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SKID TEST RESULTS OF LARGE SCALE LX-10 AND LX-14 SENSITIVE POLE BILLETS

Jim A. Crutchmer

DEVELOPMENT DIVISION

AUGUST 1979

For
Lawrence Livermore Laboratory
Livermore, California
(SANL No. 500-081)

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ABSTRACT

A skid test series was conducted using 18 kg and 36 kg sensitive pole billets of both LX-10-1 and LX-14-0. Tests were made at both the 14° and 45° drop angles. Results indicate the large scale billets are more sensitive than standard size parts in all cases except the 18 kg, 14° tests of LX-14-0 which did not show an increase in sensitivity.

DISCUSSION

Large scale billets, i.e. 18 kg and 36 kg, of LX-10-1 and LX-14-0 were skid tested using the sensitive pole configuration. The LX-10-1 material used for these tests came from Lot 77F-650-003 (94.48/5.52 HMX/Viton) while the LX-14-0 was from Lot 713-1 (95.72/4.28 HMX/ Estane). Densities of the LX-10-1 inserts were 1.864 Mg/m^3 and the LX-14-0 inserts were 1.828 Mg/m^3. RM-04-BG mock was used as the inert billet material for all test specimens. Fig. 1 shows a schematic with the dimensions of the sensitive pole billets.

A standard skid test series normally requires twenty-four drops. Since we were limited in the number of parts available for these tests, it was necessary to redrop most of those parts that did not react in order to conduct enough tests to give reasonably reliable results; even so, there appears to be insufficient data to adequately define some of the threshold heights. The past practice of remachining the pole area of used skid test billets for reuse has been discontinued because of the possibility of sand particles being embedded in the explosive at the contact spot. Those parts which were redropped were tilted forward in the direction of travel a sufficient amount to miss the original contact spot (approximately 10° tilt); this did not appear to affect the results. The total number of parts fabricated for testing is shown in Table I along with the total number of tests, including redrops. All tests were accelerometer instrumented. Reaction data are summarized in Table II.

Table I. Summary of Sensitive Pole Billets Fabricated and Tested

Nominal Weight (kg)	Nominal Weight (lb)	LX-10-1 Number of Parts Fabricated	LX-10-1 Total Number of Tests	LX-14-0 Number of Parts Fabricated	LX-14-0 Total Number of Tests
18	40	10	16	12	21
36	80	6	10	6	10

Table II. Skid Test Summary of Large Scale LX-10 and LX-14 Sensitive Pole Billets

Nominal Weight (kg)	Nominal Weight (lb)	Drop Angle	Drop Height (m)	Drop Height (ft)	LX-10-1	LX-14-0
18	40	14°	0.19	0.63	0,6*,0,0,0	-
			0.27	0.88	3,3,0	0*,0*,0*,0,0,0
			0.38	1.25	-	2,3
			0.76	2.50	-	3
		45°	0.76	2.50	0,0,0*,6*,6*	4*,0*,0*,0*,0*
			1.07	3.50	0,6*,6*	0,0,5*,0,0,4
			1.52	5.00	-	5
36	80	14°	0.13	0.44	0,0,0*	-
			0.19	0.63	0*,0*,0*,6*	0,3,0*
			0.27	0.88	-	4,0*
		45°	0.53	1.75	0,0	-
			0.76	2.50	6	0,0,0
			1.07	3.50	-	5*,6*

**Redrop*

NOTE: Critical height of standard size billets: LX-10 14°/0.38 m & 45°/1.07 m.
LX-14 14°/0.38 m & 45°/1.52 m.

The 14° tests for both materials yielded good accelerometer traces. Representative normal (solid curve) and rotational (dashed curve) accelerations and coefficient of friction curves for both materials and both billet sizes at the 14° drop angle are shown in Figs. 2 through 10.

Normally, if a skid billet cracks during testing it is indicated on the raw accelerometer traces by a slight straightening of the curves at the time of fracturing. This was the case for all 45° drops in this series. Also, the raw accelerometer traces had a much steeper rise and fall, and a much broader peak than would normally be expected for a 45° drop. However, visual examination revealed no cracks in any of the parts tested. These abnormal accelerometer traces may have been caused by a slight shift of the inserts in the mock cavities during contact. Typical acceleration and coefficient of friction curves for the 45° tests are shown in Figs. 11 through 14 as a matter of interest, but should not be considered as normal accelerometer data.

LX-10-1

The critical heights of standard billets (10.7 kg) of LX-10 are 0.38 m at 14° and 1.07 m at 45°. As shown in Table II, one No. 6 reaction was obtained out of five tests at 0.19 m and 14° with the 18 kg parts which is two drop increments lower than the critical height for standard billets. No tests were conducted lower than 0.19 m. Also two No. 3 reactions occurred at 0.27 m which is very unusual; LX-10 normally produces high-order detonations if initiated. The lower order reaction is probably due to the configuration of the part. Initiation by skid impact is very slow compared to detonator initiation. The shock front had probably not achieved high order detonation conditions by the time the HE-mock interface was reached. The 36 kg billets also gave a No. 6 reaction at 0.19 m, 14°. Three drops were made from 0.13 m with no reactions.

The 45° tests for LX-10 yielded two No. 6 reactions out of five drops from 0.76 m with 18 kg billets. This height is one increment lower than the critical height for standard LX-10 billets. No drops were made lower than 0.76 m. Also a No. 6 reaction occurred at 0.76 m, 45° for the 36 kg parts. Only two drops were made at 0.53 m.

LX-14-0

Standard billets of LX-14 have critical heights of 0.38 m at 14° and 1.52 m at 45°. The 14° tests with the 18 kg billets, as shown in Table II, yielded two each low order reactions at 0.38 m. A total of six drops were made at 0.27 m with no reactions. The 36 kg billets yielded one No. 3 reaction out of three drops at 0.19 m, 14° which is two drop increments lower than the critical height for standard LX-14 at 14°. No tests were made lower than the 0.19 m drop height. The 18 kg billets dropped at 45° yielded one No. 4 reaction out of five drops at 0.76 m or two drop increments lower than the critical height for standard billets. No drops were made lower than 0.76 m. Two reactions were obtained at 1.07 m, 45° with 36 kg billets which is only one drop increment below the critical height for standard billets. Three drops were made at 0.76 m with no reactions.

CONCLUSIONS

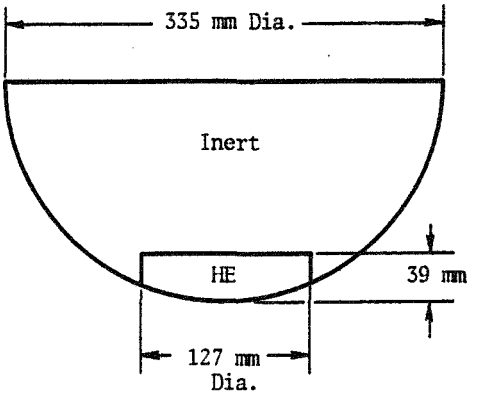
Results of this skid test series show the large scale parts to be more sensitive than standard size billets as expected. However, there were a few anomalies involved.

