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Design Memorandum

PROJECT: Mercer Island Mixed-Use (Project No. 20-37)

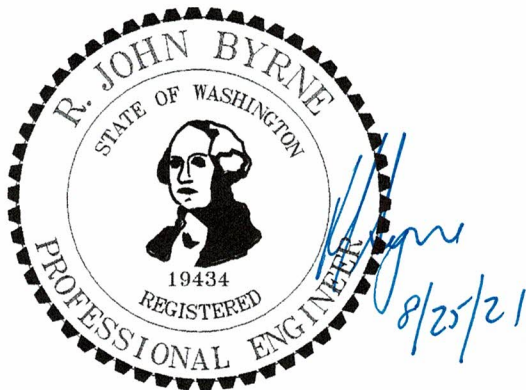
ADDRESS: 2885 78th Avenue SE
Mercer Island, WA

CLIENT: Mr. Kyle Lu
Xing Hua Group, LTD
929 108th Avenue NE, Suite 1200
Bellevue, WA 98004

DATE: September 22, 2020 – Revised August 25, 2021

REFERENCES:

1. “Geotechnical Engineering Design Report, Multi-Family Development, Mercer Island, Washington”, prepared by Hart Crowser Inc., dated November 3, 2020.
2. 2015 International Building Code.
3. “Geotechnical Engineering Circular No. 4, Ground Anchors and Anchored Systems”, FHWA, dated June 1999.



BACKGROUND:

The planned mixed-use project is located at 2885 78th Avenue SE in Mercer Island, Washington. The site is bounded by 78th Avenue SE to the east, S 29th Street to the south, 77th Avenue SE to the west, and by private property (parking lot) to the north. The site does not include a parcel to the southwest with overall dimensions of 100 feet (east-west) by 127 feet. The site slopes to the west from elevation 90 feet along 78th Avenue SE to 82-83 feet along 77th Avenue SE. Underground parking is planned that will require excavation to elevations 68-77 feet. Depths of excavation from ground surface to the base of planned footings range between 6 and 20 feet. However, except for the east portion of the site, the soils at these footing depths are unsuitable for supporting foundation loads. Suitable load bearing soils extend from a few feet up to 13 feet below foundation elevations. Procedures for dealing with this situation have not as yet been finalized and may range from over-excavate and replace where depths to good bearing soils are modest, to ground improvement or deep foundations where depths to load bearing soils are greater. Irrespective, all of these procedures will or potentially will require that the shoring be designed to support excavations that extend beyond the planned foundation levels. Therefore, at this stage, it has been conservatively assumed that the excavation will extend to the load bearing soils where these are at greater depth than the identified foundation levels. When foundation treatment methods are finalized, the shoring design might be adjusted to be less conservative at specific locations.

The overall plan dimensions of the garage footprint are on the order of 280 feet east-west by 240 feet, for a total estimated effective shored area of 13,000 SF. As noted, the actual exposed face area of the shoring might be less than this value that assumes excavation to the deeper of the foundation level or the bearing soils, whichever is deeper. This would only apply for the excavate and replace scenario which is less likely at locations where depths to the bearing soils are greater.

This revision addresses a modified foundation plan developed for the project as well as adjustments to the perimeter wall locations.

SUBSURFACE CONDITIONS:

The geotechnical report indicates that the subsurface soils consist of loose to medium dense silty granular fill, soft silt and peat overlying native soils consisting of medium stiff to hard silt and medium dense to dense sand and silty sand. The fill soils range from 5 to over 20 feet deep. Active dewatering of the site is likely required within the native sandy materials.

SHORING SYSTEM:

Given the variable soil conditions, the thickness of poor quality fill soils and the presence of groundwater, a soldier pile system with wood lagging offers the technically preferred shoring approach. For the planned depths of excavation, a single row of tieback anchors will be used to support the soldier piles. This shoring approach has also been demonstrated to provide the most positive method of deformation control of the adjacent streets.

DESIGN PARAMETERS:

Design earth pressures corresponding to the soil self-weight are recommended in the geotechnical report. For soldier piles that are supported by a single row of anchors, a soil self-weight design earth loading of 42 pcf was used.

Live load lateral surcharge pressures are as presented on the Plans to account for general traffic and construction loading and range from 100 to 150 psf.

The following design values were used to evaluate the depth of embedment of the soldier piles below the base of the excavation:

Passive Equivalent Fluid Density	175 pcf over 2.5 pile diameters (native soils below water table) 100 pcf (fill for initial cantilever condition)
Allowable Pile End Bearing	10 ksf
Allowable Pile Skin Friction	2 ksf

DESIGN:

Anchors:

Individual anchor loads are developed from the design earth pressure diagrams presented on the Plans, using a tributary area method to assign loads to the individual anchors and to the toe shear in the piles. Anchor lengths are then determined from the no-load zone (see Plans) and the required bond zone. The length of the bond zone is determined from the anchor design load and the allowable pullout value. An allowable pullout resistance of 2.5 kips per linear foot (klf) has been used for all anchors that will be bonded in the native soils. Anchor designs are presented in Appendix A.

Soldier Piles:

Soldier pile loadings are determined from the design earth pressure diagrams and the locations and inclinations of the anchors/rakers. The spreadsheet output presented in Appendix B summarizes the following design aspects for both the shoring piles and the toe piles that support the rakers:

- Calculation of soldier pile loads and bending moments, consistent with the design apparent earth pressure diagrams provided on the Plans. For each soldier pile, the calculated shear force, axial load and bending moment are provided. Representative earth pressure diagrams, together with calculated shear force and bending moment diagrams, are shown for a number of piles, in Appendix B.
- Calculation of pile toe embedment requirements using the criteria indicated on the Plans.
- Pile structural steel sizing in accordance with the AISC 360-10 Specification for Structural Steel Buildings. Combined flexure and axial load, shear, and compact section steel design checks are performed for the critically loaded section of each pile along the length of the wall. The spreadsheet output summarizes the minimum steel section required for each pile.

Similar information is provided in Appendix C for the Stage 1 cantilevered condition prior to installation of the top row of anchors.

Anchor/Pile Connections:

The designs of the connections of the anchors to the soldier piles are summarized in Table 1. Required weld lengths and connection plate sizes were determined in accordance with AISC 360-10 and for Grade 50 steel plates and E70XX weld electrodes.

Lagging:

Timber lagging will be used to support the soil between adjacent soldier piles. The average design earth pressures for the lagging are indicated in Appendix A, and these design earth pressures are derived directly from the design earth pressure diagrams. Hem-Fir No. 2 lagging (4-inch) or equivalent will provide adequate support for the soil between the soldier piles, per the recommendations of the FHWA Engineering Circular No. 4.

TABLES

DESIGN ASSUMPTIONS

E70XX Electrodes For All Welding

Cover Plates Welded to Flange at Each End, Along Narrow End & Returned Down Edge Along Pile Web

Web Stiffener Plates Are Full Depth, Are Flush At Bearing End, & Welded Full Length & Along Bearing End On One Side Only

CONNECTION INPUT DATA

Case	Pile Section	Pile Grade (ksi)	Plate Steel Grade (ksi)	Design Anchor Load (k)	Actual Design Pile Moment (ft-k)	Max Design Pile Moment (ft-k)	Flange Width b_f (in)	Flange Thick t_f (in)	Beam Depth d (in)	Web Thick t_w (in)	Max Cutout Width (in)	Max Cutout Area (in ²)
1	W14x34	50.0	50.0	70.0	133.7	133.7	6.750	0.455	14.000	0.285	3.23	1.47
2	W14x38	50.0	50.0	70.0	150.2	150.2	6.770	0.515	14.100	0.310	3.23	1.66
3	W14x43	50.0	50.0	80.0	172.2	172.2	8.000	0.530	13.700	0.305	3.85	2.04
4	W14x48	50.0	50.0	80.0	193.1	193.1	8.030	0.595	13.800	0.340	3.85	2.29
5	W14x53	50.0	50.0	90.0	214.0	214.0	8.060	0.660	13.900	0.370	3.85	2.54
6	W18x50	50.0	50.0	100.0	244.5	244.5	7.500	0.570	18.000	0.355	3.57	2.04
7	W18x55	50.0	50.0	100.0	270.3	270.3	7.530	0.630	18.100	0.390	3.57	2.25
8	W18x60	50.0	50.0	100.0	297.0	297.0	7.560	0.695	18.200	0.415	3.57	2.48
9	W18x65	50.0	50.0	100.0	321.8	321.8	7.590	0.750	18.400	0.450	3.57	2.68

DESIGN CALCULATIONS FOR COVER PLATE

Case	Max Cutout Force (k)	Design Cutout Force (k)	Cover Plate E70XX Weld Size (in)	Req'd Weld Length L (in)	Design Weld Length L (in)	Design Weld Width (in)	Req'd Weld Return Length (in)	Design Cover Plate Thick (in)	Req'd Cover Plate Width (in)	Design Cover Plate Width (in)	Req'd Cover Plate Length (in)	Design Cover Plate Length (in)
1	48.5	48.5	0.3125	10.5	11.5	2.5	9.0	0.500	2.94	3.00	24.0	24.0
2	54.9	54.9	0.3125	11.8	11.5	2.5	9.0	0.500	3.33	4.00	24.0	24.0
3	67.3	67.3	0.3125	14.5	14.5	2.5	12.0	0.500	4.08	4.00	30.0	30.0
4	75.5	75.5	0.3125	16.3	16.0	2.5	13.5	0.750	3.05	3.00	33.0	33.0
5	83.7	83.7	0.3125	18.0	17.5	2.5	15.0	0.750	3.38	4.00	36.0	36.0
6	67.2	67.2	0.3125	14.5	14.5	2.5	12.0	0.500	4.07	4.00	30.0	30.0
7	74.2	74.2	0.3125	16.0	16.0	2.5	13.5	0.750	3.00	3.00	33.0	33.0
8	81.9	81.9	0.3125	17.7	17.5	2.5	15.0	0.750	3.31	4.00	36.0	36.0
9	88.4	88.4	0.3125	19.0	19.0	2.5	16.5	0.750	3.57	4.00	39.0	39.0

DESIGN CALCULATIONS FOR WEB STIFFENER

Case	Single Stiffener Force (k)	Total Stiffener E70XX Weld Size (in)	Stiffener Thickness (in)	Req'd Weld Length (in)	Design Weld & Stiffener Length (in)	Req'd Stiffener Compress Area (in ²)	Req'd Stiffener Width (in)	Design Stiffener Width (in)	Stiffener "b/t" Ratio	Allowable Stiffener "b/t" Ratio
1	35.0	0.2500	0.500	9.4	12.0	1.167	2.3	4.0	8.0	10.7
2	35.0	0.2500	0.500	9.4	12.0	1.167	2.3	4.0	8.0	10.7
3	40.0	0.2500	0.500	10.8	12.0	1.333	2.7	4.0	8.0	10.7
4	40.0	0.2500	0.500	10.8	12.0	1.333	2.7	4.0	8.0	10.7
5	45.0	0.2500	0.500	12.1	12.0	1.500	3.0	4.0	8.0	10.7
6	50.0	0.2500	0.500	13.5	16.0	1.667	3.3	4.0	8.0	10.7
7	50.0	0.2500	0.500	13.5	16.0	1.667	3.3	4.0	8.0	10.7
8	50.0	0.2500	0.500	13.5	16.0	1.667	3.3	4.0	8.0	10.7
9	50.0	0.2500	0.500	13.5	16.0	1.667	3.3	4.0	8.0	10.7

