



PCI Design Handbook **ERRATA II**

Precast and Prestressed Concrete

Seventh Edition



ERRATA II

PCI Design Handbook

Precast and Prestressed Concrete, Seventh Edition

In 2010, the Precast/Prestressed Concrete Institute published the seventh edition of the *PCI Design Handbook: Precast and Prestressed Concrete* (MNL-120-10). Although careful efforts were made to provide an accurate document, some errors have been discovered. We suggest that you mark your seventh edition to reflect these errata so that the handbook is as accurate as possible.

ERRATA II are compiled from the errata that were published in the Spring 2011 issue of *PCI Journal* and new errata that have been observed since then.

As this edition of the handbook is used, additional errata may be discovered. You are urged to notify PCI of these items as well as any questions or comments you may have regarding the material in the handbook. Also, any comments on new material you think should be included in future editions are equally welcome.

Please direct your comments to PCI at IHBerrata@pci.org.

Additional errata will be posted on PCI's website from time to time.

Please go to <http://pci.org/publications/errata/index.cfm>.



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Chapter 1

Page 1-12, first line of the second full paragraph: Add reference 22 after “(GFRC).”

Page 1-20, right column, 13th line from bottom: Add references 20 and 25 after “... deck panels.”

Page 1-23, lines 6–9: Change references as follows: “... to good advantage in the construction of poles (Fig. 1.2.43),¹⁹ piles,²¹ railroad ties (Fig. 1.2.44), storage tanks (Fig. 1.2.45 and 1.2.46),^{23, 24} monorails (Fig. 1.2.47), retaining walls, highway and runway pavements, and sound barriers (Fig. 1.2.48).”

Page 1-27: Reference 19 should read: ASCE Task Force and PCI Committee on Prestressed Concrete Poles. 1997. Guide for the Design of Prestressed Concrete Poles Part 1, Part 2, and Part 3. *PCI Journal*, V. 42, No. 6 (November–December): pp. 94–134.

Page 1-27: Reference 21 should read: PCI Committee on Prestressed Concrete Piling. 1977. Recommended Practice for Design, Manufacture and Installation of Prestressed Concrete Piling. *PCI Journal*, V. 22, No. 2 (March–April): pp. 20–49.

Page 1-27: Reference 22 should read: PCI Committee on Glass Fiber Reinforced Concrete Panels and Task Group on Recommended Practice. 2001. *GFRC: Recommended Practice for Glass Fiber Reinforced Concrete*. MNL-128-01. 4th ed. Chicago, IL: PCI.

Chapter 2

Page 2-2: ρ should read: “= ratio of A_s to bd , not b_d .”

Page 2-10: ρ should read “= ratio of A_s to bd , not b_d .”

Page 2-10: ρ' should read “= ratio of A'_s to bd , not b_d .”

Page 2-10: ρ_p should read “= ratio of A_{ps} to bd (or bd_p), not b_d (or bd_p).”

Page 2-10: ρ_w should read “= ratio of A_s to $b_w d$, not b_{wd} .”

Page 2-15: ρ' should read “= ratio of A'_s to bd , not b_d .”

Chapter 3

Page 3-9, left column, line 15: Table 5.2.2.1 should read Table 5.2.1.

Page 3-9, Section 3.3.3, line 2: Section 5.8.4 should read Section 5.8.

Page 3-9, Section 3.3.3, line 4: Section 5.8.4 should read Table 5.8.2.

Page 3-10, Section 3.3.6, line 12: Design Aid 15.2.4 should read Design Aid 15.3.3.

Page 3-51, Design Aid 3.12.1 for 20×20 columns with 4 strands: f'_c between 7000 and 9000 should read 8000 psi, not 5000 psi.

Chapter 4

Page 4-22, Fig. 4.5.1: The locations of the center of rigidity and center of lateral load in the left diagram are not correct. The location of the center of lateral load in the right diagram is not correct. Replace with Fig. 4.5.1 as revised.

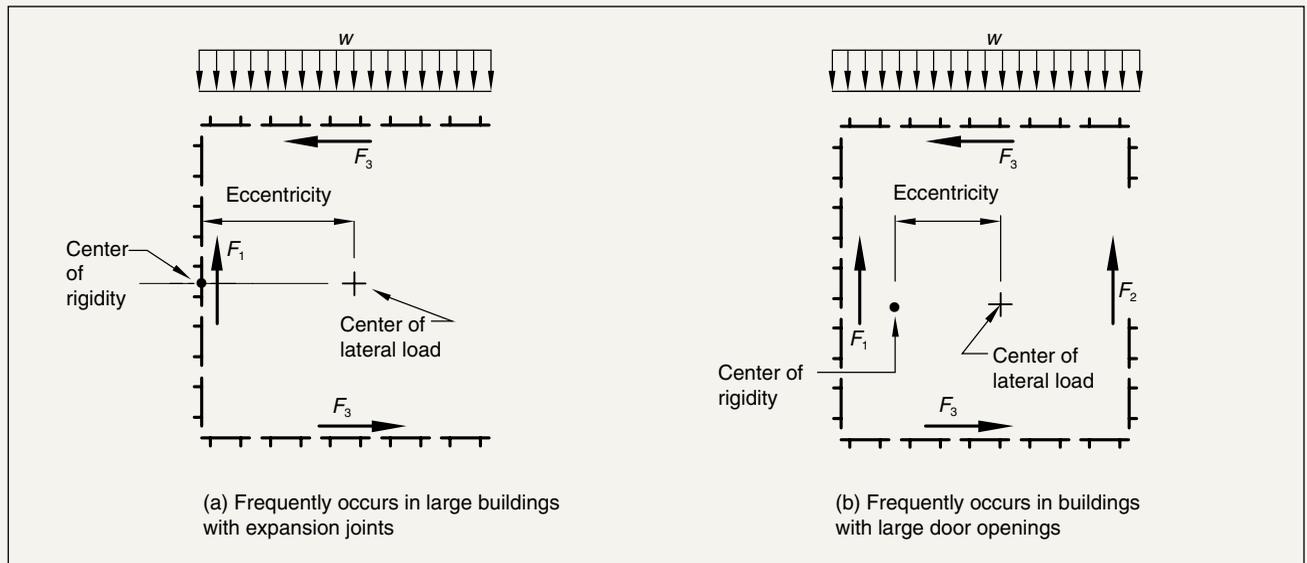


Fig. 4.5.1 (Revised) Unsymmetrical shear walls.

