AD-A037 145 MILITARY TRAFFIC MANAGEMENT COMMAND TRANSPORTATION EN--ETC F/6 13/5
DYNAMIC TESTS ON WOOD-NAIL JOINTS.(U)
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DYNAMIC TESTS ON WOOD - NAIL JOINTS.

INTERIM REPORT NO. 1.

US ARMY [illegible]
TRANSPORTATION
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(1)

DYNAMIC TESTS ON

WOOD-NAIL JOINTS

A JOINT TESTING PROGRAM CONDUCTED BY THE MILITARY TRAFFIC MANAGEMENT COMMAND AND US ARMY MATERIAL DEVELOPMENT AND READINESS COMMAND.

* * ABSTRACT * *

Approximately 250 dynamic tests have been performed on eight types of wood-nailed joints. Due to the delay in delivery of high carbon nails, a complete set of tests could not be completed until April 1975. This interim report presents the results for one type of wood-nail joint.

DYNAMIC TESTS ON WOOD-NAIL JOINTS

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PART I

BACKGROUND INFORMATION

Descriptions of laboratory procedures, equipment, and test material were included in a report titled, "Transportability Criteria for Cargo Restraints", dated July 1974. Included in the report is information describing the reason for the joint project.

The present test plan specifies testing of eight wood-nailed joints. Some laboratory tests have been performed on all eight specimens. However, only test specimen 1 has been completed because the high carbon coated nails were difficult to procure.

This report describes the procedures that are used to present the test results. Basically, it describes the procedures used after the laboratory test data are stored on the magnetic tapes.

PART II
DATA REDUCTION

A. EQUIPMENT:

Raw data stored on magnetic tapes were used to obtain digital data for evaluating the strength of the wood joints. A skematic, Figure 1, can help describe the process.

1. TAPE RECORDER:

The magnetic tape containing the raw data is read by this tape recorder.

2. A/D CONVERTER:

Before the raw data can be used in the computer it must be converted from Analog to Digital format. In the Analog format the data are continuous and therefore form a curve. To convert to Digital form, the curve is read at specific intervals starting from a designated location. The designated location is obtained by having the computer analyze the readings for Channel 1. The data for Channel 1 are compared until 10 readings having progressing values are found. Then it returns to the first of the ten readings and takes the prior 30 readings and uses those for computing the time zero value or baseline reading. Since electrical noise can cause some readings to be high and can distort the baseline reading, the computer will determine the standard deviation and will disregard any value that is greater than 2 Sigma in the recalculation of the zero value. In addition to the statistical procedure for reducing the effect of noise, a filter is used on Channel 1. Details for this filter are shown in Figure 2. The effect of the filter can be seen by comparing Figures 3 and 4.

