

Contract Change Order # 4

Project Name: <u>Tiger Hill Soldier Pile Retaining wall</u>	Project Number: <u>171703</u>
Project Location: <u>SE Crn of Kenosha and 9th St</u>	Date of Application: <u>Tuesday, September 15, 2020</u>
Contractor: <u>Stronghand LLC.</u>	Submitted By: <u>COBA/GAIC/Stronghand</u>

Summary of Change in Scope of Work

The following scope of work consisting of work location, work description, established quantities, and timeline for completion has been reviewed and agreed upon by the contractor, the origin funding department, and the Engineering and Construction Department.

Change of Work Items Included in this Change Order:

- 1) The termination of Contract No. 171703 is rescinded. Contract No. 171703 dated December 5, 2018 is reinstated and adopted and incorporated by reference herein verbatim.
- 2) Contract No. 171703 is amended to adopt and incorporate by reference the Settlement Agreement (inclusive of Exhibits 1, 2, and 3) entered between Stronghand, Great American Insurance Company, and the COBA, attached hereto as Exhibit A.
- 3) Stronghand will complete the Work according to Contract No. 171703, previously issued Change Orders, and the Steve Ford, PhD, "Modifications to Tiger Hill Retaining Wall" (see Exhibit A).
- 4) To effectuate the Settlement Agreement, COBA waives and releases any claim for delay or liquidated damages incurred prior to March 4, 2020.
- 5) To effectuate the Settlement Agreement, Stronghand is granted additional time to complete the Project in the amount of 150 days from an amended Notice to Proceed. The contractual provisions of Contract No. 171703 shall control any aspect of Liquidated Damages, as well as weather delays.
- 6) As noted within previous correspondence to the contractor, certain elements of the project have been deleted (specifically referring to the embankment modification and channel work on the existing wall) and some elements have been modified via revised plan sheets. The attached associated Amended Quantity Report reflects these values as such to complete the project as scoped incorporating these specified changes. The contract values associated shall be herein underran to reflect the final values noted within the above mentioned report.
- 7) As noted within previous correspondence to the contractor, Change Order #2 line item 2-1 shall be underran by 33% due to variation in the implementation of the change order as written.

Plan Sheets or Additional Documents Attached: ☒ Yes ☐ No ☒ Other: Exhibit A - Settlement Agreement
Quantity Amendment Report for CO4

Work Order Quantities

Item#	(Spec)	Item Description	Units	Price	Quantity	Total Amount
CO4-6		QUANTITY AMENDMENT UNDERRUNS	LS	\$ (95,079.79)	1	\$ (95,079.79)
CO4-7		CO2-1 VALUE AMENDMENT	LS	\$ (6,825.50)	1	\$ (6,825.50)

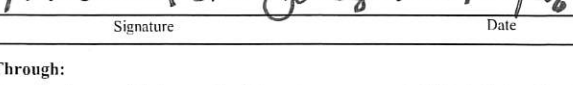
Total Change Cost: \$ (101,905.29)

**Public Contract
Application for
Contractual Changes**

Summary of Project Costs

Total Previous Change Orders:	\$ 89,568.01	Original Contract Amount:	\$ 1,498,681.24
Current Change Order:	\$ (101,905.29)	Amended Contract Amount:	\$ 1,486,343.96
Total Cost of Change Orders:	\$ (12,337.28)	Percent Change in Contract:	-0.82%
Total Cost Applicable to CBA:	\$ 89,568.01	Percent Change Applicable to CBA:	5.98%

Change Order Authorization

Change Order # <u>4</u> in the sum of: \$ (101,905.29) has been reviewed by all parties and is recommended for approval by:		
Contractor Submitting Change Order:	Chris Byrne	Digitally signed by: Chris Byrne DN: CN = Chris Byrne email = chris@stronghandllc.com C = US O = Stronghand LLC Date: 2020.09.25 12:00:44 -06'00'  Signature Date 9/25/2020
Construction Division Manager:	Timothy S Robins, PE	 Signature Date 9/25/2020
Director of Engineering & Construction:	Ethan JL Edwards, PE	 Signature Date 9/28/2020
Assistant City Manager - Operations:	Kenneth D Schwab, PE	 Signature Date 09-28-20
City Manager:	Michael Spurgeon	 Signature Date 9/29/20

This Change is Executed Through:

- ☐ This change to the contract documents is authorized by the City Manager's authority in accordance with the applicable state statutes and COBA Code of Ordinances or
- ☒ This change to the contract documents was approved at the City Council/BAMA meeting held on : Tuesday, September 8, 2020

Amended Quantity Report For Change Order #4

Item#	Item	Units	Price	Original Bid Quantity	Total Contract Revised Values	Original Contract Cost	Revised Project Costs
1	CLSM BACKFILL	CY	\$ 127.83	200.00	41.00	\$ 25,566.00	\$ 5,241.03
2	STRUCTURAL STEEL	LB	\$ 0.95	354,260.00	349,145.00	\$ 336,547.00	\$ 331,687.75
3	CLASS C CONCRETE	CY	\$ 234.36	240.00	123.00	\$ 56,246.40	\$ 28,826.28
4	RETAINING WALL	SY	\$ 365.90	1,780.00	1,780.00	\$ 651,302.00	\$ 651,302.00
5	(SP) GRAFFITI TREATMENT	SF	\$ 3.73	14,990.00	14,990.00	\$ 55,912.70	\$ 55,912.70
6	(PL) PILOT HOLES	LF	\$ 45.50	2,038.00	2,038.00	\$ 92,729.00	\$ 92,729.00
7	8" PERFORATED PIPE UNDERDRAIN ROUND	LF	\$ 24.05	1,020.00	1,020.00	\$ 24,531.00	\$ 24,531.00
8	REMOVAL OF CONCRETE PAVEMENT	SY	\$ 16.54	455.00	-	\$ 7,525.70	\$ -
9	NYOPLAST 24" DRAIN BASIN W/ STD. H-20 RATED GRATE	EA	\$ 4,166.17	2.00	1.00	\$ 8,332.34	\$ 4,166.17
10	NYOPLAST CONCRETE AREA INLET WITH BASE PLACE AND	EA	\$ 7,979.82	2.00	1.00	\$ 15,959.64	\$ 7,979.82
11	15" HDPE PIPE	LF	\$ 53.84	48.00	34.00	\$ 2,584.32	\$ 1,830.56
12	EMBANKMENT	CY	\$ 11.28	7,682.00	7,682.00	\$ 86,652.96	\$ 86,652.96
13	UNCLASSIFIED EXCAVATION	CY	\$ 50.19	563.00	563.00	\$ 28,256.97	\$ 28,256.97
14	TYPE A-SALVAGED TOPSOIL	LS	\$ 22,050.00	1.00	-	\$ 22,050.00	\$ -
15	SEEDING METHOD A	AC	\$ 9,475.59	0.41	0.41	\$ 3,884.99	\$ 3,884.99
16	MOBILIZATION	LS	\$ 80,600.22	1.00	1.00	\$ 80,600.22	\$ 80,600.22
Total Original Construction Contract					\$	1,498,681.24	
Total Underrun Valuation					\$	95,079.79	
Total Revised Project Cost (prior to change orders)					\$	1,403,601.45	



Date: September 3, 2020

Re: Tiger Hill Soldier Pile wall Contract No. 171703; Stronghand v. COBA, Tulsa County District Court Case No. CJ-20-1738

Settlement Agreement

The parties to this contract, the City of Broken Arrow (hereinafter "COBA"), Stronghand, LLC (hereinafter "Stronghand") and Great American Insurance Company (hereinafter "GAIC") agree to the following settlement in connection with CJ-20-1738 in the District Court of Tulsa County, State of Oklahoma and in connection with Broken Arrow Contract No. 171703. The documents incorporated by reference with this Settlement Agreement are Contract No. 171703, inclusive of all "Contract Documents," as defined therein; "Modifications to Tiger Hill Soldier Pile Retaining Wall" (dated 8-26-2020)¹; Tiger Hill Soldier Pile Calculation Package,² and 171703-Proposed Final Project Evaluations 8-27-2020³:

1. Stronghand will be allowed back on site and agrees to complete the Modifications to Tiger Hill Retaining Wall of Steve Ford, per his specifications of the Scope of Work under COBA/Stronghand Contract No. 171703 and Supplemental Scope:
 1. Replacement of Precast Concrete Pile Caps; and
 2. Remove and Replace Backfill; and
 3. Anti-Graffiti Coating; and
 4. Any remaining Work under the Contract.
2. Stronghand will retain a qualified subcontractor, acceptable to the COBA, to implement Supplemental Scope 4—Precast Wall/Steel Pile Connection Modifications as set forth in the Modifications to Tiger Hill Retaining Wall;
 1. Stronghand agrees to utilize a third-party inspector that is acceptable to the COBA to test all steel connections to the piles;
 2. All inspection correspondence, testing and field observation reports will be provided to the COBA and GAIC;
 3. Inspections to occur a minimum of three (3) times a week on site;
3. GAIC will remain actively involved in the monitoring of the Project until completion through regular consultation about the project with both Stronghand and the COBA, and

¹ Attached as Exhibit 1.

