



PLANT SYSTEMS GROUP - SALT LAKE CITY, UTAH

CALCULATION COVER SHEET

JOB NUMBER	CLIENT	PROJECT	CALC. NUMBER
11021	CC&V	High Grade Mill	C014

TITLE/SUBJECT:

CC&V High Grade Mill Concentrate Thickener Area Retaining wall and Foundations

STATEMENT OF PROBLEM:

Design Foundations for the Concentrate Thickener
Design Retaining wall for the containment area, including weir design for overflow

P.E. SEAL



SOURCES OF DATA, FORMULA & REFERENCES:

IBC 2003
ASCE 7-02
ACI 318-02
Foundation loadings from AutoDesk Robot Structural Analysis Professional 2012 in S-015/Combined Mill Building (Ver 6)
Foundation 3D
Enercal Structural Library
Soils Report by AMEC

CONCLUSIONS & RECOMMENDATIONS:

See details in report

A	Jun-12	Ready for Check	CCK/ECS	WC		
0	Jul-12	Issued for Permit	CCK/ECS	WC		
REV	DATE	DESCRIPTION/STATUS	CALC BY	CHKD BY	DWG./SPECS REVISED	QA REVIEW



PLANT SYSTEMS GROUP - SALT LAKE CITY, UTAH

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SOURCES OF DATA, FORMULA & REFERENCES:

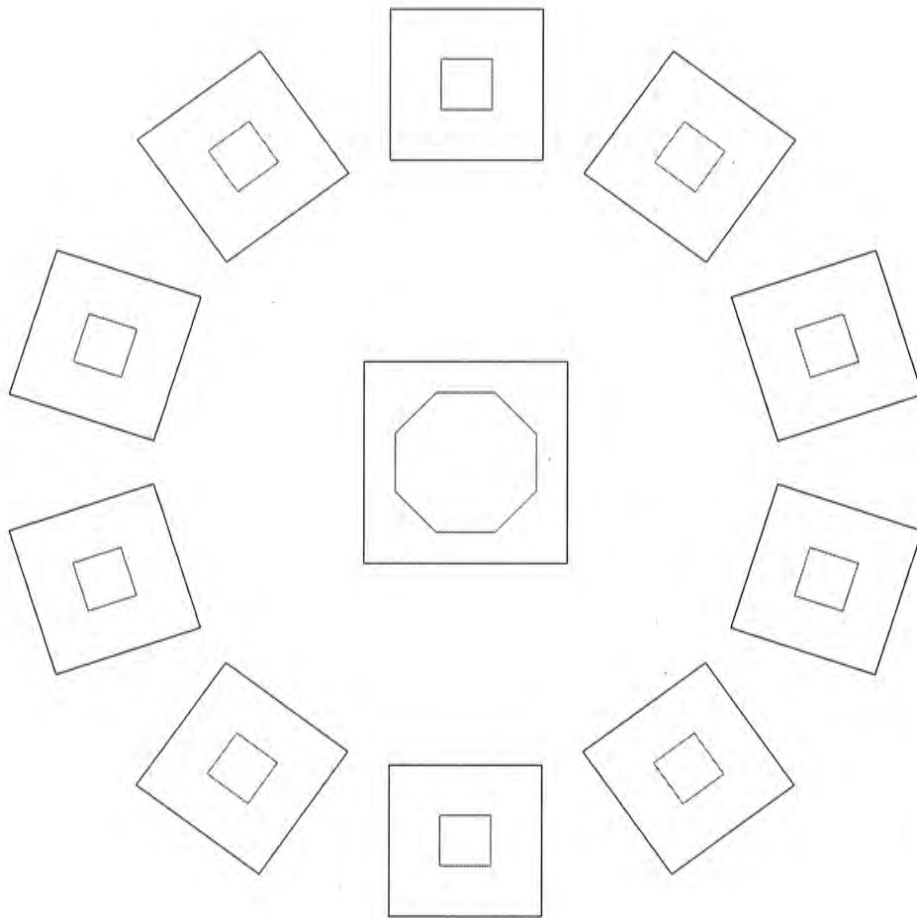
IBC 2003
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CONCLUSIONS & RECOMMENDATIONS:

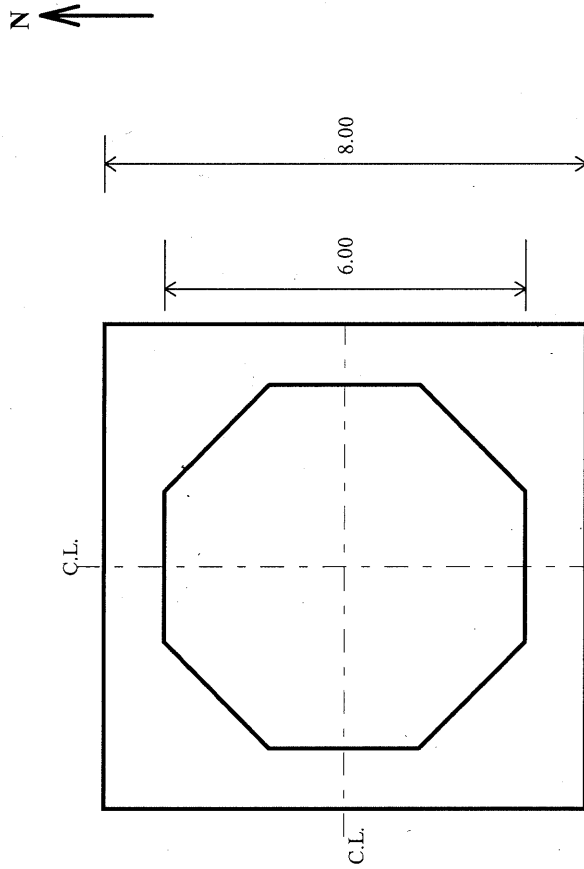
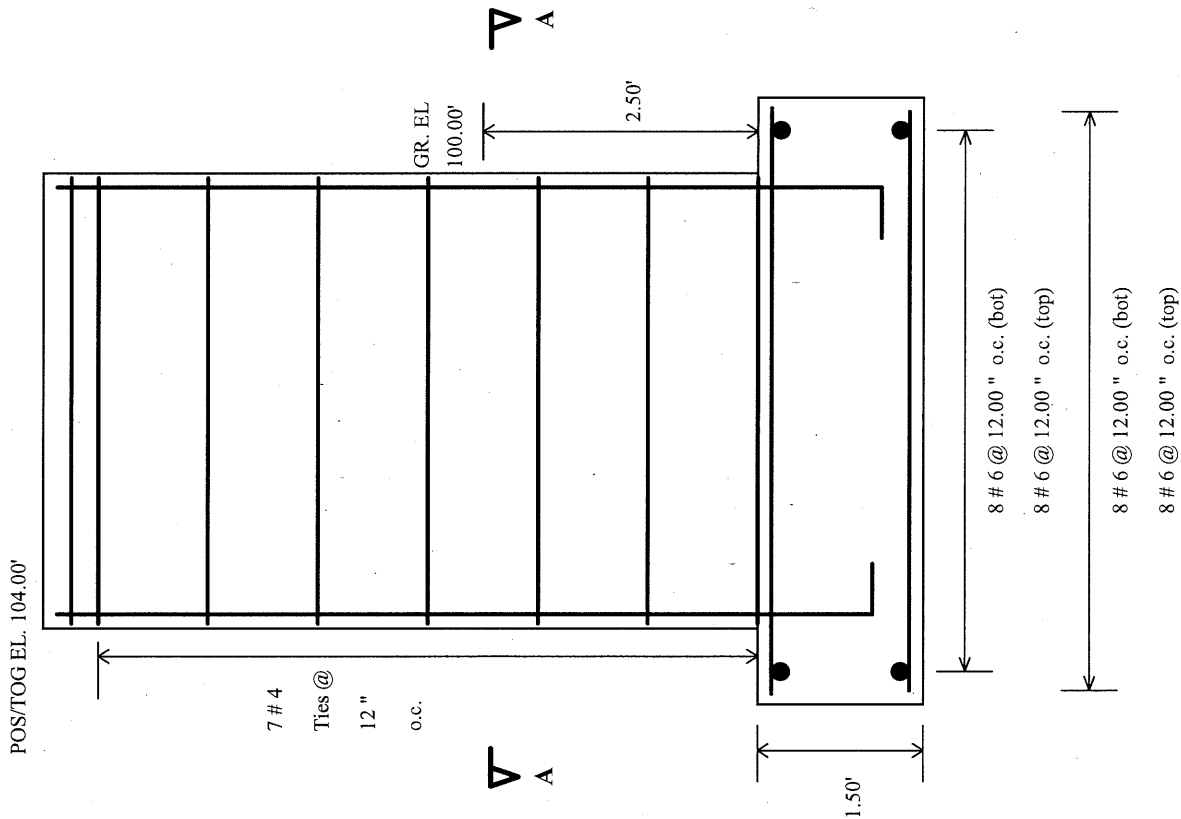
See details in report

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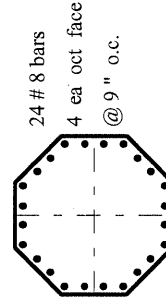
View - Cases: 1 (Self Weight)

CONCENTRATE THICKENER FOUNDATIONS

Proj. No.: 11021 Engr: WChan Date: 3/15/2012 Checker: Date:



PLAN (1 REQD.) (All dimensions in ft)



SECTION A-A

MATERIAL QUANTITIES			
CONCRETE	10.6 (CY)	GROUT	2.417 (CF)
FORMWORK	204.0 (SF)	ANCH	0.0 (LB)
REINF. STEEL	994.2 (LB)		
EXCAVATION	39.7 (CY)	ABOVE GRADE	
		FINISH	96.0 (SF)

FOUNDATION PLAN & ELEV FOR
CENTER COLUMN

ELEVATION LOOKING NORTH

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
Foundation Name	Center Column		Time	9:48:45 AM
Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\116.d	Architect		
	Center Column.mcs			

DETAIL REPORT FOR Center Column**PROJECT INFORMATION**

Project Name: CC&V High Grade Mill
Project Number: 11021
Client: CC&V
Project Location:
Foundation Description: FOUNDATION

DESIGN CODE: ACI 318 - 2008 **INPUT UNITS:** English **OUTPUT UNITS:** English

CONCRETE PARAMETERS:

Compressive Strength (psi) 4000
 Unit Weight (pcf) 150
 Pier Concrete Cover - E-W Dir (in) 2
 Pier Concrete Cover - N-S Dir (in) 2
 Footing Side Concrete Cover - E-W Dir (in) 3
 Footing Side Concrete Cover - N-S Dir (in) 3
 Footing Top Concrete Cover (in) 2
 Footing Bottom Concrete Cover - X Dir (in) 3

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi) 60
 Unit Weight (pcf) 490
 Modulus of Elasticity (ksi) 29000
 Pier Min Rebar Spacing (in) 3
 Footing Min Rebar Spacing (in) 6
 Footing Max Rebar Spacing (in) 18

SOIL PARAMETERS:

Unit Weight (pcf) 120
 Allowable Net Bearing Capacity (psf) 4000
 Bearing Capacity Method Linear Soil Pressure
 Soil Type Granular
 Passive Pressure Coefficient Kp 3.69
 Soil To Concrete Friction f 0.5
 Allowable Increase in Soil Pressure due to Short Term Loads (%)
 Wind 33.33 Earthquake 33.33 Test 20
 Erection Stability Ratio 1.5
 Operation Stability Ratio 1.5
 Test Stability Ratio 1.5
 Safety Factor against Lateral Forces 1.5

REBAR PARAMETERS:

Max Long Bar Size 9
 Min Long Bar Size 7
 Max Tie Bar Size 4
 Min Tie Bar Size 3
 Max Ftg Bar Size 18
 Temp & Shrinkage Steel Ratio 0.0018

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft) 4
 Minimum Soil Cover (ft) 0
 Grade Elevation (ft) 100

BUOYANCY CRITERIA:

Consider Buoyancy: No
 Consider soil for buoyancy: No
 Water table below grade (ft) 0

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	-2.75	0.00	0.00	0.00	0.00
2 - Operating	194.86	0.00	0.00	0.00	0.00
3 - Overflow	226.78	0.00	0.00	0.00	0.00

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
Foundation Name	Center Column		Time	9:48:45 AM
Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\Center Column.mcs			

DETAIL REPORT FOR Center Column**UNFACTORED (ALLOWABLE) LOAD COMBINATIONS****P1**

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	-2.75	0.00	0.00	0.00	0.00
2 - Dead + Operating	192.12	0.00	0.00	0.00	0.00
3 - Dead + Overflow	224.04	0.00	0.00	0.00	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS**P1**

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - 1.4Dead	-3.84	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.4Overflow	314.20	0.00	0.00	0.00	0.00
3 - 1.2Dead + 1.6Operating	308.48	0.00	0.00	0.00	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.80	4.48	0.00	0.00	0.00	0.00	
2 - Dead + Operating	3.84	4.48	0.00	0.00	0.00	0.00	
3 - Dead + Overflow	4.34	4.48	0.00	0.00	0.00	0.00	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Operating	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + Overflow	100.00	100.00	1.50	100.00	100.00	1.50	

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
Foundation Name	Center Column		Time	9:48:45 AM
Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\Center Column.mcs			

DETAIL REPORT FOR Center Column**FOOTING DESIGN INFORMATION**

E-W Dim (ft)	8.00
N-S Dim (ft)	8.00
Thickness (ft)	1.50

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1.2Dead + 1.6Operating	8	6	12	0.44	0	0	E-W
1.2Dead + 1.6Operating	8	6	12	0.44	0	0	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1.2Dead + 1.6Operating	8	6	12	0.44	0.39	4.47	E-W
1.2Dead + 1.6Operating	8	6	12	0.44	0.39	4.47	N-S

PUNCHING SHEAR**P1**

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
1.2Dead + 1.6Operating	106.86	23.99	178.37	

MAXIMUM SHEAR - E-W DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	0.10	0.47	0.35	94.87	
2 - 1.2Dead + 1.4Overflow	0.10	4.49	3.34	94.87	
3 - 1.2Dead + 1.6Operating	7.90	-4.56	3.39	94.87	

MAXIMUM SHEAR - N-S DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	0.10	0.47	0.35	94.87	
2 - 1.2Dead + 1.4Overflow	0.10	4.49	3.34	94.87	
3 - 1.2Dead + 1.6Operating	7.90	-4.56	3.39	94.87	