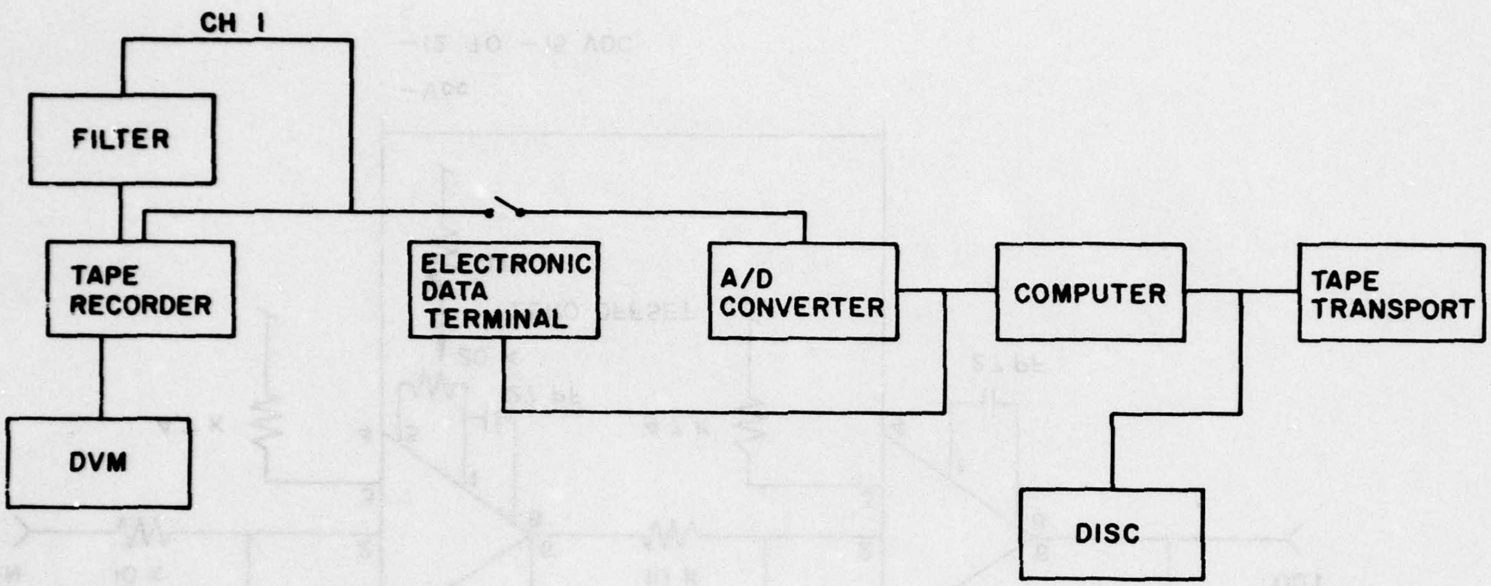

FIGURE 1. DATA REDUCTION PROCESS

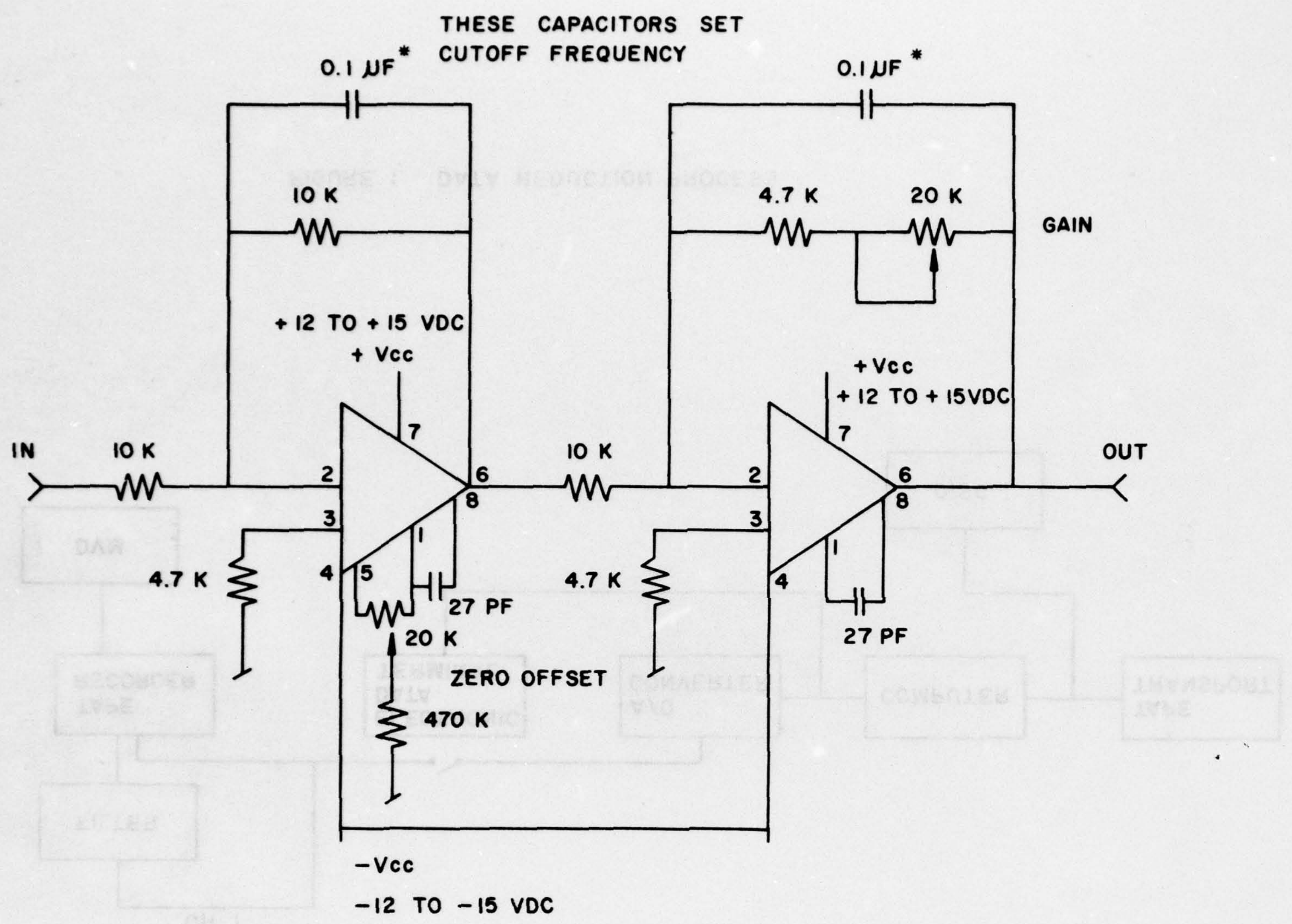

FIGURE 2. OPERATIONAL AMPLIFIER LM 301 OR EQUIVALENT

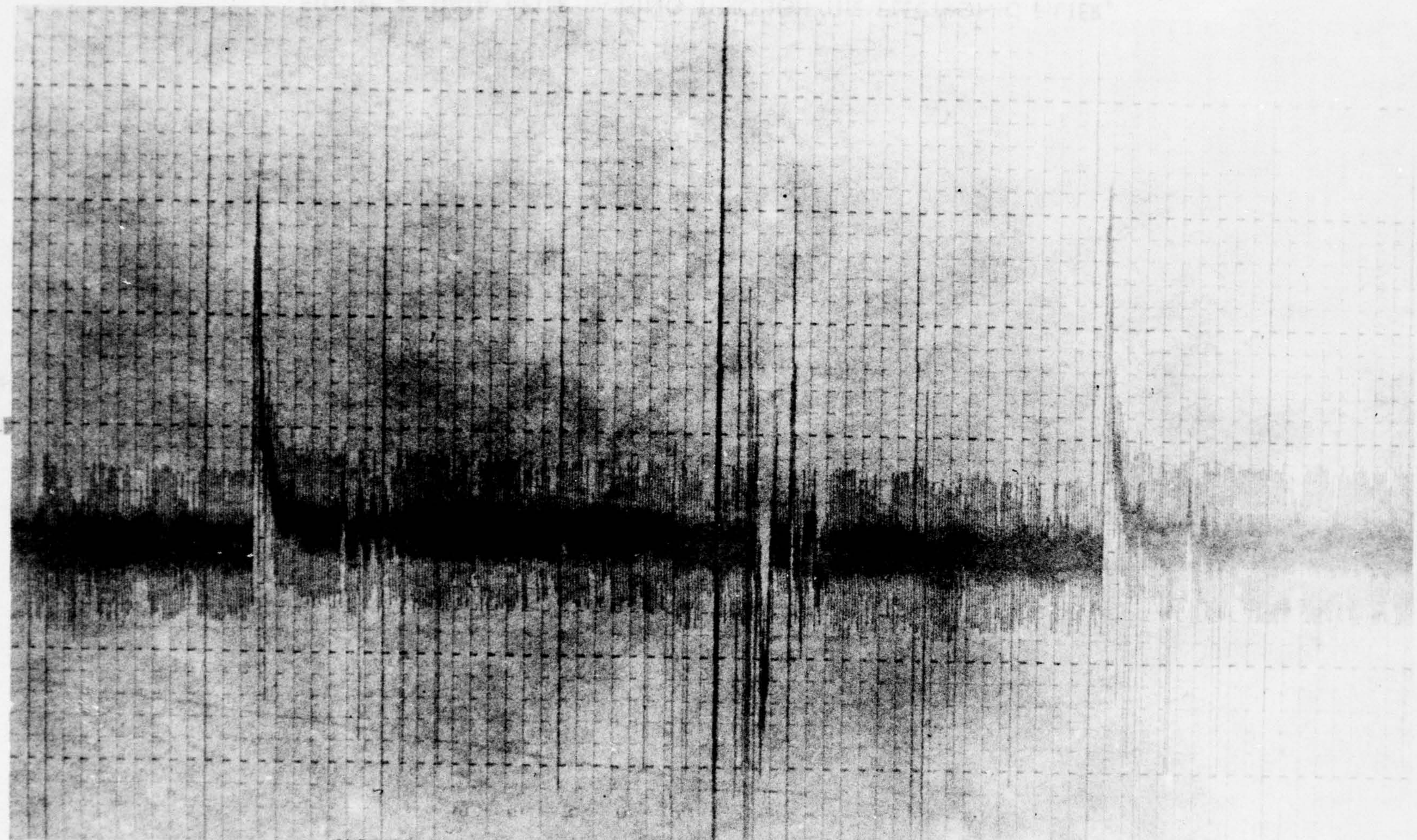

FIGURE 3. UNFILTERED DATA ON CHANNEL 1

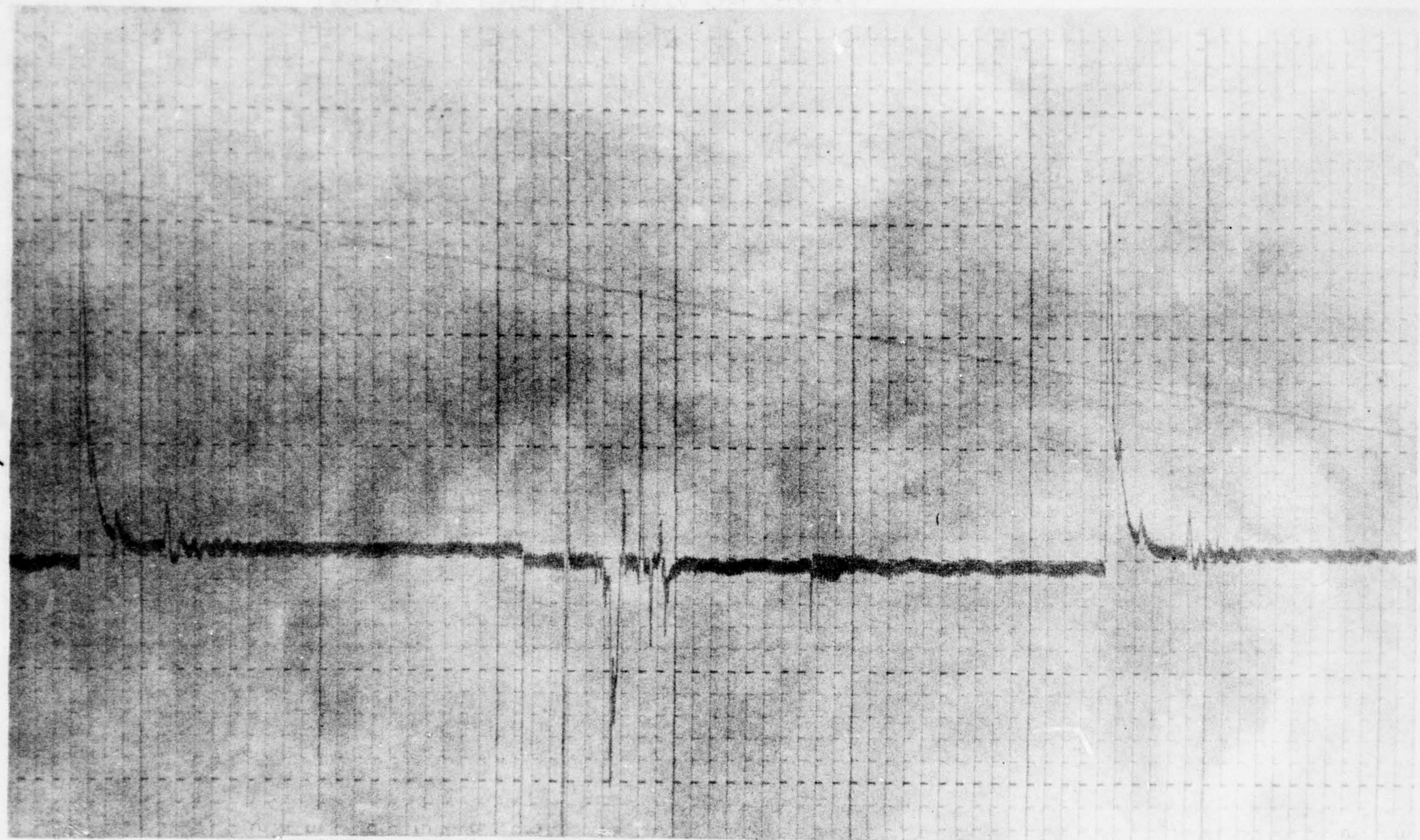

FIGURE 4. DATA AFTER PASSING THROUGH THE ELECTRONIC FILTER.

3. <u>ELECTRONIC DATA TERMINAL:</u>

This is the device used to input instructions and data to the computer, and it is also used to provide a hard copy of selected output from the computer.

4. <u>COMPUTER:</u>

All computations and repetitive type operations are performed by this electronic brain.

5. <u>DISC AND TAPE TRANSPORT:</u>

Output from the computer is stored on a computer disc and also on magnetic tape.

B. <u>PROCEDURE:</u>

1. The magnetic tape containing raw data from the laboratory tests is placed on the tape recorder. Using earphones to hear the calibration information for each of the six channels, the tape recorder channels are adjusted to yield voltage readings comparable to those recorded in the instrumentation van. This procedure will reduce the error in using two tape recorders to record and play back the information.

2. By placing a magnetic tape on the tape transport the computer system is ready for operation. After calling up the program from the computer file, the computer will instruct the operator to enter the ten digit test run number. The run number is described as follows:

```
XX  XX  X  XXX  XX
|   |   |   |    |____ Impact Number
|   |   |   |_________ Position number where dolly was released
|   |   |_____________ Sample Number
|   |_________________ Test Schedule
|_____________________ Test Specimen Number
```

When the computer receives the tenth digit number it will print "is number right?" and "is Analog tape ready?" If the answers are yes, activation of the return key will advance the computer to the next step. If the answers are no, then a "NN" reply will instruct the computer to request the test run number again. A copy of the program is presented as Appendix 1. After the computer receives the correct number and the two questions are answered, the computer will wait for the data from the magnetic tape. The data are entered by the operator starting the tape recorder, and while listening to the audible countdown for the impact, a switch is activated between the audible count of two and one. The switch allows the data to be processed through the Analog/Digital (A/D) converter to the computer. Only one-half second of data is analyzed after the computer establishes zero time. A summary of the data is printed on paper in the electronic data terminal. An explanation of the information included in the summary is presented below.

Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	
xxxxx0/ *	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Zero reference
xxxxx0/	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Maximum value
xxxxx0/	xxxxx0/	xxx/xx	xxx/xx	xxx/xx	xx/xxx	Minimum value
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	Remainder
xxxxx/	xxxxx/	xx/xxx	xx/xxx	xx/xxx	xx/xxxx	Area under curve
~~xxxxx~~	xxx/xx **	~~xxxxx~~	xx/xxx ***	~~xxxxx~~	~~xxxxx~~	

* / Shows location of decimal point.

** Work = (Area under curve for Channel 2) x (Area under curve for Channel 6) ÷ ([Time duration of impact]^2, which is a fixed value for computational purposes, 0.5 Sec^2)

*** Displacement at 0.5 Sec after impact (Permanent displacement)

The Digital data and summary are stored on the disc and magnetic tape. Each impact requires the operator to repeat the above procedure from the step of calling up the program.

3. Since each test may have approximately thirty impacts, another computer program is used to obtain data for plotting a curve that will best represent the data results for two variables. The program shown as Appendix 2 utilizes the least squares method and the Gauss elimination process of solving simultaneous equations.

4. When the program is used, the first information that must be supplied to the computer through the electronic data terminal is the degree of polynomial the user desires the equation to be. The maximum degree is 10. As a general rule, the higher the degree of the polynomial the more the best-fit curve will respond to deflections in the data. After the computer receives the two digit number it will request the x and y values of the data points. The values must be in the following form:

xx.xxyy.yy

At the conclusion of the data input, the operator must input "00.0000.00" to have the computer process the data. Output from the computer will give coefficients for each power of the equation. Then it will request the operator to enter x values for plotting the best-fit curve. When the value is entered and the return key is depressed, the computer will calculate the corresponding y value and have the x and y values printed on the paper in the data terminal. The computer will accept x values until 00.00 is entered. Because zeroes are used to signal the computer that the input is completed, all input values must be greater than zero.

C. RESULTS:

Summaries from the computer output for the impacts are numerous and are considered uneconomical to publish. The summaries were analyzed and condensed to show the yield and maximum forces that the various samples withstood. These results are shown in Appendix 3. The data for the dolly impact force; dolly, hammer, and specimen accelerations; permanent displacements; and total displacement are obtained from the impacts that provide the yield and maximum forces on the hammer.

PART III
DATA EVALUATION

A. DATA EVALUATION:

1. Data evaluation will be discussed by describing the parameters used in the tables, and by giving other details that may be of interest.

2. Refer to the column headings in Appendix 3.

B. TEST NUMBER: (Column 1). This number representa the test specimen number and the test schedule number. For example, 1-6 means that the data is for Test Specimen 1, Test Schedule 6 (See Appendix 4). Information provided under this number provides a brief description of the test specimen. The phrase "Oak on WH" means that the blocking or test specimen material is oak and the floor material is Western Hemlock. The nails are described by a phrase similar to "50d HCB" which represents a 50 penny high carbon nail with a bright finish.

C. RUN NUMBER: (Column 2). The sequential order in which the samples were tested.

D. MOISTURE CONTENT: (Column 3). Readings obtained by using the moisture detector.

E. DOLLY WEIGHT: (Column 5). The weight of the dolly including the hammer weight. Without including the weight of the hammer, the dolly weighs 1514 pounds.

F. DOLLY IMPACT FORCE: (Column 6). For this column and the remaining columns, except the hammer weight in Appendix 3, there are two lines of data for each run number. The first line contains data based on the impact that produces the yield point described under "Hammer Impact Force". The second line is based on the impact that produces the maximum value for the hammer impact force. On the computer printout, the dolly impact force is located in the first column and second row of each impact. A zero must be added to obtain the actual value. The dolly force shown on the first line of each run in the referenced appendix is obtained from the last impact in the yield point range, refer to Listing 1 Test Run Number 0106106120.

G. DOLLY ACCELERATION: (Column 7). Dolly vibrations are measured by a mechanical transducer with an electrical output. At low frequencies relative to the natural frequency of the transducer, the transducer acts as an accelerometer. Primarily, because of this characteristic and because the frequencies of the components are difficult to measure, the acceleration data should not be given a high degree of importance. The dolly acceleration is located in fourth column and the second row of each computer printed data summary. See last sentence in "Dolly Impact Force" for selection of value used in the appendix.

H. HAMMER WEIGHT: "Hammer" is the nomenclature for the load cell transducer assembly and the control weights. The hammer weight is changed by adding or removing metal slabs to provide sufficient number of impacts to locate a yield point and maximum force the specimen will sustain.

I. HAMMER IMPACT FORCE:

1. This is the most important value in the data listing. It is the peak value of the dynamic force input into the test specimen. On the computer printed output it is the value in the second column and second row.

A zero must be added to obtain the actual value. The value of the hammer impact force shown in the first line of each run in Appendix 3 is an arithmetic average value of several impacts in the yield point range. This value is the yield point for the specimen. "Yield Point" as used in this report is determined somewhat different than the procedure used to locate the point in materials like metals -- that is, to plot a stress-strain curve. Before explaining the procedure, a description of the yield point will be given. Consider the curves shown on Figure 5. The scale on the left is used to read the two upper curves; however, the bottom curve must use the scale on the right. The calibration curve is not used to determine the yield point but is included to show the force that would result if the specimen was a solid mass, that is, a single piece of lumber instead of a nailed joint. Observe the lower curve which is a plot of the permanent displacement versus the distance up the ramp on the conbur type incline ramp. There are two locations where the curve could be considered flat. The second flat portion is considered to be the location of the yield point. Since the force on the cleat or hammer impact force fluctuates within that corresponding flat range, the force is arithmetically averaged for several impacts.

