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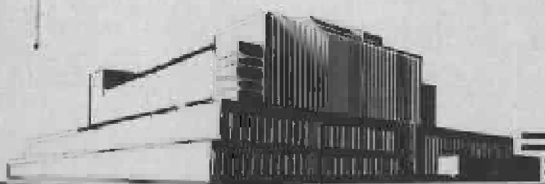

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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
In Cooperation with the University of Wisconsin

THE EFFECT OF A STIFFENER ON THE MAXIMUM LOAD OF FLAT PLYWOOD PLATES IN EDGEWISE COMPRESSION, WITH THE FACE GRAIN AT 0° AND 90° TO THE LOAD[1]

A Single Stiffener Parallel to the Direction of Loading. Load Edges Clamped, Others Simply Supported

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Summary and Conclusions

When flat plywood plates subjected to edgewise compression are stiffened by a centrally located stiffener parallel to the load, the increase in the ultimate load of the plate is related to the size of the stiffener.

The analysis of the results of tests on 45 specimens yields an empirical family of curves from which the ultimate loads can be estimated.

Introduction

A rectangular plywood plate, subjected to edgewise compression, may be strengthened by affixing a light stiffener to it. The stiffener is cemented to one face of the plate in such a position as to bisect the area of the plate and to be parallel to the direction of the load. The determination of the effect of such stiffeners on the buckling loads of plywood plates is given in a previous report (Forest Products Laboratory Report No. 1553-B). In the present investigation these same plates were again fitted with stiffeners and loades to failure.

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[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

The loads at failure were, of course, greater than those that would have been obtained if the plates had not been stiffened. The added load due to the presence of the stiffener is, in general, less than that based on the assumption that the stiffener acts as a short column. The stiffeners used had stiffnesses equal to or greater than the critical stiffness as defined by Report No. 1553-B. Nevertheless, the stiffeners buckled at loads greater than the critical loads of the panels and, thus, did not act as short columns.

The purpose of this investigation is to determine a method of estimating the maximum load that such a stiffened plate can withstand.

Preparation of Specimens

The plates used for these tests were the same ones used in the previous study (Report No. 1553-B) of the effect of stiffener stiffness on the buckling of stiffened flat plywood plates in edgewise compression. For that study they were subjected only to loads well below the proportional-limit stress of the material and, consequently, they were not damaged and were reusable for the present study. They were each again fitted with a single stiffener glued to the center of one face of the plate parallel to the direction of the load.

The stiffening members were made of edge-grained Sitka spruce. They were 1/2 inch wide, 1 inch deep, and varied in length to correspond to the lengths of the different plates. Their cross-sectional dimensions were cut to the desired test sizes after they were glued to the plates. A 4-inch length was cut from the excess end of each stiffener and tested in compression for the determination of the ultimate compressive stress of the stiffener material.

After the plates and stiffening material had been conditioned to constant weight at 75° F. and 64 percent relative humidity, the stiffeners were fastened at one of their 1/2-inch edges to the plates by means of a cold-setting urea-formaldehyde glue, at a pressure of about 100 pounds per square inch. The specimens were stored in the conditioining room until time of test.

Preparation for Test

The plates had been slotted for the clamping bolts, and the load-bearing edges had been cut straight and parallel to each other for the previous tests.

The ends of the stiffener were trimmed flush with the edges of the plate so that a uniform bearing of both the stiffener and plate on the test apparatus was obtained. The exactness of fit was ascertained by means of a feeler gage.

The cross-sectional areas of the stiffeners were reduced to such dimensions before test that various values of $(EI)_s$ (stiffener stiffness) were obtained for each series of similar plates. These values were chosen so that their ratio to the value of $(EI)_{scr}$ (critical stiffener stiffness) in each case was in the range of 0.8 to 6.

The value of the critical stiffness $(EI)_{scr}$ for the various plates was obtained from the tests for the previous report and is defined as the minimum stiffness that will cause the plate to buckle as two separate plates.

The value of the stiffness $(EI)_s$ for the various stiffeners was approximated from the computations made in connection with the previous report.

Test Procedure

The test apparatus and set-up, as shown in figures 32 and 33, were the same as those used for the buckling tests (Report No. 1553-B), except that the hardwood side rails, which gave simple support to the nonloaded edges of the plate, were cut shorter than those for the buckling tests. This was done because it was anticipated that considerable head travel would be necessary to cause the specimen to fail.

Two dial indicators were employed normal to the surface of the specimen. One at the center of the half-plate at a point about one-fourth of its length was used to indicate the buckling load by the lateral deflection method, and the other at the midpoint of the stiffener was used to determine whether or not the stiffener remained substantially straight when the plywood plates buckled. The dial indicators were removed after the plate had buckled, and the application of load was continued without interruption until the specimen failed.

