A COMPARISON OF PREDICTED BRACE LOADS IN TEMPORARY RETAINING STRUCTURES AND OBSERVED BRACE LOADS IN TWO FULL SCALE TEST SECTIONS

A Thesis

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Abstract

This thesis presents analyses of the results of a geotechnical instrumentation program performed by Eustis Engineering Company for the U.S. Army Corps of Engineers (USACE) during the construction of two covered canals in New Orleans, Louisiana. At each site, a cast-in-place concrete culvert was constructed within a sheeted and braced excavation. Information provided by Eustis Engineering Company to the USACE is presented describing the existing soil conditions, the construction schedule, the geotechnical testing apparatus and instrumentation, and the data produced from the geotechnical instrumentation program.

In this thesis, several theoretical approaches available for estimating the strut loads in braced excavations were examined and used to predict the strut loads at the two construction sites. These theoretical approaches included Coulomb pressures diagrams, Terzaghi pressure diagrams, and soil-structure interaction. The results of the theoretical strut load prediction methods are presented and compared with the results of the geotechnical instrumentation program data.

CHAPTER 1: INTRODUCTION

1.1 Scope of Thesis

This thesis presents the results of an analysis of the data obtained from a geotechnical instrumentation program performed by Eustis Engineering Company for the U.S. Army Corps of Engineers (USACE) during the construction of two covered canals in New Orleans, Louisiana. At each site, a cast-in-place concrete culvert was constructed within a sheeted and braced excavation. Information provided by Eustis Engineering Company to the USACE is presented describing the existing soil conditions, the construction schedule, the geotechnical testing apparatus and instrumentation, and the data produced from the geotechnical instrumentation program. The results of theoretical strut load prediction methods are presented and compared with the results of the geotechnical instrumentation program data.

1.2 Background of the New Orleans Area

New Orleans is the largest urban area in the country that is below sea level. Because most of the area is lower than surrounding water elevations, the area is protected from storm surges and tidal inflow by a continuous system of levees and floodwalls. This system that protects New Orleans from storm surges enhances the natural bowl in which the city sits by raising its sides, so that even more water is held within the city. Since New Orleans is the rainiest city in the U.S. with an average annual rainfall of 58 inches and the area can annually expect both a storm producing at least 4.5 inches of rain in 24 hours and a storm dropping at least 2.1 inches of rain in one hour, the city needs a way to empty that bowl. Canals and pumping stations offer drainage solutions throughout New Orleans areas. The rainwater flows through a network of interconnected canals that ultimately drain into Lake Ponchartrain by means of pumping stations.

1.3 Background Information on the SELA Project

Major urban flooding has been a familiar experience for New Orleans residents. Storms dumping millions of cubic feet of rain and causing serious flooding have occurred in nine of the last 15 years. But a flood that occurred in 1995 shocked the city into a sense of urgency. On May 8, 1995, approximately 20 inches of rain fell into the New Orleans metropolitan area, killing seven people, causing $1 billion in damages by flooding approximately 35,000 homes and thousands of businesses and public facilities. This event established the need to improve the area’s capacity to cope with rainfall flooding.

The Southeastern Louisiana (SELA) Urban Flood Control Project was created to improve the area’s capacity to cope with rainfall flooding. The objective of the SELA Project is to develop a feasible drainage plan that will enable the New Orleans area to experience a 10-year rainfall event without substantial flooding. When implemented, the SELA projects will put thousands more cubic feet of rainwater through the area’s pumps, down its canals and into Lake Ponchartrain. This requires deepening and widening some earthen canals, lining others with concrete, enlarging underground canals and increasing the existing pumping capacity through upgrades and the installation of new stations.

1.4 Location and Description of Project Sites

This thesis considers the construction of covered canals at two sites in New Orleans (see Figure 1.1). The first site (hereafter referenced as the "Napoleon Avenue Site") is located at the intersection of Napoleon Avenue and South Galvez Street. The second site (hereafter referenced as the "Hollygrove Site") is located south of the intersection of Mistletoe Street and Colapissa Street.

At the Napoleon Avenue Site, two new canals are being built under Napoleon Avenue from South Claiborne Avenue to Fontainebleau Drive. The two new canals, each 19 feet wide by 13 feet high run north and south for nine blocks along the Napoleon Avenue traffic median. The covered concrete canals parallel an existing 20-foot by 12-foot canal, which is remaining operational during construction. Together, the new canals will triple the capacity of the current canal.

The Hollygrove Site project consists of 800 feet of 10-foot by 20-foot box culvert and 800 feet of 10-foot by 16-foot box culvert along an old railroad embankment, and 1500 feet of 5-foot by 6-foot box culvert along Eagle Street. The box culvert along the old railroad embankment will run from the new Pritchard Place pump station to its intersection with Forshey Street. The Eagle Street culvert will empty into the railroad embankment culvert and will run as far as Stroelitz Street near the Palmetto Canal.

These recent drainage projects associated with the SELA Project have required construction in congested urban areas. There are many buildings, residences, and roadways in close proximity to these project sites. Because of the close proximity of these facilities and structures it is impractical to provide slopes flat enough for safety. These complexities have required the use of sheeted and braced cofferdams to replace the lateral restraint that was provided by the material being removed. The sheet piling holds back the earth behind it as workers excavate the soil between the piling and the canal.

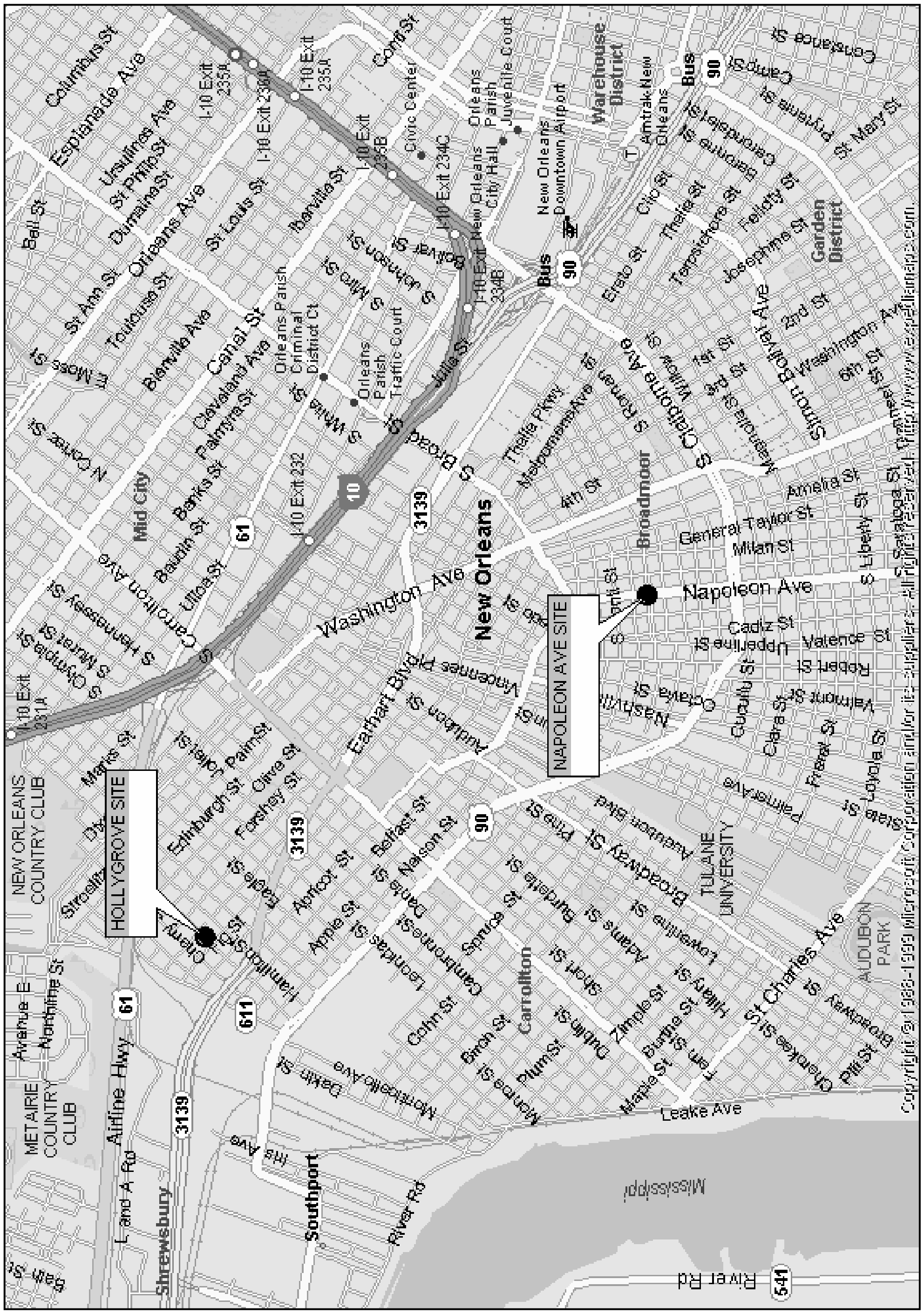


Figure 1.1 Location of Project Sites

1.5 Purpose of Geotechnical Instrumentation Program

The objective of the instrumentation program was to assess the magnitudes of lateral and horizontal movements associated with the construction of covered canals within sheeted and braced cofferdams. Geotechnical instruments, consisting of slope inclinometers and Sondex settlement rings, were also installed to provide indications of the magnitudes of soil movements at discrete locations adjacent to the excavation. Piezometers were installed to monitor pore water pressures in the foundation soils during construction. Lastly, strain gauges were attached to several struts to provide indications of the magnitudes of loads applied to these components of the cofferdam system.

1.6 Objectives of Thesis

The objectives of this thesis were to analyze the geotechnical instrumentation program data obtained by the USACE for the construction of two covered canals and to use the results to accomplish the following:

- Utilizing various design methods, estimate the magnitudes of loads applied to the struts of the cofferdam systems.
- Utilize the data obtained from the geotechnical instrumentation program to determine the applicability of the various design methods for estimating the strut loads in the cofferdam systems.
- Make recommendations based on the results of the instrumentation program.

1.7 Organization of Thesis

This thesis consists of five individual sections. The first chapter contains an introduction providing basic information about the subject, purpose and organization of the thesis. Literary research on sheeted and braced excavations is presented in Chapter 2. Chapter 3 covers the specifics of the geotechnical instrumentation program project sites and includes the results of various theoretical methods for determining strut loads. A compilation of the test data obtained from the geotechnical instrumentation program is presented in Chapter 4 and the data is compared and contrasted with the theoretical strut loads. Finally, in Chapter 5, conclusions and recommendations are made based on the results of the tests.

CHAPTER 2: LITERARY RESEARCH

2.1 Sheet Pile Walls

When excavations are made in soil, the soil adjacent to the cut loses its natural lateral support. The stress unbalance caused by the removal of lateral support increases as the excavation is made deeper and the cut is steepened. If the resulting shear stress exceeds the soil's strength the mass can fail by sliding. This can result in damage to nearby facilities or structures and can disrupt the excavation and endanger workers. When it is impractical to provide slopes flat enough for safety it becomes necessary to support the excavation. Sheet piling, braces, and tiebacks can replace the lateral restraint that was provided by the soil which was removed (American Society of Civil Engineers, 1997).

The essential elements of an excavation support system consist of a wall, supports, and a reaction to the loads transmitted through the bracing. Sheet pile walls have a number of features which distinguish them from other civil engineering structures. First, installation of the system is coordinated with the excavation and in usually built from the top downward. The excavation and support installation are performed in stages and the critical case for various elements of the system can occur at intermediate stages during the construction. Also, the support system is usually temporary with a life ranging from several months to several years. Typically for these structures, the allowable factors of safety are lower and stress levels higher than those for permanent structures. Finally, deformation of the support system can be as important as its load carrying capacity (American Society of Civil Engineers, 1997).

The design of sheet pile walls requires several operations. First, the forces and lateral pressure that act on the wall must be evaluated. Next, the depth of piling penetration must be determined. The maximum bending moments in the sheet piling must be determined. Also, the stresses in the wall need to be computed and the appropriate sheet pile section must be selected. In the case of multi-braced excavations, these operations must be performed for each stage of the excavation since the critical case for each component of the support system may occur at different stages of the construction of the system. Finally, the waling and bracing system must be designed. In order to perform these operations, the controlling dimensions must be set. These dimensions include the elevation of the top of the wall, the elevation of the ground surface in front of the wall, and the water level.

Because of the structure of natural soil deposits is fairly complex, it is essential that a subsurface investigation be performed. This investigation should consist of exploratory soil borings and laboratory tests on representative samples. Once this has been done, a soil profile can be drawn and the engineering properties of the different soil strata can be determined. After these preliminary steps are taken the final design can begin.

2.2 Loads On Sheet Pile Walls

2.2.1 Earth Pressure Theories

Earth pressure is the force per unit area exerted by the soil on the sheet pile structure. Earth pressures reflect the state of stress in the soil mass. Earth pressure depends on the physical and strength properties of the soil, the interaction at the soil-structure interface, the groundwater conditions, and the deformations of the soil-structure system. Because earth pressure is a function of the soil-structure system, the movements of the structure are a primary factor in developing earth pressures. Earth pressures for any soil-structure system may vary from an initial state of stress referred to as at-rest, to a minimum limit state referred to as active, or to a maximum limit state referred to as passive (US Army Corps of Engineers, 1994).

At-rest pressure refers to a state of stress where there is no lateral movement or strain in the soil. In the case of at-rest pressure, the pressures are the pressures that existed in the ground before the installation of the sheet pile wall. This state of stress is shown in Figure 2.1 as circle O on a Mohr diagram (US Army Corps of Engineers, 1994).

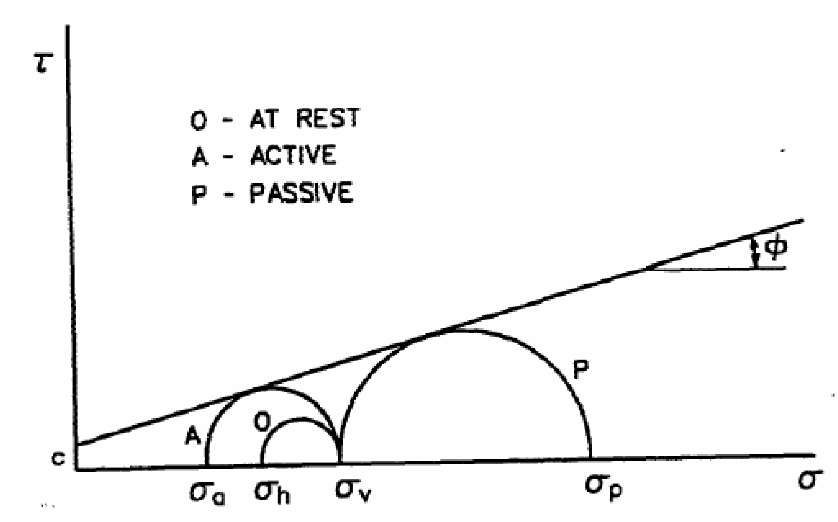


Figure 2.1 Definition of active and passive pressures (US Army Corps of Engineers, 1994).

When a sheet pile wall deflects under the action of lateral earth pressure each element of soil adjacent to the wall expands laterally which mobilizes shear resistance in the soil causing a reduction in lateral earth pressure. The lowest state of lateral stress which is produced when the full strength of the soil is activated is called the active state. The active state develops when the wall moves or rotates away from the soil. The state of stress resulting in active pressures is shown in Figure 2.1 as circle A (US Army Corps of Engineers, 1994).

If the sheet pile wall moves toward the soil, lateral pressure will increase as the shearing resistance of the soil is mobilized. The passive state exists when the full strength of the soil is mobilized. Passive pressure is the maximum possible lateral pressure that can be developed from a wall moving or rotating toward the soil. Passive stress tends to resist wall movements and failure. The state of stress resulting in passive pressure is shown in Figure 2.1 as circle P (US Army Corps of Engineers, 1994).

The amount of wall movement required to develop minimum active or passive earth pressures depends on the stiffness of the soil and the height of the wall. The required movement for stiff soils such as dense sands or over consolidated clays is relatively small. For sands of medium or higher density the movement required to reach the minimum active pressure is no more than about 0.4 percent of the wall height or about 1 inch for a 20-foot high wall. The movement required to increase the earth pressure to the maximum passive value is approximately 10 times that required for the minimum pressure or about 4.0 percent of the wall height. For loose sands the movement required to reach the minimum active or maximum passive pressures is larger. Classical design procedures assume that the sheet pile walls have enough movement to produce the active or passive pressures (US Army Corps of Engineers, 1994).

In addition to the horizontal movement, vertical movement along the wall soil interface may produce vertical stresses due to wall-soil friction for granular soils or wall-soil adhesion for cohesive soils. This vertical stress will have an effect on the magnitude of the minimum and maximum horizontal earth pressures. For the passive pressure, the wall friction or adhesion can increase the horizontal earth pressure whereas it may decrease the horizontal earth pressure for the active limit state (US Army Corps of Engineers, 1994).

2.2.1.1 Rankine Theory

The Rankine Theory is based on the assumption that the sheet pile wall introduces no changes in the shearing stresses at the soil-structure interface. This theory also assumes that the ground and failure surfaces are straight planes and that the resultant force acts parallel to the backfill slope. When the Rankine state of failure has been reached, active and passive failure zones will develop as shown in Figure 2.2 (Pile Buck, 1987).

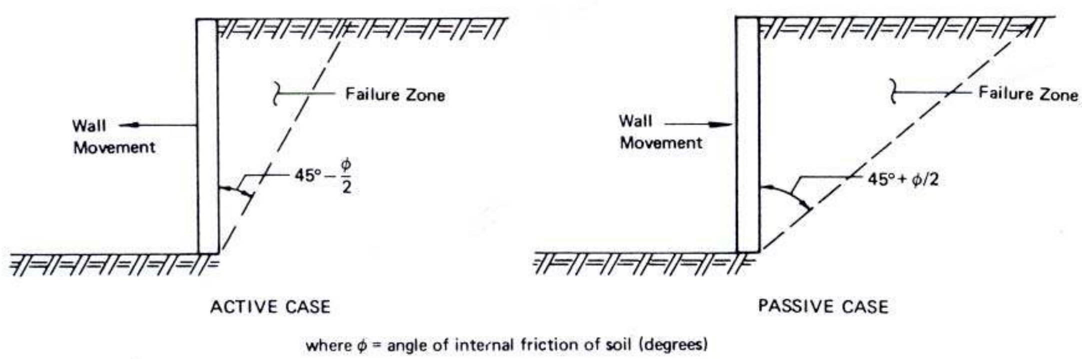


Figure 2.2 Rankine failure zones (Pile Buck, 1987).

The active and passive earth pressures for these states are expressed by the following equations:

$$p_a = \gamma Z K_a - 2c\sqrt{K_a}$$

$$p_p = \gamma Z K_p - 2c\sqrt{K_p}$$

where p_a and p_p = unit active and passive earth pressure, at a depth Z below the ground surface
γZ = vertical pressure at a depth Z due to the weight of the soil above
c = unit cohesion of the soil
K_a and K_p = coefficients of active and passive earth pressures

The coefficients according to Rankine's theory are given by the following expressions:

$$K_a = \cos\beta\left[\frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}\right]$$

$$K_p = \cos\beta\left[\frac{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}\right]$$

where ϕ = angle of friction of soil
β = angle off backfill with respect to the horizontal

If the embankment is level (β=0), the equations are reduced to:

$$K_a = \frac{1-\sin\phi}{1+\sin\phi} = \tan^2\left(45 - \phi/2\right)$$

$$K_p = \frac{1+\sin\phi}{1-\sin\phi} = \tan^2\left(45 + \phi/2\right)$$

The Rankine theory for passive pressures can only be used correctly when the embankment slope angle is zero or negative. If a large wall friction value can develop, the Rankine theory is not correct and will give less conservative results (Pile Buck, 1987).

2.2.1.2 Coulomb Theory

An assumption of the Rankine Theory is that the sheet pile wall does not affect the shearing stresses at the soil-structure interface. However, since the friction between the wall and the soil has an effect on the vertical shear stresses in the soil, the lateral stresses in the soil are different then those assumed by the Rankine Theory. This error can be avoided by using the Coulomb Theory. The Coulomb Theory provides a method of analysis that gives the resultant horizontal force on a wall for any slope of wall, wall friction, and slope of backfill. The Coulomb Theory is based on the assumption that soil shear resistance develops along the wall and failure plane. As the wall yields, the failure wedge tends to move downward for the active case and for the passive case, where the wall is forced against the soil, the wedge slides up the along the failure plane. These movements of the wedge involve vertical displacements between the wall and the backfill and create stresses on the back of the wall due to soil friction and adhesion. Because of this the resulting force is inclined at an angle to the normal to the sheet pile wall. This angle is known as the angle of wall friction, δ (Pile Buck, 1987).

The following coefficients are for a horizontal resultant pressure and a vertical wall (Pile Buck, 1987):

$$K_a = \frac{\cos^2\phi}{\cos\delta\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\cos\delta\cos\beta}}\right]^2}$$

$$K_p = \frac{\cos^2\phi}{\cos\delta\left[1-\sqrt{\frac{\sin(\phi+\delta)\sin(\phi+\beta)}{\cos\delta\cos\beta}}\right]^2}$$

where
φ = angle of internal friction of soil
δ = angle of wall friction
β = angle of the backfill with respect to the horizontal

Although the Coulomb Theory assumes a plane failure surface just as in the Rankine Theory, the position of the failure plane in the Coulomb Theory is a function of both the φ-angle of the soil and the angle of wall friction, δ. The position of the failure plane for the active and passive cases for level backfill is given by the following expressions (Pile Buck, 1987):

$$\alpha_a = 90^0 - \phi - \arctan\left[\frac{-\tan\phi + \sqrt{\tan\phi(\tan\phi + \cot\phi)(1 + \tan\delta \cdot \cot\phi)}}{1 + \tan\delta(\tan\phi + \cot\phi)}\right]$$

$$\alpha_p = 90^0 + \phi - \arctan\left[\frac{\tan\phi + \sqrt{\tan\phi(\tan\phi + \cot\phi)(1 + \tan\delta \cdot \cot\phi)}}{1 + \tan\delta(\tan\phi + \cot\phi)}\right]$$

where α_a and α_p = angle between the failure plane and the vertical for the active and passive cases

Figure 2.3 shows the Coulomb active and passive failure wedges together with the corresponding pressure distributions (Pile Buck, 1987).

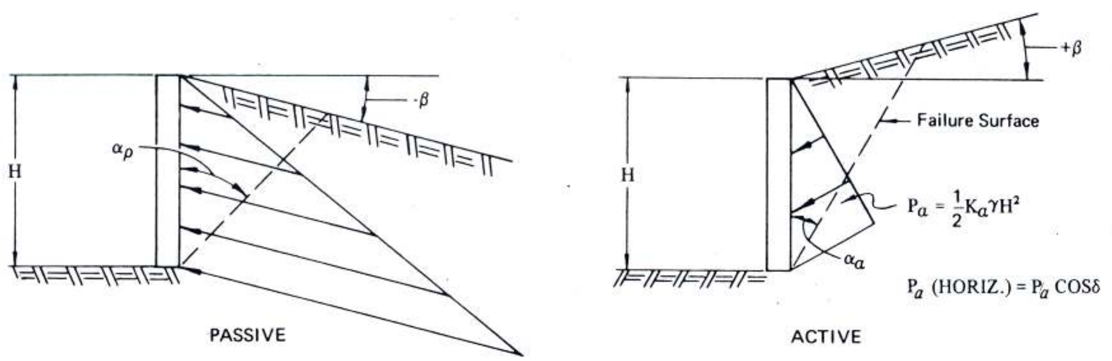


Figure 2.3 Coulomb earth pressure (Pile Buck, 1987).

2.2.2 Surcharge Loads

Sheet pile walls are often required to retain surface loadings as well as the soil behind them. Loads due to stockpiled material, railroads, machinery, roadways, buildings, and other influences resting on the soil surface in the vicinity of the wall increase the lateral pressures on the wall. Loadings that are of interest in the calculation of lateral soil pressures are uniform surcharge loads, point loads, line loads, and strip loads. For uniform loads the conventional theories of earth pressure can be used. Conversely, the effects of point, line, and strip loads are evaluated using the theory of elasticity (US Army Corps of Engineers, 1994).

2.2.2.1 Uniform Surcharge

A uniform surcharge is assumed to be applied at all points on the soil surface. The effect of the uniform surcharge is to increase the effective vertical pressure by an amount equal to the magnitude of the surcharge. Without the surcharge, the vertical pressure at a depth h would be equal to γh. When a uniform surcharge with a magnitude q is added, the vertical pressure at a depth h is equal to $\gamma h + q$. The lateral pressure due to the uniform surcharge load is equal to the magnitude of the surcharge times the lateral earth pressure coefficient. The lateral earth pressure coefficient is either the active coefficient or the passive coefficient depending on whether the wall tends to move away from or toward the surcharge area. The uniform lateral earth pressure is then added to the lateral dead weight earth pressures (US Army Corps of Engineers, 1994).

2.2.2.2 Point Loads

A surcharge load distributed over a small area may be considered as a point load. The lateral pressure distribution on a vertical line closest to the point load may be determined as shown in Figure 2.4 (US Army Corps of Engineers, 1994).

Because the pressures due to point loads vary horizontally parallel to the sheet pile wall, it may be necessary to consider several unit slices of the wall for design. As the distance from the line closest to the point load increases, the lateral stress decreases as shown in Figure 2.5 (Pile Buck, 1987).

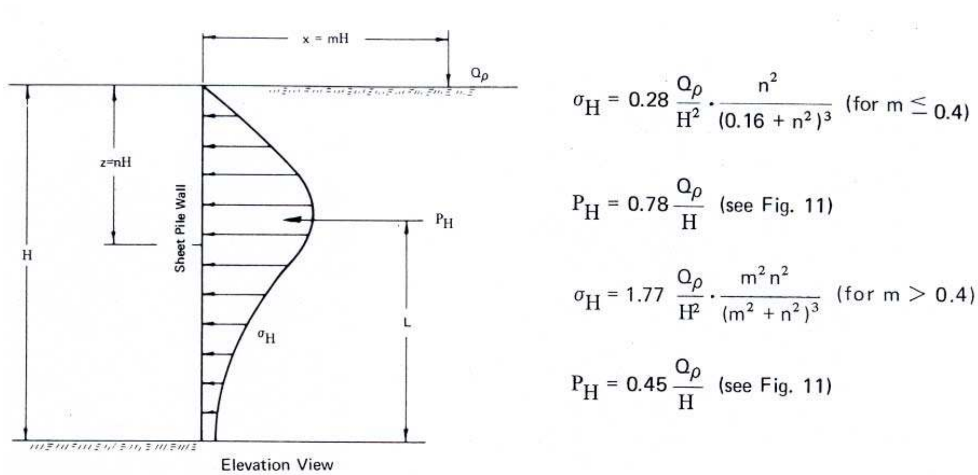


Figure 2.4 Lateral pressure due to point load (Pile Buck, 1987).

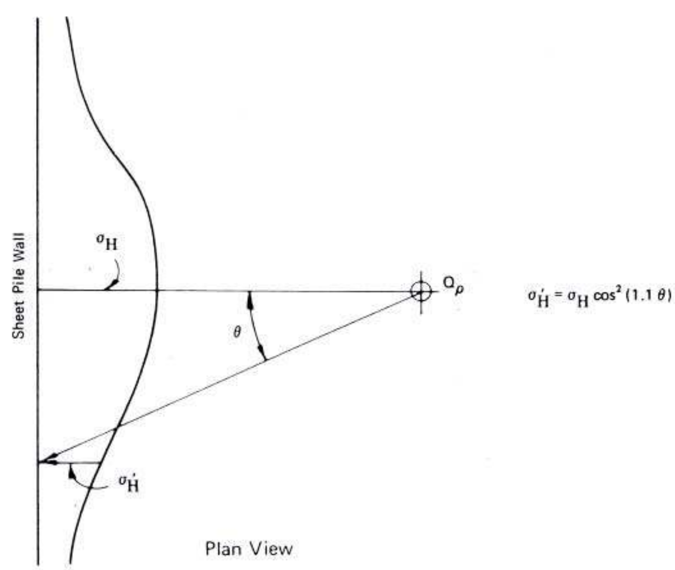
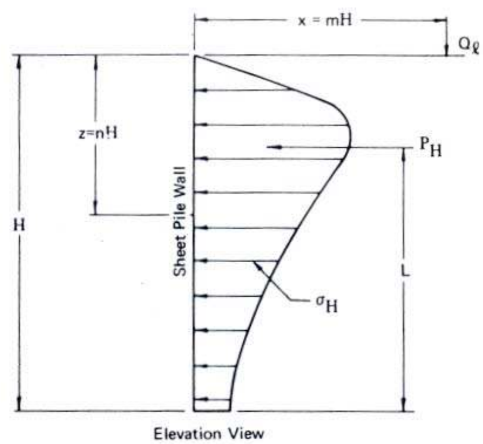


Figure 2.5 Lateral pressure due to point load (Pile Buck, 1987).

2.2.2.3 Line Loads

A continuous load parallel to the sheet pile wall but of narrow width may be treated as a line load. For line loads, the lateral pressure increases from zero at the ground surface to a maximum value at a given depth and gradually diminishes at greater depths. The lateral pressure on the sheet pile wall due to a line load may be calculated as shown in Figure 2.6 (Pile Buck, 1987).



$$\sigma_H = 0.20\frac{Q_\ell}{H}\cdot\frac{n}{(0.16+n^2)^2} \quad (\text{for } m \leq 0.4)$$

$$P_H = 0.55\,Q_\ell, \text{ resultant force}$$

$$\sigma_H = 1.28\frac{Q_\ell}{H}\cdot\frac{m^2 n}{(m^2+n^2)^2} \quad (\text{for } m > 0.4)$$

$$P_H = \frac{0.64\,Q_\ell}{(m^2+1)} \text{ resultant force}$$

Figure 2.6 Lateral pressure due to line load (Pile Buck, 1987).

2.2.2.4 Strip Loads

Continuous loads parallel to the sheet pile wall but of finite extent perpendicular to the wall may be treated as strip loads. Highways and railroads are examples of strip loads. The lateral pressure distribution on the sheet pile wall due to strip loads may be calculated as shown in Figure 2.7 (Pile Buck, 1987).

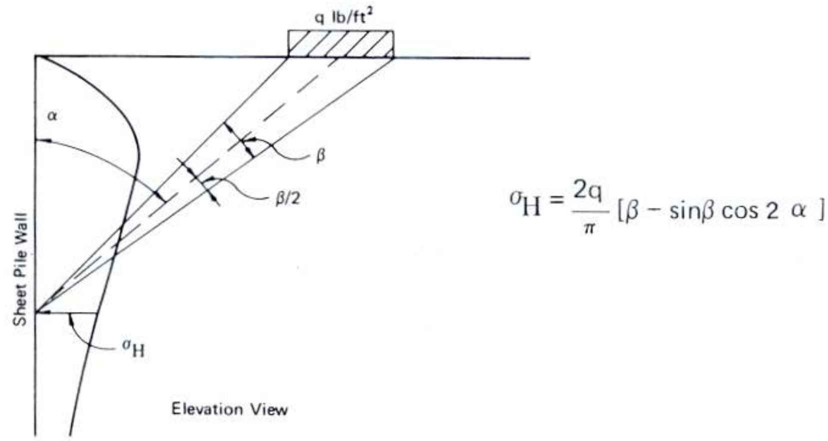


Figure 2.7 Lateral pressure due to strip load (Pile Buck, 1987).

Any negative pressures calculated for strip loads should be ignored.

2.2.3 Water Loads

A difference in water level on either side of the sheet pile wall introduces additional pressure on the back of the wall due to hydrostatic load and reduces the unit weight of the soil in front of the wall thus reducing the passive resistance. Water pressures are calculated by multiplying the depth of the water by the specific weight of the water. If hydrostatic conditions are assumed, the unbalanced hydrostatic pressure is assumed to act along the entire depth of the sheet pile wall. This water pressure is added to the effective soil pressures to obtain total pressures (US Army Corps of Engineers, 1994).

2.3 Design of Sheet Pile Walls

The design of sheet pile walls requires several successive operations. First, the forces and lateral pressures that act on the wall must be evaluated. Next, the required depth of sheet piling penetration must be determined. Then the maximum bending moments and stresses in the wall must be determined so that the appropriate sheet pile section can be selected. Finally, the waling and anchoring system must be designed (Pile Buck, 1987).

2.3.1 Preliminary Data

Before the design of the sheet pile system can commence, certain preliminary information must be obtained. The elevation of the top of the wall, the ground surface profile on each side of the wall, and the water elevation on each side of the wall must be determined. The soil profile including location and slope of subsurface layer boundaries, strength parameters, and unit weight for each layer must also be obtained. In addition, the magnitudes and locations of surface surcharge loads and external loads applied directly to the wall must be established (US Army Corps of Engineers, 1994).

2.3.2 Factors of Safety

There have been a variety of methods proposed for introducing “factors of safety” into the design process; however, no universal method has been established. The design of a sheet pile wall should contain some degree of conservatism consistent with the designer’s experience and the reliability of the values assigned to the various system parameters. A method that has gained acceptance in the Corps of Engineers is to apply a factor of safety to the soil strength parameters ϕ and c while using “best estimates” for the other quantities.

The soil pressures are evaluated by using "effective" values of ϕ and c, which are given by (US Army Corps of Engineers, 1994):

$$\phi_{eff} = \tan^{-1}(\tan(\phi)/FS)$$

$$c_{eff} = c/FS$$

where FS = factor of safety

2.3.3 Net Pressure Distribution

Sheet pile walls are subjected to a number of different pressure distributions. These pressure distributions include: (1) active and passive soil pressures due to the retained side soil, (2) pressures due to surcharge loads on the retained side surface, (3) active and passive soil pressures due to the dredge side soil, (4) pressures due to surcharge loads on the dredge side surface, and (5) net water pressures due to differential head. For convenience in the calculation of stability, the individual pressure distributions are combined into "net" active and passive pressures according to:

"Net Active Pressure" = retained side active soil pressure
- dredge side passive soil pressure
+ net water pressure
+ pressure due to retained side surcharge
- pressure due to dredge side surcharge

"Net Passive Pressure" = retained side passive soil pressure
- dredge side active soil pressure
+ net water pressure
+ pressure due to retained side surcharge
- pressure due to dredge side surcharge

In these definitions, positive pressures tend to move the wall toward the dredge side. Typical net pressure diagrams are shown in Figure 2.8 (US Army Corps of Engineers, 1994).

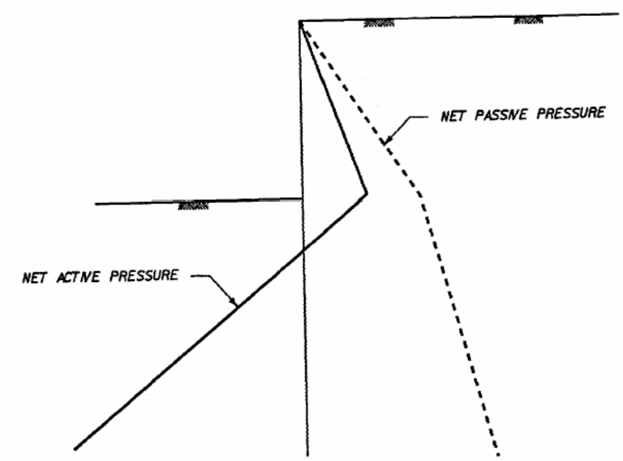


Figure 2.8 Typical net pressure distributions (US Army Corps of Engineers, 1994).

2.3.4 Cantilever Walls

In the case of cantilever walls, sheet piling are driven to a sufficient depth into the ground to become fixed as a vertical cantilever in resisting the lateral active earth pressure. The depth of penetration of the sheet piling governs the rotational stability of a cantilever wall. Cantilever walls undergo large deflections and are readily affected by scour and erosion in front of the wall. Since the lateral support for a cantilever wall comes from the passive pressure on the embedded portion, penetrations can be quite high, which results in excessive stresses and yield (US Army Corps of Engineers, 1994).

Cantilever walls are subjected to the net active pressure distribution from the top of the wall to a point near the point of zero displacement known as the transition point. The design pressure is then assumed to vary linearly from the net active pressure to the net passive pressure at the bottom of the wall. This design pressure distribution is shown in Figure 2.9. The sum of the horizontal forces and the sum of the moments about any point along the wall must be equal to zero for the wall to be in equilibrium. The two equations of equilibrium can be solved for the location of the transition point and the required depth of penetration. Because the simultaneous equations are non-linear, a trial and error solution is required (US Army Corps of Engineers, 1994).

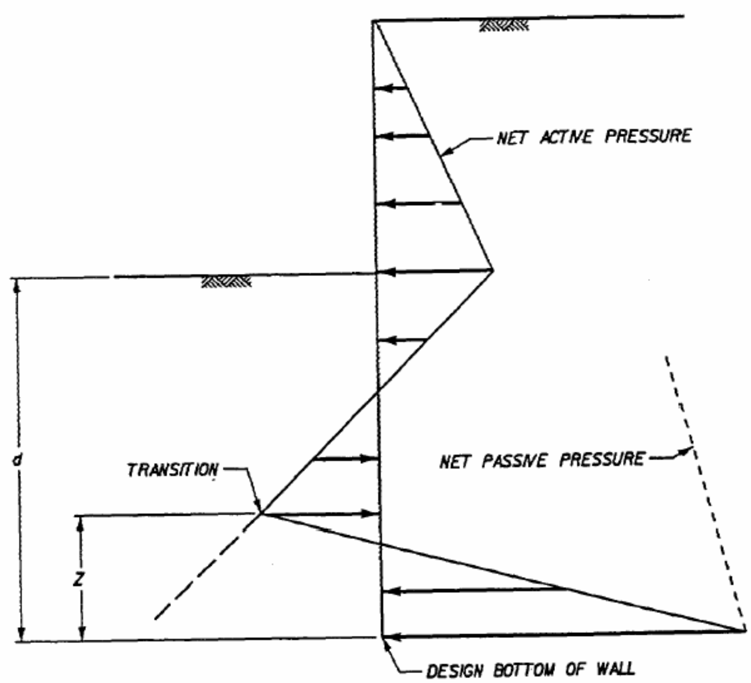


Figure 2.9 Design pressure distribution for cantilever wall (US Army Corps of Engineers, 1994).

2.3.5 Anchored Walls

Anchored sheet pile walls get their support by two means: (1) passive pressure on the front of the embedded portion of the wall and (2) anchor tie rods near the top of the wall. The overall stability of anchored sheet pile walls depends on the interaction of a number of factors, such as the stiffness of the sheet piling, the depth of the piling penetration, the compressibility and strength of the soil, and the amount of anchor yield (Pile Buck, 1987).

Several methods have been proposed for the design of anchored sheet pile walls. These methods have been classified as the "Free Earth" and "Fixed Earth" methods. In the Free Earth method, the passive pressures in front of the wall are insufficient to prevent lateral deflection and rotations at the tip of the sheet piling. In the Fixed Earth method, passive pressures have sufficiently developed on both sides of the wall to prevent both lateral deflection and rotation at the tip of the sheet piling. Figure 2.10 illustrates the difference between the Free Earth and Fixed Earth methods. Experience over the years has shown that walls designed by the Free Earth method are sufficiently stable walls with less penetration than those designed by the Fixed Earth method. The Free Earth method predicts larger moments than those that actually occur because of the flexibility of the sheet piling (Pile Buck, 1987).

2.3.5.1 Free Earth Method

In the Free Earth method, the anchor is assumed to be a rigid simple support about which the sheet pile wall rotates as a rigid body as shown in Figure 2.11. It is assumed that the wall is subjected to the net active pressure distribution as shown in Figure 2.12.

The required penetration of the sheet pile wall is determined from the equilibrium requirement that the sum of the moments about the anchor is zero. After the penetration has been determined, the anchor force is obtained by setting the sum of the horizontal forces equal to zero (US Army Corps of Engineers, 1994).

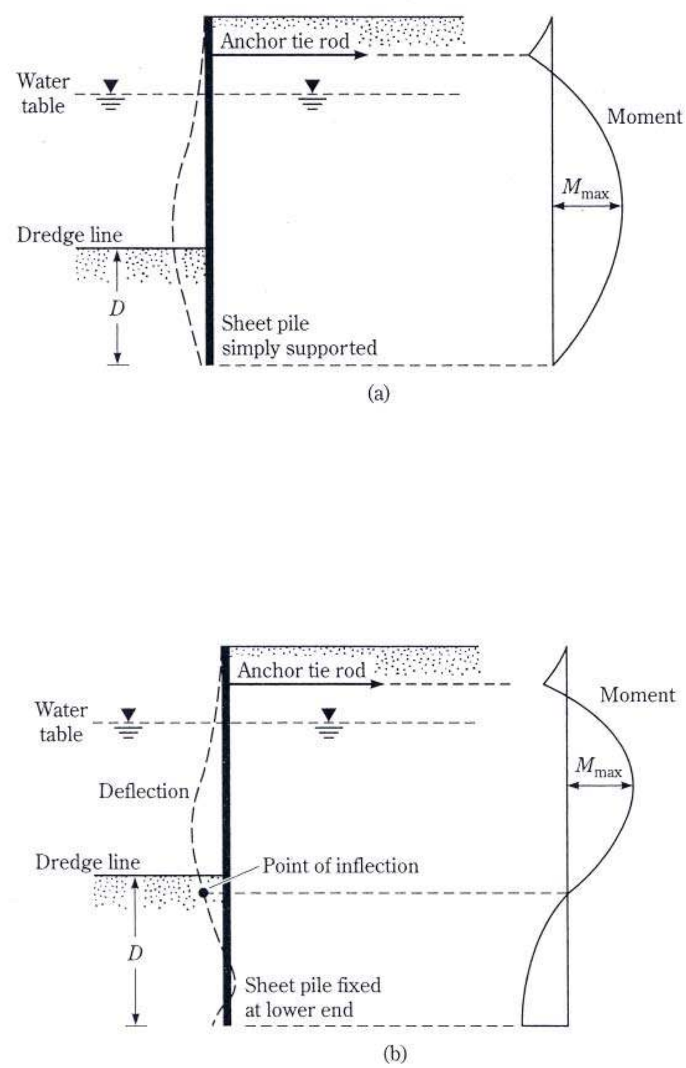


Figure 2.10 (a) Free Earth method (b) Fixed Earth method (Das, 1999).

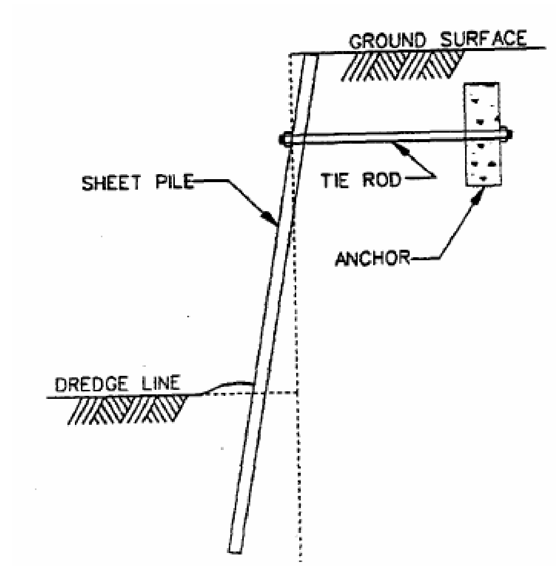


Figure 2.11 Anchored Wall (US Army Corps of Engineers, 1994).

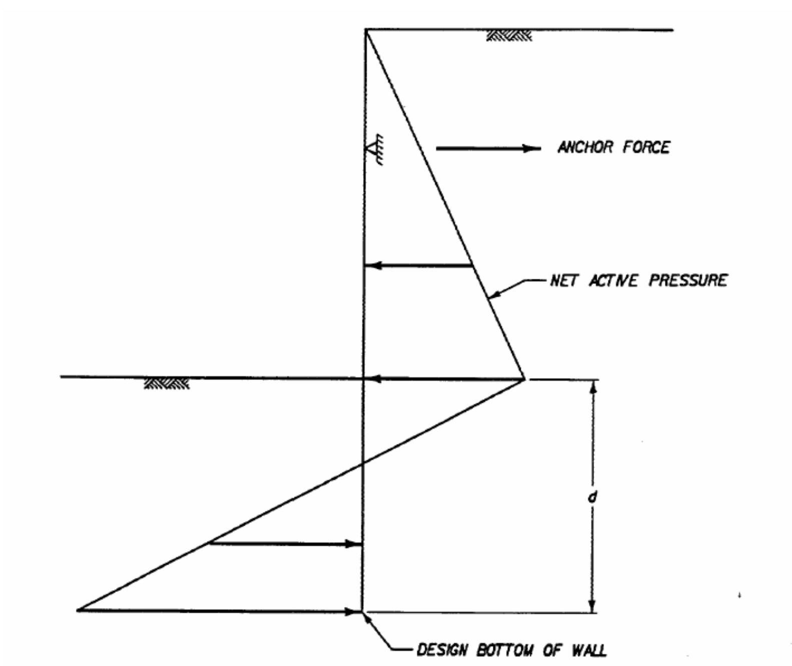


Figure 2.12 Design pressure distribution for Free Earth design of anchored walls (US Army Corps of Engineers, 1994).

2.3.5.2 Rowe's Moment Reduction Theory

Steel sheet piling is flexible and so sheet pile walls yield which redistributes the lateral earth pressures. The bending moment in sheet piling generally decreases with the increasing flexibility of the piling. With increasing flexibility, the buried part of the piling assumes a rotation about the lower edge of the bulkhead causing the center of the passive pressure to move closer to the dredge line. This decreases the maximum bending moment calculated by the Free Earth method. For that reason, Rowe suggested a procedure to reduce the maximum design moment on sheet pile walls obtained from the Free Earth method. For sheet pile walls penetrating sand, Rowe has established a relationship between the degree of flexibility of an anchored bulkhead, expressed as a coefficient ρ, and the reduction of actual bending moment, M, as compared to the Free Earth support value M_{max}. The coefficient ρ can be determined by (Pile Buck, 1987):

$$\rho = (H + D)^4/EI$$

where

H = height of the wall
D = depth of penetration
E = modulus of elasticity of the wall
I = moment of inertia of the wall section

Figure 2.13 shows the relationship between the ratio M_d/M_{max} and ρ for both medium dense and very dense granular soils. For a given sheet pile section, ρ and $M_d/_{Mmax}$ can be plotted on Figure 2.13. If the point falls above the curve for the appropriate soil density then the section is adequate (Pile Buck, 1987).

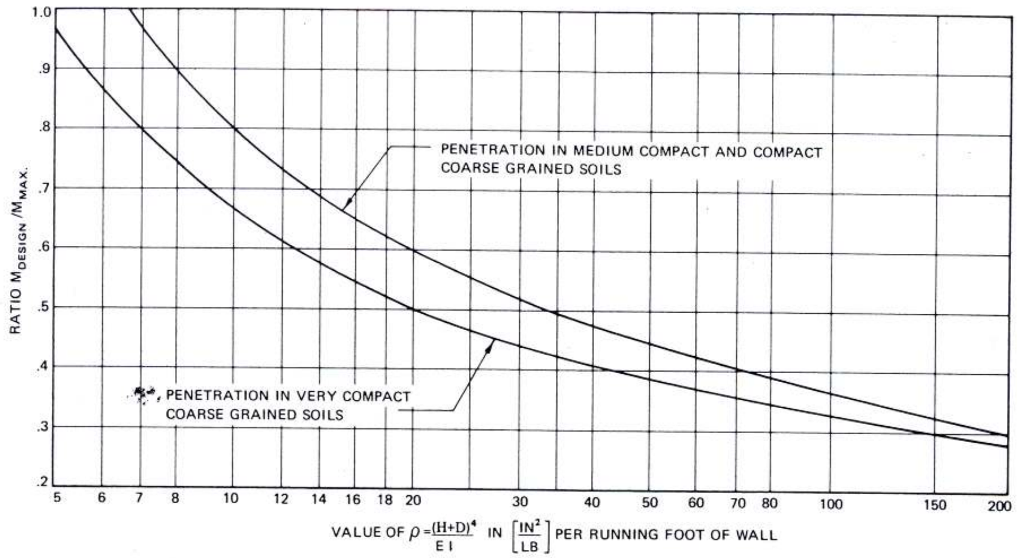


Figure 2.13 Rowe's moment reduction curves (Pile Buck, 1987).

Rowe has also developed a moment reduction technique for sheet piles penetrating clays. This technique introduces a term known as the stability number. The stability number is the ratio of the cohesion below the dredge line to $\gamma_e H$ at the dredge line and is a measure of the net passive resistance. To account for adhesion Rowe proposed the following definition (Pile Buck, 1987):

$$\text{stability number (S)} = \frac{c}{\gamma_e H}\sqrt{1+\frac{c_a}{c}} = 1.25\frac{c}{\gamma_e H}$$

Figure 2.14 shows the relationship between the stability number and the ratio of the design moment to the maximum moment calculated by the Free Earth method for various height to total length ratios, α (Pile Buck, 1987).

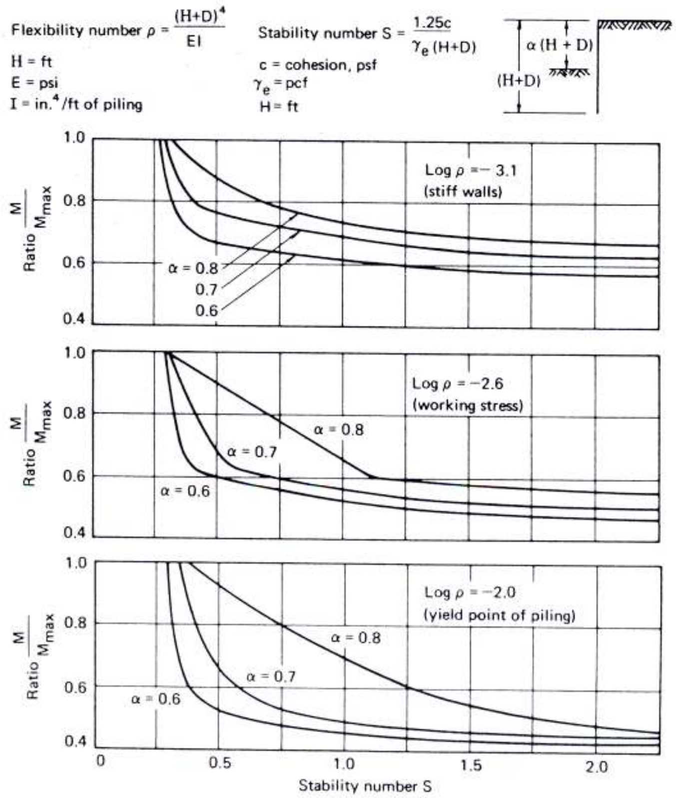


Figure 2.14 Moment reduction for cohesive soils (Pile Buck, 1987).

2.3.5.3 Fixed Earth Method

The Fixed Earth method is based on the assumption that the toe of the sheet pile is restrained from rotating. The deflected shape of the wall reverses its curvature at a point of contraflexure and becomes vertical at the tip. The wall acts like a partially built-in beam subjected to bending moments. To produce this shape the wall must be driven deep enough so that the soil beneath the dredge line provides the required restraint on the bulkhead deformations (Pile Buck, 1987).

A simplified method, developed by Blum, called the equivalent beam method is generally used to calculate the depth of penetration. Figure 2.15 illustrates the method developed by Blum. This method is limited to use in granular soils. This method assumes a hinge at the point of contraflexure, since the bending moment there is zero. The part above the hinge can be treated as a separate freely supported beam with an overhanging end. The reactions R and T and the bending moments can then be determined from statics and simple beam theory. The portion below the point of contraflexure can also be analyzed as a separate freely supported beam on two supports, R and C (Pile Buck, 1987).

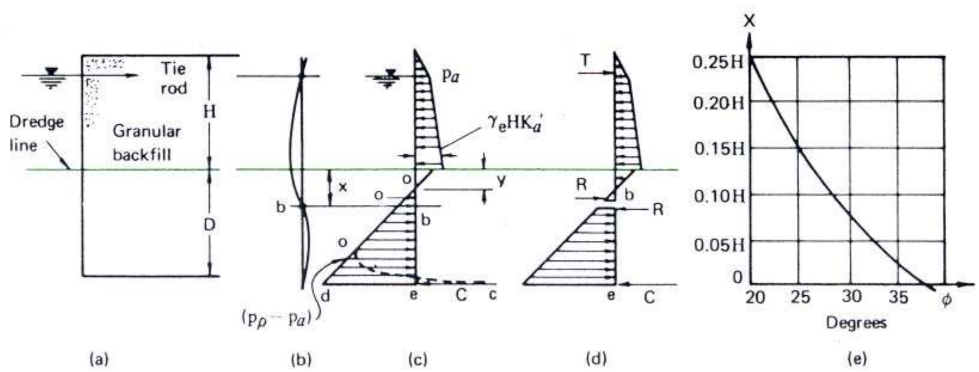


Figure 2.15 Equivalent beam method (Pile Buck, 1987).

The distance y can be determined from:

$$y = \frac{\gamma_e H K'_a}{p'_p - p'_a}$$

where

$\gamma_e H$ = weight of backfill and surcharge load above the dredge line
K'_a = coefficient of active earth pressure for the soil below the dredge line

The point of contraflexure can be determined using the chart in Figure 2.15(e). The reaction at R can be determined by treating the piling above b as a simple beam supported at b and at the anchor level. The dimension eb is determined by treating the lower portion of the piling as a simple beam and equating the moment about the base to zero. The depth of penetration, D, is equal to the sum of eb and x. To provide a margin of safety, 20 to 40 percent can be added to the calculated depth of penetration. Generally the point of contraflexure and the point of zero pressure are very close and the value of x can be taken equal to y. In this case, the depth of penetration can be expressed as (Pile Buck, 1987):

$$D = y + \sqrt{\frac{6R}{p'_p - p'_a}}$$

where

y = distance form the dredge line to the point of zero pressure
R = horizontal reaction at o
p'_p, p'_a = passive and active earth pressures in the soil below the dredge line

2.4 Braced Cofferdams

Single anchor walls are only feasible for shallow depths. For deep excavations it becomes necessary to use multi-braced sheet pile walls which are also referred to as cofferdams. Cofferdams are retaining structures, usually temporary in nature, which are used to support the sides of deep excavations. Cofferdams usually consist of steel sheet piling braced by a system of wales and struts. Cofferdams are used in excavations in urban areas where the need to prevent settlement of the adjacent ground is of prime importance or where there is not enough space available for flat slopes (Pile Buck, 1987).

