8. Check girder for floor system vibration control (see Section 5.3.2)

Girder span, $\ell_1 = 14$ ft
Joist span, $\ell_2 = 12$ ft
$\ell_{TOTAL} = 26$ ft > 20 ft

Therefore, check girder using $\ell/480$ or $\ell/600$ to stiffen floor system

Try $\ell/480$

$$\rho_{max} = \frac{4.15 \times 10^8}{EI} \text{ (as before)}$$

$$\rho_{all} = \ell/480 = \frac{14 \text{ ft} (12 \text{ in / ft})}{480} = 0.35 \text{ in}$$

$$\rho_{max} \leq \rho_{all}$$

$$\frac{4.15 \times 10^8}{EI} = 0.35 \text{ in}$$

$$EI = 1.2 \times 10^9$$

$$I = \frac{1.2 \times 10^9}{1.7 \times 10^6} = 706 \text{ in}^4$$

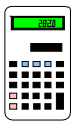
Using Table 1B in NDS, use

4 2x12s $I = 4 (178 \text{ in}^4) = 712 \text{ in}^4 > 706 \text{ in}^4$ OK

Conclusion

The bending stress limits the floor girder design to 4 2x12's (No. 1, SYP). The use of 4 2x12s also provides a "stiff" girder with respect to floor vibration (i.e., deflection limit of $\ell/480$. As a practical alternative, a steel "floor beam" (e.g., W-shape) or an engineered wood beam may also be used, particularly if "clearance" is a concern.

EXAMPLE 5.5 Subfloor Sheathing Design



Given

Joist spacing = 16 in on center
Floor live load = 40 psf
Use APA rated subflooring

Find The required sheathing span rating and thickness with the face grain perpendicular to the joist span.

Determine size and spacing of fasteners.

Solution

Determine sheathing grade and span rating and thickness by using the APA's *Design and Construction Guide for Residential and Commercial* (APA, 1998). From Table 7 in the APA guide, use 7/16-inch-thick (24/16 rating) sheathing or 15/32-inch- to 1/2-inch-thick (32/16 rating) sheathing. The first number in the rating applies to the maximum spacing of framing members for roof applications; the second to floor applications. It is fairly common to up size the sheathing to the next thickness, e.g., 3/4-inch, to provide a stiffer floor surface. Such a decision often depends on the type of floor finish to be used or the desired "feel" of the floor. Similar ratings are also available from other structural panel trademarking organizations and also comply with the PS-2 standard. It is important to ensure that the sheathing is installed with the long dimension (i.e., face grain) perpendicular to the floor framing; otherwise, the rating does not apply. For wall applications, panel orientation is not an issue.

Use 6d common nails for 7/16-inch-thick sheathing or 8d common nails for thicknesses up to 1 inch (see Table 5.7). Nails should be spaced at 6 inches on center along supported panel edges and 12 inches on center along intermediate supports.

Conclusion

Sheathing design involves matching the proper sheathing rating with the floor framing spacing and live load condition. The process is generally a "cook book" method that follows tables in manufacturer's literature or the applicable building code. Board sheathing and decking are other possible subfloor options that may be designed by using the NDS. Prescriptive tables for these options are also generally available in wood industry publications or in the applicable residential building code.