The tests were conducted in a hydraulically operated testing machine, and the load was applied at a uniform rate of total strain. Readings of the dial indicators were plotted at regular increments of load until the critical load was indicated. The load increments chosen were about one-fifteenth of the computed critical load, and the rate of strain was adjusted so that readings were obtained about every 5 seconds. After the critical load had been indicated, the dial indicators were removed and the application of load was continued at the same rate until failure of the specimen was indicated by a drop in load. The maximum load was recorded.

Explanation of Tables and Figures

Tables 14 and 15 contain a summary of the pertinent data and coordinates for figures 34 and 35. Table 14 applies to plates having the grain direction of the face plies parallel to the direction of loading, and table 15 applies to plates having the grain direction of the face plies perpendicular to the direction of loading.

In column 1 are listed the designations of the specimens. These designations are divided into three parts. The first part is the numerical and alphabetical identification of the plywood sheet from which the test plate was cut. The first numeral of this part indicates the species, number, and orientation of the veneers according to table 11, Forest Products Laboratory Report No. 1553-B. The second part is the number of the plate cut from the sheet, and the last part is a digit that is 10 times the ratio of the computed critical stress of the plate to the proportional-limit stress of the material. For example, in 2XC3-1-4, 2XC3 identifies the sheet, of which the numeral 2 indicates the species, number and orientation of veneers; 1 is the number of the test plate cut from the sheet; and 4 indicates that the ratio of the computed critical stress of the plate to the proportional-limit stress of the material is 0.4.

Columns 2 and 3 give the cross-sectional dimensions of the stiffener attached to the plate. The width (t) is the dimension parallel to the face of the plywood plate, and the depth (d) is the dimension normal to the face of the plywood plate. Column 4 lists the values of the ultimate compressive stress of the stiffener material when laterally supported, which were obtained from tests of matched coupons. Column 5 contains the computed values of the maximum load of the stiffener considered to act as a short column, which are the product of the values in columns 2, 3, and 4.

Columns 6, 7, and 8 give the dimensions of the plywood plate in which (a) is the full width, (b) is the unsupported length, and (h) is the thickness.

Column 9 lists the observed values of the maximum compression load of the specimens obtained from the tests.

Column 10 lists the values of the maximum compressive stress of the plate material obtained from tests of laterally supported matched coupons.

Column 11 lists the values of the critical buckling stress of the stiffened plywood plate when the stiffener is strong enough to remain substantially straight when the plate buckles, and thus causes it to buckle as two separate plates. These values were obtained from the computations made in connection with the previous report (Forest Products Laboratory Report No. 1553-B) and were computed according to the formula (67) of that report,

$$P_{cr2} = \frac{\pi^2 h^2}{60\lambda a^2} \left[16E_1 \frac{b^2}{a^2} + 40A + 41E_2 \frac{a^2}{b^2} \right]$$

in which E_1 and E_2 are the moduli of elasticity of the plywood plate material, perpendicular and parallel to the direction of stress, respectively, obtained from bending tests of matched coupons; and λ is associated with the Poisson's ratios of the wood of the plate and has a value of 0.99.

$$A = 2\lambda \, \mu LT + \sigma_{TL} E_L$$

in which μ_{LT} is the shear modulus of the plywood material obtained from shear plate tests of matched coupons; σ_{TL} is the Poisson's ratio of the plate material associated with imposed strains in the tangential direction of the wood and resulting strains in the direction of the grain with a value of 0.02 being used in the calculations; E_L is the modulus of elasticity of the wood of the plate in the direction of the grain and was obtained from the approximate formula,

$$E_L = \frac{20}{21} (E_1 + E_2)$$

Column 12 contains the values of the nondimensional group $(\frac{a}{a_o})$ of plate width for figure 34 of this report and was also used to determine the effective width of the plates from figure 145 of Forest Products Laboratory Report No. 1316-I. These values were derived by the equation (3) of that report,

$$\frac{a}{a_o} = \sqrt{\frac{Fuc}{P_{cr2}}}$$

Column 13 lists the values of the corresponding effective width ratios obtained from figure 145 of Forest Products Laboratory Report No. 1316-I.

Column 14 lists the values of the computed maximum compressive loads of the plates obtained by the multiplication of the values in columns 6, 8, 10, and 13.

Column 15 lists the values of L_m obtained by adding the values in column 5 to the values in column 14.

In column 16 are given the values of the ratios of the observed maximum loads of the test specimens to the computed values of L_m. These ratios were obtained by dividing the values in column 9 by the values in column 15.

Column 17 contains the ratios of the stiffness of the stiffener glued to the plate to its critical stiffness. These values were approximated from the values given in tables 8 and 9 of Forest Products Laboratory Report No. 1553-B.

Column 18 contains values of $\frac{L}{L_m}$ estimated from the family of curves drawn in figure 34.

In column 19 are listed the values of the estimated maximum loads of the specimens, which were obtained by multiplying the values in column 15 by those in column 18.