² Attached as Exhibit 2.

³ Attached as Exhibit 3.

will be copied on all correspondence and testing, and will attend progress meetings telephonically; GAIC will also engage its own independent construction consultant to visit the jobsite on a weekly basis. This consultant will prepare a report for GAIC summarizing his/her observations of the work being performed each week, which, in turn, GAIC will share with the COBA and Stronghand. These reports are for observational purposes only, however, and will have no binding authority on any party and the consultant will not be the arbiter of any disputes or the decision-maker as to any issues between the parties;

4. All litigation between COBA and Stronghand is stayed pending completion of the Project; the parties agree to the execution of any necessary pleadings with the Court to effectuate the intent of this provision;
5. The Performance Bond will remain in effect, the Warranty and Maintenance Bonds will be honored for past and future work;
6. Stronghand agrees to execute those agreements necessary to memorialize the Work to be completed;
7. Stronghand shall be provided 150 days from the date a Notice to Proceed is issued. The Contract terms regarding extra days, weather delays or other additional time will govern;
8. Consequences for Stronghand's failure to comply with time and/or quality agreements of Modifications to Tiger Hill Soldier Pile Retaining Wall and remaining Work shall be imposed pursuant to the Contract of \$1,000 per day as Liquidated Damages;
9. Stronghand will provide an updated construction schedule no less than every two (2) weeks;
10. GAIC will instruct the COBA to release the remaining Contract funds as earned; The total amount of \$347,226.16 are the remaining funds for the Project.
11. Any Liquidated Damages incurred in connection with the Modifications to Tiger Hill Soldier Pile Retaining or remaining Work wall shall remain the property of the COBA;
12. COBA agrees to withdraw the termination, but not the default or the bond claim, pending completion of the project;
13. If quality and timeliness requirements of the Project are met, the COBA will release its bond claim;
14. Once the project is completed, the parties to the litigation shall file the necessary pleadings for Stronghand v. COBA, Tulsa County District Court Case No. CJ-20-1738 that resolves all claims with prejudice by each party, with each party litigant to bear their own attorney fees.

By signature hereto, the parties intend this agreement to be a legally binding and enforceable settlement contract and acknowledge that the same has been entered without coercion or duress.

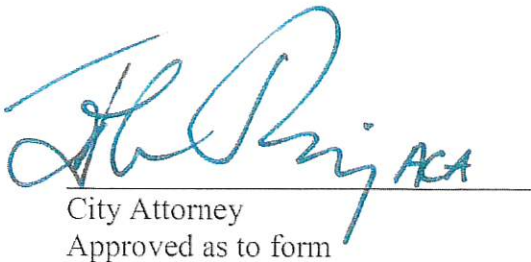
Approved as to content:

Chris Byrne
Rocky De-Herrera
Stronghand, LLC

Ryan Dierkers
Claim Mitigation Specialist, Bond Division
Great American Insurance Company



Craig Thurmond, Mayor, City of Broken Arrow



City Attorney
Approved as to form

13. If quality and timeliness requirements of the Project are met, the COBA will release its bond claim;
14. Once the project is completed, the parties to the litigation shall file the necessary pleadings to fully and finally resolve all claims asserted or that could have been asserted by the parties against one-another in that certain action styled Stronghand v. COBA, Tulsa County District Court Case No. CJ-20-1738, that resolves all claims with prejudice by each party, with each party litigant to bear their own respective costs and attorney fees.

By signature hereto, the parties intend this agreement to be a legally binding and enforceable settlement contract and acknowledge that the same has been entered without coercion or duress.

Approved as to content:

Chris Byrne

Digitally signed by: Chris Byrne
DN: CN = Chris Byrne email =
chris@stronghandllc.com C = US O =
Stronghand LLC
Date: 2020.09.04 08:16:12 -06'00'

Chris Byrne
Rocky De-Herrera
Stronghand, LLC

Ryan Dierkers
Great American Insurance Company

Craig Thurmond, Mayor, City of Broken Arrow

13. If quality and timeliness requirements of the Project are met, the COBA will release its bond claim.

14. Once the project is completed, the parties to this litigation shall file the necessary pleadings to fully and finally resolve all claims asserted or that could have been asserted by the parties against one another in that certain action styled Strongland v. COBA, Tulsa County District Court Case No. CF-20-1738, that resolves all claims with prejudice by each party, with each party obligated to bear their own respective costs and attorney fees.

By signature hereto, the parties intend this agreement to be a legally binding and enforceable settlement contract and acknowledge that the same has been entered without coercion or duress.

Approved as to content:

Chris Byrne
Rocky De-Huerta
Strongland, LLC


Ryan Dickers
Great American Insurance Company

Craig Thurmond, Mayor, City of Broken Arrow



BROKEN ARROW
Where opportunity lives

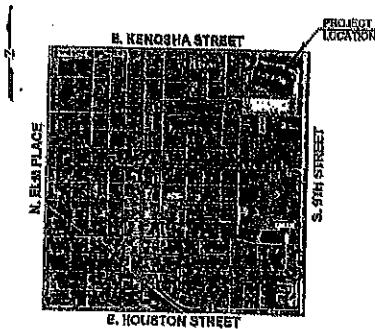
**MODIFICATIONS TO
TIGER HILL RETAINING WALL**
PROJECT NUMBER 0100

INDEX OF SHEETS

DESCRIPTION	SHEET
TITLE SHEET	
SECTION, CONST. SIG., & DET. NOTES	11.2
DETAILS	12.0

BROKEN ARROW CITY COUNCIL

MAYOR	GREG THURMAN
VICEMAYOR	SCOTT LUDY
COUNCIL	CHARLOTTE LEECH
COUNCIL	PAULA WILSON
COUNCIL	JOHN YORK



PROJECT LOCATION: SECTION 11, T-18-N, R-14-E, TULSA COUNTY



ONE OF SEVEN IN SEVEN PLANS AND SEVEN NOTES. SHEET 11.2 OF 11.2.
TULSA COUNTY, OK. AND CITY OF BOKER, OK. ARE APPROVED BY TULSA COUNTY ENGINEER
TRANSPORTATION DIVISION, TULSA COUNTY, OK. 10/11/11

APPROVAL

FOR THE CITY ENGINEER, OK
APPROVED CITY ENGINEER, OK

RECOMMENDED FOR APPROVAL

FOR THE CITY ENGINEER, OK
SECTION OF TULSA COUNTY ENGINEER

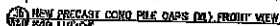
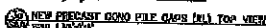
J. Skid
TULSA COUNTY ENGINEER



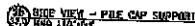
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NEAL L. FOSTER,

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2a PLAN VIEW - FILE MAP SUPPORT



FLUME-PILE INTERFACE PLAN (MYERNATE 1)



