COMPUTATION SHEET

E. P. FERRIS & ASSOCIATES, INC.

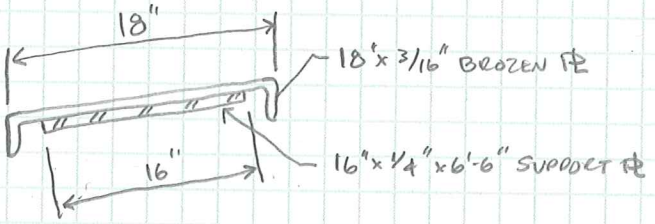
CONSULTING CIVIL ENGINEERS

BY JWE	DATE 5/15/14	TITLE CUY-90 (CCG1)	FILE NO.
CHECKED	DATE	LOCATION ABBY AVE - RAILWG	PROJECT
			SHEET 1 OF 3

DESIGNS:

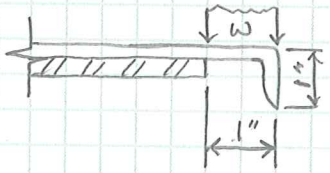
1. ABBEY AVE OVERLOOK SUPPORT (BACKER PL)
2. ABBEY AVE LEAN RAIL SUPPORT (BACKER PL)
3. BASE PLATE DESIGN.

1. ABBEY AVENUE OVERLOOK BACKER PL SUPPORT.



- CHECK BENDING OF BRONZE PL AT OVERHANG LOCATIONS.

a. • SPREAD 200# OVER 18" ∴ w = 133.33 #/ft.



a. $M = \frac{wl^2}{2} = \frac{133.33(1/12)^2}{2} = 0.463\ \#\cdot ft.$

$F_b = \frac{M}{S} = \frac{0.463\ \#\cdot ft \times 12\ in/ft}{\frac{(12 \times (3/16)^2)}{6}} = 79.0\ psi$

b. CHECK WITH 200# POINT LOAD.

$M = Pl = 200\#\,(1/12) = 16.6\ \#\cdot ft.$

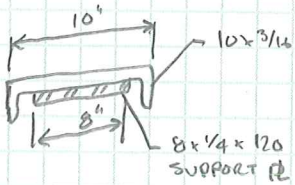
$F_b = \frac{M}{S} = \frac{16.6 \times 12}{\frac{12 \times (3/16)^2}{6}} = 2844\ psi < 21200\ psi$ ← F_b allowable.

∴ 1/4"x16"x6'-6" SUPPORT PLATE AND 3/16"x18"x6'-6" BROZE PLATE ARE BOTH ADEQUATE.

STATE OF OHIO
JAMES EUDAILY
#E-65600
REGISTERED PROFESSIONAL ENGINEER

5/19/14

2. ABBEY AVENUE LEAN RAIL BACKER PL SUPPORT



FROM PREVIOUS CALCULATION THE 200# POINT LOAD GOVERNED. CALCULATION IS THE SAME ∴ BOTH PL ARE ADEQUATE.

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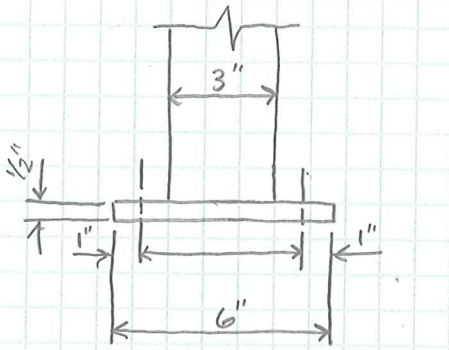
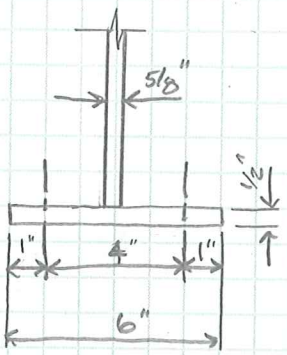
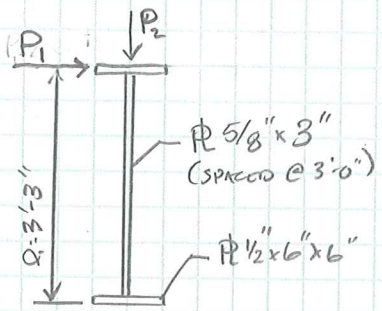
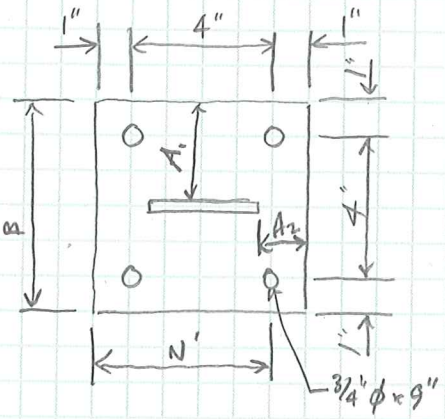
SHEET 2 OF 3

