ENGINEERING APPENDIX A

APPENDIX 8

GEOTECHNICAL DESIGN

Brazos River East Flood Gate

Soil Parameter Determination

Using the GLO database, there are six (6) borings on the east side of the Brazos. Those borings are 87-267, 87-266, and 87-265 which vary from 1200 feet to 1500 feet away from the new gate, respectively; and 83-92, 83-91, and 83-90 which vary from 2700 feet to 3500 feet away from the new gate, respectively. Ground surface elevations of the borings are not known; only the depths are known. The borings extend to depths of approximately 60 feet.

The strength test data for the 1987 borings are somewhat adequate, consisting mostly of pocket penetrometer tests and torvane tests, with occasional unconfined compression tests. Also accompanying the strength test data is soil classification, Atterberg limits, moisture contents, sieve analyses, and dry unit weight determination.

The test data for the 1983 borings are severely lacking, consisting of soil classification, moisture contents and a few unconfined compression tests/Atterberg limits/ dry unit weight determinations/sieve analyses per boring.

The determination of soil parameters relied heavily on the data from 1987, and specifically the data from boring 87-267, which is the closest boring to the new gate (approximately 1200 feet). All data was plotted in charts of Shear Strength vs. Depth and Wet Density vs. Depth. The stratification limits and the shear strength line was initially determined based on data solely from boring 87-267. Then those stratification limits and that shear strength line was overlaid onto the plot of all shear strength data from all borings to verify agreement. Adjustments were then made as needed, still heavily favoring the conditions at boring 87-267, to reflect the data as a whole. The stratification limits were then overlaid onto the plot of all wet density data, adjustments were then made as needed, and a wet density line was drawn.

For boring locations, boring logs, test data, and soil parameter plots, see Appendix A.

Pile Capacity Determination

Analyses were performed to determine the estimated ultimate single pile load capacity in compression and tension for an open end 30-inch diameter steel pipe pile with wall thickness of 5/8-inch was estimated. The estimated capacity is presented on the design plate. The capacity was determined with and without a plug formation, and the most critical condition (vs. depth) was reported. Both Q-case and S-case was examined with groundwater table at the ground surface.

Because the borings used in the development of the soil parameters lacked ground surface elevation details, the curves presented assume the ground surface at EL 0.0 NAVD 88. If ground surface elevations for each boring are determined via survey or other means, and elevations are found to be similar, the soil parameters and the curves can be adjusted accordingly. If elevations are found to not be similar, the soil parameters and the curves can be re-evaluated by the geotechnical engineer.

Soil-pile interface parameters such as adhesion and wall friction followed recommendations provided in EM 1110-2-2906. Other parameters used in the design, such as lateral earth coefficients for both

compression and tension and bearing capacity factors can be found on the pile capacity curve design plate presented in Appendix B.

Due to the lack of proximate geotechnical data, recommended design factors of safety for allowable pile capacity are as follows:

	FS w/ Load test	FS w/o Load test
Q-case	2	3.5
S-case	1.5	2

The factors of safety shown with an accompanying load test assume a static load test. It is highly recommended that a static pile load test be performed at a location within the footprint of the proposed structure. If dynamic testing only is performed, the Q-case factor of safety should be adjusted to a value of 2.5, and the S-case factor of safety should be taken as 1.75.

The piles will derive a significant portion of their supporting capacity through skin friction and therefore it will be necessary to consider the effect of group action for piles placed in groups. In this regard, the supporting value of pile groups should be investigated on the basis of group perimeter shear by the formula shown in the figure titled “Capacity of Pile Groups” provided in the Appendix. For pile groups used in tension, the second term of the formula should be deleted when evaluating group effects. All groups should be evaluated for perimeter shear. The minimum center-to-center spacing within a pile group or row of piles should be determined in accordance with the pile spacing formula shown in the figure titled “Capacity of Pile Groups” provided in Appendix B.

Pile load capacities shown on the design plate assume piles are installed vertically, but may be used to estimate horizontal load resistances for batter piles. The vertical component of the batter piles are equated to the load capacities for identical sized vertical piles driven to the same tip elevations. This relationship may be used to determine the axial capacities and horizontal components of the batter piles as shown in the figure titled “Axial and Horizontal Resistance of Batter Piles” provided in Appendix B.

Temporary Retaining Structure Design

Using the design soil parameters developed for Brazos River – East, the temporary retaining system (TRS) was designed. The TRS consists of a braced sheet pile cofferdam structure. For feasibility level design purposes, the geometry of the structure was modeled after a similar project known as the Morganza to the Gulf - GIWW West Flood Gate. This project called for a TRS dredge elevation of EL -28 and 5 levels of bracing at elevations -3.0, -9.0, -14.0, -19.0, and finally a tremie slab acting as a brace at EL -27.0. The piezometric surface inside the cofferdam was placed three (3) feet below the dredge depth for design purposes, to model uplift control.

Only the Q-case soil parameters were used in the design. A factor of safety (FOS) of 1.3 was incorporated into the soil shear strengths for determination of the tip elevation and moment. A factor of safety (FOS) of 1.0 was used for determination of the brace loadings. The design was performed in stages. Given the number of braces, seven (7) stages were required.

The available boring data extended to approximately EL -60. The soil parameters for the stratum immediately above this elevation were assumed to continue below this elevation. This is likely a conservative assumption, as soil shear strengths tend to increase with increased depth. From the boring data, the ground surface below the water surface was assumed to be at EL -8. It is recommended that project specific borings and testing be performed in later stages of the project.

The design water level was provided by the non-Federal Sponsor's AE Mott MacDonald and was based on the gauge data for Brazos, using the gauge just inside of the East Gate. The AE filtered out any water surface elevations associated with hurricanes by cross references a hurricane database (IBTracs). The data remaining (i.e. no hurricanes or tropical storms included) indicated that the maximum non-tropical water level was approximately 4.88 ft MSL. With a conversion of 0 MSL = 1.01 ft above NAVD88, the max elevation in NAVD88 would be 5.89, or rounded to EL 6.0 NAVD88.

Analyses for each stage as well as determined values for tip elevation, bending moment, and brace loadings are shown in Appendix C, with values to be used for design highlighted in the table. Taking into account the stratification and the results of the analyses, the recommended tip elevation for the sheet piles is EL -40.0 for this structure.

Based on the available boring data, the foundation at the structure location appears to be clay material throughout the depth of interest. Therefore, it is not likely that any specific dewatering requirements will be necessary for this site other than pumping within the TRS.

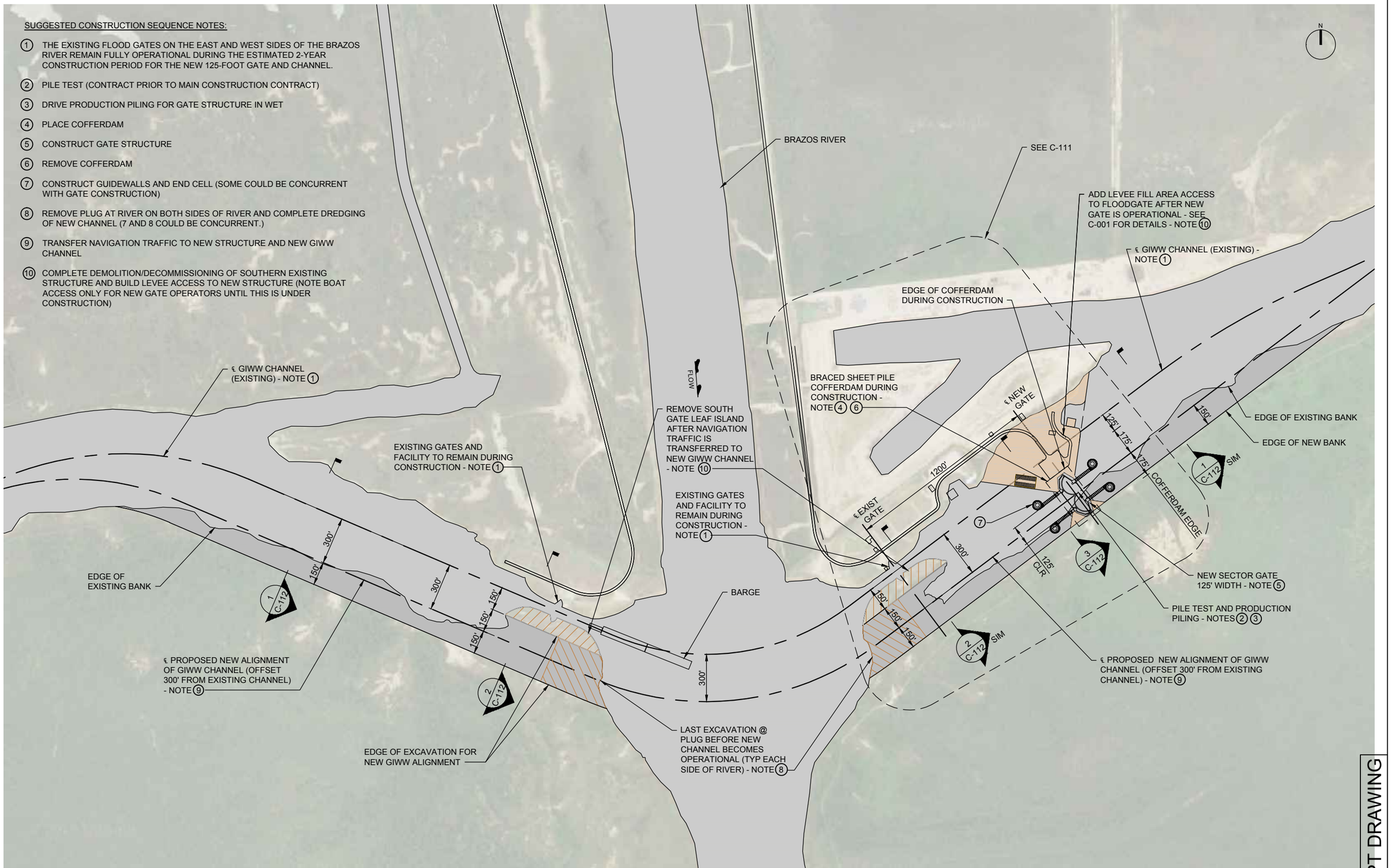
Sheet Pile Seepage Cutoff Design

Using the design soil parameters developed for Brazos River – East, the requirements for the sheet pile seepage cutoff below the base slab of the gate structure was determined. The design water levels provided were EL 10.0 on the Brazos River side of the gate and EL -2.0 on the GIWW side of the gate. The estimated tip elevation was determined using Lane's Weighted Creep Ratio method of analysis, and based on the soil parameters and stratification from the limited data and the water levels provided, the recommended tip elevation for the seepage cutoff is EL -46.0 for this structure. Analyses for determination of the seepage cutoff sheet pile are shown in Appendix D.

APPENDIX A

SUGGESTED CONSTRUCTION SEQUENCE NOTES:

1. THE EXISTING FLOOD GATES ON THE EAST AND WEST SIDES OF THE BRAZOS RIVER REMAIN FULLY OPERATIONAL DURING THE ESTIMATED 2-YEAR CONSTRUCTION PERIOD FOR THE NEW 125-FOOT GATE AND CHANNEL.
2. PILE TEST (CONTRACT PRIOR TO MAIN CONSTRUCTION CONTRACT)
3. DRIVE PRODUCTION PILING FOR GATE STRUCTURE IN WET
4. PLACE COFFERDAM
5. CONSTRUCT GATE STRUCTURE
6. REMOVE COFFERDAM
7. CONSTRUCT GUIDEWALLS AND END CELL (SOME COULD BE CONCURRENT WITH GATE CONSTRUCTION)
8. REMOVE PLUG AT RIVER ON BOTH SIDES OF RIVER AND COMPLETE DREDGING OF NEW CHANNEL (7 AND 8 COULD BE CONCURRENT.)
9. TRANSFER NAVIGATION TRAFFIC TO NEW STRUCTURE AND NEW GIWW CHANNEL
10. COMPLETE DEMOLITION/DECOMMISSIONING OF SOUTHERN EXISTING STRUCTURE AND BUILD LEVEE ACCESS TO NEW STRUCTURE (NOTE BOAT ACCESS ONLY FOR NEW GATE OPERATORS UNTIL THIS IS UNDER CONSTRUCTION)



PLAN - TSP ALTERNATIVE 3A.1 - SOUTH SHIFT OF ALIGNMENT

SCALE: 1"=300'-0"

0 300' 600'

CONCEPT DRAWING

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: 9/28/2018
SOLICITATION NO.:
CONTRACT NO.:

DESIGNED BY: J. KIKUTA
DRAWN BY: V.ROUSE
CHECKED BY: G.KATZENBERGER
SUBMITTED BY: G.KATZENBERGER
SIZE: ANSI D

GALVESTON DISTRICT
P.O. BOX 1229
GALVESTON, TX 77553-1229

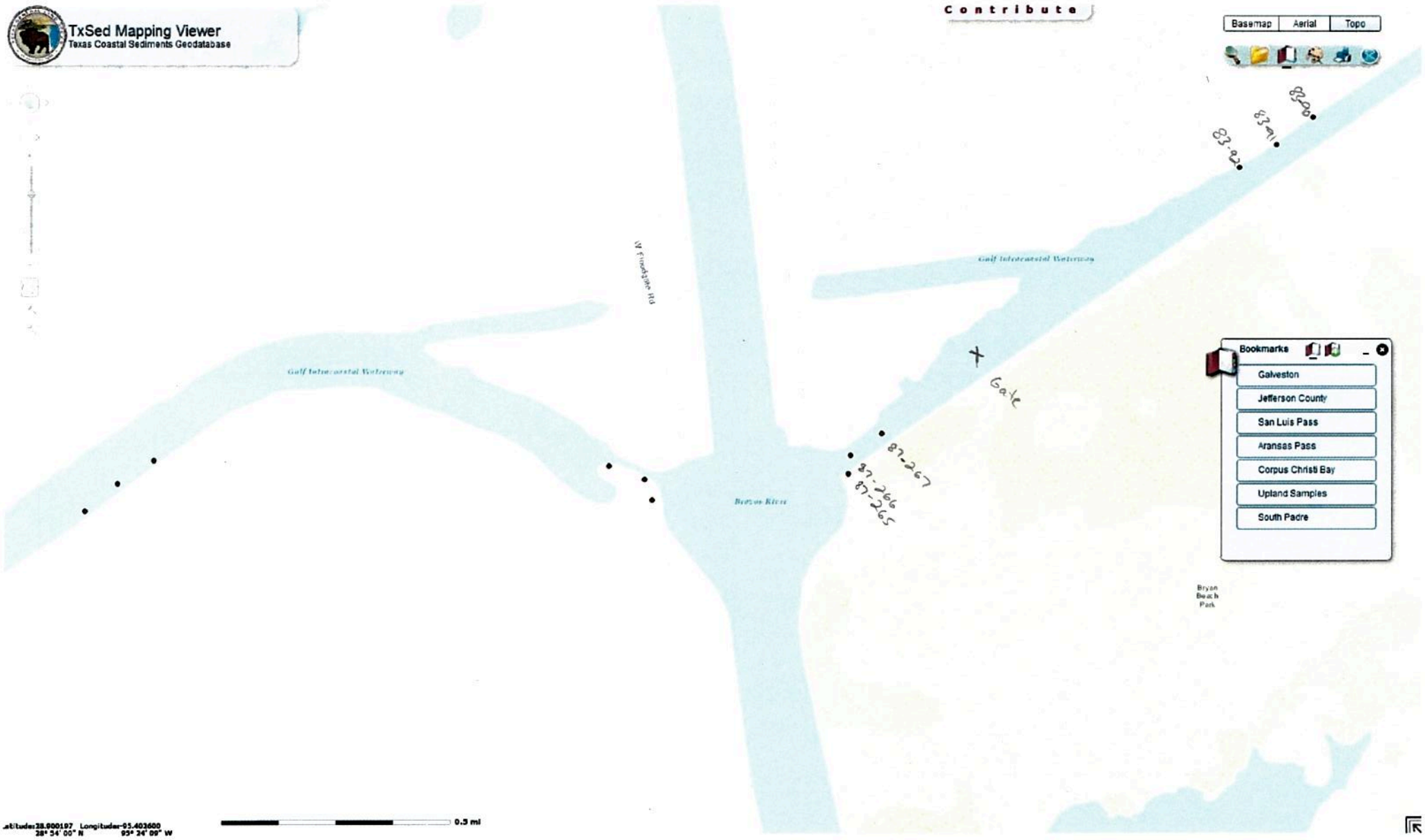
TETRA TECH
400 112TH AVENUE NE
SUITE 300
BELLEVUE, WA 98004

BRAZOS RIVER FLOODGATES
FEASIBILITY STUDY
BRAZORIA COUNTY, TX

TSP ALTERNATIVE 3A.1
SOUTH SHIFT OF ALIGNMENT
PLAN

SHEET ID
C-110

%STATUS%


TxSed Mapping Viewer
Texas Coastal Sediments Geodatabase
Contribute
Basemap
Aerial
Topo
Bookmarks
Galveston
Jefferson County
San Luis Pass
Aransas Pass
Corpus Christi Bay
Upland Samples
South Padre
Gulf Intracoastal Waterway
Gulf Intracoastal Waterway
N Freeport Rd
Brazos River
Bryan Beach Park
Gale
87-267
87-266
87-265
93-90
93-91
93-92
0.5 mi
Latitude:28.900197 Longitude:-95.403600
28° 54' 00" N 95° 24' 09" W

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-265

DATE 01-28-88 TYPE 6" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	LIQUID LIMIT	PLASTIC LIMIT
0			Reddish Brown Clay - Stiff (CH)		19			
					33	93	53	23
5			Tan Silty Sand - Loose (SM)	4	4			
10			- w/Clay Pockets 9'-11'	3	7			
			Dark Gray Clay - Soft (CH)					
			- w/Organic Material 14'-16'		65	62.7	80	32
15			- w/Sand Pockets 16'-18'		71			
			Dark Gray Sand - Loose (SW)		21			
20			- w/Shell Fragments 18'-27'	2	21			
25			Clayey Sand (SC)	3	21			
			Gray & Tan Clay - Stiff to Very Stiff (CH)					
30			- w/Calcareous Nodules 30'-32'		29	94	63	25
			Tan & Gray Sandy Clay - Very Stiff. (CL)		20			
35								
			Tan Silt & Very Fine Sand - Medium Dense (ML)	19	19			
40			- w/Sandstone Fragments 41'-43'	50/3"				
45				13	21			
50								

SHEAR STRENGTH, TSF

O – POCKET PENETROMETER
X – LABORATORY CONFINED
● – LABORATORY UNCONFINED
△ – TORVANE

0.5 1.0 1.5 2.0 2.5

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-265

DATE 01-28-88 TYPE 6" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Tan Clayey Sand - Medium Dense (SC)	10	21				
55			Reddish Brown Clay - Very Stiff (CH)						
60			Bottom @ 60'						

Weather: Sunny

Water Table Measurements: 8' after 24 Hours

Driller: Dempsey Gearen

Logger: Dempsey Gearen

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-266

DATE 01-27-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; Δ – TORVANE; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
0			Reddish Brown Clay (CH)		26				
					28	93		60	23
			Crushed Shell	13	5				
5									
10				36	18				
15				40	23				
20				18	23				
			Brown Silty Clay - Soft (CL)		36	83		34	21
25					37				
			Brown Clay (CH)		67	61		86	35
					40				
30			Gray & Tan 28'-32'		38	83		78	32
			Tan & Gray Silty Clay - Very Stiff (CL)		22				
35					19	112		34	18
					21				
			Tan & Gray Sandy Silt - Medium Dense to Dense (ML)	29	19				
40			- w/Sandstone Fragments 38'-40'						
				34	19				
45									
			- w/Sandstone Fragmenets 48'-50'	25	19				
50									

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-266

DATE 01-27-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Tan & Gray Sandy Silt (ML)						
			Reddish Brown Clay (CH)		25				
55					30	93		66	28
					26				
60			Bottom @ 60'						

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-267

DATE 01-27-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; △ – TORVANE; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT	
0			Reddish Brown Sandy Clay (CL)		31	92		48	22	C=130
					29					
5			Crushed Shell w/Clay & Sand Mixture	3	19					φ=3
10				9	15					
			Brown Clay - Very Soft to Firm (CH) - w/Sand Partings 11'-18'		41					
15					43	69		71	29	
					27	82		58	22	C=60
					28					
20					23					
			Gray & Brown 22'-26'		45	78		87	34	
			Stiff to Very Stiff Below 24'		45					
25			Greenish Gray & Tan 26'-38'		41					C=10 to 160
			w/Calcareous Nodules 28'-38'		39	82		94	31	
30			w/Alternated Thin Layers of Sand & Silt 32'-39'		34					
					16					
35					18					C=24
					14					
				25	15					
40					25					
					21	109		59	21	
45			Tan & Gray Sandy Clay - Stiff to Very Stiff (CL)		21					C=20
				11	22					
					21					
50										

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-267

DATE 01-27-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Reddish Brwon Clay - Stiff to Very Stiff (CH)		28	99		57	24
					24				
55			- w/Calcareous Nodules 54'-60'		25				
					29				
60			Bottom @ 60'						

C=18C

PROJECT: Gulf Intracoastal Waterway
Mooring Facilities - Brazos River Floodgates

BORING NO. 83-90 STATION: 237 + 150; 30' from bank TIDE READING +2.1 M.L.T.

LABORATORY LOG AND SUMMARY OF SOIL TESTS

SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
--	0 - 9.5													Water
Q-1	10 - 11	48												Clay, slightly silty w/sand pockets, gray and green, soft (CH)
Q-2	13 - 14	44												Clay w/occasional silt pockets, red and gray soft to medium stiff (CH)
Q-3	16 - 17	54												Clay w/ferrous nodules & occasional silt seams, brown, medium stiff (CH)
Q-4	19 - 20	27												Clay w/calcareous nodules & occasional ferrous nodules, stiff (CH)
Q-5	22 - 23	22												Sandy clay, brown & gray, medium stiff (CL)
Q-6	25 - 26	26	32	16	16		0	0	0	40	98	0.93		Sandy clay, w/traces of calcareous & ferrous nodules, red & light gray, medium stiff (CL)
Q-7	28 - 29	30												Clay w/calcareous; ferrous nodules & slickensides, tan & light gray, very stiff (CH)
Q-8	31 - 32	25												Clay w/calcareous & ferrous nodules & slickensides, tan, red & light gray, very stiff (CH)
Q-9	34 - 35	25												Clay w/calcareous nodules & slickensides, tan, red & gray, very stiff (CH)
Q-10	37 - 38	25	30	16	14		0	0.4	0.6	1.6				Silty clay w/occasional calcareous nodules & silt seams, red, tan & light gray, very stiff (CL)
Q-11	40 - 41	24												Silty clay w/silt seams, brown & gray, very stiff (CL)
Q-12	42 - 43	25												Silty clay, brown & red, very stiff (CL)
Q-14	46 - 47	27	37	21	16		0	0	0	4	96	1.47		Silty clay w/silt seams, brown & red, very stiff (CL)
Q-15	49 - 50	29												Silty clay w/clayey silt seams & slickensides, brown, very stiff (CL)

BORING NO. 83-90 (Continued) STATION: TIDE READING

LABORATORY LOG AND SUMMARY OF SOIL TESTS

SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
Q-16	52 - 53	32												Clay w/occasional silt seams & ferrous, red, brown & light gray, very stiff (CH)
Q-17	55 - 56	38												Clay w/shell fragments & silt laminations, light gray, stiff (CH)
Q-18	58 - 59	45	84	30	54		0	0	0.2	0.7				Clay w/occasional shell fragments, dark gray, stiff (CH)
Q-19	61 - 62	44												Clay w/occasional silt laminations, dark gray, stiff (CH)
	Bottom of boring													

PROJECT: Gulf Intracostal Waterway
Mooring Facilities - Brazos River Floodgates

BORING NO. 83-91 STATION: 237 + 525; 30' from bank TIDE READING +2.5 M.L.T.

LABORATORY LOG AND SUMMARY OF SOIL TESTS

SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
--	0 - 9													Water
Q-1	9 - 10	34												Clay, slightly silty, brown and gray, soft (CH)
Q-2	13 - 14	42												Clay w/silt pockets, gray & brown, soft (CH)
Q-3	16 - 17	52												Clay w/silt seams, brown, medium stiff (CH)
Q-4	19 - 20	33												Silty clay w/silt seams & shell fragments, gray, medium stiff (CL)
Q-5	22 - 23	31	73	24	49		0	0.1	0.9	1.6				Clay w/calcareous & ferrous nodules & slickensides, tan & gray, very stiff (CH)
Q-6	25 - 26	31												Clay w/calcareous & ferrous nodules & slickensides, red & light gray, very stiff (CH)
Q-7	28 - 29	29												Clay w/calcareous & ferrous nodules, tan, gray & red, very stiff (CH)
Q-8	31 - 32	26												Clay w/calcareous & ferrous nodules & slickensides, tan & gray, very stiff (CH)
Q-9	34 - 35	27	50	18	32		0	0	2	6	99	2.06		Clay w/silt seams & calcareous nodules, tan and gray, very stiff (CH)
Q-10	37 - 38	20												Clayey silt, tan and gray, very stiff (ML)
Q-11	40 - 41	24												Silty clay w/silt seams, red and gray, very stiff (CL)
J-12	42.5-43	26												Clayey silt w/silt seams, tan (ML)
Q-13	46 - 47	32												Clay w/silt pockets, red, very stiff (CH)
Q-14	49 - 50	31												Clay w/silt pockets, red & gray, very stiff (CH)

PROJECT:

BORING NO. 83-91 (Continued) STATION: TIDE READING

LABORATORY LOG AND SUMMARY OF SOIL TESTS

SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
Q-15	52 - 53	32												Clay w/slickensides, brown & gray, very stiff (CH)
Q-16	55 - 56	35												Clay w/silt seams & shell fragments, light gray, very stiff (CH)
Q-17	58 - 59	49	73	29	44		0	0	0.3	0.8	70	1.49		Clay w/silt seams, dark gray, stiff (CH)
Q-18	62 - 63	47												Clay w/shell fragments, dark gray, stiff (CH)
	Bottom of Boring													

PROJECT: Gulf Intracoastal Waterway
Mooring Facilities - Brazos River Floodgates

BORING NO. 83-92 STATION: 237 + 900; 55' from bank TIDE READING + 2.5 M.L.T.

LABORATORY LOG AND SUMMARY OF SOIL TESTS

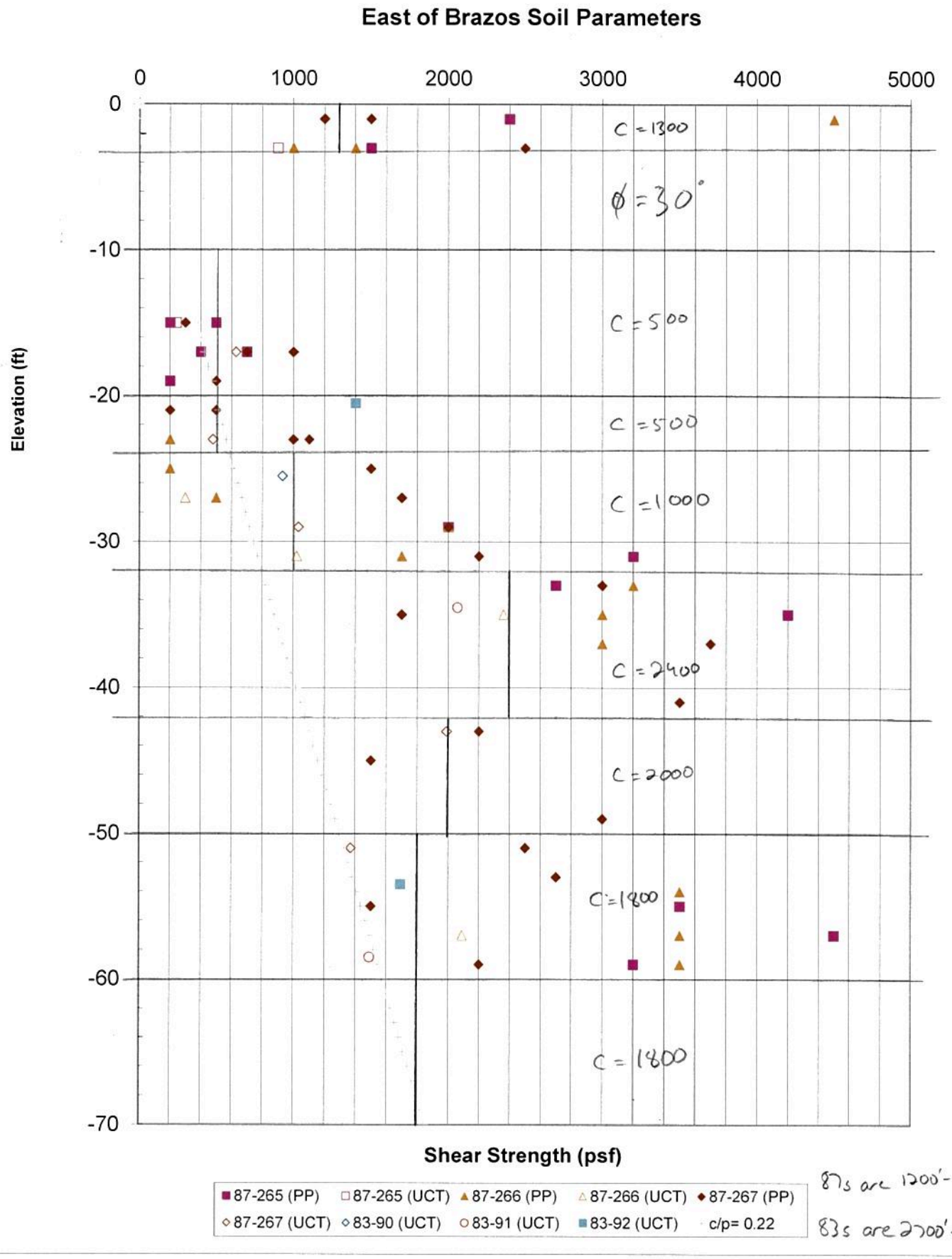
SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
--	0 - 7													Water
Q-1	7 - 7.5	33												Silty clay w/shell fragments, gray and tan, soft (CL)
Q-2	11 - 12	35												Clay w/silt seams, gray and tan, soft (CH)
Q-3	14 - 15	44												Clay w/silt seams, gray & tan, soft (CH)
Q-4	17 - 18	28												Silty clay w/silt seams & shell fragments, dark gray, medium stiff (CL)
Q-5	20 - 21	29	60	21	39		0	0	0	10	93	1.40		Clay, gray and tan, very stiff (CH)
Q-6	23 - 24	31												Clay w/occasional ferrous & calcareous nodules, gray & tan, very stiff (CH)
Q-7	26 - 27	26												Clay w/calcareous & ferrous nodules, gray & tan, very stiff (CH)
Q-8	29 - 30	24	60	22	38		0	1	2	9				Clay w/calcareous & ferrous nodules & slickensides, tan & gray, very stiff (CH)
Q-9	32 - 33	23												Clay w/calcareous & ferrous nodules, tan and gray, very stiff (CH)
Q-10	35 - 36	22												Clay w/calcareous & ferrous nodules & slickensides, & silt seams, tan & gray, very stiff (CH)
Q-11	37 - 38	18												Clay,tan & gray 37-37.8'; (CH), Clayey silt, tan, 37.8-39'(ML); Clay 39-40'
Q-12	41 - 42	23												Clayey silt w/silt seams, tan (ML)
Q-13	44 - 45	31												Clay w/silt seams & slickensides, red & gray, very stiff (CH)
Q-14	47 - 48	27												Clay w/silt seams, red & tan, very stiff(CH)

PROJECT:

BORING NO. 83-92 (Continued) STATION: TIDE READING

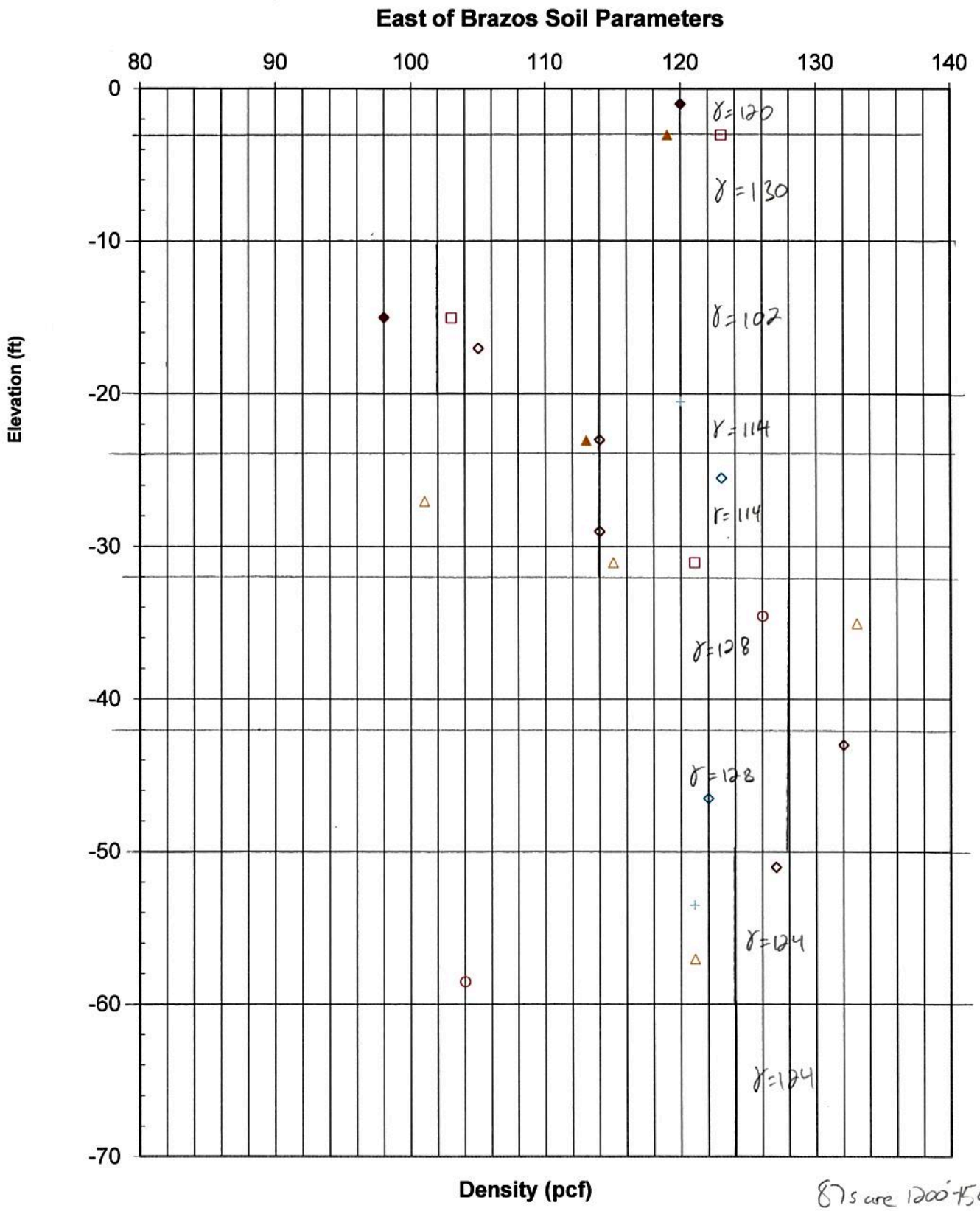
LABORATORY LOG AND SUMMARY OF SOIL TESTS

SAMPLE NO.	ELEVATION OR DEPTH FEET	W %	ATTERBERG LIMITS LL	PL	PI	SL	SIEVE ANALYSIS % RETAINED #4	#10	#40	#200	DRY UNIT WEIGHT LB/FT³	UNCONFINED COMPRESSION STRESS TSF	% STRAIN AT FAILURE	SOIL DESCRIPTION
Q-15	50 - 51	32												Clay w/silt seams, tan & red, very stiff (CH)
Q-16	53 - 54	30	64	19	45		0	0	0	1	93	1.69		Clay w/silt seams & slickensides; tan & light gray, very stiff (CH)
Q-17	56 - 57	29												Clay w/silt seams, tan and gray, very stiff (CH)
Q-18	59 - 60	47												Clay w/shell fragments & silt pockets, gray, stiff to very stiff (CH)
Q-19	62 - 63	43												Clay, dark gray, stiff (CH)
	Bottom of Boring													



87s are 1200'-1500' away

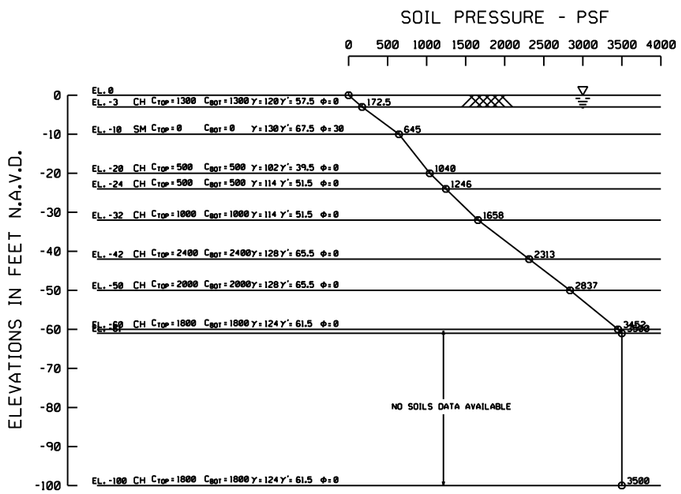
83s are 2700'-3500' away

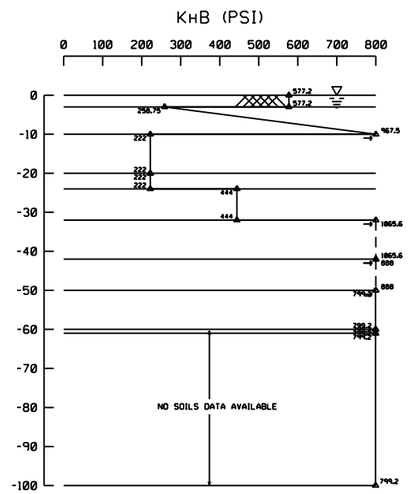


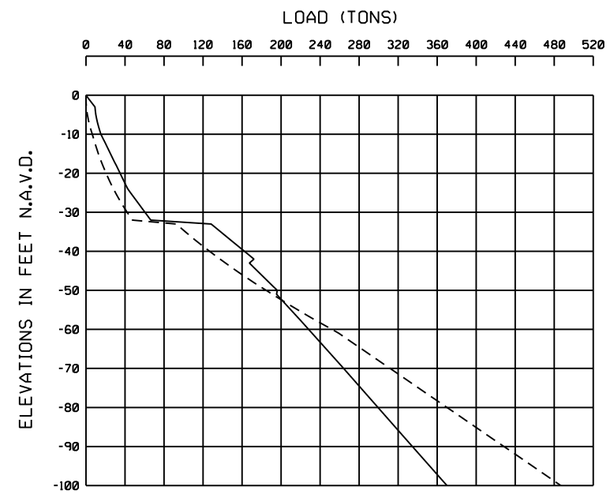
87s are 1200'-4500' away

83s are 2700'-3500' away

APPENDIX B



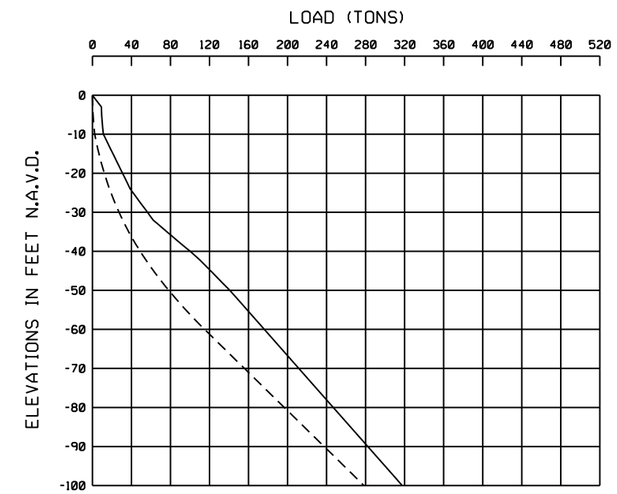




COMPRESSION (S.F.=1.0)

——— Q-CASE

— — S-CASE



TENSION (S.F.=1.0)

——— Q-CASE

— — S-CASE

EL	SOIL TYPE	Q-CASE				S-CASE			
		Kc	Kt	Nc	Nq	Kc	Kt	Nc	Nq
-3	CH	1	0.7	9	1	1	0.7	0	10
-10	SM	1.5	0.5	0	22.5	1.5	0.5	0	22.5
-20	CH	1	0.7	9	1	1	0.7	0	10
-24	CH	1	0.7	9	1	1	0.7	0	10
-32	CH	1	0.7	9	1	1	0.7	0	10
-42	CH	1	0.7	9	1	1	0.7	0	10
-50	CH	1	0.7	9	1	1	0.7	0	10
-60	CH	1	0.7	9	1	1	0.7	0	10
-100	CH	1	0.7	9	1	1	0.7	0	10

D	PILE SPACING IN DIRECTION OF LOADING
1.00	8B
.85	7B
.70	6B
.55	5B
.40	4B
.25	3B
C	LOADING CONDITION
1.00	INITIAL LOADING
0.30	CYCLIC LOADING

NOTES: $K_{H1} = k_{h1}/B = \alpha K1/B = (0.2222 q_u/B)(C)(D)$ COHESIVE (pci)

α = 0.4 = Factor of material properties of soil and pile

$k1$ = Coefficient of subgrade reaction for test plate (pci)

$B1$ = Width or diameter of test plate (in)

$K1 = k1B1 = 0.88 q_u$ (psf) = $0.5556 q_u$ (psi)

$q_u = 2c$ = Unconfined compressive strength (psf)

C = Reduction for cyclic loading

D = Group effect reduction factor

B = Width of pile measured at right angles to the direction of displacement (in)

$K_{H1} = (n_h)(Z/B)(C)(D)$ COHESIONLESS (pci)

n_h = Constant of horizontal subgrade reaction (pci)

Z = Depth below equivalent ground surface (in)

THE FACTOR SHOWN, KCOEFFICIENT OF HORIZONTAL SUBGRADE K_{H1} TIMES THE PILE WIDTH IN INCHES (B), MEASURED AT RIGHT ANGLES TO THE DIRECTION OF DISPLACEMENT MUST BE MODIFIED BY A REDUCTION FACTOR FOR THE EFFECT OF GROUP ACTION (D) AND A REDUCTION FACTOR FOR CYCLIC LOADING (C).

$$K_{H1} = \frac{0.2222 q_u (C)(D)}{B}$$

DUE TO THE LACK OF PROXIMATE GEOTECHNICAL DATA, THE FOLLOWING FACTORS OF SAFETY ARE RECOMMENDED FOR DESIGN:

	FS w / Load test	FS w /o Load test
Q-case	2	3.5
S-case	1.5	2

Brazos River Flood Gate and Colorado River Locks

East Brazos Flood Gate

Pile Capacity Curves

30"x5/8" Pipe Pile

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS

CORPS OF ENGINEERS

NEW ORLEANS, LOUISIANA

DESIGNED BY: CHB

DRAWN BY: CHB

CHECKED BY:

PLOT SCALE:

PLOT DATE:

CHB FILE:

FILE NO.

DATE: 5/7/2018

CAPACITY OF PILE GROUPS

The maximum allowable load carrying capacity of a pile group is no greater than the sum of the single pile load capacities, but may be limited to a lower value if so indicated by the result of the following formula.

$$Q_a = \frac{P \ x \ L \ x \ c}{(FSF)} + \frac{2.6 \ q_u \ (1 + 0.2 \ \frac{w}{b}) \ A}{(FSB)}$$

In Which:

Q_a	=	Allowable load carrying capacity of pile group, lb
P	=	Perimeter distance of pile group, ft
L	=	Length of pile, ft
c	=	Average (weighted) cohesion or shear strength of material between surface and depth of pile tip, psf
q_u	=	Average unconfined compressive strength of material in the zone immediately below pile tips, psf (unconfined compressive strength = cohesion x 2)
w	=	Width of base of pile group, ft
b	=	Length of base of pile group, ft
A	=	Base area of pile group, sq ft
(FSF)	=	Factor of safety for the friction area = 2
(FSB)	=	Factor of safety for the base area = 3

The values of c and q_u used in this formula should be based on applicable soil data shown on the Log of Boring and Test Results for this report. In the application of this formula, the weight of the piles, pile caps and mats, considering the effect of buoyancy, should be included.

SPACING WITHIN PILE GROUPS

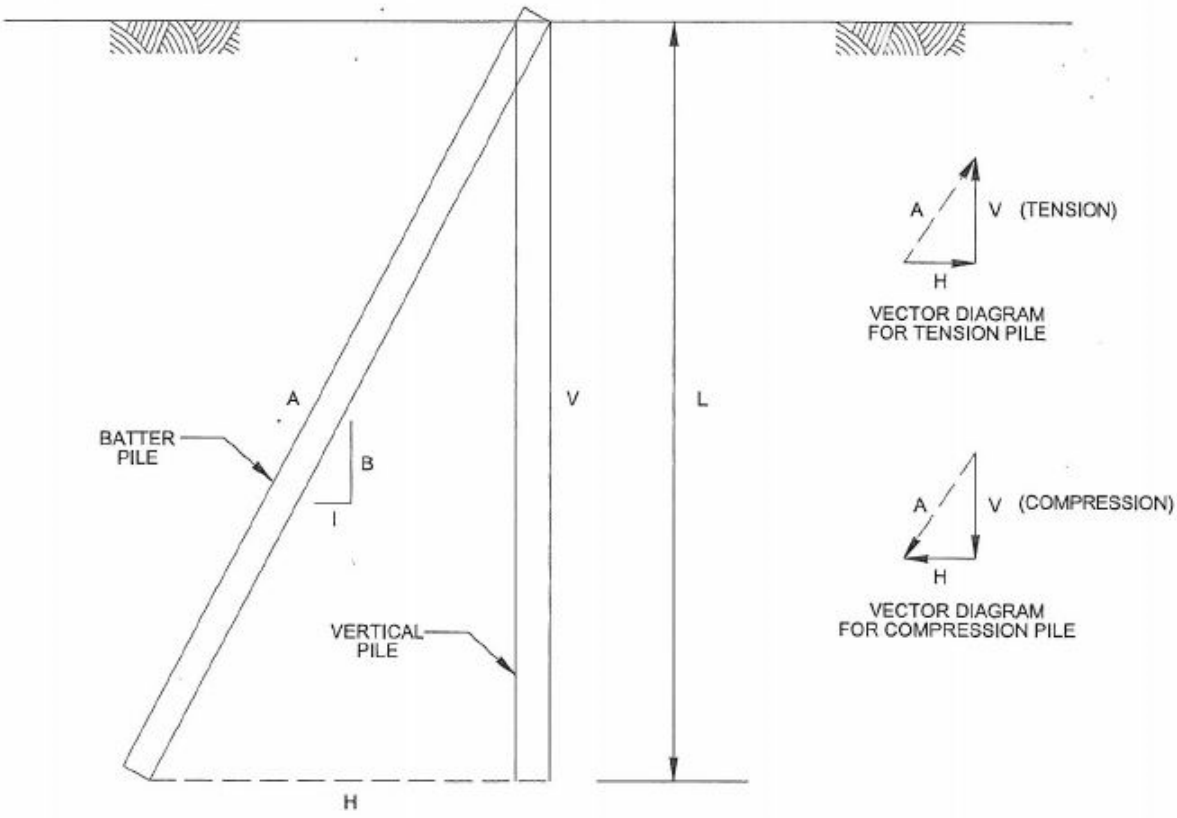
$$SPAC = 0.05 (L_1) + 0.025 (L_2) + 0.0125 (L_3)$$

In Which:

SPAC	=	Center to center of piles, feet
L_1	=	Pile penetration up to 100 feet
L_2	=	Pile penetration from 101 to 200 feet
L_3	=	Pile penetration beyond 200 feet

NOTE: Minimum pile spacing = 3 feet or 3 pile diameters, whichever is greater

AXIAL AND HORIZONTAL RESISTANCE OF BATTER PILES
ESTIMATED FROM ALLOWABLE VERTICAL LOAD CAPACITIES



L = VERTICAL COMPONENT OF BATTER PILE EMBEDMENT LENGTH.

V = ESTIMATED ALLOWABLE SINGLE LOAD CAPACITY OF A PILE DRIVEN VERTICALLY WITH EMBEDMENT LENGTH, L.

B = BATTER OF PILE EXPRESSED AS A RATIO OF VERTICAL DISTANCE TO ONE FOOT HORIZONTAL DISTANCE.

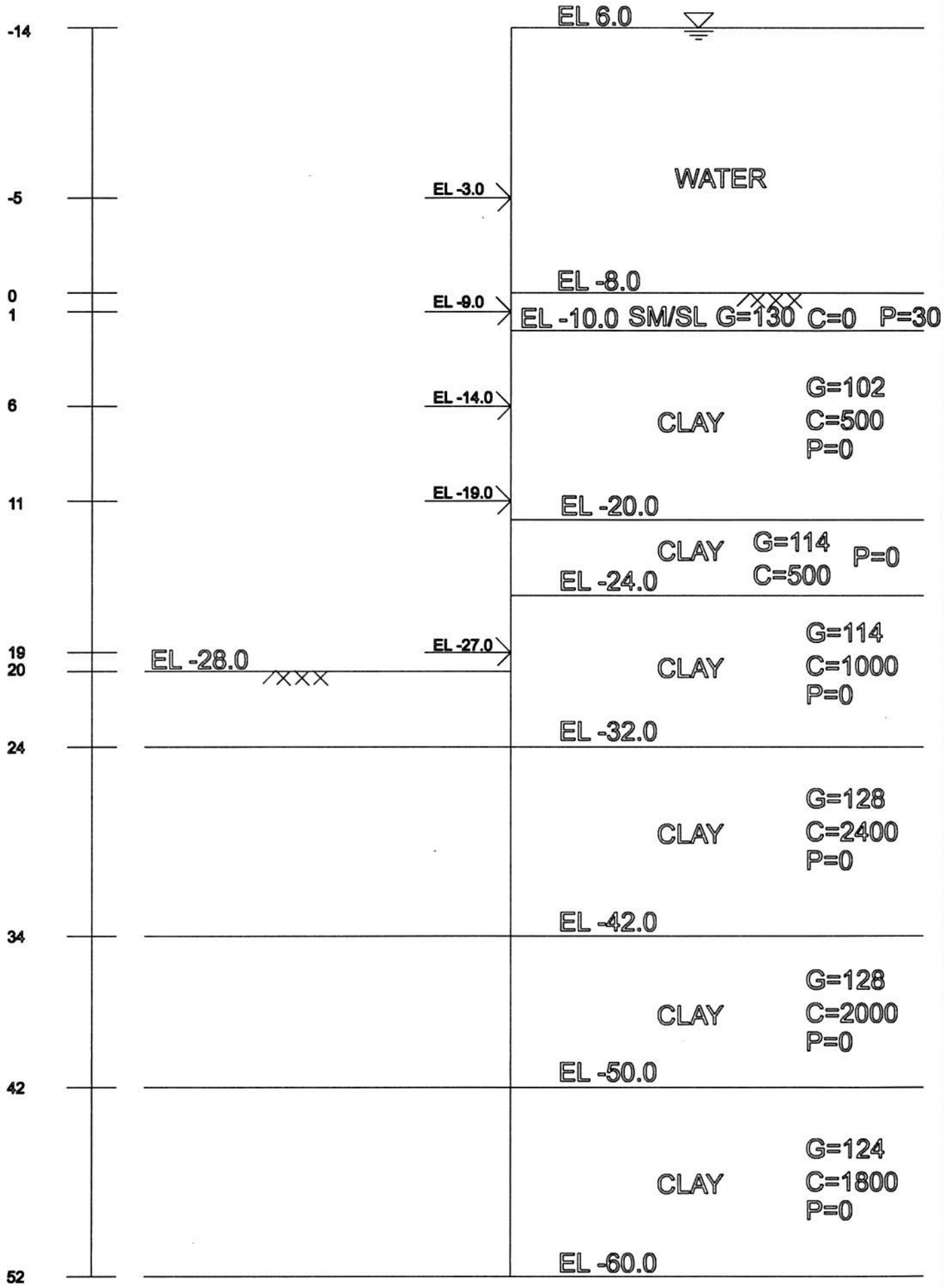
H = HORIZONTAL RESISTANCE OF BATTER PILE ESTIMATED AS FOLLOWS: $H = \frac{V}{B}$

A = ALLOWABLE AXIAL PILE LOAD CAPACITY OF A SINGLE BATTER PILE ESTIMATED AS FOLLOWS: $A = \sqrt{V^2(1+\frac{1}{B^2})}$

NOTE: THE AXIAL LOAD RESISTANCE OF A VERTICAL PILE, V, IS DEPENDENT ON THE TYPE OF LOADING - TENSION OR COMPRESSION. CAUTION SHOULD BE EXERCISED TO ENSURE THE CORRECT VERTICAL CAPACITY IS USED.

APPENDIX C

BRAZOS RIVER - EAST



...\TRS\East sketch.dgn 8/22/2018 1:12:40 PM

Brazos River - East Side

	Stages			Design							
	Braces	Water	Ground	Tip EL (ft)	Moment (ft#/ft)	Brace @ EL -3 (#/ft)	Brace @ EL -9 (#/ft)	Brace @ EL -14 (#/ft)	Brace @ EL -19 (#/ft)	* Brace @ EL -27 (#/ft)	Software
Stage 1	None	@ EL 6.0 & EL -4	@ EL -8 & EL -9	-37.00	100040	NONE	NONE	NONE	NONE	NONE	CWALSHT
Stage 1	None	@ EL 6.0 & EL -4	@ EL -8 & EL -9	-29.51	68431.9	NONE	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 2	@ EL -3	@ EL 6.0 & EL -10	@ EL -8 & EL -10	-23.09	10598	6900.3	NONE	NONE	NONE	NONE	CWALSHT
Stage 2	@ EL -3	@ EL 6.0 & EL -10	@ EL -8 & EL -10	-18.96	7615.6	6721.9	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 3	@ EL -3 & EL -9	@ EL 6.0 & EL -15	@ EL -8 & EL -15	-27.41	16759.2	4493.9	9359.0	NONE	NONE	NONE	SUPPORT IT
Stage 4	@ EL -3 & EL -9 & EL -14	@ EL 6.0 & EL -20	@ EL -8 & EL -20	-32.63	25558.4	4492.2	5397.4	14778.8	NONE	NONE	SUPPORT IT
Stage 5	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 6.0 & EL -28	@ EL -8 & EL -28	-39.28	58733.2	4506.3	5391.5	8895.4	24294.8	NONE	SUPPORT IT
Stage 6 *	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 6.0 & EL -31	@ EL -8 & EL -28	-39.87	60765.4	4490.3	5400.2	8909.2	24446.4	NONE	SUPPORT IT
Stage 7 *	@ EL -3 & EL -9 & EL -14 & EL -19 & EL -27	@ EL 6.0 & EL -31	@ EL -8 & EL -28	-28	23733.6	4493.1	5401.9	8919.4	17750.9	14541.0	SUPPORT IT

Indicates design value

FOS = 1.3 for Tip EL and Moment

FOS = 1.0 for Brace Loads

* Lowest brace is assumed to be a tremie slab

```
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'CANTILEVER CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3
CONTROL  CANTILEVER  DESIGN  1.30  1.30
WALL   6
SURFACE RIGHTSIDE   2    0   -8
                  200   -8
SURFACE LEFTSIDE   2    0   -9
                  200   -9
SOIL RIGHTSIDE  STRENGTHS   7
   130    130    30    0    0    0   -10   0
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   7
   130    130    30    0    0    0   -10   0
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
WATER ELEVATIONS   62.5    6   -4
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 30-AUGUST-2018 TIME: 15:04:28

```
***************
*  INPUT DATA  *
***************

 I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'CANTILEVER CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--CONTROL
   CANTILEVER WALL DESIGN
   FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
   FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

III.--WALL DATA
   ELEVATION AT TOP OF WALL    = 6.00 FT.

 IV.--SURFACE POINT DATA

      IV.A.--RIGHTSIDE
         DIST. FROM     ELEVATION
         WALL (FT)         (FT)
              0.00         -8.00
            200.00         -8.00

      IV.B.--LEFTSIDE
         DIST. FROM     ELEVATION
         WALL (FT)         (FT)
              0.00         -9.00
            200.00         -9.00

  V.--SOIL LAYER DATA

     V.A.--RIGHTSIDE
         LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
         LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT
```

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
130.00	130.00	30.00	0.00	0.00	0.00	-10.00	0.00	DEF	DEF
102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF

114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
130.00	130.00	30.00	0.00	0.00	0.00	-10.00	0.00	DEF	DEF
102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF
114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 6.00 (FT)
LEFTSIDE ELEVATION = -4.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 30-AUGUST-2018 TIME: 15:05:19

****

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*   SOIL PRESSURES FOR   *
* CANTILEVER WALL DESIGN *
**************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'CANTILEVER CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

ELEV. (FT)	NET WATER (PSF)	<---LEFTSIDE---> PASSIVE (PSF)	ACTIVE (PSF)	<------NET------> (SOIL + WATER) ACTIVE (PSF)	PASSIVE (PSF)	<--RIGHTSIDE---> ACTIVE (PSF)	PASSIVE (PSF)
6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	62.5	0.0	0.0	62.5	62.5	0.0	0.0
4.0	125.0	0.0	0.0	125.0	125.0	0.0	0.0
3.0	187.5	0.0	0.0	187.5	187.5	0.0	0.0
2.0	250.0	0.0	0.0	250.0	250.0	0.0	0.0
1.0	312.5	0.0	0.0	312.5	312.5	0.0	0.0
0.0	375.0	0.0	0.0	375.0	375.0	0.0	0.0
-1.0	437.5	0.0	0.0	437.5	437.5	0.0	0.0
-2.0	500.0	0.0	0.0	500.0	500.0	0.0	0.0
-3.0	562.5	0.0	0.0	562.5	562.5	0.0	0.0
-4.0	625.0	0.0	0.0	625.0	625.0	0.0	0.0
-5.0	625.0	0.0	0.0	625.0	625.0	0.0	0.0
-6.0	625.0	0.0	0.0	625.0	625.0	0.0	0.0
-7.0	625.0	0.0	0.0	625.0	625.0	0.0	0.0
-8.0	625.0	0.0	0.0	625.0	625.0	0.0	0.0
-9.0	625.0	0.0	0.0	653.5	784.7	28.5	159.7
-9.8+	625.0	127.8	22.8	497.2	1150.9	0.0	592.0
-9.8-	625.0	127.8	22.8	497.2	1150.9	0.0	505.5
-10.0	625.0	263.7	19.0	361.3	1197.9	0.0	592.0
-10.5	625.0	682.0	6.1	0.0	1390.5	0.0	771.6
-10.7+	625.0	880.1	0.0	-171.1	1481.7	0.0	856.7
-10.7-	625.0	712.0	0.0	-171.1	1481.7	0.0	856.7
-11.0	625.0	880.1	0.0	-255.1	1581.0	0.0	956.0
-12.0	625.0	916.1	0.0	-291.1	1611.2	0.0	986.2
-13.0	625.0	955.2	0.0	-330.2	1649.6	0.0	1024.6
-14.0	625.0	994.7	0.0	-369.7	1689.1	0.0	1064.1
-15.0	625.0	1034.2	0.0	-409.2	1728.2	0.0	1103.2
-16.0	625.0	1073.7	0.0	-448.7	1766.8	0.0	1141.8

-17.0	625.0	1113.2	0.0	-488.2	1805.7	0.0	1180.7
-18.0	625.0	1152.7	0.0	-527.7	1845.2	0.0	1220.2
-19.0	625.0	1192.2	0.0	-567.2	1884.7	0.0	1259.7
-20.0	625.0	1234.7	0.0	-609.7	1927.2	0.0	1302.2
-21.0	625.0	1283.2	0.0	-658.2	1975.7	0.0	1350.7
-22.0	625.0	1334.7	0.0	-709.7	2027.2	0.0	1402.2
-23.0	625.0	1386.2	0.0	-761.2	2078.7	0.0	1453.7
-24.0	625.0	1822.3	0.0	-1197.3	2514.8	0.0	1889.8
-25.0	625.0	2258.5	0.0	-1633.5	2951.0	0.0	2326.0
-26.0	625.0	2310.0	0.0	-1685.0	3002.5	0.0	2377.5
-27.0	625.0	2361.5	0.0	-1736.5	3054.0	0.0	2429.0
-28.0	625.0	2413.0	0.0	-1788.0	3105.5	0.0	2480.5
-29.0	625.0	2464.5	0.0	-1839.5	3157.0	0.0	2532.0
-30.0	625.0	2516.0	0.0	-1891.0	3208.5	0.0	2583.5
-31.0	625.0	2567.5	0.0	-1942.5	3260.0	0.0	2635.0
-32.0	625.0	3699.4	0.0	-3074.4	4391.9	0.0	3766.9
-33.0	625.0	4838.3	0.0	-4213.3	5530.8	0.0	4905.8
-34.0	625.0	4903.8	0.0	-4278.8	5596.3	0.0	4971.3
-35.0	625.0	4969.3	0.0	-4344.3	5661.8	0.0	5036.8
-36.0	625.0	5034.8	0.0	-4409.8	5727.3	0.0	5102.3
-37.0	625.0	5100.3	0.0	-4475.3	5792.8	0.0	5167.8
-38.0	625.0	5165.8	0.0	-4540.8	5858.3	0.0	5233.3
-39.0	625.0	5231.3	0.0	-4606.3	5923.8	0.0	5298.8
-40.0	625.0	5296.8	0.0	-4671.8	5989.3	0.0	5364.3
-41.0	625.0	5362.3	0.0	-4737.3	6054.8	0.0	5429.8
-42.0	625.0	5120.1	0.0	-4495.1	5812.6	0.0	5187.6
-43.0	625.0	4877.9	0.0	-4252.9	5570.4	0.0	4945.4
-44.0	625.0	4943.4	0.0	-4318.4	5635.9	0.0	5010.9
-45.0	625.0	5008.9	0.0	-4383.9	5701.4	0.0	5076.4
-46.0	625.0	5074.4	0.0	-4449.4	5766.9	0.0	5141.9
-47.0	625.0	5139.9	0.0	-4514.9	5832.4	0.0	5207.4
-48.0	625.0	5205.4	0.0	-4580.4	5897.9	0.0	5272.9
-49.0	625.0	5270.9	0.0	-4645.9	5963.4	0.0	5338.4
-50.0	625.0	5181.6	0.0	-4556.6	5874.1	0.0	5249.1
-51.0	625.0	5090.2	0.0	-4465.2	5782.7	0.0	5157.7
-52.0	625.0	5151.7	0.0	-4526.7	5844.2	0.0	5219.2
-53.0	625.0	5213.2	0.0	-4588.2	5905.7	0.0	5280.7
-54.0	625.0	5274.7	0.0	-4649.7	5967.2	0.0	5342.2
-55.0	625.0	5336.2	0.0	-4711.2	6028.7	0.0	5403.7

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                          BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:05:20

                      ***************************
                      *  SUMMARY OF RESULTS FOR  *
                      *  CANTILEVER WALL DESIGN  *
                      ***************************

    I.--HEADING
     'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
     'CANTILEVER CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 1 - 1.3

   II.--SUMMARY

        RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

        LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

   WALL BOTTOM ELEV. (FT)     :      -37.00
         PENETRATION (FT)     :       28.00

   MAX. BEND. MOMENT (LB-FT)  :  1.0004E+05
         AT ELEVATION (FT)    :      -23.94

   MAX. SCALED DEFL. (LB-IN^3):  9.3220E+10
         AT ELEVATION (FT)    :        6.00

             NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                    ELLASTICITY IN PSI TIMES PILE MOMENT
                    OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                    IN INCHES.


PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
                          BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:05:20

                      ***************************
                      * COMPLETE OF RESULTS FOR  *
                      *  CANTILEVER WALL DESIGN  *
                      ***************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'CANTILEVER CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
6.00	0.0000E+00	0.	9.3220E+10	0.00
5.00	1.0417E+01	31.	8.9745E+10	62.50
4.00	8.3333E+01	125.	8.6271E+10	125.00
3.00	2.8125E+02	281.	8.2797E+10	187.50
2.00	6.6667E+02	500.	7.9323E+10	250.00
1.00	1.3021E+03	781.	7.5850E+10	312.50
0.00	2.2500E+03	1125.	7.2380E+10	375.00
-1.00	3.5729E+03	1531.	6.8914E+10	437.50
-2.00	5.3333E+03	2000.	6.5454E+10	500.00
-3.00	7.5938E+03	2531.	6.2003E+10	562.50
-4.00	1.0417E+04	3125.	5.8566E+10	625.00
-5.00	1.3854E+04	3750.	5.5146E+10	625.00
-6.00	1.7917E+04	4375.	5.1751E+10	625.00
-7.00	2.2604E+04	5000.	4.8386E+10	625.00
-8.00	2.7917E+04	5625.	4.5061E+10	625.00
-9.00	3.3859E+04	6264.	4.1784E+10	653.52
-9.80	3.9063E+04	6725.	3.9204E+10	497.22
-10.00	4.0417E+04	6810.	3.8566E+10	361.28
-10.49	4.3807E+04	6900.	3.7003E+10	0.00
-10.73	4.5418E+04	6880.	3.6269E+10	-171.08
-11.00	4.7287E+04	6821.	3.5417E+10	-255.14
-12.00	5.3975E+04	6548.	3.2351E+10	-291.11
-13.00	6.0371E+04	6238.	2.9377E+10	-330.23
-14.00	6.6437E+04	5888.	2.6508E+10	-369.73
-15.00	7.2134E+04	5498.	2.3754E+10	-409.23
-16.00	7.7421E+04	5069.	2.1124E+10	-448.73
-17.00	8.2259E+04	4601.	1.8627E+10	-488.23
-18.00	8.6609E+04	4093.	1.6273E+10	-527.73
-19.00	9.0431E+04	3545.	1.4069E+10	-567.23
-20.00	9.3686E+04	2957.	1.2021E+10	-609.73
-21.00	9.6330E+04	2323.	1.0134E+10	-658.23
-22.00	9.8315E+04	1639.	8.4138E+09	-709.73
-23.00	9.9590E+04	903.	6.8634E+09	-761.23
-24.00	1.0004E+05	-76.	5.4850E+09	-1197.35
-25.00	9.9293E+04	-1491.	4.2793E+09	-1633.46
-26.00	9.6976E+04	-3151.	3.2449E+09	-1684.96

-27.00	9.2975E+04	-4861.	2.3779E+09	-1736.46
-28.00	8.7236E+04	-6623.	1.6713E+09	-1787.96
-29.00	7.9710E+04	-8437.	1.1152E+09	-1839.46
-30.00	7.0345E+04	-10302.	6.9649E+08	-1890.96
-30.83	6.1118E+04	-11893.	4.4148E+08	-1933.79
-31.00	5.9090E+04	-12201.	3.9912E+08	-1722.77
-32.00	4.6236E+04	-13297.	2.0361E+08	-469.33
-33.00	3.2914E+04	-13139.	8.7926E+07	784.11
-34.00	2.0376E+04	-11728.	2.9234E+07	2037.55
-35.00	9.8749E+03	-9064.	6.0441E+06	3290.99
-36.00	2.6652E+03	-5146.	3.9215E+05	4544.43
-37.00	0.0000E+00	0.	0.0000E+00	5792.53

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
6.00	0.	0.	0.	0.	0.
5.00	63.	0.	0.	0.	0.
4.00	125.	0.	0.	0.	0.
3.00	188.	0.	0.	0.	0.
2.00	250.	0.	0.	0.	0.
1.00	313.	0.	0.	0.	0.
0.00	375.	0.	0.	0.	0.
-1.00	438.	0.	0.	0.	0.
-2.00	500.	0.	0.	0.	0.
-3.00	563.	0.	0.	0.	0.
-4.00	625.	0.	0.	0.	0.
-5.00	625.	0.	0.	0.	0.
-6.00	625.	0.	0.	0.	0.
-7.00	625.	0.	0.	0.	0.
-8.00	625.	0.	0.	0.	0.
-9.00	625.	0.	0.	29.	160.
-9.80+	625.	128.	23.	0.	592.
-9.80-	625.	128.	23.	0.	506.
-10.00	625.	264.	19.	0.	592.
-10.49	625.	682.	6.	0.	772.
-10.73+	625.	880.	0.	0.	857.
-10.73-	625.	712.	0.	0.	857.
-11.00	625.	880.	0.	0.	956.
-12.00	625.	916.	0.	0.	986.

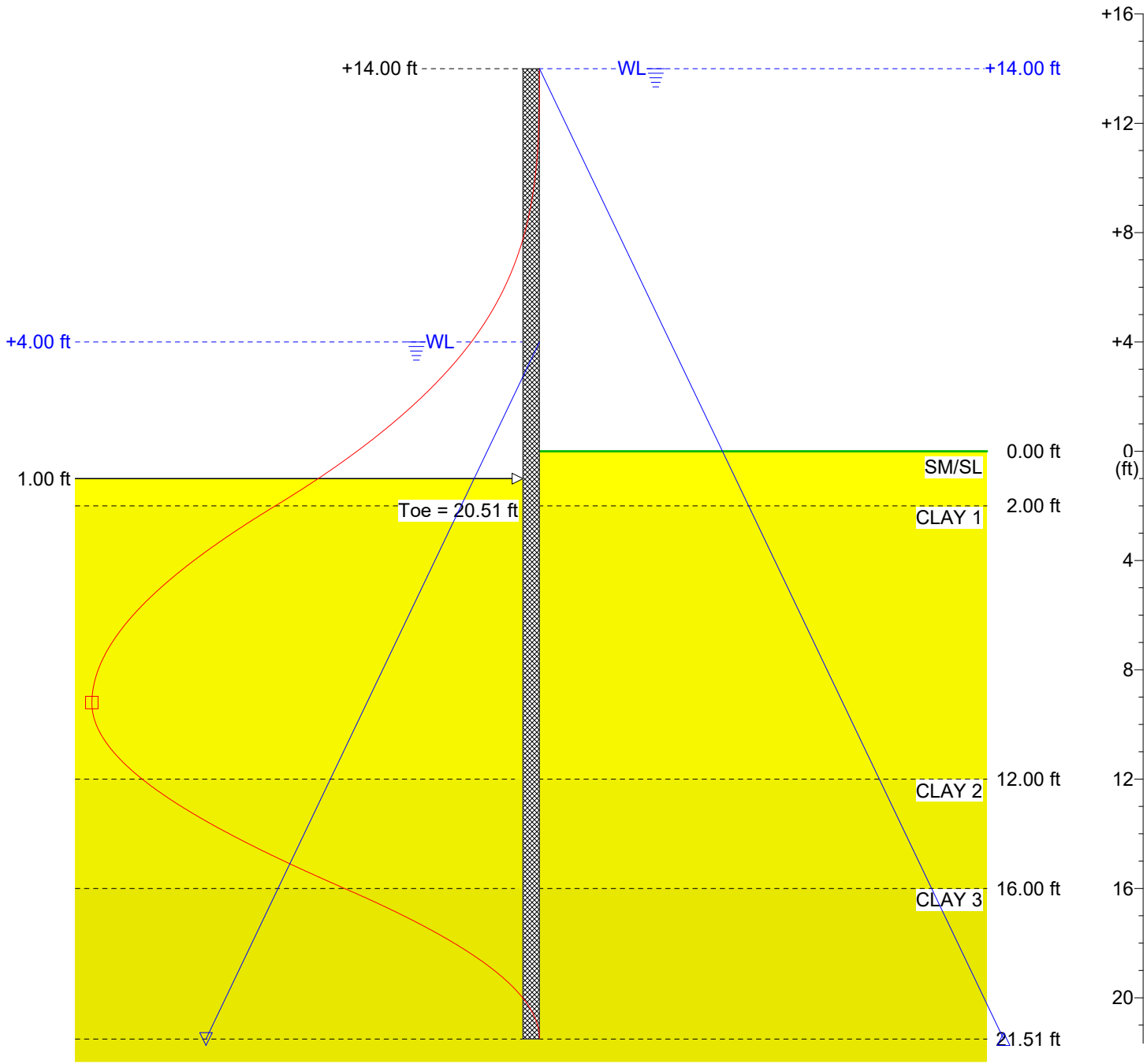
-13.00	625.	955.	0.	0.	1025.
-14.00	625.	995.	0.	0.	1064.
-15.00	625.	1034.	0.	0.	1103.
-16.00	625.	1074.	0.	0.	1142.
-17.00	625.	1113.	0.	0.	1181.
-18.00	625.	1153.	0.	0.	1220.
-19.00	625.	1192.	0.	0.	1260.
-20.00	625.	1235.	0.	0.	1302.
-21.00	625.	1283.	0.	0.	1351.
-22.00	625.	1335.	0.	0.	1402.
-23.00	625.	1386.	0.	0.	1454.
-24.00	625.	1822.	0.	0.	1890.
-25.00	625.	2258.	0.	0.	2326.
-26.00	625.	2310.	0.	0.	2377.
-27.00	625.	2361.	0.	0.	2429.
-28.00	625.	2413.	0.	0.	2480.
-29.00	625.	2464.	0.	0.	2532.
-30.00	625.	2516.	0.	0.	2583.
-30.83	625.	2559.	0.	0.	2626.
-31.00	625.	2567.	0.	0.	2635.
-32.00	625.	3699.	0.	0.	3767.
-33.00	625.	4838.	0.	0.	4906.
-34.00	625.	4904.	0.	0.	4971.
-35.00	625.	4969.	0.	0.	5037.
-36.00	625.	5035.	0.	0.	5102.
-37.00	625.	5100.	0.	0.	5168.
-38.00	625.	5166.	0.	0.	5233.

Title: Brazos River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

	Maximum	d (ft)
□	68431.9 ftlb/ft	9.20
△	2219.3 psf	21.51
△	1594.3 psf	21.51

Stage 1 - Tip & Moment only



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Title: Brazos River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 2
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Stage 1 - Tip & Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = +4.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	20.51	35.51

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	654.1 psf	1.00
Bending Moment	68431.9 ftlb/ft	9.20
Shear Force	6868.2 lb/ft	2.01

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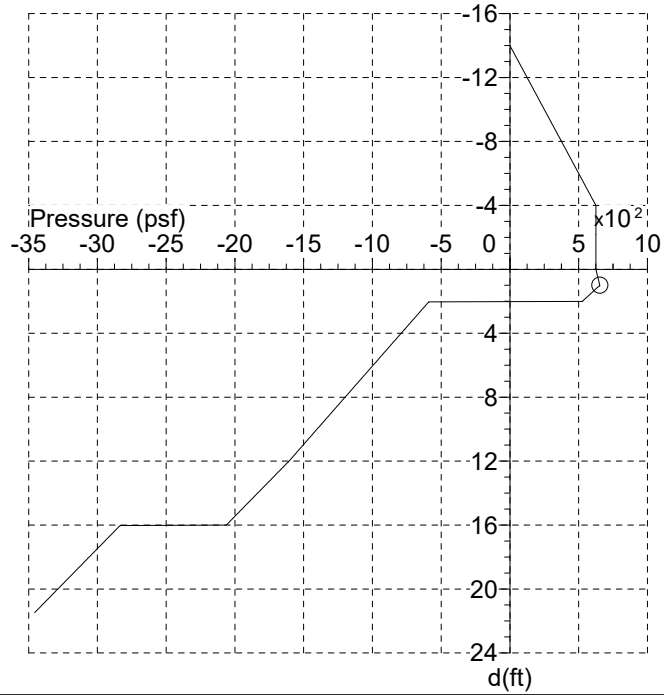
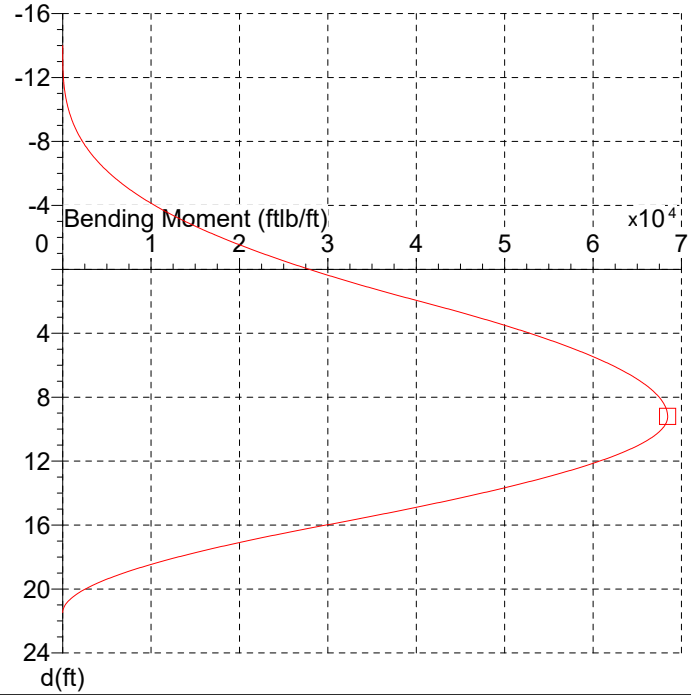
Title: Brazos River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 3
Date: 8.30.18

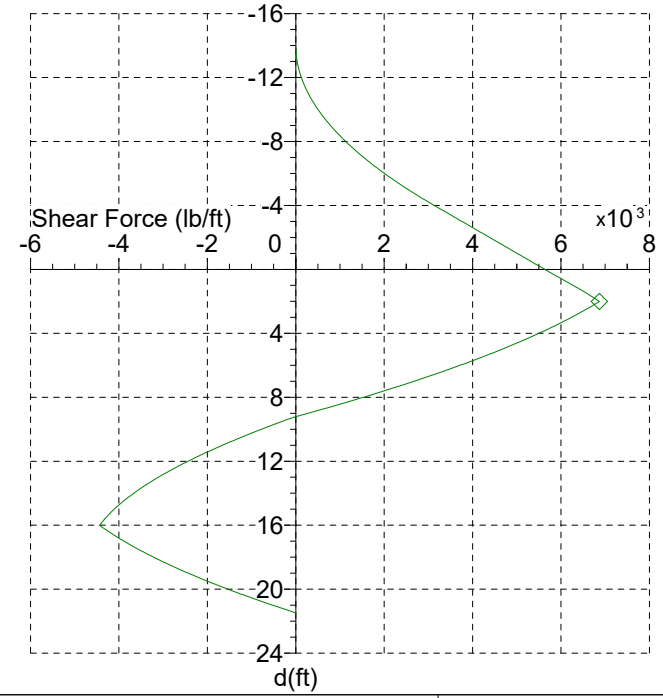
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

	Maximum	d (ft)
○	654.1 psf	1.00
□	68431.9 ftlb/ft	9.20
◇	6868.2 lb/ft	2.01

Stage 1 - Tip & Moment only







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Title: Brazos River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 4
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Stage 1 - Tip & Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	625.1	28034.3		5651.0	7.22	-1121.9	65977.2		2399.4	14.44	-1888.0	43627.7		-3885.4
0.15	630.1	28875.0		5744.0	7.37	-1136.9	66321.9		2232.5	14.60	-1904.8	42377.7		-3950.2
0.31	634.4	29729.5		5837.6	7.53	-1152.0	66641.9		2063.4	14.75	-1921.7	41107.3		-4012.5
0.46	638.7	30597.8		5931.9	7.68	-1167.1	66936.8		1892.1	14.90	-1938.6	39817.4		-4072.2
0.61	643.0	31480.1		6026.7	7.84	-1182.2	67206.2		1718.5	15.06	-1955.4	38508.6		-4129.5
0.77	648.1	32557.4		6141.4	7.99	-1200.3	67495.4		1507.3	15.21	-1975.7	36914.5		-4195.0
0.92	652.4	33470.8		6237.7	8.14	-1215.4	67707.7		1328.8	15.36	-1992.5	35567.2		-4246.8
1.08	642.5	34398.4		6333.9	8.30	-1230.5	67893.4		1148.1	15.52	-2009.4	34203.7		-4296.1
1.23	623.7	35340.0		6427.3	8.45	-1245.6	68052.3		965.1	15.67	-2026.3	32824.8		-4342.9
1.38	604.9	36295.3		6517.9	8.60	-1260.7	68184.0		779.9	15.82	-2043.1	31431.2		-4387.2
1.54	582.4	37459.1		6622.9	8.76	-1278.8	68305.7		554.7	15.98	-2062.8	29740.7		-4437.1
1.69	563.7	38443.0		6707.4	8.91	-1293.9	68376.5		364.6	16.13	-2849.5	28332.3		-4362.2
1.84	544.9	39439.2		6789.2	9.06	-1309.0	68419.0		172.3	16.29	-2866.4	26948.1		-4284.7
2.00	529.9	40447.3		6868.2	9.22	-1324.1	68431.9		-29.9	16.44	-2883.3	25589.0		-4204.7
2.15	-602.7	41457.2		6780.4	9.37	-1339.2	68403.3		-178.3	16.59	-2900.1	24255.8		-4122.2
2.30	-617.8	42454.0		6690.3	9.53	-1357.3	68306.8		-353.4	16.75	-2920.4	22691.3		-4019.9
2.46	-635.9	43632.4		6579.3	9.68	-1372.4	68175.5		-496.8	16.90	-2937.3	21417.8		-3931.9
2.61	-651.0	44599.2		6484.3	9.83	-1387.5	67998.6		-638.0	17.05	-2954.1	20172.8		-3841.5
2.77	-666.1	45551.8		6387.1	9.99	-1402.6	67776.9		-777.0	17.21	-2971.0	18957.0		-3748.5
2.92	-681.2	46490.0		6287.7	10.14	-1417.7	67511.1		-913.8	17.36	-2987.9	17771.3		-3653.0
3.07	-696.3	47413.3		6186.0	10.29	-1432.8	67201.8		-1048.3	17.51	-3008.1	16389.1		-3535.2
3.23	-714.4	48501.2		6061.1	10.45	-1450.9	66774.4		-1206.8	17.67	-3025.0	15272.2		-3434.2
3.38	-729.5	49390.7		5954.5	10.60	-1466.0	66372.1		-1336.4	17.82	-3041.8	14187.9		-3330.8
3.53	-744.6	50264.4		5845.6	10.75	-1481.1	65928.7		-1463.7	17.98	-3058.7	13137.0		-3224.8
3.69	-759.6	51121.8		5734.6	10.91	-1496.1	65444.9		-1588.9	18.13	-3075.6	12120.3		-3116.4
3.84	-774.7	51962.6		5621.3	11.06	-1511.2	64921.4		-1711.8	18.28	-3092.4	11138.5		-3005.4
3.99	-792.9	52949.4		5482.4	11.22	-1529.3	64241.8		-1856.3	18.44	-3112.7	10007.7		-2869.0
4.15	-807.9	53752.7		5364.2	11.37	-1544.4	63633.4		-1974.3	18.59	-3129.5	9105.6		-2752.6
4.30	-823.0	54538.4		5243.8	11.52	-1559.5	62987.7		-2090.0	18.74	-3146.4	8241.1		-2633.7
4.46	-838.1	55306.2		5121.1	11.68	-1574.6	62305.2		-2203.6	18.90	-3163.3	7415.0		-2512.2
4.61	-853.2	56055.7		4996.2	11.83	-1589.7	61586.7		-2314.9	19.05	-3180.2	6627.9		-2388.3
4.76	-871.3	56930.5		4843.4	11.98	-1606.7	60678.0		-2445.5	19.20	-3200.4	5736.2		-2236.3
4.92	-886.4	57638.7		4713.6	12.14	-1624.8	59882.9		-2551.8	19.36	-3217.3	5038.0		-2106.9
5.07	-901.5	58327.6		4581.5	12.29	-1641.7	59054.1		-2655.5	19.51	-3234.1	4381.5		-1975.0
5.22	-916.6	58996.8		4447.3	12.44	-1658.6	58192.5		-2756.7	19.67	-3251.0	3767.5		-1840.6
5.38	-931.7	59646.0		4310.8	12.60	-1675.4	57298.9		-2855.4	19.82	-3267.9	3196.7		-1703.7
5.53	-949.8	60398.3		4144.0	12.75	-1695.7	56185.3		-2970.6	19.97	-3288.1	2570.0		-1536.2
5.68	-964.9	61002.4		4002.6	12.91	-1712.5	55224.1		-3063.8	20.13	-3305.0	2097.3		-1393.8
5.84	-980.0	61585.5		3858.9	13.06	-1729.4	54233.3		-3154.5	20.28	-3321.8	1670.3		-1248.9
5.99	-995.1	62147.2		3713.0	13.21	-1746.3	53213.9		-3242.8	20.43	-3338.7	1290.0		-1101.5
6.15	-1010.2	62687.3		3564.9	13.37	-1763.1	52166.6		-3328.5	20.59	-3355.6	957.1		-951.6
6.30	-1025.3	63205.3		3414.6	13.52	-1783.4	50874.1		-3428.1	20.74	-3375.8	621.3		-768.5
6.45	-1043.4	63797.3		3231.2	13.67	-1800.2	49768.3		-3508.4	20.89	-3392.7	395.5		-613.1
6.61	-1058.5	64265.8		3075.9	13.83	-1817.1	48637.1		-3586.1	21.05	-3409.6	219.7		-455.3
6.76	-1073.6	64711.1		2918.4	13.98	-1834.0	47481.4		-3661.4	21.20	-3426.4	94.6		-294.9
6.91	-1088.7	65133.0		2758.7	14.13	-1850.8	46302.0		-3734.1	21.36	-3443.3	21.1		-132.1
7.07	-1103.7	65531.2		2596.7	14.29	-1867.7	45099.7		-3804.4	21.51	-3456.8	0.0		0.0

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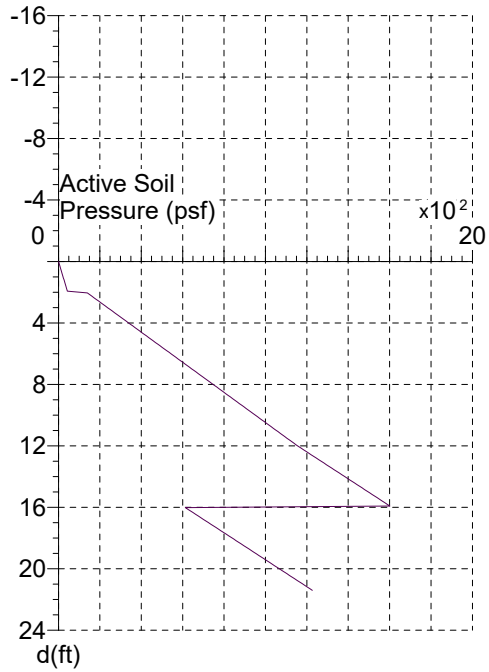
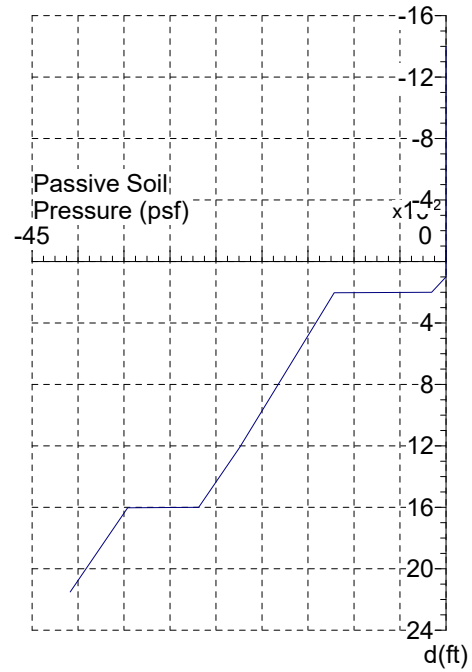
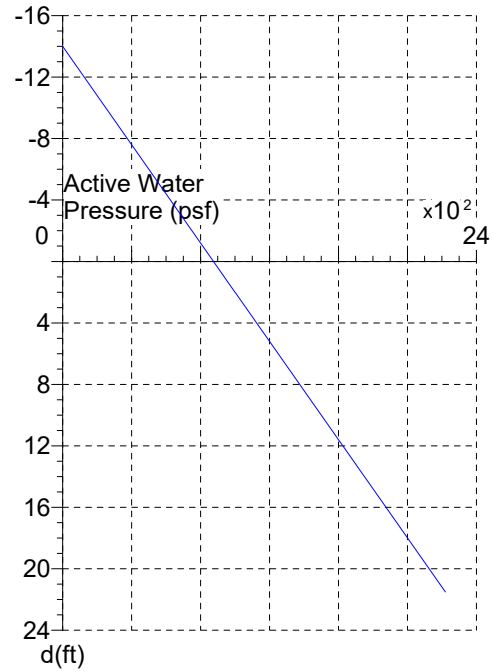
Title: Brazos River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 5
Date: 8.30.18

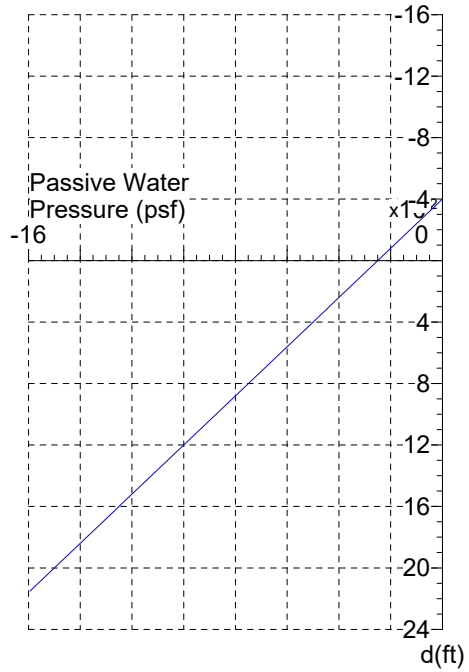
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

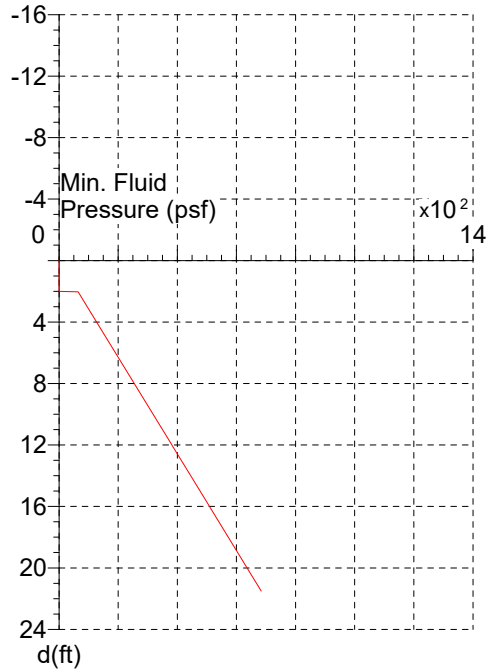
Stage 1 - Tip & Moment only

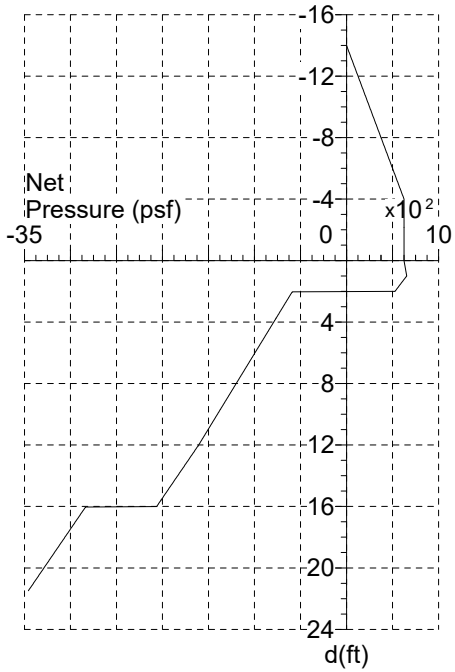












SupportIT, v2.35

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```
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3
CONTROL  ANCHORED  DESIGN  1.30  1.30
WALL   6.0   -3
SURFACE RIGHTSIDE   2    0   -8
                  200   -8
SURFACE LEFTSIDE   2    0   -10
                  200   -10
SOIL RIGHTSIDE  STRENGTHS   7
   130    130    30    0    0    0   -10   0
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   6
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
WATER ELEVATIONS   62.5    6.0   -10
FINISHED
```

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:08:25

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.3

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 6.00 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00         -8.00
                200.00         -8.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -10.00
                200.00        -10.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
130.00  130.00    30.00    0.00     0.00    0.00  -10.00   0.00   DEF  DEF
```

102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF
114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF
114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 6.00 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 30-AUGUST-2018 TIME: 15:08:39

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*   SOIL PRESSURES FOR   *
*  ANCHORED WALL DESIGN  *
*************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

ELEV. (FT)	NET WATER (PSF)	<---LEFTSIDE---> PASSIVE (PSF)	ACTIVE (PSF)	<------NET------> (SOIL + WATER) ACTIVE (PSF)	<--RIGHTSIDE---> ACTIVE (PSF)	PASSIVE (PSF)
6.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	62.5	0.0	0.0	62.5	0.0	0.0
4.0	125.0	0.0	0.0	125.0	0.0	0.0
3.0	187.5	0.0	0.0	187.5	0.0	0.0
2.0	250.0	0.0	0.0	250.0	0.0	0.0
1.0	312.5	0.0	0.0	312.5	0.0	0.0
0.0	375.0	0.0	0.0	375.0	0.0	0.0
-1.0	437.5	0.0	0.0	437.5	0.0	0.0
-2.0	500.0	0.0	0.0	500.0	0.0	0.0
-3.0	562.5	0.0	0.0	562.5	0.0	0.0
-4.0	625.0	0.0	0.0	625.0	0.0	0.0
-5.0	687.5	0.0	0.0	687.5	0.0	0.0
-6.0	750.0	0.0	0.0	750.0	0.0	0.0
-7.0	812.5	0.0	0.0	812.5	0.0	0.0
-8.0	875.0	0.0	0.0	875.0	0.0	0.0
-9.0	937.5	0.0	0.0	966.0	28.5	159.7
-9.8+	987.5	0.0	0.0	987.5	0.0	592.0
-9.8-	987.5	0.0	0.0	987.5	0.0	505.5
-10.0+	1000.0	0.0	0.0	1000.0	0.0	592.0
-10.0-	1000.0	769.2	0.0	230.8	0.0	592.0
-11.0	1000.0	808.7	0.0	191.3	0.0	956.0
-12.0	1000.0	848.2	0.0	151.8	0.0	986.2
-13.0	1000.0	887.7	0.0	112.3	0.0	1024.6
-14.0	1000.0	927.2	0.0	72.8	0.0	1064.1
-15.0	1000.0	966.7	0.0	33.3	0.0	1103.2
-15.8	1000.0	1000.0	0.0	0.0	0.0	1135.7
-16.0	1000.0	1006.2	0.0	-6.2	0.0	1141.8
-17.0	1000.0	1045.7	0.0	-45.7	0.0	1180.7

-18.0	1000.0	1085.2	0.0	-85.2	0.0	1220.2
-19.0	1000.0	1124.7	0.0	-124.7	0.0	1259.7
-20.0	1000.0	1167.2	0.0	-167.2	0.0	1302.2
-21.0	1000.0	1215.7	0.0	-215.7	0.0	1350.7
-22.0	1000.0	1267.2	0.0	-267.2	0.0	1402.2
-23.0	1000.0	1318.7	0.0	-318.7	0.0	1453.7
-24.0	1000.0	1754.8	0.0	-754.8	0.0	1889.8
-25.0	1000.0	2191.0	0.0	-1191.0	0.0	2326.0
-26.0	1000.0	2242.5	0.0	-1242.5	0.0	2377.5
-27.0	1000.0	2294.0	0.0	-1294.0	0.0	2429.0
-28.0	1000.0	2345.5	0.0	-1345.5	0.0	2480.5
-29.0	1000.0	2397.0	0.0	-1397.0	0.0	2532.0
-30.0	1000.0	2448.5	0.0	-1448.5	0.0	2583.5
-31.0	1000.0	2500.0	0.0	-1500.0	0.0	2635.0
-32.0	1000.0	3631.9	0.0	-2631.9	0.0	3766.9
-33.0	1000.0	4770.8	0.0	-3770.8	0.0	4905.8
-34.0	1000.0	4836.3	0.0	-3836.3	0.0	4971.3
-35.0	1000.0	4901.8	0.0	-3901.8	0.0	5036.8
-36.0	1000.0	4967.3	0.0	-3967.3	0.0	5102.3
-37.0	1000.0	5032.8	0.0	-4032.8	0.0	5167.8
-38.0	1000.0	5098.3	0.0	-4098.3	0.0	5233.3
-39.0	1000.0	5163.8	0.0	-4163.8	0.0	5298.8
-40.0	1000.0	5229.3	0.0	-4229.3	0.0	5364.3
-41.0	1000.0	5294.8	0.0	-4294.8	0.0	5429.8
-42.0	1000.0	5052.6	0.0	-4052.6	0.0	5187.6
-43.0	1000.0	4810.4	0.0	-3810.4	0.0	4945.4
-44.0	1000.0	4875.9	0.0	-3875.9	0.0	5010.9
-45.0	1000.0	4941.4	0.0	-3941.4	0.0	5076.4
-46.0	1000.0	5006.9	0.0	-4006.9	0.0	5141.9
-47.0	1000.0	5072.4	0.0	-4072.4	0.0	5207.4
-48.0	1000.0	5137.9	0.0	-4137.9	0.0	5272.9
-49.0	1000.0	5203.4	0.0	-4203.4	0.0	5338.4
-50.0	1000.0	5114.1	0.0	-4114.1	0.0	5249.1
-51.0	1000.0	5022.7	0.0	-4022.7	0.0	5157.7
-52.0	1000.0	5084.2	0.0	-4084.2	0.0	5219.2
-53.0	1000.0	5145.7	0.0	-4145.7	0.0	5280.7
-54.0	1000.0	5207.2	0.0	-4207.2	0.0	5342.2
-55.0	1000.0	5268.7	0.0	-4268.7	0.0	5403.7
-56.0	1000.0	5330.2	0.0	-4330.2	0.0	5465.2
-57.0	1000.0	5391.7	0.0	-4391.7	0.0	5526.7
-58.0	1000.0	5453.2	0.0	-4453.2	0.0	5588.2
-59.0	1000.0	5514.7	0.0	-4514.7	0.0	5649.7

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:08:40

                      ****************************
                      *  SUMMARY OF RESULTS FOR  *
                      *   ANCHORED WALL DESIGN   *
                      ****************************

    I.--HEADING
     'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.3

   II.--SUMMARY

        RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

        LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

   METHOD                              :    FREE EARTH         FIXED EARTH

   WALL BOTTOM ELEVATION (FT)          :        -23.09              -26.68
         PENETRATION (FT)               :        13.09               16.68

   MAXIMUM BENDING MOMENT (LB-FT)      :   -1.0598E+04         -9.1358E+03
         AT ELEVATION (FT)             :         -9.57               -9.34

   MAXIMUM SCALED DEFLECTION (LB-IN^3):   -6.0092E+08          4.2545E+08
         AT ELEVATION (FT)             :          6.00              -11.00

   ANCHOR FORCE (LB)                   :    7.6002E+03          7.3735E+03

             NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                    ELLASTICITY IN PSI TIMES PILE MOMENT
                    OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                    IN INCHES.
```

BY CLASSICAL METHODS

DATE: 30-AUGUST-2018 TIME: 15:08:40

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****************************
* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FREE EARTH METHOD   *
****************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--RESULTS (ANCHOR FORCE= 7600. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
6.00	0.0000E+00	0.	-6.0092E+08	0.00
5.00	1.0417E+01	31.	-5.4005E+08	62.50
4.00	8.3333E+01	125.	-4.7916E+08	125.00
3.00	2.8125E+02	281.	-4.1811E+08	187.50
2.00	6.6667E+02	500.	-3.5654E+08	250.00
1.00	1.3021E+03	781.	-2.9379E+08	312.50
0.00	2.2500E+03	1125.	-2.2874E+08	375.00
-1.00	3.5729E+03	1531.	-1.5975E+08	437.50
-2.00	5.3333E+03	2000.	-8.4517E+07	500.00
-3.00+	7.5937E+03	2531.	0.0000E+00	562.50
-3.00-	7.5938E+03	-5069.	0.0000E+00	562.50
-4.00	2.8165E+03	-4475.	9.5531E+07	625.00
-5.00	-1.3357E+03	-3819.	1.9602E+08	687.50
-6.00	-4.8004E+03	-3100.	2.9430E+08	750.00
-7.00	-7.5151E+03	-2319.	3.8439E+08	812.50
-8.00	-9.4173E+03	-1475.	4.6161E+08	875.00
-9.00	-1.0440E+04	-555.	5.2269E+08	966.02
-9.80	-1.0572E+04	227.	5.5869E+08	987.50
-10.00+	-1.0507E+04	426.	5.6586E+08	1000.00
-10.00-	-1.0507E+04	426.	5.6586E+08	230.77
-11.00	-9.9725E+03	637.	5.9097E+08	191.27
-12.00	-9.2469E+03	808.	5.9887E+08	151.77
-13.00	-8.3695E+03	940.	5.9081E+08	112.27
-14.00	-7.3799E+03	1033.	5.6831E+08	72.77
-15.00	-6.3175E+03	1086.	5.3307E+08	33.27
-15.84	-5.3952E+03	1100.	4.9484E+08	0.00
-16.00	-5.2218E+03	1099.	4.8691E+08	-6.23
-17.00	-4.1323E+03	1073.	4.3173E+08	-45.73

-18.00	-3.0886E+03	1008.	3.6940E+08	-85.23
-19.00	-2.1301E+03	903.	3.0172E+08	-124.73
-20.00	-1.2968E+03	757.	2.3035E+08	-167.23
-21.00	-6.3180E+02	565.	1.5671E+08	-215.73
-22.00	-1.8300E+02	324.	8.1943E+07	-267.23
-23.00	-1.4275E+00	31.	6.8246E+06	-318.73
-23.09	0.0000E+00	0.	0.0000E+00	-358.34

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
6.00	0.	0.	0.	0.	0.
5.00	63.	0.	0.	0.	0.
4.00	125.	0.	0.	0.	0.
3.00	188.	0.	0.	0.	0.
2.00	250.	0.	0.	0.	0.
1.00	313.	0.	0.	0.	0.
0.00	375.	0.	0.	0.	0.
-1.00	438.	0.	0.	0.	0.
-2.00	500.	0.	0.	0.	0.
-3.00	563.	0.	0.	0.	0.
-4.00	625.	0.	0.	0.	0.
-5.00	688.	0.	0.	0.	0.
-6.00	750.	0.	0.	0.	0.
-7.00	813.	0.	0.	0.	0.
-8.00	875.	0.	0.	0.	0.
-9.00	938.	0.	0.	29.	160.
-9.80+	988.	0.	0.	0.	592.
-9.80-	988.	0.	0.	0.	506.
-10.00+	1000.	0.	0.	0.	592.
-10.00-	1000.	769.	0.	0.	592.
-11.00	1000.	809.	0.	0.	956.
-12.00	1000.	848.	0.	0.	986.
-13.00	1000.	888.	0.	0.	1025.
-14.00	1000.	927.	0.	0.	1064.
-15.00	1000.	967.	0.	0.	1103.
-15.84	1000.	1000.	0.	0.	1136.
-16.00	1000.	1006.	0.	0.	1142.
-17.00	1000.	1046.	0.	0.	1181.
-18.00	1000.	1085.	0.	0.	1220.

-19.00	1000.	1125.	0.	0.	1260.
-20.00	1000.	1167.	0.	0.	1302.
-21.00	1000.	1216.	0.	0.	1351.
-22.00	1000.	1267.	0.	0.	1402.
-23.00	1000.	1319.	0.	0.	1454.
-24.00	1000.	1755.	0.	0.	1890.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 30-AUGUST-2018 TIME: 15:08:40

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* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
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I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--RESULTS (ANCHOR FORCE= 7374. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
6.00	0.0000E+00	0.	-3.7712E+08	0.00
5.00	1.0417E+01	31.	-3.4112E+08	62.50
4.00	8.3333E+01	125.	-3.0509E+08	125.00
3.00	2.8125E+02	281.	-2.6891E+08	187.50
2.00	6.6667E+02	500.	-2.3221E+08	250.00
1.00	1.3021E+03	781.	-1.9432E+08	312.50
0.00	2.2500E+03	1125.	-1.5414E+08	375.00
-1.00	3.5729E+03	1531.	-1.1001E+08	437.50
-2.00	5.3333E+03	2000.	-5.9650E+07	500.00
-3.00+	7.5937E+03	2531.	0.0000E+00	562.50
-3.00-	7.5938E+03	-4842.	0.0000E+00	562.50
-4.00	3.0431E+03	-4249.	7.0729E+07	625.00
-5.00	-8.8250E+02	-3592.	1.4681E+08	687.50
-6.00	-4.1206E+03	-2874.	2.2146E+08	750.00
-7.00	-6.6087E+03	-2092.	2.8910E+08	812.50
-8.00	-8.2844E+03	-1249.	3.4544E+08	875.00

-9.00	-9.0802E+03	-328.	3.8758E+08	966.02
-9.80	-9.0312E+03	453.	4.1011E+08	987.50
-10.00+	-8.9207E+03	652.	4.1418E+08	1000.00
-10.00-	-8.9207E+03	652.	4.1418E+08	230.77
-11.00	-8.1598E+03	863.	4.2545E+08	191.27
-12.00	-7.2076E+03	1035.	4.2264E+08	151.77
-13.00	-6.1036E+03	1167.	4.0740E+08	112.27
-14.00	-4.8874E+03	1259.	3.8163E+08	72.77
-15.00	-3.5984E+03	1312.	3.4743E+08	33.27
-15.84	-2.4853E+03	1326.	3.1371E+08	0.00
-16.00	-2.2761E+03	1326.	3.0701E+08	-6.23
-17.00	-9.6005E+02	1300.	2.6266E+08	-45.73
-18.00	3.1027E+02	1234.	2.1665E+08	-85.23
-19.00	1.4954E+03	1129.	1.7115E+08	-124.73
-20.00	2.5552E+03	983.	1.2823E+08	-167.23
-21.00	3.4468E+03	792.	8.9691E+07	-215.73
-22.00	4.1222E+03	550.	5.7080E+07	-267.23
-23.00	4.5304E+03	257.	3.1555E+07	-318.73
-24.00	4.5557E+03	-279.	1.3806E+07	-754.85
-25.00	3.8262E+03	-1252.	3.8212E+06	-1190.96
-26.00	1.9698E+03	-2469.	2.8199E+05	-1242.46
-27.00	0.0000E+00	-3326.	0.0000E+00	-1277.48

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
6.00	0.	0.	0.	0.	0.
5.00	63.	0.	0.	0.	0.
4.00	125.	0.	0.	0.	0.
3.00	188.	0.	0.	0.	0.
2.00	250.	0.	0.	0.	0.
1.00	313.	0.	0.	0.	0.
0.00	375.	0.	0.	0.	0.
-1.00	438.	0.	0.	0.	0.
-2.00	500.	0.	0.	0.	0.
-3.00	563.	0.	0.	0.	0.
-4.00	625.	0.	0.	0.	0.
-5.00	688.	0.	0.	0.	0.
-6.00	750.	0.	0.	0.	0.
-7.00	813.	0.	0.	0.	0.

-8.00	875.	0.	0.	0.	0.
-9.00	938.	0.	0.	29.	160.
-9.80+	988.	0.	0.	0.	592.
-9.80-	988.	0.	0.	0.	506.
-10.00+	1000.	0.	0.	0.	592.
-10.00-	1000.	769.	0.	0.	592.
-11.00	1000.	809.	0.	0.	956.
-12.00	1000.	848.	0.	0.	986.
-13.00	1000.	888.	0.	0.	1025.
-14.00	1000.	927.	0.	0.	1064.
-15.00	1000.	967.	0.	0.	1103.
-15.84	1000.	1000.	0.	0.	1136.
-16.00	1000.	1006.	0.	0.	1142.
-17.00	1000.	1046.	0.	0.	1181.
-18.00	1000.	1085.	0.	0.	1220.
-19.00	1000.	1125.	0.	0.	1260.
-20.00	1000.	1167.	0.	0.	1302.
-21.00	1000.	1216.	0.	0.	1351.
-22.00	1000.	1267.	0.	0.	1402.
-23.00	1000.	1319.	0.	0.	1454.
-24.00	1000.	1755.	0.	0.	1890.
-25.00	1000.	2191.	0.	0.	2326.
-26.00	1000.	2242.	0.	0.	2377.
-27.00	1000.	2294.	0.	0.	2429.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 30-AUGUST-2018 TIME: 15:08:43

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* PRELIMINARY DESIGN DATA FOR *
*  FREE EARTH DESIGN IN CLAY  *
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I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3
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II.--DESIGN PARAMETERS

WALL HEIGHT RATIO (ALPHA) = 0.55
ANCHOR HEIGHT RATIO (BETA) = 0.31
STABILITY NUMBER = 2.85

SHEET PILE DATA:

SHEET PILE NAME	<SECTION PROPERTIES> (PER FOOT OF WALL) SECTION MODULUS (IN^3)	MOMENT OF INERTIA (IN^4)	ALLOWABLE STRESS (PSI)	MODULUS OF ELLASTICITY (PSI)
PZ40	60.70	490.80	24000.00	2.90E+07
PZ38	46.80	280.80	24000.00	2.90E+07
PZ35	48.50	361.20	24000.00	2.90E+07
PZ32	38.30	220.40	24000.00	2.90E+07
PZ27	30.20	184.20	24000.00	2.90E+07
PZ22	18.10	84.40	24000.00	2.90E+07
PLZ25	32.80	223.25	24000.00	2.90E+07
PLZ23	30.20	203.75	24000.00	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE NAME	LOG(H^4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT
PZ40	-4.30	1.0 (***)	11.45
PZ38	-4.06	1.0 (***)	8.83
PZ35	-4.17	1.0 (***)	9.15
PZ32	-3.95	1.0 (***)	7.23
PZ27	-3.87	1.0 (***)	5.70
PZ22	-3.53	1.0 (***)	3.42
PLZ25	-3.96	1.0 (***)	6.19
PLZ23	-3.92	1.0 (***)	5.70

*** REDUCTION NOT APPLICABLE DUE TO ALPHA LESS THAN 0.6.

*** REDUCTION NOT APPLICABLE DUE TO BETA GREATER THAN 0.3.

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE BELOW TOP OF WALL.

*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER GREATER THAN 2.5.

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'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0
CONTROL  ANCHORED  DESIGN  1.00  1.00
WALL   6   -3
SURFACE RIGHTSIDE   2    0   -8
                  200   -8
SURFACE LEFTSIDE   2    0   -10
                  200   -10
SOIL RIGHTSIDE  STRENGTHS   7
   130    130    30    0    0    0   -10   0
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   6
   102    102    0    500    0    0   -20   0
   114    114    0    500    0    0   -24   0
   114    114    0    1000    0    0   -32   0
   128    128    0    2400    0    0   -42   0
   128    128    0    2000    0    0   -50   0
   124    124    0    1800    0    0
WATER ELEVATIONS   62.5    6   -10
FINISHED
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:11:28

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.0

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 6.00 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00         -8.00
                200.00         -8.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -10.00
                200.00        -10.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
130.00  130.00    30.00    0.00     0.00    0.00  -10.00   0.00   DEF  DEF
```

102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF
114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
102.00	102.00	0.00	500.00	0.00	0.00	-20.00	0.00	DEF	DEF
114.00	114.00	0.00	500.00	0.00	0.00	-24.00	0.00	DEF	DEF
114.00	114.00	0.00	1000.00	0.00	0.00	-32.00	0.00	DEF	DEF
128.00	128.00	0.00	2400.00	0.00	0.00	-42.00	0.00	DEF	DEF
128.00	128.00	0.00	2000.00	0.00	0.00	-50.00	0.00	DEF	DEF
124.00	124.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 6.00 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 30-AUGUST-2018 TIME: 15:11:39

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*   SOIL PRESSURES FOR   *
*  ANCHORED WALL DESIGN  *
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I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

ELEV. (FT)	NET WATER (PSF)	<---LEFTSIDE---> PASSIVE (PSF)	ACTIVE (PSF)	<------NET------> (SOIL + WATER) ACTIVE (PSF)	<--RIGHTSIDE---> ACTIVE (PSF)	PASSIVE (PSF)
6.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	62.5	0.0	0.0	62.5	0.0	0.0
4.0	125.0	0.0	0.0	125.0	0.0	0.0
3.0	187.5	0.0	0.0	187.5	0.0	0.0
2.0	250.0	0.0	0.0	250.0	0.0	0.0
1.0	312.5	0.0	0.0	312.5	0.0	0.0
0.0	375.0	0.0	0.0	375.0	0.0	0.0
-1.0	437.5	0.0	0.0	437.5	0.0	0.0
-2.0	500.0	0.0	0.0	500.0	0.0	0.0
-3.0	562.5	0.0	0.0	562.5	0.0	0.0
-4.0	625.0	0.0	0.0	625.0	0.0	0.0
-5.0	687.5	0.0	0.0	687.5	0.0	0.0
-6.0	750.0	0.0	0.0	750.0	0.0	0.0
-7.0	812.5	0.0	0.0	812.5	0.0	0.0
-8.0	875.0	0.0	0.0	875.0	0.0	0.0
-9.0	937.5	0.0	0.0	960.0	22.5	202.7
-9.8+	987.5	0.0	0.0	987.5	0.0	755.0
-9.8-	987.5	0.0	0.0	987.5	0.0	644.6
-10.0+	1000.0	0.0	0.0	1000.0	0.0	755.0
-10.0-	1000.0	1000.0	0.0	0.0	0.0	755.0
-11.0	1000.0	1039.5	0.0	-39.5	0.0	1207.2
-12.0	1000.0	1079.0	0.0	-79.0	0.0	1225.9
-13.0	1000.0	1118.5	0.0	-118.5	0.0	1259.8
-14.0	1000.0	1158.0	0.0	-158.0	0.0	1295.6
-15.0	1000.0	1197.5	0.0	-197.5	0.0	1334.9
-16.0	1000.0	1237.0	0.0	-237.0	0.0	1374.4
-17.0	1000.0	1276.5	0.0	-276.5	0.0	1413.9
-18.0	1000.0	1316.0	0.0	-316.0	0.0	1453.4

-19.0	1000.0	1355.5	0.0	-355.5	0.0	1492.9
-20.0	1000.0	1398.0	0.0	-398.0	0.0	1535.4
-21.0	1000.0	1446.5	0.0	-446.5	0.0	1583.9
-22.0	1000.0	1498.0	0.0	-498.0	0.0	1634.7
-23.0	1000.0	1549.5	0.0	-549.5	0.0	1685.0
-24.0	1000.0	2101.0	0.0	-1101.0	0.0	2236.0
-25.0	1000.0	2652.5	0.0	-1652.5	0.0	2787.5
-26.0	1000.0	2704.0	0.0	-1704.0	0.0	2839.0
-27.0	1000.0	2755.5	0.0	-1755.5	0.0	2890.5
-28.0	1000.0	2807.0	0.0	-1807.0	0.0	2942.0
-29.0	1000.0	2858.5	0.0	-1858.5	0.0	2993.5
-30.0	1000.0	2910.0	0.0	-1910.0	0.0	3045.0
-31.0	1000.0	2961.5	0.0	-1961.5	0.0	3096.5
-32.0	1000.0	4416.5	0.0	-3416.5	0.0	4551.5
-33.0	1000.0	5878.5	0.0	-4878.5	0.0	6013.5
-34.0	1000.0	5944.0	0.0	-4944.0	0.0	6079.0
-35.0	1000.0	6009.5	0.0	-5009.5	0.0	6144.5
-36.0	1000.0	6075.0	0.0	-5075.0	0.0	6210.0
-37.0	1000.0	6140.5	0.0	-5140.5	0.0	6275.5
-38.0	1000.0	6206.0	0.0	-5206.0	0.0	6341.0
-39.0	1000.0	6271.5	0.0	-5271.5	0.0	6406.5
-40.0	1000.0	6337.0	0.0	-5337.0	0.0	6472.0
-41.0	1000.0	6402.5	0.0	-5402.5	0.0	6537.5
-42.0	1000.0	6068.0	0.0	-5068.0	0.0	6203.0
-43.0	1000.0	5733.5	0.0	-4733.5	0.0	5868.5
-44.0	1000.0	5799.0	0.0	-4799.0	0.0	5934.0
-45.0	1000.0	5864.5	0.0	-4864.5	0.0	5999.5
-46.0	1000.0	5930.0	0.0	-4930.0	0.0	6065.0
-47.0	1000.0	5995.5	0.0	-4995.5	0.0	6130.5
-48.0	1000.0	6061.0	0.0	-5061.0	0.0	6196.0
-49.0	1000.0	6126.5	0.0	-5126.5	0.0	6261.5
-50.0	1000.0	5991.0	0.0	-4991.0	0.0	6126.0
-51.0	1000.0	5853.5	0.0	-4853.5	0.0	5988.5
-52.0	1000.0	5915.0	0.0	-4915.0	0.0	6050.0
-53.0	1000.0	5976.5	0.0	-4976.5	0.0	6111.5
-54.0	1000.0	6038.0	0.0	-5038.0	0.0	6173.0
-55.0	1000.0	6099.5	0.0	-5099.5	0.0	6234.5
-56.0	1000.0	6161.0	0.0	-5161.0	0.0	6296.0
-57.0	1000.0	6222.5	0.0	-5222.5	0.0	6357.5
-58.0	1000.0	6284.0	0.0	-5284.0	0.0	6419.0
-59.0	1000.0	6345.5	0.0	-5345.5	0.0	6480.5

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 30-AUGUST-2018                                        TIME: 15:11:40

                      ****************************
                      *  SUMMARY OF RESULTS FOR  *
                      *   ANCHORED WALL DESIGN   *
                      ****************************

    I.--HEADING
     'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.0

   II.--SUMMARY

        RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

        LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

   METHOD                              :    FREE EARTH         FIXED EARTH

   WALL BOTTOM ELEVATION (FT)          :        -17.53              -21.49
         PENETRATION (FT)               :         7.53               11.49

   MAXIMUM BENDING MOMENT (LB-FT)      :    7.5938E+03          7.5938E+03
         AT ELEVATION (FT)             :         -3.00               -3.00

   MAXIMUM SCALED DEFLECTION (LB-IN^3):    1.7139E+08          1.3110E+08
         AT ELEVATION (FT)             :         -9.80               -9.80

   ANCHOR FORCE (LB)                   :    6.9009E+03          6.7520E+03

             NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                    ELLASTICITY IN PSI TIMES PILE MOMENT
                    OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                    IN INCHES.
```

DATE: 30-AUGUST-2018 TIME: 15:11:40

```
****************************
* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FREE EARTH METHOD   *
****************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--RESULTS (ANCHOR FORCE= 6901. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
6.00	0.0000E+00	0.	-4.5131E+06	0.00
5.00	1.0417E+01	31.	-9.9156E+06	62.50
4.00	8.3333E+01	125.	-1.5291E+07	125.00
3.00	2.8125E+02	281.	-2.0505E+07	187.50
2.00	6.6667E+02	500.	-2.5205E+07	250.00
1.00	1.3021E+03	781.	-2.8718E+07	312.50
0.00	2.2500E+03	1125.	-2.9935E+07	375.00
-1.00	3.5729E+03	1531.	-2.7211E+07	437.50
-2.00	5.3333E+03	2000.	-1.8249E+07	500.00
-3.00+	7.5938E+03	2531.	0.0000E+00	562.50
-3.00-	7.5938E+03	-4370.	0.0000E+00	562.50
-4.00	3.5158E+03	-3776.	2.9465E+07	625.00
-5.00	6.2821E+01	-3120.	6.5095E+07	687.50
-6.00	-2.7026E+03	-2401.	1.0093E+08	750.00
-7.00	-4.7181E+03	-1620.	1.3221E+08	812.50
-8.00	-5.9211E+03	-776.	1.5545E+08	875.00
-9.00	-6.2453E+03	142.	1.6858E+08	959.98
-9.80	-5.8219E+03	921.	1.7139E+08	987.50
-10.00+	-5.6179E+03	1119.	1.7106E+08	1000.00
-10.00-	-5.6179E+03	1119.	1.7106E+08	0.00
-11.00	-4.5051E+03	1100.	1.6391E+08	-39.50
-12.00	-3.4319E+03	1040.	1.4896E+08	-79.00
-13.00	-2.4376E+03	942.	1.2807E+08	-118.50
-14.00	-1.5618E+03	803.	1.0295E+08	-158.00
-15.00	-8.4407E+02	626.	7.5111E+07	-197.50
-16.00	-3.2380E+02	408.	4.5784E+07	-237.00
-17.00	-4.0535E+01	152.	1.5863E+07	-276.50
-17.53	0.0000E+00	0.	0.0000E+00	-297.37

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
6.00	0.	0.	0.	0.	0.
5.00	63.	0.	0.	0.	0.
4.00	125.	0.	0.	0.	0.
3.00	188.	0.	0.	0.	0.
2.00	250.	0.	0.	0.	0.
1.00	313.	0.	0.	0.	0.
0.00	375.	0.	0.	0.	0.
-1.00	438.	0.	0.	0.	0.
-2.00	500.	0.	0.	0.	0.
-3.00	563.	0.	0.	0.	0.
-4.00	625.	0.	0.	0.	0.
-5.00	688.	0.	0.	0.	0.
-6.00	750.	0.	0.	0.	0.
-7.00	813.	0.	0.	0.	0.
-8.00	875.	0.	0.	0.	0.
-9.00	938.	0.	0.	22.	203.
-9.80+	988.	0.	0.	0.	755.
-9.80-	988.	0.	0.	0.	645.
-10.00+	1000.	0.	0.	0.	755.
-10.00-	1000.	1000.	0.	0.	755.
-11.00	1000.	1040.	0.	0.	1207.
-12.00	1000.	1079.	0.	0.	1226.
-13.00	1000.	1119.	0.	0.	1260.
-14.00	1000.	1158.	0.	0.	1296.
-15.00	1000.	1198.	0.	0.	1335.
-16.00	1000.	1237.	0.	0.	1374.
-17.00	1000.	1277.	0.	0.	1414.
-18.00	1000.	1316.	0.	0.	1453.

```
***************************
* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
***************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--RESULTS (ANCHOR FORCE= 6752. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
6.00	0.0000E+00	0.	6.6663E+07	0.00
5.00	1.0417E+01	31.	5.3352E+07	62.50
4.00	8.3333E+01	125.	4.0068E+07	125.00
3.00	2.8125E+02	281.	2.6946E+07	187.50
2.00	6.6667E+02	500.	1.4337E+07	250.00
1.00	1.3021E+03	781.	2.9159E+06	312.50
0.00	2.2500E+03	1125.	-6.2100E+06	375.00
-1.00	3.5729E+03	1531.	-1.1394E+07	437.50
-2.00	5.3333E+03	2000.	-1.0341E+07	500.00
-3.00+	7.5938E+03	2531.	0.0000E+00	562.50
-3.00-	7.5938E+03	-4221.	0.0000E+00	562.50
-4.00	3.6647E+03	-3627.	2.1599E+07	625.00
-5.00	3.6057E+02	-2971.	4.9621E+07	687.50
-6.00	-2.2560E+03	-2252.	7.8365E+07	750.00
-7.00	-4.1226E+03	-1471.	1.0332E+08	812.50
-8.00	-5.1767E+03	-627.	1.2127E+08	875.00
-9.00	-5.3520E+03	290.	1.3039E+08	959.98
-9.80	-4.8095E+03	1069.	1.3110E+08	987.50
-10.00+	-4.5758E+03	1268.	1.3041E+08	1000.00
-10.00-	-4.5758E+03	1268.	1.3041E+08	0.00
-11.00	-3.3141E+03	1248.	1.2259E+08	-39.50
-12.00	-2.0920E+03	1189.	1.0904E+08	-79.00
-13.00	-9.4885E+02	1090.	9.1861E+07	-118.50
-14.00	7.5791E+01	952.	7.3026E+07	-158.00
-15.00	9.4244E+02	774.	5.4300E+07	-197.50
-16.00	1.6116E+03	557.	3.7173E+07	-237.00
-17.00	2.0437E+03	300.	2.2797E+07	-276.50
-18.00	2.1994E+03	4.	1.1913E+07	-316.00
-19.00	2.0390E+03	-332.	4.7839E+06	-355.50
-20.00	1.5227E+03	-708.	1.1269E+06	-398.00
-21.00	6.0731E+02	-1131.	4.3729E+04	-446.50

-22.00	0.0000E+00	-1355.	0.0000E+00	-471.68

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
6.00	0.	0.	0.	0.	0.
5.00	63.	0.	0.	0.	0.
4.00	125.	0.	0.	0.	0.
3.00	188.	0.	0.	0.	0.
2.00	250.	0.	0.	0.	0.
1.00	313.	0.	0.	0.	0.
0.00	375.	0.	0.	0.	0.
-1.00	438.	0.	0.	0.	0.
-2.00	500.	0.	0.	0.	0.
-3.00	563.	0.	0.	0.	0.
-4.00	625.	0.	0.	0.	0.
-5.00	688.	0.	0.	0.	0.
-6.00	750.	0.	0.	0.	0.
-7.00	813.	0.	0.	0.	0.
-8.00	875.	0.	0.	0.	0.
-9.00	938.	0.	0.	22.	203.
-9.80+	988.	0.	0.	0.	755.
-9.80-	988.	0.	0.	0.	645.
-10.00+	1000.	0.	0.	0.	755.
-10.00-	1000.	1000.	0.	0.	755.
-11.00	1000.	1040.	0.	0.	1207.
-12.00	1000.	1079.	0.	0.	1226.
-13.00	1000.	1119.	0.	0.	1260.
-14.00	1000.	1158.	0.	0.	1296.
-15.00	1000.	1198.	0.	0.	1335.
-16.00	1000.	1237.	0.	0.	1374.
-17.00	1000.	1277.	0.	0.	1414.
-18.00	1000.	1316.	0.	0.	1453.
-19.00	1000.	1356.	0.	0.	1493.
-20.00	1000.	1398.	0.	0.	1535.
-21.00	1000.	1447.	0.	0.	1584.
-22.00	1000.	1498.	0.	0.	1635.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 30-AUGUST-2018 TIME: 15:11:42

```
*******************************
* PRELIMINARY DESIGN DATA FOR *
*  FREE EARTH DESIGN IN CLAY  *
*******************************
```

I.--HEADING
'BRAZOS RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--DESIGN PARAMETERS
WALL HEIGHT RATIO (ALPHA) = 0.68
ANCHOR HEIGHT RATIO (BETA) = 0.38
STABILITY NUMBER = 3.70

SHEET PILE DATA:

SHEET PILE NAME	<SECTION PROPERTIES> (PER FOOT OF WALL) SECTION MODULUS (IN^3)	MOMENT OF INERTIA (IN^4)	ALLOWABLE STRESS (PSI)	MODULUS OF ELLASTICITY (PSI)
PZ40	60.70	490.80	24000.00	2.90E+07
PZ38	46.80	280.80	24000.00	2.90E+07
PZ35	48.50	361.20	24000.00	2.90E+07
PZ32	38.30	220.40	24000.00	2.90E+07
PZ27	30.20	184.20	24000.00	2.90E+07
PZ22	18.10	84.40	24000.00	2.90E+07
PLZ25	32.80	223.25	24000.00	2.90E+07
PLZ23	30.20	203.75	24000.00	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE NAME	LOG(H^4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT

PZ40	-4.67	1.0 (***)	15.99
PZ38	-4.42	1.0 (***)	12.33
PZ35	-4.53	1.0 (***)	12.77
PZ32	-4.32	1.0 (***)	10.09
PZ27	-4.24	1.0 (***)	7.95
PZ22	-3.90	1.0 (***)	4.77
PLZ25	-4.32	1.0 (***)	8.64
PLZ23	-4.29	1.0 (***)	7.95

*** REDUCTION NOT APPLICABLE DUE TO BETA GREATER THAN 0.3.

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE BELOW TOP OF WALL.

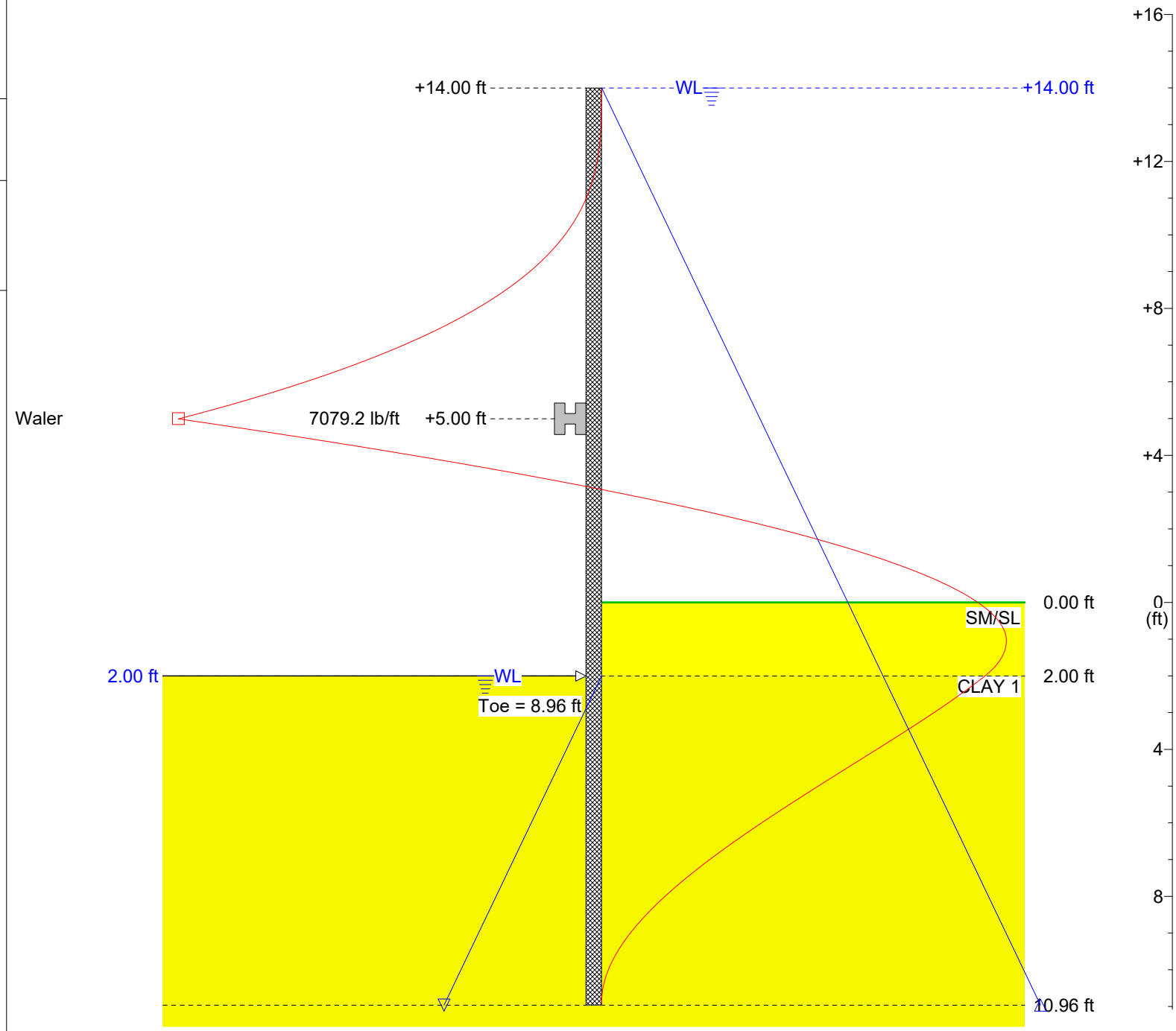
*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER GREATER THAN 2.5.