Generally, the method of construction of cofferdams begins with steel sheet piling being driven into the ground to a predetermined depth. During the excavation, the steel sheeting is braced by horizontal wales which are supported by a system of struts. The system of struts for each wale system must be in place and against the sheeting before the excavation can continue in order to prevent lateral deflection. This installation process needs to be determined during the design of the cofferdam. The designer must determine the elevation of the first level of struts based on allowable moment and deflection in the cantilever sheet pile. Each subsequent strut elevation is determined based on the allowable moment and deflection in the sheeting and allowable load for the struts. The designer also must consider what kind of work is taking place and what type of equipment is being used so that the strut spacing will allow room for this work and equipment.

The design of a temporary cofferdam usually begins with a subsurface investigation to provide general information about the site and the soil strata. After the soil parameters are obtained, the lateral earth pressures against the sheeting are computed. The cofferdam components can then be sized by selecting wale spacing and sizing the sheeting and struts. If the moments in the sheeting are too large, the spacing of the wales can be reduced. Also, if the wales are too large, the spacing of the struts can be reduced, however the struts should be wide enough to allow easy access through the system during construction. Once the components have been sized, the cofferdam can be analyzed for overall stability and for safety against piping (Pile Buck, 1987).

There are some benefits to be had by driving the sheet piling to greater depths than the design depth of the excavation. In soft clays, the additional penetration aids in resisting the heave in the bottom of the excavation. In granular soils, greater wall depths serve as a cutoff wall and reduce the danger of piping and the formation of boils (Pile Buck, 1987).

2.4.1 Lateral Pressure Distribution

Once the subsurface investigation is complete, the next step is to determine the loads acting on the cofferdam. The cofferdam may be subjected to earth pressures, surcharge loads, and hydrostatic pressures. The lateral pressures on the cofferdam due to surcharges can be calculated the same as the lateral pressures on cantilever and single anchor walls, however the lateral earth pressures cannot be calculated by the classical theories. The braced wall is subjected to earth pressures, just as other retaining structures, except with the bracing limiting the wall movement the soil behind the wall is not likely to be in an active state. The pressure is more likely to be somewhere between the active and at-rest states. With the braces the wall is pressed against the retained soil which means that the pressure profile behind the wall is more trapezoidal than triangular. Figure 2.16 shows the development of wall pressures behind a braced cofferdam (Pile Buck, 1987).

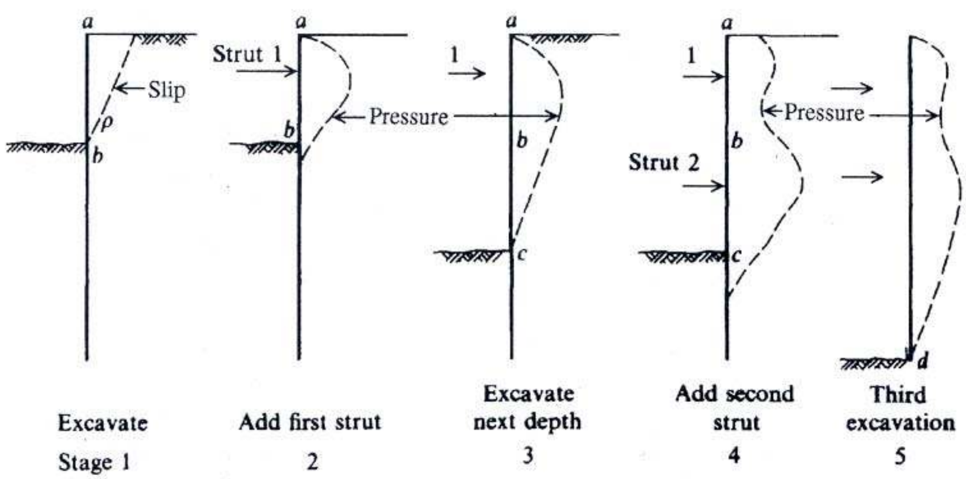


Figure 2.16 Development of lateral pressures behind a braced cofferdam (Bowles, 1996).

At the time the first row of struts is placed the excavation is not deep enough to have appreciably altered the state of stress in the soil. The lateral pressure at the first row of struts is higher than the active pressure since no significant yielding of the soil has occurred. As the excavation continues to the next row of struts, the stiffness of the first row of struts prevents yielding of the soil near the surface. The external lateral pressure tends to rotate the sheet piling about the upper struts causing some inward displacement of the sheet piling at the level of the second struts. As the excavation continues, greater deflections occur at the lower struts. These deflections mobilize soil strength and produce an arching effect which reduces the lateral pressures. At the completion of the excavation, the sheeting will have deformed to the position shown in Figure 2.17. The resulting lateral pressure diagram will have the maximum values occurring in the upper portion of the sheet pile wall which is in disagreement with the Rankine and Coulomb theories (Pile Buck, 1987).

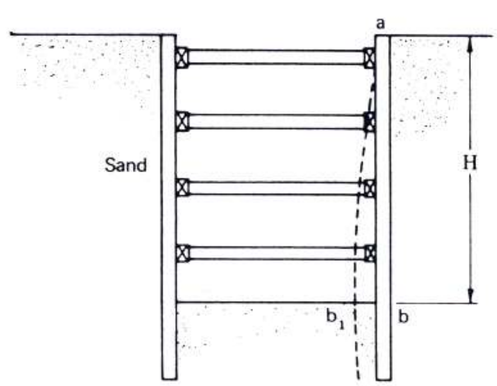


Figure 2.17 Deformation of sheet piling in a braced cofferdam (Pile Buck, 1987).

For that reason, empirical pressure envelopes developed from field observations are used for the design of braced excavations. After observations of several braced cuts during the construction of the Chicago subway system, Peck and later Terzaghi and Peck suggested using apparent pressure diagrams for braced cuts in sands and clays. These apparent pressure diagrams were obtained as the envelope of the maximum pressures that were found and plotted for several projects. The pressure envelope was given a maximum value based on a portion of the active earth pressure using the Coulomb or Rankine pressure coefficient. An illustration of the proposed apparent pressure diagrams is shown in Figure 2.18 (Bowles, 1996).

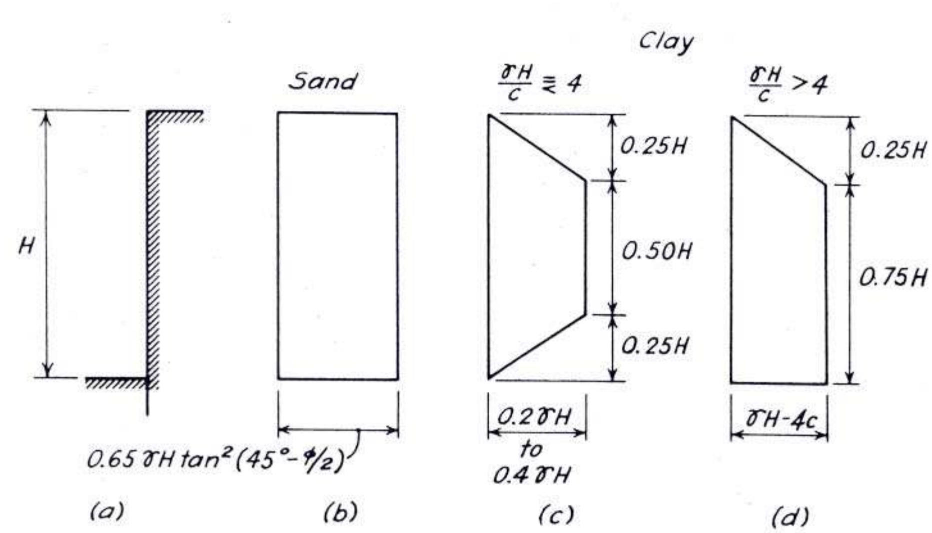


Figure 2.18 Earth pressure diagrams for braced cuts (Peck, 1974).

For stratified soils, Peck proposed that an equivalent value of cohesion and an average unit weight of the layers be used with the pressure envelopes in clay to design the cuts (Pile Buck, 1987).

$$c_{av} = \frac{1}{2H}\left[\gamma_s K_s H_s^2 \tan\phi_s + (H - H_s)n' q_u\right]$$

$$\gamma_{av} = \frac{1}{H}\left[\gamma_s H_s + (H - H_s)\gamma_c\right]$$

where

H = total height of the cut
γ_s = unit weight of sand
H_s = height of the sand layer
K_s = a lateral earth pressure coefficient for the sand layer
ϕ_s = angle of friction of sand
q_u = unconfined compression strength of clay
γ_c = unit weight of clay
n’ = a coefficient of progressive failure (ranging from 0.5 to 1.0)

2.4.2 Sizing of Cofferdam Components

Once the pressure diagram has been completed, a structural analysis can be performed in order to size the sheet piling, wales, and struts. The steel sheet piling making up the wall can be designed either as a continuous beam over several strut points or as a series of pinned beams making each span statically determinant. The maximum moment per foot of wall can be computed from the following equations (Pile Buck, 1987):

$$M_{max} = (1/10)\ wL^2 \quad \text{continuous spans}$$

$$M_{max} = (1/8)\ wL^2 \quad \text{separate single spans}$$

where
w = average lateral pressure on the wall over the longest span
L = maximum distance between wales

If the base of the excavation is unstable and heave is a problem, the sheet piling may be driven deeper into the ground. This results in an unbalanced force acting on the buried length (Figure 2.19). If this occurs, the steel sheeting is then designed as a cantilever below the last strut using the following equation for the maximum moment in the sheet (Pile Buck, 1987):

$$M_{max} = (1/3)\, wL^2$$

where

L = vertical strut spacing

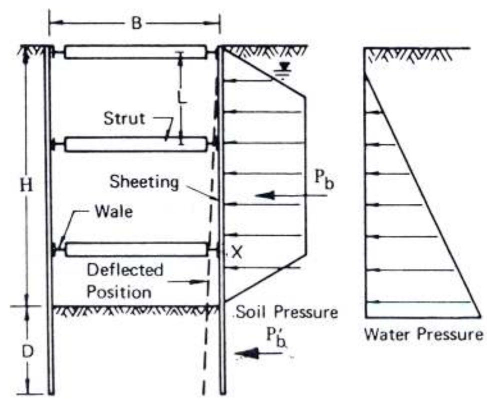


Figure 2.19 Deflected sheet pile wall with unbalanced force (Pile Buck, 1987).

Once the maximum moment is determined, the required section modulus of the sheet piling is given by

$$S = \frac{M_{max}}{\sigma_{all}}$$

where

σ_{all} = allowable steel bending stress

The wales are designed to resist the horizontal reactions from the sheet piling and may be designed as pin-ended or as continuous across the anchor points. If the excavation is of closed geometry then the wales are subject to an axial load due to the reaction from the perpendicular wales at the corners and should be designed including both lateral and axial loads. The location of the first wale can be estimated by making a cantilever wall analysis using several trials for the dredge line location and by inspecting the output for lateral movement into the excavation (Pile Buck, 1987).

The struts are actually beam-columns subjected to an axial force (Figure 2.20) and bending from member self-weight. The struts are designed as compression members with buckling being the primary consideration. The carrying capacity of the strut is inversely proportional to the ration $(L/r)^2$. The spacing between the struts must be designed in such a manner that the axial loads and the L/r ratios are kept within acceptable limits. From the construction standpoint, the spacing between the struts may be dictated by the required accessibility to the bottom of the excavation (Pile Buck, 1987).

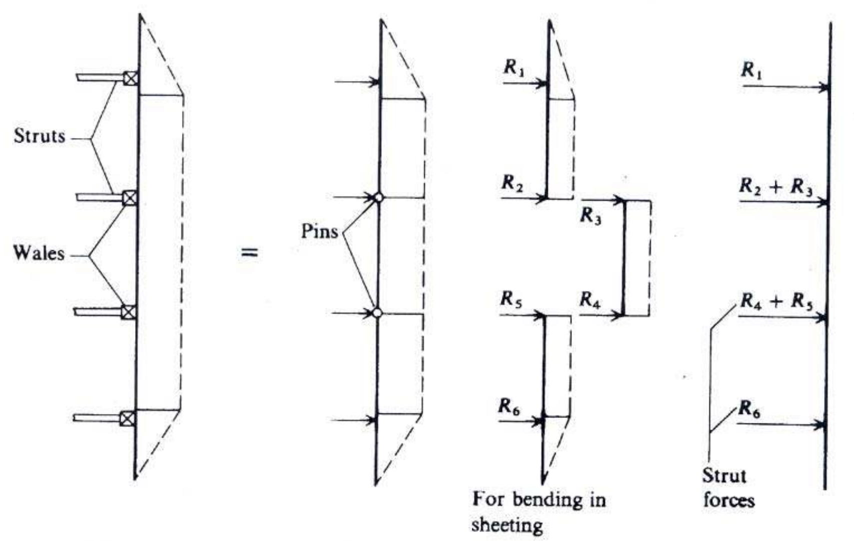


Figure 2.20 Simplified method of computing strut forces (Bowles, 1996).

2.4.3 Stability of Cofferdams - Heaving in Soft Clay

As the depth of a cut increases, the soil outside the wall behaves like a surcharge with respect to the clay inside the enclosure and causes the soil beneath the excavation to rise. This movement extends a considerable distance below the bottom of the cut unless a firm base exists within a short distance below the excavation level. If the depth of the cut becomes too deep with respect to the strength of the clay, the heave at the bottom of the excavation may become uncontrollable and settlements of the surrounding ground surface may become excessive and the bracing system may collapse. The conventional method for investigating heave was developed by Terzaghi and is shown in Figure 2.21 (Peck, 1974).

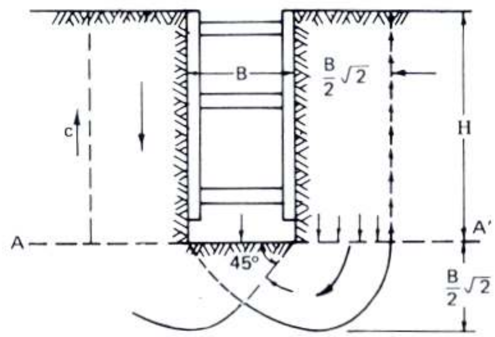


Figure 2.21 Mechanism for failure of the bottom of a deep excavation (Pile Buck, 1987).

The vertical column of soil along the sheeting exerts a pressure on the horizontal plane AA'. When the pressure exerted by the soil column exceeds the bearing capacity of the soil beneath the sheet piling a bearing type failure will occur resulting in heave of the bottom of the excavation and settlement of the surrounding ground surface. The depth of the excavation at which heave will occur can be determined by (Pile Buck, 1987):

$$H_c = \frac{5.7c}{\gamma - \sqrt{2}\left(\frac{c}{B}\right)} \qquad (\text{for} H < B)$$

where

H_c = critical height of the excavation (ft)
B = width of excavation (ft)
γ = unit weight of soil (pcf)
c = unit cohesion of soil (psf)

This method is used for excavations where the width of the cofferdam is larger than the depth of the excavation and the cofferdam is very long. For cases where the cofferdam is square, rectangular, or circular in geometry and the depth of the excavation exceeds the width a method of analysis developed by Bjerrum and Eide can be used. The depth of the excavation at which heave will occur can be determined by (Pile Buck, 1987):

$$H_c = N_c\left(\frac{c}{\overline{\gamma}}\right) \qquad \text{(for H > B)}$$

where

H_c = critical height of the excavation
$\overline{\gamma}$ = average unit weight of soil within depth of excavation
c = unit cohesion of soil
N_c = bearing capacity factor-to be determined using Figure 2.22

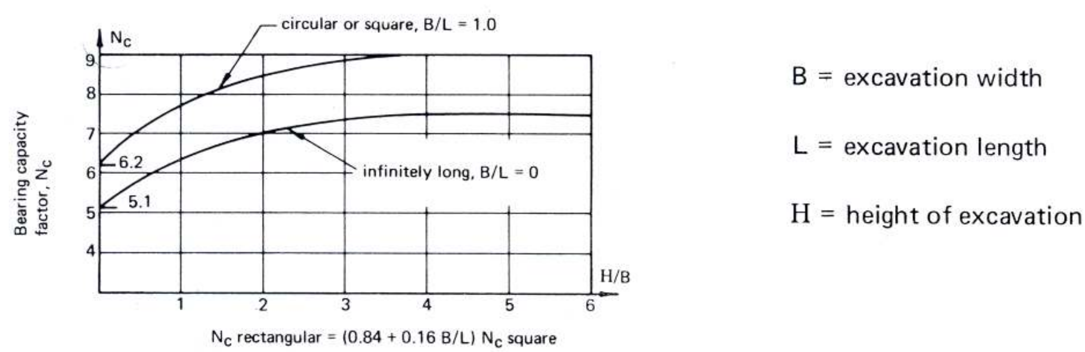


Figure 2.22 Diagram for the determination of bearing pressure coefficient, N_c (Pile Buck, 1987).

2.5 Soil-Structure Interaction Analysis

The classical design methods mentioned earlier rely on simplifying and contradictory assumptions regarding the behavior of the wall-soil system. There are several anomalies that are contained in the classical design methods. First, there are incompatible pressures and displacements. In both the cantilever and anchored wall designs, the soil pressures are assumed to be in either the limiting active or passive pressure at every point along the wall without regard to the magnitude or direction of wall displacement. The effects of the wall and anchor flexibilities are ignored and the displacements are calculated based on hypothetical supports. Another anomaly contained in the classical design methods is the effect of sheet pile penetration. In the classical design methods a greater penetration than that required for stability indicates an increase in the factory of safety, soil pressures, bending moments, anchor forces, and deflections. An increase in penetration should be expected to result in reduced deflections. Finally, the approximate methods proposed for multiple anchor walls introduce further simplifying assumptions regarding system behavior and suffer from the same limitations as single anchor walls (US Army Corps of Engineers, 1994).

2.5.1 Soil-Structure Interaction Method

The soil-structure interaction (SSI) method of analysis enforces compatibility of deflections, soil pressures, and anchor forces while accounting for wall and anchor flexibilities. The SSI method described here is based on a one-dimensional finite element model of the soil-wall system consisting of linearly elastic beam-column elements for the wall, distributed non-linear Winkler springs to represent the soil and non-linear concentrated springs to represent any anchors (US Army Corps of Engineers, 1994).

2.5.2 Preliminary Information

Before the SSI method of analysis can commence, certain preliminary information must be obtained. The elevation of the top of the wall, the ground surface profile on each side of the wall, and the water elevation on each side of the wall must be determined. The soil profile including location and slope of subsurface layer boundaries, strength parameters, and unit weight for each layer must also be obtained. In addition, the magnitudes and locations of surface surcharge loads and external loads applied directly to the wall must be established. Also, the penetration of the sheet piling, the sheet piling material and cross-sectional properties such as the area, moment of inertia, and modulus of elasticity must be obtained. Finally, the anchor properties such as the anchor area, modulus of elasticity, and flexible length are needed. These properties will be available for analysis of an existing wall-soil system. If a new system is being designed, an initial design using one of the classical methods may be performed and the SSI analysis can be used to refine the design (US Army Corps of Engineers, 1994).

2.5.3 Soil-Structure Interaction Model

As stated before, the SSI model is comprised of beam-column elements for the wall, distributed non-linear Winkler springs for the soil, and non-linear concentrated springs for any anchors. An illustration of a typical 1-foot slice of a wall-soil system is shown in Figure 2.23. Nodes in the model are place at the top and bottom of the wall, at soil layer boundaries on each side of the wall, at the ground water elevation on each side at the anchor elevations, and at other intermediate elevations to assure that the length of the beam is no more than 6 inches. Distributed soil springs and concentrated anchor springs are used to provide lateral support (US Army Corps of Engineers, 1994).

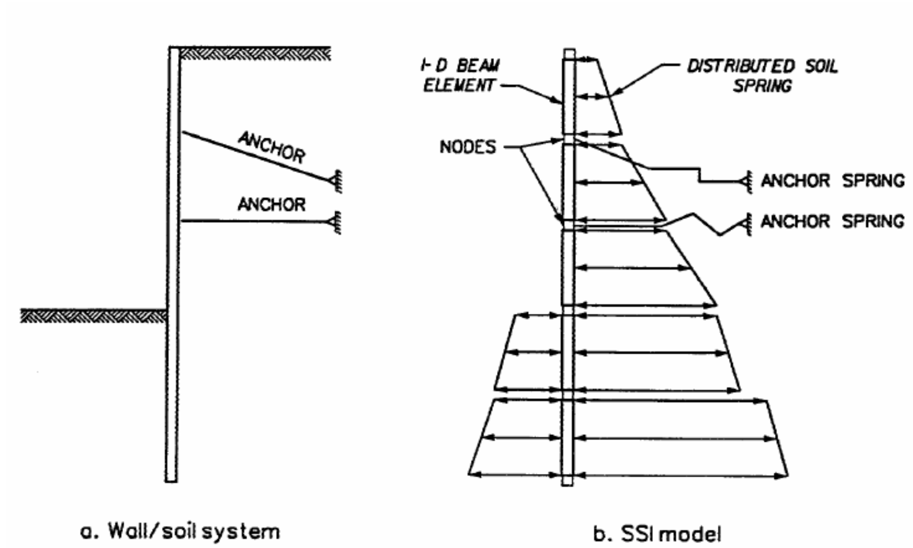


Figure 2.23 System for Soil Structure Interaction analysis (US Army Corps of Engineers, 1994).

There is currently no acceptable procedure to account for the effects of wall friction or adhesion in resisting vertical motions of the wall. The effects of these factors are included in the assessment of the lateral resistance of the soil. Conventional matrix structural analysis is used to relate the deformations of the wall-soil system to the applied external forces. For a system with N nodes the resulting system is a system of 3N non-linear simultaneous equations that must be solved by iteration (US Army Corps of Engineers, 1994).

2.5.4 Non-linear Soil Springs

As stated before, distributed non-linear Winkler springs are used to represent the soil. The forces exerted by the distributed soil springs vary with lateral wall displacement between the active and passive limits as shown in Figure 2.24 (US Army Corps of Engineers, 1994).

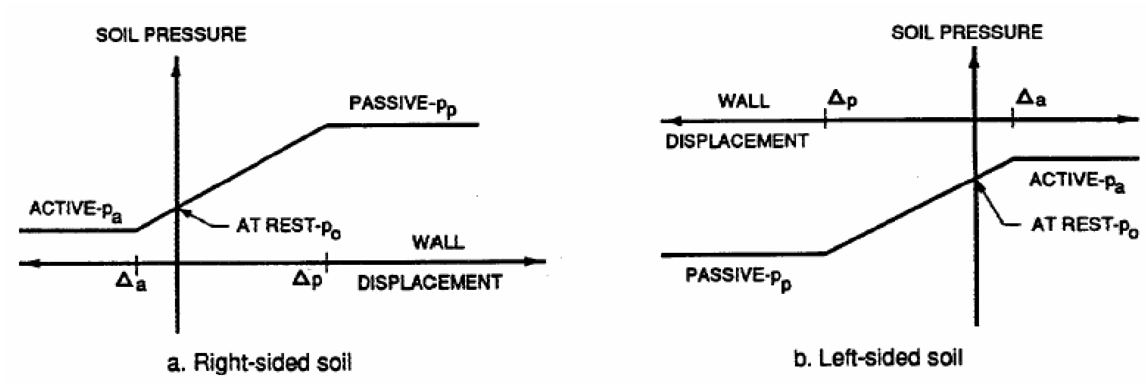


Figure 2.24 Distributed soil springs (US Army Corps of Engineers, 1994).

The active and passive soil pressures are calculated by classical earth pressure theories including wall-soil friction and adhesion. The at-rest pressure, which corresponds to zero wall displacement, is calculated using the following equation (US Army Corps of Engineers, 1994):

$$p_o = p_v K_o$$

where

p_o = at-rest earth pressure at the point of interest
p_v = effective vertical soil pressure at the point of interest
K_o = at-rest soil coefficient

The variation of soil pressure between the active and passive limits follows a curved path, but a simplified linear representation like the one shown in Figure 2.24 is used. The displacements at which the limiting active or passive pressures are reached are dependent on the type of soil and the flexibility of the wall. These influences are functions of the soil stiffness and an estimate of the distance from the wall to which the soil is significantly stressed. With these values the transition displacements for sand can be obtained as

$$\Delta_a = \frac{p_o - p_a}{(s_a \cdot p_v)/(\gamma \cdot d)}$$

$$\Delta_p = \frac{p_p - p_o}{(s_p \cdot p_v)/(\gamma \cdot d)}$$

and for clay as

$$\Delta_a = \frac{p_o - p_a}{(s_a)/(d)}$$

$$\Delta_p = \frac{p_p - p_o}{(s_p)/(d)}$$

where

p_a, p_o, and p_p = active, at-rest, and passive pressures
s_a and s_p = active and passive soil stiffnesses, respectively
p_v = effective vertical soil pressure
g = effective soil unit weight
d = interaction distance, all at the node of interest

2.5.5 Non-linear Anchor Springs

Anchors are represented in the SSI model as concentrated non-linear springs. The force in the spring varies with wall displacement as shown in Figure 2.25. The limiting tension force is given by

$$F_t = A_r f_y$$

where

A_t = the effective area of the anchor rod
f_y = the yield stress of the anchor material

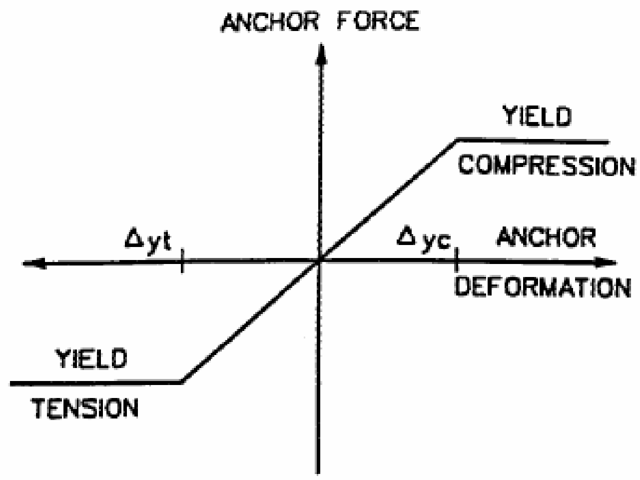


Figure 2.25 Anchor spring (US Army Corps of Engineers, 1994).

The limiting compressive force of the anchor depends on how the anchor is connected to the wales and the axial load capacity or rod buckling of the anchor. The limiting compressive force may vary from zero to the yield value given for tension. The displacements at which the linear variation of force ceases are given by

$$\Delta yt = \frac{F_t L}{E A_a}$$

$$\Delta yc = \frac{F_c L}{E A_a}$$

where

L = length of anchor rods attached to discrete anchors
E = modulus of elasticity of the rod
A_a = cross-sectional area of the rod

2.5.6 Application of Soil-Structure Interaction Analysis

The soil-structure interaction analysis gives solutions in which the bending moments, shears, anchor forces, and soil pressures are all compatible with the wall displacements at all points. SSI solutions may be obtained at intermediate stages of construction as well as for multiple anchors. The SSI method of analysis however is a “gravity turn-on” analysis. It does not take into account the cumulative effects of the construction sequence. The greatest uncertainty in the SSI method is the selection of soil stiffness parameters. Terzaghi indicated that the forces in the system are fairly insensitive to variations in the soil stiffness; however, calculated displacements are significantly affected. It must be recognized that the calculated deflections are only representative of the deformation of the wall and do not include the displacements of the entire wall-soil mass (US Army Corps of Engineers, 1994).

CHAPTER 3: TEST SITES

The objective of the instrumentation program at the test sites was to assess the magnitudes of lateral and horizontal movements associated with the construction of covered canals within sheeted and braced cofferdams. Geotechnical instruments, consisting of slope inclinometers, Sondex settlement rings, piezometers, and strain gauges were installed at the two sites. This thesis is mainly concerned with the strain gauges which were attached to several struts to provide indications of the magnitudes of loads applied to these components of the cofferdam system. Data was collected from the instruments at regular intervals and at critical stages of construction.

3.1 Subsurface Exploration

Soil test borings were drilled at each of the two test sites. All soil test borings were drilled using a truck-mounted wet rotary type rig. Samples of cohesionless soils were obtained during the performance of the in-situ Standard Penetration Test. The materials within the sampler were visually classified by a soil technician. Representative portions of the samples were retained and transported to the soil mechanics laboratory. Undisturbed samples of cohesive soil were obtained by pushing a thin-walled Shelby tube into the bore hole. Three-inch diameter soil samples were continuously obtained in the uppermost 15 feet below the ground surface and were obtained at 5-ft intervals at greater depths. Five-inch diameter soil samples were continuously obtained by fixed piston methods for the full depth of the boring.

The 3-inch diameter borings were visually classified in the field. Representative sections of each sample were retained and transported to the soil mechanics laboratory. The 5-inch diameter boring tubes were sealed with metal plates fitted with o-rings to prevent changes in moisture content. These samples were then transported to the lab for extrusion and testing.

A series of soil mechanics laboratory tests were performed on the samples obtained from the borings. These tests consisted of natural water content measurements, unit weight determinations, Atterberg limit tests, unconfined compression shear tests, and 3-point unconsolidated-undrained triaxial compression tests.

3.2 Geotechnical Instrumentation

Several struts used to brace the excavations were fitted with vibrating wire type strain gauges. The strain gauges were welded to a portion of the struts using a low voltage spot welder. The gauges were then covered with sensors that monitored the frequency at which a wire within the gauge vibrates. Changes in the length of the wire, as a result of contraction or elongation of the member to which the gauge was attached, caused changes in the frequency at which the wire vibrated. Using this principal, elongation of the gauges was recorded at discrete times by a sensor which measured the frequency at which the wire vibrated under a forced excitation. Because the wires within the strain gauges were of a known length, elongation of the wires was easily translated to strain. Assuming the coefficients of thermal expansion of the wire and the strut material are approximately the same; the strain of the gauge was equated to the strain of the strut. The strain was then converted to a load using the known cross-sectional area of the strut and the assumed modulus of elasticity for the strut material.

3.3 Napoleon Avenue Site

3.3.1 Site Conditions

The Napoleon Avenue site is located on the western side of the intersection of Napoleon Avenue and South Galvez Street (see Figure 3.1). In this location, the covered canal was being constructed in the former median of Napoleon Avenue. Construction proceeded from north to south throughout the project length. During construction, the southbound lanes of Napoleon Avenue were closed to the general public and were used as access roads for construction traffic.

At the Napoleon Avenue Site, two new canals were being built under Napoleon Avenue from South Claiborne Avenue to Fontainebleau Drive. The two new canals, each 19 feet wide by 13 feet high ran north and south for nine blocks along the Napoleon Avenue traffic median. The covered concrete canals paralleled an existing 20-foot by 12-foot canal, which was remaining operational during construction. Together, the new canals tripled the capacity of the current canal.

3.3.2 Subsurface Stratification

Two soil test boring were drilled at the Napoleon Avenue site during the period of 7 November 2001 to 10 November 2001. Three-inch diameter samples were obtained from boring NAP-I-1G (Figure 3.2) and 5-inch diameter samples were obtained from boring NAP-I-3U (Figure 3.3). Both borings were completed to a depth of 90 feet below the existing ground surface.

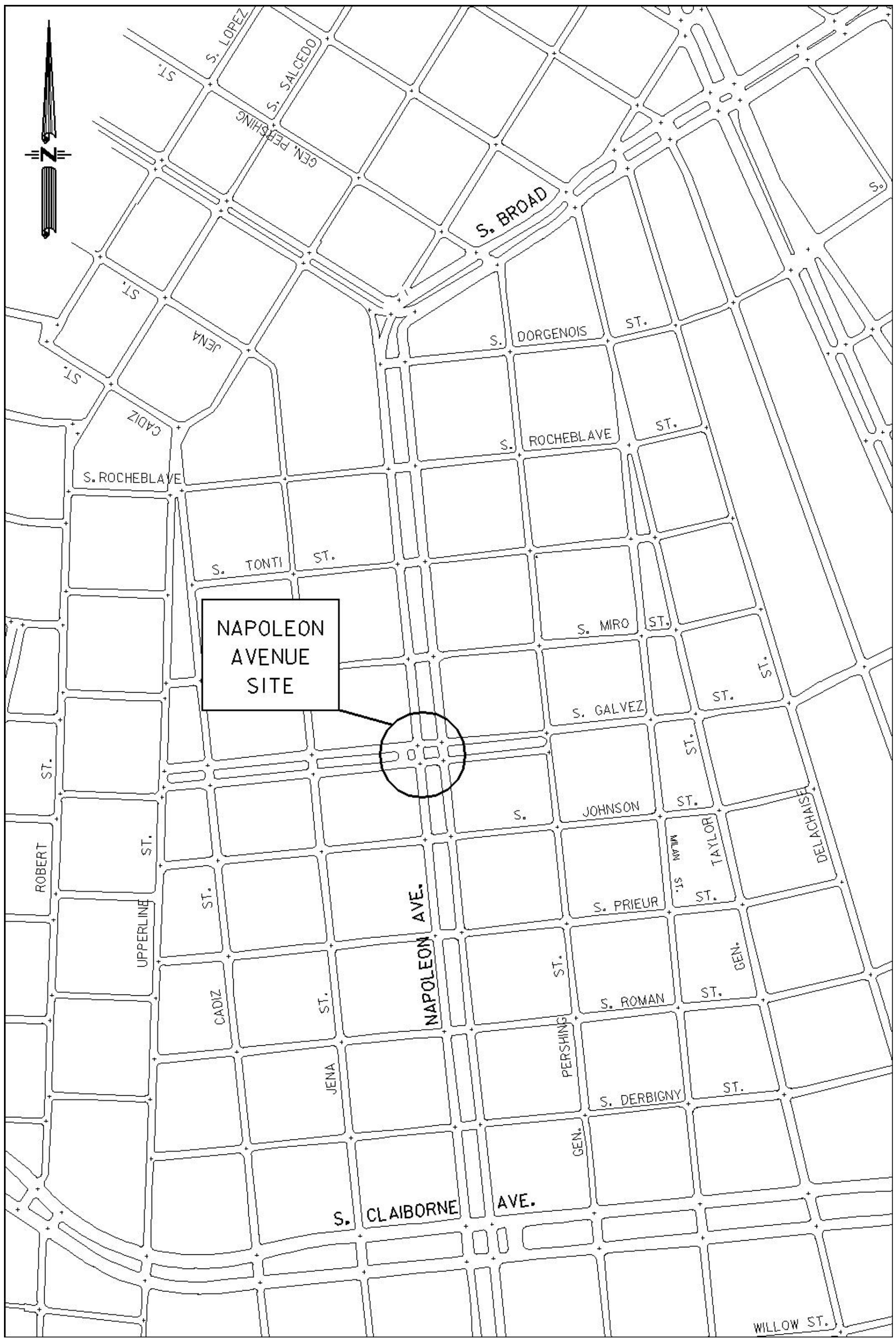


Figure 3.1 Napoleon Avenue Site

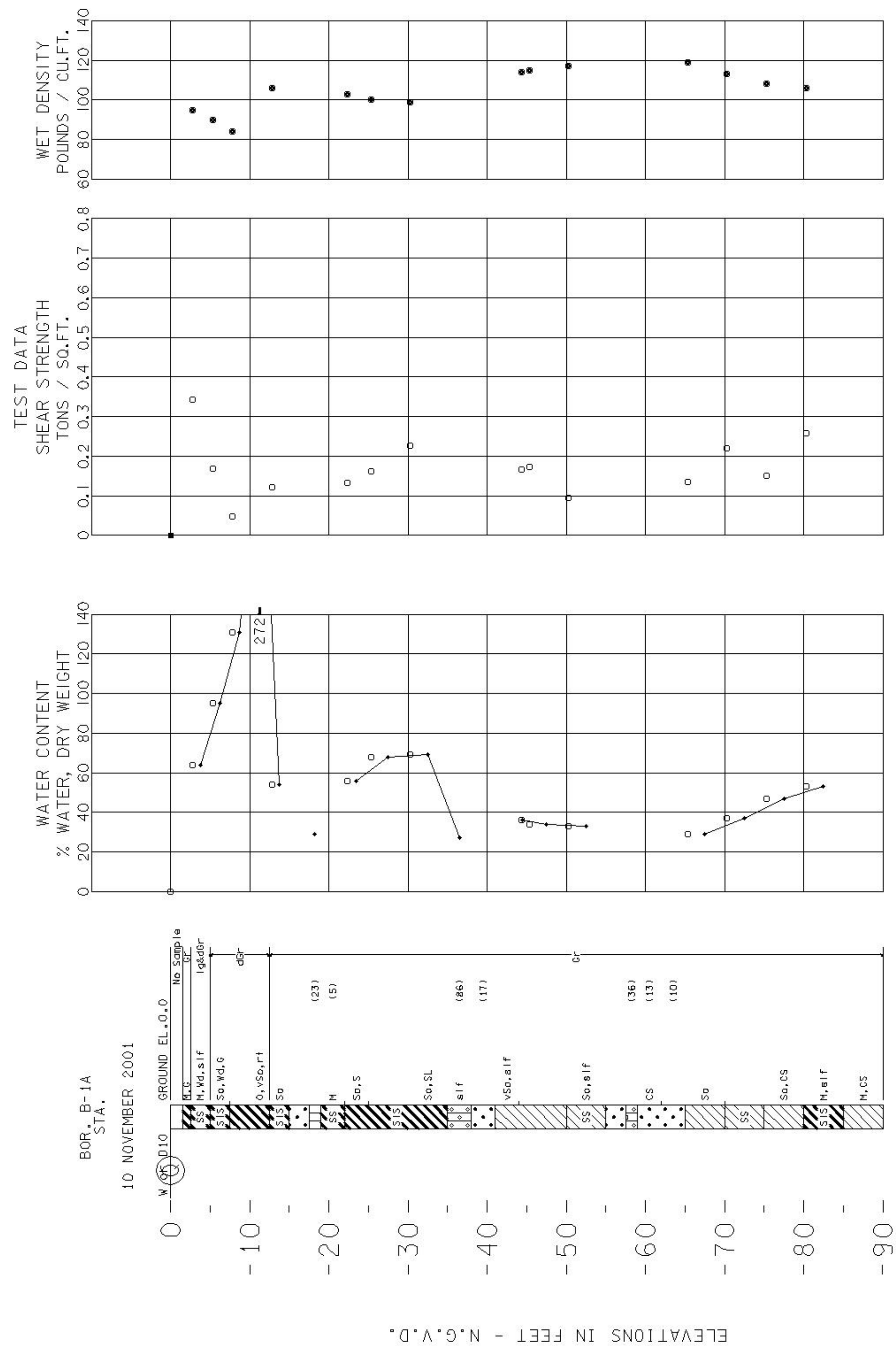


Figure 3.2 Boring NAP-I-1G

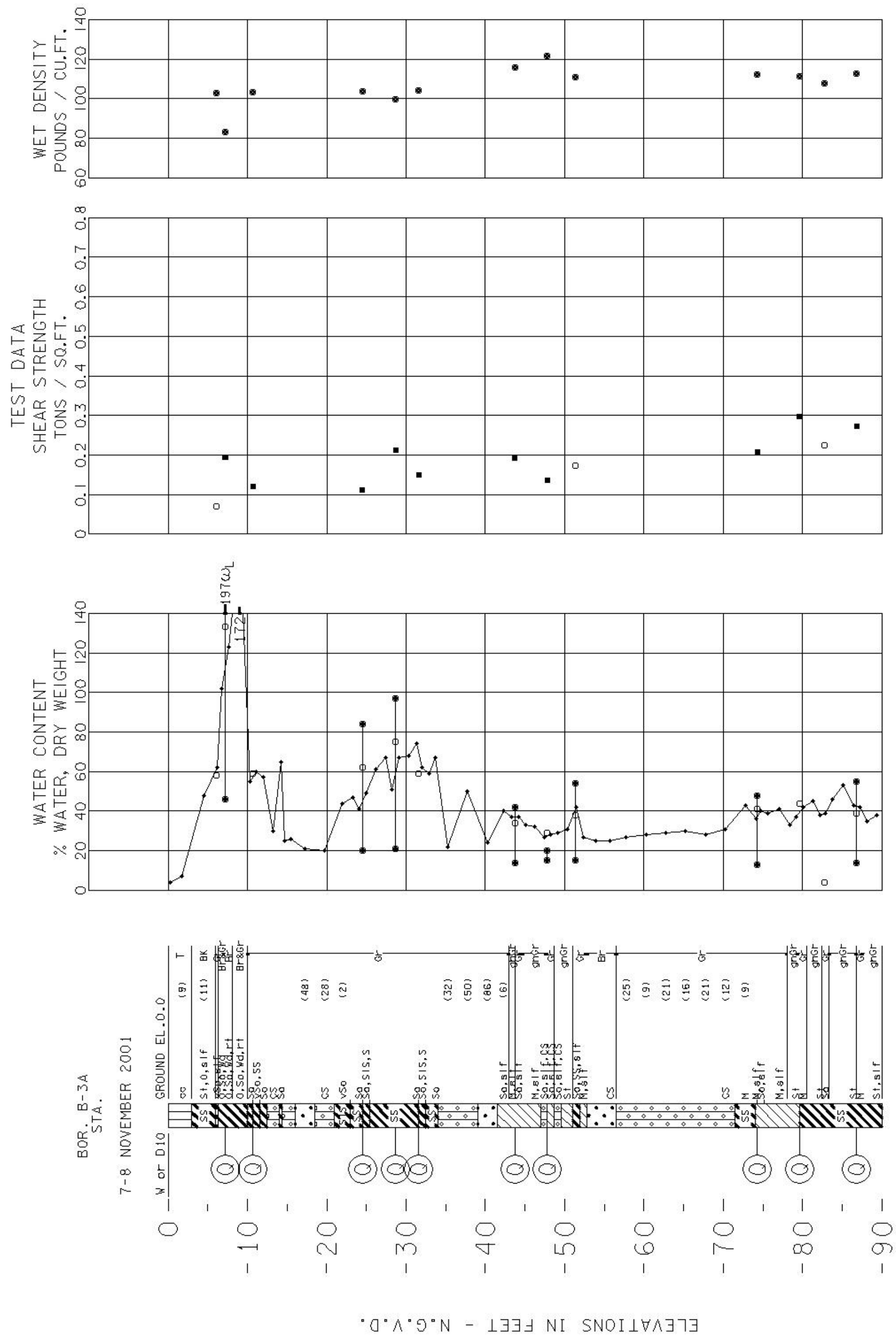


Figure 3.3 Boring NAP-I-3U

The uppermost 12 inches from the roadway surface consisted of 6 inches of asphalt over a 6-inch Portland cement concrete pavement. Borings NAP-I1G and NAP-I-3U indicated loose tan silt and soft gray and black clay with shell fragments to depths of 5.5 to 6 feet below the pavement. These materials were underlain by swamp and marsh deposits of very soft to soft brown clay and gray clay with organic clay layers, wood, and roots to a depth of 13 feet below the ground surface. The swamp and marsh deposits are underlain by groups of soft to medium stiff soft gray clay and silty clay interrupted by strata of loose to very dense gray fine sand and silty sand. The clay strata generally exhibit increasing undrained shear strengths with depth. The interrupting sand strata vary in thickness from 6 to 19 feet and vary in density. These interdistributary deposits extend to a depth of 80 feet, where they are underlain by stiff greenish-gray clay and silty clay strata. These soils are interpreted to be Pleistocene deposits and extend to the termination of the boring depth 90 feet below the ground surface.

3.3.3 Construction

Figure 3.4 shows the components of the braced cofferdam at the Napoleon Avenue site for the stage of deepest excavation with only the top strut in place and Figure 3.5 shows the final excavation with both struts in place. The cofferdam was completed in 55-foot segments and the instruments were located near the ends of two adjacent segments. This commonly resulted in two separate excavation levels being present near the instrumentation at one time. Dates were assigned to excavation depths with in the cofferdam to correspond with days on which both segments adjacent to the instruments were at a given level.

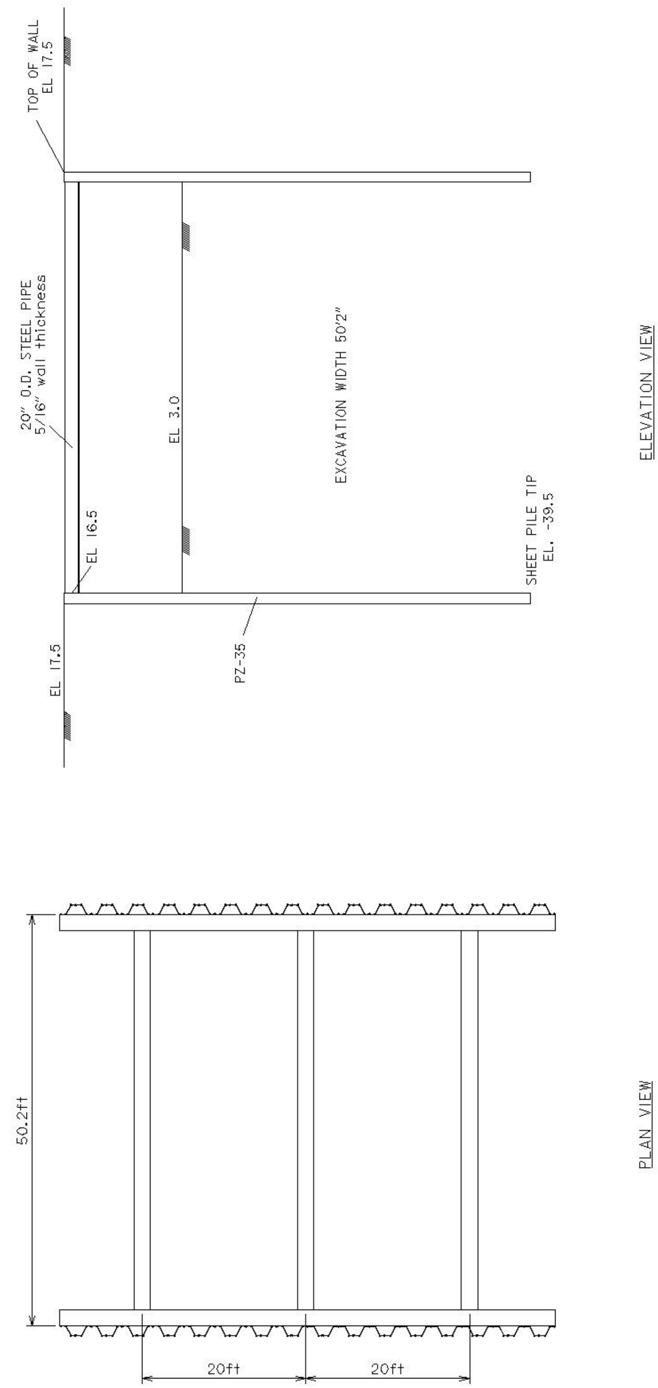


Figure 3.4 Cofferdam Components Napoleon Avenue Site – Single Strut

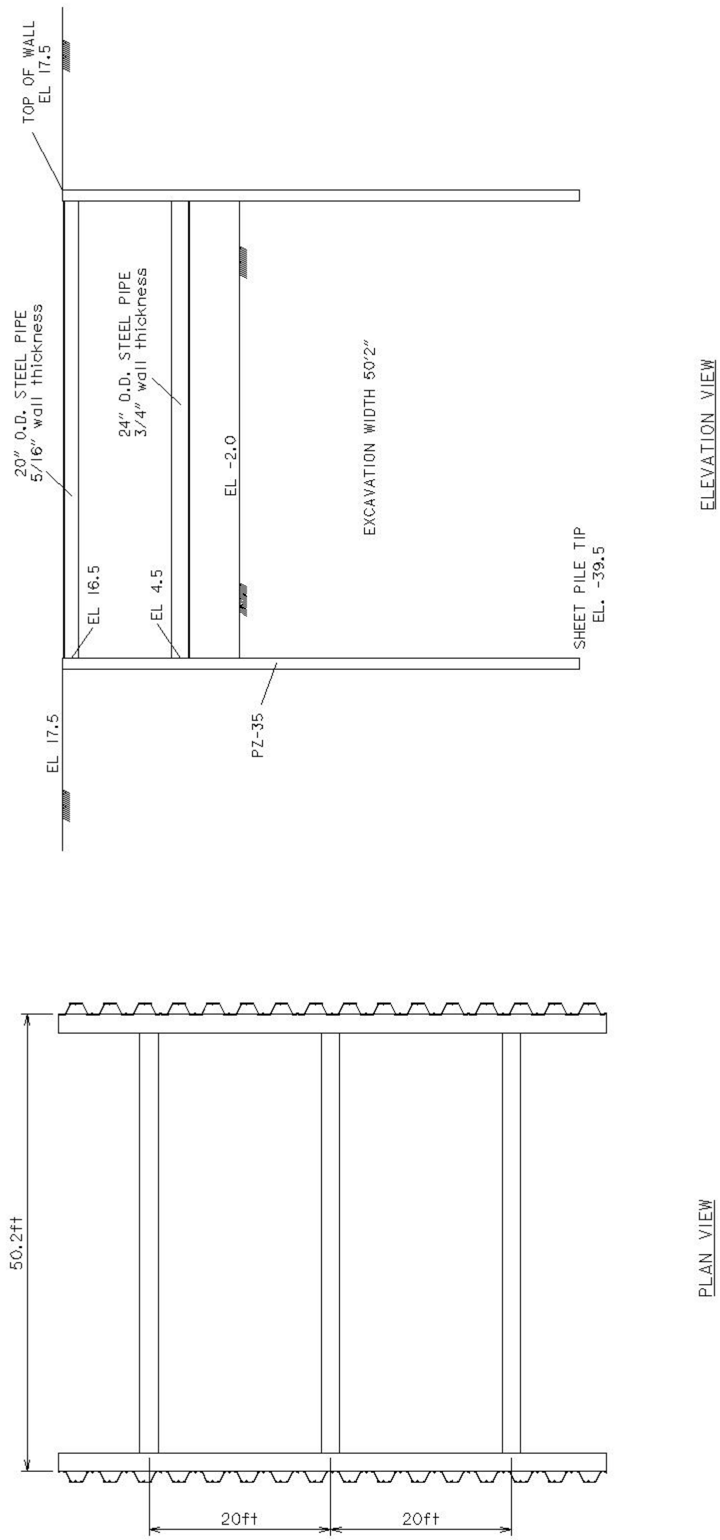


Figure 3.5 Cofferdam Components Napoleon Avenue Site – Full Excavation

3.3.4 Theoretical Strut Loads

There were three basic theoretical approaches used in determining the predicted strut loads. The first method consisted of using the Coulomb method to determine the net pressure diagram and applying that net pressure diagram to the full depth of the sheet pile. The second approach was to apply the Terzaghi pressure diagram from the top of the wall to the cut line and the net pressure diagram using the Coulomb method from the cut line to the tip of the sheet pile. Finally, the soil-structure interaction program, CWALSSI, was used to estimate the loads in the struts. The critical stages of the excavation were analyzed using these theoretical approaches with factors of safety of 1.0 and 1.3 applied to the soil parameters. This was done in order to determine whether applying factors of safety to the soil parameters is necessary.

The two stages of the excavation that were examined in this thesis were the stage of the deepest cut with only the top strut in place and the final excavation with both the top and bottom strut in place. Table 3.1 presents the results of the theoretical analyses performed for the stage of the deepest cut with only the top strut in place and Table 3.2 presents the results of the theoretical analyses performed for the final excavation.

Table 3.1 Napoleon Avenue Site Theoretical Strut Loads – Single Strut

	Strut Load in Kips	
	Factor of Safety = 1.0	**Factor of Safety = 1.3**
Coulomb	36	174
Terzaghi	89	208
CWALSSI	134	194

Table 3.2 Napoleon Avenue Site Theoretical Strut Loads – Final Excavation Stage

	Strut Load in Kips			
	Factor of Safety = 1.0		Factor of Safety = 1.3	
	Upper Strut	Lower Strut	Upper Strut	Lower Strut
Coulomb	1	319	6	474
Terzaghi	48	359	48	485
CWALSSI	-111	662	-294	1051

The theoretical analyses yielded results that were expected. The theoretical strut loads based on Terzaghi pressure diagrams were greater than the theoretical strut loads based on Coulomb pressure diagrams.

The theoretical analyses also yielded expected results when going from a single strut case to the final excavation with two struts. The results showed that the upper strut would now take less of the load because the bottom strut would pick up a large portion of the load. The soil-structure interaction analysis showed that not only would the load in the top strut be reduced, but that the top strut would actually go into tension.

3.4 Hollygrove Site

3.4.1 Site Conditions

The Hollygrove Site is located on Mistletoe Street near its intersection with Colapissa Street (see Figure 3.6). In this location, the covered canal was being constructed in the footprint of a former railroad track. Construction proceeded from west to east throughout the project length. During construction, Mistletoe Street was closed to all traffic except construction vehicles.

The Hollygrove Site project consisted of 800 feet of 10-foot by 20-foot box culvert and 800 feet of 10-foot by 16-foot box culvert along an old railroad embankment, and 1500 feet of 5-foot by 6-foot box culvert along Eagle Street. The box culvert along the old railroad embankment runs from the new Pritchard Place pump station to its intersection with Forshey Street. The Eagle Street culvert will empties into the railroad embankment culvert and runs as far as Stroelitz Street near the Palmetto Canal.

3.4.2 Subsurface Stratification

Two soil test boring were drilled at the Hollygrove Site during the period of 12 November 2001 to 14 November 2001. Three-inch diameter samples were obtained from boring HOL-I-2G (Figure 3.7) and 5-inch diameter samples were obtained from boring HOL-I-3U (Figure 3.8). Both borings were completed to a depth of 90 feet below the existing ground surface.

Medium dense gray sand fill was encountered at the ground surface in Boring HOL-I-3U, but this material was not present in Boring HOL-I-2G. Strata of soft to medium stiff gray and tan clay were encountered to a depth of approximately 10 feet from the ground surface in Boring HOL-I-2G and beneath the sand fill in Boring HOL-I-3U. Because of the high content of wood and roots in these depths, these soils appear to be swamp/marsh deposits that have been desiccated and oxidized.

The swamp/marsh deposits are underlain by a variable stratigraphy of groups of soft to medium stiff gray clay and silty clay strata interrupted by strata of loose to medium dense gray sand, clayey sand, and silty sand with interbedded silt strata. The clay strata generally exhibit increasing undrained shear strengths with depth. The interrupting sand strata vary in thickness from 4 to 7 feet.

The variable stratigraphy extends to a depth of approximately 40 feet below the ground surface, where they are underlain by medium stiff gray clays with shell fragments that were interpreted as Nearshore Gulf marine clay deposits. These Nearshore Gulf marine clay deposits exhibit increasing undrained shear strength with depth and extend to a depth of approximately 57 to 60 feet below the ground surface. At these depths, strata of stiff to very stiff greenish-gray and tan clays and silty clays were encountered. These strata were interpreted as Pleistocene-aged deposits. The Pleistocene soils extend to the termination of the soil borings at a depth of 90 feet below the ground surface.

