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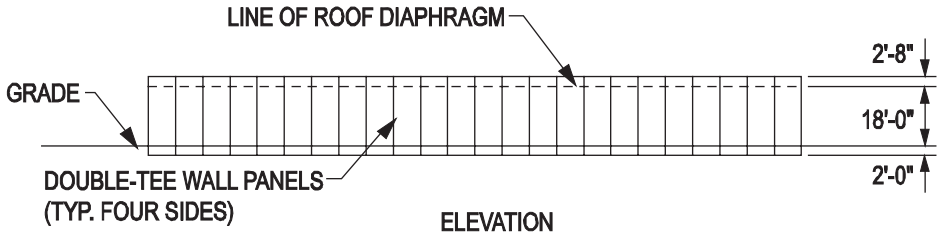
Morning Questions

p. 20, Question 104:

Change the sixth line of Design Data to read:

Use a load factor of 1.6 (PCI equation 3.2.6.4 or 3.2.6.6 consistent with ACI and ASCE 7).

On the elevation view showing the line of the roof diaphragm, extend the leader to the hidden line:



p. 25, Question 109:

Change Option (B) as shown:

(A) 60
(B) 103
(C) 137
(D) 175

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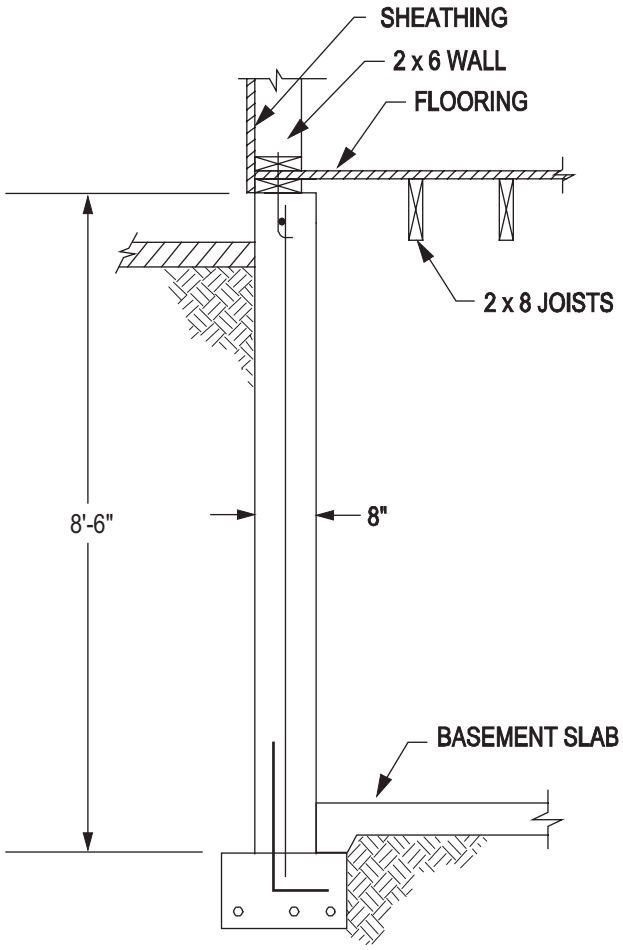
p. 31, Question 117:

Change the figure as shown:



p. 39, Question 125:

The introductory sentence should read as follows:

The 30'-0" long structural glued laminated timber beam in the figure is subjected to a uniform load.

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p. 40, Question 126:

Change the Design Data as follows:

The structural glued laminated timber is 24F-V4 DF/DF.

Change the options as follows:

(A) 1,319
(B) 1,173
(C) 682
(D) 608

p. 43, Question 129:

Change the fifth line as follows:

The span length for the deck slab design is most nearly:

p. 45, Question 131:

Change the eighth line as follows:

The span length is 9'-6".

p. 48, Question 134:

The introductory sentence should read as follows:

A 3,000-ft^2 retail structure with clear-spanning wood roof has special reinforced concrete bearing/shear walls.