Title: Brazos River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	7615.6 ftlb/ft	-5.00
△	1560.0 psf	10.96
△	560.0 psf	10.96

Stage 2 - Tip & Moment only



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Title: Brazos River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 2
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Tip & Moment only

Input Data

Depth Of Excavation = 2.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 2.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	8.96	24.96

Pressure Model: Coulomb; Assume full hydrostatic pressure to 2.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	7079.2

Maxima

	Maximum	Depth (ft)
Pressure	1057.0 psf	2.00
Bending Moment	7615.6 ftlb/ft	-5.00
Shear Force	4548.1 lb/ft	-5.00

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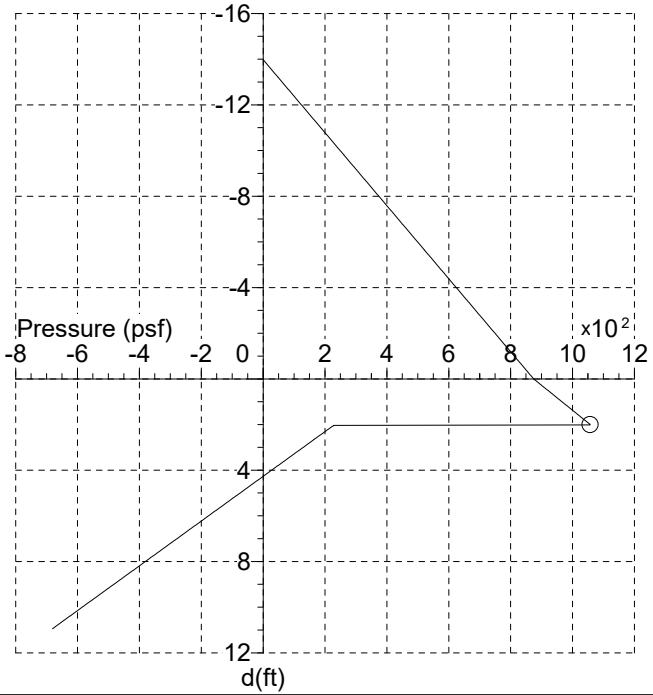
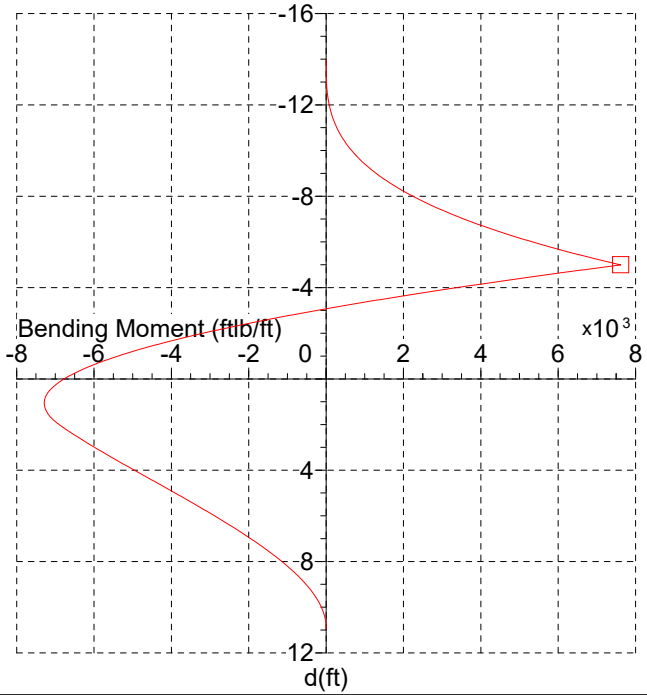
Title: Brazos River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 3
Date: 8.30.18

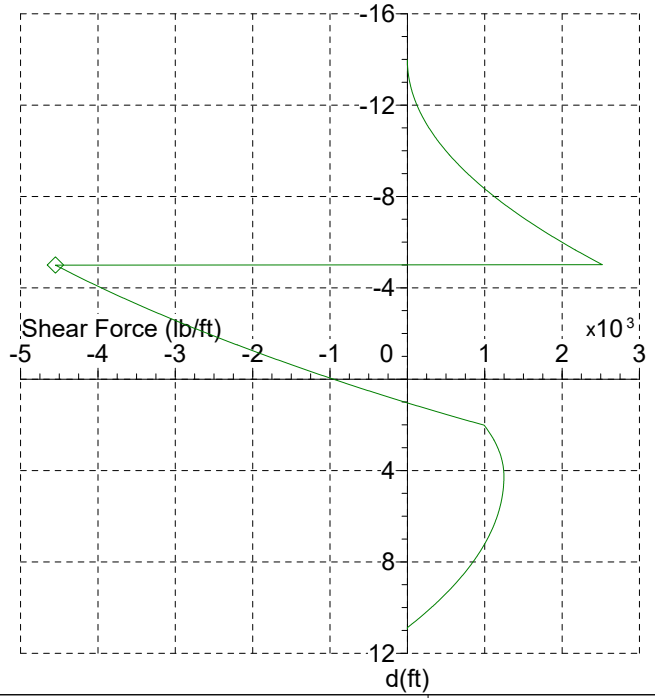
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 1057.0 psf	2.00
□ 7615.6 ftlb/ft	-5.00
◇ 4548.1 lb/ft	-5.00

Stage 2 - Tip & Moment only







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Title: Brazos River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 4
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Tip & Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	874.3	-6789.4		-941.5	3.68	59.8	-5289.8		1231.4	7.36	-315.9	-1636.1		974.0
0.08	881.9	-6846.8		-886.6	3.76	51.3	-5202.9		1236.0	7.44	-324.4	-1567.8		959.1
0.16	889.5	-6918.0		-812.8	3.84	42.8	-5115.6		1239.8	7.52	-332.9	-1500.6		943.8
0.23	897.1	-6983.1		-738.4	3.91	34.3	-5028.1		1242.9	7.59	-341.4	-1434.5		928.1
0.31	904.7	-7042.0		-663.4	3.99	25.8	-4940.4		1245.3	7.67	-347.8	-1385.6		916.1
0.39	910.4	-7082.1		-606.7	4.07	19.5	-4874.5		1246.7	7.75	-356.3	-1321.4		899.7
0.47	918.1	-7130.1		-530.5	4.15	11.0	-4786.6		1247.9	7.83	-364.8	-1258.4		882.9
0.55	925.7	-7171.7		-453.7	4.23	2.5	-4698.6		1248.3	7.91	-373.3	-1196.6		865.8
0.63	933.3	-7206.9		-376.3	4.31	-6.0	-4610.5		1248.2	7.99	-379.6	-1151.1		852.6
0.70	939.0	-7229.1		-317.9	4.38	-12.4	-4544.5		1247.8	8.06	-388.1	-1091.4		834.8
0.78	946.6	-7253.0		-239.3	4.46	-20.9	-4456.6		1247.0	8.14	-396.6	-1033.0		816.6
0.86	954.2	-7270.4		-160.2	4.54	-29.4	-4368.7		1245.8	8.22	-405.1	-976.0		797.9
0.94	961.8	-7281.2		-80.4	4.62	-37.9	-4280.9		1244.2	8.30	-413.6	-920.2		778.9
1.02	969.4	-7285.3		0.0	4.70	-44.2	-4215.1		1242.7	8.38	-420.0	-879.3		764.4
1.10	975.2	-7284.2		60.7	4.78	-52.7	-4127.5		1240.4	8.45	-428.4	-825.9		744.6
1.17	982.8	-7277.8		142.3	4.85	-61.2	-4040.1		1237.7	8.53	-436.9	-773.9		724.5
1.25	990.4	-7265.6		224.4	4.93	-69.7	-3952.9		1234.6	8.61	-445.4	-723.4		704.0
1.33	998.0	-7247.6		307.2	5.01	-76.1	-3887.7		1232.1	8.69	-451.8	-686.4		688.4
1.41	1003.7	-7230.2		369.7	5.09	-84.6	-3800.9		1228.3	8.77	-460.3	-638.4		667.2
1.49	1011.3	-7202.0		453.6	5.17	-93.0	-3714.4		1224.1	8.85	-468.8	-591.9		645.6
1.57	1018.9	-7167.7		538.2	5.25	-101.5	-3628.2		1219.6	8.92	-477.3	-547.0		623.6
1.64	1026.5	-7127.5		623.4	5.32	-110.0	-3542.4		1214.6	9.00	-483.6	-514.3		606.9
1.72	1032.3	-7093.4		687.7	5.40	-116.4	-3478.2		1210.6	9.08	-492.1	-472.1		584.2
1.80	1039.9	-7042.7		773.9	5.48	-124.9	-3393.0		1205.0	9.16	-500.6	-431.5		561.1
1.88	1047.5	-6985.8		860.8	5.56	-133.4	-3308.2		1199.0	9.24	-509.1	-392.6		537.7
1.96	1055.1	-6922.8		948.4	5.64	-141.9	-3223.8		1192.5	9.32	-515.5	-364.5		519.8
2.04	227.5	-6871.5		997.1	5.71	-148.2	-3160.8		1187.5	9.39	-524.0	-328.5		495.7
2.11	219.0	-6800.7		1015.6	5.79	-156.7	-3077.3		1180.3	9.47	-532.5	-294.1		471.1
2.19	210.5	-6728.6		1033.4	5.87	-165.2	-2994.2		1172.8	9.55	-541.0	-261.6		446.2
2.27	202.0	-6655.3		1050.5	5.95	-173.7	-2911.7		1164.9	9.63	-549.4	-230.8		420.9
2.35	195.7	-6599.5		1062.8	6.03	-180.1	-2850.2		1158.7	9.71	-555.8	-208.9		401.6
2.43	187.2	-6524.1		1078.7	6.11	-188.6	-2768.8		1150.1	9.79	-564.3	-181.2		375.6
2.51	178.7	-6447.7		1093.8	6.18	-197.1	-2687.9		1141.1	9.86	-572.8	-155.4		349.2
2.58	170.2	-6370.2		1108.2	6.26	-205.6	-2607.7		1131.8	9.94	-581.3	-131.5		322.4
2.66	161.7	-6291.7		1121.9	6.34	-211.9	-2548.0		1124.5	10.02	-587.7	-114.8		302.0
2.74	155.3	-6232.2		1131.7	6.42	-220.4	-2468.9		1114.4	10.10	-596.1	-94.3		274.5
2.82	146.8	-6152.0		1144.2	6.50	-228.9	-2390.6		1103.9	10.18	-604.6	-75.6		246.6
2.90	138.3	-6071.0		1156.0	6.58	-237.4	-2313.1		1093.1	10.26	-613.1	-59.0		218.4
2.97	129.8	-5989.2		1167.1	6.65	-243.8	-2255.4		1084.7	10.33	-619.5	-47.8		196.9
3.05	123.5	-5927.4		1174.9	6.73	-252.3	-2179.2		1073.1	10.41	-628.0	-34.7		167.9
3.13	115.0	-5844.2		1184.7	6.81	-260.7	-2103.9		1061.2	10.49	-636.5	-23.6		138.6
3.21	106.5	-5760.5		1193.9	6.89	-269.2	-2029.4		1048.8	10.57	-645.0	-14.7		108.8
3.29	98.0	-5676.1		1202.3	6.97	-277.7	-1955.8		1036.1	10.65	-651.3	-9.3		86.2
3.37	91.6	-5612.4		1208.1	7.05	-284.1	-1901.1		1026.3	10.72	-659.8	-4.0		55.8
3.44	83.1	-5527.0		1215.3	7.12	-292.6	-1829.1		1012.9	10.80	-668.3	-0.9		24.9
3.52	74.7	-5441.1		1221.8	7.20	-301.1	-1758.1		999.1	10.88	-676.8	0.0		0.0
3.60	66.2	-5354.8		1227.6	7.28	-309.6	-1688.0		984.9	10.96	-681.1	0.0		0.0

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Title: Brazos River Flood Gate - East Side
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Ref: 1.3
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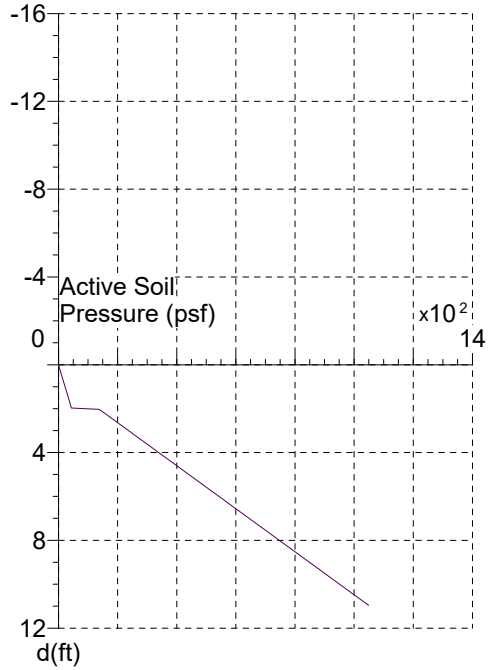
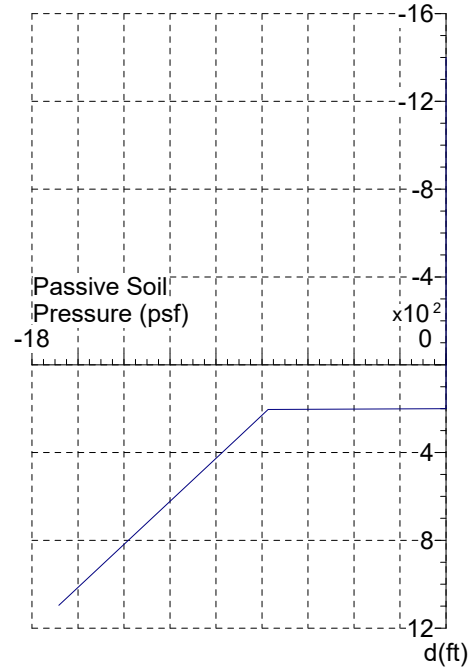
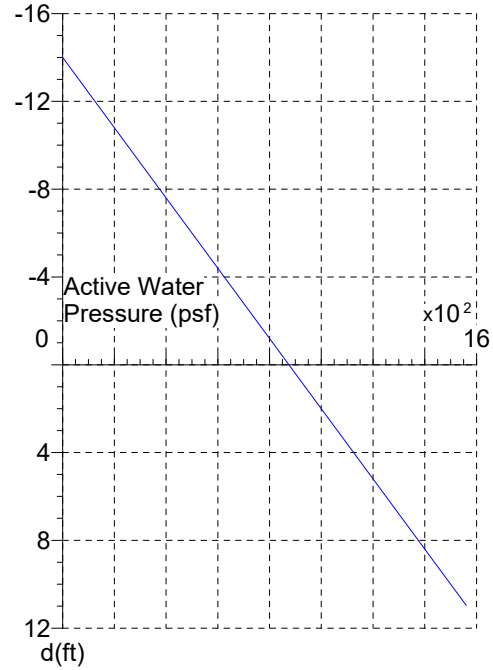
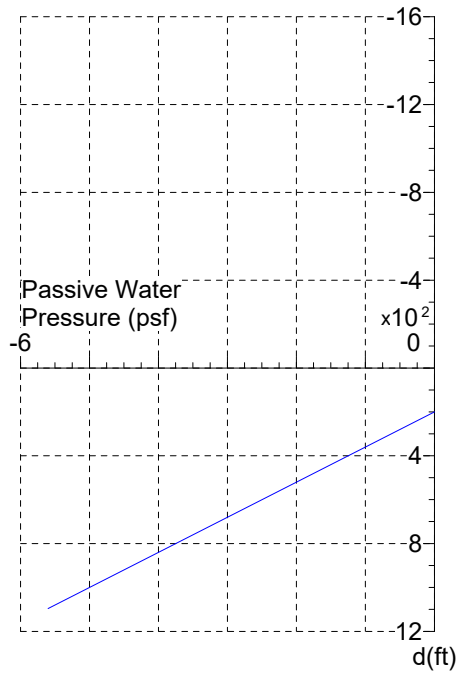
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

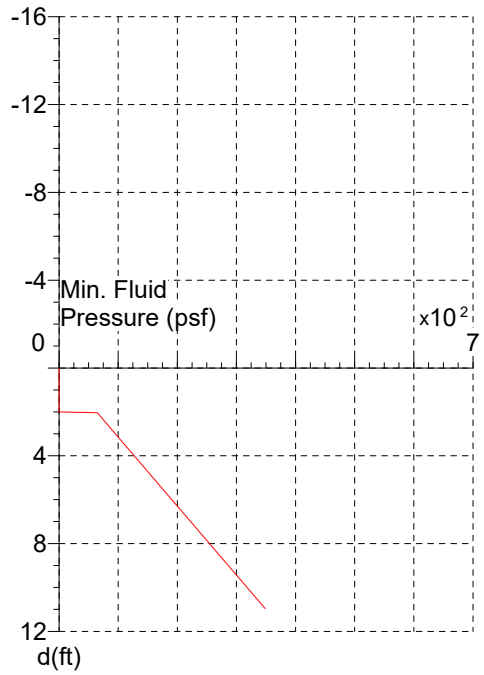
Stage 2 - Tip & Moment only

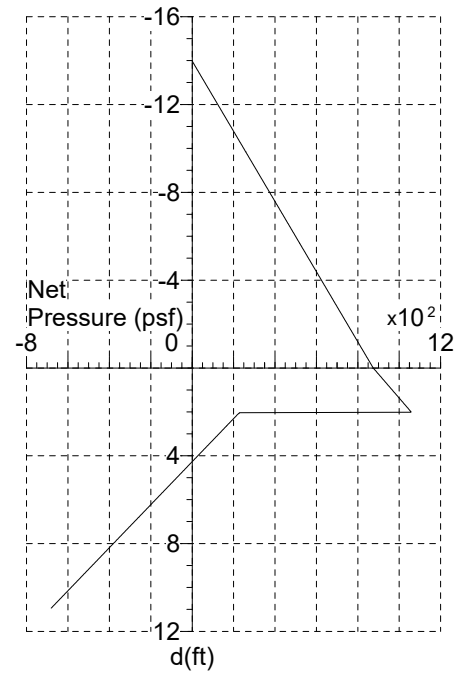












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Title: Brazos River Flood Gate - East Side
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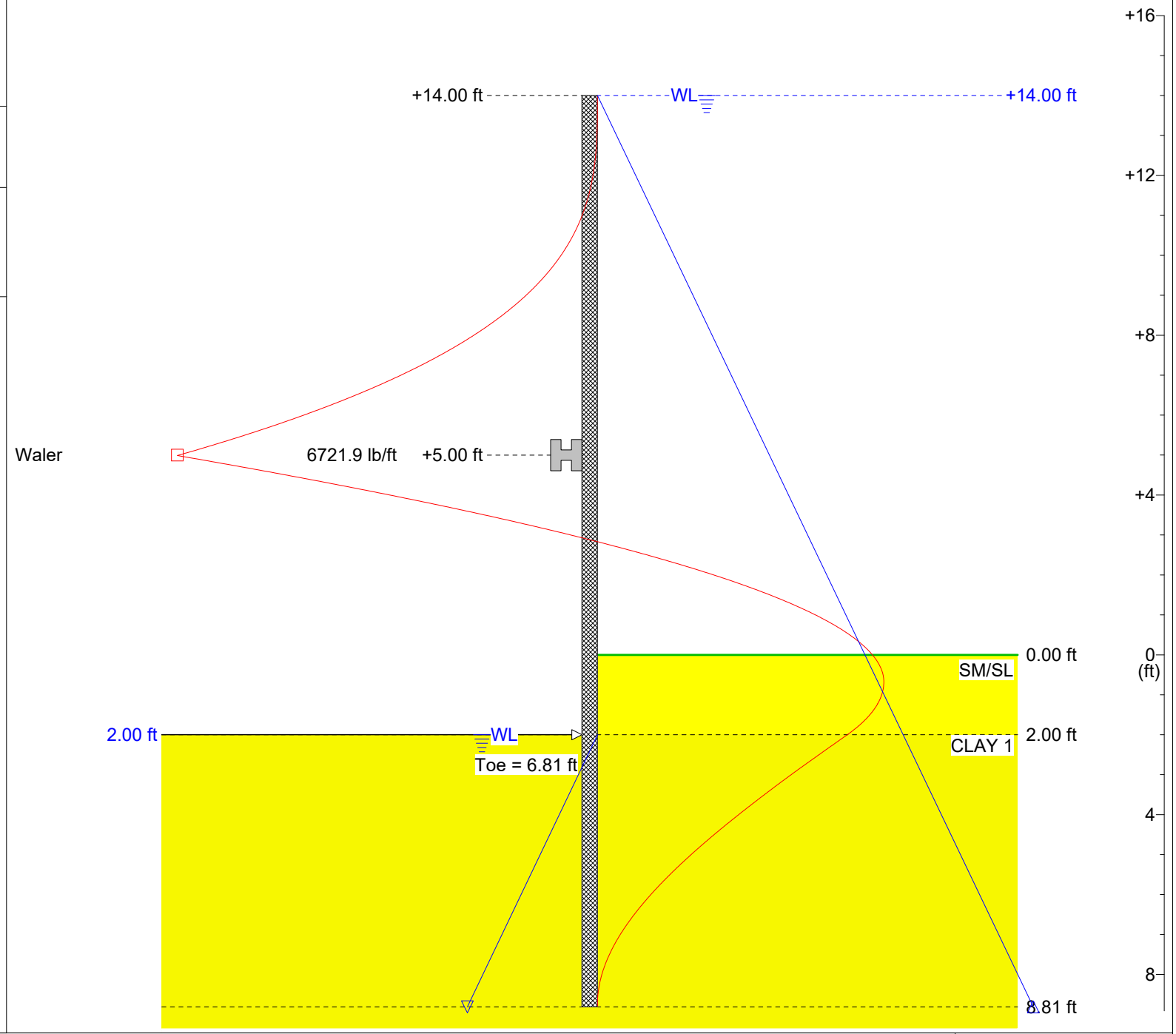
Maximum	d (ft)
7626.6 ftlb/ft	-5.00
1425.7 psf	8.81
425.7 psf	8.81

Stage 2 - Braces only



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Title: Brazos River Flood Gate - East Side
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Toe: Free Earth Support

Stage 2 - Braces only

Input Data

Depth Of Excavation = 2.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 2.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	6.81	22.81

Pressure Model: Coulomb; Assume full hydrostatic pressure to 2.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	6721.9

Maxima

	Maximum	Depth (ft)
Pressure	1043.1 psf	2.00
Bending Moment	7626.6 ftlb/ft	-5.00
Shear Force	4187.9 lb/ft	-5.00

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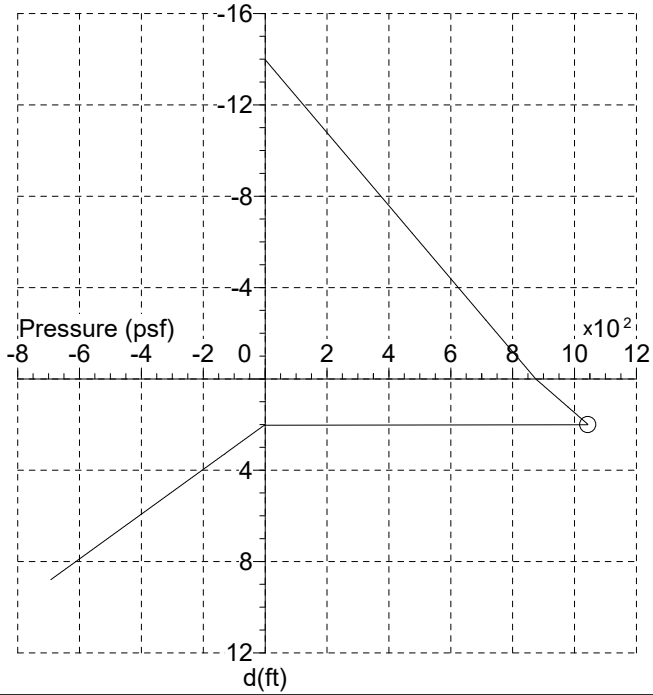
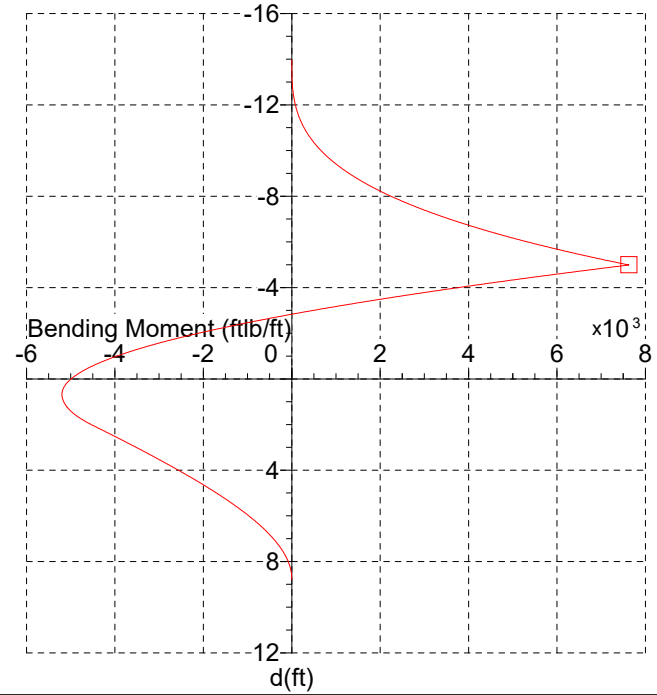
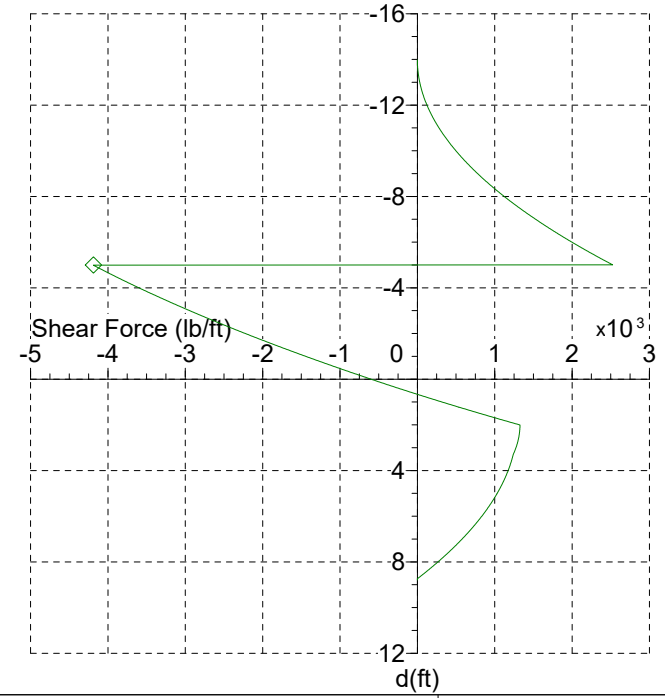
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 1043.1 psf	2.00
□ 7626.6 ftlb/ft	-5.00
◇ 4187.9 lb/ft	-5.00

Stage 2 - Braces only







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Title: Brazos River Flood Gate - East Side
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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	875.4	-4997.4		-591.2	2.96	-99.6	-3540.0		1277.1	5.92	-400.1	-1020.7		850.7
0.06	880.2	-5030.1		-541.1	3.02	-105.4	-3483.4		1271.2	5.98	-407.9	-970.7		833.6
0.13	886.7	-5069.3		-473.9	3.08	-111.2	-3427.1		1265.0	6.04	-413.7	-933.9		820.6
0.19	891.5	-5095.4		-423.1	3.15	-119.0	-3352.4		1256.2	6.11	-419.5	-897.7		807.4
0.25	896.4	-5118.5		-372.1	3.21	-124.8	-3296.8		1249.2	6.17	-425.3	-862.0		794.0
0.31	902.8	-5144.9		-303.7	3.27	-130.6	-3241.4		1241.8	6.23	-433.1	-815.5		775.9
0.38	907.7	-5161.2		-252.0	3.34	-136.4	-3186.4		1236.5	6.29	-438.9	-781.2		762.0
0.44	912.5	-5174.6		-200.0	3.40	-144.2	-3113.4		1230.5	6.36	-444.7	-747.6		748.1
0.50	917.3	-5185.0		-147.8	3.46	-150.0	-3058.8		1225.9	6.42	-452.5	-703.8		729.1
0.57	923.8	-5194.2		-77.8	3.52	-155.8	-3004.5		1221.0	6.48	-458.3	-671.6		714.7
0.63	928.6	-5197.6		-24.9	3.59	-163.6	-2932.4		1214.2	6.55	-464.1	-640.1		700.1
0.69	933.5	-5198.1		28.2	3.65	-169.4	-2878.6		1208.9	6.61	-471.9	-599.1		680.3
0.76	939.9	-5194.8		99.5	3.71	-175.2	-2825.0		1203.5	6.67	-477.7	-569.2		665.3
0.82	944.7	-5189.6		153.3	3.78	-182.9	-2754.0		1195.9	6.73	-483.5	-539.9		650.0
0.88	949.6	-5182.0		207.4	3.84	-188.8	-2701.0		1190.0	6.80	-491.3	-501.9		629.5
0.94	956.0	-5168.1		279.9	3.90	-194.6	-2648.3		1183.9	6.86	-497.1	-474.1		613.8
1.01	960.9	-5154.9		334.6	3.97	-202.3	-2578.4		1175.5	6.92	-502.9	-447.1		598.0
1.07	965.7	-5139.2		389.6	4.03	-208.2	-2526.3		1169.0	6.99	-508.7	-420.8		581.9
1.13	972.2	-5114.5		463.3	4.09	-214.0	-2474.5		1162.3	7.05	-516.5	-386.9		560.3
1.20	977.0	-5093.2		518.9	4.15	-219.8	-2423.1		1155.4	7.11	-522.3	-362.3		543.8
1.26	981.8	-5069.3		574.8	4.22	-227.5	-2354.9		1145.9	7.18	-528.1	-338.4		527.2
1.32	986.7	-5043.0		631.0	4.28	-233.4	-2304.2		1138.6	7.24	-535.8	-307.7		504.8
1.38	993.1	-5004.0		706.4	4.34	-239.2	-2253.7		1131.1	7.30	-541.7	-285.5		487.7
1.45	998.0	-4971.8		763.2	4.41	-246.9	-2187.0		1120.8	7.36	-547.5	-264.1		470.4
1.51	1002.8	-4937.1		820.3	4.47	-252.7	-2137.4		1112.9	7.43	-555.2	-236.8		447.2
1.57	1009.2	-4886.8		896.8	4.53	-258.6	-2088.2		1104.8	7.49	-561.1	-217.2		429.5
1.64	1014.1	-4846.2		954.6	4.59	-266.3	-2023.0		1093.7	7.55	-566.9	-198.4		411.6
1.70	1018.9	-4802.9		1012.6	4.66	-272.1	-1974.6		1085.1	7.62	-574.6	-174.6		387.5
1.76	1025.4	-4741.3		1090.4	4.72	-278.0	-1926.6		1076.4	7.68	-580.4	-157.7		369.2
1.83	1030.2	-4692.1		1149.0	4.78	-285.7	-1863.2		1064.5	7.74	-586.3	-141.6		350.8
1.89	1035.0	-4640.2		1208.0	4.85	-291.5	-1816.1		1055.3	7.80	-594.0	-121.4		325.9
1.95	1041.5	-4567.0		1287.0	4.91	-297.3	-1769.4		1046.0	7.87	-599.8	-107.2		307.0
2.01	-2.6	-4509.0		1326.6	4.97	-305.1	-1707.7		1033.2	7.93	-605.7	-93.8		287.9
2.08	-8.4	-4450.1		1326.2	5.04	-310.9	-1662.0		1023.5	7.99	-611.5	-81.3		268.6
2.14	-16.2	-4371.6		1325.2	5.10	-316.7	-1616.8		1013.5	8.06	-619.2	-66.0		242.6
2.20	-22.0	-4312.8		1324.1	5.16	-322.6	-1571.9		1003.4	8.12	-625.0	-55.6		222.9
2.27	-27.8	-4254.1		1322.6	5.22	-330.3	-1512.9		989.6	8.18	-630.9	-46.0		203.0
2.33	-33.6	-4195.4		1320.8	5.29	-336.1	-1469.1		979.0	8.25	-638.6	-34.5		176.2
2.39	-41.4	-4117.3		1317.9	5.35	-341.9	-1425.8		968.3	8.31	-644.4	-27.0		155.9
2.45	-47.2	-4058.9		1315.3	5.41	-349.7	-1368.8		953.6	8.37	-650.3	-20.4		135.4
2.52	-53.0	-4000.6		1312.4	5.48	-355.5	-1326.7		942.5	8.43	-658.0	-13.0		107.8
2.58	-60.8	-3923.0		1308.0	5.54	-361.3	-1285.0		931.1	8.50	-663.8	-8.5		86.9
2.64	-66.6	-3865.0		1304.3	5.60	-369.1	-1230.3		915.7	8.56	-669.6	-5.0		65.8
2.71	-72.4	-3807.2		1300.3	5.66	-374.9	-1189.8		903.9	8.62	-677.4	-1.7		37.4
2.77	-80.2	-3730.4		1294.4	5.73	-380.7	-1149.9		891.9	8.69	-683.2	-0.4		15.8
2.83	-86.0	-3673.0		1289.6	5.79	-388.5	-1097.5		875.7	8.75	-689.0	0.0		0.0
2.90	-91.8	-3615.8		1284.5	5.85	-394.3	-1058.8		863.3	8.81	-692.9	0.0		0.0

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Ref: 1.0
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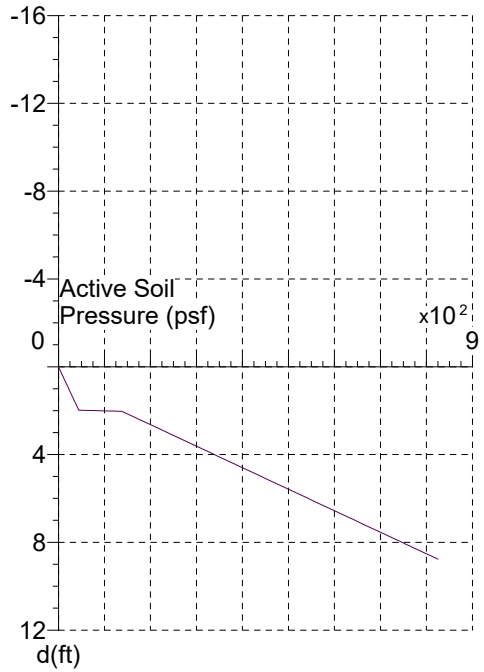
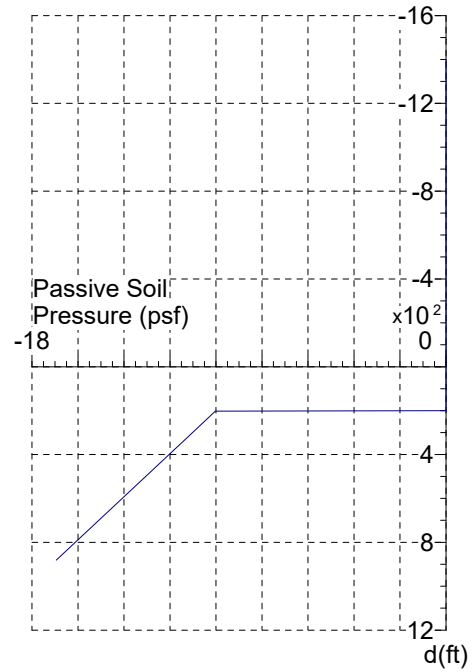
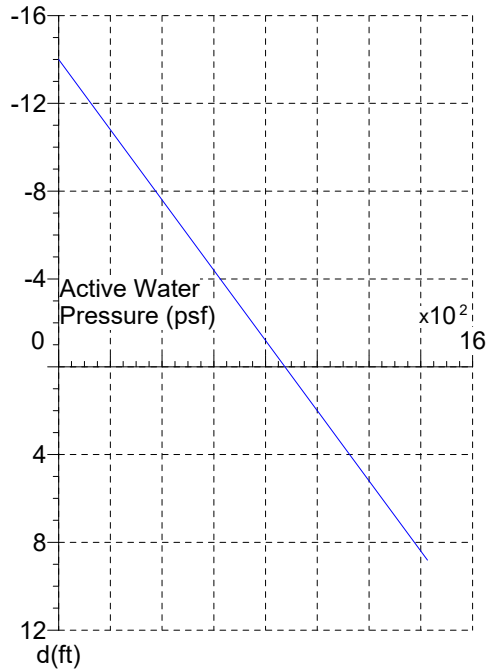
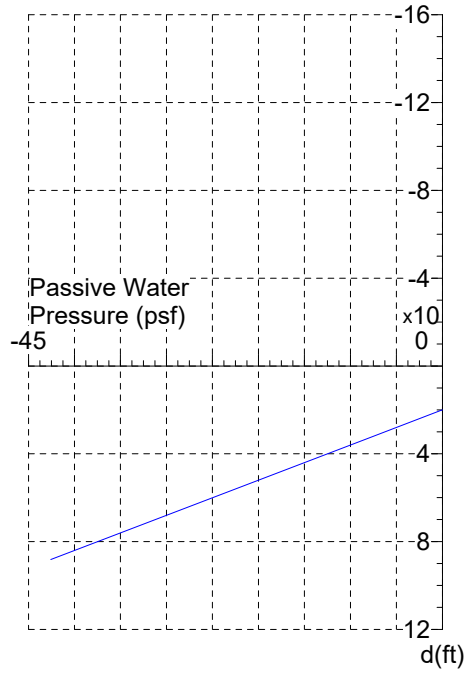
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

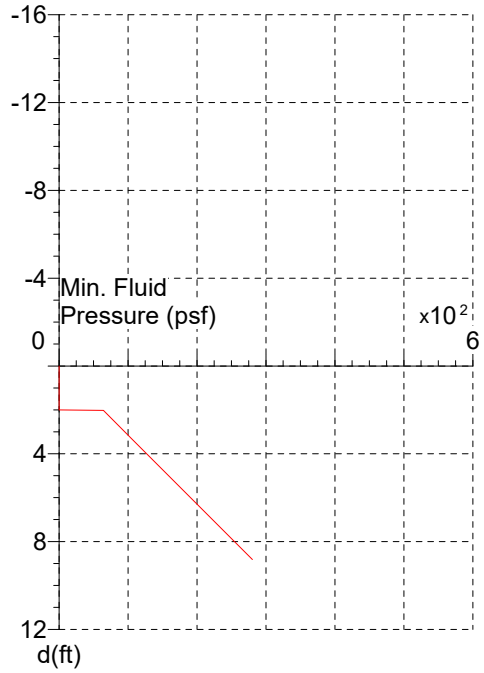
Stage 2 - Braces only

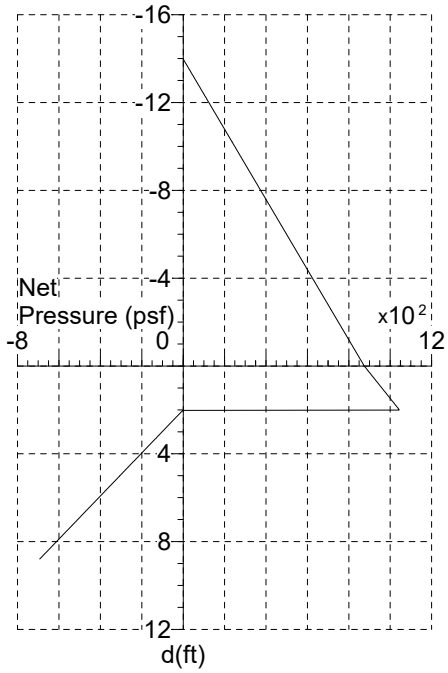












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Title: Brazos River Flood Gate - East Side
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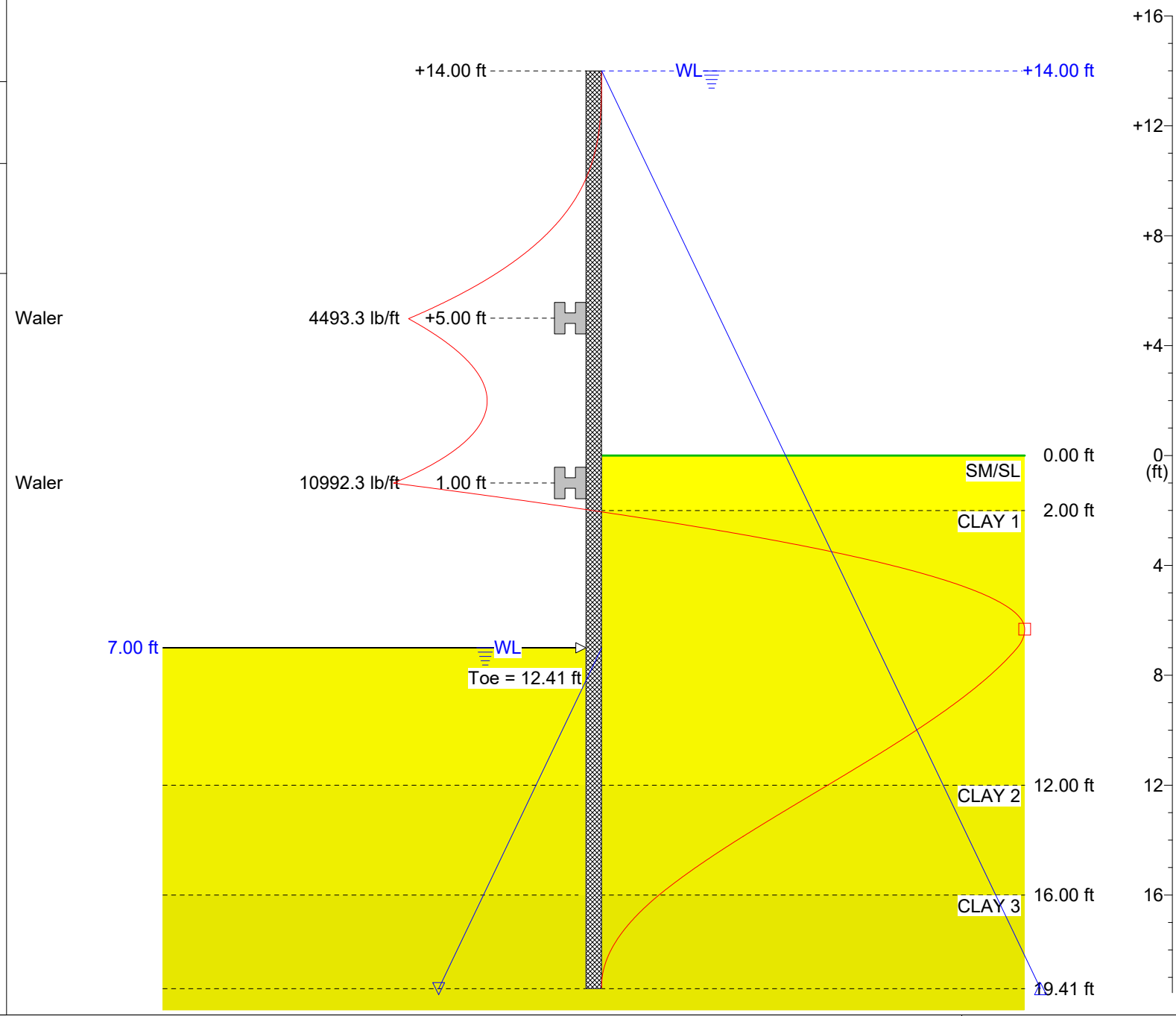
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
16759.2 ftlb/ft	6.32
2087.9 psf	19.41
775.4 psf	19.41

Stage 3 - Tip & Moment only



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Stage 3 - Tip & Moment only

Input Data

Depth Of Excavation = 7.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 7.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	12.41	33.41

Pressure Model: Coulomb; Assume full hydrostatic pressure to 7.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4493.3
1.00	Waler	10992.3

Maxima

	Maximum	Depth (ft)
Pressure	2186.0 psf	7.00
Bending Moment	16759.2 ftlb/ft	6.32
Shear Force	8441.8 lb/ft	1.00

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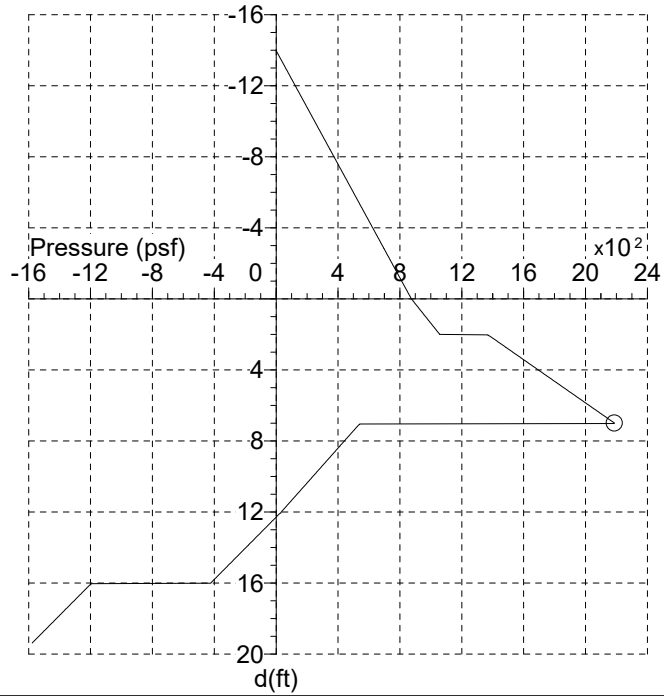
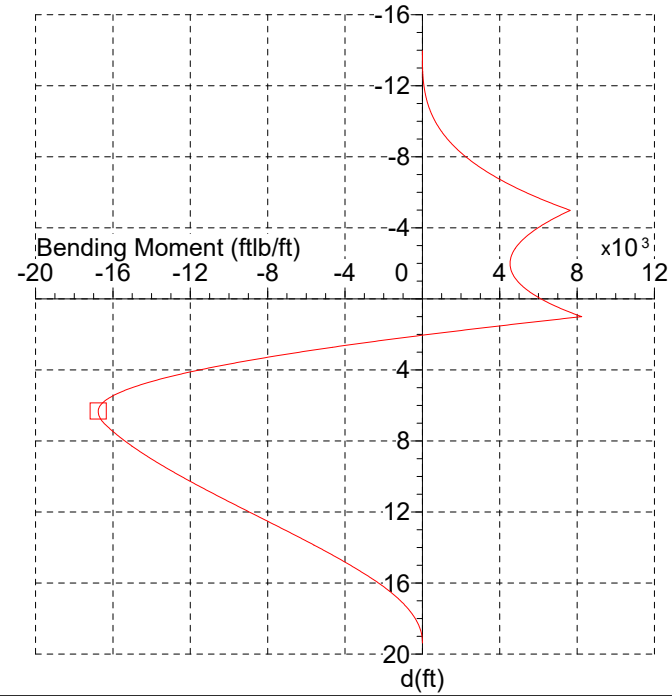
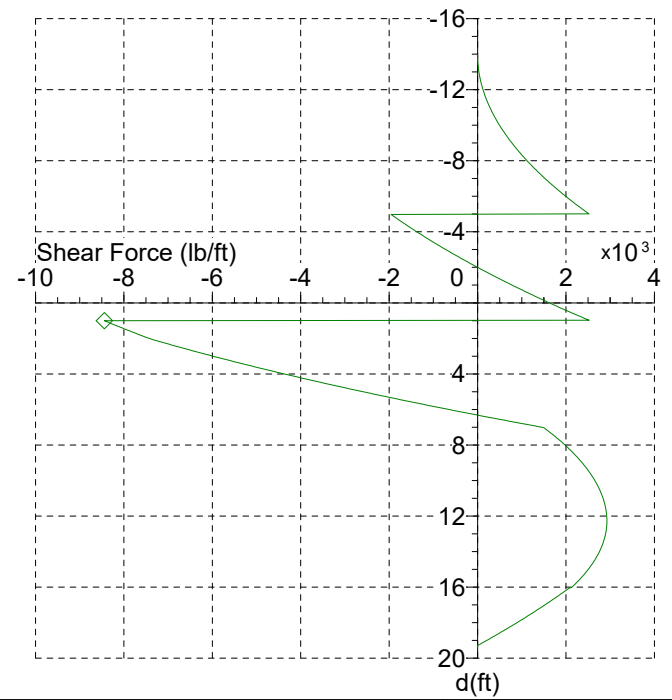
	Maximum	d (ft)
○	2186.0 psf	7.00
□	16759.2 ftlb/ft	6.32
◇	8441.8 lb/ft	1.00

Stage 3 - Tip & Moment only







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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Tip & Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	874.2	6130.5		1627.1	6.51	2108.1	-16736.9		417.4	13.03	-84.1	-7081.7		2893.9
0.14	887.0	6368.4		1749.8	6.65	2131.0	-16690.5		712.8	13.17	-100.0	-6831.3		2880.9
0.28	899.7	6623.8		1874.4	6.79	2153.9	-16618.4		1011.3	13.31	-115.9	-6582.1		2865.7
0.42	912.5	6897.0		2000.7	6.93	2176.8	-16520.3		1313.0	13.45	-131.7	-6334.3		2848.2
0.55	925.2	7188.2		2128.7	7.07	539.0	-16396.8		1525.5	13.58	-147.6	-6088.1		2828.6
0.69	937.9	7497.7		2258.6	7.21	522.0	-16262.0		1598.9	13.72	-163.5	-5843.7		2806.7
0.83	950.7	7825.7		2390.2	7.35	507.8	-16120.9		1670.4	13.86	-179.4	-5601.3		2782.6
0.97	963.4	8172.5		2523.6	7.49	493.6	-15973.7		1739.9	14.00	-195.2	-5361.0		2756.3
1.11	976.1	7313.4		-8333.5	7.62	479.4	-15820.6		1807.4	14.14	-211.1	-5123.1		2727.8
1.25	988.9	6169.3		-8196.6	7.76	465.1	-15661.7		1872.9	14.28	-227.0	-4887.7		2697.1
1.39	1001.6	5044.2		-8057.9	7.90	450.9	-15497.1		1936.5	14.42	-242.8	-4655.1		2664.2
1.52	1014.4	3938.3		-7917.4	8.04	436.7	-15327.1		1998.0	14.55	-258.7	-4425.4		2629.1
1.66	1027.1	2851.9		-7775.2	8.18	422.5	-15151.9		2057.7	14.69	-274.6	-4198.8		2591.7
1.80	1039.8	1785.4		-7631.1	8.32	408.3	-14971.5		2115.3	14.83	-290.5	-3975.5		2552.2
1.94	1052.6	738.8		-7485.3	8.46	394.1	-14786.2		2170.9	14.97	-306.3	-3755.8		2510.4
2.08	1379.7	-286.9		-7311.9	8.59	379.9	-14596.2		2224.6	15.11	-322.2	-3539.7		2466.5
2.22	1402.6	-1286.7		-7117.9	8.73	365.7	-14401.6		2276.3	15.25	-338.1	-3327.5		2420.3
2.36	1425.5	-2259.5		-6920.8	8.87	351.5	-14202.6		2326.0	15.39	-354.0	-3119.4		2371.9
2.50	1448.4	-3204.9		-6720.4	9.01	337.3	-13999.3		2373.8	15.53	-369.8	-2915.6		2321.3
2.63	1471.3	-4122.5		-6516.9	9.15	323.1	-13792.0		2419.5	15.66	-385.7	-2716.2		2268.5
2.77	1494.2	-5011.7		-6310.2	9.29	308.9	-13580.7		2463.3	15.80	-401.6	-2521.5		2213.5
2.91	1517.2	-5872.2		-6100.3	9.43	294.7	-13365.8		2505.1	15.94	-417.5	-2331.6		2156.3
3.05	1540.1	-6703.5		-5887.2	9.56	280.5	-13147.3		2545.0	16.08	-1202.6	-2147.9		2050.7
3.19	1563.0	-7505.2		-5670.9	9.70	266.3	-12925.4		2582.8	16.22	-1218.5	-1972.9		1972.6
3.33	1585.9	-8276.8		-5451.4	9.84	252.1	-12700.3		2618.7	16.36	-1234.4	-1804.6		1893.5
3.47	1608.8	-9018.0		-5228.8	9.98	237.9	-12472.1		2652.6	16.50	-1250.2	-1643.3		1813.4
3.60	1631.7	-9728.1		-5002.9	10.12	223.7	-12241.1		2684.5	16.63	-1266.1	-1488.9		1732.3
3.74	1654.6	-10406.9		-4773.9	10.26	209.5	-12007.4		2714.5	16.77	-1282.0	-1341.6		1650.1
3.88	1677.5	-11053.9		-4541.7	10.40	195.3	-11771.1		2742.5	16.91	-1297.9	-1201.5		1567.0
4.02	1700.4	-11668.6		-4306.3	10.53	181.1	-11532.5		2768.5	17.05	-1313.7	-1068.6		1482.8
4.16	1723.3	-12250.5		-4067.7	10.67	166.9	-11291.7		2792.5	17.19	-1329.6	-943.0		1397.6
4.30	1746.2	-12799.4		-3825.9	10.81	152.7	-11048.9		2814.5	17.33	-1345.5	-824.9		1311.3
4.44	1769.1	-13314.6		-3580.9	10.95	138.5	-10804.3		2834.6	17.47	-1361.4	-714.2		1224.1
4.57	1792.0	-13795.8		-3332.8	11.09	124.3	-10557.9		2852.7	17.60	-1377.2	-611.2		1135.8
4.71	1814.9	-14242.5		-3081.4	11.23	110.1	-10310.1		2868.8	17.74	-1393.1	-515.8		1046.5
4.85	1837.8	-14654.4		-2826.9	11.37	95.9	-10061.0		2882.9	17.88	-1409.0	-428.3		956.1
4.99	1860.7	-15030.8		-2569.2	11.51	81.7	-9810.7		2895.1	18.02	-1424.8	-348.6		864.8
5.13	1883.6	-15371.5		-2308.3	11.64	67.5	-9559.4		2905.3	18.16	-1440.7	-276.8		772.4
5.27	1906.5	-15675.9		-2044.2	11.78	53.3	-9307.3		2913.5	18.30	-1456.6	-213.1		679.0
5.41	1929.4	-15943.7		-1776.9	11.92	39.1	-9054.6		2919.7	18.44	-1472.5	-157.5		584.6
5.54	1952.3	-16174.3		-1506.4	12.06	23.8	-8801.4		2924.0	18.57	-1488.3	-110.1		489.1
5.68	1975.2	-16367.4		-1232.7	12.20	8.0	-8547.8		2926.0	18.71	-1504.2	-71.1		392.7
5.82	1998.1	-16522.5		-955.9	12.34	-7.9	-8294.2		2925.7	18.85	-1520.1	-40.4		295.2
5.96	2021.1	-16639.2		-675.8	12.48	-23.8	-8040.7		2923.3	18.99	-1536.0	-18.3		196.7
6.10	2039.4	-16704.5		-449.5	12.61	-39.7	-7787.5		2918.7	19.13	-1551.8	-4.7		97.2
6.24	2062.3	-16750.9		-163.7	12.75	-52.4	-7585.3		2913.4	19.27	-1567.7	0.0		0.0
6.38	2085.2	-16757.9		125.3	12.89	-68.2	-7333.1		2904.8	19.41	-1577.2	0.0		0.0

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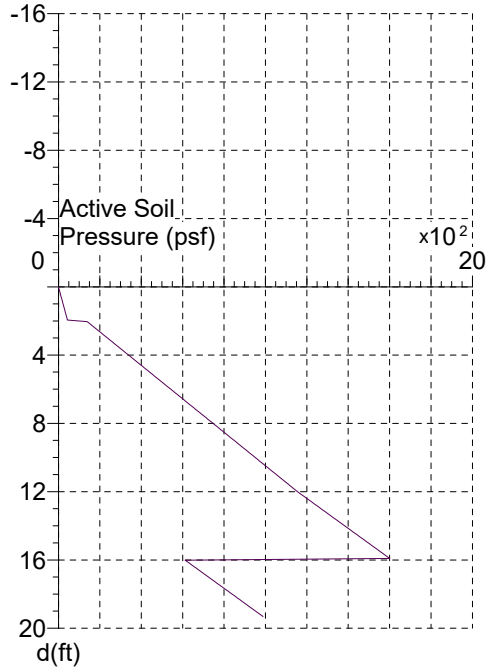
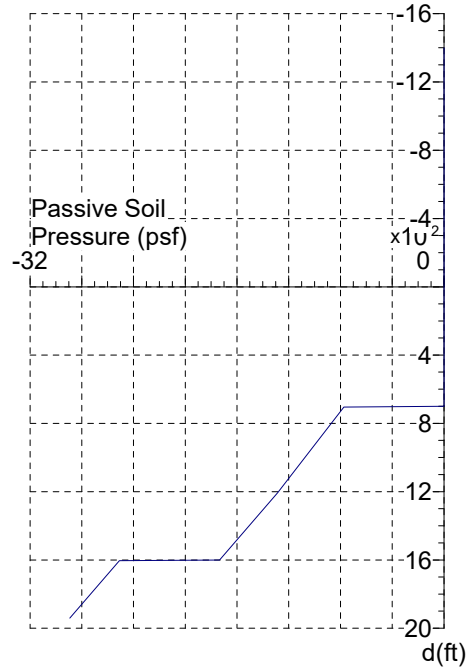
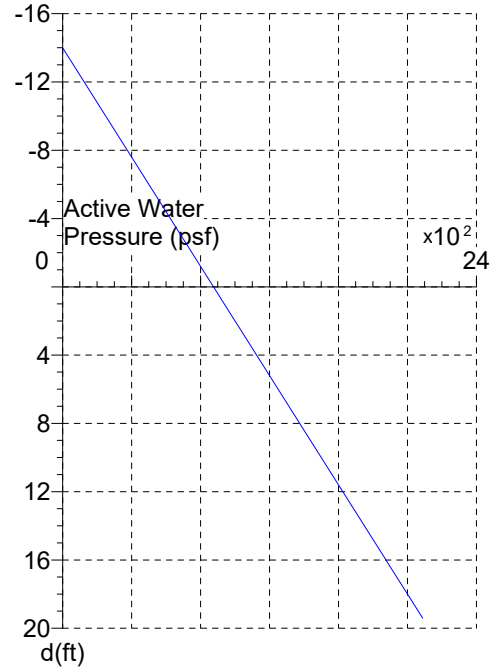
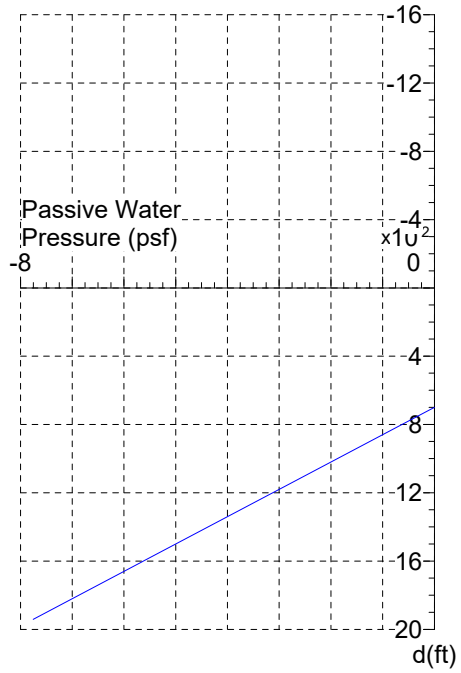
Analysis: Net Pressure
Toe: Free Earth Support

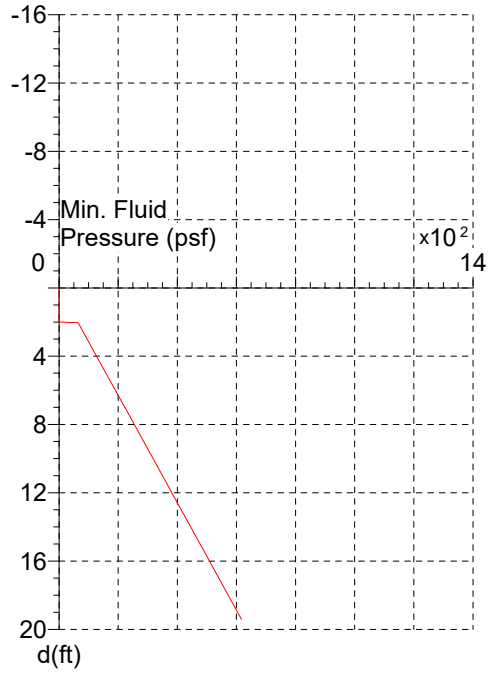
Stage 3 - Tip & Moment only

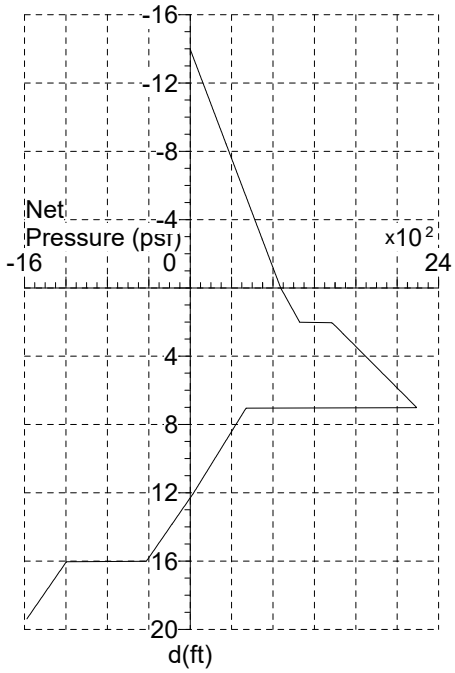












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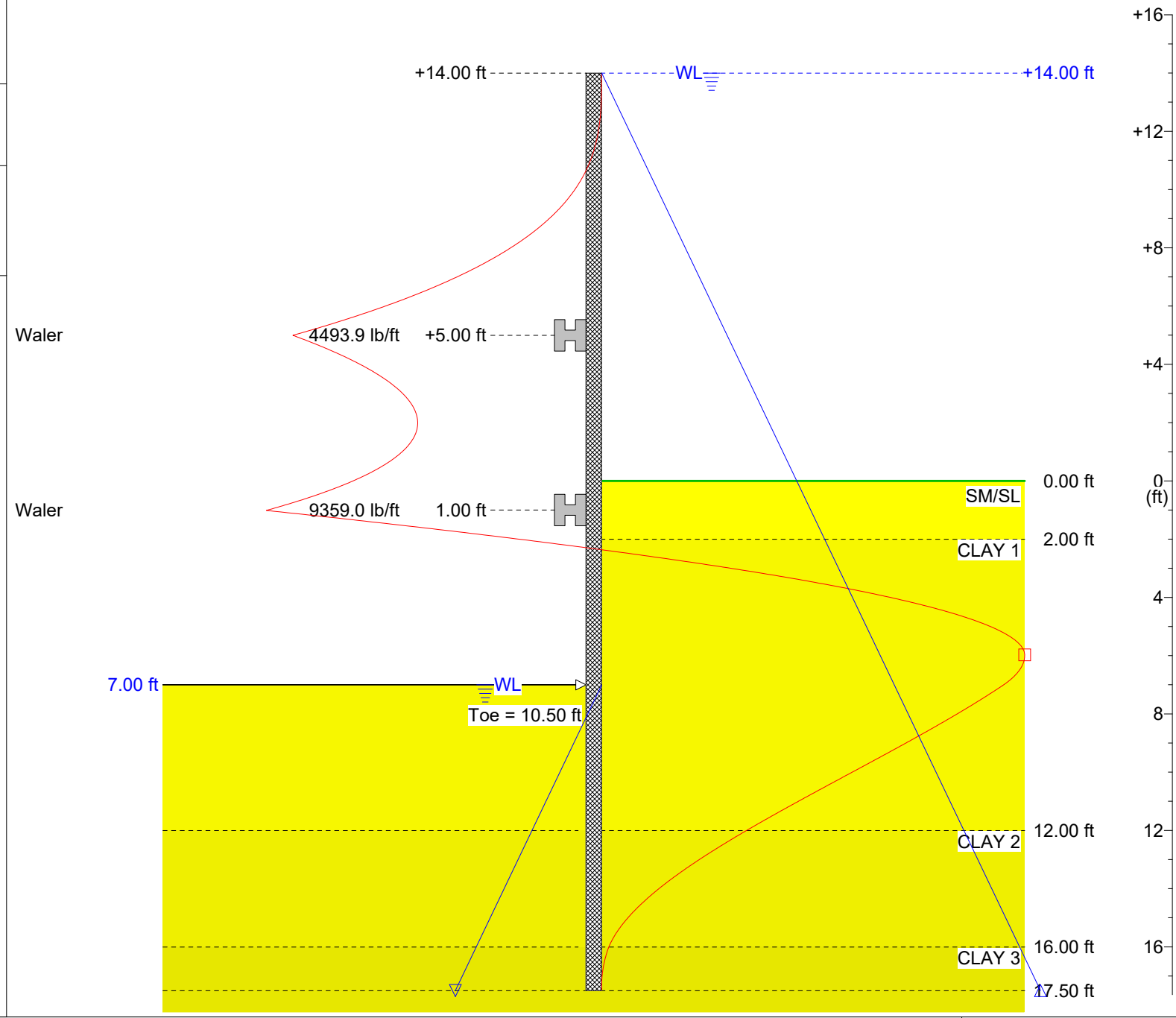
Title: Brazos River Flood Gate - East Side
Designer: Stage 3
Ref: 1.0
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	10425.2 ftlb/ft	5.98
△	1968.7 psf	17.50
△	656.2 psf	17.50

Stage 3 - Braces only



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Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Braces only

Input Data

Depth Of Excavation = 7.00ft
Surcharge = 0.0psf
Depth Of Active Water = +14.00ft
Depth Of Passive Water = 7.00ft
Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	10.50	31.50

Pressure Model: Coulomb; Assume full hydrostatic pressure to 7.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4493.9
1.00	Waler	9359.0

Maxima

	Maximum	Depth (ft)
Pressure	1956.8 psf	7.00
Bending Moment	10425.2 ftlb/ft	5.98
Shear Force	6802.7 lb/ft	1.00

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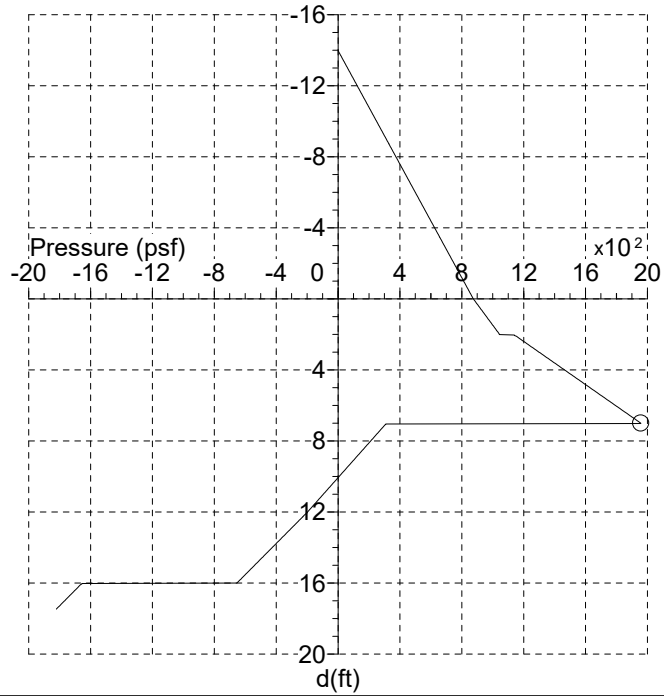
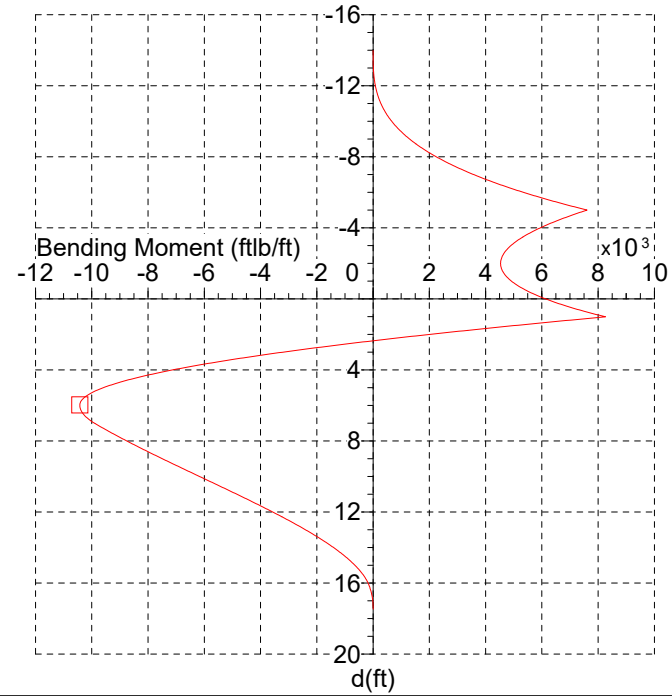
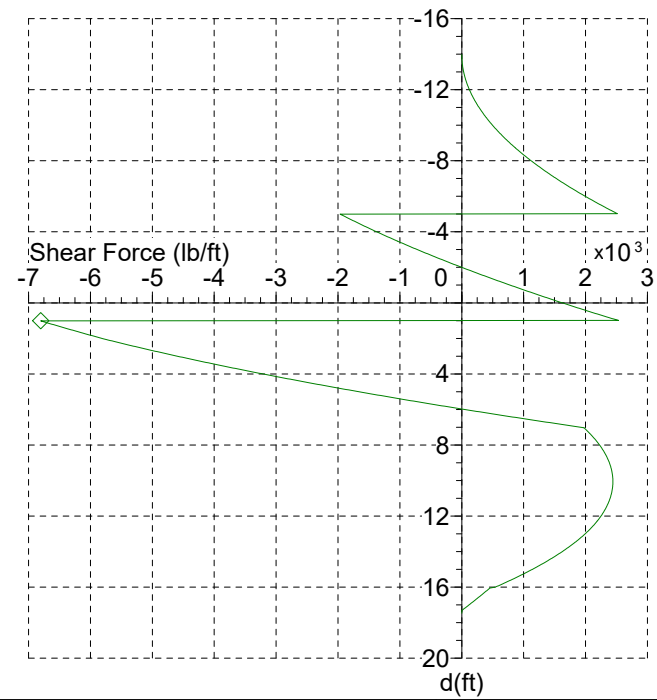
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	1956.8 psf	7.00
□	10425.2 ftlb/ft	5.98
◇	6802.7 lb/ft	1.00

Stage 3 - Braces only







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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	875.5	6151.8		1639.7	5.87	1775.4	-10418.6		-138.1	11.75	-171.5	-3883.8		2295.8
0.12	886.7	6377.2		1755.5	6.00	1792.6	-10425.2		49.5	11.87	-184.9	-3719.9		2272.3
0.25	895.6	6568.7		1849.2	6.12	1814.2	-10414.8		286.5	12.00	-197.0	-3557.6		2247.0
0.37	906.7	6822.2		1967.6	6.25	1835.8	-10387.4		526.3	12.12	-213.5	-3397.3		2219.8
0.50	917.8	7091.6		2087.5	6.37	1857.4	-10342.8		768.9	12.25	-228.5	-3239.0		2190.6
0.62	929.0	7377.1		2208.8	6.50	1874.7	-10294.4		965.1	12.37	-240.4	-3113.8		2165.8
0.75	937.9	7617.2		2306.9	6.62	1896.3	-10218.2		1212.8	12.50	-255.4	-2959.5		2133.1
0.87	949.0	7932.2		2430.9	6.75	1917.9	-10124.0		1463.4	12.62	-270.4	-2807.5		2098.4
1.00	960.2	8262.5		-6802.7	6.87	1939.5	-10011.8		1716.8	12.75	-285.4	-2658.1		2061.7
1.12	971.3	7378.3		-6675.8	7.00	1956.8	-9881.4		1973.0	12.87	-297.3	-2540.5		2031.0
1.25	980.2	6682.9		-6573.2	7.12	300.1	-9767.5		2005.0	13.00	-312.3	-2396.0		1990.8
1.37	991.3	5828.9		-6443.7	7.25	286.7	-9622.7		2043.3	13.12	-327.3	-2254.4		1948.6
1.50	1002.5	4991.9		-6312.7	7.37	273.3	-9475.1		2079.9	13.25	-342.3	-2116.0		1904.5
1.62	1013.6	4172.1		-6180.3	7.50	259.9	-9324.9		2114.7	13.37	-354.3	-2007.5		1867.8
1.75	1024.7	3369.8		-6046.3	7.62	249.2	-9203.1		2141.3	13.50	-369.2	-1874.9		1820.1
1.87	1033.6	2740.6		-5938.2	7.75	235.8	-9048.6		2173.0	13.62	-384.2	-1745.8		1770.4
2.00	1042.5	1970.1		-5801.7	7.87	222.4	-8891.9		2202.9	13.75	-399.2	-1620.4		1718.8
2.12	1157.7	1218.2		-5651.0	8.00	209.0	-8733.2		2231.0	13.87	-411.2	-1522.7		1676.1
2.25	1179.3	486.2		-5497.3	8.12	198.3	-8604.7		2252.2	14.00	-426.1	-1404.1		1621.0
2.37	1196.6	-84.9		-5372.4	8.25	184.9	-8442.5		2277.2	14.12	-441.1	-1289.5		1563.9
2.50	1218.2	-780.1		-5213.6	8.37	171.5	-8278.6		2300.4	14.25	-456.1	-1179.0		1504.8
2.62	1239.8	-1454.4		-5052.1	8.50	158.1	-8113.0		2321.9	14.37	-468.1	-1093.7		1456.1
2.75	1261.4	-2107.5		-4887.7	8.62	147.4	-7979.4		2337.8	14.50	-483.0	-991.1		1393.5
2.87	1278.6	-2614.3		-4754.1	8.75	134.0	-7811.3		2356.1	14.62	-498.0	-893.0		1329.0
3.00	1300.2	-3228.0		-4584.6	8.87	120.6	-7641.9		2372.6	14.75	-513.0	-799.6		1262.4
3.12	1321.8	-3819.4		-4412.2	9.00	107.2	-7471.3		2387.4	14.87	-528.0	-711.1		1193.9
3.25	1343.4	-4388.0		-4237.0	9.12	96.5	-7334.1		2397.9	15.00	-539.9	-643.8		1137.7
3.37	1360.7	-4826.3		-4094.8	9.25	83.1	-7161.9		2409.5	15.12	-554.9	-564.3		1065.6
3.50	1382.3	-5353.2		-3914.5	9.37	69.7	-6988.8		2419.4	15.25	-569.9	-490.0		991.6
3.62	1403.9	-5856.2		-3731.4	9.50	56.3	-6815.1		2427.4	15.37	-584.9	-421.0		915.7
3.75	1425.5	-6335.2		-3545.5	9.62	42.9	-6640.8		2433.8	15.50	-596.8	-369.8		853.5
3.87	1442.8	-6700.7		-3394.7	9.75	32.1	-6501.1		2437.6	15.62	-611.8	-310.9		773.9
4.00	1464.4	-7135.3		-3203.6	9.87	18.7	-6326.3		2440.7	15.75	-626.8	-257.7		692.5
4.12	1486.0	-7544.7		-3009.7	10.00	5.3	-6151.2		2442.1	15.87	-641.8	-210.5		609.0
4.25	1507.6	-7928.6		-2813.0	10.12	-8.1	-5976.1		2441.8	16.00	-653.4	-177.0		540.9
4.37	1529.2	-8286.5		-2613.4	10.25	-18.8	-5836.1		2440.2	16.12	-1668.8	-143.0		426.7
4.50	1546.4	-8554.0		-2451.7	10.37	-32.2	-5661.2		2436.7	16.25	-1683.8	-113.7		381.1
4.62	1568.0	-8864.3		-2247.1	10.50	-45.6	-5486.6		2431.4	16.37	-1698.8	-87.7		335.1
4.75	1589.6	-9147.8		-2039.6	10.62	-59.0	-5312.5		2424.4	16.50	-1710.7	-69.3		297.9
4.87	1611.2	-9403.9		-1829.2	10.75	-69.7	-5173.5		2417.5	16.62	-1725.7	-49.2		251.2
5.00	1628.5	-9588.8		-1658.9	10.87	-83.1	-5000.5		2407.3	16.75	-1740.7	-32.6		204.0
5.12	1650.1	-9794.8		-1443.5	11.00	-96.5	-4828.2		2395.3	16.87	-1755.7	-19.3		156.4
5.25	1671.7	-9972.4		-1225.2	11.12	-109.9	-4656.8		2381.6	17.00	-1767.7	-11.2		118.1
5.37	1693.3	-10121.3		-1004.1	11.25	-120.6	-4520.5		2369.4	17.12	-1782.6	-4.1		69.8
5.50	1710.6	-10219.5		-825.2	11.37	-134.0	-4351.1		2352.5	17.25	-1797.6	-0.5		21.1
5.62	1732.2	-10315.8		-599.0	11.50	-147.4	-4182.9		2333.8	17.37	-1812.6	0.0		0.0
5.75	1753.8	-10382.2		-369.9	11.62	-160.8	-4016.1		2313.4	17.50	-1821.6	0.0		0.0

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Title: Brazos River Flood Gate - East Side
Designer: Stage 3
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Page: 5
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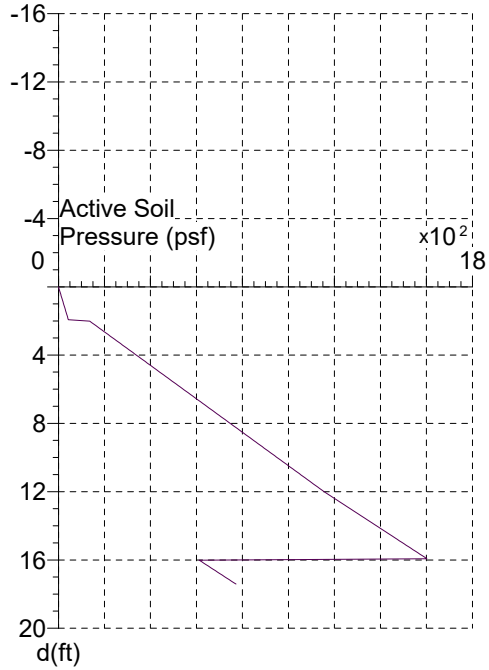
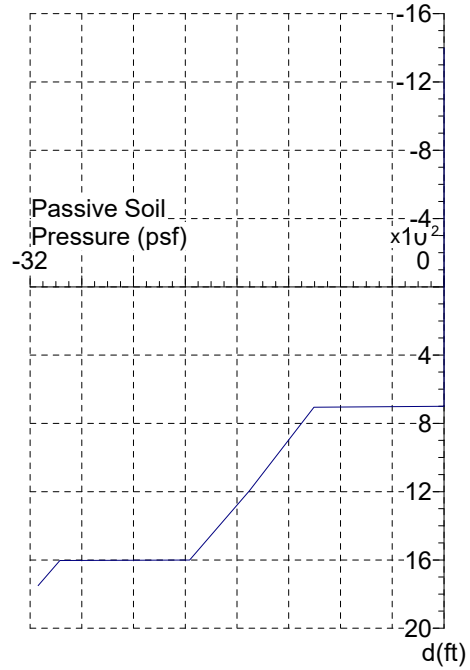
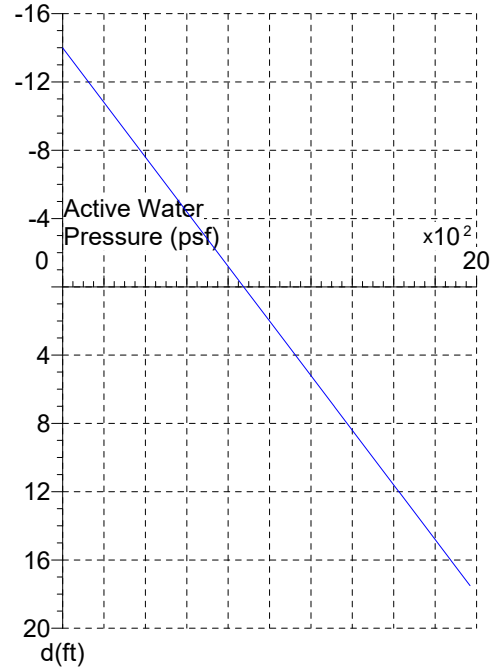
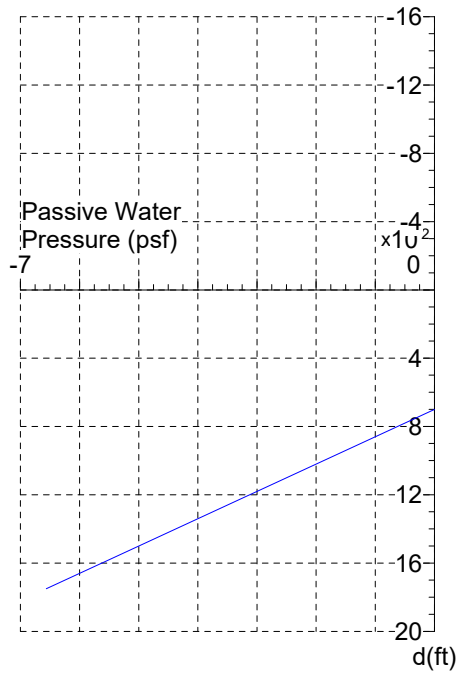
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

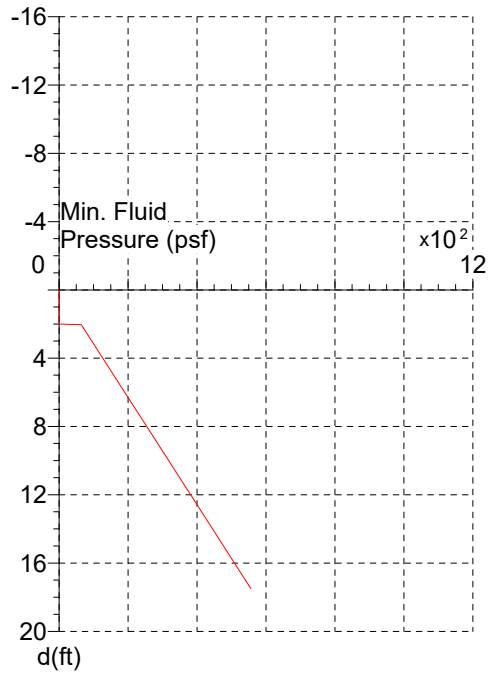
Stage 3 - Braces only

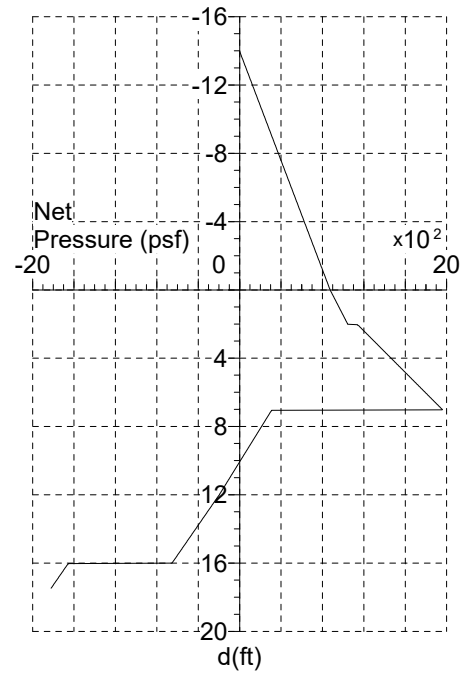












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Title: Brazos River Flood Gate - East Side
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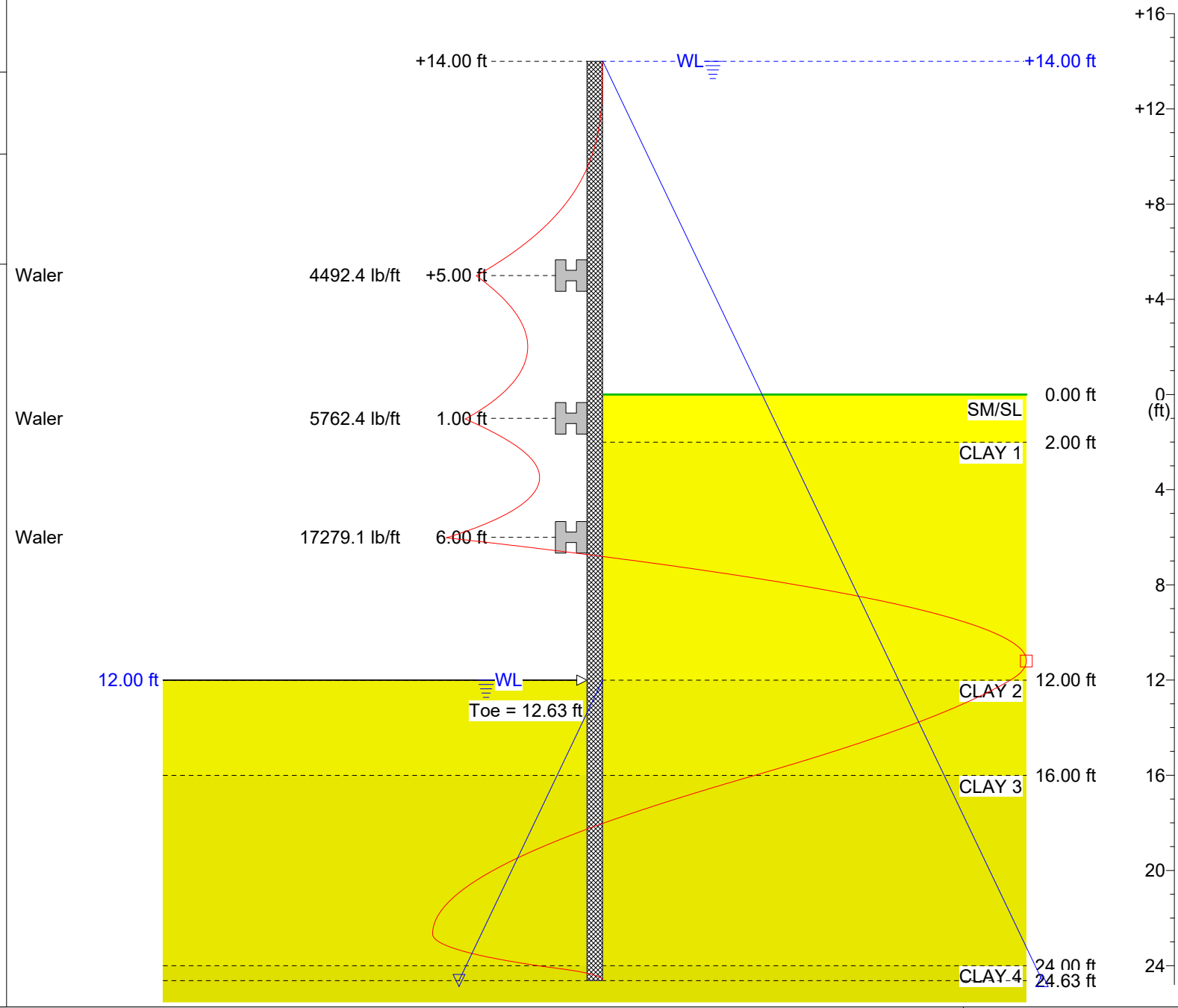
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	25558.4 ftlb/ft	11.20
△	2414.1 psf	24.63
△	789.1 psf	24.63

Stage 4 - Tip and Moment only



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Date: 8.30.18

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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 4 - Tip and Moment only

Input Data

Depth Of Excavation = 12.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 12.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	12.63	38.63

Pressure Model: Coulomb; Assume full hydrostatic pressure to 12.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4492.4
1.00	Waler	5762.4
6.00	Waler	17279.1

Maxima

	Maximum	Depth (ft)
Pressure	3012.0 psf	12.00
Bending Moment	25558.4 ftlb/ft	11.20
Shear Force	12637.1 lb/ft	6.02

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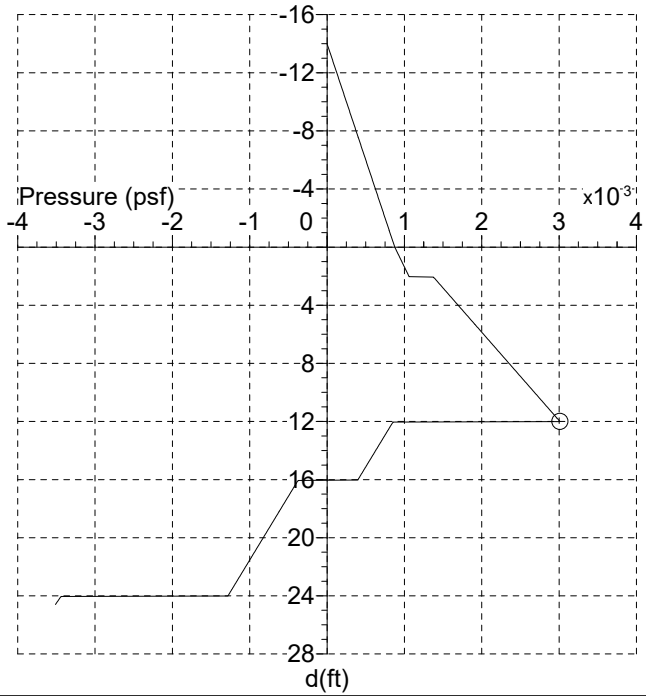
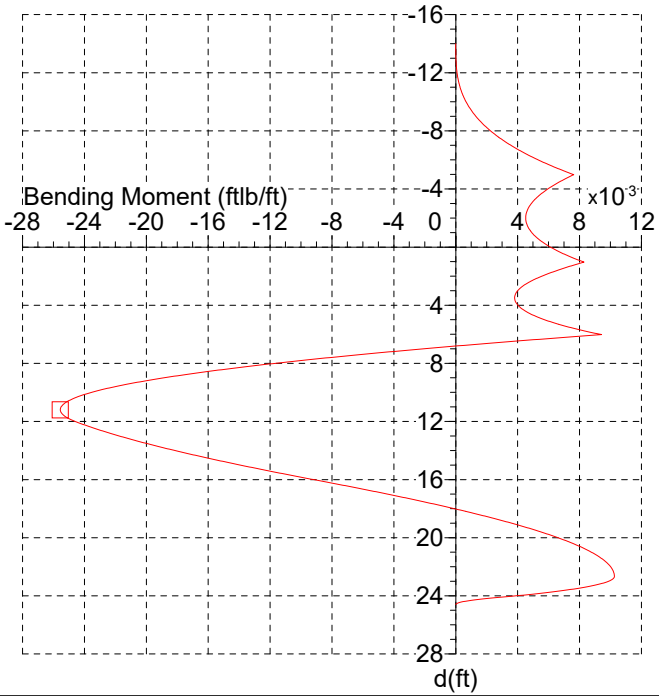
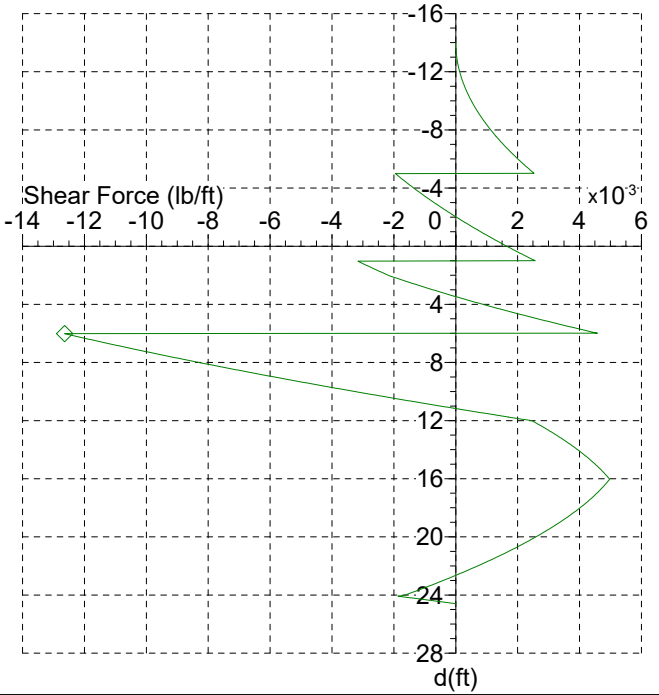
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	3012.0 psf	12.00
□	25558.4 ftlb/ft	11.20
◇	12637.1 lb/ft	6.02

Stage 4 - Tip and Moment only







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Toe: Free Earth Support

Stage 4 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	875.1	6122.1		1648.1	8.27	2397.7	-13903.4		-7646.3	16.53	-431.6	-6521.4		4765.9
0.18	892.8	6454.1		1819.1	8.44	2429.5	-15357.6		-7179.7	16.71	-453.6	-5607.6		4680.0
0.35	907.5	6756.1		1964.2	8.62	2456.0	-16499.6		-6786.1	16.89	-471.9	-4859.1		4605.3
0.53	925.2	7149.7		2141.4	8.79	2487.7	-17785.0		-6308.2	17.06	-494.0	-3977.0		4511.6
0.70	939.9	7504.0		2291.8	8.97	2514.2	-18784.6		-5905.3	17.24	-512.3	-3255.9		4430.4
0.88	957.6	7961.3		2475.3	9.15	2546.0	-19897.3		-5416.2	17.41	-530.7	-2548.2		4346.1
1.06	972.3	8183.3		-3131.6	9.32	2572.5	-20751.2		-5003.9	17.59	-552.7	-1717.0		4241.2
1.23	989.9	7568.1		-2941.8	9.50	2604.2	-21687.1		-4503.5	17.77	-571.0	-1040.1		4150.5
1.41	1004.7	7084.8		-2781.1	9.67	2630.7	-22392.0		-4081.8	17.94	-593.1	-247.4		4037.7
1.58	1022.3	6540.8		-2585.1	9.85	2657.2	-23028.1		-3655.9	18.12	-611.4	396.3		3940.5
1.76	1037.0	6117.8		-2419.1	10.03	2688.9	-23699.5		-3139.1	18.29	-633.4	1147.8		3819.9
1.93	1054.7	5647.2		-2216.9	10.20	2715.4	-24181.7		-2703.8	18.47	-651.8	1756.1		3716.2
2.11	1386.4	5287.4		-2015.6	10.38	2747.2	-24666.5		-2175.8	18.64	-673.8	2463.6		3587.8
2.29	1412.9	4964.0		-1789.9	10.55	2773.7	-24991.5		-1731.1	18.82	-692.2	3034.1		3477.6
2.46	1444.7	4626.5		-1513.5	10.73	2805.4	-25285.5		-1191.9	19.00	-714.2	3695.0		3341.5
2.64	1471.1	4388.0		-1278.4	10.91	2831.9	-25449.8		-737.8	19.17	-732.5	4225.4		3224.8
2.81	1502.9	4154.5		-990.7	11.08	2863.7	-25549.2		-187.3	19.35	-754.6	4836.8		3080.8
2.99	1529.4	4004.5		-746.3	11.26	2890.1	-25549.6		276.1	19.52	-772.9	5324.8		2957.6
3.17	1561.1	3879.1		-447.3	11.43	2921.9	-25451.2		837.8	19.70	-791.3	5792.8		2831.4
3.34	1587.6	3821.0		-193.5	11.61	2948.4	-25285.9		1310.6	19.88	-813.3	6327.3		2676.1
3.52	1619.4	3807.1		116.7	11.78	2980.2	-24986.8		1883.6	20.05	-831.6	6749.6		2543.5
3.69	1645.9	3842.7		379.8	11.96	3006.6	-24652.6		2365.8	20.23	-853.7	7227.8		2380.4
3.87	1677.6	3941.9		701.3	12.14	836.9	-24171.2		2598.7	20.40	-872.0	7602.1		2241.2
4.05	1704.1	4072.2		973.8	12.31	818.6	-23744.3		2731.7	20.58	-894.0	8021.3		2070.3
4.22	1735.9	4287.0		1306.5	12.49	800.2	-23296.1		2861.6	20.76	-912.4	8345.2		1924.7
4.40	1762.3	4515.3		1588.4	12.66	778.2	-22731.1		3013.7	20.93	-934.4	8702.7		1746.0
4.57	1794.1	4849.7		1932.4	12.84	759.9	-22238.0		3137.2	21.11	-952.8	8974.0		1593.8
4.75	1820.6	5179.4		2223.7	13.02	737.8	-21620.3		3281.4	21.28	-974.8	9266.9		1407.3
4.93	1847.1	5556.2		2519.2	13.19	719.5	-21084.5		3398.4	21.46	-993.2	9483.3		1248.7
5.10	1878.8	6071.6		2879.5	13.37	697.5	-20417.0		3534.9	21.63	-1015.2	9708.9		1054.4
5.28	1905.3	6554.6		3184.4	13.54	679.1	-19840.9		3645.4	21.81	-1033.5	9868.0		889.2
5.45	1937.1	7199.4		3556.0	13.72	657.1	-19126.3		3774.0	21.99	-1055.6	10023.6		687.2
5.63	1963.6	7791.9		3870.3	13.90	638.7	-18512.1		3878.0	22.16	-1073.9	10123.2		515.5
5.80	1995.3	8570.0		4253.1	14.07	616.7	-17753.2		3998.9	22.34	-1092.3	10195.0		340.9
5.98	2021.8	9275.3		4576.8	14.25	598.4	-17103.2		4096.4	22.51	-1114.3	10243.7		127.5
6.16	2053.6	7390.6		-12308.3	14.42	576.3	-16302.7		4209.4	22.69	-1132.6	10252.9		-53.6
6.33	2080.0	5410.7		-11975.3	14.60	558.0	-15619.2		4300.4	22.87	-1154.7	10083.4		-274.8
6.51	2111.8	3106.8		-11570.0	14.78	539.6	-14921.3		4388.4	23.04	-1173.0	9743.7		-462.4
6.68	2138.3	1247.6		-11227.6	14.95	517.6	-14065.3		4490.2	23.22	-1195.0	9093.9		-691.5
6.86	2170.1	-909.5		-10811.0	15.13	499.3	-13337.3		4571.7	23.39	-1213.4	8347.0		-885.6
7.04	2196.5	-2644.6		-10459.2	15.30	477.2	-12446.6		4665.6	23.57	-1235.4	7200.1		-1122.4
7.21	2228.3	-4650.9		-10031.5	15.48	458.9	-11690.7		4740.7	23.75	-1253.8	6032.2		-1323.0
7.39	2254.8	-6258.6		-9670.3	15.65	436.9	-10767.9		4826.8	23.92	-1275.8	4371.7		-1567.6
7.56	2281.2	-7807.4		-9304.8	15.83	418.5	-9986.5		4895.4	24.10	-3449.4	2728.4		-1755.3
7.74	2313.0	-9587.1		-8860.7	16.01	400.0	-9034.5		4973.8	24.27	-3474.1	1022.1		-1054.8
7.92	2339.5	-11003.6		-8485.9	16.18	-391.2	-8237.8		4912.2	24.45	-3494.7	225.5		-467.2
8.09	2371.3	-12622.5		-8030.5	16.36	-413.2	-7295.2		4834.1	24.63	-3511.2	0.0		0.0

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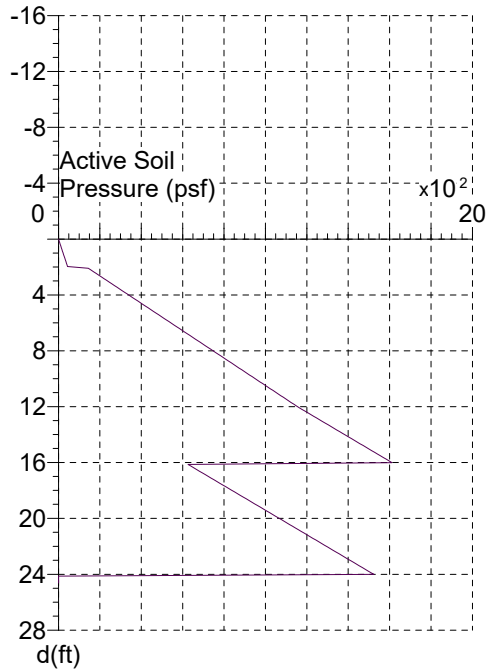

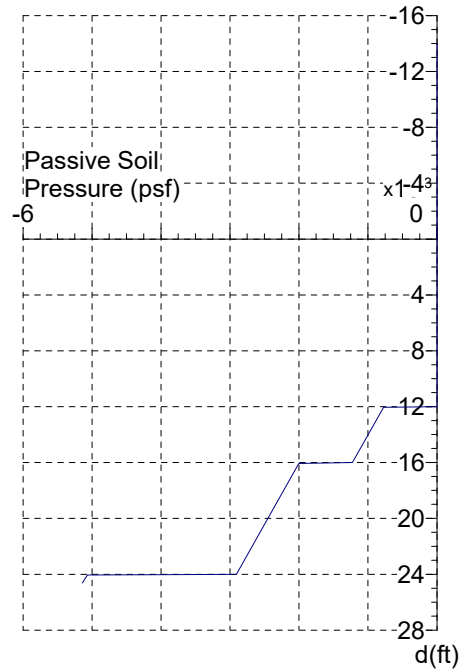

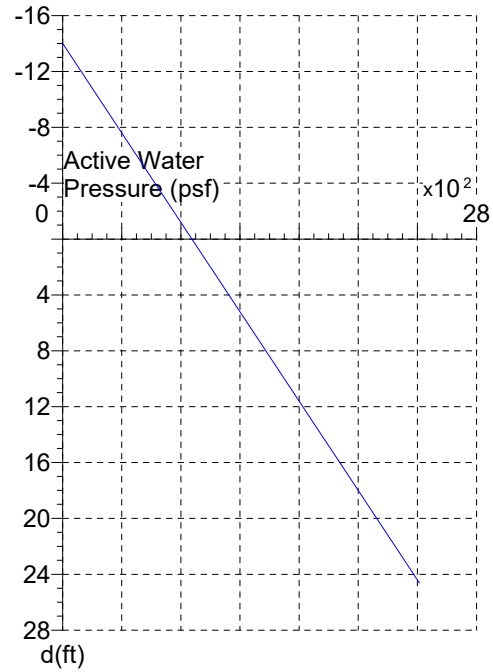

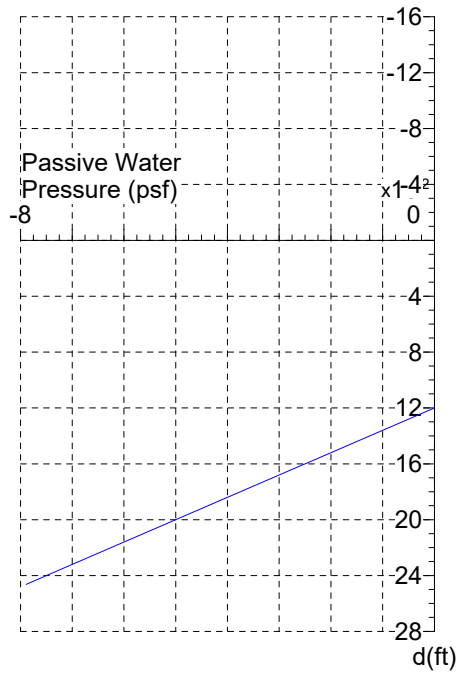

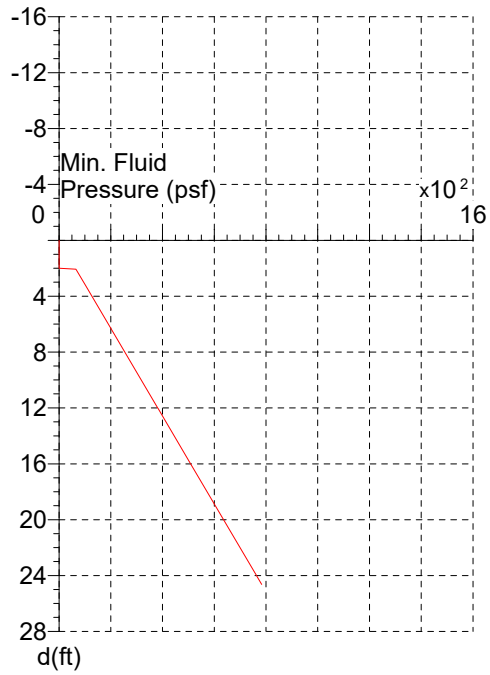

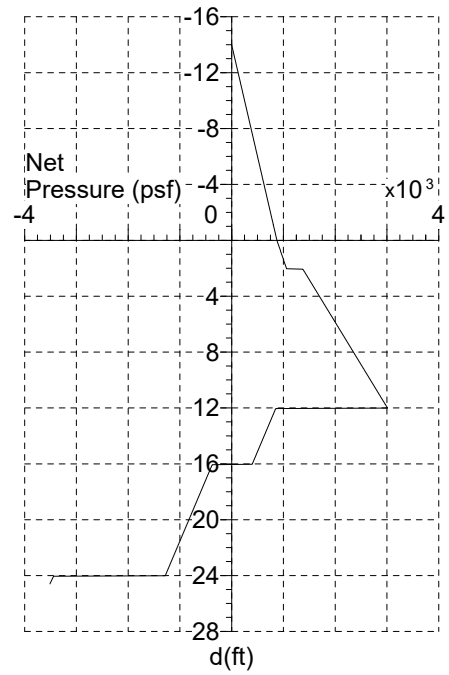

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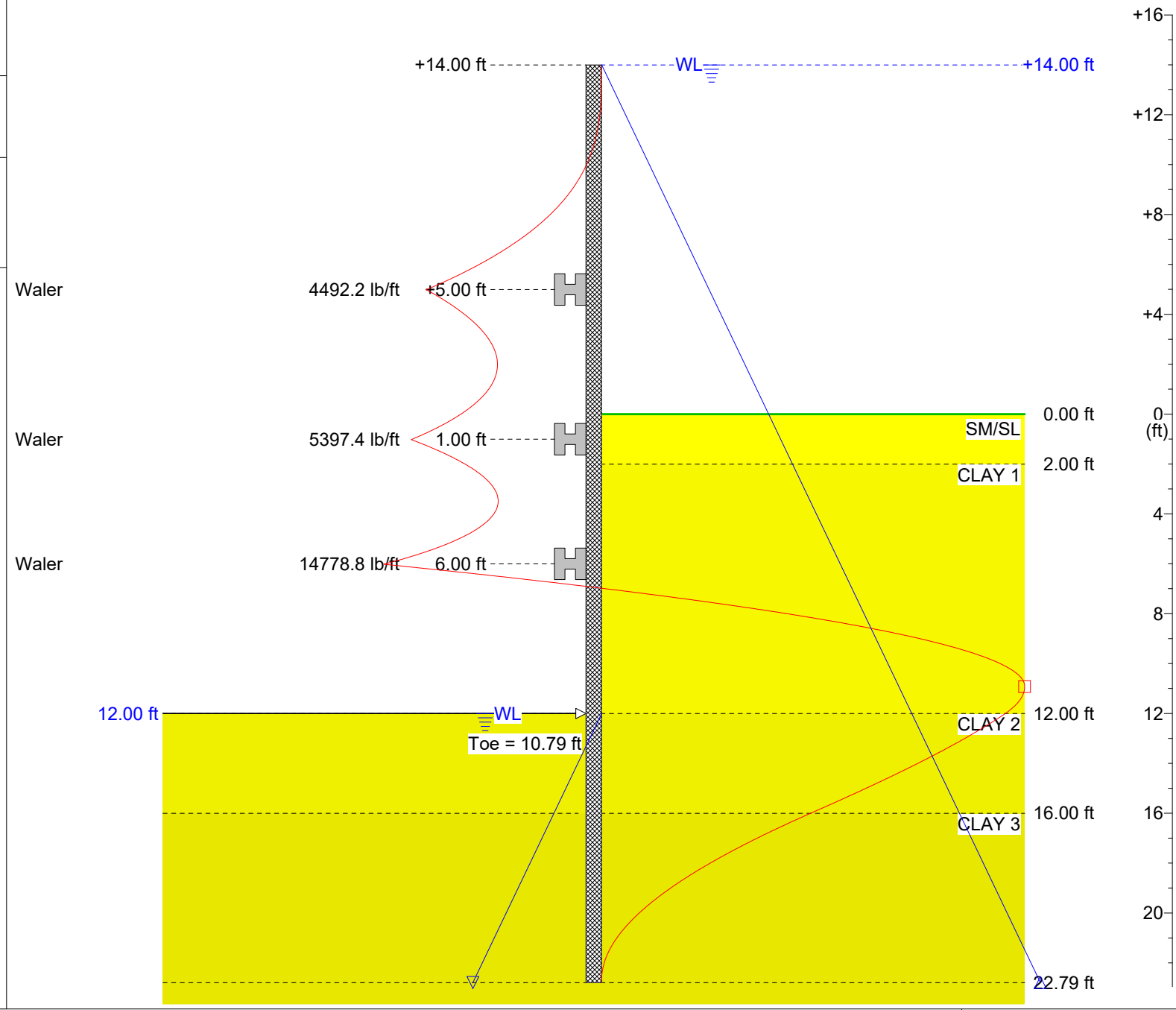
	Maximum	d (ft)
□	18429.8 ftlb/ft	10.92
△	2299.3 psf	22.79
△	674.3 psf	22.79

Stage 4 - Braces only



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Stage 4 - Braces only

Input Data

Depth Of Excavation = 12.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 12.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	10.79	36.79

Pressure Model: Coulomb; Assume full hydrostatic pressure to 12.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4492.2
1.00	Waler	5397.4
6.00	Waler	14778.8

Maxima

	Maximum	Depth (ft)
Pressure	2778.8 psf	12.00
Bending Moment	18429.8 ftlb/ft	10.92
Shear Force	10736.8 lb/ft	6.00

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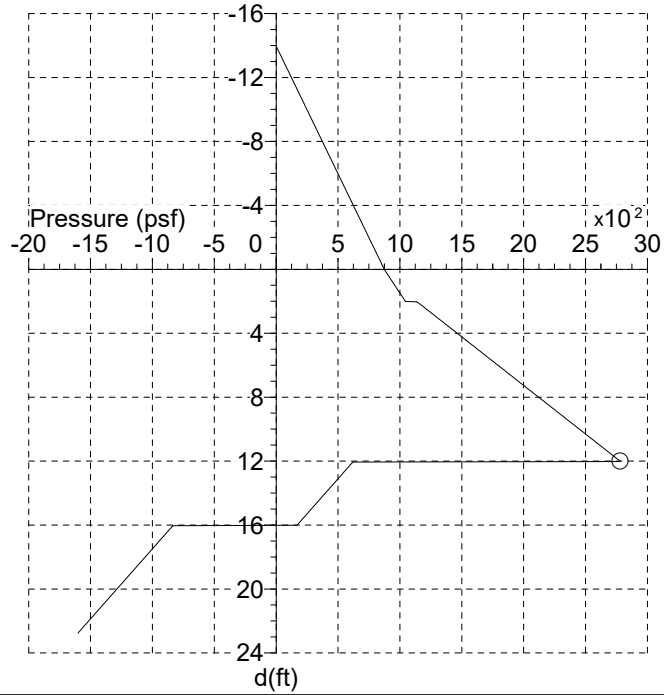
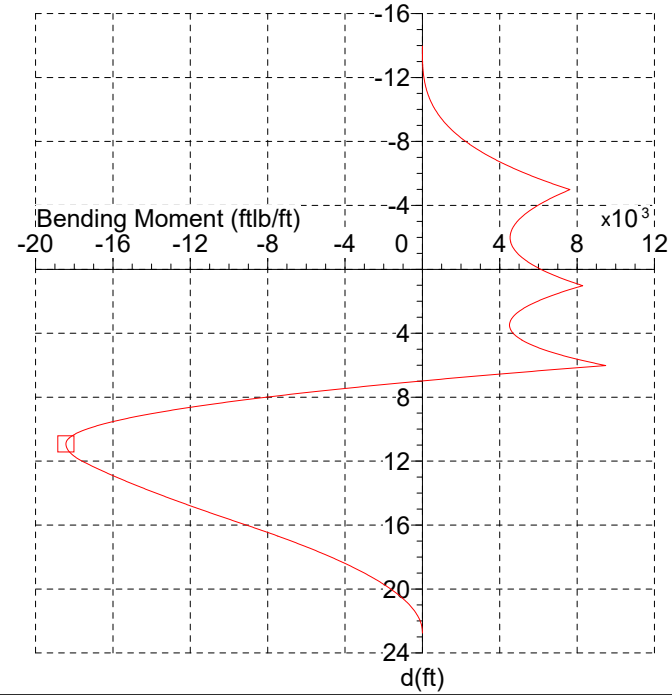
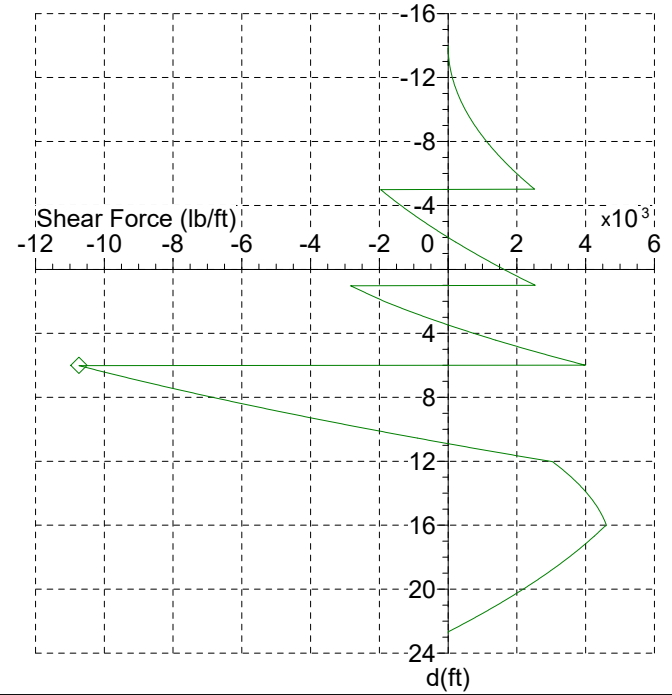
	Maximum	d (ft)
○	2778.8 psf	12.00
□	18429.8 ftlb/ft	10.92
◇	10736.8 lb/ft	6.00

Stage 4 - Braces only







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Stage 4 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	874.7	6145.9		1633.3	7.65	2067.5	-5721.5		-7535.4	15.30	248.6	-10788.7		4459.1
0.16	887.7	6410.1		1768.5	7.81	2092.8	-6854.9		-7216.1	15.46	227.7	-10347.0		4502.6
0.33	903.3	6755.4		1933.5	7.98	2118.0	-7939.2		-6893.0	15.63	210.2	-9975.8		4535.8
0.49	916.3	7066.9		2073.1	8.14	2148.3	-9174.8		-6500.2	15.79	192.7	-9602.0		4566.5
0.65	929.3	7400.4		2214.8	8.30	2173.5	-10149.1		-6168.6	15.95	171.7	-9150.2		4599.6
0.81	944.9	7830.1		2387.4	8.46	2198.7	-11072.4		-5833.1	16.11	-845.9	-8774.1		4524.3
0.98	957.9	8213.1		2533.4	8.63	2229.0	-12112.2		-5425.4	16.28	-863.4	-8404.7		4449.8
1.14	970.9	7946.3		-2715.9	8.79	2254.2	-12921.3		-5081.4	16.44	-880.9	-8041.4		4373.9
1.30	986.5	7456.4		-2535.6	8.95	2279.4	-13677.5		-4733.6	16.60	-901.9	-7613.8		4280.7
1.46	999.5	7073.9		-2383.2	9.12	2309.7	-14514.3		-4311.1	16.77	-919.4	-7264.6		4201.4
1.63	1012.5	6715.0		-2228.8	9.28	2334.9	-15152.1		-3954.7	16.93	-936.8	-6921.9		4120.6
1.79	1028.1	6316.0		-2040.9	9.44	2360.1	-15735.2		-3594.5	17.09	-957.8	-6519.5		4021.6
1.95	1041.1	6010.3		-1882.1	9.60	2385.4	-16262.9		-3230.4	17.25	-975.3	-6191.7		3937.5
2.12	1154.5	5729.8		-1709.7	9.77	2415.6	-16822.2		-2788.4	17.42	-992.8	-5870.9		3851.8
2.28	1184.7	5429.3		-1494.1	9.93	2440.8	-17226.1		-2415.8	17.58	-1013.8	-5495.3		3747.0
2.44	1210.0	5209.6		-1310.2	10.09	2466.1	-17572.7		-2039.3	17.74	-1031.3	-5190.2		3657.9
2.60	1235.2	5018.7		-1122.4	10.25	2496.3	-17912.2		-1582.5	17.90	-1048.8	-4892.5		3567.4
2.77	1260.4	4856.9		-930.8	10.42	2521.6	-18130.8		-1197.5	18.07	-1069.8	-4545.2		3456.7
2.93	1290.7	4702.4		-695.7	10.58	2546.8	-18290.3		-808.7	18.23	-1087.3	-4264.1		3362.8
3.09	1315.9	4607.2		-495.5	10.74	2577.1	-18402.8		-337.0	18.39	-1104.8	-3990.9		3267.4
3.26	1341.1	4543.1		-291.5	10.91	2602.3	-18429.8		60.4	18.56	-1122.2	-3725.5		3170.5
3.42	1371.4	4508.3		-41.6	11.07	2627.5	-18411.7		461.6	18.72	-1143.2	-3417.6		3052.2
3.58	1396.6	4515.1		170.9	11.23	2657.8	-18346.2		948.1	18.88	-1160.7	-3170.0		2951.9
3.74	1421.8	4555.5		387.3	11.39	2683.0	-18254.8		1357.8	19.04	-1178.2	-2930.7		2850.1
3.91	1452.1	4649.4		652.1	11.56	2708.2	-18129.6		1771.4	19.21	-1199.2	-2654.7		2725.9
4.07	1477.3	4766.0		877.0	11.72	2733.4	-17970.3		2188.9	19.37	-1216.7	-2434.1		2620.8
4.23	1502.5	4918.3		1105.8	11.88	2763.7	-17733.7		2694.9	19.53	-1234.2	-2222.2		2514.1
4.39	1532.8	5148.9		1385.4	12.05	619.4	-17498.2		3054.2	19.70	-1255.2	-1979.5		2384.1
4.56	1558.0	5381.7		1622.7	12.21	601.9	-17244.1		3147.6	19.86	-1272.7	-1787.2		2274.1
4.72	1583.3	5652.0		1863.8	12.37	581.0	-16929.1		3256.1	20.02	-1290.1	-1603.9		2162.6
4.88	1608.5	5960.5		2108.8	12.53	563.5	-16658.6		3343.6	20.18	-1311.1	-1396.2		2026.7
5.05	1638.7	6382.0		2407.9	12.70	546.0	-16381.0		3428.3	20.35	-1328.6	-1233.3		1911.9
5.21	1664.0	6776.6		2661.5	12.86	525.0	-16038.7		3526.5	20.51	-1346.1	-1080.0		1795.5
5.37	1689.2	7211.4		2918.8	13.02	507.5	-15746.3		3605.4	20.67	-1363.6	-936.3		1677.6
5.53	1719.5	7786.9		3232.8	13.18	490.0	-15447.4		3681.5	20.83	-1384.6	-776.7		1534.1
5.70	1744.7	8312.0		3498.7	13.35	469.0	-15080.7		3769.4	21.00	-1402.1	-654.6		1412.8
5.86	1769.9	8879.2		3768.4	13.51	451.5	-14768.5		3839.7	21.16	-1419.6	-542.5		1290.0
6.02	1800.2	9157.1		-10681.6	13.67	434.0	-14450.7		3907.3	21.32	-1440.6	-421.4		1140.7
6.19	1825.4	7539.8		-10403.3	13.84	416.6	-14127.3		3972.2	21.49	-1458.1	-331.7		1014.6
6.35	1850.6	5965.4		-10121.2	14.00	395.6	-13732.5		4046.6	21.65	-1475.5	-252.5		886.9
6.51	1880.9	4133.4		-9777.6	14.16	378.1	-13397.9		4105.6	21.81	-1496.5	-171.4		731.8
6.67	1906.1	2655.2		-9486.9	14.32	360.6	-13058.6		4162.0	21.97	-1514.0	-115.6		600.8
6.84	1931.3	1221.7		-9192.4	14.49	339.6	-12645.4		4226.0	22.14	-1531.5	-70.5		468.3
7.00	1956.6	-166.5		-8894.1	14.65	322.1	-12296.4		4276.5	22.30	-1552.5	-30.9		307.3
7.16	1986.8	-1771.7		-8530.9	14.81	304.6	-11943.3		4324.2	22.46	-1570.0	-10.1		171.4
7.32	2012.0	-3058.2		-8224.1	14.97	283.6	-11514.5		4378.0	22.63	-1587.5	-0.6		34.1
7.49	2037.3	-4297.5		-7913.3	15.14	266.1	-11153.3		4419.9	22.79	-1601.5	0.0		0.0

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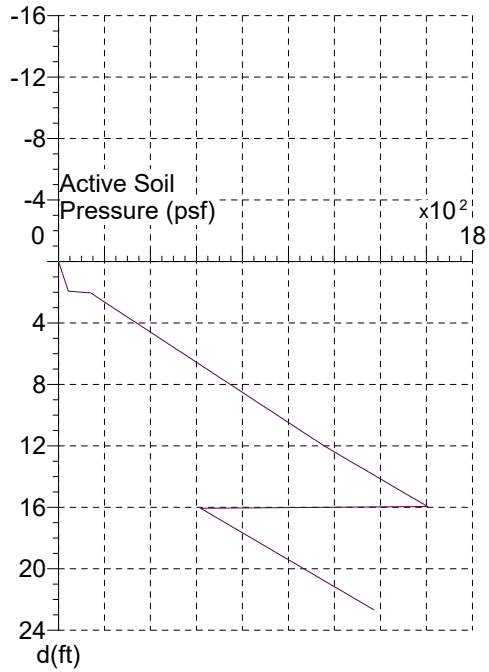
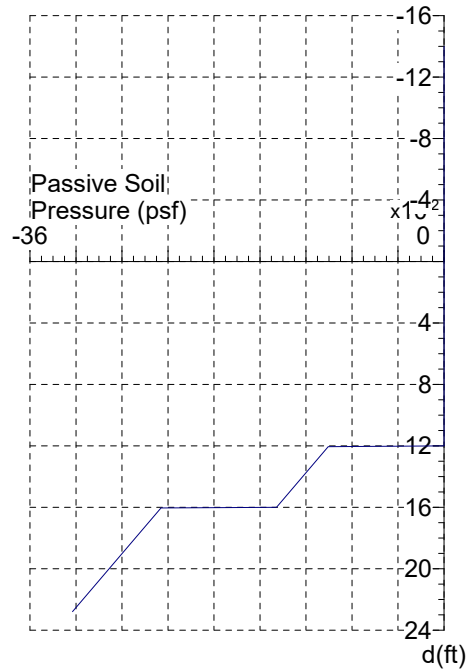
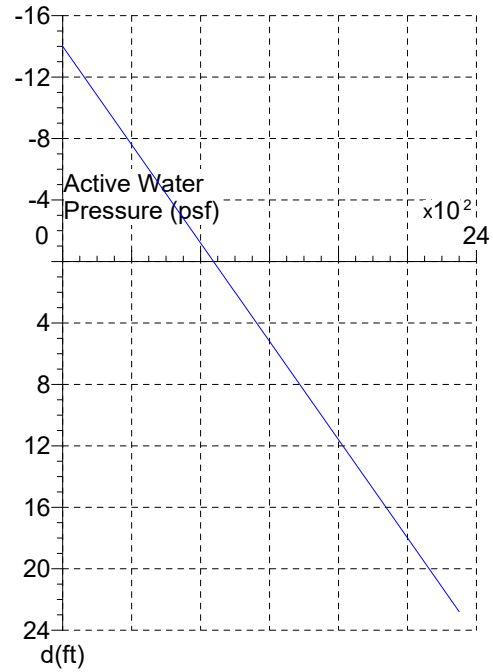
Title: Brazos River Flood Gate - East Side
Designer: Stage 4
Ref: 1.0
Page: 5
Date: 8.30.18

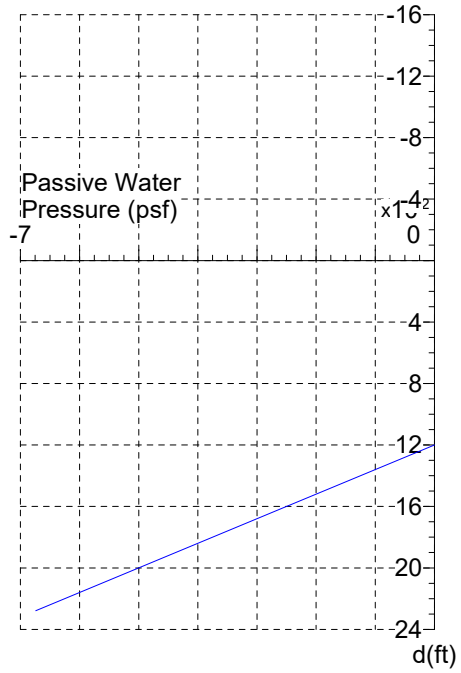
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

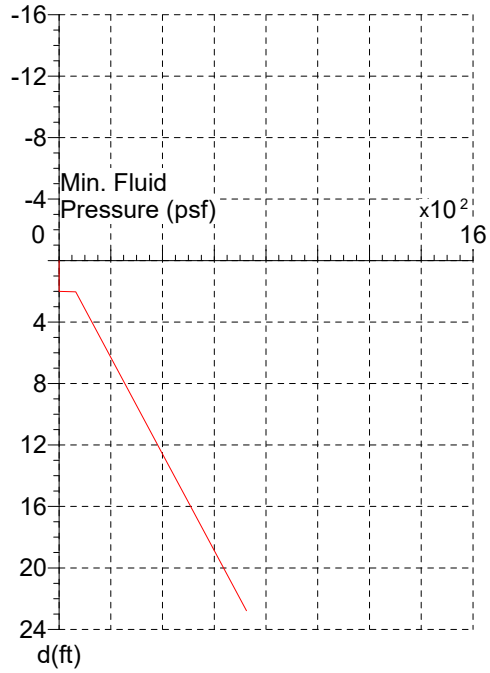
Stage 4 - Braces only

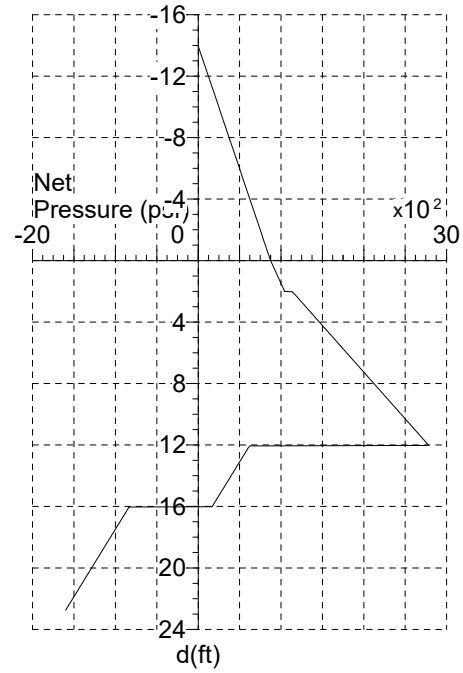












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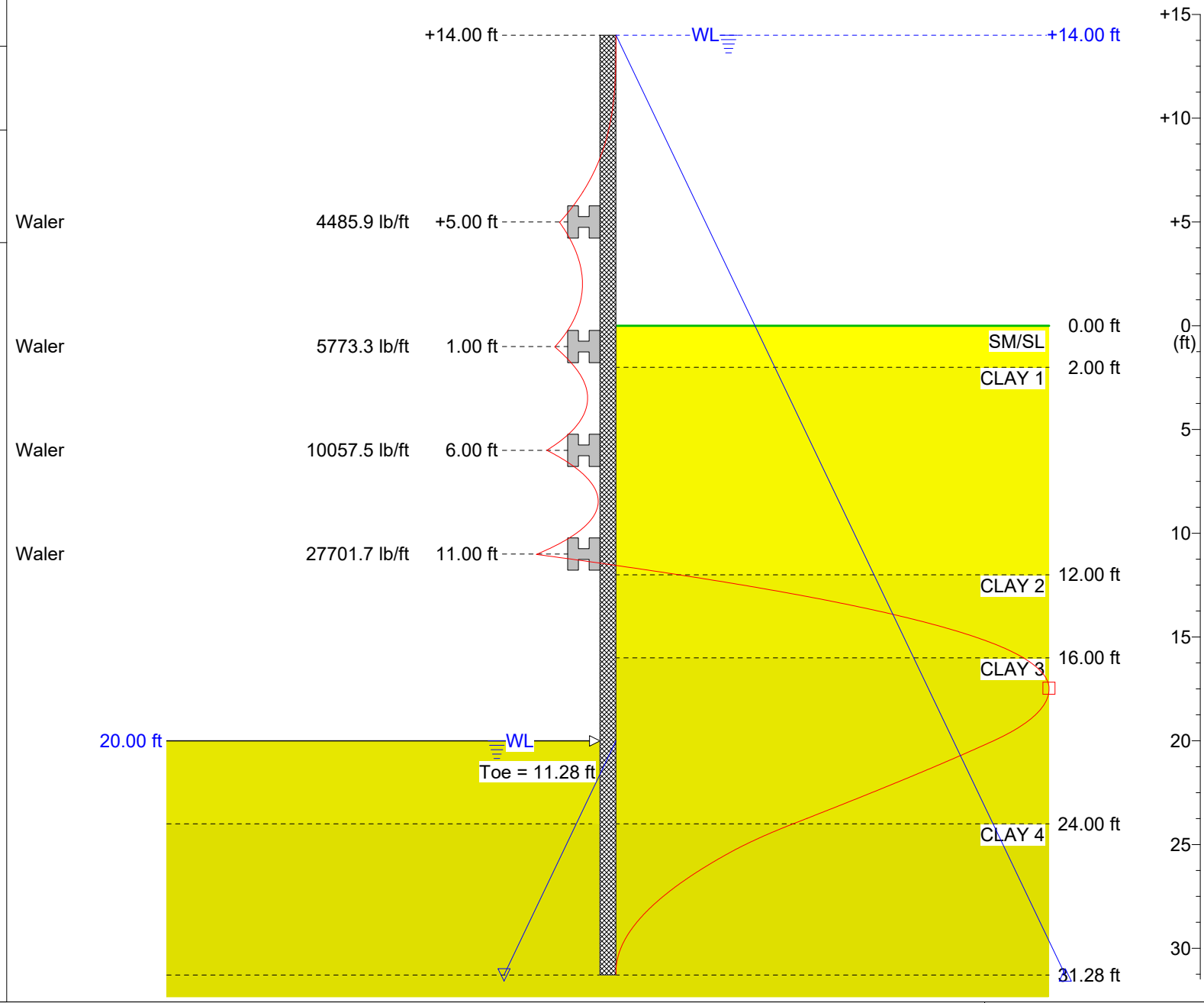
Title: Brazos River Flood Gate - East Side
Designer: Stage 5
Ref: 1.3
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	58733.2 ftlb/ft	17.47
△	2830.2 psf	31.28
△	705.2 psf	31.28

Stage 5 - Tip and Moment only



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Title: Brazos River Flood Gate - East Side
Designer: Stage 5
Ref: 1.3
Page: 2
Date: 8.30.18

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Toe: Free Earth Support

Stage 5 - Tip and Moment only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 20.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	11.28	45.28

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4485.9
1.00	Waler	5773.3
6.00	Waler	10057.5
11.00	Waler	27701.7

Maxima

	Maximum	Depth (ft)
Pressure	3716.7 psf	16.00
Bending Moment	58733.2 ftlb/ft	17.47
Shear Force	20905.3 lb/ft	11.00

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Title: Brazos River Flood Gate - East Side
Designer: Stage 5
Ref: 1.3
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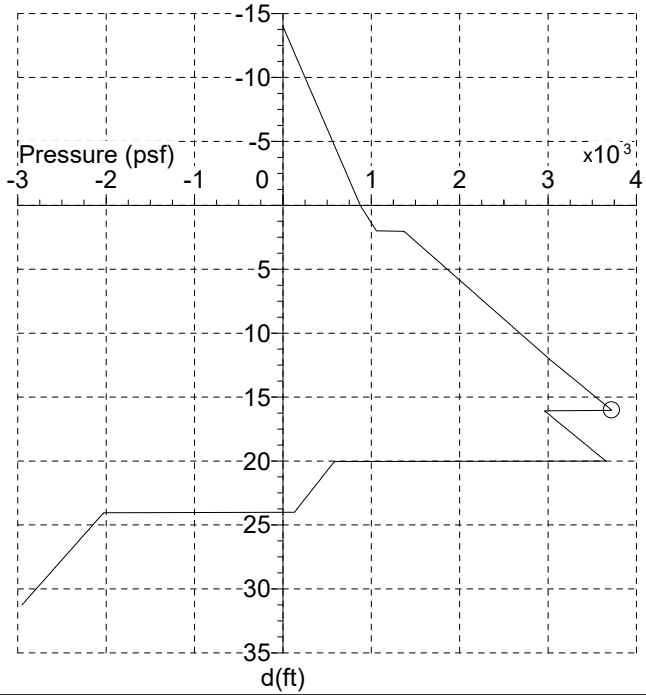
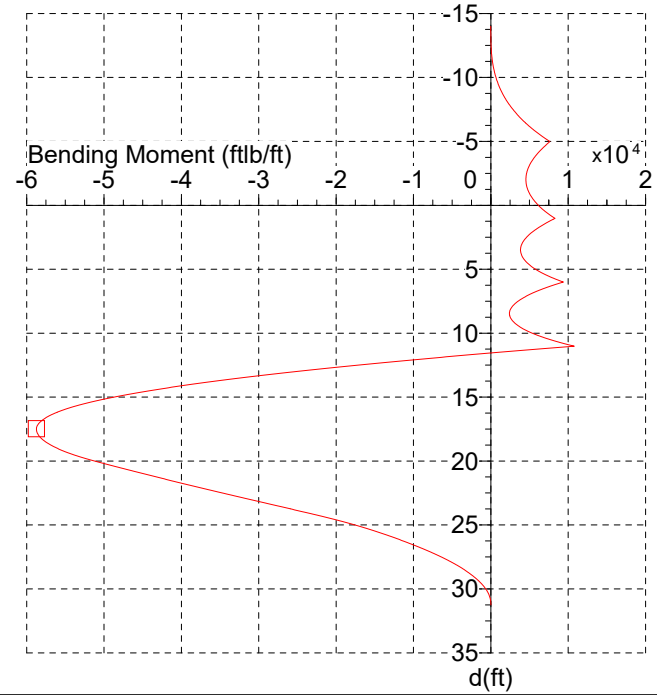
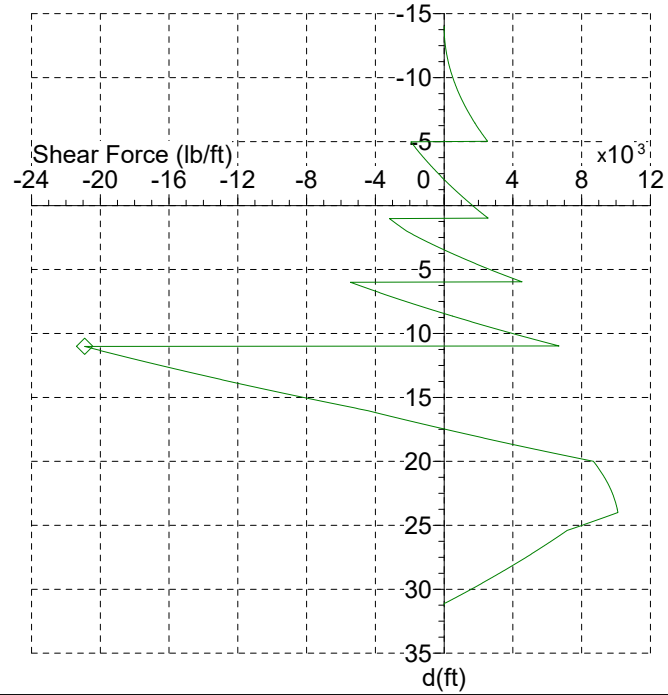
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 3716.7 psf	16.00
□ 58733.2 ftlb/ft	17.47
◇ 20905.3 lb/ft	11.00

Stage 5 - Tip and Moment only







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Title: Brazos River Flood Gate - East Side
Designer: Stage 5
Ref: 1.3
Page: 4
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	875.0	6151.4		1655.7	10.50	2768.6	7826.0		5416.9	21.00	470.2	-44709.3		9220.3
0.22	895.7	6545.1		1856.5	10.73	2805.9	9112.0		6048.7	21.23	444.4	-43216.3		9323.4
0.45	916.4	6984.8		2062.1	10.95	2843.1	10541.7		6688.9	21.45	418.6	-41707.1		9420.6
0.67	937.1	7471.4		2272.3	11.17	2880.4	6862.5		-20364.1	21.67	392.8	-40182.5		9512.0
0.89	957.8	8006.1		2487.2	11.40	2911.4	3032.3		-19817.2	21.90	367.0	-38643.7		9597.5
1.12	978.5	7929.5		-3066.5	11.62	2948.6	-1426.1		-19153.1	22.12	341.2	-37091.4		9677.2
1.34	999.2	7238.6		-2842.2	11.84	2985.9	-5732.1		-18480.5	22.35	315.4	-35526.7		9751.0
1.56	1020.0	6600.3		-2613.3	12.07	3017.4	-9883.9		-17799.7	22.57	289.5	-33950.5		9819.0
1.79	1040.7	6015.7		-2379.6	12.29	3064.0	-13879.5		-17109.8	22.79	268.0	-32628.9		9871.2
2.01	1371.9	5485.8		-2129.5	12.51	3104.0	-17716.8		-16410.8	23.02	242.2	-31034.1		9928.5
2.23	1409.2	5021.4		-1814.2	12.74	3143.9	-21393.8		-15702.7	23.24	216.4	-29430.4		9979.9
2.46	1446.4	4631.1		-1490.2	12.96	3183.9	-24908.4		-14985.6	23.46	190.6	-27818.8		10025.5
2.68	1483.7	4316.8		-1157.8	13.18	3223.8	-28258.5		-14259.4	23.69	164.8	-26200.3		10065.2
2.90	1514.7	4114.5		-874.3	13.41	3263.8	-31442.1		-13524.2	23.91	139.0	-24575.7		10099.1
3.13	1551.9	3944.9		-526.5	13.63	3303.8	-34457.0		-12780.0	24.13	-2042.7	-22959.2		9802.1
3.35	1589.2	3856.9		-170.2	13.85	3343.7	-37301.4		-12026.7	24.36	-2071.6	-21410.6		9335.8
3.58	1626.4	3851.3		194.6	14.08	3383.7	-39972.9		-11264.3	24.58	-2100.6	-19937.6		8862.9
3.80	1663.7	3930.4		567.7	14.30	3417.0	-42065.8		-10622.1	24.80	-2129.6	-18541.3		8383.4
4.02	1700.9	4094.8		949.3	14.52	3457.0	-44415.4		-9843.1	25.03	-2158.6	-17222.7		7897.4
4.25	1738.2	4346.4		1339.4	14.75	3496.9	-46586.4		-9055.2	25.25	-2187.6	-15982.9		7404.9
4.47	1775.4	4687.1		1737.8	14.97	3536.9	-48576.7		-8258.1	25.47	-2216.6	-14819.4		7034.9
4.69	1812.7	5118.8		2144.7	15.19	3576.8	-50384.4		-7452.0	25.70	-2240.7	-13885.5		6830.6
4.92	1849.9	5643.4		2560.1	15.42	3616.8	-52007.2		-6636.9	25.92	-2269.7	-12801.3		6582.5
5.14	1887.1	6262.9		2983.8	15.64	3656.8	-53443.3		-5812.7	26.14	-2298.7	-11757.2		6331.2
5.36	1924.4	6979.1		3416.0	15.87	3696.7	-54690.4		-4979.5	26.37	-2327.6	-10753.9		6076.7
5.59	1961.6	7794.0		3856.7	16.09	2960.7	-55747.7		-4195.8	26.59	-2356.6	-9791.8		5819.0
5.81	1992.7	8549.7		4230.3	16.31	3007.4	-56640.8		-3518.6	26.81	-2385.6	-8871.4		5558.1
6.03	2029.9	9169.0		-5371.1	16.54	3047.3	-57378.5		-2832.4	27.04	-2414.6	-7993.3		5294.1
6.26	2067.2	7996.5		-4906.6	16.76	3087.3	-57958.8		-2137.2	27.26	-2443.6	-7158.0		5026.8
6.48	2104.4	6930.1		-4433.6	16.98	3127.2	-58379.6		-1432.9	27.48	-2472.6	-6365.9		4756.4
6.70	2141.7	5971.5		-3952.2	17.21	3160.5	-58607.0		-839.1	27.71	-2501.5	-5617.7		4482.8
6.93	2178.9	5122.7		-3462.4	17.43	3200.5	-58730.1		-118.2	27.93	-2530.5	-4913.7		4206.0
7.15	2216.1	4385.6		-2964.2	17.65	3240.5	-58700.2		611.7	28.15	-2559.5	-4254.6		3926.0
7.37	2253.4	3762.1		-2457.5	17.88	3280.4	-58552.1		1350.7	28.38	-2588.5	-3640.8		3642.9
7.60	2290.6	3254.2		-1942.3	18.10	3320.4	-58284.3		2098.7	28.60	-2612.6	-3164.4		3404.5
7.82	2327.9	2863.6		-1418.8	18.32	3360.4	-57895.3		2855.8	28.83	-2641.6	-2635.0		3115.5
8.04	2365.1	2592.4		-886.8	18.55	3400.3	-57383.7		3621.9	29.05	-2670.6	-2152.5		2823.3
8.27	2402.4	2442.5		-346.4	18.77	3440.3	-56748.1		4397.1	29.27	-2699.6	-1717.3		2527.9
8.49	2439.6	2414.6		202.5	18.99	3480.2	-55986.9		5181.3	29.50	-2728.6	-1329.8		2229.4
8.71	2470.7	2487.7		666.3	19.22	3520.2	-55098.6		5974.5	29.72	-2757.5	-990.8		1927.6
8.94	2507.9	2691.6		1230.6	19.44	3560.2	-54082.0		6776.8	29.94	-2786.5	-700.5		1622.7
9.16	2545.1	3024.2		1803.4	19.66	3600.1	-52935.4		7588.2	30.17	-2815.5	-459.7		1314.6
9.38	2582.4	3487.1		2384.5	19.89	3640.1	-51657.4		8408.6	30.39	-2844.5	-268.6		1003.3
9.61	2619.6	4082.5		2974.2	20.11	573.5	-50500.4		8749.7	30.61	-2873.5	-128.0		688.8
9.83	2656.9	4812.2		3572.2	20.33	547.7	-49081.7		8876.1	30.84	-2902.5	-38.3		371.1
10.06	2694.1	5678.0		4178.7	20.56	521.8	-47643.0		8996.7	31.06	-2931.4	0.0		0.0
10.28	2731.4	6682.0		4793.6	20.78	496.0	-46185.2		9111.4	31.28	-2950.8	0.0		0.0

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Title: Brazos River Flood Gate - East Side
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Ref: 1.3
Page: 5
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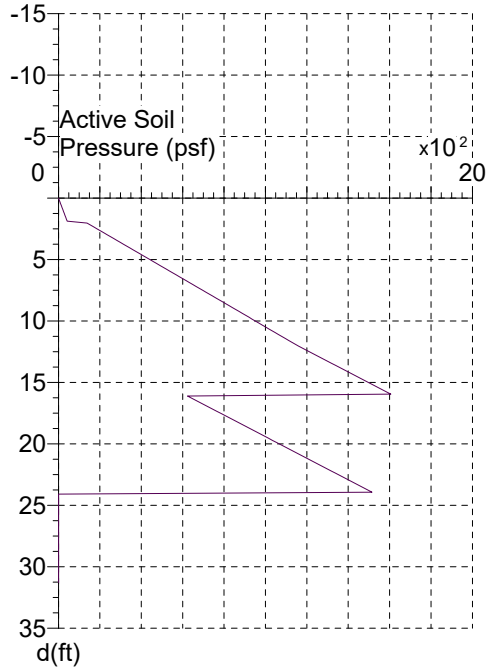
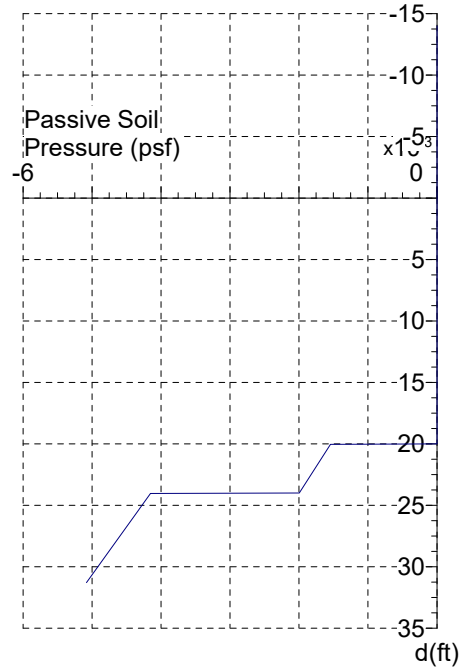
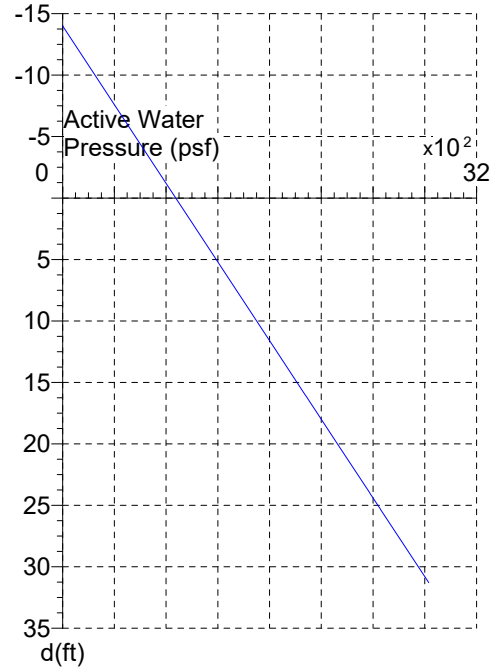
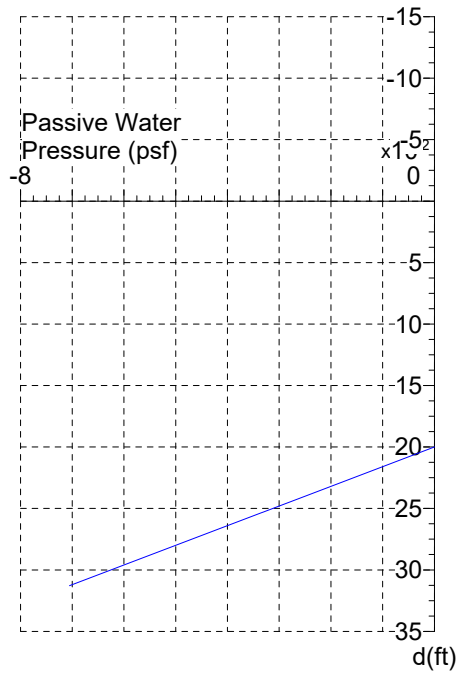
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

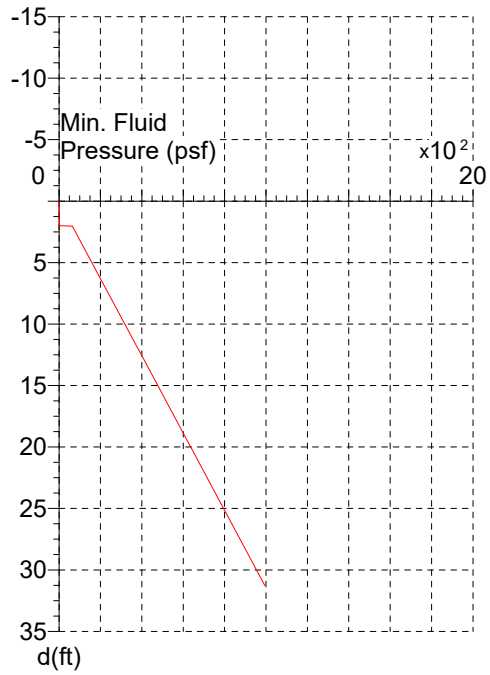
Stage 5 - Tip and Moment only

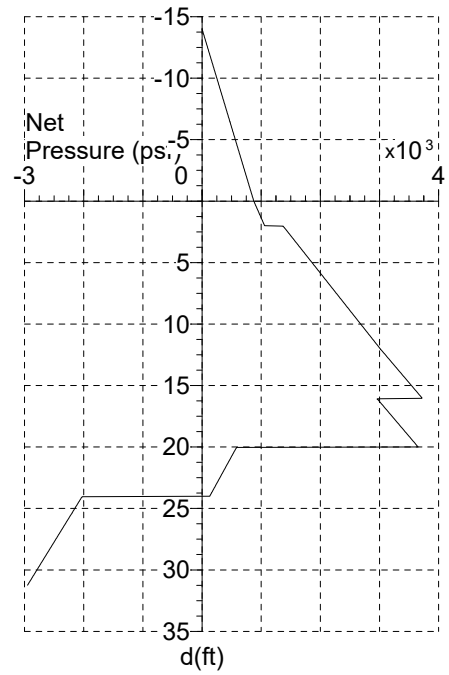












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Title: Brazos River Flood Gate - East Side
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Page: 1
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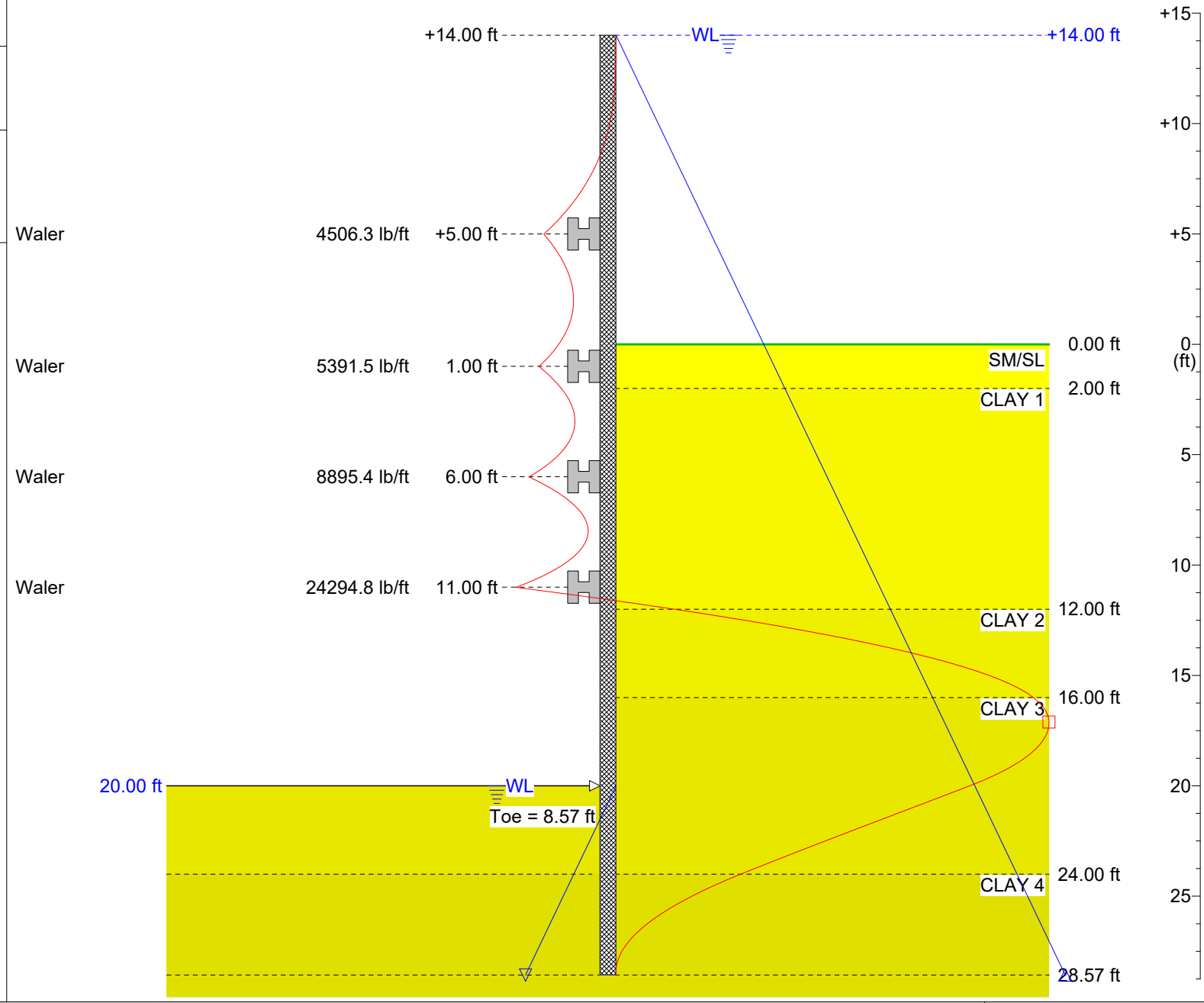
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	45776.3 ftlb/ft	17.11
△	2660.6 psf	28.57
△	535.6 psf	28.57

Stage 5 - Braces only



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Designer: Stage 5
Ref: 1.0
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Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Braces only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 20.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	8.57	42.57

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4506.3
1.00	Waler	5391.5
6.00	Waler	8895.4
11.00	Waler	24294.8

Maxima

	Maximum	Depth (ft)
Pressure	3481.8 psf	15.98
Bending Moment	45776.3 ftlb/ft	17.11
Shear Force	18099.7 lb/ft	11.00

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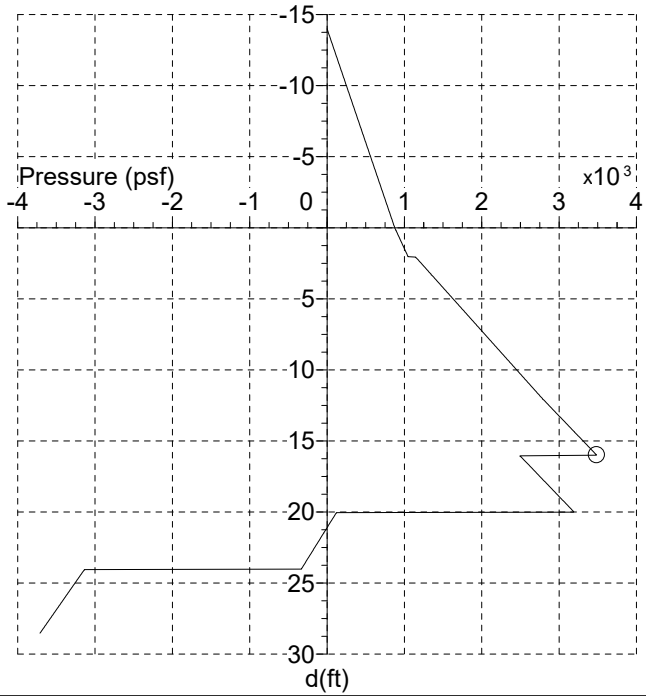
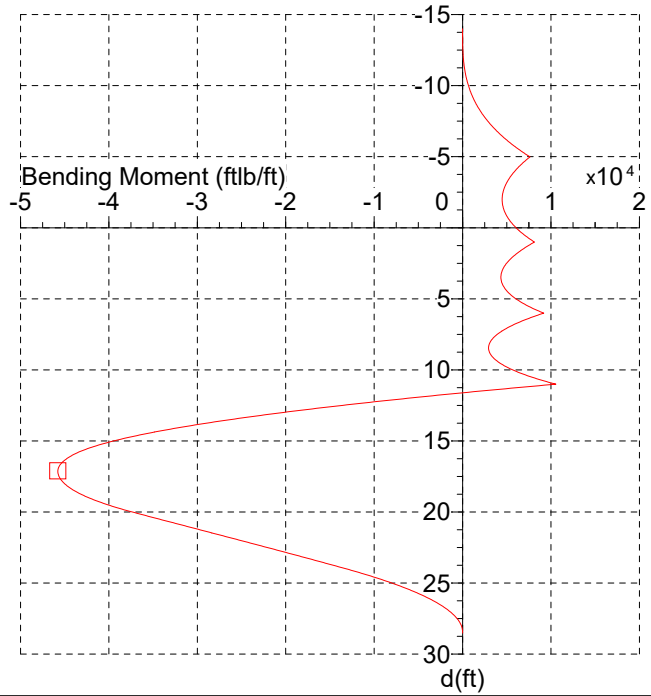
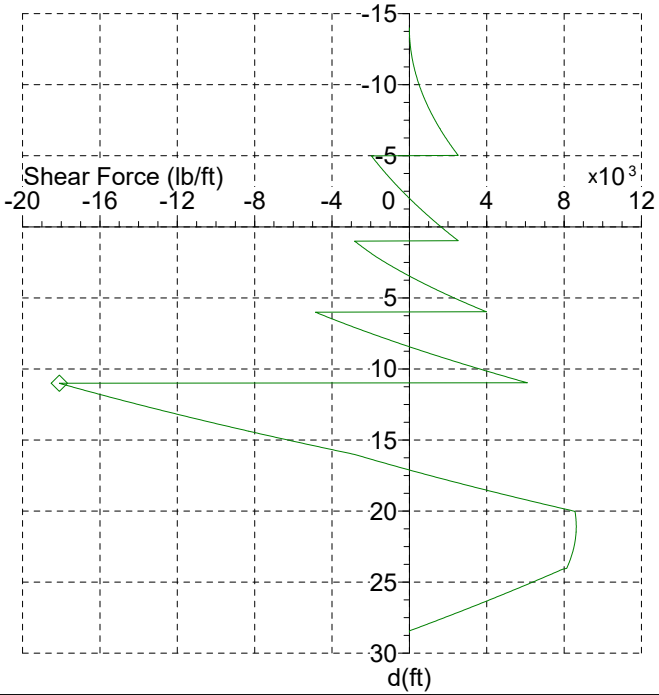
Toe: Free Earth Support

	Maximum	d (ft)
○	3481.8 psf	15.98
□	45776.3 ftlb/ft	17.11
◇	18099.7 lb/ft	11.00

Stage 5 - Braces only







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Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	876.1	6070.3		1645.4	9.59	2389.5	4488.4		2727.8	19.18	3051.5	-41467.3		6013.2
0.20	894.1	6437.2		1834.1	9.80	2418.6	5002.5		3154.7	19.39	3089.0	-40515.8		6667.3
0.41	912.2	6844.7		2026.7	10.00	2453.7	5719.9		3673.9	19.59	3120.3	-39646.9		7218.6
0.61	927.2	7215.7		2190.1	10.20	2488.7	6548.4		4200.5	19.80	3157.9	-38511.9		7887.4
0.82	945.2	7699.5		2389.7	10.41	2523.7	7489.8		4734.5	20.00	3189.2	-37275.2		8564.0
1.02	963.3	8034.8		-2798.3	10.61	2552.9	8361.5		5185.3	20.20	99.4	-35977.2		8587.5
1.22	981.3	7452.2		-2591.1	10.82	2587.9	9513.6		5733.0	20.41	79.2	-34892.9		8603.0
1.43	996.4	7000.9		-2415.4	11.02	2622.9	9919.3		-18006.6	20.61	54.9	-33589.6		8616.8
1.63	1014.4	6501.3		-2201.1	11.22	2657.9	6119.8		-17444.0	20.82	30.6	-32284.4		8625.5
1.84	1032.5	6047.9		-1982.9	11.43	2687.1	3045.8		-16969.4	21.02	6.3	-30978.3		8629.0
2.04	1146.5	5641.8		-1757.6	11.63	2722.1	-530.7		-16393.1	21.22	-13.9	-29889.7		8628.0
2.24	1175.7	5341.9		-1551.4	11.84	2757.1	-3983.4		-15809.4	21.43	-38.2	-28583.8		8622.0
2.45	1210.7	5031.3		-1296.8	12.04	2786.8	-7310.6		-15218.4	21.63	-62.5	-27279.1		8610.8
2.65	1245.7	4776.1		-1034.7	12.24	2824.3	-9986.4		-14719.6	21.84	-86.8	-25976.5		8594.5
2.86	1280.7	4577.9		-765.2	12.45	2861.9	-13079.3		-14113.8	22.04	-107.1	-24893.0		8576.9
3.06	1309.9	4457.3		-535.0	12.65	2899.5	-16042.0		-13500.0	22.24	-131.4	-23596.1		8551.1
3.27	1344.9	4367.6		-251.8	12.86	2937.0	-18872.8		-12878.1	22.45	-155.7	-22303.4		8520.1
3.47	1379.9	4338.4		38.6	13.06	2968.3	-21129.8		-12353.8	22.65	-180.0	-21015.8		8484.0
3.67	1414.9	4373.0		336.6	13.26	3005.9	-23714.3		-11717.4	22.86	-200.2	-19947.1		8449.9
3.88	1444.1	4450.6		590.7	13.47	3043.5	-26162.0		-11072.9	23.06	-224.5	-18670.7		8404.3
4.08	1479.1	4603.9		902.4	13.67	3081.0	-28471.2		-10420.4	23.26	-248.8	-17401.5		8353.5
4.29	1514.1	4824.1		1221.6	13.88	3112.3	-30288.5		-9870.6	23.47	-273.1	-16140.3		8297.5
4.49	1549.1	5113.0		1548.3	14.08	3149.9	-32339.4		-9203.5	23.67	-293.4	-15096.0		8246.9
4.69	1578.3	5407.3		1826.1	14.29	3187.5	-34246.9		-8528.3	23.88	-317.7	-13851.5		8181.4
4.90	1613.3	5826.0		2166.4	14.49	3225.1	-36009.4		-7845.2	24.08	-3138.6	-12619.8		7912.4
5.10	1648.3	6317.9		2514.2	14.69	3256.4	-37366.1		-7269.8	24.28	-3170.5	-11444.5		7553.6
5.31	1683.4	6884.4		2869.4	14.90	3293.9	-38858.3		-6572.0	24.49	-3193.2	-10506.8		7252.3
5.51	1712.5	7414.7		3171.1	15.10	3331.5	-40200.5		-5866.2	24.69	-3220.5	-9431.8		6887.8
5.71	1747.5	8122.2		3539.9	15.31	3369.1	-41391.2		-5152.5	24.90	-3247.7	-8412.1		6520.3
5.92	1782.6	8908.9		3916.2	15.51	3400.4	-42266.3		-4551.5	25.10	-3275.0	-7448.4		6149.6
6.12	1817.6	8507.8		-4595.4	15.71	3437.9	-43174.6		-3823.1	25.31	-3297.8	-6688.2		5838.4
6.33	1846.8	7706.2		-4269.9	15.92	3475.5	-43926.5		-3086.7	25.51	-3325.0	-5828.0		5462.1
6.53	1881.8	6821.9		-3872.5	16.12	2513.0	-44527.8		-2484.6	25.71	-3352.3	-5025.0		5082.7
6.73	1916.8	6024.0		-3467.6	16.33	2544.3	-44938.5		-2035.5	25.92	-3379.6	-4279.6		4700.1
6.94	1951.8	5313.9		-3055.3	16.53	2581.9	-45325.2		-1489.3	26.12	-3402.3	-3702.8		4379.0
7.14	1981.0	4790.5		-2706.0	16.73	2619.4	-45594.3		-935.1	26.33	-3429.6	-3064.3		3990.8
7.35	2016.0	4245.7		-2280.0	16.94	2657.0	-45744.3		-372.9	26.53	-3456.9	-2484.8		3599.5
7.55	2051.0	3793.4		-1846.5	17.14	2688.3	-45776.1		101.8	26.73	-3484.2	-1964.7		3205.1
7.75	2086.0	3435.1		-1405.6	17.35	2725.9	-45724.4		678.6	26.94	-3506.9	-1577.0		2874.1
7.96	2115.2	3209.5		-1032.5	17.55	2763.4	-45584.9		1263.5	27.14	-3534.2	-1167.1		2474.0
8.16	2150.2	3027.7		-577.9	17.75	2801.0	-45356.3		1856.4	27.35	-3561.4	-817.9		2070.9
8.37	2185.2	2944.6		-115.9	17.96	2832.3	-45096.9		2356.5	27.55	-3588.7	-530.0		1664.6
8.57	2220.2	2960.4		353.6	18.16	2869.9	-44701.9		2964.1	27.75	-3611.4	-337.2		1323.7
8.78	2255.2	3077.9		830.5	18.37	2907.5	-44214.5		3579.6	27.96	-3638.7	-162.7		911.7
8.98	2284.4	3253.7		1233.6	18.57	2945.0	-43633.3		4203.1	28.16	-3666.0	-50.8		496.7
9.18	2319.4	3559.7		1724.2	18.77	2976.3	-43076.6		4728.8	28.37	-3693.3	-2.0		78.6
9.39	2354.5	3970.7		2222.3	18.98	3013.9	-42320.5		5367.0	28.57	-3711.5	0.0		0.0

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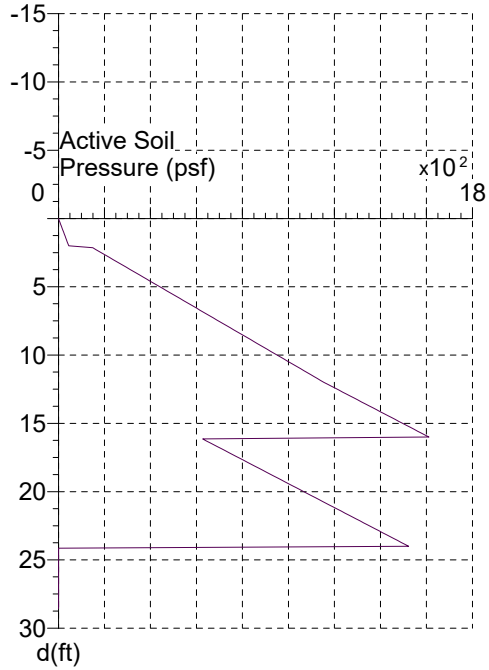
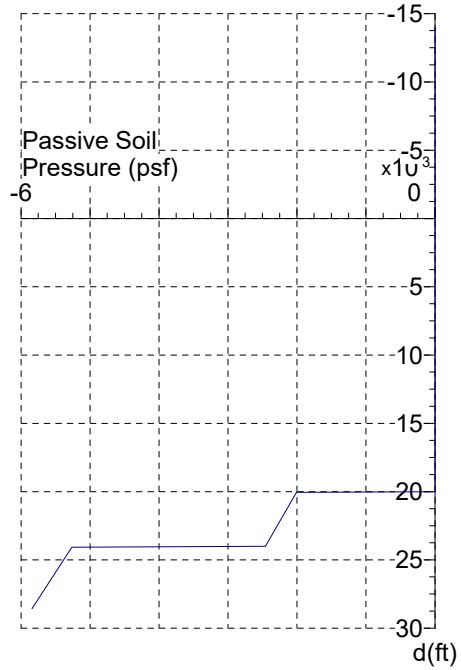
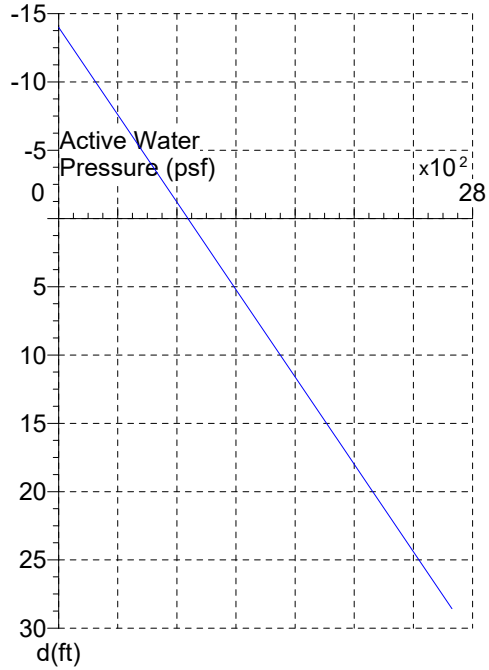
Ref: 1.0
Page: 5
Date: 8.30.18

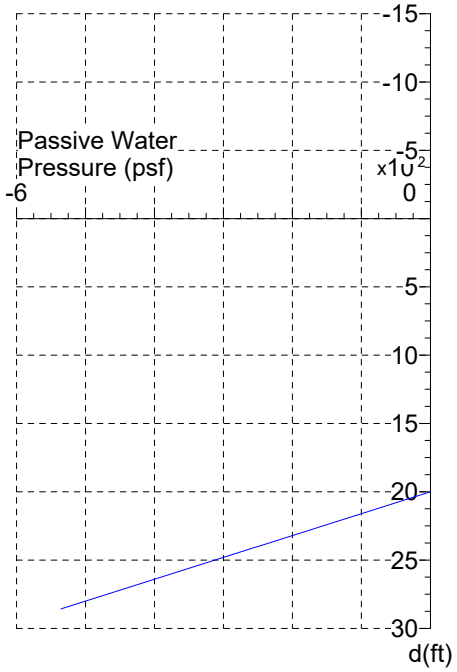
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