The 18 kg billets of LX-10-1 show a definite increase in sensitivity compared to standard billets, particularly at the 14° drop angle. It is believed that insufficient 36 kg tests were conducted to define threshold heights and lower reaction heights would be obtained with additional tests. The 18 kg LX-10-1 data appear to be very near the threshold reaction height for both drop angles.

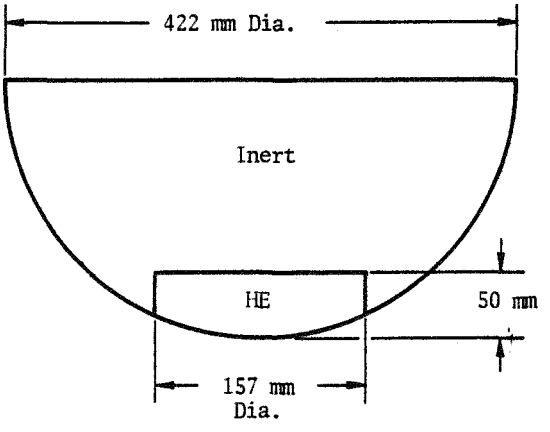
The 18 kg billets of LX-14-0 did not show an increase in sensitivity at the 14° drop angle compared to standard size parts. However, there was a significant increase in sensitivity for the 18 kg billets dropped at 45°.

Insufficient 36 kg LX-14-0 tests were conducted to adequately define threshold heights. A reaction height of 0.53 m is expected for 36 kg billets at 45°.

In summary, it is felt that the results of the 36 kg tests indicate a need for further testing of both materials.



