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Test Methods for Evaluating Mechanical Properties of Waferboard: A Preliminary Study

by

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ABSTRACT

Results of a preliminary study of test methods for evaluating mechanical properties of 11.1 mm (7/16") waferboard are presented. Waferboard properties are compared with properties obtained from identical tests on 9.5 mm (3/8") unsanded western white spruce plywood.

Detailed computer programs used to analyze the data and the computer output of all test results and statistical quantitites are presented.

The tests included small scale flexure tests, compression tests, bond tests, large scale post flexure tests and concentrated load tests. In addition, specific gravity and moisture content values were obtained.

The properties determined include modulus of rupture, modulus of elasticity, ultimate compressive stress, stiffness (EI), and ultimate bond stress.

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1. INTRODUCTION

1.1 General

In the spring of 1981 the Forest Products Working Group of the Alberta Research Council expressed interest in evaluating structural testing procedures for determining the mechanical properties of waferboard. As a result, this project was initiated as a preliminary study.

1.2 Scope

The primary purpose of the test program was to assess test methods for determining various mechanical properties of waferboard. To provide a basis of comparison identical tests were performed on plywood. The waferboard tested was 11.1 mm (7/16 inch) thick and was manufactured by Weldwood of Canada, Ltd. in Slave Lake. The plywood tested was 9.5 mm (3/8") unsanded sheeting grade plywood made from western white spruce, and manufactured by Zeidler Forest Industries Ltd. of Edmonton.

The choice of thickness was based on Table 9.23.15.A of the 1980 National Building Code of Canada which states that 9.5 mm plywood and 11.1 mm waferboard can be used interchangeably as roof sheathing for joists at 400 mm on centre without edge support, or for joists at 600 mm on centre with edge support.

The following tests were performed:

1. Small scale flexural tests (CSA Standard CAN3-

0188.0-M78, Section 6.6)

2. Small scale compression tests (Longworth, J., "Moisture-Strength Relations for Sheathing Grade Douglas Fir Plywood", Department of Civil Engineering, The University of Alberta, 1974)
3. Bond tests (CSA Standard CAN3-0188.0-M78, Section 6.7)
4. Post flexural tests (ASTM D 3043-72, Section 7)
5. Concentrated load tests on panels (ASTM E661)

In addition specific gravity and moisture content values were obtained. The number of individual tests was limited by the time available. Therefore values obtained for the various mechanical properties are not necessarily definitive values.

2. TEST PROGRAM

The following is an outline of the test procedures and equipment employed in various tests to determine mechanical properties of waferboard and plywood. Some of the test procedures used in this pilot program could be modified to increase the efficiency in testing large numbers of specimens.

2.1 Small Scale Tests

Specimens for the small scale tests were taken from ten 1200 mm x 2400 mm (4' x 8') sheets of 11.1 mm (7/16") waferboard and ten 1200 mm x 2400 mm sheets of 9.5 mm (3/8") unsanded spruce plywood. Each sheet was divided laterally into three parts, and equal numbers of samples for various tests were cut from each part.

The 880 kN capacity Baldwin universal testing machine located in the Civil Engineering building was used in all the small scale load tests.

2.1.1 Small Scale Flexural Tests

The procedure described in Section 6.6 of CSA Standard CAN3-0188.0-M78 was used for the small scale flexural tests.

2.1.1.1 Selection of Specimens

Four flexure specimens were cut from each of the three parts, for a total of twelve specimens per panel. Of the four per part, two were cut parallel and two were cut perpendicular to the longitudinal axis of the panel. Of these, one half were tested with the trademark on the tension side and one half were tested with the trademark on the compression side.

2.1.1.2 <u>Preparation of Specimens</u>

(i) The specimens were cut to a width of 75 mm and a length of 300 mm.

(ii) The specimens were labelled.

(iii) The thickness was measured at three points across the midspan of the specimen. Three width measurements were also taken, one at either end and one at the centre of the specimen. The average values for the width and thickness were used in calculations of modulus of rupture (M.O.R.) and modulus of elasticity (M.O.E.). All measurements were taken with calipers having an accuracy of ± 0.01 mm.

2.1.1.3 <u>Equipment</u>

The supports and centre loading block used in the test conformed to Figure 1 of Section 6.6 in CAN3-0188.0-M78. Load was applied by the Baldwin universal testing machine and load versus deflection curves were directly plotted by means of an x-y plotter.

2.1.1.4 <u>Test Procedure</u>

(i) The span of the support frame was set to 24t where t is the nominal specimen thickness in mm.

(ii) The specimen was placed on the support frame such that load was applied at mid-span. See Figure 1 on page 19.

(iii) The linear variable differential transducer (LVDT), which activated the x axis movement (displacement) of the x-y plotter, was placed under the specimen at mid-span as shown in Plate 1 on page 22. The y axis movement (load) was activated by the Baldwin machine.

(iv) The Baldwin machine was set to the low load range. Load was applied at a rate of 0.48 t mm/min.

(v) The specimen was loaded to failure and the value of the ultimate load was read from the machine scale and recorded.

2.1.1.5 Results

The results of the small scale flexure tests are recorded in Tables 1.1, 1.2 and 1.3 on pages 34 and 35. See Appendix C for the method of calculation.

2.1.2 Compression Tests

For the small scale compression tests, the procedure followed was that described in the following report: Longworth, J.: "Moisture-Strength Relations for Sheathing Grade Douglas Fir Plywood." Department of Civil Engineering, The University of Alberta, 1974.

2.1.2.1 Selection of Specimens

Two compression specimens were cut from each of the three parts of each panel, for a total of six compression specimens per panel. Of the two samples per part, one was cut parallel and one was cut perpendicular to the longitudinal axis of the panel.

2.1.2.2 Preparation of Specimens

(i) The specimens were cut to a width of 190.5 mm (7.5") and a length of 381 mm (15").

(ii) The specimens were labelled.

(iii) a) Prior to testing the waferboard specimens, six thickness measurements were taken, one at each corner, and two at midspan of the specimen. Calipers with an accuracy of ± 0.01 mm were used for these measurements. The average of these values was used in calculations.

Two length and width measurements were taken, to an accuracy of ± 0.5 mm using a steel scale. The averages were used in calculations.

(b) Prior to testing the plywood specimens, all of the measurements taken for waferboard were taken, and in addition, measurements of parallel ply thickness were taken. For specimens cut parallel to the longitudinal axis of the panel, the thickness of the two outer plies was measured at each of the four corners. The average was used in calculations. For specimens cut perpendicular to the longitudinal axis of the panel, the thickness of the inside ply was measured at each of the four corners and the average value was used in calculations. All thickness measurements were taken to ± 0.01 mm with calipers.

2.1.2.3 Equipment

The frame described in the above mentioned report was used for supporting the specimens. The load was applied by the Baldwin machine and load versus deflection curves were plotted directly on an x-y plotter.

2.1.2.4 Test Procedure

(i) The loading frame was positioned under the loading head.

(ii) The specimen was placed in the loading frame and the edge supports and third-point rollers were tightened. Care was taken to avoid overtightening as this would affect the failure location. See Figure 2 on page 19.

(iii) The loading head of the frame was checked to ensure that it did not bind on the edge supports of the frame.

(iv) The LVDT, attached to the x-y plotter, was positioned such that it measured the vertical movement of the loading head as shown in Plate 2 on page 22.

(v) The Baldwin machine was set to the medium load range. Load was applied at a constant strain rate of 1.14 mm/min. (0.045 in./min.).

(vi) The specimen was loaded to failure and the value of the ultimate load was read from the machine scale and recorded.

2.1.2.5 Results

Tables 2.1, 2.2 and 2.3 on pages 36 and 37 list the results of the small scale compression tests. See Appendix C for method of calculation.

2.1.3 Bond Tests

Small scale bond tests were conducted in accordance with Section 6.7 of CSA Standard CAN3-0188.0-M78. Although this is not the standard procedure for testing plywood in bond, the plywood specimens were tested in the same manner as the waferboard specimens to provide a basis for comparison of results.

2.1.3.1 Selection of Specimens

Two bond specimens were cut from each of the three parts of each panel, resulting in a total of six specimens per panel.

2.1.3.2 Preparation of Specimens

(i) The specimens were cut to 50 mm x 50 mm (± 0.2 mm).

(ii) The specimens were labelled.

(iii) The length of each of the four sides was measured to ± 0.01 mm using calipers.

(iv) The specimens were glued to the aluminum loading blocks with Sikadur Gel, a two component epoxy-resin. Although a three day curing period is recommended, the ten hour strength proved to be sufficient.

2.1.3.3 Equipment

Loading blocks and rod attachments as illustrated in Figure 2 of Section 6.7 of CSA Standard CAN3-0188.0-M78 were used. Specimens were tested in the Baldwin machine. See Figure 3 on page 20.

2.1.3.4 Test Procedure

(i) The assembly, consisting of the specimens, loading blocks, and attachment rods, was placed in the testing machine as shown in Plate 3 on page 23.

(ii) The Baldwin machine was set to the low load range. Load was applied at a rate of 0.08 t mm/min.

(iii) The specimen was loaded to failure and the value of the ultimate load was read from the machine scale and recorded. A qualitative description of the failure was also recorded.

2.1.3.5 Results

The results of the bond tests are given in Tables 3.1, 3.2 and 3.3 on pages 38 and 39. See Appendix C for method of calculation.

2.1.4 Specific Gravity and Moisture Content Tests

The specific gravity and moisture content tests conformed with Section 6.5 of CSA Standard CAN3-0188.0-M78.

2.1.4.1 Selection of Samples

Specific gravity and moisture content samples were cut from every fourth failed flexure test specimen, thus three samples were taken from each panel.

2.1.4.2 Preparation of Samples and Test Procedure

(i) The samples were cut to approximately 75 mm x 75 mm.

(ii) The length of each of the four sides, and two thickness measurements were taken using calipers with an accuracy of ± 0.01 mm.

(iii) The samples were weighed.

(iv) The samples were placed in an oven at 105°C for 24 hours.

(v) The samples were weighed again.

2.1.4.3 Results

The results of the specific gravity and moisture content tests are tabulated in Tables 4.1, 4.2 and 4.3 on pages 39 and 40. See Appendix C for method of calculation.

2.2 Large Scale Tests

2.2.1 Post Flexure Tests

The large scale post flexure tests were performed in the laboratory of the Council of Forest Industries in Vancouver in accordance with test method C of Section 7 of ASTM D 3043-72.

2.2.1.1 Selection of Specimens

Twenty panels each of waferboard and plywood were tested. Each panel was cut in two, resulting in forty waferboard specimens and forty plywood specimens. For each panel, one half was tested parallel, and the other half was tested perpendicular to the longitudinal axis of the panel. Also, half of the specimens were tested with the trademark on the tension side and half were tested with the trademark on the compression side.

2.2.1.2 Preparation of Specimens

(i) The full size panels were cut into square halves and trimmed to metric dimensions (1200 mm x 1200 mm).

(ii) The longitudinal direction was marked on each half, with one half labelled to be tested parallel, and the other half labelled to be tested perpendicular to this mark.

(iii) For the plywood specimens, the thickness of each ply was measured, and for the waferboard specimens, the overall thickness was measured. Because the laboratory saw cut produced a sharper edge than the factory saw cut, the thickness measurements were taken along an edge that had been sawn in the laboratory and at the intersection of the central axis about which bending was applied.

2.2.1.3 Equipment

The testing equipment conformed to ASTM D 3043-72, and was designed for the specific purpose of testing large scale plywood specimens in pure flexure. See Figure 4 on page 20. A LVDT was placed at the centre of each sample and load versus deflection curves were plotted directly by an x-y plotter.

2.2.1.4 Test Procedure

(i) The specimen was placed between the loading bars of the test machine as shown in Plate 4 on page 24.

(ii) The frame holding the LVDT in place was attached at the centre of the specimen and the LVDT was secured in the frame as shown in Plate 5 on page 24. The LVDT measured deflection over a span of 406 mm (16").

(iii) The load was applied.

(iv) To avoid damage, the LVDT and frame were removed from the specimen before failure.

(v) The specimen was loaded to failure and the ultimate load and time required to fail the specimen were recorded.

2.2.1.5 Results

Results of these tests are recorded in Tables 5.1, 5.2 and 5.3 on pages 41 and 42. See Appendix C for method of calculation.

2.2.2 Specific Gravity and Moisture Content Tests

The moisture content tests conformed to Section 8.1 of ASTM D3043. The specific gravity tests conformed to Section 8.2.2 of ASTM D2395.

2.2.2.1 Selection of Samples

After flexural testing, a specific gravity and moisture content sample was taken from each of the failed specimens.

2.2.2.2 Preparation of Samples and Test Procedure

(i) The samples were cut to 100 mm x 100 mm.

(ii) The samples were weighed.

(iii) The samples were oven dried at 103°C ± 2°C until weight was constant within ± 2%.

(iv) The samples were weighed again and the moisture content calculated.

(v) The samples were immersed in paraffin to seal the pores in accordance with Section 8.2.5 of ASTM D2395.

(vi) The weight of a container of water was measured.

(vii) The sample was submerged in the water by holding it down with a sharp, slender rod.

(viii) The container with the water and sample was weighed again, and the additional weight was recorded as the weight of water displaced. This was used to determine the volume of the specimen on the basis of which the specific gravity was calculated.

2.2.2.3 <u>Results</u>

The results of these tests are recorded in Tables 6.1, 6.2 and 6.3 on pages 44 and 45. See Appendix C for method of calculation.

2.2.3 <u>Concentrated Load Tests</u>

The concentrated load tests were performed in accordance with ASTM E661. The purpose of these tests was to simulate conditions of actual use.

2.2.3.1 <u>Selection of Specimens</u>

For the concentrated load tests, ten sheets of waferboard and six sheets of plywood were tested. Eight tests were performed per panel. Of these, four were performed along a free edge and are classified as unsupported, and four were performed along an edge supported by an aluminum H-clip and are classified as partially supported. Half of the tests were located in one of the centre spans and are referred to as interior tests, and half of the tests were located in one of the edge spans and are referred to as exterior tests. See Figure 5 on page 24.

2.2.3.2 Preparation of Specimens

(i) Each full-size panel was weighed.

(ii) The panels were cut in half longitudinally.

(iii) The specimens were labelled.

(iv) The thickness of each specimen was measured at the midpoint of one of the longitudinal edges.

2.2.3.3 Equipment

A steel loading frame made up of hollow structural steel (H.S.S.) sections, channels, and angles was used to support five 38 mm x 184 mm (2" x 8") joists spaced at 600 mm (24") on centre as shown in Plate 6 on page 25. Wood wedges were wedged between the joists and the vertical legs of the angles to prevent lateral movement of the joists. The H-clips used were 9.5 mm (3/8") in depth for the plywood panels and 11.1 mm (7/16") in depth for the waferboard specimens. The manufacturer of the H-clips is Plateau Manufacturing of Calgary.

A hand operated pump was used to apply the load through an 90 kN jack, to which was attached a 76.2 mm (3") diameter loading disk. A 18 kN capacity load cell was used to measure the load, and a dial gage was used to measure the deflection. The deflection dial gage was mounted on a tripod seated over the framing members adjacent to the load as shown in Plate 8 on page 26. Thus deflection of the load point was measured relative to the joist. Both load and deflection readings were recorded manually.

2.2.3.4 <u>Test Procedure</u>

(i) The two halves of one panel were placed on the joists with the longitudinal direction of the panel perpendicular to the joists.

(ii) One half of the panel was nailed to the joists using 57 mm (2 1/4"), double headed nails. The nail spacing used on the two outer joists was 152.4 mm (6"). On the three inner joists, 304.8 mm (12") spacing was used. The end distance was equal to one-half the nail spacing.

(iii) H-clips were placed between the two halves at midspans.

(iv) The second half panel was positioned with a 2 mm gap relative to the first half and then nailed to the joists as shown in Plate 7 on page 25.

(v) The load points were marked on the panels.

(vi) The cross beam was lined up with the test locations and clamped in place.

(vii) The jack was positioned directly over a test location and a small preload was applied to hold the jack in place.

(viii) The support tripod was positioned along the adjacent joist and the deflection gage was set in place.

(ix) Initial load and deflection readings were taken.

(x) Load was then applied and deflection readings were taken at 222.4 N (50 lb.) increments from 222.4 N to 889.6 N (200 lb.).

(xi) The load was removed and the deflection gage was removed to avoid damage.

(xii) The load was reapplied to failure as shown in Plate 9 on page 26 and the ultimate load was recorded. The mode of failure and failure load for the H-clips was also recorded.

(xiii) After the load had been applied to all test locations for the panel, the panel was removed and replaced with a new test panel. This panel was placed 13 mm (1/2") further along the joists than the previous one to assure nails would clear the previous nail holes. When the full length of the joists was used up, the joists were turned over and further tests were conducted.

2.2.3.5 Results

The results of the concentrated load tests are recorded in Tables 7.1, 7.2 and 7.3 on pages 46 and 47. See Appendix C for method of calculation.

