A Parametric Study of Twenty Earthen Levee Cross Sections from Southeastern Louisiana Using the LMVD Method of Planes and Other Limit Equilibrium Procedures

by

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Dedication

For my parents, Kevin and Diana, and my sisters, Stephanie and Mary.

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Abstract

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The University of Texas at Austin, 2009

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The LMVD Method of Planes has been used for many years by the New Orleans District of the U.S. Army Corps of Engineers to analyze the stability of flood control structures in the New Orleans hurricane protections system. The Method of Planes assumes a three-part, noncircular slip surface and generally does not satisfy any form of static equilibrium. In computing a factor of safety, the Method of Planes considers a balance of horizontal "resisting" and "driving" forces in computing a factor of safety.

To better understand how the results of slope stability analyses with the Method of Planes compare with results from more rigorous procedures capable of analyzing slip surfaces with different shapes, a parametric study was performed by analyzing twenty

earthen levee cross sections believed to represent the various levee configurations in southeastern Louisiana. Analyses were performed with a force equilibrium procedure that assumed a horizontal inclination for the interslice forces and Spencer's (1967) procedure, and the results were compared with the solutions from the Method of Planes. The force equilibrium procedure with horizontal side forces was selected because the procedure is believed to yield results that are similar to results from the Method of Planes, and Spencer's procedure was utilized because it is the only procedure considered in this study to completely satisfy static equilibrium.

The analyses performed with the force equilibrium and Spencer's procedures included analyses for the critical slip surfaces from the Method of Planes as well as analyses for critical circular and noncircular slip surfaces. It was shown with the results of the analyses that the shape of the assumed slip surface has a great effect on the differences in the factors of safety from Spencer's procedure and the Method of Planes.

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Chapter 1: Introduction

The New Orleans District of the U.S. Army Corps of Engineers has for many years used the LMVD Method of Planes slope stability analysis procedure to analyze various flood protection structures in the New Orleans hurricane protection system. The Method of Planes procedure assumes a simple, three-part slip surface and does not fully satisfy static equilibrium. The study reported here was undertaken to investigate how the results of slope stability analyses performed using the Method of Planes compare with results from more rigorous procedures which a assume a general shape for the slip surface and fully satisfy static equilibrium.

1.1 Scope of Research

In this study, twenty (20) earthen levee cross sections were chosen for analysis as they are believed to capture the various levee geometries and foundation soils commonly encountered in southeastern Louisiana. Parametric analyses were performed by analyzing the twenty cross sections with a force equilibrium procedure that assumed a horizontal inclination for the side forces and Spencer's (1967) procedure. The force equilibrium procedure with horizontal side forces was chosen because the procedure is believed to produce similar results to the Method of Planes. Spencer's procedure was selected to because the procedure completely satisfies static equilibrium. The Method of Planes and the force equilibrium procedure do not fully satisfy static equilibrium.

The analyses with Spencer's procedure and the force equilibrium procedure with horizontal side forces included analyses for the critical slip surface from the Method of Planes as well as searches and analyses for critical circular and noncircular slip surfaces.

The results from the analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure were then compared with the results from the Method of Planes to observe how the Method of Planes compares with procedures capable of analyzing more general shapes for the slip surface. While most of the cross sections considered do not contain reinforcement, a few cases containing reinforcement were examined to better understand how the results from the Method of Planes compare with the results from the force equilibrium and Spencer's procedures in cases where reinforcement is present.

1.2. THESIS OVERVIEW

This thesis is organized in the following manner. The mechanics of each of the slope stability analysis procedures used in this study are presented and discussed in Chapter 2. The procedures include the Method of Planes, a force equilibrium procedure with horizontal side forces, the Simplified Bishop (1955) procedure, and Spencer's procedure. In Chapter 3, the software that performs calculations for the Method of Planes is described and illustrated using an example cross section.

The compilation of a database of over five-hundred (500) levee cross sections is discussed in Chapter 4, as well as the selection of twenty (20) earthen levee cross sections for further study. Each of the cross sections (or "plates") contained the results of analyses performed by the USACE with the Method of Planes. Analyses were performed with the Method of Planes and compared with the USACE's results to verify the data from each cross section was properly extracted. The details of the analyses with the Method of Planes are also presented in Chapter 4.

Chapter 5 includes the results of analyses of the critical slip surfaces from the Method of Planes with Spencer's procedure and the force equilibrium procedure with horizontal side forces. Analyses were performed with tension cracks to eliminate tensile stresses near the crest of the slope, and the details of the analyses are also presented in Chapter 5.

In Chapter 6, searches and analyses were performed for the critical circular slip surfaces with Spencer's procedure. The results are discussed and compared with the minimum factor of safety from the Method of Planes. The critical circles from Spencer's procedure were also analyzed with the force equilibrium procedure with horizontal side forces, and the results are presented in Chapter 6.

A series of searches was conducted with Spencer's procedure to locate a critical noncircular slip surface, and the details of each of the searches, along with the results, are presented in Chapter 7. The minimum factor of safety for the noncircular slip surface is then compared with the minimum factor of safety from the Method of Planes. The results of searches for the critical noncircular slip surface are examined to see if a slip surface was located that had a shape significantly different than the critical circle.

In Chapter 8, stability analyses were performed with Spencer's procedure for six cases with reinforcement and the results are compared with the results from the USACE's analyses with the Method of Planes. Analyses with Spencer's procedure included searches for the critical circular and noncircular slip surfaces. Conclusions and recommendations are presented in Chapter 9.

Chapter 2: Mechanics of Slope Stability Analysis Procedures

Four slope stability analysis procedures were used in this study: the Method of Planes, a force equilibrium procedure with horizontal side forces, Spencer's (1967) procedure, and the Simplified Bishop (1955) procedure. An overview of the mechanics of each procedure is presented in this chapter. The results of slope stability analyses using each procedure is presented in Chapters 4 – 8.

2.1 LMVD METHOD OF PLANES

The LMVD Method of Planes considers the stability of a mass of soil above a three-part noncircular slip surface (Figure 2.1).

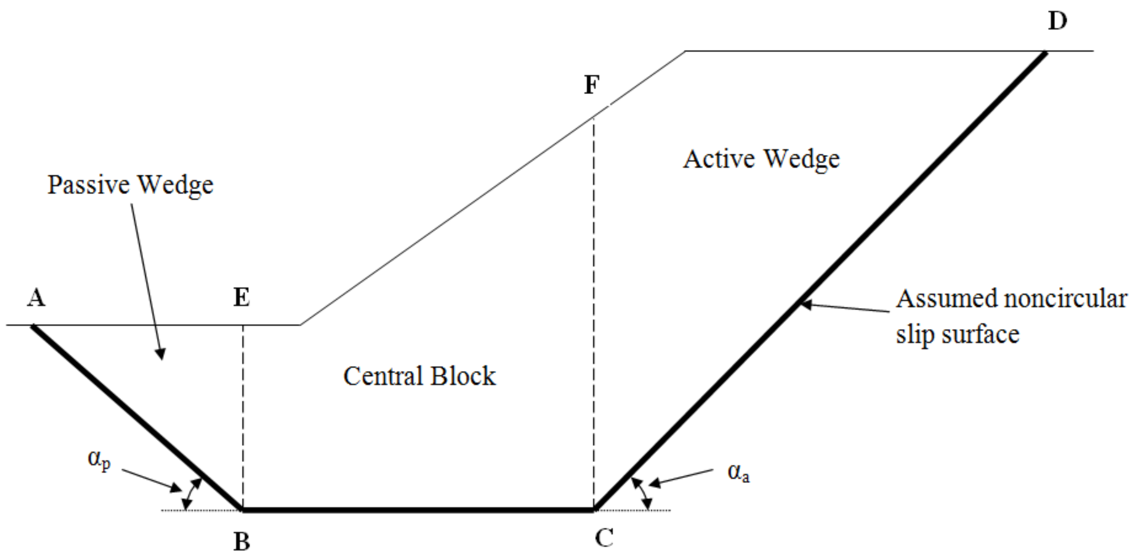

Figure 2.1: Slip surface assumed by the LMVD Method of Planes (Caver, 1973).

The soil mass above the slip surface is divided into an active wedge, a central block, and a passive wedge. Vertical boundaries are assumed between the active wedge, central block, and passive wedge. The active and passive wedges are assumed to be inclined at constant angles of (45° + ϕ/2) and (45° - ϕ/2), respectively. The inclination is never varied to determine if a more critical inclination exists. If the bases of the active and passive wedges pass through various strata with different friction angles, the base of the wedges will have a "wrinkled" appearance. The inclinations of the active (α_a) and passive (α_p) wedges are illustrated in Figure 2.1 When the slip surface for the active and passive wedges pass through different materials, the wedges are divided into vertical segments so the base of each segment is in only one material

2.1.1. Definition of the Factor of Safety

The factor of safety is defined by Eq. 2.1:

$$FS = \frac{R_a+R_b+R_p}{D_a-D_p} \tag{2.1}$$

where,

R_a = "resisting force" of active wedge

R_b = "resisting force" of central block

R_p = "resisting force" of passive wedge

D_a = "driving force" of active wedge

D_p = "driving force" of passive wedge

Although Caver (1973) states the factor of safety is determined by equating the horizontal resultants of active and passive pressures to the soil strength along a horizontal plane, a more appropriate description for the factor of safety is that it is a ratio of "driving" and "resisting" forces. In general, the solution for the factor of safety does not satisfy any form of static equilibrium. However, when the friction angle is zero, the Method of

Planes appears to give the same factor of safety as a procedure which satisfies force equilibrium only and assumes a horizontal inclination for the side forces. In the case of ϕ = 0°, the Method of Planes appears to calculate the same factor of safety as the *uncorrected*[1] Simplified Janbu procedure. Details of how the driving and resisting forces of the active wedge, central block, and passive wedge are calculated are presented below.

2.1.1. Active Wedge

The force polygons for the active wedge are illustrated in Figure 2.2. The driving force produced by the active wedge is defined as the horizontal force required for static equilibrium when there is no shear strength mobilized. This is labeled "D_a" in Figure 2.2(a). The horizontal force required for equilibrium when the shear strength is fully mobilized is "P_a" in Figure 2.2(b). The resisting force "R_a" is defined as the difference in the horizontal force required for equilibrium when no shear strength is mobilized and the horizontal force required for equilibrium when the shear strength is fully mobilized, i.e. $R_a = D_a - P_a$. The "driving force" from the active wedge is given by Eq. 2.2:

$$D_a = W_a \tan\left(45° + \frac{\phi}{2}\right) \tag{2.2}$$

where,

W_a = weight of the active wedge (lbs)

ϕ = friction angle (°)

The "resisting force" of the active wedge is computed using Eq. 2.3.

$$R_a = 2\left[W_a - U_a \sin\left(45° - \frac{\phi}{2}\right)\right] tan\phi + 2cH_a \tan\left(45° - \frac{\phi}{2}\right) \tag{2.3}$$

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[1] The Simplified Janbu procedure assumes the inclination of the side forces to be horizontal. This assumption results in calculated factors of safety that are lower than the factors of safety computed by procedures which completely satisfy static equilibrium. Janbu et al. (1956) proposed correction factors to correct the factors of safety computed by the Simplified Janbu procedure.

where,

W_a = weight of the active wedge (lbs)

U_a = uplift force (lbs)

ϕ = friction angle (°)

c = cohesion (psf)

H_a = height of the active wedge (ft)

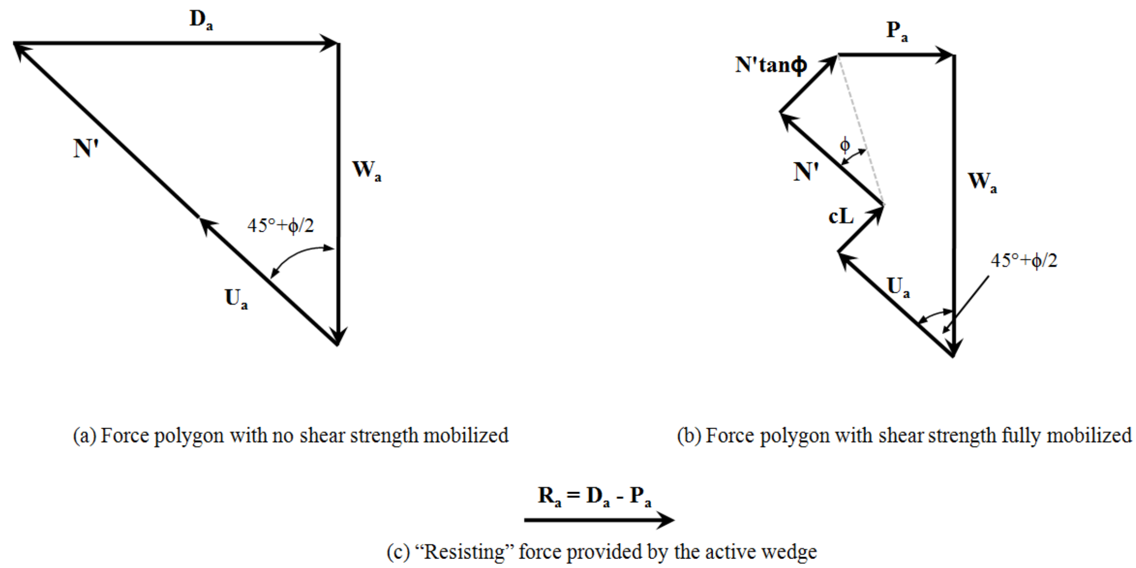


Figure 2.2: Force polygons and "resisting" force provided by the active wedge.

2.1.2. Central Block

The force polygons for the central block are illustrated in Figure 2.3. The driving force of the central block (D_b) is shown in Figure 2.3(a). The driving force is the force required to keep the central block in equilibrium when no shear strength is mobilized. The force required to keep the central block in equilibrium when the shear strength is fully mobilized is labeled "P_b" in the force polygon shown in Figure 2.3(b). The resisting force (R_b), shown in Figure 2.3(c), is determined by subtracting the force required to keep the central block in equilibrium when the shear strength is fully mobilized from the force required to keep the central block in equilibrium when no shear strength is mobilized, i.e. $R_b = D_b - P_b$.

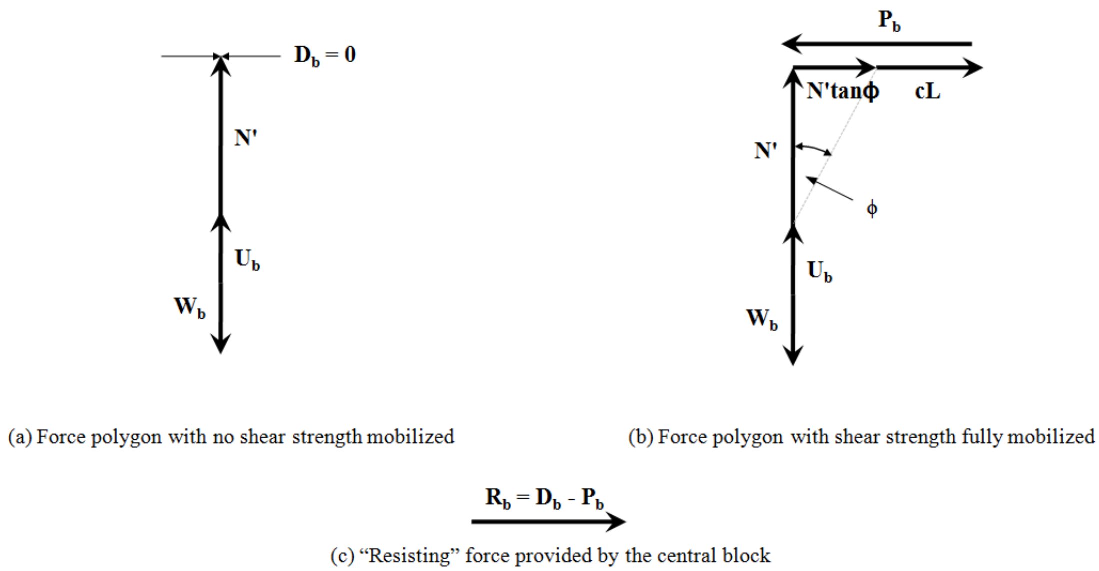


Figure 2.3: Force polygons and "resisting" force provided by the central block.

If the base of the central block is considered to be horizontal, as illustrated in Figure 2.3, the only force the central block contributes to the stability of the soil mass is the resisting force. The resisting force of the central block is computed using Eq. 2.4.

$$R_b = (W_b - U_b)tan\phi + cL_b \tag{2.4}$$

where,

W_b = weight of the central block (lbs)

U_b = uplift force (lbs)

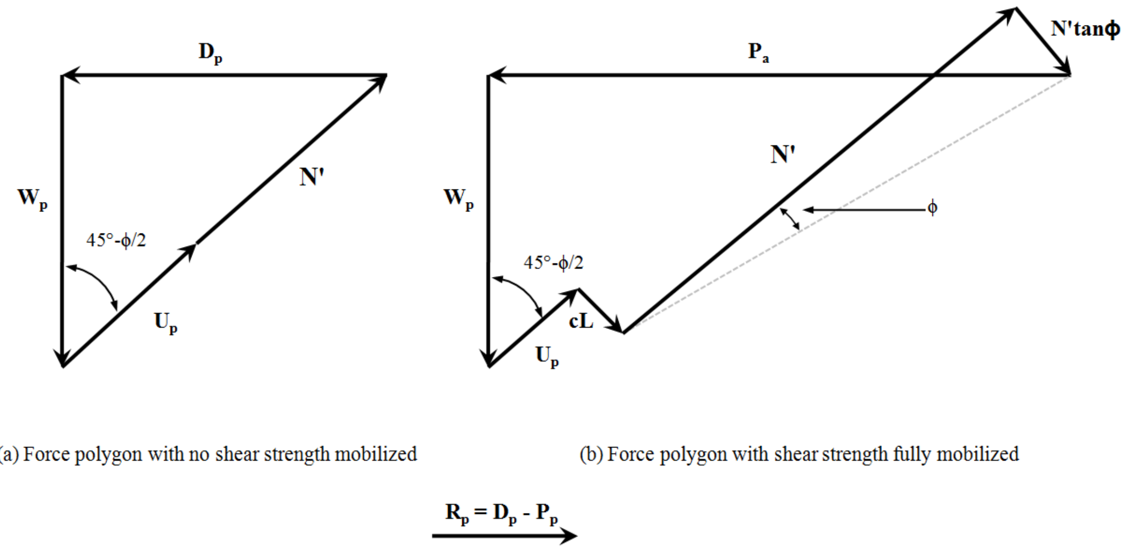
ϕ = friction angle (°)

cL_b = cohesion mobilized along the base of the central block (lbs)

If the base of the central block lies in a purely cohesive material, the resisting force of the central block is reduced to "cL_b." However, if the base of the central block lies in a cohesive material which is adjacent to frictional material, there may be a point where the base of the slip surface transitions from the cohesive material to the frictional material. This point is called the *crossover point* (Caver, 1973). The crossover point is the location at which the overburden pressure is such that the strength of the adjacent frictional material is less than that of the cohesive material; as a result, the slip surface moves from the cohesive material into the frictional material.

2.1.3. Passive Wedge

The forces the passive wedge contributes to the stability of the soil mass are a driving force (D_p) and a resisting force (R_p). The driving force is the force required to keep the passive wedge in equilibrium when no shear strength is mobilized. The force required for equilibrium when the available shear strength is fully mobilized is labeled "P_p" in Figure 2.4(b). The difference between the passive driving force and the force required for equilibrium when the available shear strength is fully mobilized is the passive resisting force (R_p), i.e. $R_p = D_p - P_p$. The driving and resisting forces for the passive wedge are calculated using Eq. 2.5 and Eq. 2.6, respectively.



(a) Force polygon with no shear strength mobilized

(b) Force polygon with shear strength fully mobilized

(c) "Resisting" force provided by the passive wedge

Figure 2.4: Force polygons and "resisting" force provided by the passive wedge.

$$D_p = W_p \tan\left(45° - \frac{\phi'}{2}\right) \tag{2.5}$$

$$R_p = 2\left[W_p - U_p \cos\left(45° - \frac{\phi'}{2}\right)\right] tan\emptyset' + 2cH_p \tan\left(45° + \frac{\phi'}{2}\right) \tag{2.6}$$

where,

W_p = weight of the passive wedge (lbs)

U_p = uplift force (lbs)

ϕ = friction angle (°)

c = cohesion (psf)

H_p = height of the active wedge (ft)

2.2. Limit Equilibrium Procedures with Alternative Definitions for the Factor of Safety

The following sections cover general features of the mechanics of limit equilibrium procedures that define the factor of safety with respect to the shear strength of the soil. The mechanics of specific procedures are covered in later sections.

2.2.1. Mechanics

The limit equilibrium procedures all define the factor of safety in a similar way, and the factor of safety is computed by solving one or more equations of static equilibrium. The factor of safety relates the shear strength to the shear stress acting along a potential slip surface (Eq. 2.7).

$$F.S. = \frac{s}{\tau} \tag{2.7}$$

where,

s = available shear strength

τ = equilibrium shear stress or mobilized shear strength

The equilibrium shear stress can be expressed as the available shear strength divided by the factor of safety (Equation 2.8).

$$\tau = \frac{s}{F.S.} \tag{2.8}$$

In Equation 2.8, the factor of safety represents the amount the available shear strength must be reduced so the reduced shear strength is in equilibrium with the shear stress. If the available shear strength is in equilibrium with the shear stress on a given slip surface in the field, the slope is slope is considered to be in a state of *limiting equilibrium*, thus the term *limit equilibrium procedures*.

Each of the limit equilibrium procedures described in this section are *procedures of slices*. Procedures of slices divide the soil mass above an assumed slip surface and the ground surface into a finite amount of vertical columns of soil called "slices," and the equations of static equilibrium are solved for each slice. When solving the equations of static equilibrium, the following conditions should be satisfied:

1. Equilibrium of forces in vertical direction
2. Equilibrium of forces in horizontal direction
3. Equilibrium of moments summed about any point

Some slope stability analysis procedures satisfy all the conditions of static equilibrium, other do not. Regardless if a procedure does or does not satisfy all the conditions of static equilibrium, assumptions must be made in order to make the problem statically determinate (i.e., same number of equilibrium equations and unknowns). Two procedures may both completely satisfy static equilibrium but compute different factors of safety because the procedures made different assumptions.