Calculations

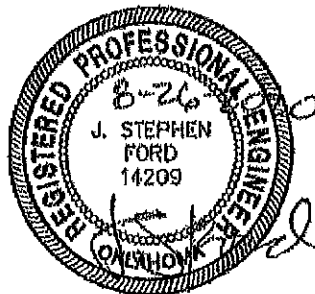
for

Modifications to Tiger Hill Soldier Pile Retaining Wall

ZFI ENGINEERING CO. PROJECT #20020-01

Prepared By:
Corey D. Casey, EI

Reviewed By:
J. Stephen Ford, PE, SE



ZFI Engineering Co.
8411 S. Walker Ave.
Oklahoma City, OK 73139
Ph: 405-634-3393

Cert. of Auth. #CA-994
Exp. 6/30/21



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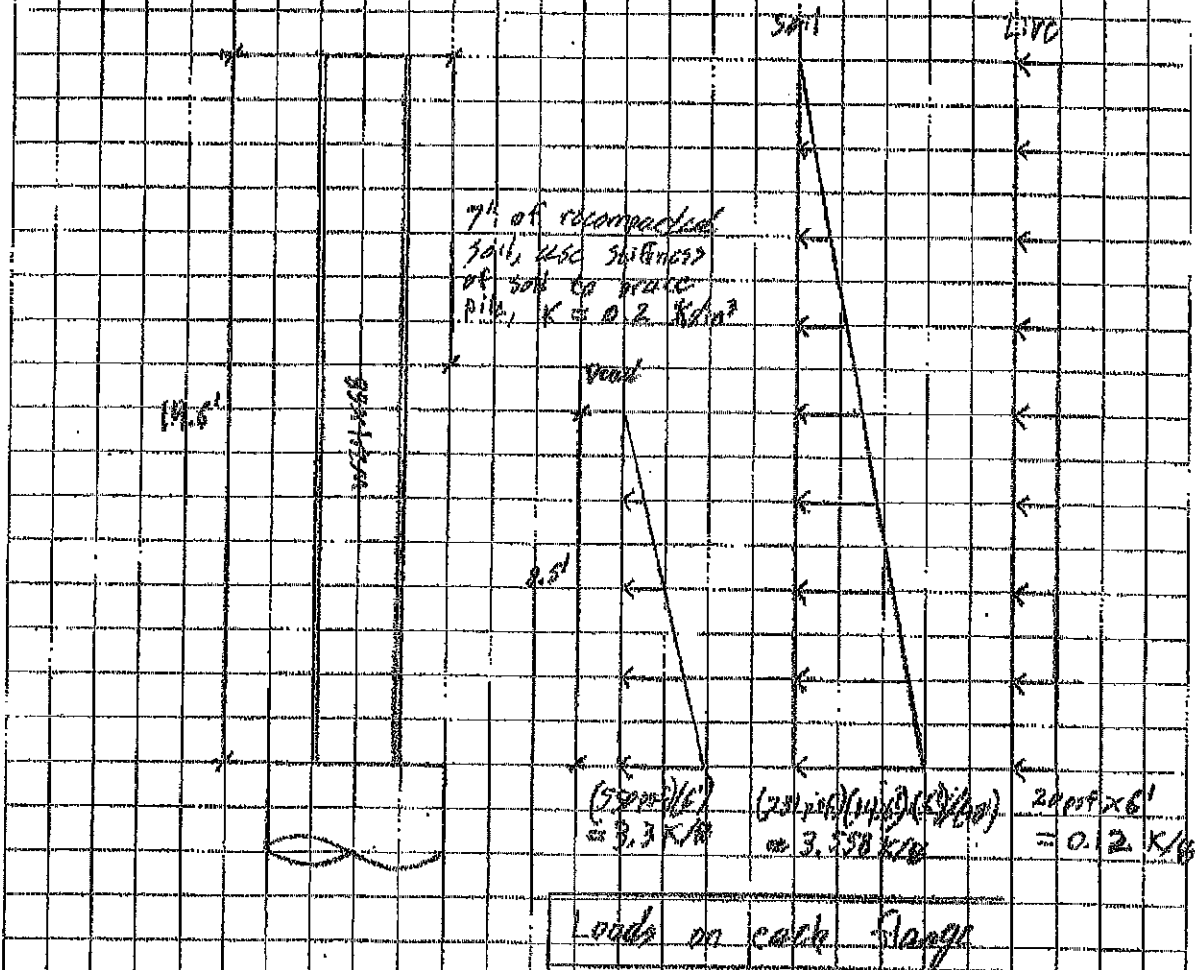
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2. COVER PLATE DESIGN	17
A. COVER PLATE SIZING	17
B. WELD SIZE AND SPACING	19
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[illegible]

PROJECT: Tiger Hill Soldier Pile
SUBJECT: Pile Torsion Analysis

PROJECT #: 20020-01 DATE: 20-Aug-2020
SHEET NO: 1/ BY: ODC

The following represents the worst case loading condition for the smallest pile w/ the most retained soil which occurs at Sta 18+52.00. The loading was per Olsson's drawings.



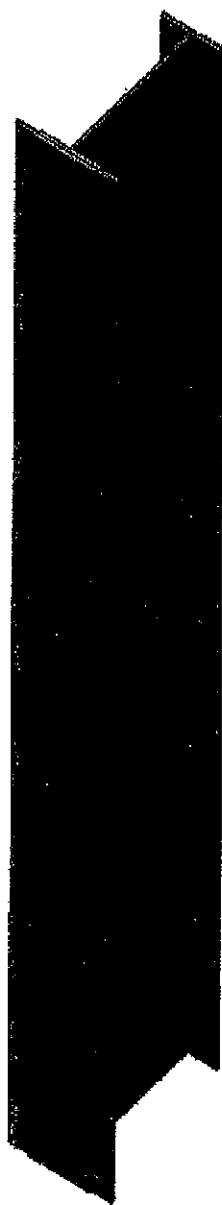
Capacity:

$$\sigma_{max} = \phi F_y = 0.9(50 \text{ Ksi}) = 45 \text{ Ksi} \quad (\text{Flexure + Torsion})$$

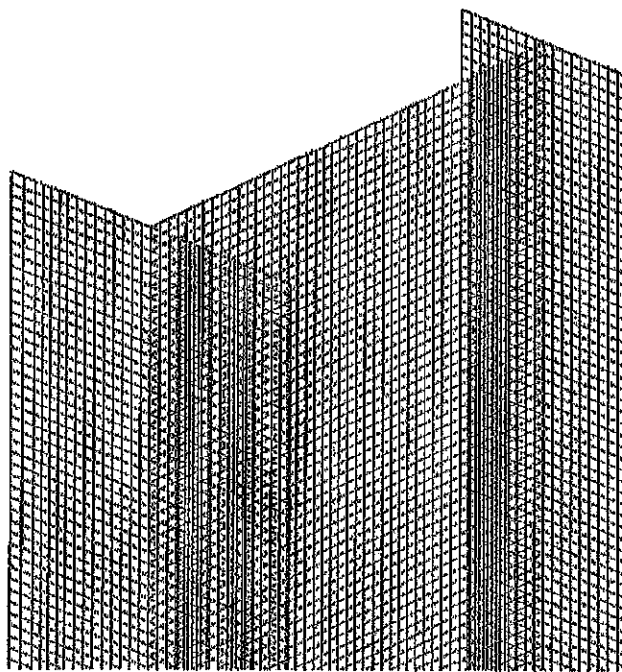
$$\tau_{max} = \phi 0.6 F_y = 0.9(0.6)(50 \text{ Ksi}) = 27 \text{ Ksi} \quad (\text{Shear + Torsion})$$

1. W24x68 with cover plate

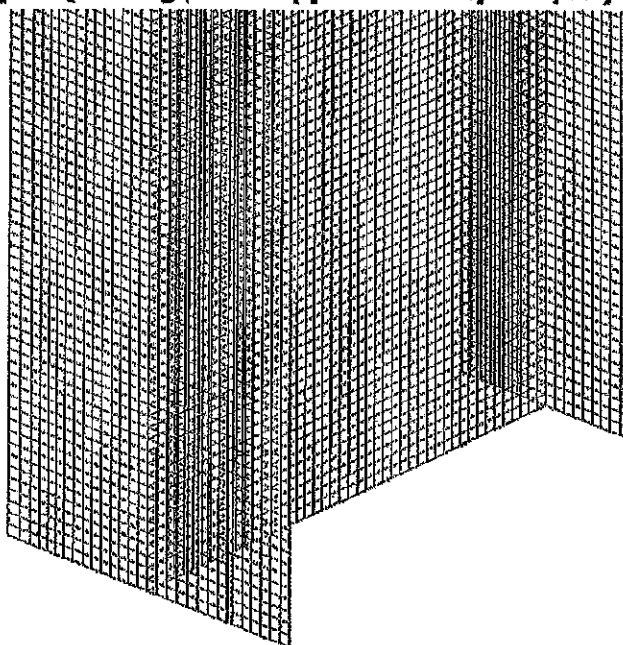
THE WORST PANEL BEARING ECCENTRICITY OCCURS ON A W24x76 PILE. A W24x68 IS THE SMALLEST PILE USED ON THE WALL AND HAS THE WORST TORSIONAL AND FLEXURAL PROPERTIES. THE ANALYSIS OF THE W24x68 WILL BE THE WORST CASE SENERIO AND BY INSPECTION WILL PROVE THE ADEQUECY OF ALL THE PILES.



