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16. Abstract

The American Association of State Highway & Transportation Officials (AASHTO) allows only two species of wood for use in constructing strong post guardrail systems, Douglas Fir and Southern Yellow Pine. Neither of these species are readily available in the great lakes region of the United States. This report examines twelve species of wood that are available in the great lakes region for use as guardrail posts. Pendulum testing was performed on all species in addition to several full-scale crash tests (NCHRP 230). As a result of this work it is suggested that a total of seven new species be added to the AASHTO specification. In addition, it has been established that the pendulum fracture energy needed to correspond to a successful full-scale crash test could be lowered from approximately 6.0 to 5.5 ft kips.

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AN INVESTIGATION OF THE SUITABILITY OF GREAT LAKE STATES TIMBER SPECIES FOR GUARDRAIL POSTS

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Joe B. Mayer, Jr.

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This report was prepared by the Southwest Research Institute for the Michigan Department of Transportation as an HPR Project in Cooperation with the Federal Highway Administration

May 1988

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SwRI Project 06-8397
FINAL REPORT

AN INVESTIGATION OF THE SUITABILITY OF GREAT LAKE STATES TIMBER SPECIES FOR GUARDRAIL POSTS

Prepared for

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Current standardized wood post guardrail systems use two wood species: Douglas fir and southern yellow pine. Performance of these species is accepted as adequate. However, many other species exist which may offer equal or superior performance while providing more cost effective installations throughout the United States.

A good post for a "strong-post guardrail system" is one that maintains adequate fracture energy while displaying a low peak force and low average force. Fracture energy relates to the ability of the guardrail system to absorb the energy of the impacting vehicle or pendulum. The peak and average forces relate to gravity forces which act on vehicle occupants when the vehicle is redirected or stopped.

The main purpose of this study was to dynamically test posts of several Great Lakes wood species to determine their acceptability as guardrail posts. A second purpose was to determine if wood species with fracture energies less than 6.0 could be found that would meet full-scale crash test criteria. The third purpose of this study was to suggest criteria for a more appropriate specification for guardrail wood posts.

The existing specifications are presented in "A Guide for Selecting, Locating, and Designing Traffic Barriers"(1) and "A Guide to Standardized Highway Barrier Rail Hardware".(2) The first publication specifies the use of Douglas fir and southern yellow pine for wood posts with no reference to physical properties. The second publication states that posts and blocks shall be made of timber with a stress grade of 1200 psi or more based on static test results, but makes no reference to species, moisture content, or dynamic impact characteristics. The stress grade of 1200 psi is widely thought to be an attempt to extend the post requirement to include other species. Thus, stress grade is the existing guideline for post selection.

This report presents the results of pendulum tests performed on 6"x8" and 8"x8" guardrail posts constructed from twelve different species of wood, the results of four full-scale crash tests of the standard G4(W) guardrail system shown in Appendix C with alternate wood posts, and the suggested criteria for wood post specifications. Section II provides a detailed description of the experimental procedures and Section III presents the results of the testing while Section IV gives a discussion of the results. The conclusions and recommendations of this project are presented in Sections V and VI, respectively. Appendix A contains the pendulum test results and Appendix B presents the full-scale test reports. The current specifications for wood posts are included as Appendix C.

II. TEST PROGRAM

This project was performed in two phases. The first phase consisted of 152 pendulum tests and one full-scale crash test and phase two consisted of 36 pendulum tests and three full-scale crash tests. The pendulum testing was used to determine dynamic characteristics of the posts. Potential species of wood posts were then selected from the results of this testing to be evaluated with full-scale crash testing. The pendulum testing program is described first, followed by a description of the full-scale crash testing.

A. Pendulum Tests

1. Test Facility. The pendulum facility located at Southwest Research Institute is shown in Figure 1 and consists of a pendulum, operating equipment and test-control and data-acquisition instrumentation.

The 4,000-pound bullet pendulum is suspended on a 26-ft swing radius such that the mass remains horizontal throughout the swing arc. An accelerometer is mounted at the rear of the mass to measure longitudinal, or forward, accelerations. The mass consists of a 3'x6'x1.5' block of reinforced concrete with a concrete-filled 8-in diameter extra-heavy steel pipe attached to the front face to act as the bumper. A 1-in thick pad of 70 durometer neoprene was attached to the surface of the steel bumper during these tests.

The post fixture is located at the point of the arc where the pendulum is lowest and where the kinetic energy of the mass is greatest. Because the project objective was to evaluate the post rather than soil characteristics, the post holder was designed to provide a fixed base. Figure 2 shows fabrication details of the 6"x8" box beam fixture. The slope on the upper front face of the rear upright was cut to prevent a sharp edge

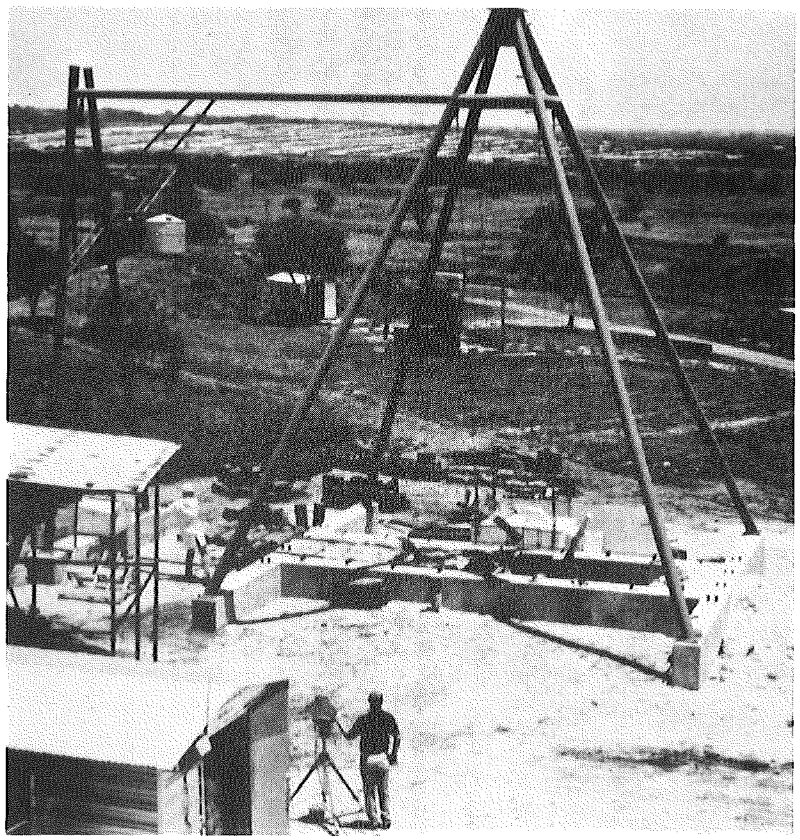


FIGURE 1. THE PENDULUM TEST FACILITY

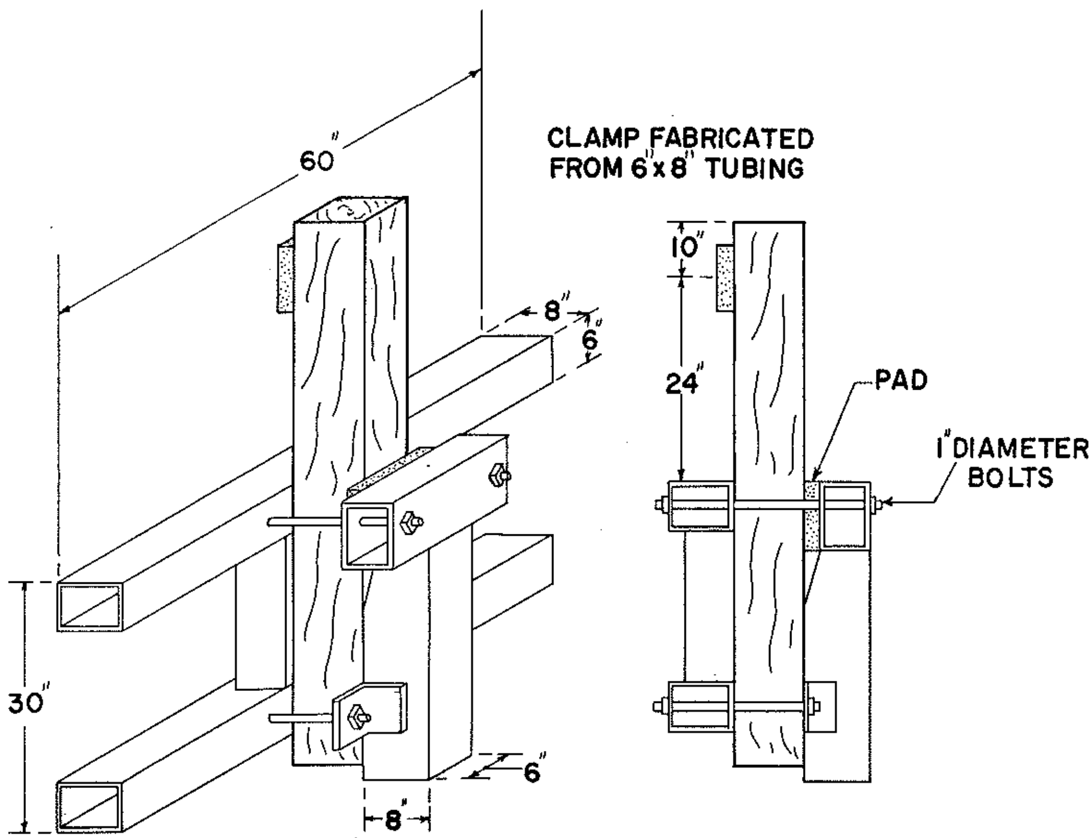


FIGURE 2. CONSTRUCTION DETAILS OF THE POST HOLDER

from affecting the reaction of wooden posts to the impact. A 2-in thick pad of 70 durometer neoprene was attached to the front of this cut section.

Impact velocity was determined by adjusting the vertical fall of the mass and is calculated by the expression:

$$V = 2gh$$

where V = velocity (ft/sec)
g = acceleration due to gravity (32.2 ft/sec^2)
h = mass drop height (ft).

Impact velocities ranging from 0 to 40 fps (27.3 mph) are obtainable within the available 25-ft drop height.

2. Data Generation. Signals from an accelerometer, mounted at the rear of the pendulum mass were continuously recorded throughout impact by a high-speed tape recorder operating at a speed of 60 in per second. The tape was simultaneously played through an oscillograph, providing hard copies of the tracings. The data from the tape were then converted and reduced using existing software with the following relationships. Using Newton's second law of motion:

$$F = ma$$

the post resisting force (F) was determined from the pendulum mass (m) and its instantaneous deceleration (a).

The pendulum impact or initial velocity (V_o) was determined with signals from a crack-wire speed-trap. The peak resistance force and time of resistance to impact could be taken directly from the force-time data. Other important parameters that were calculated include:

a. Final pendulum velocity - (V_f).

The area under the force-time curve is the linear impulse and is expressed by:

$$\int_{t_o}^{t_f} F dt = m (V_f - V_o)$$

where F = resistance force acting on the pendulum mass
m = pendulum mass
V_o = initial velocity
V_f = final velocity.

When electronic data were not available, the impulse was measured by a planimeter, and the final velocity was calculated by:

$$V_f = V_o - \frac{\text{Linear Impulse}}{m}$$

b. Fracture energy - (FE).

The fracture energy is the change in kinetic energy resulting from impact. It was obtained from:

$$FE = 1/2\ m\ (V_f^2 - V_o^2)$$

c. Post displacement during impact - (d).

The pendulum mass velocity was assumed to change linearly with time. Thus, the displacement of the post during contact with the pendulum was determined from:

$$d_i = \left(\frac{V_i + V_{i-1}}{2}\right) (t_i - t_{i-1}) \text{ and } \alpha = \Sigma d_i$$

where i is the current time step and i-1 is the previous time step.

d. Peak force - (F_{peak})

The force which occurs at the highest measured deceleration and is calculated as:

$$F_{peak} = ma_{max}$$

e. Average force during post displacement - (F_{avg}).

The average force is an idealized constant force that acts through the distance of post displacement during impact. It was derived from dividing the fracture energy by the post displacement. Thus:

$$F_{avg} = \frac{FE}{d}$$

f. Moisture content - (% moisture content).

The moisture content was taken from a slab of wood cut from the post immediately after each test and was calculated by:

$$\% \text{ moisture content} = \frac{W_C - W_D}{W_D} * 100$$

where W_C = weight of wood when cut
W_D = weight of oven dried wood

For comparing guardrail post sizes and materials, analysis of force-time data to the point of major failure is more precise than considerations of total effects. Beyond the point of major failure, it is difficult to compare wooden and steel posts, because wooden posts suffer a major material failure whereas steel posts suffer a major structural failure. Once a steel post fails initially, the subsequent force is largely that used to bend the post around the base. Figure 3 consists of photographs taken from the high-speed film of the test on Post R-16. The major failure occurred between 24 and 30 ms. Figure 4 is the digital data showing the major failure at 26 ms. The time of force generation is a factor in calculating final pendulum velocity, fracture energy and post displacement which is used to calculate the average force acting on the post during impact. Once the major failure occurs, the rate of displacement of the post top increases. By terminating the analysis at the point of major failure, the precision of comparisons is increased.

3. Test Specimens. Prior to receipt, each post was treated, visually inspected, and the desired impact face was marked by the Michigan Department of Transportation. Table 1 includes pretest information about the posts of Phase I. The pretest information for the posts for Phase II consisted only of

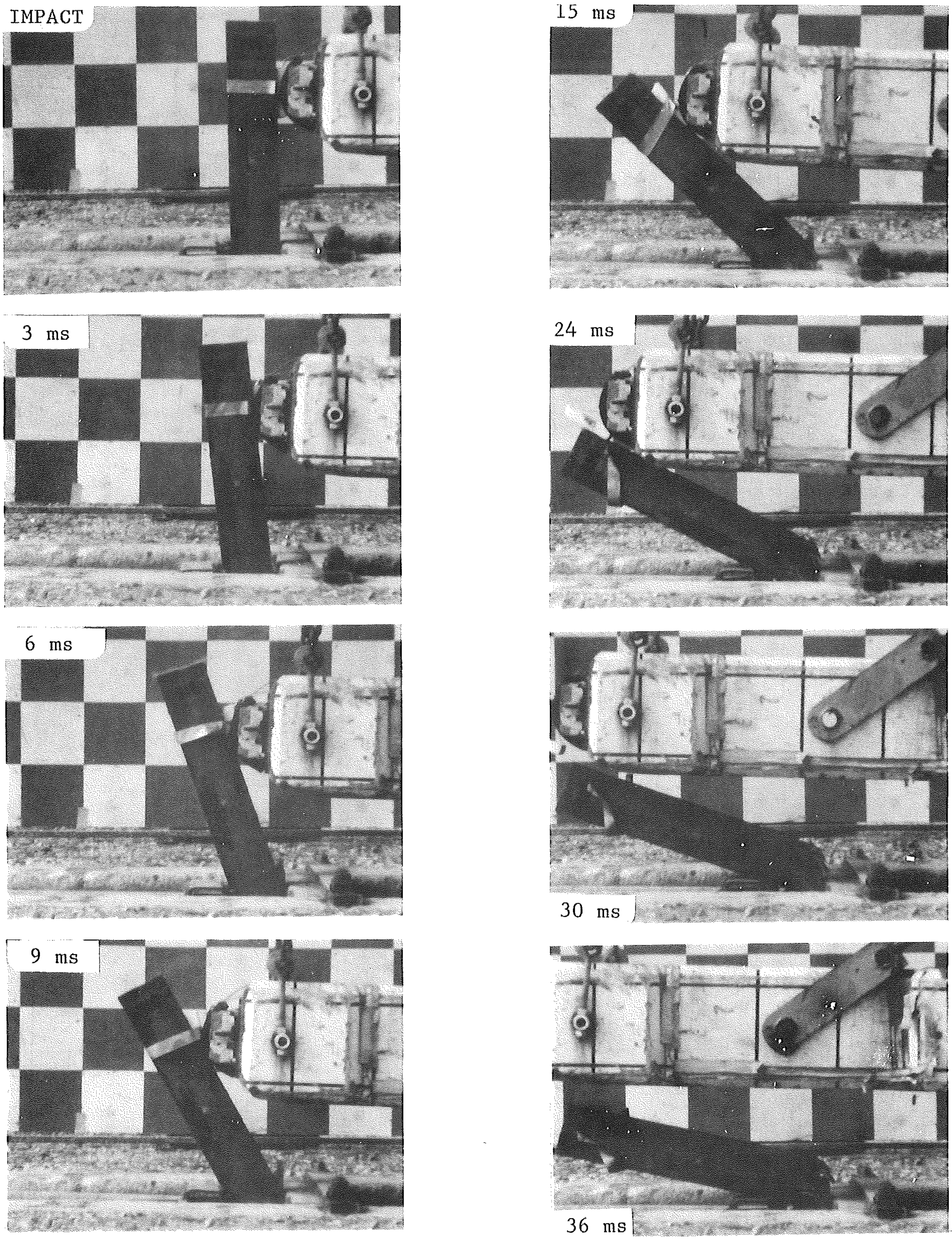
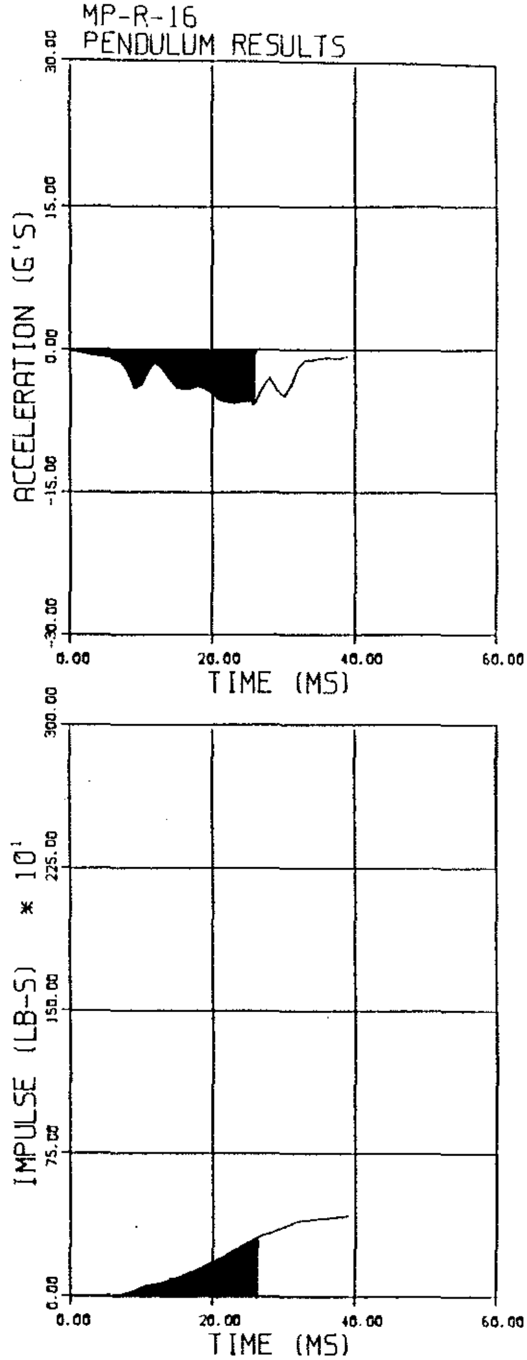


FIGURE 3. FAILURE SEQUENCE FOR RED PINE POST R16



Post R-16 - Red Pine

The shaded area represents the time to major failure.

FIGURE 4. ACCELERATION TIME AND IMPULSE CURVES FOR RED PINE POST R16

TABLE 1[1]

PRETEST POST INFORMATION FOR PHASE I

Post Number	Species	Stress Grade	Grade (1,2)	Condition After Treatment (3)	Comments (1,2,4,5,6)
*1	White Pine	1050	P&T Select	Passed	P&T, No. 1 due to defect outside stress area.
*2	White Pine	1050	P&T No. 1	Passed	
*3	White Pine	900	P&T No. 1	Passed	
*4	White Pine	950	P&T No. 2	Passed	
*5	White Pine	1150	P&T No. 1	Passed	
6	Yellow Birch	2300	P&T Select	Passed	
7	Yellow Birch	1750	MDOT	Passed	
8	Beech	1200	P&T No. 2	Passed	
9	Beech	2000	MDOT	Passed	
10	Beech	1700	MDOT	Passed	
11	Beech	1950	MDOT	Failed due to split	
12	Beech	2350	P&T Select	Passed	
13	Red Maple	1900	MDOT	Passed	
14	Beech	1100	P&T No. 2	Passed	
15	Beech	2000	P&T No. 1	Passed	
16	Beech	1800	P&T No. 1	Passed	
17	Beech	2350	P&T No. 1	Passed	
18	Red Maple	1800	MDOT	Passed	
19	Red Maple	2000	P&T Select	Passed	
20	Red Maple	2100	P&T Select	Passed	
21	Red Maple	2100	P&T Select	Passed	
22	Red Maple	1800	P&T Select	Passed	
23	Red Maple	1800	MDOT	Passed	
24	Red Maple	1850	MDOT	Failed due to check length.	
25	Red Maple	1800	P&T Select	Passed	
26	Red Maple	1450	MDOT	Passed	
27	Red Maple	1900	P&T Select	Passed	P&T No. 2 due to unsound knot.
28	Aspen	---	Reject	Passed	Rotted
29	Aspen	1300	P&T No. 1	Passed	P&T No. 2 due to unsound knot.
30	Red Maple	1950	MDOT	Passed	P&T No. 2 due to unsound knot.
31	Red Oak	2000	MDOT	Passed	P&T No. 2 due to unsound knot.
32	Red Oak	2000	P&T No. 2	Passed	
33	Red Oak	2300	MDOT	Passed	
34	Red Oak	1800	MDOT	Passed	P&T No. 2 due to unsound knot.
35	Red Oak	2100	MDOT	Passed	

* Indicates Posts with Nominal Cross-Sectional Dimensions of 8 in. x 8 in. All others are 6 in. x 8 in.

Notes on Table

1) P&T is Posts and Timbers.
   B&S is Beams and Stringers.
2) Grading rules are either Northeastern Lumber Manufacturers Association or Michigan Department of Transportation.
3) Condition after treatment is based on Michigan Department of Transportation Specification only.
4) Some posts could be considered post and timber, No. 2 due to unsound knots, however, were not graded as such since these knots were either smaller than 1/2 in. in diameter or outside the stress area.
5) Some posts could be considered post and timber, No. 2 due to white speck, however, they were not put in that grade since, according to the NELMA definition, "Pieces containing white speck are no more subject to decay than pieces which do not contain it" and "it develops in the living tree and does not develop further in wood in service."
6) If a post contained a defect outside the stress area (the middle one-half), its category was noted had the entirepost been graded. The middle half of the post was graded because the greatest forces occur in the middle third of the post when inserted in the ground to a depth equal to half their length.(3)

1. Arnold, Charles J., Letter to Southwest Research Institute, Oct. 8, 1985.

TABLE 1[1] (Continued)

PRETEST POST INFORMATION FOR PHASE I

Post Number	Species	Stress Grade	Grade (1,2)	Condition After Treatment (3)	Comments (1,2,4,5,6)
36	Red Oak	1700	MDOT	Passed	P&T No. 2 due to unsound knot.
37	Aspen	1350	B&S Select	Passed	P&T No. 2 due to unsound knot.
38	White Ash	1650	MDOT	Failed due to check depth.	P&T No. 2 due to unsound knot.
39	White Ash	2200	MDOT	Passed	P&T No. 2 due to unsound knot.
40	White Ash	1350	P&T No. 2	Passed	
41	White Ash	1800	None	Passed	
42	White Ash	2000	P&T No. 2	Failed due to split.	
43	White Ash	2200	P&T No. 1	Failed due to split.	P&T No. 2 due to unsound knot.
44	Aspen	1250	B&S Select	Passed	P&T No. 2 due to unsound knot.
45	Aspen	850	P&T No. 1	Passed	
46	Aspen	1150	P&T No. 3	Failed due to split.	
47	Aspen	1250	B&S Select	Passed	P&T No. 2 due to unsound knot.
48	White Ash	2100	P&T No. 1	Failed due to split.	P&T No. 2 due to unsound knot.
49	Aspen	1150	B&S No. 1	Passed	
50	Beech	2350	P&T Select	Passed	
51	Beech	1850	MDOT	Passed	P&T No. 2 due to unsound knot.
52	White Ash	2150	MDOT	Passed	P&T No. 2 due to unsound knot.
53	Aspen	1250	B&S Select	Passed	P&T No. 2 due to unsound knot.
54	Aspen	1300	B&S Select	Failed due to split.	
55	White Ash	2600	None	Passed	
56	White Ash	2350	None	Passed	
57	Aspen	1250	B&S Select	Failed due to split and shake.	
58	Beech	1650	MDOT	P&T No. 2 due to unsound knot.	
59	Aspen	1300	B&S Select	Failed due to shake.	P&T No. 2 due to unsound knot.
60	White Ash	2100	MDOT	Passed	P&T No. 2 due to unsound knot.
61	White Ash	2600	P&T Select	Failed due to split.	
62	Elm	1600	MDOT	Passed	
63	Elm	1350	P&T No. 1	Passed	
64	Elm	2000	MDOT	Failed due to check width.	
65	Elm	2000	MDOT	Failed due to rotted end.	
66	Elm	800	P&T No. 2	Passed	
67	Elm	1550	MDOT	Passed	
68	Elm	2000	MDOT	Failed due to check width.	
69	Elm	800	P&T No. 2	Passed	
70	Elm	1500	MDOT	Passed	P&T No. 2 due to defect outside stress area.

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1. Arnold, Charles J., Letter to Southwest Research Institute, Oct. 8, 1985.

TABLE 1[1] (Continued)

PRETEST POST INFORMATION FOR PHASE I

Post Number	Species	Stress Grade	Grade (1,2)	Condition After Treatment (3)	Comments (1,2,4,5,6)
71	Elm	1550	MDOT	Passed	
72	Elm	2000	MDOT	Passed	Reject due to decay outside stress area.
73	Elm	1750	MDOT	Failed due to check width.	
74	Yellow Birch	1650	P&T No. 2	Failed due to check depth.	
75	Sugar Maple	2200	P&T Select	Failed due to check depth.	
76	Yellow Birch	2000	P&T Select	Failed due to check depth.	
77	Aspen	1500	B&S Select	Passed	
78	Yellow Birch	1150	MDOT	Passed	
79	Aspen	1300	B&S Select	Passed	
80	Sugar Maple	1400	P&T Select	Passed	
81	Yellow Birch	1600	P&T No. 1	Failed due to check depth.	
82	Yellow Birch	2300	P&T Select	Passed	
83	Yellow Birch	2300	P&T Select	Failed due to check depth.	
84	Sugar Maple	1000	P&T No. 2	Passed	
85	Yellow Birch	2300	MDOT	Passed	
86	Sugar Maple	2200	P&T Select	Passed	
87	Yellow Birch	1800	MDOT	Failed due to check length.	
88	Sugar Maple	1300	P&T No. 2	Passed	
89	Yellow Birch	2000	P&T Select	Passed	
90	Yellow Birch	1900	P&T No. 2	Failed due to check depth.	
91	Sugar Maple	2300	P&T Select	Passed	P&T No. 2 due to unsound knot.
92	Sugar Maple	1000	P&T No. 2	Passed	
93	Sugar Maple	1900	MDOT	Passed	
94	Sugar Maple	2300	MDOT	Passed	P&T No. 2 due to unsound knot.
95	Sugar Maple	2600	MDOT	Passed	
96	Sugar Maple	2300	P&T Select	Passed	
97	Sugar Maple	1000	P&T No. 2	Passed	P&T No. 3 due to defect outside stress area.
98	Hemlock	1750	P&T Select	Failed due to shake.	P&T No. 3 due to defect outside stress area.
99	Hemlock	1200	P&T No. 1	Passed	P&T No. 2 due to unsound knot.
100	Hemlock	1700	P&T Select	Failed due to shake.	P&T No. 3 due to defect outside stress area.
101	Hemlock	1600	P&T No. 1	Failed due to shake.	P&T No. 2 due to unsound knot.
102	Hemlock	1300	P&T No. 1	Passed	
103	Red Pine	1350	B&S Select	Passed	P&T No. 2 due to white speck.
104	Red Pine	1200	P&T Select	Failed due to shake.	P&T No. 2 due to white speck.
105	Red Pine	1750	P&T No. 2	Passed	

* Indicates Posts with Nominal Cross-Sectional Dimensions of 8 in. x 8 in. All others are 6 in. x 8 in.

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6) If a post contained a defect outside the stress area (the middle one-half), its category was noted had the entirepost been graded. The middle half of the post was graded because the greatest forces occur in the middle third of the post when inserted in the ground to a depth equal to half their length.(3)

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TABLE 1[1] (Continued)

PRETEST POST INFORMATION FOR PHASE I

Post Number	Species	Stress Grade	Grade (1,2)	Condition After Treatment (3)	Comments (1,2,4,5,6)
106	Red Pine	1500	P&T Select	Passed	
107	Red Pine	1450	P&T Select	Passed	
108	Red Pine	1150	P&T No. 2	Passed	
109	Red Pine	1350	P&T No. 2	Passed	
110	Red Pine	1650	P&T No. 2	Passed	
111	Red Pine	1750	P&T Select	Passed	
112	Red Pine	1250	P&T No. 1	Passed	
113	Red Pine	1750	P&T Select	Passed	
115	White Pine	1200	P&T Select	Passed	P&T No. 2 due to white speck.
116	White Pine	1200	P&T Select	Passed	P&T No. 2 due to white speck.
119	White Pine	1200	P&T Select	Passed	P&T No. 2 due to white speck.
120	White Pine	1350	P&T Select	Passed	P&T No. 2 due to unsound knot.
121	Jack Pine	1800	P&T No. 1	Passed	P&T No. 2 due to unsound knot.
122	Jack Pine	1550	P&T Select	Passed	P&T No. 2 due to unsound knot.
123	Jack Pine	1800	P&T No. 1	Passed	P&T No. 2 due to unsound knot.
124	Jack Pine	1200	P&T No. 2	Passed	
125	Jack Pine	1450	P&T Select	Failed due to shake.	P&T no. 1 due to defect outside stress area.
126	Jack Pine	1400	P&T Select	Passed	
127	Jack Pine	1150	P&T No. 1	Passed	
128	Jack Pine	1600	B&S Select	Passed	P&T No. 2 due to unsound knot.
129	Jack Pine	1450	P&T Select	Passed	P&T No. 2 due to unsound knot.
130	Jack Pine	1550	P&T Select	Passed	
131	Jack Pine	1400	B&S Select	Passed	P&T No. 1 due to defect outside stress area.
132	Jack Pine	1150	B&S Select	Passed	P&T No. 2 due to defect outside stress area.
*133	Red Pine	950	P&T No. 1	Passed	
*134	Red Pine	1450	P&T No. 1	Passed	
*135	Red Pine	1400	P&T Select	Passed	
*136	Red Pine	900	Reject	Passed	Some rot.
*137	Red Pine	1050	P&T No. 1	Passed	
*138	Red Pine	1100	P&T No. 1	Passed	
139	Red Pine	1200	P&T No. 1	Passed	
140	White Pine	1150	P&T Select	Passed	
141	Hemlock	1450	P&T Select	Passed	
*142	White Pine	1250	P&T No. 1	Passed	P&T No. 2 due to white speck.
143	Hemlock	1000	P&T Select	Passed	

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TABLE 1[1] (Continued)

PRETEST POST INFORMATION FOR PHASE I

Post Number	Species	Stress Grade	Grade (1,2)	Condition After Treatment (3)	Comments (1,2,4,5,6)
144	White Pine	1050	P&T Select	Passed	P&T No. 2 due to white speck.
145	White Pine	900	P&T No. 1	Passed	P&T No. 2 due to white speck.
146	Hemlock	1100	P&T No. 1	Passed	
148	White Pine	1450	B&S Select	Passed	P&T No. 2 due to white speck.
149	White Pine	1250	B&S Select	Passed	
150	White Pine	1300	P&T Select	Passed	P&T No. 1 due to defect outside stress area.
152	White Pine	1150	B&S Select	Passed	B&S No. 1 due to defect outside stress area.
153	White Pine	1450	B&S Select	Passed	P&T No. 2 due to defect outside stress area.
155	White Pine	1150	B&S Select	Passed	P&T No. 2 due to white speck.
157	White Pine	1200	P&T Select	Passed	
159	Hemlock	1500	P&T Select	Passed	P&T No. 2 due to unsound knot.
160	Hemlock	1850	P&T Select	Passed	
161	Hemlock	1600	P&T No. 1	Passed	P&T No. 2 due to unsound knot.
162	Hemlock	1400	P&T Select	Passed	P&T No. 2 due to unsound knot.

* Indicates Posts with Nominal Cross-Sectional Dimensions of 8 in. x 8 in. All others are 6 in. x 8 in.

Notes on Table

1) P&T is Posts and Timbers.
B&S is Beams and Stringers.
2) Grading rules are either Northeastern Lumber Manufacturers Association or Michigan Department of Transportation.
3) Condition after treatment is based on Michigan Department of Transportation Specification only.
4) Some posts could be considered post and timber, No. 2 due to unsound knots, however, were not graded as such since these knots were either smaller than 1/2 in. in diameter or outside the stress area.
5) Some posts could be considered post and timber, No. 2 due to white speck, however, they were not put in that grade since, according to the NELMA definition, "Pieces containing white speck are no more subject to decay than pieces which do not contain it" and "it develops in the living tree and does not develop further in wood in service."
6) If a post contained a defect outside the stress area (the middle one-half), its category was noted had the entire post been graded.
6) If a post contained a defect outside the stress area (the middle one-half), its category was noted had the entirepost been graded. The middle half of the post was graded because the greatest forces occur in the middle third of the post when inserted in the ground to a depth equal to half their length.(3)

1. Arnold, Charles J., Letter to Southwest Research Institute, Oct. 8, 1985.

species. The wood posts were cut to nominal 68-in long sections for installation in the fixture. The entire length of the impact face of the post was marked for identification after the test. A 1-in thick attenuation pad of styrofoam was attached to the posts at the pendulum contact point.

B. Full-Scale Crash Tests

1. Test Facility. The test facility is located at Brooks Air Force Base approximately 20 miles from the SwRI campus. The standard G4(W) guardrail installations were constructed adjacent to an inactive runway. The length of each installation was 100 ft. consisting of W-beam rails attached to wood posts and blockouts spaced at 6 ft-3 in.

The ten posts and blockouts at the impact location and down stream from impact were constructed of the desired species of the recommended cross section. The remaining posts and blockouts were constructed of southern pine.

2. Data Acquisition. Data acquired during the impact event is obtained from electronic and photographic sources. Each is totally independent of the other which offers a means of checking the data. The electronic data consists of three accelerometers and a rate gyro mounted at the approximate center of gravity of the vehicle. These are oriented to obtain data in directions parallel to the longitudinal, lateral, and vertical axes of the vehicle. The photographic data are provided by two high-speed cameras at right angles to each other. A motion analyzer is used to provide displacement data about the vehicle during impact. Additional cameras are used to provide visual information.

3. Test Criteria. The guardrail systems were tested to NCHRP *Report 230*[4] criteria for the strength test No. 10. This requires that the systems be tested with a 4500-lb vehicle at 60 mph and a 25-degree impact angle.

III. RESULTS

A. Pendulum Test Results

Tests were performed on 188 posts made from four species of soft wood and eight species of hard wood. Two cross-sections, 6"x 8" and 8"x 8", of three species were tested. Table 2 gives a matrix of the tested posts.

The posts were tested in numerical order and the tabulated and plotted results for each post are presented in Appendix A. Table 3 provides a summary of the average results of each species while Table 4 provides the results for each post by species. The digital information for 23 of the 188 tests was unavailable because of magnetic tape failure. However, the hard copy tracings from the oscillograph were available and the necessary information was obtained from these. The digitized plots from these tracings are included in Appendix A.

Considerable variation is noted in the post impact properties determined from pendulum tests (Table 4). Even tests on the same wood species at near equal moisture contents and stress grades are subject to variations. This, however, is not unexpected because in contrast with most structural materials, the strength properties of wood and their relationships to applied loadings are highly variable. Wood is neither homogeneous or isotropic. Its strength properties are affected by moisture content and density as well as by knots, shakes, checks, splits and other flaws parallel and perpendicular to the grain.

The first four tests on white pine utilized an impact velocity of 30 fps (20.5 mph). All subsequent tests were conducted at 20 fps (13.6 mph). Since the strength properties determined by pendulum tests are independent of the impact velocity and the energy for fractures is basically the same regardless of its value, the impact velocity was reduced for smoother pendulum operations.

TABLE 2

MATRIX OF POSTS TESTED BY PENDULUM

Species	Number Tested	Description
PHASE I		
White Pine	6	8x8 inch
White Pine	12	6x8 inch
Yellow Birch	11	6x8 inch
Beech	12	6x8 inch
Red Maple	12	6x8 inch
Elm	12	6x8 inch
Red Oak	6	6x8 inch
Aspen	14	6x8 inch
White Ash	12	6x8 inch
Sugar Maple	12	6x8 inch
Hemlock	12	6x8 inch
Red Pine	12	6x8 inch
Red Pine	6	8x8 inch
Jack Pine	12	6x8 inch
TOTAL PHASE I	151	
PHASE II		
Jack Pine	8	8x8 inch
Red Pine	8	8x8 inch
Red Maple	10	6x8 inch
White Ash	10	6x8 inch
TOTAL PHASE II	36	
TOTAL	187	

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TABLE 3

AVERAGE IMPACT VALUES FOR EACH WOOD SPECIES

Type of Post	Phase in Which Posts Were Tested	Post Cross-Section ($in.^2$)	Moisture Content (%)	Fracture Energy (ft-k)	Average Force (lbs)	Displacement (ft)	Peak Force (lbs)
Soft Wood							
- White Pine 8x8	I	64.80	86	4.43	12,440	0.45	27,126
- White Pine 6x8	I	49.04	65	2.49	7,224	0.34	11,082
- Hemlock 6x8	I	49.27	50	3.35	7,823	0.43	12,277
- Red Pine 6x8	I	48.75	47	2.86	7,211	0.39	12,203
- Red Pine 8x8	I	64.42	37	2.38	6,582	0.36	10,412
- Red Pine 8x8	II	56.01	25	6.78	16,102	0.42	24,291
- Jack Pine 6x8	I	47.98	40	4.33	9,030	0.47	14,310
- Jack Pine 8x8	II	57.43	19	5.50	12,760	0.42	23,210
Hard Wood							
- Yellow Birch 6x8	I	49.69	43	7.50	10,990	0.68	19,079
- Beech 6x8	I	45.60	40	6.74	11,506	0.58	17,331
- Red Maple 6x8	I	45.12	32	5.22	10,533	0.49	16,567
- Red Maple 6x8	II	48.09	30	10.24	17,916	0.57	29,112
- Elm 6x8	I	47.06	44	14.73	12,666	1.08	18,556
- Red Oak 6x8	I	41.68	62	8.36	12,322	0.68	19,968
- Aspen 6x8	I	47.03	61	3.81	7,502	0.51	12,583
- White Ash 6x8	I	47.20	33	6.49	10,493	0.61	16,492
- White Ash 6x8	II	47.89	40	6.01	11,519	0.52	20,289
- Sugar Maple 6x8	I	51.04	36	6.99	12,026	0.58	21,319

TABLE 4

SUMMARY OF POST IMPACT PROPERTIES, PHASE I

POST NO.	TYPE OF POST	POST X-SECT AREA (SQ IN)	MOISTURE CONTENT (%)	STRESS GRADE (PSI)	PENDULUM VELOCITY IMPACT (FT/SEC)	PENDULUM VELOCITY FINAL (FT/SEC)	ELAPSED TIME (SEC)	IMPULSE (LB-SEC)	FRACTURE ENERGY (FT-K)	AVER. FORCE (LBS)	DISPLACE-MENT (FT)	PEAK FORCE (LBS)
1	WHITE PINE	65.26	103	1050	29.33	26.70	0.018	327	9.31	18261	0.51	32950
2	WHITE PINE	65.00	74	1050	29.33	28.06	0.026	158	4.61	6142	0.75	23557
3	WHITE PINE	65.00	93	900	29.33	28.01	0.014	163	4.78	11959	0.40	28387
4	WHITE PINE	64.25	100	950	29.33	28.13	0.014	149	4.36	10894	0.40	30830
5	WHITE PINE	66.02	89	1150	18.33	16.08	0.016	279	4.89	18122	0.27	28576
142	WHITE PINE	63.25	59	1250	19.80	18.34	0.020	182	3.52	9261	0.38	18454
	AVG	64.80	86				0.018	210	4.43	12440	0.45	27126
115	WHITE PINE	48.38	70	1200	19.80	18.94	0.015	107	2.11	7261	0.29	11738
116	WHITE PINE	48.94	76	1200	19.80	18.95	0.015	105	2.08	7178	0.29	7544
119	WHITE PINE	47.50	72	1200	19.80	18.72	0.020	135	2.63	6741	0.39	11299
120	WHITE PINE	48.38	70	1350	19.80	18.53	0.020	158	3.08	7888	0.39	11179
140	WHITE PINE	48.63	43	1150	19.80	19.09	0.015	88	1.75	6017	0.29	8394
148	WHITE PINE	49.51	80	1450	19.80	18.54	0.020	156	3.05	7828	0.39	12127
149	WHITE PINE	50.08	54	1250	19.80	18.96	0.015	104	2.06	7095	0.29	10316
150	WHITE PINE	48.36	63	1300	19.80	19.17	0.015	79	1.55	5350	0.29	9200
152	WHITE PINE	50.08	62	1150	19.80	19.13	0.015	83	1.65	5684	0.29	7985
153	WHITE PINE	49.26	41	1450	19.80	18.62	0.020	147	2.87	7347	0.39	11093
155	WHITE PINE	49.77	81	1150	19.80	18.60	0.020	149	2.91	7467	0.39	12596
157	WHITE PINE	49.63	62	1200	19.80	18.08	0.020	213	4.12	10836	0.38	19513
	AVG	49.04	65				0.018	127	2.49	7224	0.34	11082
7	YELLOW BIRCH	50.66	56	2300	14.67	9.97	0.040	583	7.32	14075	0.52	22993
74	YELLOW BIRCH	50.50	47	1750	19.80	17.94	0.030	231	4.44	7649	0.58	15608
76	YELLOW BIRCH	51.11	41	2000	19.80	15.45	0.050	541	9.69	10888	0.89	17773
78	YELLOW BIRCH	48.56	36	1150	19.80	15.17	0.040	576	10.23	14412	0.71	23317
81	YELLOW BIRCH	48.38	53	1600	19.80	17.65	0.035	268	5.09	7595	0.67	18483
82	YELLOW BIRCH	49.96	45	2300	19.80	17.03	0.040	344	6.45	8484	0.76	13897
83	YELLOW BIRCH	48.98	32	2300	19.80	15.08	0.050	586	10.40	11691	0.89	17995
85	YELLOW BIRCH	50.39	53	2300	19.80	16.35	0.035	429	7.88	12126	0.65	18072
87	YELLOW BIRCH	*	34	1800	19.80	16.90	0.035	360	6.73	10348	0.65	19234
89	YELLOW BIRCH	49.13	34	2000	19.80	16.38	0.035	425	7.82	12031	0.65	21394
90	YELLOW BIRCH	49.25	42	1900	19.80	17.01	0.030	347	6.49	11590	0.56	21104
	AVG	49.69	43				0.038	426	7.50	10990	0.68	19079
8	BEECH	*	44	1200	19.80	17.11	0.025	335	6.27	13944	0.45	24604
9	BEECH	46.27	41	2000	19.80	17.29	0.030	312	5.88	10506	0.56	15911
10	BEECH	46.76	33	1700	19.80	18.41	0.020	173	3.36	8833	0.38	11289
11	BEECH	45.16	40	1950	19.80	17.49	0.025	287	5.44	11583	0.47	15754
12	BEECH	44.30	44	2350	19.80	15.02	0.050	594	10.52	12091	0.87	15571
14	BEECH	45.04	34	1100	19.80	16.31	0.035	434	7.96	12445	0.64	18422
15	BEECH	44.80	40	2000	19.80	17.18	0.025	326	6.12	13028	0.47	21697
16	BEECH	44.56	39	1800	19.80	16.86	0.030	365	6.81	12164	0.56	19208
17	BEECH	46.82	46	2350	19.80	14.46	0.050	663	11.56	13139	0.88	16811
50	BEECH	45.77	40	2350	19.80	17.67	0.025	264	5.04	10732	0.47	17124
51	BEECH	45.89	44	1850	19.80	16.73	0.035	381	7.09	11074	0.64	18701
58	BEECH	46.20	36	1650	19.80	17.75	0.030	255	4.86	8535	0.57	12882
	AVG	45.60	40				0.032	366	6.74	11506	0.58	17331

Note: Multiply fps by 0.6818 to obtain mph.

TABLE 4 (Continued)

SUMMARY OF POST IMPACT PROPERTIES, PHASE I

POST NO.	TYPE OF POST	POST X-SECT AREA (SQ IN)	MOISTURE CONTENT (%)	STRESS GRADE (PSI)	PENDULUM VELOCITY IMPACT (FT/SEC)	PENDULUM VELOCITY FINAL (FT/SEC)	ELAPSED TIME (SEC)	IMPULSE (LB-SEC)	FRACTURE ENERGY (FT-K)	AVER. FORCE (LBS)	DISPLACE-MENT (FT)	PEAK FORCE (LBS)
13	RED MAPLE	43.24	30	1900	19.80	17.26	0.025	316	5.95	12658	0.47	21666
18	RED MAPLE	46.08	37	1800	19.80	17.11	0.030	334	6.27	11205	0.56	17148
19	RED MAPLE	44.38	29	2000	19.80	17.11	0.030	334	6.27	11205	0.56	18235
20	RED MAPLE	45.53	28	2100	19.80	17.51	0.025	285	5.40	11489	0.47	18756
21	RED MAPLE	45.53	30	2100	19.80	18.22	0.020	196	3.80	9991	0.38	13810
22	RED MAPLE	45.47	31	1800	19.80	18.06	0.025	217	4.16	8858	0.47	13488
23	RED MAPLE	46.02	40	1800	19.80	18.13	0.025	208	4.00	8340	0.48	13977
24	RED MAPLE	*	37	1850	19.80	17.84	0.025	243	4.66	9920	0.47	14059
25	RED MAPLE	45.23	34	1800	19.80	17.45	0.030	292	5.53	9879	0.56	13530
26	RED MAPLE	45.90	32	1450	19.80	17.13	0.030	332	6.23	11128	0.56	19794
27	RED MAPLE	45.21	27	1900	19.80	17.05	0.030	341	6.40	11436	0.56	20161
30	RED MAPLE	43.72	26	1950	19.80	18.17	0.020	203	3.91	10293	0.38	14176
	AVG	45.12	32				0.026	275	5.22	10533	0.49	16567
62	ELM	48.31	61	1600	19.80	18.36	0.020	179	3.47	9139	0.38	14108
63	ELM	44.61	24	1350	19.80	1.61	0.300	2259	24.61	9767	2.52	14753
64	ELM	46.27	27	2000	19.80	0.31	0.180	2421	24.77	15481	1.60	19307
65	ELM	48.50	55	2000	19.80	16.27	0.040	439	8.05	11023	0.73	15641
66	ELM	47.48	71	800	19.80	19.32	0.005	59	1.19	3956	0.30	8683
67	ELM	48.00	30	1550	19.80	0.35	0.110	2417	24.77	20990	1.18	29257
68	ELM	45.41	30	2000	19.80	0.61	0.160	2384	24.75	15186	1.63	21966
69	ELM	48.00	24	800	19.80	10.81	0.070	1117	17.39	15955	1.09	21176
70	ELM	44.87	27	1500	19.80	15.47	0.040	538	9.65	13405	0.72	20021
71	ELM	47.37	60	1550	19.80	16.78	0.350	375	6.98	10741	0.65	15606
72	ELM	49.77	65	2000	19.80	17.10	0.030	334	6.30	11244	0.56	17527
73	ELM	46.14	27	1750	19.80	0.12	0.190	2445	24.78	15107	1.64	24629
	AVG	47.06	44				0.125	1247	14.73	12666	1.08	18556
31	RED OAK	41.36	66	2000	19.80	17.31	0.030	310	5.84	10245	0.57	18507
32	RED OAK	44.90	64	2000	19.80	15.84	0.035	492	8.92	13937	0.64	23086
33	RED OAK	40.78	73	2300	19.80	16.47	0.035	413	7.63	11743	0.65	19376
34	RED OAK	*	73	1800	19.80	15.52	0.040	531	9.55	13087	0.73	19504
35	RED OAK	40.91	57	2100	19.80	15.29	0.040	561	10.00	13701	0.73	22283
36	RED OAK	40.44	40	1700	19.80	16.20	0.040	448	8.19	11220	0.73	17051
	AVG	41.68	62				0.037	459	8.36	12322	0.68	19968
28	ASPEN	44.92	62		19.80	18.95	0.020	105	2.08	5337	0.39	9156
29	ASPEN	44.68	48	1300	19.80	18.36	0.025	179	3.47	7235	0.48	12606
37	ASPEN	45.90	59	1350	19.80	17.95	0.035	230	4.41	6687	0.66	8464
44	ASPEN	44.56	55	1250	19.80	18.17	0.025	202	3.91	8149	0.48	13049
45	ASPEN	45.41	62	850	19.80	18.68	0.020	139	2.72	6984	0.39	11170
46	ASPEN	44.56	60	1150	19.80	18.75	0.020	131	2.56	6559	0.39	12653
47	ASPEN	46.50	68	1250	19.80	17.94	0.030	230	4.44	7783	0.57	13160
49	ASPEN	45.90	52	1150	19.80	18.11	0.025	210	4.05	8435	0.48	13337
53	ASPEN	45.64	54	1250	19.80	17.78	0.025	252	4.80	9995	0.48	16465
54	ASPEN	61.28	54	1300	19.80	18.05	0.025	218	4.19	8721	0.48	15506
57	ASPEN	44.38	53	1250	19.80	18.36	0.020	178	3.47	8905	0.39	15675
59	ASPEN	46.39	97	1300	19.80	18.74	0.025	132	2.58	5269	0.49	8721
77	ASPEN	49.00	61	1500	19.80	17.49	0.040	287	5.44	7163	0.76	12692
79	ASPEN	49.26	53	1300	19.80	17.62	0.035	271	5.16	7811	0.66	13508
	AVG	47.03	61				0.026	197	3.81	7502	0.51	12583

Note: Multiply fps by 0.6818 to obtain mph.

TABLE 4 (Continued)

SUMMARY OF POST IMPACT PROPERTIES, PHASE I

POST NO.	TYPE OF POST	POST X-SECT AREA (SQ IN)	MOISTURE CONTENT (%)	STRESS GRADE (PSI)	PENDULUM VELOCITY IMPACT (FT/SEC)	PENDULUM VELOCITY FINAL (FT/SEC)	ELAPSED TIME (SEC)	IMPULSE (LB-SEC)	FRACTURE ENERGY (FT-K)	AVER. FORCE (LBS)	DISPLACE-MENT (FT)	PEAK FORCE (LBS)
38	WHITE ASH	46.70	39	1650	19.80	15.65	0.040	515	9.30	12913	0.72	19967
39	WHITE ASH	45.53	40	2200	19.80	17.83	0.025	245	4.68	9760	0.48	15468
40	WHITE ASH	44.56	30	1350	19.80	18.23	0.025	195	3.77	7861	0.48	10627
41	WHITE ASH	61.03	27	1800	19.80	16.45	0.035	417	7.67	11807	0.65	19563
42	WHITE ASH	42.89	30	2000	19.80	17.36	0.025	303	5.73	12192	0.47	21456
43	WHITE ASH	*	25	2200	19.80	16.84	0.030	367	6.85	12240	0.56	21130
48	WHITE ASH	45.77	40	2100	19.80	15.41	0.050	545	9.77	11101	0.88	14656
52	WHITE ASH	45.90	35	2150	19.80	17.01	0.040	347	6.49	8771	0.74	14295
55	WHITE ASH	*	27	2600	19.80	17.87	0.025	240	4.59	9572	0.48	15971
56	WHITE ASH	46.27	35	2350	19.80	15.91	0.040	484	8.78	12026	0.73	17479
60	WHITE ASH	46.27	31	2100	19.80	18.30	0.025	186	3.61	7525	0.48	12988
61	WHITE ASH	47.13	39	2600	19.80	16.96	0.035	352	6.60	10151	0.65	14308
	AVG	47.20	33				0.033	350	6.49	10493	0.61	16492
75	SUGAR MAPLE	53.39	37	2200	19.80	15.65	0.040	515	9.30	12736	0.73	16408
80	SUGAR MAPLE	49.36	30	1400	19.80	15.89	0.040	485	8.82	12081	0.73	19929
84	SUGAR MAPLE	54.44	53	1000	19.80	17.27	0.025	314	5.93	12611	0.47	21411
86	SUGAR MAPLE	49.00	39	2200	19.80	16.29	0.035	436	8.01	12509	0.64	19504
88	SUGAR MAPLE	51.76	31	1300	19.80	17.62	0.025	271	5.16	10969	0.47	19950
91	SUGAR MAPLE	53.19	36	2300	19.80	16.67	0.030	388	7.21	12883	0.56	24951
92	SUGAR MAPLE	*	34	1000	19.80	16.85	0.030	366	6.83	12202	0.56	21138
93	SUGAR MAPLE	49.64	29	1900	19.80	17.59	0.025	274	5.22	11111	0.47	20232
94	SUGAR MAPLE	49.64	37	2300	19.80	16.59	0.030	398	7.38	13183	0.56	28791
95	SUGAR MAPLE	50.27	35	2600	19.80	17.45	0.025	292	5.53	11526	0.48	24053
96	SUGAR MAPLE	49.83	35	2300	19.80	16.49	0.035	411	7.59	11862	0.64	20282
97	SUGAR MAPLE	50.98	33	1000	19.80	16.81	0.035	371	6.92	10643	0.65	19180
	AVG	51.04	36				0.031	377	6.99	12026	0.58	21319
98	HEMLOCK	49.26	48	1750	19.80	18.01	0.025	222	4.28	8911	0.48	12772
99	HEMLOCK	49.07	80	1200	19.80	18.19	0.025	200	3.87	8053	0.48	13992
100	HEMLOCK	49.51	54	1700	19.80	18.56	0.025	154	3.01	6263	0.48	10518
101	HEMLOCK	50.53	65	1600	19.80	18.34	0.025	182	3.52	7332	0.48	12241
102	HEMLOCK	48.25	49	1300	19.80	18.53	0.020	157	3.08	7888	0.39	12473
141	HEMLOCK	49.45	71	1450	19.80	17.83	0.025	244	4.68	9760	0.48	15148
143	HEMLOCK	48.75	30	1000	19.80	18.48	0.020	164	3.19	8404	0.38	11285
146	HEMLOCK	50.15	52	1100	19.80	18.50	0.020	155	3.15	8281	0.38	12699
159	HEMLOCK	48.38	39	1500	19.80	19.14	0.015	82	1.62	5601	0.29	13245
160	HEMLOCK	49.26	33	1850	19.80	18.22	0.025	197	3.80	7909	0.48	11570
161	HEMLOCK	49.57	53	1600	19.80	18.53	0.020	158	3.08	7888	0.39	10463
162	HEMLOCK	49.07	27	1400	19.80	18.58	0.020	152	2.96	7588	0.39	10922
	AVG	49.27	50				0.022	172	3.35	7823	0.43	12277

Note: Multiply fps by 0.6818 to obtain mph.

TABLE 4 (Continued)

SUMMARY OF POST IMPACT PROPERTIES, PHASE I

POST NO.	TYPE OF POST	POST X-SECT AREA (SQ IN)	MOISTURE CONTENT (%)	STRESS GRADE (PSI)	PENDULUM VELOCITY IMPACT (FT/SEC)	PENDULUM VELOCITY FINAL (FT/SEC)	ELAPSED TIME (SEC)	IMPULSE (LB-SEC)	FRACTURE ENERGY (FT-K)	AVER. FORCE (LBS)	DISPLACE-MENT (FT)	PEAK FORCE (LBS)
103	RED PINE	49.19	41	1350	19.80	19.08	0.015	89	1.77	6101	0.29	8185
104	RED PINE	49.26	55	1200	19.80	18.53	0.025	158	3.08	6409	0.48	12467
105	RED PINE	49.77	50	1750	19.80	18.24	0.025	193	3.75	7813	0.48	13467
106	RED PINE	48.50	52	1500	19.80	18.04	0.025	218	4.21	8769	0.48	16280
107	RED PINE	47.38	36	1450	19.80	18.55	0.020	155	3.03	7768	0.39	12311
108	RED PINE	49.26	74	1150	19.80	19.38	0.010	53	1.04	5200	0.20	11102
109	RED PINE	49.77	65	1350	19.80	18.40	0.020	174	3.38	8666	0.39	13864
110	RED PINE	47.75	66	1650	19.80	18.35	0.025	180	3.50	7283	0.48	11847
111	RED PINE	47.25	18	1750	19.80	18.52	0.020	158	3.10	7948	0.39	11753
112	RED PINE	47.25	35	1250	19.80	18.80	0.020	125	2.44	6255	0.39	10969
113	RED PINE	50.08	45	1750	19.80	18.32	0.020	183	3.57	9383	0.38	16492
139	RED PINE	49.57	30	1200	19.80	19.22	0.015	72	1.43	4932	0.29	7702
	AVG	48.75	47				0.020	147	2.86	7211	0.39	12203
133	RED PINE	63.25	26	950	19.80	19.02	0.020	97	1.91	4907	0.39	7259
134	RED PINE	64.50	33	1450	19.80	18.29	0.020	188	3.63	9566	0.38	14601
135	RED PINE	65.00	65	1400	19.80	18.53	0.020	158	3.08	7888	0.39	12192
136	RED PINE	65.51	23	900	19.80	18.73	0.020	133	2.61	6681	0.39	12222
137	RED PINE	64.00	40	1050	19.80	19.14	0.015	82	1.62	5601	0.29	8025
138	RED PINE	64.25	35	1100	19.80	19.23	0.015	70	1.41	4848	0.29	8172
	AVG	64.42	37				0.018	121	2.38	6582	0.36	10412
121	JACK PINE	45.51	40	1800	19.80	18.15	0.025	205	3.96	8244	0.48	13356
122	JACK PINE	49.51	35	1550	19.80	18.39	0.020	175	3.40	8956	0.38	11688
123	JACK PINE	46.02	29	1800	19.80	17.21	0.030	322	6.06	10818	0.56	16470
124	JACK PINE	48.00	50	1200	19.80	17.92	0.030	234	4.48	7863	0.57	11915
125	JACK PINE	48.24	35	1450	19.80	18.53	0.020	158	3.08	8096	0.38	12350
126	JACK PINE	50.98	35	1400	19.80	18.34	0.020	182	3.52	9261	0.38	12207
127	JACK PINE	46.88	24	1150	19.80	18.19	0.025	242	3.87	8224	0.47	19659
128	JACK PINE	49.00	75	1600	19.80	17.85	0.025	242	4.64	9872	0.47	14066
129	JACK PINE	50.21	49	1450	19.80	18.77	0.020	128	2.51	6438	0.39	11844
130	JACK PINE	47.00	37	1550	19.80	16.79	0.035	374	6.96	10708	0.65	16569
131	JACK PINE	46.63	34	1400	19.80	18.05	0.025	217	4.19	8721	0.48	13910
132	JACK PINE	47.81	41	1150	19.80	17.58	0.025	276	5.24	11158	0.47	17690
	AVG	47.98	40				0.025	230	4.33	9030	0.47	14310

Note: Multiply fps by 0.6818 to obtain mph.

TABLE 4 (Continued)

SUMMARY OF POST IMPACT PROPERTIES, PHASE I

POST NO.	TYPE OF POST	POST X-SECT AREA (SQ IN)	MOISTURE CONTENT (%)	PENDULUM VELOCITY IMPACT (FT/SEC)	PENDULUM VELOCITY FINAL (FT/SEC)	ELAPSED TIME (SEC)	IMPULSE (LB-SEC)	FRACTURE ENERGY (FT-K)	AVER. FORCE (LBS)	DISPLACE-MENT (FT)	PEAK FORCE (LBS)
01	JACK PINE	56.25	21	20.00	18.49	0.020	188	3.67	9418	0.39	17542
02	JACK PINE	54.84	20	20.00	17.91	0.022	260	5.01	11645	0.43	28205
03	JACK PINE	58.14	23	20.00	19.25	0.018	93	1.86	5168	0.36	13309
04	JACK PINE	58.62	21	20.00	16.52	0.026	439	8.02	17229	0.47	30354
05	JACK PINE	58.61	18	20.00	15.74	0.023	539	9.63	23435	0.41	31570
06	JACK PINE	57.43	17	20.00	19.04	0.017	121	2.36	7115	0.33	18142
07	JACK PINE	56.95	18	20.00	18.08	0.017	243	4.63	14297	0.32	17418
08	JACK PINE	58.61	18	20.00	16.14	0.034	479	8.82	13775	0.64	29141
	AVG	57.43	19			0.022	295	5.50	12760	0.42	23210
R9	RED PINE	55.32	25	20.00	17.09	0.020	368	6.83	18403	0.37	25150
R10	RED PINE	57.62	22	20.00	18.40	0.019	203	3.89	10948	0.36	17823
R11	RED PINE	55.08	21	20.00	17.41	0.018	327	6.12	18175	0.34	19834
R12	RED PINE	55.08	25	20.00	17.16	0.023	359	6.68	15628	0.43	27758
R13	RED PINE	56.25	30	20.00	17.45	0.022	323	6.04	14660	0.41	25399
R14	RED PINE	55.78	28	20.00	16.17	0.026	484	8.75	18607	0.47	28221
R15	RED PINE	56.25	21	20.00	15.49	0.028	570	10.11	20720	0.49	27676
R16	RED PINE	56.72	30	20.00	17.54	0.026	305	5.84	11673	0.50	22466
	AVG	56.01	25			0.023	367	6.78	16102	0.42	24291
W17	RED MAPLE	48.00	31	20.00	14.77	0.031	660	11.48	21305	0.54	25835
W18	RED MAPLE	48.06	28	20.00	17.44	0.019	324	6.07	17056	0.36	24304
W19	RED MAPLE	48.94	29	20.00	14.58	0.039	685	11.85	17802	0.67	24593
W20	RED MAPLE	48.06	27	20.00	15.12	0.036	616	10.82	17363	0.62	36982
W21	RED MAPLE	47.06	30	20.00	14.85	0.036	651	11.35	18089	0.63	33781
W22	RED MAPLE	47.56	29	20.00	15.53	0.033	564	10.03	17104	0.59	33865
W23	RED MAPLE	47.74	25	20.00	17.18	0.022	356	6.62	16564	0.40	24929
W24	RED MAPLE	48.82	31	20.00	13.77	0.039	788	13.30	20199	0.66	33479
W25	RED MAPLE	48.37	32	20.00	16.28	0.026	470	8.53	18450	0.46	24700
W26	RED MAPLE	48.25	39	20.00	14.31	0.045	707	12.34	15232	0.81	28653
	AVG	48.09	30			0.032	582	10.24	17916	0.57	29112
B27	WHITE ASH	49.13	37	20.00	17.83	0.020	274	5.19	13722	0.38	19211
B28	WHITE ASH	49.43	35	20.00	17.54	0.023	311	5.83	13513	0.43	16706
B29	WHITE ASH	46.76	31	20.00	17.84	0.026	273	5.17	10713	0.48	22246
B30	WHITE ASH	47.19	42	20.00	17.25	0.028	341	6.47	12215	0.53	21897
B31	WHITE ASH	48.06	43	20.00	16.14	0.038	479	8.82	12417	0.71	20513
B32	WHITE ASH	47.75	52	20.00	16.44	0.035	442	8.20	12613	0.65	21123
B33	WHITE ASH	47.19	39	20.00	18.18	0.024	226	4.39	9344	0.47	18315
B34	WHITE ASH	48.23	42	20.00	18.44	0.022	194	3.79	8813	0.43	19251
B35	WHITE ASH	47.38	41	20.00	18.52	0.022	184	3.60	8379	0.43	19210
B36	WHITE ASH	47.81	42	20.00	16.24	0.034	467	8.61	13456	0.64	24420
	AVG	47.89	40			0.027	319	6.01	11519	0.52	20289

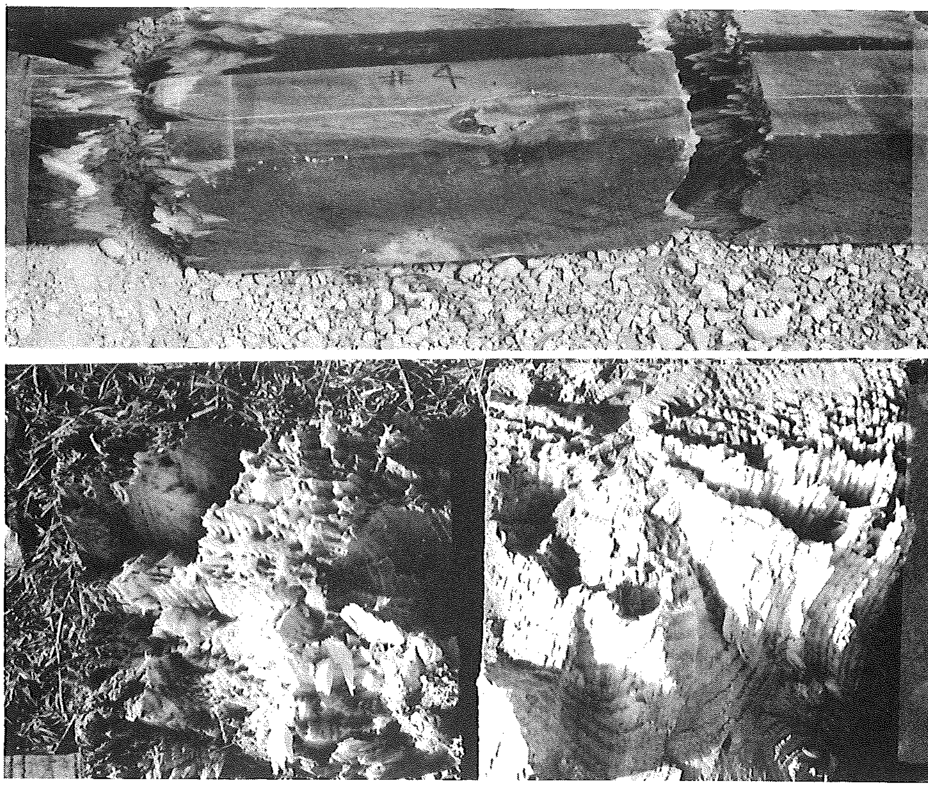
Note: Multiply fps by 0.6818 to obtain mph.

Two distinct failure modes were observed during the pendulum tests; a) brashy and fibrous, and b) shear. (The shear failure mode is an interlaminar shear generally parallel to the grain of the wood). Examples of each type are shown in Figure 5.

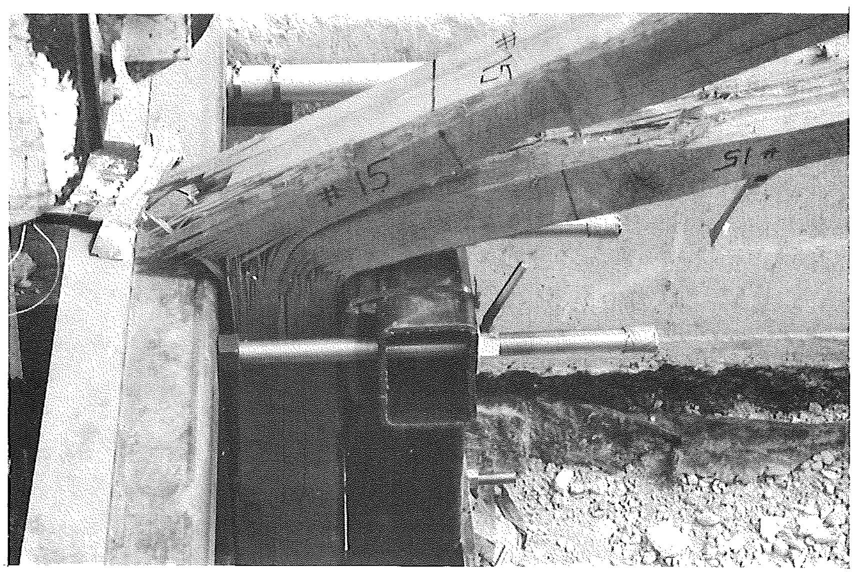
Immediately after each test, a 2-in length of the post was cut from near the failure area and weighed for later determination of moisture content. The only known difference between the posts of Phase I and the posts of Phase II was that the posts of Phase II had a lower moisture content at the time of the preservative treatment to allow for better penetration.

Soft wood. Eight sets of soft wood posts were tested including white pine, hemlock, red pine, and jack pine. The white pine, red pine, and jack pine had two sizes of cross sections, 8"x8" and 6"x8", as indicated in Table 2. All posts were tested about the strong axis. The failure mode for all soft woods was generally brashy to somewhat fibrous. Once begun, failure extended across the entire cross section without shear. When major failure occurred, no resistance remained to the pendulum. The only major exception to this was hemlock post #98 from Phase I which failed primarily in shear.

Hard Wood. Ten sets of hard wood were tested including yellow birch, beech, red maple, elm, red oak, aspen, white ash, and sugar maple. Two sets of the red maple and white ash were tested. All posts had a nominal cross section of 6x8 in and all were tested about the strong axis. Of the hard wood posts, the following stopped the pendulum mass and thus did not fail at impact: yellow birch post #7; beech posts #16, #17; white ash posts #38, #W24; elm posts #63, #64, #67, #68, and #73; and sugar maple post #91. With the exception of the beech and aspen which failed similarly to the soft woods, the hard wood posts generally failed in the shear mode. However, there was no apparent relationship between impact values and the failure mode.



a. Brashy or Fibrous Failure Mode



b. Shear Failure Mode

FIGURE 5. MODES OF FAILURE FOR WOOD POSTS

B. Full-Scale Test Results

Results from previous tests on standard G4(1W) and G4(2W) installations are presented in the AASHTO guide.[1] These and the results of the four tests performed on the different species of wood posts are presented in Table 5. The dynamic deflection of the system is the most critical comparison value. The G4(W) guardrail systems have been tested in the past and deflect approximately 2 1/2 ft in the standard strength test (60-mph, 25-degree, 4500-lb car). Based on this information, MDOT uses a design deflection distance of 2 1/2 ft for their guardrail designs. As shown, Test MWP-1 with 6x8-in white pine posts had a deflection much higher than the design values. All ten of the white pine posts fractured during this test which indicates that the deflection may be greater for an installation composed entirely of 6x8-in white pine posts. The remaining three tests compared very favorably with Report 230[4] performance criteria for G4(W) guardrail systems.

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TABLE 5

SUMMARY OF FULL-SCALE TESTS

Test No.	G4(1W)[4]	G4(2W)[4]	MWP-1	MWP-2	MWP-3	MWP-4
Report 230 Test No.	10	10	10	10	10	10
Post Type	8"x8" Douglas Fir	6"x8" Douglas Fir	6"x8" White Pine	8"x8" White Pine	8"x8" Red Pine	8"x8" Jack Pine
Test Vehicle			1978 Plymouth	1978 Plymouth	1978 Plymouth	1978 Dodge
Gross Vehicle Weight - lb	4123	4960	4700	4310	4310	4325
Impact Speed (film) - mph	60.1	68.0	59.1	61.3	60.6	58.7
Impact Angle - degrees	22.2	24.0	24.4	25.3	23.9	25.1
Exit Angle (film) - degrees	-15.0	-14.0	Not Available	-11.6	-4.3	-14.6
Dynamic Deflection - ft	2.8	2.33*	6.3**	2.8	2.6	2.9
Maximum 50-msec Avg. Accel. (film/accelerometer)						
Longitudinal	-3.0	-6.8	-2.4 (film)	-3.0/-4.8	-4.3/-5.3	-4.8/-5.0
Lateral	-6.1	-7.0	-3.6 (film)	-5.5/-7.0	-5.7/-7.3	-5.1/-7.3
Occupant Risk, NCHRP Report 230 (film/accelerometer)						
ΔV long, fps (30)***			7.0 (film)	12.9/8.8	18.2/16.6	18.9/17.4
ΔV lat, fps (20)***			11.3 (film)	16.2/15.5	18.1/18.3	16.9/18.4
Ridedown Accelerations, g's (accel)						
Longitudinal (15)***			+	+	-3.7	-4.9
Lateral (15)***			-11.3	-10.3	-10.4	-16.1

* Permanent Deflection
** All test posts fractured indicating that the deflection may be larger for an actual installation.
*** Numbers are recommended in NCHRP Report 230
\+ Occupant did not travel required flail distance

[1] AASHTO, "Guide for Selecting, Locating, and Designing Traffic Barriers," 1977.

IV. DISCUSSION OF RESULTS

Proposed Wood Post Specification

As stated in the Introduction, the only existing specifications for wood guardrail posts are presented in References 1 and 2. The 1200 psi stress grade used by AASHTO is based on static test results and does not relate to dynamic post characteristics, and no reference is made to moisture content, or species other than Douglas fir and Southern yellow pine.

1. Dynamic Strength

The dynamic strength of a guardrail post may be quantified by three properties: fracture energy, peak force, and average impact force. The fracture energy is the amount of energy the post can absorb up to failure. The peak and average forces relate to the severity of the impact. As explained below, these properties appear to be independent of static strength properties.

2. Stress Grade

From the 152 pendulum tests performed in Phase I, no relationship could be determined between static stress grade and the three dynamic characteristics, fracture energy, peak force, and average force. Figure 6 shows a plot of stress grade versus the three properties for the 6x8-in white pine posts. In each plot, the dynamic property was divided by the actual post cross-sectional area. A linear regression was performed for each set of data and the R^2 value and standard error are listed with the corresponding plot. The R^2 value, when multiplied by 100, gives the percentage of variation of the random variable which is accounted for by differences in the stress grade. Perfect correlation is indicated when $R^2 = 100\%$, and when R^2 is near zero there is almost no linear correlation between the variables. Values of R^2 near 50% indicate reasonable correlation whereas values less than about 20%

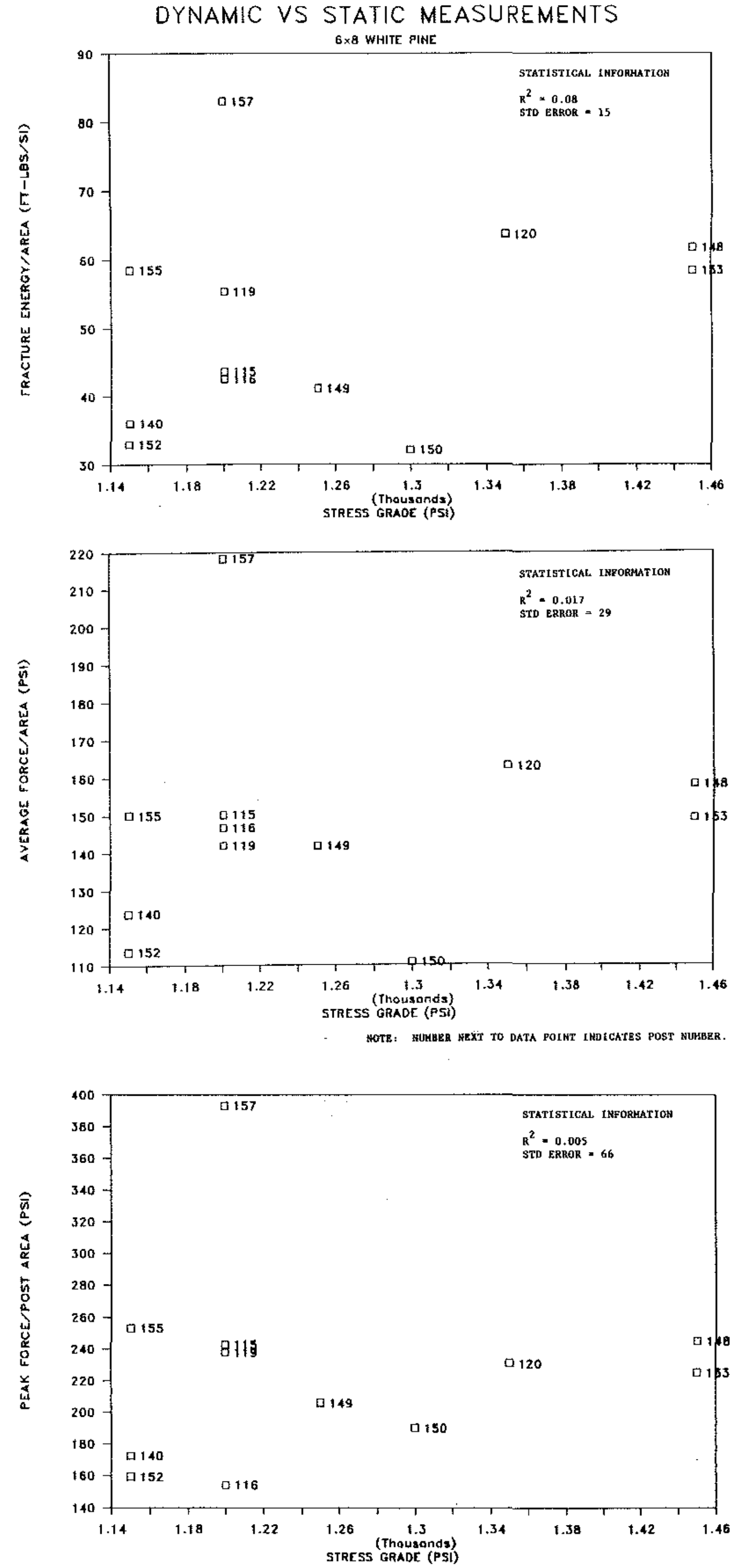


FIGURE 6. STRESS GRADE VS. DYNAMIC PROPERTIES FOR WHITE PINE POSTS

indicate very little linear relation between the variables. For example, in Figure 6, the first graph indicates that only 8 % of the variation in the fracture energy is accounted for by the change in stress grade. The standard error is the amount of the expected variation of the random variable. In the same example, for any stress grade, the predicted fracture energy could vary $\pm$ 15 ft-lbs. Figure 7 presents the same information for red maple. Only data from posts tested in Phase I are used in these figures because stress grade was not provided for Phase II posts.

Because no relationship appears to exist between stress grade and dynamic performance from this work, new or revised specifications should be established.

Critical Knots. From a USDA Forest Service study[3] in 1974, it was determined that the dynamic strength properties of wood guardrail posts depends primarily upon the density and location of defects, especially knots. The location of knots within the post and the extent of the grain distortion can have a serious effect on strength. It was determined that knots which distorted the grain for one-half or more the width of the impact face caused a reduction in dynamic strength.

3. Moisture Content

During the initial work, several post properties were considered including moisture content. In Phase I, the high moisture contents of the tested posts were thought to be conservative based on results of static testing and that the dynamic strength of the posts would increase as the moisture contents dropped below the fiber saturation point. Additional research and testing during Phase II has indicated that this may not be true and that high moisture content would slightly increase the dynamic strength. The U.S. Department of Agriculture Wood Handbook[5] states that the shock

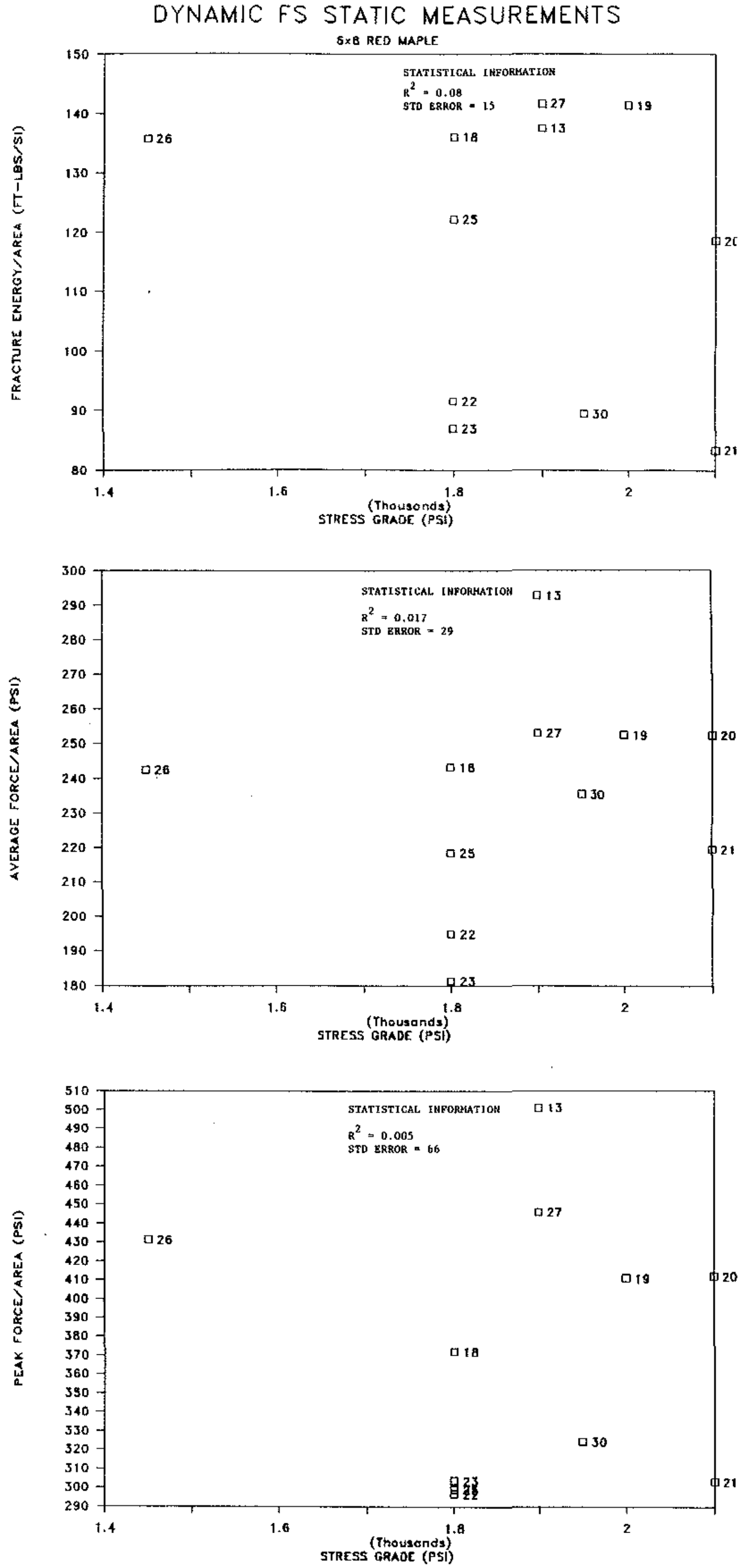


FIGURE 7. STRESS GRADE VS. DYNAMIC PROPERTIES FOR RED MAPLE POSTS

resistance, or dynamic strength, may actually decrease as wood dries because the dry wood will not bend as far as green wood before failure and, thus, the green wood will sustain a greater dynamic load.

The strength data from the pendulum tests were linearly regressed on moisture content to determine if moisture content had an effect on dynamic strength. Figures 8 and 9 illustrate these correlations graphically. As with the stress grade plots, the R^2 value and the standard error are included on each graph. From this information, no discernable relationship exists between mositure content and dynamic strength.

Multiple regressions were performed on these data by the Michigan Department of Transportation relating fracture energy to the product of stress grade and moisture content. The correlation coefficient was low and the R^2 value was approximately 25%, again indicating no significant relationship between the combination of variables.

4. Previous Studies

Two research studies performed for the USDA Forest Service in 1970(6) and 1974(3) quantified the dynamic characteristics for a total of four species of wood posts and the standard steel weak post and steel strong post. Each study tested the two steel post shapes, S3x5.7 and W6x8.5. The 1970 study tested several cross sections of red oak, Douglas fir, red pine, and southern pine posts while the 1974 study tested cross sections of red oak and southern pine. Tables 6 and 7 present the data for the cross sections of interest from each study, respectively. Stress grades of the wood posts were not reported in either study.

Because certain values from these tables will be used as comparisons for the current project, a brief discussion of the testing procedures is presented here. Only tests of posts that were rigidly fixed were considered.

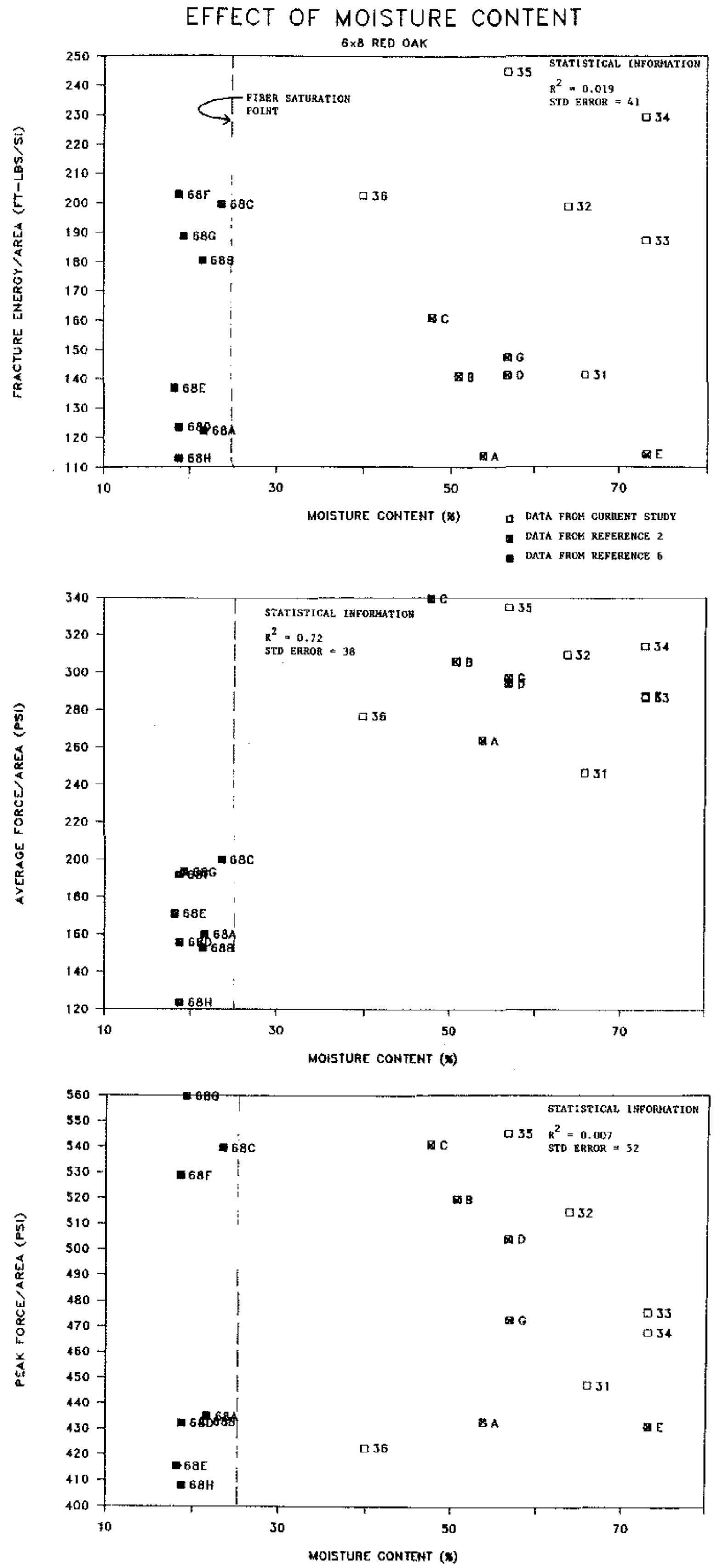


FIGURE 8. MOISTURE CONTENT VS. DYNAMIC PROPERTIES FOR 6X8 RED OAK

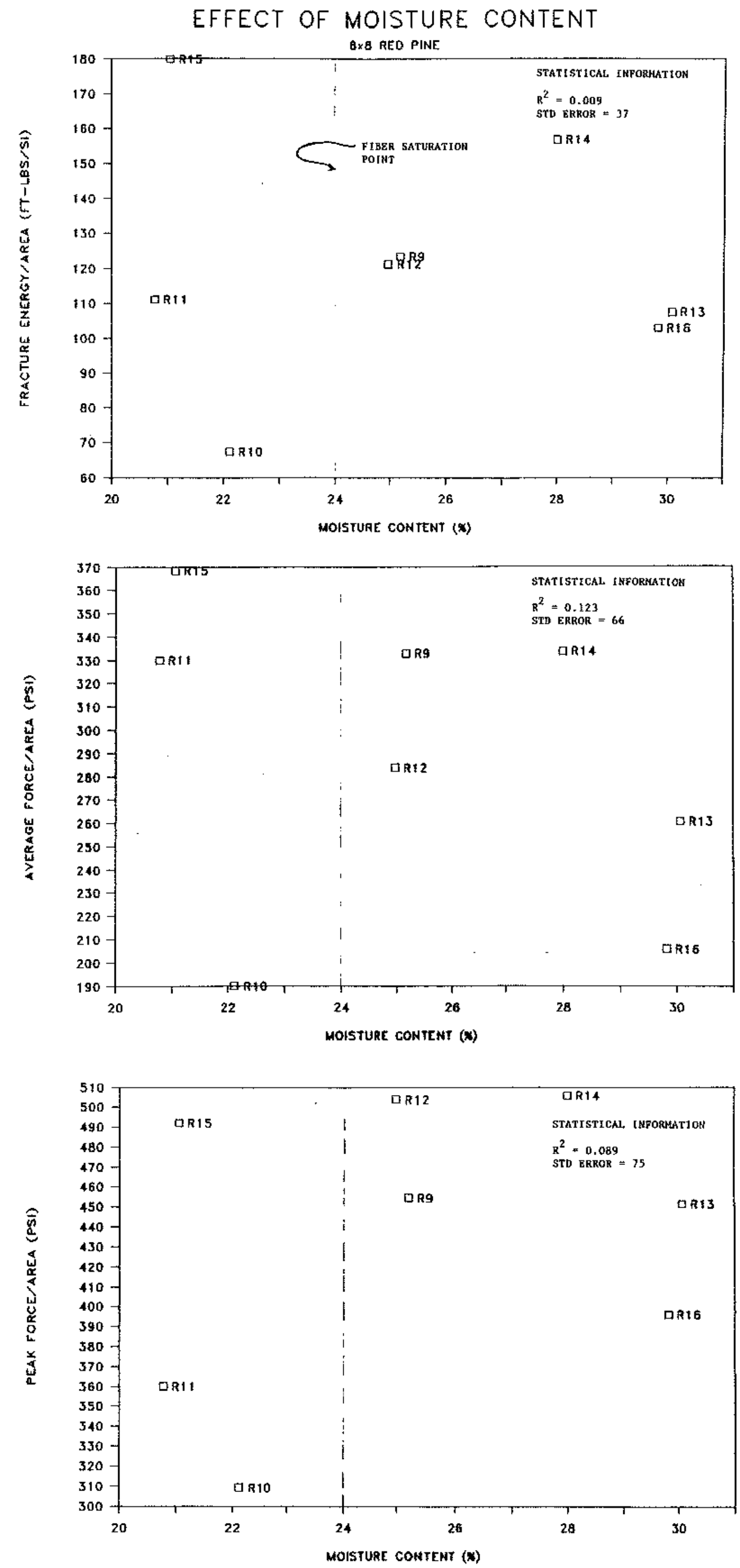


FIGURE 9. MOISTURE CONTENT VS. DYNAMIC PROPERTIES FOR 8X8 RED PINE

TABLE 6[6]

AVERAGE IMPACT VALUES FOR WOODEN POSTS, 1970 STUDY

Posts	Moisture Content	Fracture Energy	Average Force	Displacement	Peak Force
	%	ft-kips	kips	ft	kips
Wood					
Red Oak 6x6	19	3.54	5.1	--	11.6
Red Oak 6x8	20	7.42	7.9	--	22.0
Douglas Fir 6x8	15	4.86	6.8	--	16.3
Douglas Fir 8x8	15	7.25	9.1	--	20.4
Southern Pine 6x6	11	2.80	3.8	--	10.0
Southern Pine 8x8	13	11.81	10.1	--	26.1
Red Pine (Round)	--	1.73	3.5	--	9.6
Steel					
W6x8.5 (about strong axis)	--	6.04	7.4	--	15.3

[6] Michie, J. D. and Bronstad, M. E., "Dynamic Properties of Timber Guardrail Posts," USDA Forest Service, Contract 23-00,210, 1970.

TABLE 7[3]

AVERAGE IMPACT VALUES FOR WOODEN POSTS, 1974 STUDY

Posts	Moisture Content	Fracture Energy	Average Force	Displacement	Peak Force
	%	ft-kips	kips	ft	kips
Wood					
Southern Pine 6x6	23	3.16	8.8	.36	14.3
Southern Pine 8x6 (weak axis)	28	4.55	11.2	.41	18.3
Southern Pine 6x8	24	6.86	13.1	.53	22.0
Southern Pine 6x8, Dense		7.97	14.0	.57	21.0
Red Oak 6x6	52	5.53	11.4	.48	18.1
Red Oak 6x8	57	7.40	15.5	.48	25.6
Steel					
W6x8.5 (about strong axis)	--	5.94	18.0	.33	25.6

[3] Gatchell, Charles J. and Michie, Jarvis D., "Pendulum Impact Tests of Wooden and Steel Highway Guardrail Posts," USDA Forest Service Research Paper NE-311, 1974.

The fixture used for the current tests was identical to the ones used in the previous studies with the following exception. In the 1974 study and in all subsequent studies, the fixture for the steel posts was modified to keep the post from twisting which insures structural failure above the clamp. This made no difference to the test results. The slope on the front face of the T-brace was filled with a wooden block and a U-shaped metal insert was substituted for the pad at the top of the the T. In all other respects, the test procedure was comparable.

5. Behavior Comparisons

Because a relationship does not appear to exist between static and dynamic strength properties of wood, expanded specification criteria should be established for wood guardrail posts and this should be based on dynamic properties. In general, the better strong post is one that provides a lower peak resistance force and a lower average resistance force while at the same time maintaining an adequate fracture energy. Peak and average forces relate to the "G" forces acting on vehicle occupants. Fracture energy relates to the ability of a guardrail system to absorb the energy of impact. The average force is determined by dividing the fracture energy by the post displacement. The more resilient posts will provide greater displacements and, as a result, lower average force values.(3)

The behavior of the W6x8.5 steel posts is considered acceptable for a strong-post system, and is proposed for the standard of comparison. The values from the 1974 study will be used because its modified testing procedures provided a more accurate failure mode.

One of the three full-scale crash tests in Phase II performed successfully with posts made from species whose fracture energy values were less than the W6x8.5 steel post value as shown:

Post	Fracture Energy from Pendulum Test Results (ft-kips)
W6x8.5 (6)	6.04
W6x8.5 (3)	5.94
8x8 Red Pine	6.78
8x8 Jack Pine	5.50

Based on pendulum tests supported by full-scale crash testing, a fracture energy value of 5.5 ft-kips and above has been established in this study. A lower fracture energy (4.5 - 5.0 ft-kips) may be appropriate if proven in future tests.

6. Wood Post Specification Considerations

The following specifications were developed from the preceding information.

1. Wood posts and blockouts should be constructed from approved species of wood. Approval should be documented by one of two methods.
   a) A full-scale crash test, No. 10 from Reference 4, may be performed on the guardrail system, incorporating posts and blockouts constructed of the desired species.
   b) Pendulum tests may be performed on a series of posts of the desired species. If the average fracture energy of the species is equal to or greater than 5.5 ft-kips and the peak and average forces are less than 25.6 kips and 18.0 kips respectively, for the W6x8.5 post, the species is considered appropriate for a strong-post guardrail system.

2. No defects or knots may exist across more than half the face of the post.
3. A minimum stress grade should be included to insure a consistent quality of wood posts and blockouts.

V. CONCLUSIONS

Based on the proposed wood post specification presented in Section III-G, the following conclusions are made using the values presented in Table 3 for pendulum test results and Table 5 for full-scale crash test results:

A. Pendulum Tests

- The 6x8 white pine posts did not develop enough fracture energy and should not be considered for strong posts.
- The 6x8 hemlock and the 6x8 red pine posts did not develop enough fracture energy and should not be considered for strong posts.
- The 6x8 jack pine post did not develop enough fracture energy and should not be considered for strong posts.
- The 6x8 yellow birch, 6x8 beech, and 6x8 red maple posts did develop the required fracture energy and the peak and average forces were less than those for the steel post. These posts may be considered for strong-post systems.
- The 6x8 elm posts had extremely variable impact values and although most developed the appropriate fracture energy, they should not be used for guardrail posts. The high variability between posts could create problems such as vehicle snag.
- The 6x8 red oak post developed the required fracture energy and the peak and average forces were less than those for the steel post. The species may be considered for strong-post systems.
- The 6x8 aspen post did not develop enough fracture energy and should not be considered for strong posts.
- The 6x8 white ash and 6x8 sugar maple developed the required fracture energy and the peak and average forces were less than those for the steel post. These species may be considered for strong posts.
- The 8x8 jack pine posts developed the required fracture energy and the peak and average forces were less than those for the steel post. This species, with the larger cross section, may be considered for strong posts.
- The tests of the 8x8 red pine posts indicated large variability of fracture energy from Phase I to Phase II. This species should not be considered for strong posts without further testing.

- The tests of the 8x8 white pine posts indicated large variability of fracture energy from Phase I and full-scale tests behavior of Phase II. This species should not be considered for strong posts without further testing.

B. Full-Scale Crash Tests

- The guardrails incorporating the 8x8 white pine , 8x8 jack pine, and 8x8 red pine posts were comparable to existing systems and were acceptable according to NCHRP Report 230 criteria. The 8x8 jack pine may be considered for strong-post systems. Because of the variability in results between Phase I and Phase II, the red pine and white pine posts should not be used without further testing.

VI. RECOMMENDATIONS

A. General Recommendations

1. The results from the full-scale test in Phase II indicate that 8x8 jack pine posts performs adequately for the strong-post guardrail systems. It is recommended that these jack pine species be adopted for 8x8-in wood post construction.

2. Because of the extreme variability of the values for the red pine and white pine posts, it is recommended that additional testing be performed before these species are determined to be acceptable for wood post construction.

3. The results from the pendulum tests for each of the species of wood posts have been compared to the standard W6x8.5 steel post. Several species were indicated as acceptable for use as strong posts. It is recommended that 6x8 yellow birch, 6x8 beech, 6x8 red maple, 6x8 red oak, 6x8 white ash, and 6x8 sugar maple posts be adopted for use with strong-post guardrail systems.

4. Treatment of wood guardrail posts was not considered in this study. However, all the posts indicated shallow penetration of treatment. The deepest penetrations were less than two inches and the shallowest was just below the surface. One possibility would be to require a lower water content before treatment. After the post was treated, the water content could be allowed to return to equilibrium.

5. No National Standard currently exists that covers the replacement of wood posts which have naturally deteriorated due to weather, insects, or age. This deterioration will probably occur at the point where maximum stresses occur if the post is impacted, thus creating a hazard. If the post deteriorates from the center, visual inspections are ineffectual. Very little research has been done in this respect for guardrail posts. This should be pursued to establish warrants for replacement.

LIST OF REFERENCES

(1) AASHTO, "Guide for Selecting, Locating, and Designing Traffic Barriers," 1977.

(2) AASHTO-AGC-ARTBA Joint Cooperative Committee, A Guide to Standardized Highway Barrier Rail Hardware, ARTBA Technical Bulletin No. 268-B, AGC Standard Form No. 131, June 1979.

(3) Gatchell, Charles J. and Michie, Jarvis D., "Pendulum Impact Tests of Wooden and Steel Highway Guardrail Posts," USDA Forest Service Research Paper NE-311, 1974.

(4) National Cooperative Highway Research Program, Report 230 Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances, March 1986.

(5) USDA Forest Service, Wood Handbook, Handbook No. 72, 1955.

(6) Michie, J. D. and Bronstad, M. E., "Dynamic Properties of Timber Guardrail Posts," USDA Forest Service, Contract 23-00,210, 1970.

APPENDIX A

PENDULUM TEST RESULTS

Note: Multiply fps by 0.6818 to obtain mph.