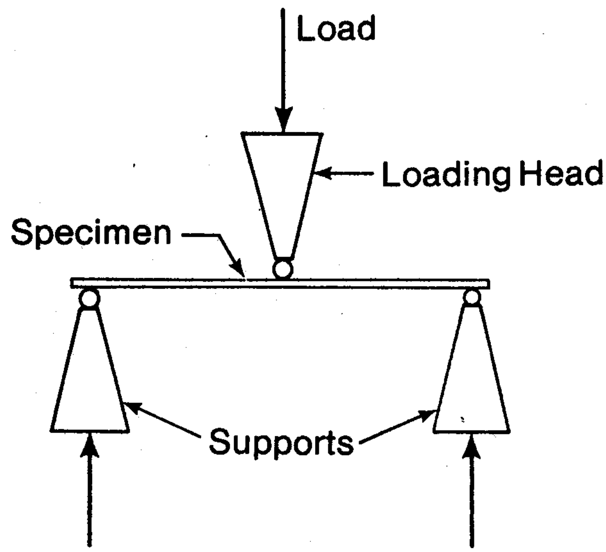


Figure 1. Schematic Diagram of Small Scale Flexure Test Apparatus

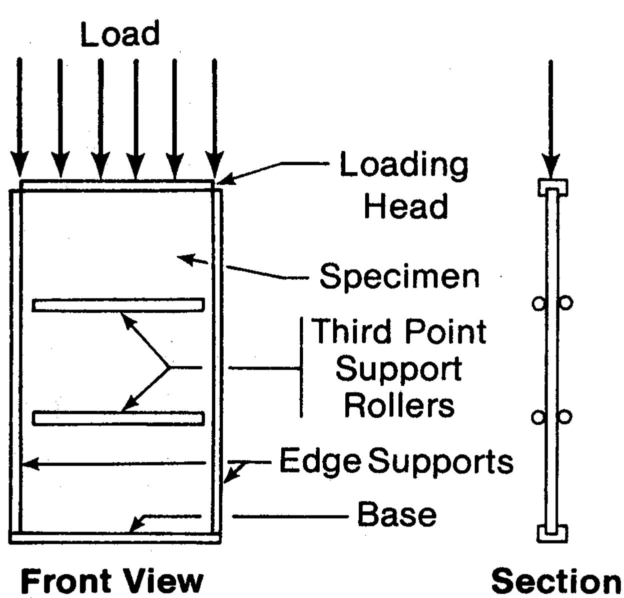


Figure 2. Schematic Diagram of Small Scale Compression Test Apparatus

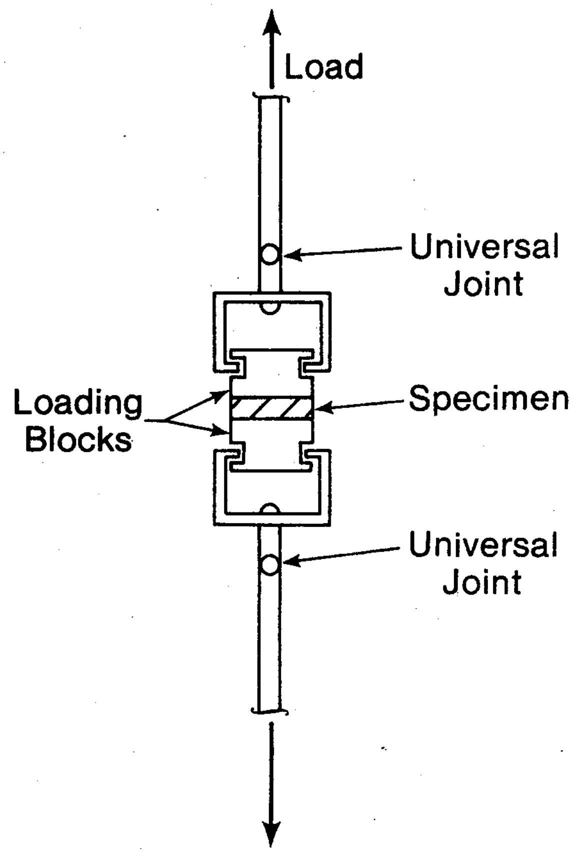


Figure 3. Schematic Diagram of Bond Test Apparatus

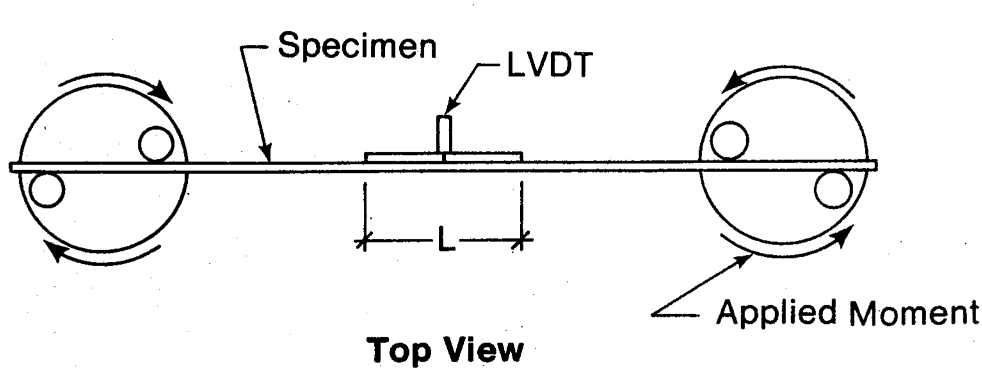


Figure 4. Schematic Diagram of Large Scale Post Flexure Test Apparatus

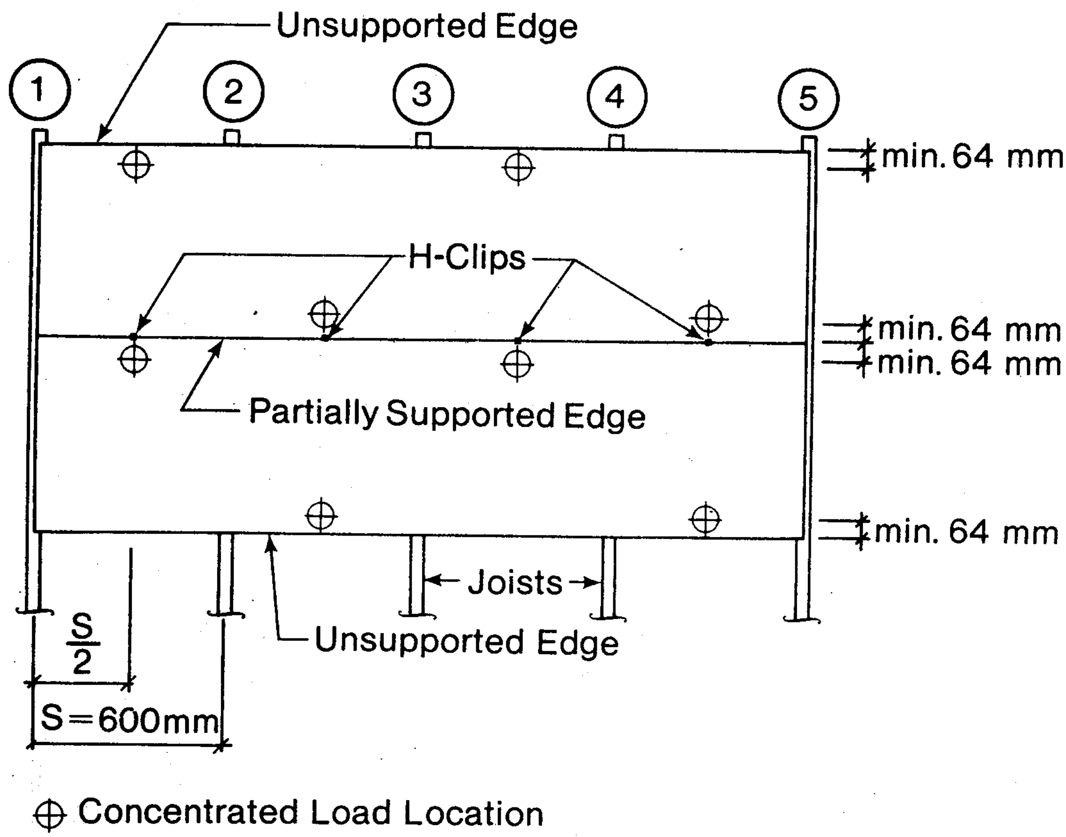


Figure 5. Location of Concentrated Load Tests

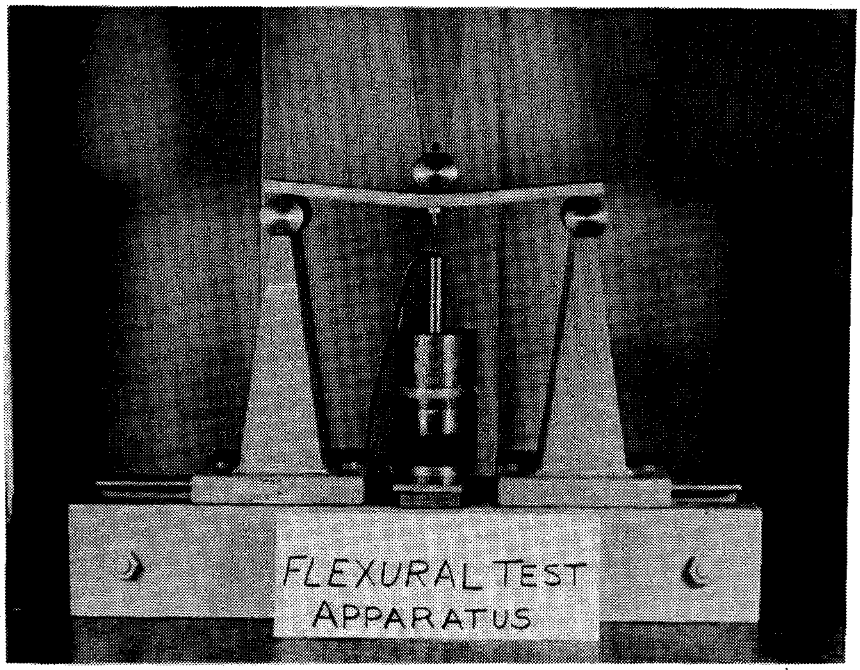


Plate 1. Flexural Test apparatus

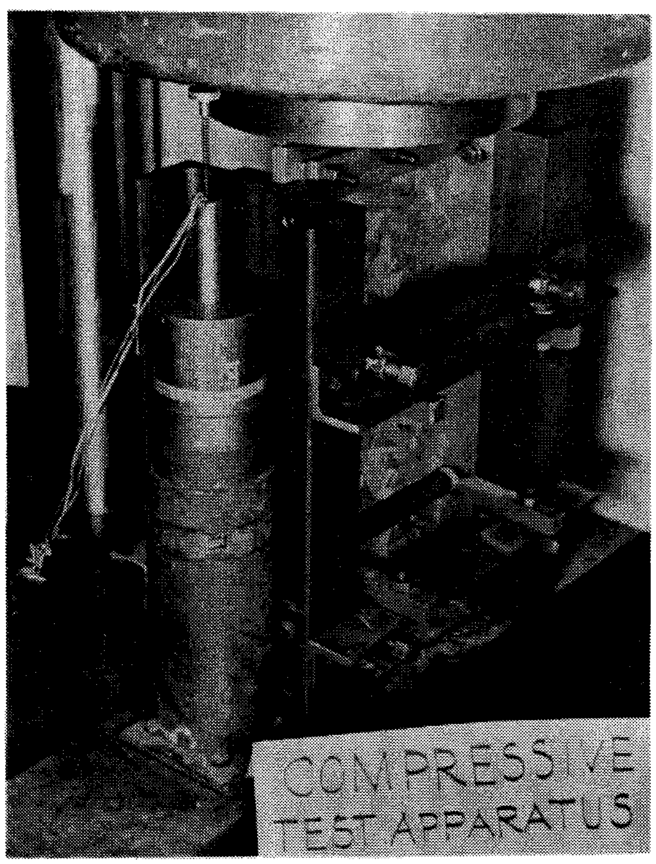


Plate 2. Compressive Test Apparatus

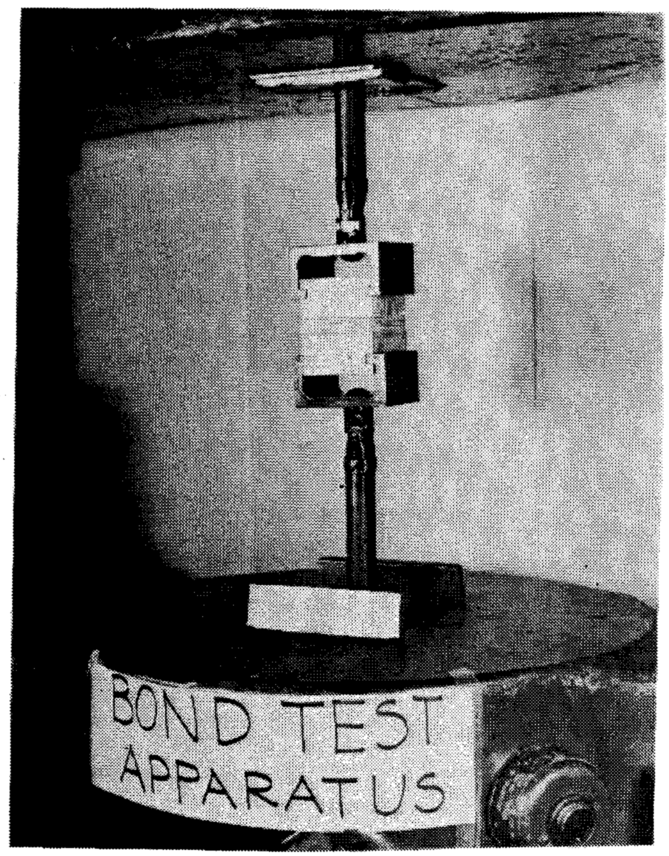


Plate 3. Bond Test Apparatus

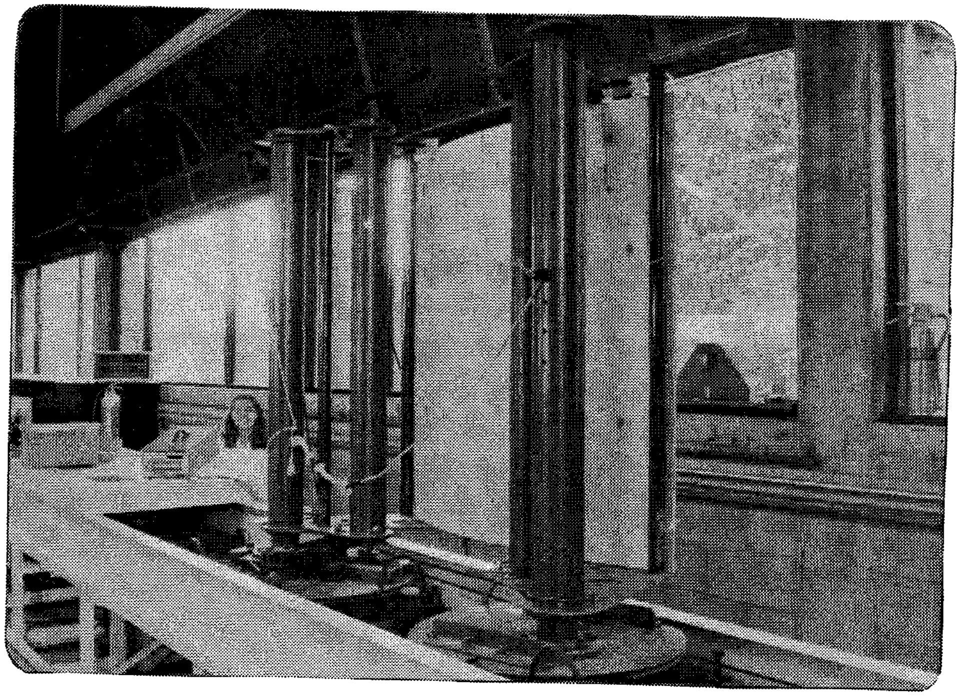


Plate 4. Large Scale Flexural Test

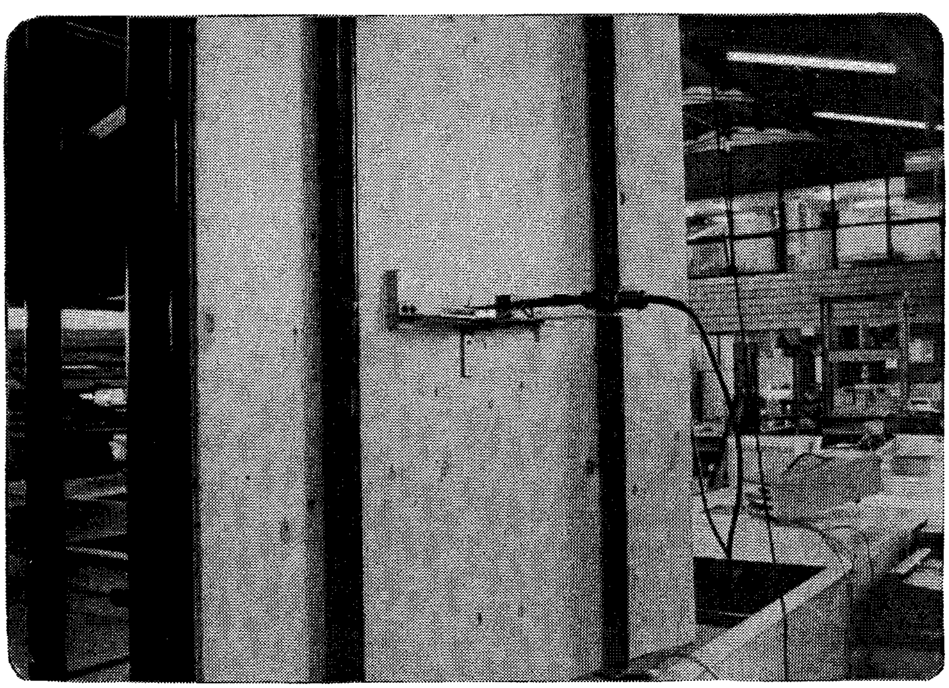


Plate 5. LVDT used in the Large Scale Flexure Tests

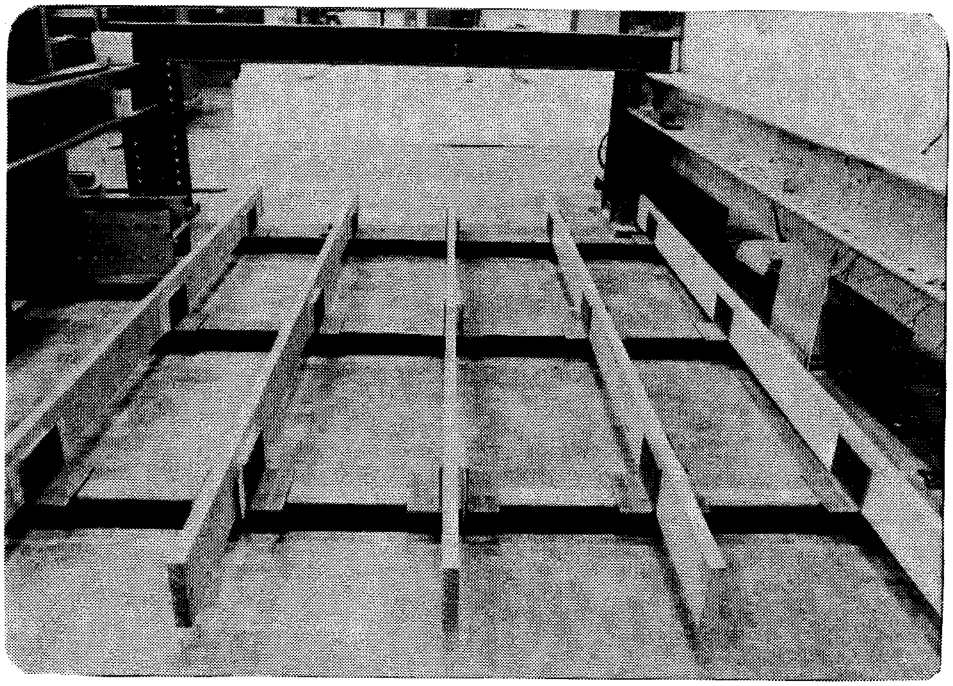


Plate 6. Steel Frame and Wood Joists used for the Concentrated Load Tests

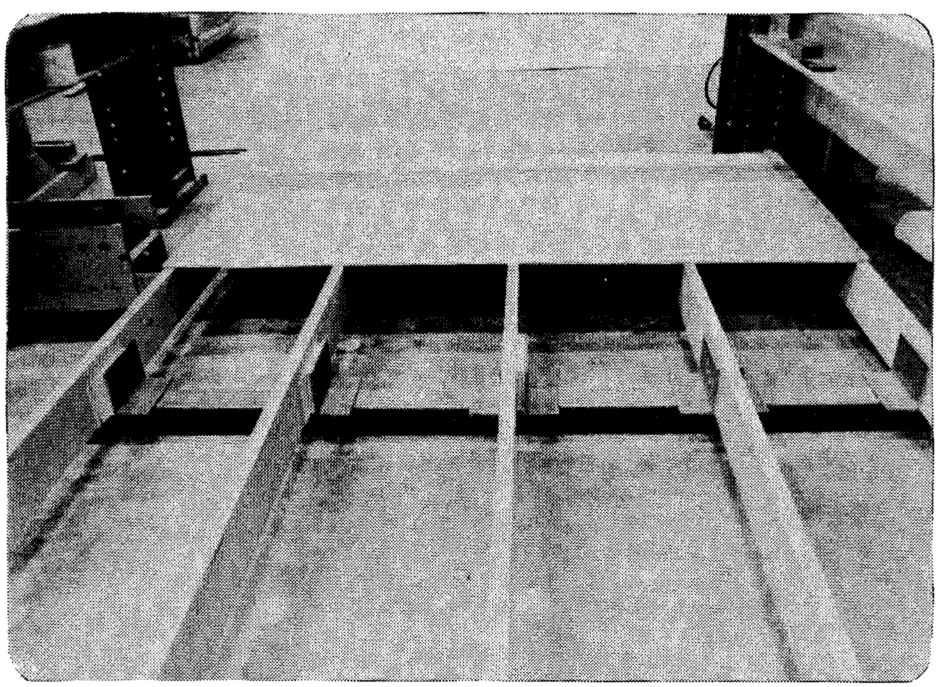


Plate 7. Concentrated Load Test Panel nailed in place on the joists.

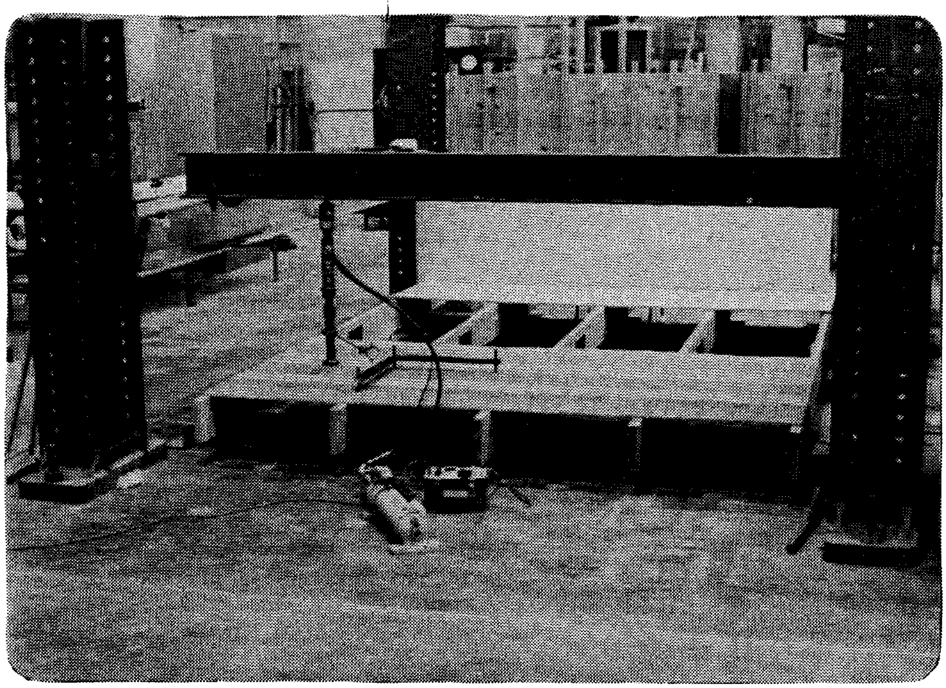


Plate 8. Concentrated Load Test Apparatus

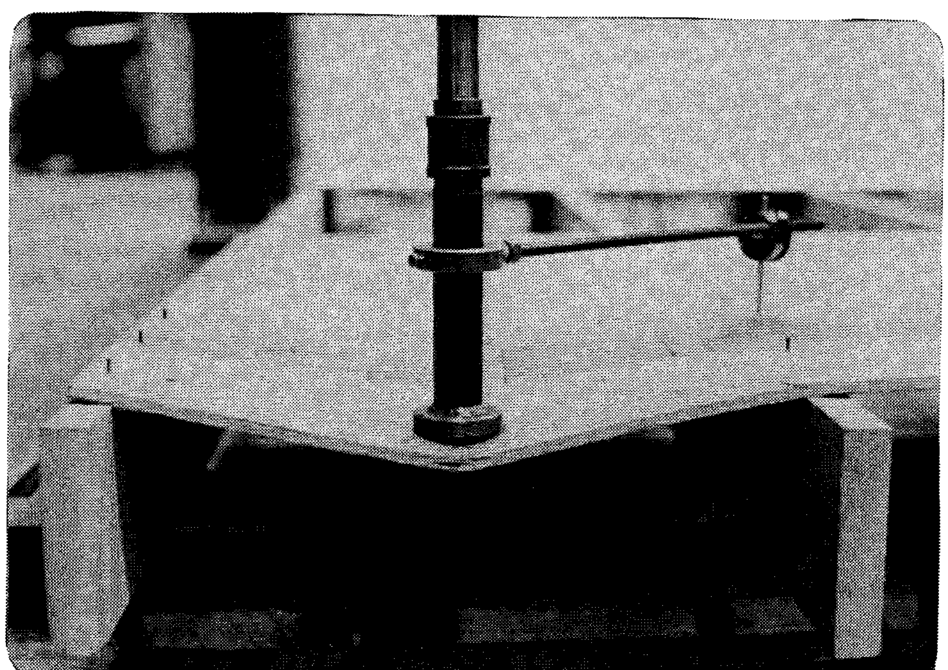


Plate 9. Concentrated Load Test Failure for Waferboard

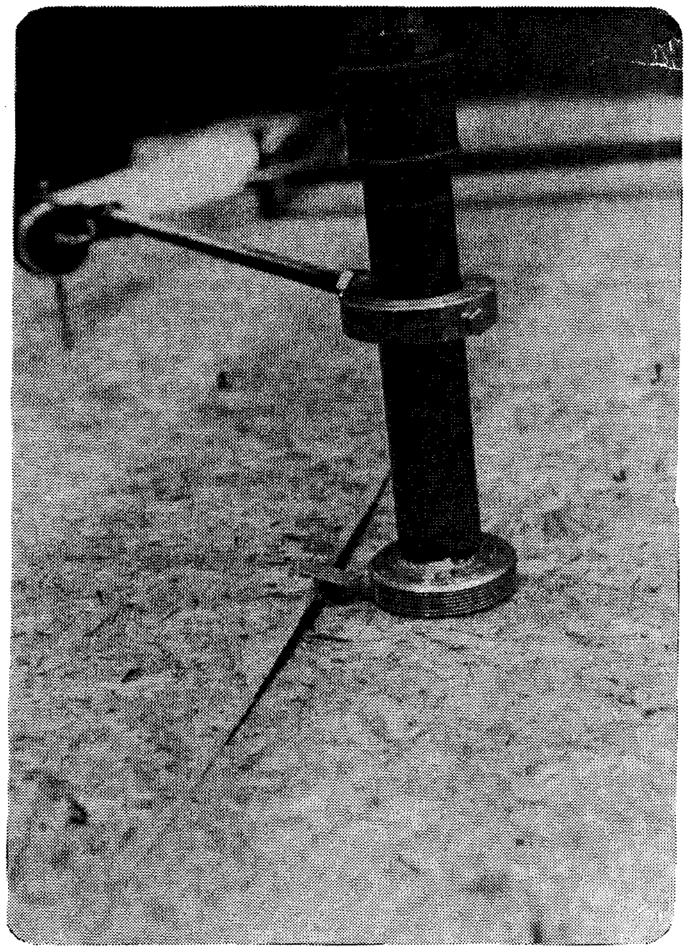


Plate 10. Concentrated Load Test. H-clip Shear Failure

3. DISCUSSION OF RESULTS

This section includes tables summarizing the results of all tests and tables comparing results of plywood and waferboard tests.

3.1 Small Scale Tests

3.1.1 Small Scale Flexural Tests

The Baldwin testing machine was not sensitive enough to measure very small loads. As a result, no tests were performed on plywood specimens cut perpendicular to the longitudinal panel axis.

For plywood, there was little difference in test results between specimens tested with the trademark side in tension and those tested with the trademark side in compression.

For waferboard, there was no significant difference in properties between specimens tested parallel and those tested perpendicular to the longitudinal axis of the panel, or between specimens tested with the trademark on the compression side and those tested with the trademark on the tension side.

3.1.2 Compression Tests

For the plywood, the values for ultimate compressive stress and modulus of elasticity, based on gross area, were significantly greater for the specimens cut parallel to the longitudinal axis of the panel than for those cut perpendicular to the longitudinal axis of the panel. The results for the waferboard specimens indicate no significant change in properties with direction. As a result, for specimens tested parallel, the stress and modulus of elasticity were greater for plywood, and for specimens tested perpendicular, the stress and modulus of elasticity were greater for waferboard.

3.1.3 Bond Tests

In all bond tests the percentage wood failure was estimated. Failures ranged from 100% wood failure to 100% glue failure. For the plywood specimens it was estimated that, on average there was approximately 40% wood failure. For the waferboard specimens, it was estimated that, on average there was approximately 30% wood failure.

3.2 Large Scale Tests

3.2.1 Large Scale Flexural Tests

The stiffness, modulus of elasticity, ultimate moment, and modulus of rupture for plywood specimens tested parallel to the longitudinal panel axis were significantly higher than for plywood specimens tested perpendicular to the longitudinal panel axis. For the waferboard, there was no significant change in properties with direction. As a result, the values for specimens tested parallel to the longitudinal panel axis were higher for plywood, and the values for specimens tested perpendicular to the longitudinal panel axis were higher for waferboard. For both plywood and waferboard, there was no significant change in properties between panels tested with the trademark side in tension and panels tested with the trademark side in compression.

3.2.2 Concentrated Load Tests

The ultimate load and the deflection at an 890 N (200 lb.) load were greater for plywood than for waferboard for all test locations.

For plywood, the ultimate load was greater and the deflection was less for interior load locations and at locations partially supported with H-clips than for exterior or unsupported load locations.

For waferboard, the same was true for interior load locations compared to exterior load locations. For partially supported load locations, the ultimate load and deflection were both less than for unsupported load locations.

The 11.1 mm (7/16") aluminum H-clips fitted very tightly on the waferboard specimens and 80% of them failed in shear as shown in Plate 10 on page 27. The 9.5 mm (3/8") aluminum H-clips fitted loosely on the plywood specimens and all of them failed by sliding out as the panel deflected at the point of the load application. For the waferboard, the slight impact load due to the shear failure of the H-clips may have resulted in the decrease in ultimate load for partially supported as compared with unsupported load locations.

The waferboard results showed no significant increase in ultimate load for interior or continuous span test locations as compared with exterior or non-continuous span test locations. This may be due to the localized nature of the failure in waferboard which does not allow effective distribution of stresses to adjacent spans. At failure, the wood flakes appeared to slide over one another at the location of the load as shown in Plate 9 on page 26.

Key to Tables

The following is an explanation of the terms and symbols used in the tables.

- number of specimens or samples tested

Parallel (//) - refers to specimens cut parallel to the longitudinal axis of the panel

Perpendicular (⊥) - refers to specimens cut perpendicular to the longitudinal axis of the panel

Up (U) - refers to specimens tested with the trademark on the tension side

Down (D) - refers to specimens tested with the trademark on the compression side

Supported - load location with H-clips

Unsupported - load location without H-clips

Interior - load location with a continuous span on both sides

Exterior - load location with a continuous span on one side only

Metric Unit Conversion Factors

1 mm = 0.0393701 inch

1 m = 3.28084 ft.

1 N = 0.224809 lbf

1 kN = 224.809 lbf

1 N•m = 0.737562 lbf•ft.

1 N•m^2 = 2.41982 lbf•$ft.^2$

1 kPa = 0.145038 psi

1 MPa = 145.038 psi

1 GPa = 145038 psi

Small Scale Flexural Test Results

Table 1.1 9.5 mm (3/8") Plywood

Moisture Content = 7.0% (see Table 4.1)

Property	#	MOE (GPa)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	60	7.56	5.79	58.4	36.8
Parallel & Up	30	7.50	5.56	59.2	37.5
Parallel & Down	30	7.62	6.00	57.7	35.8

Table 1.2 11.1 mm (7/16") Waferboard

Moisture Content = 4.9% (See Table 4.2)

Property	#	MOE (GPa)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	55	3.61	2.48	19.3	12.3
Parallel & Up	27	3.68	2.45	18.9	11.4
Parallel & Down	28	3.53	2.50	19.7	28.9

Note: All values are calculated on the basis of gross cross-sectional area.

Small Scale Flexural Test Ratios

Table 1.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

Property	MOE Ratio Average	MOE Ratio 5% Exclusion Limit	MOR Ratio Average	MOR Ratio 5% Exclusion Limit
Plywood / Waferboard	2.10	2.35	3.09	3.01
// Plywood / // Waferboard	2.09	2.33	3.02	2.99
⊥ Plywood / ⊥ Waferboard	< 1	< 1	< 1	< 1
PLYWOOD				
// U Plywood / // D Plywood	0.98	0.93	1.03	1.05
WAFERBOARD				
// Waferboard / ⊥ Waferboard	1.01	1.01	1.05	1.00
// U Waferboard / // D Waferboard	1.04	0.98	0.96	0.87
⊥ U Waferboard / ⊥ D Waferboard	1.04	1.07	1.02	0.92

Note: All values are calculated on the basis of gross cross-sectional area.

Small Scale Compression Test Results

Table 2.1 9.5 mm (3/8") Plywood

Moisture Content = 7.0% (see Table 4.1)

Property	#	Ultimate Load (kN)		Ultimate Compressive Stress (MPa)		MOE (GPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	30	42.0	35.2	23.4	19.8	4.31	3.78
All Perpendicular	30	20.8	16.7	11.6	9.38	1.85	1.38

Table 2.2 11.1 mm (7/16") Waferboard

Moisture Content = 4.9% (See Table 4.2)

Property	#	Ultimate Load (kN)		Ultimate Compressive Stress (MPa)		MOE (GPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	30	27.9	23.1	12.9	10.7	2.57	2.13
All Perpendicular	29	28.1	22.8	13.1	10.6	2.50	2.17

Note: All values are calculated on the basis of gross cross-sectional area.

Small Scale Compression Test Ratios

Table 2.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

Property	Ultimate Load Ratio		Ultimate Compressive Stress Ratio		MOE Ratio	
	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
// Plywood / // Waferboard	1.51	1.53	1.82	1.84	1.67	1.78
⊥ Plywood / ⊥ Waferboard	0.74	0.73	0.89	0.89	0.74	0.64
PLYWOOD						
// Plywood / ⊥ Plywood	2.02	2.11	2.01	2.11	2.33	2.74
WAFERBOARD						
// Waferboard / ⊥ Waferboard	0.99	1.01	0.98	0.98	1.03	1.02

Note: All values are calculated on the basis of gross cross-sectional area.

Bond Test Results

Table 3.1 9.5 mm (3/8") Plywood

Moisture Content = 7.0% (See Table 4.1)

Property / Type of Test	#	Ultimate Load (N) Average	Ultimate Load (N) 5% Exclusion Limit	Stress (kPa) Average	Stress (kPa) 5% Exclusion Limit
Overall Results	57	2220	625	881	248
Panel #1	6	3140	2040	1250	812
Panel #2	5	2570	1180	1020	470
Panel #3	6	1550	10	617	2.8
Panel #4	5	2010	1170	797	464
Panel #5	6	2080	616	823	244
Panel #6	6	2310	1240	916	492
Panel #7	5	1930	877	766	348
Panel #8	6	1830	907	725	359
Panel #9	6	2800	1670	1110	664
Panel #10	6	1970	658	780	263

Table 3.2 11.1 mm (7/16") Waferboard

Moisture Content = 4.9% (See Table 4.2)

Property / Type of Test	#	Ultimate Load (N) Average	Ultimate Load (N) 5% Exclusion Limit	Stress (kPa) Average	Stress (kPa) 5% Exclusion Limit
Overall Results	58	1250	813	496	290
Panel #1	6	1140	889	452	352
Panel #2	5	1450	1120	571	437
Panel #3	6	1240	524	493	208
Panel #4	6	1160	870	461	345
Panel #5	6	1220	953	482	378
Panel #6	6	1360	1250	539	495
Panel #7	6	1220	964	481	382
Panel #8	6	1260	1060	497	418
Panel #9	5	1260	1040	499	403
Panel #10	6	1260	826	499	327

Bond Test Ratios

Table 3.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

Property	Stress Ratio	
	Average	5% Exclusion Limit
Plywood / Waferboard	1.78	0.86

Specific Gravity and Moisture Content (Edmonton)

Table 4.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

Property	Specific Gravity Ratio		Moisture Content Ratio	
	Average	5% Exclusion Limit	Average	5% Exclusion Limit
Plywood / Waferboard	0.65	0.66	1.43	1.40

Specific Gravity and Moisture Content Test Results (Edmonton)

Table 4.1 9.5 mm (3/8") Plywood

Property / Type of Test	#	Specific Gravity Average	Specific Gravity 5% Exclusion Limit	Moisture Content (%) Average	Moisture Content (%) 5% Exclusion Limit
Overall Results	30	.411	.381	7.0	6.6
Panel #1	3	.420	.378	7.3	7.1
Panel #2	3	.392	.339	7.3	6.8
Panel #3	3	.418	.397	7.1	6.6
Panel #4	3	.402	.378	7.1	7.0
Panel #5	3	.419	.406	7.1	6.7
Panel #6	3	.395	.371	6.8	6.5
Panel #7	3	.408	.373	6.9	6.5
Panel #8	3	.408	.396	6.9	6.4
Panel #9	3	.424	.403	6.9	6.8
Panel #10	3	.420	.412	6.8	6.6

Table 4.2 11.1 mm (7/16") Waferboard

Property / Type of Test	#	Specific Gravity Average	Specific Gravity 5% Exclusion Limit	Moisture Content (%) Average	Moisture Content (%) 5% Exclusion Limit
Overall Results	30	.633	.574	4.9	4.7
Panel #1	3	.625	.612	5.0	4.8
Panel #2	3	.630	.581	4.9	4.8
Panel #3	3	.598	.508	4.8	4.6
Panel #4	3	.634	.597	4.9	4.7
Panel #5	3	.628	.587	4.9	4.8
Panel #6	3	.635	.610	4.8	4.4
Panel #7	3	.658	.528	4.9	4.8
Panel #8	3	.658	.581	4.8	4.7
Panel #9	3	.618	.588	4.8	4.7
Panel #10	3	.648	.633	4.8	4.7

Post Flexure Test Results

Table 5.1 9.5 mm (3/8") Plywood

Moisture Content = 7.5% (See Table 6.1)

Property	#	EI ($N \cdot m^2$)		MOE (GPa)		M.Ult. ($N \cdot m$)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	20	200	163	9.67	7.66	157	83.5	35.4	18.1
Parallel & Up	10	199	157	9.83	8.30	150	78.5	34.6	17.3
Parallel & Down	10	202	166	9.51	7.06	164	86.4	36.2	18.0

Table 5.2 11.1 mm (7/16") Waferboard

Moisture Content = 3.1% (See Table 6.2)

Property	#	EI ($N \cdot m^2$)		MOE (GPa)		M.Ult. ($N \cdot m$)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Parallel	19	154	121	4.44	3.51	99.8	86.7	16.0	14.4
Parallel & Up	10	156	116	4.44	3.41	101	89.4	16.4	14.8
Parallel & Down	9	152	127	4.45	3.56	98.6	83.4	15.7	14.0

NOTE: All values are calculated on the basis of gross cross-sectional area.

Post Flexure Test Results

Table 5.3 9.5 mm (3/8") Plywood

Moisture Content = 7.5% (See Table 6.1)

Property	#	EI ($N \cdot m^2$)		MOE (GPa)		M.Ult. ($N \cdot m$)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Perpendicular	20	11.3	8.2	0.56	0.37	37.4	23.2	8.59	5.10
Perpendicular & Up	10	11.5	7.6	0.57	0.34	37.7	28.8	8.66	6.19
Perpendicular & Down	10	11.0	9.0	0.55	0.39	37.1	18.6	8.53	4.09

Table 5.4 11.1 mm (7/16") Waferboard

Moisture Content = 3.1% (See Table 6.2)

Property	#	EI ($N \cdot m^2$)		MOE (GPa)		M.Ult. ($N \cdot m$)		MOR (MPa)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
All Perpendicular	19	143	125	4.11	3.46	90.8	79.6	14.5	12.6
Perpendicular & Up	9	143	129	4.20	3.42	92.6	82.1	15.0	12.9
Perpendicular & Down	10	143	122	4.03	3.52	89.2	77.6	14.0	12.5

NOTE: All values are calculated on the basis of gross cross-sectional area.

Post Flexure Ratios

Table 5.5 Ratio Comparison of Results
9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

	EI Ratio		MOE Ratio		M.Ult. Ratio		MOR Ratio	
	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit	Average	5% Exclusion Limit
Plywood / Waferboard	0.71		1.19		1.02		1.44	
// Plywood / // Waferboard	1.30	1.34	2.18	2.18	1.57	0.96	2.27	1.25
⊥ Plywood / ⊥ Waferboard	0.08	0.07	0.14	0.11	0.41	0.29	0.59	0.41
PLYWOOD								
// Plywood / ⊥ Plywood	17.78	19.84	17.30	20.79	4.19	3.59	4.12	3.54
// U Plywood / // D Plywood	0.98	0.95	1.03	1.18	0.92	0.91	0.95	0.97
⊥ U Plywood / ⊥ D Plywood	1.04	0.85	1.05	0.87	1.01	1.55	1.02	1.52
WAFERBOARD								
// Waferboard / ⊥ Waferboard	1.08	0.97	1.08	1.01	1.10	1.09	1.11	1.15
// U Waferboard / // D Waferboard	1.02	0.91	1.00	0.96	1.02	1.07	1.04	1.06
⊥ U Waferboard / ⊥ D Waferboard	1.00	1.06	1.04	0.97	1.04	1.06	1.07	1.04

NOTE: All values are calculated on the basis of gross cross-sectional area.

Specific Gravity and Moisture Content Test Results (Vancouver)

Table 6.1 9.5 mm (3/8") Plywood

Property	#	Specific Gravity		Moisture Content (%)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit
Overall Results	40	.410	.376	7.5	5.5
Parallel & Up	10	.425	.377	8.4	6.2
Parallel & Down	10	.405	.386	7.8	6.6
Perpendicular & Up	10	.410	.383	7.1	5.3
Perpendicular & Down	10	.400	.377	6.9	4.8

Table 6.2 11.1 mm (7/16") Waferboard

Property	#	Specific Gravity		Moisture Content (%)	
Type of Test		Average	5% Exclusion Limit	Average	5% Exclusion Limit
Overall Results	40	.691	.621	3.1	1.1
Parallel & Up	10	.707	.677	3.9	2.6
Parallel & Down	10	.726	.649	3.7	2.0
Perpendicular & Up	10	.657	.612	2.2	0.5
Perpendicular & Down	10	.675	.613	2.6	0.9

Specific Gravity and Moisture Content Test Ratios (Vancouver)

Table 6.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/16") Waferboard

Property	Specific Gravity Ratio		Moisture Content Ratio	
	Average	5% Exclusion Limit	Average	5% Exclusion Limit
Plywood / Waferboard	0.59	0.61	2.44	4.94
PLYWOOD				
// Plywood / ⊥ Plywood	1.02	1.00	1.15	1.26
// U Plywood / // D Plywood	1.05	0.98	1.08	0.94
⊥ U Plywood / ⊥ D Plywood	1.03	1.01	1.02	1.10
WAFERBOARD				
// Waferboard / ⊥ Waferboard	1.08	1.08	1.60	3.37
// U Waferboard / // D Waferboard	0.97	1.04	1.06	1.32
⊥ U Waferboard / ⊥ D Waferboard	0.97	1.00	0.84	0.51

Concentrated Load Test Results

Span Between Joists = 600 mm

Table 7.1 9.5 mm (3/8") Plywood

Moisture Content = 7.5% (See Table 6.1)

Property Type of Test	#	Ultimate Load (N) Average	Ultimate Load (N) 5% Exclusion Limit	Deflection (mm) at 890 N Average	Deflection (mm) at 890 N 5% Exclusion Limit
Supported with H-clips	22	3320	1720	10.2	8.4
Unsupported (No H-clips)	23	3140	1670	11.0	9.0
Interior Load Location	23	3710	2320	9.8	8.8
Exterior Load Location	22	2730	1510	11.4	9.4

Table 7.2 11.1 mm (7/16") Waferboard

Moisture Content = 3.1% (See Table 6.2)

Property Type of Test	#	Ultimate Load (N) Average	Ultimate Load (N) 5% Exclusion Limit	Deflection (mm) at 890 N Average	Deflection (mm) at 890 N 5% Exclusion Limit
Supported with H-clips	40	2000	1620	7.9	6.1
Unsupported (No H-clips)	40	2340	1790	9.0	6.9
Interior Load Location	40	2240	1610	8.2	6.3
Exterior Load Location	40	2110	1670	8.7	6.4

Concentrated Load Test Ratios

Table 7.3 Ratio Comparison of Results

9.5 mm (3/8") Plywood versus 11.1 mm (7/6") Waferboard

Property	P.Ult. Ratio		Deflection Ratio at 890 N	
	Average	5% Exclusion Limit	Average	5% Exclusion Limit
Plywood / Waferboard	1.49	1.05	1.25	1.36
Plywood Supported / Waferboard Supported	1.66	1.06	1.28	1.37
Plywood Unsupported / Waferboard Unsupported	1.34	0.94	1.22	1.31
Plywood Interior / Waferboard Interior	1.66	1.45	1.19	1.40
Plywood Exterior / Waferboard Exterior	1.29	0.91	1.30	1.47
PLYWOOD				
Plywood Interior Loading / Plywood Exterior Loading	1.36	1.53	0.87	0.93
Plywood Supported / Plywood Unsupported	1.06	1.03	0.92	0.93
WAFERBOARD				
Waferboard Interior Loading / Waferboard Exterior Loading	1.06	0.97	0.94	0.98
Waferboard Supported / Waferboard Unsupported	0.86	0.90	0.88	0.89

Table 8

Comparison of Test Results for Waferboard and Values Required in *CSA Standard CAN3-0188.2-M78

Property	Type of Test	Test Result Average	Test Result 5% Exclusion Limit	Minimum Requirement*
MOE (GPa)	Small Scale Flexure	3.60	2.46	2.70
	Compression	2.53	2.14	
	Post Flexure	4.28	2.86	
MOR (MPa)	Small Scale Flexure	18.9	12.2	14.0
	Post Flexure	15.3	9.01	
Bond (kPa)	Bond	496	290	280

From Table 8 it can be seen that different types of tests yield different values for MOE and MOR. The mean value for MOE, as determined by the post-flexure test was 16% higher than that determined by the small scale flexure test, and 40% higher than that determined by the compression tests. The mean value for MOR, as determined by the post-flexure test was 19% lower than that determined by the small scale flexure test.