TABLE 1
ANCHOR POCKET DESIGN

APPENDIX A
ANCHOR DESIGN

Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	L=NH ² N (psf/ft)	Unif. Press. P (psf)	Anchor 1						Design Beam	Pile Top Elevation	Pile Toe Embed	Pile Toe Elevation	Pile Length	Lagging Pressure
							Elevation (feet)	Angle (degrees)	Anchor Load (kips)	No. of Strands	Total Length (feet)	Bond Length (feet)						
N1	4	16.4	8	1	21	150	76.50	45	69	2	42.8	27.8	W14x38	83.0	10.0	55.0	28.0	839
N2	12	16.6	8	1	21	150	76.50	45	71	3	43.6	28.3	W14x38	83.0	10.0	55.0	28.0	848
N3	20	16.8	8	1	21	150	76.50	45	72	3	44.4	28.8	W14x43	83.0	10.0	55.0	28.0	856
N4	28	17.0	8	1	21	150	76.50	45	73	3	45.1	29.3	W14x43	83.0	10.0	55.0	28.0	865
N5	36	17.2	8	1	21	150	76.50	45	74	3	45.9	29.8	W14x43	83.0	10.0	55.0	28.0	873
N6	44	17.4	8	1	21	150	76.50	45	75	3	46.7	30.3	W14x48	83.0	10.0	54.0	29.0	882
N7	52	17.6	8	1	21	150	76.50	45	76	3	47.4	30.8	W14x48	83.0	10.0	54.0	29.0	891
N8	60	17.8	8	1	21	150	76.50	45	78	3	48.2	31.3	W14x48	83.0	10.0	54.0	29.0	899
N9	68	18.0	8	1	21	150	76.50	45	79	3	49.0	31.8	W14x53	83.0	10.0	54.0	29.0	908
N10	76	18.3	8	1	21	150	76.50	45	81	3	49.8	32.4	W14x53	83.0	10.0	54.0	29.0	917
N11	84	18.5	8	1	21	150	76.50	45	82	3	50.6	32.9	W14x53	83.0	10.0	54.0	29.0	925
N12	92	18.7	8	1	21	150	76.50	45	83	3	51.2	33.2	W18x50	83.0	10.0	53.0	30.0	934
N13	100	18.9	8	1	21	150	76.50	45	85	3	52.1	33.9	W18x50	83.0	10.0	53.0	30.0	944
N14	108	19.2	8	1	21	150	76.50	45	87	3	53.2	34.7	W18x50	83.0	10.0	53.0	30.0	955
N15	116	19.5	8	1	21	150	76.50	45	89	3	54.4	35.6	W18x55	83.0	10.0	53.0	30.0	967
N16	124	20.0	8	1	21	150	76.50	45	94	3	56.6	37.6	W18x55	84.0	10.0	53.0	31.0	991
N17	132	19.9	8	1	21	150	77.00	45	92	3	56.1	37.0	W18x55	84.0	10.0	53.0	31.0	985
N18	140	19.4	8	1	21	150	77.00	45	91	3	54.1	36.3	W18x50	84.0	10.0	54.0	30.0	963
N19	148	18.8	8	1	21	150	77.00	45	89	3	52.0	35.5	W14x48	85.0	10.0	55.0	30.0	938
N20	156	18.1	8	1	21	150	77.00	45	86	3	49.6	34.4	W14x43	85.0	10.0	56.0	29.0	912
N21	164	17.7	8	1	21	150	77.00	45	84	3	48.8	33.8	W14x34	85.0	10.0	57.0	28.0	892
N22	172	17.9	8	1	21	150	77.00	45	87	3	49.9	34.9	W14x34	85.0	10.0	57.0	28.0	903
N23	180	18.6	8	1	21	150	80.50	45	79	3	46.6	31.6	W18x50	86.0	9.3	57.0	29.0	929
N24	188	19.3	8	1	21	150	80.50	45	86	3	49.5	34.5	W18x55	87.0	9.4	57.0	30.0	960
N25	196	20.0	8	1	21	150	80.50	40	86	3	49.6	34.6	W18x55	88.0	9.5	57.0	31.0	991
N26	204	20.7	8	1	21	150	81.00	30	81	3	47.4	32.4	W18x60	88.0	9.9	57.0	31.0	1020
N27	212	21.1	8	1	21	150	81.00	30	84	3	48.8	33.8	W18x60	89.0	9.9	57.0	32.0	1037
N28	220	21.4	8	1	21	150	81.00	25	83	3	48.2	33.2	W18x60	89.0	10.0	57.0	32.0	1047
N29	228	21.6	8	1	21	150	81.50	20	80	3	47.1	32.1	W18x65	89.0	10.2	56.0	33.0	1057
N30	236	21.8	8	1	21	150	81.50	20	82	3	47.9	32.9	W18x65	89.0	10.3	56.0	33.0	1067
N31	244	22.1	8	1	21	150	81.50	20	85	3	48.9	33.9	W18x65	90.0	10.3	56.0	34.0	1078
N32	252	18.5	8	1	21	150	83.50	20	62	2	38.9	24.9	W14x53	90.0	9.6	61.0	29.0	928
N33	260	15.9	8	1	21	150	84.50	20	49	2	34.8	19.8	W14x34	90.0	8.2	65.0	25.0	820
N34	268	14.4	8	1	21	150	86.00	40	40	2	31.2	16.2	W14x34	91.0	8.0	68.0	23.0	753
N35	276	14.8	8	1	21	150	86.00	20	43	2	32.3	17.3	W14x34	91.0	8.0	68.0	23.0	771
E1	303	15.0	8	1	21	150	85.50	45	61	2	39.4	24.4	W14x34	92.0	10.0	66.0	26.0	781
E2	310.5	15.1	8	1	21	150	85.50	45	61	2	39.6	24.6	W14x34	92.0	10.0	66.0	26.0	783
E3	319	16.1	7.75	1	21	150	85.50	45	65	2	41.1	26.1	W14x34	92.0	10.0	65.0	27.0	827
E4	326	16.2	7.75	1	21	150	85.50	45	65	2	41.2	26.2	W14x34	92.0	10.0	65.0	27.0	829
E5	334.5	16.2	8.25	1	21	150	85.50	45	70	3	43.2	28.2	W14x38	92.0	11.0	64.0	28.0	831
E6	342.5	16.3	8.25	1	21	150	85.00	45	73	3	44.1	29.1	W14x34	92.0	11.0	64.0	28.0	833
E7	351	16.3	8.5	1	21	150	85.00	45	75	3	45.1	30.1	W14x34	92.0	11.0	64.0	28.0	834
E8	359.5	16.7	8.5	1	21	150	85.00	45	78	3	46.1	31.1	W14x38	92.0	11.0	63.0	29.0	853
E9	368	16.7	8.5	1	21	150	85.00	45	77	3	45.9	30.9	W14x38	92.0	11.0	63.0	29.0	851
E10	376.5	16.7	8.5	1	21	150	85.00	45	77	3	45.8	30.8	W14x38	92.0	11.0	63.0	29.0	850
E11	385	16.1	8.5	1	21	150	84.50	45	75	3	45.2	30.2	W14x34	92.0	11.0	64.0	28.0	827
E12	393.5	16.1	8.5	1	21	150	84.50	45	75	3	45.1	30.1	W14x34	92.0	11.0	64.0	28.0	825
E13	402	16.0	8.5	1	21	150	84.50	45	75	3	44.9	29.9	W14x34	92.0	11.0	64.0	28.0	824
E14	410.5	16.0	8.25	1	21	150	84.50	45	72	3	43.9	28.9	W14x34	91.0	11.0	64.0	27.0	822
E15	418.5	15.9	8	1	21	150	84.00	45	71	3	43.6	28.6	W14x34	91.0	11.0	64.0	27.0	819
E16	426.5	18.9	8	1	21	150	84.00	45	88	3	50.3	35.3	W14x53	91.0	11.0	61.0	30.0	943
E17	434.5	18.8	8.5	1	21	150	84.00	45	93	3	52.3	37.3	W14x53	91.0	11.0	61.0	30.0	940
E18	443.5	18.7	8.75	1	21	150	84.00	45	95	3	53.0	38.0	W18x50	91.0	10.0	62.0	29.0	937
E19	452	18.7	8.75	1	21	150	84.00	45	94	3	52.6	37.6	W18x50	91.0	10.0	62.0	29.0	934
E20	461	18.5	8.75	1	21	150	83.50	45	95	3	53.1	38.1	W14x53	91.0	10.0	62.0	29.0	928
E21	469.5	18.4	8.75	1	21	150	83.50	45	94	3	52.5	37.5	W14x53	91.0	10.0	62.0	29.0	923
E22	478.5	18.3	9	1	21	150	83.50	45	95	3	52.9	37.9	W14x53	91.0	10.0	62.0	29.0	917
E23	487.5	18.1	8.5	1	21	150	83.50	45	88	3	50.2	35.2	W14x48	91.0	10.0	62.0	29.0	911
E24	495.5	18.0	8	1	21	150	83.50	45	81	3	47.5	32.5	W14x48	90.0	10.0	62.0	28.0	906
E25	503.5	17.9	8	1	21	150	83.00	45	82	3	47.9	32.9	W14x43	90.0	10.0	62.0	28.0	900
E26	511.5	17.7	7.75	1	21	150	83.00	45	78	3	46.3	31.3	W14x43	90.0	10.0	62.0	28.0	895
E27	519	16.6	7.5	1	21	150	83.00	45	69	2	42.7	27.7	W14x34	90.0	10.0	63.0	27.0	848
E28	526.5	16.5	7.75	1	21	150	83.00	45	70	3	43.2	28.2	W14x34	90.0	10.0	63.0	27.0	843
E29	534.5	16.4	8	1	21	150	83.00	45	72	3	43.7	28.7	W14x34	90.0	10.0	63.0	27.0	838
S1	602.7	16.2	9	1	21	150	83.00	45	78	3	46.4	31.4	W14x38	90.0	9.0	64.0	26.0	829
S2	610.2	15.9	7.5	1	21	150	83.00	45	63	2	40.2	25.2	W14x34	89.0	9.0	64.0	25.0	819
S3	617.7	15.7	7.5	1	21	150	83.00	45	61	2	39.4	24.4	W14x34	89.0	9.0	64.0	25.0	808
S4	625.2	15.4	5.65	1	21	150	83.00	45	44	2	32.7	17.7	W14x34	89.0	8.0	65.0	24.0	798
S5	629	15.3	5.4	1	21	150	83.00	45	41	2	31.6	16.6	W14x34	89.0	8.0	65.0	24.0	793
S6	636	14.9	7	1	21	150	83.00	45	51	2	35.5	20.5	W14x34	88.0	8.0	65.0	23.0	777
S7	643	14.6	7.25	1	21	150	83.00	45	50	2	35.1	20.1	W14x34	88.0	8.0	65.0	23.0	762
S8	650.5	14.2	7.75	1	21	150	82.00	45	54	2	36.5	21.5	W14x34	88.0	8.0	65.0	23.0	745
S9	658.5	13.8	8	1	21	150	82.00	45	52	2	35.8	20.8	W14x34	87.0	8.0	65.0	22.0	728
S10	666.5	13.3	8	1	21	150	82.00	45	49	2	34.5	19.5	W14x34	87.0	8.0	65.0	22.0	710
S11	674.5	12.8	8	1	21	150	81.50	45	46	2	33.6	18.6	W14x34	86.0	8.0	65.0	21.0	689
S12	682.5	12.0	8	1	21													

Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	L=NH ² N (psf/ft)	Unif. Press. P (psf)	Anchor 1					Design Beam	Pile Top Elevation (feet)	Pile Toe Embed (feet)	Pile Toe Elevation (feet)	Pile Length (feet)	Lagging Pressure (psf)	
							Elevation (feet)	Angle (degrees)	Anchor Load (kips)	No. of Strands	Total Length (feet)							Bond Length (feet)
W1	4	19.2	8	1	21	100	75.50	45	80	3	49.7	32.0	W14x53	82.3	9.5	53.3	29.0	905
W2	12.5	18.9	8.25	1	21	100	75.50	45	80	3	49.7	32.0	W14x53	82.0	9.6	53.3	28.8	895
W3	20.5	18.7	8.25	1	21	100	75.50	45	78	3	48.8	31.1	W14x53	81.8	9.5	53.3	28.5	884
W4	29	18.4	8.25	1	21	100	75.00	45	77	3	47.8	30.8	W14x48	81.5	9.3	53.5	28.0	873
W5	37	18.2	8	1	21	100	75.00	45	72	3	46.0	29.0	W14x48	81.3	9.1	53.8	27.5	864
W6	45	18.0	8	1	21	100	75.00	45	71	3	45.4	28.4	W14x48	81.3	9.1	53.8	27.5	857
W7	53	17.9	8	1	21	100	75.00	45	70	2	44.9	27.9	W14x48	81.0	9.1	53.8	27.3	851
W8	61	17.7	8	1	21	100	75.00	45	68	2	44.4	27.4	W14x48	80.8	9.0	53.8	27.0	845
W9	69	17.6	8	1	21	100	75.00	45	67	2	43.9	26.9	W14x48	80.8	9.0	54.0	26.8	839
W10	77	17.5	8	1	21	100	75.00	45	67	2	43.7	26.7	W14x48	80.8	9.0	54.0	26.8	837
W11	85	17.7	8	1	21	100	75.00	45	68	2	44.1	27.1	W14x48	80.8	9.0	53.8	27.0	841
W12	93	17.8	8	1	21	100	75.00	45	69	2	44.5	27.5	W14x48	81.0	9.0	53.8	27.3	846
W13	101	17.9	8.25	1	21	100	75.00	55	88	3	50.4	35.4	W14x53	81.0	13.0	50.0	31.0	851
W14	109.5	18.0	8.5	1	21	100	75.00	50	83	3	48.8	33.1	W14x53	81.0	11.0	52.0	29.0	856
W15	118	17.9	8.25	1	21	100	75.00	45	72	3	46.0	29.0	W14x48	81.0	9.2	53.8	27.3	854
W16	126	17.9	8	1	21	100	75.00	45	70	2	44.9	27.9	W14x48	81.0	9.1	53.8	27.3	851
W17	134	17.8	7	1	21	100	76.00	45	57	2	41.4	23.0	W14x48	81.0	9.0	53.8	27.3	849
W18	140	17.9	7	1	21	100	73.00	45	67	2	42.0	27.0	W14x34	81.0	8.0	55.0	26.0	851
W19	148	18.1	8	1	21	100	75.00	22.5	55	2	53.4	22.0	W14x48	81.3	9.1	53.8	27.5	861
W20	156	18.4	8	1	21	100	75.00	30	60	2	48.3	24.2	W14x48	81.5	9.2	53.8	27.8	871
W21	164	18.6	8	1	21	100	75.50	42.5	71	3	47.1	28.5	W14x53	81.8	9.4	53.5	28.3	880
W22	172	18.7	8	1	21	100	75.50	45	76	3	48.0	30.3	W14x53	81.8	10.0	53.0	28.8	886
W23	180	18.9	8	1	21	100	75.50	45	77	3	48.6	30.9	W14x53	82.0	10.0	53.0	29.0	893
W24	188	19.0	7.75	1	21	100	75.50	45	76	3	48.2	30.5	W14x53	82.3	10.0	53.0	29.3	900
W25	195.5	19.2	7.5	1	21	100	74.00	45	81	3	47.9	32.3	W14x38	82.3	9.0	54.0	28.3	906
W26	203	19.3	7.75	1	21	100	75.00	45	81	3	49.3	32.3	W14x48	82.5	9.2	53.8	28.8	912
W27	211	19.5	7.5	1	21	100	75.00	45	80	3	48.9	31.9	W14x48	82.5	9.2	53.8	28.8	919
W28	214.7	19.6	7.5	1	21	100	75.00	45	80	3	49.1	32.1	W14x48	82.8	9.2	53.8	29.0	922
W29	223.5	19.8	8.65	1	21	100	75.00	45	95	3	55.0	38.0	W14x53	82.8	10.0	53.0	29.8	930
W30	232	19.9	7.75	1	21	100	75.00	45	86	3	51.6	34.6	W14x48	83.0	10.0	53.0	30.0	937
W31	239	19.9	7.75	1	21	150	76.00	45	92	3	55.0	36.7	W18x50	83.0	10.0	53.0	30.0	986
W32	247.5	19.6	8.5	1	21	150	76.00	45	98	3	57.3	39.4	W18x55	83.0	11.0	52.3	30.8	973
W33	256	19.3	8.5	1	21	150	76.00	45	96	3	56.2	38.6	W18x50	83.0	11.0	52.5	30.5	960
W34	264.5	19.0	8.5	1	21	150	76.00	45	94	3	54.9	37.7	W18x50	83.0	11.0	52.8	30.3	948
W35	273	18.7	8.5	1	21	150	75.50	45	95	3	54.0	37.9	W14x48	83.0	11.0	53.0	30.0	935
W36	281.5	18.4	8.5	1	21	150	75.50	45	92	3	52.8	37.0	W14x48	83.0	11.0	53.3	29.8	922
W37	290	18.1	8.5	1	21	150	75.50	45	90	3	51.6	36.2	W14x43	82.8	11.0	53.5	29.3	910
W38	298.5	17.8	8.5	1	21	150	75.50	45	88	3	50.3	35.3	W14x43	82.8	11.0	53.8	29.0	897
W39	307	17.5	8.5	1	21	150	75.50	45	86	3	49.5	34.5	W14x38	82.8	11.0	54.0	28.8	885
W40	315.5	17.2	8.25	1	21	150	75.50	45	82	3	47.7	32.7	W14x38	82.8	10.0	55.3	27.5	872
W41	323.5	16.9	8.25	1	21	150	75.00	45	82	3	47.8	32.8	W14x34	82.8	10.0	55.5	27.3	860
W42	332	16.6	8	1	21	150	75.00	45	78	3	46.1	31.1	W14x34	82.8	10.0	55.8	27.0	847

