ROUND TIMBER POLES AND PILES

6

6.1 General

6.1.1 Scope

6.1.1.1 Chapter 6 applies to engineering design with round timber poles and piles. Design procedures and reference design values herein pertain to the load carrying capacity of poles and piles as structural wood members.

6.1.1.2 This Specification does not apply to the load supporting capacity of the soil.

6.1.2 Specifications

6.1.2.1 The procedures and reference design values herein apply only to timber piles conforming to applicable provisions of ASTM Standard D 25 and only to poles conforming to applicable provisions of ASTM Standard D 3200.

6.1.2.2 Specifications for round timber poles and piles shall include the standard for preservative treatment, pile length, and nominal tip circumference or nominal circumference 3 feet from the butt. Specifications for piles shall state whether piles are to be used as foundation piles, land and fresh water piles, or marine piles.

6.1.3 Standard Sizes

6.1.3.1 Standard sizes for round timber piles are given in ASTM Standard D 25.

6.1.3.2 Standard sizes for round timber poles are given in ASTM Standard D 3200.

6.1.4 Preservative Treatment

6.1.4.1 Reference design values apply to untreated, air dried timber poles and piles, and shall be adjusted in accordance with 6.3.5 when conditioned and treated by an approved process (see Reference 30). Load duration factors greater than 1.6 shall not apply to structural members pressure-treated with water-borne preservatives.

6.1.4.2 Untreated, timber poles and piles shall not be used unless the cutoff is below the lowest ground water level expected during the life of the structure, but in no case less than 3 feet below the existing ground water level unless approved by the authority having jurisdiction.

6.2 Reference Design Values

6.2.1 Reference Design Values

6.2.1.1 Reference design values for round timber piles are specified in Table 6A (published in the Supplement to this Specification). Reference design values in Table 6A are based on the provisions of ASTM Standard D 2899.

6.2.1.2 Reference design values for round timber poles are specified in Table 6B (published in the Supplement to this Specification). Reference design values in Table 6B are based on provisions of ASTM Standard D 3200.

6.2.2 Other Species or Grades

Reference design values for piles of other species or grades shall be determined in accordance with ASTM Standard D 2899.

6.3 Adjustment of Reference Design Values

6.3.1 General

Reference design values (F_c, F_b, F_v, $F_{c\perp}$, E, E_{min}) from Table 6A and 6B shall be multiplied by the adjustment factors specified in Table 6.3.1 to determine adjusted design values (F_c', F_b', F_v', $F_{c\perp}'$, E', E_{min}').

6.3.2 Load Duration Factor, C_D (ASD Only)

All reference design values except modulus of elasticity, E, modulus of elasticity for column stability, E_{min}, and compression perpendicular to grain, $F_{c\perp}$, shall be multiplied by load duration factors, C_D, as specified in 2.3.2. Load duration factors greater than 1.6 shall not apply to timber poles or piles pressure-treated with wa-

Table 6.3.1 Applicability of Adjustment Factors for Round Timber Poles and Piles

		ASD only	ASD and LRFD							LRFD only		
		Load Duration Factor	Temperature Factor	Condition Treatment Factor	Size Factor	Column Stability Factor	Critical Section Factor	Bearing Area Factor	Load Sharing Factor	Format Conversion Factor K_F	Resistance Factor ϕ	Time Effect Factor
$F_c' = F_c$	x	C_D	C_t	C_{ct}	-	C_P	C_{cs}	-	C_{ls}	2.40	0.90	λ
$F_b' = F_b$	x	C_D	C_t	C_{ct}	C_F	-	-	-	C_{ls}	2.54	0.85	λ
$F_v' = F_v$	x	C_D	C_t	C_{ct}	-	-	-	-	-	2.88	0.75	λ
$F_{c\perp}' = F_{c\perp}$	x	-	C_t	C_{ct}	-	-	-	C_b	-	1.67	0.90	-
$E' = E$	x	-	C_t	-	-	-	-	-	-	-	-	-
$E_{min}' = E_{min}$	x	-	C_t	-	-	-	-	-	-	1.76	0.85	-

ter-borne preservatives, (see Reference 30), nor to structural members pressure-treated with fire retardant chemicals (see Table 2.3.2).

