAINERS IS THE MAXIMUM QUANTITY THAT CAN BE LOADED ON A TRAILER. BY USING THE METHODS SHOWN ON PAGES 4 THROUGH 8 AND THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" ON PAGE 9, LOADS OF ONE THROUGH EIGHT CONTAINERS MAY BE ACHIEVED. THESE METHODS ARE APPLICABLE FOR ANY TACTICAL VEHICLE HAVING A SUFFICIENT QUANTITY OF TIEDOWN FITTINGS LOCATED ON THE SIDEWALL OR ON THE FLOOR.

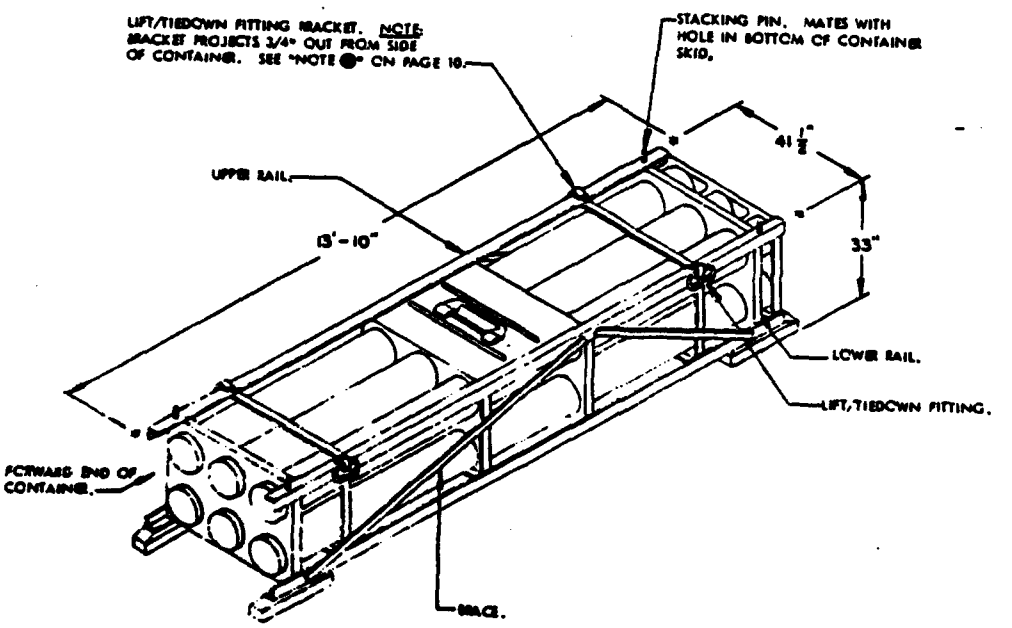
3. THE BEST METHOD OR COMBINATION OF METHODS SHOULD BE SELECTED FOR THE VEHICLE BEING LOADED. THE METHOD USED WILL DEPEND ON THE QUANTITY OF CONTAINERS TO BE LOADED AND THE TYPE OF VEHICLE USED. ANY COMBINATION OF THE LOADS SHOWN ON PAGES 4 THROUGH 8 MAY BE USED WHEN LOADING A VEHICLE.

TYPICAL TACTICAL VEHICLES AND MAXIMUM LOAD PER VEHICLE
(SEE "NOTE ●" BELOW)

TYPICAL TACTICAL VEHICLE AND/OR TRAILER BEING LOADED (SEE "NOTE ●" BELOW)	MAX NUMBER OF CONTAINERS IN LOAD, PER VEHICLE OFF-LOAD WEIGHT LIMIT, OR SIZE OF VEHICLE	SEE THE LOAD OR COMBINATION OF LOADS SHOWN PAGE (S)
TRUCK, CARGO, 2-1/2 TON, M35 AND M35C	ONE CONTAINER (WEIGHT LIMIT)	PAGE 4
TRUCK, CARGO, 5 TON, M54	TWO CONTAINERS (WEIGHT LIMIT)	PAGE 6
TRUCK, CARGO, 5 TON, M55	TWO CONTAINERS (WEIGHT LIMIT)	PAGE 6
TRUCK, CARGO, 1 TON, M520	TWO CONTAINERS (LIMITED TO VEHICLE SIZE)	PAGE 5
TRUCK, HEAVY EXPANDED MOBILITY, 10 TON, M977/M985	FOUR CONTAINERS (WEIGHT LIMIT)	PAGE 8
TRAILER, CARGO, 11 TON	FOUR CONTAINERS (WEIGHT LIMIT)	PAGE 8
SEMITRAILER, STAKE, 12 TON, M127	FIVE CONTAINERS (WEIGHT LIMIT)	PAGE 4 AND PAGE 8 OR PAGE 6 AND PAGE 7
SEMITRAILER, 22-1/2 TON, M871	EIGHT CONTAINERS (WEIGHT LIMIT)	PAGE 8
SEMITRAILER, 34 TON, M872	EIGHT CONTAINERS (LIMITED TO VEHICLE SIZE)	PAGE 8

NOTE ●:

THE TACTICAL VEHICLES LISTED IN THE CHART ABOVE AND/OR AS SHOWN WITHIN THIS DRAWING WERE SELECTED AS TYPICAL ONLY. OTHER TYPES OF VEHICLES MAY BE USED IN LIEU OF THOSE SHOWN, AS LONG AS THEY COMPLY WITH GENERAL NOTE "C" ON PAGE 2. SEE THE "LOAD PLANNING GUIDANCE FOR ONE THROUGH EIGHT CONTAINERS" CHART ON PAGE 9. SPECIFIC LOADING AND TIEDOWN PROCEDURES COVERING 1 THRU 4 LP/C UNITS ON THE M985 10 TON HEAVY EXPANDED MOBILITY TACTICAL TRUCK AND ON THE M989 11 TON HEAVY EXPANDED MOBILITY AMMUNITION TRAILER ARE SPECIFIED ON PAGES 11 THRU 22. NOTE THAT IF THE M985 AND M989 VEHICLES ARE NOT EQUIPPED WITH A SPECIAL "CARGO TIEDOWN KIT", THE LOADING AND TIEDOWN PROCEDURES SPECIFIED ON PAGES 4 THRU 9 WILL BE USED TO SECURE 1 THRU 4 LP/C UNITS ON THESE VEHICLES.



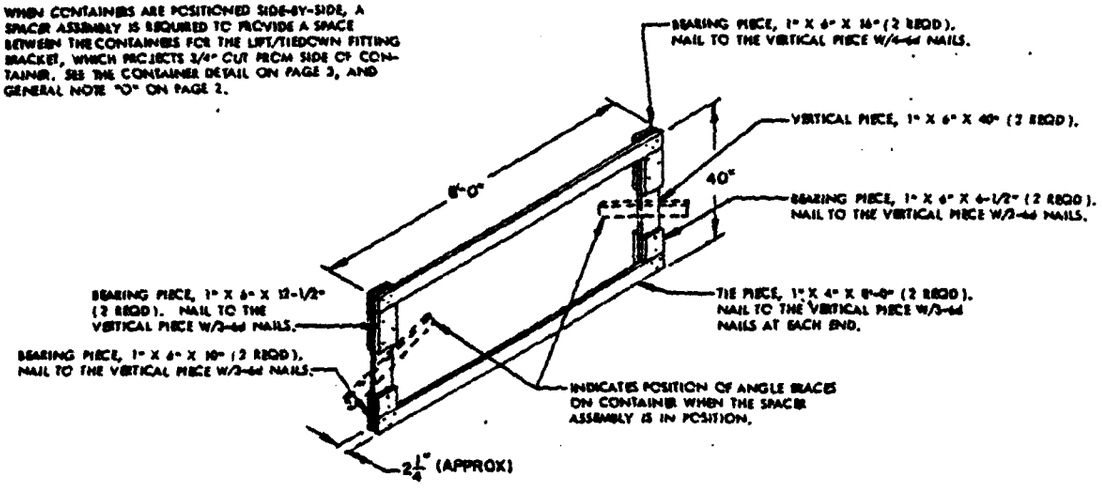
LAUNCH POD/CONTAINER
(WEIGHT: 5,878 POUNDS)

