2 x 6 KING-POST NAIL-GLUED ROOF TRUSSES

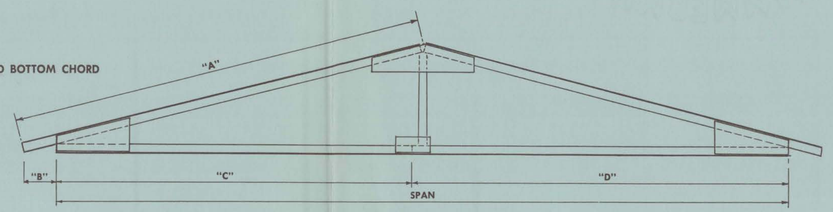
MATERIALS AND NAIL-GLUING FABRICATION

Of the nail-glued roof trusses, the 2 x 6 king-post truss is most economical for spans from 28′-0″ to 32′-8″ under design loads shown. It is sometimes used for shorter spans to satisfy building code requirements in certain areas.

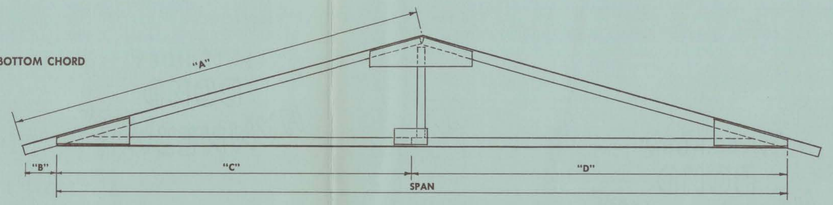
The quality of material and workmanship will determine the ultimate strength of the truss. The following instructions for selecting materials, gluing, nailing, curing, and handling the trusses must be observed. (For detailed instructions regarding nail-gluing techniques, see Small Homes Council Instruction Sheet #1, *Nail-Gluing of Roof Trusses and Frames.*)

- Each structural member should have a moisture content of 19% or less.
- For structural lumber, use No. 2, K.D. (kiln dried) southern yellow pine or *construction* grade Douglas fir or western hemlock. (Stress rating on these grades in 2 x 6 material is 1500f.)
- Use unsanded grade Douglas fir plywood, ¾″ or ½″ thick. The plywood must meet Commercial Standards CS45-55 as certified by an approved testing laboratory.
- The surface grain of the plywood should run parallel to the bottom chord for all plates.
- Use 4d common nails or 1¼″ staples for nail-gluing the plywood gusset plates. Space a row of fasteners 4 inches on center along each edge of the 2 x 6 members, ¾ inch in from the edge. Stagger a third row of fasteners down the middle of the 2 x 6 , also spaced 4 inches on center.
- The casein glue must meet Federal Specification MMM-A-125, Type I or II. Mix the glue according to the manufacturer's instructions. Protect the trusses from rain. After nailing, stack the trusses and do not handle them during the curing period.
- Fabricate and cure the trusses above 50° F. When the temperature is between 50° F. and 70° F., a 16-hour curing period is necessary; when the temperature is 70° F. or above, an 8-hour curing period is needed.

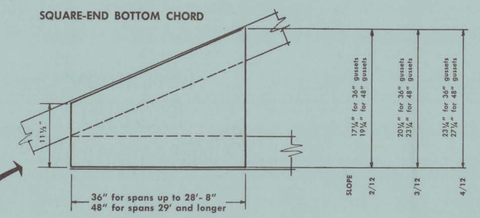
SQUARE-END BOTTOM CHORD



BEVEL-CUT BOTTOM CHORD



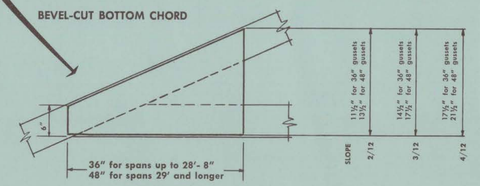
SQUARE-END BOTTOM CHORD



USE EITHER HEEL JOINT

NAIL-GLUE GUSSETS TO BOTH SIDES

BEVEL-CUT BOTTOM CHORD



STRUCTURAL DESIGN DATA FOR KING-POST TRUSSES

The graphical methods of analysis generally used for trusses designed with pin-connected joints should not be used for analyzing trusses with nail-glued plywood gussets because the rigidity of the nail-glued joints produces an entirely different stress distribution. Bending stresses become important in the rigid joint truss while the diagram analysis ignores them completely; furthermore, experimental stress analysis has shown that the actual axial stresses are substantially lower than those calculated in the diagram analysis. The large peak and heel gussets cause the top chords of the king-post trusses to act as beams with partially restrained ends; therefore, the distribution of stresses in the top chords is considerably different. The bottom chord is primarily a tension member. It also acts as a two-span continuous beam, partially restrained at the center and ends, and it resists a moment which is transferred through the heel gusset from the top chords. The center post is in tension.