18 kg (40 lb) Sensitive Pole Billet



36 kg (80 lb) Sensitive Pole Billet

Fig. 1. Large Scale Sensitive Pole Schematics

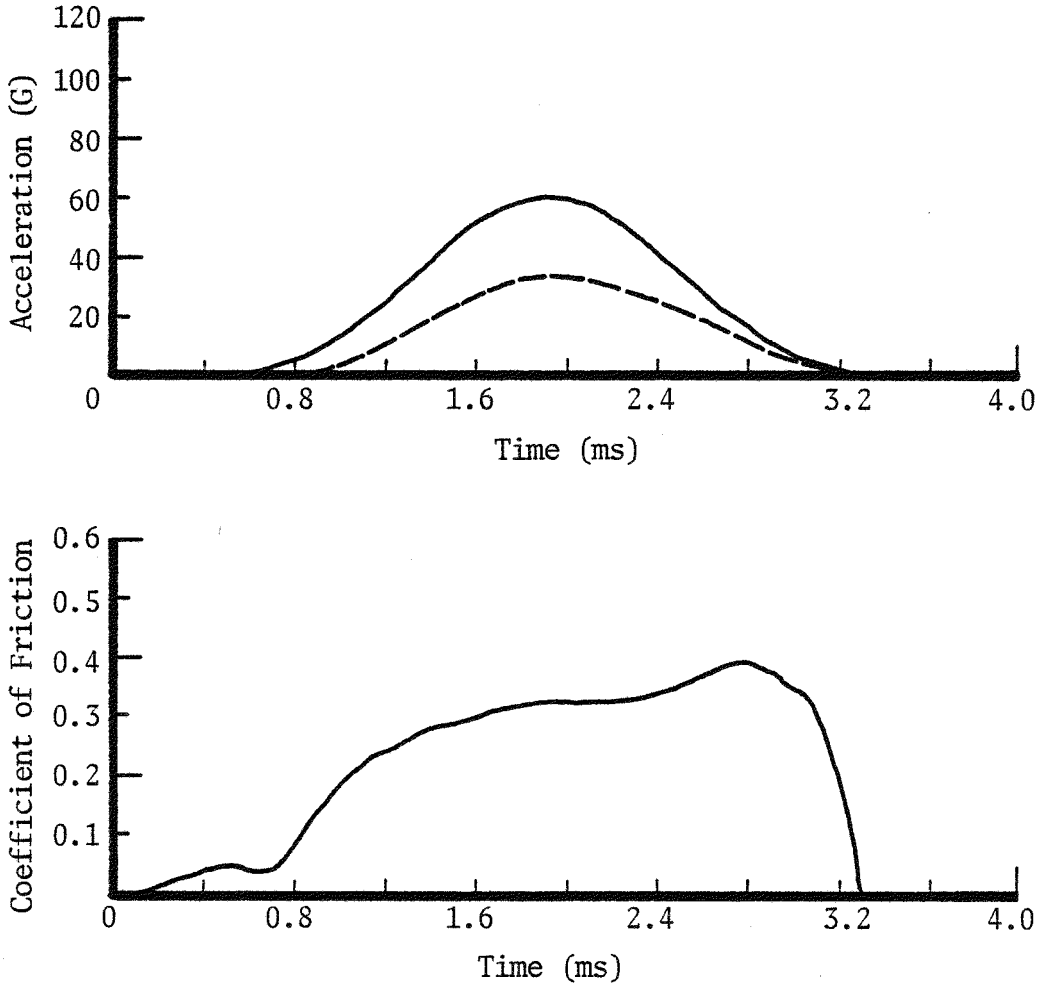


Fig. 2. Skid 1496, LX-10-1, 18.30 kg, 0.19 m, 14°

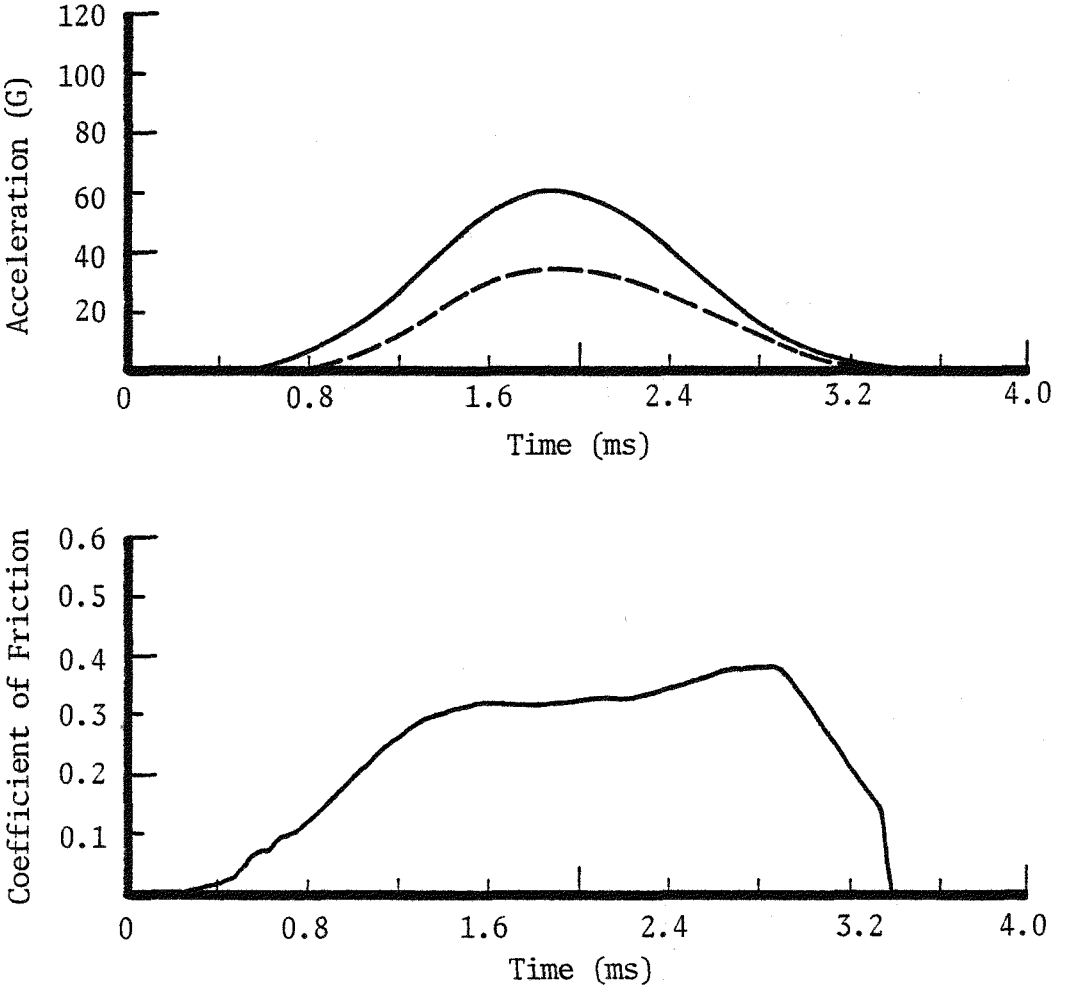


Fig. 3. Skid 1497, LX-10-1, 18.30 kg, 0.19 m, 14°