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
Foundation Name	Center Column		Time	9:48:45 AM
Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\Center Column.mcs			

DETAIL REPORT FOR Center Column**PIER/BASE PLATE DESIGN INFORMATION**

	P1
E-W Dim (ft)	6.00
N-S Dim (ft)	6.00
Height above grade (ft)	4.00
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinf. Ratio	0.0018
Provided Reinf. Ratio	0.0044
Long Bar Size	8
Bars each face	4
Total Long Bars	24
Tie Bar Size	4
Total No. of Ties	8
Major Tie Spacing (in)	12

PIER ULTIMATE LOAD CAPACITIES

	P1				
Load	Axial	Axial	Mom N-S	Mom N-S	Rem
Comb	Load	Capa.		Capa	
	(kips)	(kips)	(kip ft)	(kip ft)	
1 - 1.4Dead	36.87	5039.61	11.21	1532.54	
2 - 1.2Dead + 1.4Overflow	349.09	5039.61	106.14	1532.54	
3 - 1.2Dead + 1.6Operating	355.01	5039.61	107.94	1532.54	

Dimensional Solutions FOUNDATION3D

Version 5.8.2

Date 7/20/2012

Foundation Name

Center Column

Time

9:48:45 AM

Designed By:

FLSmith Salt Lake City

Engineer

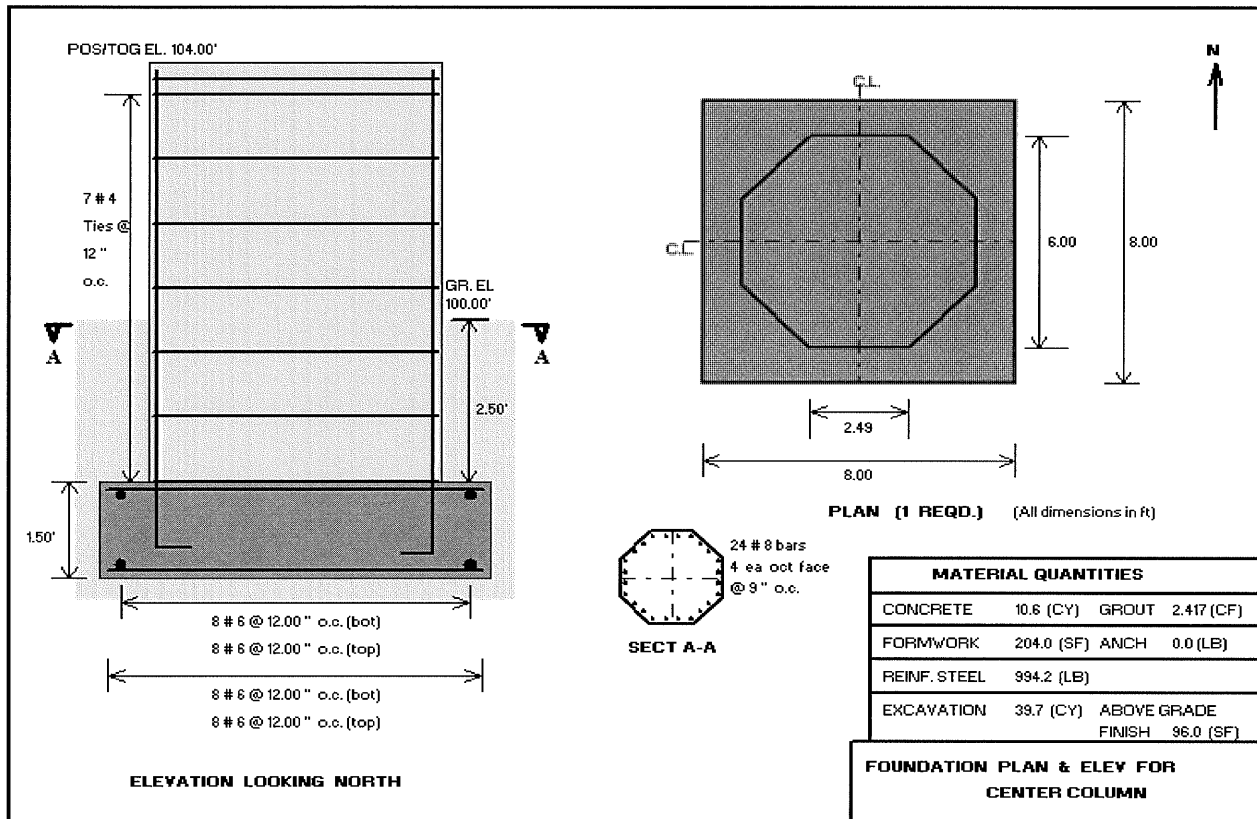
WChan

Checker

P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\

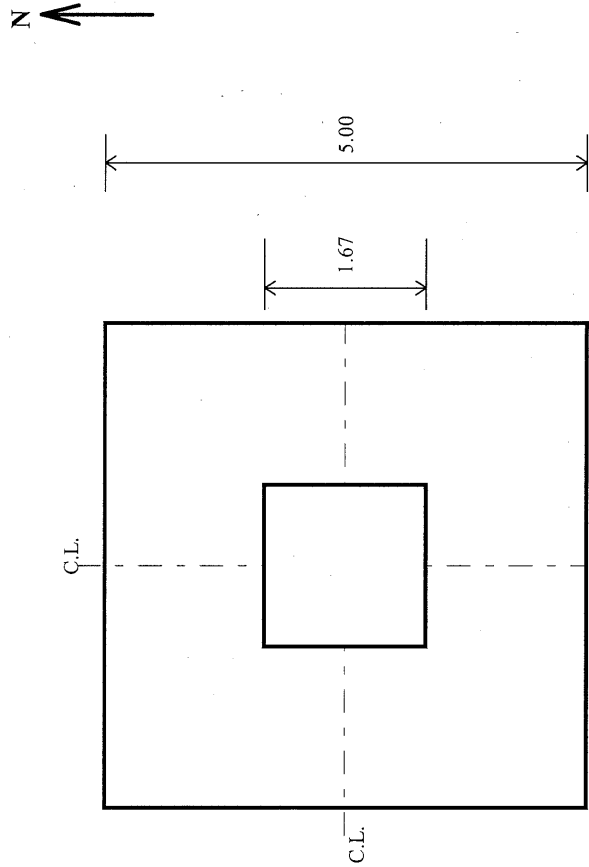
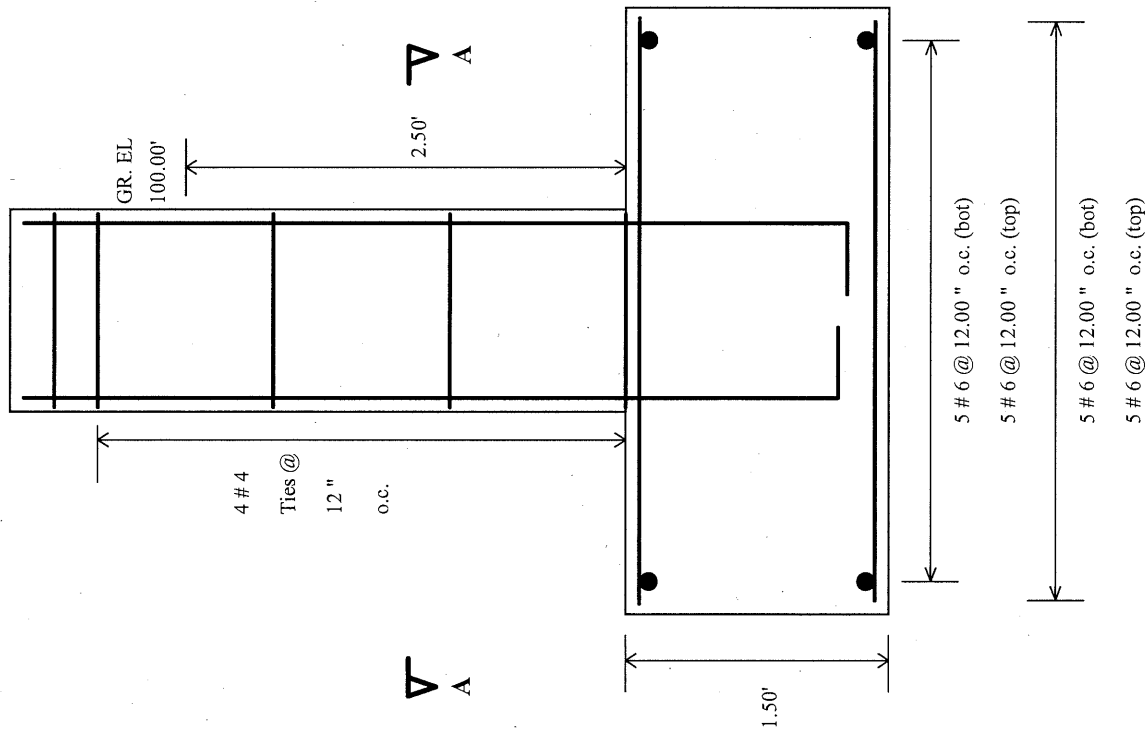
Filename:

Center Column.mcs

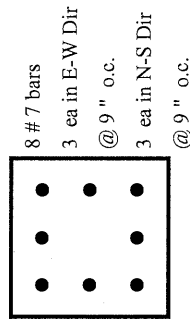
DETAIL REPORT FOR Center Column

Proj. No.: 11021 Engr: WChan Date: 3/14/2012 Checker: Date:

POS/TOG EL. 101.00'



PLAN (1 REQD.) (All dimensions in ft)



MATERIAL QUANTITIES

CONCRETE	1.7 (CY)	GROUT	0.210 (CF)
FORMWORK	53.4 (SF)	ANCH	0.0 (LB)
REINF. STEEL	239.3 (LB)		
EXCAVATION	26.8 (CY)	ABOVE GRADE	
		FINISH	6.7 (SF)

FOUNDATION PLAN & ELEV FOR
OUTER COLUMNS

ELEVATION LOOKING NORTH

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
Foundation Name	Outer Columns		Time	9:51:22 AM
Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struct\014 Concentrate Thickener\			
	Outer Columns.mcs			

DETAIL REPORT FOR Outer Columns**PROJECT INFORMATION**

Project Name: CC&V High Grade Mill
Project Number: 11021
Client: CC&V
Project Location:
Foundation Description: FOUNDATION

DESIGN CODE ACI 318 - 2008 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi) 4000
 Unit Weight (pcf) 150
 Pier Concrete Cover - E-W Dir (in) 2
 Pier Concrete Cover - N-S Dir (in) 2
 Footing Side Concrete Cover - E-W Dir (in) 3
 Footing Side Concrete Cover - N-S Dir (in) 3
 Footing Top Concrete Cover (in) 2
 Footing Bottom Concrete Cover - X Dir (in) 3

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi) 60
 Unit Weight (pcf) 490
 Modulus of Elasticity (ksi) 29000
 Pier Min Rebar Spacing (in) 3
 Footing Min Rebar Spacing (in) 6
 Footing Max Rebar Spacing (in) 18

SOIL PARAMETERS:

Unit Weight (pcf) 120
 Allowable Net Bearing Capacity (psf) 4000
 Bearing Capacity Method Linear Soil Pressure
 Soil Type Granular
 Passive Pressure Coefficient Kp 3.69
 Soil To Concrete Friction f 0.5
 Allowable Increase in Soil Pressure due to Short Term Loads (%)
 Wind 33.33 Earthquake 33.33 Test 20
 Erection Stability Ratio 1.5
 Operation Stability Ratio 1.5
 Test Stability Ratio 1.5
 Safety Factor against Lateral Forces 1.5

REBAR PARAMETERS:

Max Long Bar Size 9
 Min Long Bar Size 7
 Max Tie Bar Size 4
 Min Tie Bar Size 3
 Max Ftg Bar Size 18
 Temp & Shrinkage Steel Ratio 0.0018

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft) 4
 Minimum Soil Cover (ft) 0
 Grade Elevation (ft) 100

BUOYANCY CRITERIA:

Consider Buoyancy: No
 Consider soil for buoyancy: No
 Water table below grade (ft) 0

APPLIED LOADS**P1**

Load Case	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	5.89	0.00	0.00	0.00	0.00
2 - Operating	53.10	0.00	0.00	0.00	0.00
3 - Overflow	61.82	0.00	0.00	0.00	0.00
4 - Wind	-1.27	0.50	0.00	0.00	0.00
5 - Earthquake	5.80	4.98	0.00	0.00	0.00

Dimensional Solutions FOUNDATION3D		Version	5.8.2	Date	7/20/2012
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Designed By:	FLSmdith Salt Lake City	Engineer	WChan	Checker	
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\Outer Columns.mcs				

DETAIL REPORT FOR Outer Columns

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	5.89	0.00	0.00	0.00	0.00
2 - Dead + Operating	58.99	0.00	0.00	0.00	0.00
3 - Dead + Overflow	67.71	0.00	0.00	0.00	0.00
4 - Dead + 0.75Operating + 0.75Wind	44.76	0.38	0.00	0.00	0.00
5 - Dead + Wind	4.62	0.50	0.00	0.00	0.00
6 - 0.6Dead + Wind	2.26	0.50	0.00	0.00	0.00
7 - Dead + 0.75Operating + 0.525Earthquake	48.76	2.61	0.00	0.00	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - 1.4Dead	8.25	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.4Overflow	93.62	0.00	0.00	0.00	0.00
3 - 1.2Dead + 1.6Operating	92.03	0.00	0.00	0.00	0.00
4 - 1.2Dead + Operating + 1.6Wind	58.14	0.80	0.00	0.00	0.00
5 - 0.9Dead + 1.6Wind	3.27	0.80	0.00	0.00	0.00
6 - 1.2Dead + Operating + Earthquake	65.97	4.98	0.00	0.00	0.00
7 - 0.9Dead + Earthquake	11.10	4.98	0.00	0.00	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.79	4.48	0.00	0.00	0.00	0.00	
2 - Dead + Operating	2.91	4.48	0.00	0.00	0.00	0.00	
3 - Dead + Overflow	3.26	4.48	0.00	0.00	0.00	0.00	
4 - Dead + 0.75Operating + 0.75Wind	2.29	5.81	0.00	0.03	1.88	0.00	
5 - Dead + Wind	0.85	5.81	0.00	0.14	2.50	0.00	
6 - 0.6Dead + Wind	0.54	5.81	0.00	0.24	2.50	0.00	
7 - Dead + 0.75Operating + 0.525Earthquake	2.99	5.81	0.00	0.22	13.07	0.00	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Operating	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + Overflow	100.00	100.00	1.50	100.00	100.00	1.50	
4 - Dead + 0.75Operating + 0.75Wind	100.00	73.44	1.50	100.00	100.00	1.50	
5 - Dead + Wind	100.00	18.37	1.50	100.00	39.96	1.50	
6 - 0.6Dead + Wind	100.00	10.52	1.50	100.00	32.10	1.50	
7 - Dead + 0.75Operating + 0.525Earthquake	100.00	11.30	1.50	100.00	15.43	1.50	