Figure 32 shows the specimen fitted into the unassembled test apparatus also the grooves in the site supports.

Figure 33 shows the specimen in the assembled test apparatus.

Figure 34 is a plot of the data recorded in columns 12, 16, and 17 of table 14 and 15. The values in column 12 are used as abscissas and those in column 16 as ordinates. Each point is numbered with the associated value given in column 17. The points also serve as decimal points of these numbers.

Figure 35 is a comparison of the maximum-load values as observed in the tests to those estimated by means of the family of curves in figure 34. In it, the values in column 19 are plotted against the values in column 9 of tables 14 and 15.

Analysis of Results

The data obtained are analyzed empirically to obtain a family of curves from which design criteria can be read. The analysis involves three dimensionless groups as indicated by the equation:

$$\frac{L}{L_m} = \left[\phi \; \frac{a}{a_o} \; , \; \frac{(EI)_s}{(EI)_{scr}} \right] \qquad (1)$$

in which ϕ is an unknown function of the two dimensionless groups in the brackets. L is the maximum load sustained by the stiffened panel when it was tested. L_m is the sum of the maximum compressive load of the stiffener considered as a short column and the maximum compressive load of the panel considered as two panels simply supported at the stiffener. The maximum compressive load of the stiffener is merely the compressive strength of the wood of which the stiffener is made, multiplied by the cross-sectional area of the stiffener. The values used in this report were obtained from compression tests of pieces cut from the ends of the stiffeners before they were glued to the panels. The maximum compressive load of the panel is the product of the compressive strength of the plywood, the cross-sectional area of the panel, and the effective width ratio of the panel as obtained from figure 145 of Forest Products Laboratory Report No. 1316-I and by using the value of $\frac{a}{a_o}$ obtained from equation (3). The width of the half panel, the distance between the edge of the panel and the center of the stiffener, is denoted by a, and a_o is the width of an identical panel, except for width, whose critical stress is equal to the compressive strength of the plywood. The ratio $\frac{a}{a_o}$ is obtained from equation (3), which is derived on page 6 of Forest Products Laboratory Report No. 1316-I.

$$\frac{a}{a_o} = \sqrt{\frac{F_{cu}}{p_{cr2}}}$$

in which F_{cu} is the compressive strength of the plywood obtained, for the purposed of this report, from compression tests of coupons cut from the plywood; and p_{cr2} is the critical stress of the plywood panel considered as two panels separated by the stiffener and is calculated by means of formula (67) of Forest Products Laboratory Report No. 1553-B. The values used were taken from tables 7 and 8 of that report. The stiffness of the stiffener, $(EI)_s$ is calculated according to the method of Forest Products Laboratory Report No. 1557, and the critical stiffness of the stiffener is the required stiffness just sufficient to cause the panel to buckle as two independent panels. The values used in this report were obtained from tables 9 and 10 of Forest Products Laboratory Report No. 1553-B. Calculated values can be obtained by the method described in that report.

In figure 34 values of $\frac{L}{L_m}$ are plotted as ordinates, and values of $\frac{a}{a_o}$ as abscissas. Each experimental point plotted bears a number equal to the corresponding value of $\frac{(EI)_s}{(EI)_{scr}}$. The plotted point also serves as the decimal point of this number. A family of smooth curves, of which each is associated with a value of $\frac{(EI)_s}{(EI)_{scr}}$, is drawn that roughly agrees with the values associated with the plotted points.

The family of curves was drawn to satisfy certain theoretical requirements, and to agree as well, with the values associated with the experimental points. Each curve, of course, should not cross any other curve, but should be roughly parallel to the two adjacent curves. The curves should not extend above the line $\frac{L}{L_m} = 1$, because L_m represents the load the stiffened panel will withstand if the stiffener remains straight during the test. It may be noted that none of the experimentally determined points lie more than slightly above this line. The curve for $\frac{(EI)_s}{(EI)_{scr}} = 1$ should pass through the point 1, 1, because this curve represents the condition that the stiffener is just stiff enough to cause the panel to buckle as two independent panels, and when $\frac{a}{a_o} = 1$, these panels will not buckle, and therefore, L must equal L_m. Also, the curve should swing down to the right and be concave upward, as it is drawn, because as $\frac{a}{a_o}$ approaches infinity, $\frac{L}{L_m}$ approaches a small finite value. The curve for $\frac{(EI)_s}{(EI)_{scr}} = 2$ should start on the line $\frac{L}{L_m} = 1$, but at a point further to the right, as shown, because the heavier stiffener will buckle only if the support the panel renders them, is reduced; that is, when $\frac{a}{a_o}$ becomes larger. The other curves were drawn in with these considerations in mind.

After these curves had been drawn, the maximum loads of the panels tested were calculated by their use. In figure 35 these calculated loads were plotted against the loads determined by test. Reasonable agreement between the two was obtained.