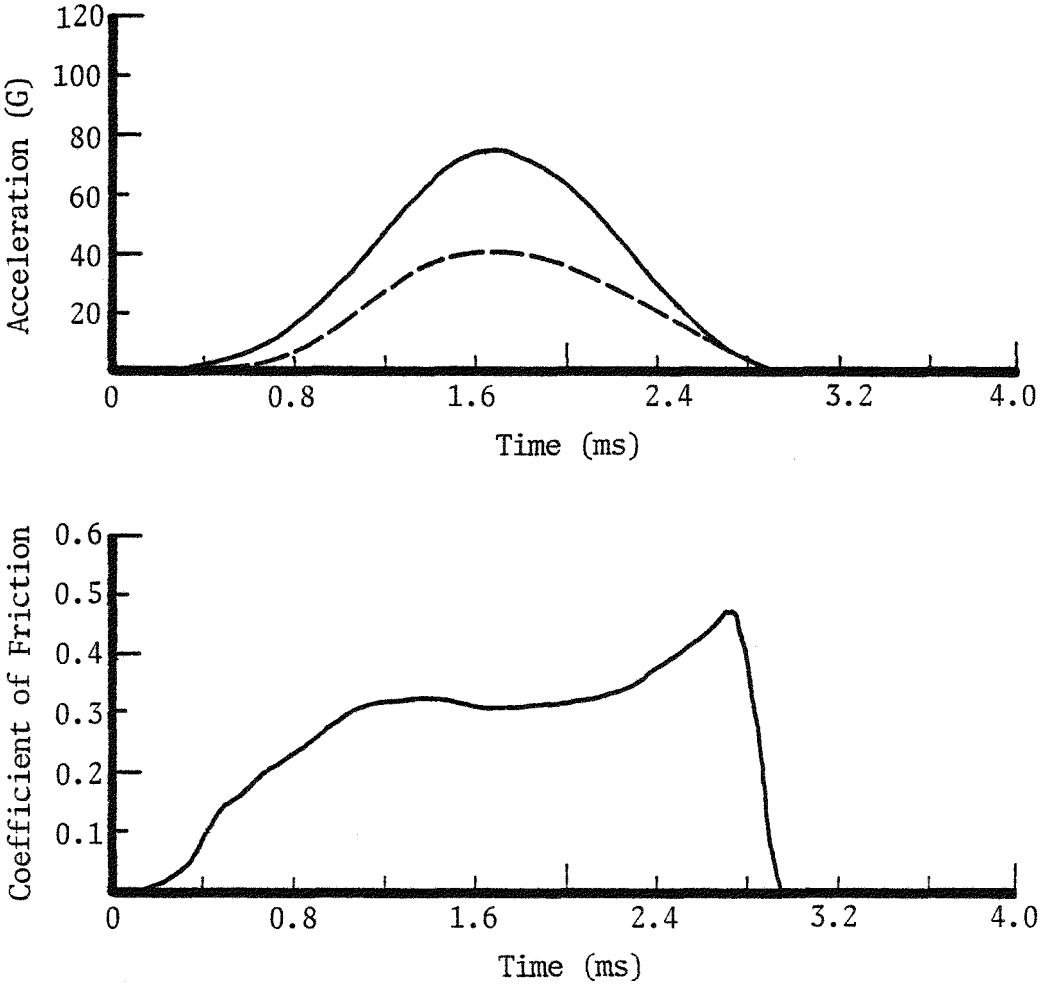


Fig. 4. Skid 1498, LX-10-1, 18.30 kg, 0.27 m, 14°

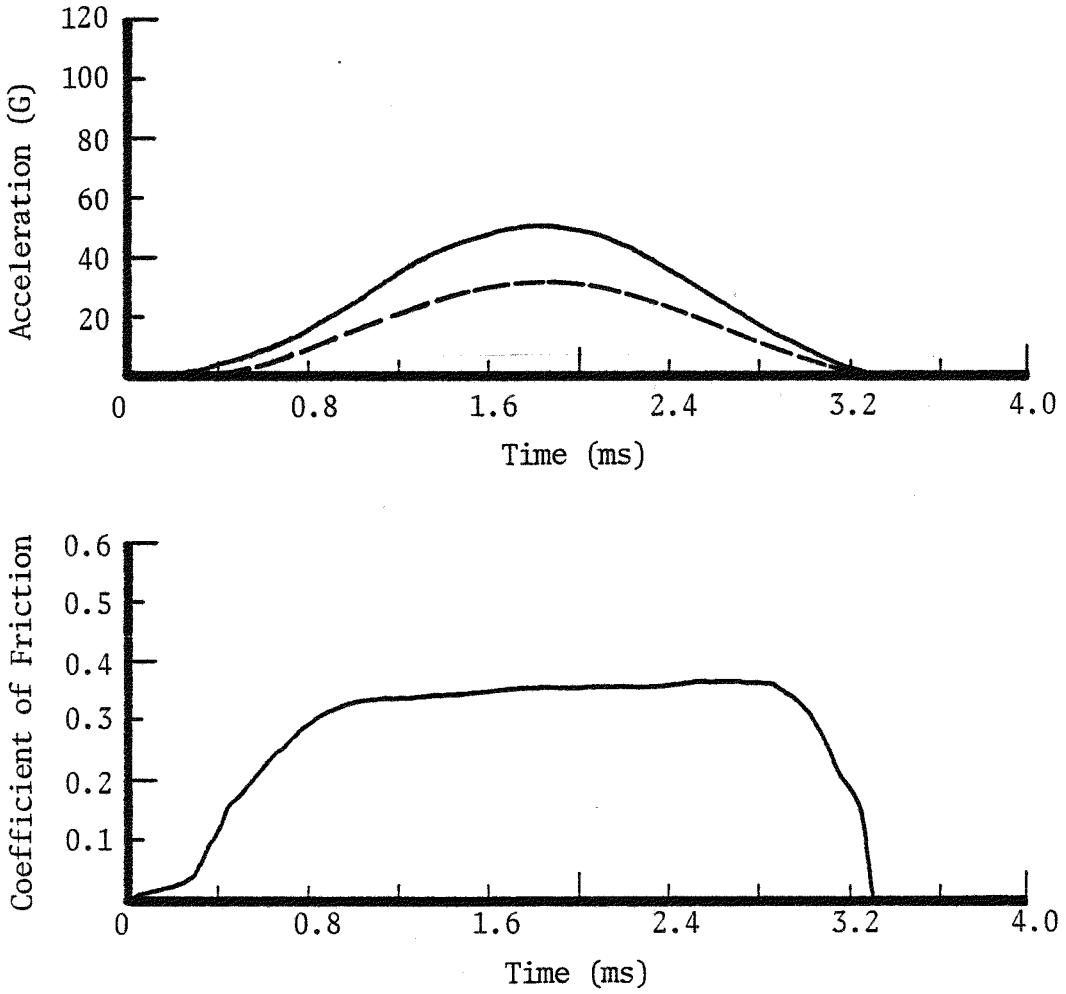


Fig. 5. Skid 1464, LX-10-1, 36.41 kg, 0.13 m, 14°

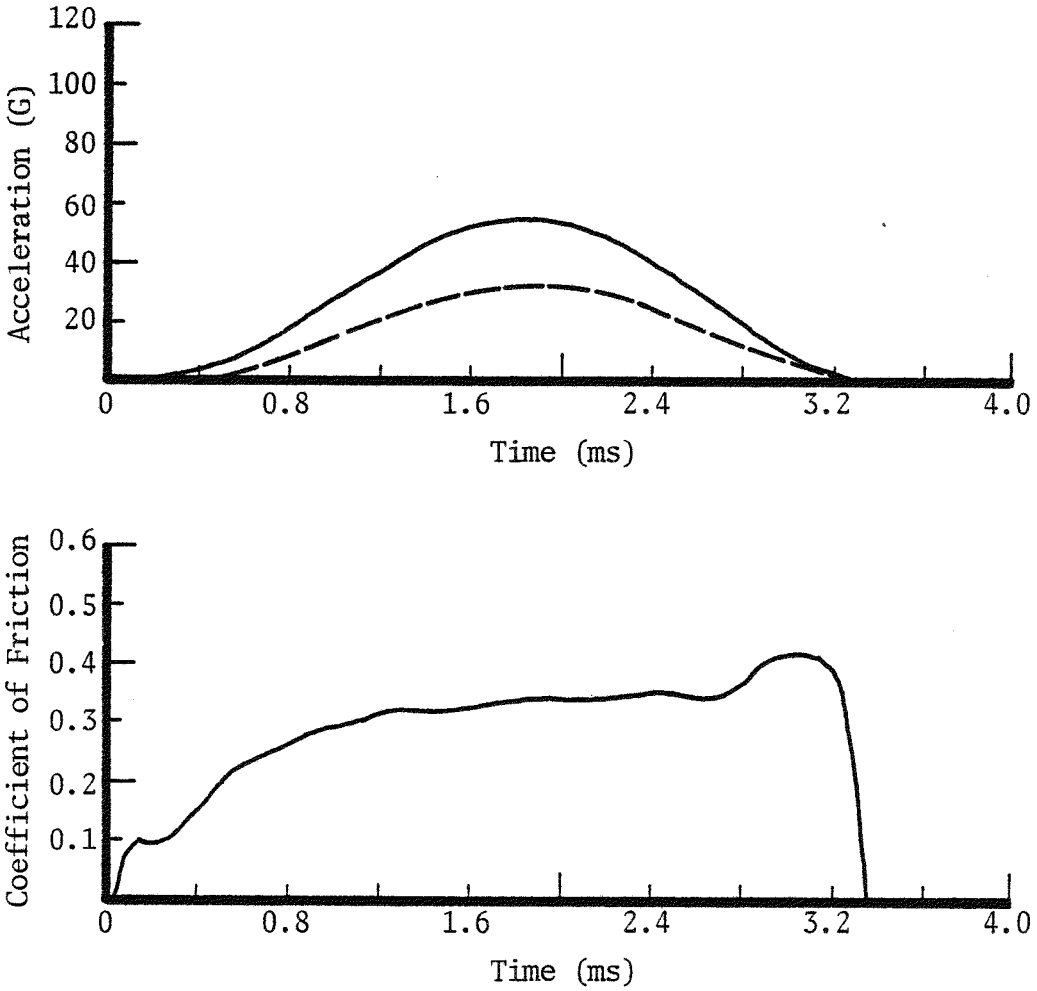
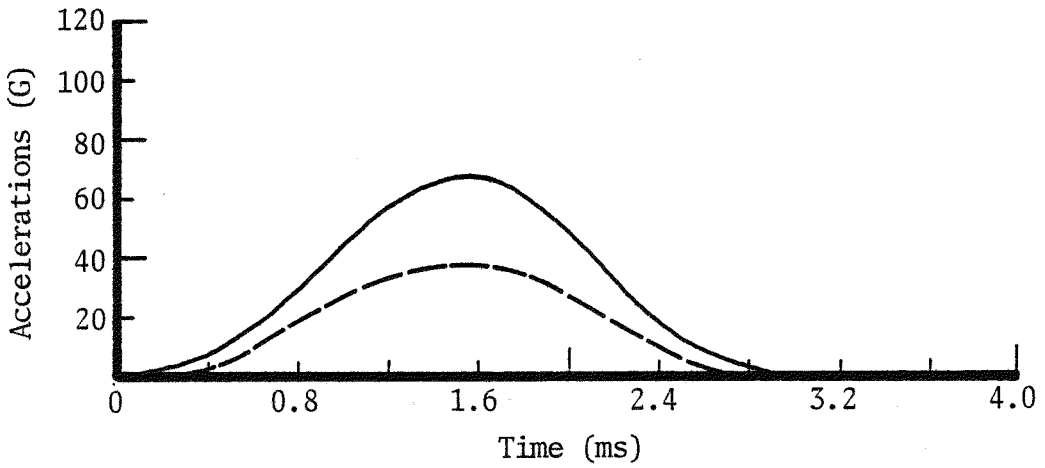


