

SHALLOW HEADERS FOR SMALL HOMES COUNCIL'S WALL-PANEL FRAMING SYSTEM

The wall-panel framing system developed by the Small Homes Council in 1954 used a double 2" x 6" continuous header, or lintel, placed at the top of the panels and extended around the entire house. The header required the use of lag screws and nails to fasten it to the tops of the panels. In 1959, in a cooperative investigation sponsored by the Lumber Dealers Research Council, the Small Homes Council - Building Research Council developed a nail-glued semi-box-beam header for the wall-panel framing system. This header is described in Instruction Sheet #21, NAIL-GLUED HEADER FOR WALL-PANEL SYSTEM, and its design is explained in Research Report #58-1, RE-EVALUATION OF PRE-ASSEMBLED WALL-PANEL FRAMING SYSTEM. For this design (The design on Instruction Sheet #21), the plywood web must be at least 3/8" thick, and at least 12" deep.

Nail-glued headers present several advantages over the original design using the double 2" x 6" continuous lintel, namely:

1. Lag screws are eliminated
2. Less material is required
3. Lumber shrinkage problems are less
4. Top plate installation is simpler

The nail-glued header is necessary in door and window panels only. A header is not required for solid wall panels with three or more studs.

SHALLOW HEADERS

When a 7'-6" height is desired for ceilings or exterior walls, there is insufficient depth to accommodate the 12" header, and a shallower header is required. This instruction sheet presents a design for these conditions. If it is assumed that the head of the rough opening for doors and windows is located 6'-10" above the finish floor, then the total depth available for the header is 8 1/2" measured to the top of the field-applied top plate. The distance from the upper edge of the top flange to the lower edge of the bottom flange will be 6 7/8". Two designs are presented for these shallow headers. The first design makes use of a 1/2" plywood web, and the second uses 3/4" plywood.

MATERIALS NEEDED FOR HEADERS

Lumber: Use Western hemlock, Douglas fir, or Southern yellow pine, of a grade which is equivalent to at least a 1200 psi stress grade. Moisture content should not exceed 19%.

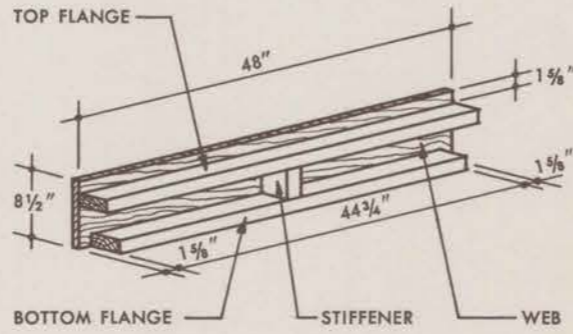
Top flange: one 2" x 4" x 48"
Bottom flange: one 2" x 4" x 44 3/4"
Stiffener: one 2" x 4" x 3 3/8"

Plywood: Use C-D grade, interior-type Douglas fir plywood. For exposed conditions, use C-C grade or better exterior-type plywood. The plywood must meet commercial standard CS45-60 as certified by an approved testing laboratory.

Web: one piece plywood 1/2" x 8 1/2" x 48"
or one piece plywood 3/4" x 8 1/2" x 48"

Adhesives: Casein meeting Federal specifications MMM-A-125, Type I or II (Type II contains a mold inhibitor), is recommended in protected and low humidity areas. Maintain the lumber, plywood, glue, and surrounding atmosphere at a minimum temperature of 50°F. during fabrication and curing. Allow 16 hours curing time when temperatures are between 50°F. and 70°F.; 8 hours where temperatures are above 70°F. When header is to be used in exposed conditions, use a "waterproof" adhesive meeting Federal specifications MIL-A-397B. Most "waterproof" adhesives require a minimum fabrication and curing temperature of 70°F. Check adhesive manufacturer's instructions *carefully* before proceeding.

Fasteners: For nail-gluing 1/2" plywood; use 4d nails or 1 1/8" staples. For nail-gluing 3/4" plywood; use 8d common nails only. Fastener spacing should not exceed 4" o.c.



STRUCTURAL DESIGN DATA

Mathematical Analysis: Under the design loads the stresses that occur in the headers are as follows:

	1/2" Plywood, 1200 lb. load	3/4" Plywood, 1350 lb. load
Maximum fiber stress	592 psi	665 psi
Maximum horizontal shear	227 psi	172 psi
Maximum shear between plies of web or between web and flange	64 psi	67 psi

Performance Tests: To establish the deflection characteristics of the headers, three sample headers of each design were tested. Each header was made from randomly selected materials obtained through normal supply channels. For the testing operation, each header was assembled into a window panel, and then the window panel was assembled into a 12' wall section, which contained a 4' solid panel on either side of the window panel. The total assembly was tied together by a continuous top plate following the pattern of normal construction. The top plate, which would normally be added in the field, was nailed only to the top flange of the header and to the top of the solid panels. Also, the extension of the plywood web at the top of the header was nailed to the field-applied top plate. No glue was used in either of these connections. A piece of 1/2" gypsum board was nailed to the inside surface of the header to simulate the interior wall finish.