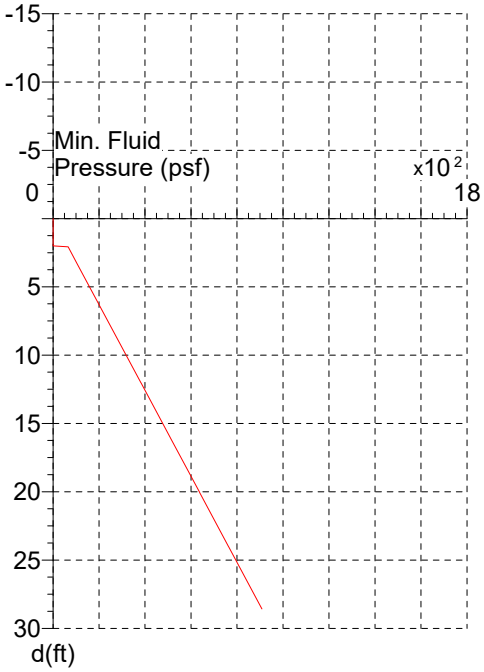
Stage 5 - Braces only

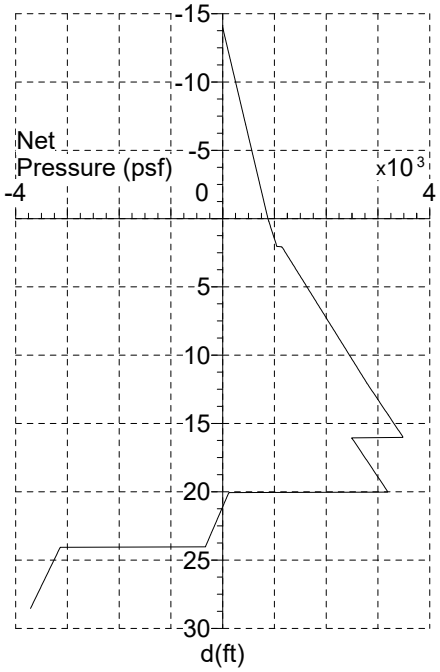












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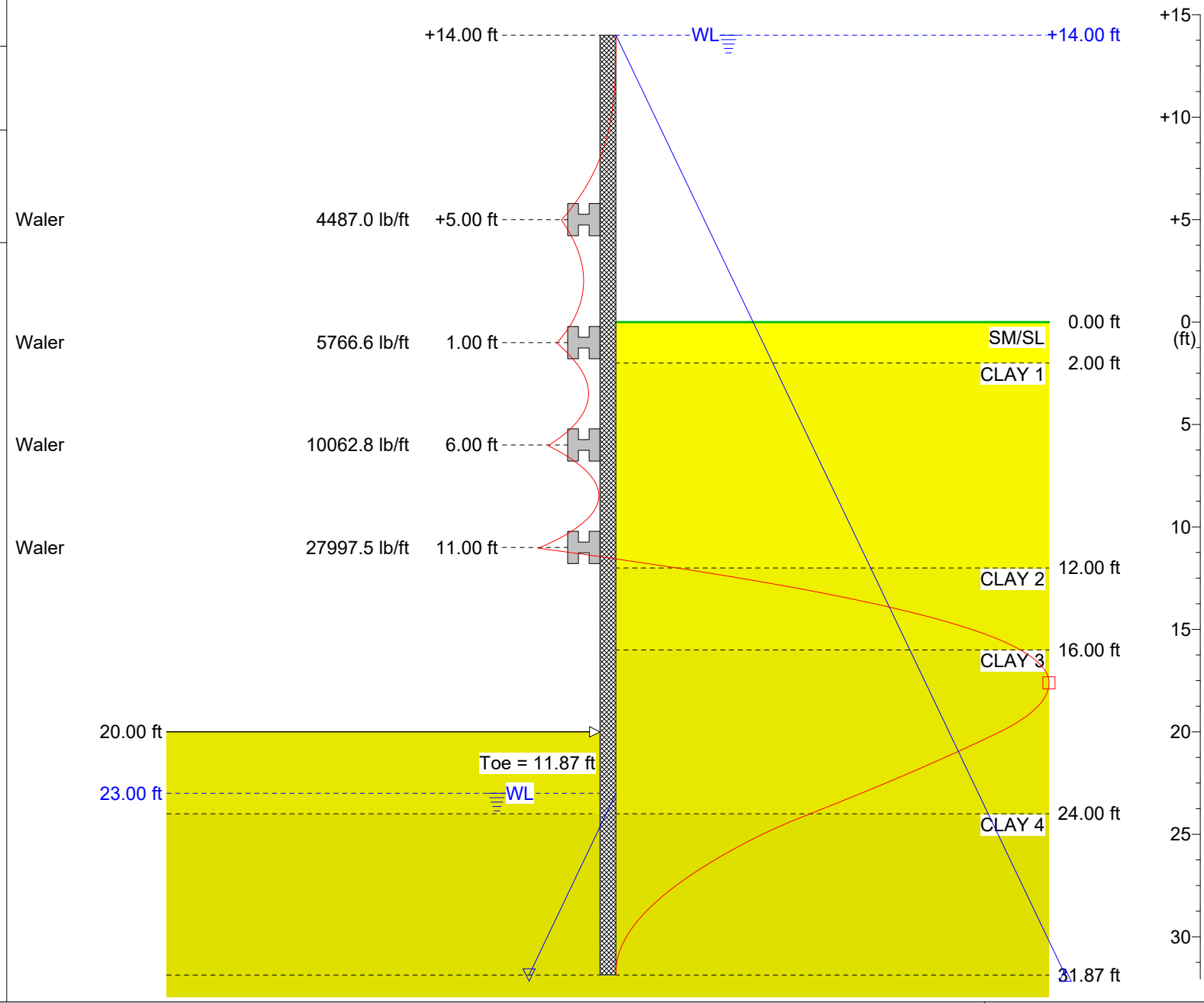
Designer: Stage 6
Ref: 1.3
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	60765.4 ftlb/ft	17.61
△	2866.7 psf	31.87
△	554.2 psf	31.87

Stage 6 - Tip and Moment only



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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 6 - Tip and Moment only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 23.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	11.87	45.87

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4487.0
1.00	Waler	5766.6
6.00	Waler	10062.8
11.00	Waler	27997.5

Maxima

	Maximum	Depth (ft)
Pressure	3710.8 psf	15.97
Bending Moment	60765.4 ftlb/ft	17.61
Shear Force	21157.6 lb/ft	11.00

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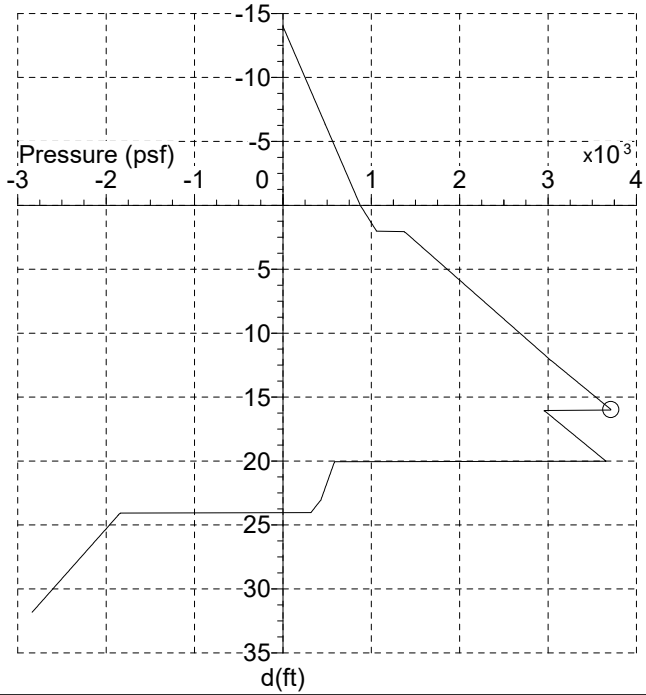
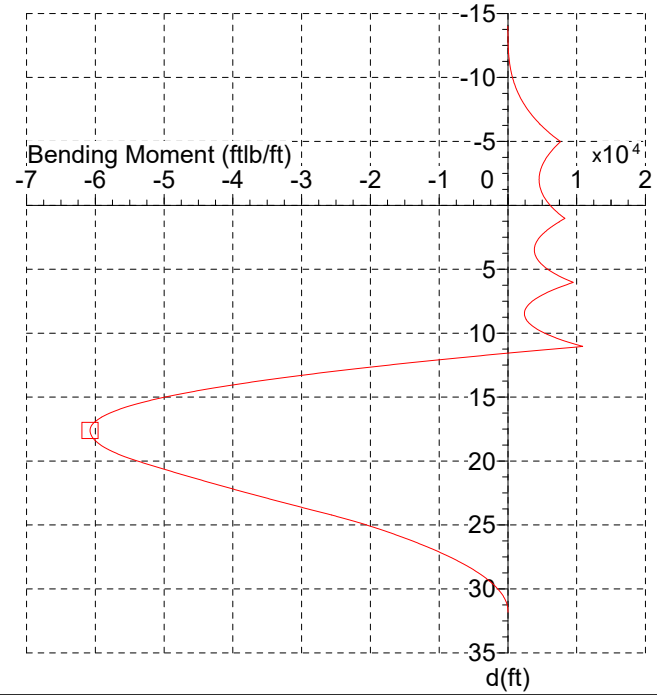
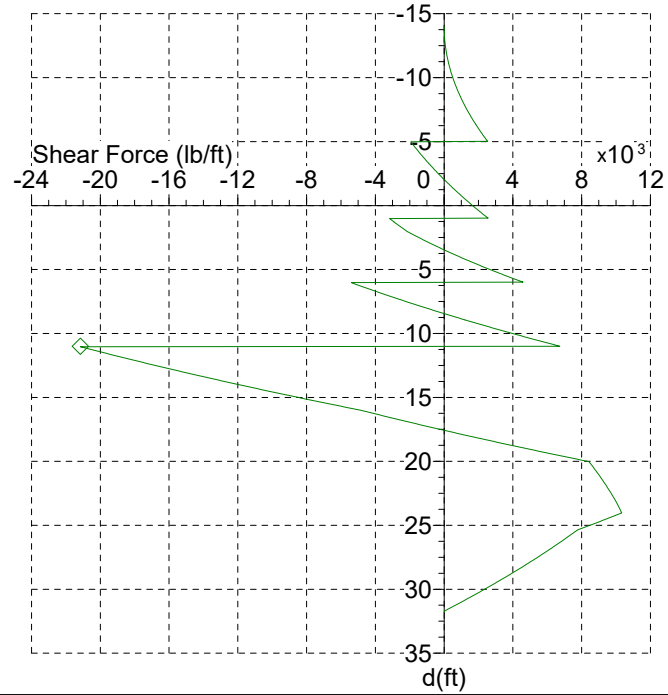
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 3710.8 psf	15.97
□ 60765.4 ftlb/ft	17.61
◇ 21157.6 lb/ft	11.00

Stage 6 - Tip and Moment only







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Stage 6 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	877.5	6191.0		1678.8	10.70	2801.8	8940.3		5974.6	21.40	512.6	-44968.5		9199.1
0.23	898.5	6595.4		1882.9	10.93	2839.5	10372.2		6622.2	21.62	500.8	-43471.9		9315.0
0.46	919.5	7047.1		2091.8	11.15	2877.2	7630.9		-20719.1	21.85	491.0	-42210.4		9409.6
0.68	940.4	7547.1		2305.4	11.38	2914.9	2876.0		-20054.2	22.08	479.2	-40680.1		9520.6
0.91	961.4	8096.7		2523.9	11.61	2946.4	-967.7		-19493.5	22.31	467.4	-39131.9		9629.0
1.14	982.4	7803.9		-3019.4	11.84	2984.1	-5436.0		-18812.8	22.53	455.6	-37566.3		9734.6
1.37	1003.4	7113.2		-2791.3	12.06	3022.6	-9745.1		-18123.6	22.76	443.7	-35983.9		9837.5
1.59	1020.8	6579.2		-2597.5	12.29	3063.1	-13893.1		-17425.2	22.99	431.9	-34385.0		9937.6
1.82	1041.8	5989.0		-2360.6	12.52	3103.6	-17877.7		-16717.3	23.22	408.1	-32770.1		10033.8
2.05	1374.5	5455.3		-2107.1	12.75	3144.1	-21696.7		-16000.1	23.44	381.9	-31140.1		10123.9
2.28	1412.2	4989.1		-1787.0	12.97	3184.6	-25348.0		-15273.7	23.67	355.7	-29495.8		10208.0
2.50	1449.9	4599.3		-1458.1	13.20	3225.0	-28829.5		-14537.9	23.90	329.5	-27838.4		10286.1
2.73	1487.7	4288.0		-1120.5	13.43	3265.5	-32138.9		-13792.9	24.13	-1852.4	-26175.4		10111.3
2.96	1525.4	4057.3		-774.3	13.66	3306.0	-35274.1		-13038.6	24.36	-1881.9	-24567.8		9682.5
3.19	1563.1	3909.2		-419.5	13.88	3346.5	-38233.0		-12275.0	24.58	-1911.3	-23030.0		9247.0
3.41	1600.8	3844.7		-56.2	14.11	3386.9	-41013.4		-11502.1	24.81	-1940.7	-21563.2		8804.8
3.64	1638.6	3867.2		316.0	14.34	3427.4	-43613.1		-10720.0	25.04	-1970.1	-20168.4		8355.8
3.87	1676.3	3975.9		696.8	14.57	3467.9	-46030.0		-9928.5	25.27	-1995.6	-18846.7		7900.2
4.10	1714.0	4172.8		1086.3	14.80	3508.4	-48261.9		-9127.8	25.49	-2028.9	-17593.1		7590.9
4.32	1751.7	4459.8		1484.4	15.02	3548.9	-50306.6		-8317.8	25.72	-2058.4	-16380.5		7354.1
4.55	1789.5	4838.9		1891.2	15.25	3589.3	-52162.1		-7498.5	25.95	-2087.8	-15206.4		7113.8
4.78	1827.2	5312.2		2306.7	15.48	3629.8	-53826.1		-6669.9	26.18	-2117.2	-14071.5		6870.2
5.01	1864.9	5881.5		2730.7	15.71	3670.3	-55296.4		-5832.1	26.40	-2146.6	-12976.2		6623.1
5.24	1902.6	6549.0		3163.5	15.93	3710.8	-56571.0		-4984.9	26.63	-2176.0	-11921.2		6372.6
5.46	1940.4	7316.5		3604.9	16.16	2981.9	-57659.1		-4276.0	26.86	-2200.5	-11073.1		6161.3
5.69	1978.1	8186.1		4054.9	16.39	3022.4	-58587.1		-3586.8	27.09	-2230.0	-10093.2		5904.6
5.92	2015.8	9159.7		4513.6	16.62	3062.9	-59353.8		-2888.2	27.31	-2259.4	-9155.1		5644.5
6.15	2053.5	8673.4		-5081.9	16.84	3096.6	-59868.1		-2299.0	27.54	-2288.8	-8259.3		5380.9
6.37	2091.3	7504.6		-4605.9	17.07	3137.1	-60333.6		-1583.4	27.77	-2318.2	-7406.4		5114.0
6.60	2122.7	6618.2		-4202.6	17.30	3177.6	-60631.8		-858.5	28.00	-2347.6	-6596.9		4843.7
6.83	2160.4	5661.4		-3710.7	17.53	3218.1	-60760.6		-124.4	28.23	-2377.0	-5831.4		4569.9
7.06	2198.2	4823.2		-3210.2	17.75	3258.5	-60732.1		619.0	28.45	-2406.4	-5110.5		4292.8
7.28	2235.9	4105.6		-2701.1	17.98	3299.0	-60581.3		1371.8	28.68	-2435.9	-4434.6		4012.2
7.51	2273.6	3510.8		-2183.3	18.21	3339.5	-60308.0		2133.8	28.91	-2465.3	-3804.3		3728.3
7.74	2311.3	3040.6		-1656.8	18.44	3380.0	-59910.8		2905.0	29.14	-2494.7	-3220.3		3440.9
7.97	2349.1	2697.4		-1121.7	18.66	3420.5	-59388.2		3685.6	29.36	-2524.1	-2683.0		3150.1
8.19	2386.8	2483.0		-577.9	18.89	3460.9	-58738.5		4475.4	29.59	-2553.5	-2192.9		2856.0
8.42	2424.5	2398.6		-25.5	19.12	3501.4	-57960.5		5274.6	29.82	-2582.9	-1750.7		2558.4
8.65	2462.2	2446.2		535.6	19.35	3541.9	-57052.4		6083.0	30.05	-2612.4	-1356.9		2257.4
8.88	2500.0	2623.3		1105.3	19.58	3582.4	-56012.9		6900.7	30.27	-2641.8	-1012.1		1953.0
9.10	2537.7	2931.9		1683.7	19.80	3622.8	-54840.5		7727.6	30.50	-2671.2	-716.7		1645.2
9.33	2575.4	3373.9		2270.7	20.03	583.5	-53533.5		8446.2	30.73	-2700.6	-471.4		1334.0
9.56	2613.1	3951.5		2866.4	20.26	571.7	-52157.6		8578.5	30.96	-2730.0	-276.6		1019.4
9.79	2650.9	4666.4		3470.7	20.49	559.9	-50760.5		8708.0	31.18	-2759.4	-133.0		701.4
10.02	2688.6	5520.8		4083.7	20.71	548.1	-49342.6		8834.8	31.41	-2788.8	-41.1		380.0
10.24	2726.3	6516.6		4705.4	20.94	536.3	-47904.3		8959.0	31.64	-2818.3	-1.5		55.2
10.47	2764.0	7655.7		5335.6	21.17	524.4	-46446.2		9080.4	31.87	-2837.9	0.0		0.0

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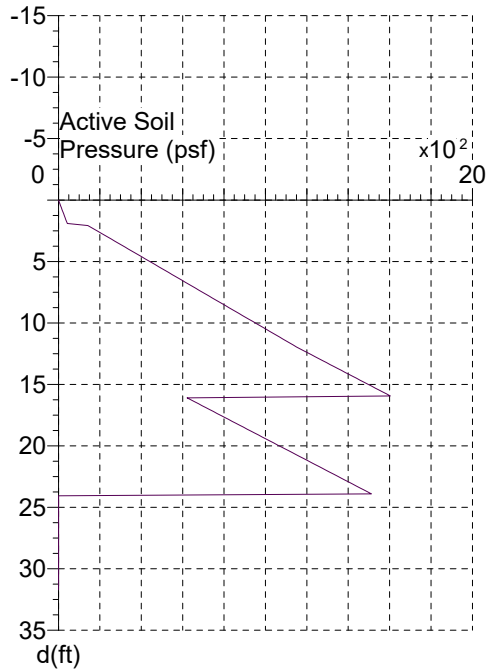
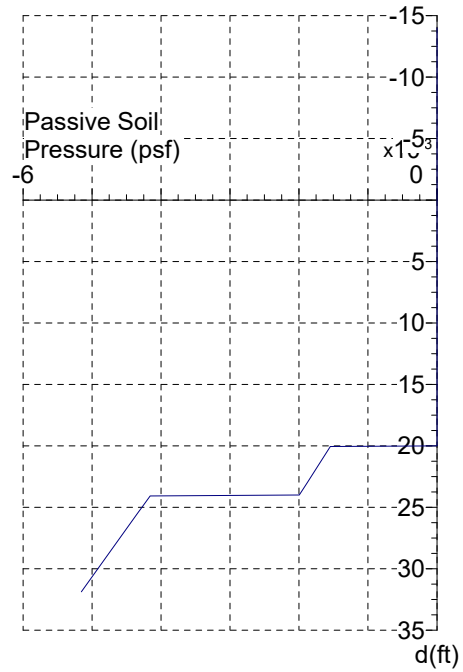
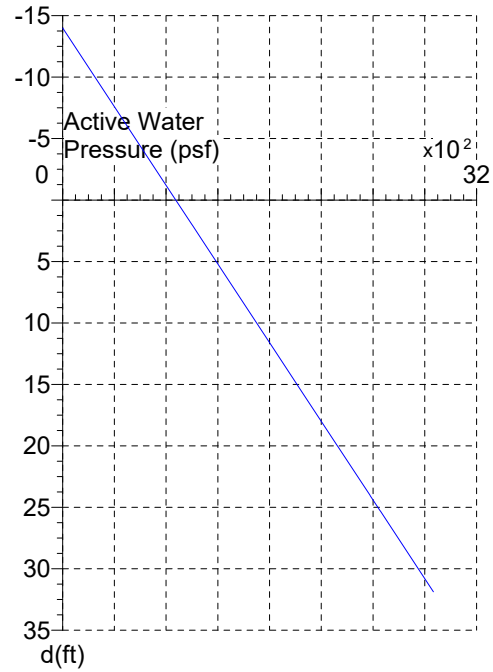
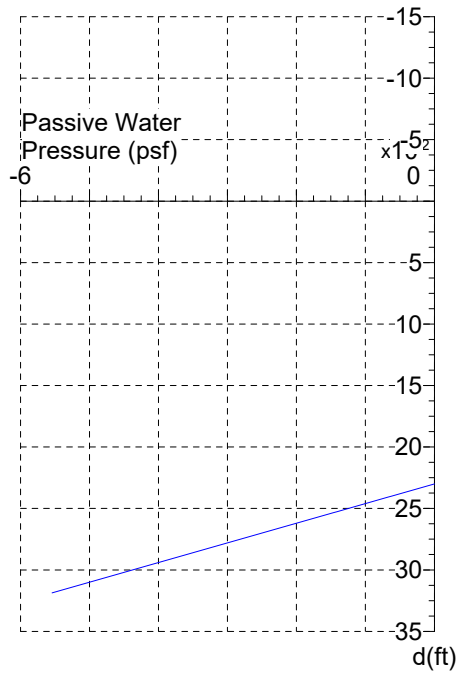
Toe: Free Earth Support

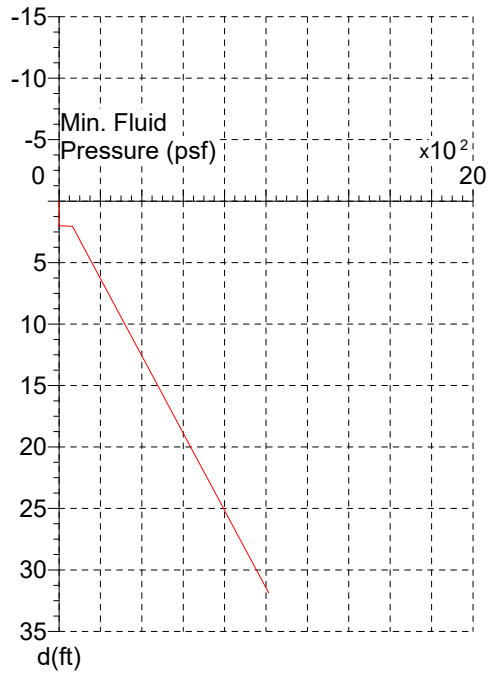
Stage 6 - Tip and Moment only

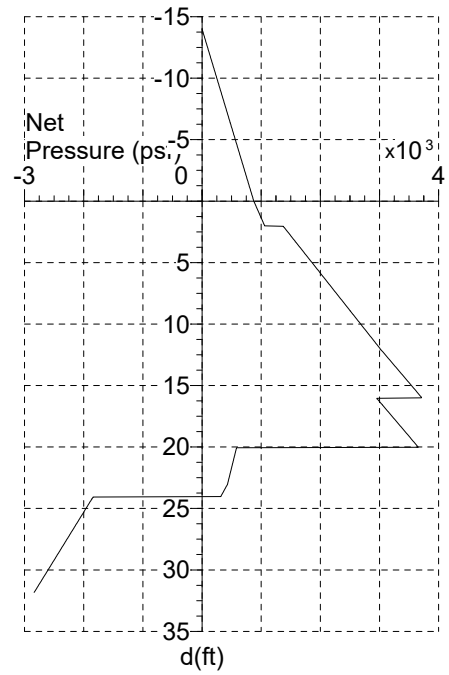












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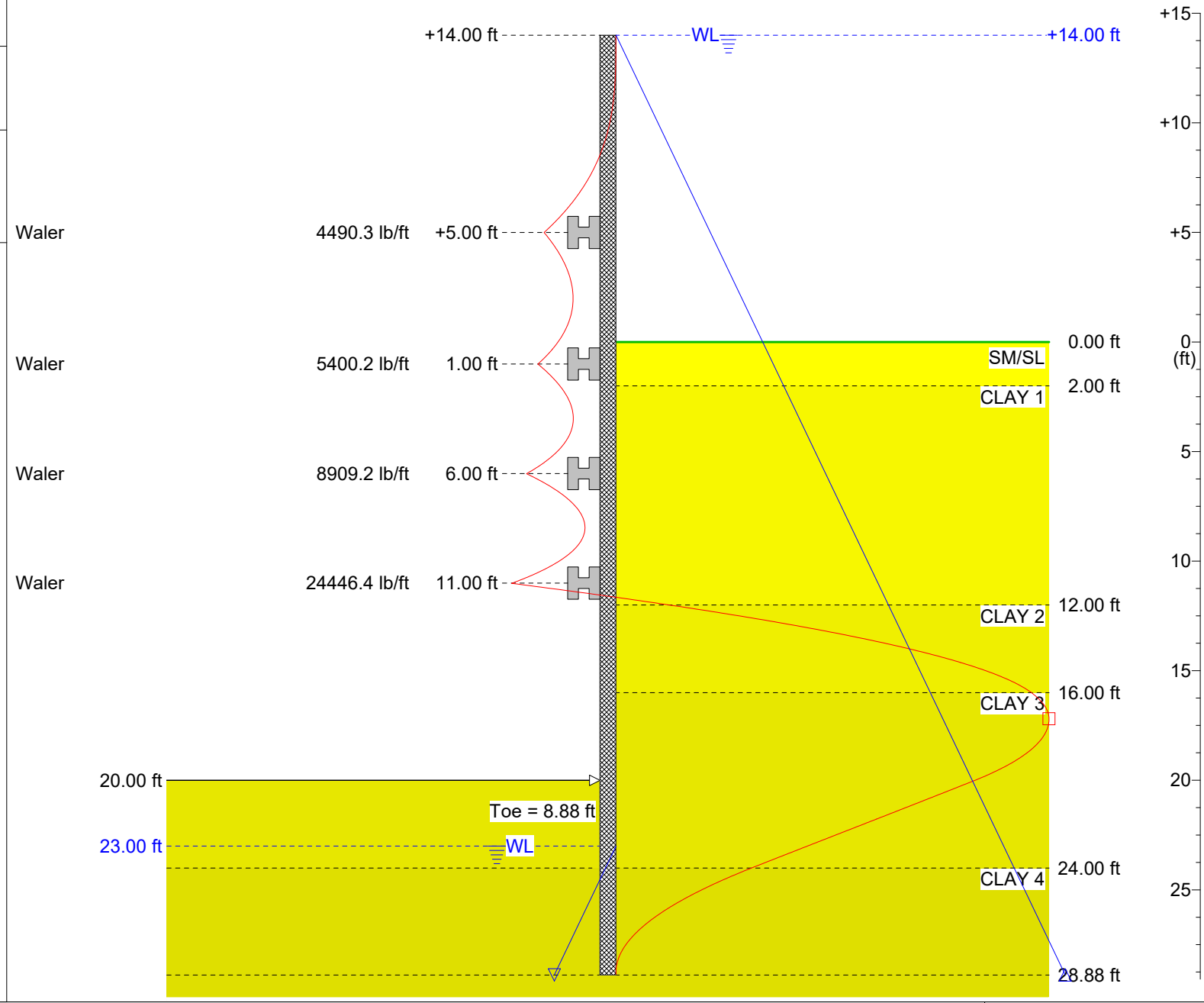
	Maximum	d (ft)
□	45880.3 ftlb/ft	17.20
△	2680.2 psf	28.88
△	367.7 psf	28.88

Stage 6 - Braces only



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Stage 6 - Braces only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 23.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	8.88	42.88

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4490.3
1.00	Waler	5400.2
6.00	Waler	8909.2
11.00	Waler	24446.4

Maxima

	Maximum	Depth (ft)
Pressure	3482.1 psf	15.98
Bending Moment	45880.3 ftlb/ft	17.20
Shear Force	18281.6 lb/ft	11.00

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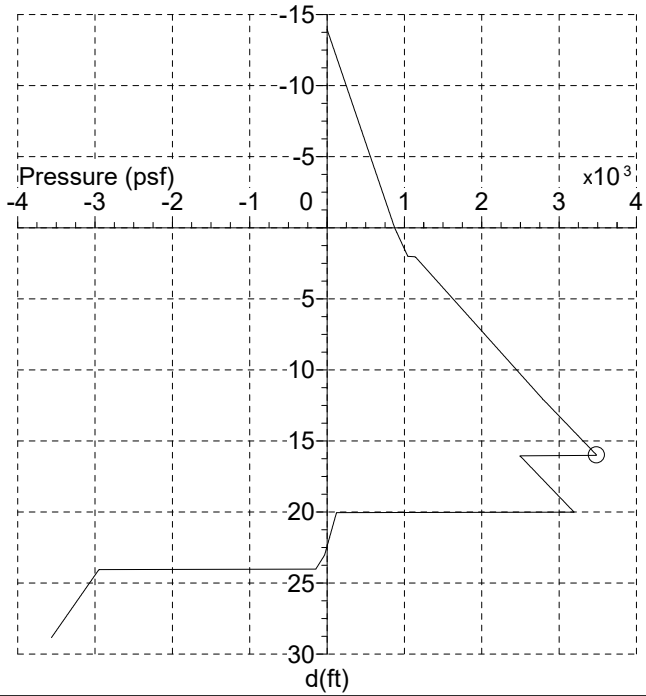
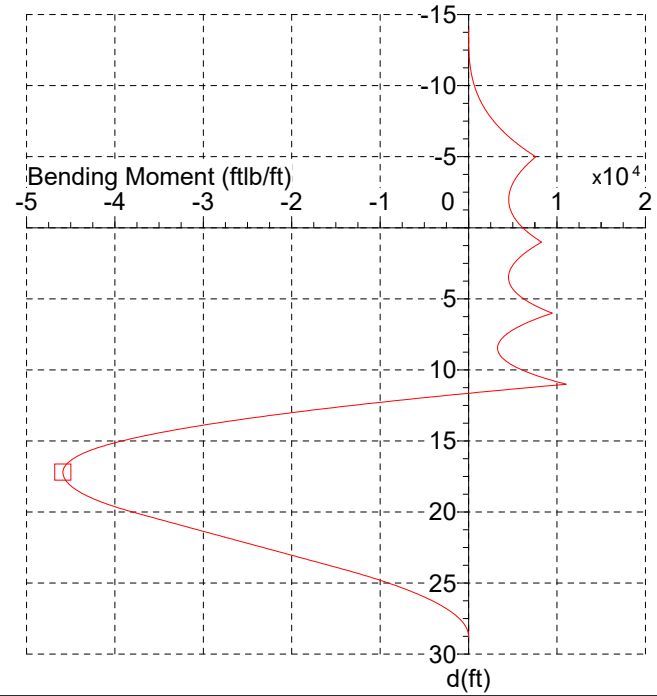
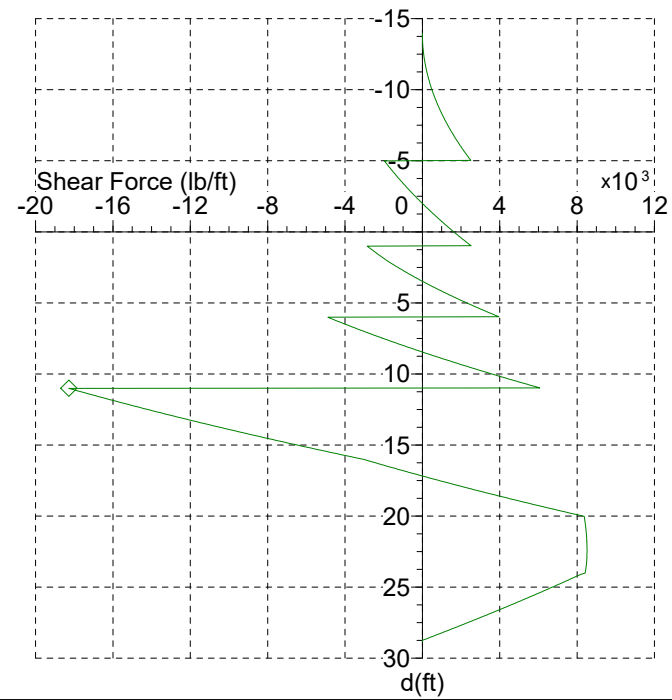
Maximum	d (ft)
○ 3482.1 psf	15.98
□ 45880.3 ftlb/ft	17.20
◇ 18281.6 lb/ft	11.00

Stage 6 - Braces only







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Pressure: Coulomb
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Toe: Free Earth Support

Stage 6 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	874.2	6149.7		1631.4	9.70	2405.2	5117.5		2930.5	19.39	3087.7	-41043.5		6457.7
0.21	892.4	6525.8		1821.2	9.90	2434.6	5688.5		3363.4	19.60	3125.6	-40035.1		7124.5
0.41	910.6	6943.9		2014.8	10.11	2469.9	6479.4		3889.9	19.81	3157.1	-39118.3		7686.4
0.62	928.8	7405.0		2212.3	10.32	2505.2	7387.2		4423.9	20.01	3195.0	-37925.0		8368.0
0.83	943.9	7822.6		2379.9	10.52	2540.5	8413.7		4965.4	20.22	112.3	-36670.6		8393.1
1.03	962.1	8167.2		-2815.6	10.73	2569.9	9360.8		5422.5	20.42	101.2	-35412.5		8415.8
1.24	980.3	7590.6		-2607.1	10.93	2605.2	10609.0		5977.9	20.63	90.2	-34151.2		8436.2
1.44	998.5	7058.4		-2394.6	11.14	2640.5	8464.9		-17905.5	20.84	81.0	-33097.9		8451.3
1.65	1013.6	6649.5		-2214.6	11.35	2675.7	4695.8		-17334.9	21.04	70.0	-31831.5		8467.3
1.86	1031.8	6200.8		-1995.0	11.55	2711.0	1049.0		-16756.8	21.25	59.0	-30562.9		8480.9
2.06	1141.0	5799.1		-1765.0	11.76	2740.4	-1895.2		-16269.2	21.46	47.9	-29292.4		8492.2
2.27	1182.1	5448.1		-1514.6	11.97	2775.7	-5313.4		-15677.2	21.66	38.7	-28232.5		8499.8
2.48	1217.4	5150.7		-1256.8	12.17	2813.3	-8604.6		-15077.6	21.87	27.7	-26959.5		8506.7
2.68	1246.8	4944.9		-1036.1	12.38	2851.2	-11767.2		-14469.6	22.07	16.7	-25685.5		8511.2
2.89	1282.1	4749.7		-764.3	12.58	2882.7	-14303.1		-13956.8	22.28	5.6	-24411.1		8513.4
3.09	1317.4	4612.7		-485.0	12.79	2920.6	-17225.2		-13334.0	22.49	-5.4	-23136.4		8513.3
3.30	1352.7	4535.4		-198.2	13.00	2958.4	-20013.8		-12703.0	22.69	-14.6	-22074.4		8511.3
3.51	1382.1	4517.6		46.7	13.20	2996.3	-22667.0		-12064.0	22.90	-25.6	-20800.3		8506.8
3.71	1417.3	4555.5		347.4	13.41	3034.1	-25183.2		-11416.8	23.11	-43.4	-19527.1		8499.5
3.92	1452.6	4660.5		655.7	13.62	3065.7	-27174.1		-10871.3	23.31	-67.8	-18255.2		8487.2
4.13	1487.9	4834.3		971.6	13.82	3103.5	-29434.5		-10209.2	23.52	-88.3	-17197.0		8472.9
4.33	1523.2	5078.6		1295.1	14.03	3141.4	-31553.0		-9539.0	23.73	-112.7	-15929.7		8450.9
4.54	1552.6	5337.2		1570.4	14.24	3179.3	-33527.8		-8860.7	23.93	-137.2	-14666.1		8423.6
4.75	1587.9	5715.1		1907.7	14.44	3210.8	-35062.4		-8289.3	24.14	-2963.8	-13420.7		8088.0
4.95	1623.2	6168.1		2252.6	14.65	3248.7	-36769.3		-7596.1	24.34	-2986.7	-12425.9		7799.7
5.16	1658.4	6698.0		2605.0	14.85	3286.5	-38327.5		-6894.8	24.55	-3014.2	-11279.9		7450.9
5.36	1687.8	7199.6		2904.5	15.06	3324.4	-39735.5		-6185.4	24.76	-3041.7	-10186.3		7098.8
5.57	1723.1	7874.8		3270.8	15.27	3355.9	-40792.7		-5588.0	24.96	-3069.2	-9145.5		6743.6
5.78	1758.4	8631.7		3644.7	15.47	3393.8	-41920.5		-4863.8	25.17	-3096.7	-8158.2		6385.2
5.98	1793.7	9465.9		-4883.1	15.68	3431.6	-42893.1		-4131.3	25.38	-3119.6	-7376.6		6084.1
6.19	1823.1	8626.1		-4559.5	15.89	3469.5	-43708.8		-3390.8	25.58	-3147.1	-6488.3		5719.8
6.40	1858.4	7694.3		-4164.2	16.09	2507.3	-44369.6		-2749.9	25.79	-3174.6	-5654.9		5352.4
6.60	1893.7	6846.9		-3761.3	16.30	2538.8	-44826.4		-2298.5	25.99	-3202.0	-4876.6		4981.7
6.81	1928.9	6085.7		-3350.8	16.50	2576.7	-45268.1		-1749.4	26.20	-3224.9	-4270.5		4670.4
7.01	1964.2	5412.1		-2932.8	16.71	2614.5	-45591.9		-1192.2	26.41	-3252.4	-3594.8		4293.9
7.22	1993.6	4918.9		-2578.7	16.92	2652.4	-45796.1		-626.9	26.61	-3279.9	-2975.5		3914.2
7.43	2028.9	4410.3		-2146.9	17.12	2683.9	-45873.7		-149.6	26.82	-3307.4	-2413.3		3531.3
7.63	2064.2	3993.8		-1707.4	17.33	2721.8	-45861.6		430.6	27.03	-3334.9	-1908.7		3145.2
7.84	2099.5	3671.2		-1260.4	17.54	2759.6	-45760.5		1019.0	27.23	-3357.8	-1532.4		2821.0
8.05	2128.9	3475.2		-882.1	17.74	2797.5	-45570.8		1615.4	27.44	-3385.3	-1134.5		2429.1
8.25	2164.2	3328.8		-421.3	17.95	2835.3	-45291.3		2219.9	27.64	-3412.8	-795.4		2033.9
8.46	2199.4	3280.7		47.2	18.15	2866.9	-44989.0		2729.9	27.85	-3440.2	-515.7		1635.6
8.66	2234.7	3334.7		523.2	18.36	2904.7	-44541.7		3349.4	28.06	-3463.1	-328.3		1301.2
8.87	2270.0	3494.6		1006.7	18.57	2942.6	-44001.2		3976.9	28.26	-3490.6	-158.6		897.1
9.08	2299.4	3709.8		1415.5	18.77	2980.4	-43366.2		4612.6	28.47	-3518.1	-49.7		489.7
9.28	2334.7	4068.0		1912.9	18.98	3012.0	-42764.0		5148.5	28.68	-3545.6	-2.0		79.1
9.49	2370.0	4536.7		2417.9	19.19	3049.8	-41952.7		5799.1	28.88	-3563.9	0.0		0.0

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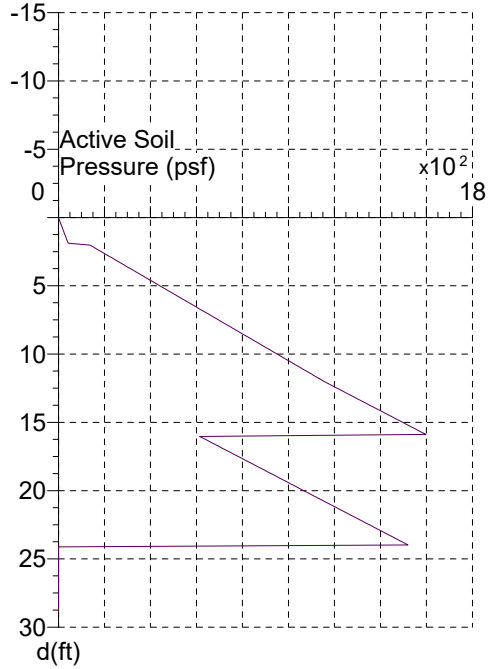
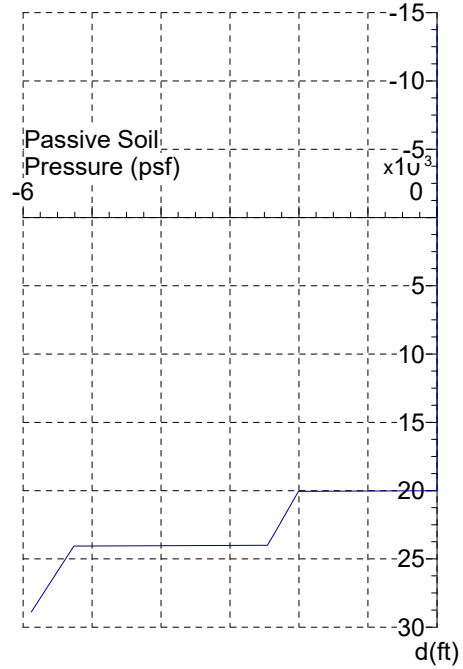
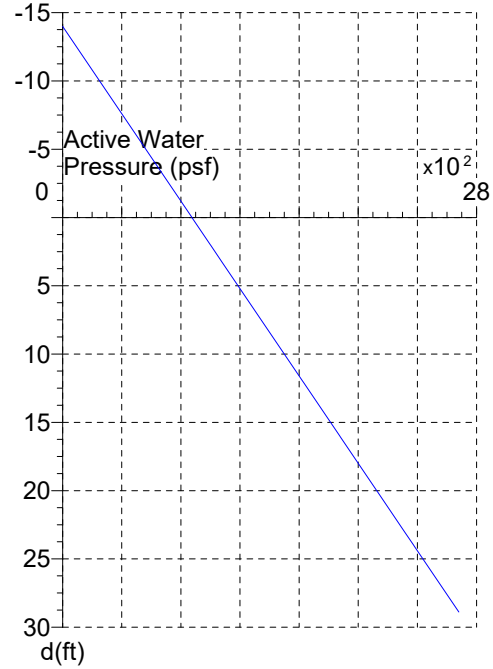
Title: Brazos River Flood Gate - East Side
Designer: Stage 6
Ref: 1.0
Page: 5
Date: 8.30.18

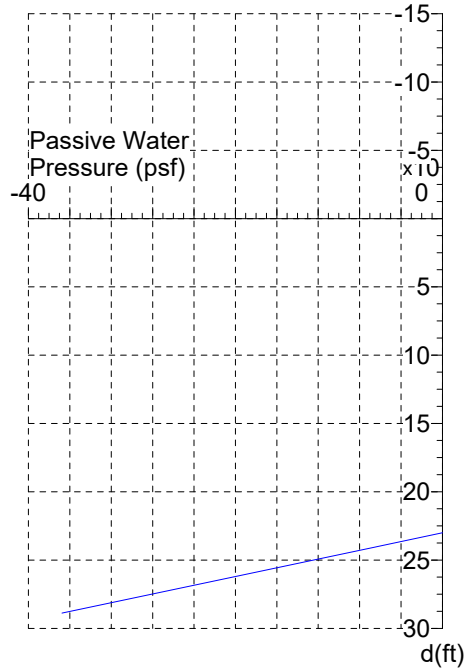
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

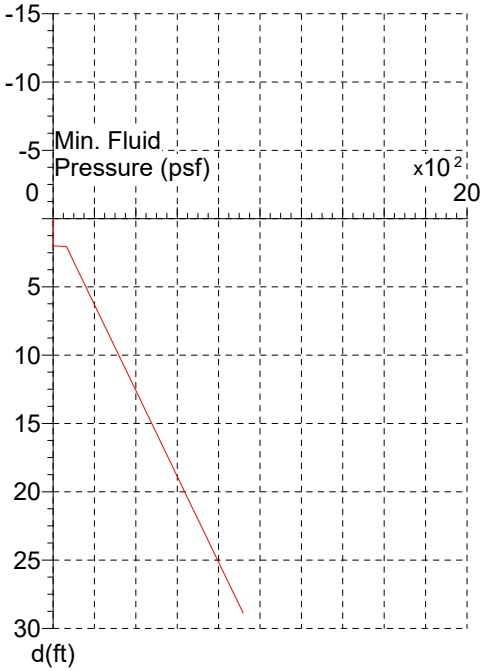
Stage 6 - Braces only

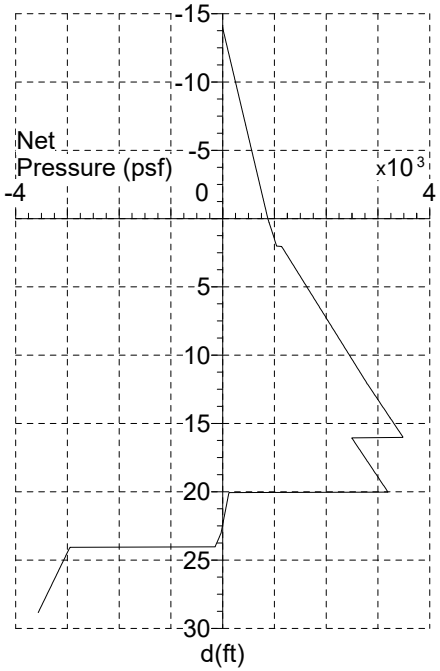












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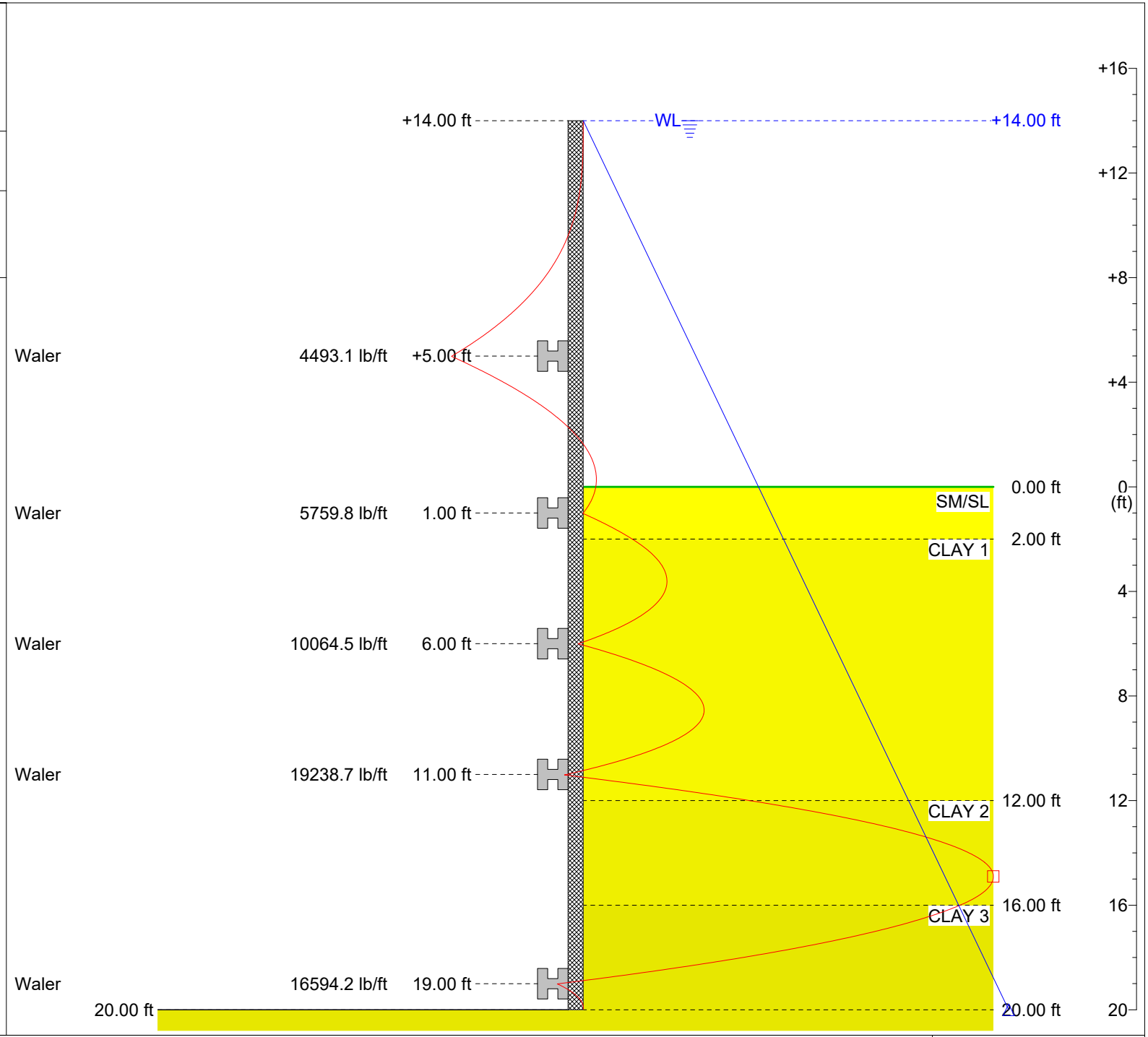
Title: Brazos River Flood Gate - East Side
Designer: Stage 7
Ref: 1.3
Page: 1
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Maximum	d (ft)
23733.6 ftlb/ft	14.90
2125.0 psf	20.00

Stage 7 - Tip and Moment only



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Title: Brazos River Flood Gate - East Side
Designer: Stage 7
Ref: 1.3
Page: 2
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Tip and Moment only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 23.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	φ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33 (0.43)	0.00 (0.00)	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	φ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00 (2.31)	0.00 (0.00)
2.00	CLAY 1	102.00	39.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0 (384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0 (1846.1)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0 (1538.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	0.00	34.00

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution (Hinge Method used for Shear Force, Bending Moment and Deflection)

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4493.1
1.00	Waler	5759.8
6.00	Waler	10064.5
11.00	Waler	19238.7
19.00	Waler	16594.2

Maxima

	Maximum	Depth (ft)
Pressure	3712.4 psf	15.98
Bending Moment	23733.6 ftlb/ft	14.90
Shear Force	13609.9 lb/ft	19.00

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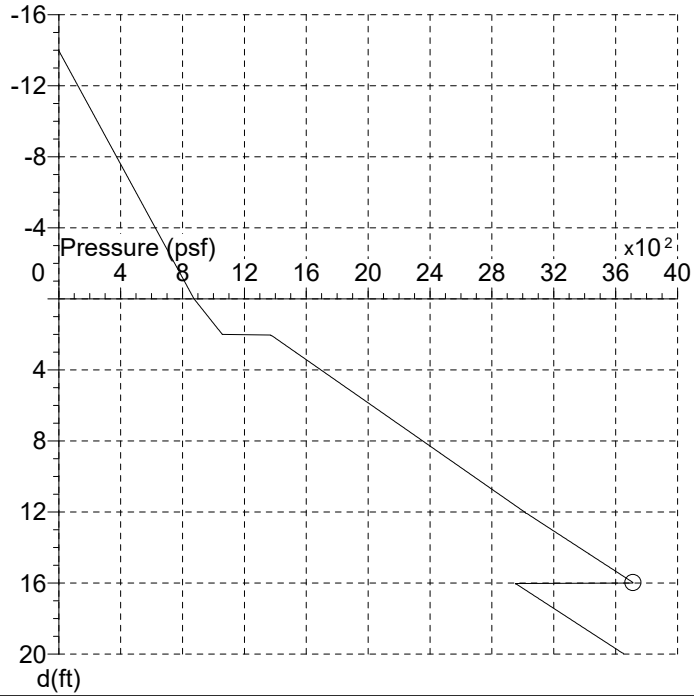
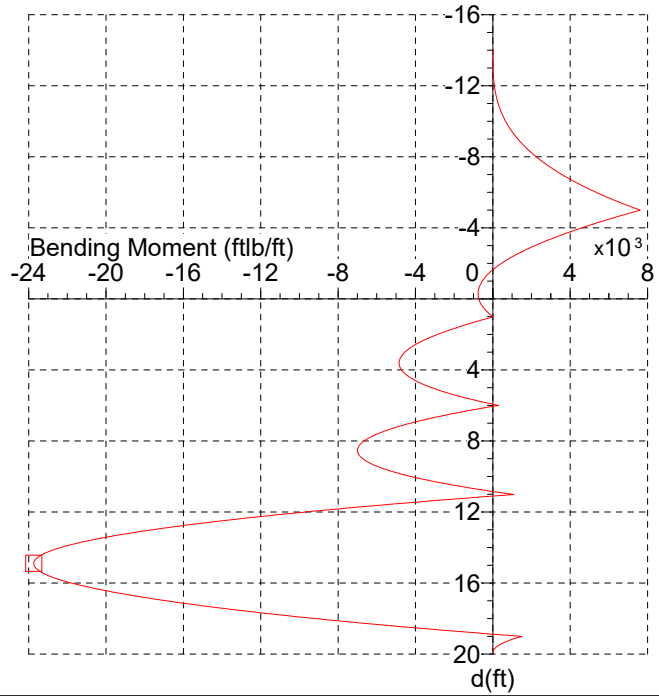
Title: Brazos River Flood Gate - East Side
Designer: Stage 7
Ref: 1.3
Page: 3
Date: 8.30.18

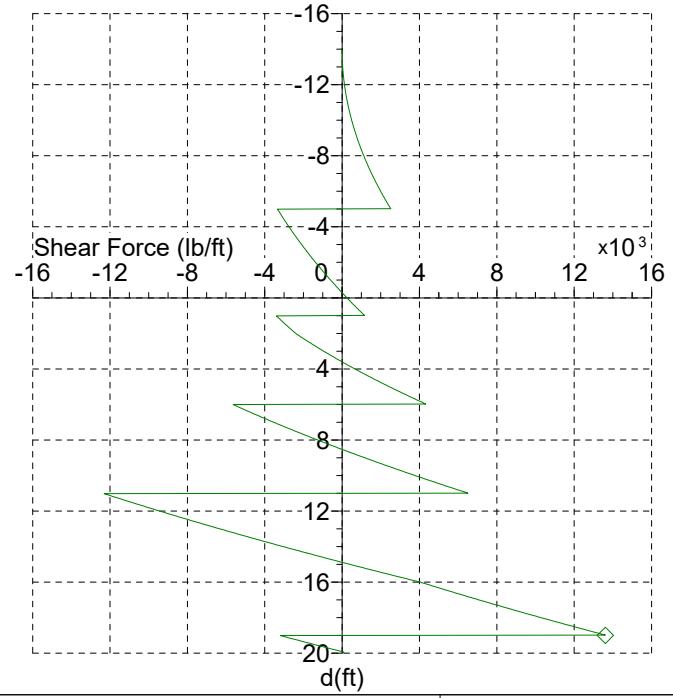
Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

	Maximum	d (ft)
○	3712.4 psf	15.98
□	23733.6 ftlb/ft	14.90
◇	13609.9 lb/ft	19.00

Stage 7 - Tip and Moment only







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Title: Brazos River Flood Gate - East Side
Designer: Stage 7
Ref: 1.3
Page: 4
Date: 8.30.18

Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	876.2	-718.3		274.5	6.71	2144.7	-3256.7		-4103.2	13.43	3267.2	-20143.2		-4860.6
0.14	889.2	-670.2		399.7	6.86	2168.0	-3810.8		-3797.3	13.57	3292.2	-20805.4		-4395.7
0.29	902.2	-603.4		526.8	7.00	2191.4	-4322.2		-3488.2	13.71	3317.2	-21401.6		-3927.1
0.43	915.1	-517.7		655.7	7.14	2214.7	-4790.4		-3175.8	13.86	3342.2	-21931.2		-3455.1
0.57	928.1	-412.7		786.4	7.29	2238.0	-5214.9		-2860.1	14.00	3367.2	-22393.7		-2979.5
0.71	941.1	-288.2		919.0	7.43	2261.3	-5595.2		-2541.0	14.14	3392.2	-22788.6		-2500.3
0.86	954.0	-143.9		1053.4	7.57	2284.6	-5931.0		-2218.7	14.29	3417.2	-23115.5		-2017.6
1.00	967.0	18.8		-3394.8	7.71	2307.9	-6221.7		-1893.1	14.43	3442.2	-23373.8		-1531.4
1.14	980.0	-452.4		-3256.7	7.86	2331.2	-6467.0		-1564.1	14.57	3467.2	-23563.0		-1041.6
1.29	992.9	-904.0		-3116.7	8.00	2354.5	-6666.2		-1231.9	14.71	3492.3	-23682.6		-548.3
1.43	1005.9	-1335.7		-2975.0	8.14	2377.8	-6819.0		-896.4	14.86	3517.3	-23732.2		-51.5
1.57	1018.8	-1747.3		-2831.4	8.29	2401.2	-6925.0		-557.5	15.00	3542.3	-23713.6		448.9
1.71	1031.8	-2138.6		-2685.9	8.43	2424.5	-6983.6		-215.4	15.14	3567.3	-23631.6		952.9
1.86	1044.8	-2509.2		-2538.7	8.57	2447.8	-6994.3		130.1	15.29	3592.3	-23485.7		1460.4
2.00	1055.1	-2859.0		-2389.6	8.71	2471.1	-6955.2		478.8	15.43	3617.3	-23275.7		1971.4
2.14	1389.4	-3185.1		-2194.2	8.86	2494.4	-6865.4		830.9	15.57	3642.3	-23001.0		2486.0
2.29	1412.8	-3483.5		-1995.4	9.00	2517.7	-6724.3		1186.2	15.71	3667.3	-22661.1		3004.1
2.43	1436.1	-3753.6		-1793.3	9.14	2541.0	-6531.4		1544.9	15.86	3692.3	-22255.7		3525.8
2.57	1459.4	-3995.1		-1587.9	9.29	2564.3	-6286.4		1906.8	16.00	3712.4	-21784.3		4050.9
2.71	1482.7	-4207.4		-1379.1	9.43	2587.6	-5988.6		2272.1	16.14	2973.1	-21252.0		4470.5
2.86	1506.0	-4390.0		-1167.1	9.57	2611.0	-5637.7		2640.7	16.29	2998.1	-20666.5		4893.8
3.00	1534.0	-4569.4		-908.3	9.71	2634.3	-5233.1		3012.5	16.43	3023.1	-20027.4		5320.6
3.14	1557.3	-4685.2		-689.0	9.86	2662.2	-4676.1		3463.1	16.57	3048.1	-19334.3		5751.0
3.29	1580.6	-4769.9		-466.4	10.00	2685.6	-4151.8		3842.3	16.71	3078.1	-18430.6		6272.2
3.43	1603.9	-4823.0		-240.5	10.14	2708.9	-3572.3		4224.7	16.86	3103.1	-17617.0		6710.4
3.57	1627.2	-4844.0		-11.3	10.29	2732.2	-2937.1		4610.4	17.00	3128.1	-16747.9		7152.1
3.71	1650.5	-4832.2		221.2	10.43	2755.5	-2245.8		4999.5	17.14	3153.2	-15823.0		7597.4
3.86	1673.8	-4786.4		457.0	10.57	2778.8	-1497.9		5391.8	17.29	3178.2	-14841.6		8046.2
4.00	1697.2	-4706.2		696.1	10.71	2802.1	-692.9		5787.5	17.43	3203.2	-13803.4		8498.6
4.14	1720.5	-4591.1		938.5	10.86	2825.4	169.8		6186.4	17.57	3228.2	-12708.0		8954.5
4.29	1743.8	-4440.5		1184.2	11.00	2848.7	1086.0		-12309.0	17.71	3253.2	-11554.8		9413.9
4.43	1767.1	-4254.1		1433.2	11.14	2872.0	-634.6		-11903.5	17.86	3278.2	-10343.5		9876.9
4.57	1790.4	-4031.4		1685.5	11.29	2895.4	-2297.6		-11494.6	18.00	3303.2	-9073.6		10343.5
4.71	1813.7	-3771.8		1941.2	11.43	2918.7	-3902.5		-11082.5	18.14	3328.2	-7744.6		10813.6
4.86	1837.0	-3474.8		2200.1	11.57	2942.0	-5448.9		-10667.0	18.29	3353.2	-6356.1		11287.2
5.00	1860.3	-3140.1		2462.3	11.71	2965.3	-6936.2		-10248.2	18.43	3378.3	-4907.7		11764.4
5.14	1883.6	-2767.2		2727.8	11.86	2988.6	-8363.9		-9826.2	18.57	3403.3	-3398.9		12245.1
5.29	1907.0	-2355.4		2996.7	12.00	3012.0	-9731.8		-9400.8	18.71	3428.3	-1829.2		12729.3
5.43	1930.3	-1904.5		3268.8	12.14	3037.0	-11039.1		-8972.1	18.86	3453.3	-198.3		13217.1
5.57	1953.6	-1413.8		3544.2	12.29	3062.1	-12285.6		-8539.8	19.00	3478.3	1500.6		-3194.3
5.71	1976.9	-882.9		3823.0	12.43	3087.1	-13470.6		-8103.8	19.14	3503.3	1075.8		-2704.4
5.86	2000.2	-311.4		4105.0	12.57	3112.1	-14593.6		-7664.4	19.29	3528.3	720.6		-2211.1
6.00	2023.5	296.1		-5640.2	12.71	3137.1	-15654.2		-7221.4	19.43	3553.3	435.5		-1714.2
6.14	2046.8	-472.9		-5351.5	12.86	3162.1	-16651.9		-6774.8	19.57	3578.3	221.0		-1213.9
6.29	2070.1	-1201.6		-5059.6	13.00	3187.1	-17586.1		-6324.7	19.71	3603.4	77.5		-710.0
6.43	2098.1	-2022.0		-4704.9	13.14	3212.1	-18456.3		-5871.1	19.86	3628.4	5.6		-202.6
6.57	2121.4	-2660.3		-4405.7	13.29	3242.1	-19415.5		-5322.1	20.00	3651.6	0.0		0.0

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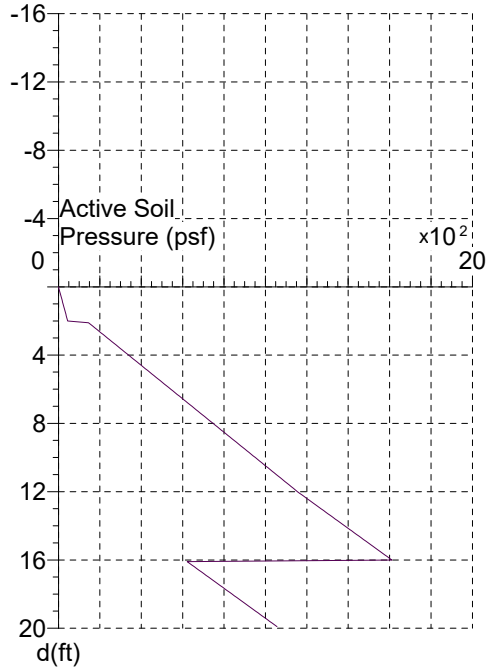
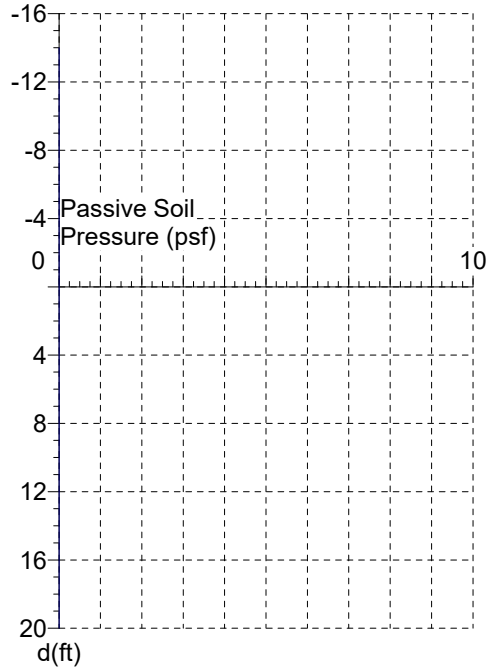
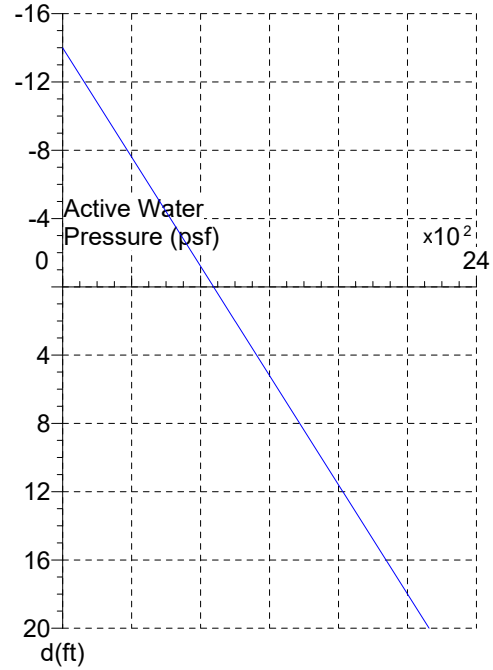
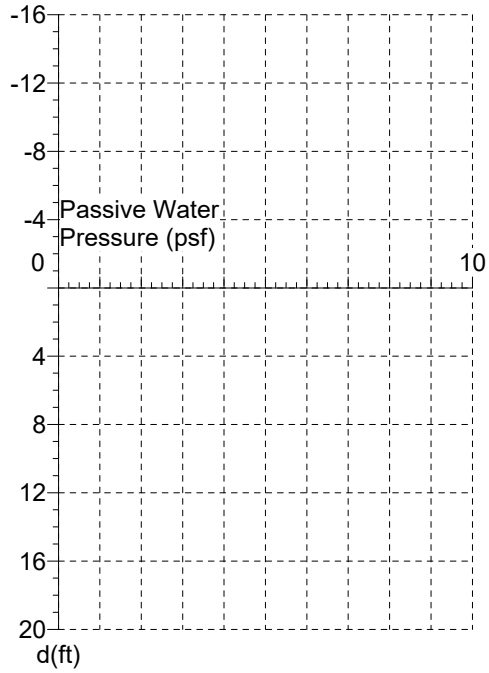
Toe: No Earth Support

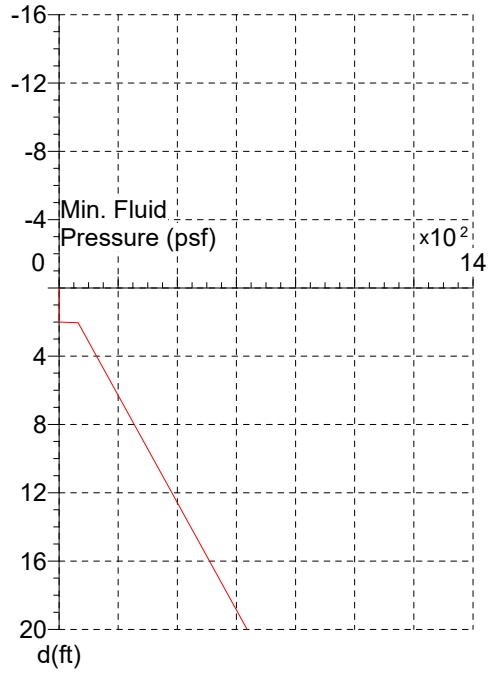
Stage 7 - Tip and Moment only

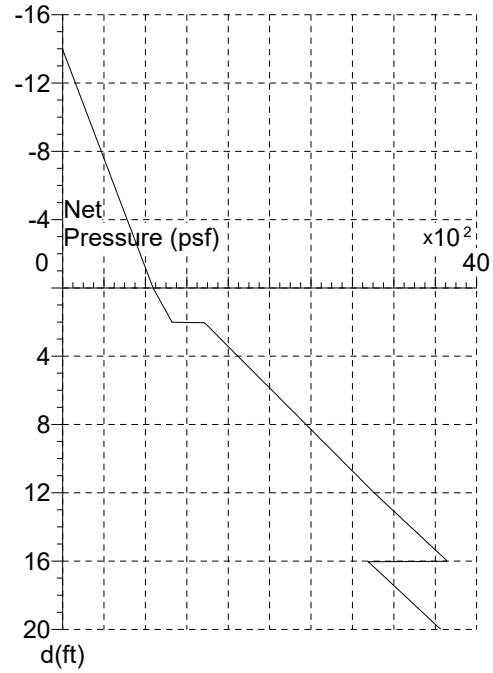












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Title: Brazos River Flood Gate - East Side
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Ref: 1.0
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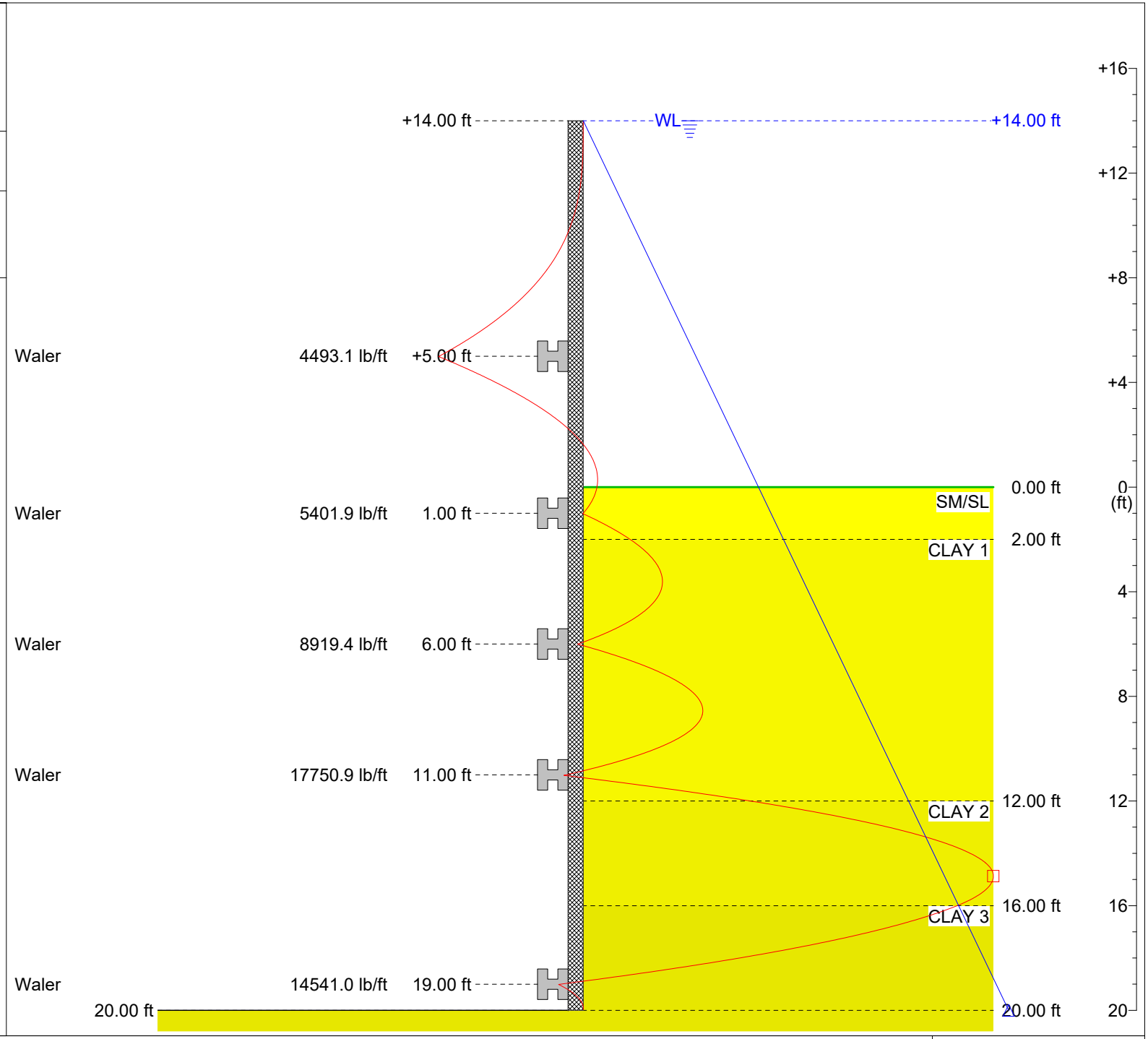
Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Maximum	d (ft)
21627.2 ftlb/ft	14.87
2125.0 psf	20.00

Stage 7 - Braces only



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Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Braces only

Input Data

Depth Of Excavation = 20.00ft
Surcharge = 0.0psf

Depth Of Active Water = +14.00ft
Depth Of Passive Water = 23.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	SM/SL	130.00	67.50	0.0	0.0	30.0	0.0	0.33	0.00	3.00	0.00
2.00	CLAY 1	102.00	39.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	CLAY 2	114.00	51.50	500.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
16.00	CLAY 3	114.00	51.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
24.00	CLAY 4	128.00	65.50	2400.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
34.00	CLAY 5	128.00	65.50	2000.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
42.00	CLAY 6	124.00	61.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								14.00	0.00	34.00

Pressure Model: Coulomb; Assume full hydrostatic pressure to 20.00ft in cohesive soils on active side

Load Model: Area Distribution (Hinge Method used for Shear Force, Bending Moment and Deflection)

Supports

d (ft)	Type	Load (lb/ft)
+5.00	Waler	4493.1
1.00	Waler	5401.9
6.00	Waler	8919.4
11.00	Waler	17750.9
19.00	Waler	14541.0

Maxima

	Maximum	Depth (ft)
Pressure	3481.6 psf	15.98
Bending Moment	21627.2 ftlb/ft	14.87
Shear Force	12090.6 lb/ft	19.00

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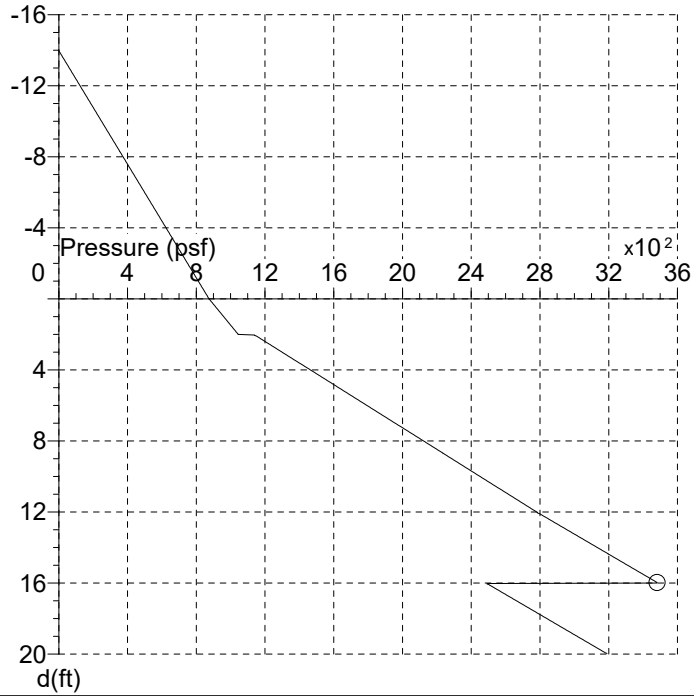
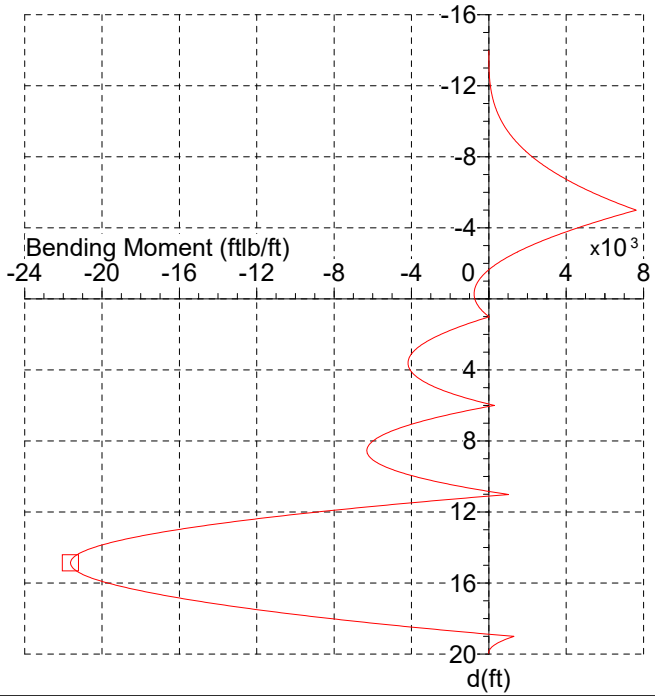
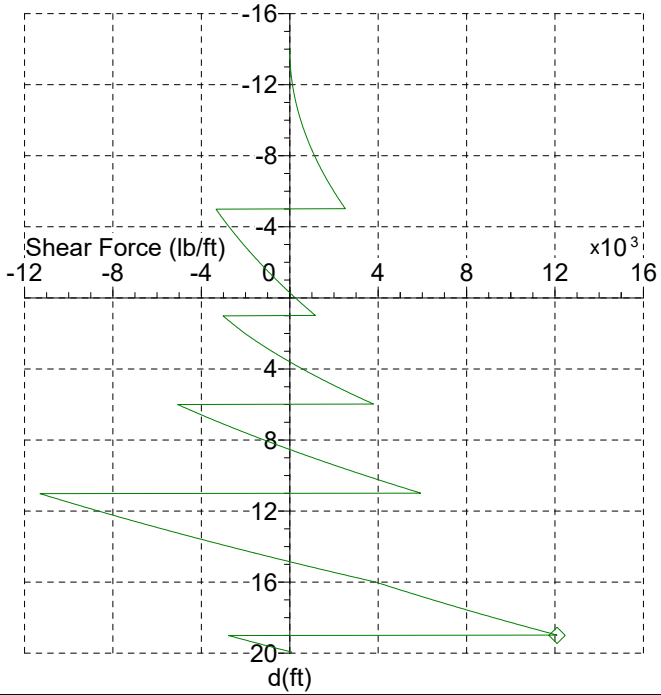
Pressure: Coulomb
Toe: No Earth Support

	Maximum	d (ft)
○	3481.6 psf	15.98
□	21627.2 ftlb/ft	14.87
◇	12090.6 lb/ft	19.00

Stage 7 - Braces only







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Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Braces only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	876.1	-717.3		274.7	6.71	1913.9	-2908.1		-3704.6	13.43	3036.4	-18438.2		-4418.2
0.14	888.1	-669.2		399.8	6.86	1937.3	-3408.6		-3431.5	13.57	3061.4	-19039.5		-3986.0
0.29	900.1	-602.4		526.6	7.00	1960.6	-3870.9		-3155.0	13.71	3086.4	-19579.5		-3550.1
0.43	912.1	-516.7		655.2	7.14	1983.9	-4294.6		-2875.3	13.86	3111.4	-20057.5		-3110.8
0.57	924.1	-411.8		785.4	7.29	2007.2	-4679.1		-2592.3	14.00	3136.4	-20473.0		-2667.9
0.71	936.2	-287.5		917.4	7.43	2030.5	-5024.1		-2305.9	14.14	3161.4	-20825.6		-2221.4
0.86	948.2	-143.5		1051.0	7.57	2053.8	-5329.0		-2016.3	14.29	3186.4	-21114.8		-1771.4
1.00	960.2	18.7		-3015.8	7.71	2077.1	-5593.4		-1723.4	14.43	3211.4	-21340.1		-1317.9
1.14	972.2	-399.2		-2878.8	7.86	2100.4	-5816.8		-1427.1	14.57	3236.5	-21500.9		-860.8
1.29	984.2	-797.7		-2740.0	8.00	2123.7	-5998.9		-1127.6	14.71	3261.5	-21596.8		-400.2
1.43	996.2	-1176.4		-2599.6	8.14	2147.1	-6139.0		-824.7	14.86	3286.5	-21627.2		64.0
1.57	1008.3	-1535.3		-2457.4	8.29	2170.4	-6236.8		-518.6	15.00	3311.5	-21595.6		531.7
1.71	1020.3	-1874.0		-2313.6	8.43	2193.7	-6291.8		-209.1	15.14	3336.5	-21505.0		1002.9
1.86	1032.3	-2192.3		-2168.0	8.57	2217.0	-6303.5		103.6	15.29	3361.5	-21355.0		1477.7
2.00	1041.9	-2490.0		-2020.8	8.71	2240.3	-6270.2		419.7	15.43	3386.5	-21144.9		1956.1
2.14	1158.7	-2766.1		-1858.1	8.86	2263.6	-6190.8		739.0	15.57	3411.5	-20874.6		2438.0
2.29	1182.0	-3018.9		-1692.0	9.00	2286.9	-6064.9		1061.7	15.71	3436.5	-20543.3		2923.4
2.43	1205.3	-3248.2		-1522.6	9.14	2310.2	-5892.0		1387.6	15.86	3461.6	-20150.9		3412.4
2.57	1228.6	-3453.4		-1349.8	9.29	2333.5	-5671.6		1716.9	16.00	3481.6	-19696.7		3904.7
2.71	1251.9	-3634.0		-1173.8	9.43	2356.9	-5403.3		2049.5	16.14	2511.5	-19187.5		4259.0
2.86	1275.2	-3789.5		-994.5	9.57	2380.2	-5086.5		2385.3	16.29	2536.5	-18633.5		4616.9
3.00	1303.2	-3942.5		-774.9	9.71	2403.5	-4720.7		2724.5	16.43	2561.5	-18034.3		4978.4
3.14	1326.5	-4041.4		-588.3	9.86	2431.5	-4216.6		3135.9	16.57	2586.5	-17389.5		5343.4
3.29	1349.8	-4113.7		-398.4	10.00	2454.8	-3741.6		3482.3	16.71	2616.5	-16554.7		5786.0
3.43	1373.1	-4159.1		-205.2	10.14	2478.1	-3216.1		3832.1	16.86	2641.6	-15807.8		6158.9
3.57	1396.4	-4177.0		-8.7	10.29	2501.4	-2639.7		4185.1	17.00	2666.6	-15013.8		6535.2
3.71	1419.7	-4166.7		191.1	10.43	2524.7	-2011.9		4541.4	17.14	2691.6	-14172.3		6915.1
3.86	1443.1	-4127.2		394.2	10.57	2548.0	-1332.2		4901.1	17.29	2716.6	-13282.8		7298.5
4.00	1466.4	-4058.0		600.6	10.71	2571.3	-600.1		5264.0	17.43	2741.6	-12344.8		7685.5
4.14	1489.7	-3958.6		810.4	10.86	2594.6	184.8		5630.3	17.57	2766.6	-11358.0		8076.0
4.29	1513.0	-3828.5		1023.4	11.00	2617.9	1019.0		-11304.3	17.71	2791.6	-10321.9		8470.1
4.43	1536.3	-3667.4		1239.7	11.14	2641.3	-561.0		-10931.4	17.86	2816.6	-9235.9		8867.7
4.57	1559.6	-3474.6		1459.3	11.29	2664.6	-2088.1		-10555.3	18.00	2841.6	-8099.8		9268.8
4.71	1582.9	-3249.7		1682.2	11.43	2687.9	-3561.7		-10175.8	18.14	2866.7	-6913.0		9673.5
4.86	1606.2	-2992.3		1908.5	11.57	2711.2	-4981.4		-9793.0	18.29	2891.7	-5675.1		10081.8
5.00	1629.5	-2701.8		2138.0	11.71	2734.5	-6346.7		-9407.0	18.43	2916.7	-4385.6		10493.5
5.14	1652.9	-2377.8		2370.8	11.86	2757.8	-7657.1		-9017.6	18.57	2941.7	-3044.2		10908.9
5.29	1676.2	-2019.8		2607.0	12.00	2781.2	-8912.1		-8624.9	18.71	2966.7	-1650.3		11327.7
5.43	1699.5	-1627.2		2846.4	12.14	2806.3	-10111.4		-8228.9	18.86	2991.7	-203.5		11750.1
5.57	1722.8	-1199.7		3089.2	12.29	2831.3	-11254.3		-7829.3	19.00	3016.7	1301.6		-2768.0
5.71	1746.1	-736.8		3335.2	12.43	2856.3	-12340.5		-7426.0	19.14	3041.7	933.4		-2344.7
5.86	1769.4	-238.0		3584.5	12.57	2881.3	-13369.3		-7019.3	19.29	3066.7	625.4		-1917.9
6.00	1792.7	292.7		-5071.6	12.71	2906.3	-14340.3		-6609.0	19.43	3091.8	378.0		-1487.6
6.14	1816.0	-399.0		-4815.6	12.86	2931.3	-15253.0		-6195.1	19.57	3116.8	191.8		-1053.8
6.29	1839.3	-1055.0		-4556.4	13.00	2956.3	-16106.9		-5777.7	19.71	3141.8	67.2		-616.5
6.43	1867.3	-1794.2		-4240.9	13.14	2981.3	-16901.4		-5356.8	19.86	3166.8	4.8		-175.8
6.57	1890.6	-2369.8		-3974.4	13.29	3011.4	-17775.9		-4847.0	20.00	3190.0	0.0		0.0

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Page: 5
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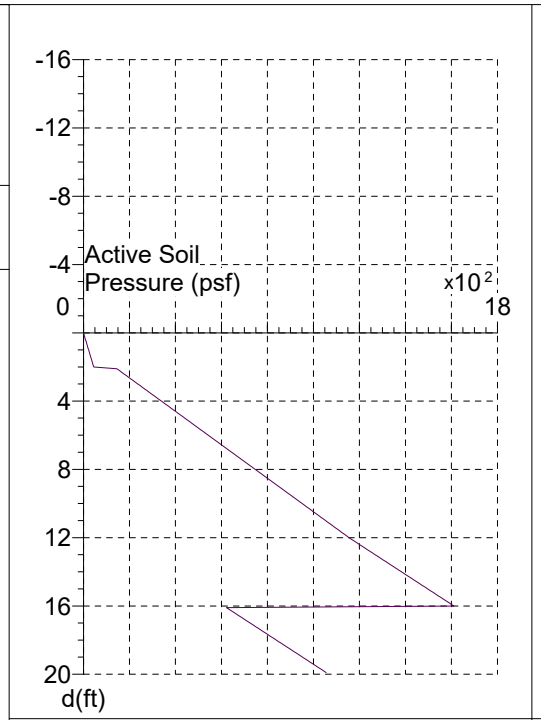
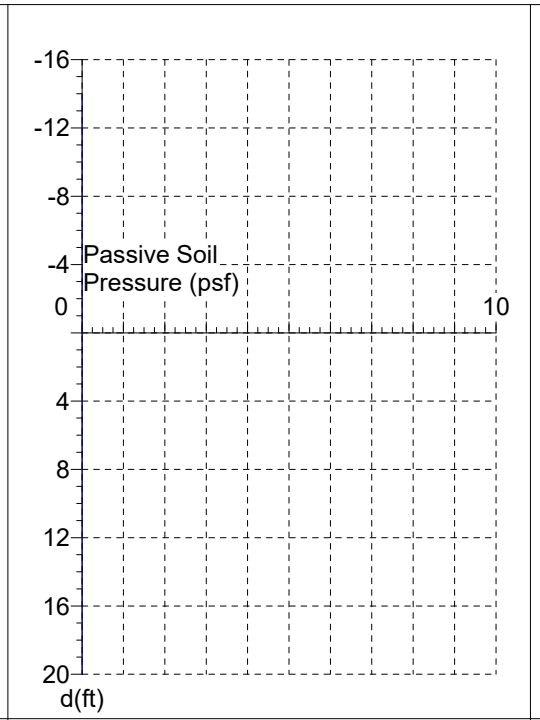
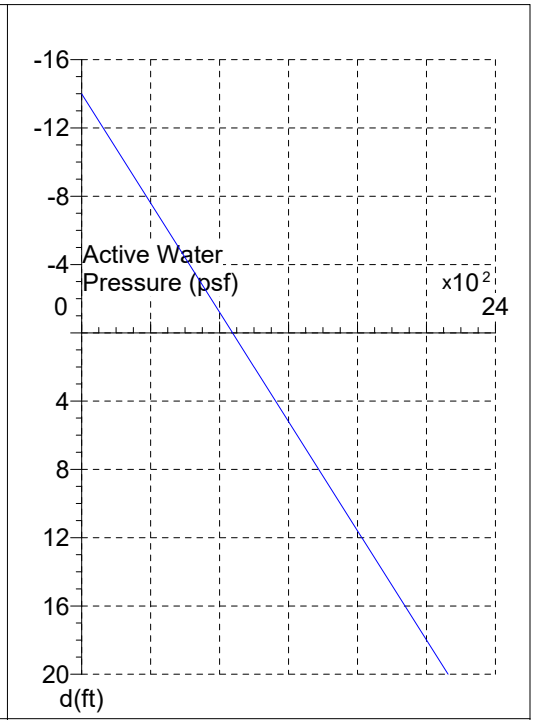
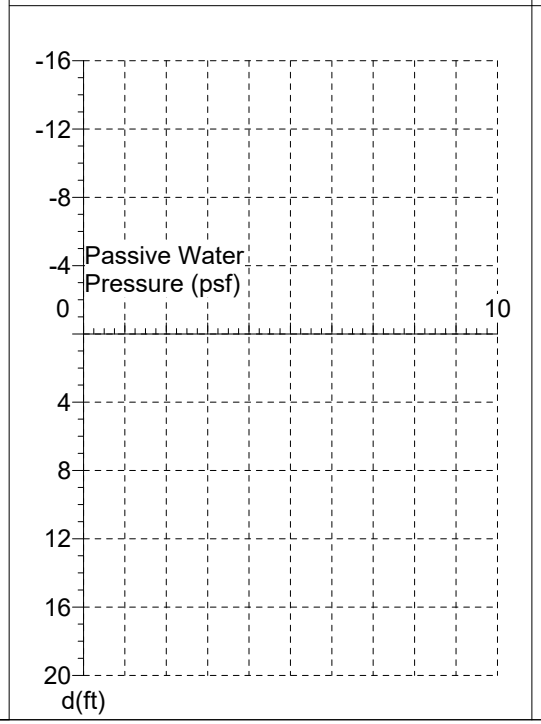
Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

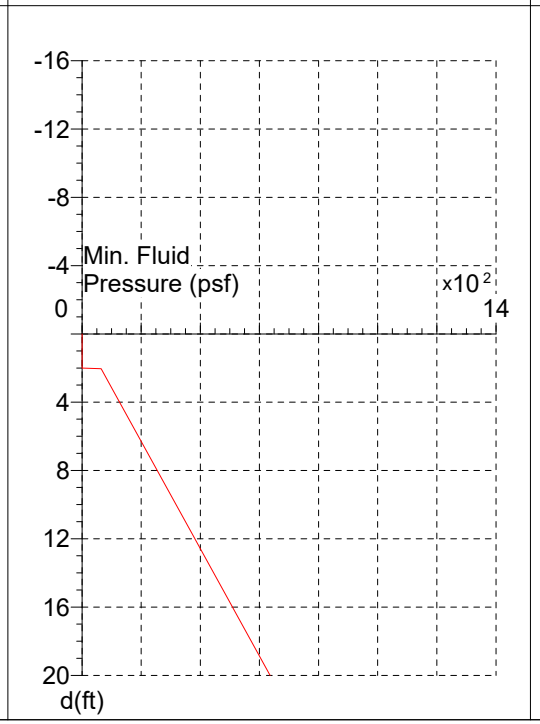
Stage 7 - Braces only

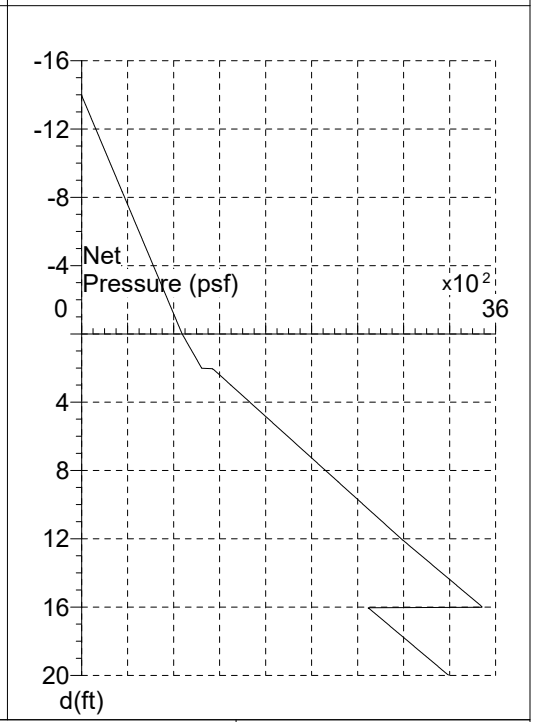












SupportIT, v2.35

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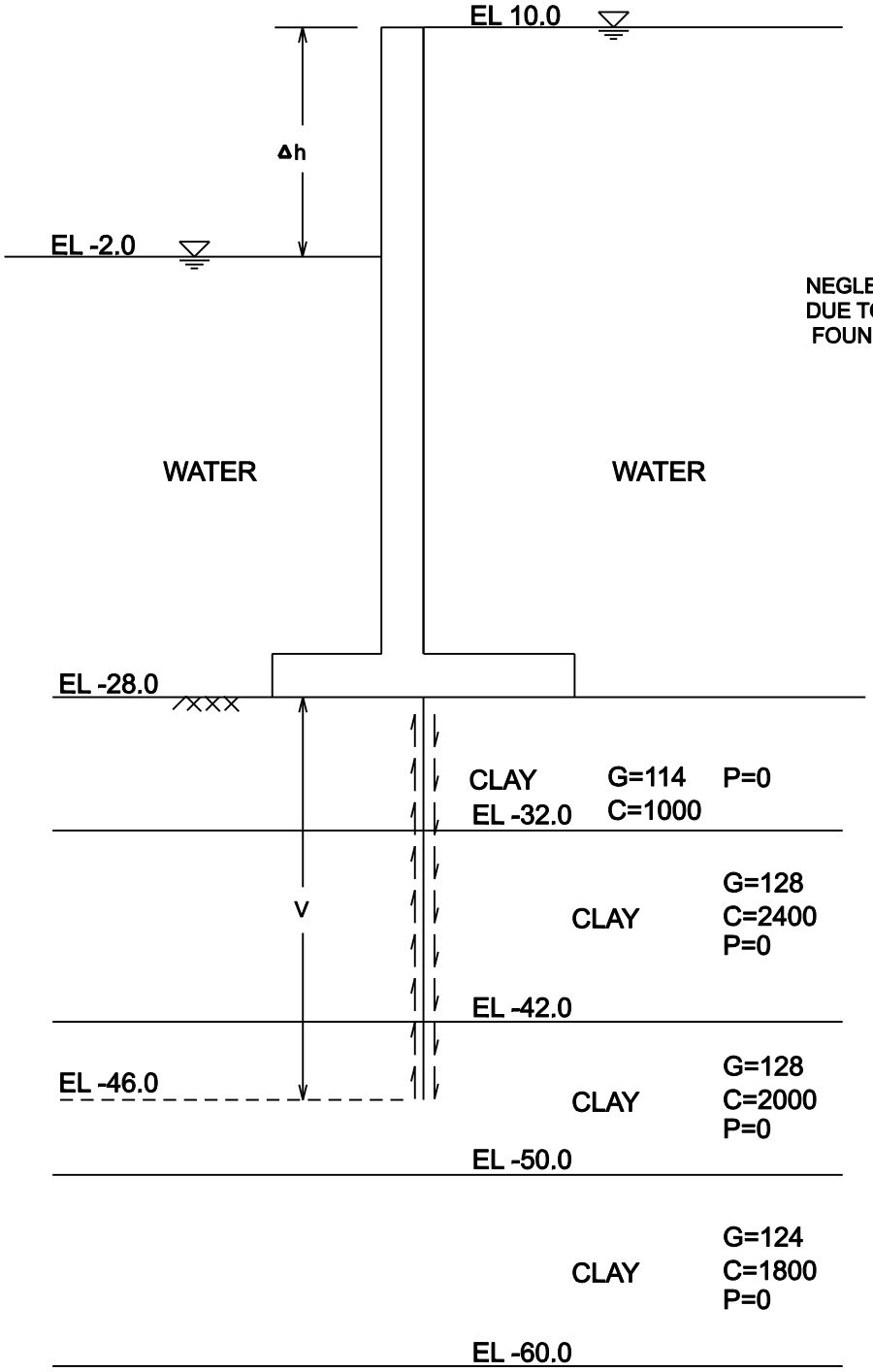
Web: www.GTSoft.org

APPENDIX D

BRAZOS RIVER - EAST SEEPAGE CUTOFF



$Cw = [(2V) + (1/3H)] / \Delta h$

NEGLECT HORIZONTAL INTERFACE OF FOOTING/SOIL DUE TO PROBABLE SOIL ARCHING FROM A PILE FOUNDED STRUCTURE.

H = 0

FOR ALL CLAY FOUNDATION, Cw >= 3

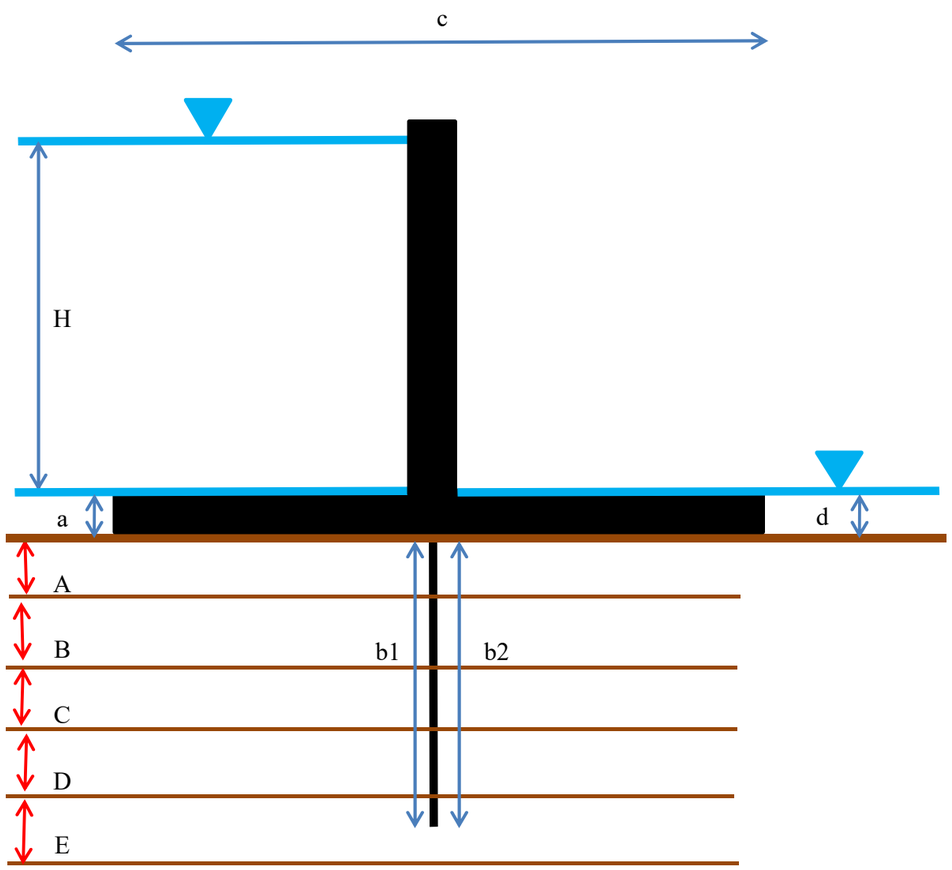
$\Delta h = (10- (-2)) = 12'$

$Cw = [(2V) + (1/3x0)] / 12 = 3$

V = 18'

TIP ELEV = -28 -18 = -46

...\Brazos-East sketch.dgn 10/23/2018 12:28:34 PM



= Input
= Output

Target Safe Creep Ratio	Base Elevation	Tip Elevation
3	-28	-46

Weighted Creep Ratio

Strata	Thickness	Material	Safe Creep Ratio	Transformed Thickness	Cumulative Transformed Thickness
A	18	CH	3	18	18
B	0	CH	3	0	18
C	0	ML	7.5	0	18
D	0	CH	2	0	18
E	0	CH	3	0	18
F	0	CH	3	0	18
G	0	CH	3	0	18

Dead Space
0

<
=

Note:
$b = b_1 = b_2$
$2*b = b_1 + b_2$

$(a + b_1 + b_2 + c/3 + d)/H$					
a	b	d	c	H	(a + 2*b + c/3 + d)/H
0	18	0	0	12	3
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0

Largest "b"
18

Use Goal Seek to get (X?-N5) to equal zero by changing K?

0

APPENDIX E

Rachel, Chad M CIV USARMY CEMVN (US)

From:	Lovett, David P Jr CIV USARMY CEMVN (US)
Sent:	Tuesday, April 24, 2018 6:45 AM
To:	Rachel, Chad M CIV USARMY CEMVN (US)
Cc:	Richard, Leeland J CIV USARMY CEMVN (US); Richie, Jeffrey M CIV USARMY CEMVN (US)
Subject:	Brazos FG Pile Curves Needed (UNCLASSIFIED)
Attachments:	Brazos Plan Drawing.pdf

CLASSIFICATION: UNCLASSIFIED

Chad,

As we discussed a few weeks back, need your assistance with developing pile curves for a 30" pipe pile w/ 5/8" wall for the proposed gate on the east side of the Brazos River crossing. I have attached the plan view of where that gate is proposed to be located.

For borings, you will have to navigate the below website to determine the closest borings to this structure. Not sure if there is another database out there that you can better locate the borings?

https://txsed.glo.texas.gov/dsweb/View/Collection-36

Please let me know if you need any additional information to complete this task.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

CLASSIFICATION: UNCLASSIFIED

Rachel, Chad M CIV USARMY CEMVN (US)

From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Tuesday, August 21, 2018 9:30 AM
To: Rachel, Chad M CIV USARMY CEMVN (US)
Cc: Richard, Leeland J CIV USARMY CEMVN (US)
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Round to water at 6 with top of cofferdam at 8

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
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-----Original Message-----
From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Tuesday, August 21, 2018 9:29 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Cc: Richard, Leeland J CIV USARMY CEMVN (US) <Leeland.J.Richard@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Dave,

So water at EL 7.89 for this one?

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: McLaughlin, Patrick W [mailto:Patrick.McLaughlin@mottmac.com]
Sent: Friday, August 17, 2018 9:02 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>; Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>; Harter, Craig <Craig.Harter@mottmac.com>; Carter, Joshua <Joshua.Carter@mottmac.com>
Subject: [Non-DoD Source] RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Dave,
Sorry about that. MSL is 1.01 ft above NAVD88. So the max elevation in NAVD88 would be 5.89, with 2 feet of freeboard the top of cofferdam would be 7.89 ft NAVD88.

Thanks,
Pat
-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Sent: Thursday, August 16, 2018 7:49 PM
To: McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>; Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>; Harter, Craig <Craig.Harter@mottmac.com>; Carter, Joshua <Joshua.Carter@mottmac.com>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Pat,

What is the conversion between MSL and NAVD88 at the Brazos again?

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

-----Original Message-----
From: McLaughlin, Patrick W [mailto:Patrick.McLaughlin@mottmac.com]
Sent: Thursday, August 16, 2018 4:47 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>; Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>; Harter, Craig <Craig.Harter@mottmac.com>; Carter, Joshua <Joshua.Carter@mottmac.com>
Subject: [Non-DoD Source] RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Hi Dave,

We also looked at the gauge data for Brazos, using the gauge just inside of the East Gate. We filtered out any WSE's associated with hurricanes by cross references a hurricane database (IBTracs) that we have access to. The plot below shows the CDF Curve for the filtered data (i.e. no hurricanes or tropical storms included). The max WSE observed was 4.88 ft MSL. Adding 2 foot of freeboard, this would result in a top elevation of 6.88 ft MSL.

Let us know if you have any questions or comments.

Thanks,

Patrick McLaughlin, P.E.

Engineer IV

D +1 (512) 777 3067 T +1 (512) 342 9516 C +1 (518) 424 5475

patrick.mclaughlin@mottmac.com <mailto:patrick.mclaughlin@mottmac.com>

<BlockedBlockedhttps://mottmac.blob.core.windows.net/media-manager/594047>

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From: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Sent: Wednesday, August 15, 2018 1:41 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Hi David,

I looked at the east lock gage reading to determine water levels. The values are reported in NGVD, but I believe there is about a 2.0ft error/shift to get to NAVD88, at least with the older data. It seems the more recent data (late 2017 to present) was shifted down to where it's supposed to be. I remember looking into this issue a while back. The surveyor we used shot a water surface elevation in the lock at a certain time. I compared the lock reading and there was about a 2ft difference between the lock reading in NGVD and the survey in NAVD88. Using the plot below, it seems every year there are some fairly high events in the 6 to 8ft NGVD range, although some of those could be tropical. If we adjust for the datum shift, the levels would be 4 to 6ft NAVD88. I would recommend an elevation to 6ft NAVD88. If only considering non-storm tidal conditions, the maximum seems about 2.5 NAVD88, which if you add 2ft of freeboard, would give 4.5 ft NAVD88.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Wednesday, August 15, 2018 12:53 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil
<mailto:Maxwell.E.Agnew@usace.army.mil> >; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com
<mailto:Patrick.McLaughlin@mottmac.com> >
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil
<mailto:Chad.M.Rachel@usace.army.mil> >
Subject: FW: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Max, Pat,

Can you please provide Chad with a maximum (non-tropical) water elevation that the cofferdam should be designed for. The cofferdams will be on the GIWW side of the existing structures so won't see the high river elevations.

Chad,

We should provide 2' above that elevation for "freeboard".

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

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-----Original Message-----

From: Rachel, Chad M CIV USARMY CEMVN (US)

Sent: Wednesday, August 15, 2018 10:12 AM

To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil <mailto:David.P.Lovett@usace.army.mil> >

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Which water level should I use for the flood side of the braced cofferdam?

Thanks,

Chad M. Rachel, P.E.

-----Original Message-----

From: Lovett, David P Jr CIV USARMY CEMVN (US)

Sent: Thursday, August 02, 2018 12:34 PM

To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil <mailto:Chad.M.Rachel@usace.army.mil> >

Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil <mailto:Jason.J.Ragolia@usace.army.mil> >; Richard, Leeland J CIV USARMY CEMVN (US) <Leeland.J.Richard@usace.army.mil <mailto:Leeland.J.Richard@usace.army.mil> >

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Also based on the available boring data, would like you to evaluate the required sheetpile cutoff elevation, the cofferdam design and the dewatering requirements (if necessary) for the 2 Colorado structures and the 1 Brazos structure. For the cofferdam design, the sill, base elevation and TRS dredge elevation would be the same as the GIWW West design that you performed for Morganza. I assume we could use the same elevations for anchor locations as we did for Morganza as well.

Please let me know approximate schedule to accomplish this work.

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

Rachel, Chad M CIV USARMY CEMVN (US)

From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Friday, September 21, 2018 11:13 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US)
Cc: Ragolia, Jason J CIV USARMY CEMVN (US); Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Brazos River & Colorado River - Seepage Cutoff
Attachments: Brazos-East sketch.pdf; Colorado-East sketch.pdf; Colorado-West sketch.pdf; Colorado-West Lanes Weighted Creep-CMR.PDF; Colorado-East Lanes Weighted Creep-CMR.PDF; Brazos-East Lanes Weighted Creep-CMR.PDF

Dave,

The estimated tip elevation (based on the soil parameters and stratification from the limited data, the water levels you provided, and using Lane's Weighted Creep Ratio method of analysis) of the seepage cutoff for the 3 structures are as follows:

Brazos-East = EL -46.0

Colorado-West = EL -50.5

Colorado-East = EL -46.0

Documentation is attached.

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 1:53 PM
To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Chad,

For cutoff, assume El 10 on the river and -2 on the GIWW side of the structure to size the tip of the cutoff wall.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
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Ph (504) 862-2680
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-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 8:11 AM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Max,

Trying to determine for the new load case you suggest, what would be the return period on that event? Trying to determine whether this would be an unusual or extreme event.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

From: Agnew, Maxwell E CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 2:19 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Hi Dave,

1) I think this is ok for completing a cost estimate, but for final design, we'd probably want to look a little closer at velocities. 1000lb stone sounds pretty extreme.

2) For an extreme hurricane event, I believe the surge will inundate the entire coastal area, so both the GIWW and River would be about the same elevation. Once the water gets above 3 or 4ft, all the land in that area is inundated, so I don't believe you'd ever have a case where the river is 16' and the GIWW so much lower at 5ft.

I think the worst differential will be during a flood event at low tide. See below plot of stages. Harvey (flood of record maybe) seemed to peak at about 8ft NGVD (~6ft NAVD88). Maybe you could assume 10ft NAVD88 in the river, and a low tide, maybe -2ft in the GIWW.

Let me know if this helps or if you need any other info.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 1:38 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: Colorado River Lock - Design Questions

Max,

Two questions:

1.) In the attachment, I used WCC design from Matt D. to assume a similar 42" layer of 1000lb stone placed in the wet, extending 200' out from the structure. This would be placed on top of geotextile and bedding material. Is this reasonable?

2.) For the design of the pile foundation, I selected 4 load cases. They are shown below. Can you validate? Particularly interested in the hurricane case, where I assume the gate will be shut in a hurricane so I designed for water to the top for survivability of the structure (133% OS). What would be the GIWW elevation if we have 16 on the R/S?

Colorado River East Flood Gate

Soil Parameter Determination

Using the GLO database, there are two (2) borings on the east side of the Colorado. Those borings are 87-214, and 87-216. Ground surface elevations of the borings are not known; only the depths are known. The ground surface of these borings are approximately 15 feet below the water surface. Although no ground surface elevation was reported, an assumption was made that the water surface was approximately zero elevation. Using this assumption and knowing the boring depth below the water surface, the ground surface elevation of the borings were assumed. The borings extend to depths of approximately 52 feet.

The strength test data for these borings are somewhat adequate, consisting mostly of pocket penetrometer tests and torvane tests, with occasional unconfined compression tests. Also accompanying the strength test data is soil classification, Atterberg limits, moisture contents, sieve analyses, and dry unit weight determination.

Determination of soil parameters relied upon the data from both borings on the East side. All data was plotted in charts of Shear Strength vs. Depth and Wet Density vs. Depth. Boring logs were laid out next to each other, from left to right in order to determine stratification lines. These stratification lines were overlaid on the plots of Shear Strength vs. Depth and Wet Density vs. Depth in order to create design lines.

For boring locations, boring logs, test data, and soil parameter plots, see Appendix A.

Pile Capacity Determination

Analyses were performed to determine the estimated ultimate single pile load capacity in compression and tension for an open end 30-inch diameter steel pipe pile with wall thickness of 5/8-inch was estimated. The estimated capacity is presented on the design plate. The capacity was determined with and without a plug formation, and the most critical condition (vs. depth) was reported. Both Q-case and S-case was examined with groundwater table at the ground surface.

For reasons explained above, the curves presented assume the ground surface at EL -15.0. If ground surface elevations for each boring are determined via survey or other means, and elevations are found to be similar, the soil parameters and the curves can be adjusted accordingly. If elevations are found to not be similar, the soil parameters and the curves can be re-evaluated by the geotechnical engineer.

Soil-pile interface parameters such as adhesion and wall friction followed recommendations provided in EM 1110-2-2906. Other parameters used in the design, such as lateral earth coefficients for both compression and tension and bearing capacity factors can be found on the pile capacity curve design plate presented in Appendix B.

Due to the lack of proximate geotechnical data, recommended design factors of safety for allowable pile capacity are as follows:

	FS w/ Load test	FS w/o Load test
Q-case	2	3.5
S-case	1.5	2

The factors of safety shown with an accompanying load test assume a static load test. It is highly recommended that a static pile load test be performed at a location within the footprint of the proposed structure. If dynamic testing only is performed, the Q-case factor of safety should be adjusted to a value of 2.5, and the S-case factor of safety should be taken as 1.75.

The piles will derive a significant portion of their supporting capacity through skin friction and therefore it will be necessary to consider the effect of group action for piles placed in groups. In this regard, the supporting value of pile groups should be investigated on the basis of group perimeter shear by the formula shown in the figure titled “Capacity of Pile Groups” provided in the Appendix. For pile groups used in tension, the second term of the formula should be deleted when evaluating group effects. All groups should be evaluated for perimeter shear. The minimum center-to-center spacing within a pile group or row of piles should be determined in accordance with the pile spacing formula shown in the figure titled “Capacity of Pile Groups” provided in Appendix B.

Pile load capacities shown on the design plate assume piles are installed vertically, but may be used to estimate horizontal load resistances for batter piles. The vertical component of the batter piles are equated to the load capacities for identical sized vertical piles driven to the same tip elevations. This relationship may be used to determine the axial capacities and horizontal components of the batter piles as shown in the figure titled “Axial and Horizontal Resistance of Batter Piles” provided in Appendix B.

Temporary Retaining Structure Design

Using the design soil parameters developed for Colorado River – East – Reach 1, the temporary retaining system (TRS) was designed. The TRS consists of a braced sheet pile cofferdam structure. For feasibility level design purposes, the geometry of the structure was modeled after a similar project known as the Morganza to the Gulf - GIWW West Flood Gate. This project called for a TRS dredge elevation of EL -28 and 5 levels of bracing at elevations -3.0, -9.0, -14.0, -19.0, and finally a tremie slab acting as a brace at EL -27.0. The piezometric surface inside the cofferdam was placed three (3) feet below the dredge depth for design purposes, to model uplift control.

Only the Q-case soil parameters were used in the design. A factor of safety (FOS) of 1.3 was incorporated into the soil shear strengths for determination of the tip elevation and moment. A factor of safety (FOS) of 1.0 was used for determination of the brace loadings. The design was performed in stages. Given the number of braces, seven (7) stages were required.

The available boring data extended to approximately EL -52. The soil parameters for the stratum immediately above this elevation were assumed to continue below this elevation. This is likely a conservative assumption, as soil shear strengths tend to increase with increased depth. From the boring

data, the ground surface below the water surface was assumed to be at EL -15. It is recommended that project specific borings and testing be performed in later stages of the project.

The design water level was provided by CEMVN-EDH and was based on the record of non-tropical data collected from Jan 2002 through Aug 2018 (present) [reference USGS 08162506 Colorado Rv Bypass Channel nr Matagorda, TX gage data] . The data indicated that the maximum non-tropical water level is approximately at EL 2.5 NAVD88. Two (2) feet of freeboard was added to this elevation to give a design water surface elevation (DWSE) of 4.5 NAVD88.

Analyses for each stage as well as determined values for tip elevation, bending moment, and brace loadings are shown in Appendix C, with values to be used for design highlighted in the table. Taking into account the stratification and the results of the analyses, the recommended tip elevation for the sheet piles is EL -42.0 for this structure.

Based on the available boring data, the foundation at the structure location appears to include a shallow sand layer that could possibly be removed via excavation. But without more detailed investigations, this would be difficult to determine. Therefore, based on the current available data, engineering judgment is that it is not likely that any specific dewatering requirements will be necessary for this site other than pumping within the TRS.

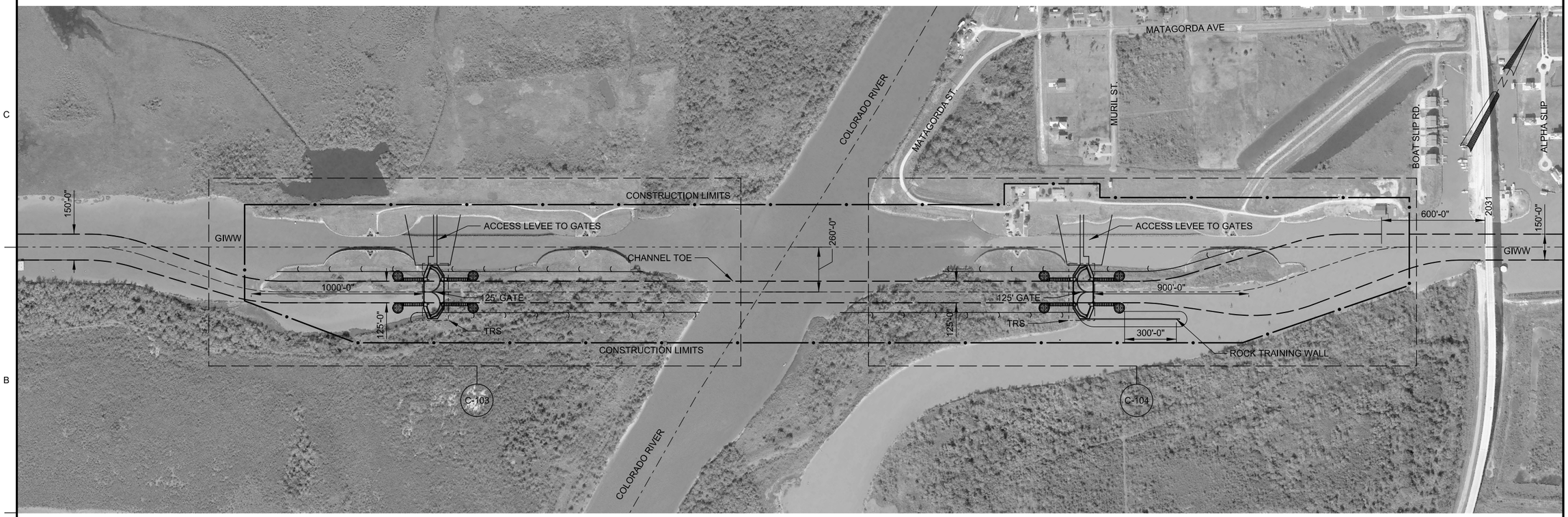
Sheet Pile Seepage Cutoff Design

Using the design soil parameters developed for Colorado River – East, the requirements for the sheet pile seepage cutoff below the base slab of the gate structure was determined. The design water levels provided were EL 10.0 on the Colorado River side of the gate and EL -2.0 on the GIWW side of the gate. The estimated tip elevation was determined using Lane's Weighted Creep Ratio method of analysis, and based on the soil parameters and stratification from the limited data and the water levels provided, the recommended tip elevation for the seepage cutoff is EL -46.0 for this structure. Analyses for determination of the seepage cutoff sheet pile are shown in Appendix D.

APPENDIX A

CONSTRUCTION SEQUENCE

1. PILE TEST
2. DREDGE ACCESS CHANNEL ON GIWW SIDE OF EACH STRUCTURE FOR CRANE ACCESS.
3. DRIVE PRODUCTION PILING FOR GATE STRUCTURE IN WET.
4. PLACE COFFERDAM
5. CONSTRUCT GATE STRUCTURE
6. REMOVE COFFERDAM
7. CONSTRUCT GUIDE WALLS AND END CELLS (SOME CONCURRENT WITH GATE CONSTRICTION)
8. CONSTRUCT ROCK TRAINING WALL
9. COMPLETE DREDGING OF NEW CHANNEL
10. TRANSFER NAVIGATION TO NEW STRUCTURE
11. COMPLETE DEMOLITION/BUILD ACCESS LEVEE



FINAL SITE PLAN

SCALE:1"=300'

0 300' 600'

US Army Corps of Engineers®
GALVESTON DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
GALVESTON, TEXAS

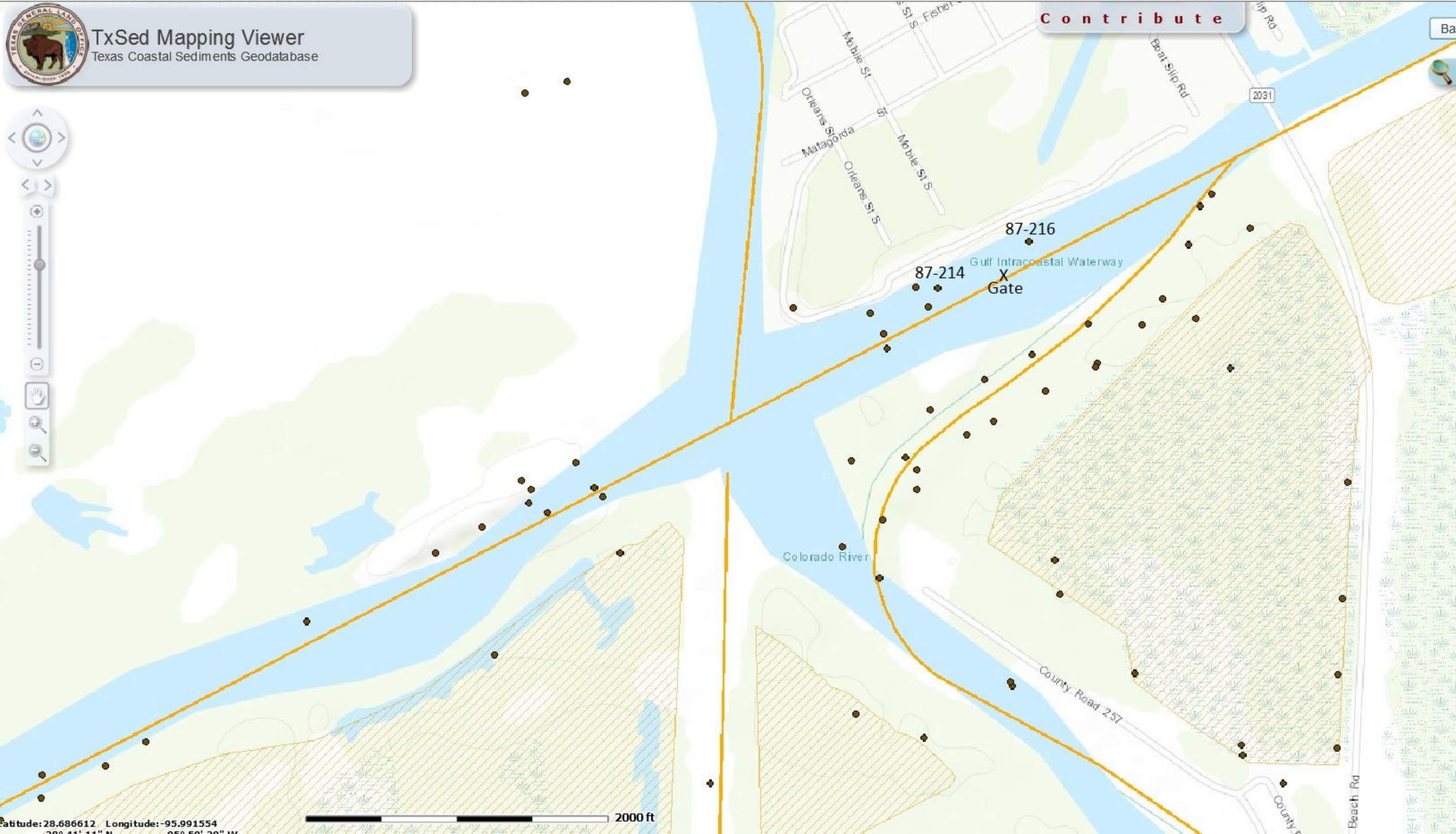
TETRA TECH
400 112TH AVE NE
SUITE 300 BELIEVE, WA 98004

DESIGNED BY: J.R./J.K.
DWN BY: D.S./ V.R.
CKD BY: D.L./G.K.
SUBMITTED BY: D LOVETT/G KOTZENBERGER
PLOT SCALE: 1:1
PLOT DATE: MM/DD/YYYY
SIZE: ANSI D
FILE NAME: C-102.dgn
DATE: DD-MON-YYYY
SOLICITATION NO.: N/A
CONTRACT NO.: N/A
FILE NUMBER: H-##-#####

GULF INTRACOASTAL WATERWAY
BRAZOS RIVER FLOODGATES AND COLORADO RIVER LOCKS SYSTEMS, FEASIBILITY STUDY
ENGINEERING APPENDIX DRAWINGS

COLORADO RIVER LOCK
FINAL SITE PLAN

SHEET IDENTIFICATION
C-102


TxSed Mapping Viewer
Texas Coastal Sediments Geodatabase
Contribute
Mobile St
Orleans St
Matagorda
Orleans St S
Mobile St S
Boat Slip Rd
2031
87-216
87-214
Gulf Intracoastal Waterway
X
Gate
Colorado River
County Road 257
2000 ft
Latitude: 28.686612 Longitude: -95.991554

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT ~~Brazos River Floodgates and~~ Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-214

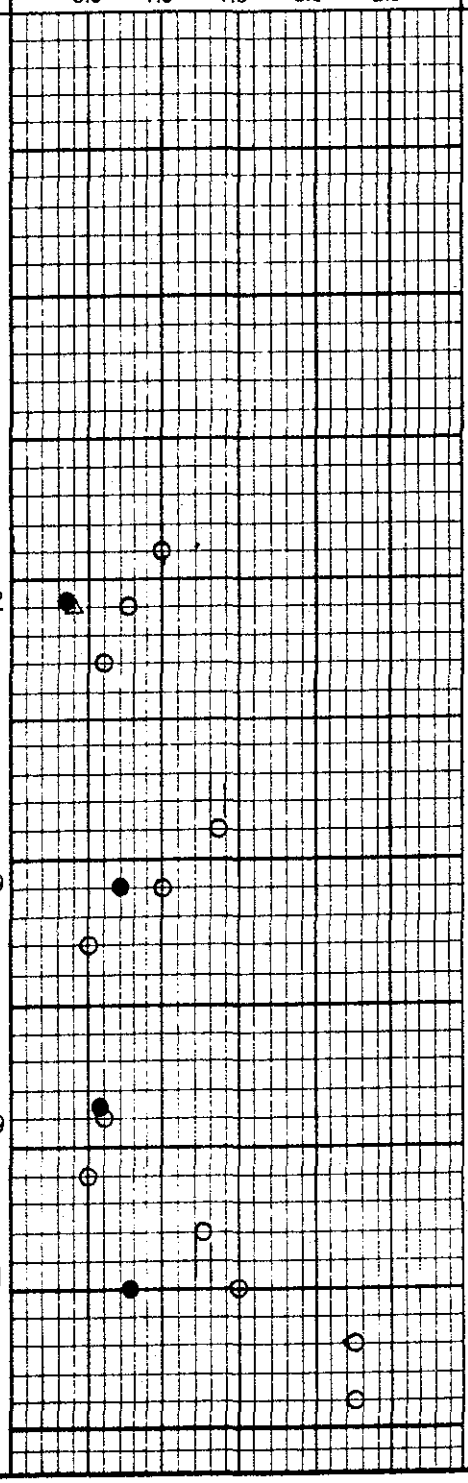
DATE 01-13-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	LIQUID LIMIT	PLASTIC LIMIT
0								
5			Water					
10								
15								
			Light Gray & Tan Clay w/Shell Fragments 18'-20' (CH)		38			
20			Light Gray & Tan Silty Clay - Firm to Stiff (CL) - w/Sand Partings		26	102	40	17
					20			
25			Light Gray & Tan Sand - Medium Dense (SM)	18	23			
			Reddish Brown Silty Clay - Stiff to Very Stiff (CL)		30			
30			w/Sand Pockets & Calcareous Nodules 32'-34'		30	99	48	24
					27			
35			Gray Clay - Stiff (CH) w/Sand Pockets 34'-36'	27	44			
			w/Shell Fragments & Sand Pockets 38'-40'		46	79	58	26
40			Gray Sandy Clay - Stiff to Very Stiff (CL)		22			
			- w/Thin Sand Layers 42'-44'		20			
45			- Reddish Brown Below 46'		20	111	38	17
					17			
			w/Calcareous Nodules 48'-50'		17			
50								

SHEAR STRENGTH, TSF

O – POCKET PENETROMETER
✖ – LABORATORY CONFINED
● – LABORATORY UNCONFINED
△ – TORVANE

0.5 1.0 1.5 2.0 2.5



AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-214

DATE 01-13-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Reddish Brown & Gray Sandy Clay (CL)		16	119	● O	26	14
			Bottom @ 52'						
55									

Water Boring East Mooring Cell

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

SUMMARY OF LABORATORY TEST DATA

PROJECT: ~~Brazos River Floodgates~~ and Colorado River Locks

BORING NUMBER	DEPTH IN FEET	MOISTURE, %	DRY DENSITY, PCF	COMPRES-SION, TSF	STRAIN, %	TYPE FAILURE	LAT. PRESSURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE (NO. 200)	CONSOLI-DATION	TORVANE
87-214													
1J	18'-20'	38.1											
2C	20'-22'	26.1	101.6	0.74	2.67	V.Split		40	17	23	94.2		0.4
3C	22'-24'	20.4											
4J	26'-28'	22.7									21.6		
5C	28'-30'	29.5											
6C	30'-32'	29.9	98.8	1.40	5.67	Bulge		48	24	24	94.1		
7C	32'-34'	27.1											
8J	34'-36'	44.3											
9C	38'-40'	45.8	79.4	1.15	5.67	Bulge		58	26	32	85.5		
10C	40'-42'	21.8											
11C	42'-44'	20.3											
12C	44'-46'	19.6	110.6	1.57	5.00	Bulge		38	17	21	75.9		
13C	46'-48'	16.8											
14C	48'-50'	16.7											
15C	50'-52'	16.3	119.0	1.19	3.00	Bulge & V.Split		26	14	12	71.3		

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT ~~Brazos River Floodgates and~~ Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-216

DATE 01-14-88 TYPE 3" Core - Hayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
0			Water						
5									
10									
15									
20			Crushed Shell w/Clay Binding		13			NP	NP
25			Tan Fine Sand (SM) - w/Shell Fragments		20				
			Reddish Brown Clay - Very Stiff (CH)	27	25				
30			- w/Silt Pockets 30'-34'		34				
					36	90		76	32
			Gray & Tan w/Sand Pockets 34'-36'		26				
35			Reddish Brown Sandy Clay (CL)	28	21			34	16
40			Reddish Brown Clay - Stiff to Very Stiff (CH)		27	99		53	23
			- w/Shell Fragments 40'-44'		26				
			Gray w/Sand Pockets 42'-48'		23	106		52	20
45					18				
			Gray & Tan Snady Clay (CL)		20	112		26	16
50									

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-216

DATE 01-14-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Gray & Tan Sandy Clay to Clayey Sand (CL) (SC)		21		O		
			Bottom @ 52'						
55									
10									
15									
20									
25									
30									
35									
40									
45									
50									

Water Boring East Boring wall

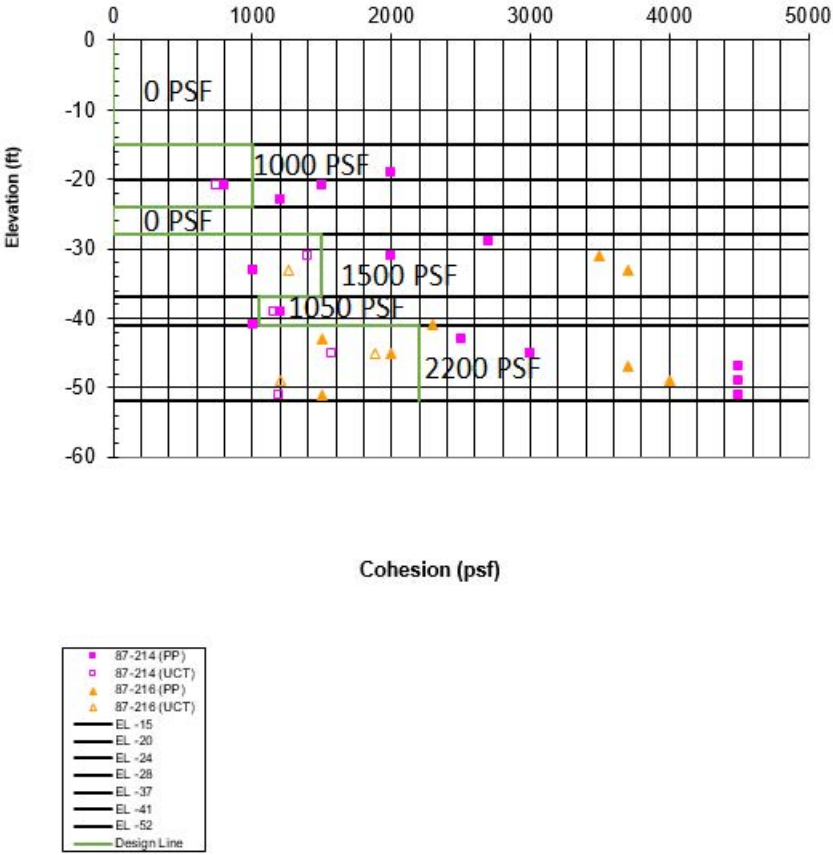
AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

SUMMARY OF LABORATORY TEST DATA

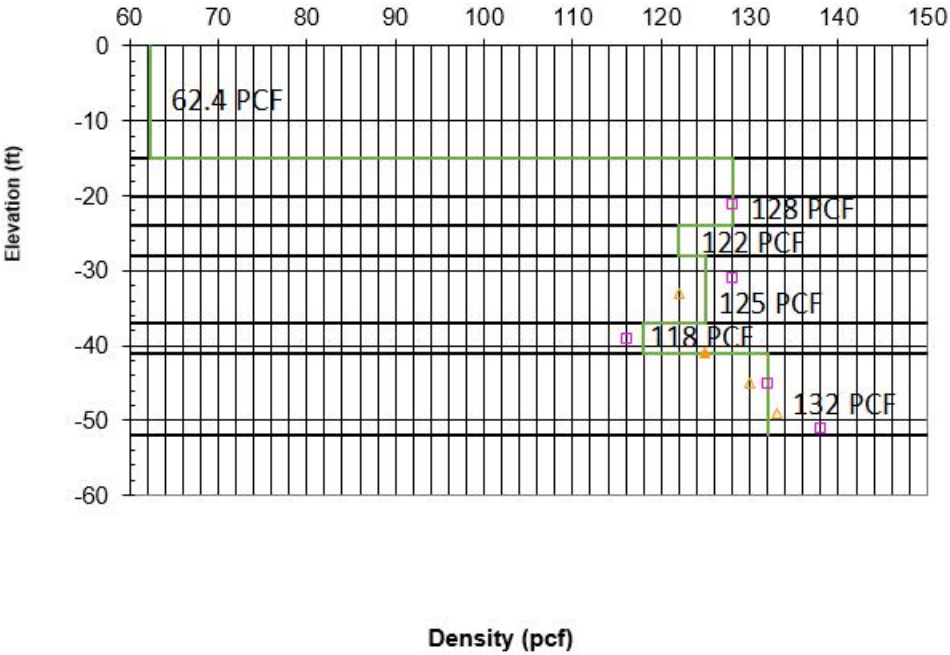
PROJECT: [redacted] and Colorado River Locks

BORING NUMBER	DEPTH IN FEET	MOISTURE, %	DRY DENSITY, PCF	COMPRES-SION, TSF	STRAIN, %	TYPE FAILURE	LAT. PRESSURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE (NO. 200)	CONSOLI-DATION	SWELL, %
87-216													
1J	20'-22'	12.8						NP	NP		21.9		
2J	26'-28'	20.4											
3J	28'-30'	24.8									31.6		
4C	30'-32'	34.4											
5C	32'-34'	35.6	90.0	1.26	4.33	Bulge		76	32	44	99.3		
6C	34'-36'	25.5											
7J	36'-38'	20.5						34	16	18	57.8		
8C	40'-42'	26.6	98.8					53	23	30	56.5		
9C	42'-44'	25.7											
10C	44'-46'	22.9	105.8	1.88	4.33	45° S		52	20	32	79.1		
11C	46'-48'	18.3											
12C	48'-50'	19.6	111.6	1.20	7.00	Bulge		26	16	10	50.9		
13C	50'-52'	21.3											

East of CRL Soil Parameters Reach 1

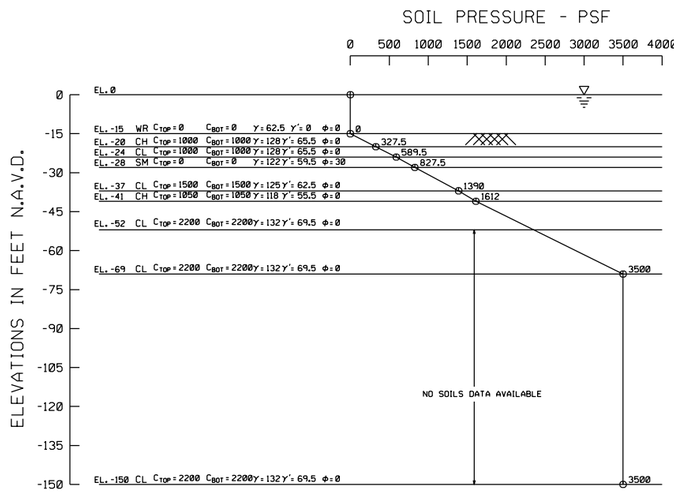


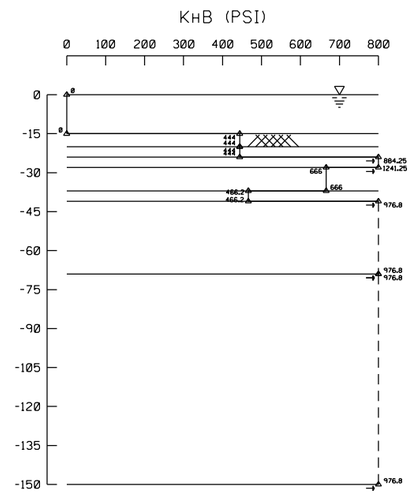
East of CRL Soil Parameters Reach 1

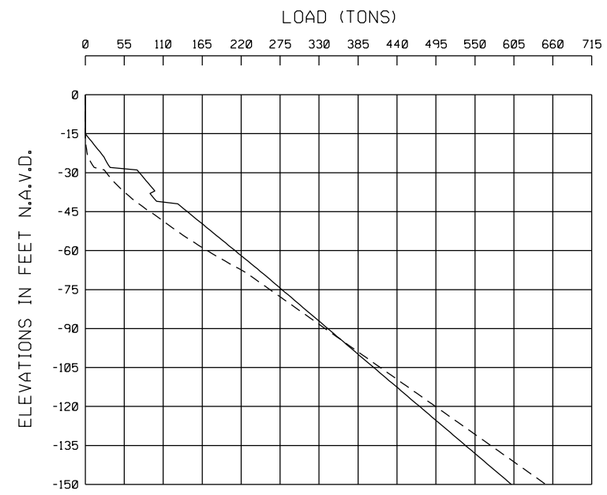


- 87-214 (PP)
- 87-214 (UCT)
- 87-216 (PP)
- 87-216 (UCT)
- EL -15
- EL -20
- EL -24
- EL -28
- EL -37
- EL -41
- EL -52
- Design Line

APPENDIX B



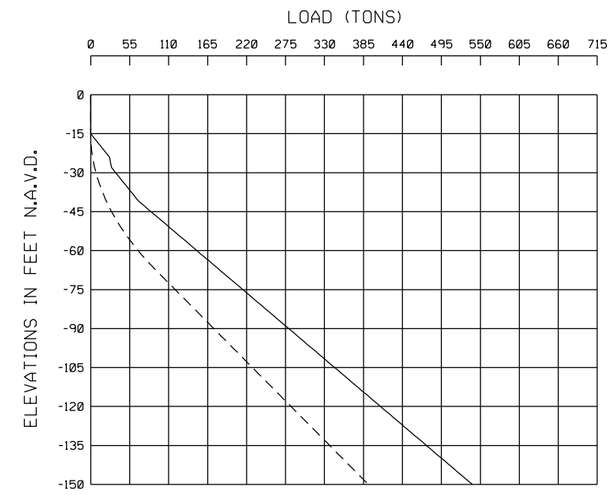




COMPRESSION (S.F.=1.0)

——— Q-CASE

— — S-CASE



TENSION (S.F.=1.0)

——— Q-CASE

— — S-CASE

EL	SOIL TYPE	Q-CASE				S-CASE			
		Kc	Kt	Nc	Nq	Kc	Kt	Nc	Nq
-15	WTR	0	0	0	1	1	0	0	10
-20	CH	1	0.7	9	1	1	0.7	0	10
-24	CL	1	0.7	9	1	1	0.7	0	10
-28	SM	1.5	0.5	0	22.5	1.5	0.5	0	22.5
-37	CL	1	0.7	9	1	1	0.7	0	10
-41	CH	1	0.7	9	1	1	0.7	0	10
-150	CL	1	0.7	9	1	1	0.7	0	10

D	PILE SPACING IN DIRECTION OF LOADING
1.00	8B
.85	7B
.70	6B
.55	5B
.40	4B
.25	3B
C	LOADING CONDITION
1.00	INITIAL LOADING
0.30	CYCLIC LOADING

NOTES: KH = e K1/B = (0.2222 q_u/B) (KN) COHESIVE

e = 0.4 = Factor of material properties of soil and pile

k1 = Modulus of subgrade reaction for test plate (pci)

B1 = Width or diameter of test plate (in)

K1 = k1B1 = 80 q_u (pcf) = 0.5556 q_u (psi)

q_u = 2 c = Unconfined compressive strength (psf)

C = Reduction for cyclic loading-not applicable

D = Group effect reduction factor

B = Width of pile measured at right angles to the direction of displacement (in)

KH = (nhXZ/B) (KN) COHESIONLESS

nh = Coeficient of horizontal subgrade reaction (pci)

Z = Depth below equivalent ground surface (in)

THE FACTOR SHOWN (MODULUS OF HORIZONTAL SUBGRADE K_h) TIMES THE PILE WIDTH IN INCHES (B) MEASURED AT RIGHT ANGLES TO THE DIRECTION OF DISPLACEMENT) MUST BE MODIFIED BY A REDUCTION FACTOR FOR THE EFFECT OF GROUP ACTION (D) AND A REDUCTION FACTOR FOR CYCLIC LOADING (C) EX: $K_h = \frac{0.2222 q_u (C)(D)}{B}$

DUE TO THE LACK OF PROXIMATE GEOTECHNICAL DATA, THE FOLLOWING FACTORS OF SAFETY ARE RECOMMENDED FOR DESIGN:

	FS w / Load test	FS w /o Load test
Q-case	2	3.5
S-case	1.5	2

Brazos River Flood Gate and Colorado River Locks

East Colorado Flood Gate

Pile Capacity Curves

30"x5/8" Pipe Pile

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

DESIGNED BY: JMS
DRAWN BY: CKD
CHECKED BY: CKD

PLOT SCALE: PLOT DATE: CADD FILE: 0
FILE NO.
DATE:

CAPACITY OF PILE GROUPS

The maximum allowable load carrying capacity of a pile group is no greater than the sum of the single pile load capacities, but may be limited to a lower value if so indicated by the result of the following formula.

$$Q_a = \frac{P \ x \ L \ x \ c}{(FSF)} + \frac{2.6 \ q_u \ (1 + 0.2 \ \frac{w}{b}) \ A}{(FSB)}$$

In Which:

Q_a	=	Allowable load carrying capacity of pile group, lb
P	=	Perimeter distance of pile group, ft
L	=	Length of pile, ft
c	=	Average (weighted) cohesion or shear strength of material between surface and depth of pile tip, psf
q_u	=	Average unconfined compressive strength of material in the zone immediately below pile tips, psf (unconfined compressive strength = cohesion x 2)
w	=	Width of base of pile group, ft
b	=	Length of base of pile group, ft
A	=	Base area of pile group, sq ft
(FSF)	=	Factor of safety for the friction area = 2
(FSB)	=	Factor of safety for the base area = 3

The values of c and q_u used in this formula should be based on applicable soil data shown on the Log of Boring and Test Results for this report. In the application of this formula, the weight of the piles, pile caps and mats, considering the effect of buoyancy, should be included.

SPACING WITHIN PILE GROUPS

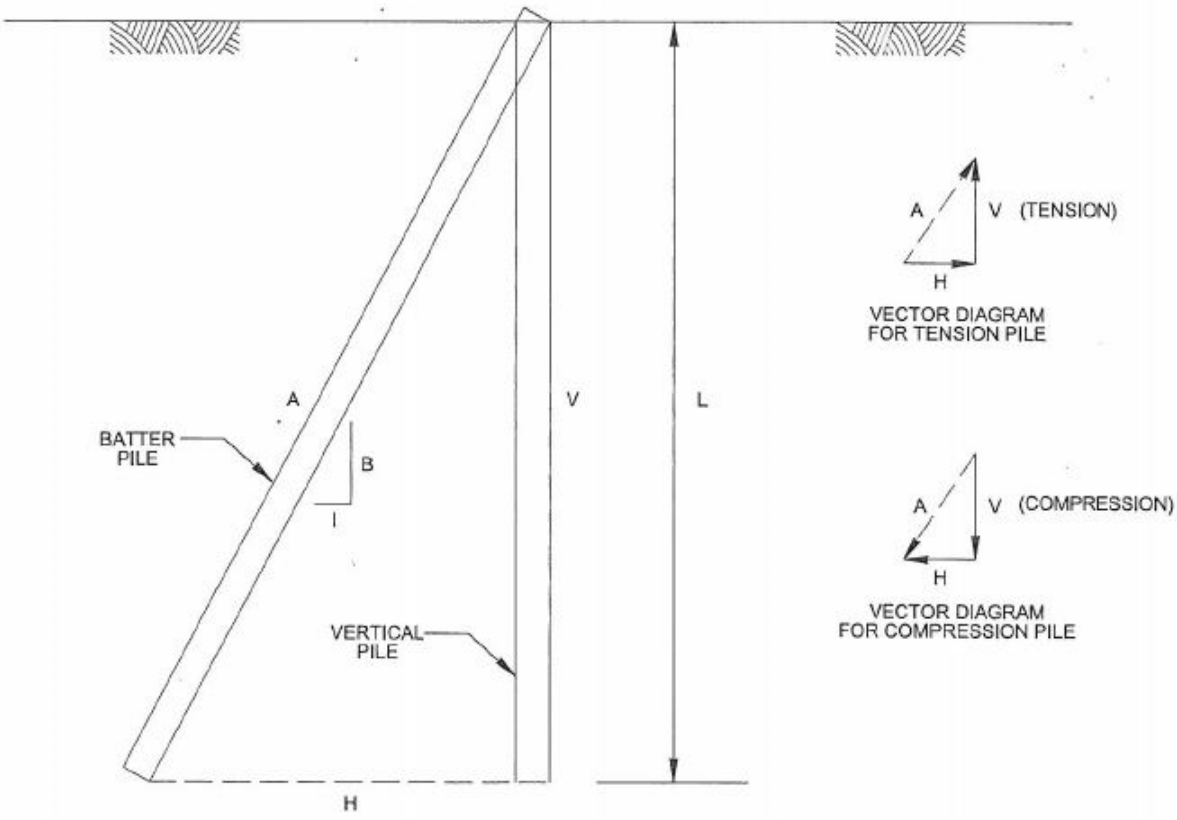
$$SPAC = 0.05 (L_1) + 0.025 (L_2) + 0.0125 (L_3)$$

In Which:

SPAC	=	Center to center of piles, feet
L_1	=	Pile penetration up to 100 feet
L_2	=	Pile penetration from 101 to 200 feet
L_3	=	Pile penetration beyond 200 feet

NOTE: Minimum pile spacing = 3 feet or 3 pile diameters, whichever is greater

AXIAL AND HORIZONTAL RESISTANCE OF BATTER PILES
ESTIMATED FROM ALLOWABLE VERTICAL LOAD CAPACITIES



L = VERTICAL COMPONENT OF BATTER PILE EMBEDMENT LENGTH.

V = ESTIMATED ALLOWABLE SINGLE LOAD CAPACITY OF A PILE DRIVEN VERTICALLY WITH EMBEDMENT LENGTH, L.

B = BATTER OF PILE EXPRESSED AS A RATIO OF VERTICAL DISTANCE TO ONE FOOT HORIZONTAL DISTANCE.

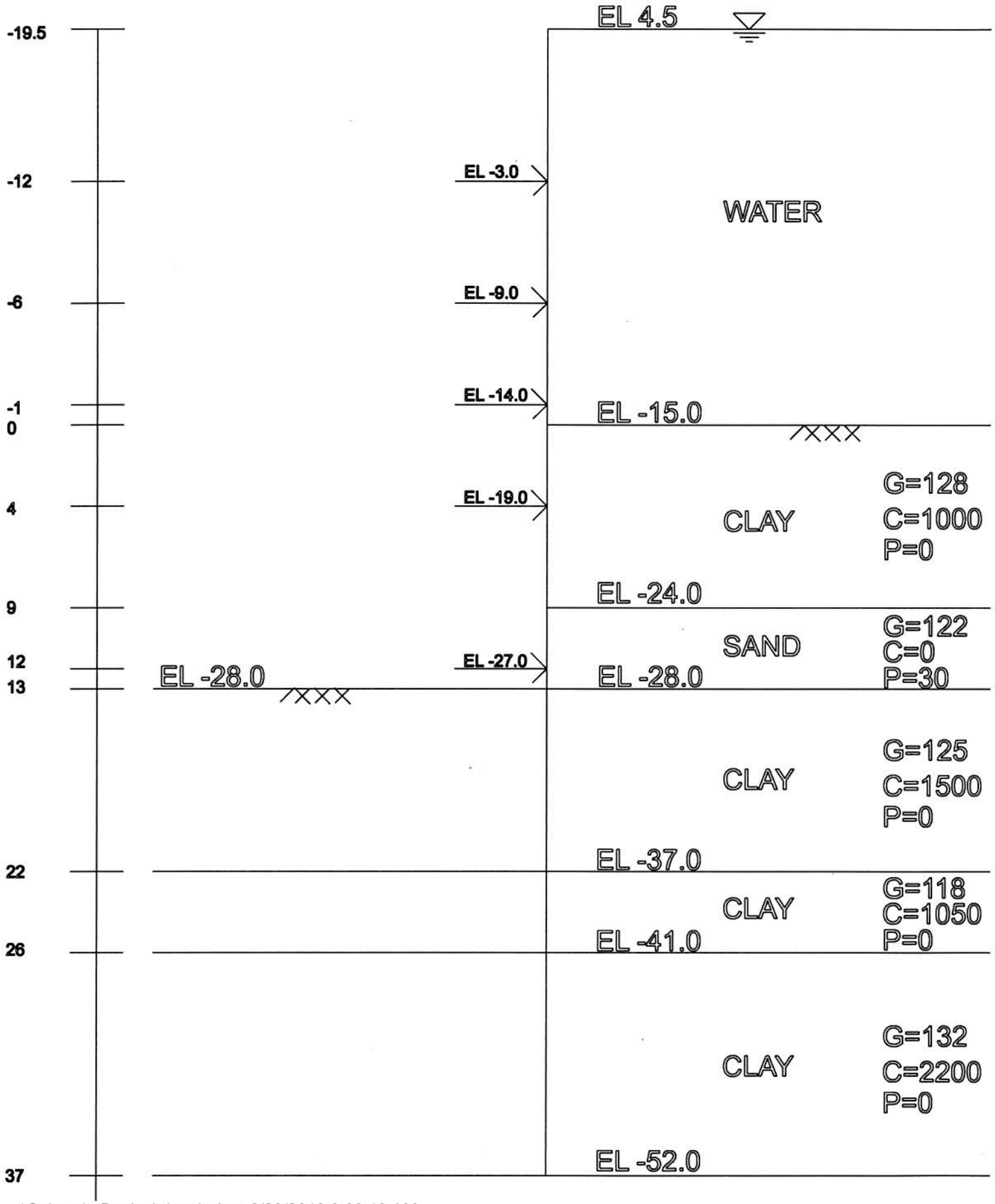
H = HORIZONTAL RESISTANCE OF BATTER PILE ESTIMATED AS FOLLOWS: $H = \frac{V}{B}$

A = ALLOWABLE AXIAL PILE LOAD CAPACITY OF A SINGLE BATTER PILE ESTIMATED AS FOLLOWS: $A = \sqrt{V^2(1+\frac{1}{B^2})}$

NOTE: THE AXIAL LOAD RESISTANCE OF A VERTICAL PILE, V, IS DEPENDENT ON THE TYPE OF LOADING - TENSION OR COMPRESSION. CAUTION SHOULD BE EXERCISED TO ENSURE THE CORRECT VERTICAL CAPACITY IS USED.

APPENDIX C

COLORADO RIVER - EAST



...\Colorado Design\sketch.dgn 8/20/2018 9:08:19 AM

Colorado River - East Side

	Stages				Design						
	Braces	Water	Ground	Tip EL (ft)	Moment (ft#/ft)	Brace @ EL -3 (#/ft)	Brace @ EL -9 (#/ft)	Brace @ EL -14 (#/ft)	Brace @ EL -19 (#/ft)	* Brace @ EL -27 (#/ft)	Software
Stage 1	None	@ EL 4.5 & EL -4	@ EL -15 & EL -16	-38.6	103750.0	NONE	NONE	NONE	NONE	NONE	CWALSHT
Stage 1	None	@ EL 4.5 & EL -4	@ EL -15 & EL -16	-32.84	90818.5	NONE	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 2	@ EL -3	@ EL 4.5 & EL -10	@ EL -15 & EL -16	-21.35	22721.0	7418.2	NONE	NONE	NONE	NONE	CWALSHT
Stage 2	@ EL -3	@ EL 4.5 & EL -10	@ EL -15 & EL -16	-22.07	20183.4	7328.9	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 3	@ EL -3 & EL -9	@ EL 4.5 & EL -15	@ EL -15 & EL -16	-22.45	5827.9	3441.2	6466.6	NONE	NONE	NONE	SUPPORT IT
Stage 4	@ EL -3 & EL -9 & EL -14	@ EL 4.5 & EL -20	@ EL -15 & EL -20	-32.39	14416.4	3438.7	4528.3	8263.7	NONE	NONE	SUPPORT IT
Stage 5	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 4.5 & EL -28	@ EL -15 & EL -28	-41.04	35283.8	3439.8	4532.4	5750.6	8514.2	NONE	SUPPORT IT
Stage 6 *	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 4.5 & EL -31	@ EL -15 & EL -28	-41.64	38207.1	3454.6	4515.3	5731.8	13962.0	NONE	SUPPORT IT
Stage 7 *	@ EL -3 & EL -9 & EL -14 & EL -19 & EL -27	@ EL 4.5 & EL -31	@ EL -15 & EL -28	-30.84	10165.9	3439.3	4530.5	5748.4	10029.8	10758.0	SUPPORT IT

Indicates design value

FOS = 1.3 for Tip EL and Moment

FOS = 1.0 for Brace Loads

* Lowest brace is assumed to be a tremie slab

```
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3
CONTROL  CANTILEVER  DESIGN  1.30  1.30
WALL   4.5
SURFACE RIGHTSIDE   2    0   -15
                  200   -15
SURFACE LEFTSIDE   2    0   -16
                  200   -16
SOIL RIGHTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
SOIL LEFTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
WATER ELEVATIONS   62.5    4.5   -4
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:05:15

```
***************
*  INPUT DATA  *
***************

 I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--CONTROL
   CANTILEVER WALL DESIGN
   FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
   FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

III.--WALL DATA
   ELEVATION AT TOP OF WALL    = 4.50 FT.