3.4.3 Construction

Figure 3.9 shows the components of the cofferdam at the Hollygrove Site. The cofferdam was installed in 36-foot segments and the instruments were located near the center of a construction segment.

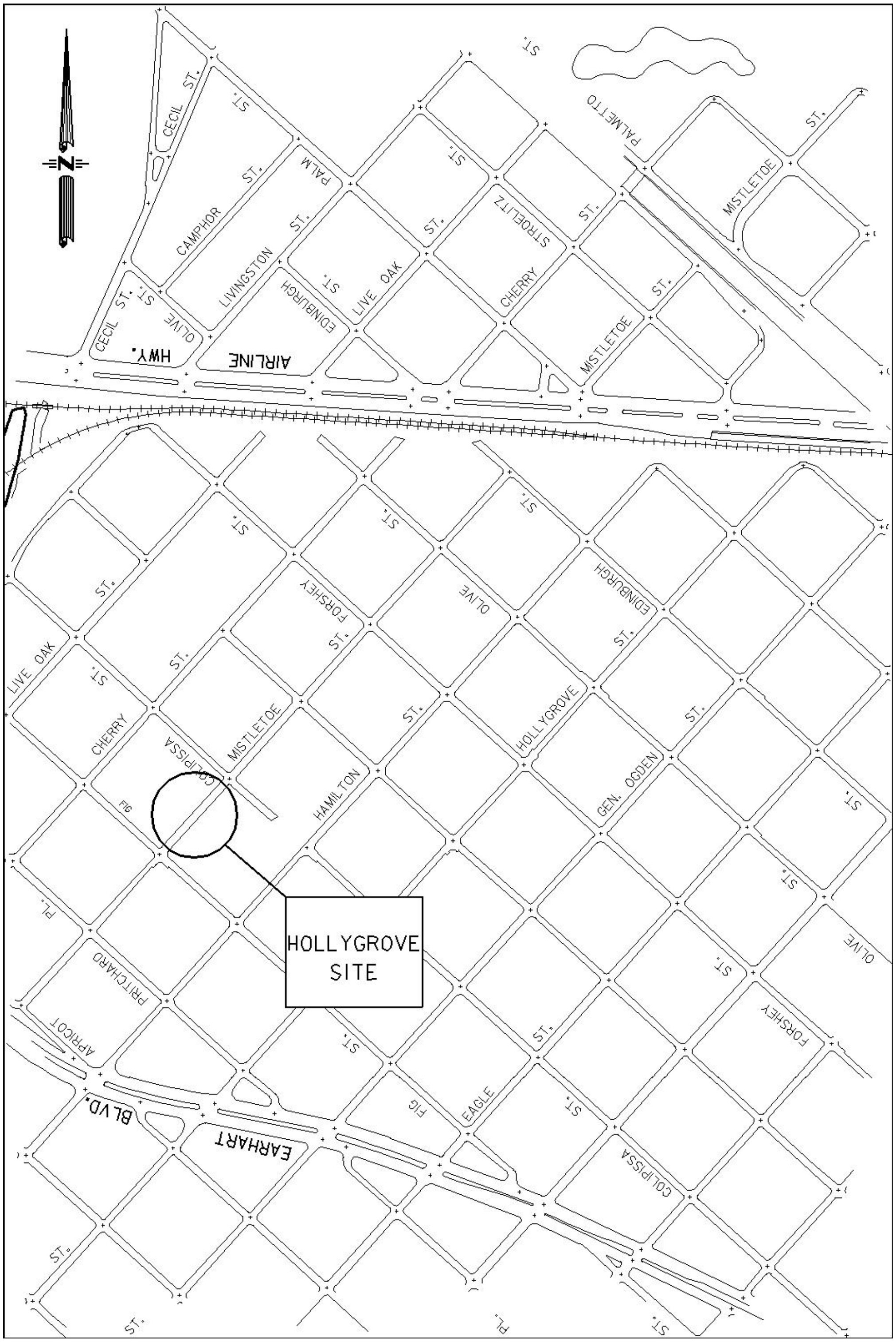


Figure 3.6 Hollygrove Site Plan

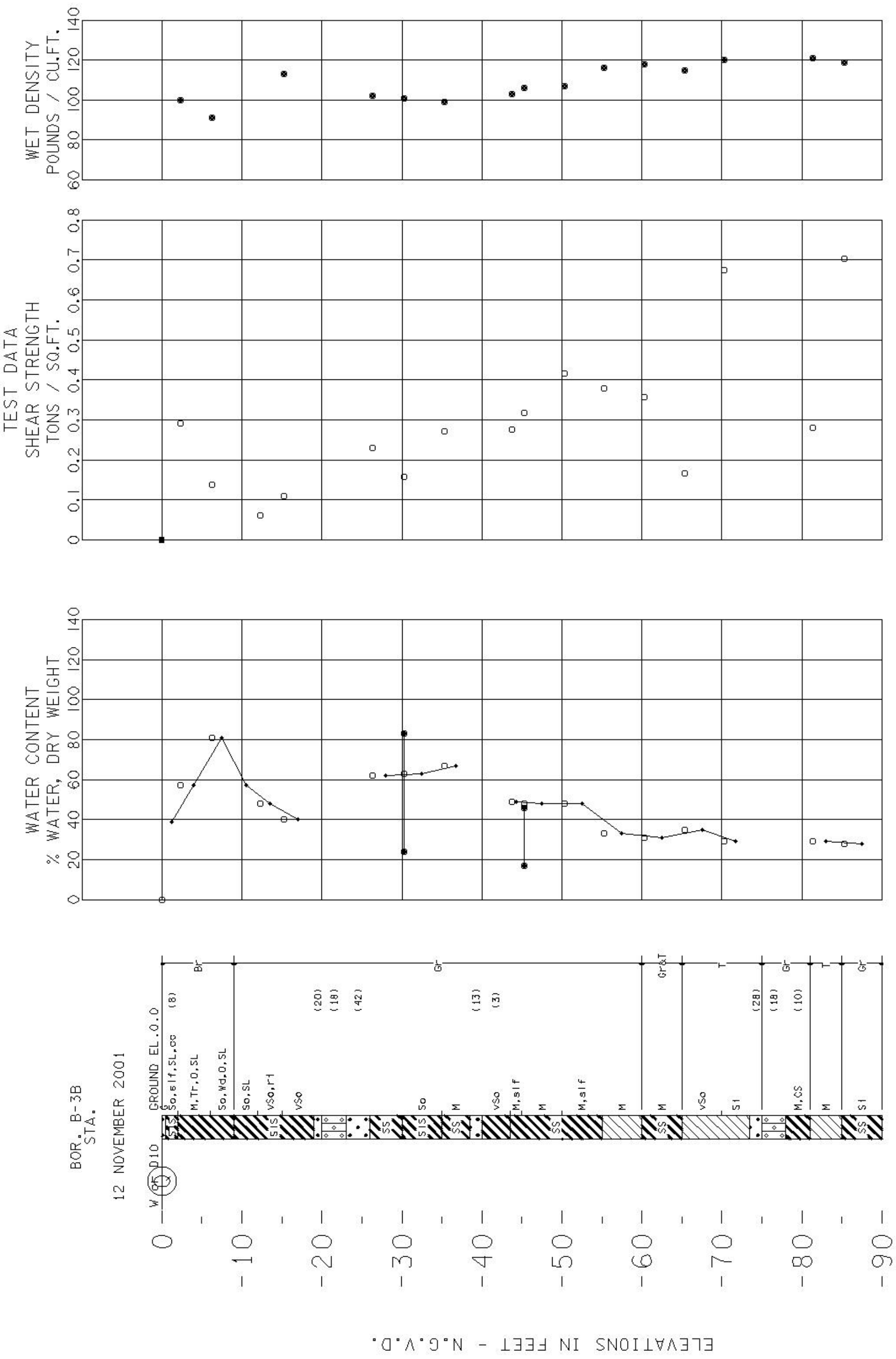


Figure 3.7 HOL-I-2G

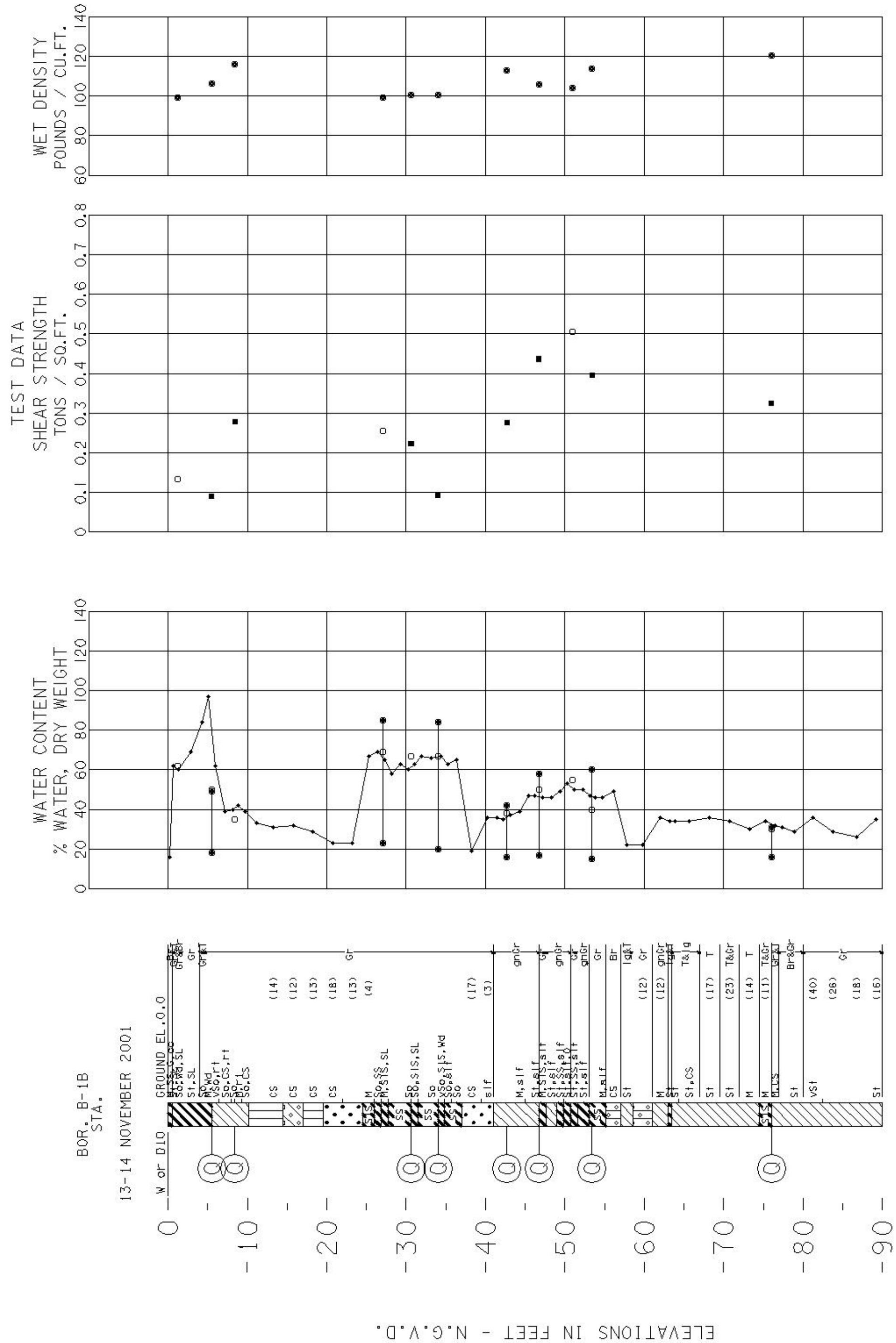


Figure 3.8 HOL-I-3U

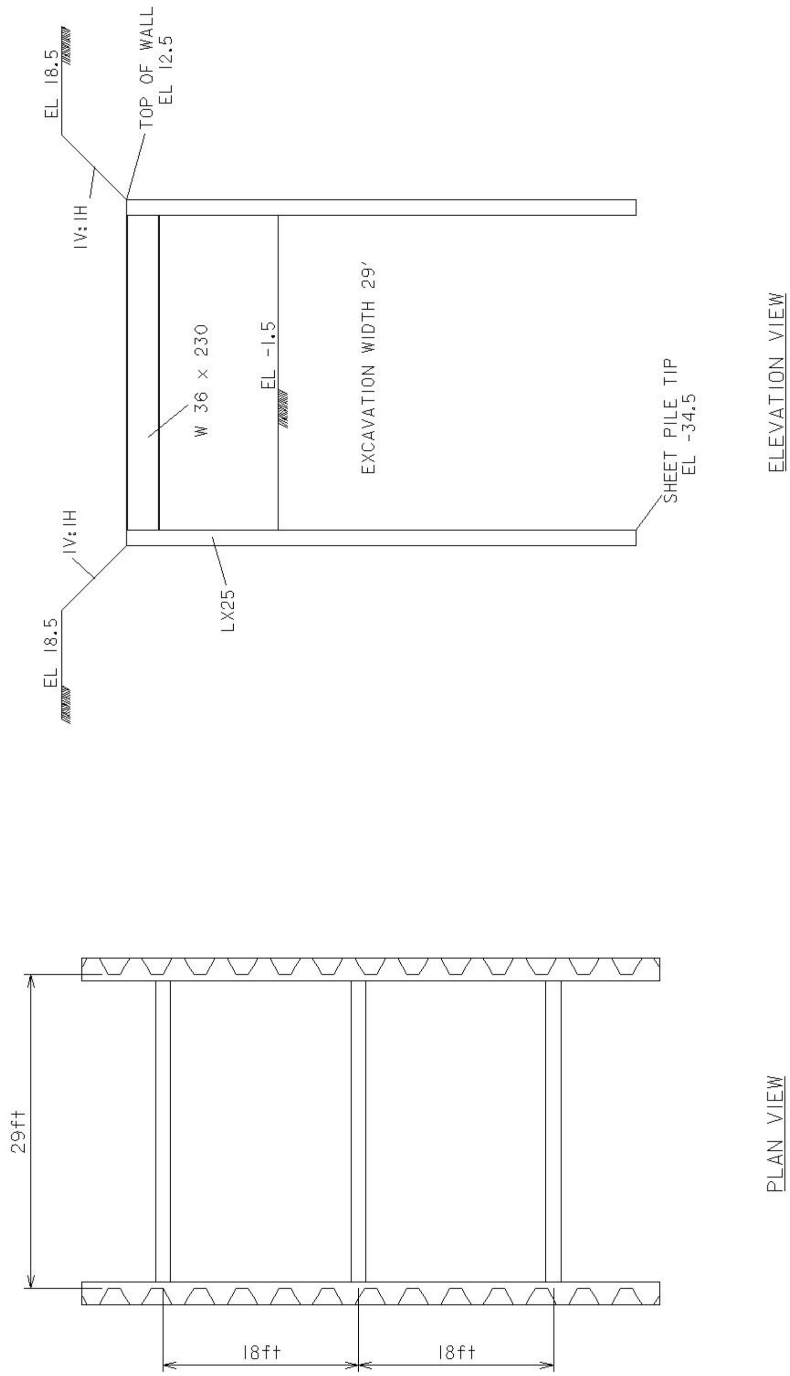


Figure 3.9 Cofferdam Components Hollygrove Site

3.4.4 Theoretical Strut Loads

The same three basic theoretical approaches used in determining the predicted strut loads at the Napoleon Avenue Site were used for the Hollygrove Site. The first method consisted of using the Coulomb method to determine the net pressure diagram and applying that net pressure diagram to the full depth of the sheet pile. The second approach was to apply the Terzaghi pressure diagram from the top of the wall to the cut line and the net pressure diagram using the Coulomb method from the cut line to the tip of the sheet pile. Finally, the soil-structure interaction program, CWALSSI, was used to estimate the loads in the struts. The critical stages of the excavation were analyzed using these theoretical approaches with factors of safety of 1.0 and 1.3 applied to the soil parameters. This was done in order to determine whether applying factors of safety to the soil parameters is necessary.

The only stage of the excavation that was examined at the Hollygrove Site was the final excavation which was the stage of the deepest cut with the top strut in place. Table 3.2 presents the results of the theoretical analyses performed for the excavation at the Hollygrove Site.

Table 3.2 Hollygrove Site Theoretical Strut Loads

	Strut Load in Kips	
	Factor of Safety = 1.0	**Factor of Safety = 1.3**
Coulomb	203	316
Terzaghi	252	360
CWALSSI	141	-

The theoretical analyses yielded results that were expected. The theoretical strut loads based on Terzaghi pressure diagrams were greater than the theoretical strut loads based on Coulomb pressure diagrams. The soil-structure interaction program CWALSSI would not yield a solution for a factor of safety of 1.3 because there were excessive deflections in the sheet piling. The sheet pile tip was a given so it had to remain at EL -34.5 so in order to incorporate a factor of safety into the analysis the soil shear strength parameters were divided by 1.3. By reducing the strength of the soil it could no longer prevent the sheet pile from deflecting excessively and the program would not complete the run.

CHAPTER 4: Instrumentation Program Results

4.1 Napoleon Avenue Site Instrumentation

At the Napoleon Avenue Site, four of the struts, two upper and two lower, were instrumented as a part of the instrumentation program. Each strut was instrumented with two vibrating wire strain gauges, one on each side to prevent misleading readings from struts that were not loaded axially. Figure 4.1 shows the layout of the strain gauges. Strain gauges NAP-SG-1 and NAP-SG-2 were on the upper northernmost strut of the test section. Strain gauges NAP-SG-3 and NAP-SG-4 were on the lower northernmost strut of the test section. Strain gauges NAP-SG-5 and NAP-SG-6 were on the upper southernmost strut of the test section. Strain gauges NAP-SG-7 and NAP-SG-8 were on the lower southernmost strut of the test section.

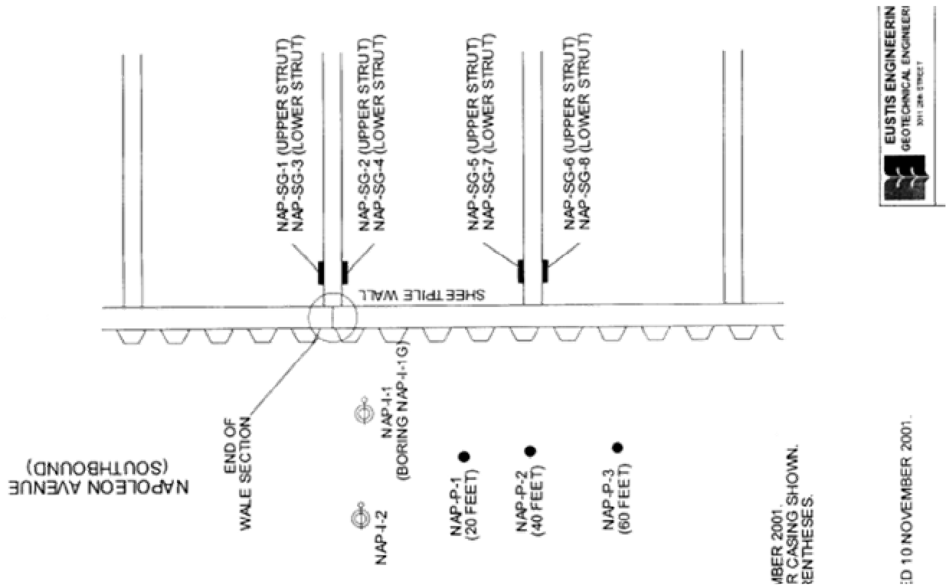


Figure 4.1 Strain Gauge Layout at Napoleon Avenue Site

Table 4.1 shows the strut loads calculated from the strain gauge readings that were taken throughout the entire duration of the instrumentation program. The strut loads that were calculated from the strain gauge readings were highly variable, especially in the northernmost struts. Strain gauge NAP-SG-5 was damaged around 7 February 2002 and was no longer readable. Because the calculated strut loads varied on each side of the same strut it was assumed that there was a slight bend in the strut or that the strut was not axially loaded and an average of the two loads was used to estimate the axial strut load. These average loads were the loads that were compared to the theoretical strut loads.

Table 4.1 Napoleon Avenue Site Strut Loads Calculated from Strain Gauge Readings.

	Strut Load in Kips					
	1/24/2002	**1/27/2002**	**2/7/2002**	**2/11/2002**	**2/27/2002**	**3/23/2002**
NAP-SG-1	422	430	450	445	430	585
NAP-SG-2	1191	1204	1232	1229	1430	
NAP-SG-3			128	20		
NAP-SG-4			174	135		
NAP-SG-5		20	65			
NAP-SG-6		29	139	135	98	319
NAP-SG-7			127	134		
NAP-SG-8			94	97		

The dates that are of interest for this thesis are 27 January 2002, 7 February 2002, and 11 February 2002. During these dates, two critical stages of construction that were of importance for this thesis had occurred. January 27, 2002 was the stage where the deepest cut was made with only the top strut in place and February 7, 2002 and February 11, 2002 was the final stage of the excavation with both the upper and lower strut in place. The stage where the deepest cut was made with only the top strut in place was of concern because this was assumed to be the stage where the top strut would carry its highest load. Table 4.2 and Table 4.3 show the average loads that were used for each strut for the two different stages of the excavation.

Table 4.2 Average Strut Loads at Napoleon Avenue Site with Only Top Strut in Place.

	Strut Load (kips)
Northernmost Top Strut	817
Southernmost Top Strut	25

Table 4.3 Average Strut Loads at Napoleon Avenue Site for Final Excavation

	2/7/2002	2/11/2002
	Strut Load (kips)	**Strut load (kips)**
Northernmost Top Strut	841	837
Southernmost Top Strut	102	135
Northernmost Bottom Strut	151	135
Southernmost Bottom Strut	111	116

The instrumentation program at the Napoleon Avenue site produced some unexpected results. First, for the single strut case there was a tremendous load in one of the upper struts and a minimal load in the other upper strut. Two theories that were considered to explain this occurrence are alignment of the sheet pile wall and installation of the struts. If the alignment of the sheet pile wall is warped then this could cause some struts to carry greater loads than others. Also, the way the struts are installed could have an effect on the load in the strut. The struts are usually hung on the wales and then pieces of steel or wood are wedged in between the wale and strut. If the wood is wedged tight against one of the struts it may induce a load in this strut that is not present in other struts that were not wedged as tight.

Comparing the predicted loads in the top struts based on theoretical calculations to the results of the instrumentation program shows a discrepancy between the two values. The observed values in one of the struts was higher than the predicted values while the values in the other strut were lower than the predicted values. This discrepancy is due to the fact that the theoretical calculations cannot take into account the installation procedures or alignment of the wall. The theories assume that the wall is straight and that the strut is in place and the system is turned on. In actuality the wall is probably warped to some extent and the struts may be prestressed due to the installation procedure. Also, at the Napoleon Avenue Site the sheet piles were driven then the material was excavated to a depth of 9.5 feet before the first strut was installed. Holding back a cut of 9.5 feet will cause the sheet piles to deflect which is not accounted for in the theoretical calculations.

Another unexpected result was that the top strut was not unloaded when a second strut was installed. According to the theoretical approaches, the load in the top strut would be relieved when a second strut was added since the second strut would now be taking some of the load. This was not the case in the test section. The increase in load in the southernmost top strut when the lower strut was added may also be due to the installation procedure. If the top strut was loosely fitted when it was installed this would explain the low load for the single strut case. Then when the excavation is deepened to add a second strut the wall has deflected enough to transfer more load to the top strut.

4.2 Hollygrove Site Instrumentation

At the Hollygrove Site, two of the struts were instrumented as a part of the instrumentation program. Each strut was instrumented with two vibrating wire strain gauges, one on each side to prevent misleading readings from struts that were not loaded axially. Figure 4.2 shows the layout of the strain gauges. Strain gauges HOL-SG-1 and HOL-SG-2 were on the westernmost strut of the test section. Strain gauges HOL-SG-3 and HOL-SG-4 were on the strut 36-feet east of the first instrumented strut.

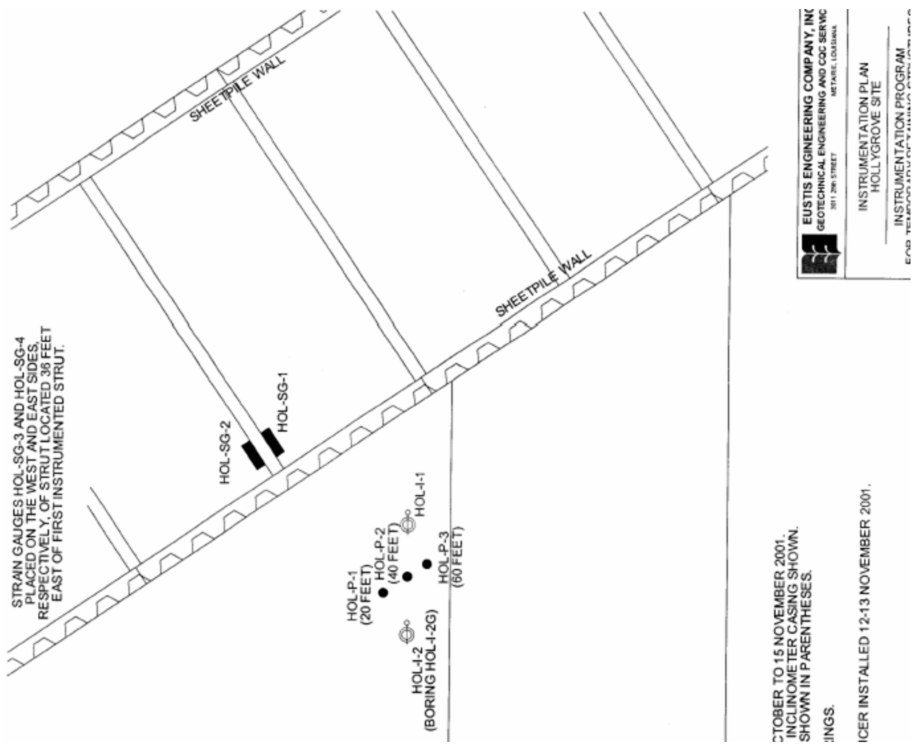


Figure 4.2 Strain Gauge Layout at Hollygrove Site

Table 4.4 shows the strut loads that were calculated from the strain gauge readings that were taken at the Hollygrove Site throughout the entire duration of the instrumentation program. Strain gauge HOL-SG-2 was irreparably damaged around 6

February 2002 and was no longer readable. Because the calculated strut loads varied on each side of the same strut it was assumed that there was a slight bend in the strut or that the strut was not axially loaded and an average of the two loads was used to estimate the axial strut load. These average loads were the loads that were compared to the theoretical strut loads.

Table 4.4 Hollygrove Site Strut Loads Calculated from Strain Gauge Readings.

	Strut Load in Kips			
	2/2/2002	**2/6/2002**	**2/21/2002**	**3/4/2002**
HOL-SG-1	32	69	78	310
HOL-SG-2	38	50		
HOL-SG-3	277	248	205	246
HOL-SG-4	94	74	68	111

The dates that are of interest for this thesis are 21 February 2002 and 4 March 2002. These dates coincided with the final stage of the excavation where the deepest cut was made with the top strut in place. Table 4.5 shows the average loads that were used for each strut for the final stage of the excavation.

Table 4.5 Average Strut Loads at Hollygrove Site for Final Excavation

	2/21/2002	3/4/2002
	Strut Load (kips)	**Strut Load (kips)**
Westernmost Strut	78	310
Easternmost Strut	137	179

Although there was some variation in the loads between the struts the results from the instrumentation program follow the predicted results from the theoretical methods. The increase in load in the westernmost strut between the 21 February 2002 and 4 March 2002 could be due to rising groundwater elevation caused by rain events or there may have been some type of equipment or other surcharge load in the vicinity of the westernmost strut.

Since there was only a single strut at this test site, a decision was made to average all of the strut loads in order to account for unequal loadings due to warped alignment of the wall and different stresses which may have been induced in the struts due to the installation procedures. The loads in Table 4.5 result in an average load of 176 kips. This average observed load follows what is expected from the theoretical loads. The predicted loads based on Coulomb and Terzaghi are slightly higher than the observed load which is expected. The predicted load based on soil-structure interaction is comparable to the observed load. The slight difference in the soil-structure interaction load as compared to the observed load could be due to the fact that the values input into the soil-structure interaction model are based on visual classification of the soil and strength parameters of the soil which may have some error disturbance in them.

CHAPTER 5: Conclusions and Recommendations

5.1 Summary

This thesis presents analyses of the results of a geotechnical instrumentation program performed by Eustis Engineering Company for the U.S. Army Corps of Engineers (USACE) during the construction of two covered canals in New Orleans, Louisiana. Information provided by Eustis Engineering Company to the USACE is presented describing the existing soil conditions, the construction schedule, the geotechnical testing apparatus and instrumentation, and the data produced from the geotechnical instrumentation program. Several theoretical approaches including Coulomb pressures diagrams, Terzaghi pressure diagrams, and soil-structure interaction were examined and used to predict the strut loads at the two construction sites. The results of the theoretical strut load prediction methods are presented and compared with the results of the geotechnical instrumentation program data.

5.2 Results of Analysis of Strut Loads

The objectives established for this thesis in Chapter 1 were to:

- Utilize various design methods to estimate the magnitudes of loads applied to the struts of the cofferdam systems.

- Utilize the data obtained from the geotechnical instrumentation program to determine the applicability of the various design methods for estimating the strut loads in the cofferdam systems.
- Make recommendations based on the results of the instrumentation program.

Calculations were performed using several theoretical methods, including Coulomb pressures diagrams, Terzaghi pressure diagrams, and soil-structure interaction to the predict strut loads for the critical stages of the excavations at each test site. The results of these analyses are presented in this thesis.

These analyses were effective in predicting the loads in the struts for the excavations at the two test sites. At the Hollygrove Site, the struts were predicted to have a load of approximately 141 to 203 kips for a factor of safety of 1.0 and a load of approximately 316 to 360 kips for a factor of safety of 1.3. At the Napoleon Avenue Site, when there was only one row of struts installed, the struts were predicted to carry a load of approximately 36 to 134 kips for a factor of safety of 1.0 and a load of approximately 174 to199 kips for a factor of safety of 1.3. When a second row of struts was installed at the Napoleon Avenue Site, the load in the upper strut was approximately –111 to 48 kips for a factor of safety of 1.0 and –294 to 48 for a factor of safety of 1.3. The load in the lower strut was approximately 318 to 662 for a factor of safety of 1.0 and 471 to 1051 for a factor of safety of 1.3.

Analysis of the data obtained from the strain gauges installed on the struts allowed for an evaluation of the applicability of the various design methods considered. As noted in Chapter 4, the average observed load at the Hollygrove Site was less than the predicted load due to the Coulomb and Terzaghi methods and comparable to the soil-structure interaction method. On the other hand, the loads observed at the Napoleon Avenue Site were greater than the predicted loads for the top strut and less than the predicted loads for the lower strut. Also, the observed loads in the top strut did not decrease when the second row of struts was added which was contradictory to the theoretical methods.

5.3 Conclusions

Based on the results of this thesis, the need for a factor of safety combined with conservative methodologies is warranted in the design of braced excavations. There are numerous factors such as the alignment of the sheet pile wall, the installation of the struts, and the determination of soil properties that the designer has no control over in the design of the sheet pile walls. In order to account for these, the designer must apply a factor of safety to the design. If one of the struts were to fail the load would be transferred to the adjacent strut which may cause it to fail. This could continue to happen and essentially unzip the excavation. This could cause major damage to adjacent structures and many workers could be killed.

After evaluating the test data it was decided that this test program may not have been the best way to approach the problem. We had no control over the construction process so we could not remove the influence of the construction process. The Hollygrove Site results were closer to what was expected because a strut was installed before any major excavation had taken place. This prevented the sheet pile from deflecting and we knew what the length of the struts would be. At the Napoleon Avenue Site 9.5 feet of soil was excavated before the first strut was in place. This would have caused deflections in the sheet piling and some of the struts may have been forced in while others may have fit loosely. This would have caused the discrepancies in the strut readings at the same elevation.

5.4 Recommendations

In order to account for the factors mentioned in section 5.3, a factor of safety and the conservative methodologies should continue to be used in the design of sheet pile walls. There was not enough evidence provided in this study to stray from this and there was a lot of evidence to stick with it.

In future test sections, I believe that it may be useful to install more inclinometers along the excavation at the instrumented strut locations in order to determine if the sheet piling is deflecting differently at each instrumented strut. This may provide information as to why the struts at the same elevation are showing different loads. Also, the inclinometers should be attached to the sheet piling to show the deflections in the sheet piling not the retained soil. There could be a significant difference between the deflection in the soil and the sheet pile. It would also be useful to note if there is any equipment or other loads that may be present near the strut when the readings are taken. This can be used to account for spikes in the strut loads. It would also be beneficial to install strain gauges on the sheet piling to see how much of the soil load is being taken up by the sheet piling. Finally, it would be useful to install pressure gauges at different depths along the sheet piling so that it can be determined what theoretical pressure diagrams if any are the closet approximation to the actual pressures that the sheet piling feels.

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Appendix

This appendix presents the theoretical analyses that were performed in order to predict the strut loads at the two test sites.

The pressure diagrams for the Coulomb and Terzaghi analyses were created in MS Excel using the following formulas:

Coulomb Analysis

$$\text{Right Side Active Pressure} = \gamma h K_a - 2c\sqrt{K_a}$$

$$\text{where } K_a = \frac{\cos^2\phi}{\cos\delta\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\cos\delta\cos\beta}}\right]^2}$$

$$\text{Left Side Passive Pressure} = \gamma h K_p + 2c\sqrt{Kp}$$

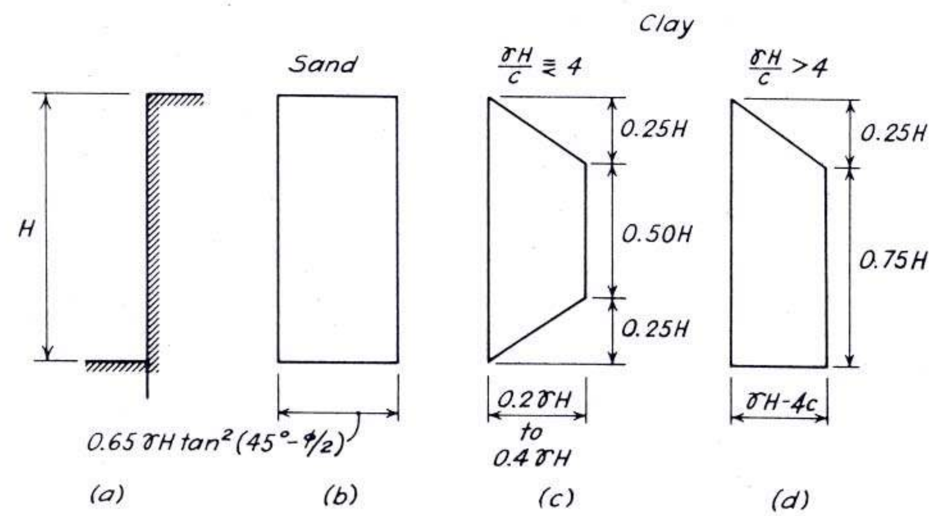
$$\text{where } K_p = \frac{\cos^2\phi}{\cos\delta\left[1-\sqrt{\frac{\sin(\phi+\delta)\sin(\phi+\beta)}{\cos\delta\cos\beta}}\right]^2}$$

Net Water Pressure = Right side water pressure – left side water pressure

Net Pressure = Right Side Active – Left Side Passive + Net Water

Terzaghi Analysis

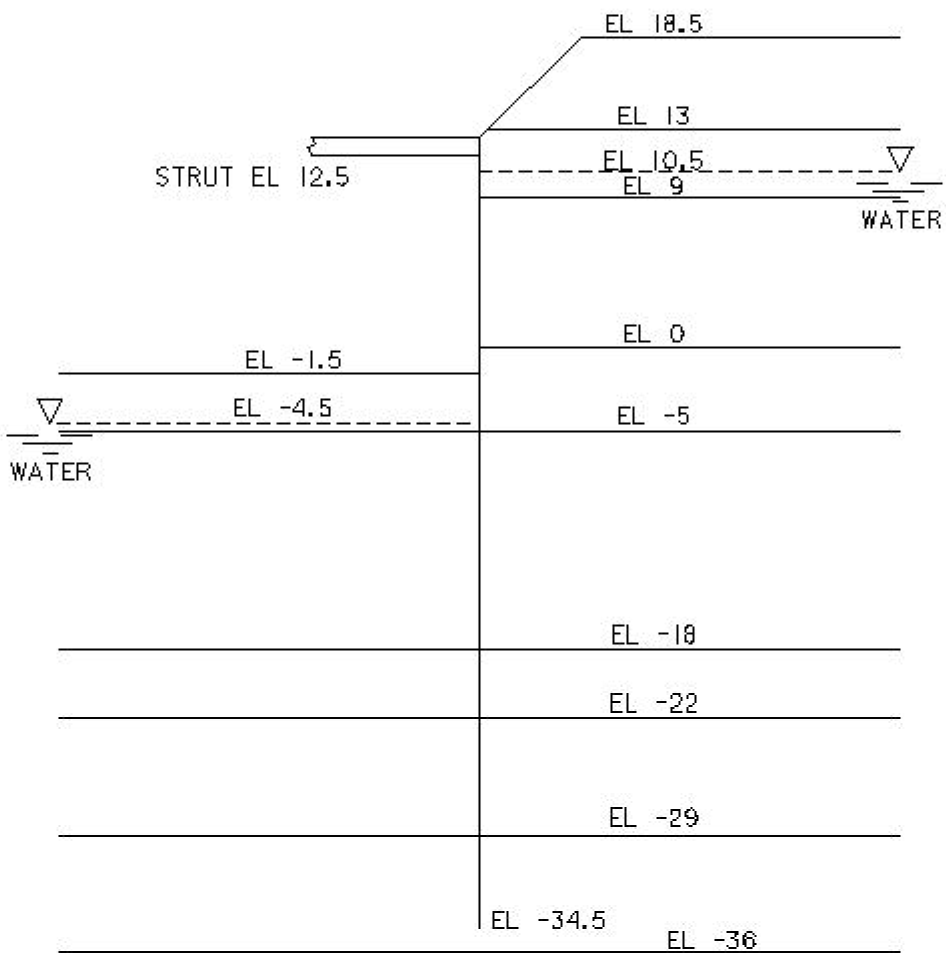
The Terzaghi pressure diagrams were calculated using the following method. For the Terzaghi analysis, the net pressure diagram based on Terzaghi pressures was applied above the cut line of the excavation and the net pressure diagram based on the Coulomb pressure diagram was applied below the cut line.



In order to solve for the strut load at the Hollygrove Site, the sum of the moments, due to the net pressure diagram, around the sheet pile tip (EL -34.5), were set equal to zero.

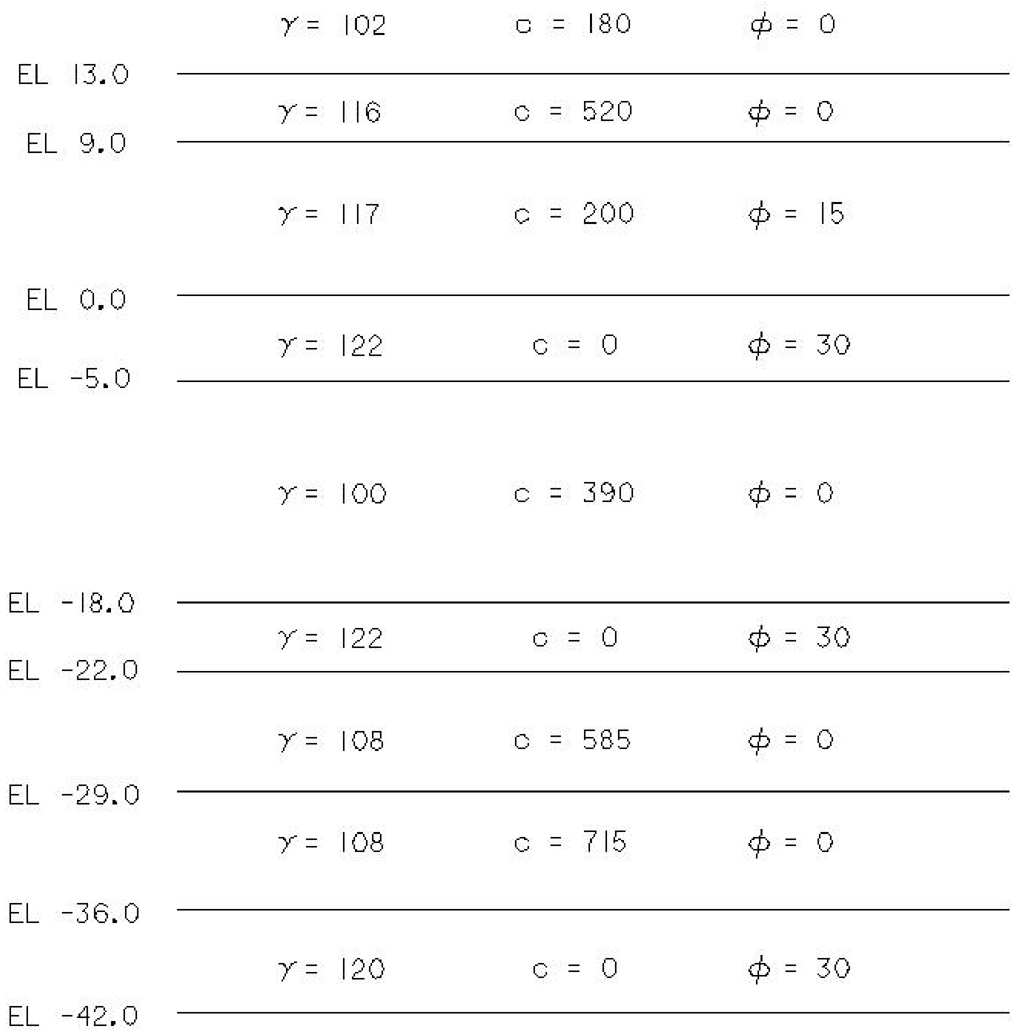
In order to solve for the single strut load at the Napoleon Avenue Site, the sum of the moments, due to the net pressure diagram, around the sheet pile tip (EL -39.5), were set equal to zero.

In order to solve for the final excavation case at the Napoleon Avenue Site, the upper strut was assumed to take the net pressure from the top of the wall to midway between the strut elevations. Then the sum of the moments, due to the net pressure diagram, around the sheet pile tip (EL -39.5), were set equal to zero to solve for the bottom strut.



HOLLYGROVE SITE

.



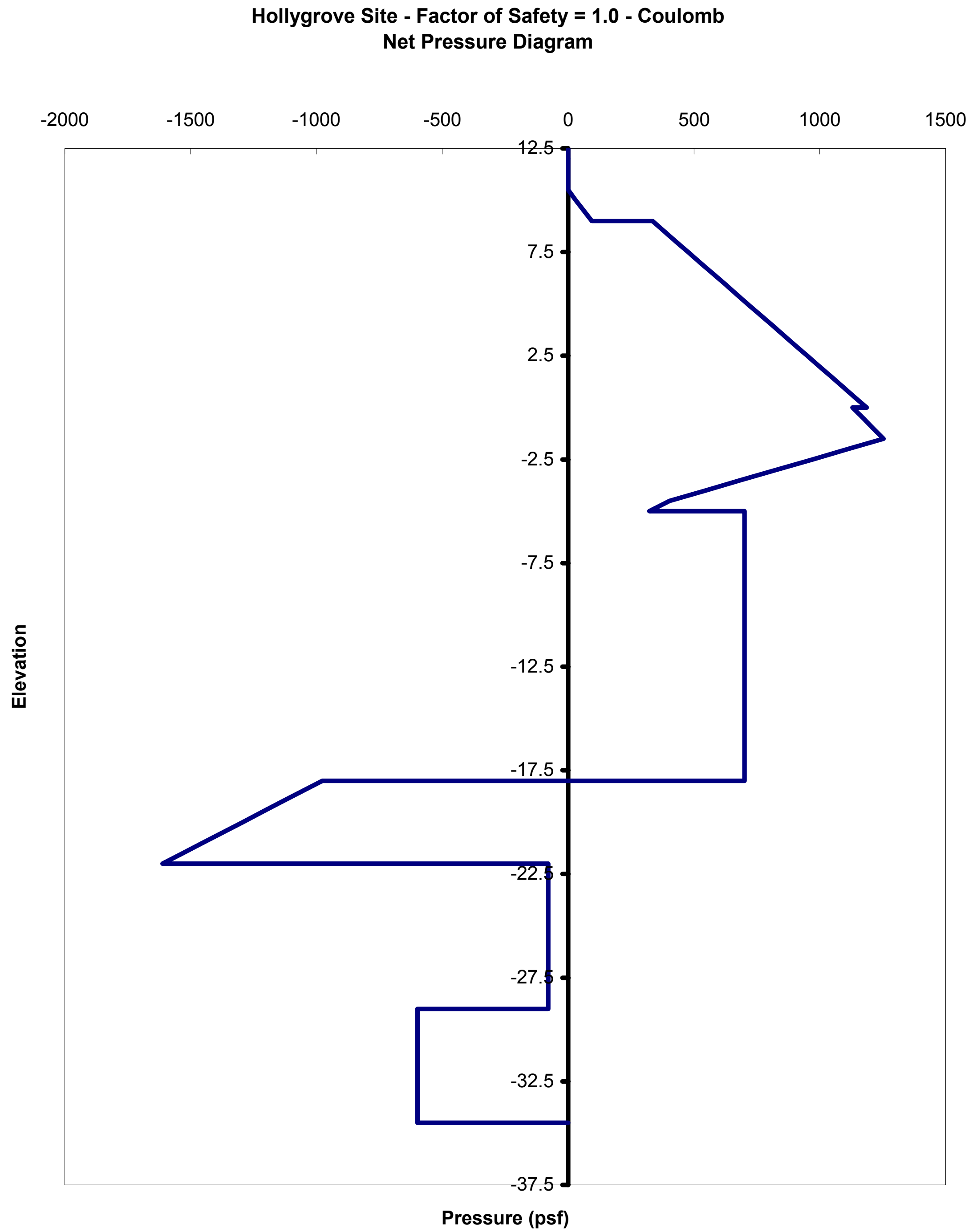
HOLLYGROVE SITE SOIL PROPERTIES

Hollygrove Site - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
12.5	-421.00	0.00	0.00	0.00
12.0	-363.00	0.00	0.00	0.00
11.5	-305.00	0.00	0.00	0.00
11.0	-247.00	0.00	0.00	0.00
10.5	-189.00	0.00	0.00	0.00
10.0	-162.25	0.00	31.25	31.25
9.5	-135.50	0.00	62.50	62.50
9.0	-108.75	0.00	93.75	93.75
9.0	241.38	0.00	93.75	335.13
8.5	257.43	0.00	125.00	382.43
8.0	273.47	0.00	156.25	429.72
7.5	289.51	0.00	187.50	477.01
7.0	305.56	0.00	218.75	524.31
6.5	321.60	0.00	250.00	571.60
6.0	337.65	0.00	281.25	618.90
5.5	353.69	0.00	312.50	666.19
5.0	369.74	0.00	343.75	713.49
4.5	385.78	0.00	375.00	760.78
4.0	401.83	0.00	406.25	808.08
3.5	417.87	0.00	437.50	855.37
3.0	433.92	0.00	468.75	902.67
2.5	449.96	0.00	500.00	949.96
2.0	466.00	0.00	531.25	997.25
1.5	482.05	0.00	562.50	1044.55
1.0	498.09	0.00	593.75	1091.84
0.5	514.14	0.00	625.00	1139.14
0.0	530.18	0.00	656.25	1186.43
0.0	473.92	0.00	656.25	1130.17
-0.5	483.83	0.00	687.50	1171.33
-1.0	493.75	0.00	718.75	1212.50
-1.5	503.67	0.00	750.00	1253.67
-1.5	503.67	0.00	750.00	1253.67
-2.0	513.58	183.00	781.25	1111.83
-2.5	523.50	366.00	812.50	970.00
-3.0	533.42	549.00	843.75	828.17
-3.5	543.33	732.00	875.00	686.33
-4.0	553.25	915.00	906.25	544.50
-4.5	563.17	1098.00	937.50	402.67
-5.0	573.08	1187.25	937.50	323.33
-5.0	939.25	1175.75	937.50	701.00
-5.5	958.00	1194.50	937.50	701.00
-6.0	976.75	1213.25	937.50	701.00

Hollygrove Site - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-6.5	995.50	1232.00	937.50	701.00
-7.0	1014.25	1250.75	937.50	701.00
-7.5	1033.00	1269.50	937.50	701.00
-8.0	1051.75	1288.25	937.50	701.00
-8.5	1070.50	1307.00	937.50	701.00
-9.0	1089.25	1325.75	937.50	701.00
-9.5	1108.00	1344.50	937.50	701.00
-10.0	1126.75	1363.25	937.50	701.00
-10.5	1145.50	1382.00	937.50	701.00
-11.0	1164.25	1400.75	937.50	701.00
-11.5	1183.00	1419.50	937.50	701.00
-12.0	1201.75	1438.25	937.50	701.00
-12.5	1220.50	1457.00	937.50	701.00
-13.0	1239.25	1475.75	937.50	701.00
-13.5	1258.00	1494.50	937.50	701.00
-14.0	1276.75	1513.25	937.50	701.00
-14.5	1295.50	1532.00	937.50	701.00
-15.0	1314.25	1550.75	937.50	701.00
-15.5	1333.00	1569.50	937.50	701.00
-16.0	1351.75	1588.25	937.50	701.00
-16.5	1370.50	1607.00	937.50	701.00
-17.0	1389.25	1625.75	937.50	701.00
-17.5	1408.00	1644.50	937.50	701.00
-18.0	1426.75	1663.25	937.50	701.00
-18.0	735.58	2649.75	937.50	-976.67
-18.5	745.50	2739.00	937.50	-1056.00
-19.0	755.42	2828.25	937.50	-1135.33
-19.5	765.33	2917.50	937.50	-1214.67
-20.0	775.25	3006.75	937.50	-1294.00
-20.5	785.17	3096.00	937.50	-1373.33
-21.0	795.08	3185.25	937.50	-1452.67
-21.5	805.00	3274.50	937.50	-1532.00
-22.0	814.92	3363.75	937.50	-1611.33
-22.0	1274.75	2291.25	937.50	-79.00
-22.5	1297.50	2314.00	937.50	-79.00
-23.0	1320.25	2336.75	937.50	-79.00
-23.5	1343.00	2359.50	937.50	-79.00
-24.0	1365.75	2382.25	937.50	-79.00
-24.5	1388.50	2405.00	937.50	-79.00
-25.0	1411.25	2427.75	937.50	-79.00
-25.5	1434.00	2450.50	937.50	-79.00
-26.0	1456.75	2473.25	937.50	-79.00
-26.5	1479.50	2496.00	937.50	-79.00
-27.0	1502.25	2518.75	937.50	-79.00

Hollygrove Site - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-27.5	1525.00	2541.50	937.50	-79.00
-28.0	1547.75	2564.25	937.50	-79.00
-28.5	1570.50	2587.00	937.50	-79.00
-29.0	1593.25	2609.75	937.50	-79.00
-29.0	1333.25	2869.75	937.50	-599.00
-29.5	1356.00	2892.50	937.50	-599.00
-30.0	1378.75	2915.25	937.50	-599.00
-30.5	1401.50	2938.00	937.50	-599.00
-31.0	1424.25	2960.75	937.50	-599.00
-31.5	1447.00	2983.50	937.50	-599.00
-32.0	1469.75	3006.25	937.50	-599.00
-32.5	1492.50	3029.00	937.50	-599.00
-33.0	1515.25	3051.75	937.50	-599.00
-33.5	1538.00	3074.50	937.50	-599.00
-34.0	1560.75	3097.25	937.50	-599.00
-34.5	1583.50	3120.00	937.50	-599.00

Summing the moments around the sheet pile tip (EL -34.5) gave a strut load of 203 kips for the Coulomb case with a 1.0 factor of safety.