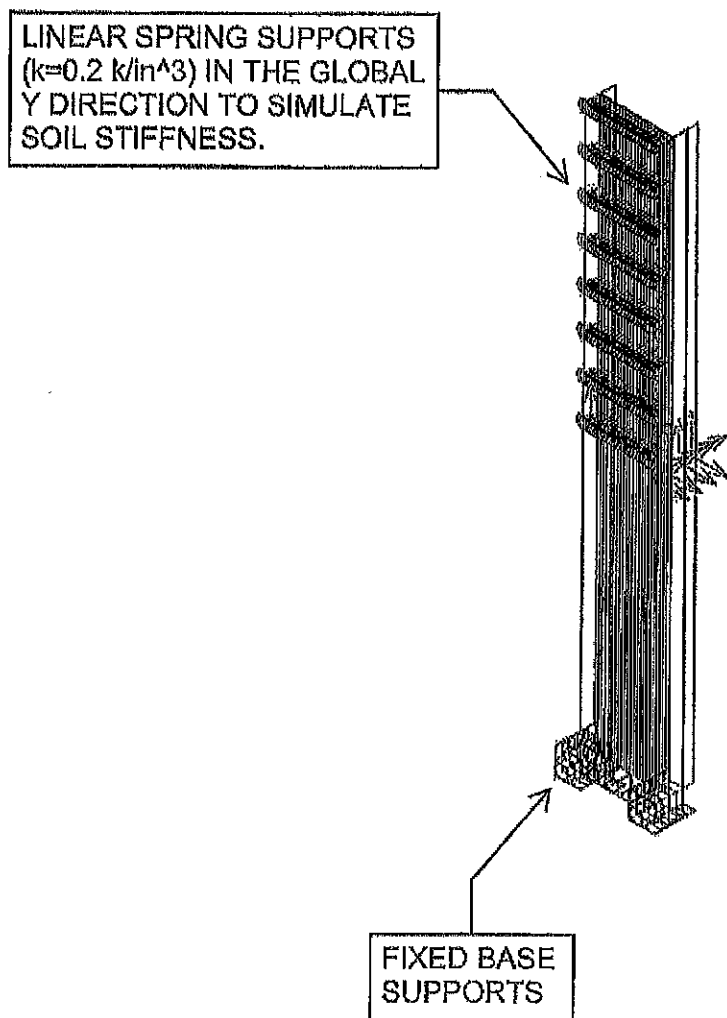
2. Mesh at top of pile (average size approximately = 1/2")



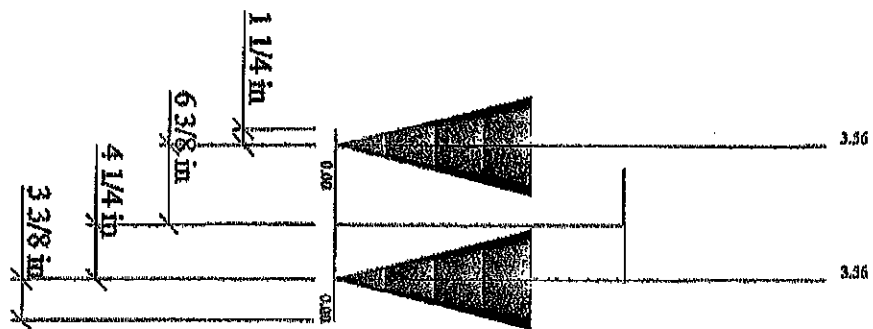
3. Mesh at bottom of pile (average size approximately = 1/2")



