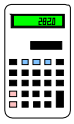
EXAMPLE 7.5 Side-Bearing Joist Connection



Given

- A 2x10 Douglas-Fir joist is side-bearing (shear connection) on a built-up wood girder
- The design shear load on the side-bearing joint is 400 lb due to floor live and dead loads

Find

1. The number of 16d box toenails required to transfer the side-bearing (shear) load.
2. A suitable joist hanger

Solution

1. Determine the number of 16d box toenails required

$$Z' = ZC_DC_dC_{tn}$$

Z	= 103 lb	(NDS Table 12.3A)
C_D	= 1.0	(normal duration load)
C_d	= 1.0	(penetration into main member > 12D)
C_{tn}	= 0.83	(NDS•12.3.7)

$$Z' = (103 \text{ lb})(0.83) = 85 \text{ lb}$$

The number of toenails required is determined as follows:

$$(400 \text{ lb})/(85 \text{ lb/nail}) = 4.7 \text{ nails}$$

Use 6 toenails with 3 on each side of the joist to allow for reasonable construction tolerance in assembling the connection in the field.

2. As an alternative, select a suitable manufactured joist hanger.

Data on metal joist hangers and various other connectors are available from a number of manufacturers of these products. The design process simply involves the selection of a properly rated connector of the appropriate size and configuration for the application. Rated capacities of specialty connectors are generally associated with a particular fastener and species of framing lumber. Adjustments may be necessary for use with various lumber species and fastener types.

Conclusion

The example problem details the design approach for two simple methods of transferring shear loads through a side-bearing connection. One approach uses a conventional practice of toe-nailing the joist to a wood girder. This approach is commonly used for short-span floor joists (i.e., tail joist to header joist connections at a floor stairwell framing). For more heavily loaded applications, a metal joist hanger is the preferred solution.

EXAMPLE 7.6 Wood Floor Ledger Connection to a Wood or Concrete Wall

Given

- A 3x8 wood ledger board (Douglas-Fir) is used to support a side-bearing floor system.
- The ledger is attached to 3x4 wall studs (Douglas-Fir) spaced at 16 inches on center in a balloon-framed portion of a home; as a second condition, the ledger is attached to a concrete wall.
- The design shear load on the ledger is 300 plf due to floor live and dead loads.

Find

1. The spacing of 5/8-inch-diameter lag screws required to fasten the ledger to the wood wall framing
2. The spacing of 5/8-inch-diameter anchor bolts required to fasten the ledger to a concrete wall

Solution

1. Determine connection requirements for use of a 5/8-inch-diameter lag screw

$Z' = ZC_DC_gC_\Delta C_d$ (Section 7.3.2)

$Z_{s\perp} = 630$ lb* (NDS Table 9.3A)
$C_D = 1.0$ (normal duration load)
$C_g = 0.98$ (2 bolts in a row) (NDS Table 7.3.6A)
$C_\Delta = 1.0$**
$C_d = p/(8D) = (3.09 \text{ in})/[8(5/8 \text{ in})] = 0.62$ (NDS•9.3.3)
p = (penetration into main member) – (tapered length of tip of lag screw)***
= 3.5 in – 13/32 in = 3.09 in

*The $Z_{s\perp}$ value is used for joints when the shear load is perpendicular to the grain of the side member (or ledger in this case).
**A C_Δ value of 1.0 is predicated on meeting the minimum edge and end distances required for lag screws and bolts; refer to NDS•8.5.3 and NDS•9.4. The required edge distance in the side member is 4D from the top of the ledger (loaded edge) and 1.5D from the bottom of the ledger (unloaded edge), where D is the diameter of the bolt or lag screw. The edge distance of 1.5D is barely met for the nominal 3-inch-wide (2.5 inch actual) stud provided the lag screws are installed along the center line of the stud.
***A 6-inch-long lag screw will extend through the side member (2.5 inches thick) and penetrate into the main member 3.5 inches. The design penetration into the main member must be reduced by the length of the tapered tip on the lag screw (see Appendix L of NDS for lag screw dimensions).

$Z' = (630 \text{ lb})(1.0)(0.98)(1.0)(0.62) = 383$ lb

The lag bolt spacing is determined as follows:

Spacing = (383 lb/lag screw)/(300 plf) = 1.3 ft

Therefore, one lag screw per stud-ledger intersection may be used (i.e., 1.33 ft spacing). The lag screws should be staggered about 2 inches from the top and bottom of the 3x8 ledger board. Since the bolts are staggered (i.e., not two bolts in a row), the value of C_g may be revised to 1.0 in the above calculations.