2. The procedure for calculating the yield point can be explained by using a sample of the computer printout, Listing 1. Observe the number in the fourth column and sixth row which is the permanent displacement. Starting at test run number 0106105116, the number is -00127. The negative sign means that the wire length in the displacement transducer is decreasing, which is

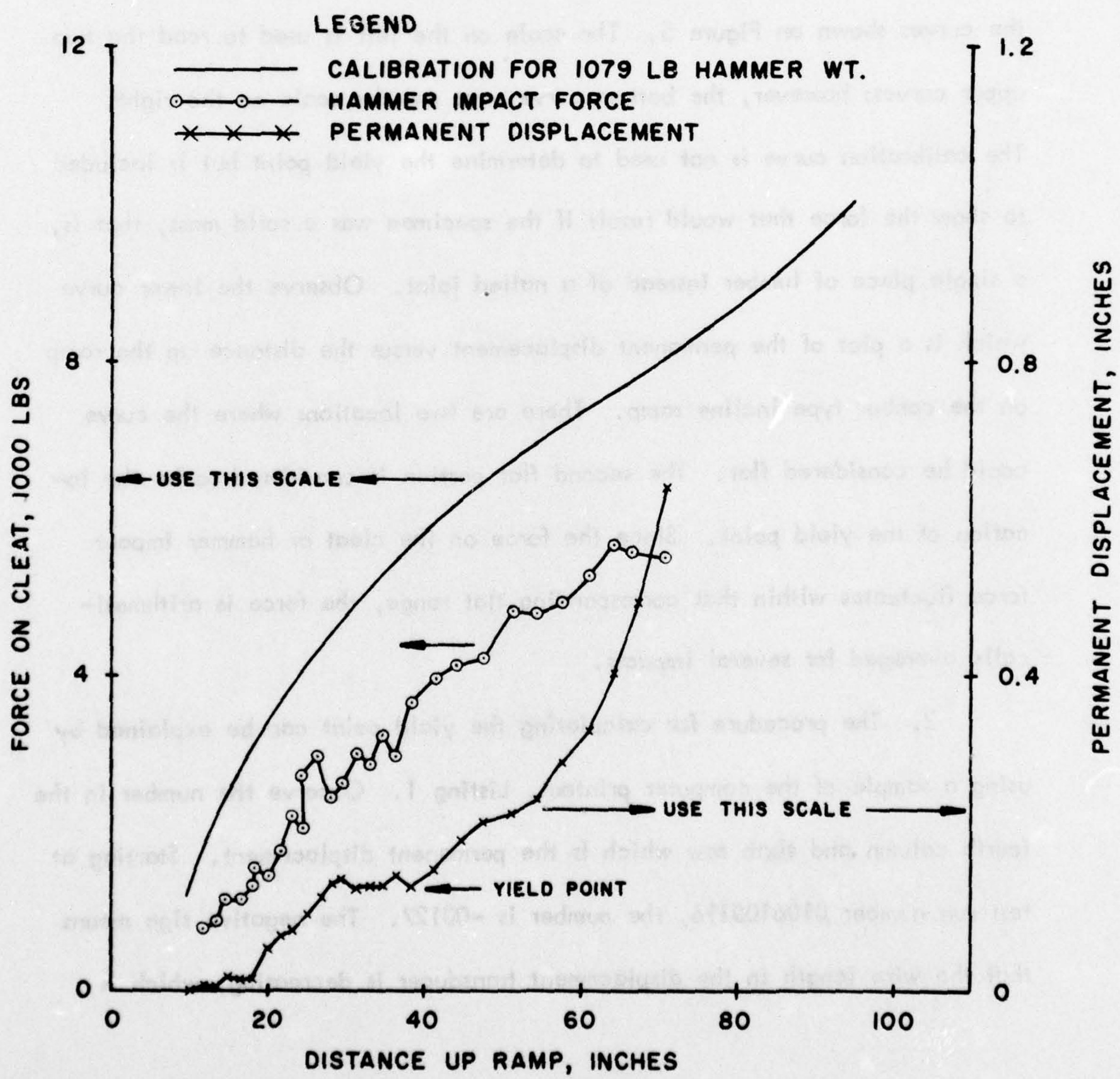

FIGURE 5. TEST RESULTS FROM TEST I-6, RUN I

```
OP?    BIDT   0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106102
      5116
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00002  +00025  -00012  -00009  -00018  -00126
+00386  +00285  +00378  +00441  +00296  +00126
+00000  -00025  -00116  -00081  -00078  -00136
+00383  +00018  +00116  +00127  +00304  -00764
+00449  +00104  +00208  +00191  +00212  -00132
+00000  +03432  -00002  -00129  -00038  -00126  !
OP?    BIDT   0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106105217
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00002  +00023  -00010  -00011  -00012  -00125
+00380  +00303  +00360  +00457  +00318  +00125
-00014  -00025  -00116  -00079  -00050  -00155
+00163  +00553  +00729  +00203  +00276  -00689
+00449  +00109  +00207  +00199  +00188  -00177
-00001  +04823  -00006  -00131  -00002  -00124  !
OP?    BIDT   0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106105318
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00002  +00010  -00014  -00016  -00020  -00127
+00398  +00332  +00462  +00406  +00342  +00127
-00008  -00016  -00064  -00072  -00044  -00177
+00012  +00579  +00498  +00379  +00004  -00760
+00456  +00177  +00234  +00237  +00232  -00210
-00002  +09292  -00008  -00136  -00002  -00126  !
OP?    BIDT   0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106105419
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00001  +00030  -00009  -00015  -00017  -00142
+00427  +00312  +00329  +00401  +00339  +00142
-00009  -00030  -00095  -00055  -00113  -00164
+00829  +00691  +00100  +00250  +00489  -00414
+00457  +00093  +00210  +00240  +00217  -00162
-00002  +03766  +00000  -00146  -00008  -00146  !
OP?    BIDT   0030
DEBUG TERMINATED
```

LISTING 1 - COMPUTER PRINTOUT SUMMARIES

```
ENTER TEST RUN NUMBER
XXXXXXXXXX
0106106120
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00002  +00020  -00014  -00014  -00018  -00146
+00436  +00346  +00408  +00420  +00360  +00146
-00020  -00020  -00184  -00059  -00096  -00184
+00479  +00634  +00558  +00691  +00637  -00542
+00477  +00142  +00234  +00233  +00231  -00186
+00000  +06603  -00006  -00143  +00002  -00136  !
OP?   BIDT  0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
01061062
IS NUMBER RIGHT?NN
ENTER TEST RUN NUMBER
XXXXXXXXXX
0106106321
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00004  +00004  -00017  -00020  -00025  -00144
+00462  +00388  +00409  +00702  +00403  +00144
-00026  -00006  -00117  -00046  -00065  -00214
+00095  +00297  +00111  +00087  +00124  -00097
+00505  +00231  +00263  +00281  +00282  -00251
-00001  +14495  -00002  -00161  -00022  -00140  !
OP?   BIDT  0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106107122
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00003  +00026  -00012  -00005  -00020  -00174
+00513  +00400  +00414  +00671  +00402  +00174
-00017  -00026  -00254  -00081  -00140  -00202
+00511  +00063  +00020  +00494  +00219  -00317
+00523  +00149  +00260  +00212  +00257  -00191
-00003  +07114  -00002  -00194  -00022  -00170  !
OP?   BIDT  0030
DEBUG TERMINATED

ENTER TEST RUN NUMBER
XXXXXXXXXX
0106107323
IS NUMBER RIGHT?
IS ANALOG TAPE READY?
-00001  +00021  -00010  -00008  -00018  -00177
+00511  +00421  +00476  +00538  +00416  +00177
-00013  -00023  -00124  -00128  -00084  -00237
+00096  +00759  +00380  +00331  +00145  -00050
+00518  +00167  +00260  +00233  +00255  -00260
+00000  +10855  -00002  -00215  -00024  -00186
```

correct for the direction the transducer is mounted. The decimal point is located three digits from right. Therefore, the permanent displacement is 0.127 inch. Continue to observe the number in the same location for each succeeding impacts. The numbers are 0.127, 0.133, 0.136, 0.145, 0.133, 0.153, 0.190, and 0.215. By comparing the values you can see that the first five values do not have a large difference nor do they continue to increase. This indicates that the yield point includes the impacts prior to and including impact 20 or test run number 0106106120. To determine the number of impacts to include in the averaging of the hammer impact force, the force values (second column, second row) must also be observed. If these values do not vary much or if the difference between the highest value and lowest value are within 80 (800 lbs) then the numbers can be averaged. If the range is more than 80, reduce the lowest number impact until the range is acceptable. The "80" value is an arbitrarily selected number. The last impact in the range, 0106106120, is used to obtain the information for the other variables that are recorded on Line 1 in Appendix 3.

3. To verify the procedure for determining the yield point, a special test was performed (Test 1-34). Components for the joint were same as those for Test 1-30. Instead of increasing the force on the specimen until failure occurred, the dolly release point was increased until it reached the position corresponding to the beginning of the yield point range of Test 1-30. At that position, the dolly was released twenty times. To complete the test, the dolly release point was increased until failure occurred.

4. Results of that test are shown in Figure 6. Note that the twenty

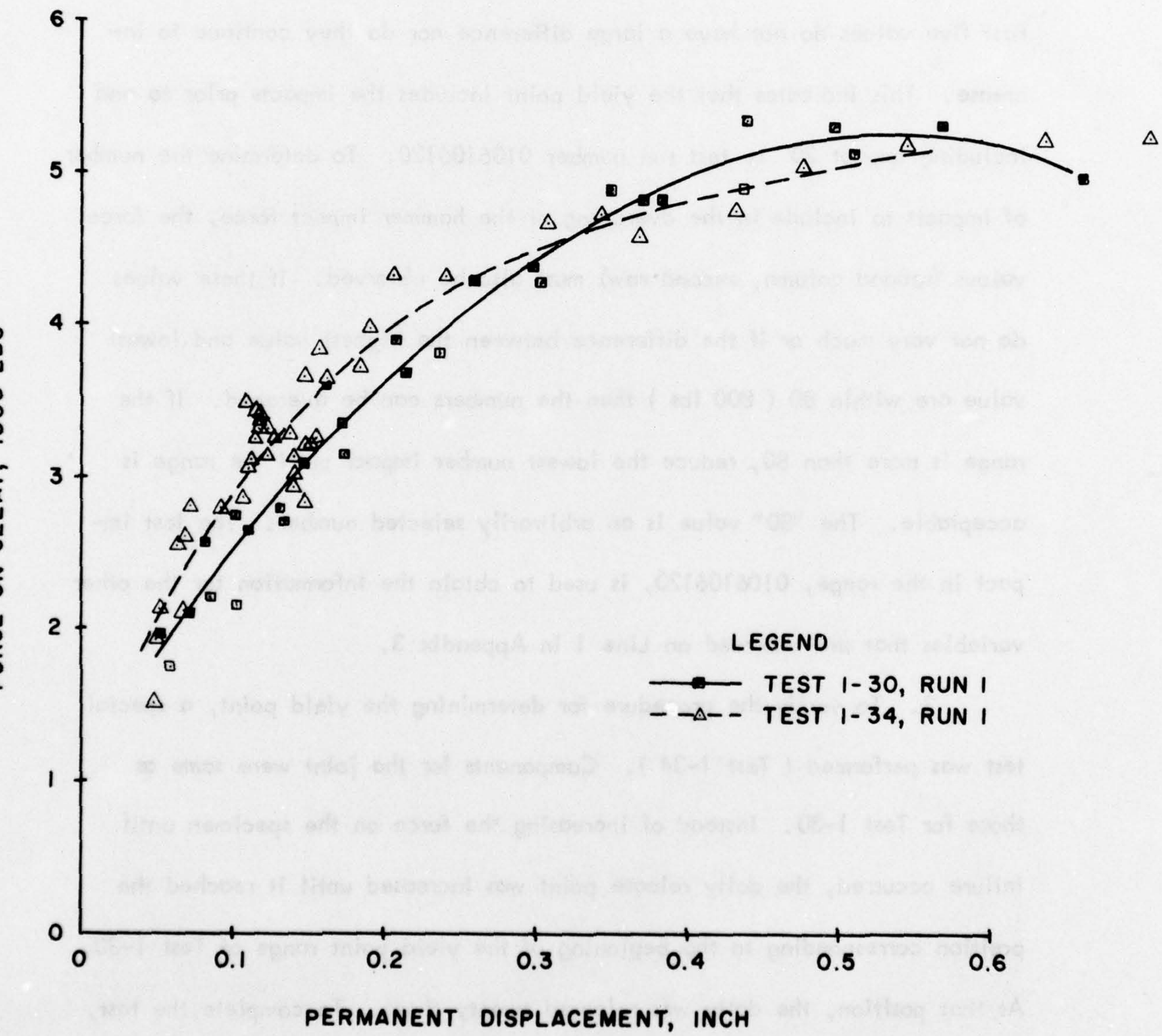

FIGURE 6. VERIFICATION OF YIELD POINT

extra impacts did not adversely affect the shape of the curve. Based on these results it is concluded that the procedure for determining the yield point is acceptable.

5. The second line for each run in Appendix 3 is for the maximum force the specimen withstood. Again the dolly force, dolly acceleration, permanent displacement, etc. correspond to the impact that gives the maximum force on the specimen.

6. The data in Appendix 3 were obtained from the computer printout without using the computer to determine a best-fit curve to represent the data. It was concluded that application of the best-fit curve was too time consuming for the benefit that it would give.

J. <u>HAMMER ACCELERATION</u>:

The hammer acceleration for each impact is found in the computer printout at the fifth column and second row. The decimal point is located two digits from the right.

K. <u>SPECIMEN ACCELERATION</u>:

Care must be exercised in using the computer printout to locate the number for the specimen acceleration. The accelerometer is mounted on the specimen in a direction that is 180 degrees from the direction the other accelerometers are mounted. Some of the personnel that operated the instrumentation van would change the polarity of the data signals from the transducer; therefore, the acceleration signals would be positive. The location on the computer printout would then be Column 3 and Row 2. However, if the polarity were not changed, the location would be Column 3 and Row 3. The decimal point is located two digits from the right.

L. PERMANENT DISPLACEMENT:

As mentioned earlier, the permanent displacement was recorded on the computer printout at location, Column 4 and Row 6. Decimal point is located three digits from right. This value represents the displacement of the cleat at 0.5 second after impact.