4. Supports

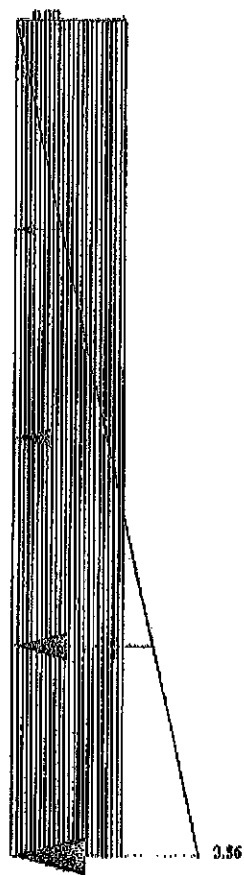


5. Eccentric flange loading (showing soil load)



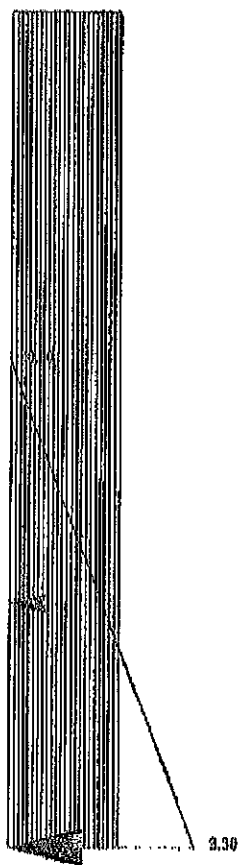
1
x

6. LC4 / Soil load (service)

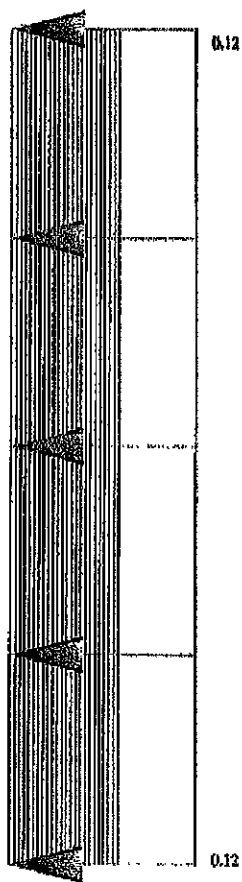


x
y

7. LC2 / Dead load (service)

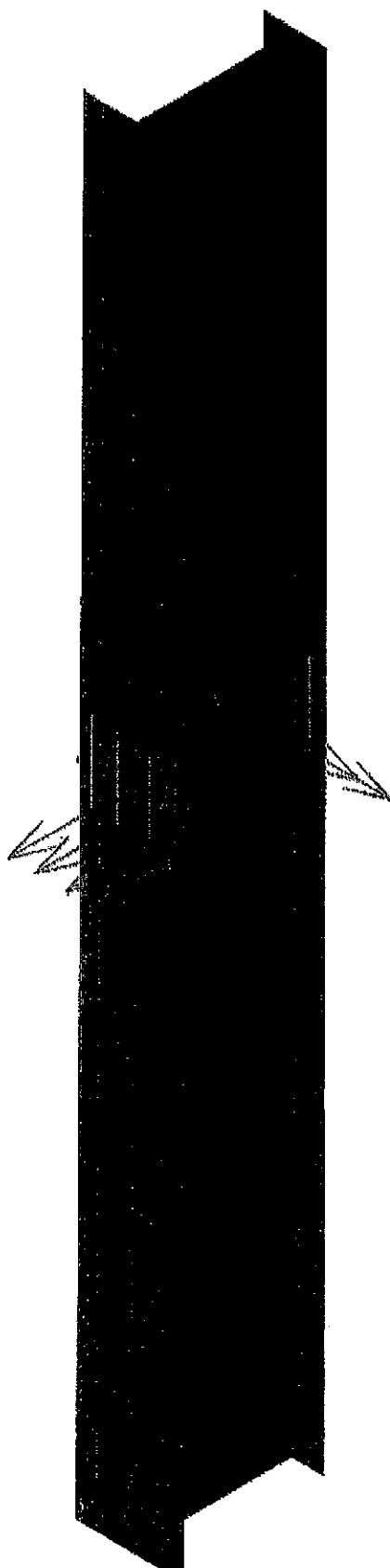


8. LC3 / Live load (service)



X

9. Orientation of 2D plate local axes



10. Total displacement

Values: U_{total}

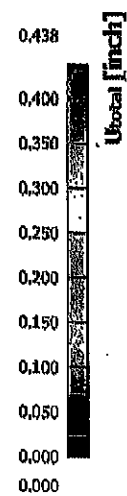
Linear calculation

Combination: D + L + H

Selection: All

Location: In nodes avg.. System:

Global

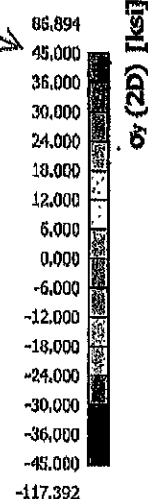


11. Local axis σ_y (vertical normal stress)

Values: σ_y (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes

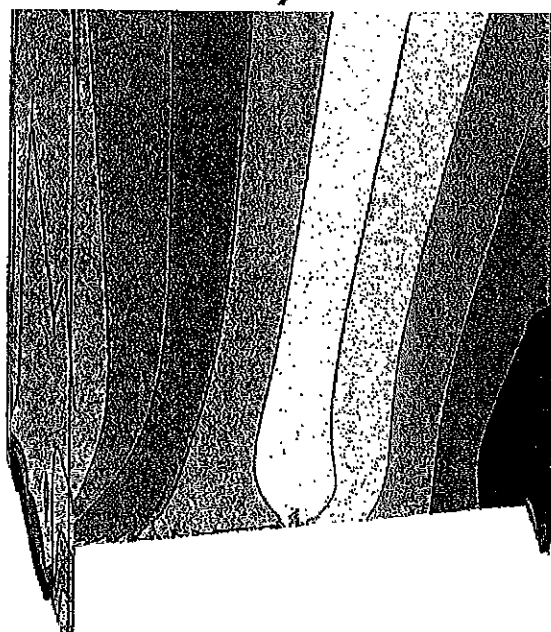


CAPACITY:
 $0.9F_y = 45 \text{ ksi}$

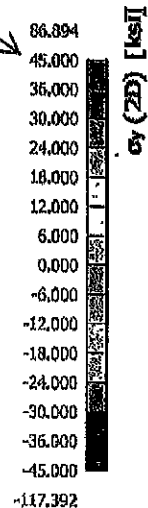


12. Local axis σ_y (vertical normal stress)

Values: σ_y (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes

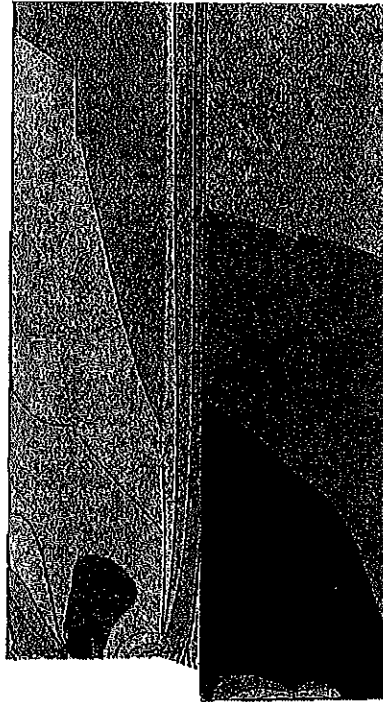


CAPACITY:
 $0.9F_y = 45 \text{ ksi}$

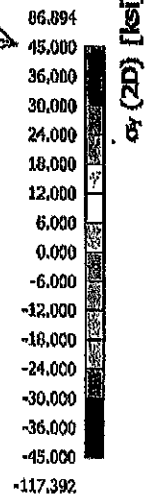


13. Local axis σ_y (vertical normal stress)

Values: σ_y (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes

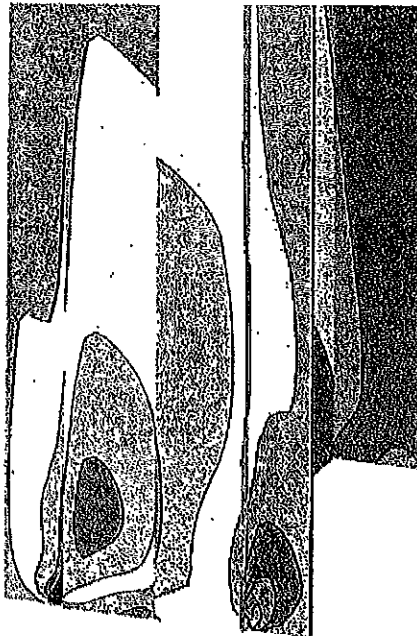


CAPACITY:
 $0.9F_y = 45 \text{ ksi}$

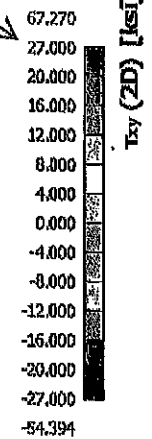


14. Local axis τ_{xy} (in-plane shear stress)

Values: τ_{xy} (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes

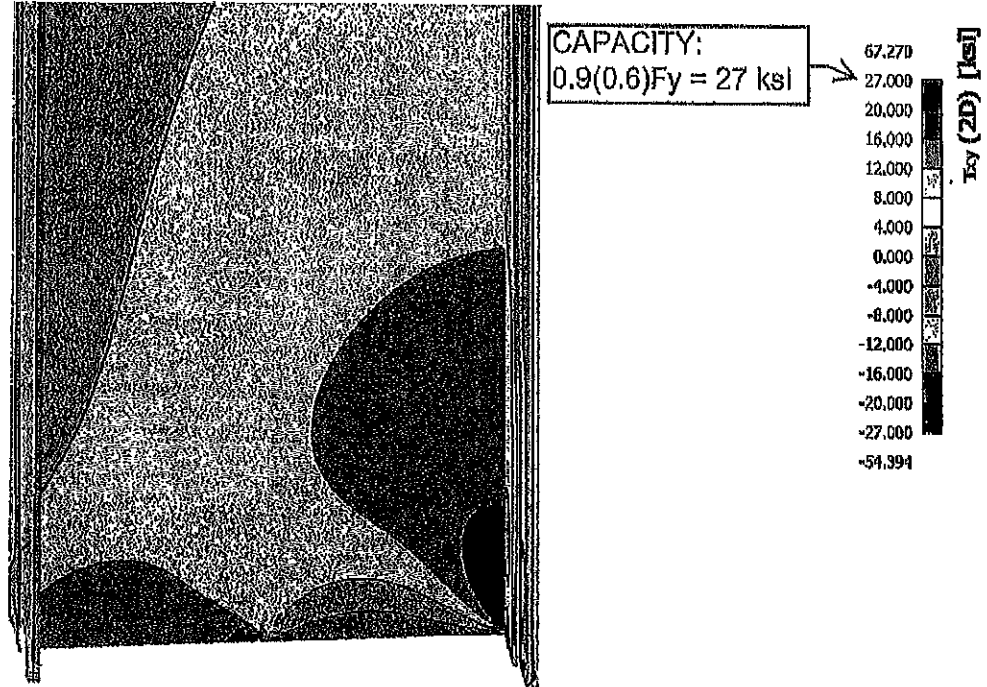


CAPACITY:
 $0.9(0.6)F_y = 27 \text{ ksi}$



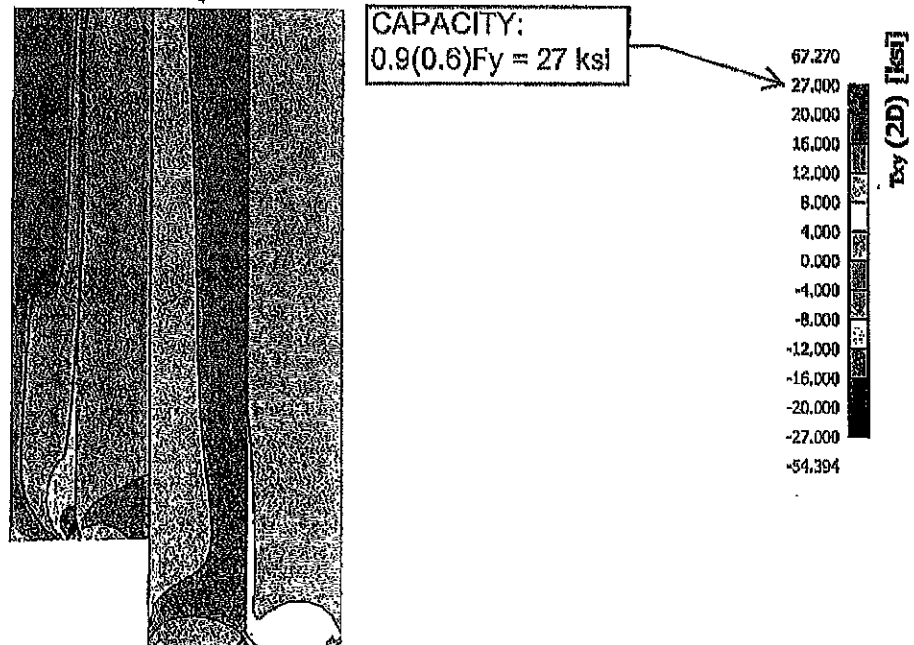
15. Local axis τ_{xy} (in-plane shear stress)

Values: τ_{xy} (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes



16. Local axis τ_{xy} (in-plane shear stress)

Values: τ_{xy} (2D)
 Linear calculation
 Combination: 1.2D + 1.6L + 1.6H
 Selection: All
 Location: In nodes avg. on macro.
 Rotation of the planar system:
 LCS-Member 2D
 Basic magnitudes





structural calculations

PROJECT: Tiger Hill Retaining Wall

PROJECT #: 20020-01 DATE: 10-Jan-2020

SUBJECT: Cover Plate Solution

SHEET NO: 1

BY: CDL

Design parameters:

Lateral soil pressure $= 7.31 \text{ psf}$

Dead load pressure $= 550 \text{ psf}$

Live load pressure $= 20 \text{ psf}$

Truck width $= 6'$

Pile height $= 16.3'$

max plate height occurs
at $56 + 36.00$

Max pressure occurs @ base of pile

$q = (1.2 \text{ psf}) (6')$
Load on Plate:

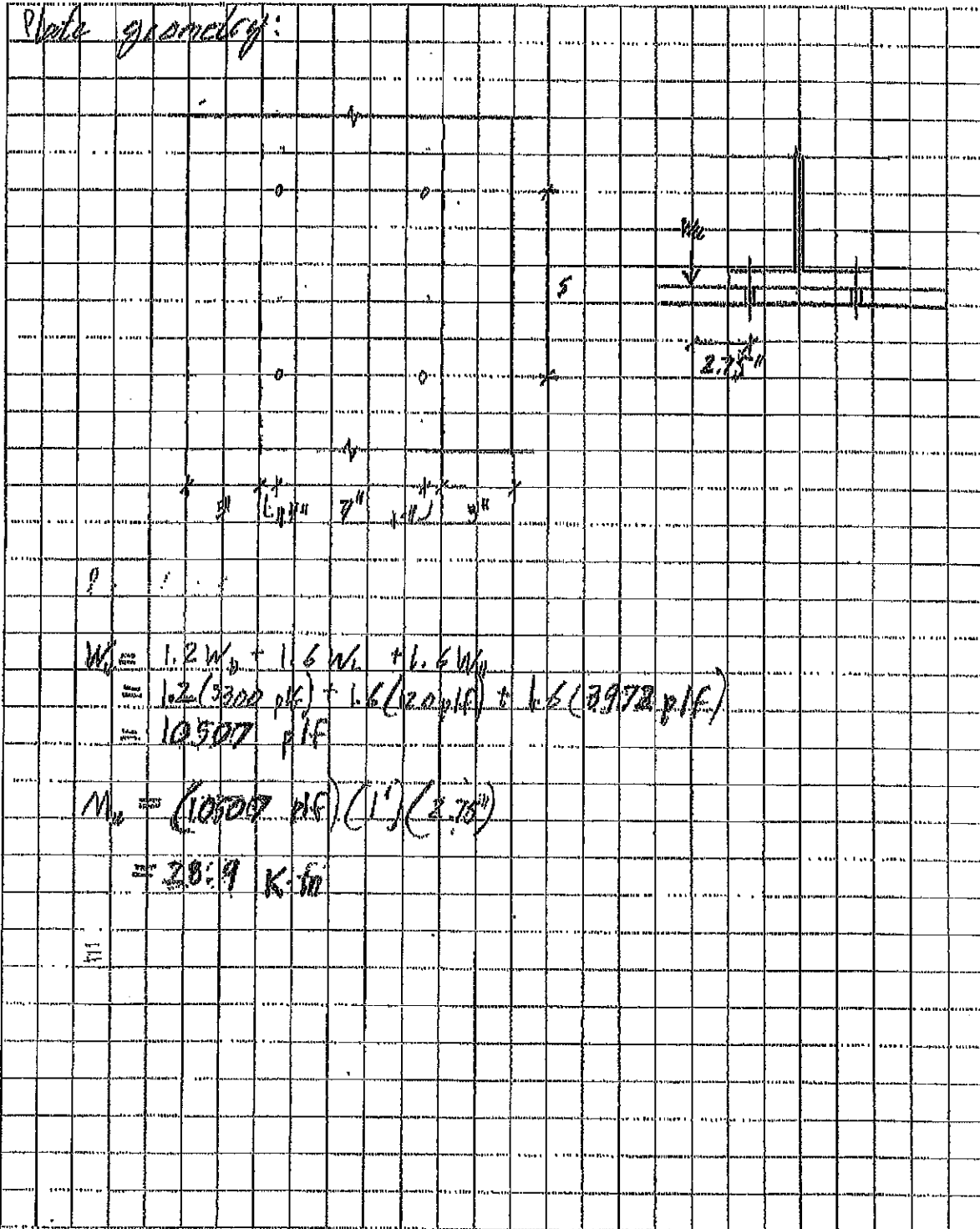
$$W_1 = (7.31 \text{ psf}) (6') (16.3') / 18'$$
$$= 397.2 \text{ plf}$$

$$W_2 = (20 \text{ psf}) (6')$$
$$= 120 \text{ plf}$$

$$W_3 = (550 \text{ psf}) (6')$$
$$= 3300 \text{ plf}$$

PROJECT: Tiger Hill Retaining Wall PROJECT #: 20070-01 DATE: 11/11/2008
SUBJECT: Cover Plate Selection SHEET NO: 2/ BY: CDK

Plate geometry:



$$\begin{aligned} W_d &= 1.2 W_d + 1.6 W_L + 1.6 W_{LL} \\ &= 1.2(3300 \text{ p.f.}) + 1.6(120 \text{ p.f.}) + 1.6(7972 \text{ p.f.}) \\ &= 10507 \text{ p.f.} \end{aligned}$$

$$\begin{aligned} M_u &= (10507 \text{ p.f.})(1')(2.75') \\ &= 28.9 \text{ K-ft} \end{aligned}$$