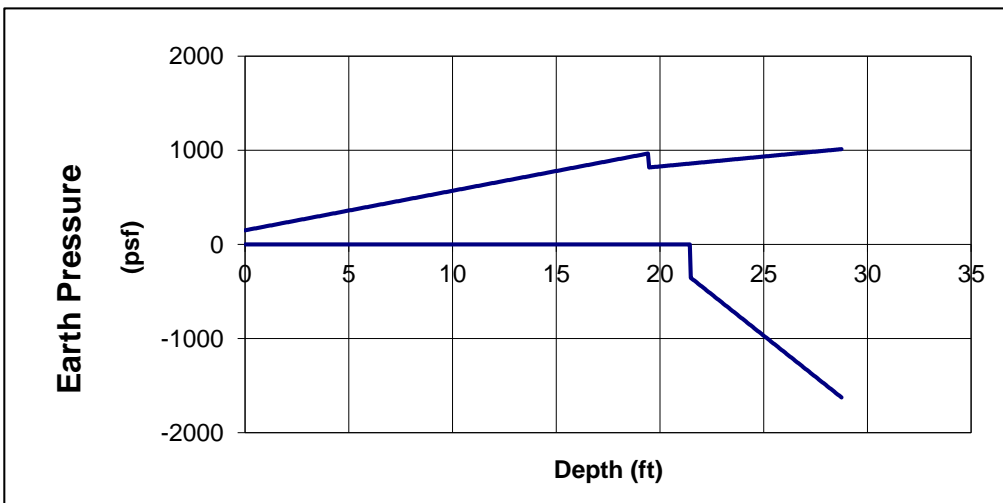
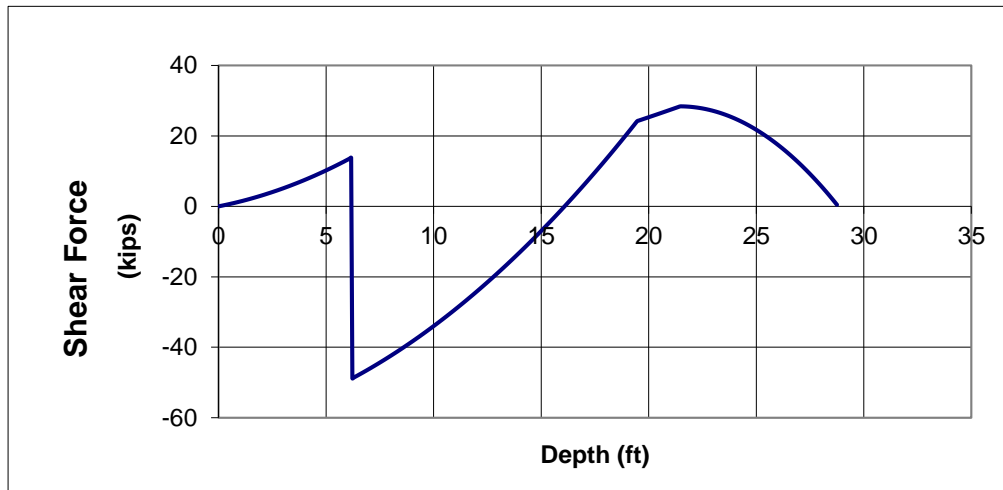
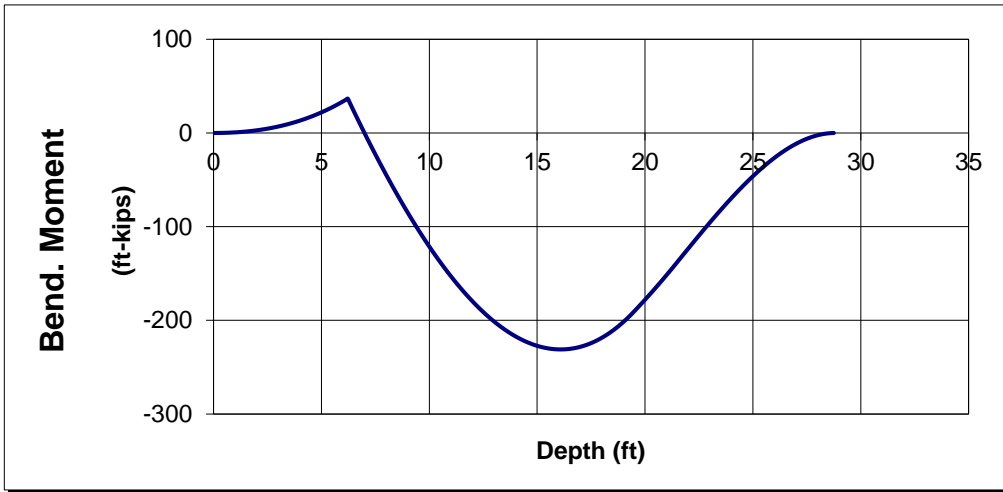
TABLE A2
ANCHOR DESIGN - WEST WALL

APPENDIX B
SOLDIER PILE DESIGN

File ID	Design Beam	Pile Vertical Load Analysis										Pile Vertical Punching Analysis														
		Soldier Beam Loads-Below Anchor 1					Pile					End Bearing					Skin Friction					Axial Load				
		Axial Load (kips)	Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio	Diameter (ft)	Pile End Area (ft ²)	Pile Skin Area (ft ² /ft)	Pile End Area (ksf)	Pile End Bearing (ksf)	Pile End Bearing (kips)	Friction (k/ft)	Axial Load (kips)	Embed Length (ft)	Pile Depth (in)	Pile Flange (in)	Pile End Area (ft ²)	Pile Skin Area (ft ² /ft)	Pile End Area (ksf)	Pile End Bearing (ksf)	Pile End Bearing (kips)	Friction (k/ft)	Axial Load (kips)	Embed Length (ft)	
N1	W14x38	49	131	10.59	W14x38	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	49	3.4	14.1	6.77	0.66	3.48	10	1.2	6.6	4.0	49	10.5	
N2	W14x38	50	137	10.78	W14x38	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	50	3.5	14.1	6.77	0.66	3.48	10	1.2	6.6	4.1	50	10.6	
N3	W14x43	51	143	10.97	W14x43	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	51	3.5	13.7	8	0.76	3.62	10	1.2	7.6	4.3	51	10.4	
N4	W14x43	52	150	11.16	W14x43	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	52	3.6	13.7	8	0.76	3.62	10	1.2	7.6	4.3	52	10.3	
N5	W14x43	53	157	11.35	W14x43	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.7	13.7	8	0.76	3.62	10	1.2	7.6	4.3	53	10.4	
N6	W14x48	53	163	11.54	W14x48	0.91	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.8	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	53	10.4	
N7	W14x48	54	170	11.73	W14x48	0.95	2.00	3.14	6.28	10.00	2.00	31.4	12.6	54	3.8	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	54	10.5	
N8	W14x48	55	178	11.92	W14x48	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	55	3.9	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	55	10.7	
N9	W14x53	56	185	12.11	W14x53	0.92	2.00	3.14	6.28	10.00	2.00	31.4	12.6	56	4.0	13.9	8.06	0.78	3.66	10	1.2	7.8	4.5	56	10.7	
N10	W14x53	57	193	12.30	W14x53	0.96	2.00	3.14	6.28	10.00	2.00	31.4	12.6	57	4.0	13.9	8.06	0.78	3.66	10	1.2	7.8	4.5	57	10.8	
N11	W14x53	58	200	12.48	W14x53	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	58	4.1	13.9	8.06	0.78	3.66	10	1.2	7.8	4.6	58	11.0	
N12	W18x50	59	205	12.67	W18x50	0.89	2.50	4.91	7.85	10.00	2.00	49.1	15.7	59	2.6	18	7.5	0.94	4.25	10	1.3	9.4	5.4	59	9.2	
N13	W18x50	60	213	12.86	W18x50	0.93	2.50	4.91	7.85	10.00	2.00	49.1	15.7	60	2.7	18	7.5	0.94	4.25	10	1.3	9.4	5.4	60	9.3	
N14	W18x50	61	222	13.05	W18x50	0.97	2.50	4.91	7.85	10.00	2.00	49.1	15.7	61	2.8	18	7.5	0.94	4.25	10	1.3	9.4	5.5	61	9.5	
N15	W18x55	63	231	13.24	W18x55	0.90	2.50	4.91	7.85	10.00	2.00	49.1	15.7	63	2.9	18.1	7.53	0.95	4.27	10	1.3	9.5	5.5	63	9.6	
N16	W18x55	66	243	13.43	W18x55	0.95	2.50	4.91	7.85	10.00	2.00	49.1	15.7	66	3.1	18.1	7.53	0.95	4.27	10	1.3	9.5	5.6	66	10.1	
N17	W18x55	65	242	13.44	W18x55	0.95	2.50	4.91	7.85	10.00	2.00	49.1	15.7	65	3.0	18.1	7.53	0.95	4.27	10	1.3	9.5	5.6	65	10.0	
N18	W18x50	64	205	12.54	W18x50	0.90	2.50	4.91	7.85	10.00	2.00	49.1	15.7	64	3.0	18	7.5	0.94	4.25	10	1.3	9.4	5.5	64	10.0	
N19	W14x48	63	173	11.63	W14x48	0.97	2.00	3.14	6.28	10.00	2.00	31.4	12.6	63	4.3	18	7.5	0.94	4.25	10	1.3	9.4	5.4	63	9.9	
N20	W14x43	61	139	10.73	W14x43	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	61	4.3	18	7.5	0.94	4.25	10	1.2	9.4	5.3	61	9.8	
N21	W14x34	60	114	10.00	W14x34	0.97	2.00	3.14	6.28	10.00	2.00	31.4	12.6	60	4.2	18	7.5	0.94	4.25	10	1.2	9.4	5.2	60	9.7	
N22	W14x34	62	114	10.00	W14x34	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	62	4.4	18	7.5	0.94	4.25	10	1.2	9.4	5.2	62	10.0	
N23	W18x50	56	231	13.50	W18x50	0.99	2.50	4.91	7.85	10.00	2.00	49.1	15.7	56	2.4	18	7.5	0.94	4.25	10	1.2	9.4	5.2	56	8.9	
N24	W18x55	61	238	13.50	W18x55	0.93	2.50	4.91	7.85	10.00	2.00	49.1	15.7	61	2.7	18.1	7.53	0.95	4.27	10	1.3	9.5	5.4	61	9.5	
N25	W18x55	245	245	13.50	W18x55	0.91	2.50	4.91	7.85	10.00	2.00	49.1	15.7	245	2.4	18.1	7.53	0.95	4.27	10	1.3	9.5	5.6	245	11.0	
N26	W18x60	40	271	14.00	W18x60	0.93	2.50	4.91	7.85	10.00	2.00	49.1	15.7	40	1.4	18.2	7.56	0.96	4.29	10	1.3	9.6	5.8	40	9.3	
N27	W18x60	42	275	14.00	W18x60	0.94	2.50	4.91	7.85	10.00	2.00	49.1	15.7	42	1.6	18.2	7.56	0.96	4.29	10	1.4	9.6	5.9	42	9.6	
N28	W18x60	35	277	14.00	W18x60	0.94	2.50	4.91	7.85	10.00	2.00	49.1	15.7	35	1.1	18.2	7.56	0.96	4.29	10	1.4	9.6	5.9	35	4.3	
N29	W18x65	27	300	14.50	W18x65	0.93	2.50	4.91	7.85	10.00	2.00	49.1	15.7	27	0.6	18.4	7.59	0.97	4.33	10	1.4	9.7	6.1	27	2.9	
N30	W18x65	28	303	14.50	W18x65	0.94	2.50	4.91	7.85	10.00	2.00	49.1	15.7	28	0.7	18.4	7.59	0.97	4.33	10	1.4	9.7	6.1	28	3.0	
N31	W18x65	29	305	14.50	W18x65	0.95	2.50	4.91	7.85	10.00	2.00	49.1	15.7	29	0.7	18.4	7.59	0.97	4.33	10	1.4	9.7	6.2	29	3.1	
N32	W14x53	21	201	12.50	W14x53	0.95	2.00	3.14	6.28	10.00	2.00	31.4	12.6	21	1.2	13.9	8.06	0.78	3.66	10	1.2	7.8	4.5	21	3.0	
N33	W14x34	17	126	10.50	W14x34	0.96	2.00	3.14	6.28	10.00	2.00	31.4	12.6	17	0.8	14	6.75	0.66	3.46	10	1.1	6.6	3.7	17	2.8	
N34	W14x34	14	107	10.00	W14x34	0.91	2.00	3.14	6.28	10.00	2.00	31.4	12.6	14	0.6	14	6.75	0.66	3.46	10	1.0	6.6	3.4	14	2.1	
N35	W14x34	15	109	10.00	W14x34	0.83	2.00	3.14	6.28	10.00	2.00	31.4	12.6	15	0.7	14	6.75	0.66	3.46	10	1.0	6.6	3.5	15	2.4	
E1	W14x34	59	188	9.80	W14x34	0.90	2.00	3.14	6.28	10.00	2.00	31.4	12.6	59	2.8	14	6.75	0.66	3.46	10	1.1	6.6	3.8	43	9.6	
E2	W14x34	43	98	9.50	W14x34	0.80	2.00	3.14	6.28	10.00	2.00	31.4	12.6	43	3.0	14	6.75	0.66	3.46	10	1.1	6.6	3.8	43	9.6	
E3	W14x34	46	123	10.50	W14x34	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	46	3.2	14	6.75	0.66	3.46	10	1.1	6.6	4.0	46	9.9	
E4	W14x34	46	123	10.50	W14x34	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	46	3.2	14	6.75	0.66	3.46	10	1.2	6.6	4.0	46	10.0	
E5	W14x38	50	132	10.50	W14x38	0.95	2.00	3.14	6.28	10.00	2.00	31.4	12.6	50	3.5	14.1	6.77	0.66	3.48	10	1.2	6.6	4.2	50	10.3	
E6	W14x34	51	117	10.00	W14x34	0.96	2.00	3.14	6.28	10.00	2.00	31.4	12.6	51	3.6	14	6.75	0.66	3.46	10	1.2	6.6	4.1	51	10.8	
E7	W14x34	52	121	10.00	W14x34	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	52	3.7	14	6.75	0.66	3.46	10	1.2	6.6	4.2	52	11.0	
E8	W14x38	55	138	10.50	W14x38	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	55	3.9	14.1	6.77	0.66	3.48	10	1.2	6.6	4.2	55	11.4	
E9	W14x38	55	138	10.50	W14x38	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	55	3.8	14.1	6.77	0.66	3.48	10	1.2	6.6	4.2	55	11.3	
E10	W14x38	54	138	10.50	W14x38	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	54	3.8	14.1	6.77	0.66	3.48	10	1.2	6.6	4.2	54	11.3	
E11	W14x34	53	106	9.50	W14x34	0.88	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.7	14	6.75	0.66	3.46	10	1.2	6.6	4.1	53	11.3	
E12	W14x34	53	106	9.50	W14x34	0.88	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.7	14	6.75	0.66	3.46	10	1.2	6.6	4.1	53	11.3	
E13	W14x34	53	106	9.50	W14x34	0.88	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.7	14	6.75	0.66	3.46	10	1.2	6.6	4.1	53	11.3	
E14	W14x34	51	102	9.50	W14x34	0.85	2.00	3.14	6.28	10.00	2.00	31.4	12.6	51	3.6	14	6.75	0.66	3.46	10	1.2	6.6	4.1	51	10.8	
E15	W14x34	50	85	9.00	W14x34	0.72	2.00	3.14	6.28	10.00	2.00	31.4	12.6	50	3.5	14	6.75	0.66	3.46	10	1.2	6.6	4.1	50	10.7	
E16	W14x53	62	186	12.00	W14x53	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	62	4.5	13.9	8.06	0.78	3.66	10	1.3	7.8	4.8	62	11.3	
E17	W14x53	66	198	12.00	W14x53	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	66	4.7	13.9	8.06	0.78	3.66	10	1.3	7.8	4.8	66	12.1	
E18	W18x50	67	201	12.00	W18x50																					