5-5

CONTAINER DETAIL

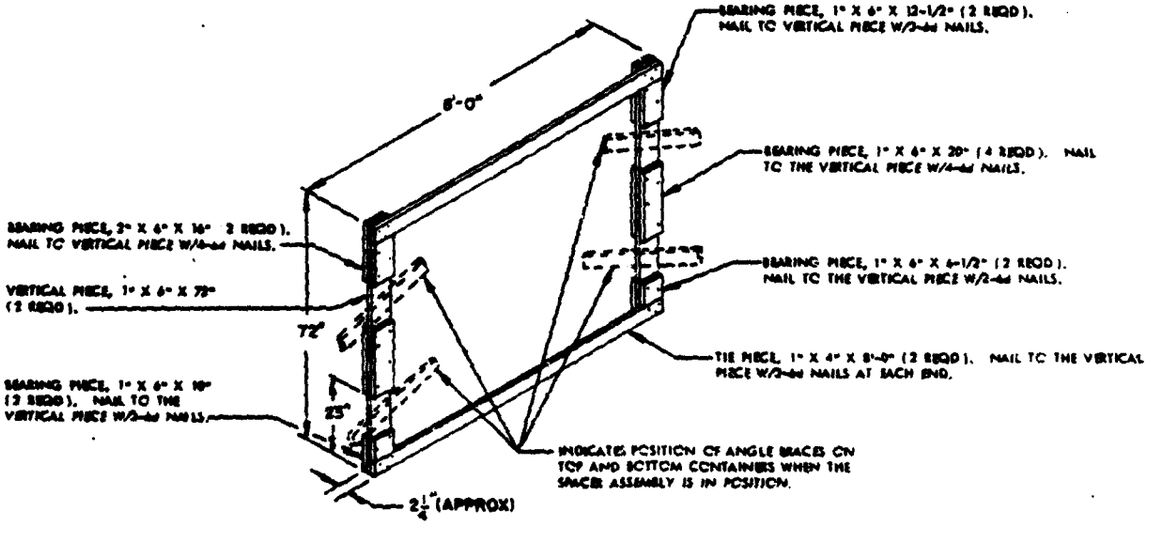
NOTE ●:

WHEN CONTAINERS ARE POSITIONED SIDE-BY-SIDE, A SPACER ASSEMBLY IS REQUIRED TO PROVIDE A SPACE BETWEEN THE CONTAINERS FOR THE LIFT/TIEDOWN FITTING BRACKET, WHICH PROJECTS 3/4" OUT FROM SIDE OF CONTAINER. SEE THE CONTAINER DETAIL ON PAGE 3, AND GENERAL NOTE "O" ON PAGE 2.



SPACER ASSEMBLY A

THIS ASSEMBLY IS FOR USE BETWEEN ONE CONTAINER HIGH LOADS. WHEN FABRICATING THIS ASSEMBLY FIELD CHECK DIMENSIONS TO ASSURE THAT THE ANGLE BRACES ON THE CONTAINERS WILL FIT AS SHOWN ABOVE AND THE BEARING PIECES ON THE SPACER ASSEMBLY WILL CONTACT THE LOWER AND UPPER RAILS ON THE CONTAINER. SEE THE DETAIL ON PAGE 3 AND "NOTE ●" ON THIS PAGE.



SPACER ASSEMBLY B

THIS ASSEMBLY IS FOR USE BETWEEN TWO CONTAINER HIGH LOADS. WHEN FABRICATING THIS ASSEMBLY FIELD CHECK DIMENSIONS TO ASSURE THAT THE ANGLE BRACES ON THE CONTAINERS WILL FIT AS SHOWN ABOVE AND THE BEARING PIECES ON THE SPACER ASSEMBLY WILL CONTACT THE LOWER AND UPPER RAILS ON THE CONTAINER. SEE THE CONTAINER DETAIL ON PAGE 3 AND "NOTE ●" ON THIS PAGE.

PROPOSED LOADING AND BRACING PROCEDURES FOR ATACMS ROCKET POD/CONTAINERS ON COMMERCIAL FLATRACK CONTAINER

INDEX

ITEM	PAGE (S)
ISOMETRIC OF FULL LOAD PROCEDURES	2
DESCRIPTION OF KEY NUMBERS	3
GATE DETAILS	4-5

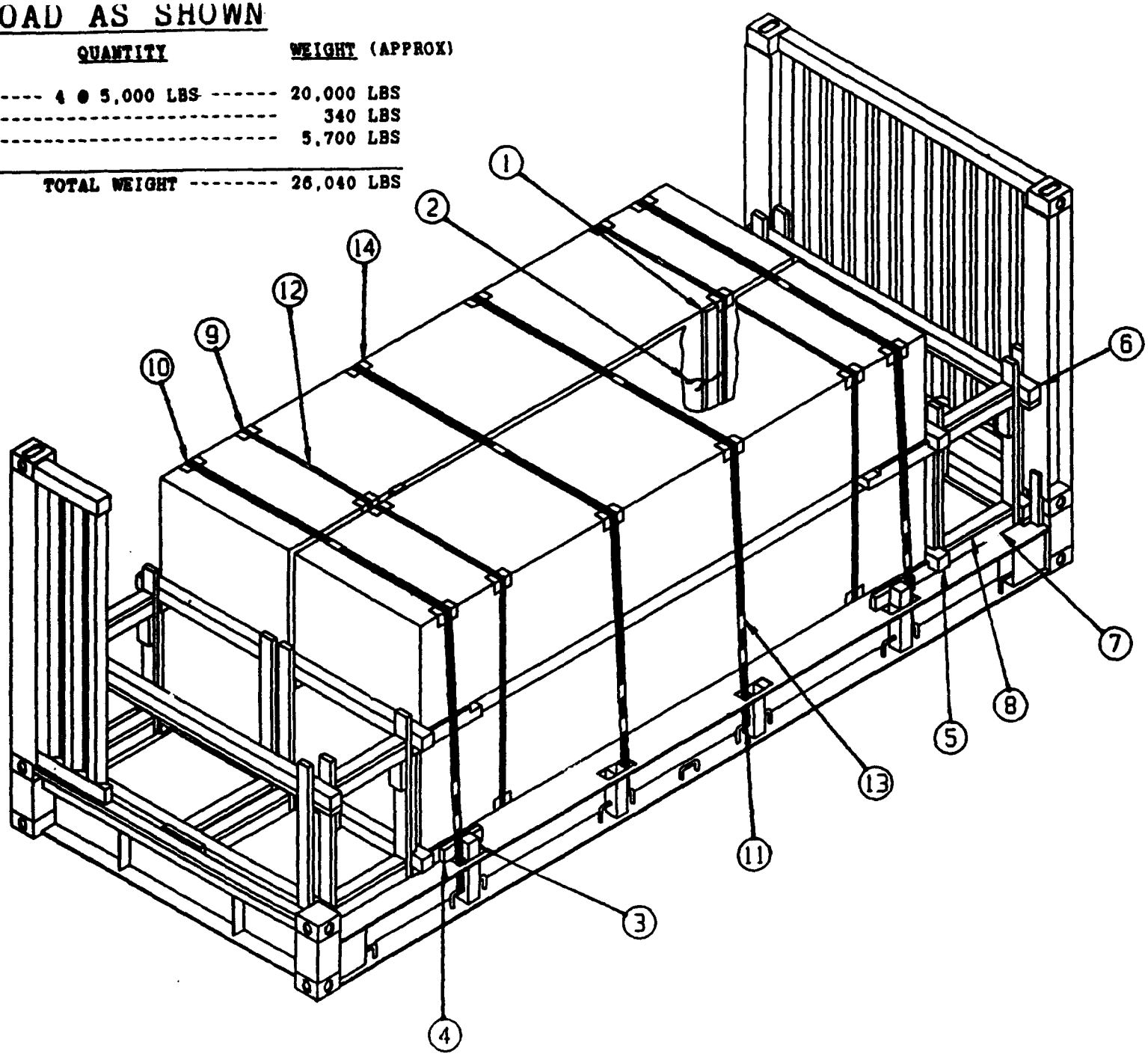
NOTE: This 5 page document delineates proposed outloading procedures to be used for the shipment of ATACMS Rocket Pod/Containers when loaded on Commercial Flatrack Container. The procedures as delineated are to be verified by rail impact, road transportability, and shipboard simulation tests prior to their approval for actual shipment.

Prepared during July 1989 by:

U.S. Army Defense Ammunition
Center and School
ATTN: SMCAC-DEO
Savanna, IL 61074-9639

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
ATACMS PODS	4 @ 5,000 LBS	20,000 LBS
DUNNAGE		340 LBS
FLATRACK		5,700 LBS
TOTAL WEIGHT		26,040 LBS



1 CENTER FILL PIECE, 2"X 4"X 62-1/2" (2 REQD). POSITION A CENTER FILL PIECE APPROXIMATELY 34" FROM EACH END OF THE LOAD AS SHOWN.

