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City of Portland, Oregon - Bureau of Development Services

1900 SW Fourth Avenue • Portland, Oregon 97201 • 503-823-7300 • www.portlandoregon.gov/bds

Deferred Submittal Requirements and Application

Applicants will provide:

- ❑ A copy of this application
- ❑ Three (3) sets of plans
- ❑ One (1) set of calculations
- ❑ Two (2) sets of product information
- ❑ Drawings and calculations must be stamped and signed by an Engineer registered in Oregon and approved by the Architect/Engineer of record for the building.
- ❑ Permit fee (paid at time of submittal)
- ❑ If the DFS includes exterior elements, plan views and elevations identifying the location(s) as approved by the Architect and Engineer of Record must be submitted.
- ❑ One (1) copy of your main building permit approved plans (NOTE: Approved plans do not need to be submitted if your project has a development liaison assigned)

Contractor submittal information:

DFS- 08

Contact name Dave Wang - INLINE Commercial Construction, Inc.

Address 18880 SW Shaw St / PO Box 5837

City Aloha State OR Zip Code 97006

Phone (503) 758-8979 E-mail davew@inline-cc.com

Value of deferred submittal $ 11,005 Issued main building permit # 12-155480-000-00-CO

Description/Scope of work ROOF TIE OFF FALL PROTECTION

Fees

Deferred submittal (DFS) fees are collected in addition to the standard building review fee paid on the main building permit. DFS fees cover the cost of the additional processing and review time associated with the design build element.

The DFS fee for processing and reviewing deferred plan submittals is 10 percent of the building permit fee calculated using the value of the particular deferred portion of the project.,

Minimum fee: Residential, one and two family dwelling ... $123 for DFS with valuation of less than or equal to $222,000

Commercial and all other projects ..... $307 for DFS with valuation of less than or equal to $680,000

The Bureau of Development Services (BDS) fee schedule is also available on the BDS web site at ***www.portlandoregon.gov/bds*** | select the Fees tab.

Helpful Information

Bureau of Development Services
1900 SW 4th Avenue, Portland, OR 97201

Submit your plans to:
Development Services Center (DSC), First Floor,
Tuesday - Friday:
8:00 am - 12:00 pm
Closed Mondays

Important Telephone Numbers

BDS main number 503-823-7300
DSC automated information line 503-823-7310
Building code information 503-823-1456
BDS 24 hour inspection request line 503-823-7000
Residential information for one and two family dwellings..... 503-823-7388
City of Portland TTY 503-823-6868

Scan

Structural Checksheet Response

Permit #: 12-155480-000-00-CO 08 **Date:** 8/13/13

Customer name and phone number: DAVE WANG 503-758-8979

Note: *Please number each change in the '#' column. Use as many lines as necessary to describe your changes. Indicate which reviewer's checksheet you are responding to and the item your change addresses. If the item is not in response to a checksheet, write* **customer** *in the last column.*

#	Description of changes, revisions, additions, etc.	Checksheet and item #
1	STRUCTURAL CALCULATIONS FOR ROOF TIE-OFF SYSTEM	

(for office use only)

Scan

1

INLINE
COMMERCIAL CONSTRUCTION INC.

SUBMITTAL TRANSMITTAL **SUBMITTAL NO. 055000D.1**

PROJECT: PCC SE Campus Learning Commons PROJECT NO.: 7378-12 SPEC. SECTION: 05 50 00 SUBCONTRACTOR: Columbia Bridge & Iron ARCHITECT: SRG Partnership Inc.	**CONTRACTOR** Inline Commercial Construction, Inc. 18880 SW Shaw St / PO Box 5837 Aloha, OR 97006 P: (503) 642-5117 / F: (503) 649-3301

TRANSMITTAL RECORD		ATTN	DATE	REVIEWED BY
To:	Architect	Greg Williams	8/1/13	D Wang
From:	Contractor			
To:	Consultant			
From:	Architect			
To:	Contractor			
From:	Architect			
To:	Subcontractor	Luke Parker	8/09/2013	
From:	Contractor			

RECEIVED
AUG 13 2013
BDS
DOCUMENT SERVICES

ACTION TAKEN			
REVIEWED	MAKE CORRECTIONS NOTED	REVISE & RESUBMIT	REJECTED / RESUBMIT
x			

Submittal was reviewed for architectural design conformity and general conformance to contract documents only. Contractor is responsible for confirming and correlating dimensions at jobsites for tolerances, clearances, quantities, fabrication processes and techniques of construction, coordination of this work with other trades and full compliance with contract documents.

QTY	DATE	DESCRIPTION
1	7/26/13	Fall Protection Structural Calculations

CONTRACTOR REMARKS	ARCHITECT REMARKS
If possible, please expedite approval. Thank you	

12-153480-000-DFS08

Portland Community College

Southeast Learning Commons

Submittal : 055000D.1 : 117

Subject:	Fall Protection Structural Calculations		
Author:	Katy Fong	**Held By:**	Katy Fong
Date Created:	07.31.2013 08:28pm	**Date Due:**	08.06.2013

Original or Revision:	Original
Specification Section:	05 50 00
We are sending:	Attached (Electronic File)
The following items:	Calculations
Submitted for:	Review & Approval
Number of Copies:	1
Submitter's Additional Comments:	If possible please expedite for approval by 8/06. Thank you

This section to be completed by the Architect/Engineer

Grading:	Reviewed
A/E's Comments:	No exceptions taken. Avery Morris/catena 8.6.13
Attached Files:	055000D.1 Fall Proctection Structural Calculations.pdf

Form Created
07.31.2013 08:28pm

To: Greg Williams
CC: Eric Ross, Dave Wang

Forward
08.01.2013 09:46am

To: Avery Morris | **From:** Greg Williams
CC:

For your review, please. Greg

Comment
08.06.2013 08:37am

By: Avery Morris
CC:

A document was attached

Attached Files: 055000D.1 Fall Proctection Structural Calculations.catena revd.pdf

Forward
08.06.2013 08:37am

To: Greg Williams | **From:** Avery Morris
CC:

Comment
08.08.2013 08:17am

By: Greg Williams
CC:

A document was attached

Attached Files: 05 50 00- D.1 Fall Proctection Structural Calculations #117 - catena & SRG rvwd.pdf

---

Forward
08.09.2013 10:14am

To: Katy Fong | **From:** Greg Williams
CC: Sue Lowery, Avery Morris, Bill Stauffer

PRC SAFETY SYSTEMS ENGINEERED FOR LIFE	Project No.Customer 2N1-2013-21379		PCC LEARNING COMMONS, OR	Date 07/26/13
	By	AFUNG	Description	
	Check		Stress Calculations for 18" tall Steel Round Anchors (Weld to Structure - PBE75-0000-18000)	
	App.			