Page 4-58, Fig. 4.8.4: The peak line for the collector force demand should line up with the upper end of the lower shear wall. Replace with Fig. 4.8.4 as revised.

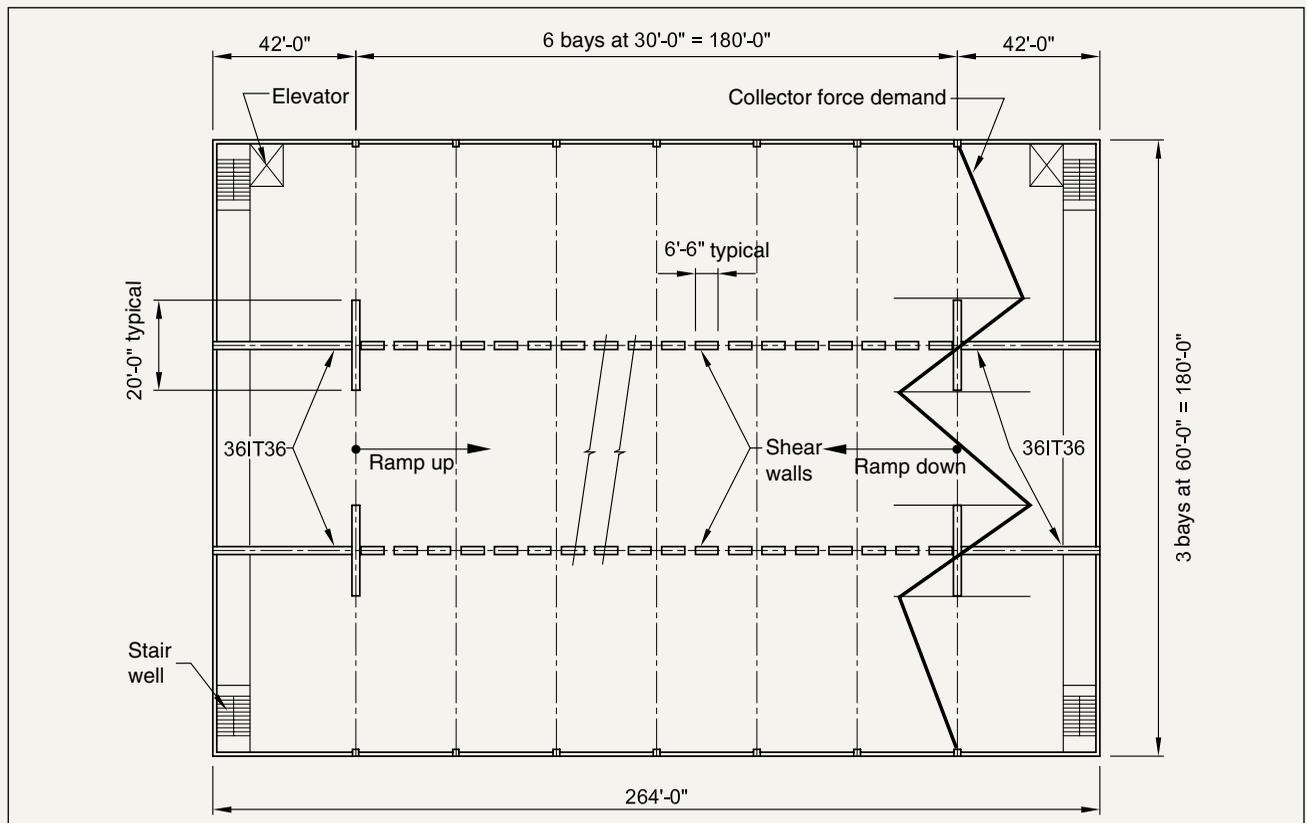


Fig. 4.8.4 (Revised) Collector force demand diagram for shear walls in a parking garage.

Page 4-77, Design Aid 4.11.1: Category heading should have footnote b deleted.

Page 4-77, Design Aid 4.11.1: Wind Factor Category 1 footnote should be b, not c.

Page 4-77, Design Aid 4.11.1: The footnote a should read as follows: Source: IBC 2006, Table 1604.5 (Information same as SEI/ASCE 7-05, Tables 1-1, 6-1, 7-4, and 11-5-1).

Page 4-92, Design Aid 4.11.20: Multifaceted at upper right of diaphragm should read multiframed.

Page 4-92: Design Aid 4.11.20 makes reference to Design Aid 4.11.1 for seasonal temperature change. This reference should be to Design Aid 4.11.11.

Chapter 5

Page 5-20, right column, 4th line: Words “decompression stress” should be inserted between “the” and “in” to read “Note that the decompression stress in non-prestressed reinforcement is caused ...”

Page 5-36, left column, third line: Fig. 5.2.7 should read: Fig. 5.2.8.

Page 5-36, left column, third line: Design Aid 5.13.4 should read: Design Aid 5.14.4.

Page 5-38, Example 5.2.3.2: The example does not coincide with the text in that it does not properly account for the load in the partially developed strand. Replace with Example 5.2.3.2 as revised.

Page 5-40, Section 5.2.4, line 4: Reference 8 should read: reference 10.

Page 5-58, Table 5.3.1: The 0.30 factor in the bottom right block should be 0.20.

Page 5-58, 6th line above section 5.3.6: Reference 10 should read: reference 11.

Page 5-58, right column, line 11: The reference 11 cited should read: reference 12.

Page 5-59, top of left column: Definition of N_u should read: “applied factored tensile force nominally perpendicular to the assumed crack plane. May be taken as 0.2 times the shear attributable to the factored dead load.”