Soldier Beam Loads-Below Anchor 1					Pile Vertical Load Analysis			Toe Dist. Depth (ft)		2		Pile Vertical Punching Analysis													
Pile ID	Design Beam	Axial Load (kips)	Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio	Pile Diameter (ft)	Pile End Area (ft^2)	Pile Skin Area (ft^2/ft)	Pile End Bear (ksf)	Pile Skin Frict (ksf)	End Bearing (kips)	End Friction (klf)	Axial Load (kips)	Embed Length (ft)	Pile Depth (in)	Pile Flange (in)	Pile End Area (ft^2)	Pile Skin Area (ft^2/ft)	Pile End Bear (ksf)	Pile Skin Frict (ksf)	End Bearing (kips)	End Friction (klf)	Axial Load (kips)	Embed Length (ft)
W1	W14x53	56	195	12.50	W14x53	0.97	2.00	3.14	6.28	10.00	2.00	31.4	12.6	56	4.0	18	7.5	0.94	4.25	10	1.3	9.4	5.4	56	8.8
W2	W14x53	56	199	12.50	W14x53	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	56	4.0	13.9	8.06	0.78	3.66	10	1.3	7.8	4.6	56	10.6
W3	W14x53	55	197	12.50	W14x53	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	55	3.9	13.9	8.06	0.78	3.66	10	1.2	7.8	4.5	55	10.4
W4	W14x48	54	179	12.00	W14x48	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	54	3.8	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	54	10.5
W5	W14x48	51	172	12.00	W14x48	0.95	2.00	3.14	6.28	10.00	2.00	31.4	12.6	51	3.6	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	51	9.9
W6	W14x48	50	171	12.00	W14x48	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	50	3.5	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	50	9.8
W7	W14x48	49	170	12.00	W14x48	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	49	3.4	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	49	9.6
W8	W14x48	48	169	12.00	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	48	3.3	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	48	9.5
W9	W14x48	47	167	12.00	W14x48	0.92	2.00	3.14	6.28	10.00	2.00	31.4	12.6	47	3.3	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	47	9.3
W10	W14x48	47	167	12.00	W14x48	0.92	2.00	3.14	6.28	10.00	2.00	31.4	12.6	47	3.2	13.8	8.03	0.77	3.64	10	1.2	7.7	4.2	47	9.3
W11	W14x48	48	168	12.00	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	48	3.3	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	48	9.4
W12	W14x48	48	169	12.00	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	48	3.4	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	48	9.5
W13	W14x53	72	175	12.00	W14x53	0.90	2.00	3.14	6.28	10.00	2.00	31.4	12.6	72	5.3	13.9	8.06	0.78	3.66	10	1.4	7.8	5.0	72	13.0
W14	W14x53	63	182	12.00	W14x53	0.92	2.00	3.14	6.28	10.00	2.00	31.4	12.6	63	4.5	13.9	8.06	0.78	3.66	10	1.3	7.8	4.7	63	11.9
W15	W14x48	51	176	12.00	W14x48	0.97	2.00	3.14	6.28	10.00	2.00	31.4	12.6	51	3.6	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	51	10.0
W16	W14x48	49	170	12.00	W14x48	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	49	3.4	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	49	9.6
W17	W14x48	41	170	13.00	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	41	2.7	13.8	8.03	0.77	3.64	10	1.2	7.7	4.3	41	7.7
W18	W14x34	48	96	10.00	W14x34	0.80	2.00	3.14	6.28	10.00	2.00	31.4	12.6	48	3.3	18	7.5	0.94	4.25	10	1.1	9.4	4.8	48	7.9
W19	W14x48	21	172	12.00	W14x48	0.91	2.00	3.14	6.28	10.00	2.00	31.4	12.6	21	1.2	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	21	3.1
W20	W14x48	30	173	12.00	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	30	1.9	13.8	8.03	0.77	3.64	10	1.2	7.7	4.4	30	5.1
W21	W14x53	48	190	12.50	W14x53	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	48	3.3	13.9	8.06	0.78	3.66	10	1.2	7.8	4.5	48	8.9
W22	W14x53	53	191	12.50	W14x53	0.95	2.00	3.14	6.28	10.00	2.00	31.4	12.6	53	3.8	13.9	8.06	0.78	3.66	10	1.3	7.8	4.6	53	9.9
W23	W14x53	54	193	12.50	W14x53	0.96	2.00	3.14	6.28	10.00	2.00	31.4	12.6	54	3.8	13.9	8.06	0.78	3.66	10	1.3	7.8	4.7	54	10.0
W24	W14x53	54	187	12.50	W14x53	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	54	3.8	13.9	8.06	0.78	3.66	10	1.3	7.8	4.7	54	9.8
W25	W14x38	57	135	11.00	W14x38	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	57	4.0	18	7.5	0.94	4.25	10	1.2	9.4	5.3	57	9.0
W26	W14x48	57	173	12.00	W14x48	0.97	2.00	3.14	6.28	10.00	2.00	31.4	12.6	57	4.0	18	7.5	0.94	4.25	10	1.3	9.4	5.3	57	8.9
W27	W14x48	56	168	12.00	W14x48	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	56	4.0	18	7.5	0.94	4.25	10	1.3	9.4	5.4	56	8.7
W28	W14x48	57	169	12.00	W14x48	0.94	2.00	3.14	6.28	10.00	2.00	31.4	12.6	57	4.0	18	7.5	0.94	4.25	10	1.3	9.4	5.4	57	8.8
W29	W14x53	67	197	12.00	W14x53	1.00	2.00	3.14	6.28	10.00	2.00	31.4	12.6	67	4.8	18	7.5	0.94	4.25	10	1.3	9.4	5.6	67	10.4
W30	W14x48	61	176	12.00	W14x48	0.99	2.00	3.14	6.28	10.00	2.00	31.4	12.6	61	4.4	18	7.5	0.94	4.25	10	1.3	9.4	5.6	61	9.2
W31	W18x50	65	215	12.91	W18x50	0.96	2.50	4.91	7.85	10.00	2.00	49.1	15.7	65	3.0	18	7.5	0.94	4.25	10	1.3	9.4	5.6	65	9.9
W32	W18x55	70	225	12.65	W18x55	0.90	2.50	4.91	7.85	10.00	2.00	49.1	15.7	70	3.3	18.1	7.53	0.95	4.27	10	1.3	9.5	5.8	70	10.5
W33	W18x50	68	213	12.39	W18x50	0.95	2.50	4.91	7.85	10.00	2.00	49.1	15.7	68	3.2	18	7.5	0.94	4.25	10	1.3	9.4	5.7	68	10.4
W34	W18x50	67	201	12.14	W18x50	0.90	2.50	4.91	7.85	10.00	2.00	49.1	15.7	67	3.1	18	7.5	0.94	4.25	10	1.3	9.4	5.6	67	10.2
W35	W14x48	67	174	11.38	W14x48	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	67	4.8	18	7.5	0.94	4.25	10	1.3	9.4	5.6	67	10.4
W36	W14x48	65	164	11.12	W14x48	0.93	2.00	3.14	6.28	10.00	2.00	31.4	12.6	65	4.7	18	7.5	0.94	4.25	10	1.3	9.4	5.5	65	10.2
W37	W14x43	64	154	10.86	W14x43	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	64	4.6	18	7.5	0.94	4.25	10	1.3	9.4	5.4	64	10.0
W38	W14x43	62	144	10.61	W14x43	0.92	2.00	3.14	6.28	10.00	2.00	31.4	12.6	62	4.5	18	7.5	0.94	4.25	10	1.3	9.4	5.4	62	9.8
W39	W14x38	61	134	10.35	W14x38	0.98	2.00	3.14	6.28	10.00	2.00	31.4	12.6	61	4.3	18	7.5	0.94	4.25	10	1.3	9.4	5.3	61	9.7
W40	W14x38	58	121	10.09	W14x38	0.89	2.00	3.14	6.28	10.00	2.00	31.4	12.6	58	4.1	18	7.5	0.94	4.25	10	1.2	9.4	5.1	58	9.5
W41	W14x34	58	97	9.35	W14x34	0.85	2.00	3.14	6.28	10.00	2.00	31.4	12.6	58	4.1	18	7.5	0.94	4.25	10	1.2	9.4	5.0	58	9.7
W42	W14x34	55	87	9.09	W14x34	0.74	2.00	3.14	6.28	10.00	2.00	31.4	12.6	55	3.9	18	7.5	0.94	4.25	10	1.2	9.4	5.0	55	9.1

TABLE B2
SOLDIER PILE DESIGN - WEST WALL



Wall Height (ft) 19.5
 Pile Spacing (ft) 8.00

FIGURE B1 SOLDIER BEAM - N15

Point	Depth	Pressure	Width	Force	Depth(CG)	Moment
A	0.00	0.0	8.00	F_{AB} 63640	12.98	1007736
B	19.46	817.4	8.00	F_{BC} 0	0.00	0
C	19.46	817.4	8.00	F_{CD} 0	0.00	0
D	19.46	0.0	8.00	F_{AD} 63640	12.98	
E	19.46	0.0	2.50	F_{EF} 21396	24.30	96425
F	19.46	817.4	2.50			
G	28.81	1013.7	2.50			
H	28.81	0.0	6.25	F_{GH} 0	0.00	0
I	21.46	-350.0	6.25	F_{HI} -45595	25.93	-131350
J	28.81	-1635.8	6.25	F_{IJ} 0	0.00	0
K	28.81	-1635.8	6.25	F_{JK} 0	0.00	0
L	28.81	-1635.8	6.25	F_{GK} -45595	25.93	
M	0.00	0.0	8.00	F_{LM} 23356	9.73	445598
N	0.00	150.0	8.00			
O	19.46	150.0	8.00			
P	0.00	0.0	8.00	F_{NO} 0	0.00	0
Q	0.00	0.0	8.00			
R	0.00	0.0	8.00	F_{PO} 0	0.00	0
S	0.00	0.0	8.00			
T	0.00	0.0	8.00	F_{RS} 0	0.00	0
U	0.00	0.0	8.00			
V	0.00	0.0	8.00			
W	19.46	0.0	8.00	F_{TU} 0	0.00	0
X	19.46	0.0	8.00	F_{UV} 0	0.00	0
Y	19.46	0.0	8.00	F_{VW} 0	0.00	0
Z	28.81	0.0	8.00	F_{TW} 0	0.00	0
AA	28.81	0	8.00			
Anchor 1				62796	6.22	1418409
Anchor 2				0	0.00	0
Anchor 3				0	0.00	0
Anchor 4				0	0.00	0
Load 1				0	0.00	0
Σ Forces				0	Σ Moments	0

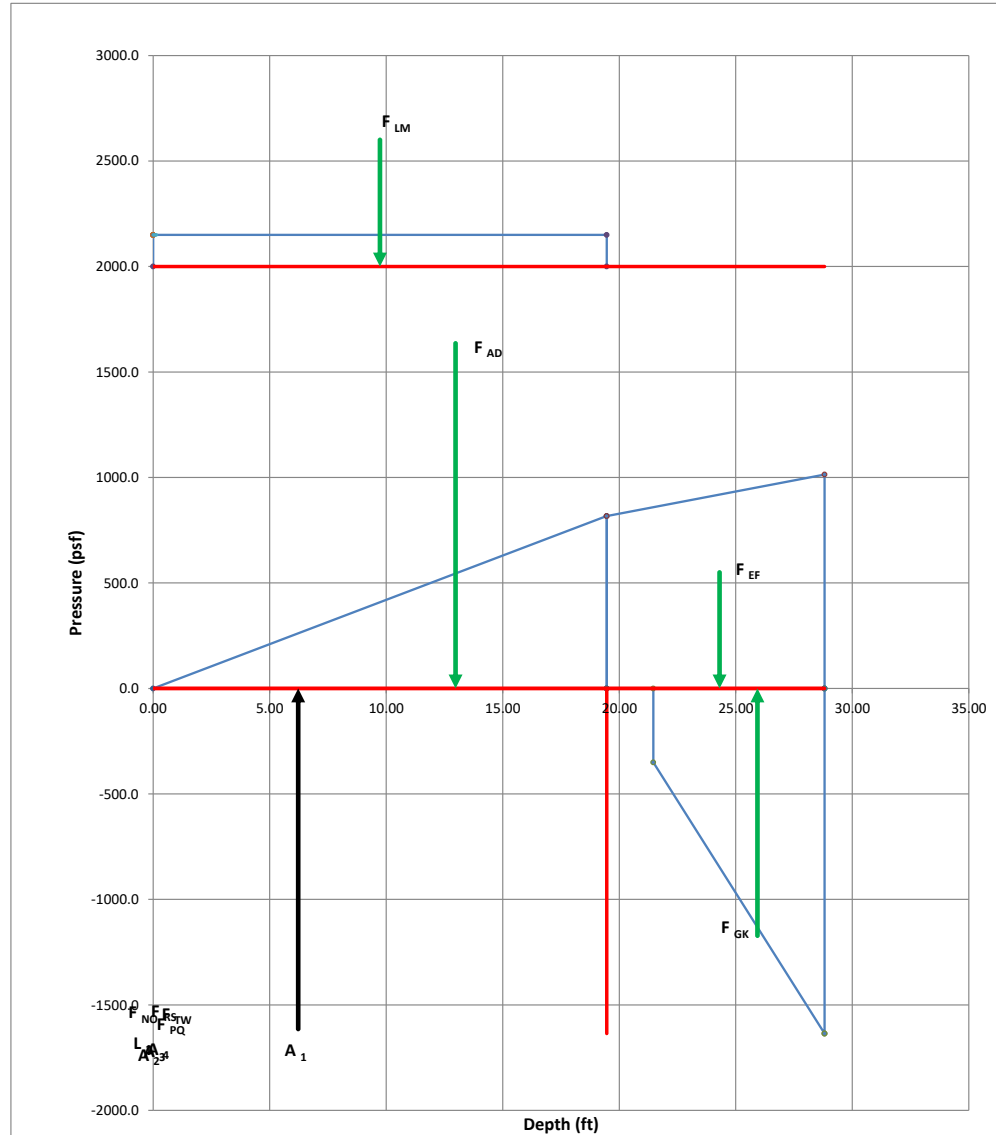
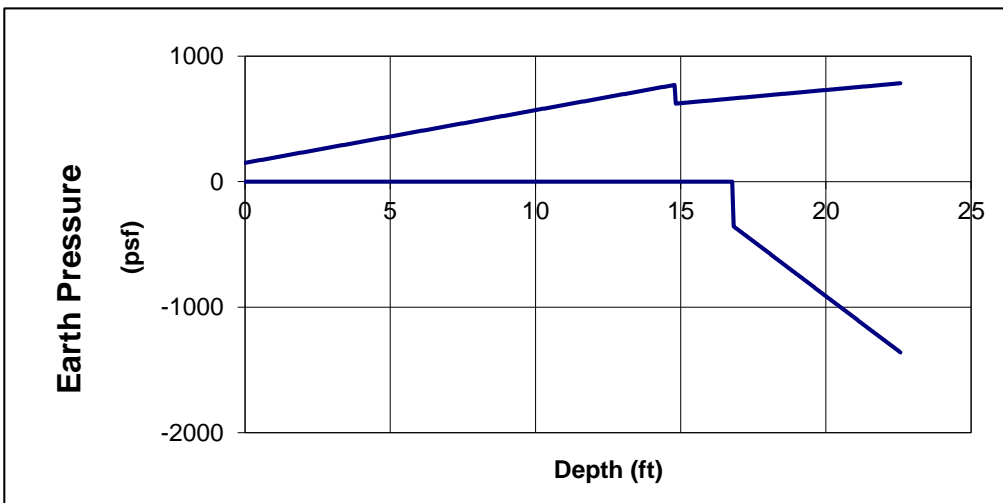
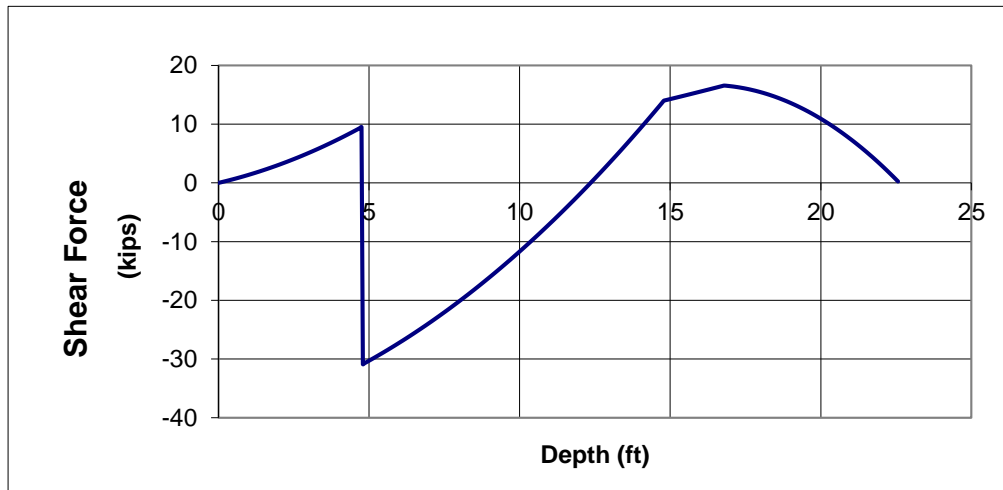
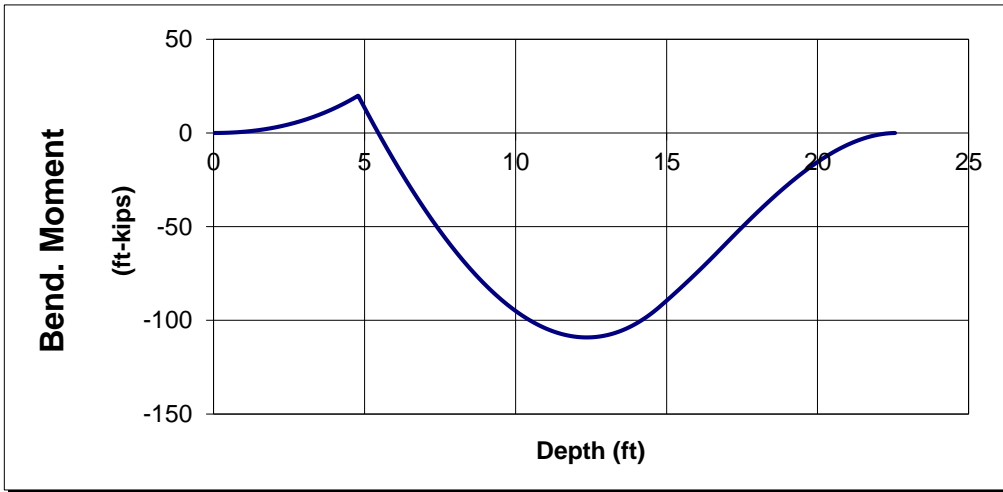