1.0. Anchor Material Properties

- Steel Sections:

E_s = 29,000,000 PSI - Modulus of Elastricity of Steel

- Mechanical properties for 44W / ASTM A36 steel plate:

$\sigma_{Y\,ST}$ = 44,000 PSI - Yield strength

$\sigma_{T\,ST}$ = 65,000 PSI - Tensile strength

- Mechanical properties for ASTM A500 GRADE C steel round tube:

σ_{YHSS} = 50,000 PSI - Yield strength

σ_{THSS} = 65,000 PSI - Tensile strength

- Mechanical properties for 304 Stainless Steel:

$\sigma_{Y\,SS}$ = 35,000 PSI - Yield strength

$\sigma_{T\,SS}$ = 84,000 PSI - Tensile strength

2013/4/29

REGISTERED PROFESSIONAL ENGINEER 60467

Ho Sik Hoi

OREGON May 17, 1999 SIK HOI HO

EXPIRES: 06/30/2015

2.0. Anchor Dimensions and Section Properties

OD = 3.50 in - Round tube O.D.

t = 0.1875 in - Round tube wall thickness

H = 18.00 in - Anchor height

H_U = 2.000 in - U-Bar height

$e = H + H_u$ = 20.000 in- Eccentricity of load on support

- Section Properties for Round Tube (HSS 3 1/2" x 3/16"):

A = 1.82 in² - Crossection area

Z = 1.93 in³ - Section modulus

SHOP DRAWINGS AND PRODUCT DATA

INLINE COMMERCIAL CONSTRUCTION INC. 503-642-5117 OR CCB #51880

☒ REVIEWED

☐ REVIEWED AS NOTED

☐ REVISE AND RESUBMIT

Reviewed only for general conformance with the design concept of the Project and general compliance with the information given in the Contract Documents. The review does not affect the Subcontractor's responsibility to perform all contract requirements with no change in contract price or time. Any actions shown are subject to the requirements of the plans and specifications. Subcontractor is responsible to confirm and correlate dimensions on the site for information that pertains solely to the fabrication processes for the means, methods, techniques, procedures, sequences and quantities necessary to complete the contract and for coordination of the work with all trades and the satisfactory performance of work. Any review is undertaken solely to satisfy Contractor's obligations, if any, to the Owner and shall not give rise to any claim by Subcontractor or other parties against Contractor, Architect or Owner.

Date: Aug 1, 2013 Job # 7378-12, PCC LC

Signed: Dave Wang Submittal # 055000D.1

PRO SAFETY SYSTEMS ENGINEERED FOR LIFE	Project No.Customer 2N1-2013-21379		PCC LEARNING COMMONS, OR	Date 07/26/13
	By	AFUNG	Description	
	Check		Stress Calculations for 18" tall Steel Round Anchors	
	App.		(Weld to Structure - PBE75-0000-18000)	

3.0. Loads on Anchor

P = 1,000 lb - Horizontal load at any direction

P_F = 4,000 lb - Horizontal Factored load at any direction (**4:1** Safety Factor applied)

U = 5,000 lb - Ultimate horizontal load at any direction

3.1. Stress on Anchor Round Tube

- Bending moment:

$$M = U \cdot e = \boxed{100{,}000} \text{ lb-in}$$

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{51{,}813} \text{ PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}747} \text{ PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{51{,}886} \text{ PSI}$$

- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\sigma_{THSS}}{\sigma_C} = \boxed{1.25} \quad > \quad 1.00 \quad \text{ok}$$

☒ REVIEWED ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT

THIS REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT, CRITERIA, AND INFORMATION GIVEN IN THE CONSTRUCTION DOCUMENTS. CORRECTIONS OR COMMENTS MADE ON THIS SUBMITTAL DURING THIS REVIEW DO NOT RELEASE THE CONTRACTOR OR THEIR AGENTS FROM COMPLIANCE WITH THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. REVIEW OF A SPECIFIC ITEM SHALL NOT INCLUDE REVIEW OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT. THE CONTRACTOR AND THEIR AGENTS ARE RESPONSIBLE FOR: DIMENSIONS TO BE CONFIRMED AND CORRELATED AT THE JOBSITE; ADHERENCE TO APPLICABLE CODES AND STANDARDS; INFORMATION THAT PERTAINS SOLELY TO THE FABRICATION PROCESSES OR TO THE MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES OF CONSTRUCTION; COORDINATING THE WORK WITH ALL OTHER TRADES; AND PERFORMING ALL WORK IN A SAFE AND SATISFACTORY MANNER.

8/6/13 AAM

DATE CATENA CONSULTING ENGINEERS BY

☒ NO EXCEPTIONS TAKEN ☐ MAKE CORRECTIONS NOTED
☐ REJECTED ☐ REVISE AND RESUBMIT

Checking is for general conformance with design concepts and compliance with Contract Document Information. Corrections or comments made do not relieve contractor from complying with contract requirements. Contractor responsible for: confirmed, correlated site dimensions, fabrication process, techniques of construction and coordination of his work with all other trades.

By: gaw - 08/08/2013

SRG PARTNERSHIP, INC.
621 SW MORRISON ST., SUITE 200
PORTLAND, OREGON 97205
(503) 222-1917

3.2. Ultimate Load on Bottom Fillet Weld (Anchor tube to Existing Steel)

σ_{TW} = 70,000 PSI - Weld metal ultimate tensile strength for E70XX

w = 0.2500 in - Bottom fillet weld size

ϕ_{weld1} = 3.500 in - Inside Diameter of Weld

ϕ_{weld2} = 3.854 in - Outside Diameter of Weld $\left[\phi_{weld2} = \phi_{weld1} + (2 \cdot w \cdot \cos 45^0)\right]$

- Section properties of Weld:

A = 2.042 in² - Crossection area

Z = 2.391 in³ - Section modulus

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{41{,}819} \text{ PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}449} \text{ PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{41{,}891} \text{ PSI}$$

- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\phi \cdot 0.6 \cdot \sigma_{TW}}{\sigma_C} = \boxed{1.00} \quad > \quad 1.00 \quad \text{ok}$$

This ultimate load has a factor of safety of 4:1 and encompass all safety factors because of uncertainities. All ϕ factors are taken as 1.

PRO SAFETY SYSTEMS ENGINEERED FOR LIFE	Project No Customer 2N1-2013-21379	PCC LEARNING COMMONS, OR	Date 07/26/13
	By AFUNG	Description	
	Check	Stress Calculations for 24" tall Steel Round Anchors	
	App.	(Weld to Structure - PBE75-0200-24000)	

1.0. Anchor Material Properties

- Steel Sections:

E_s = 29,000,000 PSI - Modulus of Elastricity of Steel

- Mechanical properties for ~~44W~~ / ASTM A36 steel plate:

36,000

$\sigma_{Y\,ST}$ = 44,000 PSI - Yield strength

$\sigma_{T\,ST}$ = 65,000 PSI - Tensile strength 58 ksi min.