The original king-post truss designs were based on test results: (1) from full-size trusses tested individually in a multiple-cylinder hydraulic testing machine, and (2) on pairs of trusses set up 24″ on center, sheathed, bridged for lateral support, and loaded with concrete blocks as live load on the roof surface and bottom chord. The data on this sheet were based upon test results from pairs of trusses set up on 24″ centers, sheathed, and loaded with concrete blocks.

Two types of tests were made to determine the performance of this design: load-and-recovery and load-to-destruction tests. In the load-and-recovery test (a performance test to observe the behavior of a truss in excess of design loads), a load of 100 psf. was applied to the trusses. Deflection readings were taken as the load was applied in increments of 20 pounds per sq. ft. Residual deflection was measured after the entire load was removed. This test determined the deflection characteristics of the truss. The nail-glued king-post trusses are exceptionally stiff and will sustain loads of at least 100 psf. ($\frac{L}{360}$ is an accepted engineering limit for deflection, but does not necessarily guarantee that plaster will not crack.)

The destruction test determined: (1) the maximum load capacity of the truss, (2) the behavior when greatly over-stressed, and (3) the critical points of the design.

DESIGN AND PERFORMANCE DATA ON 2 x 6 KING-POST TRUSSES

Span of 32′- 8″ — ⅜″ Plywood Gussets

2/12 SLOPE

Design Data

Recommended Design Load — Combined Live and Dead (pounds per sq. ft. of horizontal projection) . . . . . 40 psf.

Performance Data

Maximum allowable deflection (l/360) . . . . . 1.09″
Deflection at design load
quarter points . . . . . 0.49″
mid-point . . . . . 0.47″
Test load at failure . . . . 135 psf.

3/12 SLOPE

Design Data

Recommended Design Load — Combined Live and Dead (pounds per sq. ft. of horizontal projection) . . . . . 50 psf

Performance Data

Maximum allowable deflection (l/360) . . . . . 1.09″
Deflection at design load
quarter points . . . . . 0.48″
mid-point . . . . . 0.43″
Test load at failure . . . . 168 psf.

4/12 SLOPE

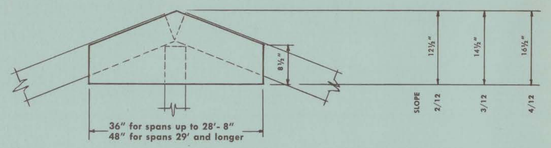
Design Data

Recommended Design Load — Combined Live and Dead (pounds per sq. ft. of horizontal projection) . . . . . 60 psf.

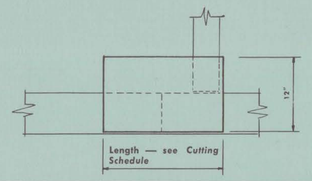
Performance Data

Maximum allowable deflection (l/360) . . . . . 1.09″
Deflection at design load
quarter points . . . . . 0.51″
mid-point . . . . . 0.38″
Test load at failure . . . . 198 psf.

PEAK GUSSETS (Both sides)



COMBINED CHORD SPLICE AND POST GUSSETS (Both sides)



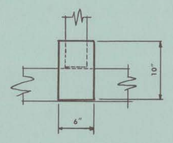
Always center splice plates over bottom-chord joint