TEST ID ----- P-1 *
TEST DATE --- 10-07-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	29.33	0.00	239.	0.
.002	-.12	29.32	.06	462.	1.
.004	-.24	29.31	.12	971.	2.
.006	-1.70	29.26	.18	6800.	8.
.008	-6.88	28.97	.23	27535.	45.
.010	-7.30	28.51	.29	29192.	102.
.012	-8.24	28.01	.35	32950.	164.
.014	-8.13	27.47	.40	32504.	231.
.016	-6.31	27.00	.46	25242.	290.
.018	-2.87	26.70	.51	11482.	327.
.020	-.96	26.60	.57	3838.	339.
.022	-1.79	26.51	.62	7151.	350.
.024	-.55	26.43	.67	2182.	360.
.026	-.07	26.41	.72	271.	362.
.028	.04	26.41	.78	-143.	362.
.030	.01	26.42	.83	-48.	362.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-7.27	.0070	.0170

START OF PROGRAM BLOCKF

POST 1 - WHITE PINE

TEST ID ----- P-2 *
TEST DATE --- 10-07-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	29.33	0.00	76.	0.
.002	-.06	29.33	.06	228.	.
.004	-.09	29.32	.12	350.	1.
.006	-.06	29.32	.18	228.	1.
.008	-.11	29.31	.23	442.	2.
.010	-.16	29.30	.29	655.	3.
.012	-.24	29.29	.35	959.	5.
.014	-.52	29.27	.41	2086.	8.
.016	-3.90	29.16	.47	15608.	21.
.018	-5.89	28.83	.53	23557.	63.
.020	-2.62	28.51	.58	10492.	101.
.022	-1.48	28.38	.64	5924.	118.
.024	-2.68	28.26	.70	10705.	133.
.026	-2.72	28.06	.75	10888.	158.
.028	-.80	27.97	.81	3183.	169.
.030	-.69	27.93	.87	2756.	174.
.032	-.49	27.89	.92	1964.	179.
.034	-.41	27.85	.98	1660.	183.
.036	-.25	27.83	1.03	990.	186.
.038	-.13	27.82	1.09	533.	187.
.040	.01*	27.82	1.14	-46.	187.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.49	.0160	.0260

POST 2 - WHITE PINE

TEST ID ----- P-3 *
TEST DATE --- 10-07-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	29.33	0.00	122.	0.
.002	-4.19	29.28	.06	16777.	6.
.004	-7.10	28.86	.12	28387.	58.
.006	-6.82	28.39	.17	27293.	117.
.008	-3.19	28.15	.23	12765.	147.
.010	-.33	28.06	.29	1337.	157.
.012	.17	28.03	.34	-669.	162.
.014	.23	28.01	.40	-912.	163.
.016	-.20	28.02	.45	790.	163.
.018	-.15	28.01	.51	608.	163.
.020	-.06	28.02	.57	243.	163.
.022	.17	28.02	.62	-669.	162.
.024	.14	28.03	.68	-547.	162.
.026	0.00	28.03	.74	0.	161.
.028	-.03	28.03	.79	122.	161.
.030	0.00	28.03	.85	0.	162.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-4.01	.0015	.0115

POST 3 - WHITE PINE

TEST ID ----- P-4*
TEST DATE --- 10-07-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.00	29.33	0.00	-15.	0.
.002	-5.77	29.24	.06	23088.	11.
.004	-7.71	28.76	.12	30830.	71.
.006	-1.76	28.45	.17	7028.	109.
.008	-2.24	28.32	.23	8941.	125.
.010	-.59	28.20	.29	2353.	141.
.012	-.85	28.17	.34	3385.	144.
.014	-1.17	28.13	.40	4660.	149.
.016	-.36	28.09	.46	1442.	154.
.018	-.16	28.06	.51	653.	157.
.020	-.24	28.04	.57	956.	161.
.022	-.28	28.02	.62	1138.	163.
.024	-.15	28.01	.68	592.	164.
.026	-.19	28.01	.74	774.	165.
.028	-.25	27.99	.79	987.	166.
.030	-.28	27.97	.85	1138.	168.
.032	-.33	27.95	.90	1321.	171.
.034	-.31	27.93	.96	1260.	174.
.036	-.31	27.91	1.02	1260.	176.
.038	-.21	27.90	1.07	835.	178.
.040	-.18	27.88	1.13	713.	180.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.52	.0005	.0105

POST 4 - WHITE PINE

TEST ID ----- P-5 *
TEST DATE --- 10-08-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	18.33	0.00	-93.	0.
.002	-4.02	18.26	.04	16076.	8.
.004	-5.53	17.91	.07	22108.	52.
.006	-6.43	17.54	.11	25715.	98.
.008	-7.14	17.10	.14	28576.	152.
.010	-6.20	16.67	.18	24782.	206.
.012	-3.02	16.36	.21	12096.	245.
.014	-2.01	16.23	.24	8022.	261.
.016	-1.72	16.08	.27	6872.	279.
.018	-.09	16.03	.31	342.	286.
.020	.19	16.03	.34	-746.	285.
.022	.02	16.04	.37	-93.	284.
.024	.07	16.05	.40	-280.	283.
.026	0.00	16.06	.44	0.	282.
.028	.12	16.06	.47	-466.	282.
.030	-.01	16.06	.50	31.	282.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-5.93	.0020	.0120

POST 5 - WHITE PINE

TEST ID ----- P-7
TEST DATE --- 10-08-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	14.67	0.00	31.	0.
.005	-3.18	14.52	.07	12729.	19.
.010	-.86	14.12	.14	3452.	68.
.015	-3.00	13.90	.21	11990.	95.
.020	-4.16	13.24	.28	16644.	177.
.025	-4.99	12.53	.35	19942.	266.
.030	-5.48	11.69	.41	21914.	371.
.035	-5.75	10.78	.46	22993.	483.
.040	-3.58	9.97	.52	14301.	583.
.045	-4.76	9.34	.56	19048.	662.
.050	-4.32	8.60	.61	17260.	754.
.055	-4.24	7.89	.65	16952.	842.
.060	-4.33	7.23	.69	17322.	925.
.065	-4.16	6.52	.72	16644.	1012.
.070	-4.19	5.86	.75	16767.	1094.
.075	-4.18	5.19	.78	16705.	1178.
.080	-4.19	4.51	.81	16767.	1262.
.085	-4.10	3.85	.83	16397.	1345.
.090	-3.74	3.20	.84	14979.	1425.
.095	-3.78	2.59	.86	15103.	1500.
.100	-3.76	1.98	.87	15041.	1576.
.105	-3.74	1.37	.88	14979.	1652.
.110	-3.68	.77	.88	14733.	1726.
.115	-3.54	.19	.89	14178.	1798.
.120	-3.33	-.37	.89	13315.	1869.
.125	-3.41	-.92	.88	13623.	1936.
.130	-3.08	-1.43	.88	12329.	2000.
.135	-3.01	-1.93	.87	12021.	2062.
.140	-2.80	-2.40	.86	11219.	2120.
.145	-2.56	-2.83	.84	10233.	2174.
.150	-2.28	-3.22	.83	9123.	2223.
.155	-2.13	-3.58	.81	8507.	2267.
.160	-1.85	-3.90	.79	7397.	2307.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.60	.0165	.0665

POST 7 - YELLOW BIRCH

TEST ID ----- P-8
TEST DATE --- 10-08-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	170.	0.
.005	-4.98	19.20	.10	19915.	74.
.010	-6.15	18.31	.19	24604.	185.
.015	-3.77	17.50	.28	15071.	285.
.020	-.37	17.21	.37	1465.	322.
.025	-.93	17.11	.45	3718.	335.
.030	-.24	17.00	.54	941.	347.
.035	-.21	16.97	.62	848.	352.
.040	-.25	16.93	.71	1003.	356.
.045	-.26	16.89	.79	1034.	361.
.050	-.44	16.83	.88	1774.	369.
.055	-.44	16.74	.96	1774.	380.
.060	-.41	16.68	1.04	1651.	387.
.065	-.27	16.63	1.13	1095.	394.
.070	-.20	16.59	1.21	818.	399.
.075	-.05	16.57	1.29	201.	401.
.080	.07	16.57	1.38	-293.	401.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.85	.0008	.0508

POST 8 - BEECH

TEST ID ----- P-9
TEST DATE --- 10-08-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	151.	0.
.005	-2.09	19.41	.10	8363.	48.
.010	-1.49	19.28	.19	5948.	65.
.015	-3.98	18.68	.29	15911.	139.
.020	-1.95	18.17	.38	7820.	202.
.025	-2.23	17.70	.47	8906.	261.
.030	-2.25	17.29	.56	8997.	312.
.035	-.46	17.12	.65	1842.	333.
.040	-1.03	17.00	.73	4136.	347.
.045	-.70	16.84	.82	2808.	368.
.050	-.38	16.76	.90	1510.	378.
.055	-.55	16.70	.98	2204.	386.
.060	-.51	16.61	1.07	2023.	396.
.065	-.26	16.54	1.15	1057.	405.
.070	-.23	16.51	1.23	936.	409.
.075	-.26	16.47	1.31	1057.	414.
.080	-.20	16.43	1.40	815.	418.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.89	.0008	.0508

POST 9 - BEECH

TEST ID ----- P-10
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.09	19.80	0.00	373.	0.
.005	-.96	19.49	.10	3856.	38.
.010	-2.67	19.32	.20	10698.	60.
.015	-2.82	18.81	.29	11289.	123.
.020	-.48	18.41	.38	1928.	173.
.025	.11	18.36	.48	-435.	179.
.030	-.30	18.30	.57	1182.	187.
.035	-.08	18.26	.66	311.	191.
.040	.33	18.29	.75	-1306.	187.
.045	.36	18.34	.84	-1431.	181.
.050	.31	18.39	.93	-1244.	175.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.99	.0090	.0190

POST 10 - BEECH

TEST ID ----- P-11
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-31.	0.
.005	-1.15	19.39	.10	4612.	51.
.010	-2.81	19.18	.19	11235.	77.
.015	-3.94	18.58	.29	15754.	152.
.020	-3.51	18.03	.38	14021.	220.
.025	-2.44	17.49	.47	9749.	287.
.030	-1.68	17.18	.56	6716.	325.
.035	-1.12	16.96	.64	4488.	353.
.040	-.80	16.81	.73	3188.	372.
.045	-.44	16.73	.81	1764.	382.
.050	-.50	16.65	.89	2012.	391.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.61	.0113	.0213

POST 11 - BEECH

TEST ID ----- P-12
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	247.	0.
.005	-.79	19.33	.10	3151.	58.
.010	-2.39	19.20	.19	9578.	75.
.015	-3.69	18.58	.29	14768.	152.
.020	-3.89	18.03	.38	15571.	220.
.025	-3.86	17.41	.47	15448.	297.
.030	-3.89	16.82	.55	15571.	370.
.035	-2.97	16.27	.64	11864.	439.
.040	-2.80	15.79	.72	11184.	498.
.045	-2.56	15.36	.80	10257.	551.
.050	-1.51	15.02	.87	6055.	594.
.055	-1.51	14.78	.95	6055.	624.
.060	-1.03	14.58	1.02	4140.	648.
.065	-1.16	14.40	1.09	4634.	671.
.070	-.97	14.22	1.16	3893.	693.
.075	-.91	14.07	1.23	3646.	711.
.080	-.87	13.93	1.30	3460.	729.
.085	-.56	13.81	1.37	2224.	744.
.090	-.68	13.71	1.44	2719.	756.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.00	.0013	.0513

POST 12 - BEECH

TEST ID ----- P-13
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	123.	0.
.005	-2.03	19.46	.10	8125.	42.
.010	-2.68	19.27	.20	10710.	66.
.015	-3.66	18.69	.29	14649.	138.
.020	-5.42	17.88	.38	21666.	238.
.025	-1.46	17.26	.47	5847.	316.
.030	-3.34	16.65	.55	13357.	392.
.035	-3.40	16.05	.64	13603.	465.
.040	-2.17	15.56	.71	8679.	526.
.045	-2.08	15.25	.79	8310.	565.
.050	-1.23	14.97	.87	4924.	600.
.055	-.54	14.86	.94	2154.	613.
.060	-.40	14.80	1.02	1600.	621.
.065	-.86	14.70	1.09	3447.	633.
.070	-.60	14.57	1.16	2401.	650.
.075	-.48	14.51	1.24	1908.	657.
.080	-.65	14.41	1.31	2585.	670.
.085	-.31	14.34	1.38	1231.	679.
.090	-.38	14.28	1.45	1539.	685.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.03	.0018	.0518

POST 13 - RED MAPLE

TEST ID ----- P-14
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	124.	0.
.005	-.40	19.39	.10	1607.	51.
.010	-2.72	19.26	.19	10880.	67.
.015	-2.77	18.68	.29	11065.	139.
.020	-4.61	18.18	.38	18422.	201.
.025	-4.28	17.56	.47	17124.	278.
.030	-3.86	16.93	.56	15455.	357.
.035	-3.77	16.31	.64	15084.	434.
.040	-3.83	15.77	.72	15331.	501.
.045	-3.42	15.17	.80	13662.	575.
.050	-3.29	14.65	.87	13167.	640.
.055	-2.58	14.17	.94	10324.	700.
.060	-2.74	13.73	1.01	10942.	755.
.065	-1.82	13.32	1.08	7295.	805.
.070	-2.09	13.03	1.15	8345.	841.
.075	-1.78	12.72	1.21	7109.	879.
.080	-1.73	12.44	1.27	6924.	915.
.085	-1.05	12.24	1.34	4204.	939.
.090	-1.36	12.02	1.40	5440.	967.
.095	-.98	11.85	1.46	3925.	987.
.100	-.94	11.69	1.52	3771.	1007.
.105	-.76	11.57	1.57	3029.	1023.
.110	-.65	11.45	1.63	2596.	1038.
.115	-.73	11.34	1.69	2905.	1051.
.120	-.53	11.23	1.74	2102.	1064.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-3.44	.0103	.0603

POST 14 - BEECH

TEST ID ----- P-15
TEST DATE --- 10-09-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	247.	0.
.005	-1.63	19.45	.10	6534.	44.
.010	-2.13	19.31	.20	8506.	61.
.015	-3.48	18.75	.29	13930.	130.
.020	-5.42	18.00	.38	21697.	224.
.025	-3.34	17.18	.47	13376.	326.
.030	-4.76	16.77	.56	19046.	377.
.035	-2.13	16.17	.64	8506.	451.
.040	-1.76	15.80	.72	7027.	497.
.045	-.85	15.56	.80	3390.	527.
.050	-.82	15.43	.87	3267.	542.
.055	-.79	15.30	.95	3144.	559.
.060	-.31	15.21	1.03	1233.	570.
.065	-.29	15.17	1.10	1171.	575.
.070	-.26	15.12	1.18	1048.	581.
.075	-.43	15.06	1.25	1726.	588.
.080	-.25	15.01	1.33	986.	595.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.73	.0018	.0518

POST 15 - BEECH

TEST ID ----- P-16
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	91.	0.
.005	-3.02	19.48	.10	12069.	40.
.010	-1.07	19.30	.20	4265.	62.
.015	-4.26	18.75	.29	17030.	130.
.020	-2.78	18.08	.38	11101.	213.
.025	-4.80	17.55	.47	19208.	280.
.030	-4.58	16.86	.56	18300.	365.
.035	-4.17	16.17	.64	16667.	451.
.040	-4.26	15.49	.72	17030.	536.
.045	-3.52	14.84	.80	14066.	616.
.050	-3.30	14.28	.87	13219.	686.
.055	-3.09	13.76	.94	12372.	751.
.060	-2.81	13.28	1.01	11222.	810.
.065	-2.19	12.88	1.07	8742.	860.
.070	-2.12	12.52	1.13	8500.	905.
.075	-1.93	12.21	1.20	7713.	943.
.080	-1.76	11.91	1.26	7048.	980.
.085	-1.76	11.63	1.32	7048.	1015.
.090	-1.62	11.36	1.37	6473.	1049.
.095	-1.60	11.10	1.43	6382.	1080.
.100	-1.40	10.86	1.48	5596.	1111.
.105	-1.29	10.64	1.54	5173.	1138.
.110	-1.22	10.43	1.59	4870.	1164.
.115	-1.17	10.23	1.64	4689.	1189.
.120	-1.13	10.05	1.69	4507.	1212.
.125	-1.13	9.86	1.74	4507.	1234.
.130	-1.11	9.68	1.79	4447.	1257.
.135	-1.05	9.52	1.84	4205.	1277.
.140	-1.01	9.35	1.89	4053.	1298.
.145	-.93	9.20	1.93	3721.	1317.
.150	-.93	9.05	1.98	3721.	1336.
.155	-.84	8.91	2.02	3358.	1353.
.160	-.82	8.77	2.07	3297.	1370.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.77	.0118	.0618

POST 16 - BEECH

TEST ID ----- P-17
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	239.	0.
.010	-.57	19.27	.20	2269.	66.
.020	-3.84	18.30	.38	15347.	186.
.030	-4.08	17.08	.56	16303.	338.
.040	-4.20	15.70	.73	16811.	509.
.050	-3.88	14.46	.88	15527.	663.
.060	-3.69	13.23	1.01	14750.	816.
.070	-3.42	12.09	1.14	13675.	957.
.080	-3.05	11.08	1.26	12182.	1084.
.090	-2.61	10.15	1.36	10451.	1198.
.100	-2.24	9.37	1.46	8958.	1296.
.110	-2.11	8.65	1.55	8420.	1385.
.120	-1.87	8.01	1.63	7465.	1465.
.130	-1.67	7.44	1.71	6688.	1535.
.140	-1.55	6.93	1.78	6211.	1599.
.150	-1.33	6.46	1.85	5315.	1657.
.160	-1.28	6.04	1.91	5136.	1710.
.170	-1.09	5.66	1.97	4359.	1757.
.180	-.94	5.33	2.03	3762.	1798.
.190	-.82	5.05	2.08	3284.	1833.
.200	-.56	4.83	2.13	2239.	1860.
.210	-.49	4.67	2.17	1971.	1880.
.220	-.46	4.51	2.22	1851.	1899.
.230	-.40	4.38	2.26	1612.	1916.
.240	-.39	4.26	2.31	1553.	1931.
.250	-.26	4.16	2.35	1045.	1943.
.260	-.24	4.08	2.39	955.	1953.
.270	-.21	4.01	2.43	836.	1962.
.280	-.13	3.95	2.47	537.	1969.
.290	-.14	3.90	2.51	567.	1975.
.300	-.04	3.87	2.55	179.	1979.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.89	.0140	.0640

POST 17 - BEECH

TEST ID ----- P-18
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	179.	0.
.005	-2.98	19.50	.10	11908.	37.
.010	-1.06	19.29	.20	4227.	63.
.015	-3.91	18.85	.29	15660.	118.
.020	-3.22	18.22	.38	12891.	196.
.025	-4.29	17.67	.47	17148.	264.
.030	-3.14	17.11	.56	12563.	334.
.035	-2.56	16.64	.64	10241.	393.
.040	-1.03	16.43	.73	4108.	419.
.045	-1.85	16.15	.81	7383.	453.
.050	-.96	15.95	.89	3840.	478.
.055	-.72	15.81	.97	2888.	496.
.060	-1.01	15.67	1.05	4049.	513.
.065	-.74	15.53	1.12	2977.	531.
.070	-.65	15.42	1.20	2620.	544.
.075	-.74	15.31	1.28	2977.	557.
.080	-.66	15.19	1.36	2650.	572.
.085	-.58	15.10	1.43	2322.	584.
.090	-.57	15.00	1.51	2263.	596.
.095	-.51	14.92	1.58	2024.	607.
.100	-.48	14.84	1.66	1935.	616.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.41	.0020	.0520

POST 18 - RED MAPLE

TEST ID ----- P-19
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	135.	0.
.005	-2.51	19.55	.10	10024.	31.
.010	-.86	19.37	.20	3431.	54.
.015	-3.67	18.97	.29	14699.	104.
.020	-4.56	18.37	.39	18235.	177.
.025	-4.18	17.63	.48	16736.	270.
.030	-4.00	17.11	.56	16017.	334.
.035	-.90	16.61	.65	3581.	396.
.040	-3.55	16.21	.73	14219.	446.
.045	-1.49	15.82	.81	5948.	495.
.050	-2.40	15.51	.89	9604.	533.
.055	-1.52	15.17	.96	6068.	575.
.060	-1.44	14.95	1.04	5769.	602.
.065	-1.49	14.72	1.11	5948.	632.
.070	-1.70	14.45	1.19	6787.	665.
.075	-1.13	14.20	1.26	4540.	696.
.080	-1.67	13.99	1.33	6668.	722.
.085	-1.37	13.75	1.40	5469.	752.
.090	-1.23	13.53	1.47	4930.	778.
.095	-1.35	13.34	1.53	5409.	803.
.100	-1.13	13.15	1.60	4540.	826.
.105	-1.32	12.94	1.66	5289.	852.
.110	-1.04	12.75	1.73	4150.	875.
.115	-1.14	12.58	1.79	4570.	896.
.120	-1.14	12.40	1.85	4570.	920.
.125	-1.05	12.22	1.92	4210.	941.
.130	-1.11	12.05	1.98	4450.	963.
.135	-.87	11.88	2.04	3491.	984.
.140	-.41	11.79	2.10	1633.	995.
.145	-.60	11.70	2.15	2412.	1006.
.150	.06	11.64	2.21	-225.	1014.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.76	.0030	.0530

POST 19 - RED MAPLE

TEST ID ----- P-20
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	59.	0.
.005	-2.84	19.56	.10	11347.	30.
.010	-1.01	19.34	.20	4057.	57.
.015	-3.97	18.91	.29	15875.	111.
.020	-4.69	18.23	.38	18756.	196.
.025	-1.30	17.51	.47	5203.	285.
.030	-2.90	17.08	.56	11583.	338.
.035	-1.19	16.76	.64	4762.	378.
.040	-.59	16.63	.73	2352.	394.
.045	-1.12	16.48	.81	4498.	412.
.050	-.83	16.31	.89	3322.	433.
.055	-.95	16.16	.97	3792.	452.
.060	-.69	16.04	1.05	2763.	468.
.065	-.82	15.92	1.13	3263.	482.
.070	-.69	15.80	1.21	2763.	497.
.075	-.73	15.68	1.29	2940.	511.
.080	-.40	15.59	1.37	1587.	523.
.085	-.29	15.53	1.45	1176.	530.
.090	-.31	15.49	1.53	1235.	535.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.20	.0025	.0525

POST 20 - RED MAPLE

TEST ID ----- P-21
TEST DATE --- 10-10-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.005	-2.62	19.58	.10	10496.	28.
.010	-1.49	19.36	.20	5954.	55.
.015	-3.45	18.87	.29	13810.	116.
.020	-2.62	18.22	.38	10496.	196.
.025	-3.31	17.74	.47	13258.	256.
.030	-2.96	17.18	.56	11846.	325.
.035	-1.26	16.88	.65	5033.	362.
.040	-.64	16.74	.73	2578.	380.
.045	-.32	16.67	.81	1289.	389.
.050	-.39	16.60	.90	1565.	398.
.055	-.23	16.56	.98	921.	403.
.060	-.23	16.52	1.06	921.	407.
.065	-.23	16.49	1.15	921.	411.
.070	-.14	16.46	1.23	552.	414.
.075	-.12	16.45	1.31	491.	417.
.080	-.18	16.42	1.39	737.	420.
.085	-.08	16.39	1.47	338.	424.
.090	-.02	16.38	1.56	61.	425.
.095	.05	16.38	1.64	-184.	425.
.100	.02	16.39	1.72	-61.	424.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.99	.0013	.0513

POST 21 - RED MAPLE

TEST ID ----- P-22
TEST DATE --- 10-11-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	244.	0.
.005	-1.86	19.49	.10	7446.	39.
.010	-1.78	19.32	.20	7110.	59.
.015	-3.37	18.83	.29	13488.	121.
.020	-2.85	18.24	.38	11413.	194.
.025	-.73	18.06	.47	2930.	217.
.030	-.58	17.99	.56	2319.	224.
.035	-1.04	17.85	.65	4150.	242.
.040	-.52	17.73	.74	2075.	257.
.045	-.70	17.64	.83	2807.	269.
.050	-.67	17.52	.92	2685.	284.
.055	-.50	17.42	1.01	2014.	296.
.060	-.47	17.33	1.09	1892.	306.
.065	-.37	17.25	1.18	1495.	316.
.070	-.06	17.22	1.27	244.	320.
.075	.12	17.23	1.35	-488.	320.
.080	.12	17.24	1.44	-488.	317.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.43	.0013	.0513

POST 22 - RED MAPLE

TEST ID ----- P-23
TEST DATE --- 10-11-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	61.	0.
.005	-2.75	19.54	.10	11012.	33.
.010	-1.48	19.31	.20	5930.	61.
.015	-3.49	18.86	.29	13977.	117.
.020	-1.86	18.38	.38	7442.	177.
.025	-.76	18.13	.48	3025.	208.
.030	-.88	18.02	.57	3509.	221.
.035	-1.09	17.86	.66	4356.	241.
.040	-1.00	17.70	.74	3993.	261.
.045	-.82	17.57	.83	3267.	277.
.050	-.88	17.45	.92	3509.	292.
.055	-.73	17.31	1.01	2935.	309.
.060	-.64	17.20	1.09	2541.	323.
.065	-.59	17.10	1.18	2360.	336.
.070	-.41	17.03	1.26	1634.	344.
.075	-.45	16.96	1.35	1815.	353.
.080	-.36	16.89	1.43	1452.	361.
.085	-.29	16.83	1.52	1150.	368.
.090	-.22	16.80	1.60	877.	373.
.095	-.21	16.77	1.69	847.	376.
.100	-.05	16.76	1.77	182.	378.
.105	-.05	16.76	1.85	212.	378.
.110	-.03	16.75	1.94	121.	379.
.115	-.12	16.75	2.02	484.	379.
.120	-.01	16.74	2.10	30.	380.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.48	.0023	.0523

POST 23 - RED MAPLE

TEST ID ----- P-24
TEST DATE --- 10-11-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	151.	0.
.005	-3.12	19.52	.10	12483.	34.
.010	-1.18	19.29	.20	4727.	63.
.015	-3.45	18.90	.29	13817.	112.
.020	-3.51	18.36	.38	14059.	179.
.025	-3.05	17.84	.47	12211.	243.
.030	-3.09	17.36	.56	12362.	304.
.035	-2.92	16.89	.65	11696.	362.
.040	-2.40	16.45	.73	9605.	416.
.045	-2.35	16.10	.81	9393.	460.
.050	-2.23	15.78	.89	8908.	499.
.055	-1.30	15.51	.97	5212.	533.
.060	-1.14	15.32	1.05	4545.	556.
.065	-1.20	15.13	1.12	4787.	580.
.070	-1.14	14.95	1.20	4545.	602.
.075	-1.15	14.78	1.27	4606.	624.
.080	-1.05	14.60	1.35	4212.	646.
.085	-.92	14.45	1.42	3666.	665.
.090	-1.03	14.29	1.49	4121.	684.
.095	-.55	14.15	1.56	2212.	701.
.100	-.47	14.07	1.63	1879.	711.
.105	-.57	13.99	1.70	2272.	721.
.110	-.64	13.89	1.77	2575.	734.
.115	-.55	13.79	1.84	2212.	747.
.120	-.47	13.71	1.91	1879.	757.
.125	-.09	13.63	1.98	364.	766.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.56	.0028	.0528

POST 24 - RED MAPLE

TEST ID ----- P-25
TEST DATE --- 10-11-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.10	19.80	0.00	420.	0.
.005	-2.50	19.55	.10	10020.	31.
.010	-1.28	19.35	.20	5130.	56.
.015	-3.35	18.90	.29	13410.	112.
.020	-3.38	18.37	.38	13530.	178.
.025	-2.80	17.90	.48	11220.	236.
.030	-2.11	17.45	.56	8430.	292.
.035	-.28	17.32	.65	1140.	308.
.040	-.82	17.24	.74	3300.	318.
.045	-.84	17.09	.82	3360.	336.
.050	-.76	16.98	.91	3060.	350.
.055	-.58	16.88	.99	2340.	363.
.060	-.55	16.79	1.08	2190.	374.
.065	-.55	16.70	1.16	2190.	385.
.070	-.46	16.61	1.24	1860.	396.
.075	-.46	16.53	1.33	1860.	406.
.080	-.43	16.47	1.41	1710.	414.
.085	-.46	16.40	1.49	1860.	422.
.090	-.55	16.32	1.57	2190.	432.
.095	-.31	16.25	1.65	1230.	441.
.100	-.36	16.20	1.74	1440.	447.
.105	-.26	16.15	1.82	1050.	453.
.110	-.40	16.09	1.90	1620.	461.
.115	-.28	16.04	1.98	1140.	467.
.120	-.34	15.99	2.06	1380.	474.
.125	-.13	15.93	2.14	540.	481.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.76	.0020	.0520

POST 25 - RED MAPLE

TEST ID ----- P-26
TEST DATE --- 10-11-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	239.	0.
.005	-3.05	19.53	.10	12181.	33.
.010	-1.58	19.30	.20	6329.	62.
.015	-3.82	18.81	.29	15286.	123.
.020	-4.95	18.14	.38	19794.	207.
.025	-3.01	17.45	.47	12031.	292.
.030	-2.57	17.13	.56	10300.	332.
.035	-1.79	16.73	.64	7165.	381.
.040	-2.12	16.40	.73	8479.	422.
.045	-1.47	16.13	.81	5881.	457.
.050	-1.37	15.89	.89	5463.	486.
.055	-.11	15.83	.97	448.	494.
.060	-.26	15.80	1.05	1045.	497.
.065	-.49	15.73	1.12	1970.	505.
.070	-.39	15.66	1.20	1552.	515.
.075	-.31	15.60	1.28	1254.	521.
.080	-.16	15.56	1.36	657.	526.
.085	-.26	15.53	1.44	1045.	530.
.090	-.27	15.49	1.51	1075.	535.
.095	-.24	15.45	1.59	955.	541.
.100	-.06	15.43	1.67	239.	543.
.105	-.01	15.42	1.75	30.	544.
.110	0.00	15.42	1.82	0.	545.
.115	-.02	15.41	1.90	90.	545.
.120	-.02	15.41	1.98	90.	545.
.125	-.09	15.41	2.05	358.	545.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.44	.0015	.0515

POST 26 - RED MAPLE

TEST ID ----- P-27
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	122.	0.
.005	-2.80	19.63	.10	11180.	22.
.010	-.73	19.37	.20	2933.	54.
.015	-3.79	18.98	.29	15151.	102.
.020	-5.04	18.31	.39	20161.	185.
.025	-2.49	17.62	.48	9958.	271.
.030	-3.35	17.05	.56	13410.	341.
.035	-1.14	16.72	.65	4552.	383.
.040	-1.15	16.54	.73	4613.	405.
.045	-.91	16.37	.81	3635.	426.
.050	-1.01	16.22	.89	4032.	445.
.055	-.82	16.07	.97	3299.	464.
.060	-.89	15.94	1.05	3543.	480.
.065	-.70	15.81	1.13	2810.	496.
.070	-.62	15.70	1.21	2474.	509.
.075	-.58	15.60	1.29	2322.	522.
.080	-.34	15.52	1.37	1344.	532.
.085	-.34	15.47	1.45	1344.	538.
.090	-.42	15.40	1.52	1680.	546.
.095	-.21	15.35	1.60	855.	553.
.100	-.21	15.32	1.68	855.	557.
.105	-.15	15.29	1.75	611.	560.
.110	-.12	15.27	1.83	489.	563.
.115	-.03	15.26	1.91	122.	564.
.120	-.03	15.25	1.98	122.	565.
.125	0.00	15.25	2.06	0.	565.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.26	.0030	.0530

POST 27 - RED MAPLE

TEST ID ----- P-28
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	41.	0.
.005	-1.94	19.71	.10	7760.	11.
.010	-.85	19.44	.20	3408.	45.
.015	-2.29	19.19	.29	9156.	76.
.020	-.38	18.95	.39	1519.	105.
.025	-.03	18.93	.48	123.	108.
.030	-.22	18.92	.58	862.	109.
.035	-.48	18.87	.67	1930.	116.
.040	-.20	18.81	.77	780.	122.
.045	-.30	18.78	.86	1191.	127.
.050	-.42	18.71	.95	1683.	135.
.055	-.39	18.64	1.05	1560.	144.
.060	-.39	18.58	1.14	1560.	152.
.065	-.44	18.51	1.23	1766.	160.
.070	-.46	18.43	1.33	1848.	170.
.075	-.37	18.36	1.42	1478.	178.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.69	.0030	.0530

POST 28 - ASPEN

TEST ID ----- P-29
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	60.	0.
.005	-2.25	19.62	.10	8987.	22.
.010	-1.00	19.43	.20	4011.	46.
.015	-2.93	19.06	.29	11732.	92.
.020	-3.15	18.59	.39	12606.	150.
.025	-.14	18.36	.48	573.	179.
.030	.04	18.36	.57	-151.	179.
.035	-.38	18.34	.66	1508.	182.
.040	-.46	18.26	.75	1840.	192.
.045	-.26	18.21	.85	1025.	198.
.050	-.29	18.16	.94	1176.	204.
.055	-.32	18.12	1.03	1297.	209.
.060	-.29	18.07	1.12	1176.	215.
.065	-.28	18.02	1.21	1116.	221.
.070	-.16	17.98	1.30	633.	226.
.075	-.20	17.95	1.39	784.	230.
.080	-.28	17.91	1.48	1116.	234.
.085	-.22	17.87	1.57	875.	240.
.090	-.20	17.84	1.66	784.	243.
.095	-.14	17.82	1.74	543.	246.
.100	-.04	17.80	1.83	151.	248.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.02	.0015	.0515

POST 29 - ASPEN

TEST ID ----- P-30
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	240.	0.
.005	-2.48	19.56	.10	9911.	30.
.010	-2.03	19.33	.20	8109.	58.
.015	-3.54	18.81	.29	14176.	123.
.020	-2.90	18.17	.38	11593.	203.
.025	-.31	18.01	.47	1231.	222.
.030	-.10	17.99	.56	390.	225.
.035	-.50	17.95	.65	1982.	230.
.040	-.38	17.87	.74	1502.	240.
.045	-.30	17.82	.83	1201.	246.
.050	-.23	17.77	.92	901.	252.
.055	-.26	17.74	1.01	1021.	256.
.060	-.21	17.70	1.10	841.	261.
.065	-.18	17.67	1.19	721.	265.
.070	-.12	17.64	1.28	481.	268.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.26	.0005	.0505

POST 30 - RED MAPLE

TEST ID ----- P-31
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	30.	0.
.005	-.96	19.75	.10	3839.	6.
.010	-2.16	19.41	.20	8639.	48.
.015	-1.81	19.18	.29	7259.	78.
.020	-4.08	18.66	.39	16317.	142.
.025	-4.63	17.96	.48	18507.	229.
.030	-2.54	17.31	.57	10168.	310.
.035	-3.25	16.99	.65	12988.	349.
.040	-2.60	16.41	.74	10408.	421.
.045	-2.23	16.04	.82	8908.	467.
.050	-1.94	15.73	.90	7769.	506.
.055	-1.69	15.41	.98	6749.	545.
.060	-1.27	15.19	1.05	5099.	573.
.065	-.96	15.01	1.13	3839.	594.
.070	-1.05	14.84	1.20	4199.	616.
.075	-.90	14.68	1.28	3599.	636.
.080	-.74	14.56	1.35	2969.	651.
.085	-.61	14.45	1.42	2430.	665.
.090	-.61	14.35	1.49	2460.	677.
.095	-.57	14.25	1.56	2280.	689.
.100	-.52	14.17	1.64	2070.	700.
.105	-.54	14.08	1.71	2160.	711.
.110	-.56	13.99	1.78	2250.	722.
.115	-.44	13.91	1.85	1770.	732.
.120	-.42	13.84	1.92	1680.	741.
.125	-.46	13.77	1.98	1860.	749.
.130	-.43	13.69	2.05	1740.	759.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.70	.0060	.0560

POST 31 - RED OAK

TEST ID ----- P-32
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.09	19.80	0.00	361.	0.
.005	-3.18	19.55	.10	12715.	31.
.010	-.63	19.29	.20	2525.	64.
.015	-3.40	19.01	.29	13587.	98.
.020	-3.94	18.39	.38	15752.	175.
.025	-5.14	17.64	.48	20561.	269.
.030	-5.77	16.77	.56	23086.	377.
.035	-5.74	15.84	.64	22966.	492.
.040	-4.18	15.01	.72	16713.	594.
.045	-3.16	14.41	.79	12625.	670.
.050	-1.20	14.02	.86	4810.	718.
.055	-.63	13.92	.93	2525.	731.
.060	-1.89	13.72	1.00	7575.	755.
.065	-1.55	13.42	1.07	6192.	792.
.070	-1.29	13.22	1.14	5170.	817.
.075	-1.44	13.00	1.20	5741.	845.
.080	-1.14	12.78	1.27	4569.	872.
.085	-1.09	12.60	1.33	4359.	895.
.090	-.95	12.44	1.39	3788.	914.
.095	-.95	12.29	1.46	3818.	934.
.100	-.81	12.13	1.52	3246.	952.
.105	-.65	12.01	1.58	2585.	968.
.110	-.80	11.89	1.64	3186.	982.
.115	-.77	11.77	1.70	3096.	998.
.120	-.65	11.65	1.75	2615.	1012.
.125	-.63	11.55	1.81	2525.	1025.
.130	-.60	11.45	1.87	2405.	1038.
.135	-.57	11.35	1.93	2285.	1049.
.140	-.47	11.27	1.98	1864.	1060.
.145	-.53	11.19	2.04	2104.	1069.
.150	-.47	11.11	2.10	1894.	1080.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.60	.0015	.0515

POST 32 - RED OAK

TEST ID ----- P-33
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	29.	0.
.005	-2.45	19.67	.10	9820.	16.
.010	-.80	19.35	.20	3195.	56.
.015	-2.35	19.16	.29	9409.	79.
.020	-3.61	18.63	.39	14451.	145.
.025	-4.33	18.00	.48	17324.	224.
.030	-4.84	17.26	.57	19376.	315.
.035	-4.02	16.47	.65	16093.	413.
.040	-.81	16.21	.73	3254.	446.
.045	-2.16	15.97	.81	8647.	476.
.050	-1.35	15.65	.89	5393.	515.
.055	-.97	15.49	.97	3899.	536.
.060	-.88	15.33	1.05	3517.	555.
.065	-.86	15.19	1.12	3430.	572.
.070	-.75	15.07	1.20	2990.	588.
.075	-.74	14.95	1.27	2961.	603.
.080	-.74	14.83	1.35	2961.	617.
.085	-.65	14.72	1.42	2609.	632.
.090	-.74	14.62	1.50	2961.	644.
.095	-.68	14.49	1.57	2726.	659.
.100	-.57	14.40	1.64	2286.	671.
.105	-.65	14.30	1.71	2609.	683.
.110	-.59	14.20	1.78	2345.	696.
.115	-.23	14.13	1.85	938.	704.
.120	-.10	14.11	1.93	381.	707.
.125	-.12	14.09	2.00	469.	709.
.130	-.21	14.06	2.07	850.	713.
.135	.05	14.04	2.14	-205.	715.
.140	.10	14.06	2.21	-410.	713.
.145	-.16	14.06	2.28	645.	713.
.150	-.06	14.03	2.35	234.	716.
.155	.02	14.03	2.42	-88.	717.
.160	-.12	14.02	2.49	469.	718.
.165	-.10	14.01	2.56	381.	720.
.170	0.00	14.00	2.63	0.	720.
.175	.01	14.00	2.70	-59.	720.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.63	.0035	.0535

POST 33 - RED OAK

TEST ID ----- P-34
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.08	19.80	0.00	309.	0.
.010	-.76	19.38	.20	3047.	53.
.020	-3.59	18.55	.39	14352.	155.
.030	-4.84	17.15	.57	19356.	329.
.040	-4.88	15.52	.73	19504.	531.
.050	-1.42	14.64	.88	5667.	641.
.060	-2.20	13.85	1.02	8788.	739.
.070	-.78	13.31	1.16	3135.	806.
.080	-.95	13.00	1.29	3812.	845.
.090	-.79	12.73	1.42	3165.	879.
.100	-.72	12.49	1.54	2870.	908.
.110	-.59	12.31	1.67	2370.	931.
.120	-.46	12.15	1.79	1840.	951.
.130	-.39	12.00	1.91	1546.	969.
.140	-.31	11.89	2.03	1251.	982.
.150	-.26	11.79	2.15	1045.	995.
.160	-.27	11.70	2.26	1075.	1006.
.170	-.19	11.63	2.38	751.	1014.
.180	-.19	11.56	2.50	751.	1023.
.190	-.14	11.51	2.61	574.	1030.
.200	-.13	11.45	2.73	515.	1037.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.50	.0140	.0640

POST 34 - RED OAK

TEST ID ----- P-35
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.010	-2.20	19.41	.20	8809.	48.
.020	-3.69	18.69	.39	14769.	138.
.030	-5.35	17.16	.57	21419.	328.
.040	-5.57	15.29	.73	22283.	561.
.050	-3.43	14.24	.88	13732.	690.
.060	-1.94	13.38	1.02	7773.	797.
.070	-2.03	12.72	1.15	8118.	879.
.080	-1.80	12.17	1.27	7212.	948.
.090	-1.37	11.69	1.39	5484.	1007.
.100	-1.25	11.26	1.51	5009.	1061.
.110	-1.25	10.88	1.62	5009.	1108.
.120	-1.03	10.51	1.72	4102.	1154.
.130	-1.17	10.15	1.83	4664.	1199.
.140	-1.03	9.82	1.93	4102.	1239.
.150	-.92	9.49	2.02	3671.	1281.
.160	-1.06	9.15	2.12	4232.	1323.
.170	-.94	8.82	2.21	3757.	1364.
.180	-1.08	8.48	2.29	4318.	1406.
.190	-1.06	8.14	2.38	4232.	1448.
.200	-.94	7.78	2.45	3757.	1493.
.210	-1.07	7.44	2.53	4275.	1536.
.220	-.97	7.09	2.60	3886.	1579.
.230	-1.08	6.76	2.67	4318.	1620.
.240	-.93	6.45	2.74	3714.	1658.
.250	-.93	6.13	2.80	3714.	1698.
.260	-.97	5.87	2.86	3886.	1731.
.270	-.84	5.58	2.92	3368.	1767.
.280	-.87	5.30	2.97	3498.	1801.
.290	-.73	5.06	3.02	2936.	1831.
.300	-.58	4.83	3.07	2332.	1859.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.80	.0155	.0655

POST 35 - RED OAK

TEST ID ----- P-36
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	151.	0.
.005	-2.97	19.56	.10	11877.	30.
.010	-1.07	19.29	.20	4290.	64.
.015	-3.16	18.92	.29	12653.	109.
.020	-4.05	18.36	.38	16189.	178.
.025	-4.26	17.68	.47	17051.	264.
.030	-2.71	17.02	.56	10843.	346.
.035	-3.31	16.69	.65	13257.	386.
.040	-1.88	16.20	.73	7523.	448.
.045	-2.15	15.91	.81	8601.	483.
.050	-1.76	15.56	.89	7049.	526.
.055	-2.28	15.24	.96	9118.	567.
.060	-2.19	14.88	1.04	8773.	611.
.065	-2.37	14.53	1.11	9463.	655.
.070	-2.45	14.14	1.18	9808.	703.
.075	-2.21	13.77	1.25	8860.	750.
.080	-2.37	13.40	1.32	9463.	795.
.085	-2.24	13.03	1.39	8946.	842.
.090	-2.19	12.66	1.45	8773.	887.
.095	-1.61	12.36	1.51	6445.	925.
.100	-2.06	12.00	1.58	8256.	968.
.105	-1.93	11.72	1.63	7739.	1004.
.110	-1.76	11.42	1.69	7049.	1041.
.115	-1.76	11.13	1.75	7049.	1077.
.120	-1.76	10.86	1.80	7049.	1111.
.125	-1.72	10.58	1.86	6876.	1146.
.130	-1.68	10.30	1.91	6704.	1180.
.135	-1.61	10.03	1.96	6445.	1214.
.140	-1.68	9.76	2.01	6704.	1248.
.145	-1.50	9.51	2.06	6014.	1279.
.150	-1.50	9.26	2.11	6014.	1309.
.155	-1.42	9.03	2.15	5669.	1338.
.160	-1.37	8.81	2.20	5497.	1366.
.165	-1.29	8.60	2.24	5152.	1392.
.170	-1.24	8.39	2.28	4979.	1417.
.175	-.40	8.24	2.32	1617.	1436.
.180	-.68	8.15	2.36	2738.	1447.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.76	.0125	.0625

POST 36 - RED OAK

TEST ID ----- P-37
TEST DATE --- 10-14-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	86.	0.
.005	-1.81	19.73	.10	7255.	8.
.010	-.56	19.43	.20	2246.	46.
.015	-2.12	19.23	.29	8464.	71.
.020	-1.90	18.91	.39	7600.	111.
.025	-2.12	18.55	.48	8464.	155.
.030	-2.00	18.23	.57	7989.	195.
.035	-1.38	17.95	.66	5527.	230.
.040	-1.04	17.78	.75	4146.	251.
.045	-1.22	17.57	.84	4880.	278.
.050	-1.01	17.39	.93	4059.	299.
.055	-.52	17.26	1.02	2073.	315.
.060	-.58	17.18	1.10	2332.	326.
.065	-.65	17.08	1.19	2591.	338.
.070	-.69	16.97	1.27	2764.	352.
.075	-.52	16.87	1.36	2073.	364.
.080	-.52	16.79	1.44	2073.	374.
.085	-.35	16.71	1.53	1382.	384.
.090	-.06	16.67	1.61	259.	389.
.095	.04	16.67	1.69	-173.	389.
.100	.04	16.67	1.78	-173.	388.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.55	.0040	.0540

POST 37 - ASPEN

TEST ID ----- P-38
TEST DATE --- 10-15-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-86.	0.
.010	-1.29	19.27	.20	5164.	66.
.020	-4.99	18.13	.38	19967.	207.
.030	-2.93	16.51	.56	11705.	408.
.040	-2.67	15.65	.72	10672.	515.
.050	-2.69	14.77	.87	10758.	625.
.060	-2.43	13.90	1.01	9725.	733.
.070	-2.17	13.26	1.15	8693.	813.
.080	-1.94	12.66	1.28	7746.	886.
.090	-1.42	12.10	1.40	5680.	956.
.100	-1.55	11.63	1.52	6197.	1016.
.110	-1.51	11.16	1.63	6025.	1074.
.120	-1.29	10.72	1.74	5164.	1128.
.130	-1.16	10.37	1.85	4648.	1172.
.140	-1.01	10.02	1.95	4045.	1215.
.150	-.95	9.70	2.05	3787.	1255.
.160	-.95	9.39	2.14	3787.	1293.
.170	-.80	9.11	2.24	3184.	1328.
.180	-.67	8.88	2.33	2668.	1356.
.190	-.82	8.72	2.42	3270.	1377.
.200	-.77	8.47	2.50	3098.	1408.
.210	-.84	8.22	2.58	3357.	1439.
.220	-.86	7.95	2.67	3443.	1472.
.230	-.71	7.71	2.74	2840.	1502.
.240	-.62	7.48	2.82	2496.	1531.
.250	-.60	7.27	2.89	2410.	1556.
.260	-.60	7.07	2.96	2410.	1581.
.270	-.62	6.88	3.03	2496.	1605.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.35	.0115	.0615

POST 38 - WHITE ASH

TEST ID ----- P-39
TEST DATE --- 10-15-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-22.	0.
.005	-2.79	19.69	.10	11154.	14.
.010	-1.12	19.32	.20	4466.	60.
.015	-3.34	18.97	.29	13354.	103.
.020	-3.87	18.43	.39	15468.	171.
.025	-2.24	17.83	.48	8953.	245.
.030	-3.05	17.39	.56	12189.	299.
.035	-1.84	16.99	.65	7357.	349.
.040	-2.31	16.67	.73	9255.	389.
.045	-1.84	16.34	.82	7357.	430.
.050	-1.67	16.06	.90	6666.	465.
.055	-1.29	15.81	.98	5156.	495.
.060	-.77	15.68	1.06	3085.	512.
.065	-1.02	15.53	1.13	4077.	531.
.070	-.81	15.38	1.21	3258.	549.
.075	-.88	15.23	1.29	3517.	567.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.42	.0045	.0545

POST 39 - WHITE ASH

TEST ID ----- P-40
TEST DATE --- 10-15-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	108.	0.
.005	-2.27	19.71	.10	9075.	12.
.010	-1.15	19.30	.20	4591.	62.
.015	-2.55	19.09	.29	10196.	89.
.020	-2.66	18.58	.39	10627.	152.
.025	-1.60	18.23	.48	6402.	195.
.030	-.11	18.13	.57	453.	208.
.035	-.38	18.09	.66	1530.	213.
.040	-.60	18.01	.75	2393.	222.
.045	-.61	17.91	.84	2436.	235.
.050	-.48	17.82	.93	1918.	247.
.055	-.51	17.73	1.02	2048.	257.
.060	-.70	17.63	1.11	2781.	270.
.065	-.60	17.52	1.19	2393.	283.
.070	-.51	17.44	1.28	2048.	293.
.075	-.35	17.37	1.37	1401.	301.
.080	-.30	17.32	1.46	1186.	308.
.085	-.27	17.28	1.54	1099.	313.
.090	-.26	17.24	1.63	1056.	319.
.095	-.18	17.20	1.71	711.	323.
.100	-.13	17.17	1.80	539.	326.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.25	.0035	.0535

POST 40 - WHITE ASH

TEST ID ----- P-41
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.23	19.80	0.00	900.	0.
.005	-2.25	19.51	.10	9004.	36.
.010	-1.00	19.34	.20	4011.	58.
.015	-3.27	18.96	.29	13097.	105.
.020	-3.91	18.43	.38	15634.	170.
.025	-4.40	17.73	.48	17599.	258.
.030	-4.89	16.98	.56	19563.	350.
.035	-1.37	16.45	.65	5484.	417.
.040	-3.36	16.03	.73	13424.	468.
.045	-1.96	15.62	.81	7858.	519.
.050	-1.70	15.31	.88	6794.	558.
.055	-1.19	15.13	.96	4748.	580.
.060	-1.37	14.90	1.03	5484.	609.
.065	-.83	14.74	1.11	3315.	629.
.070	-.82	14.62	1.18	3274.	644.
.075	-1.04	14.47	1.25	4175.	662.
.080	-.72	14.33	1.33	2865.	680.
.085	-.47	14.24	1.40	1883.	691.
.090	-.73	14.13	1.47	2906.	704.
.095	-.44	14.03	1.54	1760.	717.
.100	-.34	13.97	1.61	1351.	725.
.105	-.47	13.90	1.68	1883.	733.
.110	-.43	13.83	1.75	1719.	742.
.115	-.28	13.78	1.82	1105.	748.
.120	-.31	13.74	1.89	1228.	753.
.125	-.32	13.69	1.95	1269.	759.
.130	-.17	13.64	2.02	696.	765.
.135	.02	13.63	2.09	-82.	766.
.140	-.03	13.63	2.16	123.	766.
.145	-.11	13.62	2.23	450.	768.
.150	-.01	13.60	2.30	41.	770.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.81	.0015	.0515

POST 41 - WHITE ASH

TEST ID ----- P-42
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.03	19.80	0.00	-111.	0.
.005	-3.40	19.57	.10	13618.	28.
.010	-1.16	19.29	.20	4628.	63.
.015	-3.85	18.82	.29	15389.	122.
.020	-5.36	18.13	.38	21456.	207.
.025	-2.35	17.36	.47	9411.	303.
.030	-3.39	16.86	.56	13573.	365.
.035	-1.54	16.56	.64	6178.	403.
.040	-1.26	16.32	.72	5026.	432.
.045	-1.04	16.15	.80	4141.	454.
.050	-.92	15.98	.88	3698.	475.
.055	-.85	15.84	.96	3388.	492.
.060	-.74	15.71	1.04	2945.	508.
.065	-.60	15.61	1.12	2414.	521.
.070	-.46	15.53	1.20	1838.	530.
.075	-.56	15.45	1.28	2236.	540.
.080	-.42	15.36	1.35	1661.	552.
.085	-.29	15.30	1.43	1174.	558.
.090	-.43	15.24	1.51	1705.	566.
.095	-.40	15.17	1.58	1616.	575.
.100	-.30	15.12	1.66	1218.	582.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.40	.0025	.0525

POST 42 - WHITE ASH

TEST ID ----- P-43
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	88.	0.
.005	-3.32	19.54	.10	13294.	32.
.010	-1.29	19.27	.20	5150.	65.
.015	-3.70	18.80	.29	14791.	125.
.020	-5.28	18.12	.38	21130.	209.
.025	-4.12	17.28	.47	16464.	313.
.030	-1.99	16.84	.56	7968.	367.
.035	-1.05	16.66	.64	4182.	390.
.040	-.97	16.48	.72	3874.	412.
.045	-.65	16.35	.81	2597.	429.
.050	-.36	16.27	.89	1453.	439.
.055	-.36	16.21	.97	1453.	446.
.060	-.51	16.14	1.05	2025.	455.
.065	-.36	16.06	1.13	1453.	464.
.070	-.26	16.01	1.21	1056.	470.
.075	-.22	15.98	1.29	880.	475.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.20	.0015	.0515

POST 43 - WHITE ASH

TEST ID ----- P-44
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.005	-.24	19.78	.10	957.	2.
.010	-2.59	19.53	.20	10352.	34.
.015	-2.33	19.25	.29	9308.	69.
.020	-3.26	18.75	.39	13049.	131.
.025	-2.94	18.17	.48	11744.	202.
.030	-.46	17.98	.57	1827.	225.
.035	-.35	17.92	.66	1392.	234.
.040	-.67	17.82	.75	2697.	245.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.35	.0155	.0255

POST 44 - ASPEN

TEST ID ----- P-45
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.005	-2.75	19.58	.10	10998.	27.
.010	-1.44	19.33	.20	5757.	58.
.015	-2.79	18.91	.29	11170.	110.
.020	-.47	18.68	.39	1890.	139.
.025	-.90	18.58	.48	3609.	151.
.030	-.45	18.47	.57	1804.	165.
.035	-.43	18.41	.66	1718.	173.
.040	-.62	18.33	.76	2492.	183.
.045	-.45	18.24	.85	1804.	194.
.050	-.54	18.15	.94	2148.	205.
.055	-.56	18.06	1.03	2234.	216.
.060	-.52	17.97	1.12	2062.	227.
.065	-.37	17.90	1.21	1461.	236.
.070	-.39	17.84	1.30	1547.	243.
.075	-.30	17.79	1.39	1203.	249.
.080	-.24	17.75	1.48	945.	254.
.085	-.17	17.72	1.56	687.	258.
.090	-.17	17.69	1.65	687.	262.
.095	-.08	17.67	1.74	301.	265.
.100	-.04	17.66	1.83	172.	266.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.04	.0020	.0520

POST 45 - ASPEN

TEST ID ----- P-46
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	65.	0.
.002	.01	19.80	.04	-22.	.
.004	-.32	19.79	.08	1280.	1.
.006	-2.16	19.72	.12	8660.	10.
.008	-2.25	19.56	.16	9007.	29.
.010	-.88	19.47	.20	3538.	41.
.012	-.99	19.41	.24	3972.	48.
.014	-2.27	19.31	.27	9094.	61.
.016	-3.16	19.13	.31	12653.	83.
.018	-2.95	18.93	.35	11785.	108.
.020	-2.99	18.75	.39	11958.	131.
.022	-1.41	18.60	.43	5621.	149.
.024	-.30	18.55	.46	1194.	156.
.026	-.02	18.54	.50	65.	157.
.028	.03	18.54	.54	-109.	157.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.54	.0125	.0225

POST 46 - ASPEN

TEST ID ----- P-47
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.005	-.51	19.77	.10	2041.	4.
.010	-2.38	19.47	.20	9512.	41.
.015	-1.75	19.22	.29	6993.	72.
.020	-3.29	18.77	.39	13160.	128.
.025	-2.66	18.25	.48	10641.	192.
.030	-1.73	17.94	.57	6906.	230.
.035	-.40	17.78	.66	1607.	251.
.040	-.25	17.73	.75	999.	257.
.045	-.12	17.70	.84	478.	261.
.050	-.21	17.68	.93	825.	263.
.055	-.55	17.63	1.02	2215.	270.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.33	.0055	.0555

POST 47 - ASPEN

TEST ID ----- P-48
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.010	-1.19	19.28	.20	4771.	65.
.020	-3.66	18.22	.38	14656.	196.
.030	-3.58	17.13	.56	14312.	332.
.040	-2.20	16.19	.73	8811.	448.
.050	-2.10	15.41	.88	8381.	545.
.060	-1.62	14.90	1.04	6490.	609.
.070	-1.36	14.44	1.18	5458.	665.
.080	-1.06	14.05	1.33	4255.	714.
.090	-1.09	13.69	1.46	4341.	759.
.100	-1.00	13.36	1.60	3997.	800.
.110	-.87	13.05	1.73	3481.	839.
.120	-.98	12.74	1.86	3911.	877.
.130	-.93	12.43	1.99	3739.	915.
.140	-.98	12.10	2.11	3911.	956.
.150	-.89	11.77	2.23	3567.	997.
.160	-.85	11.48	2.34	3395.	1033.
.170	-.85	11.23	2.46	3395.	1065.
.180	-.66	11.01	2.57	2622.	1092.
.190	-.66	10.77	2.68	2622.	1121.
.200	-.66	10.59	2.78	2622.	1144.
.210	-.40	10.43	2.89	1590.	1164.
.220	-.33	10.31	2.99	1332.	1179.
.230	-.27	10.21	3.10	1074.	1191.
.240	-.27	10.11	3.20	1074.	1204.
.250	-.29	10.03	3.30	1160.	1214.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.80	.0030	.0530

POST 48 - WHITE ASH

TEST ID ----- P-49
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	86.	0.
.005	-2.28	19.67	.10	9121.	16.
.010	-1.48	19.37	.20	5937.	54.
.015	-3.21	18.98	.29	12821.	102.
.020	-3.33	18.46	.39	13337.	166.
.025	-1.94	18.11	.48	7744.	210.
.030	-.80	17.85	.57	3184.	243.
.035	-.41	17.77	.66	1635.	253.
.040	-.37	17.71	.74	1463.	260.
.045	-.49	17.63	.83	1979.	269.
.050	-.60	17.54	.92	2409.	280.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.03	.0125	.0225

POST 49 - ASPEN

TEST ID ----- P-50
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	86.	0.
.005	-2.90	19.64	.10	11616.	19.
.010	-1.40	19.27	.20	5593.	66.
.015	-3.61	18.87	.29	14456.	115.
.020	-4.28	18.25	.38	17124.	192.
.025	-1.83	17.67	.47	7314.	264.
.030	-3.66	17.19	.56	14628.	324.
.035	-2.02	16.72	.65	8089.	383.
.040	-1.23	16.47	.73	4905.	414.
.045	-.97	16.30	.81	3872.	435.
.050	-1.08	16.13	.89	4302.	455.
.055	-.71	15.98	.97	2840.	474.
.060	-.41	15.91	1.05	1635.	484.
.065	-.49	15.84	1.13	1979.	492.
.070	-.60	15.75	1.21	2409.	503.
.075	-.49	15.67	1.29	1979.	513.
.080	-.41	15.60	1.37	1635.	522.
.085	-.47	15.52	1.44	1893.	531.
.090	-.45	15.44	1.52	1807.	542.
.095	-.37	15.37	1.60	1463.	550.
.100	-.42	15.30	1.68	1678.	558.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.32	.0030	.0530

POST 50 - BEECH

TEST ID ----- P-51
TEST DATE --- 10-16-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	170.	0.
.005	-3.23	19.60	.10	12920.	25.
.010	-1.36	19.23	.20	5440.	71.
.015	-3.80	18.79	.29	15216.	125.
.020	-4.68	18.13	.38	18701.	207.
.025	-2.66	17.48	.47	10625.	289.
.030	-3.12	17.16	.56	12495.	328.
.035	-1.76	16.73	.64	7055.	381.
.040	-2.10	16.41	.73	8415.	421.
.045	-1.08	16.17	.81	4335.	451.
.050	-.81	16.04	.89	3230.	467.
.055	-.79	15.91	.97	3145.	483.
.060	-.64	15.79	1.05	2550.	498.
.065	-.43	15.71	1.13	1700.	508.
.070	-.32	15.65	1.20	1275.	515.
.075	-.40	15.59	1.28	1615.	522.
.080	-.38	15.53	1.36	1530.	531.
.085	-.40	15.47	1.44	1615.	538.
.090	-.32	15.41	1.52	1275.	545.
.095	-.23	15.37	1.59	935.	550.
.100	-.28	15.33	1.67	1105.	555.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.36	.0030	.0530

POST 51 - BEECH

TEST ID ----- P-52
TEST DATE --- 10-17-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.010	-2.23	19.43	.20	8934.	46.
.020	-3.57	18.72	.39	14295.	134.
.030	-2.81	17.63	.57	11232.	270.
.040	-1.94	17.01	.74	7743.	347.
.050	-1.66	16.46	.91	6637.	415.
.060	-1.23	15.99	1.07	4935.	474.
.070	-1.32	15.54	1.23	5276.	529.
.080	-1.05	15.18	1.38	4212.	574.
.090	-1.04	14.84	1.53	4169.	616.
.100	-1.05	14.51	1.68	4212.	657.
.110	-.87	14.21	1.82	3489.	695.
.120	-.89	13.93	1.96	3574.	730.
.130	-.74	13.67	2.10	2978.	762.
.140	-.72	13.45	2.24	2893.	789.
.150	-.72	13.23	2.37	2893.	817.
.160	-.53	13.03	2.50	2127.	841.
.170	-.53	12.87	2.63	2127.	861.
.180	-.37	12.73	2.76	1489.	879.
.190	-.36	12.59	2.89	1447.	895.
.200	-.46	12.46	3.01	1829.	911.
.210	-.26	12.35	3.14	1021.	925.
.220	-.23	12.28	3.26	936.	934.
.230	-.06	12.22	3.38	255.	941.
.240	-.06	12.18	3.50	255.	946.
.250	-.17	12.14	3.63	681.	951.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.24	.0065	.0565

POST 52 - WHITE ASH

TEST ID ----- P-53
TEST DATE --- 10-17-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.005	-2.53	19.67	.10	10102.	16.
.010	-1.49	19.34	.20	5975.	57.
.015	-3.34	18.92	.29	13369.	109.
.020	-4.12	18.34	.39	16465.	181.
.025	-1.70	17.78	.48	6792.	252.
.030	-.85	17.62	.56	3396.	270.
.035	-.91	17.45	.65	3654.	291.
.040	-.63	17.32	.74	2536.	308.
.045	-.66	17.23	.82	2622.	319.
.050	-.70	17.12	.91	2794.	333.
.055	-.46	17.04	1.00	1849.	343.
.060	-.51	16.96	1.08	2020.	353.
.065	-.55	16.88	1.17	2192.	363.
.070	-.41	16.80	1.25	1634.	373.
.075	-.40	16.74	1.33	1591.	380.
.080	-.38	16.67	1.42	1505.	388.
.085	-.40	16.61	1.50	1591.	396.
.090	-.35	16.55	1.58	1419.	404.
.095	-.38	16.49	1.67	1505.	411.
.100	-.33	16.42	1.75	1333.	419.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.68	.0030	.0530

POST 53 - ASPEN

TEST ID ----- P-54
TEST DATE --- 10-17-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-1.57	19.72	.10	6286.	10.
.010	-1.23	19.43	.20	4903.	46.
.015	-2.72	19.15	.29	10896.	81.
.020	-3.33	18.65	.39	13327.	143.
.025	-3.88	18.05	.48	15506.	218.
.030	-1.93	17.56	.57	7711.	278.
.035	-.40	17.39	.66	1592.	300.
.040	-.17	17.34	.74	671.	306.
.045	.06	17.32	.83	-251.	308.
.050	.06	17.33	.92	-251.	307.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.59	.0175	.0275

POST 54 - ASPEN

TEST ID ----- P-55
TEST DATE --- 10-17-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.005	-2.31	19.65	.10	9257.	18.
.010	-1.17	19.36	.20	4670.	55.
.015	-3.32	19.00	.29	13261.	100.
.020	-3.99	18.40	.39	15971.	174.
.025	-1.79	17.87	.48	7172.	240.
.030	-.71	17.68	.57	2836.	264.
.035	-.29	17.61	.65	1168.	272.
.040	-.02	17.59	.74	83.	275.
.045	-.08	17.59	.83	334.	275.
.050	0.00	17.58	.92	0.	276.
.055	-.17	17.57	1.00	667.	278.
.060	-.50	17.52	1.09	2002.	284.
.065	-.60	17.42	1.18	2419.	295.
.070	-.27	17.35	1.27	1084.	304.
.075	-.13	17.33	1.35	500.	307.
.080	0.00	17.32	1.44	0.	308.
.085	.13	17.33	1.53	-500.	307.
.090	.13	17.35	1.61	-500.	304.
.095	.08	17.37	1.70	-334.	302.
.100	.15	17.38	1.79	-584.	300.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.38	.0005	.0505

POST 55 - WHITE ASH

TEST ID ----- P-56
TEST DATE --- 10-17-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	166.	0.
.010	-1.33	19.35	.20	5302.	56.
.020	-3.67	18.53	.39	14663.	158.
.030	-4.37	17.12	.57	17479.	332.
.040	-1.66	15.91	.73	6627.	484.
.050	-2.42	15.09	.88	9692.	585.
.060	-2.03	14.39	1.03	8118.	672.
.070	-.99	13.94	1.17	3976.	728.
.080	-.95	13.61	1.31	3811.	769.
.090	-.72	13.35	1.45	2899.	801.
.100	-.56	13.16	1.58	2237.	825.
.110	-.58	12.97	1.71	2320.	848.
.120	-.54	12.80	1.84	2154.	870.
.130	-.50	12.63	1.96	1988.	890.
.140	-.52	12.48	2.09	2071.	910.
.150	-.37	12.34	2.21	1491.	927.
.160	-.41	12.20	2.34	1657.	945.
.170	-.39	12.07	2.46	1574.	960.
.180	-.31	11.95	2.58	1243.	975.
.190	-.39	11.83	2.70	1574.	990.
.200	-.27	11.73	2.82	1077.	1003.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-3.12	.0135	.0635

POST 56 - WHITE ASH

TEST ID ----- P-57
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	63.	0.
.005	-2.48	19.61	.10	9937.	24.
.010	-1.75	19.35	.20	6983.	55.
.015	-2.99	18.92	.29	11962.	109.
.020	-3.92	18.36	.39	15675.	178.
.025	.17	18.03	.48	-696.	219.
.030	.13	18.07	.57	-527.	215.
.035	.11	18.08	.66	-443.	213.
.040	.01	18.09	.75	-21.	213.
.045	.05	18.09	.84	-190.	212.
.050	.11	18.11	.93	-443.	210.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.35	.0125	.0225

POST 57 - ASPEN

TEST ID ----- P-58
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-85.	0.
.005	-.47	19.77	.10	1877.	3.
.010	-2.84	19.47	.20	11347.	41.
.015	-1.62	19.16	.29	6484.	79.
.020	-3.21	18.78	.39	12840.	127.
.025	-3.22	18.23	.48	12882.	195.
.030	-3.16	17.75	.57	12626.	255.
.035	-2.28	17.31	.66	9129.	309.
.040	-1.45	17.03	.74	5801.	344.
.045	-1.22	16.81	.83	4863.	371.
.050	-1.11	16.63	.91	4436.	394.
.055	-.87	16.47	1.00	3498.	413.
.060	-.85	16.34	1.08	3413.	430.
.065	-.68	16.22	1.16	2730.	444.
.070	-.27	16.15	1.24	1066.	453.
.075	-.18	16.12	1.32	725.	457.
.080	-.06	16.10	1.40	256.	460.
.085	-.01	16.09	1.48	43.	461.
.090	-.10	16.08	1.56	384.	462.
.095	-.05	16.06	1.64	213.	464.
.100	-.03	16.06	1.72	128.	465.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.06	.0060	.0560

POST 58 - BEECH

TEST ID ----- P-59
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-.17	19.78	.10	671.	2.
.010	-1.79	19.67	.20	7170.	16.
.015	-1.19	19.36	.30	4780.	54.
.020	-2.18	19.13	.39	8721.	83.
.025	-2.05	18.74	.49	8218.	132.
.030	-.25	18.58	.58	1006.	151.
.035	.06	18.58	.67	-252.	152.
.040	.07	18.59	.77	-294.	150.
.045	.13	18.60	.86	-503.	149.
.050	0.00	18.61	.95	0.	147.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.04	.0170	.0270

POST 59 - ASPEN

TEST ID ----- P-60
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-41.	0.
.005	-1.65	19.74	.10	6617.	7.
.010	-.91	19.42	.20	3635.	48.
.015	-2.47	19.21	.29	9884.	73.
.020	-3.25	18.72	.39	12988.	134.
.025	-1.35	18.30	.48	5391.	186.
.030	-1.96	18.01	.57	7842.	223.
.035	-1.20	17.77	.66	4820.	252.
.040	-1.33	17.54	.75	5310.	281.
.045	-1.23	17.35	.84	4901.	305.
.050	-1.14	17.16	.92	4575.	328.
.055	-1.10	16.97	1.01	4411.	351.
.060	-.94	16.82	1.09	3758.	371.
.065	-.90	16.68	1.18	3594.	388.
.070	-.98	16.52	1.26	3921.	407.
.075	-.80	16.38	1.34	3186.	425.
.080	-.75	16.26	1.42	2982.	440.
.085	-.74	16.14	1.50	2941.	455.
.090	-.55	16.03	1.58	2206.	468.
.095	-.49	15.95	1.66	1961.	478.
.100	-.35	15.88	1.74	1389.	487.
.105	-.22	15.83	1.82	899.	493.
.110	-.14	15.80	1.90	572.	496.
.115	-.22	15.77	1.98	899.	500.
.120	-.12	15.75	2.06	490.	504.
.125	-.12	15.73	2.14	490.	506.
.130	-.14	15.71	2.22	572.	508.
.135	-.09	15.69	2.30	368.	511.
.140	.08	15.68	2.37	-327.	511.
.145	.07	15.69	2.45	-286.	510.
.150	.14	15.71	2.53	-572.	508.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.72	.0050	.0550

POST 60 - WHITE ASH

TEST ID ----- P-61
TEST DATE --- 10-18-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	143.	0.
.005	-2.67	19.66	.10	10675.	17.
.010	-.77	19.33	.20	3082.	58.
.015	-2.97	19.09	.29	11899.	88.
.020	-2.75	18.55	.39	11001.	156.
.025	-3.51	18.10	.48	14022.	211.
.030	-3.58	17.54	.57	14308.	281.
.035	-3.18	16.96	.65	12716.	352.
.040	-1.88	16.54	.74	7531.	405.
.045	-1.97	16.28	.82	7899.	438.
.050	-1.68	15.95	.90	6715.	478.
.055	-.99	15.75	.98	3980.	503.
.060	-.88	15.61	1.06	3531.	520.
.065	-1.12	15.45	1.13	4470.	541.
.070	-.96	15.26	1.21	3858.	563.
.075	-.93	15.13	1.29	3735.	581.
.080	-1.02	14.95	1.36	4062.	602.
.085	-.85	14.81	1.44	3408.	620.
.090	-.83	14.67	1.51	3327.	637.
.095	-.81	14.55	1.58	3245.	653.
.100	-.75	14.43	1.66	3000.	667.
.105	-.71	14.31	1.73	2837.	682.
.110	-.64	14.20	1.80	2551.	696.
.115	-.53	14.10	1.87	2102.	708.
.120	-.15	14.05	1.94	592.	714.
.125	.02	14.05	2.01	-61.	715.
.130	.04	14.05	2.08	-143.	715.
.135	.05	14.06	2.15	-184.	713.
.140	.11	14.07	2.22	-429.	711.
.145	.11	14.09	2.29	-429.	709.
.150	.10	14.11	2.36	-388.	707.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.46	.0035	.0535

POST 61 - WHITE ASH

TEST ID ----- P-62
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	83.	0.
.005	-3.53	19.54	.10	14108.	33.
.010	-1.02	19.18	.20	4096.	77.
.015	-3.36	18.87	.29	13446.	115.
.020	-1.58	18.36	.38	6330.	179.
.025	.07	18.31	.48	-290.	185.
.030	.01	18.32	.57	-41.	184.
.035	.03	18.33	.66	-124.	183.
.040	.03	18.33	.75	-124.	182.
.045	.03	18.34	.84	-124.	182.
.050	.11	18.35	.93	-455.	181.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.56	.0110	.0210

POST 62 - ELM

TEST ID ----- P-63
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.010	-.84	19.25	.20	3357.	69.
.020	-3.69	18.35	.38	14753.	181.
.030	-3.46	17.22	.56	13841.	321.
.040	-3.22	16.13	.73	12888.	456.
.050	-3.09	15.12	.88	12349.	581.
.060	-3.44	14.08	1.03	13758.	711.
.070	-2.36	13.08	1.17	9448.	835.
.080	-2.80	12.19	1.29	11189.	946.
.090	-2.53	11.33	1.41	10111.	1052.
.100	-1.97	10.56	1.52	7874.	1148.
.110	-2.22	9.82	1.62	8868.	1239.
.120	-1.95	9.15	1.72	7791.	1323.
.130	-2.11	8.49	1.80	8454.	1405.
.140	-1.97	7.85	1.89	7874.	1485.
.150	-1.95	7.23	1.96	7791.	1562.
.160	-1.91	6.61	2.03	7625.	1638.
.170	-1.80	6.03	2.09	7211.	1711.
.180	-1.80	5.42	2.15	7211.	1786.
.190	-1.51	4.88	2.20	6050.	1853.
.200	-1.48	4.40	2.25	5926.	1914.
.210	-1.45	3.93	2.29	5802.	1972.
.220	-1.31	3.51	2.33	5222.	2024.
.230	-1.08	3.12	2.36	4310.	2072.
.240	-.89	2.80	2.39	3564.	2112.
.250	-.70	2.52	2.42	2818.	2146.
.260	-.73	2.28	2.44	2901.	2177.
.270	-.58	2.08	2.46	2321.	2201.
.280	-.48	1.90	2.48	1906.	2223.
.290	-.54	1.76	2.50	2155.	2241.
.300	-.41	1.61	2.52	1658.	2259.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.36	.0150	.0650

POST 63 - ELM

TEST ID ----- P-64
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	167.	0.
.010	-1.13	19.26	.20	4504.	67.
.020	-4.65	18.26	.38	18598.	191.
.030	-4.83	16.47	.56	19307.	414.
.040	-4.27	15.15	.72	17097.	578.
.050	-4.82	13.59	.86	19265.	771.
.060	-4.57	12.08	.99	18264.	959.
.070	-4.45	10.65	1.10	17806.	1136.
.080	-4.20	9.27	1.20	16805.	1308.
.090	-4.10	7.94	1.29	16388.	1473.
.100	-3.73	6.72	1.36	14929.	1625.
.110	-3.45	5.58	1.42	13803.	1766.
.120	-3.18	4.50	1.47	12718.	1901.
.130	-2.94	3.52	1.51	11759.	2022.
.140	-2.54	2.64	1.54	10175.	2132.
.150	-2.15	1.89	1.56	8590.	2225.
.160	-1.74	1.28	1.58	6964.	2300.
.170	-1.48	.76	1.59	5921.	2365.
.180	-1.29	.31	1.60	5171.	2421.
.190	-1.15	-.08	1.60	4587.	2470.
.200	-1.01	-.44	1.59	4045.	2515.
.210	-.90	-.74	1.59	3586.	2552.
.220	-.76	-1.03	1.58	3044.	2587.
.230	-.65	-1.25	1.57	2585.	2615.
.240	-.60	-1.45	1.55	2419.	2639.
.250	-.46	-1.64	1.54	1835.	2663.
.260	-.44	-1.77	1.52	1751.	2679.
.270	-.35	-1.91	1.50	1418.	2697.
.280	-.35	-2.00	1.48	1418.	2708.
.290	-.23	-2.09	1.46	917.	2719.
.300	-.06	-2.14	1.44	250.	2725.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.73	.0200	.0700

POST 64 - ELM

TEST ID ----- P-65
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	83.	0.
.010	-1.07	19.21	.20	4292.	73.
.020	-3.91	18.20	.38	15641.	198.
.030	-3.38	17.23	.56	13536.	319.
.040	-2.84	16.27	.73	11349.	439.
.050	-2.49	15.40	.89	9946.	546.
.060	-2.17	14.64	1.04	8667.	641.
.070	-1.77	14.01	1.18	7098.	719.
.080	-1.59	13.46	1.32	6356.	787.
.090	-1.32	13.03	1.45	5282.	841.
.100	-1.17	12.67	1.58	4663.	886.
.110	-.99	12.30	1.70	3962.	931.
.120	-.93	11.97	1.82	3714.	973.
.130	-.99	11.66	1.94	3962.	1011.
.140	-.83	11.37	2.06	3302.	1048.
.150	-.58	11.17	2.17	2311.	1072.
.160	-.61	10.96	2.28	2435.	1098.
.170	-.50	10.78	2.39	1981.	1120.
.180	-.58	10.61	2.50	2311.	1142.
.190	-.43	10.44	2.60	1733.	1163.
.200	-.52	10.28	2.70	2063.	1183.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.88	.0130	.0630

POST 65 - ELM

TEST ID ----- P-66
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	164.	0.
.005	-.07	19.79	.10	287.	1.
.010	-1.38	19.73	.20	5529.	9.
.015	-2.17	19.32	.30	8683.	59.
.020	-1.08	19.11	.39	4300.	86.
.025	-.73	18.97	.49	2908.	103.
.030	-.20	18.91	.58	819.	111.
.035	-.10	18.88	.68	410.	114.
.040	.04	18.86	.77	-164.	116.
.045	-.04	18.86	.86	164.	116.
.050	-.04	18.86	.96	164.	117.
.055	-.02	18.85	1.05	82.	119.
.060	.04	18.85	1.15	-164.	118.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.59	.0010	.0510

POST 66 - ELM

TEST ID ----- P-67
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.010	-1.70	19.25	.20	6811.	69.
.020	-4.69	18.24	.38	18762.	193.
.030	-6.74	16.40	.56	26943.	423.
.040	-7.27	14.16	.71	29085.	701.
.050	-7.31	11.82	.84	29257.	992.
.060	-7.06	9.52	.95	28228.	1277.
.070	-6.51	7.35	1.03	26044.	1547.
.080	-5.79	5.38	1.10	23174.	1792.
.090	-5.46	3.58	1.14	21846.	2015.
.100	-5.00	1.89	1.17	20004.	2225.
.110	-4.59	.35	1.18	18376.	2417.
.120	-4.08	-1.05	1.17	16320.	2590.
.130	-3.39	-2.27	1.16	13579.	2741.
.140	-2.84	-3.26	1.13	11351.	2865.
.150	-2.26	-4.07	1.09	9038.	2965.
.160	-1.77	-4.72	1.05	7068.	3046.
.170	-1.17	-5.19	1.00	4669.	3105.
.180	-.93	-5.56	.95	3727.	3150.
.190	-.77	-5.83	.89	3084.	3184.
.200	-.33	-5.99	.83	1328.	3204.
.210	-.14	-6.08	.77	557.	3215.
.220	-.05	-6.11	.71	214.	3219.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-6.88	.0265	.0765

POST 67 - ELM

TEST ID ----- P-68
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.03	19.80	0.00	-106.	0.
.010	-.80	19.22	.20	3205.	72.
.020	-3.94	18.29	.38	15769.	187.
.030	-5.49	16.68	.56	21966.	388.
.040	-3.86	15.39	.72	15429.	548.
.050	-4.12	14.02	.87	16490.	718.
.060	-4.36	12.64	1.00	17424.	890.
.070	-4.20	11.28	1.12	16787.	1059.
.080	-4.15	9.93	1.23	16617.	1226.
.090	-3.88	8.63	1.32	15514.	1387.
.100	-3.87	7.38	1.40	15471.	1543.
.110	-3.86	6.13	1.47	15429.	1698.
.120	-3.65	4.92	1.52	14580.	1848.
.130	-3.67	3.74	1.56	14665.	1995.
.140	-3.36	2.62	1.60	13434.	2134.
.150	-3.09	1.57	1.62	12373.	2265.
.160	-2.76	.61	1.63	11057.	2384.
.170	-2.33	-.20	1.63	9317.	2485.
.180	-1.92	-.90	1.62	7661.	2572.
.190	-1.71	-1.48	1.61	6855.	2643.
.200	-1.41	-1.98	1.59	5624.	2706.
.210	-1.25	-2.41	1.57	4987.	2759.
.220	-1.03	-2.77	1.55	4138.	2804.
.230	-.89	-3.10	1.52	3544.	2844.
.240	-.63	-3.35	1.49	2526.	2876.
.250	-.53	-3.55	1.45	2101.	2901.
.260	-.50	-3.71	1.41	2016.	2921.
.270	-.36	-3.84	1.38	1422.	2937.
.280	-.20	-3.94	1.34	785.	2949.
.290	-.19	-4.00	1.30	743.	2957.
.300	.03	-4.03	1.26	-106.	2960.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-4.36	.0215	.0715

POST 68 - ELM

TEST ID ----- P-69
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.16	19.80	0.00	637.	0.
.010	-1.50	19.13	.19	5984.	84.
.020	-5.29	17.91	.38	21176.	235.
.030	-4.33	16.39	.55	17314.	423.
.040	-4.72	14.86	.71	18885.	614.
.050	-4.76	13.31	.85	19054.	806.
.060	-3.97	11.91	.97	15871.	980.
.070	-2.60	10.81	1.09	10397.	1117.
.080	-2.05	10.06	1.19	8190.	1209.
.090	-1.98	9.41	1.29	7936.	1290.
.100	-1.75	8.80	1.38	7002.	1366.
.110	-1.71	8.21	1.46	6832.	1440.
.120	-1.64	7.66	1.54	6578.	1508.
.130	-1.66	7.12	1.62	6620.	1575.
.140	-1.58	6.60	1.69	6323.	1640.
.150	-1.54	6.10	1.75	6153.	1702.
.160	-1.51	5.60	1.81	6026.	1764.
.170	-1.51	5.13	1.86	6026.	1823.
.180	-1.44	4.65	1.91	5771.	1882.
.190	-1.43	4.19	1.96	5729.	1939.
.200	-1.39	3.75	2.00	5559.	1993.
.210	-1.23	3.32	2.03	4923.	2047.
.220	-1.16	2.95	2.06	4626.	2094.
.230	-.97	2.61	2.09	3862.	2136.
.240	-.87	2.31	2.11	3480.	2173.
.250	-.72	2.08	2.14	2886.	2202.
.260	-.63	1.86	2.16	2504.	2228.
.270	-.49	1.69	2.17	1952.	2250.
.280	-.33	1.55	2.19	1316.	2267.
.290	-.25	1.45	2.20	1018.	2280.
.300	-.29	1.36	2.22	1146.	2290.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.58	.0140	.0640

POST 69 - ELM

TEST ID ----- P-70
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	63.	0.
.010	-1.09	19.23	.20	4376.	71.
.020	-4.76	18.19	.38	19049.	200.
.030	-5.01	16.62	.56	20021.	395.
.040	-3.94	15.47	.72	15751.	538.
.050	-2.72	14.54	.87	10888.	653.
.060	-2.70	13.67	1.01	10803.	762.
.070	-2.84	12.81	1.14	11353.	868.
.080	-2.60	11.97	1.26	10381.	972.
.090	-1.74	11.22	1.38	6956.	1066.
.100	-2.07	10.61	1.49	8266.	1142.
.110	-1.86	9.98	1.59	7421.	1220.
.120	-1.13	9.55	1.69	4503.	1273.
.130	-.90	9.24	1.78	3615.	1312.
.140	-.86	8.93	1.87	3446.	1350.
.150	-1.01	8.65	1.96	4038.	1385.
.160	-.78	8.39	2.05	3108.	1417.
.170	-.72	8.13	2.13	2896.	1449.
.180	-.61	7.91	2.21	2431.	1477.
.190	-.64	7.70	2.29	2558.	1503.
.200	-.67	7.49	2.36	2685.	1529.
.210	-.59	7.30	2.44	2347.	1553.
.220	-.55	7.10	2.51	2220.	1578.
.230	-.65	6.90	2.58	2600.	1602.
.240	-.49	6.71	2.65	1966.	1626.
.250	-.63	6.53	2.71	2516.	1649.
.260	-.55	6.35	2.78	2220.	1670.
.270	-.48	6.19	2.84	1924.	1691.
.280	-.54	6.03	2.90	2178.	1710.
.290	-.46	5.87	2.96	1839.	1730.
.300	-.52	5.70	3.02	2093.	1751.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.52	.0135	.0635

POST 70 - ELM

TEST ID ----- P-71
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	41.	0.
.005	-2.48	19.64	.10	9924.	20.
.010	-1.08	19.31	.20	4324.	61.
.015	-2.67	19.07	.29	10665.	91.
.020	-3.76	18.48	.39	15029.	164.
.025	-3.39	17.95	.48	13547.	229.
.030	-3.90	17.34	.57	15606.	306.
.035	-1.91	16.78	.65	7659.	375.
.040	-3.57	16.22	.73	14288.	445.
.045	-1.51	15.78	.81	6053.	499.
.050	-.32	15.62	.89	1276.	519.
.055	-.01	15.60	.97	41.	522.
.060	.03	15.60	1.05	-124.	521.
.065	-.06	15.61	1.13	247.	521.
.070	-.11	15.60	1.20	453.	522.
.075	-.28	15.57	1.28	1112.	526.
.080	-.50	15.50	1.36	2018.	534.
.085	-.39	15.42	1.44	1565.	544.
.090	-.20	15.37	1.51	782.	550.
.095	-.01	15.36	1.59	41.	552.
.100	.05	15.35	1.67	-206.	552.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.60	.0015	.0515

POST 71 - ELM

TEST ID ----- P-72
TEST DATE --- 10-22-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-41.	0.
.005	-2.62	19.66	.10	10467.	17.
.010	-1.45	19.26	.20	5788.	67.
.015	-2.72	18.99	.29	10878.	101.
.020	-4.28	18.37	.39	17117.	177.
.025	-4.38	17.67	.48	17527.	265.
.030	-3.07	17.11	.56	12273.	334.
.035	-.89	16.83	.65	3571.	370.
.040	-.36	16.75	.73	1437.	378.
.045	-.22	16.71	.81	862.	384.
.050	-.61	16.64	.90	2422.	393.
.055	-.73	16.52	.98	2914.	407.
.060	-.34	16.42	1.06	1355.	420.
.065	-.11	16.38	1.15	452.	425.
.070	-.11	16.36	1.23	452.	427.
.075	.09	16.36	1.31	-369.	427.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.99	.0030	.0530

POST 72 - ELM

TEST ID ----- P-73
TEST DATE --- 10-24-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	82.	0.
.010	-2.78	19.38	.20	11128.	52.
.020	-3.89	18.76	.39	15546.	130.
.030	-5.85	17.28	.57	23402.	313.
.040	-6.16	15.42	.73	24629.	544.
.050	-5.05	13.81	.88	20210.	744.
.060	-4.53	12.35	1.01	18124.	925.
.070	-4.42	10.90	1.12	17674.	1105.
.080	-4.38	9.57	1.23	17510.	1271.
.090	-4.03	8.25	1.32	16119.	1435.
.100	-3.95	6.97	1.39	15792.	1594.
.110	-3.70	5.76	1.46	14810.	1745.
.120	-3.29	4.63	1.51	13174.	1885.
.130	-3.07	3.59	1.55	12274.	2014.
.140	-2.54	2.69	1.58	10146.	2125.
.150	-2.09	1.94	1.60	8346.	2219.
.160	-1.74	1.34	1.62	6955.	2293.
.170	-1.33	.85	1.63	5319.	2354.
.180	-1.15	.45	1.64	4582.	2404.
.190	-.92	.12	1.64	3682.	2445.
.200	-.78	-.17	1.64	3109.	2481.
.210	-.72	-.40	1.64	2864.	2509.
.220	-.49	-.60	1.63	1964.	2535.
.230	-.57	-.77	1.62	2291.	2555.
.240	-.35	-.90	1.62	1391.	2572.
.250	-.25	-1.02	1.61	982.	2587.
.260	-.25	-1.11	1.59	982.	2598.
.270	-.23	-1.17	1.58	900.	2605.
.280	-.25	-1.26	1.57	982.	2616.
.290	-.10	-1.29	1.56	409.	2620.
.300	.02	-1.31	1.55	-82.	2623.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.89	.0215	.0715

POST 73 - ELM

TEST ID ----- P-74
TEST DATE --- 10-24-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME .

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	41.	0.
.005	-.19	19.78	.10	770.	2.
.010	-1.92	19.68	.20	7662.	15.
.015	-2.54	19.23	.30	10176.	70.
.020	-1.19	18.99	.39	4743.	100.
.025	-3.90	18.62	.48	15608.	147.
.030	-3.37	17.94	.58	13500.	231.
.035	-2.14	17.57	.66	8554.	278.
.040	-3.09	17.13	.75	12365.	331.
.045	-2.26	16.67	.84	9041.	389.
.050	-2.24	16.34	.92	8959.	430.
.055	-2.38	15.95	1.00	9527.	478.
.060	-1.90	15.59	1.08	7581.	522.
.065	-1.55	15.32	1.16	6203.	556.
.070	-1.63	15.06	1.23	6527.	589.
.075	-1.57	14.81	1.31	6284.	620.
.080	-1.12	14.58	1.38	4500.	648.
.085	-.90	14.43	1.45	3608.	667.
.090	-.94	14.28	1.52	3770.	686.
.095	-.86	14.13	1.59	3446.	704.
.100	-.76	14.00	1.67	3041.	720.
.105	-.86	13.87	1.73	3446.	736.
.110	-.86	13.73	1.80	3446.	754.
.115	-.74	13.61	1.87	2959.	769.
.120	-.70	13.49	1.94	2797.	783.
.125	-.70	13.38	2.01	2797.	797.
.130	-.66	13.28	2.07	2635.	810.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.54	.0100	.0600

POST 74 - YELLOW BIRCH

TEST ID ----- P-75
TEST DATE --- 10-24-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-82.	0.
.010	-3.14	19.30	.20	12571.	63.
.020	-4.02	18.60	.39	16082.	149.
.030	-4.04	17.02	.56	16163.	345.
.040	-4.10	15.65	.73	16408.	515.
.050	-1.00	15.06	.88	4000.	589.
.060	-1.61	14.59	1.03	6449.	647.
.070	-1.16	14.22	1.17	4653.	693.
.080	-1.39	13.77	1.31	5551.	749.
.090	-1.33	13.40	1.45	5306.	795.
.100	-1.16	12.98	1.58	4653.	847.
.110	-1.08	12.63	1.71	4327.	890.
.120	-1.04	12.27	1.83	4163.	936.
.130	-1.16	11.91	1.95	4653.	980.
.140	-1.14	11.54	2.07	4571.	1026.
.150	-.78	11.21	2.19	3102.	1067.
.160	-.98	10.96	2.30	3918.	1098.
.170	-.67	10.65	2.40	2694.	1137.
.180	-.80	10.41	2.51	3184.	1166.
.190	-.65	10.17	2.61	2612.	1197.
.200	-.59	9.97	2.71	2367.	1221.
.210	-.65	9.77	2.81	2612.	1246.
.220	-.47	9.61	2.91	1878.	1265.
.230	-.57	9.45	3.00	2286.	1286.
.240	-.49	9.28	3.10	1959.	1307.
.250	-.38	9.13	3.19	1510.	1325.
.260	-.49	8.98	3.28	1959.	1344.
.270	-.45	8.85	3.37	1796.	1361.
.280	-.45	8.71	3.46	1796.	1378.
.290	-.43	8.56	3.54	1714.	1396.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.03	.0055	.0555

POST 75 - SUGAR MAPLE

TEST ID ----- P-76
TEST DATE --- 10-24-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-20.	0.
.010	-2.10	19.24	.20	8391.	69.
.020	-4.44	18.44	.39	17773.	169.
.030	-3.90	17.43	.56	15589.	295.
.040	-3.00	16.39	.73	11990.	424.
.050	-1.77	15.45	.89	7097.	541.
.060	-2.06	14.80	1.04	8229.	621.
.070	-1.71	14.23	1.19	6854.	692.
.080	-1.45	13.73	1.33	5803.	754.
.090	-1.43	13.28	1.46	5722.	810.
.100	-1.25	12.84	1.59	4994.	865.
.110	-1.31	12.44	1.72	5237.	915.
.120	-1.05	12.07	1.84	4185.	960.
.130	-1.11	11.72	1.96	4428.	1004.
.140	-1.15	11.34	2.08	4590.	1051.
.150	-1.13	10.96	2.19	4509.	1098.
.160	-1.01	10.63	2.30	4024.	1139.
.170	-.97	10.30	2.40	3862.	1180.
.180	-.84	10.00	2.50	3377.	1217.
.190	-.76	9.73	2.60	3053.	1251.
.200	-.72	9.47	2.70	2891.	1283.
.210	-.78	9.23	2.79	3134.	1314.
.220	-.76	8.97	2.88	3053.	1345.
.230	-.80	8.73	2.97	3215.	1375.
.240	-.65	8.51	3.06	2608.	1402.
.250	-.64	8.30	3.14	2568.	1429.
.260	-.66	8.09	3.22	2649.	1454.
.270	-.58	7.88	3.30	2325.	1481.
.280	-.64	7.69	3.38	2568.	1505.
.290	-.58	7.50	3.46	2325.	1527.
.300	-.46	7.32	3.53	1840.	1550.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.84	.0045	.0545

POST 76 - YELLOW BIRCH

TEST ID ----- P-77
TEST DATE --- 10-24-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	40.	0.
.005	-.09	19.79	.10	360.	1.
.010	-.47	19.77	.20	1882.	4.
.015	-2.41	19.51	.30	9649.	36.
.020	-1.04	19.26	.39	4164.	67.
.025	-2.85	18.96	.49	11411.	105.
.030	-3.17	18.45	.58	12692.	167.
.035	-2.96	17.98	.67	11851.	227.
.040	-2.61	17.49	.76	10450.	287.
.045	-1.04	17.23	.85	4164.	319.
.050	-1.47	17.00	.93	5886.	348.
.055	-1.09	16.79	1.02	4364.	373.
.060	-.59	16.67	1.10	2362.	389.
.065	-.77	16.56	1.19	3083.	403.
.070	-.67	16.44	1.27	2683.	418.
.075	-.43	16.36	1.35	1722.	428.
.080	-.43	16.29	1.43	1722.	436.
.085	-.48	16.22	1.51	1922.	445.
.090	-.37	16.16	1.59	1481.	453.
.095	-.41	16.10	1.67	1642.	460.
.100	-.37	16.04	1.75	1481.	467.
.105	-.27	15.99	1.83	1081.	473.
.110	-.21	15.96	1.91	841.	477.
.115	-.25	15.92	1.99	1001.	482.
.120	-.23	15.87	2.07	921.	488.
.125	-.19	15.84	2.15	761.	492.
.130	-.39	15.79	2.23	1561.	498.
.135	-.48	15.72	2.31	1922.	507.
.140	-.31	15.65	2.39	1241.	515.
.145	-.13	15.62	2.47	520.	519.
.150	-.07	15.60	2.55	280.	521.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.92	.0110	.0610

POST 77 - ASPEN

TEST ID ----- P-78
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	21.	0.
.010	-1.37	19.12	.20	5483.	85.
.020	-5.05	17.95	.38	20202.	229.
.030	-5.83	16.09	.55	23317.	461.
.040	-.39	15.17	.71	1557.	576.
.050	-.73	15.05	.86	2923.	590.
.060	-.84	14.75	1.01	3349.	627.
.070	-.56	14.55	1.15	2240.	652.
.080	-.58	14.37	1.30	2325.	674.
.090	-.45	14.20	1.44	1813.	696.
.100	-.30	14.08	1.58	1216.	710.
.110	-.28	13.97	1.72	1131.	724.
.120	-.33	13.88	1.86	1301.	735.
.130	-.33	13.77	2.00	1301.	749.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.97	.0025	.0525

POST 78 - YELLOW BIRCH

TEST ID ----- P-79
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	125.	0.
.005	-.18	19.79	.10	709.	2.
.010	-2.37	19.64	.20	9464.	20.
.015	-1.37	19.29	.29	5462.	63.
.020	-2.76	19.00	.39	11048.	99.
.025	-3.38	18.47	.48	13508.	165.
.030	-3.07	17.96	.58	12299.	229.
.035	-1.18	17.62	.66	4711.	271.
.040	-.68	17.48	.75	2710.	288.
.045	-.59	17.38	.84	2376.	300.
.050	-.74	17.27	.93	2960.	315.
.055	-.61	17.16	1.01	2460.	329.
.060	-.54	17.06	1.10	2168.	341.
.065	-.51	16.97	1.18	2043.	351.
.070	-.38	16.90	1.27	1501.	360.
.075	-.51	16.83	1.35	2043.	369.
.080	-.51	16.75	1.44	2043.	379.
.085	-.39	16.68	1.52	1543.	387.
.090	-.41	16.62	1.60	1626.	395.
.095	-.34	16.56	1.69	1376.	402.
.100	-.36	16.50	1.77	1459.	410.
.105	-.43	16.43	1.85	1709.	418.
.110	-.39	16.36	1.93	1543.	427.
.115	-.34	16.31	2.01	1376.	434.
.120	-.16	16.27	2.10	625.	439.
.125	-.11	16.25	2.18	459.	441.
.130	-.14	16.23	2.26	542.	444.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.65	.0080	.0580

POST 79 - ASPEN

TEST ID ----- P-80
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	165.	0.
.010	-3.16	19.32	.20	12652.	59.
.020	-4.98	18.43	.39	19929.	170.
.030	-3.66	16.95	.56	14637.	354.
.040	-3.10	15.89	.73	12404.	485.
.050	-1.61	15.14	.88	6450.	579.
.060	-1.12	14.63	1.03	4465.	642.
.070	-1.26	14.29	1.18	5044.	685.
.080	-.88	13.93	1.32	3514.	729.
.090	-.99	13.62	1.45	3969.	768.
.100	-1.03	13.30	1.59	4135.	808.
.110	-.87	12.98	1.72	3473.	847.
.120	-1.03	12.68	1.85	4135.	884.
.130	-1.04	12.36	1.97	4176.	924.
.140	-.99	12.03	2.10	3969.	966.
.150	-1.12	11.67	2.21	4465.	1011.
.160	-.71	11.33	2.33	2853.	1052.
.170	-1.30	11.08	2.44	5210.	1083.
.180	-.68	10.79	2.55	2729.	1119.
.190	-.70	10.56	2.66	2812.	1148.
.200	-.76	10.31	2.76	3060.	1179.
.210	-.58	10.10	2.86	2315.	1205.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.05	.0060	.0560

POST 80 - SUGAR MAPLE

TEST ID ----- P-81
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	83.	0.
.005	-.12	19.79	.10	495.	1.
.010	-.25	19.77	.20	990.	3.
.015	-3.40	19.52	.30	13615.	34.
.020	-1.86	19.05	.39	7426.	93.
.025	-2.81	18.74	.49	11222.	132.
.030	-4.62	18.10	.58	18483.	211.
.035	-1.68	17.65	.67	6725.	268.
.040	-.67	17.48	.76	2682.	289.
.045	-.11	17.42	.84	454.	296.
.050	-.04	17.40	.93	165.	298.
.055	-.10	17.39	1.02	413.	299.
.060	-.02	17.39	1.10	83.	299.
.065	-.08	17.39	1.19	330.	300.
.070	-.21	17.37	1.28	825.	302.
.075	-.25	17.32	1.37	990.	308.
.080	-.34	17.27	1.45	1361.	314.
.085	-.28	17.22	1.54	1114.	320.
.090	-.17	17.18	1.62	660.	325.
.095	-.04	17.17	1.71	165.	326.
.100	-.09	17.17	1.80	371.	327.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-1.49	.0030	.0530

POST 81 - YELLOW BIRCH

TEST ID ----- P-82
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.04	19.80	0.00	-163.	0.
.010	-.26	19.77	.20	1057.	4.
.020	-.95	19.13	.39	3820.	83.
.030	-3.41	18.10	.58	13653.	212.
.040	-3.47	17.03	.76	13897.	344.
.050	-2.32	16.14	.92	9265.	455.
.060	-2.01	15.56	1.08	8046.	526.
.070	-1.61	14.99	1.23	6420.	598.
.080	-1.64	14.44	1.38	6542.	666.
.090	-1.29	13.98	1.52	5161.	723.
.100	-1.16	13.56	1.66	4632.	776.
.110	-.75	13.22	1.79	3007.	817.
.120	-.93	12.94	1.92	3738.	852.
.130	-.98	12.63	2.05	3901.	891.
.140	-.91	12.33	2.18	3657.	927.
.150	-.69	12.07	2.30	2763.	960.
.160	-.79	11.81	2.42	3170.	992.
.170	-.77	11.65	2.53	3088.	1012.
.180	-.42	11.42	2.65	1666.	1041.
.190	-.47	11.27	2.76	1869.	1060.
.200	-.41	11.12	2.88	1625.	1078.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.65	.0120	.0620

POST 82 - YELLOW BIRCH

TEST ID ----- P-83
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.07	19.80	0.00	286.	0.
.010	-3.36	19.53	.20	13425.	33.
.020	-3.17	18.73	.39	12690.	133.
.030	-4.50	17.40	.57	17995.	298.
.040	-3.46	15.80	.73	13833.	497.
.050	-2.01	15.08	.89	8038.	586.
.060	-1.28	14.52	1.04	5101.	655.
.070	-1.07	14.16	1.18	4284.	701.
.080	-.85	13.83	1.32	3387.	741.
.090	-.95	13.58	1.46	3795.	772.
.100	-.89	13.29	1.59	3550.	809.
.110	-.89	13.01	1.72	3550.	844.
.120	-.95	12.72	1.85	3795.	880.
.130	-.81	12.45	1.98	3224.	912.
.140	-.98	12.17	2.10	3917.	948.
.150	-.87	11.88	2.22	3468.	983.
.160	-.81	11.60	2.34	3224.	1018.
.170	-.72	11.39	2.45	2897.	1044.
.180	-.72	11.14	2.57	2897.	1076.
.190	-.62	10.91	2.68	2489.	1104.
.200	-.56	10.70	2.78	2244.	1131.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-3.17	.0080	.0580

POST 83 - YELLOW BIRCH

TEST ID ----- P-84
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.28	19.80	0.00	1110.	0.
.005	-3.85	19.49	.10	15411.	39.
.010	-1.30	19.07	.19	5219.	91.
.015	-3.07	18.80	.29	12288.	124.
.020	-5.35	18.03	.38	21411.	219.
.025	-4.10	17.27	.47	16397.	314.
.030	-3.85	16.63	.55	15411.	394.
.035	-1.78	16.10	.64	7110.	459.
.040	-.36	15.88	.72	1438.	487.
.045	-.52	15.80	.80	2096.	497.
.050	-.65	15.71	.87	2589.	508.
.055	-.96	15.56	.95	3822.	527.
.060	-.65	15.44	1.03	2589.	542.
.065	-.67	15.33	1.11	2671.	555.
.070	-.46	15.24	1.18	1849.	566.
.075	-.52	15.16	1.26	2096.	576.
.080	-.42	15.09	1.33	1685.	586.
.085	-.40	15.02	1.41	1603.	593.
.090	-.54	14.95	1.49	2178.	602.
.095	-.50	14.87	1.56	2014.	612.
.100	-.46	14.80	1.63	1849.	621.
.105	-.39	14.73	1.71	1562.	630.
.110	-.42	14.66	1.78	1685.	638.
.115	-.09	14.62	1.85	370.	644.
.120	-.07	14.61	1.93	288.	645.
.125	.05	14.61	2.00	-205.	645.
.130	.13	14.62	2.07	-534.	643.
.135	.11	14.64	2.15	-452.	641.
.140	.05	14.65	2.22	-205.	639.
.145	.13	14.67	2.29	-534.	637.
.150	.09	14.69	2.37	-370.	635.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.55	.0020	.0520

POST 84 - SUGAR MAPLE

TEST ID ----- P-85
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	245.	0.
.005	-2.70	19.63	.10	10794.	21.
.010	-1.66	19.17	.20	6624.	78.
.015	-1.82	18.94	.29	7278.	107.
.020	-4.42	18.42	.38	17664.	171.
.025	-4.07	17.73	.47	16273.	257.
.030	-4.52	17.03	.56	18072.	344.
.035	-2.66	16.35	.65	10631.	429.
.040	-1.02	16.11	.73	4089.	459.
.045	-.10	16.05	.81	409.	466.
.050	0.00	16.04	.89	0.	466.
.055	0.00	16.05	.97	0.	466.
.060	.04	16.05	1.05	-164.	466.
.065	.08	16.05	1.13	-327.	465.
.070	.12	16.07	1.21	-491.	463.
.075	.08	16.08	1.29	-327.	462.
.080	.04	16.08	1.37	-164.	462.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.33	0.0000	.0500

POST 85 - YELLOW BIRCH

TEST ID ----- P-86
TEST DATE --- 10-25-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-41.	0.
.005	-1.28	19.74	.10	5111.	7.
.010	-3.08	19.26	.20	12307.	67.
.015	-1.60	18.96	.29	6419.	105.
.020	-4.88	18.46	.39	19504.	166.
.025	-4.67	17.61	.48	18686.	273.
.030	-4.49	16.87	.56	17950.	364.
.035	-2.26	16.29	.64	9036.	436.
.040	-1.13	15.97	.73	4539.	475.
.045	-.05	15.91	.81	204.	483.
.050	-.01	15.91	.88	41.	483.
.055	-.01	15.92	.96	41.	482.
.060	-.03	15.92	1.04	123.	482.
.065	.05	15.93	1.12	-204.	481.
.070	-.03	15.94	1.20	123.	480.
.075	-.05	15.94	1.28	204.	480.
.080	.03	15.94	1.36	-123.	479.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.42	.0005	.0505

POST 86 - SUGAR MAPLE

TEST ID ----- P-87
TEST DATE --- 10-28-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	127.	0.
.005	-2.96	19.70	.10	11846.	12.
.010	-1.73	19.22	.20	6921.	72.
.015	-2.37	18.98	.29	9468.	101.
.020	-4.81	18.36	.39	19234.	179.
.025	-2.94	17.72	.48	11761.	258.
.030	-2.66	17.26	.56	10657.	316.
.035	-1.09	16.90	.65	4373.	360.
.040	-1.01	16.74	.73	4034.	381.
.045	-.39	16.62	.82	1571.	395.
.050	-.24	16.56	.90	977.	403.
.055	-.20	16.53	.98	807.	407.
.060	-.16	16.50	1.06	637.	410.
.065	-.05	16.49	1.15	212.	411.
.070	-.10	16.48	1.23	382.	413.
.075	-.07	16.47	1.31	297.	414.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.02	.0025	.0525

POST 87 - YELLOW BIRCH

TEST ID ----- P-88
TEST DATE --- 10-28-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.03	19.80	0.00	-127.	0.
.005	-1.36	19.74	.10	5441.	7.
.010	-3.01	19.23	.20	12020.	70.
.015	-2.20	18.90	.29	8815.	111.
.020	-4.99	18.28	.38	19950.	189.
.025	-1.95	17.62	.47	7803.	271.
.030	-2.41	17.18	.56	9659.	325.
.035	-2.33	16.79	.65	9321.	374.
.040	-1.36	16.51	.73	5441.	408.
.045	-1.80	16.25	.81	7212.	441.
.050	-1.23	16.00	.89	4935.	472.
.055	-1.00	15.82	.97	4007.	494.
.060	-.90	15.68	1.05	3585.	512.
.065	-.60	15.55	1.13	2404.	528.
.070	-.62	15.45	1.21	2488.	540.
.075	-.81	15.34	1.28	3248.	554.
.080	-.73	15.21	1.36	2910.	570.
.085	-.64	15.11	1.44	2573.	583.
.090	-.60	15.01	1.51	2404.	595.
.095	-.60	14.92	1.59	2404.	606.
.100	-.50	14.84	1.66	1982.	617.
.105	-.50	14.76	1.73	1982.	627.
.110	-.52	14.67	1.81	2067.	637.
.115	-.35	14.60	1.88	1392.	646.
.120	-.28	14.55	1.95	1139.	652.
.125	-.39	14.49	2.03	1561.	659.
.130	-.35	14.43	2.10	1392.	667.
.135	-.20	14.39	2.17	801.	672.
.140	-.18	14.36	2.24	717.	676.
.145	-.37	14.32	2.31	1476.	680.
.150	-.28	14.27	2.39	1139.	687.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.44	.0050	.0550

POST 88 - SUGAR MAPLE

TEST ID ----- P-89
TEST DATE --- 10-28-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	168.	0.
.005	-.42	19.78	.10	1685.	3.
.010	-3.56	19.46	.20	14234.	42.
.015	-1.87	19.02	.29	7496.	97.
.020	-3.94	18.61	.39	15751.	148.
.025	-5.35	17.82	.48	21394.	246.
.030	-4.97	16.98	.57	19878.	350.
.035	-3.13	16.38	.65	12508.	425.
.040	-2.01	15.97	.73	8044.	476.
.045	-3.31	15.55	.81	13224.	528.
.050	-1.05	15.23	.89	4211.	568.
.055	-.93	15.05	.96	3706.	589.
.060	-.78	14.92	1.04	3116.	606.
.065	-.44	14.82	1.11	1769.	618.
.070	-.46	14.74	1.18	1853.	628.
.075	-.29	14.70	1.26	1179.	634.
.080	-.31	14.64	1.33	1221.	641.
.085	-.29	14.59	1.40	1179.	647.
.090	-.29	14.54	1.48	1179.	654.
.095	-.38	14.48	1.55	1516.	661.
.100	-.36	14.43	1.62	1432.	667.
.105	-.15	14.39	1.69	590.	672.
.110	-.17	14.37	1.77	674.	675.
.115	-.11	14.34	1.84	421.	678.
.120	-.04	14.32	1.91	168.	680.
.125	-.16	14.31	1.98	632.	681.
.130	-.21	14.29	2.05	842.	685.
.135	-.24	14.25	2.12	969.	690.
.140	-.13	14.22	2.19	505.	694.
.145	-.13	14.19	2.27	505.	697.
.150	-.06	14.17	2.34	253.	699.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.94	.0065	.0565

POST 89 - YELLOW BIRCH

TEST ID ----- P-90
TEST DATE --- 10-28-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	250.	0.
.005	-3.46	19.55	.10	13847.	31.
.010	-1.26	19.12	.20	5047.	84.
.015	-2.50	18.90	.29	10010.	112.
.020	-5.28	18.22	.38	21104.	197.
.025	-3.44	17.50	.47	13764.	286.
.030	-3.11	17.01	.56	12429.	347.
.035	-2.46	16.53	.64	9843.	406.
.040	-.71	16.36	.72	2836.	427.
.045	-.48	16.28	.81	1919.	437.
.050	-1.88	16.09	.89	7507.	461.
.055	-1.79	15.77	.97	7174.	501.
.060	-1.11	15.54	1.05	4421.	529.
.065	-1.53	15.34	1.12	6131.	554.
.070	-1.68	15.09	1.20	6715.	585.
.075	-1.33	14.85	1.27	5339.	615.
.080	-1.02	14.66	1.35	4087.	638.
.085	-.54	14.55	1.42	2169.	652.
.090	-.40	14.48	1.49	1585.	661.
.095	-.31	14.41	1.56	1251.	669.
.100	-.29	14.36	1.64	1168.	676.
.105	-.18	14.32	1.71	709.	681.
.110	-.17	14.30	1.78	667.	683.
.115	-.31	14.26	1.85	1251.	688.
.120	-.48	14.19	1.92	1919.	696.
.125	-.29	14.13	1.99	1168.	704.
.130	-.18	14.09	2.06	709.	710.
.135	-.18	14.06	2.13	709.	713.
.140	-.01	14.04	2.20	42.	715.
.145	.02	14.04	2.27	-83.	715.
.150	.06	14.04	2.34	-250.	715.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.38	.0035	.0535

POST 90 - YELLOW BIRCH

TEST ID ----- P-91
TEST DATE --- 10-28-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.05	19.80	0.00	208.	0.
.010	-2.75	19.32	.20	10997.	60.
.020	-4.63	18.48	.39	18536.	164.
.030	-6.24	16.67	.56	24951.	388.
.040	-4.78	15.21	.72	19119.	570.
.050	-3.63	13.85	.87	14537.	739.
.060	-3.30	12.66	1.00	13204.	887.
.070	-3.59	11.61	1.12	14371.	1017.
.080	-2.43	10.73	1.23	9705.	1126.
.090	-2.05	9.92	1.34	8206.	1227.
.100	-2.11	9.24	1.43	8456.	1312.
.110	-2.24	8.52	1.52	8956.	1401.
.120	-2.01	7.86	1.60	8039.	1483.
.130	-1.84	7.23	1.68	7373.	1562.
.140	-1.83	6.59	1.75	7331.	1641.
.150	-1.80	5.99	1.81	7206.	1715.
.160	-1.78	5.38	1.87	7123.	1792.
.170	-1.83	4.80	1.92	7331.	1864.
.180	-1.72	4.25	1.96	6873.	1932.
.190	-1.53	3.72	2.00	6123.	1998.
.200	-1.34	3.26	2.04	5373.	2055.
.210	-1.07	2.85	2.07	4290.	2105.
.220	-.89	2.55	2.09	3541.	2142.
.230	-.64	2.33	2.12	2541.	2170.
.240	-.47	2.15	2.14	1874.	2192.
.250	-.41	2.00	2.16	1625.	2211.
.260	-.34	1.85	2.18	1375.	2230.
.270	-.47	1.72	2.20	1874.	2246.
.280	-.30	1.59	2.22	1208.	2262.
.290	-.30	1.49	2.23	1208.	2275.
.300	-.30	1.40	2.25	1208.	2286.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.29	.0180	.0680

POST 91 - SUGAR MAPLE

TEST ID ----- P-92
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	127.	0.
.005	-.43	19.76	.10	1737.	5.
.010	-3.23	19.25	.20	12920.	68.
.015	-2.38	18.93	.29	9531.	108.
.020	-5.28	18.25	.39	21138.	192.
.025	-4.93	17.46	.47	19740.	291.
.030	-2.33	16.85	.56	9319.	366.
.035	-3.51	16.42	.64	14021.	420.
.040	-2.25	15.91	.72	8980.	483.
.045	-1.11	15.61	.80	4448.	520.
.050	-.88	15.48	.88	3516.	537.
.055	-1.68	15.25	.96	6735.	566.
.060	-1.05	15.04	1.03	4194.	591.
.065	-.97	14.90	1.11	3897.	609.
.070	-1.14	14.72	1.18	4575.	631.
.075	-.77	14.57	1.26	3092.	650.
.080	-.79	14.46	1.33	3177.	663.
.085	-.88	14.32	1.40	3516.	680.
.090	-.86	14.18	1.47	3431.	698.
.095	-.60	14.07	1.54	2415.	712.
.100	-.73	13.96	1.61	2923.	726.
.105	-.71	13.84	1.68	2838.	740.
.110	-.69	13.73	1.75	2753.	754.
.115	-.75	13.61	1.82	3008.	768.
.120	-.80	13.48	1.89	3219.	785.
.125	-.79	13.36	1.95	3177.	800.
.130	-.69	13.25	2.02	2753.	814.
.135	-.50	13.15	2.09	1991.	826.
.140	-.46	13.07	2.15	1821.	836.
.145	-.23	13.01	2.22	932.	844.
.150	-.18	12.97	2.28	720.	848.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.82	.0060	.0560

POST 92 - SUGAR MAPLE

TEST ID ----- P-93
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.07	19.80	0.00	279.	0.
.005	-1.86	19.71	.10	7445.	11.
.010	-2.41	19.20	.20	9633.	75.
.015	-2.12	18.93	.29	8475.	108.
.020	-5.06	18.30	.38	20232.	186.
.025	-3.45	17.59	.47	13795.	274.
.030	-2.03	17.20	.56	8131.	323.
.035	-.92	17.03	.65	3669.	345.
.040	-1.50	16.85	.73	5986.	367.
.045	-1.45	16.62	.82	5814.	395.
.050	-.86	16.44	.90	3454.	417.
.055	-.95	16.29	.98	3798.	436.
.060	-1.02	16.12	1.06	4098.	457.
.065	-1.00	15.96	1.14	4012.	477.
.070	-1.09	15.79	1.22	4355.	498.
.075	-.87	15.63	1.30	3497.	518.
.080	-.83	15.49	1.38	3326.	536.
.085	-.81	15.35	1.45	3240.	553.
.090	-.66	15.23	1.53	2639.	568.
.095	-.48	15.13	1.61	1909.	580.
.100	-.23	15.09	1.68	923.	585.
.105	-.11	15.06	1.76	451.	588.
.110	.03	15.06	1.83	-107.	588.
.115	.01	15.07	1.91	-21.	587.
.120	-.04	15.07	1.98	150.	587.
.125	-.06	15.06	2.06	236.	588.
.130	-.10	15.05	2.13	408.	590.
.135	-.34	15.00	2.21	1352.	596.
.140	-.10	14.95	2.28	408.	603.
.145	.03	14.95	2.36	-107.	603.
.150	-.06	14.95	2.43	236.	602.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.14	.0040	.0540

POST 93 - SUGAR MAPLE

TEST ID ----- P-94
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.010	-4.28	19.43	.20	17138.	47.
.020	-4.63	18.52	.39	18509.	159.
.030	-7.20	16.59	.56	28791.	398.
.040	-4.97	14.21	.72	19880.	695.
.050	-4.30	13.32	.85	17180.	805.
.060	-.94	12.59	.98	3770.	896.
.070	-1.63	12.19	1.11	6512.	945.
.080	-1.12	11.77	1.23	4499.	997.
.090	-1.36	11.39	1.34	5441.	1045.
.100	-.77	11.06	1.45	3085.	1086.
.110	-1.03	10.77	1.56	4113.	1122.
.120	-.87	10.49	1.67	3470.	1157.
.130	-.60	10.23	1.77	2399.	1188.
.140	-.73	10.01	1.87	2913.	1217.
.150	-.70	9.79	1.97	2785.	1244.
.160	-.62	9.57	2.07	2485.	1271.
.170	-.44	9.40	2.17	1757.	1292.
.180	-.58	9.25	2.26	2314.	1311.
.190	-.41	9.12	2.35	1628.	1327.
.200	-.36	9.01	2.44	1457.	1341.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.37	.0070	.0570

POST 94 - SUGAR MAPLE

TEST ID ----- P-95
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-85.	0.
.005	-.93	19.77	.10	3740.	4.
.010	-3.46	19.31	.20	13854.	61.
.015	-2.02	18.96	.29	8074.	105.
.020	-5.33	18.36	.39	21334.	179.
.025	-6.01	17.45	.48	24053.	292.
.030	-4.91	16.45	.56	19634.	417.
.035	-5.46	15.53	.64	21844.	531.
.040	-2.38	14.94	.72	9519.	604.
.045	-3.14	14.48	.79	12579.	660.
.050	-2.03	14.11	.86	8117.	707.
.055	-1.84	13.84	.93	7352.	740.
.060	-1.87	13.56	1.00	7480.	775.
.065	-1.17	13.32	1.07	4675.	805.
.070	-.49	13.20	1.13	1955.	820.
.075	-.20	13.14	1.20	807.	827.
.080	-.32	13.10	1.26	1275.	833.
.085	-.25	13.05	1.33	1020.	838.
.090	-.25	13.01	1.39	1020.	843.
.095	-.38	12.96	1.46	1530.	849.
.100	-.40	12.90	1.52	1615.	857.
.105	-.33	12.85	1.59	1317.	864.
.110	-.38	12.78	1.65	1530.	872.
.115	-.37	12.72	1.72	1487.	879.
.120	-.23	12.68	1.78	935.	884.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.69	.0060	.0560

POST 95 - SUGAR MAPLE

TEST ID ----- P-96
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	106.	0.
.005	-3.01	19.67	.10	12059.	16.
.010	-1.76	19.19	.20	7057.	76.
.015	-3.23	18.87	.29	12906.	115.
.020	-5.07	18.14	.38	20282.	206.
.025	-2.20	17.45	.47	8795.	292.
.030	-2.88	16.96	.56	11508.	352.
.035	-2.37	16.49	.64	9473.	411.
.040	-2.00	16.19	.72	7990.	449.
.045	-2.68	15.86	.80	10702.	489.
.050	-1.72	15.50	.88	6888.	534.
.055	-2.54	15.17	.96	10151.	575.
.060	-2.42	14.77	1.03	9685.	625.
.065	-2.32	14.42	1.11	9261.	669.
.070	-2.25	14.04	1.18	9007.	716.
.075	-1.93	13.67	1.25	7735.	762.
.080	-2.02	13.34	1.32	8074.	802.
.085	-1.51	13.10	1.38	6040.	833.
.090	-1.64	12.83	1.45	6549.	866.
.095	-.92	12.64	1.51	3666.	889.
.100	-.81	12.51	1.57	3243.	906.
.105	-.77	12.38	1.63	3073.	922.
.110	-.64	12.26	1.70	2564.	937.
.115	-.56	12.17	1.76	2225.	948.
.120	-.58	12.07	1.82	2310.	960.
.125	-.47	11.98	1.88	1886.	971.
.130	-.41	11.91	1.94	1632.	980.
.135	-.39	11.85	2.00	1547.	988.
.140	-.49	11.78	2.06	1971.	997.
.145	-.37	11.70	2.11	1462.	1006.
.150	-.22	11.67	2.17	869.	1010.
.155	-.56	11.60	2.23	2225.	1018.
.160	-.15	11.56	2.29	615.	1024.
.165	-.22	11.54	2.35	869.	1027.
.170	-.22	11.49	2.40	869.	1032.
.175	-.13	11.46	2.46	530.	1036.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-2.80	.0045	.0545

POST 96 - SUGAR MAPLE

TEST ID ----- P-97
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	21.	0.
.005	-.68	19.77	.10	2734.	4.
.010	-2.97	19.29	.20	11889.	64.
.015	-1.34	19.03	.29	5362.	95.
.020	-4.79	18.57	.39	19180.	152.
.025	-4.05	17.81	.48	16213.	247.
.030	-4.07	17.22	.57	16297.	320.
.035	-1.29	16.81	.65	5150.	371.
.040	.06	16.73	.73	-233.	382.
.045	-.01	16.73	.82	21.	381.
.050	.19	16.74	.90	-742.	380.
.055	.10	16.76	.98	-403.	378.
.060	.19	16.78	1.07	-742.	375.
.065	.08	16.80	1.15	-318.	373.
.070	.06	16.81	1.24	-233.	372.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-1.90	0.0000	.0500

POST 97 - SUGAR MAPLE

TEST ID ----- P-98
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.15	19.80	0.00	592.	0.
.005	-1.97	19.59	.10	7866.	26.
.010	-1.42	19.38	.20	5667.	52.
.015	-2.90	18.99	.29	11588.	101.
.020	-3.19	18.49	.39	12772.	163.
.025	-2.78	18.01	.48	11123.	222.
.030	-.41	17.80	.57	1649.	248.
.035	-.21	17.77	.66	846.	253.
.040	-.15	17.74	.74	592.	256.
.045	-.41	17.69	.83	1649.	262.
.050	-.30	17.63	.92	1184.	270.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.05	.0145	.0245

POST 98 - HEMLOCK

TEST ID ----- P-99
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	168.	0.
.005	-.88	19.75	.10	3529.	6.
.010	-1.24	19.43	.20	4958.	46.
.015	-2.62	19.18	.29	10462.	77.
.020	-3.50	18.67	.39	13992.	141.
.025	-1.11	18.19	.48	4454.	200.
.030	-.02	18.14	.57	84.	206.
.035	-.04	18.15	.66	168.	205.
.040	.08	18.14	.75	-336.	206.
.045	0.00	18.15	.84	0.	205.
.050	-.15	18.15	.93	588.	205.