- Mechanical properties for ASTM A500 GRADE C steel round tube:

σ_{YHSS} = 50,000 PSI - Yield strength

σ_{THSS} = 65,000 PSI - Tensile strength

- Mechanical properties for 304 Stainless Steel:

$\sigma_{Y\,SS}$ = 35,000 PSI - Yield strength

$\sigma_{T\,SS}$ = 84,000 PSI - Tensile strength

2013/Jul 29

REGISTERED PROFESSIONAL ENGINEER 60467 OREGON May 17, 1999 SIK HOI HO

Ho Sik Hoi

EXPIRES: 06/30/2015

2.0. Anchor Dimensions and Section Properties

OD = 4.00 in - Round tube O.D.

t = 0.1875 in - Round tube wall thickness

H = 24.00 in - Anchor height

H_U = 2.000 in - U-Bar height

$e = H + H_u$ = 26.000 in- Eccentricity of load on support

- Section Properties for Round Tube (HSS 4" x 3/16"):

A = 2.09 in² - Crossection area

Z = 2.55 in³ - Section modulus

3.0. Loads on Anchor

P = 1,000 lb - Horizontal load at any direction

P_F = 4,000 lb - Horizontal Factored load at any direction (**4:1** Safety Factor applied)

U = 5,000 lb - Ultimate horizontal load at any direction

3.1. Stress on Anchor Round Tube

- Bending moment:

$$M = U \cdot e = \boxed{130{,}000} \text{ lb-in}$$

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{50{,}980} \text{ PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}392} \text{ PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{51{,}036} \text{ PSI}$$

- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\sigma_{THSS}}{\sigma_C} = \boxed{1.27} > 1.00 \quad \text{ok}$$

$$\frac{58}{51} = 1.13 > 1.0 \checkmark$$

3.2. Ultimate Load on Bottom Fillet Weld (Anchor tube to Existing Steel)

σ_{TW} = 70,000 PSI - Weld metal ultimate tensile strength for E70XX

w = 0.2500 in - Bottom fillet weld size

ϕ_{weld1} = 4.000 in - Inside Diameter of Weld

ϕ_{weld2} = 4.354 in - Outside Diameter of Weld $\left[\phi_{weld2} = \phi_{weld1} + (2 \cdot w \cdot \cos 45^0)\right]$

- Section properties of Weld:

A = 2.319 in² - Crossection area

Z = 3.085 in³ - Section modulus

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{42{,}135}\ \text{PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}156}\ \text{PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{42{,}191}\ \text{PSI}$$

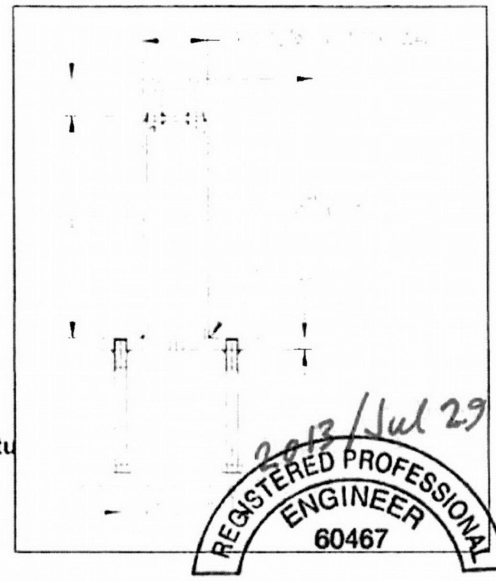
- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\phi \cdot 0.6 \cdot \sigma_{TW}}{\sigma_C} = \boxed{1.00} \quad > \quad 1.00 \quad \text{ok}$$

This ultimate load has a factor of safety of 4:1 and encompass all safety factors because of uncertainities. All ϕ factors are taken as 1.

PROBEL	Project No.Customer		PCC LEARNING COMMONS, OR	Date
	2N1-2013-21379			07/26/13
	By	AFUNG	Description	
	Check		Stress Calculations for 18" tall Steel Round Anchors	
	App.		(Cast-in Place 4 Studs - PBE74-00A4-1806S)	

1.0. Anchor Material Properties



- Steel Sections:

E_s = 29,000,000 PSI - Modulus of Elastricity of Steel

- Mechanical properties for 44W / ASTM A36 steel plate:

$\sigma_{Y\,ST}$ = 44,000 PSI - Yield strength

$\sigma_{T\,ST}$ = 65,000 PSI - Tensile strength

- Mechanical properties for ASTM A500 GRADE C steel round tu

σ_{YHSS} = 50,000 PSI - Yield strength

σ_{THSS} = 65,000 PSI - Tensile strength

- Mechanical properties for 304 Stainless Steel Bolts:

$\sigma_{Y\,SS}$ = 35,000 PSI - Yield strength

$\sigma_{T\,SS}$ = 84,000 PSI - Tensile strength

2013/Jul 29
REGISTERED PROFESSIONAL ENGINEER 60467
Ho Sik Hoi
OREGON
May 17, 1999
SIK HOI HO
EXPIRES: 06/30/2015

2.0. Anchor Dimensions and Section Properties

OD = 3.50 in - Round tube O.D.

t_w = 0.1875 in - Round tube wall thickness

H = 18.00 in - Anchor height

H_U = 2.000 in - U-Bar height

$e = H + H_u$ = 20.000 in- Eccentricity of load on support

- Section Properties for Round Tube (HSS 3 1/2" x 3/16"):

A = 1.82 in² - Crossection area

Z = 1.93 in³ - Plastic section modulus

3.0. Loads on Anchor

P = 1,000 lb - Horizontal load at any direction

P_F = 4,000 lb - Horizontal Factored load at any direction (4:1 Safety Factor applied)

U = 5,000 lb - Ultimate horizontal load at any direction

3.1. Stress on Anchor Round Tube

- Bending moment:

$$M = U \cdot e = \boxed{100{,}000} \text{ lb-in}$$

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{51{,}813} \text{ PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}747} \text{ PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{51{,}886} \text{ PSI}$$

- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\sigma_{THSS}}{\sigma_C} = \boxed{1.25} \quad > \quad 1.00 \quad \text{ok}$$

Since the Factor of Safety on Combined Stresses is greater than 1, the anchor tube (3 1/2" OD x 3/16" wall) is adequate to sustain the Ultimate Load.

3.2. Ultimate Load on Bottom Fillet Weld (Anchor tube to Base Plate)

σ_{TW} = 70,000 PSI - Weld metal ultimate tensile strength for E70XX

w = 0.25 in - Bottom fillet weld size

ϕ_{weld1} = 3.500 in - Inside Diameter of Weld

ϕ_{weld2} = 3.854 in - Outside Diameter of Weld $\left[\phi_{weld2} = \phi_{weld1} + (2 \cdot w \cdot \cos 45^0)\right]$

- Section properties of Weld:

A = 2.042 in² - Crossection area

Z = 2.391 in³ - Section modulus

- Bending stress:

$$\sigma_b = \frac{M}{Z} = \boxed{41{,}819}\ \text{PSI}$$

- Shear stress:

$$\tau = \frac{U}{A} = \boxed{2{,}449}\ \text{PSI}$$

- Total combined stress:

$$\sigma_C = \sqrt{\sigma_b^2 + \tau^2} = \boxed{41{,}891}\ \text{PSI}$$

$$\tau = \frac{}{A_W} =$$

- Factor of Safety against Ultimate Strength:

$$S_T = \frac{\phi \cdot 0.6 \cdot \sigma_{TW}}{\sigma_C} = \boxed{1.00} \quad > \quad 1.00 \quad \text{ok}$$

This ultimate load has a factor of safety of 4:1 and encompass all safety factors because of uncertainities. All ϕ factors are taken as 1.