IV.--SURFACE POINT DATA

     IV.A.--RIGHTSIDE
        DIST. FROM     ELEVATION
        WALL (FT)         (FT)
             0.00        -15.00
           200.00        -15.00

     IV.B.--LEFTSIDE
        DIST. FROM     ELEVATION
        WALL (FT)         (FT)
             0.00        -16.00
           200.00        -16.00

 V.--SOIL LAYER DATA

    V.A.--RIGHTSIDE
        LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
        LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT
```

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
128.00	128.00	0.00	1000.00	0.00	0.00	-24.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF

125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
128.00	128.00	0.00	1000.00	0.00	0.00	-24.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF
125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -4.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 20-AUGUST-2018 TIME: 13:05:31

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*   SOIL PRESSURES FOR   *
* CANTILEVER WALL DESIGN *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

				<------NET------>			
	NET	<---LEFTSIDE--->		(SOIL + WATER)		<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	PASSIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	437.5	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	500.0	0.0	0.0
-4.0	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-4.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-5.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-6.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-7.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-8.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-9.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-10.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-11.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-12.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-13.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-14.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-15.0+	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-15.0-	531.3	0.0	0.0	531.3	2069.7	0.0	1538.5
-15.5	531.3	0.0	0.0	531.3	2102.5	0.0	1571.2
-16.0+	531.3	0.0	0.0	531.3	2135.2	0.0	1604.0
-16.0-	531.3	1538.5	0.0	-1007.2	2135.2	0.0	1604.0
-16.5	531.3	1571.2	0.0	-1040.0	2168.0	0.0	1636.7
-17.0	531.3	1604.0	0.0	-1072.7	2200.7	0.0	1669.5
-17.5	531.3	1636.7	0.0	-1105.5	2233.5	0.0	1702.2
-18.5	531.3	1702.2	0.0	-1171.0	2299.0	0.0	1767.7

-19.5	531.3	1767.7	0.0	-1236.5	2364.5	0.0	1833.2
-20.5	531.3	1833.2	0.0	-1302.0	2430.0	0.0	1898.7
-21.5	531.3	1898.7	0.0	-1367.5	2495.5	0.0	1964.2
-22.5	531.3	1964.2	0.0	-1433.0	2561.0	0.0	2029.7
-23.5	531.3	2029.7	0.0	-1498.5	2626.5	0.0	2095.2
-24.0	531.3	1723.0	0.0	-1191.8	2372.1	0.0	1840.8
-24.5	531.3	1426.4	0.0	-895.2	2126.5	0.0	1595.3
-25.5	531.3	1549.8	0.0	-1018.5	2246.7	0.0	1715.4
-26.5	531.3	1676.0	0.0	-1144.7	2371.2	0.0	1840.0
-27.5	531.3	1803.0	0.0	-1271.8	2496.1	0.0	1964.8
-28.0	531.3	2473.3	0.0	-1942.1	3117.9	0.0	2586.7
-28.5	531.3	3123.6	0.0	-2592.4	3720.4	0.0	3189.1
-29.5	531.3	3186.1	0.0	-2654.9	3782.9	0.0	3251.6
-30.5	531.3	3248.6	0.0	-2717.4	3845.4	0.0	3314.1
-31.5	531.3	3303.0	0.0	-2771.7	3901.8	0.0	3370.5
-32.5	531.3	3357.0	0.0	-2825.7	3955.7	0.0	3424.5
-33.5	531.3	3419.1	0.0	-2887.8	4015.8	0.0	3484.6
-34.5	531.3	3481.6	0.0	-2950.3	4078.3	0.0	3547.1
-35.5	531.3	3544.1	0.0	-3012.8	4140.8	0.0	3609.6
-36.5	531.3	3606.6	0.0	-3075.3	4203.3	0.0	3672.1
-37.0	531.3	3290.0	0.0	-2758.7	3886.7	0.0	3355.5
-37.5	531.3	2971.6	0.0	-2440.3	3568.3	0.0	3037.1
-38.5	531.3	3027.1	0.0	-2495.8	3623.8	0.0	3092.6
-39.5	531.3	3082.6	0.0	-2551.3	3679.3	0.0	3148.1
-40.5	531.3	3138.1	0.0	-2606.8	3734.8	0.0	3203.6
-41.0	531.3	4054.4	0.0	-3523.1	4651.1	0.0	4119.9
-41.5	531.3	4974.1	0.0	-4442.9	5570.9	0.0	5039.6
-42.5	531.3	5043.6	0.0	-4512.4	5640.4	0.0	5109.1
-43.5	531.3	5113.1	0.0	-4581.9	5709.9	0.0	5178.6
-44.5	531.3	5182.6	0.0	-4651.4	5779.4	0.0	5248.1
-45.5	531.3	5252.1	0.0	-4720.9	5848.9	0.0	5317.6
-46.5	531.3	5321.6	0.0	-4790.4	5918.4	0.0	5387.1
-47.5	531.3	5391.1	0.0	-4859.9	5987.9	0.0	5456.6
-48.5	531.3	5460.6	0.0	-4929.4	6057.4	0.0	5526.1
-49.5	531.3	5530.1	0.0	-4998.9	6126.9	0.0	5595.6
-50.5	531.3	5599.6	0.0	-5068.4	6196.4	0.0	5665.1
-51.5	531.3	5669.1	0.0	-5137.9	6265.9	0.0	5734.6
-52.0	531.3	5703.9	0.0	-5172.6	6300.6	0.0	5769.4
-52.5	531.3	5738.6	0.0	-5207.4	6335.4	0.0	5804.1
-53.5	531.3	5804.4	0.0	-5273.2	6404.9	0.0	5873.6
-54.5	531.3	5869.8	0.0	-5338.5	6474.4	0.0	5943.1
-55.5	531.3	5938.9	0.0	-5407.6	6540.3	0.0	6009.0
-56.5	531.3	6008.4	0.0	-5477.1	6605.6	0.0	6074.4
-57.5	531.3	6077.9	0.0	-5546.6	6674.6	0.0	6143.4
-58.5	531.3	6147.4	0.0	-5616.1	6744.1	0.0	6212.9
-59.5	531.3	6216.9	0.0	-5685.6	6813.6	0.0	6282.4
-60.5	531.3	6286.4	0.0	-5755.1	6883.1	0.0	6351.9
-61.5	531.3	6355.9	0.0	-5824.6	6952.6	0.0	6421.4

-62.5	531.3	6425.4	0.0	-5894.1	7022.1	0.0	6490.9
-63.5	531.3	6494.9	0.0	-5963.6	7091.6	0.0	6560.4
-64.5	531.3	6564.4	0.0	-6033.1	7161.1	0.0	6629.9
-65.5	531.3	6633.9	0.0	-6102.6	7230.6	0.0	6699.4
-66.5	531.3	6703.4	0.0	-6172.1	7300.1	0.0	6768.9
-67.5	531.3	6772.9	0.0	-6241.6	7369.6	0.0	6838.4
-68.5	531.3	6842.4	0.0	-6311.1	7439.1	0.0	6907.9
-69.5	531.3	6911.9	0.0	-6380.6	7508.6	0.0	6977.4
-70.5	531.3	6981.4	0.0	-6450.1	7578.1	0.0	7046.9
-71.5	531.3	7050.9	0.0	-6519.6	7647.6	0.0	7116.4
-72.5	531.3	7120.4	0.0	-6589.1	7717.1	0.0	7185.9
-73.5	531.3	7189.9	0.0	-6658.6	7786.6	0.0	7255.4
-74.5	531.3	7259.4	0.0	-6728.1	7856.1	0.0	7324.9
-75.5	531.3	7328.9	0.0	-6797.6	7925.6	0.0	7394.4
-76.5	531.3	7398.4	0.0	-6867.1	7995.1	0.0	7463.9
-77.5	531.3	7467.9	0.0	-6936.6	8064.6	0.0	7533.4
-78.5	531.3	7537.4	0.0	-7006.1	8134.1	0.0	7602.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:05:32

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*  SUMMARY OF RESULTS FOR  *
*  CANTILEVER WALL DESIGN  *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

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WALL BOTTOM ELEV. (FT)     :      -38.60
      PENETRATION (FT)     :       22.60

MAX. BEND. MOMENT (LB-FT)  :  1.0375E+05
      AT ELEVATION (FT)    :      -22.98

MAX. SCALED DEFL. (LB-IN^3):  8.9546E+10
      AT ELEVATION (FT)    :        4.50

          NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                 ELLASTICITY IN PSI TIMES PILE MOMENT
                 OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                 IN INCHES.
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:05:32

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* COMPLETE OF RESULTS FOR  *
*  CANTILEVER WALL DESIGN  *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 1 - 1.3

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	8.9546E+10	0.00
3.50	1.0417E+01	31.	8.6152E+10	62.50
2.50	8.3333E+01	125.	8.2758E+10	125.00
1.50	2.8125E+02	281.	7.9364E+10	187.50
0.50	6.6667E+02	500.	7.5970E+10	250.00
-0.50	1.3021E+03	781.	7.2578E+10	312.50
-1.50	2.2500E+03	1125.	6.9188E+10	375.00
-2.50	3.5729E+03	1531.	6.5802E+10	437.50
-3.50	5.3333E+03	2000.	6.2422E+10	500.00
-4.00	6.3971E+03	2258.	6.0735E+10	531.25

-4.50	7.5924E+03	2523.	5.9052E+10	531.25
-5.50	1.0382E+04	3055.	5.5694E+10	531.25
-6.50	1.3702E+04	3586.	5.2355E+10	531.25
-7.50	1.7553E+04	4117.	4.9039E+10	531.25
-8.50	2.1936E+04	4648.	4.5754E+10	531.25
-9.50	2.6850E+04	5180.	4.2507E+10	531.25
-10.50	3.2296E+04	5711.	3.9306E+10	531.25
-11.50	3.8272E+04	6242.	3.6161E+10	531.25
-12.50	4.4780E+04	6773.	3.3083E+10	531.25
-13.50	5.1819E+04	7305.	3.0082E+10	531.25
-14.50	5.9389E+04	7836.	2.7170E+10	531.25
-15.00	6.3374E+04	8102.	2.5752E+10	531.25
-15.50	6.7491E+04	8367.	2.4361E+10	531.25
-16.00+	7.1741E+04	8633.	2.3000E+10	531.25
-16.00-	7.1741E+04	8633.	2.3000E+10	-1007.21
-16.50	7.5930E+04	8121.	2.1669E+10	-1039.96
-17.00	7.9859E+04	7593.	2.0371E+10	-1072.71
-17.50	8.3520E+04	7048.	1.9108E+10	-1105.46
-18.50	9.0005E+04	5910.	1.6691E+10	-1170.96
-19.50	9.5319E+04	4706.	1.4429E+10	-1236.46
-20.50	9.9396E+04	3437.	1.2332E+10	-1301.96
-21.50	1.0217E+05	2102.	1.0407E+10	-1367.46
-22.50	1.0358E+05	702.	8.6579E+09	-1432.96
-23.50	1.0355E+05	-763.	7.0876E+09	-1498.46
-24.00	1.0300E+05	-1436.	6.3695E+09	-1191.76
-24.50	1.0214E+05	-1958.	5.6960E+09	-895.15
-25.50	9.9717E+04	-2915.	4.4807E+09	-1018.55
-26.50	9.6272E+04	-3996.	3.4377E+09	-1144.75
-27.50	9.1682E+04	-5205.	2.5608E+09	-1271.78
-28.00	8.8893E+04	-6008.	2.1823E+09	-1942.09
-28.30	8.6976E+04	-6657.	1.9716E+09	-2336.39
-28.50	8.5622E+04	-7105.	1.8422E+09	-2222.36
-29.50	7.7502E+04	-9038.	1.2712E+09	-1642.96
-30.50	6.7739E+04	-10391.	8.3385E+08	-1063.57
-31.50	5.6913E+04	-11165.	5.1343E+08	-484.17
-32.50	4.5602E+04	-11359.	2.9129E+08	95.22
-33.50	3.4387E+04	-10975.	1.4796E+08	674.62
-34.50	2.3846E+04	-10010.	6.4157E+07	1254.01
-35.50	1.4560E+04	-8466.	2.1736E+07	1833.41
-36.50	7.1066E+03	-6343.	4.7387E+06	2412.81
-37.00	4.2485E+03	-5065.	1.6239E+06	2702.50
-37.50	2.0662E+03	-3641.	3.6876E+05	2992.20
-38.50	1.7943E+01	-359.	2.5738E+01	3571.60
-38.60	0.0000E+00	0.	0.0000E+00	3629.36

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELLASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION

IN INCHES.

III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.00	531.	0.	0.	0.	0.
-4.50	531.	0.	0.	0.	0.
-5.50	531.	0.	0.	0.	0.
-6.50	531.	0.	0.	0.	0.
-7.50	531.	0.	0.	0.	0.
-8.50	531.	0.	0.	0.	0.
-9.50	531.	0.	0.	0.	0.
-10.50	531.	0.	0.	0.	0.
-11.50	531.	0.	0.	0.	0.
-12.50	531.	0.	0.	0.	0.
-13.50	531.	0.	0.	0.	0.
-14.50	531.	0.	0.	0.	0.
-15.00+	531.	0.	0.	0.	0.
-15.00-	531.	0.	0.	0.	1538.
-15.50	531.	0.	0.	0.	1571.
-16.00+	531.	0.	0.	0.	1604.
-16.00-	531.	1538.	0.	0.	1604.
-16.50	531.	1571.	0.	0.	1637.
-17.00	531.	1604.	0.	0.	1669.
-17.50	531.	1637.	0.	0.	1702.
-18.50	531.	1702.	0.	0.	1768.
-19.50	531.	1768.	0.	0.	1833.
-20.50	531.	1833.	0.	0.	1899.
-21.50	531.	1899.	0.	0.	1964.
-22.50	531.	1964.	0.	0.	2030.
-23.50	531.	2030.	0.	0.	2095.
-24.00	531.	1723.	0.	0.	1841.
-24.50	531.	1426.	0.	0.	1595.
-25.50	531.	1550.	0.	0.	1715.
-26.50	531.	1676.	0.	0.	1840.
-27.50	531.	1803.	0.	0.	1965.

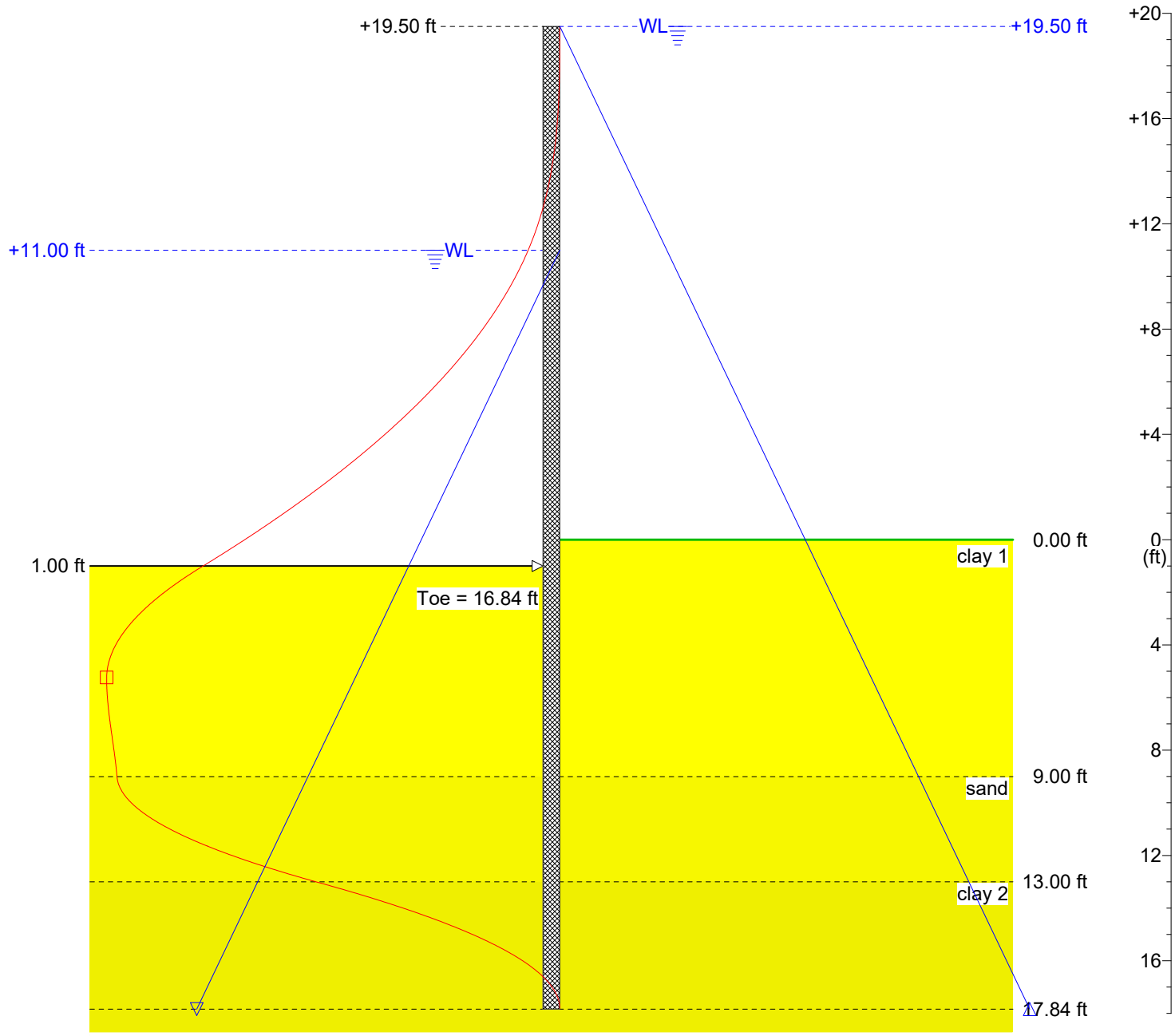
-28.00	531.	2473.	0.	0.	2587.
-28.30	531.	2868.	0.	0.	2952.
-28.50	531.	3124.	0.	0.	3189.
-29.50	531.	3186.	0.	0.	3252.
-30.50	531.	3249.	0.	0.	3314.
-31.50	531.	3303.	0.	0.	3371.
-32.50	531.	3357.	0.	0.	3424.
-33.50	531.	3419.	0.	0.	3485.
-34.50	531.	3482.	0.	0.	3547.
-35.50	531.	3544.	0.	0.	3610.
-36.50	531.	3607.	0.	0.	3672.
-37.00	531.	3290.	0.	0.	3355.
-37.50	531.	2972.	0.	0.	3037.
-38.50	531.	3027.	0.	0.	3093.
-38.60	531.	3083.	0.	0.	3148.
-40.50	531.	3138.	0.	0.	3204.

Title: Colorado River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

	Maximum	d (ft)
□	90818.5 ftlb/ft	5.24
△	2333.5 psf	17.84
△	1802.3 psf	17.84

Stage 1 - Tip and Moment only



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Title: Colorado River Flood Gate - East Side
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Works: Temporary
Pressure: Coulomb
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Toe: Cantilever

Stage 1 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = +11.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	16.84	37.34

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	531.3 psf	-10.97
Bending Moment	90818.5 ftlb/ft	5.24
Shear Force	8629.2 lb/ft	1.00

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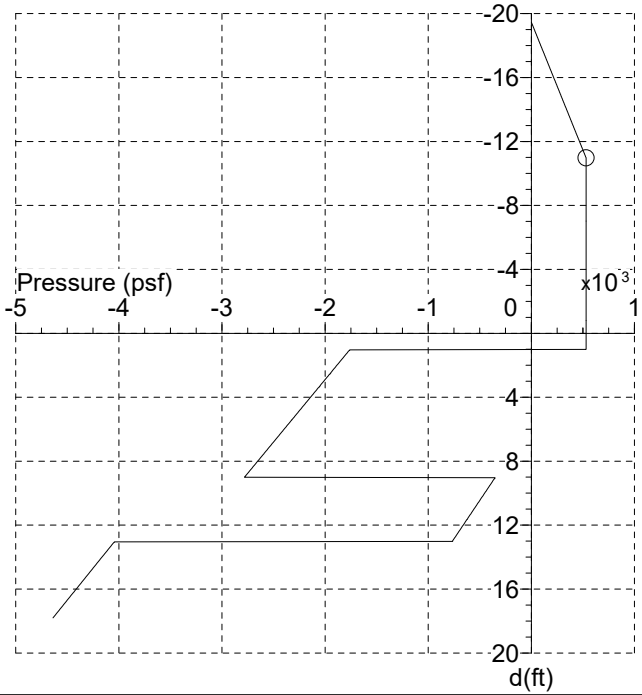
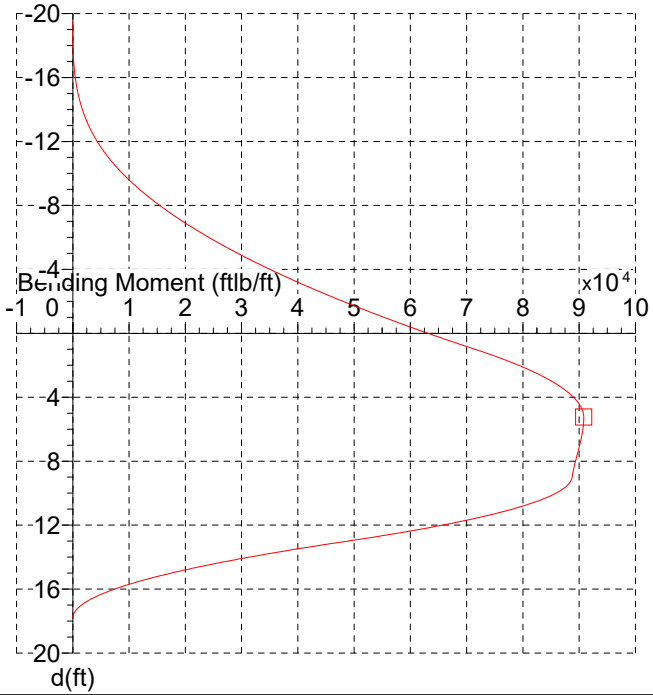
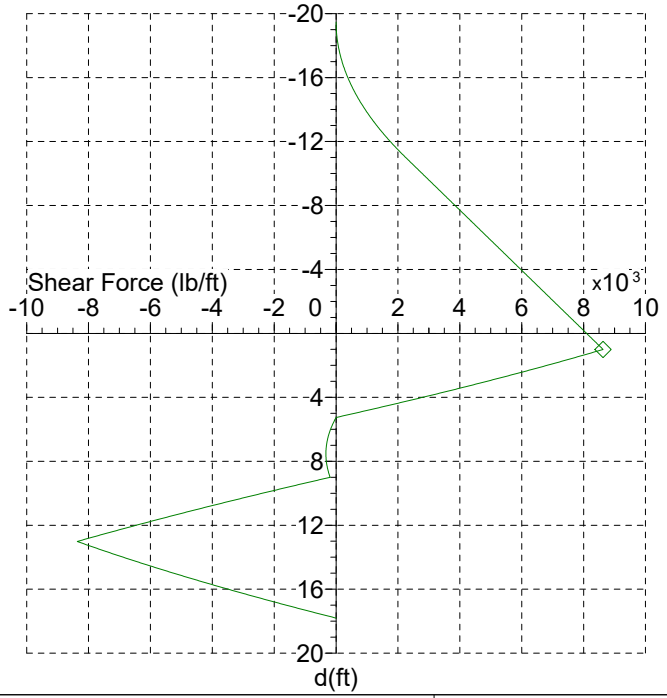
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

	Maximum	d (ft)
○	531.3 psf	-10.97
□	90818.5 ftlb/ft	5.24
◇	8629.2 lb/ft	1.00

Stage 1 - Tip and Moment only







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Title: Colorado River Flood Gate - East Side
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Toe: Cantilever

Stage 1 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	531.3	63195.7		8100.2	5.99	-2399.0	90659.7		-180.9	11.98	-659.2	65881.5		-6433.9
0.13	531.3	64206.6		8166.3	6.12	-2414.9	90605.8		-204.2	12.10	-672.2	64030.3		-6673.9
0.25	531.3	65225.6		8232.4	6.24	-2430.9	90545.6		-225.4	12.23	-685.1	62111.1		-6912.3
0.38	531.3	66511.0		8315.1	6.37	-2446.8	90479.5		-244.6	12.36	-698.1	60124.5		-7149.0
0.51	531.3	67548.5		8381.2	6.50	-2462.7	90408.2		-261.9	12.49	-714.3	57547.0		-7442.7
0.64	531.3	68594.3		8447.3	6.62	-2478.7	90332.2		-277.2	12.61	-727.2	55410.2		-7675.8
0.76	531.3	69648.3		8513.5	6.75	-2494.6	90252.1		-290.5	12.74	-740.2	53207.5		-7907.3
0.89	531.3	70710.6		8579.6	6.88	-2510.5	90168.4		-301.8	12.87	-753.1	50939.2		-8137.2
1.02	-1761.8	71781.1		8574.4	7.01	-2526.5	90081.8		-311.2	13.00	-762.8	48605.9		-8365.6
1.15	-1777.7	72837.5		8354.5	7.13	-2546.4	89970.0		-320.1	13.12	-4055.6	46251.3		-8184.8
1.27	-1793.7	73866.6		8132.5	7.26	-2562.3	89878.7		-324.9	13.25	-4071.2	43948.2		-8001.8
1.40	-1809.6	74867.9		7908.5	7.39	-2578.2	89786.1		-327.8	13.38	-4086.7	41697.2		-7817.0
1.53	-1825.5	75841.3		7682.6	7.52	-2594.2	89692.9		-328.7	13.50	-4102.3	39499.0		-7630.2
1.66	-1841.4	76786.5		7454.6	7.64	-2610.1	89599.7		-327.7	13.63	-4117.8	37353.9		-7441.4
1.78	-1861.4	77927.9		7166.9	7.77	-2626.0	89507.0		-324.6	13.76	-4133.4	35262.5		-7250.8
1.91	-1877.3	78808.7		6934.5	7.90	-2642.0	89415.4		-319.6	13.89	-4152.8	32724.8		-7009.7
2.04	-1893.2	79660.5		6700.1	8.03	-2657.9	89325.4		-312.6	14.01	-4168.4	30756.5		-6814.7
2.17	-1909.2	80483.1		6463.8	8.15	-2673.8	89237.6		-303.6	14.14	-4184.0	28843.7		-6617.7
2.29	-1925.1	81276.1		6225.4	8.28	-2689.8	89152.6		-292.6	14.27	-4199.5	26987.0		-6418.8
2.42	-1941.0	82039.4		5985.1	8.41	-2705.7	89070.9		-279.6	14.40	-4215.1	25186.9		-6218.0
2.55	-1953.0	82772.7		5742.9	8.54	-2725.6	88974.3		-260.6	14.52	-4230.6	23444.0		-6015.2
2.68	-1972.9	83475.9		5498.7	8.66	-2741.5	88902.2		-243.2	14.65	-4246.2	21758.9		-5810.5
2.80	-1988.8	84148.5		5252.4	8.79	-2757.5	88835.2		-223.8	14.78	-4261.7	20132.1		-5603.9
2.93	-2004.7	84790.4		5004.2	8.92	-2773.4	88773.9		-202.4	14.91	-4277.3	18564.1		-5395.3
3.06	-2024.7	85549.1		4691.1	9.05	-351.7	88713.6		-330.6	15.03	-4292.9	17055.5		-5184.8
3.19	-2040.6	86121.0		4438.3	9.17	-367.9	88590.1		-608.4	15.16	-4312.3	15254.1		-4918.9
3.31	-2056.5	86661.3		4183.7	9.30	-380.8	88388.1		-884.7	15.29	-4327.9	13881.1		-4704.0
3.44	-2072.4	87169.8		3927.2	9.43	-393.8	88107.8		-1159.3	15.42	-4343.4	12569.4		-4487.2
3.57	-2088.4	87646.4		3668.5	9.56	-406.7	87749.7		-1432.3	15.54	-4359.0	11319.3		-4268.5
3.69	-2104.3	88090.6		3407.8	9.68	-419.7	87314.4		-1703.7	15.67	-4374.5	10131.5		-4047.8
3.82	-2120.2	88502.4		3145.2	9.81	-435.9	86662.2		-2040.7	15.80	-4390.1	9006.6		-3825.2
3.95	-2136.2	88881.3		2880.6	9.94	-448.8	86054.6		-2308.5	15.93	-4405.7	7945.0		-3600.6
4.08	-2152.1	89227.3		2614.0	10.06	-461.8	85371.2		-2574.6	16.05	-4421.2	6947.4		-3374.1
4.20	-2168.0	89540.0		2345.4	10.19	-474.7	84612.4		-2839.2	16.18	-4436.8	6014.2		-3145.7
4.33	-2184.0	89819.2		2074.8	10.32	-487.7	83778.8		-3102.1	16.31	-4452.3	5146.0		-2915.4
4.46	-2203.9	90120.7		1733.9	10.45	-500.6	82870.7		-3363.5	16.44	-4467.9	4343.4		-2683.1
4.59	-2219.8	90323.6		1458.8	10.57	-513.6	81888.6		-3623.2	16.56	-4487.3	3433.3		-2390.0
4.71	-2235.7	90492.1		1181.8	10.70	-526.5	80833.0		-3881.3	16.69	-4502.9	2780.2		-2153.3
4.84	-2251.7	90626.2		902.8	10.83	-539.5	79704.3		-4137.8	16.82	-4518.4	2194.6		-1914.7
4.97	-2267.6	90725.4		621.9	10.96	-552.4	78503.0		-4392.7	16.94	-4534.0	1676.8		-1674.2
5.10	-2283.5	90789.6		338.9	11.08	-565.4	77229.6		-4645.9	17.07	-4549.6	1227.5		-1431.7
5.22	-2299.5	90818.5		54.0	11.21	-581.5	75537.0		-4960.2	17.20	-4565.1	847.2		-1187.3
5.35	-2315.4	90815.5		-26.5	11.34	-594.5	74102.9		-5209.9	17.33	-4580.7	536.4		-941.0
5.48	-2331.3	90804.4		-60.1	11.47	-607.4	72598.1		-5457.9	17.45	-4596.2	295.8		-692.7
5.61	-2347.2	90783.9		-91.8	11.59	-620.4	71023.1		-5704.3	17.58	-4611.8	125.8		-442.5
5.73	-2363.2	90754.6		-121.5	11.72	-633.3	69378.4		-5949.2	17.71	-4627.3	27.0		-190.4
5.86	-2383.1	90706.6		-155.7	11.85	-646.3	67664.4		-6192.3	17.84	-4639.0	0.0		0.0

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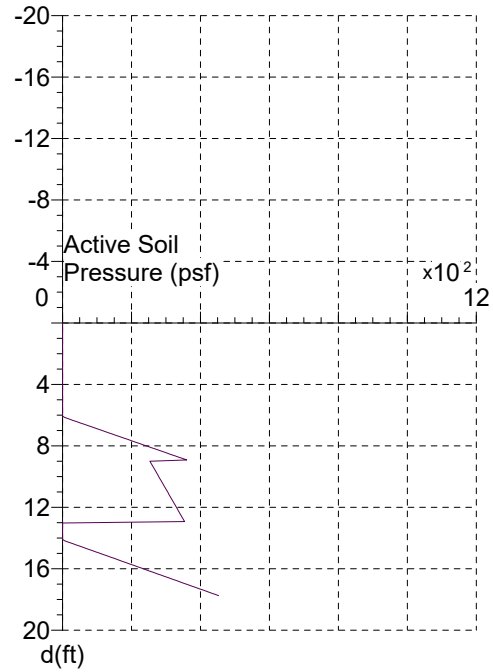
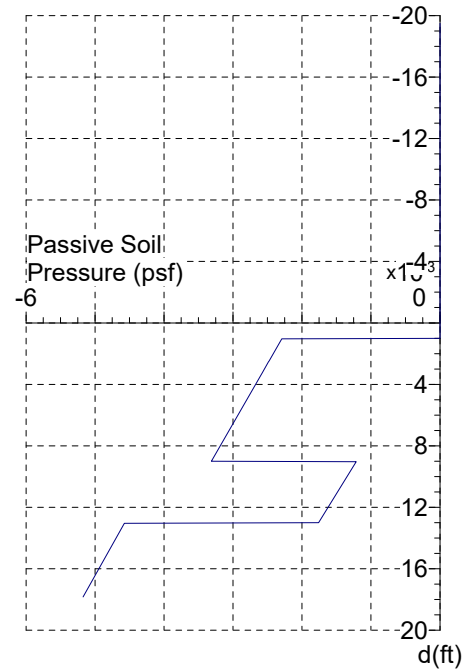
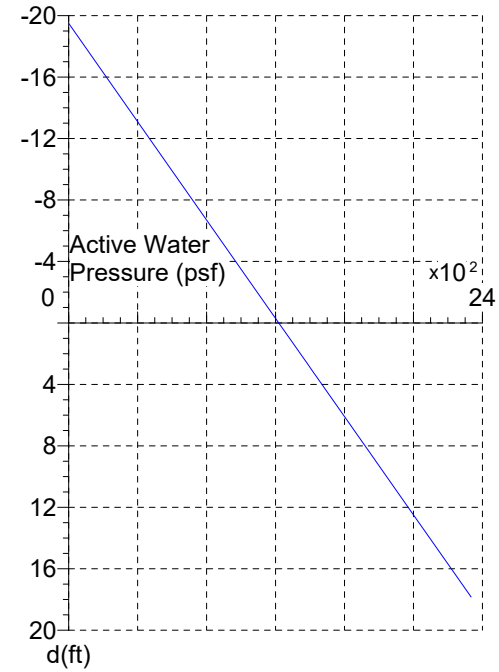
Title: Colorado River Flood Gate - East Side
Designer: Stage 1
Ref: 1.3
Page: 5
Date: 8.20.18

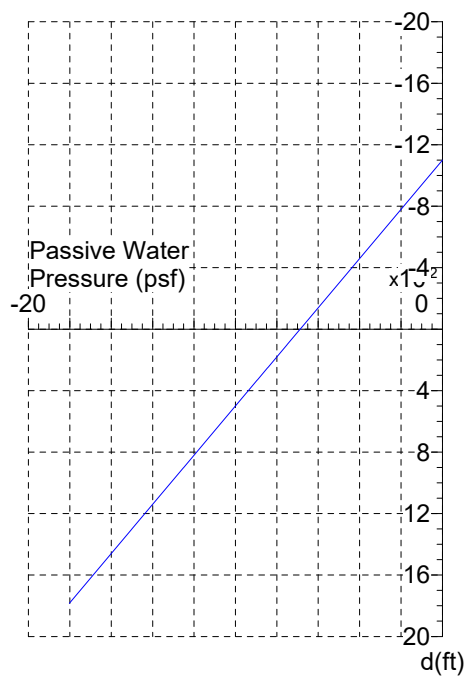
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

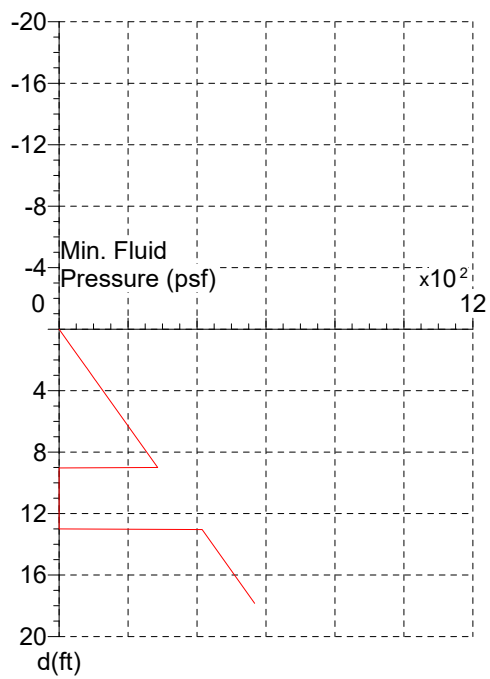
Stage 1 - Tip and Moment only

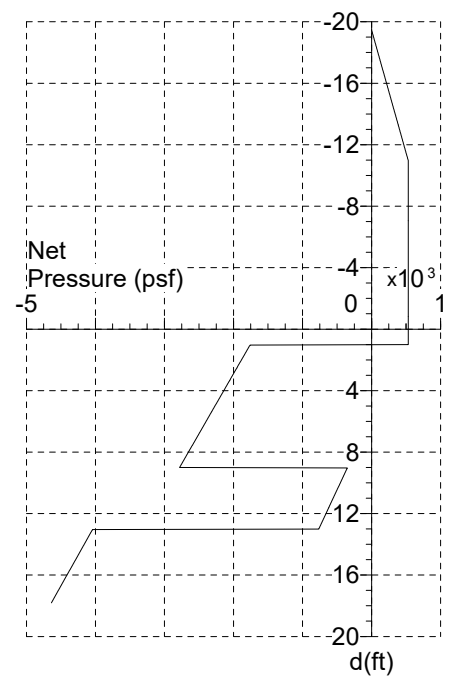












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```
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3
CONTROL  ANCHORED  DESIGN  1.30  1.30
WALL   4.5   -3
SURFACE RIGHTSIDE   2    0   -15
                  200   -15
SURFACE LEFTSIDE   2    0   -16
                  200   -16
SOIL RIGHTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
SOIL LEFTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
WATER ELEVATIONS   62.5    4.5   -10
FINISHED
```

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 20-AUGUST-2018                                        TIME: 13:01:26

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.3

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 4.50 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -15.00
                200.00        -15.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -16.00
                200.00        -16.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
128.00  128.00     0.00 1000.00     0.00    0.00  -24.00   0.00   DEF  DEF
```

122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF
125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
128.00	128.00	0.00	1000.00	0.00	0.00	-24.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF
125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 20-AUGUST-2018 TIME: 13:02:19

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* SOIL PRESSURES FOR *

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*  ANCHORED WALL DESIGN  *
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I.--HEADING

'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

ELEV. (FT)	NET WATER (PSF)	<---LEFTSIDE---> PASSIVE (PSF)	ACTIVE (PSF)	<------NET------> (SOIL + WATER) ACTIVE (PSF)	<--RIGHTSIDE---> ACTIVE (PSF)	PASSIVE (PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	0.0	0.0
-3.0	468.8	0.0	0.0	468.8	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	0.0	0.0
-4.5	562.5	0.0	0.0	562.5	0.0	0.0
-5.5	625.0	0.0	0.0	625.0	0.0	0.0
-6.5	687.5	0.0	0.0	687.5	0.0	0.0
-7.5	750.0	0.0	0.0	750.0	0.0	0.0
-8.5	812.5	0.0	0.0	812.5	0.0	0.0
-9.5	875.0	0.0	0.0	875.0	0.0	0.0
-10.0	906.3	0.0	0.0	906.3	0.0	0.0
-10.5	906.3	0.0	0.0	906.3	0.0	0.0
-11.5	906.3	0.0	0.0	906.3	0.0	0.0
-12.5	906.3	0.0	0.0	906.3	0.0	0.0
-13.5	906.3	0.0	0.0	906.3	0.0	0.0
-14.5	906.3	0.0	0.0	906.3	0.0	0.0
-15.0+	906.3	0.0	0.0	906.3	0.0	0.0
-15.0-	906.3	0.0	0.0	906.3	0.0	1538.5
-15.5	906.3	0.0	0.0	906.3	0.0	1571.2
-16.0+	906.3	0.0	0.0	906.3	0.0	1604.0
-16.0-	906.3	1538.5	0.0	-632.2	0.0	1604.0
-16.5	906.3	1571.2	0.0	-665.0	0.0	1636.7
-17.0	906.3	1604.0	0.0	-697.7	0.0	1669.5

-17.5	906.3	1636.7	0.0	-730.5	0.0	1702.2
-18.5	906.3	1702.2	0.0	-796.0	0.0	1767.7
-19.5	906.3	1767.7	0.0	-861.5	0.0	1833.2
-20.5	906.3	1833.2	0.0	-927.0	0.0	1898.7
-21.5	906.3	1898.7	0.0	-992.5	0.0	1964.2
-22.5	906.3	1964.2	0.0	-1058.0	0.0	2029.7
-23.5	906.3	2029.7	0.0	-1123.5	0.0	2095.2
-24.0	906.3	1723.0	0.0	-816.8	0.0	1840.8
-24.5	906.3	1426.4	0.0	-520.2	0.0	1595.3
-25.5	906.3	1549.8	0.0	-643.5	0.0	1715.4
-26.5	906.3	1676.0	0.0	-769.7	0.0	1840.0
-27.5	906.3	1803.0	0.0	-896.8	0.0	1964.8
-28.0	906.3	2473.3	0.0	-1567.1	0.0	2586.7
-28.5	906.3	3123.6	0.0	-2217.4	0.0	3189.1
-29.5	906.3	3186.1	0.0	-2279.9	0.0	3251.6
-30.5	906.3	3248.6	0.0	-2342.4	0.0	3314.1
-31.5	906.3	3303.0	0.0	-2396.7	0.0	3370.5
-32.5	906.3	3357.0	0.0	-2450.7	0.0	3424.5
-33.5	906.3	3419.1	0.0	-2512.8	0.0	3484.6
-34.5	906.3	3481.6	0.0	-2575.3	0.0	3547.1
-35.5	906.3	3544.1	0.0	-2637.8	0.0	3609.6
-36.5	906.3	3606.6	0.0	-2700.3	0.0	3672.1
-37.0	906.3	3290.0	0.0	-2383.7	0.0	3355.5
-37.5	906.3	2971.6	0.0	-2065.3	0.0	3037.1
-38.5	906.3	3027.1	0.0	-2120.8	0.0	3092.6
-39.5	906.3	3082.6	0.0	-2176.3	0.0	3148.1
-40.5	906.3	3138.1	0.0	-2231.8	0.0	3203.6
-41.0	906.3	4054.4	0.0	-3148.1	0.0	4119.9
-41.5	906.3	4974.1	0.0	-4067.9	0.0	5039.6
-42.5	906.3	5043.6	0.0	-4137.4	0.0	5109.1
-43.5	906.3	5113.1	0.0	-4206.9	0.0	5178.6
-44.5	906.3	5182.6	0.0	-4276.4	0.0	5248.1
-45.5	906.3	5252.1	0.0	-4345.9	0.0	5317.6
-46.5	906.3	5321.6	0.0	-4415.4	0.0	5387.1
-47.5	906.3	5391.1	0.0	-4484.9	0.0	5456.6
-48.5	906.3	5460.6	0.0	-4554.4	0.0	5526.1
-49.5	906.3	5530.1	0.0	-4623.9	0.0	5595.6
-50.5	906.3	5599.6	0.0	-4693.4	0.0	5665.1
-51.5	906.3	5669.1	0.0	-4762.9	0.0	5734.6
-52.0	906.3	5703.9	0.0	-4797.6	0.0	5769.4
-52.5	906.3	5738.6	0.0	-4832.4	0.0	5804.1
-53.5	906.3	5804.4	0.0	-4898.2	0.0	5873.6
-54.5	906.3	5869.8	0.0	-4963.5	0.0	5943.1
-55.5	906.3	5938.9	0.0	-5032.6	0.0	6009.0
-56.5	906.3	6008.4	0.0	-5102.1	0.0	6074.4
-57.5	906.3	6077.9	0.0	-5171.6	0.0	6143.4
-58.5	906.3	6147.4	0.0	-5241.1	0.0	6212.9
-59.5	906.3	6216.9	0.0	-5310.6	0.0	6282.4

-60.5	906.3	6286.4	0.0	-5380.1	0.0	6351.9
-61.5	906.3	6355.9	0.0	-5449.6	0.0	6421.4
-62.5	906.3	6425.4	0.0	-5519.1	0.0	6490.9
-63.5	906.3	6494.9	0.0	-5588.6	0.0	6560.4
-64.5	906.3	6564.4	0.0	-5658.1	0.0	6629.9
-65.5	906.3	6633.9	0.0	-5727.6	0.0	6699.4
-66.5	906.3	6703.4	0.0	-5797.1	0.0	6768.9
-67.5	906.3	6772.9	0.0	-5866.6	0.0	6838.4
-68.5	906.3	6842.4	0.0	-5936.1	0.0	6907.9
-69.5	906.3	6911.9	0.0	-6005.6	0.0	6977.4
-70.5	906.3	6981.4	0.0	-6075.1	0.0	7046.9
-71.5	906.3	7050.9	0.0	-6144.6	0.0	7116.4
-72.5	906.3	7120.4	0.0	-6214.1	0.0	7185.9
-73.5	906.3	7189.9	0.0	-6283.6	0.0	7255.4
-74.5	906.3	7259.4	0.0	-6353.1	0.0	7324.9
-75.5	906.3	7328.9	0.0	-6422.6	0.0	7394.4
-76.5	906.3	7398.4	0.0	-6492.1	0.0	7463.9
-77.5	906.3	7467.9	0.0	-6561.6	0.0	7533.4
-78.5	906.3	7537.4	0.0	-6631.1	0.0	7602.9

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:02:21

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*  SUMMARY OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

METHOD	:	FREE EARTH	FIXED EARTH
WALL BOTTOM ELEVATION (FT)	:	-21.35	-26.63
PENETRATION (FT)	:	5.35	10.63
MAXIMUM BENDING MOMENT (LB-FT)	:	-2.2721E+04	-1.8346E+04
AT ELEVATION (FT)	:	-11.23	-10.62
MAXIMUM SCALED DEFLECTION (LB-IN^3)	:	-1.4817E+09	-1.1318E+09
AT ELEVATION (FT)	:	4.50	4.50
ANCHOR FORCE (LB)	:	7.6847E+03	7.1326E+03

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:02:21

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* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FREE EARTH METHOD   *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--RESULTS (ANCHOR FORCE= 7685. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-1.4817E+09	0.00
3.50	1.0417E+01	31.	-1.2870E+09	62.50
2.50	8.3333E+01	125.	-1.0922E+09	125.00

1.50	2.8125E+02	281.	-8.9735E+08	187.50
0.50	6.6667E+02	500.	-7.0193E+08	250.00
-0.50	1.3021E+03	781.	-5.0533E+08	312.50
-1.50	2.2500E+03	1125.	-3.0643E+08	375.00
-2.50	3.5729E+03	1531.	-1.0359E+08	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-5927.	0.0000E+00	468.75
-3.50	1.4910E+03	-5685.	1.0521E+08	500.00
-4.50	-3.9332E+03	-5153.	3.1639E+08	562.50
-5.50	-8.7950E+03	-4560.	5.2084E+08	625.00
-6.50	-1.3032E+04	-3903.	7.1019E+08	687.50
-7.50	-1.6581E+04	-3185.	8.7712E+08	750.00
-8.50	-1.9380E+04	-2403.	1.0155E+09	812.50
-9.50	-2.1367E+04	-1560.	1.1205E+09	875.00
-10.00	-2.2036E+04	-1114.	1.1594E+09	906.25
-10.50	-2.2480E+04	-661.	1.1887E+09	906.25
-11.50	-2.2688E+04	245.	1.2182E+09	906.25
-12.50	-2.1990E+04	1151.	1.2087E+09	906.25
-13.50	-2.0385E+04	2058.	1.1612E+09	906.25
-14.50	-1.7875E+04	2964.	1.0787E+09	906.25
-15.00	-1.6280E+04	3417.	1.0256E+09	906.25
-15.50	-1.4458E+04	3870.	9.6541E+08	906.25
-16.00+	-1.2410E+04	4323.	8.9901E+08	906.25
-16.00-	-1.2410E+04	4323.	8.9901E+08	-632.21
-16.50	-1.0328E+04	3999.	8.2726E+08	-664.96
-17.00	-8.4134E+03	3658.	7.5103E+08	-697.71
-17.50	-6.6729E+03	3301.	6.7117E+08	-730.46
-18.50	-3.7479E+03	2538.	5.0344E+08	-795.96
-19.50	-1.6188E+03	1709.	3.2913E+08	-861.46
-20.50	-3.5121E+02	815.	1.5189E+08	-926.96
-21.35	0.0000E+00	0.	0.0000E+00	-982.86

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.

-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.00+	906.	0.	0.	0.	0.
-15.00-	906.	0.	0.	0.	1538.
-15.50	906.	0.	0.	0.	1571.
-16.00+	906.	0.	0.	0.	1604.
-16.00-	906.	1538.	0.	0.	1604.
-16.50	906.	1571.	0.	0.	1637.
-17.00	906.	1604.	0.	0.	1669.
-17.50	906.	1637.	0.	0.	1702.
-18.50	906.	1702.	0.	0.	1768.
-19.50	906.	1768.	0.	0.	1833.
-20.50	906.	1833.	0.	0.	1899.
-21.50	906.	1899.	0.	0.	1964.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:02:21

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* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS

'STAGE 2 - 1.3

II.--RESULTS (ANCHOR FORCE= 7133. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-1.1318E+09	0.00
3.50	1.0417E+01	31.	-9.8376E+08	62.50
2.50	8.3333E+01	125.	-8.3567E+08	125.00
1.50	2.8125E+02	281.	-6.8742E+08	187.50
0.50	6.6667E+02	500.	-5.3865E+08	250.00
-0.50	1.3021E+03	781.	-3.8870E+08	312.50
-1.50	2.2500E+03	1125.	-2.3645E+08	375.00
-2.50	3.5729E+03	1531.	-8.0262E+07	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-5375.	0.0000E+00	468.75
-3.50	1.7670E+03	-5133.	8.1908E+07	500.00
-4.50	-3.1051E+03	-4601.	2.4695E+08	562.50
-5.50	-7.4148E+03	-4008.	4.0670E+08	625.00
-6.50	-1.1099E+04	-3351.	5.5373E+08	687.50
-7.50	-1.4097E+04	-2633.	6.8169E+08	750.00
-8.50	-1.6344E+04	-1851.	7.8539E+08	812.50
-9.50	-1.7778E+04	-1008.	8.6096E+08	875.00
-10.00	-1.8171E+04	-562.	8.8737E+08	906.25
-10.50	-1.8339E+04	-109.	9.0594E+08	906.25
-11.50	-1.7995E+04	797.	9.1936E+08	906.25
-12.50	-1.6745E+04	1703.	9.0182E+08	906.25
-13.50	-1.4589E+04	2610.	8.5547E+08	906.25
-14.50	-1.1526E+04	3516.	7.8404E+08	906.25
-15.00	-9.6546E+03	3969.	7.4051E+08	906.25
-15.50	-7.5569E+03	4422.	6.9282E+08	906.25
-16.00+	-5.2325E+03	4875.	6.4188E+08	906.25
-16.00-	-5.2325E+03	4875.	6.4188E+08	-632.21
-16.50	-2.8753E+03	4551.	5.8868E+08	-664.96
-17.00	-6.8431E+02	4210.	5.3422E+08	-697.71
-17.50	1.3323E+03	3853.	4.7947E+08	-730.46
-18.50	4.8093E+03	3090.	3.7246E+08	-795.96
-19.50	7.4905E+03	2261.	2.7364E+08	-861.46
-20.50	9.3101E+03	1367.	1.8765E+08	-926.96
-21.50	1.0203E+04	407.	1.1761E+08	-992.46
-22.50	1.0103E+04	-618.	6.5057E+07	-1057.96
-23.50	8.9454E+03	-1709.	2.9811E+07	-1123.46
-24.00	7.9634E+03	-2194.	1.8124E+07	-816.76
-24.50	6.7769E+03	-2528.	9.8695E+06	-520.15
-25.50	3.9685E+03	-3110.	1.5537E+06	-643.55
-26.50	5.1599E+02	-3816.	2.6622E+03	-769.75
-27.50	0.0000E+00	-3920.	0.0000E+00	-786.70

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELLASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.00+	906.	0.	0.	0.	0.
-15.00-	906.	0.	0.	0.	1538.
-15.50	906.	0.	0.	0.	1571.
-16.00+	906.	0.	0.	0.	1604.
-16.00-	906.	1538.	0.	0.	1604.
-16.50	906.	1571.	0.	0.	1637.
-17.00	906.	1604.	0.	0.	1669.
-17.50	906.	1637.	0.	0.	1702.
-18.50	906.	1702.	0.	0.	1768.
-19.50	906.	1768.	0.	0.	1833.
-20.50	906.	1833.	0.	0.	1899.
-21.50	906.	1899.	0.	0.	1964.
-22.50	906.	1964.	0.	0.	2030.
-23.50	906.	2030.	0.	0.	2095.

-24.00	906.	1723.	0.	0.	1841.
-24.50	906.	1426.	0.	0.	1595.
-25.50	906.	1550.	0.	0.	1715.
-26.50	906.	1676.	0.	0.	1840.
-27.50	906.	1803.	0.	0.	1965.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:02:23

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*******************************
* PRELIMINARY DESIGN DATA FOR *
*  FREE EARTH DESIGN IN CLAY  *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--DESIGN PARAMETERS
WALL HEIGHT RATIO (ALPHA) = 0.79
ANCHOR HEIGHT RATIO (BETA) = 0.29
STABILITY NUMBER = 11.74

SHEET PILE DATA:

SHEET PILE NAME	<SECTION PROPERTIES> (PER FOOT OF WALL) SECTION MODULUS (IN^3)	MOMENT OF INERTIA (IN^4)	ALLOWABLE STRESS (PSI)	MODULUS OF ELLASTICITY (PSI)
PZ40	60.70	490.80	24000.00	2.90E+07
PZ38	46.80	280.80	24000.00	2.90E+07
PZ35	48.50	361.20	24000.00	2.90E+07
PZ32	38.30	220.40	24000.00	2.90E+07
PZ27	30.20	184.20	24000.00	2.90E+07
PZ22	18.10	84.40	24000.00	2.90E+07

PLZ25	32.80	223.25	24000.00	2.90E+07
PLZ23	30.20	203.75	24000.00	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE NAME	LOG(H^4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT
PZ40	-4.50	1.0 (***)	5.34
PZ38	-4.26	1.0 (***)	4.12
PZ35	-4.37	1.0 (***)	4.27
PZ32	-4.16	1.0 (***)	3.37
PZ27	-4.08	1.0 (***)	2.66
PZ22	-3.74	1.0 (***)	1.59
PLZ25	-4.16	1.0 (***)	2.89
PLZ23	-4.12	1.0 (***)	2.66

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE BELOW TOP OF WALL.

*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER GREATER THAN 2.5.

```
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0
CONTROL  ANCHORED  DESIGN  1.00  1.00
WALL   4.5   -3
SURFACE RIGHTSIDE   2    0   -15
                  200   -15
SURFACE LEFTSIDE   2    0   -16
                  200   -16
SOIL RIGHTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
SOIL LEFTSIDE  STRENGTHS   6
   128    128    0    1000    0    0   -24   0
   122    122    30    0    0    0   -28   0
   125    125    0    1500    0    0   -37   0
   118    118    0    1050    0    0   -41   0
   132    132    0    2200    0    0   -52   0
   132    132    0    2200    0    0
WATER ELEVATIONS   62.5    4.5   -10
FINISHED
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 20-AUGUST-2018                                        TIME: 13:03:24

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.0

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 4.50 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -15.00
                200.00        -15.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -16.00
                200.00        -16.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
128.00  128.00     0.00 1000.00     0.00    0.00  -24.00   0.00   DEF  DEF
```

122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF
125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
128.00	128.00	0.00	1000.00	0.00	0.00	-24.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-28.00	0.00	DEF	DEF
125.00	125.00	0.00	1500.00	0.00	0.00	-37.00	0.00	DEF	DEF
118.00	118.00	0.00	1050.00	0.00	0.00	-41.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00	-52.00	0.00	DEF	DEF
132.00	132.00	0.00	2200.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 20-AUGUST-2018 TIME: 13:03:35

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* SOIL PRESSURES FOR *

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*  ANCHORED WALL DESIGN  *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

				<------NET------>		
	NET	<---LEFTSIDE--->		(SOIL + WATER)	<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	0.0	0.0
-3.0	468.8	0.0	0.0	468.8	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	0.0	0.0
-4.5	562.5	0.0	0.0	562.5	0.0	0.0
-5.5	625.0	0.0	0.0	625.0	0.0	0.0
-6.5	687.5	0.0	0.0	687.5	0.0	0.0
-7.5	750.0	0.0	0.0	750.0	0.0	0.0
-8.5	812.5	0.0	0.0	812.5	0.0	0.0
-9.5	875.0	0.0	0.0	875.0	0.0	0.0
-10.0	906.3	0.0	0.0	906.3	0.0	0.0
-10.5	906.3	0.0	0.0	906.3	0.0	0.0
-11.5	906.3	0.0	0.0	906.3	0.0	0.0
-12.5	906.3	0.0	0.0	906.3	0.0	0.0
-13.5	906.3	0.0	0.0	906.3	0.0	0.0
-14.5	906.3	0.0	0.0	906.3	0.0	0.0
-15.0+	906.3	0.0	0.0	906.3	0.0	0.0
-15.0-	906.3	0.0	0.0	906.3	0.0	2000.0
-15.5	906.3	0.0	0.0	906.3	0.0	2032.8
-16.0+	906.3	0.0	0.0	906.3	0.0	2065.5
-16.0-	906.3	2000.0	0.0	-1093.8	0.0	2065.5
-16.5	906.3	2032.8	0.0	-1126.5	0.0	2098.3
-17.0	906.3	2065.5	0.0	-1159.3	0.0	2131.0

-17.5	906.3	2098.3	0.0	-1192.0	0.0	2163.8
-18.5	906.3	2163.8	0.0	-1257.5	0.0	2229.3
-19.5	906.3	2229.3	0.0	-1323.0	0.0	2294.8
-20.5	906.3	2294.8	0.0	-1388.5	0.0	2360.3
-21.5	906.3	2360.3	0.0	-1454.0	0.0	2425.8
-22.5	906.3	2425.8	0.0	-1519.5	0.0	2491.3
-23.5	906.3	2491.3	0.0	-1585.0	0.0	2556.8
-24.0	906.3	2238.0	0.0	-1331.7	0.0	2390.5
-24.5	906.3	1986.4	0.0	-1080.2	0.0	2222.1
-25.5	906.3	2085.4	0.0	-1179.2	0.0	2308.9
-26.5	906.3	2211.5	0.0	-1305.3	0.0	2428.7
-27.5	906.3	2360.6	0.0	-1454.4	0.0	2572.9
-28.0	906.3	3124.1	0.0	-2217.8	0.0	3262.2
-28.5	906.3	3860.3	0.0	-2954.0	0.0	3925.8
-29.5	906.3	3922.8	0.0	-3016.5	0.0	3988.3
-30.5	906.3	3978.8	0.0	-3072.6	0.0	4048.0
-31.5	906.3	4022.5	0.0	-3116.3	0.0	4091.8
-32.5	906.3	4072.7	0.0	-3166.5	0.0	4138.2
-33.5	906.3	4135.2	0.0	-3229.0	0.0	4200.7
-34.5	906.3	4197.7	0.0	-3291.5	0.0	4263.2
-35.5	906.3	4260.2	0.0	-3354.0	0.0	4325.7
-36.5	906.3	4322.7	0.0	-3416.5	0.0	4388.2
-37.0	906.3	3898.7	0.0	-2992.4	0.0	3964.2
-37.5	906.3	3472.9	0.0	-2566.6	0.0	3538.4
-38.5	906.3	3528.4	0.0	-2622.1	0.0	3593.9
-39.5	906.3	3583.9	0.0	-2677.6	0.0	3649.4
-40.5	906.3	3639.4	0.0	-2733.1	0.0	3704.9
-41.0	906.3	4830.2	0.0	-3923.9	0.0	4895.7
-41.5	906.3	6024.5	0.0	-5118.2	0.0	6090.0
-42.5	906.3	6077.9	0.0	-5171.6	0.0	6157.8
-43.5	906.3	6131.1	0.0	-5224.9	0.0	6211.1
-44.5	906.3	6200.5	0.0	-5294.2	0.0	6266.0
-45.5	906.3	6270.0	0.0	-5363.7	0.0	6335.5
-46.5	906.3	6339.5	0.0	-5433.2	0.0	6405.0
-47.5	906.3	6409.0	0.0	-5502.7	0.0	6474.5
-48.5	906.3	6478.5	0.0	-5572.2	0.0	6544.0
-49.5	906.3	6548.0	0.0	-5641.7	0.0	6613.5
-50.5	906.3	6617.5	0.0	-5711.2	0.0	6683.0
-51.5	906.3	6687.0	0.0	-5780.7	0.0	6752.5
-52.0	906.3	6721.7	0.0	-5815.5	0.0	6787.2
-52.5	906.3	6756.5	0.0	-5850.2	0.0	6822.0
-53.5	906.3	6826.0	0.0	-5919.7	0.0	6891.5
-54.5	906.3	6895.5	0.0	-5989.2	0.0	6961.0
-55.5	906.3	6965.0	0.0	-6058.7	0.0	7030.5
-56.5	906.3	7034.5	0.0	-6128.2	0.0	7100.0
-57.5	906.3	7104.0	0.0	-6197.7	0.0	7169.5
-58.5	906.3	7173.5	0.0	-6267.2	0.0	7239.0
-59.5	906.3	7243.0	0.0	-6336.7	0.0	7308.5

-60.5	906.3	7312.5	0.0	-6406.2	0.0	7378.0
-61.5	906.3	7382.0	0.0	-6475.7	0.0	7447.5
-62.5	906.3	7451.5	0.0	-6545.2	0.0	7517.0
-63.5	906.3	7521.0	0.0	-6614.7	0.0	7586.5
-64.5	906.3	7590.5	0.0	-6684.2	0.0	7656.0
-65.5	906.3	7660.0	0.0	-6753.7	0.0	7725.5
-66.5	906.3	7729.5	0.0	-6823.2	0.0	7795.0
-67.5	906.3	7799.0	0.0	-6892.7	0.0	7864.5
-68.5	906.3	7868.5	0.0	-6962.2	0.0	7934.0
-69.5	906.3	7938.0	0.0	-7031.7	0.0	8003.5
-70.5	906.3	8007.5	0.0	-7101.2	0.0	8073.0
-71.5	906.3	8077.0	0.0	-7170.7	0.0	8142.5
-72.5	906.3	8146.5	0.0	-7240.2	0.0	8212.0
-73.5	906.3	8216.0	0.0	-7309.7	0.0	8281.5
-74.5	906.3	8285.5	0.0	-7379.2	0.0	8351.0
-75.5	906.3	8355.0	0.0	-7448.7	0.0	8420.5
-76.5	906.3	8424.5	0.0	-7518.2	0.0	8490.0
-77.5	906.3	8494.0	0.0	-7587.7	0.0	8559.5
-78.5	906.3	8563.5	0.0	-7657.2	0.0	8629.0

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:03:36

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*  SUMMARY OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

METHOD	:	FREE EARTH	FIXED EARTH
WALL BOTTOM ELEVATION (FT)	:	-19.77	-24.00
PENETRATION (FT)	:	3.77	8.00
MAXIMUM BENDING MOMENT (LB-FT)	:	-2.0567E+04	-1.5937E+04
AT ELEVATION (FT)	:	-10.94	-10.26
MAXIMUM SCALED DEFLECTION (LB-IN^3)	:	-1.1970E+09	-8.6563E+08
AT ELEVATION (FT)	:	4.50	4.50
ANCHOR FORCE (LB)	:	7.4182E+03	6.8089E+03

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELLASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:03:36

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* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FREE EARTH METHOD   *
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I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--RESULTS (ANCHOR FORCE= 7418. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-1.1970E+09	0.00
3.50	1.0417E+01	31.	-1.0402E+09	62.50
2.50	8.3333E+01	125.	-8.8346E+08	125.00

1.50	2.8125E+02	281.	-7.2652E+08	187.50
0.50	6.6667E+02	500.	-5.6907E+08	250.00
-0.50	1.3021E+03	781.	-4.1042E+08	312.50
-1.50	2.2500E+03	1125.	-2.4949E+08	375.00
-2.50	3.5729E+03	1531.	-8.4607E+07	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-5660.	0.0000E+00	468.75
-3.50	1.6242E+03	-5418.	8.6243E+07	500.00
-4.50	-3.5335E+03	-4887.	2.5970E+08	562.50
-5.50	-8.1288E+03	-4293.	4.2714E+08	625.00
-6.50	-1.2099E+04	-3637.	5.8062E+08	687.50
-7.50	-1.5382E+04	-2918.	7.1329E+08	750.00
-8.50	-1.7915E+04	-2137.	8.1949E+08	812.50
-9.50	-1.9635E+04	-1293.	8.9485E+08	875.00
-10.00	-2.0171E+04	-848.	9.1999E+08	906.25
-10.50	-2.0481E+04	-395.	9.3641E+08	906.25
-11.50	-2.0423E+04	512.	9.4271E+08	906.25
-12.50	-1.9458E+04	1418.	9.1385E+08	906.25
-13.50	-1.7587E+04	2324.	8.5149E+08	906.25
-14.50	-1.4810E+04	3230.	7.5887E+08	906.25
-15.00	-1.3082E+04	3683.	7.0265E+08	906.25
-15.50	-1.1127E+04	4137.	6.4079E+08	906.25
-16.00+	-8.9453E+03	4590.	5.7413E+08	906.25
-16.00-	-8.9453E+03	4590.	5.7413E+08	-1093.75
-16.50	-6.7886E+03	4035.	5.0361E+08	-1126.50
-17.00	-4.9135E+03	3463.	4.3014E+08	-1159.25
-17.50	-3.3282E+03	2875.	3.5454E+08	-1192.00
-18.50	-1.0598E+03	1651.	1.9955E+08	-1257.50
-19.50	-4.8851E+01	360.	4.2543E+07	-1323.00
-19.77	0.0000E+00	0.	0.0000E+00	-1340.72

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF
ELLASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.

-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.00+	906.	0.	0.	0.	0.
-15.00-	906.	0.	0.	0.	2000.
-15.50	906.	0.	0.	0.	2033.
-16.00+	906.	0.	0.	0.	2066.
-16.00-	906.	2000.	0.	0.	2066.
-16.50	906.	2033.	0.	0.	2098.
-17.00	906.	2066.	0.	0.	2131.
-17.50	906.	2098.	0.	0.	2164.
-18.50	906.	2164.	0.	0.	2229.
-19.50	906.	2229.	0.	0.	2295.
-20.50	906.	2295.	0.	0.	2360.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 20-AUGUST-2018 TIME: 13:03:36

```
****************************
* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
****************************
```

I.--HEADING
'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--RESULTS (ANCHOR FORCE= 6809. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-8.6563E+08	0.00
3.50	1.0417E+01	31.	-7.5306E+08	62.50
2.50	8.3333E+01	125.	-6.4046E+08	125.00
1.50	2.8125E+02	281.	-5.2770E+08	187.50
0.50	6.6667E+02	500.	-4.1443E+08	250.00
-0.50	1.3021E+03	781.	-2.9997E+08	312.50
-1.50	2.2500E+03	1125.	-1.8321E+08	375.00
-2.50	3.5729E+03	1531.	-6.2516E+07	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-5051.	0.0000E+00	468.75
-3.50	1.9289E+03	-4809.	6.4174E+07	500.00
-4.50	-2.6196E+03	-4278.	1.9402E+08	562.50
-5.50	-6.6055E+03	-3684.	3.1943E+08	625.00
-6.50	-9.9665E+03	-3028.	4.3351E+08	687.50
-7.50	-1.2640E+04	-2309.	5.3046E+08	750.00
-8.50	-1.4563E+04	-1528.	6.0569E+08	812.50
-9.50	-1.5674E+04	-684.	6.5586E+08	875.00
-10.00	-1.5906E+04	-239.	6.7090E+08	906.25
-10.50	-1.5912E+04	215.	6.7908E+08	906.25
-11.50	-1.5244E+04	1121.	6.7493E+08	906.25
-12.50	-1.3670E+04	2027.	6.4457E+08	906.25
-13.50	-1.1190E+04	2933.	5.9071E+08	906.25
-14.50	-7.8034E+03	3840.	5.1765E+08	906.25
-15.00	-5.7704E+03	4293.	4.7569E+08	906.25
-15.50	-3.5108E+03	4746.	4.3124E+08	906.25
-16.00+	-1.0246E+03	5199.	3.8529E+08	906.25
-16.00-	-1.0246E+03	5199.	3.8529E+08	-1093.75
-16.50	1.4368E+03	4644.	3.3889E+08	-1126.50
-17.00	3.6166E+03	4072.	2.9310E+08	-1159.25
-17.50	5.5065E+03	3485.	2.4886E+08	-1192.00
-18.50	8.3842E+03	2260.	1.6817E+08	-1257.50
-19.50	1.0004E+04	970.	1.0180E+08	-1323.00
-20.50	1.0302E+04	-386.	5.2518E+07	-1388.50
-21.50	9.2103E+03	-1807.	2.0839E+07	-1454.00
-22.50	6.6650E+03	-3294.	4.8664E+06	-1519.50
-23.50	2.6002E+03	-4846.	1.9223E+05	-1585.00
-24.00	0.0000E+00	-5573.	0.0000E+00	-1332.69

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.00+	906.	0.	0.	0.	0.
-15.00-	906.	0.	0.	0.	2000.
-15.50	906.	0.	0.	0.	2033.
-16.00+	906.	0.	0.	0.	2066.
-16.00-	906.	2000.	0.	0.	2066.
-16.50	906.	2033.	0.	0.	2098.
-17.00	906.	2066.	0.	0.	2131.
-17.50	906.	2098.	0.	0.	2164.
-18.50	906.	2164.	0.	0.	2229.
-19.50	906.	2229.	0.	0.	2295.
-20.50	906.	2295.	0.	0.	2360.
-21.50	906.	2360.	0.	0.	2426.
-22.50	906.	2426.	0.	0.	2491.
-23.50	906.	2491.	0.	0.	2557.
-24.00	906.	2238.	0.	0.	2390.

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                          BY CLASSICAL METHODS
DATE: 20-AUGUST-2018                                          TIME: 13:03:38

                 ******************************
                 * PRELIMINARY DESIGN DATA FOR *
                 *  FREE EARTH DESIGN IN CLAY  *
                 ******************************

    I.--HEADING
    'COLORADO RIVER - EAST BRACED COFFERDAM DESIGN
    'SINGLE BRACE CONDITION
    'Q-CASE SOIL PARAMETERS
    'STAGE 2 - 1.0

   II.--DESIGN PARAMETERS
       WALL HEIGHT RATIO (ALPHA)  = 0.84
       ANCHOR HEIGHT RATIO (BETA) = 0.31
       STABILITY NUMBER           = 15.27

    SHEET PILE DATA:

                 <SECTION PROPERTIES>
                  (PER FOOT OF WALL)
       SHEET     SECTION    MOMENT OF          ALLOWABLE    MODULUS OF
        PILE     MODULUS     INERTIA             STRESS     ELLASTICITY
        NAME      (IN^3)      (IN^4)              (PSI)        (PSI)
       PZ40       60.70       490.80          24000.00       2.90E+07
       PZ38       46.80       280.80          24000.00       2.90E+07
       PZ35       48.50       361.20          24000.00       2.90E+07
       PZ32       38.30       220.40          24000.00       2.90E+07
       PZ27       30.20       184.20          24000.00       2.90E+07
       PZ22       18.10        84.40          24000.00       2.90E+07
      PLZ25       32.80       223.25          24000.00       2.90E+07
      PLZ23       30.20       203.75          24000.00       2.90E+07

  III.--PRELIMINARY DESIGN DATA

  SHEET
   PILE                      ROWE'S MOMENT    RATIO OF ALLOWABLE MOMENT
   NAME     LOG(H^4/EI)    REDUCTION COEF.     TO FREE EARTH MOMENT
  PZ40        -4.61           1.0 (***)                 5.90
  PZ38        -4.37           1.0 (***)                 4.55
```

PZ35	-4.48	1.0 (***)	4.72
PZ32	-4.27	1.0 (***)	3.72
PZ27	-4.19	1.0 (***)	2.94
PZ22	-3.85	1.0 (***)	1.76
PLZ25	-4.27	1.0 (***)	3.19
PLZ23	-4.23	1.0 (***)	2.94

*** REDUCTION NOT APPLICABLE DUE TO ALPHA GREATER THAN 0.8.

*** REDUCTION NOT APPLICABLE DUE TO BETA GREATER THAN 0.3.

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE
BELOW TOP OF WALL.

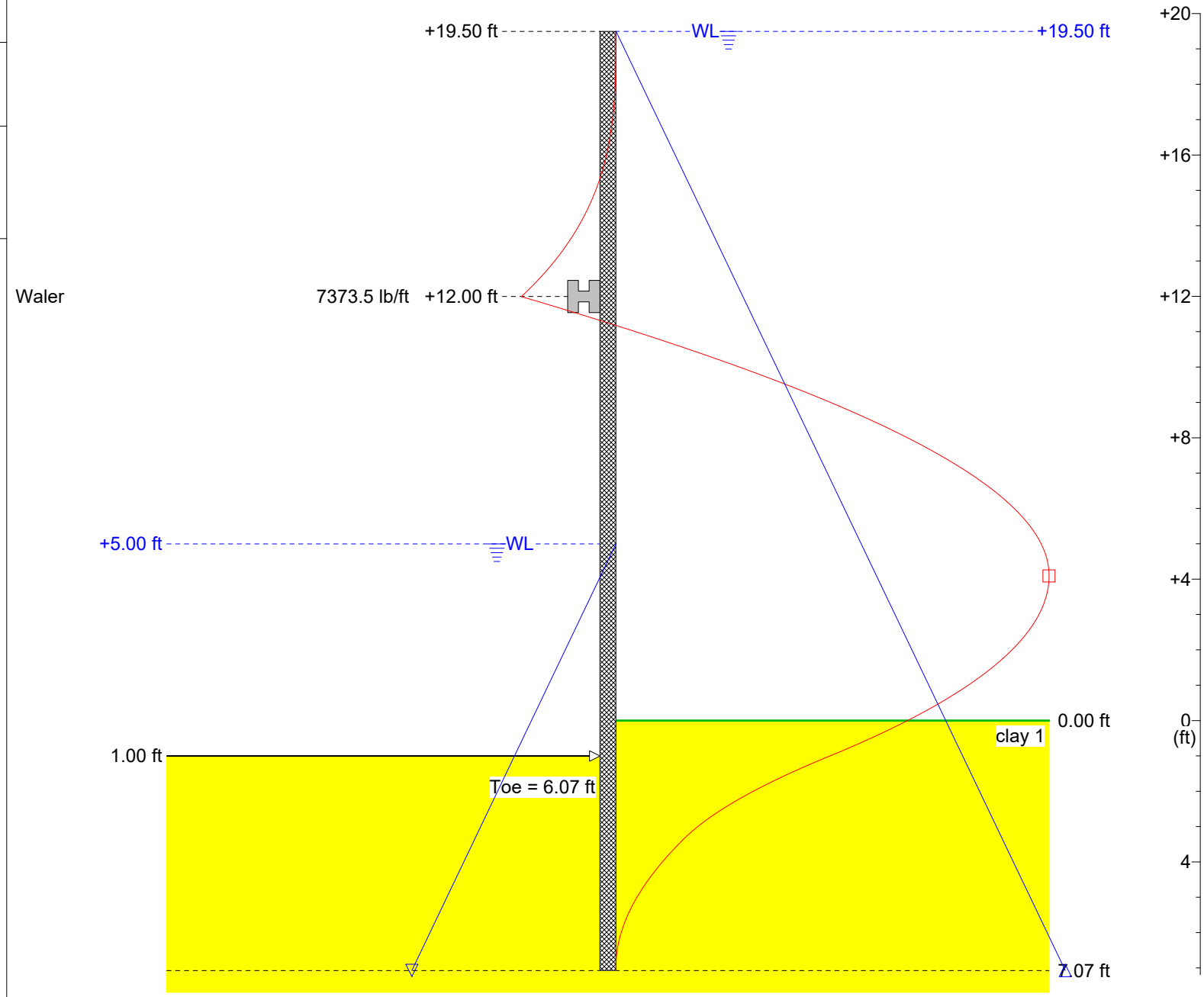
*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER
GREATER THAN 2.5.

Title: Colorado River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	20183.4 ftlb/ft	-4.09
△	1660.7 psf	7.07
△	754.4 psf	7.07

Stage 2 - Tip and Moment only



SupportIT, v2.35

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Title: Colorado River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 2
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = +5.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	6.07	26.57

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	7373.5

Maxima

	Maximum	Depth (ft)
Pressure	906.0 psf	1.00
Bending Moment	20183.4 ftlb/ft	-4.09
Shear Force	5616.6 lb/ft	-12.00

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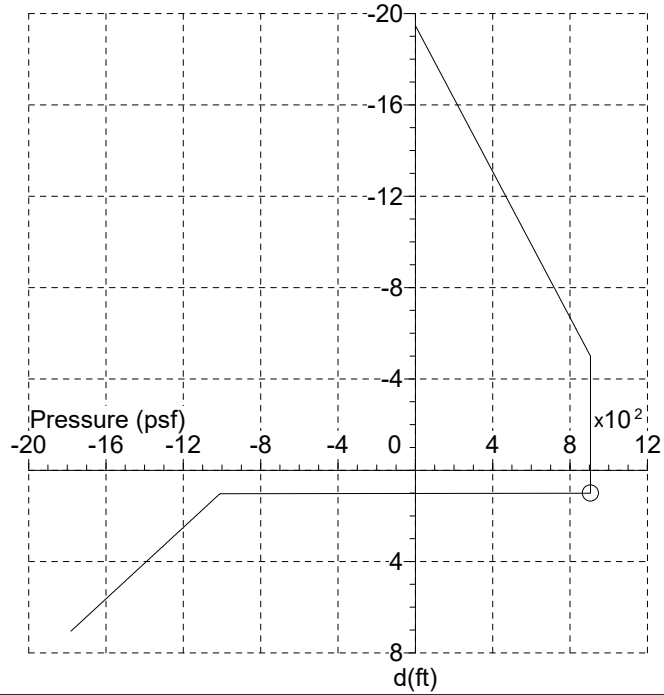
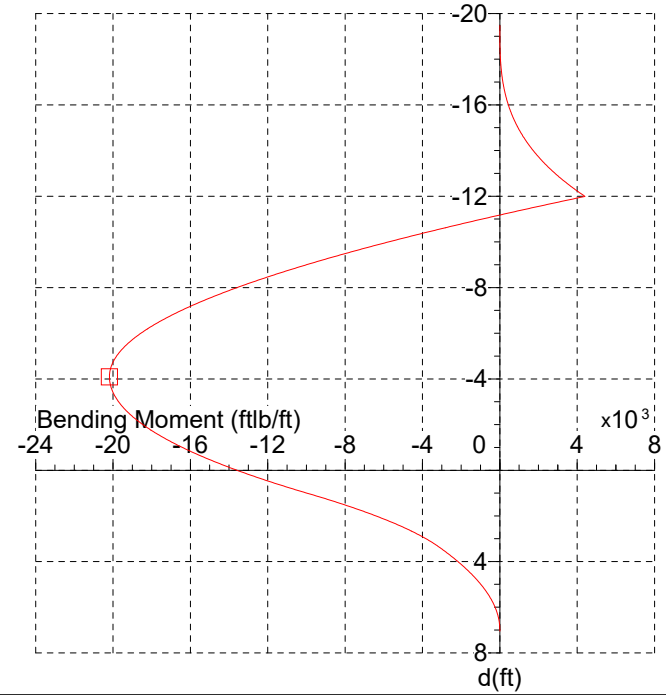
Title: Colorado River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 3
Date: 8.20.18

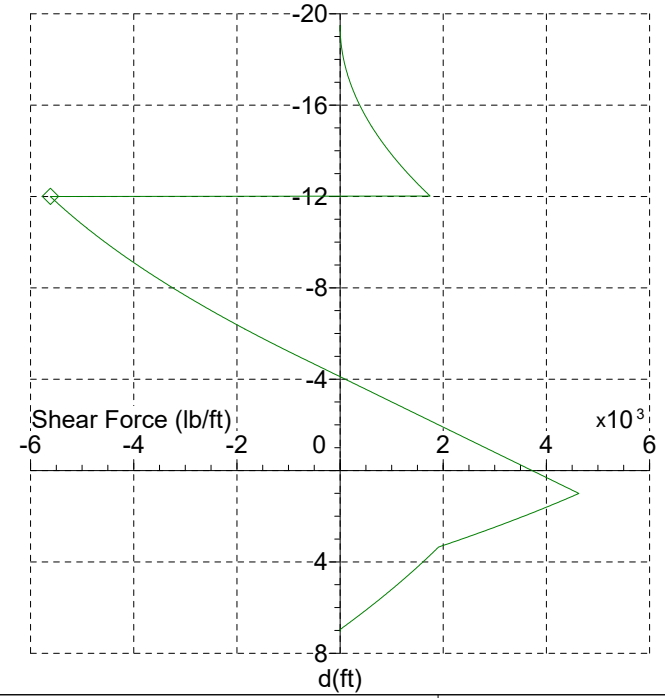
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	906.0 psf	1.00
□	20183.4 ftlb/ft	-4.09
◇	5616.6 lb/ft	-12.00

Stage 2 - Tip and Moment only







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Title: Colorado River Flood Gate - East Side
Designer: Stage 2
Ref: 1.3
Page: 4
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	906.0	-13565.0		3728.3	2.37	-1183.7	-5305.5		3124.7	4.75	-1489.7	-1214.0		1228.4
0.05	906.0	-13421.4		3768.4	2.42	-1192.2	-5126.9		3045.7	4.80	-1495.4	-1167.1		1205.7
0.10	906.0	-13203.2		3828.6	2.47	-1196.6	-5010.5		2992.8	4.85	-1501.0	-1121.0		1182.9
0.15	906.0	-13055.7		3868.7	2.53	-1200.7	-4896.0		2939.6	4.90	-1506.7	-1075.8		1160.0
0.20	906.0	-12906.7		3908.8	2.58	-1209.2	-4783.6		2886.1	4.95	-1515.2	-1009.6		1125.6
0.25	906.0	-12680.4		3969.0	2.63	-1217.7	-4618.9		2805.4	5.00	-1520.9	-966.6		1102.5
0.30	906.0	-12527.5		4009.1	2.68	-1223.4	-4511.6		2751.3	5.05	-1526.5	-924.5		1079.3
0.35	906.0	-12373.1		4049.3	2.73	-1229.0	-4406.5		2696.9	5.10	-1535.0	-862.9		1044.4
0.40	906.0	-12217.2		4089.4	2.78	-1237.5	-4252.7		2614.9	5.15	-1540.7	-823.0		1021.0
0.45	906.0	-11980.5		4149.6	2.83	-1243.2	-4152.8		2559.9	5.20	-1546.4	-784.1		997.5
0.51	906.0	-11820.7		4189.7	2.88	-1248.9	-4055.0		2504.7	5.25	-1552.0	-746.0		973.9
0.56	906.0	-11659.4		4229.8	2.93	-1254.5	-3959.3		2449.2	5.30	-1560.5	-690.5		938.4
0.61	906.0	-11414.5		4290.0	2.98	-1263.0	-3819.8		2365.5	5.35	-1566.2	-654.7		914.6
0.66	906.0	-11249.3		4330.1	3.03	-1268.7	-3729.4		2309.4	5.40	-1571.9	-619.8		890.7
0.71	906.0	-11082.6		4370.2	3.08	-1274.4	-3641.3		2253.0	5.45	-1580.4	-569.2		854.8
0.76	906.0	-10914.4		4410.4	3.13	-1282.9	-3513.1		2168.0	5.50	-1586.0	-536.6		830.7
0.81	906.0	-10659.1		4470.5	3.18	-1288.5	-3430.4		2111.0	5.56	-1591.7	-504.9		806.5
0.86	906.0	-10487.0		4510.7	3.23	-1294.2	-3349.8		2053.7	5.61	-1597.4	-474.2		782.3
0.91	906.0	-10313.4		4550.8	3.28	-1299.4	-3271.5		1996.2	5.66	-1605.9	-429.8		745.7
0.96	906.0	-10050.0		4611.0	3.33	-1305.5	-3158.2		1909.6	5.71	-1611.5	-401.4		721.2
1.01	-1010.9	-9872.5		4608.6	3.38	-1314.0	-3085.0		1889.6	5.76	-1617.2	-373.9		696.7
1.06	-1016.5	-9695.9		4563.8	3.43	-1319.7	-3012.6		1869.6	5.81	-1622.9	-347.4		672.0
1.11	-1022.2	-9521.0		4518.6	3.48	-1328.2	-2905.5		1839.4	5.86	-1631.4	-309.4		634.9
1.16	-1030.7	-9262.0		4450.3	3.54	-1333.9	-2835.0		1819.1	5.91	-1637.0	-285.2		610.1
1.21	-1036.4	-9091.5		4404.4	3.59	-1339.5	-2765.3		1798.8	5.96	-1642.7	-262.0		585.1
1.26	-1042.0	-8922.8		4358.4	3.64	-1345.2	-2696.4		1778.4	6.01	-1651.2	-229.0		547.5
1.31	-1047.7	-8755.8		4312.0	3.69	-1353.7	-2594.6		1747.6	6.06	-1656.9	-208.3		522.4
1.36	-1056.2	-8508.7		4242.1	3.74	-1359.4	-2527.6		1726.9	6.11	-1662.5	-188.4		497.1
1.41	-1061.9	-8346.2		4195.1	3.79	-1365.0	-2461.5		1706.2	6.16	-1668.2	-169.6		471.8
1.46	-1067.5	-8185.5		4147.9	3.84	-1373.5	-2363.8		1674.9	6.21	-1676.7	-143.1		433.6
1.52	-1076.0	-7947.9		4076.6	3.89	-1379.2	-2299.7		1654.0	6.26	-1682.4	-126.7		408.1
1.57	-1081.7	-7791.8		4028.8	3.94	-1384.9	-2236.3		1633.0	6.31	-1688.0	-111.3		382.4
1.62	-1087.4	-7637.5		3980.7	3.99	-1390.5	-2173.8		1611.9	6.36	-1696.5	-90.0		343.8
1.67	-1093.0	-7485.1		3932.3	4.04	-1399.0	-2081.6		1580.0	6.41	-1702.2	-77.0		318.0
1.72	-1101.5	-7259.9		3859.3	4.09	-1404.7	-2021.1		1558.7	6.46	-1707.9	-65.1		292.0
1.77	-1107.2	-7112.1		3810.4	4.14	-1410.4	-1961.4		1537.3	6.52	-1713.5	-54.1		266.0
1.82	-1112.9	-6966.2		3761.1	4.19	-1416.0	-1902.6		1515.8	6.57	-1722.0	-39.5		226.8
1.87	-1121.4	-6751.0		3686.8	4.24	-1424.5	-1815.8		1483.4	6.62	-1727.7	-31.1		200.6
1.92	-1127.0	-6609.8		3637.0	4.29	-1430.2	-1759.1		1461.6	6.67	-1733.4	-23.6		174.2
1.97	-1132.7	-6470.6		3586.9	4.34	-1435.9	-1703.1		1439.8	6.72	-1741.9	-14.3		134.6
2.02	-1138.4	-6333.3		3536.6	4.39	-1444.4	-1620.8		1407.0	6.77	-1747.5	-9.4		108.1
2.07	-1146.9	-6131.0		3460.6	4.44	-1450.0	-1567.0		1385.0	6.82	-1753.2	-5.5		81.4
2.12	-1152.5	-5998.6		3409.6	4.49	-1455.7	-1514.0		1362.9	6.87	-1758.9	-2.7		54.7
2.17	-1158.2	-5868.1		3358.4	4.55	-1461.4	-1461.9		1340.7	6.92	-1767.4	-0.3		14.5
2.22	-1166.7	-5676.1		3281.0	4.60	-1469.9	-1385.3		1307.2	6.97	-1773.0	0.0		0.0
2.27	-1172.4	-5550.5		3229.2	4.65	-1475.5	-1335.3		1284.8	7.02	-1778.7	0.0		0.0
2.32	-1178.0	-5427.0		3177.1	4.70	-1481.2	-1286.1		1262.3	7.07	-1781.5	0.0		0.0

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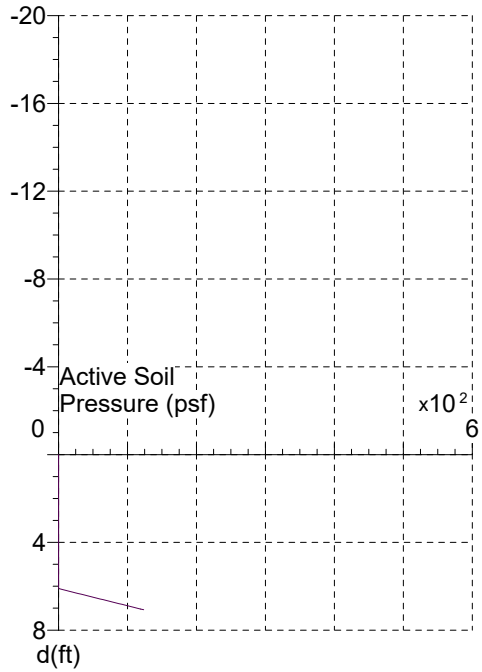

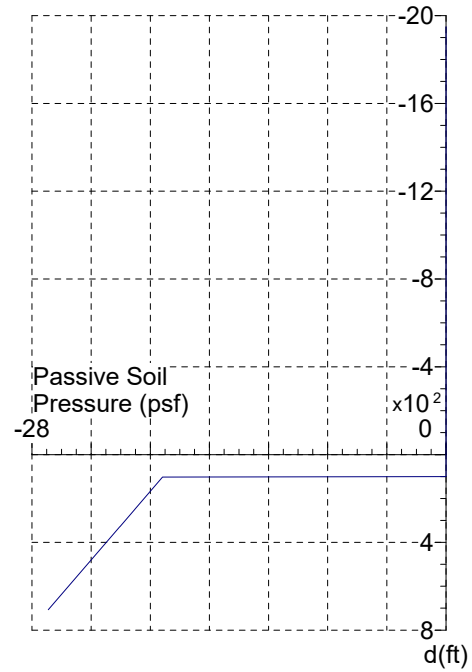

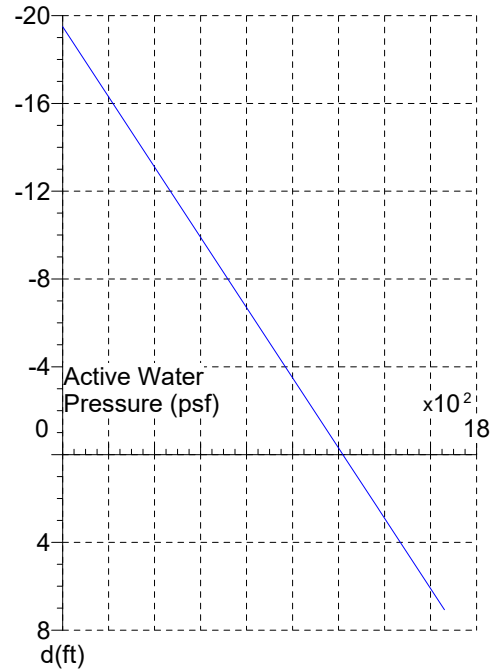

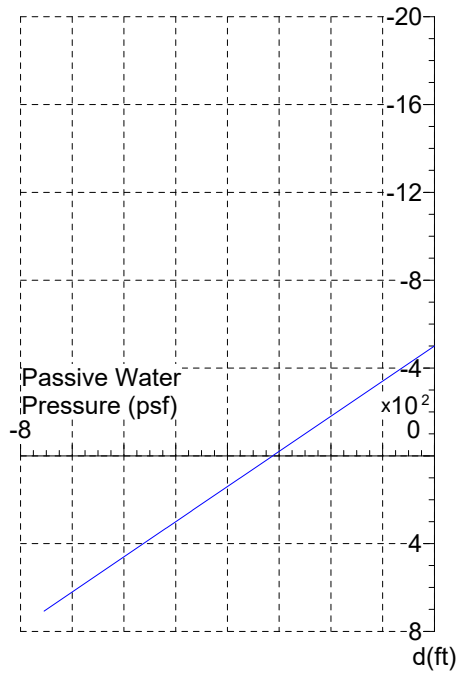

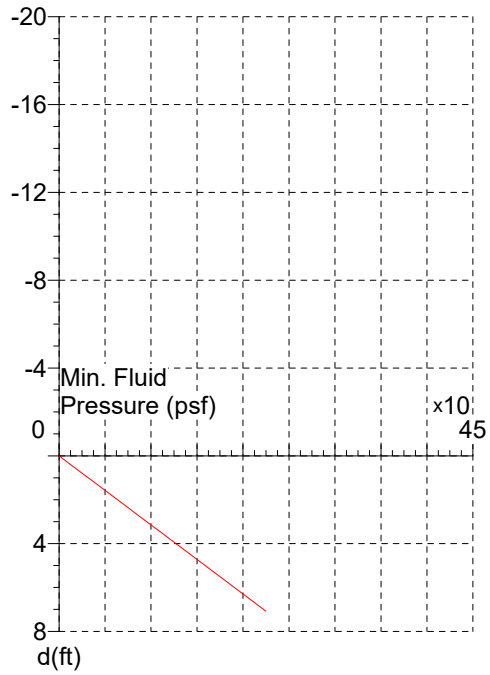

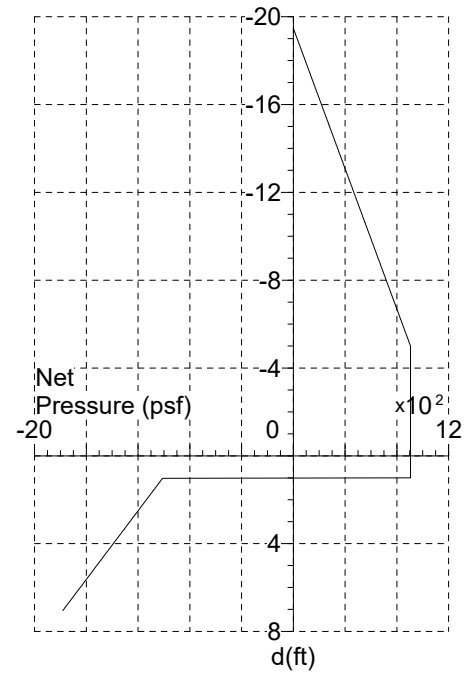

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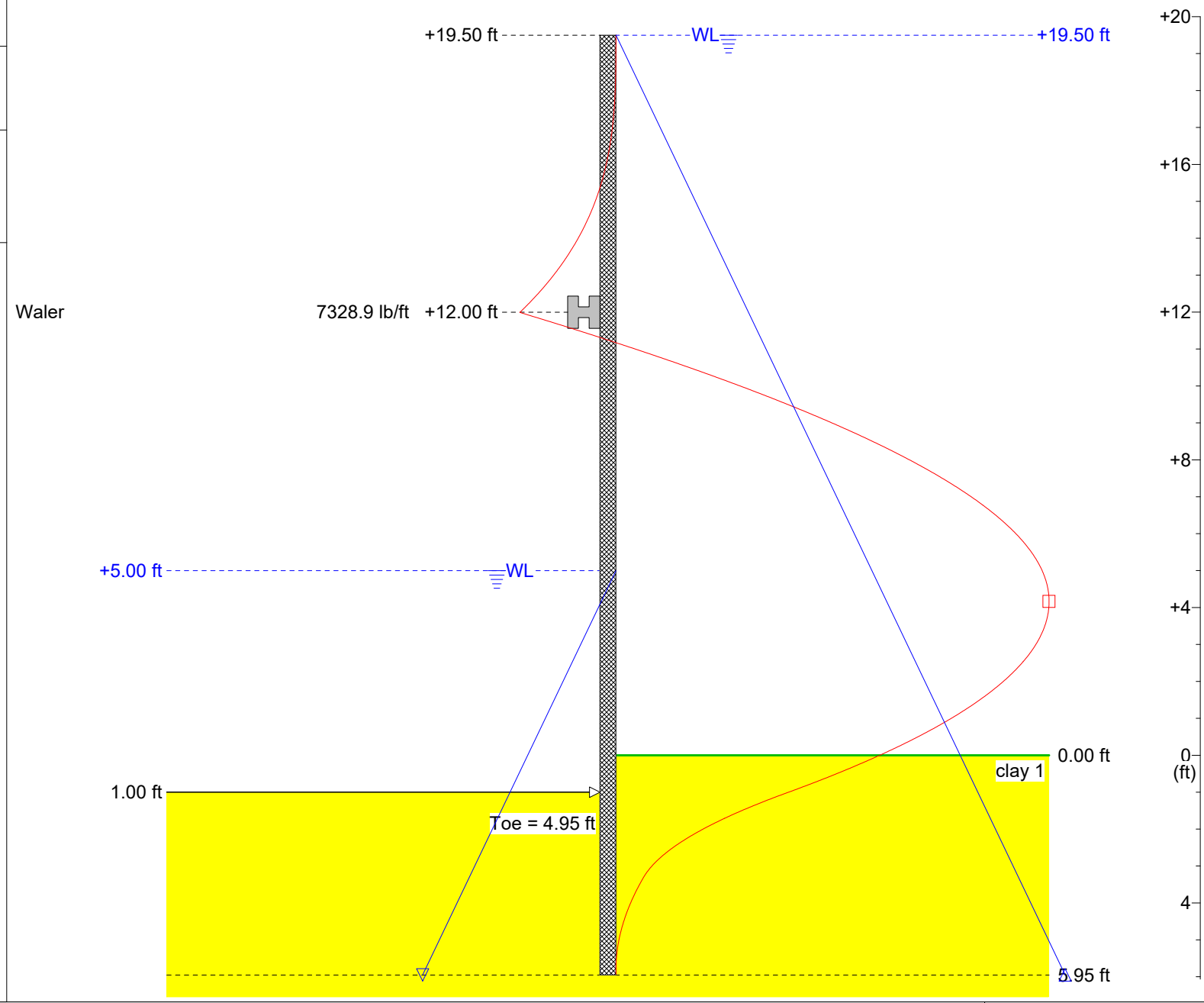
	Maximum	d (ft)
□	19864.2 ftlb/ft	-4.17
△	1590.6 psf	5.95
△	684.4 psf	5.95

Stage 2 - Wales only



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Stage 2 - Wales only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = +5.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	4.95	25.45

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	7328.9

Maxima

	Maximum	Depth (ft)
Pressure	906.7 psf	-4.99
Bending Moment	19864.2 ftlb/ft	-4.17
Shear Force	5562.6 lb/ft	-12.00

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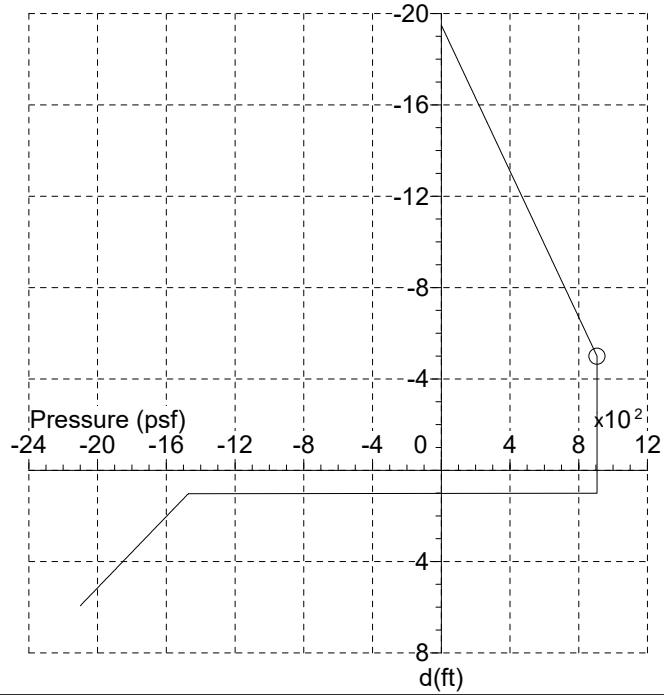
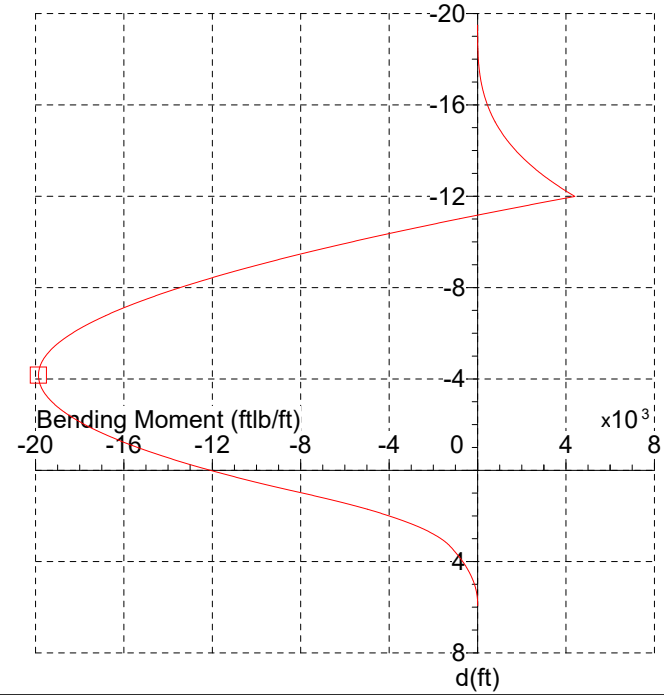
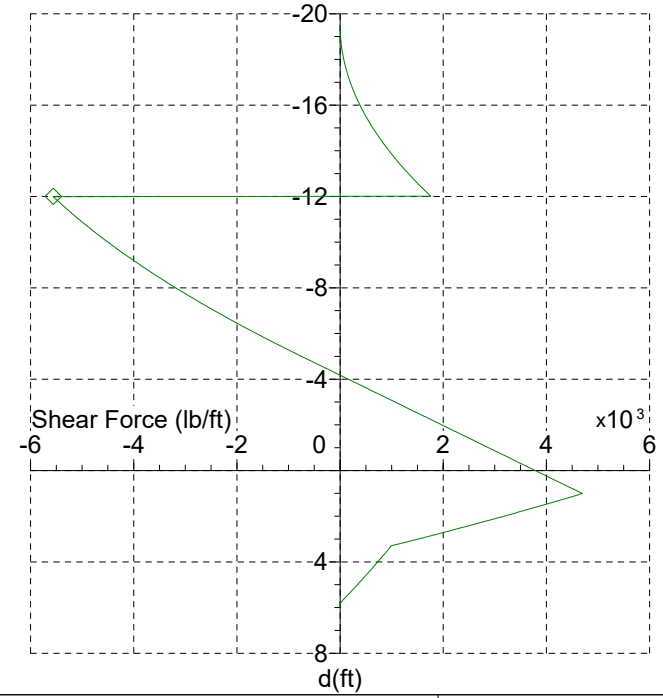
	Maximum	d (ft)
○	906.7 psf	-4.99
□	19864.2 ftlb/ft	-4.17
◇	5562.6 lb/ft	-12.00

Stage 2 - Wales only







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Stage 2 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	906.5	-12054.9		3794.2	2.00	-1597.4	-3979.0		3167.8	3.99	-1852.6	-673.4		731.8
0.04	906.5	-11895.4		3832.6	2.04	-1602.8	-3846.9		3099.8	4.04	-1858.1	-642.9		715.6
0.08	906.5	-11734.3		3871.1	2.08	-1608.3	-3717.6		3031.7	4.08	-1863.5	-613.0		699.3
0.13	906.5	-11571.6		3909.5	2.12	-1613.7	-3591.2		2963.3	4.12	-1868.9	-583.9		683.0
0.17	906.5	-11407.3		3948.0	2.17	-1619.1	-3467.7		2894.7	4.16	-1874.4	-555.4		666.7
0.21	906.5	-11241.3		3986.4	2.21	-1624.6	-3347.1		2825.8	4.21	-1879.8	-527.6		650.3
0.25	906.5	-11073.8		4024.9	2.25	-1630.0	-3229.3		2756.7	4.25	-1885.2	-500.6		633.8
0.30	906.5	-10904.6		4063.3	2.29	-1635.4	-3114.4		2687.4	4.29	-1890.7	-474.1		617.3
0.34	906.5	-10733.8		4101.8	2.34	-1640.8	-3002.5		2617.9	4.33	-1896.1	-448.4		600.8
0.38	906.5	-10561.5		4140.2	2.38	-1646.3	-2893.4		2548.1	4.38	-1901.5	-423.4		584.2
0.42	906.5	-10387.5		4178.7	2.42	-1651.7	-2787.3		2478.1	4.42	-1907.0	-399.1		567.6
0.47	906.5	-10211.8		4217.1	2.46	-1657.1	-2684.2		2407.9	4.46	-1912.4	-375.5		550.9
0.51	906.5	-10034.6		4255.6	2.51	-1662.6	-2583.9		2337.4	4.50	-1917.8	-352.6		534.2
0.55	906.5	-9855.8		4294.0	2.55	-1668.0	-2486.7		2266.7	4.55	-1923.2	-330.3		517.4
0.59	906.5	-9675.3		4332.5	2.59	-1673.4	-2392.4		2195.8	4.59	-1928.7	-308.8		500.6
0.64	906.5	-9493.3		4370.9	2.63	-1678.9	-2301.0		2124.7	4.63	-1934.1	-288.0		483.7
0.68	906.5	-9309.6		4409.4	2.68	-1684.3	-2212.7		2053.3	4.67	-1939.5	-267.9		466.8
0.72	906.5	-9124.3		4447.8	2.72	-1689.7	-2127.4		1981.7	4.72	-1945.0	-248.5		449.8
0.76	906.5	-8937.4		4486.3	2.76	-1695.2	-2045.0		1909.8	4.76	-1950.4	-229.8		432.8
0.81	906.4	-8748.9		4524.7	2.80	-1700.6	-1965.7		1837.7	4.80	-1955.8	-211.9		415.7
0.85	906.4	-8558.8		4563.1	2.85	-1706.0	-1889.4		1765.4	4.84	-1961.3	-194.6		398.6
0.89	906.4	-8367.0		4601.6	2.89	-1711.4	-1816.1		1692.9	4.89	-1966.7	-178.1		381.4
0.93	906.4	-8173.7		4640.0	2.93	-1716.9	-1745.9		1620.1	4.93	-1972.1	-162.3		364.2
0.98	906.4	-7978.7		4678.5	2.97	-1722.3	-1678.7		1547.1	4.97	-1977.6	-147.2		347.0
1.02	-1472.5	-7782.2		4666.5	3.02	-1727.7	-1614.6		1473.9	5.01	-1983.0	-132.8		329.7
1.06	-1477.9	-7587.2		4603.9	3.06	-1733.2	-1553.6		1400.5	5.06	-1988.4	-119.2		312.3
1.10	-1483.4	-7394.8		4541.1	3.10	-1738.6	-1495.7		1326.8	5.10	-1993.9	-106.2		295.0
1.15	-1488.8	-7205.0		4478.0	3.14	-1744.0	-1440.8		1252.9	5.14	-1999.3	-94.1		277.5
1.19	-1494.2	-7017.9		4414.6	3.19	-1749.5	-1389.0		1178.7	5.18	-2004.7	-82.6		260.0
1.23	-1499.6	-6833.5		4351.1	3.23	-1754.9	-1340.4		1104.3	5.23	-2010.1	-71.9		242.5
1.27	-1505.1	-6651.7		4287.3	3.27	-1760.3	-1294.9		1029.7	5.27	-2015.6	-61.9		224.9
1.32	-1510.5	-6472.6		4223.3	3.31	-1765.8	-1252.5		984.7	5.31	-2021.0	-52.7		207.3
1.36	-1515.9	-6296.2		4159.1	3.36	-1771.2	-1211.4		969.2	5.35	-2026.4	-44.1		189.6
1.40	-1521.4	-6122.5		4094.6	3.40	-1776.6	-1170.9		953.7	5.40	-2031.9	-36.4		171.9
1.44	-1526.8	-5951.5		4029.9	3.44	-1782.0	-1131.1		938.2	5.44	-2037.3	-29.4		154.1
1.49	-1532.2	-5783.2		3964.9	3.48	-1787.5	-1091.9		922.6	5.48	-2042.7	-23.1		136.3
1.53	-1537.7	-5617.6		3899.8	3.53	-1792.9	-1053.4		906.9	5.52	-2048.2	-17.6		118.4
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1.61	-1548.5	-5294.7		3768.8	3.61	-1803.8	-978.3		875.5	5.61	-2059.0	-8.8		82.5
1.66	-1554.0	-5137.4		3702.9	3.65	-1809.2	-941.7		859.7	5.65	-2064.5	-5.5		64.5
1.70	-1559.4	-4982.8		3636.8	3.70	-1814.6	-905.9		843.9	5.69	-2069.9	-3.0		46.5
1.74	-1564.8	-4831.0		3570.5	3.74	-1820.1	-870.6		828.0	5.74	-2075.3	-1.2		28.4
1.78	-1570.2	-4682.0		3504.0	3.78	-1825.5	-836.1		812.1	5.78	-2080.7	-0.2		10.2
1.83	-1575.7	-4535.8		3437.2	3.82	-1830.9	-802.2		796.1	5.82	-2086.2	0.0		0.0
1.87	-1581.1	-4392.4		3370.2	3.87	-1836.4	-769.0		780.1	5.86	-2091.6	0.0		0.0
1.91	-1586.5	-4251.8		3302.9	3.91	-1841.8	-736.5		764.1	5.91	-2097.0	0.0		0.0
1.95	-1592.0	-4114.0		3235.5	3.95	-1847.2	-704.6		747.9	5.95	-2099.8	0.0		0.0

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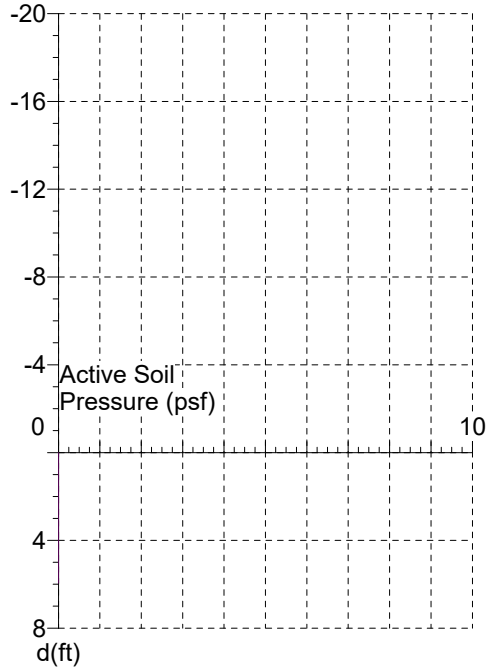
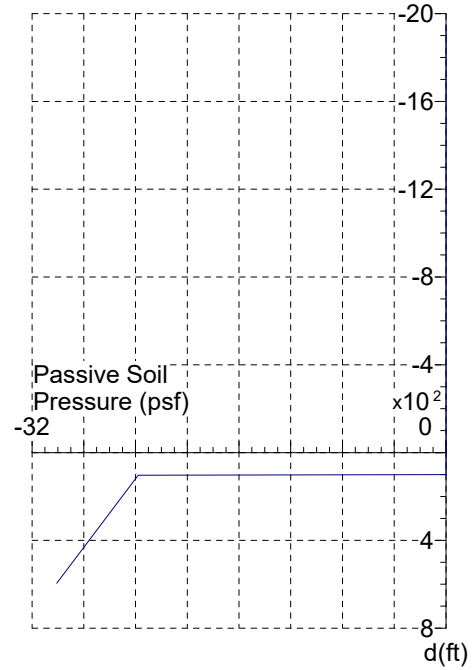
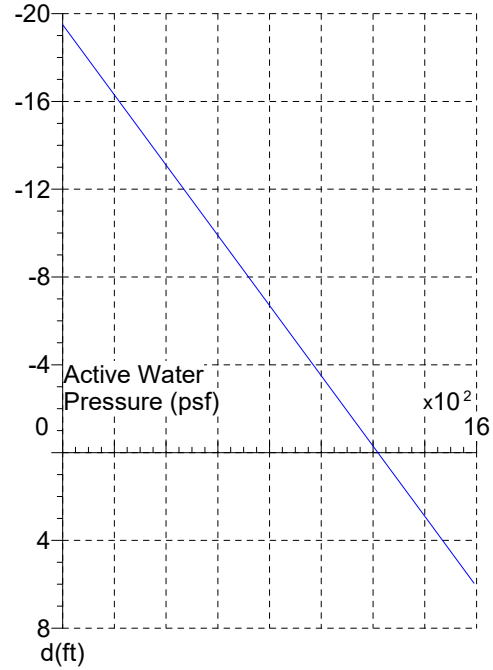
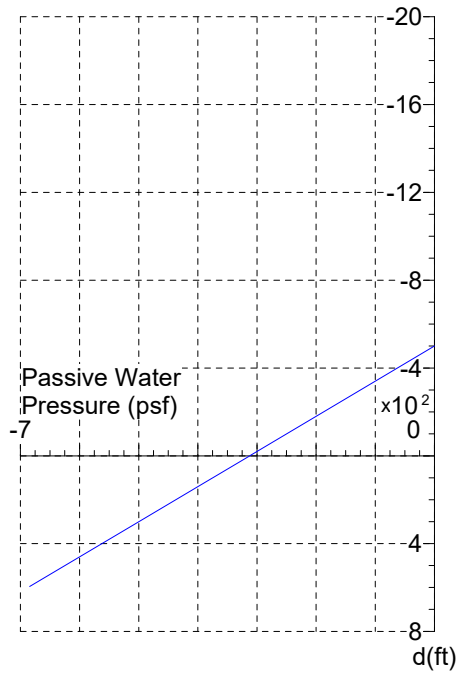
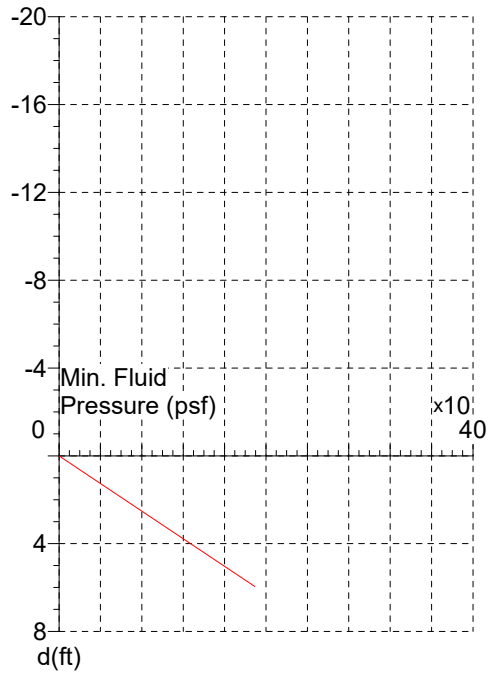
Stage 2 - Wales only

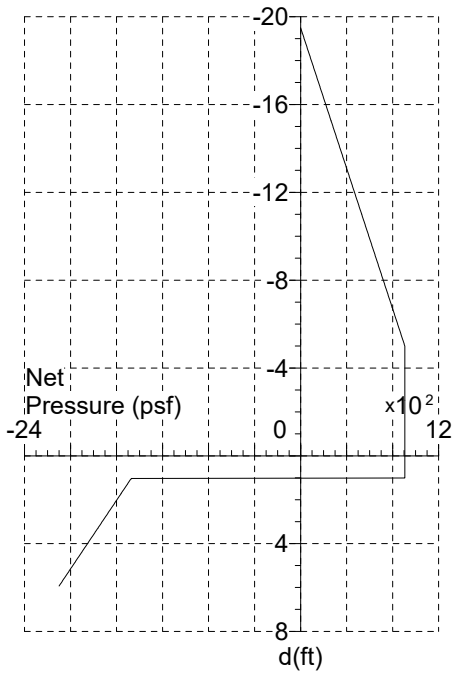












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Title: Colorado River Flood Gate - East Side
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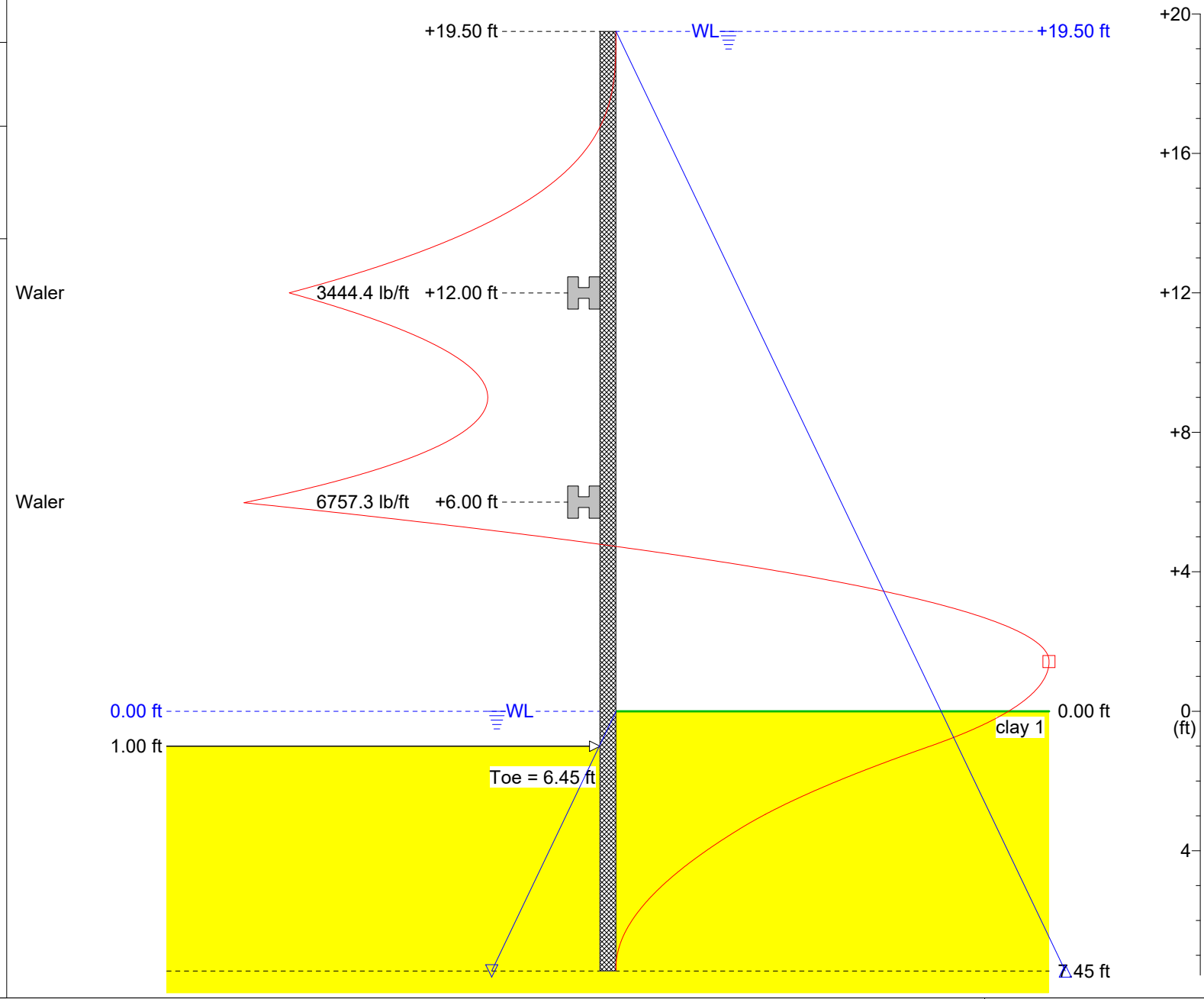
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	5827.9 ftlb/ft	-1.42
△	1684.3 psf	7.45
△	465.5 psf	7.45

Stage 3 - Tip and Moment only



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Toe: Free Earth Support

Stage 3 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 0.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	6.45	26.95

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3444.4
+6.00	Waler	6757.3

Maxima

	Maximum	Depth (ft)
Pressure	1219.7 psf	0.02
Bending Moment	5827.9 ftlb/ft	-1.42
Shear Force	4480.8 lb/ft	-6.00

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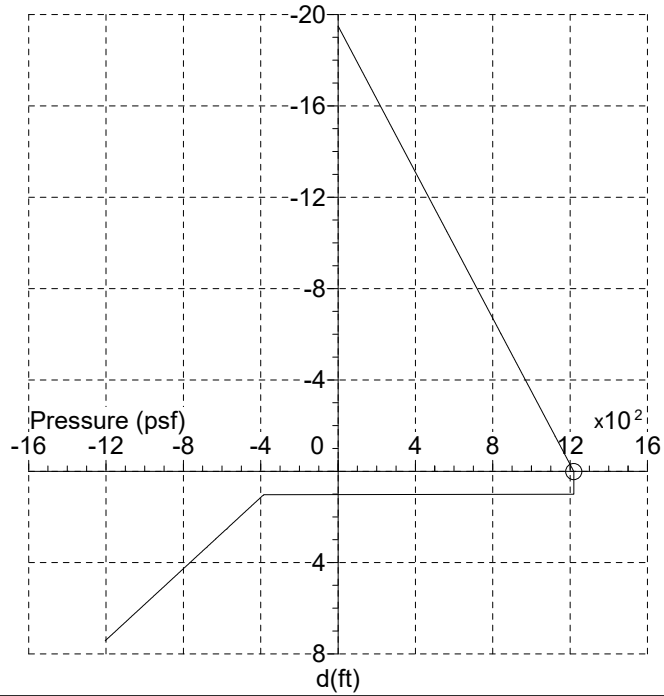
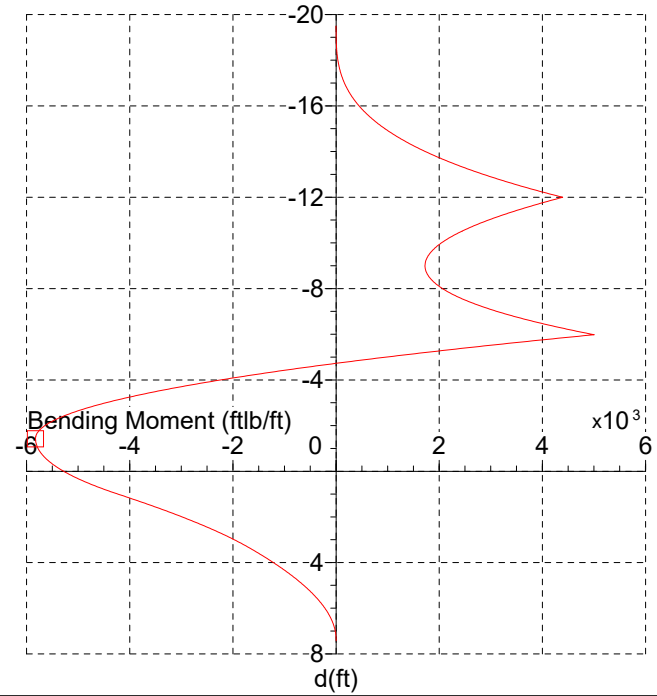
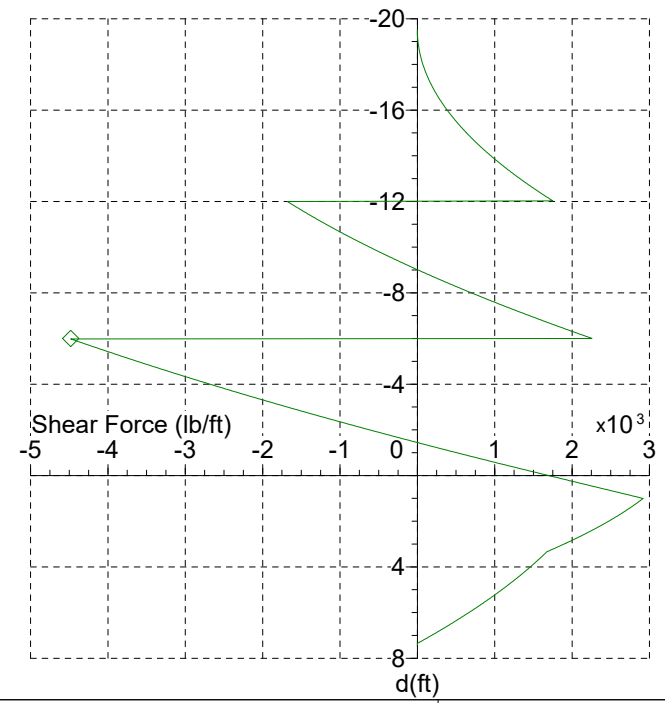
Toe: Free Earth Support

Maximum	d (ft)
○ 1219.7 psf	0.02
□ 5827.9 ftlb/ft	-1.42
◇ 4480.8 lb/ft	-6.00

Stage 3 - Tip and Moment only







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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.7	-5270.2		1713.2	2.50	-574.7	-2436.9		2196.6	5.00	-897.0	-612.6		1083.0
0.05	1219.7	-5234.6		1768.0	2.55	-583.3	-2369.3		2157.6	5.05	-902.7	-590.3		1065.0
0.11	1219.7	-5179.0		1850.2	2.61	-589.1	-2324.9		2131.2	5.11	-908.5	-568.4		1047.0
0.16	1219.7	-5140.6		1905.0	2.66	-594.9	-2281.1		2104.5	5.16	-917.1	-536.3		1019.6
0.21	1219.7	-5101.0		1959.7	2.71	-603.5	-2216.3		2064.1	5.21	-922.9	-515.4		1001.3
0.27	1219.7	-5039.5		2041.9	2.77	-609.2	-2173.9		2036.8	5.27	-928.6	-494.8		982.8
0.32	1219.7	-4997.1		2096.7	2.82	-615.0	-2132.0		2009.2	5.32	-937.3	-464.7		954.9
0.37	1219.7	-4953.5		2151.5	2.87	-623.6	-2070.2		1967.4	5.37	-943.0	-445.1		936.1
0.43	1219.7	-4886.1		2233.6	2.93	-629.4	-2029.8		1939.2	5.43	-948.8	-425.9		917.2
0.48	1219.6	-4839.7		2288.4	2.98	-635.1	-1989.9		1910.7	5.48	-957.4	-397.8		888.7
0.53	1219.6	-4768.0		2370.6	3.03	-643.8	-1931.2		1867.6	5.53	-963.2	-379.5		869.5
0.59	1219.6	-4718.8		2425.4	3.09	-649.5	-1892.8		1838.4	5.59	-971.8	-352.9		840.5
0.64	1219.6	-4668.5		2480.2	3.14	-658.2	-1836.4		1794.3	5.64	-977.5	-335.7		821.1
0.69	1219.6	-4590.9		2562.3	3.19	-663.9	-1799.5		1764.5	5.69	-983.3	-318.8		801.5
0.74	1219.6	-4537.7		2617.1	3.25	-669.7	-1763.3		1734.5	5.75	-991.9	-294.3		771.9
0.80	1219.6	-4483.5		2671.9	3.30	-678.3	-1710.0		1689.0	5.80	-997.7	-278.5		752.1
0.85	1219.6	-4399.9		2754.0	3.35	-684.1	-1675.3		1667.0	5.85	-1003.4	-263.1		732.1
0.90	1219.6	-4342.8		2808.8	3.40	-689.8	-1641.0		1653.3	5.91	-1012.1	-240.7		702.0
0.96	1219.6	-4284.6		2863.6	3.46	-698.4	-1590.1		1632.5	5.96	-1017.8	-226.3		681.7
1.01	-384.8	-4195.1		2909.7	3.51	-704.2	-1556.5		1618.5	6.01	-1026.5	-205.6		651.1
1.06	-390.6	-4135.1		2892.3	3.56	-712.8	-1506.6		1597.2	6.07	-1032.2	-192.2		630.6
1.12	-399.2	-4045.9		2865.6	3.62	-718.6	-1473.7		1582.9	6.12	-1038.0	-179.3		609.9
1.17	-404.9	-3986.8		2847.5	3.67	-724.3	-1441.1		1568.5	6.17	-1046.6	-160.8		578.7
1.22	-410.7	-3928.2		2829.1	3.72	-733.0	-1392.8		1546.7	6.22	-1052.4	-148.9		557.8
1.28	-419.3	-3840.9		2801.1	3.78	-738.7	-1360.9		1532.0	6.28	-1058.1	-137.5		536.7
1.33	-425.1	-3783.2		2782.0	3.83	-744.5	-1329.4		1517.2	6.33	-1066.7	-121.3		504.9
1.38	-430.8	-3725.9		2762.7	3.88	-753.1	-1282.7		1494.8	6.38	-1072.5	-110.9		483.5
1.44	-439.5	-3640.7		2733.3	3.94	-758.9	-1251.9		1479.7	6.44	-1078.3	-101.1		462.1
1.49	-445.2	-3584.4		2713.4	3.99	-767.5	-1206.3		1456.8	6.49	-1086.9	-87.1		429.7
1.54	-453.9	-3500.7		2683.0	4.04	-773.2	-1176.4		1441.4	6.54	-1092.6	-78.4		407.9
1.60	-459.6	-3445.5		2662.4	4.10	-779.0	-1146.7		1426.0	6.60	-1101.3	-66.1		375.1
1.65	-465.4	-3390.6		2641.6	4.15	-787.6	-1102.8		1402.5	6.65	-1107.0	-58.4		353.1
1.70	-474.0	-3309.2		2609.9	4.20	-793.4	-1073.9		1386.7	6.70	-1112.8	-51.3		330.9
1.76	-479.8	-3255.4		2588.4	4.26	-799.1	-1045.4		1370.8	6.76	-1121.4	-41.4		297.5
1.81	-485.5	-3202.1		2566.6	4.31	-807.8	-1003.2		1346.7	6.81	-1127.2	-35.3		275.0
1.86	-494.1	-3123.0		2533.5	4.36	-813.5	-975.5		1330.6	6.86	-1132.9	-29.8		252.5
1.92	-499.9	-3070.9		2511.1	4.42	-819.3	-948.2		1314.3	6.92	-1141.6	-22.3		218.4
1.97	-505.7	-3019.2		2488.5	4.47	-827.9	-907.7		1289.6	6.97	-1147.3	-17.9		195.6
2.02	-514.3	-2942.5		2454.0	4.52	-833.7	-881.2		1273.0	7.02	-1155.9	-12.2		161.1
2.07	-520.0	-2892.0		2430.8	4.58	-842.3	-842.1		1247.9	7.08	-1161.7	-9.0		138.0
2.13	-528.7	-2817.1		2395.3	4.63	-848.1	-816.4		1231.0	7.13	-1167.5	-6.3		114.8
2.18	-534.4	-2767.8		2371.4	4.68	-853.8	-791.1		1214.1	7.18	-1176.1	-3.1		79.7
2.23	-540.2	-2719.0		2347.2	4.74	-862.4	-753.8		1188.4	7.24	-1181.8	-1.6		56.2
2.29	-548.8	-2646.7		2310.4	4.79	-868.2	-729.3		1171.1	7.29	-1187.6	-0.5		32.5
2.34	-554.6	-2599.2		2285.6	4.84	-874.0	-705.3		1153.7	7.34	-1196.2	0.0		0.0
2.39	-560.3	-2552.2		2260.5	4.89	-882.6	-669.8		1127.4	7.40	-1202.0	0.0		0.0
2.45	-569.0	-2482.6		2222.3	4.95	-888.3	-646.7		1109.7	7.45	-1204.9	0.0		0.0

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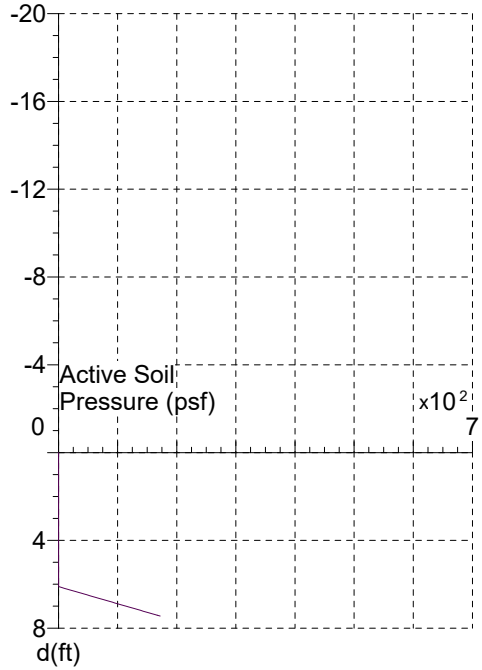
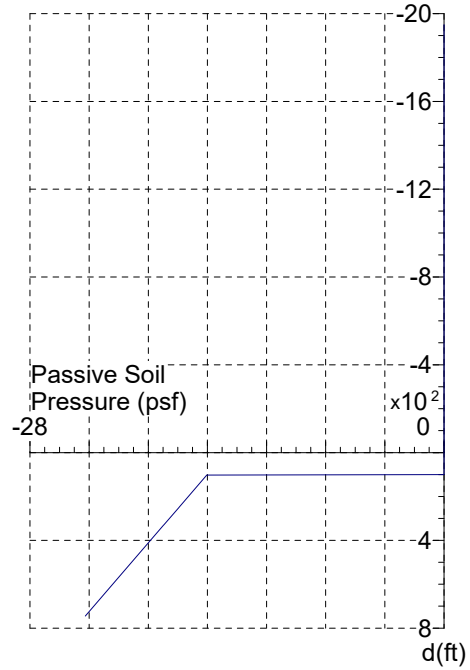
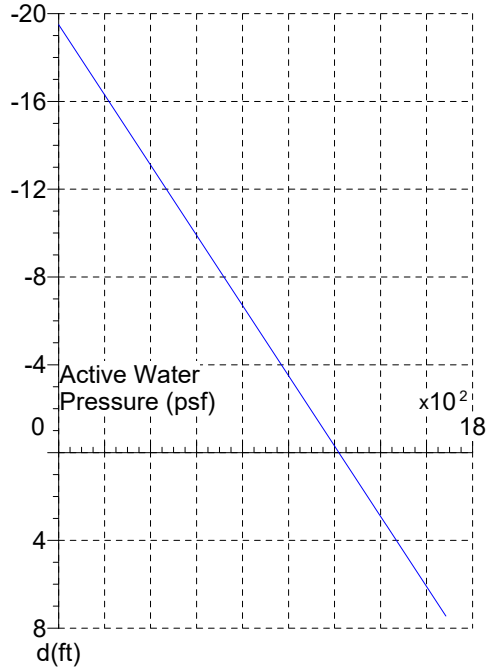
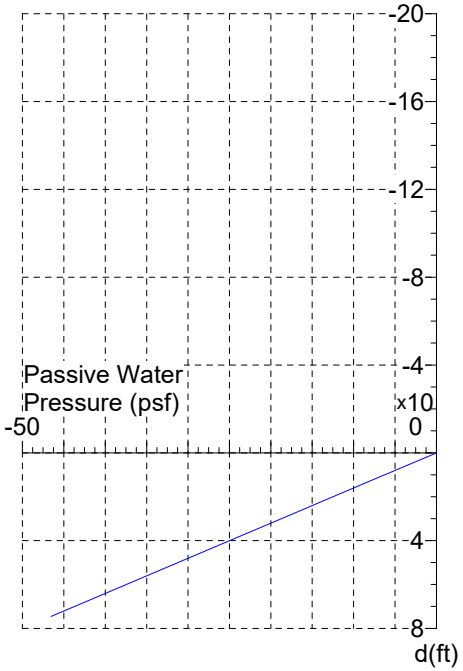
Analysis: Net Pressure
Toe: Free Earth Support

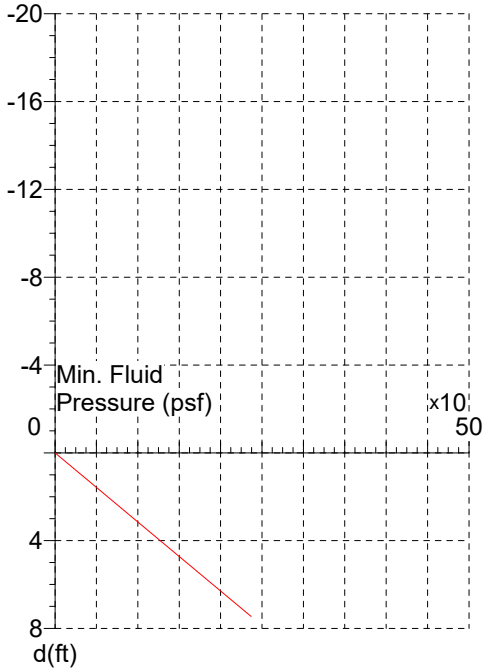
Stage 3 - Tip and Moment only

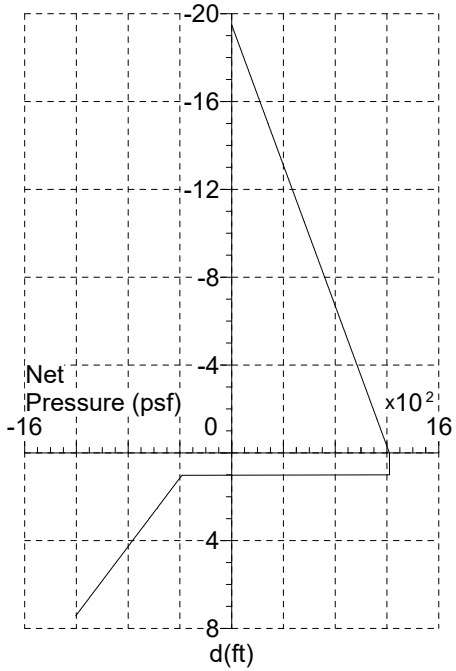












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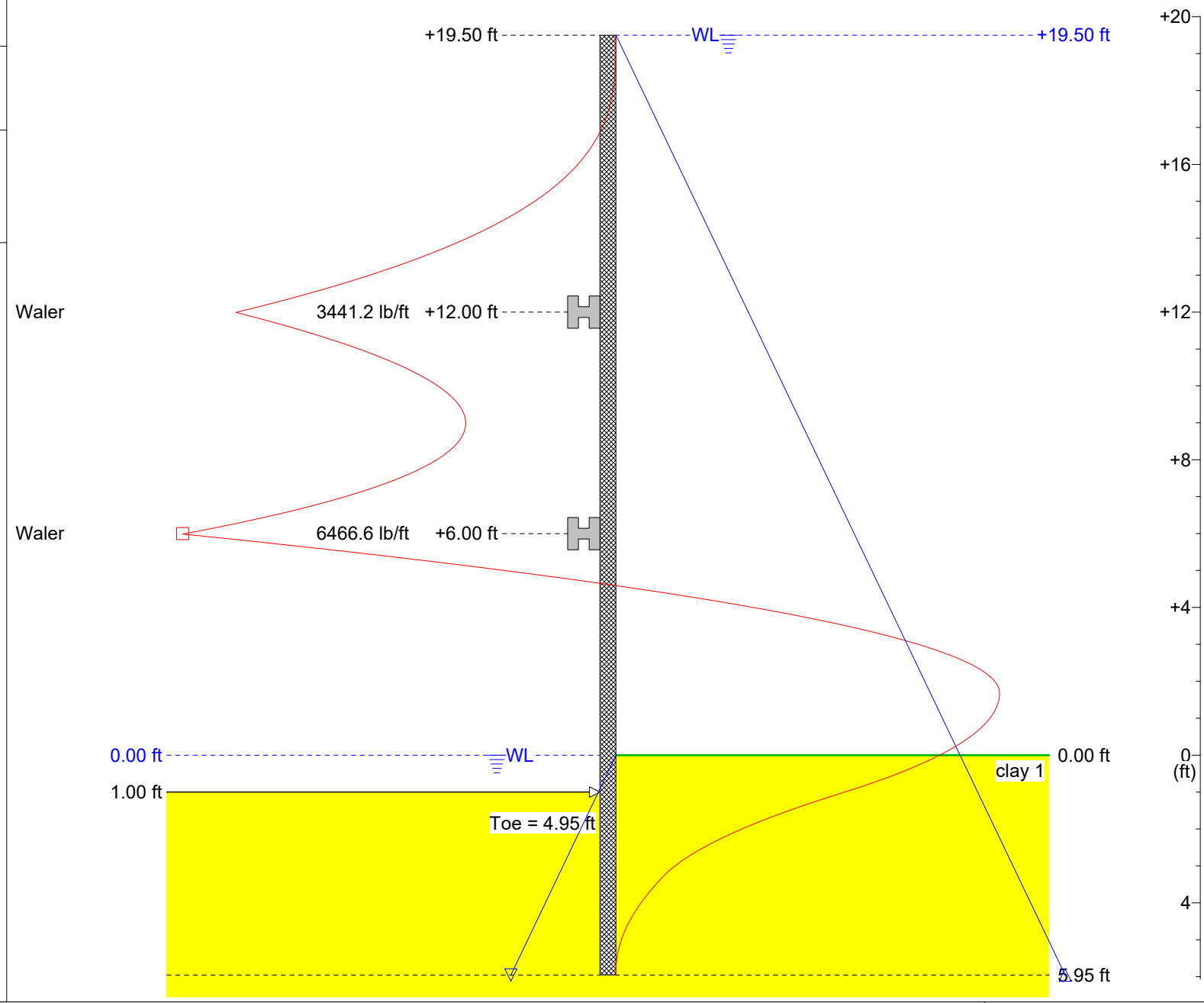
Toe: Free Earth Support

Maximum	d (ft)
5029.7 ftlb/ft	-6.00
1590.9 psf	5.95
372.2 psf	5.95

Stage 3 - Wales only



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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Wales only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 0.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	4.95	25.45

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3441.2
+6.00	Waler	6466.6

Maxima

	Maximum	Depth (ft)
Pressure	1219.4 psf	0.02
Bending Moment	5029.7 ftlb/ft	-6.00
Shear Force	4206.5 lb/ft	-6.00

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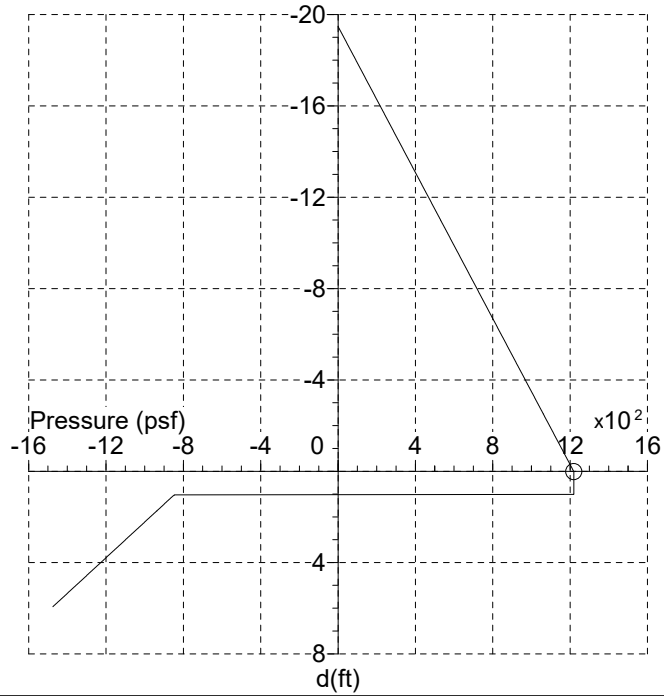
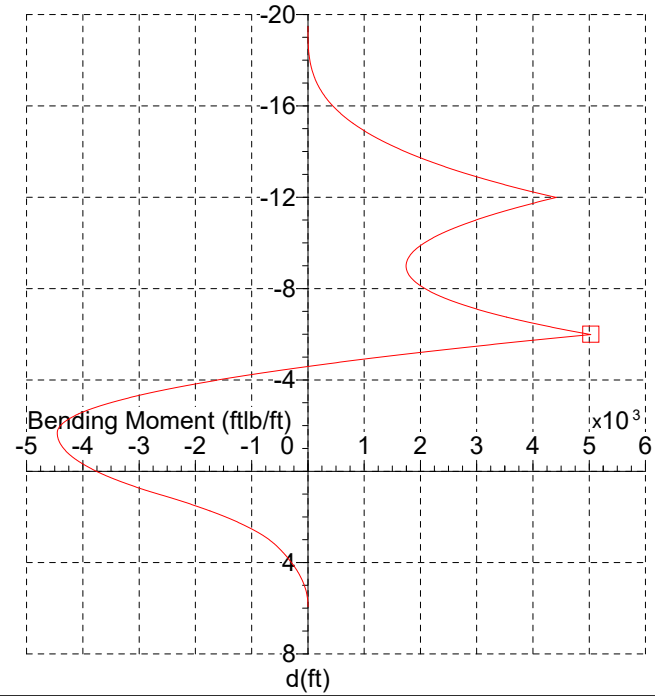
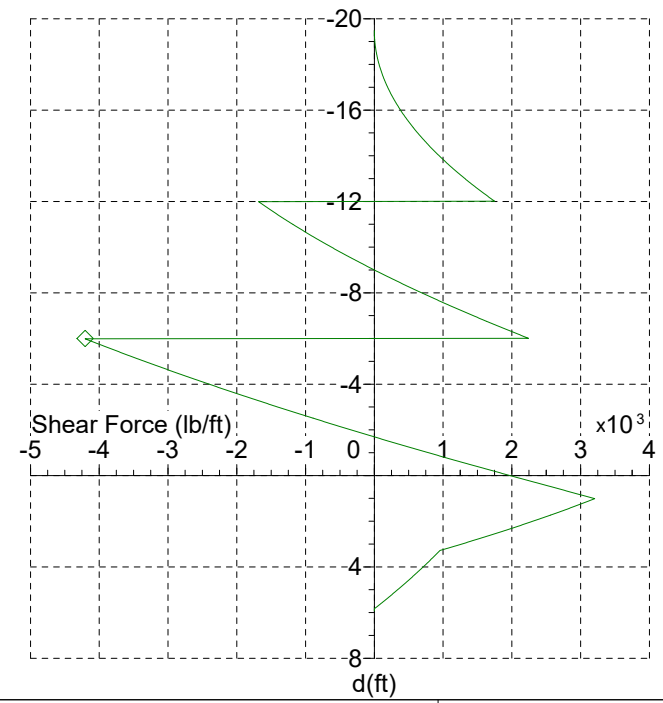
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	1219.4 psf	0.02
□	5029.7 ftlb/ft	-6.00
◇	4206.5 lb/ft	-6.00

Stage 3 - Wales only







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Toe: Free Earth Support

Stage 3 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.4	-3746.3		1990.4	2.00	-972.6	-1454.3		2298.8	4.00	-1228.1	-290.9		710.2
0.04	1219.4	-3709.8		2042.2	2.04	-978.1	-1412.6		2257.3	4.04	-1233.5	-278.0		695.2
0.09	1219.4	-3672.4		2093.9	2.08	-983.5	-1371.7		2215.7	4.08	-1238.9	-265.5		680.1
0.13	1219.4	-3634.0		2145.6	2.13	-988.9	-1331.6		2173.8	4.13	-1244.4	-253.1		664.9
0.17	1219.4	-3594.7		2197.4	2.17	-994.4	-1292.2		2131.6	4.17	-1249.8	-241.1		649.7
0.21	1219.4	-3554.5		2249.1	2.21	-999.8	-1253.6		2089.3	4.21	-1255.2	-229.4		634.4
0.26	1219.4	-3513.3		2300.8	2.25	-1005.2	-1215.8		2046.7	4.25	-1260.7	-217.9		619.1
0.30	1219.4	-3471.2		2352.6	2.30	-1010.7	-1178.7		2003.9	4.30	-1266.1	-206.7		603.7
0.34	1219.4	-3428.2		2404.3	2.34	-1016.1	-1142.4		1960.8	4.34	-1271.5	-195.8		588.2
0.38	1219.4	-3384.2		2456.0	2.38	-1021.5	-1106.9		1917.5	4.38	-1277.0	-185.1		572.6
0.43	1219.4	-3339.2		2507.7	2.42	-1027.0	-1072.2		1874.0	4.42	-1282.4	-174.8		557.0
0.47	1219.3	-3293.3		2559.5	2.47	-1032.4	-1038.3		1830.3	4.47	-1287.8	-164.7		541.3
0.51	1219.3	-3246.5		2611.2	2.51	-1037.9	-1005.2		1786.3	4.51	-1293.3	-154.9		525.6
0.55	1219.3	-3198.7		2662.9	2.55	-1043.3	-972.9		1742.1	4.55	-1298.7	-145.4		509.8
0.60	1219.3	-3150.0		2714.7	2.59	-1048.7	-941.4		1697.7	4.59	-1304.2	-136.2		493.9
0.64	1219.3	-3100.4		2766.4	2.64	-1054.2	-910.7		1653.0	4.64	-1309.6	-127.3		477.9
0.68	1219.3	-3049.8		2818.1	2.68	-1059.6	-880.8		1608.1	4.68	-1315.0	-118.7		461.9
0.72	1219.3	-2998.3		2869.8	2.72	-1065.0	-851.7		1563.0	4.72	-1320.5	-110.3		445.8
0.77	1219.3	-2945.8		2921.6	2.76	-1070.5	-823.5		1517.6	4.76	-1325.9	-102.3		429.7
0.81	1219.3	-2892.4		2973.3	2.81	-1075.9	-796.1		1472.1	4.81	-1331.3	-94.6		413.5
0.85	1219.3	-2838.0		3025.0	2.85	-1081.3	-769.5		1426.2	4.85	-1336.8	-87.1		397.2
0.89	1219.3	-2782.7		3076.8	2.89	-1086.8	-743.7		1380.2	4.89	-1342.2	-79.9		380.9
0.94	1219.3	-2726.5		3128.5	2.93	-1092.2	-718.8		1333.9	4.93	-1347.6	-73.1		364.4
0.98	1219.3	-2669.3		3180.2	2.98	-1097.6	-694.7		1287.4	4.98	-1353.1	-66.5		348.0
1.02	-847.6	-2611.2		3188.1	3.02	-1103.1	-671.5		1240.7	5.02	-1358.5	-60.3		331.4
1.06	-853.1	-2553.3		3152.0	3.06	-1108.5	-649.1		1193.7	5.06	-1363.9	-54.3		314.8
1.11	-858.5	-2496.1		3115.7	3.10	-1113.9	-627.6		1146.5	5.10	-1369.4	-48.7		298.1
1.15	-863.9	-2439.5		3079.1	3.15	-1119.4	-607.0		1099.1	5.15	-1374.8	-43.3		281.4
1.19	-869.4	-2383.7		3042.2	3.19	-1124.8	-587.2		1051.4	5.19	-1380.2	-38.3		264.6
1.23	-874.8	-2328.5		3005.2	3.23	-1130.2	-568.3		1003.5	5.23	-1385.7	-33.5		247.7
1.28	-880.2	-2273.9		2967.9	3.27	-1135.6	-550.2		955.4	5.27	-1391.1	-29.1		230.8
1.32	-885.7	-2220.1		2930.4	3.32	-1141.1	-532.9		941.5	5.32	-1396.5	-25.0		213.8
1.36	-891.1	-2166.9		2892.6	3.36	-1146.5	-515.8		927.5	5.36	-1402.0	-21.2		196.7
1.40	-896.5	-2114.4		2854.7	3.40	-1152.0	-499.0		913.5	5.40	-1407.4	-17.6		179.6
1.45	-902.0	-2062.6		2816.5	3.45	-1157.4	-482.4		899.4	5.44	-1412.8	-14.5		162.3
1.49	-907.4	-2011.5		2778.0	3.49	-1162.8	-466.1		885.3	5.49	-1418.3	-11.6		145.1
1.53	-912.9	-1961.1		2739.3	3.53	-1168.3	-450.1		871.0	5.53	-1423.7	-9.0		127.7
1.57	-918.3	-1911.5		2700.4	3.57	-1173.7	-434.3		856.7	5.57	-1429.2	-6.8		110.3
1.62	-923.7	-1862.5		2661.3	3.62	-1179.2	-418.8		842.4	5.61	-1434.6	-4.8		92.9
1.66	-929.2	-1814.2		2622.0	3.66	-1184.6	-403.5		828.0	5.66	-1440.0	-3.2		75.3
1.70	-934.6	-1766.7		2582.4	3.70	-1190.0	-388.5		813.5	5.70	-1445.5	-1.9		57.7
1.74	-940.0	-1719.8		2542.5	3.74	-1195.5	-373.7		798.9	5.74	-1450.9	-1.0		40.0
1.79	-945.5	-1673.7		2502.5	3.79	-1200.9	-359.3		784.3	5.78	-1456.3	-0.3		22.3
1.83	-950.9	-1628.4		2462.2	3.83	-1206.3	-345.1		769.6	5.83	-1461.8	0.0		0.0
1.87	-956.3	-1583.7		2421.7	3.87	-1211.8	-331.1		754.9	5.87	-1467.2	0.0		0.0
1.91	-961.8	-1539.8		2380.9	3.91	-1217.2	-317.4		740.0	5.91	-1472.6	0.0		0.0
1.96	-967.2	-1496.7		2340.0	3.96	-1222.6	-304.0		725.1	5.95	-1475.3	0.0		0.0