2.2.2. Force Equilibrium Procedure with Horizontal Side Forces

The force equilibrium procedure used in this study satisfies only force equilibrium, and can be used to perform analyses using both circular and noncircular slip surfaces. The forces that act on a slice in a force equilibrium procedure are shown in Figure 2.5, where:

W = weight of slice

Z = resultant interslice forces – i.e., horizontal (E_i) and vertical shear (X_i) forces

θ = inclination of interslice forces

N = normal force

S = shear forces

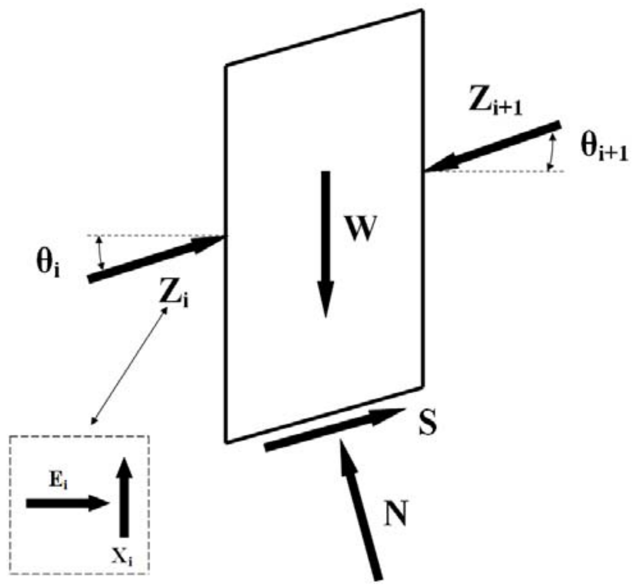


Figure 2.5: Forces acting on a slice in the force equilibrium procedure before assumptions.

In order to solve for the unknowns in the force equilibrium procedure, there must be a balance between the number of unknowns and equilibrium equations. To achieve this balance with the force equilibrium procedure, one assumption must be made. The force equilibrium procedure used in this study assumes a horizontal inclination for the side forces, and the procedure will be referred to as the *force equilibrium procedure with horizontal side forces* for the balance of this thesis. The total number of unknowns and equilibrium equations for “n” number of slices in the force equilibrium procedure are presented in Tables 2.1 and 2.2, respectively.

Table 2.1: Unknowns in force equilibrium procedure

Unknown values	Number after assumptions
Factor of safety	1
Normal forces (N)	n
Resultant side forces (Z)	n-1
Side force inclinations (θ)	0
Total number of unknowns:	2n

Table 2.2: Equilibrium equations used in the force equilibrium procedure.

Equilibrium equations	Number
Horizontal force equilibrium	n
Vertical force equilibrium	n
Total number of equations	2n

The force equilibrium procedure with horizontal side forces is similar to a procedure commonly referred to as the "Simplified Janbu" procedure, although in the Simplified Janbu procedure "corrections" are sometimes applied to the factor of safety once it is calculated assuming horizontal side forces (Janbu et al., 1956).

2.2.3 Simplified Bishop (1955) Procedure

The Simplified Bishop procedure satisfies only vertical force equilibrium and moment equilibrium, and is limited to analyses of circular slip surfaces. The Simplified Bishop procedure is one of the most commonly used analysis procedures for circular slip surfaces. The forces that act on a slice in the Simplified Bishop procedure are shown in Figure 2.6, where

W = weight of slice

X = vertical shear force

E = horizontal force

N = normal force

S = shear forces

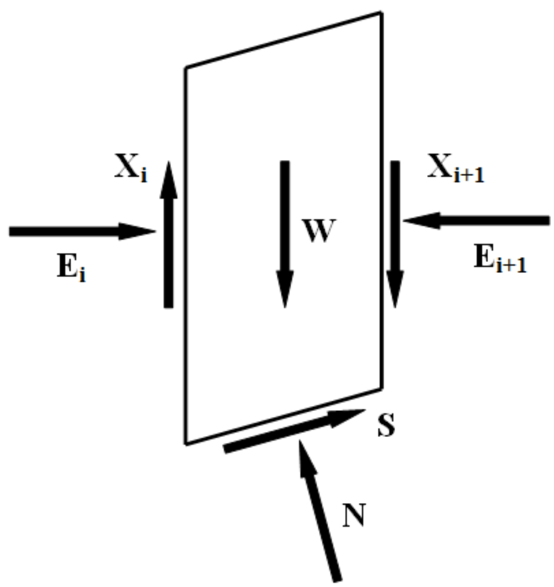


Figure 2.6: Forces acting on a slice in the Simplified Bishop procedure (Bishop, 1955).

To achieve a balance between the number of unknowns and equilibrium equations, Bishop (1955) assumed the shear forces (X_i, X_{i+1}) between slices are zero. As a result of Bishop's assumption, the interslice forces (i.e., E_i, E_{i+1}) are assumed to be horizontally inclined.

The total number of unknowns and equilibrium equations for "n" number of slices in the Simplified Bishop procedure are given in Tables 2.3 and 2.4, respectively. Since the Simplified Bishop satisfies only vertical force and moment equilibrium, only the equations of vertical force and moment equilibrium are used to solve the unknowns in Table 2.3.

Table 2.3: Unknowns in the Simplified Bishop procedure

Unknown values	Number after assumptions
Factor of safety	1
Normal forces (N)	n
Horizontal forces (E)	0
Vertical shear forces (X)	0
Total number of unknowns	n+1

Table 2.4: Equilibrium equations used in the Simplified Bishop procedure.

Equilibrium equations	Number
Overall moment equilibrium	1
Vertical force equilibrium	n
Total number of equations	n+1

2.2.4 Spencer's (1967) Procedure

Spencer's procedure is the only analysis procedure used in this study that satisfies *all* the conditions of static equilibrium. Although originally developed for analyses with circular slip surfaces, Spencer's procedure has been extended to analyses of noncircular slip surfaces as well. The forces – along with locations of forces – that act on a slice in Spencer's procedure are shown in Figure 2.7. The total number of unknowns and equilibrium equations for "n" number of slices in Spencer's procedure are given in Tables 2.5 and 2.6, respectively. Spencer achieved a balance between the number of unknowns and the number of equilibrium equations by assuming all the side forces have the same inclination.

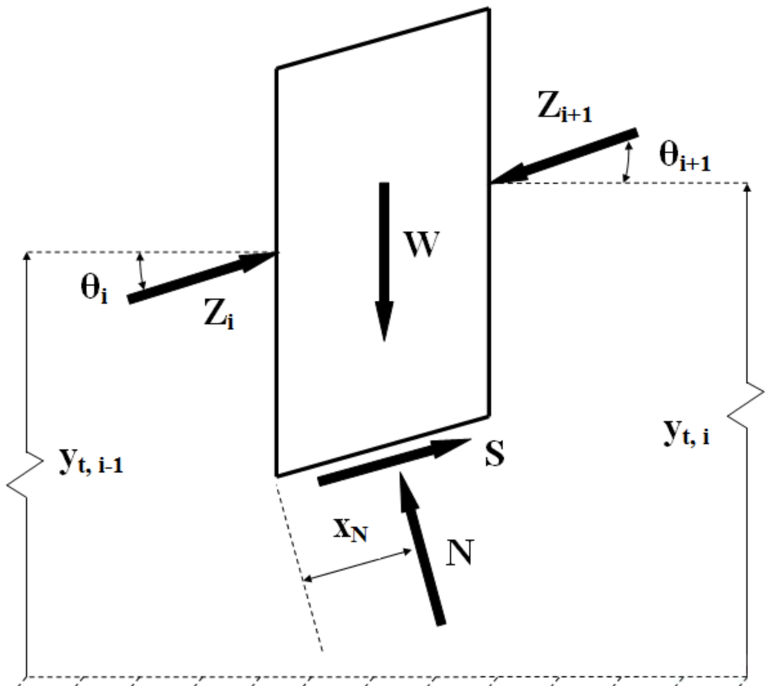


Figure 2.7: Forces, and locations of forces, on a slice in Spencer's procedure (CE 387M.1 class notes).

Table 2.5: Unknowns in Spencer's procedure.

Unknown values	Number after assumptions
Factor of safety	1
Side force inclination (θ)	1
Normal forces (N)	n
Side forces (Z)	n-1
Location of side forces	n-1
Total number of unknowns	3n

Table 2.6: Equilibrium equations used in Spencer's procedure.

Equilibrium equations	Number
Moment equilibrium	n
Vertical force equilibrium	n
Horizontal force equilibrium	n
Total number of equations	3n

2.3. SUMMARY OF SLOPE STABILITY ANALYSIS PROCEDURES

Four slope stability analysis procedures were discussed in this chapter: the Method of Planes, a force equilibrium procedure with horizontal side forces, the Simplified Bishop procedure, and Spencer's procedure. The factor of safety in the Method of Planes is defined as a ratio of "resisting" and "driving" forces, while the factor of safety in the other procedures is defined with respect to the shear strength of the soil. While most of the limit equilibrium procedures used in this study are capable of analyzing slip surfaces of different shapes, the Method of Planes is restricted to the analysis of a three-part, "wedge." Additionally, all the procedures discussed in this chapter, except the Method of Planes, satisfy at least some of the conditions of static equilibrium. The Method of Planes does not formally satisfy any condition of static equilibrium. However, it does appear that the Method of Planes satisfies force equilibrium when the friction angle (ϕ) is zero.

In order to alleviate the computational effort involved in slope stability calculations, computer software is often utilized. The software that performs the calculations for the Method of Planes is discussed in the next chapter.

Chapter 3: The Method of Planes Software

The LMVD Method of Planes has been implemented in computer software titled *Stability with Uplift*, written and maintained by the New Orleans District of the U.S. Army Corps of Engineers. The software is subsequently referred to in this thesis as the *Method of Planes Software*. The Method of Planes Software and its usage are described in this chapter.

3.1 Acquisition of the Method of Planes Software

Mr. Paul Oakland of the New Orleans District of the U.S. Army Corps of Engineers provided the University of Texas at Austin with a copy of the Method of Planes Software. The software was provided on a CD containing the following items:

- Two executable files titled *FS004.exe* and *FS005.exe*. FS004.exe is the Method of Planes Software. The software performs the slope stability calculations by reading a text (.txt) file prepared by the user. FS005.exe is a plotting program that reads one of the output files created by the Method of Planes Software (FS004.exe) and generates a DGN[2] file containing a "plate" with a drawing of the cross section.
- A fifteen page Microsoft Word document titled "Stability with Uplift – Input Data File Format Documentation." This document was written by Robert Jolissaint and is dated August 2001. The document discusses the format for an input data file for the Method of Planes Software illustrated with a sample input data file.
- A Microsoft Excel file titled *Stabcheck.xls*. Stabcheck.xls scans an input data file for syntax errors and outputs error and warning messages.

[2] DGN is a file extension indicating the file was created by one of the CAD programs developed by Bentley Systems, Inc. (e.g., *MicroStation*, *Bentley View*).

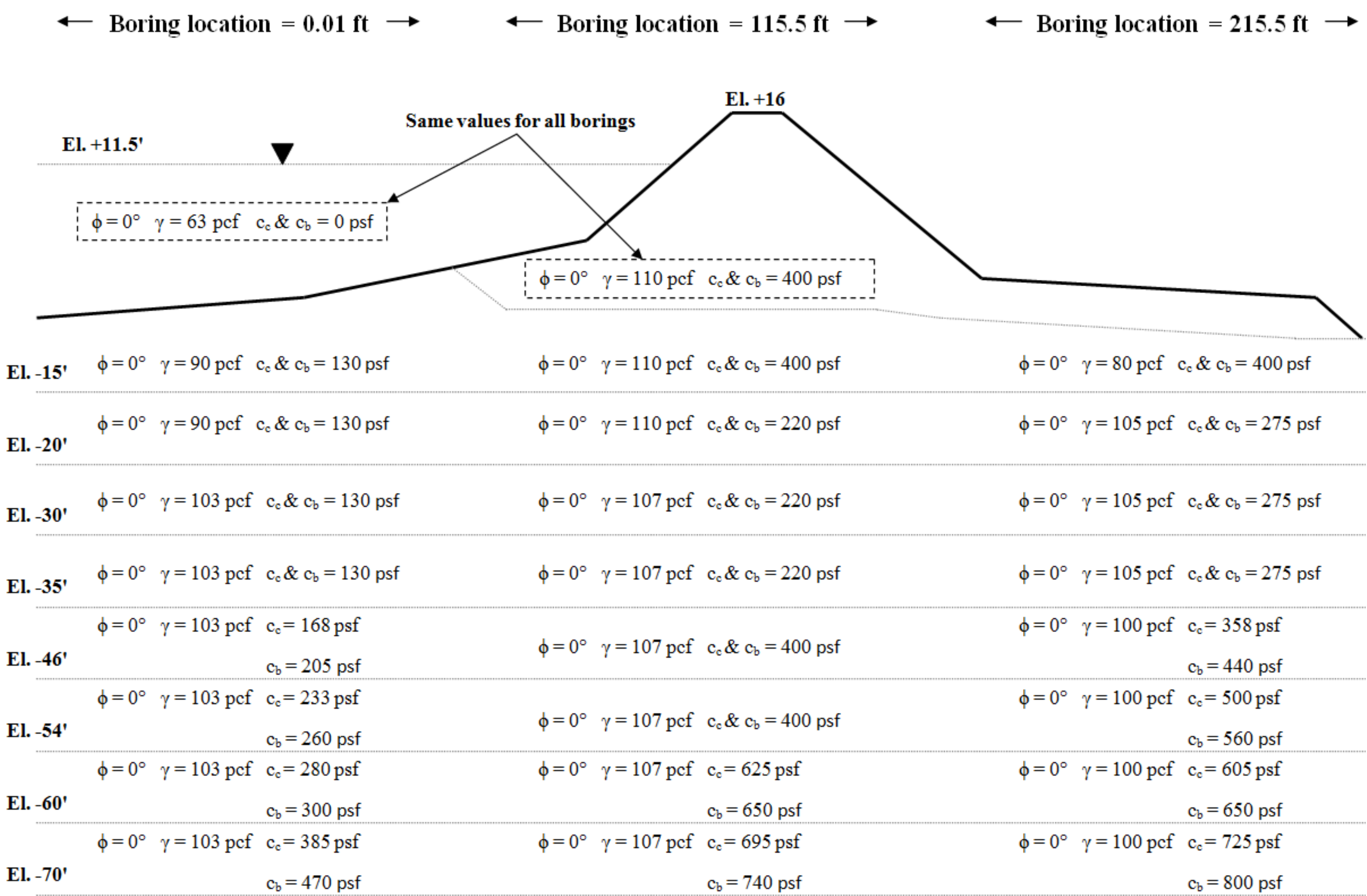
3.2. INPUT DATA FILE

Before performing slope stability computations with the Method of Planes Software, an input data file must be created using a text editor (e.g., *Notepad*). The input file is then read by the Method of Planes Software to perform the necessary computations. The following sections explain the format and details of the input file using an example input file, which is included in Table B.10 of Appendix B. The example considered is an earthen levee from Reach B of the Jefferson Parish Lakefront. A schematic of the cross section is presented in Figure 3.1, which includes the soil data used by the USACE in their analyses with the Method of Planes Software. The details presented on the schematic are discussed in the following sections. The "plate" containing the cross section from Jefferson Parish Lakefront – Reach B is presented in Figure A.8 of Appendix A. Segments of the input file are presented to illustrate what the various inputs represent. Some of the explanations presented in the following sections expand on "Stability with Uplift – Input Data File Format Documentation" (Jolissaint, 2001), other explanations are the result of the experience with the Method of Planes Software gained in this study.

3.2.1. Coordinate System

All coordinates in the input file are defined with respect to an x-axis and a y-axis (Figures 3.2 and 3.3). The type of units used for the x and y coordinates – and for *all* the input data – are English units. The y axis is vertical and positive in the upward direction. The x-axis is a horizontal axis set at an elevation of 0.0 ft, and only positive values are defined along the x-axis. As a result, the origin of the coordinate system is always defined at one of the two ends of the cross section. The direction of the slope face determines the end at which the origin of the coordinate system is defined. If a right-facing slope is considered, the origin of the coordinate system is established on the left edge of the cross section (Figure 3.2). On the other hand, if a left-facing slope is considered, the origin of the coordinate system is located on the right edge of the cross section (Figure 3.3).

Figure 3.1: Schematic of Jefferson Parish Lakefront – Reach B



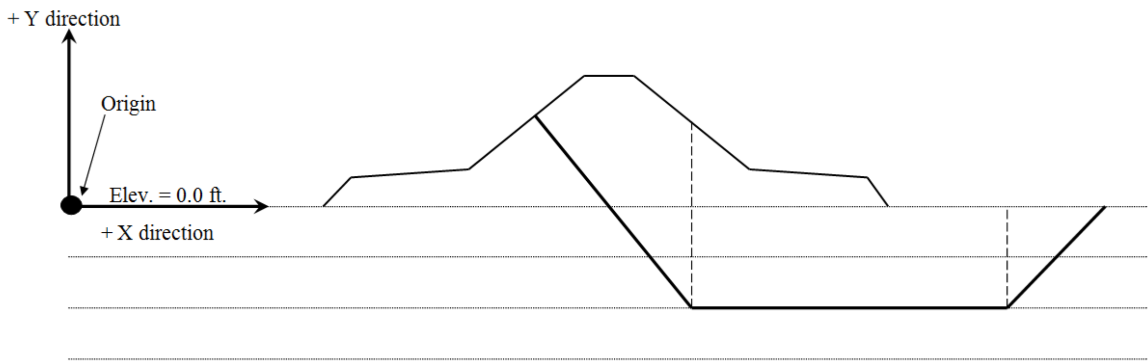


Figure 3.2: Coordinate system for a right-facing slope.

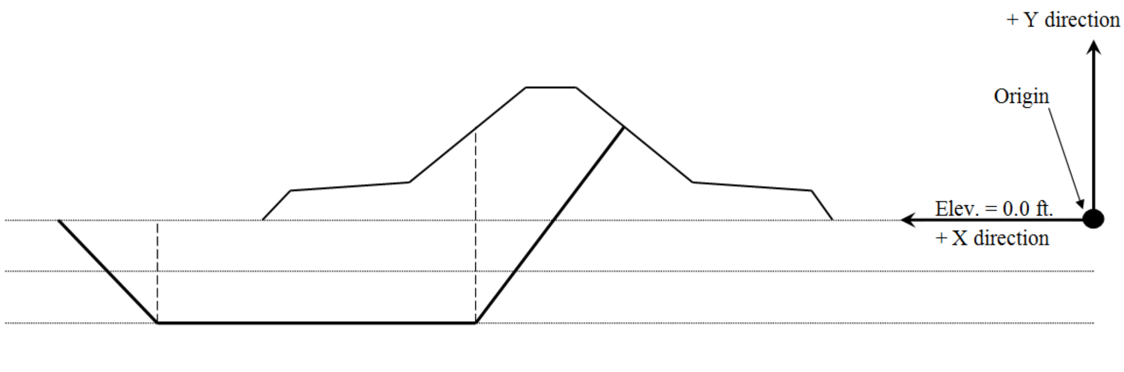


Figure 3.3: Coordinate system for left-facing slope.

3.2.1. Format of an Input Data File

The sequence of data for an input file for the Method of Planes Software is as follows:

1. Title lines
2. Plot parameters
3. Profile parameters
4. Soil boring location(s)
5. Soil unit weights and strength parameters
6. Coordinates of soil profile(s)

7. Coordinates of piezometric pressure profile(s)
8. Active and passive wedge data

Data are entered in free field format, and each value must be separated by a space or comma. A maximum of seventy-two (72) characters is allowed for each line of data entered in the input file. For each entry in the input file (e.g., soil boring locations and coordinates of soil profiles), there is a *program range* which the data must not exceed. The program range for each of the entries in the input file is described in the following sections. The example input file is presented in Figure 3.4, and line numbers – which are *not* part of the input file read by the Method of Planes Software – are included in parentheses to clearly indentify each line in the input file.

Figure 3.4: Example input file for the Method of Planes Software.

(1) "Jefferson Parish Lakefront Levee"
(2) "Reach B"
(3) 10 10 0.5 110 1 0
(4) 10 3 2 1
(5) 0.01 115.5 215.5
(6) 0 63 0 0 63 0 0 63 0 0
(7) 0 110 400 400 110 400 400 110 400 400
(8) 0 90 130 130 110 400 400 80 400 400
(9) 0 90 130 130 110 220 220 105 275 275
(10) 0 103 130 130 107 220 220 105 275 275
(11) 0 103 130 130 107 220 220 105 275 275
(12) 0 103 168 205 107 400 400 100 358 440
(13) 0 103 233 260 107 400 400 100 500 560
(14) 0 103 280 300 107 625 650 100 605 650
(15) 0 103 385 470 107 695 740 100 725 800
(16) 0 11.5 145.5 11.5 163.5 16 173.5 16 212.5 3 252.5 2 270.5 -2.5
(17) 350 -2.5 9999.9 0
(18) 0 3 40 3 85 6 137.5 9.5 145.5 11.5 163.5 16 173.5 16 212.5 3
(19) 252.5 2 270.5 -2.5 350 -2.5 9999.9 0
(20) 0 3 40 3 85 6 97 2 177.5 2 209.5 0 235 -1 260 -2.5 270.5 -2.5
(21) 350 -2.5 9999.9 0
(22) 0 -15 350 -15 9999.9 0
(23) 0 -20 350 -20 9999.9 0
(24) 0 -30 350 -30 9999.9 0
(25) 0 -35 350 -35 9999.9 0
(26) 0 -46 350 -46 9999.9 0
(27) 0 -54 350 -54 9999.9 0
(28) 0 -60 350 -60 9999.9 0
(29) 0 -70 350 -70 9999.9 0
(30) 0 11.5 145.5 11.5 212.5 3 252.5 2 270.5 -2.5 350 -2.5 9999.9 0
(31) 1 1 1 1 1 1 1 1 1 1
(32) 1 1 1 1 1 1 1 1 1 1
(33) 6 187 -35 267 -35 1
(34) 267

3.2.2. Title Lines

The first two lines of the input file are reserved for the title of the cross section or any other label that is necessary (e.g., station numbers). A maximum of forty-six (46) characters are allowed on each of the title lines. All characters on the first title line are included in the plot file generated by the METHOD OF PLANES Software. The first character on the second title line is *not* included in the plot file; therefore, it is recommended the user inserts quotes around the information presented on the second title line. In Table 3.1, quotes were placed around both entries in the title lines of the example input file to distinguish the title lines from the rest of the data entered in the input file.