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
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Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struct\C-014 Concentrate Thickener\Outer Columns.mcs			

DETAIL REPORT FOR Outer Columns**FOOTING DESIGN INFORMATION**

E-W Dim (ft) 5.00
 N-S Dim (ft) 5.00
 Thickness (ft) 1.50

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
0.9Dead + Earthquake	5	6	12	0.44	0.01	-0.53	E-W
0.9Dead + Earthquake	5	6	12	0.44	0	0	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1.2Dead + 1.4Overflow	5	6	12	0.44	0.39	5.29	E-W
1.2Dead + 1.4Overflow	5	6	12	0.44	0.39	5.29	N-S

PUNCHING SHEAR**P1**

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
1.2Dead + 1.4Overflow	64.00	33.57	189.74	

MAXIMUM SHEAR - E-W DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.50	-1.03	1.22	94.87	
2 - 1.2Dead + 1.4Overflow	4.50	-9.51	11.32	94.87	
3 - 1.2Dead + 1.6Operating	4.50	-9.41	11.20	94.87	
4 - 1.2Dead + Operating + 1.6Wind	4.50	-6.37	7.58	94.87	
5 - 0.9Dead + 1.6Wind	4.50	-0.89	1.06	94.87	
6 - 1.2Dead + Operating + Earthquake	4.50	-9.40	11.19	94.87	
7 - 0.9Dead + Earthquake	4.50	-4.00	4.77	94.87	

Dimensional Solutions FOUNDATION3D	Version	5.8.2	Date	7/20/2012
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Designed By:	FLSmith Salt Lake City	Engineer	WChan	Checker
Filename:	P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-014 Concentrate Thickener\Outer Columns.mcs			

DETAIL REPORT FOR Outer Columns**MAXIMUM SHEAR - N-S DIRECTION**

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.50	-1.03	1.22	94.87	
2 - 1.2Dead + 1.4Overflow	4.50	-9.51	11.32	94.87	
3 - 1.2Dead + 1.6Operating	4.50	-9.41	11.20	94.87	
4 - 1.2Dead + Operating + 1.6Wind	0.50	5.94	7.07	94.87	
5 - 0.9Dead + 1.6Wind	0.50	0.46	0.54	94.87	
6 - 1.2Dead + Operating + Earthquake	4.50	-6.72	8.00	94.87	
7 - 0.9Dead + Earthquake	4.50	-1.24	1.47	94.87	

PIER/BASE PLATE DESIGN INFORMATION

	P1
E-W Dim (ft)	1.67
N-S Dim (ft)	1.67
Height above grade (ft)	1.00
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinf. Ratio	0.0050
Provided Reinf. Ratio	0.0120
Long Bar Size	7
Bars in E-W Dir	3
Bars in N-S Dir	3
Total Long Bars	8
Tie Bar Size	4
Total No. of Ties	5
Major Tie Spacing (in)	12

PIER ULTIMATE LOAD CAPACITIES

	P1						
Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom N-S (kip ft)	Mom N-S Capa (kip ft)	Mom E-W (kip ft)	Mom E-W Capa (kip ft)	Rem
1 - 1.4Dead	10.30	1159.96	1.03	137.37	1.03	137.37	
2 - 1.2Dead + 1.4Overflow	95.37	1159.96	9.54	137.37	9.54	137.37	
3 - 1.2Dead + 1.6Operating	94.37	1159.96	9.44	137.37	9.44	137.37	
4 - 1.2Dead + Operating + 1.6Wind	59.60	1159.96	5.96	137.37	5.96	137.37	
5 - 0.9Dead + 1.6Wind	4.59	693.91	2.80	374.04	0.46	76.20	
6 - 1.2Dead + Operating + Earthquake	67.43	1019.26	17.43	260.79	6.74	112.65	
7 - 0.9Dead + Earthquake	12.42	237.43	17.43	318.55	1.24	26.11	

Dimensional Solutions FOUNDATION3D

Version 5.8.2

Date 7/20/2012

Foundation Name Outer Columns

Time 9:51:22 AM

Designed By: FLSmidth Salt Lake City

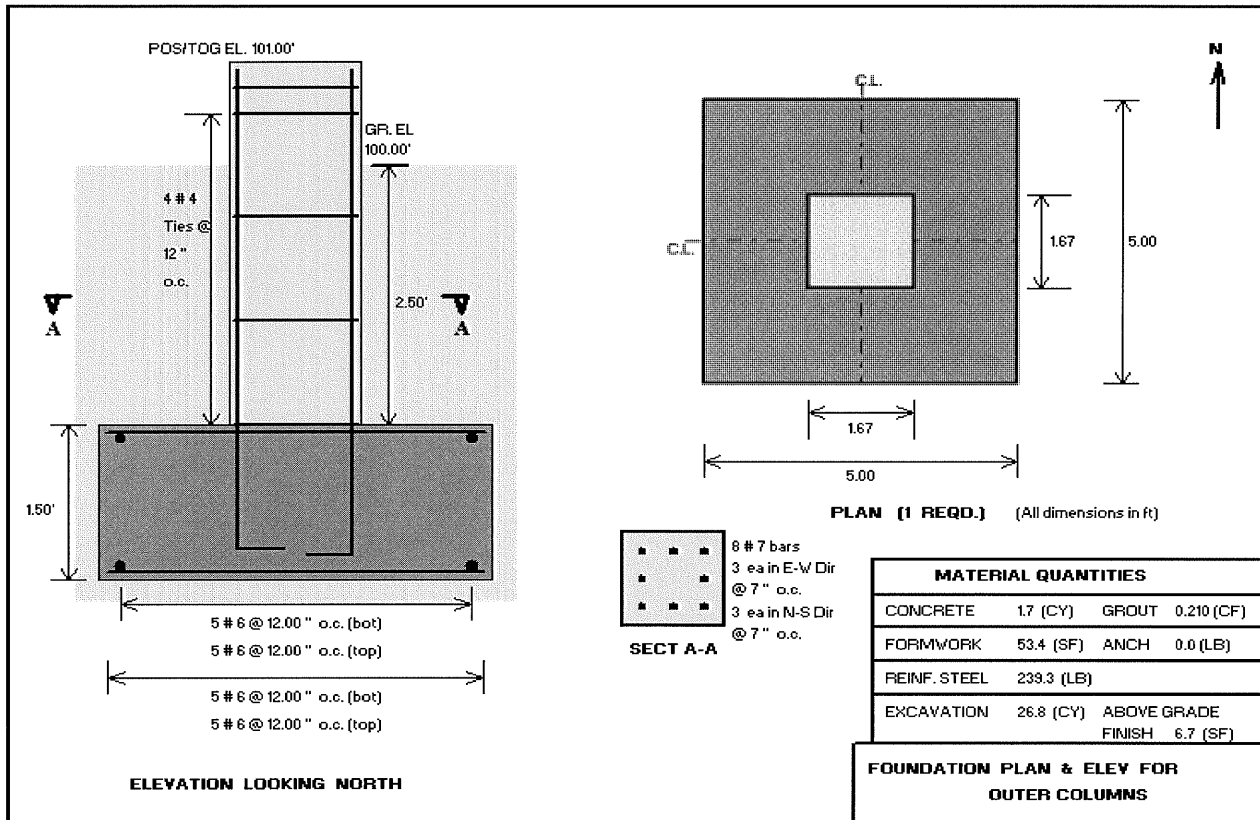
Engineer

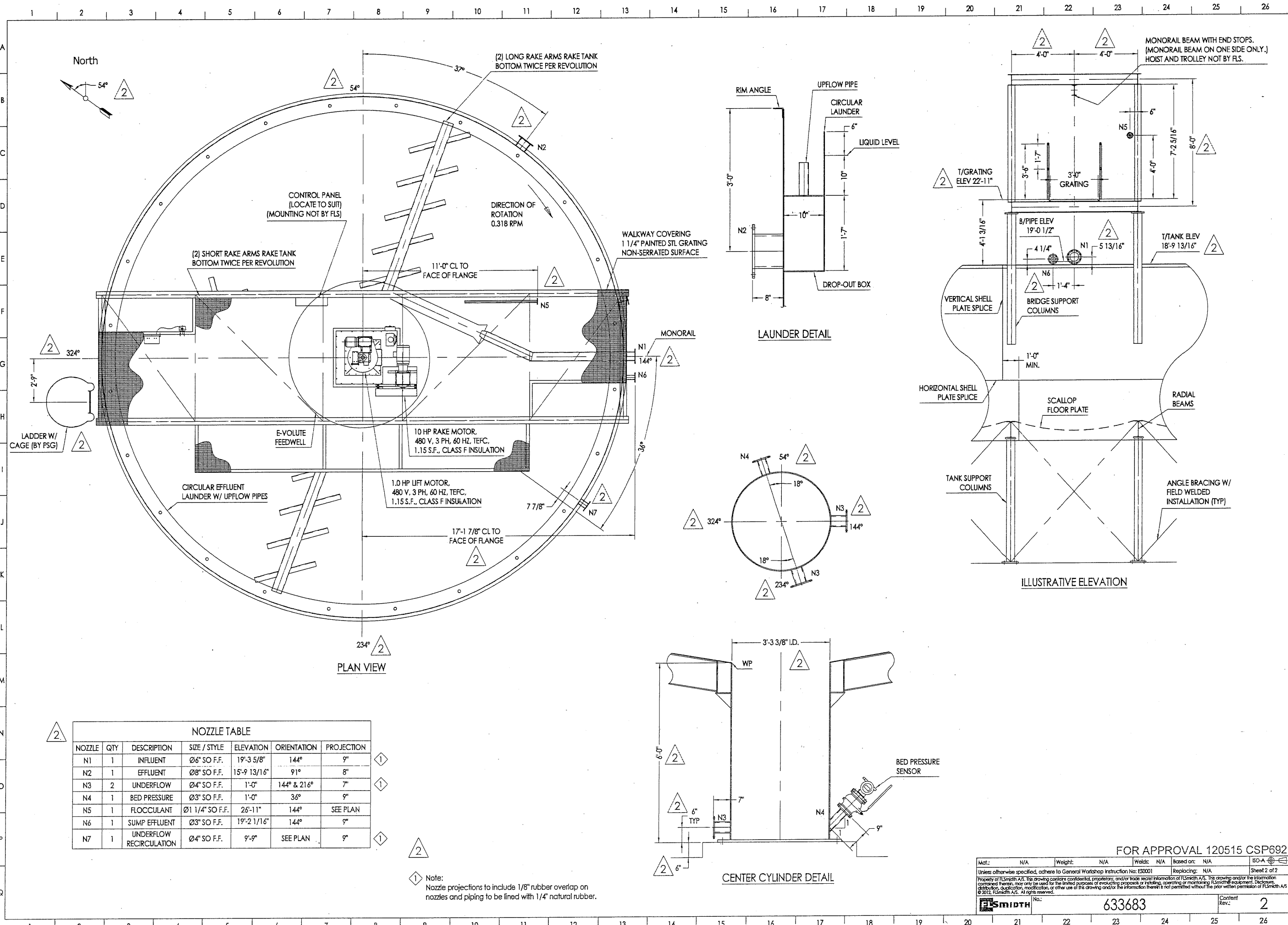
WChan

Checker

P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\1C-014 Concentrate Thickener\

Filename: Outer Columns.mcs

DETAIL REPORT FOR Outer Columns



Concentrate Thickener Weir Design

Design per Fluid Mechanics with Engineering Applications 10th Edition, p. 527-535

Weir Criteria:

$$q := 1500 \text{ gpm}$$

Incoming Flow Rate

$$E := 9 \text{ in}$$

Total Head above Weir

$$L := 24 \text{ in}$$

Weir Length

$$n := 1$$

End Contractions

Weir Design:

$$y_c := \frac{2}{3} \cdot E = 6 \text{ in}$$

Critical Flow height above Weir

$$A := L \cdot y_c = 1 \cdot \text{ft}^2$$

Area of Flow

$$V_o := \frac{q}{A} = 3.342 \cdot \frac{\text{ft}}{\text{s}}$$

Velocity of Flow

$$y := \frac{V_o^2}{2g} = 2.083 \text{ in}$$

Head Loss

$$H := E - y = 6.917 \text{ in}$$

Height of Water approaching Weir

$$L_{\text{eff}} := L - 0.1 \cdot n \cdot H = 23.308 \text{ in}$$

Weir Effective Length

$$Q := L_{\text{eff}} \sqrt{g} \left(\frac{2}{3} \right)^{1.5} \cdot E^{1.5} = 1.748 \times 10^3 \cdot \text{gpm}$$