Change the options as follows:

(A) 0.167 w
(B) 0.200 w
(C) 0.250 w
(D) 0.400 w

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p. 56, Question 140:

Add F_u to Design Data as follows:

Design Data:

$E_c = 3.8 \times 10^3$ ksi

$f'_c = 4.0$ ksi

$F_y = 36.0$ ksi

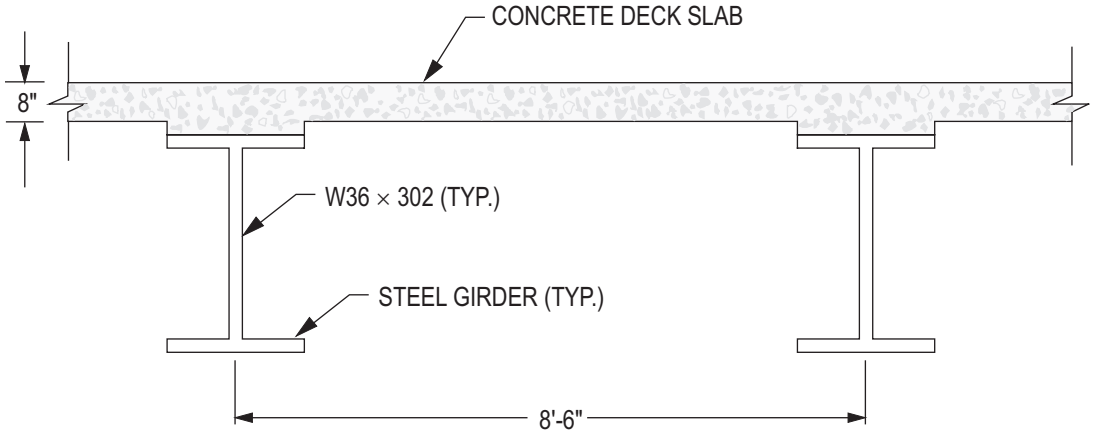
$F_u = 60.0$ ksi

Shear connectors are 3/4-in.-diameter × 4-in.-high, welded-stud type.

Change the options as follows:

(A) 114
(B) 148
(C) 175
(D) 246

The girder dimensions should be W36 × 302.



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Afternoon Questions

p. 67, Question 511:

The last sentence and options should read as follows:

The maximum factored moment per foot (ft-kips/ft) at the base of the wall for Strength V load combination is most nearly:

(A) 5.1
(B) 10.7
(C) 16.1
(D) 18.3

p. 80, Question 524:

Change LRFD Option (C) as follows:

	ASD	LRFD
(A)	0.62	0.56
(B)	0.70	0.64
(C)	0.79	0.77
(D)	0.88	0.82

p. 81, Question 525:

Change ASD option and LRFD option data as follows::

For ASD option:
$M_{rx} = 113$ ft-kips
$M_n/\Omega = 173$ ft-kips

For LRFD option:
$M_{rx} = 180$ ft-kips
$\phi_b M_{nx} = 262$ ft-kips

Change the options as follows:

	ASD	LRFD
(A)	0.750	0.774
(B)	0.733	0.745
(C)	0.693	0.731
(D)	0.672	0.716

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p. 84, Question 528:

The introductory sentence should read as follows:

A three-story masonry veneer wall is 30 ft tall and has brick veneer attached to concrete masonry walls.

The following Design Data should be added:

Design Data:
Total linear drying shrinkage per ASTM C 426 = 6.5×10^{-4} in./in.

Change Option (D) as shown:

(A) 0.035
(B) 0.075
(C) 0.110
(D) 0.225

p. 85, Question 530:

The first line should read as follows:

A concrete masonry building wall is being constructed.

The following Design Data should be added:

Design Data:
Total linear drying shrinkage per ASTM C 426 = 6.5×10^{-4} in./in.