2 TIE WIRE, NO. 14 GAGE, 24" LONG (4 REQD). FASTEN EACH CENTER FILL PIECE, PIECE MARKED 1, TO ONE STACK OF PODS AT TWO LOCATIONS BY LOOPING WIRE AROUND FRAME OF POD, BRINGING ENDS TOGETHER, AND TWISTING TAUT.

3 STAKE, 4"X 4"X 15" (4 REQD). INSTALL THE STAKES INTO THE FLATRACK STAKE POCKETS WITH A TIGHT (SNUG) FIT. NOTE: REFERENCE DIMENSIONS FOR A TIGHT FITTING STAKE ARE 3-1/4"(ACTUAL) X 3-1/4"(ACTUAL). TOENAIL TO THE FILLER PIECE, PIECE MARKED 4, W/2-10d NAILS ON EACH SIDE OF THE STAKE. NAIL 1-20d NAIL THROUGH THE HOLE PROVIDED IN THE FACE OF THE FLATRACK STAKE POCKET AND INTO THE STAKE. BEND THE PROTRUDING HEAD OF THE NAIL OVER AGAINST THE STAKE POCKET.

4 FILLER PIECE, 2"X 4"X 12" (4 REQD). CENTER ON FACE OF THE STAKE, PIECE MARKED 3, AS SHOWN.

5 LOAD BEARING GATE (2 REQD). SEE THE "LOAD BEARING GATE" DETAIL. CENTER ASSEMBLY AGAINST END OF LOAD.

6 END WALL GATE (2 REQD). SEE THE "END WALL GATE DETAIL". POSITION AS SHOWN SO THE RETAINER PIECES ARE LOCATED ON THE INSIDE EDGES OF THE CORNER POSTS. NOTE: NAIL A 1" X 4" X 5" SHIM TO FACE OF EACH END OF THE LOWER BEAM ASSEMBLY TO PROVIDE A UNIFORM FIT OF THE GATE AGAINST THE CORNER POSTS.

7 STRUT "A", 4" X 4" BY CUT-TO-FIT (REF: 22") (12 REQD). INSTALL AS SHOWN AND TOENAIL EACH END TO THE GATE W/2-12d NAILS.

8 STRUT "B", 2" X 4" BY CUT-TO-FIT (REF: 22") (12 REQD). LAMINATE TO STRUT "A" , PIECE MARKED 7, W/4-10d NAILS.

9 STACK UNITIZING STRAP, 1-1/4" X .035" OR .031" BY A LENGTH-TO-SUIT (REF:19'-0") (4 REQD). INSTALL EACH UNITIZING STRAP TO ENCIRCLE A STACK OF PODS AS SHOWN ABOVE.

10 HOLD-DOWN STRAP, 2" X .044 OR .050" BY A LENGTH-TO-SUIT (REF: 26'-0") (4 REQD). INSTALL EACH STRAP FROM TWO 13'-0" LONG PIECES FASTENED TO THE TIEDOWN PROVISIONS ON THE SIDES OF THE FLATRACK AND ON TOP OF THE LOAD AS SHOWN ABOVE.

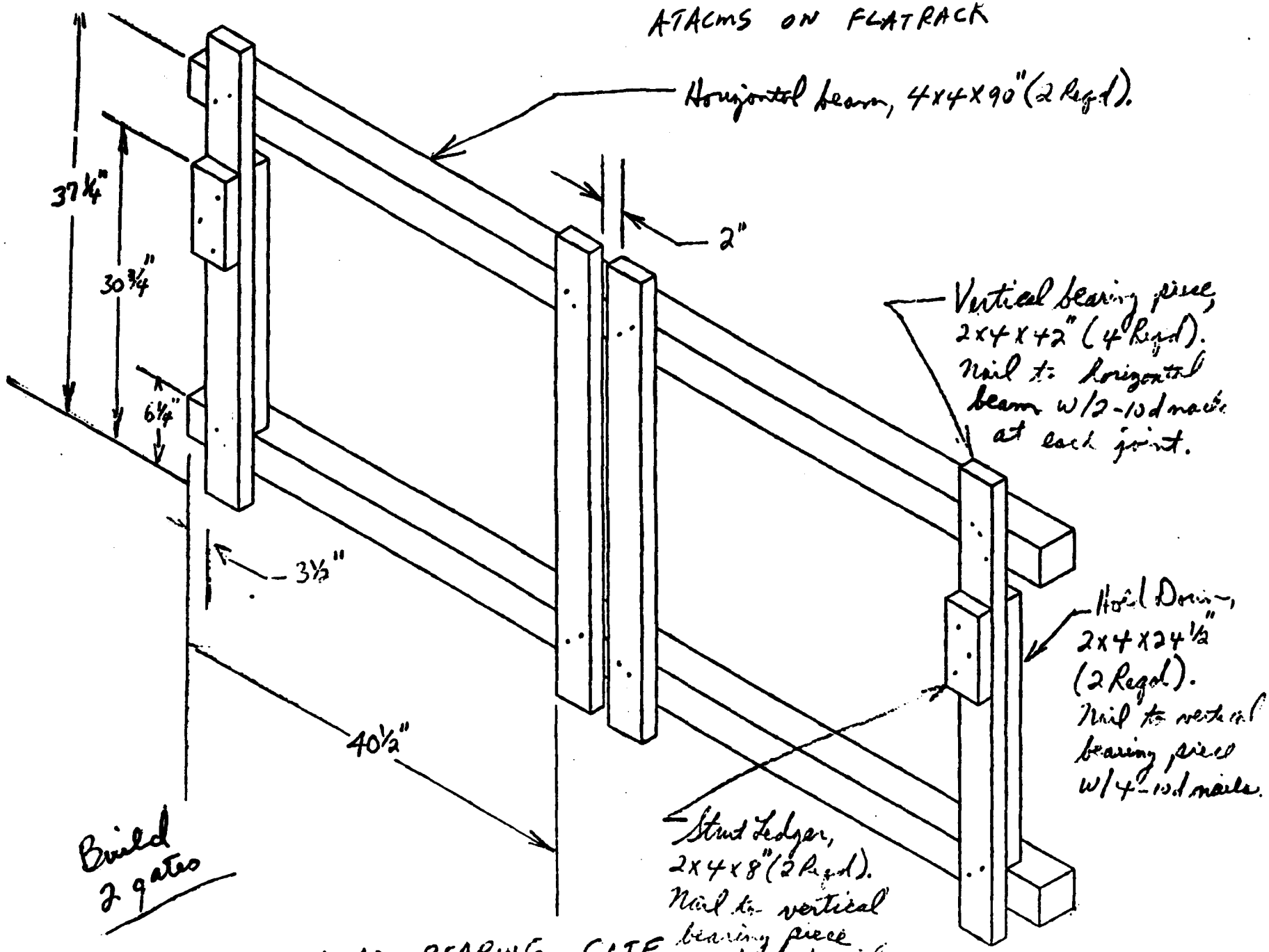
11 PAD, STRAPPING, 2" X .044" OR .050 X 18" (8 REQD). PRE-POSITION THE PAD BETWEEN THE HOLD-DOWN STRAP, PIECE MARKED 10, AND THE FLATRACK TIEDOWN PROVISION AND SECURE WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES.

12 SEAL FOR 1-1/4" STRAPPING (4 REQD, 1 PER STRAP). FASTEN EACH STACK UNITIZING STRAP, PIECE MARKED 9, WITH ONE SEAL, CRIMPED WITH TWO PAIR OF NOTCHES.

13 SEAL FOR 2" STRAPPING (20 REQD, 5 PER STRAP). FASTEN EACH HOLD-DOWN STRAP, PIECE MARKED 10, AT THREE LOCATIONS (SIDES AND TOP) WITH ONE SEAL CRIMPED WITH TWO PAIR OF NOTCHES AT EACH LOCATION. FASTEN EACH STRAPPING PAD, PIECE MARKED 11, WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES. SEE GENERAL NOTE "K" ON PAGE 2.