Flow Rate Over Weir

Result:

$$\text{Ratio} := \frac{q}{Q} = 0.858$$

Ratio of Incoming Flow Vs. Outgoing Flow

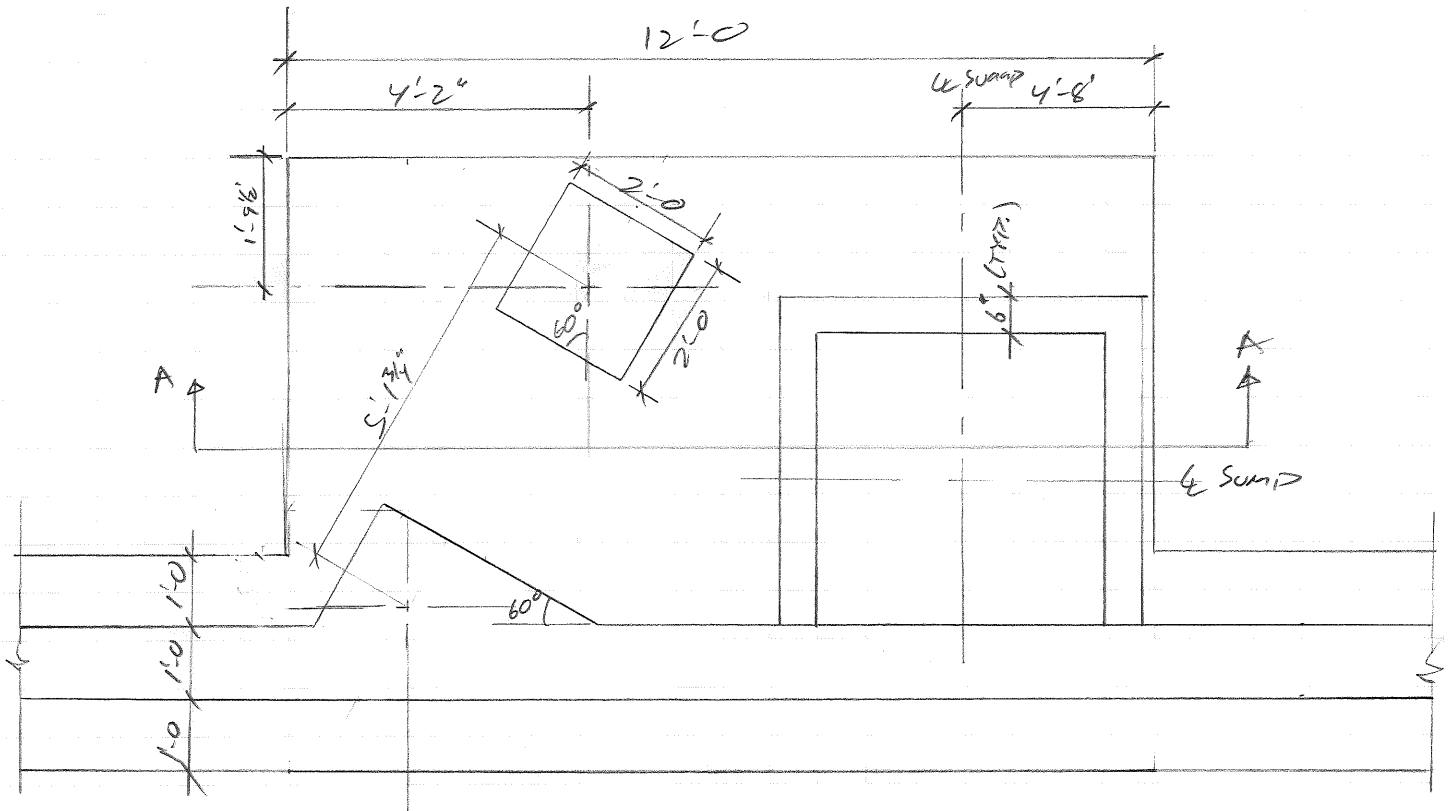
Frame Reactions

	Node	Fx (k)	Fy (k)	Fz (k)
Dead	19	0.17	-0.01	1.71
	20	-0.17	0.00	1.71
Live	19	0.19	-0.02	1.64
	20	-0.17	0.00	1.66
Wind X	19	-0.36	0.00	-1.36
	20	-0.26	0.00	1.36
Wind -X	19	0.25	0.00	1.19
	20	0.34	0.00	-1.19
Wind Y	19	0.12	-0.72	1.26
	20	0.16	-0.83	-1.62
Wind -Y	19	-0.14	0.72	-1.42
	20	-0.18	0.88	1.77
Seismic X	19	-0.05	0.00	-0.18
	20	-0.05	0.00	0.18
Seismic -X	19	0.05	0.00	0.17
	20	0.05	0.00	-0.17
Seismic Y	19	0.01	-0.03	0.09
	20	0.01	-0.03	-0.10
Seismic -Y	19	-0.01	0.03	-0.09
	20	-0.01	0.03	0.10

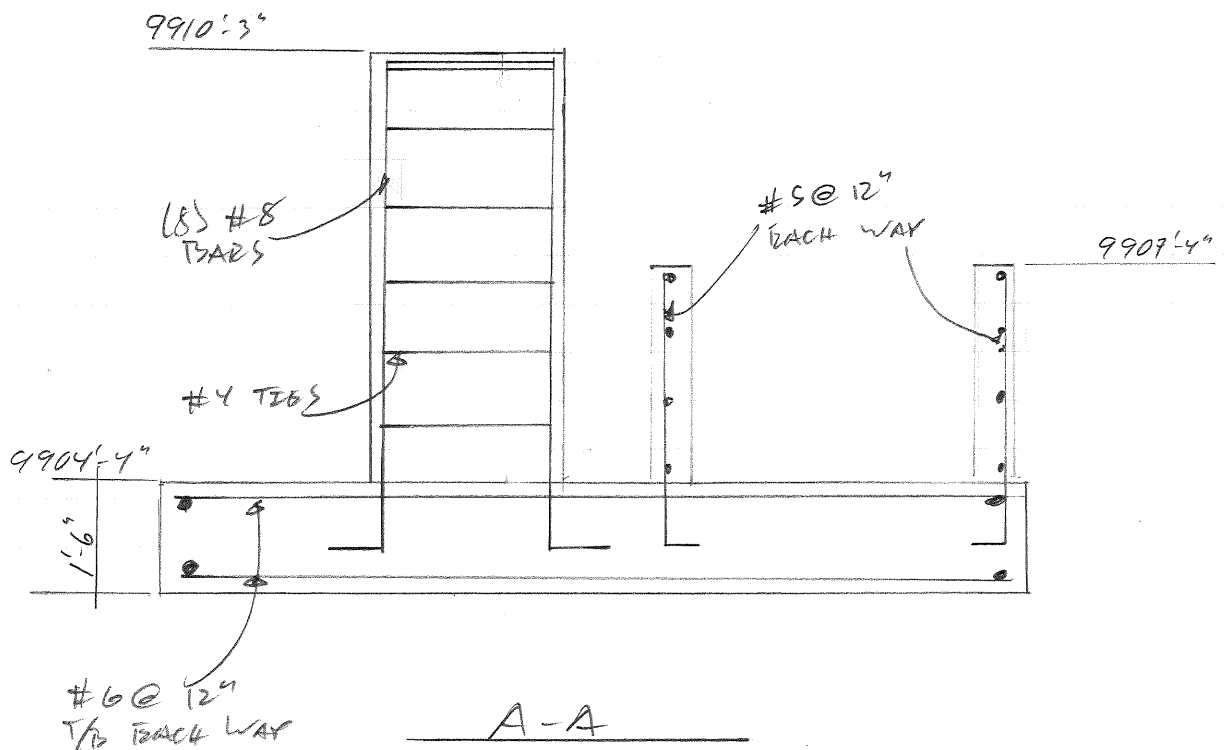


PROJECT
CC&V HIGH GRADE OBR
SUBJECT
CONCENTRATE THICKENER
PLATFORM FOOTING

PROJ NO.	11021		
CALC NO.	C-013		
BY	EC	DATE	7-13-12
CHK		DATE	
SHEET	OF	REV	



CONCENTRATE THICKENER PLATFORM FOOTING

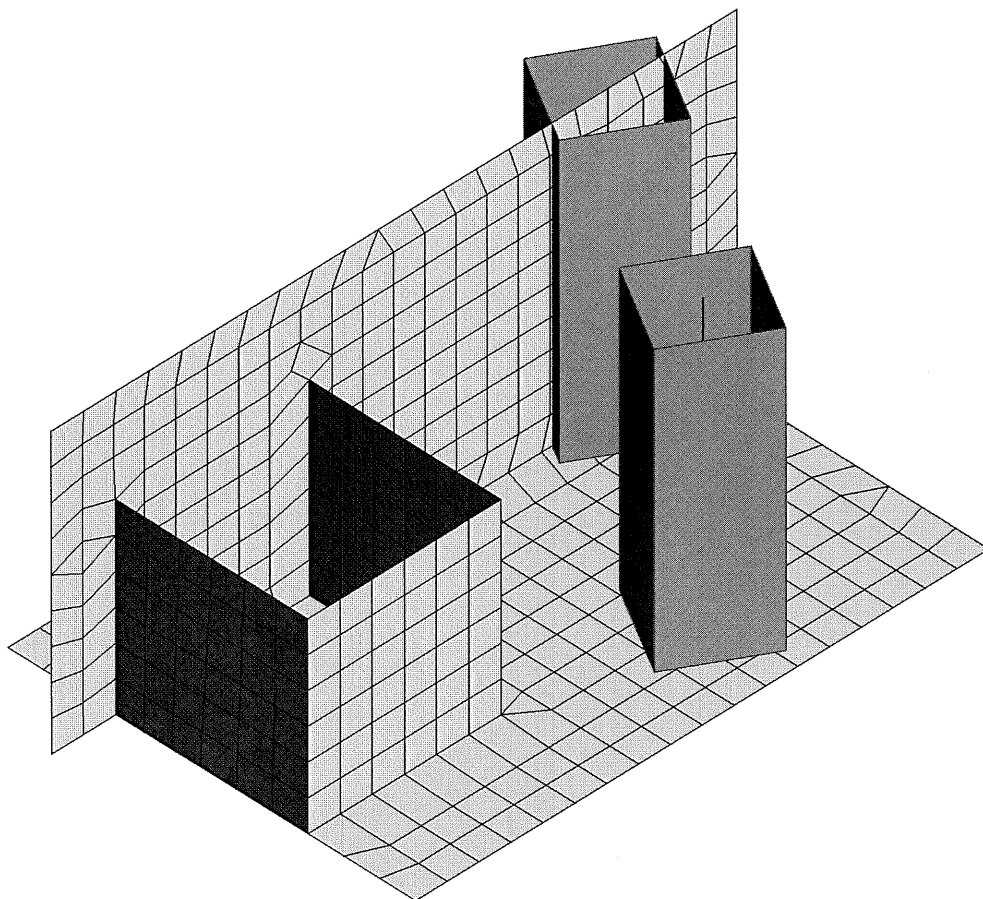




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

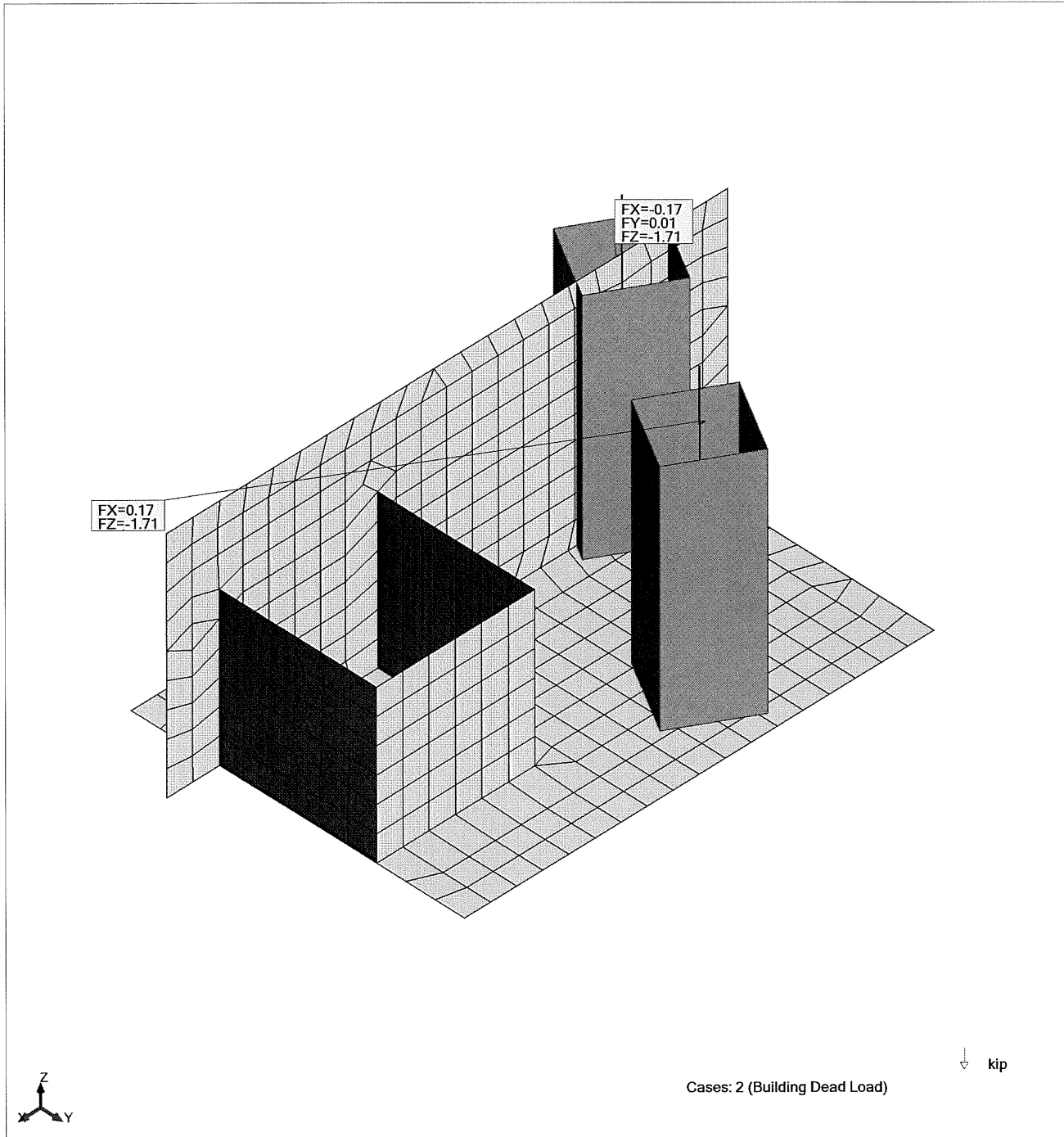
View - Cases: 33 (D+0.75L+0.75S+0.75W-y)



Date : 13/07/12
File: **Concentrate Thickener Platform Footing rev.1.rtd**
AutoDesk

Page : **1**
Robot 2012 ©

View - Cases: 2 (Building Dead Load)

