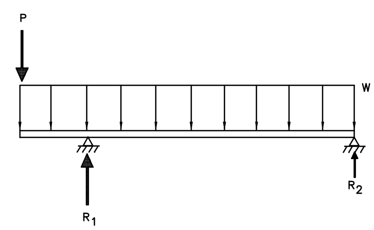
EXAMPLE 5.3 *Cantilevered Floor Joist*

Given

Joist spacing = 16 in on center
Joist size = 2x10
Bearing length = 3-1/2 in
Species = Douglas Fir-Larch, No.1 Grade
Loads on cantilever joist (see Chapter 3)
  Floor live load (L) = 40 psf
  Floor dead load (D) = 10 psf
Loads for concentrated load at end of cantilever (see Chapter 3)
  Roof snow load (S) = 11 psf (15 psf ground snow load and 7:12 roof pitch)
  Roof dead load (D) = 12 psf
  Wall dead load (D) = 8 psf
Roof span = 28 ft (clear span plus 1 ft overhang)
Wall height = 8 ft



Cantilever Joist Load Diagram

Find

Determine the maximum cantilever span for the specified floor joist based on these load combinations (Chapter 3, Table 3.1):

$D + L + 0.3\ (S \text{ or } L_r)$
$D + (S \text{ or } L_r) + 0.3L$

The analysis does not consider wind uplift that may control connections in high-wind areas, but not necessarily the cantilever joist selection.

Deflection at the end of the cantilever should be based on a limit appropriate to the given application. The application differs from a normal concern with mid-span deflection; experience indicates that deflection limits can be safely and serviceably relaxed in the present application. A deflection limit of $\ell/120$ inches at the end of cantilever is recommended, particularly when the partial composite action of the sheathing is neglected in determining the moment of inertia, I, for the deflection analysis.

Solution

1. Determine tabulated design values for species and grade from the NDS-S

F_b	=	1000 psi	S	=	21.39 in^3
F_v	=	95 psi	I	=	98.93 in^4
$F_{c\perp}$	=	625 psi	b	=	1.5 in
E	=	$1.7x10^6$ psi	d	=	9.25 in

2. Determine lumber property adjustments (see Section 5.2.4)

C_r	=	1.15	C_F	=	1.1
C_H	=	2.0	C_D	=	1.25 (includes snow)
C_b*	=	1.11	C_L	=	1.0 (continuous lateral support)**

*Joist bearing not at end of member (see NDS•2.3.10)
**The bottom (compression edge) of the cantilever is assuemd to be laterally braced with wood structural panel sheathing or equivalent. If not, the value of CL is dependent on the slenderness ratio (see NDS•3.3.3).

$F_b' = F_bC_rC_FC_DC_L$ = (1000 psi)(1.15)(1.1)(1.25)(1.0) = 1,581 psi
$F_v' = F_vC_HC_D$ = (95)(2)(1.25) = 238 psi
$F_{c\perp}' = F_{c\perp}C_b$ = 625 (1.11) = 694 psi
$E' = E = 1.7x10^6$ psi

3. Determine design loads on cantilever joist

The following load combinations (based on Chapter 3, Table 3.1) will be investigated for several load cases that may govern different safety or serviceability checks

Case I: D+S - Cantilever Deflection Check
P = wall and roof load (lb) at end of cantilever = *f* (D+S)
w = uniform load (plf) on joist = *f* (D only)

Case II: D+L - Deflection at Interior Span
P = *f* (D only)
w = *f* (D+L)

Case III: D+S+0.3L or D+L+0.3S - Bending and Horizontal Shear at Exterior Bearing Support
a. P = *f* (D+S)
w = *f* (D + 0.3L)

b. P = *f* (D+0.3S)
w = *f* (D+L)

The following values of P and W are determined by using the nominal design loads, roof span, wall height, and joist spacing given above

		Case I	Case II	Case IIIa	Case IIIb
P	=	544 lb	325 lb	544 lb	390 lb
W	=	13.3 plf	66.5 plf	29.3 plf	66.5 lb