M. TOTAL DISPLACEMENT:

Total displacement is the sum of the permanent displacement and the displacement caused by the dynamic force. It is obtained by adding the values from Column 6, Rows two and three. Decimal point is located three digits from right.

PART IV
DISCUSSION

A. In the discussion and use of the test results, there is one important factor that must be considered. Each test was performed only three times, and the lumber for those three runs may have come from the same board. This will prevent the use of statistical analysis in determining a degree of confidence for the data. However, the data does present some interesting results.

B. Observe the data in Table 1. The strength of the joints can be combined into four groups. The first group would consist of Oak on Oak using 50d high carbon, coated nails. The next eleven joints would be Group II. Group III would consist of the next eight joints. Again, only one joint would constitute a group - Group IV. Because the maximum strength for an oak on oak joint using 50d low carbon coated nails is high, it may belong in Group II instead of Group III.

C. To show the effect of changing the materials in the joint, consider Table 2. The first two groupings shows the effect of specific gravity on the strength of the joint. Comparing the average yield and maximum strengths show that a change in the specific gravity of the blocking material produces a negligible effect on the joint strength. However, a change in the specific gravity of the floor material produces a corresponding change in the strength of the joint. In considering the results from Test 1-1 and 1-25, no explanation can be given for the small difference between the two values considering the other tests in that group do show significant differences.

D. The next four groupings show the effect of nail size. Even though

TABLE I. Test Results. Yield and Maximum Strengths in Order of Decreasing Yield Strengths.

Blocking Material	Floor Material	Average Yield Strength, *Lb	Average Maximum Strength, *Lb	Nail Size	Nail Material	Nail Finish	Test Number	Group
Oak	Oak	1741	3113	50d	1040T	Coated	1-31	I
Oak	S. Pine	1293	1574	50d	1040T	Bright	1-25	
Oak	Oak	1290	2055	50d	L. Carbon	Bright	1-15	
Oak	Oak	1279	1646	50d	1040T	Bright	1-1	
Oak	Oak	1272	1969	40d	1040T	Coated	1-17	
Engleman Spruce	Oak	1237	1742	50d	1040T	Bright	1-12	
S. Pine	Oak	1209	1577	50d	1040T	Bright	1-14	II
W. Hemlock	Oak	1192	1806	50d	1040T	Bright	1-11	
Oak	S. Pine	1118	1691	50d	1040T	Coated	1-26	
Engleman Spruce	Oak	1115	1699	50d	1040T	Bright	1-13	
W. Hemlock	Oak	1113	1695	50d	1040T	Bright	1-10	
Douglas Fir	Oak	1058	1760	50d	1040T	Bright	1-8	
Oak	Douglas Fir	1049	1426	50d	1040T	Bright	1-4/ 1-23	
Oak	W. Hemlock	1038	1450	50d	1040T	Coated	1-28	
Oak	Douglas Fir	1024	1464	50d	1040T	Coated	1-24	
Oak	Oak	938	1778	50d	L. Carbon	Coated	1-16	III
Oak	Oak	931	1212	40d	1040T	Bright	1-18	
Oak	Oak	836	1508	40d	L. Carbon	Coated	1-19	
Oak	Oak	834	1342	40d	L. Carbon	Bright	1-20	
Oak	E. Spruce	804	1414	50d	1040T	Coated	1-30	
Oak	W. Hemlock	777	1435	50d	1040T	Bright	1-6/ 1-27	
Oak	Engleman	687	1119	50d	1040T	Bright	1-7/ 1-29	IV

* Based on 3 samples. Force per nail.

some of the results do not show an appreciable difference, it can be concluded that nail size affects the results. However, the data do not indicate if the nail diameter or depth of penetration contributes the major portion of the effect. This is because the nail diameter and length increase with nail size and it would be difficult to determine the effect of either parameter without manufacturing special nails.

E. The next seven pairs in the table show the effect of nail coating. With the exception of oak on oak, the coating did not appreciably affect the strength. To reduce the possibility of time affecting the strength of coated nails, most of the joints were tested within one hour after they were nailed.

F. The only comment on the last two pairs in Table 2 is that no explanation can be furnished until additional data are analyzed from other specimens.

The data have not been corrected for moisture contents above or below 12%.

G. By just comparing yield and maximum strengths without knowledge of the strength curve could cause a user of the data to overlook features that could otherwise be used. The curves in Figure 7 show how specific gravity affects the slope of the curve. A joint made of high specific gravity lumber like oak (for example Test 1-1) will have a steep slope. The yield point is located near the relative sharp break in the curve. This means that the joint will not withstand much additional force before the maximum force is obtained. However, a joint constructed of oak nailed onto Western Hemlock (for example Test 1-6) the yield point is almost one-half the maximum strength. Therefore, a designer may be able to use the oak/Western Hemlock joint without a safety

TABLE 2. Test Results. Comparisons of Joint Materials.

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-1	Sp.G_B/Sp.G_F* 0.63/0.63	1355	1357	1124	1279	1788	1600	1550	1646
1-25	0.63/0.55	1178	1455	1245	1293	1663	1600	1460	1574
1-23	0.63/0.50	1154	1053	940	1049	1410	1583	1285	1426
1-6	0.63/0.45	785	881	666	777	1415	1503	1388	1435
1-7	0.63/0.35	683	646	731	687	1140	1030	1188	1119
1-14	0.55/0.63	1232	1131	1264	1209	1598	1538	1595	1577
1-8	0.50/0.63	884	1274	1015	1058	1738	1898	1645	1760
1-9	0.50/0.63	1035	1071	1051	1052	1395	1410	1398	1401
1-10	0.45/0.63	1087	1094	1158	1113	1718	1718	1650	1695
1-11	0.45/0.63	1168	1183	1224	1192	1730	1858	1830	1806
1-12	0.35/0.63	1275	1095	1340	1237	1930	1515	1780	1742
1-13	0.35/0.63	1097	1150	1099	1115	1570	1780	1748	1699
1-16	50 LCC	767	1064	983	938	1540	1835	1958	1778
1-19	40 LCC	652	878	978	836	1555	1473	1498	1509
1-22	30 LCC	622	651	729	667	838	913	965	905
1-15	50 LCB	1228	1506	1136	1290	2238	2048	1880	2055
1-20	40 LCB	845	813	844	834	1430	1218	1378	1342
1-32	30 LCB	730	-	623	677	1308	1268	1553	1376
1-31	50 HCC	1714	1802	1708	1741	2503	3484	3353	3113
1-17	40 HCC	1169	1422	1224	1272	2030	1928	1950	1969

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-21	30 HCC	1458	1390	1208	1352	1930	1980	2010	1973
1-1	50 HCB	1355	1357	1124	1279	1788	1600	1550	1646
1-18	40 HCB	974	827	1069 853	931	1305	1115	1315 1113	1212
1-33	30 HCB	1084	1111	1103	1099	1460	1543	1505	1503
1-1	50 HCB Oak/Oak	1355	1357	1124	1279	1788	1600	1550	1646
1-31	50 HCC Oak/Oak	1714	1802	1708	1741	2503	3484	3353	3113
1-25	50 HCB Oak/S.P.	1178	1455	1245	1293	1663	1600	1460	1574
1-26	50 HCC Oak/S.P.	983	1239	1131	1118	1720	1695	1658	1691
1-23	50 HCB Oak/D.F.	1154	1053	940	1049	1410	1583	1285	1426
1-24	50 HCC Oak/D.F.	1071	911	1090	1024	1525	1488	1378	1464
1-6 or 1-27	50 HCB Oak/W.H.	785	881	666	777	1415	1503	1388	1435
1-28	50 HCC Oak/W.H.	1001	990	1124	1038	1420	1400	1530	1450
1-7 or	50 HCB Oak/E.S.	683	646	731	687	1140	1030	1188	1119
1-30	50 HCC Oak/E.S.	824	971	618	804	1338	1423	1480	1414
1-18	40 HCB Oak/Oak	974	827	1069 853	931	1305	1115	1315 1113	1212
1-17	40 HCC Oak/Oak	1169	1422	1224	1272	2030	1928	1950	1969
1-20	40 LCB Oak/Oak	845	813	844	834	1430	1218	1378	1342

Test Number	Variable	Yield Strength, Lb/Nail				Max Strength, Lb/Nail			
		1	2	3	AV	1	2	3	AV
1-19	40 LCC Oak/Oak	652	878	978	836	1555	1473	1498	1509
1-31	50 HCC	1714	1802	1708	1741	2503	3484	3353	3113
1-16	50 LCC	767	1064	983	938	1540	1835	1958	1778
1-1	50 HCB	1355	1167	1124	1215	1788	1600	1550	1646
1-15	50 LCB	1228	1506	1136	1290	2238	2048	1880	2055

* $SP.G_B/Sp.G_F$ = Specific Gravity of Blocking Material/Specific Gravity of Floor Material. Specific Gravity of Various Species of Wood are Listed Below:

Wood	Specific Gravity
Oak	0.63
Southern Pine	0.55
Douglas Fir	0.50
Western Hemlock	0.45
Engleman Spruce	0.35

factor whereas he may not be comfortable using an oak/oak joint like Test 1-1 without a safety factor.

H. It is also interesting to note on Figure 7 that the yield point is located near 0.1 inch of permanent displacement. Or in other words, a joint can be considered a failure when the joint members are displaced 1/8 inch (this is not a momentarily displacement due to a dynamic force).

I. No tests were conducted to determine the effects of improperly predrilled holes for large nails. Also no efforts were made to measure the effect of wood grain orientation with respect to the nail, i.e., wood grains are perpendicular, or parallel, or at an angle to the nails.

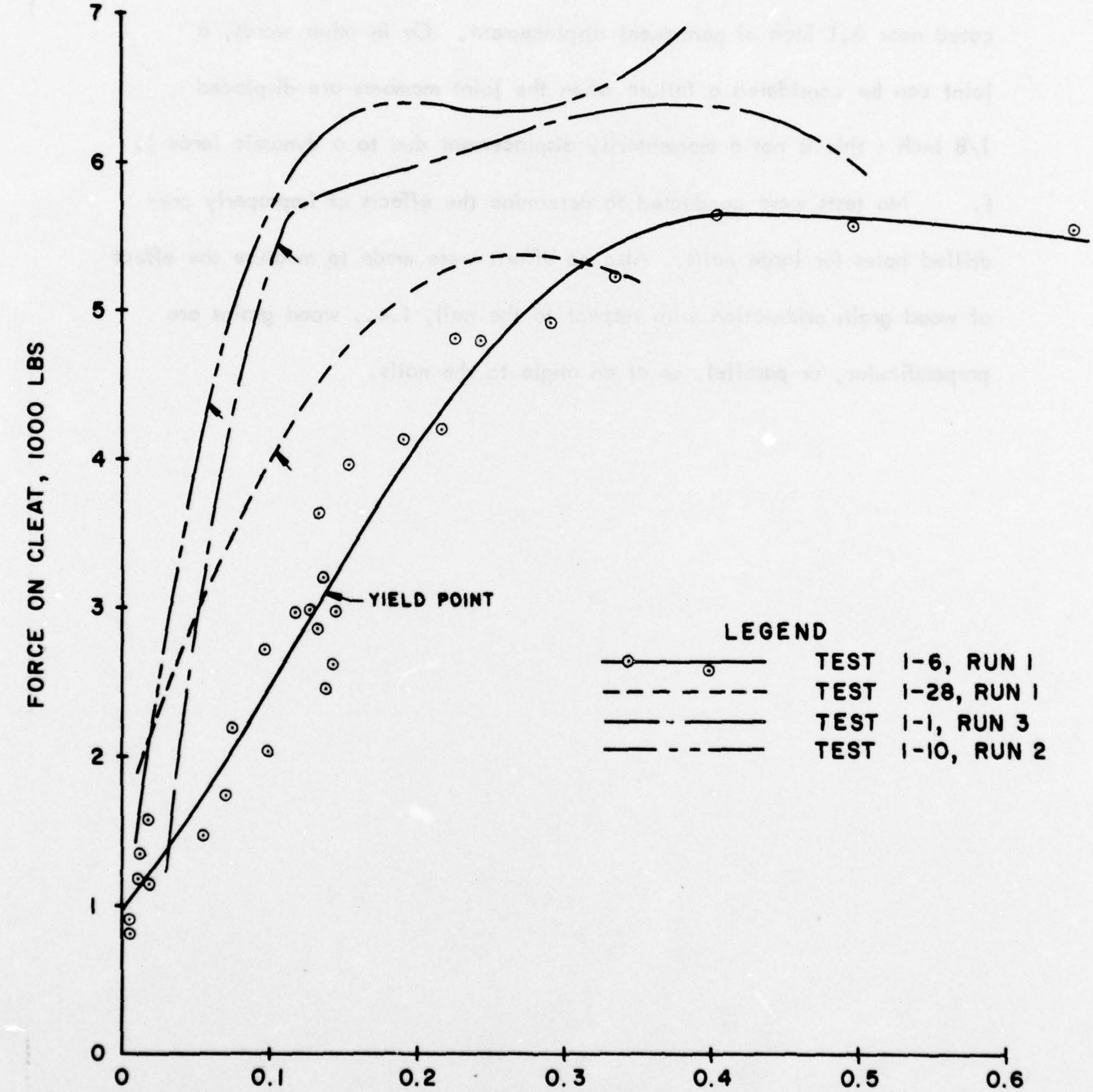

FIGURE 7. COMPARISON OF STRENGTH CHARACTERISTIC FOR SEVERAL TESTS.