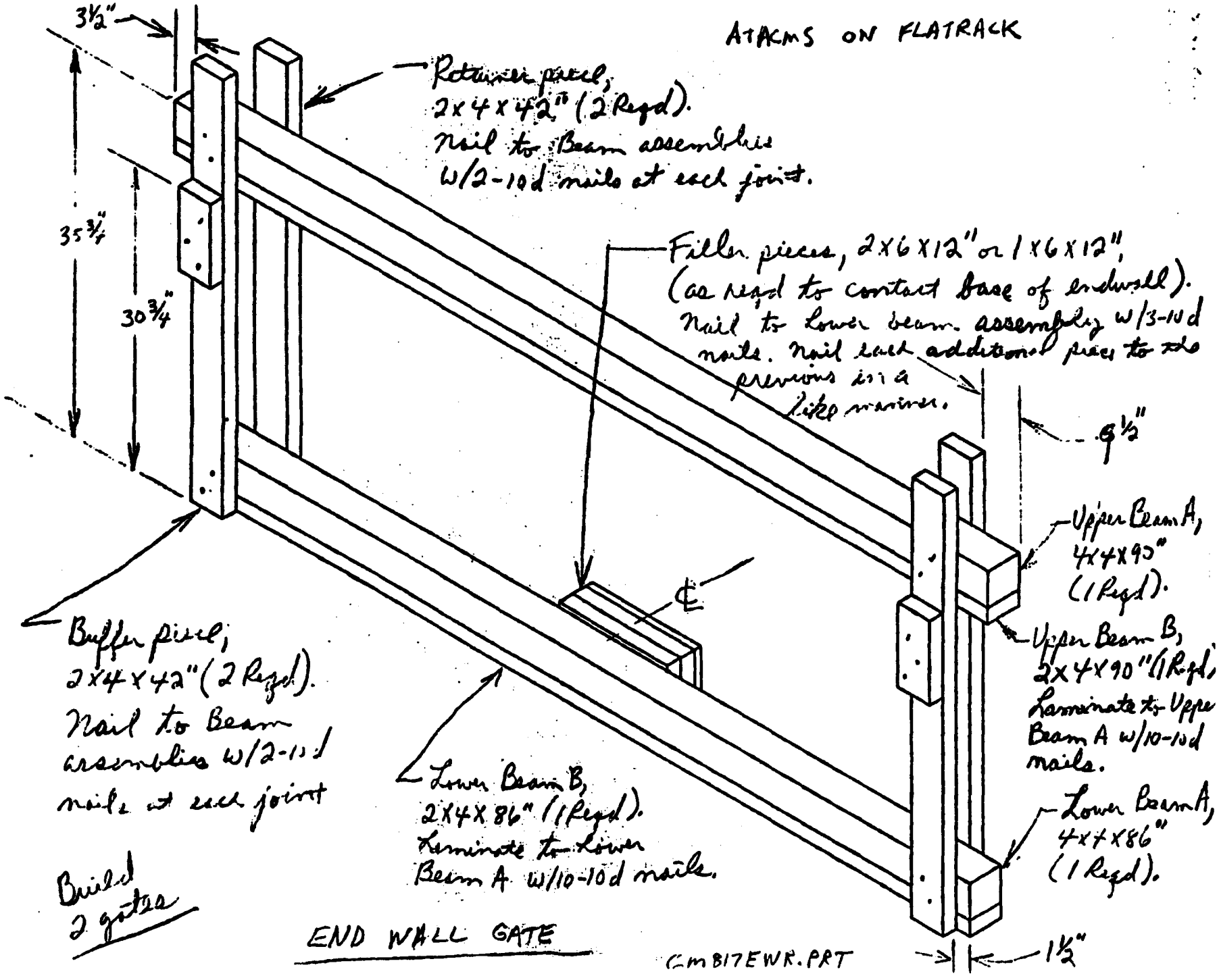
14 EDGE PROTECTOR, FOLDED FIBERBOARD (AS REQD). POSITION UNDER THE STACK UNITIZING STRAPS, PIECES MARKED 9, AND UNDER THE HOLD-DOWN STRAPS, PIECES MARKED 10, AT POINTS OF CONTACT WITH EDGES OF THE POD'S FRAME.

ATACMS ON FLATRACK



LOAD BEARING GATE

ATACMS ON FLATRACK



Build 2 gates

END WALL GATE

CMB17EWR.PRT

APPROVED BY U.S. COAST GUARD	APPROVED BY HAZARDOUS MATERIALS SYSTEMS (BCE) ASSOCIATION OF AMERICAN RAILROADS
DATE 9/15/87	DATE

MLRS

LOADING AND BRACING◑ WITH LOAD AND ROLL PLATFORM● IN COMMERCIAL CONTAINERS OF ROCKET POD/ CONTAINERS (RP/C) FOR MULTIPLE LAUNCH ROCKET SYSTEM, FOR SHIPMENT BY T/COFC CARRIER

● THE LOAD AND ROLL PLATFORM IS A COMMERCIAL PRODUCT. FOR A SOURCE OF SUPPLY, CONTACT CONTAINER CONCEPTS, INC., 1521 BOLSON DRIVE, DOWNERS GROVE, IL 60516. PHONE 1-312-968-1835.

◑ LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLAT-CAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS. SEE GENERAL NOTE "L" ON PAGE 2.

REVISIONS	
	U.S. ARMY AMC DRAWING
	DEP AMMO CEN & SCH DWG NO
	D-SMCAC-4465

DO NOT SCALE

GENERAL NOTES

THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND ALIGNMENTS TM 743-200-1 (CHAPTER 5).

THIS DOCUMENT HAS BEEN PREPARED AND ISSUED TO SUPPORT A TRIAL SHIPMENT PROGRAM. THE QUILOADING PROCEDURES DEPICTED HEREIN ARE APPLICABLE TO THE MULTIPLE LAUNCH ROCKET SYSTEM ROCKET POD/CONTAINER (RP/C). SUBSEQUENT REFERENCE TO CONTAINER HEREIN MEANS THE RP/C WITH ROCKET COMPONENTS.

FOR DETAILS OF THE ROCKET POD/CONTAINER, SEE US ARMY MISSILE COMMAND DRAWING NO. 13027900.

CONTAINER DIMENSIONS ----19'-0" LONG BY 61-1/2" WIDE BY 39" HIGH

GROSS WEIGHT ----------5,[illegible] POUNDS (APPROX).

THIS ITEM IS A DOT CLASS "A" EXPLOSIVE, AND A COAST GUARD CLASS X-C. THE QUILOADING PROCEDURES SPECIFIED HEREIN CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED CONTAINERS WHEN THEY ARE LOADED WITH AN ITEM WHICH IS IDENTIFIED DIFFERENTLY BY NOMENCLATURE THAN THE ITEM DESIGNATED IN THE DRAWING TITLE.

THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20'-0" LONG BY 8'-0" WIDE BY 8'-6" HIGH INTERMODAL COMMERCIAL CONTAINER WITH INSIDE DIMENSIONS OF 19'-4" LONG BY [illegible]" WIDE BY 95" HIGH. THE LOAD IS DESIGNED FOR TRAILER/CONTAINER-ON-FLATCAR (T/COFC) SHIPMENT, HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.

WHEN LOADING THE CONTAINERS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE TIGHT LOAD (TIGHT AGAINST THE FORWARD BLOCKING ASSEMBLY). ALTHOUGH A TOTAL OF ONE AND ONE-HALF INCHES OF UNBLOCKED SPACE ACROSS THE WIDTH OF THE LOAD BAY IS PERMITTED, LATERAL VOIDS WITHIN THE LOAD ARE TO BE HELD TO A MINIMUM. EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE FILL PIECES ON THE CORNER RETAINER PIECES. NAIL EACH ADDITIONAL PIECE TO THE FILL PIECE W/A APPROPRIATELY SIZED NAILS. ADDITIONALLY, THE THICKNESS OF THE FILL PIECES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE LENGTH OF THE LOAD AND ROLL PLATFORM.

DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 6" MATERIAL IS ACTUALLY 3/4" THICK BY 5-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" BY 5-1/2" WIDE.

WHEN STEEL STRAPPING IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER, WITH TWO PAIR OF CRIMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP TYPE SEALER IS BEING USED. REFER TO THE "STRAP JOINT A" AND "STRAP JOINT B" DETAILS ON PAGE 3 FOR GUIDANCE.

PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS ONE OF THE SIDE WALLS, HAVE NOT BEEN SHOWN IN THE LOAD VIEW FOR CLARITY PURPOSES.

DIMENSIONS GIVEN FOR DUNNAGE PIECES OR ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY AND INSTALLATION IN THE COMMERCIAL CONTAINER.

REQUIREMENTS CITED WITHIN THE BUREAU OF EXPLOSIVES PAMPHLET 6C APPLY WHEN THE SHIPMENT MOVES BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC). SPECIAL T/COFC NOTES FOLLOW:

1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN TOFC SERVICE.

2. THE LOAD LIMIT OF A T/COFC RAILCAR MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.

(CONTINUED AT RIGHT)

MATERIAL SPECIFICATIONS

1. ---------- TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC [illegible]-L-751.