Table 3.1: Title lines

"Jefferson Parish Lakefront Levee"
"Reach B"

3.2.3. Plot Parameters

The *plot parameters* are entered on line (3) of the input file. The plot parameters from the example input file are presented in Table 3.2. Six parameters are required, and the sequence of the parameters is as follows:

1. Horizontal plot scale increment
2. Vertical plot scale increment
3. Plot size
4. Starting value for the horizontal plot scale
5. Horizontal plot start control parameter
6. Plot direction control parameter

Table 3.2: Plot parameters

10 10 0.5 110 1 0

The first five plot parameters determine only the drawing scales in the DGN file generated by the plot program. Because the plot parameters were not of concern in this study, no further details of the first five plot parameters are given. These values acted as "placeholders" since plot parameters must be entered on the third line of the input file. If plots of cross sections are required, the reader is referred to Jolissaint (2001).

The only plot parameter of interest is the sixth parameter, the *plot direction control parameter*. The plot direction control parameter allows the user to "mirror" the image of the cross section that appears on the screen when the Method of Planes Software is executed. Entering a value of "1" mirrors the image of the cross section shown during execution of the Method of Planes Software about a vertical reference, while a value of "0" maintains the original image of the cross section.

3.2.4. Profile Parameters

The *profile parameters* occupy line (4) in the input file. Four parameters are entered. The profile parameters for the example input file are given in Table 3.3. The sequence of the profile parameters on line (4) is as follows:

1. Number of layers
2. Number of soil borings
3. Uplift control parameter
4. Number of piezometric surfaces

The program range for each of the profile parameters are summarized in Table 3.4. The notation for the profile parameters in Table 3.4 (e.g., *NBOR*) is consistent with the notation used by Jolissaint (2001). Each parameter is discussed further in the following sections.

Table 3.3: Profile parameters

10 3 2 1

Table 3.4: Program range for each of the profile parameters.

Profile Parameter	Program Range
Number of layers (K)	$2 \leq K \leq 25$
Number of soil borings (NBOR)	$1 \leq NBOR \leq 5$
Uplift control parameter (JUPLIFT)	1 or 2
Number of piezometric surfaces (NPHS)	$1 \leq NPHS \leq 5$

Number of Layers (K)

The term "layers" includes all soil layers, as well as surface water and dummy layers, which are are discussed later. The *number of layers* in the cross section is the first number entered on line (4). The example cross section is composed of ten (10) layers, therefore "10" is the first profile parameter entered.

Number of Soil Borings (NBOR)

The *number of soil borings* included in the cross section is entered after the number of layers in the cross sections. The Method of Planes Software allows the shear strength of the materials in the cross section to vary horizontally, and this is done by entering shear strengths at different soil boring locations. Three (3) soil borings were considered in the stability analysis of the example cross section.

Uplift Control Parameter (JUPLIFT)

The *uplift control parameter* is the third profile parameter entered. The uplift control parameter controls whether or not “uplift forces” are considered in the slope stability analysis. Uplift forces are hydrostatic forces acting on the base of the slip surface, and these forces are of concern when the slip surfaces lies in a frictional material. The magnitude of the uplift force is taken as the product of the unit weight of water and the vertical distance from a piezometric line to the point under consideration.

A value of “1” indicates that uplift forces are not considered while a value of “2” indicates that uplift forces are considered. Uplift forces were considered in the example, hence the numeral “2” as the third profile parameter entered.

Number of Piezometric Surfaces (NPHS)

The final profile parameter entered is the *number of piezometric surfaces* considered in the slope stability analysis. Although the Method of Planes Software issues a warning message when more than three piezometric surfaces are considered, the Method of Planes Software accepts a maximum of five piezometric surfaces in a slope stability analysis. In the stability analysis of the example cross section, only one piezometric surface was considered.

3.2.5. Soil Boring Locations

The *soil boring locations* are entered on line (5) of the input data. The locations may be specified as any positive real number which is greater than zero, as long as the value is within the limits of the cross section. The soil boring locations are entered in order of increasing distance from the origin of the x-axis. A maximum of five boring locations may be specified on the fifth line of input data. Since three borings were specified in the profile parameters, three boring locations are entered on the fifth line of input data in the example input file (Table 3.5).

Table 3.5: Soil boring locations

```
0.01 115.5 215.5
```

3.2.6. Soil Unit Weights and Strength Parameters

The *soil unit weights and strength parameters* for the first "layer" are entered on line (6) of the input file, and the unit weights and strength parameters for the other layers in the cross section are entered on subsequent lines in the input file. Unit weights and strength parameters for each layer are entered in a "top-down" sequence beginning with the upper most layer and ending with the layer at the bottom of the profile. The unit weights and strength parameters for each of the ten layers in the example cross section are given in Table 3.6.

Table 3.6: Soil unit weights and strength parameters.

0 63 0 0 63 0 0 63 0 0
0 110 400 400 110 400 400 110 400 400
0 90 130 130 110 400 400 80 400 400
0 90 130 130 110 220 220 105 275 275
0 103 130 130 107 220 220 105 275 275
0 103 130 130 107 220 220 105 275 275
0 103 168 205 107 400 400 100 358 440
0 103 233 260 107 400 400 100 500 560
0 103 280 300 107 625 650 100 605 650
0 103 385 470 107 695 740 100 725 800

Consider as an illustration the fourth line of data in bold font in Table 3.6. The first value entered is the internal friction angle (0), followed by the total unit weight of the material (90) and the cohesion at the center (130) and bottom (130) of the layer under consideration. Since three borings are considered in the example, three sets of unit weights and strength parameters are presented on each line of input. When multiple borings are considered, the friction angle is the same for all borings and only the unit weights and the cohesion at the center and the bottom of each layer are repeated. The soil unit weights and strength parameters are entered in a "boring-wise" order, i.e. the order in which the unit weights and strength parameters are presented must correspond to the same order the boring locations were entered. To illustrate the point, consider once again the fourth line of data in Table 3.6. The first set of parameters (i.e., 90 130 130) correspond to the first boring location in Table 3.5 (i.e., 0.01), the second set of parameters (i.e., 110 220 220) correspond to the second boring location (i.e., 115.5), etc. The Method of Planes Software uses linear interpolation to calculate shear strength values in both the horizontal and vertical directions. The program ranges for the soil unit weights and strength parameters are given in Table 3.7.

Table 3.7: Program ranges for the soil unit weights and strength parameters.

Soil Parameter (symbol, units)	Program Range
Friction Angle (φ, °)	$0 \leq \varphi \leq 44$
Unit Weight (γ, pcf) - uplift considered	$62 \leq \gamma \leq 160$
Unit Weight (γ, pcf) - uplift not considered	$0 \leq \gamma \leq 160$
Cohesion at the center of the stratum (c_c, psf)	$0 \leq c_c < 3{,}000$
Cohesion at the bottom of the stratum (c_b, psf)	$0 \leq c_b < 3{,}000$

3.2.7. Coordinates of Soil Profiles

Once the soil unit weights and strength parameters for each layer are entered, the coordinates of each layer are entered. If there are "n" layers (i.e., "n" sets of soil unit weights and strength parameters), there must be "n+1" sets of profile coordinates in the input file. Since there are ten (10) layers in the example cross section, there are eleven (11) sets of coordinates defining eleven profile lines. The coordinates of each profile in the example is given in Table 3.8. As for the unit weights and strength parameters, the profile coordinates are entered in a "top-down" sequence; therefore, the order of layers defined by the profile lines correspond to the same order in which the unit weights and strength parameters were entered. The final set of profile coordinates define the bottom of the lowest layer in the profile.

Coordinates for each profile are entered in a manner such that they begin at the origin of the x-axis and end at the other end of the cross section. Segments of different profile lines are allowed to coincide. The coordinate pair “9999.9 0” must be entered after entering all the coordinate pairs for a given profile line to inform the Method of Planes Software that the profile line has ended.

Table 3.8: Coordinate pairs for each profile line.

0 11.5 145.5 11.5 163.5 16 173.5 16 212.5 3 252.5 2 270.5 -2.5
350 -2.5 9999.9 0
0 3 40 3 85 6 137.5 9.5 145.5 11.5 163.5 16 173.5 16 212.5 3
252.5 2 270.5 -2.5 350 -2.5 9999.9 0
0 3 40 3 85 6 97 2 177.5 2 209.5 0 235 -1 260 -2.5 270.5 -2.5
350 -2.5 9999.9 0
0 -15 350 -15 9999.9 0
0 -20 350 -20 9999.9 0
0 -30 350 -30 9999.9 0
0 -35 350 -35 9999.9 0
0 -46 350 -46 9999.9 0
0 -54 350 -54 9999.9 0
0 -60 350 -60 9999.9 0
0 -70 350 -70 9999.9 0

Beneath a given profile line the material is considered to be of a given type until another profile line is encountered. A maximum of twenty-five (25) profile lines can be entered to define a total of twenty-four (24) layers. The maximum number of coordinate pairs allowed varies depending on the line of input data and is given in Table 3.9.

Table 3.9: Maximum number of coordinate pairs allowed in each profile line.

Profile number	Maximum number of coordinate pairs
1 - 4	42
5 - 13	15
14 - 25	4

3.2.8. Coordinates of Piezometric Pressure Profiles

After the coordinates for the last soil profile are entered, the coordinates of the *piezometric pressure profile(s)* are entered followed by the *uplift selector pairs*. The pressure profile coordinates and uplift selector pairs used in the analyses of the example cross section are given in Table 3.10.

Pressure Profile Coordinates

The pressure profile coordinates are entered in an identical manner to the way in which the coordinates of the profile lines were entered. The Method of Planes Software allows a maximum of twenty-six (26) coordinate pairs for each piezometric pressure profile, and a maximum of five (5) piezometric profiles may be entered. When more than one piezometric profile is used, the coordinates of the profiles are listed on separate lines.

If a piezometric pressure profile intersects a profile line, and the intersection point is not specified in the input file, the Method of Planes Software will automatically add the intersection point to the profile. This may cause the maximum number of allowed profile coordinate pairs to be exceeded, causing the Method of Planes Software to “crash.”

Table 3.10: Coordinates of piezometric pressure profile and uplift selector pairs.

0 11.5 145.5 11.5 212.5 3 252.5 2 270.5 -2.5 350 -2.5 9999.9 0
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1

Uplift Selector Pairs

The uplift selector pairs are entered after the coordinates of the piezometric pressure profiles. Uplift selector pairs are entered as “1 1”, “2 2”, “3 3”, etc. to inform the Method of Planes Software which piezometric pressure profile to use to calculate the uplift forces at the *top* and *bottom* of each layer. In this case, since there are ten (10) sets of soil unit weights and strength parameters there must be ten uplift selector pairs (Table 3.10). The first uplift selector pair entered is for the first layer defined by the first profile line, and the order of the remaining uplift selector pairs will correspond to the same order of profile lines entered in the input file.

Uplift selector pairs must be entered on the same line, otherwise the Method of Planes Software will “crash.” Uplift selector pairs may be entered on more than one line if necessary. Since only one piezometric profile was considered in the stability analysis of the example cross section, all ten uplift selector pairs are the same (i.e., “1 1.”).

3.2.9. Active and Passive Wedge Data

The *active and passive wedge data* immediately follow the data for the uplift selector pairs, and the active and passive wedge data are the final entries in the input file. Slope stability analyses are performed with the Method of Planes Software by specifying the location of the assumed “critical passive wedge,” and the Method of Planes Software determines the location of the critical active wedge by calculating the maximum driving force producing the minimum factor of safety. This is done layer-by-layer for the entire soil profile. The active and passive wedge data for the example cross section are presented in Table 3.11.

Table 3.11: Active and passive wedge data.

6 187 -35 267 -35 1
267

The first entry for the active and passive wedge data is the layer number to be "checked." Dummy layers and water loads are included in determining the layer number. In the example file, the sixth layer was analyzed.

The second value entered represents the horizontal distance – entered as an x-coordinate – at which the Method of Planes Software begins searches for the "toe point" of the critical active wedge. The software searches for the "toe point" of the critical active wedge in intervals of five feet. The Method of Planes Software assumes the base of the active wedge is inclined at an angle of (45° + ϕ/2) from the horizontal plane and extends the base of the wedge to the ground surface upon finding the "toe point" for the critical active wedge. If the active wedge passes through several materials with different friction angles, the inclination of the base of the wedge will change in each material. The Method of Planes Software terminates the search for the critical active wedge after searching twenty-five feet past a location which produces a minimum factor of safety. In order to fix the location of the active wedge at a specific location in the profile, the number "90,000" must be added to the value representing the desired active wedge location. Any horizontal distance within the limits of the cross section is allowed by the Method of

Planes Software for the start location of searches for the critical active wedge. The search for the critical active wedge began at an x-coordinate of "187" in the example input file.

The elevation for the "toe point" of the critical active wedge is the third value entered for the active and passive wedge data, and any elevation within the specified layer is allowed by the Method of Planes Software. The "toe point" for the critical active wedge in the example is at an elevation of -35 ft.

The x-coordinate for the "toe point" of the assumed critical passive wedge follows the elevation for the "toe point" of the critical active wedge. Any horizontal distance within the limits of the cross section is allowed for the location of the "toe point" of the passive wedge. In the example file, an x-coordinate of "267" is specified for the "toe point" of the passive wedge.

The elevation of the "toe point" for the assumed critical passive wedge is the fifth entry for the active and passive wedge data, and an elevation of -35 ft was also used for the elevation of the "toe point" for the passive wedge in the example file. The Method of Planes Software assumes the base of the passive wedge is inclined at an angle of (45° - ϕ/2) from the horizontal plane and the Method of Planes Software extends the base of the passive wedge to the ground surface. If the passive wedge passes through several materials with different friction angles, the inclination of the base of the wedge will change in each material. Any elevation within the specified layer is allowed by the Method of Planes Software. Sloping slip surfaces can be analyzed by varying the elevations of the "toe points" for the active and passive wedges.

The sixth, and final entry, on the first line of the active and passive wedge data is reserved for the number of additional passive wedges to analyze. Once the Method of Planes Software locates the critical active wedge, additional slip surfaces may be analyzed by entering additional horizontal distances for the "toe points" of other passive wedges to consider, and the horizontal distances are entered on the second line of the active and passive wedge data. The additional passive wedges assume the elevation specified for the critical passive wedge. The slip surfaces for the additional passive wedges are defined using the critical active wedge found based on the location of the assumed critical passive wedge. A maximum of twenty-five (25) additional passive wedge locations is allowed by the Method of Planes Software. For the example input file, only the assumed critical passive wedge is considered; therefore, the numeral "1" was entered and the horizontal distance to the assumed critical passive wedge was entered on the second line of the active and passive wedge data.

Additional passive wedges may also be analyzed when the Method of Planes Software is executed by moving the cursor with the arrow keys and pressing the ENTER key. Additional layers are analyzed by repeating the format of the data in Table 3.11. The same layer may be analyzed more than once by entering new locations for the active and passive wedges.

3.2.10. Discussion of Dummy layers

The Method of Planes Software contains an error when calculating the resisting force provided by the central block (R_B) when the base of the central block lies along the interface of two layers. In such cases, the Method of Planes Software *should* compare the shear strength at the bottom of the upper layer with the shear strength at the top of the lower layer and use the lower of the two strengths in calculating the resisting force provided by the central block. However, the Method of Planes Software compares the shear strength at the bottom of the upper layer with the shear strength at the bottom of the lower layer. This error in the Method of Planes Software must be taken into account when layers of varying cohesion are present. An example is provided to illustrate how dummy layers should be used in the Method of Planes Software.

Consider the layers of cohesive material in Figure 3.5, and the inputs for the layers in an input file (Table 3.12). The cohesion in the upper layer is constant and equal 300 psf. The cohesion in the lower layer varies from 200 psf at the top of the layer to 400 psf at the bottom of the layer (300 psf at the center of the layer).

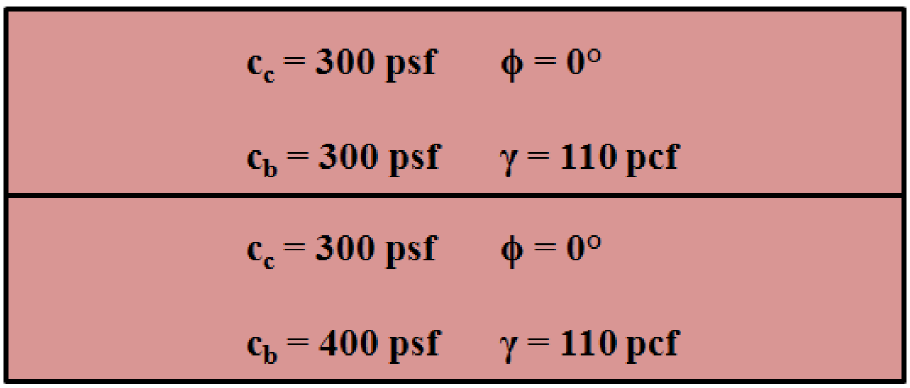


Figure 3.5: Soil unit weights and strength parameters for two adjacent soil layers.

Table 3.12: Inputs for layers presented in Figure 3.5.

0 110 300 300
0 110 300 400

In this case, the Method of Planes Software would incorrectly use a cohesion value of 300 psf to calculate the resisting force of the central block. The resulting factor of safety would be unconservative because the Method of Planes Software should use a value of 200 psf to calculate the resisting force of the central block. Inserting a dummy layer with a constant cohesion of 200 psf forces the Method of Planes Software to accurately compare the cohesion at the bottom of the upper layer and the top of the bottom dummy layer (Figure 3.6). The input data for unit weights and strength parameters with the dummy layer included are given in Table 3.13.

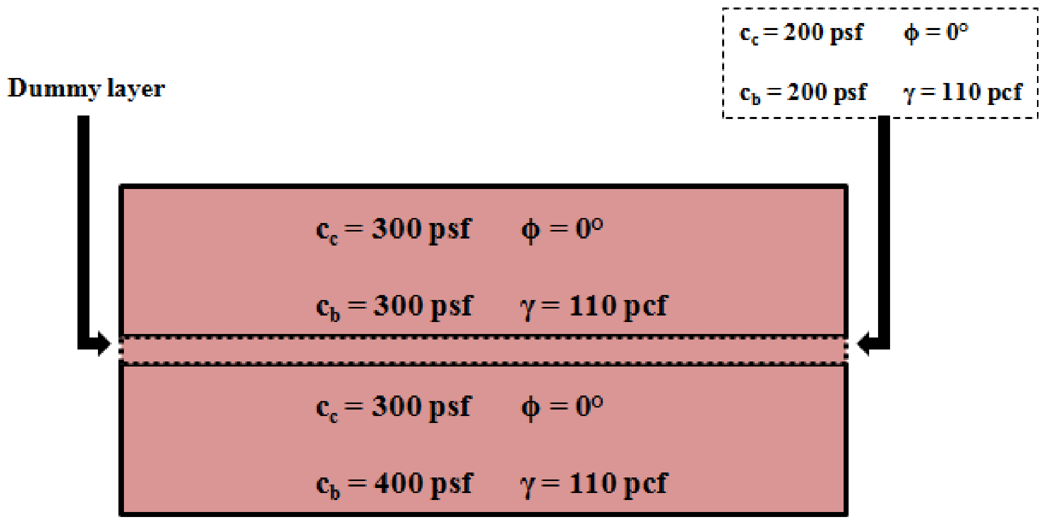


Figure 3.6: Soil unit weights and strength parameters for two adjacent layers with dummy layer included.

Table 3.13: Inputs for layers presented in Figure 3.6.

0 110 300 300
0 110 200 200
0 110 300 400

3.3. Execution of Method of Planes Software

When the Method of Planes Software is executed, a window like the one shown in Figure 3.7 appears on the computer screen. The Method of Planes Software first requests the name of the input file. For the example in Figure 3.7, the name of the input file is *l8.txt*. The name of the input file is limited to a maximum of seven (7) characters, but the period (.) before the file extension is not considered a character.

Once the file name is typed, the user must press ENTER to proceed to the second command which is the name of the plot file that the Method of Planes Software generates after completing the slope stability analysis. If the user presses ENTER without issuing a name to the plot file, the Method of Planes Software will automatically title the plot file "1," which was done in the example presented in Figure 3.7. After pressing ENTER a second time, the title of the cross section appears, along with the number of strata, profile lines, and soil borings (or "verticals"). Pressing ENTER a third time causes an image of the cross section to appear on the screen.

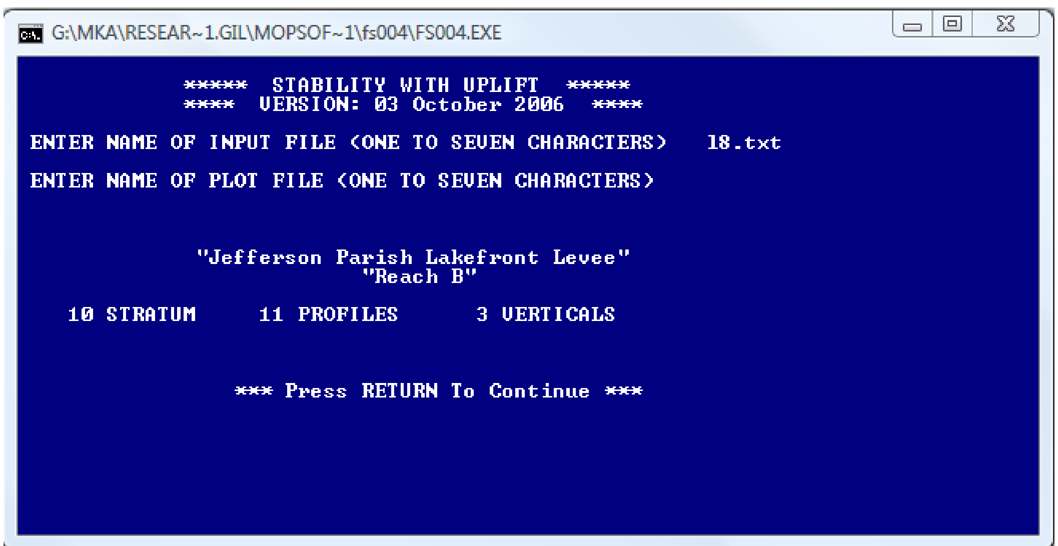


Figure 3.7: Command window for Method of Planes Software.

