FOR: Cleveland Innerbelt	JOB NO: 49633	SHEET NO:
MADE BY: KDG	CHECKED BY: dBT	BACKCHECKED BY: KDG
DATE: 8-1-12	DATE: 8-7-2012	DATE: 8-8-12

HNTB

RFI 362

5.7.5 Bearings

$\phi = 0.70$ (5.5.4.2.1)

Assume A_1 = Lower Bearing Plate = $\frac{\pi (42")^2}{4} = 1385 in.^2$

$A_2 = (27.625 + 1)^2 \pi = 2,574 in^2$

$m = \sqrt{\frac{A_2}{A_1}} = \sqrt{\frac{2574}{1385}} = 1.36 \leq 2$

$P_n = 0.85 f'_c A_1 m = 0.85 (4 ksi)(1385 in^2)(1.36) = 6,404 k$

$P_r = \phi P_n = 0.70 (6,404 k) = 4,483 k$ ⇐ controls

Assume A_1 = Masonry Plate = $(48+11)[(24 + 3.625)2] = 3,260 in^2$

$A_2 = [(28.625")2](59+2) = 3,492 in^2$

one inch larger than masonry plate

$m = \sqrt{\frac{3492}{3260}} = 1.04$

$P_r = (0.70)(0.85)(4)(3260)(1.04) = 8,069 k$

From Bearing Table

$P_u = 3,750 k < P_r$

∴ no confining reinforcing is required

ME101-1204

FOR: Cleveland Innerbelt	JOB NO: 49633	SHEET NO:
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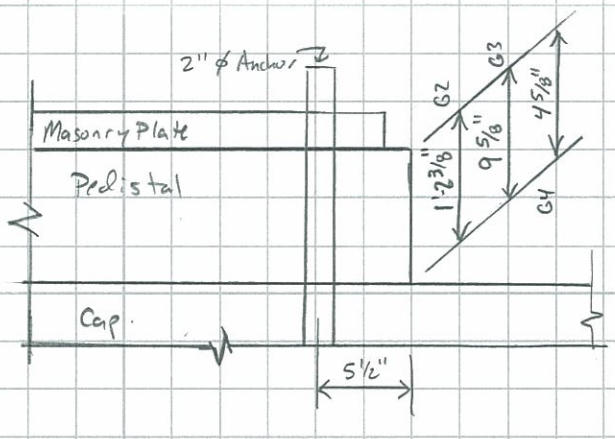
HNTB

Pier 6 Bearing have 32 Anchor Bolts each

Horizontal loads from Bearing Table

Longitudinal load = 2085 k
Transverse load = 420 k

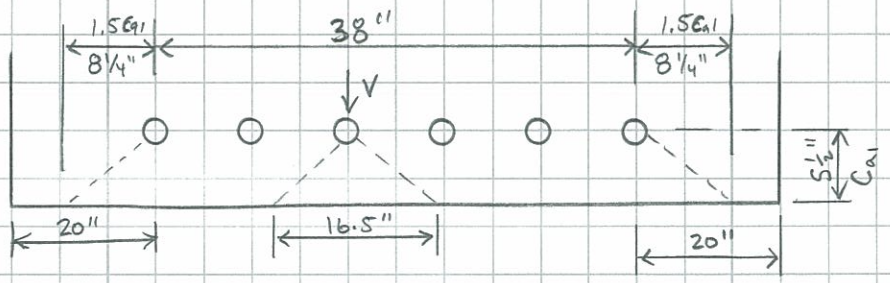


Check concrete Breakout strength for Anchors in Shear per ACI Appendix D,

D.6.2

Check Transverse force on the 6 Drill and Epoxy Anchors

V= 420k ÷ 32 bolts = 13.13 k/bolt



ME101-1204

FOR: Cleveland Innerbelt	JOB NO: 49633	SHEET NO:
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HNTB

Transverse Shear (cont.)