Hollygrove Site - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-2000
-1500
-1000
-500
0
500
1000
1500
12.5
7.5
2.5
-2.5
-7.5
-12.5
-17.5
-22.5
-27.5
-32.5
-37.5
Elevation
Pressure (psf)

Hollygrove Site - Factor of Safety = 1.0 - Terzaghi					
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive	Water Pressure	Net Pressure
12.5	604.00			0.00	604.00
12.0	604.00			0.00	604.00
11.5	604.00			0.00	604.00
11.0	604.00			0.00	604.00
10.5	604.00			0.00	604.00
10.0	604.00			31.25	635.25
9.5	604.00			62.50	666.50
9.0	604.00			93.75	697.75
9.0	604.00			93.75	697.75
8.5	604.00			125.00	729.00
8.0	604.00			156.25	760.25
7.5	604.00			187.50	791.50
7.0	604.00			218.75	822.75
6.5	604.00			250.00	854.00
6.0	604.00			281.25	885.25
5.5	604.00			312.50	916.50
5.0	604.00			343.75	947.75
4.5	604.00			375.00	979.00
4.0	604.00			406.25	1010.25
3.5	604.00			437.50	1041.50
3.0	543.60			468.75	1012.35
2.5	483.20			500.00	983.20
2.0	422.80			531.25	954.05
1.5	362.40			562.50	924.90
1.0	302.00			593.75	895.75
0.5	241.60			625.00	866.60
0.0	181.20			656.25	837.45
0.0	181.20			656.25	837.45
-0.5	120.80			687.50	808.30
-1.0	60.40			718.75	779.15
-1.5	0.00		0.00	750.00	750.00
-1.5		503.67	0.00	750.00	1253.67
-2.0		513.58	183.00	781.25	1111.83
-2.5		523.50	366.00	812.50	970.00
-3.0		533.42	549.00	843.75	828.17
-3.5		543.33	732.00	875.00	686.33
-4.0		553.25	915.00	906.25	544.50
-4.5		563.17	1098.00	937.50	402.67
-5.0		573.08	1187.25	937.50	323.33
-5.0		939.25	1175.75	937.50	701.00
-5.5		958.00	1194.50	937.50	701.00
-6.0		976.75	1213.25	937.50	701.00
-6.5		995.50	1232.00	937.50	701.00

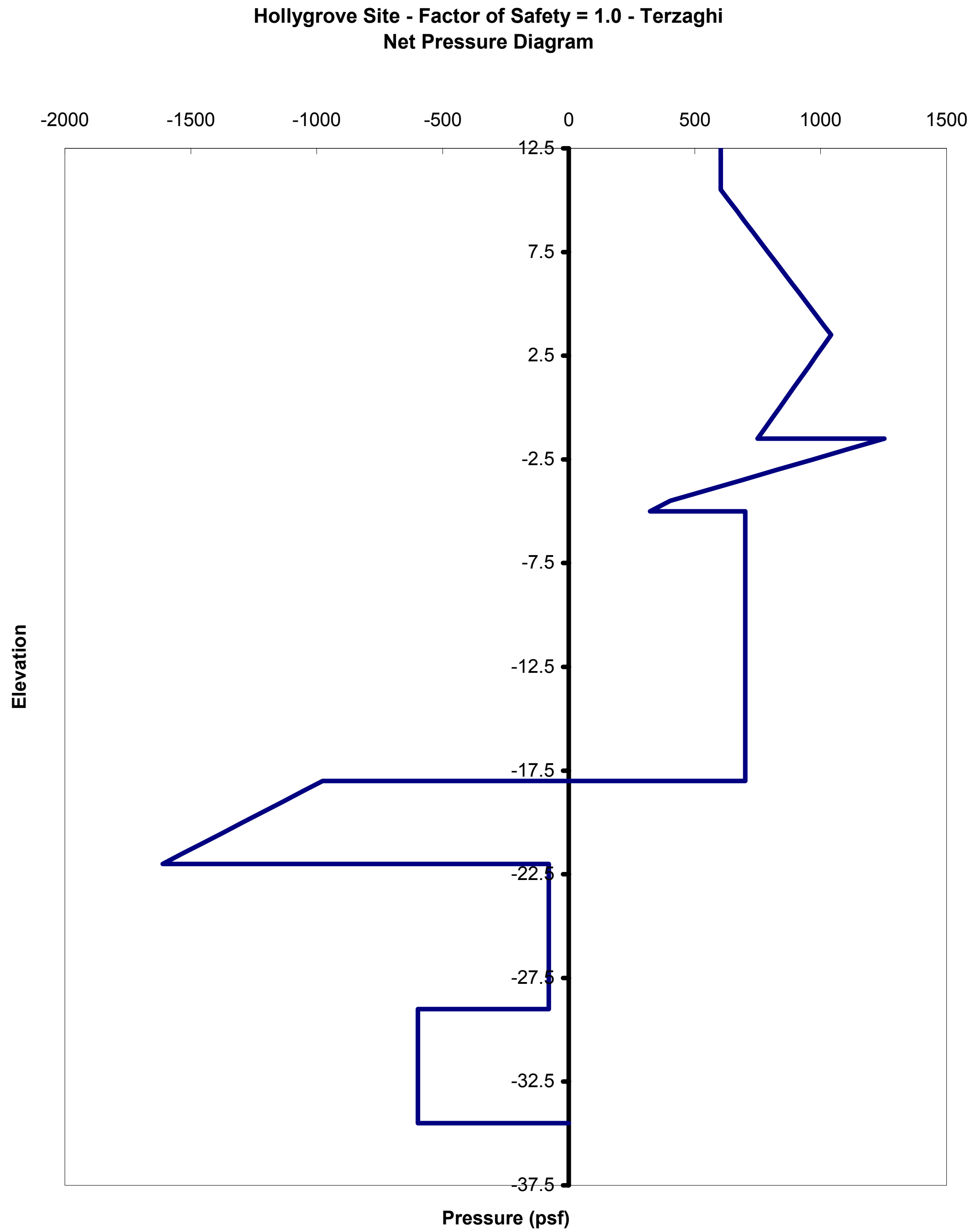
Hollygrove Site - Factor of Safety = 1.0 - Terzaghi

Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive	Water Pressure	Net Pressure
-7.0		1014.25	1250.75	937.50	701.00
-7.5		1033.00	1269.50	937.50	701.00
-8.0		1051.75	1288.25	937.50	701.00
-8.5		1070.50	1307.00	937.50	701.00
-9.0		1089.25	1325.75	937.50	701.00
-9.5		1108.00	1344.50	937.50	701.00
-10.0		1126.75	1363.25	937.50	701.00
-10.5		1145.50	1382.00	937.50	701.00
-11.0		1164.25	1400.75	937.50	701.00
-11.5		1183.00	1419.50	937.50	701.00
-12.0		1201.75	1438.25	937.50	701.00
-12.5		1220.50	1457.00	937.50	701.00
-13.0		1239.25	1475.75	937.50	701.00
-13.5		1258.00	1494.50	937.50	701.00
-14.0		1276.75	1513.25	937.50	701.00
-14.5		1295.50	1532.00	937.50	701.00
-15.0		1314.25	1550.75	937.50	701.00
-15.5		1333.00	1569.50	937.50	701.00
-16.0		1351.75	1588.25	937.50	701.00
-16.5		1370.50	1607.00	937.50	701.00
-17.0		1389.25	1625.75	937.50	701.00
-17.5		1408.00	1644.50	937.50	701.00
-18.0		1426.75	1663.25	937.50	701.00
-18.0		735.58	2649.75	937.50	-976.67
-18.5		745.50	2739.00	937.50	-1056.00
-19.0		755.42	2828.25	937.50	-1135.33
-19.5		765.33	2917.50	937.50	-1214.67
-20.0		775.25	3006.75	937.50	-1294.00
-20.5		785.17	3096.00	937.50	-1373.33
-21.0		795.08	3185.25	937.50	-1452.67
-21.5		805.00	3274.50	937.50	-1532.00
-22.0		814.92	3363.75	937.50	-1611.33
-22.0		1274.75	2291.25	937.50	-79.00
-22.5		1297.50	2314.00	937.50	-79.00
-23.0		1320.25	2336.75	937.50	-79.00
-23.5		1343.00	2359.50	937.50	-79.00
-24.0		1365.75	2382.25	937.50	-79.00
-24.5		1388.50	2405.00	937.50	-79.00
-25.0		1411.25	2427.75	937.50	-79.00
-25.5		1434.00	2450.50	937.50	-79.00
-26.0		1456.75	2473.25	937.50	-79.00
-26.5		1479.50	2496.00	937.50	-79.00
-27.0		1502.25	2518.75	937.50	-79.00
-27.5		1525.00	2541.50	937.50	-79.00
-28.0		1547.75	2564.25	937.50	-79.00

Hollygrove Site - Factor of Safety = 1.0 - Terzaghi

Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive	Water Pressure	Net Pressure
-28.5		1570.50	2587.00	937.50	-79.00
-29.0		1593.25	2609.75	937.50	-79.00
-29.0		1333.25	2869.75	937.50	-599.00
-29.5		1356.00	2892.50	937.50	-599.00
-30.0		1378.75	2915.25	937.50	-599.00
-30.5		1401.50	2938.00	937.50	-599.00
-31.0		1424.25	2960.75	937.50	-599.00
-31.5		1447.00	2983.50	937.50	-599.00
-32.0		1469.75	3006.25	937.50	-599.00
-32.5		1492.50	3029.00	937.50	-599.00
-33.0		1515.25	3051.75	937.50	-599.00
-33.5		1538.00	3074.50	937.50	-599.00
-34.0		1560.75	3097.25	937.50	-599.00
-34.5		1583.50	3120.00	937.50	-599.00

Summing the moments around the sheet pile tip (EL -34.5) gave a strut load of 252 kips for the Terzaghi case with a 1.0 factor of safety.


Hollygrove Site - Factor of Safety = 1.0 - Terzaghi
Net Pressure Diagram
-2000
-1500
-1000
-500
0
500
1000
1500
12.5
7.5
2.5
-2.5
-7.5
-12.5
-17.5
-22.5
-27.5
-32.5
-37.5
Elevation
Pressure (psf)

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:21:58

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

I.--HEADING
'HOLLYGROVE SINGLE STRUT CASE
'FS=1.0

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICITY (PSI)	MOMENT OF INERTIA (IN^4)	CROSS SECTION AREA (SQIN)
12.50	2.900E+07	416.12	9.53

ELEVATION AT BOTTOM OF WALL = -34.50

III.--ANCHOR DATA

ELEV. AT WALL (FT)	ANCHOR TYPE	ULTIMATE TENSION FORCE (LB)	ULTIMATE COMPR. FORCE (LB)	ANCHOR STIFF. (LB/IN)	ANCHOR SLOPE (FT)
12.5	FLEXIBLE	3.380E+5	3.380E+5	5.633E+6	0.000

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	12.50
100.00	12.50

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	-1.50
100.00	-1.50

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

<UNIT WEIGHT>		INT.	COH-	WALL	ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICT.	ESION	FRICT.	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
116.0	116.0	0.0	520.0	0.0	0.0	347.0	347.0	9.0	0.0
117.0	117.0	15.0	200.0	0.0	0.0	321.0	321.0	0.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-4.5	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-5.0	0.0
100.0	100.0	0.0	390.0	0.0	0.0	260.0	260.0	-18.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-22.0	0.0
108.0	108.0	0.0	585.0	0.0	0.0	390.0	390.0	-29.0	0.0
108.0	108.0	0.0	715.0	0.0	0.0	477.0	477.0		

V.B.--LEFTSIDE

<UNIT WEIGHT>		INT.	COH-	WALL	ADH-	<STIFF. COEF.>		<--BOTTOM-->	
SAT.	MOIST	FRICT.	ESION	FRICT.	ESION	ACT.	PASS.	ELEV.	SLOPE
(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)

122.0	122.0	30.0	0.0	0.0	0.0	9.3	9.3	-4.5	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-5.0	0.0
100.0	100.0	0.0	390.0	0.0	0.0	260.0	260.0	-18.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-22.0	0.0
108.0	108.0	0.0	585.0	0.0	0.0	390.0	390.0	-29.0	0.0
108.0	108.0	0.0	715.0	0.0	0.0	477.0	477.0		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 10.50 (FT)
LEFTSIDE ELEVATION = -4.50 (FT)
NO SEEPAGE

VIII.--VERTICAL SURCHARGE LOADS

VIII.A.--VERTICAL LINE LOADS
NONE

VIII.B.--VERTICAL UNIFORM LOADS

LEFTSIDE (PSF)	RIGHTSIDE (PSF)
0.00	103.17

VIII.C.--VERTICAL STRIP LOADS
NONE

VIII.D.--VERTICAL RAMP LOADS
NONE

VIII.E.--VERTICAL TRIANGULAR LOADS
NONE

VIII.F.--VERTICAL VARIABLE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:22:01

****
* LIMIT PRESSURES *
****

I.--HEADING
'HOLLYGROVE SINGLE STRUT CASE
'FS=1.0
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

	NET WATER	< LEFTSIDE SOIL PRESSURES>			<RIGHTSIDE SOIL PRESSURES>		
ELEV.	PRESS.	PASSIVE	AT-REST	ACTIVE	ACTIVE	AT-REST	PASSIVE

(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
12.50	0.00	0.00	0.00	0.00	0.00	103.17	1143.17
12.00	0.00	0.00	0.00	0.00	0.00	161.17	1201.17
11.50	0.00	0.00	0.00	0.00	0.00	219.17	1259.29
11.00	0.00	0.00	0.00	0.00	0.00	277.17	1317.17
10.50	0.00	0.00	0.00	0.00	0.00	335.17	1367.11
10.00	31.25	0.00	0.00	0.00	0.00	361.92	1405.42
9.50	62.50	0.00	0.00	0.00	0.00	388.67	1407.36
9.00+	93.75	0.00	0.00	0.00	0.00	415.42	1346.16
9.00-	93.75	0.00	0.00	0.00	0.00	307.90	1346.16
8.50	125.00	0.00	0.00	0.00	0.00	328.10	1294.55
8.00	156.25	0.00	0.00	0.00	0.00	348.30	1315.75
7.50	187.50	0.00	0.00	0.00	0.00	368.49	1365.68
7.06+	215.16	0.00	0.00	0.00	0.00	386.37	1411.96
7.06-	215.16	0.00	0.00	0.00	0.00	386.37	1406.65
7.00	218.75	0.00	0.00	0.00	1.84	388.69	1411.96
6.50	250.00	0.00	0.00	0.00	17.89	408.89	1458.24
6.00	281.25	0.00	0.00	0.00	33.93	429.08	1504.53
5.50	312.50	0.00	0.00	0.00	49.98	449.28	1550.81
5.00	343.75	0.00	0.00	0.00	66.02	469.48	1597.09
4.50	375.00	0.00	0.00	0.00	82.07	489.68	1643.37
4.00	406.25	0.00	0.00	0.00	98.11	509.87	1689.65
3.50	437.50	0.00	0.00	0.00	114.15	530.07	1735.93
3.00	468.75	0.00	0.00	0.00	130.20	550.27	1782.21
2.50	500.00	0.00	0.00	0.00	146.24	570.46	1828.49
2.00	531.25	0.00	0.00	0.00	162.29	590.66	1874.78
1.50	562.50	0.00	0.00	0.00	178.33	610.86	1921.06
1.00	593.75	0.00	0.00	0.00	193.22	631.06	1956.89
0.50	625.00	0.00	0.00	0.00	217.50	651.25	2075.29
0.00+	656.25	0.00	0.00	0.00	262.64	671.45	2399.91
0.00-	656.25	0.00	0.00	0.00	262.64	452.96	2399.91
-0.50	687.50	0.00	0.00	0.00	304.81	467.84	2745.34
-1.00	718.75	0.00	0.00	0.00	323.01	482.71	2906.37
-1.50	750.00	0.00	0.00	0.00	331.72	497.59	2985.51
-2.00	781.25	183.00	30.50	20.33	341.64	512.46	3074.76
-2.50	812.50	366.00	61.00	40.67	351.56	527.34	3164.01
-3.00	843.75	549.00	91.50	61.00	361.47	542.21	3253.26
-3.50	875.00	732.37	122.00	81.37	371.39	557.09	3342.51
-4.00	906.25	915.46	152.50	109.70	380.92	571.96	3457.45
-4.50	937.50	1072.75	183.00	70.92	393.31	586.84	3368.49
-4.68+	937.50	1163.32	188.42	0.00	401.05	601.71	3153.76
-4.68-	937.50	1105.73	188.42	0.00	401.05	1203.42	3153.76
-5.00+	937.50	1163.32	197.88	0.00	414.56	1222.17	2778.66
-5.00-	937.50	1163.32	395.75	0.00	414.56	1222.17	2778.66
-5.50	937.50	1195.94	414.50	0.00	440.08	1240.92	2154.69
-6.00	937.50	1213.35	433.25	0.00	461.23	1259.67	1995.78
-6.50	937.50	1232.00	452.00	0.00	479.67	1278.42	2039.67
-7.00	937.50	1250.75	470.75	0.00	498.42	1297.17	2058.42
-7.50	937.50	1269.50	489.50	0.00	517.17	1315.92	2077.17
-8.00	937.50	1288.25	508.25	0.00	535.92	1334.67	2095.92
-8.50	937.50	1307.00	527.00	0.00	554.67	1353.42	2114.67
-9.00	937.50	1325.75	545.75	0.00	573.42	1372.17	2133.42
-9.50	937.50	1344.50	564.50	0.00	592.17	1390.92	2152.17
-10.00	937.50	1363.25	583.25	0.00	610.92	1409.67	2170.92
-10.50	937.50	1382.00	602.00	0.00	629.67	1428.42	2189.67
-11.00	937.50	1400.75	620.75	0.00	648.42	1447.17	2208.42
-11.50	937.50	1419.50	639.50	0.00	667.17	1465.92	2227.17
-12.00	937.50	1438.25	658.25	0.00	685.92	1484.67	2245.92
-12.50	937.50	1457.00	677.00	0.00	704.67	1503.42	2264.67
-13.00	937.50	1475.75	695.75	0.00	723.42	1522.17	2283.42
-13.50	937.50	1494.50	714.50	0.00	742.17	1540.92	2302.17
-14.00	937.50	1513.25	733.25	0.00	760.92	1559.67	2320.92

-14.50	937.50	1532.00	752.00	0.00	779.67	1578.42	2339.67
-15.00	937.50	1550.75	770.75	0.00	798.42	1597.17	2358.42
-15.25+	937.50	1569.50	780.00	0.00	807.67	1615.92	2367.67
-15.25-	937.50	1560.00	780.00	0.00	807.67	1615.92	2367.67
-15.50	937.50	1569.50	789.50	9.50	817.17	1634.67	2377.17
-16.00	937.50	1588.25	808.25	28.25	835.92	1653.42	2395.92
-16.50	937.50	1607.00	827.00	47.00	854.67	1672.17	2414.67
-17.00+	937.50	1610.06	845.75	62.80	878.88	1690.92	2392.49
-17.00-	937.50	1610.06	845.75	62.80	878.88	845.46	2392.49
-17.50	937.50	1736.98	864.50	102.42	859.61	860.34	2696.09
-18.00+	937.50	2174.68	883.25	196.56	735.00	875.21	3790.02
-18.00-	937.50	2174.68	441.63	196.56	735.00	875.21	3790.02
-18.50	937.50	2646.52	456.50	286.41	606.11	890.09	4918.09
-19.00	937.50	2843.39	471.38	317.27	578.08	904.96	5291.64
-19.50	937.50	2917.50	486.25	324.17	593.39	919.84	5340.51
-20.00	937.50	3006.75	501.13	334.08	603.31	934.71	5429.76
-20.50	937.50	3096.00	516.00	344.00	613.22	949.59	5519.01
-21.00+	937.50	3202.27	530.88	360.47	621.28	964.46	5650.52
-21.00-	937.50	3202.27	530.88	360.47	621.28	1928.92	5650.52
-21.50	937.50	3173.95	545.75	324.22	643.93	1951.67	5445.53
-22.00+	937.50	2810.36	560.63	165.81	704.26	1974.42	4425.70
-22.00-	937.50	2810.36	1121.25	165.81	704.26	1974.42	4425.70
-22.50	937.50	2414.55	1144.00	13.61	770.80	1997.17	3373.66
-22.79+	937.50	2320.25	1157.17	0.00	791.28	2019.92	3216.80
-22.79-	937.50	2359.96	1157.17	0.00	791.28	2019.92	3216.80
-23.00	937.50	2320.25	1166.75	0.00	806.18	2042.67	3102.68
-23.17+	937.50	2359.50	1174.41	0.00	813.25	2065.42	3124.40
-23.17-	937.50	2333.47	1174.41	0.00	813.25	2065.42	3124.40
-23.50	937.50	2359.50	1189.50	19.50	827.17	2088.17	3167.17
-24.00	937.50	2382.25	1212.25	42.25	849.92	2110.92	3189.92
-24.50	937.50	2405.00	1235.00	65.00	872.67	2133.67	3212.67
-25.00	937.50	2427.75	1257.75	87.75	895.42	2156.42	3235.42
-25.50	937.50	2450.50	1280.50	110.50	918.17	2179.17	3258.17
-26.00	937.50	2473.25	1303.25	133.25	940.92	2201.92	3280.92
-26.50	937.50	2496.00	1326.00	156.00	963.67	2224.67	3303.67
-27.00	937.50	2518.75	1348.75	178.75	986.42	2247.42	3326.42
-27.50	937.50	2541.50	1371.50	201.50	1009.17	2270.17	3349.17
-28.00	937.50	2560.19	1394.25	228.31	1035.98	2292.92	3367.86
-28.50	937.50	2611.38	1417.00	222.62	1030.30	2315.67	3419.05
-29.00	937.50	2739.75	1439.75	139.75	947.42	2338.42	3547.42
-29.50	937.50	2868.12	1462.50	56.88	864.55	2361.17	3675.80
-30.00	937.50	2919.31	1485.25	51.19	858.86	2383.92	3726.98
-30.50	937.50	2938.00	1508.00	78.00	885.67	2406.67	3745.67
-31.00	937.50	2960.75	1530.75	100.75	908.42	2429.42	3768.42
-31.50	937.50	2983.50	1553.50	123.50	931.17	2452.17	3791.17
-32.00	937.50	3006.25	1576.25	146.25	953.92	2474.92	3813.92
-32.50	937.50	3029.00	1599.00	169.00	976.67	2497.67	3836.67
-33.00	937.50	3051.75	1621.75	191.75	999.42	0.00	3859.42
-33.50	937.50	3074.50	1644.50	214.50	1022.17	0.00	3882.17
-34.00	937.50	3097.25	1667.25	237.25	1044.92	0.00	3904.92
-34.50	937.50	3120.00	1690.00	260.00	1067.67	0.00	3927.67

DATE: 13-NOVEMBER-2003 TIME: 15:22:02

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*************
*  RESULTS  *
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I.--HEADING
'HOLLYGROVE
'FS=1.0

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION MAY NOT EXIST
ALL ELEVATIONS. SEE COMPLETE OUTPUT.

II.--MAXIMA

		MAXIMUM	MINIMUM
DEFLECTION (IN)	:	2.596E+00	1.392E-03
AT ELEVATION (FT)	:	-9.00	12.50
BENDING MOMENT (LB-FT)	:	0.000E+00	-8.967E+04
AT ELEVATION (FT)	:	-34.50	-3.50
SHEAR (LB)	:	6534.24	-7844.20
AT ELEVATION (FT)	:	-22.00	12.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	1949.16	
AT ELEVATION (FT)	:	-22.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	2938.00	
AT ELEVATION (FT)	:	-30.50	

III.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
12.50	FLEXIBLE	1.392E-03	7844.20

III..--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
12.50	0.000E+00	1.392E-03	0	-7844	0
12.00	0.000E+00	9.892E-02	0	-7805	-3911
11.50	0.000E+00	1.963E-01	0	-7788	-7809
11.00	0.000E+00	2.934E-01	0	-7794	-11704
10.50	0.000E+00	3.901E-01	0	-7794	-15601
10.00	0.000E+00	4.863E-01	0	-7786	-19497
9.50	0.000E+00	5.817E-01	0	-7763	-23385
9.00	0.000E+00	6.763E-01	0	-7724	-27257
8.50	0.000E+00	7.699E-01	0	-7669	-31106
8.00	0.000E+00	8.624E-01	0	-7599	-34924
7.50	0.000E+00	9.537E-01	0	-7513	-38702
7.06	0.000E+00	1.033E+00	0	-7424	-42008
7.00	0.000E+00	1.044E+00	0	-7411	-42434
6.50	0.000E+00	1.132E+00	0	-7289	-46110

6.00	0.000E+00	1.219E+00	0	-7143	-49719
5.50	0.000E+00	1.304E+00	0	-6974	-53250
5.00	0.000E+00	1.387E+00	0	-6781	-56689
4.50	0.000E+00	1.468E+00	0	-6564	-60027
4.00	0.000E+00	1.546E+00	0	-6324	-63250
3.50	0.000E+00	1.623E+00	0	-6060	-66347
3.00	0.000E+00	1.697E+00	0	-5772	-69306
2.50	0.000E+00	1.769E+00	0	-5461	-72115
2.00	0.000E+00	1.838E+00	0	-5126	-74763
1.50	0.000E+00	1.905E+00	0	-4767	-77237
1.00	0.000E+00	1.968E+00	0	-4385	-79526
0.50	0.000E+00	2.029E+00	0	-3978	-81618
0.00	0.000E+00	2.087E+00	0	-3538	-83499
-0.50	0.000E+00	2.142E+00	0	-3060	-85150
-1.00	0.000E+00	2.194E+00	0	-2551	-86553
-1.50	0.000E+00	2.243E+00	0	-2021	-87697
-2.00	0.000E+00	2.288E+00	0	-1488	-88574
-2.50	0.000E+00	2.331E+00	0	-975	-89189
-3.00	0.000E+00	2.370E+00	0	-480	-89552
-3.50	0.000E+00	2.406E+00	0	-5	-89672
-4.00	0.000E+00	2.439E+00	0	450	-89560
-4.50+	0.000E+00	2.469E+00	0	884	-89225
-4.50-	0.000E+00	2.469E+00	0	884	-89225
-4.68+	0.000E+00	2.479E+00	0	1036	-89051
-4.68-	0.000E+00	2.479E+00	0	1036	-89051
-5.00+	0.000E+00	2.495E+00	0	1544	-88640
-5.00-	0.000E+00	2.495E+00	0	1544	-88640
-5.50	0.000E+00	2.519E+00	0	1636	-87845
-6.00	0.000E+00	2.539E+00	0	1728	-87004
-6.50	0.000E+00	2.556E+00	0	1821	-86117
-7.00	0.000E+00	2.570E+00	0	1913	-85183
-7.50	0.000E+00	2.581E+00	0	2006	-84204
-8.00	0.000E+00	2.589E+00	0	2098	-83178
-8.50	0.000E+00	2.594E+00	0	2191	-82105
-9.00	0.000E+00	2.596E+00	0	2284	-80986
-9.50	0.000E+00	2.595E+00	0	2376	-79821
-10.00	0.000E+00	2.591E+00	0	2469	-78610
-10.50	0.000E+00	2.584E+00	0	2561	-77353
-11.00	0.000E+00	2.575E+00	0	2654	-76049
-11.50	0.000E+00	2.563E+00	0	2747	-74699
-12.00	0.000E+00	2.548E+00	0	2839	-73302
-12.50	0.000E+00	2.531E+00	0	2932	-71859
-13.00	0.000E+00	2.511E+00	0	3024	-70370
-13.50	0.000E+00	2.488E+00	0	3117	-68835
-14.00	0.000E+00	2.463E+00	0	3210	-67254
-14.50	0.000E+00	2.436E+00	0	3302	-65626
-15.00	0.000E+00	2.406E+00	0	3395	-63951
-15.25+	0.000E+00	2.391E+00	0	3439	-63109
-15.25-	0.000E+00	2.391E+00	0	3439	-63109
-15.50	0.000E+00	2.374E+00	0	3486	-62231
-16.00	0.000E+00	2.340E+00	0	3579	-60465
-16.50	0.000E+00	2.304E+00	0	3671	-58653
-17.00	0.000E+00	2.265E+00	0	3769	-56793
-17.50	0.000E+00	2.225E+00	0	3836	-54889
-18.00+	0.000E+00	2.182E+00	0	3725	-52987
-18.00-	0.000E+00	2.182E+00	0	3725	-52987
-18.50	0.000E+00	2.138E+00	0	3975	-51058
-19.00	0.000E+00	2.092E+00	0	4175	-49020
-19.50	0.000E+00	2.044E+00	0	4361	-46886
-20.00	0.000E+00	1.994E+00	0	4544	-44659
-20.50	0.000E+00	1.943E+00	0	4722	-42343
-21.00+	0.000E+00	1.890E+00	0	4897	-39938

-21.00-	0.000E+00	1.890E+00	0	4897	-39938
-21.50	0.000E+00	1.836E+00	0	5713	-37286
-22.00+	0.000E+00	1.781E+00	0	6534	-34224
-22.00-	0.000E+00	1.781E+00	0	6534	-34224
-22.50	0.000E+00	1.724E+00	0	6066	-31084
-22.79+	0.000E+00	1.691E+00	0	5878	-29356
-22.79-	0.000E+00	1.691E+00	0	5878	-29356
-23.00	0.000E+00	1.666E+00	0	5751	-28132
-23.17+	0.000E+00	1.647E+00	0	5651	-27172
-23.17-	0.000E+00	1.647E+00	0	5651	-27172
-23.50	0.000E+00	1.607E+00	0	5456	-25330
-24.00	0.000E+00	1.548E+00	0	5158	-22677
-24.50	0.000E+00	1.487E+00	0	4861	-20172
-25.00	0.000E+00	1.426E+00	0	4563	-17816
-25.50	0.000E+00	1.364E+00	0	4266	-15609
-26.00	0.000E+00	1.301E+00	0	3968	-13550
-26.50	0.000E+00	1.238E+00	0	3671	-11641
-27.00	0.000E+00	1.175E+00	0	3374	-9879
-27.50	0.000E+00	1.111E+00	0	3076	-8267
-28.00	0.000E+00	1.047E+00	0	2776	-6804
-28.50	0.000E+00	9.830E-01	0	2497	-5487
-29.00+	0.000E+00	9.185E-01	0	2224	-4306
-29.00-	0.000E+00	9.185E-01	0	2224	-4306
-29.50	0.000E+00	8.539E-01	0	1818	-3295
-30.00	0.000E+00	7.892E-01	0	1426	-2486
-30.50	0.000E+00	7.243E-01	0	1075	-1863
-31.00	0.000E+00	6.594E-01	0	775	-1403
-31.50	0.000E+00	5.945E-01	0	583	-1069
-32.00	0.000E+00	5.295E-01	0	505	-801
-32.50	0.000E+00	4.645E-01	0	543	-544
-33.00	0.000E+00	3.994E-01	0	470	-276
-33.50	0.000E+00	3.344E-01	0	245	-100
-34.00	0.000E+00	2.693E-01	0	89	-19
-34.50	0.000E+00	2.043E-01	0	0	0

IV..--SOIL PRESSURES

ELEVATION	<---------SOIL PRESSURES (PSF)-------->		
(FT)	LEFTSIDE	RIGHTSIDE	NET
12.50	0.00	101.69	101.69
12.00	0.00	56.00	56.00
11.50	0.00	10.46	10.46
11.00	0.00	0.00	0.00
10.50	0.00	0.00	0.00
10.00	0.00	0.00	0.00
9.50	0.00	0.00	0.00
9.00	0.00	0.00	0.00
8.50	0.00	0.00	0.00
8.00	0.00	0.00	0.00
7.50	0.00	0.00	0.00
7.06	0.00	0.00	0.00
7.00	0.00	1.84	1.84
6.50	0.00	17.89	17.89
6.00	0.00	33.93	33.93
5.50	0.00	49.98	49.98
5.00	0.00	66.02	66.02
4.50	0.00	82.07	82.07
4.00	0.00	98.11	98.11
3.50	0.00	114.15	114.15
3.00	0.00	130.20	130.20
2.50	0.00	146.24	146.24
2.00	0.00	162.29	162.29

1.50	0.00	178.33	178.33
1.00	0.00	193.22	193.22
0.50	0.00	217.50	217.50
0.00	0.00	262.64	262.64
-0.50	0.00	304.81	304.81
-1.00	0.00	323.01	323.01
-1.50	0.00	331.72	331.72
-2.00	76.73	341.64	264.91
-2.50	155.18	351.56	196.38
-3.00	235.15	361.47	126.32
-3.50	316.46	371.39	54.93
-4.00	398.89	380.92	-17.97
-4.50+	482.27	393.31	-88.96
-4.50-	489.81	393.31	-96.50
-4.68+	505.59	401.05	-104.54
-4.68-	505.59	1168.26	662.67
-5.00+	533.19	1186.77	653.59
-5.00-	1163.32	414.56	-748.77
-5.50	1195.94	440.08	-755.86
-6.00	1213.35	461.23	-752.11
-6.50	1232.00	479.67	-752.33
-7.00	1250.75	498.42	-752.33
-7.50	1269.50	517.17	-752.33
-8.00	1288.25	535.92	-752.33
-8.50	1307.00	554.67	-752.33
-9.00	1325.75	573.42	-752.33
-9.50	1344.50	592.17	-752.33
-10.00	1363.25	610.92	-752.33
-10.50	1382.00	629.67	-752.33
-11.00	1400.75	648.42	-752.33
-11.50	1419.50	667.17	-752.33
-12.00	1438.25	685.92	-752.33
-12.50	1457.00	704.67	-752.33
-13.00	1475.75	723.42	-752.33
-13.50	1494.50	742.17	-752.33
-14.00	1513.25	760.92	-752.33
-14.50	1532.00	779.67	-752.33
-15.00	1550.75	798.42	-752.33
-15.25+	1569.50	807.67	-761.83
-15.25-	1560.00	807.67	-752.33
-15.50	1569.50	817.17	-752.33
-16.00	1588.25	835.92	-752.33
-16.50	1607.00	854.67	-752.33
-17.00	1610.06	878.88	-731.18
-17.50	1736.98	859.61	-877.37
-18.00+	2174.68	735.00	-1439.67
-18.00-	1096.17	735.00	-361.17
-18.50	1119.34	606.11	-513.23
-19.00	1141.03	578.08	-562.95
-19.50	1161.21	593.39	-567.82
-20.00	1179.85	603.31	-576.54
-20.50	1196.92	613.22	-583.70
-21.00+	1212.42	621.28	-591.14
-21.00-	1212.42	1902.10	689.69
-21.50	1226.31	1925.62	699.31
-22.00+	1238.61	1949.16	710.55
-22.00-	2810.36	704.26	-2106.10
-22.50	2414.55	770.80	-1643.75
-22.79+	2320.25	791.28	-1528.97
-22.79-	2359.96	791.28	-1568.68
-23.00	2320.25	806.18	-1514.07
-23.17+	2359.50	813.25	-1546.25

-23.17-	2333.47	813.25	-1520.22
-23.50	2359.50	827.17	-1532.33
-24.00	2382.25	849.92	-1532.33
-24.50	2405.00	872.67	-1532.33
-25.00	2427.75	895.42	-1532.33
-25.50	2450.50	918.17	-1532.33
-26.00	2473.25	940.92	-1532.33
-26.50	2496.00	963.67	-1532.33
-27.00	2518.75	986.42	-1532.33
-27.50	2541.50	1009.17	-1532.33
-28.00	2560.19	1041.53	-1518.66
-28.50	2611.38	1141.08	-1470.29
-29.00+	2739.75	1240.87	-1498.88
-29.00-	2739.75	996.03	-1743.72
-29.50	2868.12	1113.23	-1754.90
-30.00	2919.31	1230.60	-1688.71
-30.50	2938.00	1348.10	-1589.90
-31.00	2903.32	1465.70	-1437.62
-31.50	2790.87	1583.38	-1207.49
-32.00	2678.35	1701.11	-977.24
-32.50	2565.76	1818.88	-746.88
-33.00	2453.13	999.42	-1453.71
-33.50	2340.49	1022.17	-1318.32
-34.00	2227.83	1044.92	-1182.91
-34.50	2115.17	1067.67	-1047.50

Hollygrove Site - Factor of Safety = 1.3 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
12.5	-181.00		0.00	0.00
12.0	-123.00		0.00	0.00
11.5	-65.00		0.00	0.00
11.0	-7.00		0.00	0.00
10.5	51.00		0.00	51.00
10.0	77.75		31.25	109.00
9.5	104.50		62.50	167.00
9.0	131.25		93.75	225.00
9.0	367.68		93.75	461.43
8.5	385.77		125.00	510.77
8.0	403.87		156.25	560.12
7.5	421.96		187.50	609.46
7.0	440.06		218.75	658.81
6.5	458.16		250.00	708.16
6.0	476.25		281.25	757.50
5.5	494.35		312.50	806.85
5.0	512.44		343.75	856.19
4.5	530.54		375.00	905.54
4.0	548.64		406.25	954.89
3.5	566.73		437.50	1004.23
3.0	584.83		468.75	1053.58
2.5	602.92		500.00	1102.92
2.0	621.02		531.25	1152.27
1.5	639.12		562.50	1201.62
1.0	657.21		593.75	1250.96
0.5	675.31		625.00	1300.31
0.0	693.40		656.25	1349.65
0.0	600.82		656.25	1257.07
-0.5	613.39		687.50	1300.89
-1.0	625.96		718.75	1344.71
-1.5	638.53	0.00	750.00	1388.53
-1.5	638.53	0.00	750.00	1388.53
-2.0	651.10	144.35	781.25	1288.01
-2.5	663.68	288.70	812.50	1187.48
-3.0	676.25	433.04	843.75	1086.95
-3.5	688.82	577.39	875.00	986.43
-4.0	701.39	721.74	906.25	885.90
-4.5	713.96	866.09	937.50	785.37
-5.0	726.54	936.49	937.50	727.55
-5.0	1119.25	995.75	937.50	1061.00
-5.5	1138.00	1014.50	937.50	1061.00
-6.0	1156.75	1033.25	937.50	1061.00
-6.5	1175.50	1052.00	937.50	1061.00

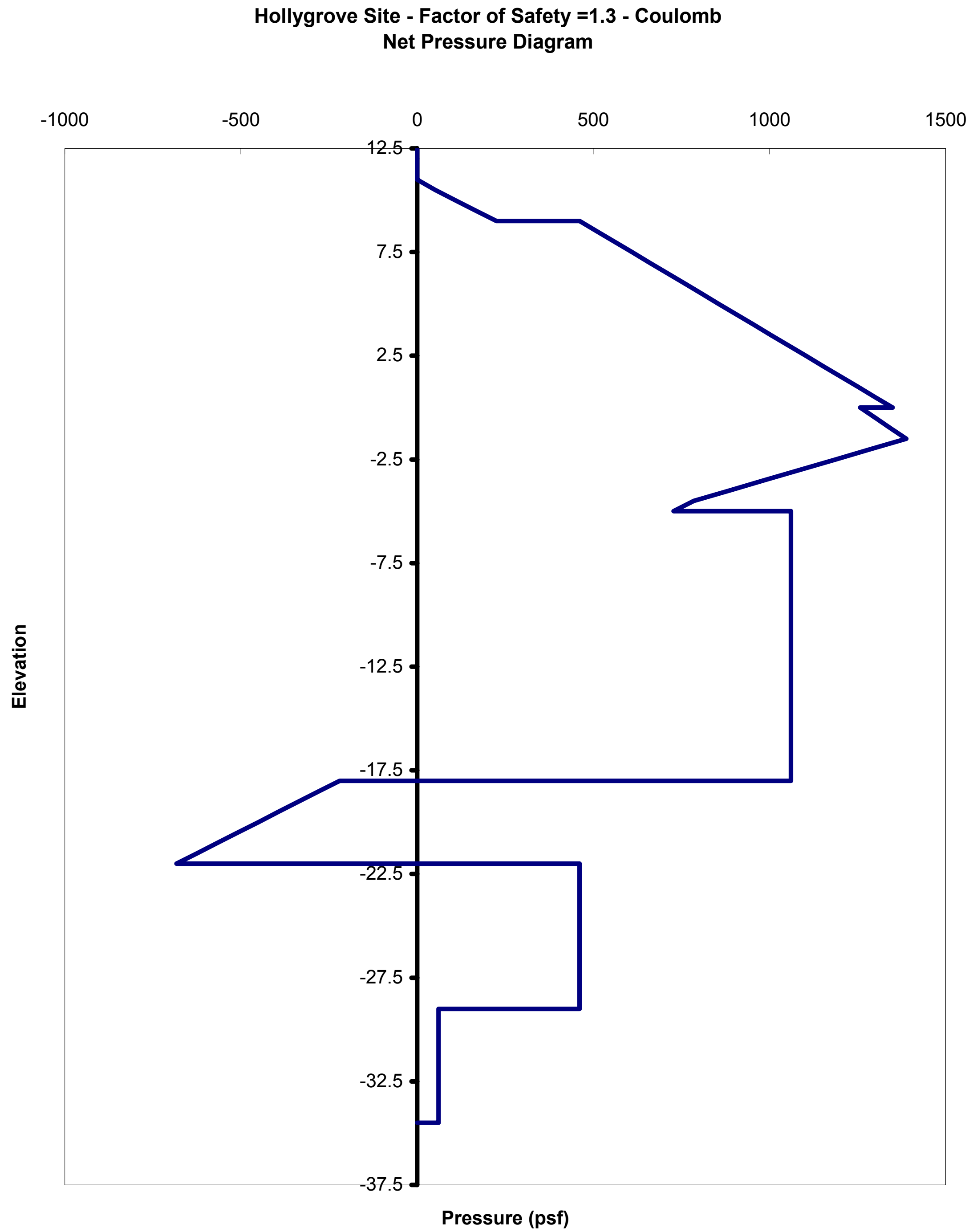
Hollygrove Site - Factor of Safety = 1.3 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-7.0	1194.25	1070.75	937.50	1061.00
-7.5	1213.00	1089.50	937.50	1061.00
-8.0	1231.75	1108.25	937.50	1061.00
-8.5	1250.50	1127.00	937.50	1061.00
-9.0	1269.25	1145.75	937.50	1061.00
-9.5	1288.00	1164.50	937.50	1061.00
-10.0	1306.75	1183.25	937.50	1061.00
-10.5	1325.50	1202.00	937.50	1061.00
-11.0	1344.25	1220.75	937.50	1061.00
-11.5	1363.00	1239.50	937.50	1061.00
-12.0	1381.75	1258.25	937.50	1061.00
-12.5	1400.50	1277.00	937.50	1061.00
-13.0	1419.25	1295.75	937.50	1061.00
-13.5	1438.00	1314.50	937.50	1061.00
-14.0	1456.75	1333.25	937.50	1061.00
-14.5	1475.50	1352.00	937.50	1061.00
-15.0	1494.25	1370.75	937.50	1061.00
-15.5	1513.00	1389.50	937.50	1061.00
-16.0	1531.75	1408.25	937.50	1061.00
-16.5	1550.50	1427.00	937.50	1061.00
-17.0	1569.25	1445.75	937.50	1061.00
-17.5	1588.00	1464.50	937.50	1061.00
-18.0	1606.75	1483.25	937.50	1061.00
-18.0	932.55	2090.09	937.50	-220.04
-18.5	945.12	2160.49	937.50	-277.87
-19.0	957.69	2230.89	937.50	-335.70
-19.5	970.26	2301.29	937.50	-393.53
-20.0	982.84	2371.69	937.50	-451.35
-20.5	995.41	2442.09	937.50	-509.18
-21.0	1007.98	2512.49	937.50	-567.01
-21.5	1020.55	2582.89	937.50	-624.84
-22.0	1033.12	2653.29	937.50	-682.66
-22.0	1544.75	2021.25	937.50	461.00
-22.5	1567.50	2044.00	937.50	461.00
-23.0	1590.25	2066.75	937.50	461.00
-23.5	1613.00	2089.50	937.50	461.00
-24.0	1635.75	2112.25	937.50	461.00
-24.5	1658.50	2135.00	937.50	461.00
-25.0	1681.25	2157.75	937.50	461.00
-25.5	1704.00	2180.50	937.50	461.00
-26.0	1726.75	2203.25	937.50	461.00
-26.5	1749.50	2226.00	937.50	461.00
-27.0	1772.25	2248.75	937.50	461.00
-27.5	1795.00	2271.50	937.50	461.00
-28.0	1817.75	2294.25	937.50	461.00

Hollygrove Site - Factor of Safety = 1.3 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-28.5	1840.50	2317.00	937.50	461.00
-29.0	1863.25	2339.75	937.50	461.00
-29.0	1663.25	2539.75	937.50	61.00
-29.5	1686.00	2562.50	937.50	61.00
-30.0	1708.75	2585.25	937.50	61.00
-30.5	1731.50	2608.00	937.50	61.00
-31.0	1754.25	2630.75	937.50	61.00
-31.5	1777.00	2653.50	937.50	61.00
-32.0	1799.75	2676.25	937.50	61.00
-32.5	1822.50	2699.00	937.50	61.00
-33.0	1845.25	2721.75	937.50	61.00
-33.5	1868.00	2744.50	937.50	61.00
-34.0	1890.75	2767.25	937.50	61.00
-34.5	1913.50	2790.00	937.50	61.00

Summing the moments around the sheet pile tip (EL -34.5) gave a strut load of 316 kips for the Coulomb case with a 1.3 factor of safety.


Hollygrove Site - Factor of Safety =1.3 - Coulomb
Net Pressure Diagram
-1000
-500
0
500
1000
1500
12.5
7.5
2.5
-2.5
-7.5
-12.5
-17.5
-22.5
-27.5
-32.5
-37.5
Elevation
Pressure (psf)

Hollygrove Site - Factor of Safety = 1.3 - Terzaghi					
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
12.5	604.00			0.00	604.00
12.0	604.00			0.00	604.00
11.5	604.00			0.00	604.00
11.0	604.00			0.00	604.00
10.5	604.00			0.00	604.00
10.0	604.00			31.25	635.25
9.5	604.00			62.50	666.50
9.0	604.00			93.75	697.75
9.0	604.00			93.75	697.75
8.5	604.00			125.00	729.00
8.0	604.00			156.25	760.25
7.5	604.00			187.50	791.50
7.0	604.00			218.75	822.75
6.5	604.00			250.00	854.00
6.0	604.00			281.25	885.25
5.5	604.00			312.50	916.50
5.0	604.00			343.75	947.75
4.5	604.00			375.00	979.00
4.0	604.00			406.25	1010.25
3.5	604.00			437.50	1041.50
3.0	604.00			468.75	1072.75
2.5	604.00			500.00	1104.00
2.0	604.00			531.25	1135.25
1.5	604.00			562.50	1166.50
1.0	604.00			593.75	1197.75
0.5	604.00			625.00	1229.00
0.0	604.00			656.25	1260.25
0.0	604.00			656.25	1260.25
-0.5	604.00			687.50	1291.50
-1.0	604.00			718.75	1322.75
-1.5	604.00		0.00	750.00	1354.00
-1.5		638.53	0.00	750.00	1388.53
-2.0		651.10	144.35	781.25	1288.01
-2.5		663.68	288.70	812.50	1187.48
-3.0		676.25	433.04	843.75	1086.95
-3.5		688.82	577.39	875.00	986.43
-4.0		701.39	721.74	906.25	885.90
-4.5		713.96	866.09	937.50	785.37
-5.0		726.54	936.49	937.50	727.55
-5.0		1119.25	995.75	937.50	1061.00
-5.5		1138.00	1014.50	937.50	1061.00
-6.0		1156.75	1033.25	937.50	1061.00
-6.5		1175.50	1052.00	937.50	1061.00

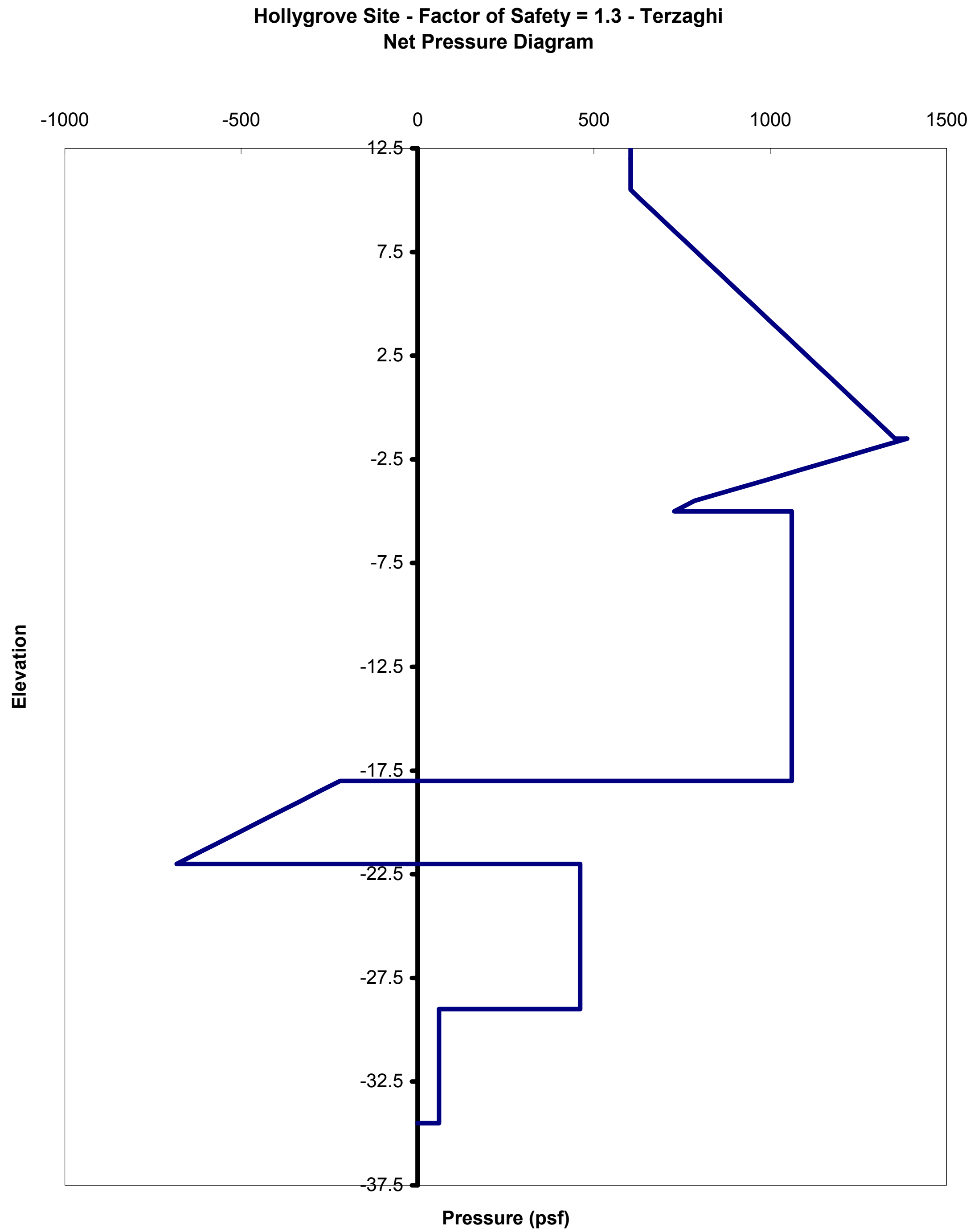
Hollygrove Site - Factor of Safety = 1.3 - Terzaghi

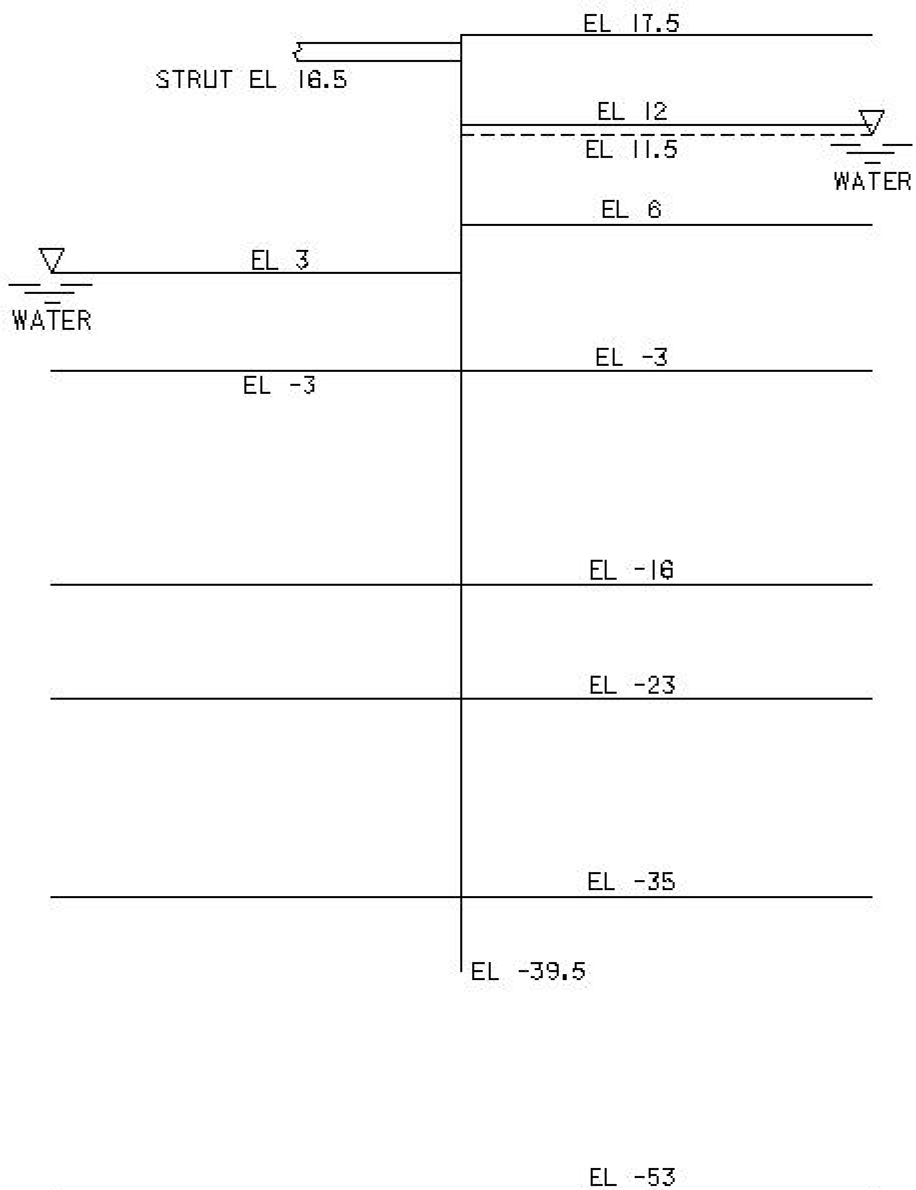
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-7.0		1194.25	1070.75	937.50	1061.00
-7.5		1213.00	1089.50	937.50	1061.00
-8.0		1231.75	1108.25	937.50	1061.00
-8.5		1250.50	1127.00	937.50	1061.00
-9.0		1269.25	1145.75	937.50	1061.00
-9.5		1288.00	1164.50	937.50	1061.00
-10.0		1306.75	1183.25	937.50	1061.00
-10.5		1325.50	1202.00	937.50	1061.00
-11.0		1344.25	1220.75	937.50	1061.00
-11.5		1363.00	1239.50	937.50	1061.00
-12.0		1381.75	1258.25	937.50	1061.00
-12.5		1400.50	1277.00	937.50	1061.00
-13.0		1419.25	1295.75	937.50	1061.00
-13.5		1438.00	1314.50	937.50	1061.00
-14.0		1456.75	1333.25	937.50	1061.00
-14.5		1475.50	1352.00	937.50	1061.00
-15.0		1494.25	1370.75	937.50	1061.00
-15.5		1513.00	1389.50	937.50	1061.00
-16.0		1531.75	1408.25	937.50	1061.00
-16.5		1550.50	1427.00	937.50	1061.00
-17.0		1569.25	1445.75	937.50	1061.00
-17.5		1588.00	1464.50	937.50	1061.00
-18.0		1606.75	1483.25	937.50	1061.00
-18.0		932.55	2090.09	937.50	-220.04
-18.5		945.12	2160.49	937.50	-277.87
-19.0		957.69	2230.89	937.50	-335.70
-19.5		970.26	2301.29	937.50	-393.53
-20.0		982.84	2371.69	937.50	-451.35
-20.5		995.41	2442.09	937.50	-509.18
-21.0		1007.98	2512.49	937.50	-567.01
-21.5		1020.55	2582.89	937.50	-624.84
-22.0		1033.12	2653.29	937.50	-682.66
-22.0		1544.75	2021.25	937.50	461.00
-22.5		1567.50	2044.00	937.50	461.00
-23.0		1590.25	2066.75	937.50	461.00
-23.5		1613.00	2089.50	937.50	461.00
-24.0		1635.75	2112.25	937.50	461.00
-24.5		1658.50	2135.00	937.50	461.00
-25.0		1681.25	2157.75	937.50	461.00
-25.5		1704.00	2180.50	937.50	461.00
-26.0		1726.75	2203.25	937.50	461.00
-26.5		1749.50	2226.00	937.50	461.00
-27.0		1772.25	2248.75	937.50	461.00
-27.5		1795.00	2271.50	937.50	461.00
-28.0		1817.75	2294.25	937.50	461.00

Hollygrove Site - Factor of Safety = 1.3 - Terzaghi

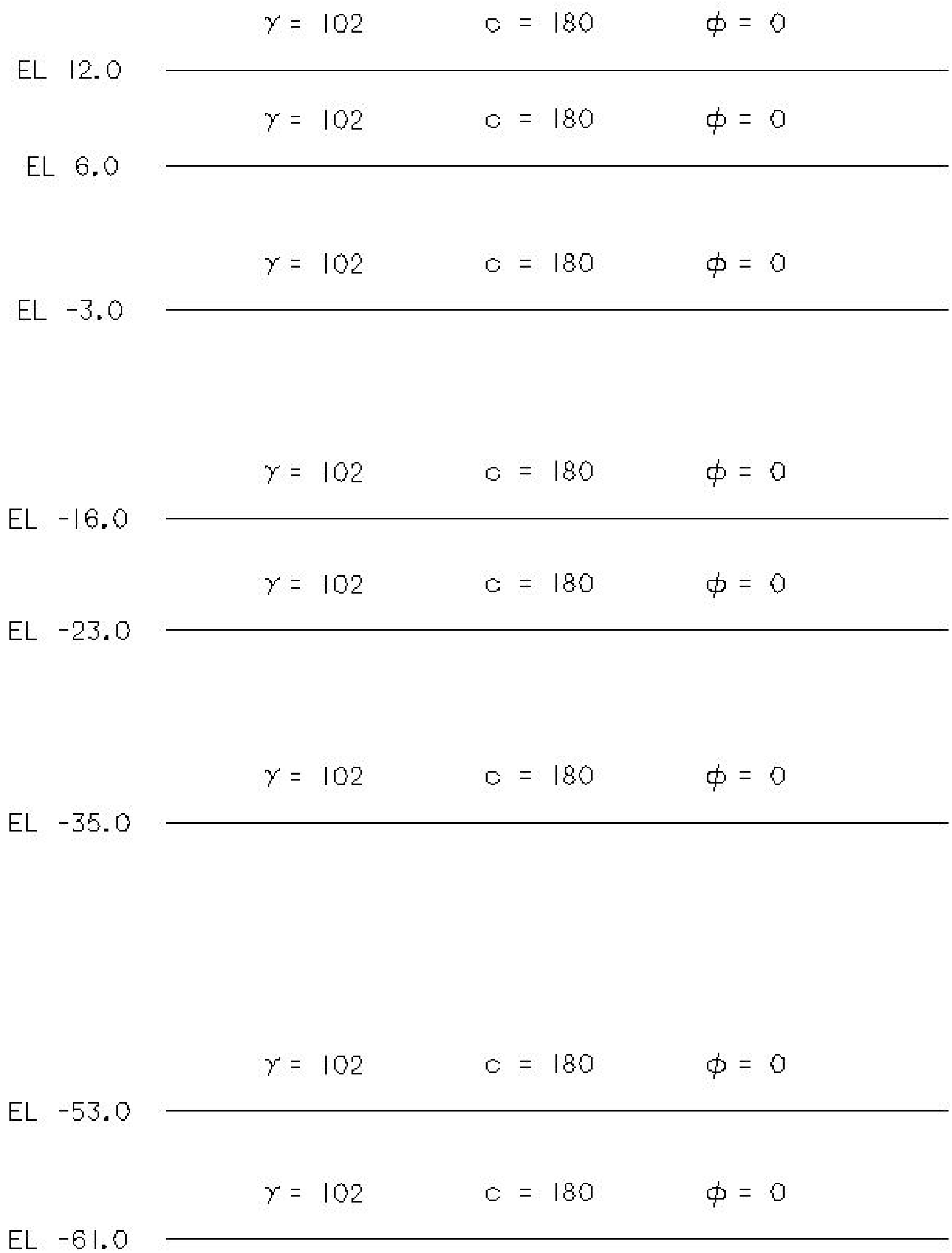
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-28.5		1840.50	2317.00	937.50	461.00
-29.0		1863.25	2339.75	937.50	461.00
-29.0		1663.25	2539.75	937.50	61.00
-29.5		1686.00	2562.50	937.50	61.00
-30.0		1708.75	2585.25	937.50	61.00
-30.5		1731.50	2608.00	937.50	61.00
-31.0		1754.25	2630.75	937.50	61.00
-31.5		1777.00	2653.50	937.50	61.00
-32.0		1799.75	2676.25	937.50	61.00
-32.5		1822.50	2699.00	937.50	61.00
-33.0		1845.25	2721.75	937.50	61.00
-33.5		1868.00	2744.50	937.50	61.00
-34.0		1890.75	2767.25	937.50	61.00
-34.5		1913.50	2790.00	937.50	61.00

Summing the moments around the sheet pile tip (EL -34.5) gave a strut load of 360 kips for the Terzaghi case with a 1.3 factor of safety.