3.4. Output Data File

The Method of Planes Software generates two files after a slope stability analysis is complete. Both files are "general" type files. One file is named "1", unless the user specifies a title before execution of the Method of Planes Software (Figure 3.7). This file is read by the plot program to generate a DGN file. The other file created by the Method of Planes Software is named "W1" and it contains the results from the slope stability analysis. Opening the "W1" file (referred to herein as Method of Planes *output file*) with a text editor allows the user to read the outputs from the Method of Planes Software. The Method of Planes output file is divided into three sections:

1. Title Lines
2. "Assumed Failure Surface Data"
3. "Active Wedge Data"

The following sections describe the information presented in each section of the Method of Planes output files using as an example the output from the stability analysis for the Jefferson Parish Lakefront – Reach B, which is presented in Table 3.14.

Table 3.14: Method of Planes output file for Jefferson Parish Lakefront – Reach B.

**** STABILITY WITH UPLIFT ****

"Jefferson Parish Lakefront Levee"
"Reach B"
11 PROFILES
3VERTICALS
UPLIFT WITH 1 PIEZOMETRIC GRADE LINES

* * STRATUM	6	ACT. WEDGE LOC.	187.0	EL.	-35.0	PASS.WEDGE LOC.	267.0	EL.	-35.0

ASSUMED FAILURE SURFACE DATA

DIST.	ELEV.	WT.	UPLIFT	STR 1	STR 2	STR USED
0.0	-35	4151	2906	130	205	130
0.0	-35	4151	2906	130	205	130
40.0	-35	4331	2906	161	273	161
85.0	-35	4658	2906	196	349	196
97.0	-35	4769	2906	206	369	206
115.5	-35	4907	2906	220	400	220
137.5	-35	4852	2906	232	409	232
145.5	-35	4901	2906	237	412	237
163.5	-35	5294	2764	246	419	246
173.5	-35	5237	2684	252	423	252
177.5	-35	5068	2653	254	425	254
209.5	-35	3770	2399	272	438	272
212.5	-35	3649	2375	273	439	273
215.5	-35	3629	2370	275	440	275
235.0	-35	3598	2340	275	440	275
252.5	-35	3581	2313	275	440	275
260.0	-35	3389	2195	275	440	275
270.5	-35	3100	2031	275	440	275
350.0	-35	3100	2031	275	440	275

ASSUMED CRIT. PASSIVE LOC.	267.0	EL.	-35.0	DP	47417	RP	21000

ACTIVE WEDGE DATA

DIST.	ELEV.	DA	RA	DB	RB	FS
187.0	-35.0	122708	30555	0	21777	0.97

CRIT. ACTIVE LOC	187	EL	-35	DA	122708	RA	30555

DIS.	EL.	DP	RP	DB	RB	FS
267.0	-35.0	47417	21000	0	21777	0.97

3.4.1. Title Lines

The first seven (7) lines of text in the output file are *title lines* and they include the name of the software ("STABILITY WITH UPLIFT"), the title of the cross section that the user specified in the input data ("Jefferson Parish Lakefront Levee Reach B"), the number of profile lines (11), number of borings (3), and the number of piezometric pressure profiles (1) considered in the stability analysis. The information on the line after the information for the piezometric grade line informs the user that the data to follow resulted from an analysis performed using the active and passive wedge locations, along with the stratum number, given on that line.

For the example considered in this chapter, the data in the output file are from the analysis of the sixth layer in the profile. The search for the critical active wedge began at a horizontal distance of one-hundred and eighty-seven (187) feet, and the critical active wedge was found based on the location of the assumed critical passive wedge. The assumed critical passive wedge is located at a distance of two-hundred and sixty seven (267) feet from the origin. The "toe points" of both the active and passive wedges are at an elevation of -35 ft.

3.4.2. Assumed Failure Surface Data

The *assumed failure surface data* are presented after the title lines. The first column in the output is titled "DIST," and lists every x-coordinate entered in the input file. The second column is titled "ELEV" and elevations in this column are the elevations of the "toe points" for the active and passive wedges specified in the input file. The column labeled "WT" is the weight of soil above the corresponding elevation. Values in the "WT" column are relevant when the shear strength is dependent on the effective normal stress. The values in the "UPLIFT" column are static pore water pressures calculated from a piezometric pressure profile at the corresponding distance and elevation. The column "STR1" lists the shear strength of the material right above the point at the corresponding distance and elevation, while "STR2" is the shear strength of the material just below the same location. When the elevations listed in "ELEV" are elevations for a layer boundary, "STR1" is the shear strength of the material in the upper layer while "STR2" is the shear strength of the material in the lower layer. In calculating the resisting force of the central block, the Method of Planes Software uses the smaller of the two shear strength values presented in "STR1" and "STR2", which is given in the last column titled "STR USED."

3.4.3. Active Wedge Data

The data presented in the *Active Wedge Data* section are the results from the search performed by the Method of Planes Software for the slip surface with the minimum factor of safety. The data includes the location of the critical active and passive wedges, "driving" and "resisting" forces for the critical slip surface, and the minimum factor of safety. In the analyses for the example cross section, the starting location of the search for the critical active wedge *was* the location of the critical active wedge. The Method of Planes Software computed a factor of safety of 0.97 for the critical slip surface.

3.5. DISCUSSION

Whenever the Method of Planes Software fails to run, the program offers no output to indicate the source of the error. By way of lengthy trail-and-error procedures, it was finally possible to understand the program. The explanations presented in this chapter represent the knowledge of the various aspects of the Method of Planes Software gained in this study, and are intended to complement Jolissaint (2001). The only reason for understanding and running the Method of Planes Software was to check results of analyses performed by the New Orleans District, which are detailed in the following chapter.

Chapter 4: Compilation of Earthen Levee Cross Sections from Southeastern Louisiana and Confirmation of Data Extraction

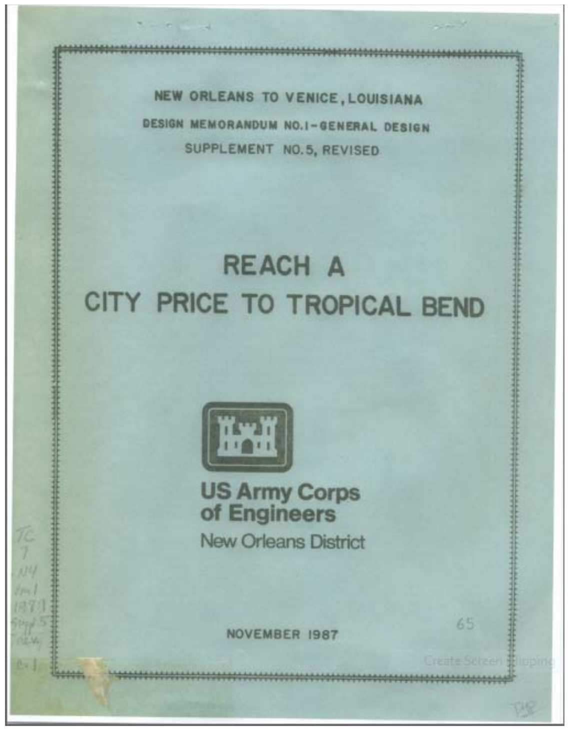
A database was created that contains over five-hundred (500) levee cross sections from southeastern Louisiana. Twenty (20) earthen levee cross sections were selected from the database for further study. Creation of the database and the selection of the cross sections for study are discussed in this chapter.

Each of the cross sections selected contained data required for stability analyses (e.g., profile geometry and soil properties), along with the results of stability analyses performed by the USACE with the Method of Planes Software. To ensure that the data from each cross section was interpreted properly, new analyses were performed with the Method of Planes Software for each of the twenty cross sections and the factors of safety are compared with results obtained by the USACE.

4.1. Obtaining Earthen Levee Cross Sections

Soon after Hurricane Katrina (2006), the Interagency Performance Evaluation Task Force (IPET) posted design memoranda for New Orleans' hurricane protection system on an Internet website (https://ipet.wes.army.mil/). The design memoranda were downloaded as PDF files from IPET's website. The title page of a typical design memorandum is shown in Figure 4.1. These design memoranda included levee cross sections, referred to as *plates* in the design memoranda. A sample plate for an earthen levee cross section is provided in Figure 4.2. A typical plate contains information regarding ground elevations, stratigraphy, and the soil parameters used in the stability analysis for the cross section. Results of analyses performed by the USACE with the

Method of Planes Software – i.e., critical slip surfaces and corresponding factors of safety – are also included on the plates.



NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO.1 – GENERAL DESIGN
SUPPLEMENT NO. 5, REVISED

REACH A
CITY PRICE TO TROPICAL BEND

US Army Corps
of Engineers
New Orleans District

NOVEMBER 1987

Figure 4.1: Title page of design memorandum.

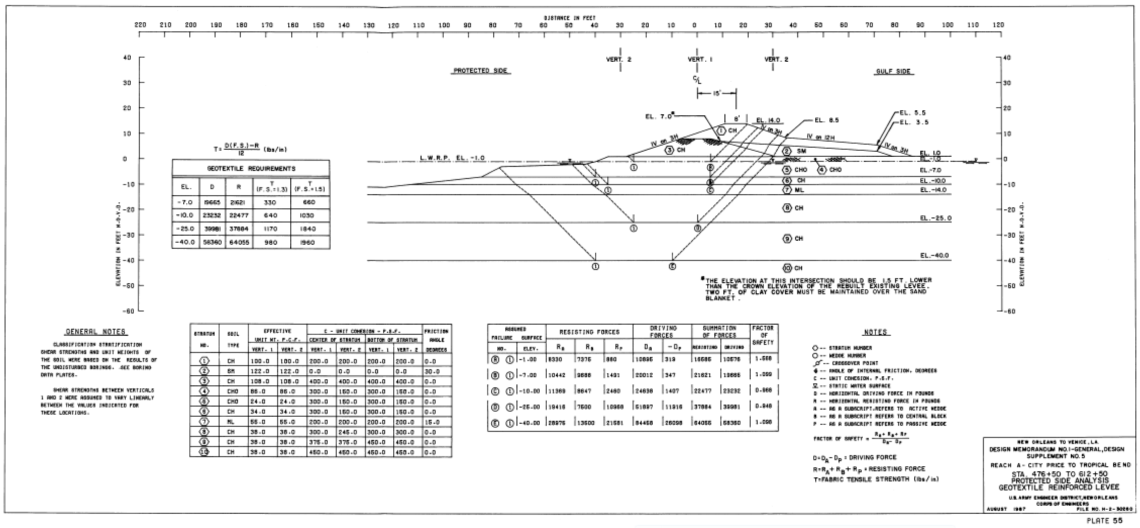


Figure 4.2: Reach A – City Price to Tropical Bend; Sta. 476+50 to 612+50.

A large number of design memoranda was examined, and data for a total of five-hundred and twenty (520) cross sections were compiled. The cross sections were compiled into a single PDF file, and information from each cross section was entered in a database using Microsoft Excel's spreadsheet software. Over half of the cross sections in the database are pure earthen levees, and the remainder of the cross sections are for levees that contain either I-walls or T-walls.

After the database was compiled, twenty (20) cross sections were chosen from the database for analysis. These cross sections are considered to collectively provide a representation of the various earthen levee configurations and subsurface conditions in New Orleans. The twenty cross sections selected are included in Appendix A. None of the cross sections selected for further study contained either I-walls or T-walls. The location of each cross section is shown on an aerial view in Figure 4.3 and is identified by a number. Each number corresponds to the numbers shown for the cross sections listed in Table 4.1. Table 4.1 also includes the following information for each of the twenty cross sections:

- Title and date of the design memorandum from which each cross section came.
- Page numbers in the PDF files containing the design memoranda.
- Plate numbers in the design memoranda.
- Number of cross sections on the plate containing the given cross section (some plates contain several cross sections).
- Location of each cross section.
- Additional description of cross section included in the title of the plate.
- Figure number for each cross section in Appendix A.

Figure 4.3: Locations of earthen levee cross sections selected for further study (Google Earth).

Table 4.1: Information regarding each of the twenty cross sections selected for analysis.

Number in Figure 4.2	Document	Date of Design Memo.	Page Number in Design Memo. (PDF file)	Plate Number in Design Memo.	Number of Cross Sections on Plate	Location	Station(s)/Description	Figure No. in Appendix A
1	Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, Design Memorandum No. 2 - General, Citrus Back Levee	21-Aug-67	142	40	3	Citrus Back Levee	483+00 to 492+29	A.1
2	Mississippi River - Gulf Outlet, Design Memorandum No. 1 - General Design, Michoud Canal	20-Jul-73	75	9	1	G.I.W.W. - Michoud Canal	507+44.6 to 540+00	A.2
3	New Orleans to Venice, Louisiana, West Bank Mississippi River Levee - City Price to Venice, LA, General Design Memorandum No. 1, Supplement No. 6	26-Mar-87	155	76	1	City Price to Venice	1313+77 to 1367+19	A.3
4	New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General, Supplement No. 3, Reach C - Phoenix to Bohemia	11-May-72	104	39	1	Phoenix to Bohemia	159+00 to 495+00	A.4
5	Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW	19-Jan-73	121	47	1	South Point to G.I.W.W.	939+60 to 1101+90	A.5
6	New Orleans to Venice, Louisiana, Reach A Revised - City Price to Tropical Bend, La., General Design Memorandum No. 1, Supplement No. 5	Nov-87	152	55	1	City Price to Tropical Bend	476+50 to 612+50	A.6
7	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 13 - General Design, Orleans Parish Lakefront Levee, West of IHNC, Vol. I	Nov-84	73	123	1	Orleans Parish Lakefront	305+41.96 B/L to 305+46.96 B/L	A.7
8	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17 - General Design, Jefferson Parish Lakefront Levee	20-Nov-87	93, 94	124, 125	1	Jefferson Parish Lakefront	Reach B Protected & Flood	A.8, A.21
9	Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road	26-May-76	134	51	1	Citrus Lakefront	121+00 B/L to 154+83 B/L	A.9
10	Lake Pontchartrain, Louisiana and Vicinity, General Design Memorandum No. 3, Chalmette Area Plan	Nov-66	208	43	2	Along MRGO - Violet Line	807+00 to 978+00	A.10
11	Westwego to Harvey Canal, LA, Hurricane Protection Project, Design Memorandum No. 1, General Design, Supplement No. 2, Appendix F, Foundation Investigations, Vol. II	Feb-90	154	F129	1	Harvey Canal	817+20 to 1014+25 B/L	A.11
12	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 22 - General Design, Orleans Parish Lakefront Remaining Work	Apr-93	130	69	1	New Orleans Lakefront Airport	W/L 32+75 to W/L 33+21	A.12
13	Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 9, New Orleans East Levee, South Point to GIWW	19-Jan-73	122	48	1	South Point to G.I.W.W. (2)	797+30 and 925+27	A.13
14	New Orleans to Venice, Louisiana, Reach A Revised - City Price to Tropical Bend, La., General Design Memorandum No. 1, Supplement No. 5	Nov-87	139	42	1	City Price to Tropical Bend (2)	245+00 to 253+02	A.14
15	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 13 - General Design, Orleans Parish Lakefront Levee, West of IHNC	Nov-84	65	115	1	Orleans Parish Lakefront (2)	136+13.19 to 159+70.0 B/L	A.15
16	Lake Pontchartrain, Louisiana and Vicinity, General Design Memorandum No. 3, Chalmette Area Plan	Nov-66	209	44	2	Along MRGO Violet Line (2)	1020+00 to 1050+00	A.16
17	Westwego to Harvey Canal, LA, Hurricane Protection Project, Design Memorandum No. 1, General Design, Supplement No. 2, Appendix F, Foundation Investigations, Vol. II	Feb-90	142	F117	1	Westminster	188+73 to 261+20 B/L	A.17
18	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 22 - General Design, Orleans Parish Lakefront Remaining Work	Apr-93	131	70	1	Bayou St. John	Earthen Closure	A.18
19	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17 - General Design, Jefferson Parish Lakefront Levee, Vol. II	20-Nov-87	91, 92	122, 123	1	Jefferson Parish Lakefront	Reach A Protected & Flood	A.19, A.20
20	Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17 - General Design, Jefferson Parish Lakefront Levee, Vol. II	20-Nov-87	95, 96	126, 127	1	Jefferson Parish Lakefront	Reach C Protected & Flood	A.22, A.23

4.2. Confirmation of Data Extraction

Analyses were performed with the Method of Planes Software in order to duplicate the results of analyses performed by the USACE. The purpose of duplicating the USACE's results was to verify that the data (e.g., profile geometry and soil properties) for each earthen levee cross section was interpreted correctly. A discussion on how the data from each cross section were extracted is presented first, followed by the results of analyses with the Method of Planes Software.

4.2.1. Collecting Information from Cross Sections

The information required for slope stability analyses included soil profile geometry, material properties, piezometric lines, and distributed loads. In order to run the Method of Planes Software this information is needed, as well as the locations of the active and passive wedges that define the three-part, noncircular slip surface.

Most of the information needed to run the Method of Planes Software was provided on the plates (e.g., soil parameters) or scaled from the cross sections using the scales presented on the plates (e.g., ground elevations). When the cross sections were difficult to read or interpret due to previous copying and scanning processes, digitizing software known as *DigiTex* – developed by Dr. Stephen G. Wright of the University of Texas at Austin – was utilized. The DigiTex software is capable of importing bitmap files and digitizing the coordinates of points in an image representing profile lines, piezometric lines, etc. on an earthen levee cross section. An example of a case where DigiTex was used is presented in Figure 4.4.

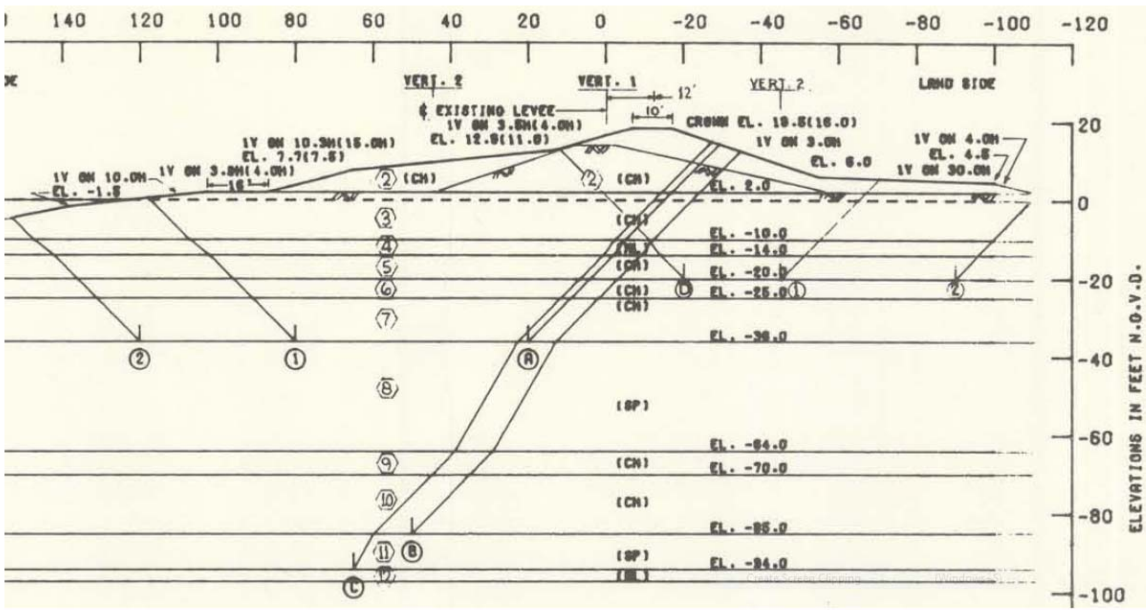


Figure 4.4: Details for the City Price to Venice cross section.

4.2.2. Results of Analyses for the Method of Planes Software

Once the relevant information needed to perform the analyses with the Method of Planes Software was extracted from each cross section, only the slip surface with the minimum factor of safety presented for each cross section was analyzed using the Method of Planes Software. The factors of safety obtained with the Method of Planes Software from the analyses for the present study are compared with the factors of safety obtained from the analyses performed by the USACE in Table 4.2. The USACE reported multiple slip surfaces with the same minimum factor of safety for their analyses for the Citrus Back Levee, City Price to Venice, Orleans Parish Lakefront (2), and Bayou St. John cross sections. All of the critical slip surfaces for these four cross sections were analyzed using the Method of Planes Software, and the factors of safety that were obtained are presented in Table 4.2. The factors of safety obtained from the analyses performed for this study agree well with the factors of safety from the analyses performed by the USACE, as the greatest difference in the factor of safety is only 5%. This suggests the data from each cross section was successfully extracted.

Table 4.2: Comparison of results obtained by the USACE and UT Austin for analyses with the Method of Planes Software.

