

Design Table for Glued Laminated Timber Arches for Vertical and Wind Loads

Values shown are for preliminary design only. A simplified loading system was used for the preliminary design of the arches in these tables. For final design, the designer should use the loads and method of loading required by the applicable building code.

			Span = 30 ft					Span = 35 ft					Span = 40 ft				
Loading	Roof Pitch	Wall Height ft	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.
Vertical Dead Load = 240 plf	10/12	8	5	7½	8¾	9½	7½	5	7½	9¼	10¼	9	5	7½	10¼	11¼	11¼
		10	5	7½	10¾	10½	7½	5	7½	10¾	11½	8¾	5	7½	12	10¾	10¾
		12	5	7½	12½	11¾	7½	5	7½	13¾	12¾	8½	5	7½	14¾	9¾	9¾
Horizontal Wind Load = 240 plf	12/12	8	5	7½	9¾	10¾	8¼	5	7½	10¼	11½	10¼	5	7½	11½	12¾	12¾
		10	5	7½	10¾	12	8	5	7½	11¾	13	9½	5	7½	13½	15	9¾
		12	5	7½	12¾	14	7½	5	7½	14¼	15¾	8	5	7½	15¾	17½	8½
Horizontal Wind Load = 240 plf	14/12	8	5	7½	10½	11¾	9½	5	7½	11¾	13	10¾	5	7½	13¼	14¾	11¾
		10	5	7½	12¾	14	8½	5	7½	14¼	15¾	9	5	7½	15¾	17½	10
		12	5	7½	14¾	16¼	7½	5	7½	17	18¾	7¾	5	7½	18¾	20¾	8¾
Vertical Dead Load = 320 plf	10/12	8	5	7½	10	11	8½	5	7½	10¾	12	10	5	7½	11½	12¾	12¾
		10	5	7½	11¼	12½	8	5	7½	12¾	14	9½	5	7½	13½	15	10¾
		12	5	7½	13½	15	7½	5	7½	15	16½	8¼	5	7½	16¼	18	9
Horizontal Wind Load = 320 plf	12/12	8	5	7½	11¼	12½	9¼	5	7½	12¾	14¼	10½	5	7½	14¾	16¼	11
		10	5	7½	13¾	15¼	7½	5	7½	15½	17¼	8¾	5	7½	17¾	19¾	9¼
		12	5	7½	16¼	18	7½	5	7½	18¼	20¼	7¾	5	7½	20½	22¾	8¾
Horizontal Wind Load = 320 plf	14/12	8	5	7½	13½	14¾	9½	5	7½	15½	17¼	9¾	5	9	17¼	19	11¼
		10	5	7½	16	17¾	8¼	5	7½	18¼	20¼	9¼	5	8¾	20½	22¾	9¾
		12	5	7¾	19	21	7½	5	8¼	21¾	24	8¼	6¾	10¼	18¼	20¼	10¼
Vertical Dead Load = 400 plf	10/12	8	5	7½	11¼	12½	9	5	7½	12¾	14	11¼	5	7½	13¾	15¼	12¼
		10	5	7½	13¾	15¼	7½	5	7½	15¼	17	9	5	7½	16¾	18½	10¼
		12	5	7½	16½	18¼	7½	5	7¾	18¼	20¼	8	5	8	20¼	22½	8¾
Horizontal Wind Load = 400 plf	12/12	8	5	7½	14	15½	8½	5	7½	15¾	17½	10	5	9¼	18	20	10¾
		10	5	7½	17	18¾	8	5	8	19	21	8½	5	9½	21¼	23½	10¼
		12	5	8½	20	22	7½	5	9¼	22½	24¾	8¼	6¾	10¼	19	21	10¼
Horizontal Wind Load = 400 plf	14/12	8	5	7¾	15¾	17½	9½	5	10½	18¾	20¾	9¾	5	12½	20¾	23	11¼
		10	5	8¾	19½	21½	8¼	5	10¾	22½	24¾	8¾	6¾	10¼	19	21	10¼
		12	6¾	10¼	18	19¾	10¼	6¾	10¼	20¼	22¼	10¼	6¾	10¼	22½	24¾	10¼

L.T. = Lower Tangent, U.T. = Upper Tangent
See Table Specifications

**Design Table for Glued Laminated Timber Arches
for Vertical and Wind Loads (continued)**

Values shown are for preliminary design only. A simplified loading system was used for the preliminary design of the arches in these tables. For final design, the designer should use the loads and method of loading required by the applicable building code.

