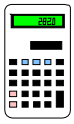
EXAMPLE 7.8 Deck Header to Post Connection



Given

- A 2x8 preservative-treated header is attached to each side of a deck post in a bolted, double shear connection to support load from deck joists bearing on the headers.
- The deck post is a preservative treated 4x4.
- The deck framing lumber is preservative-treated Southern Yellow Pine.
- The design double shear load on the connection is 2,560 lb (1,280 lb per header).

Find Determine if two 5/8-inch-diameter bolts are sufficient to resist the design load.

Solution

Calculate the design shear capacity of the bolted joint assuming that the bolts are located approximately 2 inches from the top and bottom edge of the 2x8 headers along the centerline of the 4x4 post.

$Z' = ZC_DC_MC_tC_gC_d$ (Section 7.3.2)

$Z_{s\perp}$ = 1,130 lb*	(NDS Table 8.3A)
C_D = 1.0**	(Normal duration of load)
C_M = 1.0	(MC < 19%)
C_t = 1.0	(Temperature < 100°F)
C_g = 0.98 (2 bolts in a row)	(NDS Table 7.3.6A)
C_Δ = 1.0 (for the bottom bolt only)***	(NDS•8.5.3)

*The $Z_{s\perp}$ value is used because the side members (2x8) are loaded perpendicular to grain and the main member (4x4) is loaded parallel to grain.

**A normal duration of load is assumed for the deck live load. However, load duration studies for deck live loads have not been conducted. Some recent research has indicated that a load duration factor of 1.25 is appropriate for floor live loads; refer to Table 5.3 of Chapter 5.

***The top bolt is placed 2 inches from the top (loaded) edge of the 2x8 header and does not meet the 4D (2.5 inch) edge distance requirement of NDS•8.5.3. However, neglecting the bolt entirely will under-estimate the capacity of the connection.

$Z' = (1{,}130 \text{ lb})(0.98) = 1{,}107 \text{ lb}$ (bottom bolt only)

If the top bolt is considered to be 80 percent effective based on its edge distance relative to the required edge distance (i.e., 2 inches / 2.5 inches = 0.8), then the design shear capacity for the two bolts in double shear may be estimated as follows:

$Z' = 1{,}107 \text{ lb} + 0.8(1{,}107 \text{ lb}) = 1{,}993 \text{ lb}$ < 2,560 lb NG?

Conclusion

The calculation of the design shear capacity of a double shear bolted connection is demonstrated in this example. As shown in the calculations, the connection doesn't meet the required load in the manner analyzed. A larger bolt diameter or 3 bolts may be used to meet the required design load. However, as in previous examples, this connection is typical in residential deck construction (i.e., supporting deck spans of about 8 ft each way) and may be approved by the "extensive experience" clause of NDS•7.1.1.4. As additional rationale, the

capacity of shear connections in the NDS is related to a yield (or deformation) limit state and not capacity. On the basis of capacity, the safety margins are fairly conservative for such applications; refer to Section 7.3.1. The use of a 1.25 load duration factor for the deck live load will also increase the joint capacity to a value nearly equivalent to the design load assumed in this example.