4.0. Stress on Base Plate

$B = D =$ 8.00 in - Width and Depth of plate

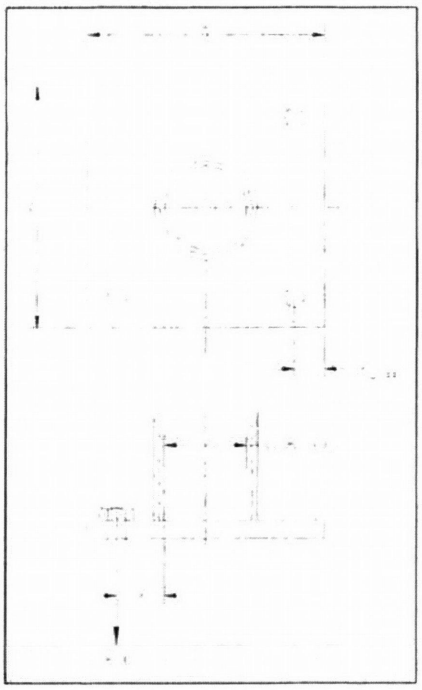
$t =$ 0.625 in - Thickness of plate

$d_{\_edge} =$ 1.000 in - Edge distance

$N' =$ 7.000 in - Edge distance

$f'_c =$ 4,000 PSI - Compressive strength of concrete

$\phi_{bearing} =$ 0.70 - Factor of bearing on concrete



- Allowable Bearing Stress:

$$f_p = \phi_{bearing} \cdot f'_c = \boxed{2{,}800} \text{ PSI}$$

- Design Bearing Stress:

$$F_p = \frac{U}{(B \cdot D)} = \boxed{78} \text{ PSI}$$

- Ratio:

$$\frac{f_p}{F_p} = \boxed{35.84} \quad > \quad 1.00 \quad \text{ok}$$

4.1. Thickness of Plate due to Anchor Bolt (Loading at 0 and 90 Degrees)

$m =$ 6.000 in - Bolt spacing

- Tension on Bolt:

$$P_t = \frac{M}{2 \cdot m} = \boxed{8{,}333} \text{ lb}$$

- Moment on Plate due to Anchor Bolt (critical at 0.8 OD):

$$x = \frac{B - (0.8 \cdot OD)}{2} - d_{\_edge} = \boxed{1.600}\ \text{in}$$

$$M_{pl} = 2 \cdot P_t \cdot x = \boxed{26{,}667}\ \text{lb-in}$$

- Plastic Section Modulus of Plate required:

$$Z_{pl} = \frac{B \cdot t^2}{4} = \boxed{0.78}\ \text{in}^3$$

- Allowable Stress:

$$\sigma_b = \frac{M_{pl}}{Z_{pl}} = \boxed{34{,}133}\ \text{PSI}$$

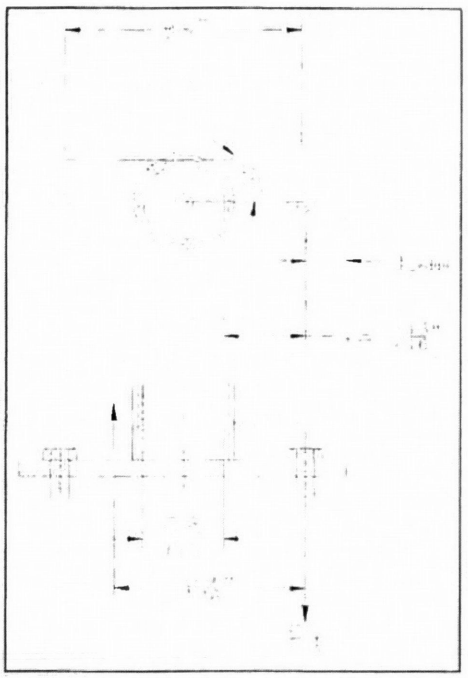
- Factor of Safety against Ultimate:

$$S_T = \frac{\sigma_{TST}}{\sigma_b} = \boxed{1.90} \quad > \quad 1.00 \quad \text{ok}$$

Since the Factor of Safety on Bending Stress (when loaded at 0 & 90 Degrees) is greater than 1, the 5/8" thick Plate is adequate to sustain the Ultimate Load.

4.2. Thickness of Plate due to Anchor Bolt (Loading at 45 Degrees)

Assume Upward Reaction occurs 1/3 from the edge of the round tube as the concrete resists the downward force



$$n = x + (OD - 2 \cdot t_W) + (x/3) = \boxed{6.875}\ \text{in}$$

- Tension on Bolt:

$$P_t = \frac{M}{n} = \boxed{14{,}545}\ \text{lb}$$

- Moment on Plate due to Anchor Bolt:

$$x = 2.8125\ \text{in}$$

$$M_{pl} = P_t \cdot x = \boxed{40{,}909}\ \text{lb-in}$$

- Plastic Section Modulus of Plate required:

$$Z_{pl} = \frac{B_{eff} \cdot t^2}{4} = \boxed{0.80}\ \text{in}^3 \qquad \text{where} \qquad B_{eff} = 8.1875\ \text{in - Effective width of Plate}$$

- Allowable Stress:

$$\sigma_b = \frac{M_{pl}}{Z_{pl}} = \boxed{51{,}164}\ \text{PSI}$$

- Factor of Safety against Ultimate:

$$S_T = \frac{\sigma_{TST}}{\sigma_b} = \boxed{1.27} \quad > \quad 1.00 \quad \text{ok}$$

Since the Factor of Safety on Bending Stress (when loaded at 45 Degrees) is greater than 1, the 5/8" thick Plate is adequate to sustain the Ultimate Load.