Hollygrove Site - Factor of Safety = 1.3 - Terzaghi
Net Pressure Diagram
-1000
-500
0
500
1000
1500
12.5
7.5
2.5
-2.5
-7.5
-12.5
-17.5
-22.5
-27.5
-32.5
-37.5
Elevation
Pressure (psf)



NAPOLEON AVENUE SITE
SINGLE STRUT CASE



NAPOLEON AVENUE SITE SOIL PROPERTIES

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
17.5	-600.00	0.00	0.00	0.00
17.0	-550.50	0.00	0.00	0.00
16.5	-501.00	0.00	0.00	0.00
16.0	-451.50	0.00	0.00	0.00
15.5	-402.00	0.00	0.00	0.00
15.0	-352.50	0.00	0.00	0.00
14.5	-303.00	0.00	0.00	0.00
14.0	-253.50	0.00	0.00	0.00
13.9	-241.13	0.00	0.00	0.00
13.5	-204.00	0.00	0.00	0.00
13.0	-154.50	0.00	0.00	0.00
12.5	-105.00	0.00	0.00	0.00
12.0	-55.50	0.00	0.00	0.00
12.0	-55.50	0.00	0.00	0.00
11.5	-4.00	0.00	0.00	0.00
11.0	16.25	0.00	31.25	47.50
10.5	36.50	0.00	62.50	99.00
10.0	56.75	0.00	93.75	150.50
9.5	77.00	0.00	125.00	202.00
9.0	97.25	0.00	156.25	253.50
8.5	117.50	0.00	187.50	305.00
8.0	137.75	0.00	218.75	356.50
7.5	158.00	0.00	250.00	408.00
7.0	178.25	0.00	281.25	459.50
6.6	193.44	0.00	304.69	498.13
6.5	198.50	0.00	312.50	511.00
6.0	218.75	0.00	343.75	562.50
6.0	272.92	0.00	343.75	616.67
5.5	282.83	0.00	375.00	657.83
5.0	292.75	0.00	406.25	699.00
4.5	302.67	0.00	437.50	740.17
4.0	312.58	0.00	468.75	781.33
3.5	322.50	0.00	500.00	822.50
3.0	332.42	0.00	531.25	863.67
3.0	332.42	0.00	531.25	863.67
2.5	342.33	89.25	531.25	784.33
2.0	352.25	178.50	531.25	705.00
1.5	362.17	267.75	531.25	625.67
1.0	372.08	357.00	531.25	546.33
0.5	382.00	446.25	531.25	467.00
0.0	391.92	535.50	531.25	387.67
-0.5	401.83	624.75	531.25	308.33
-1.0	411.75	714.00	531.25	229.00

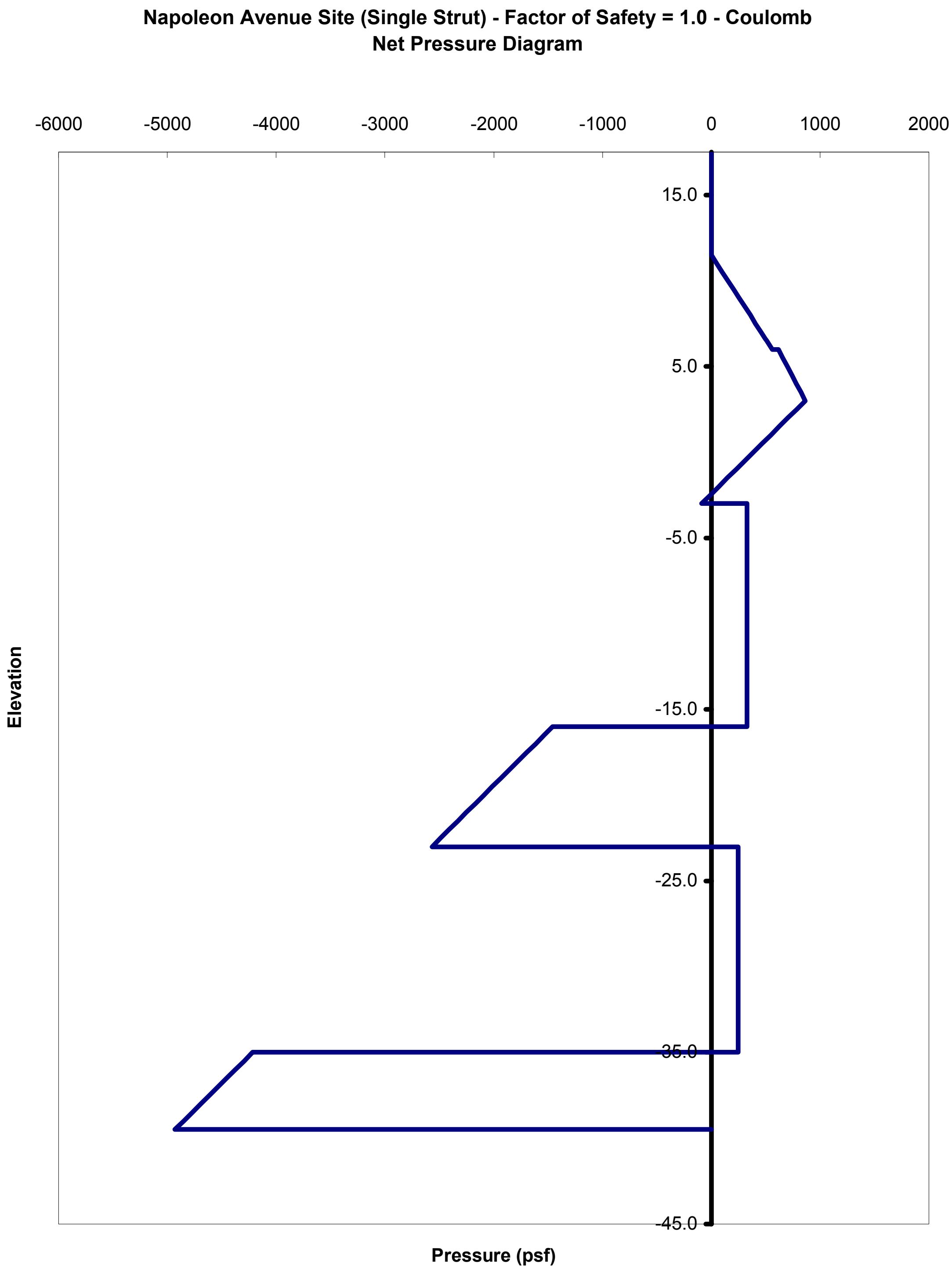
Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-1.5	421.67	803.25	531.25	149.67
-2.0	431.58	892.50	531.25	70.33
-2.5	441.50	981.75	531.25	-9.00
-3.0	451.42	1071.00	531.25	-88.33
-3.0	754.25	957.00	531.25	328.50
-3.5	774.00	976.75	531.25	328.50
-4.0	793.75	996.50	531.25	328.50
-4.5	813.50	1016.25	531.25	328.50
-5.0	833.25	1036.00	531.25	328.50
-5.5	853.00	1055.75	531.25	328.50
-6.0	872.75	1075.50	531.25	328.50
-6.5	892.50	1095.25	531.25	328.50
-7.0	912.25	1115.00	531.25	328.50
-7.5	932.00	1134.75	531.25	328.50
-8.0	951.75	1154.50	531.25	328.50
-8.5	971.50	1174.25	531.25	328.50
-9.0	991.25	1194.00	531.25	328.50
-9.5	1011.00	1213.75	531.25	328.50
-10.0	1030.75	1233.50	531.25	328.50
-10.5	1050.50	1253.25	531.25	328.50
-11.0	1070.25	1273.00	531.25	328.50
-11.5	1090.00	1292.75	531.25	328.50
-12.0	1109.75	1312.50	531.25	328.50
-12.5	1129.50	1332.25	531.25	328.50
-13.0	1149.25	1352.00	531.25	328.50
-13.5	1169.00	1371.75	531.25	328.50
-14.0	1188.75	1391.50	531.25	328.50
-14.5	1208.50	1411.25	531.25	328.50
-15.0	1228.25	1431.00	531.25	328.50
-15.5	1248.00	1450.75	531.25	328.50
-16.0	1267.75	1470.50	531.25	328.50
-16.0	622.58	2611.50	531.25	-1457.67
-16.5	632.50	2700.75	531.25	-1537.00
-17.0	642.42	2790.00	531.25	-1616.33
-17.5	652.33	2879.25	531.25	-1695.67
-18.0	662.25	2968.50	531.25	-1775.00
-18.5	672.17	3057.75	531.25	-1854.33
-19.0	682.08	3147.00	531.25	-1933.67
-19.5	692.00	3236.25	531.25	-2013.00
-20.0	701.92	3325.50	531.25	-2092.33
-20.5	711.83	3414.75	531.25	-2171.67
-21.0	721.75	3504.00	531.25	-2251.00
-21.5	731.67	3593.25	531.25	-2330.33
-22.0	741.58	3682.50	531.25	-2409.67
-22.5	751.50	3771.75	531.25	-2489.00

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0	761.42	3861.00	531.25	-2568.33
-23.0	1644.25	1927.00	531.25	248.50
-23.5	1670.00	1952.75	531.25	248.50
-24.0	1695.75	1978.50	531.25	248.50
-24.5	1721.50	2004.25	531.25	248.50
-25.0	1747.25	2030.00	531.25	248.50
-25.5	1773.00	2055.75	531.25	248.50
-26.0	1798.75	2081.50	531.25	248.50
-26.5	1824.50	2107.25	531.25	248.50
-27.0	1850.25	2133.00	531.25	248.50
-27.5	1876.00	2158.75	531.25	248.50
-28.0	1901.75	2184.50	531.25	248.50
-28.5	1927.50	2210.25	531.25	248.50
-29.0	1953.25	2236.00	531.25	248.50
-29.5	1979.00	2261.75	531.25	248.50
-30.0	2004.75	2287.50	531.25	248.50
-30.5	2030.50	2313.25	531.25	248.50
-31.0	2056.25	2339.00	531.25	248.50
-31.5	2082.00	2364.75	531.25	248.50
-32.0	2107.75	2390.50	531.25	248.50
-32.5	2133.50	2416.25	531.25	248.50
-33.0	2159.25	2442.00	531.25	248.50
-33.5	2185.00	2467.75	531.25	248.50
-34.0	2210.75	2493.50	531.25	248.50
-34.5	2236.50	2519.25	531.25	248.50
-35.0	2262.25	2545.00	531.25	248.50
-35.0	967.42	5715.00	531.25	-4216.33
-35.5	977.33	5804.25	531.25	-4295.67
-36.0	987.25	5893.50	531.25	-4375.00
-36.5	997.17	5982.75	531.25	-4454.33
-37.0	1007.08	6072.00	531.25	-4533.67
-37.5	1017.00	6161.25	531.25	-4613.00
-38.0	1026.92	6250.50	531.25	-4692.33
-38.5	1036.83	6339.75	531.25	-4771.67
-39.0	1046.75	6429.00	531.25	-4851.00
-39.5	1056.67	6518.25	531.25	-4930.33

Summing the moments around the sheet pile tip (EL -39.5) gave a strut load of 36 kips for the Coulomb case with a 1.0 factor of safety.


Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-6000
-5000
-4000
-3000
-2000
-1000
0
1000
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Terzaghi					
Elevation	**Terzaghi Pressure**	**Right Side Active Pressure**	**Left Side Passive Pressure**	**Water Pressure**	**Net Pressure**
17.5	0.00		0.00	0.00	0.00
17.0	55.04		0.00	0.00	55.04
16.5	110.07		0.00	0.00	110.07
16.0	165.11		0.00	0.00	165.11
15.5	220.14		0.00	0.00	220.14
15.0	275.18		0.00	0.00	275.18
14.5	330.21		0.00	0.00	330.21
14.0	385.25		0.00	0.00	385.25
13.9	399.00		0.00	0.00	399.00
13.5	399.00		0.00	0.00	399.00
13.0	399.00		0.00	0.00	399.00
12.5	399.00		0.00	0.00	399.00
12.0	399.00		0.00	0.00	399.00
12.0	399.00		0.00	0.00	399.00
11.5	399.00		0.00	0.00	399.00
11.0	399.00		0.00	31.25	430.25
10.5	399.00		0.00	62.50	461.50
10.0	399.00		0.00	93.75	492.75
9.5	399.00		0.00	125.00	524.00
9.0	399.00		0.00	156.25	555.25
8.5	399.00		0.00	187.50	586.50
8.0	399.00		0.00	218.75	617.75
7.5	399.00		0.00	250.00	649.00
7.0	399.00		0.00	281.25	680.25
6.6	399.00		0.00	304.69	703.69
6.5	385.25		0.00	312.50	697.75
6.0	330.21		0.00	343.75	673.96
6.0	330.21		0.00	343.75	673.96
5.5	275.18		0.00	375.00	650.18
5.0	220.14		0.00	406.25	626.39
4.5	165.11		0.00	437.50	602.61
4.0	110.07		0.00	468.75	578.82
3.5	55.04		0.00	500.00	555.04
3.0	0.00		0.00	531.25	531.25
3.0		332.42	0.00	531.25	863.67
2.5		342.33	89.25	531.25	784.33
2.0		352.25	178.50	531.25	705.00
1.5		362.17	267.75	531.25	625.67
1.0		372.08	357.00	531.25	546.33
0.5		382.00	446.25	531.25	467.00
0.0		391.92	535.50	531.25	387.67
-0.5		401.83	624.75	531.25	308.33
-1.0		411.75	714.00	531.25	229.00

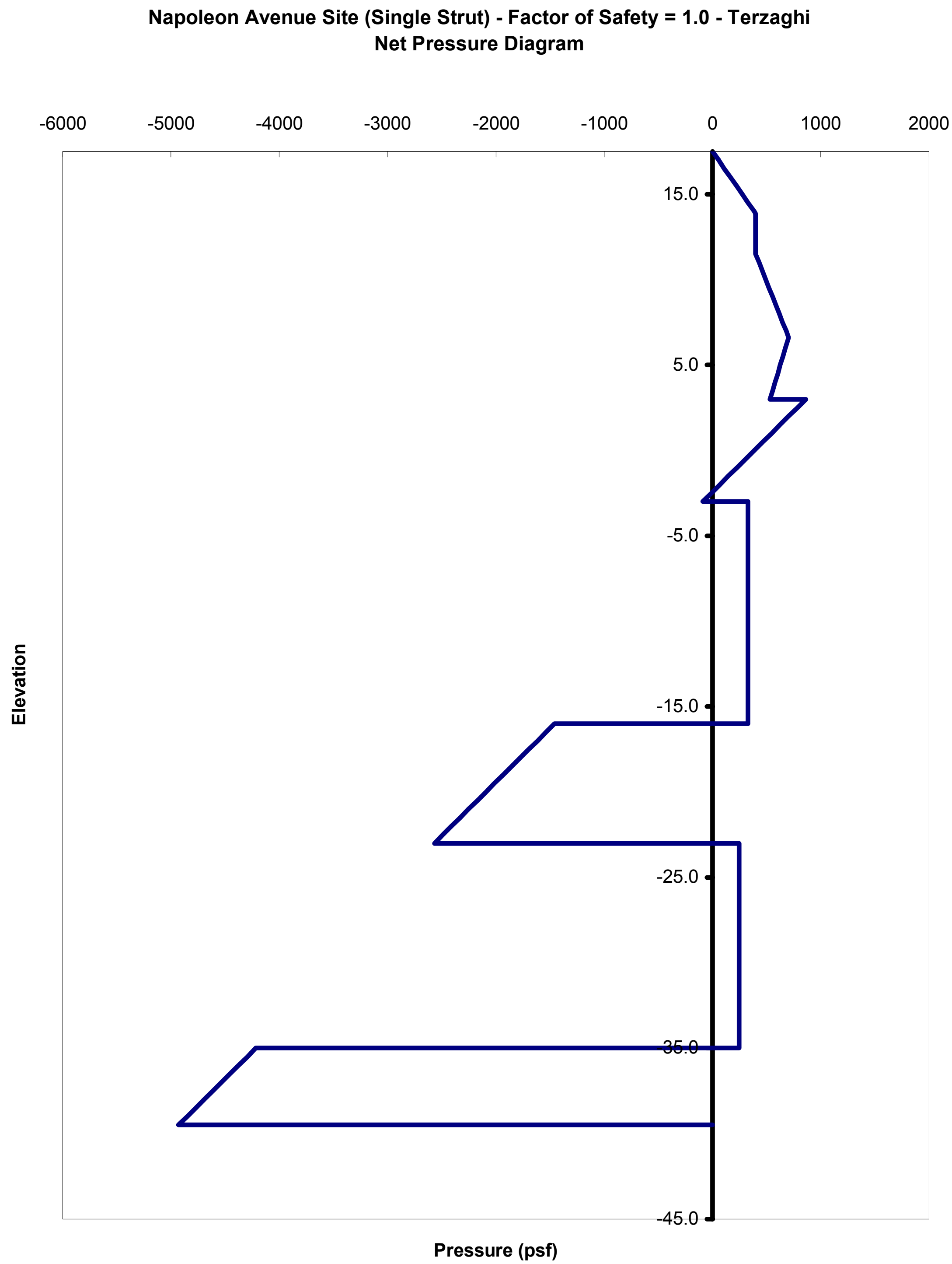
Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Terzaghi

Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-1.5		421.67	803.25	531.25	149.67
-2.0		431.58	892.50	531.25	70.33
-2.5		441.50	981.75	531.25	-9.00
-3.0		451.42	1071.00	531.25	-88.33
-3.0		754.25	957.00	531.25	328.50
-3.5		774.00	976.75	531.25	328.50
-4.0		793.75	996.50	531.25	328.50
-4.5		813.50	1016.25	531.25	328.50
-5.0		833.25	1036.00	531.25	328.50
-5.5		853.00	1055.75	531.25	328.50
-6.0		872.75	1075.50	531.25	328.50
-6.5		892.50	1095.25	531.25	328.50
-7.0		912.25	1115.00	531.25	328.50
-7.5		932.00	1134.75	531.25	328.50
-8.0		951.75	1154.50	531.25	328.50
-8.5		971.50	1174.25	531.25	328.50
-9.0		991.25	1194.00	531.25	328.50
-9.5		1011.00	1213.75	531.25	328.50
-10.0		1030.75	1233.50	531.25	328.50
-10.5		1050.50	1253.25	531.25	328.50
-11.0		1070.25	1273.00	531.25	328.50
-11.5		1090.00	1292.75	531.25	328.50
-12.0		1109.75	1312.50	531.25	328.50
-12.5		1129.50	1332.25	531.25	328.50
-13.0		1149.25	1352.00	531.25	328.50
-13.5		1169.00	1371.75	531.25	328.50
-14.0		1188.75	1391.50	531.25	328.50
-14.5		1208.50	1411.25	531.25	328.50
-15.0		1228.25	1431.00	531.25	328.50
-15.5		1248.00	1450.75	531.25	328.50
-16.0		1267.75	1470.50	531.25	328.50
-16.0		622.58	2611.50	531.25	-1457.67
-16.5		632.50	2700.75	531.25	-1537.00
-17.0		642.42	2790.00	531.25	-1616.33
-17.5		652.33	2879.25	531.25	-1695.67
-18.0		662.25	2968.50	531.25	-1775.00
-18.5		672.17	3057.75	531.25	-1854.33
-19.0		682.08	3147.00	531.25	-1933.67
-19.5		692.00	3236.25	531.25	-2013.00
-20.0		701.92	3325.50	531.25	-2092.33
-20.5		711.83	3414.75	531.25	-2171.67
-21.0		721.75	3504.00	531.25	-2251.00
-21.5		731.67	3593.25	531.25	-2330.33
-22.0		741.58	3682.50	531.25	-2409.67
-22.5		751.50	3771.75	531.25	-2489.00

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Terzaghi

		Right Side	Left Side		
Elevation	Terzaghi Pressure	Active Pressure	Passive Pressure	Water Pressure	Net Pressure
-23.0		761.42	3861.00	531.25	-2568.33
-23.0		1644.25	1927.00	531.25	248.50
-23.5		1670.00	1952.75	531.25	248.50
-24.0		1695.75	1978.50	531.25	248.50
-24.5		1721.50	2004.25	531.25	248.50
-25.0		1747.25	2030.00	531.25	248.50
-25.5		1773.00	2055.75	531.25	248.50
-26.0		1798.75	2081.50	531.25	248.50
-26.5		1824.50	2107.25	531.25	248.50
-27.0		1850.25	2133.00	531.25	248.50
-27.5		1876.00	2158.75	531.25	248.50
-28.0		1901.75	2184.50	531.25	248.50
-28.5		1927.50	2210.25	531.25	248.50
-29.0		1953.25	2236.00	531.25	248.50
-29.5		1979.00	2261.75	531.25	248.50
-30.0		2004.75	2287.50	531.25	248.50
-30.5		2030.50	2313.25	531.25	248.50
-31.0		2056.25	2339.00	531.25	248.50
-31.5		2082.00	2364.75	531.25	248.50
-32.0		2107.75	2390.50	531.25	248.50
-32.5		2133.50	2416.25	531.25	248.50
-33.0		2159.25	2442.00	531.25	248.50
-33.5		2185.00	2467.75	531.25	248.50
-34.0		2210.75	2493.50	531.25	248.50
-34.5		2236.50	2519.25	531.25	248.50
-35.0		2262.25	2545.00	531.25	248.50
-35.0		967.42	5715.00	531.25	-4216.33
-35.5		977.33	5804.25	531.25	-4295.67
-36.0		987.25	5893.50	531.25	-4375.00
-36.5		997.17	5982.75	531.25	-4454.33
-37.0		1007.08	6072.00	531.25	-4533.67
-37.5		1017.00	6161.25	531.25	-4613.00
-38.0		1026.92	6250.50	531.25	-4692.33
-38.5		1036.83	6339.75	531.25	-4771.67
-39.0		1046.75	6429.00	531.25	-4851.00
-39.5		1056.67	6518.25	531.25	-4930.33

Summing the moments around the sheet pile tip (EL -39.5) gave a strut load of 89 kips for the Terzaghi case with a 1.0 factor of safety.



Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.0 - Terzaghi
Net Pressure Diagram
-6000
-5000
-4000
-3000
-2000
-1000
0
1000
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:23:05

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

I.--HEADING
'NAPOLEON
'FS=1.0
'SINGLE STRUT

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICITY (PSI)	MOMENT OF INERTIA (IN^4)	CROSS SECTION AREA (SQIN)
17.50	2.900E+07	369.40	10.28

ELEVATION AT BOTTOM OF WALL = -39.50

III.--ANCHOR DATA

ELEV. AT WALL (FT)	ANCHOR TYPE	ULTIMATE TENSION FORCE (LB)	ULTIMATE COMPR. FORCE (LB)	ANCHOR STIFF. (LB/IN)	ANCHOR SLOPE (FT)
16.5	FLEXIBLE	9.665E+5	7.445E+5	9.343E+5	0.000

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	17.50
100.00	17.50

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	3.00
100.00	3.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	INT. FRICT. (DEG)	COH-ESION (PSF)	WALL FRICT. (DEG)	ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
99.0	99.0	0.0	300.0	0.0	0.0	200.0	200.0	12.0	0.0
103.0	103.0	0.0	300.0	0.0	0.0	200.0	200.0	6.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6	-3.0	0.0
102.0	102.0	0.0	300.0	0.0	0.0	200.0	200.0	-16.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	320.0	0.0	0.0	213.0	213.0	-35.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6		

V.B.--LEFTSIDE

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	INT. FRICT. (DEG)	COH-ESION (PSF)	WALL FRICT. (DEG)	ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)

122.0	122.0	30.0	0.0	0.0	0.0	9.3	9.3	-3.0	0.0
102.0	102.0	0.0	300.0	0.0	0.0	200.0	200.0	-16.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	320.0	0.0	0.0	213.0	213.0	-35.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 11.50 (FT)
LEFTSIDE ELEVATION = 3.00 (FT)
NO SEEPAGE

VIII.--VERTICAL SURCHARGE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:23:07

****
* LIMIT PRESSURES *
****

I.--HEADING
'NAPOLEON
'FS=1.0
'SINGLE STRUT
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

	NET WATER	< LEFTSIDE SOIL PRESSURES>			<RIGHTSIDE SOIL PRESSURES>		
ELEV. (FT)	PRESS. (PSF)	PASSIVE (PSF)	AT-REST (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	AT-REST (PSF)	PASSIVE (PSF)
17.50	0.00	0.00	0.00	0.00	0.00	0.00	703.17
17.00	0.00	0.00	0.00	0.00	0.00	49.50	649.50
16.50	0.00	0.00	0.00	0.00	0.00	99.00	699.00
16.00	0.00	0.00	0.00	0.00	0.00	148.50	748.50
15.50	0.00	0.00	0.00	0.00	0.00	198.00	798.00
15.00	0.00	0.00	0.00	0.00	0.00	247.50	847.50
14.50	0.00	0.00	0.00	0.00	0.00	297.00	897.00
14.00	0.00	0.00	0.00	0.00	0.00	346.50	946.50
13.50	0.00	0.00	0.00	0.00	0.00	396.00	996.00
13.00	0.00	0.00	0.00	0.00	0.00	445.50	1045.49
12.50	0.00	0.00	0.00	0.00	0.00	495.00	1095.12
12.00	0.00	0.00	0.00	0.00	0.00	544.50	1145.02
11.50	0.00	0.00	0.00	0.00	0.00	596.00	1187.94
11.29+	13.31	0.00	0.00	0.00	0.00	604.63	1216.24
11.29-	13.31	0.00	0.00	0.00	0.00	604.63	1200.00
11.00	31.25	0.00	0.00	0.00	16.24	616.25	1216.24
10.50	62.50	0.00	0.00	0.00	36.62	636.50	1236.62
10.00	93.75	0.00	0.00	0.00	56.75	656.75	1256.75

9.50	125.00	0.00	0.00	0.00	77.00	677.00	1277.00
9.00	156.25	0.00	0.00	0.00	97.25	697.25	1297.25
8.50	187.50	0.00	0.00	0.00	117.50	717.50	1317.50
8.00	218.75	0.00	0.00	0.00	137.75	737.75	1337.75
7.50	250.00	0.00	0.00	0.00	158.00	758.00	1358.00
7.00	281.25	0.00	0.00	0.00	177.44	778.25	1361.77
6.50	312.50	0.00	0.00	0.00	203.58	798.50	1495.77
6.00+	343.75	0.00	0.00	0.00	243.17	818.75	1955.29
6.00-	343.75	0.00	0.00	0.00	243.17	409.38	1955.29
5.50	375.00	0.00	0.00	0.00	277.76	424.25	2448.23
5.00	406.25	0.00	0.00	0.00	293.64	439.13	2650.69
4.50	437.50	0.00	0.00	0.00	302.67	454.00	2724.00
4.00	468.75	0.00	0.00	0.00	312.58	468.88	2813.25
3.50	500.00	0.00	0.00	0.00	322.50	483.75	2902.50
3.00	531.25	0.00	0.00	0.00	332.42	498.63	2991.75
2.50	531.25	89.25	14.88	9.92	342.33	513.50	3081.00
2.00	531.25	178.50	29.75	19.83	352.25	528.38	3170.25
1.50	531.25	267.75	44.63	29.75	362.17	543.25	3259.50
1.00	531.25	357.00	59.50	39.67	372.08	558.13	3348.75
0.50	531.25	446.25	74.38	49.58	382.00	573.00	3438.00
0.00	531.25	535.50	89.25	59.50	391.92	587.88	3527.25
-0.50	531.25	624.75	104.13	69.42	401.83	602.75	3616.50
-1.00	531.25	714.00	119.00	79.33	411.75	617.63	3705.75
-1.50	531.25	803.25	133.88	89.25	421.67	632.50	3795.00
-2.00	531.25	894.55	148.75	104.78	426.81	647.38	3917.47
-2.50	531.25	971.06	163.63	75.15	469.89	662.25	3775.83
-2.78+	531.25	996.08	171.93	0.00	545.52	677.13	3337.47
-2.78-	531.25	985.03	171.93	0.00	545.52	1354.25	3337.47
-3.00+	531.25	996.08	178.50	0.00	605.37	1374.00	2990.58
-3.00-	531.25	996.08	357.00	0.00	605.37	1374.00	2990.58
-3.50	531.25	987.44	376.75	0.00	745.61	1393.75	2171.67
-4.00	531.25	994.99	396.50	0.00	798.44	1413.50	1961.08
-4.50	531.25	1016.25	416.25	0.00	813.50	1433.25	2013.50
-5.00	531.25	1036.00	436.00	0.00	833.25	1453.00	2033.25
-5.50	531.25	1055.75	455.75	0.00	853.00	1472.75	2053.00
-6.00	531.25	1075.50	475.50	0.00	872.75	1492.50	2072.75
-6.50	531.25	1095.25	495.25	0.00	892.50	1512.25	2092.50
-7.00	531.25	1115.00	515.00	0.00	912.25	1532.00	2112.25
-7.50	531.25	1134.75	534.75	0.00	932.00	1551.75	2132.00
-8.00	531.25	1154.50	554.50	0.00	951.75	1571.50	2151.75
-8.50	531.25	1174.25	574.25	0.00	971.50	1591.25	2171.50
-9.00	531.25	1194.00	594.00	0.00	991.25	1611.00	2191.25
-9.15+	531.25	1213.75	600.00	0.00	997.25	1630.75	2197.25
-9.15-	531.25	1200.00	600.00	0.00	997.25	1630.75	2197.25
-9.50	531.25	1213.75	613.75	13.75	1011.00	1650.50	2211.00
-10.00	531.25	1233.50	633.50	33.50	1030.75	1670.25	2230.75
-10.50	531.25	1253.25	653.25	53.25	1050.50	1690.00	2250.50
-11.00	531.25	1273.00	673.00	73.00	1070.25	1709.75	2270.25
-11.50	531.25	1292.75	692.75	92.75	1090.00	1729.50	2290.00
-12.00	531.25	1312.50	712.50	112.50	1109.75	1749.25	2309.75
-12.50	531.25	1332.25	732.25	132.25	1129.50	1769.00	2329.50
-13.00	531.25	1352.00	752.00	152.00	1149.25	1788.75	2349.25
-13.50	531.25	1371.75	771.75	171.75	1169.00	1808.50	2369.00
-14.00	531.25	1391.50	791.50	191.50	1188.75	1828.25	2388.75
-14.50	531.25	1411.25	811.25	211.25	1208.50	1848.00	2408.50
-15.00+	531.25	1412.90	831.00	230.73	1238.37	1867.75	2378.99
-15.00-	531.25	1412.90	831.00	230.73	1238.37	933.88	2378.99
-15.50	531.25	1557.72	850.75	252.59	1187.52	948.75	2741.95
-16.00+	531.25	2058.92	870.50	277.80	942.63	963.63	4053.42
-16.00-	531.25	2058.92	435.25	277.80	942.63	963.63	4053.42
-16.50	531.25	2593.78	450.13	298.24	692.98	978.50	5398.55
-17.00	531.25	2807.56	465.00	310.35	632.37	993.38	5830.47

-17.50	531.25	2879.25	479.88	319.92	652.33	1008.25	5871.00
-18.00	531.25	2968.50	494.75	329.83	662.25	1023.13	5960.25
-18.50	531.25	3057.75	509.63	339.75	672.17	1038.00	6049.50
-19.00	531.25	3147.00	524.50	349.67	682.08	1052.88	6138.75
-19.50	531.25	3236.25	539.38	359.58	692.00	1067.75	6228.00
-20.00	531.25	3325.50	554.25	369.50	701.92	1082.63	6317.25
-20.50	531.25	3414.75	569.13	379.42	711.83	1097.50	6406.50
-21.00	531.25	3504.00	584.00	389.33	721.75	1112.38	6495.75
-21.50	531.25	3593.25	598.88	399.25	731.67	1127.25	6585.00
-22.00+	531.25	3712.97	613.75	405.70	727.73	1142.13	6735.88
-22.00-	531.25	3712.97	613.75	405.70	727.73	2284.25	6735.88
-22.50	531.25	3590.44	628.63	439.52	834.27	2310.00	6395.20
-23.00+	531.25	2877.63	643.50	542.08	1206.92	2335.75	4872.13
-23.00-	531.25	2877.63	1287.00	542.08	1206.92	2335.75	4872.13
-23.50	531.25	2134.06	1312.75	652.31	1587.23	2361.50	3318.30
-24.00	531.25	1948.53	1338.50	701.84	1709.48	2387.25	2914.62
-24.50	531.25	2004.25	1364.25	724.25	1721.50	2413.00	3001.50
-25.00	531.25	2030.00	1390.00	750.00	1747.25	2438.75	3027.25
-25.50	531.25	2055.75	1415.75	775.75	1773.00	2464.50	3053.00
-26.00	531.25	2081.50	1441.50	801.50	1798.75	2490.25	3078.75
-26.50	531.25	2107.25	1467.25	827.25	1824.50	2516.00	3104.50
-27.00	531.25	2133.00	1493.00	853.00	1850.25	2541.75	3130.25
-27.50	531.25	2158.75	1518.75	878.75	1876.00	2567.50	3156.00
-28.00	531.25	2184.50	1544.50	904.50	1901.75	2593.25	3181.75
-28.50	531.25	2210.25	1570.25	930.25	1927.50	2619.00	3207.50
-29.00	531.25	2236.00	1596.00	956.00	1953.25	2644.75	3233.25
-29.50	531.25	2261.75	1621.75	981.75	1979.00	2670.50	3259.00
-30.00	531.25	2287.50	1647.50	1007.50	2004.75	2696.25	3284.75
-30.50	531.25	2313.25	1673.25	1033.25	2030.50	2722.00	3310.50
-31.00	531.25	2339.00	1699.00	1059.00	2056.25	2747.75	3336.25
-31.50	531.25	2364.75	1724.75	1084.75	2082.00	2773.50	3362.00
-32.00	531.25	2390.50	1750.50	1110.50	2107.75	2799.25	3387.75
-32.50	531.25	2416.25	1776.25	1136.25	2133.50	2825.00	3413.50
-33.00	531.25	2442.00	1802.00	1162.00	2159.25	2850.75	3439.25
-33.50	531.25	2467.75	1827.75	1187.75	2185.00	2876.50	3465.00
-34.00+	531.25	2443.72	1853.50	1223.41	2231.04	2902.25	3409.81
-34.00-	531.25	2443.72	1853.50	1223.41	2231.04	1451.13	3409.81
-34.50	531.25	2816.44	1879.25	1180.19	2115.11	1466.00	4000.67
-35.00+	531.25	4146.37	1905.00	945.92	1610.75	1480.88	6140.87
-35.00-	531.25	4146.37	952.50	945.92	1610.75	1480.88	6140.87
-35.50	531.25	5507.06	967.38	703.98	1098.72	1495.75	8311.83
-36.00	531.25	5942.78	982.25	645.05	967.08	1510.63	8965.70
-36.50	531.25	5982.75	997.13	664.75	997.17	1525.50	8974.50
-37.00	531.25	6072.00	1012.00	674.67	1007.08	1540.38	9063.75
-37.50	531.25	6161.25	1026.88	684.58	1017.00	1555.25	9153.00
-38.00	531.25	6250.50	1041.75	694.50	1026.92	1570.13	9242.25
-38.50	531.25	6339.75	1056.63	704.42	1036.83	1585.00	9331.50
-39.00	531.25	6429.00	1071.50	714.33	1046.75	0.00	9420.75
-39.50	531.25	6518.25	1086.38	724.25	1056.67	0.00	9510.00

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                    *************
                    *  RESULTS  *
                    *************

 I.--HEADING
 'NAPOLEON
 'FS=1.0
 'SINGLE STRUT

    RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

    LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

    *****WARNING:  STANDARD WEDGE SOLUTION MAY NOT EXIST
                   ALL ELEVATIONS.  SEE COMPLETE OUTPUT.

II.--MAXIMA

                                          MAXIMUM        MINIMUM
    DEFLECTION (IN)             :      2.603E+00     -1.762E-01
         AT ELEVATION (FT)      :          -7.00          17.50

    BENDING MOMENT (LB-FT)      :      6.057E+03     -6.772E+04
         AT ELEVATION (FT)      :         -21.00           0.50

    SHEAR (LB)                  :        6095.11       -6179.97
         AT ELEVATION (FT)      :         -15.50          16.50


    RIGHTSIDE SOIL PRESSURE (PSF):       2258.62
         AT ELEVATION (FT)      :         -23.00

    LEFTSIDE SOIL PRESSURE (PSF) :       2932.51
         AT ELEVATION (FT)      :         -35.00

III.--ANCHOR FORCES

    ELEVATION      ANCHOR       ANCHOR            ANCHOR
    AT ANCHOR       TYPE      DEFORMATION          FORCE
       (FT)                       (IN)             (LB)
        16.50    FLEXIBLE      7.180E-03        6708.27

III..--WALL DEFLECTIONS AND FORCES

                <------DEFLECTION----->     <--WALL INTERNAL FORCES->
     ELEVATION     AXIAL         LATERAL      AXIAL      SHEAR    MOMENT
       (FT)         (IN)          (IN)         (LB)       (LB)    (LB-FT)
       17.50     0.000E+00   -1.762E-01         0          0         0
       17.00     0.000E+00   -8.453E-02         0        338        86
       16.50+    0.000E+00    7.180E-03         0        528       314
       16.50-    0.000E+00    7.180E-03         0      -6180       314
       16.00     0.000E+00    9.889E-02         0      -6132     -2764
       15.50     0.000E+00    1.905E-01         0      -6082     -5818
       15.00     0.000E+00    2.818E-01         0      -6032     -8846
       14.50     0.000E+00    3.728E-01         0      -5980    -11849
       14.00     0.000E+00    4.634E-01         0      -5926    -14826
       13.50     0.000E+00    5.533E-01         0      -5871    -17775
       13.00     0.000E+00    6.425E-01         0      -5814    -20696
       12.50     0.000E+00    7.309E-01         0      -5756    -23589
       12.00     0.000E+00    8.183E-01         0      -5695    -26452
       11.50     0.000E+00    9.047E-01         0      -5631    -29284
       11.29     0.000E+00    9.411E-01         0      -5603    -30480
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11.00	0.000E+00	9.898E-01	0	-5564	-32083
10.50	0.000E+00	1.074E+00	0	-5492	-34847
10.00	0.000E+00	1.156E+00	0	-5417	-37574
9.50	0.000E+00	1.237E+00	0	-5330	-40262
9.00	0.000E+00	1.317E+00	0	-5217	-42900
8.50	0.000E+00	1.394E+00	0	-5077	-45474
8.00	0.000E+00	1.470E+00	0	-4912	-47972
7.50	0.000E+00	1.544E+00	0	-4720	-50381
7.00	0.000E+00	1.616E+00	0	-4504	-52689
6.50	0.000E+00	1.685E+00	0	-4260	-54881
6.00	0.000E+00	1.753E+00	0	-3984	-56943
5.50	0.000E+00	1.818E+00	0	-3674	-58859
5.00	0.000E+00	1.881E+00	0	-3336	-60613
4.50	0.000E+00	1.941E+00	0	-2976	-62192
4.00	0.000E+00	1.999E+00	0	-2596	-63586
3.50	0.000E+00	2.054E+00	0	-2195	-64784
3.00	0.000E+00	2.107E+00	0	-1773	-65777
2.50	0.000E+00	2.157E+00	0	-1351	-66558
2.00	0.000E+00	2.204E+00	0	-949	-67132
1.50	0.000E+00	2.249E+00	0	-567	-67510
1.00	0.000E+00	2.291E+00	0	-206	-67702
0.50	0.000E+00	2.330E+00	0	133	-67719
0.00	0.000E+00	2.366E+00	0	450	-67573
-0.50	0.000E+00	2.400E+00	0	744	-67273
-1.00	0.000E+00	2.431E+00	0	1015	-66832
-1.50	0.000E+00	2.460E+00	0	1263	-66262
-2.00	0.000E+00	2.485E+00	0	1486	-65574
-2.50	0.000E+00	2.508E+00	0	1692	-64779
-2.78+	0.000E+00	2.520E+00	0	1811	-64290
-2.78-	0.000E+00	2.520E+00	0	1811	-64290
-3.00+	0.000E+00	2.529E+00	0	2081	-63861
-3.00-	0.000E+00	2.529E+00	0	2081	-63861
-3.50	0.000E+00	2.546E+00	0	2189	-62796
-4.00	0.000E+00	2.562E+00	0	2345	-61664
-4.50	0.000E+00	2.574E+00	0	2510	-60450
-5.00	0.000E+00	2.585E+00	0	2675	-59154
-5.50	0.000E+00	2.593E+00	0	2839	-57775
-6.00	0.000E+00	2.598E+00	0	3003	-56315
-6.50	0.000E+00	2.602E+00	0	3167	-54772
-7.00	0.000E+00	2.603E+00	0	3332	-53147
-7.50	0.000E+00	2.602E+00	0	3496	-51441
-8.00	0.000E+00	2.599E+00	0	3660	-49651
-8.50	0.000E+00	2.594E+00	0	3824	-47780
-9.00	0.000E+00	2.587E+00	0	3989	-45827
-9.15+	0.000E+00	2.585E+00	0	4038	-45217
-9.15-	0.000E+00	2.585E+00	0	4038	-45217
-9.50	0.000E+00	2.578E+00	0	4152	-43792
-10.00	0.000E+00	2.568E+00	0	4316	-41675
-10.50	0.000E+00	2.555E+00	0	4480	-39476
-11.00	0.000E+00	2.541E+00	0	4645	-37195
-11.50	0.000E+00	2.526E+00	0	4809	-34831
-12.00	0.000E+00	2.509E+00	0	4973	-32386
-12.50	0.000E+00	2.491E+00	0	5137	-29858
-13.00	0.000E+00	2.472E+00	0	5302	-27249
-13.50	0.000E+00	2.452E+00	0	5466	-24557
-14.00	0.000E+00	2.430E+00	0	5630	-21783
-14.50	0.000E+00	2.408E+00	0	5794	-18927
-15.00	0.000E+00	2.385E+00	0	5966	-15987
-15.50	0.000E+00	2.361E+00	0	6095	-12968
-16.00	0.000E+00	2.337E+00	0	5989	-9931
-16.50	0.000E+00	2.313E+00	0	5589	-7028
-17.00	0.000E+00	2.288E+00	0	5055	-4365

-17.50	0.000E+00	2.263E+00	0	4484	-1979
-18.00	0.000E+00	2.238E+00	0	3895	117
-18.50	0.000E+00	2.213E+00	0	3286	1913
-19.00	0.000E+00	2.187E+00	0	2656	3399
-19.50	0.000E+00	2.163E+00	0	2008	4566
-20.00	0.000E+00	2.138E+00	0	1341	5404
-20.50	0.000E+00	2.113E+00	0	656	5904
-21.00	0.000E+00	2.089E+00	0	-46	6057
-21.50	0.000E+00	2.065E+00	0	-766	5855
-22.00+	0.000E+00	2.041E+00	0	-1505	5288
-22.00-	0.000E+00	2.041E+00	0	-1505	5288
-22.50	0.000E+00	2.018E+00	0	-1521	4532
-23.00+	0.000E+00	1.994E+00	0	-1545	3765
-23.00-	0.000E+00	1.994E+00	0	-1545	3765
-23.50	0.000E+00	1.971E+00	0	-1784	2914
-24.00	0.000E+00	1.948E+00	0	-1715	2033
-24.50	0.000E+00	1.925E+00	0	-1580	1210
-25.00	0.000E+00	1.902E+00	0	-1455	451
-25.50	0.000E+00	1.879E+00	0	-1331	-245
-26.00	0.000E+00	1.856E+00	0	-1207	-880
-26.50	0.000E+00	1.833E+00	0	-1083	-1452
-27.00	0.000E+00	1.810E+00	0	-958	-1962
-27.50	0.000E+00	1.787E+00	0	-834	-2410
-28.00	0.000E+00	1.764E+00	0	-710	-2796
-28.50	0.000E+00	1.740E+00	0	-586	-3120
-29.00	0.000E+00	1.717E+00	0	-461	-3382
-29.50	0.000E+00	1.693E+00	0	-337	-3582
-30.00	0.000E+00	1.669E+00	0	-213	-3719
-30.50	0.000E+00	1.645E+00	0	-89	-3794
-31.00	0.000E+00	1.621E+00	0	36	-3808
-31.50	0.000E+00	1.597E+00	0	160	-3759
-32.00	0.000E+00	1.573E+00	0	284	-3648
-32.50	0.000E+00	1.548E+00	0	408	-3475
-33.00	0.000E+00	1.524E+00	0	533	-3239
-33.50	0.000E+00	1.499E+00	0	657	-2942
-34.00	0.000E+00	1.474E+00	0	799	-2579
-34.50	0.000E+00	1.449E+00	0	836	-2161
-35.00+	0.000E+00	1.424E+00	0	594	-1790
-35.00-	0.000E+00	1.424E+00	0	594	-1790
-35.50	0.000E+00	1.399E+00	0	700	-1456
-36.00	0.000E+00	1.373E+00	0	639	-1118
-36.50	0.000E+00	1.348E+00	0	545	-822
-37.00	0.000E+00	1.323E+00	0	456	-572
-37.50	0.000E+00	1.297E+00	0	366	-367
-38.00	0.000E+00	1.272E+00	0	275	-206
-38.50	0.000E+00	1.247E+00	0	184	-92
-39.00	0.000E+00	1.221E+00	0	92	-23
-39.50	0.000E+00	1.196E+00	0	0	0

IV..--SOIL PRESSURES

ELEVATION	<---------SOIL PRESSURES	(PSF)-------->	
(FT)	LEFTSIDE	RIGHTSIDE	NET
17.50	0.00	703.17	703.17
17.00	0.00	649.50	649.50
16.50+	0.00	95.31	95.31
16.50-	0.00	95.31	95.31
16.00	0.00	97.68	97.68
15.50	0.00	100.11	100.11
15.00	0.00	102.66	102.66
14.50	0.00	105.39	105.39
14.00	0.00	108.36	108.36

13.50	0.00	111.65	111.65
13.00	0.00	115.30	115.30
12.50	0.00	119.38	119.38
12.00	0.00	123.95	123.95
11.50	0.00	131.07	131.07
11.29	0.00	120.97	120.97
11.00	0.00	107.54	107.54
10.50	0.00	84.68	84.68
10.00	0.00	62.55	62.55
9.50	0.00	77.00	77.00
9.00	0.00	97.25	97.25
8.50	0.00	117.50	117.50
8.00	0.00	137.75	137.75
7.50	0.00	158.00	158.00
7.00	0.00	177.44	177.44
6.50	0.00	203.58	203.58
6.00	0.00	243.17	243.17
5.50	0.00	277.76	277.76
5.00	0.00	293.64	293.64
4.50	0.00	302.67	302.67
4.00	0.00	312.58	312.58
3.50	0.00	322.50	322.50
3.00	0.00	332.42	332.42
2.50	48.71	342.33	293.62
2.00	98.91	352.25	253.34
1.50	150.46	362.17	211.70
1.00	203.25	372.08	168.84
0.50	257.13	382.00	124.87
0.00	311.99	391.92	79.93
-0.50	367.69	401.83	34.14
-1.00	424.11	411.75	-12.36
-1.50	481.13	421.67	-59.46
-2.00	538.61	426.81	-111.80
-2.50	596.44	469.89	-126.55
-2.78+	628.83	545.52	-83.31
-2.78-	628.83	1324.27	695.44
-3.00+	654.50	1343.92	689.41
-3.00-	996.08	605.37	-390.71
-3.50	987.44	745.61	-241.83
-4.00	994.99	798.44	-196.55
-4.50	1016.25	813.50	-202.75
-5.00	1036.00	833.25	-202.75
-5.50	1055.75	853.00	-202.75
-6.00	1075.50	872.75	-202.75
-6.50	1095.25	892.50	-202.75
-7.00	1115.00	912.25	-202.75
-7.50	1134.75	932.00	-202.75
-8.00	1154.50	951.75	-202.75
-8.50	1174.25	971.50	-202.75
-9.00	1194.00	991.25	-202.75
-9.15+	1213.75	997.25	-216.50
-9.15-	1200.00	997.25	-202.75
-9.50	1213.75	1011.00	-202.75
-10.00	1233.50	1030.75	-202.75
-10.50	1253.25	1050.50	-202.75
-11.00	1273.00	1070.25	-202.75
-11.50	1292.75	1090.00	-202.75
-12.00	1312.50	1109.75	-202.75
-12.50	1332.25	1129.50	-202.75
-13.00	1352.00	1149.25	-202.75
-13.50	1371.75	1169.00	-202.75
-14.00	1391.50	1188.75	-202.75