6.3.3 Wet Service Factor, C_M

Reference design values apply to wet or dry service conditions ($C_M = 1.0$).

6.3.4 Temperature Factor, C_t

Reference design values shall be multiplied by temperature factors, C_t, as specified in 2.3.3.

6.3.5 Condition Treatment Factor, C_{ct}

Reference design values are based on air dried conditioning. If kiln-drying, steam-conditioning, or boultonizing is used prior to treatment (see reference 20) then the reference design values shall be multiplied by the condition treatment factors, C_{ct}, in Table 6.3.5.

Table 6.3.5 Condition Treatment Factor, C_{ct}

Air Dried	Kiln Dried	Boulton Drying	Steaming (Normal)	Steaming (Marine)
1.0	0.90	0.95	0.80	0.74

6.3.6 Beam Stability Factor, C_L

Reference bending design values, F_b, for round timber poles or piles shall not be adjusted for beam stability.

6.3.7 Size Factor, C_F

Where pole or pile circumference exceeds 43" (diameter exceeds 13.5") at the critical section in bending, the reference bending design value, F_b, shall be multiplied by the size factor, C_F, specified in 4.3.6.2 and 4.3.6.3.

6.3.8 Column Stability Factor, C_P

Reference compression design values parallel to grain, F_c, shall be multiplied by the column stability factor, C_P, specified in 3.7 for the portion of a timber pole or pile standing unbraced in air, water, or material not capable of providing lateral support.

6.3.9 Critical Section Factor, C_{cs}

Reference compression design values parallel to grain, F_c, for round timber piles and poles are based on the strength at the tip of the pile. Reference compression design values parallel to grain, F_c, in Table 6A and Table 6B shall be permitted to be multiplied by the critical section factor. The critical section factor, C_{cs}, shall be determined as follows:

$$C_{cs} = 1.0 + 0.004L_c \qquad (6.3\text{-}1)$$

where:

L_c = length from tip of pile to critical section, ft

The increase for location of critical section shall not exceed 10% for any pile or pole ($C_{cs} \leq 1.10$). The critical section factors, C_{cs}, are independent of tapered column provisions in 3.7.2 and both shall be permitted to be used in design calculations.

6.3.10 Bearing Area Factor, C_b

Reference compression design values perpendicular to grain, $F_{c\perp}$, for timber poles or piles shall be permitted to be multiplied by the bearing area factor, C_b, specified in 3.10.4.

6.3.11 Load Sharing Factor (Pile Group Factor), C_{ls}

For piles, reference design values are based on single piles. If multiple piles are connected by concrete caps or equivalent force distributing elements so that the pile group deforms as a single element when subjected to the load effects imposed on the element, reference bending design values, F_b, and reference compression design values parallel to the grain, F_c, shall be permitted to be multiplied by the load sharing factors, C_{ls}, in Table 6.3.11.

Table 6.3.11 Load Sharing Factor, C_{ls}, per ASTM D 2899

Reference Design Value	Number of Piles in Group	C_{ls}
F_c	2	1.06
	3	1.09
	4 or more	1.11
F_b	2	1.05
	3	1.07
	4 or more	1.08

6.3.12 Format Conversion Factor, K_F (LRFD Only)

For LRFD, reference design values shall be multiplied by the format conversion factor, K_F, specified in Table 6.3.1.

6.3.13 Resistance Factor, ϕ (LRFD Only)

For LRFD, reference design values shall be multiplied by the resistance factor, ϕ, specified in Table 6.3.1.

6.3.14 Time Effect Factor, λ (LRFD Only)

For LRFD, reference design values shall be multiplied by the time effect factor, λ, specified in Appendix N.3.3.