5.0. Anchor Bolts

d = 0.625 in - Anchor bolt diameter

n = 11 UNC - Threads per in

$$A_T = 0.7854\left(d - \frac{0.9743}{n}\right)^2 = \boxed{0.226}\ \text{in}^2$$ - Tensile stress area

5.1. Tensile Stress in Anchor Bolts

- Maximum Tensile Force on bolt:

$$P_{t\_max} = \boxed{14{,}545}\ \text{lb}$$

- Required Tensile Stress:

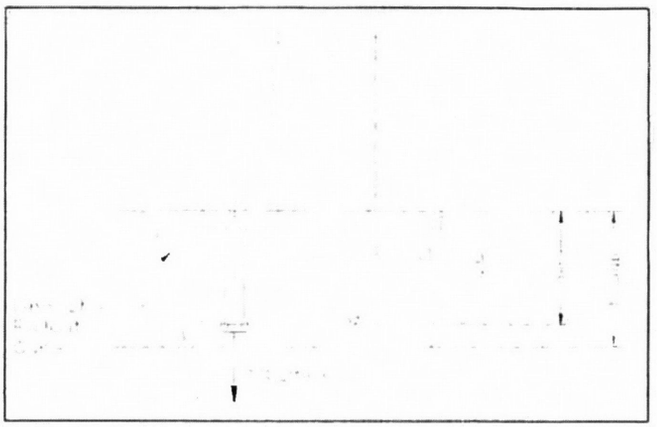
$$\sigma_{bolt} = \frac{P_{t\_max}}{A_T} = \boxed{64{,}360}\ \text{PSI}$$

- Factor of Safety against Tensile:

$$S_T = \frac{\sigma_{TSS}}{\sigma_{bolt}} = \boxed{1.31} \quad > \quad 1.00 \quad \text{ok}$$

Since the Factor of Safety on Tensile Stress (when loaded at 45 Degrees) is greater than 1, 5/8" Diameter of Bolt is adequate to sustain the Ultimate Load.

6.0. Check Pullout of Concrete of Individual Cone when Load is applied at 45 Degrees



h_{ef} = 5.250 in - Embedment depth given

d_{head} = 1.000 in - Anchor bolt head diameter

$$A_{brg} = \frac{\pi \cdot d_{head}^2}{4} = \boxed{0.785}\ in^2$$ - Bearing Area of bolt head

k = 24 - Coefficient for basic Concrete Breakout Strength in Tension
(Ref. #3: ACI 318 Building Code and Commentary D-7)

f'_c = 4,000 PSI - Compressive strength of concrete

6.1. Concrete Breakout Strength in Tension

- Equation D5.2.2 (Ref. #3: ACI 318 Building Code and Commentary D-7):

$$N_b = k \cdot \sqrt{f'_C} \cdot h_{ef}^{1.5} = \boxed{18{,}259}\ lb \quad > \quad P_{t\_max} = 14{,}545\ lb$$

6.2. Anchor Pullout Strength in Tension

- Equation D5.3.4 (Ref. #3: ACI 318 Building Code and Commentary D-13):

$$N_p = A_{brg} \cdot 8 \cdot f'_C = \boxed{25{,}133}\ lb \quad > \quad P_{t\_max} = 14{,}545\ lb$$

Since both the Allowable Concrete Breakout Strength and Pullout Strength is greater than the Maximum Design Tensile Force , 5/8" Dia. Anchor Bolts are Adequate to use.

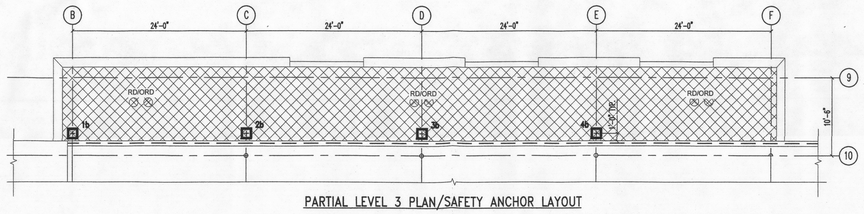
7.0. References

1) "Manual of Steel Construction - Allowable Stress Design", 9th edition, published 1995 by American Institute of Steel Construction

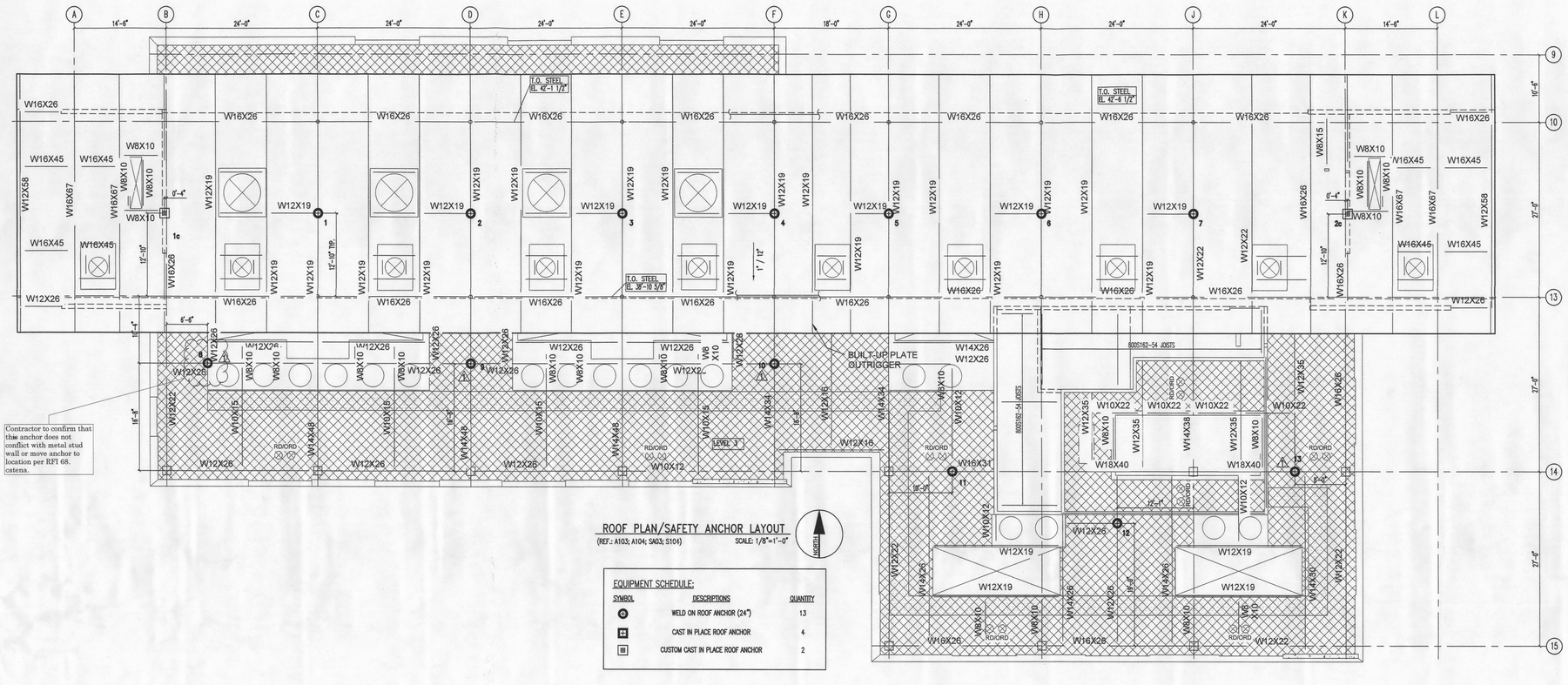
2) "Concrete Design Handbook", 2nd edition, published 1998 by Canadian Portland Cement Association

