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GUSSET PLATES FROM PLYWOOD AND HARDBOARD SCRAP

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Twenty-five Cents

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Abstract

In a pilot study, three different structural roof component designs were tested using three types of scrap panel materials as connector plates. The panel materials were cutout and cutoff pieces generated in fabricating processes of home manufacturing companies. Three randomly selected units of each component were tested for deflection under design live load before testing for ultimate load at failure. Even though these preliminary test results gave deflection and load to failure characteristics within acceptable performance criteria, it should be emphasized that further investigation needs to be undertaken.

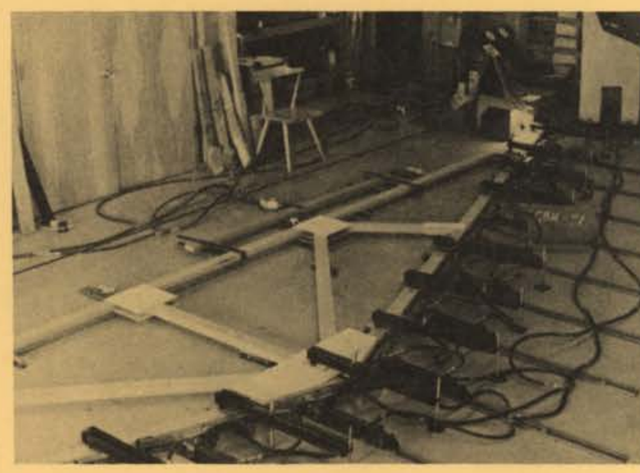

Figure 1. — Thirty-two-foot roof truss in test facility.

This technical note covers a possible use of cutouts or pieces of cutoff panel materials generated in the fabricating processes of some home manufacturing companies and other material users. Recent environmental rulings prohibiting open burning of waste materials have created disposal problems resulting in some volume builders accumulating materials in sizes generally not usable within present house designs. These cutout materials come from vent openings in soffits, window, and door openings cut from panel siding and from openings cut in interior paneling. The authors have been approached recently by several home fabricators concerning the feasibility of designing structural components to utilize some of these materials.

In a pilot study to investigate possible uses of three types of these panel materials, three different structural roof components and one flat floor-truss were considered. A program was developed to run some investigatory tests on the three roof components; however, the floor truss is still under consideration and has not been tested. The first unit tested was a 32-foot, 4/12 slope, house roof truss for 24-inch spacing (see Fig. 1).

These units were fabricated with 1,500 f stress-rated 2 by 4 lumber with an average moisture content of 10 percent. Cutout soffit material from 3/8-inch medium density overlay Douglas-fir plywood was staple-glued to the lumber as the gusset plates. The second component tested was a 12-foot half-truss, also designed for 24-inch spacing, fabricated with 2 by 4 lumber and 1/4-inch Lauan panel material staple-glued to the lumber (Fig. 2). The third unit tested (Fig. 3) was a 20-foot king-post roof truss, also for 24-inch spacing, fabricated with 2 by 4 lumber and hardboard panel siding cut from window openings. The plates used in the king post were nailed with fourpenny nails to form the connections.

Three units of each design were tested in the hydraulic test facility at the Small Homes Council, University of Illinois.[1] The tests in each case consisted of measuring lower chord deflection under the design live load and recording ultimate live loads at failure.

A design dead load of 20 pounds per square foot was used with the load equally divided between the top and bottom chords. A design live load of 30 psf was applied to the top chords for each unit. The average deflections and average maximum loads for each of the three components are listed in Table 1.

For most code bodies and lending-agency regulations, allowable deflection under design live load is

[1]Suddarth, S. K. 1956. A hydraulic test facility for timber structures. Forest Prod. J. 6(5):186-189.