PROJECT: Tiger Hall Retaining Wall

PROJECT #: 20020-01

DATE: 19-Jun-2020

SUBJECT: Corner Plate Solution

SHEET NO: 3/

BY: CDC

Plate size:

Try $1/2"$ PL GR 50

$$Z = \frac{bh^2}{4}$$

$$= \frac{(12") (1/2")^2}{4}$$

$$= 0.75 \text{ in}^3$$

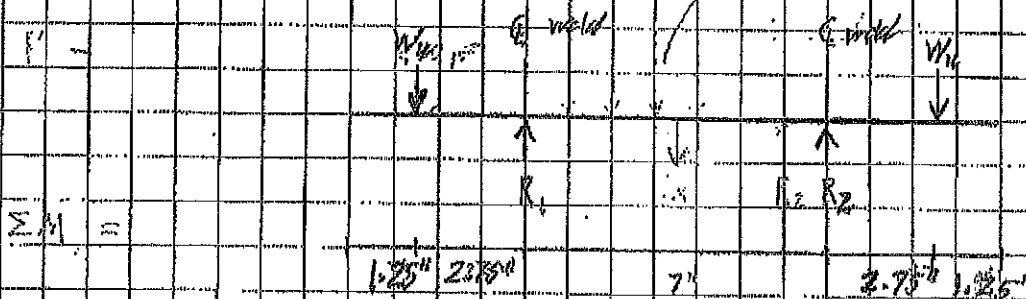
$$\phi M_p = \phi F_y Z$$

$$= 0.9 (50 \text{ ksi}) (0.75 \text{ in}^3)$$

$$= 33.75 \text{ K-in} > M_u = 28.9 \text{ K-in}$$

$\therefore 1/2"$ PL GR 50 OK

Weld Load & Size:



$$\sum M_A = R_2 \cdot 7 = W_1 \cdot 1.25 = 0$$

$$\Rightarrow R_1 = R_2 = 10.51 \text{ K/in}$$

PROJECT: Tiger Hill Retaining Wall

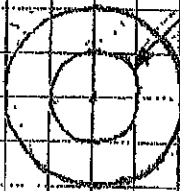
PROJECT #: 20020-01 DATE: 22-Jun-2020

SUBJECT: Corner PL Solution

SHEET NO: 1/

BY: CDC

Try = 1" Plug Weld @ 12"



Centerline of
fillet weld w/
circumference, ϕ
Outside diameter
of plug weld = 1"

$$L_w = \text{Circumference} = \pi \phi D$$

$$= 0.5" (3.1415)$$

$$= 1.57 \text{ in}$$

$$\phi R_n = 1.392 D / \phi$$

$$= 1.392 (8) (1.57 \text{ in})$$

$$= 17.48 \text{ K} / \phi \quad \phi R_n = R_n = 10.5 \text{ K}$$

AISC B-8
Assumed 1/2"
fillet weld

$\therefore$ Use 1" plug weld @ 12" O.C.

PROJECT: Tiger Hill Retaining Wall PROJECT #: 20020-01 DATE: 23-JUN-2020
SUBJECT: Cover PL Solution SHEET NO: 5/ BY: CDK

Bearing stress of panel on cover fl or flange:

$$\begin{aligned} \sigma_b &= W_u / (l_b \cdot t) \\ &= 10507 \text{ lbs} / (12 \text{ in} \cdot 1 \text{ in}) \\ &= 876 \text{ psi/in}^2 \end{aligned} \quad \text{Assume } 1'' \text{ bearing width}$$

$$\begin{aligned} \phi_c^b (0.85) &= 0.65 (0.85) (5000 \text{ psi}) \\ &= 2762 \text{ psi} \end{aligned} \quad \begin{array}{l} \text{Concrete bearing} \\ \text{strength} \\ \text{ACI 22.8} \end{array}$$

$$\begin{aligned} \text{ratio} &= 876 \text{ psi} / 2762 \text{ psi} \\ &= 0.317 \end{aligned}$$

- or -

Approximately 5/16" bearing
necessary at bottom of wall.
Friction w/ concrete cover will
provide additional resistance

PROJECT: Tiger Hill Soldier Pile PROJECT #: 20020-01 DATE: 06-Aug-2020
SUBJECT: Pile Cap Supports SHEET NO: 1/ BY: CDC

Check Angles used at back of piles

Try angles L1 1/2 x 1 1/2 x 1/4 GR 36

Check compression slenderness

$$b/t = 1.5" / 0.25" = 12$$

$$0.451 \sqrt{E/F_y} = 0.451 \sqrt{29,000 \text{ ksi} / 36 \text{ ksi}} = 12.77$$

$\therefore$ non-slender

Check flexural torsional buckling

$$0.71 \sqrt{E/F_y} = 0.71 \sqrt{29,000 \text{ ksi} / 36 \text{ ksi}} = 20.15$$

$\therefore$ don't need to check

Check flexural buckling

$$L_{e, \max} = KL$$

$$K = 2.1$$

$$L = 12 \text{ in max}$$

$$L_{e, \max} = 25.1 \text{ in}$$

$$r = 0.4651$$

P_u
↓

11/11/21

PROJECT: Tiger Hill Soldier Pile PROJECT #: 20020-1 DATE: 06-Aug-2020
SUBJECT: Pile Cap - Super SHEET NO: 2/ BY: CDC

Vertical angles used at back of piles cap

$$L_e/r = 25.2" / 0.4651$$

$$= 54.2$$

$$4.71\sqrt{E/F_y} = 4.71\sqrt{29,000 \text{ ksi} / 36 \text{ ksi}}$$

$$= 133.8$$

$$\Rightarrow F_{cr} = (0.658^{F_y/E}) F_y$$

$$F_c = \frac{\pi^2 E}{(L_e/r)^2}$$

$$= \frac{\pi^2 (29,000 \text{ ksi})}{54.2^2}$$

$$= 97.4 \text{ ksi}$$

$$F_{cr} = (0.658^{97.4/36}) (36 \text{ ksi})$$

$$= 30.84 \text{ ksi}$$

$$P_n = F_{cr} A_g$$

$$A_g = 0.359 \text{ in}^2$$

$$P_n = (30.84 \text{ ksi}) (0.359 \text{ in}^2)$$

$$= 11.07 \text{ K}$$

$$\phi P_n = 0.9 (11.07 \text{ K})$$

$$= 9.96 \text{ K}$$

PROJECT: Tiger Hill Soldier Pile PROJECT #: 20020-01 DATE: 06-Aug-2020
SUBJECT: Pile Cap Support SHEET NO: 3/ BY: CDK

Weld Angles used @ back of Piles cont.

Axial Load

$$P_u = P_o V_{ps} (1/2) (1.2) \text{ each angle}$$

$$\begin{aligned} V_{ps} &= \text{side face} + \text{front face} + \text{back face} + \text{top} \\ &= (2.33') (0.5') (1.48) + (0.5') (3.72') (2) (2) + (0.5') (2') (3.25') \\ &= 8.79 \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} P_u &= (1.2) (1/2) (8.79 \text{ ft}^2) (0.530 \text{ Kcf}) \\ &= 0.791 \text{ K} \end{aligned}$$

$$\phi R_n > P_u \quad \therefore \text{OK}$$

Weld at base

cont.

$$\phi R_n = 1.392 \text{ DL}$$

$$l = Z_{in} \text{ min}$$

$$d = Z_{(1/2" \text{ weld})}$$

$$\begin{aligned} \phi R_n &= 1.392 (2) (2) \\ &= 5.57 \text{ K} \end{aligned}$$

$$\phi R_n > P_u \quad \therefore \text{OK}$$

PROJECT: Tiger Hill Soldier Pile
SUBJECT: Pile Cap Support

PROJECT #: 20020-01 DATE: 06-Aug-2020
SHEET NO: 4/ BY: CDC

Horiz angle @ front of pile, $T_{1/2} 1.3 \times 2 \times 3/16$
Distributed load @ moment in horizontal leg of angle

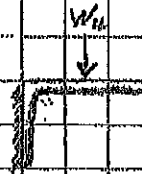
$$P_u = (0.791 \text{ K})(1.5) \\ = 1.187 \text{ K}$$