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.16	.0145	.0245

POST 99 - HEMLOCK

TEST ID ----- P-100
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	42.	0.
.005	-.37	19.78	.10	1461.	2.
.010	-2.37	19.52	.20	9474.	35.
.015	-1.72	19.25	.29	6887.	68.
.020	-2.63	18.84	.39	10518.	120.
.025	-1.14	18.56	.48	4549.	154.
.030	-1.45	18.35	.58	5801.	180.
.035	-.93	18.17	.67	3715.	203.
.040	-.68	18.04	.76	2713.	219.
.045	-.43	17.96	.85	1711.	229.
.050	-.29	17.90	.94	1169.	236.
.055	-.34	17.86	1.03	1377.	241.
.060	-.32	17.79	1.12	1294.	250.
.065	-.43	17.72	1.20	1711.	259.
.070	-.30	17.66	1.29	1210.	265.
.075	-.24	17.62	1.38	960.	271.
.080	-.20	17.58	1.47	793.	276.
.085	-.18	17.55	1.56	710.	280.
.090	-.20	17.52	1.64	793.	284.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.20	.0050	.0550

POST 100 - HEMLOCK

TEST ID ----- P-101
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	167.	0.
.005	-1.00	19.75	.10	3997.	6.
.010	-1.21	19.46	.20	4830.	42.
.015	-2.33	19.23	.29	9327.	71.
.020	-3.06	18.76	.39	12241.	129.
.025	-1.73	18.34	.48	6912.	182.
.030	-.19	18.24	.57	749.	194.
.035	-.06	18.24	.66	250.	194.
.040	-.08	18.24	.76	333.	194.
.045	.04	18.24	.85	-167.	194.
.050	.04	18.24	.94	-167.	193.
.055	.04	18.25	1.03	-167.	193.
.060	-.17	18.25	1.12	666.	192.
.065	-.58	18.19	1.21	2332.	200.
.070	-.42	18.11	1.30	1666.	210.
.075	-.17	18.07	1.39	666.	214.
.080	-.12	18.05	1.48	500.	217.
.085	-.02	18.05	1.57	83.	218.
.090	-.12	18.05	1.66	500.	218.
.095	-.04	18.04	1.75	167.	218.
.100	.04	18.04	1.84	-167.	219.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.97	0.0000	.0500

POST 101 - HEMLOCK

TEST ID ----- P-102
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	125.	0.
.005	-2.08	19.62	.10	8302.	23.
.010	-1.39	19.38	.20	5548.	53.
.015	-3.12	19.00	.29	12473.	99.
.020	-2.05	18.53	.39	8218.	157.
.025	-.07	18.44	.48	292.	169.
.030	-.39	18.40	.57	1544.	174.
.035	-.95	18.28	.66	3796.	188.
.040	-.39	18.16	.75	1544.	203.
.045	-.47	18.10	.84	1877.	211.
.050	-.34	18.03	.93	1377.	219.
.055	-.53	17.96	1.02	2128.	228.
.060	-.47	17.89	1.11	1877.	238.
.065	-.24	17.83	1.20	959.	244.
.070	-.30	17.79	1.29	1210.	250.
.075	-.30	17.75	1.38	1210.	255.
.080	-.16	17.71	1.47	626.	260.
.085	-.11	17.69	1.56	459.	262.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.10	.0015	.0515

POST 102 - HEMLOCK

TEST ID ------ P-103
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-2.05	19.62	.10	8185.	23.
.010	-1.36	19.41	.20	5429.	48.
.015	-1.15	19.08	.29	4593.	89.
.020	-.02	19.01	.39	84.	98.
.025	0.00	19.00	.48	0.	99.
.030	-.02	19.00	.58	84.	100.
.035	-.29	18.98	.67	1169.	101.
.040	-.71	18.88	.77	2840.	114.
.045	-.31	18.80	.86	1253.	124.
.050	-.17	18.77	.96	668.	128.
.055	-.33	18.73	1.05	1336.	133.
.060	-.52	18.66	1.14	2088.	141.
.065	-.40	18.59	1.24	1587.	150.
.070	-.33	18.53	1.33	1336.	158.
.075	-.23	18.49	1.42	919.	163.
.080	-.08	18.47	1.51	334.	166.
.085	-.08	18.46	1.61	334.	167.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.64	.0015	.0515

POST 103 - RED PINE

TEST ID ----- P-104
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.05	19.80	0.00	-208.	0.
.005	-.16	19.80	.10	625.	.
.010	-2.03	19.57	.20	8131.	28.
.015	-1.51	19.36	.29	6046.	55.
.020	-3.12	18.94	.39	12467.	107.
.025	-1.26	18.53	.48	5045.	158.
.030	.09	18.47	.58	-375.	166.
.035	.05	18.48	.67	-208.	163.
.040	.14	18.51	.76	-542.	161.
.045	.11	18.52	.85	-459.	160.
.050	.11	18.53	.95	-459.	158.
.055	-.14	18.53	1.04	542.	158.
.060	-.99	18.43	1.13	3961.	170.
.065	-.47	18.32	1.22	1876.	184.
.070	-.03	18.29	1.32	125.	188.
.075	-.03	18.28	1.41	125.	188.
.080	.18	18.27	1.50	-709.	190.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-.79	0.0000	.0500

POST 104 - RED PINE

TEST ID ----- P-105
TEST DATE --- 10-29-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-1.09	19.75	.10	4350.	7.
.010	-.73	19.45	.20	2928.	43.
.015	-2.93	19.19	.29	11711.	76.
.020	-3.37	18.67	.39	13467.	140.
.025	-.56	18.24	.48	2259.	193.
.030	.06	18.22	.57	-251.	196.
.035	.02	18.23	.66	-84.	195.
.040	.10	18.24	.75	-418.	194.
.045	.10	18.25	.84	-418.	193.
.050	.08	18.26	.94	-335.	192.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.13	.0140	.0240

POST 105 - RED PINE

TEST ID ----- P-106
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	260.	0.
.005	-.76	19.78	.10	3031.	2.
.010	-1.82	19.48	.20	7274.	40.
.015	-2.75	19.21	.29	10998.	73.
.020	-3.51	18.69	.39	14029.	137.
.025	-4.07	18.04	.48	16280.	218.
.030	.11	17.84	.57	-433.	243.
.035	-.02	17.85	.66	87.	242.
.040	-.04	17.85	.75	173.	242.
.045	-.02	17.85	.84	87.	243.
.050	.06	17.86	.93	-260.	242.
.055	0.00	17.86	1.02	0.	241.
.060	-.09	17.85	1.11	346.	242.
.065	0.00	17.84	1.20	0.	243.
.070	.02	17.85	1.28	-87.	242.
.075	0.00	17.85	1.37	0.	242.
.080	.06	17.84	1.46	-260.	244.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.21	0.0000	.0500

POST 106 - RED PINE

TEST ID ----- P-107
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	87.	0.
.005	-2.41	19.68	.10	9623.	14.
.010	-1.15	19.42	.20	4595.	48.
.015	-3.08	19.03	.29	12311.	95.
.020	-1.71	18.55	.39	6849.	155.
.025	-.02	18.45	.48	87.	168.
.030	.11	18.45	.57	-433.	168.
.035	.09	18.46	.66	-347.	166.
.040	.09	18.47	.76	-347.	165.
.045	.07	18.48	.85	-260.	165.
.050	0.00	18.49	.94	0.	163.
.055	.09	18.50	1.03	-347.	161.
.060	-.02	18.51	1.13	87.	161.
.065	.07	18.50	1.22	-260.	161.
.070	0.00	18.51	1.31	0.	160.
.075	-.07	18.52	1.40	260.	159.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.81	0.0000	.0500

POST 107 - RED PINE

TEST ID ----- P-108
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.05	19.80	0.00	216.	0.
.005	-2.78	19.69	.10	11102.	13.
.010	-.95	19.38	.20	3801.	53.
.015	-.51	19.19	.29	2030.	75.
.020	-.16	19.15	.39	648.	81.
.025	-.27	19.12	.48	1080.	84.
.030	-.79	19.04	.58	3153.	94.
.035	-.85	18.90	.67	3413.	112.
.040	-.51	18.79	.77	2030.	125.
.045	-.23	18.73	.86	907.	132.
.050	-.23	18.69	.96	907.	138.
.055	-.16	18.65	1.05	648.	142.
.060	-.08	18.63	1.14	302.	145.
.065	-.10	18.61	1.24	389.	147.
.070	-.16	18.59	1.33	648.	150.
.075	-.05	18.58	1.42	216.	151.
.080	-.05	18.57	1.51	216.	152.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.69	.0025	.0525

POST 108 - RED PINE

TEST ID ----- P-109
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-87.	0.
.005	-3.12	19.65	.10	12478.	19.
.010	-1.26	19.37	.20	5026.	54.
.015	-3.47	18.96	.29	13864.	104.
.020	-3.29	18.40	.39	13171.	174.
.025	-.15	18.20	.48	607.	199.
.030	.04	18.22	.57	-173.	196.
.035	.06	18.22	.66	-260.	197.
.040	.15	18.23	.75	-607.	195.
.045	0.00	18.24	.84	0.	194.
.050	.06	18.24	.93	-260.	194.
.055	.06	18.25	1.02	-260.	192.
.060	.01	18.25	1.12	-43.	192.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.97	0.0000	.0500

POST 109 - RED PINE

TEST ID ----- P-110
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	238.	0.
.005	-.58	19.78	.10	2317.	2.
.010	-1.75	19.47	.20	6996.	42.
.015	-2.29	19.25	.29	9162.	68.
.020	-2.96	18.79	.39	11847.	125.
.025	-1.16	18.35	.48	4657.	180.
.030	-.10	18.33	.57	412.	183.
.035	-.19	18.33	.67	758.	182.
.040	.07	18.34	.76	-282.	181.
.045	.01	18.35	.85	-22.	180.
.050	-.04	18.36	.94	152.	179.
.055	-.04	18.35	1.03	152.	181.
.060	-.21	18.32	1.12	845.	184.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.89	0.0000	.0500

POST 110 - RED PINE

TEST ID ----- P-111
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC
0.000	.01	19.80	0.00	-43.	0.
.005	-1.69	19.58	.10	6759.	27.
.010	-1.80	19.37	.20	7189.	54.
.015	-2.94	18.91	.29	11753.	110.
.020	-.12	18.52	.39	474.	158.
.025	.20	18.52	.48	-818.	159.
.030	.05	18.54	.57	-215.	157.
.035	-.40	18.51	.66	1593.	160.
.040	-.25	18.46	.76	990.	167.
.045	-.18	18.42	.85	732.	172.
.050	-.18	18.39	.94	732.	176.
.055	-.10	18.36	1.03	387.	179.
.060	-.12	18.33	1.12	474.	182.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.88	.0010	.0510

POST 111 - RED PINE

TEST ID ----- P-112
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	129.	0.
.005	-2.31	19.67	.10	9255.	16.
.010	-.81	19.46	.20	3256.	43.
.015	-2.74	19.14	.29	10969.	82.
.020	-.63	18.80	.39	2528.	125.
.025	-.02	18.75	.48	86.	131.
.030	0.00	18.74	.58	0.	132.
.035	-.19	18.72	.67	771.	134.
.040	-.39	18.69	.76	1543.	138.
.045	-.45	18.61	.86	1800.	148.
.050	-.26	18.55	.95	1028.	155.
.055	-.17	18.52	1.04	686.	159.
.060	-.17	18.48	1.13	686.	163.
.065	-.24	18.45	1.23	943.	168.
.070	-.15	18.42	1.32	600.	172.
.075	-.09	18.40	1.41	343.	174.
.080	-.17	18.38	1.50	686.	177.
.085	-.04	18.36	1.59	171.	179.
.090	0.00	18.35	1.69	0.	180.
.095	-.03	18.35	1.78	129.	180.
.100	-.09	18.34	1.87	343.	181.
.105	-.06	18.34	1.96	257.	182.
.110	-.06	18.33	2.05	257.	182.
.115	-.06	18.32	2.14	257.	184.
.120	-.04	18.31	2.24	171.	185.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.78	.0025	.0525

POST 112 - RED PINE

TEST ID ----- P-113
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	257.	0.
.005	-1.91	19.53	.10	7625.	34.
.010	-1.78	19.36	.20	7111.	55.
.015	-2.98	18.91	.29	11908.	111.
.020	-4.12	18.32	.38	16492.	183.
.025	-2.83	17.82	.47	11309.	247.
.030	-.61	17.59	.56	2442.	274.
.035	-.06	17.54	.65	257.	281.
.040	-.13	17.52	.74	514.	283.
.045	.11	17.52	.83	-428.	283.
.050	-.15	17.52	.91	600.	283.
.055	.09	17.51	1.00	-343.	284.
.060	.04	17.51	1.09	-171.	284.
.065	-.04	17.51	1.18	171.	284.
.070	0.00	17.50	1.26	0.	286.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.42	.0005	.0505

POST 113 - RED PINE

TEST ID ----- P-115
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	128.	0.
.005	-2.11	19.58	.10	8451.	27.
.010	-1.60	19.35	.20	6402.	56.
.015	-2.93	18.94	.29	11738.	107.
.020	-.17	18.76	.39	683.	129.
.025	0.00	18.76	.48	0.	129.
.030	-.14	18.76	.57	555.	130.
.035	-.90	18.69	.67	3585.	138.
.040	-.36	18.58	.76	1451.	152.
.045	-.18	18.54	.85	726.	157.
.050	-.36	18.49	.95	1451.	163.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.06	.0065	.0165

POST 115 - WHITE PINE

TEST ID ----- P-116
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.46	19.80	0.00	1828.	0.
.005	-1.89	19.55	.10	7544.	31.
.010	-1.85	19.33	.20	7418.	59.
.015	-1.63	18.95	.29	6536.	105.
.020	-.08	18.86	.39	315.	116.
.025	-.06	18.86	.48	231.	117.
.030	-.04	18.84	.57	147.	119.
.035	-.16	18.83	.67	651.	121.
.040	-.48	18.77	.76	1912.	128.
.045	-.20	18.72	.86	820.	135.
.050	-.12	18.70	.95	483.	137.
.055	-.10	18.68	1.04	399.	139.
.060	-.14	18.66	1.14	567.	141.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.69	0.0000	.0500

POST 116 - WHITE PINE

TEST ID ----- P-119
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	149.	0.
.005	-2.23	19.59	.10	8916.	26.
.010	-1.23	19.40	.20	4915.	50.
.015	-2.82	19.01	.29	11299.	98.
.020	-.40	18.72	.39	1596.	135.
.025	.05	18.68	.48	-192.	139.
.030	-.29	18.66	.57	1170.	142.
.035	-.61	18.59	.67	2447.	151.
.040	-.42	18.50	.76	1681.	161.
.045	-.27	18.44	.85	1085.	169.
.050	-.36	18.40	.94	1426.	174.
.055	-.25	18.35	1.04	1000.	180.
.060	-.14	18.33	1.13	575.	183.
.065	-.10	18.31	1.22	404.	185.
.070	.05	18.31	1.31	-192.	186.
.075	.05	18.32	1.40	-192.	184.
.080	.05	18.33	1.49	-192.	183.
.085	.09	18.34	1.58	-362.	181.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.88	.0015	.0515

POST 119 - WHITE PINE

TEST ID ----- P-120
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	43.	0.
.005	-2.16	19.56	.10	8629.	30.
.010	-1.42	19.37	.20	5696.	54.
.015	-2.79	18.96	.29	11179.	105.
.020	-1.68	18.53	.39	6716.	158.
.025	-.14	18.43	.48	553.	170.
.030	-.06	18.41	.57	255.	172.
.035	-.27	18.39	.66	1063.	176.
.040	-.57	18.31	.75	2295.	185.
.045	-.44	18.23	.84	1743.	195.
.050	-.33	18.17	.94	1318.	203.
.055	-.29	18.12	1.03	1148.	209.
.060	-.22	18.08	1.12	893.	214.
.065	-.23	18.04	1.21	935.	219.
.070	-.18	18.01	1.30	723.	223.
.075	-.16	17.98	1.39	638.	226.
.080	-.10	17.96	1.48	383.	229.
.085	-.01	17.95	1.57	43.	230.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.02	.0010	.0510

POST 120 - WHITE PINE

TEST ID ----- P-121
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	42.	0.
.005	-1.79	19.56	.10	7143.	29.
.010	-1.51	19.39	.20	6044.	51.
.015	-2.72	19.00	.29	10862.	99.
.020	-3.34	18.51	.39	13356.	161.
.025	-1.02	18.15	.48	4100.	205.
.030	-.10	18.09	.57	380.	213.
.035	.03	18.10	.66	-127.	212.
.040	.07	18.09	.75	-296.	212.
.045	.10	18.10	.84	-380.	211.
.050	.16	18.11	.93	-634.	210.
.055	.01	18.11	1.02	-42.	210.
.060	.01	18.10	1.11	-42.	211.
.065	.10	18.11	1.20	-380.	210.
.070	-.01	18.11	1.29	42.	210.
.075	.05	18.11	1.38	-211.	210.
.080	.03	18.12	1.47	-127.	209.
.085	.04	18.12	1.56	-169.	208.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-1.05	0.0000	.0500

POST 121 - JACK PINE

TEST ID ----- P-122
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.21	19.80	0.00	847.	0.
.005	-1.61	19.54	.10	6437.	33.
.010	-2.34	19.31	.20	9359.	61.
.015	-2.92	18.86	.29	11688.	116.
.020	-2.29	18.39	.38	9147.	175.
.025	-.85	18.14	.48	3388.	206.
.030	-1.59	17.96	.57	6352.	229.
.035	-1.12	17.75	.65	4489.	255.
.040	-1.14	17.54	.74	4574.	280.
.045	-1.27	17.36	.83	5082.	303.
.050	-1.16	17.16	.92	4658.	328.
.055	-1.06	16.98	1.00	4235.	350.
.060	-.83	16.84	1.09	3303.	367.
.065	-.66	16.73	1.17	2626.	382.
.070	-.61	16.62	1.25	2456.	394.
.075	-.61	16.53	1.34	2456.	406.
.080	-.57	16.43	1.42	2287.	418.
.085	-.51	16.35	1.50	2033.	429.
.090	-.44	16.27	1.58	1779.	438.
.095	-.32	16.20	1.66	1270.	447.
.100	-.23	16.15	1.74	932.	453.
.105	-.23	16.11	1.83	932.	458.
.110	-.23	16.08	1.91	932.	463.
.115	-.17	16.05	1.99	678.	466.
.120	-.32	16.01	2.07	1270.	471.
.125	-.34	15.96	2.15	1355.	478.
.130	-.13	15.92	2.23	508.	482.
.135	-.06	15.91	2.31	254.	484.
.140	-.17	15.89	2.38	678.	486.
.145	-.13	15.86	2.46	508.	489.
.150	-.08	15.85	2.54	339.	491.
.155	-.08	15.83	2.62	339.	493.
.160	-.08	15.81	2.70	339.	496.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.66	.0020	.0520

POST 122 - JACK PINE

TEST ID ----- P-123
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	127.	0.
.005	-2.10	19.61	.10	8383.	23.
.010	-1.62	19.39	.20	6478.	51.
.015	-3.16	18.96	.29	12659.	104.
.020	-4.12	18.39	.39	16470.	175.
.025	-3.33	17.74	.48	13337.	256.
.030	-1.56	17.21	.56	6224.	322.
.035	-.37	17.11	.65	1482.	334.
.040	-.22	17.08	.73	889.	338.
.045	-.73	16.99	.82	2921.	350.
.050	-.41	16.89	.90	1651.	362.
.055	-.35	16.83	.99	1397.	369.
.060	-.56	16.76	1.07	2244.	378.
.065	-.46	16.67	1.16	1821.	389.
.070	-.37	16.61	1.24	1482.	397.
.075	-.32	16.56	1.32	1270.	403.
.080	-.48	16.49	1.40	1905.	412.
.085	-.37	16.42	1.49	1482.	420.
.090	-.22	16.38	1.57	889.	425.
.095	-.24	16.34	1.65	974.	430.
.100	-.15	16.30	1.73	593.	435.
.105	-.16	16.28	1.81	635.	437.
.110	-.18	16.26	1.90	720.	440.
.115	-.20	16.22	1.98	804.	444.
.120	-.05	16.21	2.06	212.	446.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.82	.0015	.0515

POST 123 - JACK PINE

TEST ID ----- P-124
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.09	19.80	0.00	379.	0.
.005	-1.53	19.71	.10	6105.	12.
.010	-1.13	19.42	.20	4505.	47.
.015	-1.88	19.22	.29	7536.	72.
.020	-2.98	18.80	.39	11915.	124.
.025	-2.56	18.36	.48	10231.	179.
.030	-2.47	17.92	.57	9894.	234.
.035	-.12	17.77	.66	463.	252.
.040	-.07	17.76	.75	295.	253.
.045	-.01	17.76	.84	42.	254.
.050	.18	17.77	.93	-716.	252.
.055	-.01	17.78	1.02	42.	251.
.060	.01	17.77	1.11	-42.	252.
.065	.01	17.77	1.19	-42.	252.
.070	-.03	17.78	1.28	126.	251.
.075	-.49	17.74	1.37	1979.	256.
.080	-.37	17.66	1.46	1474.	266.
.085	-.07	17.63	1.55	295.	270.
.090	-.12	17.62	1.64	463.	271.
.095	-.05	17.61	1.72	211.	272.
.100	.03	17.61	1.81	-126.	272.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-1.26	0.0000	.0500

POST 124 - JACK PINE

TEST ID ----- P-125
TEST DATE --- 10-30-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	0.00	19.80	0.00	0.	0.
.005	-2.00	19.54	.10	8006.	32.
.010	-2.11	19.29	.20	8432.	63.
.015	-3.09	18.82	.29	12350.	121.
.020	-.68	18.53	.38	2726.	158.
.025	-.43	18.47	.48	1704.	166.
.030	-1.09	18.33	.57	4344.	182.
.035	-.52	18.22	.66	2087.	197.
.040	-.72	18.12	.75	2896.	209.
.045	-.70	18.00	.84	2811.	224.
.050	-.45	17.90	.93	1789.	236.
.055	-.55	17.82	1.02	2215.	246.
.060	-.55	17.73	1.11	2215.	257.
.065	-.40	17.66	1.20	1618.	266.
.070	-.36	17.60	1.29	1448.	273.
.075	-.36	17.54	1.37	1448.	281.
.080	-.19	17.50	1.46	767.	286.
.085	-.11	17.47	1.55	426.	289.
.090	-.11	17.45	1.64	426.	292.
.095	-.04	17.43	1.72	170.	295.
.100	.02	17.42	1.81	-85.	296.
.105	-.06	17.41	1.90	256.	297.
.110	-.02	17.41	1.98	85.	297.
.115	.02	17.41	2.07	-85.	297.
.120	0.00	17.41	2.16	0.	297.
.125	-.09	17.41	2.25	341.	297.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.18	.0010	.0510

POST 125 - JACK PINE

TEST ID ----- P-126
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.06	19.80	0.00	-221.	0.
.005	-2.22	19.59	.10	8890.	27.
.010	-2.01	19.36	.20	8050.	55.
.015	-3.05	18.89	.29	12207.	113.
.020	-1.64	18.34	.38	6546.	182.
.025	-.03	18.31	.48	133.	185.
.030	-.07	18.31	.57	265.	185.
.035	-.02	18.31	.66	88.	185.
.040	-.02	18.31	.75	88.	186.
.045	-.06	18.29	.84	221.	187.
.050	-.03	18.29	.93	133.	188.
.055	.03	18.29	1.03	-133.	188.
.060	-.04	18.28	1.12	177.	189.
.065	-.03	18.26	1.21	133.	191.
.070	-.01	18.26	1.30	44.	192.
.075	.01	18.26	1.39	-44.	191.
.080	-.03	18.25	1.48	133.	193.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.94	.0010	.0510

POST 126 - JACK PINE

TEST ID ----- P-127
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.07	19.80	0.00	263.	0.
.005	-1.84	19.53	.10	7372.	34.
.010	-2.73	19.31	.20	10927.	61.
.015	-3.23	18.80	.29	12901.	124.
.020	-4.91	18.19	.38	19659.	200.
.025	-.09	17.85	.47	351.	242.
.030	-.27	17.85	.56	1097.	243.
.035	.15	17.85	.65	-614.	242.
.040	-.08	17.85	.74	307.	242.
.045	-.24	17.82	.83	965.	246.
.050	.02	17.79	.92	-88.	249.
.055	.01	17.79	1.01	-44.	250.
.060	.02	17.79	1.10	-88.	249.
.065	.11	17.80	1.19	-439.	248.
.070	.05	17.81	1.28	-219.	247.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.25	0.0000	.0500

POST 127 - JACK PINE

TEST ID ----- P-128
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	66.	0.
.005	-2.96	19.49	.10	11834.	38.
.010	-1.32	19.27	.20	5272.	66.
.015	-3.32	18.84	.29	13278.	119.
.020	-3.52	18.29	.38	14066.	187.
.025	-1.38	17.85	.47	5534.	242.
.030	-.54	17.73	.56	2166.	257.
.035	-.42	17.66	.65	1684.	265.
.040	-.27	17.61	.74	1072.	272.
.045	.01	17.60	.83	-22.	273.
.050	-.18	17.57	.92	722.	277.
.055	-.08	17.55	1.00	328.	279.
.060	-.11	17.53	1.09	459.	282.
.065	-.19	17.50	1.18	766.	285.
.070	-.16	17.47	1.27	634.	290.
.075	-.07	17.45	1.35	284.	291.
.080	-.04	17.44	1.44	153.	293.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.38	.0005	.0505

POST 128 - JACK PINE

TEST ID ----- P-129
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	108.	0.
.005	-2.96	19.63	.10	11844.	21.
.010	-1.15	19.40	.20	4595.	50.
.015	-2.56	19.03	.29	10248.	95.
.020	-.42	18.77	.39	1661.	128.
.025	.06	18.76	.48	-237.	129.
.030	-.12	18.76	.57	496.	129.
.035	-.58	18.72	.67	2308.	135.
.040	-.29	18.64	.76	1143.	144.
.045	-.11	18.61	.85	453.	148.
.050	-.12	18.59	.95	496.	151.
.055	-.15	18.56	1.04	582.	154.
.060	-.08	18.54	1.13	324.	156.
.065	-.08	18.52	1.23	324.	159.
.070	-.06	18.51	1.32	237.	161.
.075	-.02	18.50	1.41	65.	161.
.080	-.06	18.50	1.50	237.	162.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.76	.0020	.0520

POST 129 - JACK PINE

TEST ID ----- P-130
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-22.	0.
.005	-2.07	19.53	.10	8274.	33.
.010	-1.76	19.33	.20	7021.	58.
.015	-2.96	18.89	.29	11860.	113.
.020	-4.10	18.32	.38	16396.	184.
.025	-4.14	17.62	.47	16569.	271.
.030	-1.98	17.04	.56	7928.	343.
.035	-1.57	16.79	.65	6286.	374.
.040	-.77	16.64	.73	3089.	392.
.045	-.29	16.59	.81	1145.	399.
.050	-.17	16.55	.89	670.	403.
.055	-.34	16.50	.98	1361.	410.
.060	-.34	16.42	1.06	1361.	419.
.065	-.20	16.37	1.14	799.	426.
.070	-.08	16.34	1.22	324.	429.
.075	-.22	16.31	1.31	886.	433.
.080	-.29	16.26	1.39	1145.	439.
.085	-.37	16.22	1.47	1491.	445.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.02	.0010	.0510

POST 130 - JACK PINE

TEST ID ----- P-131
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.42	19.80	0.00	1698.	0.
.005	-1.46	19.55	.10	5826.	31.
.010	-1.95	19.36	.20	7804.	55.
.015	-2.66	18.94	.29	10642.	106.
.020	-3.48	18.43	.39	13910.	170.
.025	-1.24	18.05	.48	4966.	217.
.030	-.71	18.00	.57	2859.	224.
.035	-1.57	17.77	.66	6299.	252.
.040	-.81	17.60	.74	3246.	273.
.045	-.89	17.46	.83	3547.	290.
.050	-1.06	17.31	.92	4235.	309.
.055	-.92	17.14	1.00	3676.	330.
.060	-.97	16.99	1.09	3891.	349.
.065	-.82	16.84	1.17	3289.	367.
.070	-.65	16.72	1.26	2601.	383.
.075	-.60	16.62	1.34	2386.	395.
.080	-.59	16.52	1.42	2343.	407.
.085	-.54	16.43	1.51	2171.	419.
.090	-.37	16.36	1.59	1483.	428.
.095	-.34	16.31	1.67	1354.	434.
.100	-.32	16.26	1.75	1268.	440.
.105	-.20	16.22	1.83	795.	445.
.110	-.20	16.19	1.91	795.	448.
.115	-.08	16.17	2.00	322.	451.
.120	-.08	16.16	2.08	322.	453.
.125	-.04	16.15	2.16	150.	454.
.130	-.15	16.13	2.24	580.	456.
.135	-.07	16.11	2.32	279.	459.
.140	-.06	16.10	2.40	236.	460.
.145	-.11	16.08	2.48	451.	462.
.150	-.12	16.07	2.56	494.	464.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.56	.0020	.0520

POST 131 - JACK PINE

TEST ID ----- P-132
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.19	19.80	0.00	752.	0.
.005	-2.39	19.53	.10	9565.	33.
.010	-1.61	19.30	.20	6427.	62.
.015	-3.21	18.83	.29	12832.	121.
.020	-4.42	18.21	.38	17690.	198.
.025	-3.10	17.58	.47	12402.	276.
.030	-1.96	17.28	.56	7845.	314.
.035	-1.38	17.03	.65	5524.	344.
.040	-.87	16.83	.73	3461.	368.
.045	-1.12	16.68	.81	4492.	387.
.050	-1.18	16.50	.90	4707.	410.
.055	-.93	16.32	.98	3719.	433.
.060	-.95	16.17	1.06	3805.	451.
.065	-.84	16.03	1.14	3375.	469.
.070	-.75	15.89	1.22	2988.	485.
.075	-.49	15.80	1.30	1956.	497.
.080	-.52	15.71	1.38	2085.	508.
.085	-.61	15.62	1.46	2429.	519.
.090	-.57	15.54	1.54	2300.	530.
.095	-.40	15.46	1.61	1612.	539.
.100	-.40	15.40	1.69	1612.	546.
.105	-.41	15.34	1.77	1655.	555.
.110	-.40	15.27	1.84	1612.	563.
.115	-.32	15.21	1.92	1268.	570.
.120	-.23	15.16	2.00	924.	576.
.125	-.15	15.12	2.07	580.	581.
.130	-.08	15.10	2.15	322.	584.
.135	-.40	15.07	2.22	1612.	588.
.140	-.25	15.03	2.30	1010.	593.
.145	-.15	15.00	2.37	580.	596.
.150	-.19	14.98	2.45	752.	599.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-2.07	.0025	.0525

POST 132 - JACK PINE

TEST ID ----- P-133*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-84.	0.
.005	-1.77	19.73	.10	7090.	9.
.010	-1.24	19.41	.20	4980.	49.
.015	-1.81	19.15	.29	7259.	81.
.020	-.23	19.02	.39	928.	97.
.025	-.01	19.00	.48	42.	100.
.030	-.17	18.97	.58	675.	103.
.035	-.79	18.91	.67	3165.	111.
.040	-.74	18.76	.77	2954.	129.
.045	-.33	18.68	.86	1308.	139.
.050	-.18	18.65	.95	717.	143.
.055	-.23	18.62	1.05	928.	147.
.060	-.18	18.59	1.14	717.	151.
.065	-.06	18.57	1.23	253.	153.
.070	-.13	18.56	1.33	506.	154.
.075	-.08	18.55	1.42	338.	156.
.080	.02	18.54	1.51	-84.	156.
.085	.02	18.55	1.60	-84.	155.
.090	.02	18.55	1.70	-84.	155.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.72	.0030	.0530

POST 133 - RED PINE

TEST ID ----- P-134*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.06	19.80	0.00	253.	0.
.005	-2.52	19.55	.10	10094.	32.
.010	-1.40	19.23	.20	5587.	70.
.015	-3.65	18.80	.29	14601.	124.
.020	-2.29	18.29	.38	9174.	188.
.025	-.16	18.14	.47	621.	206.
.030	-.39	18.09	.56	1541.	212.
.035	-.64	18.03	.66	2552.	219.
.040	-.71	17.90	.75	2828.	235.
.045	-.74	17.79	.83	2966.	250.
.050	-.56	17.69	.92	2230.	262.
.055	-.67	17.58	1.01	2690.	275.
.060	-.74	17.47	1.10	2966.	290.
.065	-.56	17.37	1.19	2230.	302.
.070	-.43	17.29	1.27	1725.	312.
.075	-.29	17.24	1.36	1173.	318.
.080	-.16	17.21	1.44	621.	322.
.085	-.11	17.19	1.53	437.	324.
.090	-.16	17.16	1.62	621.	328.
.095	-.06	17.14	1.70	253.	331.
.100	-.09	17.13	1.79	345.	332.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.32	.0010	.0510

POST 134 - RED PINE

TEST ID ----- P-135*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.12	19.80	0.00	481.	0.
.005	-2.63	19.65	.10	10519.	19.
.010	-1.16	19.35	.20	4622.	55.
.015	-3.05	19.04	.29	12192.	94.
.020	-2.71	18.53	.39	10853.	158.
.025	-.25	18.36	.48	983.	178.
.030	-.20	18.34	.57	816.	181.
.035	-.12	18.32	.66	481.	184.
.040	.01	18.31	.75	-21.	185.
.045	.03	18.31	.84	-105.	186.
.050	-.12	18.31	.94	481.	186.
.055	-.04	18.30	1.03	146.	187.
.060	-.25	18.29	1.12	983.	188.
.065	-.26	18.24	1.21	1025.	193.
.070	-.15	18.20	1.30	606.	198.
.075	-.06	18.19	1.39	230.	200.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.93	.0010	.0510

POST 135 - RED PINE

TEST ID ----- P-136*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-2.45	19.56	.10	9795.	29.
.010	-1.00	19.34	.20	4018.	58.
.015	-3.06	19.01	.29	12222.	98.
.020	-.08	18.73	.39	335.	133.
.025	.13	18.72	.48	-502.	134.
.030	-.87	18.66	.57	3474.	142.
.035	-.61	18.50	.67	2428.	161.
.040	-.33	18.44	.76	1339.	169.
.045	-.42	18.38	.85	1674.	176.
.050	-.54	18.31	.94	2177.	186.
.055	-.42	18.23	1.03	1674.	195.
.060	-.50	18.15	1.12	2009.	205.
.065	-.50	18.08	1.21	2009.	214.
.070	-.42	18.01	1.31	1674.	223.
.075	-.38	17.95	1.39	1507.	230.
.080	-.28	17.89	1.48	1130.	237.
.085	-.21	17.86	1.57	837.	241.
.090	-.21	17.84	1.66	837.	244.
.095	-.15	17.81	1.75	586.	247.
.100	0.00	17.80	1.84	0.	248.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.93	.0025	.0525

POST 136 - RED PINE

TEST ID ----- P-137*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	42.	0.
.005	-2.01	19.58	.10	8025.	27.
.010	-1.13	19.36	.20	4532.	55.
.015	-.78	19.14	.29	3119.	82.
.020	-.20	19.09	.39	790.	89.
.025	.01	19.08	.48	-42.	89.
.030	.01	19.09	.58	-42.	88.
.035	.03	19.09	.67	-125.	88.
.040	.03	19.10	.77	-125.	87.
.045	-.11	19.09	.86	457.	88.
.050	-.07	19.08	.96	291.	90.
.055	.01	19.08	1.06	-42.	90.
.060	.03	19.08	1.15	-125.	89.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.45	.0005	.0505

POST 137 - RED PINE

TEST ID ----- P-138*
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0..00	126.	0.
.005	-2.04	19.60	.10	8172.	25.
.010	-.67	19.38	.20	2682.	52.
.015	-1.20	19.23	.29	4819.	70.
.020	-.34	19.10	.39	1341.	86.
.025	-.25	19.05	.48	1006.	93.
.030	-.31	19.01	.58	1257.	98.
.035	-.29	18.96	.67	1173.	105.
.040	-.17	18.92	.77	671.	109.
.045	-.03	18.91	.86	126.	111.
.050	-.03	18.90	.96	126.	112.
.055	-.20	18.88	1.05	796.	114.
.060	-.13	18.86	1.15	503.	117.
.065	-.13	18.84	1.24	503.	120.
.070	-.10	18.82	1.33	419.	122.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.56	.0005	.0505

POST 138 - RED PINE

TEST ID ----- P-139
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	84.	0.
.005	-1.93	19.74	.10	7702.	7.
.010	-.82	19.45	.20	3265.	44.
.015	-1.84	19.22	.29	7367.	72.
.020	-.21	19.09	.39	837.	88.
.025	0.00	19.07	.48	0.	90.
.030	.04	19.07	.58	-167.	90.
.035	-.10	19.08	.68	419.	90.
.040	-.27	19.05	.77	1088.	93.
.045	-.19	19.01	.87	753.	98.
.050	.19	19.00	.96	-753.	99.

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.63	.0050	.0150

POST 139 - RED PINE

TEST ID ----- P-140
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.01	19.80	0.00	-42.	0.
.005	-1.91	19.64	.10	7642.	20.
.010	-1.18	19.44	.20	4719.	45.
.015	-2.10	19.09	.29	8394.	88.
.020	.01	19.02	.39	-42.	97.
.025	.26	19.03	.48	-1044.	96.
.030	.01	19.04	.58	-42.	95.
.035	-.16	19.03	.67	626.	95.
.040	-.60	18.97	.77	2380.	103.
.045	-.24	18.90	.86	961.	112.
.050	-.16	18.87	.96	626.	115.
.055	-.07	18.86	1.05	292.	117.
.060	.01	18.85	1.15	-42.	118.
.065	-.02	18.85	1.24	84.	118.
.070	.01	18.84	1.33	-42.	120.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.58	.0010	.0510

POST 140 - WHITE PINE

TEST ID ----- P-141
TEST DATE --- 10-31-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.02	19.80	0.00	-86.	0.
.005	-2.78	19.66	.10	11126.	18.
.010	-1.22	19.35	.20	4878.	56.
.015	-3.10	19.00	.29	12410.	99.
.020	-3.79	18.48	.39	15148.	164.
.025	-3.27	17.83	.48	13094.	244.
.030	-.32	17.60	.57	1284.	273.
.035	0.00	17.57	.65	0.	276.
.040	-.10	17.56	.74	385.	279.
.045	-.03	17.54	.83	128.	281.
.050	-.49	17.49	.92	1968.	287.
.055	-.41	17.40	1.00	1626.	298.
.060	-.12	17.36	1.09	471.	303.
.065	-.19	17.34	1.18	770.	306.
.070	-.15	17.32	1.26	599.	309.
.075	-.30	17.28	1.35	1198.	313.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-1.46	.0025	.0525

POST 141 - HEMLOCK

TEST ID ----- P-142*
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.09	19.80	0.00	358.	0.
.005	-4.61	19.63	.10	18454.	21.
.010	-1.28	19.27	.20	5106.	66.
.015	-3.43	18.80	.29	13706.	124.
.020	-.72	18.34	.38	2867.	182.
.025	-.12	18.30	.48	493.	186.
.030	-.87	18.24	.57	3494.	194.
.035	-1.05	18.04	.66	4210.	219.
.040	-.65	17.92	.75	2598.	233.
.045	-.72	17.81	.84	2867.	247.
.050	-.58	17.71	.93	2329.	259.
.055	-.45	17.63	1.01	1792.	270.
.060	-.45	17.57	1.10	1792.	278.
.065	-.43	17.51	1.19	1702.	285.
.070	-.45	17.43	1.28	1792.	294.
.075	-.25	17.37	1.36	985.	302.
.080	-.04	17.35	1.45	179.	304.
.085	-.18	17.33	1.54	717.	306.
.090	-.09	17.32	1.62	358.	308.
.095	.02	17.31	1.71	-90.	309.
.100	-.04	17.31	1.80	179.	309.
.105	-.09	17.31	1.88	358.	310.
.110	-.04	17.29	1.97	179.	312.
.115	-.09	17.28	2.06	358.	313.
.120	-.10	17.26	2.14	403.	315.
.125	-.07	17.25	2.23	269.	317.
.130	0.00	17.24	2.32	0.	318.
.135	-.04	17.23	2.40	179.	319.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.31	.0020	.0520

POST 142 - WHITE PINE

TEST ID ----- P-143
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	134.	0.
.005	-1.64	19.55	.10	6557.	31.
.010	-2.27	19.36	.20	9099.	54.
.015	-2.82	18.92	.29	11285.	110.
.020	-.04	18.48	.38	178.	164.
.025	.13	18.46	.48	-535.	167.
.030	.03	18.46	.57	-134.	166.
.035	-.19	18.45	.66	758.	168.
.040	-.31	18.41	.75	1249.	172.
.045	-.22	18.37	.85	892.	178.
.050	-.26	18.32	.94	1026.	183.
.055	-.21	18.28	1.03	847.	189.
.060	-.14	18.26	1.12	580.	192.
.065	-.14	18.25	1.21	580.	193.
.070	-.03	18.24	1.30	134.	194.
.075	.06	18.24	1.39	-223.	194.
.080	-.01	18.24	1.49	45.	194.
.085	-.03	18.23	1.58	134.	195.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.92	.0010	.0510

POST 143 - HEMLOCK

TEST ID ----- P-146
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.07	19.80	0.00	268.	0.
.005	-1.59	19.51	.10	6349.	37.
.010	-2.68	19.29	.20	10731.	64.
.015	-3.17	18.80	.29	12699.	124.
.020	-.42	18.55	.38	1699.	155.
.025	-.11	18.54	.48	447.	157.
.030	-.18	18.52	.57	715.	159.
.035	-.25	18.48	.66	984.	164.
.040	-.16	18.45	.75	626.	168.
.045	-.16	18.42	.85	626.	171.
.050	-.16	18.40	.94	626.	174.
.055	-.07	18.38	1.03	268.	177.
.060	-.19	18.36	1.12	760.	179.
.065	-.18	18.33	1.21	715.	183.
.070	-.09	18.30	1.31	358.	186.
.075	-.16	18.29	1.40	626.	187.
.080	-.09	18.28	1.49	358.	189.
.085	0.00	18.27	1.58	0.	190.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.97	.0005	.0505

POST 146 - HEMLOCK

TEST ID ----- P-148
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	180.	0.
.005	-2.91	19.61	.10	11633.	24.
.010	-1.55	19.37	.20	6198.	54.
.015	-3.03	18.93	.29	12127.	108.
.020	-.18	18.54	.39	719.	156.
.025	.27	18.54	.48	-1078.	157.
.030	.09	18.55	.57	-359.	156.
.035	-.04	18.54	.66	180.	156.
.040	-.20	18.51	.76	808.	160.
.045	-.18	18.47	.85	719.	165.
.050	-.18	18.45	.94	719.	168.
.055	-.09	18.43	1.03	359.	170.
.060	-.20	18.42	1.13	808.	172.
.065	-.17	18.40	1.22	674.	174.
.070	-.04	18.38	1.31	180.	176.
.075	-.04	18.38	1.40	180.	176.
.080	-.09	18.37	1.49	359.	178.
.085	-.09	18.35	1.58	359.	180.
.090	-.04	18.35	1.68	180.	181.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.84	.0015	.0515

POST 148 - WHITE PINE

TEST ID ----- P-149
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	67.	0.
.005	-2.58	19.61	.10	10316.	24.
.010	-1.87	19.37	.20	7464.	53.
.015	-1.81	18.96	.29	7241.	104.
.020	-.28	18.86	.39	1136.	116.
.025	-.03	18.83	.48	111.	120.
.030	-.38	18.78	.57	1537.	127.
.035	-.33	18.71	.67	1315.	135.
.040	-.26	18.67	.76	1047.	141.
.045	-.17	18.64	.86	691.	144.
.050	-.15	18.62	.95	602.	146.
.055	-.21	18.59	1.04	824.	150.
.060	-.19	18.56	1.13	780.	154.
.065	-.18	18.53	1.23	735.	158.
.070	-.19	18.49	1.32	780.	162.
.075	-.08	18.47	1.41	334.	166.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.74	.0015	.0515

POST 149 - WHITE PINE

TEST ID ----- P-150
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.74	19.80	0.00	2964.	0.
.005	-1.37	19.53	.10	5467.	34.
.010	-2.30	19.31	.20	9200.	61.
.015	-.06	19.17	.29	242.	79.
.020	.04	19.17	.39	-154.	78.
.025	-.30	19.15	.48	1208.	80.
.030	-.54	19.07	.58	2174.	91.
.035	-.30	19.00	.67	1208.	100.
.040	-.28	18.96	.77	1120.	105.
.045	-.37	18.91	.86	1471.	110.
.050	-.19	18.88	.96	769.	115.
.055	-.19	18.85	1.05	769.	118.
.060	-.19	18.82	1.15	769.	122.
.065	-.06	18.79	1.24	242.	125.
.070	-.06	18.78	1.33	242.	126.
.075	-.13	18.76	1.43	505.	129.
.080	-.13	18.74	1.52	505.	132.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.58	0.0000	.0500

POST 150 - WHITE PINE

TEST ID ----- P-152
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	177.	0.
.005	-1.82	19.53	.10	7275.	33.
.010	-2.00	19.32	.20	7985.	60.
.015	-.22	19.13	.29	887.	83.
.020	-.07	19.13	.39	266.	83.
.025	-.35	19.11	.48	1420.	86.
.030	-.33	19.05	.58	1331.	94.
.035	-.20	19.00	.67	798.	99.
.040	-.16	18.98	.77	621.	102.
.045	-.11	18.95	.86	444.	105.
.050	-.02	18.95	.96	89.	106.
.055	-.16	18.93	1.05	621.	108.
.060	-.18	18.91	1.15	710.	110.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.53	0.0000	.0500

POST 152 - WHITE PINE

TEST ID ------ P-153
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	88.	0.
.005	-2.67	19.63	.10	10696.	21.
.010	-1.44	19.41	.20	5746.	48.
.015	-2.77	19.01	.29	11093.	98.
.020	-.20	18.62	.39	796.	147.
.025	.08	18.60	.48	-309.	149.
.030	.06	18.59	.57	-221.	150.
.035	.08	18.59	.67	-309.	150.
.040	.06	18.60	.76	-221.	149.
.045	-.08	18.60	.85	309.	149.
.050	-.01	18.60	.94	44.	149.
.055	-.02	18.60	1.04	88.	149.
.060	-.06	18.59	1.13	221.	150.
.065	-.01	18.59	1.22	44.	150.
.070	-.03	18.59	1.32	133.	150.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-.74	0.0000	.0500

POST 153 - WHITE PINE

TEST ID ----- P-155
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	.04	19.80	0.00	-177.	0.
.005	-3.15	19.64	.10	12596.	20.
.010	-1.21	19.41	.20	4834.	49.
.015	-2.86	19.04	.29	11442.	94.
.020	-1.30	18.60	.39	5189.	149.
.025	-.02	18.55	.48	89.	156.
.030	-.58	18.52	.57	2306.	160.
.035	-.75	18.39	.66	3016.	175.
.040	-.49	18.30	.76	1951.	186.
.045	-.53	18.22	.85	2129.	196.
.050	-.44	18.13	.94	1774.	207.
.055	-.38	18.07	1.03	1508.	215.
.060	-.38	18.01	1.12	1508.	223.
.065	-.13	17.96	1.21	532.	229.
.070	-.04	17.94	1.30	177.	231.
.075	-.13	17.93	1.39	532.	233.
.080	-.13	17.90	1.48	532.	236.
.085	-.11	17.89	1.57	444.	237.
.090	-.11	17.88	1.66	444.	238.
.095	-.09	17.87	1.75	355.	239.
.100	-.02	17.86	1.84	89.	241.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.05	.0020	.0520

POST 155 - WHITE PINE

TEST ID ----- P-157
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.01	19.80	0.00	22.	0.
.005	-3.95	19.50	.10	15783.	37.
.010	-4.88	18.72	.19	19513.	134.
.015	-1.64	18.23	.29	6549.	195.
.020	-.88	18.08	.38	3530.	213.
.025	-.62	17.87	.47	2464.	240.
.030	-.11	17.83	.56	422.	245.
.035	-.17	17.80	.65	688.	248.
.040	-.33	17.75	.73	1310.	254.
.045	-.17	17.72	.82	688.	258.
.050	-.17	17.69	.91	688.	263.
.055	-.11	17.67	1.00	422.	265.
.060	-.13	17.65	1.09	511.	268.
.065	-.15	17.63	1.18	599.	270.
.070	-.11	17.62	1.26	422.	271.
.075	-.11	17.61	1.35	422.	272.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.31	.0010	.0510

POST 157 - WHITE PINE

TEST ID ----- P-159
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	88.	0.
.005	-3.31	19.64	.10	13245.	20.
.010	-1.38	19.37	.20	5500.	53.
.015	-.43	19.14	.29	1716.	82.
.020	-.19	19.09	.39	748.	88.
.025	-.14	19.06	.48	572.	92.
.030	-.20	19.03	.58	792.	95.
.035	-.43	18.98	.67	1716.	101.
.040	-.47	18.91	.77	1892.	110.
.045	-.34	18.85	.86	1364.	118.
.050	-.25	18.80	.96	1012.	124.
.055	-.25	18.76	1.05	1012.	129.
.060	-.12	18.73	1.14	484.	133.
.065	-.12	18.71	1.24	484.	135.
.070	-.19	18.69	1.33	748.	138.
.075	-.17	18.66	1.43	660.	142.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.[illegible]3	.0020	.0520

POST 159 - HEMLOCK

TEST ID ----- P-160
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.02	19.80	0.00	88.	0.
.005	-1.75	19.55	.10	7012.	31.
.010	-1.84	19.37	.20	7363.	54.
.015	-2.89	18.94	.29	11570.	107.
.020	-2.31	18.41	.39	9248.	172.
.025	-1.58	18.22	.48	6311.	197.
.030	-1.29	17.99	.57	5172.	225.
.035	-1.16	17.79	.66	4646.	249.
.040	-.88	17.65	.75	3506.	267.
.045	-.68	17.54	.83	2717.	281.
.050	-.61	17.43	.92	2454.	294.
.055	-.37	17.35	1.01	1490.	304.
.060	-.53	17.27	1.09	2104.	314.
.065	-.38	17.19	1.18	1534.	324.
.070	-.35	17.13	1.27	1402.	332.
.075	-.37	17.07	1.35	1490.	339.
.080	-.26	17.03	1.44	1052.	344.
.085	-.26	16.99	1.52	1052.	349.
.090	-.13	16.95	1.61	526.	353.
.095	-.03	16.95	1.69	131.	354.
.100	.04	16.95	1.78	-175.	354.
.105	-.02	16.95	1.86	88.	354.
.110	-.24	16.94	1.95	964.	355.
.115	-.07	16.93	2.03	263.	357.
.120	-.07	16.91	2.11	263.	359.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-1.48	.0015	.0515

POST 160 - HEMLOCK

TEST ID ----- P-161
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.03	19.80	0.00	131.	0.
.005	-2.31	19.60	.10	9237.	24.
.010	-1.67	19.41	.20	6698.	49.
.015	-2.62	18.98	.29	10463.	101.
.020	-2.02	18.53	.39	8099.	158.
.025	-1.46	18.31	.48	5822.	185.
.030	-.27	18.14	.57	1094.	207.
.035	-.12	18.12	.66	482.	209.
.040	-.16	18.09	.75	657.	212.
.045	-.34	18.05	.84	1357.	218.
.050	-.40	17.99	.93	1620.	225.
.055	-.27	17.95	1.02	1094.	230.
.060	-.16	17.91	1.11	657.	234.
.065	-.30	17.88	1.20	1182.	239.
.070	-.19	17.86	1.29	744.	242.
.075	-.13	17.83	1.38	525.	245.

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-1.13	.0020	.0520

POST 161 - HEMLOCK

TEST ID ----- P-162
TEST DATE --- 11-01-85

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
0.000	-.04	19.80	0.00	175.	0.
.005	-2.38	19.62	.10	9524.	22.
.010	-1.42	19.40	.20	5679.	49.
.015	-2.73	19.00	.29	10922.	100.
.020	-1.64	18.58	.39	6553.	152.
.025	-.02	18.44	.48	87.	169.
.030	.07	18.43	.57	-262.	171.
.035	-.22	18.42	.66	874.	172.
.040	-.33	18.36	.75	1311.	179.
.045	-.26	18.31	.85	1048.	184.
.050	-.17	18.29	.94	699.	188.
.055	-.17	18.26	1.03	699.	191.
.060	-.12	18.24	1.12	481.	194.
.065	-.02	18.23	1.21	87.	196.
.070	-.11	18.21	1.30	437.	197.
.075	-.02	18.20	1.39	87.	199.

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-.94	.0010	.0510

POST 162 - HEMLOCK

TEST ID ----- MP-O-01
TEST DATE --- 12-10-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.27	20.00	.00	1084.	.0
.002	-.95	19.97	.04	3818.	3.4
.004	-1.15	19.90	.08	4619.	12.2
.006	-1.50	19.81	.12	5986.	24.0
.008	-1.64	19.70	.16	6551.	37.0
.010	-1.96	19.59	.20	7824.	51.2
.012	-2.40	19.45	.24	9615.	68.7
.014	-3.34	19.27	.28	13361.	91.2
.016	-4.31	19.02	.31	17250.	122.3
.018	-3.79	18.75	.35	15176.	155.4
.020	-4.70	18.49	.39	18805.	188.0
.022	-.90	18.27	.43	3582.	215.0
.024	-1.04	18.20	.46	4147.	223.2
.026	-.91	18.17	.50	3629.	227.6
.028	-.22	18.14	.54	895.	231.3

TEST ID ----- MP-O-01
TEST DATE --- 12-10-86

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.70	.0115	.0215

POST O-01 - JACK PINE

TEST ID ----- MP-0-02
TEST DATE --- 12-10-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.19	20.00	.00	761.	.0
.002	-.57	19.98	.04	2265.	2.3
.004	-.75	19.93	.08	3017.	8.6
.006	-1.46	19.86	.12	5837.	17.9
.008	-2.32	19.74	.16	9268.	32.4
.010	-2.79	19.57	.20	11147.	53.4
.012	-2.93	19.39	.24	11711.	75.5
.014	-3.40	19.19	.28	13591.	100.6
.016	-4.34	18.94	.31	17351.	131.4
.018	-4.90	18.64	.35	19607.	169.0
.020	-5.47	18.31	.39	21862.	209.8
.022	-6.93	17.91	.43	27737.	259.7
.024	-.66	17.62	.46	2641.	295.1
.026	-1.13	17.58	.50	4521.	300.2
.028	-.61	17.57	.53	2453.	301.6

TEST ID ----- MP-0-02
TEST DATE --- 12-10-86

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.96	.0135	.0235

POST 0-02 - JACK PINE

TEST ID ----- MP-O-03
TEST DATE --- 12-10-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	.12	20.00	.00	-478.	.0
.002	.01	20.01	.04	-56.	-.7
.004	-.21	20.00	.08	835.	-.4
.006	-.54	19.97	.12	2147.	4.0
.008	-1.10	19.91	.16	4398.	10.9
.010	-1.39	19.84	.20	5546.	20.5
.012	-1.72	19.74	.24	6882.	32.2
.014	-2.23	19.62	.28	8922.	47.8
.016	-2.85	19.45	.32	11383.	68.3
.018	-3.27	19.25	.36	13071.	93.3
.020	-1.96	19.06	.39	7820.	116.6
.022	-.97	18.99	.43	3882.	125.5
.024	-.22	18.96	.47	881.	129.5
.026	-.10	18.94	.51	413.	132.2
.028	-.28	18.92	.55	1116.	133.8

TEST ID ----- MP-O-03
TEST DATE --- 12-10-86

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-2.43	.0110	.0210

POST O-03 - JACK PINE

TEST ID ----- MP-0-08
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.05	20.00	.00	188.	.0
.002	-.28	19.99	.04	1131.	1.4
.004	-.50	19.97	.08	2002.	3.8
.006	-.78	19.93	.12	3109.	8.8
.008	-2.78	19.83	.16	11117.	21.4
.010	-2.27	19.62	.20	9092.	47.0
.012	-1.51	19.54	.24	6030.	57.6
.014	-2.69	19.42	.28	10740.	72.3
.016	-3.92	19.18	.32	15686.	102.5
.018	-3.19	18.94	.35	12742.	131.5
.020	-4.44	18.70	.39	17759.	161.4
.022	-5.28	18.38	.43	21104.	201.5
.024	-5.24	18.03	.47	20962.	244.6
.026	-5.43	17.69	.50	21716.	287.1
.028	-5.51	17.34	.54	22046.	330.6
.030	-5.68	16.98	.57	22705.	375.1
.032	-6.55	16.59	.60	26215.	423.7
.034	-7.16	16.14	.64	28641.	478.9
.036	-5.55	15.79	.67	22187.	522.9
.038	-5.10	15.44	.70	20397.	566.1
.040	-2.18	15.14	.73	8715.	603.1
.042	-2.71	14.94	.76	10858.	628.8
.044	-.85	14.87	.79	3392.	636.7
.046	-.49	14.85	.82	1978.	639.9
.048	-.25	14.82	.85	989.	643.3

TEST ID ----- MP-0-08
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-5.94	.0275	.0375

POST 0-08 - JACK PINE

TEST ID ----- MP-R-16
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.11	20.00	.00	439.	.0
.002	-.36	19.99	.04	1434.	1.7
.004	-.56	19.96	.08	2240.	5.4
.006	-.86	19.91	.12	3426.	10.9
.008	-2.07	19.83	.16	8286.	21.1
.010	-3.62	19.60	.20	14474.	49.5
.012	-1.16	19.46	.24	4659.	66.7
.014	-3.01	19.34	.28	12056.	82.5
.016	-4.10	19.09	.32	16418.	113.0
.018	-3.74	18.84	.35	14948.	144.5
.020	-4.56	18.57	.39	18220.	177.1
.022	-5.43	18.24	.43	21729.	218.4
.024	-5.38	17.89	.46	21539.	262.5
.026	-5.52	17.54	.50	22061.	305.3
.028	-2.86	17.28	.53	11439.	337.5
.030	-4.86	17.03	.57	19453.	368.7
.032	-1.84	16.80	.60	7362.	397.6
.034	-1.06	16.71	.64	4256.	408.2
.036	-.79	16.66	.67	3141.	415.5
.038	-.83	16.61	.70	3331.	421.7

TEST ID ----- MP-R-16
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-4.91	.0173	.0273

POST R-16 - RED PINE

TEST ID ----- MP-W-26
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.18	20.00	.00	734.	.0
.005	-.49	19.96	.10	1973.	4.6
.010	-2.52	19.65	.20	10100.	43.0
.015	-3.57	19.35	.30	14294.	80.8
.020	-3.81	18.76	.39	15247.	154.2
.025	-4.96	17.98	.48	19823.	250.8
.030	-5.69	17.13	.57	22778.	356.0
.035	-7.04	16.10	.66	28164.	483.9
.040	-6.52	14.96	.73	26066.	625.6
.045	-4.12	14.31	.81	16486.	706.5
.050	-1.71	13.78	.88	6859.	772.6
.055	-3.26	13.32	.94	13031.	830.0
.060	-2.19	12.85	1.01	8741.	888.3
.065	-2.33	12.52	1.07	9337.	929.6
.070	-1.80	12.16	1.13	7192.	973.3
.075	-1.73	11.87	1.19	6906.	1010.4
.080	-1.31	11.69	1.25	5238.	1032.5
.085	-1.24	11.50	1.31	4952.	1055.6
.090	-1.12	11.34	1.37	4475.	1075.8
.095	-1.08	11.17	1.42	4333.	1097.2

TEST ID ----- MP-W-26
TEST DATE --- 12-12-86

HIGHEST 50.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-4.27	.0133	.0633

POST W-26 - RED MAPLE

TEST ID ----- MP-B-30
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.16	20.00	.00	638.	.0
.002	-.30	19.99	.04	1219.	1.7
.004	-.41	19.96	.08	1654.	4.8
.006	-1.56	19.91	.12	6249.	11.2
.008	-3.36	19.71	.16	13455.	36.3
.010	-.63	19.60	.20	2525.	49.7
.012	-1.44	19.53	.24	5765.	58.4
.014	-3.99	19.35	.28	15970.	81.0
.016	-3.25	19.10	.32	13020.	111.7
.018	-3.77	18.91	.35	15099.	135.8
.020	-5.03	18.62	.39	20129.	172.0
.022	-5.18	18.28	.43	20710.	213.3
.024	-5.38	17.95	.46	21532.	254.6
.026	-5.50	17.59	.50	22016.	298.9
.028	-5.12	17.25	.53	20468.	341.2
.030	-4.29	16.93	.57	17179.	381.8
.032	-4.71	16.68	.60	18848.	412.7
.034	-4.60	16.61	.64	18388.	421.6
.036	-1.18	16.51	.67	4701.	433.6
.038	-.09	16.40	.70	348.	447.2

TEST ID ----- MP-B-30
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-5.26	.0198	.0298

POST B-30 - WHITE ASH

TEST ID ----- MP-B-31
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.20	20.00	.00	815.	.0
.002	-.59	19.98	.04	2366.	2.7
.004	-.66	19.93	.08	2657.	8.4
.006	-.83	19.88	.12	3336.	14.4
.008	-1.25	19.82	.16	4984.	22.6
.010	-1.71	19.73	.20	6827.	34.1
.012	-2.57	19.59	.24	10269.	50.9
.014	-2.89	19.41	.28	11578.	73.4
.016	-2.82	19.23	.32	11287.	95.8
.018	-3.46	19.03	.35	13857.	121.0
.020	-4.05	18.78	.39	16184.	151.2
.022	-4.22	18.52	.43	16863.	184.4
.024	-4.60	18.23	.47	18390.	219.7
.026	-4.74	17.94	.50	18948.	256.3
.028	-4.64	17.63	.54	18560.	294.9
.030	-4.96	17.32	.57	19821.	333.4
.032	-5.04	17.00	.61	20160.	373.0
.034	-4.29	16.68	.64	17154.	413.0
.036	-3.77	16.46	.67	15093.	440.3
.038	-5.02	16.14	.71	20063.	479.0
.040	-3.95	15.88	.74	15796.	512.3
.042	-4.32	15.60	.77	17299.	546.4
.044	-4.32	15.32	.80	17299.	581.6
.046	-.24	15.15	.83	960.	603.0
.048	-.60	15.11	.86	2415.	607.7

TEST ID ----- MP-B-31
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	END
-4.84	.0240	.0340

POST B-31 - WHITE ASH

TEST ID ----- MP-B-32
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.31	20.00	.00	1258.	.0
.005	-.82	19.92	.10	3272.	10.4
.010	-2.88	19.68	.20	11518.	40.2
.015	-2.88	19.24	.30	11518.	94.0
.020	-4.28	18.63	.39	17127.	169.8
.025	-5.19	17.85	.48	20771.	266.5
.030	-4.23	17.01	.57	16912.	371.5
.035	-4.35	16.44	.65	17415.	442.0
.040	-2.74	15.82	.73	10943.	518.9
.045	-1.01	15.43	.81	4039.	567.3
.050	-1.75	15.22	.89	7012.	593.9
.055	-1.45	14.97	.96	5813.	624.9
.060	-1.27	14.76	1.04	5094.	651.4
.065	-1.13	14.58	1.11	4519.	672.8
.070	-1.01	14.41	1.18	4039.	694.6
.075	-1.02	14.24	1.26	4063.	715.9
.080	-1.03	14.06	1.33	4135.	737.6
.085	-1.19	13.87	1.40	4758.	761.3
.090	-1.14	13.68	1.47	4567.	784.7
.095	-1.06	13.51	1.53	4231.	806.8

TEST ID ----- MP-B-32
TEST DATE --- 12-12-86

HIGHEST 50.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.09	.0075	.0575

POST B-32 - WHITE ASH

TEST ID ----- MP-B-33
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	.07	20.00	.00	-260.	.0
.002	-.09	20.00	.04	366.	.0
.004	-.24	19.99	.08	944.	1.2
.006	-1.05	19.96	.12	4219.	5.5
.008	-3.41	19.78	.16	13657.	27.3
.010	-.57	19.67	.20	2292.	41.6
.012	-1.56	19.60	.24	6241.	50.0
.014	-3.49	19.42	.28	13946.	71.5
.016	-3.08	19.20	.32	12309.	99.0
.018	-3.37	19.00	.35	13465.	123.7
.020	-4.50	18.75	.39	17991.	155.7
.022	-4.37	18.46	.43	17462.	191.5
.024	-4.20	18.18	.47	16787.	226.0
.026	-2.10	18.01	.50	8408.	246.8
.028	-3.90	17.81	.54	15608.	272.4
.030	-2.13	17.61	.57	8505.	297.1
.032	-.75	17.52	.61	3015.	307.7
.034	-.84	17.47	.64	3352.	314.6
.036	-1.14	17.40	.68	4556.	322.8
.038	-1.04	17.33	.71	4170.	331.2
.040	-.84	17.27	.75	3352.	338.6
.042	-.69	17.22	.78	2774.	344.8
.044	-.77	17.18	.82	3063.	350.7
.046	-.72	17.13	.85	2894.	356.8
.048	-.72	17.08	.89	2894.	362.4

TEST ID ----- MP-B-33
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.90	.0150	.0250

POST B-33 - WHITE ASH

TEST ID ----- MP-B-34
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.14	20.00	.00	572.	.0
.002	-.33	19.98	.04	1315.	1.9
.004	-.41	19.96	.08	1650.	5.1
.006	-.76	19.92	.12	3039.	9.7
.008	-1.88	19.85	.16	7517.	19.2
.010	-3.46	19.65	.20	13840.	43.9
.012	-1.21	19.50	.24	4835.	61.5
.014	-2.20	19.40	.28	8810.	74.5
.016	-3.69	19.20	.32	14750.	99.2
.018	-3.75	18.95	.35	14989.	129.8
.020	-3.89	18.71	.39	15564.	159.7
.022	-4.73	18.44	.43	18917.	194.4
.024	-1.11	18.24	.47	4452.	218.4
.026	-1.59	18.16	.50	6368.	228.6
.028	-1.65	18.04	.54	6607.	243.6

TEST ID ----- MP-B-34
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

	TIME (SEC)	
G'S	START	END
-3.63	.0138	.0238

POST B-34 - WHITE ASH

TEST ID ----- MP-B-35
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.11	20.00	.00	435.	.0
.002	-.31	19.99	.04	1223.	1.6
.004	-.45	19.96	.08	1796.	4.7
.006	-.72	19.93	.12	2894.	9.3
.008	-1.64	19.86	.16	6571.	17.9
.010	-3.58	19.67	.20	14307.	40.8
.012	-1.30	19.51	.24	5186.	60.7
.014	-1.76	19.42	.28	7025.	72.2
.016	-3.47	19.26	.32	13877.	91.9
.018	-3.90	19.02	.35	15597.	122.0
.020	-3.64	18.79	.39	14546.	150.9
.022	-4.72	18.52	.43	18892.	184.2
.024	-2.02	18.32	.47	8099.	208.8
.026	-3.52	18.13	.50	14068.	231.7
.028	-2.67	17.92	.54	10678.	258.1
.030	-3.03	17.77	.57	12111.	277.6
.032	-2.25	17.58	.61	9006.	300.7
.034	-1.59	17.49	.64	6380.	311.7
.036	-1.80	17.38	.68	7192.	325.0
.038	-1.37	17.27	.71	5497.	338.7

TEST ID ----- MP-B-35
TEST DATE --- 12-12-86

HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-3.50	.0170	.0270

POST B-35 - WHITE ASH

TEST ID ----- MP-B-36
TEST DATE --- 12-12-86

PENDULUM KINETICS SUMMARY
NOTE: VALUES ARE INSTANEOUS AT TIME

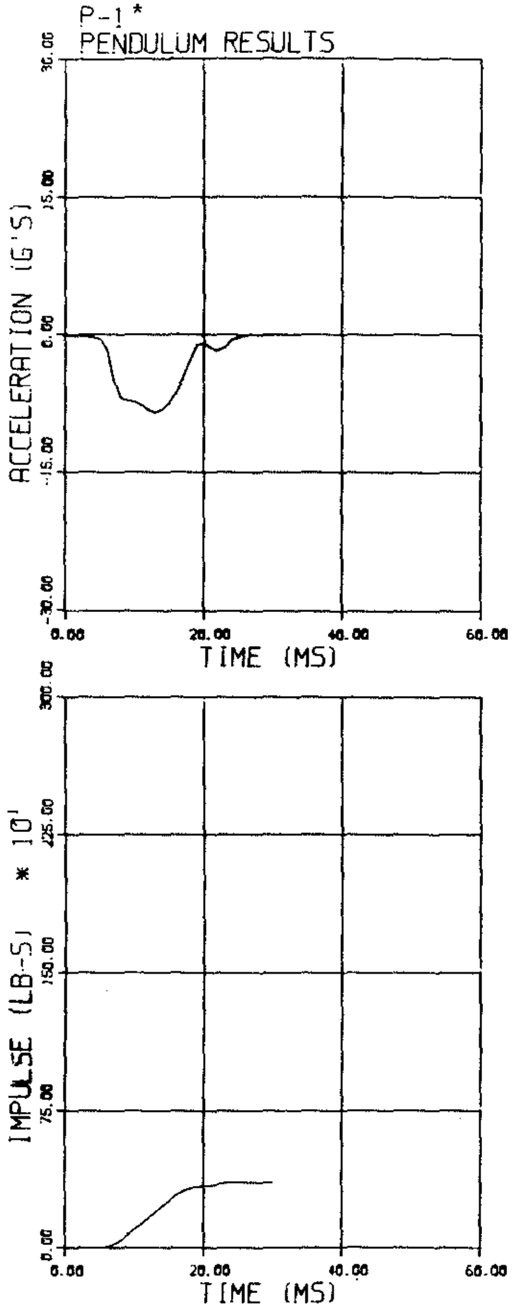
TIME (S)	ACCEL (G'S)	VEL (FPS)	DISP (F)	FORCE (LBS)	IMPULSE (LB-SEC)
.000	-.28	20.00	.00	1129.	.0
.002	-.39	19.98	.04	1558.	2.8
.004	-.52	19.95	.08	2082.	6.1
.006	-.81	19.91	.12	3226.	11.2
.008	-1.76	19.83	.16	7039.	21.1
.010	-3.46	19.64	.20	13853.	45.0
.012	-1.45	19.49	.24	5800.	63.0
.014	-2.36	19.37	.28	9421.	78.2
.016	-3.95	19.16	.32	15807.	104.4
.018	-3.77	18.91	.35	15092.	136.0
.020	-3.88	18.67	.39	15521.	165.5
.022	-5.08	18.38	.43	20334.	201.9
.024	-5.17	18.04	.46	20668.	243.6
.026	-5.23	17.72	.50	20906.	283.8
.028	-5.48	17.37	.54	21907.	327.2
.030	-5.70	17.01	.57	22812.	371.8
.032	-6.00	16.62	.60	24003.	419.4
.034	-5.66	16.24	.64	22621.	467.3
.036	-1.60	16.13	.67	6419.	480.4
.038	-1.93	15.99	.70	7706.	497.7

TEST ID ----- MP-B-36
TEST DATE --- 12-12-86

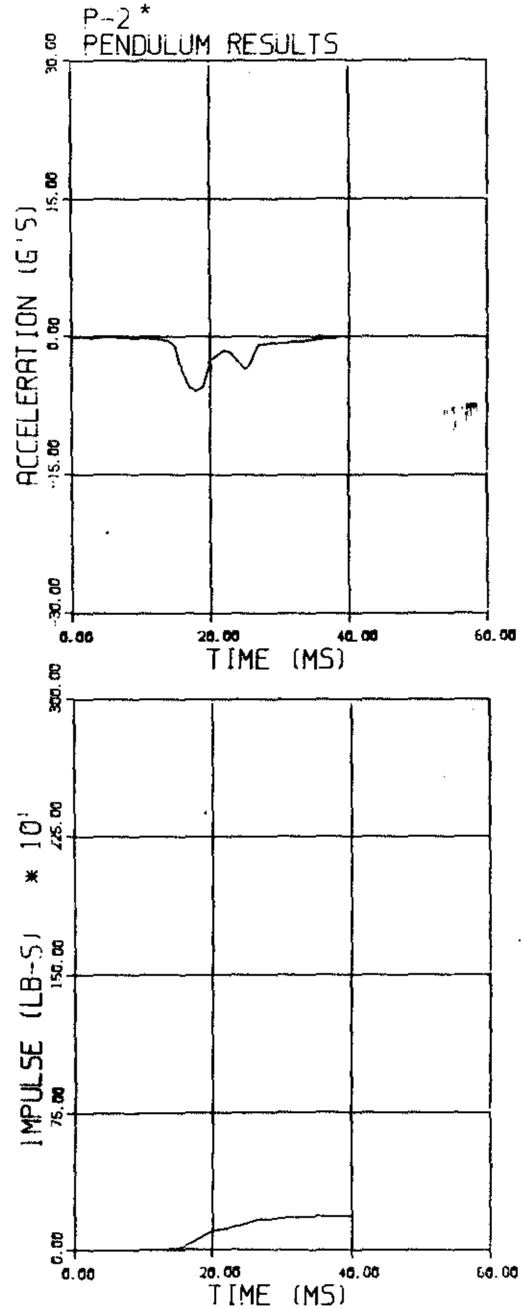
HIGHEST 10.0-MS AVG. ACCEL.