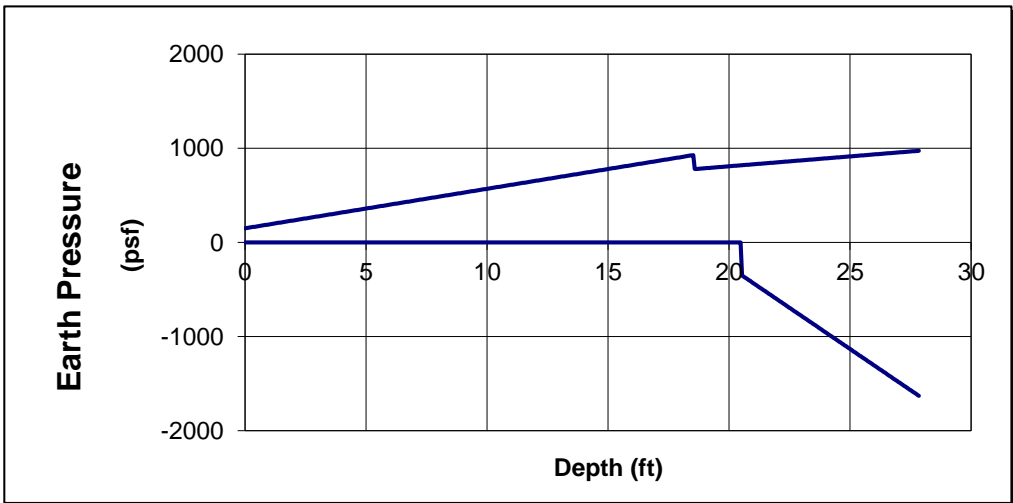
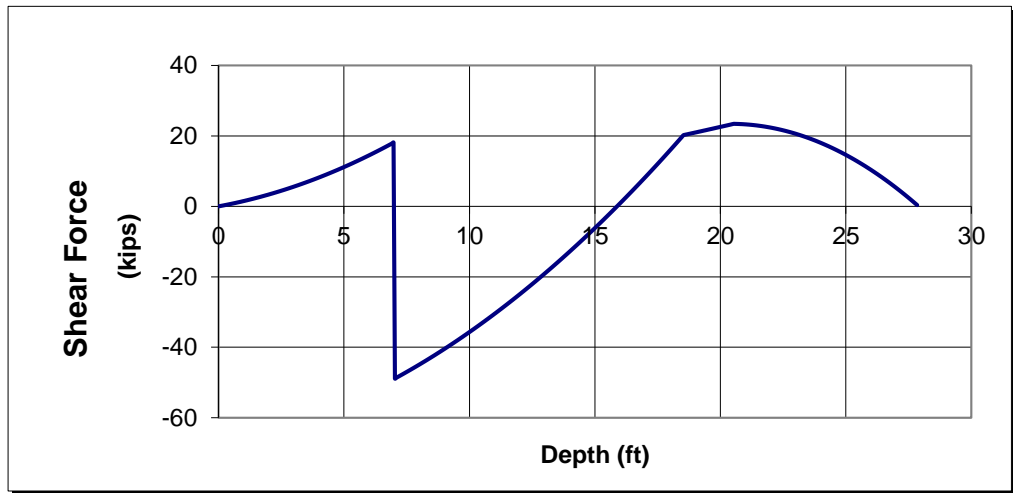
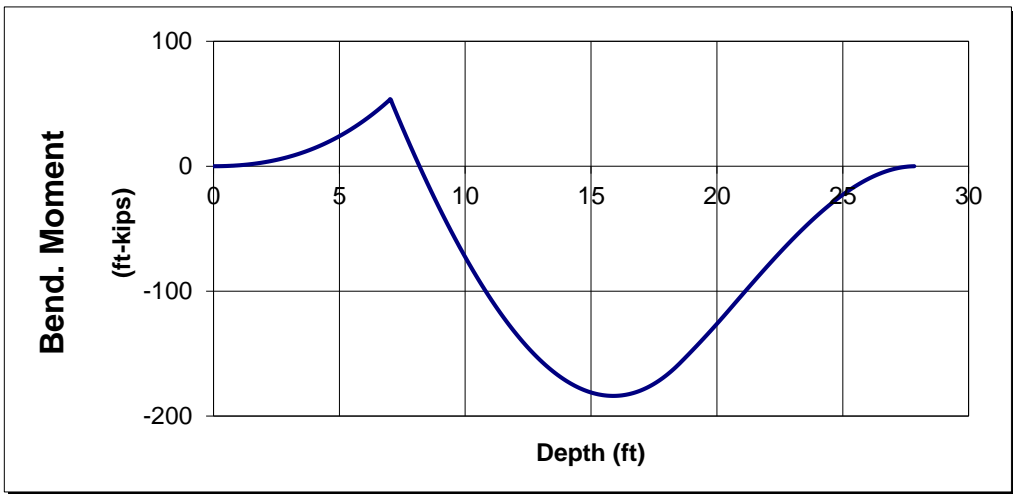
FIGURE B1 (cont'd)

SOLDIER BEAM - N15



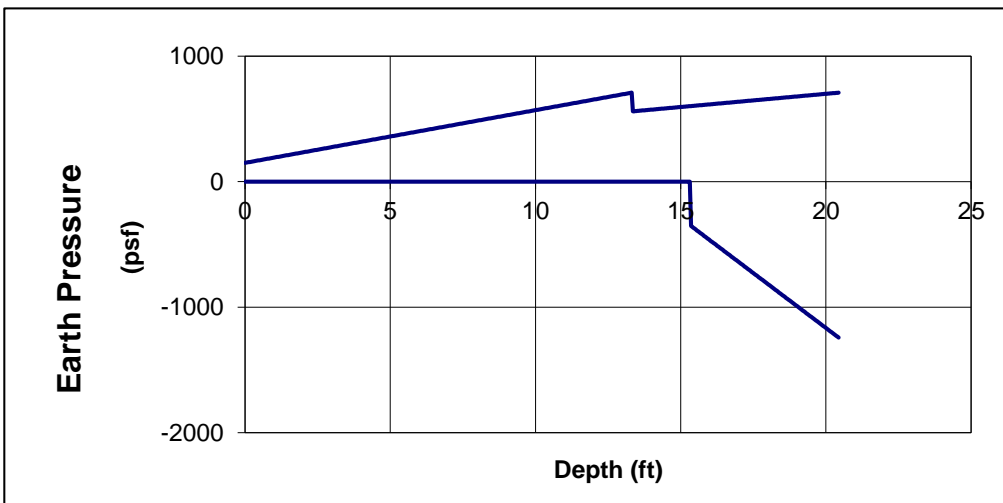
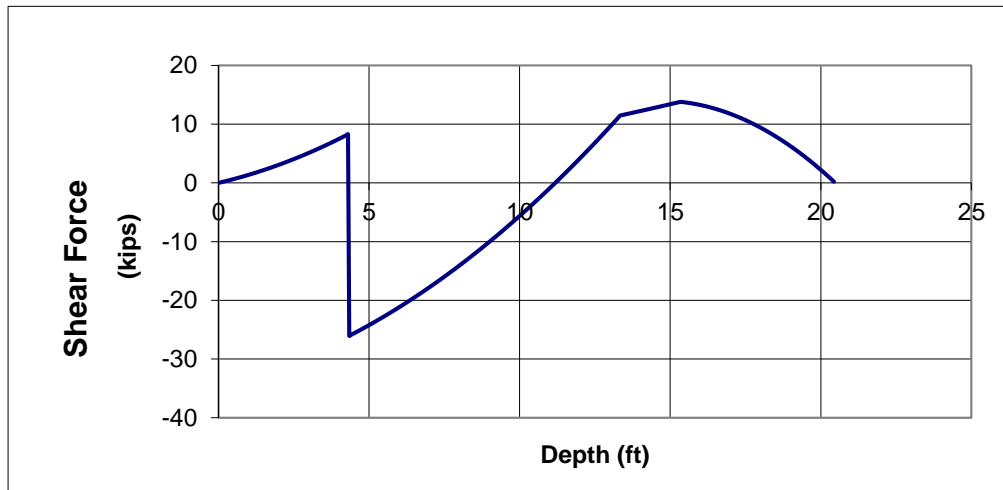
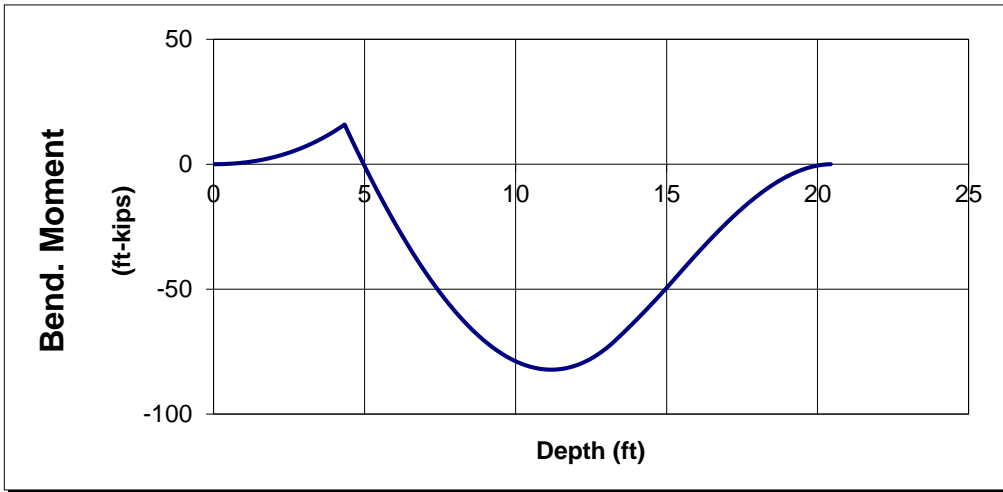
Wall Height (ft) 14.8
 Pile Spacing (ft) 8.00

FIGURE B2 SOLDIER BEAM - N35



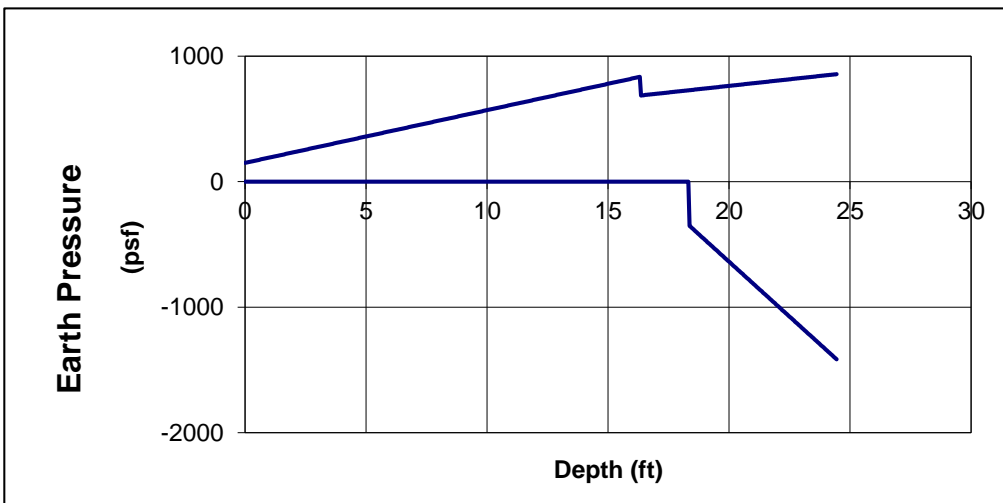
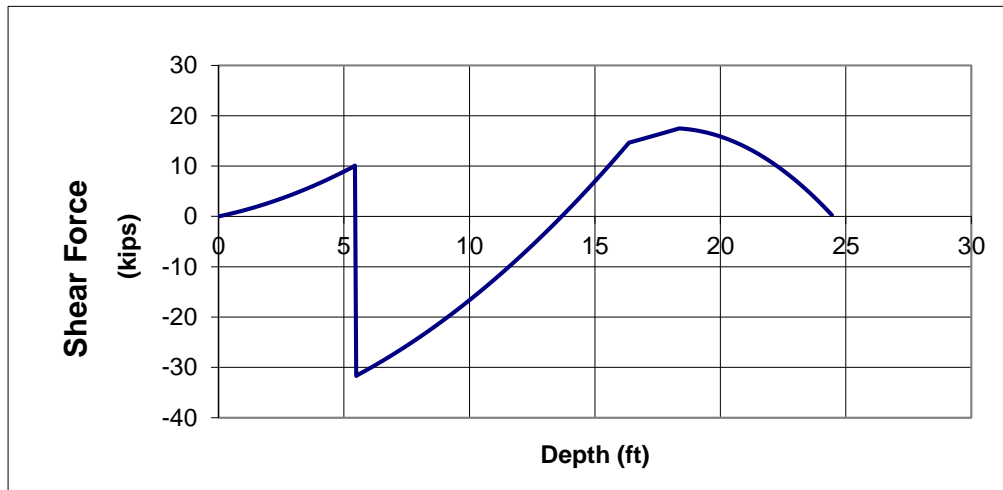
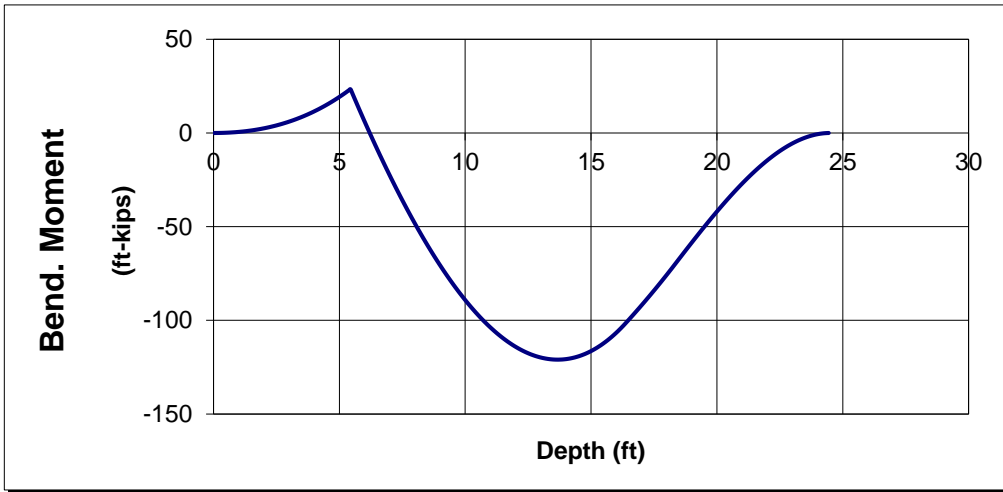
Wall Height (ft) 18.5
 Pile Spacing (ft) 8.75