Fig. 6. Skid 1466, LX-10-1, 36.41 kg, 0.19 m, 14°



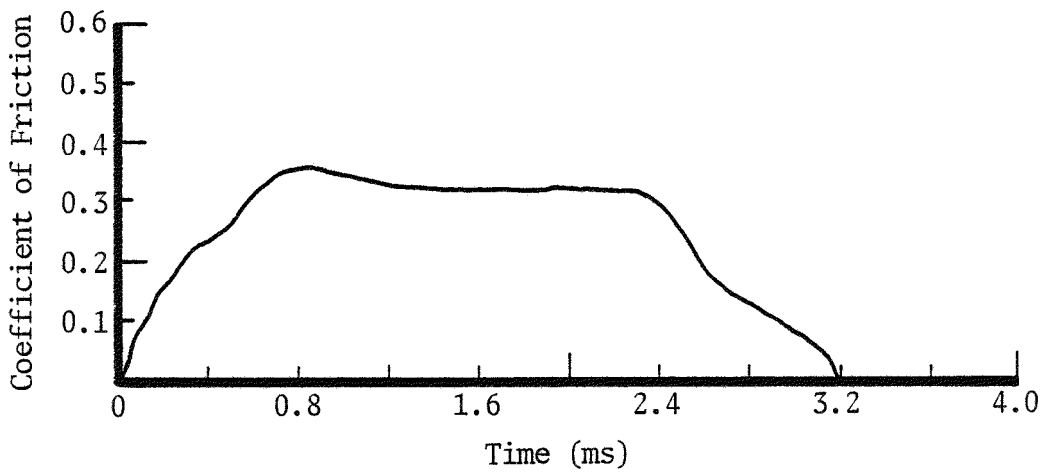


Fig. 7. Skid 1566, LX-14-0, 18.13 kg, 0.27 m, 14°

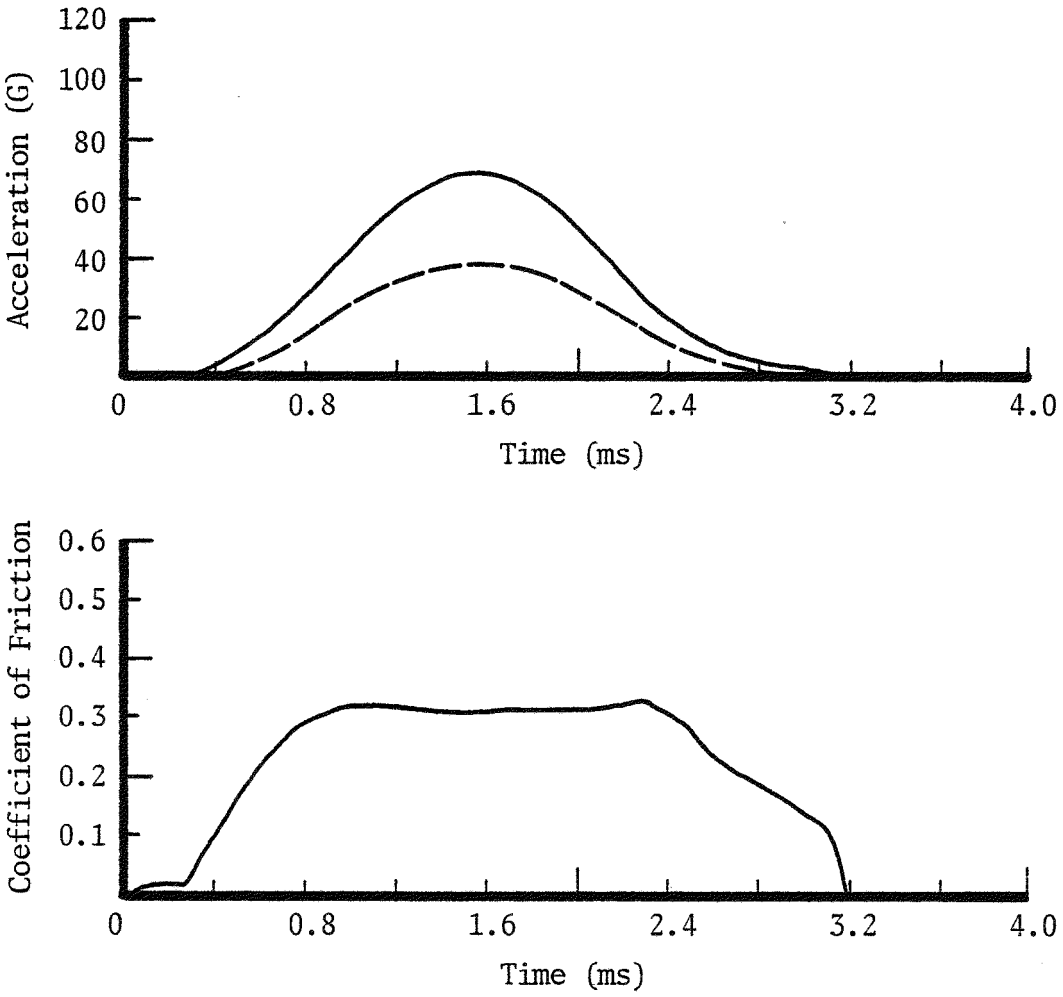
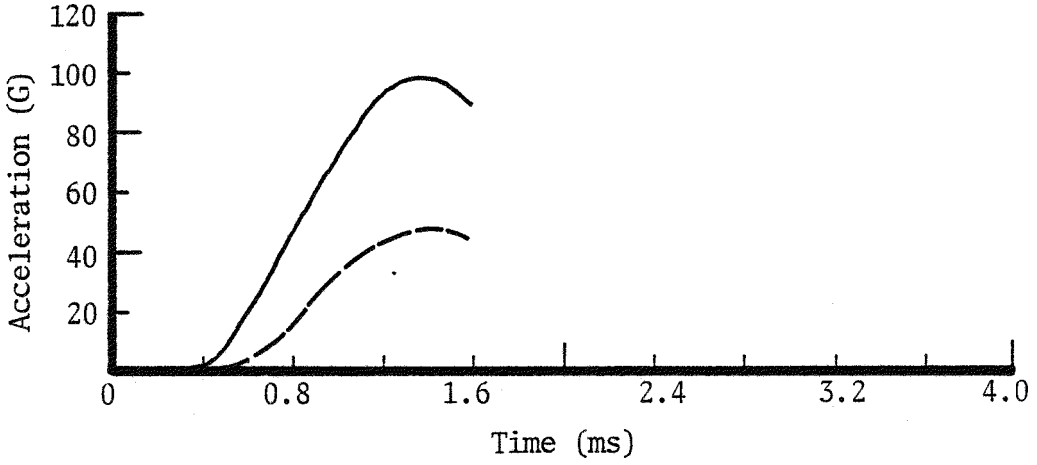