G'S	TIME (SEC) START	TIME (SEC) END
-5.60	.0243	.0343

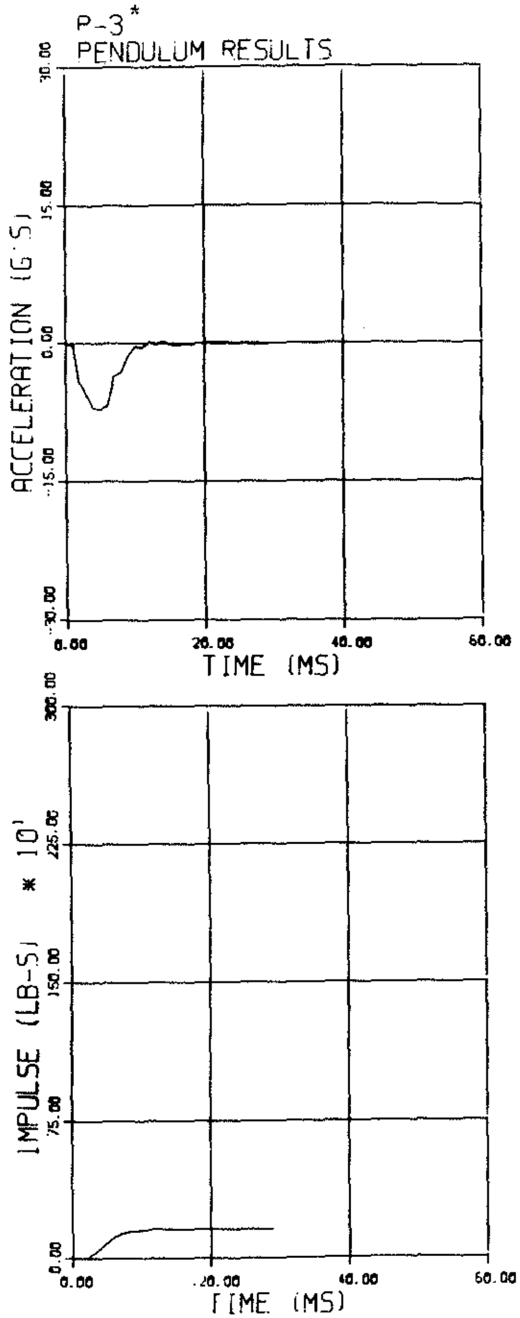
POST B-36 - WHITE ASH



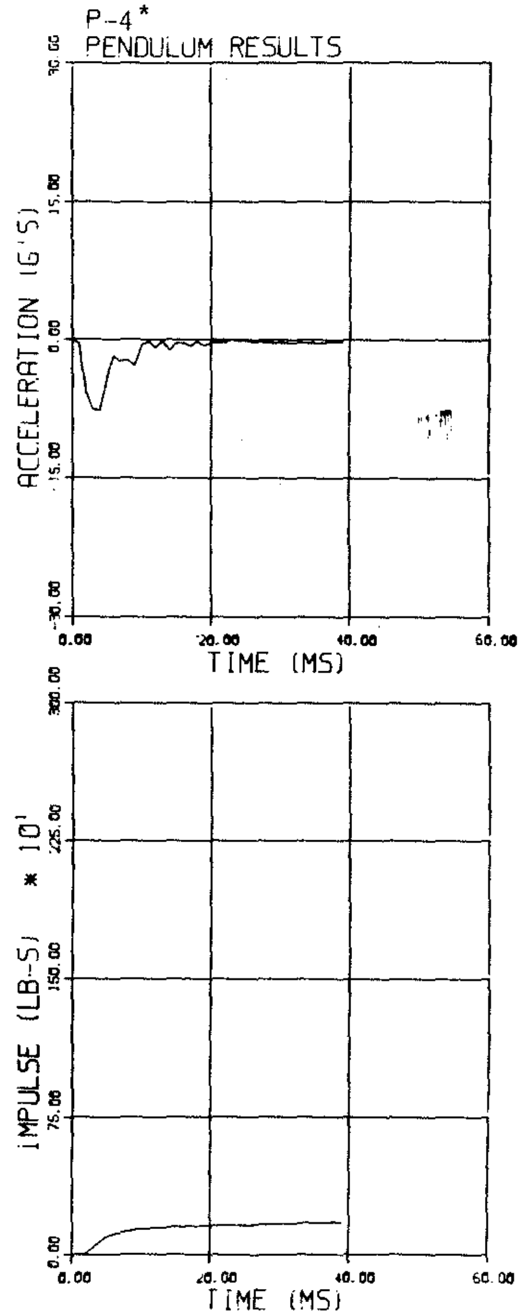
Post 1* - White Pine



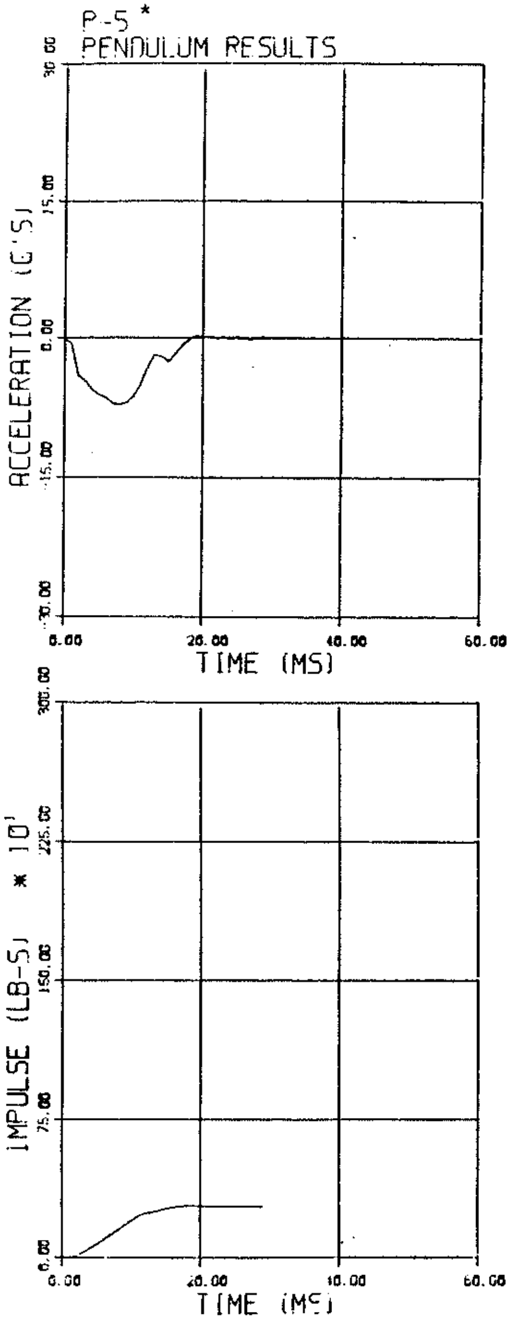
Post 2* - White Pine



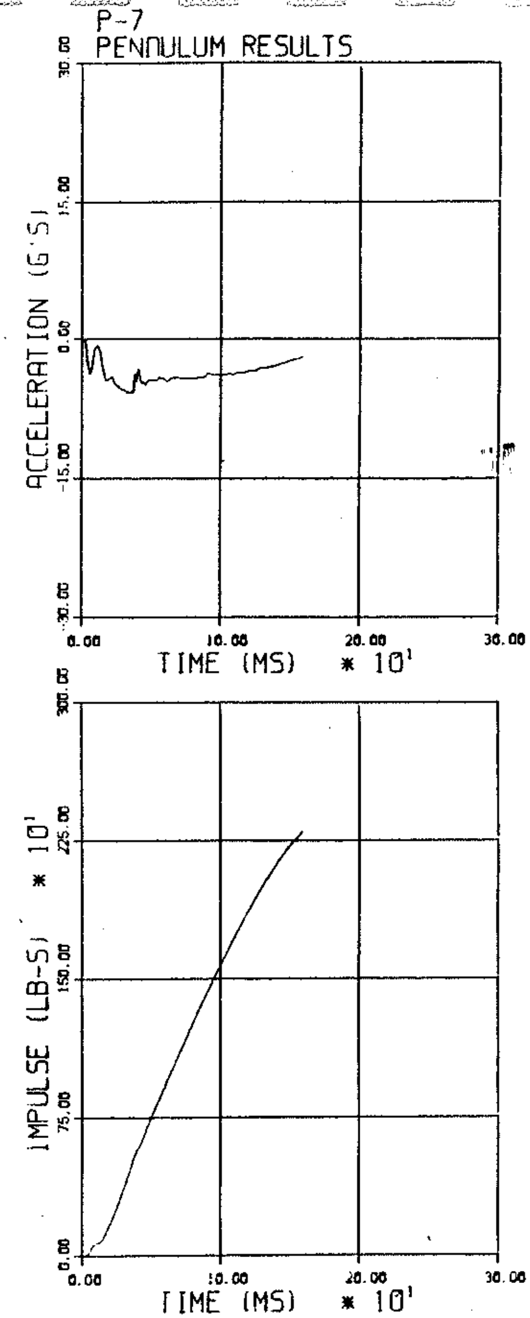
Post 3* - White Pine



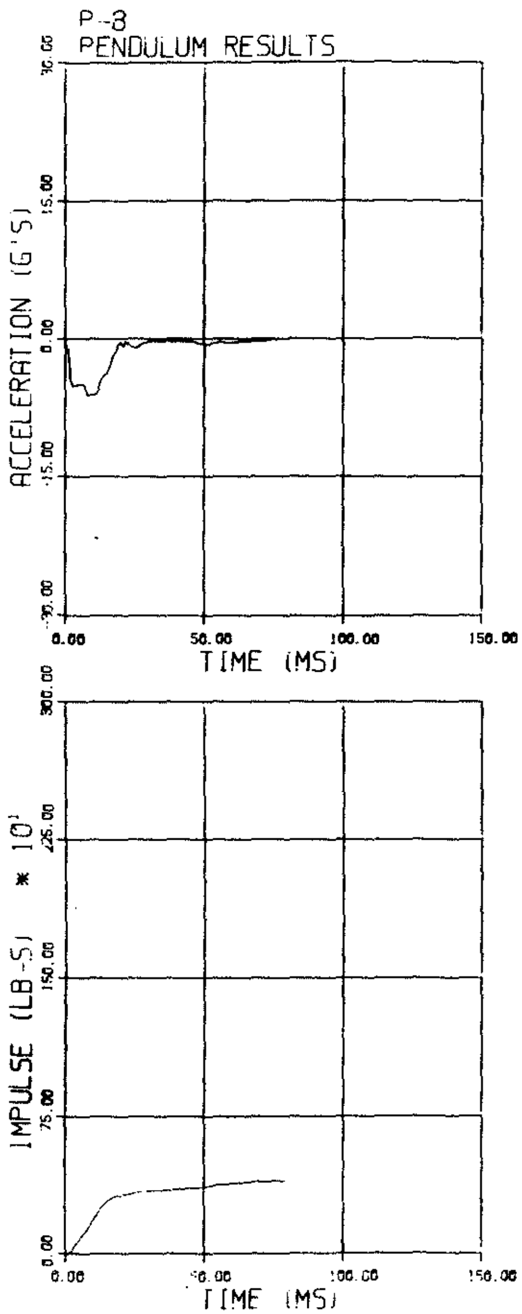
Post 4* - White Pine



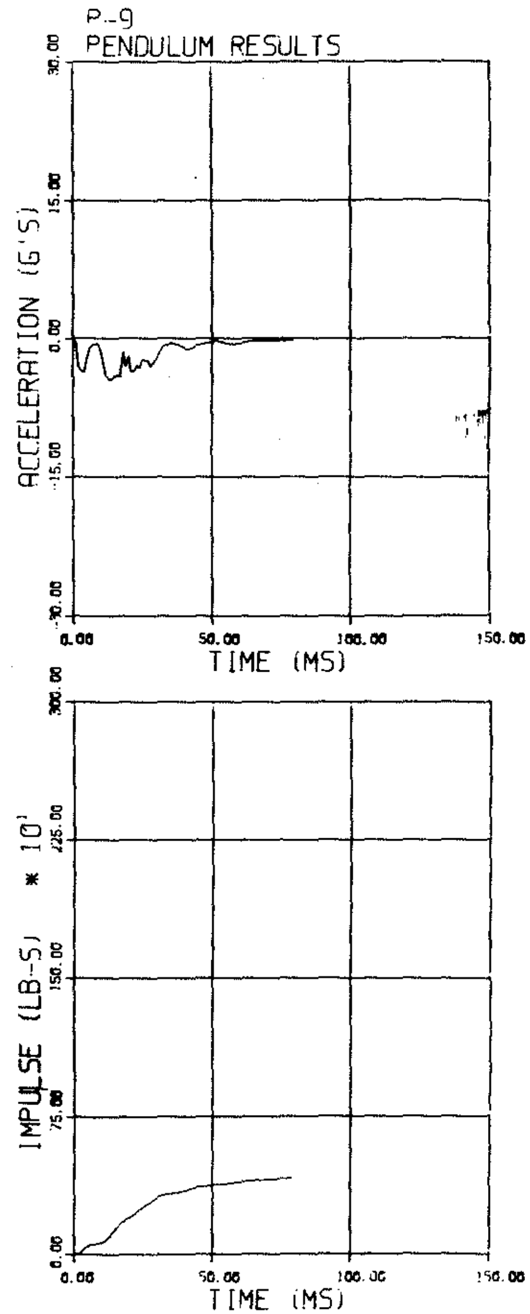
Post 5* - White Pine



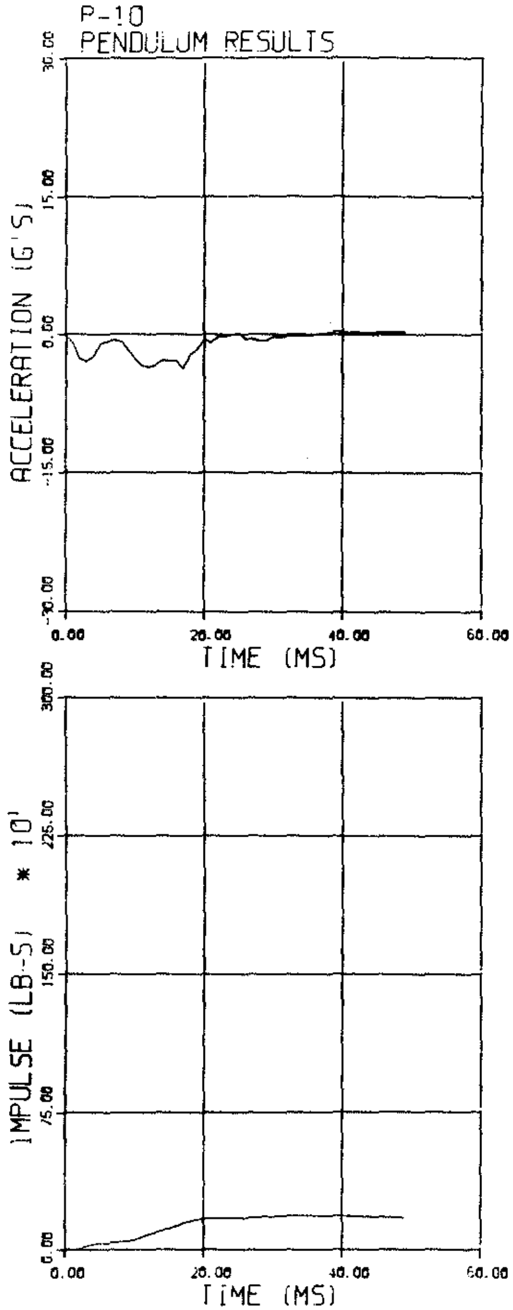
Post 7 - Yellow Birch



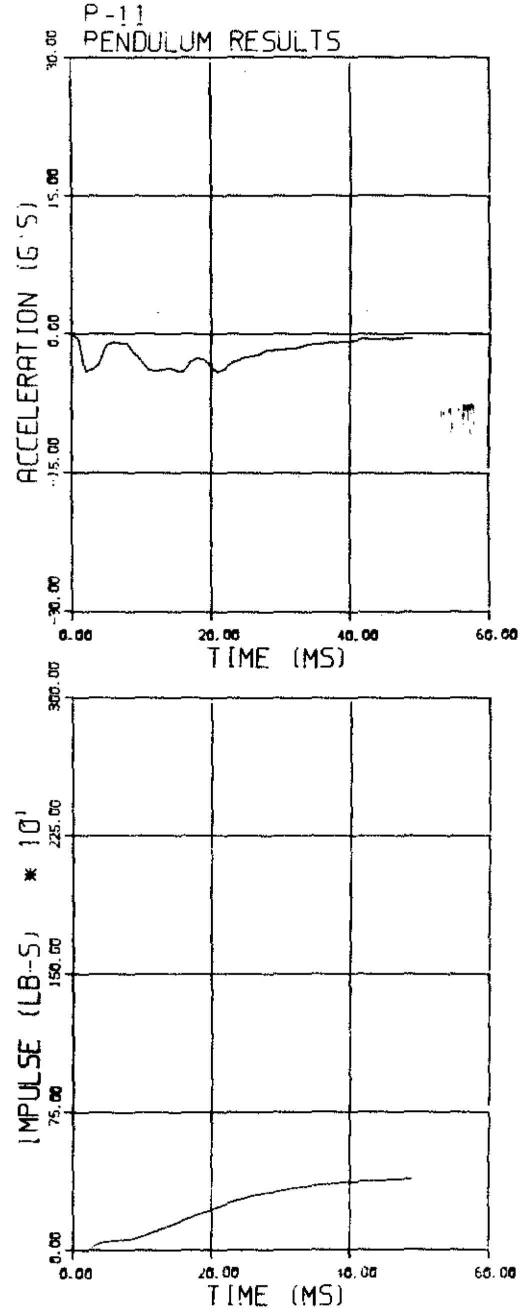
Post 8 - Beech



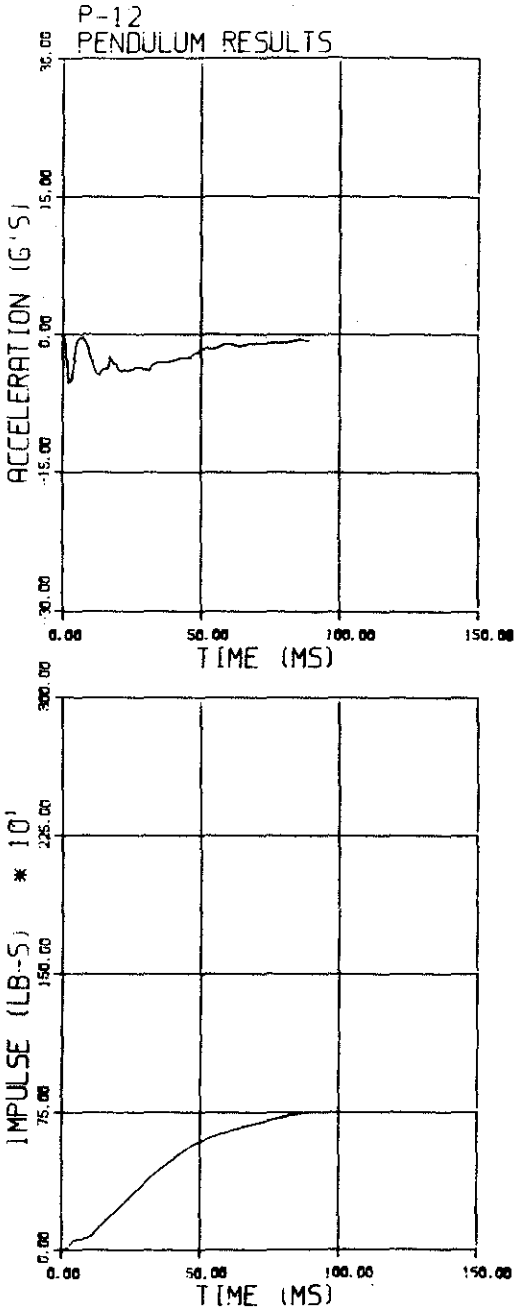
Post 9 - Beech



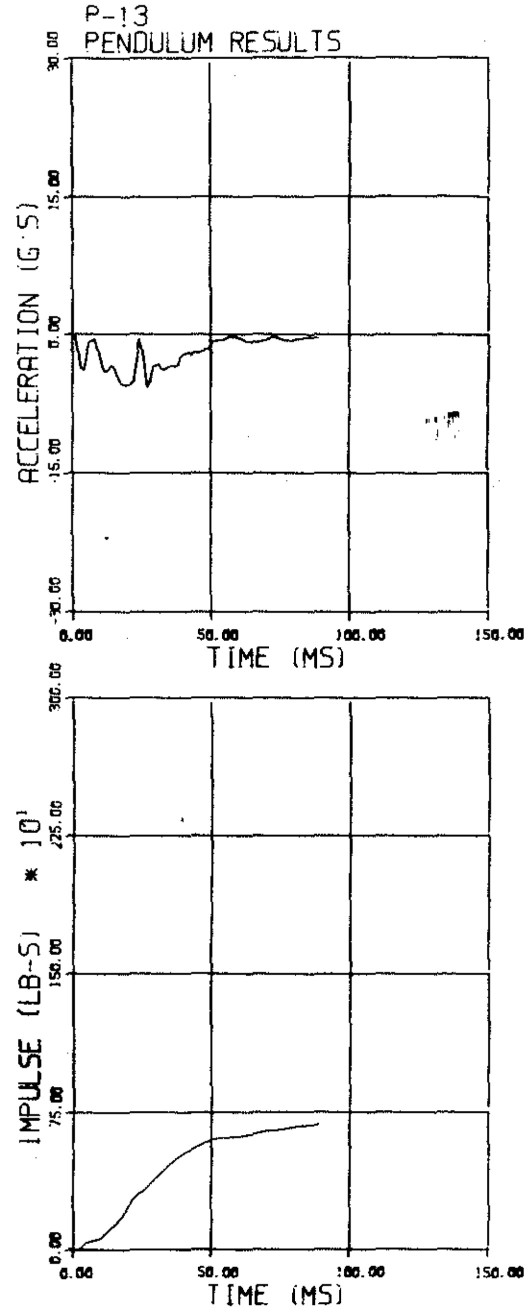
Post 10 - Beech



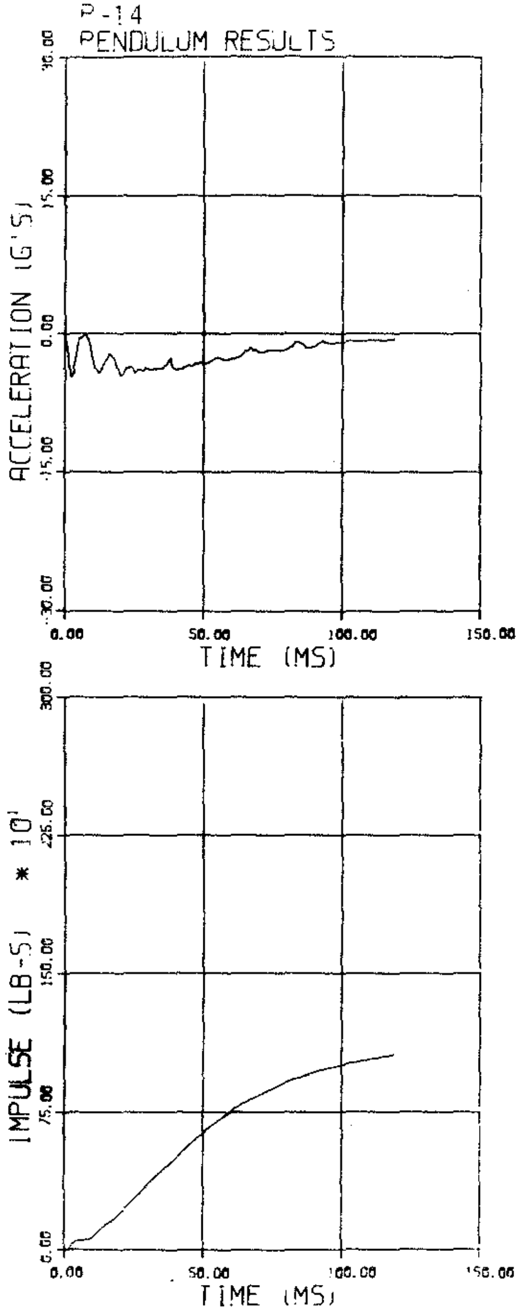
Post 11 - Beech



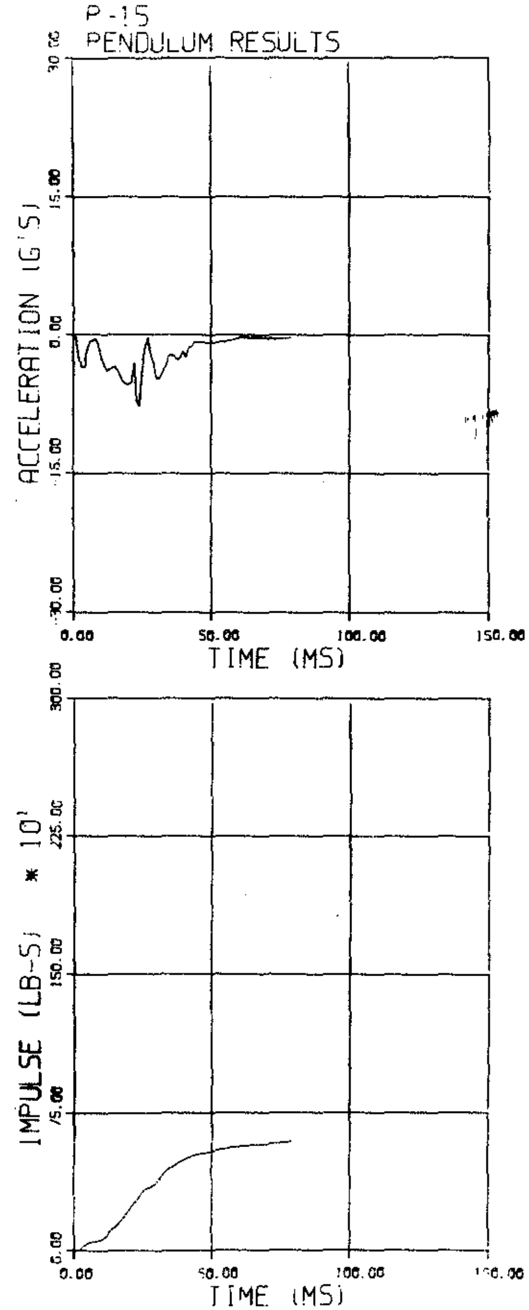
Post 12 - Beech



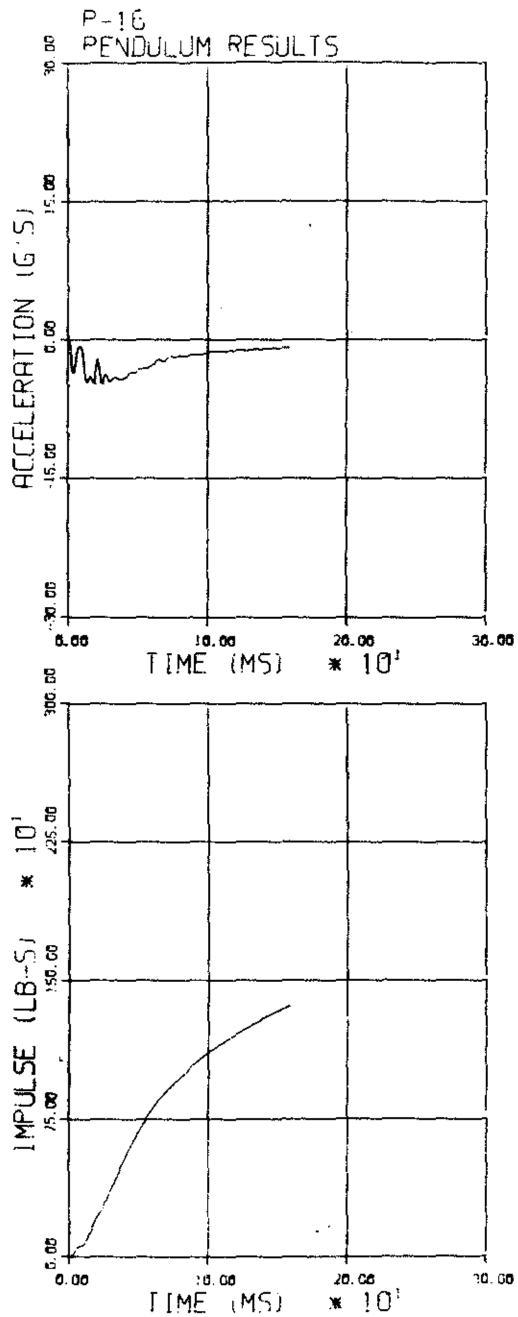
Post 13 - Red Maple



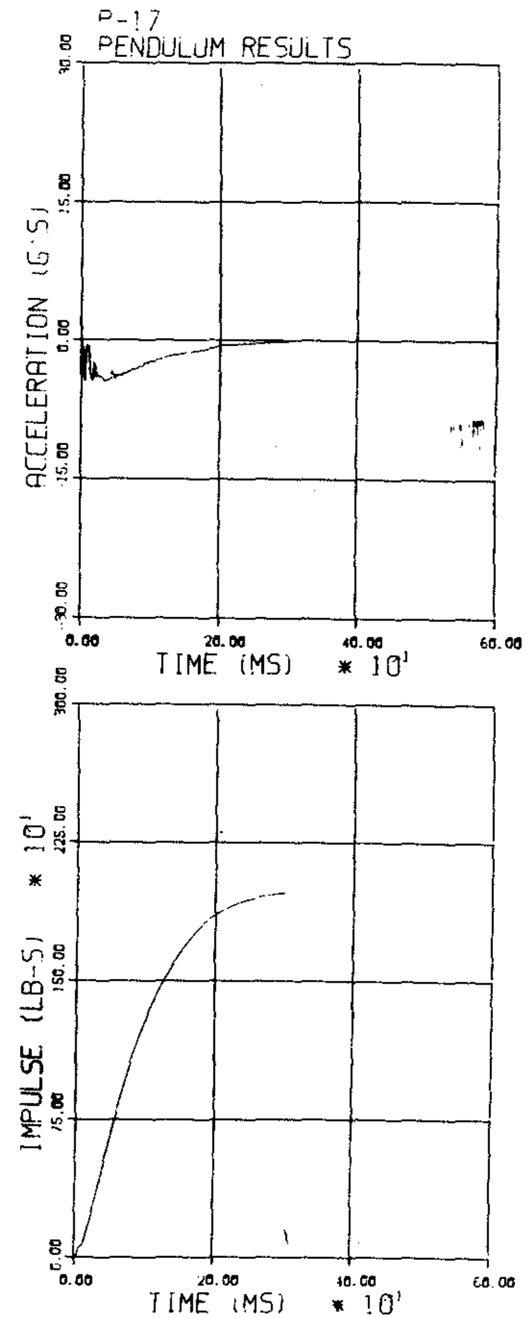
Post 14 - Beech



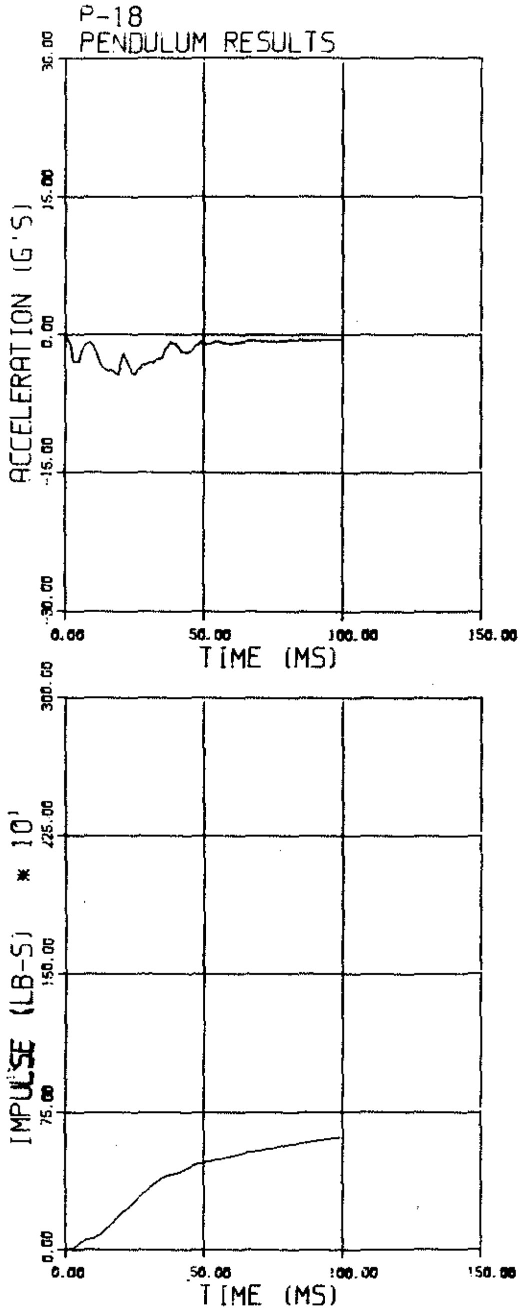
Post 15 - Beech



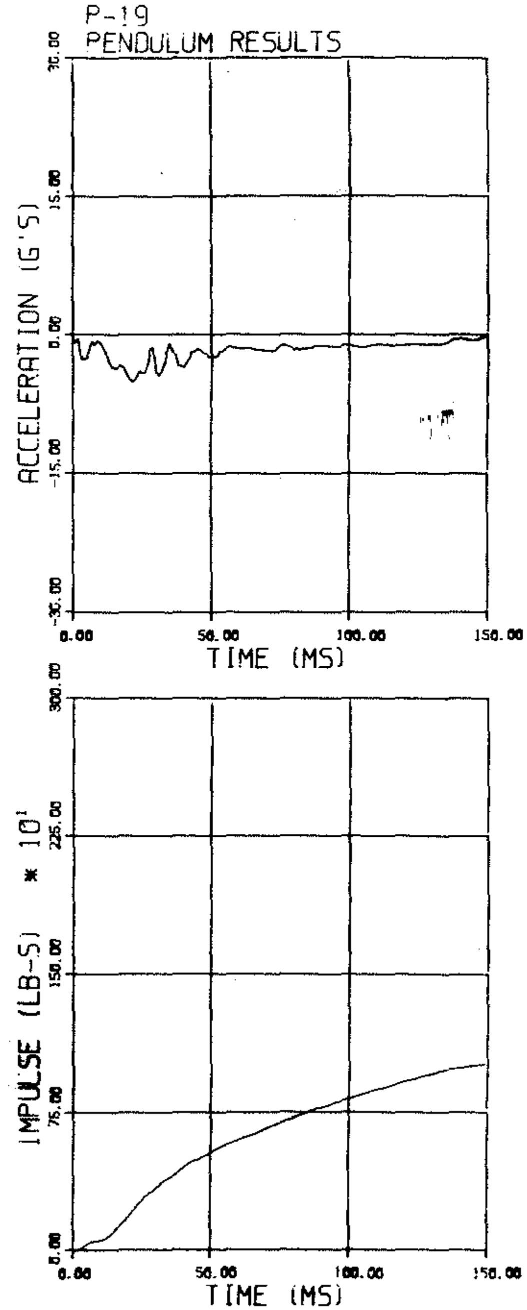
Post 16 - Beech



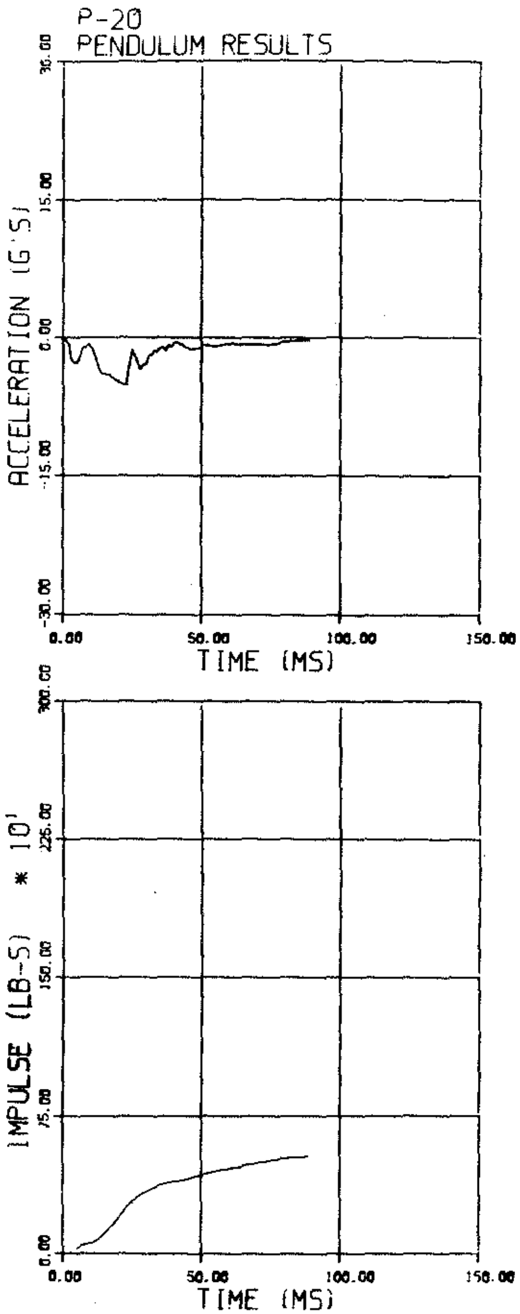
Post 17 - Beech



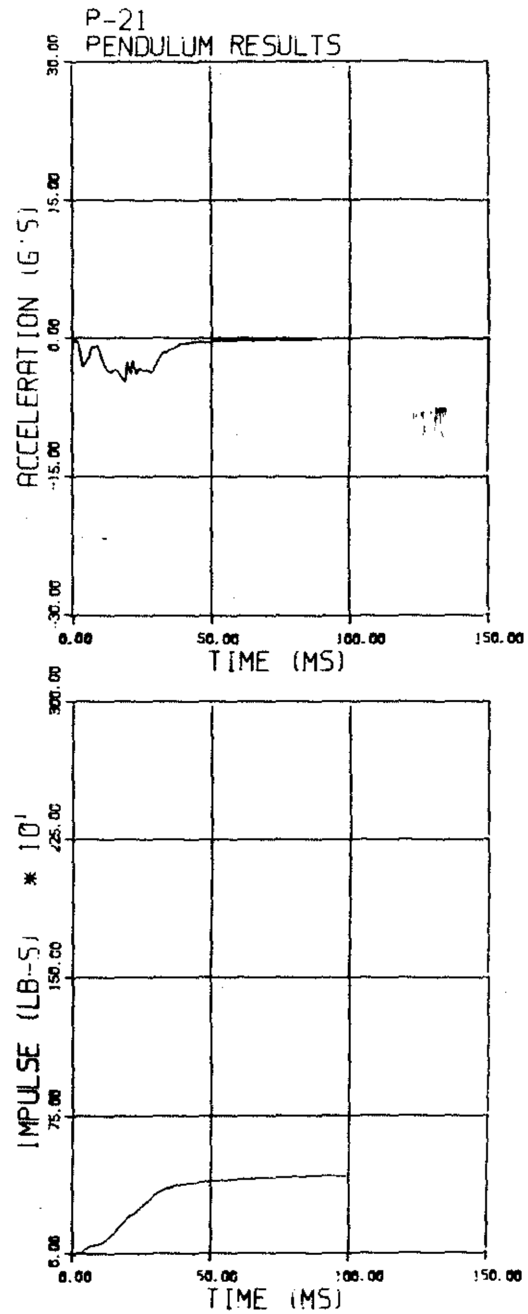
Post 18 - Red Maple



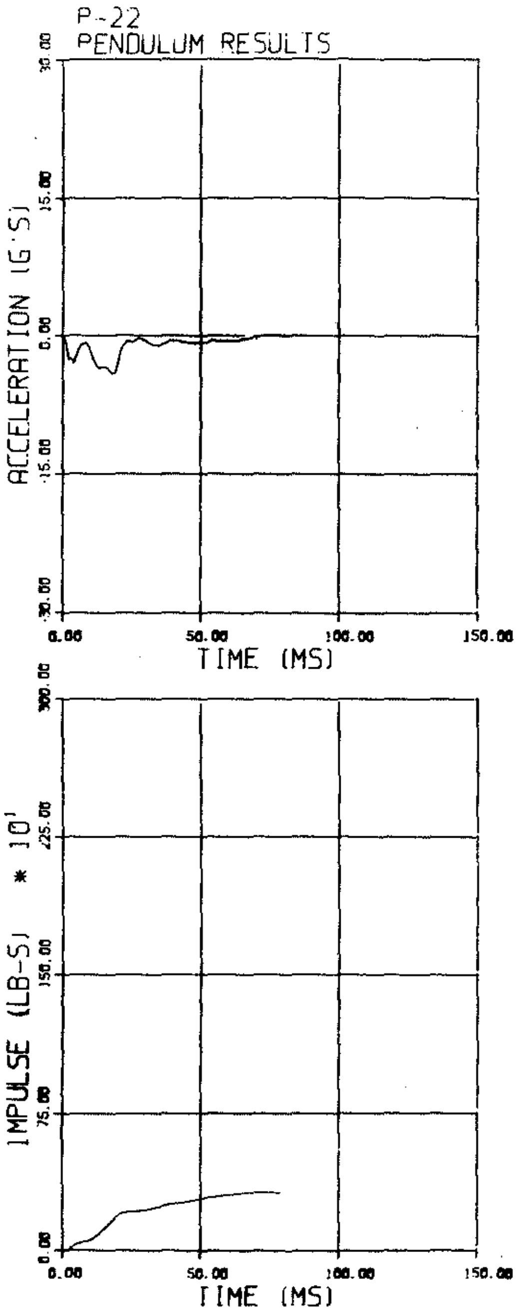
Post 19 - Red Maple



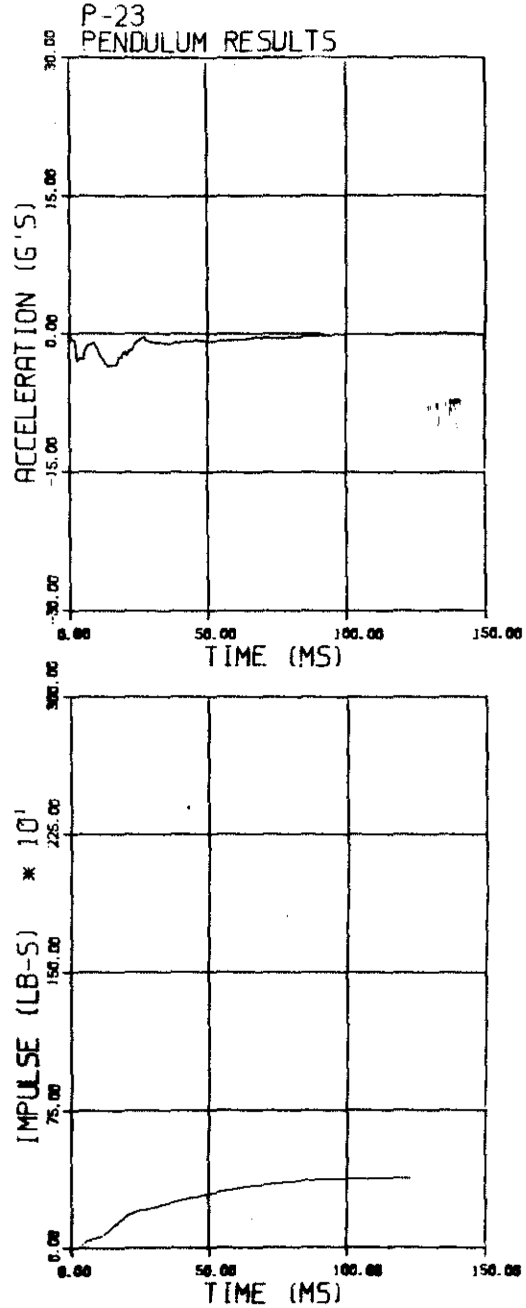
Post 20 - Red Maple



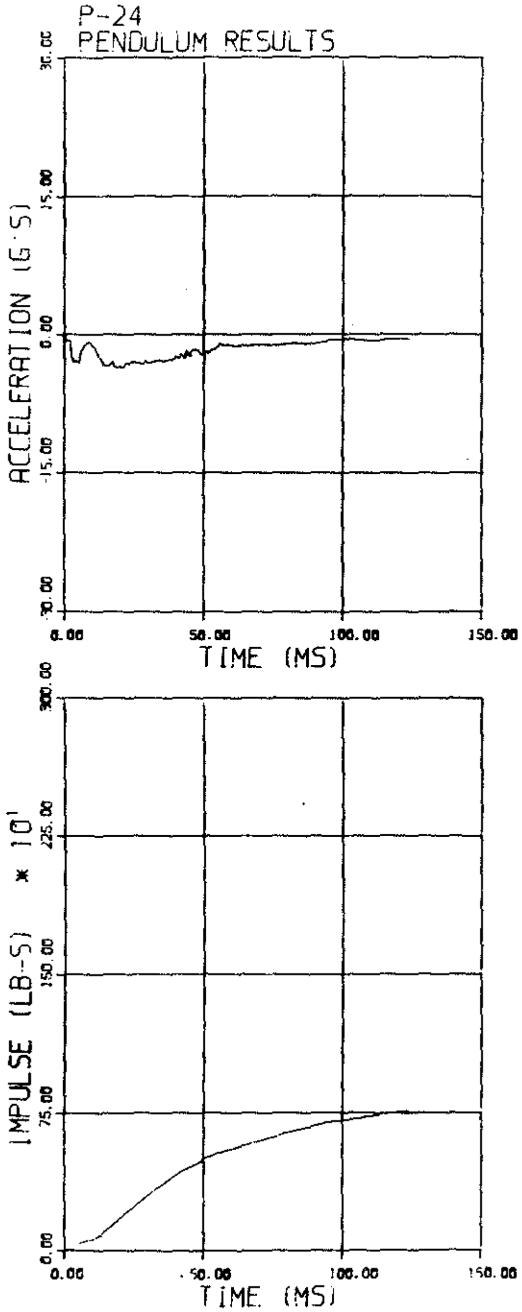
Post 21 - Red Maple



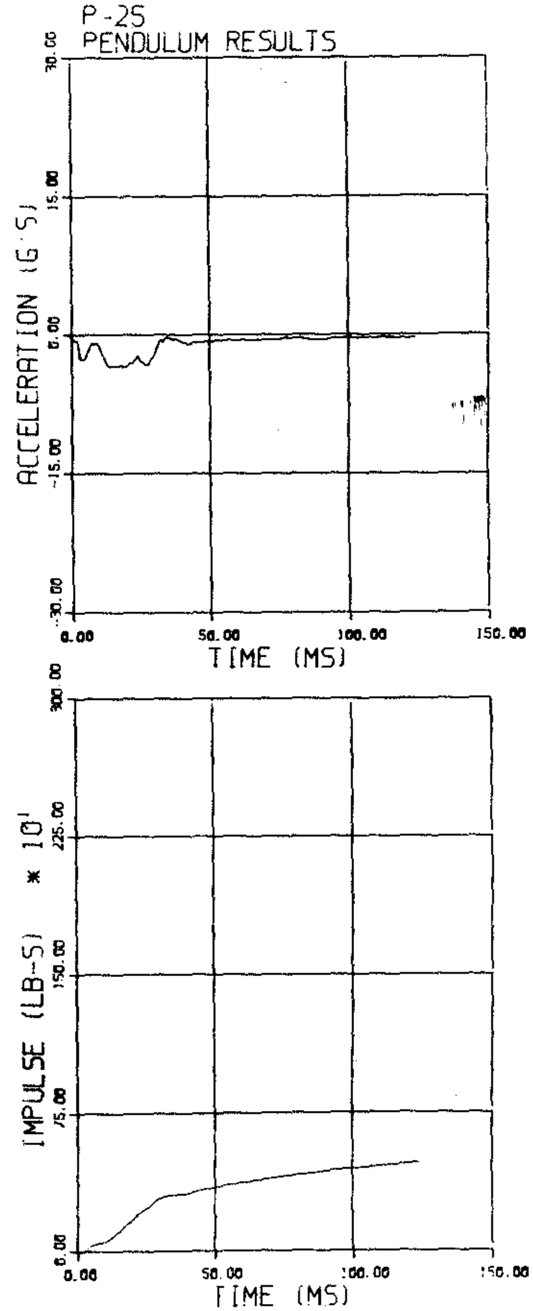
Post 22 - Red Maple



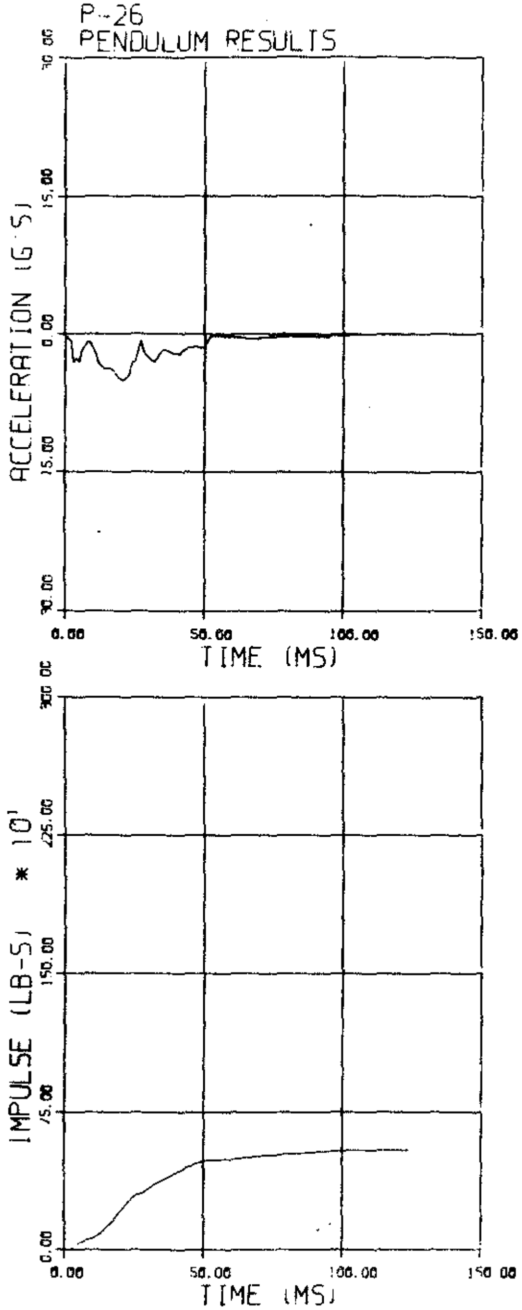
Post 23 - Red Maple



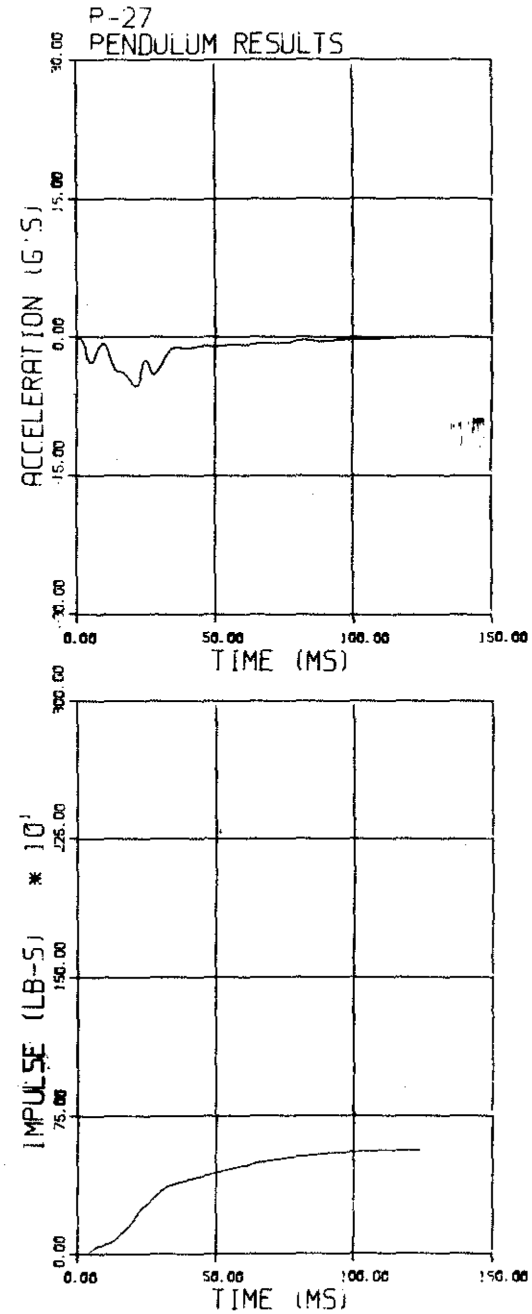
Post 24 - Red Maple



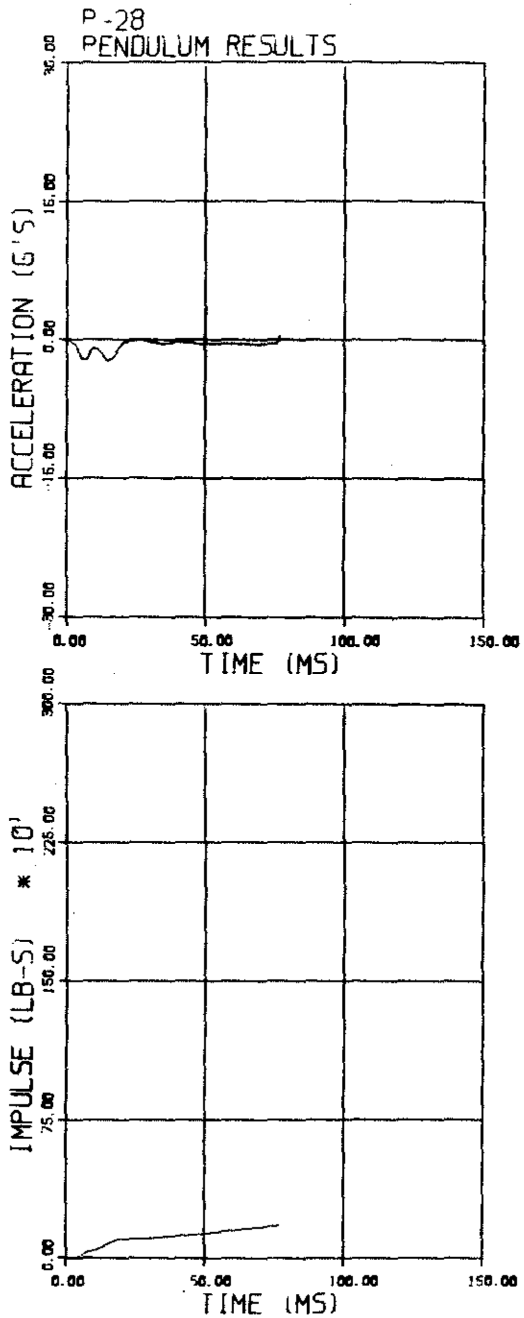
Post 25 - Red Maple



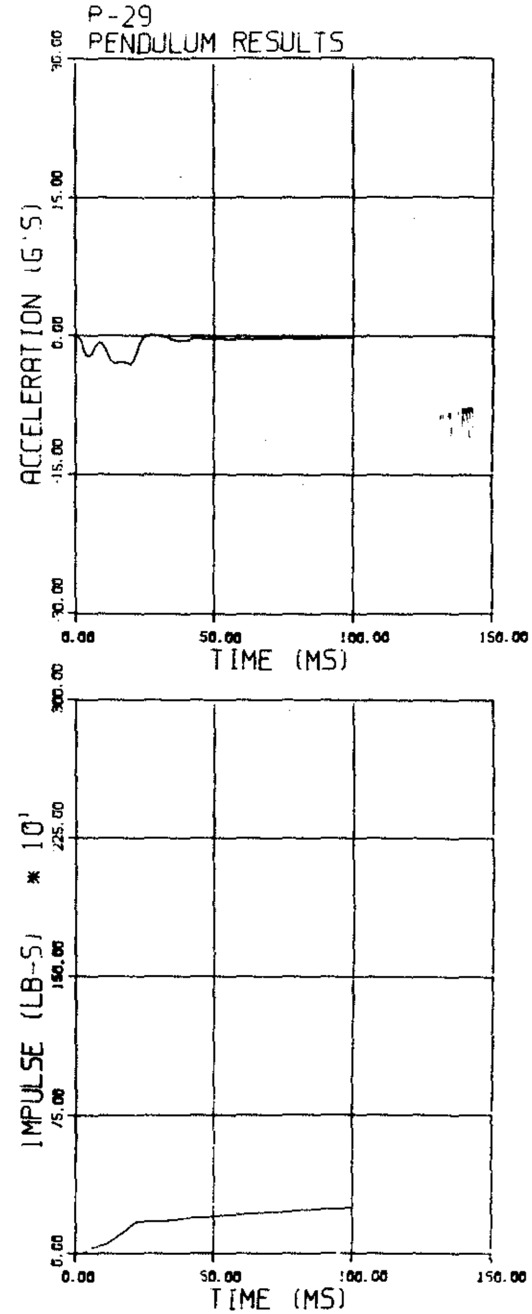
Post 26 - Red Maple



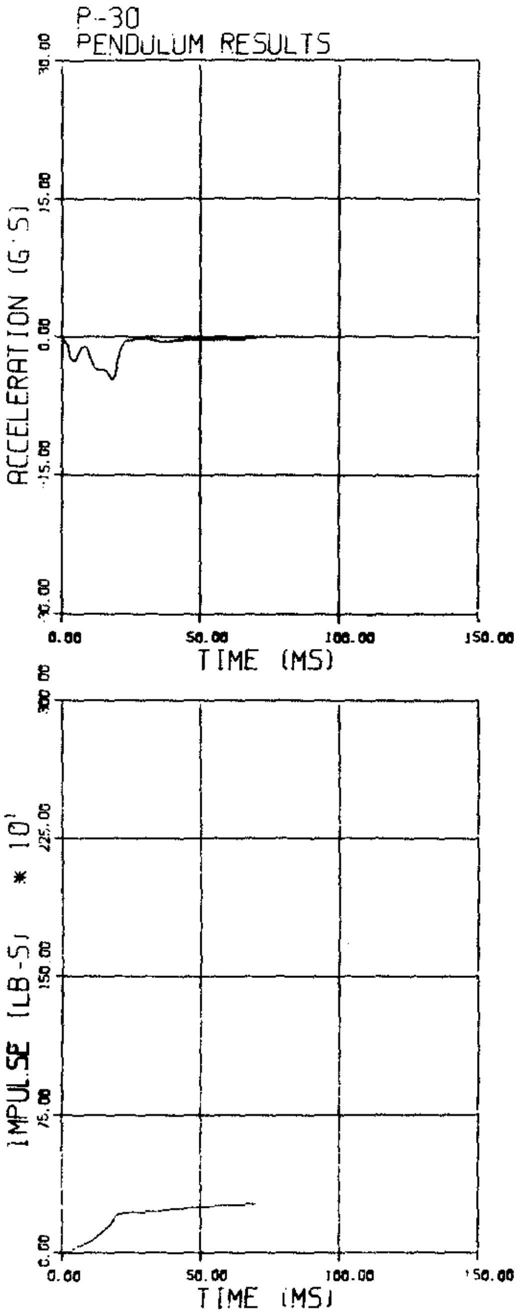
Post 27 - Red Maple



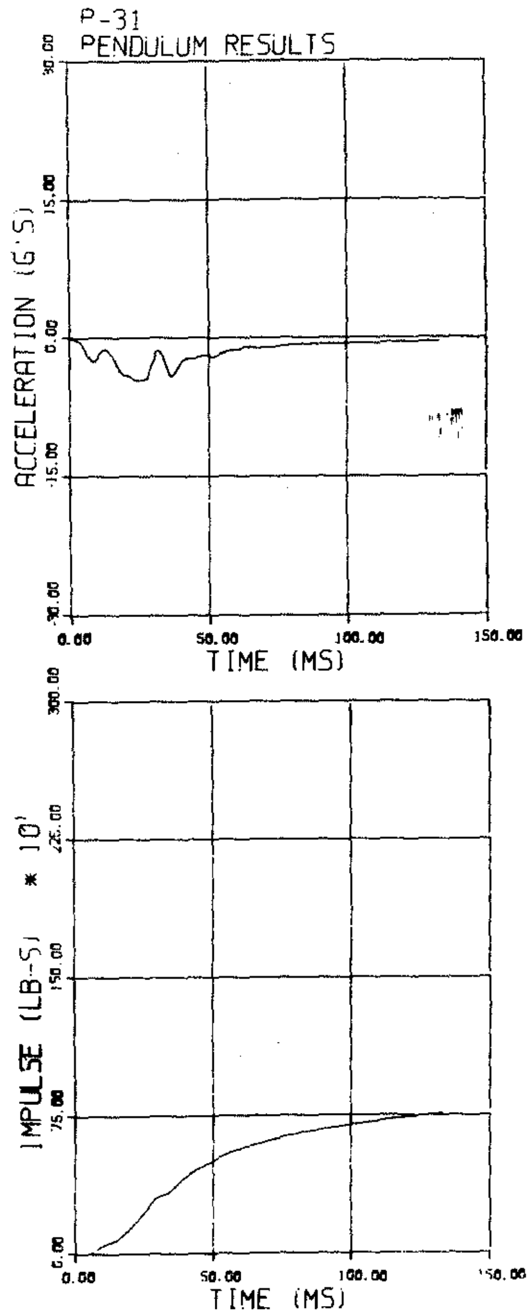
Post 28 - Aspen



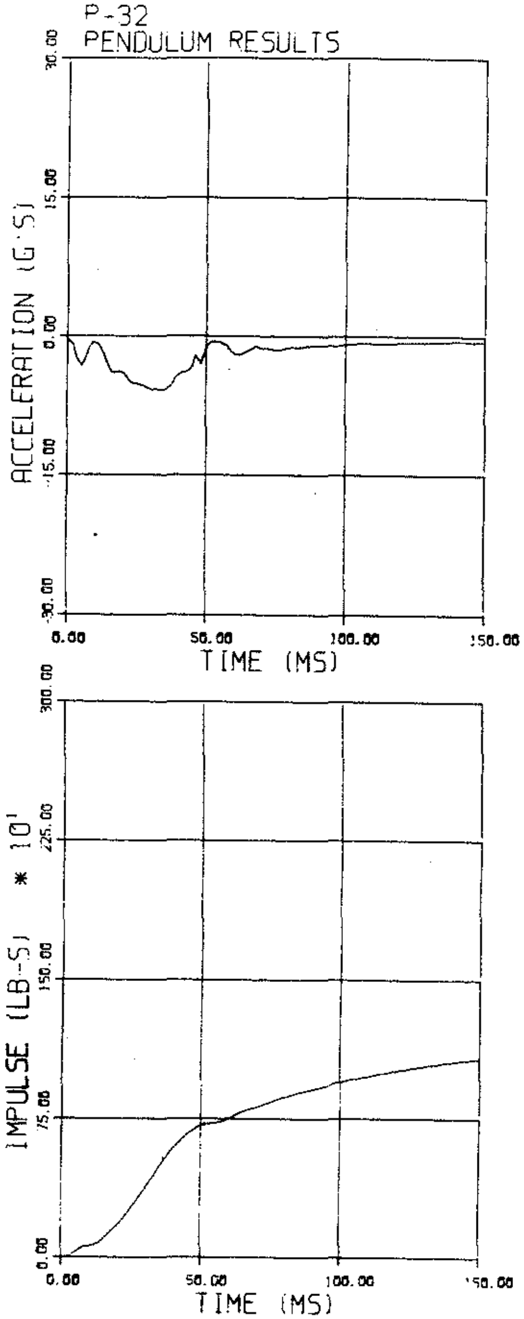
Post 29 - Aspen



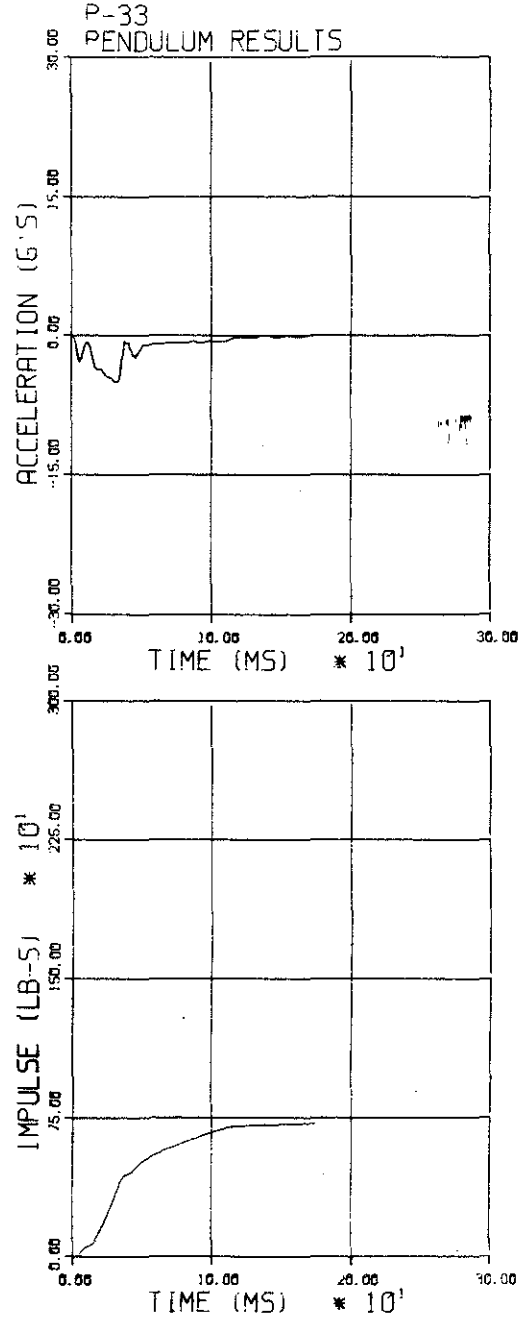
Post 30 - Red Maple



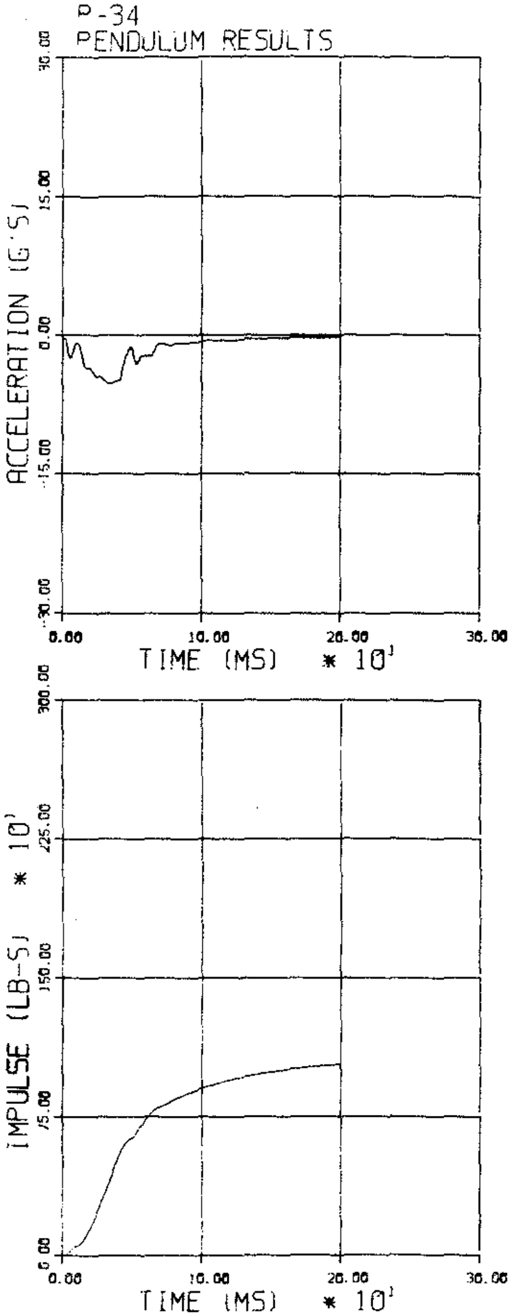
Post 31 - Red Oak



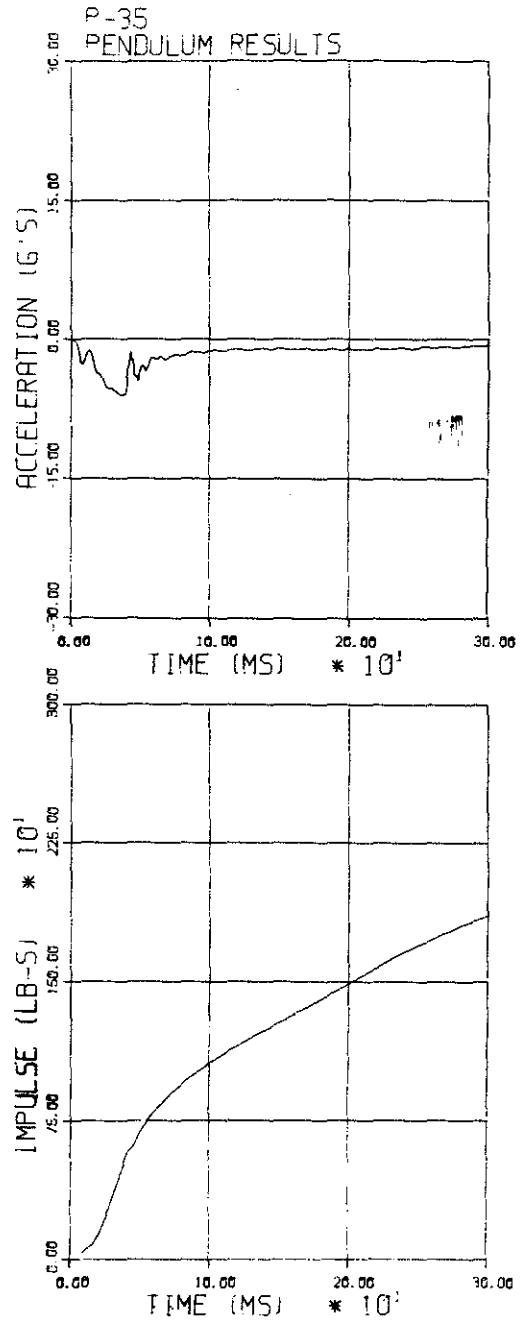
Post 32 - Red Oak



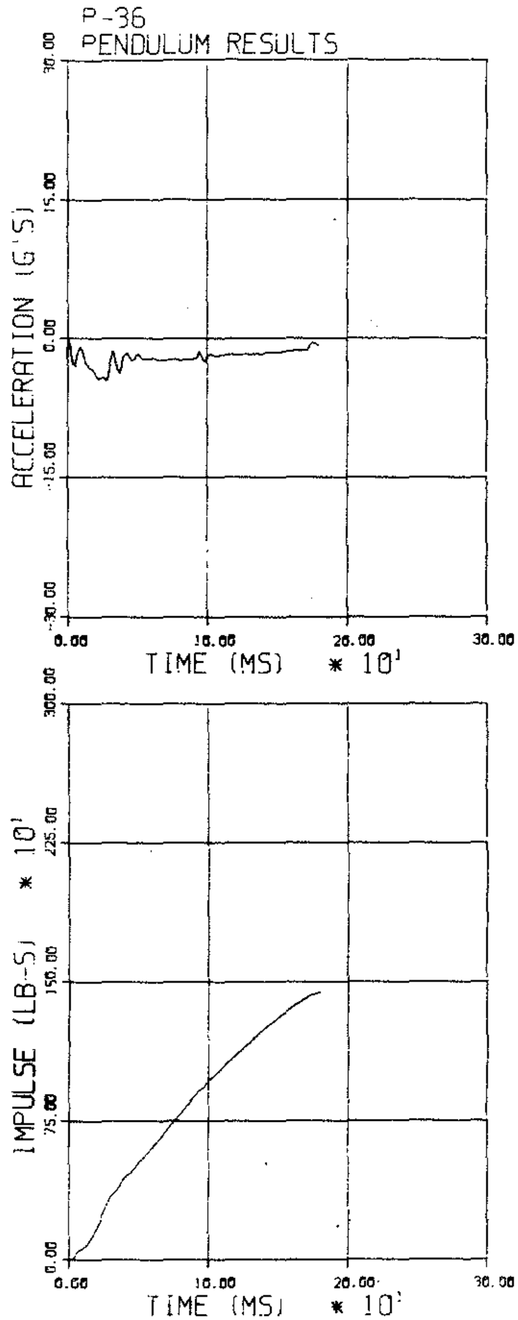
Post 33 - Red Oak



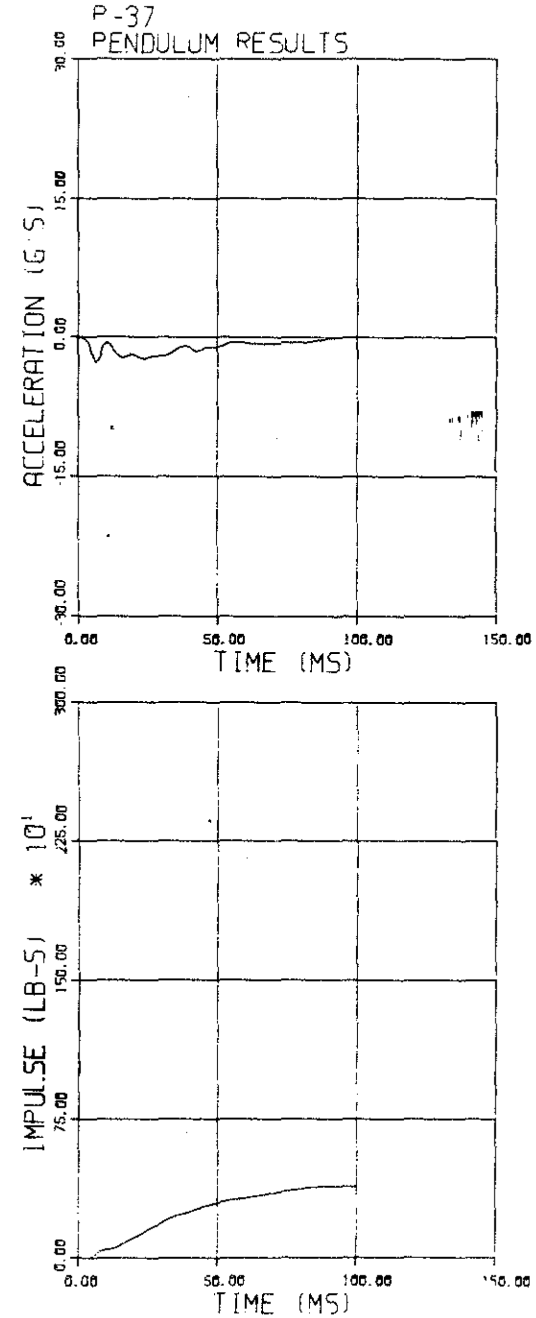
Post 34 - Red Oak



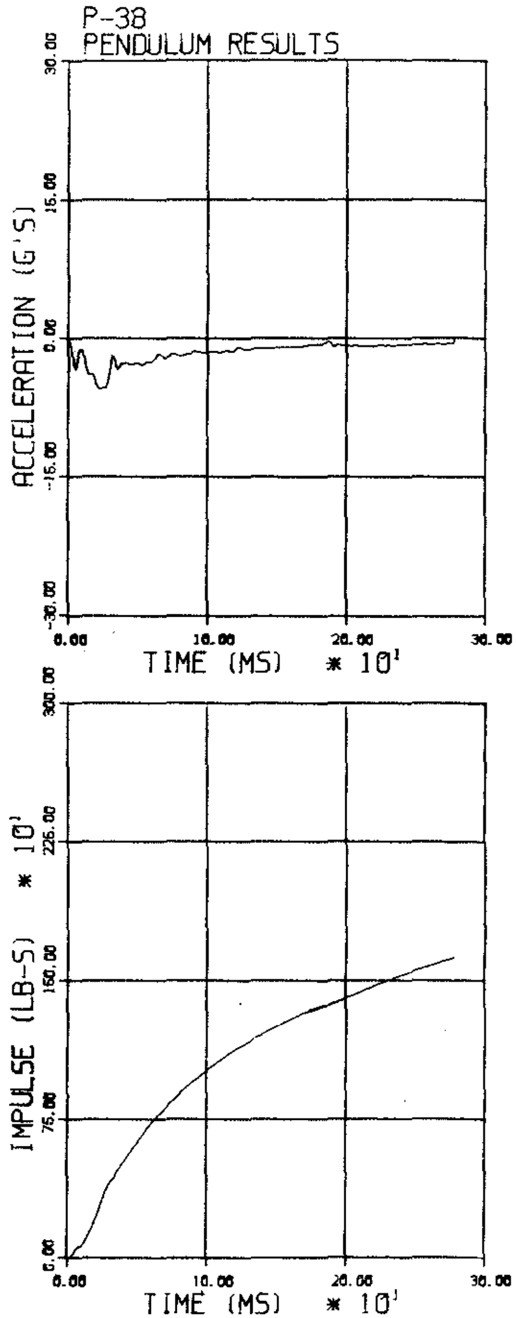
Post 35 - Red Oak



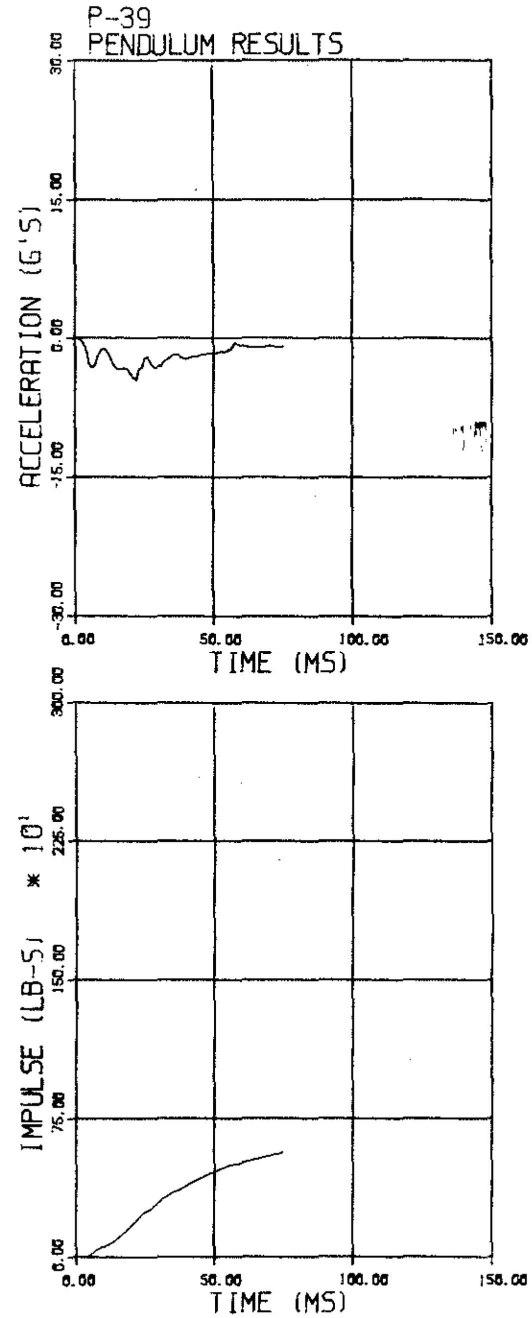
Post 36 - Red Oak



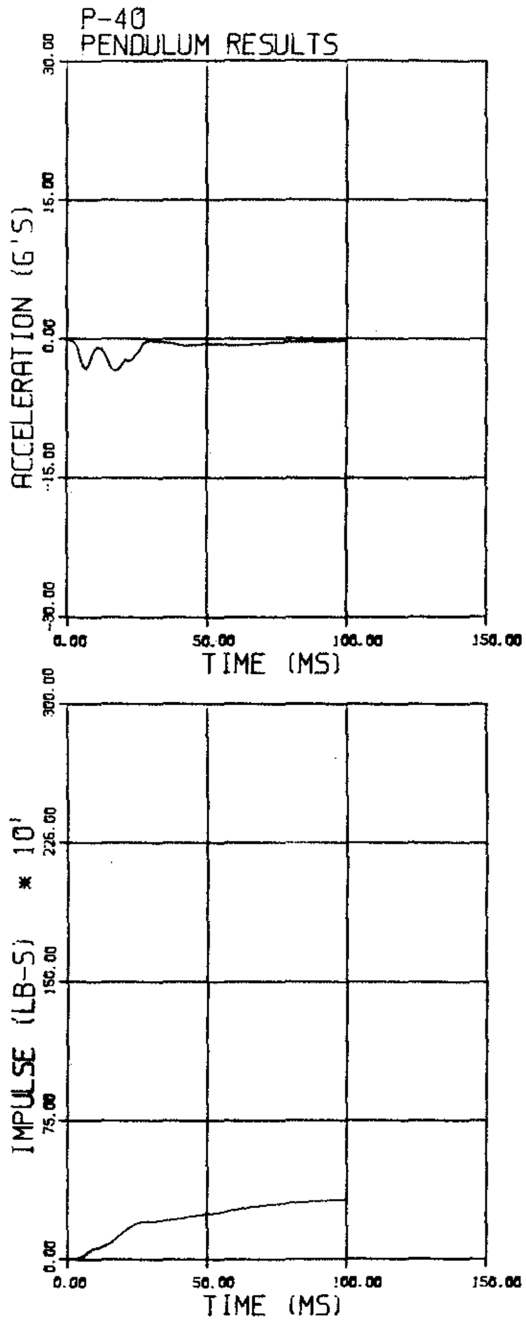
Post 37 - Aspen



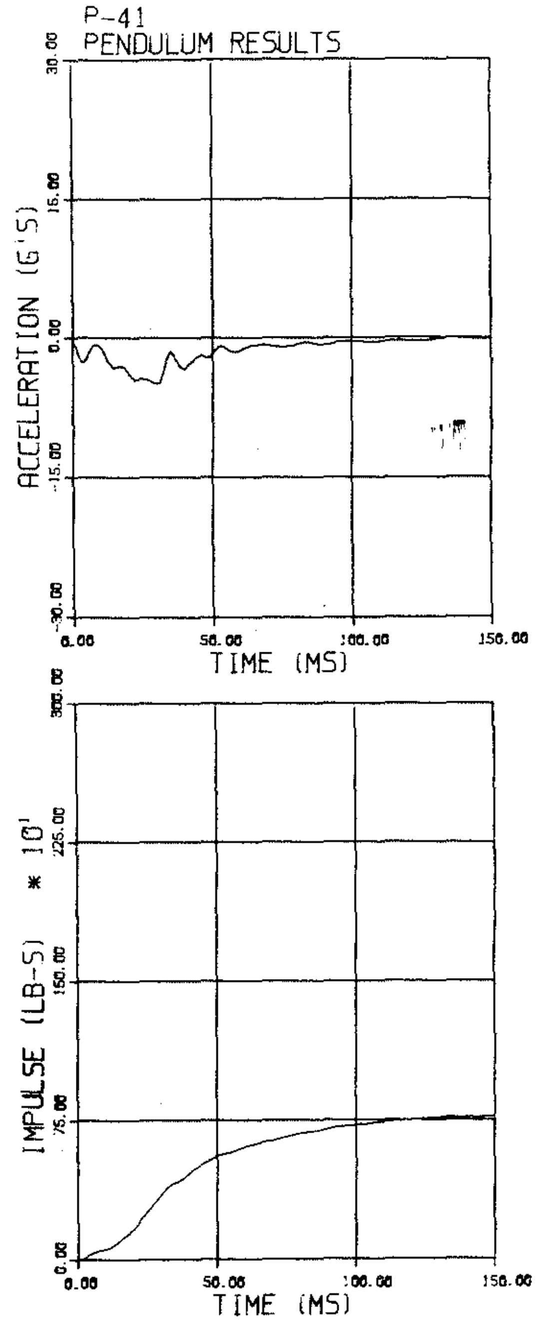
Post 38 - White Ash



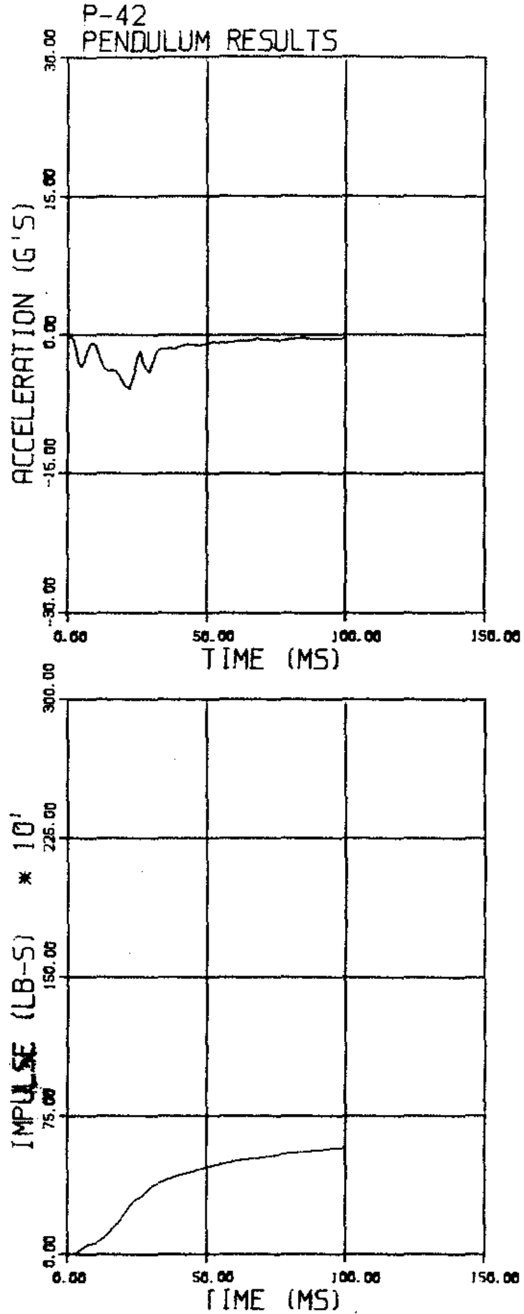
Post 39 - White Ash



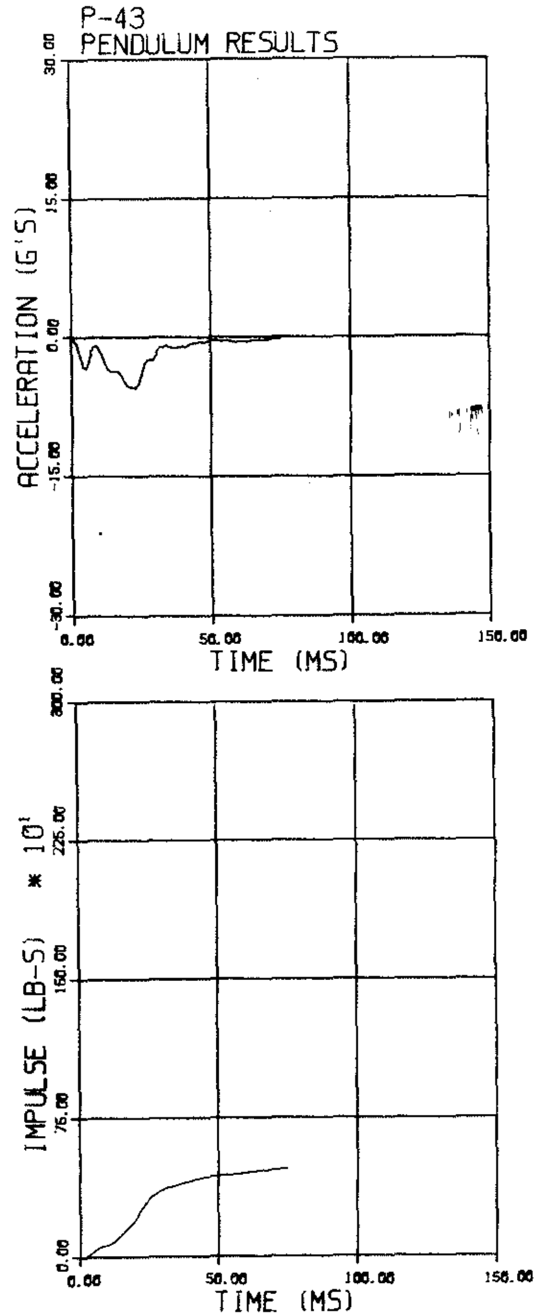
Post 40 - White Ash



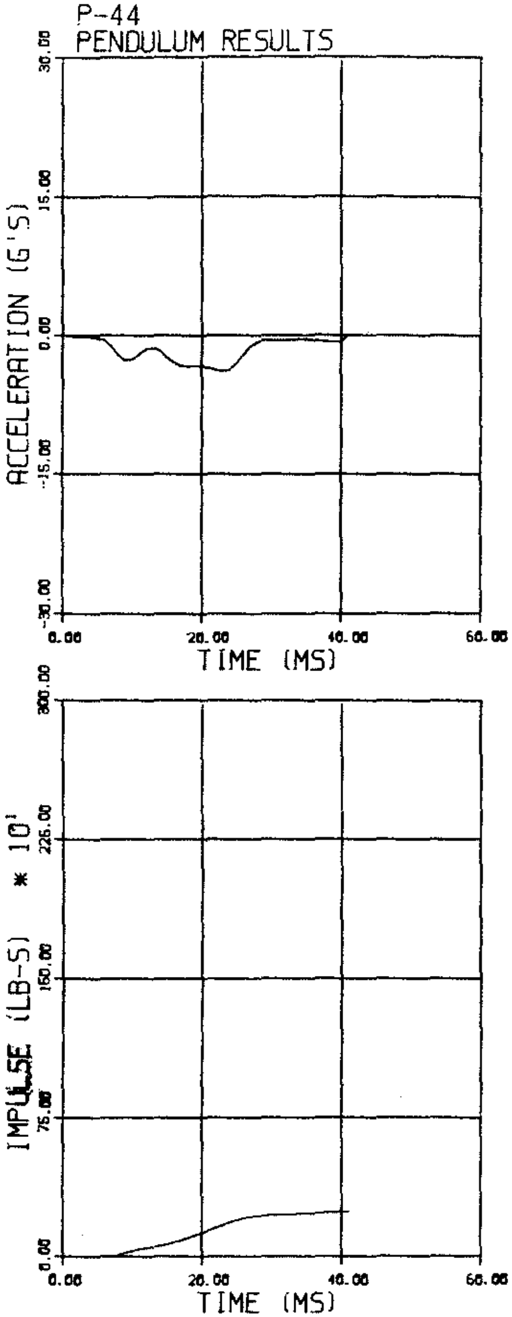
Post 41 - White Ash



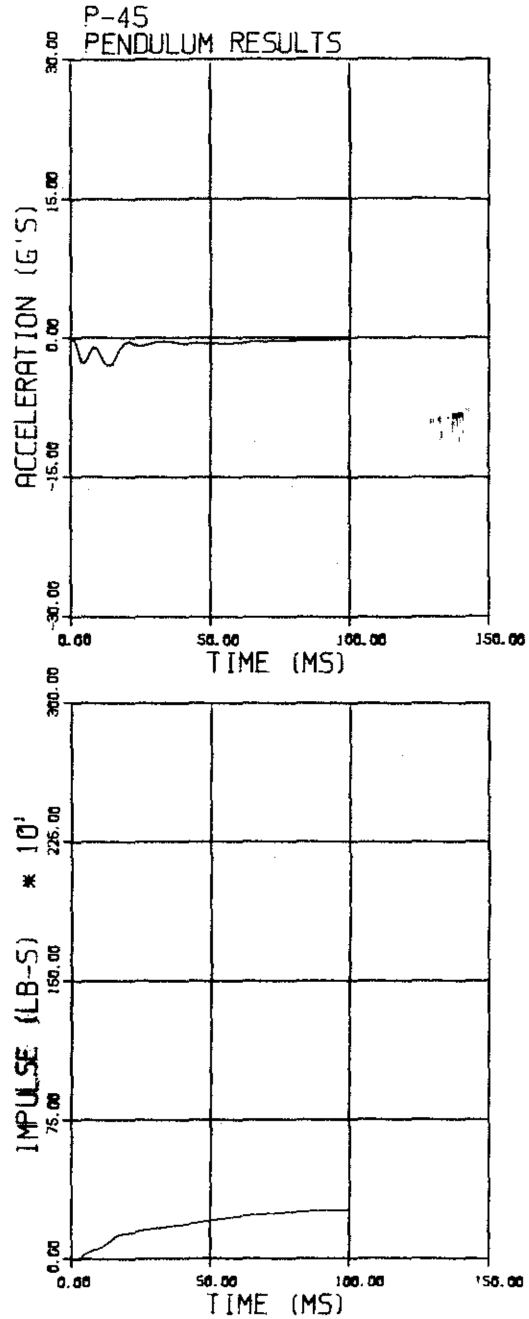
Post 42 - White Ash



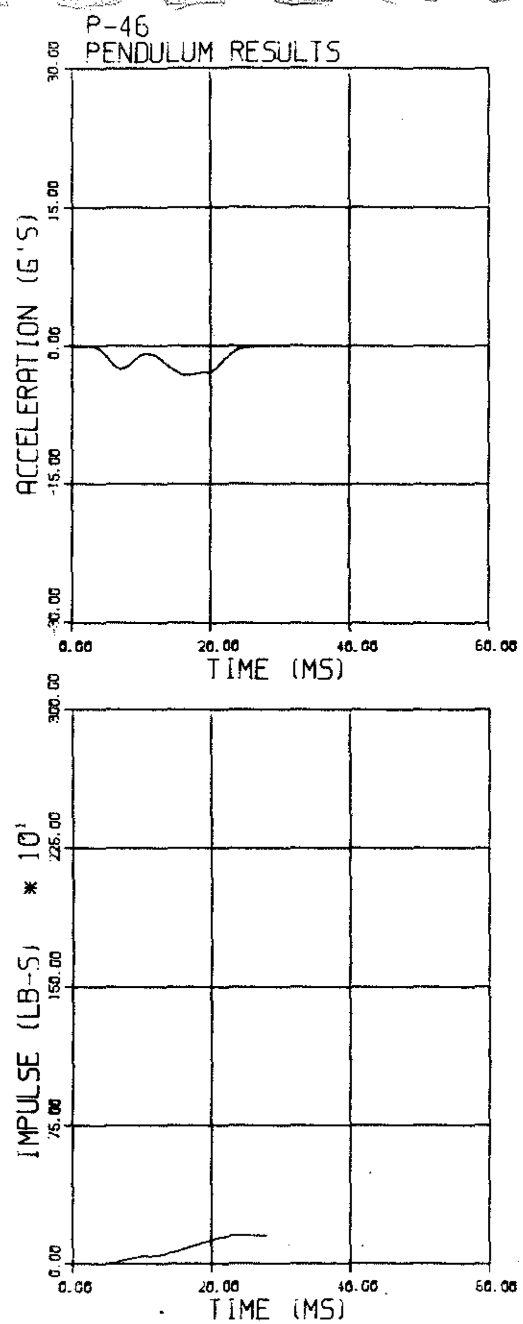
Post 43 - White Ash



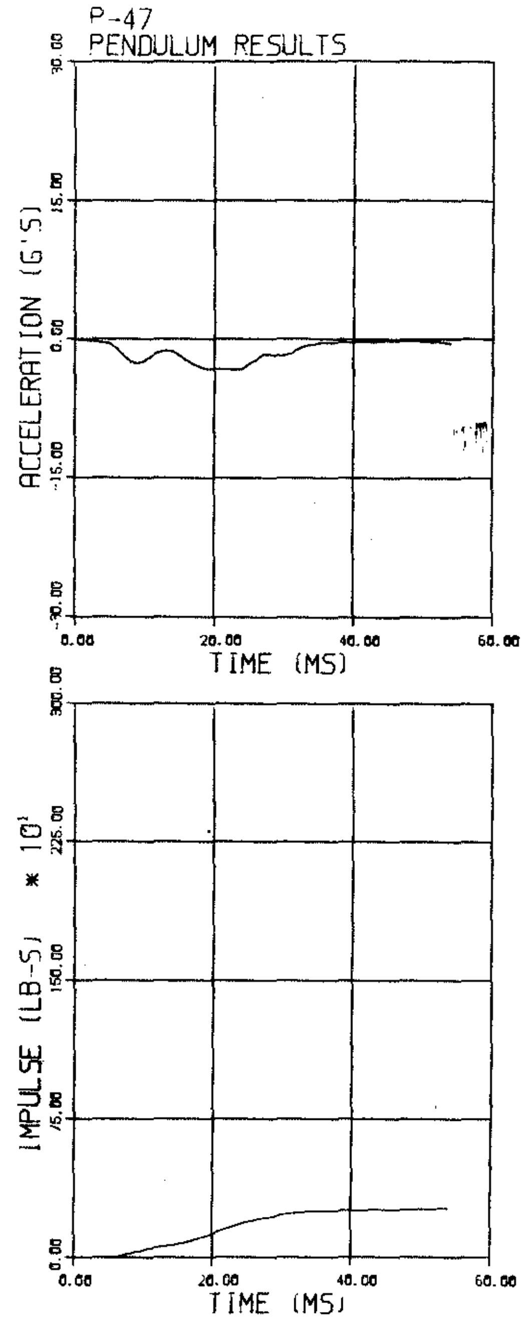
Post 44 - Aspen



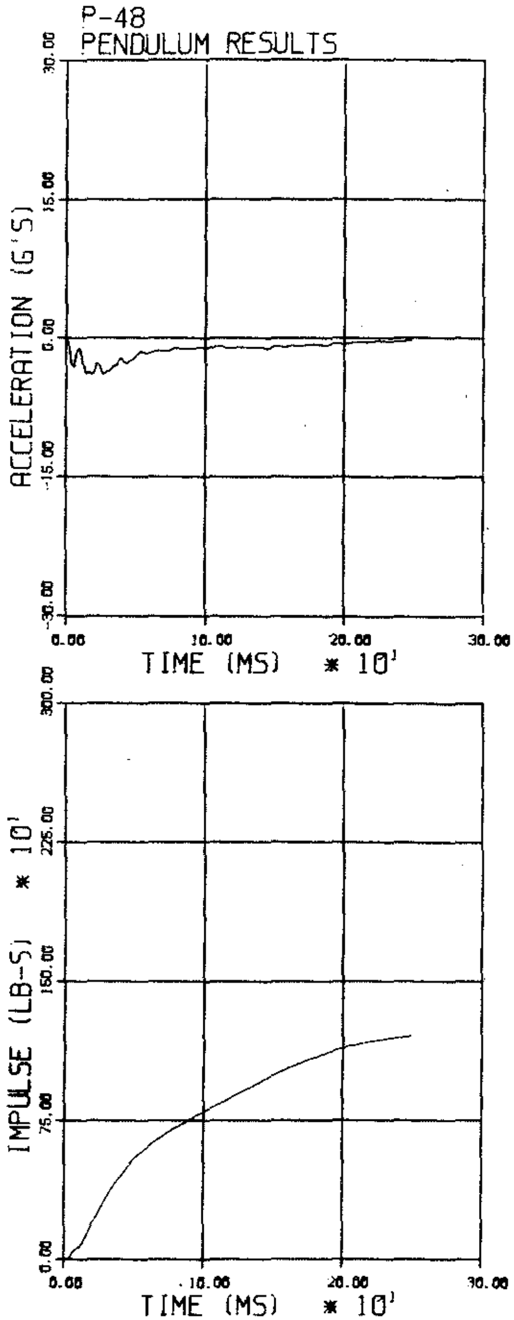
Post 45 - Aspen



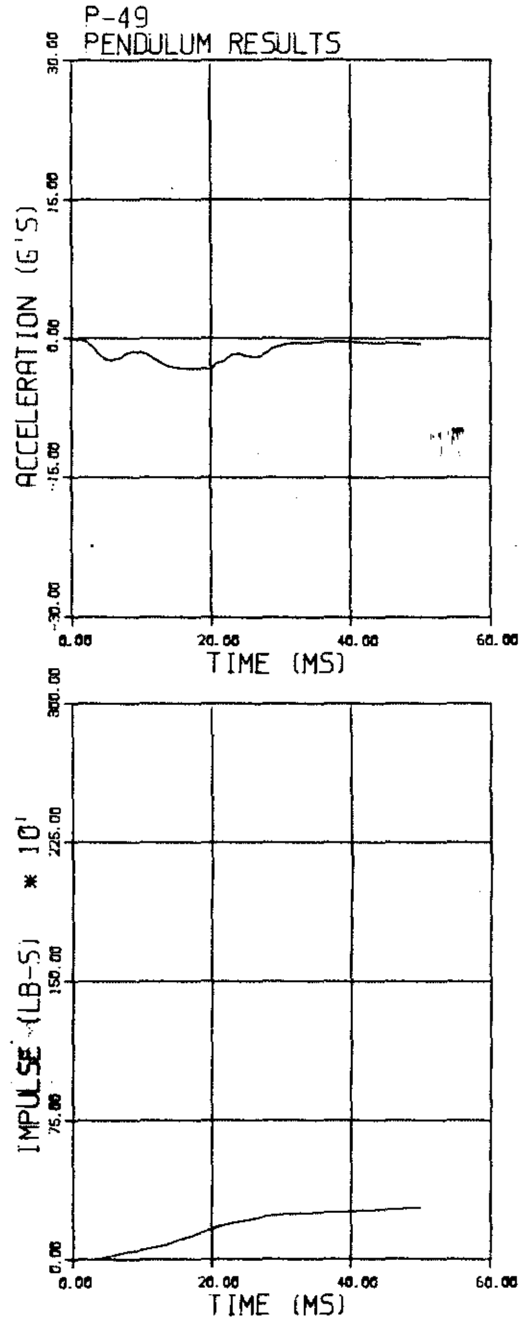
Post 46 - Aspen



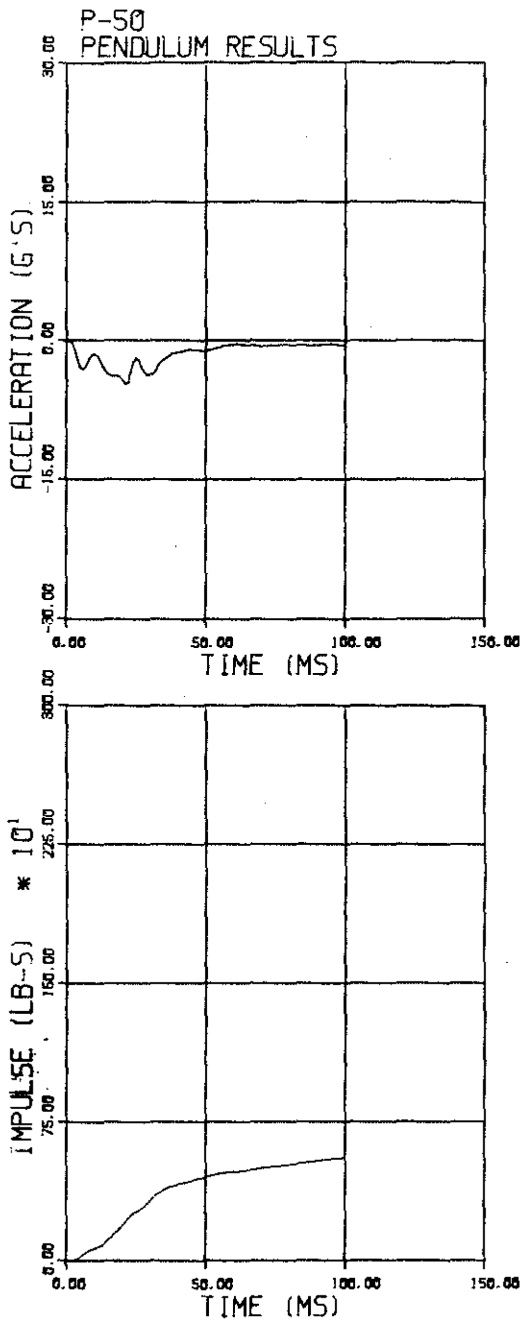
Post 47 - Aspen



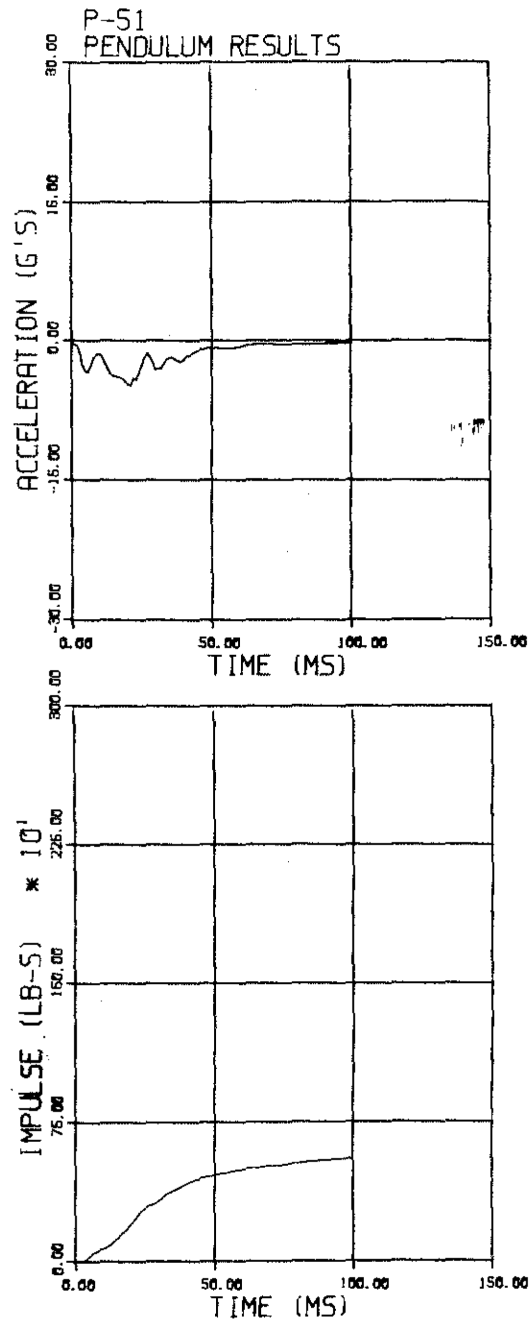
Post 48 - White Ash



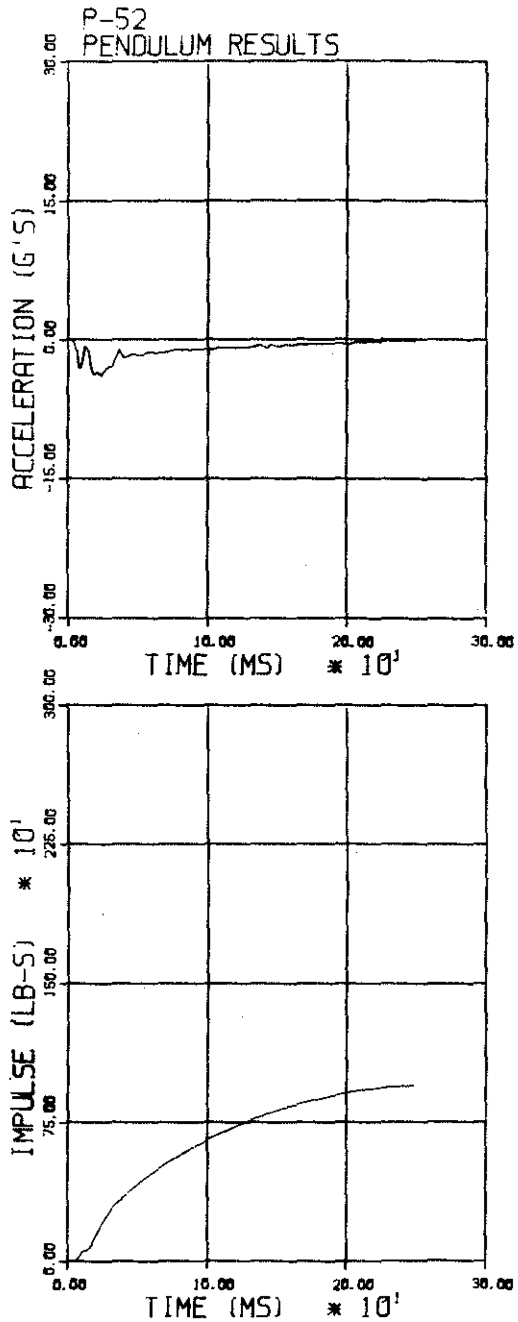
Post 49 - Aspen



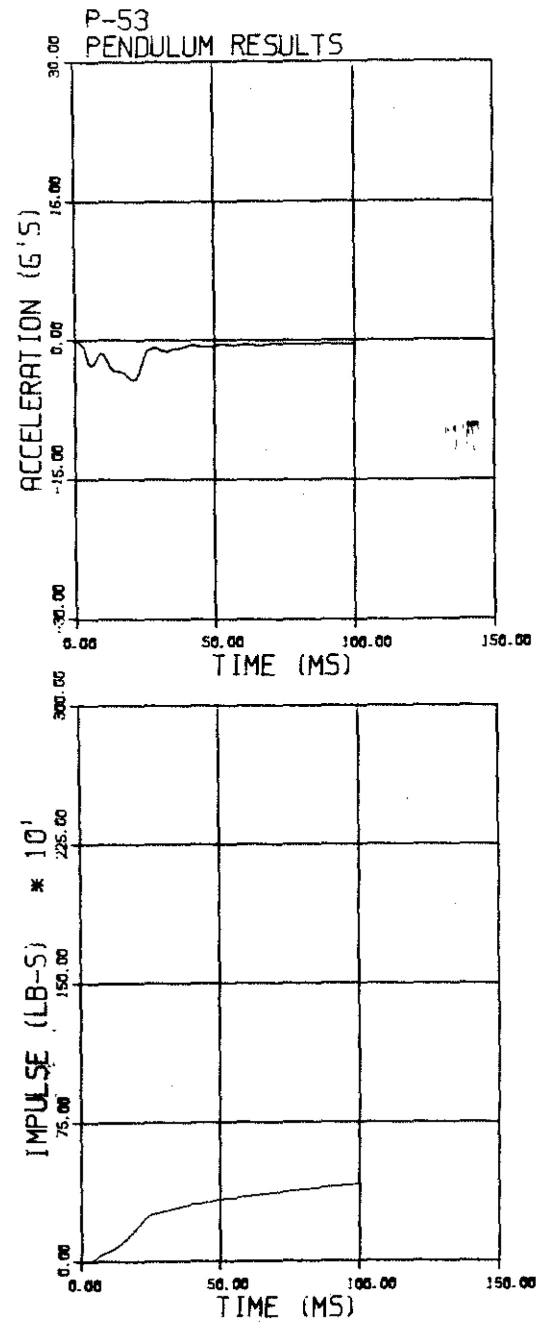
Post 50 - Beech



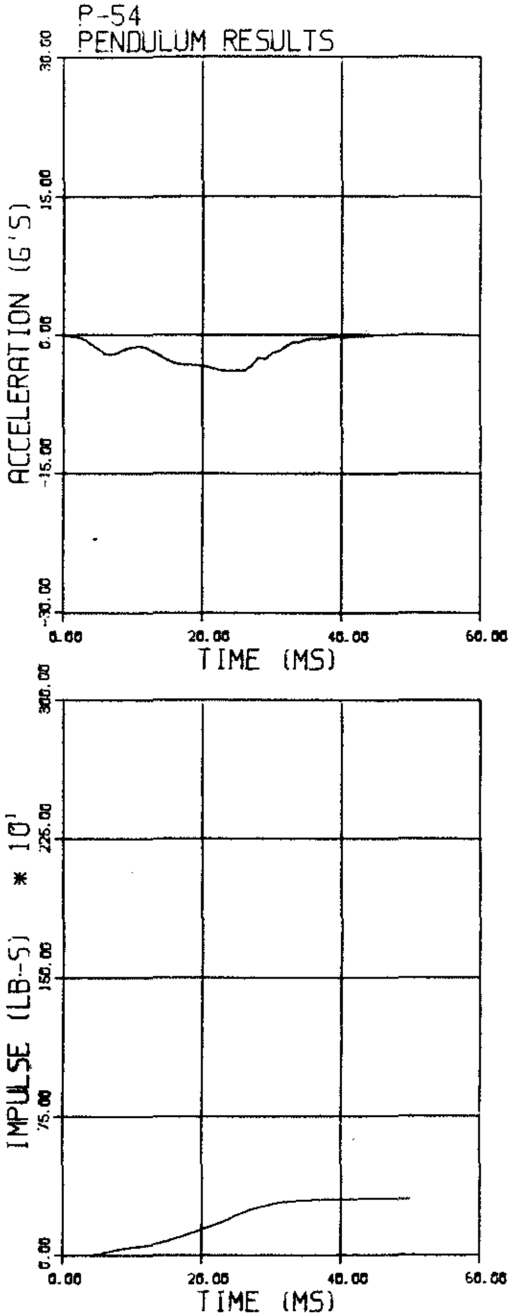
Post 51 - Beech



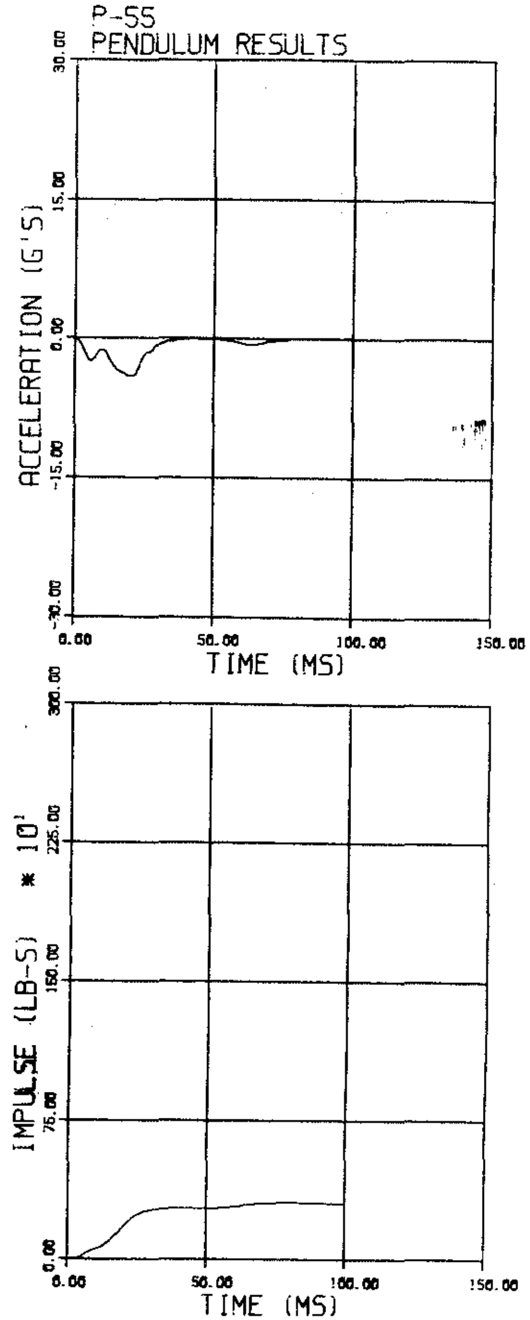
Post 52 - White Ash



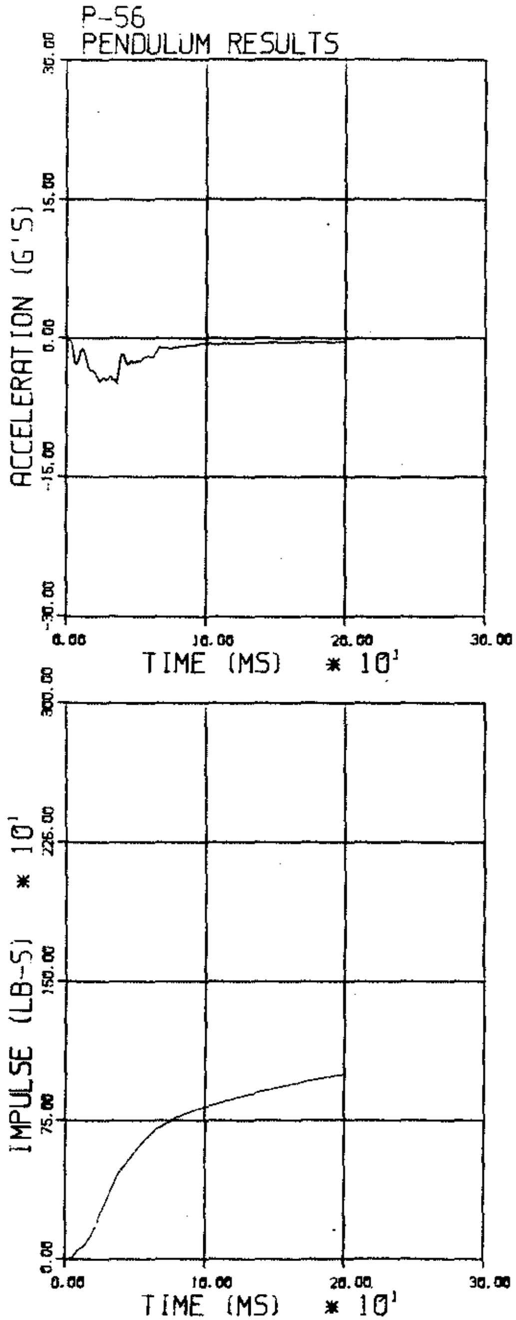
Post 53 - Aspen



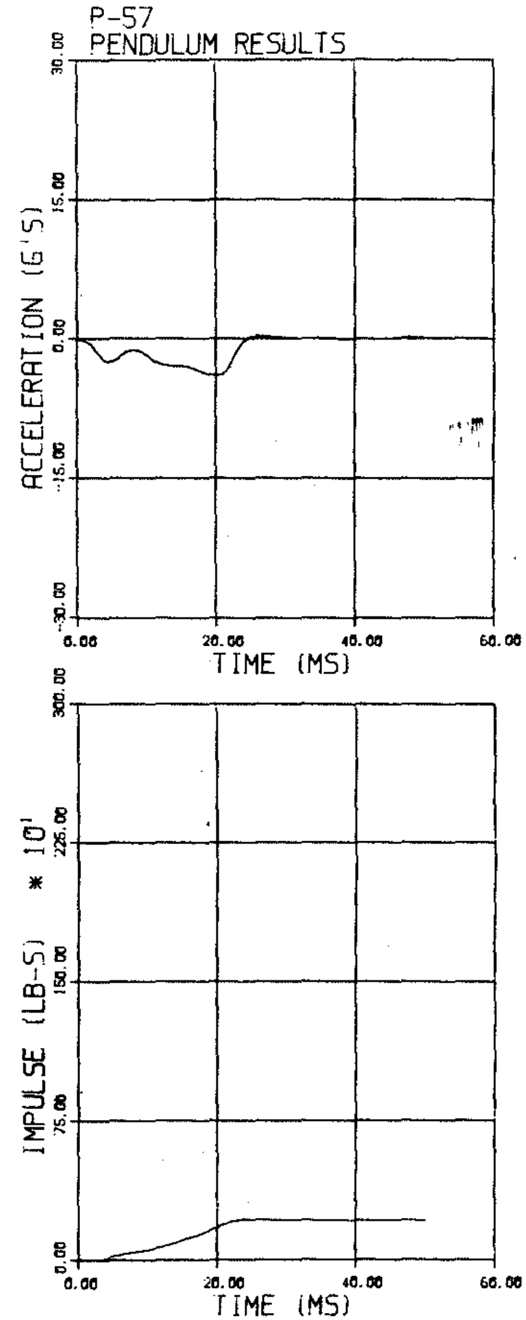
Post 54 - Aspen



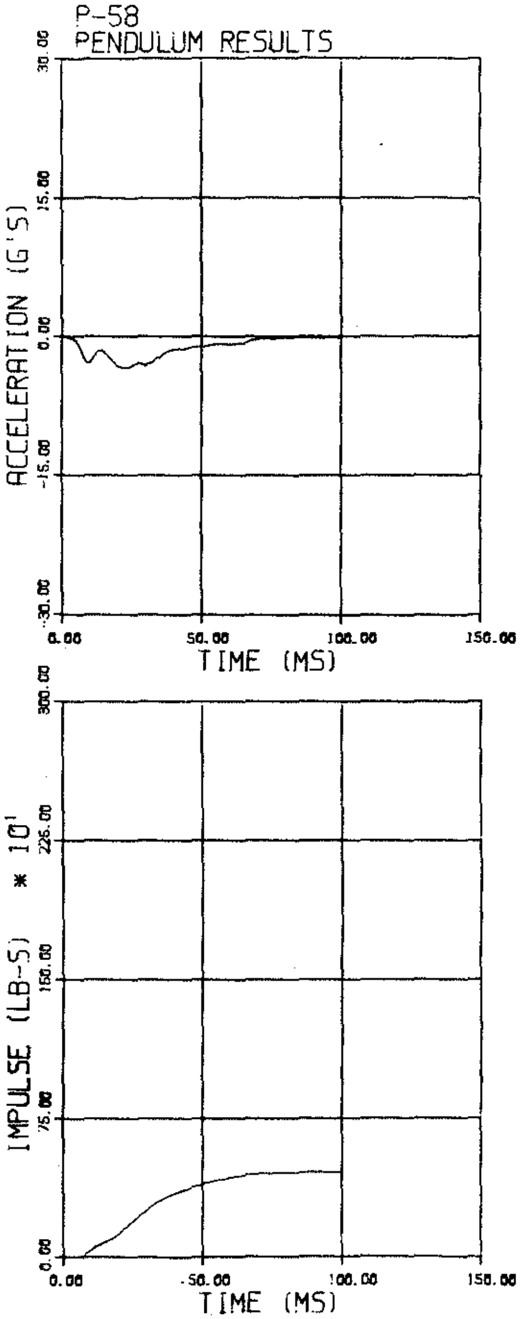
Post 55 - White Ash



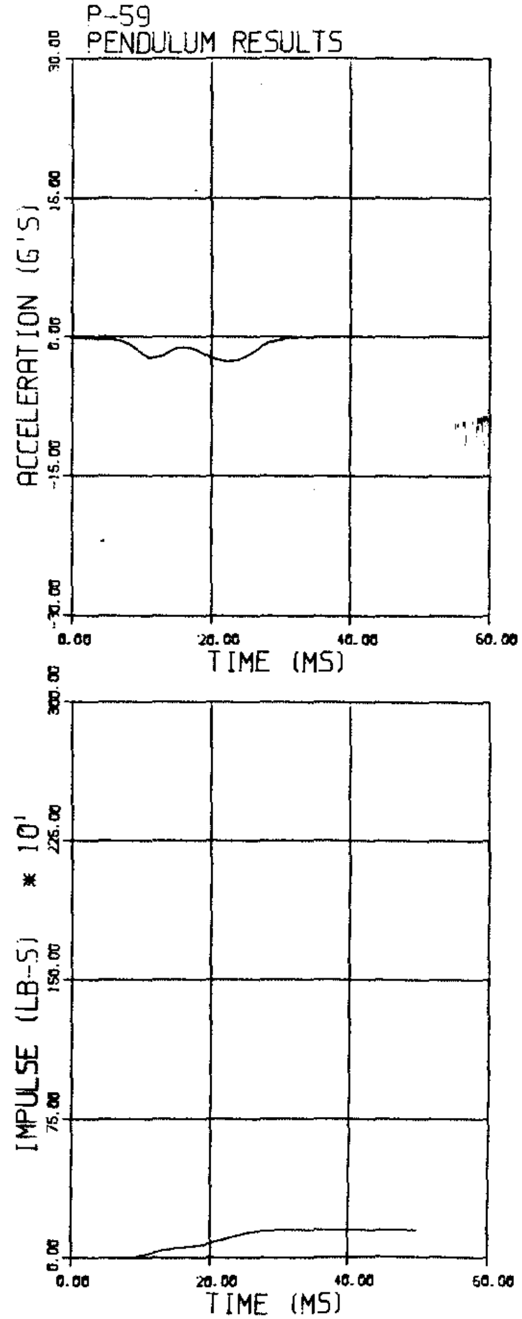
Post 56 - White Ash



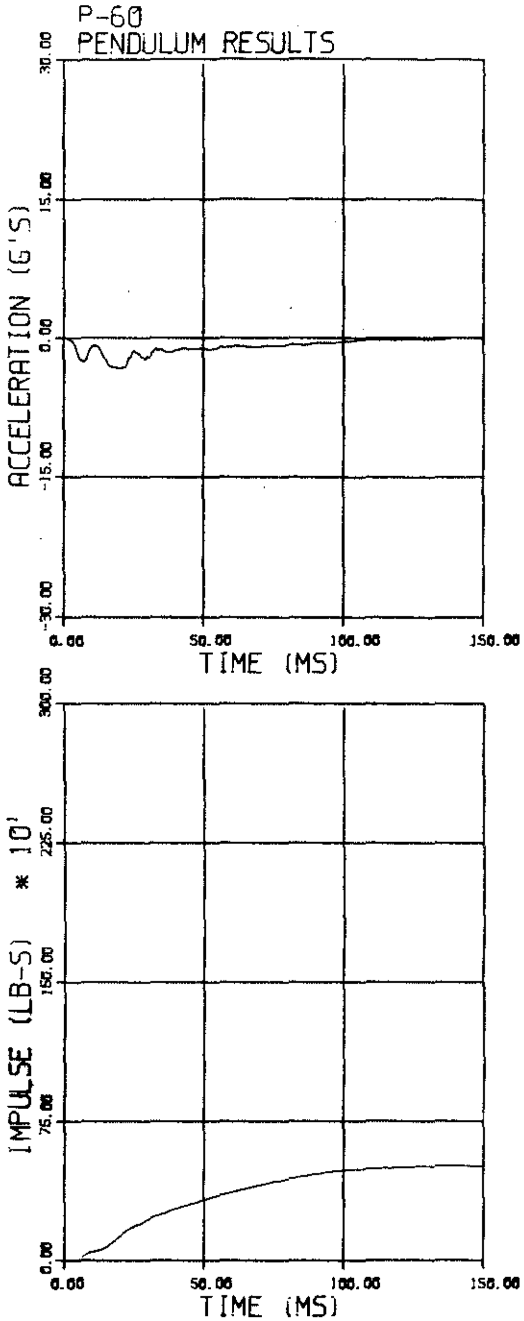
Post 57 - Aspen



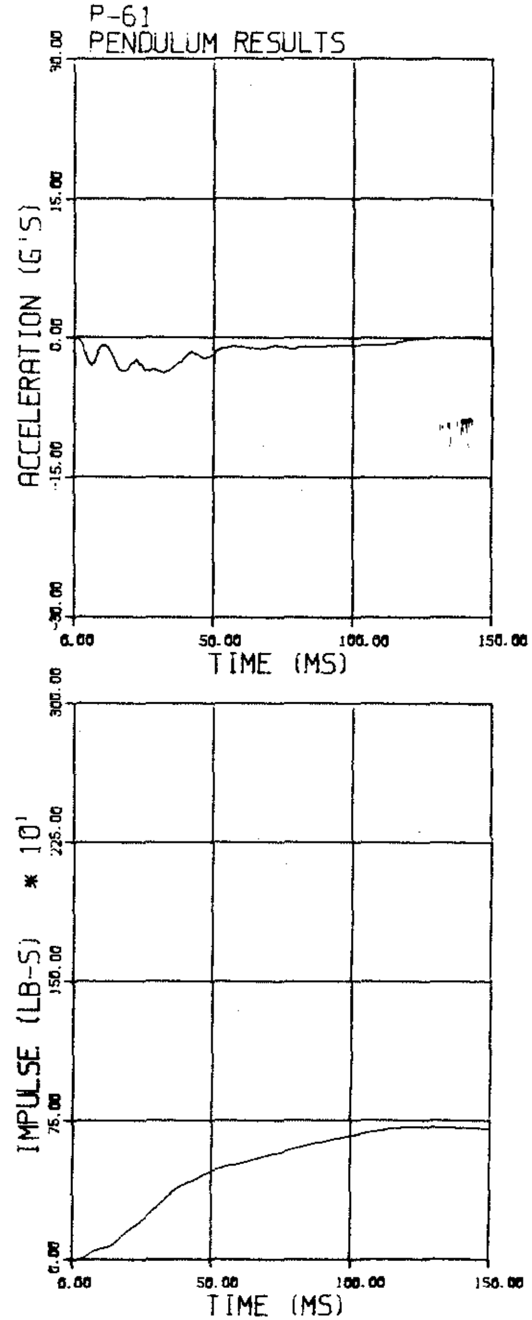
Post 58 - Beech



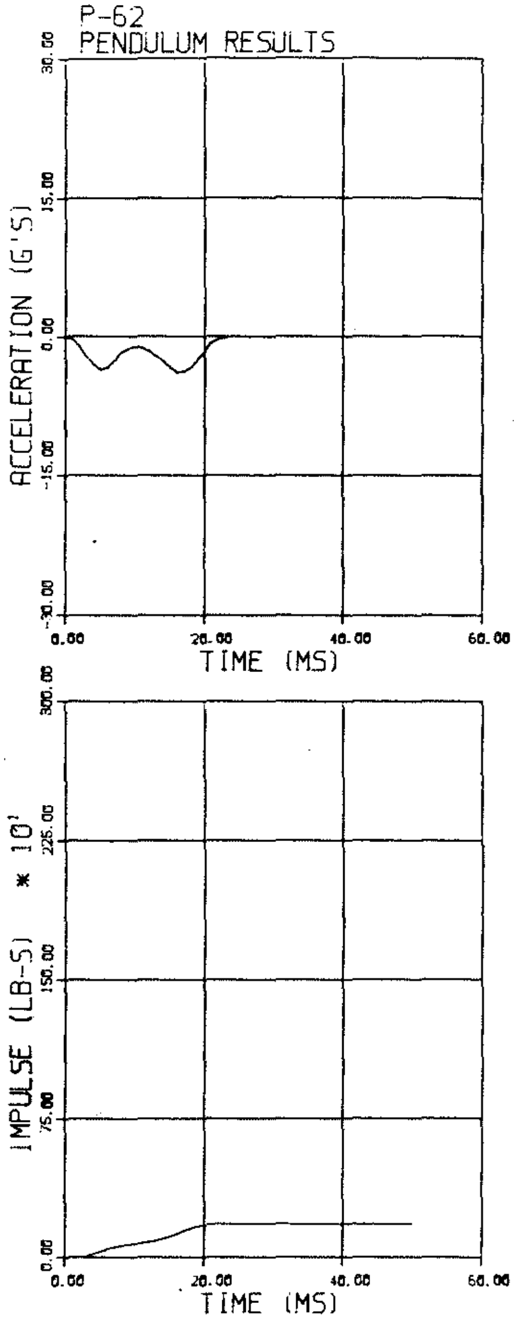
Post 59 - Aspen



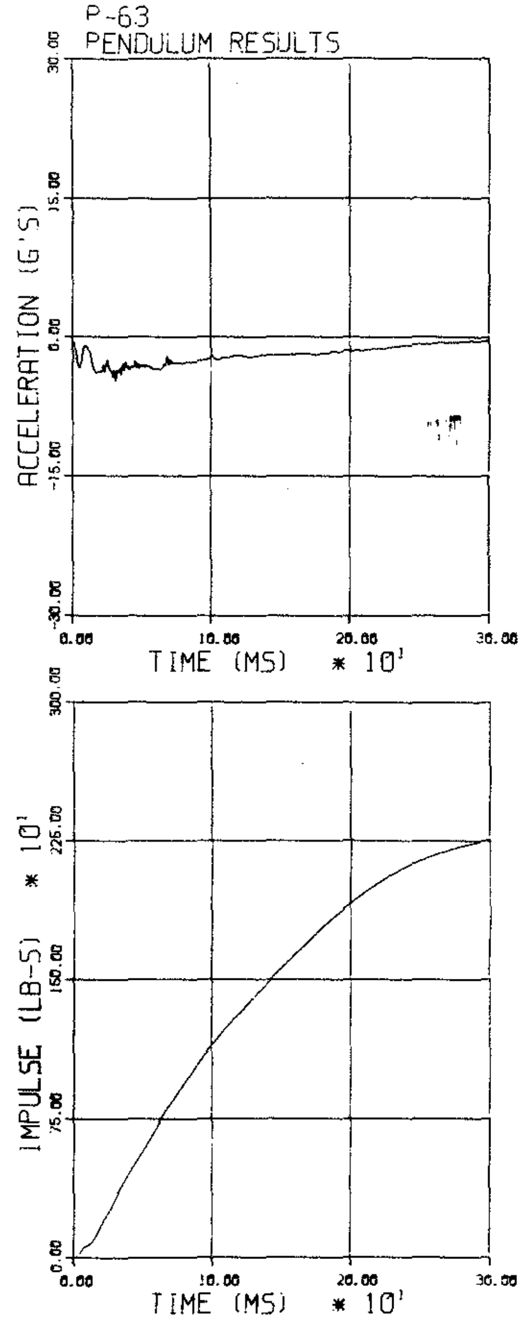
Post 60 - White Ash



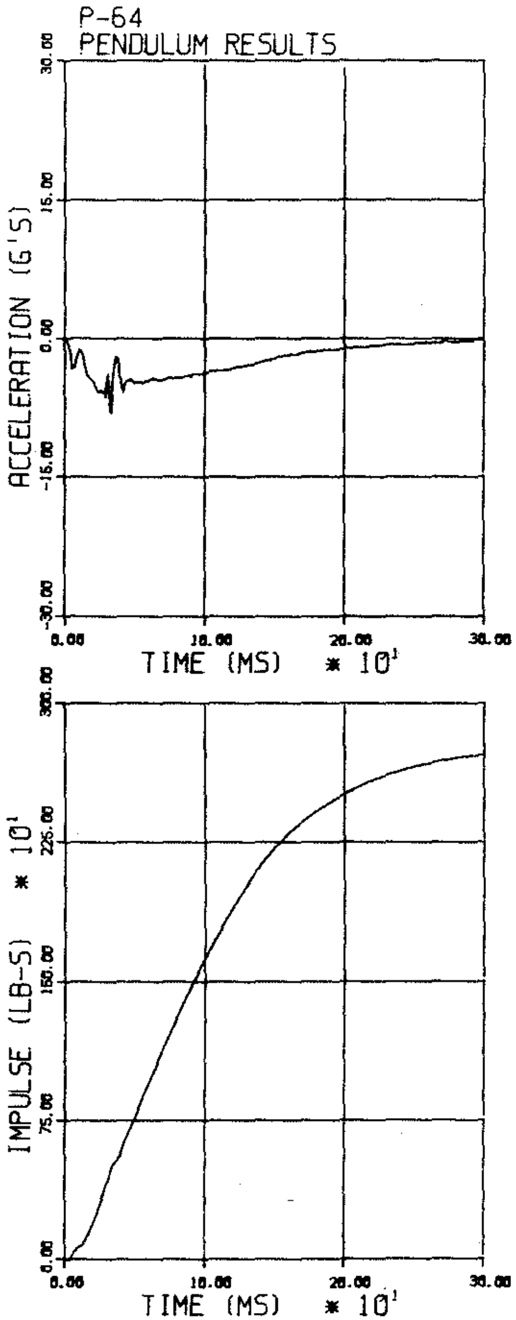
Post 61 - White Ash



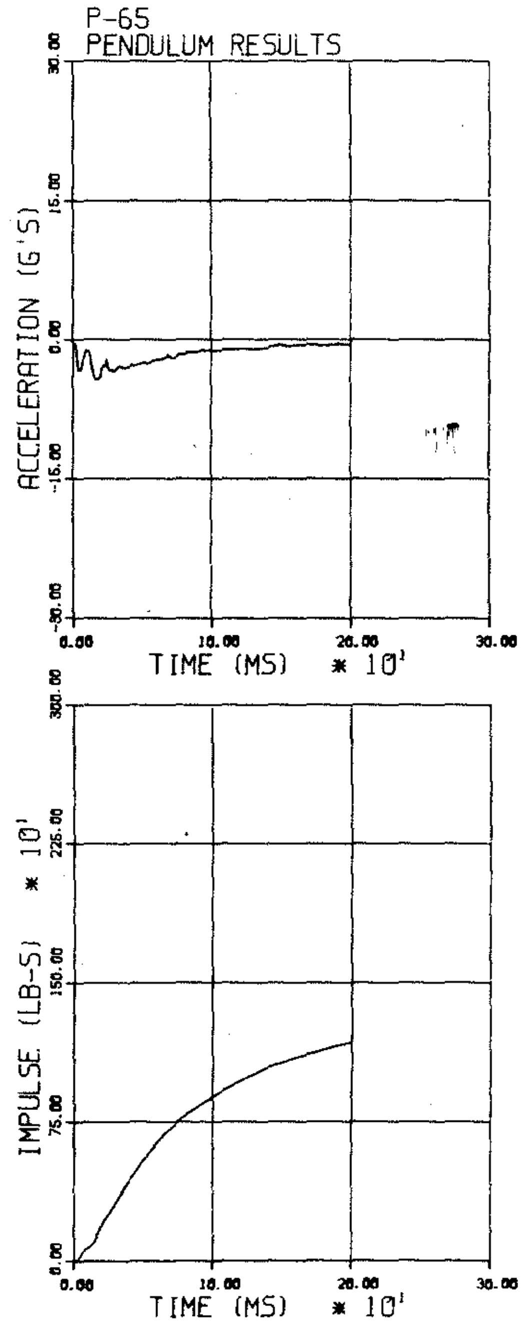
Post 62 - Elm



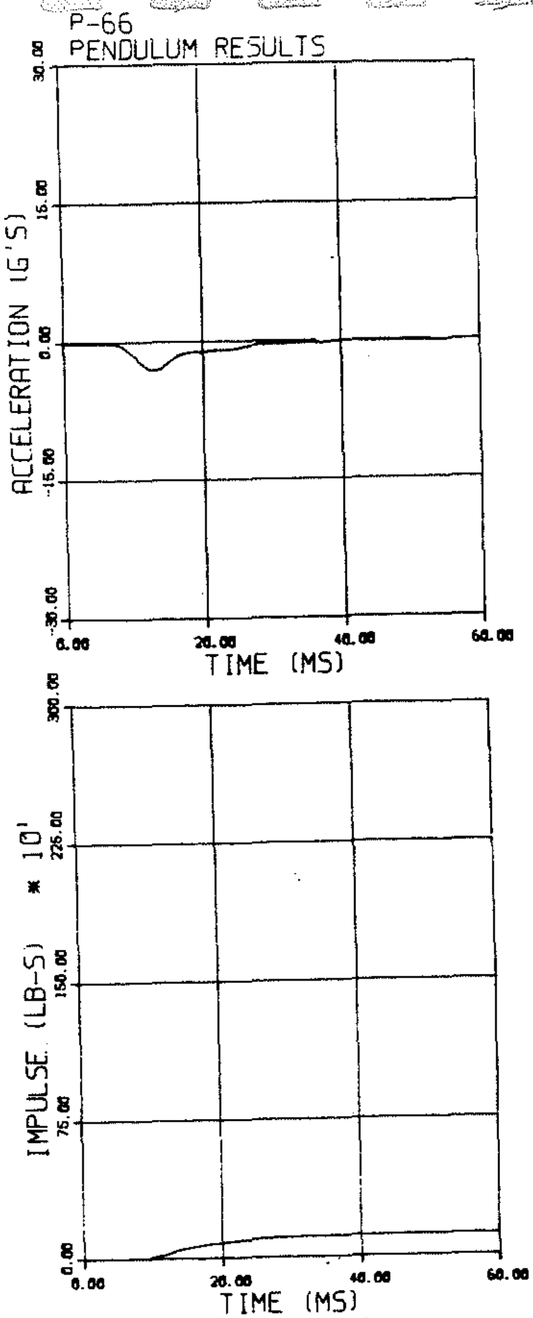
Post 63 - Elm



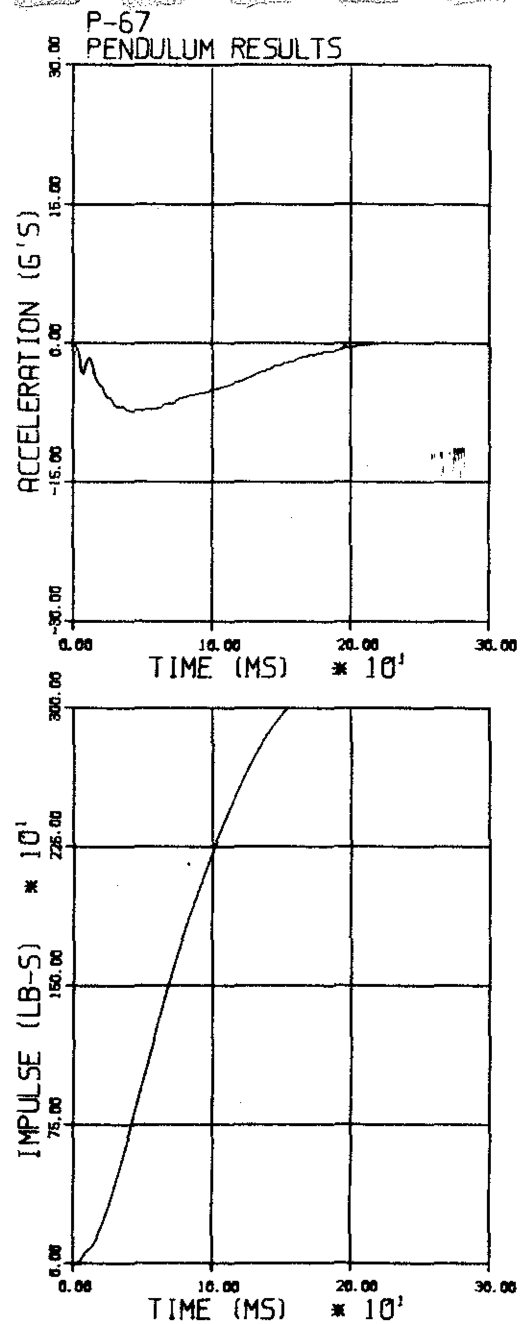
Post 64 - Elm



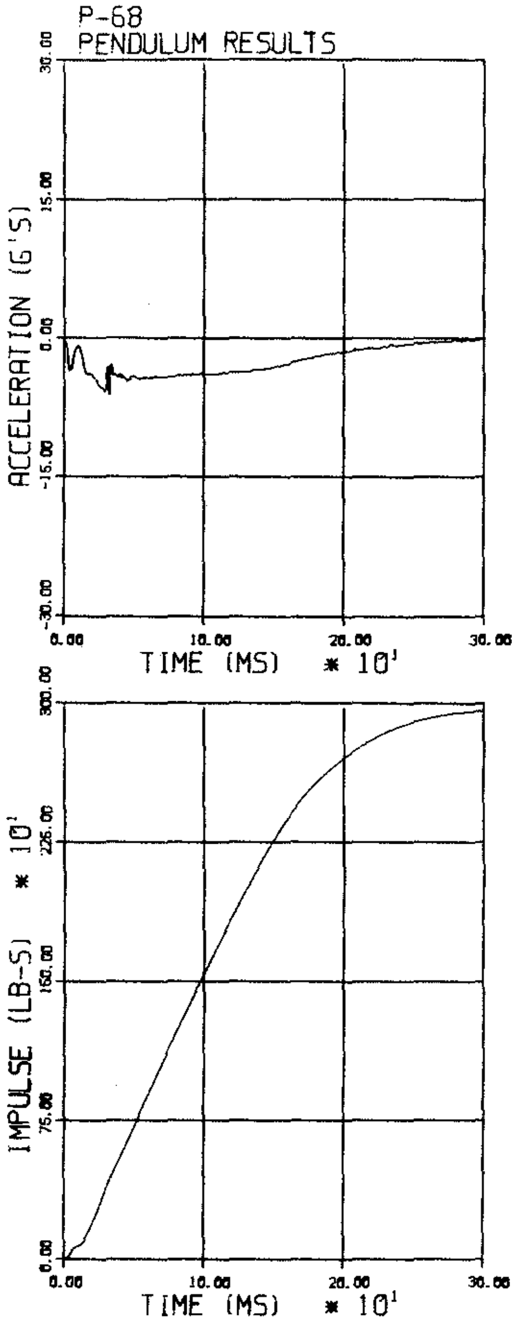
Post 65 - Elm



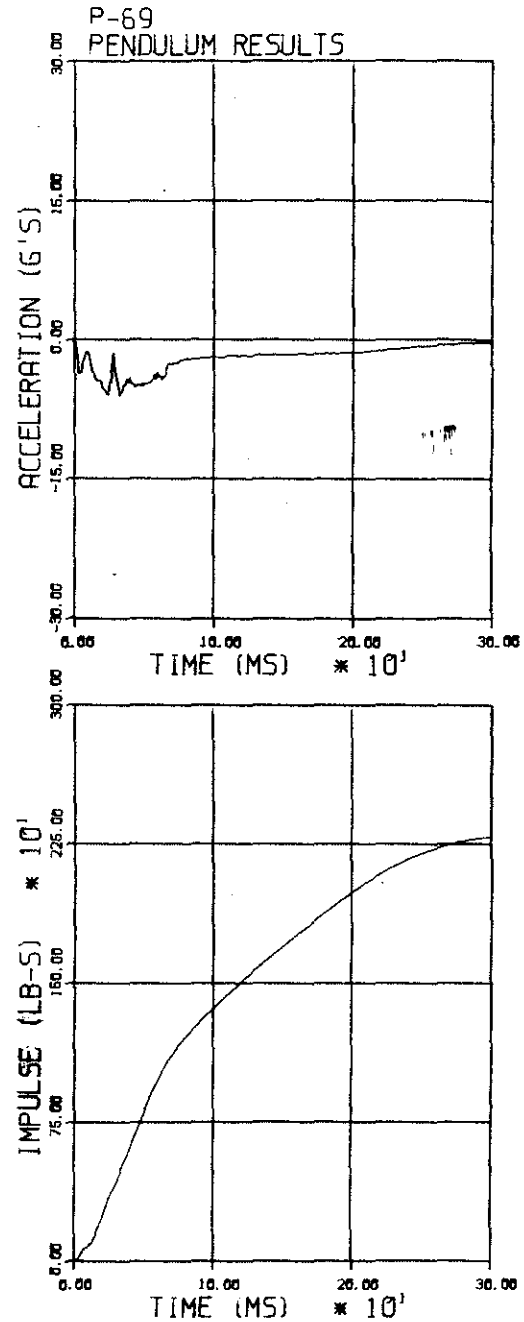
Post 66 - Elm



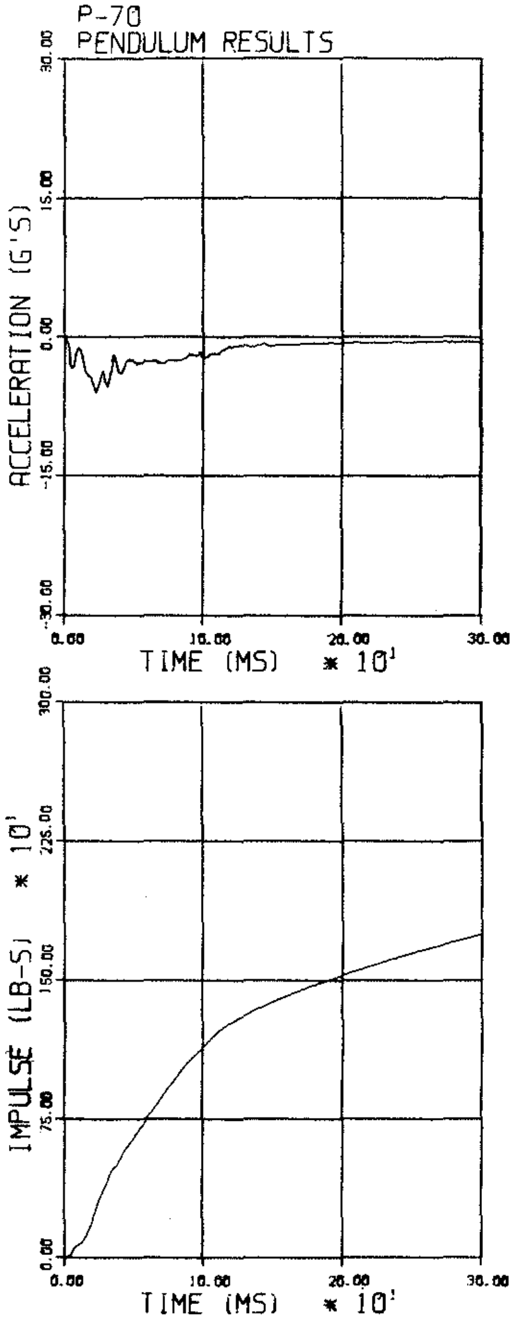
Post 67 - Elm



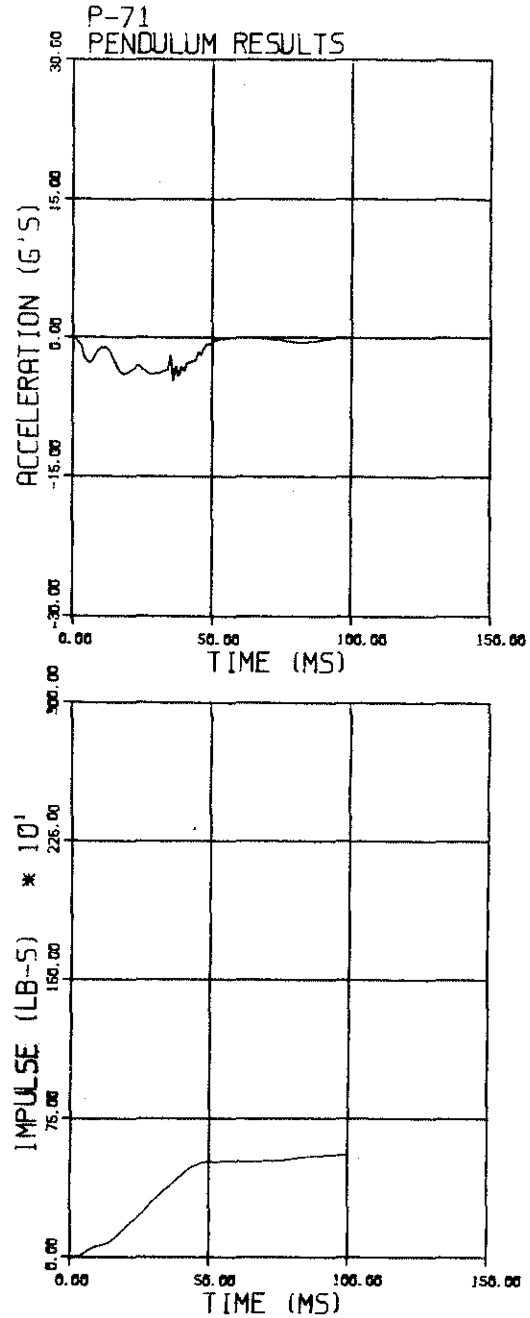
Post 68 - Elm



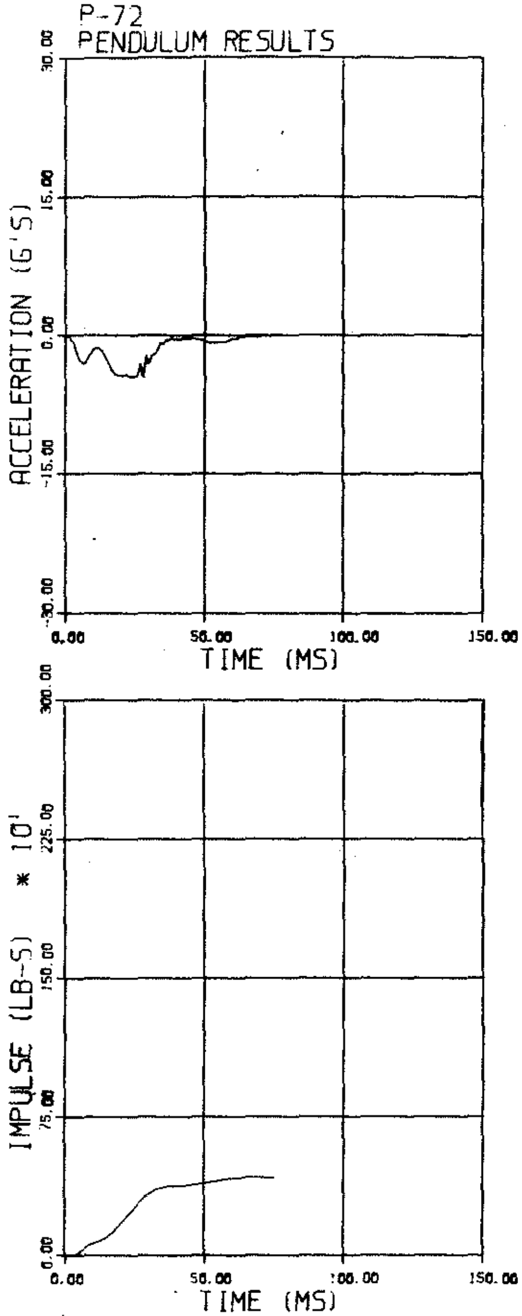
Post 69 - Elm



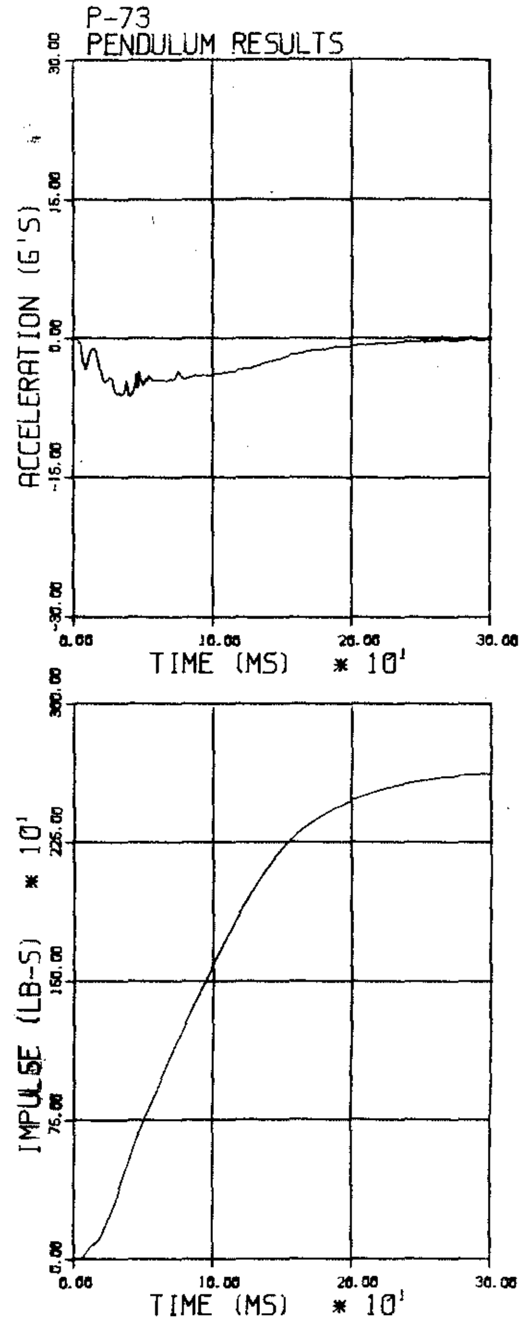
Post 70 - Elm



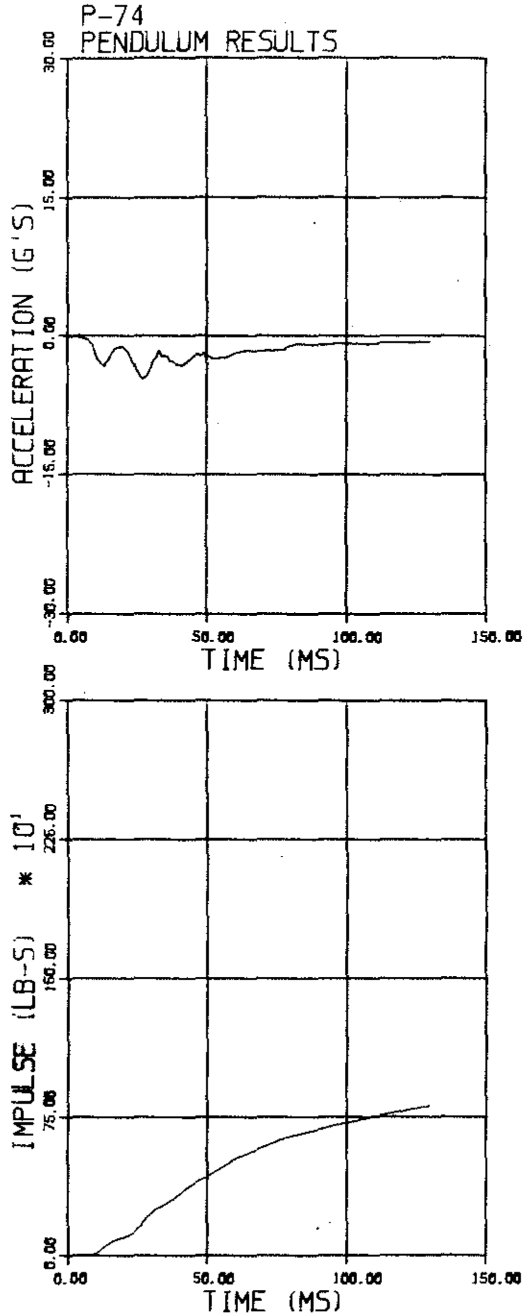
Post 71 - Elm



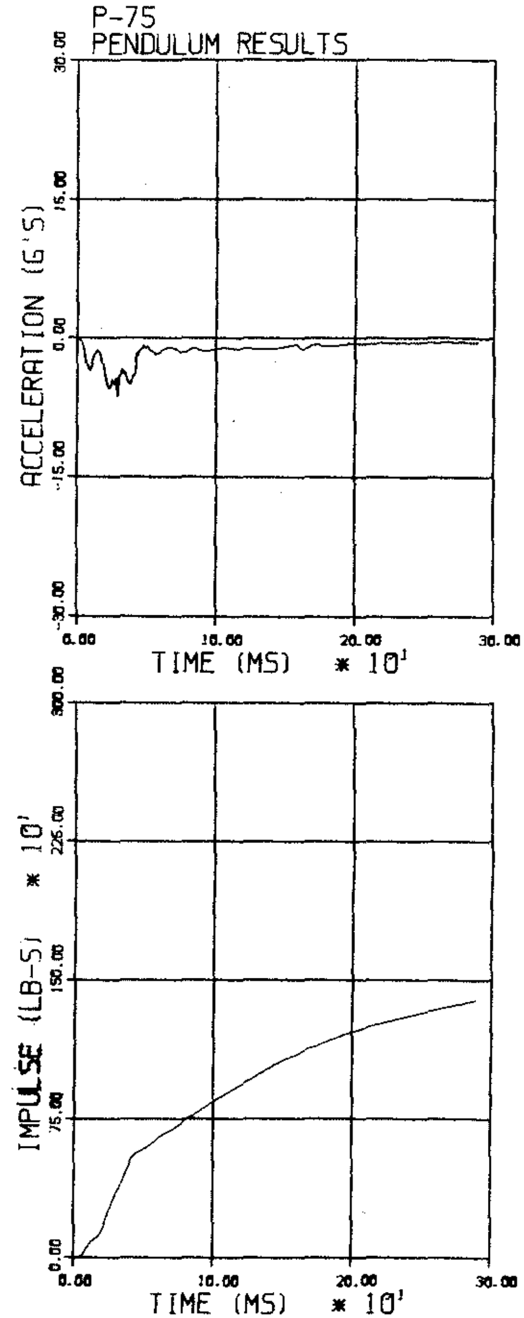
Post 72 - Elm



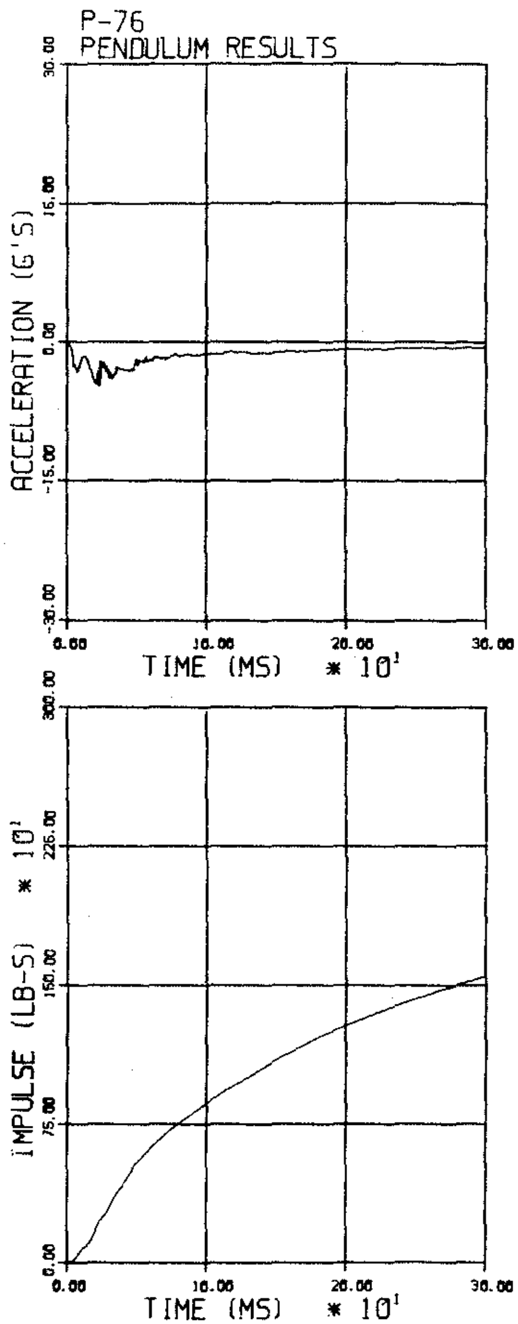
Post 73 - Elm



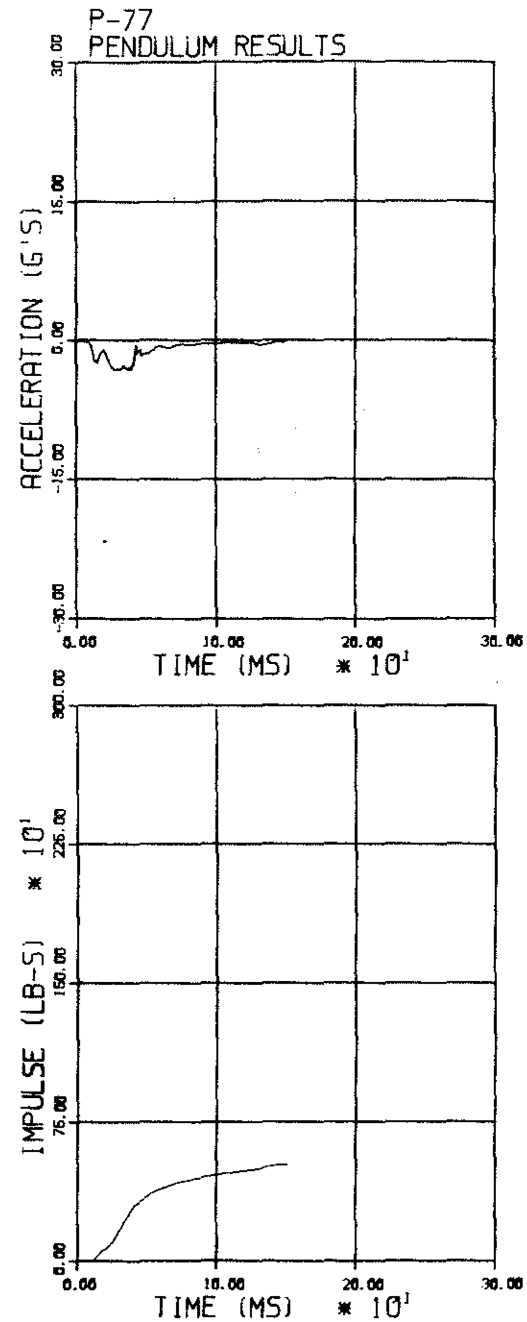
Post 74 - Yellow Birch



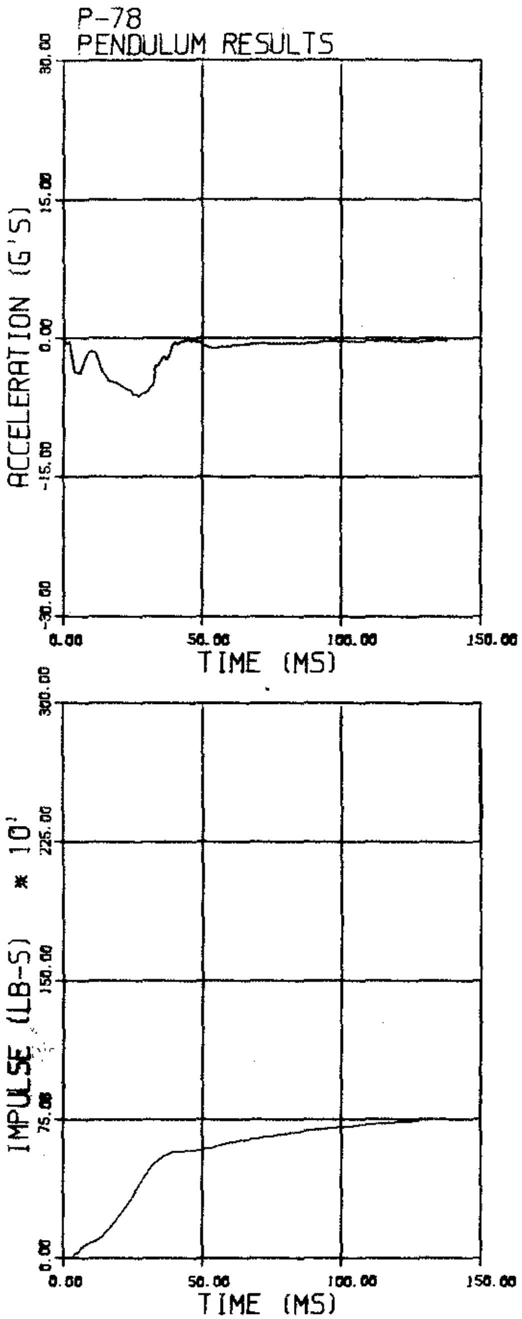
Post 75 - Sugar Maple



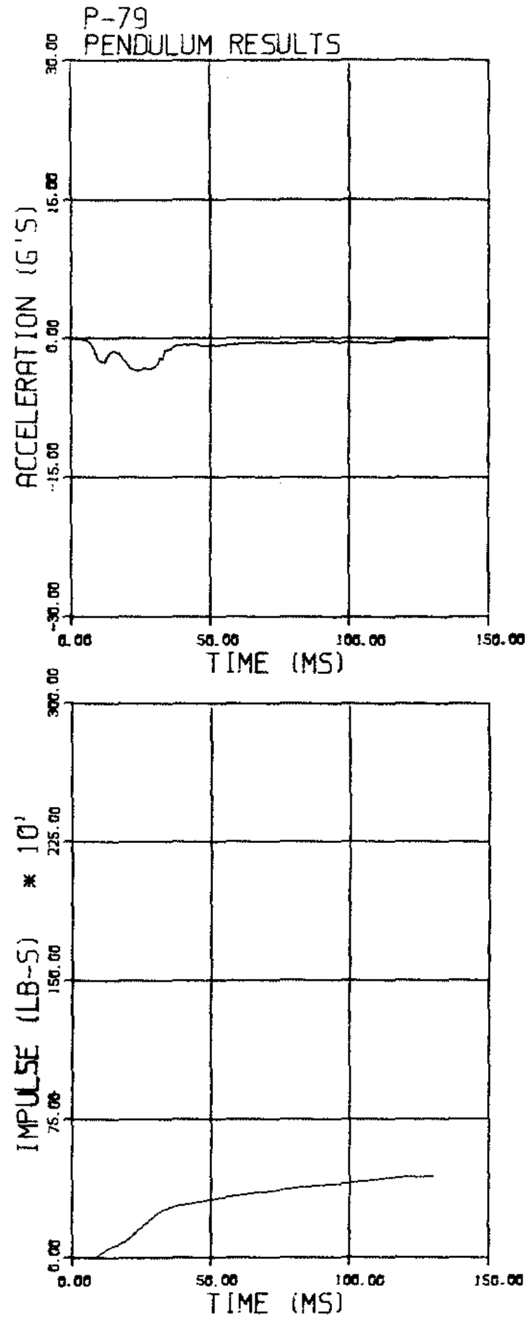
Post 76 - Yellow Birch



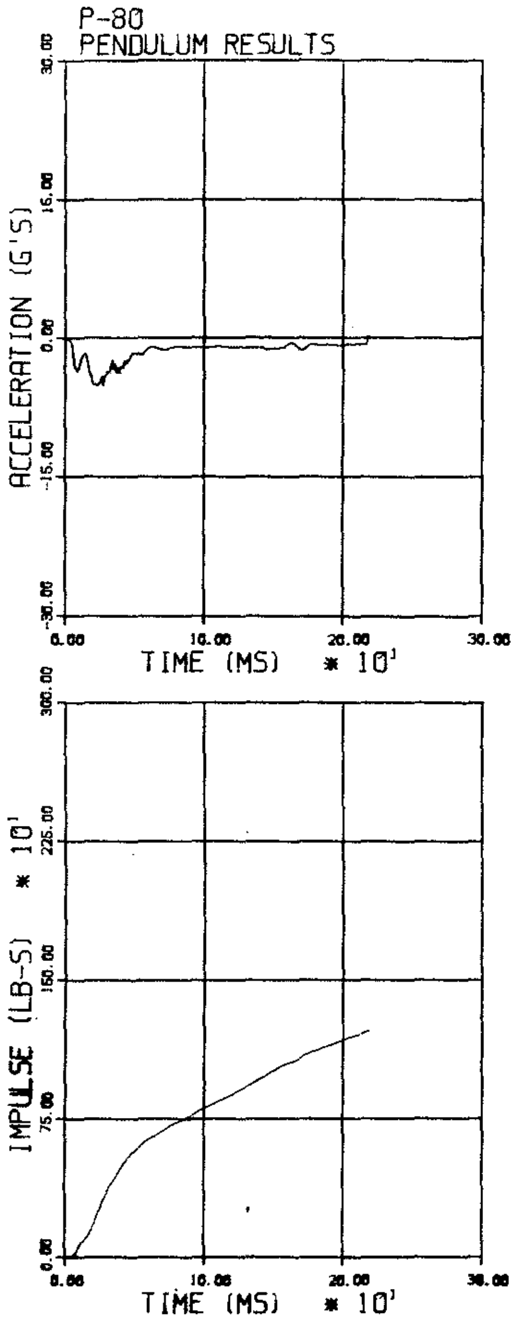
Post 77 - Aspen



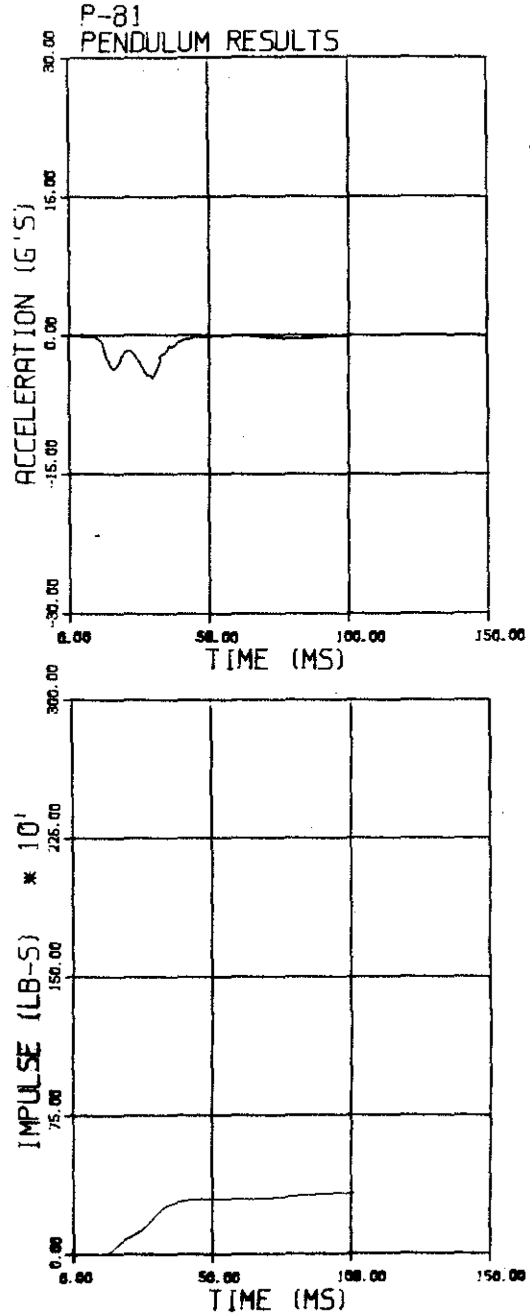
Post 78 - Yellow Birch



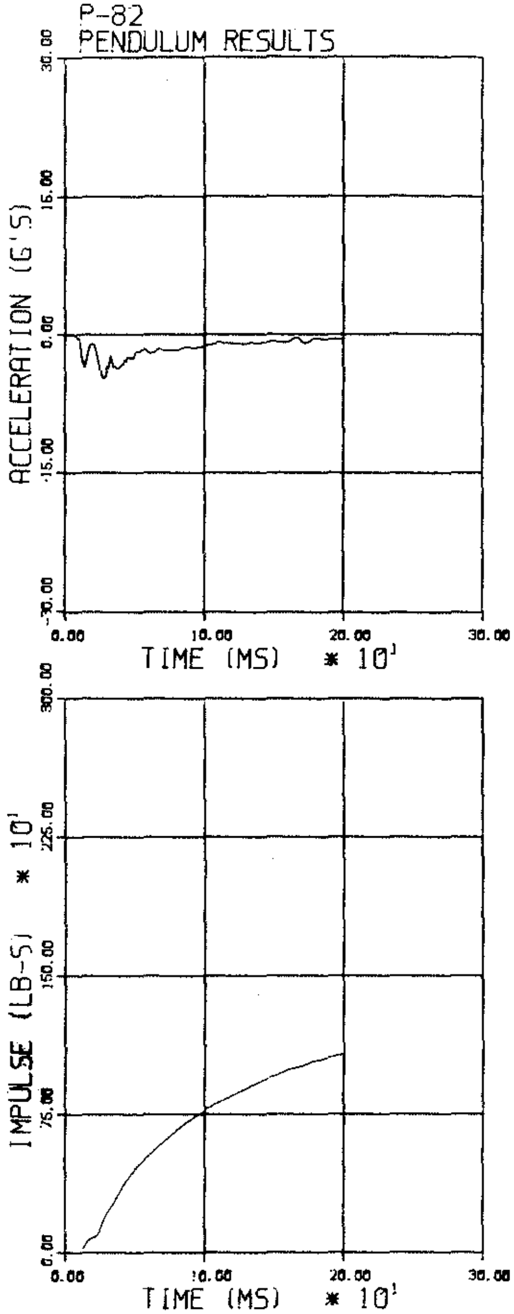
Post 79 - Aspen



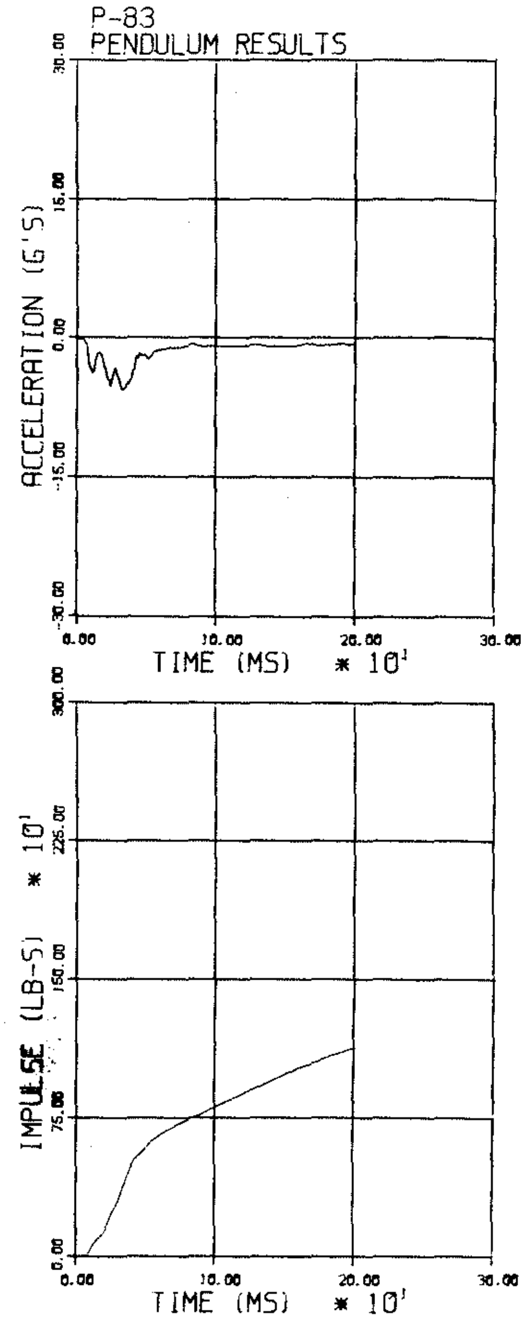
Post 80 - Sugar Maple



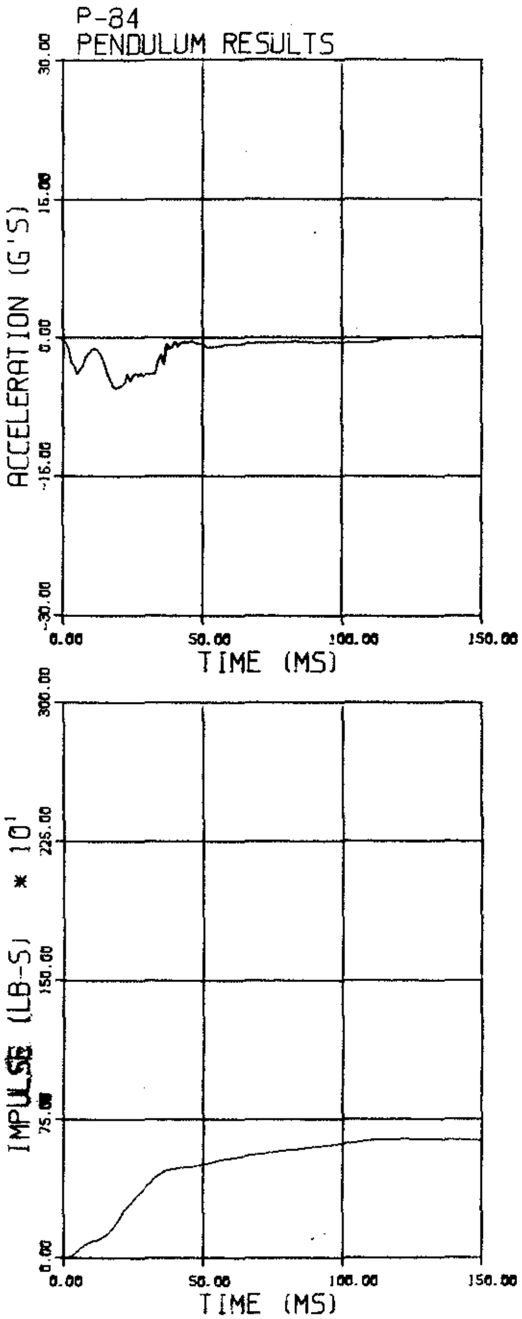
Post 81 - Yellow Birch



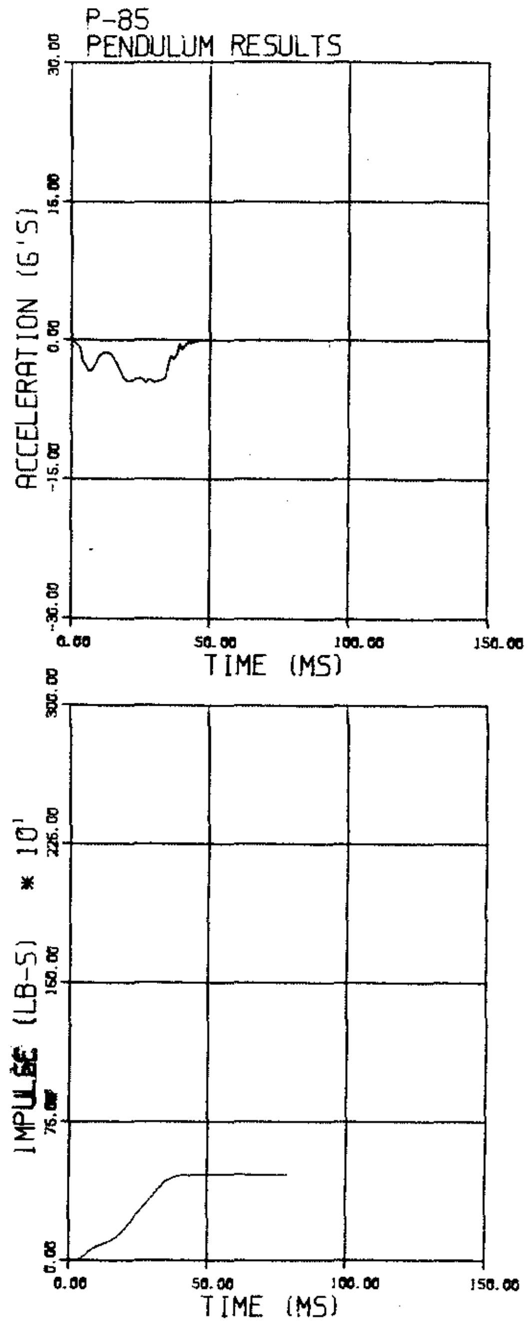
Post 82 - Yellow Birch



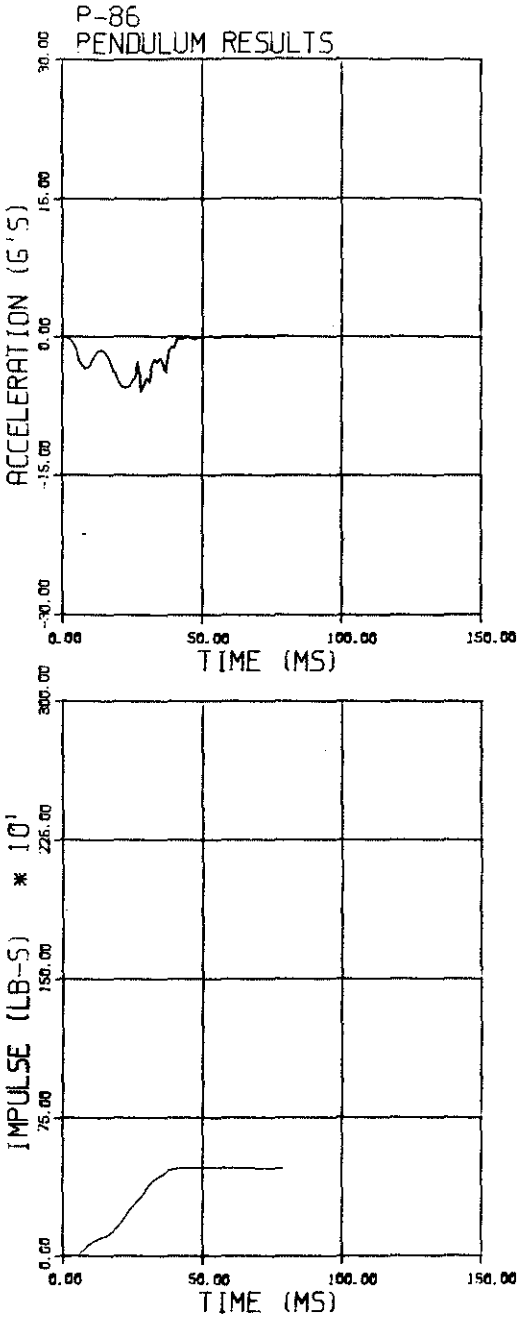
Post 83 - Yellow Birch



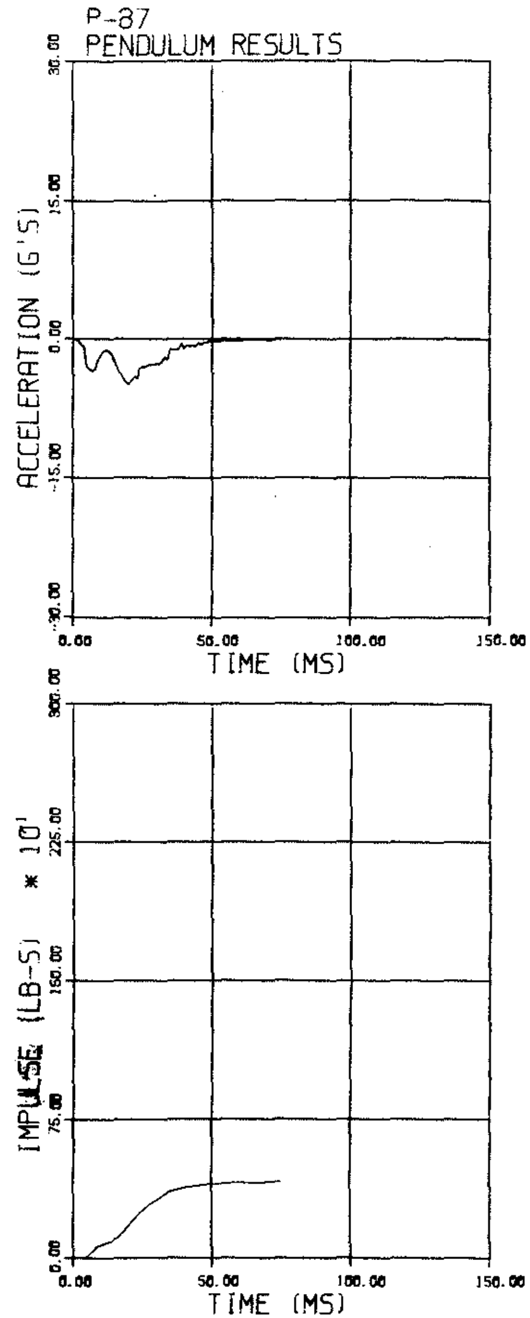
Post 84 - Sugar Maple



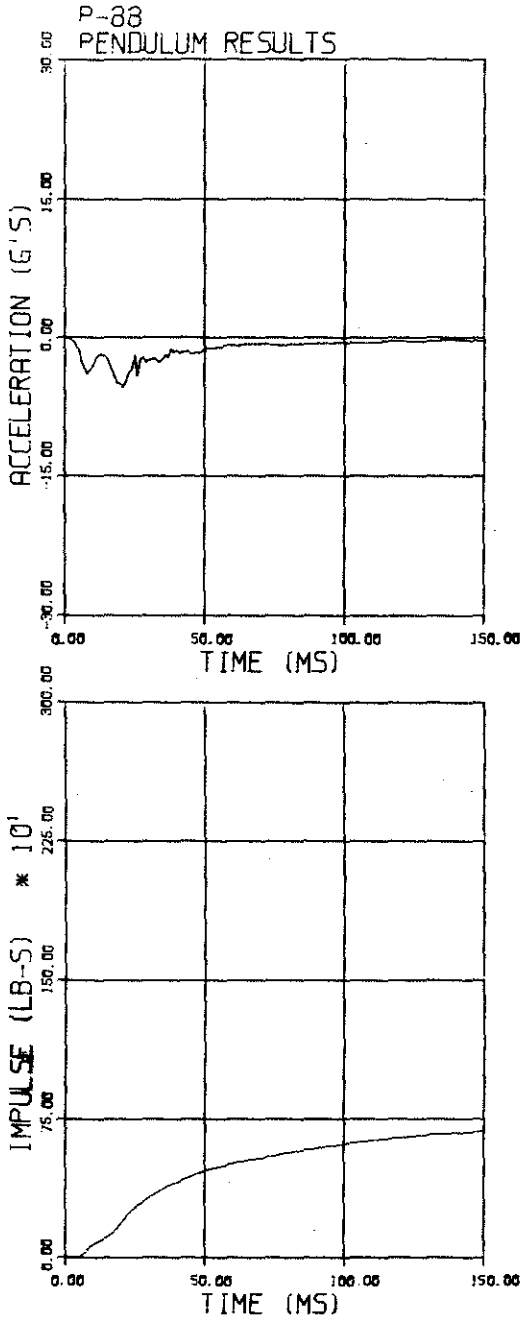
Post 85 - Yellow Birch



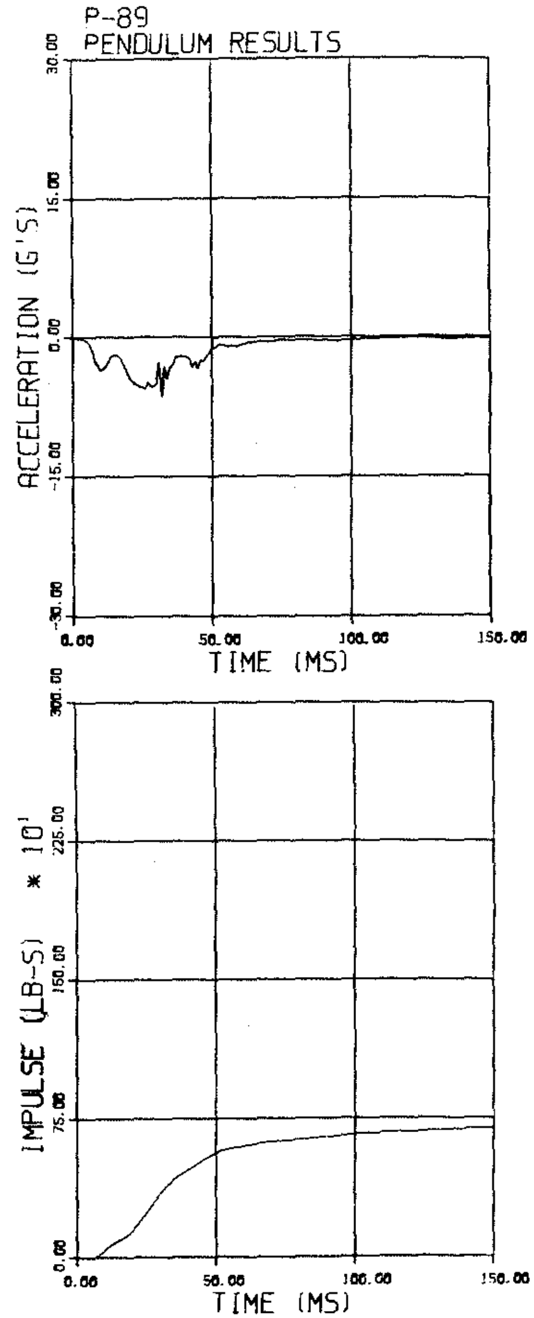
Post 86 - Sugar Maple



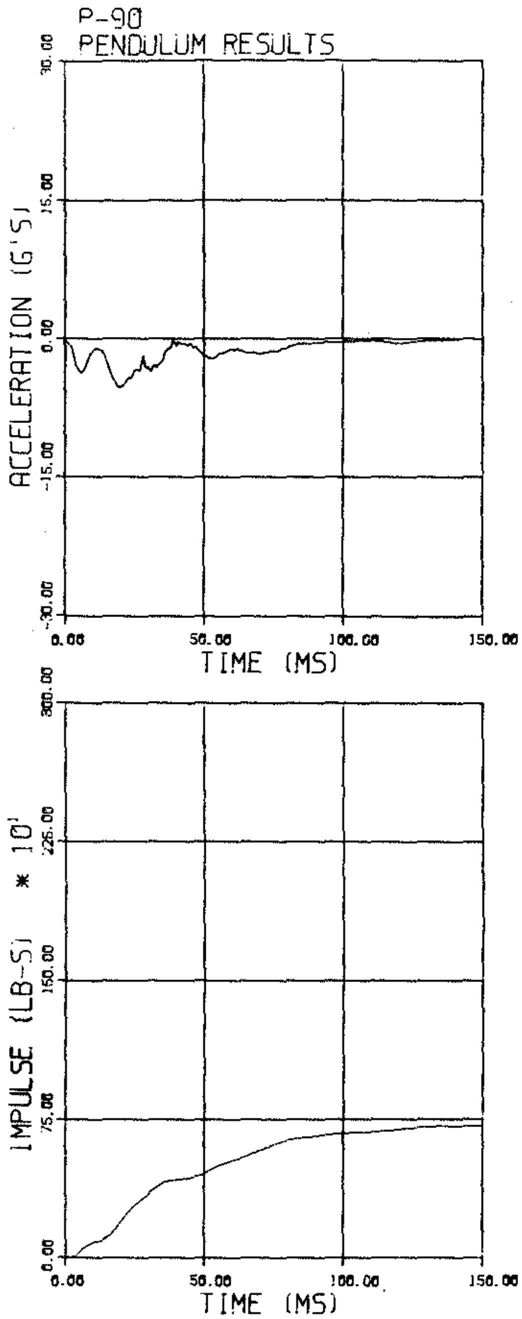
Post 87 - Yellow Birch



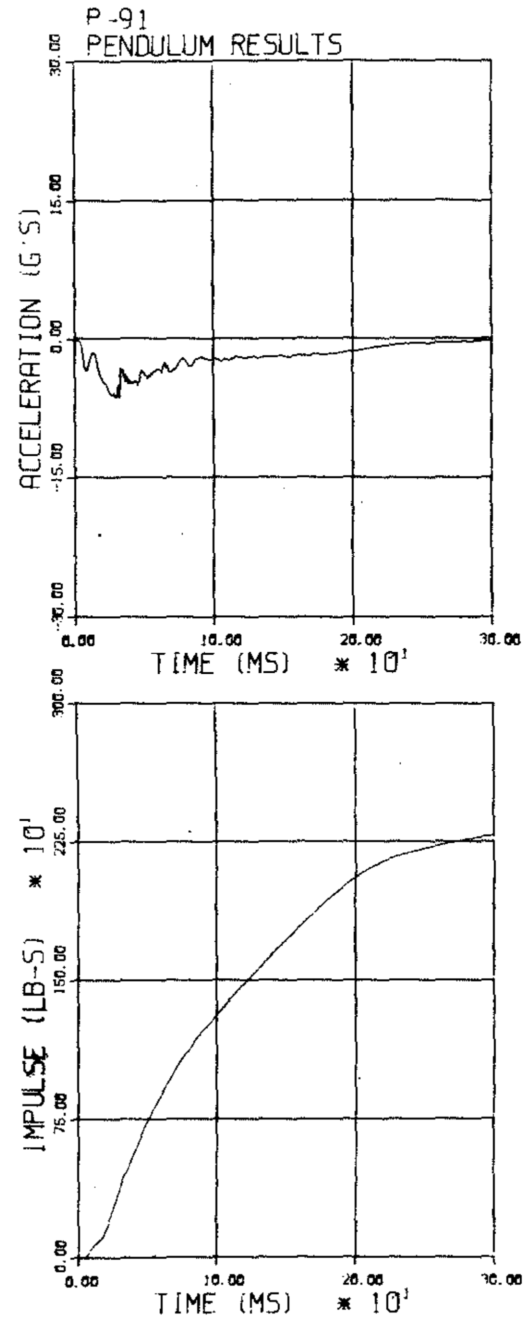
Post 88 - Sugar Maple



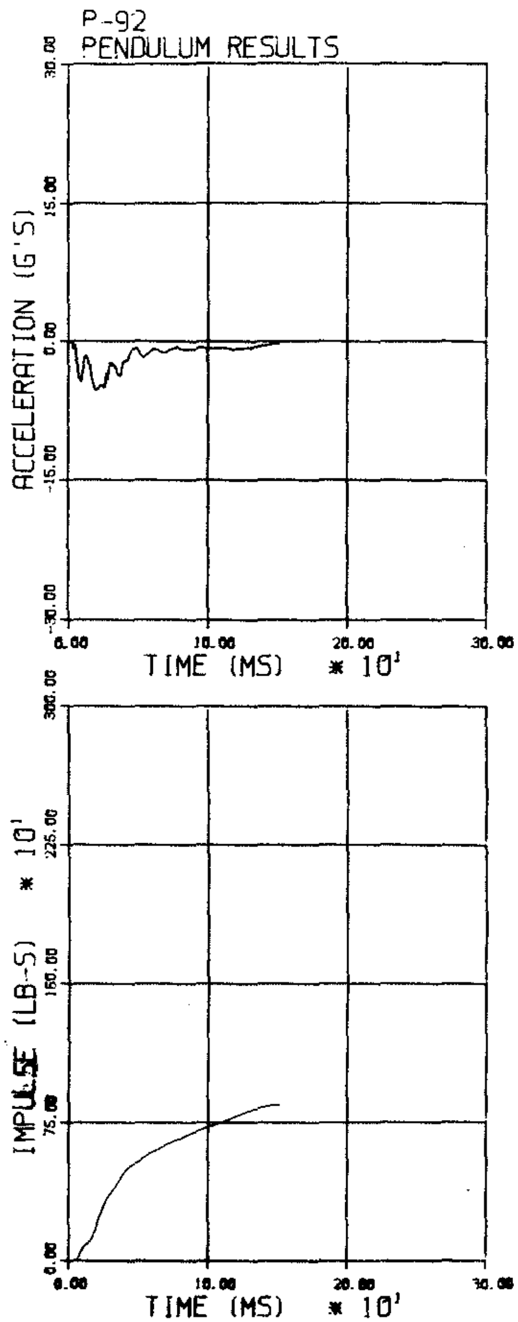
Post 89 - Yellow Birch



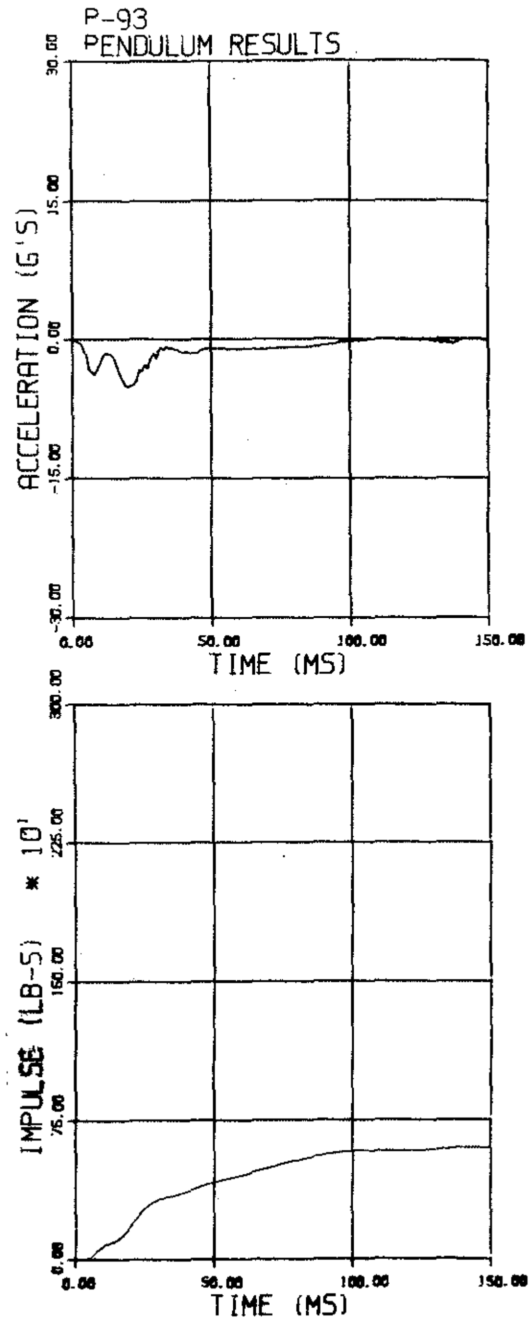
Post 90 - Yellow Birch



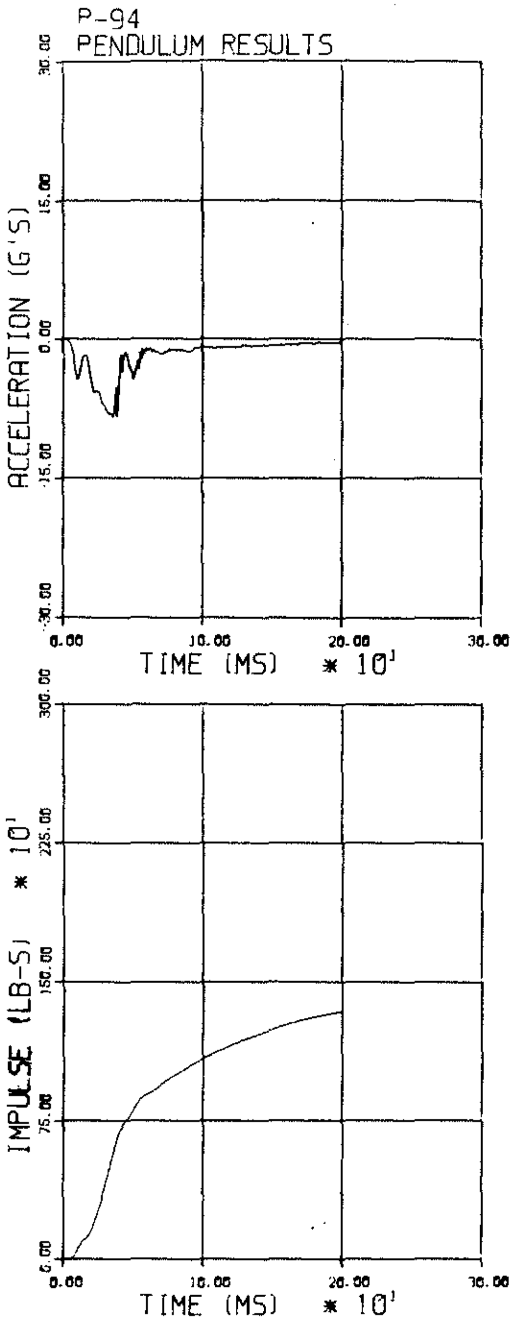
Post 91 - Sugar Maple



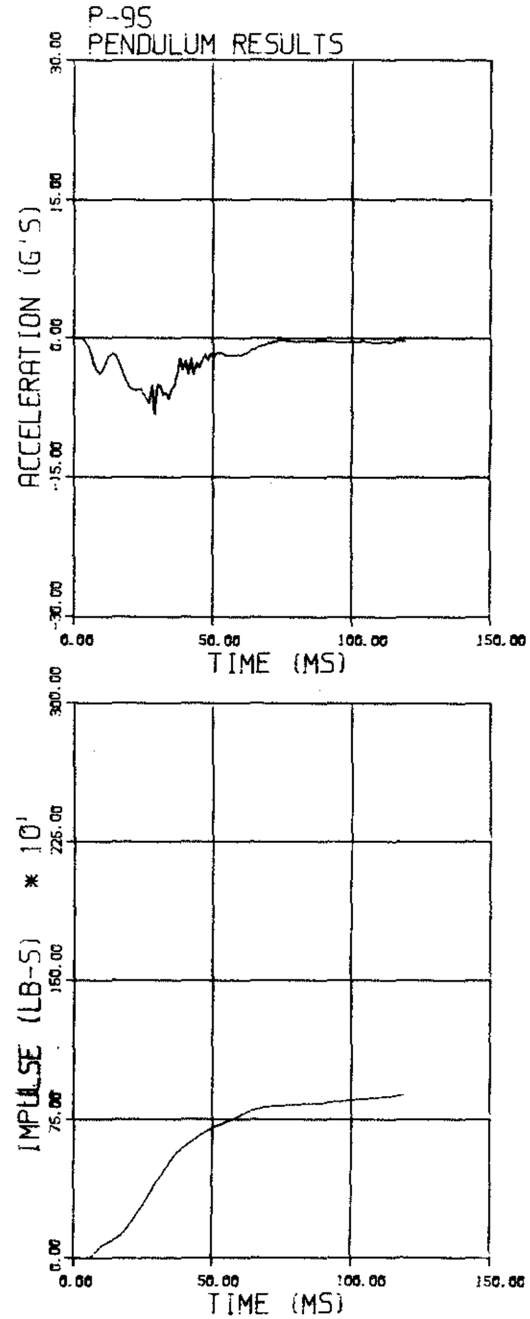
Post 92 - Sugar Maple



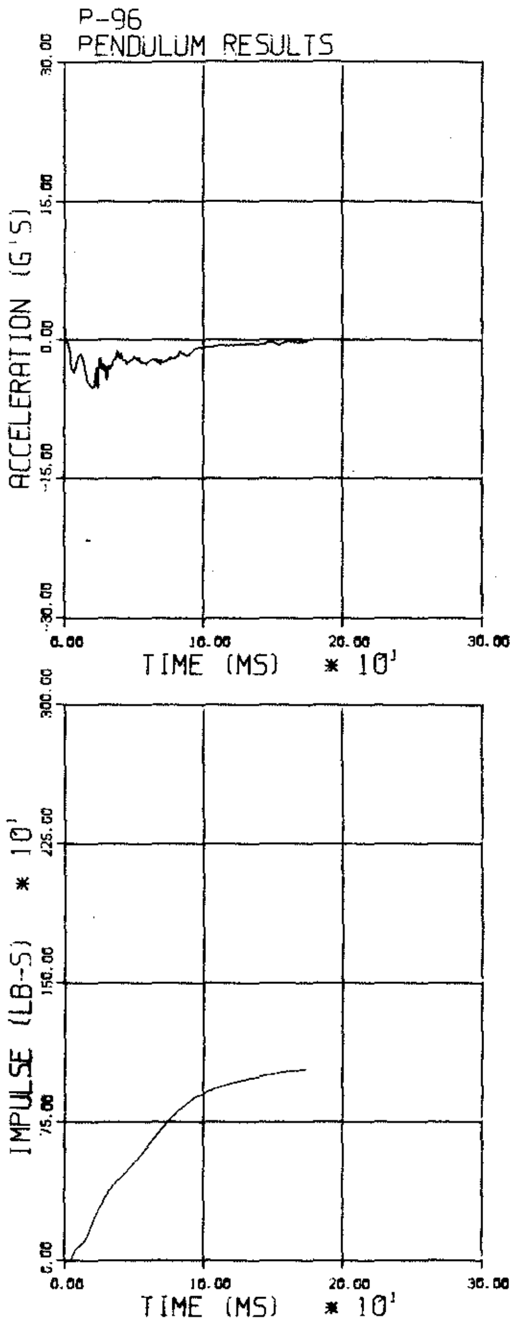
Post 93 - Sugar Maple



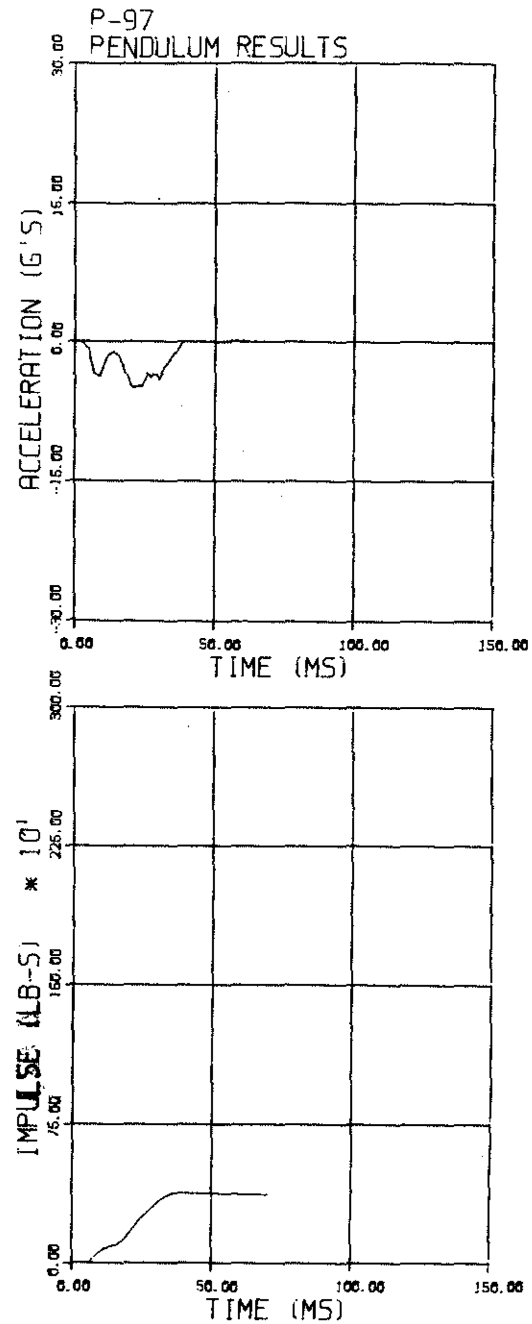
Post 94 - Sugar Maple



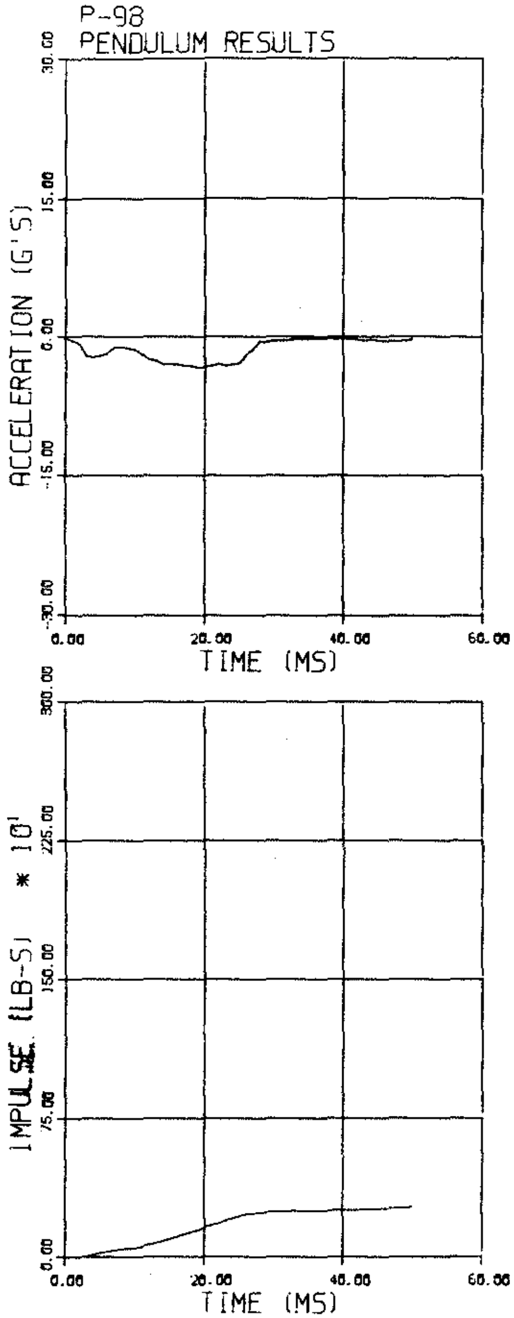
Post 95 - Sugar Maple



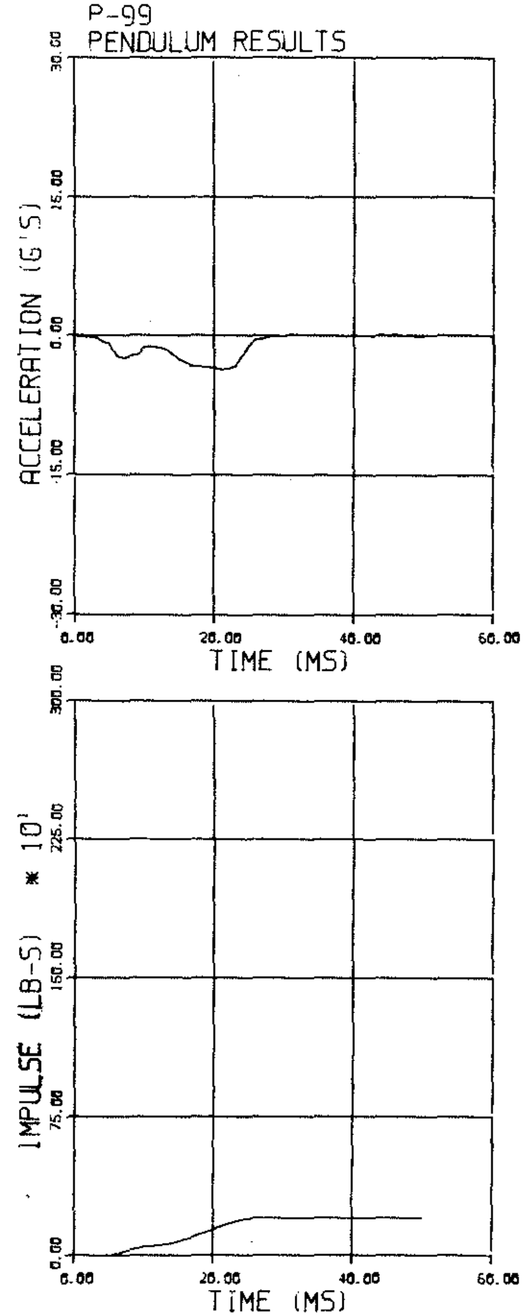
Post 96 - Sugar Maple



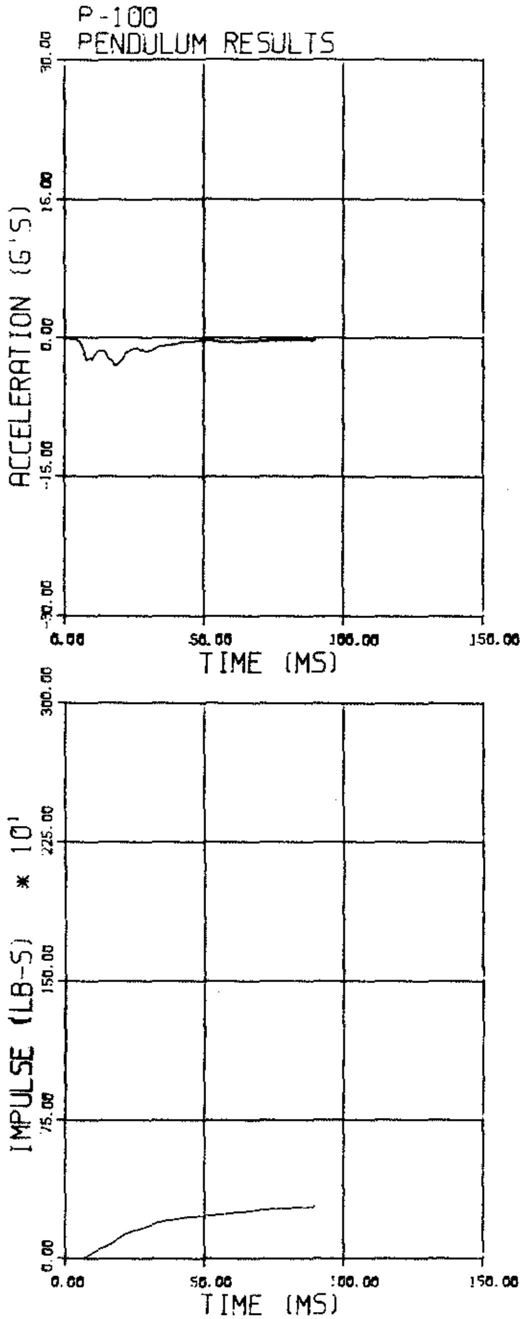
Post 97 - Sugar Maple



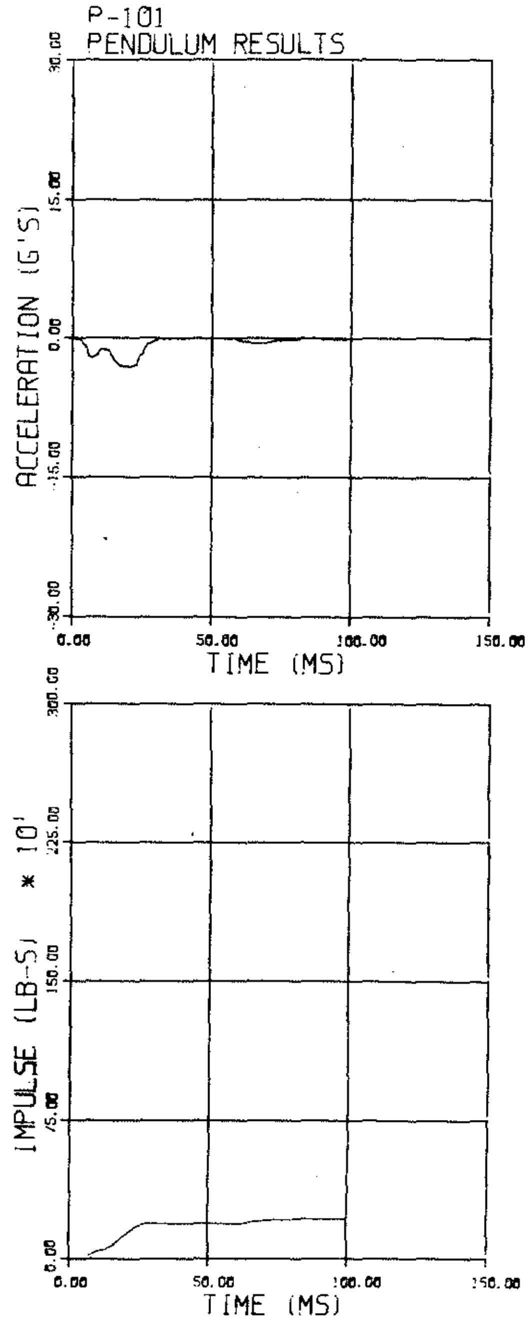
Post 98 - Hemlock



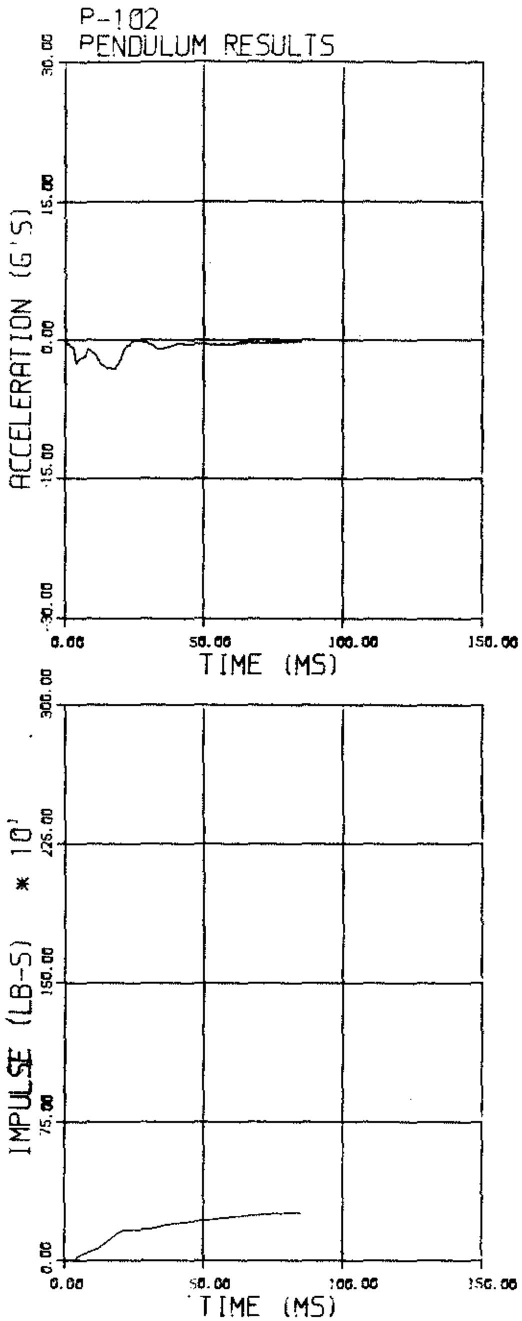
Post 99 - Hemlock



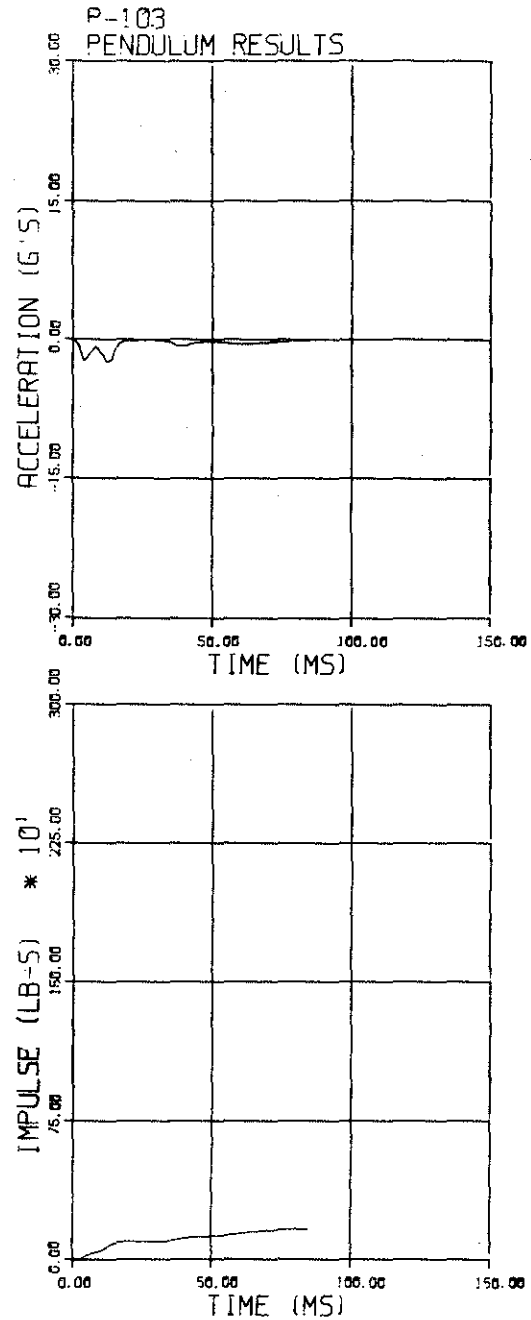
Post 100 - Hemlock



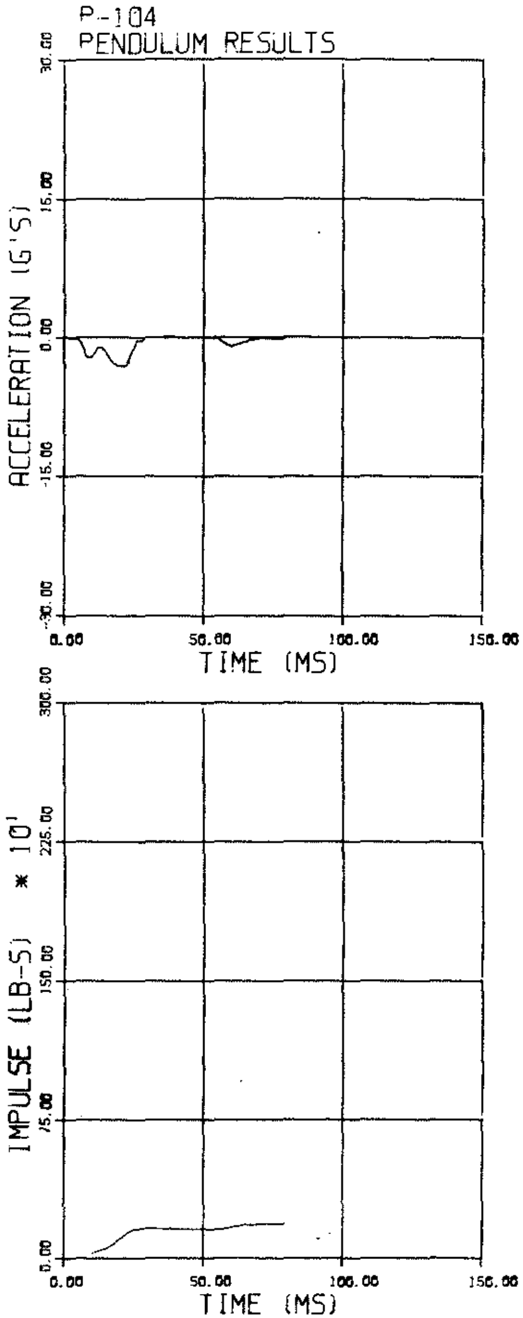
Post 101 - Hemlock



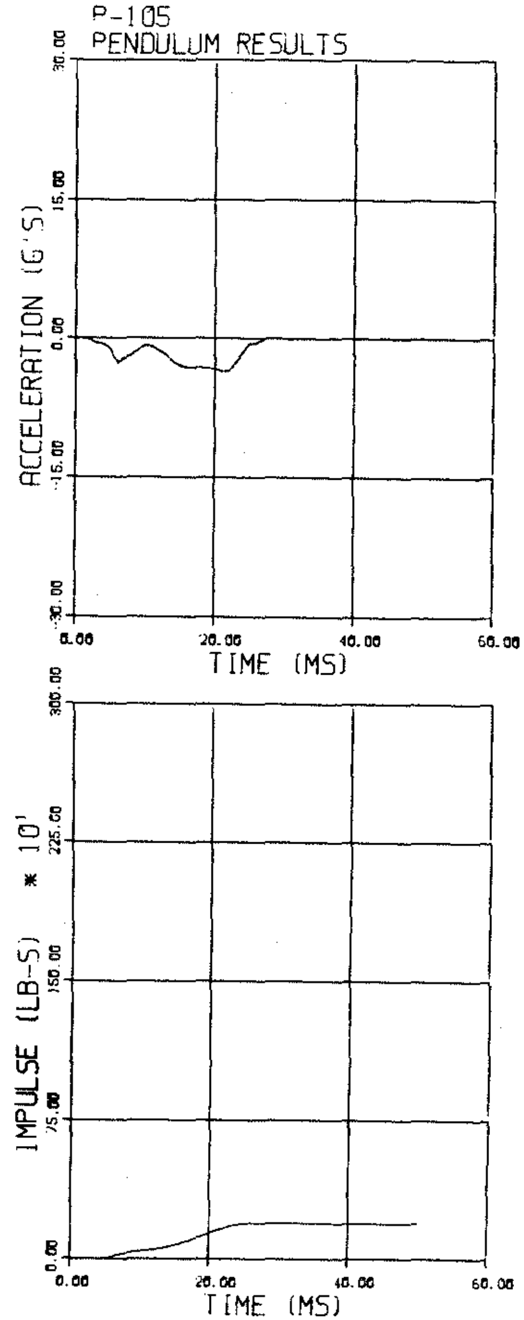
Post 102 - Hemlock



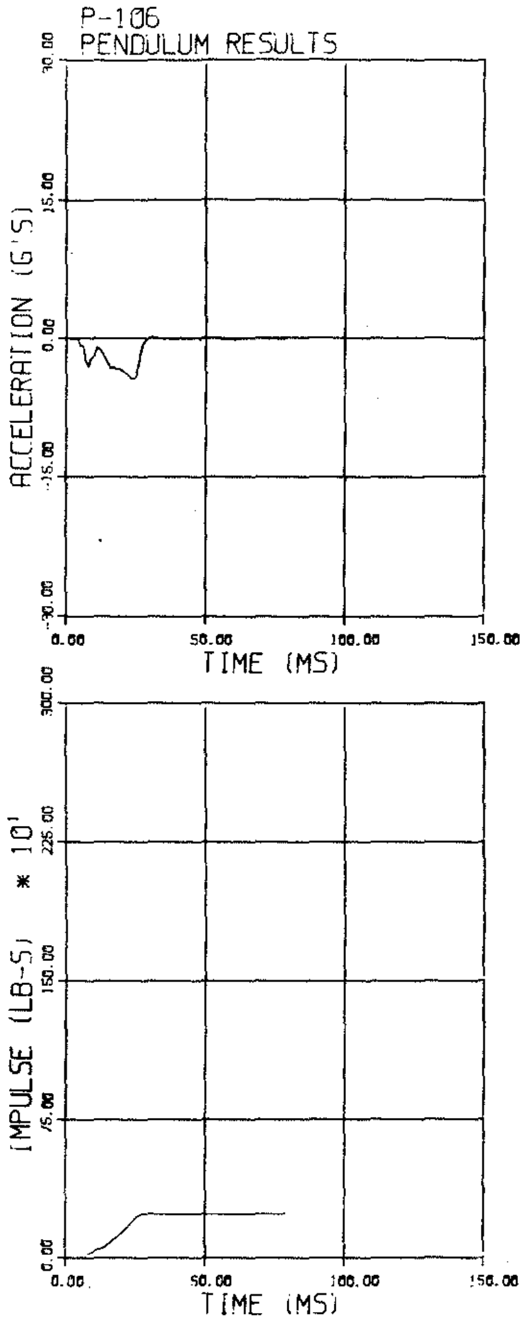
Post 103 - Red Pine



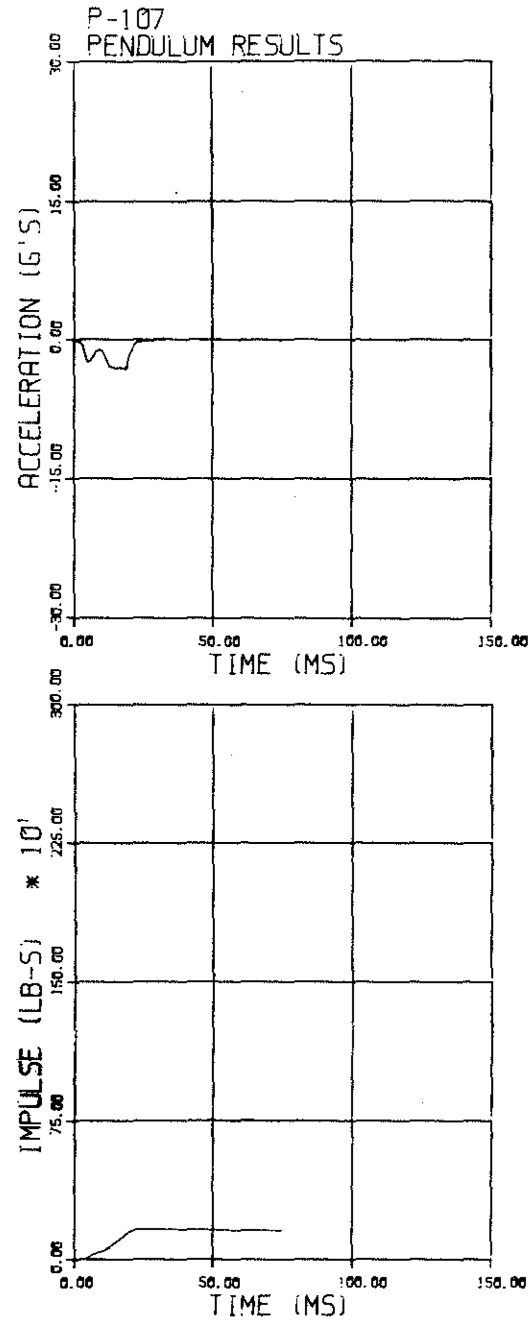
Post 104 - Red Pine



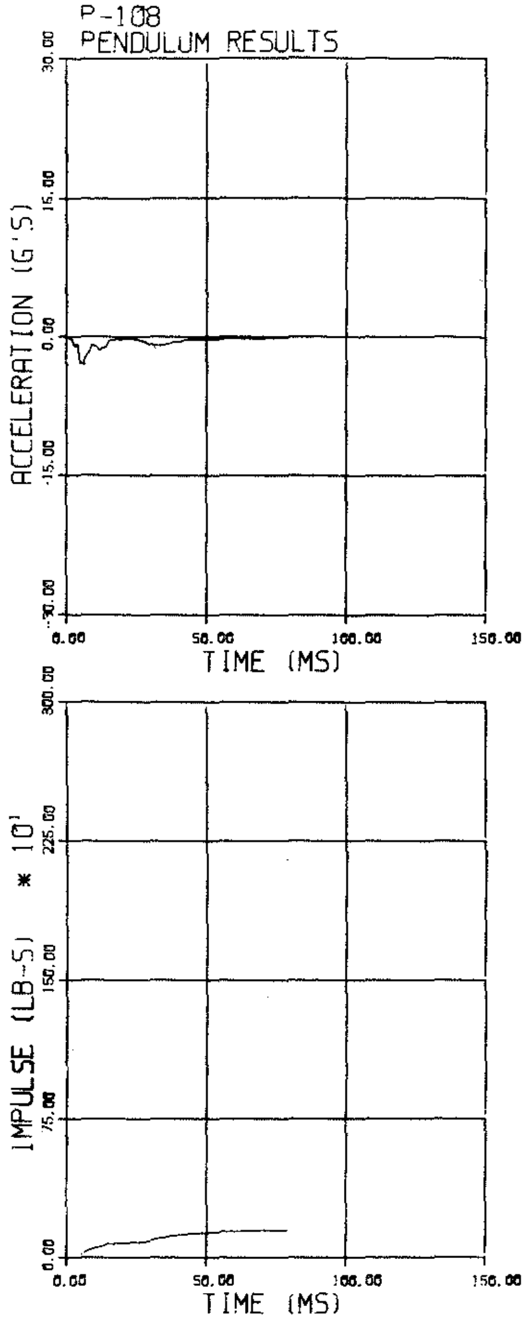
Post 105 - Red Pine



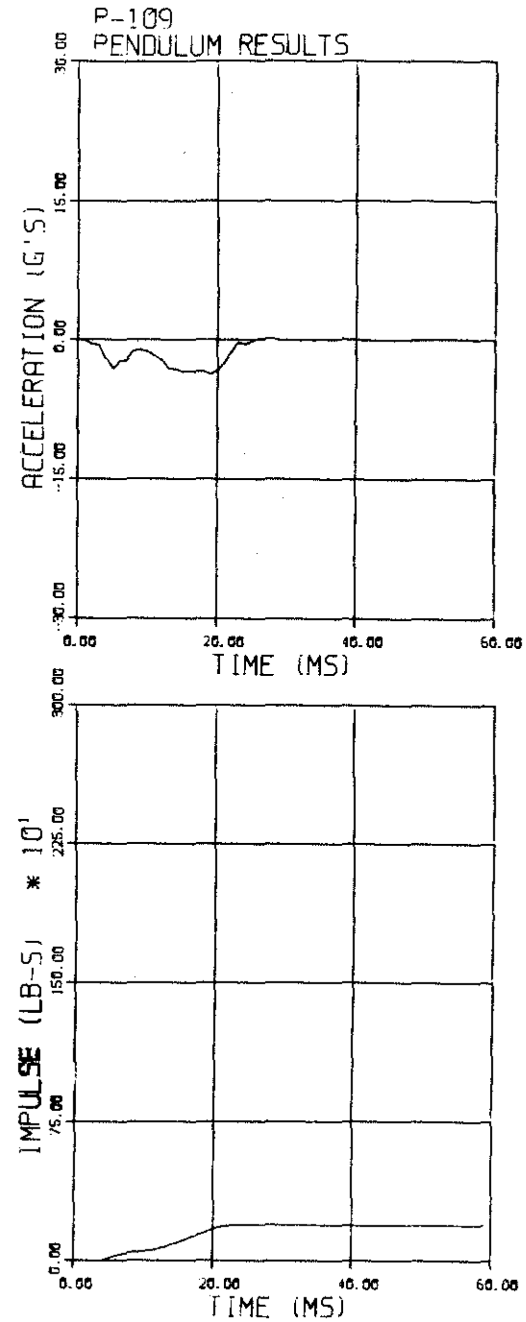
Post 106 - Red Pine



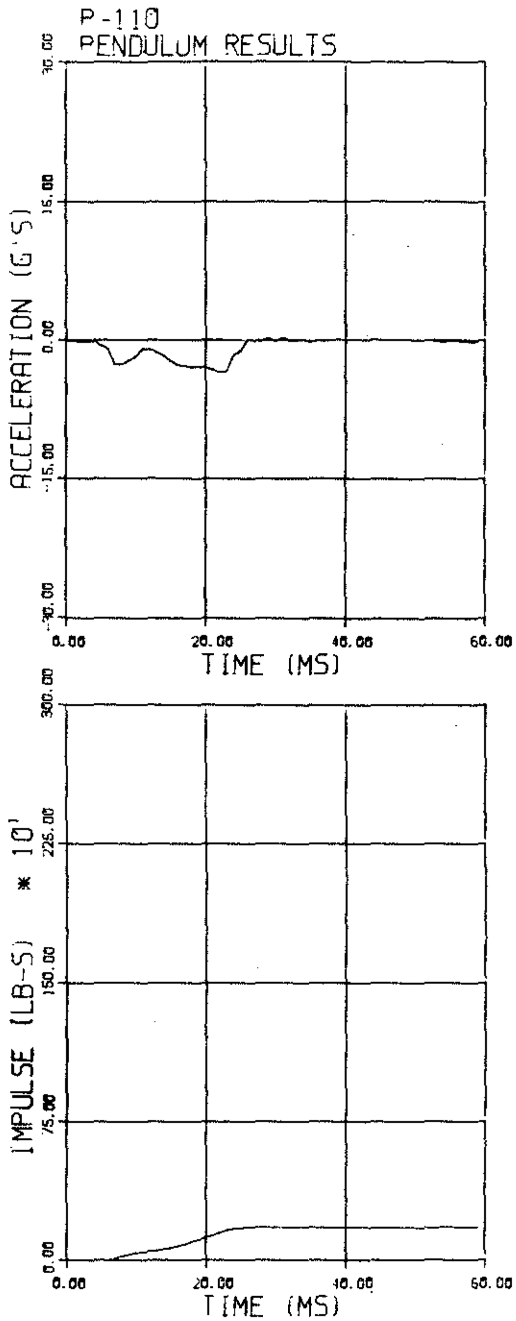
Post 107 - Red Pine



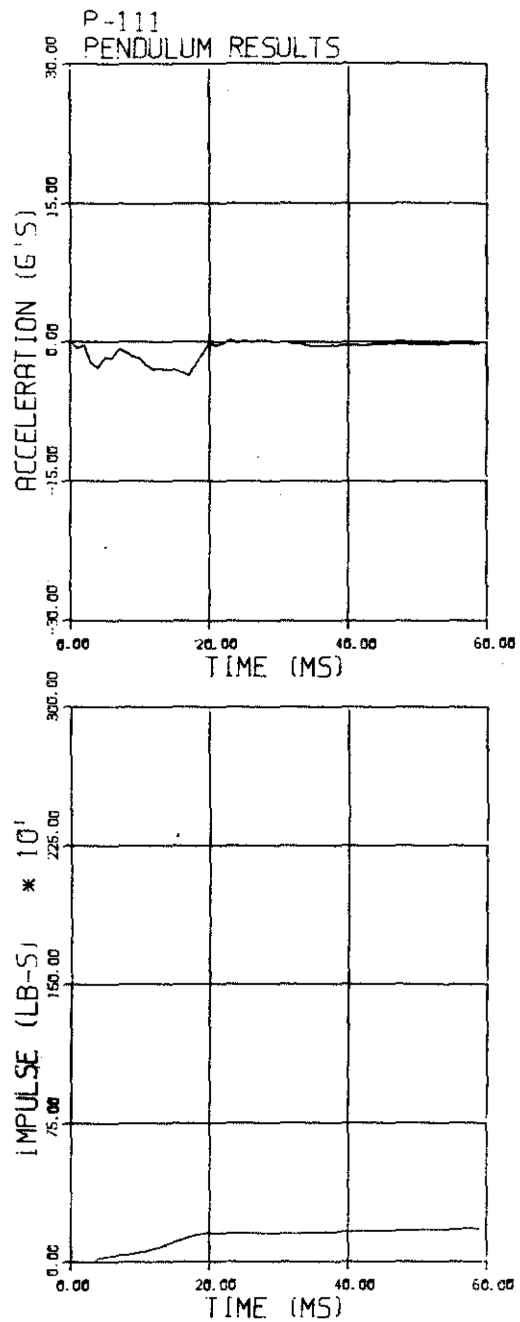
Post 108 - Red Pine



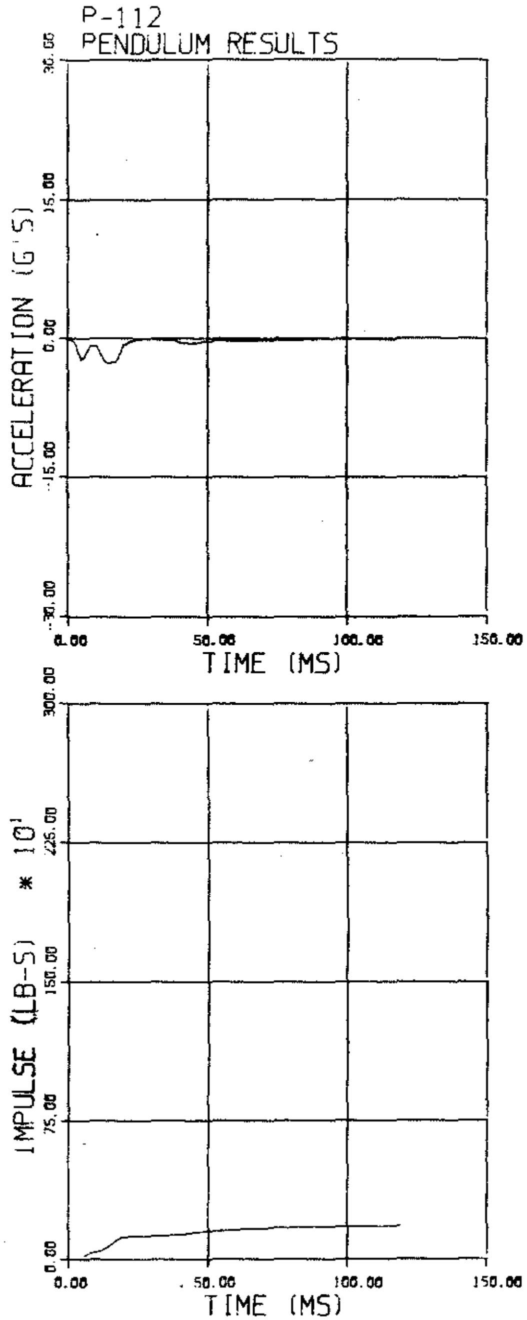
Post 109 - Red Pine



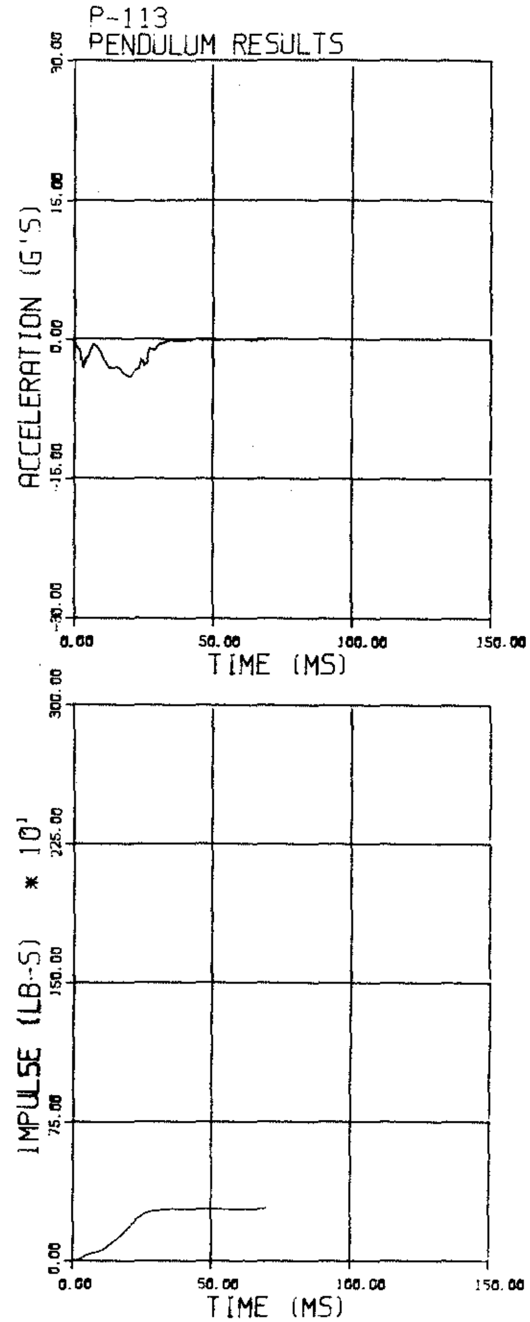
Post 110 - Red Pine



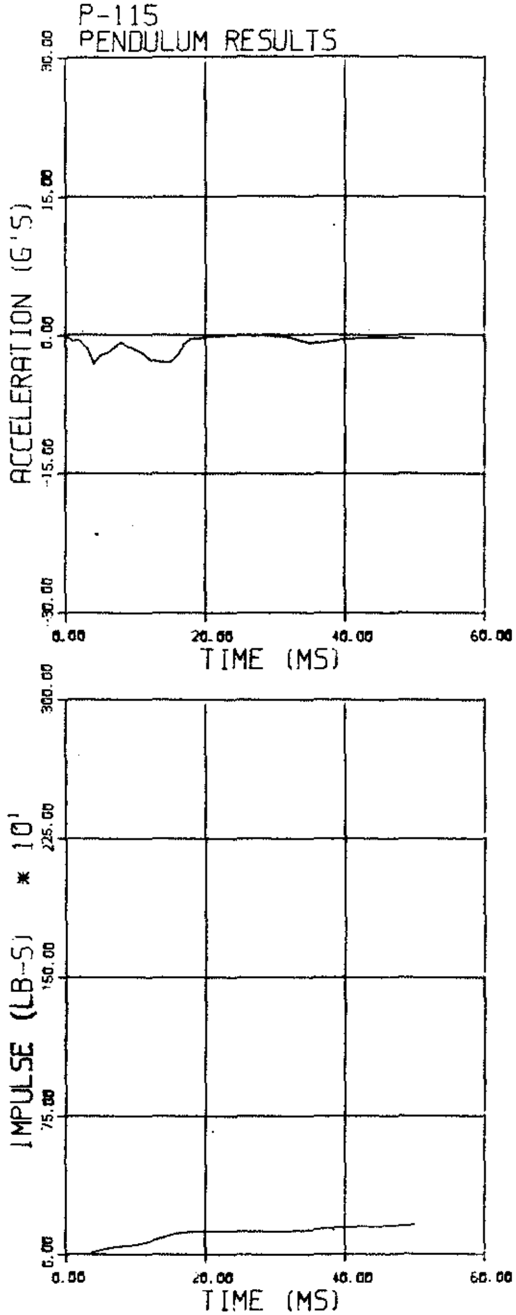
Post 111 - Red Pine



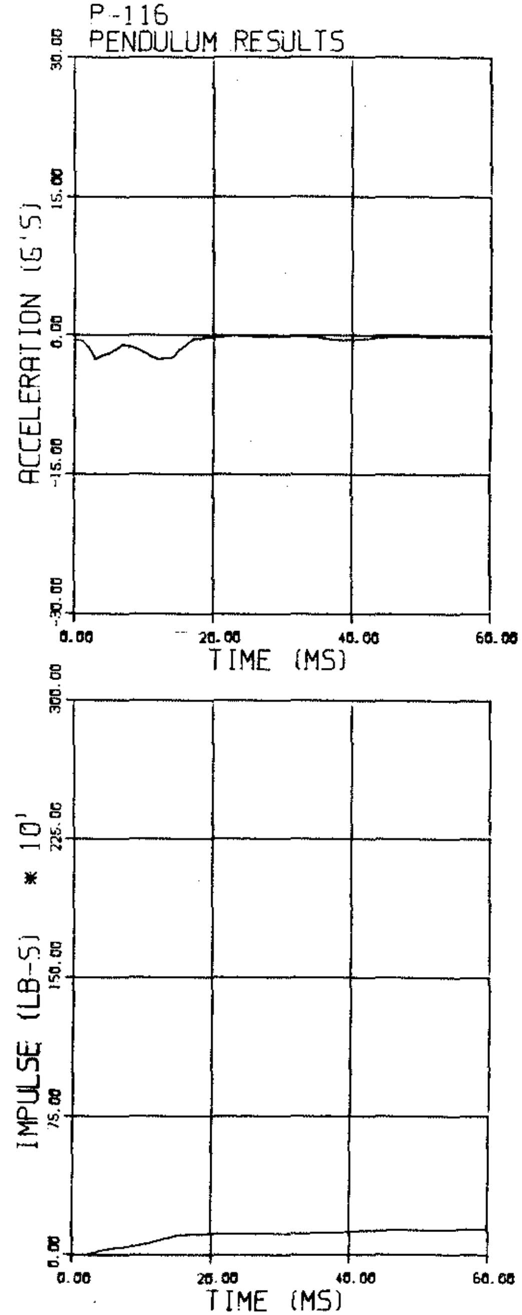
Post 112 - Red Pine



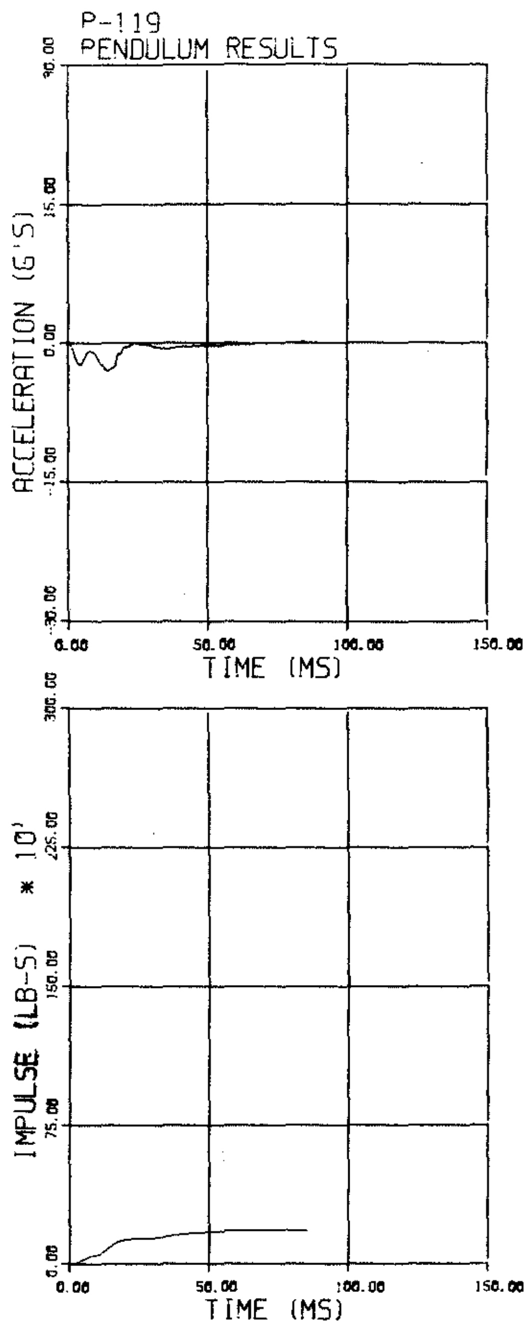
Post 113 - Red Pine



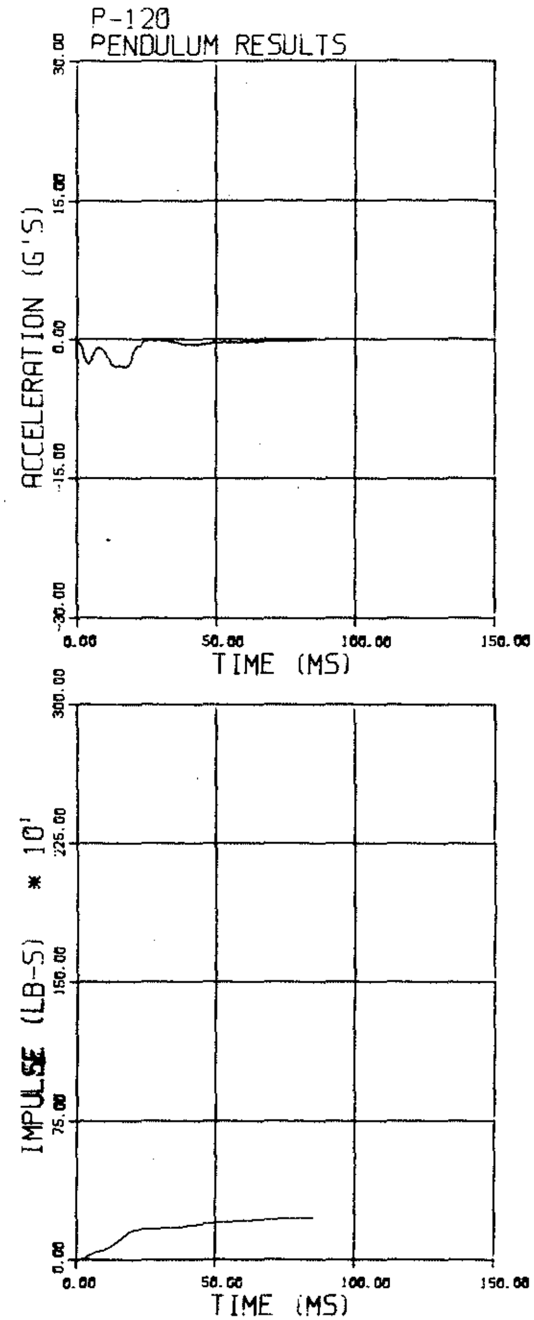
Post 115 - White Pine



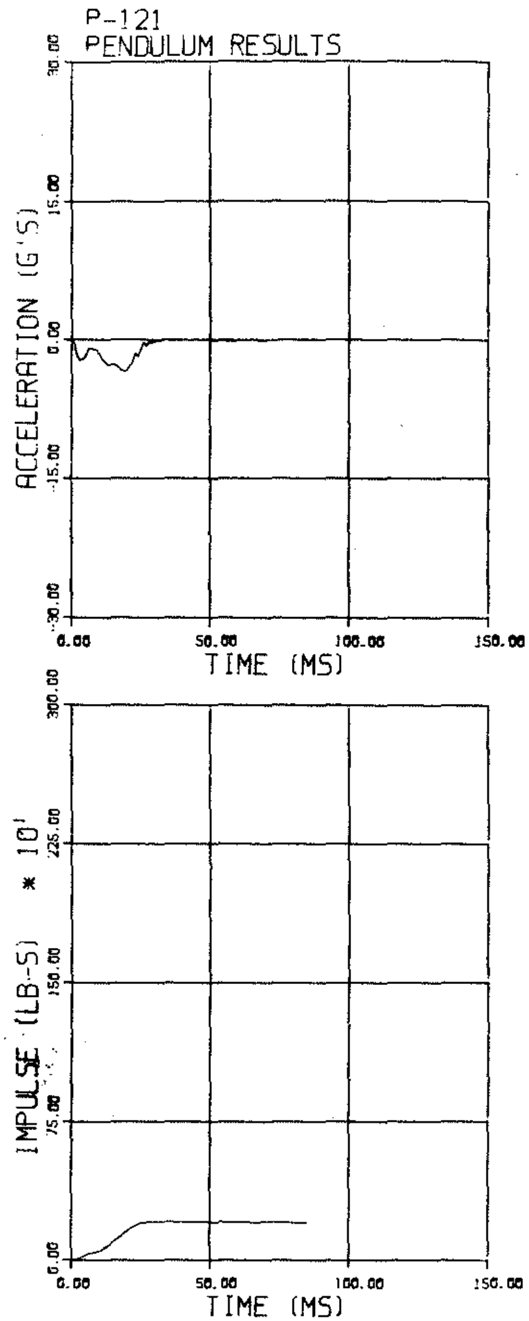
Post 116 - White Pine



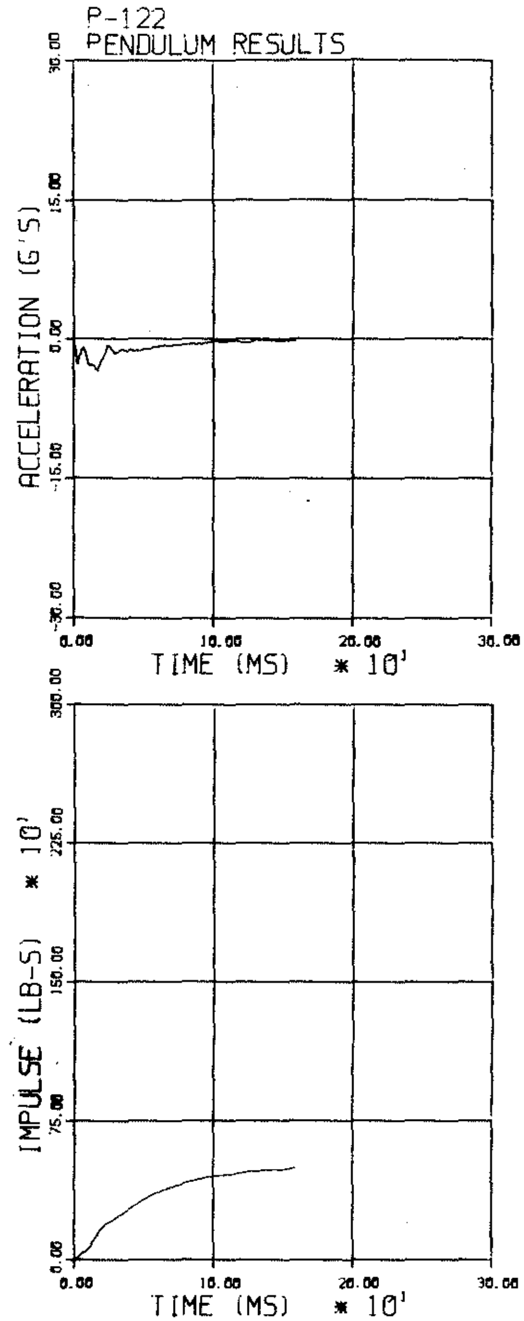
Post 119 - White Pine



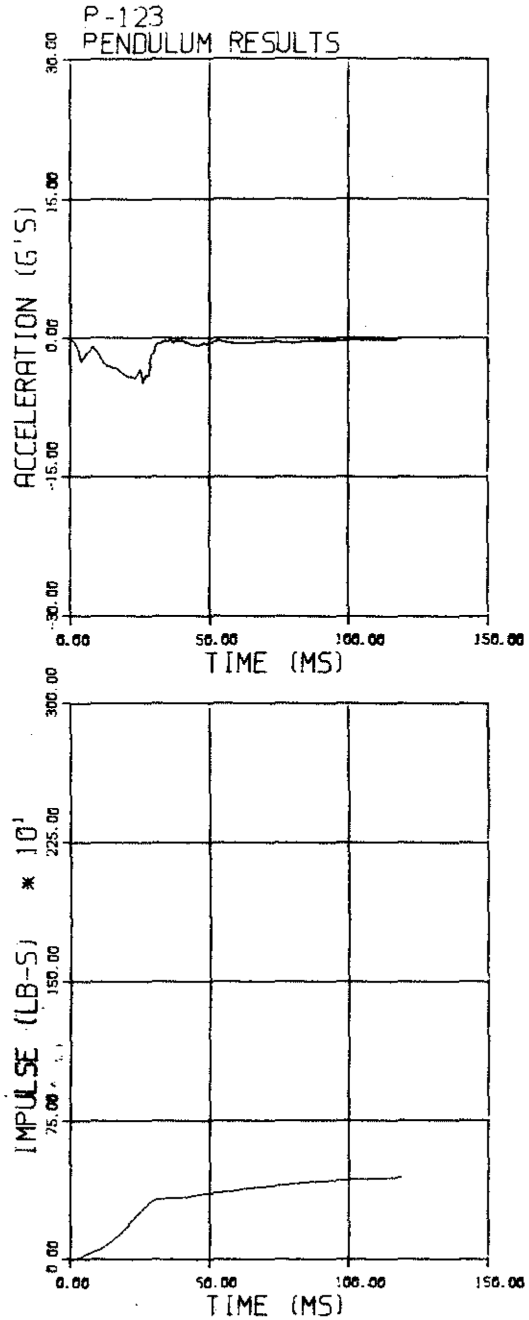
Post 120 - White Pine



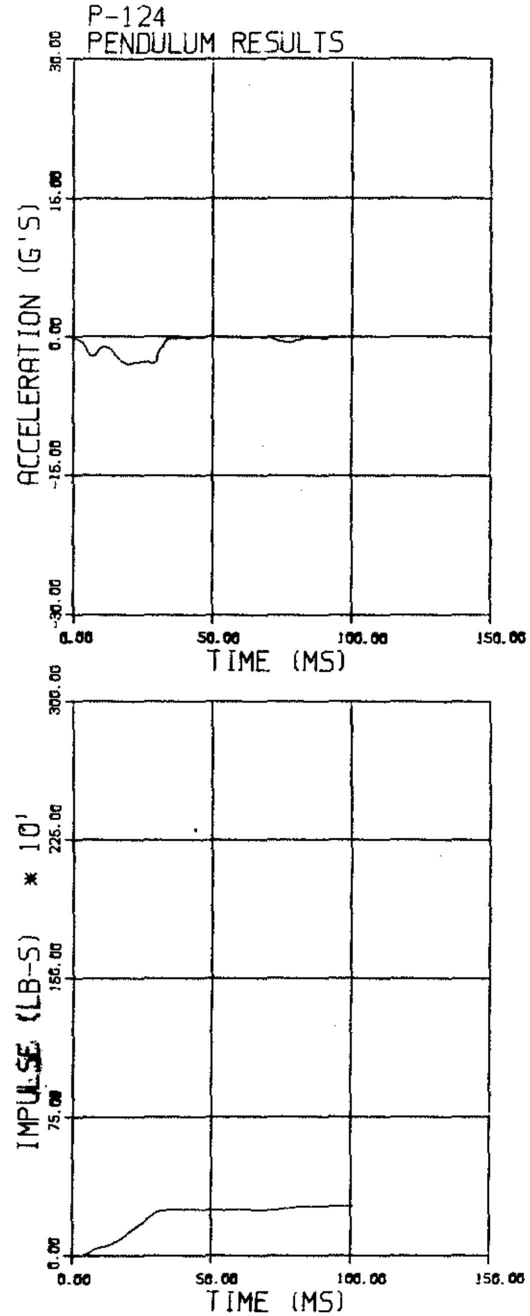
Post 121 - Jack Pine



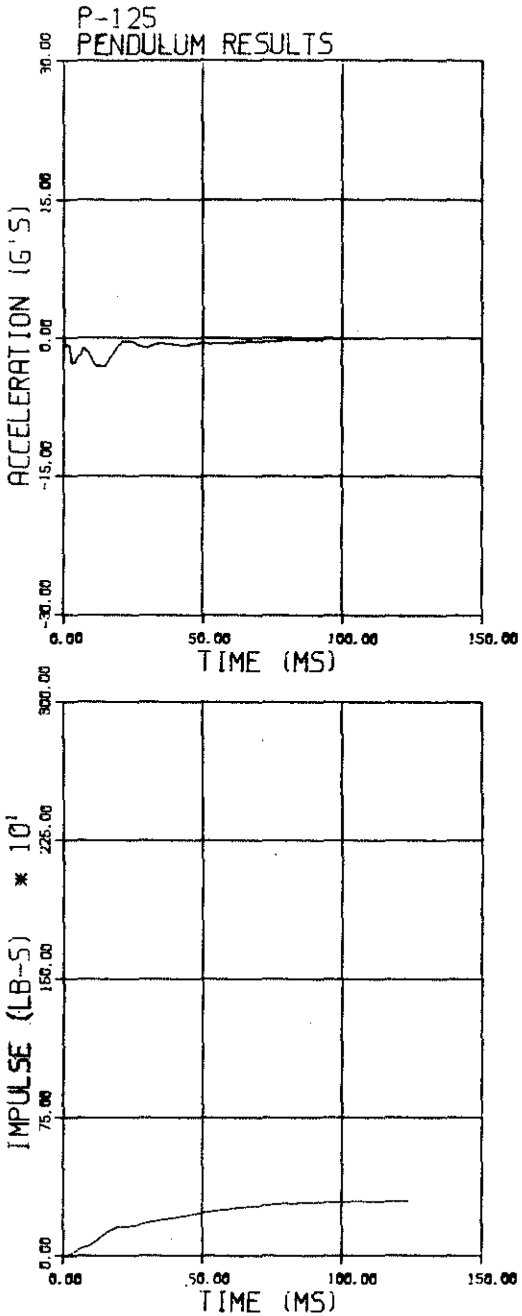
Post 122 - Jack Pine



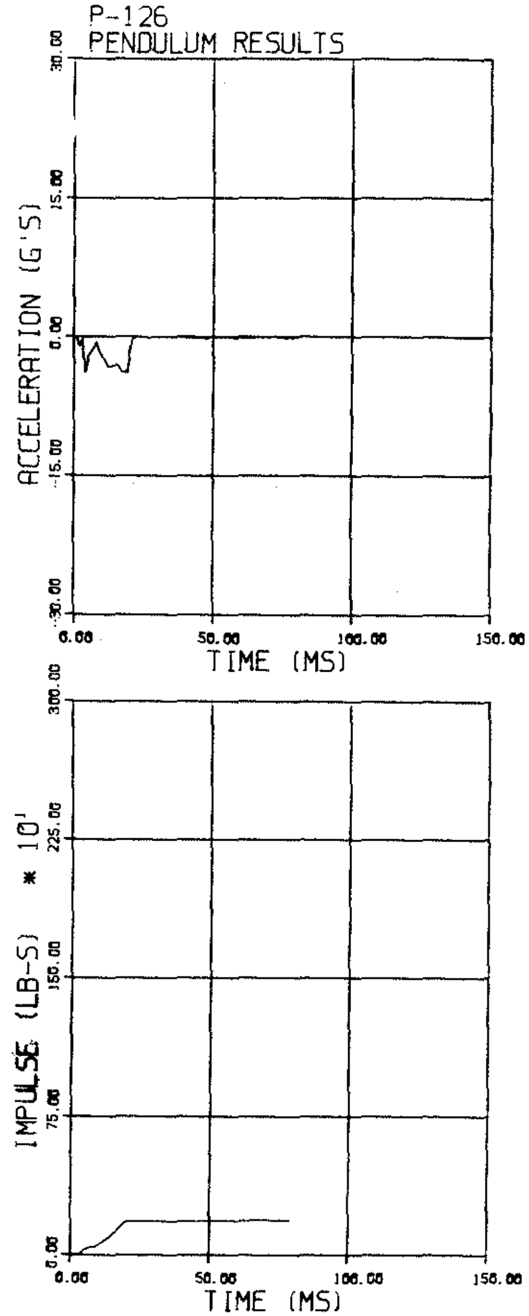
Post 123 - Jack Pine



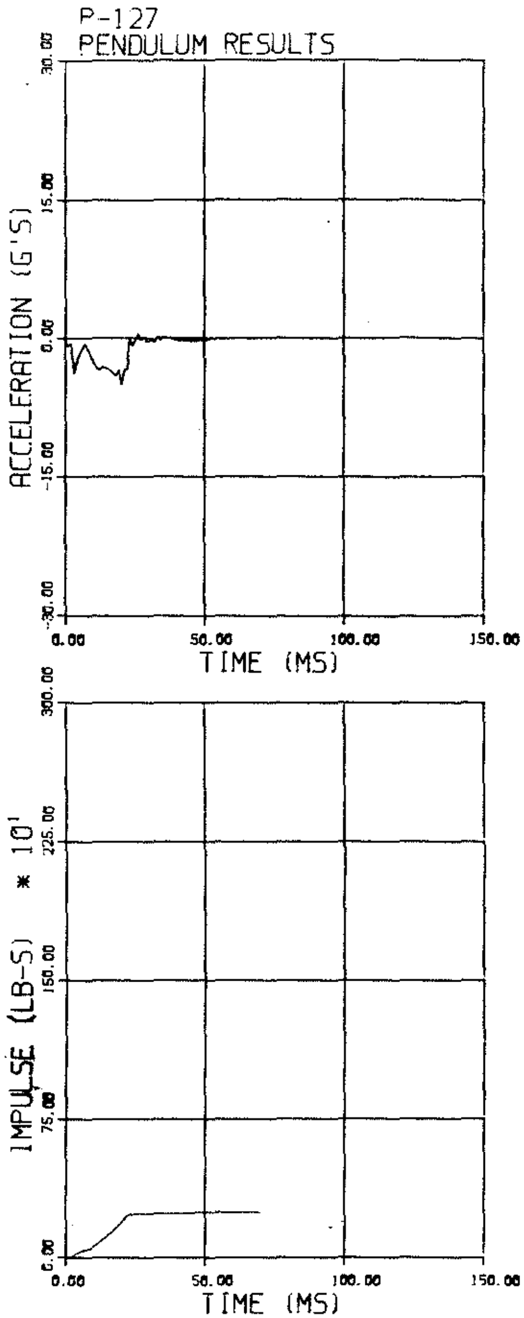
Post 124 - Jack Pine



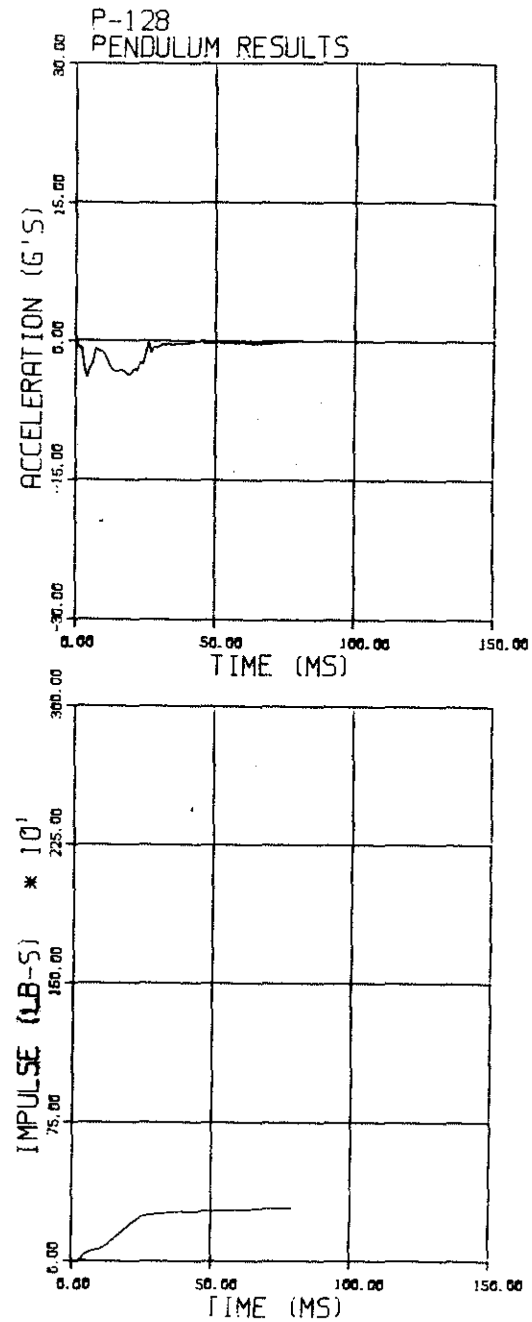
Post 125 - Jack Pine



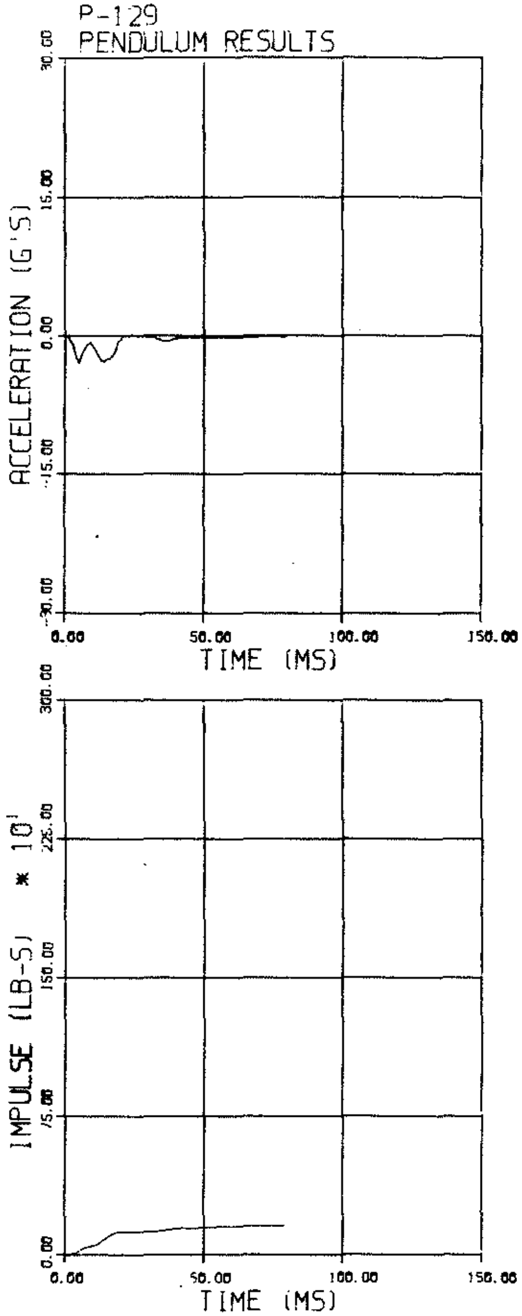
Post 126 - Jack Pine



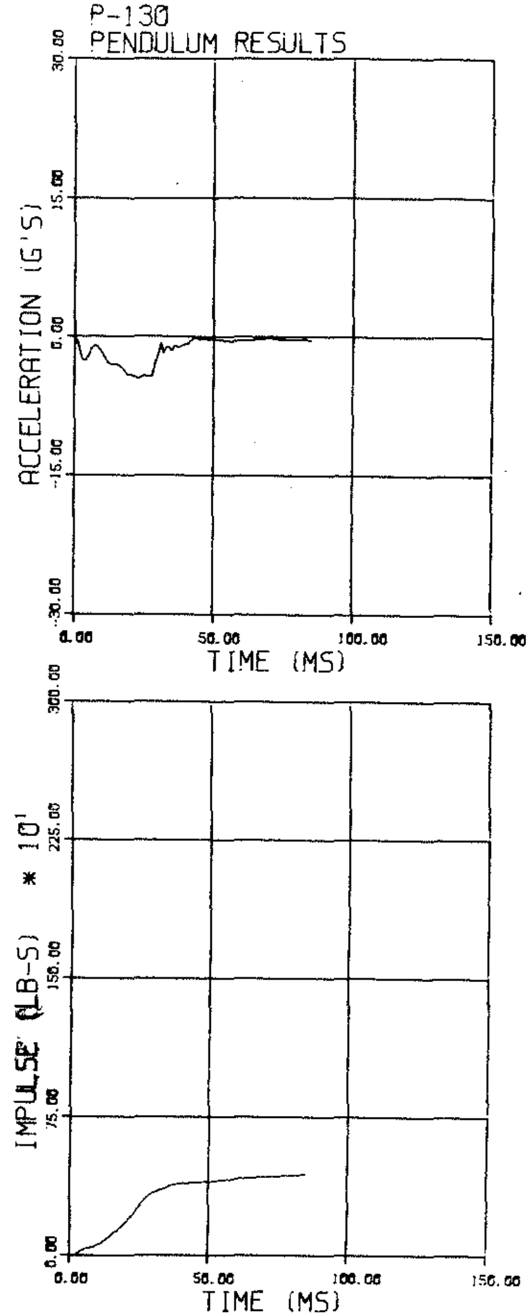
Post 127 - Jack Pine



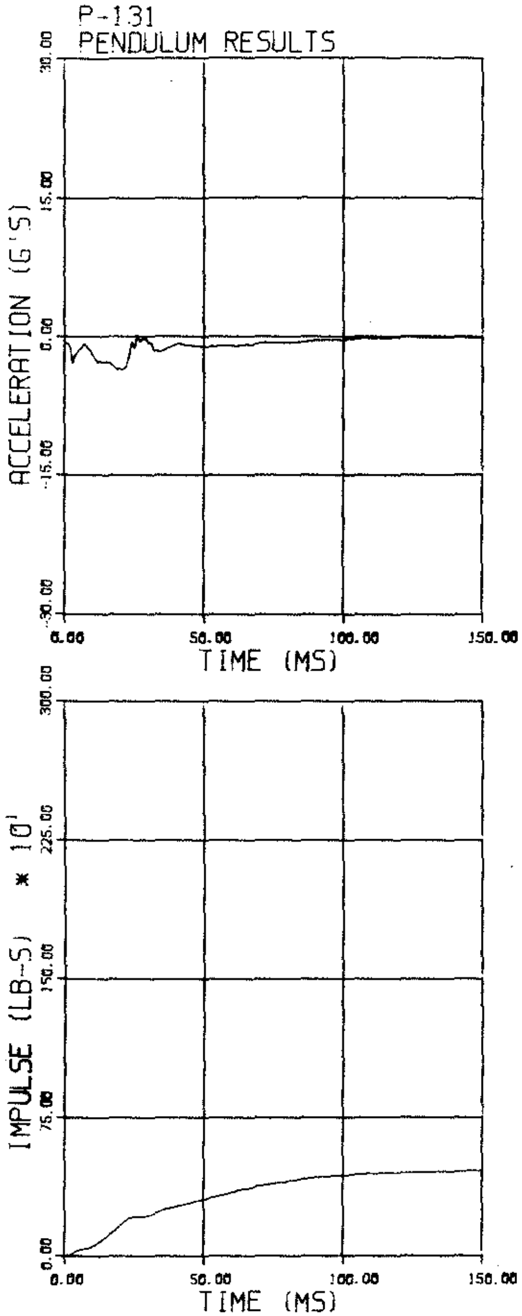
Post 128 - Jack Pine



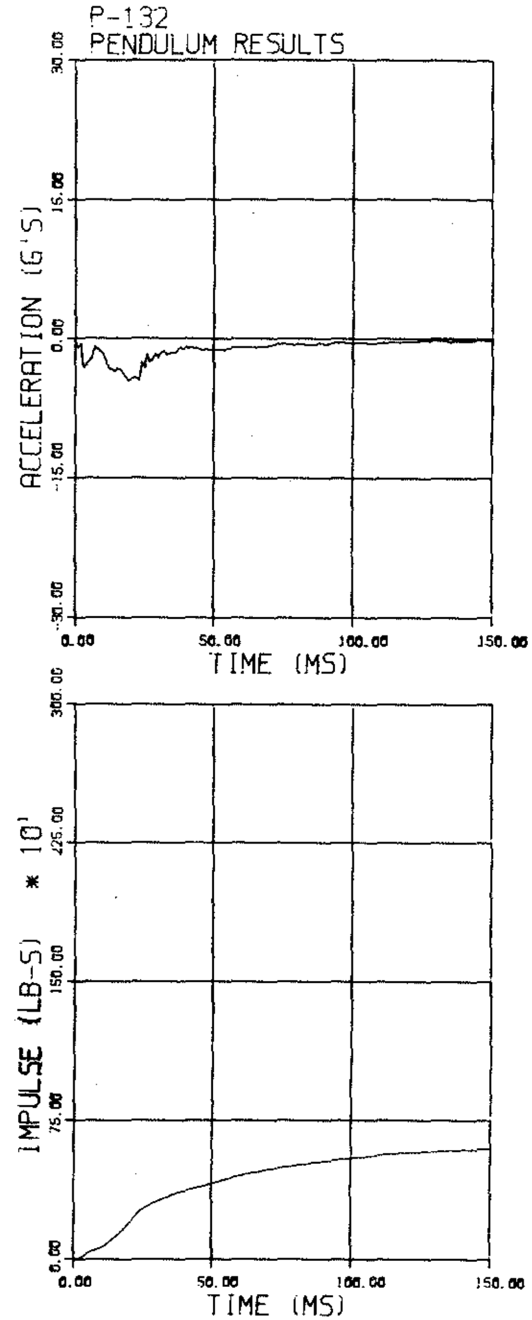
Post 129 - Jack Pine



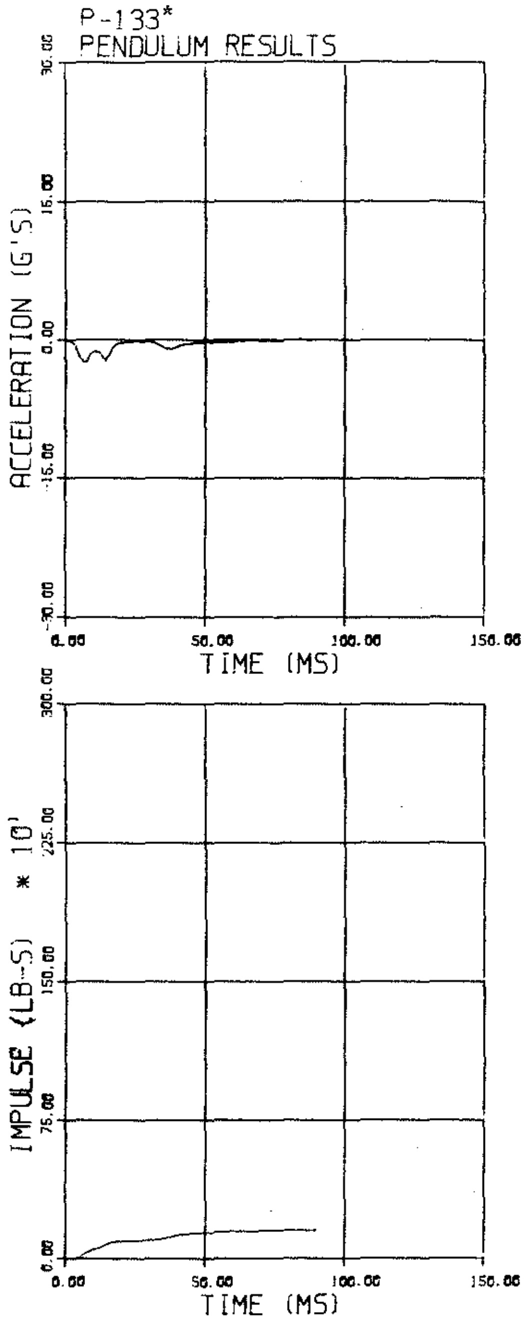
Post 130 - Jack Pine



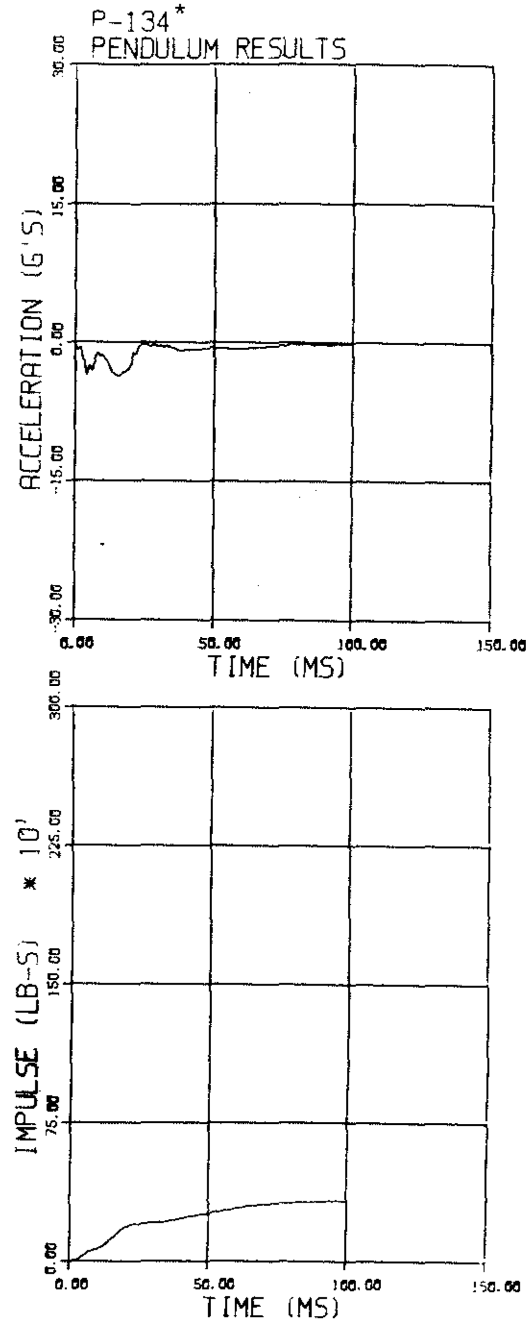
Post 131 - Jack Pine



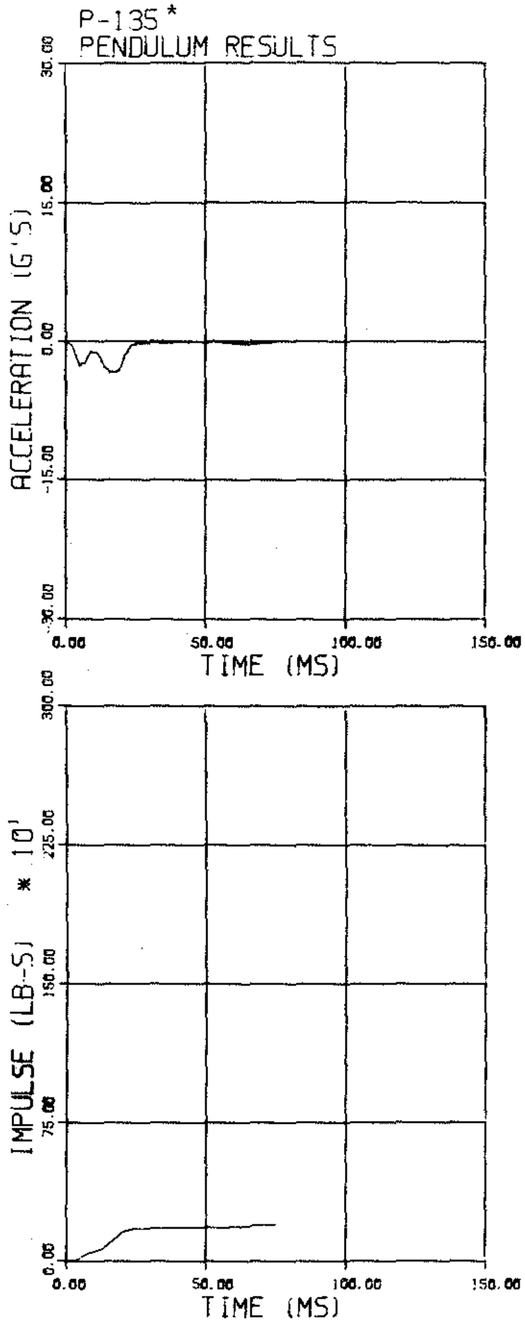
Post 132 - Jack Pine



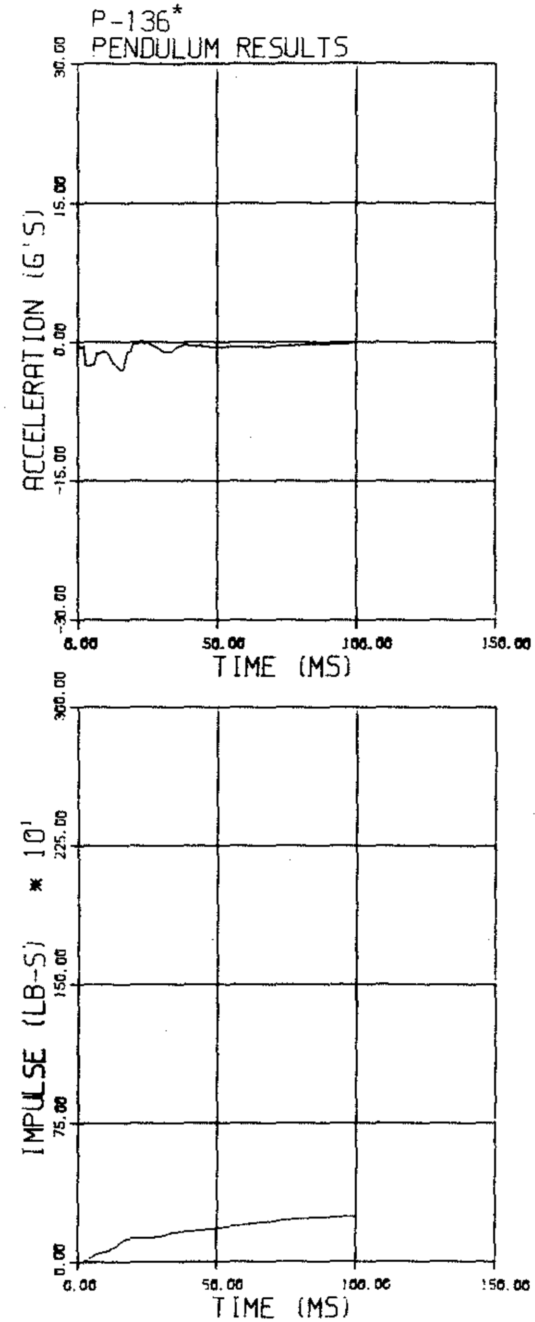
Post 133* - Red Pine



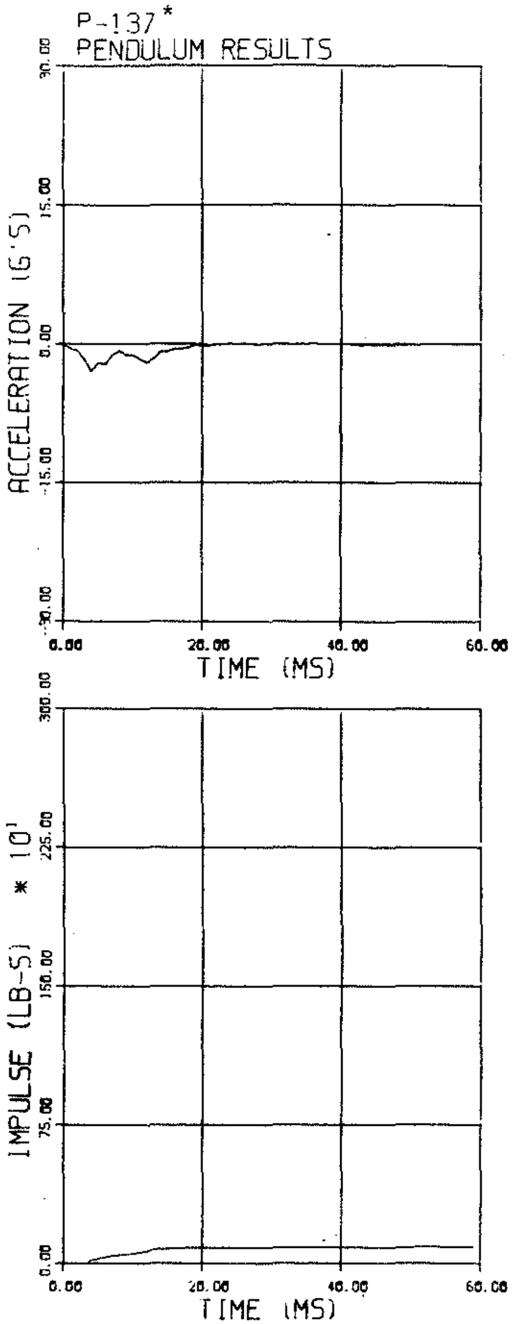
Post 134* - Red Pine



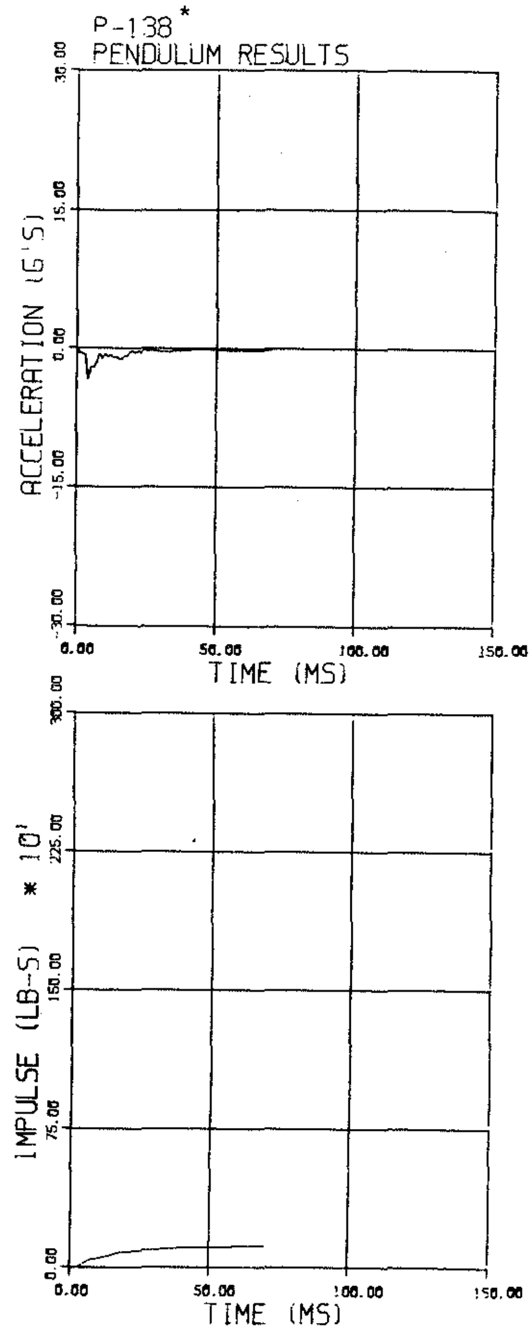
Post 135* - Red Pine



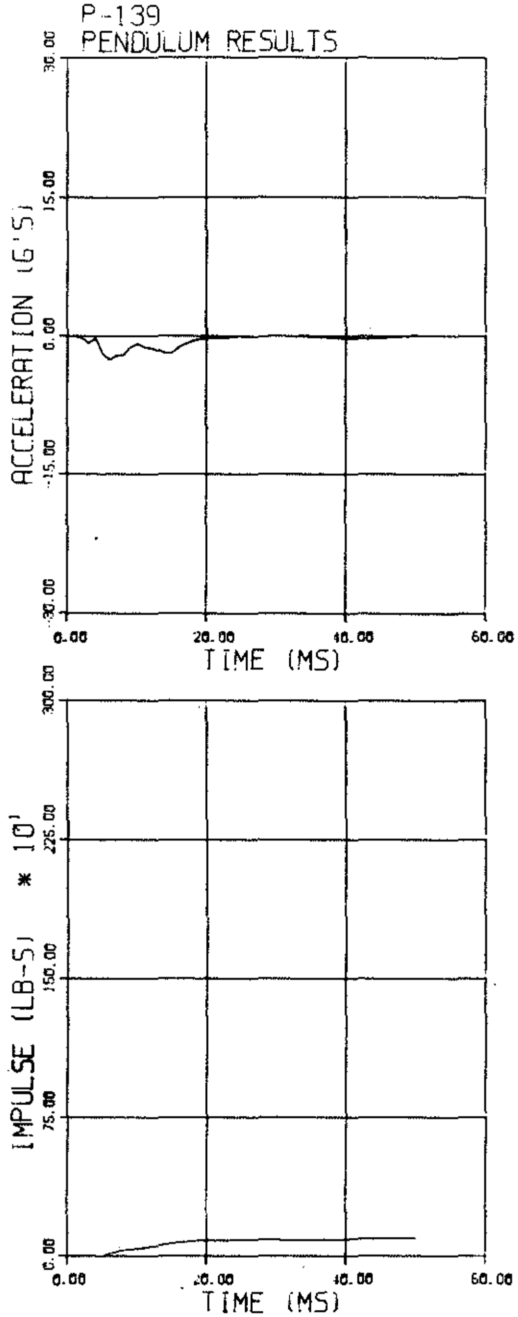
Post 136* - Red Pine



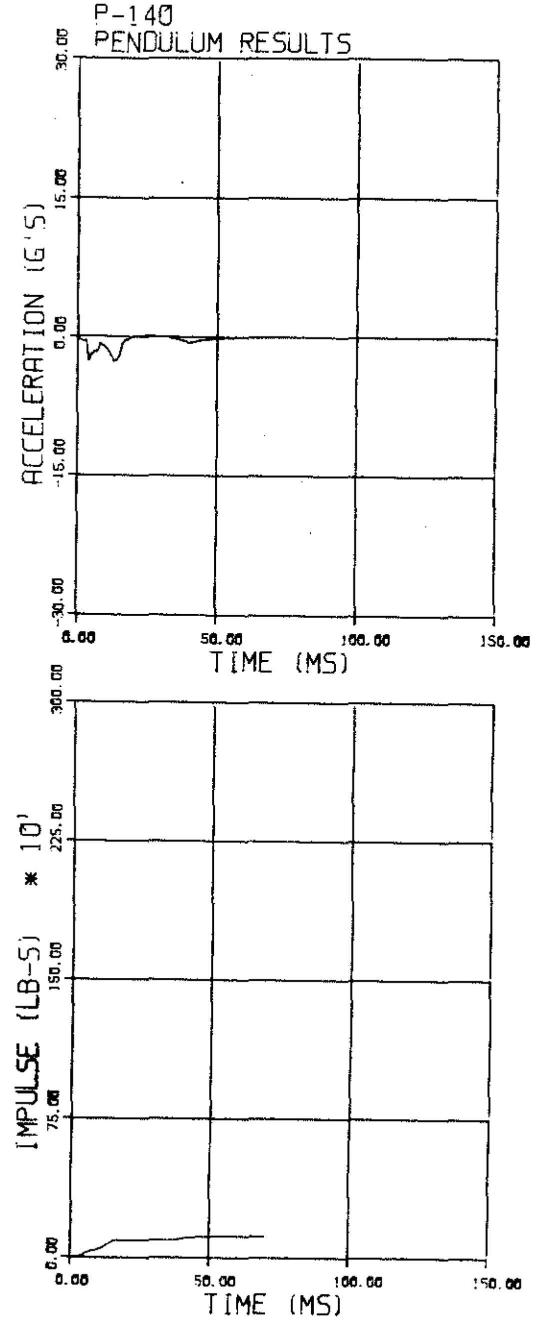
Post 137* - Red Pine



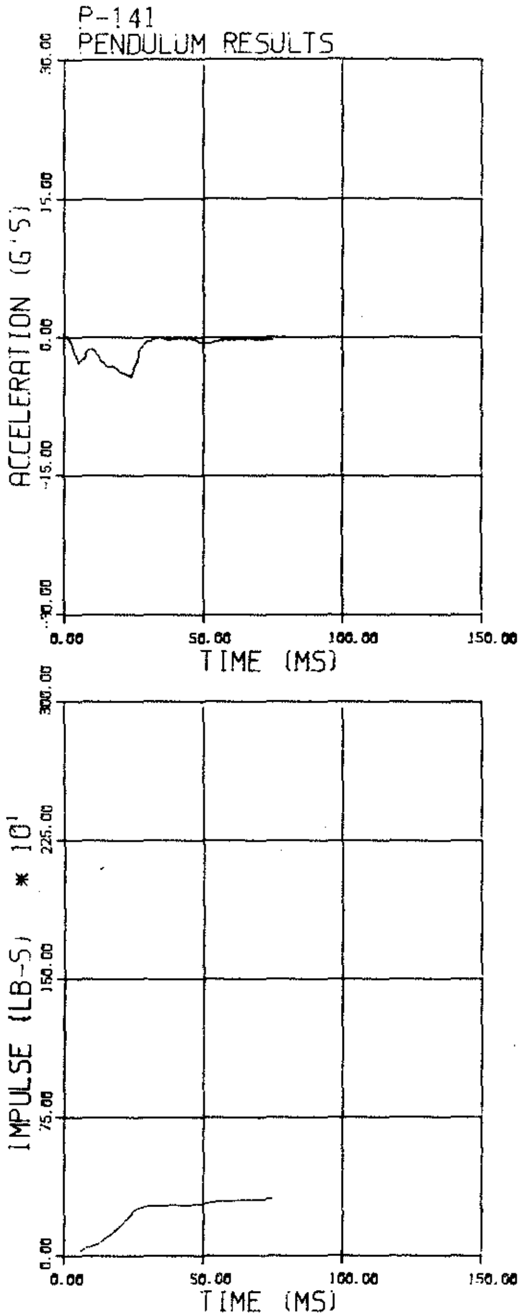
Post 138* - Red Pine



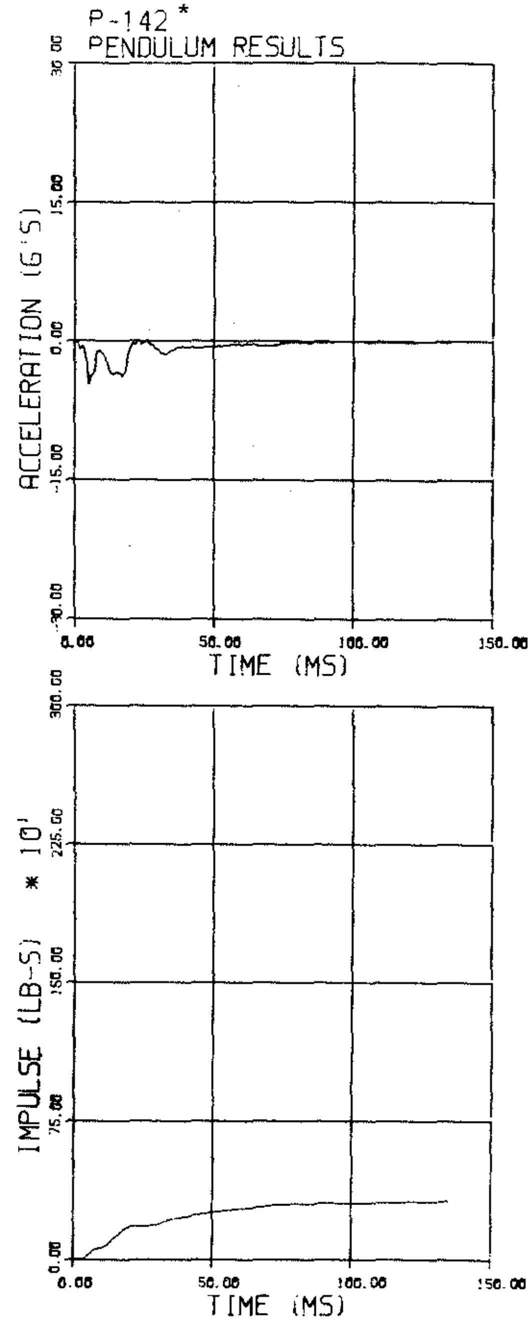
Post 139 - Red Pine



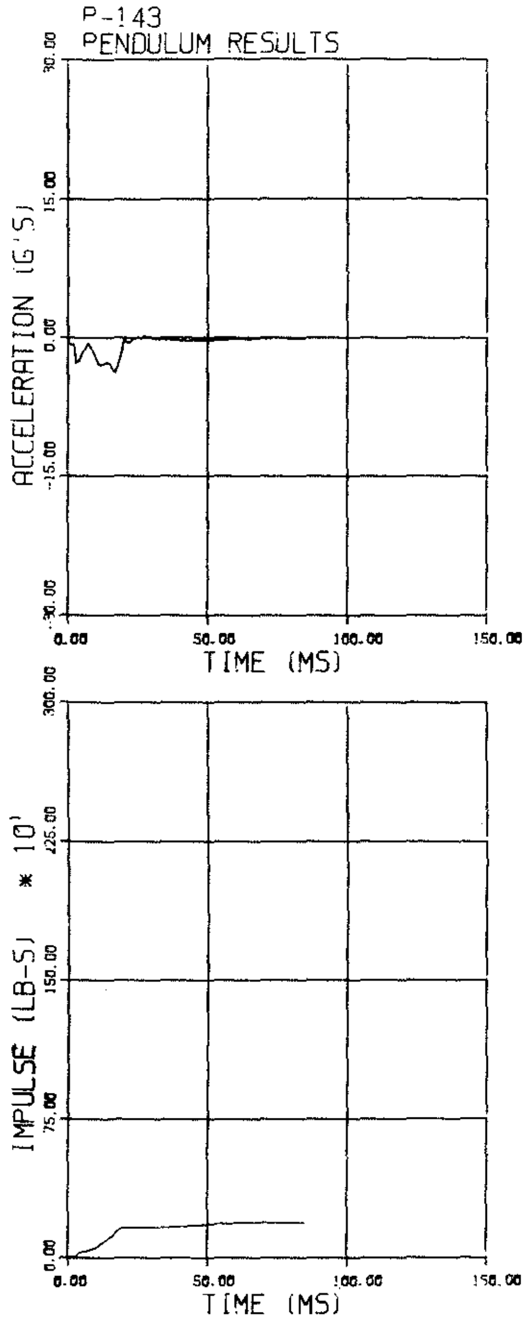
Post 140 - White Pine



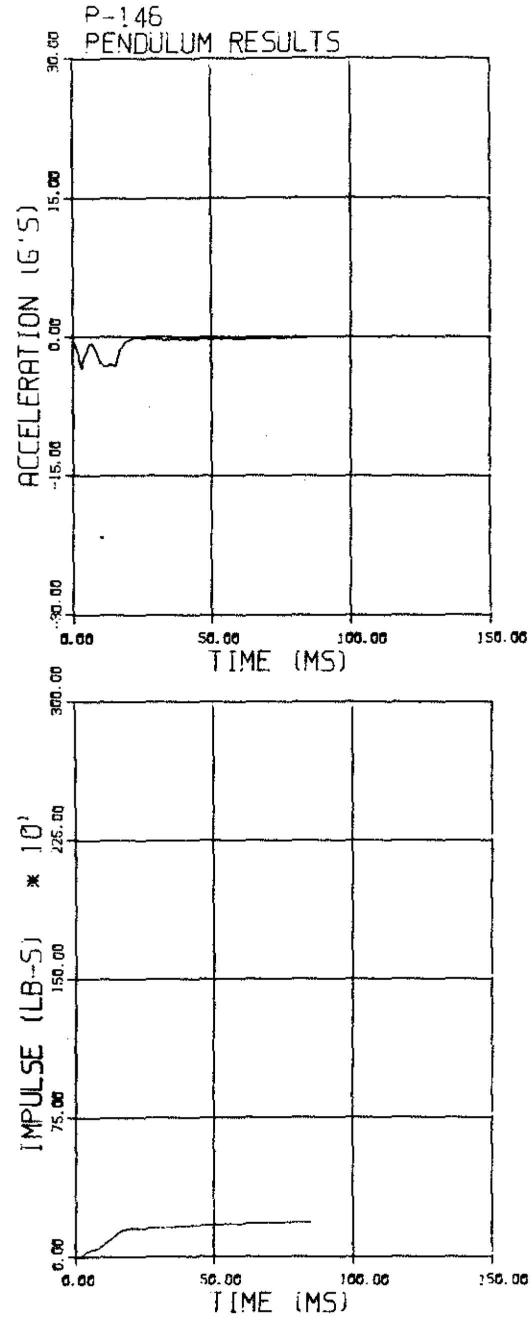
Post 141 - Hemlock



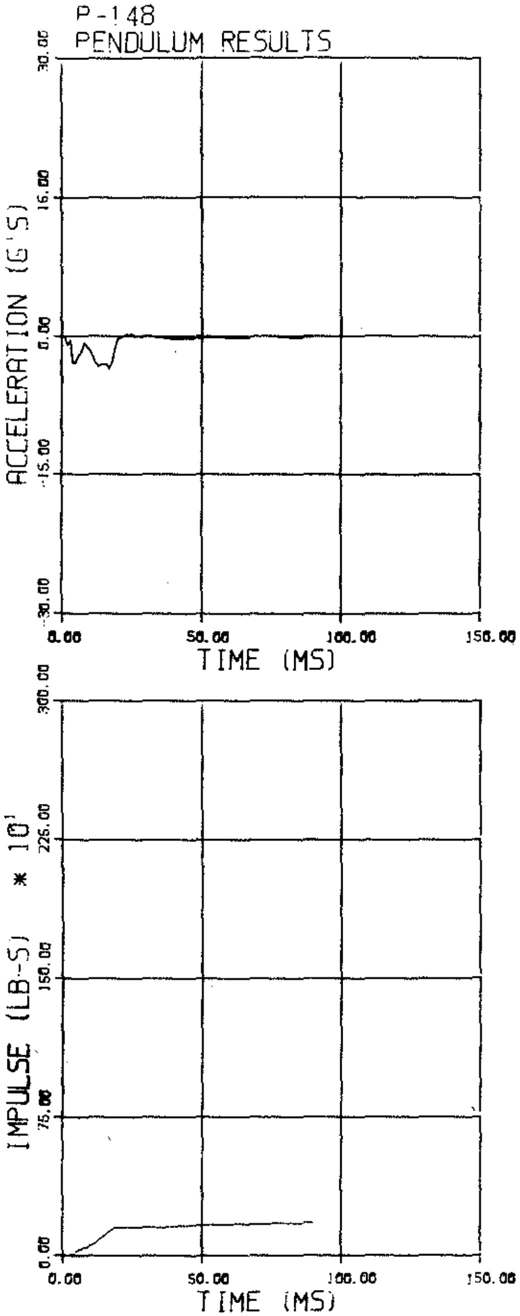
Post 142* - White Pine



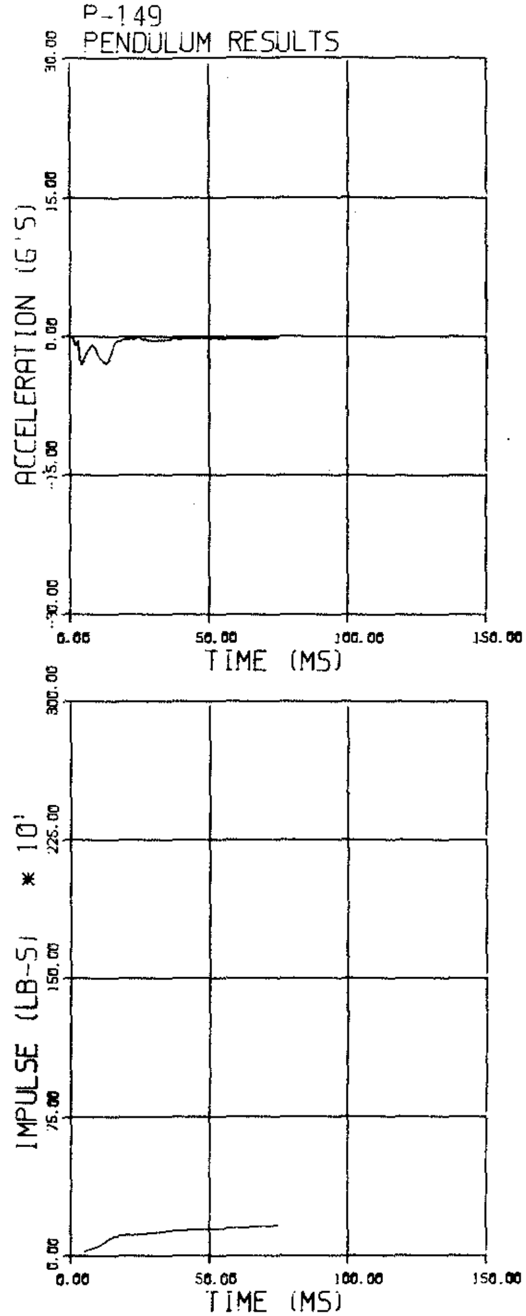
Post 143 - Hemlock



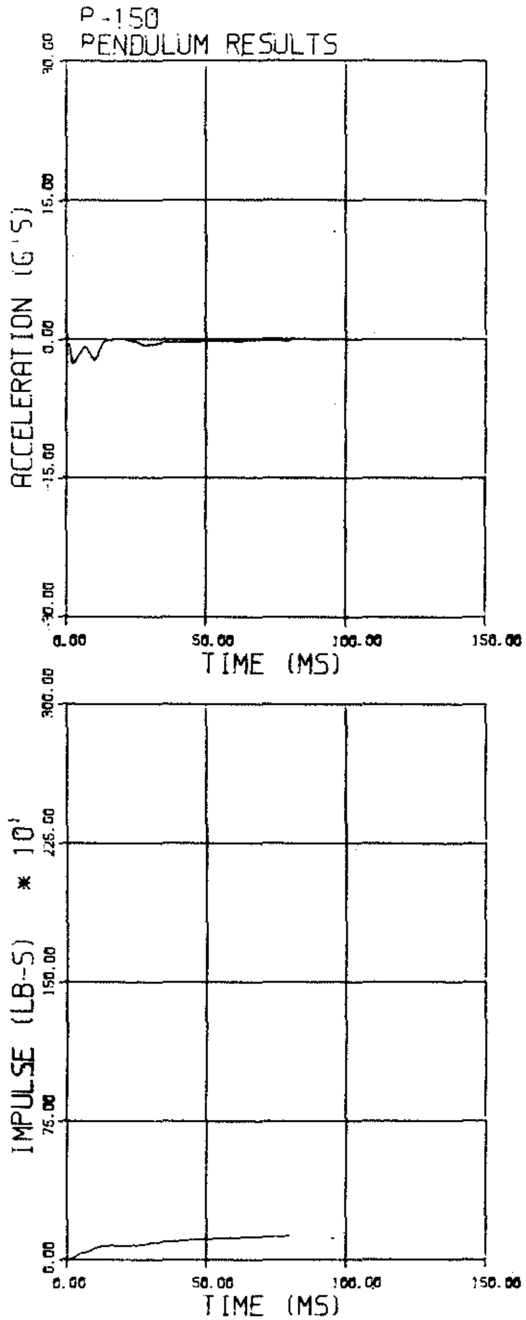
Post 146 - Hemlock



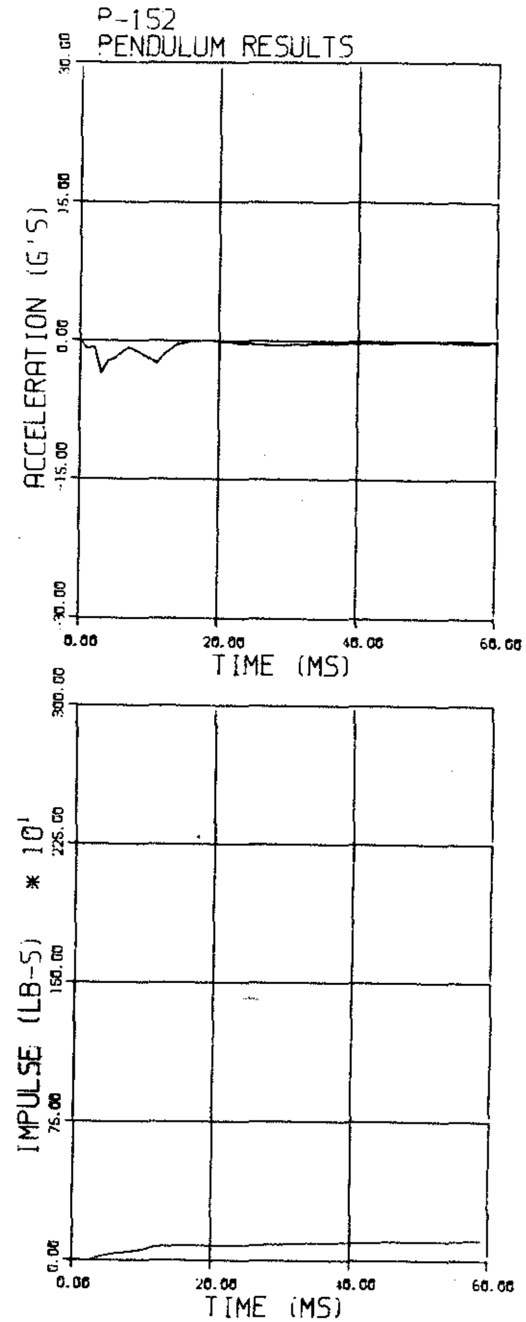
Post 148 - White Pine



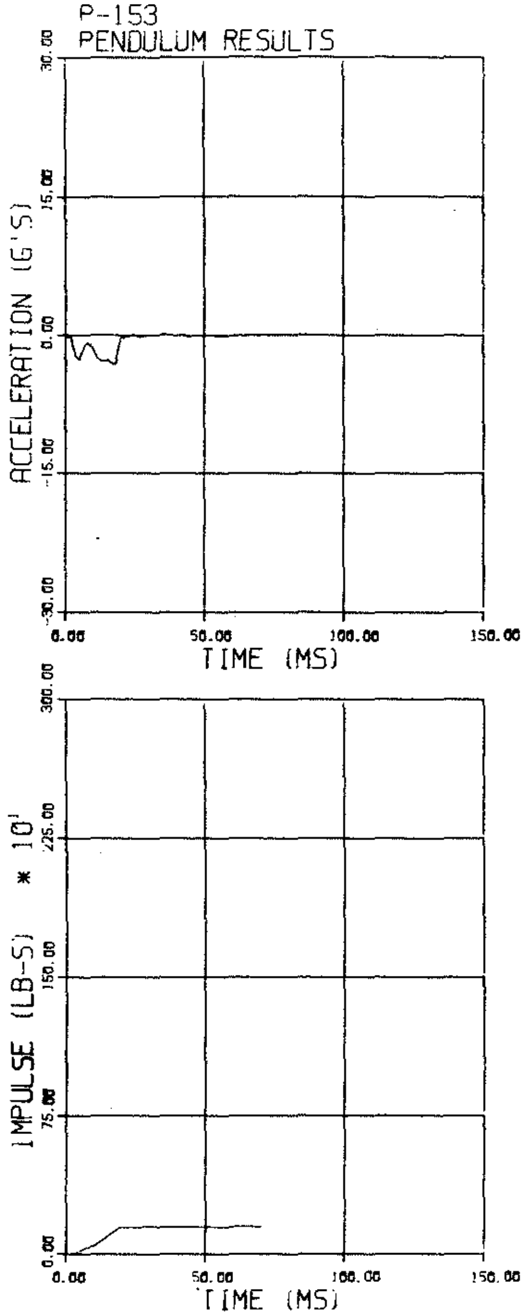
Post 149 - White Pine



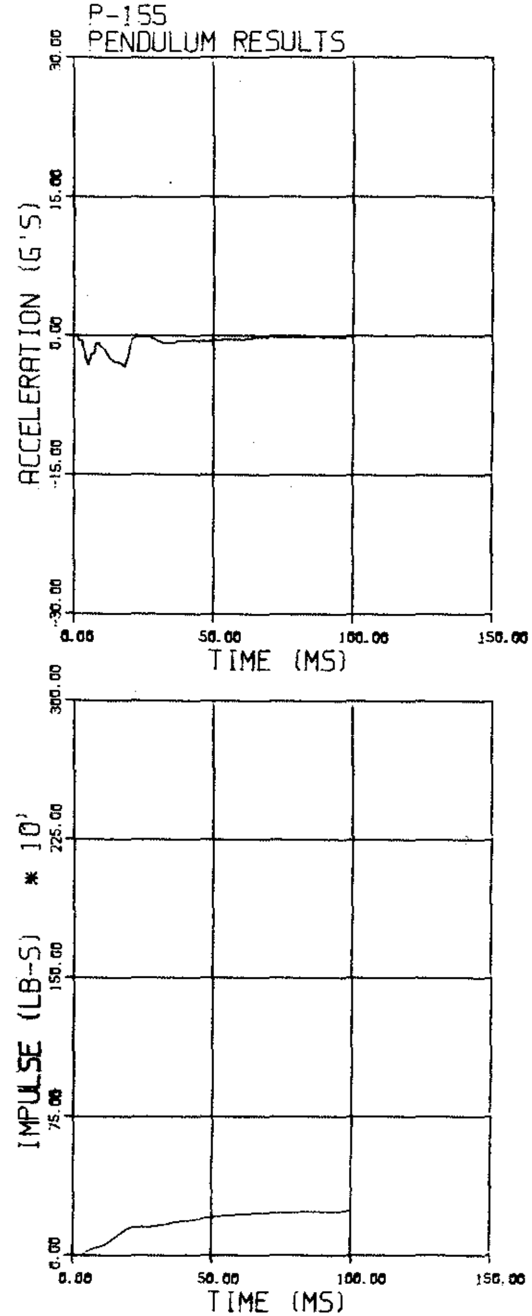
Post 150 - White Pine



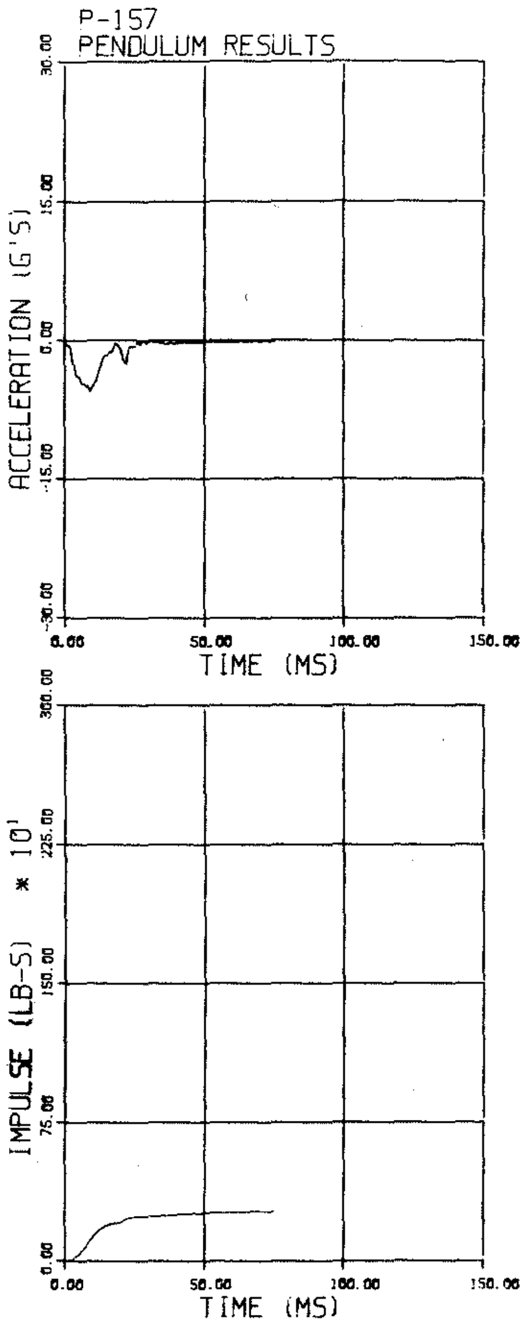
Post 152 - White Pine



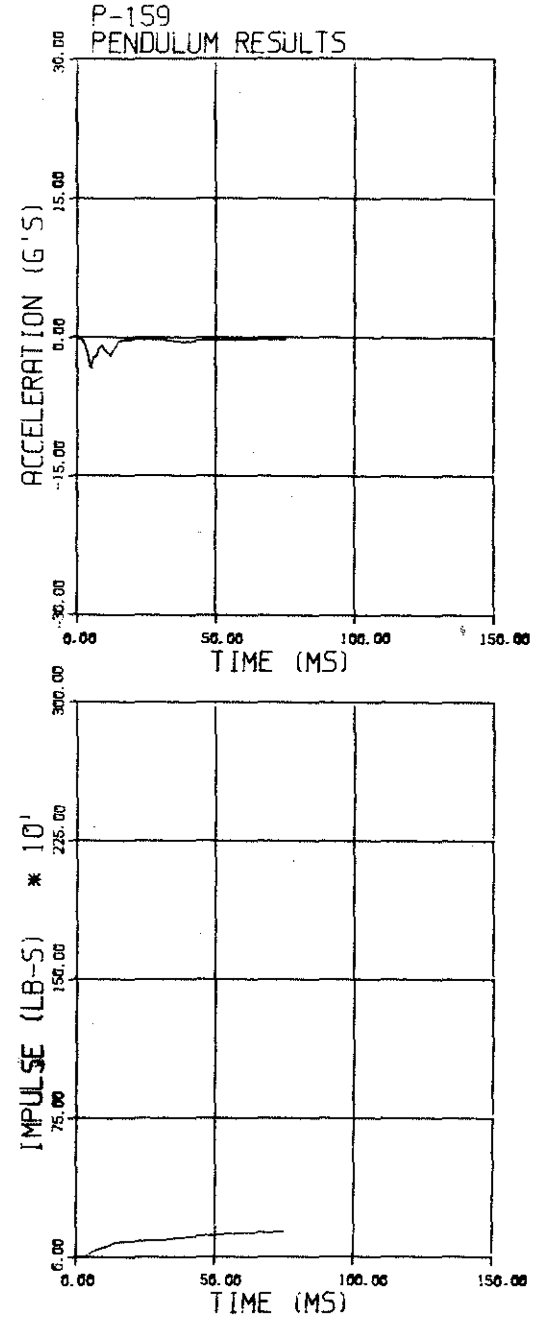
Post 153 - White Pine



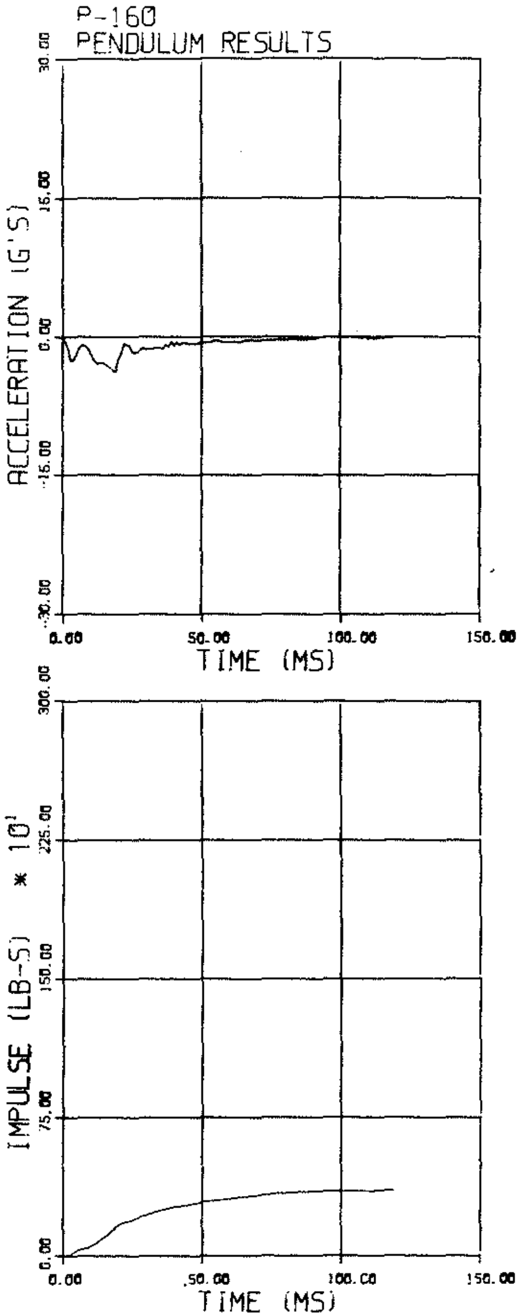
Post 155 - White Pine



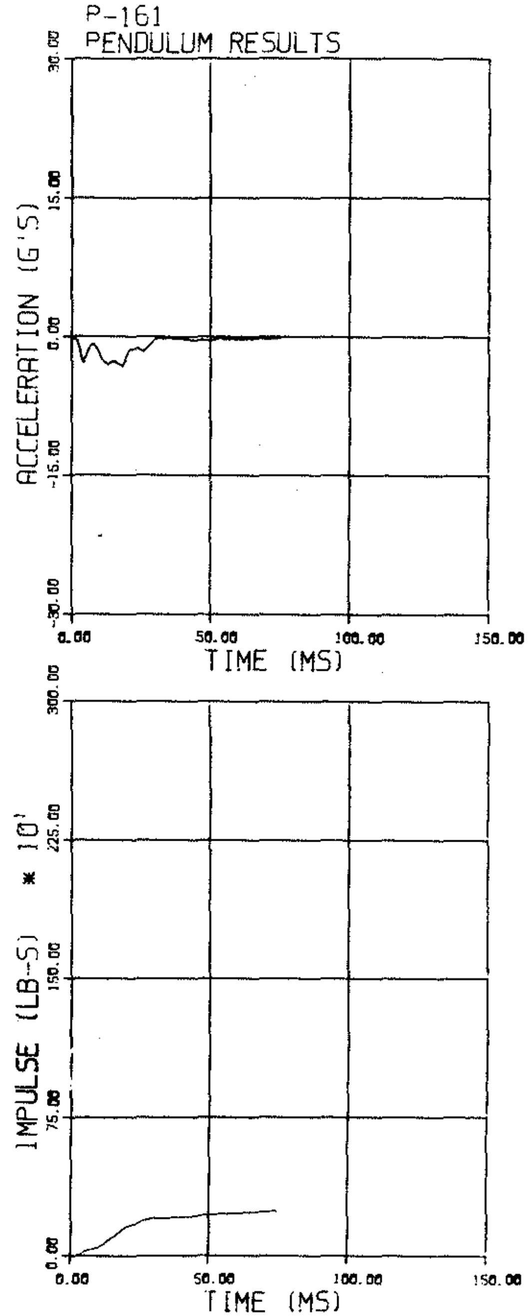
Post 157 - White Pine



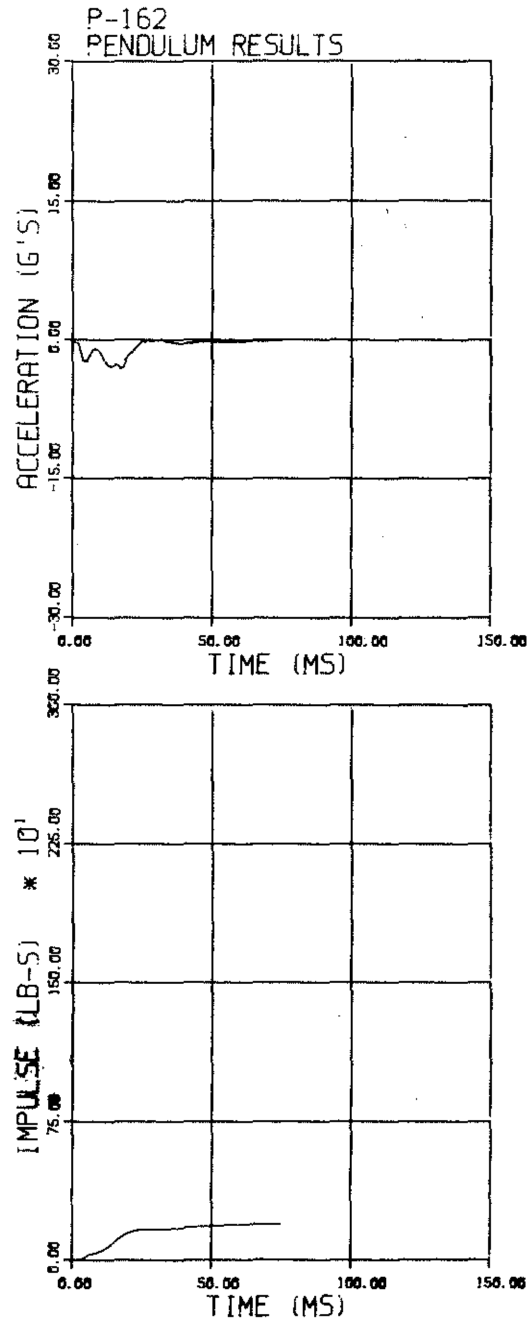
Post 159 - Hemlock



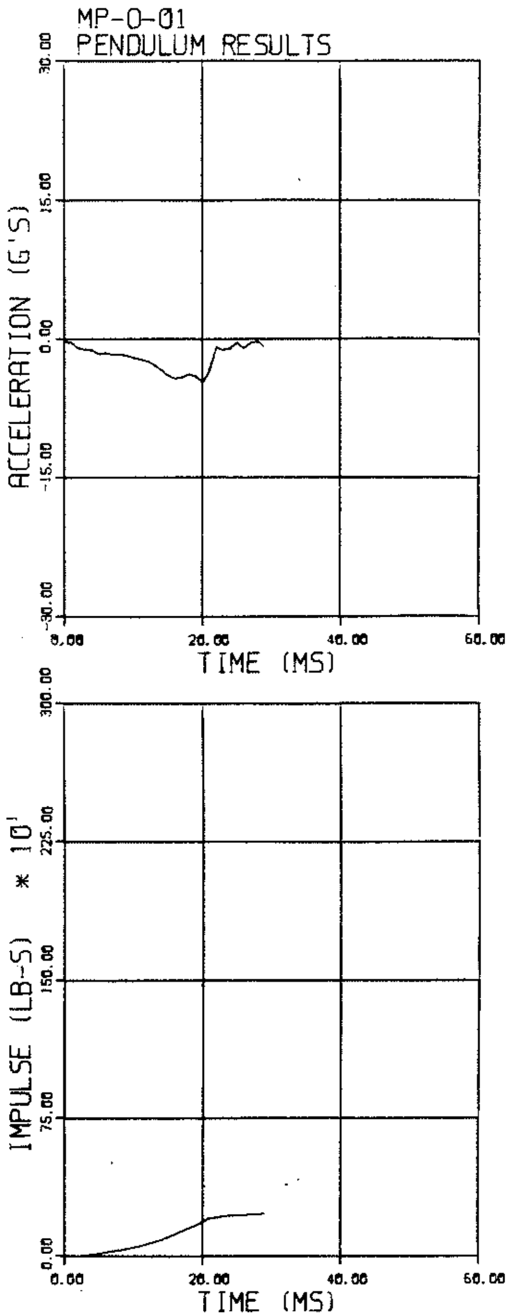
Post 160 - Hemlock



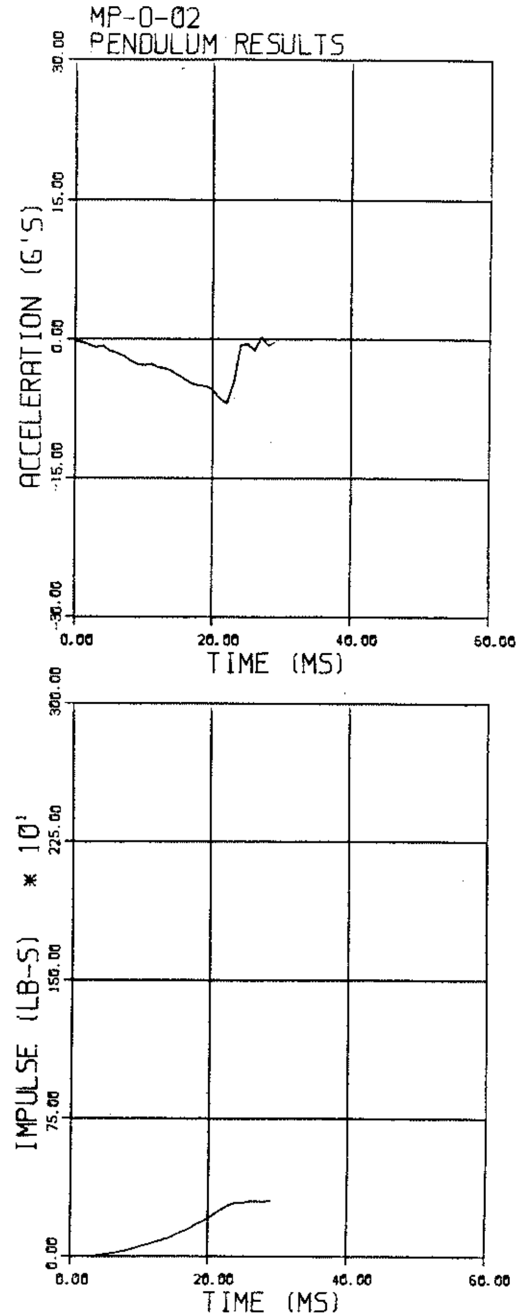
Post 161 - Hemlock



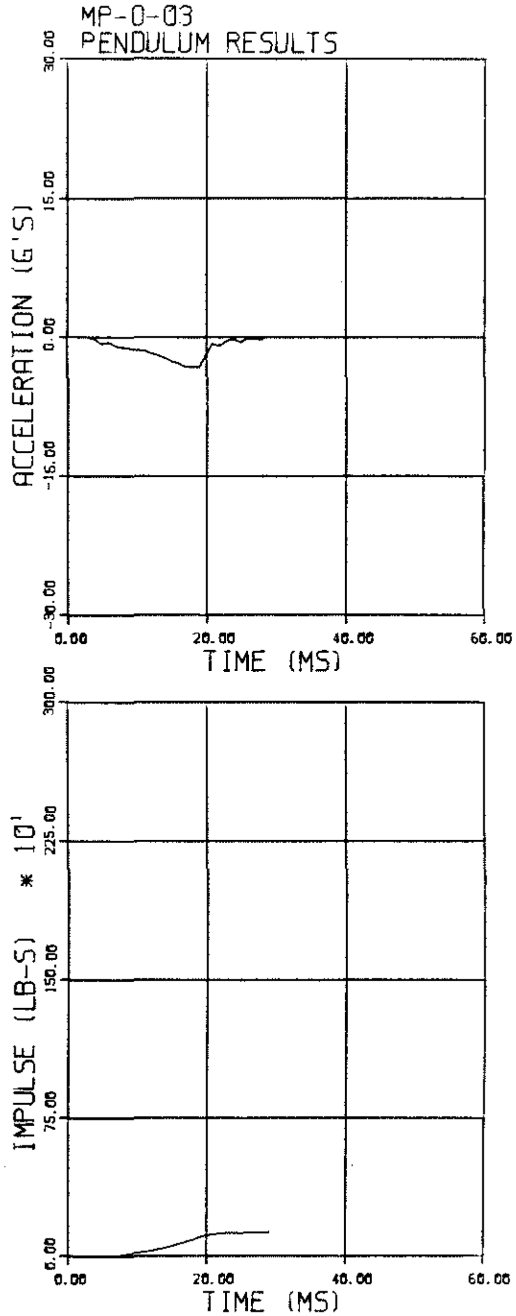
Post 162 - Hemlock



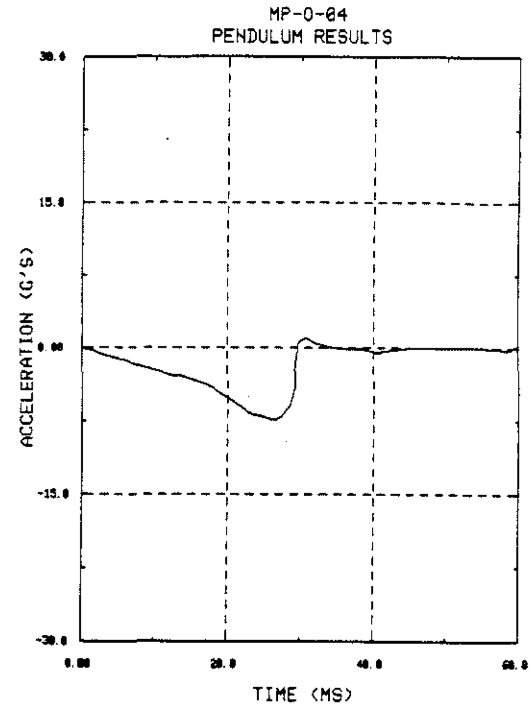
Post 0-01 - Jack Pine



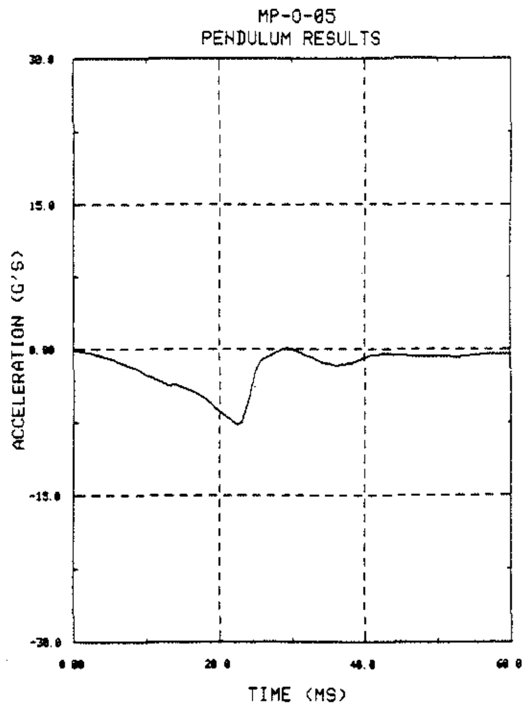
Post 0-02 - Jack Pine



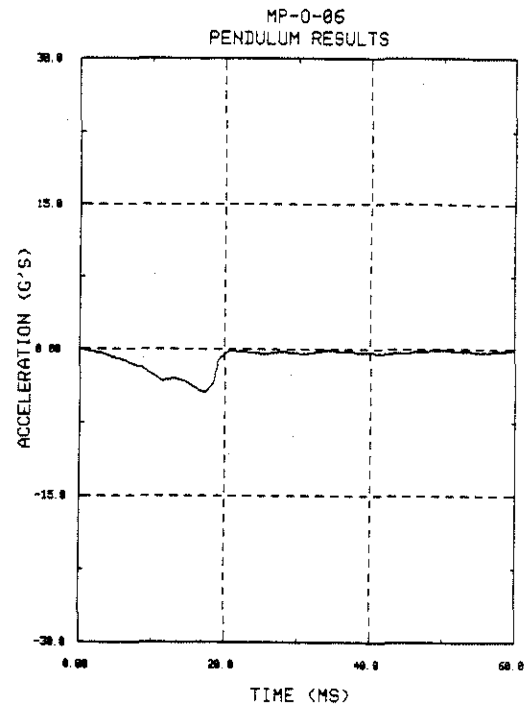
Post 0-03 - Jack Pine



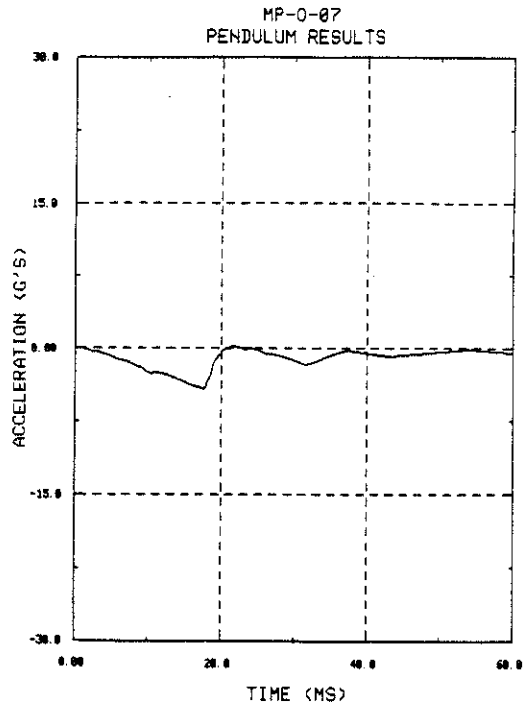
Post 0-04 - Jack Pine



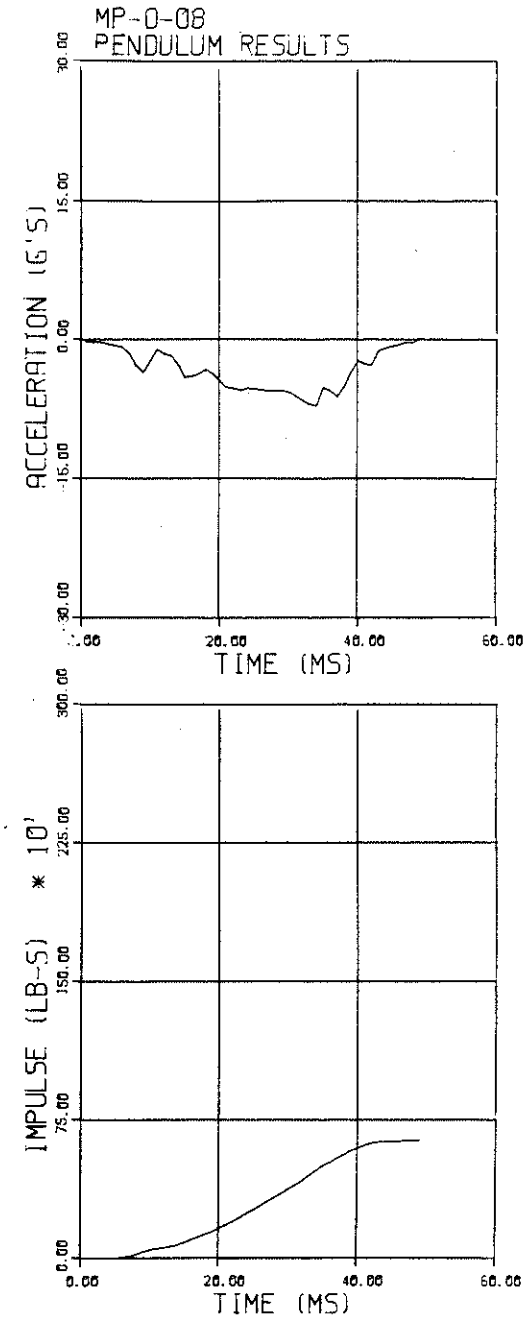
Post 0-05 - Jack Pine



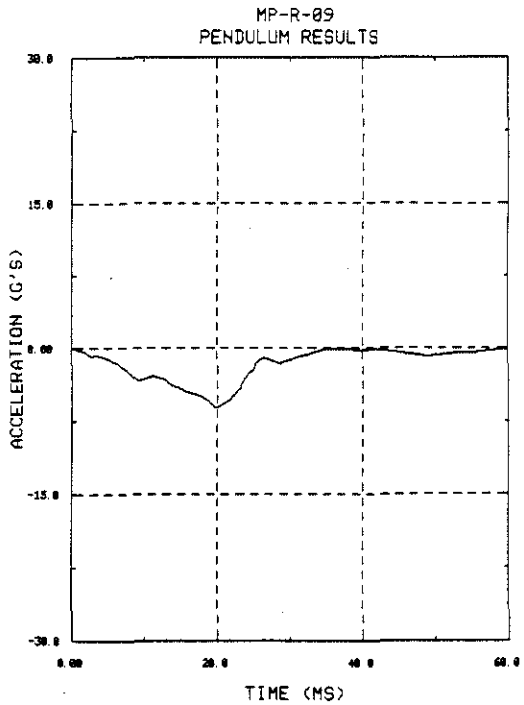
Post 0-06 - Jack Pine



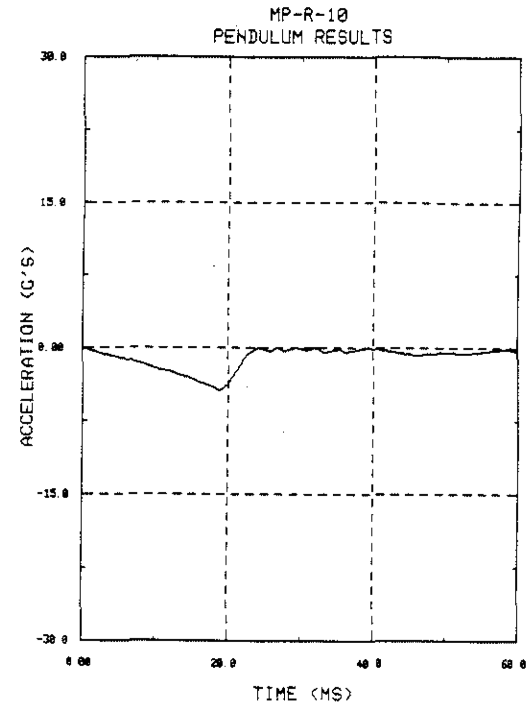
Post 0-07 - Jack Pine



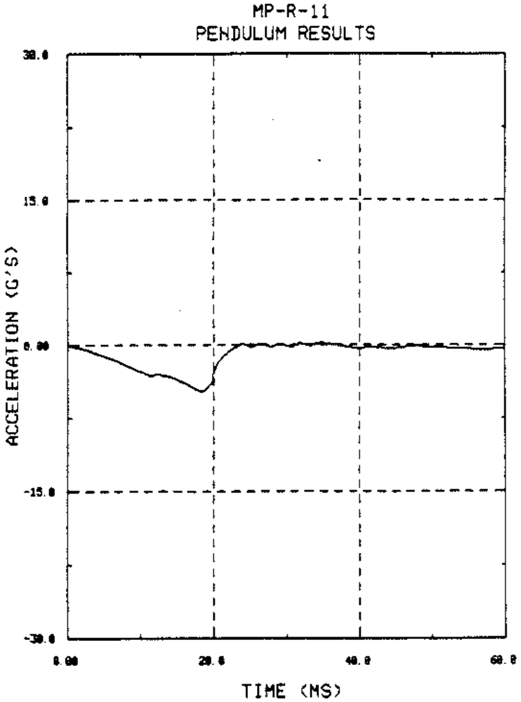
Post 0-08 - Jack Pine



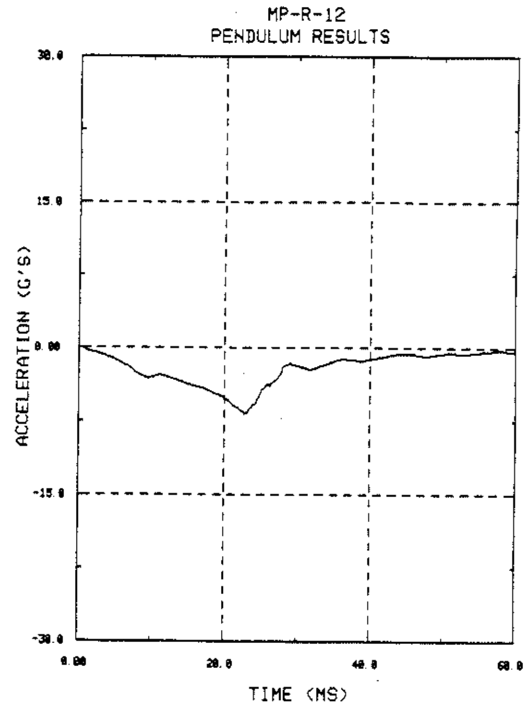
Post R-09 - Red Pine



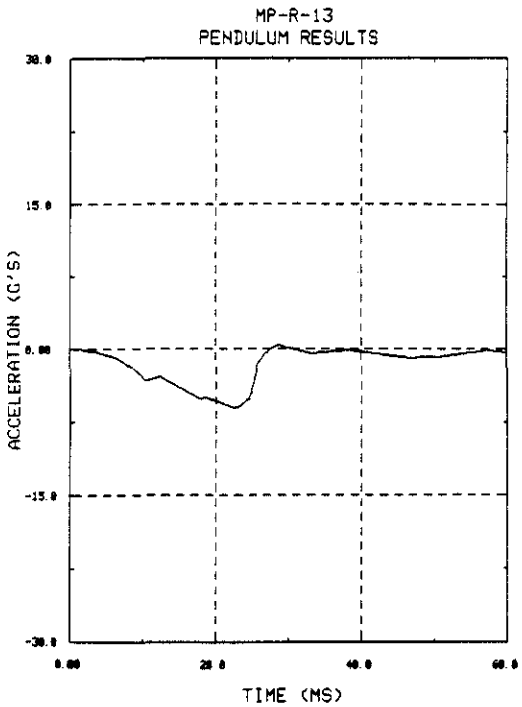
Post R-10 - Red Pine



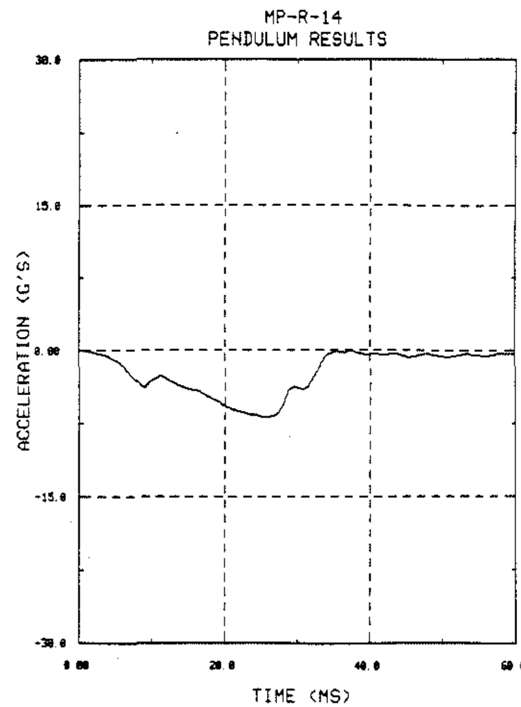
Post R-11 - Red Pine



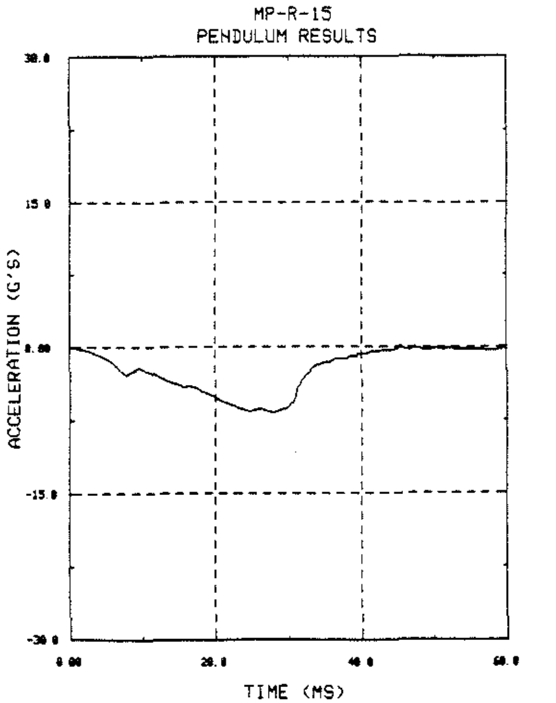