4. ANALYSIS OF TEST METHODS

Because this was a pilot study, some of the test procedures were not as efficient as they could be. Some modifications would be desirable for future testing of large numbers of specimens. This section includes recommendations for improvement of the procedures followed. In addition estimates of approximate time requirements for the various tests are given.

4.1 Small Scale Tests

Most of the measurements of the small scale test specimens were taken using calipers with an accuracy of ± .01 mm. As these measurements must be taken by hand, this procedure becomes very time consuming when large numbers of specimens are involved, especially if measurements are repeated for improved accuracy.

4.1.1 Flexural Tests

In the pilot study, three width measurements were taken per specimen. For future tests, it is recommended that only one width measurement be taken at the mid-span of each specimen.

Once the x-y plotter was calibrated and running smoothly, the testing rate was approximately ten specimens per hour. To save time, measurements were taken while tests were performed. This rate of testing does not include time for cutting and labelling specimens, or additional time required for measuring specimens.

4.1.2 Compression Tests

Six thickness, two length, and two width measurements were taken for each specimen. For future tests, it is recommended that two thickness measurements be taken, one from either side of the specimen at mid-span. It is also recommended that one length and one width measurement be taken along the centreline of the specimen.

After the x-y plotter was calibrated and running smoothly, the test rate was about six specimens per hour. Measurements were taken while tests were performed. This test rate does not include time for cutting, labelling and additional time required for measuring specimens.

4.1.3 Bond Tests

The length of each of the four sides of the bond test specimens was measured prior to testing. It is recommended that only two measurements be taken, along the centreline of two adjacent sides.

For the bond tests, the rate determining step was the ten hour curing time of the glue. Twelve pairs of aluminum load blocks were used, so specimens were tested twelve at a time. The actual testing of twelve specimens took between an hour and an hour and a half. The time required to glue this number of specimens was about forty-five minutes. If more aluminum load blocks were available, the total time for testing a given number of specimens could be decreased.

4.1.4 Density and Moisture Content Tests

The length of each of the four sides, and two thickness measurements were taken for each sample. These values were then used to calculate the volume of each sample. This method was more time consuming and less accurate than the water displacement method used at the laboratory of the Council of Forest Industries in Vancouver. Therefore, it is recommended that a method similar to that used in Vancouver be used for all density and moisture content tests in the future.

The rate determining step in this procedure was the oven drying time of twenty-four hours.

4.2 Large Scale Tests

For the large scale tests, the measuring of specimens did not create the same time problems as it did for the small scale tests. This is because no width or length measurements were taken after the specimen had been cut, and only one thickness measurement was taken per specimen.

4.2.1 Post Flexure Tests

The large scale post flexure test procedure employed in tests at the laboratory of the Council of Forest Industries in Vancouver was efficient and suited to handling large numbers of test specimens.

Although only one thickness measurement was taken per specimen, all but one of the values were acceptably close to the nominal thickness. For the specimen in question, a second thickness reading was taken and the two values were averaged to give a representative value for the entire specimen. One thickness reading per specimen should be adequate unless the value of that reading is in question.

Between twenty and twenty-five specimens were tested per day, excluding the time required for cutting, labelling and measuring specimens.

4.2.2 Density and Moisture Content Tests

The procedure for determining density and moisture content, as performed at the laboratory in Vancouver, was efficient and suited for handling large numbers of samples. No measurements were required, therefore the rate determining step was the oven drying time.

4.2.3 Concentrated Load Tests

The procedure used for performing concentrated load tests could be improved in a number of ways to facilitate testing large numbers of specimens. The following are a few suggestions:

1. A system of rollers and clamps could be introduced to facilitate the movement of the loading jack to various test locations within a grid.
2. An automatic pump in place of a hand pump would

ensure a uniform load rate.

3. Plotting load versus deflection curves on an x-y plotter rather than taking readings manually would decrease the testing and calculation time.

Weighing the specimens and taking thickness measurements was done for the purpose of calculating density. It is unnecessary for the load tests themselves.

Using the set-up presently available, the test rate is about two panels per day, for eight load locations per panel. This includes time to nail the panels in place and remove them. It does not include time for cutting and labelling specimens.

5. CONCLUSIONS

The procedures employed in conducting the standard tests for small scale flexure, compression and bond tests were considered satisfactory, and acceptable for a possible future extensive test program. However, the load capacity of the Baldwin machine was much larger than required for these tests. As a result, it was difficult to calibrate the x-y plotter for load versus deflection curves. For future testing, it would be desirable to use a smaller load capacity testing machine.

The procedures and equipment utilized in large scale post flexure tests and specific gravity and moisture content tests performed at the Council of Forest Industries laboratory are suited to efficient testing of large numbers of specimens.

The procedure and equipment used for the concentrated load tests were satisfactory for testing a small number of specimens but would have to be revised for testing a large number of specimens. Suggested revisions can be found in Section 4.2.3.

The type of failure observed in the H-clips indicates that their effectiveness is questionable. It may be desirable to do a separate study to further determine the behavior of H-clips in this type of construction.

For all tests, the number of individual specimens tested was insufficient to establish definitive values of the various mechanical properties.

Summary Table of Test Results

Type of Test	Face Grain Direction	Panel Type	Replicates	Test Results Mean	Standard Deviation	CV (%)	5% Exclusion Limit
Small Scale Flexure MOE (GPa)	Parallel	Plywood	60	7.56	1.07	14.2	5.79
		Waferboard	58	3.61	0.69	19.0	2.48
	Perpendicular	Plywood	0	---	---	---	---
		Waferboard	59	3.58	0.69	19.3	2.44
Small Scale Flexure MOR (MPa)	Parallel	Plywood	60	58.4	13.1	22.4	36.8
		Waferboard	55	19.3	4.28	22.2	12.3
	Perpendicular	Plywood	0	---	---	---	---
		Waferboard	59	18.5	3.79	20.5	12.2
Ultimate Compressive Stress (MPa)	Parallel	Plywood	30	23.4	2.24	9.5	19.8
		Waferboard	30	12.9	1.31	10.1	10.7
	Perpendicular	Plywood	30	11.6	1.37	11.8	9.38
		Waferboard	29	13.1	1.53	11.7	10.6
Compression MOE (GPa)	Parallel	Plywood	30	4.31	0.32	7.4	3.8
		Waferboard	30	2.57	0.27	10.5	2.1
	Perpendicular	Plywood	30	1.84	0.28	15.3	1.38
		Waferboard	29	2.50	0.20	8.0	2.17
Post Flexure EI ($N \cdot m^2$)	Parallel	Plywood	20	201	23.0	11.5	163
		Waferboard	20	154	19.8	12.9	121
	Perpendicular	Plywood	20	11.3	1.87	16.6	8.20
		Waferboard	19	143	10.9	7.6	125

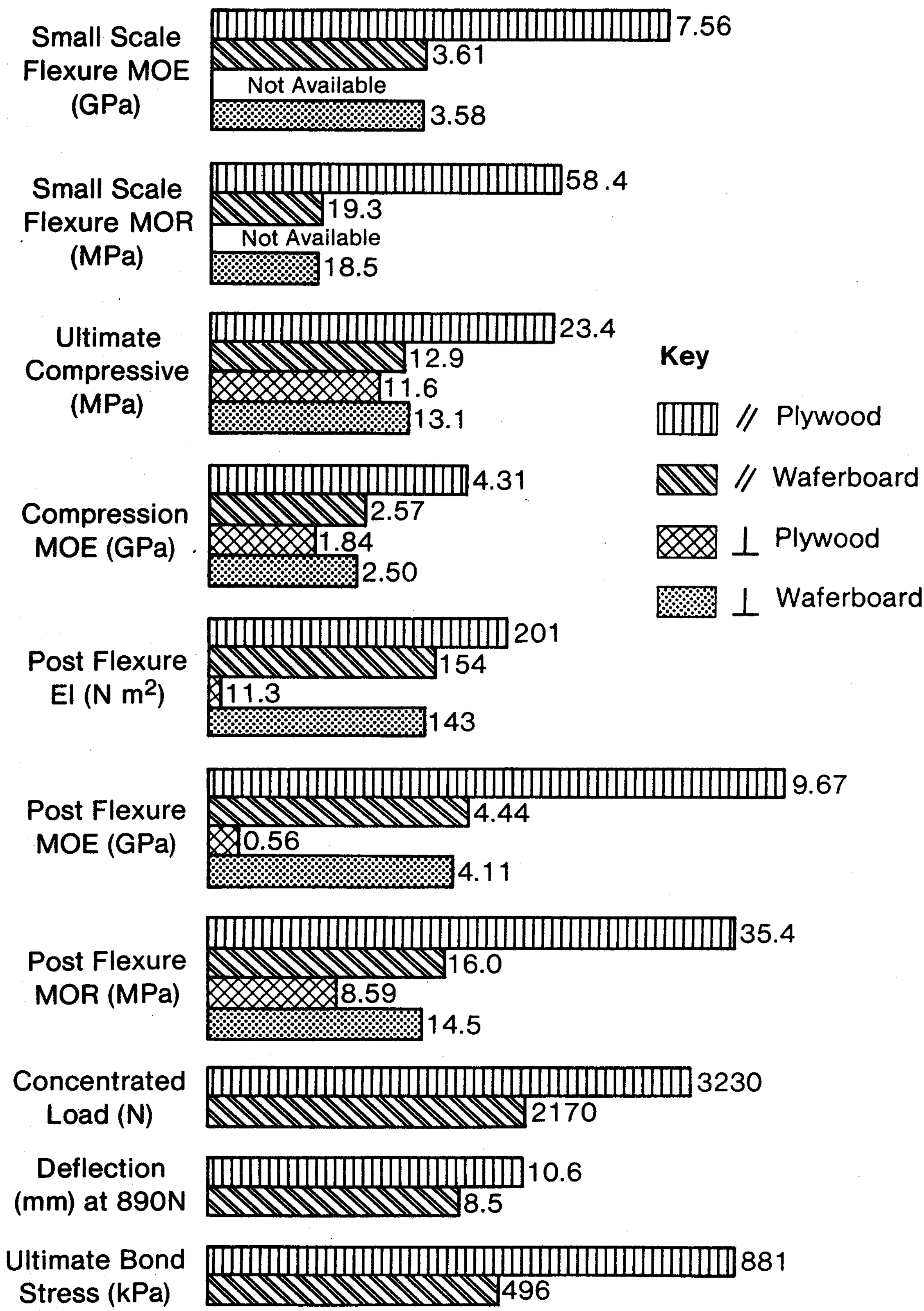
continued

Summary Table of Test Results continued

Type of Test	Face Grain Direction	Panel Type	Replicates	Test Results Mean	Standard Deviation	CV (%)	5% Exclusion Limit
Post Flexure MOE (GPa)	Parallel	Plywood	20	9.67	1.22	12.6	7.66
		Waferboard	20	4.44	0.57	12.7	3.51
	Perpendicular	Plywood	20	0.56	0.12	20.6	0.37
		Waferboard	19	4.11	0.39	9.5	3.46
Post Flexure MOR (MPa)	Parallel	Plywood	20	35.4	10.5	29.7	18.0
		Waferboard	19	16.0	0.99	6.19	14.4
	Perpendicular	Plywood	20	8.59	2.12	24.7	5.10
		Waferboard	19	14.5	1.17	8.09	12.6

Type of Test	Property	Panel Type	Replicates	Test Results Mean	Standard Deviation	CV (%)	5% Exclusion Limit
Concentrated Load Test	Ultimate Load (N)	Plywood	45	3230	925	28.6	1700
		Waferboard	80	2170	334	15.4	1620
	Deflection (mm) at 890 N	Plywood	45	10.6	1.21	11.4	8.59
		Waferboard	79	8.5	1.32	15.6	6.30
Bond	Ultimate Bond Stress (kPa)	Plywood	57	881	384	43.6	248
		Waferboard	58	496	125	25.2	290

Bar Graph Summary of Test Results



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1. Canadian Standards Association, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard, CSA Standard CAN3-0188.0-M78.

2. Longworth, J., Moisture-Strength Relations for Sheathing Grade Douglas Fir Plywood, Department of Civil Engineering, The University of Alberta, September, 1974.

3. American Society for Testing and Materials, Standard Methods for Testing Plywood in Flexure, ASTM Standard D3043-72.

4. American Society for Testing and Materials, Standard Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads, ASTM Standard E661-78.

5. American Society for Testing and Materials, Standard Test Methods for Specific Gravity of Wood and Wood-Base Materials, ASTM Standard D2395-69.

Appendix A

This appendix contains the computer printout of all test data, and statistical results. The statistical results include the numbers of tests, the average, standard deviation, coefficient of variation, five percent exclusion limit, maximum and minimum values.

The statistics were calculated as follows:

(i) Average

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

(ii) Standard Deviation

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(\bar{x} - x_i)^2}{n - 1}}$$

(iii) Coefficient of Variation C.O.V.

$$\text{C.O.V.} = \frac{\sigma}{\bar{x}}$$

(iv) 5% Exclusion Limit

$$5\%\ \text{ex. lt.} = \bar{x} - 1.65\sigma$$

The following are definitions of some of the terms used in the Appendix:

Parallel (//) - refers to specimens cut parallel to the longitudinal axis of the panel.

Perpendicular (⊥) - refers to specimens cut perpendicular to the longitudinal axis of the panel.

Up (U) - refers to specimens tested with the trademark side in tension.

Down (D) - refers to specimens tested with the trademark side in compression.

Supported - refers to a load location with H-clips.

Unsupported - refers to a load location without H-clips.

Interior - refers to a load location with a continuous span on both sides.

Exterior - refers to a load location with a continuous span on one side only.

Small Scale Flexural Test Results for Plywood

Panel #1, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3200	75.630	1240.0	0.18340	8.9459	64.724
9.3500	75.600	780.00	0.17570	8.4915	39.431
9.5300	75.650	1350.0	0.20000	9.1224	57.376
9.7800	75.670	970.00	0.19610	8.2738	45.956
9.4000	75.700	1000.0	0.17950	8.5262	51.264
9.2700	75.680	1060.0	0.18350	9.0904	55.890

Panel #2, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.2300	75.680	1280.0	0.17570	8.8177	68.076
9,3500	75.670	1070.0	0.16420	7.9284	55.463
9.2500	75.650	1080.0	0.16260	8.1106	57.214
9.3500	75.600	1080.0	0.15580	7.5297	56.033
9.2800	75.600	500.00	0.12330	6.0949	26.334
9.1500	75.620	1020.0	0.13750	7.0888	55.244

Panel #3, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.5500	75.720	840.00	0.11030	4.9849	41.709
9.4200	75.670	1300.0	0.12370	5.8407	66.387
9.1200	75.630	1390.0	0.14580	7.5901	75.770
9.0500	75.700	1410.0	0.18320	9.7511	77.982
9.4300	75.750	1000.0	0.15840	7.4474	50.905
9.3500	75.750	1260.0	0.14710	7.0952	65.243

Panel #4, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3000	75.650	1300.0	0.16090	7.8971	68.130
9.3000	75.730	1190.0	0.17280	8.4722	62.299
9.4300	75.730	1420.0	0.19720	9.2741	72.304
9.4500	75.680	1570.0	0.17320	8.0992	79.657
9.3300	75.730	1080.0	0.12770	6.2008	56.177
9.3000	75.730	800.00	0.14550	7.1337	41.882

Panel #5, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3500	75.720	980.00	0.14670	7.0787	50.764
9.2500	75.750	1000.0	0.14670	7.3079	52.906
9.3800	75.700	1170.0	0.18320	8.7577	60.235
9.2800	75.720	1430.0	0.17720	8.7454	75.196
9.3800	75.750	1250.0	0.15290	7.3044	64.312
9.6000	75.750	1440.0	0.15150	6.9667	72.227

Panel #6, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3700	75.700	1040.0	0.12630	6.0570	53.657
9.3800	75.700	910.00	0.12500	5.9755	46.850
9.5000	75.680	950.00	0.13240	6.0940	47.694
9.4800	75.620	1070.0	0.14710	6.8190	53.988
9.7500	75.730	660.00	0.14580	6.2036	31.436
9.8000	75.720	1360.0	0.19400	8.1298	64.127

Panel #7, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3700	75.700	1500.0	0.17580	8.4309	77.390
9.3000	75.670	790.00	0.15560	7.6349	41.391
9.4200	75.730	900.00	0.13850	6.5343	45.924
9.3800	75.630	1360.0	0.15580	7.4548	70.082
9.2300	75.700	890.00	0.12770	6.4071	47.321
9.4200	75.670	980.00	0.14520	6.8558	50.046

Panel #8, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.5500	75.730	1330.0	0.15120	6.8461	66.030
9.5700	75.700	730.00	0.13170	5.9282	36.105
9.4200	75.680	1010.0	0.12940	6.1090	51.571
9.3800	75.730	760.00	0.12280	5.8680	39.112
9.2700	75.600	1320.0	0.15730	7.8008	69.672
9.2500	75.680	1080.0	0.17910	8.9301	57.191

Panel #9, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.3200	75.700	1260.0	0.15380	7.4952	65.707
9.3700	75.670	940.00	0.16360	7.8489	48.517
9.6800	75.650	1460.0	0.15380	6.6941	70.625
9.7200	75.620	1120.0	0.16300	7.0100	53.755
9.3800	75.780	1460.0	0.19480	9.3024	75.086
9.4700	75.750	820.00	0.17580	8.1612	41.390

Panel #10, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
9.6300	75.670	1070.0	0.18980	8.3881	52.285
9.7800	75.770	1610.0	0.19440	8.1913	76.176
9.1300	75.720	1400.0	0.15570	8.0693	76.058
8.9300	75.700	1360.0	0.14440	7.9999	77.252
9.6300	75.770	1450.0	0.18750	8.2755	70.760
9.6200	75.780	1470.0	0.18180	8.0479	71.875

Small Scale Flexure Test Results for Waferboard

Panel #1, Parallel, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.700	75.810	0.0	0.0	0.0	0.0
11.760	75.830	225.00	0.80300E-01	3.0840	8.8038
11.850	75.850	325.00	0.70700E-01	2.8012	12.880
11.840	75.880	485.00	0.88800E-01	3.4387	18.818
11.090	75.760	418.00	0.58900E-01	2.6087	17.943
11.230	75.850	500.00	0.51700E-01	2.2870	20.961

Panel #1, Perpendicular, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.310	75.600	535.00	0.89200E-01	3.8852	22.127
11.310	75.650	553.00	0.70700E-01	3.0615	22.856
11.460	75.810	350.00	0.13760	5.7155	14.060
11.500	75.520	450.00	0.10170	4.1964	18.021
11.320	75.460	410.00	0.67500E-01	2.9226	16.958
11.310	75.660	460.00	0.61200E-01	2.6498	19.010

Panel #2, Parallel, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.070	75.610	250.00	0.84600E-01	3.9090	10.792
11.160	75.620	470.00	0.87200E-01	3.9319	19.959
11.390	75.690	420.00	0.88600E-01	3.7544	17.107
11.190	75.620	460.00	0.80000E-01	3.5783	19.430
11.730	75.780	600.00	0.11280	4.3709	23.015
11.610	75.750	625.00	0.98100E-01	3.9220	24.482

Panel #2, Perpendicular, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.190	75.680	450.00	0.70800E-01	3.1643	18.993
11.120	75.690	500.00	0.91000E-01	4.1438	21.367
11.620	75.750	500.00	0.10050	4.0076	19.552
11.550	75.640	510.00	0.10380	4.2210	20.215
11.580	75.490	540.00	0.78600E-01	3.1778	21.336
11.610	75.700	450.00	0.76500E-01	3.0604	17.639

Panel #3, Parallel, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.700	75.630	385.00	0.59700E-01	2.3358	14.873
11.710	75.700	330.00	0.65800E-01	2.5655	12.715
11.320	75.660	360.00	0.80200E-01	3.4633	14.851
11.300	75.700	450.00	0.65600E-01	2.8463	18.620
10.820	75.780	550.00	0.84300E-01	4.1620	24.795
10.930	75.760	520.00	0.0	0.0	22.979

Panel #3, Perpendicular, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
10.850	75.530	410.00	0.71400E-01	3.5076	18.443
10.840	75.750	430.00	0.74100E-01	3.6397	19.322
11.120	75.730	560.00	0.78900E-01	3.5910	23.918
11.060	75.730	0.0	0.93800E-01	4.3389	0.0
11.060	75.630	280.00	0.63800E-01	2.9551	12.105
11.220	75.660	320.00	0.77500E-01	3.4369	13.437

Panel #4, Parallel, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.480	75.700	460.00	0.86900E-01	3.5959	18.441
11.570	75.850	490.00	0.83200E-01	3.3653	19.352
11.090	75.710	0.0	0.65800E-01	3.0199	0.0
11.070	75.480	0.0	0.70700E-01	3.2723	0.0
11.180	75.630	410.00	0.82600E-01	3.7040	17.347
11.190	75.760	510.00	0.58900E-01	2.6287	21.502

Panel #4, Perpendicular, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.390	75.770	470.00	0.93900E-01	3.9748	19.124
11.280	75.680	420.00	0.90500E-01	3.9487	17.445
10.950	75.760	500.00	0.80500E-01	3.8356	22.015
10.940	75.620	350.00	0.70000E-01	3.3506	15.467
11.210	75.530	450.00	0.84400E-01	3.7594	18.963
11.280	75.680	400.00	0.58300E-01	2.5438	16.614

Panel #5, Parallel, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.810	75.690	460.00	0.78900E-01	2.9992	17.428
11.820	75.700	425.00	0.96400E-01	3.6546	16.072
11.680	75.750	400.00	0.10120	3.9736	15.481
11.650	75.690	620.00	0.99600E-01	3.9442	24.139
11.240	75.840	500.00	0.82500E-01	3.6305	20.872
11.360	75.740	0.0	0.76200E-01	3.2524	0.0

Panel #5, Perpendicular, 1,3,5=up, 2,4,6=down

Avg. d (mm)	Avg. b (mm)	P ult. (N)	P/y (kN/mm)	M.O.E. (GPa)	M.O.R. (MPa)
11.740	75.610	490.00	0.79000E-01	3.0603	18.806
11.660	75.750	330.00	0.97600E-01	3.8520	12.816
11.490	75.750	680.00	0.12830	5.2917	27.196
11.420	75.830	600.00	0.13300	5.5812	24.266
11.660	75.680	310.00	0.86800E-01	3.4298	12.054
11.630	75.710	350.00	0.62900E-01	2.5031	13.670

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The statistics:

Small Scale Flexure Test Results for Waferboard

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	117	3.5958	0.68646	0.19092	2.4630	5.9605	2.2870
P ult (N)	114	449.96	91.780	0.20397	298.53	680.00	225.00
M.O.R. (MPa)	114	18.896	4.0418	0.21389	12.227	29.875	8.6038

All parallel results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	58	3.6086	0.68692	0.19035	2.4752	5.9605	2.2870
P ult (N)	55	460.96	91.230	0.19791	310.43	650.00	225.00
M.O.R. (MPa)	55	19.340	4.2839	0.22150	12.272	29.875	8.6038

All perpendicular results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	59	3.5830	0.69167	0.19304	2.4417	5.7155	2.5031
P ult (N)	59	439.71	91.873	0.20894	288.12	680.00	240.00
M.O.R. (MPa)	59	18.482	3.7921	0.20517	12.226	28.567	11.022

All parallel and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	29	3.6837	0.74744	0.20291	2.4504	5.9605	2.3358
P ult (N)	27	451.96	92.434	0.20452	299.45	620.00	250.00
M.O.R. (MPa)	27	18.934	4.5862	0.24223	11.368	29.875	10.792

All parallel and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	29	3.5335	0.62468	0.17678	2.5028	5.0334	2.2870
P ult (N)	28	469.64	90.880	0.19351	319.69	650.00	225.00
M.O.R. (MPa)	28	19.732	4.0156	0.20351	13.106	28.864	8.6038

All perpendicular and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	30	3.6837	0.67352	0.18580	2.5137	5.7155	2.5357
P ult (N)	30	451.96	99.926	0.22719	274.95	680.00	240.00
M.O.R. (MPa)	30	18.934	4.1035	0.22251	11.671	27.196	11.022

All perpendicular and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
M.O.E. (GPa)	29	3.5395	0.71926	0.20321	2.3528	5.5812	2.5031
P ult (N)	29	439.59	84.513	0.19226	300.14	650.00	280.00
M.O.R. (MPa)	29	18.524	3.5134	0.18966	12.727	28.567	12.816

Small Scale Compression Test Results for Plywood

The Calculated Plywood Quantities:

Panel #1 1-3 parallel, 4-6 perpendicular

M.O.E. gross (GPa)	M.O.E. parallel (GPa)	Stress, gross (MPa)	Stress, parallel (MPa)
4.2735	6.4725	22.492	34.066
4.4903	7.0296	25.023	39.174
3.8004	5.7911	23.034	35.100
2.3032	6.9545	12.065	36.430
1.5810	5.2662	9.9205	33.044
1.7987	5.6980	10.343	32.764

Panel #2 1-3 parallel, 4-6 perpendicular

M.O.E. gross (GPa)	M.O.E. parallel (GPa)	Stress, gross (MPa)	Stress, parallel (MPa)
4.0347	6.3608	21.801	34.371
4.5985	7.3891	25.688	41.277
4.1579	6.3799	23.134	35.498
1.6905	5.0714	11.675	35.024
1.7590	5.3057	11.584	34.939
1.2081	3.5936	8.8516	26.330

Panel #3 1-3 parallel, 4-6 perpendicular

M.O.E. gross (GPa)	M.O.E. parallel (GPa)	Stress, gross (MPa)	Stress, parallel (MPa)
4.1837	6.5962	23.263	36.690
4.5967	7.2370	23.709	37.327
3.9036	6.0140	23.506	36.214
2.3804	7.4479	12.876	40.288
1.8773	5.8498	13.799	42.998
1.5070	4.4444	11.810	34.829

Panel #4 1-3 parallel, 4-6 perpendicular

M.O.E. gross (GPa)	M.O.E. parallel (GPa)	Stress, gross (MPa)	Stress, parallel (MPa)
4.6755	7.2661	22.357	34.745
4.6074	7.0355	23.873	36.454
4.1548	6.7127	18.706	31.838
1.8318	5.6053	10.893	33.333
1.7003	5.4237	10.739	34.254
1.6584	5.2404	11.909	37.632

Panel #5 1-3 parallel, 4-6 perpendicular

M.O.E. gross (GPa)	M.O.E. parallel (GPa)	Stress, gross (MPa)	Stress, parallel (MPa)
4.5260	7.0446	21.526	33.505
4.5293	7.0120	27.453	42.500
4.2545	6.4944	19.650	29.996
2.0766	6.7778	12.453	40.646
2.1465	6.7852	15.603	49.323
1.8209	5.8897	10.969	35.478

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The statistics:

Small Scale Compression Test Results for Plywood

Results for All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	60	31419.	11239.	0.35771	12875.	49500.	15700.
M.O.E. par (GPa)	60	6.2142	0.85898	0.13823	4.7969	7.5199	3.5936
M.O.E. gro (GPa)	60	3.0766	1.2758	0.41470	0.97143	5.1776	1.2081
Stress par (MPa)	60	36.296	3.9303	0.10828	29.811	49.323	26.330
Stress gro (MPa)	60	17.545	6.2276	0.35496	7.2692	27.453	8.7168

All parallel results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	30	42049.	4131.3	0.98250E-01	35232.	49500.	31100.
M.O.E. par (GPa)	30	6.6510	0.45662	0.68655E-01	5.8976	7.5199	5.7911
M.O.E. gro (GPa)	30	4.3068	0.31745	0.73709E-01	3.7830	5.1776	3.6915
Stress par (MPa)	30	36.229	3.5691	0.98516E-01	30.339	42.500	28.417
Stress gro (MPa)	30	23.444	2.2388	0.95495E-01	19.750	27.453	17.687

All perpendicular results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	30	20789.	2475.4	0.11907	16705.	28000.	15700.
M.O.E. par (GPa)	30	5.7775	0.94763	0.16402	4.2140	7.4479	3.5936
M.O.E. gro (GPa)	30	1.8464	0.28234	0.15292	1.3805	2.3804	1.2081
Stress par (MPa)	30	36.364	4.3220	0.11885	29.233	49.323	26.330
Stress gro (MPa)	30	11.645	1.3730	0.11790	9.3799	15.603	8.7168

The statistics:

Small Scale Compression Test Results for Waferboard

Results for All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	59	27975.	3041.9	0.10874	22956.	34000.	21700.
M.O.E. (GPa)	59	2.5342	0.23878	0.94222E-01	2.1402	3.1177	2.0308
Stress (MPa)	59	12.982	1.4139	0.10883	10.659	15.568	9.9949

All parallel results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	30	27899.	2932.2	0.10510	23061.	34000.	22250.
M.O.E. (GPa)	30	2.5716	0.26998	0.10498	2.1261	3.1177	2.0308
Stress (MPa)	30	12.891	1.3068	0.10137	10.735	15.529	10.017

All perpendicular results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	29	28053.	3201.7	0.11413	22770.	33750.	21700.
M.O.E. (GPa)	29	2.4956	0.19892	0.79711E-01	2.1673	2.8831	2.1758
Stress (MPa)	29	13.096	1.5329	0.11705	10.567	15.568	9.9949

Small Scale Bond Test Results for Plywood.

The statistics:

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	57	2221.1	967.52	0.43560	624.73	4390.0	550.00
Stress (kPa)	57	881.27	384.03	0.43576	247.63	1741.2	218.27

Results For Each Group of 6 Specimens:

Panel #1	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	3141.7	667.34	0.21241	2040.6	4390.0	2450.0
Stress (kPa)	6	1247.6	264.00	0.21161	811.98	1741.2	974.44

Panel #2	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	5	2570.0	840.86	0.32718	1182.6	3420.0	1710.0
Stress (kPa)	5	1020.3	333.65	0.32701	469.78	1358.5	679.30

Panel #3	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1553.3	935.32	0.60214	10.053	3000.0	550.00
Stress (kPa)	6	617.15	372.34	0.60332	2.7886	1193.6	218.27

Panel #4	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	5	2010.0	508.48	0.25297	1171.0	2670.0	1240.0
Stress (kPa)	5	796.61	201.53	0.25299	464.08	1058.0	491.27

Panel #5	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	2076.7	885.32	0.42632	615.89	3280.0	910.00
Stress (kPa)	6	823.46	351.28	0.42659	243.85	1299.5	359.39

Panel #6	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	2306.7	644.23	0.27929	1243.7	3270.0	1530.0
Stress (kPa)	6	915.62	256.63	0.28028	492.18	1299.5	606.05

Panel #7	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	5	1932.0	639.59	0.33105	876.68	2530.0	1130.0
Stress (kPa)	5	766.12	253.27	0.33059	348.23	1002.0	448.14

Panel #8	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1830.0	559.84	0.30582	906.59	2650.0	1000.0
Stress (kPa)	6	725.30	222.10	0.30621	358.84	1050.6	395.20

Panel #9	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	2799.2	681.84	0.24359	1674.1	3500.0	1880.0
Stress (kPa)	6	1110.6	270.41	0.24349	664.40	1386.1	745.28

Panel #10	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1966.7	793.41	0.40343	657.53	3360.0	1200.0
Stress (kPa)	6	779.89	313.54	0.40203	262.55	1331.2	477.99

Small Scale Bond Test Results for Waferboard.