FIGURE B3 SOLDIER BEAM - E20



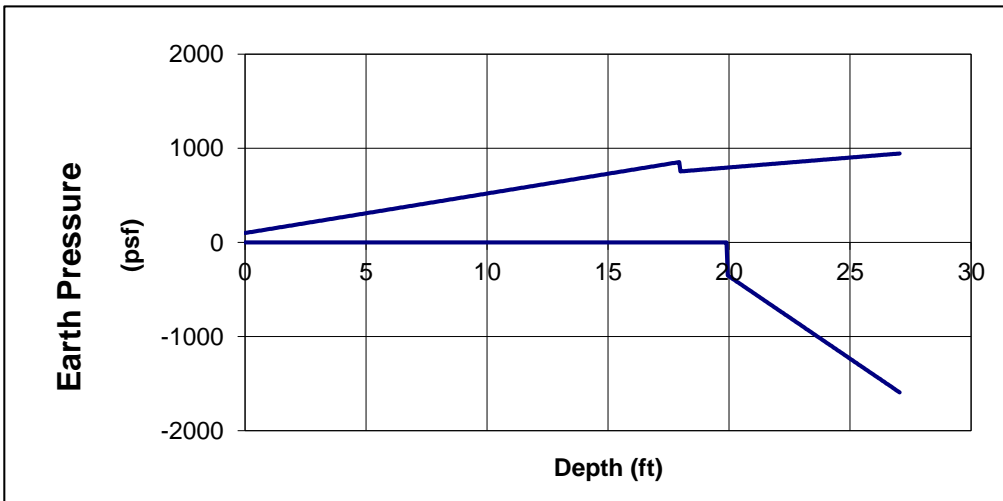
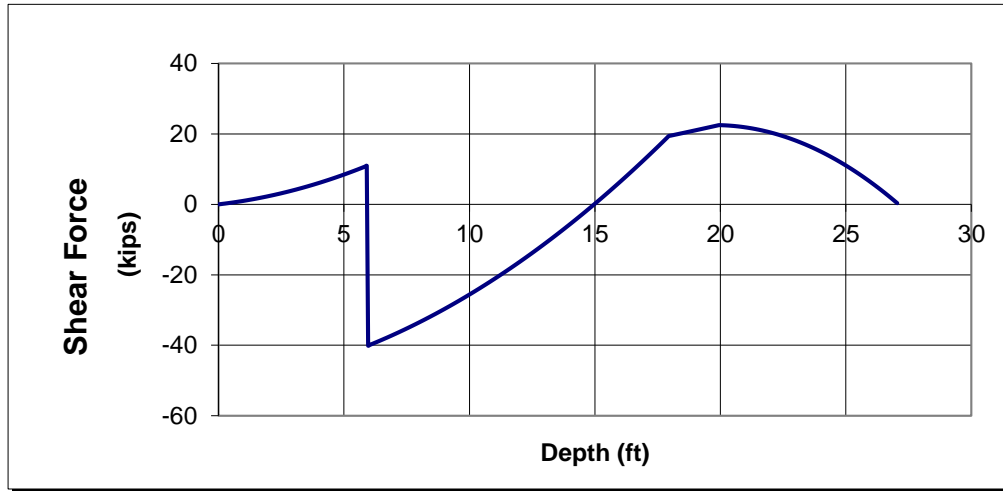
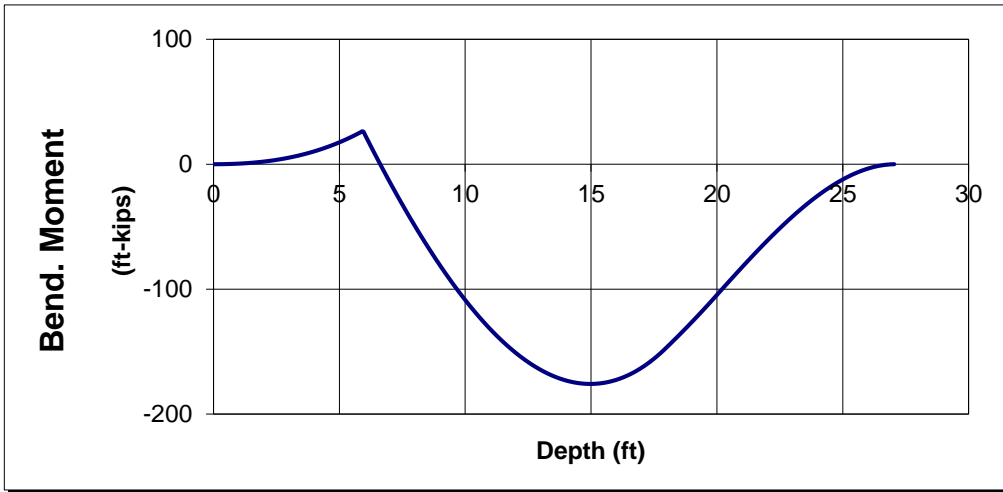
Wall Height (ft) 13.3
 Pile Spacing (ft) 8.00

FIGURE B4 SOLDIER BEAM - S10



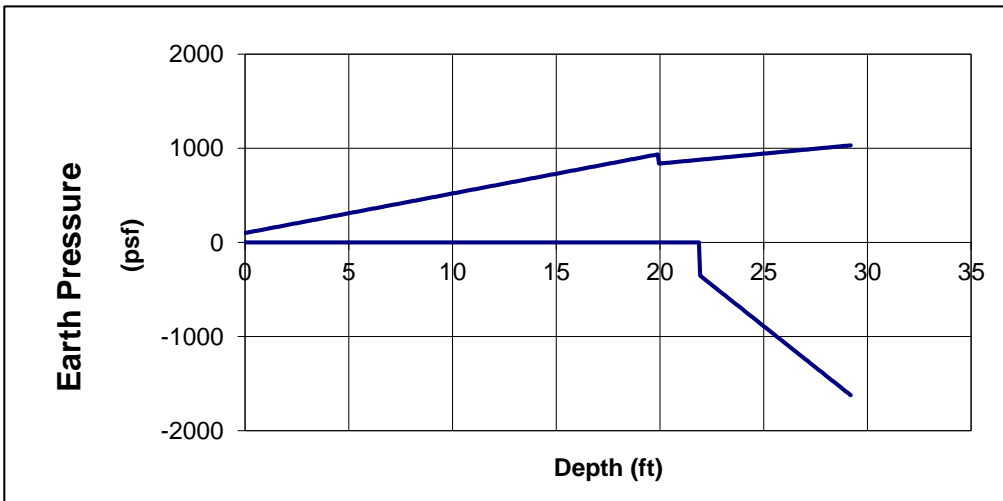
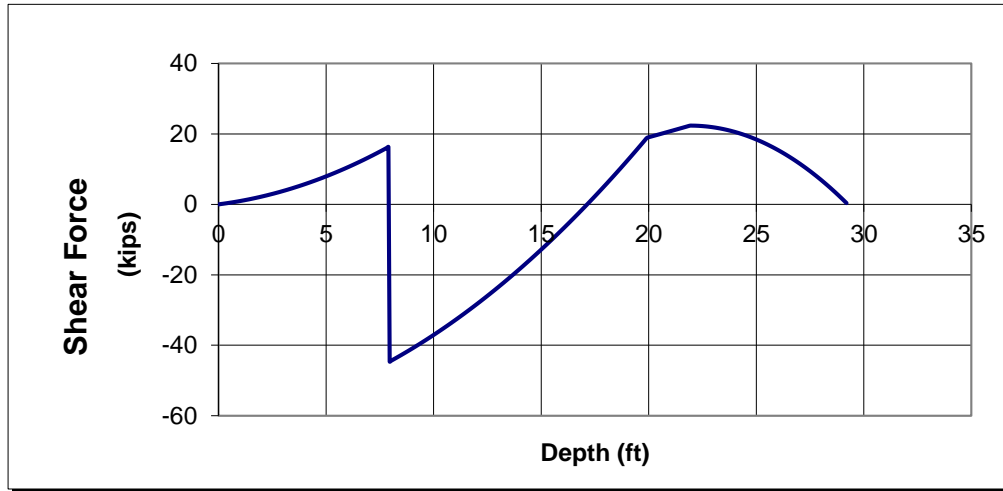
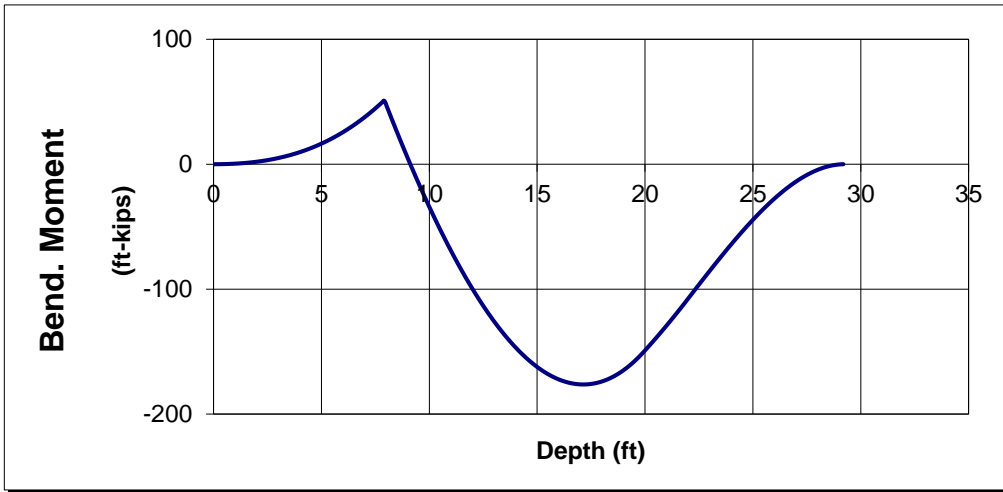
Wall Height (ft) 16.4
 Pile Spacing (ft) 7.00

FIGURE B5 SOLDIER BEAM - S22



Wall Height (ft) 17.9
 Pile Spacing (ft) 8.25

FIGURE B6 SOLDIER BEAM - W15



Wall Height (ft) 19.9
 Pile Spacing (ft) 7.75

FIGURE B7 SOLDIER BEAM - W30

APPENDIX C

SOLDIER PILE DESIGN – STAGE 1 CANTILEVER

Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	L=NH		Design Beam	Pile Top Elevation (feet)	Pile Toe Embed (feet)	Pile Toe Elevation (feet)	Pile Length (feet)	Lagging Pressure (psf)	Soldier Beam - Flexure/Compression				
					Unif. Press. (psf)	N (psf/ft)							Axial Load (kips)	Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio
N1	4	7.8	8	0	21	100	W14x48	82.5	17.1	57.3	25.3	428	0	179	7.81	W14x48	0.91
N2	12	7.8	8	0	21	100	W14x48	82.5	17.2	57.3	25.3	429	0	180	7.83	W14x48	0.92
N3	20	7.8	8	0	21	100	W14x48	82.5	17.3	57.0	25.5	429	0	181	7.84	W14x48	0.93
N4	28	7.9	8	0	21	100	W14x48	82.5	17.4	57.0	25.5	430	0	183	7.86	W14x48	0.93
N5	36	7.9	8	0	21	100	W14x48	82.5	17.5	57.0	25.5	431	0	184	7.88	W14x48	0.94
N6	44	7.9	8	0	21	100	W14x48	82.5	17.6	56.8	25.8	431	0	185	7.89	W14x48	0.95
N7	52	7.9	8	0	21	100	W14x48	82.5	17.7	56.8	25.8	432	0	187	7.91	W14x48	0.95
N8	60	7.9	8	0	21	100	W14x48	82.5	17.8	56.5	26.0	433	0	188	7.93	W14x48	0.96
N9	68	7.9	8	0	21	100	W14x48	82.5	17.9	56.5	26.0	434	0	189	7.94	W14x48	0.96
N10	76	8.0	8	0	21	100	W14x48	82.5	18.0	56.5	26.0	434	0	190	7.96	W14x48	0.97
N11	84	8.0	8	0	21	100	W14x48	82.5	18.1	56.3	26.3	435	0	191	7.98	W14x48	0.97
N12	92	8.0	8	0	21	100	W14x48	82.5	18.2	56.3	26.3	436	0	192	7.99	W14x48	0.98
N13	100	8.0	8	0	21	100	W14x48	82.8	18.3	56.0	26.8	438	0	195	8.05	W14x48	1.00
N14	108	8.1	8	0	21	100	W14x53	82.8	18.5	55.8	27.0	441	0	200	8.13	W14x53	0.92
N15	116	8.2	8	0	21	100	W14x53	82.8	18.7	55.8	27.0	445	0	206	8.22	W14x53	0.94
N16	124	8.6	8	0	21	100	W18x50	83.3	18.1	56.3	27.0	461	0	218	8.59	W18x50	0.91
N17	132	8.5	8	0	21	100	W18x50	83.5	17.9	57.0	26.5	455	0	210	8.45	W18x50	0.87
N18	140	8.8	8	0	21	100	W18x50	84.0	18.0	56.8	27.3	470	0	233	8.82	W18x50	0.96
N19	148	9.1	8	0	21	100	W18x55	84.3	18.1	56.8	27.5	484	0	252	9.13	W18x55	0.94
N20	156	9.4	8	0	21	100	W18x55	84.5	18.1	56.8	27.5	495	0	267	9.40	W18x55	0.98
N21	164	9.7	8	0	21	100	W18x60	84.8	18.1	56.8	28.0	506	0	279	9.67	W18x60	0.93
N22	172	9.9	8	0	21	100	W18x60	85.0	18.0	57.0	28.0	517	0	286	9.93	W18x60	0.96
N23	180	7.1	8	0	21	100	W14x38	85.8	16.0	62.5	23.3	396	0	141	7.05	W14x38	0.92
N24	188	7.8	8	0	21	100	W14x43	86.5	16.6	61.8	24.8	427	0	173	7.79	W14x43	0.99
N25	196	8.5	8	0	21	100	W14x53	87.3	17.2	61.3	26.0	458	0	204	8.53	W14x53	0.94
N26	204	8.7	8	0	21	100	W14x53	87.8	17.2	61.8	26.0	466	0	209	8.72	W14x53	0.96
N27	212	9.1	8	0	21	100	W18x50	88.3	16.1	62.8	25.5	483	0	215	9.13	W18x50	0.88
N28	220	9.4	8	0	21	100	W18x50	88.5	16.1	62.8	25.8	493	0	219	9.36	W18x50	0.90
N29	228	9.1	8	0	21	100	W14x53	88.8	17.1	62.3	26.5	482	0	210	9.09	W14x53	0.96
N30	236	9.3	8	0	21	100	W18x50	89.0	16.0	63.5	25.5	492	0	214	9.33	W18x50	0.88
N31	244	9.6	8	0	21	100	W18x50	89.3	16.7	63.8	26.3	503	0	230	9.61	W18x50	0.95
N32	252	8.0	8	0	21	100	W14x43	89.8	15.4	66.0	23.8	437	0	155	8.03	W14x43	0.89
N33	260	7.4	8	0	21	100	W14x34	90.0	14.6	67.8	22.3	413	0	130	7.45	W14x34	0.95
N34	268	6.4	8	0	21	100	W14x34	90.5	12.9	71.0	19.5	367	0	90	6.37	W14x34	0.66
N35	276	6.8	8	0	21	100	W14x34	91.0	13.5	70.3	20.8	385	0	105	6.79	W14x34	0.77
E1	303	7.5	8	0	21	100	W14x34	91.3	14.7	68.8	22.5	416	0	133	7.52	W14x34	0.97
E2	310.5	7.6	8	0	21	100	W14x34	91.3	14.7	68.8	22.5	418	0	135	7.57	W14x34	0.99
E3	319	7.6	7.75	0	21	100	W14x34	91.3	14.6	68.8	22.5	420	0	132	7.62	W14x34	0.97
E4	326	7.7	7.75	0	21	100	W14x34	91.3	14.7	68.8	22.5	422	0	134	7.67	W14x34	0.98
E5	334.5	7.7	8.25	0	21	100	W14x38	91.3	15.2	68.3	23.0	424	0	147	7.72	W14x38	0.96
E6	342.5	8.3	8.25	0	21	100	W14x43	91.5	16.0	66.8	24.8	447	0	173	8.27	W14x43	1.00
E7	351	8.3	8.5	0	21	100	W14x48	91.5	16.2	66.8	24.8	448	0	180	8.28	W14x48	0.92
E8	359.5	8.2	8.5	0	21	100	W14x48	91.3	16.2	66.8	24.5	446	0	178	8.24	W14x48	0.91
E9	368	8.2	8.5	0	21	100	W14x48	91.3	16.1	66.8	24.5	444	0	176	8.20	W14x48	0.90
E10	376.5	8.2	8.5	0	21	100	W14x43	91.3	16.0	66.8	24.5	443	0	174	8.16	W14x43	1.00
E11	385	8.6	8.5	0	21	100	W14x53	91.3	16.8	65.5	25.8	462	0	198	8.62	W14x53	0.91
E12	393.5	8.6	8.5	0	21	100	W14x53	91.3	16.7	65.8	25.5	460	0	196	8.58	W14x53	0.90
E13	402	8.5	8.5	0	21	100	W14x48	91.5	16.5	65.8	25.5	459	0	194	8.54	W14x48	0.99
E14	410.5	8.5	8.25	0	21	100	W14x48	91.0	16.4	66.0	25.0	457	0	185	8.50	W14x48	0.94
E15	418.5	8.9	8	0	21	100	W14x53	91.0	16.8	65.0	26.0	475	0	201	8.94	W14x53	0.92
E16	426.5	8.9	8	0	21	100	W14x53	91.0	16.8	65.0	26.0	473	0	198	8.88	W14x53	0.91
E17	434.5	8.8	8.5	0	21	100	W14x53	91.0	17.1	64.8	26.3	470	0	210	8.82	W14x53	0.96
E18	443.5	8.7	8.75	0	21	100	W14x53	90.8	17.2	64.8	26.0	467	0	213	8.75	W14x53	0.98
E19	452	8.7	8.75	0	21	100	W14x53	90.8	17.0	64.8	26.0	464	0	208	8.67	W14x53	0.96
E20	461	9.0	8.75	0	21	100	W18x50	90.8	16.1	65.3	25.5	479	0	220	9.03	W18x50	0.91
E21	469.5	8.9	8.75	0	21	100	W18x50	90.5	15.9	65.5	25.0	474	0	212	8.90	W18x50	0.88
E22	478.5	8.8	9	0	21	100	W18x50	90.5	15.9	65.5	25.0	468	0	211	8.76	W18x50	0.87
E23	487.5	8.6	8.5	0	21	100	W14x53	90.3	16.8	64.5	25.8	462	0	198	8.62	W14x53	0.91
E24	495.5	8.5	8	0	21	100	W14x48	90.0	16.2	65.3	24.8	457	0	178	8.49	W14x48	0.91
E25	503.5	8.9	8	0	21	100	W14x53	90.0	16.7	64.3	25.8	472	0	198	8.87	W14x53	0.91
E26	511.5	8.7	7.75	0	21	100	W14x48	89.8	16.3	64.5	25.3	467	0	184	8.74	W14x48	0.94
E27	519	8.6	7.5	0	21	100	W14x43	89.8	16.0	65.0	24.8	462	0	171	8.63	W14x43	0.98
E28	526.5	8.5	7.75	0	21	100	W14x43	89.8	16.0	65.0	24.8	457	0	172	8.51	W14x43	0.99
E29	534.5	8.4	8	0	21	100	W14x43	89.5	16.0	65.0	24.5	452	0	172	8.39	W14x43	0.99
S1	602.7	8.2	9	0	21	100	W18x50	89.3	16.8	64.0	25.3	443	0	218	8.18	W18x50	0.99
S2	610.2	7.9	7.5	0	21	100	W14x43	89.0	16.7	64.3	24.8	433	0	170	7.93	W14x43	0.98
S3	617.7	7.7	7.5	0	21	100	W14x43	88.8	16.4	64.5	24.3	422	0	158	7.68	W14x43	0.91
S4	625.2	7.4	5.65	0	21	100	W14x34	88.5	14.7	66.3	22.3	412	0	106	7.43	W14x34	0.77
S5	629	7.3	5.4	0	21	100	W14x34	88.5	14.3	66.5	22.0	407	0	96	7.30	W14x34	0.71
S6	636	6.9	7	0	21	100	W14x34	88.0	15.0	66.0	22.0	391	0	115	6.93	W14x34	0.85
S7	643	6.6	7.25	0	21	100	W14x34	87.8	14.6	66.3	21.5	376	0	106	6.57	W14x34	0.78
S8	650.5	7.2	7.75	0	21	100	W14x38	87.3	15.4	64.5	22.8	401	0	137	7.18	W14x38	0.89
S9	658.5	6.8	8	0	21	100	W14x34	87.0	15.0	65.0	22.0	384	0	125	6.76	W14x34	0.91
S10	666.5	6.3	8	0	21	100	W14x34	86.5	14.4	65.5	21.0	366	0	108	6.34	W14x34	0.79
S11	674.5	6.3	8	0	21	100	W14x34	86.0	14.2	65.3	20.8	366	0	107	6.34	W14x34	0.78
S12	682.5	6.0	8	0	21	100	W14x34	85.5	13.5	65.3	19.8	352	0	93	6.00	W14x34	0.68
S13	690.5	6.0	8	0	21	100	W14x34	84.8	13.4	65.0	19.8	353	0	92	6.02	W14x34	0.68
S14	698.5	6.0	8	0	21	100	W14x34	84.3	13.2	64.8	19.5	353	0	91	6.03	W14x34	0.6