APPENDIX I

		REVISIONS		
		LTR	DESCRIPTION	DATE	APPROVED

APPLICATION

MTMC DATA CONVERSION AND REDUCTION PROGRAM

DARCOM AMMUNITION CENTER
DATA ANALYSIS

MTMC DATA CONVERSION AND REDUCTION PROGRAM

A	28620	1000002
SCALE N/A	DATE 12-15-75	SHEET 1

```
* 1000002  MTMCSP  MTMC DATA REDUCTION PROGRAM
        TITL MTMS DATA REDUCTION PROGRAM
DATRED DSEG
        DATA DATREP,X'8000',0,0,0,0,0
        DATA DATRED,DATREP,DF,CRUB
        DATA X'8000',DATREP,0,0,0,0,0,0
DT      DATA DATRED,0,0,0
DF      DATA X'0041'
IN      DATA DATRED,BUF1,0,0,X'441'
MTO      DATA DATRED,BUF,128,128,X'0042'
MTO1    DATA DATRED,0,10710,10710,X'0042'
DFO     DATA DATRED,BUF,128,128,X'0043'
BUF     RES  64
BUF1    RES  64
IKNT    DATA 0
IMAX    DATA 0
IMIN    DATA 0
ISUM    DATA 0
        DATA 0
ISTD    DATA 0
ILIM    DATA 0,0
ILPSW   DATA 0
I       DATA 0
IST     DATA 0
J       DATA 0
JJ      DATA 0
IEND    DATA 0
RSUM     DATA 0
IXA     DATA 0
IYA     DATA 0
IXX2    DATA 0
IYY2   DATA 0
LFCR    EQU  X'0D0A'
        DATA L2-L1-1*2
L1      DATA LFCR,C'ENTER TEST RUN NUMBER'
        DATA LFCR,C'XXXXXXXXXX',LFCR
        DATA L3-L2-1*2
L2      DATA LFCR,C'IS NUMBER RIGHT?'
        DATA L4-L3-1*2
L3      DATA LFCR,C'IS ANALOG TAPE READY?'
        DATA L5-L4-1*2
L4      DATA LFCR,C'NO PEAK ON CHANNEL 1'
        DATA 2
L5      DATA LFCR
        END
DATREP PSEG
R0      EQU  X'88'
R1      EQU  X'89'
R2      EQU  X'8A'
        LA   0,0
*  INPUT TEST RUN NUMBER
        ST   0,DDDD+1
        BL   2,OT1
        DATA L1
        BL   2,IN1
        DATA BUF,10
```

```
* IS NUMBER CORRECT NO START OVER
* YES CONTINUE
        BL   2,DT1
        DATA L2
        BL   2,IN1
        DATA $+3,2
DDDD    LA   0,0
        CRA  0,C'NN'
        BC   11,DATREP
* IS ANALOG TAPE READY NO WAIT
* YES CONTINUE
DT1     BL   2,DT1
        DATA L3
        BL   2,IN1
        DATA $+3,2
        LA   0,0
        CRA 0,C'NN'
        BC   11,DT1
CRUB    EQU  X'0F30'
        LA   4,DATREP
* RESET A/D CONVERTER
        SSB  RESET
        LA   0,0
        LDS  $+2
        DATA $+2,X'81C0'
*  SEARCH FOR START SIGNAL
SERH1   LDCR (0,0),CTRWRD
        LDCR (16,0),CMDWRD
        SETB 11,1
        SETB 11,0
        LDCR (16,0),OUTWRD
        SETB 12,1
        L     0,ISUM
        L     1,ISUM+1
        DA   0,833
        ST    0,DATAB+18,3
        ST    1,DATAB+24,3
        SETB 13,0
        CML  OUTWRD+1,LIM
        NOP
        B    $+4
        B    $+6
        LA   0,0
        B    SERH1
        AA   0,1
        CRA  0,10
        BC   11,CVTSTR
        B    SERH1
CTRWRD DATA X'25'
CMDWRD DATA X'0500'
OUTWRD DATA 0,0
LIM     DATA 625,875
* WHEN START SIGNAL FOUND SEQUENTIALLY
* CONVERT AND STORE DATA
CVTSTR LDCR (0,0),CTRWRD
        LDCR (16,0),CMDWRD
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 03

```
         SETB 11,1
         SETB 11,0
         LA   1,0
         LA   3,0
         LA   4,0
CVTST2 LA   0,16
CVTST3 LDCR (16,0),R0
         SETB 12,1
         SETB 12,0
         BBNE 13,1,$
         LDCR (16,0),R1
         SETB 8,1
         STCR (16,0),R2
         SETB 13,1
         SETB 13,0
         SETB 8,0
         ST   2,DATAB,3
         AA   3,1
         CRA  3,24000
         BC   11,CVTST1
         AA   0,16
         CRA  0,112
         BC   11,CVTST2
         B    CVTST3
CVTST1 LA   4,DATRED
         LDS  $+2
         DATA $+2,X'8000'
         B    SCALE
RESET    DATA 0,0,$+1
         LDS  $+3
ZERO     DATA 0
         DATA $+2,X'81C0'
         LDCR (0,0),ZERO
         LDCR (16,0),ZERO
         SETB 9,1
         SETB 9,0
         LDS  RESET
* SCALE DATA IN MEMORY
SCALE    LA   0,23999
         MLA  1,DATAB,0
         ARB  -1,$-2,0
* SEARCH DATA 1 FOR PEAK
         L    3,ZERO
         ST   3,IKNT
         ST   3,I
         B    $+6
SERLOP L    3,I
         AA   3,6
         ST   3,I
         CRA  3,24000
         BC   10,B210
         L    0,DATAB,3
         SA   0,100
         BC   10,$+4
         B    B200
         L    0,DATAB,3
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 04

```
         SA    0,1000
         BC    12,B202
B200     L     3,ZERO
         ST    3,IKNT
         B     SERLOP
B202     L     3,IKNT
         AA    3,1
         ST    3,IKNT
         SA    3,10
         BC    10,B204
         B     SERLOP
* CALCULATE START AND STOP INDEX
* OF DATA FIELD
B204     L     0,I
         SA    0,40*6
         ST    0,IST
         AA    0,446*6
         ST    0,IEND
         B     B211
B210     BL    2,OT1
         DATA L4
         B     DATREP
B211     B     B300
* QUERY I/O DRIVERS
OT1      L     3,2,2
         BC    11,3,2
         ST    3,OT+1
         L     3,-1,3
         ST    3,OT+3
         LA    3,=OT
         SXBS  *127
         B     3,2
IN1      L     3,2,2
         BC    11,4,2
         ST    3,IN+1
         L     3,3,2
         ST    3,IN+2
         LA    3,=IN
         SXBS  *127
         B     4,2
* CALCULATE THE ZERO REFERENCE FOR EACH
* DATA CHANNEL USING A STANDARD DEVIATION
* OF 2 FOR DROPPING ERRORS AND THEN
* RECALCULATE THE AVERAGE
* STORE THE RESULTS
B300     L     3,ZERO
         B     $+6
B153     L     3,J
         AA    3,1
         ST    3,J
         CRA   3,5
         BC    10,B154.
         L     0,ZERO
         ST    0,IKNT
         L     3,ZERO
         B     $+6
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 05

```
B151    L     3,I
        AA    3,6
        ST    3,I
        CRA   3,174
        BC    10,B152
        A     3,IST
        A     3,J
        L     0,IKNT
        A     0,DATAB,3
        ST    0,IKNT
        B     B151
B152    L     0,IKNT
        MA    0,1
        DA    0,30
        L     3,J
        ST    1,DATAB,3
        L     0,ZERO
        ST    0,ISUM
        ST    0,ISUM+1
        ST    0,ISTD
        ST    0,IKNT
        L     3,ZERO
        B     $+6
B180    L     3,I
        AA    3,6
        ST    3,I
        CRA   3,174
        BC    10,B181
        A     3,IST
        A     3,J
        L     1,J
        L     0,DATAB,3
        S     0,DATAB,1
        ST    0,$+3
        MA    0,0
        DAD   0,ISUM
        ST    0,ISUM
        ST    1,ISUM+1
        B     B180
B181    DA    0,29
        LA    0,0
        LA    3,X'1C00'
        SXBS  *127
        MA    0,2
        ST    1,ISTD
        L     3,J
        L     1,DATAB,3
        A     1,ISTD
        ST    1,ILIM
        L     1,DATAB,3
        S     1,ISTD
        ST    1,ILIM+1
        CR    1,ILIM
        BC    10,B187
        L     0,ILIM
        ST    0,ILIM+1
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 06

```
        ST    1,ILIM
B187    L     0,ZERO
        ST    0,ISUM
        ST    0,ISUM+1
        ST    0,IKNT
        L     3,ZERO
        B     $+6
B182    L     3,I
        AA    3,6
        ST    3,I
        CRA   3,174
        BC    10,B184
        A     3,IST
        A     3,J
        L     0,DATAB,3
        CR    0,ILIM
        BC    12,B182
        CR    0,ILIM+1
        BC    10,B182
        AMI   IKNT,1
        L     0,DATAB,3
        A     0,ISUM
        ST    0,ISUM
        B     B182
B184    L     0,IKNT
        ST    0,B185+1
        L     0,ISUM
        MA    0,1
B185    DA    0,0
        L     3,J
        ST    1,DATAB,3
        B     B153
* PRINT ZERO REFERENCE VALUES
B154    BL    7,PRNT
        DATA  DATAB
        B     B158
PRNT    L     3,2,7
        ST    3,B159+1
        BL    2,OT1
        DATA  L5
        L     3,ZERO
        B     $+6
B156    L     3,I
        AA    3,1
        ST    3,I
        CRA   3,5
        BC    10,3,7
B159    L     0,0,3
        LA    3,X'2800'+BUF1+1
        SXBS  *127
        LA    3,C'  '
        ST    3,BUF1+4
        LA    3,8
        ST    3,BUF1
        BL    2,OT1
        DATA  BUF1+1
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 07

```
        B     B156
* LOCATE MAXIMUM AND MINIMUM VALUES
* FOR EACH CHANNEL
B158    L     3,ZERO
        B     $+6
B165    L     3,J
        AA    3,1
        ST    3,J
        CRA   3,5
        BC    10,B166
        L     0,ZERO
        ST    0,IMAX
        ST    0,IMIN
        ST    0,ISUM
        ST    0,ISUM+1
        ST    0,RSUM
        L     3,IST
        AA    3,180
        B     $+6
B163    L     3,I
        AA    3,6
        ST    3,I
        CR    3,IEND
        BC    10,B164
        A     3,J
        L     0,DATAB,3
        BC    12,B161
        CR    0,IMAX
        BC    12,B162
        ST    0,IMAX
        B     B162
B161    CR    0,IMIN
        BC    10,B162
        ST    0,IMIN
* CALCULATE AREA UNDER EACH CURVE
B162    L     3,J
        S     0,DATAB,3
        MA    0,10
        DAD   0,ISUM
        ST    0,ISUM
        ST    1,ISUM+1
        B     B163
B164    L     3,J
        L     0,IMAX
        S     0,DATAB,3
        ST    0,DATAB+6,3
        L     0,IMIN
        S     0,DATAB,3
        ST    0,DATAB+12,3
        L     0,ISUM
        L     1,ISUM+1
        DA    0,833
        ST    0,DATAB+18,3
        ST    1,DATAB+24,3
        B     B165
* PRINT MINIMUM VALUE
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 08

```
B166   BL    7,PRNT
       DATA DATAB+6
* PRINT MAXIMUM VALUE
       BL    7,PRNT
       DATA DATAB+12
* PRINT WORK REMAINDER
       BL    7,PRNT
       DATA DATAB+18
* PRINT WORK
       BL    7,PRNT
       DATA DATAB+24
* CALCULATE FINAL VALUE OF CHANNEL 6
* BASED ON TWO STD. DEVIATIONS
       L     0,DATAB+29
       M     0,DATAB+25
       DA    0,-4
       ST    0,DATAB+30
       ST    1,DATAB+31
       L     1,IEND
       AA    1,-1
       ST    1,IEND
       LA    2,9
       LA    0,0
       A     0,DATAB,1
       AA    1,-6
       ARB   -1,$-4,2
       MA    0,1
       DA    0,10
       ST    0,DATAB+32
       ST    1,DATAB+33
       LA    0,0
       ST    0,ISUM
       ST    0,ISUM+1
       L     3,IEND
       LA    2,9
B240   L     0,DATAB,3
       S     0,DATAB+33
       ST    0,$+3
       MA    0,0
       DAD   0,ISUM
       ST    0,ISUM
       ST    1,ISUM+1
       AA    3,-6
       ARB   -1,B240,2
       DA    0,9
       LA    0,0
       LA    3,X'1C00'
       SXBS  *127
       MA    0,2
       ST    1,ISTD
       L     0,DATAB+33
       A     0,ISTD
       ST    0,ILIM
       L     0,DATAB+33
       S     0,ISTD
       ST    0,ILIM+1
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 09

