

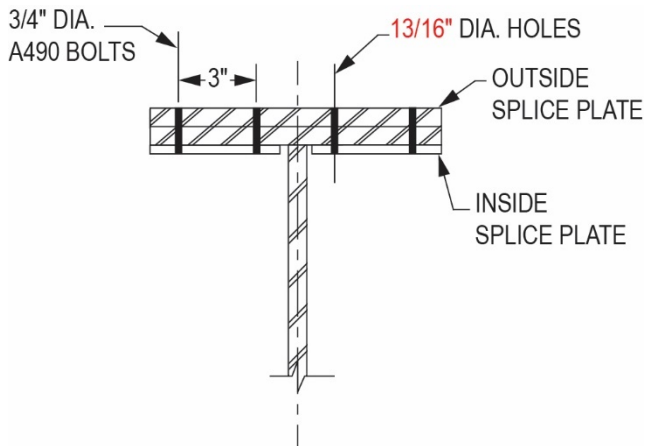
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Revisions are shown in red.

Vertical Forces Depth—Bridges, Scenario 1, No. 8

Variable	Value
A_g (in ²)	0.8
A_e (in ²)	0.95
A_n (in ²)	19.125
F_{yf} (ksi)	22.55
F_u (ksi)	24
P_{fy} (ksi)	50
ϕ_u	70
ϕ_y	1,127.5

Vertical Forces Depth—Bridges, Scenario 1, No. 11



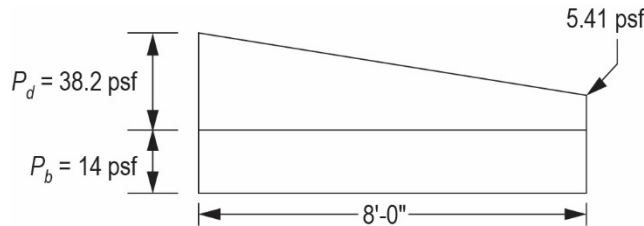
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Vertical Forces Depth—Buildings, Scenario 2, No. 4

$$p_d = (2.33 \text{ ft})(16.6 \text{ pcf}) = 38.2 \text{ psf}$$

$$W = 4h_d = 4(2.33 \text{ ft}) = 9.32 \text{ ft}$$

$$P_b = 14 \text{ psf}$$



$$\left[S = (14 + 5.41) \left(\frac{8 \text{ ft}}{2} \right) \left(\frac{12 \text{ ft}}{2} \right) \right] + \frac{(38.2 - 5.41)}{2} \left(\frac{2}{3} \right) (8 \text{ ft}) \left(\frac{12 \text{ ft}}{2} \right)$$

$$= 1.52 \text{ kips} \leftarrow \text{Governs snow}$$

$$D + L_r = 2.09 + 0.48 = 2.57 \text{ kips}$$

$$D + S = 2.09 + 0.990 = 3.08 \text{ kips} \leftarrow \text{Governs}$$

LRFD (Strength Design)

$$1.2D + 1.6L_r = 3.28 \text{ kips}$$

$$1.2D + 1.6S = 4.09 \text{ kips}$$

THE CORRECT ANSWER IS: ASD 3.0 to 3.2 kips
LRFD 4.0 to 4.2 kips

Vertical Forces Depth—Bridges, Scenario 1, No. 4

$$3n = 3 \times 8.5 = 25.5$$

$$\bar{y} = \frac{3,260.49}{106.14} = 30.72 \text{ in.}$$

$$I_{LT} = 45,618.42 \text{ in}^4 + 7,840.21 \text{ in}^4 = 53,438.63 \text{ in}^4$$

$$S_{LT}^b = \frac{53,438.63 \text{ in}^4}{30.72 \text{ in.}} = 1,740.19 \text{ in}^3$$

$$f_{bLT} = 1,200 / 1,740.19 \left(\frac{12 \text{ in.}}{\text{ft}} \right) = 8.27 \text{ ksi}$$