Table 14.--The effect of stiffener size on the maximum load. Face grain of plywood parallel to the load

Plate No.	Stiffener: Width t	Stiffener: Depth d	Stiffener: F_{ucs}	Short-column load of stiffener	Plywood plate: Width a	Plywood plate: Length b	Plywood plate: Thickness h	L	F_{uc}	Compute p_{cr_2}	$\frac{a}{a_0}$	Effective width ratio of half-plate	Computed ultimate load of plate alone	L_m	$\frac{L}{L_m}$	$\frac{(EI)_s}{(EI)_{scr}}$	$\frac{L}{L_m}$ from curves of fig. 3	Estimated value of L
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	In.	In.	P.s.i.	Lb.	In.	In.	In.	Lb.	P.s.i.	P.s.i.			Lb.	Lb.				Lb.
2xB-1-2	0.510	0.761	5,540	2,150	16.36	35.41	0.139	5,250	8,340	776	3.28	0.32	6,070	8,220	0.64	2.5	0.64	5,260
2xc-1-2	.509	1.002	5,760	2,938	16.40	35.35	.138	6,830	7,755	783	3.15	.33	5,790	8,728	.78	4.0	.77	6,720
2xc3-1-2	.510	.882	5,580	2,510	16.39	35.41	.138	5,980	8,020	763	3.24	.32	5,810	8,320	.72	3.5	.72	6,000
2xc4-1-2	.370	1.000	5,600	2,072	16.38	35.42	.140	6,820	8,740	735	3.44	.32	6,415	8,487	.80	4.5	.76	6,450
2xc-1-4	.388	1.011	6,040	2,369	12.39	26.49	.139	6,900	7,755	1,431	2.32	.40	5,340	7,709	.90	4.0	.89	6,860
2xc-2-4	.388	1.011	5,710	2,240	12.40	26.42	.139	6,860	7,755	1,442	2.32	.40	5,340	7,580	.90	4.0	.89	6,745
2xc3-1-4	.386	.880	5,540	1,882	12.40	26.39	.140	5,990	8,020	1,438	2.36	.40	5,570	7,452	.80	3.0	.82	6,180
2xc4-1-4	.258	1.010	5,710	1,488	12.40	26.37	.140	6,200	8,740	1,424	2.48	.38	5,765	7,253	.85	3.8	.85	6,165
2xc4-2-4	.387	.761	5,540	1,632	12.40	26.45	.139	5,610	8,740	1,381	2.51	.37	5,580	7,212	.78	2.8	.78	6,345
9xc2-1-4	.512	.974	6,100	3,040	12.01	29.99	.176	6,400	3,562	1,270	1.67	.52	3,915	6,955	.92	4.6	1.00	6,955
9xc2-2-4	.390	1.010	5,950	2,340	12.01	29.95	.180	5,980	3,562	1,300	1.66	.52	4,000	6,340	.94	4.1	1.00	6,440
9xc2-3-4	.259	1.011	5,800	1,520	12.01	29.95	.179	5,240	3,562	1,335	1.64	.52	3,980	5,500	.95	2.8	.97	5,340
9xc2-4-4	.389	.749	5,580	1,630	12.01	30.02	.177	4,580	3,562	1,344	1.63	.52	3,940	5,570	.82	2.0	.88	4,930
9xc3-1-6	.510	1.003	5,750	2,941	10.40	24.99	.177	6,720	3,490	1,935	1.34	.62	3,985	6,929	.97	4.8	1.00	6,929
9xc3-2-6	.510	.753	5,740	2,204	10.40	24.98	.177	5,680	3,490	1,891	1.36	.62	3,985	6,189	.92	2.4	1.00	6,189
9xc4-1-6	.388	1.003	6,040	2,351	10.39	24.97	.177	6,000	3,640	1,886	1.39	.60	4,020	6,371	.94	4.0	1.00	6,371
9xc4-2-6	.238	1.003	5,740	1,370	10.39	24.98	.177	4,160	3,640	1,935	1.37	.61	4,085	5,455	.76	3.2	1.00	5,455
17xa-1-4	.511	1.012	5,880	3,041	22.37	36.02	.228	10,050	4,542	925	2.22	.42	9,730	12,771	.79	2.2	.77	9,840
17xe-1-4	.517	1.013	5,420	2,839	22.39	36.17	.227	9,350	3,968	897	2.09	.43	8,670	11,509	.81	2.2	.80	9,220
17g-1-4	.512	1.022	5,300	2,775	22.00	35.34	.238	9,900	3,620	1,087	1.83	.47	8,920	11,695	.85	2.1	.85	9,950
17xa-1-6	.386	1.013	5,540	2,170	18.37	29.53	.227	9,750	4,542	1,370	1.82	.47	8,905	11,075	.88	2.0	.84	9,300
17xe-1-6	.509	1.012	5,750	2,962	18.37	29.24	.228	10,700	4,580	1,375	1.83	.47	9,030	11,992	.89	2.5	.88	10,620
21xA-1-6	.509	1.001	5,600	2,853	20.87	33.00	.299	10,900	3,620	1,513	1.55	.54	12,200	15,053	.72	.8	.71	10,690
21xe-2-6	.388	1.027	6,060	2,415	20.88	32.90	.293	10,450	3,430	1,515	1.51	.56	11,750	14,165	.74	.8	.75	10,620
22x-4-2	.388	.754	5,540	1,620	11.13	20.01	.106	3,880	5,055	1,005	2.24	.42	2,505	4,125	.94	6.0	.98	4,042
22x-5-2	.281	.758	5,950	1,267	11.12	20.01	.102	3,250	5,055	947	2.34	.40	2,300	3,567	.91	5.0	.94	3,350