Page 5-59, top of left column: Reference 12 noted at N_u should be deleted.

Page 5-62, Eq. 5-37: The V_n in the denominator should be V_u .

Page 5-77, Section 5.6.2, line 7: Reference 11 should be new reference 45.

Page 5-78, 9th line from bottom: Design Aid 15.2.9 should read: Design Aid 15.4.4.

Page 5-78, 2nd line from bottom: Insert an equals sign (=) between the term with notation and the term with numbers. It should read as follows:

$$A_{sh} = \frac{(A_{vf} + A_n) f_y}{\mu_e f_{ys}} = \frac{0.94(60,000)}{3.4(60,000)} = 0.28 \text{ in.}^2$$

Page 5-79, Section 5.6.3, lines 6 and 7: Reference 17 should be new reference 44 and reference 18 should be deleted.

Page 5-79, Note 5 in left column: Reference 16 should be new reference 44.

Page 5-79, Eq. 5-56, Note for N_u should read: “ $N_u = 0.2$ times the shear attributable to the factored dead load.”

Page 5-79, Eq. 5-56: Reference 11 noted for N_u should be deleted.

EXAMPLE 5.2.3.2 (Revised)

Moment Capacity of Component with Debonded Strands in Development Region

Given:

10-ft-wide double-tee, one stem shown

$$b = 10 \text{ ft} = 120 \text{ in.}$$

(10) $1/2$ -in.-diameter, 270 ksi strands (five each stem)

$$A_{ps} = 10(0.153) = 1.53 \text{ in.}^2$$

Concrete:

$$f'_c = 5000 \text{ psi, normalweight}$$

$$E_c = 4300 \text{ ksi}$$

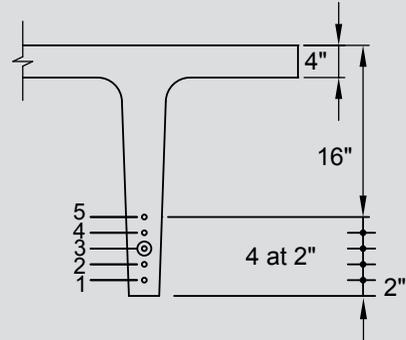
Prestressing strands:

$$f_{pu} = 270 \text{ ksi}$$

$$f_{se} = 170 \text{ ksi}$$

$$E_{ps} = 28,500 \text{ ksi (based on strand data)}$$

$$\epsilon_{se} = 170/28500 = 0.0060$$



Problem:

Strand #3 is debonded for 5 ft from the end.

Find M_n at 12 ft from the end.

Solution:

Maximum f_{ps} for fully bonded strand (from separate analysis) = 269 ksi.

$$\text{Transfer length} = (f_{se}/3)d_b = (170/3)(0.5) = 28.33 \text{ in.}$$

For debonded strands, double the transfer and development length per ACI 318-05, Section 12.9.3.

Transfer length for debonded strands = $2(28.33) = 56.7 \text{ in.}$

$$l_d = [f_{ps} - (2/3)f_{se}]d_b = (269 - 113.3)(0.5) = 77.85 \text{ in.}$$

$$l_d \text{ for debonded strands} = 2(77.85) = 155.7 \text{ in.}$$

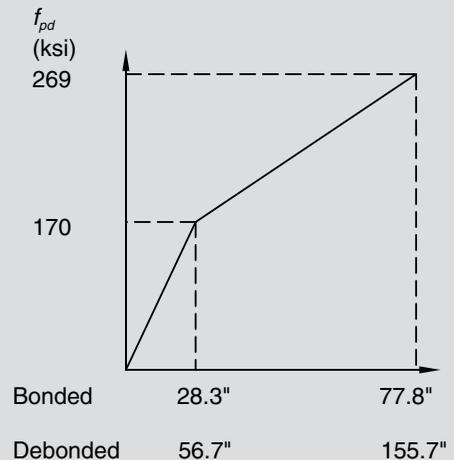
The maximum strength the strand can develop at 12 ft from the end (7 ft or 84 in. from the point of debonding) is given by:

$$f_{pd} = 170 + \frac{84 - 56.7}{155.7 - 56.7}(269 - 170) = 197.3 \text{ ksi}$$

Note: Due to the presence of underdeveloped strand adjacent to fully developed strand the assumption of strain compatibility is not valid at this section. At capacity the underdeveloped strand will slip while maintaining partial development as necessary for the fully developed strands to adequately strain in order to yield.

$$T = 8(0.153)269 + 2(0.153)197.3 = 389.6 \text{ kip}$$

$$a = \frac{T}{0.85f'_c b} = \frac{389.6}{0.85(5)(120)} = 0.76 \text{ in.}$$



Distance from point of debonding
(end of component for fully bonded strands)

EXAMPLE 5.2.3.2 (Revised)

Moment Capacity of Component with Debonded Strands in Development Region (cont.)

Because this is less than the flange thickness, the design is like a rectangular beam.

$$M_n = T \left(d - \frac{a}{2} \right) = 389.6 \left(20 - \frac{0.76}{2} \right) = 7644 \text{ kip-in.} = 637 \text{ kip-ft}$$

ϕ of the debonded strand at 12 ft from the end: (by interpolation)

$$\phi = (0.9) - \left[\left(\frac{269 - 197.3}{269 - 170} \right) (0.9 - 0.75) \right] = 0.79$$

Where ϕ of the fully bonded strand at 12 ft from the end = 0.9

And ϕ for the debonded strands through their transfer length = 0.75 (ACI 318-05, Section 9.3.2.7)

Then, flexural ϕ at section 12 ft from the end:

$$\phi = \frac{2(0.79) + 8(0.9)}{10} = 0.88$$

In this case:

$$\phi M_n = 0.88(637) = 560 \text{ kip-ft}$$

Page 5-82, 5th line of item 3: A'_s should be $A'_{s,br}$.