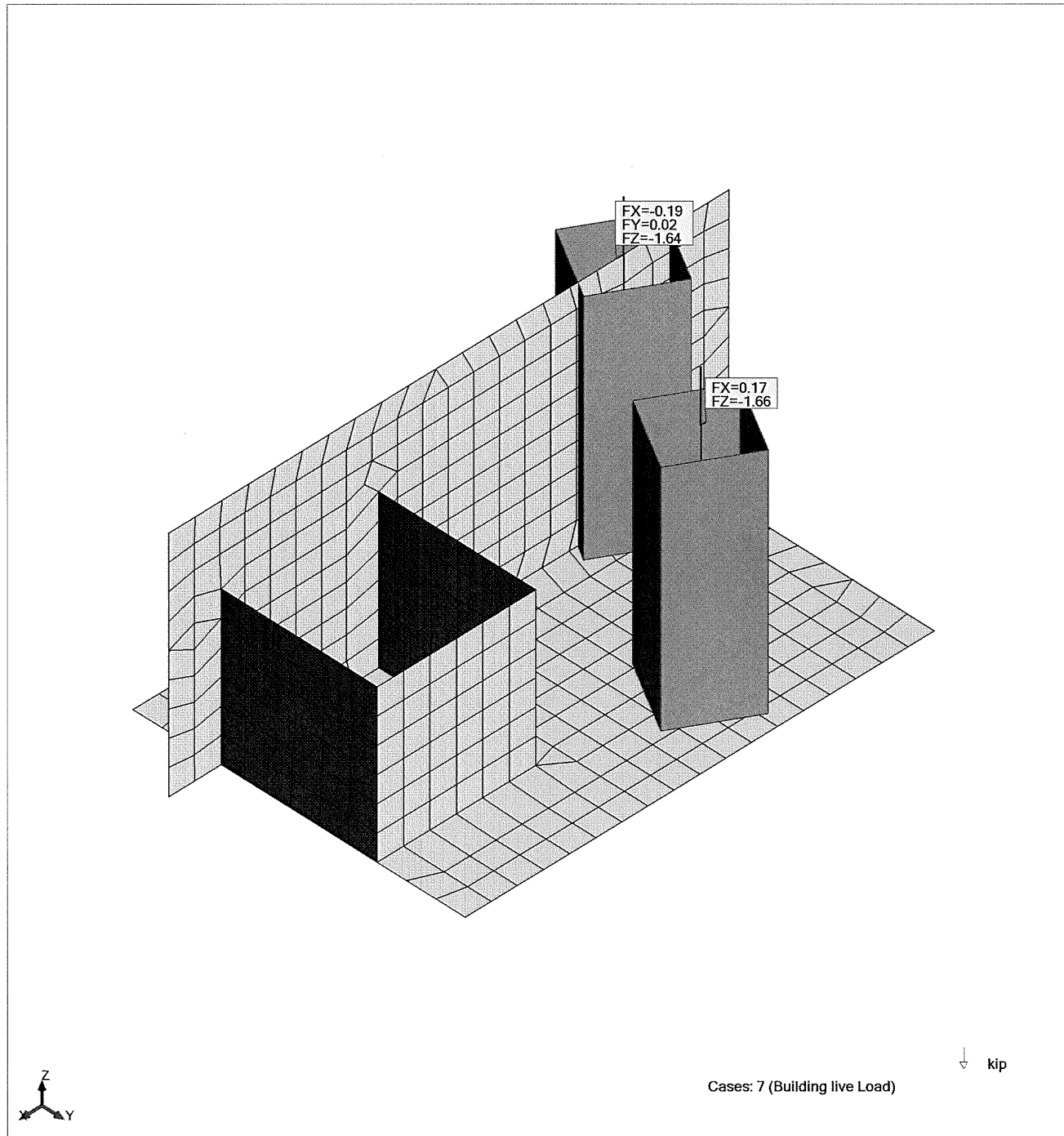




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

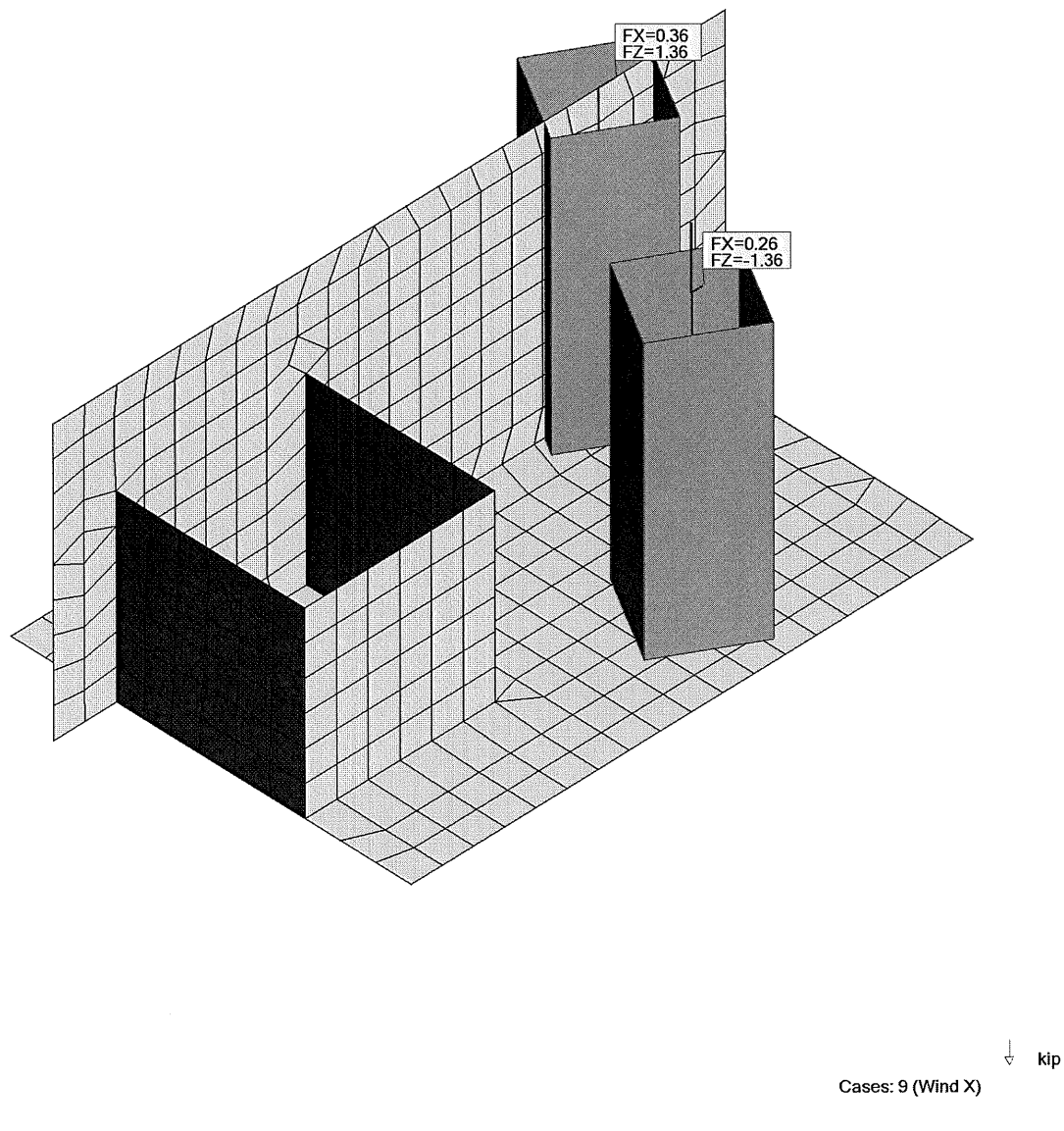
View - Cases: 7 (Building live Load)



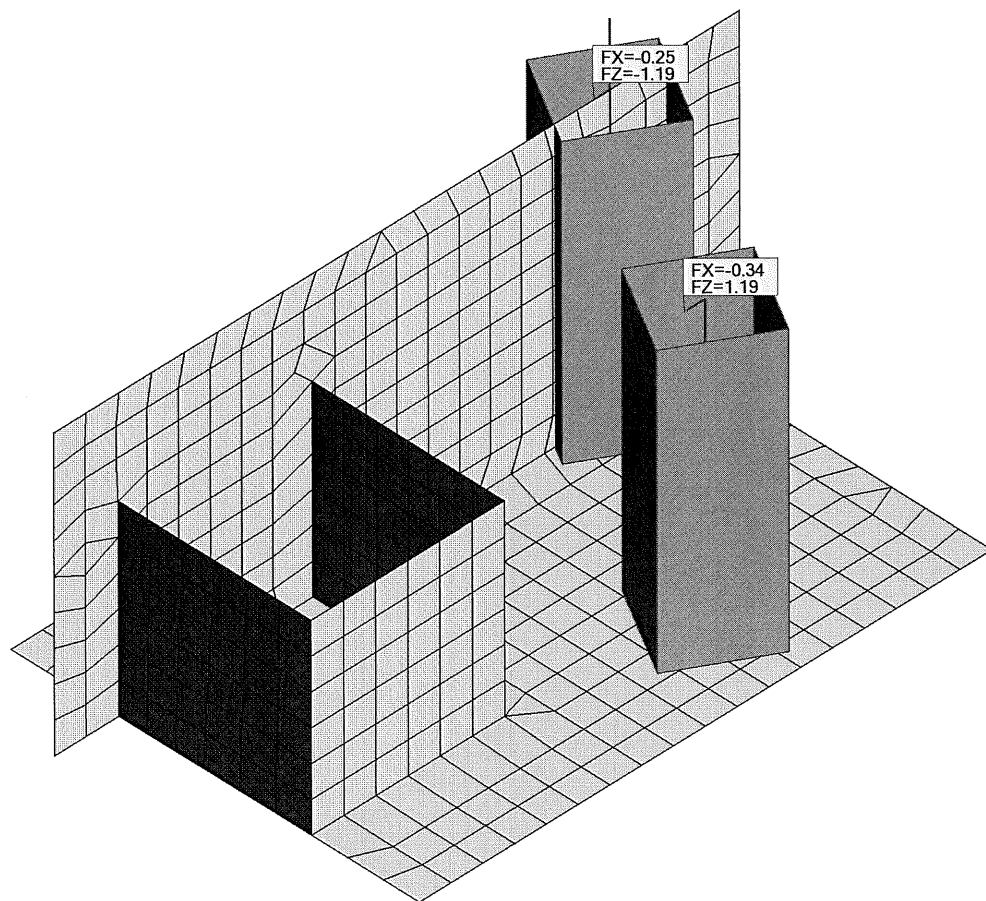
Date : 13/07/12
File: **Concentrate Thickener Platform Footing rev.1.rtd**
AutoDesk

Page : **1**
Robot 2012 ©

View - Cases: 9 (Wind X)

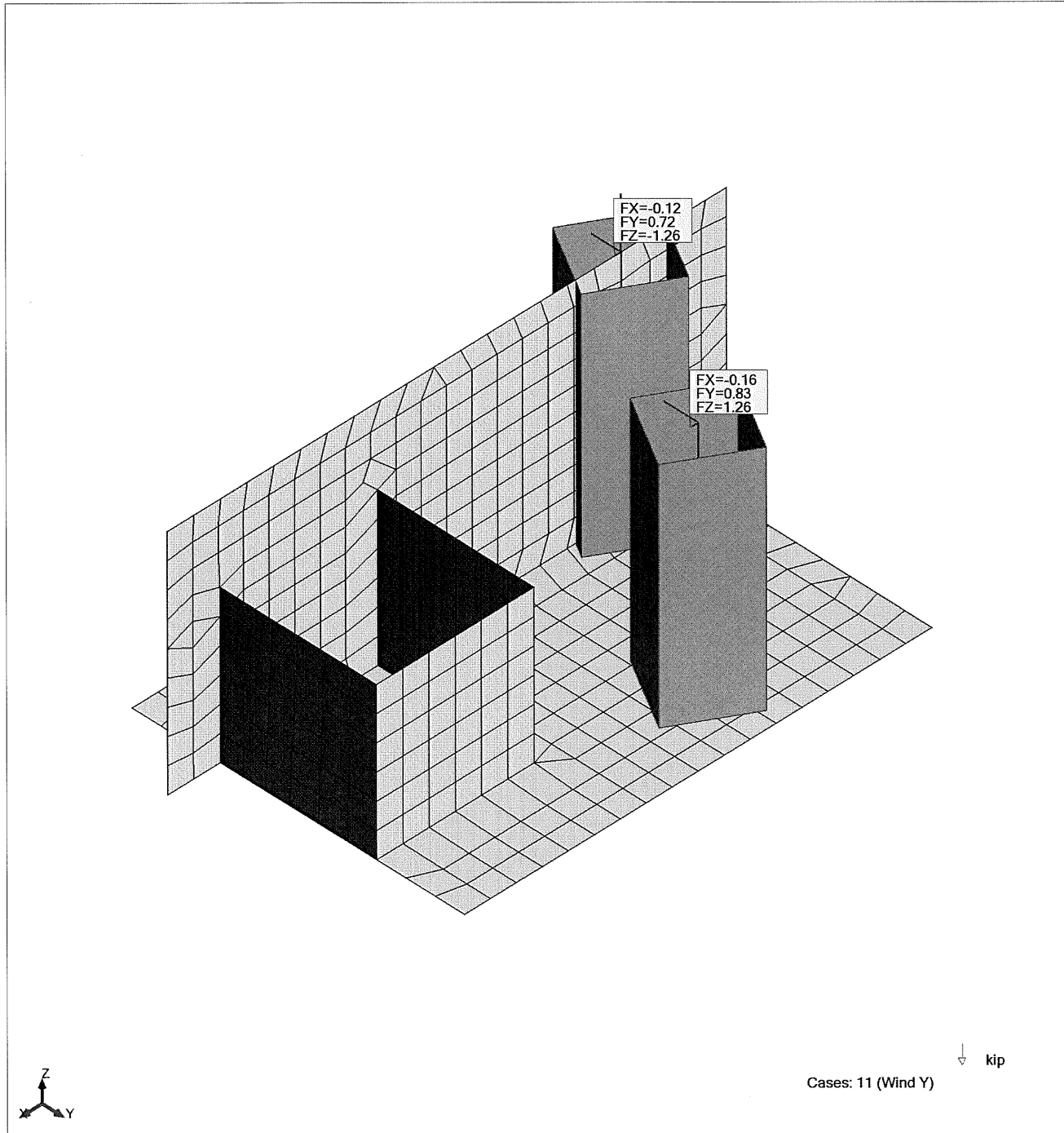


View - Cases: 10 (Wind -X)



Cases: 10 (Wind -X) kip

View - Cases: 11 (Wind Y)