In the process of study, slight modifications were made in the designs as the testing proceeded. Twelve samples of the 1/2" plywood header and 15 samples of the 3/4" header were loaded to 2700 pounds (at least twice the design load) without any evidence of fracture or rupture.

Only one header was loaded until fracture occurred. A 3/4" plywood header with total depth of 7 3/8" (1 3/8" extension on a flange to flange depth of 6") failed in shear between the first and second plies adjacent to top flange at the end of the header. The load at failure was 3400 pounds.

Capacity of Headers: In determining the load-carrying capacity of the headers, the deflection under load proved to be more critical than the calculated stresses in the header.

If the maximum allowable deflection limit is considered, the span length divided by 360, then the deflection of the header cannot exceed 0.133 inches. Under these circumstances, as shown by the performance tests, the maximum permissible concentrated load at the center of the span of the header is:

for header with 1/2" plywood, maximum load = 1200 lbs.
for header with 3/4" plywood, maximum load = 1350 lbs.

For convenience in selecting the proper header design, the load capacity of each header has been expressed in terms of the length of the roof structure which it can support under varying design loads. The lengths shown in this table are maximum over-all lengths of trusses (including overhangs) which are permitted under L/360 deflection limits.

CAPACITY OF HEADERS (Load at Center of 4-foot Span)

Combined Dead and Live Load on Roof and Ceiling Structure	Length of Roof Structure (including overhangs)	
	1/2" Plywood Web	3/4" Plywood Web
30 psf.	40 feet	45 feet
40 psf.	30 feet	33 feet
50 psf.	24 feet	27 feet

LIMITATIONS

These headers are designed to be used under a single concentrated load in the center of the span. This load may be due to a truss or a rafter resting at this point. Other loadings should not be used.

Do not use the horizontal-girt panel with the nail-glued header system. The double plate over the solid wall panels is not sufficiently strong to carry the superimposed loads of the roof and ceiling structure without excessive deflection.

FABRICATION OF HEADERS

The headers can be fabricated as individual units, or as an integral part of window or door panels. In either case, maintain the recommended fabrication and curing temperatures. After fabrication and stacking, do not handle the headers during the curing period as discussed under "adhesives." For nail-gluing techniques, follow the instructions found in Instruction Sheet #1, NAIL-GLUING OF ROOF TRUSSES, FRAMES, AND OTHER STRUCTURAL COMPONENTS.

PANEL AND FIELD ASSEMBLY

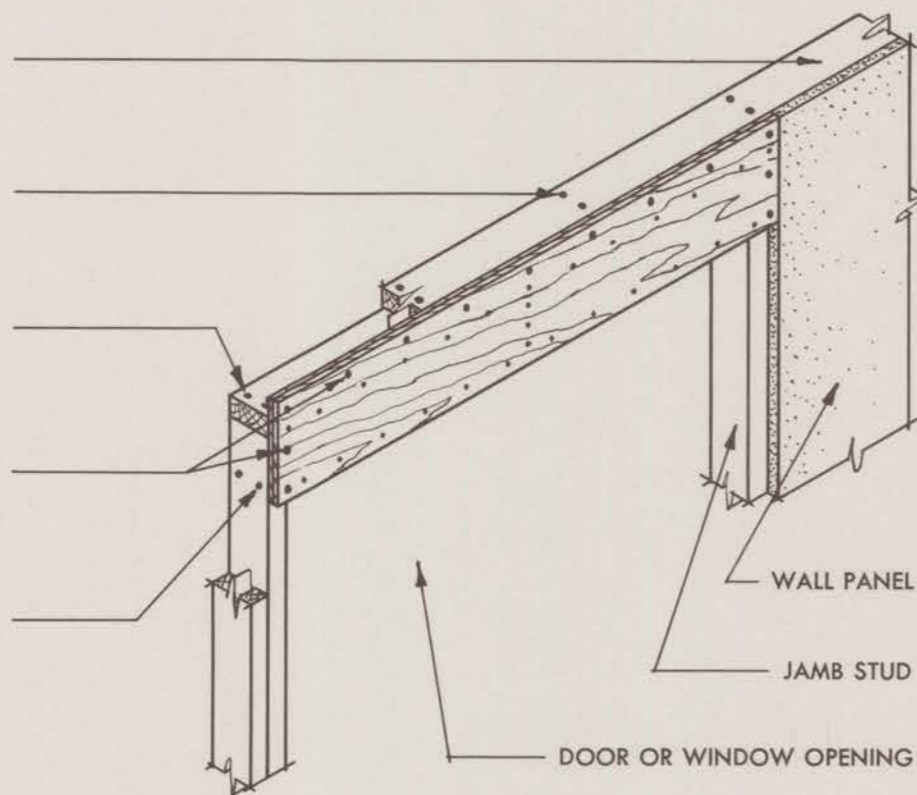
Field-applied top plate must extend at least 2 feet beyond header