Page 5-84, right column, 11th line from bottom: Units for M_g should read lb-in. not in./lb.

Page 5-85, first and third lines from bottom: P_o should be P_i at three places.

Page 5-91, last calculation for Δ_{cr} : I_g in the denominator should be I_{cr} .

Page 5-107, just above horizontal line: Should read: "Determine whether standard panel (Design Aid 3.12.5) is adequate."

Page 5-108, line near middle of page: Should read "Using interaction curve in Design Aid 3.12.5," not Design Aid 3.7.5.

Page 5-108, line near middle of page: Should read "Point is to left (not below) of curve."

Page 5-109, end of example: Should read "By comparison with Design Aid 3.12.5," not Design Aid 3.7.5.

Page 5-116, Fig. 5.9.7: Curve for $h'/r = 0$ should not have the slight uptick at zero bending moment. Replace with Fig. 5.9.7 as revised.

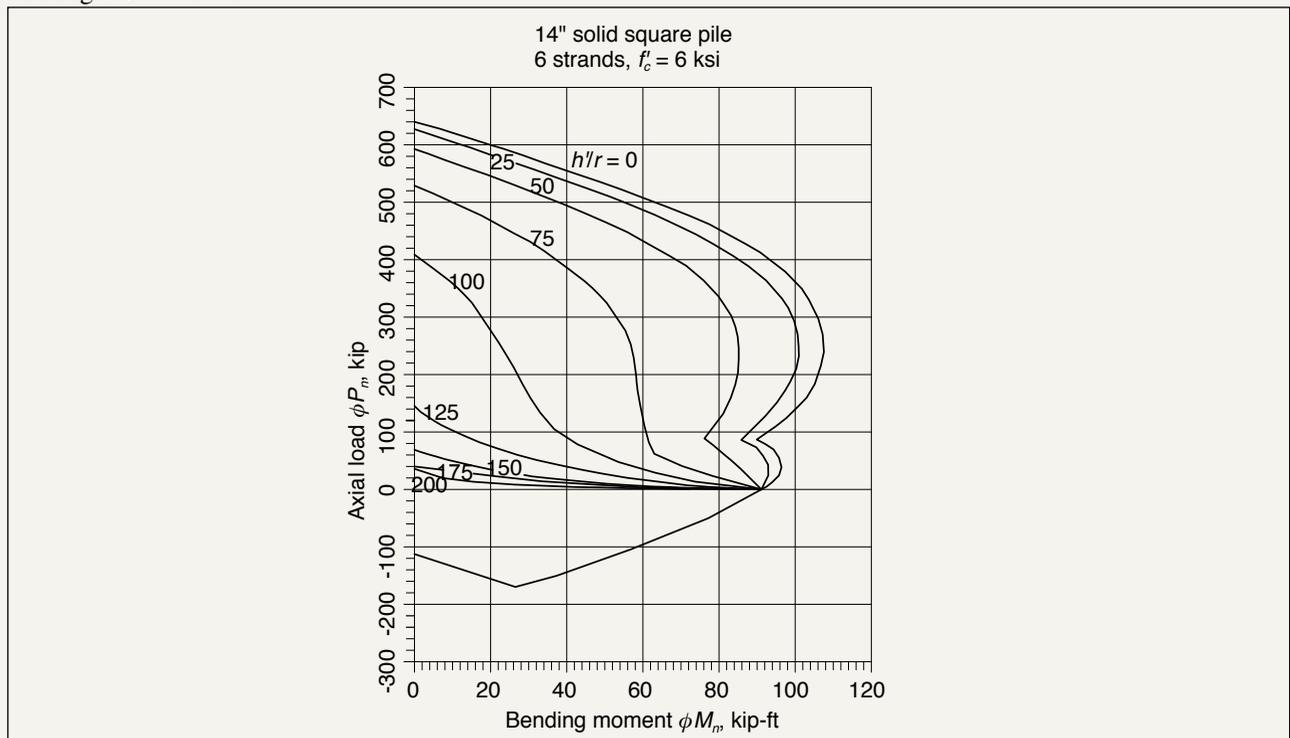


Fig. 5.9.7 (Revised) Typical pile interaction curve.

Page 5-132, Example 5.12.1.1, 3rd line from bottom: The reference to Design Aid 15.5.1 should read Design Aid 15.5.3.

Page 5-136: Reference 28 should read "PCI Committee on Prestressed Concrete Piling. 1993. Recommended Practice for Design, Manufacture, and Installation of Prestressed Concrete Piling. *PCI Journal*, V. 38, No. 2 (March–April): pp. 14–41."

Page 5-137: Add new reference 44: Mattock A. H., and T. C. Chan. 1979. Design and Behavior of Dapped-End Beams. *PCI Journal*, V. 24, No. 6 (November–December): pp. 28–45.

Page 5-137: Add new reference 45; Shah, V. 1980. "Reinforced Bearing Connection for Precast Concrete Members." Master's thesis, University of Wisconsin–Milwaukee.

Chapter 6

Page 6-16, 8th line from bottom: N_{cbg} should be ϕN_{cbg} .

Page 6-19, 9th line from bottom: V_{co3} should be ϕV_{c3} .

Page 6-19, 4th line from bottom: $A_s f_y$ should be $\phi A_s f_y$.

Page 6-19, 4th and 7th line from bottom: ϕV_{c3} should be ϕV_n .

Page 6-23, 5th line of solution: C_{h3} should be C_{c3} .

Page 6-35, right column, last line just above Fig. 6.6.5: Fig. 6.6.5 should read Fig. 6.6.6.

Page 6-46, last line of Section 6.7.2: Design Aid 15.4.2 should read Design Aid 15.7.2.

Page 6-47, Example 6.7.3.1, 6th line from bottom: Eq. 6-60 should read Eq. 6-58 (including the throat dimension and length).

Page 6-58, right column, 9th line from bottom: Design Aid 15.5.2 should read Design Aid 15.8.2.