Location	Flood/Protected Side Analysis	USACE Analysis w/ MOP Software	UT Austin Analysis w/ MOP Software	$(FS_{USACE} - FS_{UT})/FS_{USACE}$ - %
Citrus Back Levee	Protected (A1)	1.30	1.27	2.3
	Protected (A2)	1.30	1.30	0.0
G.I.W.W. - Michoud Canal	Flood	1.32	1.32	0.0
City Price to Venice	Flood (A1)	1.30	1.27	2.3
	Flood (A2)	1.30	1.26	3.1
	Flood (A3)	1.30	1.24	4.6
	Flood (A4)	1.30	1.24	4.6
	Flood (B1)	1.30	1.25	3.8
	Protected (D1)	1.30	1.31	-0.8
	Protected (D2)	1.30	1.37	-5.4
Phoenix to Bohemia	Protected	1.35	1.31	3.0
South Point to G.I.W.W.	Protected	1.34	1.34	0.0
City Price to Tropical Bend	Flood	0.95	0.95	0.0
Orleans Parish Lakefront	Protected	1.31	1.32	-0.8
Jefferson Parish Lakefront - Reach B	Protected	0.97	0.97	0.0
Citrus Lakefront	Flood	1.78	1.78	0.0
Along MRGO - Violet Line	Flood	1.39	1.39	0.0
Harvey Canal	Flood	1.30	1.30	0.0
New Orleans Lakefront Airport	Protected	2.98	2.97	0.3
South Point to G.I.W.W. (2)	Flood	1.36	1.35	0.7
City Price to Tropical Bend (2)	Flood	1.30	1.30	0.0
Orleans Parish Lakefront (2)	Protected (B1)	1.29	1.29	0.0
	Protected (B3)	1.29	1.29	0.0
Along MRGO - Violet Line (2)	Flood	1.50	1.50	0.0
Westminster	Protected	1.30	1.30	0.0
Bayou St. John	Flood (J2)	1.50	1.50	0.0
	Flood (L2)	1.50	1.50	0.0
Jefferson Parish Lakefront - Reach A	Protected	1.09	1.09	0.0
	Flood	1.36	1.36	0.0
Jefferson Parish Lakefront - Reach B	Flood	0.88	0.88	0.0
Jefferson Parish Lakefront - Reach C	Protected	0.89	0.89	0.0
	Flood	1.14	1.15	-0.9

4.3. SUMMARY

The factors of safety from the USACE's analysis and the analysis for the present study with the Method of Planes Software agree well; as a result, it is believed that the data for the various cross sections selected were interpreted correctly. After the data were extracted from the cross sections, parametric analyses were performed to compare the results from the Method of Planes to those from more conventional limit equilibrium procedures.

Chapter 5: Analyses with the Critical Slip Surfaces from the Method of Planes and Comparison with Method of Planes Solutions

The critical slip surfaces located by the USACE for the cross sections selected in Chapter 4 were analyzed with a force equilibrium procedure with horizontal side forces and Spencer's procedure. The UTEXAS4 slope stability analysis software (Wright, 1999) was used to perform the calculations for both procedures. In this chapter, the results of analyses with both procedures are compared with the results from the Method of Planes.

The force equilibrium procedure with horizontal side forces was chosen because the procedure is believed to produce similar factors of safety to the Method of Planes. Spencer's procedure was selected to allow for a comparison between the results from the Method of Planes and a procedure that *completely* satisfies static equilibrium.

One limitation of the Method of Planes is the inability to introduce "tension cracks" to eliminate tensile stresses present around the crest of the slope. A separate series of analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure was performed to evaluate how the factors of safety from the Method of Planes compare with the factors of safety from the force equilibrium and Spencer's procedure when tension cracks were included in the analyses.

5.1. UTEXAS4 BACKGROUND

UTEXAS4 is used to perform slope stability calculations by reading an input data file containing information about a given problem. The input data file for UTEXAS4 contains similar information to the input data file for the Method of Planes Software (e.g., profile lines and material properties). However, while the Method of Planes Software is restricted to analysis of a noncircular slip surface with a specific shape, UTEXAS4 is capable of analyzing circular and noncircular slip surfaces with a variety of shapes. UTEXAS4 can analyze either a single, selected slip surface or perform an automatic search to locate a *critical* slip surface with a minimum factor of safety.

Calculations for the force equilibrium procedure with horizontal side forces were performed in UTEXAS4 by selecting the “Corps of Engineers’ Modified Swedish” procedure and specifying a horizontal inclination for the side forces (Wright, 1999).

5.2. Identifying Points Along the Slip Surface

The process of selecting points along the slip surface for input into the UTEXAS4 Software began by locating the “toe points” of the active and passive wedges for the critical slip surface from the Method of Planes (Figure 5.1). These toe points are provided in the output file generated by the Method of Planes Software. The output file created by the Method of Planes Software was discussed in Chapter 3.

Once the toe points for the active and passive wedges were identified, additional points on the slip surface were chosen where the slip surface intersected layer boundaries, and at the ground surface. The points defined along the slip surface are displayed in Figure 5.1.

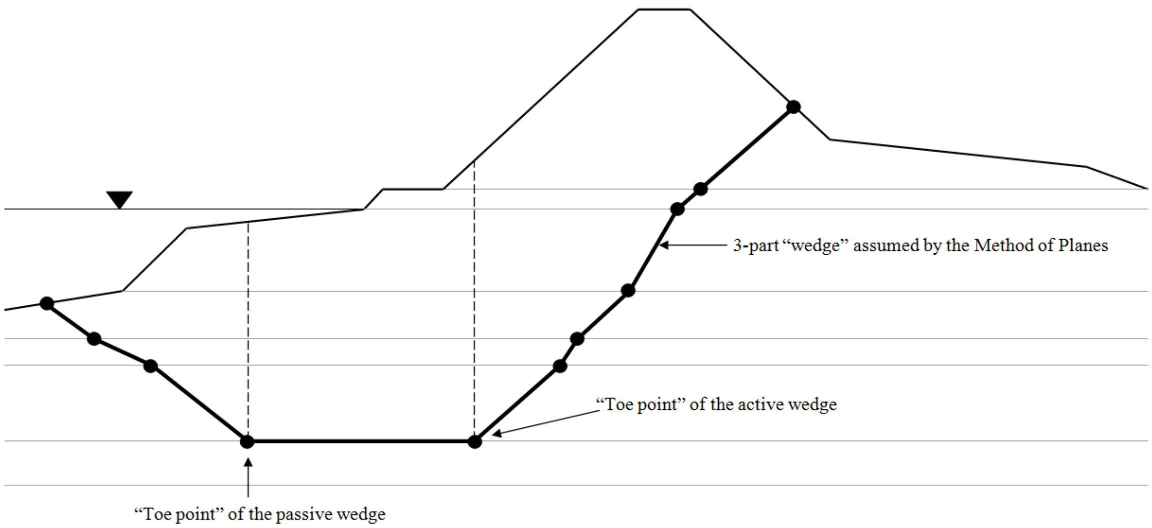


Figure 5.1: Points identified along the slip surface from the Method of Planes.

5.3. Comparison of Factors of Safety from the Force Equilibrium Procedure with Horizontal Side Forces and the Method of Planes

The results of analyses with the force equilibrium procedure with horizontal side forces and the Method of Planes are presented in Table 5.1. The force equilibrium procedure computed factors of safety that agree very well with the factors of safety from the Method of Planes. The greatest difference in the factor of safety from the force equilibrium procedure and the Method of Planes was 7%. The differences in the factors of safety only appeared in cases where the slip surface went through frictional ($\phi > 0°$) material. When the slip surface passed only through cohesive ($\phi = 0°$) material, the factors of safety from both procedures were identical. This finding suggests that the Method of Planes satisfies force equilibrium only for the $\phi = 0°$ case.

The results of analyses with the force equilibrium procedure with horizontal side forces also suggest that the force equilibrium procedure can be used as a surrogate for the

Method of Planes for analyses with circular and general noncircular slip surfaces, different from the three-part, “wedge” assumed for the Method of Planes.

Table 5.1: Comparison of factors of safety from the Method of Planes and the force equilibrium procedure with horizontal side forces.

Location	Flood/Protected Side Analysis	Frictional Material Present Along the Slip Surface?	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Force Equilibrium procedure with horiz side forces	$(FS_{ForceEq} - FS_{MOP})/FS_{ForceEq}$ - %
	Protected (A1)	No	1.27	1.27	0.0
Citrus Back Levee	Protected (A2)	No	1.30	1.30	0.0
G.I.W.W. - Michoud Canal	Flood	No	1.32	1.32	0.0
	Flood (A1)	Yes	1.27	1.24	-2.4
	Flood (A2)	Yes	1.26	1.25	-0.8
	Flood (A3)	Yes	1.24	1.25	0.8
	Flood (A4)	Yes	1.24	1.25	0.8
	Flood (B1)	Yes	1.25	1.29	3.1
	Protected (D1)	Yes	1.31	1.29	-1.6
City Price to Venice	Protected (D2)	Yes	1.37	1.36	-0.7
Phoenix to Bohemia	Protected	Yes	1.31	1.40	6.4
South Point to G.I.W.W.	Protected	No	1.34	1.34	0.0
City Price to Tropical Bend	Flood	Yes	0.95	0.94	-1.1
Orleans Parish Lakefront	Protected	Yes	1.32	1.33	0.8
Jefferson Parish Lakefront - Reach B	Protected	No	0.97	0.98	1.0
Citrus Lakefront	Flood	Yes	1.78	1.92	7.3
Along MRGO - Violet Line	Flood	No	1.39	1.39	0.0
Harvey Canal	Flood	No	1.30	1.30	0.0
New Orleans Lakefront Airport	Protected	Yes	2.97	2.98	0.3
South Point to G.I.W.W. (2)	Flood	Yes	1.35	1.36	0.7
City Price to Tropical Bend (2)	Flood	Yes	1.30	1.30	0.0
	Protected (B1)	Yes	1.29	1.32	2.3
Orleans Parish Lakefront (2)	Protected (B3)	Yes	1.29	1.32	2.3
Along MRGO - Violet Line (2)	Flood	No	1.50	1.50	0.0
Westminster	Protected	No	1.30	1.30	0.0
	Flood (J2)	Yes	1.50	1.54	2.6
Bayou St. John	Flood (L2)	Yes	1.50	1.52	1.3
	Protected	No	1.09	1.09	0.0
Jefferson Parish Lakefront - Reach A	Flood	No	1.36	1.36	0.0
Jefferson Parish Lakefront - Reach B	Flood	No	0.88	0.88	0.0
	Protected	No	0.89	0.89	0.0
Jefferson Parish Lakefront - Reach C	Flood	No	1.15	1.15	0.0

5.4. Comparison of Factors of Safety from Spencer's Procedure and the Method of Planes

The factors of safety from Spencer's procedure are presented in Table 5.2, where they are compared with the factors of safety from the Method of Planes. For every case except one, the factor of safety from Spencer's procedure was greater than that from the Method of Planes. When Spencer's procedure computed a higher factor of safety, the difference in the factor of safety from Spencer's procedure and the Method of Planes varied from 2% to 33%.

The only case where the factor of safety from Spencer's procedure was lower than the Method of Planes' solution was the Orleans Parish Lakefront (2) cross section. When the slip surfaces from the Orleans Parish Lakefront (2) cross section were analyzed with Spencer's procedure, Spencer's procedure calculated negative inclinations for the side forces. The side force inclinations for the critical slip surfaces titled "B1" and "B3" were -9.23° and -7°, respectively. The Orleans Parish Lakefront (2) cross section was the only case in Table 5.2 where Spencer's procedure calculated negative inclinations for the side forces. The sign conventions used for the side force inclinations in this thesis are illustrated in Figure 5.2.

If a slip surface is analyzed with a force equilibrium procedure using the same inclination for the side forces determined by Spencer's procedure, both Spencer's and the force equilibrium procedures should calculate the same factor of safety. In order to better understand how the inclination of the side forces affected the factor of safety computed using Spencer's procedure, slip surface "B1" was analyzed again with the force equilibrium procedure using four different inclinations for the side forces: +5°, 0°, -5°, and -10°. The results of the analyses are provided in Figure 5.3. As the inclination of the side forces decreased from a value of +5° to -10°, the computed factor of safety also decreased. This trend shows that lower side force inclinations will results in lower factors of safety for this cross section. As a result of the negative inclination for the side forces from Spencer's procedure, the factor of safety from Spencer's procedure was lower than that from the Method of Planes for slip surface "B1."

Table 5.2: Comparison of factors of safety from the Method of Planes and Spencer's procedure.

Location	Flood/Protected Side Analysis	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Spencer's procedure	$(FS_{Spencer} - FS_{MOP})/FS_{Spencer}$ - %
	Protected (A1)	1.27	1.40	9.3
Citrus Back Levee	Protected (A2)	1.30	1.43	9.1
G.I.W.W. - Michoud Canal	Flood	1.32	1.50	12.0
	Flood (A1)	1.27	1.55	18.1
	Flood (A2)	1.26	1.50	16.0
	Flood (A3)	1.24	1.44	13.9
	Flood (A4)	1.24	1.37	9.5
	Flood (B1)	1.25	1.45	13.8
	Protected (D1)	1.31	1.49	12.1
City Price to Venice	Protected (D2)	1.37	1.56	12.2
Phoenix to Bohemia	Protected	1.31	1.62	19.1
South Point to G.I.W.W.	Protected	1.34	1.64	18.3
City Price to Tropical Bend	Flood	0.95	1.22	22.1
Orleans Parish Lakefront	Protected	1.32	1.51	12.6
Jefferson Parish Lakefront - Reach B	Protected	0.97	1.06	8.5
Citrus Lakefront	Flood	1.78	2.65	32.8
Along MRGO - Violet Line	Flood	1.39	1.87	25.7
Harvey Canal	Flood	1.30	1.46	11.0
New Orleans Lakefront Airport	Protected	2.97	4.07	27.0
South Point to G.I.W.W. (2)	Flood	1.35	1.55	12.9
City Price to Tropical Bend (2)	Flood	1.30	1.53	15.0
	Protected (B1)	1.29	1.13	-14.2
Orleans Parish Lakefront (2)	Protected (B3)	1.29	1.32	2.3
Along MRGO - Violet Line (2)	Flood	1.50	1.73	13.3
Westminster	Protected	1.30	1.46	11.0
	Flood (J2)	1.50	1.70	11.8
Bayou St. John	Flood (L2)	1.50	1.83	18.0
	Protected	1.09	1.28	14.8
Jefferson Parish Lakefront - Reach A	Flood	1.36	1.61	15.5
Jefferson Parish Lakefront - Reach B	Flood	0.88	0.95	7.4
	Protected	0.89	0.97	8.2
Jefferson Parish Lakefront - Reach C	Flood	1.15	1.21	5.0

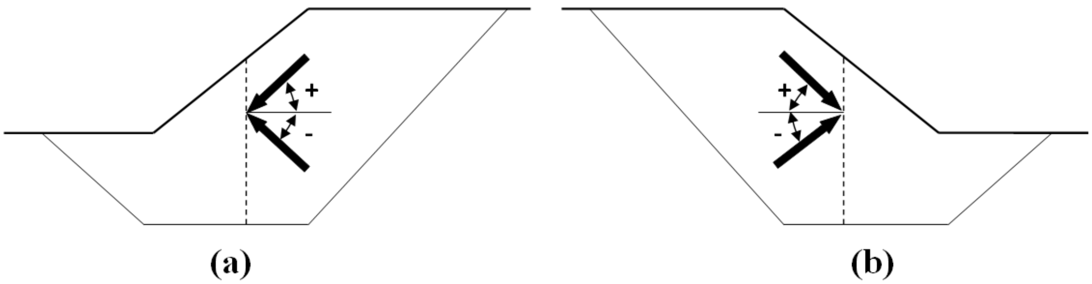


Figure 5.2: Sign convention of side force inclinations for (a) left-facing and (b) right-facing slopes.

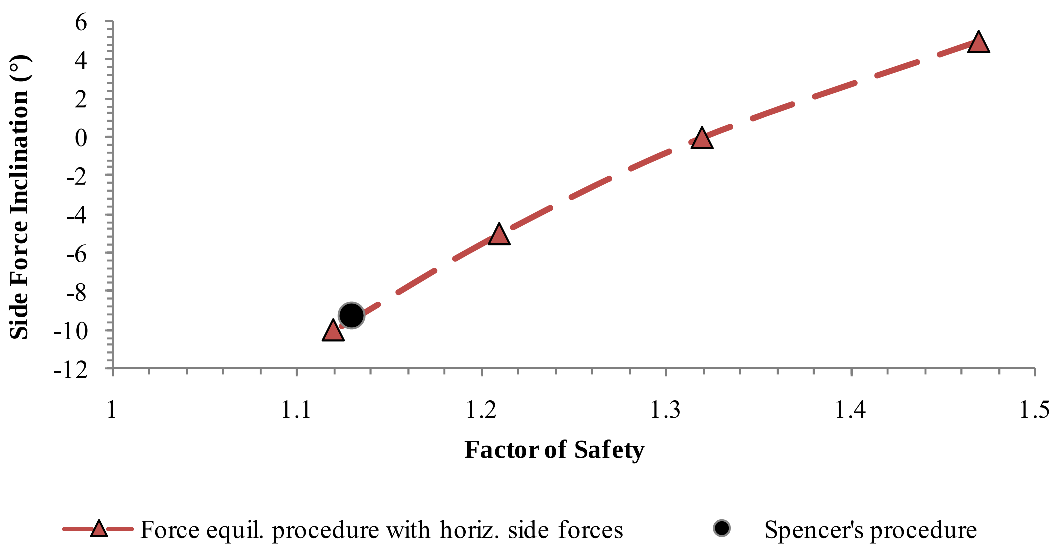


Figure 5.3: Influence of the side force inclination on the factor of safety.

The negative inclination for the side forces from Spencer's procedure in the Orleans Parish Lakefront (2) cross section are believed to be caused by the relatively low undrained shear strength (80 psf) assigned to the layer between elevations +3.0 ft and -2.0 ft (N.G.V.D.[3]). In this case, the soil near the crest of the slope – with an undrained shear strength of 700 psf – is responsible for holding the slope in place and causes the shear forces between slices to act in a direction not normally found, i.e. the side force inclinations become negative (Figure 5.4).

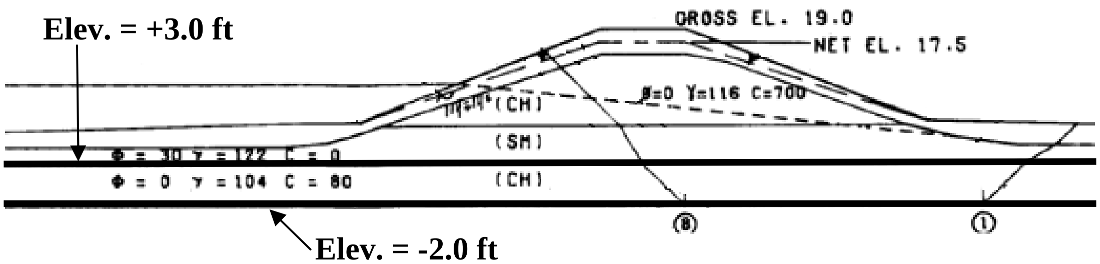


Figure 5.4: Weak layer at depth in the Orleans Parish Lakefront (2) cross section.

The size of the differences in the factors of safety calculated by the Method of Planes and Spencer's procedure appeared to be related, at least in part, to the geometry of the slip surfaces being analyzed. Two parameters may be used to characterize the geometry of the slip surface. These two parameters are presented in the following sections and were used to explain the size in the differences in the factors of safety from Spencer's procedure and the Method of Planes.

[3] National Geodetic Vertical Datum

5.4.1. Depth to Length Ratio for Slip Surface

The first parameter that can be used to describe the geometry of the slip surface is the *D:L ratio*, which is illustrated in Figure 5.5. The distance between the two end points of the slip surface is *L*, and *D* is the furthest distance from the chord line titled "L" to the slip surface. The D:L ratio used is this thesis is very similar to the *d:l ratio* used in Janbu's "correction" factor (Janbu et al., 1956). The D:L ratio is a measure of a slip surface's *length* relative to its depth in a soil profile.

The size of the differences in the factors of safety computed by Spencer's procedure and the Method of Planes was expressed by the *relative difference*. The relative difference was expressed as a percentage and defined as:

$$\frac{FS_{Spencer} - FS_{Method\ of\ Planes}}{FS_{Spencer}} * 100\% \tag{5.1}$$

The D:L ratios for the slip surfaces analyzed in this chapter are plotted against the relative differences in the factors of safety in Figure 5.6.

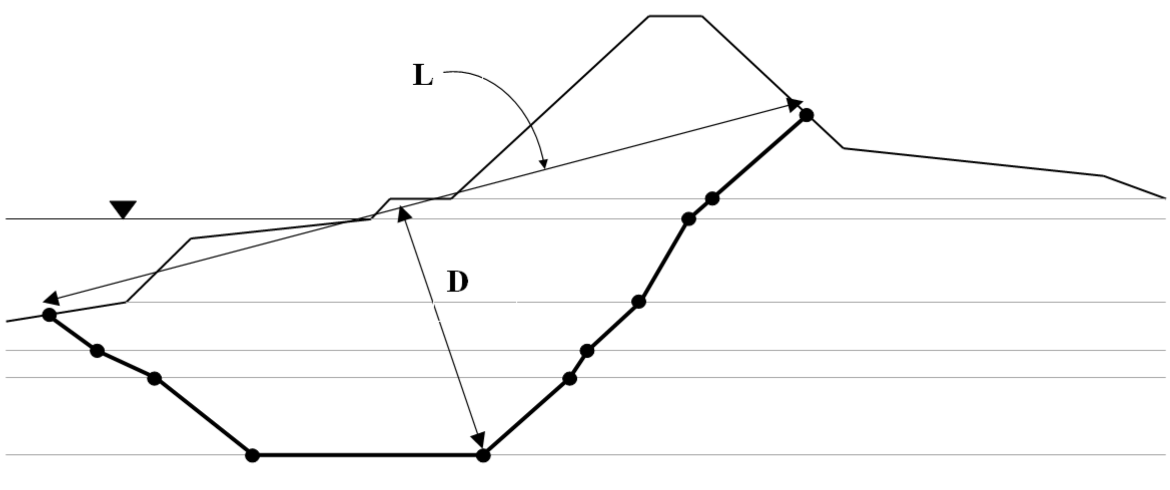


Figure 5.5: Schematic illustrating the D:L ratio to describe the three-part, noncircular slip surface from the Method of Planes.