The statistics:

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	59	1253.1	266.60	0.21275	813.24	1700.0	380.00
Stress (kPa)	58	496.08	125.13	0.25223	289.62	674.66	150.52

Results For Each Group of 6 Specimens:

Panel #1	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1143.3	154.23	0.13489	888.85	1360.0	900.00
Stress (kPa)	6	452.32	60.826	0.13447	351.96	537.90	356.07

Panel #2	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	5	1448.0	200.17	0.13824	1117.7	1700.0	1220.0
Stress (kPa)	5	571.35	81.630	0.14287	436.66	674.66	484.12

Panel #3	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1243.3	435.74	0.35046	524.37	1540.0	380.00
Stress (kPa)	6	492.50	172.65	0.35056	207.63	611.35	150.52

Panel #4	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1162.5	177.53	0.15272	869.57	1375.0	950.00
Stress (kPa)	6	460.94	70.388	0.15270	344.80	546.28	377.09

Panel #5	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1216.7	159.58	0.13116	953.36	1460.0	1000.0
Stress (kPa)	6	482.06	62.860	0.13040	378.34	577.00	395.74

Panel #6	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1360.0	66.030	0.48552E-01	1251.1	1420.0	1250.0
Stress (kPa)	6	539.04	26.710	0.49551E-01	494.97	562.25	494.60

Panel #7	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1215.0	152.02	0.12512	964.17	1420.0	1000.0
Stress (kPa)	6	481.37	60.227	0.12512	381.99	562.98	396.11

Panel #8	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1255.0	120.79	0.96246E-01	1055.7	1410.0	1100.0
Stress (kPa)	6	496.94	48.020	0.96631E-01	417.71	558.73	435.46

Panel #9	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1260.8	131.47	0.10427	1043.9	1505.0	1130.0
Stress (kPa)	5	498.76	57.834	0.11596	403.33	597.45	450.97

Panel #10	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
P ult. (N)	6	1259.2	262.31	0.20832	826.36	1495.0	910.00
Stress (kPa)	6	498.52	103.93	0.20847	327.04	592.01	359.31

Specific Gravity and Moisture Content for Plywood (Edmonton)

The Statistics:

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	30	0.41088	0.18226E-01	0.44381E-01	0.38061	0.44498	0.35987
Moisture Content	30	6.9999	0.23657	0.33796E-01	6.6096	7.5617	6.5979

Results For Each Group of 3 Specimens:

Panel #1

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.42017	0.25433E-01	0.60531E-01	0.37821	0.44498	0.39415
Moisture Content	3	7.2770	0.11082	0.15229E-01	7.0941	7.3709	7.1547

Panel #2

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.39163	0.32179E-01	0.82167E-01	0.33853	0.42421	0.35987
Moisture Content	3	7.2615	0.29178	0.40182E-01	6.7801	7.5617	6.9790

Panel #3

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.41812	0.12690E-01	0.30350E-01	0.39718	0.42795	0.40379
Moisture Content	3	7.0501	0.24616	0.34915E-01	6.6439	7.2283	6.7692

Panel #4

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.40228	0.14705E-01	0.36554E-01	0.37802	0.41811	0.38905
Moisture Content	3	7.0860	0.45767E-01	0.64588E-02	7.0105	7.1176	7.0335

Panel #5

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.41908	0.77217E-02	0.18425E-01	0.40634	0.42782	0.41318
Moisture Content	3	7.1077	0.22899	0.32217E-01	6.7299	7.3623	6.9185

Panel #6

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.39489	0.14537E-01	0.36812E-01	0.37090	0.40510	0.37825
Moisture Content	3	6.7749	0.16293	0.24050E-01	6.5061	6.9407	6.6149

Panel #7

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.40757	0.20975E-01	0.51464E-01	0.37296	0.42945	0.38763
Moisture Content	3	6.8520	0.20987	0.30630E-01	6.5058	7.0678	6.6486

Panel #8

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.40832	0.76665E-02	0.18776E-01	0.39567	0.41646	0.40125
Moisture Content	3	6.8488	0.25406	0.37096E-01	6.4296	7.1059	6.5979

Panel #9

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.42437	0.12980E-01	0.30586E-01	0.40295	0.43194	0.40938
Moisture Content	3	6.8956	0.42407E-01	0.61498E-02	6.8256	6.9382	6.8534

Panel #10

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.42040	0.50085E-02	0.11914E-01	0.41214	0.42406	0.41469
Moisture Content	3	6.8458	0.13019	0.19018E-01	6.6309	6.9325	6.6961

Specific Gravity and Moisture Content for Waferboard (Edmonton)

The Statistics:

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	30	0.63322	0.35929E-01	0.56740E-01	0.57394	0.71164	0.54401
Moisture Content	30	4.8605	0.10606	0.21820E-01	4.6855	5.0621	4.5770

Results For Each Group of 3 Specimens:

Panel #1

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.62472	0.79629E-02	0.12746E-01	0.61159	0.63392	0.61989
Moisture Content	3	4.9687	0.97033E-01	0.19529E-01	4.8086	5.0621	4.8684

Panel #2

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.63034	0.29837E-01	0.47335E-01	0.58111	0.64874	0.59591
Moisture Content	3	4.9213	0.73710E-01	0.14978E-01	4.7997	4.9742	4.8371

Panel #3

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.59826	0.54984E-01	0.91906E-01	0.50754	0.65395	0.54401
Moisture Content	3	4.8271	0.12308	0.25497E-01	4.6240	4.9638	4.7253

Panel #4

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.63404	0.22691E-01	0.35787E-01	0.59660	0.64722	0.60784
Moisture Content	3	4.9183	0.11002	0.22369E-01	4.7368	4.9988	4.7929

Panel #5

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.62810	0.24774E-01	0.39443E-01	0.58722	0.64486	0.59964
Moisture Content	3	4.8781	0.39668E-01	0.81319E-02	4.8127	4.9049	4.8325

Panel #6

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.63474	0.15104E-01	0.23795E-01	0.60982	0.64435	0.61733
Moisture Content	3	4.7731	0.21706	0.45473E-01	4.4150	5.0063	4.5770

Panel #7

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.65807	0.79134E-01	0.12025	0.52750	0.71164	0.56718
Moisture Content	3	4.8985	0.42346E-01	0.86445E-02	4.8287	4.9410	4.8563

Panel #8

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.65803	0.46959E-01	0.71364E-01	0.58055	0.70760	0.61421
Moisture Content	3	4.7921	0.58350E-01	0.12176E-01	4.6958	4.8423	4.7281

Panel #9

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.61820	0.18267E-01	0.29549E-01	0.58806	0.63816	0.60231
Moisture Content	3	4.7888	0.65263E-01	0.13628E-01	4.6811	4.8421	4.7160

Panel #10

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	3	0.64772	0.90984E-02	0.14047E-01	0.63270	0.65602	0.63799
Moisture Content	3	4.8392	0.59856E-01	0.12369E-01	4.7404	4.8905	4.7734

The statistics:

Large Scale Flexural Test Results For Plywood

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	40	105.90	97.188	0.91754	-54.427	251.24	5.7340
M.O.E. (MPa) :	40	5114.5	4691.9	0.91738	-2627.2	11439.	305.38
M ult. (Nm) :	40	97.073	68.169	0.70225	-15.407	233.34	21.470
M.O.R. (kPa) :	40	21996.	15501.	0.70471	-3580.4	56174.	4502.4

All parallel results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	20	200.52	22.968	0.11454	162.63	251.24	155.97
M.O.E. (MPa) :	20	9670.2	1216.7	0.12582	7662.7	11439.	7356.6
M ult. (Nm) :	20	156.73	44.406	0.28333	83.461	233.34	93.903
M.O.R. (kPa) :	20	35399.	10512.	0.29696	18054.	56174.	20844.

All perpendicular results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	20	11.279	1.8684	0.16565	8.1961	14.912	5.7340
M.O.E. (MPa) :	20	558.82	115.28	0.20630	368.60	794.03	305.38
M ult. (Nm) :	20	37.414	8.6016	0.22990	23.222	54.240	21.470
M.O.R. (kPa) :	20	8592.5	2119.4	0.24666	5095.5	12156.	4502.4

All parallel and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	198.56	25.008	0.12595	157.30	251.24	155.97
M.O.E. (MPa) :	10	9827.1	924.19	0.94045E-01	8302.2	11000.	7985.2
M ult. (Nm) :	10	149.92	43.312	0.28891	78.452	217.30	93.903
M.O.R. (kPa) :	10	34569.	10443.	0.30209	17338.	51437.	21147.

All parallel and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	202.49	21.902	0.10816	166.35	238.23	170.91
M.O.E. (MPa) :	10	9513.3	1488.7	0.15649	7056.9	11439.	7356.6
M ult. (Nm) :	10	163.54	46.731	0.28574	86.439	233.34	95.598
M.O.R. (kPa) :	10	36228.	11077.	0.30575	17952.	56174.	20844.

All perpendicular and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	11.527	2.3849	0.20689	7.5922	14.912	5.7340
M.O.E. (MPa) :	10	571.29	138.29	0.24206	343.12	794.03	305.38
M ult. (Nm) :	10	37.685	5.4047	0.14342	28.768	44.522	29.606
M.O.R. (kPa) :	10	8657.3	1493.8	0.17255	6192.6	10770.	6053.8

All perpendicular and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	11.031	1.2429	0.11267	8.9798	13.000	8.9855
M.O.E. (MPa) :	10	546.35	92.672	0.16962	393.44	734.73	419.97
M ult. (Nm) :	10	37.143	11.262	0.30319	18.562	54.240	21.470
M.O.R. (kPa) :	10	8527.7	2691.1	0.31558	4087.3	12156.	4502.4

The statistics:

Large Scale Flexural Test Results For Waferboard

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	39	148.57	29.392	0.19783	100.07	204.54	114.88
M.O.E. (MPa) :	39	4280.9	862.24	0.20141	2858.2	5734.1	3502.5
M ult. (Nm) :	38	95.306	23.760	0.24930	56.102	117.68	81.227
M.O.R. (kPa) :	38	15266.	3788.8	0.24818	9014.6	17363.	12767.

All parallel results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	20	153.92	19.814	0.12873	121.22	204.54	114.88
M.O.E. (MPa) :	20	4441.9	566.05	0.12743	3507.9	5734.1	3502.5
M ult. (Nm) :	19	99.777	7.9306	0.79483E-01	86.892	117.68	84.097
M.O.R. (kPa) :	19	16037.	991.97	0.61856E-01	14400.	17363.	14297.

All perpendicular results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	19	142.94	10.858	0.75961E-01	125.03	166.24	127.02
M.O.E. (MPa) :	19	4111.5	392.52	0.95470E-01	3463.8	5266.3	3604.1
M ult. (Nm) :	19	90.834	6.7863	0.74711E-01	79.637	104.48	81.227
M.O.R. (kPa) :	19	14495.	1172.1	0.80860E-01	12561.	16923.	12767.

All parallel and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	155.60	24.128	0.15506	115.79	204.54	114.88
M.O.E. (MPa) :	10	4434.7	623.37	0.14057	3406.1	5734.1	3502.5
M ult. (Nm) :	10	100.86	6.9245	0.68656E-01	89.433	110.79	88.402
M.O.R. (kPa) :	10	16350.	909.71	0.55640E-01	14849.	17363.	14650.

All parallel and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	152.24	15.504	0.10184	126.65	188.11	127.02
M.O.E. (MPa) :	10	4449.1	536.39	0.12056	3564.1	5080.0	3726.1
M ult. (Nm) :	9	98.575	9.1915	0.93243E-01	83.409	117.68	84.097
M.O.R. (kPa) :	9	15690.	1012.3	0.64523E-01	14019.	16987.	14297.

All perpendicular and up results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	9	142.69	8.5187	0.59701E-01	128.63	156.90	131.69
M.O.E. (MPa) :	9	4199.6	470.06	0.11193	3424.0	5266.3	3604.1
M ult. (Nm) :	9	92.644	6.4112	0.69203E-01	82.065	103.04	82.949
M.O.R. (kPa) :	9	14995.	1243.1	0.82901E-01	12944.	16923.	13515.

All perpendicular and down results:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
EI (Nm2) :	10	143.18	13.083	0.91379E-01	121.59	166.24	127.02
M.O.E. (MPa) :	10	4032.2	311.42	0.77235E-01	3518.3	4565.7	3620.0
M ult. (Nm) :	10	89.206	7.0251	0.78751E-01	77.614	104.48	81.227
M.O.R. (kPa) :	10	14045.	947.60	0.67470E-01	12481.	16049.	12767.

Specific Gravity and Moisture Content for Plywood (Vancouver)

The statistics :

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	40	0.40998	0.20444E-01	0.49867E-01	0.37624	0.47631	0.37935
Moisture Cont. (%)	40	7.5476	1.2375	0.16396	5.5058	10.740	5.3673

Results For Each Group of 10 Panels:

#1 Ten Panels Tested Parallel and Up

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.42465	0.28718E-01	0.67628E-01	0.37726	0.47631	0.38176
Moisture Cont. (%)	10	8.3668	1.3331	0.15933	6.1672	10.740	6.6838

#2 Ten Panels Tested Perpendicular and Up

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.41038	0.16816E-01	0.40976E-01	0.38263	0.43392	0.37935
Moisture Cont. (%)	10	7.1120	1.1136	0.15658	5.2745	9.3909	5.8355

#3 Ten Panels Tested Parallel and Down

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.40461	0.11402E-01	0.28180E-01	0.38580	0.42683	0.39394
Moisture Cont. (%)	10	7.7718	0.72935	0.93846E-01	6.5684	9.1644	6.8965

#4 Ten Panels Tested Perpendicular and Down

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.40026	0.14055E-01	0.35114E-01	0.37707	0.42903	0.38127
Moisture Cont. (%)	10	6.9400	1.2900	0.18588	4.8115	9.2643	5.3673

Specific Gravity and Moisture Content for Waferboard (Vancouver)

The statistics :

Results For All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	40	0.69107	0.42517E-01	0.61524E-01	0.62091	0.78612	0.61111
Moisture Cont. (%)	40	3.0876	1.1984	0.38748	1.1138	5.7455	1.6216

Results For Each Group of 10 Panels:

#1 Ten Panels Tested Parallel and Up

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.70671	0.18237E-01	0.25806E-01	0.67662	0.74429	0.68911
Moisture Cont. (%)	10	3.9005	0.79091	0.20277	2.5955	5.7455	2.8834

#2 Ten Panels Tested Perpendicular and Up

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.65691	0.27223E-01	0.41442E-01	0.61199	0.69746	0.61111
Moisture Cont. (%)	10	2.1656	1.0357	0.47824	0.45672	4.9929	1.6216

#3 Ten Panels Tested Parallel and Down

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.72571	0.46539E-01	0.64129E-01	0.64892	0.78612	0.65901
Moisture Cont. (%)	10	3.6945	1.0438	0.28253	1.9722	5.6832	1.7591

#4 Ten Panels Tested Perpendicular and Down

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Specific Gravity	10	0.67495	0.37460E-01	0.55500E-01	0.61314	0.74976	0.64507
Moisture Cont. (%)	10	2.5899	1.0256	0.39599	0.89772	4.8780	1.6760

The statistics:

Concentrated Load Test Results for Plywood

Results for All Panels:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	45	5.3272	2.7659	0.51920	0.76354	11.176	0.29210
222.4 N:	45	2.8166	0.37261	0.13229	2.2018	3.8227	2.1844
444.8 N:	45	5.7226	0.64488	0.11269	4.6586	7.2263	4.5466
667.2 N:	45	8.2661	0.92026	0.11133	6.7477	10.312	6.6802
889.6 N:	45	10.580	1.2052	0.11391	8.5916	13.411	8.6487
P ult (N):	45	3229.3	924.87	0.28640	1703.3	5438.6	1707.1
Clip (N):	22	2607.3	467.88	0.17945	2442.7	3394.7	1756.1

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	23	4.1634	2.4578	0.59034	0.10803	9.8933	0.29210
222.4 N:	23	2.9903	0.34023	0.11378	2.4290	3.8227	2.4511
444.8 N:	23	5.9966	0.56000	0.93386E-01	5.0726	7.0866	5.0419
667.2 N:	23	8.6164	0.86342	0.10021	7.1918	10.312	7.2898
889.6 N:	23	10.986	1.1979	0.10904	9.0093	13.411	9.2202
P ult (N):	23	3143.5	891.66	0.28365	1672.3	4761.6	1707.1

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	22	6.5440	2.5818	0.39454	2.2839	11.176	2.6924
222.4 N:	22	2.6350	0.31940	0.12121	2.1080	3.6271	2.1844
444.8 N:	22	5.4362	0.61207	0.11259	4.4263	7.2263	4.5466
667.2 N:	22	7.9000	0.84768	0.10730	6.5013	10.312	6.6802
889.6 N:	22	10.156	1.0824	0.10658	8.3703	13.012	8.6487
P ult (N):	22	3319.0	971.00	0.29255	1716.9	5438.6	2047.4
Clip (N):	22	2607.3	467.88	0.17945	2442.7	3394.7	1756.1

Interior:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	23	5.1451	2.3424	0.45526	1.2803	10.592	1.0287
222.4 N:	23	2.7109	0.29970	0.11055	2.2164	3.3731	2.1844
444.8 N:	23	5.4925	0.48886	0.89006E-01	4.6858	6.3881	4.5466
667.2 N:	23	7.7926	0.56330	0.72286E-01	6.8632	8.8214	6.6802
889.6 N:	23	9.8367	0.63852	0.64912E-01	8.7832	11.044	8.6487
P ult (N):	23	3708.6	838.66	0.22614	2324.8	5438.6	1979.4
Clip (N):	11	2974.3	320.66	0.10781	2814.8	3394.7	2105.7

Exterior:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	22	5.5176	3.1948	0.57902	0.24620	11.176	0.29210
222.4 N:	22	2.9271	0.41446	0.14159	2.2433	3.8227	2.3114
444.8 N:	22	5.9632	0.70874	0.11885	4.7938	7.2263	4.8006
667.2 N:	22	8.7613	0.96933	0.11064	7.1619	10.312	7.1120
889.6 N:	22	11.358	1.1738	0.10335	9.4208	13.411	9.0932
P ult (N):	22	2728.2	735.35	0.26954	1514.9	4761.6	1707.1
Clip (N):	11	2240.2	245.86	0.10975	1834.5	2600.2	1756.1

Panel #3 1-4,unsupported, 5-8,supported

All Tests:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	8	4.3386	2.1950	0.50591	0.71694	8.1534	0.29210
222.4 N:	8	2.6956	0.31856	0.11818	2.1699	3.1115	2.1844
444.8 N:	8	5.5277	0.59415	0.10749	4.5473	6.3627	4.5466
667.2 N:	8	8.0169	0.84869	0.10586	6.6165	9.3345	6.6802
889.6 N:	8	10.273	1.0817	0.10530	8.4879	11.874	8.6487
P ult (N):	8	2989.3	829.70	0.27756	1620.3	4267.0	1821.0
Clip (N):	4	2674.1	622.14	0.23265	1647.6	3394.7	1756.1

Supported:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	4	5.5499	1.9528	0.35186	2.3278	8.1534	2.8194
222.4 N:	4	2.4384	0.20080	0.82351E-01	2.1071	2.6924	2.1844
444.8 N:	4	5.0673	0.39247	0.77451E-01	4.4197	5.6134	4.5466
667.2 N:	4	7.4104	0.54042	0.72927E-01	6.5187	8.2042	6.6802
889.6 N:	4	9.6234	0.80363	0.83508E-01	8.2974	10.871	8.6487
P ult (N):	4	3395.5	643.71	0.18958	2333.4	4267.0	2728.4
Clip (N):	4	2674.1	622.14	0.23265	1647.6	3394.7	1756.1

Unsupported:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	4	3.1274	1.6994	0.54341	0.32330	4.4704	0.29210
222.4 N:	4	2.9527	0.17425	0.59012E-01	2.6652	3.1115	2.6670
444.8 N:	4	5.9880	0.35792	0.59772E-01	5.3975	6.3627	5.3975
667.2 N:	4	8.6233	0.64264	0.74523E-01	7.5629	9.3345	7.6708
889.6 N:	4	10.922	0.92256	0.84468E-01	9.3998	11.874	9.8901
P ult (N):	4	2583.1	795.25	0.30787	1927.0	3836.8	1821.0

Panel #4 1-4,unsupported, 5-8,supported

All Tests:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	8	6.1563	2.9580	0.48049	1.2756	11.176	1.2065
222.4 N:	8	2.7241	0.30114	0.11054	2.2273	3.3528	2.4003
444.8 N:	8	5.5626	0.62366	0.11212	4.5336	6.9723	4.8006
667.2 N:	8	8.0407	0.88939	0.11061	6.5732	10.020	7.1120
889.6 N:	8	10.316	1.1849	0.11487	8.3604	12.916	9.0932
P ult (N):	8	2617.5	610.01	0.23305	1611.0	3823.9	1756.1
Clip (N):	4	2359.0	333.30	0.14129	1809.0	2928.1	2105.7

Supported:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	4	6.6738	2.7181	0.40728	2.1890	11.176	4.0513
222.4 N:	4	2.5178	0.15486	0.61507E-01	2.2623	2.7813	2.4003
444.8 N:	4	5.1975	0.32570	0.62664E-01	4.6601	5.6261	4.8006
667.2 N:	4	7.5374	0.40724	0.54029E-01	6.8655	7.9756	7.1120
889.6 N:	4	9.6996	0.47978	0.49464E-01	8.9080	10.376	9.0932
P ult (N):	4	2661.9	347.20	0.13043	2089.0	3221.2	2306.3
Clip (N):	4	2359.0	333.30	0.14129	1809.0	2928.1	2105.7

Unsupported:

Deflection in mm at :	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
33.4 N:	4	5.6388	3.0945	0.54879	0.53285	9.8933	1.2065
222.4 N:	4	2.9305	0.26871	0.91695E-01	2.4871	3.3528	2.6416
444.8 N:	4	5.9277	0.63655	0.10738	4.8774	6.9723	5.3594
667.2 N:	4	8.5439	0.95378	0.11163	6.9702	10.020	7.6835
889.6 N:	4	10.932	1.3488	0.12338	8.7061	12.916	9.6266
P ult (N):	4	2573.2	787.24	0.30594	1923.7	3823.9	1756.1

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Concentrated Load Test Results for Waferboard

Panel #1 1-4,unsupported, 5-8,supported

Deflection in mm at various values of load:

33.4 N (7.5 lbs)	222.4 N (50 lbs)	444.8 N (100 lbs)	667.2 N (150 lbs)	889.6 N (200 lbs)	Pult (N)	P clip (N)
6.5532	1.9304	3.6957	6.6040	8.7630	2945.0	0.0
7.0231	2.7559	5.7277	8.6360	11.697	1846.8	0.0
6.0452	2.0320	4.8514	7.7597	10.490	2183.1	0.0
6.2992	2.4892	5.2324	7.6962	10.033	2844.9	0.0
7.2136	1.6383	3.5814	5.7150	7.7724	2060.3	1671.1
9.2329	2.1463	4.5593	6.6929	8.6995	1886.0	1380.2
5.1435	1.7145	3.8227	5.8928	7.9375	1690.7	1501.2
4.6101	1.7907	3.9497	6.0833	8.2931	2105.7	1478.1

Panel #2 1-4,unsupported, 5-8,supported

Deflection in mm at various values of load:

33.4 N (7.5 lbs)	222.4 N (50 lbs)	444.8 N (100 lbs)	667.2 N (150 lbs)	889.6 N (200 lbs)	Pult (N)	P clip (N)
4.9784	1.9304	4.1910	6.3373	8.4201	2241.3	0.0
3.6830	1.4986	3.4798	5.4610	7.5946	2701.7	0.0
5.1181	1.8288	4.1021	6.4643	8.9281	2079.9	0.0
3.4925	2.0701	4.2545	6.2484	8.1407	2548.7	0.0
3.7084	1.3716	3.1242	5.0800	7.0104	1886.0	2031.4
6.5913	1.4351	3.2004	4.8768	6.6929	2306.3	2079.9
6.4008	1.8415	3.7719	5.6642	7.5565	2235.1	1674.2
5.6769	1.4859	3.3401	5.2070	7.0485	1943.8	2209.3

Panel #3 1-4,unsupported, 5-8,supported

Deflection in mm at various values of load:

33.4 N (7.5 lbs)	222.4 N (50 lbs)	444.8 N (100 lbs)	667.2 N (150 lbs)	889.6 N (200 lbs)	Pult (N)	P clip (N)
6.3373	2.2987	4.8895	7.2771	9.7155	1866.4	0.0
7.5057	2.0574	4.5212	6.9723	9.5631	2691.5	0.0
4.0386	2.1082	4.6990	7.2898	9.7282	2073.2	0.0
3.2385	4.3053	6.3627	8.4455	10.490	2416.2	0.0
7.1755	1.2827	2.7559	4.3942	6.1087	2289.8	2118.6
5.3594	1.3970	3.3020	4.9022	6.6548	2354.8	1950.4
5.1816	1.5240	3.4798	5.3975	7.3152	2293.4	1582.8
7.6454	1.4986	3.3655	5.3340	7.2898	2260.9	1723.6

Panel #4 1-4,unsupported, 5-8,supported

Deflection in mm at various values of load:

33.4 N (7.5 lbs)	222.4 N (50 lbs)	444.8 N (100 lbs)	667.2 N (150 lbs)	889.6 N (200 lbs)	Pult (N)	P clip (N)
6.9342	2.2860	4.8260	7.3533	9.5504	1966.5	0.0
6.2484	2.3241	5.0038	7.7978	10.630	2073.2	0.0
4.6593	2.4257	4.8641	7.0231	8.9789	2367.7	0.0
11.125	2.0447	4.3307	6.4516	8.3820	2921.4	0.0
5.7404	1.7907	3.6576	5.7404	-5.7404	1934.4	2095.9
6.2738	1.4478	3.4290	5.3086	7.2390	2070.1	2454.9
7.1120	1.7526	3.9878	6.2230	8.4074	1641.8	1625.3
3.7719	1.5367	3.4417	5.4356	7.5057	2111.9	1950.4

Panel #5 1-4,unsupported, 5-8,supported

Deflection in mm at various values of load:

33.4 N (7.5 lbs)	222.4 N (50 lbs)	444.8 N (100 lbs)	667.2 N (150 lbs)	889.6 N (200 lbs)	Pult (N)	P clip (N)
8.0010	1.6256	2.2098	3.5814	5.5118	2632.8	0.0
9.3726	1.3462	3.2512	4.7498	6.8326	2629.7	0.0
6.4770	2.3368	5.3340	8.3820	11.252	2118.6	0.0
3.5814	2.4892	5.4102	7.8740	10.338	2164.0	0.0
6.8580	1.4478	3.4290	5.4356	7.3406	1882.4	2083.0
3.3020	1.4986	3.4798	5.4102	7.2644	2409.5	1853.5
9.7028	1.8542	4.1148	6.3246	8.3820	1891.3	1366.9
6.2992	1.9304	4.2672	6.4770	8.6868	1599.5	1429.1

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The statistics:

Concentrated Load Test Results for Waferboard

Results for All Panels:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	80	4.6514	3.1042	0.66738	-0.47062	13.640	0.38100E-01
222.4 N:	80	1.8156	0.47149	0.25970	1.0376	4.3053	0.62230
444.8 N:	80	4.1308	0.82092	0.19873	2.7763	6.3627	1.9558
667.2 N:	80	6.3377	1.1196	0.17665	4.4905	8.6360	2.9464
889.6 N:	79	8.4826	1.3221	0.15586	6.3011	11.697	4.8133
P ult (N):	80	2172.2	334.02	0.15377	1621.1	3128.3	1592.8
Clip (N):	40	1758.4	245.32	0.13951	1694.4	2454.9	1366.9

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	40	4.5841	3.1259	0.68190	-0.57361	13.640	0.27940
222.4 N:	40	1.9818	0.53585	0.27039	1.0976	4.3053	0.92710
444.8 N:	40	4.4251	0.80060	0.18092	3.1041	6.3627	2.2098
667.2 N:	40	6.7867	1.0852	0.15989	4.9862	8.6360	3.5814
889.6 N:	40	9.0399	1.3037	0.14422	6.8888	11.697	5.5118
P ult (N):	40	2341.2	335.26	0.14320	1788.0	3128.3	1769.4

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	40	4.7187	3.1208	0.66136	-0.43053	10.541	0.38100E-01
222.4 N:	40	1.6493	0.32636	0.19787	1.1108	2.1844	0.62230
444.8 N:	40	3.8366	0.73932	0.19270	2.6167	6.2992	1.9558
667.2 N:	40	5.8889	0.97365	0.16534	4.2823	8.3820	2.9464
889.6 N:	39	7.9110	1.0869	0.13739	6.1176	10.439	4.8133
P ult (N):	40	2003.2	234.56	0.11709	1616.2	2409.5	1592.8
Clip (N):	40	1758.4	245.32	0.13951	1694.4	2454.9	1366.9

Interior:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	40	4.4391	3.0775	0.69327	-0.63878	11.125	0.38100E-01
222.4 N:	40	1.8583	0.54906	0.29547	0.95230	4.3053	0.92710
444.8 N:	40	4.1013	0.82337	0.20076	2.7428	6.3627	1.9558
667.2 N:	40	6.2035	1.0817	0.17437	4.4187	8.4455	2.9464
889.6 N:	40	8.2456	1.2048	0.14612	6.2577	10.490	4.8133
P ult (N):	40	2237.3	381.53	0.17053	1607.8	3128.3	1641.8
Clip (N):	20	1754.7	252.77	0.14405	1661.5	2454.9	1366.9

Exterior:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	40	4.8638	3.1554	0.64875	-0.34256	13.640	0.35560
222.4 N:	40	1.7728	0.38092	0.21487	1.1443	2.7559	0.62230
444.8 N:	40	4.1603	0.82789	0.19900	2.7943	6.2992	2.4892
667.2 N:	40	6.4721	1.1541	0.17831	4.5679	8.6360	4.3942
889.6 N:	39	8.7256	1.4066	0.16120	6.4048	11.697	6.1087
P ult (N):	40	2107.1	267.85	0.12712	1665.2	2701.7	1592.8
Clip (N):	20	1762.1	244.15	0.13856	1359.2	2209.3	1429.1

Panel #3 1-4,unsupported, 5-8,supported

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	8	5.8102	1.5303	0.28338	3.2852	7.6454	3.2385
222.4 N:	8	2.0590	0.91835	0.44602	0.54371	4.3053	1.2827
444.8 N:	8	4.1719	1.0958	0.26265	2.3639	6.3627	2.7559
667.2 N:	8	6.2516	1.3372	0.21390	4.0452	8.4455	4.3942
889.6 N:	8	8.3582	1.5775	0.18873	5.7553	10.490	6.1087
P ult (N):	8	2280.8	225.81	0.99007E-01	1908.2	2691.5	1866.4
Clip (N):	4	1846.4	202.66	0.10976	1512.0	2118.6	1592.8

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	6.3405	1.0846	0.17106	4.5508	7.6454	5.1816
222.4 N:	4	1.4256	0.95198E-01	0.66779E-01	1.2685	1.5240	1.2827
444.8 N:	4	3.2258	0.27868	0.86390E-01	2.7660	3.4798	2.7559
667.2 N:	4	5.0070	0.40185	0.80258E-01	4.3439	5.3975	4.3942
889.6 N:	4	6.8421	0.49930	0.72975E-01	6.0183	7.3152	6.1087
P ult (N):	4	2299.7	34.183	0.14864E-01	2243.3	2354.8	2260.9
Clip (N):	4	1846.4	202.66	0.10976	1512.0	2118.6	1592.8

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	5.2800	1.7161	0.32502	2.4484	7.5057	3.2385
222.4 N:	4	2.6924	0.93554	0.34748	1.1488	4.3053	2.0574
444.8 N:	4	5.1181	0.73028	0.14269	3.9131	6.3627	4.5212
667.2 N:	4	7.4962	0.56264	0.75057E-01	6.5678	8.4455	6.9723
889.6 N:	4	9.8742	0.36151	0.36611E-01	9.2778	10.490	9.5631
P ult (N):	4	2261.8	316.38	0.13988	2000.8	2691.5	1866.4