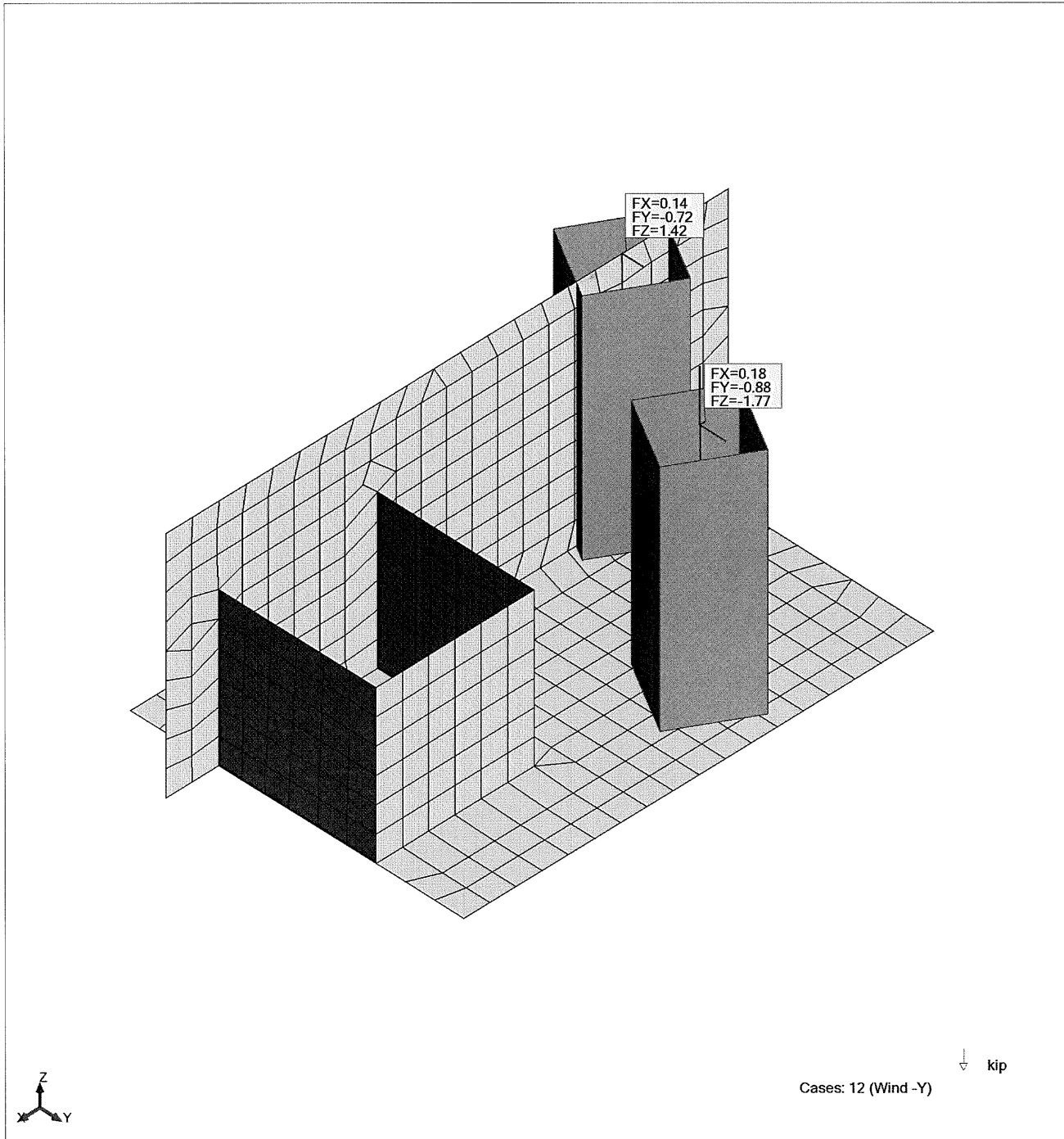




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

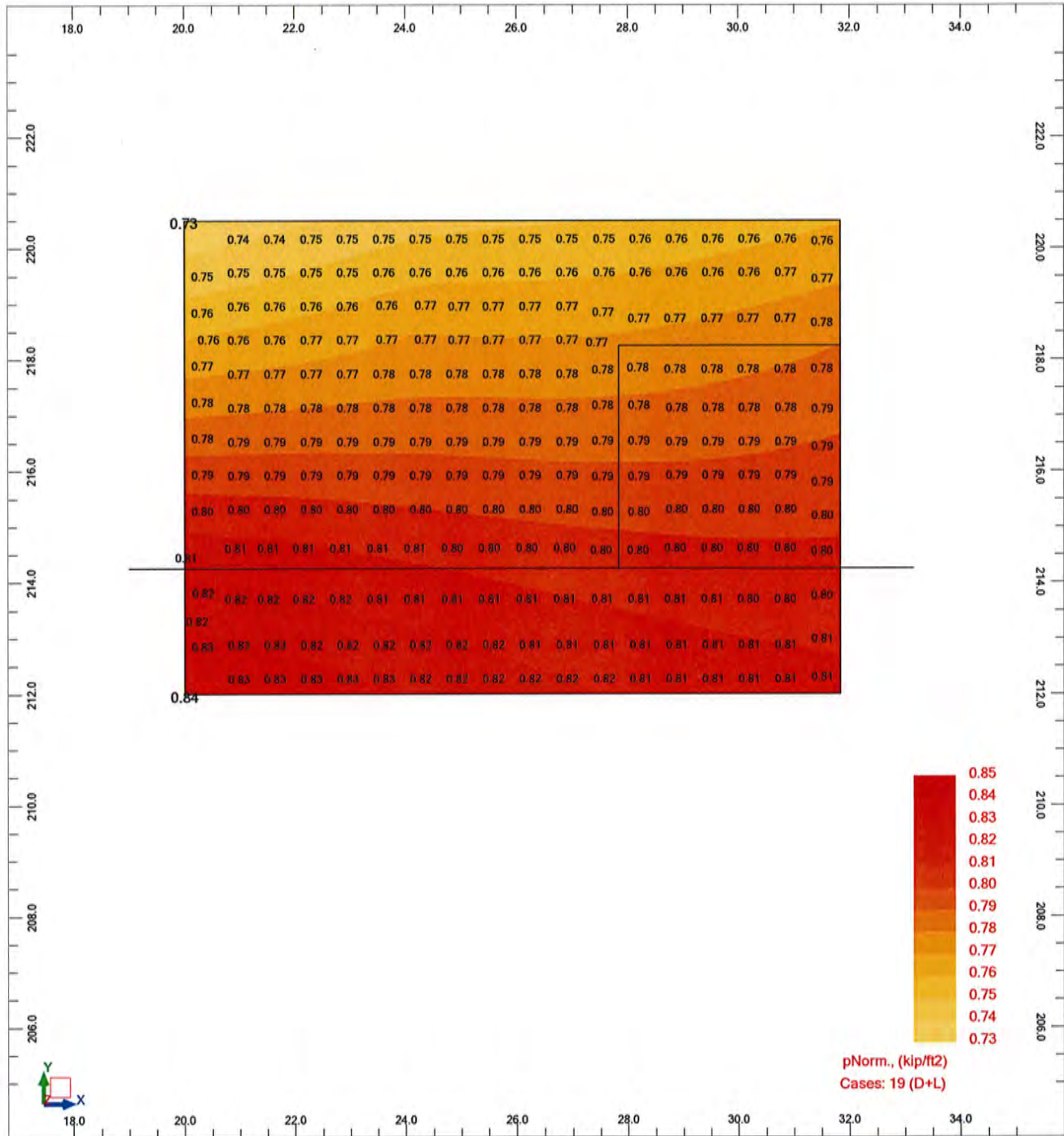
View - Cases: 12 (Wind -Y)



Date : 13/07/12
File: **Concentrate Thickener Platform Footing rev.1.rtd**
AutoDesk

Page : **1**
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View - pNorm. (kip/ft2) Cases: 19 (D+L)





7158 S FLSmith Drive
Midvale, UT 84047
(801) 233-5600 • FAX (801) 233-5601

DRAWING AND DOCUMENT TRANSMITTAL CC&V HIGH GRADE MILL

Page 1 of 1
July 13, 2012

FLSmith Job No.: 11021

Date: _____
FLSmith File No.: 11021.114.031.c.002

sent via _____ Email _____

TO: STT – Stanco
Attn: Behram Divecha
12391 Horseshoe Way
Richmond, British Columbia,
Canada V7A 4X6

Phone: 604-273-6441

Email: BDivecha@sttstanco.com

PROJECT: CC&V
High Grade Mill Project

RE: STT Stanco
CC&V P.O. 190074-0A
RFQ-031
Trans 1073-CT-002
Lime Slaking System
Preliminary Arrangement

CODE:

- (1) Approved as Submitted. Forward Final Certified Drawings. Proceed with fabrication.
- (2) Approved as Noted. Forward Final Certified Drawings. Proceed with fabrication.
- (3) **Disapproved as Noted. Resubmit.**
- (4) For Approval
- (5) For Record
- (6) For Information / As Requested
- (7) For Review/Comment
- (8) Status Print
- (9) For Design Revision
- (10) For Bid

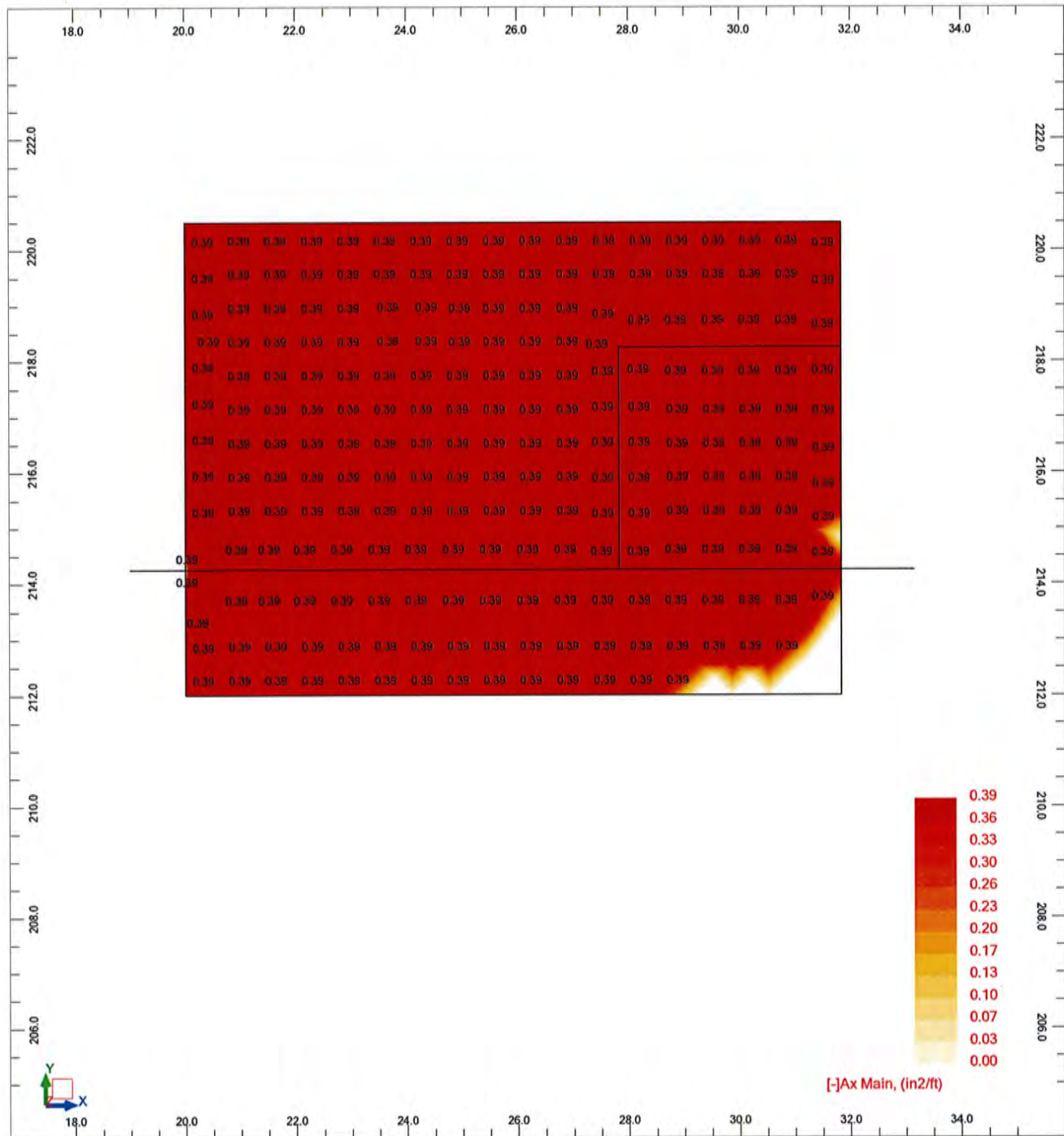
NOTE: Return Comments Must Be Received

BY: _____ **July 20, 2012**

No. of prints	Drawing/Spec. No.	Rev.	Code	Title
.pdf	PD-1073-1-M-100-1	0	3	Lime Slaking System – Preliminary Arrangement

Copy of Transmittal To:	No. of Prints	Transmitted: Darryl Bodily/nl
11021.114.031.c.002 - Donna Fraser – STT Stanco dfraser@sttstanco.com - Art Hanson – FLS Art.Hanson@flsmith.com - Darryl Bodily – FLS Darryl.Bodily@flsmith.com - Joyce Owen – FLS Joyce.Owen@flsmith.com - Marie Martinez – FLS Marie.Martinez@flsmith.com Man = Manual 1 cc = 1 copy T=Transmittal, E=Email, R=11x17/Reduce, F=Full	T 1 cc All E	Please acknowledge receipt of prints by signing and returning a copy of transmittal. Date Received: _____ By: _____

View - [-]Ax Main (in2/ft)