Post R-12 - Red Pine



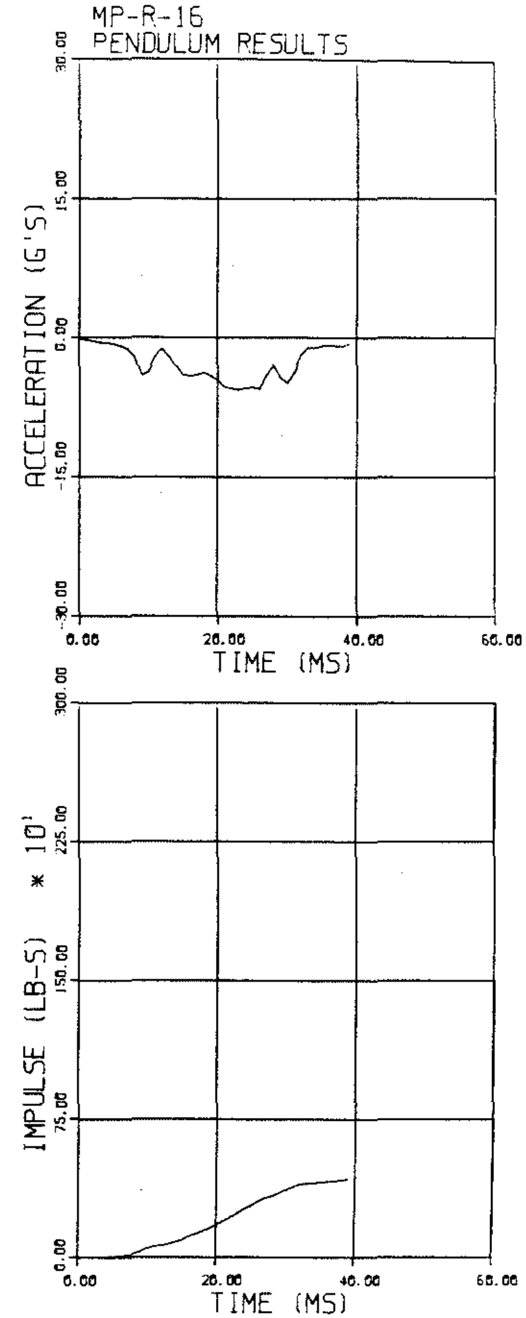
Post R-13 - Red Pine



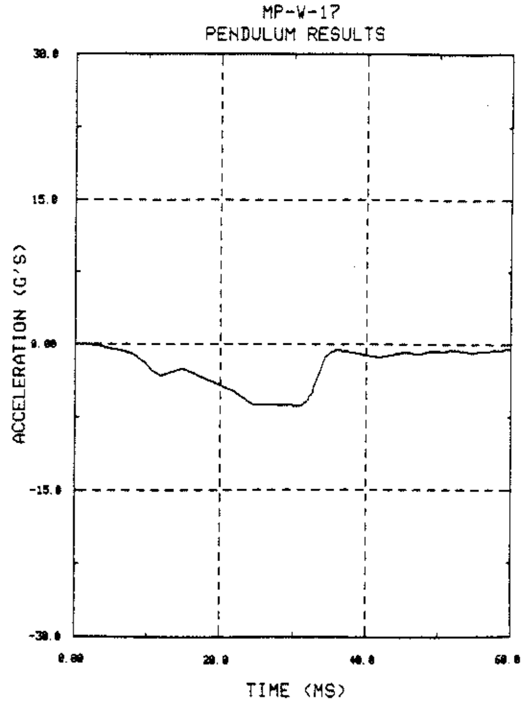
Post R-14 - Red Pine



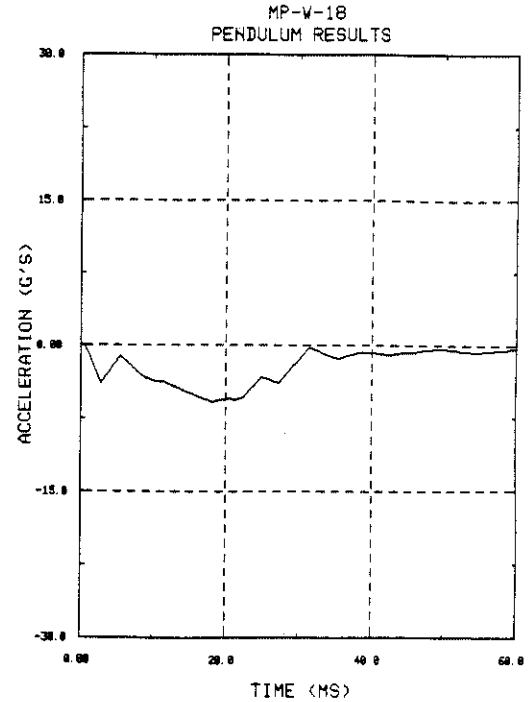
Post R-15 - Red Pine



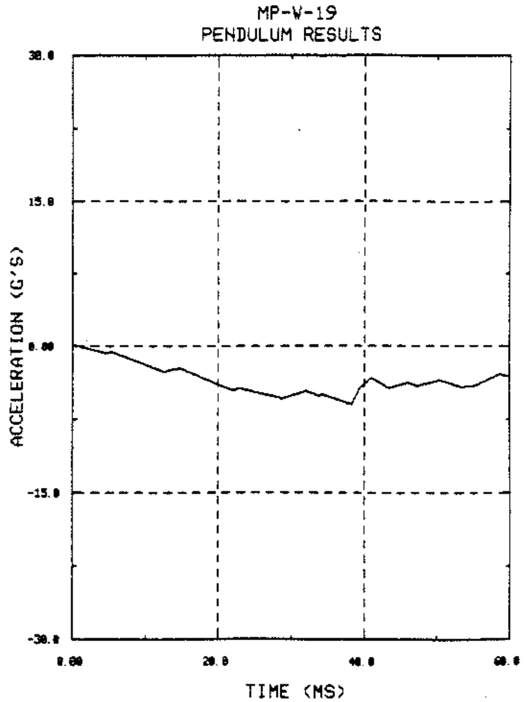
Post R-16 - Red Pine



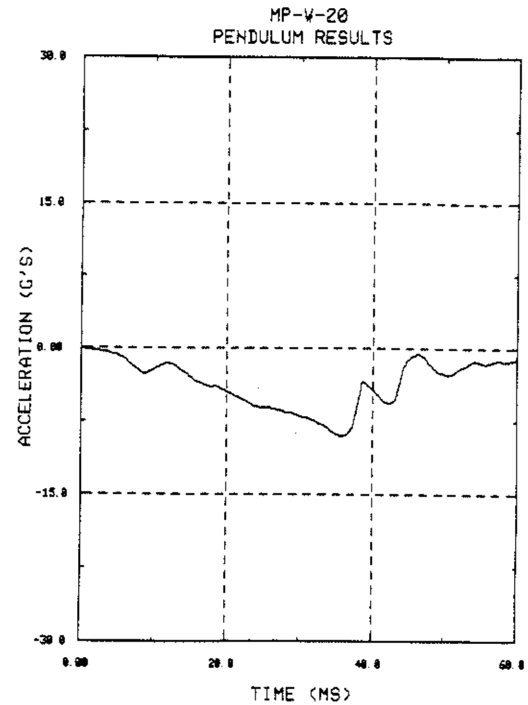
Post W-17 - Red Maple



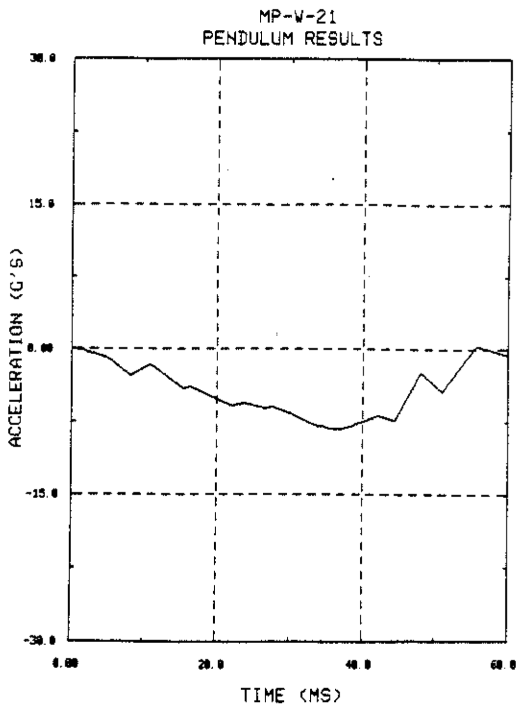
Post W-18 - Red Maple



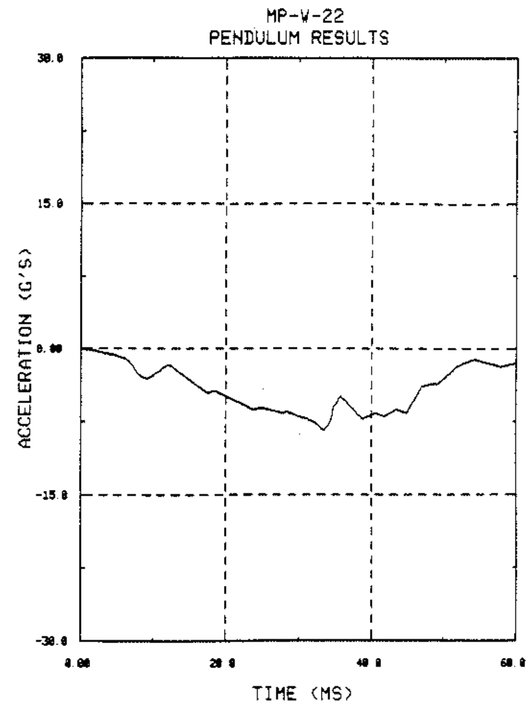
Post W-19 - Red Maple



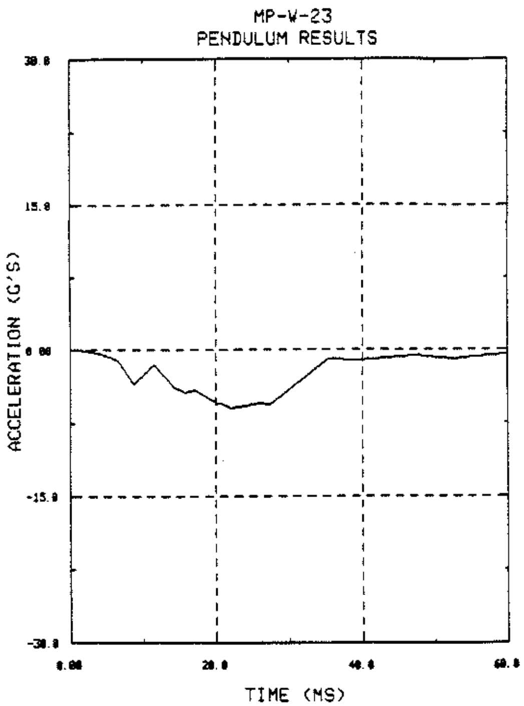
Post W-20 - Red Maple



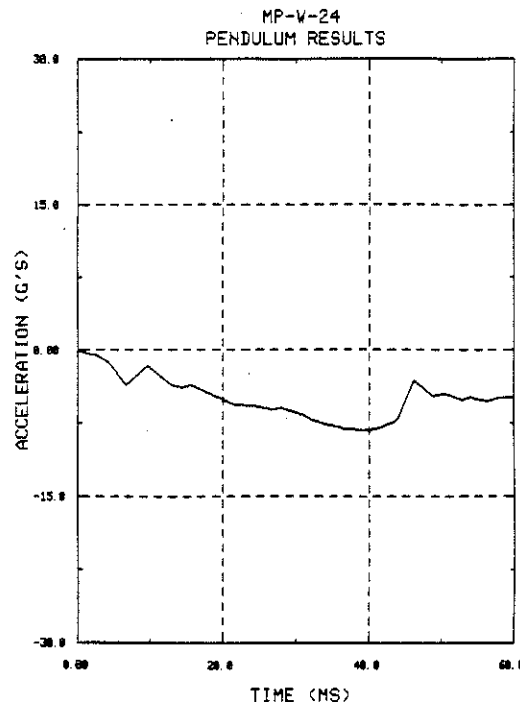
Post W-21 - Red Maple



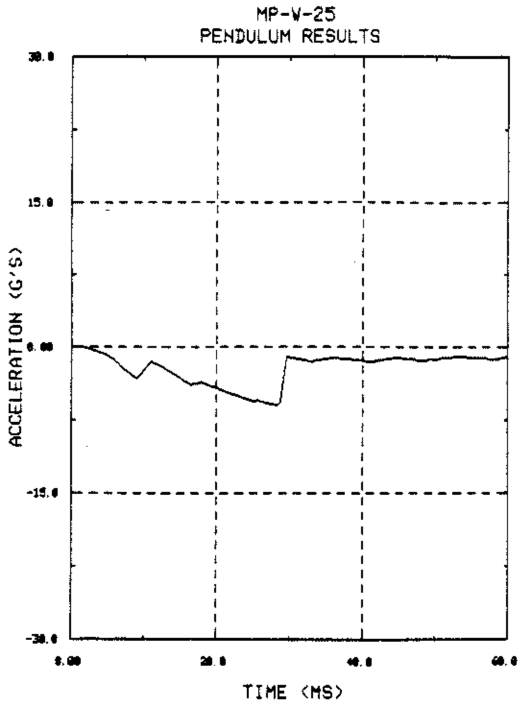
Post W-22 - Red Maple



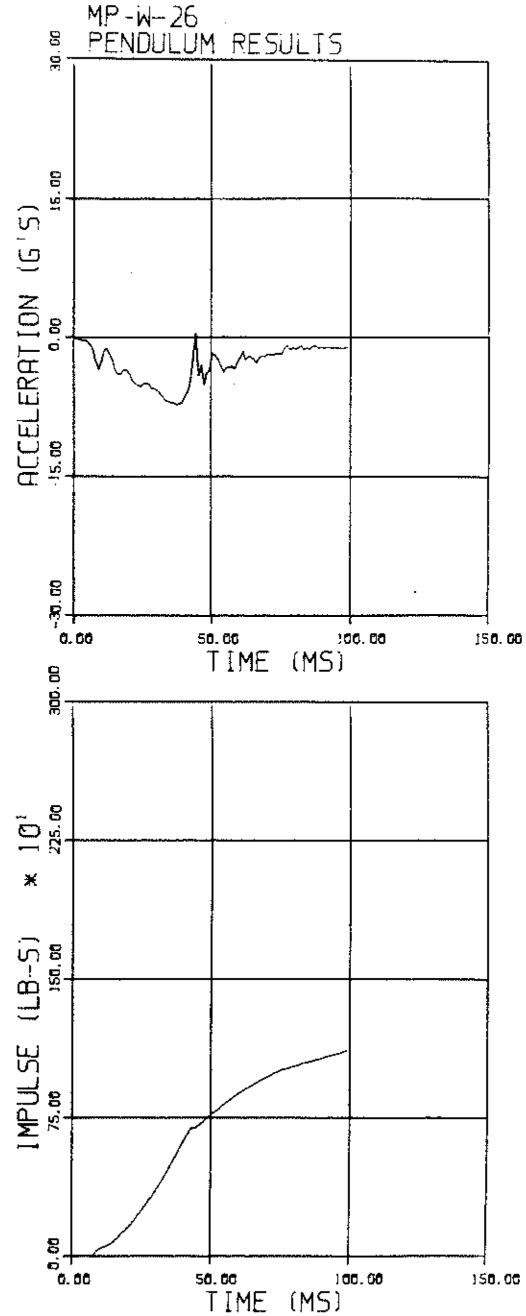
Post W-23 - Red Maple



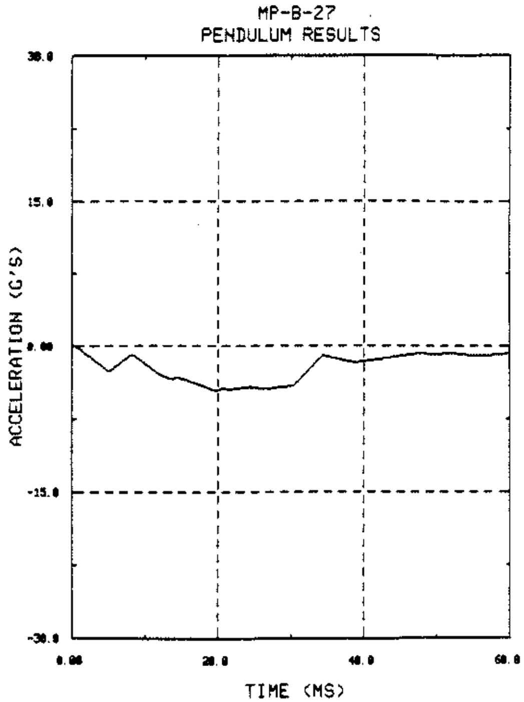
Post W-24 - Red Maple



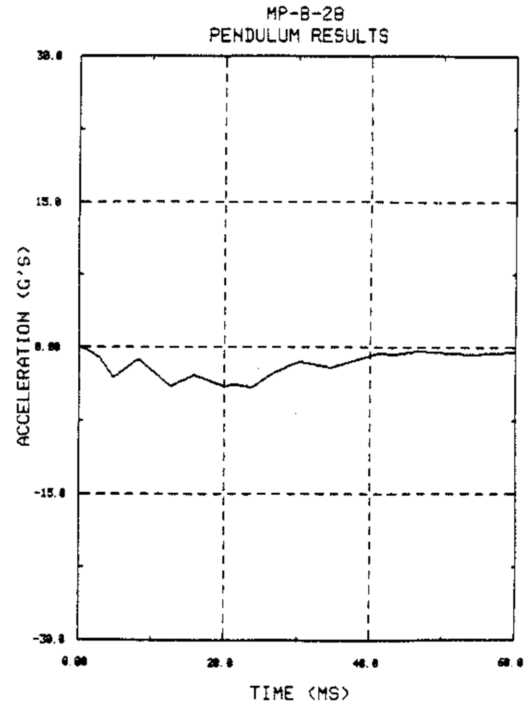
Post W-25 - Red Maple



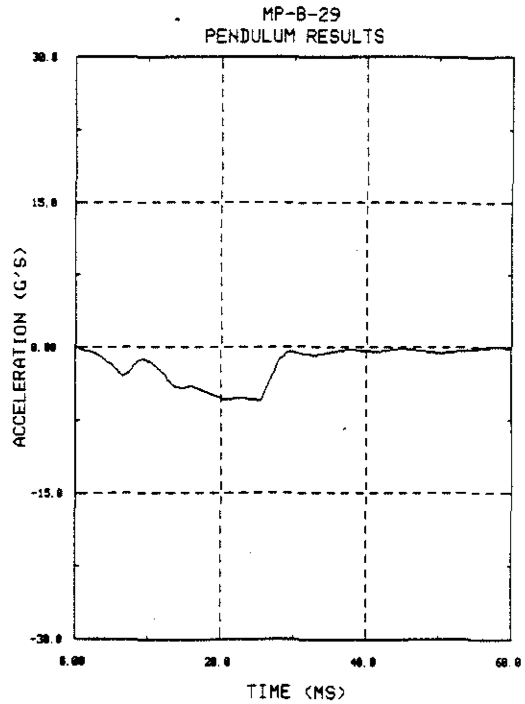
Post W-26 - Red Maple



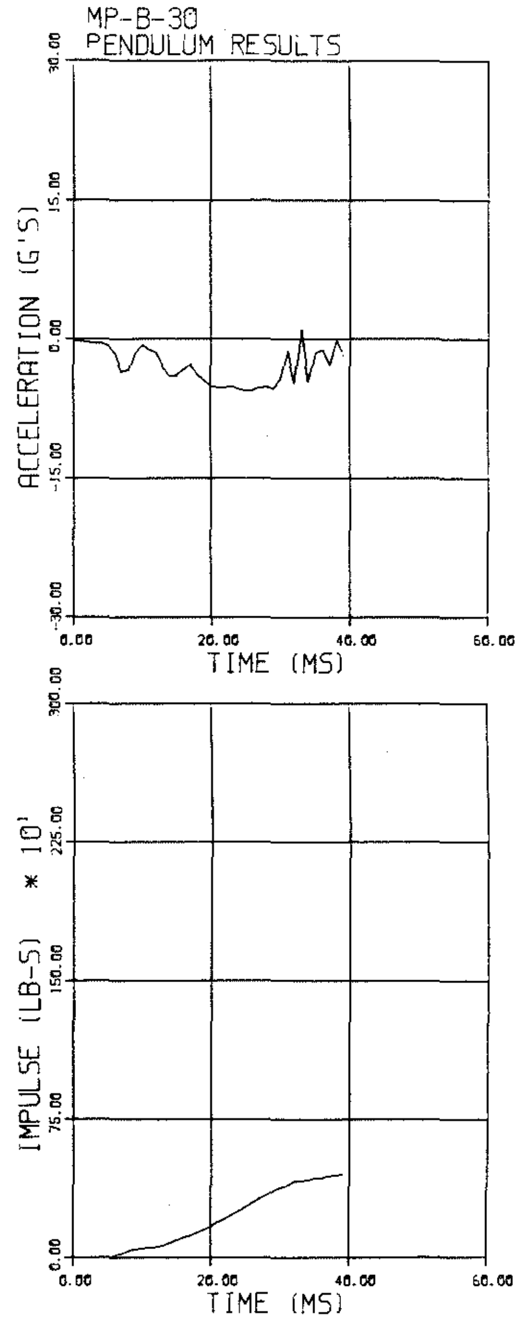
Post B-27 - White Ash



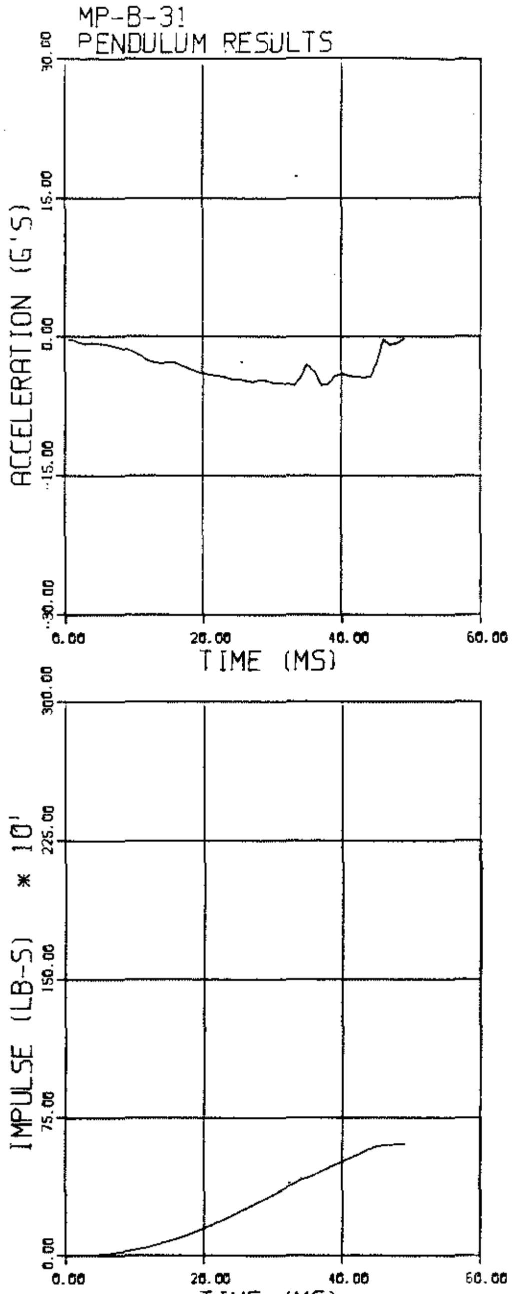
Post B-28 - White Ash



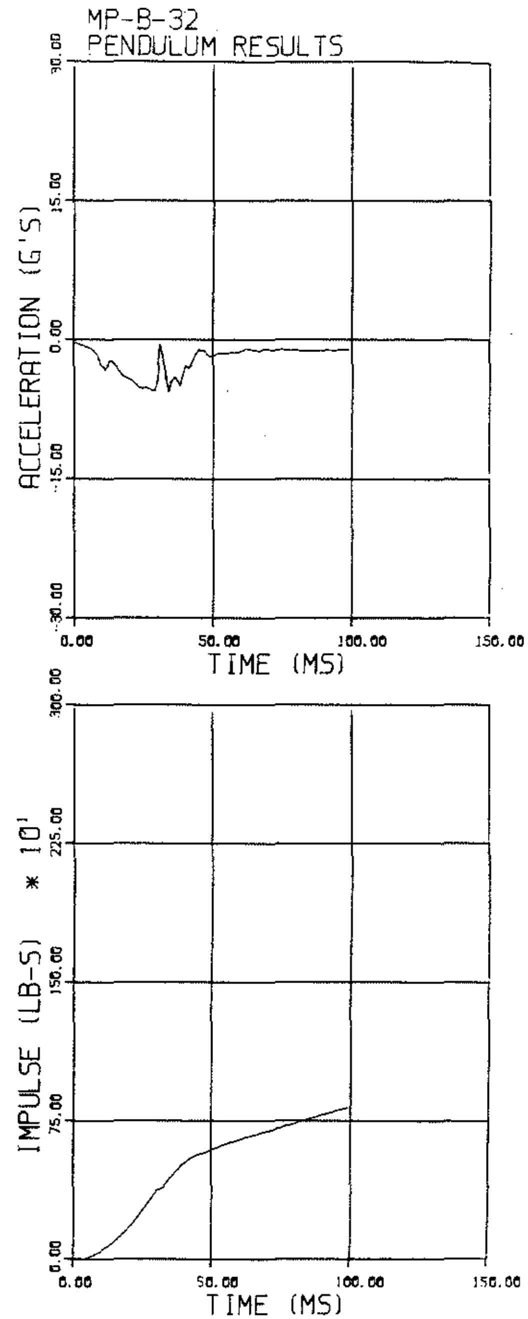
Post B-29 - White Ash



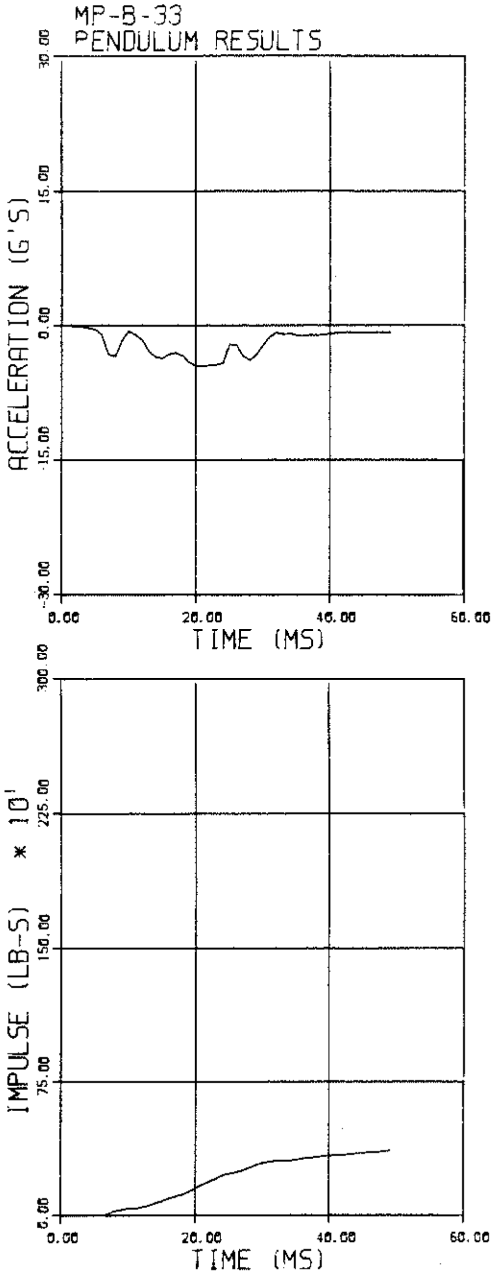
Post B-30 - White Ash



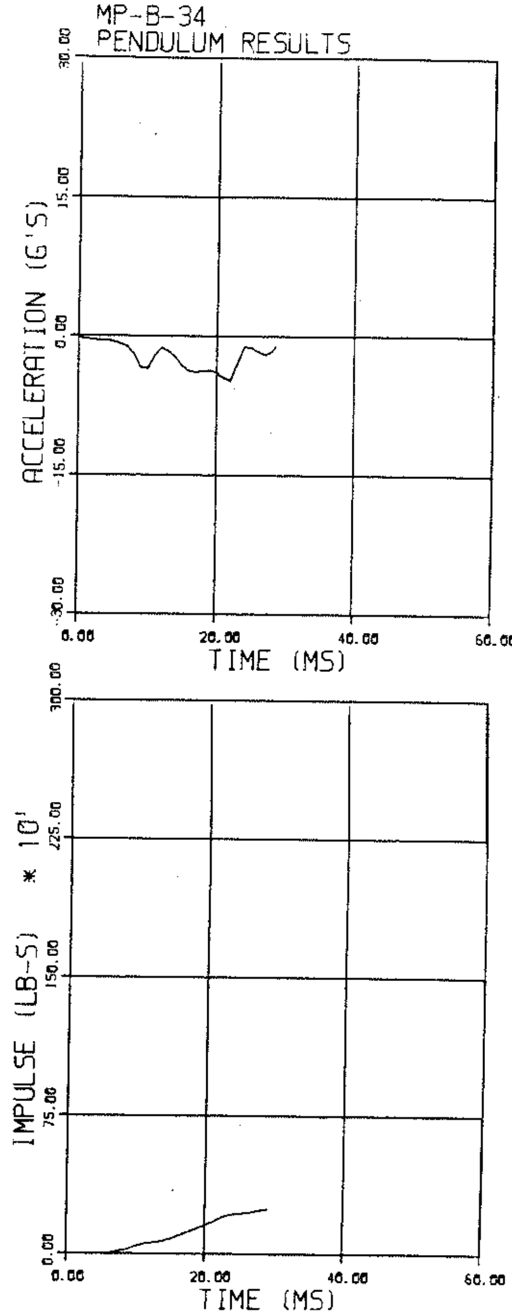
Post B-31 - White Ash



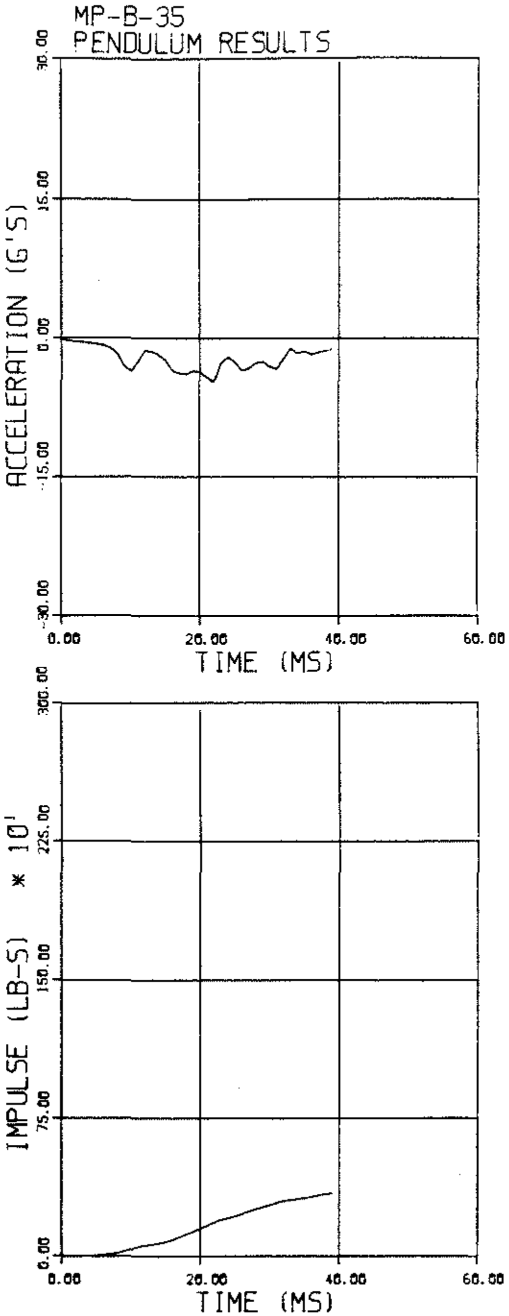
Post B-32 - White Ash



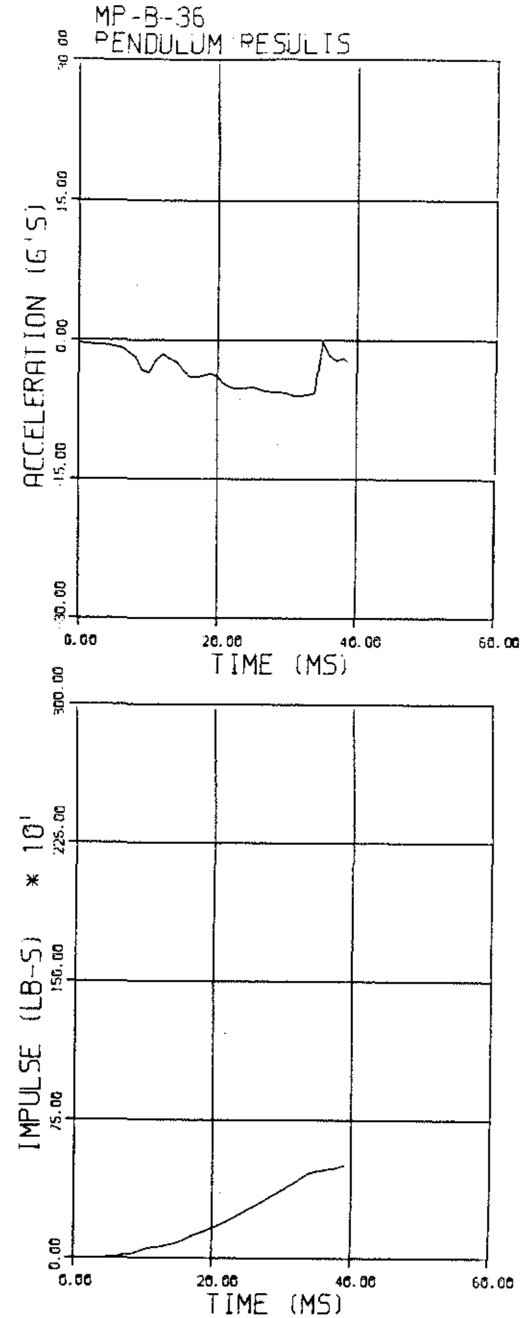
Post B-33 - White Ash



Post B-34 - White Ash



Post B-35 - White Ash



Post B-36 - White Ash

APPENDIX B

FULL-SCALE CRASH TEST REPORTS

Note: Multiply fps by 0.6818 to obtain mph.

SUMMARY OF RESULTS, TEST MWP-1

Test No..MWP-1

Date...1-27-86

Installation Length - ft (m)...100 (30)

Beam
  Member in. (cm)..12 ga W-beam
  Length - ft (m)..12.5 (3.8)

Posts 4 through 13
  Material...Michigan White Pine
  Description..6x8x72 (15x20x183)
  Embedment - ft (m)...3.3 (1.0)
  Spacing - ft (m)...6.4 (1.2)

Maximum Deflections - in. (cm)
  Dynamic..75.6 (192.0)
  Permanent..57.6 (146.3)

Soil Type and Condition..S1 (dry)

Vehicle..1978 Plymouth Sedan

Mass - lb (kg)
  Test Inertia...4370 (1982)
  Dummy..330 (150)
  Gross..4700 (2132)

Speed - mph (km/h)
  Impact...59.1 (95.1)

Angle - deg
  Impact...24.4

Occupant Impact Velocity - fps (m/s)
  Forward (film)...7.0 (2.1)
  Lateral (film)...-11.3 (-3.4)

Occupant Ridedown Accelerations - g's
  Forward (film)...*
  Lateral (film)...-11.3

Maximum 50-msec Avg Accelerations - g's
  Longitudinal (film)..-2.4
  Lateral (film)...3.6

Damage
  TAD..01-FR-3
  VDI..01FREW5

* Occupant did not travel required distance.

TEST MWP-1

Barrier Installation: The barrier evaluated in the test was a standard G4(2W) blocked-out W-beam (wood post) system. White pine posts and blockouts were incorporated in the impact area of the barrier. Figure B.1 presents construction details as well as a listing of post numbers vs. specimen numbers and moisture content of the specimens.

Test Vehicle: The vehicle used in the test was a 1978 Plymouth sedan. Gross test weight, including the dummies and instrumentation, was 4700 lb (2132 kg). Figure B.2 contains photographs of the barrier and test vehicle.

Performance: Impact conditions were 59.1 mph (95.1 km/h) and a 24.4-degree impact angle. As shown in Figure B.3 the vehicle impacted the barrier 1.7 ft (0.9 m) upstream of Post 6. The barrier deflected laterally 6.3 ft (1.9 m) while the vehicle remained in contact with the system for 48 ft (1.5 m) before redirection. Observation of the test film indicated that the specimen posts fractured due to rail deflection before vehicle impact. The vehicle came to rest 205 ft (62 m) downstream of and in line with the impact point.

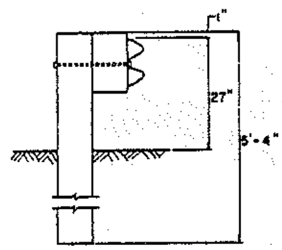
Maximum 50-msec average accelerations measured by film analysis were -2.4 g (longitudinal) and 3.6 g (lateral). Figure B.4 presents a summary of test results. Permanent barrier deflections are presented in Table B.1. Table B.2 contains vehicle kinetic data as well as occupant risk data from film analysis. Figure B.5 contains photographs of barrier and vehicle damage.

Barrier Damage: Damage to the system consisted of deformation of six sections of W-beam. Post 1 was split vertically through the rail attachment hole. Longitudinal displacement of the footing was also evident. Posts 3 through 14 were fractured during impact.

Vehicle Damage: Vehicle damage consisted of sheet metal deformation of the right front fender, side, hood, and the headlight/grille area. The right front tire was blown out during impact. The front bumper was deformed and displaced laterally to the left.

Metric Conversions

1 ft. = 0.305 m
1 in. = 25.4 mm
1 mph = 1.61 km/hr
1 lb = 0.454 kg



SYSTEM	G4(2W) Blocked-Out "W" Beam (Wood Post)
BARRIER DESCRIPTION	
POST SPACING	6' 3"
POST TYPE	6" x 8" white pine
BEAM TYPE	Steel "W" section, 12 GA
OFFSET BRACKETS	6" x 8" x 14" wood block
MOUNTINGS	5/8" diameter carriage bolts
FOOTINGS	None

LIST OF POST NUMBERS VS. SPECIMEN NUMBERS

Post No.	Specimen No.	% Moisture
4	114	67
5	117	48
6	145	30
7	151	46
8	154	64
9	118	56
10	144	58
11	147	52
12	156	40
13	158	21

Average 48%

FIGURE B.1 CONSTRUCTION DETAILS, TEST MWP-1

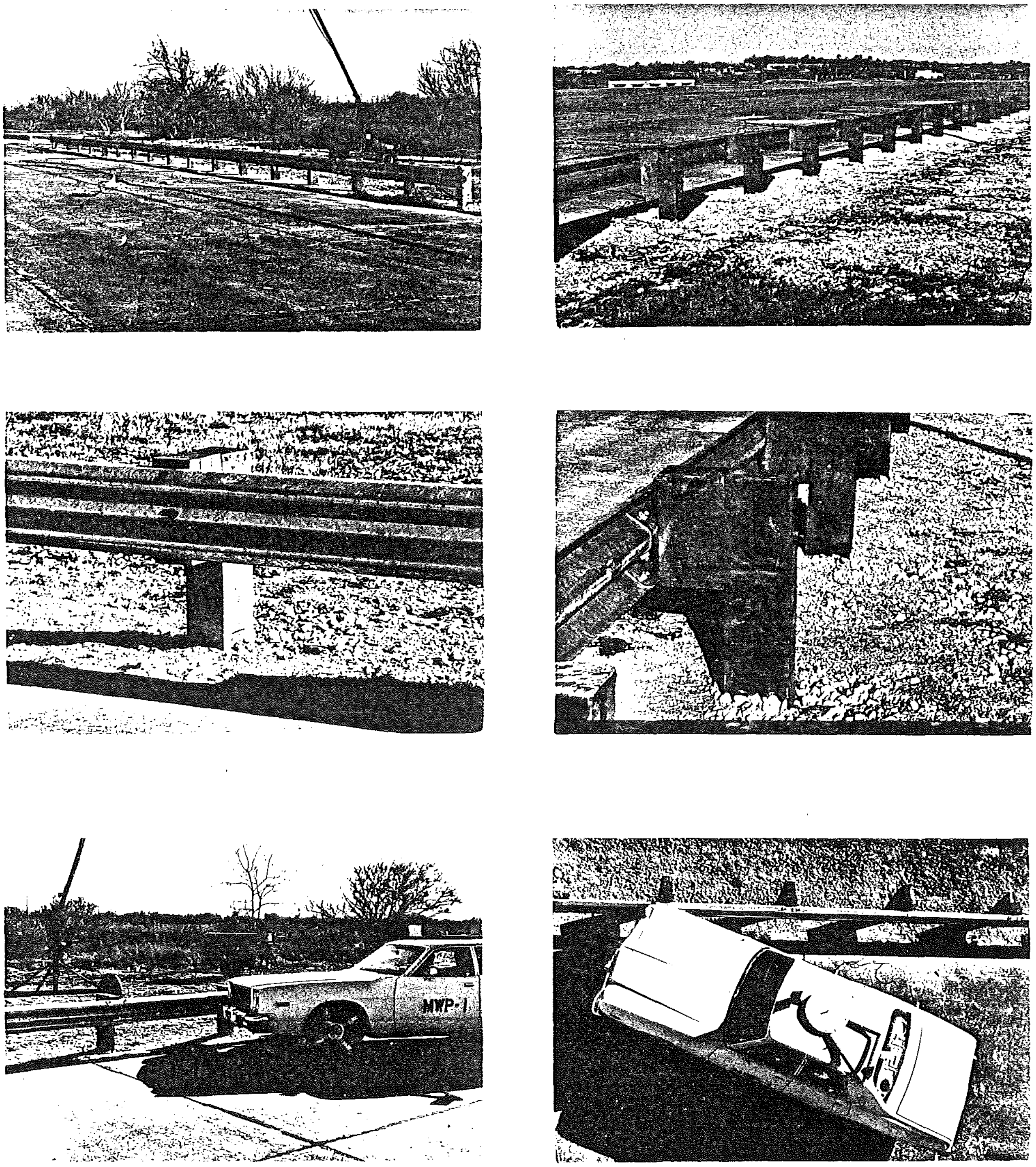


FIGURE B.2 BARRIER AND VEHICLE DETAILS, TEST MWP-1

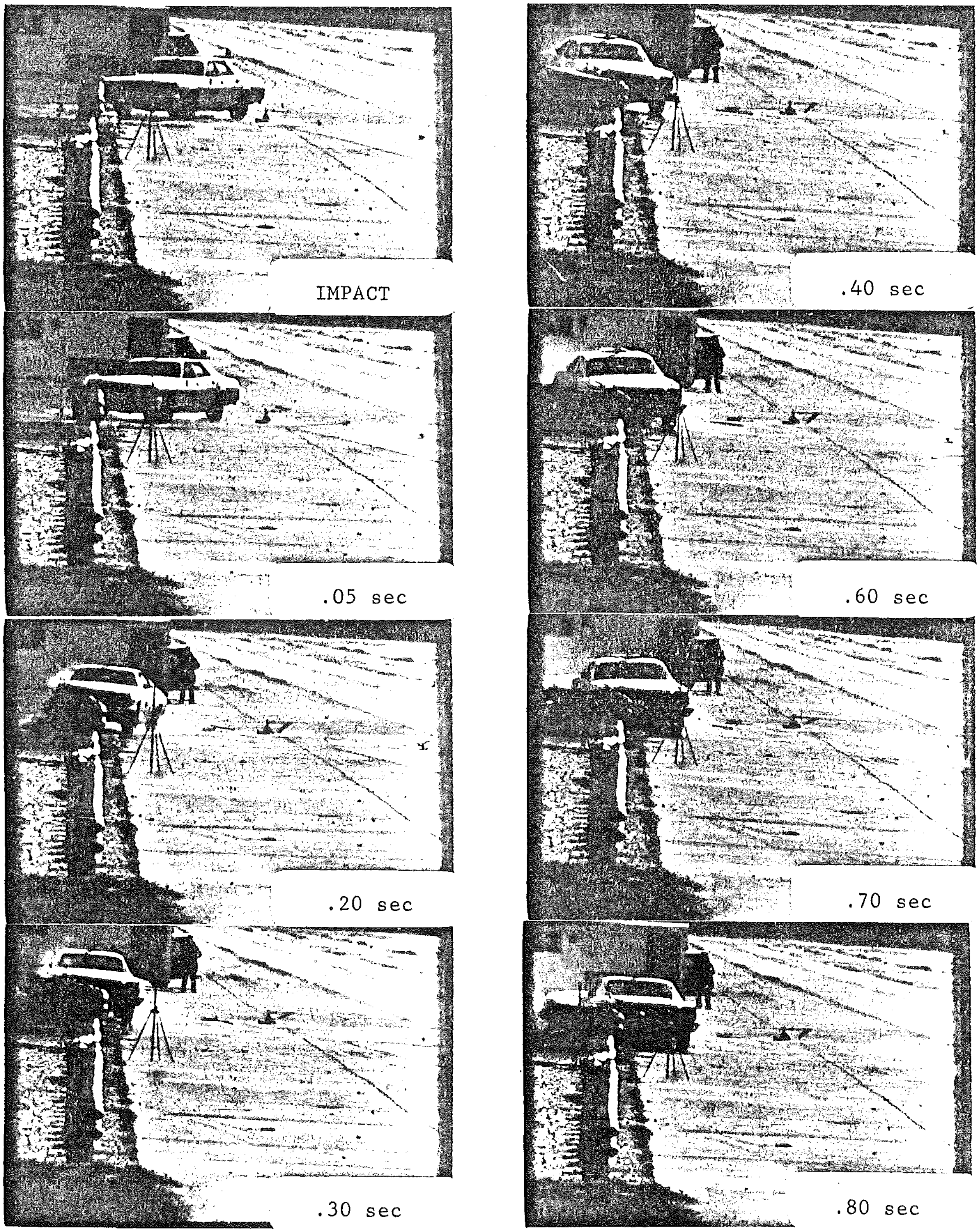
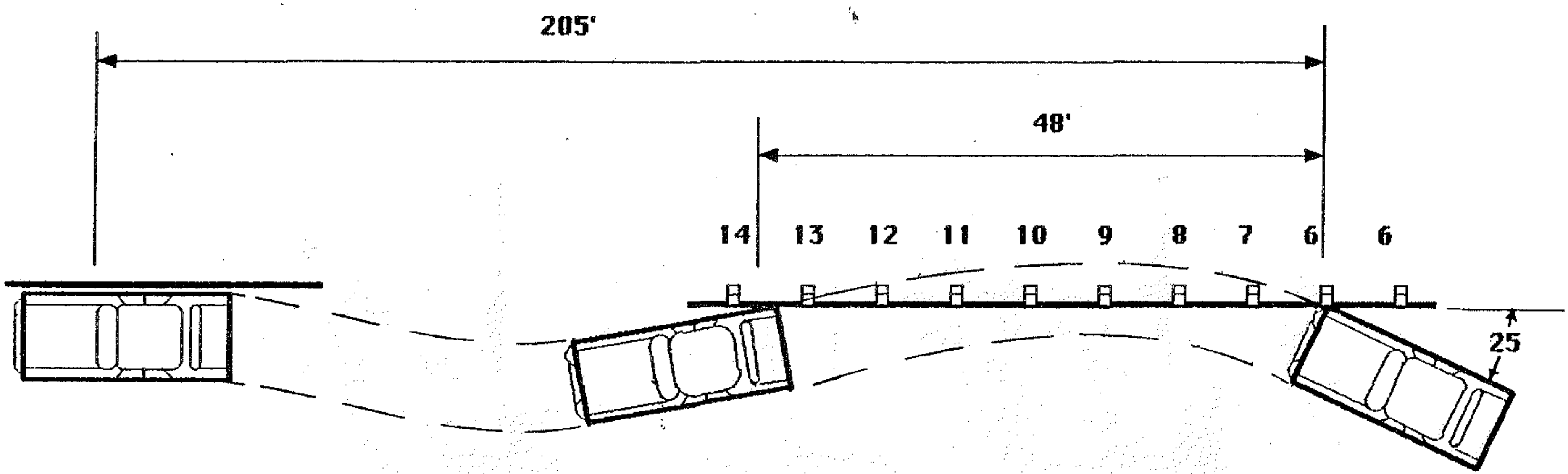


FIGURE B.3 SEQUENTIAL PHOTOGRAPHS, TEST MWP-1



Test No.	MWP-1
Date	1-27-86
Installation Length - ft (m)	100 (30)
Beam	
Member in. (cm)	12 ga W-beam
Length - ft (m)	12.5 (3.8)
Posts 4 through 13	
Material	Michigan White Pine
Description	6x8x72 (15x20x183)
Embedment - ft (m)	3.3 (1.0)
Spacing - ft (m)	6.4 (1.2)
Maximum Deflections - in. (cm)	
Dynamic	75.6 (192.0)
Permanent	57.6 (146.3)
Soil Type and Condition	S1 (dry)
Vehicle	1978 Plymouth Sedan

Mass - lb (kg)	
Test Inertia	4370 (1982)
Dummy	330 (150)
Gross	4700 (2132)
Speed - mph (km/h)	
Impact	59.1 (95.1)
Angle - deg	
Impact	24.4
Occupant Impact Velocity - fps (m/s)	
Forward (film)	7.0 (2.1)
Lateral (film)	-11.3 (-3.4)
Occupant Ridedown Accelerations - g's	
Forward (film)	*
Lateral (film)	-11.3
Maximum 50-msec Avg Accelerations - g's	
Longitudinal (film)	-2.4
Lateral (film)	3.6
Damage	
TAD	01-FR-3
VDI	01FREW5

* Occupant did not travel required distance.

FIGURE B.4 SUMMARY OF RESULTS, TEST MWP-1

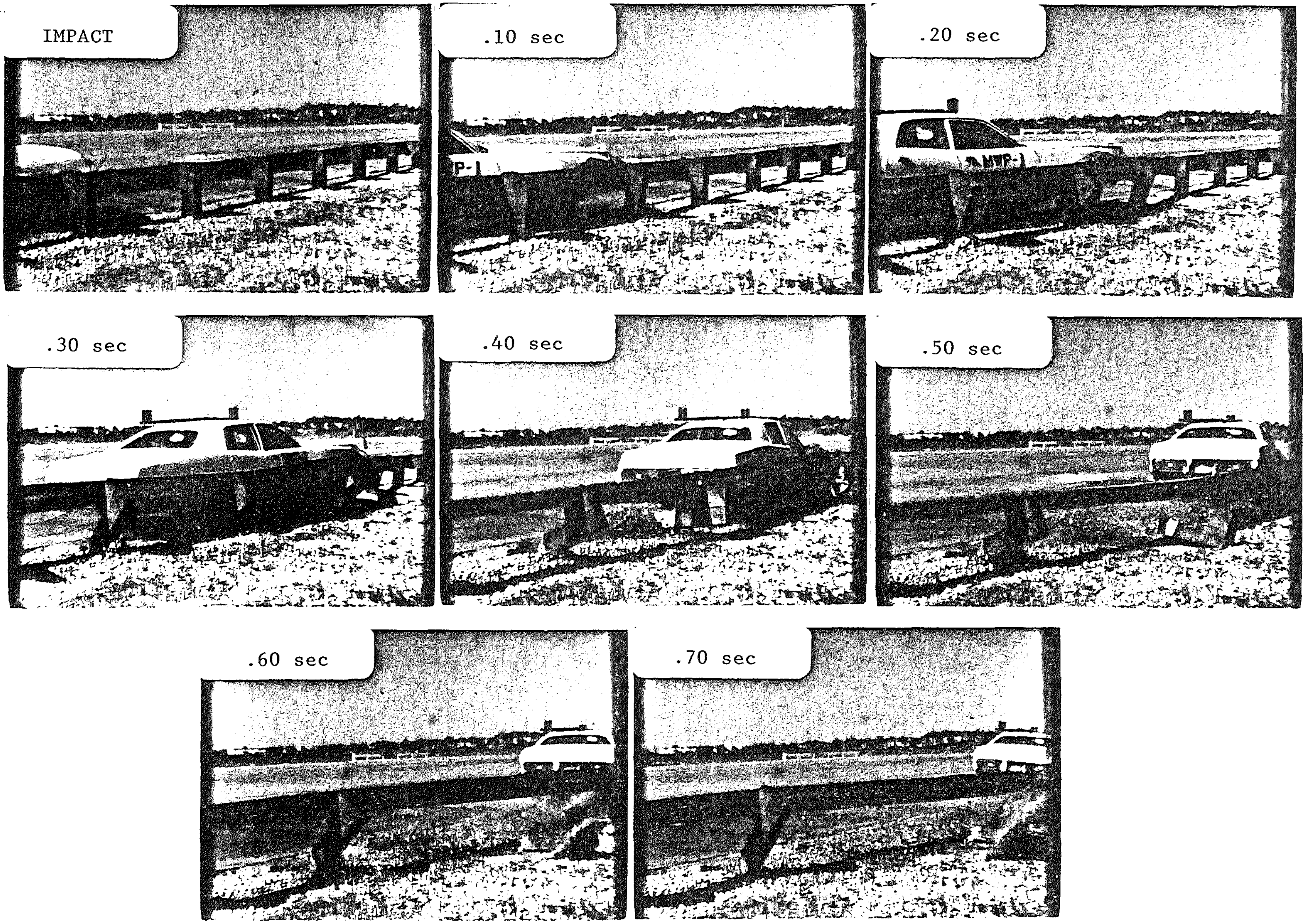


FIGURE B.4 SUMMARY OF RESULTS, TEST MWP-1 (Continued)

TABLE B.1

PERMANENT BARRIER DEFLECTIONS, TEST MWP-1

Post/Location	Deflections (in.)
2	0
3	10.5
4	18.5
5	30.5
6	45.0
7	57.0
8	58.0
9	45.0
10	34.0
11	27.5
12	20.0
13	7.0
14	2.0
15	0

TABLE B.2

FILM ANALYSIS DATA, TEST MWP-1

MICHIGAN WHITE PINE TEST MWP1 1-27-86

VEHICLE KINETICS SUMMARY--FROM FILM ANALYSIS

TIME (S)	VEH. ACCEL.(G'S) LONG.	LAT.	HEADING ANGLE (DEG)	VEH. VEL.(FPS) LONG.	LAT.	VEH. DISP.(F) X	Y
0.000	-.64	2.15	24.39	86.67	-.22	-5.48	-5.67
.010	-.67	2.29	24.34	86.46	.42	-4.69	-5.31
.020	-.70	2.37	24.22	86.24	.99	-3.90	-4.96
.030	-.73	2.42	24.02	86.01	1.47	-3.11	-4.62
.040	-.77	2.42	23.75	85.78	1.84	-2.32	-4.29
.050	-.82	2.39	23.39	85.54	2.08	-1.52	-3.96
.060	-.87	2.35	22.95	85.28	2.19	-.73	-3.65
.070	-.94	2.29	22.43	85.01	2.16	.06	-3.34
.080	-1.03	2.22	21.83	84.71	2.00	.86	-3.04
.090	-1.13	2.16	21.15	84.39	1.70	1.65	-2.75
.100	-1.24	2.11	20.39	84.03	1.28	2.44	-2.46
.110	-1.36	2.07	19.57	83.62	.74	3.24	-2.18
.120	-1.50	2.05	18.67	83.17	.10	4.03	-1.92
.130	-1.64	2.05	17.71	82.66	-.63	4.81	-1.65
.140	-1.78	2.07	16.70	82.09	-1.42	5.60	-1.40
.150	-1.92	2.12	15.63	81.46	-2.27	6.38	-1.15
.160	-2.05	2.19	14.52	80.77	-3.16	7.15	-.92
.170	-2.17	2.29	13.36	80.01	-4.06	7.92	-.69
.180	-2.28	2.41	12.17	79.20	-4.96	8.69	-.47
.190	-2.37	2.54	10.94	78.34	-5.85	9.45	-.26
.200	-2.44	2.68	9.69	77.43	-6.71	10.21	-.06
.210	-2.48	2.84	8.43	76.48	-7.52	10.96	.13
.220	-2.49	2.99	7.14	75.50	-8.29	11.70	.32
.230	-2.48	3.14	5.85	74.50	-8.99	12.43	.49
.240	-2.44	3.28	4.56	73.50	-9.63	13.16	.65
.250	-2.37	3.40	3.27	72.50	-10.19	13.88	.80
.260	-2.28	3.50	1.99	71.51	-10.69	14.60	.93
.270	-2.17	3.58	.72	70.56	-11.12	15.31	1.06
.280	-2.03	3.62	-.53	69.63	-11.49	16.01	1.17
.290	-1.88	3.64	-1.75	68.75	-11.79	16.70	1.28
.300	-1.72	3.61	-2.94	67.92	-12.05	17.39	1.37
.310	-1.55	3.55	-4.10	67.15	-12.25	18.07	1.45
.320	-1.38	3.46	-5.21	66.44	-12.42	18.74	1.52
.330	-1.21	3.33	-6.28	65.79	-12.56	19.42	1.57
.340	-1.05	3.16	-7.29	65.20	-12.68	20.08	1.62
.350	-.90	2.97	-8.25	64.68	-12.78	20.74	1.66
.360	-.76	2.74	-9.15	64.21	-12.87	21.40	1.69
.370	-.64	2.50	-9.99	63.80	-12.96	22.05	1.71
.380	-.53	2.25	-10.75	63.44	-13.04	22.70	1.72
.390	-.45	1.98	-11.45	63.12	-13.13	23.35	1.73
.400	-.39	1.71	-12.07	62.84	-13.22	23.99	1.73
.410	-.35	1.45	-12.62	62.60	-13.31	24.63	1.73
.420	-.33	1.19	-13.09	62.38	-13.40	25.27	1.72
.430	-.33	.95	-13.48	62.18	-13.49	25.91	1.70

TABLE B.2 (Continued)

FILM ANALYSIS DATA, TEST MWP-1

.440	-.35	.73	-13.80	62.00	-13.56	26.54	1.69
.450	-.38	.54	-14.04	61.83	-13.61	27.17	1.67
~~.460~~	~~-.43~~	~~.39~~	~~-14.21~~	~~61.66~~	~~-13.64~~	~~27.81~~	~~1.65~~
.470	-.50	.26	-14.30	61.48	-13.64	28.44	1.63
.480	-.57	.18	-14.33	61.31	-13.60	29.07	1.61
~~.490~~	~~-.66~~	~~.14~~	~~-14.29~~	~~61.12~~	~~-13.51~~	~~29.69~~	~~1.59~~
.500	-.75	.14	-14.19	60.91	-13.36	30.32	1.57
.510	-.84	.18	-14.04	60.69	-13.15	30.94	1.55
~~.520~~	~~-.94~~	~~.26~~	~~-13.83~~	~~60.45~~	~~-12.86~~	~~31.56~~	~~1.54~~
.530	-1.04	.38	-13.59	60.19	-12.50	32.17	1.52
.540	-1.13	.53	-13.30	59.90	-12.06	32.79	1.50
~~.550~~	~~-1.21~~	~~.71~~	~~-12.99~~	~~59.59~~	~~-11.54~~	~~33.40~~	~~1.47~~
.560	-1.29	.91	-12.65	59.25	-10.93	34.00	1.45
.570	-1.36	1.13	-12.30	58.89	-10.23	34.60	1.43
.580	-1.41	1.35	-11.94	58.51	-9.46	35.19	1.40
.590	-1.44	1.58	-11.56	58.11	-8.61	35.78	1.37
.600	-1.46	1.79	-11.19	57.69	-7.69	36.37	1.34
.610	-1.45	1.98	-10.82	57.27	-6.71	36.94	1.30
.620	-1.42	2.14	-10.45	56.85	-5.68	37.52	1.25
.630	-1.36	2.26	-10.10	56.43	-4.62	38.08	1.20
.640	-1.28	2.34	-9.75	56.03	-3.53	38.64	1.15
.650	-1.17	2.37	-9.41	55.65	-2.44	39.20	1.08
.660	-1.04	2.34	-9.08	55.31	-1.37	39.75	1.01
.670	-.90	2.25	-8.76	55.00	-.32	40.30	.93
.680	-.74	2.11	-8.45	54.73	.68	40.84	.85
.690	-.59	1.94	-8.15	54.51	1.63	41.38	.76
.700	-.46	1.74	-7.85	54.33	2.50	41.91	.66
.710	-.36	1.54	-7.57	54.19	3.29	42.45	.56
.720	-.32	1.37	-7.32	54.07	4.00	42.98	.46
.730	-.36	1.27	-7.10	53.94	4.63	43.51	.35

HIGHEST 50-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-2.44	.1950	.2450
LAT.	3.62	.2650	.3150

TABLE B.2 (Continued)

FILM ANALYSIS DATA, TEST MWP-1

MICHIGAN WHITE PINE TEST MWP1 1-27-86