Panel #4 1-4,unsupported, 5-8,supported

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	8	6.4706	2.0570	0.31789	3.0766	11.125	3.7719
222.4 N:	8	1.9510	0.34919	0.17898	1.3749	2.4257	1.4478
444.8 N:	8	4.1926	0.61281	0.14617	3.1814	5.0038	3.4290
667.2 N:	8	6.4167	0.85432	0.13314	5.0070	7.7978	5.3086
889.6 N:	7	8.6705	1.0867	0.12534	6.8774	10.630	7.2390
P ult (N):	8	2135.9	352.33	0.16496	1554.5	2921.4	1641.8
Clip (N):	4	2031.6	297.88	0.14662	1540.1	2454.9	1625.3

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	5.7245	1.2288	0.21465	3.6970	7.1120	3.7719
222.4 N:	4	1.6319	0.14382	0.88130E-01	1.3946	1.7907	1.4478
444.8 N:	4	3.6290	0.22618	0.62326E-01	3.2558	3.9878	3.4290
667.2 N:	4	5.6769	0.35218	0.62038E-01	5.0958	6.2230	5.3086
889.6 N:	3	7.7174	0.49993	0.64780E-01	6.8925	8.4074	7.2390
P ult (N):	4	1939.5	184.02	0.94879E-01	1635.9	2111.9	1641.8
Clip (N):	4	2031.6	297.88	0.14662	1540.1	2454.9	1625.3

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	7.2168	2.4164	0.33483	3.2297	11.125	4.5593
222.4 N:	4	2.2701	0.13981	0.61586E-01	2.0394	2.4257	2.0447
444.8 N:	4	4.7561	0.25440	0.53488E-01	4.3364	5.0038	4.3307
667.2 N:	4	7.1564	0.49109	0.68623E-01	6.3461	7.7978	6.4516
889.6 N:	4	9.3853	0.82886	0.88315E-01	8.0177	10.630	8.3820
P ult (N):	4	2332.2	370.58	0.15890	2026.5	2921.4	1966.5

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Panel #7 1-4,unsupported, 5-8,supported

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	8	1.6256	1.5648	0.96263	-0.95639	5.0038	0.38100E-01
222.4 N:	8	1.5700	0.47464	0.30231	0.78689	2.0574	0.62230
444.8 N:	8	3.9973	0.81066	0.20280	2.6597	4.9657	2.4892
667.2 N:	8	6.1785	1.1174	0.18085	4.3348	7.8867	4.4577
889.6 N:	8	8.3518	1.3790	0.16511	6.0765	10.516	6.5405
P ult (N):	8	2196.6	383.28	0.17448	1564.2	3128.3	1837.0
Clip (N):	4	1759.4	187.82	0.10675	1449.5	1998.9	1494.5

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	0.87630	0.66907	0.76352	-0.22767	1.7018	0.38100E-01
222.4 N:	4	1.2859	0.49288	0.38331	0.47262	1.8034	0.62230
444.8 N:	4	3.4163	0.72529	0.21230	2.2196	4.2164	2.4892
667.2 N:	4	5.4229	0.78960	0.14560	4.1201	6.2992	4.4577
889.6 N:	4	7.4612	0.88247	0.11827	6.0052	8.5344	6.5405
P ult (N):	4	1987.5	175.57	0.88337E-01	1697.8	2286.7	1837.0
Clip (N):	4	1759.4	187.82	0.10675	1449.5	1988.9	1494.5

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	2.3749	1.8240	0.76803	-0.63468	5.0038	0.27940
222.4 N:	4	1.8542	0.21478	0.11583	1.4998	2.0574	1.5240
444.8 N:	4	4.5783	0.33631	0.73457E-01	4.0234	4.9657	4.1783
667.2 N:	4	6.9342	0.85539	0.12336	5.5228	7.8867	5.9309
889.6 N:	4	9.2424	1.1992	0.12975	7.2637	10.516	7.9756
P ult (N):	4	2405.8	418.91	0.17412	2060.2	3128.3	2118.6

Panel #8 1-4,unsupported, 5-8,supported

All Tests:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	8	1.1128	0.93061	0.83625	-0.42268	2.8448	0.35560
222.4 N:	8	1.6669	0.20218	0.12129	1.3333	1.9812	1.2573
444.8 N:	8	3.9624	0.39727	0.10026	3.3069	4.4450	3.1877
667.2 N:	8	6.1849	0.45485	0.73557E-01	5.4342	6.8326	5.6261
889.6 N:	8	8.3836	0.51087	0.60937E-01	7.5406	9.2964	7.7470
P ult (N):	8	2167.5	337.64	0.15578	1610.3	2888.1	1739.6
Clip (N):	4	1666.1	135.08	0.81078E-01	1443.2	1886.0	1527.4

Supported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	1.0541	0.87002	0.82537	-0.38143	2.5146	0.35560
222.4 N:	4	1.7621	0.14124	0.80155E-01	1.5291	1.9812	1.6002
444.8 N:	4	4.1053	0.30445	0.74161E-01	3.6029	4.4450	3.7592
667.2 N:	4	6.3182	0.49134	0.77765E-01	5.5075	6.8326	5.7658
889.6 N:	4	8.4836	0.64182	0.75654E-01	7.4246	9.2964	7.7470
P ult (N):	4	1994.8	247.88	0.12426	1585.8	2403.3	1739.6
Clip (N):	4	1666.1	135.08	0.81078E-01	1443.2	1886.0	1527.4

Unsupported:

	#	Average	Std. Dev.	Coef. of Var.	5% Ex Lt	Maximum	Minimum
Deflection in mm at :							
33.4 N:	4	1.1716	0.98400	0.83989	-0.45202	2.8448	0.38100
222.4 N:	4	1.5716	0.20895	0.13295	1.2269	1.8415	1.2573
444.8 N:	4	3.8195	0.42676	0.11173	3.1154	4.2418	3.1877
667.2 N:	4	6.0515	0.37010	0.61158E-01	5.4409	6.5024	5.6261
889.6 N:	4	8.2836	0.30005	0.36222E-01	7.7885	8.7376	7.9502
P ult (N):	4	2340.1	327.04	0.13975	2070.3	2888.1	2047.4