Page 6-60, right column, 5th line from top: $[V_u(\phi \ell_p + g + c + 0.5S_w)]$ should be $[V_u(0.5\ell_p + g + c + 0.5S_w)]$.

Page 6-62: Eq. 5-33 should include ϕ and λ in the numerator.

Page 6-68, Fig. 6.10.4, left side: Should read "...of contact surface" not "...or contact surface."

Page 6-72, 5th line from bottom: Design Aid 6.14.6 should read Design Aid 6.15.6.

Page 6-72, last line: An equals sign (=) should replace the minus sign (-) between the variable expression and the numerical expression. It should read as follows:

$$e_h = \frac{N_p}{1.26f'_c d_o C_{crp}} = \frac{20}{1.26(4)(1)(1.0)}$$

Page 6-80 and 6-81, Example 6.13.2: Replace with Example 6.13.2 as revised.

Page 6-100: Reference 19 should read: American Welding Society (AWS). 2005. *Structural Welding Code-Reinforcing Steel*. AWS D1.4-05. Miami, FL: AWS.

Page 6-101, Design Aid 6.15.1: Replace with Design Aid 6.15.1 as revised.

Page 6-102, Design Aid 6.15.3: Replace with Design Aid 6.15.3 as revised.

Page 6-103, Design Aid 6.15.4: Replace with Design Aid 6.15.4 as revised.

Page 6-104, Design Aid 6.15.5: Replace with Design Aid 6.15.5 as revised.

Page 6-105, Design Aid 6.15.6: The first bolt diameter shown in the left column as 1½ in. should be 1¼ in.

Page 6-106, Design Aid 6.15.9: ℓ_1 in line for angle thickness should be ℓ_e in four places.

Page 6-109, Design Aid 6.15.12: In chart for "Thickness required for bolt loading" middle chart for Tension on external anchor bolts, 6th column: should read 2 - 1¼ in., not 2 - 1¾ in.

Page 6-109, Design Aid 6.15.12: In chart for "Thickness required for bolt loading" bottom chart for Compression on anchor bolts or tension on internal anchor bolts: 6th and 7th columns should read 2 - 1¼ in., not 2 - 1¾ in.

EXAMPLE 6.13.2 (Revised)

Plate-and-Bar Diaphragm Shear Connection – Reference Fig. 4.8.2

Given:

Double-tee to double-tee diaphragm shear connection shown in Fig. 4.8.2(a).

Concrete $f'_c = 5000$ psi, normalweight

Reinforcing bar (ASTM A615) $f_y = 60$ ksi

Plate: $F_y = 36$ ksi; $F_u = 58$ ksi

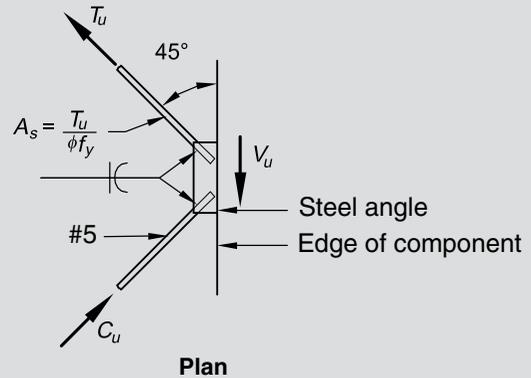
Welds: E70 - plate to angle

E90 - rebar to angle

Reinforcing bars fully developed and welds as shown in Design Aid 6.15.3.

Problem:

Determine the shear strength of the connection.



Solution:

Strength based on tension and compression in the bars:

$$\phi T_n = \phi A_s f_y = 0.9(0.31)(60) = 16.7 \text{ kip}$$

$$\phi C_n = \phi A_s f_y = 0.65(0.31)(60) = 12.1 \text{ kip}$$

$$\begin{aligned} \phi V_n &= \phi T_n \cos 45 + \phi C_n \cos 45 \\ &= 16.7(0.707) + 12.1(0.707) = 20.4 \text{ kip} \end{aligned}$$

Strength based on weld shear through the effective throat with applied eccentricity based on erection plate size and analysis based on erection instantaneous center method from American Institute of Steel Construction's *Steel Construction Manual*⁴ (see also Example 6.7.4.1).

$$xl = \frac{(kl)^2}{2(kl) + l} = \frac{(1)^2}{2(1) + 4} = 0.167 \text{ in.}$$

$$kl = 1 \quad k = \frac{1}{4} = 0.25$$

$$al = \frac{3}{2} - xl; \quad a = \frac{1.5 - 0.167}{4} = 0.333$$

From Reference 4:

$$C = 2.46 \text{ (by interpolation)}$$

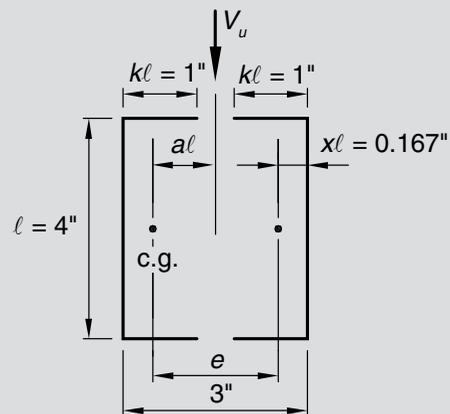
$$C_1 = 1.0$$

$$D = 4$$

$$l = 4$$

$$V_n = CC_1 D l = 2.46(1.0)(4)(4) = 39.4 \text{ kip}$$

$$\phi V_n = 0.75(39.4) = 29.6 \text{ kip}$$



Plan of $\frac{1}{4}$ " fillet weld

c.g. = center of gravity

EXAMPLE 6.13.2 (Revised)

Plate-and-Bar Diaphragm Shear Connection – Reference Fig. 4.8.2 (cont.)