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Table 15.—The effect of stiffener size on the maximum load. Face grain of plywood perpendicular to the load

Plate No.	Stiffener			Short-column load of stiffener	Plywood plate			L	F_{uc}	Compute P_{cr_2}	$\frac{a}{a_o}$	Effective width ratio of half-plate	Computed ultimate load of plate alone	L_m	$\frac{L}{L_m}$	$\frac{(EI)_s}{(EI)_{scr}}$	$\frac{L}{L_m}$ from curves of fig. 3	Estimated value of L
	Width t	Depth d	F_{ucs}		Width a	Length b	Thickness h											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	In.	In.	P.s.i.	Lb.	In.	In.	In.	Lb.	P.s.i.	P.s.i.			Lb.	Lb.				Lb.
2xA-2-2	0.246	0.504	4,260	528	22.39	14.27	0.137	3,290	4,815	406	3.44	0.31	4,580	5,108	0.644	4.5	0.77	3,935
2xA-1-2	.245	.251	4,970	306	22.39	14.27	.139	2,340	4,815	426	3.36	.32	4,800	5,106	.460	1.0	.49	2,478
2xc2-2-2	.192	.500	4,860	466	22.40	14.26	.140	3,130	4,385	430	3.19	.33	4,540	5,006	.625	2.5	.64	3,206
2xB-2-6	.192	.374	4,730	340	13.39	8.42	.139	3,390	4,640	1,249	1.93	.44	3,800	4,140	.819	2.5	.86	3,542
2xB-3-6	.166	.498	4,730	438	13.39	8.40	.142	3,380	4,640	1,263	1.93	.44	3,880	4,318	.782	1.75	.79	3,390
9xc3-3-4	.377	.492	4,730	878	22.02	13.00	.170	3,220	2,297	400	2.40	.39	3,355	4,233	.761	3.0	.81	3,430
9xc4-1-4	.258	.491	4,730	600	22.03	12.86	.172	2,900	2,222	393	2.38	.39	3,290	3,890	.746	2.5	.77	2,975
9xc5-1-6	.260	.242	4,730	298	18.03	10.45	.177	1,880	2,087	540	1.97	.44	2,930	3,228	.583	.8	.64	2,065
9xc5-2-6	.255	.491	4,730	592	18.02	10.51	.172	3,000	2,087	496	2.05	.43	2,780	3,372	.890	3.0	.89	3,000
17xd-1-4	.246	.748	4,730	871	23.40	20.05	.226	5,350	3,100	790	1.98	.44	7,140	8,011	.668	1.3	.71	5,685
17xd-2-4	.239	1.008	4,730	1,140	23.40	20.05	.222	7,940	3,100	749	2.03	.42	6,770	7,910	1.004	2.5	.84	6,642
17xd-3-4	.376	.497	4,730	884	23.40	20.06	.226	5,110	3,100	761	2.02	.42	6,890	7,774	.657	.9	.66	5,132
17xe-1-4	.379	.748	4,730	1,340	23.38	20.03	.228	7,040	3,456	870	1.99	.44	7,370	8,710	.808	2.0	.79	6,940
17xe-2-4	.376	1.019	4,730	1,810	23.40	20.06	.221	6,820	3,456	798	2.08	.43	7,685	9,485	.719	3.3	.89	8,440
19x-2-2	.270	.503	4,730	642	12.88	10.51	.107	2,370	2,958	737	2.00	.44	1,790	2,432	.975	5.0	.98	2,383
19x-1-2	.266	.274	4,730	345	12.88	10.53	.107	1,720	2,958	764	1.98	.45	1,830	2,175	.791	2.0	.80	1,740
22h-1-2	.201	.507	4,730	482	16.64	12.64	.103	1,962	2,903	444	2.56	.38	1,890	2,372	.827	3.3	.80	1,897
22h-1-4	.255	.501	4,730	605	11.90	9.98	.105	2,380	2,903	900	1.81	.47	1,705	2,310	1.030	4.4	1.00	2,310
22g-2-4	.205	.502	4,730	487	11.89	9.98	.103	2,170	3,119	748	2.04	.43	1,642	2,129	1.010	4.6	.96	2,045