-14.50	1411.25	1208.50	-202.75
-15.00	1412.90	1238.37	-174.53
-15.50	1557.72	1187.52	-370.20
-16.00	2058.92	942.63	-1116.29
-16.50	2234.40	692.98	-1541.42
-17.00	2288.43	632.37	-1656.06
-17.50	2341.05	652.33	-1688.71
-18.00	2392.32	662.25	-1730.07
-18.50	2442.31	672.17	-1770.14
-19.00	2491.09	682.08	-1809.01
-19.50	2538.72	692.00	-1846.72
-20.00	2585.26	701.92	-1883.34
-20.50	2630.74	711.83	-1918.91
-21.00	2675.22	721.75	-1953.47
-21.50	2718.70	731.67	-1987.04
-22.00+	2761.21	727.73	-2033.49
-22.00-	2761.21	2205.31	-555.91
-22.50	2802.74	2231.97	-570.77
-23.00+	2843.26	2258.62	-584.64
-23.00-	2726.32	1244.17	-1482.15
-23.50	2134.06	1587.23	-546.83
-24.00	1948.53	1709.48	-239.05
-24.50	2004.25	1721.50	-282.75
-25.00	2030.00	1747.25	-282.75
-25.50	2055.75	1773.00	-282.75
-26.00	2081.50	1798.75	-282.75
-26.50	2107.25	1824.50	-282.75
-27.00	2133.00	1850.25	-282.75
-27.50	2158.75	1876.00	-282.75
-28.00	2184.50	1901.75	-282.75
-28.50	2210.25	1927.50	-282.75
-29.00	2236.00	1953.25	-282.75
-29.50	2261.75	1979.00	-282.75
-30.00	2287.50	2004.75	-282.75
-30.50	2313.25	2030.50	-282.75
-31.00	2339.00	2056.25	-282.75
-31.50	2364.75	2082.00	-282.75
-32.00	2390.50	2107.75	-282.75
-32.50	2416.25	2133.50	-282.75
-33.00	2442.00	2159.25	-282.75
-33.50	2467.75	2185.00	-282.75
-34.00	2443.72	2231.04	-212.68
-34.50	2816.44	2115.11	-701.33
-35.00+	2932.51	1610.75	-1321.76
-35.00-	1667.60	1610.75	-56.85
-35.50	1680.80	1098.72	-582.08
-36.00	1693.58	967.08	-726.50
-36.50	1705.93	997.17	-708.77
-37.00	1717.88	1007.08	-710.79
-37.50	1729.41	1017.00	-712.41
-38.00	1740.54	1026.92	-713.62
-38.50	1751.26	1036.83	-714.43
-39.00	1761.59	1046.75	-714.84
-39.50	1771.51	1056.67	-714.85

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
17.5	-461.54	0.00	0.00	0.00
17.0	-412.04	0.00	0.00	0.00
16.5	-362.54	0.00	0.00	0.00
16.0	-313.04	0.00	0.00	0.00
15.5	-263.54	0.00	0.00	0.00
15.0	-214.04	0.00	0.00	0.00
14.5	-164.54	0.00	0.00	0.00
14.0	-115.04	0.00	0.00	0.00
13.9	-102.66	0.00	0.00	0.00
13.5	-65.54	0.00	0.00	0.00
13.0	-16.04	0.00	0.00	0.00
12.5	33.46	0.00	0.00	33.46
12.0	82.96	0.00	0.00	82.96
12.0	82.96	0.00	0.00	82.96
11.5	134.46	0.00	0.00	134.46
11.0	154.71	0.00	31.25	185.96
10.5	174.96	0.00	62.50	237.46
10.0	195.21	0.00	93.75	288.96
9.5	215.46	0.00	125.00	340.46
9.0	235.71	0.00	156.25	391.96
8.5	255.96	0.00	187.50	443.46
8.0	276.21	0.00	218.75	494.96
7.5	296.46	0.00	250.00	546.46
7.0	316.71	0.00	281.25	597.96
6.6	331.90	0.00	304.69	636.59
6.5	336.96	0.00	312.50	649.46
6.0	357.21	0.00	343.75	700.96
6.0	345.99	0.00	343.75	689.74
5.5	358.57	0.00	375.00	733.57
5.0	371.14	0.00	406.25	777.39
4.5	383.71	0.00	437.50	821.21
4.0	396.28	0.00	468.75	865.03
3.5	408.85	0.00	500.00	908.85
3.0	421.43	0.00	531.25	952.68
3.0	421.43	0.00	531.25	952.68
2.5	434.00	70.40	531.25	894.85
2.0	446.57	140.80	531.25	837.02
1.5	459.14	211.20	531.25	779.19
1.0	471.71	281.60	531.25	721.37
0.5	484.29	352.00	531.25	663.54
0.0	496.86	422.40	531.25	605.71
-0.5	509.43	492.80	531.25	547.89
-1.0	522.00	563.20	531.25	490.06

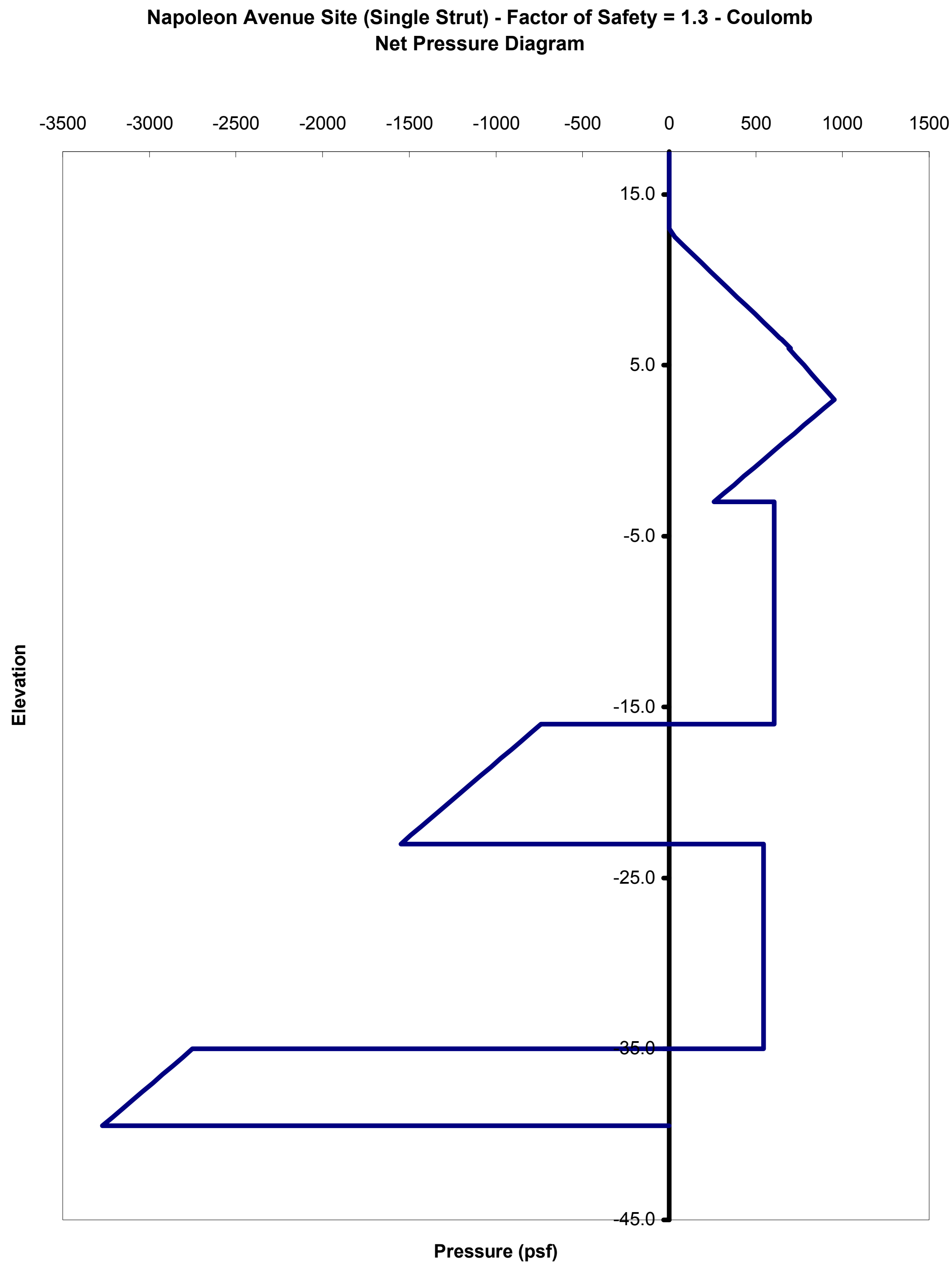
Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-1.5	534.58	633.59	531.25	432.23
-2.0	547.15	703.99	531.25	374.40
-2.5	559.72	774.39	531.25	316.58
-3.0	572.29	844.79	531.25	258.75
-3.0	892.71	818.54	531.25	605.42
-3.5	912.46	838.29	531.25	605.42
-4.0	932.21	858.04	531.25	605.42
-4.5	951.96	877.79	531.25	605.42
-5.0	971.71	897.54	531.25	605.42
-5.5	991.46	917.29	531.25	605.42
-6.0	1011.21	937.04	531.25	605.42
-6.5	1030.96	956.79	531.25	605.42
-7.0	1050.71	976.54	531.25	605.42
-7.5	1070.46	996.29	531.25	605.42
-8.0	1090.21	1016.04	531.25	605.42
-8.5	1109.96	1035.79	531.25	605.42
-9.0	1129.71	1055.54	531.25	605.42
-9.5	1149.46	1075.29	531.25	605.42
-10.0	1169.21	1095.04	531.25	605.42
-10.5	1188.96	1114.79	531.25	605.42
-11.0	1208.71	1134.54	531.25	605.42
-11.5	1228.46	1154.29	531.25	605.42
-12.0	1248.21	1174.04	531.25	605.42
-12.5	1267.96	1193.79	531.25	605.42
-13.0	1287.71	1213.54	531.25	605.42
-13.5	1307.46	1233.29	531.25	605.42
-14.0	1327.21	1253.04	531.25	605.42
-14.5	1346.96	1272.79	531.25	605.42
-15.0	1366.71	1292.54	531.25	605.42
-15.5	1386.46	1312.29	531.25	605.42
-16.0	1406.21	1332.04	531.25	605.42
-16.0	789.29	2059.92	531.25	-739.38
-16.5	801.86	2130.32	531.25	-797.21
-17.0	814.43	2200.72	531.25	-855.04
-17.5	827.01	2271.12	531.25	-912.86
-18.0	839.58	2341.52	531.25	-970.69
-18.5	852.15	2411.92	531.25	-1028.52
-19.0	864.72	2482.32	531.25	-1086.34
-19.5	877.29	2552.72	531.25	-1144.17
-20.0	889.87	2623.12	531.25	-1202.00
-20.5	902.44	2693.52	531.25	-1259.83
-21.0	915.01	2763.92	531.25	-1317.65
-21.5	927.58	2834.31	531.25	-1375.48
-22.0	940.15	2904.71	531.25	-1433.31
-22.5	952.73	2975.11	531.25	-1491.14

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0	965.30	3045.51	531.25	-1548.96
-23.0	1791.94	1779.31	531.25	543.88
-23.5	1817.69	1805.06	531.25	543.88
-24.0	1843.44	1830.81	531.25	543.88
-24.5	1869.19	1856.56	531.25	543.88
-25.0	1894.94	1882.31	531.25	543.88
-25.5	1920.69	1908.06	531.25	543.88
-26.0	1946.44	1933.81	531.25	543.88
-26.5	1972.19	1959.56	531.25	543.88
-27.0	1997.94	1985.31	531.25	543.88
-27.5	2023.69	2011.06	531.25	543.88
-28.0	2049.44	2036.81	531.25	543.88
-28.5	2075.19	2062.56	531.25	543.88
-29.0	2100.94	2088.31	531.25	543.88
-29.5	2126.69	2114.06	531.25	543.88
-30.0	2152.44	2139.81	531.25	543.88
-30.5	2178.19	2165.56	531.25	543.88
-31.0	2203.94	2191.31	531.25	543.88
-31.5	2229.69	2217.06	531.25	543.88
-32.0	2255.44	2242.81	531.25	543.88
-32.5	2281.19	2268.56	531.25	543.88
-33.0	2306.94	2294.31	531.25	543.88
-33.5	2332.69	2320.06	531.25	543.88
-34.0	2358.44	2345.81	531.25	543.88
-34.5	2384.19	2371.56	531.25	543.88
-35.0	2409.94	2397.31	531.25	543.88
-35.0	1226.46	4507.93	531.25	-2750.22
-35.5	1239.03	4578.33	531.25	-2808.05
-36.0	1251.60	4648.73	531.25	-2865.87
-36.5	1264.17	4719.12	531.25	-2923.70
-37.0	1276.75	4789.52	531.25	-2981.53
-37.5	1289.32	4859.92	531.25	-3039.35
-38.0	1301.89	4930.32	531.25	-3097.18
-38.5	1314.46	5000.72	531.25	-3155.01
-39.0	1327.03	5071.12	531.25	-3212.84
-39.5	1339.61	5141.52	531.25	-3270.66

Summing the moments around the sheet pile tip (EL -39.5) gave a strut load of 174 kips for the Coulomb case with a 1.3 factor of safety.


Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Coulomb
Net Pressure Diagram
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

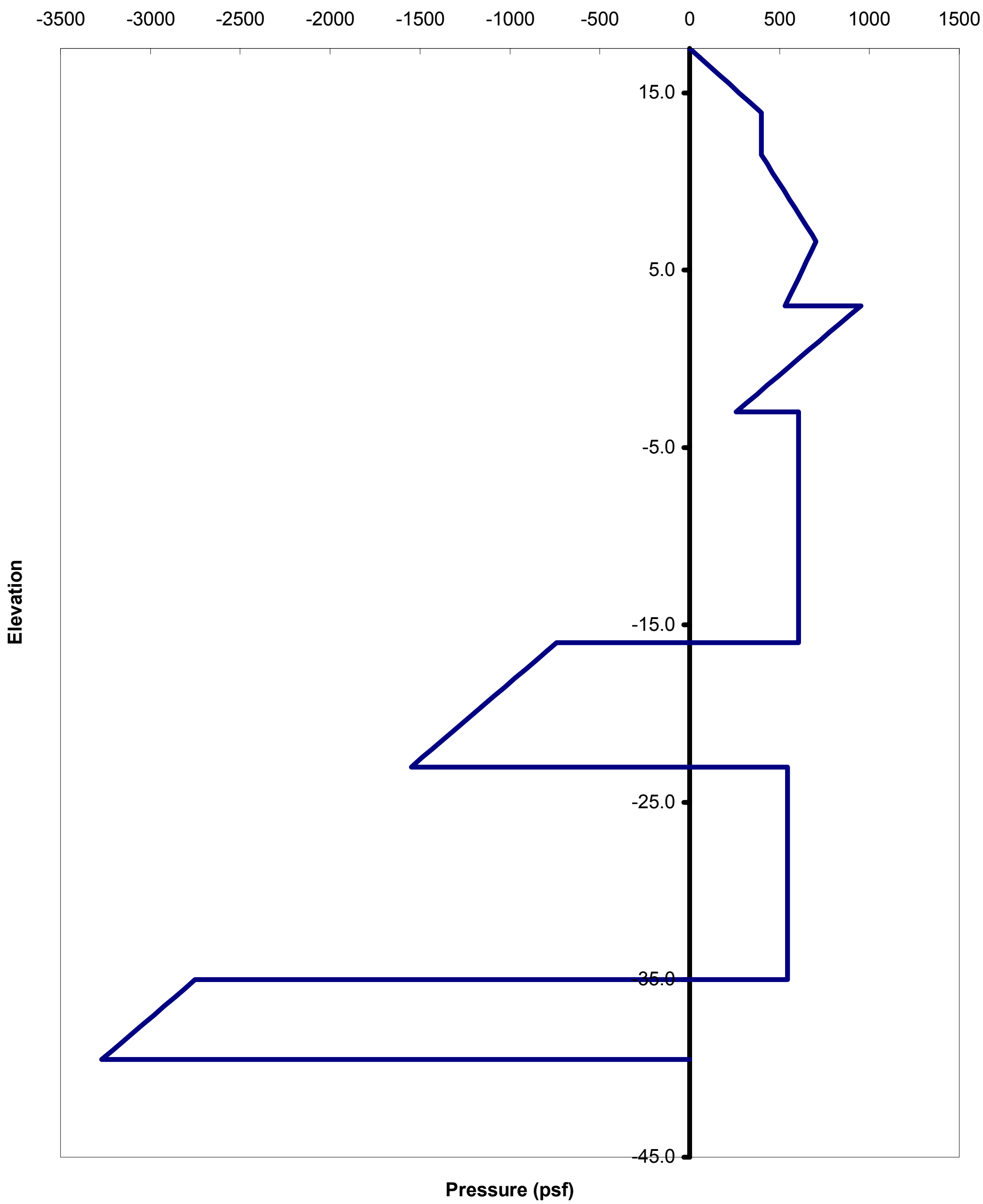
Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Terzaghi					
Elevation	**Terzaghi Pressure**	**Right Side Active Pressure**	**Left Side Passive Pressure**	**Water Pressure**	**Net Pressure**
17.5	0.00		0.00	0.00	0.00
17.0	55.04		0.00	0.00	55.04
16.5	110.07		0.00	0.00	110.07
16.0	165.11		0.00	0.00	165.11
15.5	220.14		0.00	0.00	220.14
15.0	275.18		0.00	0.00	275.18
14.5	330.21		0.00	0.00	330.21
14.0	385.25		0.00	0.00	385.25
13.9	399.00		0.00	0.00	399.00
13.5	399.00		0.00	0.00	399.00
13.0	399.00		0.00	0.00	399.00
12.5	399.00		0.00	0.00	399.00
12.0	399.00		0.00	0.00	399.00
12.0	399.00		0.00	0.00	399.00
11.5	399.00		0.00	0.00	399.00
11.0	399.00		0.00	31.25	430.25
10.5	399.00		0.00	62.50	461.50
10.0	399.00		0.00	93.75	492.75
9.5	399.00		0.00	125.00	524.00
9.0	399.00		0.00	156.25	555.25
8.5	399.00		0.00	187.50	586.50
8.0	399.00		0.00	218.75	617.75
7.5	399.00		0.00	250.00	649.00
7.0	399.00		0.00	281.25	680.25
6.6	399.00		0.00	304.69	703.69
6.5	385.25		0.00	312.50	697.75
6.0	330.21		0.00	343.75	673.96
6.0	330.21		0.00	343.75	673.96
5.5	275.18		0.00	375.00	650.18
5.0	220.14		0.00	406.25	626.39
4.5	165.11		0.00	437.50	602.61
4.0	110.07		0.00	468.75	578.82
3.5	55.04		0.00	500.00	555.04
3.0	0.00		0.00	531.25	531.25
3.0		421.43	0.00	531.25	952.68
2.5		434.00	70.40	531.25	894.85
2.0		446.57	140.80	531.25	837.02
1.5		459.14	211.20	531.25	779.19
1.0		471.71	281.60	531.25	721.37
0.5		484.29	352.00	531.25	663.54
0.0		496.86	422.40	531.25	605.71
-0.5		509.43	492.80	531.25	547.89
-1.0		522.00	563.20	531.25	490.06

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Terzaghi					
Elevation	**Terzaghi Pressure**	**Right Side Active Pressure**	**Left Side Passive Pressure**	**Water Pressure**	**Net Pressure**
-1.5		534.58	633.59	531.25	432.23
-2.0		547.15	703.99	531.25	374.40
-2.5		559.72	774.39	531.25	316.58
-3.0		572.29	844.79	531.25	258.75
-3.0		892.71	818.54	531.25	605.42
-3.5		912.46	838.29	531.25	605.42
-4.0		932.21	858.04	531.25	605.42
-4.5		951.96	877.79	531.25	605.42
-5.0		971.71	897.54	531.25	605.42
-5.5		991.46	917.29	531.25	605.42
-6.0		1011.21	937.04	531.25	605.42
-6.5		1030.96	956.79	531.25	605.42
-7.0		1050.71	976.54	531.25	605.42
-7.5		1070.46	996.29	531.25	605.42
-8.0		1090.21	1016.04	531.25	605.42
-8.5		1109.96	1035.79	531.25	605.42
-9.0		1129.71	1055.54	531.25	605.42
-9.5		1149.46	1075.29	531.25	605.42
-10.0		1169.21	1095.04	531.25	605.42
-10.5		1188.96	1114.79	531.25	605.42
-11.0		1208.71	1134.54	531.25	605.42
-11.5		1228.46	1154.29	531.25	605.42
-12.0		1248.21	1174.04	531.25	605.42
-12.5		1267.96	1193.79	531.25	605.42
-13.0		1287.71	1213.54	531.25	605.42
-13.5		1307.46	1233.29	531.25	605.42
-14.0		1327.21	1253.04	531.25	605.42
-14.5		1346.96	1272.79	531.25	605.42
-15.0		1366.71	1292.54	531.25	605.42
-15.5		1386.46	1312.29	531.25	605.42
-16.0		1406.21	1332.04	531.25	605.42
-16.0		789.29	2059.92	531.25	-739.38
-16.5		801.86	2130.32	531.25	-797.21
-17.0		814.43	2200.72	531.25	-855.04
-17.5		827.01	2271.12	531.25	-912.86
-18.0		839.58	2341.52	531.25	-970.69
-18.5		852.15	2411.92	531.25	-1028.52
-19.0		864.72	2482.32	531.25	-1086.34
-19.5		877.29	2552.72	531.25	-1144.17
-20.0		889.87	2623.12	531.25	-1202.00
-20.5		902.44	2693.52	531.25	-1259.83
-21.0		915.01	2763.92	531.25	-1317.65
-21.5		927.58	2834.31	531.25	-1375.48
-22.0		940.15	2904.71	531.25	-1433.31
-22.5		952.73	2975.11	531.25	-1491.14

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Terzaghi					
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0		965.30	3045.51	531.25	-1548.96
-23.0		1791.94	1779.31	531.25	543.88
-23.5		1817.69	1805.06	531.25	543.88
-24.0		1843.44	1830.81	531.25	543.88
-24.5		1869.19	1856.56	531.25	543.88
-25.0		1894.94	1882.31	531.25	543.88
-25.5		1920.69	1908.06	531.25	543.88
-26.0		1946.44	1933.81	531.25	543.88
-26.5		1972.19	1959.56	531.25	543.88
-27.0		1997.94	1985.31	531.25	543.88
-27.5		2023.69	2011.06	531.25	543.88
-28.0		2049.44	2036.81	531.25	543.88
-28.5		2075.19	2062.56	531.25	543.88
-29.0		2100.94	2088.31	531.25	543.88
-29.5		2126.69	2114.06	531.25	543.88
-30.0		2152.44	2139.81	531.25	543.88
-30.5		2178.19	2165.56	531.25	543.88
-31.0		2203.94	2191.31	531.25	543.88
-31.5		2229.69	2217.06	531.25	543.88
-32.0		2255.44	2242.81	531.25	543.88
-32.5		2281.19	2268.56	531.25	543.88
-33.0		2306.94	2294.31	531.25	543.88
-33.5		2332.69	2320.06	531.25	543.88
-34.0		2358.44	2345.81	531.25	543.88
-34.5		2384.19	2371.56	531.25	543.88
-35.0		2409.94	2397.31	531.25	543.88
-35.0		1226.46	4507.93	531.25	-2750.22
-35.5		1239.03	4578.33	531.25	-2808.05
-36.0		1251.60	4648.73	531.25	-2865.87
-36.5		1264.17	4719.12	531.25	-2923.70
-37.0		1276.75	4789.52	531.25	-2981.53
-37.5		1289.32	4859.92	531.25	-3039.35
-38.0		1301.89	4930.32	531.25	-3097.18
-38.5		1314.46	5000.72	531.25	-3155.01
-39.0		1327.03	5071.12	531.25	-3212.84
-39.5		1339.61	5141.52	531.25	-3270.66

Summing the moments around the sheet pile tip (EL -39.5) gave a strut load of 208 kips for the Terzaghi case with a 1.3 factor of safety.

Napoleon Avenue Site (Single Strut) - Factor of Safety = 1.3 - Terzaghi
Net Pressure Diagram



PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:27:18

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

I.--HEADING
'NAPOLEON
'FS=1.0
'SINGLE STRUT

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICITY (PSI)	MOMENT OF INERTIA (IN^4)	CROSS SECTION AREA (SQIN)
17.50	2.900E+07	369.40	10.28

ELEVATION AT BOTTOM OF WALL = -39.50

III.--ANCHOR DATA

ELEV. AT WALL (FT)	ANCHOR TYPE	ULTIMATE TENSION FORCE (LB)	ULTIMATE COMPR. FORCE (LB)	ANCHOR STIFF. (LB/IN)	ANCHOR SLOPE (FT)
16.5	FLEXIBLE	9.665E+5	7.445E+5	9.343E+5	0.000

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	17.50
100.00	17.50

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	3.00
100.00	3.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	INT. FRICT. (DEG)	COH-ESION (PSF)	WALL FRICT. (DEG)	ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
99.0	99.0	0.0	231.0	0.0	0.0	154.0	154.0	12.0	0.0
103.0	103.0	0.0	231.0	0.0	0.0	154.0	154.0	6.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6	-3.0	0.0
102.0	102.0	0.0	231.0	0.0	0.0	154.0	154.0	-16.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	246.0	0.0	0.0	164.0	164.0	-35.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6		

V.B.--LEFTSIDE

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	INT. FRICT. (DEG)	COH-ESION (PSF)	WALL FRICT. (DEG)	ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)

122.0	122.0	24.0	0.0	0.0	0.0	9.3	9.3	-3.0	0.0
102.0	102.0	0.0	231.0	0.0	0.0	154.0	154.0	-16.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	246.0	0.0	0.0	164.0	164.0	-35.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 11.50 (FT)
LEFTSIDE ELEVATION = 3.00 (FT)
NO SEEPAGE

VIII.--VERTICAL SURCHARGE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:27:21

****
* LIMIT PRESSURES *
****

I.--HEADING
'NAPOLEON
'FS=1.0
'SINGLE STRUT
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

	NET WATER	< LEFTSIDE SOIL PRESSURES>			<RIGHTSIDE SOIL PRESSURES>		
ELEV. (FT)	PRESS. (PSF)	PASSIVE (PSF)	AT-REST (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	AT-REST (PSF)	PASSIVE (PSF)
17.50	0.00	0.00	0.00	0.00	0.00	0.00	462.00
17.00	0.00	0.00	0.00	0.00	0.00	49.50	511.50
16.50	0.00	0.00	0.00	0.00	0.00	99.00	561.00
16.00	0.00	0.00	0.00	0.00	0.00	148.50	610.50
15.50	0.00	0.00	0.00	0.00	0.00	198.00	660.00
15.00	0.00	0.00	0.00	0.00	0.00	247.50	709.50
14.50	0.00	0.00	0.00	0.00	0.00	297.00	759.00
14.00	0.00	0.00	0.00	0.00	0.00	346.50	808.50
13.50	0.00	0.00	0.00	0.00	0.00	396.00	858.00
13.00	0.00	0.00	0.00	0.00	0.00	445.50	907.49
12.83+	0.00	0.00	0.00	0.00	0.00	461.96	957.12
12.83-	0.00	0.00	0.00	0.00	0.00	461.96	924.00
12.50	0.00	0.00	0.00	0.00	33.12	495.00	957.12
12.00	0.00	0.00	0.00	0.00	83.02	544.50	1007.02
11.50	0.00	0.00	0.00	0.00	125.94	596.00	1049.94
11.00	31.25	0.00	0.00	0.00	154.24	616.25	1078.24
10.50	62.50	0.00	0.00	0.00	174.62	636.50	1098.62
10.00	93.75	0.00	0.00	0.00	194.75	656.75	1118.75

9.50	125.00	0.00	0.00	0.00	215.00	677.00	1139.00
9.00	156.25	0.00	0.00	0.00	235.25	697.25	1159.25
8.50	187.50	0.00	0.00	0.00	255.50	717.50	1179.50
8.00	218.75	0.00	0.00	0.00	275.75	737.75	1199.75
7.50	250.00	0.00	0.00	0.00	296.00	758.00	1220.00
7.00	281.25	0.00	0.00	0.00	316.46	778.25	1229.73
6.50	312.50	0.00	0.00	0.00	335.43	798.50	1322.44
6.00+	343.75	0.00	0.00	0.00	349.03	818.75	1624.04
6.00−	343.75	0.00	0.00	0.00	349.03	485.73	1624.04
5.50	375.00	0.00	0.00	0.00	358.91	503.38	1950.01
5.00	406.25	0.00	0.00	0.00	370.24	521.03	2092.62
4.50	437.50	0.00	0.00	0.00	382.93	538.68	2153.04
4.00	468.75	0.00	0.00	0.00	395.48	556.33	2223.58
3.50	500.00	0.00	0.00	0.00	408.02	573.98	2294.12
3.00	531.25	0.00	0.00	0.00	420.57	591.63	2364.66
2.50	531.25	70.54	17.65	12.55	433.12	609.28	2435.21
2.00	531.25	141.09	35.30	25.09	445.66	626.93	2505.75
1.50	531.25	211.63	52.95	37.64	458.21	644.58	2576.29
1.00	531.25	282.17	70.60	50.19	470.76	662.23	2646.83
0.50	531.25	352.71	88.25	62.73	483.30	679.88	2717.38
0.00	531.25	423.26	105.90	75.28	495.85	697.53	2787.92
-0.50	531.25	493.80	123.55	87.83	508.40	715.18	2858.46
-1.00	531.25	564.34	141.20	100.37	520.94	732.83	2929.01
-1.50	531.25	634.88	158.85	112.92	533.49	750.48	2999.55
-2.00	531.25	706.06	176.50	129.43	540.99	768.13	3092.08
-2.50	531.25	773.39	194.15	114.05	588.69	785.78	3009.86
-3.00+	531.25	819.66	211.80	24.64	733.55	803.43	2500.62
-3.00−	531.25	819.66	357.00	24.64	733.55	1354.25	2500.62
-3.14+	531.25	841.33	362.66	0.00	776.08	1374.00	2347.56
-3.14−	531.25	825.87	362.66	0.00	776.08	1374.00	2347.56
-3.50	531.25	841.33	376.75	0.00	881.89	1393.75	1966.77
-4.00	531.25	858.27	396.50	0.00	936.74	1413.50	1834.15
-4.50	531.25	878.25	416.25	0.00	951.50	1433.25	1875.50
-5.00	531.25	898.00	436.00	0.00	971.25	1453.00	1895.25
-5.50	531.25	917.75	455.75	0.00	991.00	1472.75	1915.00
-5.66+	531.25	937.50	462.00	0.00	997.25	1492.50	1921.25
-5.66−	531.25	924.00	462.00	0.00	997.25	1492.50	1921.25
-6.00	531.25	937.50	475.50	13.50	1010.75	1512.25	1934.75
-6.50	531.25	957.25	495.25	33.25	1030.50	1532.00	1954.50
-7.00	531.25	977.00	515.00	53.00	1050.25	1551.75	1974.25
-7.50	531.25	996.75	534.75	72.75	1070.00	1571.50	1994.00
-8.00	531.25	1016.50	554.50	92.50	1089.75	1591.25	2013.75
-8.50	531.25	1036.25	574.25	112.25	1109.50	1611.00	2033.50
-9.00	531.25	1056.00	594.00	132.00	1129.25	1630.75	2053.25
-9.50	531.25	1075.75	613.75	151.75	1149.00	1650.50	2073.00
-10.00	531.25	1095.50	633.50	171.50	1168.75	1670.25	2092.75
-10.50	531.25	1115.25	653.25	191.25	1188.50	1690.00	2112.50
-11.00	531.25	1135.00	673.00	211.00	1208.25	1709.75	2132.25
-11.50	531.25	1154.75	692.75	230.75	1228.00	1729.50	2152.00
-12.00	531.25	1174.50	712.50	250.50	1247.75	1749.25	2171.75
-12.50	531.25	1194.25	732.25	270.25	1267.50	1769.00	2191.50
-13.00	531.25	1214.00	752.00	290.00	1287.25	1788.75	2211.25
-13.50	531.25	1233.75	771.75	309.75	1307.00	1808.50	2231.00
-14.00	531.25	1253.50	791.50	329.50	1326.75	1828.25	2250.75
-14.50	531.25	1273.25	811.25	349.25	1346.50	1848.00	2270.50
-15.00+	531.25	1281.37	831.00	369.67	1375.94	1867.75	2257.25
-15.00−	531.25	1281.37	831.00	369.67	1375.94	1108.07	2257.25
-15.50	531.25	1381.34	850.75	384.87	1328.06	1125.72	2506.78
-16.00+	531.25	1711.40	870.50	385.95	1094.86	1143.37	3392.36
-16.00−	531.25	1711.40	516.44	385.95	1094.86	1143.37	3392.36
-16.50	531.25	2066.07	534.09	383.54	858.18	1161.02	4302.54
-17.00	531.25	2216.43	551.73	391.59	803.15	1178.67	4602.46

-17.50	531.25	2275.74	569.38	404.76	825.33	1196.32	4640.41
-18.00	531.25	2346.29	587.03	417.30	837.87	1213.97	4710.95
-18.50	531.25	2416.83	604.68	429.85	850.42	1231.61	4781.49
-19.00	531.25	2487.37	622.33	442.40	862.97	1249.26	4852.04
-19.50	531.25	2557.91	639.98	454.94	875.51	1266.91	4922.58
-20.00	531.25	2628.46	657.63	467.49	888.06	1284.56	4993.12
-20.50	531.25	2699.00	675.28	480.03	900.60	1302.21	5063.66
-21.00	531.25	2769.54	692.93	492.58	913.15	1319.86	5134.21
-21.50	531.25	2840.09	710.58	505.13	925.70	1337.51	5204.75
-22.00+	531.25	2930.69	728.23	513.68	925.24	1355.16	5316.72
-22.00-	531.25	2930.69	728.23	513.68	925.24	2284.25	5316.72
-22.50	531.25	2861.85	745.88	553.87	1028.50	2310.00	5098.32
-23.00+	531.25	2403.81	763.53	672.29	1381.20	2335.75	4084.77
-23.00-	531.25	2403.81	1287.00	672.29	1381.20	2335.75	4084.77
-23.50	531.25	1924.07	1312.75	797.10	1740.29	2361.50	3049.51
-24.00	531.25	1810.79	1338.50	850.39	1856.65	2387.25	2786.67
-24.50	531.25	1856.25	1364.25	872.25	1869.50	2413.00	2853.50
-25.00	531.25	1882.00	1390.00	898.00	1895.25	2438.75	2879.25
-25.50	531.25	1907.75	1415.75	923.75	1921.00	2464.50	2905.00
-26.00	531.25	1933.50	1441.50	949.50	1946.75	2490.25	2930.75
-26.50	531.25	1959.25	1467.25	975.25	1972.50	2516.00	2956.50
-27.00	531.25	1985.00	1493.00	1001.00	1998.25	2541.75	2982.25
-27.50	531.25	2010.75	1518.75	1026.75	2024.00	2567.50	3008.00
-28.00	531.25	2036.50	1544.50	1052.50	2049.75	2593.25	3033.75
-28.50	531.25	2062.25	1570.25	1078.25	2075.50	2619.00	3059.50
-29.00	531.25	2088.00	1596.00	1104.00	2101.25	2644.75	3085.25
-29.50	531.25	2113.75	1621.75	1129.75	2127.00	2670.50	3111.00
-30.00	531.25	2139.50	1647.50	1155.50	2152.75	2696.25	3136.75
-30.50	531.25	2165.25	1673.25	1181.25	2178.50	2722.00	3162.50
-31.00	531.25	2191.00	1699.00	1207.00	2204.25	2747.75	3188.25
-31.50	531.25	2216.75	1724.75	1232.75	2230.00	2773.50	3214.00
-32.00	531.25	2242.50	1750.50	1258.50	2255.75	2799.25	3239.75
-32.50	531.25	2268.25	1776.25	1284.25	2281.50	2825.00	3265.50
-33.00	531.25	2294.00	1802.00	1310.00	2307.25	2850.75	3291.25
-33.50	531.25	2319.75	1827.75	1335.75	2333.00	2876.50	3317.00
-34.00+	531.25	2312.20	1853.50	1371.08	2377.34	2902.25	3288.08
-34.00-	531.25	2312.20	1853.50	1371.08	2377.34	1721.80	3288.08
-34.50	531.25	2570.01	1879.25	1330.10	2273.29	1739.45	3695.45
-35.00+	531.25	3468.60	1905.00	1104.79	1813.70	1757.10	5149.56
-35.00-	531.25	3468.60	1130.17	1104.79	1813.70	1757.10	5149.56
-35.50	531.25	4388.89	1147.82	873.09	1347.73	1774.75	6625.36
-36.00	531.25	4691.14	1165.47	819.02	1230.58	1792.40	7077.17
-36.50	531.25	4728.73	1183.12	841.04	1261.61	1810.05	7093.40
-37.00	531.25	4799.28	1200.77	853.58	1274.15	1827.70	7163.94
-37.50	531.25	4869.82	1218.41	866.13	1286.70	1845.35	7234.48
-38.00	531.25	4940.36	1236.06	878.67	1299.25	1863.00	7305.03
-38.50	531.25	5010.90	1253.71	891.22	1311.79	1880.64	7375.57
-39.00	531.25	5081.45	1271.36	903.77	1324.34	0.00	7446.11
-39.50	531.25	5151.99	1289.01	916.31	1336.88	0.00	7516.65

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                    *************
                    *  RESULTS  *
                    *************

 I.--HEADING
 'NAPOLEON
 'FS=1.0
 'SINGLE STRUT

    RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

    LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

    *****WARNING:  STANDARD WEDGE SOLUTION MAY NOT EXIST
                   ALL ELEVATIONS.  SEE COMPLETE OUTPUT.

 II.--MAXIMA

                                        MAXIMUM        MINIMUM
    DEFLECTION (IN)            :      7.051E+00     -3.993E-01
         AT ELEVATION (FT)     :         -12.00          17.50

    BENDING MOMENT (LB-FT)     :      2.298E+02     -1.213E+05
         AT ELEVATION (FT)     :          16.50          -4.00

    SHEAR (LB)                 :        6917.01       -9249.45
         AT ELEVATION (FT)     :         -16.00          16.50


    RIGHTSIDE SOIL PRESSURE (PSF):      2377.34
         AT ELEVATION (FT)     :         -34.00

    LEFTSIDE SOIL PRESSURE (PSF) :      3468.60
         AT ELEVATION (FT)     :         -35.00

III.--ANCHOR FORCES

    ELEVATION      ANCHOR       ANCHOR           ANCHOR
    AT ANCHOR       TYPE      DEFORMATION         FORCE
       (FT)                       (IN)             (LB)
        16.50    FLEXIBLE      1.033E-02        9651.18