OCCUPANT RISK SUMMARY -- FROM FILM ANALYSIS
NOTE: AVG. ACCEL. FOR PRIOR 0.010 SEC. CALCULATED
FROM VEHICLE VELOCITY CHANGE
RELATIVE VALUES-(OCCUPANT W.R.T. VEHICLE)

	(------- VEHICLE	--------)	(	------------ OCCUPANT	------------)		
TIME	ACCEL. (G'S)		ANG. VEL	VEL. (FPS)		DISP. (F)	
(S)	LONG.	LAT.	(RAD/S)	LONG.	LAT.	LONG.	LAT.
0.000	-.64	2.15	.43	0.00	0.00	0.00	0.00
.010	-.67	2.29	.42	.06	-.57	.00	-.00
.020	-.70	2.37	.42	.12	-1.17	.00	-.01
.030	-.73	2.42	.42	.18	-1.77	.00	-.03
.040	-.77	2.42	.41	.23	-2.38	.00	-.05
.050	-.82	2.39	.41	.28	-2.98	.01	-.07
.060	-.87	2.35	.40	.34	-3.58	.01	-.11
.070	-.94	2.29	.39	.41	-4.16	.01	-.15
.080	-1.03	2.22	.38	.49	-4.74	.01	-.19
.090	-1.13	2.16	.37	.60	-5.30	.02	-.24
.100	-1.24	2.11	.36	.72	-5.86	.02	-.30
.110	-1.36	2.07	.34	.88	-6.42	.02	-.36
.120	-1.50	2.05	.33	1.06	-6.99	.03	-.43
.130	-1.64	2.05	.31	1.28	-7.57	.03	-.50
.140	-1.78	2.07	.29	1.53	-8.17	.04	-.58
.150	-1.92	2.12	.27	1.81	-8.81	.04	-.66
.160	-2.05	2.19	.25	2.13	-9.50	.05	-.76
.170	-2.17	2.29	.23	2.47	-10.23	.05	-.86
.180	-2.28	2.41	.21	2.84	-11.02*	.06	-.96*
.190	-2.37	2.54	.19	3.23	-11.88	.07	-1.08
.200	-2.44	2.68	.17	3.63	-12.81	.08	-1.20
.210	-2.48	2.84	.15	4.03	-13.81	.09	-1.34
.220	-2.49	2.99	.12	4.43	-14.88	.10	-1.48
.230	-2.48	3.14	.10	4.80	-16.02	.11	-1.64
.240	-2.44	3.28	.08	5.16	-17.23	.12	-1.81
.250	-2.37	3.40	.06	5.48	-18.50	.13	-1.99
.260	-2.28	3.50	.03	5.77	-19.83	.14	-2.19
.270	-2.17	3.58	.01	6.01	-21.20	.15	-2.39
.280	-2.03	3.62	-.01	6.20	-22.60	.16	-2.62
.290	-1.88	3.64*	-.03	6.34	-24.02	.16	-2.85
.300	-1.72	3.61	-.05	6.42	-25.45	.16	-3.10
.310	-1.55	3.55	-.07	6.46	-26.87	.16	-3.37
.320	-1.38	3.46	-.09	6.44	-28.26	.16	-3.65
.330	-1.21	3.33	-.11	6.39	-29.62	.15	-3.94
.340	-1.05	3.16	-.13	6.29	-30.94	.14	-4.25
.350	-.90	2.97	-.14	6.17	-32.19	.13	-4.56
.360	-.76	2.74	-.16	6.02	-33.37	.12	-4.89
.370	-.64	2.50	-.17	5.87	-34.47	.10	-5.23
.380	-.53	2.25	-.19	5.72	-35.49	.09	-5.59
.390	-.45	1.98	-.20	5.58	-36.41	.08	-5.95
.400	-.39	1.71	-.21	5.46	-37.24	.06	-6.32

TABLE B.2 (Continued)

FILM ANALYSIS DATA, TEST MWP-1

.410	-.35	1.45	-.22	5.37	-37.98	.06	-6.69
.420	-.33	1.19	-.23	5.33	-38.62	.05	-7.08
.430	-.33	.95	-.24	5.33	-39.18	.06	-7.46
.440	-.35	.73	-.24	5.38	-39.65	.07	-7.86
.450	-.38	.54	-.25	5.49	-40.04	.09	-8.26
.460	-.43	.39	-.25	5.67	-40.36	.12	-8.66
.470	-.50	.26	-.25	5.90	-40.63	.16	-9.07
.480	-.57	.18	-.25	6.20	-40.85	.22	-9.47
.490	-.66	.14	-.25	6.57	-41.03	.29	-9.88
.500	-.75	.14	-.25	6.99+	-41.18	.38+	-10.29

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
<LONG. VEL. AFTER 2.0 FT. DISP.	--	.500	6.99
<LAT. VEL. AFTER 1.0 FT. DISP.	--	.183	-11.30

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME (S)	ACC. (G'S)
<LAT. ACCELERATION	--	.290	3.64

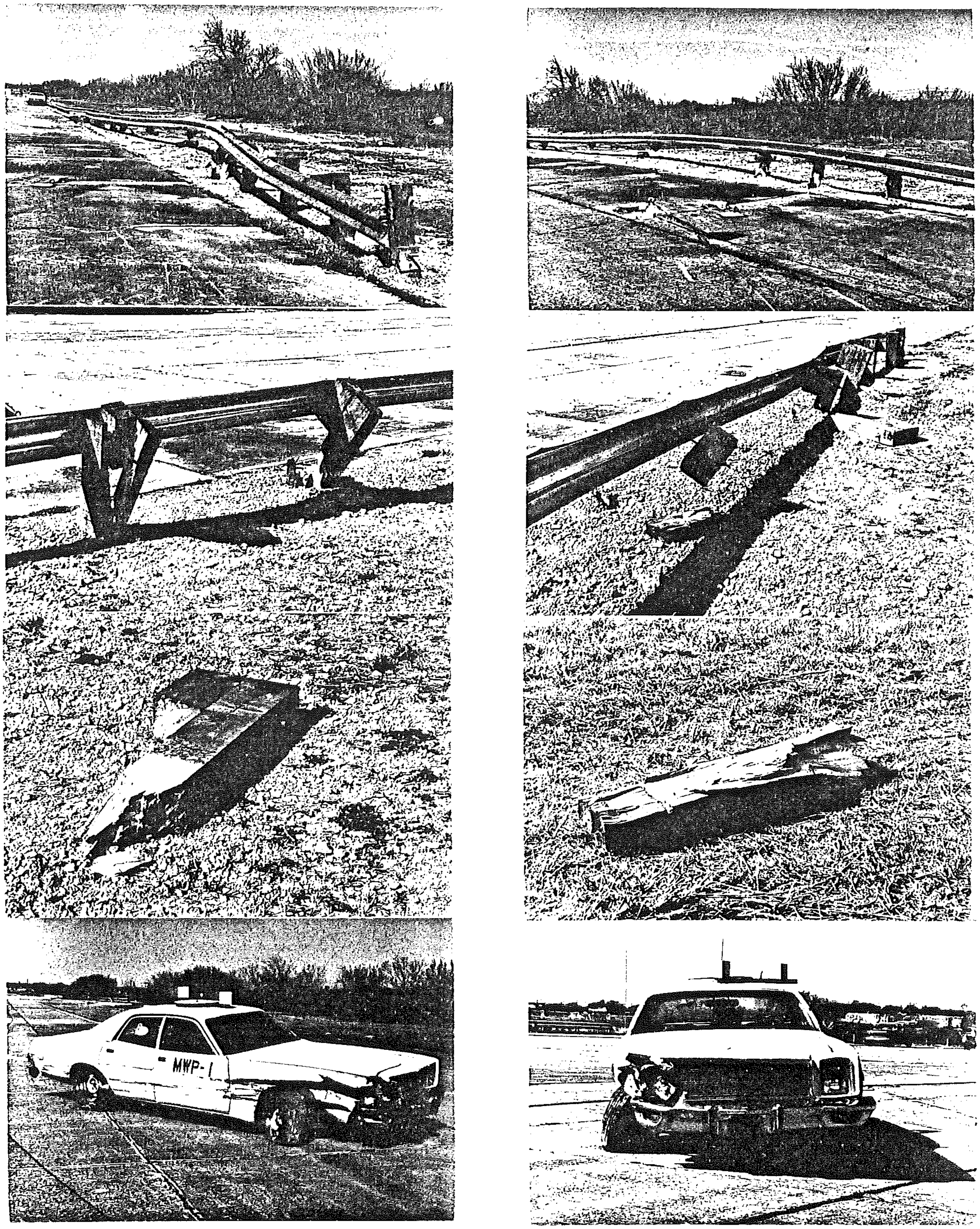


FIGURE B.5 BARRIER AND VEHICLE DAMAGE, TEST MWP-1

SUMMARY OF RESULTS, TEST MWP-2

Test No...MWP-2

Date..01/14/87

Installation Length - ft (m)..100 (30)

Beam
   Member...12 ga W-beam
   Length - ft (m)..12.5 (3.8)

Posts (in test area)
   Material...White Pine
   Description..8"x8"x64"
   Embedment..44"
   Spacing..6'-3"

Maximum Deflections - in. (cm)
   Dynamic..34.0 (86.4)
   Static...23 (58)

Soil type and condition...S1 (dry)

Vehicle...1978 Plymouth sedan

Mass - lb (kg)
   Gross Test Inertia...4310 (1955)

Speed - mph (km/h)..61.3 (98.7)

Impact angle - deg..25.3

Occupant Impact Velocity - fps (m/s)
   Forward (film/accel)...12.9 (3.9)/8.8 (2.7)
   Lateral (film/accel)...16.2 (4.9)/15.5 (4.7)

Occupant Ridedown Accelerations - g's
   Forward (accel)..*
   Lateral (accel)..-10.3

Maximum 50-msec Avg Accelerations - g's
   Longitudinal (film/accel)..-3.0/-4.8
   Lateral (film/accel)...-5.5/-7.0

Damage
   TAD..11-FL-4
   VDI..11FLEE5

* Occupant did not travel required flail distance.

TEST MWP-2

Barrier Installation: The barrier evaluated in the test was a standard G4(1W) incorporating Michigan White Pine posts and blockouts in the test area (Posts 5 through 14). Total barrier length was 100 ft (30 m). Figure B.6 presents system details and the moisture contents of the white pine posts.

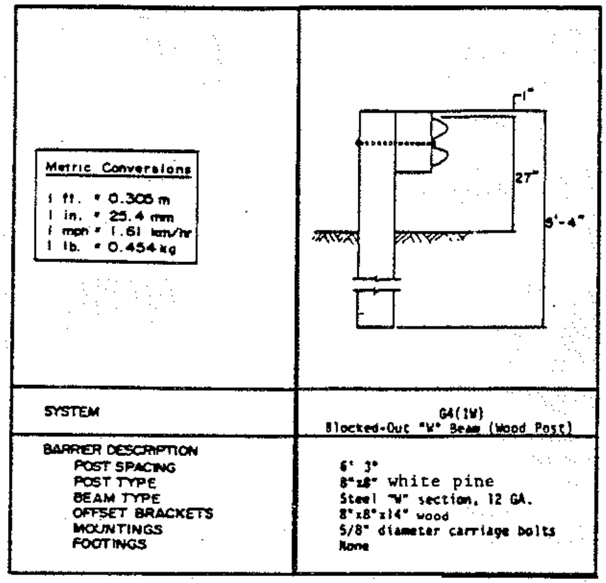
Test Vehicle: The vehicle used in the test was a 1978 Plymouth sedan. Gross test weight, including instrumentation, was 4310 lb (1955 kg). Figure B.7 contains photographs of the barrier and the test vehicle.

Performance: Impact conditions were 61.3 mph (98.7 km/h) and a 25.3-degree impact angle. As shown in Figure B.8, the vehicle impacted the barrier 1 ft (1.1 m) upstream of Post 6. The vehicle remained in contact with the barrier for 28 ft (9 m) while laterally deflecting the W-beam 34.0 in. (86.4 cm) before smooth redirection at a -11.6-degree angle. Final rest position of the vehicle was 315 ft (96 m) downstream of impact and 40 ft (12 m) out from the barrier plane.

Maximum 50-msec average accelerations measured by film analysis were -3.0 g (longitudinal) and -5.5 g (lateral). Transducer data indicated 50-msec averages of -4.8 g (longitudinal) and -7.0 g (lateral). Figure B.9 presents a summary of test results. Table B.3 presents permanent barrier deflections. The vehicle kinetics obtained from film and onboard transducers are presented in Table B.4. Table B.5 contains occupant risk data. Figure B.10 contains photographs of vehicle and barrier damage. Plots of transducer data are presented in Figure B.11.

Barrier Damage: Damage to the barrier consisted of deformation of three sections of W-beam. Although deflected laterally in the soil at the impact area, all posts remained intact.

Vehicle Damage: Damage to the vehicle consisted of sheet metal deformation of the left front fender, side, and the headlight/grille area. The front bumper was also deformed. The left front tire was blown out and the A-frame was displaced rearward. All windows remained intact.



MOISTURE CONTENT OF POSTS

Post No.	% Moisture
5	59
6	59
7	35
8	38
9	57
10	35
11	50
12	42
13	61
14	46
Average	48%

FIGURE B.6 SYSTEM DETAILS, TEST MWP-2

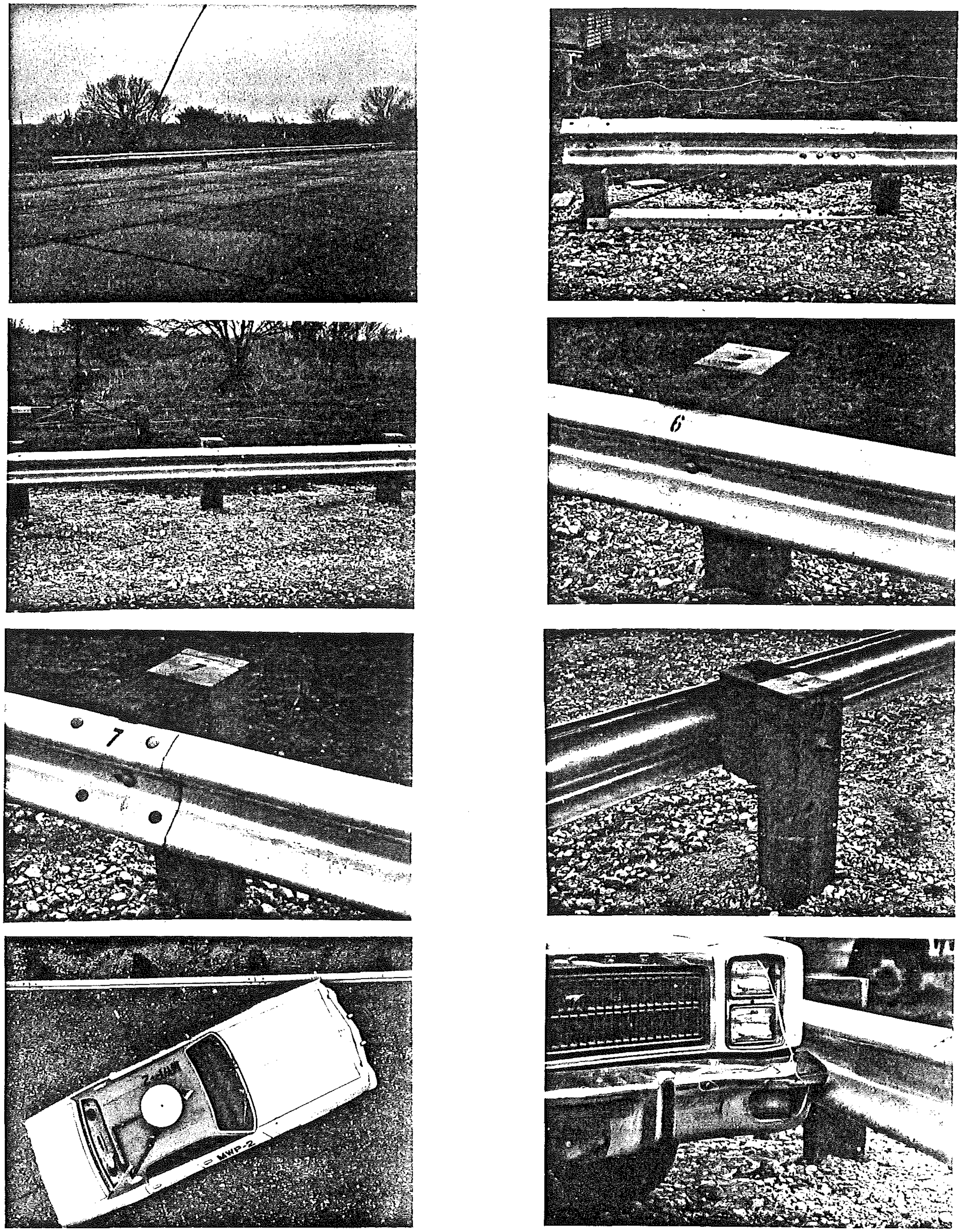


FIGURE B.7 BARRIER AND VEHICLE DETAILS, TEST MWP-2

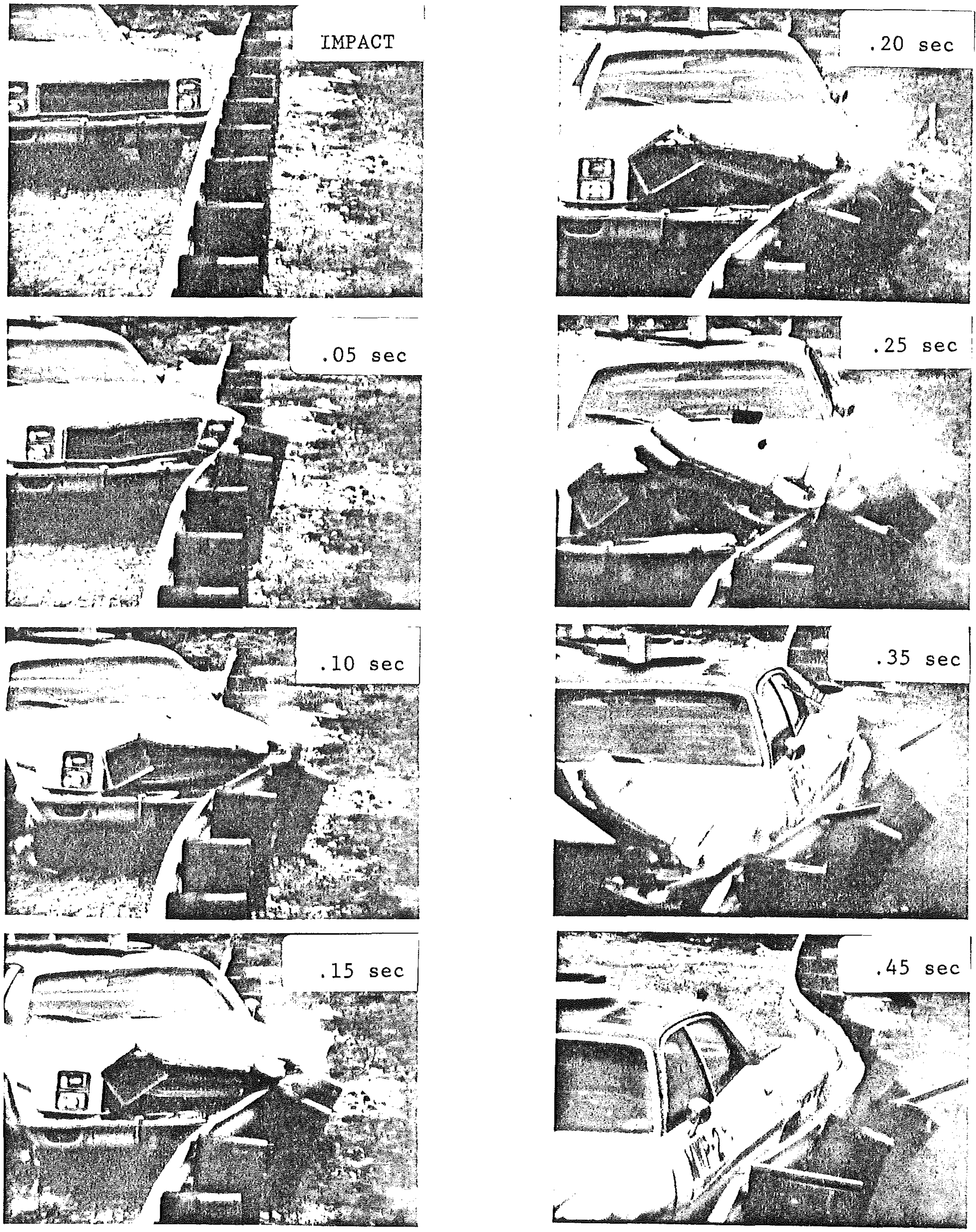
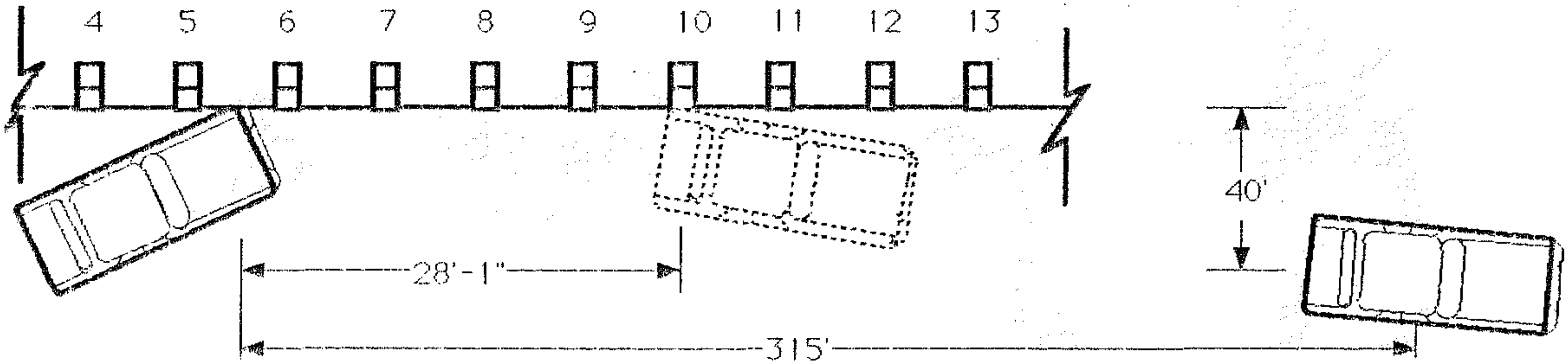


FIGURE B.8 SEQUENTIAL PHOTOGRAPHS, TEST MWP-2



Test No. ... MWP-2

Date ... 01/14/87

Installation Length - ft (m) ... 100 (30)

Beam
- Member ... 12 ga W-beam
- Length - ft (m) ... 12.5 (3.8)

Posts (in test area)
- Material ... White Pine
- Description ... 8"x8"x64"
- Embedment ... 44"
- Spacing ... 6'-3"

Maximum Deflections - in. (cm)
- Dynamic ... 34.0 (86.4)
- Static ... 23 (58)

Soil type and condition ... S1 (dry)

Vehicle ... 1978 Plymouth sedan

Mass - lb (kg)
- Gross Test Inertia ... 4310 (1955)

Speed - mph (km/h) ... 61.3 (98.7)

Impact angle - deg ... 25.3

Occupant Impact Velocity - fps (m/s)
- Forward (film/accel) ... 12.9 (3.9)/8.8 (2.7)
- Lateral (film/accel) ... 16.2 (4.9)/15.5 (4.7)

Occupant Ridedown Accelerations - g's
- Forward (accel) ... *
- Lateral (accel) ... -10.3

Maximum 50-msec Avg Accelerations - g's
- Longitudinal (film/accel) ... -3.0/-4.8
- Lateral (film/accel) ... -5.5/-7.0

Damage
- TAD ... 11-FL-4
- VDI ... 11FLEE5

* Occupant did not travel required flail distance.

FIGURE B.9 SUMMARY OF RESULTS, TEST MWP-2

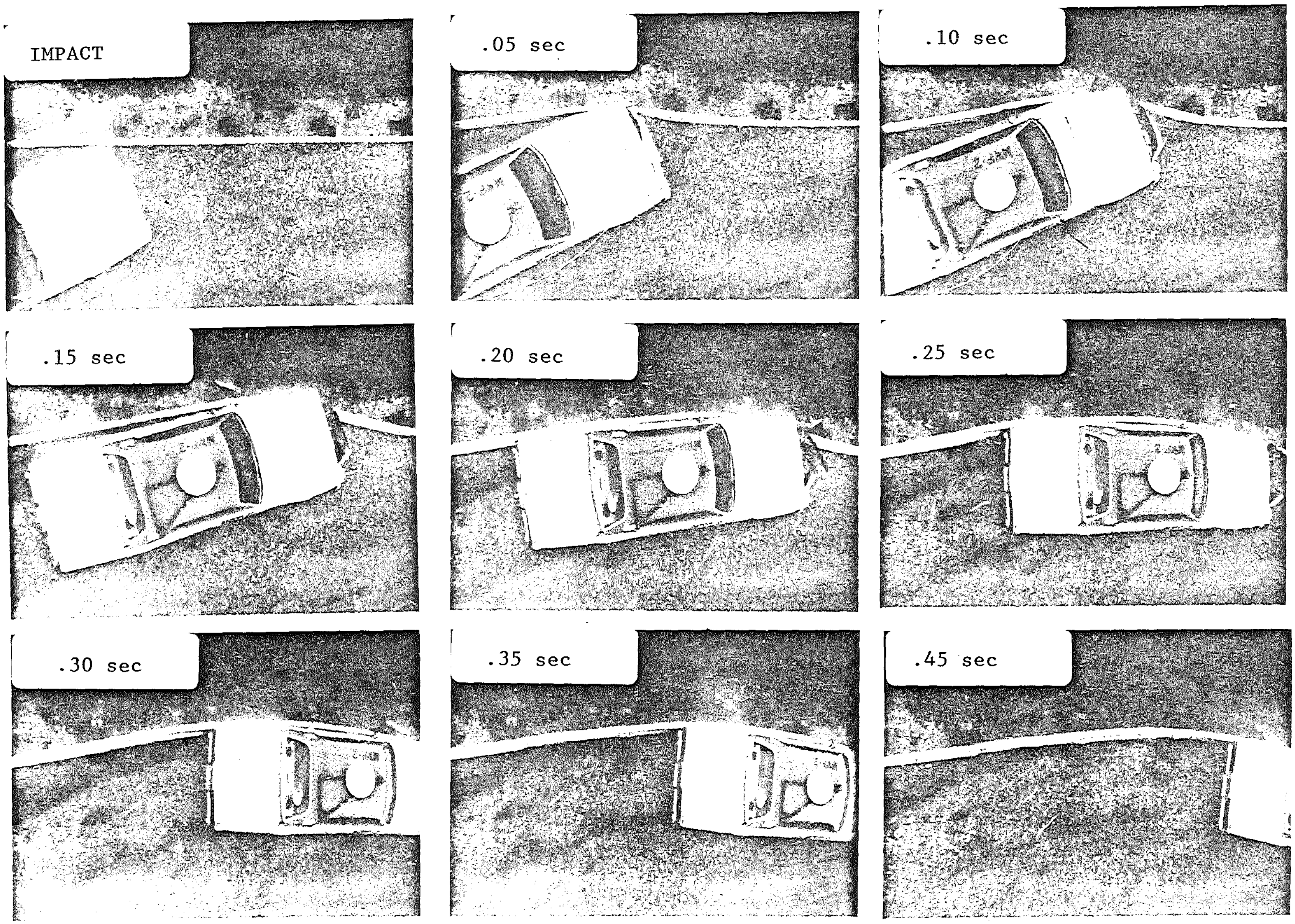


FIGURE B.9 SUMMARY OF RESULTS, TEST MWP-2 (Continued)

TABLE B.3

PERMANENT BARRIER DEFLECTIONS, TEST MWP-2

Post/Location	Deflections (in.)
3	0
4	1.0
5	5.0
6	14.0
7	21.0
Midway Between 7 & 8	23.0
8	21.0
9	12.0
10	1.5
11	0

TABLE B.4

VEHICLE KINETICS DATA, TEST MWP-2

MICHIGAN WOOD POST TEST MWP-2 1-14-87

VEHICLE KINETICS SUMMARY--FROM FILM ANALYSIS

TIME (S)	VEH. ACCEL.(G'S) LONG.	LAT.	HEADING ANGLE (DEG)	VEH. VEL.(FPS) LONG.	LAT.	VEH. DISP.(F) X	Y
0.000	-1.34	-1.18	25.33	89.97	-4.56	-3.71	-5.50
.010	-1.52	-1.40	25.28	89.52	-4.91	-2.88	-5.16
.020	-1.70	-1.62	25.14	89.01	-5.18	-2.05	-4.82
.030	-1.87	-1.86	24.91	88.46	-5.38	-1.22	-4.49
.040	-2.05	-2.09	24.58	87.86	-5.51	-.40	-4.18
.050	-2.21	-2.34	24.14	87.21	-5.56	.42	-3.86
.060	-2.38	-2.59	23.59	86.53	-5.52	1.24	-3.56
.070	-2.53	-2.84	22.94	85.80	-5.40	2.05	-3.27
.080	-2.66	-3.10	22.17	85.04	-5.21	2.86	-2.99
.090	-2.78	-3.36	21.29	84.24	-4.96	3.66	-2.73
.100	-2.89	-3.63	20.32	83.41	-4.66	4.46	-2.48
.110	-2.97	-3.89	19.26	82.55	-4.33	5.26	-2.24
.120	-3.03	-4.14	18.11	81.66	-3.98	6.05	-2.01
.130	-3.07	-4.39	16.89	80.76	-3.63	6.84	-1.80
.140	-3.08	-4.62	15.62	79.85	-3.30	7.62	-1.61
.150	-3.07	-4.83	14.30	78.93	-3.00	8.39	-1.44
.160	-3.03	-5.02	12.95	78.02	-2.74	9.16	-1.28
.170	-2.98	-5.18	11.59	77.11	-2.53	9.93	-1.14
.180	-2.91	-5.31	10.22	76.22	-2.40	10.68	-1.02
.190	-2.82	-5.41	8.87	75.35	-2.33	11.43	-.92
.200	-2.71	-5.46	7.53	74.52	-2.34	12.18	-.84
.210	-2.60	-5.48	6.24	73.72	-2.42	12.92	-.77
.220	-2.48	-5.45	4.98	72.95	-2.58	13.65	-.72
.230	-2.35	-5.38	3.79	72.23	-2.81	14.38	-.69
.240	-2.23	-5.26	2.65	71.55	-3.10	15.10	-.68
.250	-2.11	-5.11	1.58	70.91	-3.44	15.81	-.69
.260	-1.98	-4.91	.59	70.32	-3.83	16.52	-.71
.270	-1.87	-4.67	-.33	69.76	-4.24	17.22	-.75
.280	-1.76	-4.40	-1.18	69.24	-4.67	17.91	-.81
.290	-1.66	-4.09	-1.95	68.76	-5.11	18.60	-.87
.300	-1.56	-3.76	-2.66	68.31	-5.54	19.28	-.95
.310	-1.47	-3.41	-3.29	67.88	-5.94	19.96	-1.05
.320	-1.39	-3.04	-3.86	67.48	-6.30	20.63	-1.15
.330	-1.31	-2.65	-4.37	67.11	-6.62	21.30	-1.26
.340	-1.23	-2.27	-4.83	66.75	-6.87	21.96	-1.38
.350	-1.16	-1.88	-5.25	66.42	-7.06	22.61	-1.51
.360	-1.10	-1.51	-5.63	66.10	-7.16	23.27	-1.65
.370	-1.03	-1.15	-5.98	65.80	-7.16	23.92	-1.78
.380	-.97	-.80	-6.31	65.52	-7.11	24.56	-1.93
.390	-.91	-.48	-6.63	65.26	-6.96	25.20	-2.07
.400	-.85	-.19	-6.94	65.01	-6.72	25.84	-2.21
.410	-.79	.06	-7.24	64.79	-6.40	26.48	-2.36
.420	-.73	.28	-7.54	64.57	-6.00	27.11	-2.50
.430	-.68	.45	-7.85	64.38	-5.54	27.74	-2.65
.440	-.63	.58	-8.16	64.20	-5.02	28.37	-2.79
.450	-.58	.66	-8.48	64.03	-4.47	29.00	-2.93

TABLE B.4 (Continued)

VEHICLE KINETICS DATA, TEST MWP-2

.460	-.53	.70	-8.80	63.87	-3.89	29.63	-3.07
.470	-.49	.70	-9.12	63.73	-3.30	30.25	-3.20
.480	-.45	.65	-9.44	63.59	-2.73	30.87	-3.33
.490	-.42	.56	-9.75	63.46	-2.18	31.50	-3.46
.500	-.39	.44	-10.06	63.34	-1.68	32.12	-3.59
.510	-.37	.29	-10.35	63.23	-1.24	32.74	-3.72
.520	-.36	.11	-10.62	63.11	-.88	33.36	-3.84
.530	-.35	-.08	-10.87	63.00	-.60	33.97	-3.97
.540	-.36	-.28	-11.09	62.89	-.42	34.59	-4.09
.550	-.37	-.48	-11.28	62.78	-.34	35.21	-4.22
.560	-.40	-.66	-11.43	62.65	-.35	35.82	-4.35
.570	-.45	-.82	-11.56	62.52	-.45	36.43	-4.47