3) "Building Code Requirements for Structural Concrete (ACI 318-02) and Commentary (ACI 318R-02) ", by ACI

DWG NO.	DESCRIPTION
1.01	LAYOUT, NOTES & DETAILS



PARTIAL LEVEL 3 PLAN/SAFETY ANCHOR LAYOUT



ROOF PLAN/SAFETY ANCHOR LAYOUT

(REF.: A103; A104; SA03; S104) SCALE: 1/8"=1'-0"

NORTH

EQUIPMENT SCHEDULE:

SYMBOL	DESCRIPTIONS	QUANTITY
⊕	WELD ON ROOF ANCHOR (24")	13
⊞	CAST IN PLACE ROOF ANCHOR	4
▣	CUSTOM CAST IN PLACE ROOF ANCHOR	2

SPECIAL INSPECTIONS ARE REQUIRED ON THIS PERMIT FOR THE FOLLOWING AREAS OF CONSTRUCTION:

- [x] STRUCTURAL STEEL
- [ ] ADHESIVE ANCHORS
- [ ] REINFORCED CONCRETE
- [ ] _____
- [ ] EXPANSION/SCREW ANCHORS
- [ ] STRUCTURAL OBSERVATION BY THE ENGINEER IS TO OCCUR AT THE FOLLOWING STAGES OF CONSTRUCTION:

_____

IMPORTANT NOTES

1. WORKERS TO USE A SHOCK ABSORBING LANYARD RATED FOR 900 lbs. MAXIMUM ARREST FORCE.
2. SUPPORTING STRUCTURE DESIGN
   STRUCTURAL ENGINEER FOR THE OVERALL PROJECT IS RESPONSIBLE FOR DESIGN OF THE BUILDING STRUCTURE, AND LOCAL REINFORCEMENT WHERE REQUIRED, TO WITHSTAND THE APPLIED LOADS OF SAFETY EQUIPMENT SUPPLIED BY PRO-BEL.
3. INSTALLATION OF HORIZONTAL LIFELINES, STATIC LINES AND/OR DOG LINES BETWEEN ANCHORS WITHOUT PRIOR WRITTEN APPROVAL FROM PRO-BEL ENTERPRISES LTD. IS STRICTLY PROHIBITED, AND MAY RESULT IN LEGAL ACTION AGAINST ALL PARTIES INITIATING SUCH ACTION(S).
4. ACCESS TO ANY AREA WITHIN 6'-0" OF ROOF EDGE WHERE THE PARAPET WALL/RAILING IS LESS THAN 42" TALL IS RESTRICTED. WORKERS MUST FIRST BE TIED OFF TO AN ANCHOR OUTSIDE THESE AREAS PRIOR TO APPROACHING AND REMAIN CONTINUOUSLY TIED OFF WHEN WORKING WITHIN THESE AREAS.
5. WORKERS SHALL ARRANGE THEIR LIFELINES IN SUCH A WAY THAT THEY CANNOT TRAVEL BEYOND ROOF EDGE. IN OTHER WORDS, FREE FALL CANNOT OCCUR.

PRO-BEL ROOF ANCHORS HAVE A HOLE CLOSE TO THE TOP OF THE ANCHOR. THE HOLE WAS FOR THE GALVANIZING PROCESS AND HAS BEEN SEALED AFTER FABRICATION.

IMPORTANT NOTES

(1) CONTRACTOR SHALL ENSURE THAT THE SEAL TO THE HOLE IS IN GOOD CONDITION DURING CONSTRUCTION. IT IS THE GENERAL CONTRACTOR'S RESPONSIBILITY TO RESEAL MISSING OR DAMAGED SEALS DURING CONSTRUCTION.

(2) IT IS THE OWNER'S RESPONSIBILITY, THROUGH ANNUAL INSPECTION, TO ENSURE THAT THE SEAL TO THE HOLE IS IN GOOD CONDITION. ANY LOOSE, CRACKED OR BROKEN-DOWN SEAL MUST BE REMOVED AND RESEALED TO PREVENT WATER FROM LEAKING INSIDE THE ANCHOR.

GENERAL NOTES

1. PRO-BEL ENTERPRISES LIMITED IS TO BE NOTIFIED OF ALL CHANGES TO AND/OR DEVIATIONS FROM THIS DRAWING.
2. GENERAL CONTRACTOR/ARCHITECT/CLIENT IS TO VERIFY THAT THE LOCATION OF THE EQUIPMENT SUPPLIED BY PRO-BEL DOES NOT CONFLICT WITH DOORWAYS, ROOF DRAINS, MECHANICAL UNITS ETC...
3. TO THE EXTENT POSSIBLE, PRO-BEL EQUIPMENT HAS BEEN LOCATED AND ORIENTED TO WORK WITH THE KNOWN LOCATIONS OF ANY POTENTIAL OBSTRUCTIONS. G.C. TO NOTIFY PRO-BEL OF ANY CHANGES TO THE WORK OF OTHERS WHICH MAY IMPACT OUR EQUIPMENT.
4. THE PORTIONS OF BUILDING STRUCTURE THAT SUPPORT PRO-BEL EQUIPMENT SHALL BE VERIFIED BY THE PROJECT STRUCTURAL ENGINEER/ ARCHITECT FOR THE RESULTING FORCES AND MOMENTS DUE TO THE LOADS SHOWN ON PRO-BEL SHOP DRAWING(S). THE LOADS SHOWN ARE UN-FACTORED WORKING LOADS UNLESS NOTED OTHERWISE.
5. INSTALLATION OF HORIZONTAL LIFELINES, STATIC LINES AND/OR DOG LINES BETWEEN ANCHORS/DAVITS WITHOUT PRIOR WRITTEN APPROVAL FROM PRO-BEL ENTERPRISES LTD. IS STRICTLY PROHIBITED, AND MAY RESULT IN LEGAL ACTION AGAINST ALL PARTIES INITIATING SUCH ACTION(S).

ENGINEERING NOTES

1. DESIGN OF THE SAFETY SYSTEM LAYOUT IS BY OTHERS. REFERENCE DWG NO. A103; A104 BY SRG PARTNERSHIP INC., DATED OCTOBER 17, 2012. THE ARCHITECT/CLIENT IS RESPONSIBLE FOR THE LOCATION AND INTENDED USE OF THE ROOF ANCHOR.
2. DESIGNED TO FEDERAL OSHA REGULATION (STANDARDS-29 CFR) PART 1910 OCCUPATIONAL SAFETY & HEALTH STANDARDS):
   -APPENDIX C TO SUBPART F (PERSONAL FALL ARREST SYSTEM)
   -ALL APPLICABLE INTERPRETATIONS AND MEMORANDUMS
3. ALL STRUCTURAL STEEL IS DESIGNED AS PER AISC SPECIFICATIONS.
4. ALL HOLLOW STRUCTURAL SECTIONS ARE TO BE GRADE 350W ACCORDING TO CSA/CAN3-G40.21-M81 WITH Fy=50.8 ksi AND Fu=65.3 ksi.
5. ALL STEEL PLATE AND OTHER SECTIONS ARE TO BE GRADE 300W ACCORDING TO CSA/CAN3-G40.21-M81 WITH Fy=43.5 ksi AND Fu=65.3 ksi.
6. STAINLESS STEEL IS TO BE TYPE 304.
7. ALL BOLTS ARE TO BE TYPE 304 STAINLESS STEEL WITH COMPATIBLE NUTS AND WASHERS.
8. THE SAFETY ANCHOR HAS BEEN TESTED TO ENSURE THAT FRACTURE OR DETACHMENT DOES NOT OCCUR WITH A 22.2 kN (5,000 lb.) LOAD.
9. THE WORKING LOAD OF THE SAFETY ANCHORS IS 4.45 kN (1,000 lb.).
10. REINFORCING OF BUILDING STRUCTURE BY OTHERS AS REQUIRED BY THE PROJECT STRUCTURAL ENGINEER TO RESIST THE LOADS IMPOSED BY PRO-BEL EQUIPMENT.