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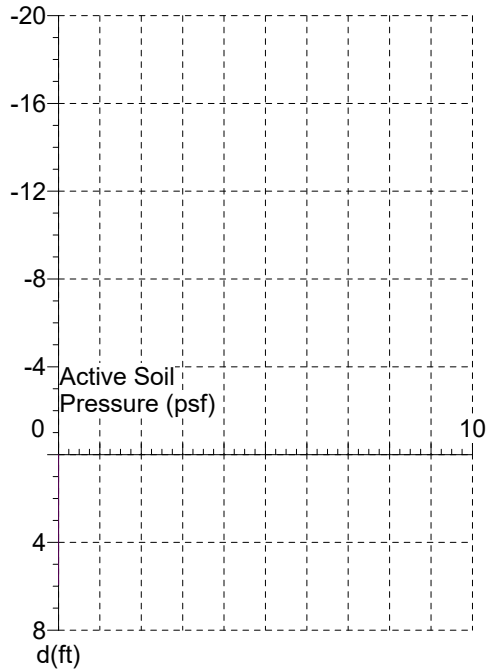
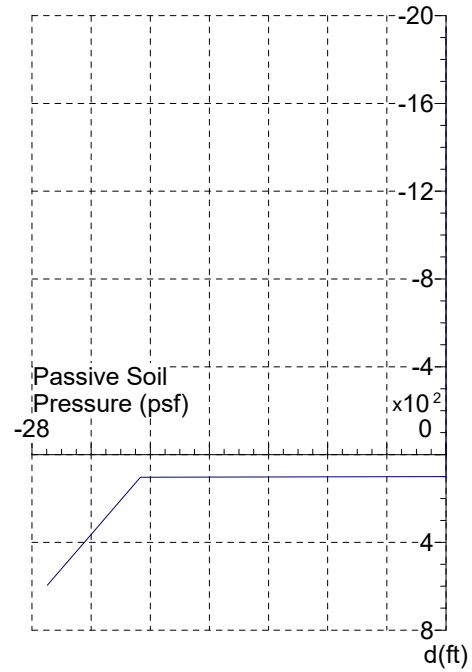
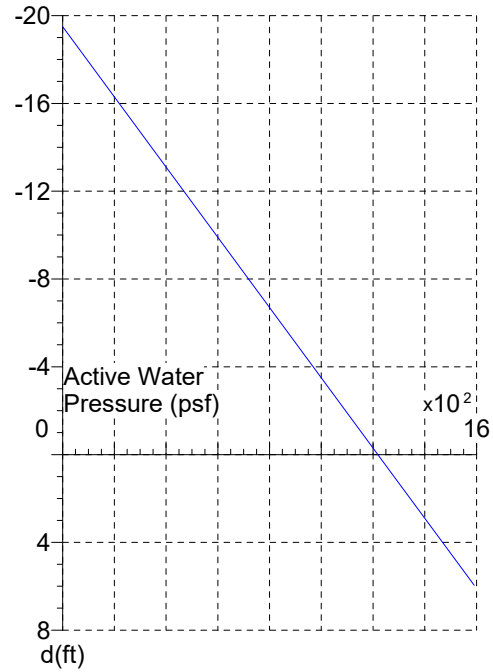
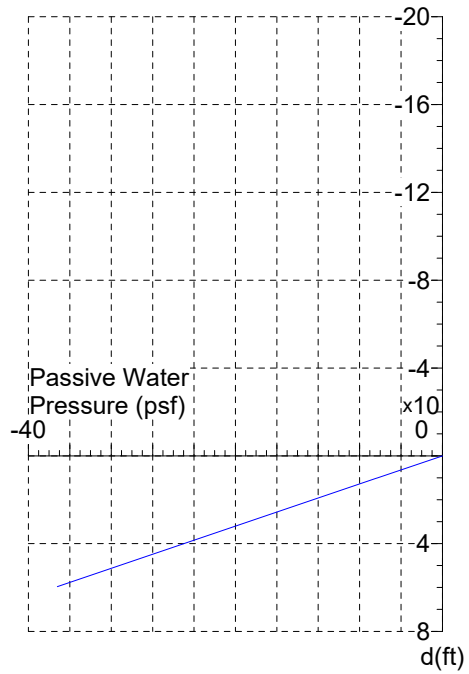
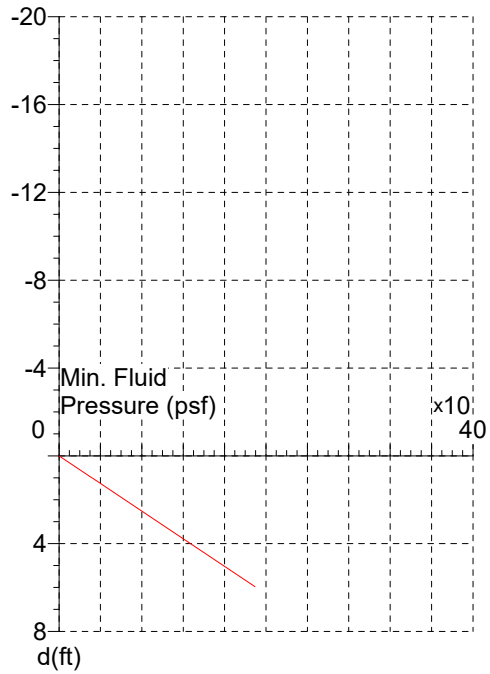
Stage 3 - Wales only

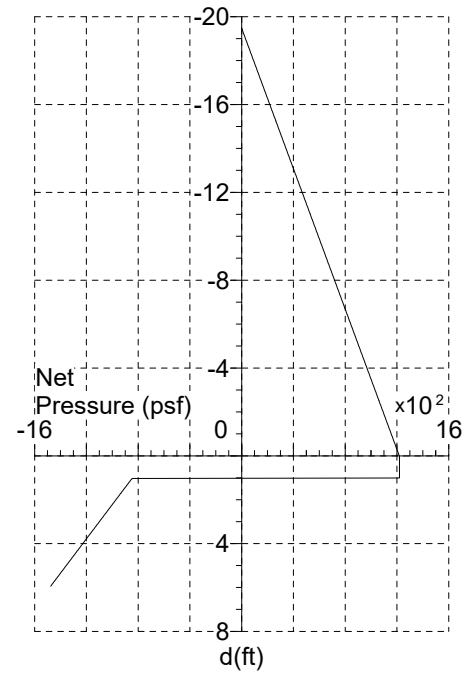












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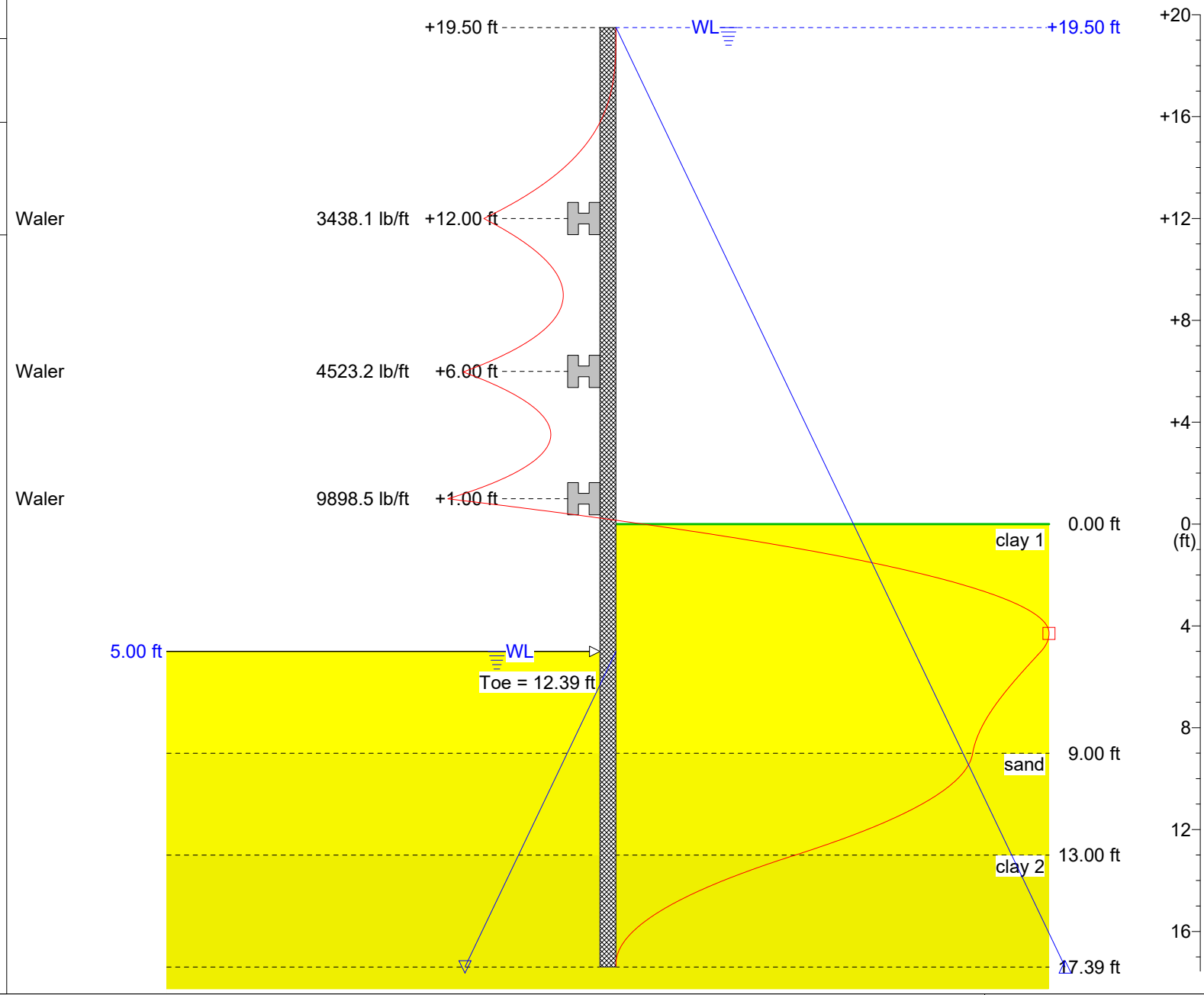
	Maximum	d (ft)
□	14416.4 ftlb/ft	4.30
△	2305.9 psf	17.39
△	774.7 psf	17.39

Stage 4 - Tip and Moment only



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Toe: Free Earth Support

Stage 4 - Tip and Moment only

Input Data

Depth Of Excavation = 5.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 5.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	12.39	36.89

Pressure Model: Coulomb; Assume full hydrostatic pressure to 5.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3438.1
+6.00	Waler	4523.2
+1.00	Waler	9898.5

Maxima

	Maximum	Depth (ft)
Pressure	1851.5 psf	5.00
Bending Moment	14416.4 ftlb/ft	4.30
Shear Force	7163.2 lb/ft	-1.00

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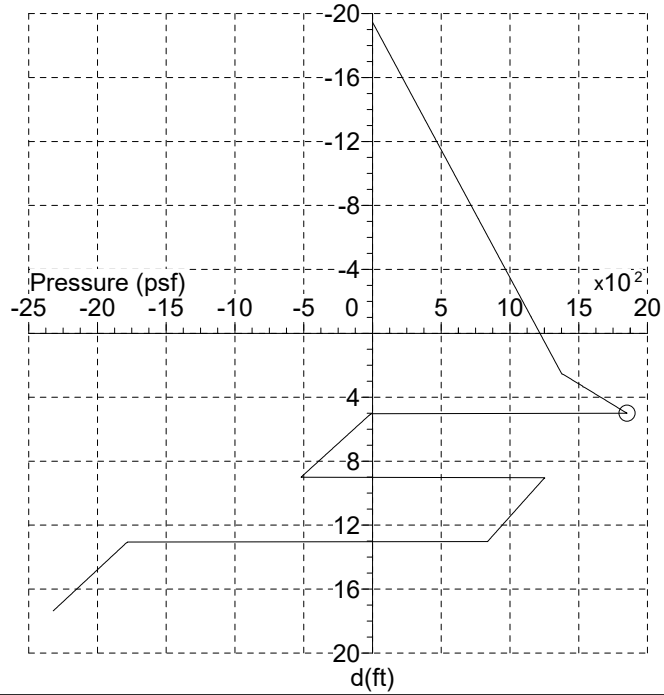
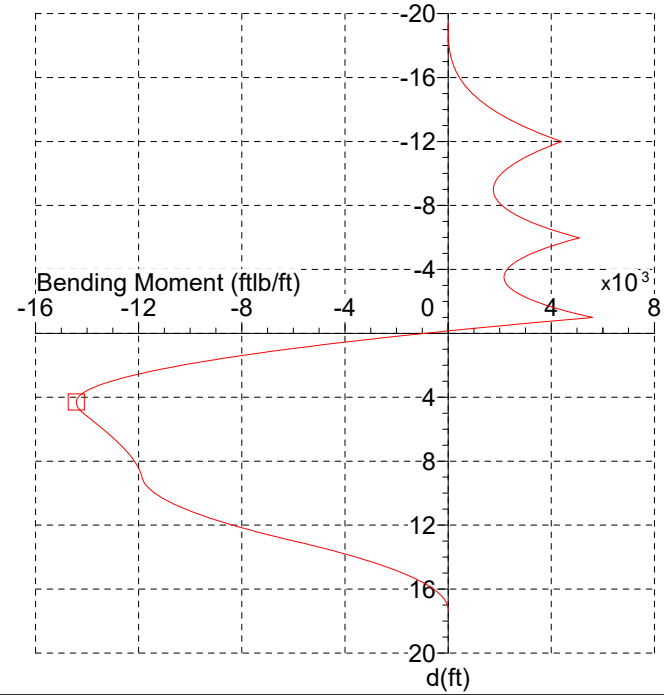
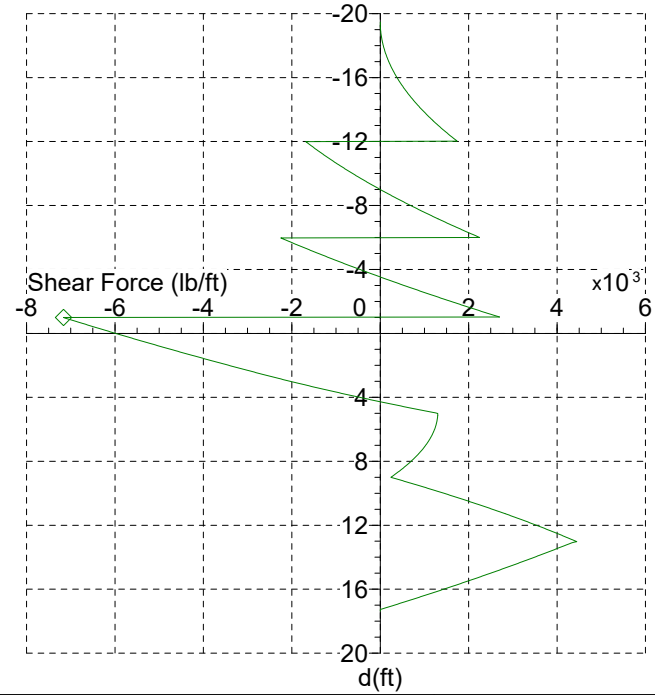
	Maximum	d (ft)
○	1851.5 psf	5.00
□	14416.4 ftlb/ft	4.30
◇	7163.2 lb/ft	-1.00

Stage 4 - Tip and Moment only







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Analysis: Net Pressure
Toe: Free Earth Support

Stage 4 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.3	-1039.0		-5957.4	5.84	-118.4	-13481.4		1246.6	11.68	974.4	-8954.8		3252.5
0.12	1227.0	-1759.8		-5806.8	5.96	-134.2	-13389.6		1230.8	11.80	961.6	-8710.9		3371.3
0.25	1234.7	-2462.3		-5655.3	6.09	-149.9	-13299.0		1213.1	11.93	948.8	-8458.2		3488.6
0.37	1242.4	-3146.1		-5502.9	6.21	-165.6	-13209.8		1193.4	12.05	936.0	-8196.9		3604.3
0.50	1250.1	-3811.3		-5349.5	6.34	-181.4	-13122.1		1171.9	12.18	923.2	-7927.1		3718.4
0.62	1257.8	-4457.8		-5195.2	6.46	-197.1	-13036.0		1148.3	12.30	910.4	-7648.9		3830.9
0.75	1265.5	-5085.3		-5039.9	6.59	-212.9	-12951.8		1122.9	12.42	897.6	-7362.4		3941.9
0.87	1273.2	-5693.8		-4883.7	6.71	-228.6	-12869.5		1095.5	12.55	884.8	-7067.7		4051.3
0.99	1280.8	-6283.2		-4726.5	6.83	-244.3	-12789.2		1066.2	12.67	872.0	-6765.0		4159.2
1.12	1288.5	-6853.4		-4568.4	6.96	-260.1	-12711.2		1034.9	12.80	859.2	-6454.3		4265.4
1.24	1296.2	-7404.1		-4409.3	7.08	-275.8	-12635.5		1001.7	12.92	846.4	-6135.8		4370.1
1.37	1303.9	-7935.5		-4249.3	7.21	-291.5	-12562.4		966.6	13.05	-1783.9	-5809.6		4392.8
1.49	1311.6	-8447.2		-4088.4	7.33	-307.3	-12491.9		929.5	13.17	-1799.3	-5489.2		4254.2
1.62	1319.3	-8939.2		-3926.5	7.45	-323.0	-12424.2		890.5	13.29	-1814.6	-5177.6		4141.7
1.74	1327.0	-9411.4		-3763.7	7.58	-338.8	-12359.4		849.6	13.42	-1830.0	-4874.4		4028.3
1.86	1334.7	-9863.7		-3599.9	7.70	-354.5	-12297.8		806.7	13.54	-1845.4	-4579.5		3913.8
1.99	1342.4	-10295.9		-3435.1	7.83	-370.2	-12239.3		761.9	13.67	-1860.7	-4293.2		3798.4
2.11	1350.1	-10707.9		-3269.5	7.95	-386.0	-12184.2		715.2	13.79	-1876.1	-4015.4		3682.1
2.24	1357.8	-11099.7		-3102.8	8.08	-401.7	-12132.7		666.5	13.92	-1891.5	-3746.2		3564.8
2.36	1367.4	-11560.7		-2893.2	8.20	-417.4	-12084.7		615.9	14.04	-1906.8	-3485.7		3446.6
2.48	1377.0	-11906.4		-2724.4	8.32	-433.2	-12040.6		563.4	14.16	-1922.2	-3234.1		3327.4
2.61	1400.4	-12231.4		-2553.4	8.45	-452.9	-11991.0		494.9	14.29	-1937.6	-2991.2		3207.2
2.73	1423.9	-12535.4		-2379.4	8.57	-468.6	-11956.0		438.0	14.41	-1956.8	-2700.2		3055.7
2.86	1447.3	-12818.0		-2202.5	8.70	-484.3	-11925.2		379.2	14.54	-1972.2	-2477.6		2933.3
2.98	1470.7	-13078.9		-2022.7	8.82	-500.1	-11898.8		318.4	14.66	-1987.5	-2264.0		2810.1
3.11	1494.2	-13317.6		-1840.0	8.95	-515.8	-11877.0		255.7	14.79	-2002.9	-2059.5		2685.9
3.23	1517.6	-13533.9		-1654.5	9.07	1246.2	-11856.8		355.1	14.91	-2018.3	-1864.3		2560.7
3.35	1541.0	-13727.4		-1466.2	9.19	1233.4	-11826.3		507.4	15.03	-2033.6	-1678.3		2434.5
3.48	1564.5	-13897.8		-1274.9	9.32	1220.6	-11784.6		658.1	15.16	-2049.0	-1501.7		2307.5
3.60	1587.9	-14044.7		-1080.7	9.44	1207.8	-11731.8		807.2	15.28	-2064.4	-1334.6		2179.4
3.73	1611.3	-14167.7		-883.6	9.57	1195.0	-11667.9		954.7	15.41	-2079.7	-1176.9		2050.4
3.85	1634.8	-14266.5		-683.6	9.69	1182.2	-11593.2		1100.7	15.53	-2095.1	-1028.8		1920.4
3.98	1658.2	-14340.7		-480.8	9.82	1169.4	-11507.8		1245.1	15.66	-2110.5	-890.3		1789.5
4.10	1681.6	-14390.1		-275.1	9.94	1156.6	-11411.7		1388.0	15.78	-2125.9	-761.6		1657.7
4.22	1705.1	-14414.1		-66.5	10.06	1143.9	-11305.1		1529.2	15.90	-2141.2	-642.7		1524.8
4.35	1728.5	-14414.0		145.0	10.19	1131.1	-11188.1		1668.9	16.03	-2156.6	-533.5		1391.1
4.47	1751.9	-14397.3		359.4	10.31	1118.3	-11060.8		1807.0	16.15	-2172.0	-434.4		1256.3
4.60	1775.4	-14364.7		576.7	10.44	1105.5	-10923.3		1943.6	16.28	-2187.3	-345.2		1120.6
4.72	1798.8	-14316.0		796.8	10.56	1092.7	-10775.7		2078.6	16.40	-2202.7	-266.1		984.0
4.85	1822.2	-14250.9		1019.8	10.69	1079.9	-10618.2		2212.0	16.52	-2218.1	-197.1		846.4
4.97	1845.7	-14169.2		1245.7	10.81	1067.1	-10450.9		2343.8	16.65	-2233.4	-138.3		707.8
5.09	-20.1	-14073.9		1301.3	10.93	1054.3	-10273.9		2474.0	16.77	-2248.8	-89.8		568.3
5.22	-35.8	-13977.7		1297.6	11.06	1041.5	-10087.3		2602.7	16.90	-2264.2	-51.7		427.8
5.34	-55.5	-13857.9		1290.3	11.18	1028.7	-9891.2		2729.8	17.02	-2279.5	-23.9		286.4
5.47	-71.2	-13762.7		1282.3	11.31	1015.9	-9685.8		2855.3	17.15	-2294.9	-6.7		144.0
5.59	-86.9	-13668.1		1272.3	11.43	999.9	-9416.0		3010.0	17.27	-2310.3	0.0		0.0
5.72	-102.7	-13574.3		1260.4	11.55	987.1	-9189.9		3132.0	17.39	-2321.8	0.0		0.0

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Title: Colorado River Flood Gate - East Side
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Ref: 1.3
Page: 5
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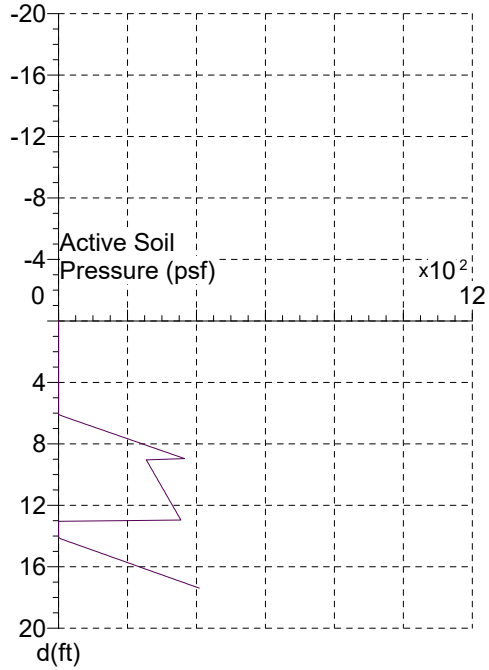
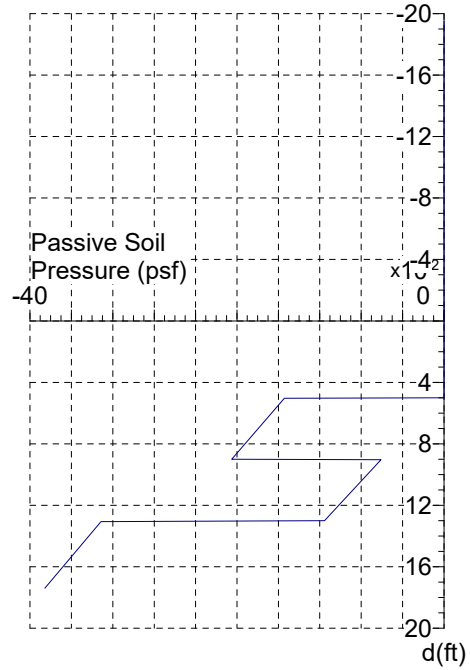
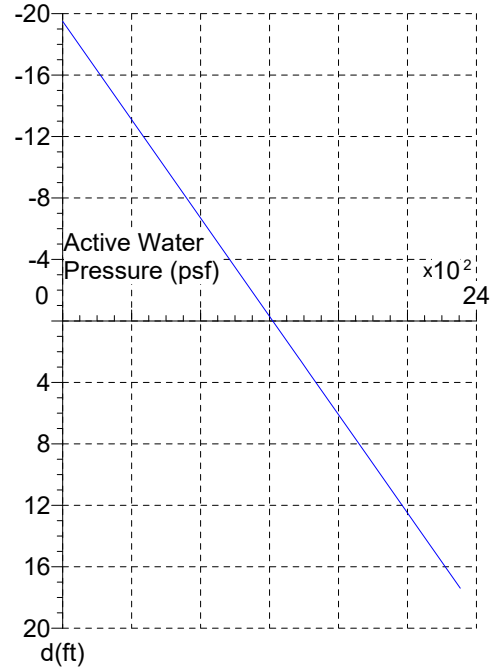
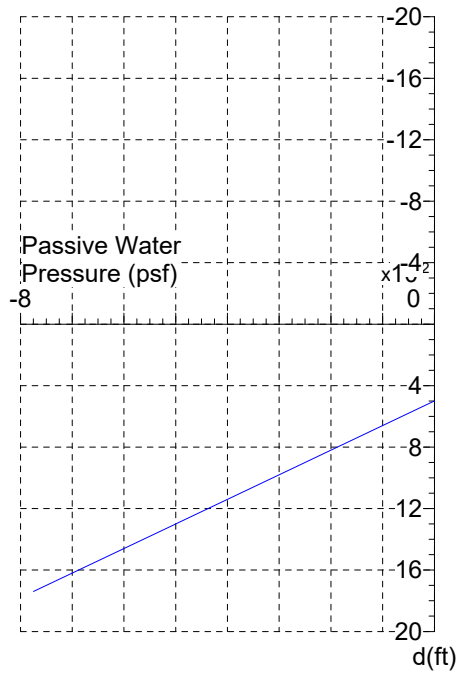
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

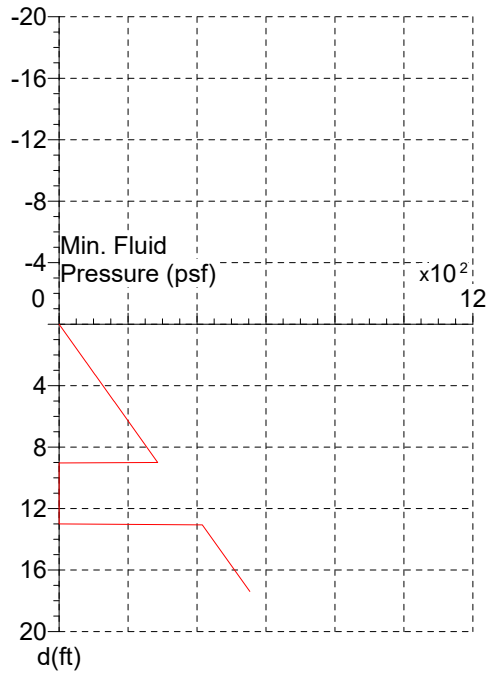
Stage 4 - Tip and Moment only

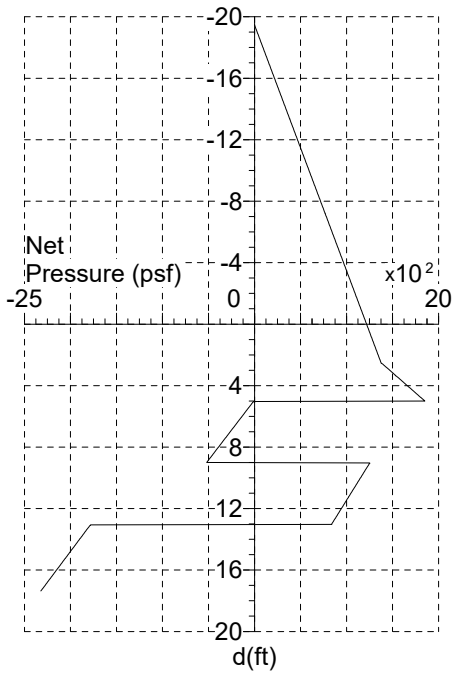












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Title: Colorado River Flood Gate - East Side
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Works: Temporary
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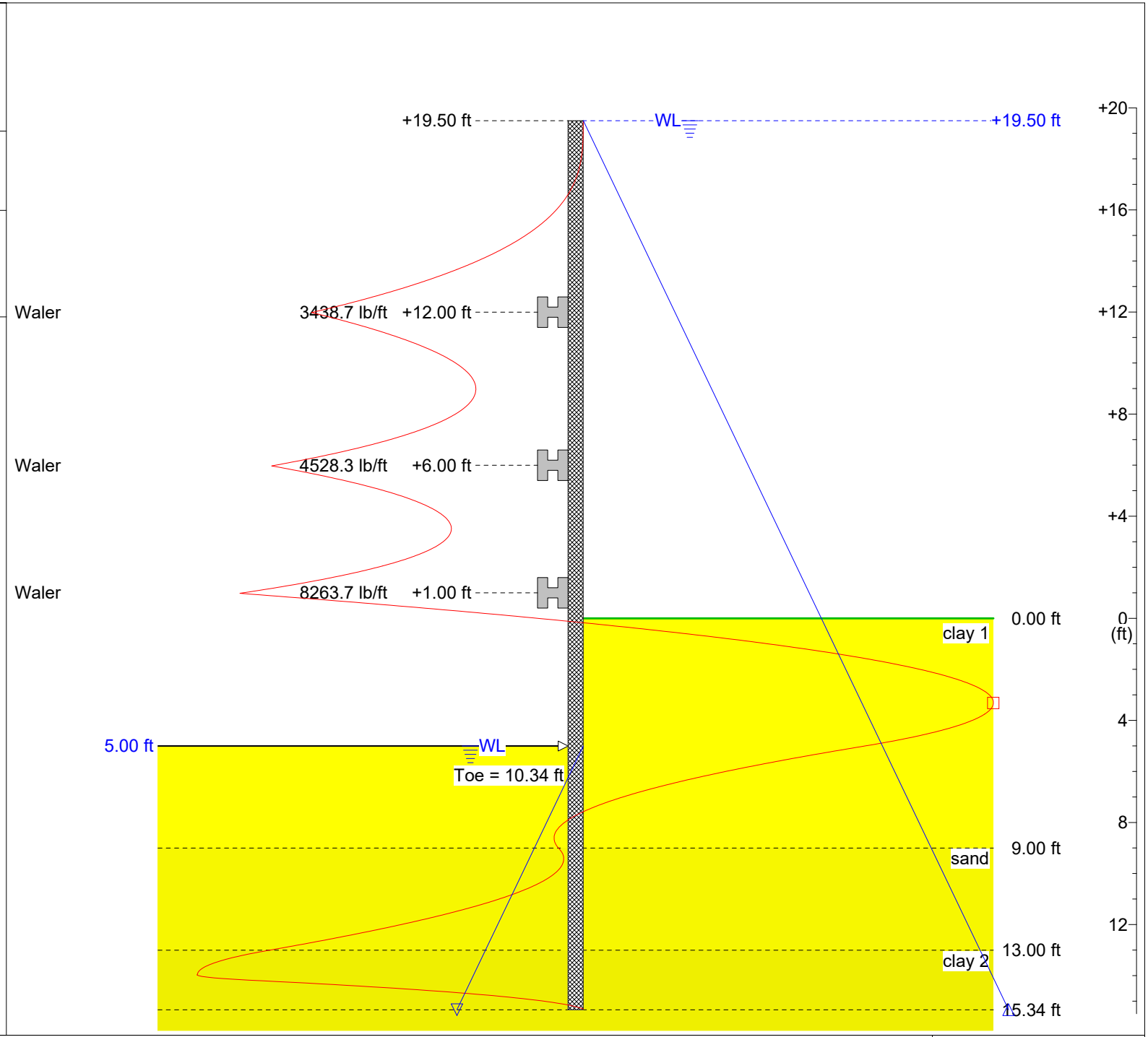
Toe: Free Earth Support

Maximum	d (ft)
6692.4 ftlb/ft	3.32
2177.4 psf	15.34
646.1 psf	15.34

Stage 4 - Wales only



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Title: Colorado River Flood Gate - East Side
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Toe: Free Earth Support

Stage 4 - Wales only

Input Data

Depth Of Excavation = 5.00ft
Surcharge = 0.0psf
Depth Of Active Water = +19.50ft
Depth Of Passive Water = 5.00ft
Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	10.34	34.84

Pressure Model: Coulomb; Assume full hydrostatic pressure to 5.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3438.7
+6.00	Waler	4528.3
+1.00	Waler	8263.7

Maxima

	Maximum	Depth (ft)
Pressure	1530.9 psf	5.00
Bending Moment	6692.4 ftlb/ft	3.32
Shear Force	5517.6 lb/ft	-1.00

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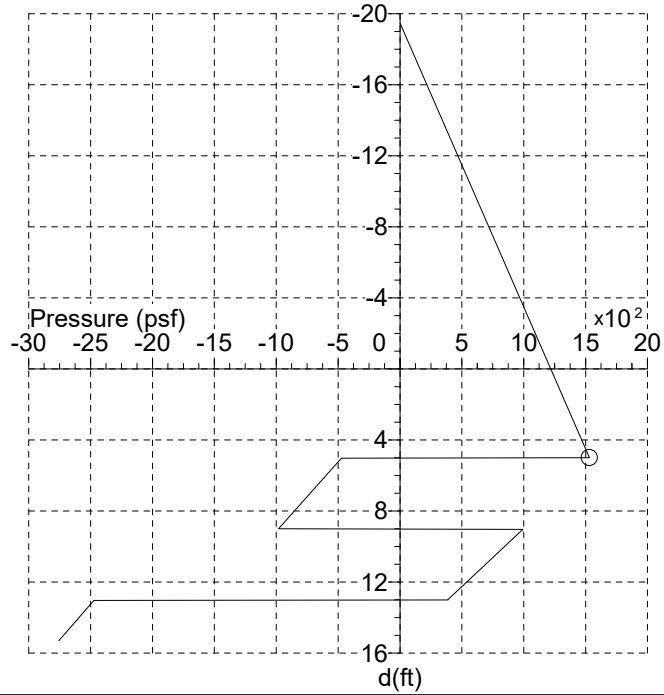
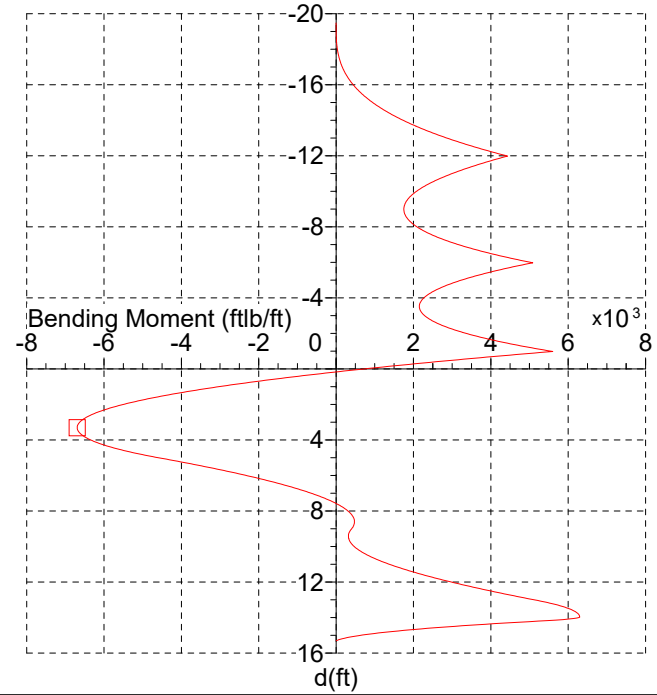
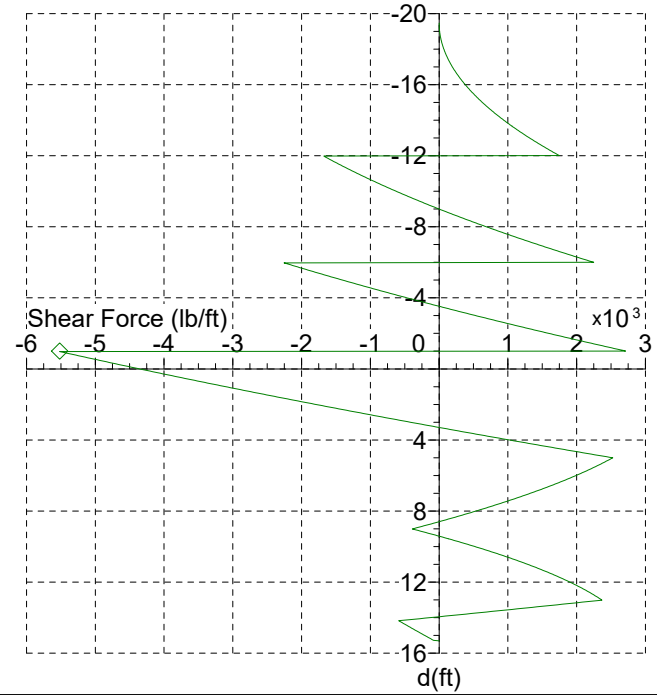
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 1530.9 psf	5.00
□ 6692.4 ftlb/ft	3.32
◇ 5517.6 lb/ft	-1.00

Stage 4 - Wales only







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Title: Colorado River Flood Gate - East Side
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Works: Temporary
Pressure: Coulomb
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Toe: Free Earth Support

Stage 4 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1218.5	704.5		-4344.4	5.15	-491.9	-4165.5		2440.7	10.30	797.4	668.2		778.6
0.11	1225.8	205.3		-4202.4	5.26	-503.1	-3954.2		2397.2	10.41	779.7	762.6		869.9
0.22	1233.1	-277.3		-4059.5	5.37	-517.9	-3678.4		2337.7	10.52	766.3	840.4		937.1
0.33	1240.3	-743.3		-3915.8	5.48	-532.8	-3409.6		2276.4	10.63	748.6	953.0		1024.8
0.44	1245.8	-1081.8		-3807.4	5.59	-547.6	-3148.0		2213.5	10.74	730.8	1075.8		1110.4
0.55	1253.0	-1518.4		-3662.2	5.70	-558.8	-2956.6		2165.2	10.85	713.1	1208.4		1194.0
0.66	1260.3	-1938.1		-3516.2	5.81	-573.6	-2708.0		2099.2	10.96	695.3	1350.6		1275.5
0.77	1267.6	-2340.7		-3369.3	5.92	-588.5	-2467.2		2031.5	11.07	682.0	1463.4		1335.3
0.88	1273.0	-2631.5		-3258.6	6.03	-603.4	-2234.3		1962.1	11.17	664.3	1621.9		1413.2
0.99	1280.3	-3004.1		-3110.2	6.14	-614.5	-2009.5		1891.1	11.28	646.5	1789.4		1489.1
1.10	1287.5	-3359.4		-2961.0	6.24	-629.4	-1846.4		1836.6	11.39	628.8	1965.5		1562.9
1.21	1294.8	-3697.3		-2811.0	6.35	-644.2	-1636.3		1762.4	11.50	615.4	2103.2		1616.8
1.31	1300.3	-3939.3		-2697.9	6.46	-659.1	-1434.9		1686.5	11.61	597.7	2294.0		1687.0
1.42	1307.5	-4246.6		-2546.4	6.57	-674.0	-1242.4		1608.9	11.72	579.9	2492.9		1755.1
1.53	1314.8	-4536.1		-2394.0	6.68	-685.1	-1104.0		1549.6	11.83	562.2	2699.6		1821.2
1.64	1322.0	-4808.0		-2240.8	6.79	-700.0	-927.6		1468.9	11.94	544.4	2913.9		1885.2
1.75	1329.3	-5061.9		-2086.8	6.90	-714.8	-760.6		1386.6	12.05	531.1	3079.5		1931.8
1.86	1334.8	-5240.6		-1970.7	7.01	-729.7	-603.2		1302.5	12.16	513.4	3306.5		1992.2
1.97	1342.0	-5463.1		-1815.2	7.12	-740.8	-491.6		1238.3	12.27	495.6	3540.4		2050.5
2.08	1349.3	-5667.5		-1658.8	7.23	-755.7	-351.6		1151.2	12.38	477.8	3781.0		2106.8
2.19	1356.5	-5853.6		-1501.6	7.34	-770.5	-221.8		1062.4	12.49	464.5	3965.6		2147.7
2.30	1362.0	-5981.1		-1383.1	7.45	-785.4	-102.3		971.8	12.60	446.8	4217.4		2200.3
2.41	1369.3	-6135.1		-1224.4	7.56	-800.3	6.5		879.5	12.71	429.0	4475.1		2250.9
2.52	1376.5	-6270.6		-1064.9	7.67	-811.4	81.1		809.2	12.82	411.3	4738.6		2299.4
2.63	1383.8	-6387.5		-904.5	7.78	-826.3	170.9		713.9	12.93	398.0	4939.9		2334.5
2.74	1391.0	-6485.7		-743.3	7.89	-841.1	249.6		616.8	13.04	-2474.2	5213.0		2296.7
2.85	1396.5	-6547.0		-621.8	8.00	-856.0	316.9		518.1	13.15	-2488.7	5467.1		2008.4
2.96	1403.8	-6612.3		-459.1	8.11	-867.1	359.9		442.9	13.26	-2503.2	5687.8		1718.3
3.07	1411.0	-6658.6		-295.6	8.22	-882.0	406.9		341.3	13.37	-2517.8	5874.6		1426.6
3.18	1418.3	-6685.8		-131.2	8.33	-896.9	442.1		237.8	13.48	-2528.6	5992.5		1206.7
3.29	1423.7	-6692.2		-7.4	8.44	-911.7	465.1		132.6	13.58	-2543.2	6119.8		912.0
3.40	1431.0	-6685.8		158.5	8.55	-926.6	474.0		25.6	13.69	-2557.7	6212.8		615.6
3.51	1438.3	-6660.1		325.2	8.65	-937.7	473.8		-55.7	13.80	-2572.2	6271.3		317.5
3.62	1445.5	-6615.1		492.8	8.76	-952.6	462.6		-165.7	13.91	-2583.1	6292.5		92.9
3.72	1451.0	-6568.5		619.0	8.87	-967.4	438.5		-277.4	14.02	-2597.6	6223.1		-208.1
3.83	1458.2	-6489.3		788.0	8.98	-981.1	401.4		-390.8	14.13	-2612.1	5685.2		-510.7
3.94	1465.5	-6390.4		957.9	9.09	983.8	369.8		-304.6	14.24	-2626.6	4751.8		-547.5
4.05	1472.8	-6271.7		1128.6	9.20	966.1	339.4		-191.6	14.35	-2641.1	3868.5		-495.2
4.16	1480.0	-6133.2		1300.1	9.31	948.3	322.0		-80.7	14.46	-2652.0	3263.6		-455.8
4.27	1485.5	-6016.2		1429.3	9.42	930.6	319.4		28.1	14.57	-2666.5	2534.1		-403.0
4.38	1492.7	-5842.7		1602.4	9.53	917.2	324.2		108.4	14.68	-2681.0	1893.2		-349.9
4.49	1500.0	-5649.1		1776.2	9.64	899.5	341.4		213.6	14.79	-2695.5	1341.3		-296.5
4.60	1507.3	-5435.2		1951.0	9.75	881.7	370.7		316.8	14.90	-2706.4	986.0		-256.3
4.71	1512.7	-5261.5		2082.6	9.86	864.0	411.9		417.9	15.01	-2720.9	591.1		-202.4
4.82	1520.0	-5012.0		2258.7	9.97	846.2	464.8		516.9	15.12	-2735.4	286.5		-148.2
4.93	1527.2	-4742.0		2435.8	10.08	832.9	511.9		589.8	15.23	-2749.9	72.7		-93.7
5.04	-473.3	-4453.1		2497.1	10.19	815.2	584.6		685.3	15.34	-2757.2	0.0		0.0

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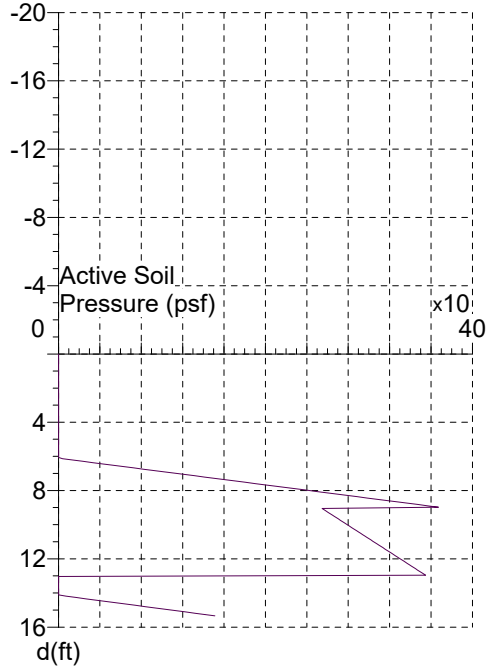
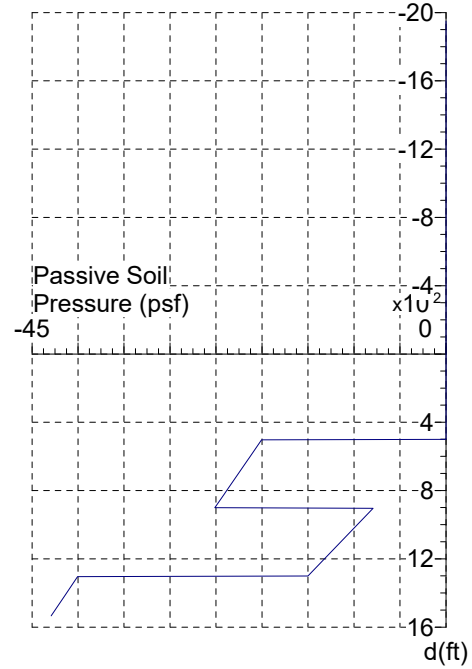
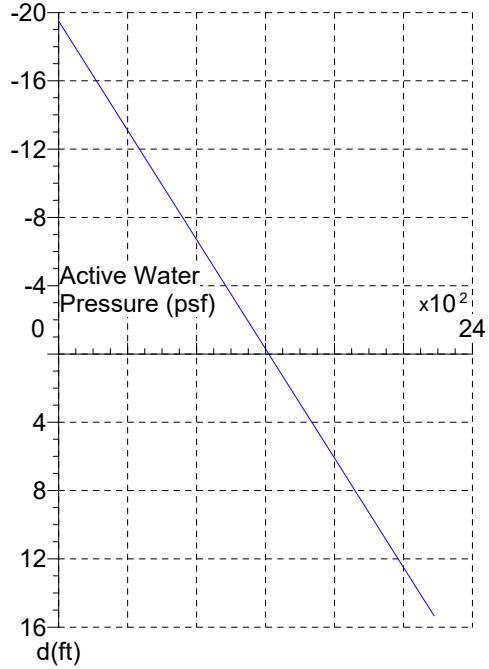
Title: Colorado River Flood Gate - East Side
Designer: Stage 4
Ref: 1.0
Page: 5
Date: 8.20.18

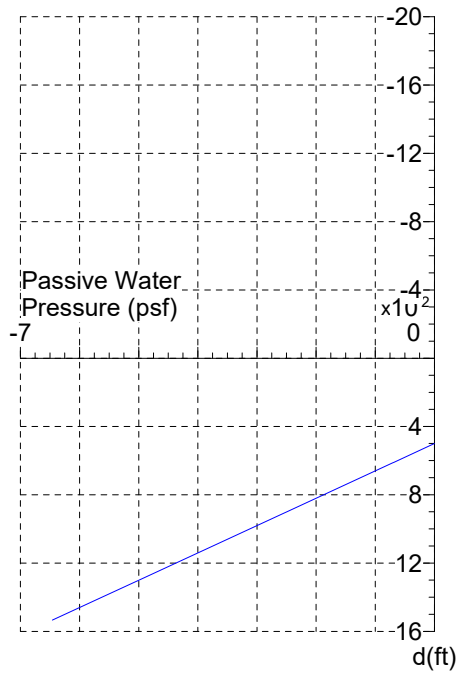
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

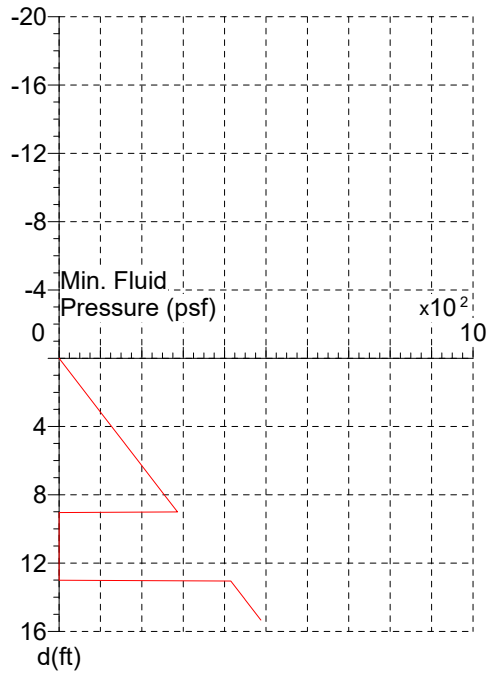
Stage 4 - Wales only

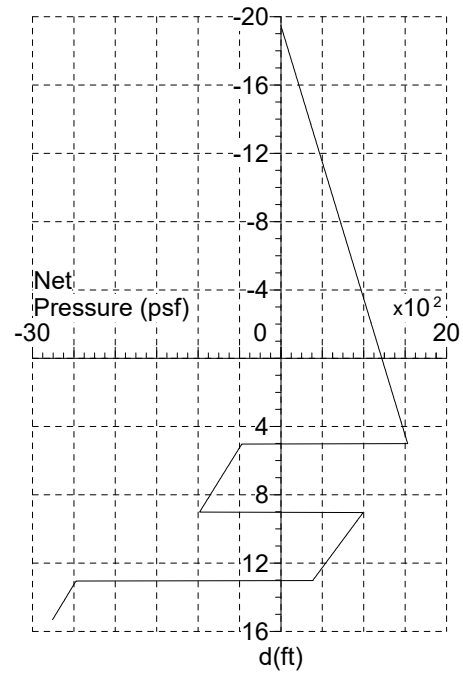












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Title: Colorado River Flood Gate - East Side
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Page: 1
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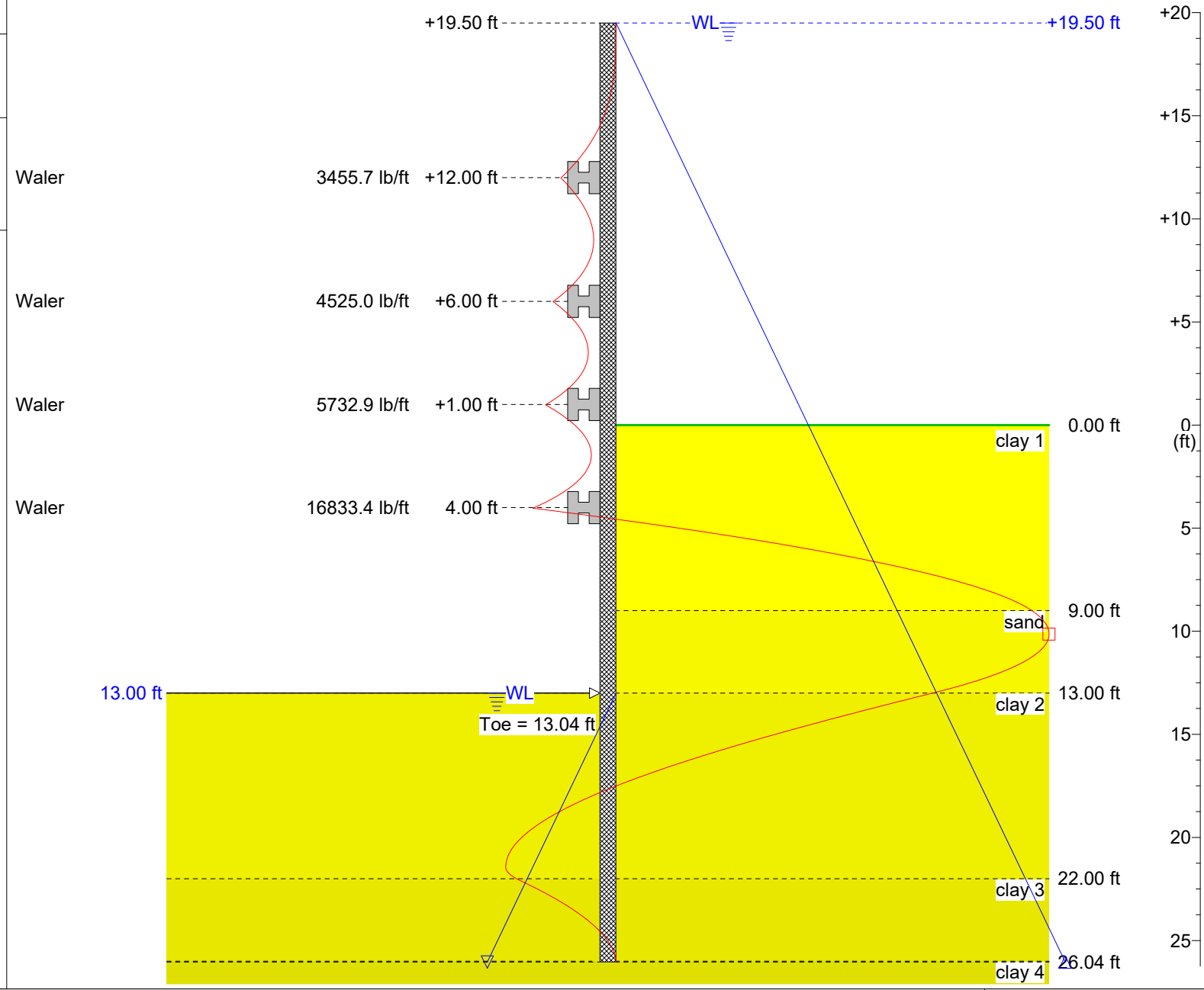
Works: Temporary
Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	35283.9 ftlb/ft	10.14
△	2846.4 psf	26.04
△	815.2 psf	26.04

Stage 5 - Tip and Moment only



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Title: Colorado River Flood Gate - East Side
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Ref: 1.3
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Date: 8.20.18

Works: Temporary
Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Tip and Moment only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	13.04	45.54

Pressure Model: Manual

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3455.7
+6.00	Waler	4525.0
+1.00	Waler	5732.9
4.00	Waler	16833.4

Maxima

	Maximum	Depth (ft)
Pressure	2611.7 psf	8.96
Bending Moment	35283.9 ftlb/ft	10.14
Shear Force	13066.0 lb/ft	4.00

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Title: Colorado River Flood Gate - East Side
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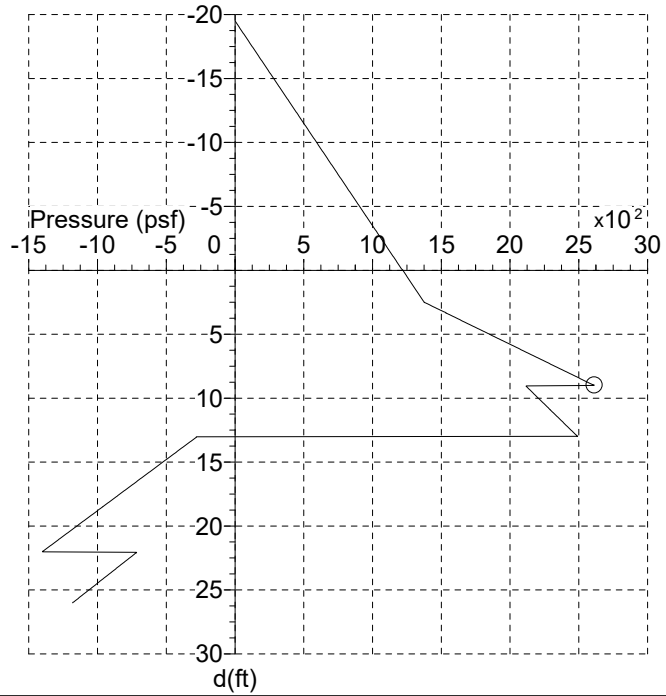
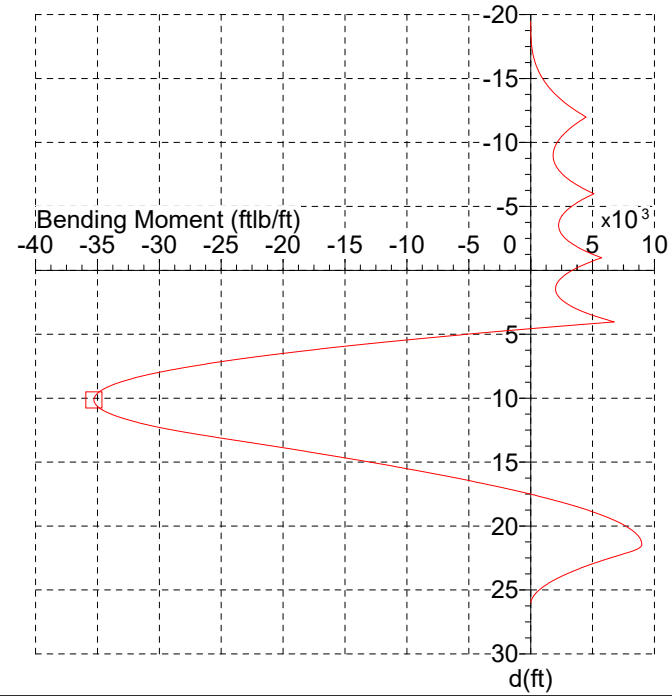
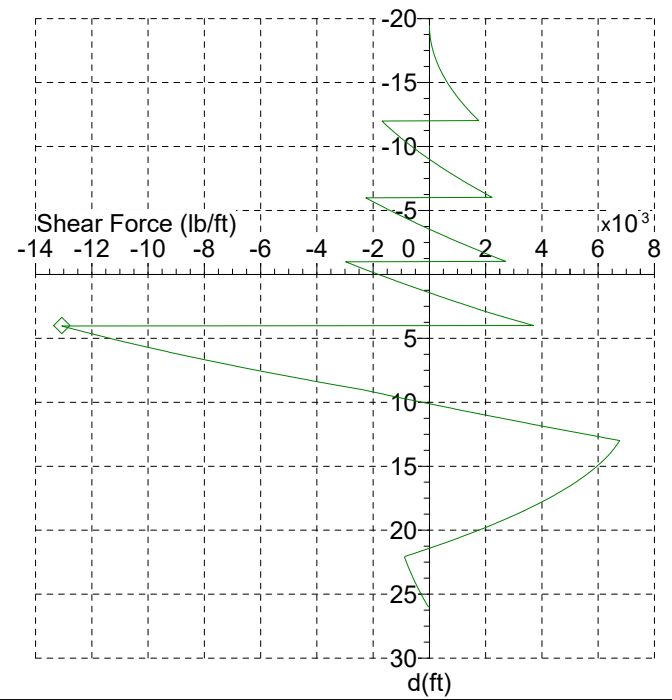
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	2611.7 psf	8.96
□	35283.9 ftlb/ft	10.14
◇	13066.0 lb/ft	4.00

Stage 5 - Tip and Moment only







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Title: Colorado River Flood Gate - East Side
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Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1220.4	3346.4		-1805.3	8.74	2568.9	-33255.7		-3002.5	17.49	-838.6	-20.1		4242.4
0.19	1232.6	3020.9		-1572.3	8.93	2611.7	-33788.5		-2510.6	17.67	-862.3	772.8		4080.6
0.37	1244.4	2739.9		-1337.1	9.12	2121.9	-34149.3		-2170.3	17.86	-886.0	1534.6		3914.2
0.56	1256.1	2503.8		-1099.6	9.30	2139.9	-34530.6		-1765.5	18.04	-909.8	2264.5		3743.4
0.74	1267.9	2313.0		-859.9	9.49	2158.0	-34834.9		-1357.4	18.23	-933.5	2961.7		3568.0
0.93	1279.6	2167.9		-618.0	9.67	2176.1	-35061.4		-945.8	18.42	-957.2	3625.3		3388.2
1.12	1291.4	2069.0		-373.8	9.86	2194.2	-35209.5		-530.8	18.60	-976.2	4131.3		3241.1
1.30	1303.2	2016.7		-127.4	10.05	2212.3	-35278.5		-112.4	18.79	-1000.0	4732.2		3053.1
1.49	1314.9	2011.4		121.2	10.23	2230.3	-35267.9		309.5	18.97	-1023.7	5297.1		2860.7
1.67	1324.3	2042.1		321.7	10.42	2248.4	-35176.9		734.8	19.16	-1047.4	5825.1		2663.7
1.86	1336.1	2124.8		574.4	10.60	2266.5	-35005.0		1163.5	19.35	-1071.2	6315.4		2462.2
2.05	1347.8	2257.2		829.2	10.79	2284.6	-34751.4		1595.6	19.53	-1094.9	6767.1		2256.3
2.23	1359.6	2439.7		1086.4	10.98	2299.0	-34489.4		1943.8	19.72	-1118.7	7179.4		2045.8
2.42	1372.3	2672.6		1345.7	11.16	2317.1	-34087.2		2382.2	19.90	-1142.4	7551.4		1830.8
2.60	1399.9	2956.5		1608.6	11.35	2335.2	-33601.7		2823.9	20.09	-1166.1	7882.2		1611.3
2.79	1436.6	3292.5		1878.5	11.53	2353.3	-33032.0		3269.1	20.28	-1189.9	8171.1		1387.3
2.98	1473.2	3681.8		2155.2	11.72	2371.4	-32377.6		3717.7	20.46	-1208.9	8371.4		1204.9
3.16	1509.8	4125.8		2439.0	11.91	2389.4	-31637.8		4169.8	20.65	-1232.6	8582.5		972.8
3.35	1543.8	4625.9		2729.4	12.09	2407.5	-30811.9		4625.3	20.83	-1256.3	8749.2		736.2
3.53	1572.7	5067.3		2966.5	12.28	2425.6	-29899.4		5084.2	21.02	-1280.1	8870.7		495.1
3.72	1608.8	5671.6		3269.1	12.46	2443.7	-28899.4		5546.6	21.21	-1303.8	8946.0		249.5
3.91	1644.8	6335.7		3578.5	12.65	2461.8	-27811.5		6012.3	21.39	-1327.5	8980.1		-0.7
4.09	1680.9	5769.2		-12938.7	12.84	2476.2	-26877.4		6387.4	21.58	-1351.3	8902.7		-255.3
4.28	1717.0	3337.4		-12615.6	13.02	-282.2	-25629.4		6754.0	21.76	-1375.0	8630.8		-514.4
4.46	1753.1	967.4		-12285.7	13.21	-302.1	-24351.8		6698.6	21.95	-1401.0	8161.2		-778.1
4.65	1789.2	-1339.5		-11948.9	13.39	-325.9	-23085.0		6638.5	22.14	-729.1	7519.3		-873.0
4.84	1825.3	-3581.9		-11605.2	13.58	-349.6	-21830.0		6574.0	22.32	-747.0	6995.6		-847.3
5.02	1861.4	-5758.5		-11254.8	13.77	-373.3	-20587.6		6504.9	22.51	-769.4	6363.1		-814.4
5.21	1897.5	-7868.1		-10897.4	13.95	-397.1	-19358.6		6431.4	22.69	-791.8	5755.9		-780.5
5.39	1926.4	-9506.6		-10606.6	14.14	-420.8	-18143.9		6353.3	22.88	-814.2	5174.8		-745.6
5.58	1962.5	-11492.2		-10236.9	14.32	-444.5	-16944.4		6270.8	23.07	-836.6	4620.3		-709.7
5.77	1998.6	-13407.1		-9860.4	14.51	-468.3	-15760.9		6183.7	23.25	-859.1	4093.4		-672.8
5.95	2034.7	-15250.0		-9477.1	14.70	-492.0	-14594.2		6092.2	23.44	-881.5	3594.7		-635.0
6.14	2070.8	-17019.6		-9086.9	14.88	-511.0	-13673.6		6015.7	23.62	-903.9	3124.9		-596.2
6.32	2106.9	-18714.7		-8689.8	15.07	-534.7	-12539.5		5916.0	23.81	-926.3	2684.9		-556.5
6.51	2143.0	-20333.8		-8285.9	15.25	-558.5	-11424.6		5811.8	24.00	-948.7	2275.3		-515.8
6.70	2179.0	-21875.7		-7875.1	15.44	-582.2	-10329.8		5703.2	24.18	-966.6	1970.0		-482.5
6.88	2215.1	-23339.1		-7457.5	15.63	-605.9	-9256.0		5590.0	24.37	-989.0	1617.0		-440.0
7.07	2251.2	-24722.7		-7033.1	15.81	-629.7	-8204.0		5472.3	24.55	-1011.4	1296.6		-396.5
7.25	2280.1	-25771.3		-6688.6	16.00	-653.4	-7174.7		5350.1	24.74	-1033.8	1009.3		-352.1
7.44	2316.2	-27008.0		-6251.8	16.18	-677.2	-6168.9		5223.4	24.93	-1056.2	756.0		-306.7
7.63	2352.3	-28161.2		-5808.1	16.37	-700.9	-5187.5		5092.2	25.11	-1078.6	537.5		-260.4
7.81	2388.4	-29229.8		-5357.6	16.56	-724.6	-4231.4		4956.5	25.30	-1101.1	354.4		-213.1
8.00	2424.5	-30212.2		-4900.3	16.74	-743.6	-3485.2		4844.7	25.48	-1123.5	207.4		-164.7
8.18	2460.6	-31107.4		-4436.1	16.93	-767.4	-2576.6		4700.9	25.67	-1145.9	97.4		-115.5
8.37	2496.7	-31913.9		-3965.1	17.11	-791.1	-1695.7		4552.5	25.86	-1168.3	25.0		-65.2
8.56	2532.8	-32630.4		-3487.2	17.30	-814.8	-843.2		4399.7	26.04	-1181.1	0.0		0.0

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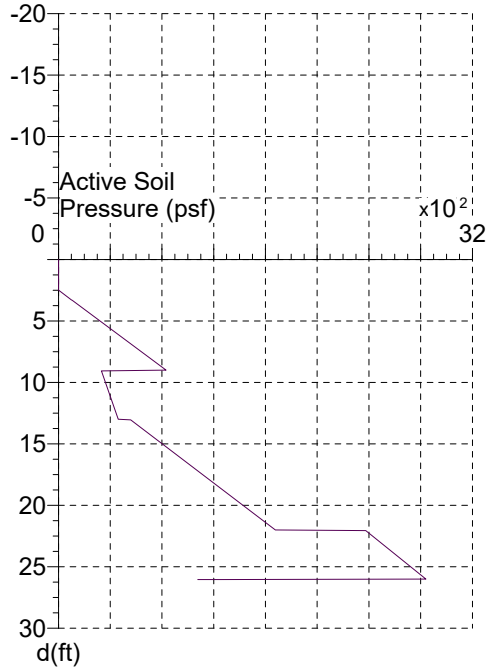
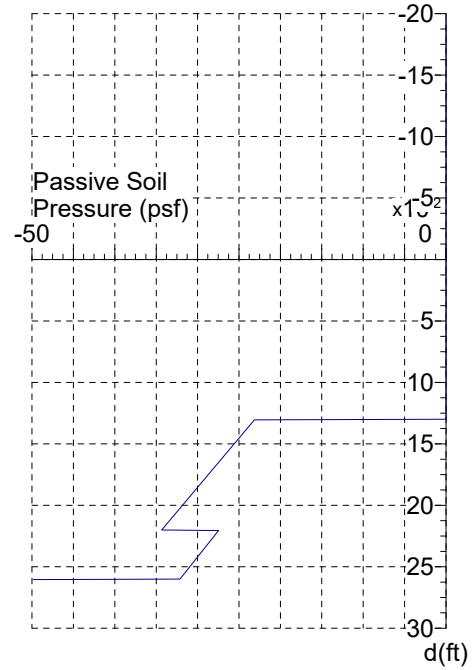
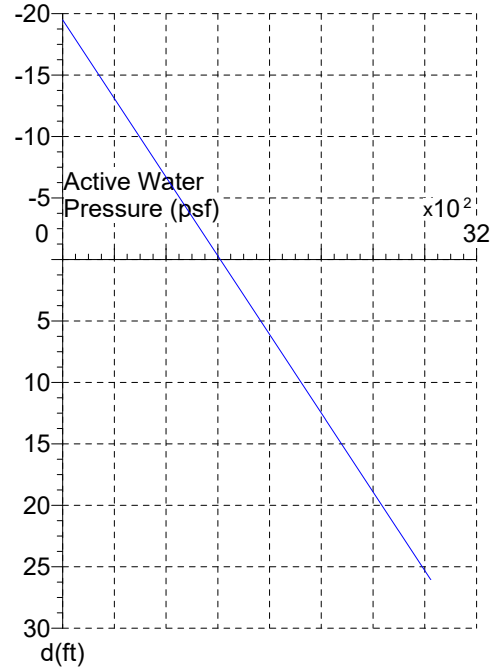
Title: Colorado River Flood Gate - East Side
Designer: Stage 5
Ref: 1.3
Page: 5
Date: 8.20.18

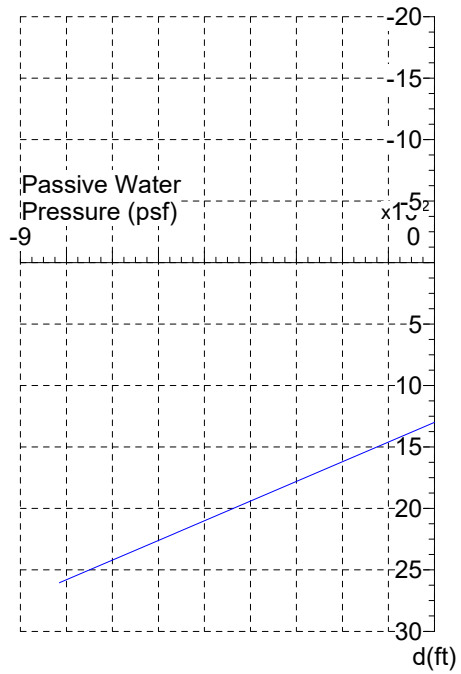
Works: Temporary
Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

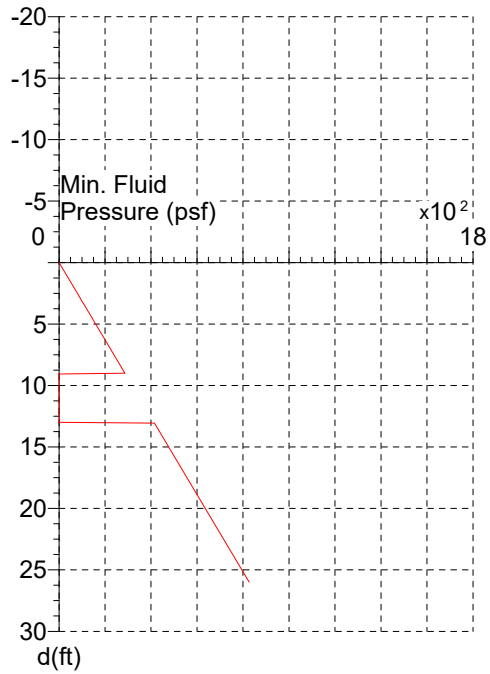
Stage 5 - Tip and Moment only

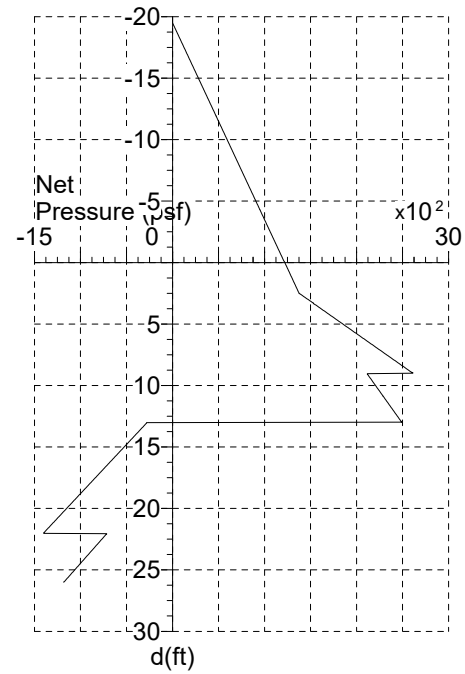












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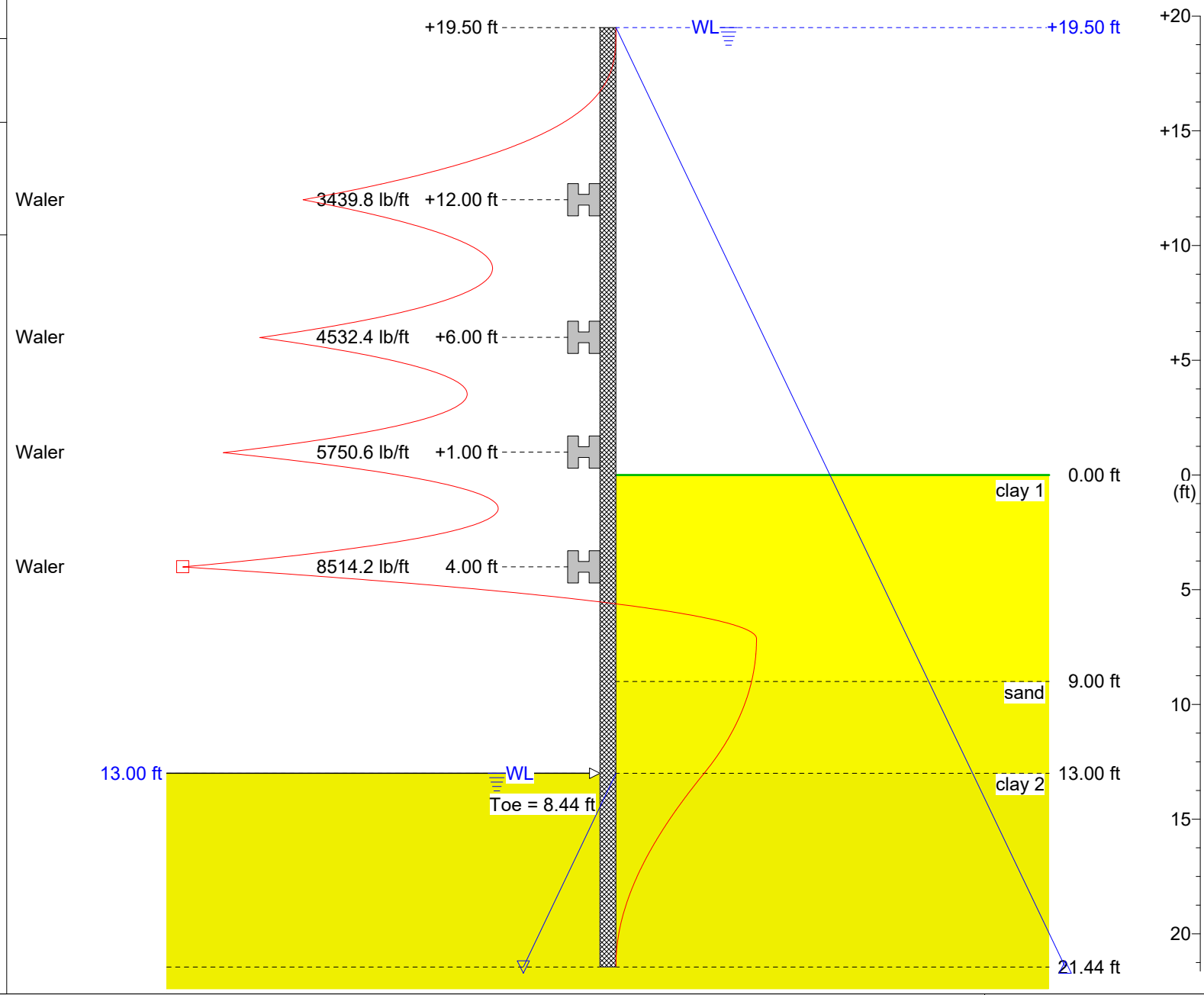
Title: Colorado River Flood Gate - East Side
Designer: Stage 5
Ref: 1.0
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
6098.7 ftlb/ft	4.00
2558.9 psf	21.44
527.7 psf	21.44

Stage 5 - Wales only



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Title: Colorado River Flood Gate - East Side
Designer: Stage 5
Ref: 1.0
Page: 2
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Wales only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	8.44	40.94

Pressure Model: Coulomb; Assume full hydrostatic pressure to 13.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3439.8
+6.00	Waler	4532.4
+1.00	Waler	5750.6
4.00	Waler	8514.2

Maxima

	Maximum	Depth (ft)
Pressure	2385.4 psf	13.00
Bending Moment	6098.7 ftlb/ft	4.00
Shear Force	12607.0 lb/ft	13.02

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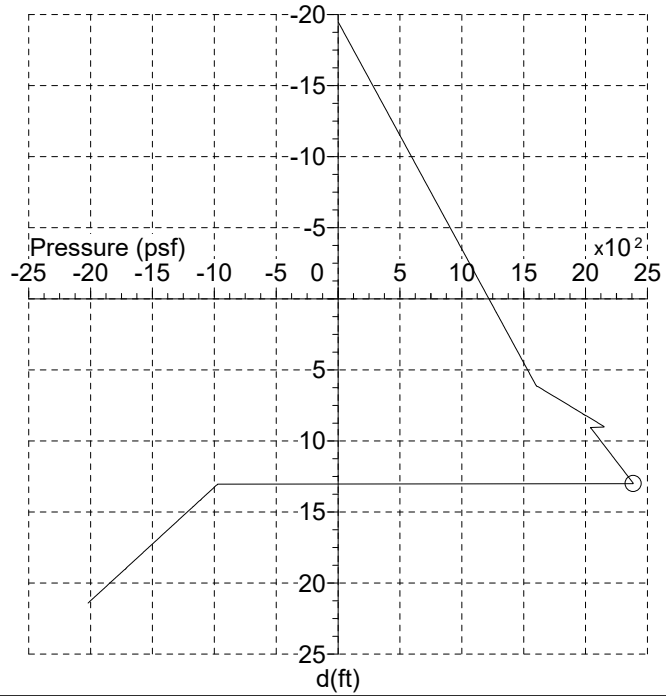
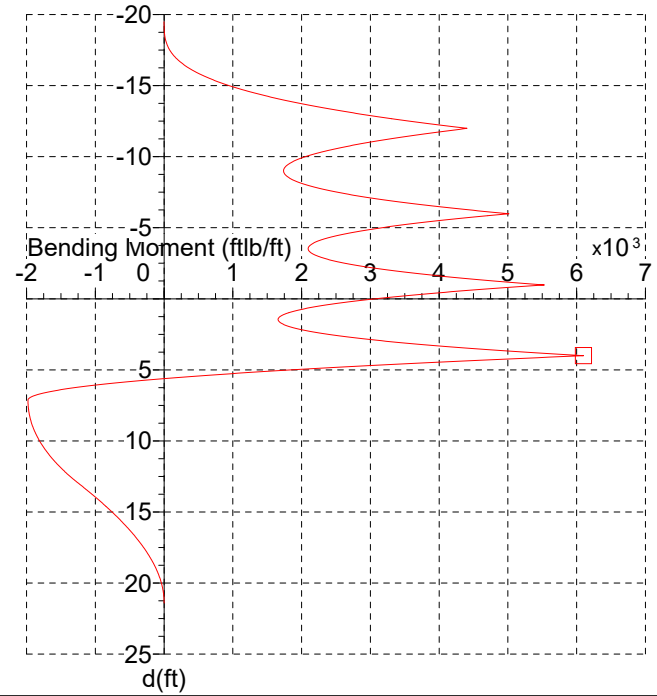
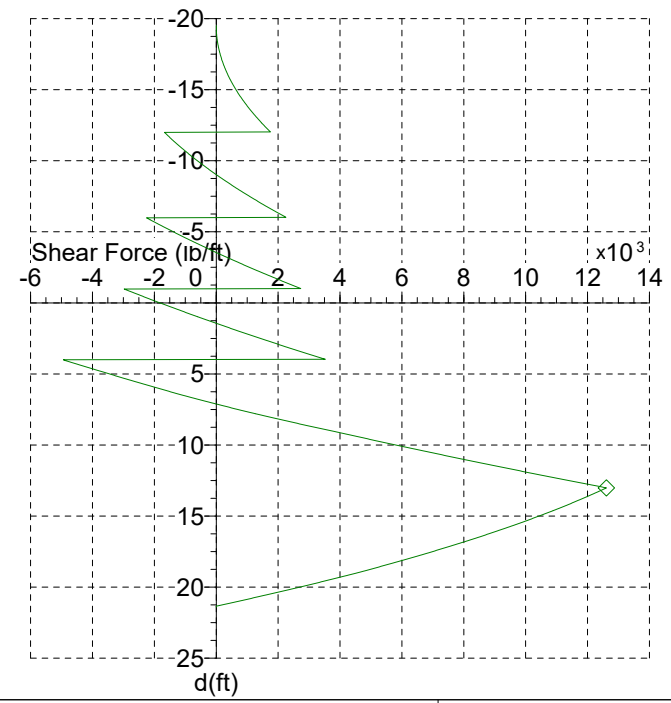
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	2385.4 psf	13.00
□	6098.7 ftlb/ft	4.00
◇	12607.0 lb/ft	13.02

Stage 5 - Wales only







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Toe: Free Earth Support

Stage 5 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.7	3039.8		-1799.6	7.20	1811.8	-1978.9		175.6	14.40	-1144.6	-890.0		11125.7
0.15	1230.4	2734.7		-1590.4	7.35	1844.3	-1977.8		488.0	14.55	-1161.6	-858.5		10968.0
0.31	1238.9	2517.4		-1421.8	7.50	1870.3	-1976.1		742.0	14.70	-1183.0	-819.7		10767.6
0.46	1247.5	2324.2		-1252.0	7.66	1896.3	-1973.7		999.4	14.86	-1200.1	-789.2		10604.7
0.61	1258.1	2116.8		-1038.1	7.81	1928.8	-1969.7		1326.3	15.01	-1221.4	-751.7		10397.8
0.77	1266.7	1978.3		-865.6	7.96	1954.8	-1965.7		1591.7	15.16	-1238.5	-722.2		10229.7
0.92	1277.3	1839.8		-648.5	8.12	1980.8	-1959.5		1928.3	15.32	-1259.8	-686.1		10016.2
1.07	1285.9	1756.9		-473.4	8.27	2013.3	-1953.7		2201.5	15.47	-1276.9	-657.7		9842.8
1.23	1296.5	1688.3		-253.0	8.42	2045.8	-1945.4		2548.3	15.62	-1298.2	-622.9		9622.8
1.38	1305.0	1661.8		-75.3	8.58	2071.8	-1937.8		2829.7	15.78	-1315.3	-595.7		9444.2
1.53	1315.7	1663.8		148.4	8.73	2104.3	-1927.2		3186.5	15.93	-1336.7	-562.4		9217.6
1.68	1324.2	1693.2		328.7	8.88	2130.3	-1917.8		3475.9	16.08	-1353.7	-536.3		9033.7
1.84	1334.9	1764.8		555.7	9.04	2039.8	-1904.9		3838.2	16.24	-1375.1	-504.4		8800.6
1.99	1343.4	1850.0		738.6	9.19	2051.8	-1893.7		4117.5	16.39	-1392.2	-479.5		8611.5
2.14	1354.1	1991.7		968.9	9.34	2066.8	-1878.5		4469.1	16.54	-1413.5	-449.2		8371.8
2.30	1362.6	2133.4		1154.4	9.50	2078.9	-1865.5		4752.2	16.69	-1430.6	-425.5		8177.4
2.45	1373.3	2346.3		1388.0	9.65	2093.9	-1848.0		5108.4	16.85	-1451.9	-396.8		7931.2
2.60	1381.8	2545.3		1576.1	9.80	2105.9	-1833.2		5395.2	17.00	-1469.0	-374.4		7731.6
2.76	1392.5	2830.3		1813.0	9.96	2120.9	-1813.4		5756.0	17.15	-1490.3	-347.2		7478.8
2.91	1401.0	3087.5		2003.7	10.11	2133.0	-1796.7		6046.4	17.31	-1507.4	-326.1		7274.0
3.06	1411.7	3445.7		2243.8	10.26	2148.0	-1774.7		6411.8	17.46	-1528.8	-300.5		7014.6
3.22	1420.2	3761.8		2437.2	10.42	2160.0	-1756.1		6706.0	17.61	-1545.8	-280.7		6804.5
3.37	1430.9	4194.1		2680.6	10.57	2175.0	-1731.6		7076.0	17.77	-1567.2	-256.9		6538.6
3.52	1439.4	4570.0		2876.6	10.72	2187.1	-1711.2		7373.9	17.92	-1584.3	-238.5		6323.3
3.68	1450.1	5077.5		3123.2	10.87	2202.1	-1684.3		7748.6	18.07	-1605.6	-216.3		6050.8
3.83	1458.6	5513.9		3321.9	11.03	2214.1	-1661.9		8050.1	18.23	-1622.7	-199.3		5830.3
3.98	1469.2	6098.7		-4942.5	11.18	2229.1	-1632.7		8429.4	18.38	-1644.0	-178.9		5551.2
4.14	1477.8	5428.7		-4741.2	11.33	2241.2	-1608.4		8734.6	18.53	-1661.1	-163.4		5325.4
4.29	1488.4	4630.3		-4488.0	11.49	2256.2	-1576.7		9118.5	18.69	-1682.4	-144.8		5039.9
4.44	1497.0	4022.9		-4284.2	11.64	2268.2	-1550.4		9427.4	18.84	-1699.5	-130.7		4808.8
4.59	1507.6	3303.4		-4027.7	11.79	2283.2	-1516.2		9815.9	18.99	-1716.6	-113.9		4516.9
4.75	1516.2	2759.6		-3821.2	11.95	2295.3	-1487.9		10128.5	19.15	-1737.9	-101.3		4270.8
4.90	1526.8	2119.9		-3561.5	12.10	2310.3	-1451.3		10521.6	19.30	-1759.3	-86.6		3959.7
5.05	1535.3	1640.4		-3352.4	12.25	2322.3	-1420.9		10838.0	19.45	-1776.3	-75.5		3708.2
5.21	1546.0	1081.6		-3089.4	12.41	2337.3	-1381.7		11235.7	19.60	-1797.7	-62.8		3390.3
5.36	1554.5	667.3		-2877.6	12.56	2349.4	-1349.4		11555.7	19.76	-1814.8	-53.4		3133.2
5.51	1565.2	190.4		-2611.4	12.71	2364.4	-1307.6		11958.0	19.91	-1836.1	-42.7		2808.5
5.67	1573.7	-158.0		-2397.0	12.87	2376.4	-1273.2		12281.7	20.06	-1853.2	-35.0		2546.0
5.82	1584.4	-551.9		-2127.5	13.02	-973.8	-1228.9		12573.7	20.22	-1874.5	-26.4		2214.4
5.97	1592.9	-833.6		-1910.5	13.17	-990.9	-1193.2		12439.5	20.37	-1891.6	-20.3		1946.5
6.13	1603.8	-1143.6		-1637.6	13.33	-1012.2	-1149.1		12268.3	20.52	-1912.9	-13.9		1608.1
6.28	1636.3	-1357.6		-1415.6	13.48	-1029.3	-1114.3		12128.7	20.68	-1930.0	-9.6		1334.7
6.43	1668.8	-1581.8		-1133.1	13.63	-1050.7	-1071.3		11950.9	20.83	-1951.4	-5.3		989.5
6.59	1694.8	-1726.0		-903.1	13.78	-1067.7	-1037.4		11806.1	20.98	-1968.4	-2.8		710.6
6.74	1727.3	-1861.3		-610.7	13.94	-1089.1	-995.6		11621.7	21.14	-1989.8	-0.8		358.5
6.89	1753.3	-1933.2		-372.7	14.09	-1103.4	-962.6		11471.7	21.29	-2006.9	-0.1		74.2
7.05	1785.8	-1976.6		-70.3	14.24	-1127.5	-922.0		11281.0	21.44	-2019.7	0.0		0.0

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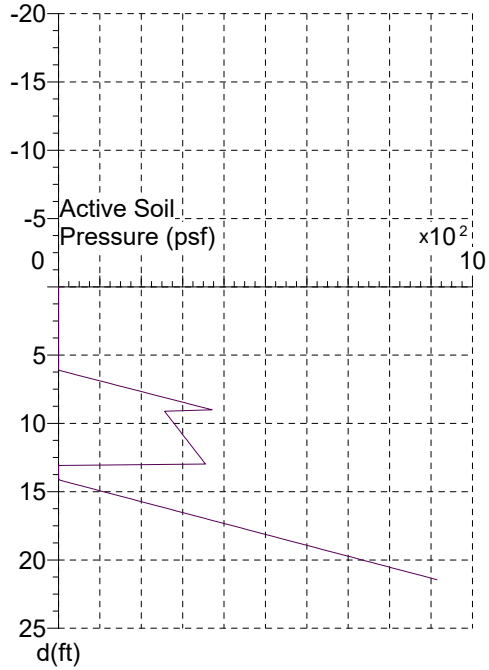
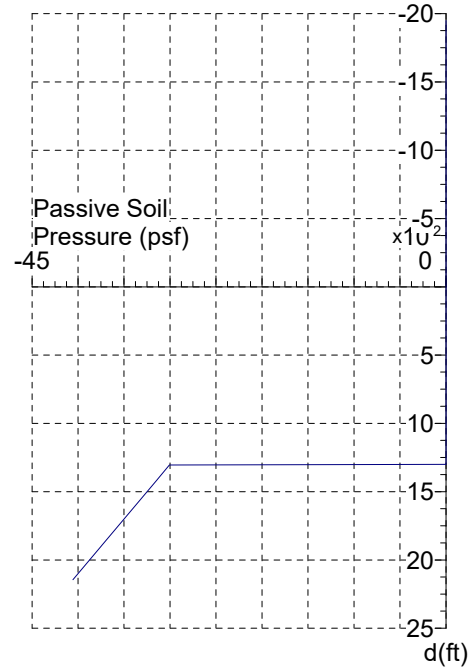
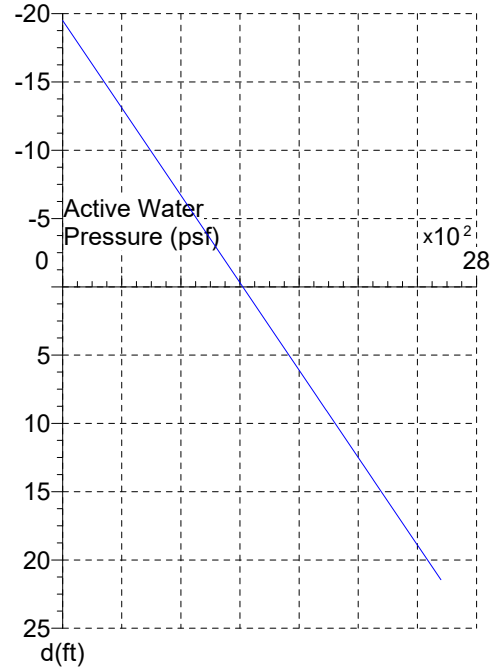
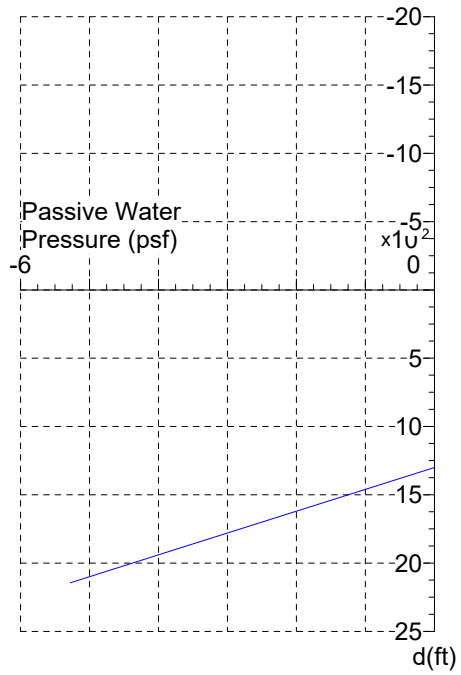
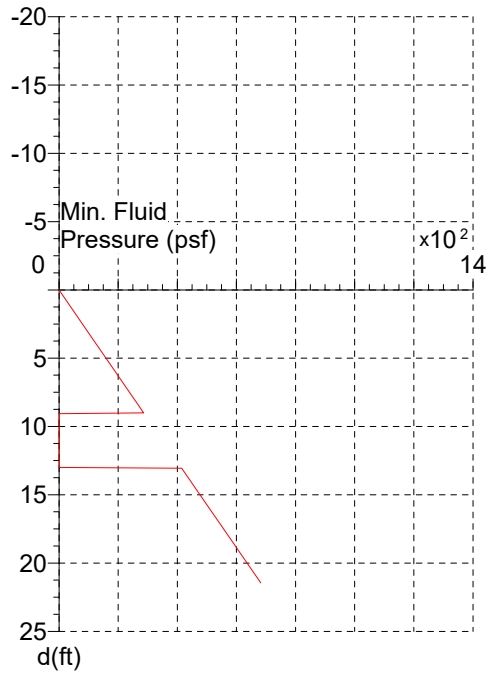
Stage 5 - Wales only

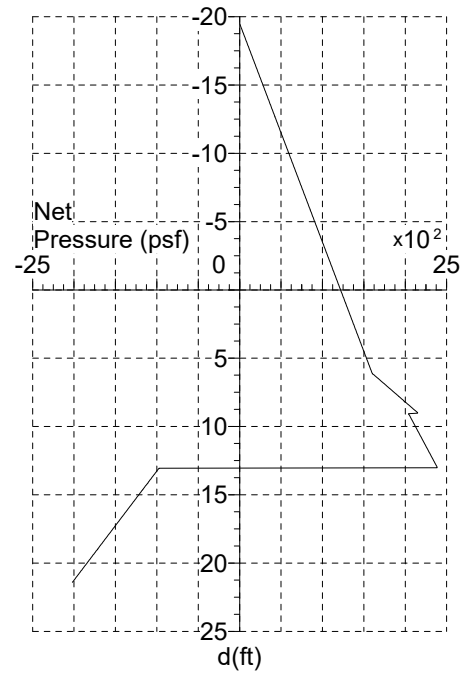












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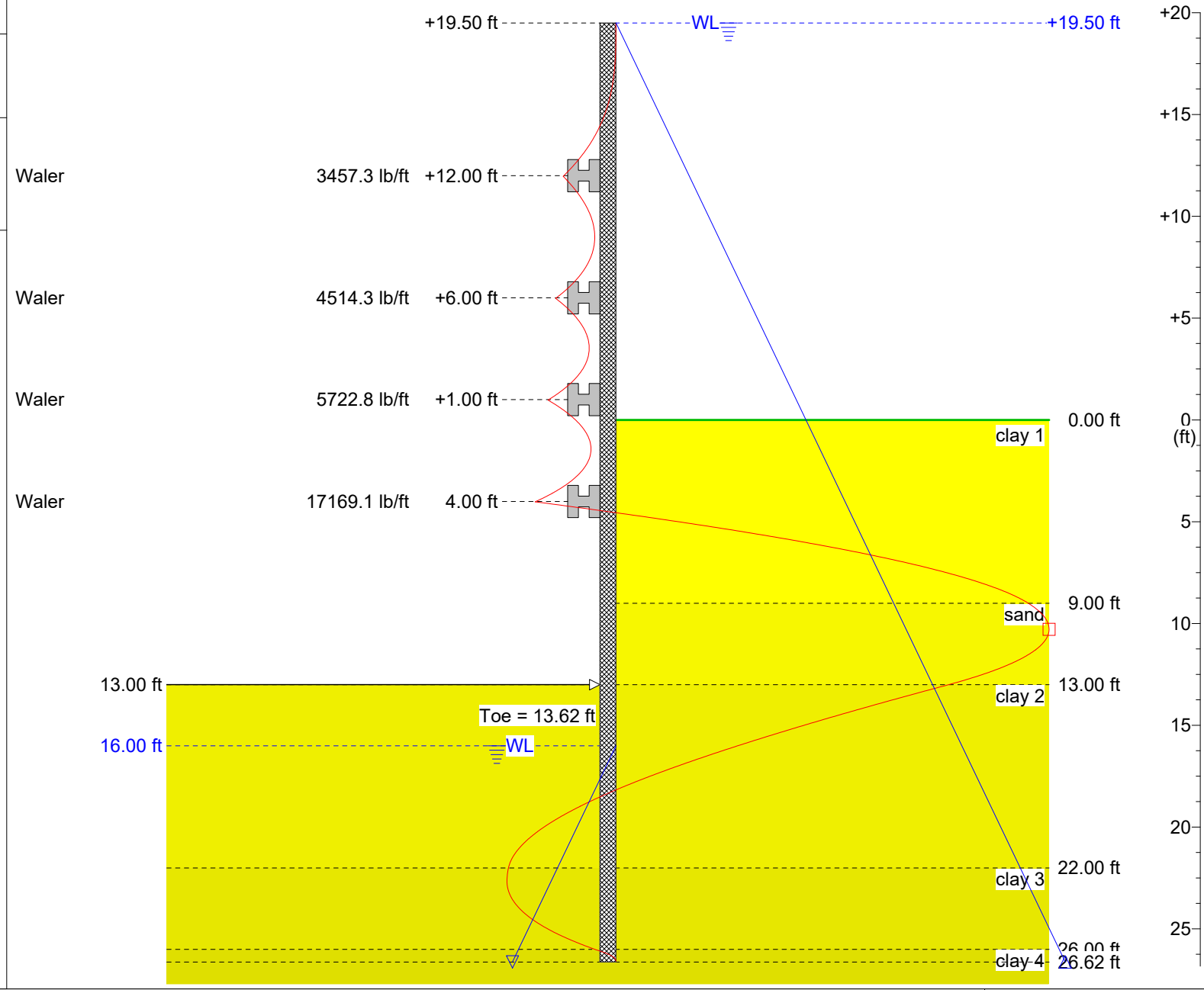
	Maximum	d (ft)
□	37103.4 ftlb/ft	10.29
△	2882.7 psf	26.62
△	663.9 psf	26.62

Stage 6 - Tip and Moment only



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Toe: Free Earth Support

Stage 6 - Tip and Moment only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 16.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	13.62	46.12

Pressure Model: Manual

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3457.3
+6.00	Waler	4514.3
+1.00	Waler	5722.8
4.00	Waler	17169.1

Maxima

	Maximum	Depth (ft)
Pressure	2612.3 psf	8.98
Bending Moment	37103.4 ftlb/ft	10.29
Shear Force	13396.6 lb/ft	4.00

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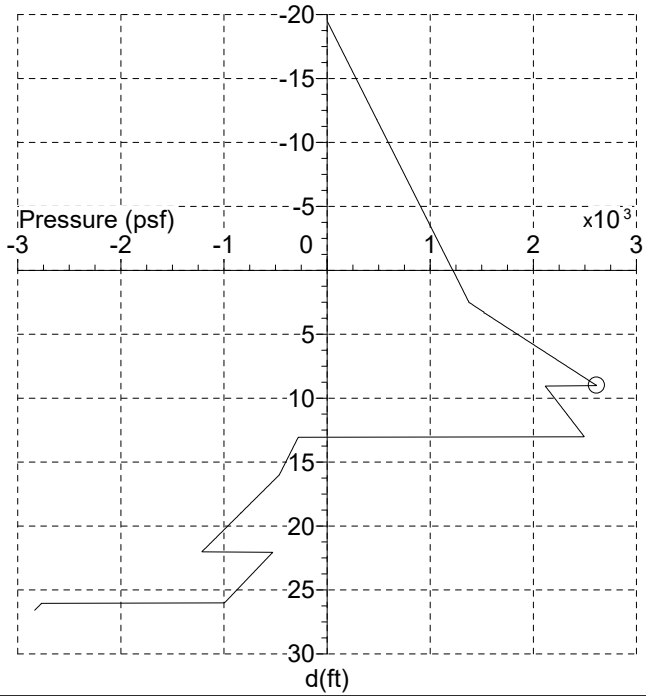
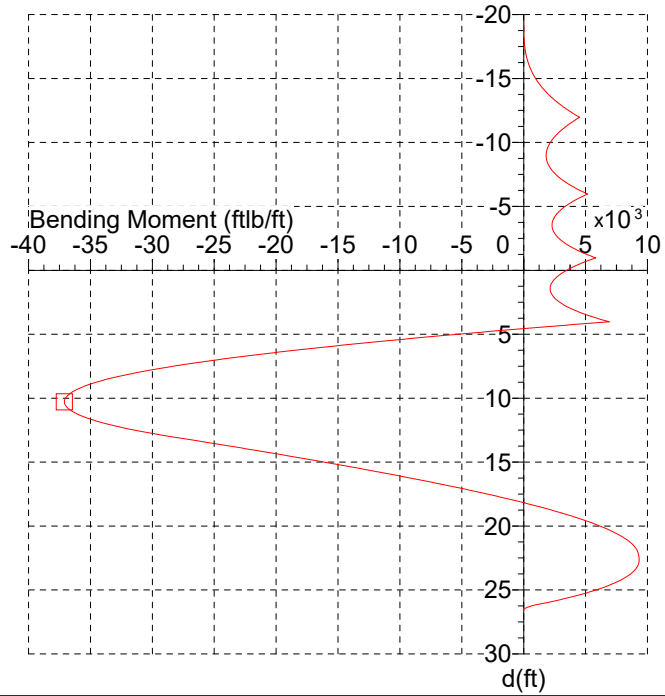
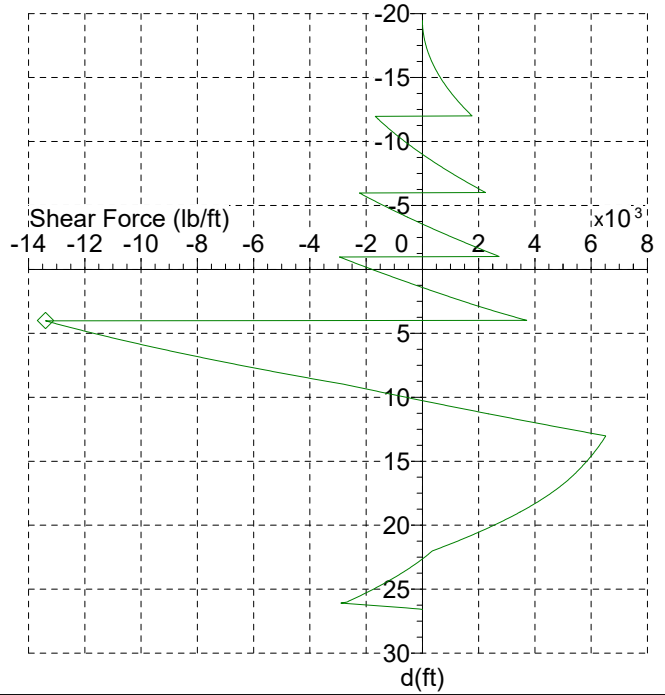
	Maximum	d (ft)
○	2612.3 psf	8.98
□	37103.4 ftlb/ft	10.29
◇	13396.6 lb/ft	4.00

Stage 6 - Tip and Moment only







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Stage 6 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1220.9	3418.5		-1759.3	8.94	2601.3	-35149.4		-2899.3	17.88	-700.5	-1156.6		4300.2
0.19	1234.4	3095.4		-1523.0	9.13	2123.7	-35668.7		-2454.0	18.07	-724.5	-340.7		4162.8
0.38	1246.3	2818.3		-1284.4	9.32	2142.1	-36107.6		-2043.8	18.26	-748.5	448.5		4020.8
0.57	1258.2	2587.7		-1043.5	9.51	2160.4	-36467.6		-1630.0	18.45	-772.5	1210.0		3874.2
0.76	1270.1	2404.1		-800.3	9.70	2178.8	-36748.0		-1212.7	18.64	-796.5	1943.0		3723.0
0.95	1282.0	2267.8		-554.9	9.89	2197.2	-36948.2		-791.9	18.83	-820.5	2646.6		3567.1
1.14	1293.9	2179.3		-307.1	10.08	2215.6	-37067.5		-367.5	19.02	-844.5	3319.8		3406.7
1.33	1303.4	2143.2		-107.3	10.27	2233.9	-37103.4		60.4	19.21	-868.6	3961.9		3241.6
1.52	1315.3	2142.0		144.6	10.46	2252.3	-37058.7		491.9	19.40	-887.8	4452.5		3106.2
1.71	1327.2	2190.8		398.7	10.65	2270.7	-36930.8		926.8	19.59	-911.8	5036.2		2932.8
1.90	1339.1	2290.2		655.2	10.84	2289.0	-36719.1		1365.3	19.78	-935.8	5586.2		2754.9
2.09	1351.0	2440.6		913.9	11.03	2307.4	-36422.7		1807.3	19.97	-959.8	6101.7		2572.2
2.28	1362.9	2642.4		1174.9	11.22	2325.8	-36041.2		2252.9	20.16	-983.8	6581.7		2385.0
2.47	1374.7	2896.2		1438.3	11.41	2344.2	-35573.8		2702.0	20.35	-1007.8	7025.4		2193.2
2.66	1408.6	3202.5		1706.0	11.60	2362.5	-35019.8		3154.6	20.54	-1031.8	7431.8		1996.7
2.85	1444.3	3562.4		1980.8	11.79	2380.9	-34378.5		3610.7	20.73	-1055.8	7800.2		1795.7
3.04	1480.1	3977.4		2262.5	11.98	2399.3	-33649.3		4070.4	20.92	-1079.8	8129.5		1590.0
3.23	1520.8	4448.8		2551.3	12.17	2414.0	-33002.2		4440.7	21.11	-1103.8	8419.0		1379.7
3.42	1548.2	4977.8		2845.9	12.36	2432.4	-32113.0		4906.8	21.30	-1127.9	8667.7		1164.8
3.61	1585.1	5565.9		3147.6	12.55	2450.7	-31134.0		5376.3	21.49	-1151.9	8874.8		945.3
3.80	1621.9	6214.4		3456.5	12.74	2469.1	-30064.5		5849.4	21.68	-1175.9	9039.3		721.2
3.99	1658.7	6919.7		-13396.6	12.93	2487.5	-28903.7		6326.0	21.87	-1199.9	9160.4		492.4
4.18	1695.5	4377.1		-13073.6	13.12	-284.5	-27663.5		6485.2	22.06	-528.8	9238.1		312.2
4.37	1732.4	1897.0		-12743.5	13.31	-296.5	-26421.4		6429.1	22.25	-553.8	9290.1		207.5
4.56	1769.2	-519.3		-12406.4	13.50	-308.5	-25190.3		6370.8	22.44	-576.5	9321.7		98.5
4.75	1806.0	-2870.5		-12062.1	13.69	-320.5	-23970.6		6310.1	22.63	-599.2	9332.2		-14.9
4.94	1835.5	-4703.7		-11781.6	13.88	-332.5	-22762.8		6247.1	22.82	-621.9	9310.4		-132.7
5.13	1872.3	-6934.1		-11424.6	14.07	-344.5	-21567.2		6181.8	23.01	-640.1	9262.5		-230.1
5.32	1909.1	-9095.7		-11060.6	14.26	-356.4	-20384.3		6114.3	23.20	-662.8	9163.3		-355.7
5.51	1945.9	-11186.9		-10689.5	14.45	-368.4	-19214.6		6044.4	23.39	-685.5	9019.0		-485.7
5.70	1982.7	-13206.5		-10311.2	14.64	-380.4	-18058.5		5972.2	23.58	-708.3	8828.0		-620.1
5.90	2019.6	-15153.0		-9926.0	14.83	-392.4	-16916.5		5897.7	23.77	-731.0	8588.8		-758.8
6.09	2056.4	-17025.2		-9533.6	15.02	-404.4	-15788.9		5820.9	23.96	-753.7	8299.9		-901.9
6.28	2093.2	-18821.6		-9134.2	15.21	-416.3	-14676.3		5741.8	24.15	-776.4	7959.6		-1049.4
6.47	2130.0	-20541.0		-8727.6	15.40	-428.3	-13579.1		5660.4	24.34	-799.1	7566.5		-1201.2
6.66	2166.8	-22181.9		-8314.0	15.59	-440.3	-12497.7		5576.7	24.53	-821.8	7118.9		-1357.4
6.85	2203.7	-23743.0		-7893.4	15.78	-449.9	-11644.2		5508.1	24.72	-844.5	6615.5		-1517.9
7.04	2240.5	-25223.0		-7465.6	15.97	-463.4	-10592.4		5420.2	24.91	-867.2	6054.5		-1682.9
7.23	2277.3	-26620.4		-7030.8	16.16	-484.4	-9557.7		5329.0	25.10	-890.0	5434.5		-1852.1
7.42	2314.1	-27934.0		-6588.9	16.35	-508.4	-8540.8		5233.2	25.29	-912.7	4753.9		-2025.8
7.61	2350.9	-29162.3		-6139.9	16.54	-532.4	-7542.8		5132.7	25.48	-935.4	4011.1		-2203.8
7.80	2387.8	-30304.1		-5683.9	16.73	-556.4	-6564.4		5027.6	25.67	-958.1	3204.7		-2386.2
7.99	2424.6	-31357.9		-5220.8	16.92	-580.4	-5606.5		4917.9	25.86	-980.8	2333.1		-2572.9
8.18	2461.4	-32322.4		-4750.6	17.11	-604.4	-4670.1		4803.6	26.05	-2771.7	1389.8		-2900.2
8.37	2498.2	-33196.3		-4273.3	17.30	-628.5	-3756.0		4684.7	26.24	-2797.5	525.9		-1744.1
8.56	2527.7	-33829.2		-3886.4	17.50	-652.5	-2865.2		4561.1	26.43	-2821.2	73.0		-578.1
8.75	2564.5	-34536.5		-3396.3	17.69	-676.5	-1998.4		4433.0	26.62	-2835.4	0.0		0.0

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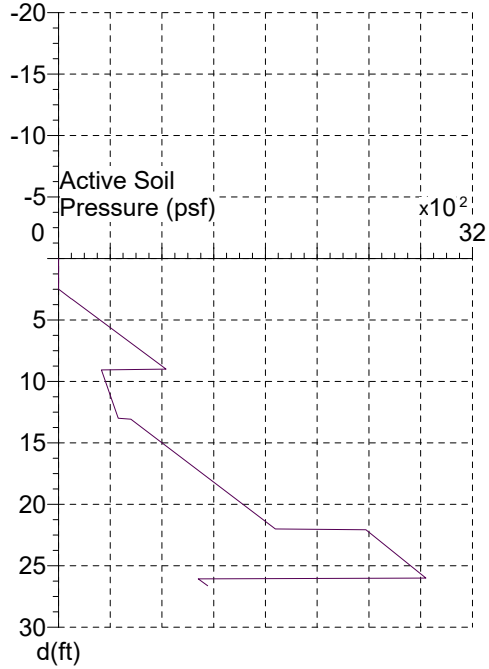
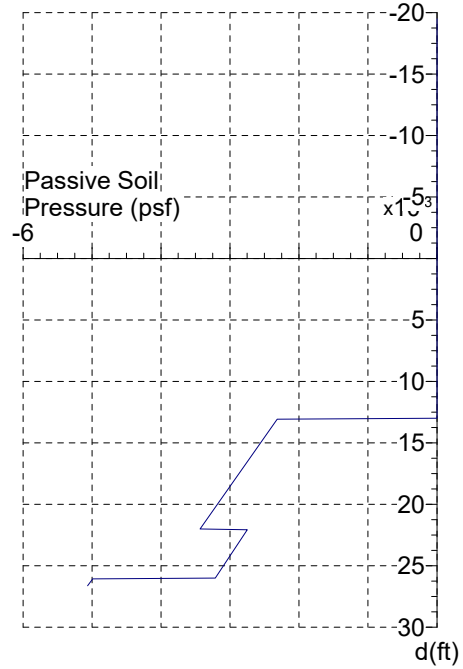
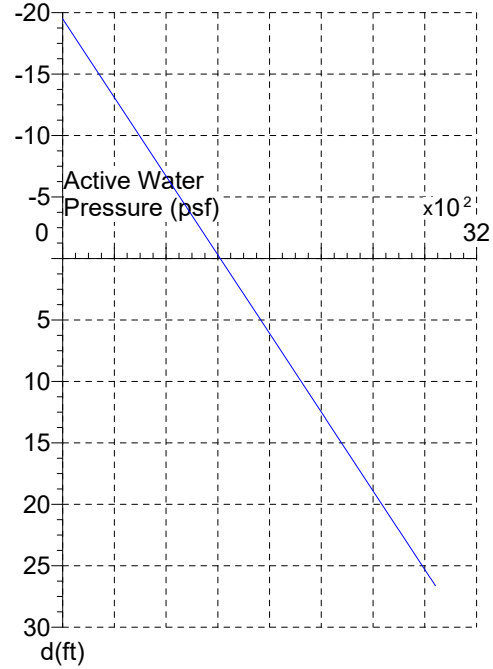
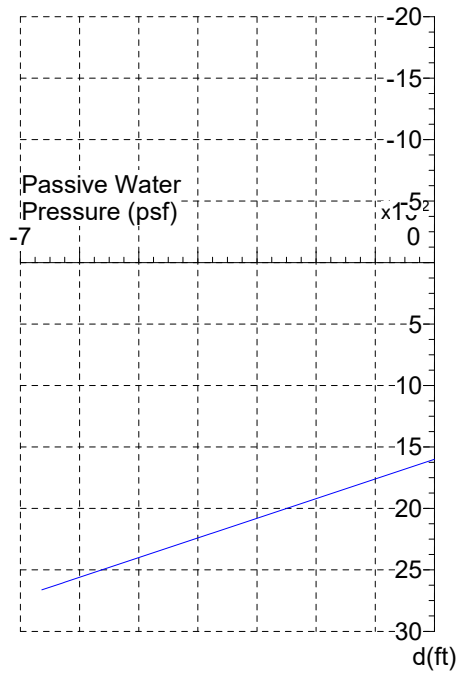
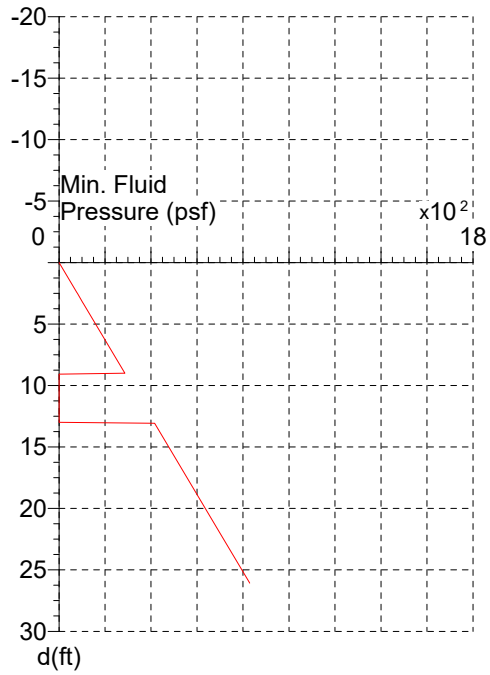
Stage 6 - Tip and Moment only

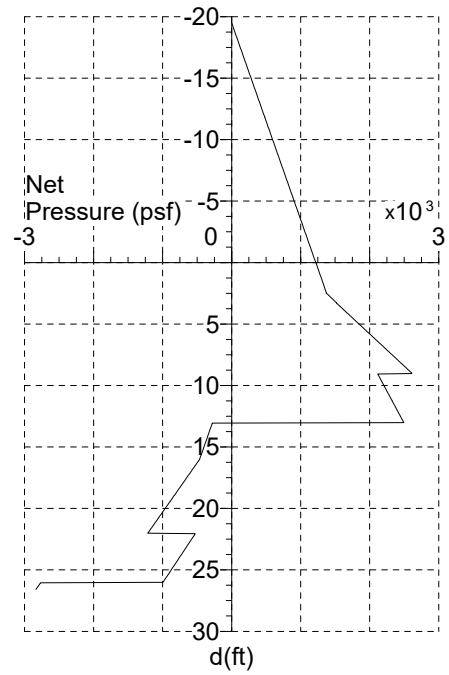












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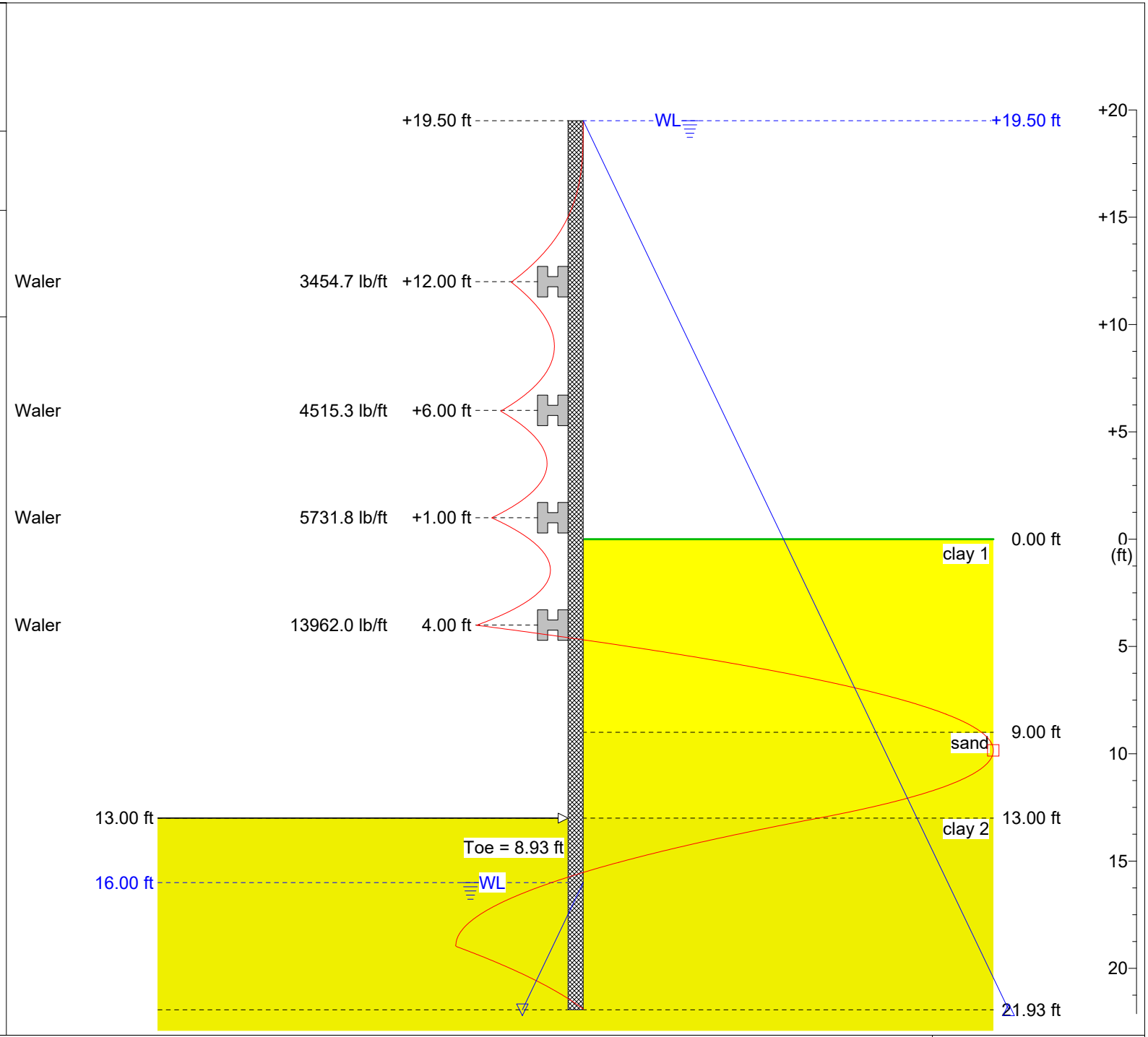
	Maximum	d (ft)
□	25650.8 ftlb/ft	9.85
△	2589.4 psf	21.93
△	370.6 psf	21.93

Stage 6 - Wales only



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Stage 6 - Wales only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 16.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	8.93	41.43

Pressure Model: Manual

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3454.7
+6.00	Waler	4515.3
+1.00	Waler	5731.8
4.00	Waler	13962.0

Maxima

	Maximum	Depth (ft)
Pressure	2385.4 psf	13.00
Bending Moment	25650.8 ftlb/ft	9.85
Shear Force	10369.2 lb/ft	4.00

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Analysis: Net Pressure
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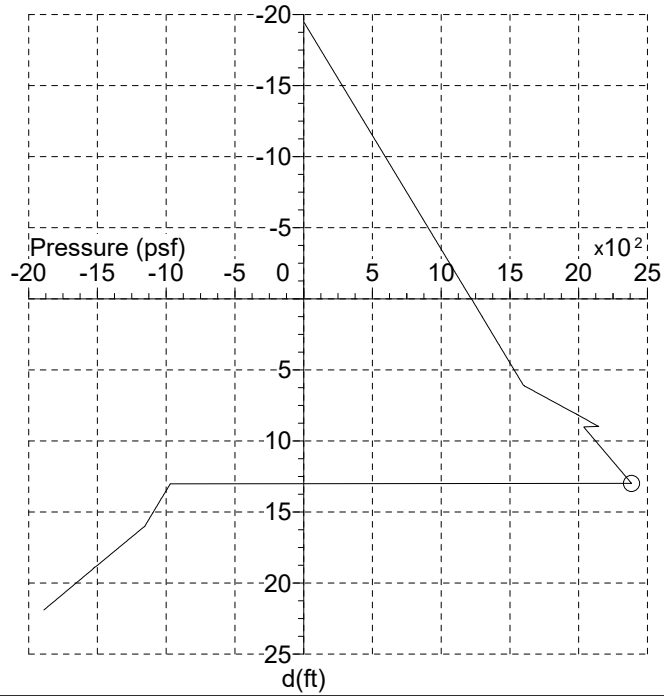
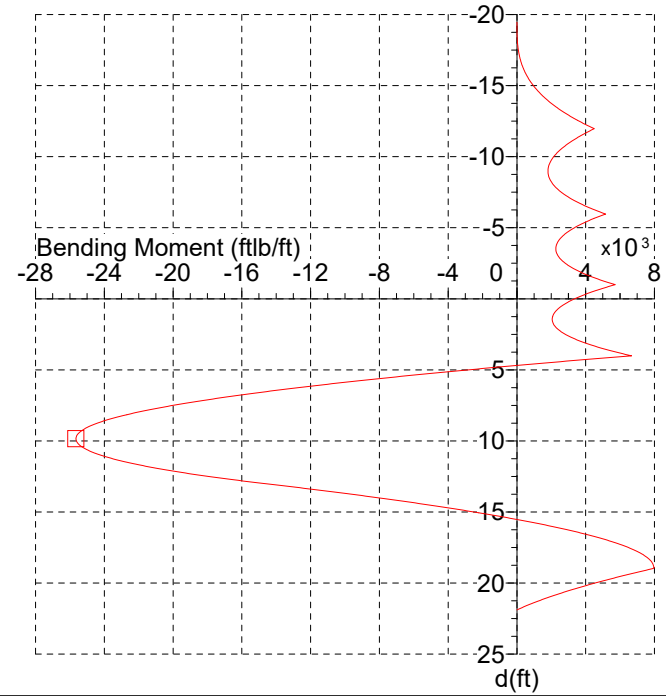
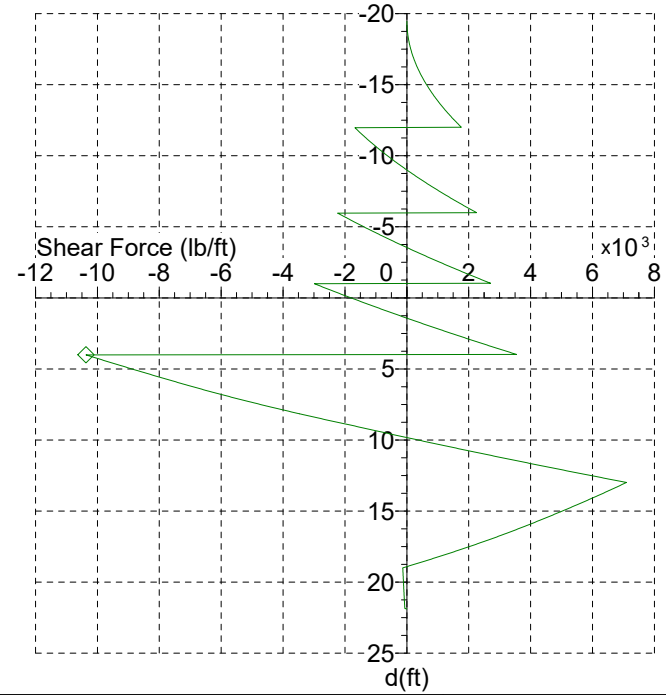
Maximum	d (ft)
○ 2385.4 psf	13.00
□ 25650.8 ftlb/ft	9.85
◇ 10369.2 lb/ft	4.00

Stage 6 - Wales only







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Title: Colorado River Flood Gate - East Side
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Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

Stage 6 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1220.2	3346.9		-1796.4	7.36	1845.3	-19486.9		-4928.7	14.72	-1077.6	-3819.7		5295.6
0.16	1231.3	3057.3		-1584.6	7.52	1871.5	-20150.3		-4671.6	14.88	-1086.2	-3096.0		5146.1
0.31	1239.8	2851.5		-1413.8	7.68	1904.3	-20929.5		-4345.1	15.04	-1096.9	-2220.6		4957.5
0.47	1250.5	2626.9		-1198.6	7.83	1930.5	-21512.3		-4079.8	15.19	-1105.5	-1543.8		4805.2
0.63	1259.1	2473.4		-1025.2	7.99	1963.3	-22189.3		-3743.2	15.35	-1116.2	-727.4		4613.3
0.78	1269.8	2314.7		-806.7	8.15	1995.3	-22689.1		-3469.4	15.51	-1124.8	-98.3		4458.4
0.94	1280.4	2193.1		-586.4	8.30	2022.7	-23260.7		-3122.5	15.66	-1135.5	658.0		4263.1
1.10	1289.0	2122.8		-408.9	8.46	2048.2	-23674.8		-2841.0	15.82	-1146.2	1380.4		4066.0
1.25	1299.7	2068.7		-185.3	8.62	2080.0	-24137.9		-2484.1	15.98	-1155.3	1933.7		3907.0
1.41	1308.2	2052.8		-5.0	8.77	2105.4	-24464.0		-2194.7	16.13	-1175.8	2594.4		3705.6
1.57	1318.9	2067.9		221.9	8.93	2137.2	-24815.5		-1827.9	16.29	-1193.1	3097.7		3541.7
1.72	1327.4	2109.2		404.8	9.09	2042.4	-25051.5		-1542.5	16.45	-1214.7	3694.8		3333.5
1.88	1338.1	2197.3		635.0	9.24	2057.5	-25291.9		-1188.4	16.60	-1232.0	4146.5		3164.3
2.04	1346.7	2297.3		820.6	9.40	2072.6	-25471.4		-831.7	16.76	-1253.5	4678.0		2949.4
2.19	1357.3	2459.5		1054.1	9.56	2084.7	-25570.8		-544.4	16.92	-1270.8	5076.3		2774.8
2.35	1365.9	2619.2		1242.3	9.71	2099.9	-25639.4		-182.9	17.07	-1292.4	5540.1		2553.2
2.51	1376.6	2856.4		1479.2	9.87	2112.0	-25649.6		108.1	17.23	-1309.7	5883.5		2373.2
2.66	1385.1	3076.5		1670.1	10.03	2127.1	-25605.6		474.3	17.39	-1331.3	6277.5		2144.9
2.82	1395.8	3389.9		1910.3	10.18	2139.2	-25524.9		769.1	17.54	-1348.5	6564.1		1959.5
2.98	1406.5	3746.1		2152.3	10.34	2154.4	-25366.5		1139.9	17.70	-1370.1	6886.2		1724.5
3.13	1415.0	4062.0		2347.3	10.50	2166.5	-25193.7		1438.5	17.86	-1391.7	7167.5		1485.8
3.29	1425.7	4496.0		2592.7	10.65	2181.6	-24919.4		1814.0	18.01	-1409.0	7362.7		1292.1
3.45	1434.3	4874.5		2790.4	10.81	2193.7	-24653.2		2116.4	18.17	-1430.5	7568.9		1046.6
3.60	1445.1	5387.3		3039.1	10.97	2208.8	-24261.6		2496.6	18.33	-1447.8	7703.2		847.6
3.76	1453.7	5829.4		3239.4	11.12	2221.0	-23901.0		2802.7	18.48	-1469.4	7832.1		595.4
3.92	1464.5	6422.2		3491.5	11.28	2236.1	-23390.6		3187.7	18.64	-1486.7	7903.8		391.0
4.07	1473.1	5957.7		-10267.6	11.44	2251.2	-22813.5		3575.2	18.80	-1508.3	7953.5		132.1
4.23	1483.9	4213.4		-10012.2	11.59	2263.3	-22303.6		3887.2	18.95	-1529.6	7962.9		-78.0
4.39	1492.5	2849.7		-9806.5	11.75	2278.5	-21605.5		4279.5	19.11	-1546.9	7397.4		-127.9
4.54	1503.2	1184.8		-9547.7	11.90	2290.6	-20998.1		4595.2	19.27	-1564.0	6916.6		-125.0
4.70	1511.8	-115.1		-9339.4	12.06	2305.7	-20177.4		4992.1	19.42	-1585.4	6331.1		-121.4
4.86	1522.6	-1699.6		-9077.3	12.22	2317.8	-19471.4		5311.6	19.58	-1602.5	5875.1		-118.4
5.01	1531.2	-2934.8		-8866.3	12.37	2332.9	-18526.7		5713.3	19.74	-1623.8	5320.9		-114.7
5.17	1542.0	-4437.9		-8600.8	12.53	2345.0	-17720.9		6036.5	19.89	-1645.2	4784.5		-110.9
5.33	1552.7	-5895.4		-8333.5	12.69	2360.2	-16650.7		6442.9	20.05	-1662.3	4368.4		-107.9
5.48	1561.4	-7028.2		-8118.4	12.84	2372.3	-15743.9		6769.9	20.21	-1683.7	3864.6		-104.0
5.64	1572.1	-8402.7		-7847.7	13.00	-971.7	-14546.8		7065.0	20.36	-1700.8	3474.8		-100.9
5.80	1580.7	-9468.7		-7629.9	13.16	-978.6	-13578.0		6930.3	20.52	-1722.1	3004.4		-96.9
5.95	1591.5	-10759.1		-7355.9	13.31	-989.4	-12393.3		6760.3	20.68	-1739.2	2641.6		-93.7
6.11	1606.9	-11757.4		-7135.1	13.47	-998.0	-11466.7		6622.9	20.83	-1760.6	2205.2		-89.7
6.27	1635.5	-12962.6		-6855.1	13.63	-1008.8	-10335.2		6449.5	20.99	-1777.7	1870.0		-86.4
6.42	1661.8	-13891.9		-6627.0	13.78	-1019.5	-9233.9		6274.3	21.15	-1799.0	1468.5		-82.3
6.58	1694.5	-15009.1		-6336.7	13.94	-1028.1	-8374.6		6132.7	21.30	-1816.1	1161.5		-78.9
6.74	1720.8	-15866.8		-6100.4	14.10	-1038.7	-7328.2		5954.0	21.46	-1837.5	795.6		-74.7
6.89	1753.5	-16893.0		-5800.0	14.25	-1047.6	-6513.3		5809.8	21.62	-1854.6	517.4		-71.3
7.05	1779.8	-17676.6		-5555.6	14.41	-1058.3	-5522.8		5627.8	21.77	-1876.0	187.9		-66.9
7.21	1812.5	-18608.6		-5244.9	14.57	-1066.9	-4753.1		5480.9	21.93	-1888.8	0.0		0.0

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Title: Colorado River Flood Gate - East Side
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Ref: 1.0
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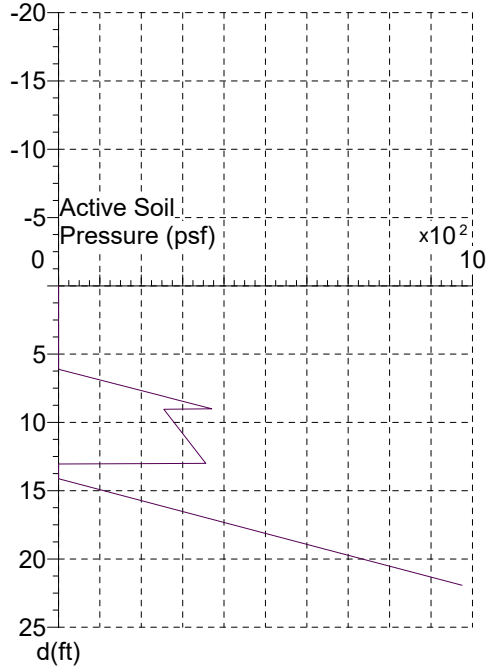
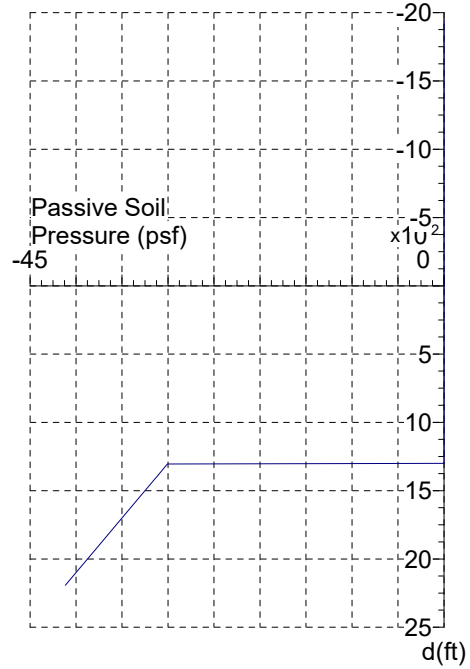
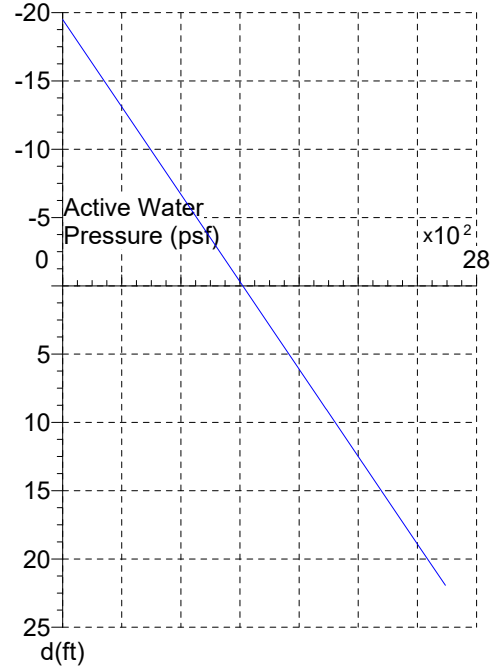
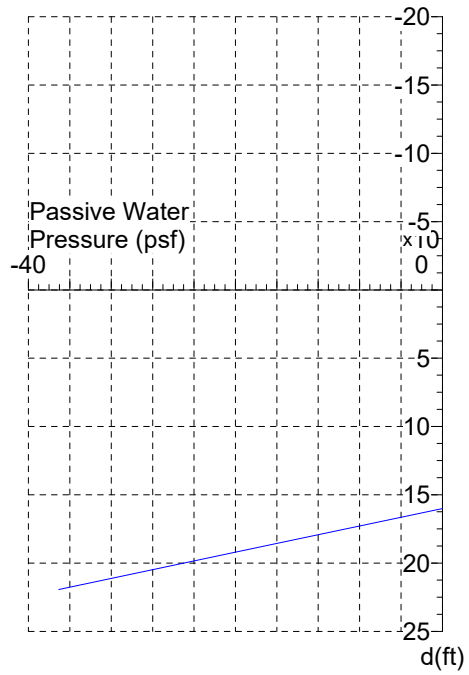
Works: Temporary
Pressure: Manual
Analysis: Net Pressure
Toe: Free Earth Support

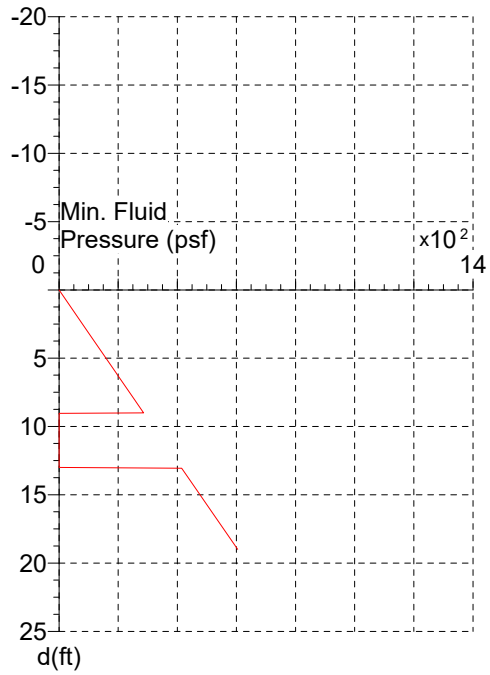
Stage 6 - Wales only

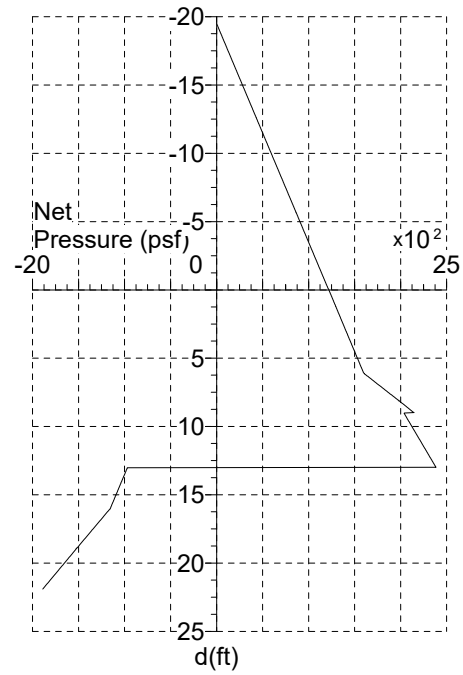












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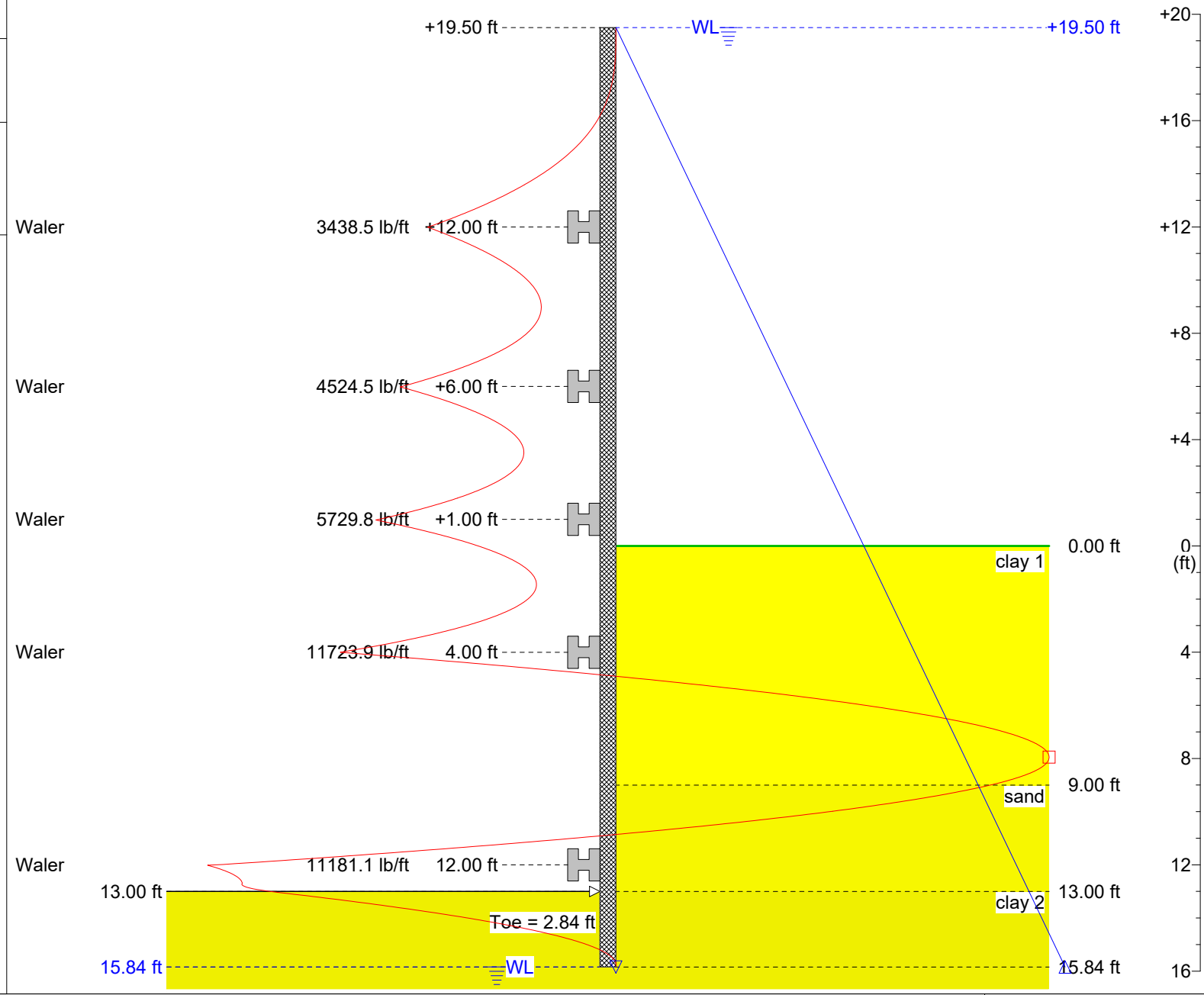
Toe: Free Earth Support

	Maximum	d (ft)
□	10165.7 ftlb/ft	7.95
△	2208.9 psf	15.84
△	0.2 psf	15.84

Stage 7 - Tip and Moment only



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Stage 7 - Tip and Moment only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 15.84ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1 (769.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
13.00	clay 2	125.00	62.50	1499.9 (1153.8)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0 (807.7)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0 (1692.3)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	2.84	35.34

Pressure Model: Coulomb; Assume full hydrostatic pressure to 13.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3438.5
+6.00	Waler	4524.5
+1.00	Waler	5729.8
4.00	Waler	11723.9
12.00	Waler	11181.1

Maxima

	Maximum	Depth (ft)
Pressure	2609.3 psf	8.98
Bending Moment	10165.7 ftlb/ft	7.95
Shear Force	9412.3 lb/ft	11.98

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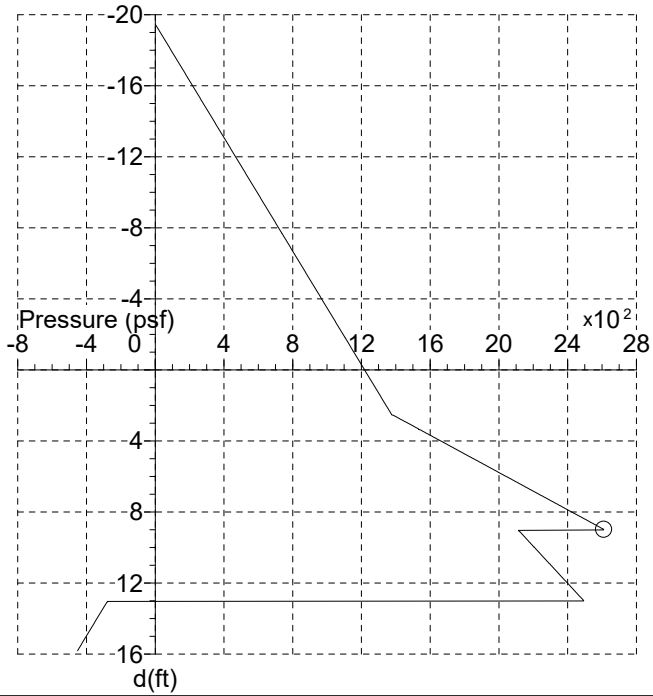
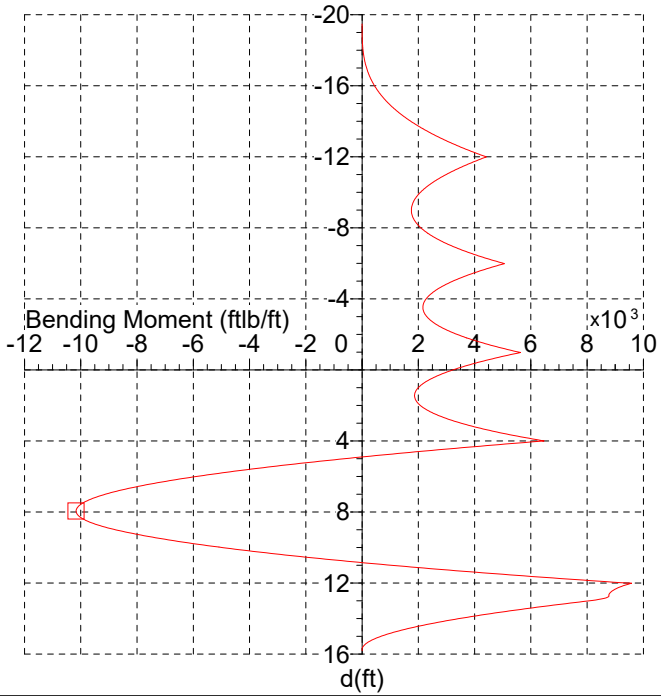
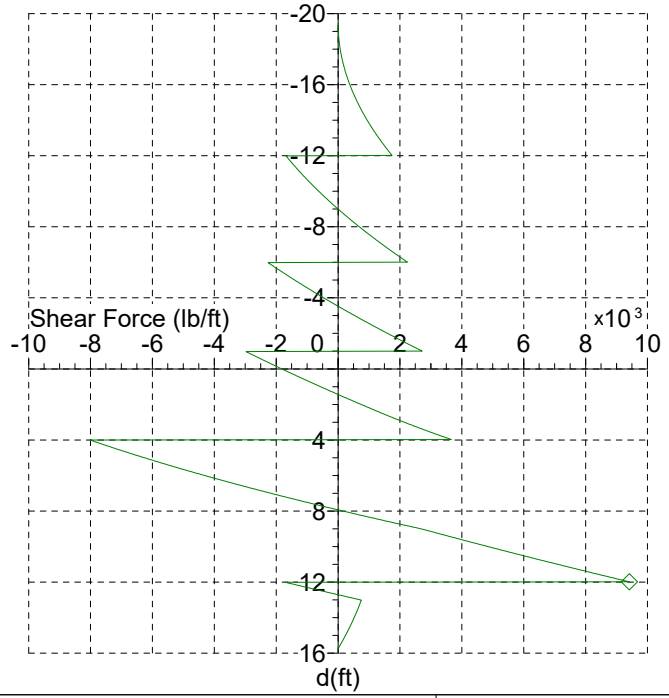
Maximum	d (ft)
○ 2609.3 psf	8.98
□ 10165.7 ftlb/ft	7.95
◇ 9412.3 lb/ft	11.98