2. ---------- FED SPEC PP-[illegible]-100, COMMON.

3. ---------- FED SPEC QQ-[illegible]-461.

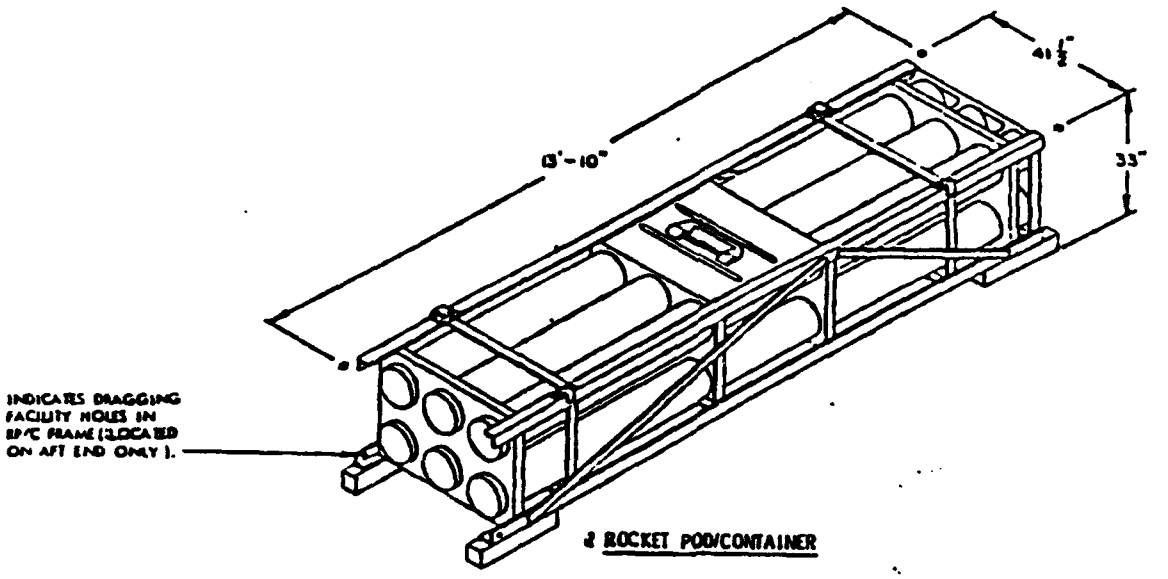
4. ROLL PLATFORM - US P-[illegible]-A1, PATENT PENDING 763[illegible].

5. CHAFING MATERIAL
[illegible] ---------- FED SPEC PPP-F-320 TYPE SF (SOLID FIBERBOARD).

(GENERAL NOTES CONTINUED)

M. DURING INTRASTATE AND/OR INTERSTATE MOVES BY MOTOR CARRIER, A PROPER CHASSIS/MODIFIED FLAT BED TRAILER MUST BE USED TO PRECLUDE VIOLATION OF ONE OR MORE "WEIGHT LAWS" APPLICABLE TO THE STATE OR STATES INVOLVED.

N. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4MM AND ONE POUND EQUALS 0.454KG.



2 ROCKET POD/CONTAINER

SPECIAL HANDLING GUIDANCE

1. CONTAINER STACKING FOR OUTLOADING PURPOSES.

   A. THE UPPER CONTAINER SHOULD BE PLACED AS CLOSELY AS POSSIBLE IN VERTICAL ALIGNMENT WITH THE LOWER CONTAINER.

   B. WHEN STACKING THESE CONTAINERS, CARE MUST BE EXERCISED TO ENSURE THAT THE INTERLOCKING HOLES IN THE BOTTOM OF THE CONTAINER SKIDS ALIGN CORRECTLY WITH THE INTERLOCKING PINS ON THE TOP OF THE CONTAINER FRAME. THIS WILL PRECLUDE DAMAGE TO THE SKIDS AND INSURE PROPER FUNCTIONING OF THE CONTAINER INTERLOCKS.

2. CONTAINER OR CONTAINER STACK HANDLING.

   NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED CONTAINERS.

   (2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.

   A. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR HANDLING THE DEPICTED CONTAINERS.

   B. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE CONTAINERS SHOULD BE HANDLED FROM A SIDE POSITION ONLY. CARE MUST BE EXERCISED WHEN INSERTING THE FORKS UNDER THE CONTAINER TO PREVENT DAMAGE TO THE CONTAINER BY THE FORK TINES OR THE FORKLIFT PACKAGE GUARD. ADDITIONALLY, THE FORK TINES SHOULD BE PLACED UNDER THE CONTAINER'S STRONGEST AREAS, THAT IS, THE LATERAL FRAME MEMBERS/BULKHEADS LOCATED NEAR THE LONGITUDINAL CENTER OF THE CONTAINER.

3. MECHANICAL CONTAINER LOADING.

   A. NOTE: FOR EASE IN LOADING THE LOAD AND ROLL PLATFORM INTO THE COMMERCIAL CONTAINER, SET THE FORWARD END OF THE LOAD AND ROLL PLATFORM IN THE OPEN END OF THE COMMERCIAL CONTAINER AND INSTALL APPROPRIATELY SIZED 4" BY PLATFORM WIDTH MATERIAL UNDER THE REAR OF THE LOAD AND ROLL PLATFORM UNTIL THE PLATFORM IS LEVEL HORIZONTALLY.

   B. LOAD THE CONTAINERS OR CONTAINER STACKS BY FIRST INSERTING THE FAR SKIDS IN THE CENTER SKID HOLDERS ON THE LOAD AND ROLL PLATFORM, THEN LOWERING AND INSERTING THE REAR SKIDS INTO THE OUTSIDE SKID HOLDERS ON THE PLATFORM. NOTE: THE AFT END OF THE CONTAINERS MUST BE POSITIONED AT THE FORWARD END OF LOAD AND ROLL PLATFORM.

   C. APPLY THE STACK UNITIZING STRAP. NOTE: FIBERBOARD ANTI-CHAFING MATERIAL MUST BE INSTALLED UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE CONTAINERS.

(CONTINUED AT RIGHT)

(SPECIAL HANDLING GUIDANCE CONTINUED)

   D. INSTALL THE CENTER FILL PIECES. POSITION THE CENTER FILL PIECES SO THAT THEY ARE SUPPORTED BY THE TOP SIDE OF THE FORK POCKET (TUNNEL) ON THE LOAD AND ROLL PLATFORM. WIRE TIE THE CENTER FILL PIECES TO THE CONTAINER FRAME.