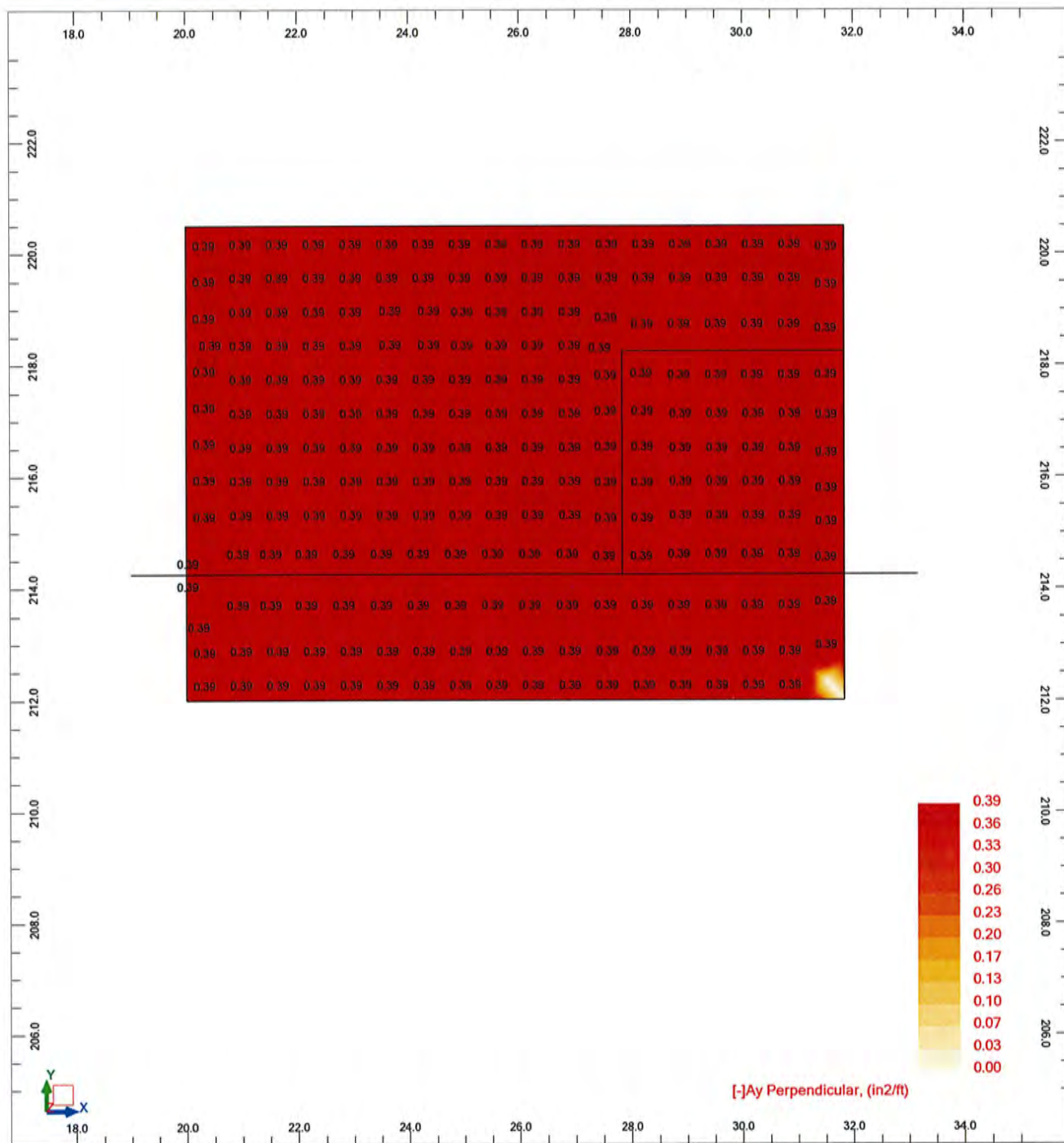




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

View - [-]Ay Perpendicular (in2/ft)

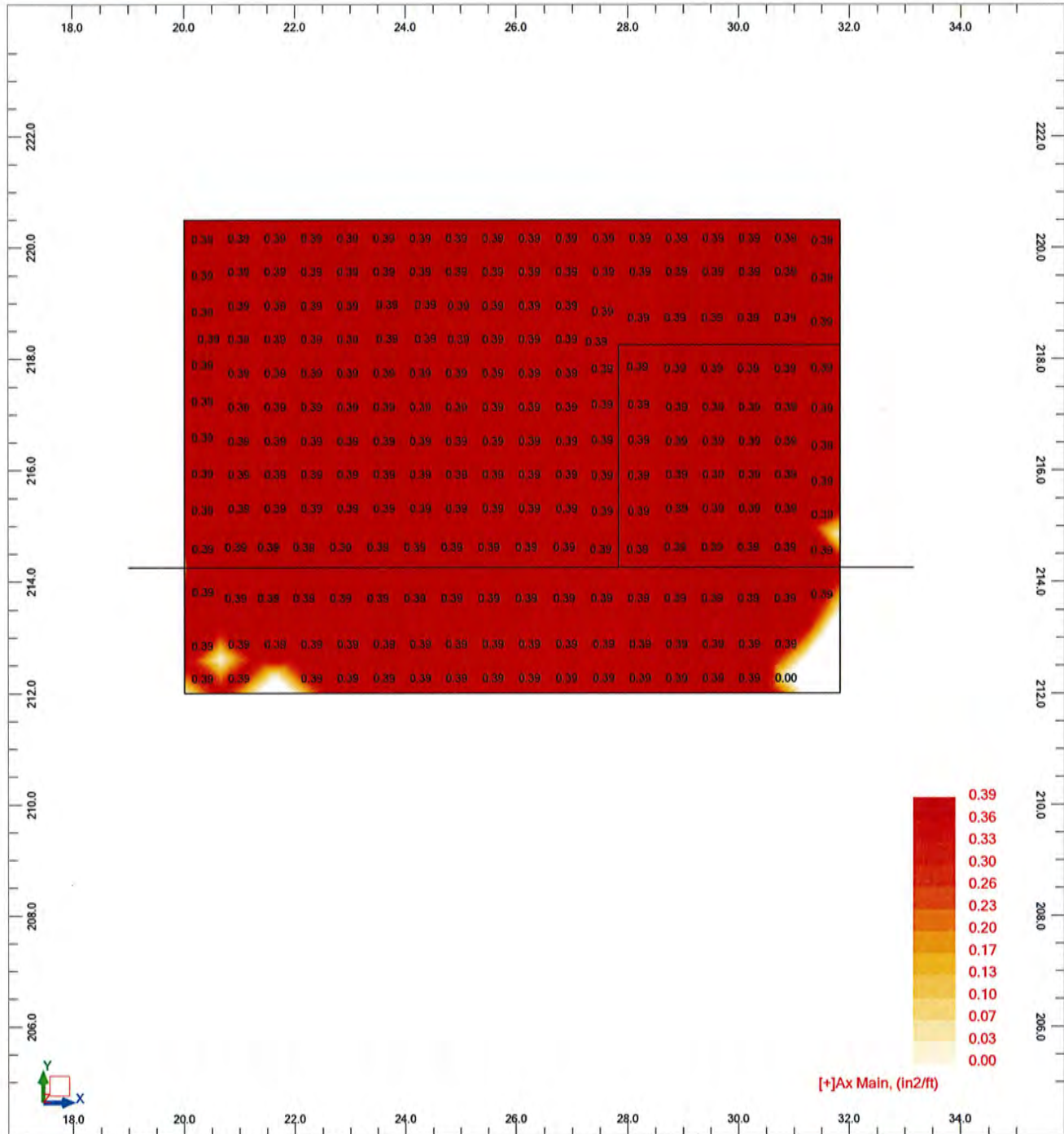




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

View - [x]Ax Main (in2/ft)

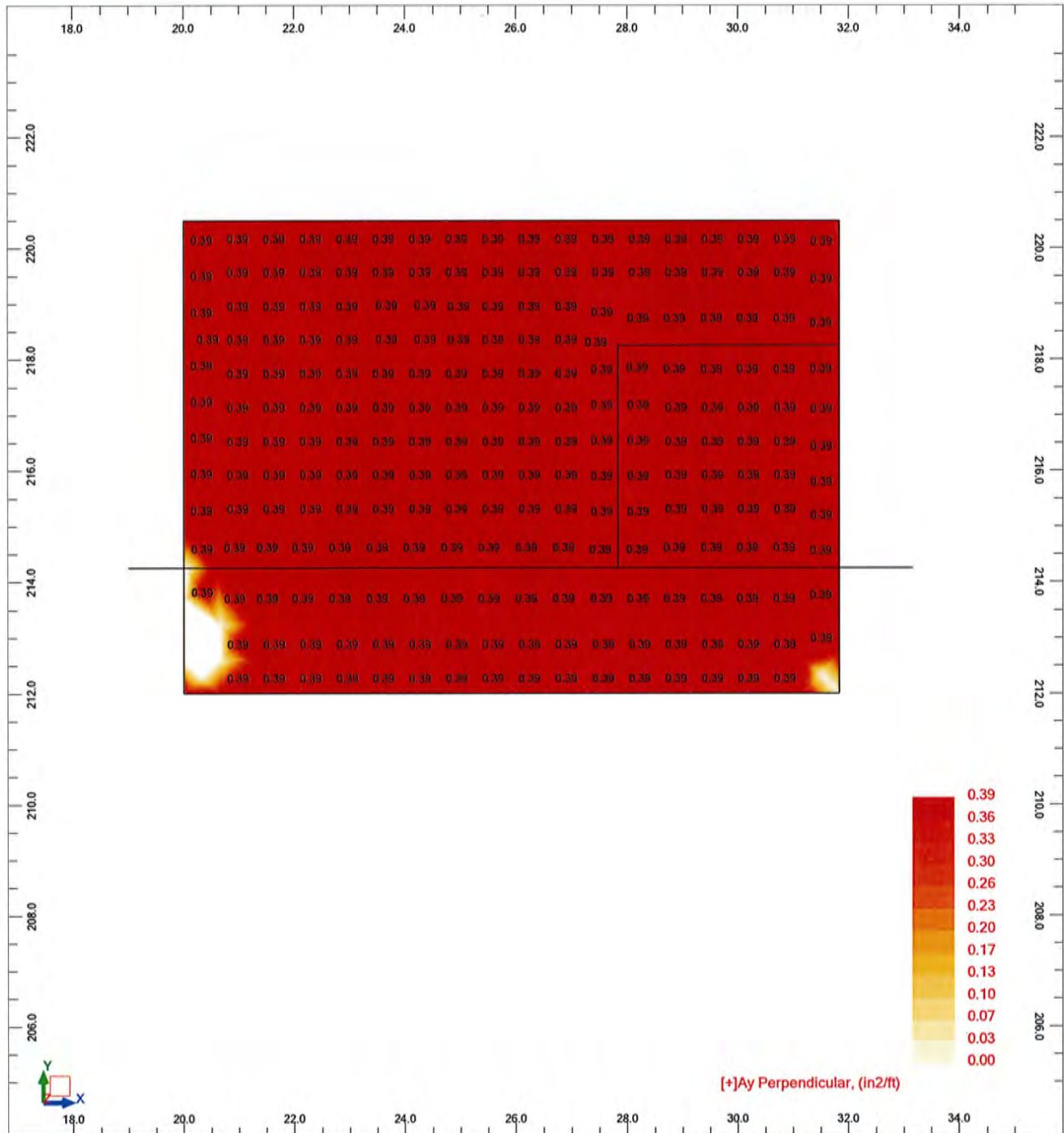




7158 S. FLSmidth Drive
Midvale, Utah 84047-5559

Engineer: **Ed Summers**
Calc No.: **C-013** Job.: **11021**
Project: **Concentrate Thickener Platform Footing re**
Client: **CC&V High Grade Ore**

View - **[+]Ay Perpendicular (in2/ft)**



Project Notes :

Printed: 5 MAR 2012, 10:09AM

Cantilevered Retaining Wall

File: P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\C-013 Concentrate Thickener Flotation Area.ecb
ENERCALC, INC. 1983-2011, Build:6.12.01.12, Ver:6.11.8.31

Lic. # : KW-06000120

Licensee : flsmidth centry

Description : 6.5' Retaining Wall

Criteria

Retained Height	=	6.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	2.00 : 1
Height of Soil over Toe	=	30.00 in
Water height over heel	=	0.0 ft
Vertical component of active		
Lateral soil pressure options:		
NOT USED for Soil Pressure.		
NOT USED for Sliding Resistance.		
NOT USED for Overturning Resistance.		

Soil Data

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	400.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore		
for passive pressure	=	0.00 in

Calculations per ACI 318-08, ACI 530-08, IBC 2009,
CBC 2010, ASCE 7-05

Design Summary

Wall Stability Ratios

Overturning	=	2.54 OK
Sliding	=	3.73 OK
(Vertical Component NOT Used)		
Total Bearing Load	=	3,108 lbs
...resultant ecc.	=	5.45 in

Soil Pressure @ Toe	=	961 psf OK
Soil Pressure @ Heel	=	283 psf OK
Allowable	=	4,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,153 psf
ACI Factored @ Heel	=	339 psf
Footing Shear @ Toe	=	1.5 psi OK
Footing Shear @ Heel	=	17.3 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,190.5 lbs
less 100% Passive Force	=	- 3,200.0 lbs
less 100% Friction Force	=	- 1,248.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Design Height Above Ftg

ft =	6.50
Wall Material Above "Ht"	= Concrete
Thickness	in = 8.00
Rebar Size	= # 6
Rebar Spacing	in = 12.00
Rebar Placed at	= Edge

Design Data

fb/FB + fa/Fa	=	0.000
Total Force @ Section	lbs =	0.0
Moment.....Actual	ft-l =	0.0
Moment.....Allowable	ft-l =	10,495.0
Shear.....Actual	psi =	0.0
Shear.....Allowable	psi =	94.9
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.63
Lap splice if above	in =	22.20
Lap splice if below	in =	9.96
Hook embed into footing	in =	9.96

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Project Notes :

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Cantilevered Retaining Wall

File: P:\11021\116 - Calculations\116.d - Arch_Civil_Struct\013 Concentrate Thickener\Flotation Area.ec6
ENERCALC, INC. 1983-2011, Build:6.12.01.12, Ver:6.11.8.31

Lic. # : KW-06000120

Licensee : flsmidth centry

Description : 6.5' Retaining Wall

Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	3.00
Total Footing Width	=	5.00
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'_c =	4,000 psi	F_y = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	3.00	@ Btm. = 3.00 in

Footing Design Results

	Toe	Heel
Factored Pressure	= 1,153	339 psf
M_u' : Upward	= 2,088	0 ft-lb
M_u' : Downward	= 1,260	3,588 ft-lb
M_u : Design	= 828	3,588 ft-lb
Actual 1-Way Shear	= 1.54	17.30 psi
Allow 1-Way Shear	= 94.87	94.87 psi
Toe Reinforcing	= # 6 @ 12.00 in	
Heel Reinforcing	= # 6 @ 12.00 in	
Key Reinforcing	= None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd, $M_u < S * F_r$
Heel: Not req'd, $M_u < S * F_r$
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

.....OVERTURNING.....				RESISTING.....				
Item		Force lbs	Distance ft	Moment ft-lb		Force lbs	Distance ft	Moment ft-lb
Heel Active Pressure	=	1,470.5	3.06	4,493.2	Soil Over Heel	=	1,820.0	3.83 6,976.7
Surcharge over Heel	=				Sloped Soil Over Heel	=	163.3	4.22 689.6
Toe Active Pressure	=	-280.0	1.33	-373.3	Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	1.00	
					Surcharge Over Toe	=		
					Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
					Footing Weight	=	1,125.0	2.50 2,812.5
					Key Weight	=		
					Vert. Component	=		
								</

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Project Notes :

Printed: 5 MAR 2012, 10:10AM

Cantilevered Retaining Wall

File: P:\11021\116 - Calculations\116.d - Arch_Civil_Struc\013 Concentrate Thickener\Flotation Area.ec6
ENERCALC, INC. 1983-2011, Build:6.12.01.12, Ver:6.11.8.31

Lic. #: KW-06000120

Licensee : flsmith centry

Description : 6.5' Retaining Wall (Reduced Soil)

Criteria

Retained Height	=	4.50 ft
Wall height above soil	=	2.00 ft
Slope Behind Wall	=	2.00 : 1
Height of Soil over Toe	=	30.00 in
Water height over heel	=	0.0 ft
Vertical component of active		
Lateral soil pressure options:		
NOT USED for Soil Pressure.		
NOT USED for Sliding Resistance.		
NOT USED for Overturning Resistance.		