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Appendix B

This appendix contains the computer programs used to calculate material properties and perform statistical analysis.

```
C       This program was written to manipulate data from small
C      scale flexural tests performed on plywood and waferboard
C      specimens.
C
C       The data file should be set up as follows:
C
C         1.  MAIN TITLE
C         2.  T, NPOINTS, SKIP
C               NOTE: NPOINTS will default to 120 if left blank,
C                     and if all the values are parallel, let
C                     SKIP be equal to one.  Otherwise, leave it
C                     blank.
C         3.  First group of 6 title
C         4.  Dbar, Bbar, Pult, P/y
C         5.-9.  Repeat line 4.
C               NOTE: Repeat lines 3 - 9 for as many groups of
C                     6 as you have.  If you have less than
C                     20, change NPOINTS, and if you have more
C                     than 20, change the dimensioning of the
C                     vectors and arrays.
C
C       Dimension the various vectors and arrays.  They are thus:
C
C         DBAR - - The average d.
C         BBAR - - The average b.
C         PULT - - The ultimate load.
C         POVERY - The slope of the load deflection curve,
C                  i.e., P/y.
C         MOE  - - The modulus of Elasticity.
C         MOR  - - The modulus of Rupture.
C         TITLE  - The overall title for the run.
C         TITLEA - The titles of the groups of six.  Each line
C                  is one title.
C
      REAL DBAR(120), BBAR(120), PULT(120), POVERY(120),
     * MOE(120), MOR(120), TITLE(30), TITLEA(20,30)
C
C       Define some logical (T/F) indicators for later.
C      PARA is true for parallel values, DOWN true for down
C      values, and POPPAR will be true if there are no
C      parallel values, and POPPER if there are no perpendicular
C      values.  This, is the case for plywood.  To set POPPER
C      to be true (for plywood), let SKIP (from the third line
C      of the data file) be greater than zero. i.e., let SKIP=1.
C
      LOGICAL*1 PARA /.FALSE./, DOWN /.TRUE./, POPPER /.FALSE./,
     * POPPAR /.FALSE./
C
C       Read in the main title and the wood thickness.  ELL
C      is the length of the specimens, and is equal to 24 T.
C
      READ(5,500)(TITLE(I),I=1,20)
500   FORMAT(30A4)
      CALL FREAD(5,'R,2I:',T,NPOINT,SKIP)
C
C       We assign the number of points to be equal to 120,
C      but we can assign some other number if necessary.
C
      IF(NPOINT.LE.0)NPOINT = 120
C
C       N6 is the number of groups of 6.
C
      N6 = NPOINT / 6
C
C       Decide whether everything is parallel.  By default, it
C      is not.
C
      IF(SKIP.GT.0)POPPER = .TRUE.
C
C       Find the length.
C
      ELL = 24. * T
C
C       Read in the first group of 6 title:
C
      READ(5,500)(TITLEA(1,J),J=1,20)
C
C       The loop will read in all the other data, and do
C      some calculations for M.O.E. and M.O.R.
C
      DO 10 I=1,NPOINT
C
C       Find out when 6 READ statements have gone by, in order
C      that we may read in another group of 6 title.
C
      A = I / 6
      I6 = A * 6
      NTIT = I6 / 6 + 1
C
C       Read in the information.
C
      CALL FREAD(5,'4R:',DBAR(I),BBAR(I),PULT(I),POVERY(I))
C
C       If 6 READ statements have gone by, read in a new title.
C      NTIT is the title number.
C
      IF(NTIT.GT.N6)GOTO 11
      IF(I6.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11    CONTINUE
C
```

```
C
      PEDEMX = -1E10
      PEDEMN = 1E10
      PEDRMX = -1E10
      PEDRMN = 1E10
      PEDPMX = -1E10
      PEDPMN = 1E10
C
      PAAEMX = -1E10
      PAAEMN = 1E10
      PAARMX = -1E10
      PAARMN = 1E10
      PAAPMX = -1E10
      PAAPMN = 1E10
C
      PEAEMX = -1E10
      PEAEMN = 1E10
      PEARMX = -1E10
      PEARMN = 1E10
      PEAPMX = -1E10
      PEAPMN = 1E10
      EVEEMX = -1E10
      EVEEMN = 1E10
      EVERMX = -1E10
      EVERMN = 1E10
      EVEPMX = -1E10
      EVEPMN = 1E10
C
C       And now start a DO loop to calculate the maximum and
C       minimum values.
C
      DO 20 I=1,NPOINT
C
C       First, see if the range is parallel, and set a T/F
C     indicator.
C
      II = I - 1
      IA6 = II / 6
      IA62 = IA6 / 2
      IA622 = IA62 * 2
      PARA = .FALSE.
      IF(IA622.EQ.IA6)PARA = .TRUE.
C
C       And next, whether it is odd or even.
C
      IO2 = I / 2
      IO22 = IO2 * 2
      DOWN = .FALSE.
      IF(IO22.EQ.I)DOWN = .TRUE.
C
C       Having established line ranges, check out what to do.
C     I6 refers to the group of six, I2 to alternating values.
C
C         IF PARA and DOWN, refers to PARDN
C         IF PARA and not DOWN, refers to PARUP
C         IF not PARA and DOWN, refers to PERDN
C         IF not PARA and not DOWN, refers to PERUP
C         IF PARA, refers to PARAL
C         IF not PARA, refers to PERAL
C
C       Now find the maximum and minimum values.
C
C       If everything is parallel (POPPER = .TRUE.) then make
C     sure PARA is .TRUE.
C
      IF(POPPER) PARA = .TRUE.
C
C       Get the various values.
C
      IF(MOE(I).LE.0.0)GOTO 800
      IEVER1 = IEVER1 + 1
      EVERYE = EVERYE + MOE(I)
      IF( MOE(I).GT.EVEEMX)EVEEMX =  MOE(I)
      IF( MOE(I).LT.EVEEMN)EVEEMN =  MOE(I)
800   CONTINUE
      IF(PULT(I).LE.0.0)GOTO 810
      IEVER2 = IEVER2 + 1
      EVERYP = EVERYP +  PULT(I)
      IF(PULT(I).GT.EVEPMX)EVEPMX = PULT(I)
      IF(PULT(I).LT.EVEPMN)EVEPMN = PULT(I)
810   CONTINUE
      IF(MOR(I).LE.0.0)GOTO 820
      IEVER3 = IEVER3 + 1
      EVERYR = EVERYR + MOR(I)
      IF(MOR(I).GT.EVERMX)EVERMX =  MOR(I)
      IF(MOR(I).LT.EVERMN)EVERMN =  MOR(I)
820   CONTINUE
      IF(PARA)GOTO 31
      IF(MOE(I).LE.0.0)GOTO 80
      IPERP1 = IPERP1 + 1
      PERALE = PERALE + MOE(I)
      IF( MOE(I).GT.PEAEMX)PEAEMX =  MOE(I)
      IF( MOE(I).LT.PEAEMN)PEAEMN =  MOE(I)
80    CONTINUE
      IF(PULT(I).LE.0.0)GOTO 81
      IPERP2 = IPERP2 + 1
      PERALP = PERALP +  PULT(I)
      IF(PULT(I).GT.PEAPMX)PEAPMX = PULT(I)
      IF(PULT(I).LT.PEAPMN)PEAPMN = PULT(I)
81    CONTINUE
```

```
      GOTO 40
C
C       Perpendicular and down.
C
43    CONTINUE
      IF(MOE(I).LE.0.0)GOTO 95
      IPERD1 = IPERD1 + 1
      PERDNE = PERDNE + MOE(I)
      IF( MOE(I).GT.PEDEMX)PEDEMX =  MOE(I)
      IF( MOE(I).LT.PEDEMN)PEDEMN =  MOE(I)
95    CONTINUE
      IF(PULT(I).LE.0.0)GOTO 96
      IPERD2 = IPERD2 + 1
      PERDNP = PERDNP + PULT(I)
      IF(PULT(I).GT.PEDPMX)PEDPMX = PULT(I)
      IF(PULT(I).LT.PEDPMN)PEDPMN = PULT(I)
96    CONTINUE
      IF(MOR(I).LE.0.0)GOTO 97
      IPERD3 = IPERD3 + 1
      PERDNR = PERDNR + MOR(I)
      IF( MOR(I).GT.PEDRMX)PEDRMX =  MOR(I)
      IF( MOR(I).LT.PEDRMN)PEDRMN =  MOR(I)
97    CONTINUE
40    CONTINUE
20    CONTINUE
C
C
C       Initialize the averages.  If any is not changed, then
C     it will have a value of -0.0.
C
      PARAVE = -0.0
      PARAVP = -0.0
      PARAVR = -0.0
      PERAVE = -0.0
      PERAVP = -0.0
      PERAVR = -0.0
      PAUAVE = -0.0
      PAUAVP = -0.0
      PAUAVR = -0.0
      PADAVE = -0.0
      PADAVP = -0.0
      PADAVR = -0.0
      PEUAVE = -0.0
      PEUAVP = -0.0
      PEUAVR = -0.0
      PEDAVE = -0.0
      PEDAVP = -0.0
      PEDAVR = -0.0
      EVEAVE = -0.0
      EVEAVP = -0.0
      EVEAVR = -0.0
C
C       Calculate the averages.  If any counter is equal to zero,
C     i.e., no values have been read, skip over it.
C
C       Everything
C
      IF(IEVER1.LE.0)GOTO 1001
      EVEAVE = EVERYE / IEVER1
1001  CONTINUE
      IF(IEVER2.LE.0)GOTO 1011
      EVEAVP = EVERYP / IEVER2
1011  CONTINUE
      IF(IEVER3.LE.0)GOTO 1021
      EVEAVR = EVERYR / IEVER3
1021  CONTINUE
C
C       All the parallel.
C
      IF(IPARA1.LE.0)GOTO 100
      PARAVE = PARALE / IPARA1
100   CONTINUE
      IF(IPARA2.LE.0)GOTO 101
      PARAVP = PARALP / IPARA2
101   CONTINUE
      IF(IPARA3.LE.0)GOTO 102
      PARAVR = PARALR / IPARA3
102   CONTINUE
C
C       All the perpendicular.
C
      IF(IPERP1.LE.0)GOTO 103
      PERAVE = PERALE / IPERP1
103   CONTINUE
      IF(IPERP2.LE.0)GOTO 104
      PERAVP = PERALP / IPERP2
104   CONTINUE
      IF(IPERP3.LE.0)GOTO 105
      PERAVR = PERALR / IPERP3
105   CONTINUE
C
C       All the parallel and up.
C
      IF(IPARU1.LE.0)GOTO 106
      PAUAVE = PARUPE / IPARU1
106   CONTINUE
      IF(IPARU2.LE.0)GOTO 107
      PAUAVP = PARUPP / IPARU2
107   CONTINUE
      IF(IPARU3.LE.0)GOTO 108
```

```
C
C        If everything is parallel (POPPER = .TRUE.) then make
C      sure PARA is .TRUE.
C
       IF(POPPER) PARA = .TRUE.
C
C        Everything
C
       IF(MOE(I).LE.0.0)GOTO 1801
       EVEES = EVEES + (( MOE(I) - EVEAVE)**2)
1801   CONTINUE
       IF(PULT(I).LE.0.0)GOTO 1811
       EVEPS = EVEPS + ((PULT(I) - EVEAVP)**2)
1811   CONTINUE
       IF(MOR(I).LE.0.0)GOTO 1821
       EVERS = EVERS + (( MOR(I) - EVEAVR)**2)
1821   CONTINUE
C
C        All Perpendicular.
C
       IF(PARA)GOTO 131
       IF(MOE(I).LE.0.0)GOTO 180
       PEAES = PEAES + (( MOE(I) - PERAVE)**2)
180    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 181
       PEAPS = PEAPS + ((PULT(I) - PERAVP)**2)
181    CONTINUE
       IF(MOR(I).LE.0.0)GOTO 182
       PEARS = PEARS + (( MOR(I) - PERAVR)**2)
182    CONTINUE
       GOTO 130
C
C        All Parallel.
C
131    CONTINUE
       IF(MOE(I).LE.0.0)GOTO 183
       PAAES = PAAES + (( MOE(I) - PARAVE)**2)
183    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 184
       PAAPS = PAAPS + ((PULT(I) - PARAVP)**2)
184    CONTINUE
       IF(MOR(I).LE.0.0)GOTO 185
       PAARS = PAARS + (( MOR(I) - PARAVR)**2)
185    CONTINUE
130    CONTINUE
C
C        And now for the quantities involving multiple IF's.
C
       IF(PARA.AND.DOWN)GOTO 141
       IF(.NOT.DOWN.AND.PARA)GOTO 142
       IF(.NOT.PARA.AND.DOWN)GOTO 143
C
C        Perpendicular and up.
C
       IF(MOE(I).LE.0.0)GOTO 186
       PEUES = PEUES + (( MOE(I) - PEUAVE)**2)
186    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 187
       PEUPS = PEUPS + ((PULT(I) - PEUAVP)**2)
187    CONTINUE
       IF(MOR(I).LE.0.0)GOTO 188
       PEURS = PEURS + (( MOR(I) - PEUAVR)**2)
188    CONTINUE
       GOTO 140
C
C        Parallel and down.
C
141    CONTINUE
       IF(MOE(I).LE.0.0)GOTO 189
       PADES = PADES + (( MOE(I) - PADAVE)**2)
189    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 190
       PADPS = PADPS + ((PULT(I) - PADAVP)**2)
190    CONTINUE
       IF(MOR(I).LE.0.0)GOTO 191
       PADRS = PADRS + (( MOR(I) - PADAVR)**2)
191    CONTINUE
       GOTO 140
C
C        Parallel and up.
C
142    CONTINUE
       IF(MOE(I).LE.0.0)GOTO 192
       PAUES = PAUES + (( MOE(I) - PAUAVE)**2)
192    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 193
       PAUPS = PAUPS + ((PULT(I) - PAUAVP)**2)
193    CONTINUE
       IF(MOR(I).LE.0.0)GOTO 194
       PAURS = PAURS + (( MOR(I) - PAUAVR)**2)
194    CONTINUE
       GOTO 140
C
C        Perpendicular and down.
C
143    CONTINUE
       IF(MOE(I).LE.0.0)GOTO 195
       PEDES = PEDES + (( MOE(I) - PEDAVE)**2)
195    CONTINUE
       IF(PULT(I).LE.0.0)GOTO 196
```

```
      EVERCO = EVERSD / EVEAVR
      AN = FLOAT(IEVER3)
      EVERSP = EVEAVR - (1.650 * (EVERSD ))
902   CONTINUE
C
C       All the parallel.
C
      IF(IPARA1.LE.0)GOTO 1100
      PAAESD = SQRT(PAAES / (IPARA1-1))
      PAAECO = PAAESD / PARAVE
      AN = FLOAT(IPARA1)
      PAAESP = PARAVE - (1.650 * (PAAESD ))
1100  CONTINUE
      IF(IPARA2.LE.0)GOTO 1101
      PAAPSD = SQRT(PAAPS / (IPARA2-1))
      PAAPCO = PAAPSD / PARAVP
      AN = FLOAT(IPARA2)
      PAAPSP = PARAVP - (1.650 * (PAAPSD ))
1101  CONTINUE
      IF(IPARA3.LE.0)GOTO 1102
      PAARSD = SQRT(PAARS / (IPARA3-1))
      PAARCO = PAARSD / PARAVR
      AN = FLOAT(IPARA3)
      PAARSP = PARAVR - (1.650 * (PAARSD ))
1102  CONTINUE
C
C       All the perpendicular.
C
      IF(IPERP1.LE.0)GOTO 1103
      PEAESD = SQRT(PEAES / (IPERP1-1))
      PEAECO = PEAESD / PERAVE
      AN = FLOAT(IPERP1)
      PEAESP = PERAVE - (1.650 * (PEAESD ))
1103  CONTINUE
      IF(IPERP2.LE.0)GOTO 1104
      PEAPSD = SQRT(PEAPS / (IPERP2-1))
      PEAPCO = PEAPSD / PERAVP
      AN = FLOAT(IPERP2)
      PEAPSP = PERAVP - (1.650 * (PEAPSD ))
1104  CONTINUE
      IF(IPERP3.LE.0)GOTO 1105
      PEARSD = SQRT(PEARS / (IPERP3-1))
      PEARCO = PEARSD / PERAVR
      AN = FLOAT(IPERP3)
      PEARSP = PERAVR - (1.650 * (PEARSD ))
1105  CONTINUE
C
C       All the parallel and up.
C
      IF(IPARU1.LE.0)GOTO 1106
      PAUESD = SQRT(PAUES / (IPARU1-1))
      PAUECO = PAUESD / PAUAVE
      AN = FLOAT(IPARU1)
      PAUESP = PAUAVE - (1.650 * (PAUESD ))
1106  CONTINUE
      IF(IPARU2.LE.0)GOTO 1107
      PAUPSD = SQRT(PAUPS / (IPARU2-1))
      PAUPCO = PAUPSD / PAUAVP
      AN = FLOAT(IPARU2)
      PAUPSP = PAUAVP - (1.650 * (PAUPSD ))
1107  CONTINUE
      IF(IPARU3.LE.0)GOTO 1108
      PAURSD = SQRT(PAURS / (IPARU3-1))
      PAURCO = PAURSD / PAUAVR
      AN = FLOAT(IPARU3)
      PAURSP = PAUAVR - (1.650 * (PAURSD ))
1108  CONTINUE
C
C       All the perpendicular and up.
C
      IF(IPERU1.LE.0)GOTO 1109
      PEUESD = SQRT(PEUES / (IPERU1-1))
      PEUECO = PEUESD / PEUAVE
      AN = FLOAT(IPERU1)
      PEUESP = PEUAVE - (1.650 * (PEUESD ))
1109  CONTINUE
      IF(IPERU2.LE.0)GOTO 1110
      PEUPSD = SQRT(PEUPS / (IPERU2-1))
      PEUPCO = PEUPSD / PEUAVP
      AN = FLOAT(IPERU2)
      PEUPSP = PEUAVP - (1.650 * (PEUPSD ))
1110  CONTINUE
      IF(IPERU3.LE.0)GOTO 1111
      PEURSD = SQRT(PEURS / (IPERU3-1))
      PEURCO = PEURSD / PEUAVR
      AN = FLOAT(IPERU3)
      PEURSP = PEUAVR - (1.650 * (PEURSD ))
1111  CONTINUE
C
C       All the parallel and down.
C
      IF(IPARD1.LE.0)GOTO 1112
      PADESD = SQRT(PADES / (IPARD1-1))
      PADECO = PADESD / PADAVE
      AN = FLOAT(IPARD1)
      PADESP = PADAVE - (1.650 * (PADESD ))
1112  CONTINUE
      IF(IPARD2.LE.0)GOTO 1113
      PADPSD = SQRT(PADPS / (IPARD2-1))
      PADPCO = PADPSD / PADAVP
```

```
      * IEVER3, EVEAVR,EVERSD, EVERCO, EVERSP, EVERMX, EVERMN
632    FORMAT(20X,'M.O.E. (GPa)    ',I3, 6(2X, G12.5)/
      * 20X,'P ult  (N)      ',I3, 6(2X, G12.5)/
      * 20X,'M.O.R. (MPa)    ',I3, 6(2X, G12.5)/)
       WRITE(6,621)
621    FORMAT(/////20X,'All parallel results:'/)
       WRITE(6,666)
       WRITE(6,622)IPARA1,PARAVE, PAAESD, PAAECO, PAAE5P,
      * PAAEMX, PAAEMN, IPARA2, PARAVP,
      * PAAPSD, PAAPCO, PAAP5P, PAAPMX, PAAPMN,
      * IPARA3, PARAVR,PAARSD, PAARCO, PAAR5P, PAARMX, PAARMN
622    FORMAT(20X,'M.O.E. (GPa)    ',I3, 6(2X, G12.5)/
      * 20X,'P ult  (N)      ',I3, 6(2X, G12.5)/
      * 20X,'M.O.R. (MPa)    ',I3, 6(2X, G12.5)/)
       IF (POPPER) GO TO 630
       WRITE(6,623)
623    FORMAT(/////20X,'All perpendicular results:'/)
       WRITE(6,666)
       WRITE(6,622)IPERP1, PERAVE, PEAESD, PEAECO, PEAE5P,
      * PEAEMX, PEAEMN, IPERP2, PERAVP,
      * PEAPSD, PEAPCO, PEAP5P, PEAPMX, PEAPMN,
      * IPERP3, PERAVR, PEARSD, PEARCO, PEAR5P, PEARMX, PEARMN
630    CONTINUE
       WRITE(6,624)
624    FORMAT(/////20X,'All parallel and up results:'/)
       WRITE(6,666)
       WRITE(6,622)IPARU1, PAUAVE, PAUESD, PAUECO, PAUE5P,
      * PAUEMX, PAUEMN, IPARU2, PAUAVP,
      * PAUPSD, PAUPCO, PAUP5P, PAUPMX, PAUPMN,
      * IPARU3, PAUAVR, PAURSD, PAURCO, PAUR5P, PAURMX, PAURMN
       WRITE(6,625)
625    FORMAT(/////20X,'All parallel and down results:'/)
       WRITE(6,666)
       WRITE(6,622)IPARD1, PADAVE, PADESD, PADECO, PADE5P,
      * PADEMX, PADEMN, IPARD2, PADAVP,
      * PADPSD, PADPCO, PADP5P, PADPMX, PADPMN,
      * IPARD3, PADAVR, PADRSD, PADRCO, PADR5P, PADRMX, PADRMN
       IF (POPPER) GO TO 651
       WRITE(6,626)
626    FORMAT(/////20X,'All perpendicular and up results:'/)
       WRITE(6,666)
       WRITE(6,622)IPERU1, PAUAVE, PEUESD, PEUECO, PEUE5P,
      * PEUEMX, PEUEMN, IPERU2, PAUAVP,
      * PEUPSD, PEUPCO, PEUP5P, PEUPMX, PEUPMN,
      * IPERU3, PAUAVR, PEURSD, PEURCO, PEUR5P, PEURMX, PEURMN
       WRITE(6,627)
627    FORMAT(/////20X,'All perpendicular and down results:'/)
       WRITE(6,666)
       WRITE(6,622)IPERD1, PEDAVE, PEDESD, PEDECO, PEDE5P,
      * PEDEMX, PEDEMN, IPERD2, PEDAVP,
      * PEDPSD, PEDPCO, PEDP5P, PEDPMX, PEDPMN,
      * IPERD3, PEDAVR, PEDRSD, PEDRCO, PEDR5P, PEDRMX, PEDRMN
651    CONTINUE
99999 CONTINUE
       STOP
       END
```

```
C
12    CONTINUE
      CALL FREAD(5,'4R:',LENGTH(I),AREAGR(I),PULT(I),POVERY(I))
13    CONTINUE
C
C       If 6 READ statements have gone by, read in a new title.
C     Unless, of course, it is the last one, in which case, don't.
C     NTIT is the title number.
C
      IF(NTIT.GT.N6)GOTO 11
      IF(I6.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11    CONTINUE
C
C       And calculate the M.O.E's and stress quantities.
C
      SIGGRO(I) = PULT(I) / AREAGR(I)
      MOEGRO(I) = POVERY(I) * LENGTH(I) / AREAGR(I)
      IF(WAFER) GOTO 14
      SIGPAR(I) = PULT(I) / AREAPA(I)
      MOEPAR(I) = POVERY(I) * LENGTH(I) / AREAPA(I)
14    CONTINUE
10    CONTINUE
C
C       And now calculate the averages.
C
C       Getting some things straight:
C
C         For I = 4, 10, 16, ... it is perpendicular.
C         For I = 1,  7, 13, ... it is parallel.
C
C         We want the average of:
C                                     (name)
C        a) sigma parallel            SIGP
C        b) sigma gross               SIGG
C        c) M.O.E. parallel           MOEP
C        d) M.O.E. gross              MOEG
C        e) PULT                      PULT
C
C         with PA,PE,TO endings to establish whether they are
C       parallel, perpendicular, or total quanties.  The 'gross'
C       quantities (SIGG, MOEG) will be use for the waferboard,
C       along with PULT.
C
C       Initialize these quantities.  These will be divided by
C     the counters to find the averages.
C
      SIGPPA = 0.0
      SIGPPE = 0.0
      SIGPTO = 0.0
      SIGGPA = 0.0
      SIGGPE = 0.0
      SIGGTO = 0.0
      MOEPPA = 0.0
      MOEPPE = 0.0
      MOEPTO = 0.0
      MOEGPA = 0.0
      MOEGPE = 0.0
      MOEGTO = 0.0
      PULTPA = 0.0
      PULTPE = 0.0
      PULTTO = 0.0
C
C       And initialize some counter quantities.  These are needed
C     to find the averages.
C
      ISIGPT = 0
      ISIGPP = 0
      ISIGPE = 0
      ISIGGT = 0
      ISIGGP = 0
      ISIGGE = 0
      IMOEPT = 0
      IMOEPP = 0
      IMOEPE = 0
      IMOEGT = 0
      IMOEGP = 0
      IMOEGE = 0
      IPULTT = 0
      IPULTP = 0
      IPULTE = 0
C
C       And some values to find maximum and minimum quantities.
C
      PULPMX = -1E10
      PULPMN = 1E10
      PULEMX = -1E10
      PULEMN = 1E10
      PULTMX = -1E10
      PULTMN = 1E10
C
      PMEPMX = -1E10
      PMEPMN = 1E10
      PMEEMX = -1E10
      PMEEMN = 1E10
      PMETMX = -1E10
      PMETMN = 1E10
C
      GMEPMX = -1E10
      GMEPMN = 1E10
      GMEEMX = -1E10
```

```
      IF(MOEPAR(I).GT.PMEEMX)PMEEMX = MOEPAR(I)
      IF(MOEPAR(I).LT.PMEEMN)PMEEMN = MOEPAR(I)
73    CONTINUE
      IF(PULT(I).LE.0.0)GOTO 74
      IPULTE = IPULTE + 1
      PULTPE = PULTPE + PULT(I)
      IF(PULT(I).GT.PULEMX)PULEMX = PULT(I)
      IF(PULT(I).LT.PULEMN)PULEMN = PULT(I)
74    CONTINUE
      GOTO 30
31    CONTINUE
      IF(SIGGRO(I).LE.0.0)GOTO 80
      ISIGGP = ISIGGP + 1
      SIGGPA = SIGGPA + SIGGRO(I)
      IF(SIGGRO(I).GT.SGGPMX)SGGPMX = SIGGRO(I)
      IF(SIGGRO(I).LT.SGGPMN)SGGPMN = SIGGRO(I)
80    CONTINUE
      IF(WAFER)GOTO 81
      IF(SIGPAR(I).LE.0.0)GOTO 81
      ISIGPP = ISIGPP + 1
      SIGPPA = SIGPPA + SIGPAR(I)
      IF(SIGPAR(I).GT.SPGPMX)SPGPMX = SIGPAR(I)
      IF(SIGPAR(I).LT.SPGPMN)SPGPMN = SIGPAR(I)
81    CONTINUE
      IF(MOEGRO(I).LE.0.0)GOTO 82
      IMOEGP = IMOEGP + 1
      MOEGPA = MOEGPA + MOEGRO(I)
      IF(MOEGRO(I).GT.GMEPMX)GMEPMX = MOEGRO(I)
      IF(MOEGRO(I).LT.GMEPMN)GMEPMN = MOEGRO(I)
82    CONTINUE
      IF(WAFER)GOTO 83
      IF(MOEPAR(I).LE.0.0)GOTO 83
      IMOEPP = IMOEPP + 1
      MOEPPA = MOEPPA + MOEPAR(I)
      IF(MOEPAR(I).GT.PMEPMX)PMEPMX = MOEPAR(I)
      IF(MOEPAR(I).LT.PMEPMN)PMEPMN = MOEPAR(I)
83    CONTINUE
      IF(PULT(I).LE.0.0)GOTO 84
      IPULTP = IPULTP + 1
      PULTPA = PULTPA + PULT(I)
      IF(PULT(I).GT.PULPMX)PULPMX = PULT(I)
      IF(PULT(I).LT.PULPMN)PULPMN = PULT(I)
84    CONTINUE
30    CONTINUE
20    CONTINUE
C
C       Initialize the averages.  If any is not changed, then
C     it will have a value of -0.0.
C
      ASIGPT = -0.0
      ASIGPP = -0.0
      ASIGPE = -0.0
      ASIGGT = -0.0
      ASIGGP = -0.0
      ASIGGE = -0.0
      AMOEPT = -0.0
      AMOEPP = -0.0
      AMOEPE = -0.0
      AMOEGT = -0.0
      AMOEGP = -0.0
      AMOEGE = -0.0
      APULTT = -0.0
      APULTP = -0.0
      APULTE = -0.0
C
C       Calculate the averages.  If any counter is equal to zero,
C     i.e., no values have been read, skip over it.
C
C       The overall averages.
C
      IF(WAFER)GOTO 90
      IF(ISIGPT.LE.0)GOTO 90
      ASIGPT = SIGPTO / ISIGPT
90    CONTINUE
      IF(ISIGGT.LE.0)GOTO 91
      ASIGGT = SIGGTO / ISIGGT
91    CONTINUE
      IF(WAFER)GOTO 92
      IF(IMOEPT.LE.0)GOTO 92
      AMOEPT = MOEPTO / IMOEPT
92    CONTINUE
      IF(IMOEGT.LE.0)GOTO 93
      AMOEGT = MOEGTO / IMOEGT
93    CONTINUE
      IF(IPULTT.LE.0)GOTO 94
      APULTT = PULTTO / IPULTT
94    CONTINUE
C
C       And the averages for the perpendicular.
C
      IF(WAFER)GOTO 95
      IF(ISIGPP.LE.0)GOTO 95
      ASIGPP = SIGPPA / ISIGPP
95    CONTINUE
      IF(ISIGGP.LE.0)GOTO 96
      ASIGGP = SIGGPA / ISIGGP
96    CONTINUE
      IF(WAFER)GOTO 97
      IF(IMOEPP.LE.0)GOTO 97
      AMOEPP = MOEPPA / IMOEPP
```

```
      IF(MOEPAR(I).LE.0.0)GOTO 173
      PMEES = PMEES + ((MOEPAR(I) - AMOEPE)**2)
173   CONTINUE
      IF(PULT(I).LE.0.0)GOTO 174
      PULES = PULES + ((PULT(I) - APULTE)**2)
174   CONTINUE
      GOTO 130
131   CONTINUE
      IF(SIGGRO(I).LE.0.0)GOTO 180
      SGGPS = SGGPS + ((SIGGRO(I) - ASIGGP)**2)
180   CONTINUE
      IF(WAFER)GOTO 181
      IF(SIGPAR(I).LE.0.0)GOTO 181
      SPGPS = SPGPS + ((SIGPAR(I) - ASIGPP)**2)
181   CONTINUE
      IF(MOEGRO(I).LE.0.0)GOTO 182
      GMEPS = GMEPS + ((MOEGRO(I) - AMOEGP)**2)
182   CONTINUE
      IF(WAFER)GOTO 183
      IF(MOEPAR(I).LE.0.0)GOTO 183
      PMEPS = PMEPS + ((MOEPAR(I) - AMOEPP)**2)
183   CONTINUE
      IF(PULT(I).LE.0.0)GOTO 184
      PULPS = PULPS + ((PULT(I) - APULTP)**2)
184   CONTINUE
130   CONTINUE
120   CONTINUE
C
C       Initialize the statistics.  If any is not changed, then
C     it will have a value of -0.0.
C
      SGGPSD = -0.0
      SGGPCO = -0.0
      SGGP5P = -0.0
      SGGESD = -0.0
      SGGECO = -0.0
      SGGE5P = -0.0
      SGGTSD = -0.0
      SGGTCO = -0.0
      SGGT5P = -0.0
C
      SPGPSD = -0.0
      SPGPCO = -0.0
      SPGP5P = -0.0
      SPGESD = -0.0
      SPGECO = -0.0
      SPGE5P = -0.0
      SPGTSD = -0.0
      SPGTCO = -0.0
      SPGT5P = -0.0
C
      GMEPSD = -0.0
      GMEPCO = -0.0
      GMEP5P = -0.0
      GMEESD = -0.0
      GMEECO = -0.0
      GMEE5P = -0.0
      GMETSD = -0.0
      GMETCO = -0.0
      GMET5P = -0.0
C
      PMEPSD = -0.0
      PMEPCO = -0.0
      PMEP5P = -0.0
      PMEESD = -0.0
      PMEECO = -0.0
      PMEE5P = -0.0
      PMETSD = -0.0
      PMETCO = -0.0
      PMET5P = -0.0
C
      PULPSD = -0.0
      PULPCO = -0.0
      PULP5P = -0.0
      PULESD = -0.0
      PULECO = -0.0
      PULE5P = -0.0
      PULTSD = -0.0
      PULTCO = -0.0
      PULT5P = -0.0
C
C      Calculate the statistics.  If any counter is equal to zero,
C     i.e., no values have been read, skip over it.
C
      IF(WAFER)GOTO 190
      IF(ISIGPT.LE.0)GOTO 190
      SPGTSD = SQRT(SPGTS / (ISIGPT-1))
      SPGTCO = SPGTSD / ASIGPT
      AN = FLOAT(ISIGPT)
      SPGT5P = ASIGPT - (1.650 * (SPGTSD ))
190   CONTINUE
      IF(ISIGGT.LE.0)GOTO 191
      SGGTSD = SQRT(SGGTS / (ISIGGT-1))
      SGGTCO = SGGTSD / ASIGGT
      AN = FLOAT(ISIGGT)
      SGGT5P = ASIGGT - (1.650 * (SGGTSD ))
191   CONTINUE
      IF(WAFER)GOTO 192
      IF(IMOEPT.LE.0)GOTO 192
      PMETSD = SQRT(PMETS / (IMOEPT-1))
```

```
      WRITE(6,602)
602   FORMAT(27X,'Length',8X,'parallel area',5X,'gross area',
     * 9X,'P ult.',12X,'P/y',/, 28X, '(mm)', 13X, '(mm2)',
     * 11X,'(mm2)', 13X, '(N)', 12X, '(kN/mm)',/)
      GOTO 111
110   CONTINUE
      WRITE(6,603)
603   FORMAT(27X,'Length',12X,'Area',12X,'P ult.',
     * 12X,'P/y',13X,'M.O.E.',11X,'Stress',/, 28X,'(mm)',
     * 13X, '(mm2)', 13X, '(N)', 11X, '(kN/mm)',11X,
     * '(GPa)', 12X, '(MPa)',/)
111   CONTINUE
C
C       The loop will write out all the data as a little
C     check.
C
      DO 50 I=1,NPOINT
C
C       Find out when 6 WRITE statements have gone by.
C
      A = I / 6
      I6 = A * 6
      NTIT = (I6 / 6) + 1
C
C       Write out the information.
C
      IF(WAFER)GOTO 112
      WRITE(6,616) LENGTH(I),AREAPA(I),AREAGR(I),PULT(I),POVERY(I)
616   FORMAT(20X,5(5X,G12.5))
      GOTO 113
112   CONTINUE
      WRITE(6,604) LENGTH(I),AREAGR(I),PULT(I),POVERY(I),
     * MOEGRO(I), SIGGRO(I)
604   FORMAT(20X,6(5X,G12.5))
113   CONTINUE
C
C       If 6 WRITE statements have gone by, write out the next
C     title.
C
      IF(NTIT.GT.N6)GOTO 52
      IF(I6.EQ.I)GOTO 51
52    CONTINUE
50    CONTINUE
      GOTO 53
C
C       A little outside piece for doing things on an IF statement.
C
51    CONTINUE
      WRITE(6,601)(TITLEA(NTIT,J),J=1,20)
      IF(WAFER)WRITE(6,603)
      IF(.NOT.WAFER)WRITE(6,602)
      GOTO 52
53    CONTINUE
      IF(WAFER) GOTO 57
C
C       The loop will write out the calculated values for
C     the plywood.
C
C       Write out the initial title, and then start the loop.
C
      WRITE(6,600)(TITLE(I),I=1,20)
      WRITE(6,606)
606   FORMAT(4(/),20X,'The Calculated Plywood Quantities:',/)
      WRITE(6,699)(TITLEA(1,J),J=1,20)
699   FORMAT(5(/),20X,30A4,/)
      WRITE(6,615)
      DO 54 I=1,NPOINT
C
C       Find out when 6 WRITE statements have gone by.
C
      A = I / 6
      I6 = A * 6
      NTIT = (I6 / 6) + 1
C
C       Write out the information.
C
      WRITE(6,617) MOEGRO(I),MOEPAR(I),SIGGRO(I),SIGPAR(I)
617   FORMAT(20X,4(5X,G12.5))
C
C       If 6 WRITE statements have gone by, write out the next
C     title.
C
      IF(NTIT.GT.N6)GOTO 56
      IF(I6.EQ.I)GOTO 55
56    CONTINUE
54    CONTINUE
      GOTO 57
C
C       A little outside piece for doing things on an IF statement.
C
55    CONTINUE
      WRITE(6,699)(TITLEA(NTIT,J),J=1,20)
      WRITE(6,615)
615   FORMAT(/25X,'M.O.E. gross',3X,'M.O.E. parallel',3X,
     * 'Stress, gross',3X,'Stress, parallel',/, 28X,'(GPa)',
     * 12X, '(GPa)', 12X, '(MPa)', 12X, '(MPa)',//)
      GOTO 56
57    CONTINUE
```

```
C        This program was written for the purpose of
C       manipulating data from bond tests performed
C       on plywood and waferboard specimens.
C
C        The data file should be set up as follows:
C
C          1.  MAIN TITLE
C          2.  NPOINTS,
C                NOTE: NPOINTS will default to 120 if left blank,
C                      and if the values are for plywood, let
C                      SKIP be equal to one.  Otherwise, leave it
C                      blank.  This will then assume waferboard.
C          3.  First group of 6 title
C          4.  Width 1, 2, Length 1, 2, Area, Pult, Stress
C          5.-9.  Repeat line 4.
C                NOTE: Repeat lines 3 - 9 for as many groups of
C                      6 as you have.  If you have less than
C                      20, change NPOINTS, and if you have more
C                      than 20, change the dimensioning of the
C                      vectors and arrays.
C
C        Dimension the various vectors and arrays.  They are thus:
C
C          TITLE  - The overall title for the run.
C          TITLEA - The titles of the groups of six.  Each line
C                     is one title.
C
      REAL  PULT(120), SIGMA(120),  TITLE(20), TITLEA(20,20)
      REAL PULTME(20), PULTSD(20),
     * PULTCO(20), PULT5P(20), PULTMX(20), PULTMN(20)
      REAL SIGMME(20), SIGMSD(20), SIGMCO(20), SIGM5P(20),
     * SIGMMX(20), SIGMMN(20)
C
C        Some vectors for counting.
C
      INTEGER IPULT(20), ISIGM(20)
C
C        Read in the main title.
C
      READ(5,500)(TITLE(I),I=1,20)
500   FORMAT(20A4)
      CALL FREAD(5,'I:',NPOINT)
C
C        We assign the number of points to be equal to 120,
C       but we can assign some other number if necessary.
C
      IF(NPOINT.LE.0)NPOINT = 120
C
C        N6 is the number of groups of 6.
C
      N6 = NPOINT / 6
C
C        Read in the first group of 6 title:
C
      READ(5,500)(TITLEA(1,J),J=1,20)
C
C        The loop will read in all the other information.
C
      DO 10 I=1,NPOINT
C
C        Find out when 6 READ statements have gone by, in order
C       that we may read in another group of 6 title.
C
      A = I / 6
      I6 = A * 6
      NTIT = I6 / 6 + 1
C
C        Read in the information.  Check which type to read.
C
      CALL FREAD(5,'2R:',PULT(I),SIGMA(I))
C
C        If 6 READ statements have gone by, read in a new title.
C       NTIT is the title number.
C
      IF(NTIT.GT.N6)GOTO 11
      IF(I6.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11    CONTINUE
10    CONTINUE
C
C        And now calculate the various statistical quantities.
C
C                                    (name)
C         a) PULT                    PULT
C         b) Stress                  SIGM
C
C         with ME, SD, CO, 5P, MX, MN to establish whether they
C       are mean, standard deviation, coefficent of variation,
C       5 % confidence limit, maximum, or minimum for that group
C       of 6.
C
C        Initialize these quantities.  These will be divided by
C       the counters to find the averages for the entire run.
C
      EPUL = 0.0
      ESIG = 0.0
      EPULMX = -1.0E+10
      EPULMN = 1.0E+10
      ESIGMX = -1.0E+10
      ESIGMN = 1.0E+10
```

```
63    CONTINUE
      IF(IESIG.LE.0)GOTO 64
      ESGSD = ESGSD + ((SIGMA(K) - AESIG)**2)
64    CONTINUE
31    CONTINUE
C
C       The calculations for standard deviation, coefficient
C      of variation, and 5% exclusion limit.
C
      IF(IPULT(J).LE.0)GOTO 70
      PULTSD(J) = SQRT(PULSD /(IPULT(J)-1))
      PULTCO(J) = PULTSD(J) / PULTME(J)
      AN = FLOAT(IPULT(J))
      PULT5P(J) = PULTME(J) - (1.650 * PULTSD(J) )
70    CONTINUE
      IF(ISIGM(J).LE.0)GOTO 71
      SIGMSD(J) = SQRT(SIGSD /(ISIGM(J)-1))
      SIGMCO(J) = SIGMSD(J) / SIGMME(J)
      AN = FLOAT(ISIGM(J))
      SIGM5P(J) = SIGMME(J) - (1.650 * SIGMSD(J) )
71    CONTINUE
21    CONTINUE
      IF(IEPUL.LE.0)GOTO 72
      EPULSD = SQRT(EPLSD / (IEPUL-1))
      EPULCO = EPULSD / AEPUL
      AN = FLOAT(IEPUL)
      EPUL5P = AEPUL - (1.650 * EPULSD )
72    CONTINUE
      IF(IESIG.LE.0)GOTO 73
      ESIGSD = SQRT(ESGSD /(IESIG-1))
      ESIGCO = ESIGSD / AESIG
      AN = FLOAT(IESIG)
      ESIG5P = AESIG - (1.650 * ESIGSD )
73    CONTINUE
C
C       Start to write out the results.
C
      WRITE(6,600)(TITLE(I),I=1,20)
600   FORMAT('1',8(/),40X,30A4,/)
C
C       Write out the first title.
C
      WRITE(6,601)(TITLEA(1,J),J=1,20)
601   FORMAT(/45X,30A4)
C
C       Write out the header:
C
      WRITE(6,603)
603   FORMAT(56X,'P ult.',11X,'Stress',/, 57X,'(N)',
     *14X,'(kPa)',/)
C
C       The loop will write out all the data as a little
C      check.
C
      DO 50 I=1,NPOINT
C
C       Find out when 6 WRITE statements have gone by.
C
      A = I / 6
      I6 = A * 6
      NTIT = (I6 / 6) + 1
C
C       Write out the information.
C
      WRITE(6,616) PULT(I),SIGMA(I)
616   FORMAT(50X,2(5X,G12.5))
C
C       If 6 WRITE statements have gone by, write out the next
C      title.
C
      IF(NTIT.GT.N6)GOTO 52
      IF(I6.EQ.I)GOTO 51
52    CONTINUE
50    CONTINUE
      GOTO 53
C
C       A little outside piece for doing things on an IF statement.
C
51    CONTINUE
      WRITE(6,601)(TITLEA(NTIT,J),J=1,20)
      WRITE(6,603)
      GOTO 52
53    CONTINUE
C
C       The loop will write out the calculated values.
C
C       Write out the initial title, and then start the loop.
C
      WRITE(6,606)(TITLE(I),I=1,20)
606   FORMAT('1',8(/),20X,20A4,4(/),
     * 20X,'The statistics:',4(/))
C
C       Write out the information.
C
618   FORMAT(20X,'P ult. (N)      ',I2, 6(2X, G12.5)/
     *20X, 'Stress (kPa)    ',I2, 6(2X, G12.5))
      WRITE(6,617)
617   FORMAT(20X,'Results For All Tests:',/)
```

```
C         This program was written for the purpose of
C       manipulating data from small scale SPECIFIC GRAVITY
C       and MOISTURE CONTENT tests performed on plywood and
C       waferboard samples.
C
C         The data file should be set up as follows:
C
C           1.  MAIN TITLE
C           2.  NPOINTS,
C           3.  First group of 3 title
C           4.  Specific Gravity, Moisture Content
C           5.-9.  Repeat line 4.
C                 NOTE: Repeat lines 3 - 9 for as many groups of
C                       3 as you have.  If you have less than
C                       10, change NPOINTS, and if you have more
C                       than 10, change the dimensioning of the
C                       vectors and arrays.
C
C         Dimension the various vectors and arrays.  They are thus:
C
C           TITLE  - The overall title for the run.
C           TITLEA - The titles of the groups of three.  Each line
C                      is one title.
C
C         Define some real variables.
C
        REAL  SPGR(30), MASS1(30), MASSDR(30), VOL(30),
       * MOIST(30),  TITLE(20), TITLEA(10,20)
        REAL SPGRME(10), SPGRSD(10),
       * SPGRCO(10), SPGR5P(10), SPGRMX(10), SPGRMN(10)
        REAL MOISME(10), MOISSD(10), MOISCO(10), MOIS5P(10),
       * MOISMX(10), MOISMN(10), MOI, MOISD
C
C         Some vectors for counting.
C
        INTEGER ISPGR(10), IMOIS(10)
C
C         Read in the main title.
C
        READ(5,500)(TITLE(I),I=1,20)
500     FORMAT(20A4)
        CALL FREAD(5,'I:',NPOINT)
C
C         N3 is the number of groups of 3.
C
        N3 = NPOINT / 3
C
C         Read in the first group of 3 title:
C
        READ(5,500)(TITLEA(1,J),J=1,20)
C
C         The loop will read in the data.
C
        DO 10 I=1,NPOINT
C
C         Find out when 3 READ statements have gone by, in order
C       that we may read in another group of 3 title.
C
        A = I / 3
        I3 = A * 3
        NTIT = I3 / 3 + 1
C
C         Read in the information.  Check which type to read.
C
        CALL FREAD(5,'3R:',MASS1(I),MASSDR(I),VOL(I))
C
C         Calculate the specific gravity and moisture content.
C
        SPGR(I) = MASSDR(I)/VOL(I)
        MOIST(I) = 100*(MASS1(I) - MASSDR(I))/MASSDR(I)
C
C         If 3 READ statements have gone by, read in a new title.
C       Unless, of course, it is the last one, in which case, don't.
C       NTIT is the title number.
C
        IF(NTIT.GT.N3)GOTO 11
        IF(I3.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11      CONTINUE
10      CONTINUE
C
C         And now calculate the various statistical quantities.
C
C                                         (name)
C           a) Specific Gravity           SPGR
C           b) Moisture Content           MOIS
C
C           with ME, SD, CO, 5P, MX, MN to establish whether they
C         are mean, standard deviation, coefficent of variation,
C         5 % confidence limit, maximum, or minimum for that group
C         of 3.
C
C         Initialize these quantities.  These will be divided by
C       the counters to find the maximums and minimums for the
C       entire run.
C
        ESPG = 0.0
        EMOI = 0.0
        ESPGMX = -1.0E+10
        ESPGMN = 1.0E+10
        EMOISX = -1.0E+10
        EMOISN = 1.0E+10
```

```
64    CONTINUE
31    CONTINUE
C
C       The calculations for standard deviation, coefficient
C       of variation, and 5% exclusion limit.
C
      IF(ISPGR(J).LE.0)GOTO 70
      SPGRSD(J) = SQRT(SPGRD / FLOAT(ISPGR(J)-1))
      SPGRCO(J) = SPGRSD(J) / SPGRME(J)
      AN = FLOAT(ISPGR(J))
      SPGR5P(J) = SPGRME(J) - (1.650 * SPGRSD(J) )
70    CONTINUE
      IF(IMOIS(J).LE.0)GOTO 71
      MOISSD(J) = SQRT(MOISD / FLOAT(IMOIS(J)-1))
      MOISCO(J) = MOISSD(J) / MOISME(J)
      AN = FLOAT(IMOIS(J))
      MOIS5P(J) = MOISME(J) - (1.650 * MOISSD(J) )
71    CONTINUE
21    CONTINUE
      IF(IESPG.LE.0)GOTO 72
      ESPGRD = SQRT(ESGSD / FLOAT(IESPG-1))
      ESPGCO = ESPGRD / AESPG
      AN = FLOAT(IESPG)
      ESPG5P = AESPG - (1.650 * ESPGRD )
72    CONTINUE
      IF(IEMOI.LE.0)GOTO 73
      EMOISD = SQRT(EMCSD / FLOAT(IEMOI-1))
      EMOICO = EMOISD / AEMOI
      AN = FLOAT(IEMOI)
      EMOI5P = AEMOI - (1.650 * EMOISD )
73    CONTINUE
C
C       Start to write out the results.
C
      WRITE(6,600)(TITLE(I),I=1,20)
600   FORMAT('1',8(/),30X,30A4,5(/))
C
C       Write out the first title.
C
      WRITE(6,601)(TITLEA(1,J),J=1,20)
601   FORMAT(3(/),40X,30A4,2(/))
C
C       Write out the header.
C
      WRITE(6,603)
603   FORMAT(40X,'Specific Gravity',17X,'Moisture Content',
     * /79X, '(%)', /)
C
C       The loop will write out all the data as a little
C     check.
C
      DO 50 I=1,NPOINT
C
C       Find out when 3 WRITE statements have gone by.
C
      A = I / 3
      I3 = A * 3
      NTIT = (I3 / 3) + 1
C
C       Write out the information.
C
      WRITE(6,616) SPGR(I),MOIST(I)
616   FORMAT(43X, G12.5, 21X, G12.5)
C
C       If 3 WRITE statements have gone by, write out the title
C     of the next little bit.
C
      IF(NTIT.GT.N3)GOTO 52
      IF(I3.EQ.I)GOTO 51
52    CONTINUE
50    CONTINUE
      GOTO 53
C
C       A little outside piece for doing things on an IF statement.
C
51    CONTINUE
      WRITE(6,601)(TITLEA(NTIT,J),J=1,20)
      WRITE(6,603)
      GOTO 52
53    CONTINUE
C
C       The loop will write out the calculated values.
C
C       Write out the initial title, and then start the loop.
C
      WRITE(6,699)(TITLE(I),I=1,20)
699   FORMAT('1',8(/),20X,30A4,5(/))
      WRITE(6,606)
606   FORMAT(3(/),20X,'The Statistics:',5(/), 20X,
     * 'Results For All Tests:',3(/))
C
C       Write out the information.
C
      WRITE(6,666)
666   FORMAT(37X,' #', 2X, 'Average', 7X, 'Std. Dev.',2X,
     *'Coef. of Var.', 1X, '5% Ex Lt', 6X, 'Maximum', 6X,
     *'Minimum',/)
      WRITE(6,618)IESPG,AESPG,ESPGRD,ESPGCO,ESPG5P,ESPGMX,ESPGMN,
     * IEMOI,AEMOI,EMOISD,EMOICO,EMOI5P,EMOISX,EMOISN
618   FORMAT(20X,'Specific Gravity ', I2, 6(1X,G12.5)/
     * 20X, 'Moisture Content ', I2, 6(1X,G12.5),3(/))
```

```
C         This program was written for the purpose of manipulating
C       data for large scale flexural tests performed on plywood
C       and waferboard specimens.
C
C         The data file should be set up as follows:
C
C           1.  MAIN TITLE
C           2.  T, NPOINTS
C           3.  First group of 10 title
C           4.  EI, MOE, Mult, MOR
C           5.-9.  Repeat line 4.
C                 NOTE: Repeat lines 3 - 9 for as many groups of
C                       10 as you have.  If you have less than
C                       4, change NPOINTS, and if you have more
C                       than 4, change the dimensioning of the
C                       vectors and arrays.
C
C         Dimension the various vectors and arrays.  They are thus:
C
C           EI    - - The stiffness
C           MULT  - - The ultimate moment
C           MOE   - - The modulus of Elasticity.
C           MOR   - - The modulus of Rupture.
C           TITLE  - The overall title for the run.
C           TITLEA - The titles of the groups of ten.  Each line
C                      is one title.
C
        REAL EI(120), MOE(120), MULT(120),
       *MOR(120), TITLE(30), TITLEA(20,30)
        REAL PARCOE, PARSDE, PARS2E, PARSPE, PARCOR, PARSDR, PARS2R,
       * PARSPR, PARCOM, PARSDM, PARS2M, PARSPM,
       * PARCOI, PARSDI, PARS2I, PARSPI
C
C          Some logical quantities.
C
        LOGICAL*1 DOWN /.FALSE./, PARA /.TRUE./, PERP /.FALSE./
C
C         Read in the main title and the wood thickness.
C
        READ(5,500)(TITLE(I),I=1,20)
500     FORMAT(30A4)
        CALL FREAD(5,'R,1I:',T,NPOINT)
C
C         N10 is the number of groups of 10.
C
        N10 = NPOINT / 10
C
C         Read in the first group of 10 title:
C
        READ(5,500)(TITLEA(1,J),J=1,20)
C
C         The loop will read in all the data.
C
        DO 10 I=1,NPOINT
C
C         Find out when 10 READ statements have gone by, in order
C       that we may read in another group of 10 title.
C
        A = I / 10
        I10 = A * 10
        NTIT = I10 / 10 + 1
C
C         Read in the information.
C
        CALL FREAD(5,'4R:',EI(I),MOE(I),MULT(I),MOR(I))
C
C         Convert units from Imperial to metric.
C
        EI(I) = EI(I)*4.448*645.2/1000**2
        MOE(I) = MOE(I)*6.895
        MULT(I) = MULT(I)*1.356/12
        MOR(I) = MOR(I)*6.895
C
C         If 10 READ statements have gone by, read in a new title.
C       Unless, of course, it is the last one, in which case, don't.
C       NTIT is the title number.
C
        IF(NTIT.GT.N10)GOTO 11
        IF(I10.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11      CONTINUE
10      CONTINUE
C
C         Calculate the averages.
C
C         Getting some things straight:
C
C           For I = 1 - 10, ... it is parallel up.
C           For I = 11 - 20, ... it is parallel down.
C           For I = 21 - 30, ... it is perpendicular up.
C           For I = 31 - 40, ... it is perpendicular down.
C
C           We want the average of:
C                                           (name)
C           a) parallel up.                 PARUP
C           b) parallel down.               PARDN
C           c) perpendicular up.            PERUP
C           d) perpendicular down.          PERDN
C           e) all parallel.                PARAL
C           f) all perpendicular.           PERAL
C           g) everything                   EVERY
```

```
C
C         And initialize some counter quantities.  These are needed
C       to find the maximums and minimums.
C
C        Parallel
        IPARA1 = 0
        IPARA2 = 0
        IPARA3 = 0
        IPARA4 = 0
C        Perpendicular
        IPERP1 = 0
        IPERP2 = 0
        IPERP3 = 0
        IPERP4 = 0
C        Parallel and Down
        IPARD1 = 0
        IPARD2 = 0
        IPARD3 = 0
        IPARD4 = 0
C        Parallel and Up
        IPARU1 = 0
        IPARU2 = 0
        IPARU3 = 0
        IPARU4 = 0
C        Perpendicular and Down
        IPERD1 = 0
        IPERD2 = 0
        IPERD3 = 0
        IPERD4 = 0
C        Perpendicular and Up
        IPERU1 = 0
        IPERU2 = 0
        IPERU3 = 0
        IPERU4 = 0
C        Everything
        IEVER1 = 0
        IEVER2 = 0
        IEVER3 = 0
        IEVER4 = 0
C
C         And now start a DO loop to find the maximums and minimums.
C
        DO 20 I=1,NPOINT
C
C         Find out some things about the number.
C
C         First, see if the range is parallel, and set a T/F
C       indicator.
C
        PARA = .FALSE.
        IF(I.LE.20)PARA = .TRUE.
