

Calculations For	Clev. Innerbelt - Unit 3 & Ramp A5	Job No.	49633	Sheet No.
Made by	VWR	Date	06/05/12	
Checked by	KDG	Date	06/18/12	
Backchecked by	VWR	Date	06/22/12	

HNTB

Title: **Additional Anchor Rod Checks**

NOTE: Input data is denoted by yellow shading. All other values are calculations performed by the spreadsheet.

Design Codes: AASHTO 5th Ed. (2010)

Block Shear Rupture

$U_{bs} = 1.00$ AASHTO 6.13.4
 $R_p = 0.90$ AASHTO 6.13.4
AASHTO 6.8.2.1 (conservative)

	Ramp A5	Unit 3 Gdrs 5 & 6	Unit 3 All Other Gdrs	
Case 1 - Failure plane perpendicular to line of bolts (i.e. perpendicular to CL Girder) due to transverse load				
$\phi_{bs} =$	1.00	1.00	0.80	AASHTO 6.5.4.2 & 6.5.5
$A_{tg} \text{ (in.}^2\text{)} =$	24.00	32.25	25.00	
# of Bolt Holes in Tension, $n_t =$	2.00	7.00	2.00	
$A_{tn} \text{ (in.}^2\text{)} = A_{tg} - n_t * d_h * t =$	20.50	20.00	21.50	AASHTO 6.8.3
$A_{vg} \text{ (in.}^2\text{)} =$	0.00	0.00	0.00	
# of Bolt Holes in Shear, $n_s =$	0.00	0.00	0.00	
$A_{vn} \text{ (in.}^2\text{)} = A_{vg} - n_s * d_h * t =$	0.00	0.00	0.00	AASHTO 6.8.3
$R_r = \text{Min of } \phi_{bs} R_p (0.58 F_y A_{vg} + U_{bs} F_u A_{tn}) =$	1199.3	1170.0	1006.2	AASHTO 6.13.4-1
or $\phi_{bs} R_p (0.58 F_u A_{vn} + U_{bs} F_u A_{tn}), \text{ (kips)} =$	1199.3	1170.0	1006.2	
$R_r \text{ (kip)} =$	1199.3 OK	1170.0 OK	1006.2 OK	

Case 2 - Failure plane in line with bolts (i.e. parallel to CL Girder) due to longitudinal load

$A_{tg} \text{ (in.}^2\text{)} =$	0.00	0.00	0.00	
# of Bolt Holes in Tension, $n_t =$	0.00	0.00	0.00	
$A_{tn} \text{ (in.}^2\text{)} = A_{tg} - n_t * d_h * t =$	0.00	0.00	0.00	AASHTO 6.8.3
$A_{vg} \text{ (in.}^2\text{)} =$	24.00	32.25	25.00	
# of Bolt Holes in Shear, $n_s =$	2.00	7.00	2.00	
$A_{vn} \text{ (in.}^2\text{)} = A_{vg} - n_s * d_h * t =$	20.50	20.00	21.50	AASHTO 6.8.3
$R_r = \text{Min of } \phi_{bs} R_p (0.58 F_y A_{vg} + U_{bs} F_u A_{tn}) =$	626.4	841.7	522.0	AASHTO 6.13.4-1
or $\phi_{bs} R_p (0.58 F_u A_{vn} + U_{bs} F_u A_{tn}), \text{ (kips)} =$	695.6	678.6	583.6	
$R_r =$	626.4 OK	678.6 OK	522.0 OK	

Weld Check

	Ramp A5	Unit 3 Gdrs 5 & 6	Unit 3 All Other Gdrs	
Weld Metal				
$\phi_{e2} =$	1.00	1.00	0.80	AASHTO 6.5.4.2 & 6.5.5
$F_{exx} \text{ (ksi)} =$	60	70	60	(min per AISC Table 8-3)
Fillet Weld Leg (in.) =	0.3125	0.3750	0.3125	AASHTO Table 6.13.3.4-1
Effective Throat Thick. (in.), $t_e =$	0.221	0.265	0.221	
Weld Length (in.), $l =$	24.00	32.25	25.00	
Weld Capacity (kip), $0.60 \phi_{e2} F_{exx} t_e l =$	190.9 OK	359.2 OK	159.1 OK	AASHTO 6.13.3.2.4b-1
Base Metal				
Weld Capacity (kip), $0.60 \phi_{e2} F_u \text{ Leg } l =$	292.5 OK	471.7 OK	243.8 OK	AASHTO C6.13.3.2.4b

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Set Up

Anchor rod couplers @ Ramp A5 (Pier 1) and Unit 3 (Pier 14) were set incorrectly by the Contractor and additional anchor rods must be used.

Use the same size & quantity (i.e. same capacity) and the same longitudinal location (to avoid capbeam reinforcing)

Contractor should verify location of pier capbeam reinforcing prior to drilling new anchor rods.

See attached design sketch.

Geometry & Properties

Anchor Rod Dia. =	1.50	in.	(match in-place rods)
Hole Dia., d_h =	1.75	in.	
PL Thick., t =	1.00	in.	0.5 in. less in-place masonry PL
Yield Strength, F_y =	50	ksi	
Tensile Strength, F_u =	65	ksi	

	Ramp A5		Unit 3 Gdrs 5 & 6		Unit 3 All Other Gdrs	
Factored Longitudinal Force (kip) =	44	(Ext Event LS)	18	(Ext Event LS)	143	(Strength LS)
Factored Transverse Force (kip) =	119	(Ext Event LS)	668	(Ext Event LS)	56	(Strength LS)
Resultant (kip) =	127		668		154	
Number of Bolts per Bearing =	4		14		4	
Resultant per Bolt (kip) =	32		48		38	
Min. Plate Length (in.) =	24.00		32.25		25.00	
Edge Distance (in.) =	2.625		2.25		2.25	
Min. End Dist for Oversized Hole =	2.38 in	OK	2.38 in	NG	2.38 in	NG

Anchor Bolt Bearing

AASHTO 6.13.2.9

	Ramp A5		Unit 3 Gdrs 5 & 6		Unit 3 All Other Gdrs	
ϕ_{bb} =	1.00		1.00		0.80	AASHTO 6.5.4.2 & 6.5.5
End Clear Distance (in.), L_c =	1.750		1.375		1.375	
$\phi_{bb}R_n$ (k/bolt) = $\phi_{bb}1.2L_c t F_u$ =	136.5	OK	107.3	OK	85.8	OK

AASHTO 6.13.2.9-2