Fig. 8. Skid 1567, LX-14-0, 18.13 kg, 0.27 m, 14°



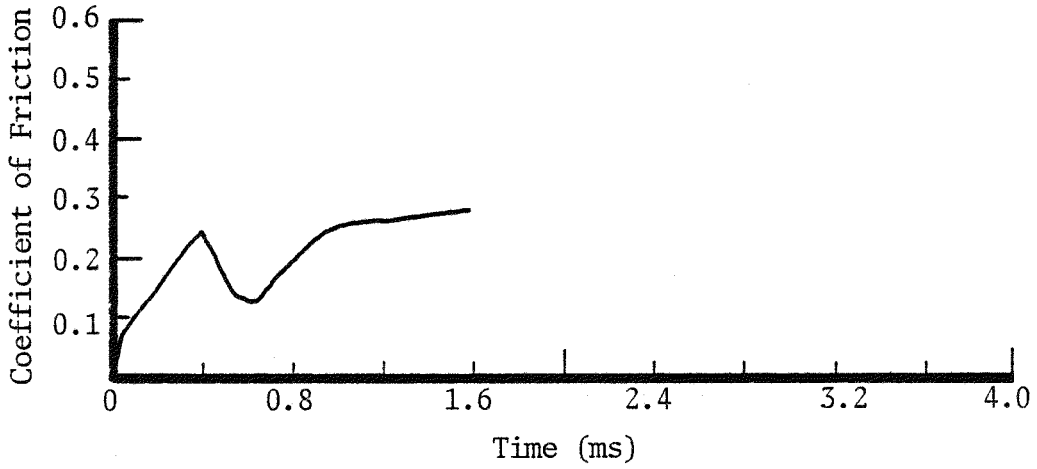


Fig. 9. Skid 1267, LX-14-0, 18.13 kg, 0.38 m, 14°

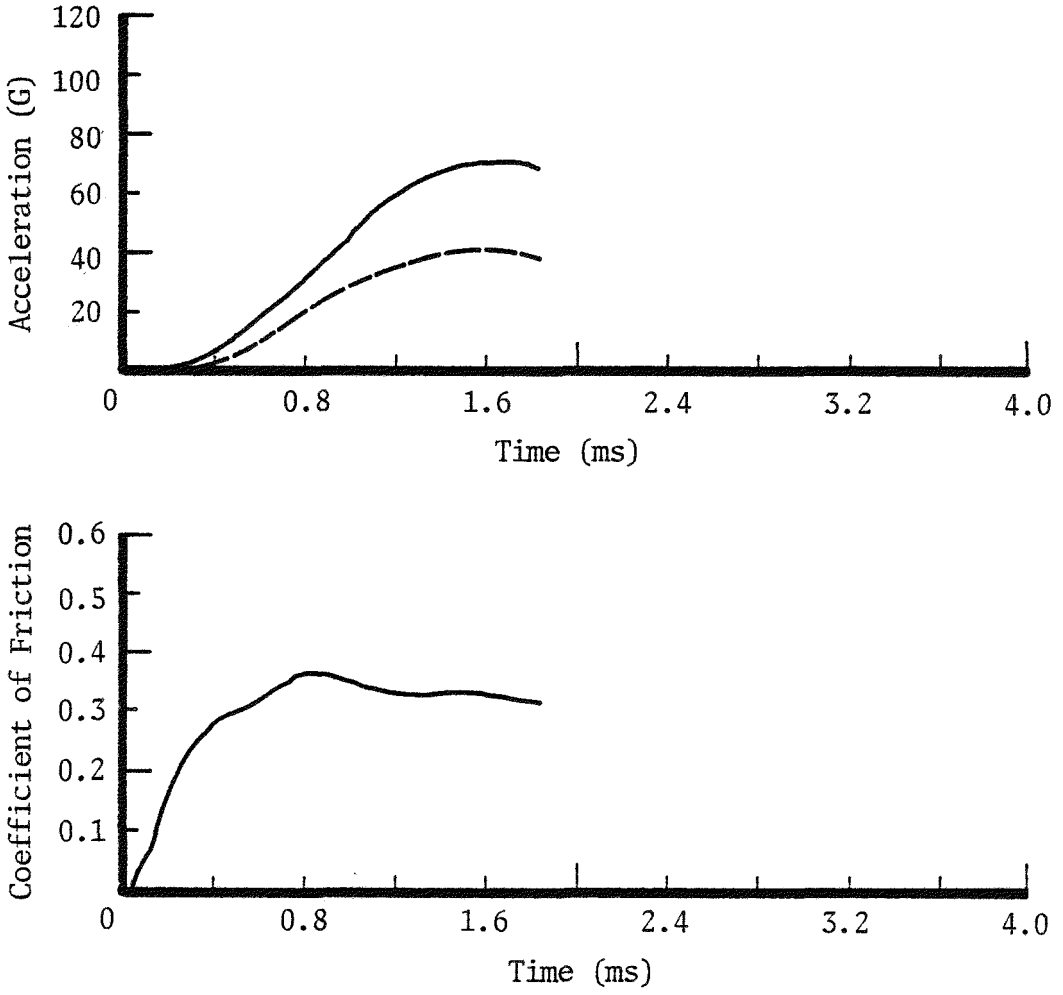
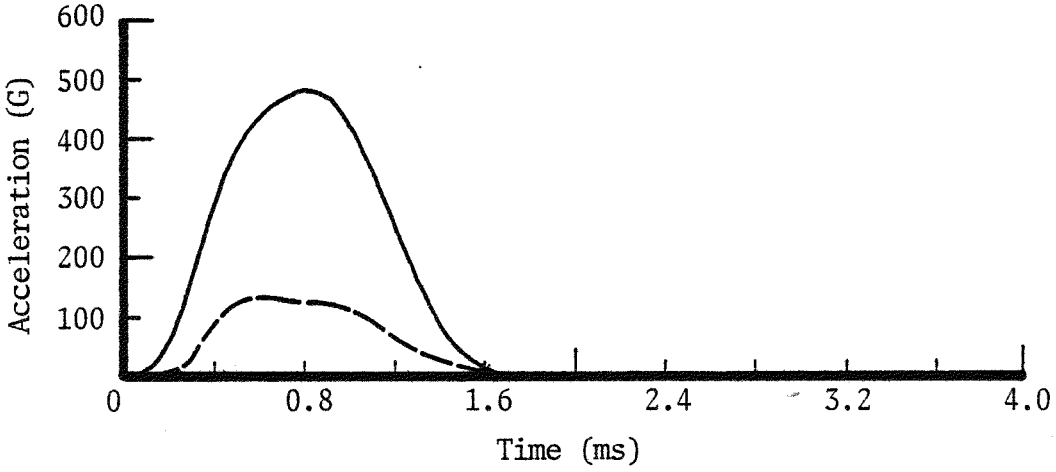