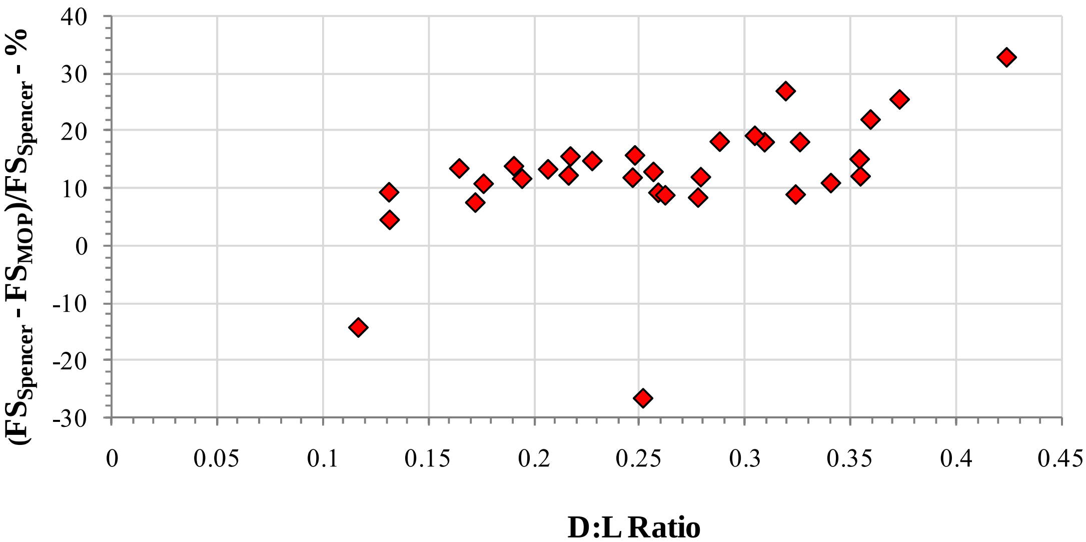


Figure 5.6: Relationship between the D:L ratio and the relative difference in the factor of safety from the Method of Planes and Spencer's procedure.

Although there is a noticeable amount of scatter in Figure 5.6, there appears to be a relationship between the D:L ratio and the relative difference in the factor of safety from Spencer's procedure and the Method of Planes. The general trend observed in Figure 5.6 is that the relative difference in computed factors of safety increases as the D:L ratio increases. Another way of describing the trend is that the differences in the factors of safety are greater for relatively deep-seated slip surfaces.

The data point with the negative relative difference in Figure 5.6 corresponds to results of analyses for slip surface "B1" from the Orleans Parish Lakefront (2) cross section. In that case, Spencer's procedure calculated a negative inclination for the side forces, causing the factor of safety from Spencer's procedure to be lower than that from the Method of Planes.

5.4.2. Height to Width Ratio for Slip Surface

A second parameter that can be used to characterize the geometry of slip surfaces is the *H:W ratio*, where *H* is the height of the slip surface and *W* is the total length of the slip surface (Figure 5.7). The H:W ratio is a measure of a slip surface's *width* relative to its depth.

The relative differences in the factors of safety are plotted versus the H:W ratios for the slip surfaces in Figure 5.8. The difference in the factors of safety tends to increase as H:W increases. A clear trend is observed for H:W ratios less than approximately 0.20, while more scatter is present when the H:W ratio is greater than 0.20. The data point with a negative relative difference once again corresponds to slip surface "B1" from the Orleans Parish Lakefront (2) cross section. In this case, Spencer's procedure calculated a lower factor of safety than the Method of Planes because of the negative inclination for the side forces in Spencer's procedure.

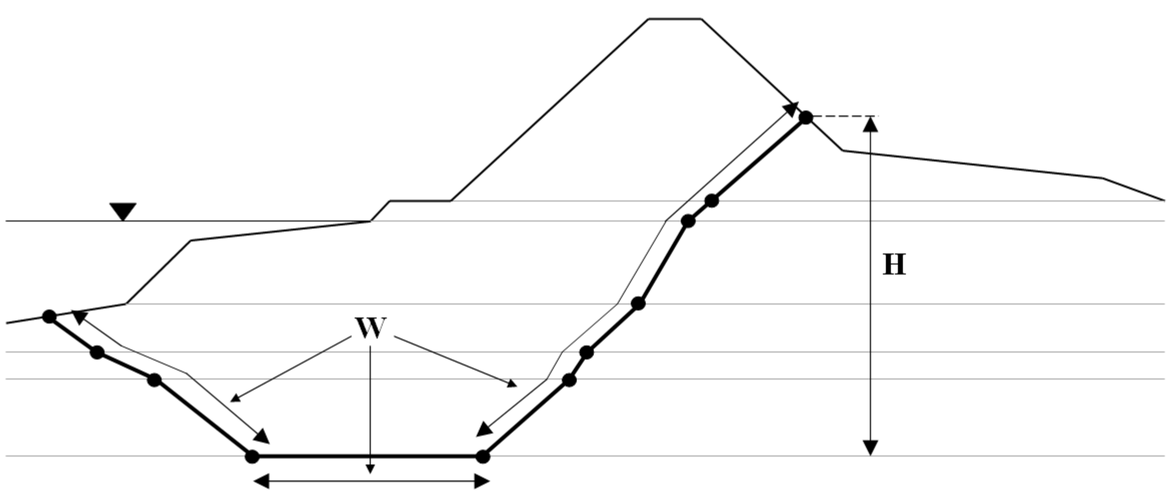


Figure 5.7: Schematic illustrating the H:W ratio to describe the three-part, noncircular slip surface from the Method of Planes.

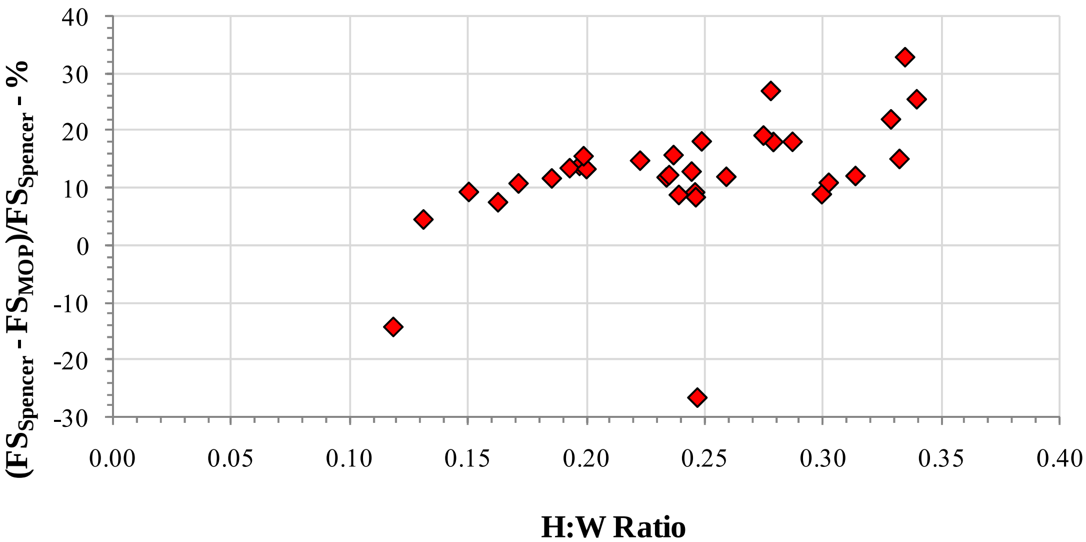


Figure 5.8: Relationship between the H:W ratio and the relative difference in the factor of safety from the Method of Planes and Spencer's procedure.

5.5. ANALYSES WITH TENSION CRACKS

The analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure indicated tensile stresses were present near the crest of the slope in several of the cross sections analyzed, particularly for the Orleans Parish Lakefront (2) cross section. The presence of tension is reasonable due to the significant cohesion values assigned to the materials near the ground surface. Analyses were performed with and without tension cracks to examine the effect of a tension crack on the factors of safety. Analyses were performed with both the force equilibrium procedure with horizontal side forces and Spencer's procedure. A comparison was then made between the results from analyses with tension cracks included and the Method of Planes, which does not accommodate a tension crack, to establish if introducing a tension crack has a noticeable effect on the differences in the factors of safety reported in Tables 5.1 and 5.2.

5.5.1. Force Equilibrium Procedure with Horizontal Side Forces

For analyses with tension cracks, tension cracks were placed to a depth that eliminated both negative side forces and negative normal stresses on the slip surface. The depths were determined by trial and error procedures.

The results from the analyses performed with tension cracks and the force equilibrium procedure with horizontal side forces are presented in Table 5.3. The factors of safety obtained with no tension cracks (tension allowed) are titled “F.S. – No Tension Crack,” and the factors of safety computed with a tension crack are titled “F.S. – Tension Crack.” The depth of the tension crack required in the analysis of each slip surface is included in Table 5.3.

In general, the effect of accounting for a tension crack had a minor effect on the factor of safety, as the differences in the factor of safety were generally less than 8%. The Orleans Parish Lakefront (2) cross section was the only case where eliminating tension had a significant effect on the factor of safety. In that case, the differences in the factors of safety were about 20% for the two slip surfaces analyzed. The relatively low undrained shear strength (80 psf) assigned to the layer between elevations +3.0 ft and -2.0 ft, which was discussed previously, is believed to be responsible for the significant amount of tension present near the crest of the slope.

To further understand the effect of a tension crack in analyses with the force equilibrium procedure with horizontal side forces, additional analyses were performed for the slip surface from the Harvey Canal cross section. The Harvey Canal cross section was selected because except for the Orleans Parish Lakefront (2) cross section, the largest difference (8%) in the factor of safety with and with a tension crack was observed for this case.

Table 5.3: Results of analyses with and without tension cracks using the force equilibrium procedure with horizontal side forces.

Location	Flood/Protected Side Analysis	Depth of Tension Crack (ft)	F.S. - No Tension Crack	F.S. - Tension Crack	$(FS_{No\ Crack} - FS_{Crack})/FS_{No\ Crack}$ - %
	Protected (A1)	6.29	1.273	1.216	4.5
Citrus Back Levee	Protected (A2)	6.29	1.304	1.253	3.9
G.I.W.W. - Michoud Canal	Flood	5.45	1.323	1.29	2.5
	Flood (A1)	No Crack	1.242	1.242	0
	Flood (A2)	No Crack	1.246	1.246	0
	Flood (A3)	No Crack	1.248	1.248	0
	Flood (A4)	No Crack	1.246	1.246	0
	Flood (B1)	No Crack	1.294	1.294	0
	Protected (D1)	8.10	1.292	1.251	3.2
City Price to Venice	Protected (D2)	8.10	1.357	1.323	2.5
Phoenix to Bohemia	Protected	3.28	1.395	1.385	0.7
South Point to G.I.W.W.	Protected	No Crack	1.341	1.341	0
City Price to Tropical Bend	Protected	7.32	0.944	0.927	1.8
Orleans Parish Lakefront	Protected	5.02	1.33	1.291	2.9
Jefferson Parish Lakefront - Reach B	Protected	9.50	0.975	0.948	2.8
Citrus Lakefront	Flood	8.03	1.919	1.901	0.9
Along MRGO - Violet Line	Flood	No Crack	1.388	1.388	0
Harvey Canal	Flood	7.74	1.296	1.192	8.0
New Orleans Lakefront Airport	Protected	3.02	2.983	2.953	1.0
South Point to G.I.W.W. (2)	Flood	No Crack	1.356	1.356	0
City Price to Tropical Bend (2)	Flood	4.44	1.302	1.274	2.2
	Protected (B1)	11.50	1.322	1.034	21.8
Orleans Parish Lakefront (2)	Protected (B3)	11.08	1.322	1.084	18.0
Along MRGO - Violet Line (2)	Flood	0.87	1.501	1.499	0.1
Westminster	Protected	2.93	1.301	1.285	1.2
	Flood (J2)	No Crack	1.536	1.536	0
Bayou St. John	Flood (L2)	No Crack	1.52	1.52	0
	Protected	8.24	1.094	1.059	3.2
Jefferson Parish Lakefront - Reach A	Flood	9.54	1.358	1.346	0.9
Jefferson Parish Lakefront - Reach B	Flood	8.00	0.882	0.856	2.9
	Protected	11.50	0.89	0.864	2.9
Jefferson Parish Lakefront - Reach C	Flood	6.43	1.153	1.108	3.9

Both the horizontal side force acting on the right side of each slice and the effective normal stresses acting on the slip surface were examined in order to see if the distribution or magnitude of those forces and stresses were affected when tension was eliminated. The horizontal side force is plotted versus distance in Figure 5.9, and the effective normal stress is plotted versus distance in Figure 5.10. As expected, the tension crack eliminated negative side forces and effective normal stresses around the "active" zone of the slope; however, the distribution and magnitude of the side forces and normal stresses were not affected in any other section of the soil mass when a tension crack was introduced.

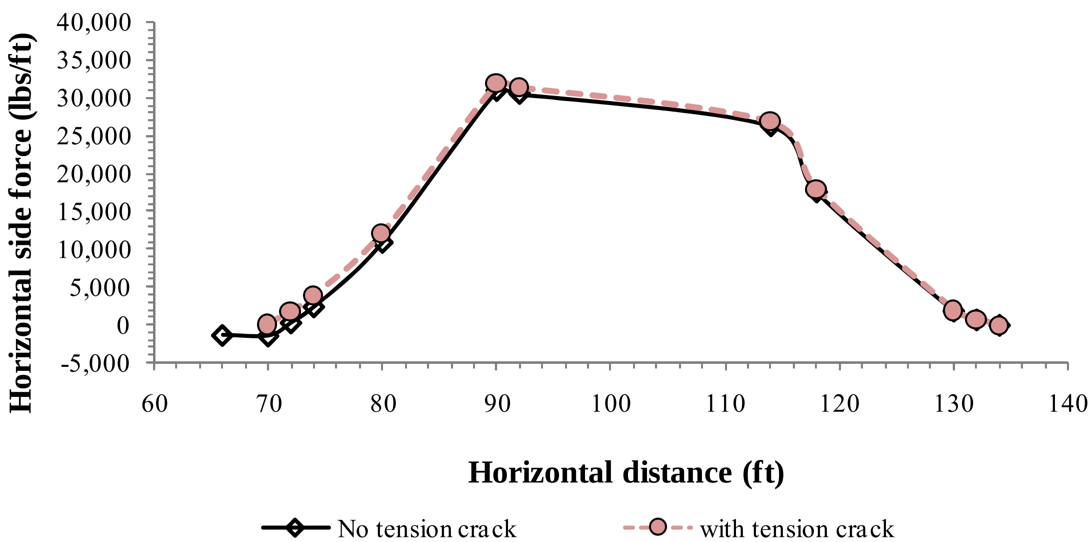


Figure 5.9: Horizontal side force acting on the right side of each slice (Harvey Canal).

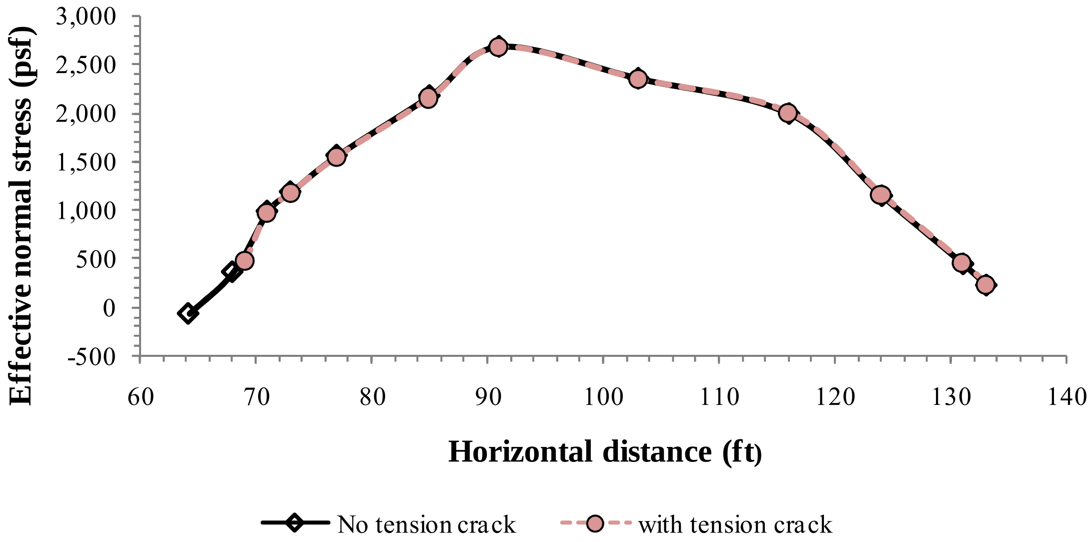


Figure 5.10: Effective normal stress acting on the base of the slip surface (Harvey Canal cross section).

The results of analyses with tension cracks are compared with the results from the Method of Planes in Table 5.4. While it was shown in Table 5.1 that the results from the force equilibrium procedure with horizontal side forces procedure are very similar to – and in the case of $\phi = 0°$, identical to – the results from the Method of Planes, the two procedures do not produce similar results when a tension crack is introduced.

Including a tension crack in the analysis with the force equilibrium procedure caused the factor of safety to be lower than that from the Method of Planes, although the difference was generally less than 10%. The one case where introducing a tension crack had a significiant effect on the factor of safety was the Orleans Parish Lakefront (2) cross section, as the factor of safety from the force equilibrium procedure was 25% lower than the factor of safety computed by the Method of Planes.

Table 5.4: Results of analyses with the force equilibrium procedure with horizontal side forces (with tension cracks) and the Method of Planes.

Location	Flood/Protected Side Analysis	Frictional Material Present?	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Force Equilibrium procedure with horiz side forces	$(FS_{ForceEq} - FS_{MOP})/FS_{ForceEq}$ - %
Citrus Back Levee	Protected (A1)	No	1.27	1.22	-4.1
	Protected (A2)	No	1.30	1.25	-4.0
G.I.W.W. - Michoud Canal	Flood	No	1.32	1.29	-2.3
City Price to Venice	Flood (A1)	Yes	1.27	1.24	-2.4
	Flood (A2)	Yes	1.26	1.25	-0.8
	Flood (A3)	Yes	1.24	1.25	0.8
	Flood (A4)	Yes	1.24	1.25	0.8
	Flood (B1)	Yes	1.25	1.29	3.1
	Protected (D1)	Yes	1.31	1.25	-4.8
	Protected (D2)	Yes	1.37	1.32	-3.8
Phoenix to Bohemia	Protected	Yes	1.31	1.39	5.8
South Point to G.I.W.W.	Protected	No	1.34	1.34	0.0
City Price to Tropical Bend	Flood	Yes	0.95	0.93	-2.2
Orleans Parish Lakefront	Protected	Yes	1.32	1.29	-2.3
Jefferson Parish Lakefront - Reach B	Protected	No	0.97	0.95	-2.1
Citrus Lakefront	Flood	Yes	1.78	1.90	6.3
Along MRGO - Violet Line	Flood	No	1.39	1.39	0.0
Harvey Canal	Flood	No	1.30	1.19	-9.2
New Orleans Lakefront Airport	Protected	Yes	2.97	2.95	-0.7
South Point to G.I.W.W. (2)	Flood	Yes	1.35	1.36	0.7
City Price to Tropical Bend (2)	Flood	Yes	1.30	1.27	-2.4
Orleans Parish Lakefront (2)	Protected (B1)	Yes	1.29	1.03	-25.2
	Protected (B3)	Yes	1.29	1.08	-19.4
Along MRGO - Violet Line (2)	Flood	No	1.50	1.50	0.0
Westminster	Protected	No	1.30	1.29	-0.8
Bayou St. John	Flood (J2)	Yes	1.50	1.54	2.6
	Flood (L2)	Yes	1.50	1.52	1.3
Jefferson Parish Lakefront - Reach A	Protected	No	1.09	1.06	-2.8
	Flood	No	1.36	1.35	-0.7
Jefferson Parish Lakefront - Reach B	Flood	No	0.88	0.86	-2.3
Jefferson Parish Lakefront - Reach C	Protected	No	0.89	0.86	-3.5
	Flood	No	1.15	1.11	-3.6

5.5.2. Spencer's Procedure

Similar analyses to those with the force equilibrium procedure were also performed with Spencer's procedure. Tension cracks were placed to a depth that eliminated negative side forces and negative normal stresses acting on the slip surface. The depths were again determined by trial and error procedures. Table 5.5 includes the tension crack depths necessary to eliminate negative side forces and negative normal stresses acting on the slip surface, as well as the corresponding values for the factors of safety when tension was considered and eliminated.

Except for the Orleans Parish Lakefront (2) cross section, tension cracks had very little effect on the factor of safety; in fact, the factors of safety determined by Spencer's procedure were less affected by the inclusion of a tension crack than those computed by the force equilibrium procedure with horizontal side forces. The differences in the factor of safety in every case except the Orleans Parish Lakefront (2) cross section ranged from 0% to 3%. As with the force equilibrium procedure with horizontal side forces, the Orleans Parish Lakefront (2) cross section was the only case where eliminating tension had a noticeable effect on the factor of safety. The differences in the factors of safety with and without a tension crack were about 10% to 15% for the two slip surfaces analyzed for the Orleans Parish Lakefront (2) site.

Further analyses were performed on the slip surface from the flood side analysis of the Jefferson Parish Lakefront – Reach C cross section to observe if any of the following were significantly affected in the process of eliminating tension in analyses with Spencer's procedure:

1. Magnitude and distribution of effective normal stresses acting on the slip surface.
2. Magnitude and distribution of horizontal side forces
3. Location of horizontal side forces

The Jefferson Parish Lakefront – Reach C cross section was selected because except for the Orleans Parish Lakefront (2) cross section, the largest difference (3%) in the factor of safety with and with a tension crack was observed for this cross section.

The effective normal stress, horizontal side force, and location of the horizontal side force with and without a tension crack are plotted against distance in Figures 5.11, 5.12, and 5.13, respectively. Although the tension crack affected the normal stresses, side forces, and location of side forces in a small region near the crest of the slope, the normal stresses, side forces, and location of side forces were not affected in any other section of the soil mass when a tension crack was introduced.

Table 5.5: Results of analyses with and without a tension crack using Spencer's procedure.