```
         CR    0,ILIM
         BC    10,B241
         L     1,ILIM
         ST    1,ILIM+1
         ST    0,ILIM
B241     LA    0,0
         ST    0,ISUM
         ST    0,ISUM+1
         ST    0,IKNT
         L     3,IEND
         LA    2,9
B243     L     0,DATAB,3
         CR    0,ILIM
         BC    12,B242
         CR    0,ILIM+1
         BC    10,B242
         AMI   IKNT,1
         L     0,DATAB,3
         A     0,ISUM
         ST    0,ISUM
B242     AA    3,-6
         ARB   -1,B243,2
         L     0,IKNT
         ST    0,B245+1
         L     0,ISUM
         MA    0,1
B245     DA    0,0
         ST    0,DATAB+32
         ST    1,DATAB+33
* OUTPUT CHANNEL 6 RESULTS
         BL    7,PRNT
         DATA  DATAB+30
         B     B235
* PROGRAM EXIT
B227     LA    3,X'0400'
         SXBS  *127
* PRINT DATA SUBROUTINE
PRNT1    L     3,2,7
         ST    3,B175+1
         BL    2,OT1
         DATA  L5
         L     3,ZERO
         B     $+6
B176     L     3,I
         AA    3,6
         ST    3,I
         CRA   3,60
         BC    10,3,7
B175     L     0,0,3
         LA    3,X'2800'+=BUF1+1
         SXBS  *127
         LA    3,C'  '
         ST    3,BUF1+4
         LA    3,8
         ST    3,BUF1
         BL    2,OT1
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 10

```
         DATA BUF1+1
         B    B176
* FORMAT TEST DATA TO BINARY DATA
B235     LA   0,X'2020'
         LA   1,63
         ST   0,BUF1,1
         ARB  -1,$-2,1
         L    0,BUF
         ST   0,BUF1+2
         L    0,BUF+1
         ST   0,BUF1+5
         L    0,BUF+2
         MRA  8,X'88'
         OR   0,BUF1+8
         ST   0,BUF1+8
         L    0,BUF+2
         MLA  8,X'88'
         L    1,BUF+3
         MRA  8,X'89'
         OR   0,X'89'
         ST   0,BUF1+11
         L    0,BUF+3
         NA   0,X'F'
         OR   0,BUF1+14
         ST   0,BUF1+14
         L    0,BUF+4
         ST   0,BUF1+17
         LA   0,62
         LA   1,0
         ST   1,BUF+1,0
         ARB  -1,$-2,0
         LA   0,X'1700'
         ST   0,BUF
         LA   1,5
         LA   2,0
         LA   3,X'2C00'+=BUF1
B190     ST   3,$+5
         SXBS *127
         LA   3,0
         AA   3,3
         ST   0,BUF+1,2
         AA   2,1
         ARB  -1,B190,1
         LA   3,X'4000'+=BUF+7
         SXBS *127
         LA   0,0
         ST   0,BUF+12
         LA   0,32
         L    1,DATAB,0
         ST   1,BUF+13,0
         ARB  -1,$-4,0
* OUTPUT LIBRARY RECORD
         LA   3,=DFO
         SXBS *127
* OUTPUT LIBRARY RECORD TO MAG TAPE
         LA   3,=MTO
```

```
        SXBS *127
        L     3,IST
        AA    3,DATAB
        ST    3,MTO1+1
* OUTPUT DATA TO MAG TAPE
        LA    3,*MTO1
        SXBS *127
        B     B227
IXX     DATA 0
IYY     DATA 0
        RES   40
DATAB   RES   24000
        END
```

MTMC DATA CONVERSION AND REDUCTION PROGRAM	A	28620	1000002
	SCALE N/A	DATE 12-15-75	SHEET 12

APPENDIX II

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

APPLICATION

A PROGRAM FOR LEAST SQUARE CURVE FITTING

DARCOM AMMUNITION CENTER DATA ANALYSIS	
A PROGRAM FOR LEAST SQUARE CURVE FITTING	

A	28620	1000012
SCALE N/A	DATE 1975	SHEET 1

```
C 1000012 LSTSQS A PROGRAM FOR LEAST
CSQUARE CURVE FITTING
CDATE 1975
C       A PROGRAM FOR LEAST SQUARE CURVE FITTING
        DIMENSION X(200),Y(200),A(11,11),B(11),C(11),P(20)
        WRITE(2,2)
2       FORMAT ('ENTER DEGREE OF POLYNOMIAL,XX,MAX IS 10')
        READ(2,4)M
4       FORMAT(I2)
C
        WRITE(2,6)
6       FORMAT ('ENTER VALUES OF X AND Y, XX.XXYY.YY, WHEN
      1 FINISHED, TYPE 00.0000.00')
        DO 20 I=1,201
        READ(2,10)X(I),Y(I)
10      FORMAT (2F5.2)
        IF (X(I))20,30,20
20      CONTINUE
        CALL EXIT
C
30      NUM=I-1
        MX2=M*2
        DO 40 I=1,MX2
        P(I)=0.0
        DO 40 J=1,NUM
        P(I)=P(I)+X(J)**I
40      CONTINUE
C
        N=M+1
        DO 70 I=1,N
        DO 70 J=1,N
        K=I+J-2
        IF (K)60,60,50
50      A(I,J)=P(K)
        GO TO 70
60      A(1,1)=NUM
70      CONTINUE
C
        B(1)=0.0
        DO 80 J=1,NUM
        B(1)=B(1)+Y(J)
80      CONTINUE
        DO 90 I=2,N
        B(I)=0.0
        DO 90 J=1,NUM
        B(I)=B(I)+Y(J)*X(J)**(I-1)
90      CONTINUE
C
```