Pile ID	Station (ft)	Height (ft)	Spacing (ft)	No. Anchors	L=NH ² Unif. Press.		Design Beam	Pile Top Elevation (feet)	Pile Toe Embed (feet)	Pile Toe Elevation (feet)	Pile Length (feet)	Lagging Pressure (psf)	Soldier Beam - Flexure/Compression				
					N (psf/ft)	P (psf)							Axial Load (kips)	Free Moment (ft-kips)	Free Length (feet)	Steel Section	Flex/Ax Ratio
W1	4	8.7	8	0	21	100	W18x50	83.0	17.8	55.0	28.0	464	0	224	8.68	W18x50	0.89
W2	12.5	8.4	8.25	0	21	100	W14x53	82.0	18.9	54.0	28.0	454	0	226	8.42	W14x53	0.99
W3	20.5	8.2	8.25	0	21	100	W14x53	82.0	18.5	54.0	28.0	443	0	210	8.17	W14x53	0.97
W4	29	8.4	8.25	0	21	100	W14x53	82.0	18.7	54.0	28.0	453	0	225	8.41	W14x53	0.99
W5	37	8.2	8	0	21	100	W14x53	82.0	18.2	54.0	28.0	444	0	203	8.18	W14x53	0.93
W6	45	8.0	8	0	21	100	W14x48	82.0	18.0	55.0	27.0	437	0	194	8.03	W14x48	0.99
W7	53	7.9	8	0	21	100	W14x48	81.0	17.8	55.0	26.0	431	0	186	7.89	W14x48	0.95
W8	61	7.7	8	0	21	100	W14x48	81.0	17.5	55.0	26.0	425	0	177	7.74	W14x48	0.90
W9	69	7.6	8	0	21	100	W14x43	81.0	17.3	55.0	26.0	419	0	169	7.59	W14x43	0.97
W10	77	7.5	8	0	21	100	W14x43	81.0	17.3	55.0	26.0	417	0	167	7.54	W14x43	0.96
W11	85	7.7	8	0	21	100	W14x43	81.0	17.4	55.0	26.0	421	0	173	7.65	W14x43	0.99
W12	93	7.8	8	0	21	100	W14x48	81.0	17.6	55.0	26.0	426	0	179	7.76	W14x48	0.91
W13	101	7.9	8.25	0	21	100	W14x48	81.0	17.9	55.0	26.0	431	0	192	7.88	W14x48	0.98
W14	109.5	8.0	8.5	0	21	100	W14x53	81.0	18.3	54.0	27.0	436	0	206	7.99	W14x53	0.95
W15	118	7.9	8.25	0	21	100	W14x48	81.0	18.0	54.0	27.0	434	0	196	7.94	W14x48	1.00
W16	126	7.9	8	0	21	100	W14x48	81.0	17.8	55.0	26.0	431	0	185	7.88	W14x48	0.95
W17	134	6.8	7	0	21	100	W14x34	81.0	16.0	58.0	23.0	387	0	112	6.82	W14x34	0.82
W18	140	9.9	7	0	21	100	W18x55	81.0	17.7	53.0	28.0	515	0	255	9.89	W18x55	0.91
W19	148	8.1	8	0	21	100	W14x53	82.0	18.1	54.0	28.0	441	0	199	8.12	W14x53	0.91
W20	156	8.4	8	0	21	100	W14x53	82.0	18.4	54.0	28.0	451	0	213	8.35	W14x53	0.98
W21	164	8.1	8	0	21	100	W14x48	82.0	18.2	55.0	27.0	439	0	196	8.06	W14x48	1.00
W22	172	8.2	8	0	21	100	W14x53	82.0	18.4	55.0	27.0	445	0	205	8.22	W14x53	0.94
W23	180	8.4	8	0	21	100	W14x53	82.0	18.7	54.0	28.0	452	0	215	8.38	W14x53	0.99
W24	188	8.5	7.75	0	21	100	W14x53	83.0	18.7	54.0	29.0	459	0	217	8.54	W14x53	1.00
W25	195.5	10.2	7.5	0	21	100	W18x60	83.0	18.8	53.0	30.0	528	0	302	10.19	W18x60	0.98
W26	203	9.3	7.75	0	21	100	W18x55	83.0	18.3	54.0	29.0	492	0	258	9.34	W18x55	0.92
W27	211	9.5	7.5	0	21	100	W18x55	83.0	18.3	54.0	29.0	499	0	258	9.50	W18x55	0.92
W28	214.7	9.6	7.5	0	21	100	W18x55	83.0	18.4	54.0	29.0	502	0	263	9.57	W18x55	0.94
W29	223.5	9.8	8.65	0	21	100	W18x65	83.0	19.5	53.0	30.0	510	0	325	9.75	W18x65	0.98
W30	232	9.9	7.75	0	21	100	W18x60	83.0	19.1	53.0	30.0	517	0	298	9.92	W18x60	0.97
W31	239	9.0	7.75	0	21	100	W18x50	83.0	18.2	55.0	28.0	477	0	235	8.98	W18x50	0.93
W32	247.5	8.9	8.5	0	21	100	W18x55	83.0	18.6	55.0	28.0	476	0	259	8.94	W18x55	0.93
W33	256	8.9	8.5	0	21	100	W18x55	83.0	18.4	55.0	28.0	474	0	256	8.90	W18x55	0.91
W34	264.5	8.9	8.5	0	21	100	W18x55	83.0	18.3	55.0	28.0	472	0	253	8.86	W18x55	0.90
W35	273	9.3	8.5	0	21	100	W18x60	83.0	18.6	54.0	29.0	491	0	283	9.31	W18x60	0.92
W36	281.5	9.3	8.5	0	21	100	W18x55	83.0	18.4	55.0	28.0	489	0	279	9.27	W18x55	1.00
W37	290	9.2	8.5	0	21	100	W18x55	83.0	18.3	55.0	28.0	488	0	274	9.23	W18x55	0.98
W38	298.5	9.2	8.5	0	21	100	W18x55	83.0	18.1	55.0	28.0	486	0	270	9.18	W18x55	0.96
W39	307	9.1	8.5	0	21	100	W18x55	83.0	18.0	55.0	28.0	484	0	266	9.14	W18x55	0.95
W40	315.5	9.1	8.25	0	21	100	W18x55	83.0	17.6	55.0	28.0	482	0	253	9.10	W18x55	0.90
W41	323.5	9.6	8.25	0	21	100	W18x55	83.0	18.0	55.0	28.0	501	0	278	9.56	W18x55	0.99
W42	332	9.5	8	0	21	100	W18x55	83.0	17.6	55.0	28.0	500	0	264	9.52	W18x55	0.94

TABLE C2
SOLDIER PILE DESIGN - STAGE 1 CANTILEVER
WEST WALL

		Wall Height (ft)	9.40								
		Depth of Embed (ft)	18.10								
		Depth to Top of Passive (ft)	11.40								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	A1	100.0			9.40	8.00	7520		4.70	22.80	171435
	A2			42.0	9.40	8.00		14844	6.27	21.23	315156
	A3	394.8			18.10	2.50	17862		18.45	9.05	161625
	A4			21.0	18.10	2.50		8597	21.46	6.03	51861
Resisting	P1	200.0			16.10	6.25	20121		19.45	8.05	161950
	P2			100.0	6.73	6.25		14164	15.89	11.61	164430
	P3	1328.2			9.36	6.25	77738		22.81	4.68	363999
	P4			175.0	9.36	6.25		47961	24.38	3.12	149714

Moments about pile toe

Sum of resisting moments (ft-lbf)	840093
Sum of driving moments (ft-lbf)	700078
FS	1.20

Depth to Zero Shear (ft) at "M" 19.32

		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	a1	100.0			9.40	8.00	7520		4.70	14.62	109979
	a2			42.0	9.40	8.00		14844	6.27	13.06	193841
	a3	394.8			9.92	2.50	9796		14.36	4.96	48611
	a4			21.0	9.92	2.50		2586	16.02	3.31	8554
Resisting	p1	200.0			7.92	6.25	9906		15.36	3.96	39252
	p2			100.0	6.73	6.25		14164	15.89	3.44	48676
	p3	1328.2			1.19	6.25	9898		18.73	0.60	5901
	p4			175.0	1.19	6.25		778	18.93	0.40	309

Moments at Zero Shear Point

Sum of shear forces (lb/ft) at "M"	0
Sum of moments (ft-lbf) at "M"	266847

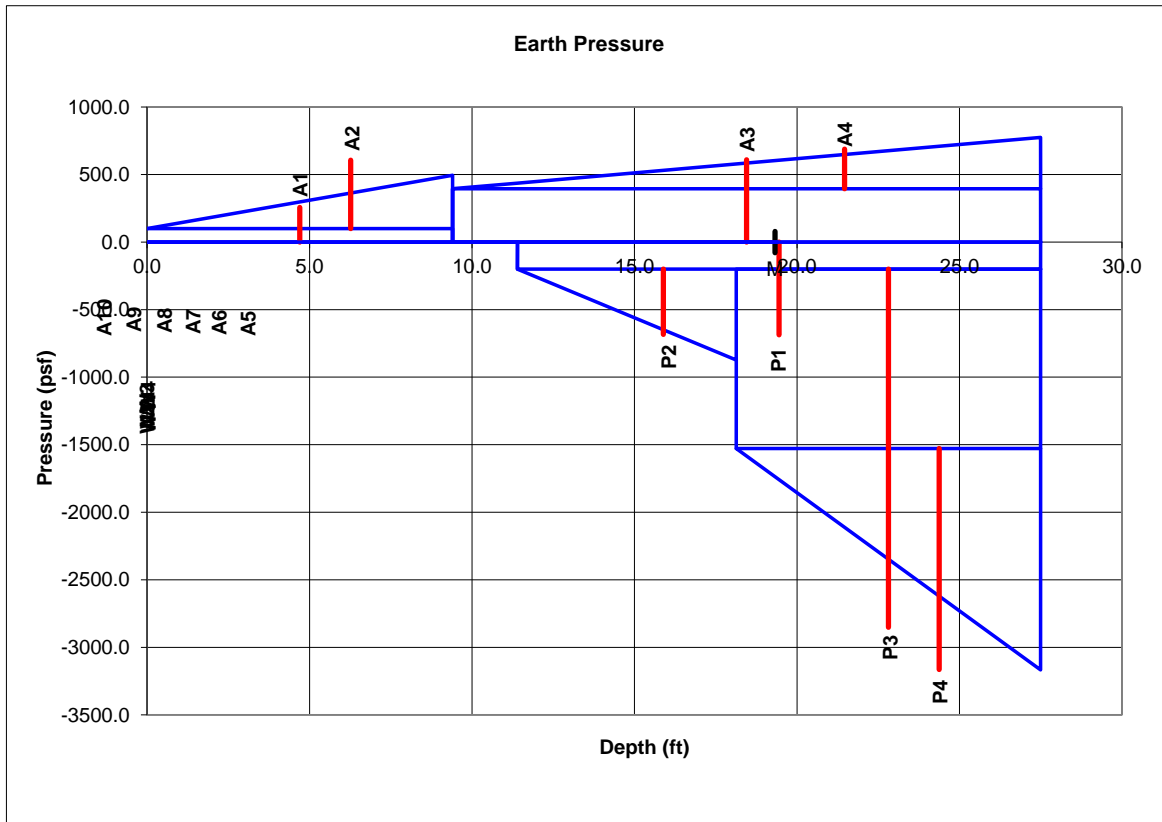


FIGURE C1 SOLDIER BEAM - N20

		Wall Height (ft)	7.30								
		Depth of Embed (ft)	14.30								
		Depth to Top of Passive (ft)	9.30								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	A1		100.0		7.30	5.40	3942		3.65	17.95	70773
	A2			42.0	7.30	5.40		6043	4.87	16.74	101143
	A3		306.6		14.30	2.00	8771		14.45	7.15	62728
	A4			21.0	14.30	2.00		4296	16.84	4.77	20485
Resisting	P1		200.0		12.30	5.00	12304		15.45	6.15	75689
	P2			100.0	6.00	5.00		9000	13.30	8.30	74732
	P3		1200.0		6.30	5.00	37821		18.45	3.15	119205
	P4			175.0	6.30	5.00		17384	19.50	2.10	36527