   E. NEXT, LOAD AND UNITIZE THE REMAINING CONTAINERS IN THE MANNER DETAILED IN PARAGRAPHS 3B AND 3C AT LEFT.

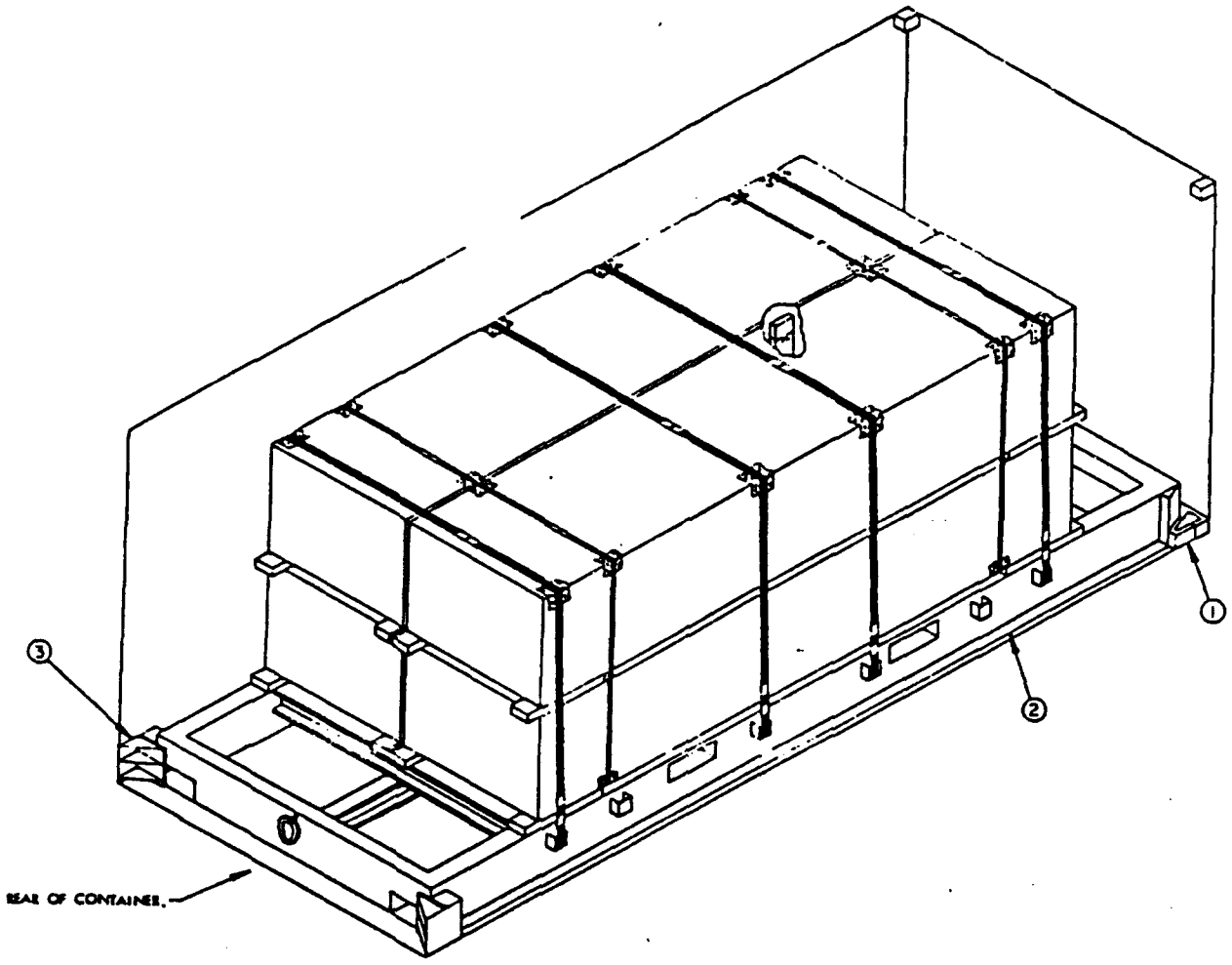
   F. APPLY THE HOLD-DOWN STRAPS, POSITIONING FIBERBOARD ANTI-CHAFING MATERIAL UNDER THE STRAPS AT ALL POINTS OF CONTACT WITH THE CONTAINERS. CAUTION: THE HOLD-DOWN STRAPS MUST BE INSTALLED WITH CARE SO AS NOT TO HAVE EDGE-TO-EDGE CONTACT WITH THE STACK UNITIZING STRAPS.

   G. POSITION THE FORWARD BLOCKING ASSEMBLY IN THE COMMERCIAL CONTAINER. LIFT THE REAR END OF THE LOAD AND ROLL PLATFORM WITH APPROPRIATELY SIZED MHE UNTIL ONLY THE ROLLER CONTACTS THE COMMERCIAL CONTAINER FLOOR (REF: 4"). ROLL THE PLATFORM INTO THE CONTAINER UNTIL IT CONTACTS THE FORWARD BLOCKING ASSEMBLY. SET THE REAR OF THE PLATFORM ON THE COMMERCIAL CONTAINER FLOOR. INSTALL THE CORNER RETAINER PIECES AND FILL MATERIAL AS NECESSARY.

UNLOADING THE LOAD AND ROLL PLATFORM FROM THE COMMERCIAL CONTAINER.

   A. THE LOAD AND ROLL PLATFORM MAY BE UNLOADED USING THE REVERSE OF THE METHOD DETAILED IN 3G ABOVE.

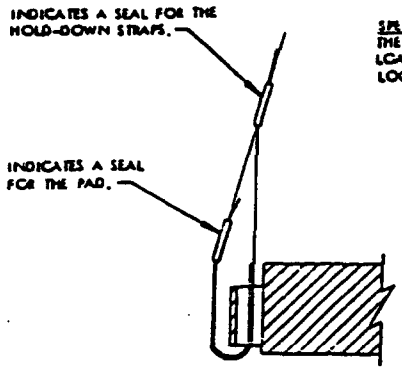
   B. THE LOAD AND ROLL PLATFORM MAY ALSO BE UNLOADED USING A VEHICLE WITH AN APPROPRIATELY SIZED WINCH. FIRST, REMOVE THE CORNER RETAINER PIECES. ATTACH THE WINCH TO THE D-RING ON THE REAR OF THE LOAD AND ROLL PLATFORM. RAISE THE PLATFORM UNTIL THE ROLLER CONTACTS THE COMMERCIAL CONTAINER FLOOR, AND PULL THE CONTAINER [illegible] THE WINCHING VEHICLE. BRAKE CARE NOT TO PULL THE PLATFORM TOTALLY OUT OF THE COMMERCIAL CONTAINER. SET BLOCKING UNDER THE REAR END OF THE PLATFORM, AND UNLOAD THE MLRS CONTAINERS, USING APPROPRIATELY SIZED MHE.



ISOMETRIC VIEW

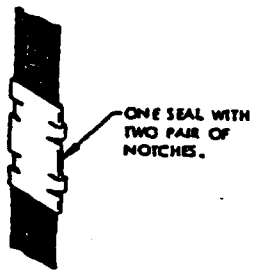
KEY NUMBERS

1. FORWARD BLOCKING ASSEMBLY (1 REQD).
2. LOAD AND ROLL PLATFORM, LOADED (1 REQD). SEE THE DETAIL ON PAGE 6.
3. CORNER RETAINER PIECE (2 REQD).



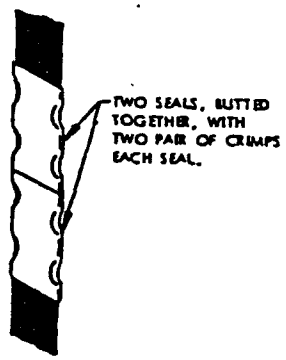
SPECIAL NOTE:
THE SEAL(S) USED TO FASTEN THE HOLD-DOWN STRAPS TO LOAD AND ROLL PLATFORM TIEDOWN ANCHOR SHOULD BE LOCATED A MINIMUM OF 18" ABOVE THE PLATFORM DECK.

TIEDOWN DETAIL



STRAP JOINT A

METHOD OF SECURING A STRAP JOINT WHEN USING A NOTCH-TYPE SEALER.



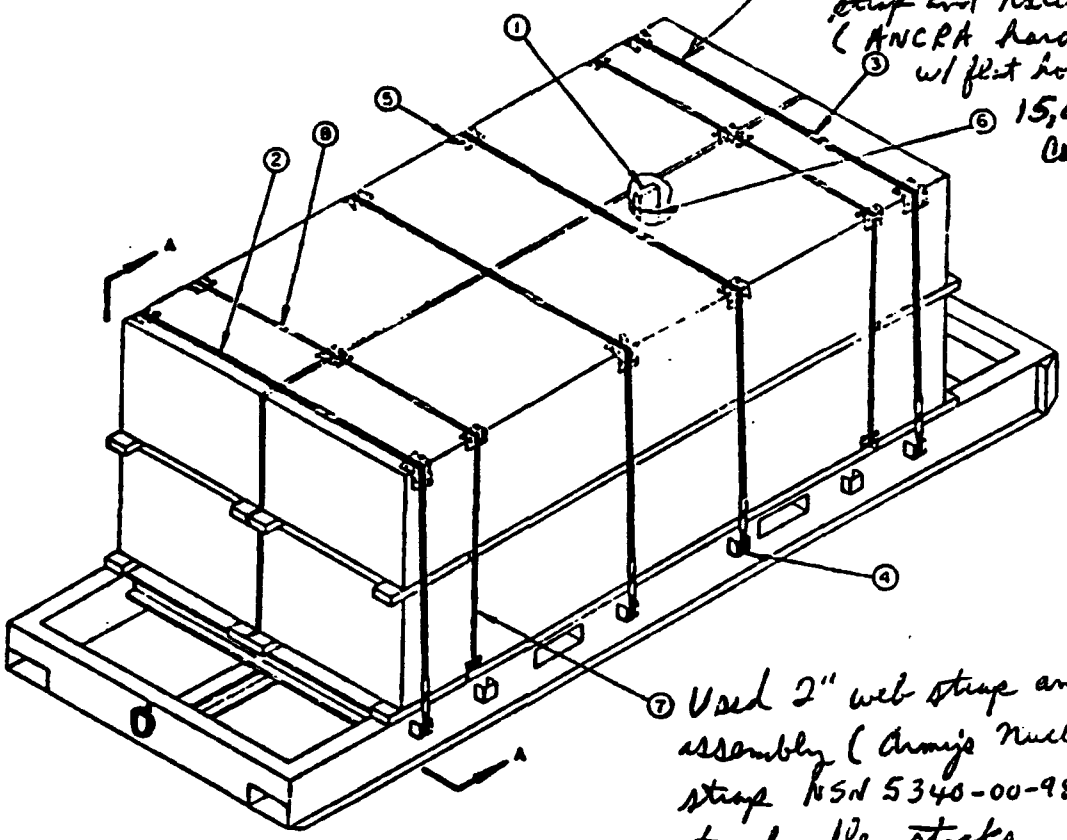
STRAP JOINT B

METHOD OF SECURING A STRAP JOINT WHEN USING A CRIMP-TYPE SEALER.

BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
2" X 6"	11	11
STEEL STRAPPING, 2" X .050"	128" REQD	43 LBS
SEAL, FOR 2" STRAPPING	24 REQD	5 LBS
STEEL STRAPPING, 1-1/4" X .035" OR .031"	88" REQD	12 LBS
SEAL FOR 1-1/4" STRAPPING	8 REQD	1/2 LBS
WIRE, NO. 14 GAGE	8" REQD	NIL
FIBERBOARD ANTI-CHAFING MATERIAL	AS REQD	NIL
LOAD AND ROLL PLATFORM	1 REQD	1,933 LBS

LOAD AS SHOWN

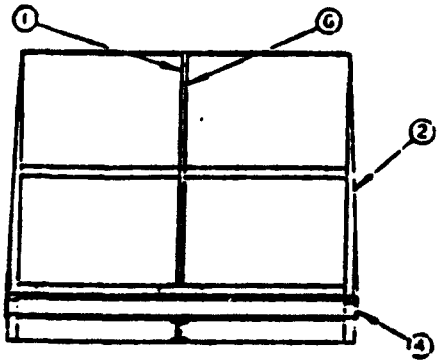
ITEM	QUANTITY	WEIGHT (APPROX)
MLRS BP/C	4	20,312 LBS
DUNNAGE		2,016 LBS
COMMERCIAL CONTAINER	1	4,700 LBS
TOTAL WEIGHT		27,028 LBS



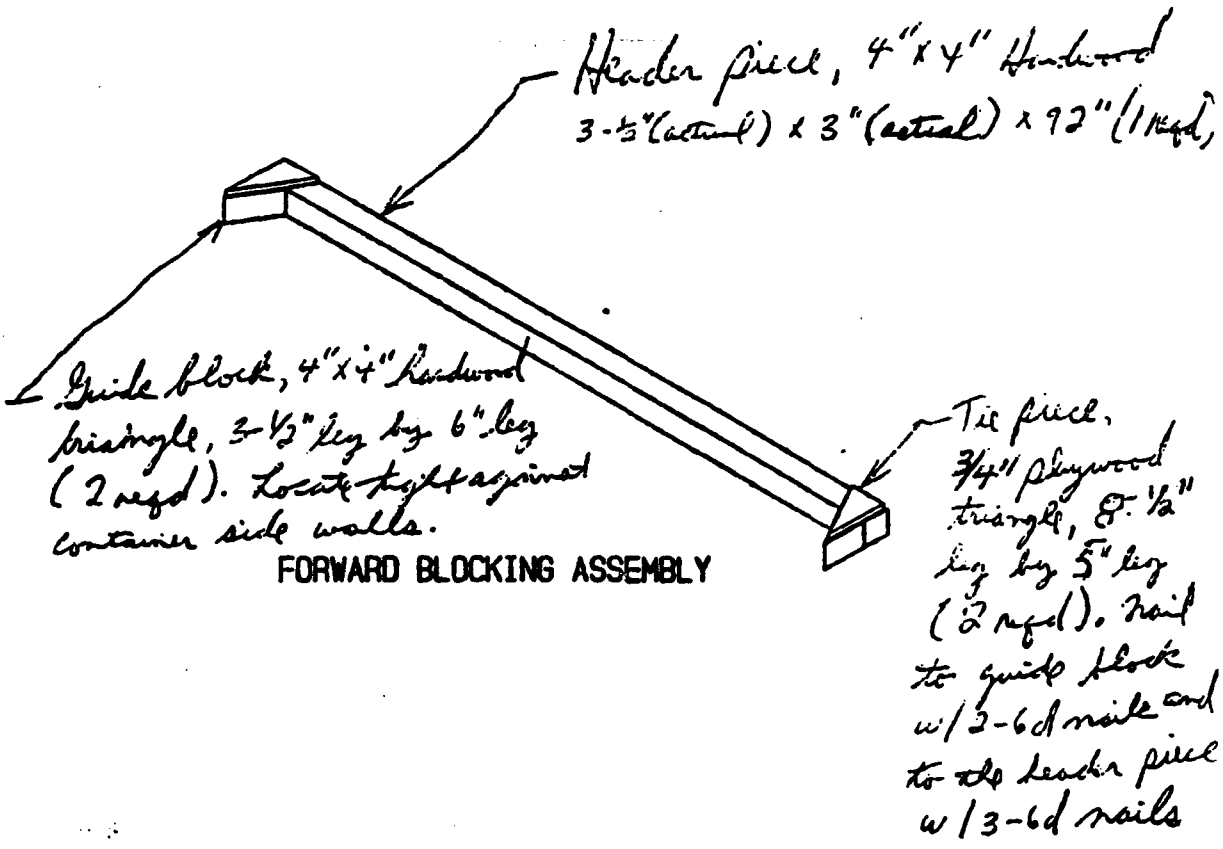
ISOMETRIC VIEW

KEY NUMBERS

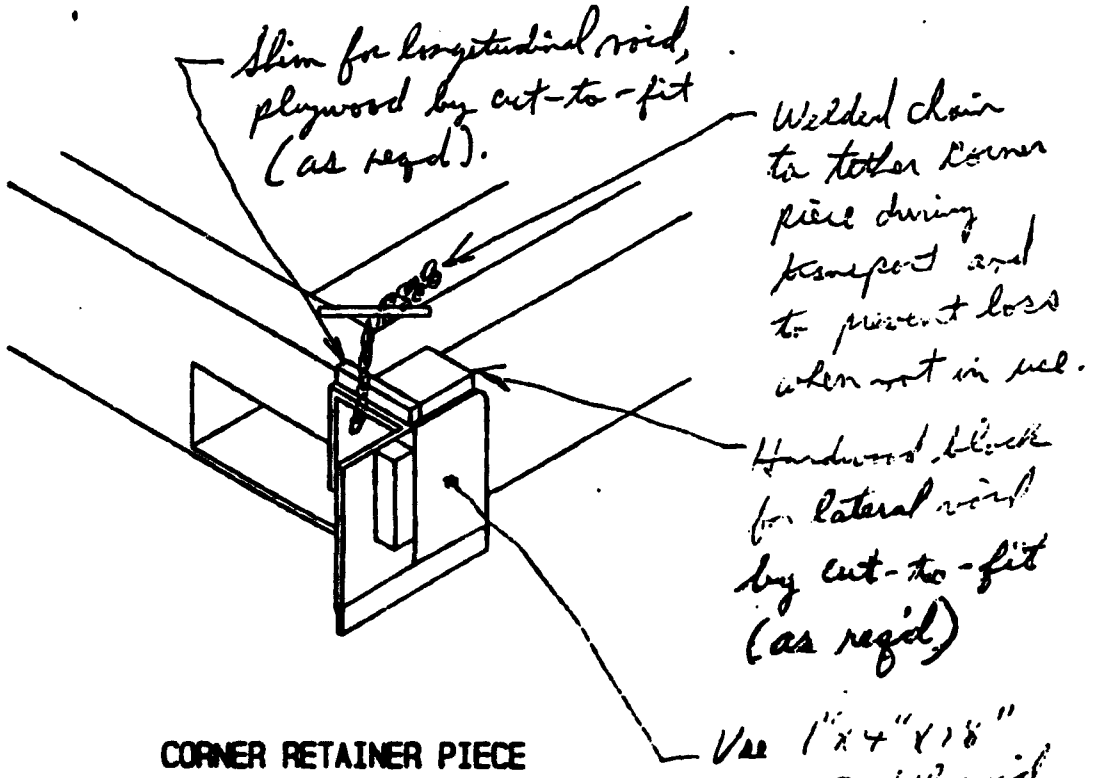
1. CENTER FILL PIECE, 2" X 6" X 66" (3 REQD). POSITION ON THE FORKLIFT TUNNEL.
2. HOLD-DOWN STRAP, 2" X .050" X 28'-0" LONG STEEL STRAPPING (4 REQD). INSTALL EACH STRAP FROM TWO 14'-0" LONG PIECES.
3. SEAL, 2" (24 REQD, 6 PER STRAP). DOUBLE CRIMP EACH SEAL, EXCEPT THOSE USED TO SECURE THE PADS, PIECES MARKED (4). SEE GENERAL NOTE "H" ON PAGE 2.
4. PAD, STRAPPING, 2" X .050" X 24" (8 REQD). PREPOSITION THE PAD BETWEEN THE STRAPPING, PIECE MARKED (2), AND THE LOAD AND ROLL PLATFORM HOLDOWN PROVISION AND SECURE WITH ONE PAIR OF CRIMPS. SEE THE "TIEDOWN DETAIL" ON PAGE 5.
5. FREEBOARD ANTI-CHAFING MATERIAL (AS REQD). PLACE UNDER STRAPPING AT ALL POINTS OF CONTACT WITH THE CONTAINERS.
6. TIE WIRE, NO. 16 GAGE WIRE, 24" LONG (4 REQD). WIRE TO FORM A LOOP AROUND A HORIZONTAL FRAME MEMBER OF A CONTAINER AND THE CENTER FILL PIECE, PIECE MARKED (1). BRING ENDS TOGETHER AND TWIST TAUT.
7. STACK BINDING STRAP, 1-1/4" X .020" UP .031" BY A LENGTH-TO-SUIT (REF: 20'-0") (4 REQD). INSTALL TO ENCIRCLE THE CONTAINERS IN ONE STACK.
8. SEAL, 1-1/4" (8 REQD, 2 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF CRIMPS. SEE GENERAL NOTE "H" ON PAGE 2