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```
      NM1=N-1
      DO 300 K=1,NM1
      KP1=K+1
      L=K
      DO 400 I=KP1,N
      IF (ABS(A(I,K))-ABS(A(L,K)))400,400,401
401   L=I
400   CONTINUE
      IF (L-K)500,500,405
405   DO 410 J=K,N
      TEMP=A(K,J)
      A(K,J)=A(L,J)
      A(L,J)=TEMP
410   CONTINUE
      TEMP=B(K)
      B(K)=B(L)
      B(L)=TEMP
C
500   DO 300 I=KP1,N
      FAC=A(I,K)/A(K,K)
      A(I,K)=0.0
      DO 301 J=KP1,N
      A(I,J)=A(I,J)-FAC*A(K,J)
301   CONTINUE
      B(I)=B(I)-FAC*B(K)
300   CONTINUE
      C(N)=B(N)/A(N,N)
      I=NM1
710   IP1=I+1
      SUM=0.0
      DO 700 J=IP1,N
      SUM=SUM+A(I,J)*C(J)
700   CONTINUE
      C(I)=(B(I)-SUM)/A(I,I)
      I=I-1
      IF (I)800,800,710
800   DO 900 I=1,N
      WRITE(2,901)I,C(I)
900   CONTINUE
901   FORMAT (I5,E15.7)
C
      WRITE (2,920)
920   FORMAT ('ENTER VALUES FOR PLOTTING LEAST SQUARES
     1 CURVE, XX.XX, WHEN FINISHED TYPE 00.00')
940   READ(2,950)XT
950   FORMAT (F5.2)
      IF (XT)960,1100,960
960   CONTINUE
      YT=0.0
      YT=YT+C(1)
      DO 1000 I=2,N
      YT=YT+C(I)*XT**(I-1)
1000  CONTINUE
      WRITE(2,1050)XT,YT
1050  FORMAT (2F12.3)
      GO TO 940
1100  CONTINUE
      END
```

A PROGRAM FOR LEAST SQUARE CURVE FITTING	A	28620	1000012	
	SCALE N/A		DATE 1975	SHEET 03

APPENDIX III

APPENDIX 3. YIELD AND MAXIMUM FORCES OF WOOD JOINTS

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-1	1	10	12	2264 & 2593	5360 (1)	4.48	750 & 1079	3615 (2)	5.09	2.65	0.144	0.338
Oak on Oak					9210 (3)	8.49	"	8310 (4)	8.00	-	1.138	1.456
50d HCB	2	10	12	2593	6270	5.75	1079	5422	5.82	6.75	0.048	0.361
Sound					8290	8.40	"	7150	7.39	6.58	0.179	0.630
	3	10	12	2593	6140	5.43	1079	5427	5.28	1.94	0.076	0.344
					8130	8.03	"	6400	6.45	6.50	0.328	0.730
	4	10	12	2593	5820	6.02	1079	4494	4.95	2.15	0.057	0.426
					7220	6.97	"	6200	6.09	2.19	0.169	0.606
1-2	1	12.5	12	2593	4570	4.89	1079	3885	3.75	1.52	0.062	0.342
Oak on Oak					7570	7.45	"	7050	6.60	-	0.237	0.726
50d HCB	2	12.5	12	2593	5400	5.52	1079	4657	4.74	2.29	0.067	0.310
Average					8020	8.16	"	7210	6.90	3.87	0.181	0.626
	3				4460	4.10		3153	3.51	1.68	0.137	0.438
					6630	6.66		5110	5.25	1.97	0.290	0.802
1-3	1	17	12	2593	3020	2.37	1079	2027	2.15	1.08	0.130	0.314
Oak on Oak					4550	5.27		3700	3.82	1.20	0.289	0.672
50d HCB	2	17	12	2593	3540	2.73	1079	2142	2.53	0.80	0.107	0.302
Fair					5500	6.59	"	4300	4.45	0.96	0.232	0.638
	3	17	12	2593	4540	5.10	1079	3208	3.66	0.96	0.102	0.440
					5450	6.67	"	4650	4.83	1.62	0.214	0.646

(1) Dolly impact force obtained from last impact in yield range for hammer impact force. Data in Columns 7, 10, 11, 12, and 13 are obtained from same impact.

(2) Average hammer impact force in yield range.

(3) Dolly impact force obtained from the impact that produced the maximum force on the specimen.

(4) Maximum force on specimen.

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-4	Same as 1-23											
1-5	Same as 1-25											
1-6	1	13	18.5	2593	4580	3.74	1079	3138	3.74	4.03	0.133	0.336
Oak on WH					6290	6.99	"	5660	5.25	6.85	0.401	0.720
50d HCB												
1-6	2	13	18.5	2593	4940	5.67	1079	3523	3.94	4.73	0.115	0.318
					6870	8.82	"	6010	5.50	6.75	0.396	0.840
	3	13	18.5	2593	3870	4.96	1079	2665	3.27	3.28	0.103	0.242
					6560	8.74	"	5550	5.18	7.16	0.369	0.766
1-7	1	7	12	2593	3680	3.56	1079	2733	3.19	3.85	0.078	0.220
Oak on ES				"	5500	6.26	"	4560	4.31	4.76	0.397	0.608
50d HCB	2	7	12	2593	3900	5.42	1079	2583	2.90	3.26	0.098	0.230
				"	5160	6.52	"	4120	4.05	5.00	0.414	0.578
	3	7	12	2593	3840	3.94	1079	2923	3.42	5.99	0.063	0.224
					5360	7.85	"	4750	4.56	-	0.353	0.614
1-8	1	16	17	2593	6040	6.30	1079	3536	4.82	6.05	0.048	0.202
DF on Oak					8110	10.01	"	6950	6.77	9.13	0.392	0.746
50d HCB	2	17.5	17	2593	5970	6.32	1079	5095	5.14	5.54	0.063	0.236
					8700	-	"	7590	7.12	7.43	0.349	0.714
	3	17.5	17	2593	5650	5.58	1079	4060	4.53	6.03	0.056	0.202
					7580	8.41	"	6580	6.44	7.05	0.382	0.782
1-9	1	11	12	2014	7940	7.01	500	4140	8.44	4.42	0.229	0.514
DF(1) on Oak												
50d HCB		11	9	2593	7480	7.52	1079	5580	5.42	4.23	0.285	0.734
	2	11.5	12	2014	8040	6.94	500	4283	7.55	5.20	0.359	0.600

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
		11	11.5	2349	7940	7.82	835	5640	7.10	4.01	0.240	0.632
	3	11	12.	2014	7520	6.53	500	4205	7.72	3.83	0.087	0.290
		11	11.5	2349	7640	7.99	835	5590	7.25	4.44	0.484	0.842
1-10	1	19	17	2593	6090	6.51	1079	4348	5.04	6.53	0.053	0.262
WH on Oak				"	7890	9.17	"	6870	6.65	7.17	0.348	0.800
50d HCB	2	19	17	2593	5840	5.75	1079	4377	5.16	Bad data	0.041	0.234
				"	8450	8.90	"	6870	6.87	-	0.381	0.876
	3	19	17	2593	5310	5.68	1079	4633	4.84	8.91	0.036	0.280
				"	7830	8.07	"	6600	6.42	6.04	0.424	0.850
1-11	1	17.5	17	2593	6100	5.77	1079	4670	5.11	5.80	0.090	0.322
WH(1) on Oak				"	7920	9.37	"	6920	6.54	8.14	0.421	0.806
50d HCB	2	17.5	17	2593	5910	5.15	1079	4730	5.29	7.06	0.086	0.332
				"	8030	10.72	"	7430	7.41	10.41	0.469	0.888
	3	17.5	17	2593	6240	6.06	1079	4897	5.77	9.89	0.078	0.306
				"	8110	10.52	"	7320	7.40	-	0.398	0.782
1-12	1	12	11.5	2593	6720	5.77	1079	5098	5.64	6.08	0.087	0.280
ES on Oak					8490	7.89	"	7720	7.76	10.38	0.315	0.710
50d HCB	2	12	11.5	2593	5340	5.11	1079	4382	5.07	5.23	0.056	0.272
				"	6980	7.39	"	6060	6.36	6.68	0.339	0.700
	3	12	11.5	2593	6230	6.14	1079	5360	5.89	6.97	0.051	0.284
				"	7680	7.05	"	7120	7.01	8.16	0.198	0.544
1-13	1	12	11.5	2593	4980	4.09	1079	4386	4.93	4.01	0.046	0.274
ES(1) on Oak				"	7170	7.85	"	6280	6.31	7.45	0.255	0.638

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST	RUN	MOISTURE CONTENT %		DOLLY WEIGHT	DOLLY IMPACT FORCE	DOLLY ACC.	HAMMER WEIGHT	HAMMER IMPACT FORCE	HAMMER ACC.	SPECIMEN ACC.	PERM. DISPL.	TOTAL DISPL.
NUMBER	NO.	CLEAT	FLOOR	LBS	LBS	G'S	LBS	LBS	G'S	G'S	IN.	IN.
50d HCB	2	12	11.5	2593	6080	6.28	1079	4600	5.32	8.12	0.086	0.334
				"	8350	8.67	"	7120	7.33	10.33	0.336	0.768
	3	12	11.5	2593	4890	5.19	1079	4398	4.83	5.94	0.069	0.296
				"	7680	7.25	"	6990	7.09	7.10	0.440	0.796
1-14	1	11	11.5	2349	6690	5.84	835	4927	5.96	5.18	0.099	0.286
SP on Oak				"	9150	8.63	"	6390	8.27	-	0.528	0.792
50d HCB	2	10	11.5	2349	6030	6.12	835	4525	5.64	2.42	0.080	0.298
				"	7800	8.87	"	6150	7.70	4.54	0.235	0.616
	3	12	11.5	2349	6950	6.72	835	5056	6.70	7.03	0.081	0.280
				"	8710	7.45	"	6380	7.88	8.78	0.166	0.460
1-15	1	18	13	2593	5720	4.55	1079	4913	4.84	5.66	0.123	0.262
Oak on Oak				"	9050	7.88	"	8950	8.40	-	0.566	0.786
50d LCB	2	18	13	2593	7550	5.98	1079	6024	5.61	7.32	0.147	0.304
				"	8420	8.70	"	8190	7.01	-	0.378	0.586
	3	18	13	2715	5350	5.10	1201	4545	4.42	5.66	0.092	0.242
				"	8210	7.38	"	7520	6.77	-	0.723	0.934
1-16	1	18	13	2715	4500	4.30	1201	3510	3.65	5.79	0.052	0.140
Oak on Oak				"	7080	7.89	"	6150	5.40	7.99	0.488	0.646
50d LCC	2	18	13	2715	4420	4.40	1201	3068	3.08	3.94	0.044	0.124
				"	7380	6.54	"	6720	5.88	-	0.605	0.802
	3	18	13	2715	4400	4.63	1201	3298	3.43	5.33	0.058	0.160
					6970	6.45	"	6210	5.86	-	0.571	0.752
1-17	1	11	8.5	2959	7190	4.51	1445	4677	3.84	4.10	0.088	0.262
Oak on Oak				"	9600	3.77	"	8120	6.53	5.83	0.550	0.842

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
40d HCC	2	11	8.5	2959	7900	-	1445	5688	5.20	1.64	0.078	0.280
4 Nails				"	9740	-	"	7710	6.50	2.45	0.414	0.682
	3	11	8.5	2959	7200	5.49	1445	4897	3.45	4.03	0.109	0.338
				"	9660	3.33	"	7800	5.40	6.10	0.497	0.818
1-18	1	18	11.5	2349	5400	5.10	835	3898	5.27	1.21	0.083	0.274
Oak on Oak				"	7230	6.65	"	5220	6.55	3.55	0.306	0.586
40d HCB	2	18	11.5	2349	4620	4.78	835	3307	4.41	0.99	0.124	0.280
				"	6500	6.78	"	4460	5.66	1.66	0.391	0.582
	3	18	11.5	2349	5150	4.96	835	3411	4.56	1.70	0.167	0.354
					5960	6.78	"	4450	5.61	1.85	0.293	0.534
	4	18	16	2349	5290	4.90	835	4278	5.17	1.94	0.098	0.294
				"	6260	6.31	"	5260	5.95	1.70	0.207	0.450
1-19	1	18	16	2349	4390	4.74	835	2609	3.78	1.49	0.052	0.138
Oak on Oak				"	8340	7.39	"	6220	7.68	2.28	0.550	0.790
40d LCC	2	18	16	2349	4830	4.70	835	3510	4.38	1.38	0.073	0.204
				"	7800	6.83	"	5890	6.80	3.07	0.441	0.650
	3	14	16	2349	5870	4.84	835	3912	4.98	4.26	0.088	0.226
				"	7910	7.54	835	5990	7.00	4.24	0.406	0.604
1-20	1	18	16	2349	5230	5.00	835	3380	4.80	4.83	0.084	0.216
Oak on Oak				"	7690	7.03	"	5720	7.05	7.48	0.393	0.586
40d LCB	2	18	16	2349	4730	4.81	835	3253	4.09	1.24	0.091	0.218
				"	6230	6.37	"	4870	5.68	2.01	0.322	0.480
	3	18	16	2349	5160	4.12	835	3377	4.44	1.79	0.059	0.186
				"	7430	6.30	"	5510	6.58	2.15	0.364	0.586

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-21	1	11	11.5	2959	8110	5.71	1445	5830	5.53	4.59	0.091	0.298
Oak on Oak	Floor grain parallel to nails			"	9710	7.32	"	7720	7.19	5.97	0.364	0.700
30d HCC	2	11	11.5	2959	7810	5.73	1445	5560	5.72	4.62	0.096	0.330
				"	9570	3.42	"	7920	7.34	5.65	0.360	0.756
1-21	3	12	11	2959	7540	5.56	1445	4832	4.88	2.82	0.061	0.242
	Nails close (≈1 inch) to previous nail hole			"	9880	2.87	"	8040	5.99	3.90	0.380	0.694
1-22	1			2349	3950	3.61	835	2486	3.38	1.16	0.062	0.164
Oak on Oak				"	5200	4.37	•	3350	4.27	1.26	0.247	0.382
30d LCC	2			2349	4230	3.90	835	2602	3.64	1.03	0.045	0.158
				"	5880	5.71	"	3650	4.81	4.60	0.314	0.514
	3			2349	4050	4.10	835	2916	3.91	5.30	0.079	0.206
				"	5080	4.84	"	3860	4.62	7.70	0.283	0.464
1-23	1	18	10	2471	5590	5.24	957	4616	5.49	5.63	0.103	0.318
Oak on DF				"	6960	7.04	"	5640	6.16	8.79	0.282	0.614
50d HCB	2	18	10	2471	5510	5.12	957	4212	4.80	5.30	0.048	0.236
				"	8040	7.77	"	6330	6.64	7.02	0.251	0.802
	3	18	10	2471	4460	4.62	957	3758	3.95	4.78	0.043	0.316