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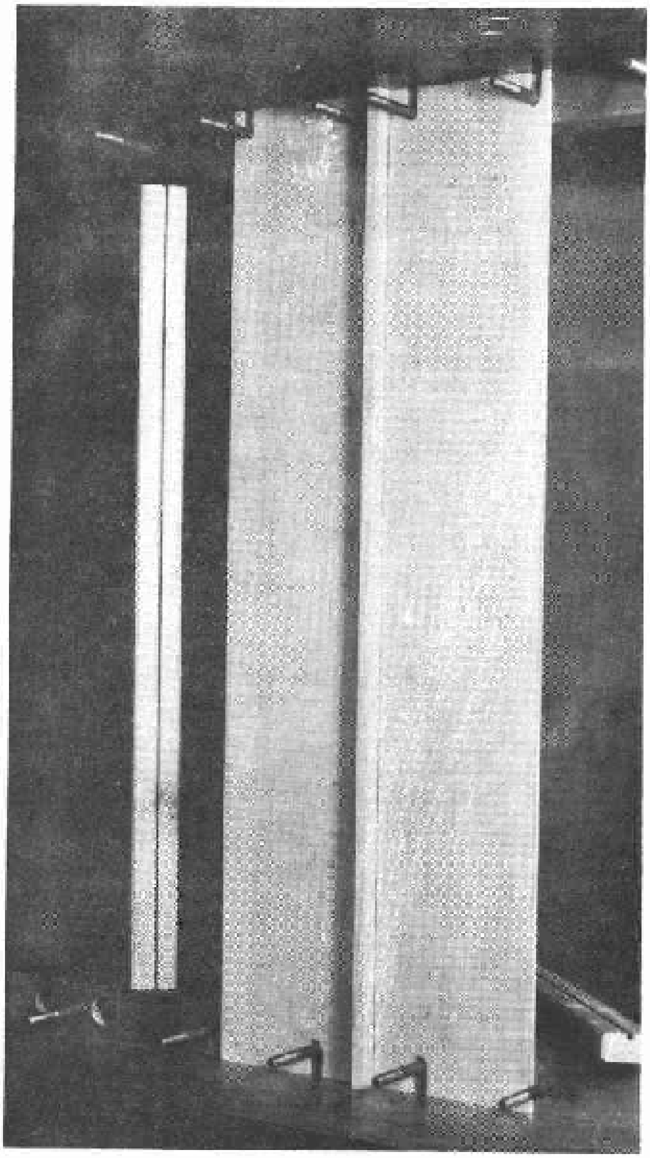

Figure 32.--Test specimen fitted into test apparatus.

ZM 68524 F

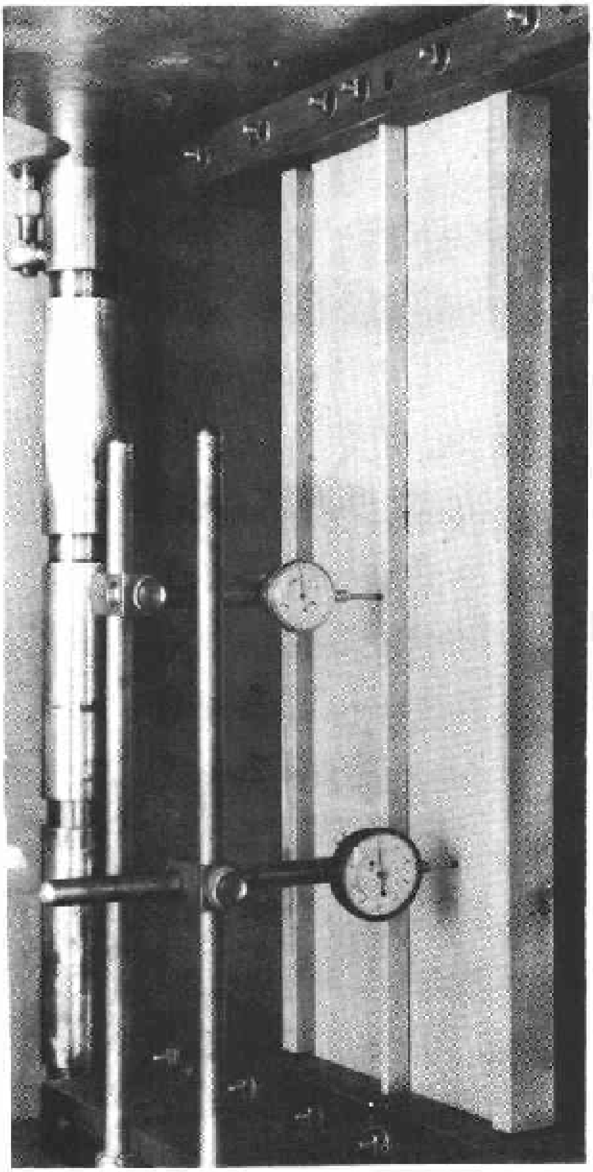

Figure 33.--Completed test set-up and specimen ready for test.