CUTTING SCHEDULE

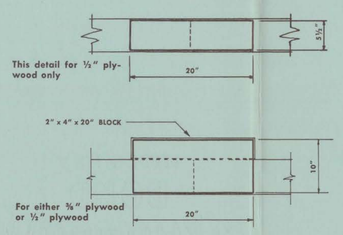
			25′			26′			27′			28′			29′			30′			31′			32′		
SPAN			0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″
TOP CHORDS	Length "A"		16′- 0″									18′- 0″												20′- 0″		
	Overhang "B"	2/12	39½″	37½″	35½″	33½″	31½″	29½″	27½″	25½″	47½″	45½″	43½″	41½″	39½″	37½″	35½″	33½″	31½″	29½″	27½″	25½″	23½″	45½″	43½″	41½″
		3/12	36¼″	34¼″	32¼″	30¼″	28¼″	26¼″	24¼″	22¼″	44¼″	42¼″	40¼″	38¼″	36¼″	34¼″	32¼″	30¼″	28¼″	26¼″	24¼″	22¼″	20¼″	42¼″	40¼″	38¼″
		4/12	32⅛″	30⅛″	28⅛″	26⅛″	24⅛″	22⅛″	20⅛″	18⅛″	38⅞″	36⅞″	34⅞″	32⅞″	30⅞″	28⅞″	26⅞″	24⅞″	22⅞″	20⅞″	18⅞″	16⅞″	14⅞″	34¾″	32¾″	30¾″
BOTTOM CHORDS	"C" or "D"		12′- 0″						14′- 0″									16′- 0″								
			13′- 0″	13′- 4″	13′- 8″	14′- 0″	12′- 4″	12′- 8″	13′- 0″	13′- 4″	13′- 8″	14′- 0″	14′- 4″	14′- 8″	15′- 0″	15′- 4″	15′- 8″	14′- 0″	14′- 4″	14′- 8″	15′- 0″	15′- 4″	15′- 8″	16′- 0″	16′- 4″	16′- 8″
SPLICE PLATES — LENGTH			20″	20″	24″	28″	24″	20″	20″	20″	20″	20″	20″	20″	20″	20″	24″	28″	24″	20″	20″	20″	20″	20″	20″	20″
POST LENGTH	Square-Cut on Bottom Chord	2/12	24⅜″	25″	25⅜″	25⅜″	26″	26⅜″	26⅜″	27″	27⅜″	27⅜″	28″	28⅜″	28⅜″	29″	29⅜″	29⅜″	30″	30⅜″	30⅜″	31″	31⅜″	31⅜″	32″	32⅜″
		3/12	37″	37½″	38″	38½″	39″	39½″	40″	40½″	41″	41½″	42″	42½″	43″	43½″	44″	44½″	45″	45½″	46″	46½″	47″	47½″	48″	48½″
		4/12	49⅝″	50″	50⅝″	51⅜″	52″	52⅝″	53⅜″	54″	54⅝″	55⅜″	56″	56⅝″	57⅜″	58″	58⅝″	59⅜″	60″	60⅝″	61⅜″	62″	62⅝″	63⅜″	64″	64⅝″
	Beveled Cut on Bottom Chord		Reduce all post lengths above by 3½ inches.																							

ALTERNATE BOTTOM-CHORD DESIGN — Separate post joint and bottom-chord splice

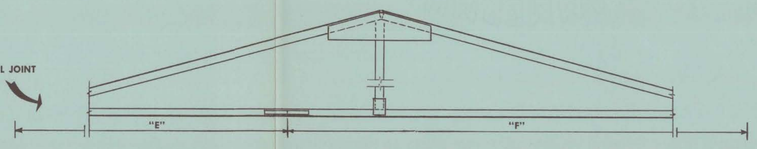
POST GUSSETS (Both sides)



SPLICE JOINTS (Both sides)



USE EITHER HEEL JOINT



CUTTING SCHEDULE

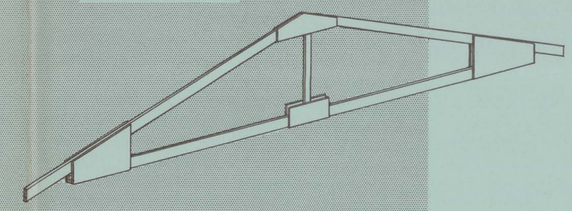
		25′			26′			27′			28′			29′			30′			31′			32′		
SPAN		0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″	0″	4″	8″
BOTTOM-CHORD MEMBERS	"E"	10′- 0″						12′- 0″												14′- 0″					
	"F"	15′- 0″	15′- 4″	15′- 8″	16′- 0″	16′- 4″	14′- 8″	15′- 0″	15′- 4″	15′- 8″	16′- 0″	16′- 4″	16′- 8″	17′- 0″	17′- 4″	17′- 8″	18′- 0″	18′- 4″	16′- 8″	17′- 0″	17′- 4″	17′- 8″	18′- 0″	18′- 4″	18′- 8″

2 x 6 KING-POST NAIL-GLUED ROOF TRUSSES

2′ on Center — 2/12, 3/12, 4/12 Slopes

25′-0″ to 32′-8″ Spans

INSTRUCTION SHEET #7



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