Assume 3/4 the pile cap weight is on angle. Conservative.

$$W_u = P_u / l_{angle}$$

$$l_{angle} = 14 \text{ in}$$

$$W_u = 1.187 \text{ K} / 14 \text{ in} \\ = 0.085 \text{ K/in}$$



Assume load acts @ midpoint of angle, $e = 1.5 \text{ in}$

$$M_u = W_u e \\ = (0.085 \text{ K/in})(1.5 \text{ in}) \\ = 0.127 \text{ K/in} \cdot \text{in}$$

Angle capacity

$$\phi = \frac{b^3}{4} \quad \text{for } 1 \text{ in width of angle} \\ = \frac{(1 \text{ in})^3}{4} \\ = 0.00875 \text{ in}^3$$

$$M_u = F_y \phi \\ = (36 \text{ ksi})(0.00875 \text{ in}^3) \\ = 0.315 \text{ K/in} \cdot \text{in}$$

$$\phi M_u = 0.9(0.315 \text{ K/in} \cdot \text{in}) \\ = 0.283 \text{ K/in} \cdot \text{in} > 0.127 \Rightarrow 0.127 \text{ K/in} \cdot \text{in}$$

PROJECT: Tiger Hill Soldier Pile PROJECT #: 20020-01 DATE: 07-Aug-2020
SUBJECT: Pile Cap Support SHEET NO: 5/ BY: GDK

Weld Design:

Req 1/2" weld/c

$R = 11.392 \text{ kips}$

$\phi R_n = 1.392 \text{ D1}$

$= 3.1392 (2) (1)$

$= 11.1 \text{ kips} > P_u = 11.392 \text{ kips}$

$\phi_w = 1.1$

$= 1.1 \text{ weld/c}$

$= 1.1 \text{ (2) (1)}$

$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$

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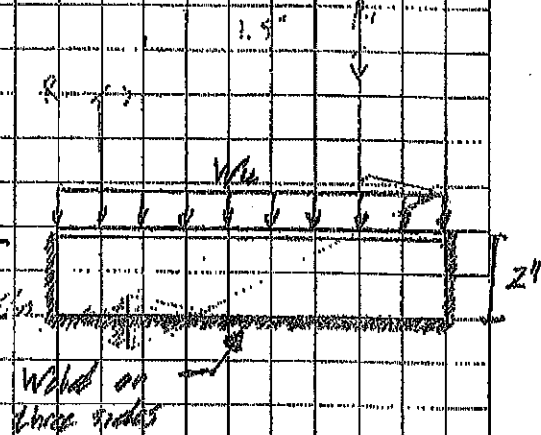
$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$

$= 1.1 \text{ kips}$





Engineering and Construction Department
435 North Poplar Avenue
Broken Arrow, OK 74012
Ph. (918) 259-7000 ~ Fax (918) 259-8433

<u>Periodic Estimate for Payment Change Order Summary</u>			
<u>Approved Change Orders</u>			
Number	Additions	Deductions	Days Added
1	\$75,900.00		
2	\$4,725.51		
TOTALS	\$80,625.51		
NET CHANGE BY CHANGE ORDERS		\$80,625.51	

Note: Reimburse for this project is not applied to Stored Materials 2/6/19

Payment of \$ 347,225.16 TO: Stronghold, LLC

Is Recommended By

Signature _____ Date _____ Contract Administrator (Print) _____

Signature _____ Date _____ Timothy Robins, PE
Construction Division Manager

Not for Issuance

Signature _____ Date _____

Kenneth J. Smyth, PE
Assistant City Manager
Operations

Contractors Certification

The undersigned Contractor certifies that to the best of its knowledge (1) all previous progress payments received from Owner on account of Work done after the Contract has been applied in accordance to discharge Contractor's liability to obligations incurred in connection with Work covered by prior Applications for Payment (2) this bill of Work, materials and equipment incorporated in and Work or obligations listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances except such as are created by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interests or encumbrances, and (3) all Work covered by this Application for Payment is in compliance with the Contract Documents and in fact complete.

Date: _____ By: (Signature & Title) _____

**The City of Broken Arrow Payment Application
Payment Authorization Summary**



Periodical Estimate - Unit Price Work

Contractor's Application

For (Contract):	Tiger Hill Solder Pile Retaining Wall		Contract Number:		171703		Application Period:		To		
Contractor:	Strongland, LLC		Application Number:		Proposed Unit		Application Date:				
Item											
Bid Item No.	Description	Units	Bid Item Quantity	Unit Price	Bid Item Value (\$)	Quantity Installed Previously	Quantity Installed This Period	Total Requested This Period (\$)	Total Installed to Date	% Installed	Balance to Finish
1	CLSM Backfill	CY	200.0	\$ 127.83	\$25,566.00	41.00			\$3,241.03	20.3%	\$20,324.97
2	Structural Steel	LB	354,260.0	\$ 0.95	\$336,547.00	349,143.00			\$331,687.75	98.6%	\$4,859.25
3	Class C Concrete	CY	240.0	\$ 234.36	\$56,246.40		123.00	\$28,826.28	\$28,826.28	51.3%	\$27,420.12
4	Retaining Wall	SY	1,780.0	\$ 363.90	\$645,302.00	1,716.00			\$23,417.60	100.0%	
5	(SP) Gravel Treatment	SP	14,990.0	\$ 3.73	\$55,912.70		14,990.00	\$55,912.70	\$55,912.70	100.0%	
6	(PL) Pilot Holes	LP	2,038.0	\$ 45.50	\$92,729.00	2,038.00			\$92,729.00	100.0%	
7	8" Perforated Pipe Underdrain Round	LP	1,020.0	\$ 24.05	\$24,531.00	1,020.00			\$24,531.00	100.0%	
8	Removal of Concrete Pavement	SV	453.0	\$ 16.54	\$7,493.70						
9	Nyloplast 24" Drain Basins w/Standard H-20 Rapid Opn	BA	2.0	\$ 4,166.17	\$8,332.34		1.00	\$4,166.17	\$4,166.17	50.0%	\$7,525.70
10	Nyloplast Concrete Area Inlet with Base Plate and Dog	BA	2.0	\$ 7,979.82	\$15,959.64		1.00	\$7,979.82	\$7,979.82	50.0%	\$7,979.82
11	15" HDPE Pipe	LP	43.0	\$ 53.84	\$2,314.32		34.00	\$1,830.56	\$1,830.56	79.1%	\$753.76
12	Subcontract	CY	7,682.0	\$ 11.38	\$86,632.06		7,682.00	\$86,632.06	\$86,632.06	100.0%	
13	Unasphalted Excavation	CY	563.0	\$ 30.19	\$16,895.97		563.00	\$16,895.97	\$16,895.97	100.0%	
14	Type A-Engineered Topsoil	LS	1.0	\$ 22,050.00	\$22,050.00						\$22,050.00
15	Seedling Method A	AC	0.41	\$ 2,475.59	\$1,014.99		0.41	\$1,014.99	\$1,014.99	100.0%	
16	Mobilization	LS	1.0	\$ 80,600.22	\$80,600.22	1.00			\$80,600.22	100.0%	
Change Orders											
C01-1	Dirt work	LS	1	\$49,500.00	\$49,500.00	1.00			\$49,500.00	100.0%	
C02-1	Wall work	LS	1	\$20,075.00	\$20,075.00	0.66			\$13,249.50	66.0%	\$6,825.50
C01-3	Drainage	GS	1	\$6,325.00	\$6,325.00	1.00			\$6,325.00	100.0%	
C02-1	Storm Sewer Conflict	LS	1	\$4,725.36	\$4,725.36	0.89	0.11	\$510.81	\$4,725.36	100.0%	
Total Stored Materials Remaining								\$3,688.22			
Totals					\$1,579,336.00			\$241,447.86	\$1,481,089.75	93.8%	\$101,506.25

DRAFT

Not for Issuance

The City of Tucson Arrete Payment Application
Unit Price Project Costs Break Down

Contractor's Application

Not for Issuance

The City of Broken Arrow Payment Application Stored Materials List