Nail top plate with 16d nails 16" on center

Two 16d nails driven through top flange into each jamb stud

Plywood web nailed to top plate and jamb stud with 8d nails 6" on center

Two 16d nails driven through jamb stud into each end of bottom flange



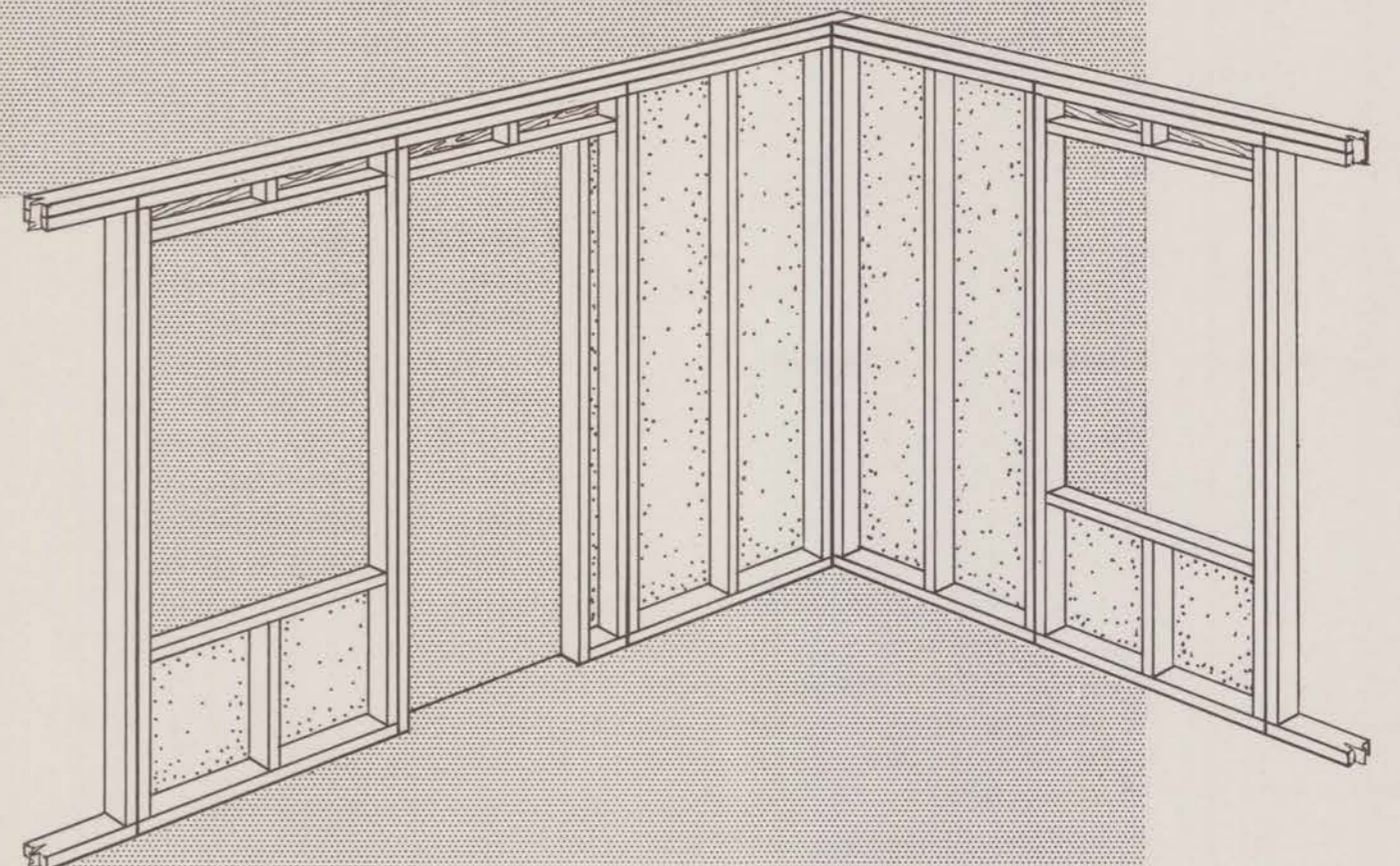
FABRICATION OF WALL PANELS

To build the wall panels, follow the instructions of the basic wall-panel framing system, as explained in Instruction Sheet #20, WALL-PANEL CONSTRUCTION, except as they must be modified by the shorter wall height and the use of the headers.

SHALLOW HEADERS FOR WALL-PANEL SYSTEM

4'-0" Span

INSTRUCTION SHEET #23



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Responsibility for headers built from these plans shall rest with the user of the plans and in nowise on the University of Illinois. When variations from these plans are incorporated by the user, the headers so built shall not be represented as having been built from a design developed at the University of Illinois.

Price: 50 cents