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p. 90, Question 536:

The Assumptions should read as follows:

Assumptions:

Roof dead load	15 psf
Nonreducible roof snow load	40 psf
Average wall dead load	54 psf

Wind and seismic forces do not govern.
The wall is reinforced with #5 @ 48-in. o.c. vertically at the centerline of the wall and #5 @ 32-in. o.c. horizontally.

p. 91, Question 537:

The last sentence in the question and options should read as follows:

For the load combination D + 0.75W + 0.75S, the maximum design moment (ft-lb/ft) for the masonry wall is most nearly:

(A) 105
(B) 360
(C) 435
(D) 600

p. 93, Question 539:

The Assumptions should read as follows:

Assumptions:
Working stress design provisions apply.
The wall is reinforced with #5 @ 48-in. o.c. vertically at the centerline of the wall and #5 @ 32-in. o.c. horizontally.

Change Option (B) as shown:

(A) 665
(B) 790
(C) 1,465
(D) 2,335

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p. 94, Question 540:

The Assumptions should read as follows:

Assumptions:
The wall is reinforced with #5 @ 24-in. o.c. vertically at the centerline of the walls.
Working stress design provisions apply.

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Morning Solutions

p. 100, Solution 107:

Change the eighth line as follows:

$$g_c = \frac{55}{8.16^2} + \frac{6 \times 75}{8.16^3} = 1.654 \text{ ksf} < 4 \text{ ksf}$$

p. 102, Solution 109:

The solution should read as follows:

$\phi V_c = \phi 4 b_o d \sqrt{f'_c}$ ACI Sections 11.12.1.2 and 11.12.2.1

$\phi = 0.75$ ACI Section 9.3.2.3

$f'_c = 3,000$

$b_o = 4(10 + 8.5) = 74$ in.

$d = 8.5$

$$\phi V_c = \frac{0.75(4)(74)(8.5)\sqrt{3,000}}{1,000} = 103 \text{ kips}$$

p. 106, Solution 123:

Change the third and fourth lines as follows:

$$= \frac{650}{789} - \frac{650(24.73 - 4)}{8,089} + \frac{(594)(12)}{8,089} = 0.039 \text{ ksi, compression}$$

$$f_b = \frac{650}{789} + \frac{650(20.73)}{10,543} - \frac{(594)(12)}{10,543} = 1.426 \text{ ksi, compression}$$

p. 106, Solution 124:

THE CORRECT ANSWER IS: (B)

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p. 107, Solution 126:

The solution should read as follows:

$$F_{CE} = 0.822\frac{E'_{min}}{\left(L_e/d\right)^2}$$ NDS 3.7.1.5 and Appendix H.2 (2005)

$$L_e = K_e L = (1.0)(30)(12) = 360 \text{ in.}$$ NDS Appendix G

$$L_e/d = \frac{360}{10.75} = 33.5 < 50$$ OK NDS 3.7.1.4 and Appendix H.2

$$E'_{y\,min} = \left(C_m\right)\left(C_t\right)\left(E_{y\,min}\right)$$ NDS Table 5.3.1, Sections 5.1.5, 5.3.3, and 5.3.4

$$= (1.0)(1.0)(830,000) = 830,000 \text{ psi}$$

$$F_{CE} = 0.822\frac{(830,000)}{\left(33.5\right)^2} = 608 \text{ psi}$$

THE CORRECT ANSWER IS: (D)

p. 108, Solution 129

The solution should read as follows:

AASHTO Section 4.6.2.1.6

s = 8'-0" (℄ to ℄ of supporting members)

THE CORRECT ANSWER IS: (D)

p. 109, Solution 131:

The solution should read as follows:

From AASHTO Table A4-1 with span of 9'-6"

M_{L+IM} = 7.15 ft-kips/ft

THE CORRECT ANSWER IS: (B)

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p. 110, Solution 133:

The solution should read as follows:

Occupancy Category IV (Table 1604.5)

Table 1613.5.6(1) for S_{DS}, given. Table 1613.5.6(2) for S_{D1}, given.