Plate strength:

Shear yielding due to direct shear:

A_w = area of plate $\frac{1}{4}$ in. \times 4 in.

$$\phi V_n = \phi(0.6F_y)A_w$$

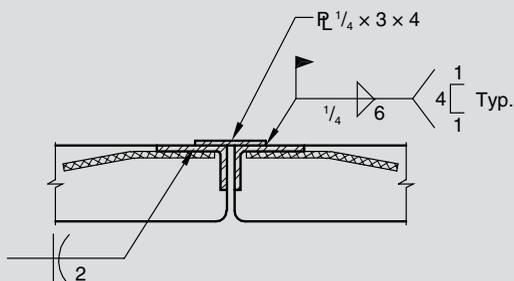
$$\phi V_n = 0.9(0.6)(36)(0.25)(4) = 19.4 \text{ kip}$$

Plate moment strength due to inplane bending from eccentric shear load:

$$\phi V_n = \frac{\phi(F_y)Z_p}{\frac{e}{2}} = \frac{\phi(F_y)\left(\frac{bd^2}{4}\right)}{\frac{e}{2}}$$

$$\phi V_n = \frac{0.9(36)\left(\frac{0.25(4)^2}{4}\right)}{\frac{3 - 2(0.167)}{2}} = 24.2 \text{ kip}$$

Failure mode	Design strength, kip
Reinforcing bar	20.4
Weld	29.6
Plate	19.4



Critical $\phi V_n = 19.4$ kip.

6.15 Design Aids

Design Aid 6.15.1 (Revised)

Allowable and Design Stress for Fillet and Partial Penetration Welds^a

Electrode	Allowable ^b working stress, ksi	Design ^c strength, ksi
E70	21	31.5
E80	24	36.0
E90	27	40.5
E100	30	45.0

a. For partial penetration welds loaded in shear parallel to the axis of the weld.

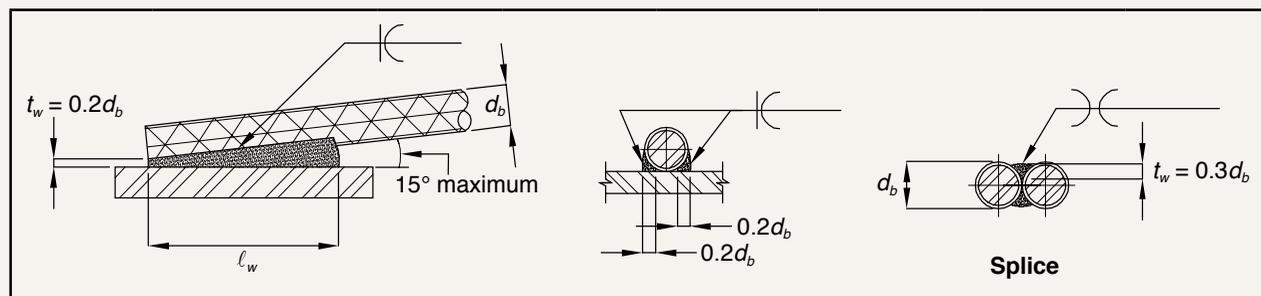
b. Based on AISC *Steel Construction Manual*.⁴

c. Based on AISC *Steel Construction Manual*. Includes $\phi = 0.75$.

Design Aid 6.15.3 (Revised)

Minimum Length of Weld to Develop Full Strength of Bar Weld Parallel to Bar

Length^{a,b,c}



Electrode	Bar size, #	Plate thickness in.	Minimum length of weld, in. ^a					Min. ^e splice length, in.
			1/4	5/16	3/8	7/16	1/2	
E70	3		1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/4
	4		2	2	2	2	2	1 3/4
	5		2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2
	6		3	3	3	3	3	2 1/2
	7		3 3/4	3 1/4	3 1/4	3 1/4	3 1/4	2 3/4
	8		5	4	3 3/4	3 3/4	3 3/4	3 1/4
	9		6 1/4	5	4 1/4	4 1/4	4 1/4	3 1/2
	10		8	6 1/4	5 1/4	4 3/4	4 3/4	4
E80 ^d	3		1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1
	4		1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 1/2
	5		2 1/4	2 1/4	2 1/4	2 1/4	2 1/4	1 3/4
	6		2 3/4	2 1/2	2 1/2	2 1/2	2 1/2	2
	7		3 3/4	3	3	3	3	2 1/2
	8		5	4	3 1/2	3 1/2	3 1/2	2 3/4
	9		6 1/4	5	4 1/4	3 3/4	3 3/4	3
	10		8	6 1/4	5 1/4	4 1/4	4 1/4	3 1/2
E90 ^d	3		1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1
	4		1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/4
	5		2	2	2	2	2	1 1/2
	6		2 3/4	2 1/4	2 1/4	2 1/4	2 1/4	2
	7		3 3/4	3	2 3/4	2 3/4	2 3/4	2 1/4
	8		5	4	3 1/4	3	3	2 1/2
	9		6 1/4	5	4 1/4	3 3/4	3 1/2	2 3/4
	10		8	6 1/4	5 1/4	4 1/2	4	3 1/4
	11		9 3/4	7 3/4	6 1/2	5 1/2	5	3 1/2

a. Lengths above the heavy line are governed by weld strength. Lengths below the heavy line are governed by plate shear.

Basis: bar $f_y = 60$ ksi; plate $F_y = 36$ ksi; shear on plate limited to $0.9(0.6)(36) = 19.44$ ksi.

b. Weld length listed is the required effective length of weld. Engineer should consider whether weld at start and stop is fully effective.

c. Refer to Design Aid 15.7.2 for specifications of flare bevel groove welds.

d. Refer to AWS D1.4-05, Table 5.1 for matching weld metal and AWS D1.4-05, Table 2.1 for cases where matching filler metal is required and unmatched filler metal may be used.

e. Values shown represent $1.25f_y$ in accordance with ACI 318-05, Section 12.14.2.4. For bar sizes #5 and smaller, a waiver is permitted if ACI 318-05, Section 12.15.4 is satisfied.