INSTALLATION

1. EQUIPMENT IS TO BE SUPPLIED BY PRO-BEL AND INSTALLED BY OTHERS.
2. ROOFING IN OF PRO-BEL EQUIPMENT IS TO BE BY OTHERS.
3. CAST-IN BOLTS AND CAGES ARE TO BE SUPPLIED BY PRO-BEL AND INSTALLED BY OTHERS. PRO-BEL ENTERPRISES LIMITED IS TO BE NOTIFIED OF ANY DEVIATIONS OF THE POSITION OR DETAILS OF THE CAST-IN ITEMS FROM THIS DRAWING.
4. ALL ON-SITE WELDING OF PRO-BEL EQUIPMENT SHALL BE PERFORMED BY CERTIFIED WELDERS REGISTERED IN THE STATE WHERE EQUIPMENT IS INSTALLED. WELDING SHALL COMPLY WITH AWS D1.1 "STRUCTURAL WELDING CODE - STEEL". ON-SITE WELDING COMPANY MUST SUPPLY PROOF OF CERTIFICATION TO PRO-BEL ENTERPRISES LIMITED.
5. ALL WELDING SHALL BE DONE ON BARE STEEL. FIELD-WELDED AREAS SHALL BE FIELD GALVANIZED PER ASTM A780. WELDING ELECTRODE: E70-XX.

INSPECTION AND TESTING

1. PRO-BEL EQUIPMENT IS NOT TO BE LOAD TESTED WITHOUT PRIOR CONSULTATION WITH PRO-BEL ENTERPRISES LIMITED.
2. ALL PRO-BEL EQUIPMENT IS TO BE INSPECTED BY A COMPETENT PERSON BEFORE EACH SCHEDULED SERVICE CYCLE AND NOT LESS THAN ONCE A YEAR TO ENSURE THAT IT IS IN GOOD WORKING ORDER. ANY DAMAGED OR DETERIORATED COMPONENT MUST BE REPAIRED OR REPLACED UNDER THE DIRECTION O." A PROFESSIONAL ENGINEER.
3. YIELDING OF THE EQUIPMENT AND/OR SUPPORTING STRUCTURE MAY OCCUR IN THE EVENT OF A FALL ARREST INCIDENT. WHEN THE EQUIPMENT HAS BEEN IMPACTED BY FALL ARREST LOADING, A THOROUGH INSPECTION OF PRO-BEL EQUIPMENT AND THE SUPPORTING STRUCTURE IS TO BE CONDUCTED, AND ANY DAMAGED COMPONENT MUST BE REPAIRED OR REPLACED, UNDER THE DIRECTION OF A PROFESSIONAL ENGINEER.

USAGE

1. WORKER MUST BE TIED OFF FOR FALL ARREST PRIOR TO APPROACHING, AND REMAIN CONTINUOUSLY TIED OFF WHEN WORKING, WITHIN 6'-0" OF ROOF EDGE WHERE PARAPET HEIGHT IS LESS THAN SAFETY RAILING HEIGHT.
2. PRO-BEL EQUIPMENT SHALL BE RE-CERTIFIED AT PERIODS NOT TO EXCEED 5 YEARS. THE RE-CERTIFICATION RECORD SHALL BE INCLUDED IN THE BUILDING LOGBOOK. IF AN AREA OF SUSPICION IS IDENTIFIED, A TEST PROCEDURE, IF NECESSARY, SHALL BE PERFORMED UNDER THE DIRECTION OF A PROFESSIONAL ENGINEER.
3. USERS MUST COMPLY WITH ALL APPLICABLE SAFETY CODES AND REGULATIONS WHEN USING THIS SYSTEM.
4. THIS DRAWING MUST BE READ AND USED IN CONJUNCTION WITH THE OPERATING INSTRUCTIONS DESCRIBED IN THE LOG BOOK SUPPLIED BY PRO-BEL.

CONCRETE

1. CONCRETE SHALL NOT CONTAIN CALCIUM CHLORIDE OR ADMIXTURES WITH CHLORIDE G.C. TO VERIFY.

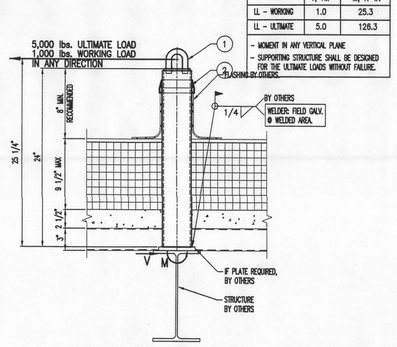
City of Portland
REVIEWED FOR CODE COMPLIANCE
AUG 27 2013
12-155480 DFS 08 CO
Permit Number

PRO-BEL FULL ASSEMBLY MODEL #FA-PBE75-0200-24000

1. 3/4"ø STAINLESS STEEL U-BAR.
2. 4" O.D. GALVANIZED STEEL PIER.

REACTION AT ANCHOR	V, KIP	M, K-IN
LL - WORKING	1.0	25.3
LL - ULTIMATE	5.0	128.3

- MOMENT IN ANY VERTICAL PLANE
- SUPPORTING STRUCTURE SHALL BE DESIGNED FOR THE ULTIMATE LOADS WITHOUT FAILURE.



WELD-ON ROOF ANCHOR DETAIL ⊕

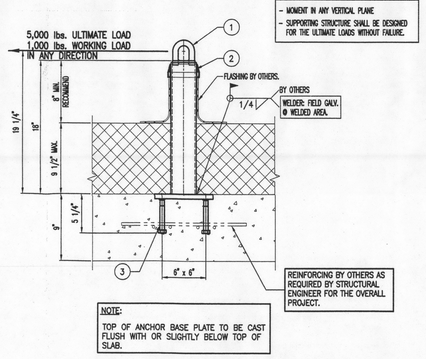
SCALE: 1 1/2"=1'-0"

PRO-BEL FULL ASSEMBLY MODEL #FA-PBE74-00A4-1806S

1. 3/4"ø STAINLESS STEEL U-BAR.
2. 3 1/2" O.D. GALVANIZED STEEL PIER WITH 8"x8" BASE PLATE.
3. 5/8"ø STAINLESS STEEL BOLT (4x).