Stage 7 - Tip and Moment only







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Toe: Free Earth Support

Stage 7 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.6	3187.5		-1785.3	5.32	1913.4	-2540.3		-5642.2	10.64	2269.4	-1293.3		6318.5
0.11	1225.1	3030.4		-1677.2	5.43	1935.9	-3187.1		-5415.2	10.75	2280.7	-526.1		6586.7
0.23	1232.5	2836.1		-1532.4	5.54	1958.3	-3807.4		-5185.4	10.86	2289.2	70.4		6788.7
0.34	1239.9	2659.2		-1386.6	5.66	1980.8	-4400.8		-4953.1	10.98	2300.4	894.0		7059.2
0.45	1247.2	2499.8		-1240.0	5.77	2003.2	-4967.1		-4718.1	11.09	2311.7	1749.9		7331.1
0.57	1254.6	2357.9		-1092.5	5.88	2020.0	-5373.8		-4540.1	11.20	2323.0	2638.4		7604.2
0.68	1262.0	2233.8		-944.2	6.00	2042.5	-5891.8		-4300.5	11.32	2334.3	3559.6		7878.8
0.79	1267.5	2152.4		-832.3	6.11	2064.9	-6381.8		-4058.2	11.43	2345.6	4513.6		8154.6
0.91	1274.9	2059.4		-682.5	6.22	2087.4	-6843.5		-3813.3	11.54	2354.1	5250.8		8362.3
1.02	1282.2	1984.5		-531.7	6.34	2109.8	-7276.5		-3565.7	11.66	2365.4	6262.8		8640.5
1.13	1289.6	1927.6		-380.1	6.45	2132.3	-7680.6		-3315.5	11.77	2376.6	7308.1		8920.0
1.24	1297.0	1889.0		-227.7	6.56	2149.1	-7964.6		-3126.1	11.88	2387.9	8386.8		9200.8
1.36	1304.3	1868.6		-74.3	6.68	2171.6	-8317.3		-2871.2	12.00	2399.2	9581.4		-1698.1
1.47	1311.7	1866.6		79.9	6.79	2194.0	-8640.3		-2613.8	12.11	2410.5	9335.5		-1414.7
1.58	1317.2	1877.3		196.1	6.90	2216.5	-8933.2		-2353.6	12.22	2421.8	9133.5		-1129.8
1.70	1324.6	1908.0		351.8	7.02	2238.9	-9195.7		-2090.9	12.33	2430.3	9010.9		-915.4
1.81	1332.0	1957.6		508.4	7.13	2261.4	-9427.5		-1825.4	12.45	2441.5	8886.1		-628.2
1.92	1339.3	2026.1		665.9	7.24	2278.2	-9581.0		-1624.6	12.56	2452.8	8805.8		-339.8
2.04	1346.7	2113.7		824.2	7.36	2300.7	-9758.3		-1354.6	12.67	2464.1	8770.1		-50.0
2.15	1354.1	2220.4		983.4	7.47	2323.1	-9904.1		-1081.9	12.79	2475.4	8719.9		241.2
2.26	1359.6	2313.0		1103.4	7.58	2345.5	-10018.1		-806.6	12.90	2486.7	8421.9		533.6
2.38	1367.0	2453.5		1264.1	7.70	2368.0	-10099.8		-528.6	13.01	2492.3	8035.1		753.8
2.49	1374.6	2613.4		1425.7	7.81	2390.4	-10149.1		-248.0	13.13	-284.8	7404.8		724.7
2.60	1397.1	2792.9		1589.1	7.92	2412.9	-10165.7		35.3	13.24	-292.1	6797.3		698.9
2.72	1419.5	2992.3		1755.4	8.03	2429.7	-10156.1		249.5	13.35	-299.5	6211.9		672.5
2.83	1442.0	3211.8		1924.3	8.15	2452.2	-10113.4		537.4	13.47	-306.8	5649.1		645.4
2.94	1458.8	3389.9		2052.7	8.26	2474.6	-10036.2		827.9	13.58	-314.2	5109.5		617.7
3.06	1481.3	3645.6		2226.2	8.37	2497.1	-9924.1		1121.1	13.69	-319.7	4720.4		596.5
3.17	1503.7	3922.3		2402.3	8.49	2519.5	-9776.9		1417.0	13.81	-327.1	4222.8		567.6
3.28	1526.2	4220.4		2581.1	8.60	2542.0	-9594.2		1715.4	13.92	-334.4	3749.9		538.1
3.39	1548.6	4540.2		2762.4	8.71	2558.8	-9433.6		1941.0	14.03	-341.8	3302.4		507.9
3.51	1571.1	4882.0		2946.5	8.83	2581.3	-9188.1		2244.1	14.15	-349.1	2880.6		477.1
3.62	1593.5	5246.1		3133.3	8.94	2603.7	-8906.2		2549.9	14.26	-356.5	2485.3		445.6
3.73	1610.3	5534.1		3275.0	9.05	2114.2	-8588.1		2828.1	14.37	-363.9	2116.9		413.4
3.85	1632.8	5938.1		3466.4	9.17	2128.3	-8238.8		3078.4	14.48	-369.4	1858.7		388.9
3.96	1655.2	6365.4		3660.4	9.28	2139.6	-7859.6		3329.9	14.60	-376.7	1538.8		355.6
4.07	1677.7	5776.6		-7866.8	9.39	2148.1	-7555.4		3519.5	14.71	-384.1	1247.5		321.7
4.19	1700.1	4869.6		-7667.5	9.51	2159.3	-7123.4		3773.4	14.82	-391.4	985.2		287.1
4.30	1722.6	3986.0		-7465.5	9.62	2170.6	-6661.0		4028.6	14.94	-398.8	752.5		251.8
4.41	1739.4	3338.7		-7312.4	9.73	2181.9	-6168.0		4285.1	15.05	-406.2	550.0		215.9
4.53	1761.9	2496.6		-7105.8	9.85	2193.2	-5644.2		4543.0	15.16	-411.7	418.2		188.5
4.64	1784.3	1678.7		-6896.6	9.96	2204.5	-5089.6		4802.2	15.28	-419.0	269.8		151.5
4.75	1806.8	885.2		-6684.7	10.07	2215.8	-4504.0		5062.8	15.39	-426.4	153.0		113.8
4.87	1829.2	116.5		-6470.2	10.18	2224.3	-4044.3		5259.1	15.50	-433.7	68.6		75.4
4.98	1851.7	-627.2		-6253.0	10.30	2235.5	-3403.9		5521.9	15.62	-441.1	16.9		36.4
5.09	1868.5	-1168.2		-6088.4	10.41	2246.8	-2732.1		5786.1	15.73	-448.5	0.0		0.0
5.21	1891.0	-1867.2		-5866.7	10.52	2258.1	-2028.6		6051.7	15.84	-452.1	0.0		0.0

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Title: Colorado River Flood Gate - East Side
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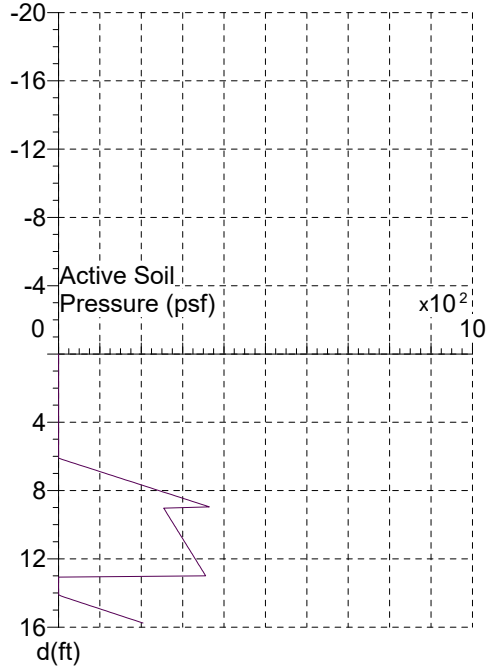
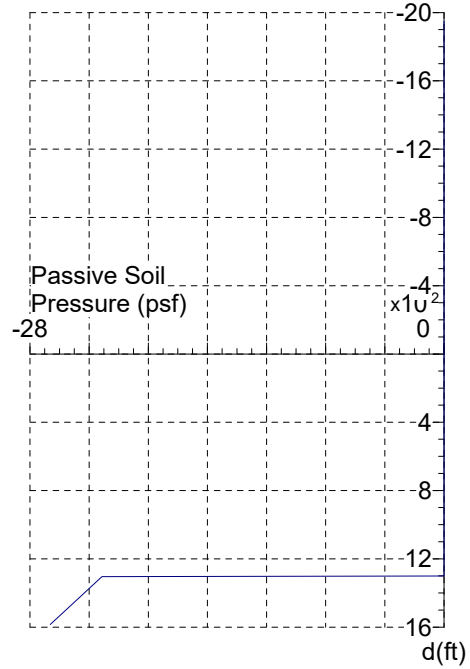
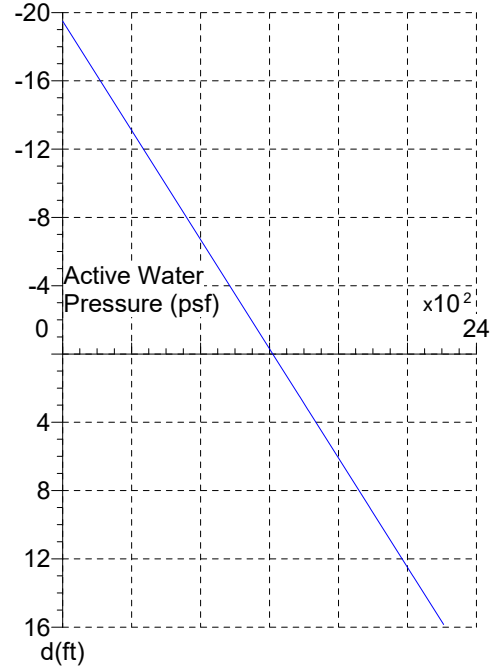
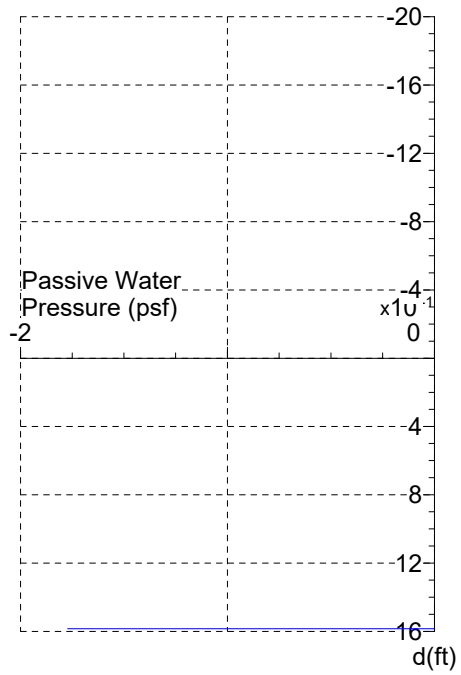
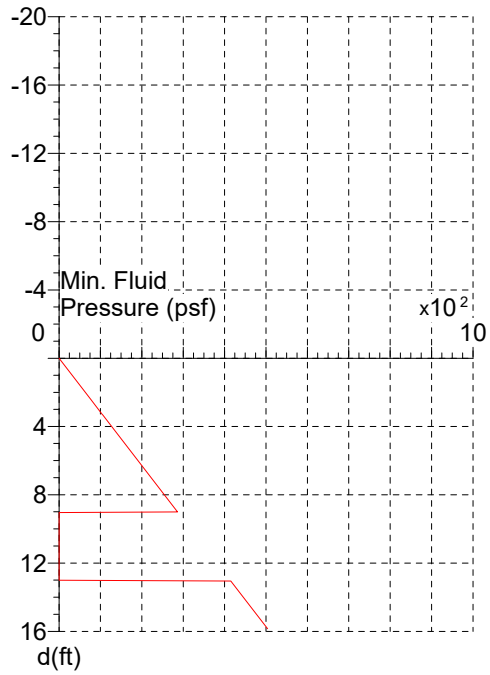
Stage 7 - Tip and Moment only

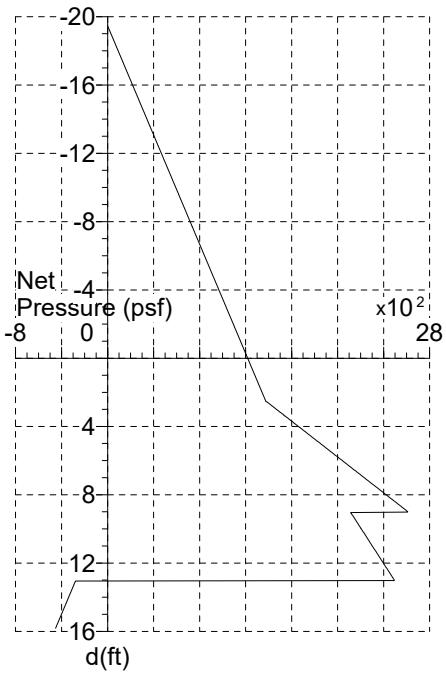












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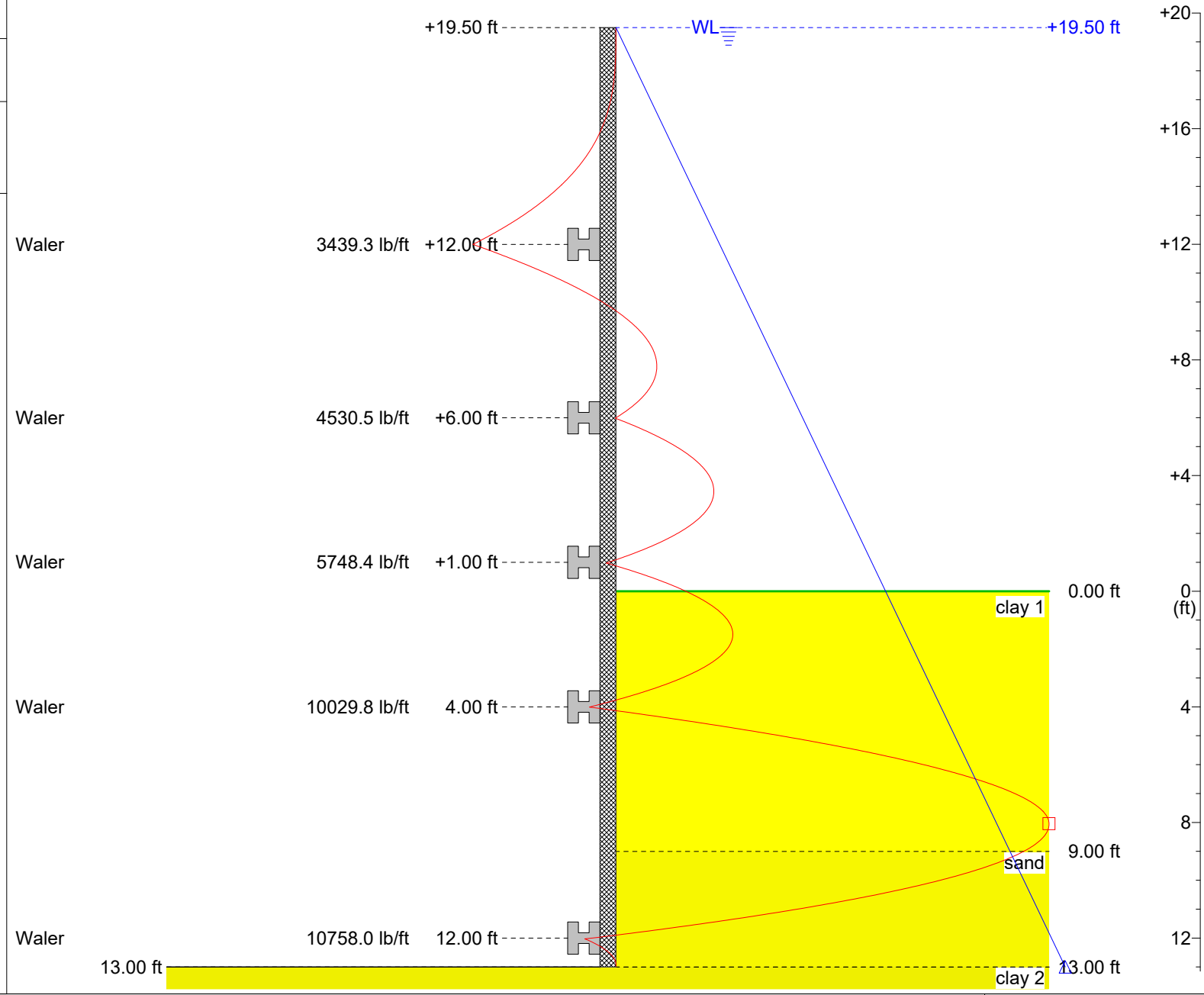
Title: Colorado River Flood Gate - East Side
Designer: Stage 7
Ref: 1.0
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

	Maximum	d (ft)
□	13328.4 ftlb/ft	8.04
△	2031.3 psf	13.00

Stage 7 - Wales only



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Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Wales only

Input Data

Depth Of Excavation = 13.00ft
Surcharge = 0.0psf

Depth Of Active Water = +19.50ft
Depth Of Passive Water = 16.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	128.00	65.50	1000.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
9.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
13.00	clay 2	125.00	62.50	1499.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
22.00	clay 3	118.00	55.50	1050.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
26.00	clay 4	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00
37.00	clay 5	132.00	69.50	2200.0	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								19.50	0.00	32.50

Pressure Model: Coulomb; Assume full hydrostatic pressure to 13.00ft in cohesive soils on active side

Load Model: Area Distribution (Hinge Method used for Shear Force, Bending Moment and Deflection)

Supports

d (ft)	Type	Load (lb/ft)
+12.00	Waler	3439.3
+6.00	Waler	4530.5
+1.00	Waler	5748.4
4.00	Waler	10029.8
12.00	Waler	10758.0

Maxima

	Maximum	Depth (ft)
Pressure	2385.4 psf	13.00
Bending Moment	13328.4 ftlb/ft	8.04
Shear Force	8476.9 lb/ft	12.00

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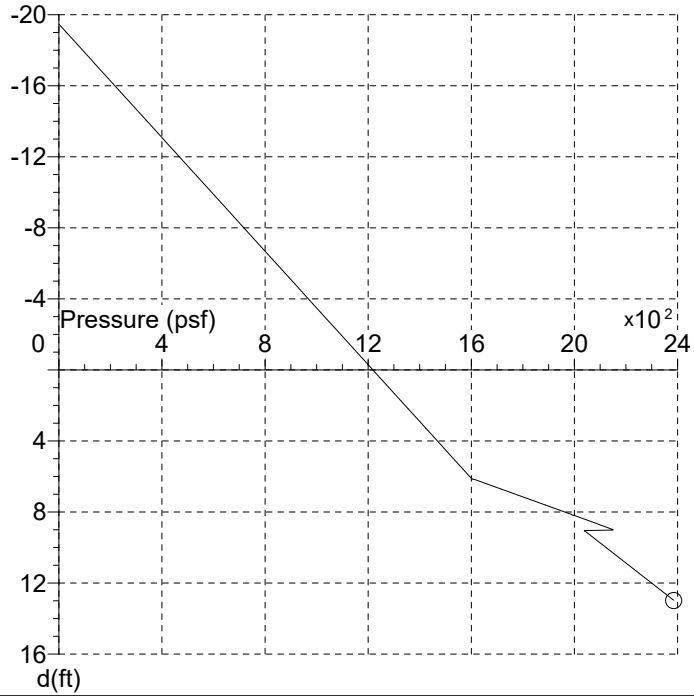
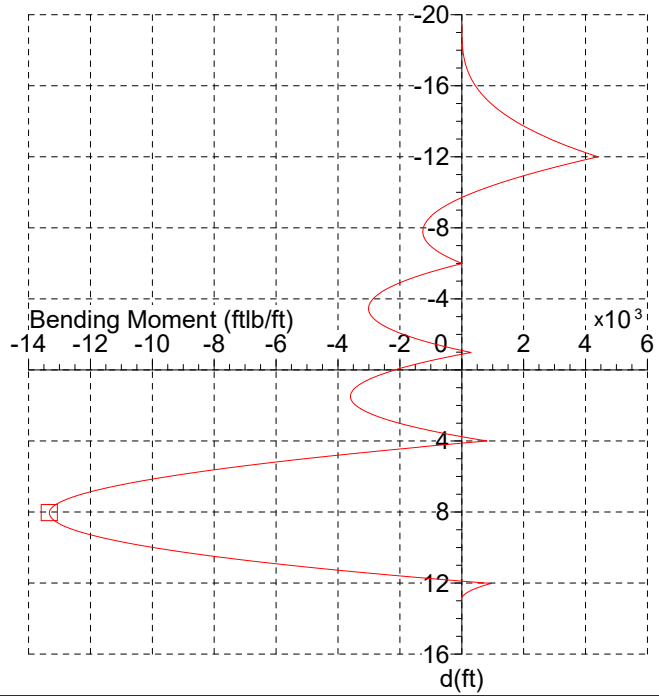
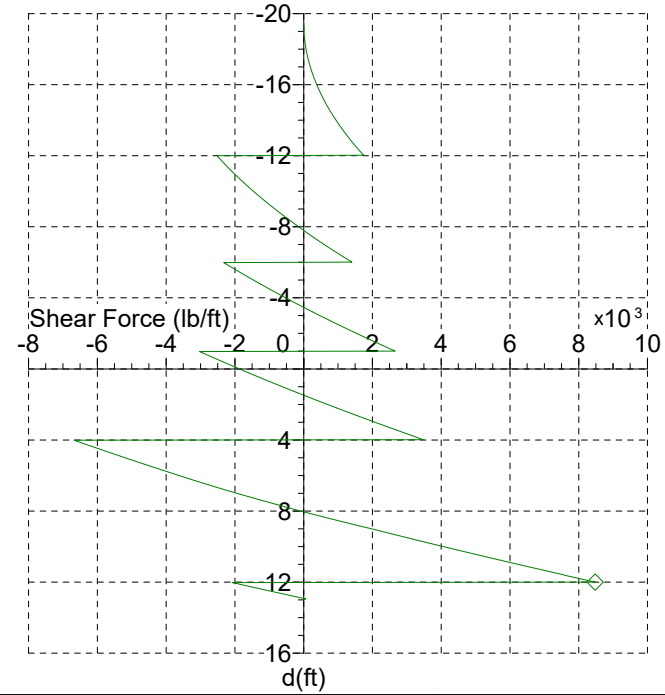
Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

	Maximum	d (ft)
○	2385.4 psf	13.00
□	13328.4 ftlb/ft	8.04
◇	8476.9 lb/ft	12.00

Stage 7 - Wales only







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Ref: 1.0
Page: 4
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Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.8	-2199.5		-1837.8	4.36	1492.5	-1603.1		-6118.8	8.73	2103.6	-12912.4		1438.9
0.09	1224.9	-2348.5		-1738.4	4.46	1497.6	-2093.7		-5997.3	8.82	2119.1	-12807.7		1610.7
0.19	1229.9	-2489.2		-1638.6	4.55	1504.4	-2732.4		-5834.6	8.91	2139.7	-12649.3		1841.6
0.28	1236.7	-2664.1		-1504.9	4.64	1509.5	-3200.0		-5712.1	9.01	2150.0	-12516.3		2016.2
0.37	1241.8	-2785.6		-1404.1	4.74	1514.5	-3657.7		-5589.2	9.10	2045.7	-12320.3		2237.3
0.46	1248.6	-2934.6		-1269.1	4.83	1521.3	-4252.4		-5424.6	9.19	2052.9	-12159.8		2403.9
0.56	1253.7	-3036.6		-1167.4	4.92	1526.4	-4686.9		-5300.7	9.29	2060.0	-11987.6		2571.1
0.65	1260.4	-3159.5		-1031.1	5.01	1533.2	-5250.6		-5134.9	9.38	2069.6	-11739.8		2794.9
0.74	1265.5	-3241.8		-928.5	5.11	1538.3	-5661.6		-5010.1	9.47	2076.7	-11540.2		2963.5
0.84	1270.6	-3315.6		-825.4	5.20	1545.0	-6193.9		-4843.0	9.56	2086.3	-11255.6		3189.1
0.93	1277.4	-3400.8		-687.3	5.29	1550.1	-6581.4		-4717.2	9.66	2093.5	-11028.4		3359.0
1.02	1282.5	-3454.6		-583.2	5.39	1555.2	-6958.7		-4590.9	9.75	2103.0	-10706.9		3586.5
1.11	1289.2	-3513.1		-443.8	5.48	1562.0	-7445.9		-4422.0	9.84	2110.2	-10451.8		3757.7
1.21	1294.3	-3546.8		-338.8	5.57	1567.1	-7799.3		-4294.8	9.94	2117.3	-10184.7		3929.5
1.30	1301.1	-3578.3		-198.1	5.66	1573.8	-8254.6		-4124.6	10.03	2126.9	-9809.8		4159.6
1.39	1306.2	-3591.8		-92.1	5.76	1578.9	-8584.0		-3996.4	10.12	2134.0	-9514.6		4332.8
1.49	1311.3	-3596.5		14.3	5.85	1585.7	-9007.1		-3824.9	10.21	2143.6	-9102.0		4564.6
1.58	1318.0	-3589.0		156.8	5.94	1590.8	-9312.3		-3695.8	10.31	2150.7	-8778.4		4739.2
1.67	1323.1	-3573.0		264.2	6.04	1595.9	-9607.1		-3566.3	10.40	2160.3	-8327.8		4972.8
1.76	1329.9	-3537.7		408.0	6.13	1603.0	-9983.8		-3392.9	10.49	2167.5	-7975.5		5148.7
1.86	1335.0	-3500.8		516.3	6.22	1623.6	-10254.1		-3261.4	10.59	2174.6	-7611.0		5325.2
1.95	1341.7	-3437.6		661.4	6.31	1644.3	-10597.9		-3084.1	10.68	2184.2	-7105.6		5561.4
2.04	1346.8	-3379.7		770.7	6.41	1659.8	-10843.2		-2949.7	10.77	2191.3	-6712.1		5739.3
2.14	1351.9	-3312.6		880.4	6.50	1680.4	-11153.3		-2768.5	10.86	2200.9	-6168.0		5977.3
2.23	1358.7	-3209.0		1027.3	6.59	1695.9	-11373.0		-2631.1	10.96	2208.0	-5745.3		6156.5
2.32	1363.8	-3120.6		1138.0	6.69	1711.4	-11581.6		-2492.5	11.05	2217.6	-5162.2		6396.4
2.41	1370.5	-2988.4		1286.2	6.78	1732.0	-11842.3		-2305.7	11.14	2224.7	-4710.2		6576.9
2.51	1375.6	-2878.5		1397.8	6.87	1747.5	-12024.6		-2164.1	11.24	2231.9	-4245.5		6758.1
2.60	1382.4	-2717.4		1547.3	6.96	1768.1	-12249.7		-1973.4	11.33	2241.4	-3606.2		7000.5
2.69	1387.5	-2585.8		1659.9	7.06	1783.6	-12405.1		-1828.9	11.42	2248.6	-3111.8		7183.0
2.79	1392.6	-2444.8		1772.9	7.15	1804.3	-12594.1		-1634.3	11.51	2258.2	-2432.7		7427.3
2.88	1399.3	-2242.1		1924.2	7.24	1819.7	-12722.0		-1486.8	11.61	2265.3	-1908.4		7611.1
2.97	1404.4	-2079.1		2038.2	7.34	1835.2	-12838.0		-1338.1	11.70	2274.9	-1189.3		7857.2
3.06	1411.2	-1847.0		2190.8	7.43	1855.9	-12973.9		-1137.9	11.79	2282.0	-634.9		8042.4
3.16	1416.3	-1661.9		2305.7	7.52	1871.3	-13061.7		-986.3	11.89	2289.2	-67.5		8228.2
3.25	1423.1	-1400.1		2459.6	7.61	1892.0	-13159.6		-782.2	11.98	2298.7	709.3		8476.9
3.34	1428.1	-1192.5		2575.5	7.71	1907.5	-13218.6		-627.6	12.07	2305.9	847.6		-1950.7
3.44	1433.2	-975.4		2691.8	7.80	1928.1	-13277.7		-419.6	12.16	2315.4	646.3		-1702.3
3.53	1440.0	-670.8		2847.5	7.89	1943.6	-13307.4		-262.1	12.26	2322.6	513.1		-1515.4
3.62	1445.1	-431.0		2964.8	7.99	1959.1	-13324.3		-103.3	12.35	2332.2	359.1		-1265.3
3.71	1451.9	-96.1		3121.8	8.08	1979.7	-13327.0		110.3	12.44	2339.3	261.3		-1077.1
3.81	1456.9	166.6		3240.0	8.17	1990.0	-13315.5		271.9	12.54	2346.5	178.9		-888.2
3.90	1463.7	532.0		3398.3	8.26	2015.8	-13282.5		489.4	12.63	2356.0	93.0		-635.5
3.99	1468.8	814.9		-6680.6	8.36	2031.3	-13244.4		654.0	12.72	2363.2	46.5		-445.4
4.09	1473.9	278.9		-6560.9	8.45	2052.0	-13175.7		875.5	12.81	2372.7	8.6		-190.9
4.18	1480.7	-420.6		-6400.8	8.54	2067.4	-13110.5		1043.0	12.91	2379.9	-1.8		0.6
4.27	1485.7	-933.9		-6280.2	8.64	2082.9	-13033.5		1211.9	13.00	2385.4	0.0		0.0

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Ref: 1.0
Page: 5
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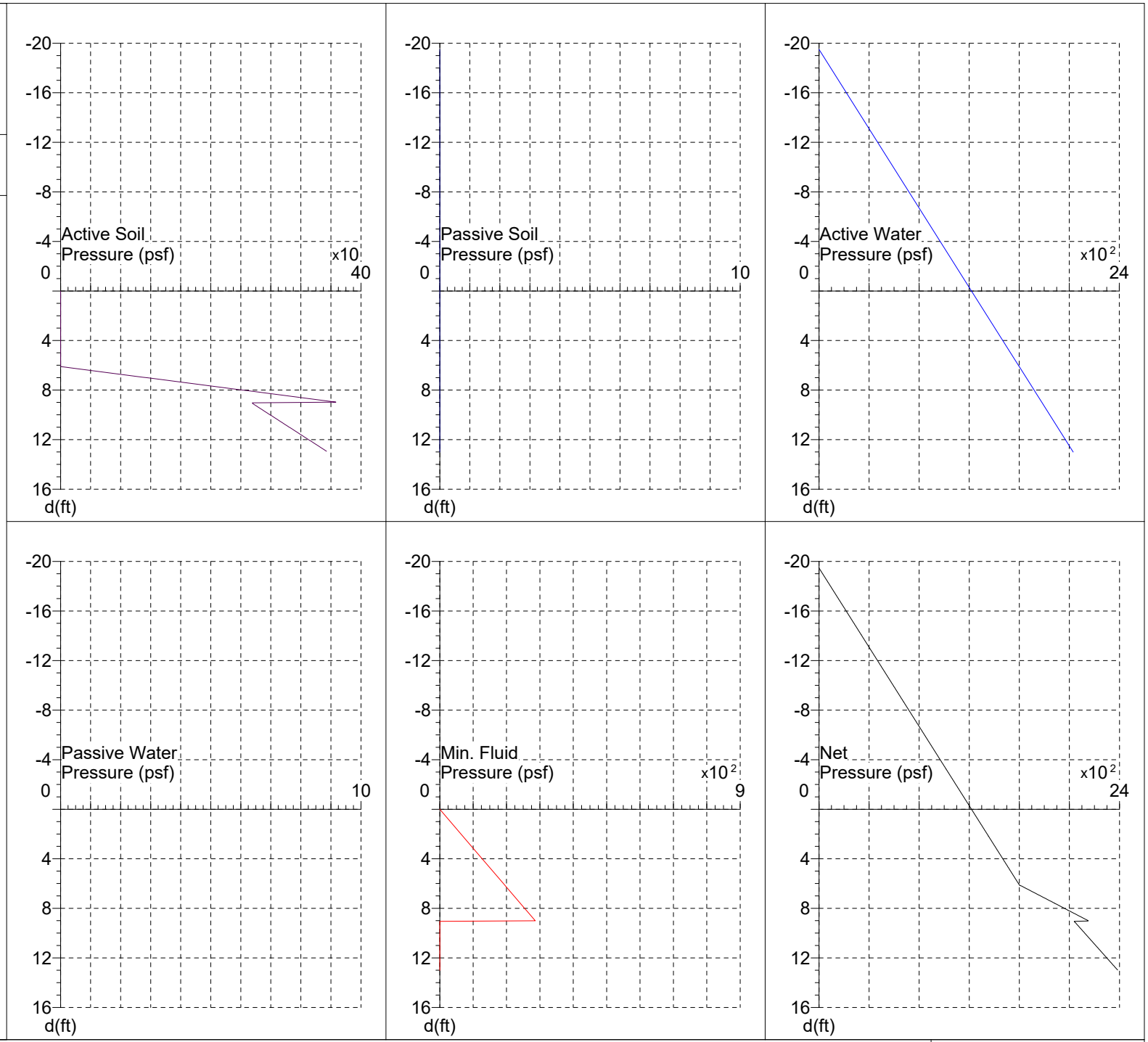
Works: Temporary
Pressure: Coulomb
Toe: No Earth Support

Stage 7 - Wales only



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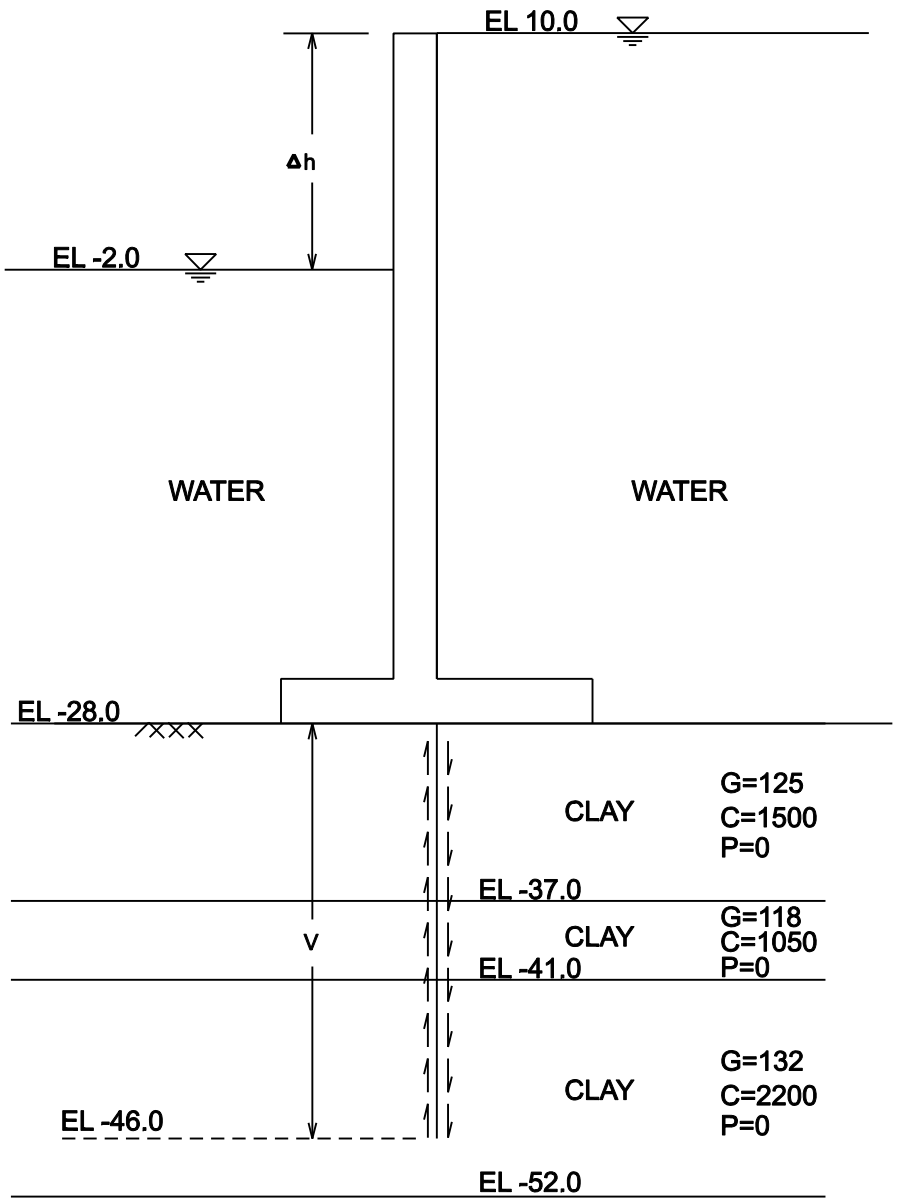
APPENDIX D

COLORADO RIVER - EAST SEEPAGE CUTOFF



$Cw = [(2V) + (1/3H)]/ \Delta h$

NEGLECT HORIZONTAL INTERFACE OF FOOTING/SOIL DUE TO PROBABLE SOIL ARCHING FROM A PILE FOUNDED STRUCTURE.

$H = 0$

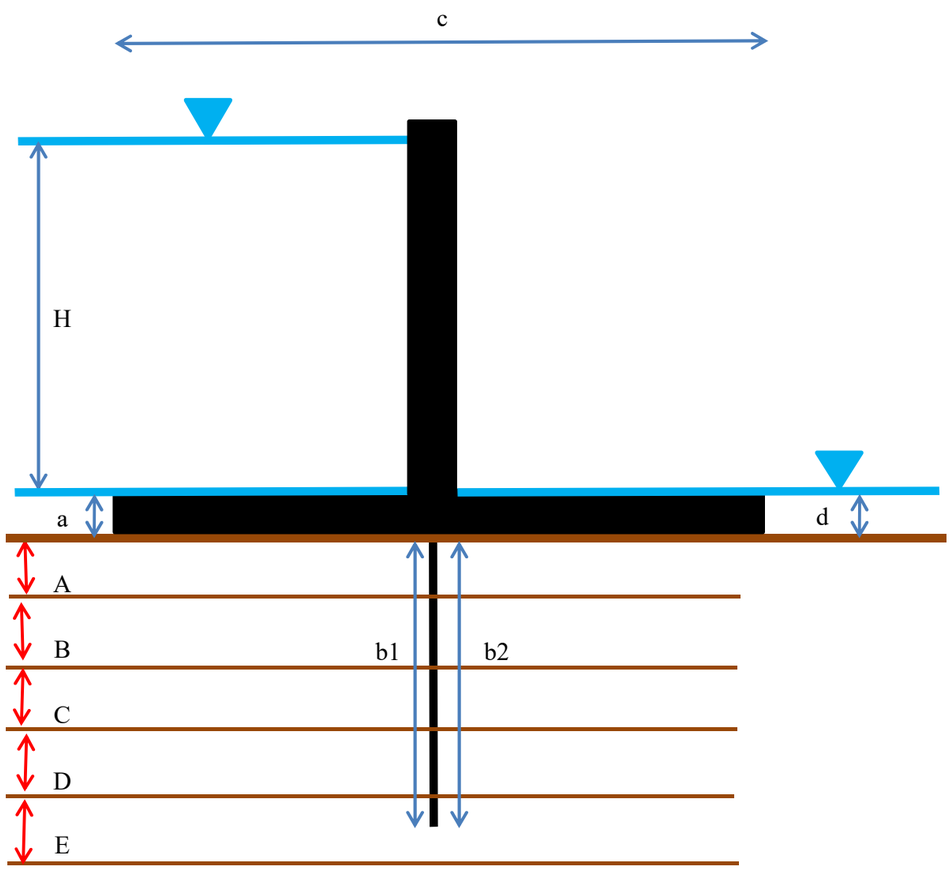
FOR ALL CLAY FOUNDATION, $Cw >= 3$

$\Delta h = (10- (-2)) = 12'$

$Cw = [(2V) + (1/3 \times 0)] / 12 = 3$

$V = 18'$

TIP ELEV = -28 -18 = -46



= Input
= Output

Target Safe Creep Ratio	Base Elevation	Tip Elevation
3	-28	-46

Weighted Creep Ratio

Strata	Thickness	Material	Safe Creep Ratio	Transformed Thickness	Cumulative Transformed Thickness
A	18	CH	3	18	18
B	0	CH	3	0	18
C	0	ML	7.5	0	18
D	0	CH	2	0	18
E	0	CH	3	0	18
F	0	CH	3	0	18
G	0	CH	3	0	18

Dead Space
0

<
=

Note:
$b = b_1 = b_2$
$2*b = b_1 + b_2$

$(a + b_1 + b_2 + c/3 + d)/H$					
a	b	d	c	H	(a + 2*b + c/3 + d)/H
0	18	0	0	12	3
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0

Largest "b"
18

Use Goal Seek to get (X?-N5) to equal zero by changing K?

0

APPENDIX E

Rachel, Chad M CIV USARMY CEMVN (US)

From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Thursday, August 02, 2018 11:31 AM
To: Rachel, Chad M CIV USARMY CEMVN (US)
Cc: Ragolia, Jason J CIV USARMY CEMVN (US); Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Need a 30" pile capacity curve for a new 125' gate on either side of the river crossing. Each gate will be mid-way between the existing river and GIWW side gate, directly to the south of the existing earthen chamber. See below for locations.

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

Ph (504) 862-2680

Cell (504) 717-9565

Rachel, Chad M CIV USARMY CEMVN (US)

From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Friday, August 17, 2018 6:20 AM
To: Rachel, Chad M CIV USARMY CEMVN (US)
Cc: Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Re: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Stick to 4.5 then for the water elevation.

Sent from my BlackBerry 10 smartphone on the Verizon Wireless 4G LTE network.
Original Message
From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Friday, August 17, 2018 6:11 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US)
Cc: Richard, Leeland J CIV USARMY CEMVN (US)
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Dave,

Does this mean you want the water at EL 4 or at EL 6?

Please confirm as soon as you can, as I have already done an entire design yesterday for one of them with water at EL 4.5 as the hydraulic engineer provided.

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Thursday, August 16, 2018 7:50 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Let's design for El 4 with a top El of 6.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch

Ph (504) 862-2680
Cell (504) 717-9565

-----Original Message-----
From: Agnew, Maxwell E CIV USARMY CEMVN (US)
Sent: Wednesday, August 15, 2018 1:41 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Hi David,

I looked at the east lock gage reading to determine water levels. The values are reported in NGVD, but I believe there is about a 2.0ft error/shift to get to NAVD88, at least with the older data. It seems the more recent data (late 2017 to present) was shifted down to where it's supposed to be. I remember looking into this issue a while back. The surveyor we used shot a water surface elevation in the lock at a certain time. I compared the lock reading and there was about a 2ft difference between the lock reading in NGVD and the survey in NAVD88. Using the plot below, it seems every year there are some fairly high events in the 6 to 8ft NGVD range, although some of those could be tropical. If we adjust for the datum shift, the levels would be 4 to 6ft NAVD88. I would recommend an elevation to 6ft NAVD88. If only considering non-storm tidal conditions, the maximum seems about 2.5 NAVD88, which if you add 2ft of freeboard, would give 4.5 ft NAVD88.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Wednesday, August 15, 2018 12:53 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: FW: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Max, Pat,

Can you please provide Chad with a maximum (non-tropical) water elevation that the cofferdam should be designed for. The cofferdams will be on the GIWW side of the existing structures so won't see the high river elevations.

Chad,

We should provide 2' above that elevation for "freeboard".

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

Ph (504) 862-2680

Cell (504) 717-9565

-----Original Message-----

From: Rachel, Chad M CIV USARMY CEMVN (US)

Sent: Wednesday, August 15, 2018 10:12 AM

To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Which water level should I use for the flood side of the braced cofferdam?

Thanks,

Chad M. Rachel, P.E.

-----Original Message-----

From: Lovett, David P Jr CIV USARMY CEMVN (US)

Sent: Thursday, August 02, 2018 12:34 PM

To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>

Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>; Richard, Leeland J CIV USARMY CEMVN (US) <Leeland.J.Richard@usace.army.mil>

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Also based on the available boring data, would like you to evaluate the required sheetpile cutoff elevation, the cofferdam design and the dewatering requirements (if necessary) for the 2 Colorado structures and the 1 Brazos structure. For the cofferdam design, the sill, base elevation and TRS dredge elevation would be the same as the GIWW West design that you performed for Morganza. I assume we could use the same elevations for anchor locations as we did for Morganza as well.

Please let me know approximate schedule to accomplish this work.

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

Rachel, Chad M CIV USARMY CEMVN (US)

From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Friday, September 21, 2018 11:13 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US)
Cc: Ragolia, Jason J CIV USARMY CEMVN (US); Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Brazos River & Colorado River - Seepage Cutoff
Attachments: Brazos-East sketch.pdf; Colorado-East sketch.pdf; Colorado-West sketch.pdf; Colorado-West Lanes Weighted Creep-CMR.PDF; Colorado-East Lanes Weighted Creep-CMR.PDF; Brazos-East Lanes Weighted Creep-CMR.PDF

Dave,

The estimated tip elevation (based on the soil parameters and stratification from the limited data, the water levels you provided, and using Lane's Weighted Creep Ratio method of analysis) of the seepage cutoff for the 3 structures are as follows:

Brazos-East = EL -46.0

Colorado-West = EL -50.5

Colorado-East = EL -46.0

Documentation is attached.

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 1:53 PM
To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Chad,

For cutoff, assume El 10 on the river and -2 on the GIWW side of the structure to size the tip of the cutoff wall.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 8:11 AM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Max,

Trying to determine for the new load case you suggest, what would be the return period on that event? Trying to determine whether this would be an unusual or extreme event.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

From: Agnew, Maxwell E CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 2:19 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Hi Dave,

1) I think this is ok for completing a cost estimate, but for final design, we'd probably want to look a little closer at velocities. 1000lb stone sounds pretty extreme.

2) For an extreme hurricane event, I believe the surge will inundate the entire coastal area, so both the GIWW and River would be about the same elevation. Once the water gets above 3 or 4ft, all the land in that area is inundated, so I don't believe you'd ever have a case where the river is 16' and the GIWW so much lower at 5ft.

I think the worst differential will be during a flood event at low tide. See below plot of stages. Harvey (flood of record maybe) seemed to peak at about 8ft NGVD (~6ft NAVD88). Maybe you could assume 10ft NAVD88 in the river, and a low tide, maybe -2ft in the GIWW.

Let me know if this helps or if you need any other info.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 1:38 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: Colorado River Lock - Design Questions

Max,

Two questions:

1.) In the attachment, I used WCC design from Matt D. to assume a similar 42" layer of 1000lb stone placed in the wet, extending 200' out from the structure. This would be placed on top of geotextile and bedding material. Is this reasonable?

2.) For the design of the pile foundation, I selected 4 load cases. They are shown below. Can you validate? Particularly interested in the hurricane case, where I assume the gate will be shut in a hurricane so I designed for water to the top for survivability of the structure (133% OS). What would be the GIWW elevation if we have 16 on the R/S?

Colorado River West Flood Gate

Soil Parameter Determination

Using the GLO database, there are three (3) borings on the west side of the Colorado. Those borings are 87-205, 87-206, and 87-207. Ground surface elevations of the borings are not known; only the depths are known. The ground surface of these borings are approximately 18 feet below the water surface. Although no ground surface elevation was reported, an assumption was made that the water surface was approximately zero elevation. Using this assumption and knowing the boring depth below the water surface, the ground surface elevation of the borings were assumed. The borings extend to depths of approximately 52 feet.

The strength test data for these borings are somewhat adequate, consisting mostly of pocket penetrometer tests and torvane tests, with occasional unconfined compression tests. Also accompanying the strength test data is soil classification, Atterberg limits, moisture contents, sieve analyses, and dry unit weight determination.

Determination of soil parameters relied upon the data from all 3 borings on the West side. All data was plotted in charts of Shear Strength vs. Depth and Wet Density vs. Depth. Boring logs were laid out next to each other, from left to right in order to determine stratification lines. Theses stratification lines were laid on top of the plots of Shear Strength vs. Depth and Wet Density vs. Depth in order to create design lines.

For boring locations, boring logs, test data, and soil parameter plots, see Appendix A.

Pile Capacity Determination

Analyses were performed to determine the estimated ultimate single pile load capacity in compression and tension for an open end 30-inch diameter steel pipe pile with wall thickness of 5/8-inch was estimated. The estimated capacity is presented on the design plate. The capacity was determined with and without a plug formation, and the most critical condition (vs. depth) was reported. Both Q-case and S-case was examined with groundwater table at the ground surface.

For reasons explained above, the curves presented assume the ground surface at EL -18.0. If ground surface elevations for each boring are determined via survey or other means, and elevations are found to be similar, the soil parameters and the curves can be adjusted accordingly. If elevations are found to not be similar, the soil parameters and the curves can be re-evaluated by the geotechnical engineer.

Soil-pile interface parameters such as adhesion and wall friction followed recommendations provided in EM 1110-2-2906. Other parameters used in the design, such as lateral earth coefficients for both compression and tension and bearing capacity factors can be found on the pile capacity curve design plate presented in Appendix B.

Due to the lack of proximate geotechnical data, recommended design factors of safety for allowable pile capacity are as follows:

	FS w/ Load test	FS w/o Load test
Q-case	2	3.5
S-case	1.5	2

The factors of safety shown with an accompanying load test assume a static load test. It is highly recommended that a static pile load test be performed at a location within the footprint of the proposed structure. If dynamic testing only is performed, the Q-case factor of safety should be adjusted to a value of 2.5, and the S-case factor of safety should be taken as 1.75.

The piles will derive a significant portion of their supporting capacity through skin friction and therefore it will be necessary to consider the effect of group action for piles placed in groups. In this regard, the supporting value of pile groups should be investigated on the basis of group perimeter shear by the formula shown in the figure titled “Capacity of Pile Groups” provided in the Appendix. For pile groups used in tension, the second term of the formula should be deleted when evaluating group effects. All groups should be evaluated for perimeter shear. The minimum center-to-center spacing within a pile group or row of piles should be determined in accordance with the pile spacing formula shown in the figure titled “Capacity of Pile Groups” provided in the Appendix B.

Pile load capacities shown on the design plate assume piles are installed vertically, but may be used to estimate horizontal load resistances for batter piles. The vertical component of the batter piles are equated to the load capacities for identical sized vertical piles driven to the same tip elevations. This relationship may be used to determine the axial capacities and horizontal components of the batter piles as shown in the figure titled “Axial and Horizontal Resistance of Batter Piles” provided in the Appendix B.

Temporary Retaining Structure Design

Using the design soil parameters developed for Colorado River – West – Reach 1, the temporary retaining system (TRS) was designed. The TRS consists of a braced sheet pile cofferdam structure. For feasibility level design purposes, the geometry of the structure was modeled after a similar project known as the Morganza to the Gulf - GIWW West Flood Gate. This project called for a TRS dredge elevation of EL -28 and 5 levels of bracing at elevations -3.0, -9.0, -14.0, -19.0, and finally a tremie slab acting as a brace at EL -27.0. The piezometric surface inside the cofferdam was placed three (3) feet below the dredge depth for design purposes, to model uplift control.

Only the Q-case soil parameters were used in the design. A factor of safety (FOS) of 1.3 was incorporated into the soil shear strengths for determination of the tip elevation and moment. A factor of safety (FOS) of 1.0 was used for determination of the brace loadings. The design was performed in stages. Given the number of braces, seven (7) stages were required.

The available boring data extended to approximately EL -52. The soil parameters for the stratum immediately above this elevation were assumed to continue below this elevation. This is likely a conservative assumption, as soil shear strengths tend to increase with increased depth. From the boring

data, the ground surface below the water surface was assumed to be at EL -18. It is recommended that project specific borings and testing be performed in later stages of the project.

The design water level was provided by CEMVN-EDH and was based on the record of non-tropical data collected from Jan 2002 through Aug 2018 (present) [reference USGS 08162506 Colorado Rv Bypass Channel nr Matagorda, TX gage data]. The data indicated that the maximum non-tropical water level is approximately at EL 2.5 NAVD88. Two (2) feet of freeboard was added to this elevation to give a design water surface elevation (DWSE) of 4.5 NAVD88.

Analyses for each stage as well as determined values for tip elevation, bending moment, and brace loadings are shown in Appendix C, with values to be used for design highlighted in the table. Taking into account the stratification and the results of the analyses, the recommended tip elevation for the sheet piles is EL -48.0 for this structure.

Based on the available boring data, the foundation at the structure location includes a sand layer slightly deeper than the dredge elevation. This sand layer may need specific dewatering, but the sheet pile will likely cut off much of the flow from this layer if there is any. Without more investigation (additional borings, piezometers, etc.) this would be difficult to determine. Therefore, based on the current available data, engineering judgment is that it is likely that specific dewatering requirements will be necessary for this site in addition to pumping within the TRS.

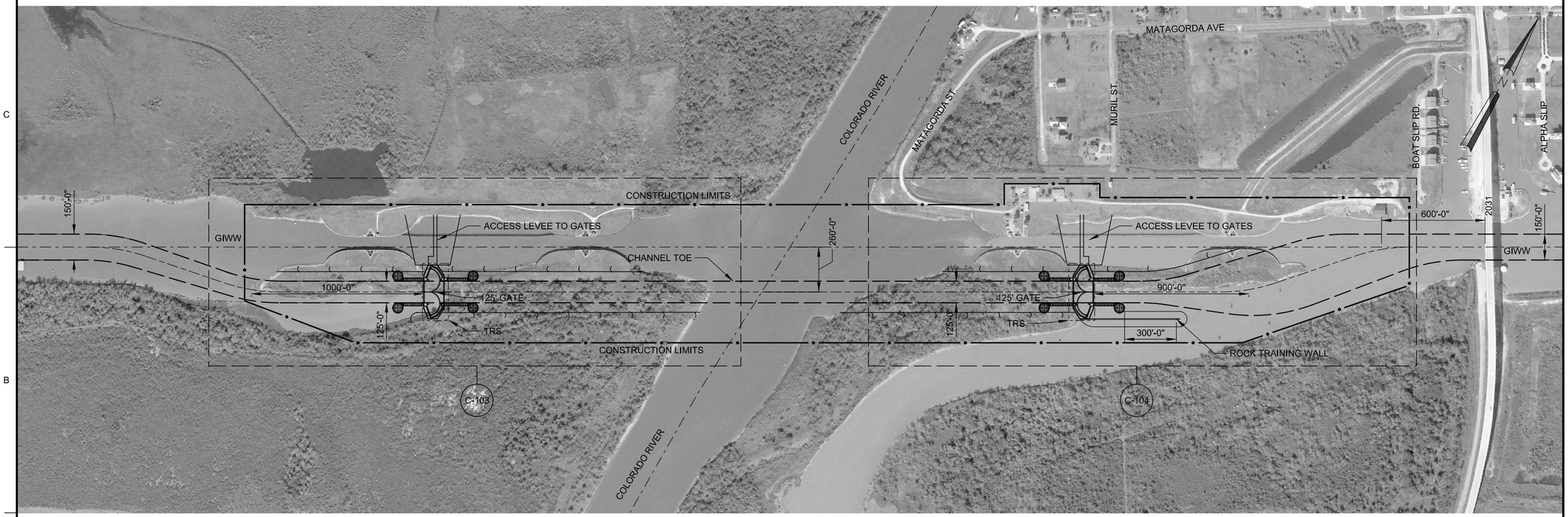
Sheet Pile Seepage Cutoff Design

Using the design soil parameters developed for Colorado River – West, the requirements for the sheet pile seepage cutoff below the base slab of the gate structure was determined. The design water levels provided were EL 10.0 on the Colorado River side of the gate and EL -2.0 on the GIWW side of the gate. The estimated tip elevation was determined using Lane's Weighted Creep Ratio method of analysis, and based on the soil parameters and stratification from the limited data and the water levels provided, the recommended tip elevation for the seepage cutoff is EL -50.5 for this structure. Analyses for determination of the seepage cutoff sheet pile are shown in Appendix D.

APPENDIX A

CONSTRUCTION SEQUENCE

1. PILE TEST
2. DREDGE ACCESS CHANNEL ON GIWW SIDE OF EACH STRUCTURE FOR CRANE ACCESS.
3. DRIVE PRODUCTION PILING FOR GATE STRUCTURE IN WET.
4. PLACE COFFERDAM
5. CONSTRUCT GATE STRUCTURE
6. REMOVE COFFERDAM
7. CONSTRUCT GUIDE WALLS AND END CELLS (SOME CONCURRENT WITH GATE CONSTRICTION)
8. CONSTRUCT ROCK TRAINING WALL
9. COMPLETE DREDGING OF NEW CHANNEL
10. TRANSFER NAVIGATION TO NEW STRUCTURE
11. COMPLETE DEMOLITION/BUILD ACCESS LEVEE



FINAL SITE PLAN

SCALE:1"=300'

0 300' 600'

US Army Corps of Engineers®
GALVESTON DISTRICT

MARK	DESCRIPTION	DATE	APPR.

MARK	DESCRIPTION	DATE	APPR.

U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
GALVESTON, TEXAS

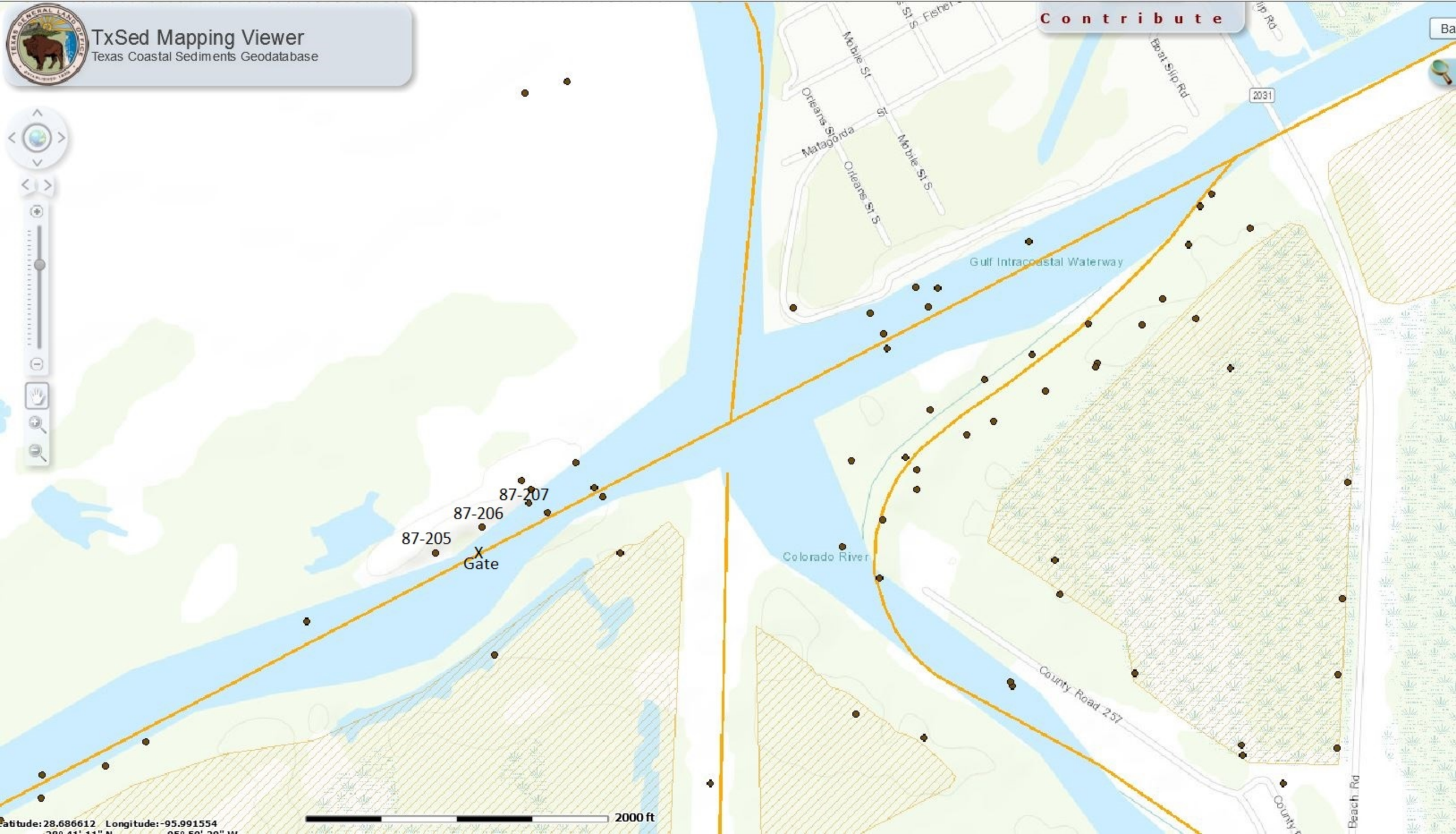
TETRA TECH
400 112TH AVE NE
SUITE 300 BELIEVE, WA 98004

DESIGNED BY: J.R./J.K.
DWN BY: D.S./ V.R.
CKD BY: D.L./G.K.
SUBMITTED BY: D LOVETT/G KOTZENBERGER
PLOT SCALE: 1:1
PLOT DATE: MM/DD/YYYY
SIZE: ANSI D
FILE NAME: C-102.dgn
DATE: DD-MON-YYYY
SOLICITATION NO.: N/A
CONTRACT NO.: N/A
FILE NUMBER: H-##-#####

GULF INTRACOASTAL WATERWAY
BRAZOS RIVER FLOODGATES AND COLORADO RIVER LOCKS SYSTEMS, FEASIBILITY STUDY
ENGINEERING APPENDIX DRAWINGS

COLORADO RIVER LOCK
FINAL SITE PLAN

SHEET IDENTIFICATION
C-102


TxSed Mapping Viewer
Texas Coastal Sediments Geodatabase
Contribute
Mobile St
Orleans St
Matagorda St
Mobile St S
Orleans St S
Boat Slip Rd
2031
Gulf Intracoastal Waterway
Colorado River
County Road 257
87-207
87-206
87-205
X
Gate
2000 ft
Latitude: 28.686612 Longitude: -95.991554

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-205

DATE 01-11-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

SHEAR STRENGTH, TSF: O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; Δ – TORVANE (0.5, 1.0, 1.5, 2.0, 2.5)

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	LIQUID LIMIT	PLASTIC LIMIT
0			Water					
5								
10								
15								
20			Soft Silt					
			Reddish Brown & Gray Silty Clay (CL)		44		35	17
25			Reddish Brown Clay w/Small Gravel (CH)		32			
					26			
			Reddish Brown Silty Clay w/ Shell (CL)		29	79	46	17
30			Reddish Brown Silty Sand w/ Clay Pockets and Layers (SM)		25			
					28	98		
35			Tan Sand		25			
			Reddish Brown Silty Clay (CL)		24	105	44	19
40			Reddish Brown Clay w/Clayey Sand Layers (CH)		25			
					29	101	50	21
45			Tan & Gray Clay w/Calcareous Nodules		38			
50			Greenish Gray & Tan Clay w/ Calcareous Nodules		30	96	81	36

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-205

DATE 01-11-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Greenish Gray & Tan Clay w/ Calcareous Nodules (CH)						
			Bottom @ 52'						
55									

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

SUMMARY OF LABORATORY TEST DATA

PROJECT: Brazos River Floodgates and Colorado River Locks

BORING NUMBER	DEPTH IN FEET	MOISTURE, %	DRY DENSITY, PCF	COMPRES-SION, TSF	STRAIN, %	TYPE FAILURE	LAT. PRESSURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE (NO. 200)	CONSOLI-DATION	TORVANE
87-205													
1C	22'-24'	43.5						35	17	18	72.8		0.1
2J	24'-26'	32.3											
3C	26'-28'	26.2											
4C	28'-30'	29.1	79.0	X				46	17	29	82.7		0.1
5C	30'-32'	25.4											
6C	32'-34'	28.2	98.3					25	16	9	49.9		
7J	34'-36'	24.9									46.6		
8C	38'-40'	24.4	105.0	1.53	8.67	Bulge		44	19	25	65.4		
9C	40'-42'	25.0											
10C	42'-44'	29.3	101.2	1.31	7.67	Bulge 45° S							
11J	44'-46'	31.6						50	21	29	96.1		
12C	46'-48'	37.6											
13C	48'-50'	30.0	96.0	2.72	4.00	45° S		81	36	45	92.1		
14C	50'-52'	39.9	85.8	0.63	9.33	Bulge							

AVILES ENGINEERING CORP. GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-206

DATE 01-12-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

SHEAR STRENGTH, TSF: O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; △ – TORVANE (0.5, 1.0, 1.5, 2.0, 2.5)

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	LIQUID LIMIT	PLASTIC LIMIT
0								
5			Water					
10								
15			Reddish Brown & Tan Sandy Clay w/Clay Pockets		28	95	23	15
20			w/Sandy Clay Layers (CL)		34			
			w/Silt Pockets		21	110	23	15
			Reddish Brown & Tan Sand (SP)	10	20			
25			Reddish Brown Silty Clay w/ Sand Layers (CL)		34			
					27	99	48	23
30			Reddish Brown Sand (SP)	51	24			
35								
			Reddish Brown Clay (CH)	54	25			
40					26	98		
			w/Sand Layers		29			
45			Greenish Gray Clay w/Small Shell and Calcareous Nodules		28		52	22
			w/Sandstone Nodules		28			
50			Tan & Gray Clay w/Calcareous Nodules		25	102	67	28

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-206

DATE 01-12-87 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; ✱ – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
0			Tan & Gray Silty Clay (CL)		23		O		
			Bottom at 52'						
5									
10									
15									
20									
25									
30									
35									
40									
45									
50									

Water Boring - West Morning Wall

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

SUMMARY OF LABORATORY TEST DATA

PROJECT: Brazos River Floodgates and Colorado River Locks

BORING NUMBER	DEPTH IN FEET	MOISTURE, %	DRY DENSITY, PCF	COMPRES-SION, TSF	STRAIN, %	TYPE FAILURE	LAT. PRESSURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE (NO. 200)	CONSOLI-DATION	TORVANE
87-206													
1C	17'-19'	28.4	94.5	0.44	3.33	Bulge		23	15	8	42.0		0.15
2J	19'-21'	33.5											
3C	21'-23'	21.0	110.2	0.49	3.67	Bulge		23	15	8	60.4		
4J	23'-25'	20.1									12.0		
5C	25'-27'	33.8											
6C	27'-29'	26.8	98.5	0.88	2.33	Vertical Split		48	23	25	54.2		
7J	31'-33'	23.7											
8J	38'-40'	24.8									69.0		
9C	40'-42'	26.4	98.2	1.18	3.00	45° S		52	22	30	98.4		
10C	42'-44'	29.2											
11C	44'-46'	27.9											
12C	46'-48'	28.4											
13C	48'-50'	25.0	101.6	1.25	3.00	45° S		67	28	39	95.8		
14C	50'-52'	23.3											

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-207

DATE 01-12-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
0									
5									
10			Water						
15									
20									
25			Dark Gray Clay - Organic (OH)		86				
30									
			Brownish Gray Clay w/Silt & Small Shell		92			82	36
35			Reddish Brown Clay w/Sand Layers (CH)		82				
40					31	95		60	25
			Reddish Brown & Gray Clay w/ Small Shell		31				
					28				
45			Greenish Gray Clay w/ Calcareous Nodules		28	100		75	32
			Reddish Brown Clay w/Silt Pockets		33	97			
50					23				

AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

PROJECT Brazos River Floodgates and Colorado River Locks, Gulf Intracoastal Waterway

BORING 87-207

DATE 01-12-88 TYPE 3" Core - Mayhew 200 LOCATION See Plan

DEPTH IN FEET	SYMBOL	CORES	DESCRIPTION	BLOWS / FOOT	M.C., %	U.D.W., PCF	SHEAR STRENGTH, TSF (O – POCKET PENETROMETER; X – LABORATORY CONFINED; ● – LABORATORY UNCONFINED; 0.5 1.0 1.5 2.0 2.5)	LIQUID LIMIT	PLASTIC LIMIT
50			Reddish Brown Clay w/Sand Pockets (CH)		34	90		57	26
55			Bottom at 53'						

Water Boring - West Mooring wall

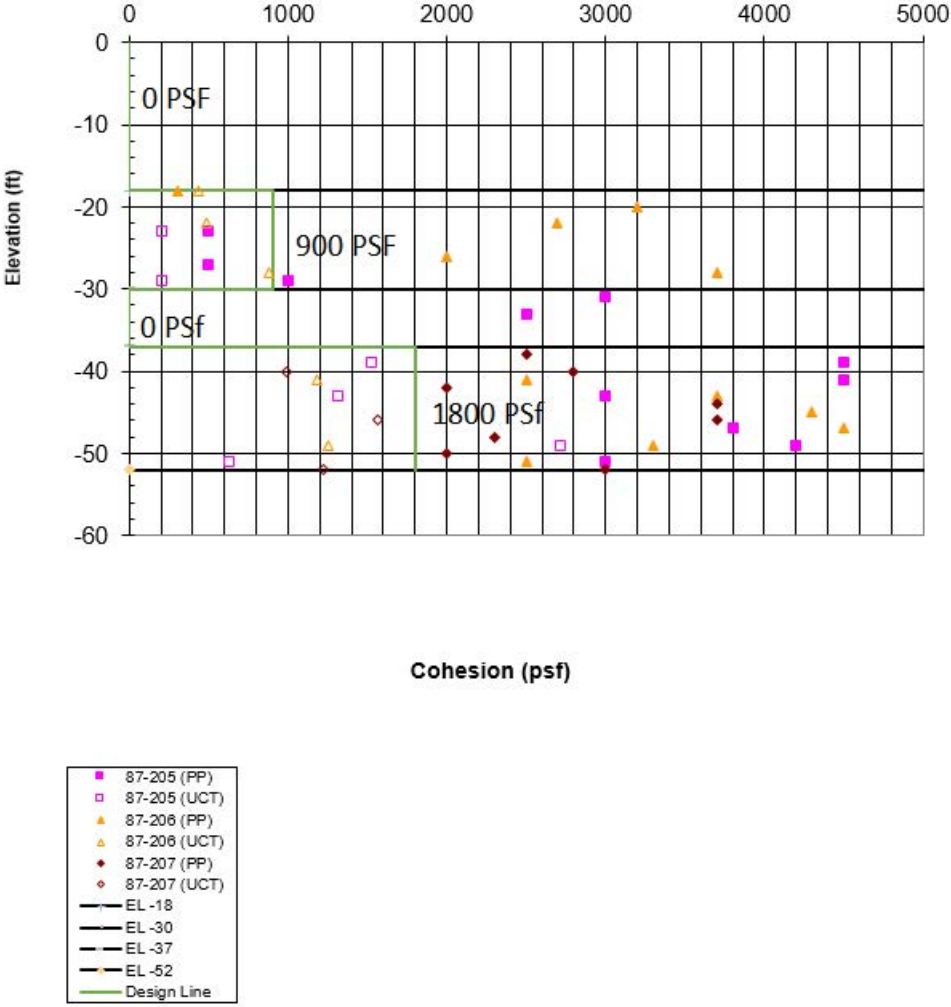
AVILES ENGINEERING CORP.
GEOTECHNICAL ENGINEERS

SUMMARY OF LABORATORY TEST DATA

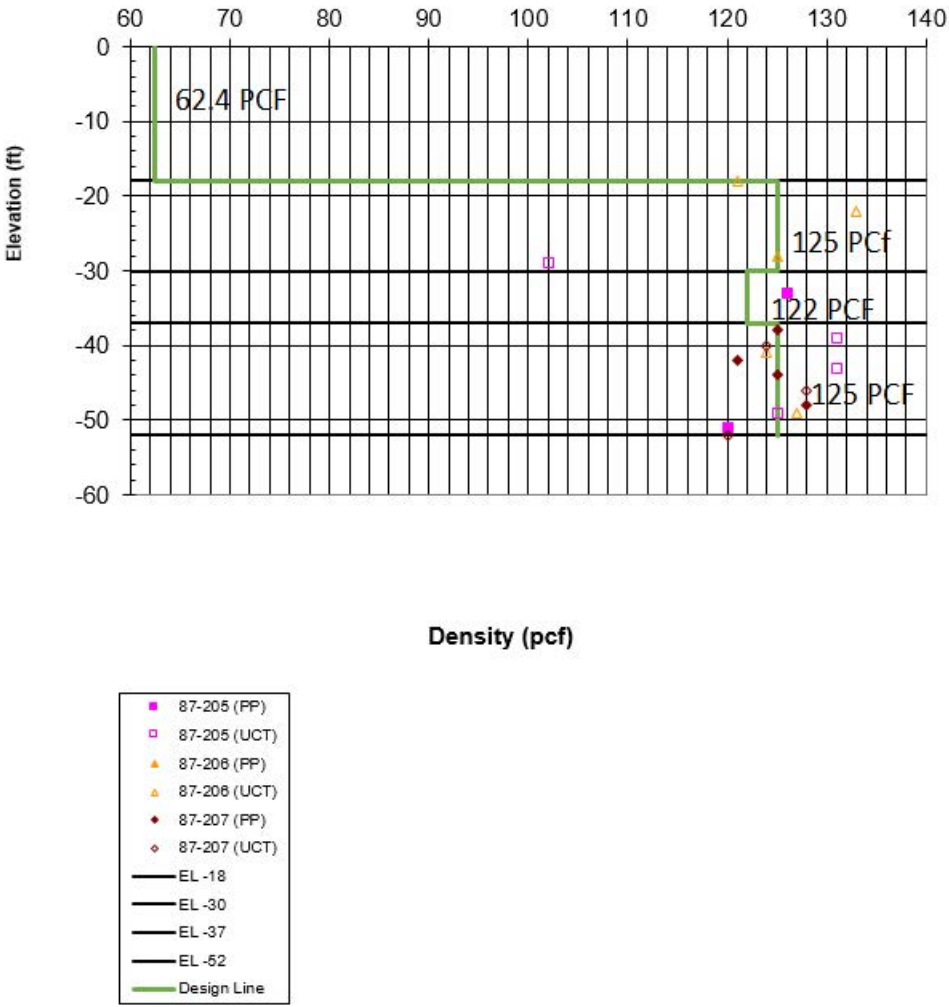
PROJECT: ~~Brazos River Floodgates and~~ Colorado River Locks

BORING NUMBER	DEPTH IN FEET	MOISTURE, %	DRY DENSITY, PCF	COMPRESSION, TSF	STRAIN, %	TYPE FAILURE	LAT. PRESSURE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SIEVE (NO. 200)	CONSOLIDATION	SWELL, %
87-207													
1C	27'-29'	85.9											
2J	33'-35'	91.6						82	36	46	80.7		
3C	35'-37'	81.9											
4C	37'-39'	28.8	97.2										
5C	39'-41'	30.6	94.6	0.99	4.00	Bulge		60	25	35	92.6		
6C	41'-43'	31.2	92.5										
7C	43'-45'	28.1	97.8										
8C	45'-47'	28.3	99.5	1.57	2.33	45° S		75	32	43	91.6		
9C	47'-49'	32.5	96.8										
10C	49'-51'	22.7											
11C	51'-53'	33.7	89.6	1.22	5.33	Bulge		57	26	31	96.0		

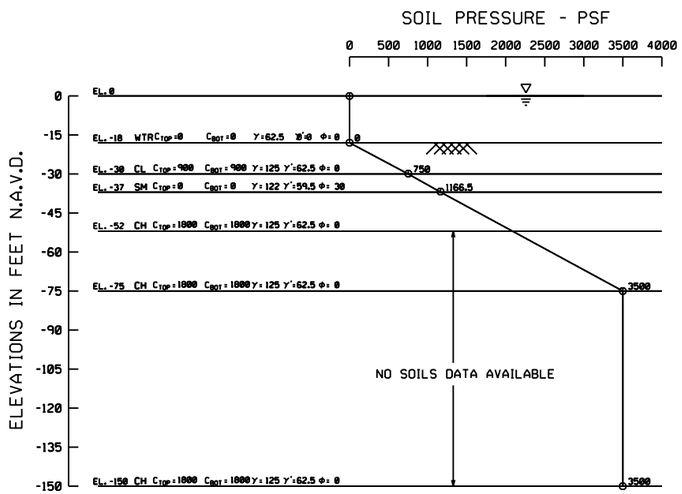
Reach 1 West of CRL Soil Parameters

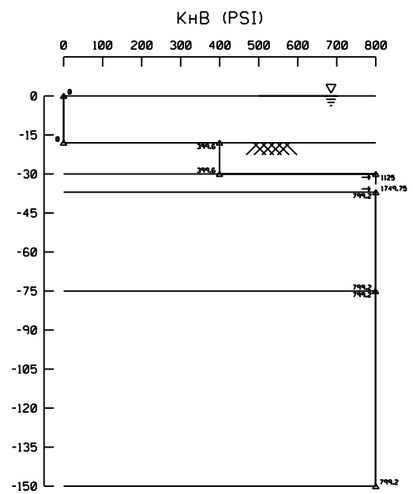


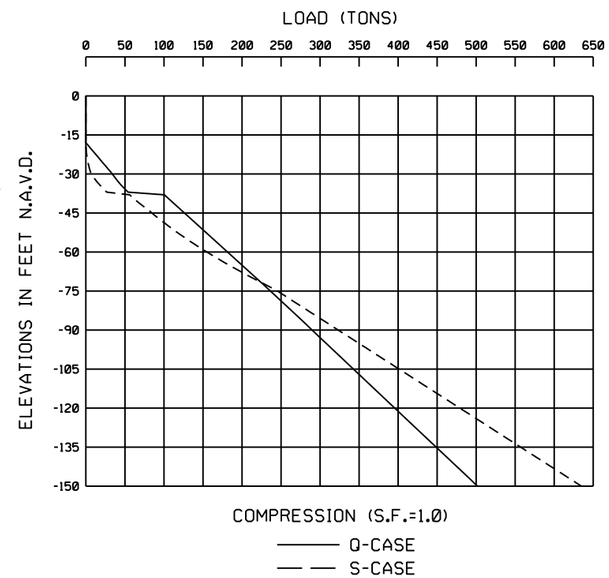
Reach 1 West of CRL Soil Parameters

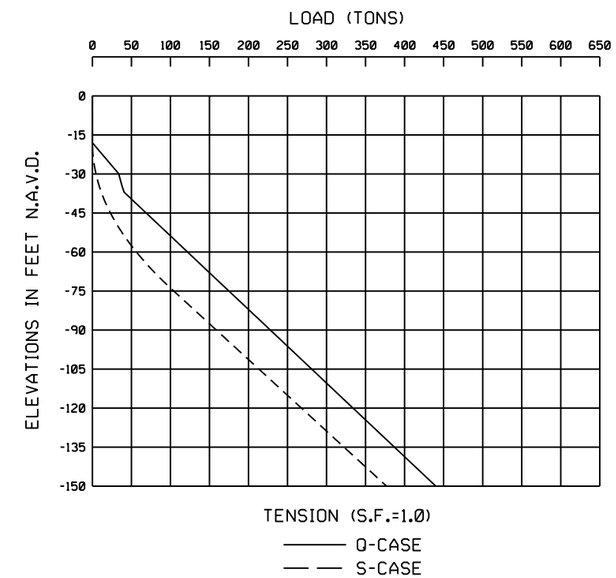


APPENDIX B









EL	SOIL TYPE	Q-CASE				S-CASE			
		Kc	Kt	Nc	Nq	Kc	Kt	Nc	Nq
-18	WTR	1	0	0	1	1	0	0	10
-30	CL	1	0.7	9	1	1	0.7	0	10
-37	SM	1.5	0.5	0	22.5	1.5	0.5	0	22.5
-150	CH	1	0.7	9	1	1	0.7	0	10

D	PILE SPACING IN DIRECTION OF LOADING
1.00	8B
.85	7B
.70	6B
.55	5B
.40	4B
.25	3B
C	LOADING CONDITION
1.00	INITIAL LOADING
0.30	CYCLIC LOADING

NOTES: KH = εK1/B=(0.2222qu/BXCXD) COHESIVE
ε = 0.4 = Factor of material properties of soil and pile
k1 = Modulus of subgrade reaction for test plate (pci)
B1 = Width or diameter of test plate (in)
K1 = k1B1 = 80qu(pcf) = 0.5556qu(psi)
qu = 2 c = Unconfined compressive strength (psf)
C = Reduction for cyclic loading-not applicable
D = Group effect reduction factor
B = Width of pile measured at right angles to the direction of displacement (in)
KH = (nhXZ/BXCXD) COHESIONLESS
nh = Coeficient of horizontal subgrade reaction (pci)
Z = Depth below equivalent ground surface (in)

THE FACTOR SHOWN, (MODULUS OF HORIZONTAL SUBGRADE Kh, TIMES THE PILE WIDTH IN INCHES (B), MEASURED AT RIGHT ANGLES TO THE DIRECTION OF DISPLACEMENT) MUST BE MODIFIED BY A REDUCTION FACTOR FOR THE EFFECT OF GROUP ACTION (D) AND A REDUCTION FACTOR FOR CYCLIC LOADING (C) EX: $K_h = \frac{0.2222qu(CXD)}{(B)}$

DUE TO THE LACK OF PROXIMATE GEOTECHNICAL DATA, THE FOLLOWING FACTORS OF SAFETY ARE RECOMMENDED FOR DESIGN:

	FS w / Load test	FS w /o Load test
Q-case	2	3.5
S-case	1.5	2

Brazos River Flood Gate and Colorado River Locks
West Colorado Flood Gate
Pile Capacity Curves
30"x5/8" Pipe Pile

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

DESIGNED BY: CRD
DRAWN BY: CRD
CHECKED BY: CWR
PLOT SCALE:
PLOT DATE:
DATE:
CADD FILE:
FILE NO.

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CAPACITY OF PILE GROUPS

The maximum allowable load carrying capacity of a pile group is no greater than the sum of the single pile load capacities, but may be limited to a lower value if so indicated by the result of the following formula.

$$Q_a = \frac{P \ x \ L \ x \ c}{(FSF)} + \frac{2.6 \ q_u \ (1 + 0.2 \ \frac{w}{b}) \ A}{(FSB)}$$

In Which:

Q_a	=	Allowable load carrying capacity of pile group, lb
P	=	Perimeter distance of pile group, ft
L	=	Length of pile, ft
c	=	Average (weighted) cohesion or shear strength of material between surface and depth of pile tip, psf
q_u	=	Average unconfined compressive strength of material in the zone immediately below pile tips, psf (unconfined compressive strength = cohesion x 2)
w	=	Width of base of pile group, ft
b	=	Length of base of pile group, ft
A	=	Base area of pile group, sq ft
(FSF)	=	Factor of safety for the friction area = 2
(FSB)	=	Factor of safety for the base area = 3

The values of c and q_u used in this formula should be based on applicable soil data shown on the Log of Boring and Test Results for this report. In the application of this formula, the weight of the piles, pile caps and mats, considering the effect of buoyancy, should be included.

SPACING WITHIN PILE GROUPS

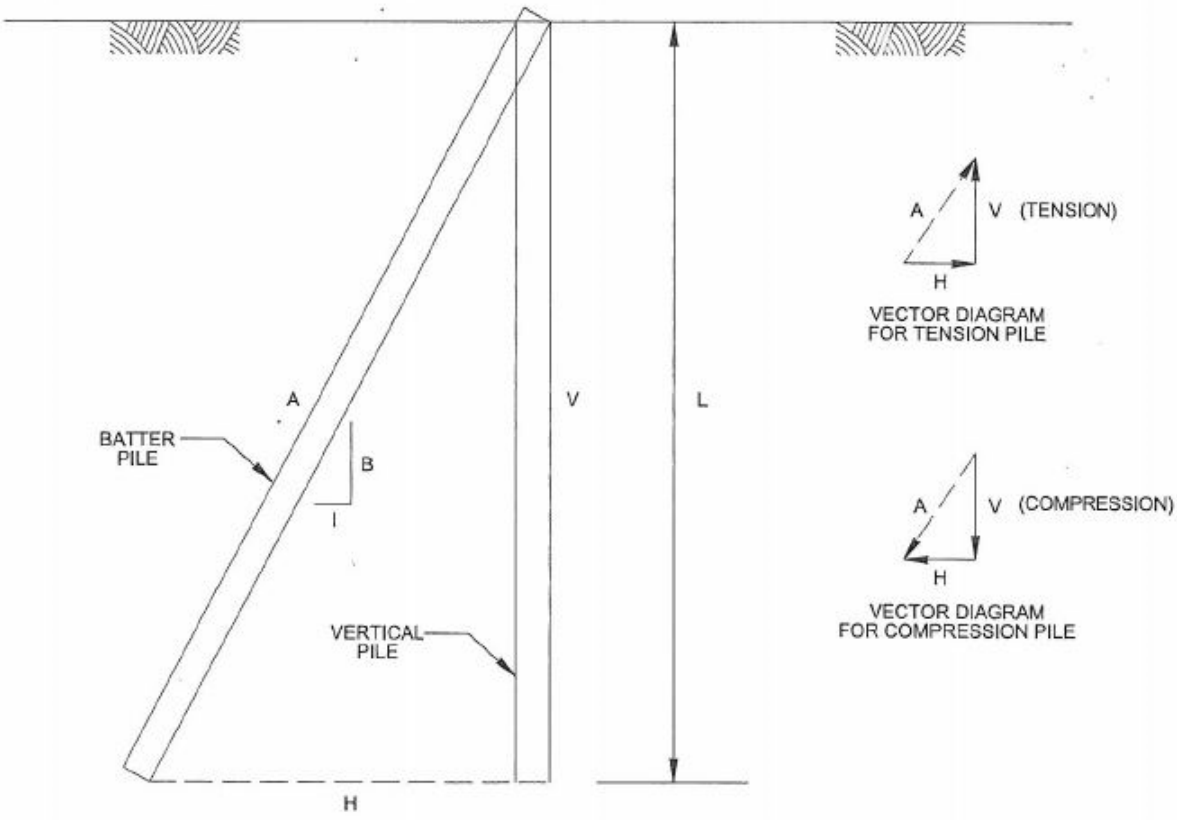
$$SPAC = 0.05 (L_1) + 0.025 (L_2) + 0.0125 (L_3)$$

In Which:

SPAC	=	Center to center of piles, feet
L_1	=	Pile penetration up to 100 feet
L_2	=	Pile penetration from 101 to 200 feet
L_3	=	Pile penetration beyond 200 feet

NOTE: Minimum pile spacing = 3 feet or 3 pile diameters, whichever is greater

AXIAL AND HORIZONTAL RESISTANCE OF BATTER PILES
ESTIMATED FROM ALLOWABLE VERTICAL LOAD CAPACITIES



L = VERTICAL COMPONENT OF BATTER PILE EMBEDMENT LENGTH.

V = ESTIMATED ALLOWABLE SINGLE LOAD CAPACITY OF A PILE DRIVEN VERTICALLY WITH EMBEDMENT LENGTH, L.

B = BATTER OF PILE EXPRESSED AS A RATIO OF VERTICAL DISTANCE TO ONE FOOT HORIZONTAL DISTANCE.

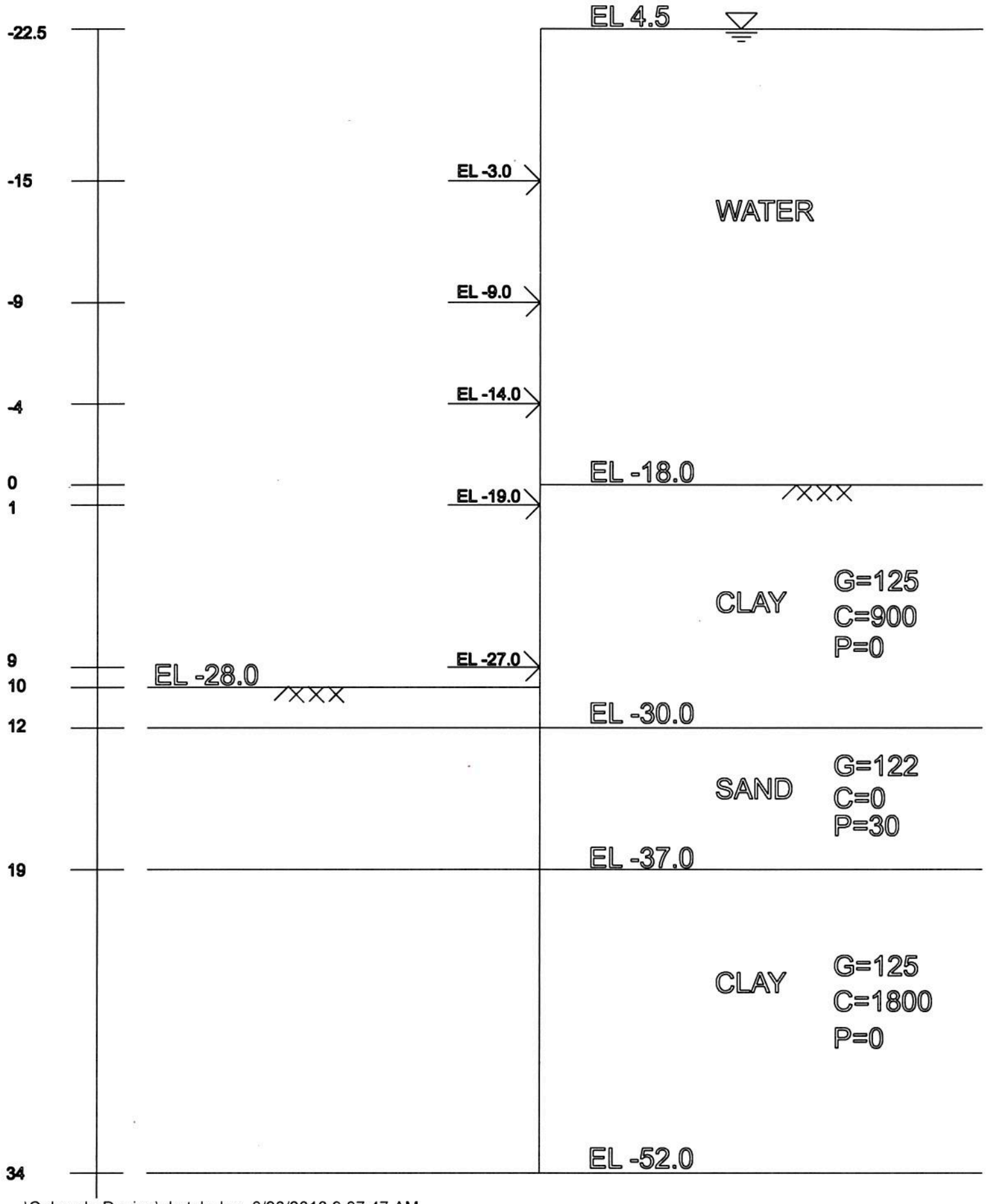
H = HORIZONTAL RESISTANCE OF BATTER PILE ESTIMATED AS FOLLOWS: $H = \frac{V}{B}$

A = ALLOWABLE AXIAL PILE LOAD CAPACITY OF A SINGLE BATTER PILE ESTIMATED AS FOLLOWS: $A = \sqrt{V^2(1+\frac{1}{B^2})}$

NOTE: THE AXIAL LOAD RESISTANCE OF A VERTICAL PILE, V, IS DEPENDENT ON THE TYPE OF LOADING - TENSION OR COMPRESSION. CAUTION SHOULD BE EXERCISED TO ENSURE THE CORRECT VERTICAL CAPACITY IS USED.

APPENDIX C

COLORADO RIVER - WEST



...\Colorado Design\sketch.dgn 8/20/2018 9:07:47 AM

Colorado River - West Side

	Stages				Design						
	Braces	Water	Ground	Tip EL (ft)	Moment (ft#/ft)	Brace @ EL -3 (#/ft)	Brace @ EL -9 (#/ft)	Brace @ EL -14 (#/ft)	Brace @ EL -19 (#/ft)	* Brace @ EL -27 (#/ft)	Software
Stage 1	None	@ EL 4.5 & EL -4	@ EL -18 & EL -19	-42.66	135270.0	NONE	NONE	NONE	NONE	NONE	CWALSHT
Stage 1	None	@ EL 4.5 & EL -4	@ EL -18 & EL -19	-37.23	126491.9	NONE	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 2	@ EL -3	@ EL 4.5 & EL -10	@ EL -18 & EL -19	-26.51	38157.0	8992.8	NONE	NONE	NONE	NONE	CWALSHT
Stage 2	@ EL -3	@ EL 4.5 & EL -10	@ EL -18 & EL -19	-26.34	33423.8	8631.6	NONE	NONE	NONE	NONE	SUPPORT IT
Stage 3	@ EL -3 & EL -9	@ EL 4.5 & EL -15	@ EL -18 & EL -19	-27.46	17913.5	3441.9	8516.7	NONE	NONE	NONE	SUPPORT IT
Stage 4	@ EL -3 & EL -9 & EL -14	@ EL 4.5 & EL -20	@ EL -18 & EL -20	-29.52	8961.9	3448.0	4530.6	7922.8	NONE	NONE	SUPPORT IT
Stage 5	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 4.5 & EL -28	@ EL -18 & EL -28	-47.32	101638.6	3434.9	4509.4	5711.0	20611.7	NONE	SUPPORT IT
Stage 6 *	@ EL -3 & EL -9 & EL -14 & EL -19	@ EL 4.5 & EL -31	@ EL -18 & EL -28	-47.32	95784.3	3435.0	4499.7	5711.0	19961.9	NONE	SUPPORT IT
Stage 7 *	@ EL -3 & EL -9 & EL -14 & EL -19 & EL -27	@ EL 4.5 & EL -31	@ EL -18 & EL -28	-42.6	12754.6	3436.0	4518.5	5730.7	9984.0	15721.6	SUPPORT IT

Indicates design value

FOS = 1.3 for Tip EL and Moment

FOS = 1.0 for Brace Loads

* Lowest brace is assumed to be a tremie slab

```
'Colorado River - West Braced Cofferdam Design
'Cantilever Condition - no braces
'Q-Case Soil Parameters
'Stage 1 - 1.3
CONTROL  CANTILEVER  DESIGN  1.30  1.30
WALL   4.5
SURFACE RIGHTSIDE   2    0   -18
                  200   -18
SURFACE LEFTSIDE   2    0   -18
                  200   -18
SOIL RIGHTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
WATER ELEVATIONS   62.5    4.5   -4
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-AUGUST-2018 TIME: 15:23:35

```
***************
*  INPUT DATA  *
***************

      I.--HEADING
     'Colorado River - West Braced Cofferdam Design
     'Cantilever Condition - no braces
     'Q-Case Soil Parameters
     'Stage 1 - 1.3

     II.--CONTROL
        CANTILEVER WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 4.50 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -18.00
               200.00        -18.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -18.00
               200.00        -18.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT
```

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
125.00	125.00	0.00	900.00	0.00	0.00	-30.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF

125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
125.00	125.00	0.00	900.00	0.00	0.00	-30.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -4.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 16-AUGUST-2018 TIME: 15:23:38

```
*************************
*   SOIL PRESSURES FOR   *
* CANTILEVER WALL DESIGN *
*************************
```

I.--HEADING
'Colorado River - West Braced Cofferdam Design

'Cantilever Condition - no braces
'Q-Case Soil Parameters
'Stage 1 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

				<------NET------>			
	NET	<---LEFTSIDE--->		(SOIL + WATER)		<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	PASSIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	437.5	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	500.0	0.0	0.0
-4.0	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-4.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-5.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-6.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-7.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-8.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-9.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-10.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-11.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-12.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-13.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-14.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-15.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-16.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-17.5	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-18.0+	531.3	0.0	0.0	531.3	531.3	0.0	0.0
-18.0-	531.3	1384.6	0.0	-853.4	1915.9	0.0	1384.6
-18.5	531.3	1415.9	0.0	-884.6	1947.1	0.0	1415.9
-19.0	531.3	1447.1	0.0	-915.9	1978.4	0.0	1447.1
-19.5	531.3	1478.4	0.0	-947.1	2009.6	0.0	1478.4
-20.5	531.3	1540.9	0.0	-1009.6	2072.1	0.0	1540.9
-21.5	531.3	1603.4	0.0	-1072.1	2134.6	0.0	1603.4
-22.5	531.3	1665.9	0.0	-1134.6	2197.1	0.0	1665.9
-23.5	531.3	1728.4	0.0	-1197.1	2259.6	0.0	1728.4
-24.5	531.3	1790.9	0.0	-1259.6	2322.1	0.0	1790.9

-25.5	531.3	1853.4	0.0	-1322.1	2384.6	0.0	1853.4
-26.5	531.3	1915.9	0.0	-1384.6	2447.1	0.0	1915.9
-27.5	531.3	1978.4	0.0	-1447.1	2509.6	0.0	1978.4
-28.5	531.3	2040.9	0.0	-1509.6	2572.1	0.0	2040.9
-29.5	531.3	2103.4	0.0	-1572.1	2634.6	0.0	2103.4
-30.0	531.3	2053.0	0.0	-1521.8	2584.3	0.0	2053.0
-30.5	531.3	2008.2	0.0	-1477.0	2539.5	0.0	2008.2
-31.5	531.3	2120.1	0.0	-1588.9	2651.4	0.0	2120.1
-32.5	531.3	2238.1	0.0	-1706.9	2769.4	0.0	2238.1
-33.5	531.3	2359.0	0.0	-1827.7	2890.2	0.0	2359.0
-34.5	531.3	2500.8	0.0	-1969.5	3032.0	0.0	2500.8
-35.5	531.3	2623.4	0.0	-2092.2	3154.7	0.0	2623.4
-36.5	531.3	2748.7	0.0	-2217.5	3280.0	0.0	2748.7
-37.0	531.3	3399.0	0.0	-2867.7	3930.2	0.0	3399.0
-37.5	531.3	4028.8	0.0	-3497.6	4560.1	0.0	4028.8
-38.5	531.3	4088.1	0.0	-3556.8	4619.3	0.0	4088.1
-39.5	531.3	4133.3	0.0	-3602.0	4664.5	0.0	4133.3
-40.5	531.3	4181.7	0.0	-3650.4	4712.9	0.0	4181.7
-41.5	531.3	4244.2	0.0	-3712.9	4775.4	0.0	4244.2
-42.5	531.3	4306.7	0.0	-3775.4	4837.9	0.0	4306.7
-43.5	531.3	4369.2	0.0	-3837.9	4900.4	0.0	4369.2
-44.5	531.3	4431.7	0.0	-3900.4	4962.9	0.0	4431.7
-45.5	531.3	4494.2	0.0	-3962.9	5025.4	0.0	4494.2
-46.5	531.3	4556.7	0.0	-4025.4	5087.9	0.0	4556.7
-47.5	531.3	4619.2	0.0	-4087.9	5150.4	0.0	4619.2
-48.5	531.3	4681.7	0.0	-4150.4	5212.9	0.0	4681.7
-49.5	531.3	4742.1	0.0	-4210.8	5273.3	0.0	4742.1
-50.5	531.3	4794.4	0.0	-4263.1	5325.6	0.0	4794.4
-51.5	531.3	4848.7	0.0	-4317.5	5380.0	0.0	4848.7
-52.0	531.3	4880.0	0.0	-4348.7	5411.2	0.0	4880.0
-52.5	531.3	4911.2	0.0	-4380.0	5442.5	0.0	4911.2
-53.5	531.3	4973.7	0.0	-4442.5	5505.0	0.0	4973.7
-54.5	531.3	5036.2	0.0	-4505.0	5567.5	0.0	5036.2
-55.5	531.3	5098.7	0.0	-4567.5	5630.0	0.0	5098.7
-56.5	531.3	5161.2	0.0	-4630.0	5692.5	0.0	5161.2
-57.5	531.3	5223.7	0.0	-4692.5	5755.0	0.0	5223.7
-58.5	531.3	5286.2	0.0	-4755.0	5817.5	0.0	5286.2
-59.5	531.3	5348.7	0.0	-4817.5	5880.0	0.0	5348.7
-60.5	531.3	5411.2	0.0	-4880.0	5942.5	0.0	5411.2
-61.5	531.3	5473.7	0.0	-4942.5	6005.0	0.0	5473.7
-62.5	531.3	5536.2	0.0	-5005.0	6067.5	0.0	5536.2
-63.5	531.3	5598.7	0.0	-5067.5	6130.0	0.0	5598.7
-64.5	531.3	5661.2	0.0	-5130.0	6192.5	0.0	5661.2
-65.5	531.3	5723.7	0.0	-5192.5	6255.0	0.0	5723.7
-66.5	531.3	5786.2	0.0	-5255.0	6317.5	0.0	5786.2
-67.5	531.3	5848.7	0.0	-5317.5	6380.0	0.0	5848.7
-68.5	531.3	5911.2	0.0	-5380.0	6442.5	0.0	5911.2
-69.5	531.3	5973.7	0.0	-5442.5	6505.0	0.0	5973.7

-70.5	531.3	6036.2	0.0	-5505.0	6567.5	0.0	6036.2
-71.5	531.3	6098.7	0.0	-5567.5	6630.0	0.0	6098.7
-72.5	531.3	6161.2	0.0	-5630.0	6692.5	0.0	6161.2
-73.5	531.3	6223.7	0.0	-5692.5	6755.0	0.0	6223.7
-74.5	531.3	6286.2	0.0	-5755.0	6817.5	0.0	6286.2
-75.5	531.3	6348.7	0.0	-5817.5	6880.0	0.0	6348.7
-76.5	531.3	6411.2	0.0	-5880.0	6942.5	0.0	6411.2
-77.5	531.3	6473.7	0.0	-5942.5	7005.0	0.0	6473.7
-78.5	531.3	6536.2	0.0	-6005.0	7067.5	0.0	6536.2
-79.5	531.3	6598.7	0.0	-6067.5	7130.0	0.0	6598.7
-80.5	531.3	6661.2	0.0	-6130.0	7192.5	0.0	6661.2
-81.5	531.3	6723.7	0.0	-6192.5	7255.0	0.0	6723.7
-82.5	531.3	6786.2	0.0	-6255.0	7317.5	0.0	6786.2
-83.5	531.3	6848.7	0.0	-6317.5	7380.0	0.0	6848.7
-84.5	531.3	6911.2	0.0	-6380.0	7442.5	0.0	6911.2
-85.5	531.3	6973.7	0.0	-6442.5	7505.0	0.0	6973.7
-86.5	531.3	7036.2	0.0	-6505.0	7567.5	0.0	7036.2

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-AUGUST-2018 TIME: 15:23:39

```
****************************
*  SUMMARY OF RESULTS FOR  *
*  CANTILEVER WALL DESIGN  *
****************************
```

I.--HEADING
'Colorado River - West Braced Cofferdam Design
'Cantilever Condition - no braces
'Q-Case Soil Parameters
'Stage 1 - 1.3

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

```
WALL BOTTOM ELEV. (FT)     :      -42.66
      PENETRATION (FT)     :       24.66

MAX. BEND. MOMENT (LB-FT)  :  1.3527E+05
      AT ELEVATION (FT)    :      -26.63

MAX. SCALED DEFL. (LB-IN^3):  1.4309E+11
      AT ELEVATION (FT)    :        4.50

          NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                 ELLASTICITY IN PSI TIMES PILE MOMENT
                 OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                 IN INCHES.
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-AUGUST-2018 TIME: 15:23:39

```
****************************
* COMPLETE OF RESULTS FOR  *
*  CANTILEVER WALL DESIGN  *
****************************
```

I.--HEADING
'Colorado River - West Braced Cofferdam Design
'Cantilever Condition - no braces
'Q-Case Soil Parameters
'Stage 1 - 1.3

II.--RESULTS

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	1.4309E+11	0.00
3.50	1.0417E+01	31.	1.3819E+11	62.50
2.50	8.3333E+01	125.	1.3330E+11	125.00
1.50	2.8125E+02	281.	1.2840E+11	187.50
0.50	6.6667E+02	500.	1.2351E+11	250.00
-0.50	1.3021E+03	781.	1.1861E+11	312.50
-1.50	2.2500E+03	1125.	1.1372E+11	375.00
-2.50	3.5729E+03	1531.	1.0884E+11	437.50
-3.50	5.3333E+03	2000.	1.0396E+11	500.00
-4.00	6.3971E+03	2258.	1.0152E+11	531.25

-4.50	7.5924E+03	2523.	9.9083E+10	531.25
-5.50	1.0382E+04	3055.	9.4225E+10	531.25
-6.50	1.3702E+04	3586.	8.9384E+10	531.25
-7.50	1.7553E+04	4117.	8.4567E+10	531.25
-8.50	2.1936E+04	4648.	7.9781E+10	531.25
-9.50	2.6850E+04	5180.	7.5032E+10	531.25
-10.50	3.2296E+04	5711.	7.0330E+10	531.25
-11.50	3.8272E+04	6242.	6.5684E+10	531.25
-12.50	4.4780E+04	6773.	6.1104E+10	531.25
-13.50	5.1819E+04	7305.	5.6602E+10	531.25
-14.50	5.9389E+04	7836.	5.2189E+10	531.25
-15.50	6.7491E+04	8367.	4.7879E+10	531.25
-16.50	7.6124E+04	8898.	4.3685E+10	531.25
-17.50	8.5288E+04	9430.	3.9624E+10	531.25
-18.00+	9.0069E+04	9695.	3.7647E+10	531.25
-18.00-	9.0069E+04	9695.	3.7647E+10	-853.37
-18.50	9.4809E+04	9261.	3.5709E+10	-884.62
-19.00	9.9327E+04	8811.	3.3813E+10	-915.87
-19.50	1.0362E+05	8345.	3.1959E+10	-947.12
-20.50	1.1148E+05	7367.	2.8387E+10	-1009.62
-21.50	1.1833E+05	6326.	2.5008E+10	-1072.12
-22.50	1.2411E+05	5222.	2.1833E+10	-1134.62
-23.50	1.2875E+05	4056.	1.8872E+10	-1197.12
-24.50	1.3220E+05	2828.	1.6134E+10	-1259.62
-25.50	1.3439E+05	1537.	1.3624E+10	-1322.12
-26.50	1.3525E+05	184.	1.1346E+10	-1384.62
-27.50	1.3474E+05	-1232.	9.3013E+09	-1447.12
-28.50	1.3277E+05	-2710.	7.4894E+09	-1509.62
-29.50	1.2929E+05	-4251.	5.9067E+09	-1572.12
-30.00	1.2697E+05	-5025.	5.1996E+09	-1521.77
-30.50	1.2427E+05	-5774.	4.5472E+09	-1476.96
-31.50	1.1774E+05	-7307.	3.4023E+09	-1588.88
-32.50	1.0962E+05	-8955.	2.4605E+09	-1706.87
-33.50	9.9792E+04	-10722.	1.7080E+09	-1827.74
-34.28	9.0842E+04	-12194.	1.2407E+09	-1938.55
-34.50	8.8133E+04	-12598.	1.1276E+09	-1761.69
-35.50	7.4789E+04	-13955.	6.9930E+08	-952.02
-36.50	6.0493E+04	-14502.	4.0007E+08	-142.34
-37.00	5.3241E+04	-14472.	2.9121E+08	262.49
-37.50	4.6054E+04	-14240.	2.0535E+08	667.33
-38.50	3.2283E+04	-13168.	9.0314E+07	1477.01
-39.50	1.9988E+04	-11286.	3.1271E+07	2286.68
-40.50	9.9808E+03	-8594.	7.0965E+06	3096.36
-41.50	3.0695E+03	-5093.	6.1505E+05	3906.03
-42.50	6.4290E+01	-782.	2.4870E+02	4715.71
-42.66	0.0000E+00	0.	0.0000E+00	4848.17

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF

ELLASTICITY IN PSI TIMES PILE MOMENT
OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.00	531.	0.	0.	0.	0.
-4.50	531.	0.	0.	0.	0.
-5.50	531.	0.	0.	0.	0.
-6.50	531.	0.	0.	0.	0.
-7.50	531.	0.	0.	0.	0.
-8.50	531.	0.	0.	0.	0.
-9.50	531.	0.	0.	0.	0.
-10.50	531.	0.	0.	0.	0.
-11.50	531.	0.	0.	0.	0.
-12.50	531.	0.	0.	0.	0.
-13.50	531.	0.	0.	0.	0.
-14.50	531.	0.	0.	0.	0.
-15.50	531.	0.	0.	0.	0.
-16.50	531.	0.	0.	0.	0.
-17.50	531.	0.	0.	0.	0.
-18.00+	531.	0.	0.	0.	0.
-18.00-	531.	1385.	0.	0.	1385.
-18.50	531.	1416.	0.	0.	1416.
-19.00	531.	1447.	0.	0.	1447.
-19.50	531.	1478.	0.	0.	1478.
-20.50	531.	1541.	0.	0.	1541.
-21.50	531.	1603.	0.	0.	1603.
-22.50	531.	1666.	0.	0.	1666.
-23.50	531.	1728.	0.	0.	1728.
-24.50	531.	1791.	0.	0.	1791.
-25.50	531.	1853.	0.	0.	1853.
-26.50	531.	1916.	0.	0.	1916.
-27.50	531.	1978.	0.	0.	1978.
-28.50	531.	2041.	0.	0.	2041.

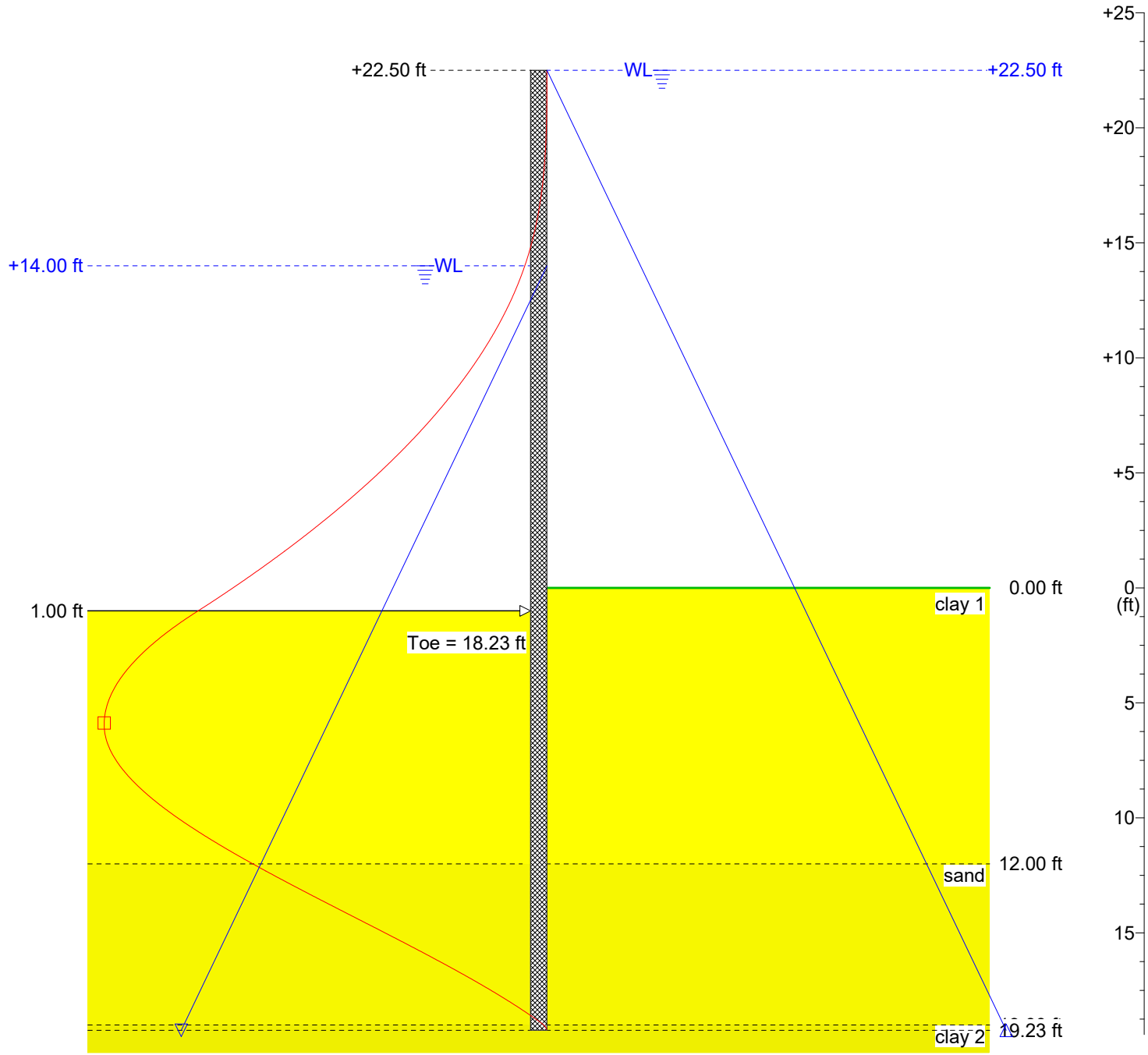
-29.50	531.	2103.	0.	0.	2103.
-30.00	531.	2053.	0.	0.	2053.
-30.50	531.	2008.	0.	0.	2008.
-31.50	531.	2120.	0.	0.	2120.
-32.50	531.	2238.	0.	0.	2238.
-33.50	531.	2359.	0.	0.	2359.
-34.28	531.	2470.	0.	0.	2470.
-34.50	531.	2501.	0.	0.	2501.
-35.50	531.	2623.	0.	0.	2623.
-36.50	531.	2749.	0.	0.	2749.
-37.00	531.	3399.	0.	0.	3399.
-37.50	531.	4029.	0.	0.	4029.
-38.50	531.	4088.	0.	0.	4088.
-39.50	531.	4133.	0.	0.	4133.
-40.50	531.	4182.	0.	0.	4182.
-41.50	531.	4244.	0.	0.	4244.
-42.50	531.	4307.	0.	0.	4307.
-42.66	531.	4369.	0.	0.	4369.
-44.50	531.	4432.	0.	0.	4432.

Title: Colorado River Flood Gate - West Side
Designer: Stage 1
Ref: 1.3
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
126491.9 ftlb/ft	5.88
2608.3 psf	19.23
2077.1 psf	19.23

Stage 1 - Tip and Moment only



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Title: Colorado River Flood Gate - West Side
Designer: Stage 1
Ref: 1.3
Page: 2
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Stage 1 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = +14.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	18.23	41.73

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Maxima

	Maximum	Depth (ft)
Pressure	678.8 psf	1.00
Bending Moment	126491.9 ftlb/ft	5.88
Shear Force	10307.7 lb/ft	1.01

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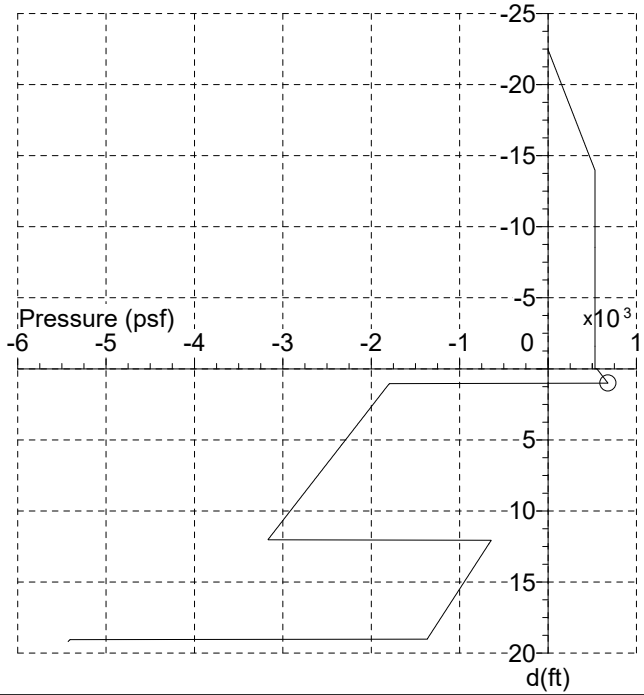
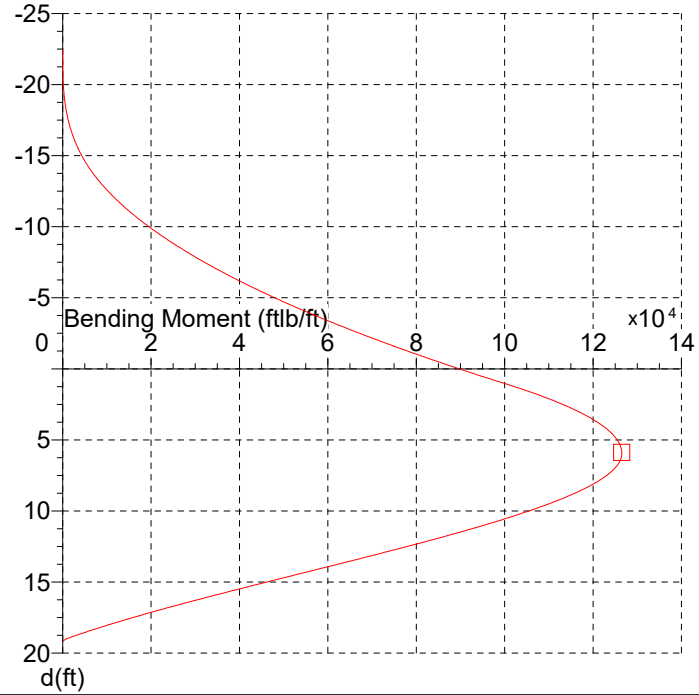
Title: Colorado River Flood Gate - West Side
Designer: Stage 1
Ref: 1.3
Page: 3
Date: 8.20.18

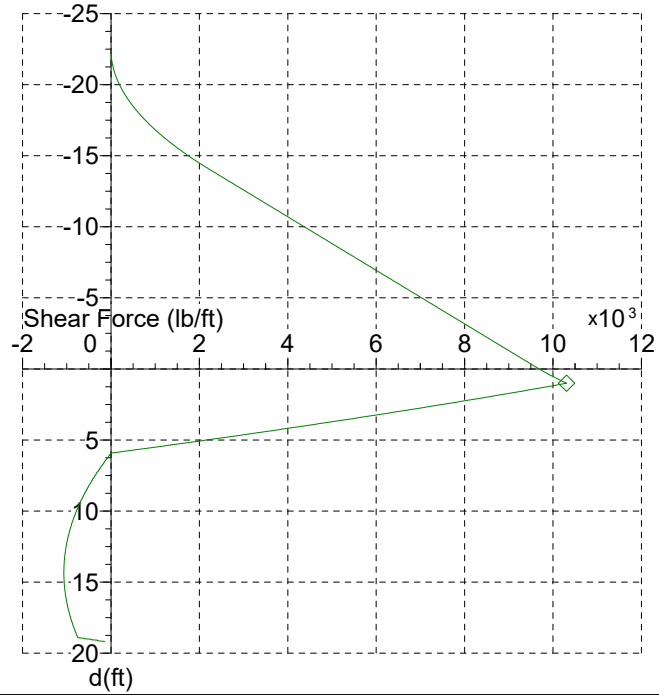
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Maximum	d (ft)
○ 678.8 psf	1.00
□ 126491.9 ftlb/ft	5.88
◇ 10307.7 lb/ft	1.01

Stage 1 - Tip and Moment only







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Title: Colorado River Flood Gate - West Side
Designer: Stage 1
Ref: 1.3
Page: 4
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

Stage 1 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	552.7	89705.5		9684.5	6.46	-2474.9	126098.0		-127.1	12.91	-733.8	72554.5		-1034.4
0.14	570.1	91056.3		9762.9	6.59	-2492.3	125858.8		-157.5	13.05	-748.2	70810.9		-1042.1
0.27	587.5	92418.1		9843.7	6.73	-2509.7	125568.9		-187.5	13.19	-762.7	69058.0		-1046.7
0.41	604.8	93791.3		9926.9	6.87	-2527.0	125222.9		-231.5	13.33	-777.2	67297.6		-1050.7
0.55	622.2	95176.2		10012.6	7.01	-2544.4	124821.7		-260.3	13.46	-791.7	65529.8		-1054.3
0.69	639.6	96573.1		10100.7	7.14	-2561.8	124372.5		-288.5	13.60	-806.1	63755.8		-1057.3
0.82	657.0	97982.4		10191.1	7.28	-2579.2	123870.4		-316.2	13.74	-817.0	62422.3		-1059.9
0.96	674.4	99404.4		10284.1	7.42	-2596.6	123316.2		-343.4	13.88	-831.5	60640.5		-1061.9
1.10	-1805.5	100830.4		10120.2	7.56	-2614.0	122716.8		-370.1	14.01	-845.9	58855.0		-1063.5
1.24	-1822.9	102224.6		9868.1	7.69	-2631.4	122072.9		-409.2	14.15	-860.4	57067.2		-1064.5
1.37	-1840.3	103583.7		9613.6	7.83	-2648.8	121374.7		-434.6	14.29	-874.9	55278.2		-1065.0
1.51	-1857.7	104907.2		9356.7	7.97	-2666.1	120633.9		-459.6	14.43	-889.3	53488.7		-1064.9
1.65	-1875.0	106194.8		9097.4	8.11	-2683.5	119851.4		-484.0	14.56	-903.8	51699.7		-1064.1
1.79	-1892.4	107446.3		8835.7	8.24	-2696.6	119231.3		-507.9	14.70	-918.3	49912.2		-1062.9
1.92	-1909.8	108661.2		8571.5	8.38	-2714.0	118368.0		-531.4	14.84	-932.8	48127.4		-1061.2
2.06	-1927.2	109839.3		8304.9	8.52	-2731.3	117465.5		-554.3	14.97	-947.2	46346.2		-1058.9
2.20	-1944.6	110980.2		8035.9	8.66	-2748.7	116520.0		-576.7	15.11	-961.7	44569.2		-1056.2
2.34	-1962.0	112083.5		7764.5	8.79	-2766.1	115532.5		-598.6	15.25	-976.2	42797.3		-1051.1
2.47	-1979.4	113149.0		7490.6	8.93	-2783.5	114508.6		-620.1	15.39	-990.7	41032.8		-1047.1
2.61	-1996.7	114176.3		7214.4	9.07	-2800.9	113449.2		-651.2	15.52	-1005.1	39275.2		-1042.6
2.75	-2009.8	114921.5		7005.6	9.20	-2818.3	112346.4		-671.4	15.66	-1019.6	37525.4		-1037.6
2.89	-2027.2	115881.1		6725.1	9.34	-2835.7	111210.0		-691.1	15.80	-1034.1	35786.6		-1032.1
3.02	-2044.6	116801.5		6442.2	9.48	-2853.1	110036.8		-710.2	15.94	-1048.5	34057.4		-1026.1
3.16	-2061.9	117682.5		6156.9	9.62	-2870.4	108827.8		-728.9	16.07	-1063.0	32338.7		-1016.1
3.30	-2076.3	118523.7		5869.1	9.75	-2887.8	107587.8		-747.0	16.21	-1077.5	30634.4		-1008.9
3.43	-2096.7	119324.8		5579.1	9.89	-2905.2	106317.8		-773.3	16.35	-1092.0	28942.5		-1001.1
3.57	-2114.1	120085.4		5286.5	10.03	-2922.6	105011.4		-790.2	16.49	-1102.8	27682.7		-997.0
3.71	-2131.5	120805.2		4991.5	10.17	-2940.0	103676.8		-806.6	16.62	-1117.3	26016.4		-984.0
3.85	-2148.9	121483.8		4694.1	10.30	-2957.4	102314.9		-822.4	16.76	-1131.8	24366.9		-974.8
3.98	-2166.3	122121.0		4394.2	10.44	-2974.8	100920.1		-837.8	16.90	-1146.2	22733.2		-965.0
4.12	-2183.7	122716.3		4092.0	10.58	-2992.2	99499.9		-852.7	17.04	-1160.7	21118.3		-954.7
4.26	-2201.0	123269.5		3787.3	10.72	-3009.5	98055.0		-867.1	17.17	-1175.2	19523.3		-943.9
4.40	-2218.4	123780.1		3480.2	10.85	-3026.9	96583.6		-887.7	17.31	-1189.6	17946.8		-932.6
4.53	-2235.8	124248.0		3170.7	10.99	-3040.0	95462.2		-894.3	17.45	-1204.1	16389.8		-914.7
4.67	-2253.2	124672.6		2858.7	11.13	-3057.4	93948.8		-907.2	17.58	-1218.6	14858.1		-902.1
4.81	-2270.6	125053.8		2544.4	11.27	-3074.7	92414.2		-925.5	17.72	-1233.1	13347.8		-889.1
4.95	-2288.0	125391.1		2227.6	11.40	-3092.1	90854.2		-937.1	17.86	-1247.5	11859.6		-875.5
5.08	-2305.4	125684.3		1908.4	11.54	-3109.5	89275.0		-948.2	18.00	-1262.0	10400.4		-861.4
5.22	-2322.8	125932.9		1586.8	11.68	-3126.9	87677.3		-958.8	18.13	-1276.5	8965.2		-846.9
5.36	-2340.1	126136.7		1262.8	11.81	-3144.3	86057.8		-968.9	18.27	-1291.0	7554.8		-831.8
5.50	-2353.2	126259.9		1018.2	11.95	-3161.7	84421.8		-978.5	18.41	-1305.4	6173.6		-808.2
5.63	-2370.6	126384.4		689.9	12.09	-643.3	82770.1		-987.6	18.55	-1319.9	4822.4		-791.9
5.77	-2388.0	126463.1		359.2	12.23	-661.4	81101.7		-1000.3	18.68	-1334.4	3498.8		-775.1
5.91	-2405.3	126489.4		0.0	12.36	-675.9	79417.7		-1008.1	18.82	-1348.8	2207.4		-757.7
6.04	-2422.7	126475.7		-32.6	12.50	-690.4	77720.8		-1015.4	18.96	-1363.3	1008.1		-599.5
6.18	-2440.1	126407.3		-64.6	12.64	-704.8	76010.4		-1022.2	19.10	-5420.5	252.2		-300.1
6.32	-2457.5	126285.5		-96.1	12.78	-719.3	74287.5		-1028.5	19.23	-5429.2	63.1		-150.1

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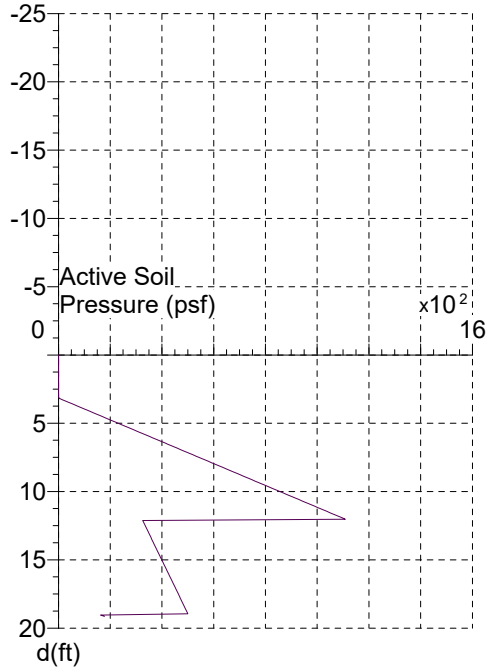
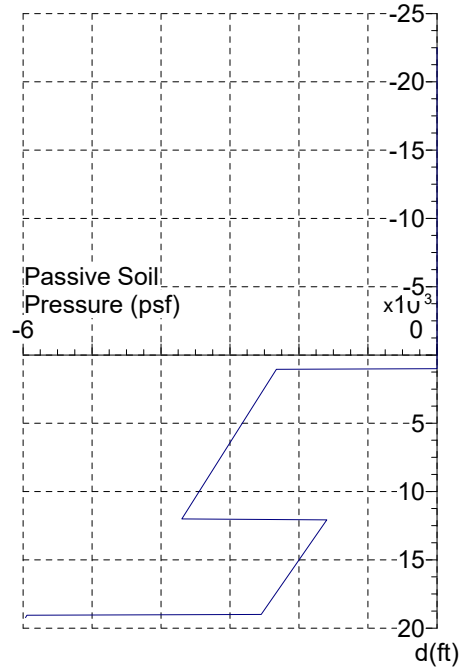
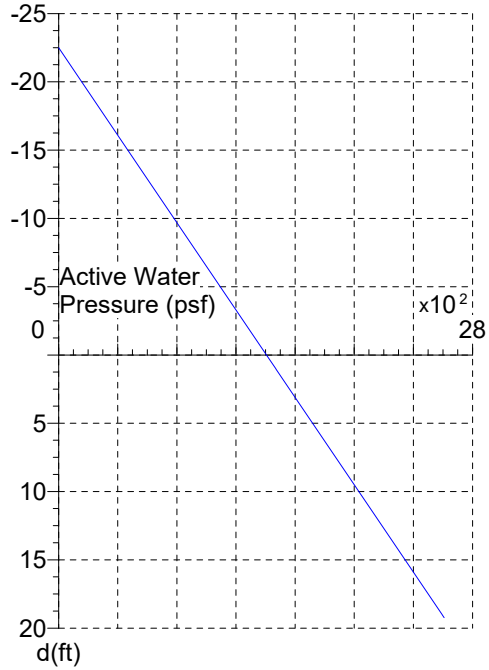
Title: Colorado River Flood Gate - West Side
Designer: Stage 1
Ref: 1.3
Page: 5
Date: 8.20.18

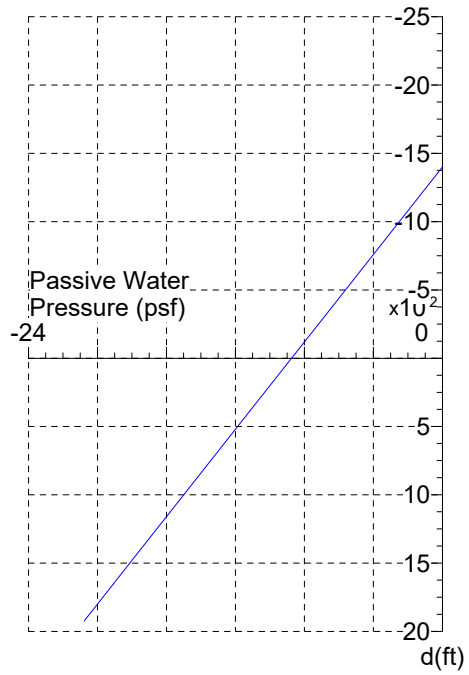
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Cantilever

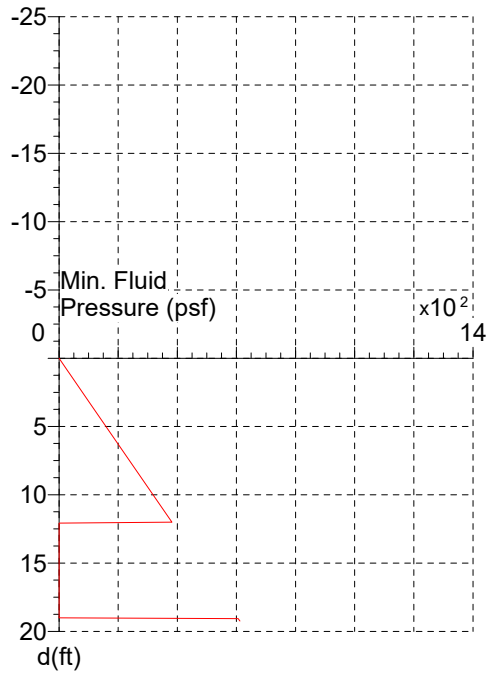
Stage 1 - Tip and Moment only

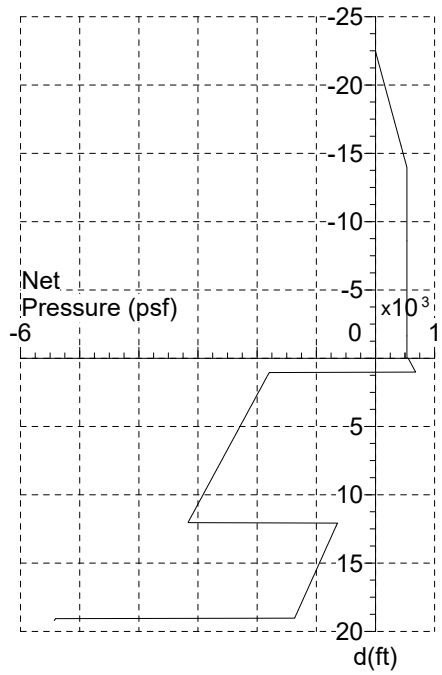












SupportIT, v2.35

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'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3
CONTROL  ANCHORED  DESIGN  1.30  1.30
WALL   4.5   -3
SURFACE RIGHTSIDE   2    0   -18
                  200   -18
SURFACE LEFTSIDE   2    0   -19
                  200   -19
SOIL RIGHTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
WATER ELEVATIONS   62.5    4.5   -10
FINISHED
```

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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 16-AUGUST-2018                                        TIME: 15:28:58

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.3

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.30
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.30

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 4.50 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -18.00
                200.00        -18.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -19.00
                200.00        -19.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
125.00  125.00     0.00  900.00     0.00    0.00  -30.00   0.00   DEF  DEF
```

122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
125.00	125.00	0.00	900.00	0.00	0.00	-30.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 16-AUGUST-2018 TIME: 15:29:16

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*************************
*   SOIL PRESSURES FOR  *
*  ANCHORED WALL DESIGN *
*************************
```

I.--HEADING

'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

				<------NET------>		
	NET	<---LEFTSIDE--->		(SOIL + WATER)	<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	0.0	0.0
-3.0	468.8	0.0	0.0	468.8	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	0.0	0.0
-4.5	562.5	0.0	0.0	562.5	0.0	0.0
-5.5	625.0	0.0	0.0	625.0	0.0	0.0
-6.5	687.5	0.0	0.0	687.5	0.0	0.0
-7.5	750.0	0.0	0.0	750.0	0.0	0.0
-8.5	812.5	0.0	0.0	812.5	0.0	0.0
-9.5	875.0	0.0	0.0	875.0	0.0	0.0
-10.0	906.3	0.0	0.0	906.3	0.0	0.0
-10.5	906.3	0.0	0.0	906.3	0.0	0.0
-11.5	906.3	0.0	0.0	906.3	0.0	0.0
-12.5	906.3	0.0	0.0	906.3	0.0	0.0
-13.5	906.3	0.0	0.0	906.3	0.0	0.0
-14.5	906.3	0.0	0.0	906.3	0.0	0.0
-15.5	906.3	0.0	0.0	906.3	0.0	0.0
-16.5	906.3	0.0	0.0	906.3	0.0	0.0
-17.5	906.3	0.0	0.0	906.3	0.0	0.0
-18.0+	906.3	0.0	0.0	906.3	0.0	0.0
-18.0-	906.3	0.0	0.0	906.3	0.0	1384.6
-18.5	906.3	0.0	0.0	906.3	0.0	1415.9
-19.0+	906.3	0.0	0.0	906.3	0.0	1447.1
-19.0-	906.3	1384.6	0.0	-478.4	0.0	1447.1
-19.5	906.3	1415.9	0.0	-509.6	0.0	1478.4
-20.0	906.3	1447.1	0.0	-540.9	0.0	1509.6
-20.5	906.3	1478.4	0.0	-572.1	0.0	1540.9

-21.5	906.3	1540.9	0.0	-634.6	0.0	1603.4
-22.5	906.3	1603.4	0.0	-697.1	0.0	1665.9
-23.5	906.3	1665.9	0.0	-759.6	0.0	1728.4
-24.5	906.3	1728.4	0.0	-822.1	0.0	1790.9
-25.5	906.3	1790.9	0.0	-884.6	0.0	1853.4
-26.5	906.3	1853.4	0.0	-947.1	0.0	1915.9
-27.5	906.3	1915.9	0.0	-1009.6	0.0	1978.4
-28.5	906.3	1978.4	0.0	-1072.1	0.0	2040.9
-29.5	906.3	2040.9	0.0	-1134.6	0.0	2103.4
-30.0	906.3	1940.6	0.0	-1034.3	0.0	2053.0
-30.5	906.3	1847.2	0.0	-940.9	0.0	2008.2
-31.5	906.3	1962.2	0.0	-1055.9	0.0	2120.1
-32.5	906.3	2082.0	0.0	-1175.7	0.0	2238.1
-33.5	906.3	2204.7	0.0	-1298.4	0.0	2359.0
-34.5	906.3	2345.7	0.0	-1439.4	0.0	2500.8
-35.5	906.3	2469.7	0.0	-1563.4	0.0	2623.4
-36.5	906.3	2597.6	0.0	-1691.4	0.0	2748.7
-37.0	906.3	3292.1	0.0	-2385.9	0.0	3399.0
-37.5	906.3	3966.3	0.0	-3060.1	0.0	4028.8
-38.5	906.3	4024.8	0.0	-3118.6	0.0	4088.1
-39.5	906.3	4070.0	0.0	-3163.8	0.0	4133.3
-40.5	906.3	4119.2	0.0	-3212.9	0.0	4181.7
-41.5	906.3	4181.7	0.0	-3275.4	0.0	4244.2
-42.5	906.3	4244.2	0.0	-3337.9	0.0	4306.7
-43.5	906.3	4306.7	0.0	-3400.4	0.0	4369.2
-44.5	906.3	4369.2	0.0	-3462.9	0.0	4431.7
-45.5	906.3	4431.7	0.0	-3525.4	0.0	4494.2
-46.5	906.3	4494.2	0.0	-3587.9	0.0	4556.7
-47.5	906.3	4556.7	0.0	-3650.4	0.0	4619.2
-48.5	906.3	4619.2	0.0	-3712.9	0.0	4681.7
-49.5	906.3	4671.8	0.0	-3765.6	0.0	4742.1
-50.5	906.3	4724.1	0.0	-3817.9	0.0	4794.4
-51.5	906.3	4786.2	0.0	-3880.0	0.0	4848.7
-52.0	906.3	4817.5	0.0	-3911.2	0.0	4880.0
-52.5	906.3	4848.7	0.0	-3942.5	0.0	4911.2
-53.5	906.3	4911.2	0.0	-4005.0	0.0	4973.7
-54.5	906.3	4973.7	0.0	-4067.5	0.0	5036.2
-55.5	906.3	5036.2	0.0	-4130.0	0.0	5098.7
-56.5	906.3	5098.7	0.0	-4192.5	0.0	5161.2
-57.5	906.3	5161.2	0.0	-4255.0	0.0	5223.7
-58.5	906.3	5223.7	0.0	-4317.5	0.0	5286.2
-59.5	906.3	5286.2	0.0	-4380.0	0.0	5348.7
-60.5	906.3	5348.7	0.0	-4442.5	0.0	5411.2
-61.5	906.3	5411.2	0.0	-4505.0	0.0	5473.7
-62.5	906.3	5473.7	0.0	-4567.5	0.0	5536.2
-63.5	906.3	5536.2	0.0	-4630.0	0.0	5598.7
-64.5	906.3	5598.7	0.0	-4692.5	0.0	5661.2
-65.5	906.3	5661.2	0.0	-4755.0	0.0	5723.7

-66.5	906.3	5723.7	0.0	-4817.5	0.0	5786.2
-67.5	906.3	5786.2	0.0	-4880.0	0.0	5848.7
-68.5	906.3	5848.7	0.0	-4942.5	0.0	5911.2
-69.5	906.3	5911.2	0.0	-5005.0	0.0	5973.7
-70.5	906.3	5973.7	0.0	-5067.5	0.0	6036.2
-71.5	906.3	6036.2	0.0	-5130.0	0.0	6098.7
-72.5	906.3	6098.7	0.0	-5192.5	0.0	6161.2
-73.5	906.3	6161.2	0.0	-5255.0	0.0	6223.7
-74.5	906.3	6223.7	0.0	-5317.5	0.0	6286.2
-75.5	906.3	6286.2	0.0	-5380.0	0.0	6348.7
-76.5	906.3	6348.7	0.0	-5442.5	0.0	6411.2
-77.5	906.3	6411.2	0.0	-5505.0	0.0	6473.7
-78.5	906.3	6473.7	0.0	-5567.5	0.0	6536.2
-79.5	906.3	6536.2	0.0	-5630.0	0.0	6598.7
-80.5	906.3	6598.7	0.0	-5692.5	0.0	6661.2
-81.5	906.3	6661.2	0.0	-5755.0	0.0	6723.7
-82.5	906.3	6723.7	0.0	-5817.5	0.0	6786.2
-83.5	906.3	6786.2	0.0	-5880.0	0.0	6848.7
-84.5	906.3	6848.7	0.0	-5942.5	0.0	6911.2
-85.5	906.3	6911.2	0.0	-6005.0	0.0	6973.7
-86.5	906.3	6973.7	0.0	-6067.5	0.0	7036.2
-87.5	906.3	7036.2	0.0	-6130.0	0.0	7098.7
-88.5	906.3	7098.7	0.0	-6192.5	0.0	7161.2
-89.5	906.3	7161.2	0.0	-6255.0	0.0	7223.7
-90.5	906.3	7223.7	0.0	-6317.5	0.0	7286.2

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-AUGUST-2018 TIME: 15:29:17

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*  SUMMARY OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
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I.--HEADING
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS

```
  'STAGE 2 - 1.3

II.--SUMMARY

     RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

     LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

METHOD                              :    FREE EARTH         FIXED EARTH

WALL BOTTOM ELEVATION (FT)          :        -26.51              -32.94
      PENETRATION (FT)               :         7.51               13.94

MAXIMUM BENDING MOMENT (LB-FT)      :   -3.8157E+04         -3.1236E+04
      AT ELEVATION (FT)             :        -13.09              -12.30

MAXIMUM SCALED DEFLECTION (LB-IN^3):   -3.4421E+09         -2.6948E+09
      AT ELEVATION (FT)             :          4.50                4.50

ANCHOR FORCE (LB)                   :    9.3699E+03          8.6560E+03

          NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                 ELLASTICITY IN PSI TIMES PILE MOMENT
                 OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                 IN INCHES.



PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 16-AUGUST-2018                                      TIME: 15:29:17

                      ****************************
                      * COMPLETE OF RESULTS FOR  *
                      *   ANCHORED WALL DESIGN   *
                      *   BY FREE EARTH METHOD   *
                      ****************************

  I.--HEADING
  'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
  'SINGLE BRACE CONDITION
  'Q-CASE SOIL PARAMETERS
  'STAGE 2 - 1.3

 II.--RESULTS (ANCHOR FORCE= 9370. (LB))
```

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-3.4421E+09	0.00
3.50	1.0417E+01	31.	-2.9860E+09	62.50
2.50	8.3333E+01	125.	-2.5299E+09	125.00
1.50	2.8125E+02	281.	-2.0736E+09	187.50
0.50	6.6667E+02	500.	-1.6168E+09	250.00
-0.50	1.3021E+03	781.	-1.1588E+09	312.50
-1.50	2.2500E+03	1125.	-6.9850E+08	375.00
-2.50	3.5729E+03	1531.	-2.3428E+08	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-7612.	0.0000E+00	468.75
-3.50	6.4837E+02	-7370.	2.3584E+08	500.00
-4.50	-6.4611E+03	-6839.	7.0682E+08	562.50
-5.50	-1.3008E+04	-6245.	1.1667E+09	625.00
-6.50	-1.8930E+04	-5589.	1.6042E+09	687.50
-7.50	-2.4165E+04	-4870.	2.0091E+09	750.00
-8.50	-2.8649E+04	-4089.	2.3724E+09	812.50
-9.50	-3.2321E+04	-3245.	2.6862E+09	875.00
-10.00	-3.3833E+04	-2800.	2.8226E+09	906.25
-10.50	-3.5119E+04	-2346.	2.9444E+09	906.25
-11.50	-3.7013E+04	-1440.	3.1419E+09	906.25
-12.50	-3.8000E+04	-534.	3.2757E+09	906.25
-13.50	-3.8081E+04	372.	3.3439E+09	906.25
-14.50	-3.7255E+04	1279.	3.3464E+09	906.25
-15.50	-3.5524E+04	2185.	3.2847E+09	906.25
-16.50	-3.2886E+04	3091.	3.1618E+09	906.25
-17.50	-2.9342E+04	3997.	2.9821E+09	906.25
-18.00	-2.7230E+04	4450.	2.8729E+09	906.25
-18.50	-2.4891E+04	4904.	2.7519E+09	906.25
-19.00+	-2.2326E+04	5357.	2.6202E+09	906.25
-19.00-	-2.2326E+04	5357.	2.6202E+09	-478.37
-19.50	-1.9709E+04	5110.	2.4788E+09	-509.62
-20.00	-1.7219E+04	4847.	2.3289E+09	-540.87
-20.50	-1.4865E+04	4569.	2.1715E+09	-572.12
-21.50	-1.0592E+04	3965.	1.8385E+09	-634.62
-22.50	-6.9547E+03	3300.	1.4871E+09	-697.12
-23.50	-4.0141E+03	2571.	1.1236E+09	-759.62
-24.50	-1.8331E+03	1780.	7.5304E+08	-822.12
-25.50	-4.7429E+02	927.	3.7919E+08	-884.62
-26.50	-6.4880E-02	11.	4.3868E+06	-947.12
-26.51	0.0000E+00	0.	0.0000E+00	-947.85

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.50	906.	0.	0.	0.	0.
-16.50	906.	0.	0.	0.	0.
-17.50	906.	0.	0.	0.	0.
-18.00+	906.	0.	0.	0.	0.
-18.00-	906.	0.	0.	0.	1385.
-18.50	906.	0.	0.	0.	1416.
-19.00+	906.	0.	0.	0.	1447.
-19.00-	906.	1385.	0.	0.	1447.
-19.50	906.	1416.	0.	0.	1478.
-20.00	906.	1447.	0.	0.	1510.
-20.50	906.	1478.	0.	0.	1541.
-21.50	906.	1541.	0.	0.	1603.
-22.50	906.	1603.	0.	0.	1666.
-23.50	906.	1666.	0.	0.	1728.
-24.50	906.	1728.	0.	0.	1791.
-25.50	906.	1791.	0.	0.	1853.
-26.50	906.	1853.	0.	0.	1916.
-27.50	906.	1916.	0.	0.	1978.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 16-AUGUST-2018 TIME: 15:29:17

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****************************
* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
****************************
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I.--HEADING
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--RESULTS (ANCHOR FORCE= 8656. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-2.6948E+09	0.00
3.50	1.0417E+01	31.	-2.3383E+09	62.50
2.50	8.3333E+01	125.	-1.9819E+09	125.00
1.50	2.8125E+02	281.	-1.6252E+09	187.50
0.50	6.6667E+02	500.	-1.2680E+09	250.00
-0.50	1.3021E+03	781.	-9.0969E+08	312.50
-1.50	2.2500E+03	1125.	-5.4905E+08	375.00
-2.50	3.5729E+03	1531.	-1.8446E+08	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-6898.	0.0000E+00	468.75
-3.50	1.0053E+03	-6656.	1.8605E+08	500.00
-4.50	-5.3903E+03	-6125.	5.5806E+08	562.50
-5.50	-1.1223E+04	-5531.	9.2084E+08	625.00
-6.50	-1.6432E+04	-4875.	1.2643E+09	687.50
-7.50	-2.0952E+04	-4156.	1.5795E+09	750.00
-8.50	-2.4723E+04	-3375.	1.8586E+09	812.50
-9.50	-2.7681E+04	-2531.	2.0950E+09	875.00
-10.00	-2.8836E+04	-2086.	2.1957E+09	906.25
-10.50	-2.9765E+04	-1633.	2.2838E+09	906.25
-11.50	-3.0945E+04	-726.	2.4213E+09	906.25
-12.50	-3.1218E+04	180.	2.5054E+09	906.25
-13.50	-3.0585E+04	1086.	2.5357E+09	906.25
-14.50	-2.9046E+04	1992.	2.5133E+09	906.25

-15.50	-2.6600E+04	2899.	2.4408E+09	906.25
-16.50	-2.3248E+04	3805.	2.3225E+09	906.25
-17.50	-1.8990E+04	4711.	2.1642E+09	906.25
-18.00	-1.6522E+04	5164.	2.0722E+09	906.25
-18.50	-1.3826E+04	5617.	1.9731E+09	906.25
-19.00+	-1.0904E+04	6071.	1.8681E+09	906.25
-19.00-	-1.0904E+04	6071.	1.8681E+09	-478.37
-19.50	-7.9300E+03	5824.	1.7583E+09	-509.62
-20.00	-5.0832E+03	5561.	1.6452E+09	-540.87
-20.50	-2.3717E+03	5283.	1.5298E+09	-572.12
-21.50	2.6145E+03	4679.	1.2970E+09	-634.62
-22.50	6.9661E+03	4013.	1.0687E+09	-697.12
-23.50	1.0621E+04	3285.	8.5230E+08	-759.62
-24.50	1.3515E+04	2494.	6.5416E+08	-822.12
-25.50	1.5588E+04	1641.	4.7925E+08	-884.62
-26.50	1.6776E+04	725.	3.3115E+08	-947.12
-27.50	1.7017E+04	-253.	2.1190E+08	-1009.62
-28.50	1.6249E+04	-1294.	1.2191E+08	-1072.12
-29.50	1.4408E+04	-2398.	5.9848E+07	-1134.62
-30.00	1.3071E+04	-2940.	3.8366E+07	-1034.33
-30.50	1.1476E+04	-3434.	2.2521E+07	-940.90
-31.50	7.5528E+03	-4432.	4.8853E+06	-1055.92
-32.50	2.5728E+03	-5548.	1.4852E+05	-1175.70
-33.50	0.0000E+00	-6080.	0.0000E+00	-1230.02

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.

-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.50	906.	0.	0.	0.	0.
-16.50	906.	0.	0.	0.	0.
-17.50	906.	0.	0.	0.	0.
-18.00+	906.	0.	0.	0.	0.
-18.00-	906.	0.	0.	0.	1385.
-18.50	906.	0.	0.	0.	1416.
-19.00+	906.	0.	0.	0.	1447.
-19.00-	906.	1385.	0.	0.	1447.
-19.50	906.	1416.	0.	0.	1478.
-20.00	906.	1447.	0.	0.	1510.
-20.50	906.	1478.	0.	0.	1541.
-21.50	906.	1541.	0.	0.	1603.
-22.50	906.	1603.	0.	0.	1666.
-23.50	906.	1666.	0.	0.	1728.
-24.50	906.	1728.	0.	0.	1791.
-25.50	906.	1791.	0.	0.	1853.
-26.50	906.	1853.	0.	0.	1916.
-27.50	906.	1916.	0.	0.	1978.
-28.50	906.	1978.	0.	0.	2041.
-29.50	906.	2041.	0.	0.	2103.
-30.00	906.	1941.	0.	0.	2053.
-30.50	906.	1847.	0.	0.	2008.
-31.50	906.	1962.	0.	0.	2120.
-32.50	906.	2082.	0.	0.	2238.
-33.50	906.	2205.	0.	0.	2359.

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* PRELIMINARY DESIGN DATA FOR *
*  FREE EARTH DESIGN IN CLAY  *
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I.--HEADING
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.3

II.--DESIGN PARAMETERS
WALL HEIGHT RATIO (ALPHA) = 0.76
ANCHOR HEIGHT RATIO (BETA) = 0.24
STABILITY NUMBER = 11.08

SHEET PILE DATA:

SHEET PILE NAME	<SECTION PROPERTIES> (PER FOOT OF WALL) SECTION MODULUS (IN^3)	MOMENT OF INERTIA (IN^4)	ALLOWABLE STRESS (PSI)	MODULUS OF ELLASTICITY (PSI)
PZ40	60.70	490.80	24000.00	2.90E+07
PZ38	46.80	280.80	24000.00	2.90E+07
PZ35	48.50	361.20	24000.00	2.90E+07
PZ32	38.30	220.40	24000.00	2.90E+07
PZ27	30.20	184.20	24000.00	2.90E+07
PZ22	18.10	84.40	24000.00	2.90E+07
PLZ25	32.80	223.25	24000.00	2.90E+07
PLZ23	30.20	203.75	24000.00	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE NAME	LOG(H^4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT
PZ40	-4.19	1.0 (***)	3.18
PZ38	-3.94	1.0 (***)	2.45
PZ35	-4.05	1.0 (***)	2.54
PZ32	-3.84	1.0 (***)	2.01
PZ27	-3.76	1.0 (***)	1.58
PZ22	-3.42	1.0 (***)	0.95
PLZ25	-3.85	1.0 (***)	1.72
PLZ23	-3.81	1.0 (***)	1.58

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE

BELOW TOP OF WALL.

*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER GREATER THAN 2.5.

```
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0
CONTROL  ANCHORED  DESIGN  1.00  1.00
WALL   4.5   -3
SURFACE RIGHTSIDE   2    0   -18
                  200   -18
SURFACE LEFTSIDE   2    0   -19
                  200   -19
SOIL RIGHTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
SOIL LEFTSIDE  STRENGTHS   4
   125    125    0    900    0    0   -30   0
   122    122    30    0    0    0   -37   0
   125    125    0    1800    0    0   -52   0
   125    125    0    1800    0    0
WATER ELEVATIONS   62.5    4.5   -10
FINISHED
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PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 16-AUGUST-2018                                        TIME: 15:33:43

                            ***************
                            *  INPUT DATA  *
                            ***************

      I.--HEADING
     'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.0

     II.--CONTROL
        ANCHORED WALL DESIGN
        FACTOR OF SAFETY FOR ACTIVE PRESSURES  = 1.00
        FACTOR OF SAFETY FOR PASSIVE PRESSURES = 1.00

    III.--WALL DATA
        ELEVATION AT TOP OF WALL    = 4.50 FT.
        ELEVATION AT ANCHOR         = -3.00 FT.