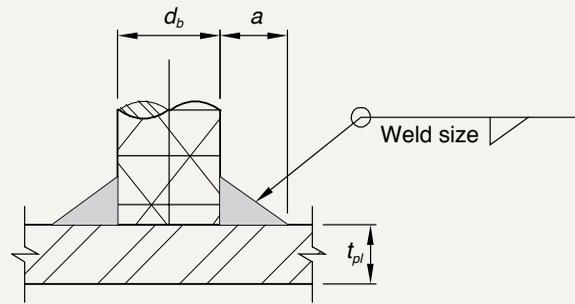
Design Aid 6.15.4 (Revised)
Size of Fillet Weld Required to Develop Full Strength of Bar Butt Weld.

**BAR PERPENDICULAR
 TO PLATE, WELDED
 ONE SIDE**

$$l_w = \pi \left(d_b + \frac{a}{2} \right)$$

$$\text{Plate} = F_y = 36 \text{ ksi}$$

$$\text{Plate area} = \pi(d_b + 2a)t_{pl}$$



Grade 40 bar

Bar size, #	E70 electrode		E80 electrode ^a		E90 electrode ^a	
	Weld size, ^b in.	Minimum plate thickness, ^c in.	Weld size, ^b in.	Minimum plate thickness, ^c in.	Weld size, ^b in.	Minimum plate thickness, ^c in. t_{pl}
3	3/16	1/4	3/16	1/4	3/16	1/4
4	1/4	1/4	3/16	1/4	3/16	1/4
5	1/4	1/4	1/4	1/4	1/4	1/4
6	5/16	1/4	1/4	1/4	1/4	1/4
7	3/8	5/16	5/16	5/16	5/16	5/16
8	7/16	5/16	3/8	5/16	5/16	3/8
9	7/16	3/8	7/16	3/8	3/8	3/8
10	1/2	3/8	7/16	7/16	7/16	7/16
11	9/16	7/16	1/2	7/16	7/16	1/2

Grade 60 bar

3	1/4	1/4	3/16	1/4	3/16	1/4
4	5/16	1/4	1/4	1/4	1/4	1/4
5	3/8	1/4	5/16	1/4	5/16	5/16
6	7/16	5/16	3/8	5/16	3/8	5/16
7	1/2	3/8	7/16	3/8	3/8	3/8
8	9/16	3/8	1/2	7/16	7/16	7/16
9	5/8	7/16	9/16	1/2	1/2	1/2
10	11/16	1/2	5/8	1/2	9/16	9/16
11	3/4	9/16	11/16	9/16	5/8	5/8

a. Refer to AWS D1.4-05, Table 5.1 for matching weld metal and AWS D1.4-05, Table 2.1 for cases where matching filler metal is required and unmatched filler metal may be used.

b. A minimum of 3/16 in. weld size is suggested.

c. Theoretical thickness for shear stress on base metal = 0.9(0.6)(36) ksi. A more practical thickness might be taken as 1/2 d_b as used with headed studs. A minimum of 1/4 in. plate thickness is suggested.

Design Aid 6.15.5 (Revised)

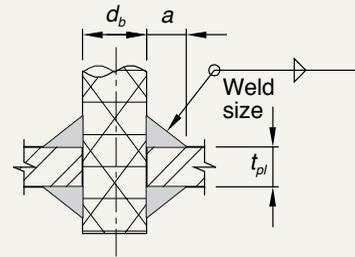
Size of Fillet Weld Required to Develop Full Strength of Bar. Weld Through Hole.

BAR PERPENDICULAR TO PLATE, WELDED BOTH SIDES

$$\ell_w = \pi \left[d_b + \frac{a}{2} \right]^2$$

$$\text{Plate} = F_y = 36 \text{ ksi}$$

$$\text{Plate area} = \pi(d_b + 2a)t_{pl}$$



Grade 40 bar

Bar size, #	E70 electrode		E80 electrode ^a		E90 electrode ^a	
	Weld size, ^b in.	Minimum plate thickness, ^c in.	Weld size, ^b in.	Minimum plate thickness, ^c in.	Weld size, ^b in.	Minimum plate thickness, ^c in.
3	3/16	1/4	3/16	1/4	3/16	1/4
4	3/16	1/4	3/16	1/4	3/16	1/4
5	3/16	1/4	3/16	1/4	3/16	1/4
6	3/16	5/16	3/16	5/16	3/16	5/16
7	3/16	3/8	3/16	3/8	3/16	3/8
8	1/4	3/8	3/16	7/16	3/16	7/16
9	1/4	7/16	1/4	7/16	3/16	7/16
10	5/16	1/2	1/4	1/2	1/4	1/2
11	5/16	9/16	5/16	9/16	1/4	9/16

Grade 60 bar

3	3/16	1/4	3/16	1/4	3/16	1/4
4	3/16	1/4	3/16	5/16	3/16	5/16
5	3/16	5/16	3/16	3/8	3/16	3/8
6	1/4	3/8	1/4	7/16	3/16	7/16
7	5/16	7/16	1/4	1/2	1/4	1/2
8	5/16	1/2	5/16	9/16	1/4	9/16
9	3/8	9/16	5/16	5/8	5/16	5/8
10	3/8	5/8	3/8	11/16	5/16	11/16
11	7/16	11/16	3/8	3/4	3/8	3/4

a. Refer to AWS D1.4-05, Table 5.1 for matching weld metal and AWS D1.4-05, Table 2.1 for cases where matching filler metal is required and unmatched filler metal may be used.

b. A minimum of 3/16 in. weld size is suggested.

c. Theoretical thickness for shear stress on base metal = 0.9(0.6)(36) ksi. A more practical thickness might be taken as 1/2 d_b as used with headed studs. A minimum of 1/4 in. plate thickness is suggested.

Chapter 7

Page 7-29, column at right for Wind:

Column noted “Out” should read “In.”

Column noted “In” should read “Out.”

Page 7-30, last line of Section 7.6.2.1: Reference 4 noted should read reference 1.

Chapter 8

Page 8-19, Equation 8-2: The equals sign (=) should be deleted.

Chapter 11

Page 11-6, second item under Miscellaneous in the left column: “fiberous” should read “fibrous.”