ZM 68523 F

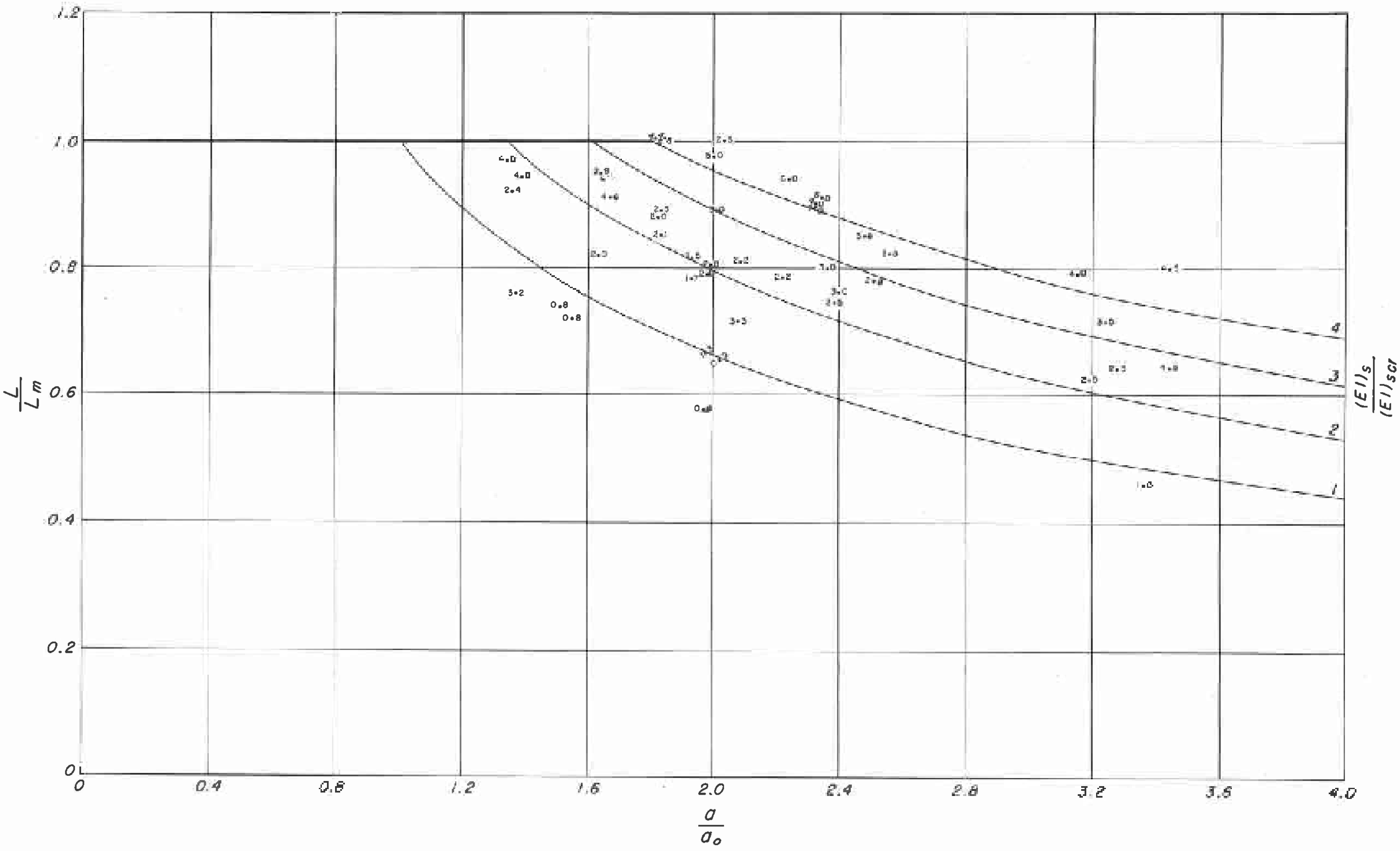

Figure 34.--Curves for estimating the ultimate loads of stiffened plywood panels subjected to edgewise compression.