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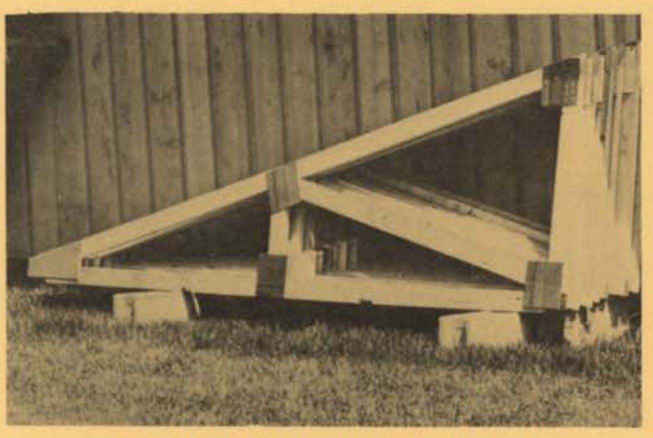


Figure 2. — Twelve-foot half-truss with panel cutout material as gussets.

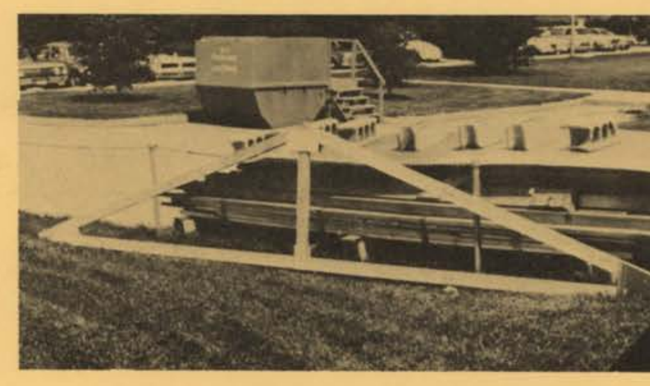


Figure 3. — Twenty-foot king-post truss using 3/8 inch hardboard cutout siding material.

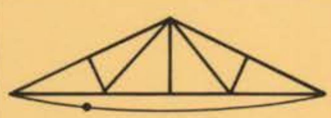
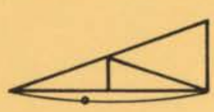
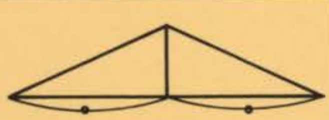
limited to L/360, where L is the span converted to inches. For the 32-foot truss, allowable deflection is 1.07 inches at the most critical point. Actual live load deflection averaged 0.259 inch for the three units, well within the allowable. Ultimate load at failure averaged 8,733 pounds, an indicated safety factor of 3.88 on live load.

For the 12-foot half-truss, allowable deflection is 0.394 inch at the most critical point. Actual live load deflection averaged 0.068 inch for the three units, well within the allowable. Ultimate load at failure averaged 2,681 pounds, an indicated safety factor of 3.06 on live load.

For the 20-foot king-post truss, allowable deflection is 0.66 inch at the most critical point. Actual live load deflection averaged 0.298 inch, well within the allowable. Ultimate load at failure averaged 3,813 pounds, an indicated safety factor of 2.51 on live load.

It is significant to note that all failures observed were in the members and that the connections in the test samples were, therefore, more than adequate. From these preliminary tests a conclusion can be drawn that when properly fabricated, using these cutout materials, the configurations hold promise for structural components. It must be emphasized, however, that these results and designs should not be used without further consideration with particular regard to the use of the cutout materials for connections. Durability of the connections is a major consideration in this respect and the quality of gluelines in the gusset plates must be clearly specified. When adhesives are used to bond the plates to the members, surface quality of the plywood and the adhesive process must be carefully tested and specified. Nail patterns must either be determined according to established values or further testing must be conducted to assure their adequacy.

Table 1. — AVERAGE DEFLECTIONS AND AVERAGE MAXIMUM LOADS FOR EACH OF THE THREE COMPONENTS TESTED.

UNIT	AVERAGE DEFLECTION at 30 psf LIVE LOAD (in.)	LOCATION	AVERAGE TOTAL LOAD AT FAILURE (lbs.)	AVERAGE LIVE LOAD AT FAILURE (lbs.)	INDICATED SAFETY FACTOR ON LIVE LOAD
32' FINK TRUSS WITH CENTER POST	0.259"		8733	7453	3.88
12' HOWE HALF TRUSS	0.068"		2681	2201	3.06
20' KING POST	0.298"		3813	3013	2.51