III..--WALL DEFLECTIONS AND FORCES

              <------DEFLECTION----->     <--WALL INTERNAL FORCES->
     ELEVATION     AXIAL        LATERAL      AXIAL     SHEAR    MOMENT
       (FT)         (IN)          (IN)        (LB)      (LB)    (LB-FT)
       17.50     0.000E+00   -3.993E-01        0          0         0
       17.00     0.000E+00   -1.945E-01        0        243        60
       16.50+    0.000E+00    1.033E-02        0        402       230
       16.50-    0.000E+00    1.033E-02        0      -9249       230
       16.00     0.000E+00    2.151E-01        0      -9210     -4384
       15.50     0.000E+00    4.198E-01        0      -9186     -8983
       15.00     0.000E+00    6.240E-01        0      -9178    -13573
       14.50     0.000E+00    8.277E-01        0      -9185    -18164
       14.00     0.000E+00    1.031E+00        0      -9185    -22756
       13.50     0.000E+00    1.233E+00        0      -9185    -27348
       13.00     0.000E+00    1.434E+00        0      -9185    -31941
       12.83     0.000E+00    1.500E+00        0      -9185    -33468
       12.50     0.000E+00    1.633E+00        0      -9179    -36532
       12.00     0.000E+00    1.832E+00        0      -9150    -41116
       11.50     0.000E+00    2.028E+00        0      -9098    -45679
```

11.00	0.000E+00	2.223E+00	0	-9020	-50209
10.50	0.000E+00	2.416E+00	0	-8914	-54694
10.00	0.000E+00	2.606E+00	0	-8783	-59119
9.50	0.000E+00	2.794E+00	0	-8626	-63472
9.00	0.000E+00	2.980E+00	0	-8443	-67741
8.50	0.000E+00	3.162E+00	0	-8234	-71911
8.00	0.000E+00	3.342E+00	0	-8000	-75971
7.50	0.000E+00	3.519E+00	0	-7740	-79907
7.00	0.000E+00	3.693E+00	0	-7454	-83706
6.50	0.000E+00	3.863E+00	0	-7142	-87356
6.00	0.000E+00	4.030E+00	0	-6807	-90845
5.50	0.000E+00	4.193E+00	0	-6451	-94160
5.00	0.000E+00	4.352E+00	0	-6073	-97292
4.50	0.000E+00	4.507E+00	0	-5674	-100229
4.00	0.000E+00	4.659E+00	0	-5253	-102962
3.50	0.000E+00	4.806E+00	0	-4810	-105478
3.00	0.000E+00	4.949E+00	0	-4345	-107768
2.50	0.000E+00	5.087E+00	0	-3883	-109823
2.00	0.000E+00	5.221E+00	0	-3451	-111656
1.50	0.000E+00	5.351E+00	0	-3047	-113279
1.00	0.000E+00	5.476E+00	0	-2673	-114708
0.50	0.000E+00	5.596E+00	0	-2327	-115957
0.00	0.000E+00	5.712E+00	0	-2011	-117040
-0.50	0.000E+00	5.823E+00	0	-1724	-117973
-1.00	0.000E+00	5.929E+00	0	-1465	-118769
-1.50	0.000E+00	6.031E+00	0	-1236	-119443
-2.00	0.000E+00	6.128E+00	0	-1037	-120009
-2.50	0.000E+00	6.219E+00	0	-859	-120483
-3.00	0.000E+00	6.306E+00	0	-661	-120865
-3.14+	0.000E+00	6.330E+00	0	-595	-120955
-3.14-	0.000E+00	6.330E+00	0	-595	-120955
-3.50	0.000E+00	6.388E+00	0	-408	-121135
-4.00	0.000E+00	6.466E+00	0	-112	-121265
-4.50	0.000E+00	6.538E+00	0	191	-121245
-5.00	0.000E+00	6.605E+00	0	494	-121074
-5.50	0.000E+00	6.668E+00	0	796	-120752
-5.66+	0.000E+00	6.687E+00	0	890	-120618
-5.66-	0.000E+00	6.687E+00	0	890	-120618
-6.00	0.000E+00	6.726E+00	0	1097	-120279
-6.50	0.000E+00	6.778E+00	0	1399	-119655
-7.00	0.000E+00	6.826E+00	0	1702	-118879
-7.50	0.000E+00	6.870E+00	0	2004	-117953
-8.00	0.000E+00	6.908E+00	0	2306	-116876
-8.50	0.000E+00	6.942E+00	0	2608	-115647
-9.00	0.000E+00	6.971E+00	0	2911	-114267
-9.50	0.000E+00	6.995E+00	0	3213	-112736
-10.00	0.000E+00	7.015E+00	0	3515	-111054
-10.50	0.000E+00	7.031E+00	0	3817	-109221
-11.00	0.000E+00	7.042E+00	0	4120	-107237
-11.50	0.000E+00	7.048E+00	0	4422	-105102
-12.00	0.000E+00	7.051E+00	0	4724	-102815
-12.50	0.000E+00	7.049E+00	0	5026	-100378
-13.00	0.000E+00	7.044E+00	0	5329	-97789
-13.50	0.000E+00	7.034E+00	0	5631	-95049
-14.00	0.000E+00	7.020E+00	0	5933	-92158
-14.50	0.000E+00	7.003E+00	0	6235	-89116
-15.00	0.000E+00	6.982E+00	0	6543	-85922
-15.50	0.000E+00	6.958E+00	0	6819	-82578
-16.00	0.000E+00	6.931E+00	0	6917	-79133
-16.50	0.000E+00	6.900E+00	0	6727	-75710
-17.00	0.000E+00	6.866E+00	0	6337	-72439
-17.50	0.000E+00	6.829E+00	0	5887	-69383

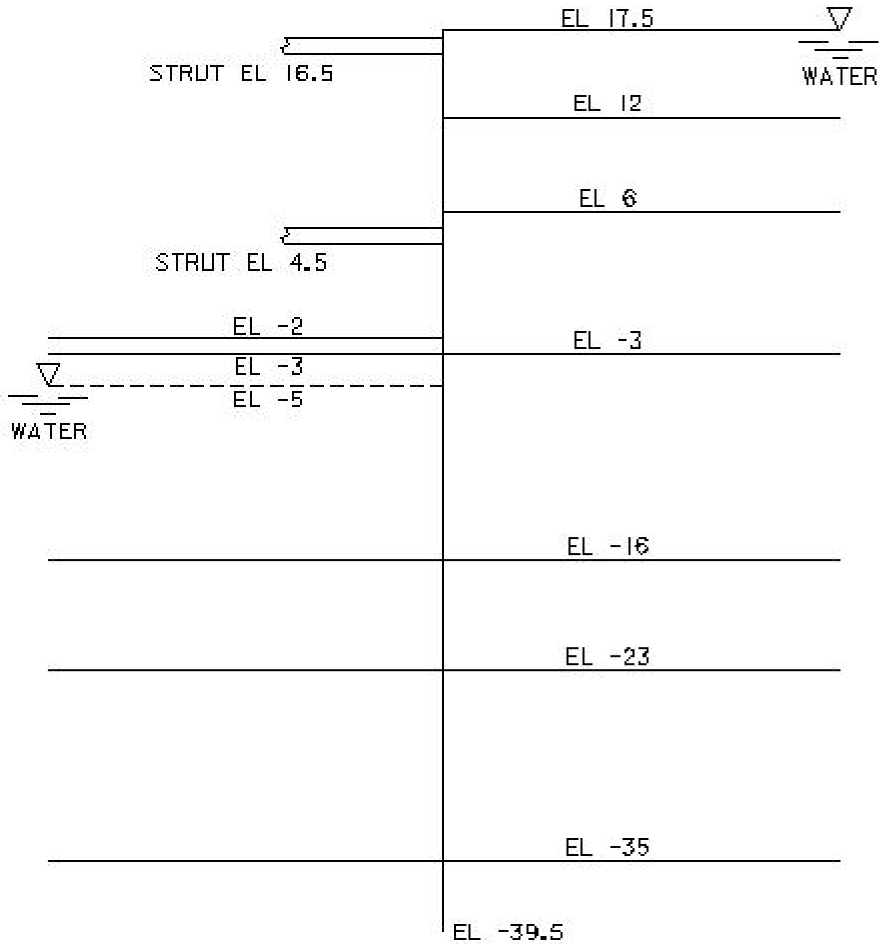
-18.00	0.000E+00	6.790E+00	0	5412	-66557
-18.50	0.000E+00	6.747E+00	0	4909	-63975
-19.00	0.000E+00	6.703E+00	0	4377	-61652
-19.50	0.000E+00	6.655E+00	0	3816	-59603
-20.00	0.000E+00	6.606E+00	0	3226	-57841
-20.50	0.000E+00	6.554E+00	0	2607	-56381
-21.00	0.000E+00	6.499E+00	0	1959	-55239
-21.50	0.000E+00	6.443E+00	0	1282	-54427
-22.00+	0.000E+00	6.384E+00	0	568	-53963
-22.00-	0.000E+00	6.384E+00	0	568	-53963
-22.50	0.000E+00	6.323E+00	0	411	-53720
-23.00+	0.000E+00	6.260E+00	0	400	-53528
-23.00-	0.000E+00	6.260E+00	0	400	-53528
-23.50	0.000E+00	6.195E+00	0	364	-53354
-24.00	0.000E+00	6.127E+00	0	595	-53119
-24.50	0.000E+00	6.058E+00	0	875	-52751
-25.00	0.000E+00	5.986E+00	0	1148	-52246
-25.50	0.000E+00	5.912E+00	0	1420	-51604
-26.00	0.000E+00	5.836E+00	0	1692	-50826
-26.50	0.000E+00	5.758E+00	0	1964	-49912
-27.00	0.000E+00	5.679E+00	0	2237	-48861
-27.50	0.000E+00	5.597E+00	0	2509	-47675
-28.00	0.000E+00	5.513E+00	0	2781	-46353
-28.50	0.000E+00	5.427E+00	0	3053	-44894
-29.00	0.000E+00	5.340E+00	0	3326	-43299
-29.50	0.000E+00	5.250E+00	0	3598	-41568
-30.00	0.000E+00	5.160E+00	0	3870	-39701
-30.50	0.000E+00	5.067E+00	0	4142	-37698
-31.00	0.000E+00	4.973E+00	0	4415	-35559
-31.50	0.000E+00	4.878E+00	0	4687	-33284
-32.00	0.000E+00	4.781E+00	0	4959	-30872
-32.50	0.000E+00	4.683E+00	0	5231	-28325
-33.00	0.000E+00	4.583E+00	0	5504	-25641
-33.50	0.000E+00	4.483E+00	0	5776	-22821
-34.00	0.000E+00	4.382E+00	0	6061	-19863
-34.50	0.000E+00	4.280E+00	0	6269	-16773
-35.00+	0.000E+00	4.178E+00	0	6046	-13666
-35.00-	0.000E+00	4.178E+00	0	6046	-13666
-35.50	0.000E+00	4.074E+00	0	5489	-10772
-36.00	0.000E+00	3.971E+00	0	4787	-8201
-36.50	0.000E+00	3.867E+00	0	4066	-5989
-37.00	0.000E+00	3.763E+00	0	3359	-4133
-37.50	0.000E+00	3.658E+00	0	2663	-2628
-38.00	0.000E+00	3.554E+00	0	1978	-1468
-38.50	0.000E+00	3.449E+00	0	1305	-648
-39.00	0.000E+00	3.345E+00	0	646	-161
-39.50	0.000E+00	3.240E+00	0	0	0

IV..--SOIL PRESSURES

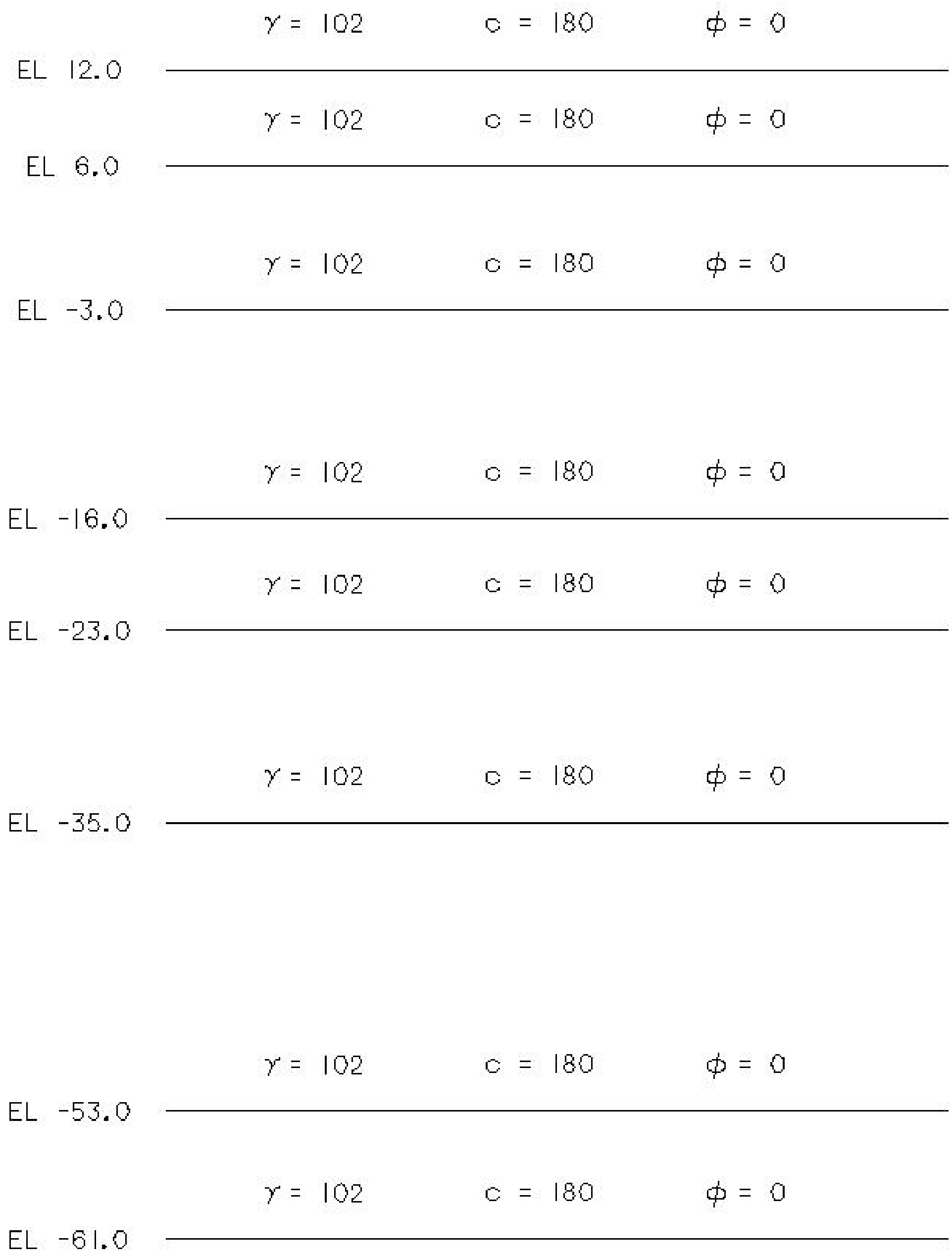
ELEVATION	<---------SOIL PRESSURES (PSF)-------->		
(FT)	LEFTSIDE	RIGHTSIDE	NET
17.50	0.00	462.00	462.00
17.00	0.00	511.50	511.50
16.50+	0.00	94.91	94.91
16.50-	0.00	94.91	94.91
16.00	0.00	63.35	63.35
15.50	0.00	31.85	31.85
15.00	0.00	0.50	0.50
14.50	0.00	0.00	0.00
14.00	0.00	0.00	0.00
13.50	0.00	0.00	0.00

13.00	0.00	0.00	0.00
12.83	0.00	0.00	0.00
12.50	0.00	33.12	33.12
12.00	0.00	83.02	83.02
11.50	0.00	125.94	125.94
11.00	0.00	154.24	154.24
10.50	0.00	174.62	174.62
10.00	0.00	194.75	194.75
9.50	0.00	215.00	215.00
9.00	0.00	235.25	235.25
8.50	0.00	255.50	255.50
8.00	0.00	275.75	275.75
7.50	0.00	296.00	296.00
7.00	0.00	316.46	316.46
6.50	0.00	335.43	335.43
6.00	0.00	349.03	349.03
5.50	0.00	358.91	358.91
5.00	0.00	370.24	370.24
4.50	0.00	382.93	382.93
4.00	0.00	395.48	395.48
3.50	0.00	408.02	408.02
3.00	0.00	420.57	420.57
2.50	70.54	433.12	362.57
2.00	141.09	445.66	304.58
1.50	211.63	458.21	246.58
1.00	282.17	470.76	188.59
0.50	352.71	483.30	130.59
0.00	423.26	495.85	72.59
-0.50	493.80	508.40	14.60
-1.00	564.34	520.94	-43.40
-1.50	634.88	533.49	-101.40
-2.00	706.06	540.99	-165.07
-2.50	773.39	588.69	-184.70
-3.00	819.66	733.55	-86.12
-3.14+	841.33	776.08	-65.25
-3.14-	825.87	776.08	-49.79
-3.50	841.33	881.89	40.57
-4.00	858.27	936.74	78.47
-4.50	878.25	951.50	73.25
-5.00	898.00	971.25	73.25
-5.50	917.75	991.00	73.25
-5.66+	937.50	997.25	59.75
-5.66-	924.00	997.25	73.25
-6.00	937.50	1010.75	73.25
-6.50	957.25	1030.50	73.25
-7.00	977.00	1050.25	73.25
-7.50	996.75	1070.00	73.25
-8.00	1016.50	1089.75	73.25
-8.50	1036.25	1109.50	73.25
-9.00	1056.00	1129.25	73.25
-9.50	1075.75	1149.00	73.25
-10.00	1095.50	1168.75	73.25
-10.50	1115.25	1188.50	73.25
-11.00	1135.00	1208.25	73.25
-11.50	1154.75	1228.00	73.25
-12.00	1174.50	1247.75	73.25
-12.50	1194.25	1267.50	73.25
-13.00	1214.00	1287.25	73.25
-13.50	1233.75	1307.00	73.25
-14.00	1253.50	1326.75	73.25
-14.50	1273.25	1346.50	73.25
-15.00	1281.37	1375.94	94.57

-15.50	1381.34	1328.06	-53.28
-16.00	1711.40	1094.86	-616.54
-16.50	2066.07	858.18	-1207.89
-17.00	2216.43	803.15	-1413.28
-17.50	2275.74	825.33	-1450.42
-18.00	2346.29	837.87	-1508.41
-18.50	2416.83	850.42	-1566.41
-19.00	2487.37	862.97	-1624.41
-19.50	2557.91	875.51	-1682.40
-20.00	2628.46	888.06	-1740.40
-20.50	2699.00	900.60	-1798.40
-21.00	2769.54	913.15	-1856.39
-21.50	2840.09	925.70	-1914.39
-22.00+	2930.69	925.24	-2005.45
-22.00-	2930.69	2037.30	-893.39
-22.50	2861.85	2065.41	-796.44
-23.00+	2403.81	2093.60	-310.21
-23.00-	2403.81	1381.20	-1022.61
-23.50	1924.07	1740.29	-183.78
-24.00	1810.79	1856.65	45.86
-24.50	1856.25	1869.50	13.25
-25.00	1882.00	1895.25	13.25
-25.50	1907.75	1921.00	13.25
-26.00	1933.50	1946.75	13.25
-26.50	1959.25	1972.50	13.25
-27.00	1985.00	1998.25	13.25
-27.50	2010.75	2024.00	13.25
-28.00	2036.50	2049.75	13.25
-28.50	2062.25	2075.50	13.25
-29.00	2088.00	2101.25	13.25
-29.50	2113.75	2127.00	13.25
-30.00	2139.50	2152.75	13.25
-30.50	2165.25	2178.50	13.25
-31.00	2191.00	2204.25	13.25
-31.50	2216.75	2230.00	13.25
-32.00	2242.50	2255.75	13.25
-32.50	2268.25	2281.50	13.25
-33.00	2294.00	2307.25	13.25
-33.50	2319.75	2333.00	13.25
-34.00	2312.20	2377.34	65.14
-34.50	2570.01	2273.29	-296.72
-35.00+	3468.60	1813.70	-1654.90
-35.00-	3228.40	1813.70	-1414.69
-35.50	3226.18	1347.73	-1878.46
-36.00	3222.13	1230.58	-1991.55
-36.50	3216.27	1261.61	-1954.66
-37.00	3208.65	1274.15	-1934.50
-37.50	3199.31	1286.70	-1912.61
-38.00	3188.27	1299.25	-1889.03
-38.50	3175.56	1311.79	-1863.77
-39.00	3161.19	1324.34	-1836.86
-39.50	3145.18	1336.88	-1808.30



NAPOLEON AVENUE SITE
FINAL EXCAVATION



NAPOLEON AVENUE SITE SOIL PROPERTIES

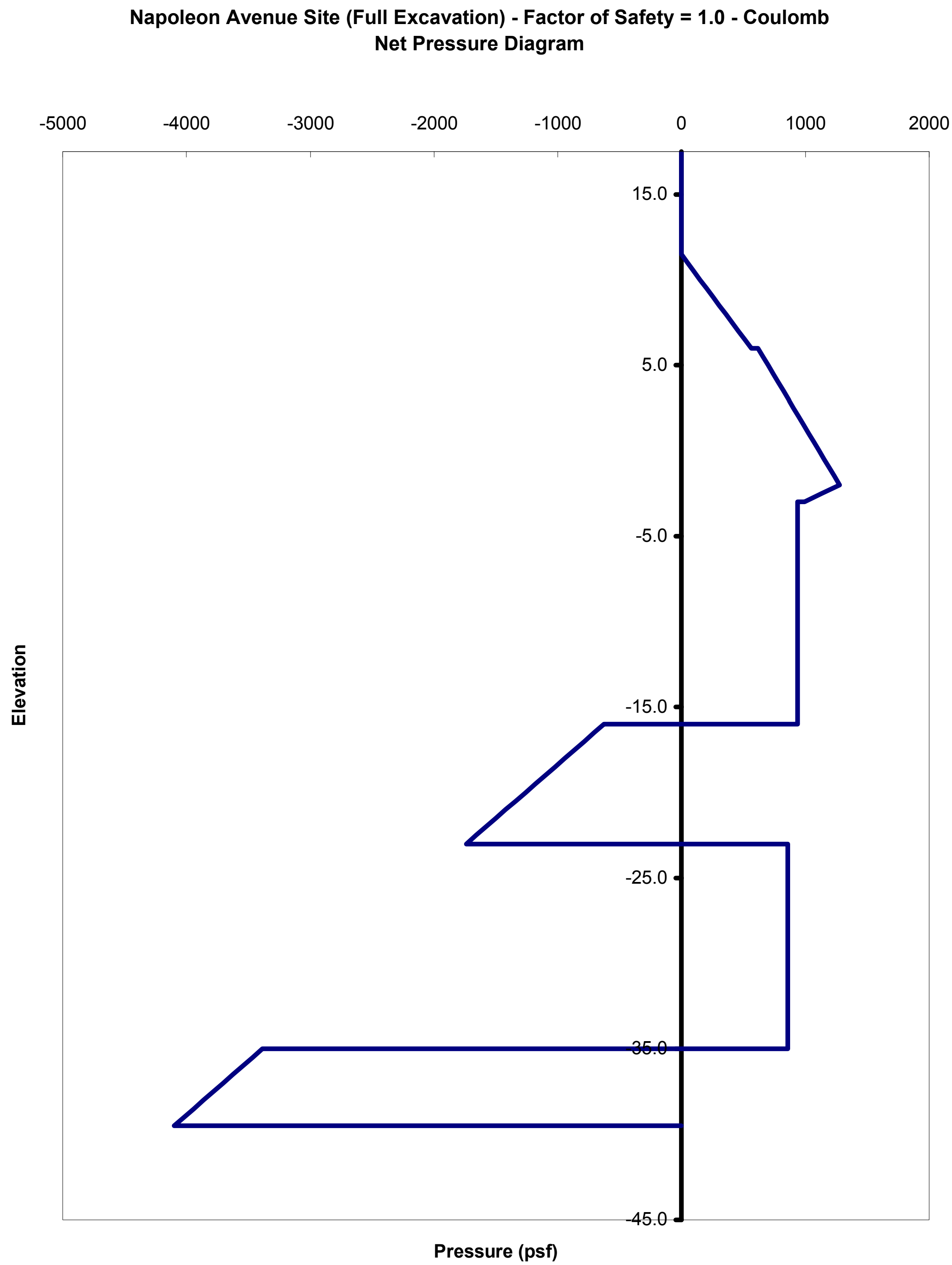
Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
17.5	-600.00	0.00	0.00	0.00
17.0	-550.50	0.00	0.00	0.00
16.5	-501.00	0.00	0.00	0.00
16.0	-451.50	0.00	0.00	0.00
15.5	-402.00	0.00	0.00	0.00
15.0	-352.50	0.00	0.00	0.00
14.5	-303.00	0.00	0.00	0.00
14.0	-253.50	0.00	0.00	0.00
13.5	-204.00	0.00	0.00	0.00
13.0	-154.50	0.00	0.00	0.00
12.6	-117.38	0.00	0.00	0.00
12.5	-105.00	0.00	0.00	0.00
12.0	-55.50	0.00	0.00	0.00
12.0	-55.50	0.00	0.00	0.00
11.5	-4.00	0.00	0.00	0.00
11.0	16.25	0.00	31.25	47.50
10.5	36.50	0.00	62.50	99.00
10.0	56.75	0.00	93.75	150.50
9.5	77.00	0.00	125.00	202.00
9.0	97.25	0.00	156.25	253.50
8.5	117.50	0.00	187.50	305.00
8.0	137.75	0.00	218.75	356.50
7.5	158.00	0.00	250.00	408.00
7.0	178.25	0.00	281.25	459.50
6.5	198.50	0.00	312.50	511.00
6.0	218.75	0.00	343.75	562.50
6.0	272.92	0.00	343.75	616.67
5.5	282.83	0.00	375.00	657.83
5.0	292.75	0.00	406.25	699.00
4.5	302.67	0.00	437.50	740.17
4.0	312.58	0.00	468.75	781.33
3.5	322.50	0.00	500.00	822.50
3.0	332.42	0.00	531.25	863.67
2.9	334.90	0.00	539.06	873.96
2.5	342.33	0.00	562.50	904.83
2.0	352.25	0.00	593.75	946.00
1.5	362.17	0.00	625.00	987.17
1.0	372.08	0.00	656.25	1028.33
0.5	382.00	0.00	687.50	1069.50
0.0	391.92	0.00	718.75	1110.67
-0.5	401.83	0.00	750.00	1151.83
-1.0	411.75	0.00	781.25	1193.00
-1.5	421.67	0.00	812.50	1234.17

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb

Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-2.0	431.58	0.00	843.75	1275.33
-2.0	431.58	0.00	843.75	1275.33
-2.5	441.50	183.00	875.00	1133.50
-3.0	451.42	366.00	906.25	991.67
-3.0	754.25	722.00	906.25	938.50
-3.5	774.00	773.00	937.50	938.50
-4.0	793.75	824.00	968.75	938.50
-4.5	813.50	875.00	1000.00	938.50
-5.0	833.25	926.00	1031.25	938.50
-5.5	853.00	945.75	1031.25	938.50
-6.0	872.75	965.50	1031.25	938.50
-6.5	892.50	985.25	1031.25	938.50
-7.0	912.25	1005.00	1031.25	938.50
-7.5	932.00	1024.75	1031.25	938.50
-8.0	951.75	1044.50	1031.25	938.50
-8.5	971.50	1064.25	1031.25	938.50
-9.0	991.25	1084.00	1031.25	938.50
-9.5	1011.00	1103.75	1031.25	938.50
-10.0	1030.75	1123.50	1031.25	938.50
-10.5	1050.50	1143.25	1031.25	938.50
-11.0	1070.25	1163.00	1031.25	938.50
-11.5	1090.00	1182.75	1031.25	938.50
-12.0	1109.75	1202.50	1031.25	938.50
-12.5	1129.50	1222.25	1031.25	938.50
-13.0	1149.25	1242.00	1031.25	938.50
-13.5	1169.00	1261.75	1031.25	938.50
-14.0	1188.75	1281.50	1031.25	938.50
-14.5	1208.50	1301.25	1031.25	938.50
-15.0	1228.25	1321.00	1031.25	938.50
-15.5	1248.00	1340.75	1031.25	938.50
-16.0	1267.75	1360.50	1031.25	938.50
-16.0	622.58	2281.50	1031.25	-627.67
-16.5	632.50	2370.75	1031.25	-707.00
-17.0	642.42	2460.00	1031.25	-786.33
-17.5	652.33	2549.25	1031.25	-865.67
-18.0	662.25	2638.50	1031.25	-945.00
-18.5	672.17	2727.75	1031.25	-1024.33
-19.0	682.08	2817.00	1031.25	-1103.67
-19.5	692.00	2906.25	1031.25	-1183.00
-20.0	701.92	2995.50	1031.25	-1262.33
-20.5	711.83	3084.75	1031.25	-1341.67
-21.0	721.75	3174.00	1031.25	-1421.00
-21.5	731.67	3263.25	1031.25	-1500.33
-22.0	741.58	3352.50	1031.25	-1579.67
-22.5	751.50	3441.75	1031.25	-1659.00

Napoleon Average Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0	761.42	3531.00	1031.25	-1738.33
-23.0	1644.25	1817.00	1031.25	858.50
-23.5	1670.00	1842.75	1031.25	858.50
-24.0	1695.75	1868.50	1031.25	858.50
-24.5	1721.50	1894.25	1031.25	858.50
-25.0	1747.25	1920.00	1031.25	858.50
-25.5	1773.00	1945.75	1031.25	858.50
-26.0	1798.75	1971.50	1031.25	858.50
-26.5	1824.50	1997.25	1031.25	858.50
-27.0	1850.25	2023.00	1031.25	858.50
-27.5	1876.00	2048.75	1031.25	858.50
-28.0	1901.75	2074.50	1031.25	858.50
-28.5	1927.50	2100.25	1031.25	858.50
-29.0	1953.25	2126.00	1031.25	858.50
-29.5	1979.00	2151.75	1031.25	858.50
-30.0	2004.75	2177.50	1031.25	858.50
-30.5	2030.50	2203.25	1031.25	858.50
-31.0	2056.25	2229.00	1031.25	858.50
-31.5	2082.00	2254.75	1031.25	858.50
-32.0	2107.75	2280.50	1031.25	858.50
-32.5	2133.50	2306.25	1031.25	858.50
-33.0	2159.25	2332.00	1031.25	858.50
-33.5	2185.00	2357.75	1031.25	858.50
-34.0	2210.75	2383.50	1031.25	858.50
-34.5	2236.50	2409.25	1031.25	858.50
-35.0	2262.25	2435.00	1031.25	858.50
-35.0	967.42	5385.00	1031.25	-3386.33
-35.5	977.33	5474.25	1031.25	-3465.67
-36.0	987.25	5563.50	1031.25	-3545.00
-36.5	997.17	5652.75	1031.25	-3624.33
-37.0	1007.08	5742.00	1031.25	-3703.67
-37.5	1017.00	5831.25	1031.25	-3783.00
-38.0	1026.92	5920.50	1031.25	-3862.33
-38.5	1036.83	6009.75	1031.25	-3941.67
-39.0	1046.75	6099.00	1031.25	-4021.00
-39.5	1056.67	6188.25	1031.25	-4100.33

Based on the net pressure diagram, the top strut load would be 1 kip for the Coulomb case with a 1.0 factor of safety. Summing the moments around the sheet pile tip (EL -39.5) gave a bottom strut load of 319 kips for the Coulomb case with a 1.0 factor of safety.


Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-5000
-4000
-3000
-2000
-1000
0
1000
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

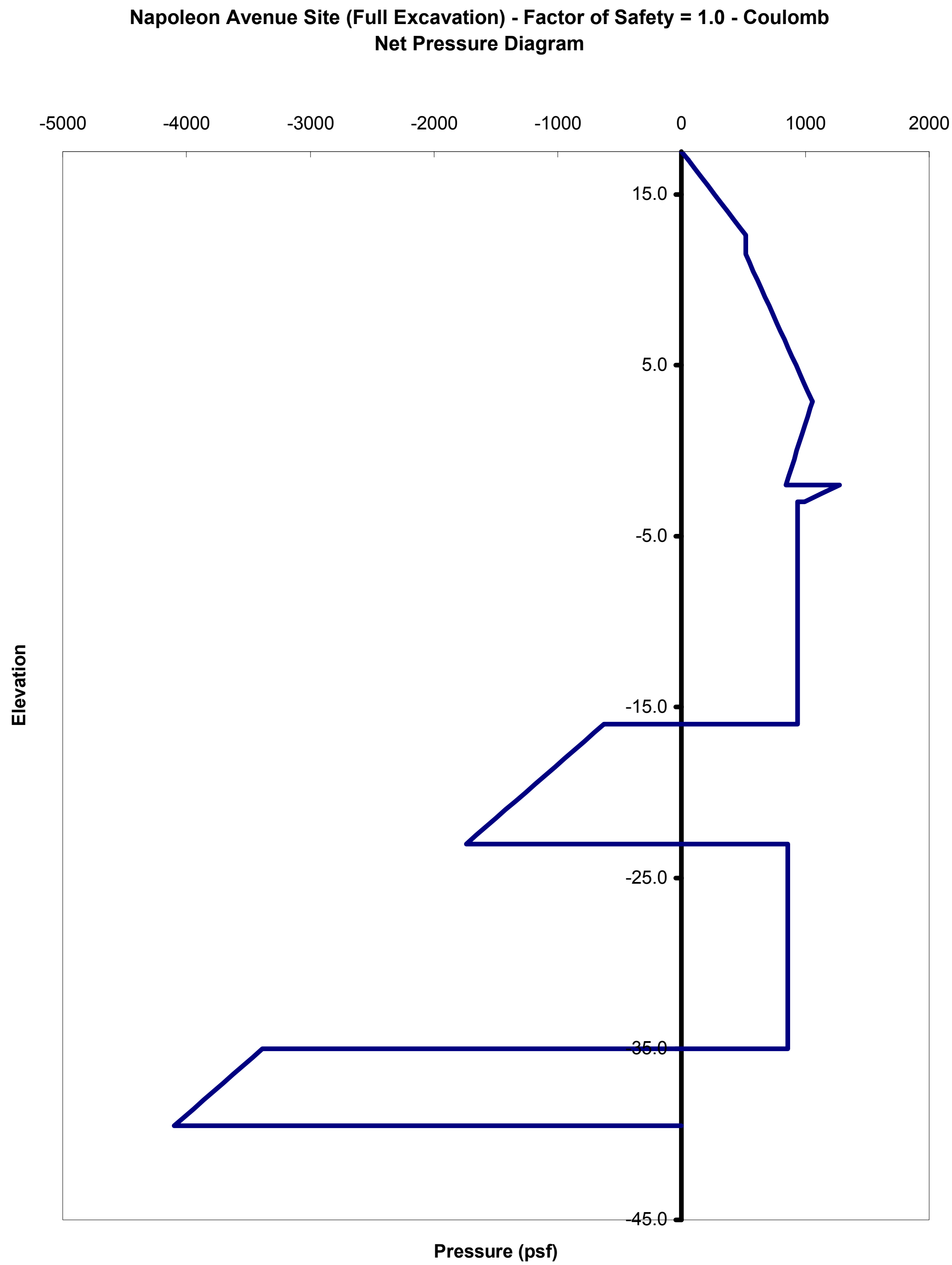
Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Terzaghi					
Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
17.5	0.00		0.00	0.00	0.00
17.0	53.13		0.00	0.00	53.13
16.5	106.26		0.00	0.00	106.26
16.0	159.38		0.00	0.00	159.38
15.5	212.51		0.00	0.00	212.51
15.0	265.64		0.00	0.00	265.64
14.5	318.77		0.00	0.00	318.77
14.0	371.90		0.00	0.00	371.90
13.5	425.02		0.00	0.00	425.02
13.0	478.15		0.00	0.00	478.15
12.6	518.00		0.00	0.00	518.00
12.5	518.00		0.00	0.00	518.00
12.0	518.00		0.00	0.00	518.00
12.0	518.00		0.00	0.00	518.00
11.5	518.00		0.00	0.00	518.00
11.0	518.00		0.00	31.25	549.25
10.5	518.00		0.00	62.50	580.50
10.0	518.00		0.00	93.75	611.75
9.5	518.00		0.00	125.00	643.00
9.0	518.00		0.00	156.25	674.25
8.5	518.00		0.00	187.50	705.50
8.0	518.00		0.00	218.75	736.75
7.5	518.00		0.00	250.00	768.00
7.0	518.00		0.00	281.25	799.25
6.5	518.00		0.00	312.50	830.50
6.0	518.00		0.00	343.75	861.75
6.0	518.00		0.00	343.75	861.75
5.5	518.00		0.00	375.00	893.00
5.0	518.00		0.00	406.25	924.25
4.5	518.00		0.00	437.50	955.50
4.0	518.00		0.00	468.75	986.75
3.5	518.00		0.00	500.00	1018.00
3.0	518.00		0.00	531.25	1049.25
2.9	518.00		0.00	539.06	1057.06
2.5	478.15		0.00	562.50	1040.65
2.0	425.02		0.00	593.75	1018.77
1.5	371.90		0.00	625.00	996.90
1.0	318.77		0.00	656.25	975.02
0.5	265.64		0.00	687.50	953.14
0.0	212.51		0.00	718.75	931.26
-0.5	159.38		0.00	750.00	909.38
-1.0	106.26		0.00	781.25	887.51
-1.5	53.13		0.00	812.50	865.63

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Terzaghi					
		Right Side	Left Side		
Elevation	Terzaghi Pressure	Active Pressure	Passive Pressure	Water Pressure	Net Pressure
-2.0	0.00		0.00	843.75	843.75
-2.0		431.58	0.00	843.75	1275.33
-2.5		441.50	183.00	875.00	1133.50
-3.0		451.42	366.00	906.25	991.67
-3.0		754.25	722.00	906.25	938.50
-3.5		774.00	773.00	937.50	938.50
-4.0		793.75	824.00	968.75	938.50
-4.5		813.50	875.00	1000.00	938.50
-5.0		833.25	926.00	1031.25	938.50
-5.5		853.00	945.75	1031.25	938.50
-6.0		872.75	965.50	1031.25	938.50
-6.5		892.50	985.25	1031.25	938.50
-7.0		912.25	1005.00	1031.25	938.50
-7.5		932.00	1024.75	1031.25	938.50
-8.0		951.75	1044.50	1031.25	938.50
-8.5		971.50	1064.25	1031.25	938.50
-9.0		991.25	1084.00	1031.25	938.50
-9.5		1011.00	1103.75	1031.25	938.50
-10.0		1030.75	1123.50	1031.25	938.50
-10.5		1050.50	1143.25	1031.25	938.50
-11.0		1070.25	1163.00	1031.25	938.50
-11.5		1090.00	1182.75	1031.25	938.50
-12.0		1109.75	1202.50	1031.25	938.50
-12.5		1129.50	1222.25	1031.25	938.50
-13.0		1149.25	1242.00	1031.25	938.50
-13.5		1169.00	1261.75	1031.25	938.50
-14.0		1188.75	1281.50	1031.25	938.50
-14.5		1208.50	1301.25	1031.25	938.50
-15.0		1228.25	1321.00	1031.25	938.50
-15.5		1248.00	1340.75	1031.25	938.50
-16.0		1267.75	1360.50	1031.25	938.50
-16.0		622.58	2281.50	1031.25	-627.67
-16.5		632.50	2370.75	1031.25	-707.00
-17.0		642.42	2460.00	1031.25	-786.33
-17.5		652.33	2549.25	1031.25	-865.67
-18.0		662.25	2638.50	1031.25	-945.00
-18.5		672.17	2727.75	1031.25	-1024.33
-19.0		682.08	2817.00	1031.25	-1103.67
-19.5		692.00	2906.25	1031.25	-1183.00
-20.0		701.92	2995.50	1031.25	-1262.33
-20.5		711.83	3084.75	1031.25	-1341.67
-21.0		721.75	3174.00	1031.25	-1421.00
-21.5		731.67	3263.25	1031.25	-1500.33
-22.0		741.58	3352.50	1031.25	-1579.67
-22.5		751.50	3441.75	1031.25	-1659.00

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Terzaghi

Elevation	Terzaghi Pressure	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0		761.42	3531.00	1031.25	-1738.33
-23.0		1644.25	1817.00	1031.25	858.50
-23.5		1670.00	1842.75	1031.25	858.50
-24.0		1695.75	1868.50	1031.25	858.50
-24.5		1721.50	1894.25	1031.25	858.50
-25.0		1747.25	1920.00	1031.25	858.50
-25.5		1773.00	1945.75	1031.25	858.50
-26.0		1798.75	1971.50	1031.25	858.50
-26.5		1824.50	1997.25	1031.25	858.50
-27.0		1850.25	2023.00	1031.25	858.50
-27.5		1876.00	2048.75	1031.25	858.50
-28.0		1901.75	2074.50	1031.25	858.50
-28.5		1927.50	2100.25	1031.25	858.50
-29.0		1953.25	2126.00	1031.25	858.50
-29.5		1979.00	2151.75	1031.25	858.50
-30.0		2004.75	2177.50	1031.25	858.50
-30.5		2030.50	2203.25	1031.25	858.50
-31.0		2056.25	2229.00	1031.25	858.50
-31.5		2082.00	2254.75	1031.25	858.50
-32.0		2107.75	2280.50	1031.25	858.50
-32.5		2133.50	2306.25	1031.25	858.50
-33.0		2159.25	2332.00	1031.25	858.50
-33.5		2185.00	2357.75	1031.25	858.50
-34.0		2210.75	2383.50	1031.25	858.50
-34.5		2236.50	2409.25	1031.25	858.50
-35.0		2262.25	2435.00	1031.25	858.50
-35.0		967.42	5385.00	1031.25	-3386.33
-35.5		977.33	5474.25	1031.25	-3465.67
-36.0		987.25	5563.50	1031.25	-3545.00
-36.5		997.17	5652.75	1031.25	-3624.33
-37.0		1007.08	5742.00	1031.25	-3703.67
-37.5		1017.00	5831.25	1031.25	-3783.00
-38.0		1026.92	5920.50	1031.25	-3862.33
-38.5		1036.83	6009.75	1031.25	-3941.67
-39.0		1046.75	6099.00	1031.25	-4021.00
-39.5		1056.67	6188.25	1031.25	-4100.33

Based on the net pressure diagram, the top strut load would be 48 kips for the Terzaghi case with a 1.0 factor of safety. Summing the moments around the sheet pile tip (EL -39.5) gave a bottom strut load of 359 kips for the Terzaghi case with a 1.0 factor of safety.


Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-5000
-4000
-3000
-2000
-1000
0
1000
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

```
PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003                                        TIME: 15:27:55

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

    I.--HEADING
   'NAPOLEON
   'FS=1.0
   'FULL EXCAVATION

   II.--WALL SEGMENT DATA

      ELEVATION                                              CROSS
      AT TOP OF       MODULUS OF       MOMENT OF       SECTION
       SEGMENT        ELASTICITY        INERTIA          AREA
         (FT)           (PSI)           (IN^4)          (SQIN)
         17.50        2.900E+07         369.40           10.28

      ELEVATION AT BOTTOM OF WALL = -39.50

  III.--ANCHOR DATA

                        ULTIMATE     ULTIMATE
  ELEV.    ANCHOR      TENSION       COMPR.       ANCHOR      ANCHOR
 AT WALL    TYPE        FORCE        FORCE        STIFF.       SLOPE
  (FT)                  (LB)         (LB)        (LB/IN)       (FT)
    16.5  FLEXIBLE   9.665E+5     7.445E+5   9.343E+5      0.000
     4.5  FLEXIBLE   2.739E+6     2.739E+6   2.648E+6      0.000

   IV.--SURFACE POINT DATA

        IV.A.--RIGHTSIDE
           DIST. FROM     ELEVATION
           WALL (FT)        (FT)
                0.00         17.50
              100.00         17.50

        IV.B.--LEFTSIDE
           DIST. FROM     ELEVATION
           WALL (FT)        (FT)
                0.00         -2.00
              100.00         -2.00

    V.--SOIL LAYER DATA

         V.A.--RIGHTSIDE
<UNIT WEIGHT>   INT.   COH-    WALL    ADH-   <STIFF. COEF.>   <--BOTTOM-->
SAT.    MOIST  FRICT.  ESION  FRICT.  ESION   ACT.     PASS.   ELEV.  SLOPE
(PCF)   (PCF)  (DEG)   (PSF)  (DEG)   (PSF)   (PCI)    (PCI)   (FT)    (FT)
 99.0    99.0    0.0   300.0    0.0     0.0  200.0    200.0    12.0     0.0
103.0   103.0    0.0   300.0    0.0     0.0  200.0    200.0     6.0     0.0
122.0   122.0   30.0     0.0    0.0     0.0    4.6      4.6    -3.0     0.0
102.0   102.0    0.0   300.0    0.0     0.0  200.0    200.0   -16.0     0.0
122.0   122.0   30.0     0.0    0.0     0.0   15.1     15.1   -23.0     0.0
114.0   114.0    0.0   320.0    0.0     0.0  213.0    213.0   -35.0     0.0
122.0   122.0   30.0     0.0    0.0     0.0    4.6      4.6