SECTION A-A

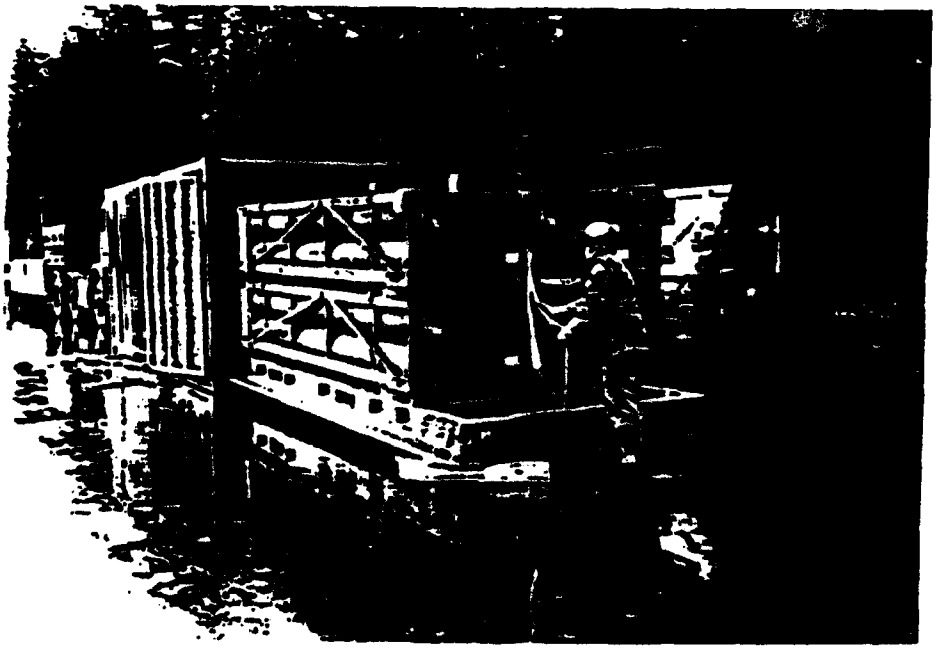


FORWARD BLOCKING ASSEMBLY

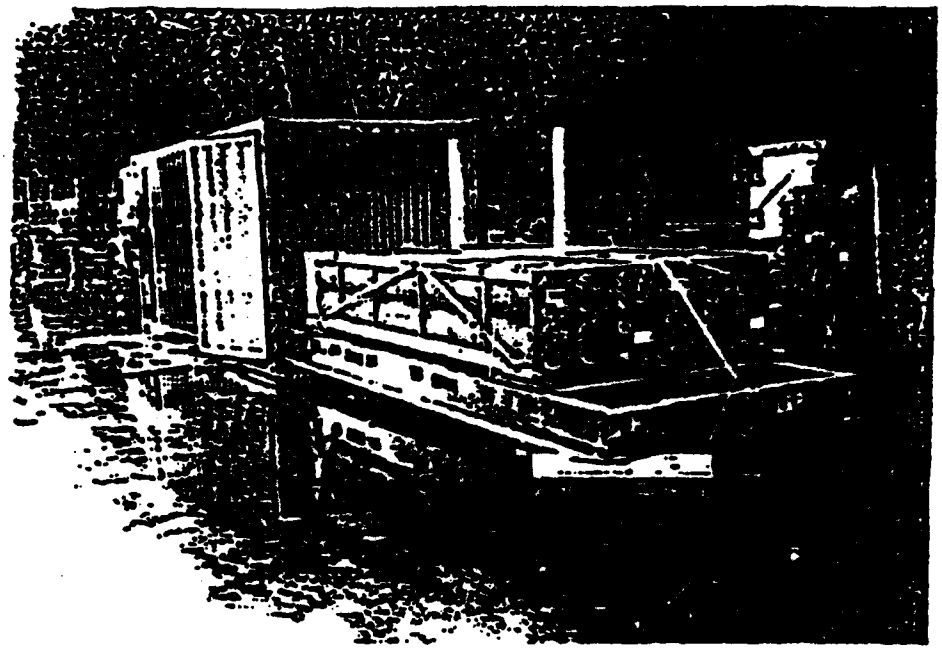


CORNER RETAINER PIECE

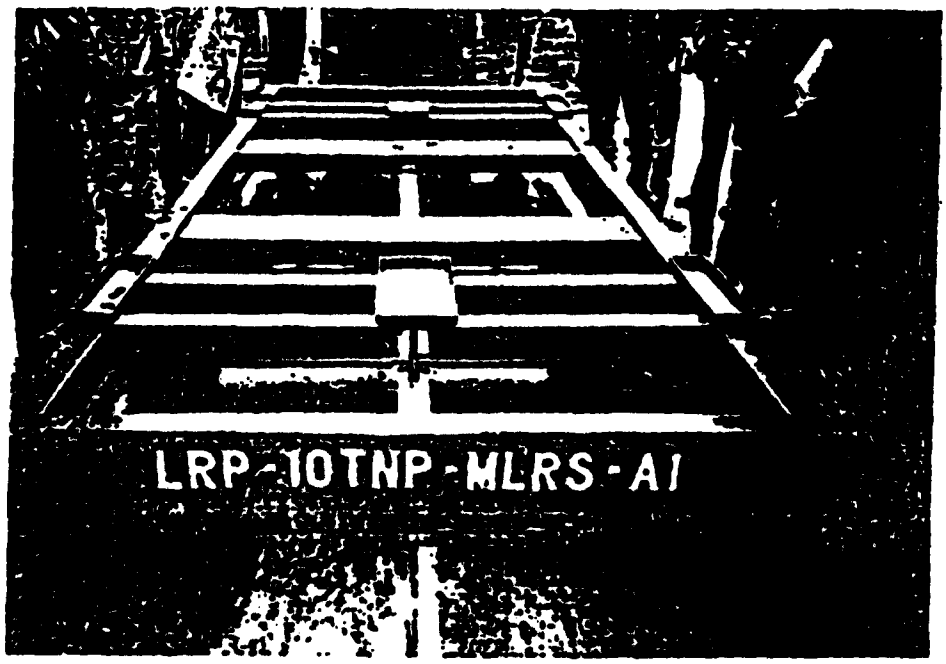
MLRS PODS SECURED ON LOAD AND ROLL PLATFORM (LRP)
AND BLOCKED INSIDE STANDARD COMMERCIAL CONTAINER



AFTER REMOVING CORNER BLOCKS AND ROLLING OUT LRP,
MLRS PODS ARE ACCESSIBLE FOR DIRECT SIDE HANDLING



TWO 6K FORKLIFTS PERFORM ENTIRE UNLOADING OPERATION AND LOAD TRAILER WITH THE FOUR PODS IN 5 MINUTES



OBSERVERS VIEW EMPTY LRP JUST PRIOR TO BEING ROLLED BACK INTO COMMERCIAL END OPENING CONTAINER