.580	-.50	-.96	-11.65	62.36	-.64	37.04	-4.61
.590	-.58	-1.05	-11.72	62.19	-.89	37.65	-4.74
.600	-.66	-1.09	-11.77	61.99	-1.18	38.26	-4.88
.610	-.76	-1.07	-11.81	61.76	-1.48	38.86	-5.02
.620	-.87	-1.00	-11.85	61.50	-1.77	39.46	-5.16
.630	-.99	-.88	-11.90	61.20	-2.02	40.06	-5.30
.640	-1.10	-.65	-11.97	60.87	-2.19	40.65	-5.45
.650	-1.21	-.39	-12.07	60.50	-2.26	41.24	-5.60
.660	-1.31	-.08	-12.20	60.10	-2.20	41.82	-5.75
.670	-1.36	.25	-12.36	59.67	-2.01	42.41	-5.89
.680	-1.41	.60	-12.53	59.23	-1.69	42.98	-6.04

HIGHEST 50-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-3.01	.1150	.1650
LAT.	-5.47	.1850	.2350

TABLE B.4 (Continued)

VEHICLE KINETICS DATA, TEST MWP-2

TEST ID ------- MWP-2
TEST DATE ----- 01-14-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 89.97 FPS

VEHICLE KINETICS SUMMARY
NOTE: VALUES ARE INSTANTANEOUS AT TIME

TIME	ACCEL.(G'S)		HEAD.ANG.	VELOCITY(FPS),		DISP.(F)	
S.	LONG.	LAT.	DEG	LONG.	LAT.	X	Y
.000	-2.87	.19	25.33	89.97	-4.58	-3.71	-5.50
.010	8.67	-12.06	25.36	89.73	-2.96	-2.89	-5.15
.020	8.52	-2.60	25.42	88.99	-5.03	-2.06	-4.81
.030	-6.08	-2.43	25.31	88.70	-6.15	-1.23	-4.48
.040	-1.45	-16.02	25.15	88.17	-7.62	-.41	-4.16
.050	-.85	-3.78	24.79	87.43	-7.93	.42	-3.86
.060	-5.26	-8.34	24.30	86.73	-6.98	1.25	-3.57
.070	-1.90	-1.76	23.81	85.41	-6.64	2.06	-3.28
.080	-2.87	-4.46	23.27	84.58	-6.71	2.87	-3.00
.090	-1.30	1.78	22.59	83.97	-6.99	3.67	-2.74
.100	-10.56	-5.47	21.86	83.06	-7.53	4.47	-2.49
.110	-3.54	-9.35	21.02	81.39	-8.21	5.26	-2.26
.120	-4.58	-1.92	19.98	80.96	-8.24	6.05	-2.05
.130	-6.38	-6.32	18.80	79.51	-7.80	6.83	-1.86
.140	-6.08	-7.16	17.41	78.47	-7.68	7.61	-1.69
.150	-5.48	2.12	15.92	76.94	-6.00	8.37	-1.53
.160	-.78	-7.83	14.36	76.40	-5.44	9.13	-1.39
.170	2.87	-10.03	12.63	75.68	-5.76	9.88	-1.26
.180	-4.29	-5.81	10.82	74.70	-5.53	10.63	-1.17
.190	-9.21	-2.94	8.91	72.72	-5.03	11.36	-1.09
.200	-6.82	-3.95	7.04	70.89	-3.07	12.08	-1.03
.210	3.09	-13.58	5.36	70.93	-3.70	12.79	-.99
.220	-3.39	-6.23	3.74	69.21	-3.64	13.49	-.97
.230	-2.94	-5.47	2.29	68.98	-4.00	14.18	-.98
.240	-6.97	2.62	.76	68.69	-4.99	14.87	-1.00
.250	-2.64	-11.21	-.57	67.31	-4.54	15.55	-1.05
.260	-.48	-8.34	-1.69	66.47	-6.34	16.22	-1.12
.270	-1.97	-3.61	-2.73	66.18	-6.49	16.88	-1.21
.280	-4.43	-2.09	-3.56	65.17	-6.91	17.54	-1.31
.290	4.28	-3.95	-4.26	64.27	-6.76	18.17	-1.42
.300	-3.09	.61	-4.85	64.72	-6.64	18.81	-1.54
.310	-.25	-2.09	-5.45	64.41	-6.57	19.45	-1.66
.320	-2.49	-3.53	-6.07	64.23	-6.11	20.08	-1.79
.330	-2.94	-.57	-6.73	63.59	-5.79	20.71	-1.92
.340	-1.30	1.11	-7.35	63.64	-5.40	21.34	-2.06
.350	-.55	1.61	-7.93	63.32	-5.08	21.96	-2.19
.360	-1.60	-1.84	-8.48	63.21	-4.92	22.58	-2.33
.370	-1.00	-.57	-9.03	62.98	-4.78	23.19	-2.46
.380	-.48	-.57	-9.55	63.09	-4.48	23.81	-2.62
.390	-.48	1.45	-10.03	62.79	-4.20	24.42	-2.77
.400	-2.05	.77	-10.53	62.75	-3.76	25.03	-2.93

TABLE B.4 (Continued)

VEHICLE KINETICS DATA, TEST MWP-2

.410	-.85	-1.59	-11.03	62.37	-3.15	25.64	-3.08
.420	-1.00	-1.08	-11.54	62.38	-3.09	26.25	-3.23
.430	.34	.19	-12.07	62.55	-2.33	26.85	-3.38
.440	-.85	.94	-12.56	62.40	-1.86	27.46	-3.54
.450	-1.08	-1.42	-13.00	62.22	-1.45	28.06	-3.69
.460	-.10	.94	-13.43	62.15	-1.25	28.66	-3.85
.470	-.48	-.24	-13.84	61.84	-.92	29.26	-4.00
.480	.19	-.49	-14.24	61.85	-.55	29.86	-4.16
.490	-.48	.10	-14.63	61.74	-.08	30.46	-4.32
.500	.34	1.28	-15.02	61.77	.51	31.06	-4.47

HIGHEST 50.0-MS AVG. ACCEL.

	G'S	TIME (SEC) START	END
LONG.	-4.76	.155	.205
LAT.	-7.00	.202	.252

TABLE B.5

OCCUPANT RISK DATA, TEST MWP-2

MICHIGAN WOOD POST TEST MWP-2   1-14-87
OCCUPANT RISK SUMMARY -- FROM FILM ANALYSIS
NOTE: AVG. ACCEL. FOR PRIOR 0.010 SEC. CALCULATED
FROM VEHICLE VELOCITY CHANGE
RELATIVE VALUES-(OCCUPANT W.R.T. VEHICLE)

	(------- VEHICLE	--------)		(------------ OCCUPANT	------------)		
TIME (S)	ACCEL. (G'S) LONG.	LAT.	ANG. VEL (RAD/S)	VEL. (FPS) LONG.	LAT.	DISP. (F) LONG.	LAT.
0.000	-1.34	-1.18	.44	0.00	0.00	0.00	0.00
.010	-1.52	-1.40	.44	.29	.25	.00	.00
.020	-1.70	-1.62	.44	.62	.55	.01	.01
.030	-1.67	-1.86	.43	.98	.90	.01	.01
.040	-2.05	-2.09	.43	1.37	1.33	.03	.02
.050	-2.21	-2.34	.42	1.80	1.82	.04	.04
.060	-2.38	-2.59	.41	2.26	2.40	.06	.06
.070	-2.53	-2.84	.40	2.76	3.08	.09	.09
.080	-2.66	-3.10	.39	3.29	3.87	.11	.13
.090	-2.76	-3.36	.37	3.85	4.77	.15	.17
.100	-2.89	-3.63	.35	4.43	5.80	.19	.23
.110	-2.97	-3.89	.34	5.02	6.95	.23	.29
.120	-3.03	-4.14	.32	5.62	8.24	.27	.37
.130	-3.07	-4.39	.29	6.22	9.65	.32	.47
.140	-3.08	-4.62	.27	6.81	11.20	.38	.58
.150	-3.07	-4.83	.25	7.37	12.87	.43	.71
.160	-3.03	-5.02	.23	7.91	14.66*	.49	.86*
.170	-2.98	-5.18	.20	8.42	16.55	.55	1.03
.180	-2.91	-5.31	.18	8.89	18.52	.61	1.22
.190	-2.82	-5.41	.15	9.32	20.57	.67	1.43
.200	-2.71	-5.46	.13	9.70	22.68	.73	1.66
.210	-2.60	-5.48*	.11	10.04	24.82	.79	1.92
.220	-2.48	-5.45	.09	10.35	26.97	.85	2.19
.230	-2.35	-5.38	.07	10.61	29.11	.90	2.49
.240	-2.23	-5.26	.05	10.85	31.23	.96	2.81
.250	-2.11	-5.11	.03	11.05	33.30	1.01	3.15
.260	-1.98	-4.91	.01	11.24	35.30	1.06	3.51
.270	-1.87	-4.67	-.01	11.40	37.22	1.12	3.89
.280	-1.76	-4.40	-.02	11.56	39.04	1.17	4.29
.290	-1.66	-4.09	-.03	11.71	40.75	1.23	4.71
.300	-1.56	-3.76	-.05	11.85	42.33	1.29	5.14
.310	-1.47	-3.41	-.06	12.00	43.77	1.35	5.58
.320	-1.39	-3.04	-.07	12.13	45.07	1.41	6.04
.330	-1.31	-2.65	-.08	12.27	46.22	1.47	6.51
.340	-1.23	-2.27	-.08	12.40	47.23	1.54	6.99
.350	-1.16	-1.88	-.09	12.52	48.08	1.62	7.48
.360	-1.10	-1.51	-.10	12.62	48.78	1.69	7.97
.370	-1.03	-1.15	-.10	12.71	49.35	1.77	8.48
.380	-.97	-.80	-.11	12.78	49.78	1.84	8.98
.390	-.91	-.48	-.12	12.83	50.08	1.92	9.49
.400	-.85	-.19	-.12	12.86+	50.28	2.00+	10.00

TABLE B.5 (Continued)

OCCUPANT RISK DATA, TEST MWP-2

.410	-.79+	.06	-.13	12.85	50.37	2.07	10.52
.420	-.73	.28	-.13	12.82	50.39	2.14	11.03
.430	-.66	.45	-.14	12.77	50.33	2.21	11.55
.440	-.63	.58	-.14	12.69	50.23	2.27	12.06
.450	-.58	.66	-.15	12.60	50.09	2.33	12.58
.460	-.53	.70	-.15	12.46	49.94	2.39	13.09
.470	-.49	.70	-.16	12.36	49.76	2.43	13.60
.480	-.45	.65	-.16	12.24	49.64	2.48	14.11
.490	-.42	.56	-.17	12.12	49.53	2.52	14.62
.500	-.39	.44	-.16	12.01	49.47	2.56	15.13

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
<LONG. VEL. AFTER 2.0 FT. DISP.	--	.400	12.86
<LAT. VEL. AFTER 1.0 FT. DISP.	--	.168	16.23

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME (S)	ACC. (G'S)
<LONG. ACCELERATION	--	.410	-.79
<LAT. ACCELERATION	--	.210	-5.48

TABLE B.5 (Continued)

OCCUPANT RISK DATA, TEST MWP-2

TEST ID ------- MWP-2
TEST DATE ----- 01-14-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 89.97 FPS

OCCUPANT RISK SUMMARY
NOTE: INSTANTANEOUS 10-MS AVERAGE ACCELERATIONS

	(------- VEHICLE	--------)	(	------------ OCCUPANT	-----------		)
TIME	ACCEL. (G'S)		ANG. VEL	VEL. (FPS)		DISP. (F)	
(S)	LONG.	LAT.	(RAD/S)	LONG.	LAT.	LONG.	LAT.
.000	-2.87	.19	.07	.00	.00	.00	.00
.010	3.16	-.05	-.02	.13	-1.79	.01	-.01
.020	-3.07	-4.82	-.23	.59	-.06	.01	-.01
.030	-2.18	-3.99	-.13	1.02	1.35	.02	-.01
.040	-1.50	-4.77	-.36	1.27	2.78	.03	.01
.050	-1.35	-.76	-.74	1.56	3.19	.05	.04
.060	-4.44	.03	-.80	2.22	2.94	.06	.07
.070	-1.53	-2.02	-.89	3.45	3.25	.09	.10
.080	-5.65	-4.09	-1.14	3.98	3.87	.12	.14
.090	-1.95	-4.24	-1.13	4.61	5.22	.17	.19
.100	-4.25	-4.25	-1.45	5.13	6.51	.21	.25
.110	-2.26	-6.41	-1.60	6.58	8.33	.27	.33
.120	-3.98	-3.65	-1.93	6.56	9.58	.33	.42
.130	-4.44	-4.42	-2.32	7.42	10.52	.39	.53
.140	-4.82	-5.20	-2.40	8.19	12.46	.45	.65
.150	-2.32	.16	-2.73	9.08	12.71	.52	.79
.160	-4.15	-8.77	-2.80	9.22	14.49*	.59	.94*
.170	-2.41	-6.46	-3.17	9.06	17.03	.65	1.12
.180	-5.90	-5.79	-3.28	9.38	19.45	.70	1.32
.190	-5.02	-5.65	-3.39	10.57	21.75	.75	1.55
.200	-6.10	-2.76*	-3.17	11.95	22.91	.81	1.80
.210	-.42	-9.59	-2.92	11.50	26.38	.88	2.08
.220	-3.07	-5.22	-2.68	12.73	29.04	.93	2.38
.230	-.50	-7.17	-2.76	12.11	31.45	.99	2.71
.240	-5.14	-5.57	-2.76	11.54	34.69	1.03	3.07
.250	-1.99	-6.74	-1.97	13.12	37.15	1.08	3.45
.260	-2.83	-8.86	-1.99	13.23	40.54	1.14	3.86
.270	-2.21	-1.99	-1.62	13.31	42.63	1.20	4.30
.280	-4.05	-4.44	-1.32	14.12	44.61	1.27	4.76
.290	-.14	-.11	-1.05	14.88	45.78	1.36	5.22
.300	-.46	-2.42	-1.00	14.07	46.54	1.44	5.70
.310	-.71	-1.78	-1.05	13.89	47.26	1.52	6.18
.320	-1.70	-1.04	-1.09	13.56	47.61	1.59	6.67
.330	-.89	-1.09	-1.22	13.54	48.03	1.64	7.17
.340	-1.33	-.72	-.94	13.36	48.83	1.70	7.68
.350	-.42	-1.61	-.98	13.17	49.25	1.75	8.18
.360	-.58	-1.38	-.92	12.91	49.91	1.80	8.70
.370	-.93	-1.25	-1.01	12.58	50.40	1.84	9.22
.380	.51	-.84	-.86	12.24	50.99	1.88	9.74
.390	-.37	-.55	-.87	12.12	51.33	1.92	10.27
.400	-.99	.11	-.86	11.75	51.56	1.95	10.80

TABLE B.5 (Continued)

OCCUPANT RISK DATA, TEST MWP-2

.410	-.64	-.36	-.87	11.69	51.60	1.97	11.33
.420	.01	-.62	-.90	11.20	52.16	1.98	11.87
.430	-.16	-.27	-.92	10.53	52.07	1.97	12.41
.440	-.57	-.24	-.86	10.33	52.31	1.97	12.95
.450	-.67	-.14	-.73	10.26	52.63	1.97	13.49
.460	-.48	-.93	-.77	9.89	52.93	1.97	14.03
.470	-.42	-.40	-.72	9.88	53.18	1.97	14.57
.480	-.09	.15	-.70	9.54	53.34	1.96	15.12
.490	-.38	.36	-.66	9.32	53.42	1.95	15.67
.500	.04	.73	-.65	8.93	53.31	1.93	16.21

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
>LONG. VEL. AFTER 2.0 FT. DISP.	--	.510	8.84
>LAT. VEL. AFTER 1.0 FT. DISP.	--	.163	15.49

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME(S)	ACC.(GS)
>LAT. ACCELERATION	--	.207	-10.33

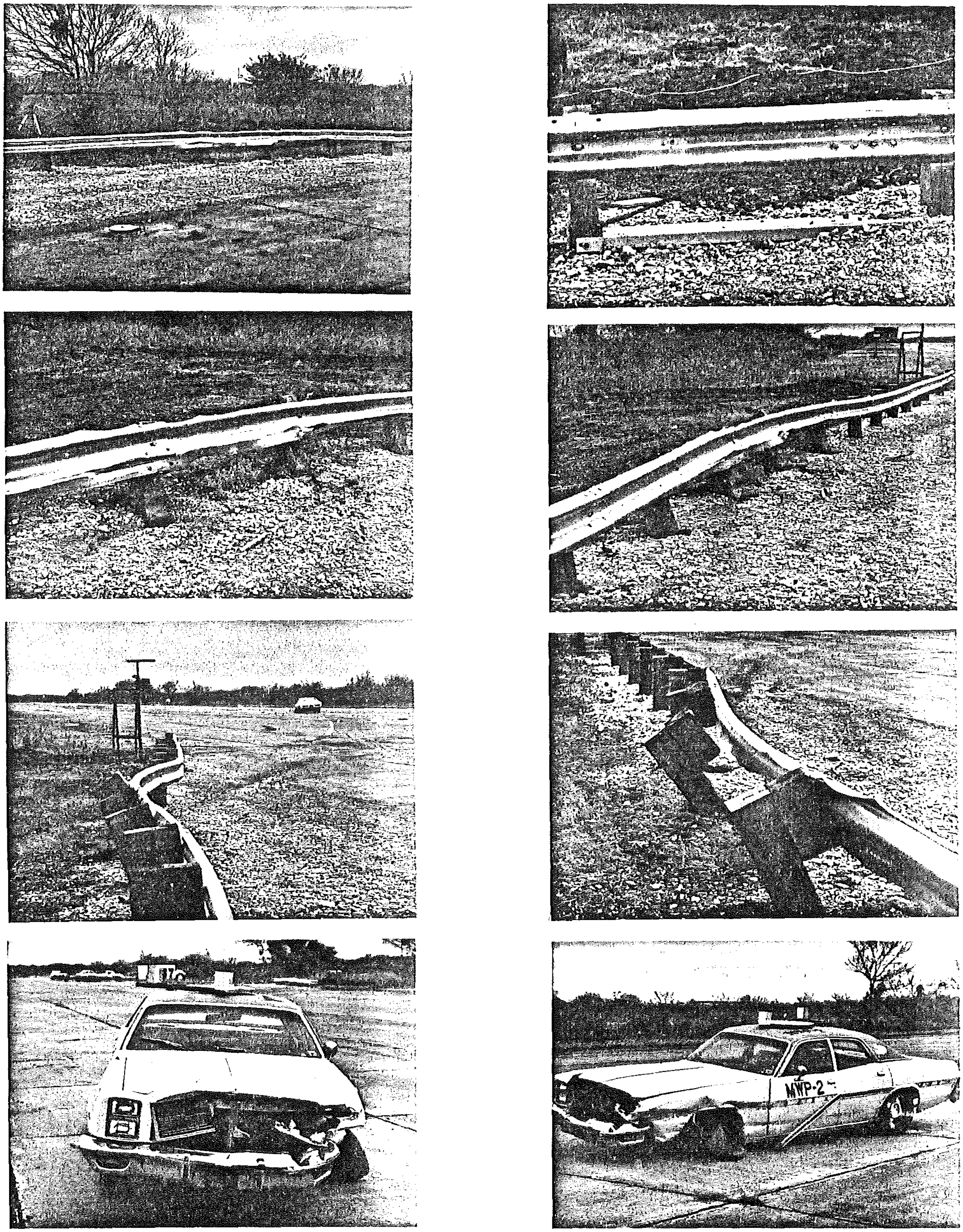


FIGURE B.10 BARRIER AND VEHICLE DAMAGE, TEST MWP-2

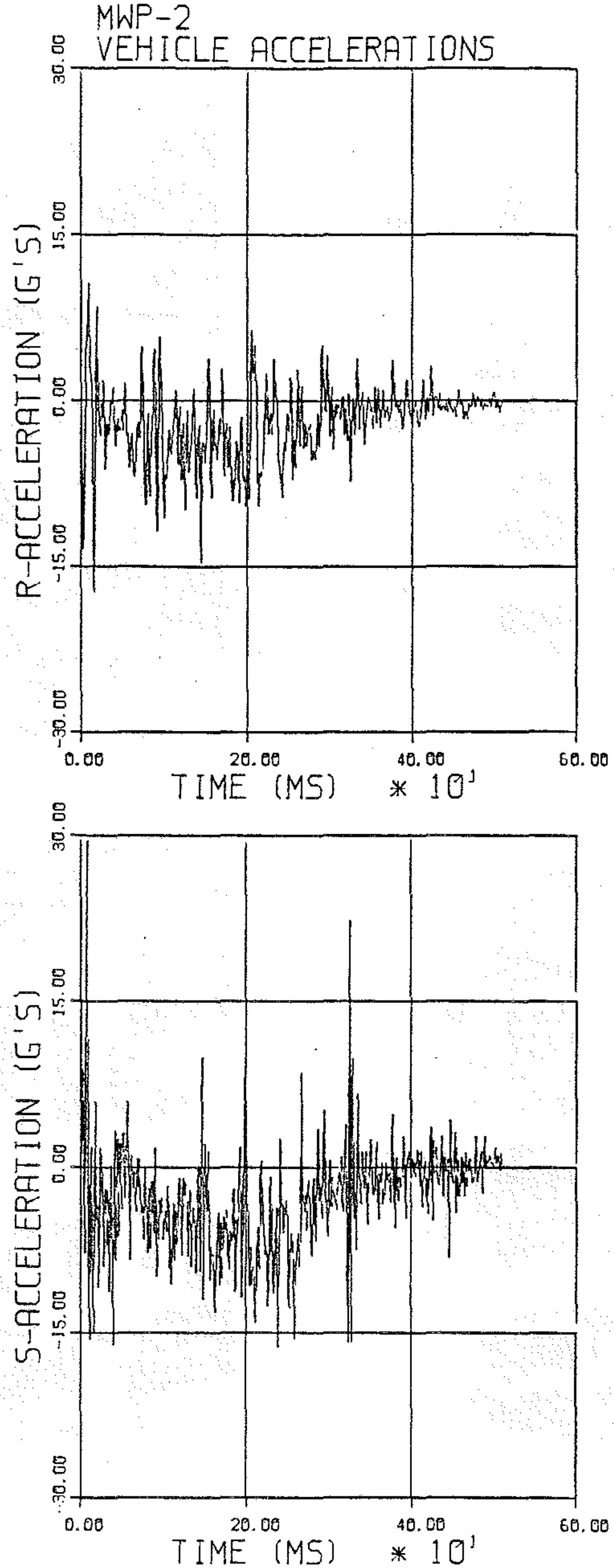


FIGURE B.11 VEHICLE ACCELERATIONS, TEST MWP-2

SUMMARY OF RESULTS, TEST MWP-3

Test No.	MWP-3
Date	01/15/87
Installation Length - ft (m)	100 (30)
Beam	
Member	12 ga W-beam
Length - ft (m)	12.5 (3.8)
Posts (in test area)	
Material	Red Pine
Description	8"x8"x64"
Embedment	44"
Spacing	6'-3"
Maximum Deflections - in. (cm)	
Dynamic	31.3 (79.5)
Static	20.5 (52.1)
Soil type and condition	S1 (dry)
Vehicle	1978 Plymouth Fury
Mass - lb (kg)	
Gross Test Inertia	4310 (1955)
Speed - mph (km/h)	60.6 (97.4)
Impact angle - deg	23.9
Occupant Impact Velocity - fps (m/s)	
Forward (film/accel)	18.2 (5.5)/16.6 (5.1)
Lateral (film/accel)	18.1 (5.5)/18.3 (5.5)
Occupant Ridedown Accelerations - g's	
Forward (accel)	-3.7
Lateral (accel)	-10.4
Maximum 50-msec Avg Accelerations - g's	
Longitudinal (film/accel)	-4.3/-5.3
Lateral (film/accel)	-5.7/-7.2
Damage	
TAD	11-FL-2
VDI	11FLEE4

TEST MWP-3

Barrier Installation: The barrier evaluated in the test was a standard G4(1W) incorporating Michigan Red Pine posts and blockouts in the test area (Posts 5 through 14). Total barrier length was 100 ft (30 m). Figure B.12 presents system details and the moisture content for each red pine post.