$S_{DS} = 0.4 \Rightarrow$ Seismic Design Category D
$S_{D1} = 0.1 \Rightarrow$ Seismic Design Category C
$\therefore$ S_{DS} controls – Seismic Design Category D

p. 110, Solution 134:

The solution should read as follows:

Per ASCE 7-05:

Occupancy Category I (Table 1-1)
Importance Factor, I = 1.0 (Table 11.5-1)

Using Tables 11.6-1 and 11.6-2, seismic design category D

For special concrete shear walls in bearing wall system, R = 5

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I}\right)} = \frac{1.0}{\left(\frac{5}{1.0}\right)} = 0.200 \text{ w} \qquad \text{(Sec. 12.8.1.1)}$$

THE CORRECT ANSWER IS: (B)

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p. 113, Solution 140:

The solution should read as follows:

AASHTO 6.10.10.4.2

$$P_{1p} = 0.85\, f'_c b_s t_s = (0.85)(4)(102)(8) = 2,774.4 \text{ kips} \quad \leftarrow \text{Controls}$$

$$P_{2p} = F_{yw} D t_w + F_{yt} b_{ft} t_{ft} + F_{yc} b_{fc} t_{fc} = 36(88.8) = 3{,}196 \text{ kips}$$

$$b_s = \frac{1}{4}(85)(12) = 255 \text{ in.}$$

$$b_s = (12 \times 8) + \frac{16.655 \text{ in.}}{2} = 104.3 \text{ in.}$$

$$b_s = 8.5 \times 12 = 102 \text{ in.} \quad \leftarrow \text{Controls}$$

AASHTO 4.6.2.6

$$P = \sqrt{P_p^{\,2} + \cancel{F_p^{\,2}}^{\,0}} = 2,774.4 \text{ kips} \qquad F_p = 0 \text{ for straight spans}$$

AASHTO 6.10.10.4.3

$$Q_n = 0.5 A_{sc} \sqrt{f'_c E_c} \le A_{sc} F_u$$

$$Q_n = 0.5 \frac{\pi}{4}(0.75)^2 \sqrt{(4.0)\left(3.8 \times 10^3\right)} = 27.2 \text{ kips}$$

$$\text{or } Q_n = A_{sc} F_u = \left(\frac{\pi}{4}\right)(0.75)^2 (60 \text{ ksi}) = 26.5 \text{ kips} \leftarrow \text{Controls}$$

$$Q_r = \phi_{sc} Q_n \qquad \phi_{sc} = 0.85$$ AASHTO 6.5.4.2

$$Q_r = 0.85(26.5) = 22.5 \text{ kips}$$

$$N = \frac{2,774.4}{22.5} = 123$$ AASHTO 6.10.10.4.1 - 2

Total = 246 shear connections

THE CORRECT ANSWER IS: (D)

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Afternoon Solutions

p. 119, Solution 509:

Line 6 should read:

$$M_u = (0.9)(3.16)(60)(27.5)\left[1-(0.59)(0.0064)\left(\frac{60}{4}\right)\right]$$

p. 120, Solution 511:

The last two lines of the solution should read:

$$M_u = 0.4\,(1.65) + 1.35\,(4) + 1.5\,(6.66)$$
$$= 0.66 + 5.4 + 10.0 = 16.1 \text{ ft-kips/ft}$$

THE CORRECT ANSWER IS: (C)

p. 121, Solution 514:

The AASHTO reference in line 1 should be 3.10.5.
The AASHTO reference in line 3 should be 3.10.6.1.
The AASHTO reference in line 4 should be 3.10.6.1-1.