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Vertical Forces Depth—Bridges, Scenario 1, No. 5

Weld E = 5/16 in.
3/4-in. stiffener to 5/8-in. web
3/4-in. stiffener controls
Use 1/4-in. weld

Vertical Forces Depth—Bridges, Scenario 1, No. 8

$$A_g = (16 \text{ in.})(1.5 \text{ in.}) = 24 \text{ in}^2$$

$$A_e = \frac{0.8 (70)}{0.95 (50)} (19.125) = 22.55 \text{ in}^2$$

AASHTO 6.13.6.1.3 b-2

$$A_n = \left[16 - 4 \left(\frac{13}{16} \right) \right] (1.5) = 19.125 \text{ in}^2$$

Hole for 3/4-in.-diameter bolt

Table 6.13.3.4-1

$$F_{yf} = 50 \text{ ksi}$$

Table 6.4.1-1

$$F_u = 70 \text{ ksi}$$

Table 6.4.1-1

$$P_{fy} = A_e F_{yf} = 1,127.5 \text{ kips}$$

$$\phi_u = 0.8$$

6.5.4.2

$$\phi_y = 0.95$$

6.5.4.2

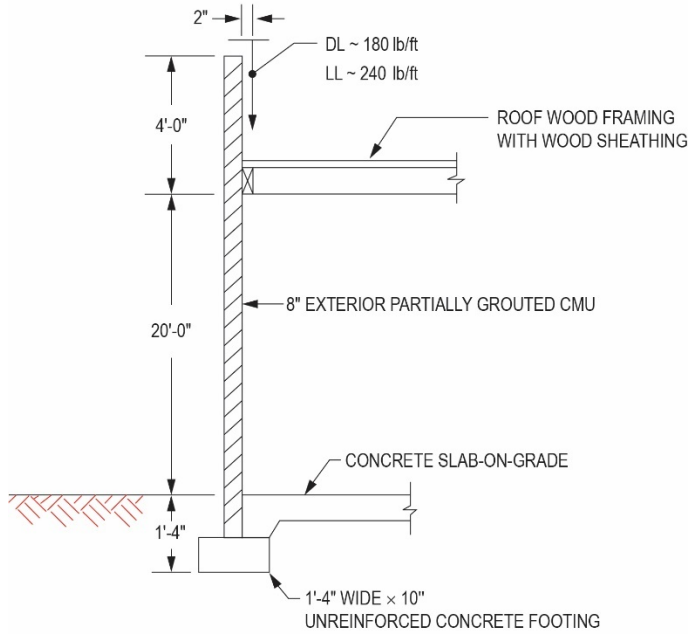
Lateral Forces Depth—Buildings, Scenario 2

Material Specifications:

Steel reinforcement ASTM A615, $f_y = 60 \text{ ksi}$

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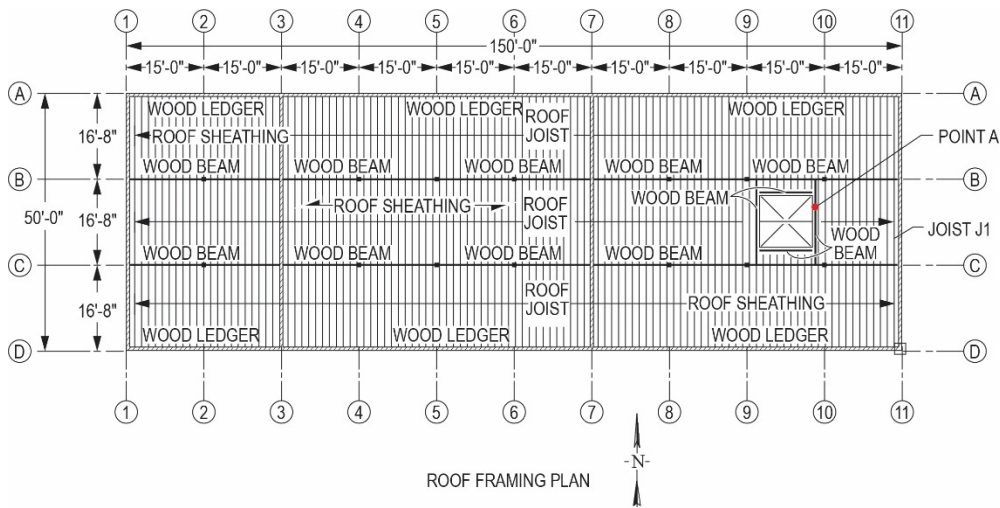
Lateral Forces Depth—Buildings, Scenario 2, Figure A