3. Base Plate Design:









B = 6"
N = 5'
A_1 = 2.6875"
A_2 = 1.5"

Allowable Stress

F_y = 36 ksi x 0.6 = 21.6 ksi

f'_c = 4000 psi

P_1 = 0.2 + 0.05 (3.0)
= 0.35 k

P_2 = 0.05 (3) = 0.15 k.

$M_{BASE} = P_1 \times \ell_1$
= 0.35 (3.25)
= 1.1375 k-ft x 1.7 = 1.93 k-ft (FACT) = 23.16 k-in

A. Check Base PL:

a. $F_p = 0.35 f'_c \sqrt{\frac{A_c}{A_p}} \leq 0.7 f'_c$

$= 0.35 (4) \sqrt{4} = 2.8$ ksi ≤ 2.8 ksi

b. $f' = \frac{f_p B N'}{2} = \frac{2.8(6)(5)}{2} = 42$ ksi

c. $A = \frac{f' \pm \sqrt{f'^2 - 4(f_6 B/6)(P_2 A + M)}}{f_p B/3}$

$= \frac{42 \pm \sqrt{42^2 - 4(2.8(6)/6)(0.15(2.6875) + 23.16)}}{(2.8(6)/3)}$

$= 0.58$ in or 14.4 in $\therefore$ 0.58" < 6.75 in Good.

or $\frac{42 \pm \sqrt{42^2 - (4(2.8)(6)/6)(0.15)(1.5) + 23.16}}{(2.8(6)/3)}$

$= 0.58$ in or 14.4 in $\therefore$ 0.58 in < 6.75 in Good.

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d. TENSION IN BOLTS:

$$T = \frac{f_p BA}{2} - p = \frac{2.8(6)(0.58)}{2} - 0.15$$

$$= \frac{4.722^K}{2} = 2.36\ K/\text{BOLT} < 19.9^K \text{ GOOD}$$

2 = # BOLTS ON EACH SIDE

e. LOAD ON PL:

$$M = \frac{2.8(0.58)}{2} = 0.812\ K\text{-in}$$

$$t_p = \sqrt{\frac{6M}{\phi F_y}} = \sqrt{\frac{6(0.812)}{0.75(36)}} = 0.18\ in < 1/2" \therefore \text{GOOD.}$$

USE $6 \times 6 \times 1/2$ PL W/ $4 - 3/4"\phi$

B. ANCHOR BOLT CHECK.

$3/4" \times 9"$ (A325) $\therefore$ Tensile Strength = 120 ksi

$f_{allowable} = 19.9$ ksi

a = BOLT SIZE: A_g

$$A_g = \frac{T_u}{1/3 F_a} = \frac{2.36}{1/3(120)} = 0.06\ in^2 \therefore 3/4"\phi = 0.44\ in^2$$

GOOD

b = EMBEDMENT: Ld.

$$Ld = \sqrt{\frac{T_u}{\phi 4 \sqrt{f'_c}\,\pi}} = \sqrt{\frac{2.36(1000)}{0.9(4)\sqrt{4000}\,\pi}} = 1.81\ in < 9\ in \text{ GOOD}$$