     IV.--SURFACE POINT DATA

          IV.A.--RIGHTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -18.00
                200.00        -18.00

          IV.B.--LEFTSIDE
             DIST. FROM     ELEVATION
             WALL (FT)         (FT)
                  0.00        -19.00
                200.00        -19.00

      V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
             LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE  = DEFAULT
             LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

                ANGLE OF         ANGLE OF                        <-SAFETY->
  SAT.   MOIST  INTERNAL  COH-     WALL    ADH-    <--BOTTOM-->  <-FACTOR->
 WGHT.   WGHT.  FRICTION  ESION  FRICTION  ESION   ELEV.  SLOPE  ACT. PASS.
 (PCF)   (PCF)    (DEG)   (PSF)    (DEG)   (PSF)   (FT)  (FT/FT)
125.00  125.00     0.00  900.00     0.00    0.00  -30.00   0.00   DEF  DEF
```

122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
125.00	125.00	0.00	900.00	0.00	0.00	-30.00	0.00	DEF	DEF
122.00	122.00	30.00	0.00	0.00	0.00	-37.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00	-52.00	0.00	DEF	DEF
125.00	125.00	0.00	1800.00	0.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 4.50 (FT)
LEFTSIDE ELEVATION = -10.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS
DATE: 16-AUGUST-2018 TIME: 15:33:54

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*   SOIL PRESSURES FOR  *
*  ANCHORED WALL DESIGN *
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I.--HEADING

'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--SOIL PRESSURES

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

				<------NET------>		
	NET	<---LEFTSIDE--->		(SOIL + WATER)	<--RIGHTSIDE--->	
ELEV.	WATER	PASSIVE	ACTIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.5	0.0	0.0	0.0	0.0	0.0	0.0
3.5	62.5	0.0	0.0	62.5	0.0	0.0
2.5	125.0	0.0	0.0	125.0	0.0	0.0
1.5	187.5	0.0	0.0	187.5	0.0	0.0
0.5	250.0	0.0	0.0	250.0	0.0	0.0
-0.5	312.5	0.0	0.0	312.5	0.0	0.0
-1.5	375.0	0.0	0.0	375.0	0.0	0.0
-2.5	437.5	0.0	0.0	437.5	0.0	0.0
-3.0	468.8	0.0	0.0	468.8	0.0	0.0
-3.5	500.0	0.0	0.0	500.0	0.0	0.0
-4.5	562.5	0.0	0.0	562.5	0.0	0.0
-5.5	625.0	0.0	0.0	625.0	0.0	0.0
-6.5	687.5	0.0	0.0	687.5	0.0	0.0
-7.5	750.0	0.0	0.0	750.0	0.0	0.0
-8.5	812.5	0.0	0.0	812.5	0.0	0.0
-9.5	875.0	0.0	0.0	875.0	0.0	0.0
-10.0	906.3	0.0	0.0	906.3	0.0	0.0
-10.5	906.3	0.0	0.0	906.3	0.0	0.0
-11.5	906.3	0.0	0.0	906.3	0.0	0.0
-12.5	906.3	0.0	0.0	906.3	0.0	0.0
-13.5	906.3	0.0	0.0	906.3	0.0	0.0
-14.5	906.3	0.0	0.0	906.3	0.0	0.0
-15.5	906.3	0.0	0.0	906.3	0.0	0.0
-16.5	906.3	0.0	0.0	906.3	0.0	0.0
-17.5	906.3	0.0	0.0	906.3	0.0	0.0
-18.0+	906.3	0.0	0.0	906.3	0.0	0.0
-18.0-	906.3	0.0	0.0	906.3	0.0	1800.0
-18.5	906.3	0.0	0.0	906.3	0.0	1831.3
-19.0+	906.3	0.0	0.0	906.3	0.0	1862.5
-19.0-	906.3	1800.0	0.0	-893.8	0.0	1862.5
-19.5	906.3	1831.3	0.0	-925.0	0.0	1893.8
-20.0	906.3	1862.5	0.0	-956.3	0.0	1925.0
-20.5	906.3	1893.8	0.0	-987.5	0.0	1956.3

-21.5	906.3	1956.3	0.0	-1050.0	0.0	2018.8
-22.5	906.3	2018.8	0.0	-1112.5	0.0	2081.3
-23.5	906.3	2081.3	0.0	-1175.0	0.0	2143.8
-24.5	906.3	2143.8	0.0	-1237.5	0.0	2206.3
-25.5	906.3	2206.3	0.0	-1300.0	0.0	2268.8
-26.5	906.3	2268.8	0.0	-1362.5	0.0	2331.3
-27.5	906.3	2331.3	0.0	-1425.0	0.0	2393.8
-28.5	906.3	2393.8	0.0	-1487.5	0.0	2456.3
-29.5	906.3	2456.3	0.0	-1550.0	0.0	2518.7
-30.0	906.3	2516.1	0.0	-1609.8	0.0	2661.4
-30.5	906.3	2568.0	0.0	-1661.8	0.0	2792.3
-31.5	906.3	2638.9	0.0	-1732.7	0.0	2851.8
-32.5	906.3	2746.1	0.0	-1839.8	0.0	2952.6
-33.5	906.3	2887.5	0.0	-1981.3	0.0	3090.2
-34.5	906.3	3038.6	0.0	-2132.3	0.0	3240.2
-35.5	906.3	3182.6	0.0	-2276.4	0.0	3381.4
-36.5	906.3	3358.5	0.0	-2452.2	0.0	3553.8
-37.0	906.3	4134.8	0.0	-3228.6	0.0	4263.8
-37.5	906.3	4880.3	0.0	-3974.1	0.0	4942.8
-38.5	906.3	4942.8	0.0	-4036.6	0.0	5005.3
-39.5	906.3	4998.7	0.0	-4092.5	0.0	5064.9
-40.5	906.3	5028.9	0.0	-4122.7	0.0	5095.1
-41.5	906.3	5065.7	0.0	-4159.4	0.0	5128.2
-42.5	906.3	5128.2	0.0	-4221.9	0.0	5190.7
-43.5	906.3	5190.7	0.0	-4284.4	0.0	5253.2
-44.5	906.3	5253.2	0.0	-4346.9	0.0	5315.7
-45.5	906.3	5315.7	0.0	-4409.4	0.0	5378.2
-46.5	906.3	5378.2	0.0	-4471.9	0.0	5440.7
-47.5	906.3	5440.7	0.0	-4534.4	0.0	5503.2
-48.5	906.3	5486.2	0.0	-4579.9	0.0	5564.5
-49.5	906.3	5526.2	0.0	-4619.9	0.0	5604.5
-50.5	906.3	5583.1	0.0	-4676.9	0.0	5645.6
-51.5	906.3	5645.6	0.0	-4739.4	0.0	5708.1
-52.0	906.3	5676.9	0.0	-4770.6	0.0	5739.4
-52.5	906.3	5708.1	0.0	-4801.9	0.0	5770.6
-53.5	906.3	5770.6	0.0	-4864.4	0.0	5833.1
-54.5	906.3	5833.1	0.0	-4926.9	0.0	5895.6
-55.5	906.3	5895.6	0.0	-4989.4	0.0	5958.1
-56.5	906.3	5958.1	0.0	-5051.9	0.0	6020.6
-57.5	906.3	6020.6	0.0	-5114.4	0.0	6083.1
-58.5	906.3	6083.1	0.0	-5176.9	0.0	6145.6
-59.5	906.3	6145.6	0.0	-5239.4	0.0	6208.1
-60.5	906.3	6208.1	0.0	-5301.9	0.0	6270.6
-61.5	906.3	6270.6	0.0	-5364.4	0.0	6333.1
-62.5	906.3	6333.1	0.0	-5426.9	0.0	6395.6
-63.5	906.3	6395.6	0.0	-5489.4	0.0	6458.1
-64.5	906.3	6458.1	0.0	-5551.9	0.0	6520.6
-65.5	906.3	6520.6	0.0	-5614.4	0.0	6583.1

-66.5	906.3	6583.1	0.0	-5676.9	0.0	6645.6
-67.5	906.3	6645.6	0.0	-5739.4	0.0	6708.1
-68.5	906.3	6708.1	0.0	-5801.9	0.0	6770.6
-69.5	906.3	6770.6	0.0	-5864.4	0.0	6833.1
-70.5	906.3	6823.8	0.0	-5917.6	0.0	6895.6
-71.5	906.3	6873.0	0.0	-5966.8	0.0	6958.1
-72.5	906.3	6931.5	0.0	-6025.3	0.0	7014.5
-73.5	906.3	6994.0	0.0	-6087.8	0.0	7063.7
-74.5	906.3	7056.5	0.0	-6150.3	0.0	7119.0
-75.5	906.3	7119.0	0.0	-6212.8	0.0	7181.5
-76.5	906.3	7181.5	0.0	-6275.3	0.0	7244.0
-77.5	906.3	7244.0	0.0	-6337.8	0.0	7306.5
-78.5	906.3	7306.5	0.0	-6400.3	0.0	7369.0
-79.5	906.3	7369.0	0.0	-6462.8	0.0	7431.5
-80.5	906.3	7431.5	0.0	-6525.3	0.0	7494.0
-81.5	906.3	7494.0	0.0	-6587.8	0.0	7556.5
-82.5	906.3	7556.5	0.0	-6650.3	0.0	7619.0
-83.5	906.3	7619.0	0.0	-6712.8	0.0	7681.5
-84.5	906.3	7681.5	0.0	-6775.3	0.0	7744.0
-85.5	906.3	7744.0	0.0	-6837.8	0.0	7806.5
-86.5	906.3	7806.5	0.0	-6900.3	0.0	7869.0
-87.5	906.3	7869.0	0.0	-6962.8	0.0	7931.5
-88.5	906.3	7931.5	0.0	-7025.3	0.0	7994.0
-89.5	906.3	7994.0	0.0	-7087.8	0.0	8056.5
-90.5	906.3	8056.5	0.0	-7150.3	0.0	8119.0

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-AUGUST-2018 TIME: 15:33:55

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*  SUMMARY OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
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I.--HEADING
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS

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  'STAGE 2 - 1.0

II.--SUMMARY

     RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

     LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

METHOD                              :    FREE EARTH         FIXED EARTH

WALL BOTTOM ELEVATION (FT)          :        -24.40              -29.94
      PENETRATION (FT)               :         5.40               10.94

MAXIMUM BENDING MOMENT (LB-FT)      :   -3.4430E+04         -2.7318E+04
      AT ELEVATION (FT)             :        -12.67              -11.82

MAXIMUM SCALED DEFLECTION (LB-IN^3):   -2.8006E+09         -2.1250E+09
      AT ELEVATION (FT)             :          4.50                4.50

ANCHOR FORCE (LB)                   :    8.9928E+03          8.2237E+03

          NOTE:  DIVIDE SCALED DEFLECTION MODULUS OF
                 ELLASTICITY IN PSI TIMES PILE MOMENT
                 OF INERTIA IN IN^4 TO OBTAIN DEFLECTION
                 IN INCHES.



PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 16-AUGUST-2018                                        TIME: 15:33:55

                      ****************************
                      * COMPLETE OF RESULTS FOR  *
                      *   ANCHORED WALL DESIGN   *
                      *   BY FREE EARTH METHOD   *
                      ****************************

     I.--HEADING
     'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
     'SINGLE BRACE CONDITION
     'Q-CASE SOIL PARAMETERS
     'STAGE 2 - 1.0

    II.--RESULTS (ANCHOR FORCE= 8993. (LB))
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ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-2.8006E+09	0.00
3.50	1.0417E+01	31.	-2.4300E+09	62.50
2.50	8.3333E+01	125.	-2.0594E+09	125.00
1.50	2.8125E+02	281.	-1.6887E+09	187.50
0.50	6.6667E+02	500.	-1.3174E+09	250.00
-0.50	1.3021E+03	781.	-9.4495E+08	312.50
-1.50	2.2500E+03	1125.	-5.7020E+08	375.00
-2.50	3.5729E+03	1531.	-1.9151E+08	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-7235.	0.0000E+00	468.75
-3.50	8.3696E+02	-6993.	1.9309E+08	500.00
-4.50	-5.8954E+03	-6461.	5.7889E+08	562.50
-5.50	-1.2065E+04	-5868.	9.5458E+08	625.00
-6.50	-1.7610E+04	-5211.	1.3095E+09	687.50
-7.50	-2.2467E+04	-4493.	1.6341E+09	750.00
-8.50	-2.6575E+04	-3711.	1.9200E+09	812.50
-9.50	-2.9870E+04	-2868.	2.1601E+09	875.00
-10.00	-3.1193E+04	-2422.	2.2611E+09	906.25
-10.50	-3.2291E+04	-1969.	2.3487E+09	906.25
-11.50	-3.3807E+04	-1063.	2.4816E+09	906.25
-12.50	-3.4417E+04	-157.	2.5562E+09	906.25
-13.50	-3.4120E+04	749.	2.5715E+09	906.25
-14.50	-3.2918E+04	1656.	2.5280E+09	906.25
-15.50	-3.0809E+04	2562.	2.4277E+09	906.25
-16.50	-2.7794E+04	3468.	2.2743E+09	906.25
-17.50	-2.3873E+04	4374.	2.0730E+09	906.25
-18.00	-2.1572E+04	4828.	1.9565E+09	906.25
-18.50	-1.9045E+04	5281.	1.8306E+09	906.25
-19.00+	-1.6291E+04	5734.	1.6966E+09	906.25
-19.00-	-1.6291E+04	5734.	1.6966E+09	-893.75
-19.50	-1.3538E+04	5279.	1.5554E+09	-925.00
-20.00	-1.1015E+04	4809.	1.4085E+09	-956.25
-20.50	-8.7314E+03	4323.	1.2567E+09	-987.50
-21.50	-4.9127E+03	3304.	9.4277E+08	-1050.00
-22.50	-2.1440E+03	2223.	6.2018E+08	-1112.50
-23.50	-4.8775E+02	1079.	2.9373E+08	-1175.00
-24.40	0.0000E+00	0.	0.0000E+00	-1231.06

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.
-15.50	906.	0.	0.	0.	0.
-16.50	906.	0.	0.	0.	0.
-17.50	906.	0.	0.	0.	0.
-18.00+	906.	0.	0.	0.	0.
-18.00-	906.	0.	0.	0.	1800.
-18.50	906.	0.	0.	0.	1831.
-19.00+	906.	0.	0.	0.	1863.
-19.00-	906.	1800.	0.	0.	1863.
-19.50	906.	1831.	0.	0.	1894.
-20.00	906.	1863.	0.	0.	1925.
-20.50	906.	1894.	0.	0.	1956.
-21.50	906.	1956.	0.	0.	2019.
-22.50	906.	2019.	0.	0.	2081.
-23.50	906.	2081.	0.	0.	2144.
-24.50	906.	2144.	0.	0.	2206.

DATE: 16-AUGUST-2018 TIME: 15:33:55

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* COMPLETE OF RESULTS FOR  *
*   ANCHORED WALL DESIGN   *
*   BY FIXED EARTH METHOD  *
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I.--HEADING
'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
'SINGLE BRACE CONDITION
'Q-CASE SOIL PARAMETERS
'STAGE 2 - 1.0

II.--RESULTS (ANCHOR FORCE= 8224. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	SCALED DEFLECTION (LB-IN^3)	NET PRESSURE (PSF)
4.50	0.0000E+00	0.	-2.1250E+09	0.00
3.50	1.0417E+01	31.	-1.8445E+09	62.50
2.50	8.3333E+01	125.	-1.5640E+09	125.00
1.50	2.8125E+02	281.	-1.2833E+09	187.50
0.50	6.6667E+02	500.	-1.0022E+09	250.00
-0.50	1.3021E+03	781.	-7.1977E+08	312.50
-1.50	2.2500E+03	1125.	-4.3510E+08	375.00
-2.50	3.5729E+03	1531.	-1.4648E+08	437.50
-3.00+	4.3945E+03	1758.	0.0000E+00	468.75
-3.00-	4.3945E+03	-6466.	0.0000E+00	468.75
-3.50	1.2215E+03	-6224.	1.4808E+08	500.00
-4.50	-4.7418E+03	-5692.	4.4453E+08	562.50
-5.50	-1.0143E+04	-5099.	7.3286E+08	625.00
-6.50	-1.4918E+04	-4442.	1.0038E+09	687.50
-7.50	-1.9007E+04	-3724.	1.2490E+09	750.00
-8.50	-2.2345E+04	-2942.	1.4615E+09	812.50
-9.50	-2.4871E+04	-2099.	1.6354E+09	875.00
-10.00	-2.5810E+04	-1653.	1.7066E+09	906.25
-10.50	-2.6523E+04	-1200.	1.7666E+09	906.25
-11.50	-2.7270E+04	-294.	1.8520E+09	906.25
-12.50	-2.7111E+04	612.	1.8905E+09	906.25
-13.50	-2.6046E+04	1518.	1.8822E+09	906.25
-14.50	-2.4074E+04	2425.	1.8290E+09	906.25
-15.50	-2.1196E+04	3331.	1.7344E+09	906.25
-16.50	-1.7412E+04	4237.	1.6033E+09	906.25
-17.50	-1.2722E+04	5143.	1.4422E+09	906.25
-18.00	-1.0037E+04	5597.	1.3529E+09	906.25
-18.50	-7.1253E+03	6050.	1.2593E+09	906.25
-19.00+	-3.9872E+03	6503.	1.1626E+09	906.25

-19.00-	-3.9872E+03	6503.	1.1626E+09	-893.75
-19.50	-8.4875E+02	6048.	1.0642E+09	-925.00
-20.00	2.0584E+03	5578.	9.6537E+08	-956.25
-20.50	4.7265E+03	5092.	8.6745E+08	-987.50
-21.50	9.3142E+03	4073.	6.7876E+08	-1050.00
-22.50	1.2852E+04	2992.	5.0602E+08	-1112.50
-23.50	1.5277E+04	1848.	3.5533E+08	-1175.00
-24.50	1.6527E+04	642.	2.3086E+08	-1237.50
-25.50	1.6540E+04	-627.	1.3478E+08	-1300.00
-26.50	1.5253E+04	-1958.	6.7090E+07	-1362.50
-27.50	1.2603E+04	-3352.	2.5561E+07	-1425.00
-28.50	8.5283E+03	-4808.	5.6059E+06	-1487.50
-29.50	2.9661E+03	-6327.	1.7309E+05	-1550.00
-30.00	0.0000E+00	-7027.	0.0000E+00	-1603.19

NOTE: DIVIDE SCALED DEFLECTION MODULUS OF ELLASTICITY IN PSI TIMES PILE MOMENT OF INERTIA IN IN^4 TO OBTAIN DEFLECTION IN INCHES.

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
4.50	0.	0.	0.	0.	0.
3.50	63.	0.	0.	0.	0.
2.50	125.	0.	0.	0.	0.
1.50	188.	0.	0.	0.	0.
0.50	250.	0.	0.	0.	0.
-0.50	313.	0.	0.	0.	0.
-1.50	375.	0.	0.	0.	0.
-2.50	438.	0.	0.	0.	0.
-3.00	469.	0.	0.	0.	0.
-3.50	500.	0.	0.	0.	0.
-4.50	563.	0.	0.	0.	0.
-5.50	625.	0.	0.	0.	0.
-6.50	688.	0.	0.	0.	0.
-7.50	750.	0.	0.	0.	0.
-8.50	813.	0.	0.	0.	0.
-9.50	875.	0.	0.	0.	0.
-10.00	906.	0.	0.	0.	0.
-10.50	906.	0.	0.	0.	0.
-11.50	906.	0.	0.	0.	0.
-12.50	906.	0.	0.	0.	0.
-13.50	906.	0.	0.	0.	0.
-14.50	906.	0.	0.	0.	0.

-15.50	906.	0.	0.	0.	0.
-16.50	906.	0.	0.	0.	0.
-17.50	906.	0.	0.	0.	0.
-18.00+	906.	0.	0.	0.	0.
-18.00-	906.	0.	0.	0.	1800.
-18.50	906.	0.	0.	0.	1831.
-19.00+	906.	0.	0.	0.	1863.
-19.00-	906.	1800.	0.	0.	1863.
-19.50	906.	1831.	0.	0.	1894.
-20.00	906.	1863.	0.	0.	1925.
-20.50	906.	1894.	0.	0.	1956.
-21.50	906.	1956.	0.	0.	2019.
-22.50	906.	2019.	0.	0.	2081.
-23.50	906.	2081.	0.	0.	2144.
-24.50	906.	2144.	0.	0.	2206.
-25.50	906.	2206.	0.	0.	2269.
-26.50	906.	2269.	0.	0.	2331.
-27.50	906.	2331.	0.	0.	2394.
-28.50	906.	2394.	0.	0.	2456.
-29.50	906.	2456.	0.	0.	2519.
-30.00	906.	2516.	0.	0.	2661.

```
PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
                         BY CLASSICAL METHODS
DATE: 16-AUGUST-2018                                          TIME: 15:33:56

                 ******************************
                 * PRELIMINARY DESIGN DATA FOR *
                 *  FREE EARTH DESIGN IN CLAY  *
                 ******************************

    I.--HEADING
    'COLORADO RIVER - WEST BRACED COFFERDAM DESIGN
    'SINGLE BRACE CONDITION
    'Q-CASE SOIL PARAMETERS
    'STAGE 2 - 1.0