Fig. 10. Skid 1457, LX-14-0, 36.38 kg, 0.19 m, 14°



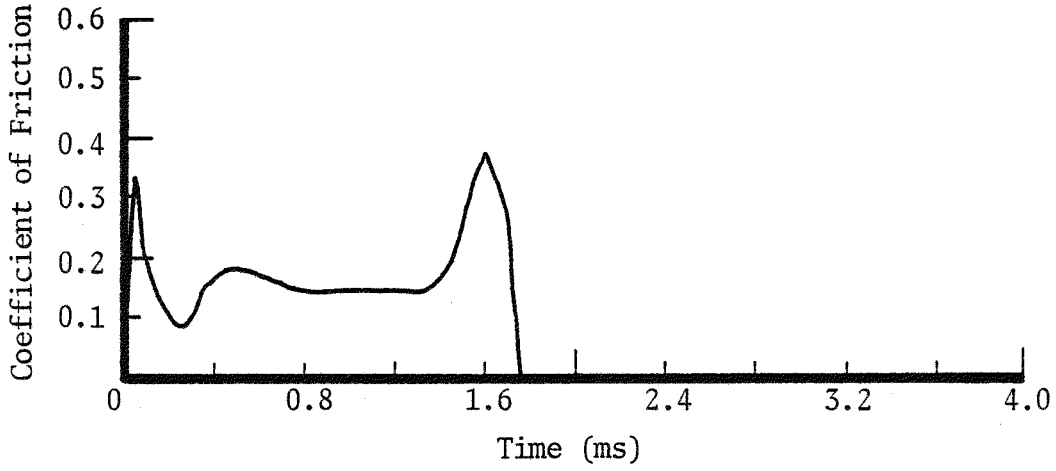


Fig. 11. Skid 1602, LX-10-1, 18.30 kg, 0.76 m, 45°

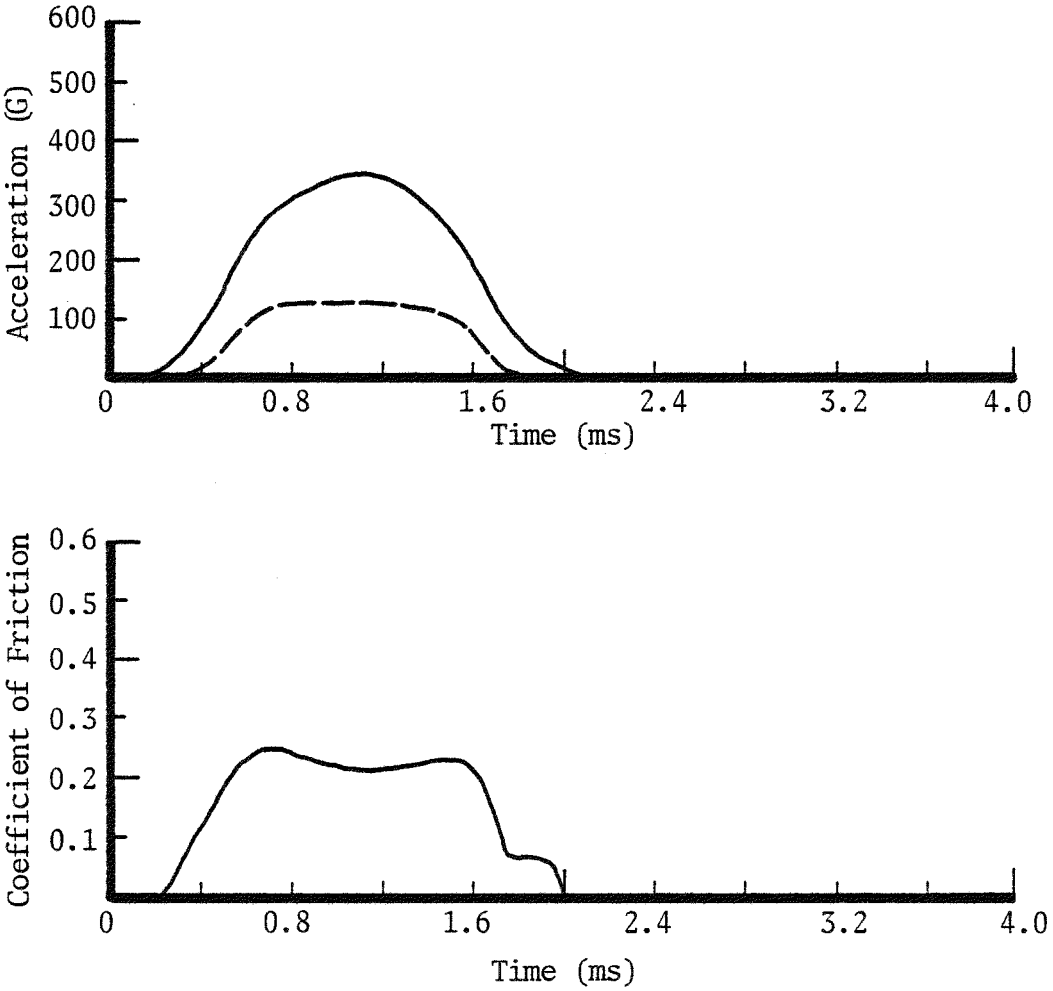
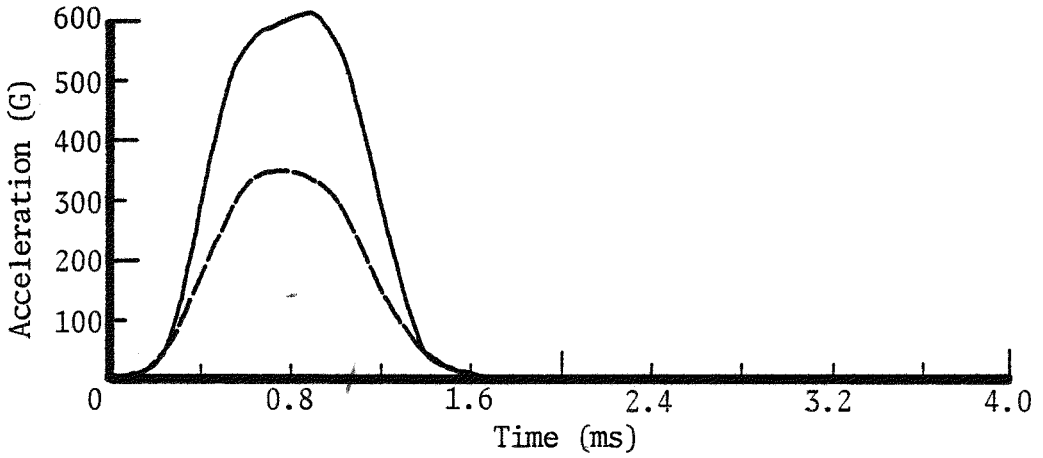