WALL SECTION

FIGURE A

Lateral Forces Depth—Buildings, Scenario 2, Figure B

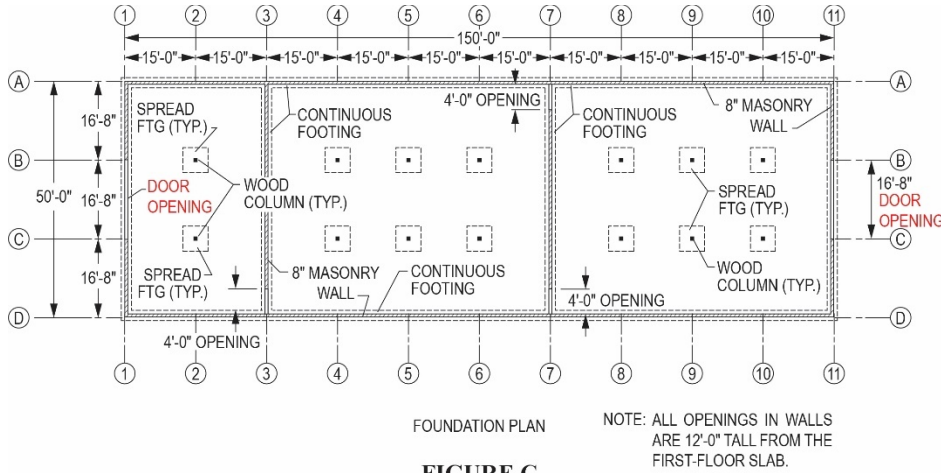


ROOF FRAMING PLAN

FIGURE B

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Lateral Forces Depth—Buildings, Scenario 2, Figure C



Lateral Forces Depth—Buildings, Scenario 2, No. 1

Design Data:

- Base wind speed = 142 mph
- Exposure C
- $K_{zt} = 1.0$
- $K_e = 1.0$

The wind velocity pressure q_p (psf) at the top of the building's parapet is _____.

Lateral Forces Depth—Buildings, Scenario 2, No. 2

Based on a wind velocity pressure of 50 psf and vertical reinforcement at 16 in. o.c., the wind design pressure p (psf) at the top of the windward parapet at Grid Line 5 is _____.

Lateral Forces Depth—Buildings, Scenario 2, No. 3

Based on a wind velocity pressure of 50 psf and vertical reinforcement at 16 in. o.c., the building's leeward parapet design wind pressure p (psf) at Grid Line 5 is _____.

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Lateral Forces Depth—Buildings, Scenario 2, No. 4

Assumptions:

$q_z = 35$ psf at 15 ft above floor slab

$q_h = 40$ psf at 20 ft above floor slab

Total leeward parapet design wind pressure = 85 psf

Anchorage from the wall to the roof has an effective wind area of 50 ft².

Enclosed building

The wind loads R_B (plf of roof) from the **windward** wall at Grid Line 5 that are resisted by the roof diaphragm are _____.

Lateral Forces Depth—Buildings, Scenario 2, No. 5

Based on the wind pressures in the table, the maximum moment M_{max} (lb-ft) **due to wind pressures on the wall shown in Figure A** is _____.