Moments about pile toe

Sum of resisting moments (ft-lbf)	306154
Sum of driving moments (ft-lbf)	255129
FS	1.20

		Depth to Zero Shear (ft) at "M"	15.50								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	a1		100.0		7.30	5.40	3942		3.65	11.85	46718
	a2			42.0	7.30	5.40		6043	4.87	10.63	64266
	a3		306.6		8.20	2.00	5029		11.40	4.10	20622
	a4			21.0	8.20	2.00		1412	12.77	2.73	3861
Resisting	p1		200.0		6.20	5.00	6201		12.40	3.10	19228
	p2			100.0	6.00	5.00		9000	13.30	2.20	19811
	p3		1200.0		0.20	5.00	1208		15.40	0.10	122
	p4			175.0	0.20	5.00		18	15.43	0.07	1

Moments at Zero Shear Point

Sum of shear forces (lb/ft) at "M"	0
Sum of moments (ft-lbf) at "M"	96305

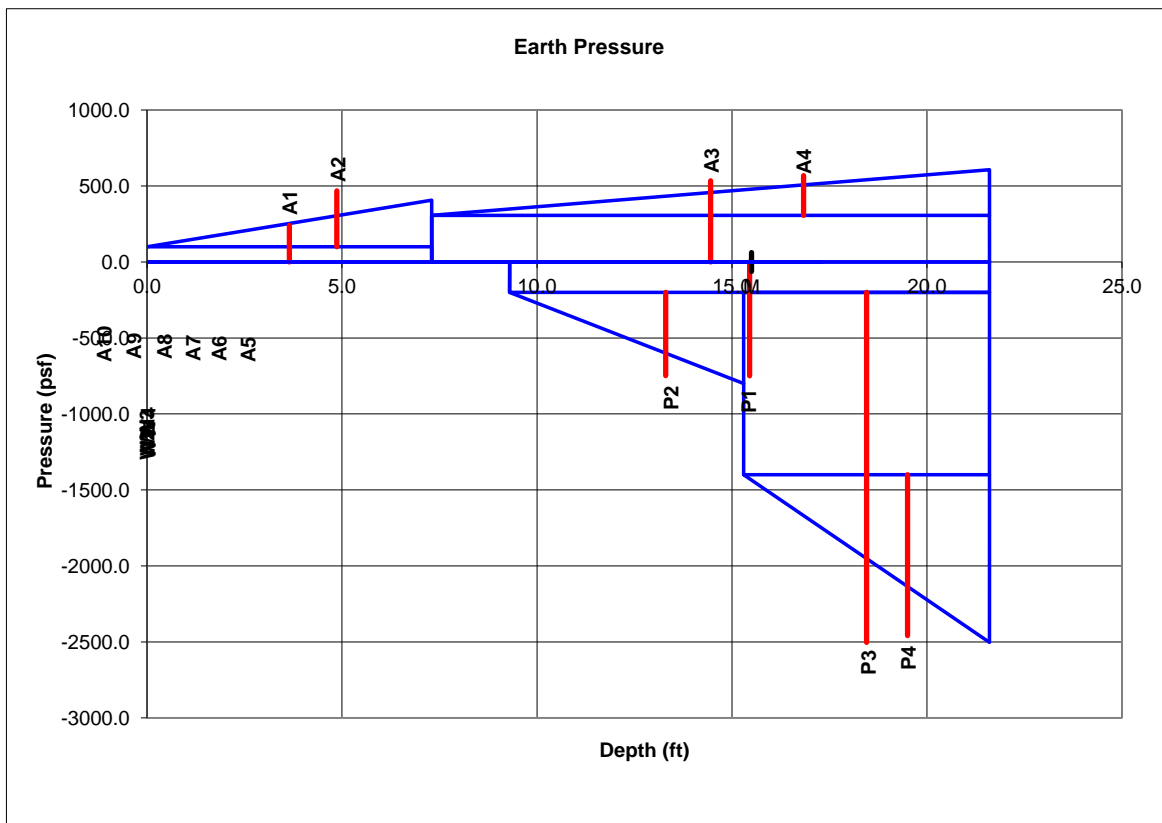


FIGURE C2 SOLDIER BEAM - S5

		Wall Height (ft)	10.19								
		Depth of Embed (ft)	18.85								
		Depth to Top of Passive (ft)	12.19								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	A1	100.0			10.19	7.50	7643		5.10	23.94	182966
	A2			42.0	10.19	7.50		16354	6.79	22.24	363753
	A3	428.0			18.85	2.50	20164		19.61	9.42	189999
	A4			21.0	18.85	2.50		9323	22.75	6.28	58565
Resisting	P1	200.0			16.85	6.25	21057		20.61	8.42	177358
	P2			100.0	7.00	6.25		15313	16.86	12.18	186489
	P3	1375.0			9.85	6.25	84610		24.11	4.92	416517
	P4			175.0	9.85	6.25		53011	25.75	3.28	173975

Moments about pile toe

Sum of resisting moments (ft-lbf)	954339
Sum of driving moments (ft-lbf)	795282
FS	1.20

		Depth to Zero Shear (ft) at "M"	20.49								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	a1	100.0			10.19	7.50	7643		5.10	15.40	117671
	a2			42.0	10.19	7.50		16354	6.79	13.70	224029
	a3	428.0			10.30	2.50	11023		15.34	5.15	56777
	a4			21.0	10.30	2.50		2786	17.06	3.43	9567
Resisting	p1	200.0			8.30	6.25	10377		16.34	4.15	43076
	p2			100.0	7.00	6.25		15313	16.86	3.64	55665
	p3	1375.0			1.30	6.25	11188		19.84	0.65	7283
	p4			175.0	1.30	6.25		927	20.06	0.43	402

Moments at Zero Shear Point

Sum of shear forces (lb/ft) at "M"	0
Sum of moments (ft-lbf) at "M"	301617

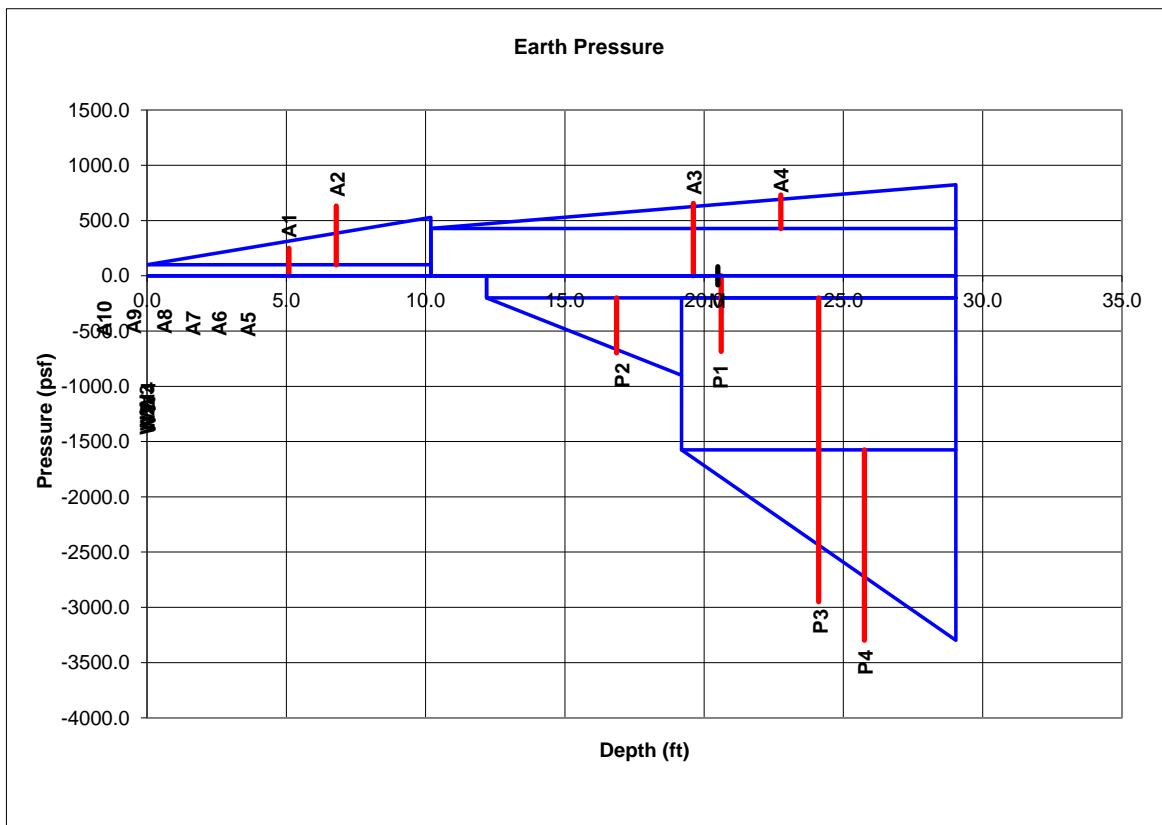


FIGURE C3 SOLDIER BEAM - W25

		Wall Height (ft)	9.75								
		Depth of Embed (ft)	19.51								
		Depth to Top of Passive (ft)	11.75								
		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	A1		100.0		9.75	8.65	8434		4.88	24.39	205670
	A2			42.0	9.75	8.65		17268	6.50	22.76	393049
	A3	409.5			19.51	2.50	19975		19.51	9.76	194872
	A4			21.0	19.51	2.50		9993	22.76	6.50	64996
Resisting	P1	200.0			17.51	6.25	21889		20.51	8.76	191660
	P2			100.0	8.00	6.25		20000	17.08	12.18	243565
	P3	1550.0			9.51	6.25	92143		24.51	4.76	438215
	P4			175.0	9.51	6.25		49476	26.09	3.17	156865

Moments about pile toe

Sum of resisting moments (ft-lbf)	1030305
Sum of driving moments (ft-lbf)	858587
FS	1.20

Depth to Zero Shear (ft) at "M" 20.62

		Force	p (psf)	$K\gamma$ (psf)	h (ft)	w (ft)	phw (lb/ft)	$K\gamma h^2 w/2$ (lb/ft)	depth (ft)	moment arm (ft)	moment (ft-lbf)
Driving	a1		100.0		9.75	8.65	8434		4.88	15.75	132791
	a2			42.0	9.75	8.65		17268	6.50	14.12	243829
	a3	409.5			10.87	2.50	11128		15.19	5.44	60484
	a4			21.0	10.87	2.50		3102	17.00	3.62	11239
Resisting	p1	200.0			8.87	6.25	11088		16.19	4.44	49175
	p2			100.0	8.00	6.25		20000	17.08	3.54	70737
	p3	1550.0			0.87	6.25	8430		20.19	0.44	3668
	p4			175.0	0.87	6.25		414	20.33	0.29	120

Moments at Zero Shear Point

Sum of shear forces (lb/ft) at "M"	0
Sum of moments (ft-lbf) at "M"	324642

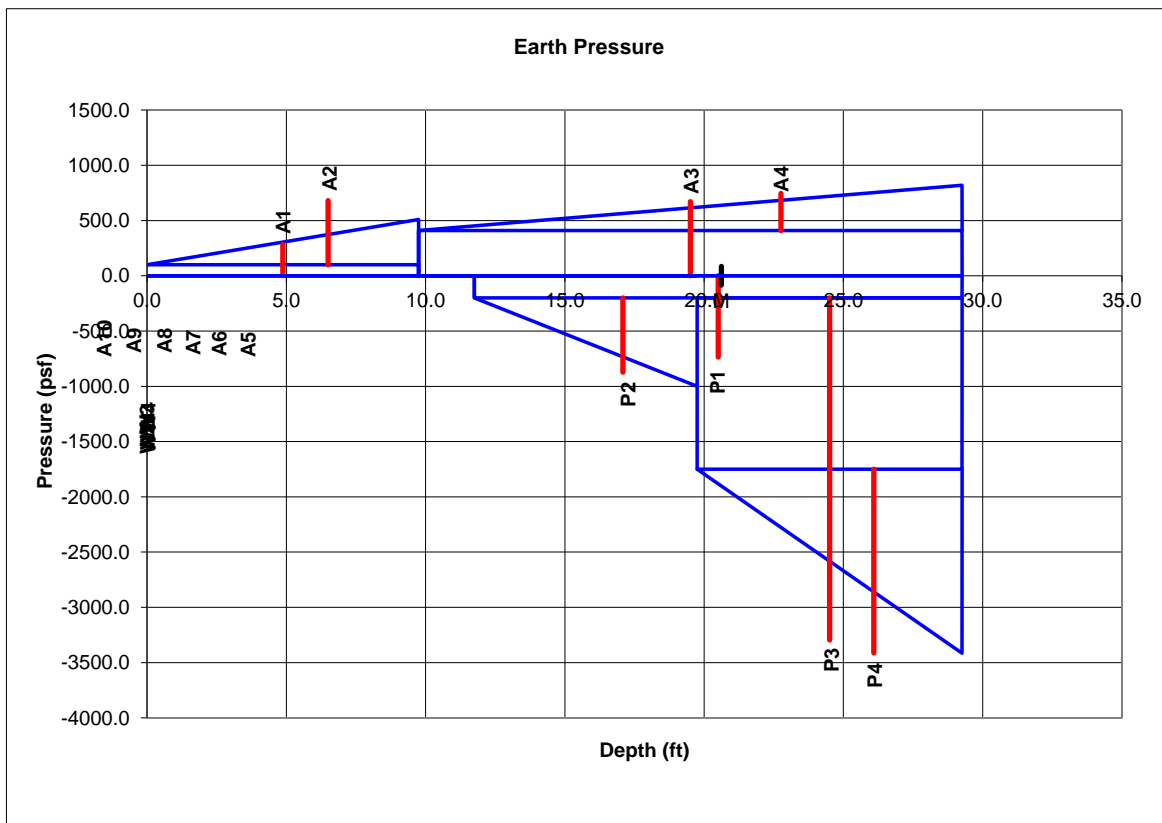


FIGURE C4 SOLDIER BEAM - W29