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p. 126, Solution 524:

The second line of the ASD option should be changed to:

$D + 0.75W + 0.75\ L_r$

The solution to the LRFD option should be changed to:

ASCE 2.3.2, Eq. 4

$1.2\ D + 1.6\ W + 0.5\ L_r$

$1.2(40) + 1.6(70) + 0.5(60) = 190$ ft-kips

ASCE 2.3.2, Eq. 3

$1.2\ D + 1.6\ L_r + 0.8\ W$

$1.2(40) + 1.6(60) + 0.8(70) = 200$ ft-kips ← Controls

AISC Table 3-10

for $L_b = 15$ ft $\qquad \phi M_n = 261$ ft-kips

$$\frac{M_r}{M_c} = \frac{M_r}{\phi M_n} = \frac{200}{261} = 0.77$$

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p. 127, Solution 525:

The solution should read as follows:

ASD option:

Load combination: D + 0.75W + 0.75L ASCE 7, Eq. 2.4.1.6

$P = 7.2 + 0.75\,(4.0) + 0.75\,(12.6) = 19.65$ kips

W14 × 53 $A = 15.6$ in^2

$r_x = 5.89$ in.

$r_y = 1.92$ in.

$$\frac{K_x L}{r_x} = \frac{2.0\,(15 \times 12)}{5.89} = 61.1$$

$$\frac{K_y L}{r_y} = \frac{1.0\,(15 \times 12)}{1.92} = 93.8 \leftarrow \text{Controls}$$

$F_{cr} / \Omega = 15.7$ ksi AISC Table 4-22

$P_c = F_{cr} A_g = 15.7(15.6) = 245$ kips

$$\frac{P_r}{P_c} = \frac{19.65}{245} = 0.08 < 0.2 \rightarrow \text{Use AISC Eq. H1-1b}$$

So AISC Eq. H1-1b

$$\frac{P_r}{2\,P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}} \right) = \frac{19.65}{2\,(245)} + \frac{113}{173} = 0.040 + 0.653 = 0.693$$

THE CORRECT ANSWER IS: (C)

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p. 127, Solution 525 (continued):

LRFD option:
Load combinations:

$1.2\ D + 1.6\ L_r + 0.8W$ ASCE 7, Eq. 2.3.2.3

$P_r = 1.2\ (7.2) + 1.6\ (12.6) + 0.8\ (4.0) = 32.0$ kips ← Controls

$1.2\ D + 1.6\ W + 0.5\ L_r$

$P_r = 1.2\ (7.2) + 1.6\ (4.0) + 0.5\ (12.6) = 21.3$ kips

$$\frac{K_x L}{r_x} = \frac{2.0\,(15 \times 12)}{5.29} = 61.1$$

$$\frac{K_y L}{r_y} = \frac{1.0\,(15 \times 12)}{1.92} = 93.8 \quad \leftarrow \text{Controls}$$

$\varnothing F_{cr} = 23.6$ ksi AISC Table 4-22

$P_c = 23.6\ (15.6) = 368$ kips

$$\frac{P_r}{P_c} = \frac{32.0}{368} = 0.09 < 0.2 \quad \rightarrow \quad \text{Use AISC Eq. H1-1b}$$

So AISC Eq. H1-1b,

$$\frac{P_r}{2P_c} + \left(\frac{M_{rx}}{M_{cx}} + \frac{M_{ry}}{M_{cy}} \right) = \frac{32.0}{2(368)} + \frac{180}{262}$$

$$= 0.044 + 0.687 = 0.731$$

THE CORRECT ANSWER IS: (C)

p. 131, Solution 528:

The last two lines should read as follows:

Shrinkage of concrete masonry wall	(30 ft)(12 in./ft)(0.5)(6.5×10^{-4} in./in.) = 0.117 in.
Total differential change	0.108 + 0.117 = 0.225 in.

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p. 135, Solution 535:

The last seven lines of the LFRD solution should be changed to:

$$\text{Allowable } \phi R_n = \phi F_{nt} A_b = 0.75 \times 45 \times 0.994 = 33.5 \text{ kips} > T_{max} = 30.6 \text{ kips}$$

Alternate method, as shear is small, use Table 7-2.

