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 Horizontal Wind Load = 320 plf	10/12	8	5⅛	7½	7½	11	7½	5⅛	7½	7½	12	10¼	5⅛	7½	8¼	13	12¾
		10	5⅛	7½	9¼	12½	12½	5⅛	7½	10	13¼	8	5⅛	7½	10¾	14¼	11¾
		12	5⅛	7½	11¼	13¾	13¾	5⅛	7½	12	14¾	7½	5⅛	7½	12¾	15¾	9¾
	12/12	8	5⅛	7½	7½	12½	8¾	5⅛	7½	8¼	13½	12	5⅛	7½	8¾	14¾	14½
		10	5⅛	7½	9¾	13¾	9	5⅛	7½	10½	15	10¼	5⅛	7½	11	16¼	13¾
		12	5⅛	7½	11¾	15¼	15¼	5⅛	7½	12½	16½	9	5⅛	7½	13¼	17½	11¾
	14/12	8	5⅛	7½	8¾	13¾	10½	5⅛	7½	9	15	13¾	5⅛	7½	9½	16¼	16¼
		10	5⅛	7½	11¼	15¼	8¼	5⅛	7½	11½	16½	12¼	5⅛	7½	12½	18	15¾
		12	5⅛	7½	13¼	17	17	5⅛	7½	14	18	8¼	5⅛	7½	14½	19½	14¼
Vertical Dead Load = 320 plf Horizontal Wind Load = 320 plf	10/12	8	5⅛	7½	7½	10¾	9	5⅛	7½	8¼	11¾	11½	5⅛	7½	9	13	13
		10	5⅛	7½	10	12	7½	5⅛	7½	10¾	13	10½	5⅛	7½	11½	14	13½
		12	5⅛	7½	12	13¼	13¼	5⅛	7½	12¾	14¼	8½	5⅛	7½	13¾	15¼	12½
	12/12	8	5⅛	7½	8¼	12¼	10¼	5⅛	7½	9	13¼	13¼	5⅛	7½	9½	14¾	14¾
		10	5⅛	7½	10½	13½	9	5⅛	7½	11¼	14¾	12¼	5⅛	7½	12	15¾	15¼
		12	5⅛	7½	12½	15	9	5⅛	7½	13¼	16	10½	5⅛	7½	14¼	17¼	14¼
	14/12	8	5⅛	7½	8¾	13½	12	5⅛	7½	9¼	14¾	14¾	5⅛	7½	10	16½	16½
		10	5⅛	7½	10¾	15	10¼	5⅛	7½	11¾	16¼	14¼	5⅛	7½	12½	17½	17¼
		12	5⅛	7½	12¾	16½	8¼	5⅛	7½	13¾	17¾	12½	5⅛	7½	14¾	19¼	16½
Vertical Dead Load = 480 plf Horizontal Wind Load = 320 plf	10/12	8	5⅛	7½	9	10½	10½	5⅛	7½	9¾	12	12	5⅛	8	10½	13½	13½
		10	5⅛	7½	11¼	11½	10¼	5⅛	7½	12¼	12½	12½	5⅛	7¾	13¼	14	14
		12	5⅛	7½	13½	12¾	8¾	5⅛	7½	14¾	13½	12½	5⅛	7¾	16	14¾	14¾
	12/12	8	5⅛	7½	9¼	12	12	5⅛	7½	10¼	13½	13½	5⅛	7¾	11	15¼	15¼
		10	5⅛	7½	11¾	13¼	11½	5⅛	7½	12¾	14¼	14¼	5⅛	7¾	13¾	15¾	15¾
		12	5⅛	7½	13¾	14½	10	5⅛	7½	15	15½	14	5⅛	7¾	16¼	16¾	16¾
	14/12	8	5⅛	7½	9¾	13¼	13¼	5⅛	7½	10½	15	15	5⅛	7¾	11¼	17	17
		10	5⅛	7½	12	14¾	13	5⅛	7½	13	16	16	5⅛	7¾	14	17¾	17¾
		12	5⅛	7½	14¼	16	11½	5⅛	7½	15½	17½	15½	5⅛	7¾	16½	18¾	18¾

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 = 50 ft				
Loading	Roof Pitch	Wall Height ft	Width in. (b)	Base in. (d)	L.T. in.	U.T. in.	Crown in.
Vertical Dead Load = 240 plf Horizontal Wind Load = 320 plf	10/12	8	5⅛	7½	9¼	15½	15½
		10	5⅛	7½	12	16¼	16¼
		12	5⅛	7½	14¼	17½	16
	12/12	8	5⅛	7½	9¾	17½	17½
		10	5⅛	7½	12½	18½	18½
		12	5⅛	7½	14¾	20	18¼
	14/12	8	5⅛	7½	10¼	19½	19½
		10	5⅛	7¾	13¼	20½	20½
		12	5⅛	8¼	16	22	20¾
Vertical Dead Load = 320 plf Horizontal Wind Load = 320 plf	10/12	8	5⅛	8	10	15¾	15¾
		10	5⅛	7¾	13	16½	16½
		12	5⅛	7¾	15¾	17¼	17¼
	12/12	8	5⅛	7¾	10½	17¾	17¾
		10	5⅛	7¾	13½	18¾	18¾
		12	5⅛	7¾	16	19½	19½
	14/12	8	5⅛	7¾	10½	19¾	19¾
		10	5⅛	7¾	13¾	20¾	20¾
		12	5⅛	8	16½	21¾	21¾
Vertical Dead Load = 480 plf Horizontal Wind Load = 320 plf	10/12	8	5⅛	10¼	11¼	16½	16½
		10	5⅛	10	15¼	17	17
		12	5⅛	9¾	18	17½	17½
	12/12	8	5⅛	9¾	11¾	18½	18½
		10	5⅛	9¾	15½	19	19
		12	5⅛	9½	18¼	19¾	19¾
	14/12	8	5⅛	9½	12	20½	20½
		10	5⅛	9½	15½	21¼	21¼
		12	5⅛	9½	18½	22¼	22¼

L.T. = Lower Tangent, U.T. = Upper Tangent

See Table Specifications

Table Specifications

1. **Preliminary Design Only.** Sizes are for arches manufactured with Douglas Fir -- Larch lumber using a 9'-4" haunch radius and based on the following design criteria:
   a. Bending design value, F_b = 2400 psi
   b. Shear design value, F_v = 165 psi
   c. Compression parallel to grain, F_c = 1500 psi
   d. Modulus of elasticity, E = 1,600,000 psi
   e. Tabular design values are increased by 15% for two-month duration for 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.