Lateral Forces Depth—Buildings, Scenario 2, No. 6

Assume an ASD moment of 1,080 ft-lb, or a strength level moment of 1,800 ft-lb. Based on **Figure A**, the maximum spacing of #5 vertical bar reinforcement for bars placed at the center of the 8-in. CMU wall is:

Lateral Forces Depth—Buildings, Scenario 2, No. 7

Assumptions:

$q_h = 46$ psf

Enclosed building

Bridging/blocking fully braces bottom of joists.

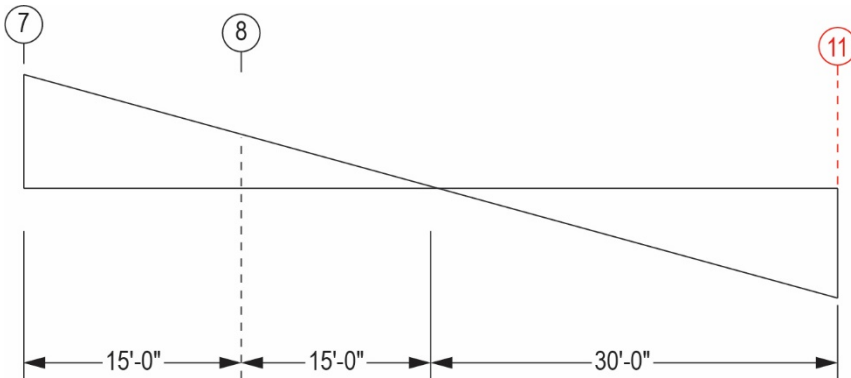
Joists are spaced at 16 in. o.c.

The **minimum** 2× wood joist size required for bending stresses **due to wind pressure on Joist J1** on the roof framing plan in **Figure B** is _____.

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Lateral Forces Depth—Buildings, Scenario 2, No. 8

For a distributed diaphragm wind load W of 2,300 plf (strength/LRFD level) and based on $2\times$ joists and blocking at all panel edges, what are the required horizontal plywood nail size and spacing, respectively, along Grids 7 and 8?



Lateral Forces Depth—Bridges, Scenario 1, No. 3

Assume half the mass of the columns contributes to the weight of the structure. The weight (kips) of the structure used to compute the period of the structure is _____.

Lateral Forces Depth—Buildings, Scenario 2, No. 1

142 mph, Exposure C
RC II, parapet 20–24 ft

$$q_p = 0.00256(K_z)(K_{zt})(K_d)(K_e)(V)^2$$

at z of 20 ft, $K_z = 0.90$; at z of 24 ft, $K_z = 0.932$
 $K_{zt} = 1.0$, $K_d = 0.85$, $K_e = 1.0$

$$q_p = 0.00256(0.932)(1.0)(0.85)(1.0)(142)^2 = 40.9 \text{ psf}$$

Range: 40.5 to 41.5

THE CORRECT ANSWER IS: 40.5 to 41.5

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Lateral Forces Depth—Buildings, Scenario 2, No. 2

Effective wind area = $4(4)/3 = 5.33 < 10 \text{ ft}^2$; use 10 ft^2
 Wall Zone 4 positive coefficient = $+1.0$
 Roof Zone 2 uplift pressure coefficient = -2.3

$GC_{pi} = 0$ for solid parapet

$q_p = 50$ psf, given

$$p = q_p[(GC_p) - (GC_{pi})] = 50[1.0(0.9) - 0] - 50(-2.3 - 0) = 50(3.2)$$

$p = 160$ psf

Footnote 5, Figure 30.3-1

Figure 30.3-1

Figure 30.3-2A

THE CORRECT ANSWER IS: 155 to 165

Lateral Forces Depth—Buildings, Scenario 2, No. 3

$q_2 = 50$ psf

$GC_{pi} = 0.00$ (solid parapet)

Effective wind area = $4.0 \text{ ft} \times 4.0 \text{ ft}/3 = 5.33 \text{ ft}^2$