C
C         And next, whether it is up or down.
C
        DOWN = .FALSE.
        IF(I.LE.20.AND.I.GE.11)DOWN = .TRUE.
        IF(I.GE.31)DOWN = .TRUE.
C
C         Having established line ranges, check out what to do.
C       I10 refers to the group of ten, I2 to alternating values.
C
C            IF PARA and DOWN, refers to PARDN
C            IF PARA and not DOWN, refers to PARUP
C            IF not PARA and DOWN, refers to PERDN
C            IF not PARA and not DOWN, refers to PERUP
C            IF PARA, refers to PARAL
C            IF not PARA, refers to PERAL
C
C         Find the maximums and minimums.
C
C         Perpendicular
C
        IF(PARA)GOTO 31
        IF(EI(I).LE.0.0)GOTO 80
        IF(EI(I).GT.PERMXI)PERMXI=EI(I)
        IF(EI(I).LT.PERMNI)PERMNI=EI(I)
        IPERP1 = IPERP1 + 1
        PERALI = PERALI + EI(I)
80      CONTINUE
        IF(MOE(I).LE.0.0)GOTO 81
        IF(MOE(I).GT.PERMXE)PERMXE=MOE(I)
        IF(MOE(I).LT.PERMNE)PERMNE=MOE(I)
        IPERP2 = IPERP2 + 1
        PERALE = PERALE +  MOE(I)
81      CONTINUE
        IF(MULT(I).LE.0.0)GOTO 82
        IF(MULT(I).GT.PERMXM)PERMXM=MULT(I)
        IF(MULT(I).LT.PERMNM)PERMNM=MULT(I)
        IPERP3 = IPERP3 + 1
        PERALM = PERALM + MULT(I)
82      CONTINUE
        IF(MOR(I).LE.0.0)GOTO 182
        IF(MOR(I).GT.PERMXR)PERMXR=MOR(I)
        IF(MOR(I).LT.PERMNR)PERMNR=MOR(I)
        IPERP4 = IPERP4 + 1
        PERALR = PERALR + MOR(I)
182     CONTINUE
```

```
      IF(MOE(I).LE.0.0)GOTO 93
      IF(MOE(I).GT.PAUMXE)PAUMXE=MOE(I)
      IF(MOE(I).LT.PAUMNE)PAUMNE=MOE(I)
      IPARU2 = IPARU2 + 1
      PARUPE = PARUPE + MOE(I)
93    CONTINUE
      IF(MULT(I).LE.0.0)GOTO 94
      IF(MULT(I).GT.PAUMXM)PAUMXM=MULT(I)
      IF(MULT(I).LT.PAUMNM)PAUMNM=MULT(I)
      IPARU3 = IPARU3 + 1
      PARUPM = PARUPM + MULT(I)
94    CONTINUE
      IF(MOR(I).LE.0.0)GOTO 194
      IF(MOR(I).GT.PAUMXR)PAUMXR=MOR(I)
      IF(MOR(I).LT.PAUMNR)PAUMNR=MOR(I)
      IPARU4 = IPARU4 + 1
      PARUPR = PARUPR + MOR(I)
194   CONTINUE
      GOTO 40
C
C       Perpendicular and down.
C
43    CONTINUE
      IF(EI(I).LE.0.0)GOTO 95
      IF(EI(I).GT.PEDMXI)PEDMXI=EI(I)
      IF(EI(I).LT.PEDMNI)PEDMNI=EI(I)
      IPERD1 = IPERD1 + 1
      PERDNI = PERDNI + EI(I)
95    CONTINUE
      IF(MOE(I).LE.0.0)GOTO 96
      IF(MOE(I).GT.PEDMXE)PEDMXE=MOE(I)
      IF(MOE(I).LT.PEDMNE)PEDMNE=MOE(I)
      IPERD2 = IPERD2 + 1
      PERDNE = PERDNE + MOE(I)
96    CONTINUE
      IF(MULT(I).LE.0.0)GOTO 97
      IF(MULT(I).GT.PEDMXM)PEDMXM=MULT(I)
      IF(MULT(I).LT.PEDMNM)PEDMNM=MULT(I)
      IPERD3 = IPERD3 + 1
      PERDNM = PERDNM + MULT(I)
97    CONTINUE
      IF(MOR(I).LE.0.0)GOTO 197
      IF(MOR(I).GT.PEDMXR)PEDMXR=MOR(I)
      IF(MOR(I).LT.PEDMNR)PEDMNR=MOR(I)
      IPERD4 = IPERD4 + 1
      PERDNR = PERDNR + MOR(I)
197   CONTINUE
40    CONTINUE
C
C       Everything
C
      IF(EI(I).LE.0.0)GOTO 195
      IF(EI(I).GT.EVEMXI)EVEMXI=EI(I)
      IF(EI(I).LT.EVEMNI)EVEMNI=EI(I)
      IEVER1 = IEVER1 + 1
      EVERTI = EVERTI + EI(I)
195   CONTINUE
      IF(MOE(I).LE.0.0)GOTO 196
      IF(MOE(I).GT.EVEMXE)EVEMXE=MOE(I)
      IF(MOE(I).LT.EVEMNE)EVEMNE=MOE(I)
      IEVER2 = IEVER2 + 1
      EVERTE = EVERTE + MOE(I)
196   CONTINUE
      IF(MULT(I).LE.0.0)GOTO 198
      IF(MULT(I).GT.EVEMXM)EVEMXM=MULT(I)
      IF(MULT(I).LT.EVEMNM)EVEMNM=MULT(I)
      IEVER3 = IEVER3 + 1
      EVERTM = EVERTM + MULT(I)
198   CONTINUE
      IF(MOR(I).LE.0.0)GOTO 199
      IF(MOR(I).GT.EVEMXR)EVEMXR=MOR(I)
      IF(MOR(I).LT.EVEMNR)EVEMNR=MOR(I)
      IEVER4 = IEVER4 + 1
      EVERTR = EVERTR + MOR(I)
199   CONTINUE
20    CONTINUE
C
C       Initialize the averages.  If any is not changed, then
C     it will have a value of -0.0.
C
C      Parallel
      PARAVE = -0.0
      PARAVM = -0.0
      PARAVI = -0.0
      PARAVR = -0.0
C      Perpendicular
      PERAVE = -0.0
      PERAVM = -0.0
      PERAVI = -0.0
      PERAVR = -0.0
C      Parallel and Up
      PAUAVE = -0.0
      PAUAVM = -0.0
      PAUAVI = -0.0
      PAUAVR = -0.0
C      Parallel and Down
      PADAVE = -0.0
      PADAVM = -0.0
      PADAVI = -0.0
      PADAVR = -0.0
```

```
116    CONTINUE
       IF(IPERD3.LE.O)GOTO 117
       PEDAVM = PERDNM / IPERD3
117    CONTINUE
       IF(IPERD4.LE.O)GOTO 217
       PEDAVR = PERDNR / IPERD4
217    CONTINUE
C
C        The averages of everything.
C
       IF(IEVER1.LE.O)GOTO 118
       EVERYI = EVERTI / IEVER1
118    CONTINUE
       IF(IEVER2.LE.O)GOTO 119
       EVERYE = EVERTE / IEVER2
119    CONTINUE
       IF(IEVER3.LE.O)GOTO 120
       EVERYM = EVERTM / IEVER3
120    CONTINUE
       IF(IEVER4.LE.O)GOTO 220
       EVERYR = EVERTR / IEVER4
220    CONTINUE
C
C        Calculate the statistics.
C
C        Initialize.
C
       PARSDI = 0.0
       PARSDE = 0.0
       PARSDM = 0.0
       PARSDR = 0.0
C
       PERSDI = 0.0
       PERSDE = 0.0
       PERSDM = 0.0
       PERSDR = 0.0
C
       PAUSDI = 0.0
       PAUSDE = 0.0
       PAUSDM = 0.0
       PAUSDR = 0.0
C
       PEUSDI = 0.0
       PEUSDE = 0.0
       PEUSDM = 0.0
       PEUSDR = 0.0
C
       PADSDI = 0.0
       PADSDE = 0.0
       PADSDM = 0.0
       PADSDR = 0.0
C
       PEDSDI = 0.0
       PEDSDE = 0.0
       PEDSDM = 0.0
       PEDSDR = 0.0
C
       EVESDI = 0.0
       EVESDE = 0.0
       EVESDM = 0.0
       EVESDR = 0.0
C
       DO 32 I = 1, NPOINT
C
       PERP = .TRUE.
       PARA = .FALSE.
       IF(I.LE.20)PARA = .TRUE.
       IF(I.LE.20)PERP = .FALSE.
       DOWN = .FALSE.
       IF(I.LE.20.AND.I.GE.11)DOWN = .TRUE.
       IF(I.GE.31)DOWN = .TRUE.
C
C        Change the index here instead of all through the following.
C
       K = I
       IF(PERP)GOTO 33
C
C        All the parallel
C
       IF(EI(K).LE.O)GOTO 61
       PARSDI = PARSDI + ((EI(K) - PARAVI)**2)
61     CONTINUE
       IF(MOE(K).LE.O)GOTO 161
       PARSDE = PARSDE + ((MOE(K) - PARAVE)**2)
161    CONTINUE
       IF(MULT(K).LE.O)GOTO 261
       PARSDM = PARSDM + ((MULT(K) - PARAVM)**2)
261    CONTINUE
       IF(MOR(K).LE.O)GOTO 361
       PARSDR = PARSDR + ((MOR(K) - PARAVR)**2)
361    CONTINUE
       GOTO 34
C
C        All the perpendicular
C
33     CONTINUE
       IF(EI(K).LE.O)GOTO 62
       PERSDI = PERSDI + ((EI(K) - PERAVI)**2)
62     CONTINUE
```

```
C
C       The calculations for standard deviation, coefficient of
C      variation, and 5% exclusion limit.
C
C       All parallel
C
       IF(IPARA1.LE.0)GOTO 70
       PARS2I = SQRT(PARSDI / (IPARA1-1))
       PARCOI = PARS2I / PARAVI
       AN = FLOAT(IPARA1)
       PAR5PI = PARAVI - (1.650 * PARS2I )
 70    CONTINUE
       IF(IPARA2.LE.0)GOTO 170
       PARS2E = SQRT(PARSDE / (IPARA2-1))
       PARCOE = PARS2E / PARAVE
       AN = FLOAT(IPARA2)
       PAR5PE = PARAVE - (1.650 * PARS2E )
 170   CONTINUE
       IF(IPARA3.LE.0)GOTO 270
       PARS2M = SQRT(PARSDM / (IPARA3-1))
       PARCOM = PARS2M / PARAVM
       AN = FLOAT(IPARA3)
       PAR5PM = PARAVM - (1.650 * PARS2M )
 270   CONTINUE
       IF(IPARA4.LE.0)GOTO 370
       PARS2R = SQRT(PARSDR / (IPARA4-1))
       PARCOR = PARS2R / PARAVR
       AN = FLOAT(IPARA4)
       PAR5PR = PARAVR - (1.650 * PARS2R )
 370   CONTINUE
C
C       All perpendicular
C
       IF(IPERP1.LE.0)GOTO 71
       PERS2I = SQRT(PERSDI / (IPERP1-1))
       PERCOI = PERS2I / PERAVI
       AN = FLOAT(IPERP1)
       PER5PI = PERAVI - (1.650 * PERS2I )
 71    CONTINUE
       IF(IPERP2.LE.0)GOTO 171
       PERS2E = SQRT(PERSDE / (IPERP2-1))
       PERCOE = PERS2E / PERAVE
       AN = FLOAT(IPERP2)
       PER5PE = PERAVE - (1.650 * PERS2E )
 171   CONTINUE
       IF(IPERP3.LE.0)GOTO 271
       PERS2M = SQRT(PERSDM / (IPERP3-1))
       PERCOM = PERS2M / PERAVM
       AN = FLOAT(IPERP3)
       PER5PM = PERAVM - (1.650 * PERS2M )
 271   CONTINUE
       IF(IPERP4.LE.0)GOTO 371
       PERS2R = SQRT(PERSDR / (IPERP4-1))
       PERCOR = PERS2R / PERAVR
       AN = FLOAT(IPERP4)
       PER5PR = PERAVR - (1.650 * PERS2R )
 371   CONTINUE
C
C       All parallel up
C
       IF(IPARU1.LE.0)GOTO 72
       PAUS2I = SQRT(PAUSDI / (IPARU1-1))
       PAUCOI = PAUS2I / PAUAVI
       AN = FLOAT(IPARU1)
       PAU5PI = PAUAVI - (1.650 * PAUS2I )
 72    CONTINUE
       IF(IPARU2.LE.0)GOTO 172
       PAUS2E = SQRT(PAUSDE / (IPARU2-1))
       PAUCOE = PAUS2E / PAUAVE
       AN = FLOAT(IPARU2)
       PAU5PE = PAUAVE - (1.650 * PAUS2E )
 172   CONTINUE
       IF(IPARU3.LE.0)GOTO 272
       PAUS2M = SQRT(PAUSDM / (IPARU3-1))
       PAUCOM = PAUS2M / PAUAVM
       AN = FLOAT(IPARU3)
       PAU5PM = PAUAVM - (1.650 * PAUS2M )
 272   CONTINUE
       IF(IPARU4.LE.0)GOTO 372
       PAUS2R = SQRT(PAUSDR / (IPARU4-1))
       PAUCOR = PAUS2R / PAUAVR
       AN = FLOAT(IPARU4)
       PAU5PR = PAUAVR - (1.650 * PAUS2R )
 372   CONTINUE
C
C       All perpendicular up
C
       IF(IPERU1.LE.0)GOTO 73
       PEUS2I = SQRT(PEUSDI / (IPERU1-1))
       PEUCOI = PEUS2I / PEUAVI
       AN = FLOAT(IPERU1)
       PEU5PI = PEUAVI - (1.650 * PEUS2I )
 73    CONTINUE
       IF(IPERU2.LE.0)GOTO 173
       PEUS2E = SQRT(PEUSDE / (IPERU2-1))
       PEUCOE = PEUS2E / PEUAVE
       AN = FLOAT(IPERU2)
       PEU5PE = PEUAVE - (1.650 * PEUS2E )
 173   CONTINUE
       IF(IPERU3.LE.0)GOTO 273
       PEUS2M = SQRT(PEUSDM / (IPERU3-1))
       PEUCOM = PEUS2M / PEUAVM
       AN = FLOAT(IPERU3)
```

```
C
C       Write out the thickness.
C
      WRITE(6,601)T
601   FORMAT(/30X,'Thickness (mm) =  ',G12.5)
C
C       Write out the first title.
C
      WRITE(6,602)(TITLEA(1,J),J=1,20)
602   FORMAT(/////30X,30A4,//)
C
C       Write out the header:
C
      WRITE(6,603)
603   FORMAT(//,38X,'EI',14X,'MOE',13X,'M ult.',
     * 12X,'MOR',/, 38X, '(Nm2)',11X, '(MPa)',
     * 13X, '(Nm)', 12X, '(kPa)',/)
C
C       The loop will write out all the data as a little
C     check.
C
      DO 50 I=1,NPOINT
C
C       Find out when 10 WRITE statements have gone by.
C
      A = I / 10
      I10 = A * 10
      NTIT = (I10 / 10) + 1
C
C       Write out the information.
C
      WRITE(6,604) EI(I),MOE(I),MULT(I),MOR(I)
604   FORMAT(30X,4(5X,G12.5))
C
C       If 10 WRITE statements have gone by, write out the title
C     of the next little bit.
C
      IF(NTIT.GT.N10)GOTO 52
      IF(I10.EQ.I)GOTO 51
52    CONTINUE
50    CONTINUE
      GOTO 53
C
C       A little outside piece for doing things on an IF statement.
C
51    CONTINUE
      WRITE(6,602)(TITLEA(NTIT,J),J=1,20)
      WRITE(6,603)
      GOTO 52
53    CONTINUE
C
C       Write out the statistics.  If none were calculated
C     then don't write them out.
C
666   FORMAT(/35X,' #', 4X, 'Average', 7X, 'Std. Dev.',2X,
     *'Coef. of Var.', 4X, '5% Ex Lt', 6X, 'Maximum', 7X,
     *'Minimum',/)
610   FORMAT(20X,'EI (Nm2) :      ', I2, 6(2X,G12.5),/20X,
     * 'M.O.E. (MPa) : ', I2, 6(2X,G12.5),/20X,
     * 'M ult. (Nm) :  ', I2, 6(2X,G12.5),/20X,
     * 'M.O.R. (kPa) : ', I2, 6(2X,G12.5),/)
C
C       And the statistics.
C
      WRITE(6,620)(TITLE(I),I=1,20)
620   FORMAT('1',8(/),20X,'The statistics:',///20X,20A4)
C
      WRITE(6,628)
628   FORMAT(///20X,'All Tests:',/)
      WRITE(6,666)
      WRITE(6,610)IEVER1, EVERYI, EVES2I, EVECOI, EVE5PI,
     * EVEMXI, EVEMNI, IEVER2, EVERYE,
     * EVES2E, EVECOE, EVE5PE, EVEMXE, EVEMNE,
     * IEVER3, EVERYM, EVES2M, EVECOM, EVE5PM, EVEMXM, EVEMNM,
     * IEVER4, EVERYR, EVES2R, EVECOR, EVE5PR, EVEMXR, EVEMNR
C
      WRITE(6,621)
621   FORMAT(////20X,'All parallel results:',/)
      WRITE(6,666)
      WRITE(6,610)IPARA1, PARAVI, PARS2I, PARCOI, PAR5PI,
     * PARMXI, PARMNI, IPARA2, PARAVE,
     * PARS2E, PARCOE, PAR5PE, PARMXE, PARMNE,
     * IPARA3, PARAVM, PARS2M, PARCOM, PAR5PM, PARMXM, PARMNM,
     * IPARA4, PARAVR, PARS2R, PARCOR, PAR5PR, PARMXR, PARMNR
C
      WRITE(6,623)
623   FORMAT(////20X,'All perpendicular results:',/)
      WRITE(6,666)
      WRITE(6,610)IPERP1, PERAVI, PERS2I, PERCOI, PER5PI,
     * PERMXI, PERMNI, IPERP2, PERAVE,
     * PERS2E, PERCOE, PER5PE, PERMXE, PERMNE,
     * IPERP3, PERAVM, PERS2M, PERCOM, PER5PM, PERMXM, PERMNM,
     * IPERP4, PERAVR, PERS2R, PERCOR, PER5PR, PERMXR, PERMNR
C
      WRITE(6,624)
624   FORMAT(////20X,'All parallel and up results:',/)
      WRITE(6,666)
      WRITE(6,610)IPARU1, PAUAVI, PAUS2I, PAUCOI, PAU5PI,
     * PAUMXI, PAUMNI, IPARU2, PAUAVE,
     * PAUS2E, PAUCOE, PAU5PE, PAUMXE, PAUMNE,
     * IPARU3, PAUAVM, PAUS2M, PAUCOM, PAU5PM, PAUMXM, PAUMNM,
     * IPARU4, PAUAVR, PAUS2R, PAUCOR, PAU5PR, PAUMXR, PAUMNR
```

```
C       This program was written to manipulate data
C       from large scale SPECIFIC GRAVITY and
C       MOISTURE CONTENT tests performed on
C       plywood and waferboard specimens.
C
C       The data file should be set up as follows:
C
C          1.  MAIN TITLE
C          2.  NPOINTS,
C          3.  First group of 10 title
C          4.  Original Weight, Oven Dry Weight, Volume
C          5.-9.  Repeat line 4.
C                NOTE: Repeat lines 3 - 9 for as many groups of
C                      10 as you have.  If you have less than
C                      4, change NPOINTS, and if you have more
C                      than 4, change the dimensioning of the
C                      vectors and arrays.
C
C       Dimension the various vectors and arrays.  They are thus:
C
C         TITLE  - The overall title for the run.
C         TITLEA - The titles of the groups of ten.  Each line
C                  is one title.
C
C       Define some real variables.
C
      REAL  SPGR(40), MASS1(40), MASSDR(40), VOL(40),
     * MOIST(40),  TITLE(20), TITLEA(4,20)
      REAL SPGRME(4), SPGRSD(4),
     * SPGRCO(4), SPGR5P(4), SPGRMX(4), SPGRMN(4)
      REAL MOISME(4), MOISSD(4), MOISCO(4), MOIS5P(4),
     * MOISMX(4), MOISMN(4), MOI, MOISD
C
C       Some vectors for counting.
C
      INTEGER ISPGR(4), IMOIS(4)
C
C       Read in the main title.
C
      READ(5,500)(TITLE(I),I=1,20)
500   FORMAT(20A4)
      CALL FREAD(5,'I:',NPOINT)
C
C       N10 is the number of groups of 10.
C
      N10 = NPOINT / 10
C
C       Read in the first group of 10 title:
C
      READ(5,500)(TITLEA(1,J),J=1,20)
C
C       The loop will read in all the data.
C
      DO 10 I=1,NPOINT
C
C       Find out when 10 READ statements have gone by, in order
C     that we may read in another group of 10 title.
C
      A = I / 10
      I10 = A * 10
      NTIT = I10 / 10 + 1
C
C       Read in the information.  Check which type to read.
C
      CALL FREAD(5,'3R:',MASS1(I),MASSDR(I),VOL(I))
C
C       Calcualte the specific gravity and the moisture content.
C
      SPGR(I) = MASSDR(I)/VOL(I)
      MOIST(I) = 100*(MASS1(I) - MASSDR(I))/MASSDR(I)
C
C       If 10 READ statements have gone by, read in a new title.
C     NTIT is the title number.
C
      IF(NTIT.GT.N10)GOTO 11
      IF(I10.EQ.I)READ(5,500)(TITLEA(NTIT,J),J=1,20)
11    CONTINUE
10    CONTINUE
C
C       And now calculate the various statistical quantities.
C
C                                     (name)
C         a) Specific Gravity         SPGR
C         b) Moisture Content         MOIS
C
C         with ME, SD, CO, 5P, MX, MN to establish whether they
C       are mean, standard deviation, coefficent of variation,
C       5 % confidence limit, maximum, or minimum for that group
C       of 10.
C
C       Initialize these quantities.  These will be divided by
C     the counters to find the maximums and minimums for the
C     entire run.
C
      ESPG = 0.0
      EMOI = 0.0
      ESPGMX = -1.0E+10
      ESPGMN = 1.0E+10
      EMOISX = -1.0E+10
      EMOISN = 1.0E+10
```

```
63    CONTINUE
      IF(IEMOI.LE.0)GOTO 64
      EMCSD = EMCSD + ((MOIST(K) - AEMOI)**2)
64    CONTINUE
31    CONTINUE
C
C       The calculations for standard deviation, coefficient of
C     variation, and 5% confidence limit.
C
      IF(ISPGR(J).LE.0)GOTO 70
      SPGRSD(J) = SQRT(SPGRD / FLOAT(ISPGR(J)-1))
      SPGRCO(J) = SPGRSD(J) / SPGRME(J)
      AN = FLOAT(ISPGR(J))
      SPGR5P(J) = SPGRME(J) - (1.650 * SPGRSD(J) )
70    CONTINUE
      IF(IMOIS(J).LE.0)GOTO 71
      MOISSD(J) = SQRT(MOISD / FLOAT(IMOIS(J)-1))
      MOISCO(J) = MOISSD(J) / MOISME(J)
      AN = FLOAT(IMOIS(J))
      MOIS5P(J) = MOISME(J) - (1.650 * MOISSD(J) )
71    CONTINUE
21    CONTINUE
      IF(IESPG.LE.0)GOTO 72
      ESPGRD = SQRT(ESGSD / FLOAT(IESPG-1))
      ESPGCO = ESPGRD / AESPG
      AN = FLOAT(IESPG)
      ESPG5P = AESPG - (1.650 * ESPGRD )
72    CONTINUE
      IF(IEMOI.LE.0)GOTO 73
      EMOISD = SQRT(EMCSD / FLOAT(IEMOI-1))
      EMOICO = EMOISD / AEMOI
      AN = FLOAT(IEMOI)
      EMOI5P = AEMOI - (1.650 * EMOISD )
73    CONTINUE
C
C       Start to write out the results.
C
      WRITE(6,600)(TITLE(I),I=1,20)
600   FORMAT('1',8(/),30X,30A4,5(/))
C
C       Write out the first title.
C
      WRITE(6,601)(TITLEA(1,J),J=1,10)
601   FORMAT(7(/),40X,30A4,2(/))
C
C       Write out the header.
C
      WRITE(6,603)
603   FORMAT(/,43X,'Specific Gravity',12X,'Moisture Content',/,
     * 78X, '(%)', /)
C
C       The loop will write out all the data as a little
C     check.
C
      DO 50 I=1,NPOINT
C
C       Find out when 10 WRITE statements have gone by.
C
      A = I / 10
      I10 = A * 10
      NTIT = (I10 /10) + 1
C
C       Write out the information.
C
      WRITE(6,616) SPGR(I),MOIST(I)
616   FORMAT(47X,G12.5,15X,G12.5)
C
C       If 10 WRITE statements have gone by, write out the title
C     of the next little bit.
C
      IF(NTIT.GT.N10)GOTO 52
      IF(I10.EQ.I)GOTO 51
52    CONTINUE
50    CONTINUE
      GOTO 53
C
C       A little outside piece for doing things on an IF statement.
C
51    CONTINUE
      WRITE(6,601)(TITLEA(NTIT,J),J=1,20)
      WRITE(6,603)
      GOTO 52
53    CONTINUE
C
C       The loop will write out the calculated values.
C
C       Write out the initial title, and then start the loop.
C
      WRITE(6,699)(TITLE(I),I=1,20)
699   FORMAT('1',8(/),20X,30A4,5(/))
      WRITE(6,606)
606   FORMAT(4(/),20X,'The statistics :',5(/),20X,
     * 'Results For All Tests:',2(/))
```

```
C        This program was written for the purpose of
C      manipulating data from large scale concentrated
C      load tests performed on plywood and waferboard
C      panels.
C
C        The data file should be set up as follows:
C
C          1.  MAIN TITLE
C          2.  NPOINTS
C                NOTE: NPOINTS will default to 120 if left blank,
C                      and if all the values are parallel, let
C                      SKIP be equal to one.  Otherwise, leave it
C                      blank.
C          3.  First group of 8 title
C          4.  Data
C          5.-11.  Repeat line 4.
C                NOTE: Repeat lines 3 - 11 for as many groups of
C                      8 as you have.
C
C        Dimension the various vectors and arrays.  They are thus:
C
C          ASU### - Average supported values.
C          AV###  - Average deflection values.
C          AUN### - Average unsupported deflections.
C          AVPULT - Average ultimate load per panel.
C          AVCLIP - Average clip failure load per panel.
C          CLIP - - The clip load.
C          SUPULT - Average ultimate supported load.
C          UNPULT - Average ultimate unsupported load.
C          LB###  - Deflection for that load.
C          PULT - - Ultimate load.
C          TITLE  - Individual titles.
C          TITLEA - Titles of the groups of eight.  Each line
C                     is one title.
C
       REAL LB75(100), LB50(100), LB100(100), LB150(100),
     * LB200(100), PULT(100), CLIP(100), AV75(12), AV50(12),
     * AV100(12), AV150(12), AV200(12), AVPULT(12), AVCLIP(12),
     * AUN75(12), AUN50(12), AUN100(12), AUN150(12), AUN200(12),
     * UNPULT(12), ASU75(12), ASU50(12), SUCLIP(12),
     * ASU100(12), ASU150(12), ASU200(12), SUPULT(12),
     * D75(12), D50(12),
     * D100(12), D150(12), D200(12), DPULT(12), DCLIP(12),
     * DUN75(12), DUN50(12), DUN100(12), DUN150(12), DUN200(12),
     * DUNPU(12), DSU75(12), DSU50(12), DSCLIP(12),
     * DSU100(12), DSU150(12), DSU200(12), DSUPU(12),
     * C75(12), C50(12),
     * C100(12), C150(12), C200(12), CPULT(12), CCLIP(12),
     * CUN75(12), CUN50(12), CUN100(12), CUN150(12), CUN200(12),
     * CUNPU(12), CSU75(12), CSU50(12), CSCLIP(12),
     * CSU100(12), CSU150(12), CSU200(12), CSUPU(12)
C
       REAL P75(12), P50(12),
     * P100(12), P150(12), P200(12), PPULT(12), PCLIP(12),
     * PUN75(12), PUN50(12), PUN100(12), PUN150(12), PUN200(12),
     * PUNPU(12), PSU75(12), PSU50(12), PSCLIP(12),
     * PSU100(12), PSU150(12), PSU200(12), PSUPU(12),
     * TITLE(20), TITLEA(12,20)
C
       REAL P75MX(12), P75MN(12), P50MX(12), P50MN(12),
     * P10MX(12), P15MX(12), P20MX(12), PPUMX(12), PCLMX(12),
     * P10MN(12), P15MN(12), P20MN(12), PPUMN(12), PCLMN(12)
       REAL PS75MX(12), PS75MN(12), PS50MX(12), PS50MN(12),
     * PS10MX(12), PS15MX(12), PS20MX(12), PSPUMX(12), PSCLMX(12),
     * PS10MN(12), PS15MN(12), PS20MN(12), PSPUMN(12), PSCLMN(12)
       REAL PU75MX(12), PU75MN(12), PU50MX(12), PU50MN(12),
     * PU10MX(12), PU15MX(12), PU20MX(12), PUPUMX(12),
     * PU10MN(12), PU15MN(12), PU20MN(12), PUPUMN(12)
C
       INTEGER I75(12), I50(12),
     * I100(12), I150(12), I200(12), IPULT(12), ICLIP(12),
     * IUN75(12), IUN50(12), IUN100(12), IUN150(12), IUN200(12),
     * IUNPU(12), ISU75(12), ISU50(12), ISUCL(12),
     * ISU100(12), ISU150(12), ISU200(12), ISUPU(12)
C
C
C        Read in the main title.
C
       READ(5,500)(TITLE(I),I=1,20)
500    FORMAT(20A4)
       CALL FREAD(5,'I:',NPOINT)
C
C        N8 is the number of groups of 8.
C
       N8 = NPOINT / 8
C
C        Read in the first group of 8 title:
C
       READ(5,500)(TITLEA(1,J),J=1,20)
C
C        The loop will read in all the other stuff.
C
       DO 10 I=1,NPOINT
C
C        Find out when 8 READ statements have gone by, in order
C      that we may read in another group of 8 title.
C
       A = I / 8
       I8 = A * 8
       NTIT = I8 / 8 + 1
```

```
C
      S75SMU = 0.0
      S50SMU = 0.0
      S10SMU = 0.0
      S15SMU = 0.0
      S20SMU = 0.0
      SPUSMU = 0.0
      SCLSMU = 0.0
      I75SMU = 0
      I50SMU = 0
      I10SMU = 0
      I15SMU = 0
      I20SMU = 0
      IPUSMU = 0
      ICLSMU = 0
C
      S75SME = 0.0
      S50SME = 0.0
      S10SME = 0.0
      S15SME = 0.0
      S20SME = 0.0
      SPUSME = 0.0
      SCLSME = 0.0
      I75SME = 0
      I50SME = 0
      I10SME = 0
      I15SME = 0
      I20SME = 0
      IPUSME = 0
      ICLSME = 0
C
      S75MXS = -1.0E10
      S50MXS = -1.0E10
      S10MXS = -1.0E10
      S15MXS = -1.0E10
      S20MXS = -1.0E10
      SPUMXS = -1.0E10
      SCLMXS = -1.0E10
C
      S75MNS = 1.0E10
      S50MNS = 1.0E10
      S10MNS = 1.0E10
      S15MNS = 1.0E10
      S20MNS = 1.0E10
      SPUMNS = 1.0E10
      SCLMNS = 1.0E10
C
      S75MXU = -1.0E10
      S50MXU = -1.0E10
      S10MXU = -1.0E10
      S15MXU = -1.0E10
      S20MXU = -1.0E10
      SPUMXU = -1.0E10
      SCLMXU = -1.0E10
C
      S75MNU = 1.0E10
      S50MNU = 1.0E10
      S10MNU = 1.0E10
      S15MNU = 1.0E10
      S20MNU = 1.0E10
      SPUMNU = 1.0E10
      SCLMNU = 1.0E10
C
      S75MXE = -1.0E10
      S50MXE = -1.0E10
      S10MXE = -1.0E10
      S15MXE = -1.0E10
      S20MXE = -1.0E10
      SPUMXE = -1.0E10
      SCLMXE = -1.0E10
C
      S75MNE = 1.0E10
      S50MNE = 1.0E10
      S10MNE = 1.0E10
      S15MNE = 1.0E10
      S20MNE = 1.0E10
      SPUMNE = 1.0E10
      SCLMNE = 1.0E10
C
C        Now, start the loop to run through the groups of 8.
C
      DO 20 J=1, N8
C
C        Initialize the quantities for the eight.
C
      DEF75  = 0.0
      DEF50  = 0.0
      DEF100 = 0.0
      DEF150 = 0.0
      DEF200 = 0.0
      PULTTO = 0.0
      CLIPTO = 0.0
      I75(J)   = 0
      I50(J)   = 0
      I100(J) = 0
      I150(J) = 0
      I200(J) = 0
      IPULT(J) = 0
      ICLIP(J) = 0
```

```
62    CONTINUE
      IF(LB150(K).LE.0.0)GOTO 63
      IEX150 = IEX150 + 1
      AEX150 = AEX150 + LB150(K)
63    CONTINUE
      IF(LB200(K).LE.0.0)GOTO 64
      IEX200 = IEX200 + 1
      AEX200 = AEX200 + LB200(K)
64    CONTINUE
      IF(PULT(K).LE.0.0)GOTO 320
      IEXPUL = IEXPUL + 1
      AEXPUL = AEXPUL + PULT(K)
320   CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 321
      IEXCLI = IEXCLI + 1
      AEXCLI = AEXCLI + CLIP(K)
321   CONTINUE
      GOTO 71
C
C       Interior.
C
70    CONTINUE
      IF(LB75(K).LE.0.0)GOTO 65
      IIN75 = IIN75 + 1
      AIN75 = AIN75 + LB75(K)
65    CONTINUE
      IF(LB50(K).LE.0.0)GOTO 66
      IIN50 = IIN50 + 1
      AIN50 = AIN50 + LB50(K)
66    CONTINUE
      IF(LB100(K).LE.0.0)GOTO 67
      IIN100 = IIN100 + 1
      AIN100 = AIN100 + LB100(K)
67    CONTINUE
      IF(LB150(K).LE.0.0)GOTO 68
      IIN150 = IIN150 + 1
      AIN150 = AIN150 + LB150(K)
68    CONTINUE
      IF(LB200(K).LE.0.0)GOTO 69
      IIN200 = IIN200 + 1
      AIN200 = AIN200 + LB200(K)
69    CONTINUE
      IF(PULT(K).LE.0.0)GOTO 322
      IINPUL = IINPUL + 1
      AINPUL = AINPUL + PULT(K)
322   CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 323
      IINCLI = IINCLI + 1
      AINCLI = AINCLI + CLIP(K)
323   CONTINUE
71    CONTINUE
C
C       Now, for the unsupported and supported parts.
C
      IF(I.LT.5)GOTO 72
C
C       Supported.
C
      IF(LB75(K).LE.0.0)GOTO 80
      ISU75(J) = ISU75(J) + 1
      SU75 = SU75 + LB75(K)
      I75SMS = I75SMS + 1
      S75SMS = S75SMS + LB75(K)
80    CONTINUE
      IF(LB50(K).LE.0.0)GOTO 81
      ISU50(J) = ISU50(J) + 1
      SU50 = SU50 +  LB50(K)
      I50SMS = I50SMS + 1
      S50SMS = S50SMS + LB50(K)
81    CONTINUE
      IF(LB100(K).LE.0.0)GOTO 82
      ISU100(J) = ISU100(J) + 1
      SU100 = SU100 + LB100(K)
      I10SMS = I10SMS + 1
      S10SMS = S10SMS + LB100(K)
82    CONTINUE
      IF(LB150(K).LE.0.0)GOTO 83
      ISU150(J) = ISU150(J) + 1
      SU150 = SU150 + LB150(K)
      I15SMS = I15SMS + 1
      S15SMS = S15SMS + LB150(K)
83    CONTINUE
      IF(LB200(K).LE.0.0)GOTO 84
      ISU200(J) = ISU200(J) + 1
      SU200 = SU200 + LB200(K)
      I20SMS = I20SMS + 1
      S20SMS = S20SMS + LB200(K)
84    CONTINUE
      IF(PULT(K).LE.0.0)GOTO 85
      ISUPU(J) = ISUPU(J) + 1
      SUPU = SUPU + PULT(K)
      IPUSMS = IPUSMS + 1
      SPUSMS = SPUSMS + PULT(K)
85    CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 86
      ISUCL(J) = ISUCL(J) + 1
      SUCL = SUCL + CLIP(K)
      ICLSMS = ICLSMS + 1
      SCLSMS = SCLSMS + CLIP(K)
86    CONTINUE
      GOTO 73
72    CONTINUE
```

```
108   CONTINUE
      IF(IUN100(J).LE.0)GOTO 109
      AUN100(J) = UN100 / IUN100(J)
109   CONTINUE
      IF(IUN150(J).LE.0)GOTO 110
      AUN150(J) = UN150 / IUN150(J)
110   CONTINUE
      IF(IUN200(J).LE.0)GOTO 111
      AUN200(J) = UN200 / IUN200(J)
111   CONTINUE
      IF(IUNPU(J).LE.0)GOTO 112
      UNPULT(J) = UNPU / IUNPU(J)
112   CONTINUE
C
C       All the supported quantites.
C
      IF(ISU75(J).LE.0)GOTO 113
      ASU75(J) = SU75 / ISU75(J)
113   CONTINUE
      IF(ISU50(J).LE.0)GOTO 114
      ASU50(J) = SU50 /,ISU50(J)
114   CONTINUE
      IF(ISU100(J).LE.0)GOTO 115
      ASU100(J) = SU100 / ISU100(J)
115   CONTINUE
      IF(ISU150(J).LE.0)GOTO 116
      ASU150(J) = SU150 / ISU150(J)
116   CONTINUE
      IF(ISU200(J).LE.0)GOTO 117
      ASU200(J) = SU200 / ISU200(J)
117   CONTINUE
      IF(ISUPU(J).LE.0)GOTO 118
      SUPULT(J) = SUPU / ISUPU(J)
118   CONTINUE
      IF(ISUCL(J).LE.0)GOTO 119
      SUCLIP(J) = SUCL / ISUCL(J)
119   CONTINUE
20    CONTINUE
C
C       And now find the overall averages.
C
C       Initialize the averages for interior and exterior.
C
      AVI75  = -0.0
      AVI50  = -0.0
      AVI100 = -0.0
      AVI150 = -0.0
      AVI200 = -0.0
      AVIPUL = -0.0
      AVICLI = -0.0
      AVE75  = -0.0
      AVE50  = -0.0
      AVE100 = -0.0
      AVE150 = -0.0
      AVE200 = -0.0
      AVEPUL = -0.0
      AVECLI = -0.0
C
C       Initialize the averages for everything.
C
      S75AVS  = -0.0
      S50AVS  = -0.0
      S10AVS  = -0.0
      S15AVS  = -0.0
      S20AVS  = -0.0
      SPUAVS  = -0.0
      SCLAVS  = -0.0
C
      S75AVU  = -0.0
      S50AVU  = -0.0
      S10AVU  = -0.0
      S15AVU  = -0.0
      S20AVU  = -0.0
      SPUAVU  = -0.0
C
      S75AVE  = -0.0
      S50AVE  = -0.0
      S10AVE  = -0.0
      S15AVE  = -0.0
      S20AVE  = -0.0
      SPUAVE  = -0.0
      SCLAVE  = -0.0
C
C       Everything.
C
      IF(I75SME.LE.0)GOTO 130
      S75AVE = S75SME / I75SME
130   CONTINUE
      IF(I50SME.LE.0)GOTO 131
      S50AVE = S50SME / I50SME
131   CONTINUE
      IF(I10SME.LE.0)GOTO 132
      S10AVE = S10SME / I10SME
132   CONTINUE
      IF(I15SME.LE.0)GOTO 133
      S15AVE = S15SME / I15SME
133   CONTINUE
      IF(I20SME.LE.0)GOTO 134
      S20AVE = S20SME / I20SME
```

```
C
C       And now, the statistics.
C
      STI75  = 0.0
      STI50  = 0.0
      STI100 = 0.0
      STI150 = 0.0
      STI200 = 0.0
      STIPUL = 0.0
      STICLI = 0.0
C
C       And the exterior average running total counters.
C
      STE75  = 0.0
      STE50  = 0.0
      STE100 = 0.0
      STE150 = 0.0
      STE200 = 0.0
      STEPUL = 0.0
      STECLI = 0.0
C
C       Maximum and minimum values, Initiation of.
C
      PE75MX = -1E+10
      PE75MN = 1E+10
      PE50MX = -1E+10
      PE50MN = 1E+10
      PE10MX = -1E+10
      PE10MN = 1E+10
      PE15MX = -1E+10
      PE15MN = 1E+10
      PE20MX = -1E+10
      PE20MN = 1E+10
      PEPUMX = -1E+10
      PEPUMN = 1E+10
      PECLMX = -1E+10
      PECLMN = 1E+10
C
      PI75MX = -1E+10
      PI75MN = 1E+10
      PI50MX = -1E+10
      PI50MN = 1E+10
      PI10MX = -1E+10
      PI10MN = 1E+10
      PI15MX = -1E+10
      PI15MN = 1E+10
      PI20MX = -1E+10
      PI20MN = 1E+10
      PIPUMX = -1E+10
      PIPUMN = 1E+10
      PICLMX = -1E+10
      PICLMN = 1E+10
C
      S75SE = 0.0
      S50SE = 0.0
      S10SE = 0.0
      S15SE = 0.0
      S20SE = 0.0
      SPUSE = 0.0
      SCLSE = 0.0
C
      S75SS = 0.0
      S50SS = 0.0
      S10SS = 0.0
      S15SS = 0.0
      S20SS = 0.0
      SPUSS = 0.0
      SCLSS = 0.0
C
      S75SU = 0.0
      S50SU = 0.0
      S10SU = 0.0
      S15SU = 0.0
      S20SU = 0.0
      SPUSU = 0.0
C
C       Now, start the loop to run through the groups of 8.
C
      DO 21 J=1, N8
C
C       Initialize the quantities for the eight.
C
      S75  = 0.0
      S50  = 0.0
      S100 = 0.0
      S150 = 0.0
      S200 = 0.0
      SPULT  = 0.0
      SCLIP  = 0.0
C
C       Initialize the quantities for the unsupported four.
C
      SUN75  = 0.0
      SUN50  = 0.0
      SUN100 = 0.0
      SUN150 = 0.0
      SUN200 = 0.0
      SUNPU  = 0.0
```

```
244   CONTINUE
      IF(PULT(K).LE.0.0)GOTO 245
      SPULT = SPULT + ((PULT(K) - AVPULT(J))**2)
      SPUSE = SPUSE + ((PULT(K) - SPUAVE)**2)
      IF(PULT(K).GT.PPUMX(J))PPUMX(J) = PULT(K)
      IF(PULT(K).LT.PPUMN(J))PPUMN(J) = PULT(K)
      IF(PULT(K).GT.SPUMXE)SPUMXE = PULT(K)
      IF(PULT(K).LT.SPUMNE)SPUMNE = PULT(K)
245   CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 246
      SCLIP = SCLIP + ((CLIP(K) - AVCLIP(J))**2)
      SCLSE = SCLSE + ((CLIP(K) - SCLAVE)**2)
      IF(CLIP(K).GT.PCLMX(J))PCLMX(J) = CLIP(K)
      IF(CLIP(K).LT.PCLMN(J))PCLMN(J) = CLIP(K)
      IF(CLIP(K).GT.SCLMXE)SCLMXE = CLIP(K)
      IF(CLIP(K).LT.SCLMNE)SCLMNE = CLIP(K)
246   CONTINUE
C
C       And now for the overall quantities.
C
      IF(I.EQ.1.OR.I.EQ.4.OR.I.EQ.6.OR.I.EQ.7)GOTO 74
C
C       Exterior.
C
      IF(LB75(K).LE.0.0)GOTO 260
      STE75 = STE75 + ((LB75(K) - AVE75)**2)
      IF(LB75(K).GT.PE75MX)PE75MX = LB75(K)
      IF(LB75(K).LT.PE75MN)PE75MN = LB75(K)
260   CONTINUE
      IF(LB50(K).LE.0.0)GOTO 261
      STE50 = STE50 + ((LB50(K) - AVE50)**2)
      IF(LB50(K).GT.PE50MX)PE50MX = LB50(K)
      IF(LB50(K).LT.PE50MN)PE50MN = LB50(K)
261   CONTINUE
      IF(LB100(K).LE.0.0)GOTO 262
      STE100 = STE100 + ((LB100(K) - AVE100)**2)
      IF(LB100(K).GT.PE10MX)PE10MX = LB100(K)
      IF(LB100(K).LT.PE10MN)PE10MN = LB100(K)
262   CONTINUE
      IF(LB150(K).LE.0.0)GOTO 263
      STE150 = STE150 + ((LB150(K) - AVE150)**2)
      IF(LB150(K).GT.PE15MX)PE15MX = LB150(K)
      IF(LB150(K).LT.PE15MN)PE15MN = LB150(K)
263   CONTINUE
      IF(LB200(K).LE.0.0)GOTO 264
      STE200 = STE200 + ((LB200(K) - AVE200)**2)
      IF(LB200(K).GT.PE20MX)PE20MX = LB200(K)
      IF(LB200(K).LT.PE20MN)PE20MN = LB200(K)
264   CONTINUE
      IF(PULT(K).LE.0.0)GOTO 328
      STEPUL = STEPUL + ((PULT(K) - AVEPUL)**2)
      IF(PULT(K).GT.PEPUMX)PEPUMX = PULT(K)
      IF(PULT(K).LT.PEPUMN)PEPUMN = PULT(K)
328   CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 329
      STECLI = STECLI + ((CLIP(K) - AVECLI)**2)
      IF(CLIP(K).GT.PECLMX)PECLMX = CLIP(K)
      IF(CLIP(K).LT.PECLMN)PECLMN = CLIP(K)
329   CONTINUE
      GOTO 75
C
C       Interior.
C
74    CONTINUE
      IF(LB75(K).LE.0.0)GOTO 265
      STI75 = STI75 + ((LB75(K) - AVI75)**2)
      IF(LB75(K).GT.PI75MX)PI75MX = LB75(K)
      IF(LB75(K).LT.PI75MN)PI75MN = LB75(K)
265   CONTINUE
      IF(LB50(K).LE.0.0)GOTO 266
      STI50 = STI50 + ((LB50(K) - AVI50)**2)
      IF(LB50(K).GT.PI50MX)PI50MX = LB50(K)
      IF(LB50(K).LT.PI50MN)PI50MN = LB50(K)
266   CONTINUE
      IF(LB100(K).LE.0.0)GOTO 267
      STI100 = STI100 + ((LB100(K) - AVI100)**2)
      IF(LB100(K).GT.PI10MX)PI10MX = LB100(K)
      IF(LB100(K).LT.PI10MN)PI10MN = LB100(K)
267   CONTINUE
      IF(LB150(K).LE.0.0)GOTO 268
      STI150 = STI150 + ((LB150(K) - AVI150)**2)
      IF(LB150(K).GT.PI15MX)PI15MX = LB150(K)
      IF(LB150(K).LT.PI15MN)PI15MN = LB150(K)
268   CONTINUE
      IF(LB200(K).LE.0.0)GOTO 269
      STI200 = STI200 + ((LB200(K) - AVI200)**2)
      IF(LB200(K).GT.PI20MX)PI20MX = LB200(K)
      IF(LB200(K).LT.PI20MN)PI20MN = LB200(K)
269   CONTINUE
      IF(PULT(K).LE.0.0)GOTO 330
      STIPUL = STIPUL + ((PULT(K) - AVIPUL)**2)
      IF(PULT(K).GT.PIPUMX)PIPUMX = PULT(K)
      IF(PULT(K).LT.PIPUMN)PIPUMN = PULT(K)
330   CONTINUE
      IF(CLIP(K).LE.0.0)GOTO 331
      STICLI = STICLI + ((CLIP(K) - AVICLI)**2)
      IF(CLIP(K).GT.PICLMX)PICLMX = CLIP(K)
      IF(CLIP(K).LT.PICLMN)PICLMN = CLIP(K)
331   CONTINUE
```

```
315    CONTINUE
       IF(ISU150(J).LE.0)GOTO 316
       DSU150(J) = SQRT(SSU150 / ISU150(J))
       CSU150(J) = DSU150(J) / ASU150(J)
       AN = FLOAT(ISU150(J))
       PSU150(J) = ASU150(J) - (1.650 * (DSU150(J) ))
316    CONTINUE
       IF(ISU200(J).LE.0)GOTO 317
       DSU200(J) = SQRT(SSU200 / ISU200(J))
       CSU200(J) = DSU200(J) / ASU200(J)
       AN = FLOAT(ISU200)
       PSU200(J) = ASU200(J) - (1.650 * (DSU200(J) ))
317    CONTINUE
       IF(ISUPU(J).LE.0)GOTO 318
       DSUPU(J) = SQRT(SSUPU / ISUPU(J))
       CSUPU(J) = DSUPU(J) / SUPULT(J)
       AN = FLOAT(ISUPU(J))
       PSUPU(J) = SUPULT(J) - (1.650 * (DSUPU(J) ))
318    CONTINUE
       IF(ISUCL(J).LE.0)GOTO 319
       DSCLIP(J) = SQRT(SSUCL / ISUCL(J))
       CSCLIP(J) = DSCLIP(J) / SUCLIP(J)
       AN = FLOAT(ISUCL(J))
       PSCLIP(J) = SUCLIP(J) - (1.650 * (DSCLIP(J) ))
319    CONTINUE
21     CONTINUE
C
C        Initialize some statistical quantities.
C
       DIN75  = -0.0
       DIN50  = -0.0
       DIN100 = -0.0
       DIN150 = -0.0
       DIN200 = -0.0
       DINPUL = -0.0
       DINCLI = -0.0
C
       CIN75  = -0.0
       CIN50  = -0.0
       CIN100 = -0.0
       CIN150 = -0.0
       CIN200 = -0.0
       CINPUL = -0.0
       CINCLI = -0.0
C
       PIN75  = -0.0
       PIN50  = -0.0
       PIN100 = -0.0
       PIN150 = -0.0
       PIN200 = -0.0
       PINPUL = -0.0
       PINCLI = -0.0
C
       DEX75  = -0.0
       DEX50  = -0.0
       DEX100 = -0.0
       DEX150 = -0.0
       DEX200 = -0.0
       DEXPUL = -0.0
       DEXCLI = -0.0
C
       CEX75  = -0.0
       CEX50  = -0.0
       CEX100 = -0.0
       CEX150 = -0.0
       CEX200 = -0.0
       CEXPUL = -0.0
       CEXCLI = -0.0
C
       PEX75  = -0.0
       PEX50  = -0.0
       PEX100 = -0.0
       PEX150 = -0.0
       PEX200 = -0.0
       PEXPUL = -0.0
       PEXCLI = -0.0
C
       S75SDE = -0.0
       S50SDE = -0.0
       S10SDE = -0.0
       S15SDE = -0.0
       S20SDE = -0.0
       SPUSDE = -0.0
       SCLSDE = -0.0
C
       S75CDE = -0.0
       S50CDE = -0.0
       S10CDE = -0.0
       S15CDE = -0.0
       S20CDE = -0.0
       SPUCDE = -0.0
       SCLCDE = -0.0
C
       S75SPE = -0.0
       S50SPE = -0.0
       S10SPE = -0.0
       S15SPE = -0.0
       S20SPE = -0.0
       SPUSPE = -0.0
       SCLSPE = -0.0
```

```
415   CONTINUE
      IF(IEX50.LE.O)GOTO 416
      DEX50 = SQRT(STE50 / (IEX50-1))
      CEX50 = DEX50 / AVE50
      AN = FLOAT(IEX50)
      PEX50 = AVE50 - (1.650 * (DEX50 ))
416   CONTINUE
      IF(IEX100.LE.O)GOTO 417
      DEX100 = SQRT(STE100 / (IEX100-1))
      CEX100 = DEX100 / AVE100
      AN = FLOAT(IEX100)
      PEX100 = AVE100 - (1.650 * (DEX100 ))
417   CONTINUE
      IF(IEX150.LE.O)GOTO 418
      DEX150 = SQRT(STE150 / (IEX150-1))
      CEX150 = DEX150 / AVE150
      AN = FLOAT(IEX150)
      PEX150 = AVE150 - (1.650 * (DEX150 ))
418   CONTINUE
      IF(IEX200.LE.O)GOTO 419
      DEX200 = SQRT(STE200 / (IEX200-1))
      CEX200 = DEX200 / AVE200
      AN = FLOAT(IEX200)
      PEX200 = AVE200 - (1.650 * (DEX200 ))
419   CONTINUE
      IF(IEXPUL.LE.O)GOTO 420
      DEXPUL = SQRT(STEPUL / (IEXPUL-1))
      CEXPUL = DEXPUL / AVEPUL
      AN = FLOAT(IEXPUL)
      PEXPUL = AVEPUL - (1.650 * (DEXPUL ))
420   CONTINUE
      IF(IEXCLI.LE.O)GOTO 421
      DEXCLI = SQRT(STECLI / (IEXCLI-1))
      CEXCLI = DEXCLI / AVECLI
      AN = FLOAT(IEXCLI)
      PEXCLI = AVECLI - (1.650 * (DEXCLI ))
421   CONTINUE
C
C       Everything.
C
      IF(I75SME.LE.O)GOTO 430
      S75SDE = SQRT(S75SE / (I75SME-1))
      S75CDE = S75SDE / S75AVE
      AN = FLOAT(I75SME)
      S755PE = S75AVE - (1.650 * (S75SDE ))
430   CONTINUE
      IF(I50SME.LE.O)GOTO 431
      S50SDE = SQRT(S50SE / (I50SME-1))
      S50CDE = S50SDE / S50AVE
      AN = FLOAT(I50SME)
      S505PE = S50AVE - (1.650 * (S50SDE ))
431   CONTINUE
      IF(I10SME.LE.O)GOTO 432
      S10SDE = SQRT(S10SE / (I10SME-1))
      S10CDE = S10SDE / S10AVE
      AN = FLOAT(I10SME)
      S105PE = S10AVE - (1.650 * (S10SDE ))
432   CONTINUE
      IF(I15SME.LE.O)GOTO 433
      S15SDE = SQRT(S15SE / (I15SME-1))
      S15CDE = S15SDE / S15AVE
      AN = FLOAT(I15SME)
      S155PE = S15AVE - (1.650 * (S15SDE ))
433   CONTINUE
      IF(I20SME.LE.O)GOTO 434
      S20SDE = SQRT(S20SE / (I20SME-1))
      S20CDE = S20SDE / S20AVE
      AN = FLOAT(I20SME)
      S205PE = S20AVE - (1.650 * (S20SDE ))
434   CONTINUE
      IF(IPUSME.LE.O)GOTO 435
      SPUSDE = SQRT(SPUSE / (IPUSME-1))
      SPUCDE = SPUSDE / SPUAVE
      AN = FLOAT(IPUSME)
      SPU5PE = SPUAVE - (1.650 * (SPUSDE ))
435   CONTINUE
      IF(ICLSME.LE.O)GOTO 436
      SCLSDE = SQRT(SCLSE / (ICLSME-1))
      SCLCDE = SCLSDE / SCLAVE
      AN = FLOAT(ICLSME)
      SCL5PE = SCLAVE - (1.650 * (SCLSDE /  SQRT(AN)))
436   CONTINUE
C
C       Supported.
C
      IF(I75SMS.LE.O)GOTO 440
      S75SDS = SQRT(S75SS / (I75SMS-1))
      S75CDS = S75SDS / S75AVS
      AN = FLOAT(I75SMS)
      S755PS = S75AVS - (1.650 * (S75SDS ))
440   CONTINUE
      IF(I50SMS.LE.O)GOTO 441
      S50SDS = SQRT(S50SS / (I50SMS-1))
      S50CDS = S50SDS / S50AVS
      AN = FLOAT(I50SMS)
      S505PS = S50AVS - (1.650 * (S50SDS ))
441   CONTINUE
      IF(I10SMS.LE.O)GOTO 442
      S10SDS = SQRT(S10SS / (I10SMS-1))
      S10CDS = S10SDS / S10AVS
      AN = FLOAT(I10SMS)
      S105PS = S10AVS - (1.650 * (S10SDS ))
```

```
C
C         Write out the information.
C
       WRITE(6,603) LB75(I),LB50(I),LB100(I),LB150(I),
      * LB200(I), PULT(I), CLIP(I)
603    FORMAT(20X,7(3X,G12.5))
C
C         If 8 WRITE statements have gone by, write out the next
C      title.
C
       IF(NTIT.GT.N8)GOTO 52
       IF(I8.EQ.I)GOTO 51
52     CONTINUE
50     CONTINUE
       GOTO 53
C
C         A little outside piece for doing things on an IF statement.
C
51     CONTINUE
       WRITE(6,601)(TITLEA(NTIT,J),J=1,20)
       WRITE(6,602)
       GOTO 52
C
C         Write out the statistics.
C
53     CONTINUE
       WRITE(6,604)(TITLE(I),I=1,20)
604    FORMAT('1',8(/),20X,'The statistics:',
      * ///20X,20A4,/)
       WRITE(6,628)
628    FORMAT(//20X,'Results for All Panels:',/)
       WRITE(6,666)
666    FORMAT(/32X,' #', 3X, 'Average', 6X, 'Std. Dev.',3X,
      *'Coef. of Var.', 4X, '5% Ex Lt', 6X, 'Maximum', 7X,
      * 'Minimum',/)
       WRITE(6,620)I75SME,S75AVE,S75SDE,S75COE,S755PE,S75MXE,S75MNE,
      *I50SME,S50AVE,S50SDE,S50COE,S505PE,S50MXE,S50MNE,
      *I10SME,S10AVE,S10SDE,S10COE,S105PE,S10MXE,S10MNE,
      *I15SME,S15AVE,S15SDE,S15COE,S155PE,S15MXE,S15MNE,
      *I20SME,S20AVE,S20SDE,S20COE,S205PE,S20MXE,S20MNE,
      *IPUSME,SPUAVE,SPUSDE,SPUCOE,SPU5PE,SPUMXE,SPUMNE,
      *ICLSME,SCLAVE,SCLSDE,SCLCOE,SCL5PE,SCLMXE,SCLMNE
C
       WRITE(6,626)
626    FORMAT(///20X,'Unsupported:')
       WRITE(6,666)
       WRITE(6,621)I75SMU,S75AVU,S75SDU,S75COU,S755PU,S75MXU,S75MNU,
      *I50SMU,S50AVU,S50SDU,S50COU,S505PU,S50MXU,S50MNU,
      *I10SMU,S10AVU,S10SDU,S10COU,S105PU,S10MXU,S10MNU,
      *I15SMU,S15AVU,S15SDU,S15COU,S155PU,S15MXU,S15MNU,
      *I20SMU,S20AVU,S20SDU,S20COU,S205PU,S20MXU,S20MNU,
      *IPUSMU,SPUAVU,SPUSDU,SPUCOU,SPU5PU,SPUMXU,SPUMNU
C
       WRITE(6,627)
627    FORMAT(///20X,'Supported:')
       WRITE(6,666)
       WRITE(6,620)I75SMS,S75AVS,S75SDS,S75COS,S755PS,S75MXS,S75MNS,
      *I50SMS,S50AVS,S50SDS,S50COS,S505PS,S50MXS,S50MNS,
      *I10SMS,S10AVS,S10SDS,S10COS,S105PS,S10MXS,S10MNS,
      *I15SMS,S15AVS,S15SDS,S15COS,S155PS,S15MXS,S15MNS,
      *I20SMS,S20AVS,S20SDS,S20COS,S205PS,S20MXS,S20MNS,
      *IPUSMS,SPUAVS,SPUSDS,SPUCOS,SPU5PS,SPUMXS,SPUMNS,
      *ICLSMS,SCLAVS,SCLSDS,SCLCOS,SCL5PS,SCLMXS,SCLMNS
C
       WRITE(6,605)
605    FORMAT(///20X,'Interior:')
       WRITE(6,666)
620    FORMAT(20X, 'Deflection',/,20X,'in mm at :',/
      * 21X,'33.4  N:   ',I3, 6(2X, G12.5)/
      * 21X,'222.4 N:   ',I3, 6(2X, G12.5)/
      * 21X,'444.8 N:   ',I3, 6(2X, G12.5)/
      * 21X,'667.2 N:   ',I3, 6(2X, G12.5)/
      * 21X,'889.6 N:   ',I3, 6(2X, G12.5)/
      * 20X,'P ult (N): ',I3, 6(2X, G12.5)/
      * 20X,'Clip  (N): ',I3, 6(2X, G12.5)/)
621    FORMAT(20X, 'Deflection',/,20X,'in mm at :',/
      * 21X,'33.4  N:   ',I3, 6(2X, G12.5)/
      * 21X,'222.4 N:   ',I3, 6(2X, G12.5)/
      * 21X,'444.8 N:   ',I3, 6(2X, G12.5)/
      * 21X,'667.2 N:   ',I3, 6(2X, G12.5)/
      * 21X,'889.6 N:   ',I3, 6(2X, G12.5)/
      * 20X,'P ult (N): ',I3, 6(2X, G12.5)/)
       WRITE(6,620)IIN75,AVI75,DIN75,CIN75,PIN75,
      * PI75MX,PI75MN,
      *IIN50,AVI50,DIN50,CIN50,PIN50,
      * PI50MX,PI50MN,
      *IIN100,AVI100,DIN100,CIN100,PIN100,
      * PI10MX,PI10MN,
      *IIN150,AVI150,DIN150,CIN150,PIN150,
      * PI15MX,PI15MN,
      *IIN200,AVI200,DIN200,CIN200,PIN200,
      * PI20MX,PI20MN,
      *IINPUL,AVIPUL,DINPUL,CINPUL,PINPUL,
      * PIPUMX,PIPUMN,
      *IINCLI,AVICLI,DINCLI,CINCLI,PINCLI,
      * PICLMX,PICLMN
```