Location	Flood/Protected Side Analysis	Depth of Tension Crack (ft)	F.S. - No Tension Crack	F.S. - Tension Crack	$(FS_{No\ Crack} - FS_{Crack})/FS_{No\ Crack}$ - %
Citrus Back Levee	Protected (A1)	6.29	1.395	1.382	0.9
	Protected (A2)	6.29	1.433	1.408	1.7
G.I.W.W. - Michoud Canal	Flood	4.66	1.499	1.487	0.8
City Price to Venice	Flood (A1)	5.79	1.55	1.543	0.5
	Flood (A2)	5.95	1.496	1.488	0.5
	Flood (A3)	5.07	1.44	1.435	0.3
	Flood (A4)	5.35	1.368	1.361	0.5
	Flood (B1)	6.26	1.445	1.444	0.1
	Protected (D1)	8.1	1.491	1.487	0.3
	Protected (D2)	8.09	1.555	1.538	1.1
Phoenix to Bohemia	Protected	2.55	1.621	1.618	0.2
South Point to G.I.W.W.	Protected	6.17	1.636	1.633	0.2
City Price to Tropical Bend	Protected	6.23	1.218	1.216	0.2
Orleans Parish Lakefront	Protected	4.39	1.505	1.484	1.4
Jefferson Parish Lakefront - Reach B	Protected	10.06	1.064	1.05	1.3
Citrus Lakefront	Flood	6.89	2.65	2.65	0.0
Along MRGO - Violet Line	Flood	1.37	1.866	1.866	0.0
Harvey Canal	Flood	6.34	1.462	1.445	1.2
New Orleans Lakefront Airport	Protected	3	4.066	4.058	0.2
South Point to G.I.W.W. (2)	Flood	6.33	1.55	1.532	1.2
City Price to Tropical Bend (2)	Flood	5.36	1.526	1.503	1.5
Orleans Parish Lakefront (2)	Protected (B1)	11.5	1.133	1.019	10.1
	Protected (B3)	10.24	1.321	1.127	14.7
Along MRGO - Violet Line (2)	Flood	1.05	1.731	1.729	0.1
Westminster	Protected	2.46	1.458	1.448	0.7
Bayou St. John	Flood (J2)	7.79	1.699	1.675	1.4
	Flood (L2)	8.7	1.833	1.826	0.4
Jefferson Parish Lakefront - Reach A	Protected	8.24	1.284	1.28	0.3
	Flood	8.7	1.611	1.605	0.4
Jefferson Parish Lakefront - Reach B	Flood	7.59	0.952	0.935	1.8
Jefferson Parish Lakefront - Reach C	Protected	11.5	0.972	0.96	1.2
	Flood	6.22	1.205	1.169	3.0

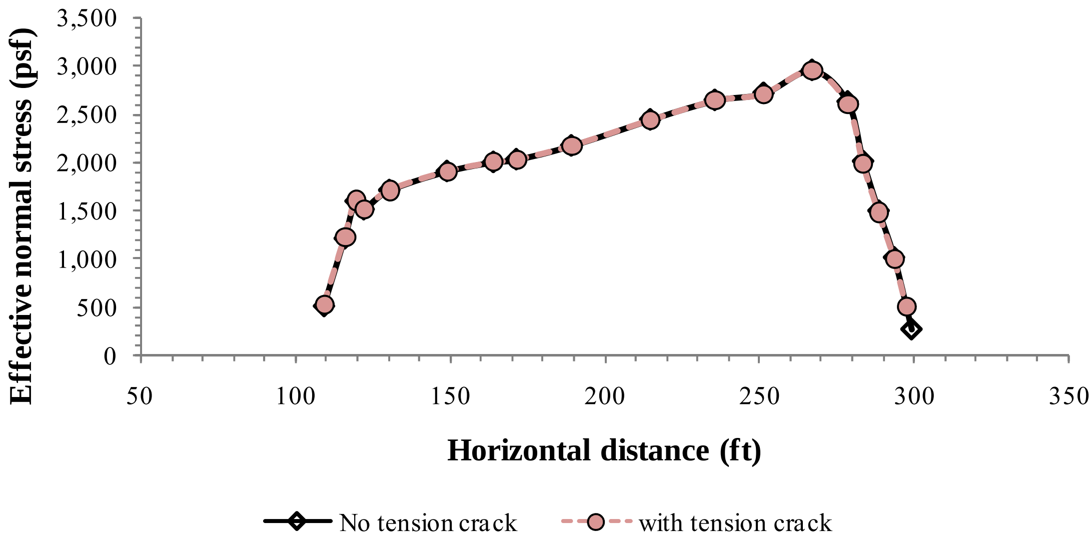


Figure 5.11: Effective normal stresses acting on the base of the slip surface (Jefferson Parish Lakefront – Reach C).

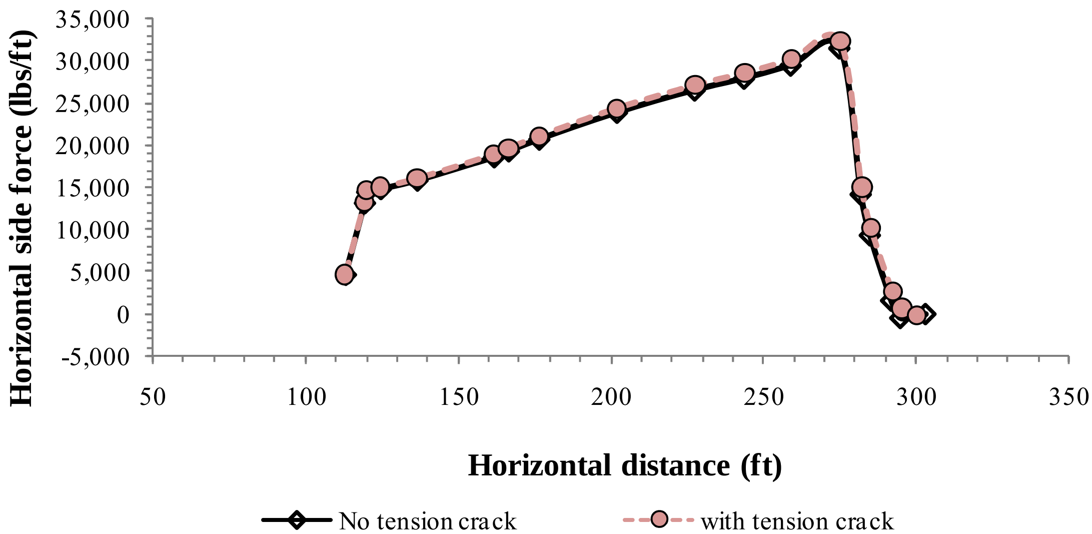


Figure 5.12: Horizontal side force acting on the right side of each slice (Jefferson Parish Lakefront – Reach C).

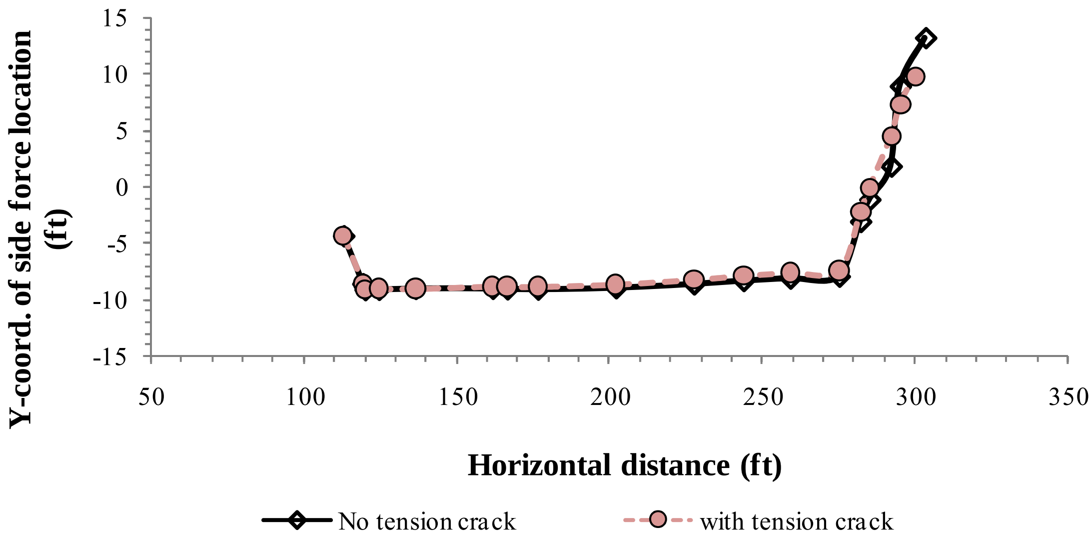


Figure 5.13: Location of horizontal side forces (Jefferson Parish Lakefront – Reach C).

The results of analyses with tension cracks are compared with the results from the Method of Planes with no tension cracks in Table 5.6. In all but one case, a higher factor of safety was computed with Spencer's procedure than the Method of Planes, even when a tension crack was included in the analyses. The one instance where introducing a tension crack considerably influenced the factor of safety was the Orleans Parish Lakefront (2) cross section. When tension cracks were included in the analyses for the Orleans Parish Lakefront (2) cross section, the factors of safety were 27% and 14% lower than the factors from the Method of Planes for the same slip surfaces, proving that including tension cracks in analyses with Spencer's procedure could produce factors of safety that are considerably lower than those from the Method of Planes.

Table 5.6: Results of analyses with Spencer's procedure (with tension cracks) and the Method of Planes.

Location	Flood/Protected Side Analysis	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Spencer's procedure	$(FS_{Spencer} - FS_{MOP})/FS_{Spencer}$ - %
Citrus Back Levee	Protected (A1)	1.27	1.38	8.0
	Protected (A2)	1.30	1.41	7.8
G.I.W.W. - Michoud Canal	Flood	1.32	1.49	11.4
City Price to Venice	Flood (A1)	1.27	1.54	17.5
	Flood (A2)	1.26	1.49	15.4
	Flood (A3)	1.24	1.44	13.9
	Flood (A4)	1.24	1.36	8.8
	Flood (B1)	1.25	1.44	13.2
	Protected (D1)	1.31	1.49	12.1
	Protected (D2)	1.37	1.54	11.0
Phoenix to Bohemia	Protected	1.31	1.62	19.1
South Point to G.I.W.W.	Protected	1.34	1.63	17.8
City Price to Tropical Bend	Flood	0.95	1.22	22.1
Orleans Parish Lakefront	Protected	1.32	1.48	10.8
Jefferson Parish Lakefront - Reach B	Protected	0.97	1.05	7.6
Citrus Lakefront	Flood	1.78	2.65	32.8
Along MRGO - Violet Line	Flood	1.39	1.87	25.7
Harvey Canal	Flood	1.30	1.45	10.3
New Orleans Lakefront Airport	Protected	2.97	4.06	26.8
South Point to G.I.W.W. (2)	Flood	1.35	1.53	11.8
City Price to Tropical Bend (2)	Flood	1.30	1.5	13.3
Orleans Parish Lakefront (2)	Protected (B1)	1.29	1.02	-26.5
	Protected (B3)	1.29	1.13	-14.2
Along MRGO - Violet Line (2)	Flood	1.50	1.73	13.3
Westminster	Protected	1.30	1.45	10.3
Bayou St. John	Flood (J2)	1.50	1.68	10.7
	Flood (L2)	1.50	1.83	18.0
Jefferson Parish Lakefront - Reach A	Protected	1.09	1.28	14.8
	Flood	1.36	1.61	15.5
Jefferson Parish Lakefront - Reach B	Flood	0.88	0.94	6.4
Jefferson Parish Lakefront - Reach C	Protected	0.89	0.96	7.3
	Flood	1.15	1.17	1.7

5.5.3. Discussion

As a result of the analyses with and without a tension crack, a tension crack was assumed for the Orleans Parish Lakefront (2) cross section, while it was neglected in all other cross sections in analyses performed with the force equilibrium procedure with horizontal side forces and Spencer's procedure in this thesis (i.e., a tension crack was introduced *only* for analyses of the Orleans Parish Lakefront (2) cross section). For all other cross sections, tension cracks were not included to simplify the analyses.

5.6. SUMMARY

Analyses with the force equilibrium procedure with horizontal side forces showed that the Method of Planes is identical to the force equilibrium procedure with horizontal side forces for slip surfaces that pass through only cohesive ($\phi = 0°$) material. The only differences in the factors of safety from the force equilibrium procedure with horizontal side forces and the Method of Planes occurred in cases where the slip surface passed though frictional ($\phi > 0°$) material. Even then the greatest difference was only 7%.

When analyses were performed with Spencer's procedure, the resulting factors of safety were higher than the factors of safety from the Method of Planes in all but one case. The differences in the factors of safety from Spencer's procedure and the Method of Planes varied widely, from 2% to 33%, and the differences in the factor of safety increased as the depth of the critical slip surface from the Method of Planes increased.

Introducing a tension crack in analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure did not have a considerable effect on the computed factor of safety in all but two cases. However, in those two cases, considering a tension crack in analyses with Spencer's procedure resulted in the Method of Planes underestimating the factor of safety by as much as 27%. While considering a tension crack is the standard in engineering practice, a tension crack was *not* considered out of convenience in all subsequent analyses if the tension crack had a minor effect on the factor of safety. However, if the tension crack had a considerable effect on the factor of safety, a tension crack was considered.

Chapter 6: Analyses with Circular Slip Surfaces and Comparison with Method of Planes Solutions

Analyses were performed with circular slip surfaces for the twenty earthen levee cross sections. The procedures used were:

- Spencer's procedure
- Force equilibrium procedure with horizontal side forces
- Simplified Bishop procedure

The results of analyses with these procedures are presented in this chapter. Spencer's and the Simplified Bishop procedures were used to locate the circular slip surface with the minimum factor of safety, while the force equilibrium procedure with horizontal side forces was only utilized to analyze the critical circles found using Spencer's procedure. The force equilibrium procedure with horizontal side forces was used as an equivalent to the Method of Planes for analyses of the circular slip surfaces because the Method of Planes is restricted to analysis of a three-part, noncircular slip surface. The force equilibrium procedure with horizontal side forces and the Method of Planes were found to produce very similar factors of safety for the analyses presented in Chapter 5. Searches for the critical circles and the calculations for each procedure were performed using UTEXAS4.

In this chapter, the results from searches and analyses for the critical circle with Spencer's procedure are compared with the minimum factor of safety from the Method of Planes and results from the force equilibrium procedure with horizontal side forces. Finally, searches and analyses were performed with the Simplified Bishop procedure and the results are compared to the results from Spencer's procedure. This was done to serve as a "check" for the results from Spencer's procedure, as previous experience has shown that the Simplified Bishop procedure computes factors of safety that agree well with the factors of safety from limit equilibrium procedures that completely satisfy static equilibrium when circular slip surfaces are considered (Duncan and Wright, 2005).

6.1. Search Scheme Used to Locate the Critical Circle

A *floating grid* search scheme implemented in UTEXAS4 was used to locate the critical circles. The floating grid search scheme uses a square, nine point grid (3 x 3) to define the locations of the center points for the circular slip surfaces. The grid is moved and the spacing between grid points is reduced as the search proceeds until the grid reaches a minimum size and the lowest factor of safety is calculated for the center point in the nine point grid (Wright, 1999). The grid size is reduced until the points are separated by a *minimum grid spacing*, which is specified as input. To ensure the critical circle was located, a minimum grid spacing equal to 1% of the thickness of the thinnest stratum in the profile was used for the searches discussed in this chapter. The minimum grid spacings used for each levee location are listed in Table 6.1.

Table 6.1: Minimum grid spacings used to locate the critical circle.

Location	Flood/Protected Side Analysis	Minimum Grid Spacing (ft)
Citrus Back Levee	Protected	0.03
G.I.W.W. - Michoud Canal	Flood	0.03
	Flood	0.04
City Price to Venice	Protected	0.04
Phoenix to Bohemia	Protected	0.04
South Point to G.I.W.W.	Protected	0.05
City Price to Tropical Bend	Flood	0.03
Orleans Parish Lakefront	Protected	0.05
Jefferson Parish Lakefront - Reach B	Protected	0.05
Citrus Lakefront	Flood	0.06
Along MRGO - Violet Line	Flood	0.04
Harvey Canal	Flood	0.04
New Orleans Lakefront Airport	Protected	0.06
South Point to G.I.W.W. (2)	Flood	0.04
City Price to Tropical Bend (2)	Flood	0.02
Orleans Parish Lakefront (2)	Protected	0.01
Along MRGO - Violet Line (2)	Flood	0.06
Westminster	Protected	0.05
Bayou St. John	Flood	0.03
	Protected	0.1
Jefferson Parish Lakefront - Reach A	Flood	0.1
Jefferson Parish Lakefront - Reach B	Flood	0.05
	Protected	0.06
Jefferson Parish Lakefront - Reach C	Flood	0.06

6.2. Comparison of Results from Spencer's Procedure and the Method of Planes

The first series of analyses for the critical circle was performed with Spencer's procedure. The results of the analyses are presented in Table 6.2 along with the minimum factor of safety computed by the Method of Planes and the factor of safety from Spencer's procedure for the slip surface from the Method of Planes. The factors of safety by the Method of Planes were obtained from analyses performed at UT Austin by the writer. In several locations, more than one critical slip surface was reported by the USACE in their analyses with the Method of Planes (e.g., City Price to Venice). In those cases, the factor of safety for the critical circle was compared with the *lowest* factor of safety from analyses with the Method of Planes.

In all but one case presented in Table 6.2, the factor of safety for the critical circle from Spencer's procedure was higher than the minimum factor of safety determined by the Method of Planes. For the cases where the factor of safety for the critical circle was higher than the factor of safety from the Method of Planes, the relative differences in the factor of safety ranged from 1% (Along MGRO – Violet Line) to 15% (Phoenix to Bohemia and Bayou St. John). The only case where the factor of safety for the critical circle was lower than the factor of safety for the Method of Planes was for the Orleans Parish Lakefront (2) site. In that case, a tension crack was introduced in the analyses with circles to eliminate a large amount of the tension near the crest of the slope.

For over half the cases presented in Table 6.2, the locations of the critical circle from Spencer's procedure and the critical slip surface from the Method of Planes were similar. An example of this result is presented in Figure 6.1. The locations of the critical circle and the critical slip surface from the Method of Planes for each cross section are plotted in Appendix E.

Table 6.2: Results of analyses by the Method of Planes and Spencer's procedure.

Location	Location No.	Flood/Protected Side Analysis	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Spencer's procdure	Critical Circle: Spencer's procedure	$(FS_{Circle} - FS_{MOP})/FS_{Circle}$ - %
Citrus Back Levee	1	Protected	1.27	1.40	1.36	6.6
G.I.W.W. - Michoud Canal	2	Flood	1.32	1.50	1.40	5.7
	3	Flood	1.24	1.37	1.32	6.1
City Price to Venice	4	Protected	1.31	1.49	1.41	7.1
Phoenix to Bohemia	5	Protected	1.31	1.62	1.54	14.9
South Point to G.I.W.W.	6	Protected	1.34	1.64	1.46	8.2
City Price to Tropical Bend	7	Flood	0.95	1.22	1.05	9.5
Orleans Parish Lakefront	8	Protected	1.32	1.51	1.51	12.6
Jefferson Parish Lakefront - Reach B	9	Protected	0.97	1.06	1.09	11.0
Citrus Lakefront	10	Flood	1.78	2.65	1.93	7.8
Along MRGO - Violet Line	11	Flood	1.39	1.87	1.41	1.4
Harvey Canal	12	Flood	1.30	1.46	1.46	11.0
New Orleans Lakefront Airport	13	Protected	2.97	4.07	3.16	6.0
South Point to G.I.W.W. (2)	14	Flood	1.35	1.55	1.48	8.8
City Price to Tropical Bend (2)	15	Flood	1.30	1.53	1.43	9.1
Orleans Parish Lakefront (2)	16	Protected	1.29	1.13	1.16	-11.2
Along MRGO - Violet Line (2)	17	Flood	1.50	1.73	1.68	10.7
Westminster	18	Protected	1.30	1.46	1.50	13.3
Bayou St. John	19	Flood	1.50	1.70	1.76	14.8
	20	Protected	1.09	1.28	1.26	13.5
Jefferson Parish Lakefront - Reach A	21	Flood	1.36	1.61	1.43	4.9
Jefferson Parish Lakefront - Reach B	22	Flood	0.88	0.95	0.98	10.2
	23	Protected	0.89	0.97	1.00	11.0
Jefferson Parish Lakefront - Reach C	24	Flood	1.15	1.21	1.32	12.9

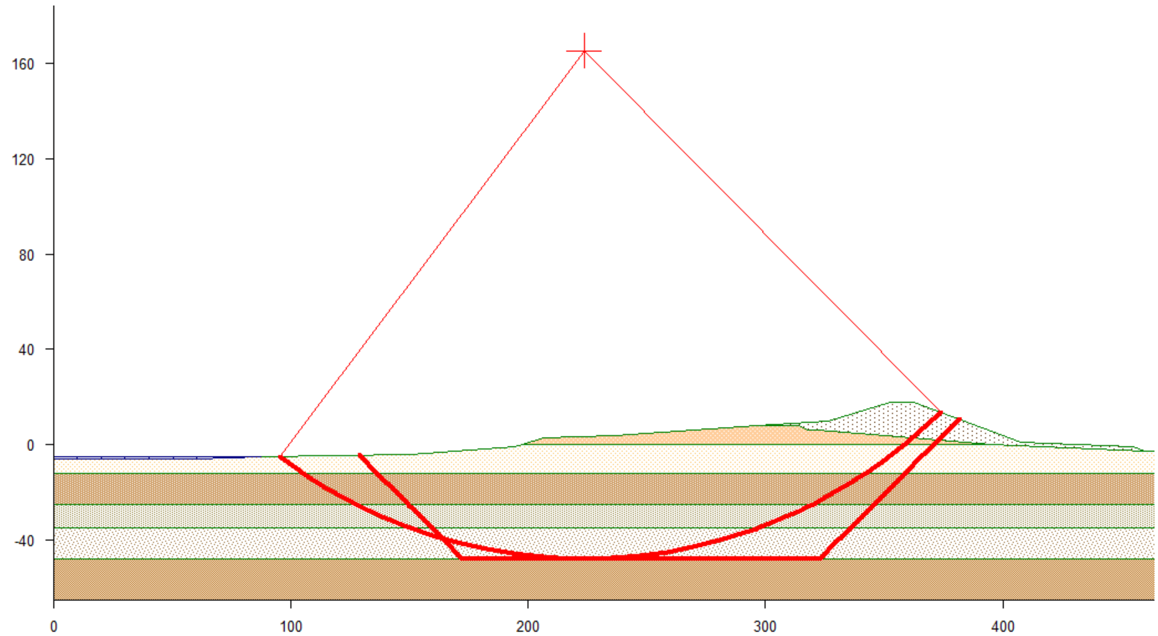


Figure 6.1: Critical circle from Spencer's procedure and critical slip surface from the Method of Planes (Jefferson Parish Lakefront – Reach A).