         V.B.--LEFTSIDE
<UNIT WEIGHT>   INT.   COH-    WALL    ADH-   <STIFF. COEF.>   <--BOTTOM-->
SAT.    MOIST  FRICT.  ESION  FRICT.  ESION   ACT.     PASS.   ELEV.  SLOPE
```

(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
122.0	122.0	30.0	0.0	0.0	0.0	9.3	9.3	-3.0	0.0
102.0	102.0	0.0	300.0	0.0	0.0	200.0	200.0	-16.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	320.0	0.0	0.0	213.0	213.0	-35.0	0.0
122.0	122.0	30.0	0.0	0.0	0.0	4.6	4.6		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 11.50 (FT)
LEFTSIDE ELEVATION = -5.00 (FT)
NO SEEPAGE

VIII.--VERTICAL SURCHARGE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:27:58

****
* LIMIT PRESSURES *
****

I.--HEADING
'NAPOLEON
'FS=1.0
'FULL EXCAVATION
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

	NET WATER	< LEFTSIDE SOIL PRESSURES>			<RIGHTSIDE SOIL PRESSURES>		
ELEV. (FT)	PRESS. (PSF)	PASSIVE (PSF)	AT-REST (PSF)	ACTIVE (PSF)	ACTIVE (PSF)	AT-REST (PSF)	PASSIVE (PSF)
17.50	0.00	0.00	0.00	0.00	0.00	0.00	600.00
17.00	0.00	0.00	0.00	0.00	0.00	49.50	649.50
16.50	0.00	0.00	0.00	0.00	0.00	99.00	699.00
16.00	0.00	0.00	0.00	0.00	0.00	148.50	748.50
15.50	0.00	0.00	0.00	0.00	0.00	198.00	798.00
15.00	0.00	0.00	0.00	0.00	0.00	247.50	847.50
14.50	0.00	0.00	0.00	0.00	0.00	297.00	897.00
14.00	0.00	0.00	0.00	0.00	0.00	346.50	946.50
13.50	0.00	0.00	0.00	0.00	0.00	396.00	996.00
13.00	0.00	0.00	0.00	0.00	0.00	445.50	1045.49
12.50	0.00	0.00	0.00	0.00	0.00	495.00	1095.12
12.00	0.00	0.00	0.00	0.00	0.00	544.50	1145.02
11.50	0.00	0.00	0.00	0.00	0.00	596.00	1187.94
11.29+	13.31	0.00	0.00	0.00	0.00	604.63	1216.24
11.29-	13.31	0.00	0.00	0.00	0.00	604.63	1200.00
11.00	31.25	0.00	0.00	0.00	16.24	616.25	1216.24
10.50	62.50	0.00	0.00	0.00	36.62	636.50	1236.62

10.00	93.75	0.00	0.00	0.00	56.75	656.75	1256.75
9.50	125.00	0.00	0.00	0.00	77.00	677.00	1277.00
9.00	156.25	0.00	0.00	0.00	97.25	697.25	1297.25
8.50	187.50	0.00	0.00	0.00	117.50	717.50	1317.50
8.00	218.75	0.00	0.00	0.00	137.75	737.75	1337.75
7.50	250.00	0.00	0.00	0.00	158.00	758.00	1358.00
7.00	281.25	0.00	0.00	0.00	177.44	778.25	1361.77
6.50	312.50	0.00	0.00	0.00	203.58	798.50	1495.77
6.00+	343.75	0.00	0.00	0.00	243.17	818.75	1955.29
6.00-	343.75	0.00	0.00	0.00	243.17	409.38	1955.29
5.50	375.00	0.00	0.00	0.00	277.76	424.25	2448.23
5.00	406.25	0.00	0.00	0.00	293.64	439.13	2650.69
4.50	437.50	0.00	0.00	0.00	302.67	454.00	2724.00
4.00	468.75	0.00	0.00	0.00	312.58	468.88	2813.25
3.50	500.00	0.00	0.00	0.00	322.50	483.75	2902.50
3.00	531.25	0.00	0.00	0.00	332.42	498.63	2991.75
2.50	562.50	0.00	0.00	0.00	342.33	513.50	3081.00
2.00	593.75	0.00	0.00	0.00	352.25	528.38	3170.25
1.50	625.00	0.00	0.00	0.00	362.17	543.25	3259.50
1.00	656.25	0.00	0.00	0.00	372.08	558.13	3348.75
0.50	687.50	0.00	0.00	0.00	382.00	573.00	3438.00
0.00	718.75	0.00	0.00	0.00	391.92	587.88	3527.25
-0.50	750.00	0.00	0.00	0.00	401.83	602.75	3616.50
-1.00	781.25	0.00	0.00	0.00	411.75	617.63	3705.75
-1.50	812.50	0.00	0.00	0.00	421.67	632.50	3795.00
-2.00	843.75	0.00	0.00	0.00	426.81	647.38	3917.47
-2.50	875.00	216.38	30.50	0.00	469.89	662.25	3775.83
-3.00+	906.25	509.97	61.00	0.00	605.37	677.13	2990.58
-3.00-	906.25	509.97	122.00	0.00	605.37	1354.25	2990.58
-3.50	937.50	739.63	173.00	0.00	745.61	1374.00	2171.67
-4.00	968.75	830.20	224.00	0.00	798.44	1393.75	1961.08
-4.50	1000.00	875.00	275.00	0.00	813.50	1413.50	2013.50
-5.00	1031.25	917.94	326.00	0.00	833.25	1433.25	2033.25
-5.50	1031.25	945.75	345.75	0.00	853.00	1453.00	2053.00
-6.00	1031.25	965.62	365.50	0.00	872.75	1472.75	2072.75
-6.50	1031.25	985.25	385.25	0.00	892.50	1492.50	2092.50
-7.00	1031.25	1005.00	405.00	0.00	912.25	1512.25	2112.25
-7.50	1031.25	1024.75	424.75	0.00	932.00	1532.00	2132.00
-8.00	1031.25	1044.50	444.50	0.00	951.75	1551.75	2151.75
-8.50	1031.25	1064.25	464.25	0.00	971.50	1571.50	2171.50
-9.00	1031.25	1084.00	484.00	0.00	991.25	1591.25	2191.25
-9.50	1031.25	1103.75	503.75	0.00	1011.00	1611.00	2211.00
-10.00	1031.25	1123.50	523.50	0.00	1030.75	1630.75	2230.75
-10.50	1031.25	1143.25	543.25	0.00	1050.50	1650.50	2250.50
-11.00	1031.25	1163.00	563.00	0.00	1070.25	1670.25	2270.25
-11.50	1031.25	1182.75	582.75	0.00	1090.00	1690.00	2290.00
-11.94+	1031.25	1202.50	600.00	0.00	1107.25	1709.75	2307.25
-11.94-	1031.25	1200.00	600.00	0.00	1107.25	1709.75	2307.25
-12.00	1031.25	1202.50	602.50	2.50	1109.75	1729.50	2309.75
-12.50	1031.25	1222.25	622.25	22.25	1129.50	1749.25	2329.50
-13.00	1031.25	1242.00	642.00	42.00	1149.25	1769.00	2349.25
-13.50	1031.25	1261.75	661.75	61.75	1169.00	1788.75	2369.00
-14.00	1031.25	1281.50	681.50	81.50	1188.75	1808.50	2388.75
-14.50	1031.25	1301.25	701.25	101.25	1208.50	1828.25	2408.50
-15.00	1031.25	1306.34	721.00	119.59	1238.37	1848.00	2378.99
-15.50+	1031.25	1427.09	740.75	149.47	1187.52	1867.75	2741.95
-15.50-	1031.25	1427.09	740.75	149.47	1187.52	933.88	2741.95
-16.00+	1031.25	1838.92	760.50	204.46	942.63	948.75	4053.42
-16.00-	1031.25	1838.92	380.25	204.46	942.63	948.75	4053.42
-16.50	1031.25	2284.41	395.13	254.70	692.98	963.63	5398.55
-17.00	1031.25	2474.12	410.00	274.82	632.37	978.50	5830.47
-17.50	1031.25	2549.25	424.88	283.25	652.33	993.38	5871.00

-18.00	1031.25	2638.50	439.75	293.17	662.25	1008.25	5960.25
-18.50	1031.25	2727.75	454.63	303.08	672.17	1023.13	6049.50
-19.00	1031.25	2817.00	469.50	313.00	682.08	1038.00	6138.75
-19.50	1031.25	2906.25	484.38	322.92	692.00	1052.88	6228.00
-20.00	1031.25	2995.50	499.25	332.83	701.92	1067.75	6317.25
-20.50	1031.25	3084.75	514.13	342.75	711.83	1082.63	6406.50
-21.00	1031.25	3174.00	529.00	352.67	721.75	1097.50	6495.75
-21.50	1031.25	3263.25	543.88	362.58	731.67	1112.38	6585.00
-22.00	1031.25	3379.53	558.75	370.18	727.73	1127.25	6735.88
-22.50+	1031.25	3281.06	573.63	395.98	834.27	1142.13	6395.20
-22.50-	1031.25	3281.06	573.63	395.98	834.27	2284.25	6395.20
-23.00+	1031.25	2657.63	588.50	468.75	1206.92	2310.00	4872.13
-23.00-	1031.25	2657.63	1177.00	468.75	1206.92	2310.00	4872.13
-23.50	1031.25	2003.44	1202.75	549.19	1587.23	2335.75	3318.30
-24.00	1031.25	1841.97	1228.50	590.70	1709.48	2361.50	2914.62
-24.50	1031.25	1894.25	1254.25	614.25	1721.50	2387.25	3001.50
-25.00	1031.25	1920.00	1280.00	640.00	1747.25	2413.00	3027.25
-25.50	1031.25	1945.75	1305.75	665.75	1773.00	2438.75	3053.00
-26.00	1031.25	1971.50	1331.50	691.50	1798.75	2464.50	3078.75
-26.50	1031.25	1997.25	1357.25	717.25	1824.50	2490.25	3104.50
-27.00	1031.25	2023.00	1383.00	743.00	1850.25	2516.00	3130.25
-27.50	1031.25	2048.75	1408.75	768.75	1876.00	2541.75	3156.00
-28.00	1031.25	2074.50	1434.50	794.50	1901.75	2567.50	3181.75
-28.50	1031.25	2100.25	1460.25	820.25	1927.50	2593.25	3207.50
-29.00	1031.25	2126.00	1486.00	846.00	1953.25	2619.00	3233.25
-29.50	1031.25	2151.75	1511.75	871.75	1979.00	2644.75	3259.00
-30.00	1031.25	2177.50	1537.50	897.50	2004.75	2670.50	3284.75
-30.50	1031.25	2203.25	1563.25	923.25	2030.50	2696.25	3310.50
-31.00	1031.25	2229.00	1589.00	949.00	2056.25	2722.00	3336.25
-31.50	1031.25	2254.75	1614.75	974.75	2082.00	2747.75	3362.00
-32.00	1031.25	2280.50	1640.50	1000.50	2107.75	2773.50	3387.75
-32.50	1031.25	2306.25	1666.25	1026.25	2133.50	2799.25	3413.50
-33.00	1031.25	2332.00	1692.00	1052.00	2159.25	2825.00	3439.25
-33.50	1031.25	2357.75	1717.75	1077.75	2185.00	2850.75	3465.00
-34.00	1031.25	2337.16	1743.50	1112.26	2231.04	2876.50	3409.81
-34.50+	1031.25	2685.81	1769.25	1077.06	2115.11	2902.25	4000.67
-34.50-	1031.25	2685.81	1769.25	1077.06	2115.11	1451.13	4000.67
-35.00+	1031.25	3926.37	1795.00	872.58	1610.75	1466.00	6140.87
-35.00-	1031.25	3926.37	897.50	872.58	1610.75	1466.00	6140.87
-35.50	1031.25	5197.69	912.38	660.44	1098.72	1480.88	8311.83
-36.00	1031.25	5609.35	927.25	609.53	967.08	1495.75	8965.70
-36.50	1031.25	5652.75	942.13	628.08	997.17	1510.63	8974.50
-37.00	1031.25	5742.00	957.00	638.00	1007.08	1525.50	9063.75
-37.50	1031.25	5831.25	971.88	647.92	1017.00	1540.38	9153.00
-38.00	1031.25	5920.50	986.75	657.83	1026.92	1555.25	9242.25
-38.50	1031.25	6009.75	1001.63	667.75	1036.83	1570.13	9331.50
-39.00	1031.25	6099.00	1016.50	677.67	1046.75	1585.00	9420.75
-39.50	1031.25	6188.25	1031.38	687.58	1056.67	0.00	9510.00

* RESULTS *
****

I.--HEADING
'NAPOLEON
'FS=1.0
'FULL EXCAVATION

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION MAY NOT EXIST
ALL ELEVATIONS. SEE COMPLETE OUTPUT.

II.--MAXIMA

		MAXIMUM	MINIMUM
DEFLECTION (IN)	:	4.026E+00	-1.289E-01
AT ELEVATION (FT)	:	-39.50	9.50
BENDING MOMENT (LB-FT)	:	1.162E+05	-3.303E+04
AT ELEVATION (FT)	:	4.50	-28.00
SHEAR (LB)	:	15723.24	-17391.72
AT ELEVATION (FT)	:	4.50	4.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	2231.04	
AT ELEVATION (FT)	:	-34.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	3926.37	
AT ELEVATION (FT)	:	-35.00	

III.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
16.50	FLEXIBLE	-5.962E-03	-5570.27
4.50	FLEXIBLE	1.251E-02	33114.95

III..--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
17.50	0.000E+00	1.974E-02	0	0	0
17.00	0.000E+00	6.890E-03	0	0	0
16.50+	0.000E+00	-5.962E-03	0	26	4
16.50-	0.000E+00	-5.962E-03	0	5596	4
16.00	0.000E+00	-1.880E-02	0	5673	2820
15.50	0.000E+00	-3.151E-02	0	5789	5683
15.00	0.000E+00	-4.400E-02	0	5946	8616
14.50	0.000E+00	-5.615E-02	0	6142	11636
14.00	0.000E+00	-6.782E-02	0	6377	14764
13.50	0.000E+00	-7.890E-02	0	6651	18020
13.00	0.000E+00	-8.925E-02	0	6962	21422
12.50	0.000E+00	-9.873E-02	0	7310	24988
12.00	0.000E+00	-1.072E-01	0	7693	28737
11.50	0.000E+00	-1.145E-01	0	8111	32687
11.29	0.000E+00	-1.173E-01	0	8300	34435

11.00	0.000E+00	-1.205E-01	0	8563	36854
10.50	0.000E+00	-1.250E-01	0	9047	41255
10.00	0.000E+00	-1.279E-01	0	9561	45906
9.50	0.000E+00	-1.289E-01	0	10103	50820
9.00	0.000E+00	-1.278E-01	0	10670	56013
8.50	0.000E+00	-1.245E-01	0	11261	61495
8.00	0.000E+00	-1.187E-01	0	11873	67277
7.50	0.000E+00	-1.102E-01	0	12501	73370
7.00	0.000E+00	-9.873E-02	0	13143	79781
6.50	0.000E+00	-8.404E-02	0	13796	86515
6.00+	0.000E+00	-6.586E-02	0	14454	93578
6.00-	0.000E+00	-6.586E-02	0	14454	93578
5.50	0.000E+00	-4.391E-02	0	14864	100907
5.00	0.000E+00	-1.789E-02	0	15287	108444
4.50+	0.000E+00	1.251E-02	0	15723	116196
4.50-	0.000E+00	1.251E-02	0	-17392	116196
4.00	0.000E+00	4.748E-02	0	-16938	107613
3.50	0.000E+00	8.679E-02	0	-16466	99261
3.00	0.000E+00	1.301E-01	0	-15976	91150
2.50	0.000E+00	1.771E-01	0	-15469	83288
2.00	0.000E+00	2.275E-01	0	-14946	75684
1.50	0.000E+00	2.809E-01	0	-14408	68345
1.00	0.000E+00	3.370E-01	0	-13855	61278
0.50	0.000E+00	3.957E-01	0	-13289	54491
0.00	0.000E+00	4.565E-01	0	-12710	47991
-0.50	0.000E+00	5.193E-01	0	-12119	41783
-1.00	0.000E+00	5.837E-01	0	-11516	35874
-1.50	0.000E+00	6.496E-01	0	-10903	30269
-2.00	0.000E+00	7.167E-01	0	-10278	24973
-2.50	0.000E+00	7.849E-01	0	-9635	19994
-3.00+	0.000E+00	8.538E-01	0	-8955	15344
-3.00-	0.000E+00	8.538E-01	0	-8955	15344
-3.50	0.000E+00	9.234E-01	0	-8414	11006
-4.00	0.000E+00	9.934E-01	0	-7941	6918
-4.50	0.000E+00	1.064E+00	0	-7472	3065
-5.00	0.000E+00	1.134E+00	0	-7001	-553
-5.50	0.000E+00	1.204E+00	0	-6529	-3935
-6.00	0.000E+00	1.275E+00	0	-6060	-7083
-6.50	0.000E+00	1.345E+00	0	-5591	-9995
-7.00	0.000E+00	1.414E+00	0	-5122	-12673
-7.50	0.000E+00	1.483E+00	0	-4652	-15117
-8.00	0.000E+00	1.552E+00	0	-4183	-17326
-8.50	0.000E+00	1.619E+00	0	-3714	-19300
-9.00	0.000E+00	1.686E+00	0	-3245	-21040
-9.50	0.000E+00	1.752E+00	0	-2775	-22545
-10.00	0.000E+00	1.818E+00	0	-2306	-23815
-10.50	0.000E+00	1.882E+00	0	-1837	-24851
-11.00	0.000E+00	1.945E+00	0	-1368	-25652
-11.50	0.000E+00	2.007E+00	0	-898	-26218
-11.94+	0.000E+00	2.061E+00	0	-489	-26521
-11.94-	0.000E+00	2.061E+00	0	-489	-26521
-12.00	0.000E+00	2.068E+00	0	-430	-26550
-12.50	0.000E+00	2.128E+00	0	40	-26648
-13.00	0.000E+00	2.187E+00	0	509	-26511
-13.50	0.000E+00	2.245E+00	0	978	-26139
-14.00	0.000E+00	2.302E+00	0	1447	-25533
-14.50	0.000E+00	2.358E+00	0	1917	-24692
-15.00	0.000E+00	2.413E+00	0	2392	-23615
-15.50	0.000E+00	2.467E+00	0	2831	-22306
-16.00	0.000E+00	2.520E+00	0	3062	-20819
-16.50	0.000E+00	2.572E+00	0	2956	-19300
-17.00	0.000E+00	2.623E+00	0	2613	-17902

-17.50	0.000E+00	2.674E+00	0	2194	-16699
-18.00	0.000E+00	2.724E+00	0	1742	-15713
-18.50	0.000E+00	2.773E+00	0	1249	-14964
-19.00	0.000E+00	2.822E+00	0	717	-14470
-19.50	0.000E+00	2.870E+00	0	146	-14253
-20.00	0.000E+00	2.918E+00	0	-466	-14331
-20.50	0.000E+00	2.965E+00	0	-1117	-14725
-21.00	0.000E+00	3.011E+00	0	-1807	-15454
-21.50	0.000E+00	3.057E+00	0	-2538	-16539
-22.00	0.000E+00	3.102E+00	0	-3318	-18000
-22.50+	0.000E+00	3.147E+00	0	-4077	-19853
-22.50-	0.000E+00	3.147E+00	0	-4077	-19853
-23.00+	0.000E+00	3.190E+00	0	-3975	-21880
-23.00-	0.000E+00	3.190E+00	0	-3975	-21880
-23.50	0.000E+00	3.233E+00	0	-3926	-23876
-24.00	0.000E+00	3.275E+00	0	-3548	-25751
-24.50	0.000E+00	3.315E+00	0	-3108	-27414
-25.00	0.000E+00	3.355E+00	0	-2679	-28861
-25.50	0.000E+00	3.393E+00	0	-2250	-30093
-26.00	0.000E+00	3.431E+00	0	-1821	-31111
-26.50	0.000E+00	3.467E+00	0	-1391	-31914
-27.00	0.000E+00	3.501E+00	0	-962	-32502
-27.50	0.000E+00	3.535E+00	0	-533	-32876
-28.00	0.000E+00	3.567E+00	0	-104	-33035
-28.50	0.000E+00	3.597E+00	0	326	-32979
-29.00	0.000E+00	3.627E+00	0	755	-32709
-29.50	0.000E+00	3.655E+00	0	1184	-32224
-30.00	0.000E+00	3.682E+00	0	1613	-31525
-30.50	0.000E+00	3.707E+00	0	2043	-30611
-31.00	0.000E+00	3.731E+00	0	2472	-29482
-31.50	0.000E+00	3.755E+00	0	2901	-28139
-32.00	0.000E+00	3.777E+00	0	3330	-26581
-32.50	0.000E+00	3.797E+00	0	3760	-24808
-33.00	0.000E+00	3.817E+00	0	4189	-22821
-33.50	0.000E+00	3.836E+00	0	4618	-20619
-34.00	0.000E+00	3.854E+00	0	5064	-18200
-34.50	0.000E+00	3.872E+00	0	5411	-15572
-35.00+	0.000E+00	3.889E+00	0	5205	-12882
-35.00-	0.000E+00	3.889E+00	0	5205	-12882
-35.50	0.000E+00	3.905E+00	0	4891	-10346
-36.00	0.000E+00	3.921E+00	0	4388	-8022
-36.50	0.000E+00	3.936E+00	0	3830	-5967
-37.00	0.000E+00	3.951E+00	0	3253	-4195
-37.50	0.000E+00	3.966E+00	0	2652	-2718
-38.00	0.000E+00	3.981E+00	0	2026	-1547
-38.50	0.000E+00	3.996E+00	0	1375	-696
-39.00	0.000E+00	4.011E+00	0	700	-176
-39.50	0.000E+00	4.026E+00	0	0	0

IV..--SOIL PRESSURES

ELEVATION	<---------SOIL PRESSURES (PSF)-------->		
(FT)	LEFTSIDE	RIGHTSIDE	NET
17.50	0.00	0.00	0.00
17.00	0.00	0.00	0.00
16.50+	0.00	113.28	113.28
16.50-	0.00	113.28	113.28
16.00	0.00	193.51	193.51
15.50	0.00	273.47	273.47
15.00	0.00	352.89	352.89
14.50	0.00	431.47	431.47
14.00	0.00	508.92	508.92

13.50	0.00	584.95	584.95
13.00	0.00	659.23	659.23
12.50	0.00	731.45	731.45
12.00	0.00	801.25	801.25
11.50	0.00	870.28	870.28
11.29	0.00	885.43	885.43
11.00	0.00	904.89	904.89
10.50	0.00	935.95	935.95
10.00	0.00	963.01	963.01
9.50	0.00	985.65	985.65
9.00	0.00	1003.37	1003.37
8.50	0.00	1015.68	1015.68
8.00	0.00	1022.05	1022.05
7.50	0.00	1021.92	1021.92
7.00	0.00	1014.70	1014.70
6.50	0.00	999.77	999.77
6.00+	0.00	976.49	976.49
6.00-	0.00	459.62	459.62
5.50	0.00	458.97	458.97
5.00	0.00	453.76	453.76
4.50+	0.00	451.12	451.12
4.50-	0.00	451.12	451.12
4.00	0.00	457.59	457.59
3.50	0.00	462.47	462.47
3.00	0.00	465.74	465.74
2.50	0.00	467.40	467.40
2.00	0.00	467.45	467.45
1.50	0.00	465.90	465.90
1.00	0.00	462.77	462.77
0.50	0.00	458.07	458.07
0.00	0.00	451.83	451.83
-0.50	0.00	444.08	444.08
-1.00	0.00	434.86	434.86
-1.50	0.00	424.20	424.20
-2.00	0.00	426.81	426.81
-2.50	44.45	469.89	425.44
-3.00+	91.36	605.37	514.01
-3.00-	509.97	798.00	288.03
-3.50	739.63	772.43	32.80
-4.00	830.20	798.44	-31.76
-4.50	875.00	813.50	-61.50
-5.00	917.94	833.25	-84.69
-5.50	945.75	853.00	-92.75
-6.00	965.62	872.75	-92.87
-6.50	985.25	892.50	-92.75
-7.00	1005.00	912.25	-92.75
-7.50	1024.75	932.00	-92.75
-8.00	1044.50	951.75	-92.75
-8.50	1064.25	971.50	-92.75
-9.00	1084.00	991.25	-92.75
-9.50	1103.75	1011.00	-92.75
-10.00	1123.50	1030.75	-92.75
-10.50	1143.25	1050.50	-92.75
-11.00	1163.00	1070.25	-92.75
-11.50	1182.75	1090.00	-92.75
-11.94+	1202.50	1107.25	-95.25
-11.94-	1200.00	1107.25	-92.75
-12.00	1202.50	1109.75	-92.75
-12.50	1222.25	1129.50	-92.75
-13.00	1242.00	1149.25	-92.75
-13.50	1261.75	1169.00	-92.75
-14.00	1281.50	1188.75	-92.75

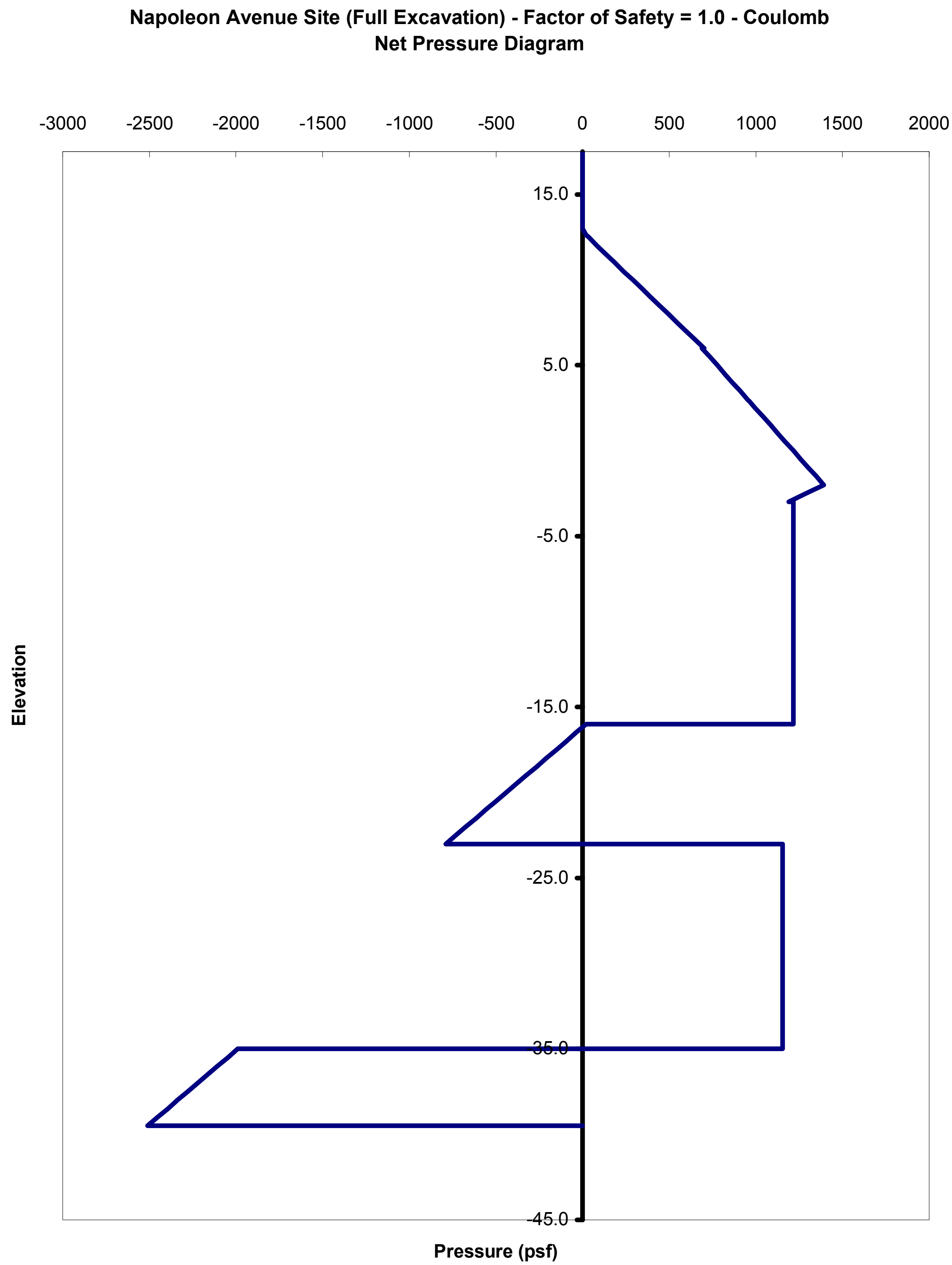
-14.50	1301.25	1208.50	-92.75
-15.00	1306.34	1238.37	-67.97
-15.50	1427.09	1187.52	-239.58
-16.00	1838.92	942.63	-896.29
-16.50	2284.41	692.98	-1591.42
-17.00	2474.12	632.37	-1841.74
-17.50	2549.25	652.33	-1896.92
-18.00	2638.50	662.25	-1976.25
-18.50	2727.75	672.17	-2055.58
-19.00	2817.00	682.08	-2134.92
-19.50	2906.25	692.00	-2214.25
-20.00	2995.50	701.92	-2293.58
-20.50	3084.75	711.83	-2372.92
-21.00	3174.00	721.75	-2452.25
-21.50	3263.25	731.67	-2531.58
-22.00	3379.53	727.73	-2651.80
-22.50+	3281.06	834.27	-2446.80
-22.50-	3281.06	2129.99	-1151.08
-23.00+	2657.63	2153.60	-504.03
-23.00-	2657.63	1206.92	-1450.71
-23.50	2003.44	1587.23	-416.20
-24.00	1841.97	1709.48	-132.48
-24.50	1894.25	1721.50	-172.75
-25.00	1920.00	1747.25	-172.75
-25.50	1945.75	1773.00	-172.75
-26.00	1971.50	1798.75	-172.75
-26.50	1997.25	1824.50	-172.75
-27.00	2023.00	1850.25	-172.75
-27.50	2048.75	1876.00	-172.75
-28.00	2074.50	1901.75	-172.75
-28.50	2100.25	1927.50	-172.75
-29.00	2126.00	1953.25	-172.75
-29.50	2151.75	1979.00	-172.75
-30.00	2177.50	2004.75	-172.75
-30.50	2203.25	2030.50	-172.75
-31.00	2229.00	2056.25	-172.75
-31.50	2254.75	2082.00	-172.75
-32.00	2280.50	2107.75	-172.75
-32.50	2306.25	2133.50	-172.75
-33.00	2332.00	2159.25	-172.75
-33.50	2357.75	2185.00	-172.75
-34.00	2337.16	2231.04	-106.11
-34.50	2685.81	2115.11	-570.70
-35.00+	3926.37	1610.75	-2315.62
-35.00-	2983.16	1610.75	-1372.41
-35.50	3041.46	1098.72	-1942.74
-36.00	3099.82	967.08	-2132.74
-36.50	3158.27	997.17	-2161.11
-37.00	3216.87	1007.08	-2209.79
-37.50	3275.64	1017.00	-2258.64
-38.00	3334.61	1026.92	-2307.69
-38.50	3393.81	1036.83	-2356.97
-39.00	3453.25	1046.75	-2406.50
-39.50	3512.96	1056.67	-2456.29

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Coulomb				
Elevation	**Right Side Active Pressure**	**Left Side Passive Pressure**	**Water Pressure**	**Net Pressure**
17.5	-461.54	0.00	0.00	0.00
17.0	-412.04	0.00	0.00	0.00
16.5	-362.54	0.00	0.00	0.00
16.0	-313.04	0.00	0.00	0.00
15.5	-263.54	0.00	0.00	0.00
15.0	-214.04	0.00	0.00	0.00
14.5	-164.54	0.00	0.00	0.00
14.0	-115.04	0.00	0.00	0.00
13.5	-65.54	0.00	0.00	0.00
13.0	-16.04	0.00	0.00	0.00
12.6	21.09	0.00	0.00	21.09
12.5	33.46	0.00	0.00	33.46
12.0	82.96	0.00	0.00	82.96
12.0	82.96	0.00	0.00	82.96
11.5	134.46	0.00	0.00	134.46
11.0	154.71	0.00	31.25	185.96
10.5	174.96	0.00	62.50	237.46
10.0	195.21	0.00	93.75	288.96
9.5	215.46	0.00	125.00	340.46
9.0	235.71	0.00	156.25	391.96
8.5	255.96	0.00	187.50	443.46
8.0	276.21	0.00	218.75	494.96
7.5	296.46	0.00	250.00	546.46
7.0	316.71	0.00	281.25	597.96
6.5	336.96	0.00	312.50	649.46
6.0	357.21	0.00	343.75	700.96
6.0	345.99	0.00	343.75	689.74
5.5	358.57	0.00	375.00	733.57
5.0	371.14	0.00	406.25	777.39
4.5	383.71	0.00	437.50	821.21
4.0	396.28	0.00	468.75	865.03
3.5	408.85	0.00	500.00	908.85
3.0	421.43	0.00	531.25	952.68
2.9	424.57	0.00	539.06	963.63
2.5	434.00	0.00	562.50	996.50
2.0	446.57	0.00	593.75	1040.32
1.5	459.14	0.00	625.00	1084.14
1.0	471.71	0.00	656.25	1127.96
0.5	484.29	0.00	687.50	1171.79
0.0	496.86	0.00	718.75	1215.61
-0.5	509.43	0.00	750.00	1259.43
-1.0	522.00	0.00	781.25	1303.25
-1.5	534.58	0.00	812.50	1347.08

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-2.0	547.15	0.00	843.75	1390.90
-2.0	547.15	0.00	843.75	1390.90
-2.5	559.72	144.35	875.00	1290.37
-3.0	572.29	288.70	906.25	1189.84
-3.0	892.71	583.54	906.25	1215.42
-3.5	912.46	634.54	937.50	1215.42
-4.0	932.21	685.54	968.75	1215.42
-4.5	951.96	736.54	1000.00	1215.42
-5.0	971.71	787.54	1031.25	1215.42
-5.5	991.46	807.29	1031.25	1215.42
-6.0	1011.21	827.04	1031.25	1215.42
-6.5	1030.96	846.79	1031.25	1215.42
-7.0	1050.71	866.54	1031.25	1215.42
-7.5	1070.46	886.29	1031.25	1215.42
-8.0	1090.21	906.04	1031.25	1215.42
-8.5	1109.96	925.79	1031.25	1215.42
-9.0	1129.71	945.54	1031.25	1215.42
-9.5	1149.46	965.29	1031.25	1215.42
-10.0	1169.21	985.04	1031.25	1215.42
-10.5	1188.96	1004.79	1031.25	1215.42
-11.0	1208.71	1024.54	1031.25	1215.42
-11.5	1228.46	1044.29	1031.25	1215.42
-12.0	1248.21	1064.04	1031.25	1215.42
-12.5	1267.96	1083.79	1031.25	1215.42
-13.0	1287.71	1103.54	1031.25	1215.42
-13.5	1307.46	1123.29	1031.25	1215.42
-14.0	1327.21	1143.04	1031.25	1215.42
-14.5	1346.96	1162.79	1031.25	1215.42
-15.0	1366.71	1182.54	1031.25	1215.42
-15.5	1386.46	1202.29	1031.25	1215.42
-16.0	1406.21	1222.04	1031.25	1215.42
-16.0	789.29	1799.62	1031.25	20.92
-16.5	801.86	1870.02	1031.25	-36.91
-17.0	814.43	1940.42	1031.25	-94.74
-17.5	827.01	2010.82	1031.25	-152.56
-18.0	839.58	2081.22	1031.25	-210.39
-18.5	852.15	2151.62	1031.25	-268.22
-19.0	864.72	2222.02	1031.25	-326.04
-19.5	877.29	2292.42	1031.25	-383.87
-20.0	889.87	2362.82	1031.25	-441.70
-20.5	902.44	2433.22	1031.25	-499.53
-21.0	915.01	2503.61	1031.25	-557.35
-21.5	927.58	2574.01	1031.25	-615.18
-22.0	940.15	2644.41	1031.25	-673.01
-22.5	952.73	2714.81	1031.25	-730.84

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Coulomb				
Elevation	Right Side Active Pressure	Left Side Passive Pressure	Water Pressure	Net Pressure
-23.0	965.30	2785.21	1031.25	-788.66
-23.0	1791.94	1669.31	1031.25	1153.88
-23.5	1817.69	1695.06	1031.25	1153.88
-24.0	1843.44	1720.81	1031.25	1153.88
-24.5	1869.19	1746.56	1031.25	1153.88
-25.0	1894.94	1772.31	1031.25	1153.88
-25.5	1920.69	1798.06	1031.25	1153.88
-26.0	1946.44	1823.81	1031.25	1153.88
-26.5	1972.19	1849.56	1031.25	1153.88
-27.0	1997.94	1875.31	1031.25	1153.88
-27.5	2023.69	1901.06	1031.25	1153.88
-28.0	2049.44	1926.81	1031.25	1153.88
-28.5	2075.19	1952.56	1031.25	1153.88
-29.0	2100.94	1978.31	1031.25	1153.88
-29.5	2126.69	2004.06	1031.25	1153.88
-30.0	2152.44	2029.81	1031.25	1153.88
-30.5	2178.19	2055.56	1031.25	1153.88
-31.0	2203.94	2081.31	1031.25	1153.88
-31.5	2229.69	2107.06	1031.25	1153.88
-32.0	2255.44	2132.81	1031.25	1153.88
-32.5	2281.19	2158.56	1031.25	1153.88
-33.0	2306.94	2184.31	1031.25	1153.88
-33.5	2332.69	2210.06	1031.25	1153.88
-34.0	2358.44	2235.81	1031.25	1153.88
-34.5	2384.19	2261.56	1031.25	1153.88
-35.0	2409.94	2287.31	1031.25	1153.88
-35.0	1226.46	4247.63	1031.25	-1989.92
-35.5	1239.03	4318.03	1031.25	-2047.74
-36.0	1251.60	4388.43	1031.25	-2105.57
-36.5	1264.17	4458.82	1031.25	-2163.40
-37.0	1276.75	4529.22	1031.25	-2221.23
-37.5	1289.32	4599.62	1031.25	-2279.05
-38.0	1301.89	4670.02	1031.25	-2336.88
-38.5	1314.46	4740.42	1031.25	-2394.71
-39.0	1327.03	4810.82	1031.25	-2452.54
-39.5	1339.61	4881.22	1031.25	-2510.36

Based on the net pressure diagram, the top strut load would be 6 kips for the Coulomb case with a 1.3 factor of safety. Summing the moments around the sheet pile tip (EL -39.5) gave a bottom strut load of 474 kips for the Coulomb case with a 1.3 factor of safety.

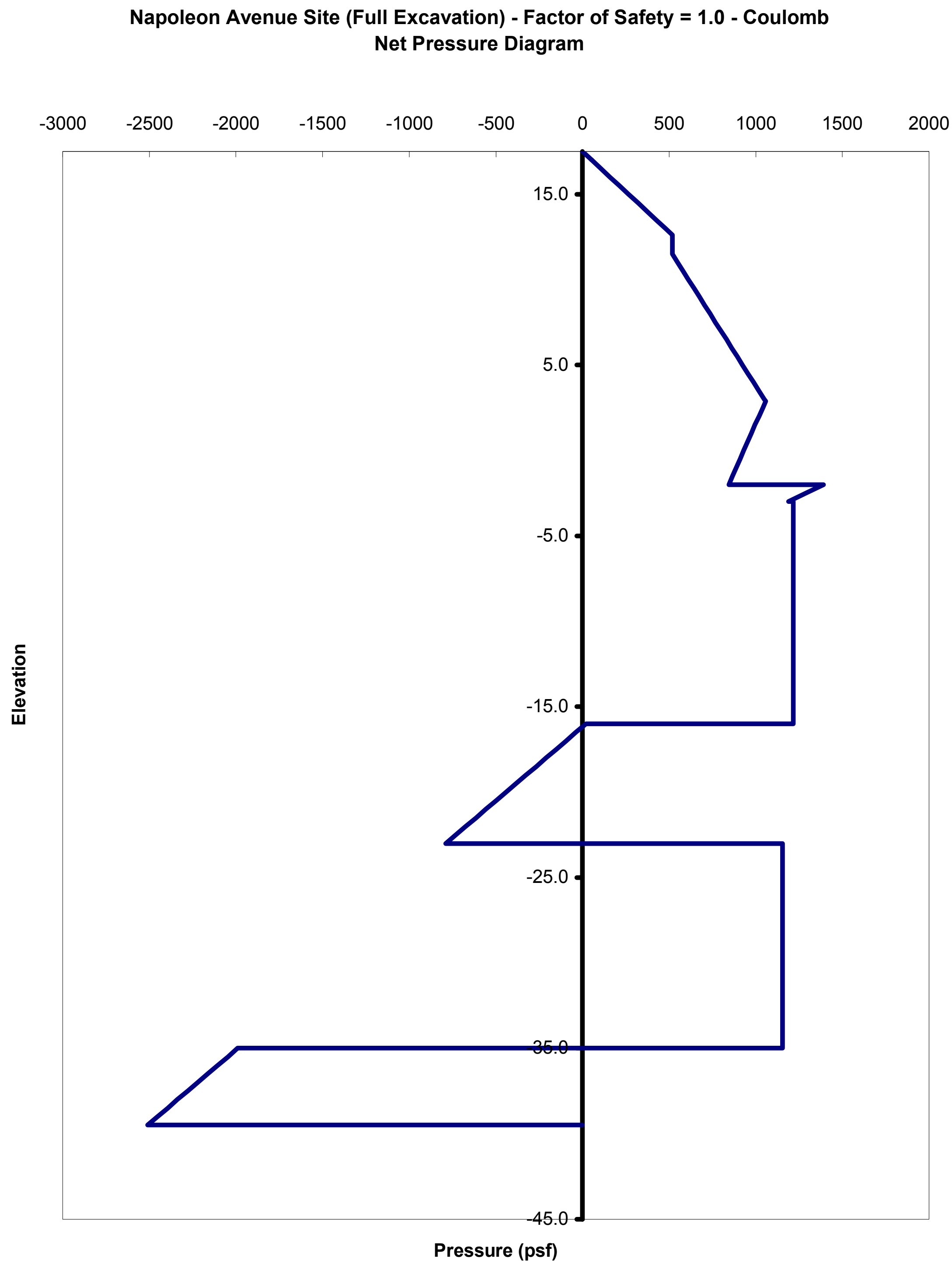

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Terzaghi					
Elevation	**Terzaghi Pressure**	**Right Side Active Pressure**	**Left Side Passive Pressure**	**Water Pressure**	**Net Pressure**
17.5	0.00		0.00	0.00	0.00
17.0	53.13		0.00	0.00	53.13
16.5	106.26		0.00	0.00	106.26
16.0	159.38		0.00	0.00	159.38
15.5	212.51		0.00	0.00	212.51
15.0	265.64		0.00	0.00	265.64
14.5	318.77		0.00	0.00	318.77
14.0	371.90		0.00	0.00	371.90
13.5	425.02		0.00	0.00	425.02
13.0	478.15		0.00	0.00	478.15
12.6	518.00		0.00	0.00	518.00
12.5	518.00		0.00	0.00	518.00
12.0	518.00		0.00	0.00	518.00
12.0	518.00		0.00	0.00	518.00
11.5	518.00		0.00	0.00	518.00
11.0	518.00		0.00	31.25	549.25
10.5	518.00		0.00	62.50	580.50
10.0	518.00		0.00	93.75	611.75
9.5	518.00		0.00	125.00	643.00
9.0	518.00		0.00	156.25	674.25
8.5	518.00		0.00	187.50	705.50
8.0	518.00		0.00	218.75	736.75
7.5	518.00		0.00	250.00	768.00
7.0	518.00		0.00	281.25	799.25
6.5	518.00		0.00	312.50	830.50
6.0	518.00		0.00	343.75	861.75
6.0	518.00		0.00	343.75	861.75
5.5	518.00		0.00	375.00	893.00
5.0	518.00		0.00	406.25	924.25
4.5	518.00		0.00	437.50	955.50
4.0	518.00		0.00	468.75	986.75
3.5	518.00		0.00	500.00	1018.00
3.0	518.00		0.00	531.25	1049.25
2.9	518.00		0.00	539.06	1057.06
2.5	478.15		0.00	562.50	1040.65
2.0	425.02		0.00	593.75	1018.77
1.5	371.90		0.00	625.00	996.90
1.0	318.77		0.00	656.25	975.02
0.5	265.64		0.00	687.50	953.14
0.0	212.51		0.00	718.75	931.26
-0.5	159.38		0.00	750.00	909.38
-1.0	106.26		0.00	781.25	887.51
-1.5	53.13		0.00	812.50	865.63

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Terzaghi					
		Right Side	Left Side		
	Terzaghi	Active	Passive	Water	Net
Elevation	**Pressure**	**Pressure**	**Pressure**	**Pressure**	**Pressure**
-2.0	0.00		0.00	843.75	843.75
-2.0		547.15	0.00	843.75	1390.90
-2.5		559.72	144.35	875.00	1290.37
-3.0		572.29	288.70	906.25	1189.84
-3.0		892.71	583.54	906.25	1215.42
-3.5		912.46	634.54	937.50	1215.42
-4.0		932.21	685.54	968.75	1215.42
-4.5		951.96	736.54	1000.00	1215.42
-5.0		971.71	787.54	1031.25	1215.42
-5.5		991.46	807.29	1031.25	1215.42
-6.0		1011.21	827.04	1031.25	1215.42
-6.5		1030.96	846.79	1031.25	1215.42
-7.0		1050.71	866.54	1031.25	1215.42
-7.5		1070.46	886.29	1031.25	1215.42
-8.0		1090.21	906.04	1031.25	1215.42
-8.5		1109.96	925.79	1031.25	1215.42
-9.0		1129.71	945.54	1031.25	1215.42
-9.5		1149.46	965.29	1031.25	1215.42
-10.0		1169.21	985.04	1031.25	1215.42
-10.5		1188.96	1004.79	1031.25	1215.42
-11.0		1208.71	1024.54	1031.25	1215.42
-11.5		1228.46	1044.29	1031.25	1215.42
-12.0		1248.21	1064.04	1031.25	1215.42
-12.5		1267.96	1083.79	1031.25	1215.42
-13.0		1287.71	1103.54	1031.25	1215.42
-13.5		1307.46	1123.29	1031.25	1215.42
-14.0		1327.21	1143.04	1031.25	1215.42
-14.5		1346.96	1162.79	1031.25	1215.42
-15.0		1366.71	1182.54	1031.25	1215.42
-15.5		1386.46	1202.29	1031.25	1215.42
-16.0		1406.21	1222.04	1031.25	1215.42
-16.0		789.29	1799.62	1031.25	20.92
-16.5		801.86	1870.02	1031.25	-36.91
-17.0		814.43	1940.42	1031.25	-94.74
-17.5		827.01	2010.82	1031.25	-152.56
-18.0		839.58	2081.22	1031.25	-210.39
-18.5		852.15	2151.62	1031.25	-268.22
-19.0		864.72	2222.02	1031.25	-326.04
-19.5		877.29	2292.42	1031.25	-383.87
-20.0		889.87	2362.82	1031.25	-441.70
-20.5		902.44	2433.22	1031.25	-499.53
-21.0		915.01	2503.61	1031.25	-557.35
-21.5		927.58	2574.01	1031.25	-615.18
-22.0		940.15	2644.41	1031.25	-673.01
-22.5		952.73	2714.81	1031.25	-730.84

Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.3 - Terzaghi					
		Right Side	Left Side		
Elevation	Terzaghi Pressure	Active Pressure	Passive Pressure	Water Pressure	Net Pressure
-23.0		965.30	2785.21	1031.25	-788.66
-23.0		1791.94	1669.31	1031.25	1153.88
-23.5		1817.69	1695.06	1031.25	1153.88
-24.0		1843.44	1720.81	1031.25	1153.88
-24.5		1869.19	1746.56	1031.25	1153.88
-25.0		1894.94	1772.31	1031.25	1153.88
-25.5		1920.69	1798.06	1031.25	1153.88
-26.0		1946.44	1823.81	1031.25	1153.88
-26.5		1972.19	1849.56	1031.25	1153.88
-27.0		1997.94	1875.31	1031.25	1153.88
-27.5		2023.69	1901.06	1031.25	1153.88
-28.0		2049.44	1926.81	1031.25	1153.88
-28.5		2075.19	1952.56	1031.25	1153.88
-29.0		2100.94	1978.31	1031.25	1153.88
-29.5		2126.69	2004.06	1031.25	1153.88
-30.0		2152.44	2029.81	1031.25	1153.88
-30.5		2178.19	2055.56	1031.25	1153.88
-31.0		2203.94	2081.31	1031.25	1153.88
-31.5		2229.69	2107.06	1031.25	1153.88
-32.0		2255.44	2132.81	1031.25	1153.88
-32.5		2281.19	2158.56	1031.25	1153.88
-33.0		2306.94	2184.31	1031.25	1153.88
-33.5		2332.69	2210.06	1031.25	1153.88
-34.0		2358.44	2235.81	1031.25	1153.88
-34.5		2384.19	2261.56	1031.25	1153.88
-35.0		2409.94	2287.31	1031.25	1153.88
-35.0		1226.46	4247.63	1031.25	-1989.92
-35.5		1239.03	4318.03	1031.25	-2047.74
-36.0		1251.60	4388.43	1031.25	-2105.57
-36.5		1264.17	4458.82	1031.25	-2163.40
-37.0		1276.75	4529.22	1031.25	-2221.23
-37.5		1289.32	4599.62	1031.25	-2279.05
-38.0		1301.89	4670.02	1031.25	-2336.88
-38.5		1314.46	4740.42	1031.25	-2394.71
-39.0		1327.03	4810.82	1031.25	-2452.54
-39.5		1339.61	4881.22	1031.25	-2510.36

Based on the net pressure diagram, the top strut load would be 48 kips for the Terzaghi case with a 1.3 factor of safety. Summing the moments around the sheet pile tip (EL -39.5) gave a bottom strut load of 485 kips for the Terzaghi case with a 1.3 factor of safety.


Napoleon Avenue Site (Full Excavation) - Factor of Safety = 1.0 - Coulomb
Net Pressure Diagram
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
1500
2000
15.0
5.0
-5.0
-15.0
-25.0
-35.0
-45.0
Elevation
Pressure (psf)

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:28:23

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

I.--HEADING
'NAPOLEON
'FS=1.0
'FULL EXCAVATION

II.--WALL SEGMENT DATA

ELEVATION AT TOP OF SEGMENT (FT)	MODULUS OF ELASTICITY (PSI)	MOMENT OF INERTIA (IN^4)	CROSS SECTION AREA (SQIN)
17.50	2.900E+07	369.40	10.28

ELEVATION AT BOTTOM OF WALL = -39.50

III.--ANCHOR DATA

ELEV. AT WALL (FT)	ANCHOR TYPE	ULTIMATE TENSION FORCE (LB)	ULTIMATE COMPR. FORCE (LB)	ANCHOR STIFF. (LB/IN)	ANCHOR SLOPE (FT)
16.5	FLEXIBLE	9.665E+5	7.445E+5	9.343E+5	0.000
4.5	FLEXIBLE	2.739E+6	2.739E+6	2.648E+6	0.000

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	17.50
100.00	17.50

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	-2.00
100.00	-2.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

<UNIT WEIGHT> SAT. (PCF)	MOIST (PCF)	INT. FRICT. (DEG)	COH-ESION (PSF)	WALL FRICT. (DEG)	ADH-ESION (PSF)	<STIFF. COEF.> ACT. (PCI)	PASS. (PCI)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT)
99.0	99.0	0.0	231.0	0.0	0.0	154.0	154.0	12.0	0.0
103.0	103.0	0.0	231.0	0.0	0.0	154.0	154.0	6.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6	-3.0	0.0
102.0	102.0	0.0	231.0	0.0	0.0	154.0	154.0	-16.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	246.0	0.0	0.0	164.0	164.0	-35.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6		

V.B.--LEFTSIDE

<UNIT WEIGHT> SAT.	MOIST	INT. FRICT.	COH-ESION	WALL FRICT.	ADH-ESION	<STIFF. COEF.> ACT.	PASS.	<--BOTTOM--> ELEV.	SLOPE

(PCF)	(PCF)	(DEG)	(PSF)	(DEG)	(PSF)	(PCI)	(PCI)	(FT)	(FT)
122.0	122.0	24.0	0.0	0.0	0.0	9.3	9.3	-3.0	0.0
102.0	102.0	0.0	231.0	0.0	0.0	154.0	154.0	-16.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	15.1	15.1	-23.0	0.0
114.0	114.0	0.0	246.0	0.0	0.0	164.0	164.0	-35.0	0.0
122.0	122.0	24.0	0.0	0.0	0.0	4.6	4.6		

VI.--INTERACTION ZONE DATA
NONE

VII.--WATER DATA
UNIT WEIGHT = 62.50 (PCF)
RIGHTSIDE ELEVATION = 11.50 (FT)
LEFTSIDE ELEVATION = -5.00 (FT)
NO SEEPAGE

VIII.--VERTICAL SURCHARGE LOADS
NONE

IX.--HORIZONTAL LOADS
NONE

PROGRAM CWALSSI - SOIL-STRUCTURE INTERACTION ANALYSIS OF SHEET PILE WALLS
DATE: 13-NOVEMBER-2003 TIME: 15:28:25

****
* LIMIT PRESSURES *
****

I.--HEADING
'NAPOLEON
'FS=1.0
'FULL EXCAVATION
RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

	NET WATER	< LEFTSIDE SOIL PRESSURES>			<RIGHTSIDE SOIL PRESSURES>		
ELEV.	PRESS.	PASSIVE	AT-REST	ACTIVE	ACTIVE	AT-REST	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
17.50	0.00	0.00	0.00	0.00	0.00	0.00	462.00
17.00	0.00	0.00	0.00	0.00	0.00	49.50	511.50
16.50	0.00	0.00	0.00	0.00	0.00	99.00	561.00
16.00	0.00	0.00	0.00	0.00	0.00	148.50	610.50
15.50	0.00	0.00	0.00	0.00	0.00	198.00	660.00
15.00	0.00	0.00	0.00	0.00	0.00	247.50	709.50
14.50	0.00	0.00	0.00	0.00	0.00	297.00	759.00
14.00	0.00	0.00	0.00	0.00	0.00	346.50	808.50
13.50	0.00	0.00	0.00	0.00	0.00	396.00	858.00
13.00	0.00	0.00	0.00	0.00	0.00	445.50	907.49
12.83+	0.00	0.00	0.00	0.00	0.00	461.96	957.12
12.83-	0.00	0.00	0.00	0.00	0.00	461.96	924.00
12.50	0.00	0.00	0.00	0.00	33.12	495.00	957.12
12.00	0.00	0.00	0.00	0.00	83.02	544.50	1007.02
11.50	0.00	0.00	0.00	0.00	125.94	596.00	1049.94
11.00	31.25	0.00	0.00	0.00	154.24	616.25	1078.24
10.50	62.50	0.00	0.00	0.00	174.62	636.50	1098.62

10.00	93.75	0.00	0.00	0.00	194.75	656.75	1118.75
9.50	125.00	0.00	0.00	0.00	215.00	677.00	1139.00
9.00	156.25	0.00	0.00	0.00	235.25	697.25	1159.25
8.50	187.50	0.00	0.00	0.00	255.50	717.50	1179.50
8.00	218.75	0.00	0.00	0.00	275.75	737.75	1199.75
7.50	250.00	0.00	0.00	0.00	296.00	758.00	1220.00
7.00	281.25	0.00	0.00	0.00	316.46	778.25	1229.73
6.50	312.50	0.00	0.00	0.00	335.43	798.50	1322.44
6.00+	343.75	0.00	0.00	0.00	349.03	818.75	1624.04
6.00-	343.75	0.00	0.00	0.00	349.03	485.73	1624.04
5.50	375.00	0.00	0.00	0.00	358.91	503.38	1950.01
5.00	406.25	0.00	0.00	0.00	370.24	521.03	2092.62
4.50	437.50	0.00	0.00	0.00	382.93	538.68	2153.04
4.00	468.75	0.00	0.00	0.00	395.48	556.33	2223.58
3.50	500.00	0.00	0.00	0.00	408.02	573.98	2294.12
3.00	531.25	0.00	0.00	0.00	420.57	591.63	2364.66
2.50	562.50	0.00	0.00	0.00	433.12	609.28	2435.21
2.00	593.75	0.00	0.00	0.00	445.66	626.93	2505.75
1.50	625.00	0.00	0.00	0.00	458.21	644.58	2576.29
1.00	656.25	0.00	0.00	0.00	470.76	662.23	2646.83
0.50	687.50	0.00	0.00	0.00	483.30	679.88	2717.38
0.00	718.75	0.00	0.00	0.00	495.85	697.53	2787.92
-0.50	750.00	0.00	0.00	0.00	508.40	715.18	2858.46
-1.00	781.25	0.00	0.00	0.00	520.94	732.83	2929.01
-1.50	812.50	0.00	0.00	0.00	533.49	750.48	2999.55
-2.00	843.75	0.00	0.00	0.00	540.99	768.13	3092.08
-2.50	875.00	172.27	36.19	0.00	588.69	785.78	3009.86
-3.00+	906.25	412.50	72.38	0.00	733.55	803.43	2500.62
-3.00-	906.25	412.50	122.00	0.00	733.55	1354.25	2500.62
-3.50	937.50	607.37	173.00	0.00	881.89	1374.00	1966.77
-4.00	968.75	691.09	224.00	0.00	936.74	1393.75	1834.15
-4.50	1000.00	737.00	275.00	0.00	951.50	1413.50	1875.50
-5.00	1031.25	779.94	326.00	0.00	971.25	1433.25	1895.25
-5.50	1031.25	807.75	345.75	0.00	991.00	1453.00	1915.00
-6.00	1031.25	827.62	365.50	0.00	1010.75	1472.75	1934.75
-6.50	1031.25	847.25	385.25	0.00	1030.50	1492.50	1954.50
-7.00	1031.25	867.00	405.00	0.00	1050.25	1512.25	1974.25
-7.50	1031.25	886.75	424.75	0.00	1070.00	1532.00	1994.00
-8.00	1031.25	906.50	444.50	0.00	1089.75	1551.75	2013.75
-8.44+	1031.25	926.25	462.00	0.00	1107.25	1571.50	2031.25
-8.44-	1031.25	924.00	462.00	0.00	1107.25	1571.50	2031.25
-8.50	1031.25	926.25	464.25	2.25	1109.50	1591.25	2033.50
-9.00	1031.25	946.00	484.00	22.00	1129.25	1611.00	2053.25
-9.50	1031.25	965.75	503.75	41.75	1149.00	1630.75	2073.00
-10.00	1031.25	985.50	523.50	61.50	1168.75	1650.50	2092.75
-10.50	1031.25	1005.25	543.25	81.25	1188.50	1670.25	2112.50
-11.00	1031.25	1025.00	563.00	101.00	1208.25	1690.00	2132.25
-11.50	1031.25	1044.75	582.75	120.75	1228.00	1709.75	2152.00
-12.00	1031.25	1064.50	602.50	140.50	1247.75	1729.50	2171.75
-12.50	1031.25	1084.25	622.25	160.25	1267.50	1749.25	2191.50
-13.00	1031.25	1104.00	642.00	180.00	1287.25	1769.00	2211.25
-13.50	1031.25	1123.75	661.75	199.75	1307.00	1788.75	2231.00
-14.00	1031.25	1143.50	681.50	219.50	1326.75	1808.50	2250.75
-14.50	1031.25	1163.25	701.25	239.25	1346.50	1828.25	2270.50
-15.00	1031.25	1173.73	721.00	258.68	1375.94	1848.00	2257.25
-15.50+	1031.25	1257.20	740.75	280.83	1328.06	1867.75	2506.78
-15.50-	1031.25	1257.20	740.75	280.83	1328.06	1108.07	2506.78
-16.00+	1031.25	1525.99	760.50	307.76	1094.86	1125.72	3392.36
-16.00-	1031.25	1525.99	451.18	307.76	1094.86	1125.72	3392.36
-16.50	1031.25	1819.38	468.83	331.19	858.18	1143.37	4302.54
-17.00	1031.25	1953.25	486.48	346.19	803.15	1161.02	4602.46
-17.50	1031.25	2014.91	504.13	358.37	825.33	1178.67	4640.41

-18.00	1031.25	2085.46	521.78	370.91	837.87	1196.32	4710.95
-18.50	1031.25	2156.00	539.42	383.46	850.42	1213.97	4781.49
-19.00	1031.25	2226.54	557.07	396.00	862.97	1231.61	4852.04
-19.50	1031.25	2297.08	574.72	408.55	875.51	1249.26	4922.58
-20.00	1031.25	2367.63	592.37	421.10	888.06	1266.91	4993.12
-20.50	1031.25	2438.17	610.02	433.64	900.60	1284.56	5063.66
-21.00	1031.25	2508.71	627.67	446.19	913.15	1302.21	5134.21
-21.50	1031.25	2579.26	645.32	458.74	925.70	1319.86	5204.75
-22.00	1031.25	2667.50	662.97	468.28	925.24	1337.51	5316.72
-22.50+	1031.25	2615.16	680.62	501.51	1028.50	1355.16	5098.32
-22.50-	1031.25	2615.16	680.62	501.51	1028.50	2284.25	5098.32
-23.00+	1031.25	2218.39	698.27	594.09	1381.20	2310.00	4084.77
-23.00-	1031.25	2218.39	1177.00	594.09	1381.20	2310.00	4084.77
-23.50	1031.25	1799.93	1202.75	693.07	1740.29	2335.75	3049.51
-24.00	1031.25	1703.15	1228.50	739.40	1856.65	2361.50	2786.67
-24.50	1031.25	1746.25	1254.25	762.25	1869.50	2387.25	2853.50
-25.00	1031.25	1772.00	1280.00	788.00	1895.25	2413.00	2879.25
-25.50	1031.25	1797.75	1305.75	813.75	1921.00	2438.75	2905.00
-26.00	1031.25	1823.50	1331.50	839.50	1946.75	2464.50	2930.75
-26.50	1031.25	1849.25	1357.25	865.25	1972.50	2490.25	2956.50
-27.00	1031.25	1875.00	1383.00	891.00	1998.25	2516.00	2982.25
-27.50	1031.25	1900.75	1408.75	916.75	2024.00	2541.75	3008.00
-28.00	1031.25	1926.50	1434.50	942.50	2049.75	2567.50	3033.75
-28.50	1031.25	1952.25	1460.25	968.25	2075.50	2593.25	3059.50
-29.00	1031.25	1978.00	1486.00	994.00	2101.25	2619.00	3085.25
-29.50	1031.25	2003.75	1511.75	1019.75	2127.00	2644.75	3111.00
-30.00	1031.25	2029.50	1537.50	1045.50	2152.75	2670.50	3136.75
-30.50	1031.25	2055.25	1563.25	1071.25	2178.50	2696.25	3162.50
-31.00	1031.25	2081.00	1589.00	1097.00	2204.25	2722.00	3188.25
-31.50	1031.25	2106.75	1614.75	1122.75	2230.00	2747.75	3214.00
-32.00	1031.25	2132.50	1640.50	1148.50	2255.75	2773.50	3239.75
-32.50	1031.25	2158.25	1666.25	1174.25	2281.50	2799.25	3265.50
-33.00	1031.25	2184.00	1692.00	1200.00	2307.25	2825.00	3291.25
-33.50	1031.25	2209.75	1717.75	1225.75	2333.00	2850.75	3317.00
-34.00	1031.25	2204.56	1743.50	1260.08	2377.34	2876.50	3288.08
-34.50+	1031.25	2445.87	1769.25	1226.06	2273.29	2902.25	3695.45
-34.50-	1031.25	2445.87	1769.25	1226.06	2273.29	1721.80	3695.45
-35.00+	1031.25	3283.19	1795.00	1026.60	1813.70	1739.45	5149.56
-35.00-	1031.25	3283.19	1064.91	1026.60	1813.70	1739.45	5149.56
-35.50	1031.25	4142.20	1082.56	820.74	1347.73	1757.10	6625.36
-36.00	1031.25	4427.96	1100.21	773.62	1230.58	1774.75	7077.17
-36.50	1031.25	4467.90	1117.86	794.65	1261.61	1792.40	7093.40
-37.00	1031.25	4538.45	1135.51	807.19	1274.15	1810.05	7163.94
-37.50	1031.25	4608.99	1153.16	819.74	1286.70	1827.70	7234.48
-38.00	1031.25	4679.53	1170.81	832.28	1299.25	1845.35	7305.03
-38.50	1031.25	4750.07	1188.45	844.83	1311.79	1863.00	7375.57
-39.00	1031.25	4820.62	1206.10	857.38	1324.34	1880.64	7446.11
-39.50	1031.25	4891.16	1223.75	869.92	1336.88	0.00	7516.65

****

* RESULTS *

****

I.--HEADING

'NAPOLEON

'FS=1.0

'FULL EXCAVATION

RIGHTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION MAY NOT EXIST
ALL ELEVATIONS. SEE COMPLETE OUTPUT.

II.--MAXIMA

		MAXIMUM	MINIMUM
DEFLECTION (IN)	:	1.110E+01	-2.995E-01
AT ELEVATION (FT)	:	-39.50	9.50
BENDING MOMENT (LB-FT)	:	2.354E+05	-6.847E+04
AT ELEVATION (FT)	:	4.50	-26.00
SHEAR (LB)	:	26575.99	-25969.96
AT ELEVATION (FT)	:	4.50	4.50
RIGHTSIDE SOIL PRESSURE (PSF)	:	2377.34	
AT ELEVATION (FT)	:	-34.00	
LEFTSIDE SOIL PRESSURE (PSF)	:	4891.16	
AT ELEVATION (FT)	:	-39.50	

III.--ANCHOR FORCES

ELEVATION AT ANCHOR (FT)	ANCHOR TYPE	ANCHOR DEFORMATION (IN)	ANCHOR FORCE (LB)
16.50	FLEXIBLE	-1.574E-02	-14703.15
4.50	FLEXIBLE	1.985E-02	52545.95

III..--WALL DEFLECTIONS AND FORCES

	<------DEFLECTION----->		<--WALL INTERNAL FORCES->		
ELEVATION (FT)	AXIAL (IN)	LATERAL (IN)	AXIAL (LB)	SHEAR (LB)	MOMENT (LB-FT)
17.50	0.000E+00	4.517E-02	0	0	0
17.00	0.000E+00	1.471E-02	0	0	0
16.50+	0.000E+00	-1.574E-02	0	27	4
16.50-	0.000E+00	-1.574E-02	0	14730	4
16.00	0.000E+00	-4.614E-02	0	14821	7390
15.50	0.000E+00	-7.624E-02	0	14963	14834
15.00	0.000E+00	-1.057E-01	0	15158	22362
14.50	0.000E+00	-1.344E-01	0	15404	30000
14.00	0.000E+00	-1.617E-01	0	15701	37774
13.50	0.000E+00	-1.876E-01	0	16047	45709
13.00	0.000E+00	-2.116E-01	0	16440	53829
12.83	0.000E+00	-2.192E-01	0	16581	56575
12.50	0.000E+00	-2.335E-01	0	16879	62157
12.00	0.000E+00	-2.528E-01	0	17364	70716
11.50	0.000E+00	-2.693E-01	0	17879	79526

11.00	0.000E+00	-2.826E-01	0	18419	88599
10.50	0.000E+00	-2.923E-01	0	18986	97949
10.00	0.000E+00	-2.981E-01	0	19580	107589
9.50	0.000E+00	-2.995E-01	0	20199	117533
9.00	0.000E+00	-2.962E-01	0	20844	127793
8.50	0.000E+00	-2.877E-01	0	21514	138381
8.00	0.000E+00	-2.737E-01	0	22211	149311
7.50	0.000E+00	-2.536E-01	0	22933	160596
7.00	0.000E+00	-2.270E-01	0	23673	172247
6.50	0.000E+00	-1.935E-01	0	24409	184268
6.00+	0.000E+00	-1.526E-01	0	25137	196655
6.00-	0.000E+00	-1.526E-01	0	25137	196655
5.50	0.000E+00	-1.037E-01	0	25613	209342
5.00	0.000E+00	-4.643E-02	0	26095	222269
4.50+	0.000E+00	1.985E-02	0	26576	235437
4.50-	0.000E+00	1.985E-02	0	-25970	235437
4.00	0.000E+00	9.544E-02	0	-25476	222574
3.50	0.000E+00	1.800E-01	0	-24968	209963
3.00	0.000E+00	2.730E-01	0	-24447	197608
2.50	0.000E+00	3.740E-01	0	-23915	185517
2.00	0.000E+00	4.825E-01	0	-23373	173695
1.50	0.000E+00	5.980E-01	0	-22824	162145
1.00	0.000E+00	7.201E-01	0	-22269	150872
0.50	0.000E+00	8.482E-01	0	-21695	139880
0.00	0.000E+00	9.819E-01	0	-21098	129180
-0.50	0.000E+00	1.121E+00	0	-20480	118785
-1.00	0.000E+00	1.265E+00	0	-19840	108704
-1.50	0.000E+00	1.413E+00	0	-19178	98949
-2.00	0.000E+00	1.565E+00	0	-18495	89530
-2.50	0.000E+00	1.721E+00	0	-17800	80456
-3.00+	0.000E+00	1.880E+00	0	-17075	71735
-3.00-	0.000E+00	1.880E+00	0	-17075	71735
-3.50	0.000E+00	2.042E+00	0	-16465	63350
-4.00	0.000E+00	2.206E+00	0	-15859	55269
-4.50	0.000E+00	2.373E+00	0	-15251	47492
-5.00	0.000E+00	2.541E+00	0	-14642	40018
-5.50	0.000E+00	2.711E+00	0	-14033	32850
-6.00	0.000E+00	2.883E+00	0	-13426	25985
-6.50	0.000E+00	3.056E+00	0	-12818	19424
-7.00	0.000E+00	3.229E+00	0	-12211	13167
-7.50	0.000E+00	3.403E+00	0	-11604	7213
-8.00	0.000E+00	3.577E+00	0	-10997	1563
-8.44+	0.000E+00	3.731E+00	0	-10459	-3190
-8.44-	0.000E+00	3.731E+00	0	-10459	-3190
-8.50	0.000E+00	3.751E+00	0	-10390	-3784
-9.00	0.000E+00	3.925E+00	0	-9783	-8827
-9.50	0.000E+00	4.099E+00	0	-9175	-13566
-10.00	0.000E+00	4.272E+00	0	-8568	-18002
-10.50	0.000E+00	4.445E+00	0	-7961	-22134
-11.00	0.000E+00	4.616E+00	0	-7354	-25963
-11.50	0.000E+00	4.787E+00	0	-6746	-29488
-12.00	0.000E+00	4.956E+00	0	-6139	-32709
-12.50	0.000E+00	5.124E+00	0	-5532	-35627
-13.00	0.000E+00	5.291E+00	0	-4925	-38241
-13.50	0.000E+00	5.456E+00	0	-4317	-40552
-14.00	0.000E+00	5.619E+00	0	-3710	-42558
-14.50	0.000E+00	5.781E+00	0	-3103	-44262
-15.00	0.000E+00	5.941E+00	0	-2491	-45660
-15.50	0.000E+00	6.099E+00	0	-1907	-46757
-16.00	0.000E+00	6.255E+00	0	-1481	-47594
-16.50	0.000E+00	6.410E+00	0	-1314	-48282
-17.00	0.000E+00	6.562E+00	0	-1326	-48938

-17.50	0.000E+00	6.712E+00	0	-1395	-49617
-18.00	0.000E+00	6.861E+00	0	-1489	-50337
-18.50	0.000E+00	7.007E+00	0	-1612	-51111
-19.00	0.000E+00	7.151E+00	0	-1763	-51954
-19.50	0.000E+00	7.293E+00	0	-1944	-52879
-20.00	0.000E+00	7.433E+00	0	-2154	-53902
-20.50	0.000E+00	7.571E+00	0	-2392	-55038
-21.00	0.000E+00	7.707E+00	0	-2660	-56300
-21.50	0.000E+00	7.840E+00	0	-2957	-57702
-22.00	0.000E+00	7.971E+00	0	-3290	-59262
-22.50+	0.000E+00	8.100E+00	0	-3607	-60990
-22.50-	0.000E+00	8.100E+00	0	-3607	-60990
-23.00+	0.000E+00	8.226E+00	0	-3351	-62738
-23.00-	0.000E+00	8.226E+00	0	-3351	-62738
-23.50	0.000E+00	8.350E+00	0	-3060	-64357
-24.00	0.000E+00	8.471E+00	0	-2521	-65756
-24.50	0.000E+00	8.589E+00	0	-1936	-66870
-25.00	0.000E+00	8.705E+00	0	-1359	-67693
-25.50	0.000E+00	8.818E+00	0	-781	-68228
-26.00	0.000E+00	8.928E+00	0	-204	-68475
-26.50	0.000E+00	9.036E+00	0	373	-68432
-27.00	0.000E+00	9.140E+00	0	950	-68101
-27.50	0.000E+00	9.242E+00	0	1528	-67482
-28.00	0.000E+00	9.342E+00	0	2105	-66574
-28.50	0.000E+00	9.438E+00	0	2682	-65377
-29.00	0.000E+00	9.532E+00	0	3259	-63892
-29.50	0.000E+00	9.624E+00	0	3837	-62118
-30.00	0.000E+00	9.712E+00	0	4414	-60055
-30.50	0.000E+00	9.799E+00	0	4991	-57704
-31.00	0.000E+00	9.883E+00	0	5568	-55064
-31.50	0.000E+00	9.965E+00	0	6146	-52135
-32.00	0.000E+00	1.004E+01	0	6723	-48918
-32.50	0.000E+00	1.012E+01	0	7300	-45412
-33.00	0.000E+00	1.020E+01	0	7877	-41618
-33.50	0.000E+00	1.027E+01	0	8455	-37535
-34.00	0.000E+00	1.035E+01	0	9044	-33161
-34.50	0.000E+00	1.042E+01	0	9560	-28503
-35.00	0.000E+00	1.049E+01	0	9665	-23669
-35.50	0.000E+00	1.056E+01	0	9115	-18947
-36.00	0.000E+00	1.063E+01	0	8132	-14627
-36.50	0.000E+00	1.069E+01	0	7047	-10832
-37.00	0.000E+00	1.076E+01	0	5945	-7582
-37.50	0.000E+00	1.083E+01	0	4814	-4891
-38.00	0.000E+00	1.090E+01	0	3654	-2773
-38.50	0.000E+00	1.096E+01	0	2465	-1242
-39.00	0.000E+00	1.103E+01	0	1247	-313
-39.50	0.000E+00	1.110E+01	0	0	0

IV..--SOIL PRESSURES

ELEVATION (FT)	<---------SOIL PRESSURES (PSF)--------> LEFTSIDE	RIGHTSIDE	NET
17.50	0.00	0.00	0.00
17.00	0.00	0.00	0.00
16.50+	0.00	127.82	127.82
16.50-	0.00	127.82	127.82
16.00	0.00	233.01	233.01
15.50	0.00	337.64	337.64
15.00	0.00	441.18	441.18
14.50	0.00	543.07	543.07
14.00	0.00	642.74	642.74
13.50	0.00	739.62	739.62

13.00	0.00	833.12	833.12
12.83	0.00	863.37	863.37
12.50	0.00	922.65	922.65
12.00	0.00	1007.02	1007.02
11.50	0.00	1049.94	1049.94
11.00	0.00	1078.24	1078.24
10.50	0.00	1098.62	1098.62
10.00	0.00	1118.75	1118.75
9.50	0.00	1139.00	1139.00
9.00	0.00	1159.25	1159.25
8.50	0.00	1179.50	1179.50
8.00	0.00	1199.75	1199.75
7.50	0.00	1220.00	1220.00
7.00	0.00	1194.07	1194.07
6.50	0.00	1152.96	1152.96
6.00+	0.00	1098.24	1098.24
6.00-	0.00	601.36	601.36
5.50	0.00	584.84	584.84
5.00	0.00	558.77	558.77
4.50+	0.00	534.11	534.11
4.50-	0.00	534.11	534.11
4.00	0.00	533.62	533.62
3.50	0.00	529.78	529.78
3.00	0.00	522.52	522.52
2.50	0.00	511.78	511.78
2.00	0.00	497.51	497.51
1.50	0.00	479.67	479.67
1.00	0.00	470.76	470.76
0.50	0.00	483.30	483.30
0.00	0.00	495.85	495.85
-0.50	0.00	508.40	508.40
-1.00	0.00	520.94	520.94
-1.50	0.00	533.49	533.49
-2.00	0.00	540.99	540.99
-2.50	66.78	588.69	521.91
-3.00+	139.22	733.55	594.33
-3.00-	412.50	733.55	321.05
-3.50	607.37	881.89	274.52
-4.00	691.09	936.74	245.65
-4.50	737.00	951.50	214.50
-5.00	779.94	971.25	191.31
-5.50	807.75	991.00	183.25
-6.00	827.62	1010.75	183.13
-6.50	847.25	1030.50	183.25
-7.00	867.00	1050.25	183.25
-7.50	886.75	1070.00	183.25
-8.00	906.50	1089.75	183.25
-8.44+	926.25	1107.25	181.00
-8.44-	924.00	1107.25	183.25
-8.50	926.25	1109.50	183.25
-9.00	946.00	1129.25	183.25
-9.50	965.75	1149.00	183.25
-10.00	985.50	1168.75	183.25
-10.50	1005.25	1188.50	183.25
-11.00	1025.00	1208.25	183.25
-11.50	1044.75	1228.00	183.25
-12.00	1064.50	1247.75	183.25
-12.50	1084.25	1267.50	183.25
-13.00	1104.00	1287.25	183.25
-13.50	1123.75	1307.00	183.25
-14.00	1143.50	1326.75	183.25
-14.50	1163.25	1346.50	183.25

-15.00	1173.73	1375.94	202.21
-15.50	1257.20	1328.06	70.86
-16.00	1525.99	1094.86	-431.13
-16.50	1819.38	858.18	-961.20
-17.00	1953.25	803.15	-1150.10
-17.50	2014.91	825.33	-1189.59
-18.00	2085.46	837.87	-1247.58
-18.50	2156.00	850.42	-1305.58
-19.00	2226.54	862.97	-1363.58
-19.50	2297.08	875.51	-1421.57
-20.00	2367.63	888.06	-1479.57
-20.50	2438.17	900.60	-1537.57
-21.00	2508.71	913.15	-1595.56
-21.50	2579.26	925.70	-1653.56
-22.00	2667.50	925.24	-1742.26
-22.50+	2615.16	1028.50	-1586.66
-22.50-	2615.16	1886.64	-728.52
-23.00+	2218.39	1906.20	-312.19
-23.00-	2218.39	1381.20	-837.20
-23.50	1799.93	1740.29	-59.64
-24.00	1703.15	1856.65	153.50
-24.50	1746.25	1869.50	123.25
-25.00	1772.00	1895.25	123.25
-25.50	1797.75	1921.00	123.25
-26.00	1823.50	1946.75	123.25
-26.50	1849.25	1972.50	123.25
-27.00	1875.00	1998.25	123.25
-27.50	1900.75	2024.00	123.25
-28.00	1926.50	2049.75	123.25
-28.50	1952.25	2075.50	123.25
-29.00	1978.00	2101.25	123.25
-29.50	2003.75	2127.00	123.25
-30.00	2029.50	2152.75	123.25
-30.50	2055.25	2178.50	123.25
-31.00	2081.00	2204.25	123.25
-31.50	2106.75	2230.00	123.25
-32.00	2132.50	2255.75	123.25
-32.50	2158.25	2281.50	123.25
-33.00	2184.00	2307.25	123.25
-33.50	2209.75	2333.00	123.25
-34.00	2204.56	2377.34	172.78
-34.50	2445.87	2273.29	-172.58
-35.00	3283.19	1813.70	-1469.48
-35.50	4142.20	1347.73	-2794.47
-36.00	4427.96	1230.58	-3197.38
-36.50	4467.90	1261.61	-3206.30
-37.00	4538.45	1274.15	-3264.29
-37.50	4608.99	1286.70	-3322.29
-38.00	4679.53	1299.25	-3380.29
-38.50	4750.07	1311.79	-3438.28
-39.00	4820.62	1324.34	-3496.28
-39.50	4891.16	1336.88	-3554.28

Vita

Daniel R. Haggerty, Jr. was born on September 22, 1975 in New Orleans, Louisiana, the son of Mr. and Mrs. Daniel R. Haggerty. He graduated from Benjamin Franklin High School in New Orleans, Louisiana in 1993. Mr. Haggerty graduated from the University of New Orleans in December of 2000 with a Bachelor of Science degree in Civil Engineering. In 2001, he enrolled in the Graduate Program in the College of Engineering at the University of New Orleans pursuing a degree of Master of Science in Engineering. Mr. Haggerty has been employed by the U.S. Army Corps of Engineers since 1999. He married the former Ms. Melanie Ann Albaral in 2001.