Z M 81546 F

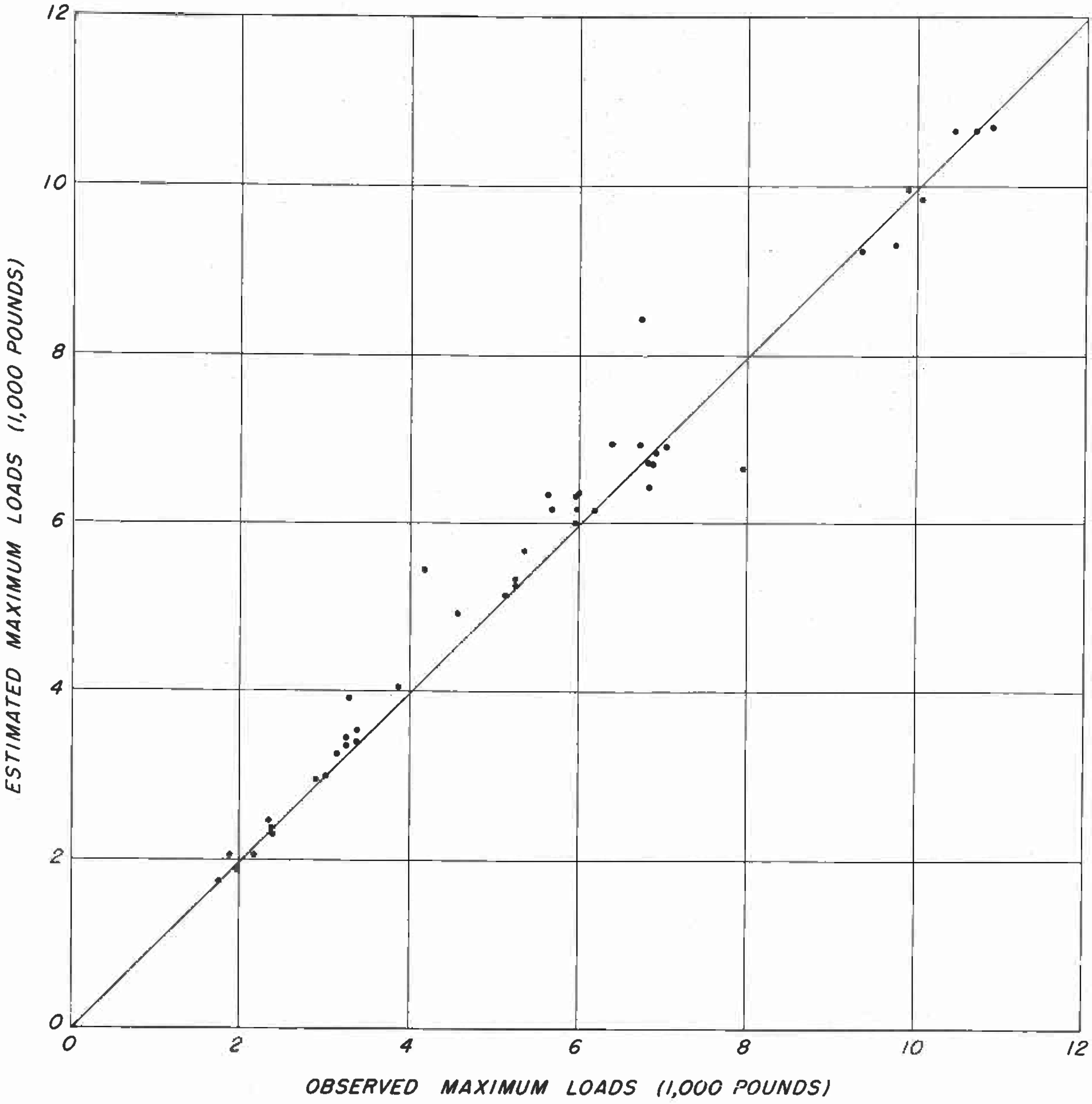

Figure 35.--Comparison of estimated maximum loads to maximum loads obtained by tests.

Z M 81547 F

SUBJECT LISTS OF PUBLICATIONS ISSUED BY THE FOREST PRODUCTS LABORATORY

The following are obtainable free on request from the Director, Forest Products Laboratory, Madison 5, Wisconsin:

List of publications on Box and Crate Construction and Packaging Data

List of publications on Chemistry of Wood and Derived Products

List of publications on Fungus Defects in Forest Products and Decay in Trees

List of publications on Glue, Glued Products, and Veneer

List of publications on Growth, Structure, and Identification of Wood

List of publications on Mechanical Properties and Structural Uses of Wood and Wood Products

Partial list of publications for Architects, Builders, Engineers, and Retail Lumbermen

List of publications on Fire Protection

List of publications on Logging, Milling, and Utilization of Timber Products

List of publications on Pulp and Paper

List of publications on Seasoning of Wood

List of publications on Structural Sandwich, Plastic Laminates, and Wood-Base Aircraft Components

List of publications on Wood Finishing

List of publications on Wood Preservation

Partial list of publications for Furniture Manufacturers, Woodworkers and Teachers of Woodshop Practice

Note: Since Forest Products Laboratory publications are so varied in subject no single list is issued. Instead a list is made up for each Laboratory division. Twice a year, December 31 and June 30, a list is made up showing new reports for the previous six months. This is the only item sent regularly to the Laboratory's mailing list. Anyone who has asked for and received the proper subject lists and who has had his name placed on the mailing list can keep up to date on Forest Products Laboratory publications. Each subject list carries descriptions of all other subject lists.