$A_{Vc} = (16.5)(1.5*5.5) = 136 in^2$

$A_{Vco} = 4.5(c_{a1})^2 = 4.5(5.5)^2 = 136 in^2$

$\psi_{ec,V} = 1.0$
$\psi_{ed,V} = 1.0$
$\psi_{c,V} = 1.4$
$\psi_{h,V} = 1.0$

$$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\sqrt{f'_c}\,(c_{a1})^{1.5}$$

$$= 7\left(\frac{16}{2}\right)^{0.2}\sqrt{2}\,\sqrt{4000}\,(5.5)^{1.5} = 12.2\,k$$

$$V_b = 9\sqrt{f'_c}\,(c_{a1})^{1.5} = 9\sqrt{4000}\,(5.5)^{1.5} = 7.3\,k \quad \Leftarrow \text{controls}$$

$$V_{cbg} = \frac{A_{Vc}}{A_{Vco}}\psi_{ec,V}\psi_{ed,V}\psi_{c,V}\psi_{h,V}V_b = \frac{136}{136}(1.4)(7.3) = 10.2\,k$$

$\phi V_{cbg} < V_u$

$\therefore$ NG

Need to add Additional Concrete to side of Bearing Pedistal

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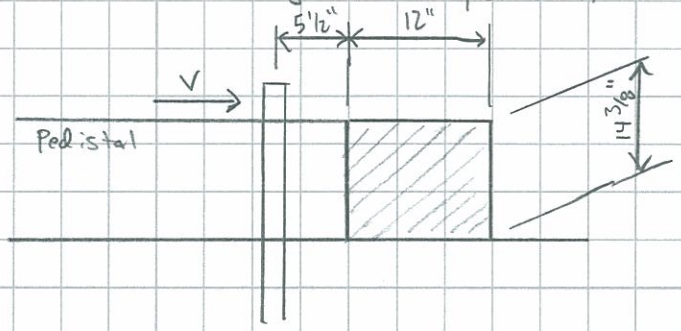
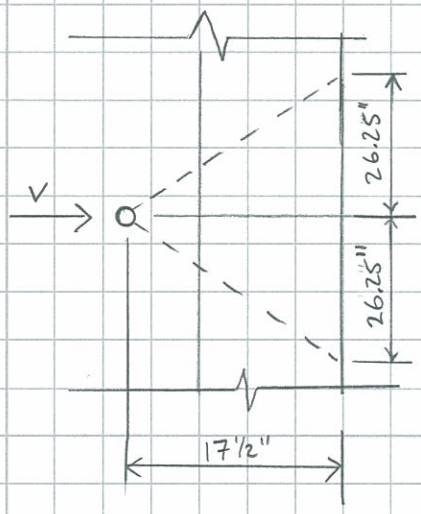
HNTB

Add 12" concrete Adjacent to pedistal





$A_{Vc} = (26.25 + 26.25)(14.375") = 754.7\ in^2$

$A_{Vco} = 4.5\ (17.5)^2 = 1378.1\ in^2$

$\Psi_{ec,v} = 1.0$

$\Psi_{ed,v} = 0.7 + 0.3\ \frac{20}{26.25} = 0.93$

$\Psi_{c,v} = 1.4$

$\Psi_{h,v} = \sqrt{\frac{26.25}{14.375}} = 1.35$

$V_p = 9\sqrt{4000}\ (17.5)^{1.5} = 41.7\ k$

$V_{cb} = \frac{754.7}{1378.1}\ (1.4)(0.93)(1.35)(41.7) = 40.1\ k$

$\phi V_{cb} = 0.85\ (40.1) = 34.1\ k > 13.13$ ok

ME101-1204

FOR: Cleveland Innerbelt	JOB NO: 49633	SHEET NO:
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DATE: 8-3-12	DATE: 8-7-2012	DATE: 8-8-12