$GC_p =$ Figure 30.3-1

Reference Footnote 5, Figure 30.3-1

$$= -1.0 \times 0.9 = +0.9 = GC_p \text{ for } p_{\text{roof}}$$

$$-1.1 \times 0.9 = -0.99 = GC_p \text{ for } p_{\text{wall}}$$

$$p_{\text{roof}} = 50 \text{ psf } (0.9 - \emptyset) = 45 \text{ psf}$$

$$p_{\text{wall}} = 50 \text{ psf } (0.99 - \emptyset) = 49.5 \text{ psf}$$

$$p_{\text{total}} = 94.5 \text{ psf}$$

THE CORRECT ANSWER IS: 90.0 to 99.0

Lateral Forces Depth—Buildings, Scenario 2, No. 6

From *NCEES PE Structural Reference Handbook*:

$$2/jk = (12)(3.81)^2(900)/1,080 = 12.1$$

$$np = 0.019$$

$$npj = 16.11(1,080)(12)/12(3.81)^2(32,000) = 0.037$$

$$np = 0.041$$

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Lateral Forces Depth—Buildings, Scenario 2, No. 7

Effective wind area need not be less than $(16.67)(16.67/3) = 93 \text{ ft}^2$
Therefore, use effective wind area = 93 ft^2

ASCE 7 Figure 30.3-2A, Zone 2: $G C_p$ can be taken with range of -1.7 to -1.9

Design wind uplift pressure, LRFD/Strength: $P = 46 \text{ psf} \left(\begin{matrix} -1.7 & -0.18 \\ -1.9 & -0.18 \end{matrix} \right) = \begin{matrix} 86.5 \text{ psf} \\ \text{to} \\ 95.7 \text{ psf} \end{matrix}$

Distributed wind load on joist: $W = \left(\begin{matrix} 86.5 \text{ psf} \\ \text{to} \\ 95.7 \text{ psf} \end{matrix} \right) (1.33 \text{ ft}) = \begin{matrix} 115.0 \text{ plf} \\ \text{to} \\ 127.3 \text{ plf} \end{matrix}$

Moment in joist: $\frac{Wl^2}{8} = \frac{W(16.67 \text{ ft})^2}{8} = \begin{matrix} 3,995 \text{ lb-ft} & 47,936 \text{ lb-in.} \\ \text{to} & \text{to} \\ 4,422 \text{ lb-ft} & 53,063 \text{ lb-in.} \end{matrix}$

ASD (Allowable Design)

$$S_{req} = \frac{(0.6)(47,936)}{1,656 \text{ psi}} = 17.4 \text{ in}^3$$
$$= \frac{(0.6)(53,063)}{1,656 \text{ psi}} = 19.2 \text{ in}^3$$

$2 \times 8 S_x = 13.14 < 17.4 \text{ in}^3 \therefore \text{NG}$

$2 \times 10 S_x = 21.39 > 19.2 \text{ in}^3 \therefore \text{OK}; \text{ use } 2 \times 10$

LRFD (Strength Design)

$$S_{req} = M/F_b'$$

$$S_{req} = \frac{47,936 \text{ lb-in.}}{3,575 \text{ psi}} = 13.4 \text{ in}^2$$

to

$$\frac{53,063 \text{ lb-in.}}{3,575 \text{ psi}} = 14.8 \text{ in}^2$$

$2 \times 8 S_x = 13.14 < 13.4 \text{ in}^2 \therefore \text{NG}$

$2 \times 10 S_x = 21.39 > 14.8 \text{ in}^2 \therefore \text{OK}; \text{ use } 2 \times 10$

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Lateral Forces Depth—Buildings, Scenario 2, No. 8

LRFD (Strength Design)

Shear at Grid Line 7: $V_7 = 2,300 \text{ plf} (30 \text{ ft}) = 69,000 \text{ lb}$
 $v_7 = 69,000 \text{ lb}/50 \text{ ft} = 1,380 \text{ lb/ft}$

ASD (Allowable Design)

$v_7 = 0.6(1,380 \text{ lb-ft}) = 828 \text{ lb-ft}$
 $v_8 = 0.6(690 \text{ lb-ft}) = 414 \text{ lb-ft}$