   II.--DESIGN PARAMETERS
       WALL HEIGHT RATIO (ALPHA)  = 0.81
```

ANCHOR HEIGHT RATIO (BETA) = 0.26
STABILITY NUMBER = 14.40

SHEET PILE DATA:

SHEET PILE NAME	<SECTION PROPERTIES> (PER FOOT OF WALL) SECTION MODULUS (IN^3)	MOMENT OF INERTIA (IN^4)	ALLOWABLE STRESS (PSI)	MODULUS OF ELLASTICITY (PSI)
PZ40	60.70	490.80	24000.00	2.90E+07
PZ38	46.80	280.80	24000.00	2.90E+07
PZ35	48.50	361.20	24000.00	2.90E+07
PZ32	38.30	220.40	24000.00	2.90E+07
PZ27	30.20	184.20	24000.00	2.90E+07
PZ22	18.10	84.40	24000.00	2.90E+07
PLZ25	32.80	223.25	24000.00	2.90E+07
PLZ23	30.20	203.75	24000.00	2.90E+07

III.--PRELIMINARY DESIGN DATA

SHEET PILE NAME	LOG(H^4/EI)	ROWE'S MOMENT REDUCTION COEF.	RATIO OF ALLOWABLE MOMENT TO FREE EARTH MOMENT
PZ40	-4.31	1.0 (***)	3.53
PZ38	-4.07	1.0 (***)	2.72
PZ35	-4.18	1.0 (***)	2.82
PZ32	-3.96	1.0 (***)	2.22
PZ27	-3.88	1.0 (***)	1.75
PZ22	-3.55	1.0 (***)	1.05
PLZ25	-3.97	1.0 (***)	1.91
PLZ23	-3.93	1.0 (***)	1.75

*** REDUCTION NOT APPLICABLE DUE TO ALPHA GREATER THAN 0.8.

*** REDUCTION NOT APPLICABLE DUE TO RIGHTSIDE SURFACE BELOW TOP OF WALL.

*** REDUCTION NOT APPLICABLE DUE TO STABILITY NUMBER GREATER THAN 2.5.

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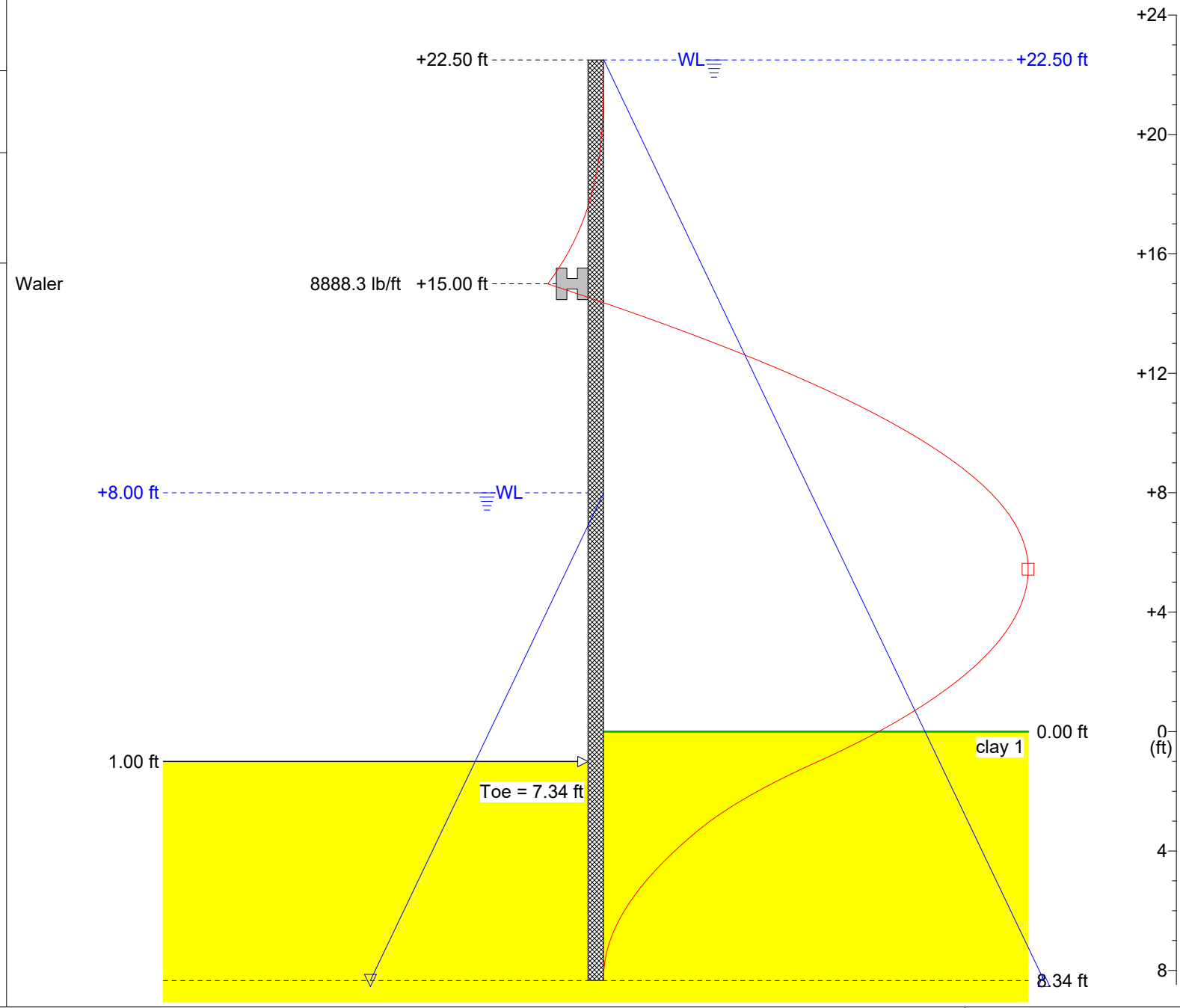
Designer: Stage 2
Ref: 1.3
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	33423.8 ftlb/ft	-5.44
△	1927.4 psf	8.34
△	1021.2 psf	8.34

Stage 2 - Tip and Moment only



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Title: Colorado River Flood Gate - West Side
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Ref: 1.3
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Works: Temporary
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Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = +8.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	7.34	30.84

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	8888.3

Maxima

	Maximum	Depth (ft)
Pressure	1052.0 psf	1.00
Bending Moment	33423.8 ftlb/ft	-5.44
Shear Force	7122.5 lb/ft	-15.00

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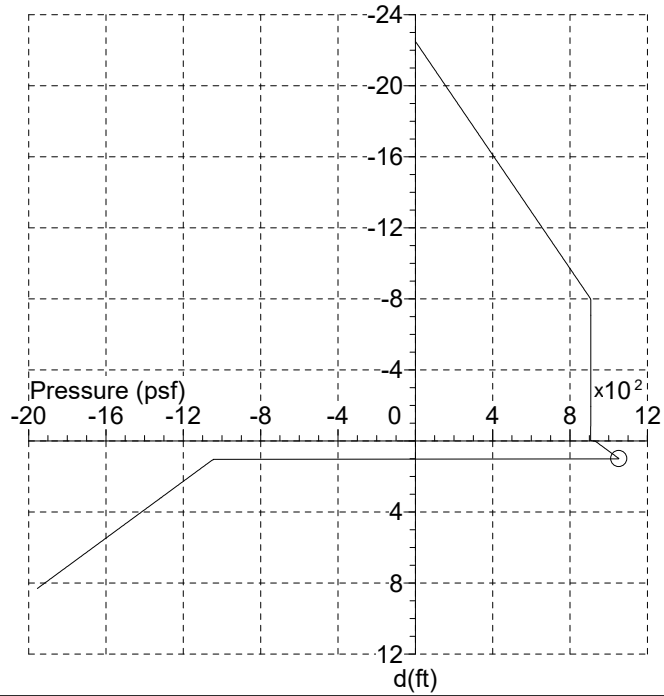
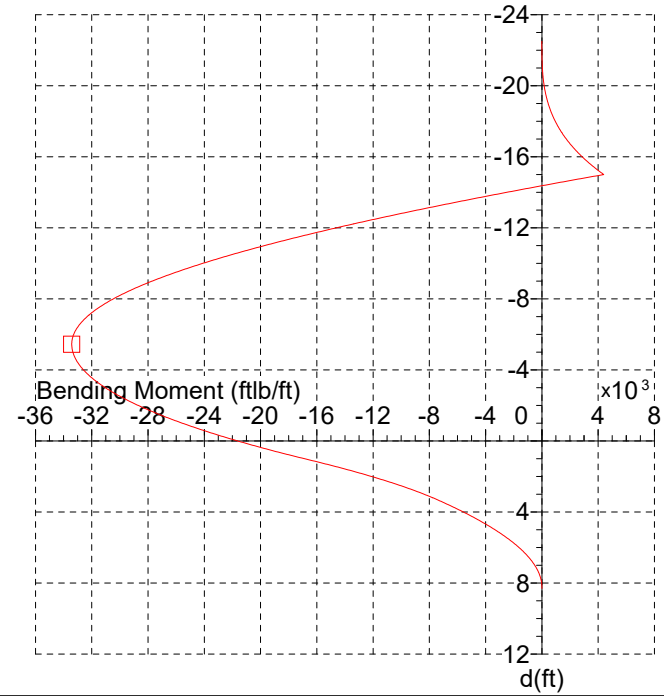
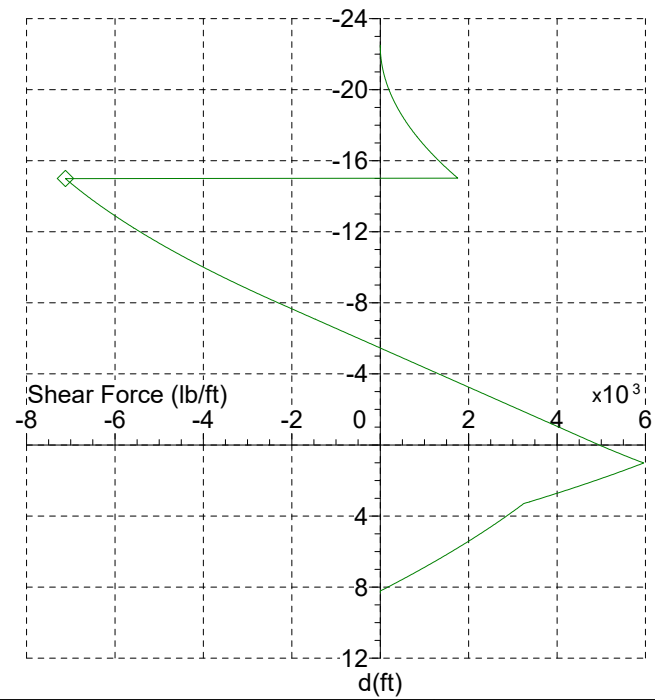
Toe: Free Earth Support

	Maximum	d (ft)
○	1052.0 psf	1.00
□	33423.8 ftlb/ft	-5.44
◇	7122.5 lb/ft	-15.00

Stage 2 - Tip and Moment only







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Stage 2 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	930.0	-21593.5		4963.2	2.80	-1267.3	-8996.5		3879.4	5.60	-1617.7	-2223.8		1871.9
0.06	936.4	-21369.6		5011.3	2.86	-1273.7	-8822.7		3814.0	5.66	-1624.1	-2139.9		1838.3
0.12	946.0	-21029.7		5084.0	2.92	-1283.4	-8567.5		3715.3	5.72	-1633.7	-2017.0		1787.7
0.18	952.5	-20800.4		5132.8	2.98	-1289.8	-8401.0		3649.1	5.78	-1640.2	-1936.9		1753.8
0.24	958.9	-20568.9		5182.0	3.04	-1296.2	-8237.6		3582.5	5.84	-1646.6	-1858.4		1719.8
0.30	968.5	-20217.4		5256.5	3.10	-1305.9	-7998.0		3482.1	5.90	-1653.0	-1781.3		1685.6
0.36	974.9	-19980.3		5306.5	3.16	-1312.3	-7842.1		3414.7	5.96	-1662.7	-1668.7		1634.1
0.42	981.3	-19740.9		5356.9	3.22	-1318.7	-7689.1		3347.0	6.02	-1669.1	-1595.6		1599.6
0.48	991.0	-19377.6		5433.0	3.28	-1325.2	-7539.3		3279.0	6.08	-1675.5	-1524.0		1564.9
0.54	997.4	-19132.6		5484.2	3.34	-1334.8	-7319.8		3217.4	6.14	-1685.2	-1419.5		1512.7
0.60	1003.8	-18885.2		5535.7	3.40	-1341.2	-7175.3		3189.6	6.19	-1691.6	-1351.8		1477.8
0.66	1013.5	-18509.8		5613.6	3.45	-1347.7	-7032.1		3161.8	6.25	-1698.0	-1285.7		1442.7
0.71	1019.9	-18256.6		5665.9	3.51	-1357.3	-6819.6		3119.8	6.31	-1707.7	-1189.5		1389.8
0.77	1026.3	-18001.0		5718.6	3.57	-1363.7	-6679.6		3091.6	6.37	-1714.1	-1127.4		1354.3
0.83	1032.7	-17743.1		5771.6	3.63	-1370.2	-6540.7		3063.3	6.43	-1720.5	-1066.9		1318.8
0.89	1042.3	-17351.7		5851.7	3.69	-1379.8	-6334.9		3020.5	6.49	-1730.2	-979.0		1265.2
0.95	1048.8	-17087.8		5905.5	3.75	-1386.2	-6199.3		2991.9	6.55	-1736.6	-922.5		1229.3
1.01	1052.0	-16821.4		5959.6	3.81	-1392.7	-6065.0		2963.1	6.61	-1743.0	-867.6		1193.2
1.07	-1051.9	-16420.9		5878.8	3.87	-1402.3	-5866.0		2919.7	6.67	-1752.7	-788.3		1138.9
1.13	-1058.4	-16157.0		5824.5	3.93	-1408.7	-5734.9		2890.6	6.73	-1759.1	-737.4		1102.6
1.19	-1064.8	-15895.5		5769.9	3.99	-1415.2	-5605.2		2861.3	6.79	-1765.5	-688.2		1066.1
1.25	-1074.4	-15507.9		5687.3	4.05	-1424.8	-5413.0		2817.2	6.85	-1775.2	-617.5		1011.1
1.31	-1080.9	-15252.6		5631.8	4.11	-1431.2	-5286.6		2787.6	6.91	-1781.6	-572.4		974.2
1.37	-1087.3	-14999.8		5576.0	4.17	-1437.7	-5161.5		2757.9	6.97	-1788.0	-529.0		937.3
1.43	-1096.9	-14625.3		5491.7	4.23	-1447.3	-4976.3		2713.1	7.03	-1797.7	-467.0		881.6
1.49	-1103.4	-14378.8		5435.1	4.29	-1453.7	-4854.6		2683.0	7.09	-1804.1	-427.7		844.3
1.55	-1109.8	-14134.9		5378.1	4.35	-1460.2	-4734.2		2652.8	7.15	-1810.5	-390.1		806.9
1.61	-1119.4	-13773.8		5292.0	4.41	-1469.8	-4556.1		2607.3	7.21	-1817.0	-354.3		769.3
1.67	-1125.9	-13536.3		5234.2	4.47	-1476.2	-4439.1		2576.8	7.27	-1826.6	-303.6		712.7
1.73	-1132.3	-13301.4		5176.1	4.53	-1482.7	-4323.5		2546.2	7.33	-1833.0	-272.0		674.8
1.79	-1141.9	-12954.0		5088.3	4.59	-1489.1	-4209.3		2515.4	7.39	-1839.5	-242.0		636.8
1.85	-1148.4	-12725.6		5029.4	4.65	-1498.7	-4040.5		2469.0	7.45	-1849.1	-200.3		579.5
1.91	-1154.8	-12500.0		4970.1	4.71	-1505.2	-3929.8		2437.9	7.51	-1855.5	-174.7		541.1
1.97	-1161.2	-12277.0		4910.5	4.77	-1511.6	-3820.4		2406.6	7.56	-1862.0	-150.8		502.6
2.03	-1170.9	-11947.5		4820.5	4.82	-1521.2	-3659.0		2359.5	7.62	-1871.6	-118.1		444.6
2.08	-1177.3	-11731.3		4760.1	4.88	-1527.7	-3553.2		2327.9	7.68	-1878.1	-98.6		405.8
2.14	-1183.7	-11517.8		4699.3	4.94	-1534.1	-3448.8		2296.2	7.74	-1884.5	-80.7		366.9
2.20	-1193.4	-11202.6		4607.6	5.00	-1543.7	-3294.9		2248.4	7.80	-1894.1	-57.3		308.2
2.26	-1199.8	-10996.0		4546.0	5.06	-1550.2	-3194.1		2216.4	7.86	-1900.6	-43.9		268.9
2.32	-1206.2	-10792.1		4484.1	5.12	-1556.6	-3094.7		2184.2	7.92	-1907.0	-32.2		229.5
2.38	-1215.9	-10491.5		4390.6	5.18	-1566.2	-2948.4		2135.7	7.98	-1916.6	-18.1		170.1
2.44	-1222.3	-10294.7		4327.8	5.24	-1572.7	-2852.6		2103.2	8.04	-1923.1	-10.9		130.3
2.50	-1228.7	-10100.6		4264.7	5.30	-1579.1	-2758.3		2070.5	8.10	-1929.5	-5.4		90.4
2.56	-1238.4	-9814.9		4169.5	5.36	-1588.7	-2619.7		2021.3	8.16	-1939.1	-0.7		30.3
2.62	-1244.8	-9628.0		4105.6	5.42	-1595.2	-2529.1		1988.3	8.22	-1945.6	0.0		0.0
2.68	-1251.2	-9443.9		4041.4	5.48	-1601.6	-2440.0		1955.2	8.28	-1952.0	0.0		0.0
2.74	-1260.9	-9173.3		3944.4	5.54	-1611.2	-2309.1		1905.3	8.34	-1955.2	0.0		0.0

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Title: Colorado River Flood Gate - West Side
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Ref: 1.3
Page: 5
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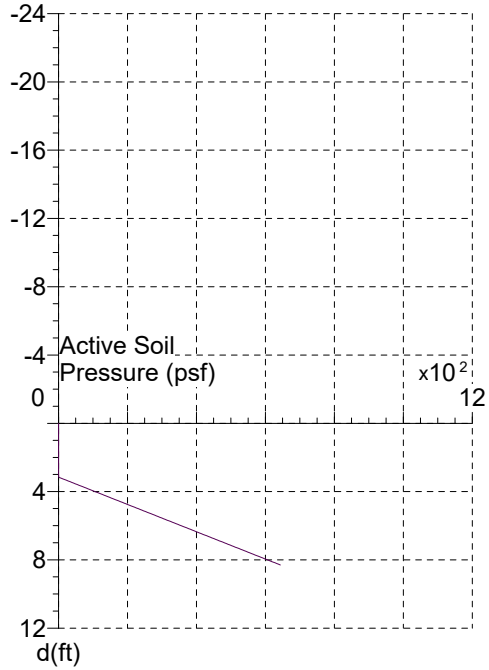
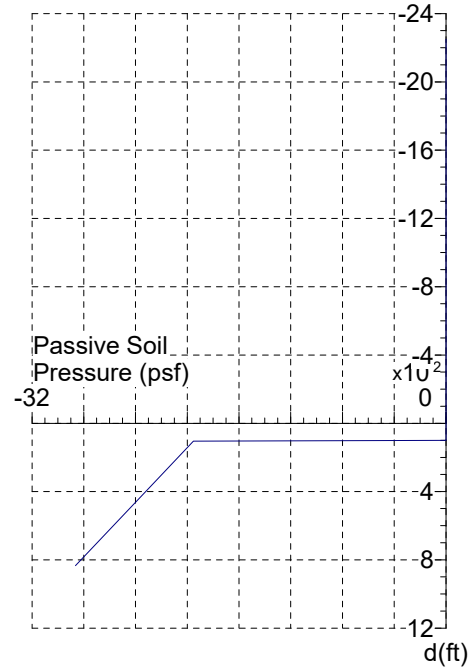
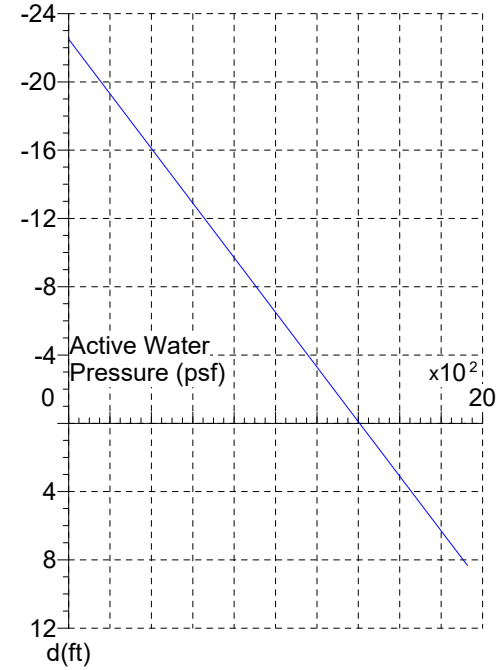
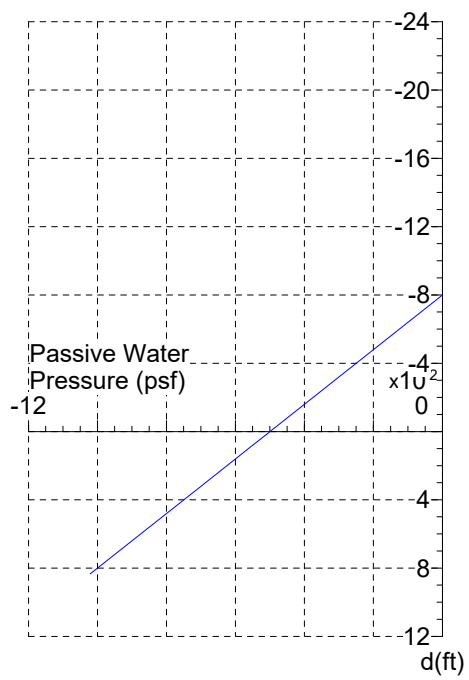
Analysis: Net Pressure
Toe: Free Earth Support

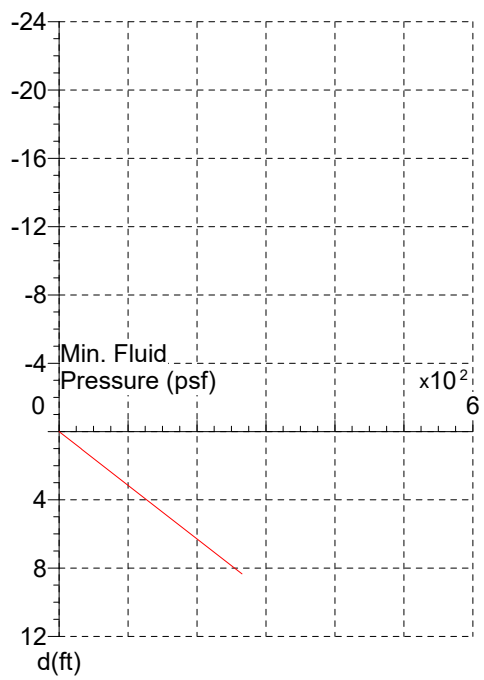
Stage 2 - Tip and Moment only

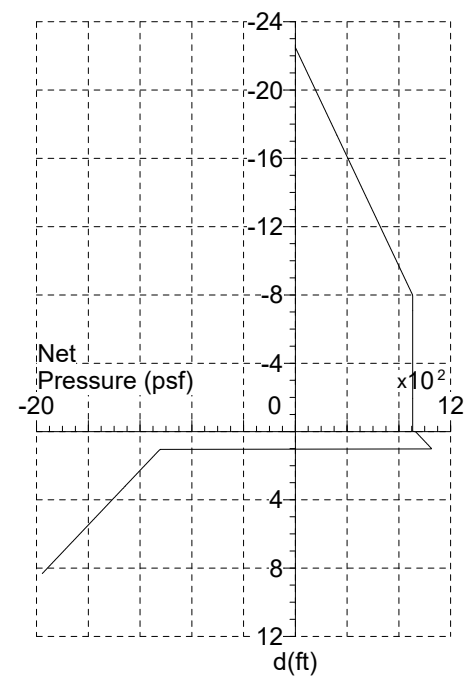












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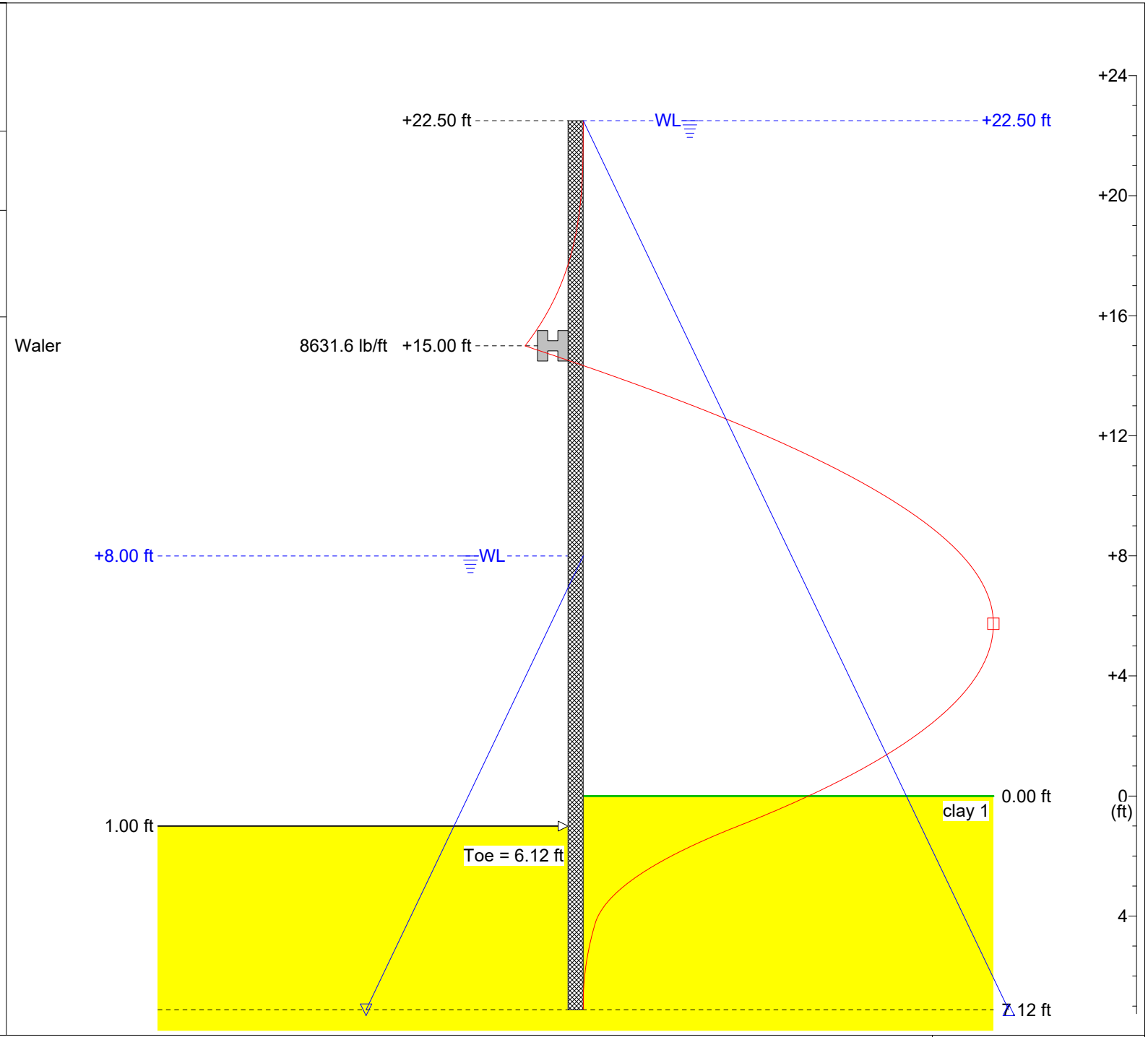
Ref: 1.0
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	31007.8 ftlb/ft	-5.74
△	1851.4 psf	7.12
△	945.1 psf	7.12

Stage 2 - Wales only



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Title: Colorado River Flood Gate - West Side
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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Wales only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = +8.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	6.12	29.62

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	8631.6

Maxima

	Maximum	Depth (ft)
Pressure	907.2 psf	-7.96
Bending Moment	31007.8 ftlb/ft	-5.74
Shear Force	6866.0 lb/ft	-15.00

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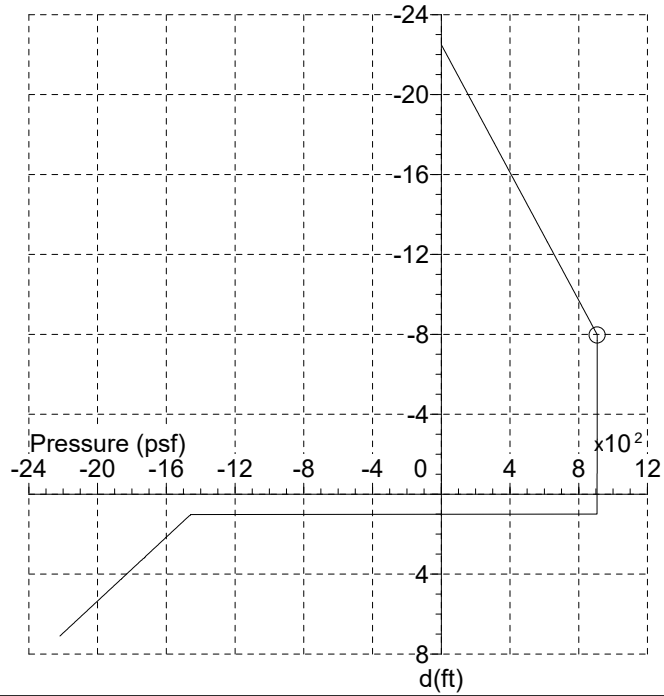
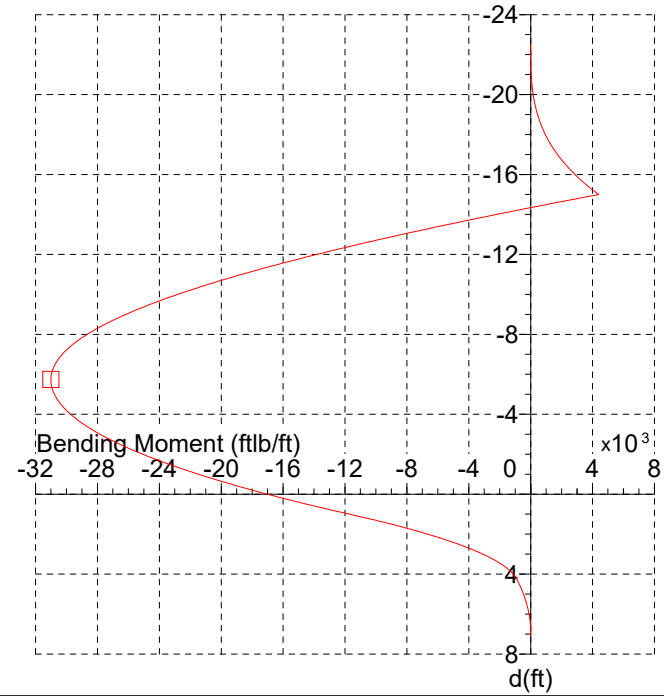
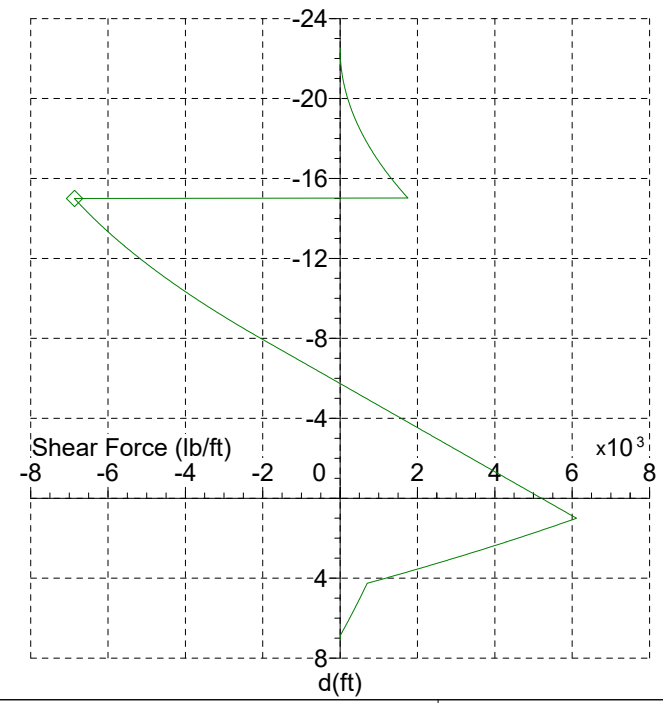
Toe: Free Earth Support

	Maximum	d (ft)
○	907.2 psf	-7.96
□	31007.8 ftlb/ft	-5.74
◇	6866.0 lb/ft	-15.00

Stage 2 - Wales only







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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 2 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	906.7	-16967.5		5216.9	2.39	-1632.0	-5026.3		3937.5	4.78	-1931.4	-569.5		563.8
0.05	906.7	-16725.0		5261.6	2.44	-1638.2	-4844.5		3856.7	4.83	-1937.6	-543.5		551.2
0.10	906.7	-16480.3		5306.4	2.49	-1644.4	-4666.6		3775.6	4.88	-1943.8	-518.1		538.7
0.15	906.7	-16233.7		5351.1	2.54	-1650.5	-4492.3		3694.2	4.93	-1950.0	-493.3		526.0
0.20	906.7	-15984.9		5395.9	2.59	-1656.7	-4321.9		3612.4	4.99	-1956.1	-469.0		513.4
0.25	906.7	-15734.1		5440.7	2.65	-1662.9	-4155.3		3530.4	5.04	-1962.3	-445.3		500.7
0.31	906.7	-15481.1		5485.4	2.70	-1669.0	-3992.5		3448.1	5.09	-1968.5	-422.3		487.9
0.36	906.7	-15226.1		5530.2	2.75	-1675.2	-3833.5		3365.5	5.14	-1974.7	-399.8		475.1
0.41	906.7	-14969.1		5575.0	2.80	-1681.4	-3678.3		3282.5	5.19	-1980.8	-377.9		462.3
0.46	906.7	-14579.6		5642.1	2.85	-1687.6	-3527.0		3199.3	5.24	-1987.0	-356.6		449.4
0.51	906.7	-14317.3		5686.9	2.90	-1693.7	-3379.5		3115.8	5.29	-1993.2	-335.9		436.5
0.56	906.7	-14053.0		5731.6	2.95	-1703.0	-3165.6		2989.9	5.34	-1999.4	-315.8		423.6
0.61	906.7	-13786.6		5776.4	3.00	-1709.2	-3027.9		2905.6	5.39	-2005.5	-296.3		410.6
0.66	906.6	-13518.1		5821.1	3.05	-1715.4	-2894.1		2820.9	5.44	-2011.7	-277.4		397.6
0.71	906.6	-13247.5		5865.9	3.10	-1721.5	-2764.2		2736.0	5.49	-2021.0	-250.2		377.9
0.76	906.6	-12974.9		5910.7	3.15	-1727.7	-2638.3		2650.9	5.55	-2027.1	-232.8		364.8
0.81	906.6	-12700.1		5955.4	3.20	-1733.9	-2516.3		2565.4	5.60	-2033.3	-216.0		351.7
0.86	906.6	-12423.3		6000.2	3.26	-1740.1	-2398.3		2479.6	5.65	-2039.5	-199.9		338.4
0.92	906.6	-12144.5		6044.9	3.31	-1746.2	-2284.2		2393.5	5.70	-2045.7	-184.3		325.2
0.97	906.6	-11863.5		6089.7	3.36	-1752.4	-2174.2		2307.1	5.75	-2051.8	-169.4		311.9
1.02	-1459.1	-11580.5		6076.1	3.41	-1758.6	-2068.2		2220.3	5.80	-2058.0	-155.1		298.6
1.07	-1465.3	-11299.5		6003.9	3.46	-1764.7	-1966.2		2133.3	5.85	-2064.2	-141.4		285.2
1.12	-1471.5	-11021.8		5931.3	3.51	-1770.9	-1868.2		2045.9	5.90	-2070.4	-128.3		271.8
1.17	-1477.7	-10747.5		5858.4	3.56	-1777.1	-1774.3		1958.3	5.95	-2076.5	-115.8		258.4
1.22	-1483.8	-10476.5		5785.3	3.61	-1783.3	-1684.5		1870.3	6.00	-2082.7	-104.0		244.9
1.27	-1493.1	-10076.5		5674.9	3.66	-1789.4	-1598.8		1782.0	6.05	-2088.9	-92.8		231.4
1.32	-1499.3	-9814.1		5601.0	3.71	-1795.6	-1517.1		1693.5	6.10	-2095.1	-82.2		217.8
1.37	-1505.4	-9555.1		5526.7	3.76	-1801.8	-1439.6		1604.6	6.16	-2101.2	-72.3		204.2
1.42	-1511.6	-9299.6		5452.2	3.82	-1811.1	-1331.0		1470.7	6.21	-2107.4	-63.0		190.5
1.48	-1517.8	-9047.5		5377.3	3.87	-1817.2	-1263.8		1381.1	6.26	-2113.6	-54.3		176.8
1.53	-1524.0	-8799.0		5302.1	3.92	-1823.4	-1200.8		1291.1	6.31	-2122.8	-42.5		156.2
1.58	-1530.1	-8553.9		5226.7	3.97	-1829.6	-1142.0		1200.9	6.36	-2129.0	-35.4		142.5
1.63	-1536.3	-8312.3		5150.9	4.02	-1835.7	-1087.3		1110.3	6.41	-2135.2	-28.9		128.6
1.68	-1542.5	-8074.2		5074.8	4.07	-1841.9	-1036.8		1019.4	6.46	-2141.4	-23.1		114.8
1.73	-1548.7	-7839.6		4998.5	4.12	-1848.1	-990.6		928.3	6.51	-2147.5	-18.0		100.9
1.78	-1554.8	-7608.7		4921.8	4.17	-1854.3	-948.6		836.8	6.56	-2153.7	-13.4		86.9
1.83	-1561.0	-7381.2		4844.8	4.22	-1860.4	-910.8		745.1	6.61	-2159.9	-9.6		72.9
1.88	-1567.2	-7157.4		4767.5	4.27	-1866.6	-877.3		693.1	6.66	-2166.1	-6.4		58.9
1.93	-1573.3	-6937.1		4689.9	4.32	-1872.8	-845.3		681.0	6.72	-2172.2	-3.8		44.8
1.98	-1579.5	-6720.4		4612.0	4.37	-1879.0	-813.9		668.8	6.77	-2178.4	-1.9		30.7
2.03	-1585.7	-6507.4		4533.8	4.43	-1885.1	-783.0		656.6	6.82	-2184.6	-0.6		16.6
2.09	-1591.9	-6298.0		4455.3	4.48	-1891.3	-752.7		644.4	6.87	-2190.8	0.0		0.0
2.14	-1601.1	-5990.7		4336.9	4.53	-1897.5	-722.9		632.1	6.92	-2196.9	0.0		0.0
2.19	-1607.3	-5790.4		4257.6	4.58	-1903.7	-693.7		619.8	6.97	-2203.1	0.0		0.0
2.24	-1613.5	-5593.8		4178.1	4.63	-1912.9	-651.0		601.2	7.02	-2209.3	0.0		0.0
2.29	-1619.7	-5400.9		4098.2	4.68	-1919.1	-623.3		588.8	7.07	-2215.5	0.0		0.0
2.34	-1625.8	-5211.7		4018.0	4.73	-1925.3	-596.1		576.3	7.12	-2218.5	0.0		0.0

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Designer: Stage 2
Ref: 1.0
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Works: Temporary
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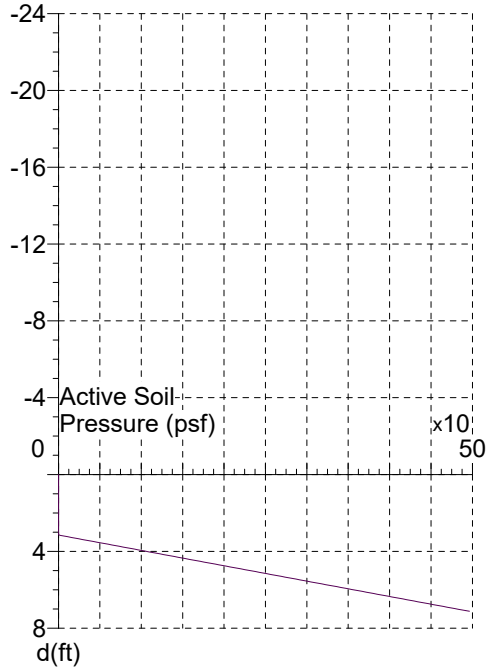
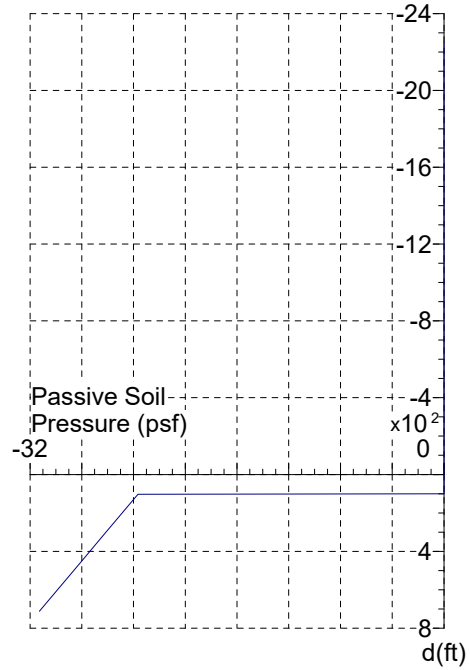
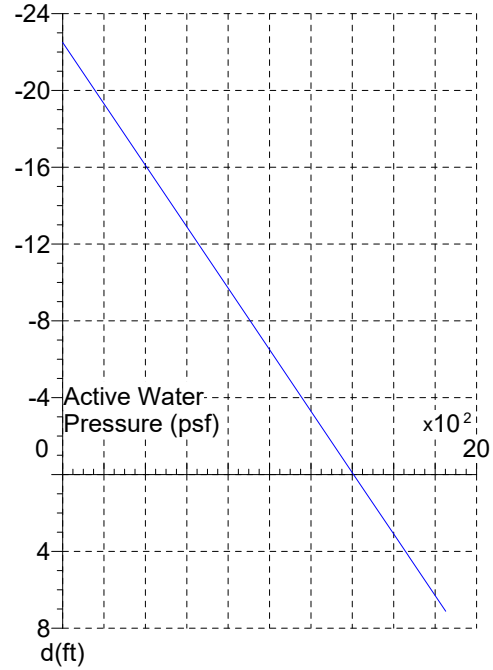
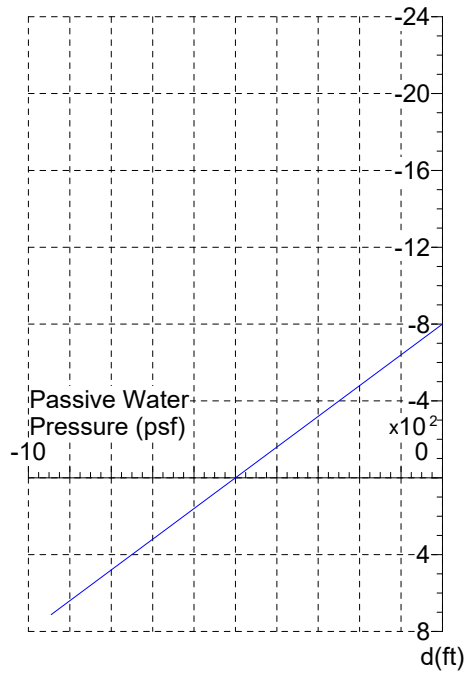
Analysis: Net Pressure
Toe: Free Earth Support

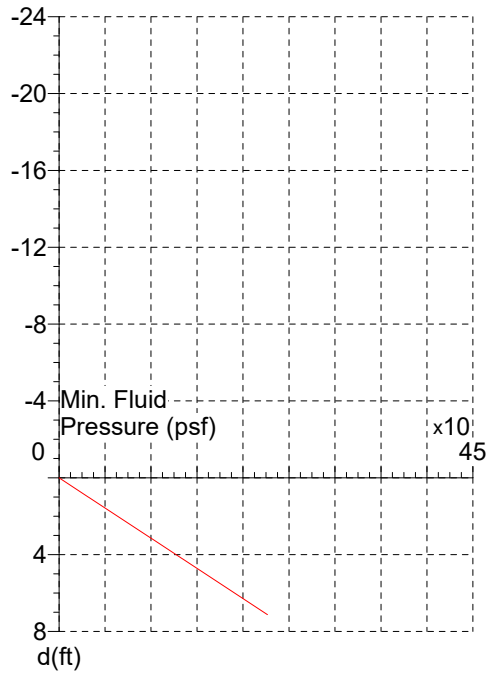
Stage 2 - Wales only

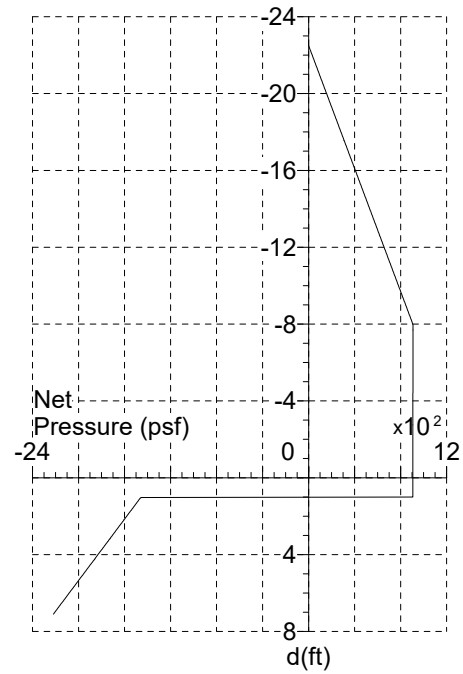












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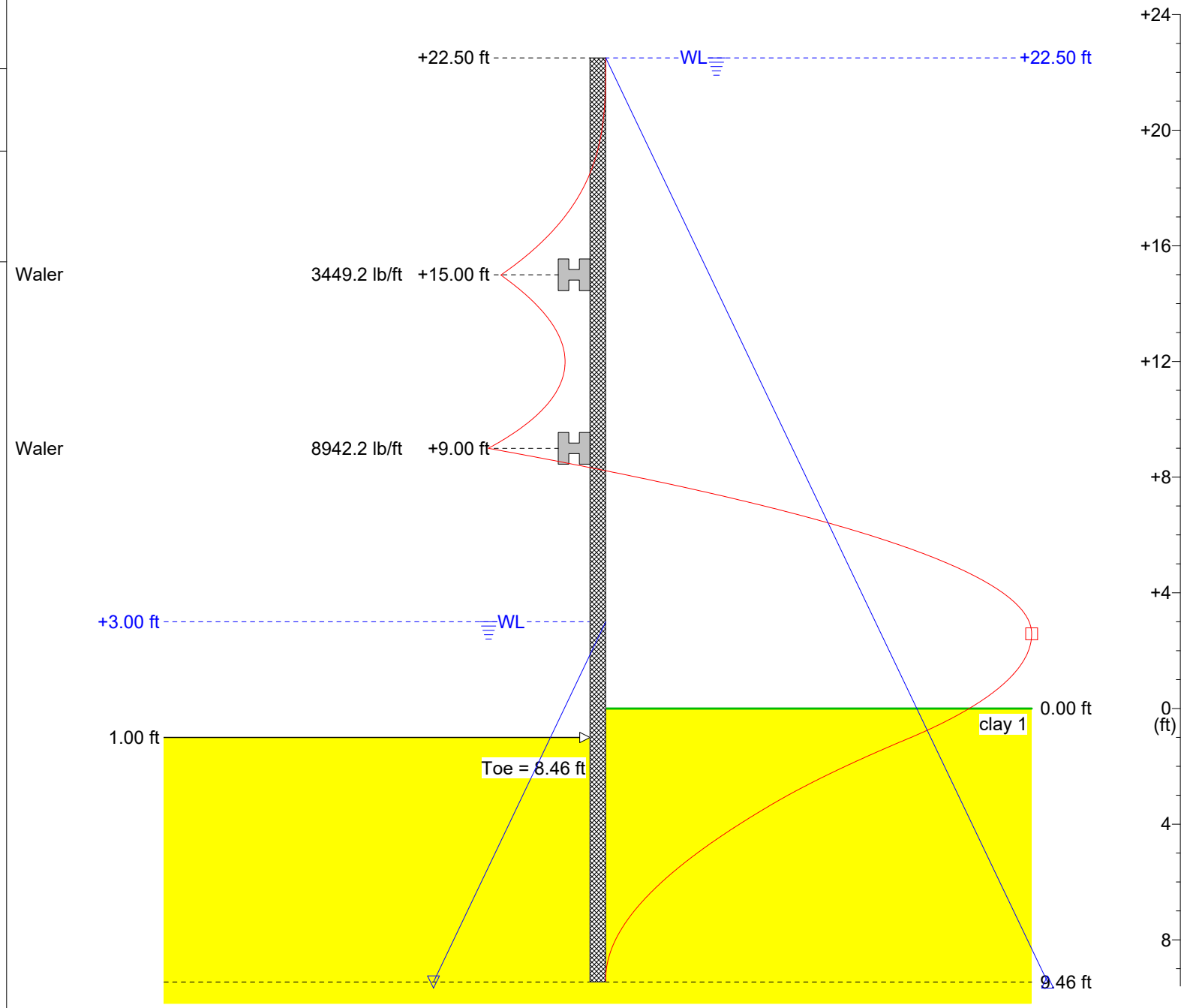
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	17913.5 ftlb/ft	-2.58
△	1997.3 psf	9.46
△	778.6 psf	9.46

Stage 3 - Tip and Moment only



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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Tip and Moment only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = +3.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	8.46	31.96

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3449.2
+9.00	Waler	8942.2

Maxima

	Maximum	Depth (ft)
Pressure	1364.7 psf	1.00
Bending Moment	17913.5 ftlb/ft	-2.58
Shear Force	6683.2 lb/ft	-9.00

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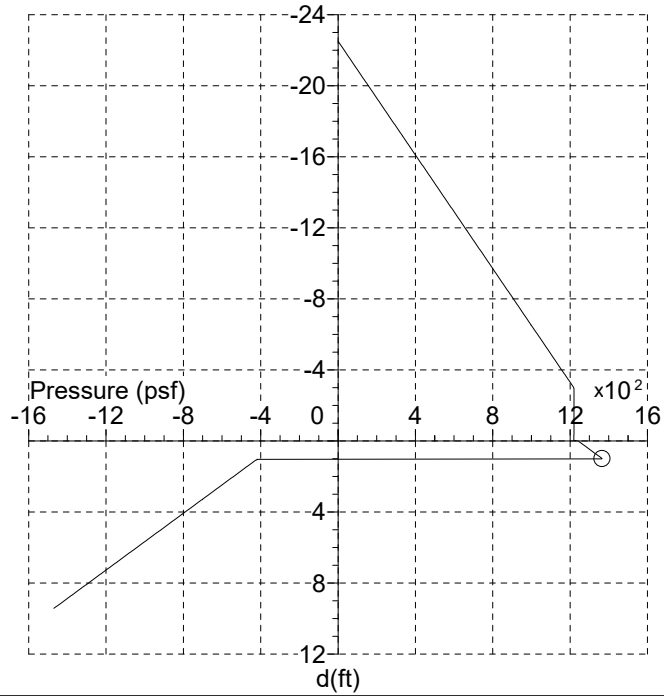
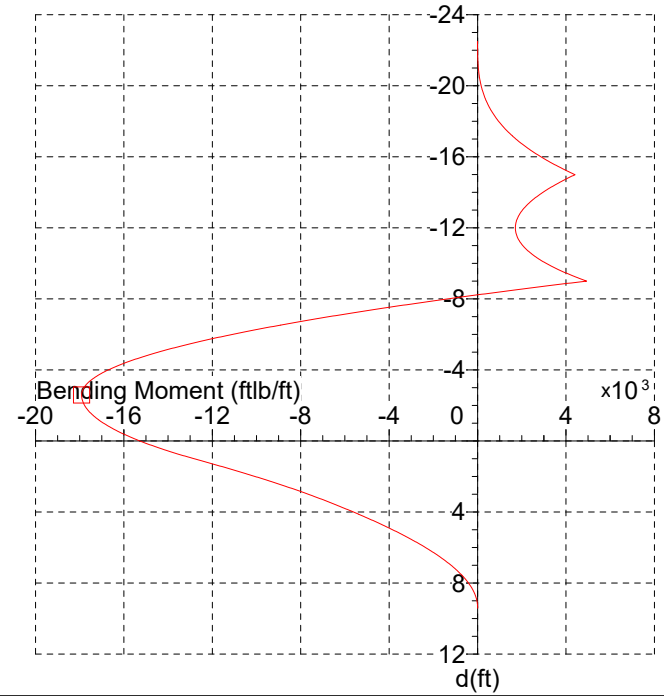
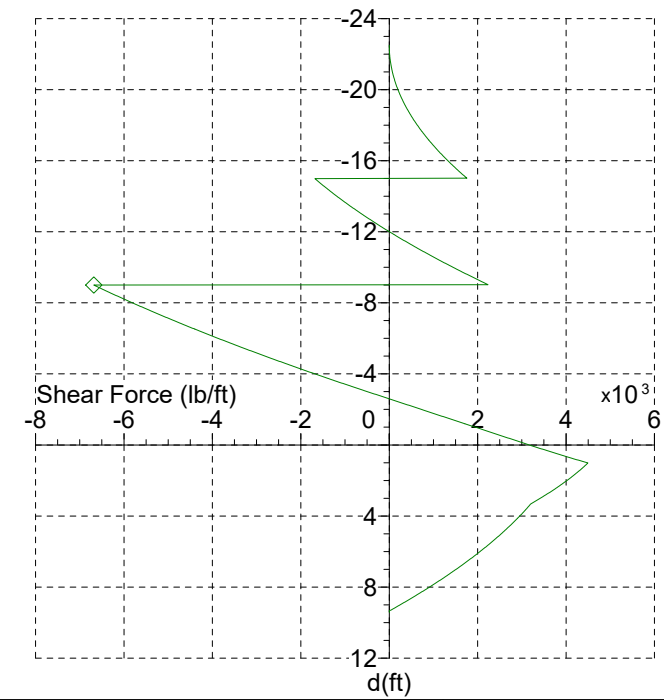
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	1364.7 psf	1.00
□	17913.5 ftlb/ft	-2.58
◇	6683.2 lb/ft	-9.00

Stage 3 - Tip and Moment only







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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1241.7	-15280.0		3171.7	3.17	-690.2	-7234.3		3281.3	6.35	-1086.7	-1894.4		1861.7
0.07	1251.6	-15114.7		3271.5	3.24	-696.9	-7121.8		3244.3	6.42	-1093.4	-1830.6		1833.2
0.14	1258.3	-15001.7		3338.4	3.31	-706.9	-6955.5		3197.7	6.49	-1103.3	-1736.8		1790.2
0.20	1268.3	-14827.8		3439.5	3.38	-713.5	-6845.7		3179.2	6.55	-1110.0	-1675.5		1761.3
0.27	1278.2	-14648.7		3541.3	3.45	-723.5	-6682.2		3151.0	6.62	-1120.0	-1585.5		1717.6
0.34	1284.9	-14526.3		3609.7	3.51	-730.2	-6574.1		3132.0	6.69	-1126.7	-1526.7		1688.2
0.41	1294.9	-14338.4		3712.9	3.58	-740.2	-6413.0		3103.1	6.76	-1136.7	-1440.4		1643.9
0.47	1301.5	-14210.2		3782.1	3.65	-746.9	-6306.5		3083.7	6.82	-1146.7	-1356.4		1599.1
0.54	1311.5	-14013.3		3886.6	3.72	-756.9	-6148.0		3054.2	6.89	-1153.3	-1301.6		1569.1
0.61	1318.2	-13879.1		3956.7	3.78	-763.5	-6043.2		3034.3	6.96	-1163.3	-1221.5		1523.7
0.68	1328.1	-13673.2		4062.6	3.85	-773.5	-5887.2		3004.2	7.03	-1170.0	-1169.4		1493.2
0.74	1334.8	-13533.0		4133.6	3.92	-780.2	-5784.1		2983.9	7.09	-1180.0	-1093.2		1447.2
0.81	1344.8	-13318.0		4240.7	3.99	-790.2	-5630.7		2953.1	7.16	-1186.6	-1043.7		1416.2
0.88	1351.4	-13171.5		4312.6	4.05	-800.2	-5479.0		2921.9	7.23	-1196.6	-971.4		1369.5
0.95	1361.4	-12947.3		4421.1	4.12	-806.8	-5378.7		2900.9	7.30	-1203.3	-924.6		1338.2
1.01	1364.7	-12794.7		4493.8	4.19	-816.8	-5229.7		2869.1	7.36	-1213.3	-856.4		1290.8
1.08	-427.0	-12563.5		4460.1	4.26	-823.5	-5131.2		2847.6	7.43	-1220.0	-812.3		1259.1
1.15	-433.7	-12410.4		4437.1	4.32	-833.5	-4984.9		2815.2	7.50	-1230.0	-748.2		1211.1
1.22	-443.7	-12182.1		4401.9	4.39	-840.1	-4888.3		2793.3	7.57	-1236.6	-706.9		1178.8
1.28	-453.7	-11955.7		4365.9	4.46	-850.1	-4744.8		2760.1	7.63	-1246.6	-646.9		1130.2
1.35	-460.3	-11805.9		4341.5	4.53	-856.8	-4650.1		2737.8	7.70	-1256.6	-589.5		1081.1
1.42	-470.3	-11582.6		4304.2	4.59	-866.8	-4509.5		2704.0	7.77	-1263.3	-552.6		1048.2
1.49	-477.0	-11434.8		4278.8	4.66	-873.5	-4416.8		2681.3	7.84	-1273.3	-499.4		998.5
1.55	-487.0	-11214.9		4240.2	4.73	-883.5	-4279.1		2646.9	7.90	-1279.9	-465.3		965.2
1.62	-493.7	-11069.3		4214.0	4.80	-890.1	-4188.3		2623.7	7.97	-1289.9	-416.4		914.8
1.69	-503.6	-10852.7		4174.0	4.86	-900.1	-4053.6		2588.6	8.04	-1296.6	-385.3		881.1
1.76	-510.3	-10709.4		4146.9	4.93	-910.1	-3920.7		2553.1	8.11	-1306.6	-340.7		830.1
1.82	-520.3	-10496.3		4105.6	5.00	-916.8	-3833.1		2529.2	8.17	-1313.2	-312.5		795.8
1.89	-527.0	-10355.3		4077.6	5.07	-926.8	-3703.3		2493.1	8.24	-1323.2	-272.3		744.2
1.96	-537.0	-10145.8		4035.0	5.13	-933.4	-3617.8		2468.8	8.31	-1329.9	-247.0		709.5
2.03	-543.6	-10007.3		4006.1	5.20	-943.4	-3491.1		2432.0	8.38	-1339.9	-211.3		657.2
2.09	-553.6	-9801.5		3962.2	5.27	-950.1	-3407.7		2407.2	8.44	-1346.6	-189.0		622.1
2.16	-563.6	-9597.9		3917.4	5.34	-960.1	-3284.2		2369.8	8.51	-1356.6	-157.8		569.2
2.23	-570.3	-9463.5		3887.1	5.40	-966.8	-3203.0		2344.6	8.58	-1366.6	-129.4		515.8
2.30	-580.3	-9263.8		3841.0	5.47	-976.7	-3082.7		2306.5	8.65	-1373.2	-112.0		480.1
2.36	-586.9	-9132.0		3809.9	5.54	-983.4	-3003.6		2280.9	8.71	-1383.2	-88.2		426.1
2.43	-596.9	-8936.4		3762.4	5.61	-993.4	-2886.7		2242.2	8.78	-1389.9	-73.8		389.8
2.50	-603.6	-8807.3		3730.4	5.67	-1000.1	-2809.8		2216.1	8.85	-1399.9	-54.7		335.2
2.57	-613.6	-8615.8		3681.6	5.74	-1010.1	-2696.2		2176.7	8.92	-1406.5	-43.4		298.5
2.63	-620.3	-8489.5		3648.7	5.81	-1020.1	-2584.6		2136.9	8.98	-1416.5	-29.0		243.2
2.70	-630.3	-8302.2		3598.6	5.88	-1026.7	-2511.4		2110.2	9.05	-1423.2	-21.0		206.2
2.77	-636.9	-8178.7		3564.8	5.94	-1036.7	-2403.3		2069.8	9.12	-1433.2	-11.3		150.2
2.84	-646.9	-7995.8		3513.3	6.01	-1043.4	-2332.3		2042.6	9.19	-1439.8	-6.4		112.7
2.90	-653.6	-7875.3		3478.6	6.08	-1053.4	-2227.7		2001.5	9.25	-1449.8	-1.6		56.1
2.97	-663.6	-7696.8		3425.9	6.15	-1060.0	-2159.1		1973.9	9.32	-1456.5	0.0		0.0
3.04	-673.6	-7521.0		3372.3	6.21	-1070.0	-2058.1		1932.1	9.39	-1466.5	0.0		0.0
3.11	-680.2	-7405.4		3336.2	6.28	-1076.7	-1991.9		1904.1	9.46	-1469.8	0.0		0.0

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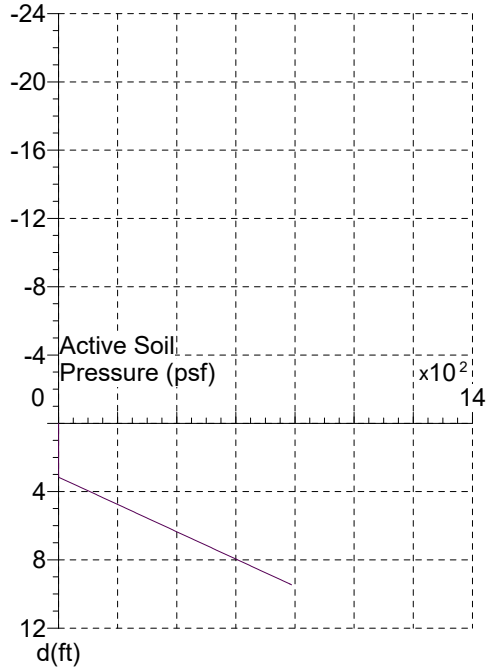
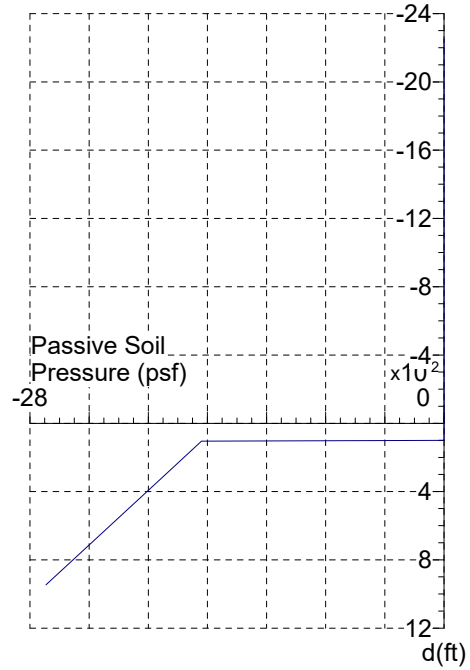
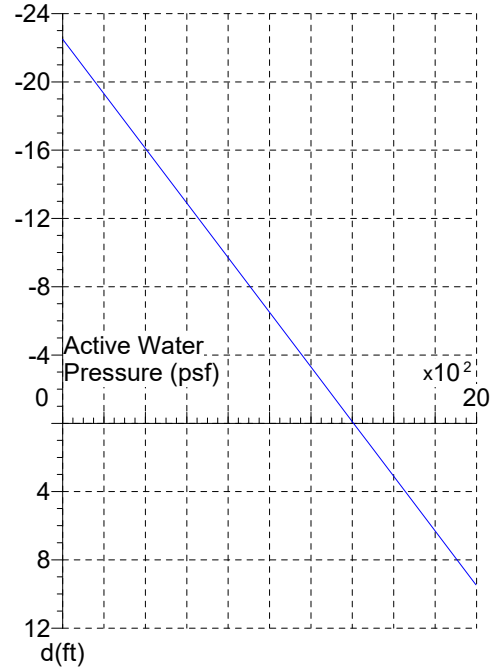
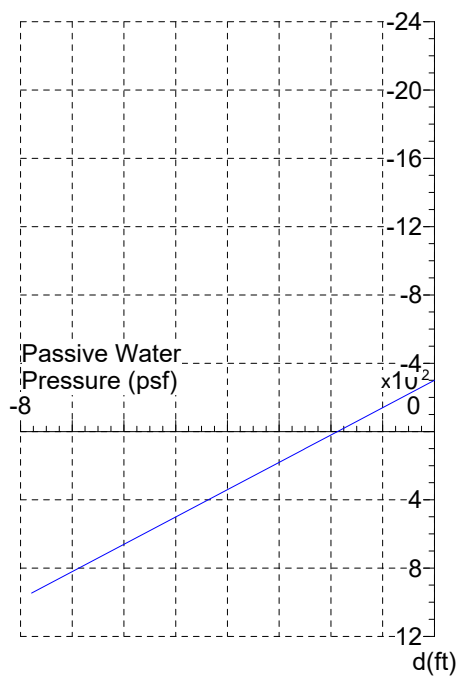
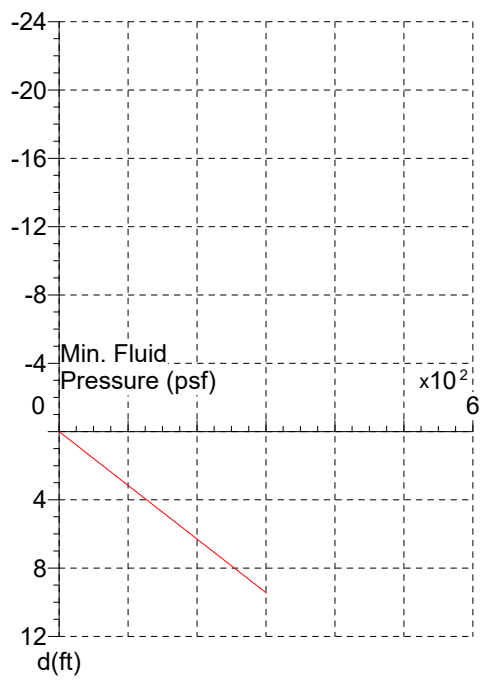
Stage 3 - Tip and Moment only

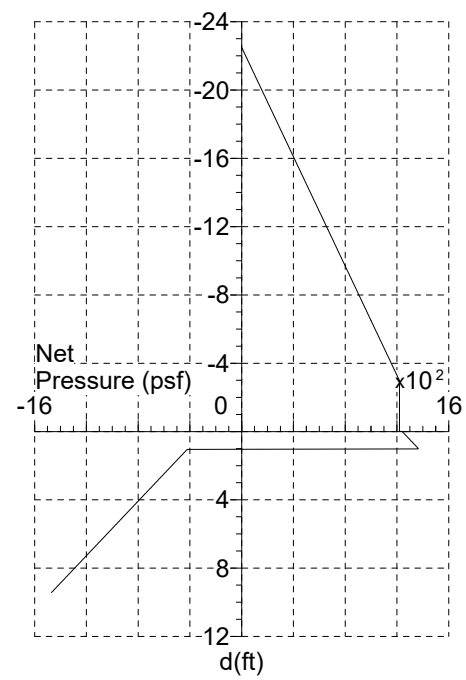












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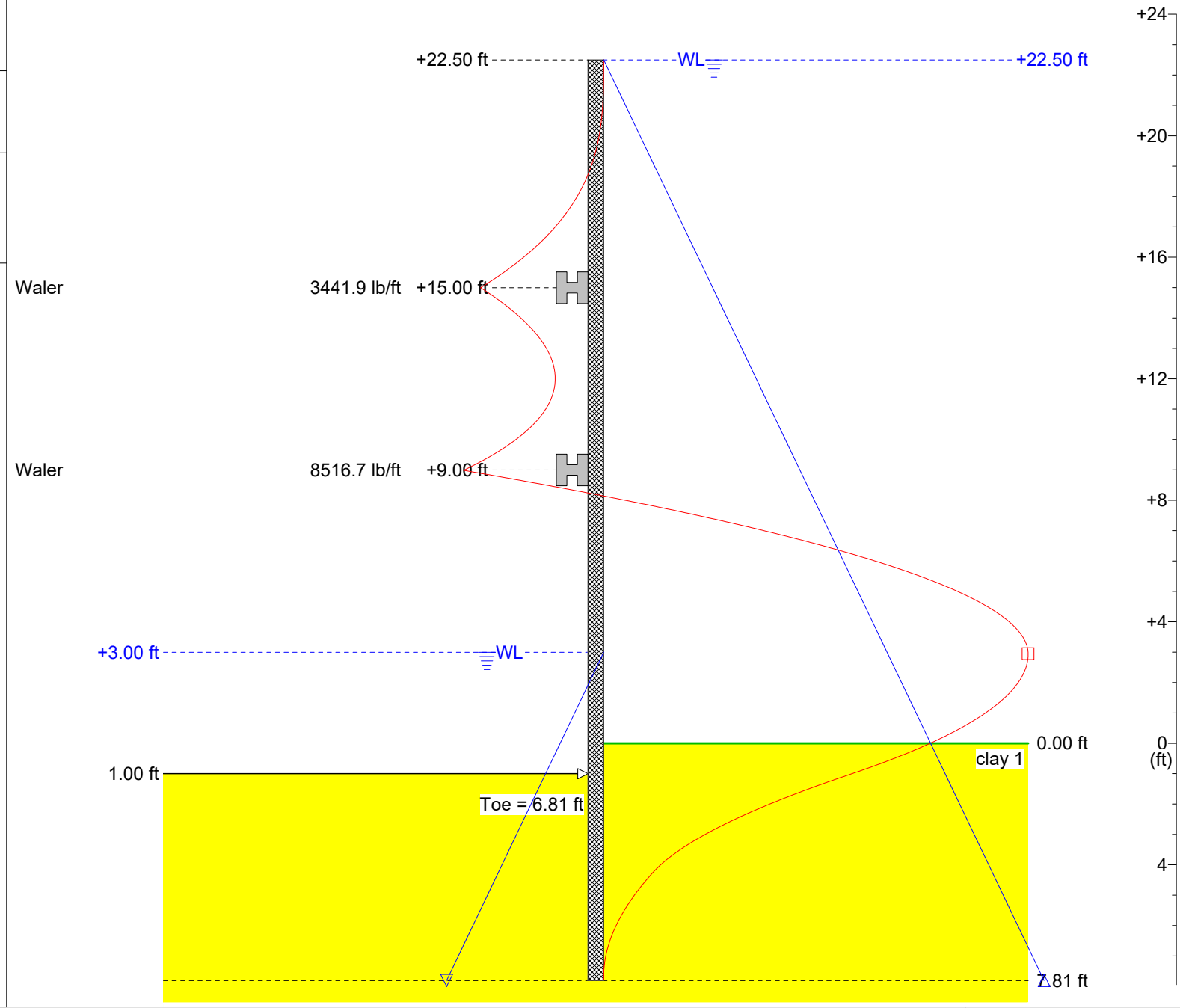
	Maximum	d (ft)
□	15168.0 ftlb/ft	-2.95
△	1894.4 psf	7.81
△	675.6 psf	7.81

Stage 3 - Wales only



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Stage 3 - Wales only

Input Data

Depth Of Excavation = 1.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = +3.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	6.81	30.31

Pressure Model: Coulomb; Assume full hydrostatic pressure to 1.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3441.9
+9.00	Waler	8516.7

Maxima

	Maximum	Depth (ft)
Pressure	1220.3 psf	-2.95
Bending Moment	15168.0 ftlb/ft	-2.95
Shear Force	6241.5 lb/ft	-9.00

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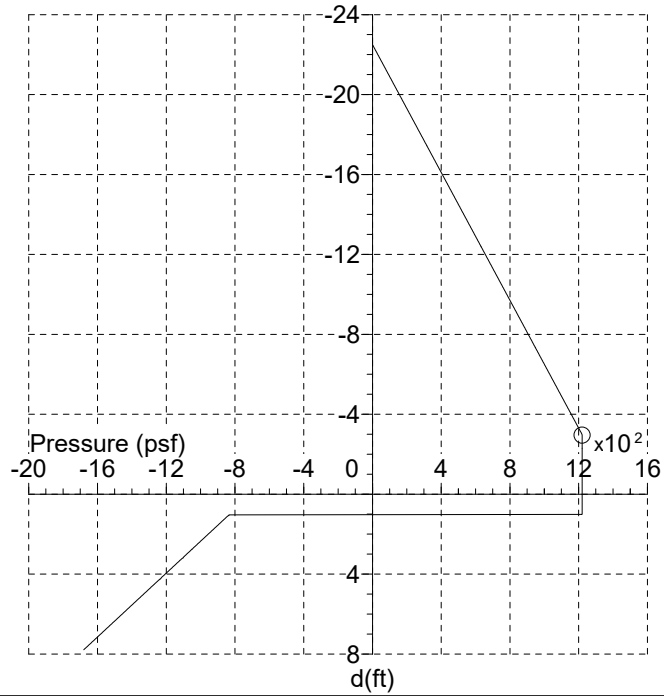
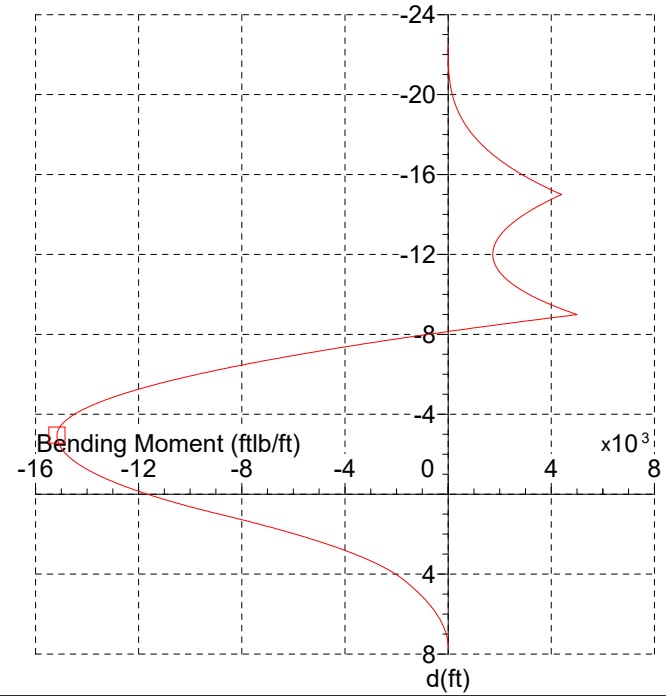
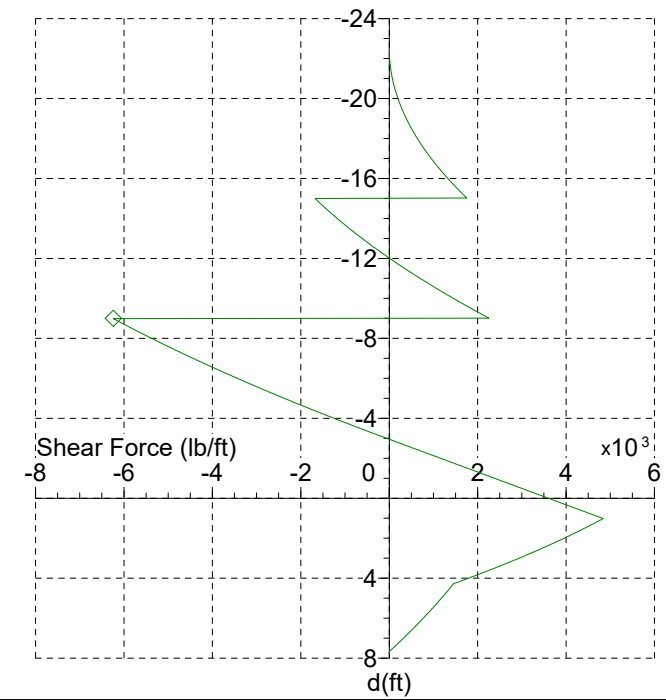
Toe: Free Earth Support

	Maximum	d (ft)
○	1220.3 psf	-2.95
□	15168.0 ftlb/ft	-2.95
◇	6241.5 lb/ft	-9.00

Stage 3 - Wales only







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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 3 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1219.9	-11654.5		3606.0	2.62	-1034.7	-4397.5		3326.9	5.24	-1363.4	-903.8		1078.9
0.06	1219.9	-11471.2		3698.4	2.68	-1041.0	-4286.2		3274.4	5.30	-1369.7	-867.8		1058.5
0.11	1219.9	-11346.5		3760.1	2.73	-1050.5	-4122.5		3195.0	5.36	-1376.0	-832.4		1038.0
0.17	1219.8	-11219.7		3821.7	2.79	-1056.8	-4015.6		3141.7	5.41	-1385.5	-780.6		1007.2
0.22	1219.8	-11090.8		3883.3	2.85	-1063.1	-3910.5		3088.1	5.47	-1391.8	-746.9		986.5
0.28	1219.8	-10959.8		3944.9	2.90	-1069.4	-3807.2		3034.2	5.52	-1398.2	-714.0		965.7
0.33	1219.8	-10759.5		4037.4	2.96	-1075.7	-3705.8		2979.9	5.58	-1404.5	-681.7		944.8
0.39	1219.8	-10623.3		4099.0	3.01	-1085.2	-3557.0		2897.9	5.63	-1410.8	-650.1		923.8
0.45	1219.8	-10485.1		4160.6	3.07	-1091.5	-3460.1		2842.8	5.69	-1420.3	-604.1		892.1
0.50	1219.8	-10344.8		4222.2	3.12	-1096.8	-3365.1		2787.5	5.75	-1426.6	-574.3		870.9
0.56	1219.8	-10202.5		4283.8	3.18	-1101.0	-3271.9		2731.9	5.80	-1432.9	-545.3		849.6
0.61	1219.8	-9985.1		4376.3	3.24	-1110.5	-3180.6		2675.8	5.86	-1439.2	-516.9		828.2
0.67	1219.8	-9837.5		4437.9	3.29	-1120.0	-3047.2		2591.2	5.91	-1445.6	-489.3		806.7
0.73	1219.8	-9687.9		4499.5	3.35	-1126.3	-2960.6		2534.4	5.97	-1455.1	-449.2		774.3
0.78	1219.8	-9536.3		4561.1	3.40	-1132.6	-2876.0		2477.3	6.02	-1461.4	-423.3		752.6
0.84	1219.7	-9382.5		4622.7	3.46	-1139.0	-2793.2		2419.8	6.08	-1467.7	-398.2		730.7
0.89	1219.7	-9148.1		4715.2	3.51	-1145.3	-2712.4		2362.1	6.14	-1474.0	-373.9		708.8
0.95	1219.7	-8989.1		4776.8	3.57	-1154.8	-2594.9		2274.8	6.19	-1480.3	-350.2		686.8
1.00	1219.7	-8828.2		4838.4	3.63	-1161.1	-2518.9		2216.2	6.25	-1489.8	-316.2		653.6
1.06	-835.5	-8666.0		4796.2	3.68	-1167.4	-2445.0		2157.3	6.30	-1496.1	-294.4		631.3
1.12	-845.0	-8505.2		4753.6	3.74	-1173.7	-2373.0		2098.1	6.36	-1502.5	-273.4		609.0
1.17	-854.5	-8266.8		4689.1	3.79	-1180.1	-2303.0		2038.6	6.42	-1508.8	-253.1		586.5
1.23	-860.8	-8109.6		4645.7	3.85	-1189.5	-2201.8		1948.7	6.47	-1515.1	-233.6		564.0
1.28	-867.1	-7953.9		4601.9	3.90	-1195.9	-2136.9		1888.4	6.53	-1524.6	-205.8		530.0
1.34	-873.4	-7799.7		4557.9	3.96	-1202.2	-2073.9		1827.7	6.58	-1530.9	-188.2		507.3
1.39	-882.9	-7571.2		4491.2	4.02	-1208.5	-2013.1		1766.7	6.64	-1537.2	-171.3		484.4
1.45	-889.2	-7420.7		4446.4	4.07	-1218.0	-1925.6		1674.7	6.69	-1543.6	-155.2		461.4
1.51	-895.6	-7271.7		4401.2	4.13	-1224.3	-1869.8		1612.9	6.75	-1553.0	-132.6		426.8
1.56	-901.9	-7124.2		4355.8	4.18	-1230.6	-1816.2		1550.8	6.81	-1559.4	-118.4		403.6
1.62	-908.2	-6978.3		4310.0	4.24	-1237.0	-1764.6		1488.5	6.86	-1565.7	-105.0		380.3
1.67	-917.7	-6762.3		4240.7	4.30	-1243.3	-1715.1		1448.0	6.92	-1572.0	-92.5		357.0
1.73	-924.0	-6620.2		4194.1	4.35	-1252.8	-1642.6		1420.1	6.97	-1578.3	-80.7		333.5
1.79	-930.3	-6479.7		4147.1	4.41	-1259.1	-1595.1		1401.4	7.03	-1587.8	-64.5		298.1
1.84	-936.7	-6340.8		4099.9	4.46	-1265.4	-1548.2		1382.6	7.08	-1594.1	-54.6		274.4
1.90	-943.0	-6203.5		4052.3	4.52	-1271.7	-1501.9		1363.6	7.14	-1600.5	-45.6		250.6
1.95	-952.5	-6000.5		3980.4	4.57	-1278.0	-1456.2		1344.6	7.20	-1606.8	-37.4		226.7
2.01	-958.8	-5867.2		3932.1	4.63	-1287.5	-1389.0		1316.0	7.25	-1613.1	-30.0		202.7
2.06	-965.1	-5735.5		3883.4	4.69	-1293.8	-1344.9		1296.7	7.31	-1622.6	-20.4		166.5
2.12	-971.4	-5605.5		3834.4	4.74	-1300.2	-1301.5		1277.4	7.36	-1628.9	-15.0		142.3
2.18	-977.8	-5477.1		3785.1	4.80	-1306.5	-1258.8		1257.9	7.42	-1635.2	-10.4		118.0
2.23	-987.2	-5287.6		3710.5	4.85	-1312.8	-1216.7		1238.4	7.48	-1641.5	-6.7		93.6
2.29	-993.6	-5163.4		3660.4	4.91	-1322.3	-1154.8		1209.0	7.53	-1647.9	-3.7		69.0
2.34	-999.9	-5040.8		3610.0	4.96	-1328.6	-1114.3		1189.2	7.59	-1657.4	-0.9		32.1
2.40	-1006.2	-4920.0		3559.2	5.02	-1334.9	-1074.5		1169.4	7.64	-1663.7	0.0		0.0
2.45	-1012.5	-4800.8		3508.1	5.08	-1341.3	-1035.4		1149.4	7.70	-1670.0	0.0		0.0
2.51	-1022.0	-4625.4		3430.9	5.13	-1347.6	-997.0		1129.4	7.75	-1676.3	0.0		0.0
2.57	-1028.3	-4510.6		3379.1	5.19	-1357.1	-940.6		1099.1	7.81	-1679.5	0.0		0.0

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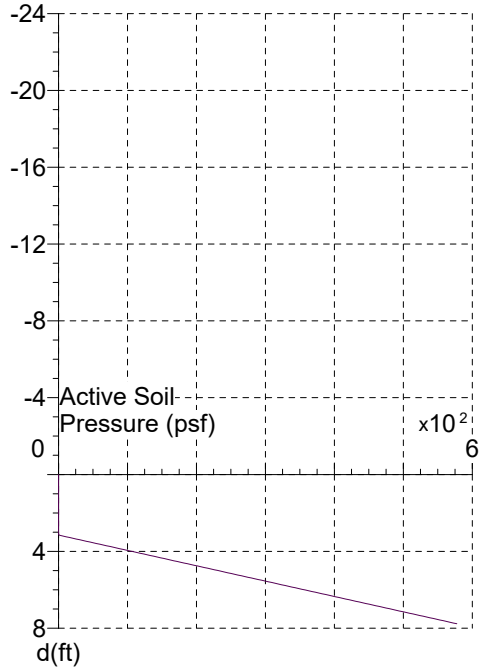
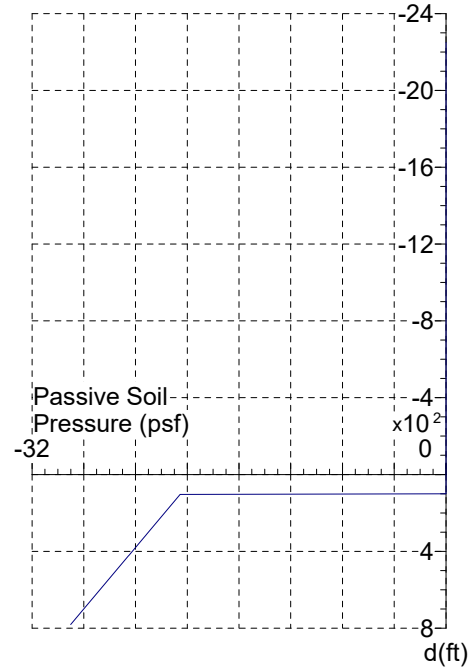
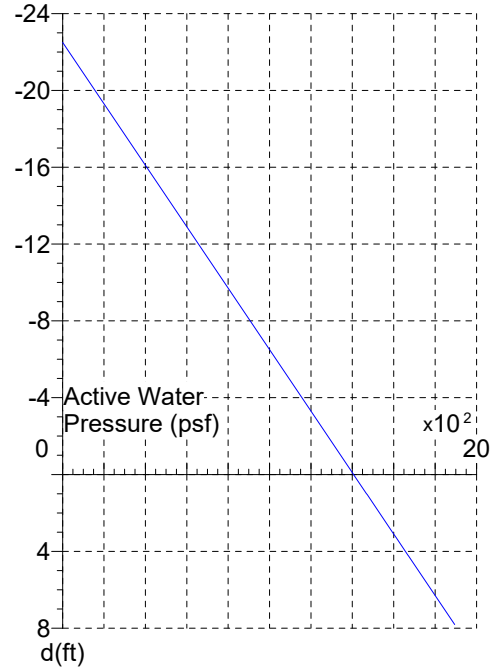
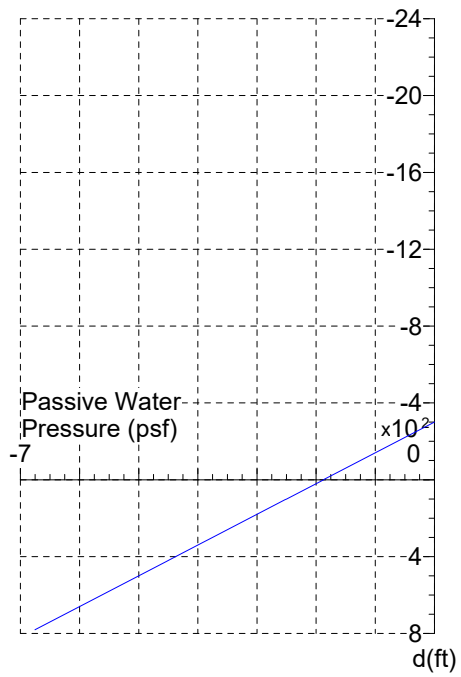
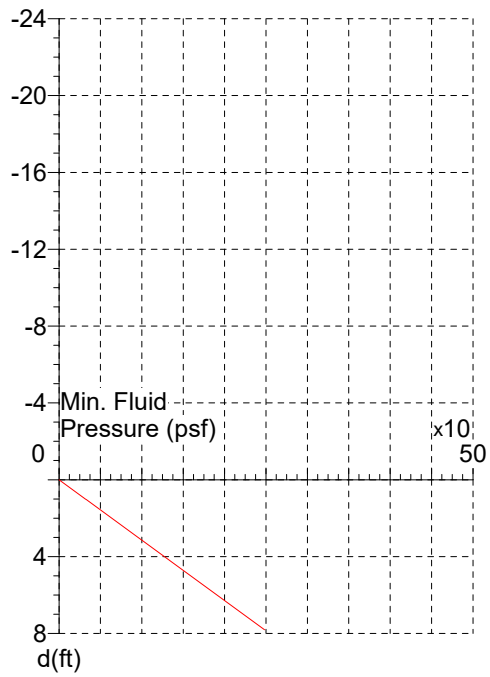
Stage 3 - Wales only

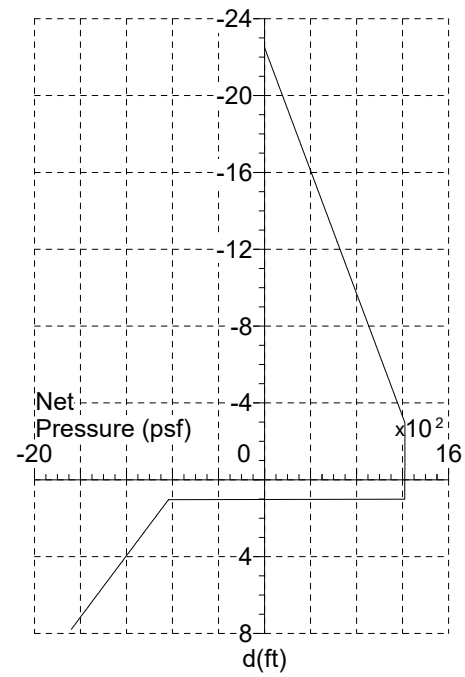












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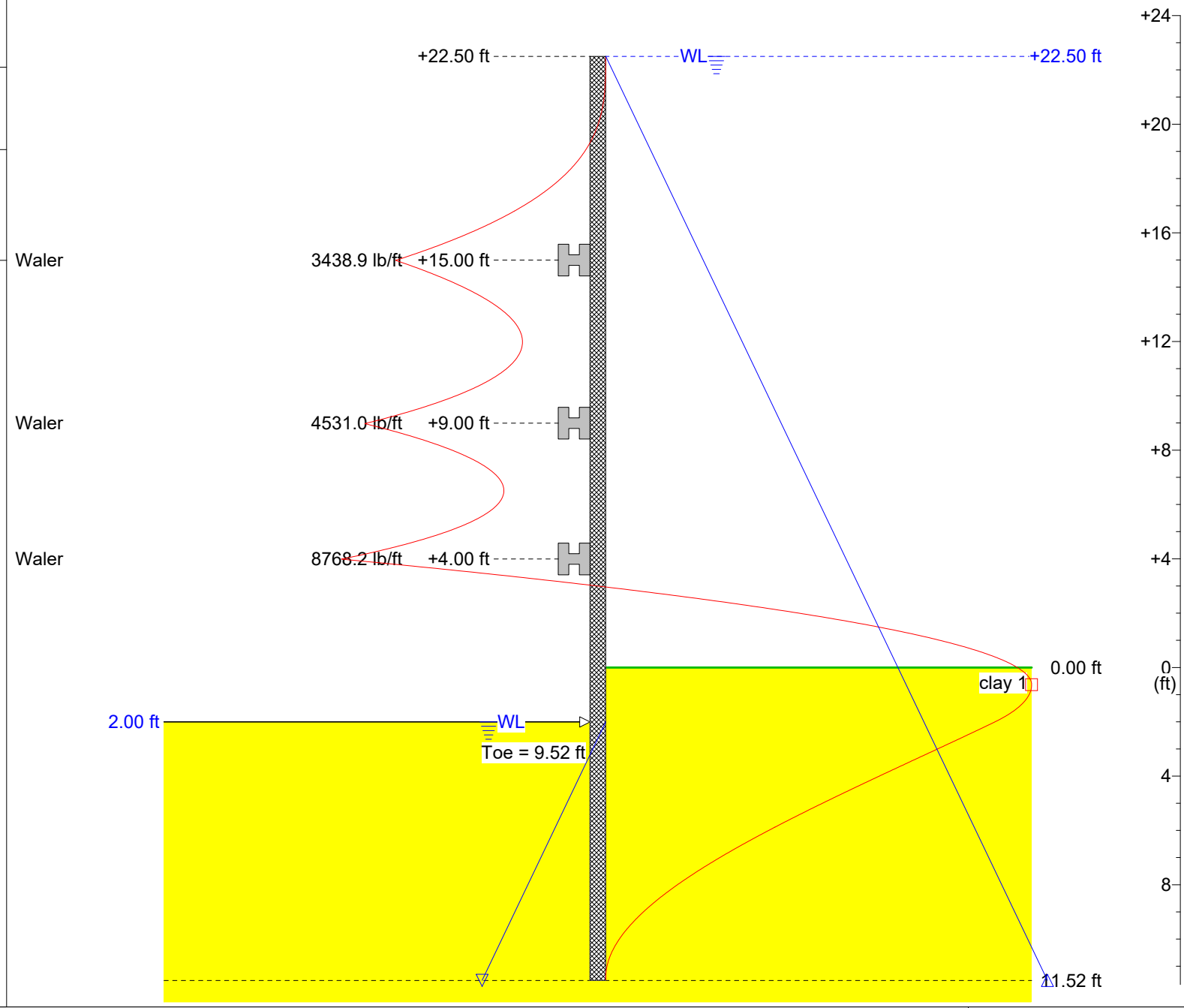
Maximum	d (ft)
8961.9 ftlb/ft	0.63
2126.2 psf	11.52
594.9 psf	11.52

Stage 4 - Tip and Moment only



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Stage 4 - Tip and Moment only

Input Data

Depth Of Excavation = 2.00ft
Surcharge = 0.0psf
Depth Of Active Water = +22.50ft
Depth Of Passive Water = 2.00ft
Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in⁴/ft)	f (psi)	Z (in³/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in²/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	9.52	34.02

Pressure Model: Coulomb; Assume full hydrostatic pressure to 2.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3438.9
+9.00	Waler	4531.0
+4.00	Waler	8768.2

Maxima

	Maximum	Depth (ft)
Pressure	1801.1 psf	2.00
Bending Moment	8961.9 ftlb/ft	0.63
Shear Force	6036.5 lb/ft	-4.00

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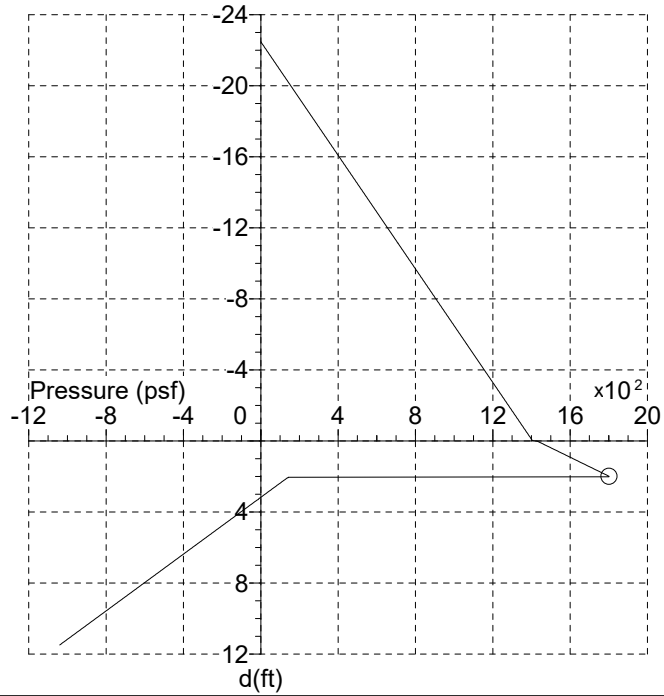
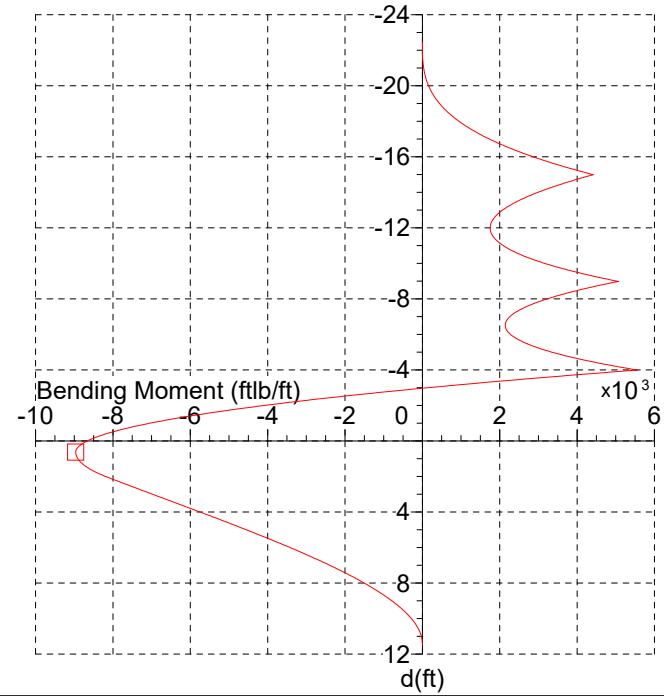
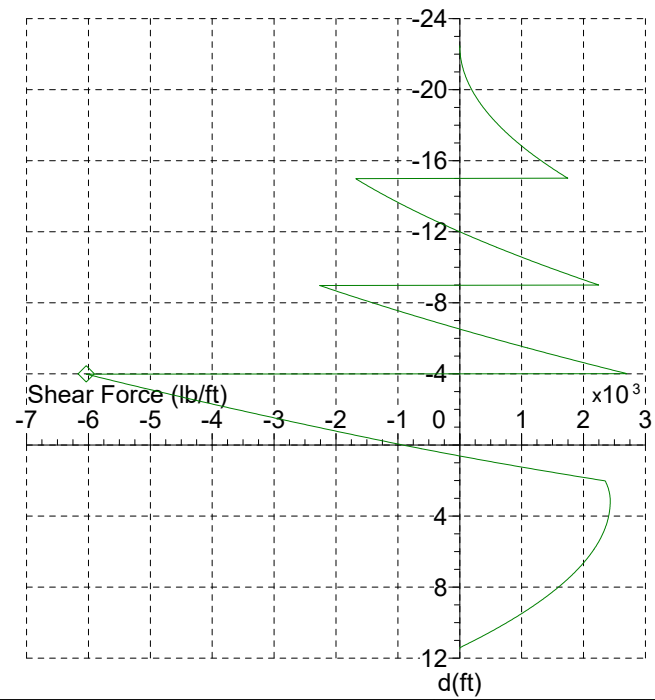
Maximum	d (ft)
○ 1801.1 psf	2.00
□ 8961.9 ftlb/ft	0.63
◇ 6036.5 lb/ft	-4.00

Stage 4 - Tip and Moment only







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Stage 4 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1428.9	-8668.3		-911.1	3.87	-89.4	-5885.2		2412.3	7.73	-571.7	-1717.0		1680.3
0.08	1444.8	-8741.9		-788.7	3.95	-96.5	-5816.1		2409.3	7.82	-582.3	-1645.2		1652.1
0.16	1460.8	-8805.2		-664.9	4.03	-107.1	-5712.5		2404.2	7.90	-593.0	-1574.5		1623.5
0.25	1476.7	-8858.0		-539.7	4.11	-117.8	-5609.2		2398.7	7.98	-603.6	-1505.1		1594.3
0.33	1492.7	-8900.1		-413.3	4.20	-128.4	-5506.1		2392.6	8.06	-614.2	-1436.9		1564.7
0.41	1508.6	-8931.5		-285.4	4.28	-139.0	-5403.3		2386.0	8.15	-624.9	-1370.1		1534.5
0.49	1524.6	-8952.0		-156.2	4.36	-149.7	-5300.7		2378.9	8.23	-632.0	-1326.2		1514.1
0.58	1535.2	-8959.6		-69.3	4.44	-160.3	-5198.5		2371.3	8.31	-642.6	-1261.5		1483.0
0.66	1551.2	-8961.7		62.2	4.53	-171.0	-5096.6		2363.2	8.39	-653.3	-1198.2		1451.4
0.74	1567.1	-8957.1		195.0	4.61	-181.6	-4995.1		2354.5	8.47	-663.9	-1136.2		1419.3
0.82	1583.1	-8946.8		329.2	4.69	-192.2	-4893.9		2345.4	8.56	-674.5	-1075.6		1386.7
0.91	1599.0	-8930.7		464.7	4.77	-202.9	-4793.2		2335.7	8.64	-685.2	-1016.4		1353.6
0.99	1615.0	-8908.7		601.6	4.85	-210.0	-4726.3		2328.9	8.72	-695.8	-958.7		1320.0
1.07	1630.9	-8880.9		739.9	4.94	-220.6	-4626.2		2318.4	8.80	-706.4	-902.4		1285.8
1.15	1646.9	-8847.1		879.5	5.02	-231.2	-4526.7		2307.3	8.89	-717.1	-847.6		1251.1
1.23	1662.8	-8807.2		1020.4	5.10	-241.9	-4427.6		2295.7	8.97	-727.7	-794.3		1215.9
1.32	1678.8	-8761.3		1162.8	5.18	-252.5	-4329.0		2283.6	9.05	-734.8	-759.6		1192.2
1.40	1694.7	-8709.2		1306.4	5.27	-263.2	-4231.0		2271.0	9.13	-745.5	-708.8		1156.1
1.48	1705.4	-8671.1		1403.0	5.35	-273.8	-4133.4		2257.9	9.22	-756.1	-659.6		1119.6
1.56	1721.3	-8608.6		1548.9	5.43	-284.4	-4036.5		2244.2	9.30	-766.7	-612.0		1082.5
1.65	1737.3	-8539.9		1696.2	5.51	-295.1	-3940.2		2230.1	9.38	-777.4	-565.9		1044.9
1.73	1753.2	-8464.8		1844.9	5.59	-305.7	-3844.5		2215.4	9.46	-788.0	-521.5		1006.8
1.81	1769.2	-8383.3		1994.9	5.68	-312.8	-3781.0		2205.3	9.54	-798.6	-478.8		968.1
1.89	1785.1	-8295.3		2146.2	5.76	-323.4	-3686.4		2189.8	9.63	-809.3	-437.7		929.0
1.97	1801.1	-8200.8		2299.0	5.84	-334.1	-3592.4		2173.7	9.71	-819.9	-398.3		889.3
2.06	141.1	-8100.4		2358.0	5.92	-344.7	-3499.1		2157.1	9.79	-830.6	-360.6		849.1
2.14	126.9	-7998.8		2369.1	6.01	-355.4	-3406.6		2140.0	9.87	-837.7	-336.5		822.0
2.22	116.3	-7896.7		2379.3	6.09	-366.0	-3314.8		2122.4	9.96	-848.3	-301.7		781.0
2.30	109.2	-7828.5		2385.6	6.17	-376.6	-3223.8		2104.3	10.04	-858.9	-268.7		739.4
2.39	98.6	-7725.7		2394.3	6.25	-387.3	-3133.5		2085.6	10.12	-869.6	-237.5		697.3
2.47	87.9	-7622.6		2402.1	6.34	-397.9	-3044.1		2066.5	10.20	-880.2	-208.1		654.7
2.55	77.3	-7519.2		2408.9	6.42	-408.6	-2955.5		2046.8	10.28	-890.9	-180.6		611.6
2.63	66.6	-7415.5		2414.9	6.50	-415.7	-2896.9		2033.4	10.37	-901.5	-154.9		568.0
2.72	56.0	-7311.5		2420.0	6.58	-426.3	-2809.7		2012.8	10.45	-912.1	-131.1		523.8
2.80	45.4	-7207.4		2424.1	6.66	-436.9	-2723.4		1991.8	10.53	-922.8	-109.2		479.2
2.88	34.7	-7103.0		2427.4	6.75	-447.6	-2638.0		1970.2	10.61	-933.4	-89.2		434.0
2.96	24.1	-6998.6		2429.7	6.83	-458.2	-2553.6		1948.1	10.70	-940.5	-77.0		403.6
3.04	13.4	-6894.0		2431.2	6.91	-468.8	-2470.1		1925.5	10.78	-951.1	-60.3		357.5
3.13	6.4	-6824.3		2431.7	6.99	-479.5	-2387.6		1902.4	10.86	-961.8	-45.6		311.0
3.21	-4.3	-6719.7		2431.6	7.08	-490.1	-2306.1		1878.7	10.94	-972.4	-32.9		263.9
3.29	-12.8	-6615.1		2430.7	7.16	-500.8	-2225.7		1854.6	11.03	-983.1	-22.2		216.3
3.37	-25.6	-6510.6		2429.6	7.24	-511.4	-2146.2		1829.9	11.11	-993.7	-13.6		168.2
3.46	-36.2	-6406.1		2428.0	7.32	-518.5	-2093.9		1813.1	11.19	-1004.3	-7.1		119.5
3.54	-46.8	-6301.7		2425.9	7.40	-529.1	-2016.3		1787.6	11.27	-1015.0	-2.6		70.4
3.62	-57.5	-6197.4		2423.3	7.49	-539.8	-1939.7		1761.5	11.35	-1025.6	-0.3		20.7
3.70	-68.1	-6093.2		2420.2	7.57	-550.4	-1864.3		1735.0	11.44	-1036.3	0.0		0.0
3.78	-78.8	-5989.1		2416.5	7.65	-561.0	-1790.1		1707.9	11.52	-1039.8	0.0		0.0

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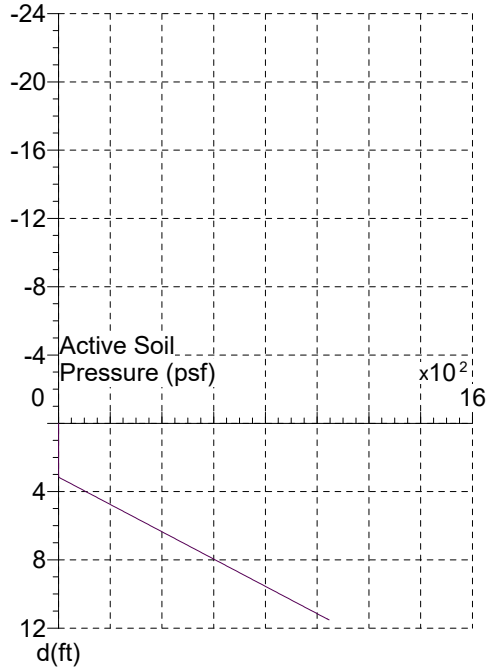
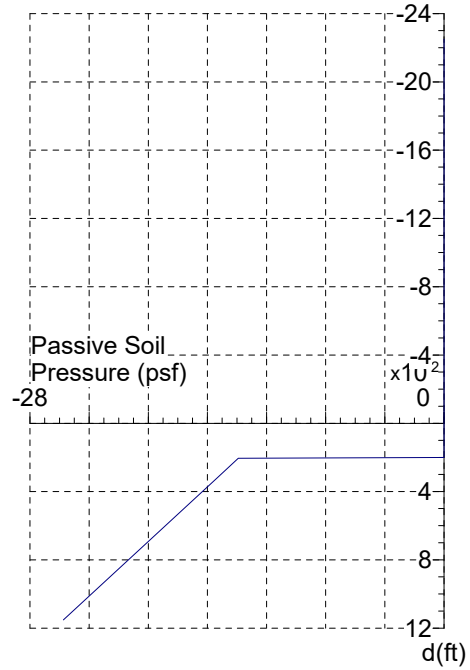
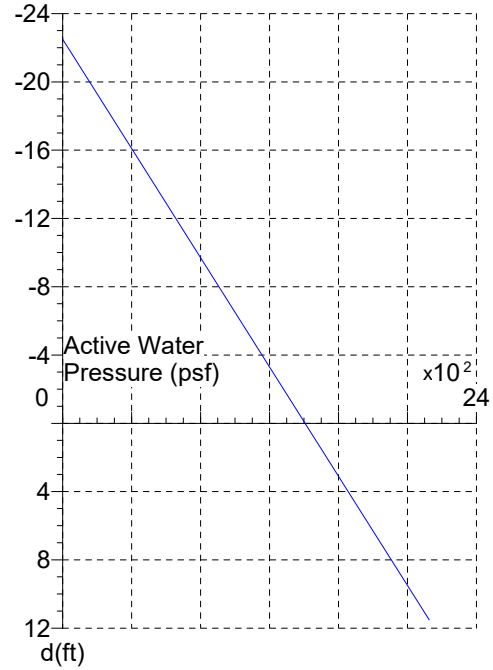
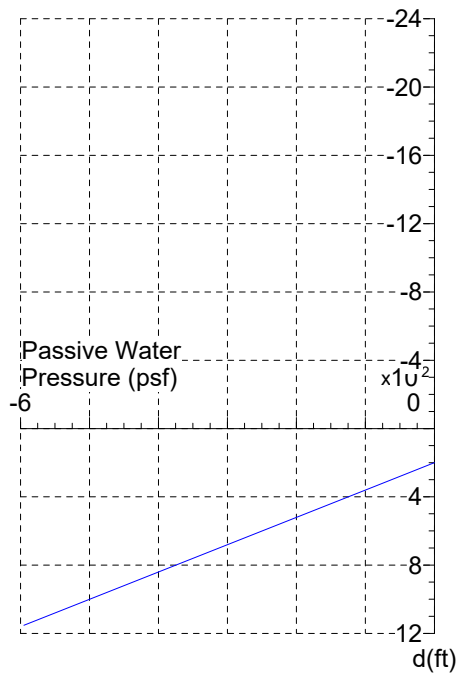
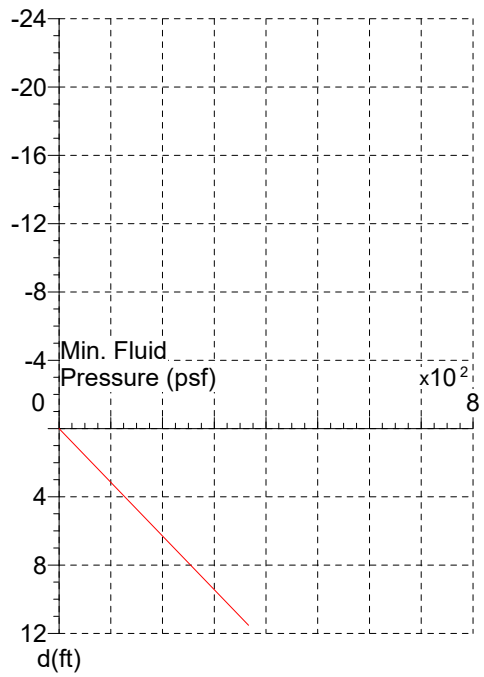
Stage 4 - Tip and Moment only

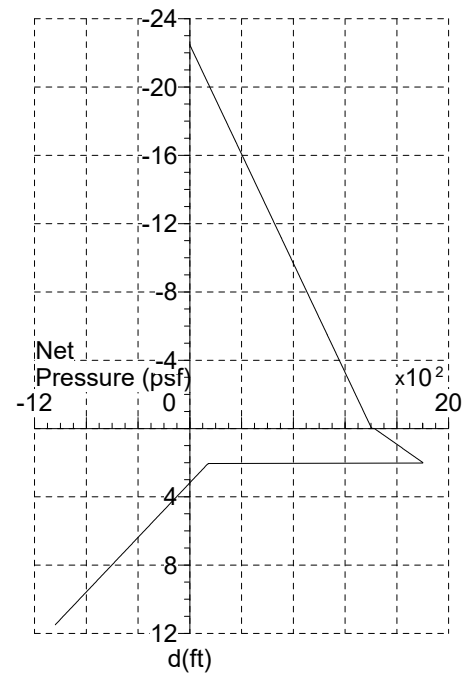












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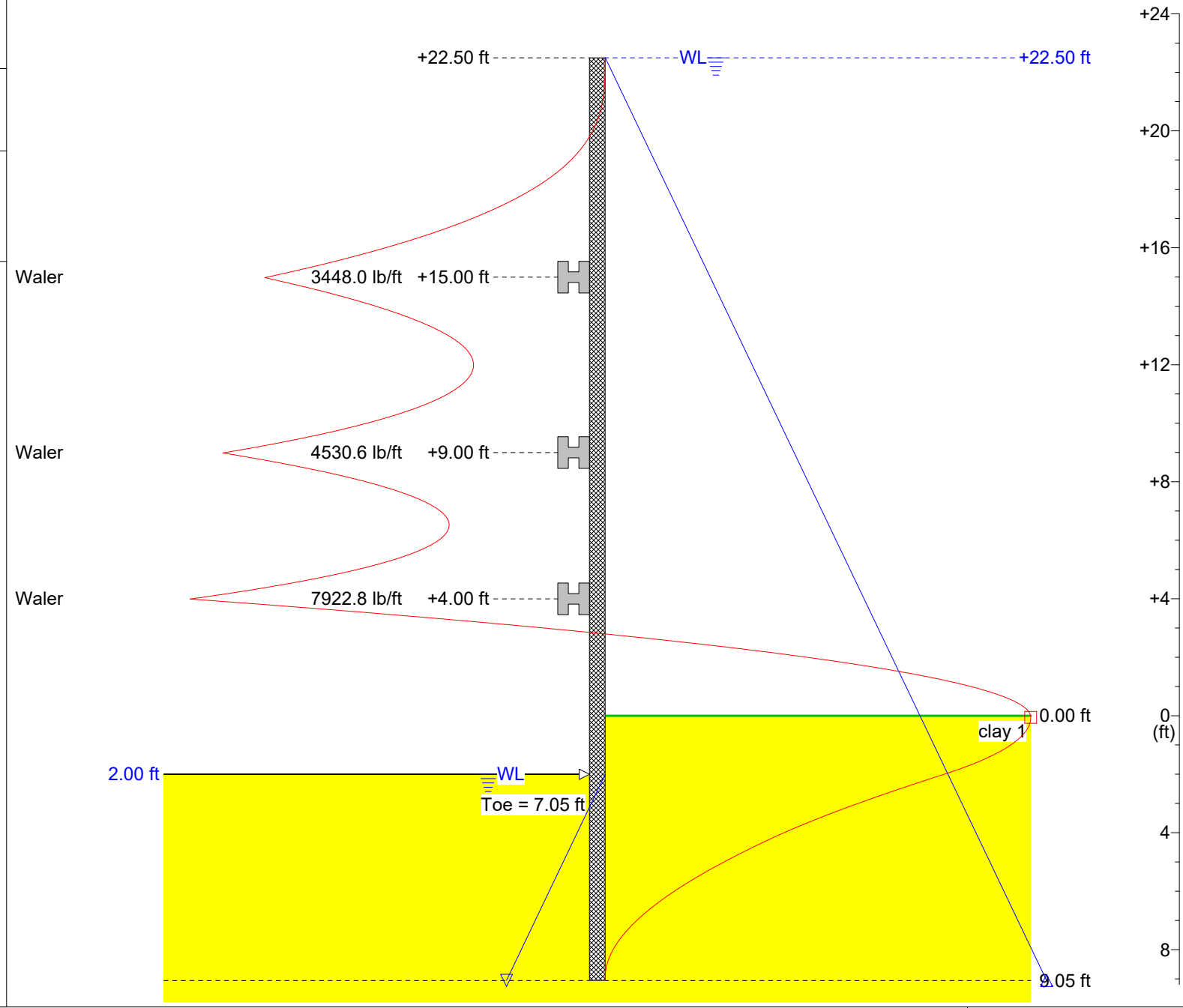
Maximum	d (ft)
5537.2 ftlb/ft	0.06
1972.0 psf	9.05
440.7 psf	9.05

Stage 4 - Wales only



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Title: Colorado River Flood Gate - West Side
Designer: Stage 4
Ref: 1.0
Page: 2
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 4 - Wales only

Input Data

Depth Of Excavation = 2.00ft
Surcharge = 0.0psf
Depth Of Active Water = +22.50ft
Depth Of Passive Water = 2.00ft
Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	7.05	31.55

Pressure Model: Coulomb; Assume full hydrostatic pressure to 2.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3448.0
+9.00	Waler	4530.6
+4.00	Waler	7922.8

Maxima

	Maximum	Depth (ft)
Pressure	1531.6 psf	2.00
Bending Moment	5537.2 ftlb/ft	0.06
Shear Force	5178.9 lb/ft	-4.00

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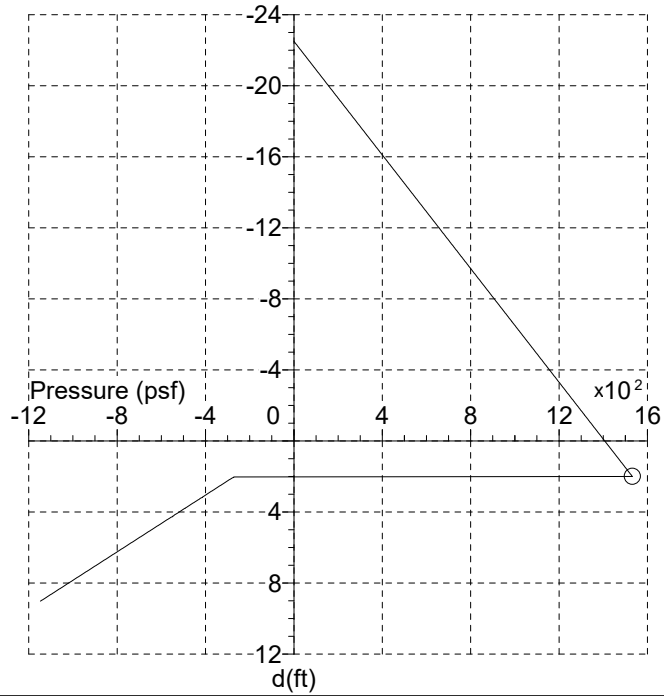
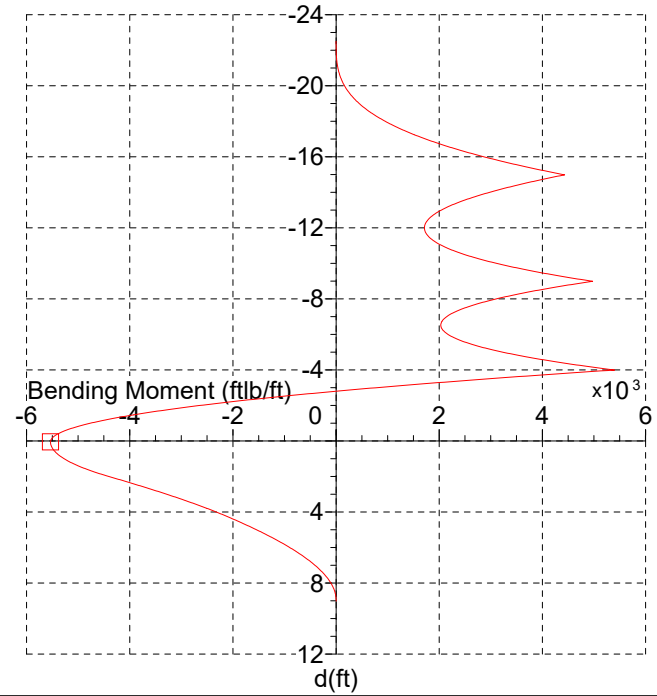
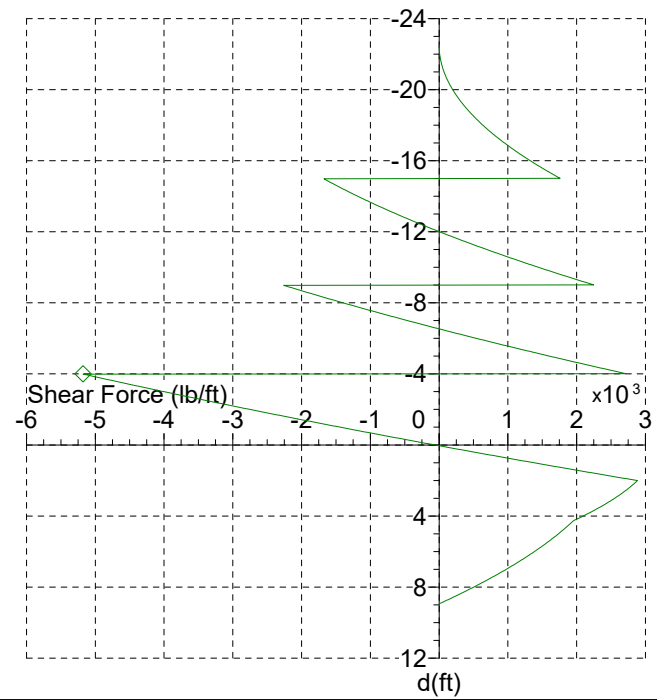
Toe: Free Earth Support

Maximum	d (ft)
○ 1531.6 psf	2.00
□ 5537.2 ftlb/ft	0.06
◇ 5178.9 lb/ft	-4.00

Stage 4 - Wales only







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Title: Colorado River Flood Gate - West Side
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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 4 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1406.7	-5535.6		-52.9	3.04	-400.7	-3229.4		2530.5	6.08	-778.8	-855.1		1355.9
0.06	1411.6	-5537.0		58.3	3.10	-407.3	-3174.8		2509.2	6.14	-788.7	-811.5		1325.3
0.13	1414.9	-5535.3		132.7	3.17	-413.9	-3093.8		2476.7	6.21	-795.3	-782.9		1304.7
0.19	1419.8	-5529.8		244.6	3.23	-423.8	-3040.4		2454.5	6.27	-805.1	-741.0		1273.5
0.26	1423.1	-5524.1		319.4	3.30	-433.6	-2961.2		2420.6	6.34	-811.7	-713.6		1252.5
0.32	1428.0	-5512.5		431.9	3.36	-440.2	-2909.0		2397.5	6.40	-821.6	-673.3		1220.7
0.39	1431.3	-5502.8		507.1	3.43	-450.1	-2831.7		2362.3	6.47	-828.2	-647.0		1199.3
0.45	1434.6	-5491.4		582.5	3.49	-456.6	-2780.8		2338.3	6.53	-838.0	-608.5		1166.8
0.52	1439.5	-5471.3		695.9	3.56	-463.2	-2730.4		2314.1	6.59	-844.6	-583.4		1144.9
0.58	1442.8	-5455.9		771.7	3.62	-473.1	-2655.7		2277.0	6.66	-854.5	-546.7		1111.8
0.65	1447.8	-5429.6		885.8	3.69	-479.6	-2606.7		2251.9	6.72	-861.0	-522.7		1089.5
0.71	1451.0	-5410.1		962.1	3.75	-489.5	-2534.1		2213.5	6.79	-867.6	-499.3		1067.1
0.78	1456.0	-5377.6		1076.8	3.81	-496.1	-2486.4		2187.5	6.85	-877.5	-465.1		1033.1
0.84	1459.3	-5354.0		1153.5	3.88	-505.9	-2415.9		2147.9	6.92	-884.1	-442.9		1010.2
0.91	1464.2	-5315.3		1268.9	3.94	-512.5	-2369.6		2121.0	6.98	-893.9	-410.5		975.5
0.97	1467.5	-5287.5		1346.0	4.01	-522.4	-2301.3		2080.1	7.05	-900.5	-389.6		952.2
1.03	1472.4	-5242.6		1462.0	4.07	-529.0	-2256.5		2052.3	7.11	-910.4	-359.1		916.9
1.10	1475.7	-5210.6		1539.5	4.14	-538.8	-2190.4		2010.1	7.18	-916.9	-339.4		893.2
1.16	1480.6	-5159.4		1656.2	4.20	-543.4	-2147.1		1981.5	7.24	-926.8	-310.8		857.3
1.23	1483.9	-5123.2		1734.2	4.27	-555.3	-2083.3		1945.5	7.31	-933.4	-292.4		833.1
1.29	1487.2	-5085.3		1812.4	4.33	-561.8	-2041.4		1931.0	7.37	-943.2	-265.8		796.5
1.36	1492.1	-5025.3		1929.9	4.40	-568.4	-1999.7		1916.3	7.44	-949.8	-248.7		772.0
1.42	1495.4	-4983.1		2008.5	4.46	-578.3	-1937.8		1893.9	7.50	-956.4	-232.2		747.2
1.49	1500.3	-4916.7		2126.7	4.53	-584.9	-1897.0		1878.8	7.56	-966.2	-208.3		709.7
1.55	1503.6	-4870.3		2205.8	4.59	-594.7	-1836.3		1855.8	7.63	-972.8	-193.1		684.5
1.62	1508.6	-4797.5		2324.6	4.66	-601.3	-1796.3		1840.2	7.69	-982.7	-171.4		646.4
1.68	1511.8	-4746.9		2404.1	4.72	-611.2	-1736.9		1816.6	7.76	-989.3	-157.5		620.8
1.75	1516.8	-4667.7		2523.6	4.78	-617.7	-1697.7		1800.6	7.82	-999.1	-137.8		582.1
1.81	1520.1	-4612.7		2603.5	4.85	-627.6	-1639.6		1776.3	7.89	-1005.7	-125.4		556.1
1.87	1525.0	-4527.0		2723.7	4.91	-634.2	-1601.3		1759.9	7.95	-1015.6	-107.8		516.7
1.94	1528.3	-4467.7		2804.0	4.98	-644.0	-1544.5		1735.0	8.02	-1022.1	-96.7		490.2
2.00	1531.6	-4406.6		2884.5	5.04	-650.6	-1507.1		1718.1	8.08	-1032.0	-81.3		450.2
2.07	-279.1	-4313.4		2862.8	5.11	-660.5	-1451.7		1692.6	8.15	-1038.6	-71.7		423.3
2.13	-285.7	-4251.6		2847.9	5.17	-667.1	-1415.2		1675.3	8.21	-1048.4	-58.4		382.6
2.20	-295.5	-4159.5		2824.8	5.24	-673.6	-1379.1		1657.9	8.28	-1055.0	-50.3		355.3
2.26	-302.1	-4098.5		2809.0	5.30	-683.5	-1325.6		1631.4	8.34	-1061.6	-42.8		327.8
2.33	-312.0	-4007.7		2784.7	5.37	-690.1	-1290.4		1613.6	8.41	-1071.5	-32.6		286.3
2.39	-318.5	-3947.6		2768.0	5.43	-699.9	-1238.4		1586.5	8.47	-1078.0	-26.5		258.4
2.46	-328.4	-3858.2		2742.4	5.50	-706.5	-1204.2		1568.2	8.53	-1087.9	-18.6		216.2
2.52	-335.0	-3799.0		2724.8	5.56	-716.4	-1153.7		1540.5	8.60	-1094.5	-14.1		187.8
2.59	-344.8	-3710.9		2697.9	5.62	-722.9	-1120.5		1521.8	8.66	-1104.3	-8.5		145.0
2.65	-351.4	-3652.7		2679.5	5.69	-732.8	-1071.5		1493.4	8.73	-1110.9	-5.5		116.2
2.72	-361.3	-3566.2		2651.3	5.75	-739.4	-1039.3		1474.2	8.79	-1120.8	-2.2		72.8
2.78	-367.9	-3509.0		2632.0	5.82	-749.2	-991.8		1445.2	8.86	-1127.4	-0.8		43.6
2.84	-374.4	-3452.2		2612.4	5.88	-755.8	-960.7		1425.7	8.92	-1137.2	0.0		0.0
2.91	-384.3	-3367.8		2582.3	5.95	-762.4	-930.0		1405.9	8.99	-1143.8	0.0		0.0
2.97	-390.9	-3312.1		2561.9	6.01	-772.3	-884.7		1376.0	9.05	-1147.1	0.0		0.0

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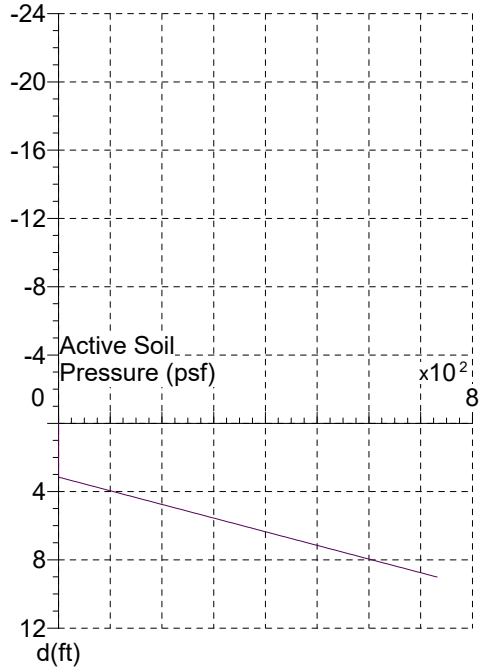
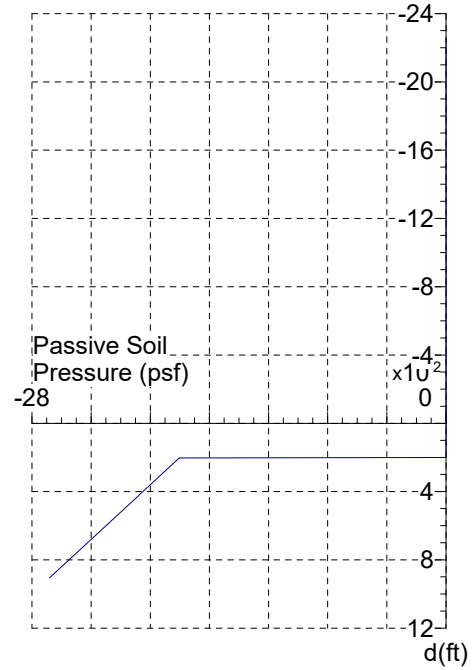
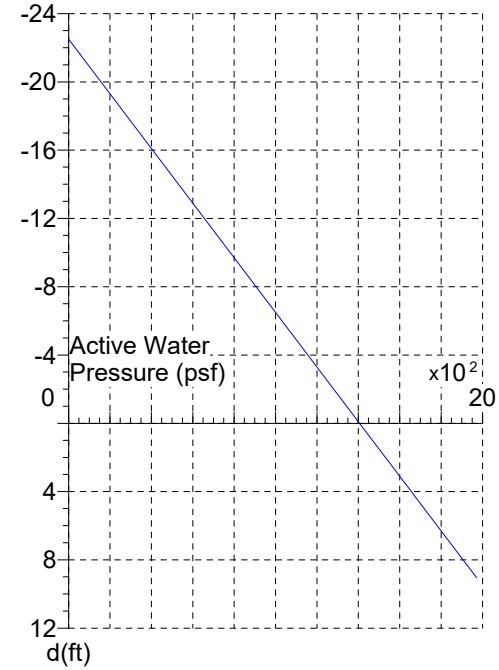
Designer: Stage 4
Ref: 1.0
Page: 5
Date: 8.20.18

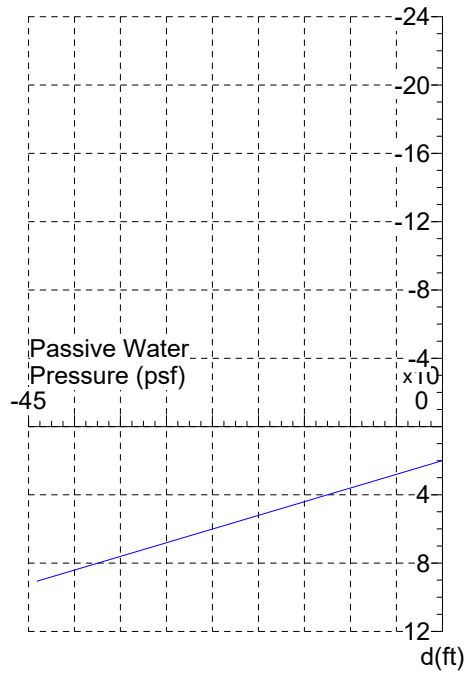
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

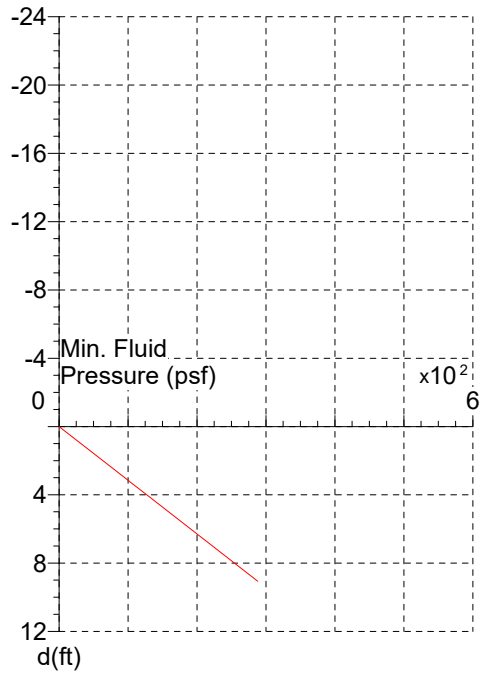
Stage 4 - Wales only

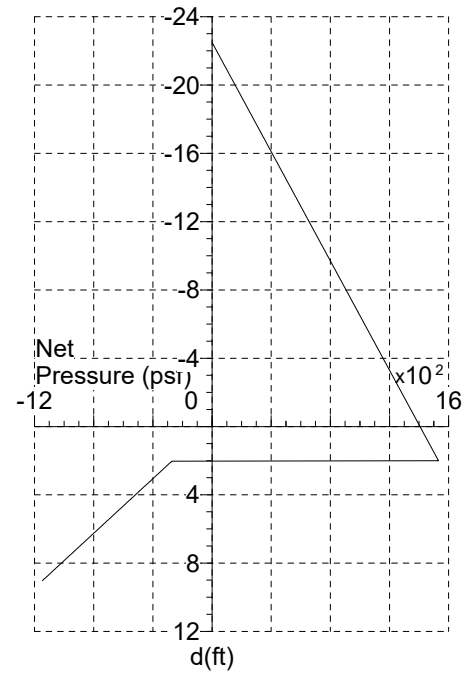












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Title: Colorado River Flood Gate - West Side
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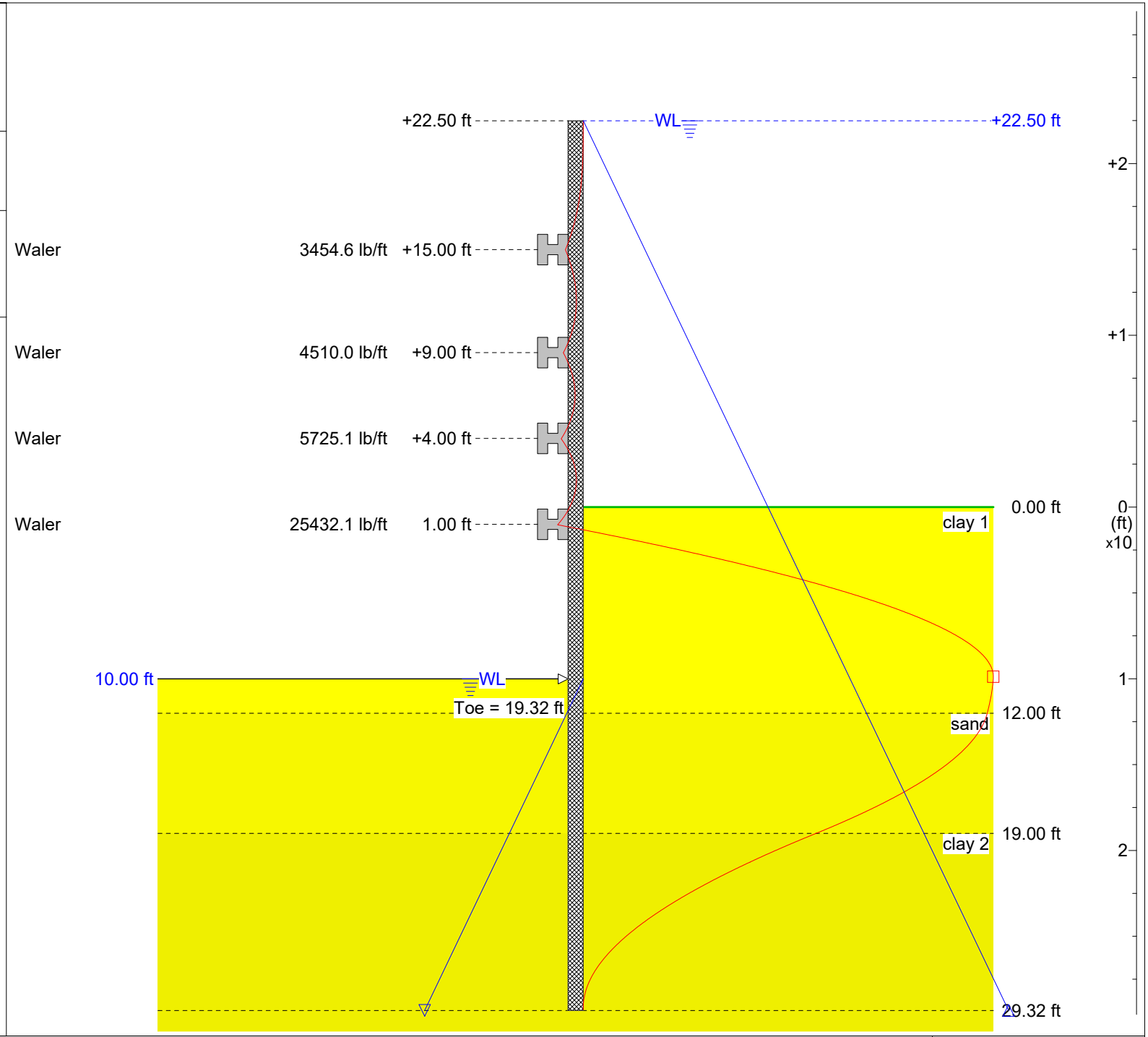
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	101638.6 ftlb/ft	9.88
△	3238.4 psf	29.32
△	1207.2 psf	29.32

Stage 5 - Tip and Moment only



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Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Tip and Moment only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 10.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	19.32	51.82

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3454.6
+9.00	Waler	4510.0
+4.00	Waler	5725.1
1.00	Waler	25432.1

Maxima

	Maximum	Depth (ft)
Pressure	3305.4 psf	10.00
Bending Moment	101638.6 ftlb/ft	9.88
Shear Force	21692.6 lb/ft	1.00

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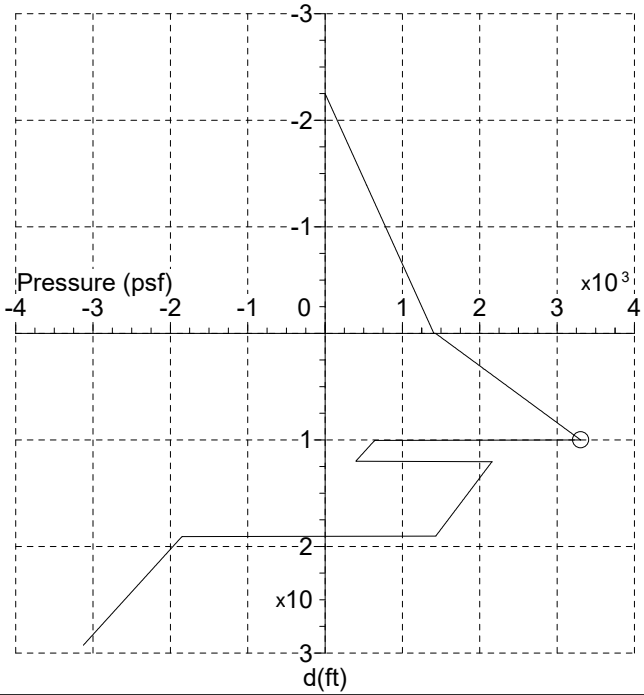
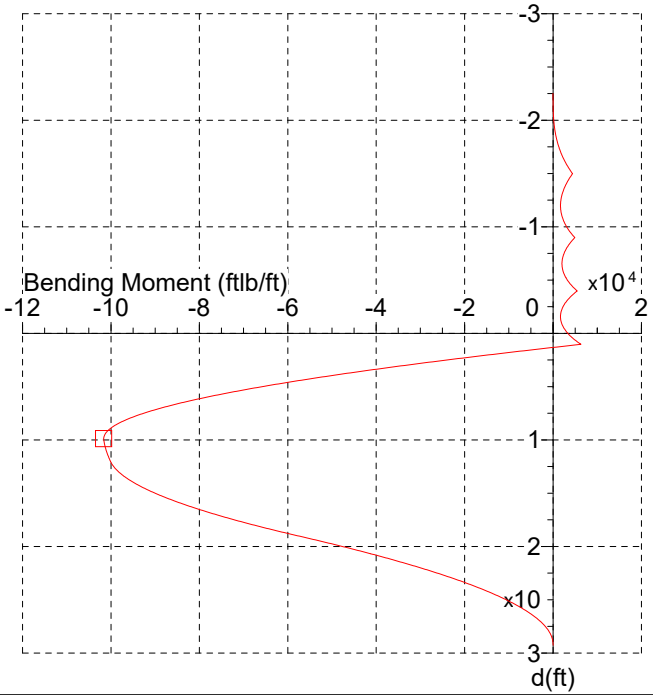
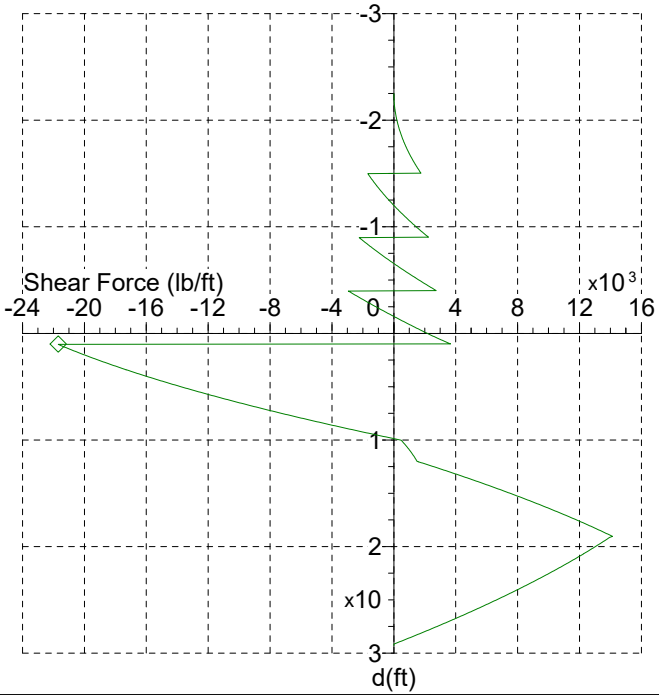
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 3305.4 psf	10.00
□ 101638.6 ftlb/ft	9.88
◇ 21692.6 lb/ft	1.00

Stage 5 - Tip and Moment only







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Designer: Stage 5
Ref: 1.3
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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1435.2	3422.5		2217.8	9.84	3281.1	-101638.6		40.8	19.68	-1927.2	-50760.5		13371.5
0.21	1467.6	3821.7		2469.1	10.05	640.2	-101606.0		495.6	19.89	-1954.2	-48636.9		13136.4
0.42	1508.1	4382.5		2791.2	10.26	613.2	-101518.0		630.6	20.10	-1981.2	-46551.1		12898.1
0.63	1548.5	5013.5		3122.1	10.47	586.3	-101408.9		759.5	20.31	-2008.2	-44503.7		12656.5
0.84	1589.0	5716.7		3461.6	10.68	559.3	-101279.4		882.5	20.52	-2035.2	-42495.1		12411.7
1.05	1629.5	5389.8		-21622.2	10.89	532.3	-101130.7		999.8	20.73	-2062.2	-40525.9		12163.6
1.26	1670.0	716.0		-21265.2	11.10	505.3	-100963.6		1111.2	20.94	-2089.2	-38596.5		11912.2
1.47	1710.5	-3879.4		-20899.4	11.31	483.7	-100817.3		1196.1	21.15	-2110.8	-37082.1		11708.7
1.68	1742.8	-7497.9		-20600.5	11.52	456.7	-100619.5		1297.1	21.36	-2137.8	-35225.9		11451.5
1.88	1783.3	-11947.2		-20218.9	11.73	429.7	-100405.9		1392.1	21.57	-2164.8	-33411.0		11191.0
2.09	1823.8	-16312.8		-19828.7	11.94	402.7	-100177.5		1481.4	21.78	-2191.8	-31638.0		10927.2
2.30	1864.3	-20592.6		-19429.7	12.14	2144.8	-99920.5		1870.4	21.99	-2218.8	-29907.4		10660.1
2.51	1904.8	-24785.0		-19021.9	12.35	2122.3	-99591.9		2330.5	22.20	-2245.8	-28219.7		10389.8
2.72	1945.2	-28887.8		-18605.5	12.56	2099.9	-99189.9		2785.8	22.41	-2267.4	-26900.8		10171.2
2.93	1977.6	-32104.3		-18266.0	12.77	2081.9	-98816.2		3146.6	22.61	-2294.4	-25291.7		9895.0
3.14	2018.1	-36041.3		-17833.8	12.98	2059.4	-98284.3		3593.1	22.82	-2321.4	-23727.0		9615.6
3.35	2058.6	-39883.5		-17393.2	13.19	2036.9	-97681.3		4034.8	23.03	-2348.4	-22207.1		9332.9
3.56	2099.1	-43629.0		-16943.5	13.40	2014.5	-97008.0		4471.7	23.24	-2375.4	-20732.7		9046.9
3.77	2139.6	-47276.0		-16485.1	13.61	1992.0	-96265.1		4903.7	23.45	-2402.4	-19304.3		8757.6
3.98	2180.0	-50822.4		-16017.9	13.82	1969.5	-95453.4		5330.9	23.66	-2429.4	-17922.3		8465.1
4.19	2220.5	-54266.4		-15542.0	14.03	1951.6	-94755.1		5669.1	23.87	-2451.0	-16850.5		8228.8
4.40	2252.9	-56946.6		-15155.0	14.24	1929.1	-93821.6		6087.5	24.08	-2478.0	-15553.5		7930.4
4.61	2293.4	-60201.5		-14663.3	14.45	1906.6	-92821.4		6501.1	24.29	-2505.0	-14304.4		7628.7
4.82	2333.9	-63348.7		-14163.0	14.66	1884.1	-91755.5		6909.8	24.50	-2532.0	-13103.8		7323.8
5.03	2374.3	-66386.2		-13653.9	14.87	1861.7	-90624.5		7313.7	24.71	-2559.0	-11952.1		7015.6
5.23	2414.8	-69312.2		-13136.0	15.08	1839.2	-89429.2		7712.7	24.92	-2586.0	-10849.9		6704.1
5.44	2455.3	-72124.7		-12609.4	15.29	1816.7	-88170.3		8106.8	25.13	-2613.0	-9797.8		6389.4
5.65	2495.8	-74821.9		-12074.1	15.50	1798.7	-87118.1		8418.7	25.34	-2634.5	-8992.4		6135.3
5.86	2528.2	-76895.4		-11639.5	15.70	1776.3	-85746.9		8804.1	25.55	-2661.5	-8031.7		5814.7
6.07	2568.6	-79380.1		-11088.4	15.91	1753.8	-84314.4		9184.7	25.76	-2688.5	-7122.4		5490.8
6.28	2609.1	-81744.3		-10528.6	16.12	1731.3	-82821.4		9560.4	25.96	-2715.5	-6265.1		5163.7
6.49	2649.6	-83985.8		-9960.1	16.33	1708.8	-81268.5		9931.3	26.17	-2742.5	-5460.3		4833.3
6.70	2690.1	-86102.9		-9382.8	16.54	1686.4	-79656.7		10297.3	26.38	-2769.5	-4708.6		4499.7
6.91	2730.6	-88093.7		-8796.8	16.75	1663.9	-77986.6		10658.5	26.59	-2791.1	-4145.7		4230.4
7.12	2763.0	-89594.0		-8321.7	16.96	1645.9	-76609.2		10943.9	26.80	-2818.1	-3490.8		3890.9
7.33	2803.4	-91352.4		-7719.9	17.17	1623.4	-74836.2		11296.3	27.01	-2845.1	-2890.4		3548.1
7.54	2843.9	-92979.2		-7109.4	17.38	1601.0	-73007.2		11643.9	27.22	-2872.1	-2345.1		3202.0
7.75	2884.4	-94472.4		-6490.2	17.59	1578.5	-71123.0		11986.7	27.43	-2899.1	-1855.3		2852.7
7.96	2924.9	-95830.1		-5862.2	17.80	1556.0	-69184.2		12324.5	27.64	-2926.1	-1421.5		2500.1
8.17	2965.4	-97050.3		-5225.5	18.01	1533.5	-67191.7		12657.6	27.85	-2953.1	-1044.4		2144.2
8.38	3005.8	-98131.3		-4580.0	18.22	1515.6	-65559.5		12920.5	28.06	-2974.7	-783.8		1857.2
8.59	3038.2	-98894.5		-4057.4	18.43	1493.1	-63472.3		13244.8	28.27	-3001.7	-509.9		1495.5
8.79	3078.7	-99720.0		-3396.2	18.64	1470.6	-61333.5		13564.2	28.48	-3028.7	-294.0		1130.5
9.00	3119.2	-100400.8		-2726.3	18.85	1448.1	-59143.9		13878.8	28.69	-3055.7	-136.7		762.2
9.21	3159.7	-100935.1		-2047.6	19.05	-1851.6	-56904.3		14047.2	28.90	-3082.7	-38.5		390.7
9.42	3200.1	-101320.9		-1360.2	19.26	-1878.6	-54676.5		13786.3	29.11	-3109.7	0.0		0.0
9.63	3240.6	-101556.4		-664.1	19.47	-1905.6	-52486.2		13557.1	29.32	-3125.9	0.0		0.0

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Ref: 1.3
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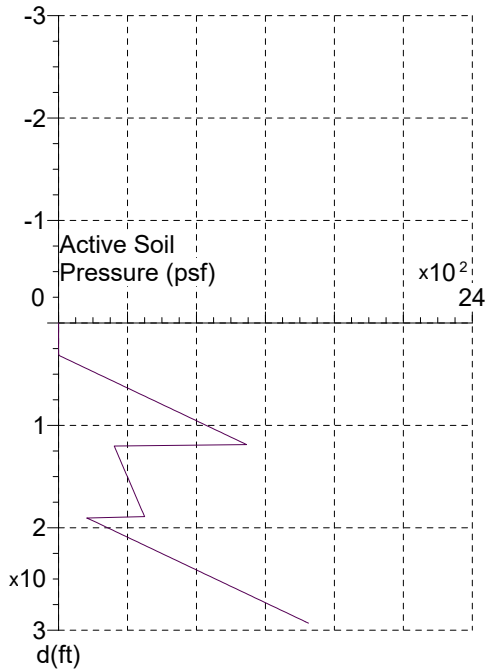
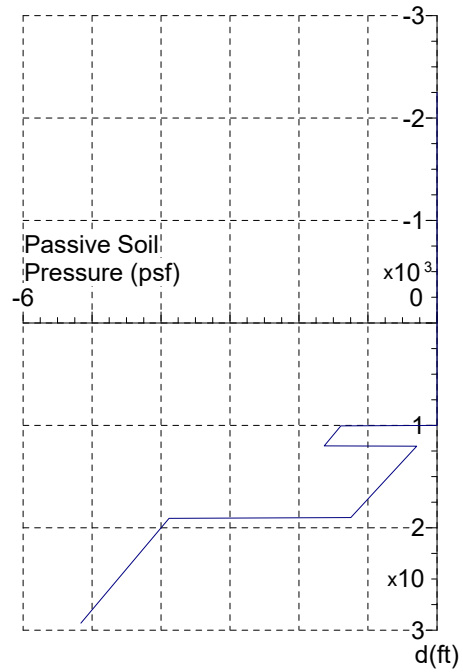
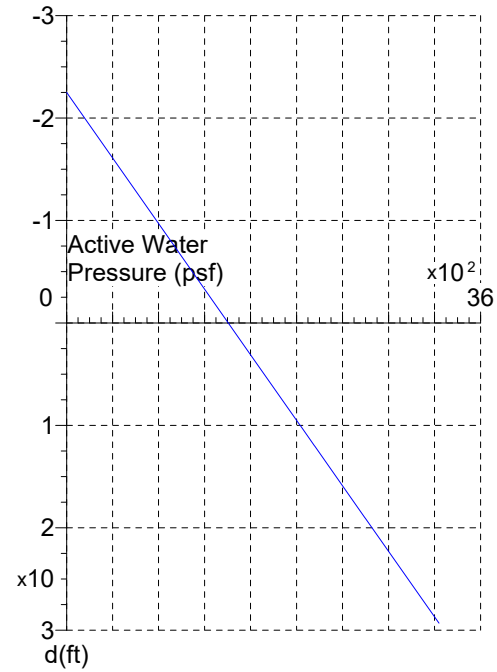
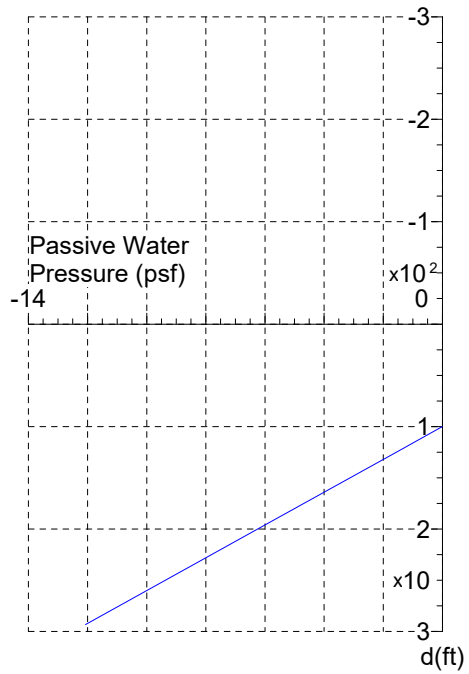
Analysis: Net Pressure
Toe: Free Earth Support

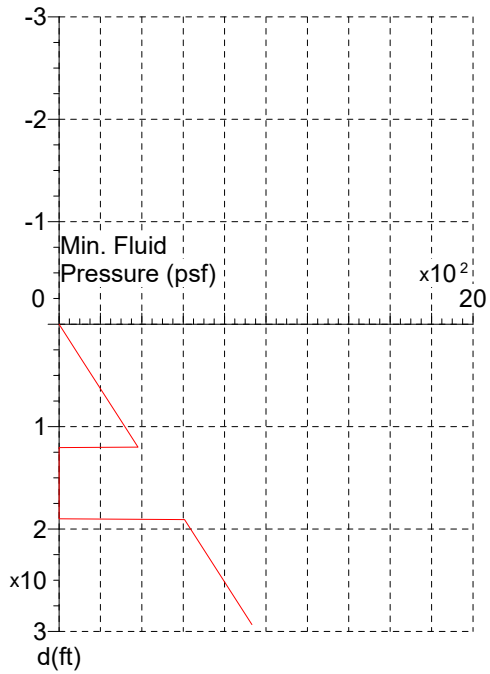
Stage 5 - Tip and Moment only

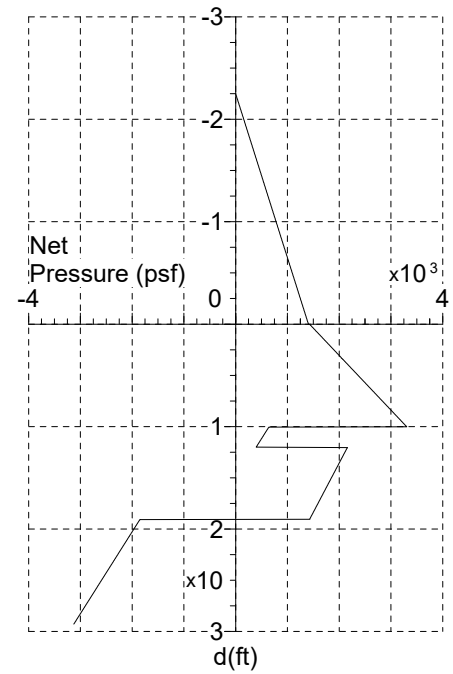












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Title: Colorado River Flood Gate - West Side
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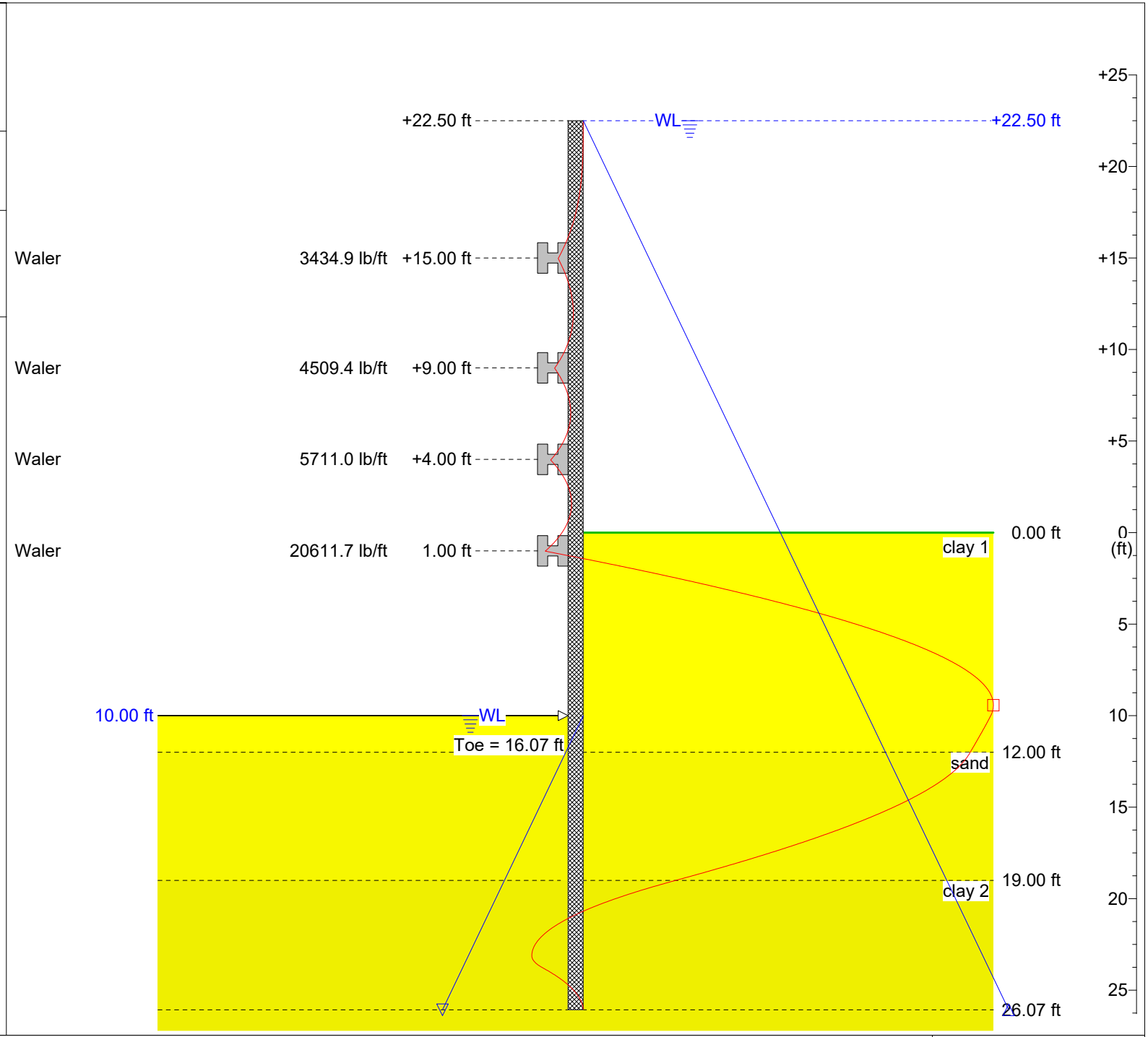
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	72850.2 ftlb/ft	9.44
△	3035.7 psf	26.07
△	1004.4 psf	26.07

Stage 5 - Wales only



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Toe: Free Earth Support

Stage 5 - Wales only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 10.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	16.07	48.57

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3434.9
+9.00	Waler	4509.4
+4.00	Waler	5711.0
1.00	Waler	20611.7

Maxima

	Maximum	Depth (ft)
Pressure	2886.8 psf	10.00
Bending Moment	72850.2 ftlb/ft	9.44
Shear Force	17000.7 lb/ft	1.00

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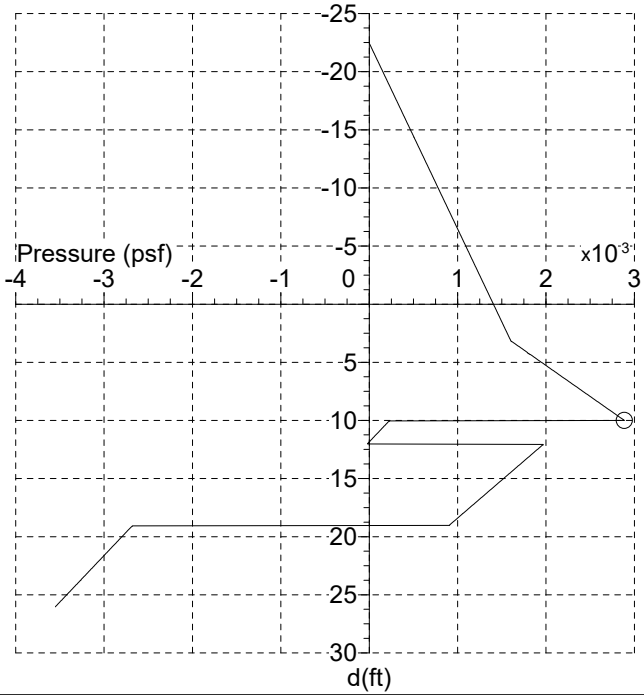
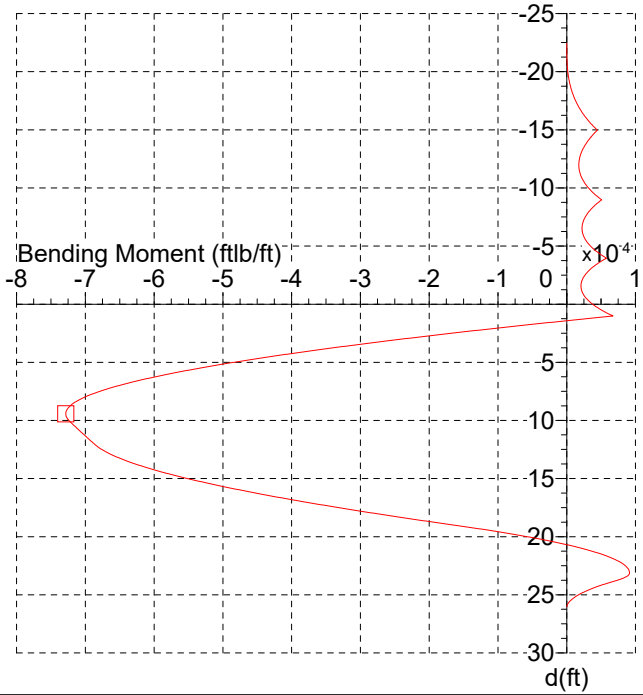
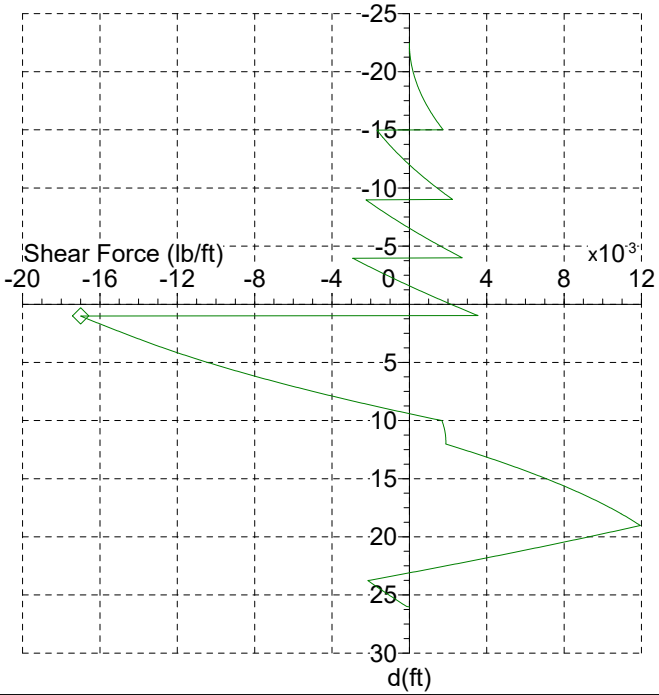
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	2886.8 psf	10.00
□	72850.2 ftlb/ft	9.44
◇	17000.7 lb/ft	1.00

Stage 5 - Wales only







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Title: Colorado River Flood Gate - West Side
Designer: Stage 5
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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 5 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1405.2	3773.4		2155.8	8.75	2659.1	-72288.4		-1691.5	17.50	1132.7	-32875.2		10419.8
0.19	1417.8	4248.0		2441.7	8.94	2689.5	-72534.9		-1257.9	17.69	1108.0	-31177.1		10600.7
0.37	1430.5	4782.6		2730.2	9.12	2727.4	-72744.3		-709.0	17.88	1077.0	-29013.6		10821.1
0.56	1440.6	5253.9		2962.8	9.31	2757.8	-72831.7		-264.4	18.06	1046.1	-26806.0		11035.3
0.74	1453.3	5897.8		3255.9	9.50	2795.7	-72839.7		298.3	18.25	1021.3	-25009.1		11202.2
0.93	1463.4	6457.2		3492.2	9.68	2833.7	-72733.3		868.7	18.44	990.4	-22725.3		11405.1
1.12	1476.1	4698.4		-16821.8	9.87	2864.0	-72564.7		1330.6	18.62	965.6	-20869.0		11563.0
1.30	1488.7	1333.4		-16521.6	10.06	225.1	-72252.6		1698.4	18.81	934.7	-18513.1		11754.6
1.49	1498.8	-1315.0		-16279.5	10.24	199.8	-71975.5		1732.0	18.99	910.0	-16118.9		11940.3
1.68	1511.5	-4570.4		-15974.6	10.43	174.5	-71621.8		1769.3	19.18	-2696.7	-14212.0		11505.1
1.86	1521.6	-7130.4		-15728.9	10.61	149.2	-71261.0		1801.6	19.37	-2722.0	-11927.7		10956.3
2.05	1534.3	-10274.5		-15419.4	10.80	129.0	-70967.9		1823.7	19.55	-2742.2	-10180.6		10513.6
2.23	1546.9	-13356.0		-15107.4	10.99	103.7	-70596.9		1846.7	19.74	-2767.5	-8097.8		9955.6
2.42	1557.1	-15775.9		-14855.9	11.17	83.5	-70296.9		1861.5	19.93	-2792.8	-6128.4		9392.4
2.61	1569.7	-18743.5		-14539.3	11.36	58.2	-69919.0		1875.3	20.11	-2813.0	-4635.1		8938.2
2.79	1579.9	-21071.6		-14284.1	11.55	32.9	-69538.6		1884.0	20.30	-2838.3	-2872.3		8365.9
2.98	1592.5	-23923.6		-13962.8	11.73	12.7	-69233.3		1887.3	20.48	-2858.5	-1545.8		7904.3
3.17	1603.9	-26710.8		-13639.0	11.92	-12.6	-68851.3		1886.8	20.67	-2883.8	7.0		7322.7
3.35	1641.9	-28893.2		-13375.0	12.10	1969.1	-68542.7		2044.6	20.86	-2909.1	1441.7		6736.1
3.54	1679.8	-31560.9		-13038.1	12.29	1930.9	-68097.0		2437.9	21.04	-2929.3	2503.7		6263.0
3.72	1710.2	-33645.9		-12763.1	12.48	1900.0	-67572.1		2824.9	21.23	-2954.6	3723.1		5667.1
3.91	1748.1	-36189.2		-12412.4	12.66	1875.2	-67096.1		3130.0	21.41	-2974.8	4611.6		5186.7
4.10	1786.1	-38661.2		-12054.0	12.85	1844.3	-66432.1		3505.8	21.60	-3000.1	5612.4		4581.6
4.28	1808.9	-40586.5		-11762.4	13.04	1819.5	-65846.5		3801.9	21.79	-3025.4	6490.4		3971.4
4.47	1854.4	-42926.5		-11390.1	13.22	1788.6	-65047.4		4166.3	21.97	-3045.6	7103.6		3479.5
4.66	1884.8	-44744.1		-11086.8	13.41	1757.6	-64175.0		4524.5	22.16	-3070.9	7757.8		2860.1
4.84	1922.7	-46946.9		-10700.8	13.59	1732.9	-63425.3		4806.6	22.35	-3091.2	8190.6		2360.9
5.03	1960.7	-49071.2		-10307.1	13.78	1702.0	-62424.2		5153.5	22.53	-3116.4	8617.6		1732.2
5.21	1991.1	-50713.2		-9986.5	13.97	1677.2	-61573.2		5426.6	22.72	-3141.7	8917.0		1098.4
5.40	2029.0	-52692.6		-9579.0	14.15	1646.3	-60447.6		5762.3	22.90	-3162.0	9063.8		587.7
5.59	2059.4	-54216.5		-9247.4	14.34	1615.3	-59254.6		6091.7	23.09	-3187.3	9136.1		-55.2
5.77	2097.3	-56045.8		-8826.0	14.52	1590.6	-58252.5		6350.7	23.28	-3207.5	9024.2		-573.3
5.96	2135.3	-57789.6		-8397.0	14.71	1559.6	-56941.3		6668.8	23.46	-3232.8	8556.3		-1225.5
6.15	2165.7	-59122.0		-8048.2	14.90	1534.9	-55846.3		6918.8	23.65	-3256.9	7721.1		-1882.8
6.33	2203.6	-60708.0		-7605.3	15.08	1504.0	-54421.0		7225.7	23.84	-3278.3	6805.5		-2076.9
6.52	2234.0	-61912.1		-7245.5	15.27	1473.0	-52934.1		7526.3	24.02	-3303.6	5679.3		-1901.0
6.70	2271.9	-63335.2		-6788.8	15.46	1448.3	-51701.1		7762.3	24.21	-3323.8	4849.5		-1759.3
6.89	2309.9	-64665.7		-6324.4	15.64	1417.3	-50106.6		8051.6	24.39	-3349.1	3902.1		-1581.0
7.08	2340.3	-65662.3		-5947.3	15.83	1392.6	-48789.0		8278.6	24.58	-3374.4	3055.0		-1401.3
7.26	2378.2	-66822.2		-5469.1	16.01	1361.6	-47090.9		8556.7	24.77	-3394.6	2450.1		-1256.6
7.45	2408.6	-67680.3		-5081.0	16.20	1330.7	-45337.0		8828.5	24.95	-3419.9	1785.7		-1074.5
7.63	2446.5	-68664.4		-4588.9	16.39	1306.0	-43894.5		9041.4	25.14	-3440.1	1327.9		-927.9
7.82	2484.5	-69548.9		-4089.2	16.57	1275.0	-42043.4		9302.0	25.33	-3465.4	848.5		-743.3
8.01	2514.9	-70183.5		-3683.9	16.76	1250.3	-40524.9		9505.9	25.51	-3490.7	472.9		-557.5
8.19	2552.8	-70884.5		-3170.3	16.95	1219.3	-38580.7		9755.1	25.70	-3510.9	247.8		-407.8
8.38	2583.2	-71370.4		-2754.0	17.13	1188.4	-36586.5		9998.2	25.88	-3536.2	61.2		-219.4
8.57	2621.1	-71882.8		-2226.6	17.32	1163.6	-34956.1		10188.1	26.07	-3551.4	0.0		0.0

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Title: Colorado River Flood Gate - West Side
Designer: Stage 5
Ref: 1.0
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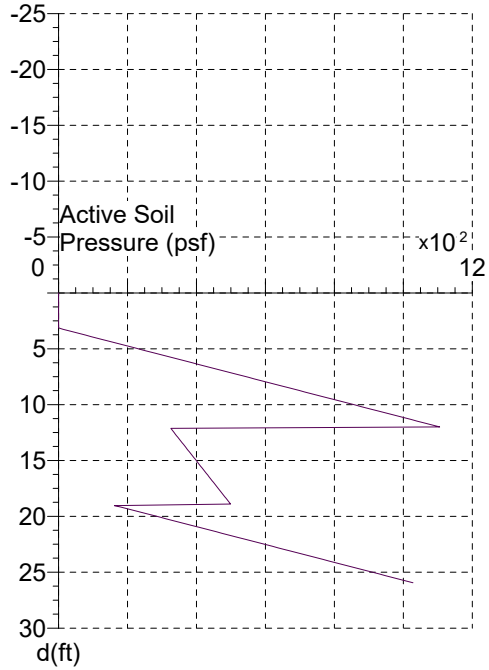
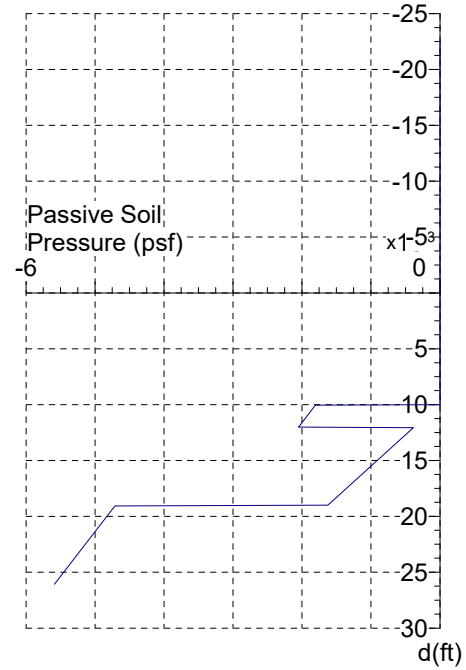
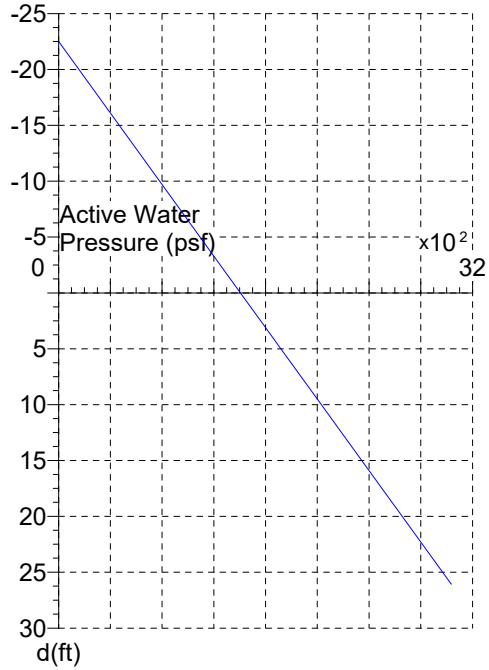
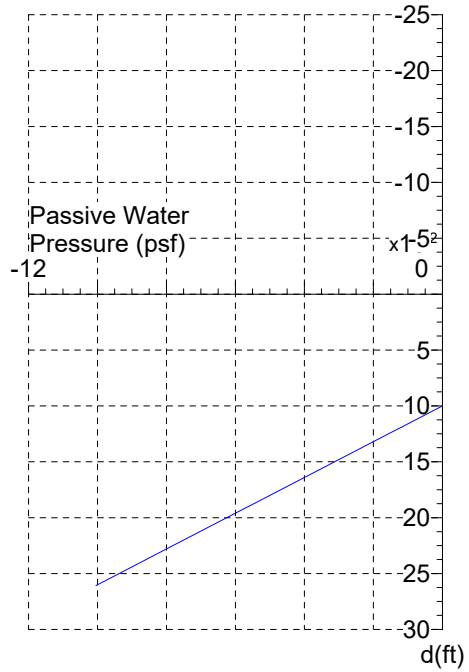
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

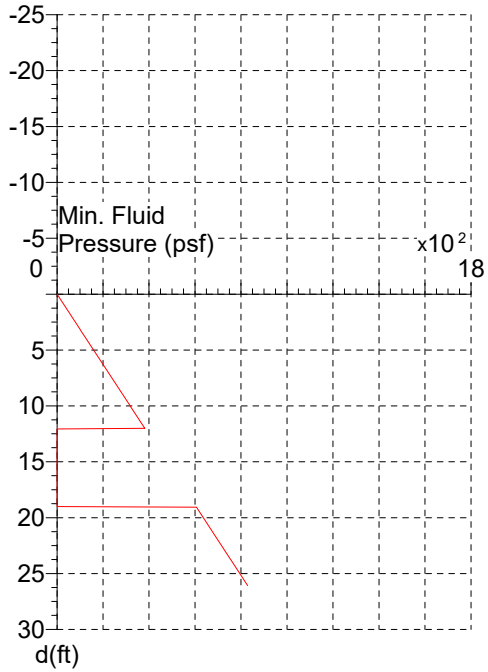
Stage 5 - Wales only

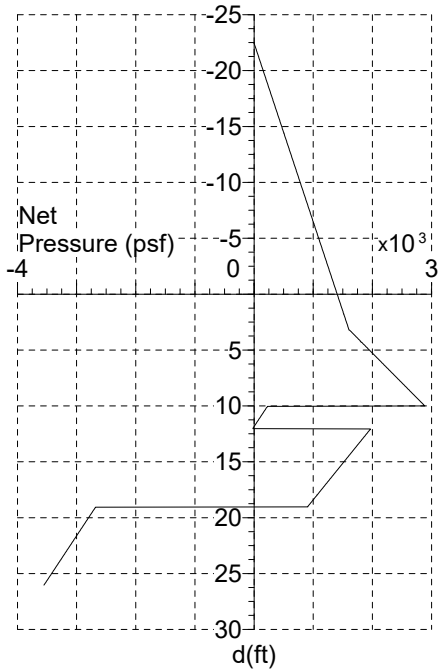












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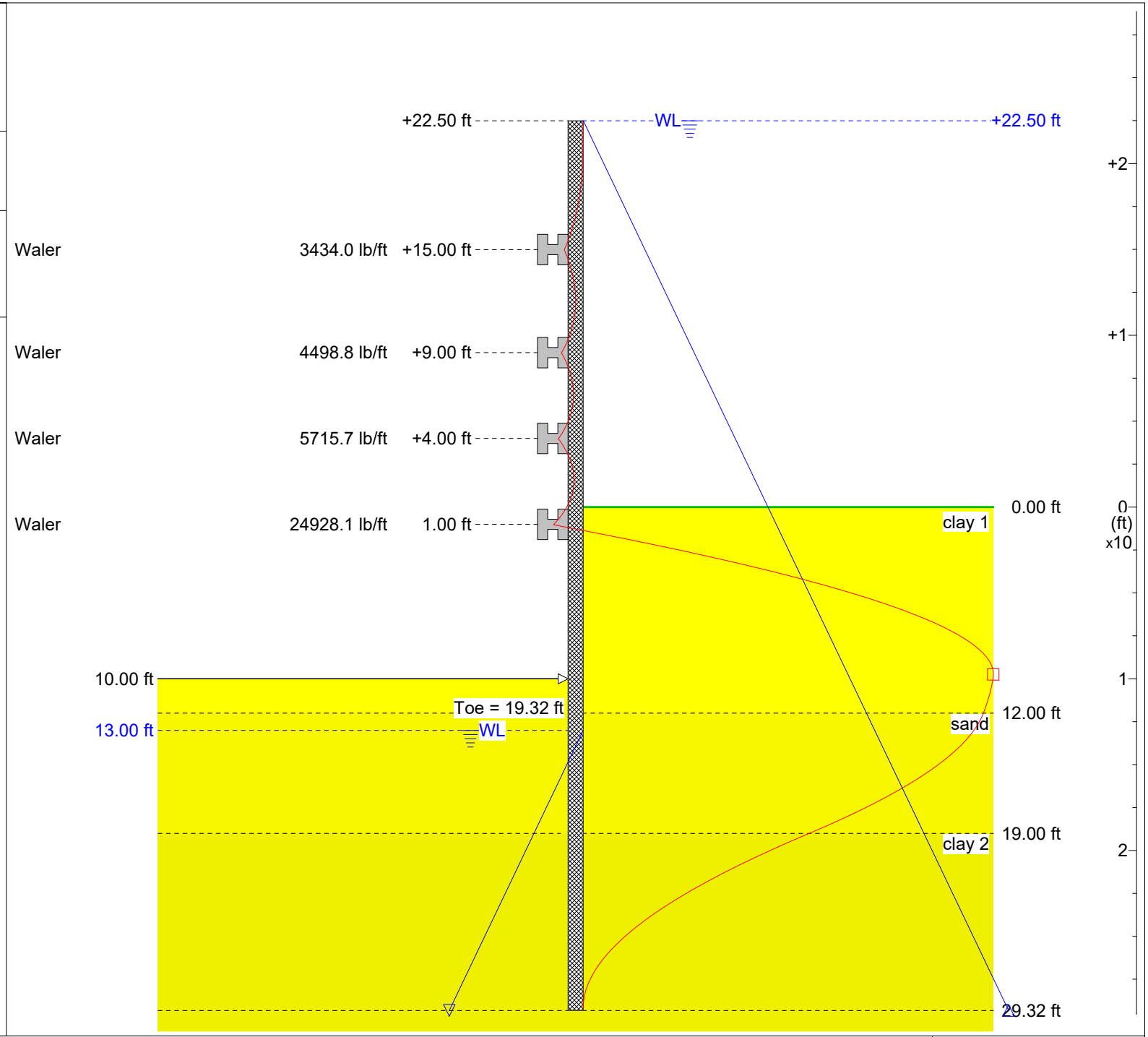
Toe: Free Earth Support

	Maximum	d (ft)
□	95784.3 ftlb/ft	9.76
△	3238.6 psf	29.32
△	1019.9 psf	29.32

Stage 6 - Tip and Moment only



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Stage 6 - Tip and Moment only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	19.32	51.82

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3434.0
+9.00	Waler	4498.8
+4.00	Waler	5715.7
1.00	Waler	24928.1

Maxima

	Maximum	Depth (ft)
Pressure	3304.7 psf	10.00
Bending Moment	95784.3 ftlb/ft	9.76
Shear Force	21194.6 lb/ft	1.03

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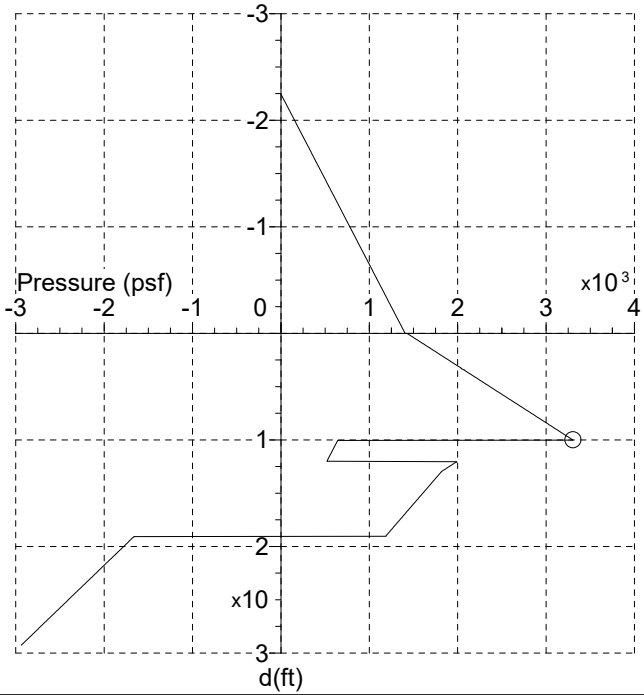
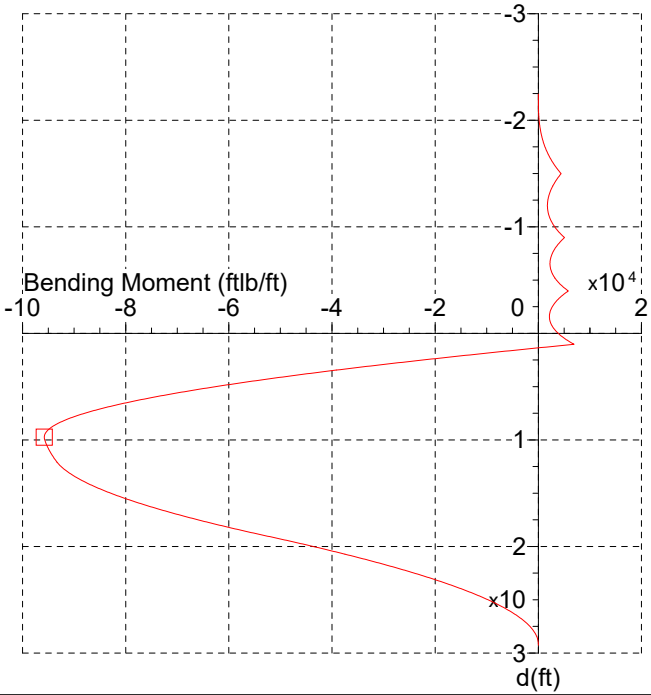
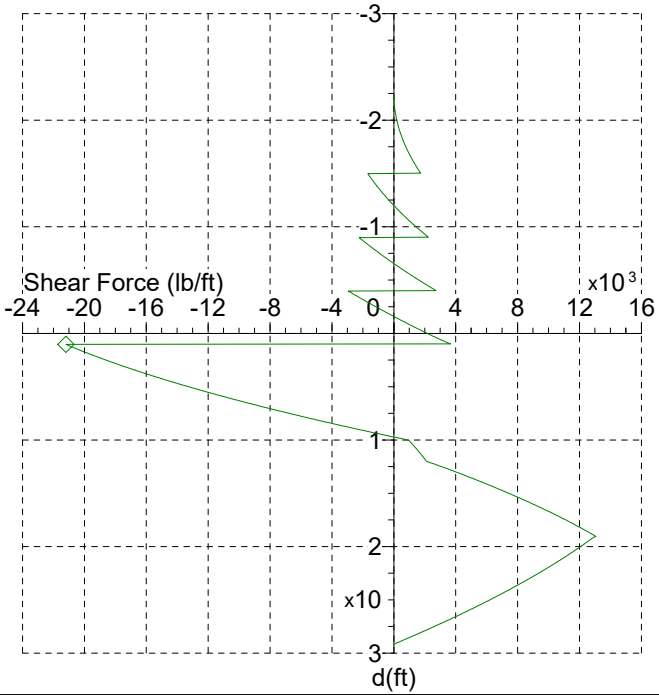
Analysis: Net Pressure
Toe: Free Earth Support

Maximum	d (ft)
○ 3304.7 psf	10.00
□ 95784.3 ftlb/ft	9.76
◇ 21194.6 lb/ft	1.03

Stage 6 - Tip and Moment only







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Stage 6 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1433.9	3943.3		2212.9	9.84	3272.3	-95773.2		389.6	19.68	-1739.5	-46464.7		12376.0
0.21	1466.3	4355.8		2464.1	10.05	641.8	-95667.2		986.0	19.89	-1766.5	-44531.8		12163.7
0.42	1506.8	4935.3		2785.9	10.26	628.4	-95503.5		1123.0	20.10	-1793.5	-42632.5		11948.1
0.63	1547.3	5587.5		3116.5	10.47	614.9	-95318.5		1256.9	20.31	-1820.5	-40767.2		11729.3
0.84	1587.8	6314.4		3455.8	10.68	601.4	-95112.5		1387.9	20.52	-1847.5	-38936.6		11507.2
1.05	1628.2	6030.8		-21124.3	10.89	587.9	-94886.2		1516.0	20.73	-1874.6	-37141.2		11281.8
1.26	1668.7	1503.7		-20767.5	11.10	574.4	-94639.9		1641.2	20.94	-1901.6	-35381.4		11053.1
1.47	1709.2	-2945.7		-20401.9	11.31	563.6	-94428.8		1739.2	21.15	-1923.2	-33999.6		10867.9
1.68	1741.6	-6447.9		-20103.2	11.52	550.2	-94147.7		1859.2	21.36	-1950.2	-32305.2		10633.3
1.88	1782.1	-10752.6		-19721.9	11.73	536.7	-93847.9		1976.2	21.57	-1977.2	-30648.0		10395.5
2.09	1822.6	-14974.2		-19331.9	11.94	523.2	-93529.9		2090.3	21.78	-2004.2	-29028.3		10154.5
2.30	1863.1	-19110.9		-18933.1	12.15	1965.2	-93182.2		2454.7	21.99	-2031.2	-27446.8		9910.1
2.51	1903.6	-23160.9		-18525.6	12.36	1925.1	-92769.7		2873.8	22.20	-2058.2	-25903.8		9662.5
2.72	1944.1	-27122.2		-18109.4	12.56	1885.0	-92291.8		3284.3	22.41	-2079.8	-24697.7		9462.1
2.93	1976.5	-30226.1		-17770.1	12.77	1853.0	-91863.4		3606.4	22.62	-2106.8	-23225.6		9208.6
3.14	2017.0	-34023.0		-17338.1	12.98	1812.9	-91271.3		4001.3	22.83	-2133.8	-21793.6		8951.9
3.35	2057.5	-37725.9		-16897.7	13.19	1792.4	-90617.5		4390.3	23.04	-2160.9	-20402.1		8691.9
3.56	2098.0	-41333.1		-16448.3	13.40	1769.9	-89902.9		4774.4	23.24	-2187.9	-19051.8		8428.6
3.77	2138.5	-44842.5		-15990.0	13.61	1747.4	-89128.2		5153.6	23.45	-2214.9	-17743.0		8162.1
3.98	2179.0	-48252.4		-15523.1	13.82	1724.9	-88294.1		5528.0	23.66	-2241.9	-16476.4		7892.3
4.19	2219.5	-51560.7		-15047.4	14.03	1706.9	-87584.7		5824.0	23.87	-2263.5	-15493.8		7674.1
4.40	2251.9	-54133.0		-14660.5	14.24	1684.4	-86645.8		6189.6	24.08	-2290.5	-14304.3		7398.4
4.61	2292.3	-57253.8		-14169.1	14.45	1662.0	-85649.6		6550.3	24.29	-2317.5	-13158.3		7119.4
4.82	2332.8	-60267.9		-13668.9	14.66	1639.5	-84597.1		6906.3	24.50	-2344.5	-12056.4		6837.2
5.03	2373.3	-63173.3		-13160.0	14.87	1617.0	-83488.9		7257.3	24.71	-2371.5	-10999.2		6551.7
5.24	2413.8	-65968.2		-12642.3	15.08	1594.5	-82325.8		7603.5	24.92	-2398.5	-9987.0		6263.0
5.44	2454.3	-68650.6		-12115.9	15.29	1572.0	-81108.5		7944.9	25.13	-2425.6	-9020.4		5971.0
5.65	2486.7	-70714.3		-11688.5	15.50	1554.0	-80096.2		8214.5	25.34	-2447.2	-8280.3		5735.0
5.86	2527.2	-73189.5		-11146.3	15.71	1531.5	-78783.5		8547.1	25.55	-2474.2	-7397.1		5437.1
6.07	2567.7	-75547.0		-10595.5	15.92	1509.1	-77418.7		8874.8	25.76	-2501.2	-6561.0		5135.9
6.28	2608.2	-77784.9		-10035.8	16.12	1486.6	-76002.7		9197.8	25.97	-2528.2	-5772.5		4831.5
6.49	2648.7	-79901.3		-9467.4	16.33	1464.1	-74536.2		9515.8	26.18	-2555.2	-5032.0		4523.8
6.70	2689.2	-81894.3		-8890.3	16.54	1441.6	-73020.0		9829.0	26.39	-2582.2	-4340.1		4212.8
6.91	2729.7	-83762.1		-8304.5	16.75	1419.1	-71454.9		10137.3	26.60	-2603.8	-3821.9		3961.7
7.12	2762.1	-85164.8		-7829.5	16.96	1401.1	-70168.0		10380.5	26.80	-2630.8	-3218.8		3644.9
7.33	2802.6	-86802.3		-7227.9	17.17	1378.6	-68516.7		10680.1	27.01	-2657.8	-2665.7		3324.8
7.54	2843.1	-88309.3		-6617.5	17.38	1356.2	-66818.6		10974.9	27.22	-2684.8	-2163.2		3001.4
7.75	2883.6	-89683.8		-5998.5	17.59	1333.7	-65074.4		11264.8	27.43	-2711.9	-1711.7		2674.8
7.96	2924.1	-90924.0		-5370.6	17.80	1311.2	-63284.9		11549.8	27.64	-2738.9	-1311.8		2344.8
8.17	2964.5	-92027.9		-4734.1	18.01	1288.7	-61450.9		11830.0	27.85	-2765.9	-963.9		2011.7
8.38	3005.0	-92993.8		-4088.8	18.22	1270.7	-59952.2		12050.6	28.06	-2787.5	-723.5		1742.8
8.59	3037.4	-93665.8		-3566.2	18.43	1248.2	-58040.0		12322.1	28.27	-2814.5	-470.7		1403.7
8.80	3077.9	-94378.3		-2905.2	18.64	1225.7	-56085.4		12588.7	28.48	-2841.5	-271.5		1061.4
9.00	3118.4	-94947.5		-2235.4	18.85	1203.3	-54089.2		12850.4	28.69	-2868.5	-126.3		715.8
9.21	3158.9	-95371.4		-1556.8	19.06	-1663.9	-52052.2		12984.6	28.90	-2895.5	-35.6		367.0
9.42	3199.4	-95648.1		-869.5	19.27	-1690.9	-50027.0		12750.0	29.11	-2922.5	0.0		0.0
9.63	3239.9	-95775.8		-173.5	19.48	-1717.9	-48034.9		12543.5	29.32	-2938.7	0.0		0.0

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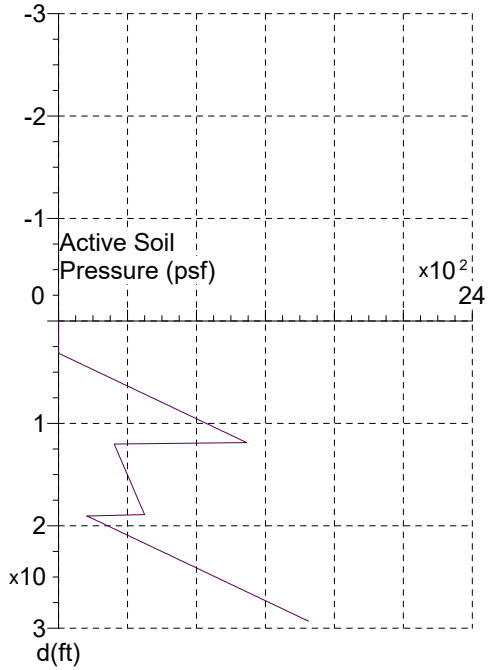
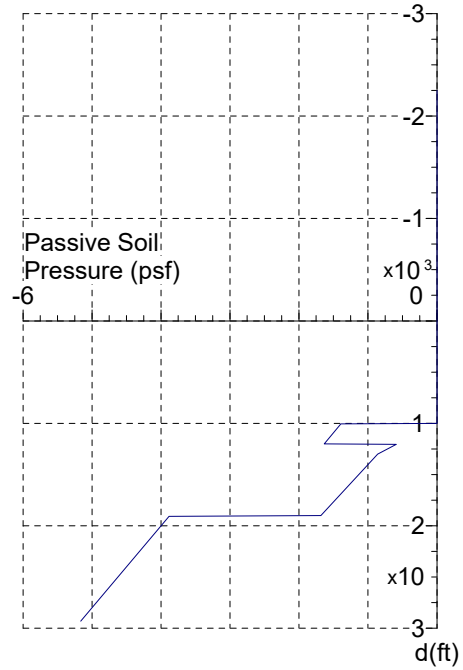
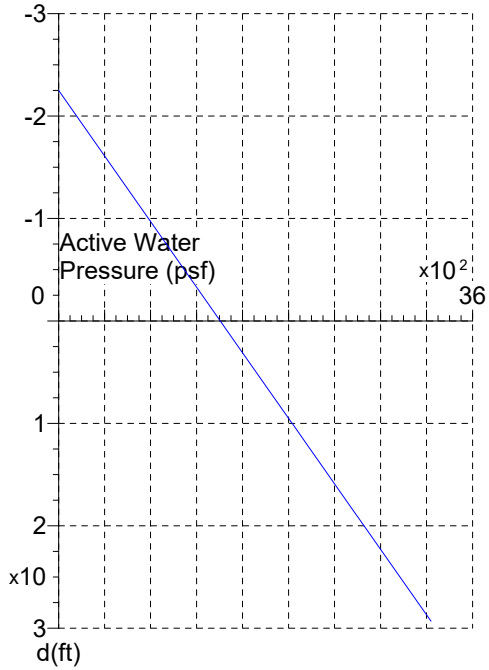
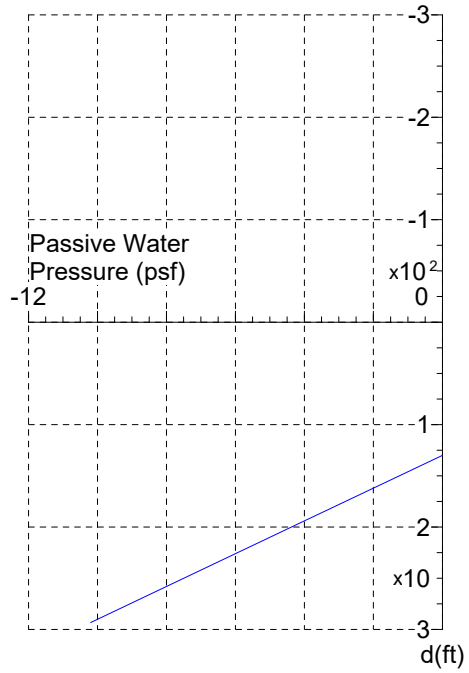
Analysis: Net Pressure
Toe: Free Earth Support

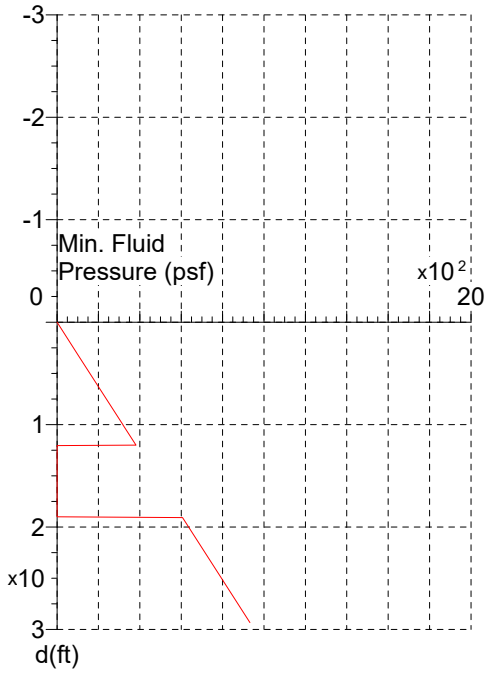
Stage 6 - Tip and Moment only

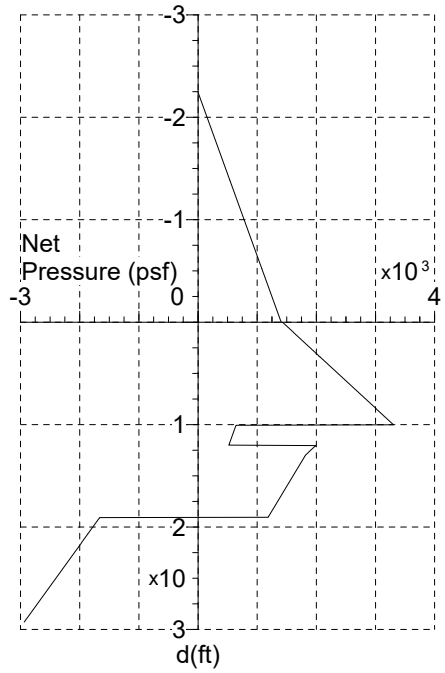












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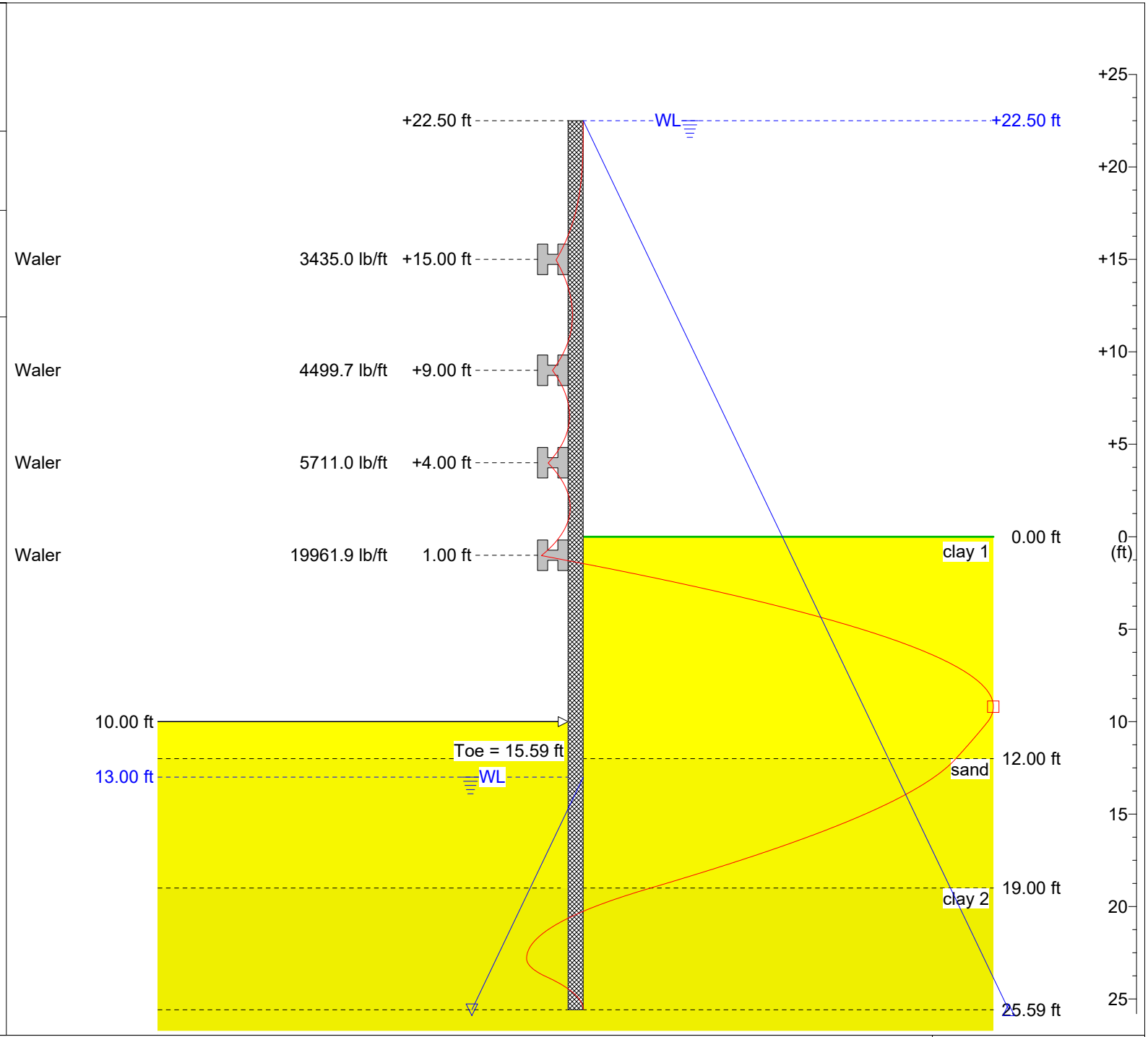
Title: Colorado River Flood Gate - West Side
Designer: Stage 6
Ref: 1.0
Page: 1
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	67300.8 ftlb/ft	9.20
△	3005.4 psf	25.59
△	786.6 psf	25.59

Stage 6 - Wales only



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Toe: Free Earth Support

Stage 6 - Wales only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	15.59	48.09

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3435.0
+9.00	Waler	4499.7
+4.00	Waler	5711.0
1.00	Waler	19961.9

Maxima

	Maximum	Depth (ft)
Pressure	2886.2 psf	10.00
Bending Moment	67300.8 ftlb/ft	9.20
Shear Force	16332.3 lb/ft	1.00

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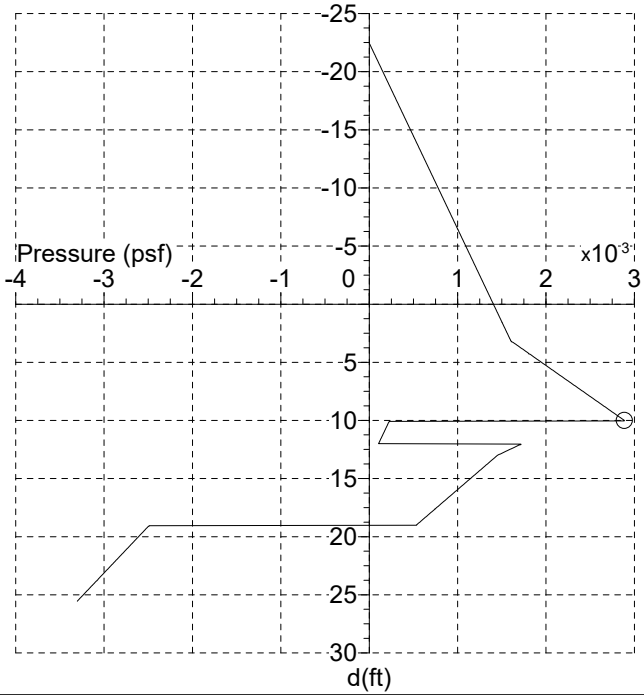
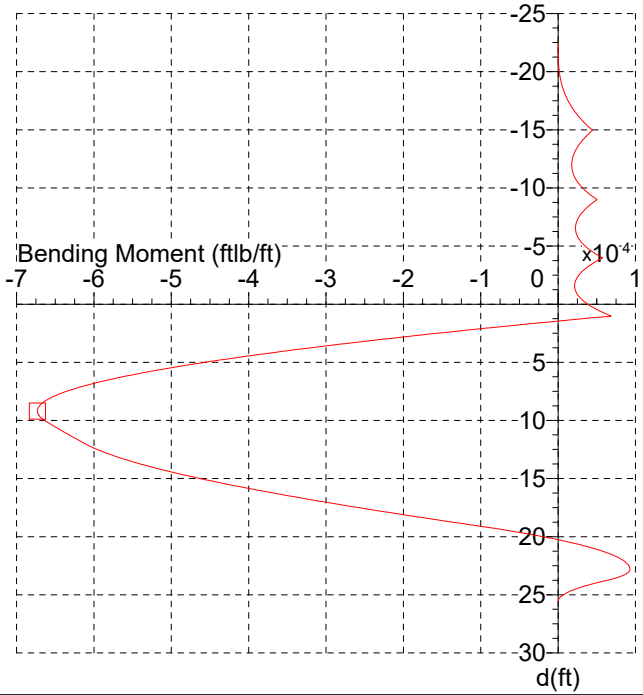
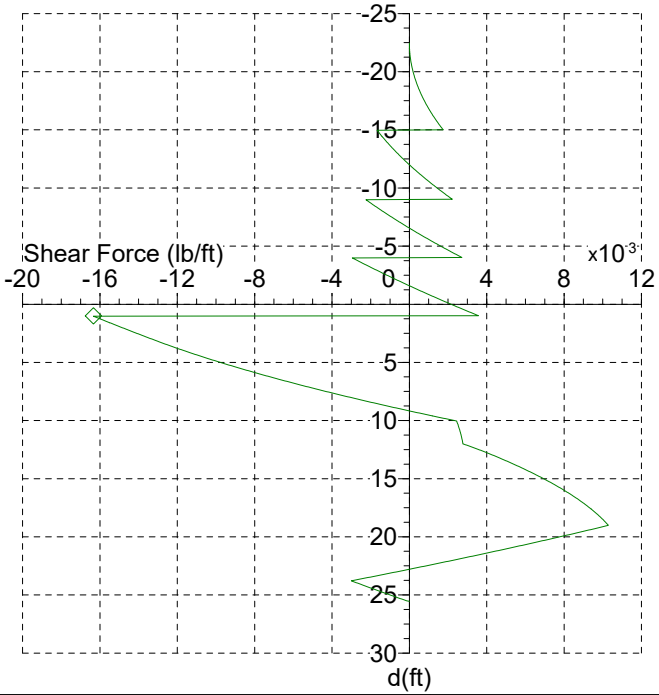
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	2886.2 psf	10.00
□	67300.8 ftlb/ft	9.20
◇	16332.3 lb/ft	1.00

Stage 6 - Wales only







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Pressure: Coulomb
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Toe: Free Earth Support

Stage 6 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1406.2	3894.8		2188.2	8.59	2623.2	-66826.2		-1538.9	17.18	806.6	-28436.0		9090.8
0.18	1418.7	4370.9		2471.4	8.77	2660.7	-67091.4		-1008.8	17.36	782.1	-26971.1		9217.6
0.37	1428.8	4794.1		2699.8	8.96	2690.8	-67227.0		-579.3	17.54	751.5	-25111.8		9370.7
0.55	1441.3	5376.4		2987.6	9.14	2728.4	-67299.4		-35.7	17.73	727.0	-23602.6		9488.7
0.73	1451.3	5885.3		3219.6	9.32	2765.9	-67262.5		515.5	17.91	696.4	-21689.8		9630.6
0.91	1463.8	6575.6		3511.9	9.50	2796.0	-67153.1		961.9	18.09	665.7	-19749.1		9766.5
1.10	1473.9	5560.8		-16214.3	9.69	2833.6	-66915.2		1526.6	18.28	641.2	-18177.3		9870.7
1.28	1486.4	2345.2		-15917.5	9.87	2863.7	-66643.1		1983.8	18.46	610.6	-16189.4		9995.5
1.46	1496.4	-184.5		-15678.2	10.05	225.4	-66199.4		2454.5	18.64	586.1	-14581.3		10090.9
1.64	1509.0	-3292.6		-15376.9	10.23	215.4	-65803.8		2489.8	18.82	555.5	-12550.2		10204.7
1.83	1521.5	-6340.4		-15073.1	10.42	202.9	-65301.5		2531.4	19.01	537.1	-10909.1		10291.5
2.01	1531.5	-8734.8		-14828.2	10.60	190.4	-64791.1		2570.6	19.19	-2512.2	-8887.1		9790.4
2.19	1544.1	-11672.5		-14519.8	10.78	180.4	-64377.3		2600.1	19.37	-2532.2	-7342.0		9385.7
2.38	1554.1	-13978.3		-14271.3	10.97	167.9	-63853.5		2634.7	19.55	-2557.2	-5502.2		8875.4
2.56	1566.6	-16804.4		-13958.5	11.15	157.9	-63429.5		2660.6	19.74	-2582.3	-3765.1		8360.0
2.74	1576.6	-19020.2		-13706.3	11.33	145.3	-62894.0		2690.7	19.92	-2602.3	-2449.9		7944.1
2.92	1589.2	-21733.1		-13388.9	11.51	135.3	-62461.3		2713.0	20.10	-2627.3	-900.1		7419.7
3.11	1599.2	-24382.4		-13069.1	11.70	122.8	-61915.6		2738.6	20.29	-2647.4	263.8		6996.6
3.29	1631.1	-26455.7		-12809.8	11.88	112.8	-61475.5		2757.3	20.47	-2672.4	1623.1		6463.1
3.47	1668.7	-28988.5		-12478.5	12.06	1716.5	-60918.6		2907.9	20.65	-2692.4	2633.3		6032.8
3.66	1698.7	-30966.7		-12208.0	12.24	1649.7	-60309.0		3242.8	20.83	-2717.5	3798.7		5490.3
3.84	1736.3	-33378.1		-11863.1	12.43	1605.1	-59773.4		3502.8	21.02	-2737.5	4652.5		5052.7
4.02	1766.4	-35257.3		-11581.8	12.61	1549.4	-59046.1		3817.7	21.20	-2762.5	5620.8		4501.2
4.20	1804.0	-37542.6		-11223.4	12.79	1504.9	-58419.4		4061.6	21.38	-2787.6	6478.2		3944.7
4.39	1834.0	-39319.0		-10931.5	12.98	1450.5	-57581.8		4356.5	21.57	-2807.6	7083.6		3495.9
4.57	1871.6	-41473.3		-10559.5	13.16	1425.4	-56869.6		4586.4	21.75	-2832.6	7738.8		2930.4
4.75	1909.2	-43552.6		-10180.0	13.34	1394.8	-55927.9		4868.3	21.93	-2852.7	8181.2		2474.3
4.93	1939.2	-45161.2		-9871.0	13.52	1370.2	-55134.2		5089.4	22.11	-2877.7	8631.0		1899.8
5.12	1976.8	-47101.9		-9477.9	13.71	1339.6	-54092.6		5360.3	22.30	-2897.7	8907.7		1436.5
5.30	2006.9	-48597.6		-9158.1	13.89	1309.0	-52997.2		5625.0	22.48	-2922.8	9148.8		852.9
5.48	2044.5	-50394.8		-8751.5	14.07	1284.5	-52083.0		5832.4	22.66	-2947.8	9272.7		264.3
5.67	2074.5	-51773.7		-8420.8	14.26	1253.9	-50894.0		6086.0	22.84	-2967.8	9283.5		-210.2
5.85	2112.1	-53422.6		-8000.6	14.44	1229.3	-49906.4		6284.6	23.03	-2992.9	9084.9		-807.8
6.03	2142.2	-54680.8		-7659.0	14.62	1198.7	-48627.6		6527.2	23.21	-3012.9	8735.3		-1289.6
6.21	2179.7	-56176.4		-7225.3	14.80	1174.2	-47569.9		6716.9	23.39	-3037.9	8057.7		-1896.2
6.40	2217.3	-57584.8		-6784.1	14.99	1143.6	-46205.4		6948.5	23.58	-3058.0	7322.0		-2385.2
6.58	2247.4	-58647.6		-6425.7	15.17	1112.9	-44794.9		7173.9	23.76	-3078.0	6158.3		-3000.6
6.76	2285.0	-59895.1		-5970.9	15.35	1088.4	-43634.3		7349.8	23.94	-3103.0	5130.9		-2742.0
6.94	2315.0	-60827.3		-5601.6	15.53	1057.8	-42144.4		7564.2	24.12	-3128.1	3975.7		-2416.3
7.13	2352.6	-61909.1		-5133.3	15.72	1033.3	-40921.7		7731.3	24.31	-3153.1	2964.9		-2088.0
7.31	2382.7	-62706.7		-4753.2	15.90	1002.7	-39356.2		7934.7	24.49	-3173.1	2261.2		-1823.5
7.49	2420.2	-63617.9		-4271.3	16.08	978.2	-38074.7		8092.9	24.67	-3198.2	1513.5		-1490.5
7.68	2457.8	-64432.2		-3781.8	16.27	947.5	-36437.6		8285.2	24.85	-3218.2	1021.7		-1222.2
7.86	2487.9	-65012.9		-3384.9	16.45	923.0	-35100.5		8434.7	25.04	-3243.3	540.7		-884.5
8.04	2525.5	-65649.1		-2881.9	16.63	892.4	-33395.8		8615.9	25.22	-3263.3	263.8		-612.5
8.22	2555.5	-66085.3		-2474.1	16.81	861.8	-31655.3		8791.0	25.40	-3288.3	53.4		-270.1
8.41	2593.1	-66538.4		-1957.5	17.00	837.3	-30237.9		8926.7	25.59	-3303.3	0.0		0.0

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Ref: 1.0
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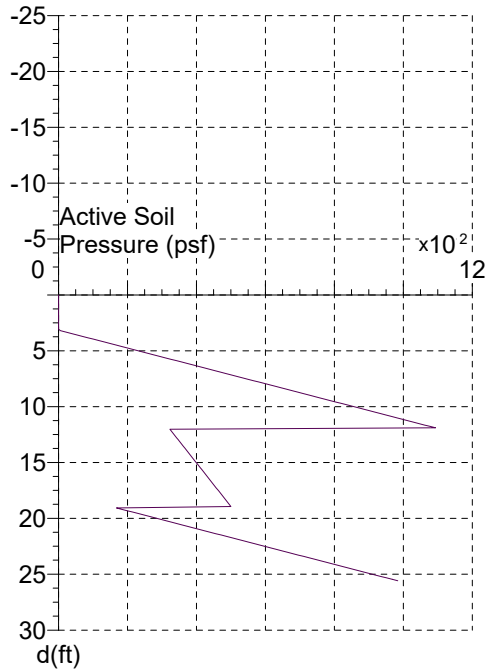
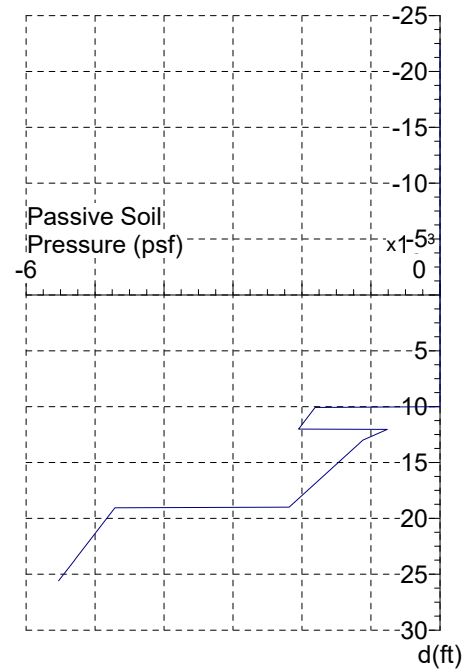
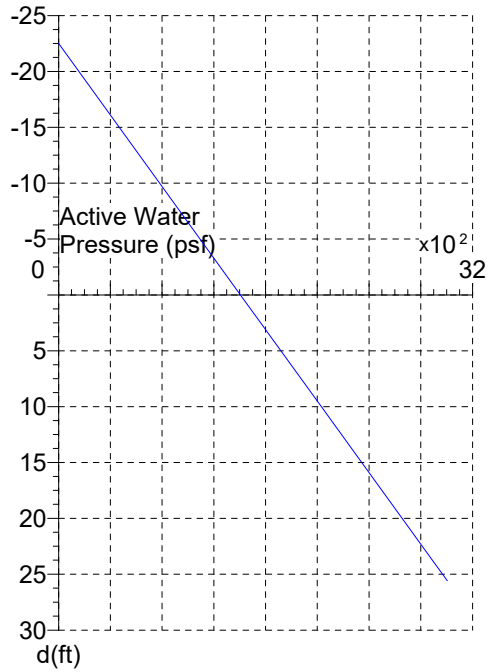
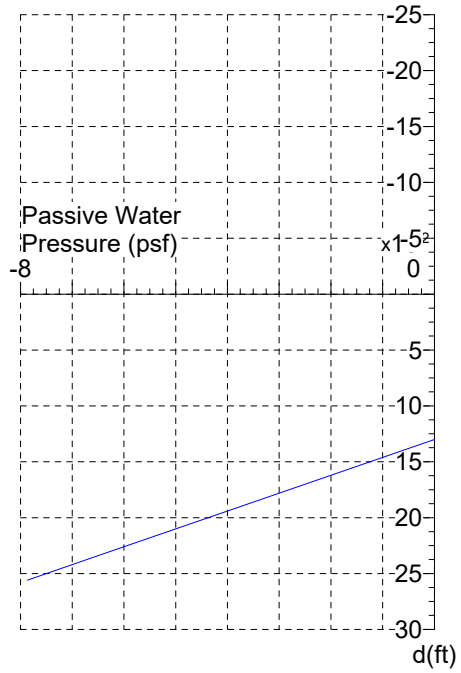
Analysis: Net Pressure
Toe: Free Earth Support

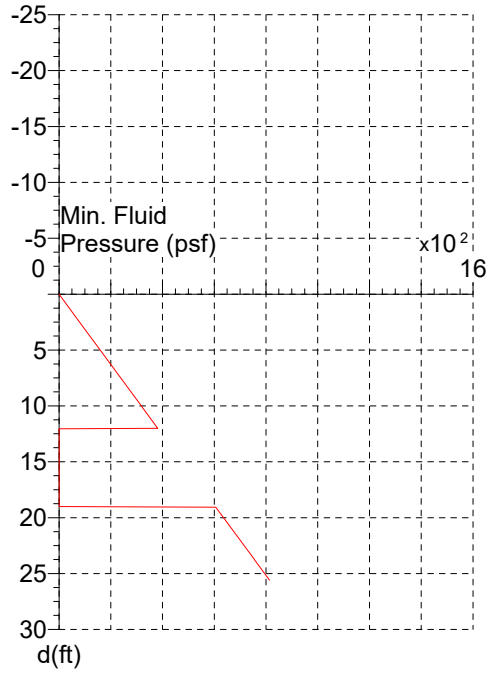
Stage 6 - Wales only

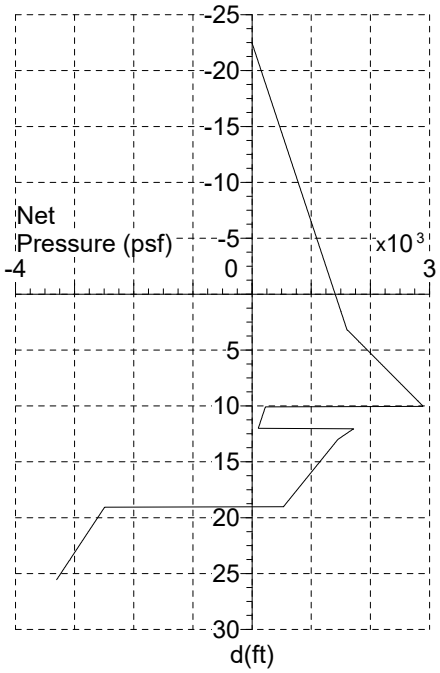












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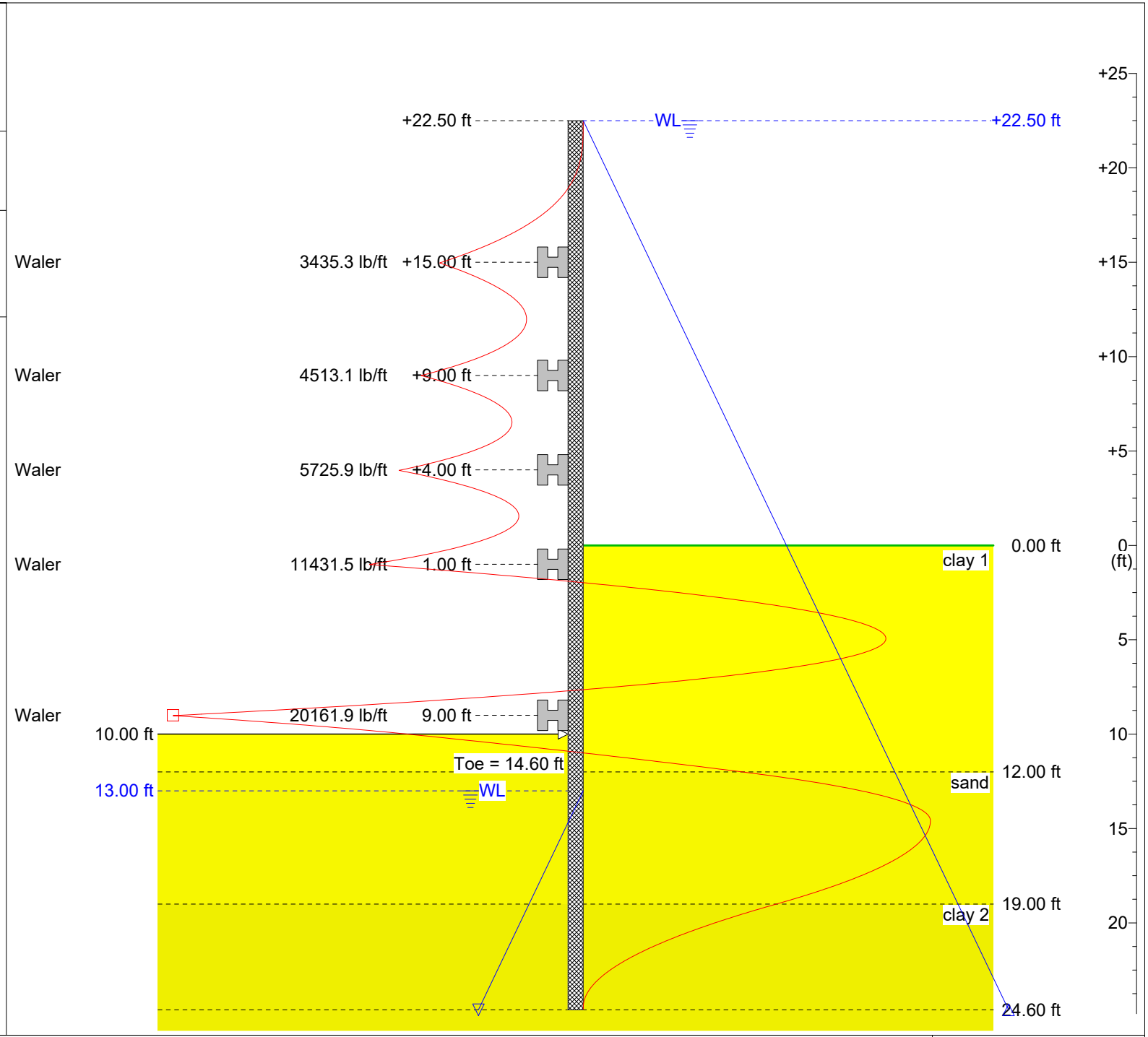
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
□	12754.6 ftlb/ft	9.00
△	2943.9 psf	24.60
△	725.1 psf	24.60

Stage 7 - Tip and Moment only



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Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 7 - Tip and Moment only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile — Active Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43 (0.56)	0.00 (0.00)	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Soil Profile — Passive Side

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1 (692.4)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00 (2.31)	0.00 (0.00)
19.00	clay 2	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9 (1384.6)	0.0	0.0	0.0	1.00	2.00	1.00	2.00

( ) indicates factored value used in all calculations. Factor(s): K_ax1.3; K_p÷1.3; C_{act}÷1.3; C_{pas}÷1.3

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	14.60	47.10

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3435.3
+9.00	Waler	4513.1
+4.00	Waler	5725.9
1.00	Waler	11431.5
9.00	Waler	20161.9

Maxima

	Maximum	Depth (ft)
Pressure	3302.1 psf	10.00
Bending Moment	12754.6 ftlb/ft	9.00
Shear Force	11105.1 lb/ft	9.00

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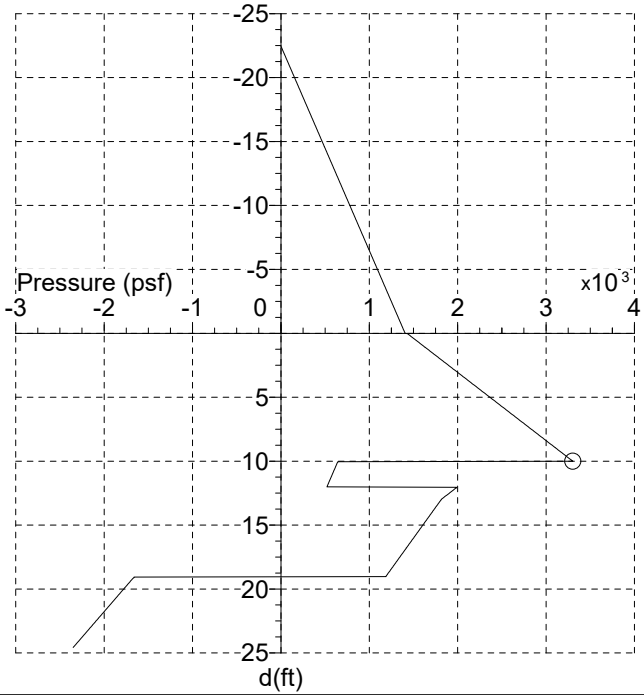
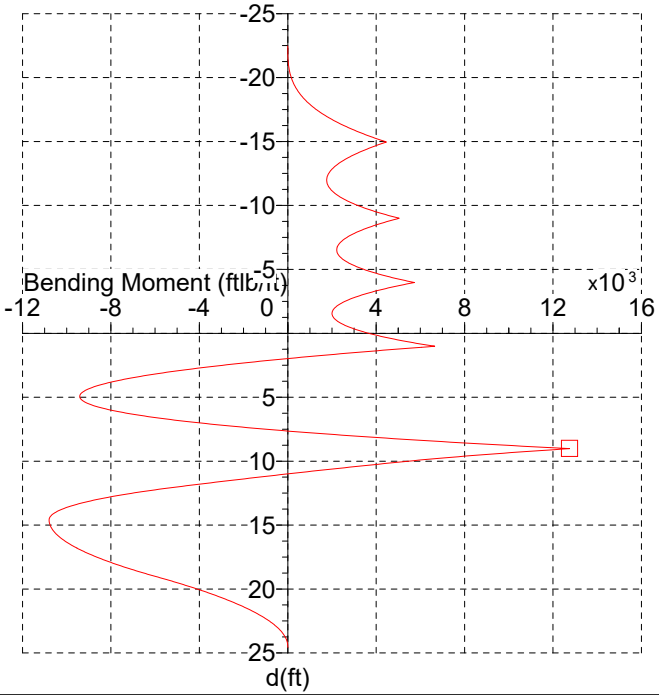
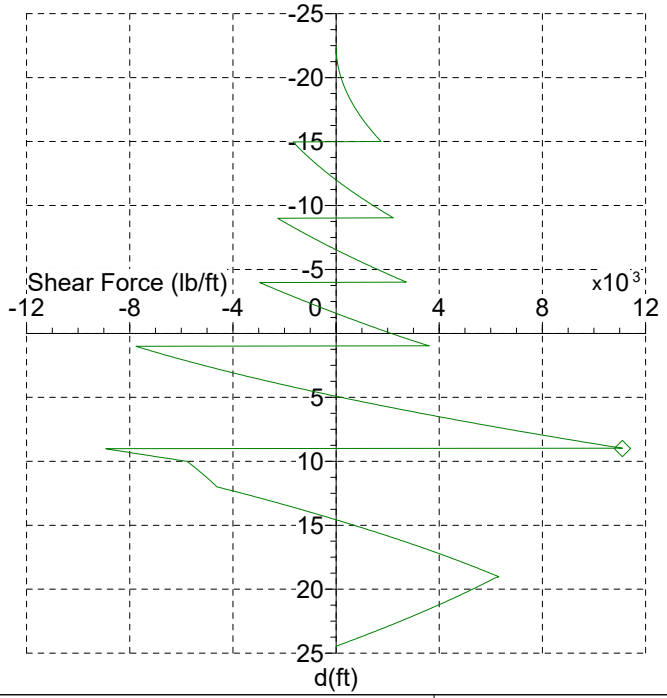
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

	Maximum	d (ft)
○	3302.1 psf	10.00
□	12754.6 ftlb/ft	9.00
◇	11105.1 lb/ft	9.00

Stage 7 - Tip and Moment only







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Title: Colorado River Flood Gate - West Side
Designer: Stage 7
Ref: 1.3
Page: 4
Date: 8.20.18

Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

Stage 7 - Tip and Moment only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1432.2	3734.5		2175.4	8.26	2978.2	5136.0		8951.5	16.52	1443.4	-9792.8		3064.7
0.18	1461.7	4100.9		2403.2	8.44	3015.0	6976.0		9540.3	16.69	1427.1	-9629.9		3289.7
0.35	1498.5	4611.4		2694.4	8.61	3044.4	8533.2		10016.6	16.87	1406.7	-9409.9		3567.4
0.53	1527.9	5062.7		2932.5	8.79	3081.3	10587.5		10618.4	17.05	1390.3	-9221.1		3786.7
0.70	1564.7	5681.5		3236.7	8.96	3110.7	12318.1		11105.1	17.22	1374.0	-9021.0		4003.3
0.88	1594.2	6221.3		3485.3	9.14	3147.5	11378.9		-8442.0	17.40	1353.5	-8755.2		4270.6
1.05	1631.0	6046.6		-7629.0	9.31	3177.0	10080.8		-7945.0	17.57	1337.2	-8530.2		4481.5
1.23	1660.4	4876.4		-7370.1	9.49	3206.4	8861.2		-7443.3	17.75	1316.8	-8233.6		4741.5
1.41	1697.2	3470.8		-7039.8	9.67	3243.2	7448.1		-6809.7	17.92	1300.4	-7984.3		4946.7
1.58	1726.7	2392.8		-6770.5	9.84	3272.7	6407.6		-6297.6	18.10	1280.0	-7657.9		5199.5
1.76	1756.1	1356.9		-6496.5	10.02	643.3	5220.7		-5755.6	18.28	1263.6	-7385.0		5398.8
1.93	1792.9	122.4		-6147.5	10.19	633.5	4321.7		-5655.5	18.45	1243.2	-7029.5		5644.4
2.11	1822.4	-816.1		-5863.1	10.37	621.2	3219.9		-5532.6	18.63	1226.8	-6733.8		5838.0
2.28	1859.2	-1926.7		-5501.1	10.54	611.4	2355.8		-5436.0	18.80	1206.4	-6350.0		6076.4
2.46	1888.6	-2764.1		-5206.3	10.72	599.2	1296.8		-5317.4	18.98	1190.1	-6032.0		6264.2
2.64	1925.5	-3746.1		-4831.3	10.90	589.4	466.3		-5224.3	19.15	-1677.2	-5629.2		6104.6
2.81	1954.9	-4479.0		-4526.1	11.07	577.1	-551.4		-5110.1	19.33	-1696.8	-5316.4		5951.7
2.99	1991.7	-5327.8		-4138.1	11.25	567.3	-1349.5		-5020.5	19.51	-1721.3	-4936.5		5758.0
3.16	2021.2	-5952.4		-3822.5	11.42	555.0	-2327.5		-4910.6	19.68	-1741.0	-4641.7		5601.1
3.34	2058.0	-6663.6		-3421.5	11.60	545.2	-3094.5		-4824.4	19.86	-1765.5	-4284.6		5402.4
3.51	2087.4	-7176.2		-3095.5	11.77	533.0	-4034.3		-4718.8	20.03	-1785.2	-4008.2		5241.5
3.69	2124.2	-7745.3		-2681.5	11.95	523.2	-4771.3		-4636.1	20.21	-1809.7	-3674.5		5037.8
3.87	2153.7	-8142.3		-2345.1	12.13	1968.3	-5660.8		-4304.6	20.38	-1829.3	-3417.1		4872.9
4.04	2190.5	-8564.6		-1918.1	12.30	1939.2	-6319.5		-3998.4	20.56	-1853.9	-3107.4		4664.2
4.22	2219.9	-8842.4		-1571.2	12.48	1902.7	-7075.6		-3622.1	20.74	-1873.5	-2869.3		4495.3
4.39	2256.7	-9113.5		-1131.2	12.65	1873.6	-7627.6		-3326.2	20.91	-1893.2	-2640.1		4324.6
4.57	2286.2	-9268.5		-774.0	12.83	1837.1	-8252.6		-2962.8	21.09	-1917.7	-2366.0		4108.7
4.74	2323.0	-9383.7		-321.0	13.00	1814.4	-8701.5		-2677.0	21.26	-1937.4	-2156.8		3934.0
4.92	2352.4	-9412.3		46.6	13.18	1794.9	-9105.7		-2394.2	21.44	-1961.9	-1908.1		3713.1
5.10	2389.2	-9365.7		512.6	13.36	1774.5	-9548.7		-2044.3	21.61	-1981.5	-1719.5		3534.4
5.27	2418.7	-9260.9		890.7	13.53	1758.1	-9853.7		-1767.3	21.79	-2006.1	-1496.8		3308.6
5.45	2455.5	-9044.3		1369.7	13.71	1737.7	-10174.1		-1424.7	21.97	-2025.7	-1329.1		3125.9
5.62	2485.0	-8801.5		1758.1	13.88	1721.4	-10382.0		-1153.5	22.14	-2050.3	-1133.0		2895.0
5.80	2514.4	-8496.2		2151.1	14.06	1700.9	-10582.3		-818.0	22.32	-2069.9	-986.8		2708.3
5.97	2551.2	-8025.6		2649.0	14.23	1684.6	-10695.2		-552.6	22.49	-2094.4	-817.8		2472.4
6.15	2580.7	-7577.0		3052.4	14.41	1664.1	-10778.0		-224.4	22.67	-2114.1	-693.6		2281.7
6.33	2617.5	-6924.8		3563.2	14.59	1647.8	-10797.1		35.3	22.84	-2138.6	-552.2		2040.8
6.50	2646.9	-6329.1		3977.1	14.76	1627.4	-10786.5		356.3	23.02	-2158.3	-450.4		1846.1
6.68	2683.7	-5490.6		4500.9	14.94	1611.0	-10763.2		610.2	23.20	-2182.8	-337.4		1600.2
6.85	2713.2	-4744.0		4925.1	15.11	1590.6	-10715.6		923.9	23.37	-2202.5	-258.4		1401.5
7.03	2750.0	-3714.7		5461.9	15.29	1574.2	-10662.9		1172.1	23.55	-2227.0	-174.3		1150.6
7.20	2779.4	-2813.4		5896.6	15.46	1553.8	-10579.2		1478.6	23.72	-2246.6	-118.7		947.9
7.38	2816.2	-1588.5		6446.4	15.64	1537.4	-10498.0		1721.0	23.90	-2271.2	-64.0		692.1
7.56	2845.7	-528.9		6891.5	15.82	1517.0	-10378.9		2020.3	24.07	-2290.8	-32.2		485.4
7.73	2882.5	896.4		7454.3	15.99	1500.7	-10269.8		2256.9	24.25	-2315.4	-7.5		224.5
7.91	2911.9	2118.2		7909.8	16.17	1480.2	-10116.3		2549.0	24.43	-2335.0	0.0		0.0
8.08	2948.7	3748.4		8485.6	16.34	1463.9	-9979.9		2779.8	24.60	-2349.7	0.0		0.0

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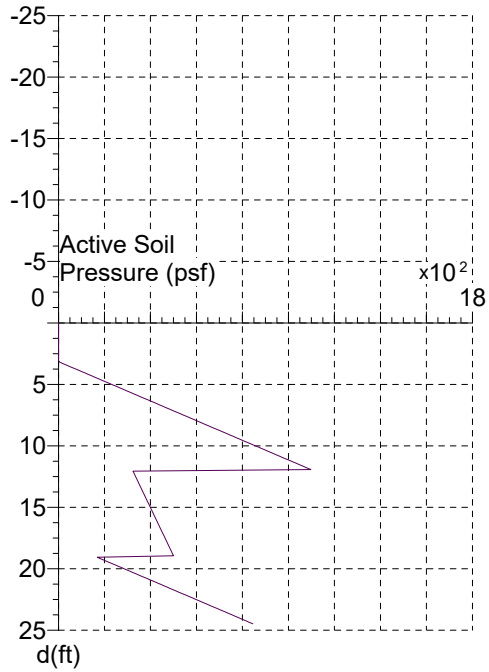
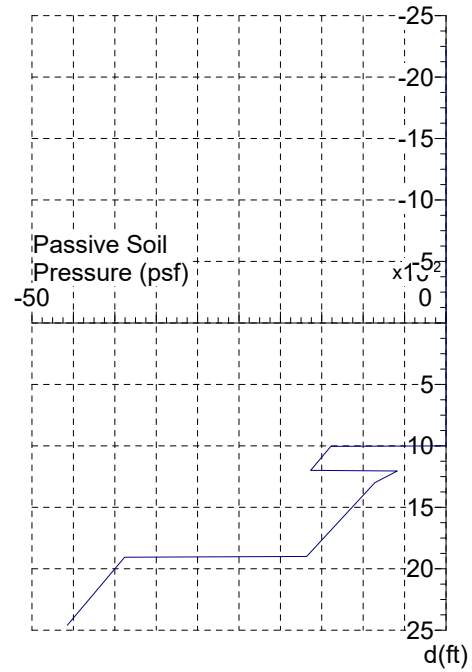
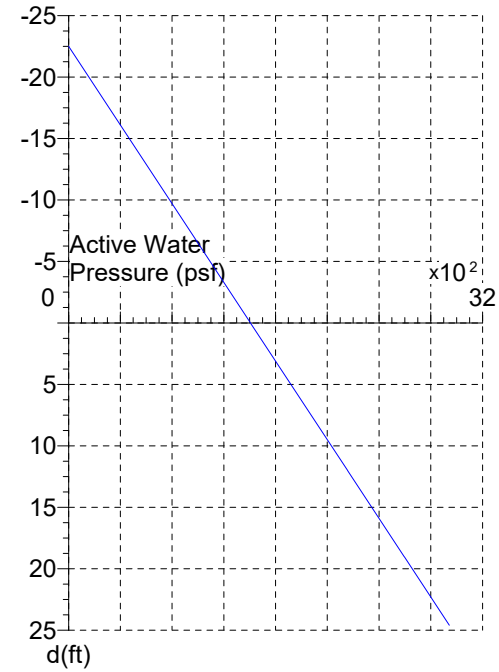
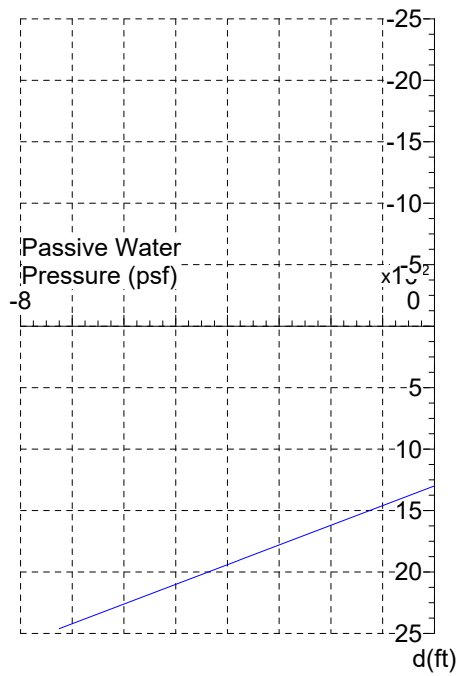
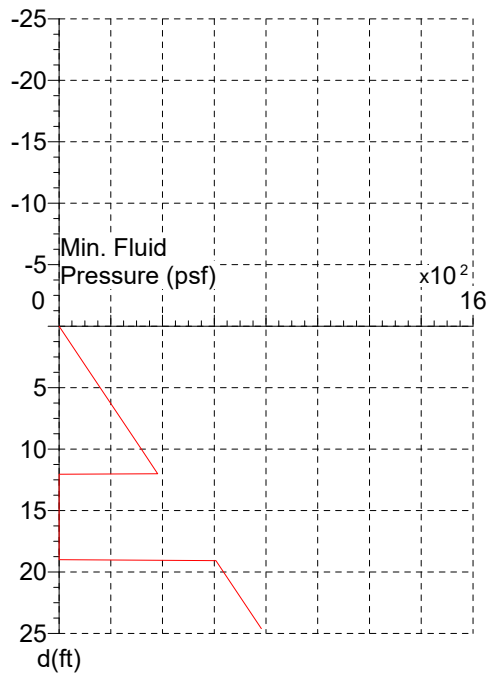
Stage 7 - Tip and Moment only

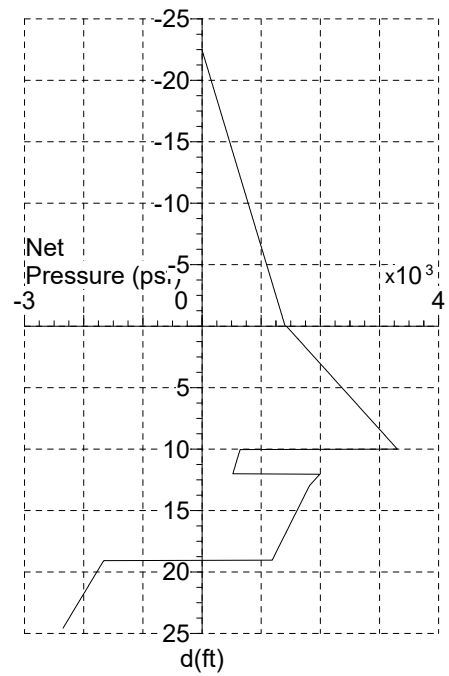












SupportIT, v2.35

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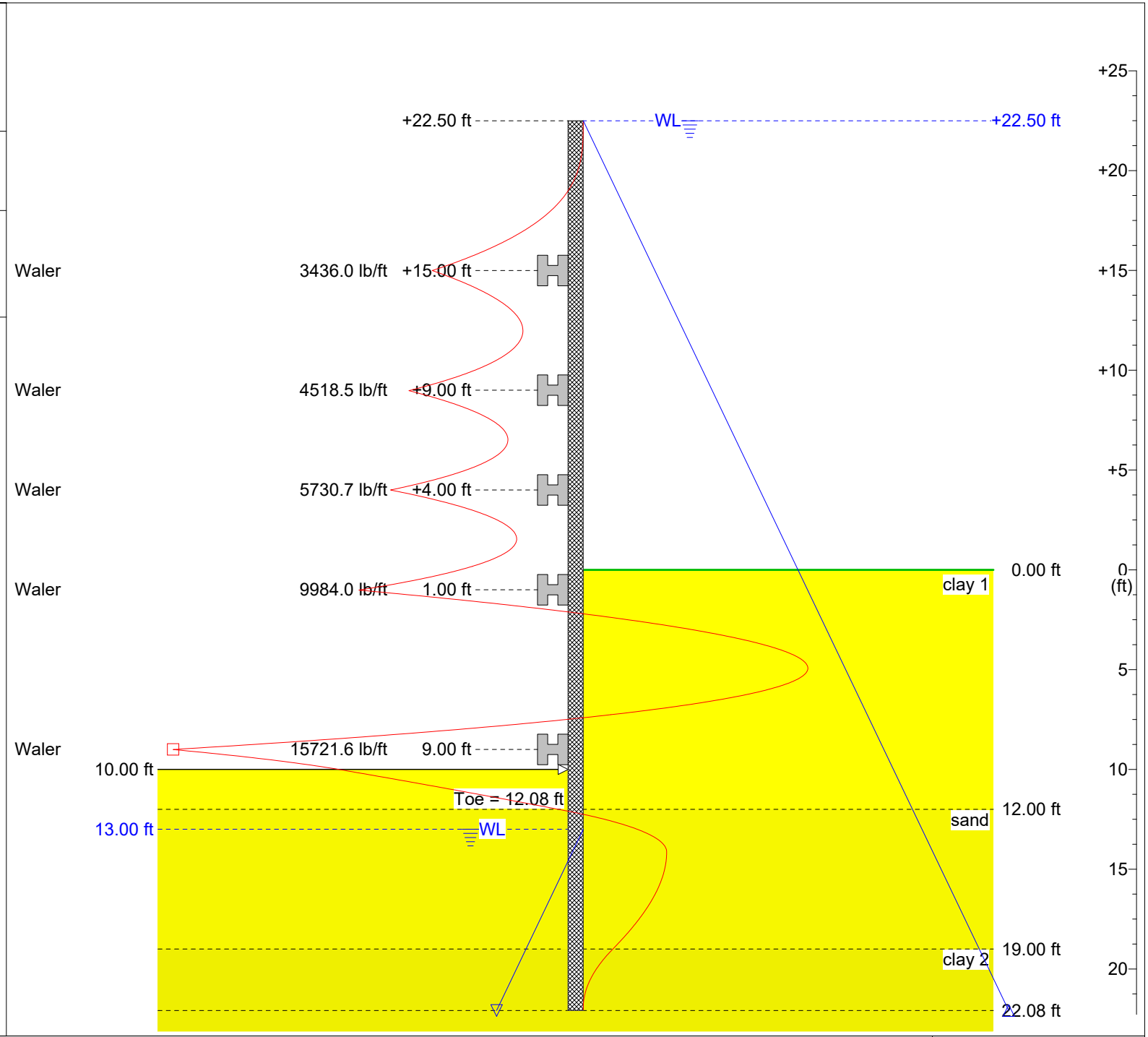
	Maximum	d (ft)
□	11963.4 ftlb/ft	9.00
△	2786.4 psf	22.08
△	567.6 psf	22.08

Stage 7 - Wales only



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Toe: Free Earth Support

Stage 7 - Wales only

Input Data

Depth Of Excavation = 10.00ft
Surcharge = 0.0psf

Depth Of Active Water = +22.50ft
Depth Of Passive Water = 13.00ft

Water Density = 62.50pcf
Minimum Fluid Density = 31.80pcf

Soil Profile

Depth (ft)	Soil Name	γ (pcf)	γ' (pcf)	C (psf)	C_a (psf)	ϕ (°)	δ (°)	K_a	K_{ac}	K_p	K_{pc}
0.00	clay 1	125.00	62.50	900.1	0.0	0.0	0.0	1.00	2.00	1.00	2.00
12.00	sand	122.00	59.50	0.0	0.0	30.0	0.0	0.43	0.00	3.00	0.00
19.00	clay 2	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00
200.00	clay 3	125.00	62.50	1799.9	0.0	0.0	0.0	1.00	2.00	1.00	2.00

Solution

Sheet

Sheet Name	E (psi)	I (in^4/ft)	f (psi)	Z (in^3/ft)	Allowed M_{max} (ftlb/ft)	b (in)	A (in^2/ft)	W (lb/ft)	Upstand (ft)	Toe (ft)	Length (ft)
	3.04E+07								22.50	12.08	44.58

Pressure Model: Coulomb; Assume full hydrostatic pressure to 10.00ft in cohesive soils on active side

Load Model: Area Distribution

Supports

d (ft)	Type	Load (lb/ft)
+15.00	Waler	3436.0
+9.00	Waler	4518.5
+4.00	Waler	5730.7
1.00	Waler	9984.0
9.00	Waler	15721.6

Maxima

	Maximum	Depth (ft)
Pressure	2888.1 psf	10.00
Bending Moment	11963.4 ftlb/ft	9.00
Shear Force	9390.7 lb/ft	8.97

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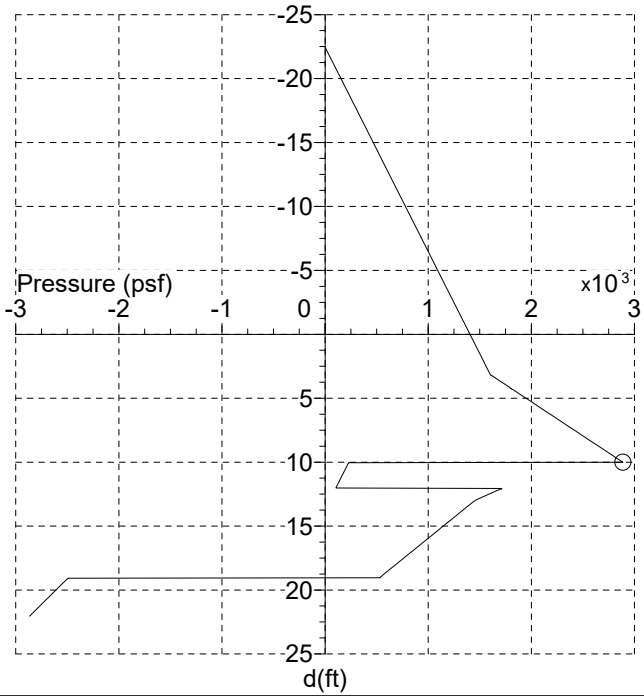
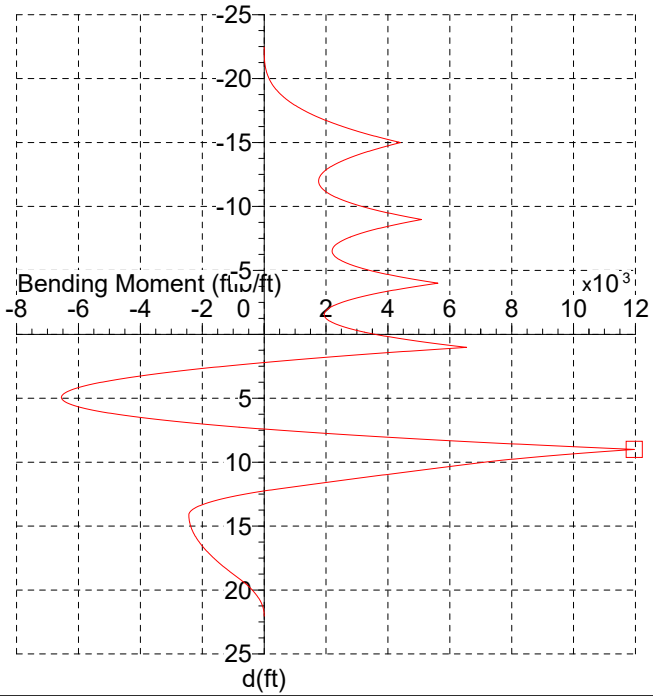
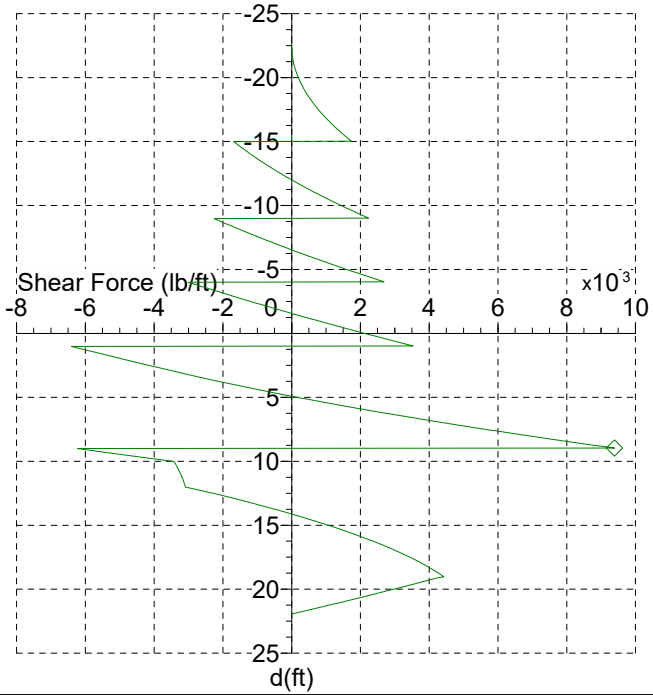
	Maximum	d (ft)
○	2888.1 psf	10.00
□	11963.4 ftlb/ft	9.00
◇	9390.7 lb/ft	8.97

Stage 7 - Wales only







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Stage 7 - Wales only

depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)	depth (ft)	P (psf)	M (ftlb/ft)	D (in)	F (lb/ft)
0.00	1406.0	3619.9		2141.6	7.41	2407.4	183.5		5500.9	14.83	1170.3	-2394.7		873.3
0.16	1415.3	3959.9		2351.4	7.57	2435.2	1037.5		5861.2	14.98	1147.6	-2376.7		1045.1
0.32	1426.9	4430.2		2615.6	7.73	2463.1	1946.4		6225.7	15.14	1119.2	-2349.6		1255.1
0.47	1436.2	4842.9		2828.5	7.89	2491.0	2910.7		6594.3	15.30	1096.4	-2324.3		1419.3
0.63	1445.5	5288.4		3042.8	8.04	2525.8	4195.0		7060.9	15.46	1073.7	-2295.9		1580.2
0.79	1454.8	5766.7		3258.5	8.20	2553.7	5286.4		7438.8	15.62	1051.0	-2264.5		1737.6
0.95	1466.4	6411.2		3530.0	8.36	2581.6	6435.3		7820.9	15.77	1022.6	-2220.9		1929.7
1.10	1475.7	5838.1		-6235.2	8.52	2609.4	7642.3		8207.2	15.93	999.8	-2182.8		2079.5
1.26	1485.0	4928.6		-6015.0	8.68	2644.3	9233.8		8695.8	16.09	977.1	-2141.8		2226.0
1.42	1494.3	4051.6		-5793.5	8.83	2672.1	10574.0		9091.3	16.25	954.4	-2098.1		2369.1
1.58	1505.9	3001.6		-5514.6	8.99	2700.0	11963.4		-6230.6	16.40	925.9	-2039.6		2543.2
1.74	1515.2	2198.8		-5289.9	9.15	2727.9	11070.3		-5826.8	16.56	903.2	-1989.8		2678.7
1.89	1524.5	1429.3		-5063.9	9.31	2762.7	10037.7		-5316.1	16.72	880.5	-1937.4		2810.8
2.05	1533.8	693.3		-4836.5	9.46	2790.6	9279.4		-4903.0	16.88	857.7	-1882.5		2939.5
2.21	1545.4	-179.4		-4550.3	9.62	2818.5	8582.1		-4485.7	17.03	829.3	-1810.5		3095.7
2.37	1554.7	-839.3		-4319.8	9.78	2846.3	7946.3		-4064.3	17.19	806.6	-1750.2		3216.8
2.52	1564.0	-1465.1		-4087.9	9.94	2881.2	7238.9		-3531.7	17.35	783.8	-1687.6		3334.6
2.68	1573.3	-2056.5		-3854.6	10.09	223.0	6732.9		-3399.2	17.51	761.1	-1622.8		3448.9
2.84	1584.9	-2747.1		-3561.1	10.25	213.7	6235.3		-3366.9	17.67	732.7	-1538.7		3587.1
3.00	1594.2	-3260.5		-3324.7	10.41	204.5	5742.4		-3336.0	17.82	710.0	-1469.1		3693.9
3.15	1606.1	-3738.8		-3086.8	10.57	192.9	5132.5		-3299.3	17.98	687.2	-1397.5		3797.3
3.31	1633.9	-4181.8		-2845.8	10.73	183.6	4649.3		-3271.5	18.14	664.5	-1323.8		3897.3
3.47	1668.8	-4685.1		-2538.4	10.88	174.3	4170.2		-3245.1	18.30	636.1	-1229.2		4017.6
3.63	1696.6	-5046.5		-2287.8	11.04	165.0	3694.9		-3220.0	18.45	613.3	-1151.4		4110.0
3.79	1724.5	-5370.6		-2033.1	11.20	153.4	3105.7		-3190.7	18.61	590.6	-1071.9		4199.0
3.94	1752.4	-5656.9		-1774.2	11.36	144.1	2638.2		-3168.7	18.77	567.9	-990.7		4284.7
4.10	1787.2	-5960.5		-1444.8	11.51	134.9	2173.9		-3148.2	18.93	539.5	-886.9		4387.0
4.26	1808.1	-6159.3		-1177.2	11.67	125.6	1712.4		-3129.0	19.09	-2494.0	-802.7		4241.4
4.42	1843.0	-6318.3		-904.8	11.83	114.0	1139.5		-3107.0	19.24	-2517.3	-722.8		4032.7
4.57	1870.8	-6436.8		-628.4	11.99	106.4	683.9		-3090.8	19.40	-2535.9	-646.9		3822.5
4.73	1898.7	-6514.2		-347.8	12.15	1683.1	243.9		-2838.0	19.56	-2559.1	-557.7		3557.5
4.89	1933.5	-6552.2		8.8	12.30	1641.8	-159.4		-2591.8	19.72	-2577.7	-491.0		3343.8
5.05	1961.4	-6534.5		298.7	12.46	1590.2	-613.2		-2292.5	19.87	-2596.3	-428.3		3128.6
5.21	1989.3	-6472.5		592.8	12.62	1548.9	-937.2		-2060.1	20.03	-2614.8	-369.8		2911.8
5.36	2017.2	-6365.8		891.0	12.78	1507.6	-1227.3		-1833.7	20.19	-2638.1	-302.6		2638.6
5.52	2052.0	-6168.4		1269.6	12.93	1466.3	-1484.5		-1613.5	20.35	-2656.7	-253.6		2418.4
5.68	2079.9	-5958.6		1577.1	13.09	1431.8	-1761.0		-1345.3	20.50	-2675.3	-208.7		2196.6
5.84	2107.7	-5702.0		1888.8	13.25	1409.0	-1947.0		-1134.6	20.66	-2693.8	-168.2		1973.2
5.99	2135.6	-5397.8		2204.6	13.41	1386.3	-2102.2		-927.3	20.82	-2717.1	-123.5		1691.9
6.15	2170.5	-4950.0		2605.2	13.56	1363.6	-2227.1		-723.4	20.98	-2735.7	-92.7		1465.0
6.31	2198.3	-4536.8		2930.3	13.72	1340.8	-2322.3		-522.9	21.14	-2754.2	-66.2		1236.7
6.47	2226.2	-4074.1		3259.6	13.88	1312.4	-2400.2		-277.0	21.29	-2772.8	-44.1		1006.7
6.62	2254.1	-3561.2		3593.0	14.04	1289.7	-2430.3		-84.1	21.45	-2796.1	-22.8		717.2
6.78	2288.9	-2848.7		4015.6	14.20	1266.9	-2433.2		105.4	21.61	-2814.6	-10.7		483.8
6.94	2316.8	-2220.8		4358.4	14.35	1244.2	-2429.8		291.6	21.77	-2833.2	-3.1		248.8
7.10	2344.7	-1540.7		4705.2	14.51	1215.8	-2420.6		519.6	21.92	-2851.8	0.0		0.0
7.26	2372.5	-807.8		5056.3	14.67	1193.1	-2409.4		698.1	22.08	-2865.7	0.0		0.0

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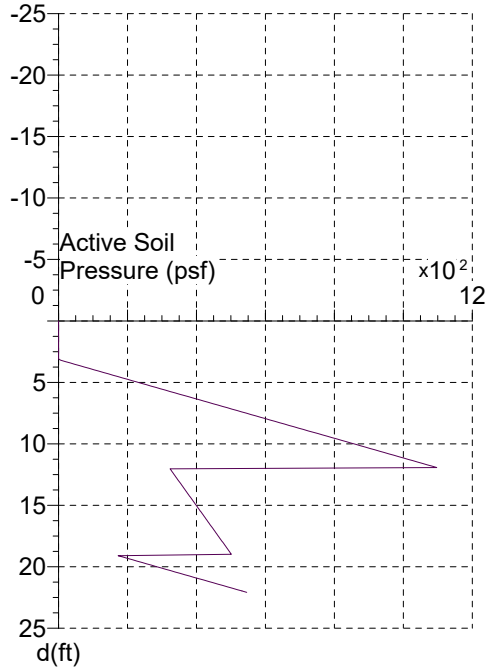
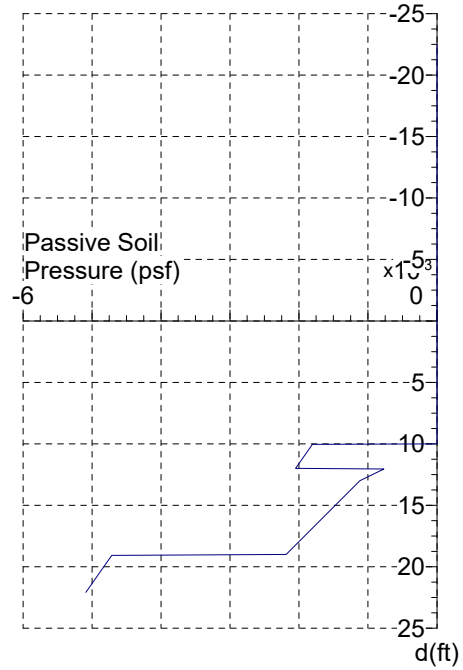
Web: www.GTSoft.org

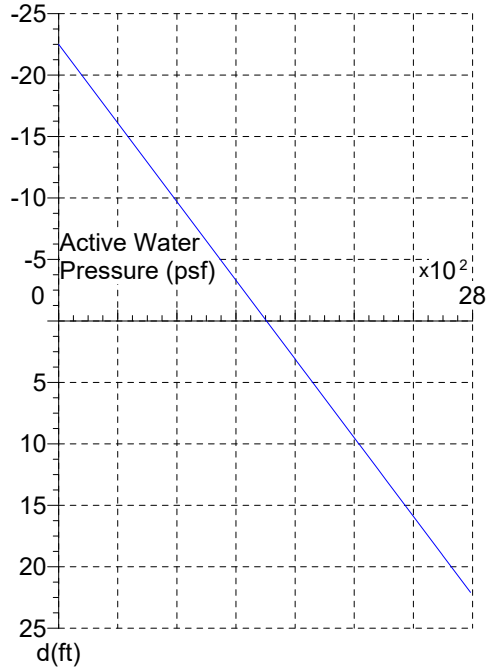
Title: Colorado River Flood Gate - West Side
Designer: Stage 7
Ref: 1.0
Page: 5
Date: 8.20.18

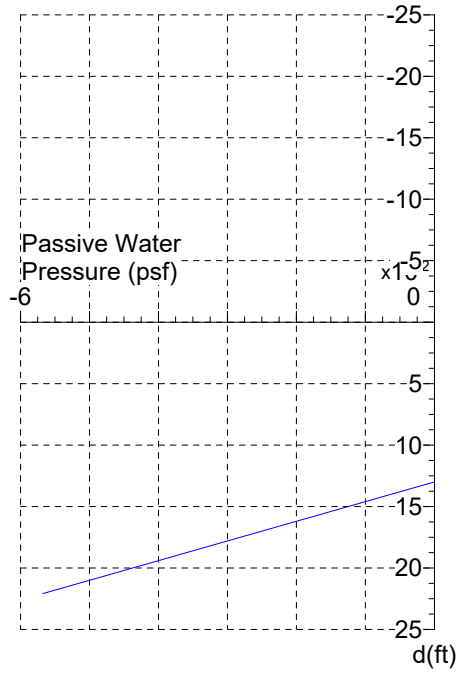
Works: Temporary
Pressure: Coulomb
Analysis: Net Pressure
Toe: Free Earth Support

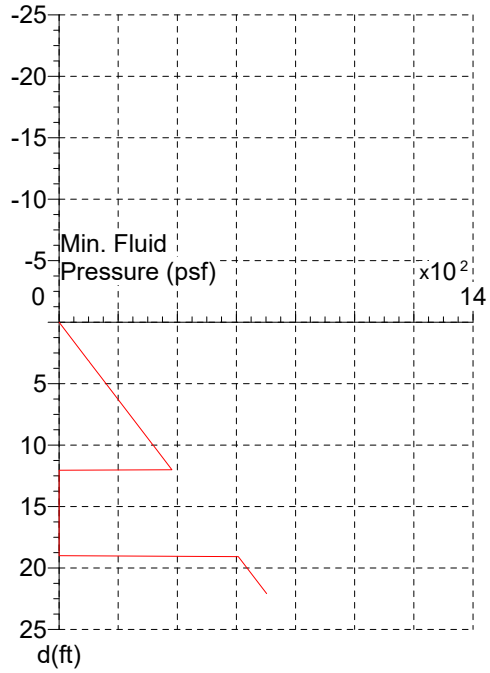
Stage 7 - Wales only

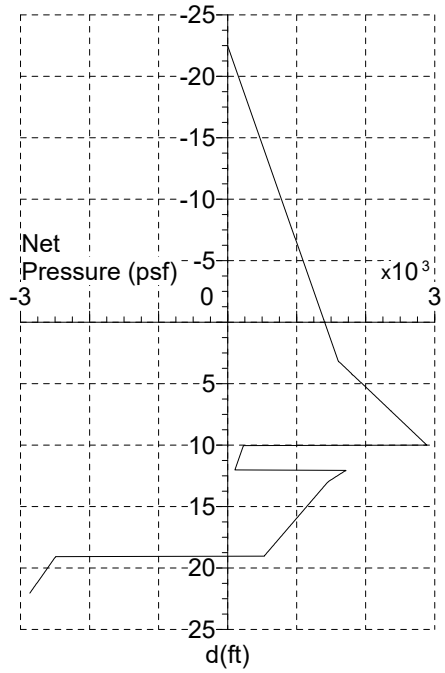












SupportIT, v2.35

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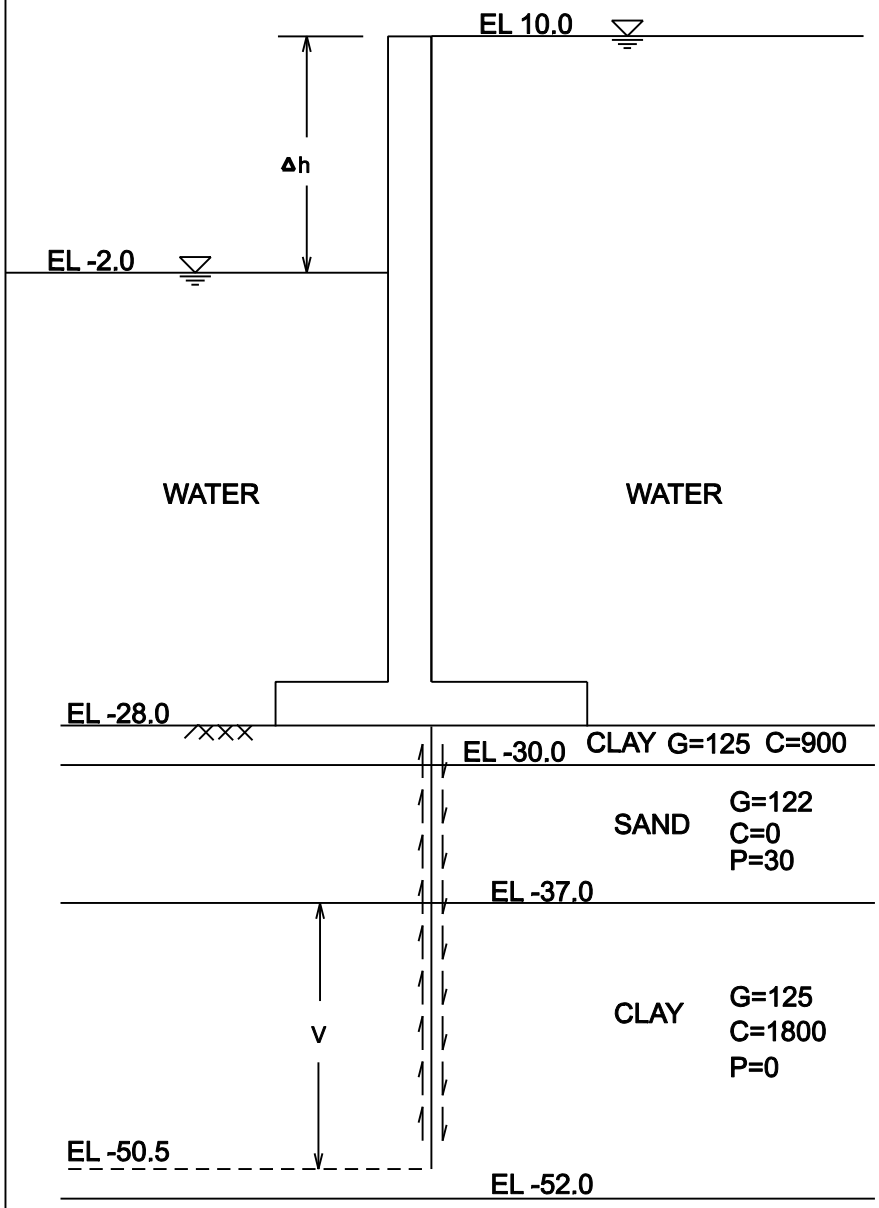
Web: www.GTSoft.org

APPENDIX D

COLORADO RIVER - WEST SEEPAGE CUTOFF



$Cw = [(2V) + (1/3H)] / \Delta h$

NEGLECT HORIZONTAL INTERFACE OF FOOTING/SOIL DUE TO PROBABLE SOIL ARCHING FROM A PILE FOUNDED STRUCTURE.

$H = 0$

FOR CLAY, $Cw >= 3$

FOR SAND, $Cw >= 8.5$ (REQUIRES TRANSFORMING)

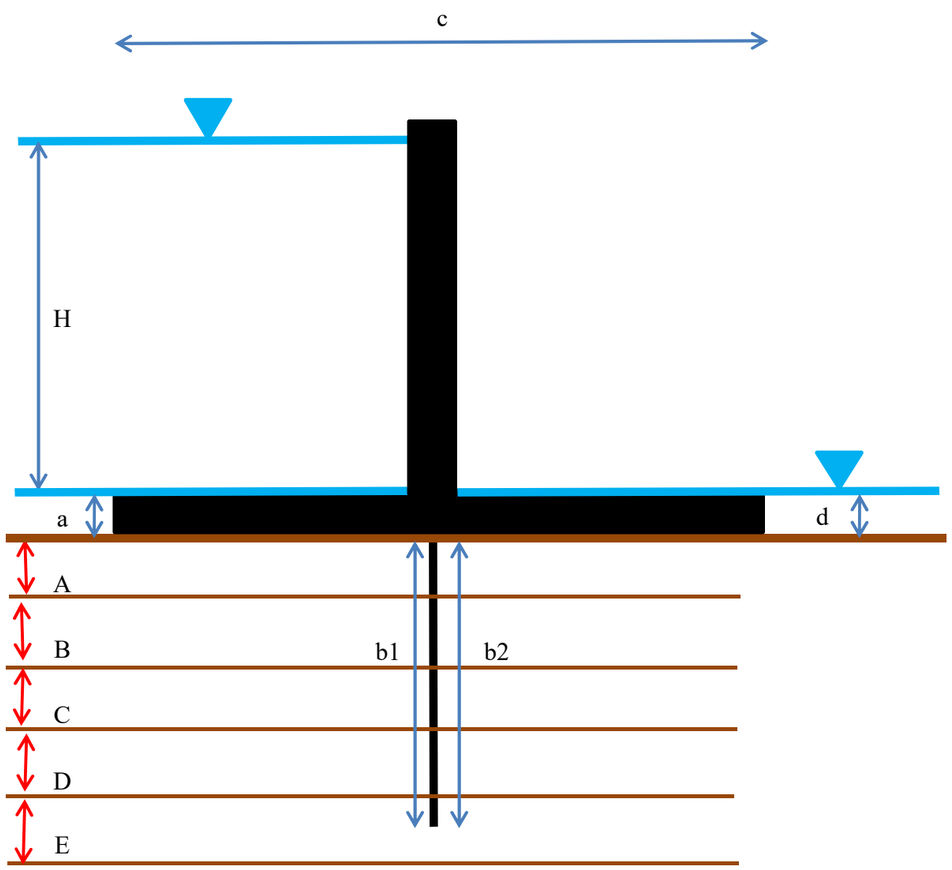
$\Delta h = (10- (-2)) = 12'$

$Cw = [2(2) + 7(2)(3/8.5) + V(2) +(1/3x0)] / 12 = 3$

$V = 13.5'$

TIP ELEV = -37 -13.5 = -50.5

...\Colorado-West sketch.dgn 10/23/2018 12:24:57 PM



= Input
= Output

Target Safe Creep Ratio	Base Elevation	Tip Elevation
3	-28	-50.5294118

Weighted Creep Ratio

Strata	Thickness	Material	Safe Creep Ratio	Transformed Thickness	Cumulative Transformed Thickness
A	2	CH	3	2	2
B	7	SM	8.5	2.470588235	4.470588235
C	13.529412	CH	3	13.52941176	18
D	0	CH	3	0	18
E	0	CH	3	0	18
F	0	CH	3	0	18
G	0	CH	3	0	18

Dead Space
4.529411765

<
=

Note:
$b = b_1 = b_2$
$2*b = b_1 + b_2$

$(a + b_1 + b_2 + c/3 + d)/H$					
a	b	d	c	H	(a + 2*b + c/3 + d)/H
0	2	0	0	12	0.333333333
0	4.4705882	0	0	12	0.745098039
0	18	0	0	12	3
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0
0	0	0	0	12	0

Largest "b"
18

Use Goal Seek to get (X?-N5) to equal zero by changing K?

-3.55E-15

APPENDIX E

Rachel, Chad M CIV USARMY CEMVN (US)

From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Thursday, August 02, 2018 11:31 AM
To: Rachel, Chad M CIV USARMY CEMVN (US)
Cc: Ragolia, Jason J CIV USARMY CEMVN (US); Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Need a 30" pile capacity curve for a new 125' gate on either side of the river crossing. Each gate will be mid-way between the existing river and GIWW side gate, directly to the south of the existing earthen chamber. See below for locations.

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

Ph (504) 862-2680

Cell (504) 717-9565

Rachel, Chad M CIV USARMY CEMVN (US)

From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Friday, August 17, 2018 6:20 AM
To: Rachel, Chad M CIV USARMY CEMVN (US)
Cc: Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Re: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Stick to 4.5 then for the water elevation.

Sent from my BlackBerry 10 smartphone on the Verizon Wireless 4G LTE network.
Original Message
From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Friday, August 17, 2018 6:11 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US)
Cc: Richard, Leeland J CIV USARMY CEMVN (US)
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Dave,

Does this mean you want the water at EL 4 or at EL 6?

Please confirm as soon as you can, as I have already done an entire design yesterday for one of them with water at EL 4.5 as the hydraulic engineer provided.

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Thursday, August 16, 2018 7:50 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Let's design for El 4 with a top El of 6.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch

Ph (504) 862-2680
Cell (504) 717-9565

-----Original Message-----
From: Agnew, Maxwell E CIV USARMY CEMVN (US)
Sent: Wednesday, August 15, 2018 1:41 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Hi David,

I looked at the east lock gage reading to determine water levels. The values are reported in NGVD, but I believe there is about a 2.0ft error/shift to get to NAVD88, at least with the older data. It seems the more recent data (late 2017 to present) was shifted down to where it's supposed to be. I remember looking into this issue a while back. The surveyor we used shot a water surface elevation in the lock at a certain time. I compared the lock reading and there was about a 2ft difference between the lock reading in NGVD and the survey in NAVD88. Using the plot below, it seems every year there are some fairly high events in the 6 to 8ft NGVD range, although some of those could be tropical. If we adjust for the datum shift, the levels would be 4 to 6ft NAVD88. I would recommend an elevation to 6ft NAVD88. If only considering non-storm tidal conditions, the maximum seems about 2.5 NAVD88, which if you add 2ft of freeboard, would give 4.5 ft NAVD88.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Wednesday, August 15, 2018 12:53 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>; McLaughlin, Patrick W <Patrick.McLaughlin@mottmac.com>
Cc: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Subject: FW: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Max, Pat,

Can you please provide Chad with a maximum (non-tropical) water elevation that the cofferdam should be designed for. The cofferdams will be on the GIWW side of the existing structures so won't see the high river elevations.

Chad,

We should provide 2' above that elevation for "freeboard".

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

New Orleans District

Engineering Division

Structures Branch

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-----Original Message-----

From: Rachel, Chad M CIV USARMY CEMVN (US)

Sent: Wednesday, August 15, 2018 10:12 AM

To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

Which water level should I use for the flood side of the braced cofferdam?

Thanks,

Chad M. Rachel, P.E.

-----Original Message-----

From: Lovett, David P Jr CIV USARMY CEMVN (US)

Sent: Thursday, August 02, 2018 12:34 PM

To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>

Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>; Richard, Leeland J CIV USARMY CEMVN (US) <Leeland.J.Richard@usace.army.mil>

Subject: RE: Colorado River Locks - Pile Curve Needed (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Chad,

Also based on the available boring data, would like you to evaluate the required sheetpile cutoff elevation, the cofferdam design and the dewatering requirements (if necessary) for the 2 Colorado structures and the 1 Brazos structure. For the cofferdam design, the sill, base elevation and TRS dredge elevation would be the same as the GIWW West design that you performed for Morganza. I assume we could use the same elevations for anchor locations as we did for Morganza as well.

Please let me know approximate schedule to accomplish this work.

Thanks,

David P. Lovett Jr., P.E.

Supervisory Civil Engineer

U.S. Army Corps of Engineers

Rachel, Chad M CIV USARMY CEMVN (US)

From: Rachel, Chad M CIV USARMY CEMVN (US)
Sent: Friday, September 21, 2018 11:13 AM
To: Lovett, David P Jr CIV USARMY CEMVN (US)
Cc: Ragolia, Jason J CIV USARMY CEMVN (US); Richard, Leeland J CIV USARMY CEMVN (US)
Subject: Brazos River & Colorado River - Seepage Cutoff
Attachments: Brazos-East sketch.pdf; Colorado-East sketch.pdf; Colorado-West sketch.pdf; Colorado-West Lanes Weighted Creep-CMR.PDF; Colorado-East Lanes Weighted Creep-CMR.PDF; Brazos-East Lanes Weighted Creep-CMR.PDF

Dave,

The estimated tip elevation (based on the soil parameters and stratification from the limited data, the water levels you provided, and using Lane's Weighted Creep Ratio method of analysis) of the seepage cutoff for the 3 structures are as follows:

Brazos-East = EL -46.0

Colorado-West = EL -50.5

Colorado-East = EL -46.0

Documentation is attached.

Thanks,
Chad M. Rachel, P.E.

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 1:53 PM
To: Rachel, Chad M CIV USARMY CEMVN (US) <Chad.M.Rachel@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Chad,

For cutoff, assume El 10 on the river and -2 on the GIWW side of the structure to size the tip of the cutoff wall.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
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Cell (504) 717-9565

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Monday, September 17, 2018 8:11 AM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Max,

Trying to determine for the new load case you suggest, what would be the return period on that event? Trying to determine whether this would be an unusual or extreme event.

Thanks,
David P. Lovett Jr., P.E.
Supervisory Civil Engineer
U.S. Army Corps of Engineers
New Orleans District
Engineering Division
Structures Branch
Ph (504) 862-2680
Cell (504) 717-9565

From: Agnew, Maxwell E CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 2:19 PM
To: Lovett, David P Jr CIV USARMY CEMVN (US) <David.P.Lovett@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: RE: Colorado River Lock - Design Questions

Hi Dave,

1) I think this is ok for completing a cost estimate, but for final design, we'd probably want to look a little closer at velocities. 1000lb stone sounds pretty extreme.

2) For an extreme hurricane event, I believe the surge will inundate the entire coastal area, so both the GIWW and River would be about the same elevation. Once the water gets above 3 or 4ft, all the land in that area is inundated, so I don't believe you'd ever have a case where the river is 16' and the GIWW so much lower at 5ft.

I think the worst differential will be during a flood event at low tide. See below plot of stages. Harvey (flood of record maybe) seemed to peak at about 8ft NGVD (~6ft NAVD88). Maybe you could assume 10ft NAVD88 in the river, and a low tide, maybe -2ft in the GIWW.

Let me know if this helps or if you need any other info.

Thanks,

Max

-----Original Message-----
From: Lovett, David P Jr CIV USARMY CEMVN (US)
Sent: Friday, September 14, 2018 1:38 PM
To: Agnew, Maxwell E CIV USARMY CEMVN (US) <Maxwell.E.Agnew@usace.army.mil>
Cc: Ragolia, Jason J CIV USARMY CEMVN (US) <Jason.J.Ragolia@usace.army.mil>
Subject: Colorado River Lock - Design Questions

Max,

Two questions:

1.) In the attachment, I used WCC design from Matt D. to assume a similar 42" layer of 1000lb stone placed in the wet, extending 200' out from the structure. This would be placed on top of geotextile and bedding material. Is this reasonable?

2.) For the design of the pile foundation, I selected 4 load cases. They are shown below. Can you validate? Particularly interested in the hurricane case, where I assume the gate will be shut in a hurricane so I designed for water to the top for survivability of the structure (133% OS). What would be the GIWW elevation if we have 16 on the R/S?