Appendix C

This appendix contains the formulas used in the calculation of material properties for each of the tests. For all tests, section properties were calculated on the basis of gross cross-sectional area.

C.1 Small Scale Flexural Tests

The modulus of elasticity (MOE) and modulus of rupture (MOR) were calculated in accordance with CSA Standard CAN3-0188.0-M78, as follows:

$$\text{MOE (GPa)} = \frac{L^3}{4bd^3} \times \frac{P}{y}$$

$$\text{MOR (MPa)} = \frac{3PL}{2bd^2}$$

where b = width (mm)

d = average thickness (mm)

L = length of span (mm)

P = maximum load (N)

P/y = slope of the load-deflection curve (kN/mm)

C.2 Small Scale Compression Tests

The following formulas were used to calculate ultimate compressive stress (σ) and modulus of elasticity (MOE):

$$\sigma \text{ (MPa)} = \frac{P}{bd}$$

$$\text{MOE (GPa)} = \frac{P}{y} \times \frac{L}{bd}$$

where P = ultimate load (N)

b = width (mm)

d = thickness (mm)

L = length (mm)

P/y = slope of load deflection curve (kN/m)

C.3 Bond Tests

$$\sigma = \frac{P}{b\ell}$$

where σ = bond stress (kPa)

P = ultimate load (N)

b = width (mm)

ℓ = length (mm)

C.4 Specific Gravity and Moisture Content (Edmonton)

The formula used to calculate moisture content is in accordance with CSA Standard CAN3-0188.0-M78:

$$\text{M.C. (\%)} = \frac{100\ (M - F)}{F}$$

where M = mass at the time of test

F = oven dry mass

Specific gravity was calculated instead of density so the density formula in the above mentioned standard was not used. Specific gravity was calculated as follows:

$$Sp.Gr. = \frac{F}{V} \frac{1}{Sp.Gr.\ H_2O}$$

where F = oven dry mass (gm)

V = volume (cm^3)

Sp.Gr. H_2O = specific gravity of water

= 1 gm/cm^3

C.5 Post Flexure Test

For the post flexure test, all values were calculated in Imperial units and then converted to metric units. Section properties were calculated on the basis of full cross-sectional area. Calculations were made as follows:

Section Properties for 12 inch Width

$$A = t \times b$$

$$I = \frac{bh^3}{12}$$

$$c = \frac{t}{2}$$

$$S = \frac{I}{c}$$

where A = area (in.^{2})

t = gross thickness (in.)

b = width (set equal to 12 in.)

Mechanical Properties for 12 inch Width

i) Ultimate moment (M.Ult.)

$$\text{M.Ult. (for 12" width)} = \frac{\text{M.Ult.(recorded)}}{\text{Full panel width}} \times \text{12" width}$$

ii) Stiffness (EI)

$$EI = MR$$

where M = moment at the proportional limit (p.l.)

R = radius of curvature.

M (for 12" width) = (y axis value on graph at P.L.) x (Scale factor on Load Cell) x (y setting on x-y recorder) x 12" width/full panel width

$$R = \frac{L^2}{8h} + \frac{h}{2}$$

where h = (x axis value on graph at P.L.) x (scale factor) x (x setting on x-y recorder)

iii) $MOE = \frac{EI}{I}$

iv) $MOR = \frac{\text{M.Ult.}}{S}$

Conversion to Metric

i) M.Ult. (lb•in) x $\left(\frac{1.356}{12}\right)$ → N•m

ii) EI (lb•in^2) x $\left[\frac{4.448 \times 645.2}{(1000)^2}\right]$ → N•m^2

iii) MOE (ksi) x (0.00689476) → GPa

iv) MOR (psi) x (0.00689476) → MPa

C.6 Specific Gravity and Moisture Content

$$\text{Sp.Gr.} = \frac{F}{m_{H_2O}}$$

where f = oven dry mass of wood

m_{H_2O} = mass of water displaced

$$\text{M.C. (\%)} = \frac{100\ (M - F)}{F}$$

where M = mass at time of test

F = oven dry mass

C.7 Concentrated Load Test

No calculations were necessary for these tests as all values were measured directly.