Soil Data

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	400.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore	=	0.00 in
for passive pressure	=	0.00 in

Calculations per ACI 318-08, ACI 530-08, IBC 2009,
CBC 2010, ASCE 7-05

Design Summary

Wall Stability Ratios

Overturning	=	2.09 OK
Sliding	=	7.59 OK
(Vertical Component NOT Used)		
Total Bearing Load	=	1,448 lbs
...resultant ecc.	=	5.79 in
Soil Pressure @ Toe		
Soil Pressure @ Heel	=	949 psf OK
Allowable	=	17 psf OK
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	4,000 psf
ACI Factored @ Heel	=	1,138 psf
Footing Shear @ Toe	=	20 psf
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	7.4 psi OK
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	94.9 psi
less 100% Passive Force	=	497.8 lbs
less 100% Friction Force	=	3,200.0 lbs
Added Force Req'd	=	579.8 lbs
....for 1.5 : 1 Stability	=	0.0 lbs OK
	=	0.0 lbs OK

Stem Construction

Top Stem

Design Height Above Ftg

ft =	6.50
Wall Material Above "Ht"	= Concrete
Thickness	= 8.00
Rebar Size	= # 6
Rebar Spacing	= 12.00
Rebar Placed at	= Edge

Design Data

fb/FB + fa/Fa	=	0.000
Total Force @ Section	lbs =	0.0
Moment.....Actual	ft-l =	0.0
Moment.....Allowable	ft-l =	10,495.0
Shear.....Actual	psi =	0.0
Shear.....Allowable	psi =	94.9
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.63
Lap splice if above	in =	22.20
Lap splice if below	in =	9.96
Hook embed into footing	in =	9.96

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Project Notes :

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Cantilevered Retaining Wall

File: P:\11021\116 - Calculations\116.d - Arch_Civil_Struct\013 Concentrate Thickener\Flotation Area.ec6
ENERCALC, INC. 1983-2011, Build:6.12.01.12, Ver:6.11.8.31

Lic. # : KW-06000120

Licensee : flsmith centry

Description : 6.5' Retaining Wall (Reduced Soil)

Footing Dimensions & Strengths

Toe Width	=	1.00 ft
Heel Width	=	2.00
Total Footing Width	=	3.00
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	4,000 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	3.00	@ Btm. = 3.00 in

Footing Design Results

	Toe	Heel
Factored Pressure	= 1,138	20 psf
Mu' : Upward	= 507	0 ft-lb
Mu' : Downward	= 315	873 ft-lb
Mu: Design	= 192	873 ft-lb
Actual 1-Way Shear	= 0.00	7.40 psi
Allow 1-Way Shear	= 94.87	94.87 psi
Toe Reinforcing	= # 6 @ 12.00 in	
Heel Reinforcing	= # 6 @ 12.00 in	
Key Reinforcing	= None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

.....OVERTURNING.....				RESISTING.....					
Item		Force lbs	Distance ft	Moment ft-lb		Force lbs	Distance ft	Moment ft-lb	
Heel Active Pressure	=	777.8	2.22	1,728.4	Soil Over Heel	=	720.0	2.33	1,680.0
Surcharge over Heel	=				Sloped Soil Over Heel	=	53.3	2.56	136.3
Toe Active Pressure	=	-280.0	1.33	-373.3	Surcharge Over Heel	=			
Surcharge Over Toe	=				Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=			
Added Lateral Load	=				* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=		0.50	
					Surcharge Over Toe	=			
					Stem Weight(s)	=			
					Earth @ Stem Transitions	=			
					Footing Weight	=	675.0	1.50	1,012.5
					Key Weight	=			
					Vert. Component	=			

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Project Notes :

Printed: 5 MAR 2012, 10:09AM

Cantilevered Retaining Wall

File: P:\11021\116 - Calculations\116.d - Arch_Civil_Struct\013 Concentrate Thickener\Flotation Area.ec6
ENERCALC, INC. 1983-2011, Build:6.12.01.12, Ver:6.11.8.31

Lic. # : KW-06000120

Licensee : flsmith centry

Description : 3.75' Retaining Wall

Criteria

Retained Height	=	3.75 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	2.00 : 1
Height of Soil over Toe	=	30.00 in
Water height over heel	=	0.0 ft
Vertical component of active		
Lateral soil pressure options:		
NOT USED for Soil Pressure.		
NOT USED for Sliding Resistance.		
NOT USED for Overturning Resistance.		

Soil Data

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	400.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	0.00 pcf
Friction Coeff btwn Ftg & Soil	=	0.400
Soil height to ignore for passive pressure	=	0.00 in

Calculations per ACI 318-08, ACI 530-08, IBC 2009,
CBC 2010, ASCE 7-05

Design Summary

Wall Stability Ratios

Overturning	=	4.23 OK
Sliding	=	8.93 OK
(Vertical Component NOT Used)		
Total Bearing Load	=	1,838 lbs
...resultant ecc.	=	0.59 in
Soil Pressure @ Toe		
Soil Pressure @ Heel	=	426 psf OK
Allowable	=	493 psf OK
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	511 psf
ACI Factored @ Heel	=	592 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	12.0 psi OK
Allowable	=	94.9 psi
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	440.5 lbs
less 100% Passive Force	= -	3,200.0 lbs
less 100% Friction Force	= -	736.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Stem Construction

Design Height Above Ftg

ft =	6.50
Wall Material Above "Ht"	= Concrete
Thickness	= 8.00
Rebar Size	= # 6
Rebar Spacing	= 12.00
Rebar Placed at	= Edge

Design Data

fb/FB + fa/Fa	=	0.000
Total Force @ Section	lbs =	0.0
Moment....Actual	ft-l =	0.0
Moment.....Allowable	ft-l =	10,495.0
Shear.....Actual	psi =	0.0
Shear.....Allowable	psi =	94.9
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	5.63
Lap splice if above	in =	22.20
Lap splice if below	in =	9.96
Hook embed into footing	in =	9.96

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Load Factors

Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Project Notes :

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Footing Dimensions & Strengths

Toe Width	=	1.00 ft
Heel Width	=	3.00
Total Footing Width	=	4.00
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	4,000 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	3.00	@ Btm. = 3.00 in

Footing Design Results

	Toe	Heel
Factored Pressure	= 511	592 psf
Mu' : Upward	= 259	0 ft-lb
Mu' : Downward	= 315	2,510 ft-lb
Mu: Design	= 56	2,510 ft-lb
Actual 1-Way Shear	= 0.00	11.99 psi
Allow 1-Way Shear	= 94.87	94.87 psi
Toe Reinforcing	= # 6 @ 12.00 in	
Heel Reinforcing	= # 6 @ 12.00 in	
Key Reinforcing	= None Spec'd	

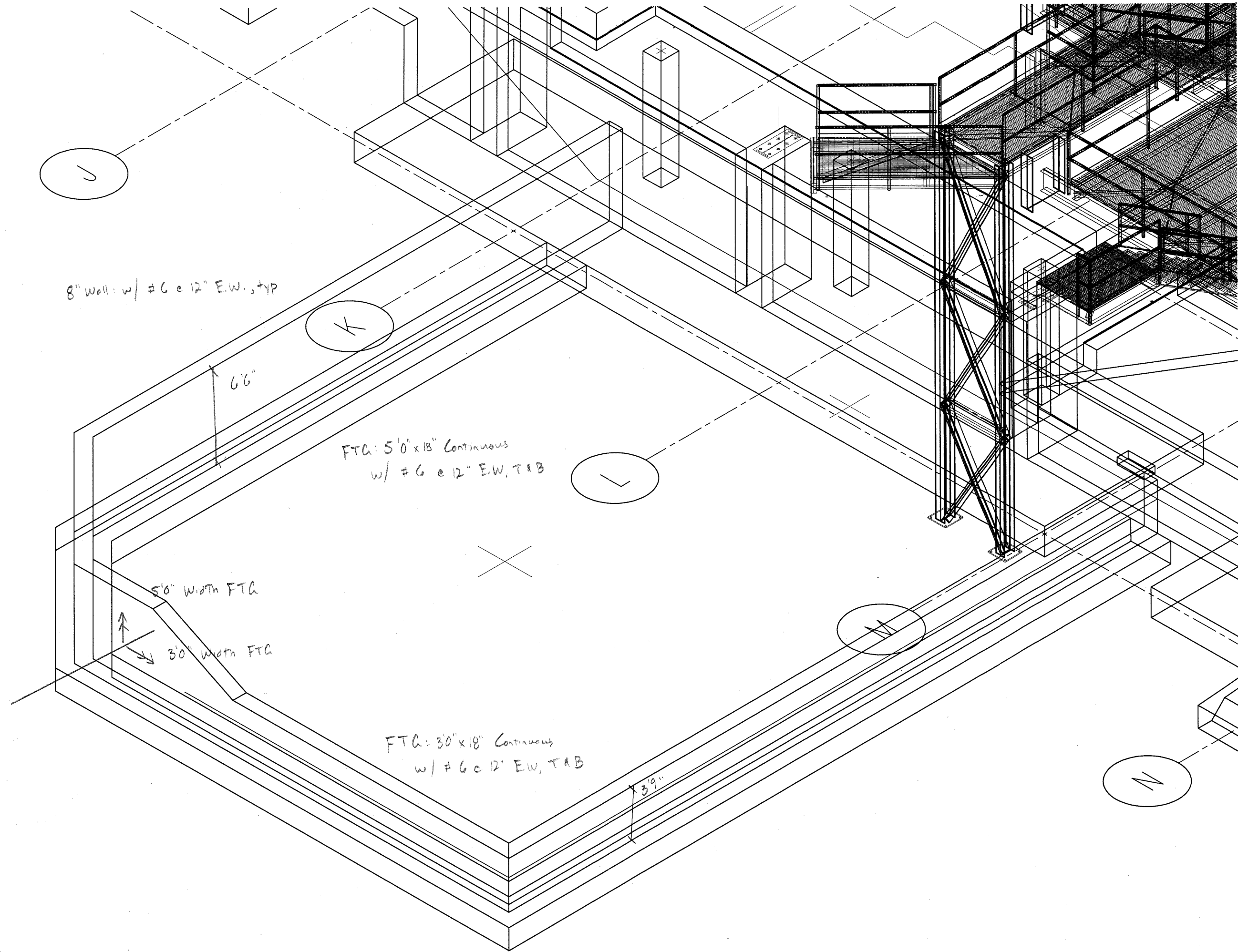
Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

.....OVERTURNING.....				RESISTING.....							
Item		Force lbs	Distance ft	Moment ft-lb		Force lbs	Distance ft	Moment ft-lb			
Heel Active Pressure	=	720.5	2.14	1,541.2	Soil Over Heel	=	1,050.0	2.83	2,975.0		
Surcharge over Heel	=				Sloped Soil Over Heel	=	163.3	3.22	526.3		
Toe Active Pressure	=	-280.0	1.33	-373.3	Surcharge Over Heel	=					
Surcharge Over Toe	=				Adjacent Footing Load	=					
Adjacent Footing Load	=				Axial Dead Load on Stem	=					
Added Lateral Load	=				* Axial Live Load on Stem	=					
Load @ Stem Above Soil	=				Soil Over Toe	=		0.50			
					Surcharge Over Toe	=					
					Stem Weight(s)	=	-275.0	1.33	-366.7		
					Earth @ Stem Transitions	=					
					Footing Weight	=	900.0	2.00	1,800.0		
					Key Weight	=					
					Vert. Component	=					
Total	=	440.5	O.T.M.	=	1,167.8	Total	=	1,838.3 lbs	R.M.	=	4,934.6
Resisting/Overturning Ratio				=	4.23						
Vertical Loads used for Soil Pressure =				1,838.3	lbs						
Vertical component of active pressure NOT used for soil pressure											

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.



Concentrate Thickener Weir Design

Design per Fluid Mechanics with Engineering Applications 10th Edition, p. 527-535

Weir Criteria:

$$q := 1500 \text{ gpm}$$

Incoming Flow Rate

$$E := 9 \text{ in}$$

Total Head above Weir

$$L := 24 \text{ in}$$

Weir Length

$$n := 1$$

End Contractions

Weir Design:

$$y_c := \frac{2}{3} \cdot E = 6 \text{ in}$$

Critical Flow height above Weir

$$A := L \cdot y_c = 1 \text{ ft}^2$$

Area of Flow

$$V_o := \frac{q}{A} = 3.342 \frac{\text{ft}}{\text{s}}$$

Velocity of Flow

$$y := \frac{V_o^2}{2g} = 2.083 \text{ in}$$

Head Loss

$$H := E - y = 6.917 \text{ in}$$

Height of Water approaching Weir

$$L_{\text{eff}} := L - 0.1 \cdot n \cdot H = 23.308 \text{ in}$$

Weir Effective Length

$$Q := L_{\text{eff}} \cdot \sqrt{g} \cdot \left(\frac{2}{3} \right)^{1.5} \cdot E^{1.5} = 1.748 \times 10^3 \text{ gpm}$$

Flow Rate Over Weir

Result:

$$\text{Ratio} := \frac{q}{Q} = 0.858$$

Ratio of Incoming Flow Vs. Outgoing Flow