HNTB

Shrinkage and Temperature Reinforcing (5.10.8)

$$A_s \geq \frac{1.3bh}{2(b+h)f_y} = \frac{1.3\left(6.5' \times 12\frac{in}{\#}\right)(14.375'')}{2(6.5 \times 12 + 14.375)\,60\,ksi} = 0.13\ in^2/ft$$

use # 4 @ 15" $\Rightarrow$ $A_s = 0.16\ in^2/ft$

chk dBT 8-7-2012
EDG 8-8-12

HIT-RE 500 Epoxy Adhesive Anchoring System 3.2.7

HIT-RE 500 Ultimate Bond Capacity and Steel Strength for Rebar in Concrete

Nominal Rebar Size	Embedment Depth in. (mm)	Concrete Compressive Strength f'_c = 2000 psi (13.8 MPa) Ultimate Bond Strength lb (kN)	f'_c = 2000 psi (13.8 MPa) Embed. to Develop Yield Strength[1] in. (mm)	f'_c = 2000 psi (13.8 MPa) Embed. to Develop Tensile Strength[1] in. (mm)	Concrete Compressive Strength f'_c = 4000 psi (27.6 MPa) Ultimate Bond Strength lb (kN)	f'_c = 4000 psi (27.6 MPa) Embed. to Develop Yield Strength[1] in. (mm)	f'_c = 4000 psi (27.6 MPa) Embed. to Develop Tensile Strength[1] in. (mm)	Grade 60 Rebar Yield Strength lb (kN)	Grade 60 Rebar Tensile Strength lb (kN)
#3	3-3/8 (86)	10105 (45.0)	2-1/4 (57)	3-3/8 (86)	10810 (48.1)	2-1/8 (54)	3-1/4 (84)	6600 (29.4)	9900 (44.0)
	4-1/2 (114)	10920 (48.6)			10810 (48.1)				
#4	4-1/2 (114)	15980 (71.1)	3-3/8 (86)	5-5/8 (143)	18540 (82.5)	3 (76)	4-3/8 (111)	12000 (53.4)	18000 (80.1)
	6 (152)	18830 (83.8)			18655 (83.0)				
#5	5-5/8 (143)	20630 (91.8)	5-1/8 (130)	8-7/8 (225)	27790 (123.6)	3-7/8 (98)	5-3/4 (146)	18600 (82.7)	27900 (124.1)
	7-1/2 (191)	24870 (110.6)			27790 (128.6)				
#6	6-3/4 (171)	33695 (149.9)	5-3/8 (136)	9-3/8 (238)	44675 (198.7)	4 (102)	6 (152)	26400 (117.4)	39600 (176.2)
	9 (229)	38960 (173.3)			44870 (200.0)				
#7	7-7/8 (200)	40525 (180.3)	7 (178)	12-3/8 (314)	59340 (264.0)	4-7/8 (124)	7-1/4 (184)	36000 (160.1)	54000 (240.2)
	10-1/2 (267)	48460 (215.6)			61720 (274.6)				
#8	9 (229)	63940 (284.4)	8-1/4 (210)	12-7/8 (327)	72820 (323.9)	5-7/8 (149)	8-7/8 (225)	47400 (210.9)	71100 (316.3)
	12 (305)	69610 (309.7)			72950 (324.5)				
#9	10-1/8 (257)	72245 (321.4)	8-1/2 (216)	13 (330)	81235 (361.4)	7-1/2 (191)	12 (305)	60000 (266.9)	90000 (400.4)
	13-1/2 (343)	94205 (419.1)			84015 (373.7)				
#10	11-1/4 (286)	92000 (409.3)	9-3/8 (238)	17-7/8 (454)	96725 (430.3)	8-7/8 (225)	14 (356)	76200 (339.0)	114300 (508.5)
	15 (381)	95850 (426.4)			97070 (431.8)				
#11	12-3/8 (314)	118615 (527.6)	9-7/8 (251)	18-3/4 (476)	123120 (547.7)	9-1/2 (241)	16-1/2 (419)	93600 (416.4)	140400 (624.6)
	16-1/2 (419)	123570 (549.7)			123790 (550.7)				

1 Based on comparison of average ultimate adhesive bond test values versus minimum yield and ultimate tensile strength of rebar. For more information, contact Hilti.