			Span = 45 ft					Span = 50 ft				
Loading	Roof Pitch	Wall Height ft	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.
Vertical Dead Load = 240 plf	10/12	8	5	7½	11	12	12	5	7½	12¼	13½	13½
		10	5	7½	12½	13½	13½	5	7½	13½	15	12¾
		12	5	7½	15	15¼	10¼	5	7½	15	16½	11¼
Horizontal Wind Load = 240 plf	12/12	8	5	7½	12¼	13½	13½	5	7½	14¼	15¼	15¼
		10	5	7½	14½	16	11½	5	7½	15¼	17½	12¼
		12	5	7½	17¼	19	9¾	5	7½	19	21	10¼
Horizontal Wind Load = 240 plf	14/12	8	5	7½	14½	16	13¼	5	8	16¼	18	14½
		10	5	7½	17½	19¼	11¼	5	7½	18¾	20¾	12½
		12	5	7½	20¼	22½	9¾	5	7½	22	24¼	11
Vertical Dead Load = 320 plf	10/12	8	5	7½	13	14¼	14¼	5	9¼	14¼	15¾	15¾
		10	5	7½	15¼	17	11¼	5	7½	16½	18¼	12½
		12	5	8½	18	20	9¾	5	8	19½	21½	11
Horizontal Wind Load = 320 plf	12/12	8	5	7½	15¾	17½	13	5	9	17¼	19	15
		10	5	7½	18¾	20¾	11¼	5	9¼	20½	22¾	12¼
		12	5	9	22¼	24½	9¾	5	10¼	18½	20½	10½
Horizontal Wind Load = 320 plf	14/12	8	5	10½	18¾	20¾	12¾	5	12½	20¾	23	14¼
		10	5	10¾	22½	24¾	11	5	10¼	18¼	20¼	12½
		12	6¾	10¼	20¼	22¼	10¼	6¾	10¼	21½	23¾	11
Vertical Dead Load = 400 plf	10/12	8	5	9	15½	17¼	13	5	10½	17	18¾	14½
		10	5	8½	18½	20½	11¼	5	10¼	20¼	22½	12¼
		12	5	8¾	22	24¼	9¾	5	10¼	18	20	11
Horizontal Wind Load = 400 plf	12/12	8	5	10¾	19	21	13	5	13¼	21½	23¾	13½
		10	6¾	10¼	17½	19¼	11¼	6¾	10¼	19½	21½	11¾
		12	6¾	10¼	20½	22¾	10¼	6¾	10¼	22½	25	10½
Horizontal Wind Load = 400 plf	14/12	8	5	14¼	22½	24¾	13	6¾	11¼	19½	21½	14½
		10	6¾	10¼	20¾	23	11¼	6¾	10¾	22½	24¾	12½
		12	6¾	10¼	24½	27	10¼	6¾	11¼	26¼	29	11

**L.T. = Lower Tangent, U.T. = Upper Tangent
See Table Specifications**

Table Specifications

1. **Preliminary Design Only.** Sizes are for arches manufactured with Southern Pine lumber using a 7'-0" haunch radius and based on the following design criteria:
 - a. Bending design value, $F_b = 2400$ psi
 - b. Shear design value, $F_v = 200$ psi
 - c. Compression parallel to grain, $F_c = 1700$ psi
 - d. Modulus of elasticity, $E = 1,700,000$ psi
 - e. Tabular design values are increased by 15% for two-month duration of snow or live loads and 33% for wind or earthquake loads.

Design values for other softwood species can be found in *AITC 117 – Design*.

2. Vertical arch legs are laterally supported.
3. Vertical dead and live loads are uniformly distributed on the horizontal projection of arch.
4. Horizontal wind loads are uniformly distributed on the entire vertical projection of arch.
5. Many building codes require special loadings for arches, such as:
 - a. Full unbalanced live loads.
 - b. Simultaneous application of dead, live and wind loads.
 - c. Different components of wind loads to be applied to windward wall, windward slope, leeward wall and leeward slope, depending on arch geometry.

Unique loading requirements, different arch geometries or special deflection controls must be checked by a competent designer. Thrust load must also be considered at the base of arch.

6. Many arch configurations other than those tabulated can be utilized. Additional information on arch design is available from AITC laminators, the *Timber Construction Manual*, and *AITC Technical Note No. 23*.

While these specifications have been prepared in accordance with recognized engineering principles and are based on the most accurate technical data available, they should not be used without competent professional examination and verification of their accuracy, suitability and applicability by a licensed design professional. Any user of this information assumes all risks and liability arising from such use.