				"	6160	5.90	"	5140	5.35	5.52	0.201	0.590
1-24	1	12	12	2959	6140	[illegible]	1445	4283	4.31	4.67	0.104	0.320
Oak on DF				"	9060	7.95	"	6100	5.74	5.70	0.316	0.708
50d HCC	2	12	12.5	2959	5750	3.56	1445	3643	3.93	2.47	0.068	0.250
				"	8620	6.87	"	5950	5.64	-	0.238	0.610
	3			2959	6790	4.20	1445	4360	4.28	3.29	0.066	0.320
				"	8250	6.90	"	5510	5.02	6.91	0.193	0.598

1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
1-25	1			2349	6360	5.69	835	4713	5.75	6.25	0.075	0.262
Oak on SP				"	8600	7.58	"	6650	7.84	11.08	0.249	0.602
50d HCB	2	18	10	2471	6480	6.28	957	5820	6.25	7.27	0.077	0.334
					7130	7.45	"	6400	6.65	8.00	0.167	0.508
1-25	3	18	10	2471	5870	5.03	957	4980	5.51	5.69	0.093	0.288
				"	6810	6.33	"	5840	6.44	7.31	0.175	0.494
1-26	1	11.5	11.5	2959	5840	3.46	1445	3933	3.67	-	0.087	0.226
Oak on SP		Used 4 nails		"	9470	6.42	"	6880	6.06	1.32	0.549	0.938
50d HCC	2	13.5	11.0	2959	6730	5.17	1445	4958	4.46	4.84	0.081	0.278
		Used 4 nails		"	9710	7.78	"	6780	6.47	6.82	0.440	0.802
	3	13.5	11.0	2959	6550	4.26	1445	4523	4.65	4.96	0.044	0.264
		Used 4 nails		"	9790	9.03	"	6630	5.94	5.27	0.529	0.856
1-27	Same as 6											
1-28	1	11.5	12	2959	5700	3.73	1445	4003	3.88	3.31	0.089	0.326
Oak on WH		Used 4 nails		"	7940	5.92	"	5680	5.06	4.76	0.206	0.568
50d HCC	2	11.5	13	2959	5920	3.63	1445	3960	3.87	3.51	0.080	0.318
		Used 4 nails		"	8060	6.31		5600	5.37	4.69	0.239	0.626
	3	11.5	13	2959	6090	5.22	1445	4495	4.08	4.20	0.107	0.338
1-29	Same as 7			"	8910	7.67	"	6120	5.78	6.07	0.237	0.650
1-30	1	13	10.5	2959	5670	3.94	1445	3295	3.93	3.37	0.163	0.422
Oak on ES		Used 4 nails		"	7640	5.01	"	5350	4.92	4.15	0.437	0.81
50d HCC	2	13	10.5	2959	5070	3.55	1445	3883	3.40	2.31	0.111	0.302
		Used 4 nails			8450	5.92	"	5690	5.29	2.23	0.651	1.08
	3	13	10.5	2959	5770	3.48	1445	2743	3.71	4.79	0.104	0.394

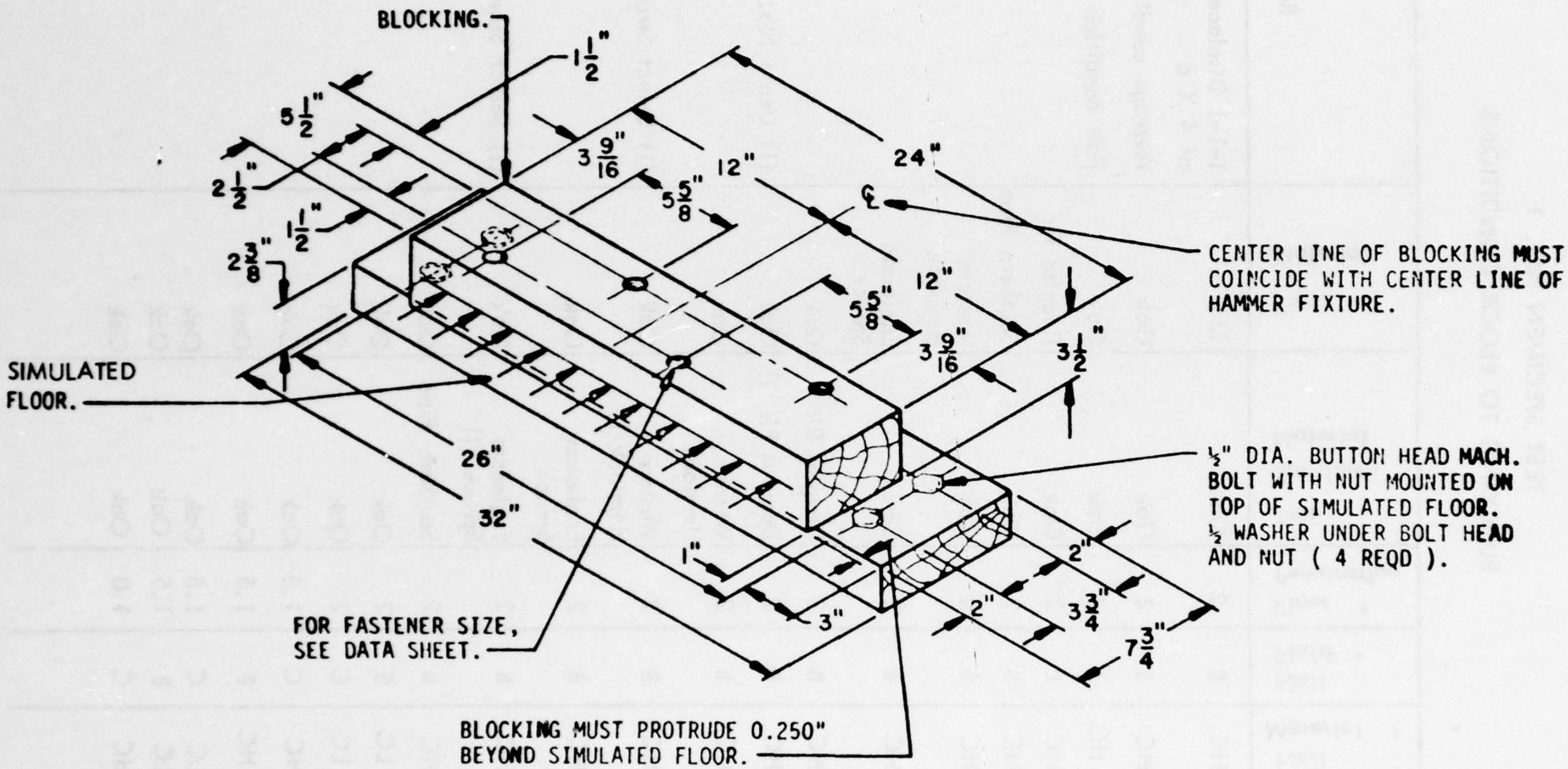
1	2	3	4	5	6	7	8	9	10	11	12	13
TEST NUMBER	RUN NO.	MOISTURE CONTENT % CLEAT	FLOOR	DOLLY WEIGHT LBS	DOLLY IMPACT FORCE LBS	DOLLY ACC. G'S	HAMMER WEIGHT LBS	HAMMER IMPACT FORCE LBS	HAMMER ACC. G'S	SPECIMEN ACC. G'S	PERM. DISPL. IN.	TOTAL DISPL. IN.
		Used 4 nails			8240	6.12		5920	5.55	2.25	0.540	0.924
1-31	1	12	7.5	2959	8380	7.36	1445	6854	7.30	5.61	0.073	0.304
Oak on Oak		4 nails		"	10160	6.87	"	10010	7.22	3.16	0.462	0.844
50d HCC	2	12	7.5	2959	7700	5.15	1445	5405	5.36	4.32	0.082	0.370
		3 nails		"	9670	4.14	"	7840	6.44	5.74	0.530	0.918
1-31	3	12	7.5	2959	7200	5.97	1445	5123	4.70	-	0.084	0.334
		3 nails	"	"	9770	4.26	"	10060	9.02	-	0.742	1.104
1-16	1	13	7.75	2959	5170	3.98	1445	3068	3.49	3.29	0.066	0.210
		4 nails		"	8510	7.83	"	6160	5.57	-	0.553	0.704
	2	13	7.75	2959	6250	4.69	1445	4258	3.75	1.12	0.078	0.222
		4 + nails		"	9670	6.87	"	7340	6.23	9.46	0.441	0.624
	3	-	7.75	2959	5640	4.36	1445	3933	3.44	1.07	0.062	0.188
				"	10190	7.91	"	7830	5.34	11.37	0.410	0.594
1-32	1	14	9.5		4540	3.20	1445	2918	2.58	2.39	0.045	0.158
					7070	5.15		5230	4.16	4.48	0.443	0.604
	2	14	9.5	2959			1445					
	Cleat 3-7/8" Thick			"	7450	4.46	"	5070	3.42	4.56	0.470	0.618
	3			2959	3980	2.83	1445	2490	2.19	1.95	0.056	0.176
					7240	6.38		6210	4.83	6.89	0.639	0.778
1-33	1	14	11	2959	6410	4.84	1445	4335	2.94	3.94	0.073	0.248
	Cleat 3-3/8" Thick			"	8200	6.73	"	5840	4.20	4.55	0.253	0.530
	2	14	11	2959	6250	4.75	1445	4445	4.30	3.04	0.050	0.226
	Cleat 3-3/8" Thick				8990	6.68	"	6170	5.93	2.61	0.346	0.642
	3	14	11	2959	6520	5.08	1445	4410	4.05	1.82	0.066	0.250
					8610	6.12	"	6020	5.46	2.73	0.289	0.562

APPENDIX IV

TEST SPECIMEN NO. 1

BLOCKING TO FLOOR CONDITIONS

BLOCKING GRAIN ORIENTATION PARALLEL TO FLOOR GRAIN
HAMMER FORCE APPLIED NORMAL TO BLOCKING GRAIN.



TEST SPECIMEN NO. 1

BLOCKING TO FLOOR CONDITIONS

Test Schedule	Nail Size	Nail Material *	Nail Finish *	Floor Penetration *	Test Specimen Material	Floor Material	Remarks
1	50d	HC	B	2	Oak	Oak	1-1-1 Displacement gage at top of 4 X 6
2	50d	HC	B	2	Oak	Oak	Average condition floor
3	50d	HC	B	2	Oak	Oak	Fair condition floor
4	50d	HC	B	2	Oak	Douglas Fir	
5	50d	HC	B	2	Oak	Southern Pine	
6	50d	HC	B	2	Oak	Western Hemlock	
7	50d	HC	B	2	Oak	Engleman Spruce	
8	50d	HC	B	2	Douglas Fir	Oak	
9	50d	HC	B	2	Douglas Fir (1)	Oak	(1) Dense No. 1
10	50d	HC	B	2	Western Hemlock	Oak	
11	50d	HC	B	2	Western Hemlock (1)	Oak	(1) Select Structural No. 1
12	50d	HC	B	2	Engleman Spruce	Oak	
13	50d	HC	B	2	Engleman Spruce (1)	Oak	(1) Select Structural No. 1
14	50d	HC	B	2	Southern Pine	Oak	
15	50d	LC	B	2	Oak	Oak	
16	50d	LC	C	2	Oak	Oak	
17	40d	HC	C	1.5	Oak	Oak	
18	40d	HC	B	1.5	Oak	Oak	
19	40d	LC	C	1.5	Oak	Oak	
20	40d	LC	B	1.5	Oak	Oak	
21	30d	HC	C	1.0	Oak	Oak	

Test Schedule	Nail Size	Nail Material *	Nail Finish *	Floor Penetration *	Test Specimen Material	Floor Material	Remarks
22	30d	LC	C	1.0	Oak	Oak	
23	50d	HC	B	2	Oak	Douglas Fir	
24	50d	HC	C	2	Oak	Douglas Fir	
25	50d	HC	B	2	Oak	Southern Pine	
26	50d	HC	C	2	Oak	Southern Pine	
27	50d	HC	B	2	Oak	Western Hemlock	
28	50d	HC	C	2	Oak	Western Hemlock	
29	50d	HC	B	2	Oak	Engleman Spruce	
30	50d	HC	C	2	Oak	Engleman Spruce	
31	50d	HC	C	2	Oak	Oak	
32	30d	LC	B	1.0	Oak	Oak	
33	30d	HC	B	1.0	Oak	Oak	

* HC - High Carbon Nail - AISI 1040 - Tempered, 42 Rockwell C
LC - Low Carbon Nail
B - Bright
C - Coated
Floor penetration in inches
Additional Nail Characteristics:

Flat Head
Diamond Point
Plain Shank
Nailed Vertically into Lumber

APPENDIX V

APPENDIX 5 -- EQUIPMENT AND INSTRUMENT SPECIFICATIONS.

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD	LINEARITY	OTHER INFORMATION
1. Shock Absorber	Ace Controls, Inc.	S AHS (1-1/2 X 6-1/2)				
2. Load Cell (Ch. #1)	Revere Corp of America	Drawing C-43234	100,000 Lb	1.75±.02% MV/V Input	0 to ± .15% of full load output	Input impedance at 75°F = 750 ± 1OHMS
3. Load Cell (Ch #2)	Ammunition Center					
4. Accelerometers (Ch #3)	Consolidated Electrodynamics	4-202-0001	±50g, 46.98 MV		±0.53% FR	Ser. No. 15280, input Resist.= 341 OHMS
(Ch #4)		4-202-0001				
(Ch #5)		4-202-0001	±50g, 43.06 MV		0.19% FR	Ser. No. 16909, input Resist. = 341OHMS
5. Position Transducer (Ch #6)	Transducer Controls Corp.	PT-101-20A	20 Inch	47.325 MV/V Input	±0.1% Full	Excitation = 15 Volts AC or DC output resistance = 0-500 OHMS
6. Power Supply	Consolidated Electrodynamics	3-140	Voltage, 24 DC current, 200 MA			Regulation, 0.05% no load to full load 0.03%, with a ± 10% line change.
7. Balance Bridge (Universal Signal Conditioning Module)	Consolidated Electrodynamics	8-113-2	Control Bridges up to 1000 OHMS			Compensates for a 10% unbalance of full scale output of bridges.
8. DC Amplifier	Consolidated Electrodynamids	1-168	10 to 500 Volts Accuracy = ± 2% @ DC	Input = 20 MV to 100V Peak, FS (10V) output	±.25% of FS	Output = ± 10 Volts Peak @ 100 Ma
9. FM Record Amplifier	Consolidated Electrodynamics	12-354 B	20 to 27 Ma Peak-to-Peak Square Wave		±0.5% of FS	Input Imped = 10,000 OHMS nominal freq response = DC to 20 KH_z, ±0.5db

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD	LINEARITY	OTHER INFORMATION
10. Magnetic Tape Recorder	Bell & Howell	VR - 3360	1-7/8 to 60 IPS			Accuracy = ± 0.25% @ 60 H_z
11. FM Reproduce Amplifier	Consolidated Electrodynamics	12-357A	± 1.414 V DC (or i V RMS) FS output for ± 40% deviation of carrier center frequency		± 0.5% Terminal	Signal to noise ratio = 55 db Min. Harmonic Distortion = 1% Max. Frequency response = Uniform within 0.6 db
12. Oscillograph	Consolidated Electrodynamics	5-133	Transport Speeds = 0.1 to 160 IPS Max writing speed = 90,000 IPS			Timing intervals, 0.001 Sec to 10.0 Sec, 10th line accented
13. Magnetic Tape	Ampex	746-57G111	1 In X 3600 Ft	+ 1 db ± 1		Sig. to DC Noise - 62 db $^{+3}_{-\infty}$ Max input level distortion = 3.5% + 0.3, - No limit Signal transfer - 46 db
14. Computer	Texas Instruments	960A	Execution Time Load, 3.3 Micro Sec Store, 3.6 " " Add, 3.6 " "			32 Bit Instruction Word 16 Bit Data Word Internal Storage = Up to 32,768 Words Memory Cycle = 750 Nan - seconds
15. Tape Transport	Texas Instruments	979	Tape Velocity 15 - 45 IPS	Long Term, ± 2% Short Term, ∓ 3%		Start Time, 10 MS Stop Time, 10 MS Start Distance, 0.190 Inches Stop Distance, 0.220 Inches
16. Electronic Data Terminal	Texas Instruments	Silent 700 733-ASR	Transmit, Receive, Print, Play Back (From Tape), and Record on Tape the ASC11 Code and Character Set at Speeds of 10, 15, or 30 Characters Per Second.			

INSTRUMENT OR EQUIPMENT	MANUFACTURER	MODEL NUMBER	RATED FULL SCALE OUTPUT	SENSITIVITY OR CHANGE IN OUTPUT NO LOAD TO FULL LOAD	LINEARITY	OTHER INFORMATION
17. Magnetic Tape Recorder (Computer Room)	Honeywell	5600 C	15/16 to 60 IPS			Speed Accuracy Within 0.15% of Selected Speed
18. A/D Converter	Texas Instruments	For 960A Computer RTP 7460/20	Input Voltage Ranges, $\pm$ 4.096, $\pm$ 5.12, $\pm$ 10.24		$\pm$ 0.02% of FS	Accuracy, $\pm$ 0.05% of Full Scale Channel Rate, up to 20,000 Samples/Sec (includes A/D Conversion Time)
19. Industrial Radiographic X-Ray Apparatus	For Dept of the Army	FSN 6635-179-4322 & 6635-179-4321	300 KV at 3.0 Ma			Timer 0 - 5 Minutes, Auto Reset X-Ray Field Coverage = 44°
20. Radiographic Paper and Developer Assembly	Banner Metals, Inc.	FSN 6525-930-3274				Film Developing Time: 3000 X Film Packet = 10 Sec TLX Film Packet = 45 Sec
21. Moisture Detector Solid State	Delmhorst Instrument	RC - IC	Ranges 5-12%, 12-20 %, 20 - Saturation Point			Accuracy = Within 0.5% on Range
22. Optical Velocity Sensor	MTS Systems Inc.	VS 2000	200 Milliseconds			System Accuracy; 10 Microseconds