REACTION AT ANCHOR	V, KIP	M, K-IN
LL - WORKING	1.0	19.3
LL - ULTIMATE	5.0	96.3

- MOMENT IN ANY VERTICAL PLANE
- SUPPORTING STRUCTURE SHALL BE DESIGNED FOR THE ULTIMATE LOADS WITHOUT FAILURE.



NOTE:
TOP OF ANCHOR BASE PLATE TO BE CAST FLUSH WITH OR SLIGHTLY BELOW TOP OF SLAB.

CAST IN PLACE ROOF ANCHOR DETAIL ⊞

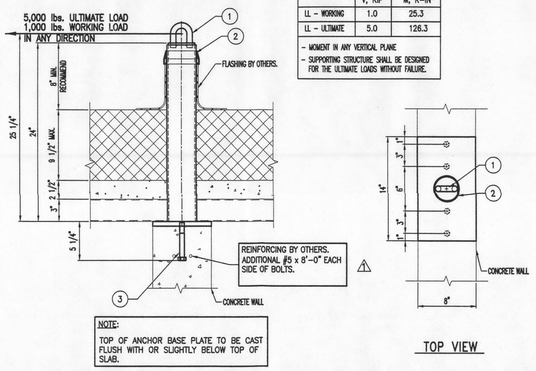
SCALE: 1 1/2"=1'-0"

PRO-BEL FULL ASSEMBLY MODEL #FA-CUSTOM

1. 3/4"ø STAINLESS STEEL U-BAR.
2. 3 1/2" O.D. GALVANIZED STEEL PIER WITH 8"x14" BASE PLATE.
3. 5/8"ø STAINLESS STEEL BOLT (4x).

REACTION AT ANCHOR	V, KIP	M, K-IN
LL - WORKING	1.0	25.3
LL - ULTIMATE	5.0	126.3

- MOMENT IN ANY VERTICAL PLANE
- SUPPORTING STRUCTURE SHALL BE DESIGNED FOR THE ULTIMATE LOADS WITHOUT FAILURE.

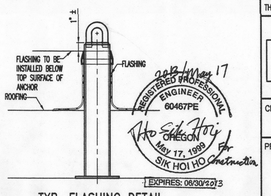


NOTE:
TOP OF ANCHOR BASE PLATE TO BE CAST FLUSH WITH OR SLIGHTLY BELOW TOP OF SLAB.

CAST IN PLACE WALL TOP ROOF ANCHOR DETAIL ▣

(REF.:) SCALE: 1 1/2"=1'-0"

TOP VIEW



TYP. FLASHING DETAIL

[ ] NO EXCEPTIONS TAKEN	[x] MAKE CORRECTIONS NOTED
[ ] REJECTED	[ ] REVISE AND RESUBMIT

Checking is for general conformance with design concepts and compliance with Contract Document Information. Corrections or comments made do not relieve contractor from complying with contract requirements. Contractor responsible for: confirmed, correlated site dimensions, fabrication process, techniques of construction and coordination of his work with all other trades.

By: gaw - 05/24/2013

SRG PARTNERSHIP, INC.
621 SW MORRISON ST., SUITE 200
PORTLAND, OREGON 97205
(503) 222-1917

[x] REVIEWED	[x] MAKE CORRECTIONS NOTED
[ ] REJECTED	[ ] REVISE AND RESUBMIT

THIS REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT, CRITERIA, AND INFORMATION GIVEN IN THE CONSTRUCTION DOCUMENTS. CORRECTIONS OR COMMENTS MADE ON THIS SUBMITTAL DURING THIS REVIEW DO NOT RELEASE THE CONTRACTOR OR THEIR AGENTS FROM COMPLIANCE WITH THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. REVIEW OF A SPECIFIC ITEM SHALL NOT INCLUDE REVIEW OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT. THE CONTRACTOR AND THEIR AGENTS ARE RESPONSIBLE FOR: DIMENSIONS TO BE CONFIRMED AND CORRELATED AT THE JOBSITE: ADHERENCE TO APPLICABLE CODES AND STANDARDS: INFORMATION THAT PERTAINS SOLELY TO THE FABRICATION PROCESSES OR TO THE MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES OF CONSTRUCTION: COORDINATING THE WORK WITH ALL OTHER TRADES; AND PERFORMING ALL WORK IN A SAFE AND SATISFACTORY MANNER.

5/23/13 AJAM

DATE CATENA CONSULTING ENGINEERS BY

No.	REVISION	BY	CHKD	mm/dd/yy
1	AS BUILT DRAWING	AS	JH	05/14/13

REFERENCES

ARCHITECTURAL		STRUCTURAL	
SRG PARTNERSHIP INC.		SRG PARTNERSHIP INC.	
A103;A104	OCTOBER 17, 2012	S103;S104	AUGUST 9,2012

THE ENGINEER'S SEAL INDICATES ONLY THAT THE STRUCTURAL COMPONENTS SUPPLIED BY PRO-BEL:

a) WILL RESIST THE LOADS INDICATED ON THIS DRAWING WHEN ANALYZED BY CONVENTIONAL STRUCTURAL TECHNIQUES OR
b) HAVE BEEN LAB TESTED FOR THE LOADS INDICATED.

THIS DRAWING IS ON LOAN ONLY, IT MUST NOT IN ANY WAY SHAPE OR FORM BE COPIED AND/OR DUPLICATED WITHOUT THE PERMISSION OF PRO-BEL ENTERPRISES LIMITED.

THE CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE.

ANY DEVIATION FROM THIS DRAWING MUST BE REPORTED TO PRO-BEL ENTERPRISES LIMITED.

THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNTIL IT IS APPROVED.

PRO-BEL
SAFETY SYSTEMS ENGINEERED FOR LIFE

PRO-BEL GROUP LTD.
#103-350 EAST KENT AVE. S
VANCOUVER, B.C., CANADA V5X 4N6
Tel:(604) 687-1301, Fax:(604) 687-1306
Toll Free: 1 (800) 461-0375
Web: www.pro-belgroup.com
E-Mail: info@pro-bel.ca

CLIENT:
COLUMBIA BRIDGE AND IRON INC.

PROJECT:
PCC LEARNING COMMONS
2305 SE 82ND AVENUE
PORTLAND, OR

SUPPLY/ONLY

mm/dd/yyyy: 05/02/2013	TECH. REVIEW:	.	
SCALE: AS INDICATED	SALES	PM.	ENG.
DRAWN BY: JP	LH	JH	

TITLE:
LOCALIZED FALL PROTECTION SAFETY SYSTEM LAYOUT, NOTES & DETAILS

JOB NO.	DRAWING NO.		REV. NO.
2N1-2013-21379	1.01	E	1

12-155480-DFS-08-CO

SCAN