$\phi r_n = 33.5 \text{ kips} > 30.6 \text{ kips}$ OK

Use a 1 1/8-in.-diameter bolt.

p. 136, Solution 537:

The solution should read as follows:

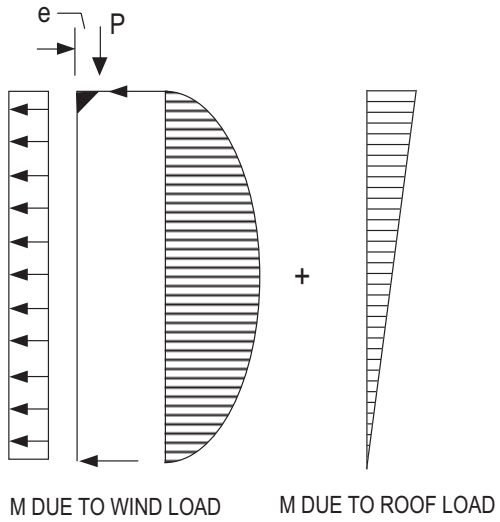
$$P_{roof} = 12 \text{ ft (15 psf)} + 0.75[(12 \text{ ft})(40 \text{ psf})] = 540 \text{ plf}$$

$$e = \frac{7.625 \text{ in.}}{2} + 3.5 \text{ in.} = 7.31 \text{ in.}$$

$$M_{roof} = 540 \text{ plf } (7.31 \text{ in.})/12 \text{ in./ft } = \text{ 329 ft-lb/ft}$$

$$M_{wind} @ \text{ midheight} = 0.75 \text{ [20 psf } (12 \text{ ft})^2/8] = 270 \text{ ft-lb/ft}$$

$$M_{\text{midheight (approximate max)}} = 270 + 329/2 = 435 \text{ ft-lb/ft}$$



THE CORRECT ANSWER IS: (C)

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p. 136, Solution 538:

The solution should read as follows:

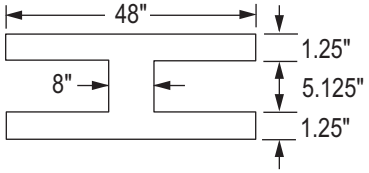
$h = 144, \qquad r = 2.66 \qquad h/r = 54.1 < 99$

$$P_a = (0.25\, f'_m A_n + 0.65\, A_{st} F_s)\left[1 - \left(\frac{h}{140\, r}\right)^2\right]$$ ACI 530-05, Section 2.3.3.2.1

$$P_a = [0.25(1{,}500)(161) + 0.65\,(0.31)(24{,}000)]\left[1 - \left(\frac{54.1}{140}\right)^2\right]$$

$P_a = 55{,}473$ lb/4-ft length

$= 13{,}868$ plf $\approx 13{,}000$ plf



Note: equivalent masonry wall thickness is

$A = 48 \times 1.25 \times 2 + 5.125 \times 8 = 161$ in^2/48 in.

THE CORRECT ANSWER IS: (A)

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p. 137, Solution 539:

The last four lines of the solution were changed. The solution should read as follows:

Working Stress Design

$f'_m = 1{,}500$ psi

$E_m = 900\, f'_m$ ACI 530-05, Section 1.8.2.2.1

$E_m = 900(1{,}500) = 1.35 \times 10^6$ psi

n = 29/1.35 = 21.5

$\rho = 0.31/48\left(\frac{7.625}{2}\right) = 0.0017$

nρ = 0.0364

$k = \sqrt{n\rho^2 + 2n\rho} - n\rho = 0.236$

j = 1 – k/3 = 0.921

$F_b = 1/3\, f'_m = 500$ psi

$M_{max} = F_b bkjd^2/[2(12)] = 500(12)(0.236)(0.921)(7.625/2)^2/[2(12)]$

$= 790$ ft-lb/ft

p. 137, Solution 540:

The last line of the solution should read as follows:

$M_{allowable}$ = (0.31/2)(24,000)(0.895)(7.625/2)/12 = 1,058 ft-lb/ft

THE CORRECT ANSWER IS: (A)