Test Vehicle: The vehicle used in the test was a 1978 Plymouth Fury. Gross test weight, including instrumentation, was 4310 lb (1955 kg). Figure B.13 contains photographs of the barrier and the test vehicle.

Performance: Impact conditions were 60.6 mph (97.4 km/h) and a 23.9-degree impact angle. As shown in Figure B.14, the vehicle impacted the barrier 4 ft (1.2 m) upstream of Post 6. The vehicle remained in contact with the barrier for 19.3 ft (5.9 m) while laterally deflecting the W-beam 31.3 in. (79.5 cm) before smooth redirection at a -4.3-degree angle. Final rest position of the vehicle was 190 ft (58 m) downstream of impact and 55 ft (17 m) behind the barrier plane.

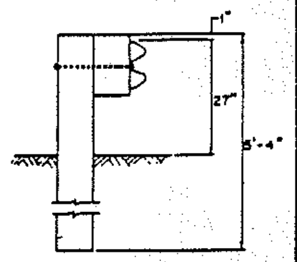
Maximum 50-msec average accelerations measured by film analysis were -4.3 g (longitudinal) and -5.7 g (lateral). Transducer data indicated 50-msec averages of -5.3 g (longitudinal) and -7.2 g (lateral). Figure B.15 presents a summary of test results. Table B.6 presents permanent barrier deflections. The vehicle kinetics obtained from film and onboard transducers are presented in Table B.7. Table B.8 contains occupant risk data. Figure B.16 contains photographs of vehicle and barrier damage. Plots of transducer data are presented in Figure B.17.

Barrier Damage: Damage to the barrier consisted of deformation of three sections of W-beam. Although deflected laterally in the soil at the impact area, all posts remained intact. The blockout at Post 8 was split vertically through the rail attachment hole.

Vehicle Damage: Damage to the vehicle consisted of sheet metal deformation of the left front fender, side, and the headlight/grille area. The front bumper was also deformed. The left front tire was blown out during impact. All windows remained intact.

Metric Conversions

1 ft. = 0.305 m
1 in. = 25.4 mm
1 mph = 1.61 km/hr
1 lb. = 0.454 kg



SYSTEM	G4(1W) Blocked-Out "W" Beam (Wood Post)
BARRIER DESCRIPTION	
POST SPACING	6' 3"
POST TYPE	8"x8" red pine
BEAM TYPE	Steel "W" section, 12 GA.
OFFSET BRACKETS	8"x8"x14" wood
MOUNTINGS	5/8" diameter carriage bolts
FOOTINGS	None

MOISTURE CONTENT OF POSTS

Post No.	% Moisture
5	17
6	21
7	6
8	15
9	19
10	15
11	20
12	16
13	23
14	16
Average	17%

FIGURE B.12 SYSTEM DETAILS, TEST MWP-3

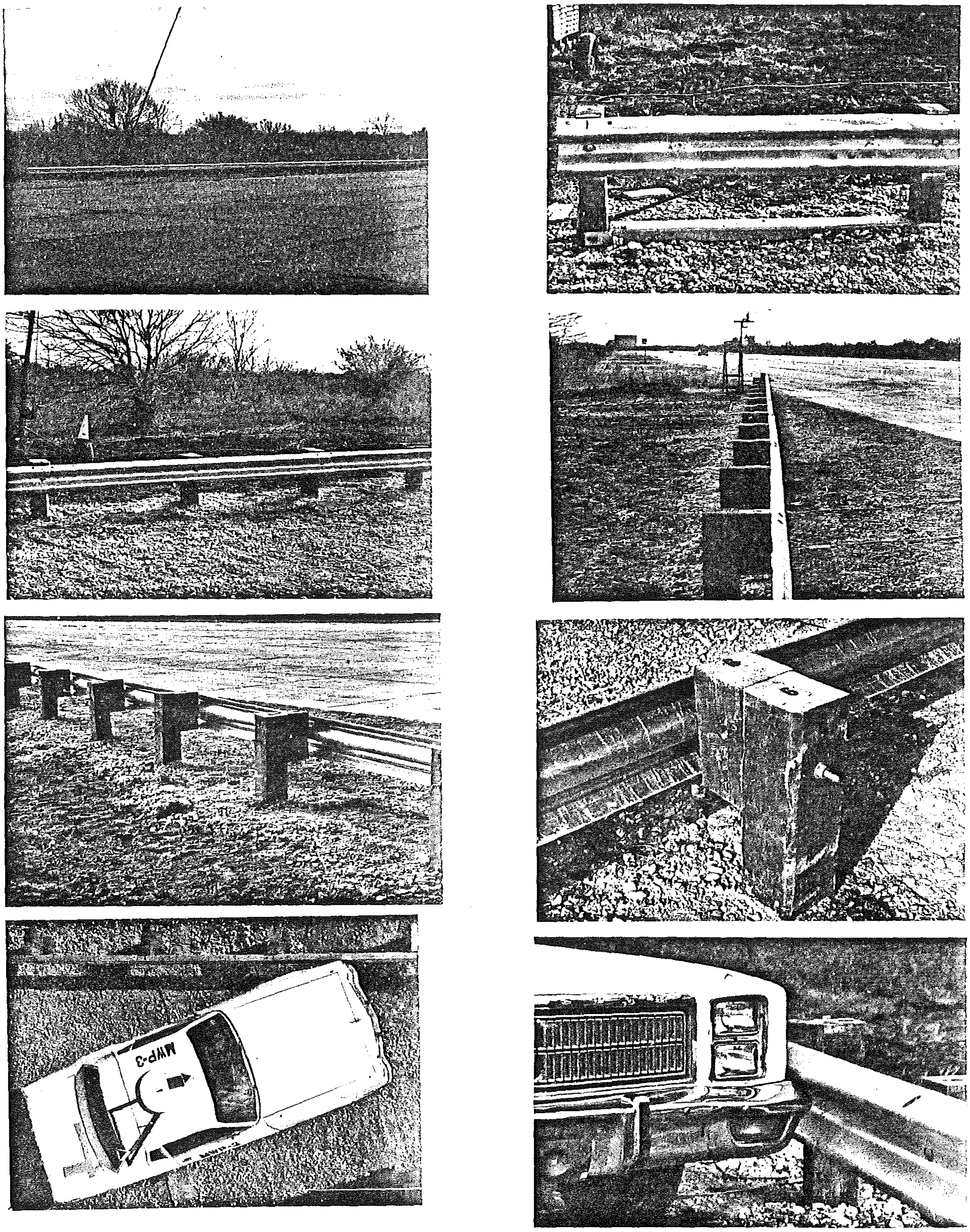


FIGURE B.13 BARRIER AND VEHICLE DETAILS, TEST MWP-3

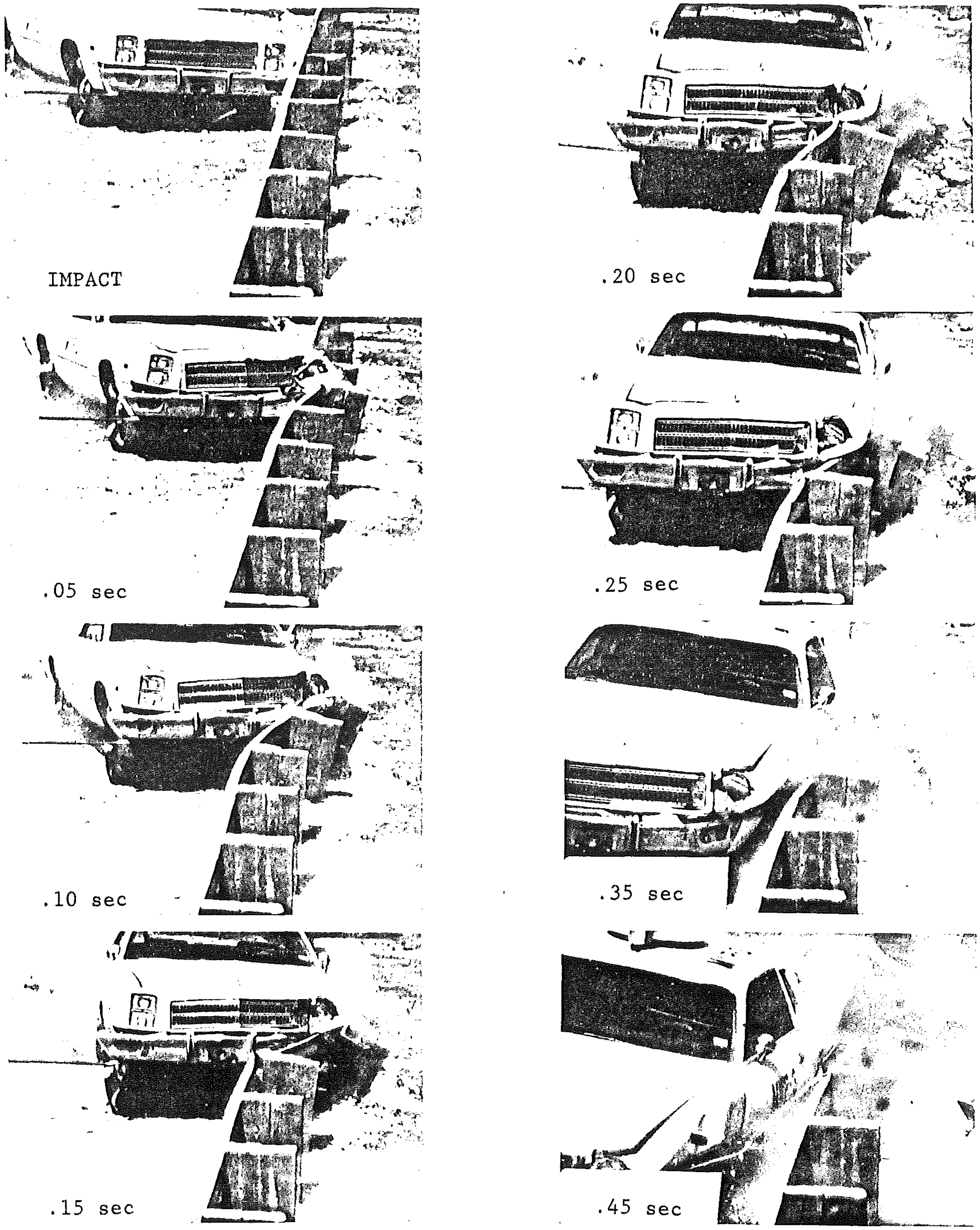
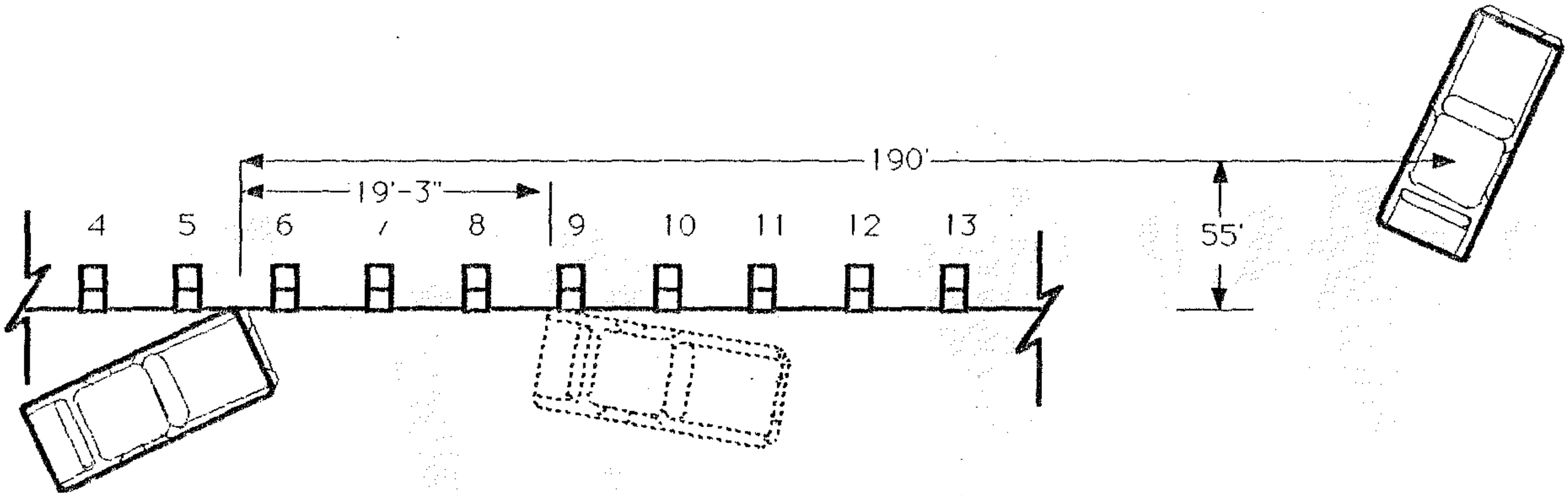


FIGURE B.14 SEQUENTIAL PHOTOGRAPHS, TEST MWP-3



Test No.	MWP-3
Date	01/15/87
Installation Length - ft (m)	100 (30)
Beam	
Member	12 ga W-beam
Length - ft (m)	12.5 (3.8)
Posts (in test area)	
Material	Red Pine
Description	8"x8"x64"
Embedment	44"
Spacing	6'-3"
Maximum Deflections - in. (cm)	
Dynamic	31.3 (79.5)
Static	20.5 (52.1)
Soil type and condition	S1 (dry)
Vehicle	1978 Plymouth Fury
Mass - lb (kg)	
Gross Test Inertia	4310 (1955)
Speed - mph (km/h)	60.6 (97.4)
Impact angle - deg	23.9
Occupant Impact Velocity - fps (m/s)	
Forward (film/accel)	18.2 (5.5)/16.6 (5.1)
Lateral (film/accel)	18.1 (5.5)/18.3 (5.5)
Occupant Ridedown Accelerations - g's	
Forward (accel)	-3.7
Lateral (accel)	-10.4
Maximum 50-msec Avg Accelerations - g's	
Longitudinal (film/accel)	-4.3/-5.3
Lateral (film/accel)	-5.7/-7.2
Damage	
TAD	11-FL-2
VDI	11FLEE4

FIGURE B.15 SUMMARY OF RESULTS, TEST MWP-3

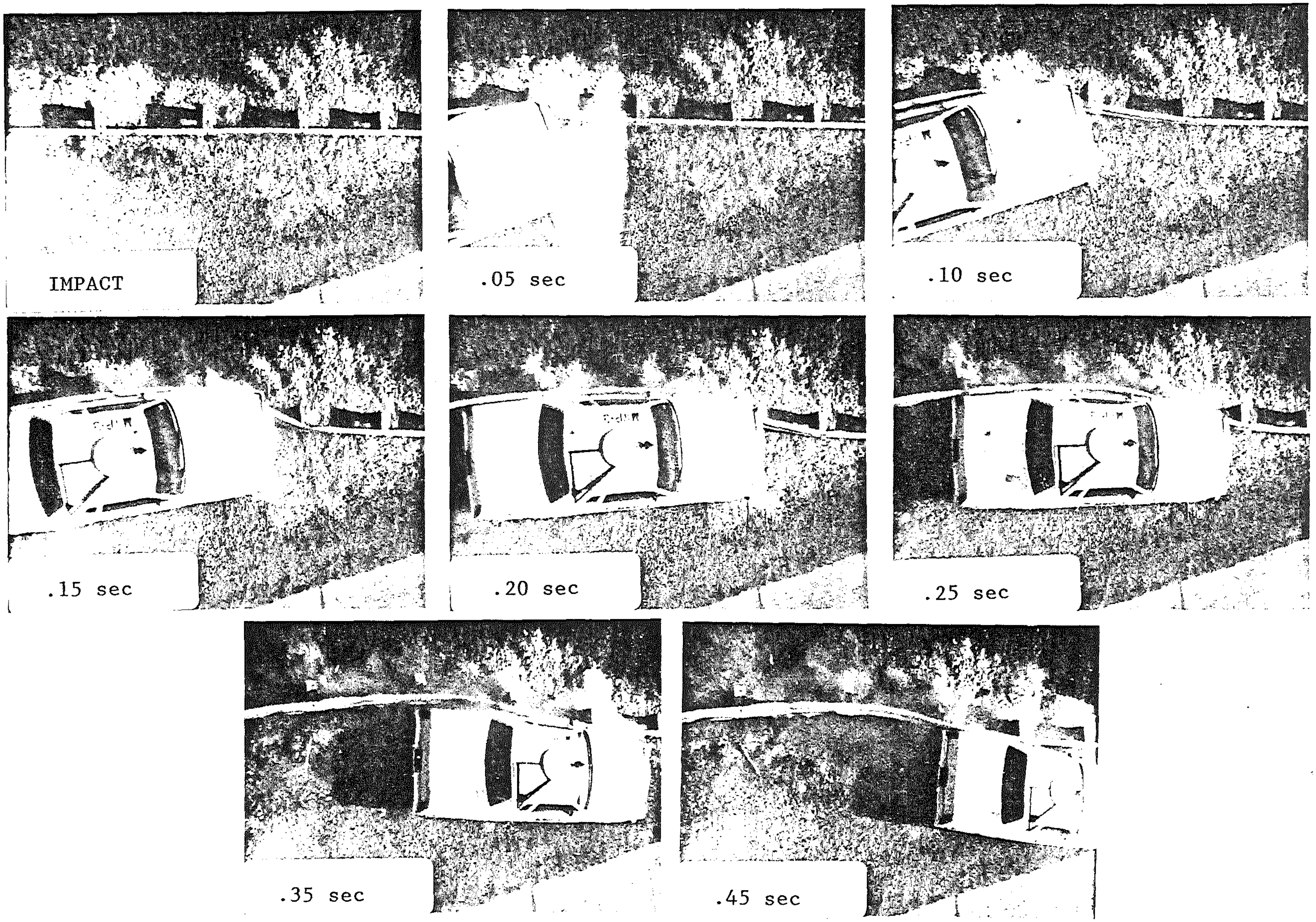


FIGURE B.15 SUMMARY OF RESULTS, TEST MWP-3 (Continued)

TABLE B.6

PERMANENT BARRIER DEFLECTIONS, TEST MWP-3

Post/Location	Deflections (in.)
3	0
4	1.5
5	7.0
6	17.0
7	20.5
8	11.5
9	1.5
10	0

TABLE B.7

VEHICLE KINETICS DATA, TEST MWP-3

MICHIGAN WOOD POST TEST MWP-3 1-15-87

VEHICLE KINETICS SUMMARY--FROM FILM ANALYSIS

TIME (S)	VEH. ACCEL.(G'S) LONG.	LAT.	HEADING ANGLE (DEG)	VEH. VEL.(FPS) LONG.	LAT.	VEH. DISP.(F) X	Y
0.000	-.48	-1.62	23.93	88.83	-2.84	-6.77	-4.65
.010	-.64	-1.93	23.70	88.66	-3.06	-5.95	-4.32
.020	-.86	-2.26	23.36	88.44	-3.21	-5.12	-4.00
.030	-1.16	-2.60	22.91	88.13	-3.30	-4.30	-3.68
.040	-1.53	-2.95	22.35	87.73	-3.33	-3.47	-3.37
.050	-1.92	-3.30	21.68	87.21	-3.31	-2.65	-3.08
.060	-2.31	-3.65	20.91	86.58	-3.26	-1.83	-2.79
.070	-2.71	-3.99	20.05	85.82	-3.20	-1.01	-2.52
.080	-3.08	-4.32	19.11	84.94	-3.13	-.19	-2.26
.090	-3.42	-4.63	18.10	83.95	-3.08	.62	-2.02
.100	-3.72	-4.91	17.03	82.85	-3.07	1.42	-1.80
.110	-3.97	-5.15	15.93	81.67	-3.11	2.22	-1.60
.120	-4.16	-5.36	14.81	80.42	-3.22	3.01	-1.41
.130	-4.29	-5.52	13.68	79.13	-3.40	3.79	-1.25
.140	-4.36	-5.63	12.56	77.80	-3.66	4.56	-1.10
.150	-4.37	-5.68	11.45	76.47	-3.99	5.32	-.98
.160	-4.32	-5.68	10.38	75.15	-4.40	6.08	-.88
.170	-4.22	-5.62	9.34	73.86	-4.88	6.82	-.80
.180	-4.07	-5.50	8.36	72.61	-5.41	7.55	-.73
.190	-3.88	-5.33	7.42	71.43	-5.98	8.27	-.69
.200	-3.65	-5.11	6.55	70.31	-6.58	8.98	-.67
.210	-3.39	-4.84	5.73	69.27	-7.19	9.68	-.66
.220	-3.12	-4.55	4.98	68.32	-7.79	10.37	-.67
.230	-2.83	-4.20	4.28	67.46	-8.37	11.06	-.70
.240	-2.52	-3.84	3.65	66.70	-8.92	11.73	-.74
.250	-2.22	-3.47	3.06	66.03	-9.43	12.40	-.79
.260	-1.92	-3.09	2.53	65.45	-9.87	13.06	-.86
.270	-1.63	-2.71	2.05	64.96	-10.25	13.72	-.93
.280	-1.36	-2.35	1.60	64.56	-10.56	14.37	-1.01
.290	-1.11	-2.01	1.18	64.24	-10.80	15.01	-1.10
.300	-.88	-1.69	.80	64.00	-10.96	15.66	-1.20
.310	-.66	-1.40	.43	63.82	-11.04	16.30	-1.31
.320	-.51	-1.14	.08	63.70	-11.06	16.94	-1.41
.330	-.38	-.92	-.27	63.62	-11.01	17.57	-1.52
.340	-.29	-.75	-.61	63.58	-10.90	18.21	-1.64
.350	-.23	-.61	-.95	63.56	-10.74	18.84	-1.76
.360	-.22	-.51	-1.29	63.56	-10.54	19.47	-1.87
.370	-.24	-.45	-1.64	63.55	-10.30	20.11	-2.00
.380	-.29	-.42	-2.00	63.53	-10.05	20.74	-2.12
.390	-.38	-.43	-2.36	63.48	-9.78	21.37	-2.24
.400	-.50	-.47	-2.73	63.40	-9.51	22.00	-2.36
.410	-.65	-.53	-3.11	63.28	-9.26	22.63	-2.49
.420	-.82	-.60	-3.49	63.10	-9.01	23.25	-2.62
.430	-1.00	-.68	-3.88	62.87	-8.80	23.88	-2.75
.440	-1.19	-.77	-4.26	62.58	-8.61	24.50	-2.88
.450	-1.36	-.85	-4.64	62.22	-8.46	25.11	-3.01

TABLE B.7 (Continued)

VEHICLE KINETICS DATA, TEST MWP-3

.460	-1.57	-.92	-5.02	61.80	-8.34		25.72	-3.15
.470	-1.76	-.97	-5.38	61.32	-8.25		26.33	-3.29
.480	-1.93	-.99	-5.73	60.77	-8.20		26.93	-3.43
.490	-2.07	-.99	-6.06	60.17	-8.17		27.52	-3.57
.500	-2.19	-.94	-6.36	59.53	-8.16		28.11	-3.72
.510	-2.29	-.85	-6.65	58.85	-8.15		28.69	-3.87
.520	-2.34	-.72	-6.91	58.14	-8.14		29.26	-4.02
.530	-2.36	-.54	-7.14	57.42	-8.11		29.82	-4.17
.540	-2.33	-.31	-7.35	56.69	-8.04		30.38	-4.32
.550	-2.26	-.05	-7.53	55.97	-7.92		30.92	-4.47
.560	-2.15	.26	-7.68	55.28	-7.74		31.47	-4.62
.570	-1.99	.59	-7.81	54.63	-7.48		32.00	-4.77
.580	-1.79	.95	-7.91	54.04	-7.14		32.53	-4.92
.590	-1.55	1.31	-8.00	53.51	-6.70		33.05	-5.06
.600	-1.27	1.66	-8.06	53.06	-6.15		33.57	-5.20
.610	-.96	2.03	-8.11	52.71	-5.51		34.08	-5.33
.620	-.64	2.34	-8.14	52.45	-4.78		34.60	-5.46
.630	-.30	2.61	-8.16	52.30	-3.96		35.11	-5.57
.640	.03	2.81	-8.17	52.26	-3.08		35.62	-5.68
.650	.35	2.93	-8.16	52.32	-2.16		36.14	-5.78
.660	.63	2.95	-8.14	52.48	-1.23		36.65	-5.88
.670	.87	2.67	-8.10	52.72	-.32		37.17	-5.96
.680	1.04	2.66	-8.05	53.03	.52		37.70	-6.03
.690	1.13	2.34	-7.98	53.38	1.26		38.22	-6.10
.700	1.12	1.88	-7.89	53.75	1.86		38.76	-6.15
.710	.97	1.32	-7.77	54.10	2.27		39.29	-6.21
.720	.69	.65	-7.63	54.37	2.46		39.83	-6.26
.730	.23	-.08	-7.47	54.53	2.40		40.38	-6.30

HIGHEST 50-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-4.25	.1250	.1750
LAT.	-5.67	.1350	.1850

TABLE B.7 (Continued)

VEHICLE KINETICS DATA, TEST MWP-3

TEST ID ------- MWP-3
TEST DATE ----- 01-15-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 88.83 FPS

VEHICLE KINETICS SUMMARY
NOTE: VALUES ARE INSTANTANEOUS AT TIME

TIME	ACCEL.(G'S)		HEAD.ANG.	VELOCITY(FPS),		DISP.(F)	
S.	LONG.	LAT.	DEG	LONG.	LAT.	X	Y
.000	-2.80	-1.66	23.93	88.83	-2.64	-6.77	-4.85
.010	-2.57	-7.49	23.77	88.11	-4.43	-5.95	-4.52
.020	-14.13	.95	23.43	86.84	-5.66	-5.13	-4.22
.030	3.64	-5.80	23.06	84.57	-6.14	-4.32	-3.94
.040	-.25	-.90	22.73	84.25	-7.08	-3.52	-3.67
.050	-1.60	-8.85	22.20	84.72	-6.85	-2.71	-3.41
.060	12.62	18.23	21.52	84.88	-5.92	-1.90	-3.16
.070	-1.90	-7.16	20.72	85.39	-4.68	-1.09	-2.90
.080	2.15	1.46	19.74	85.62	-3.64	-.28	-2.64
.090	-6.55	-5.80	18.66	85.53	-2.74	.55	-2.38
.100	-3.10	-1.92	17.37	83.77	-3.33	1.36	-2.16
.110	-10.61	-12.48	15.93	82.18	-3.26	2.17	-1.95
.120	.20	2.05	14.51	80.50	-3.64	2.96	-1.77
.130	-10.01	-11.55	13.23	78.44	-2.82	3.74	-1.60
.140	-.25	2.22	12.13	77.81	-4.75	4.51	-1.47
.150	-2.80	3.73	11.25	76.73	-4.33	5.28	-1.36
.160	6.19	2.64	10.31	77.61	-3.15	6.04	-1.25
.170	-5.50	-7.16	9.46	76.69	-3.63	6.81	-1.15
.180	-4.45	-8.00	8.70	75.48	-5.87	7.57	-1.07
.190	-6.70	-.14	7.99	74.36	-6.98	8.32	-1.03
.200	-7.45	-6.82	7.42	73.30	-7.54	9.06	-1.00
.210	-13.16	-.06	6.90	71.21	-8.46	9.79	-.99
.220	2.00	-.31	6.50	69.04	-8.94	10.49	-1.00
.230	-1.30	-1.66	6.20	68.81	-9.85	11.19	-1.02
.240	-3.10	-3.27	5.83	69.19	-9.41	11.88	-1.04
.250	-3.85	-4.62	5.46	68.72	-9.38	12.58	-1.07
.260	4.24	.11	5.03	68.13	-9.09	13.27	-1.10
.270	-3.85	-5.64	4.54	67.86	-9.30	13.95	-1.13
.280	.73	-1.92	4.12	67.24	-9.48	14.63	-1.17
.290	-.17	.95	3.78	66.71	-9.59	15.31	-1.22
.300	.50	-2.42	3.39	66.64	-9.82	15.98	-1.27
.310	-1.75	-1.75	3.03	66.13	-10.03	16.65	-1.34
.320	-1.60	2.47	2.71	66.01	-10.16	17.31	-1.40
.330	1.85	2.64	2.42	65.80	-9.97	17.97	-1.47
.340	.35	-1.33	2.14	65.55	-9.84	18.64	-1.55
.350	-1.00	-1.75	1.85	65.38	-9.81	19.29	-1.62
.360	-2.05	1.04	1.59	65.16	-9.83	19.95	-1.70
.370	-1.45	-2.76	1.34	64.88	-9.91	20.60	-1.78
.380	-1.30	-2.09	1.07	64.81	-9.99	21.25	-1.87

TABLE B.7 (Continued)

VEHICLE KINETICS DATA, TEST MWP-3

.390	-1.07	-1.66	.80	64.64	-9.92	21.90	-1.96
.400	.50	-4.45	.51	64.15	-9.76	22.55	-2.05
.410	-1.90	.62	.22	63.73	-9.43	23.19	-2.14
.420	-1.75	-2.00	.05	63.15	-8.95	23.82	-2.23
.430	-1.90	-1.92	-.14	62.52	-8.77	24.45	-2.32
.440	-1.00	-.23	-.25	62.19	-8.77	25.07	-2.41

HIGHEST 50.0-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-5.34	.166	.216
LAT.	-7.15	.089	.139

TABLE B.8

OCCUPANT RISK DATA, TEST MWP-3

MICHIGAN WOOD POST TEST MWP-3 1-15-87
OCCUPANT RISK SUMMARY -- FROM FILM ANALYSIS
NOTE: AVG. ACCEL. FOR PRIOR 0.010 SEC. CALCULATED
FROM VEHICLE VELOCITY CHANGE
RELATIVE VALUES-(OCCUPANT W.R.T. VEHICLE)

	(------- VEHICLE	--------)		(----------- OCCUPANT			-----------)
TIME	ACCEL. (G'S)		ANG. VEL	VEL. (FPS)		DISP. (F)	
(S)	LONG.	LAT.	(RAD/S)	LONG.	LAT.	LONG.	LAT.
0.000	-.48	-1.62	.42	0.00	0.00	0.00	0.00
.010	-.64	-1.93	.41	-.05	.35	-.00	.00
.020	-.88	-2.26	.41	-.06	.79	-.00	.01
.030	-1.18	-2.60	.40	.01	1.33	-.00	.02
.040	-1.53	-2.95	.39	.18	2.00	-.00	.03
.050	-1.92	-3.30	.38	.46	2.80	.00	.06
.060	-2.31	-3.65	.36	.86	3.74	.01	.09
.070	-2.71	-3.99	.35	1.38	4.82	.02	.13
.080	-3.08	-4.32	.33	2.03	6.07	.03	.19
.090	-3.42	-4.63	.32	2.79	7.46	.05	.26
.100	-3.72	-4.91	.30	3.65	9.00	.08	.34
.110	-3.97	-5.15	.28	4.59	10.68	.11	.44
.120	-4.16	-5.36	.26	5.59	12.49	.15	.56
.130	-4.29	-5.52	.24	6.64	14.41	.20	.70
.140	-4.36	-5.63	.22	7.71	16.43*	.26	.85*
.150	-4.37	-5.68*	.20	8.79	18.51	.32	1.04
.160	-4.32	-5.68	.18	9.85	20.63	.39	1.24
.170	-4.22	-5.62	.16	10.89	22.78	.47	1.46
.180	-4.07	-5.50	.15	11.89	24.91	.56	1.71
.190	-3.88	-5.33	.13	12.83	27.02	.65	1.98
.200	-3.65	-5.11	.11	13.72	29.06	.75	2.27
.210	-3.39	-4.84	.10	14.53	31.02	.86	2.58
.220	-3.12	-4.53	.09	15.27	32.88	.97	2.91
.230	-2.83	-4.20	.07	15.93	34.62	1.09	3.26
.240	-2.52	-3.84	.06	16.51	36.23	1.22	3.63
.250	-2.22	-3.47	.05	17.00	37.71	1.35	4.01
.260	-1.92	-3.09	.04	17.40	39.03	1.48	4.41
.270	-1.63	-2.71	.04	17.72	40.22	1.62	4.82
.280	-1.36	-2.35	.03	17.96	41.26	1.75	5.24
.290	-1.11	-2.01	.02	18.11+	42.16	1.90+	5.67
.300	-.88	-1.69	.01	18.19	42.93	2.04	6.11
.310	-.68	-1.40	.01	18.19	43.59	2.18	6.56
.320	-.51	-1.14	.00	18.13	44.14	2.32	7.01
.330	-.38	-.92	-.00	18.02	44.60	2.46	7.47
.340	-.29	-.75	-.01	17.86	44.98	2.59	7.93
.350	-.23	-.61	-.02	17.66	45.30	2.72	8.40
.360	-.22	-.51	-.02	17.45	45.58	2.84	8.87
.370	-.24	-.45	-.03	17.22	45.83	2.96	9.34
.380	-.29	-.42	-.03	17.00	46.06	3.07	9.82
.390	-.38	-.43	-.04	16.79	46.30	3.18	10.30
.400	-.50	-.47	-.05	16.61	46.54	3.28	10.79

TABLE B.8 (Continued)

OCCUPANT RISK DATA, TEST MWP-3

.410	-.65	-.53	-.05	16.47	46.80	3.37	11.28
.420	-.82	-.60	-.06	16.38	47.09	3.46	11.77
.430	-1.00	-.68	-.07	16.35	47.41	3.54	12.27
.440	-1.19	-.77	-.07	16.36	47.76	3.62	12.77
.450	-1.38	-.85	-.06	16.48	48.15	3.70	13.27
.460	-1.57	-.92	-.09	16.66	48.57	3.77	13.78
.470	-1.76	-.97	-.09	16.91	49.01	3.85	14.29
.480	-1.93	-.99	-.10	17.23	49.47	3.93	14.80
.490	-2.07	-.99	-.11	17.63	49.94	4.02	15.32
.500	-2.19+	-.94	-.11	18.09	50.40	4.12	15.85

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
<LONG. VEL. AFTER 2.0 FT. DISP.	--	.297	18.17
<LAT. VEL. AFTER 1.0 FT. DISP.	--	.148	18.10

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME (S)	ACC. (G'S)
<LONG. ACCELERATION	--	.500	-2.19
<LAT. ACCELERATION	--	.150	-5.68

TABLE B.8 (Continued)

OCCUPANT RISK DATA, TEST MWP-3

TEST ID ------- MWP-3
TEST DATE ----- 01-15-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 88.83 FPS

OCCUPANT RISK SUMMARY
NOTE: INSTANTANEOUS 10-MS AVERAGE ACCELERATIONS

	(------- VEHICLE	--------)	(	------------ OCCUPANT		------------)	
TIME	ACCEL. (G'S)		ANG. VEL	VEL. (FPS)		DISP. (F)	
(S)	LONG.	LAT.	(RAD/S)	LONG.	LAT.	LONG.	LAT.
.000	-2.80	-1.66	-.08	.00	.00	.00	.00
.010	-6.93	-7.65	-.29	.47	1.78	.00	.01
.020	-1.82	-1.83	-.91	.97	2.76	.01	.03
.030	-5.51	-4.26	-.57	3.68	4.25	.04	.07
.040	2.33	-2.56	-.80	3.72	5.41	.08	.12
.050	-1.61	-3.38	-.94	3.08	5.84	.11	.17
.060	2.13	3.58	-1.19	2.59	5.64	.14	.23
.070	.27	-1.56	-1.57	1.58	5.17	.15	.28
.080	2.20	1.00	-1.68	1.16	5.52	.16	.34
.090	-4.15	-9.18	-2.15	.58	5.72	.16	.39
.100	-4.88	-7.58	-2.28	2.02	8.14	.16	.47
.110	-6.68	-5.44	-2.70	2.88	9.78	.17	.56
.120	-3.15	-2.77	-2.36	4.71	12.76	.20	.68
.130	-6.14	-9.93	-2.04	6.87	14.32	.23	.81
.140	-4.00	-6.06	-1.73	7.60	18.31*	.29	.98*
.150	-1.36	-1.76	-1.53	8.68	19.49	.36	1.18
.160	2.91	-.47	-1.40	7.67	19.89	.42	1.38
.170	-6.17	-9.07*	-1.59	8.07	21.43	.47	1.59
.180	-3.74	-7.86	-1.38	9.27	25.07	.54	1.83
.190	-2.80	-5.66	-.96	10.65	27.77	.61	2.10
.200	-5.00	-3.82	-.91	11.55	29.25	.70	2.39
.210	-9.02	-5.29	-.99	13.33	30.84	.80	2.70
.220	-.95	-2.65	-.41	16.05	32.65	.93	3.03
.230	-.49	-1.09	-.54	16.00	33.84	1.07	3.36
.240	-1.18	-1.74	-.65	15.32	33.83	1.21	3.71
.250	-2.28	-.66	-.77	15.48	34.20	1.34	4.06
.260	-.59	-.98	-.85	15.76	34.43	1.46	4.41
.270	-2.15	-1.89	-.86	15.80	35.37	1.58	4.78
.280	-1.95	-1.56	-.63	16.51	36.45	1.71	5.15
.290	-.97	-1.97	-.65	16.83	37.04	1.84	5.52
.300	-1.24	-1.84	-.64	16.73+	37.87	1.97+	5.91
.310	-1.32	-1.62	-.45	17.30	38.82	2.10	6.30
.320	-.48	-1.66	-.48	17.22	39.39	2.24	6.71
.330	-.63	-.30	-1.18	16.39	38.75	2.37	7.11
.340	-.77	-.82	-.33	17.56	40.09	2.51	7.52
.350	-1.10	-.62	-.59	17.25	40.16	2.64	7.93
.360	-.87	-1.50	-.40	17.56	40.79	2.78	8.35
.370	-.26	-1.18	-.40	17.69	41.23	2.92	8.77

TABLE B.8 (Continued)

OCCUPANT RISK DATA, TEST MWP-3

.380	-1.01	-.65	-.35	17.68	41.76	3.05	9.20
.390	-.99	-1.05	-.48	17.54	41.93	3.18	9.63
.400	-1.44	.00	-.39	17.99	42.29	3.31	10.07
.410	-1.92	.48	-.27	18.38	42.53	3.44	10.51
.420	-1.68	.24	-.32	18.79	42.23	3.59	10.94
.430	-1.76	-.10	-.30	19.34	42.34	3.75	11.38
.440	-1.66+	-.10	-.14	19.80	42.70	3.92	11.81

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
>LONG. VEL. AFTER 2.0 FT. DISP.	--	.302	16.55
>LAT. VEL. AFTER 1.0 FT. DISP.	--	.141	18.29

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME(S)	ACC.(GS)
>LONG. ACCELERATION	--	.444	-3.07
>LAT. ACCELERATION	--	.177	-10.40

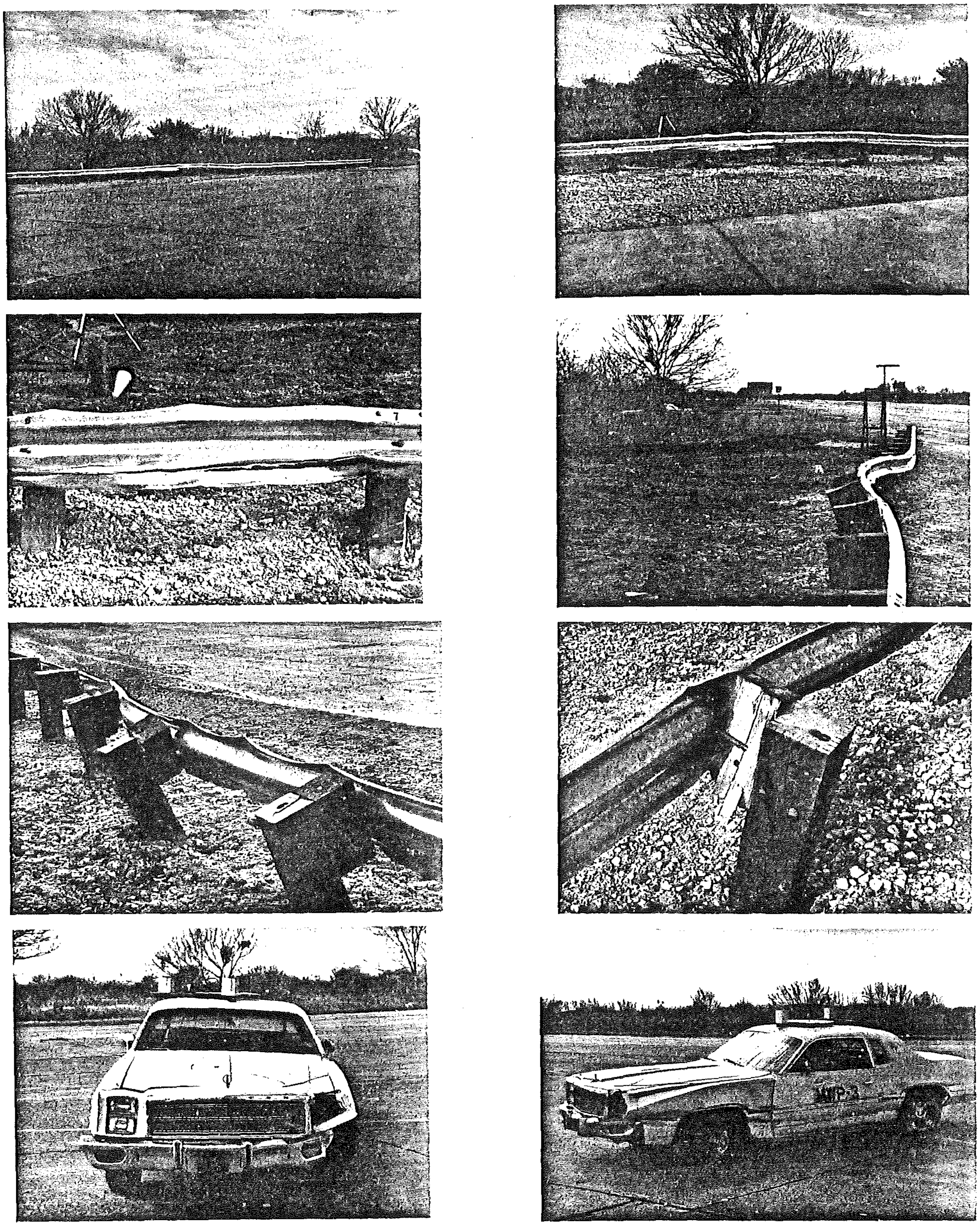


FIGURE B.16 BARRIER AND VEHICLE DAMAGE, TEST MWP-3

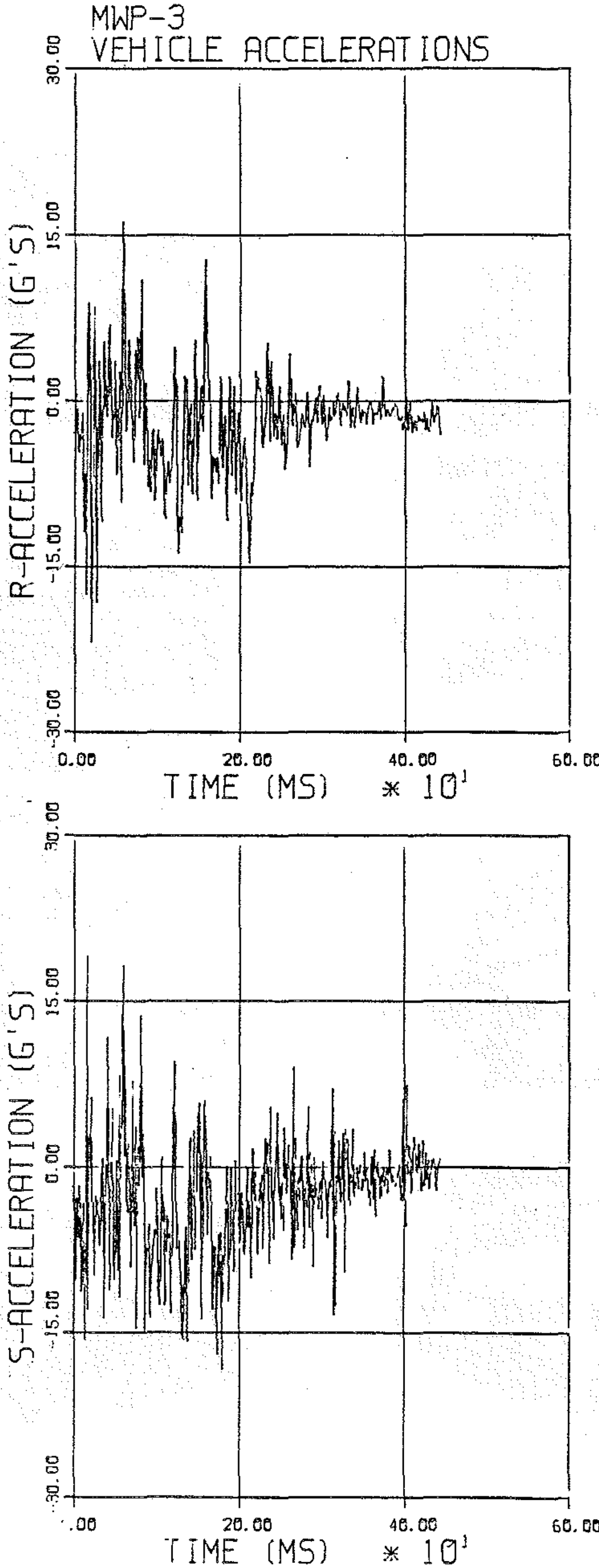


FIGURE B.17 VEHICLE ACCELERATIONS, TEST MWP-3

SUMMARY OF RESULTS, TEST MWP-4

Test No.	MWP-4
Date	02/11/87
Installation Length - ft (m)	100 (30)
Beam	
Member	12 ga W-beam
Length - ft (m)	12.5 (3.8)
Posts (5 thru 14)	
Material	Jack Pine
Description	8"x8"x72"
Embedment	44"
Spacing	6'-3"
Maximum Deflections - in. (cm)	
Dynamic	34.5 (87.6)
Static	20 (51)
Soil type and condition	S1 (dry)
Vehicle	1978 Dodge sedan
Mass - lb (kg)	
Gross Test Inertia	4325 (1961)
Speed - mph (km/h)	58.7 (94.4)
Impact Angle - deg	25.1
Occupant Impact Velocity - fps (m/s)	
Forward (film/accel)	18.9 (5.8)/17.4 (5.3)
Lateral (film/accel)	16.9 (5.2)/18.4 (5.6)
Occupant Ridedown Accelerations - g's	
Forward (accel)	-4.9
Lateral (accel)	-16.1
Maximum 50-msec Avg Accelerations - g's	
Longitudinal (film/accel)	-4.8/-5.0
Lateral (film/accel)	-5.1/-7.3
Damage	
TAD	11-FL-4
VDI	11FLEE5

TEST MWP-4

Barrier Installation: The barrier evaluated in the test was a standard G4(1W) incorporating Michigan Jack Pine posts and blockouts in the test area (Posts 5 through 14). Total barrier length was 100 ft (30 m). Figure B.18 presents system details and moisture content of test posts.

Test Vehicle: The vehicle used in the test was a 1978 Dodge sedan. Gross test weight, including instrumentation, was 4325 lb (1961 kg). Figure B.19 contains photographs of the barrier and the test vehicle.

Performance: Impact conditions were 58.7 mph (94.4 km/h) and a 25.1-degree impact angle. As shown in Figure B.20, the vehicle impacted the barrier 0.7 ft (0.2 m) upstream of Post 6. The vehicle remained in contact with the barrier for 19.4 ft (5.9 m) while laterally deflecting the W-beam 34.5 in. (87.6 cm) before smooth redirection at a -14.6-degree angle. Final rest position of the vehicle was 115 ft (35 m) downstream of impact and 25 ft (8 m) out from the barrier plane.

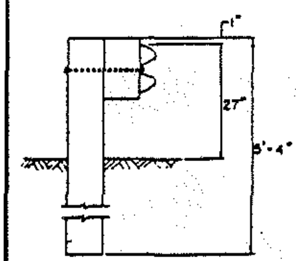
Maximum 50-msec average accelerations measured by film analysis were -4.8 g (longitudinal) and -5.1 g (lateral). Transducer data indicated 50-msec averages of -5.0 g (longitudinal) and -7.3 g (lateral). Figure B.21 presents a summary of test results. Table B.9 presents permanent barrier deflections. The vehicle kinetics obtained from film and onboard transducers are presented in Table B.10. Table B.11 contains occupant risk data. Figure B.22 contains photographs of vehicle and barrier damage. Plots of transducer data are presented in Figure B.23.

Barrier Damage: Damage to the barrier consisted of deformation of three sections of W-beam. Although deflected laterally in the soil at the impact area, all posts remained intact.

Vehicle Damage: Damage to the vehicle consisted of sheet metal deformation of the left from fender, side, and the headlight/grille area. The front bumper was also deformed. The left front tire was blown out during impact. All windows remained intact. It should be noted that the vehicle right side tires struck a guide pylon which caused the tires to blow out just prior tc impact. The blowouts did not significantly alter the results of the test.

Metric Conversions

1 ft. = 0.305 m
1 in. = 25.4 mm
1 mph = 1.61 km/hr
1 lb. = 0.454 kg



SYSTEM	G4(1W) Blocked-Out "W" Beam (Wood Post)
BARRIER DESCRIPTION	
POST SPACING	6' 3"
POST TYPE	8"x8" Jack pine
BEAM TYPE	Steel "W" section, 12 GA.
OFFSET BRACKETS	8"x8"x14" wood
MOUNTINGS	5/8" diameter carriage bolts
FOOTINGS	None

MOISTURE CONTENT OF POSTS

Post No.	% Moisture
5	19
6	19
7	22
8	17
9	19
10	18
11	17
12	20
13	18
14	19
Average	19%

FIGURE B.18 SYSTEM DETAILS, TEST MWP-4

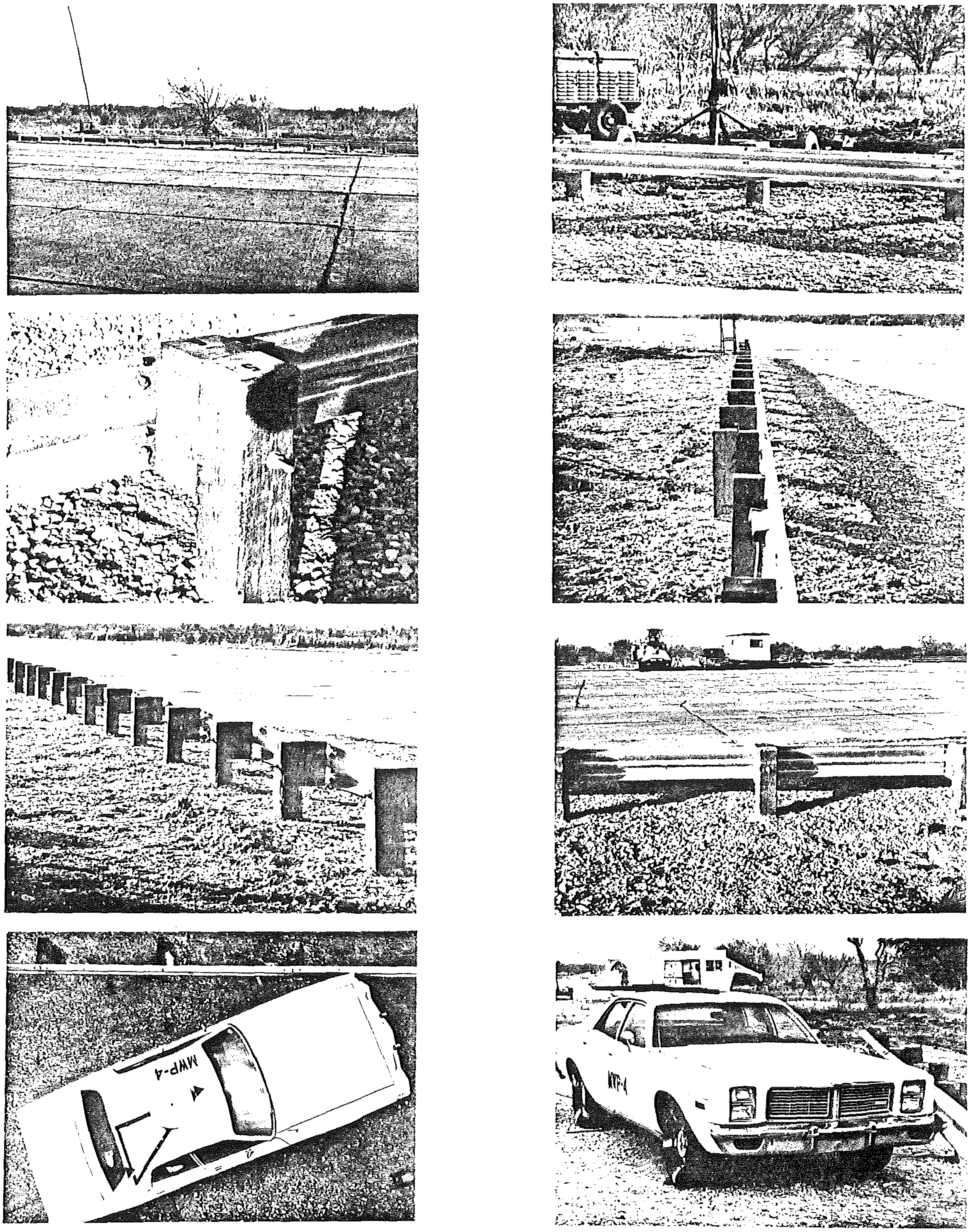


FIGURE B.19 BARRIER AND VEHICLE DETAILS, TEST MWP-4

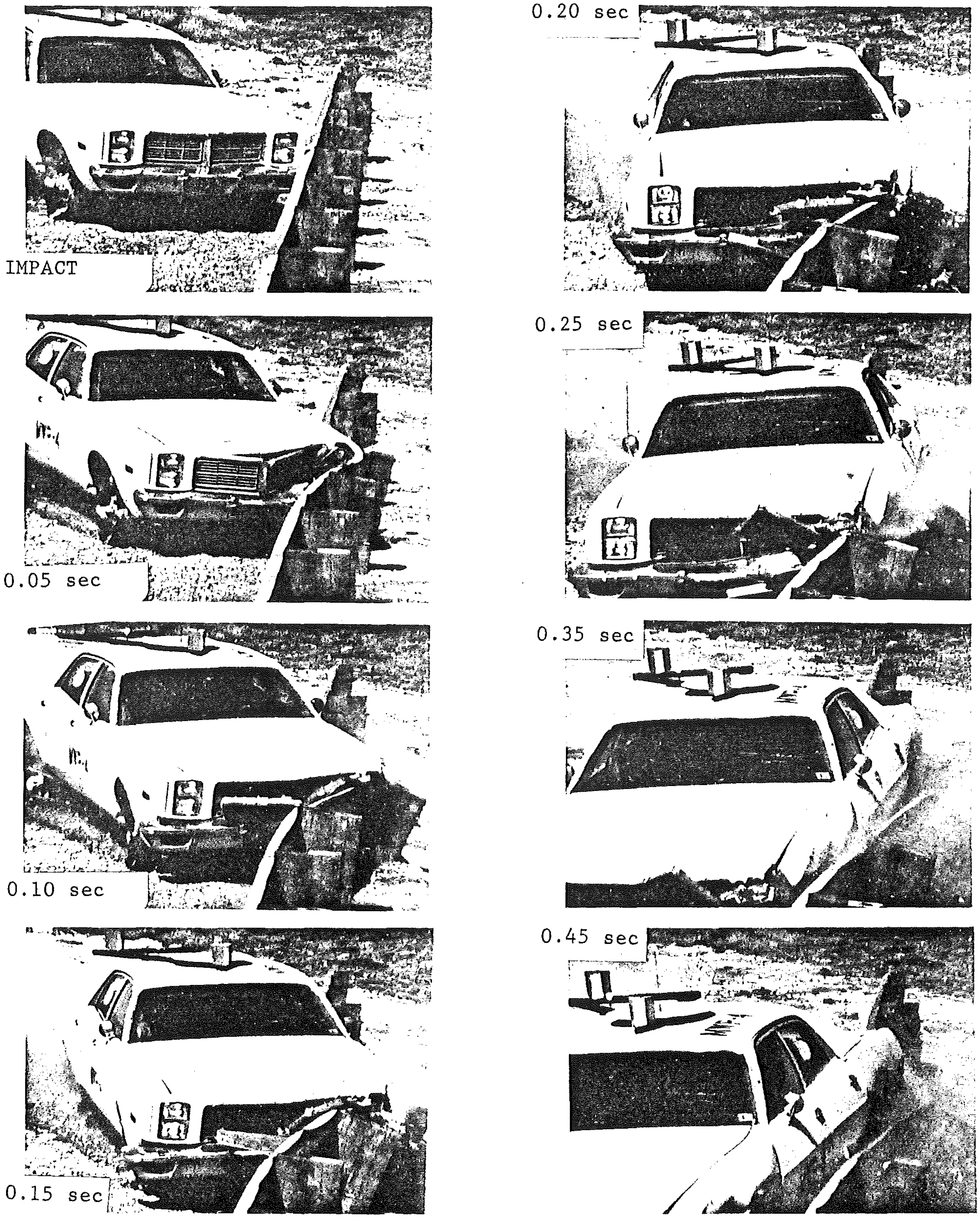
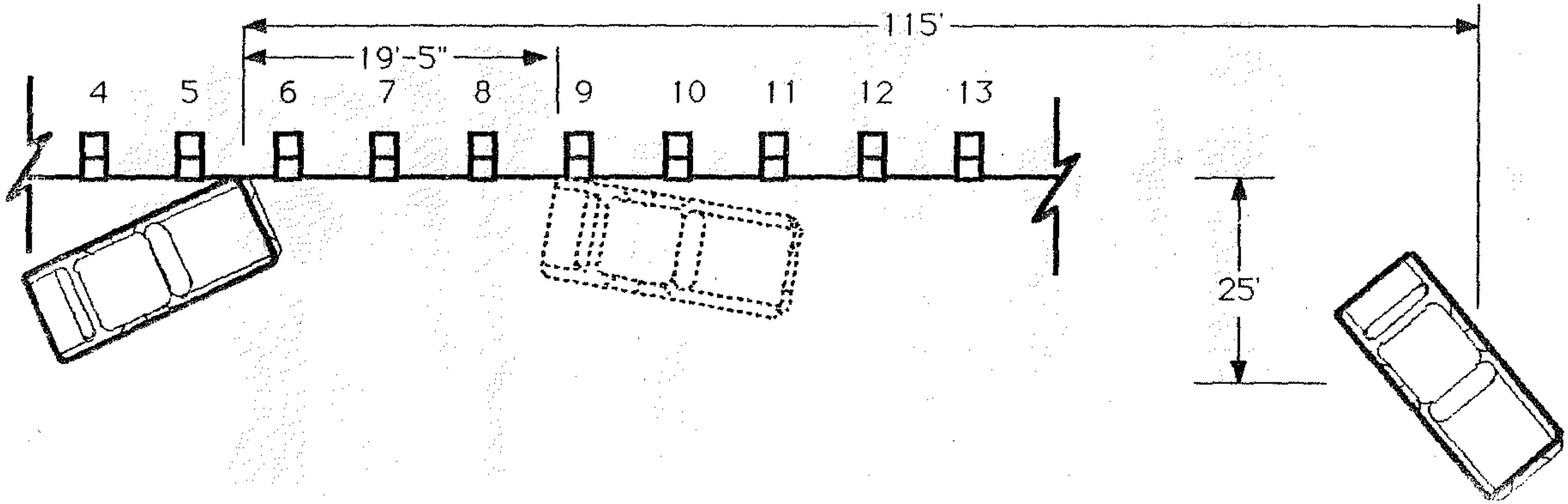


FIGURE B.20 SEQUENTIAL PHOTOGRAPHS, TEST MWP-4



Test No.	MWP-4
Date	02/11/87
Installation Length - ft (m)	100 (30)
Beam	
Member	12 ga W-beam
Length - ft (m)	12.5 (3.8)
Posts (5 thru 14)	
Material	Jack Pine
Description	8"x8"x72"
Embedment	44"
Spacing	6'-3"
Maximum Deflections - in. (cm)	
Dynamic	34.5 (87.6)
Static	20 (51)
Soil type and condition	S1 (dry)
Vehicle	1978 Dodge sedan
Mass - lb (kg)	
Gross Test Inertia	4325 (1961)
Speed - mph (km/h)	58.7 (94.4)
Impact Angle - deg	25.1
Occupant Impact Velocity - fps (m/s)	
Forward (film/accel)	18.9 (5.8)/17.4 (5.3)
Lateral (film/accel)	16.9 (5.2)/18.4 (5.6)
Occupant Ridedown Accelerations - g's	
Forward (accel)	-4.9
Lateral (accel)	-16.1
Maximum 50-msec Avg Accelerations - g's	
Longitudinal (film/accel)	-4.8/-5.0
Lateral (film/accel)	-5.1/-7.3
Damage	
TAD	11-FL-4
VDI	11FLEE5

FIGURE B.21 SUMMARY OF RESULTS, TEST MWP-4

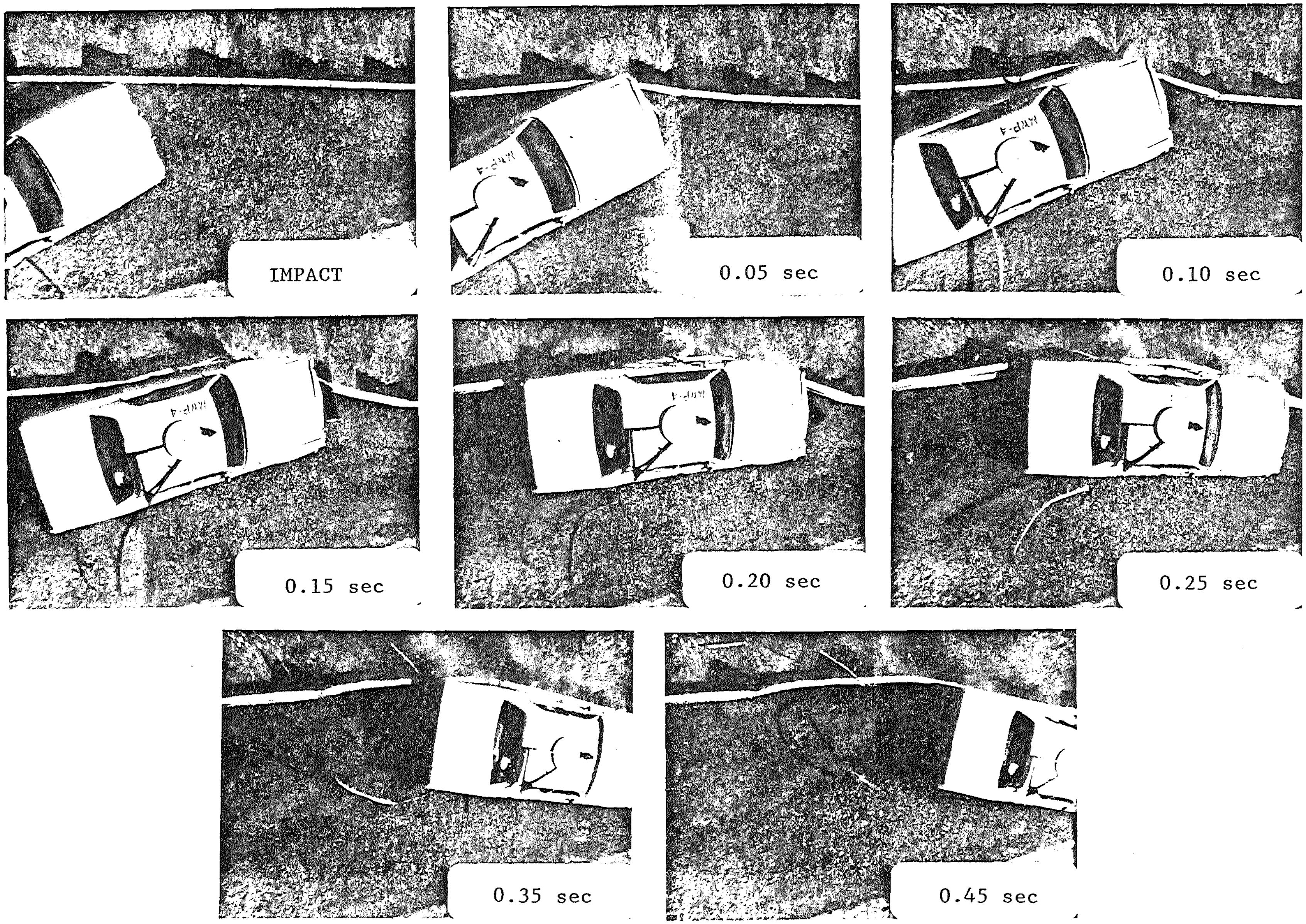


FIGURE B.21 SUMMARY OF RESULTS, TEST MWP-4 (Continued).

TABLE B.9

PERMANENT BARRIER DEFLECTIONS, TEST MWP-4

Post/Location	Deflections (in.)
3	0
4	0.3
5	2.4
6	9.5
7	17.5
Midway Between 7 & 8	20.0
8	15.5
9	5.5
10	0.8
11	0

TABLE B.10

VEHICLE KINETICS DATA, TEST MWP-4

MICHIGAN WOOD POST TEST MWP-4 2-11-87

VEHICLE KINETICS SUMMARY--FROM FILM ANALYSIS

TIME (S)	VEH. ACCEL.(G'S) LONG.	LAT.	HEADING ANGLE (DEG)	VEH. VEL.(FPS) LONG.	LAT.	VEH. DISP.(F) X	Y
0.000	-1.94	-1.50	25.08	86.09	-.64	-1.55	-5.40
.010	-2.39	-1.83	24.92	85.39	-.94	-.77	-5.04
.020	-2.82	-2.14	24.66	84.56	-1.20	.01	-4.70
.030	-3.24	-2.45	24.29	83.59	-1.39	.78	-4.36
.040	-3.62	-2.75	23.80	82.50	-1.52	1.54	-4.03
.050	-3.97	-3.05	23.19	81.29	-1.59	2.30	-3.72
.060	-4.27	-3.33	22.47	79.98	-1.59	3.05	-3.42
.070	-4.51	-3.61	21.63	78.59	-1.55	3.79	-3.14
.080	-4.70	-3.87	20.68	77.13	-1.47	4.52	-2.87
.090	-4.82	-4.12	19.64	75.62	-1.36	5.24	-2.62
.100	-4.89	-4.35	18.50	74.08	-1.24	5.95	-2.39
.110	-4.90	-4.56	17.28	72.53	-1.12	6.65	-2.18
.120	-4.85	-4.74	16.00	70.98	-1.00	7.35	-1.98
.130	-4.75	-4.89	14.65	69.46	-.91	8.02	-1.80
.140	-4.60	-5.00	13.27	67.97	-.85	8.69	-1.65
.150	-4.42	-5.08	11.86	66.54	-.82	9.35	-1.51
.160	-4.20	-5.12	10.44	65.17	-.83	10.00	-1.39
.170	-3.95	-5.12	9.02	63.88	-.88	10.64	-1.29
.180	-3.69	-5.08	7.62	62.67	-.98	11.26	-1.21
.190	-3.43	-5.00	6.25	61.55	-1.11	11.88	-1.14
.200	-3.16	-4.88	4.91	60.52	-1.28	12.49	-1.09
.210	-2.89	-4.72	3.63	59.58	-1.48	13.09	-1.06
.220	-2.64	-4.54	2.41	58.72	-1.71	13.68	-1.05
.230	-2.40	-4.32	1.25	57.95	-1.96	14.27	-1.05
.240	-2.18	-4.08	.17	57.25	-2.23	14.84	-1.06
.250	-1.99	-3.82	-.83	56.62	-2.51	15.41	-1.09
.260	-1.82	-3.55	-1.75	56.05	-2.80	15.97	-1.13
.270	-1.68	-3.27	-2.58	55.53	-3.08	16.53	-1.18
.280	-1.57	-2.99	-3.33	55.05	-3.36	17.08	-1.24
.290	-1.47	-2.70	-4.00	54.60	-3.64	17.62	-1.31
.300	-1.41	-2.42	-4.59	54.18	-3.90	18.16	-1.39
.310	-1.36	-2.14	-5.11	53.77	-4.15	18.70	-1.47
.320	-1.34	-1.88	-5.57	53.36	-4.37	19.23	-1.57
.330	-1.33	-1.62	-5.96	52.97	-4.57	19.75	-1.66
.340	-1.34	-1.38	-6.30	52.56	-4.74	20.27	-1.77
.350	-1.35	-1.15	-6.60	52.16	-4.87	20.79	-1.87
.360	-1.37	-.94	-6.86	51.74	-4.97	21.30	-1.98
.370	-1.40	-.74	-7.10	51.32	-5.02	21.80	-2.10
.380	-1.43	-.56	-7.32	50.88	-5.03	22.30	-2.21
.390	-1.45	-.40	-7.54	50.44	-5.00	22.80	-2.32
.400	-1.47	-.25	-7.75	49.98	-4.91	23.29	-2.44
.410	-1.48	-.12	-7.97	49.53	-4.78	23.78	-2.56
.420	-1.47	-.00	-8.21	49.07	-4.60	24.26	-2.67
.430	-1.46	.10	-8.46	48.62	-4.37	24.73	-2.79
.440	-1.43	.19	-8.73	48.18	-4.09	25.21	-2.90
.450	-1.38	.26	-9.03	47.74	-3.77	25.67	-3.01

TABLE B.10 (Continued)

VEHICLE KINETICS DATA, TEST MWP-4

.460	-1.32	.32	-9.35	47.33	-3.41	26.14	-3.13
.470	-1.25	.36	-9.70	46.93	-3.01	26.60	-3.24
.480	-1.16	.42	-10.07	46.56	-2.58	27.05	-3.34
.490	-1.06	.46	-10.46	46.22	-2.12	27.51	-3.45
.500	-.94	.48	-10.86	45.91	-1.64	27.95	-3.55
.510	-.82	.50	-11.28	45.64	-1.16	28.40	-3.65
.520	-.70	.52	-11.69	45.40	-.66	28.85	-3.75
.530	-.58	.52	-12.10	45.19	-.17	29.29	-3.85
.540	-.46	.52	-12.50	45.03	.31	29.73	-3.95
.550	-.36	.51	-12.87	44.89	.77	30.17	-4.04
.560	-.27	.48	-13.22	44.79	1.20	30.61	-4.13
.570	-.20	.45	-13.54	44.70	1.60	31.05	-4.22
.580	-.16	.40	-13.82	44.64	1.95	31.48	-4.31
.590	-.16	.34	-14.05	44.58	2.26	31.92	-4.40
.600	-.18	.26	-14.24	44.52	2.50	32.36	-4.48
.610	-.25	.16	-14.39	44.44	2.68	32.80	-4.57
.620	-.35	.05	-14.50	44.34	2.80	33.23	-4.65
.630	-.48	-.08	-14.57	44.21	2.85	33.67	-4.74
.640	-.64	-.22	-14.62	44.02	2.84	34.10	-4.82
.650	-.82	-.36	-14.64	43.79	2.77	34.54	-4.90
.660	-1.01	-.50	-14.67	43.49	2.65	34.96	-4.99
.670	-1.17	-.63	-14.70	43.14	2.49	35.39	-5.07
.680	-1.28	-.74	-14.76	42.74	2.31	35.81	-5.16
.690	-1.31	-.81	-14.85	42.32	2.13	36.23	-5.25
.700	-1.21	-.82	-15.00	41.90	1.97	36.64	-5.33
.710	-.93	-.74	-15.21	41.54	1.87	37.05	-5.42
.720	-.39	-.55	-15.47	41.31	1.85	37.45	-5.52
.730	.49	-.18	-15.80	41.31	1.96	37.86	-5.61

HIGHEST 50-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-4.81	.0850	.1350
LAT.	-5.14	.1450	.1950

TABLE B.11

OCCUPANT RISK DATA, TEST MWP-4

TEST ID ------- MWP-4
TEST DATE ----- 02-11-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 86.09 FPS

VEHICLE KINETICS SUMMARY
NOTE: VALUES ARE INSTANTANEOUS AT TIME

TIME	ACCEL.(G'S)		HEAD.ANG.	VELOCITY(FPS),		DISP.(F)	
S.	LONG.	LAT.	DEG	LONG.	LAT.	X	Y
.000	-.48	-.16	25.08	86.09	-.64	-1.55	-5.40
.010	.93	8.79	25.06	86.44	.18	-.77	-5.04
.020	-5.84	-3.43	24.97	85.53	.62	.01	-4.67
.030	3.37	1.57	24.84	85.67	1.39	.78	-4.30
.040	-3.46	.42	24.71	85.00	2.16	1.55	-3.93
.050	-1.67	.83	24.57	85.20	2.16	2.32	-3.55
.060	8.70	3.70	24.45	84.70	2.69	3.07	-3.18
.070	-1.67	2.80	24.41	84.07	1.73	3.83	-2.81
.080	1.89	-2.04	24.06	83.29	1.04	4.59	-2.46
.090	-1.82	-3.52	23.67	83.28	.62	5.35	-2.11
.100	-4.20	-1.14	23.20	82.19	-.37	6.11	-1.78
.110	-9.26	-5.40	22.59	80.98	.32	6.86	-1.46
.120	-2.86	-6.14	22.00	79.64	-.01	7.60	-1.16
.130	3.07	-5.57	21.39	78.36	-.16	8.33	-.86
.140	-9.85	-2.21	20.75	76.83	-.02	9.06	-.58
.150	-.48	.17	19.87	75.79	-.97	9.78	-.32
.160	-.19	-5.24	18.88	74.58	-1.26	10.49	-.08
.170	-5.84	-6.39	17.75	73.31	-1.29	11.20	.14
.180	-8.51	-2.94	16.43	71.55	-.99	11.89	.34
.190	-6.80	-9.99	15.03	70.00	-1.12	12.58	.52
.200	-4.20	-5.07	13.43	68.37	-1.45	13.25	.68
.210	-5.84	-7.70	11.74	67.12	-.48	13.91	.82
.220	-4.20	-5.89	9.82	66.39	-.32	14.57	.94
.230	-.19	-5.65	7.73	64.45	.09	15.21	1.04
.240	-1.23	-4.83	5.60	63.54	1.16	15.85	1.12
.250	-4.05	-6.47	3.42	62.56	2.35	16.48	1.18
.260	-5.61	-11.63	1.35	61.00	2.53	17.09	1.24
.270	-2.79	-6.55	-.53	58.78	-.58	17.69	1.25
.280	-5.09	1.65	-2.06	57.13	-.40	18.26	1.23
.290	-5.24	-3.60	-3.41	56.92	.74	18.83	1.21
.300	-2.71	-5.89	-4.75	55.06	1.06	19.39	1.17
.310	-1.67	-6.55	-5.99	55.42	1.08	19.94	1.13
.320	-5.84	-3.60	-7.10	54.41	.27	20.49	1.08
.330	.85	-2.94	-7.99	53.66	-.40	21.03	1.00
.340	-2.12	-7.53	-8.76	53.41	-.53	21.56	.92
.350	-3.76	-6.14	-9.38	52.54	-.44	22.08	.83
.360	-1.23	1.08	-9.91	52.26	-.01	22.59	.74
.370	-2.27	1.49	-10.45	51.74	.09	23.11	.65
.380	-7.03	-6.88	-11.03	50.86	.16	23.61	.56
.390	2.48	2.14	-11.58	51.03	1.19	24.11	.47
.400	-1.30	-.65	-11.98	49.45	.41	24.61	.37

TABLE B.11 (Continued)

OCCUPANT RISK DATA, TEST MWP-4

.410	-1.52	2.80	-12.59	49.07	.83	25.09	.27
.420	-.11	-.98	-13.10	48.86	1.31	25.57	.18
.430	-2.27	.17	-13.54	48.55	1.54	26.05	.08
.440	1.00	.91	-13.91	48.33	2.03	26.52	-.02
.450	-.19	.83	-14.33	48.08	2.59	26.99	-.12
.460	-.11	-.98	-14.71	47.68	2.71	27.46	-.21
.470	-1.08	-.40	-15.11	47.32	2.85	27.93	-.31
.480	-.19	-2.45	-15.47	47.11	3.11	28.39	-.40
.490	-1.67	1.08	-15.88	46.73	3.62	28.86	-.50
.500	-.11	1.49	-16.25	46.45	4.14	29.31	-.59

HIGHEST 50.0-MS AVG. ACCEL.

		TIME (SEC)	
	G'S	START	END
LONG.	-4.99	.164	.214
LAT.	-7.30	.219	.269

TABLE B.11 (Continued)

OCCUPANT RISK DATA, TEST MWP-4

MICHIGAN WOOD POST TEST MWP-4 2-11-87
OCCUPANT RISK SUMMARY -- FROM FILM ANALYSIS
NOTE: AVG. ACCEL. FOR PRIOR 0.010 SEC. CALCULATED
FROM VEHICLE VELOCITY CHANGE
RELATIVE VALUES-(OCCUPANT W.R.T. VEHICLE)

	(------- VEHICLE	--------)		(------------ OCCUPANT			------------)
TIME	ACCEL. (G'S)		ANG. VEL	VEL. (FPS)		DISP. (F)	
(S)	LONG.	LAT.	(RAD/S)	LONG.	LAT.	LONG.	LAT.
0.000	-1.94	-1.50	.44	0.00	0.00	0.00	0.00
.010	-2.39	-1.83	.43	.47	.32	.00	.00
.020	-2.82	-2.14	.43	1.07	.73	.01	.01
.030	-3.24	-2.45	.42	1.78	1.23	.02	.02
.040	-3.62	-2.75	.42	2.61	1.84	.05	.03
.050	-3.97	-3.05	.40	3.54	2.57	.08	.05
.060	-4.27	-3.33	.39	4.56	3.42	.12	.09
.070	-4.51	-3.61	.38	5.65	4.40	.16	.13
.080	-4.70	-3.87	.36	6.79	5.51	.22	.18
.090	-4.82	-4.12	.34	7.96	6.77	.29	.25
.100	-4.89	-4.35	.32	9.14	8.17	.37	.33
.110	-4.90	-4.56	.30	10.31	9.70	.46	.42
.120	-4.85	-4.74	.28	11.45	11.37	.56	.54
.130	-4.75	-4.89	.26	12.53	13.17	.67	.68
.140	-4.60	-5.00	.23	13.55	15.08*	.78	.84*
.150	-4.42	-5.08	.21	14.50	17.08	.90	1.02
.160	-4.20	-5.12*	.18	15.35	19.16	1.02	1.22
.170	-3.95	-5.12	.16	16.10	21.30	1.14	1.45
.180	-3.69	-5.08	.13	16.76	23.47	1.27	1.71
.190	-3.43	-5.00	.11	17.32	25.65	1.39	1.98
.200	-3.16	-4.88	.09	17.79	27.81	1.52	2.28
.210	-2.89	-4.72	.06	18.18	29.95	1.65	2.61
.220	-2.64	-4.54	.04	18.49	32.03	1.77	2.96
.230	-2.40	-4.32	.02	18.74+	34.04	1.89+	3.32
.240	-2.18+	-4.08	.00	18.95	35.96	2.02	3.71
.250	-1.99	-3.82	-.01	19.11	37.77	2.14	4.11
.260	-1.82	-3.55	-.03	19.26	39.48	2.26	4.54
.270	-1.68	-3.27	-.05	19.39	41.07	2.38	4.97
.280	-1.57	-2.99	-.06	19.52	42.53	2.51	5.42
.290	-1.47	-2.70	-.07	19.66	43.87	2.64	5.88
.300	-1.41	-2.42	-.08	19.82	45.07	2.77	6.36
.310	-1.36	-2.14	-.09	19.99	46.15	2.91	6.84
.320	-1.34	-1.88	-.10	20.19	47.10	3.06	7.33
.330	-1.33	-1.62	-.10	20.41	47.93	3.21	7.83
.340	-1.34	-1.38	-.11	20.65	48.64	3.37	8.33
.350	-1.35	-1.15	-.12	20.91	49.24	3.53	8.84
.360	-1.37	-.94	-.12	21.18	49.74	3.70	9.35
.370	-1.40	-.74	-.12	21.46	50.15	3.87	9.86
.380	-1.43	-.56	-.13	21.75	50.47	4.05	10.38
.390	-1.45	-.40	-.13	22.03	50.71	4.23	10.90
.400	-1.47	-.25	-.14	22.30	50.89	4.41	11.43

TABLE B.11 (Continued)

OCCUPANT RISK DATA, TEST MWP-4

.410	-1.48	-.12	-.14	22.55	51.02	4.59	11.95
.420	-1.47	-.00	-.14	22.78	51.10	4.76	12.48
.430	-1.46	.10	-.15	22.98	51.14	4.94	13.02
.440	-1.43	.19	-.15	23.15	51.16	5.10	13.55
.450	-1.38	.26	-.16	23.28	51.16	5.26	14.09
.460	-1.32	.32	-.16	23.37	51.14	5.42	14.63
.470	-1.25	.38	-.17	23.42	51.13	5.56	15.18
.480	-1.16	.42	-.18	23.43	51.11	5.69	15.72
.490	-1.06	.46	-.18	23.39	51.10	5.82	16.27
.500	-.94	.48	-.19	23.33	51.09	5.94	16.83

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
<LONG. VEL. AFTER 2.0 FT. DISP.	--	.239	18.92
<LAT. VEL. AFTER 1.0 FT. DISP.	--	.149	16.88

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME (S)	ACC. (G'S)
<LONG. ACCELERATION	--	.240	-2.18
<LAT. ACCELERATION	--	.160	-5.12

TABLE B.11 (Continued)

OCCUPANT RISK DATA, TEST MWP-4

TEST ID ------- MWP-4
TEST DATE ----- 02-11-87
VEHICLE CLASS - STANDARD
IMPACT SPEED -- 86.09 FPS

OCCUPANT RISK SUMMARY
NOTE: INSTANTANEOUS 10-MS AVERAGE ACCELERATIONS

TIME (S)	VEHICLE ACCEL. (G'S) LONG.	VEHICLE ACCEL. (G'S) LAT.	VEHICLE ANG. VEL (RAD/S)	OCCUPANT VEL. (FPS) LONG.	OCCUPANT VEL. (FPS) LAT.	OCCUPANT DISP. (F) LONG.	OCCUPANT DISP. (F) LAT.
.000	-.48	-.16	-.03	.00	.00	.00	.00
.010	-1.71	.72	-.12	-.45	-.89	.00	.00
.020	-3.19	2.62	-.26	.28	-1.38	.00	-.02
.030	1.65	1.56	-.16	.26	-1.82	.00	-.03
.040	-1.73	.31	-.30	.76	-2.58	.00	-.05
.050	-2.48	1.12	-.19	.70	-2.22	.01	-.08
.060	-.30	-1.97	-.04	1.37	-2.39	.03	-.10
.070	-1.30	-4.10	-.51	1.44	-1.95	.04	-.12
.080	-1.67	-2.18	-.45	2.27	-.67	.06	-.13
.090	.27	-2.50	-.83	1.81	-.12	.08	-.14
.100	-5.65	-4.39	-1.12	2.52	1.21	.10	-.13
.110	-4.31	-1.56	-.99	3.87	1.61	.14	-.11
.120	-3.78	-3.32	-1.07	5.06	2.72	.18	-.09
.130	-2.38	-2.74	-1.07	6.30	3.79	.24	-.06
.140	-6.44	-6.08	-1.34	7.43	4.27	.31	-.02
.150	-3.07	-4.29	-1.55	8.11	6.28	.39	.04
.160	-3.62	-5.27	-1.74	8.94	7.80	.47	.12
.170	-4.37	-5.14	-2.18	9.47	8.97	.56	.21
.180	-5.92	-3.17	-2.26	10.87	10.55	.65	.32
.190	-5.08	-8.45	-2.69	11.56	12.23	.76	.45
.200	-3.61	-4.40	-2.99	12.37	14.55	.86	.61
.210	-5.46	-3.46	-3.26	12.76	15.74	.97	.79
.220	-3.05	-7.51	-3.29	12.75	18.33*	1.07	.99*
.230	-3.11	-5.39	-3.71	13.30	20.43	1.16	1.23
.240	-3.09	-3.71	-3.78	13.14	22.31	1.24	1.49
.250	-4.65	-4.23	-3.74	13.04	24.26	1.31	1.77
.260	-6.80	-12.79*	-3.43	13.81	27.34	1.37	2.07
.270	-4.21	-8.10	-3.26	15.08	33.23	1.45	2.42
.280	-4.01	-2.41	-2.76	16.34	35.75	1.54	2.81
.290	-1.75	-3.89	-2.14	16.39	37.17	1.64	3.21
.300	-2.12	-1.75	-2.17	17.24	38.57	1.72	3.63
.310	-.70	-4.63	-2.30	15.80	40.02	1.80	4.06
.320	-4.05	-5.91	-1.43	17.03	43.33	1.88	4.51
.330	-1.31	-3.38	-1.31	17.21+	45.26	1.98+	4.99
.340	-.37	-1.66	-1.39	16.74	46.28	2.08	5.47
.350	-3.46	-1.36	-.91	17.68	47.55	2.19	5.96
.360	-.36	-.44	-.85	17.59	47.87	2.31	6.46
.370	-2.57	-1.46	-.90	17.58	48.37	2.42	6.96
.380	-.69	.13	-.80	18.08	49.13	2.52	7.47
.390	-2.70+	-.25	-.88	17.33	48.67	2.62	7.98
.400	-2.91	-3.52	-1.39	17.92	49.30	2.75	8.50

TABLE B.11 (Continued)

OCCUPANT RISK DATA, TEST MWP-4

.410	-1.16	.44	-1.77	17.26	49.15	2.83	9.03
.420	-.23	-.15	-.78	18.24	50.49	2.93	9.55
.430	-1.54	-.07	-.68	18.27	50.90	3.04	10.08
.440	-.20	.48	-.64	18.19	50.91	3.16	10.61
.450	-.80	.13	-.68	18.00	50.80	3.26	11.14
.460	-1.03	-.70	-.70	18.02	51.09	3.36	11.68
.470	-1.05	-.22	-.65	18.06	51.47	3.46	12.21
.480	-.96	-.02	-.72	17.82	51.54	3.56	12.75
.490	-1.23	.82	-.65	17.90	51.59	3.64	13.29
.500	-.60	.28	-.75	17.68	51.36	3.74	13.83

OCCUP. RISK FACTORS		TIME (S)	VELOCITY (FPS)
>LONG. VEL. AFTER 2.0 FT. DISP.	--	.332	17.35
>LAT. VEL. AFTER 1.0 FT. DISP.	--	.220	18.43

MAX. ACCEL. AFTER OCCUPANT IMPACT		TIME(S)	ACC.(GS)
>LONG. ACCELERATION	--	.396	-4.90
>LAT. ACCELERATION	--	.263	-16.06

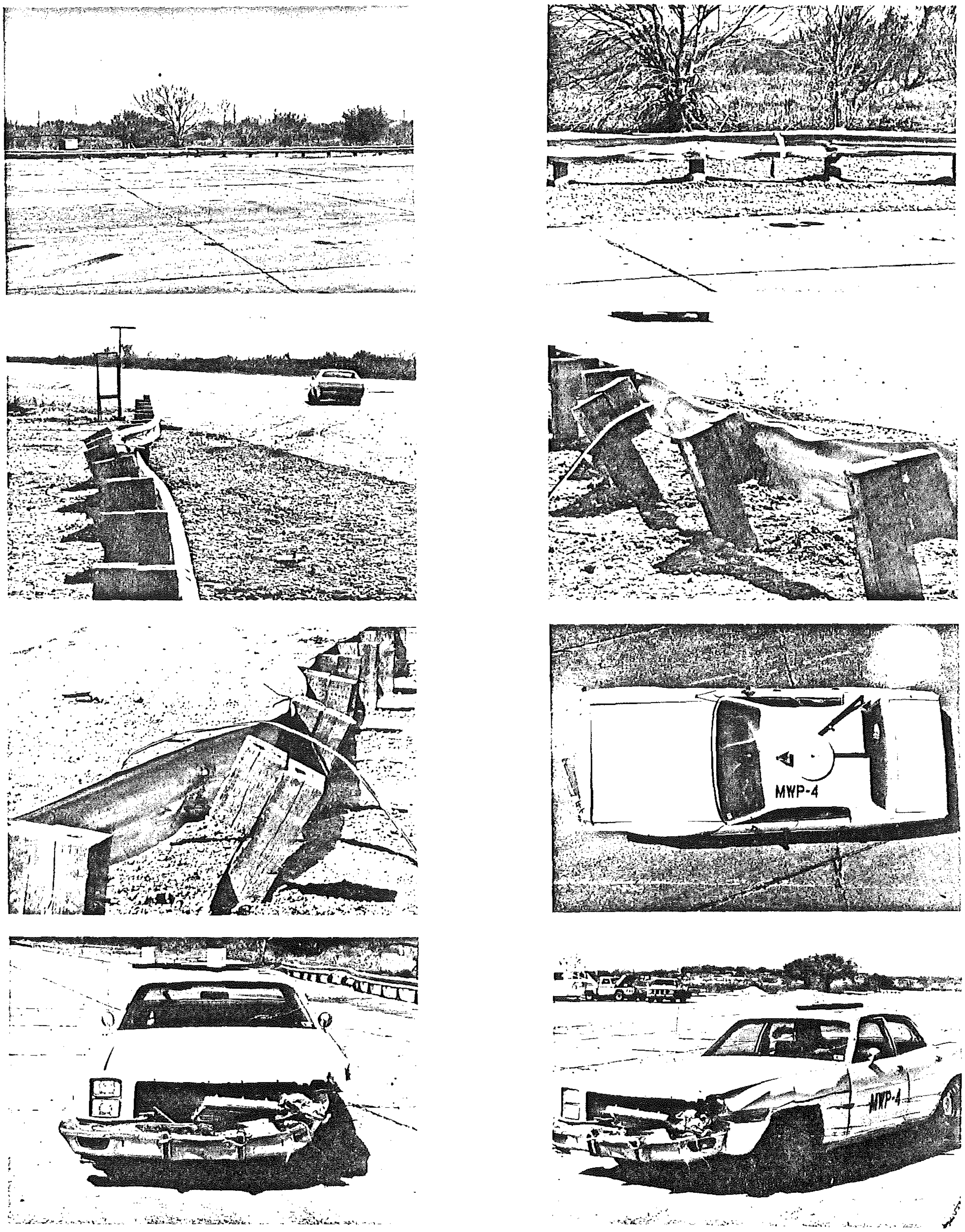
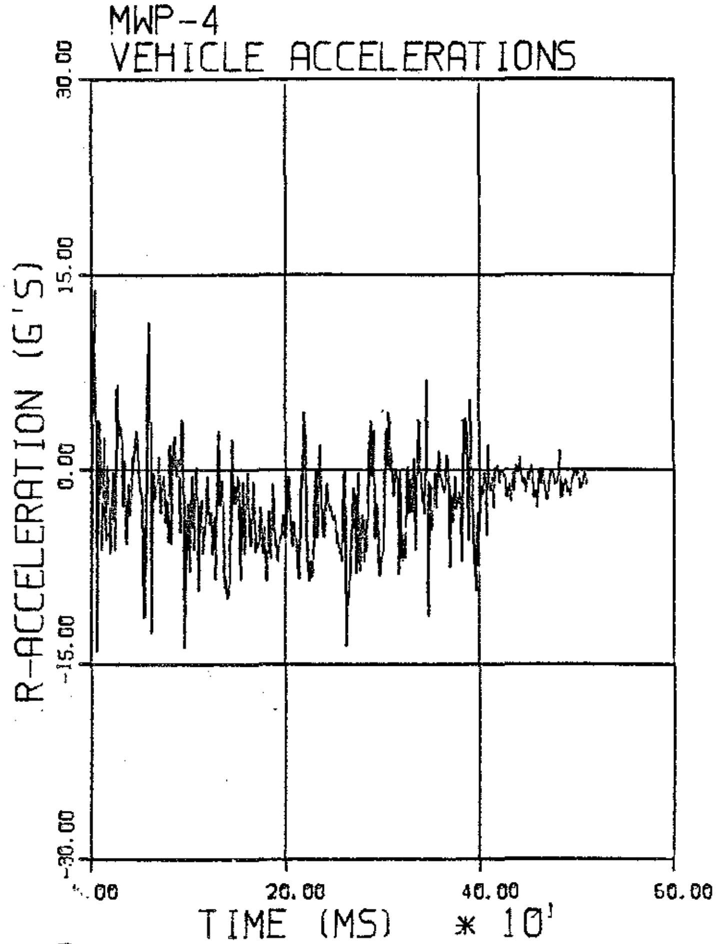


FIGURE B.22 BARRIER AND VEHICLE DAMAGE, TEST MWP-4



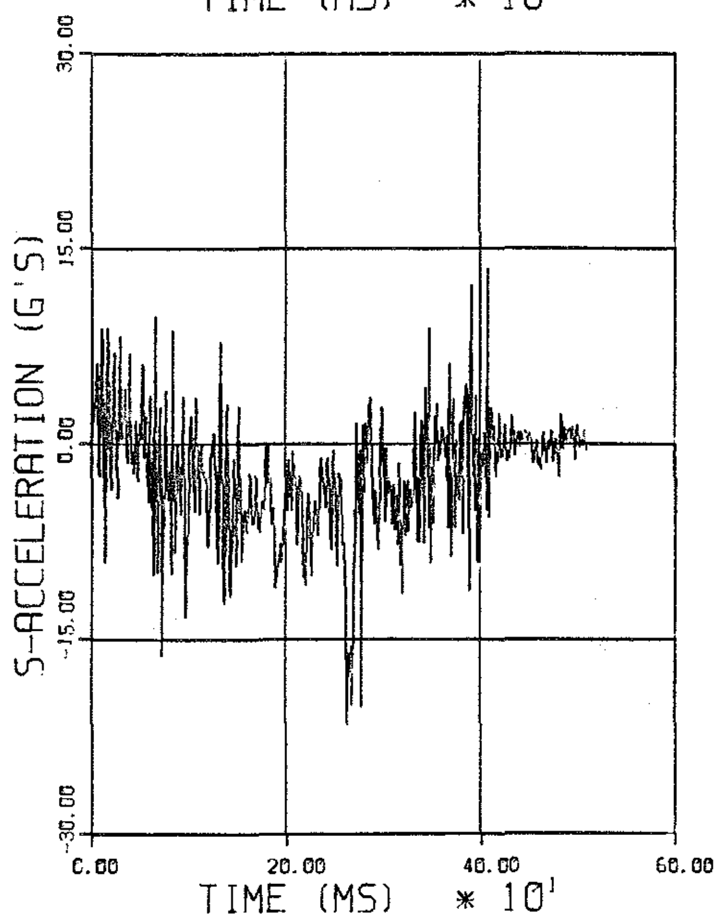
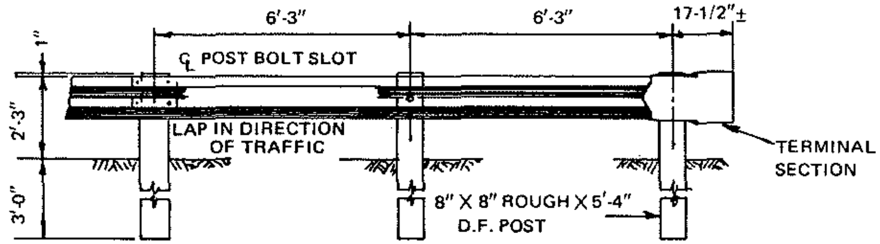


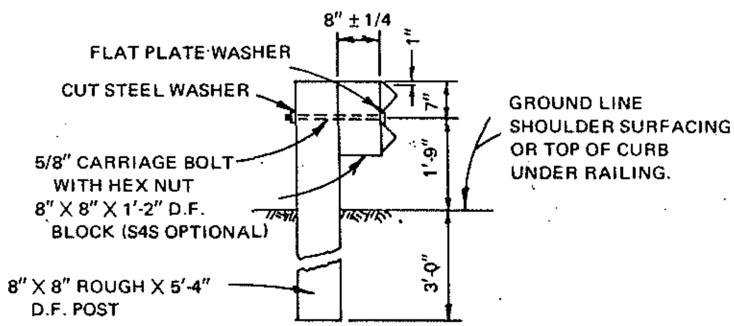
FIGURE B.23 VEHICLE ACCELERATIONS, TEST MWP-4

APPENDIX C

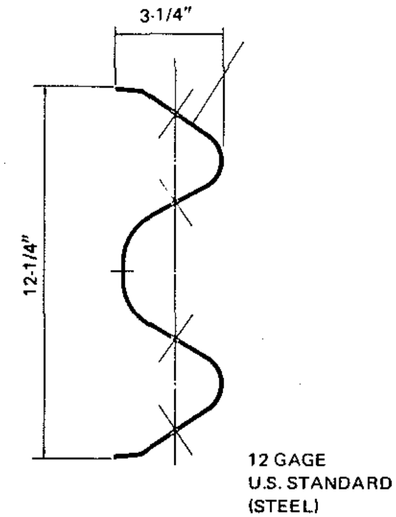
CURRENT SPECIFICATIONS FOR WOOD POSTS



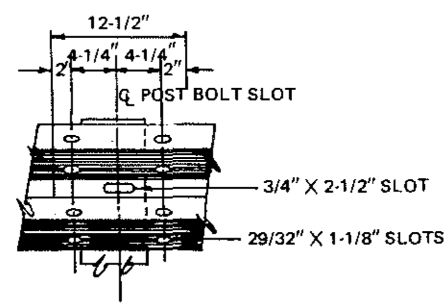
METAL BEAM GUARD RAILING



TYPICAL POST SPACING 6'-3" C. TO C.



SECTION THRU RAIL ELEMENT



RAIL SPLICE

5/8" X 1-1/4" BUTTON HEAD OVAL SHOULDER BOLTS WITH 1-1/4" RECESSED HEX NUTS. TOTAL 8 PER SPLICE AND 4 PER TERMINAL SECTION.

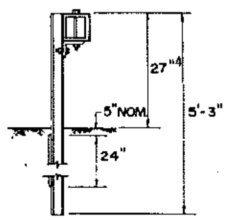
GENERAL NOTES

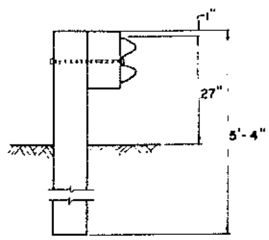
1. Except where noted, cut washers are required at all bolt installations where nut would bear on wood.
2. See Sheet 2 for Anchorage Details.
3. See Sheets 3 and 4 for Flare Details.
4. See Sheet 5 for Connection Details.
5. Do not use S4S and rough blocks in the same installation.

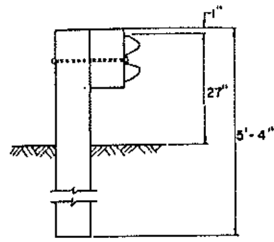
GUARDRAIL
SYSTEM G 4 W
BLOCKED OUT "W" BEAM
TIMBER POST
DATE JUNE 68 REV 1971
DEVELOPED BY CALIFORNIA

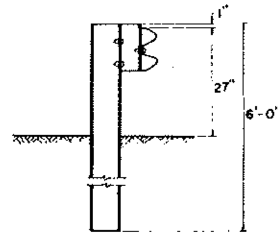
Table III-B-1 Continued

Metric Conversions
1 ft. = 0.305 m
1 in. = 25.4 mm
1 mph = 1.61 km/hr
1 lb. = 0.454 kg









SYSTEM	G3 Box Beam		G4(1W) Blocked-Out "W" Beam (Wood Post)		G4(2W) Blocked-Out "W" Beam (Wood Post)		G4(1S) Blocked-Out "W" Beam (Steel Post)	
BARRIER DESCRIPTION POST SPACING POST TYPE BEAM TYPE OFFSET BRACKETS MOUNTINGS FOOTINGS	6' 4" S3x5.7 steel 6"x6"x0.180" steel tube L5"x3½"x¼" steel angle, 4½" long 3/8" dia. steel bolt(beam to angle) ¼"x8"x24" steel plate welded to post		6' 3" 8"x8" Douglas Fir Steel "W" section, 12 GA. 8"x8"x14" Douglas Fir Block 5/8" diameter carriage bolts None		6' 3" 6" x 8" Douglas Fir Steel "W" section, 12 GA 6" x 8" x 14" Douglas Fir Block 5/8" diameter carriage bolts None		6' 3" W6x8.5 steel post Steel "W" section, 12 GA W6x8.5x 14" long steel block[4] 5/8" diameter bolt None	
IMPACT PERFORMANCE	IMPACT ANGLE = 15°	IMPACT ANGLE = 26°	IMPACT ANGLE = 15°	IMPACT ANGLE = 22.2°	IMPACT ANGLE = 15°	IMPACT ANGLE = 24°	IMPACT ANGLE = 15°	IMPACT ANGLE = 25° (28.4°)
IMPACT CONDITIONS Speed (mph) Vehicle Weight (lb.)	NO TEST	57.7 4031	NO TEST	60.1 4123	NO TEST	68.0 4960	NO TEST	66.0 (56.8) 4960 (3813)
BARRIER Dynamic Deflection (ft.)		4.80		2.80		2.33[3]		2.60 (4.05)
VEHICLE ACCLERATIONS (G's)[1] Lateral Longitudinal Total		5.80 2.80 UNAV		6.10 3.00 UNAV		7.0 6.8 UNAV		6.85 (6.60) 3.78 (3.90) UNAV (UNAV)
VEHICLE TRAJECTORY Exit Angle (deg.) Roll Angle (deg.) Pitch Angle (deg.)		0.00 UNAV UNAV		15 UNAV UNAV		14 ≈15 UNAV		16 (8) 0 (UNAV) 0 (UNAV)
BARRIER DAMAGE		UNAV		UNAV		25' of "W" section and 4 posts		25' of "W" section and 3 posts
REFERENCES		18		18		19		19, (18)
FIELD PERFORMANCE DATA[2]	YES		YES[3]		NO		YES	
REMARKS	Excellent redirection, vehicle came to rest parallel to the rail.		Smooth redirection. Southern yellow pine is acceptable alternate to Douglas Fir. See G4(2W) system for smaller post size.		System is similar to G4(1W) except for smaller posts and block-out size. System performed well.		See text for explanation of differences in data shown for 25° and 28.4° tests. Smooth redirection.	

UNAV — unavailable

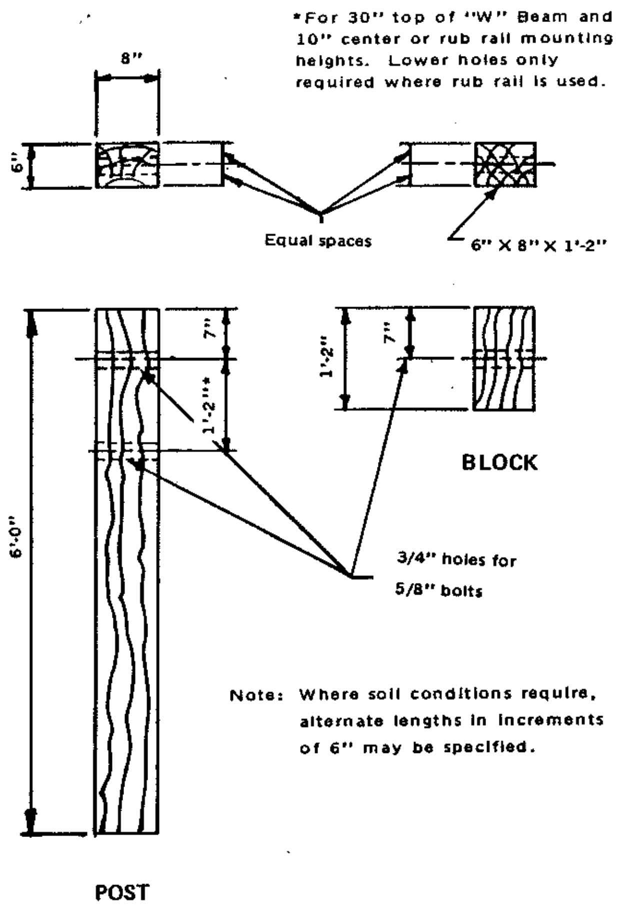
[1] 50 millisecond average unless otherwise noted

[2] If available, see summary in Appendix A

[3] Data for 6-inch block-out.

[4] Through studies (137) subsequent to the tests reported here, the State of New York has concluded that the box beam performs better at a height of 30 inches.

AASHTO, "Guide for Selecting, Locating, and Designing Traffic Barriers," 1977.



SPECIFICATIONS

Posts and blocks shall be made of timber with a stress grade of 1200psi or more. Testing shall be in accordance with West Coast Lumber Inspection Bureau, Southern Pine Inspection Bureau or other appropriate timber association. Timber for posts and blocks shall be either rough sawn (unplaned) or S4S with nominal dimensions indicated. The size tolerance of rough sawn blocks in the direction of the bolt holes shall be not more than ± 1/4 inch. Only one combination of post and block finish shall be used for any one continuous length of guardrail.

All timber shall receive a preservation treatment in accordance with AASHTO Designation M-133.

Dimensional tolerances not shown or implied are intended to be those consistent with the proper functioning of the part, including its appearance, and accepted manufacturing practices.

INTENDED USE

This post and block are used in the standard "W" Beam Guardrail and "W" Beam Median Barrier systems G4 and MB4.

Note: Some barrier stiffness transition designs call for strengthening posts by the addition of soil bearing plates with areas of about 1-1/3 to 2 sq. ft. No details for this are proposed herein.

G4 AND MB4
6 X 8 TIMBER POST AND BLOCK

HM-TF-13 | STANDARD | P-11-79

AASHTO-AGC-ARTBA Joint Cooperative Committee, A Guide to Standardized Highway Barrier Rail Hardware, ARTBA Technical Bulletin No. 268-B, AGC Standard Form No. 131, June 1979.