Fig. 12. Skid 1511, LX-10-1, 36.41 kg, 0.53 m, 45°



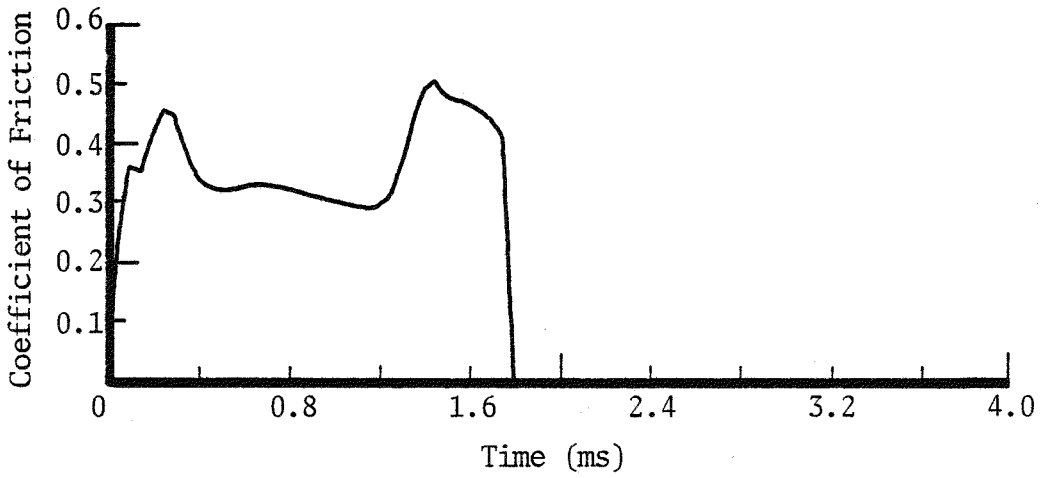
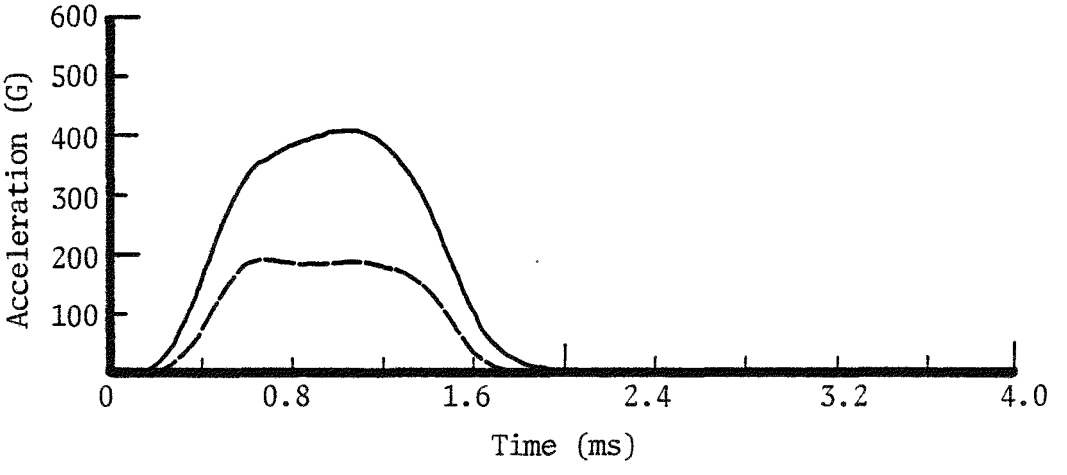


Fig. 13. Skid 1261, LX-14-0, 18.13 kg, 1.07 m, 45°



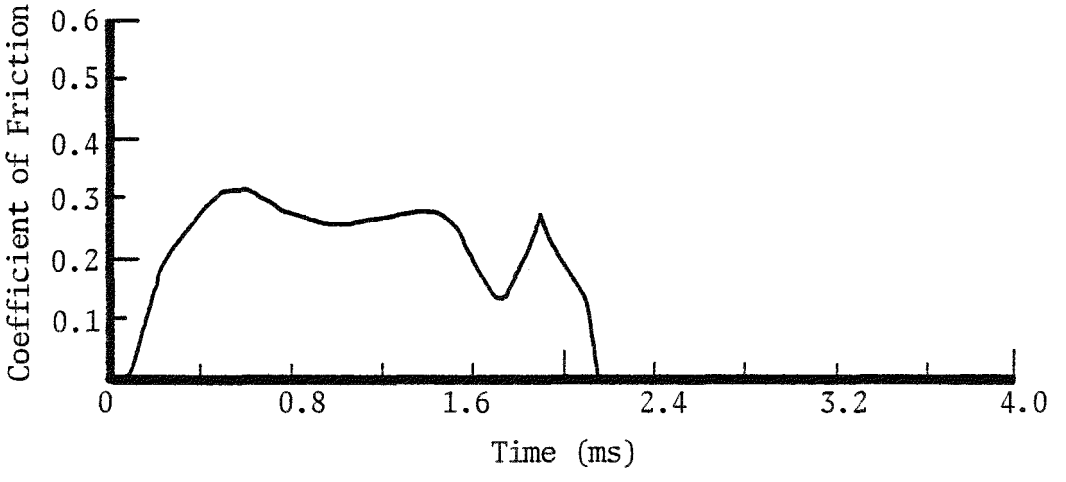


Fig. 14. Skid 1452, LX-14-0, 36.38 kg, 0.76 m, 45°

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