Page 11-17, Insulated Path Chart, Total row for R-Winter should read 14.78 (not 13.95) and R-Summer should read 14.86 (not 14.03).

Page 11-18: The terms in the denominator in the equation for Winter should be changed from 13.05 to 14.78 and for Summer from 14.03 to 14.86. This then makes the values for R in the next line equal 8.57 (not 8.31) and 8.79 (not 8.52.).

Page 11-24, Table 11.2.3: ICC in the footnote should be IIC.

Chapter 12

Page 12-4: Eq. 12-4 should read $f_n = \left(\frac{1.58}{\ell^2} \right) \sqrt{\frac{gE_d I}{w}}$.

Page 12-6: Table 12.7.2: Values in four columns should shift up one row to line up with first harmonic and second harmonic.

Page 12-6, Table 12.7.2, 5th column, line for Lively concert or sports event, first harmonic: 8 should be 7.5.

Page 12-7: Example 12.8.1: Replace with Example 12.8.1 (Revised).

EXAMPLE 12.8.1 (Revised)

Stadium Seat

Given:

Stadium seat section shown

- $f'_c = 5000$ psi, normalweight
- $E_d = 4287$ ksi $\times 1.2 = 5144$ ksi
- $w = 474$ lb/ft
- $I = 12,422$ in.⁴ on inclined weak principal axis

Problem:

Find maximum span governed by vibration.

Solution:

Use Eq. 12-6 to find minimum natural frequency:

$$\text{Minimum, } f_n = f_r \sqrt{1 + \left(\frac{k_r}{a_o / g} \right) \left(\frac{\alpha_i w_p}{w_t} \right)}$$

where:

$k_r = 1.7$ for sports events (see Section 12.7.2).

Refer to Tables 12.7.1 and 12.7.2.

For first harmonic, use the following assumptions:

Forcing frequency $f_f = 2.5$ Hz (engineer's judgement within range of Table 12.7.2)

Acceleration limit $a_o/g = 0.06$ (engineer's judgement within range of Table 12.7.1)

Weight of participants $w_p = 30$ lb/ft² (Table 12.7.2)

Dynamic load $\alpha_i w_p = 7.5$ lb/ft² (Table 12.7.2)

Dynamic load component in weak direction $= 7.5 \left(\frac{64}{12} \right) (\cos 31.8) = 34.0$ lb/ft

Total weight (a measure of mass) $= 474 + 30 \times \frac{64}{12} = 634$ lb/ft

Note that the mass is not reduced by $\cos 31.8$ deg, because mass is the same in all directions.

For bays of uniform width (Fig. 12.8.1)

$$f_n = 2.5 \sqrt{1 + \left(\frac{1.7}{0.06} \right) \left(\frac{34.0}{634} \right)} = 3.97 \text{ Hz}$$

Find maximum span from Eq. 12-4:

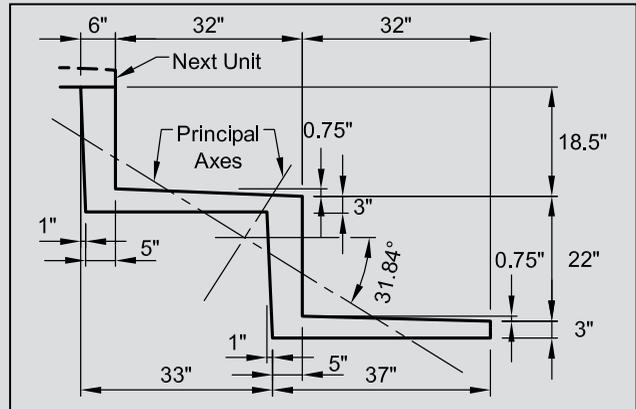
$$f_n = \frac{1.58}{\ell_{max}^2} \sqrt{\frac{E I g}{w}} = \frac{1.58}{\ell_{max}^2} \sqrt{\frac{5144 (12,422) (386)}{0.634 / 12}} = \frac{1,079,550}{\ell_{max}^2}$$

$$\ell_{max}^2 = \frac{1,079,550}{f_n} = \frac{1,079,550}{3.97}$$

$$\ell_{max} = \sqrt{271,927} = 521.5 \text{ in.} = 43.5 \text{ ft}$$

For bays of non-uniform width (Fig. 12.8.1), the minimum frequency may be reduced by 25% $f_n = 0.75(3.97) = 2.98$ Hz

$$\ell_{max} = \sqrt{\frac{1,079,550}{3.0}} = 600 \text{ in.} = 50 \text{ ft} \qquad \begin{array}{l} 2.98 < 3.0 \\ \therefore \text{ use } 3.0 \end{array}$$



Chapter 14

Page 14-24, Section 14.4.2.2, last sentence: Replace MNL-130-91 with MNL-130-09.

Page 14-27, Section 14.4.6.1: Replace MNL-130-91 with MNL-130-09.

Page 14-28, Section 14.4.8.3: Replace MNL-130-91 with MNL-130-09.

Page 14-28, Section 14.4.9.2, last sentence of the section: Replace Section 14.2 with Section 14.4.11.2.

Page 14-30, Section 14.4.10: Replace MNL-130-91 with MNL-130-09.

Page 14-35, Section 14.5.3, last sentence of second paragraph: Replace Section 14.3.1 with Section 14.4.3.2.

Chapter 15

Page 15-13, Design Aid 15.1.3 – 3A.1: a and b in the diagram should be replaced with $\ell/2$.

Page 15-54, Design Aid 15.8.1, Circle: The value of c should read $c = \frac{d}{2} = R$.

Page 15-57, Design Aid 15.8.2: Z_s in heading of the second column should read Z_p .

Page 15-57, dimensions for tube section in bottom row: b_1 should be inside dimension and b_l as shown should be b .

Appendix

Page A-20, Chapter 15: On page 15-39, the equation for compression development length should now include a lambda (λ) factor in the denominator where λ is in conformance with ACI 318-08, Section 12.2.4 (d).