While the factor of safety for the critical circle by Spencer's procedure was generally higher than the minimum factor of safety from the Method of Planes, the relative differences in the factors of safety were not as large as the relative differences when the slip surfaces from the Method of Planes were analyzed with Spencer's procedure (Chapter 5). Searching for a more critical slip surface with a different shape than the one from the Method of Planes caused the relative differences in the factor of safety to decrease for these cross sections.

To examine the differences in the factor of safety from the Method of Planes and Spencer's procedure a bar chart was generated (Figure 6.2) that contains the differences in the factors of safety from both procedures when the three-part slip surface from the Method of Planes was analyzed and analyses were performed for the critical circle with Spencer's procedure. The x-axis of the bar chart contains a "location number" that corresponds to a location in Table 6.2. For each location number, there is a black bar and a red bar. The black bar represents the relative difference in the factor of safety when the three-part “wedge” from the Method of Planes was analyzed with both procedures, and the red bar represents the relative difference in the factor of safety for the critical circle from Spencer’s procedure and the minimum factor of safety computed by the Method of Planes. It is shown in Figure 6.2 that when critical slip surfaces are analyzed by respective procedures (i.e. three-part “wedge” by the Method of Planes and critical circle by Spencer’s procedure), the differences in the factor of safety are smaller than the cases where the “wedge” was analyzed by both procedures.

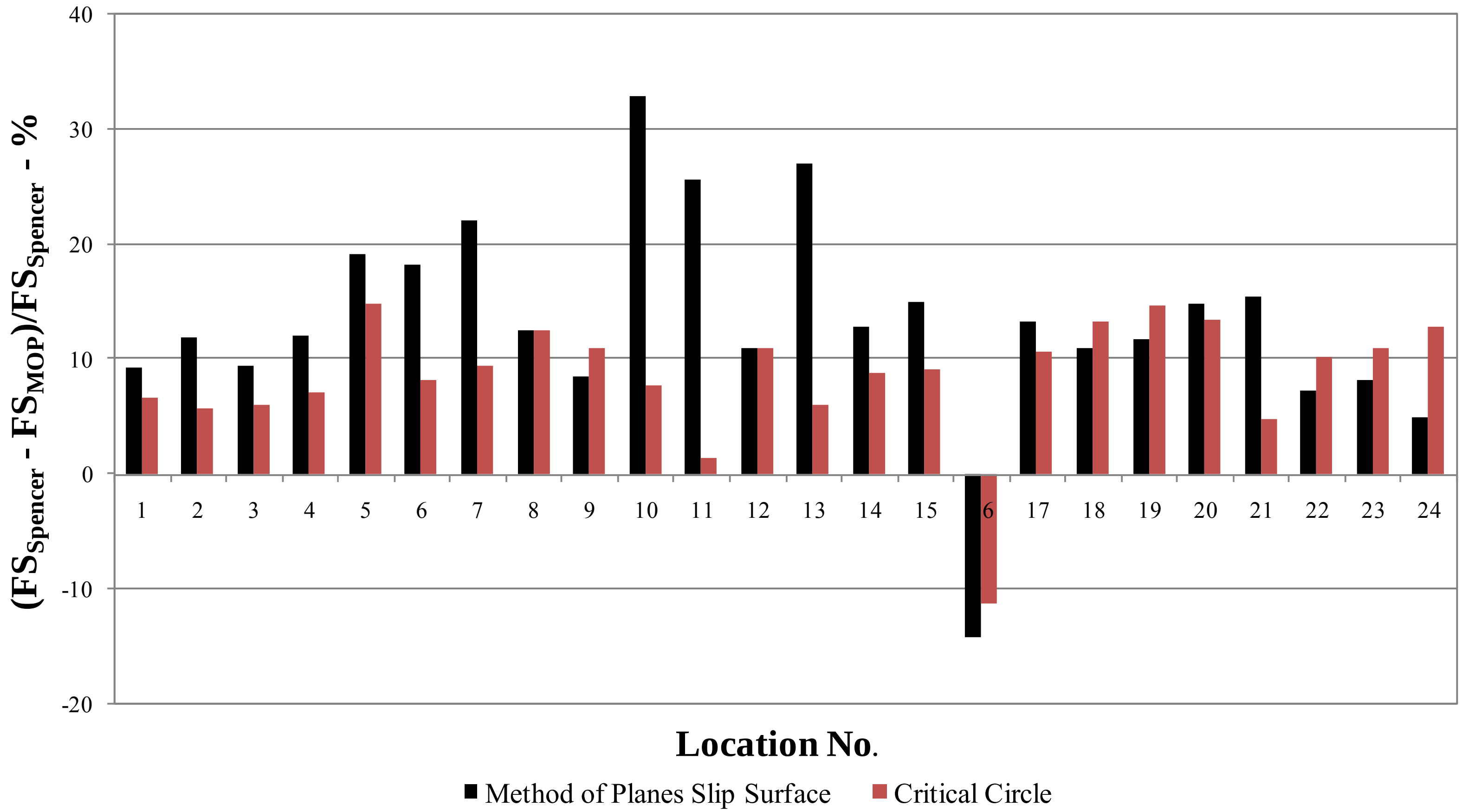


Figure 6.2: Differences in the factors of safety from Spencer's procedure and the Method of Planes for the three-part "wedge" from the Method of Planes and the critical circle from Spencer's procedure.

6.3. Comparison of Results from Spencer's Procedure and the Force Equilibrium Procedure with Horizontal Side Forces

The differences in the factors of safety in Table 6.2 reflect the combined effect of different slip surfaces (Method of Planes slip surface vs. critical circle) analyzed with different analysis procedures (Method of Planes vs. Spencer's procedure). To better understand the differences in the factors of safety, the critical circles from Spencer's procedure were also analyzed using the force equilibrium procedure with horizontal side forces. The results of the analyses with Spencer's procedure and the force equilibrium procedure for the critical circles found by Spencer's procedure are summarized in Table 6.3. Results with Spencer's procedure and the force equilibrium procedure are also shown for the critical slip surfaces from the Method of Planes. In all cases except one, the factor of safety from Spencer's procedure was higher than that from the force equilibrium procedure with horizontal side forces. When the factor of safety from Spencer's procedure was greater than the factor of safety from the force equilibrium procedure, the differences in the factors of safety ranged from 2% to 11% for the analyses with circles. The one case was the Orleans Parish Lakefront (2) cross section where a higher factor of safetywas computed by the force equilibrium procedure than Spencer's procedure because a tension crack was introduced to eliminate tension near the crest of the slope.

For a given location, if the relative difference in the factor of safety for the critical circle was about the same as the relative difference in the factor of safety for the slip surface from the Method of Planes, the differences in the factor of safety would be attributed to the *mechanics* of Spencer's procedure and the force equilibrium procedure with horizontal side forces. However, if the relative difference in the factor of safety for the slip surfaces analyzed were off by a considerable amount, the difference in the factor of safety would be credited to the *shape* of the slip surface. For over half the cases presented in Table 6.3, the difference in the factor of safety from analyses for the slip surface from the Method of Planes was at least 50 percent greater than the difference in the factor of safety from analyses for the critical circle. This result suggests that for the majority of the cases, the differences in the factors of safety are due to the shape of the slip surface analyzed.

Another reason the relative differences in the factor of safety are smaller for the critical circles than for the critical slip surfaces from the Method of Planes is because of the inclination of the side forces computed by Spencer's procedure, which are included in Table 6.3. In all but five cases, the side force inclination computed by Spencer's procedure in analyses for the critical circle was flatter than the inclination computed for the critical slip surface from the Method of Planes. The relatively flat side force inclinations from Spencer's procedure resulted is a better agreement in the factors of safety from Spencer's procedure and the force equilibrium procedure with horizontal side forces for circles than the slip surfaces from the Method of Planes.

Table 6.3: Results of analyses for the critical circle found by Spencer's procedure using both Spencer's procedure and the force equilibrium procedure with horizontal side forces.

Location	Location No.	Flood/Protected Side Analysis	Critical Circle: Force Equilibrium procedure with horiz. side forces	Critical Circle: Spencer's procedure	Critical Circle: Side force inclination from Spencer's procedure (°)	Critical Circle: $(FS_{Spencer} - FS_{ForceEq})/FS_{Spencer}$ - %	Critical Slip Surface from Method of Planes: Force Equilibrium procedure with horiz. side forces	Critical Slip Surface from Method of Planes: Spencer's procedure	Critical Slip Surface from Method of Planes: Side force inclination from Spencer's procedure (°)	Critical Slip Surface from Method of Planes: $(FS_{Spencer} - FS_{ForceEq})/FS_{Spencer}$ - %
Citrus Back Levee	1	Protected	1.31	1.36	1.56	3.7	1.27	1.40	2.17	9.0
G.I.W.W. - Michoud Canal	2	Flood	1.33	1.40	2.28	5.0	1.32	1.50	2.95	12.0
	3	Flood	1.21	1.32	3.71	8.3	1.25	1.37	4.30	8.6
City Price to Venice	4	Protected	1.28	1.41	2.62	9.2	1.36	1.56	3.64	12.5
Phoenix to Bohemia	5	Protected	1.42	1.54	3.47	7.8	1.40	1.62	4.01	13.6
South Point to G.I.W.W.	6	Protected	1.36	1.46	2.95	6.8	1.34	1.64	3.80	18.1
City Price to Tropical Bend	7	Flood	1.00	1.05	7.05	4.8	0.94	1.22	5.40	22.8
Orleans Parish Lakefront	8	Protected	1.35	1.51	5.97	10.6	1.33	1.51	6.85	11.6
Jefferson Parish Lakefront - Reach B	9	Protected	1.03	1.09	1.75	5.5	0.98	1.06	2.24	7.9
Citrus Lakefront	10	Flood	1.77	1.93	3.82	8.3	1.92	2.65	3.78	27.5
Along MRGO - Violet Line	11	Flood	1.29	1.41	2.89	8.5	1.39	1.87	4.77	25.5
Harvey Canal	12	Flood	1.42	1.46	1.04	2.7	1.30	1.46	2.57	11.0
New Orleans Lakefront Airport	13	Protected	2.86	3.16	4.32	9.5	2.98	4.07	4.35	26.7
South Point to G.I.W.W. (2)	14	Flood	1.37	1.48	3.53	7.4	1.36	1.55	3.82	12.3
City Price to Tropical Bend (2)	15	Flood	1.32	1.43	3.82	7.7	1.30	1.53	3.92	14.8
Orleans Parish Lakefront (2)	16	Protected	1.19	1.16	-1.34	-2.6	1.03	1.02	-0.43	-1.0
Along MRGO - Violet Line (2)	17	Flood	1.59	1.68	5.14	5.4	1.50	1.73	3.71	13.3
Westminster	18	Protected	1.38	1.50	1.94	8.0	1.30	1.46	3.31	10.8
Bayou St. John	19	Flood	1.59	1.76	1.99	9.7	1.54	1.70	2.98	9.4
	20	Protected	1.20	1.26	2.05	4.8	1.09	1.28	4.39	15.1
Jefferson Parish Lakefront - Reach A	21	Flood	1.33	1.43	3.92	7.0	1.36	1.61	3.79	15.6
Jefferson Parish Lakefront - Reach B	22	Flood	0.96	0.98	2.03	2.0	0.88	0.95	2.36	7.6
	23	Protected	0.96	1.00	1.24	4.0	0.89	0.97	1.74	8.4
Jefferson Parish Lakefront - Reach C	24	Flood	1.25	1.32	2.70	5.3	1.15	1.21	2.23	4.6

6.4. Comparison of Results from the Simplified Bishop and Spencer's Procedures

Previous experience with the Simplified Bishop procedure has shown that the factors of safety calculated by the procedure agree favorably with those from limit equilibrium procedures that completely satisfy static equilibrium (Duncan and Wright, 2005). To confirm previous findings and to verify the results from Spencer's procedure, additional analyses were performed with the Simplified Bishop procedure to determine the critical circular slip surface and the minimum factor of safety. The factors of safety calculated by the Simplified Bishop procedure are presented in Table 6.4 with the factors of safety from Spencer's procedure. As expected, the factors of safety from both procedures are very similar. The greatest difference in the factor of safety is 4% which occurred for the analyses of the Orleans Parish Lakefront (2) cross section where a tension crack was introduced.

Table 6.4: Results of analyses for the critical circle with Spencer's and the Simplified Bishop procedures.

Location	Flood/Protected Side Analysis	Spencer's procedure	Simplified Bishop procedure	$(FS_{Spencer} - FS_{Bishop})/FS_{Spencer}$ - %
Citrus Back Levee	Protected	1.36	1.36	0.0
G.I.W.W. - Michoud Canal	Flood	1.40	1.40	0.0
City Price to Venice	Flood	1.32	1.32	0.0
	Protected	1.41	1.41	0.0
Phoenix to Bohemia	Protected	1.54	1.55	-0.6
South Point to G.I.W.W.	Protected	1.46	1.46	0.0
City Price to Tropical Bend	Flood	1.05	1.05	0.0
Orleans Parish Lakefront	Protected	1.51	1.51	0.0
Jefferson Parish Lakefront - Reach B	Protected	1.09	1.09	0.0
Citrus Lakefront	Flood	1.93	1.95	-1.0
Along MRGO - Violet Line	Flood	1.41	1.41	0.0
Harvey Canal	Flood	1.46	1.46	0.0
New Orleans Lakefront Airport	Protected	3.16	3.14	0.6
South Point to G.I.W.W. (2)	Flood	1.48	1.48	0.0
City Price to Tropical Bend (2)	Flood	1.43	1.43	0.0
Orleans Parish Lakefront (2)	Protected	1.16	1.21	-4.3
Along MRGO - Violet Line (2)	Flood	1.68	1.68	0.0
Westminster	Protected	1.50	1.50	0.0
Bayou St. John	Flood	1.76	1.76	0.0
Jefferson Parish Lakefront - Reach A	Protected	1.26	1.26	0.0
	Flood	1.43	1.43	0.0
Jefferson Parish Lakefront - Reach B	Flood	0.98	0.98	0.0
Jefferson Parish Lakefront - Reach C	Protected	1.00	1.00	0.0
	Flood	1.32	1.32	0.0

6.5. Summary

While in most cases the factors of safety for the critical circles were higher than the minimum factor of safety from the Method of Planes, the relative differences in the factors of safety were not as large as the cases where the three-part, noncircular slip surfaces from the Method of Planes were analyzed. When the slip surfaces from the Method of Planes were analyzed, the relative difference in the factors of safety from the Method of Planes and Spencer's procedure ranged from 5% to 33%. The relative difference in the factor of safety from the Method of Planes and Spencer's procedure ranged from only 1% to 15% when analyses with Spencer's procedure were performed for the critical circle. While it was shown in Chapter 5 that Spencer's procedure computed higher factors of safety than the Method of Planes for the three-part "wedge," the differences in the factors of safety from Spencer's procedure and the Method of Planes were smaller when a more critical shape for the slip surface, than that from the Method of Planes, was found.

Chapter 7: Analyses with Noncircular Slip Surfaces and Comparison with Analyses with Circles and the Method of Planes

A series of analyses was performed to locate a noncircular slip surface with a minimum factor of safety (i.e., the *critical noncircular slip surface*). Spencer's procedure was used to analyze the noncircular slip surfaces. The analyses consisted of several different searches with different starting points. The searches and the calculations for Spencer's procedure were performed using UTEXAS4. One search procedure that was used is a procedure introduced by Ardaman & Associates, Inc. (2008). The procedure is believed to currently be in use to analyze the stability of T-walls and earthen levees in New Orleans' hurricane protection system. To assess how effective the Ardaman procedure is in locating the critical noncircular slip surface in analyses for earthen levees, searches were performed with the Ardaman procedure and the results are compared with the results from other searches in this chapter.

In order to see if a noticeably more critical shape for the slip surface exists than a critical circle, the results of searches for the critical noncircular slip surface were compared with the results of searches for the critical circles in this chapter. A comparison was then made between the factor of safety for the critical noncircular slip surface and the minimum factor of safety for the Method of Planes to see how the solutions from the Method of Planes compare with the results from Spencer's procedure when a search is performed to locate a critical noncircular slip surface.

7.1. SEARCH ROUTINE EMPLOYED BY UTEXAS4

The noncircular search routine implemented in UTEXAS4 was used to locate a critical noncircular slip surface. The search scheme is based on the procedure first introduced by Celestino and Duncan (1981). The procedure requires several "trials" to locate the critical noncircular slip surface. Each "trial" is initiated by shifting each of the points along the slip surface to two new positions (Figure 7.1). The direction of shifting for each point is specified as input, and the new positions are *temporary* positions. Each time a point is shifted, all other points on the slip surface remain in their initial location, and a factor of safety is computed for the temporary position of the slip surface.

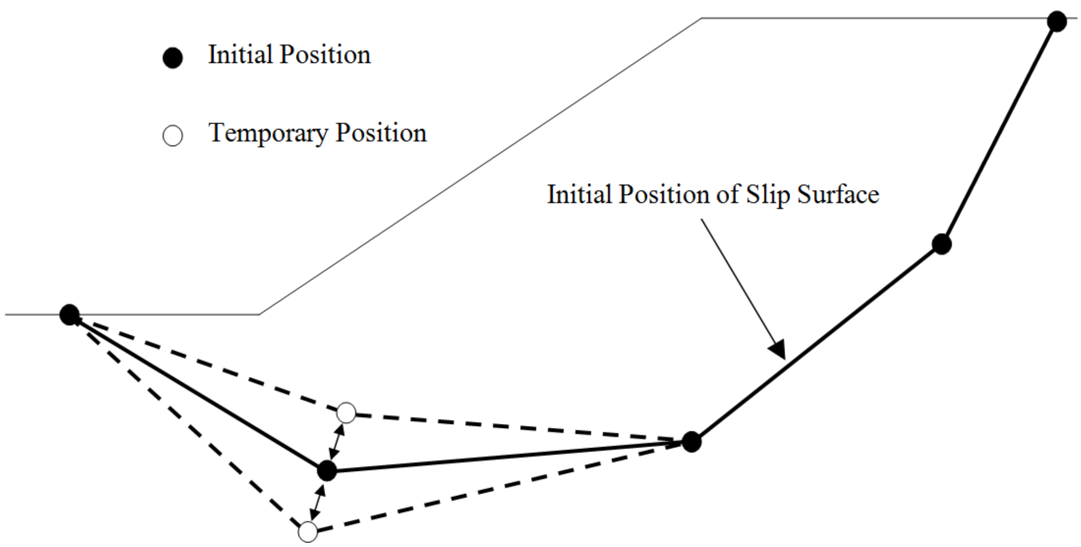


Figure 7.1: Shifting points according to Celestino and Duncan (1981).

Once each point on the slip surface has been shifted, an improved location estimated to produce a lower factor of safety is calculated using equations presented in Celestino and Duncan (1981), and each point is *permanently* moved (Figure 7.2). A single "trial" concludes after the slip surface is permanently moved. Additional “trials” are subsequently performed until a critical noncircular slip surface is located.

The initial temporary shift distance for each point is referred to as the *initial incremental shift distance* (Wright, 1999). After each “trial”, UTEXAS4 reduces the distance each point is temporarily shifted until the *final incremental shift distance* is reached. Both the initial and final incremental shift distances are specified as input data for UTEXAS4.

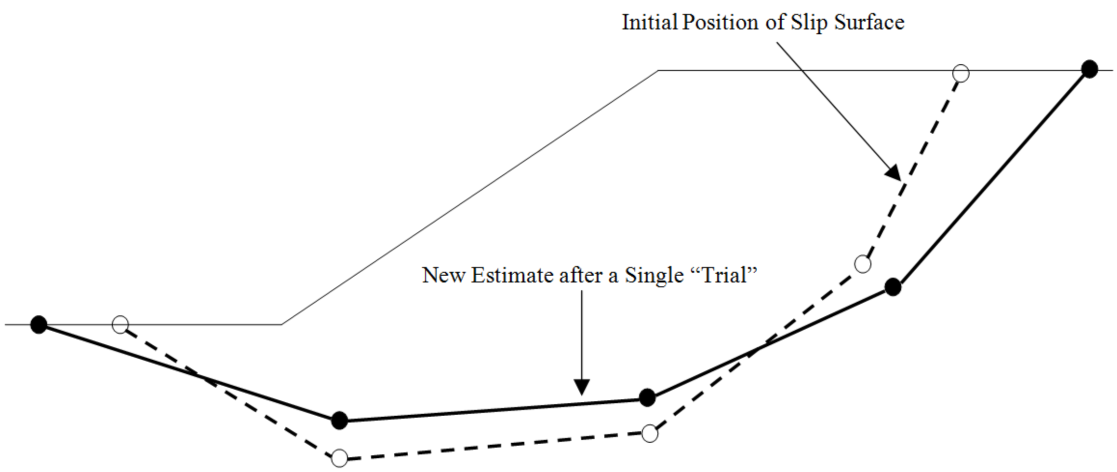


Figure 7.2: New estimate for the slip surface with the minimum factor of safety after a single “trial.”

7.2. TYPES OF NONCIRCULAR SEARCHES PERFORMED

Several different searches were performed in an attempt to find the noncircular slip surface that produced a minimum factor of safety. Searches were performed using two different starting slip surfaces. The first starting slip surface was the same as the critical circular slip surface identified in Chapter 6, and the second starting surface was the critical slip surface from the Method of Planes analyzed in Chapter 5. Searches were also performed using a procedure outlined by Ardaman & Associates, Inc. (2008). The details of each search are discussed in the following sections.

7.2.1. Searches starting with the Location of the Critical Circles

Searches were performed using the critical circle as a starting point, by selecting points along the critical circle where the circle intersected layer boundaries and the ground surface. A few points were also selected along the lower portion of the circle in the lowest layer.

Two different searches were performed using the critical circle as a starting point:

1. Type 1 search. In the Type 1 search, every point along the slip surface was shifted in a direction approximately normal to the slip surface. The points shifted and shift directions for each point in the Type 1 search are illustrated in Figure 7.3.
2. Type 2 search. The Type 2 search was performed by shifting points at layer boundaries horizontally, while the other points along the lower portion of the slip surface were shifted in a direction approximately normal to the slip surface. The points shifted and shift directions for each point are shown in Figure 7.4.

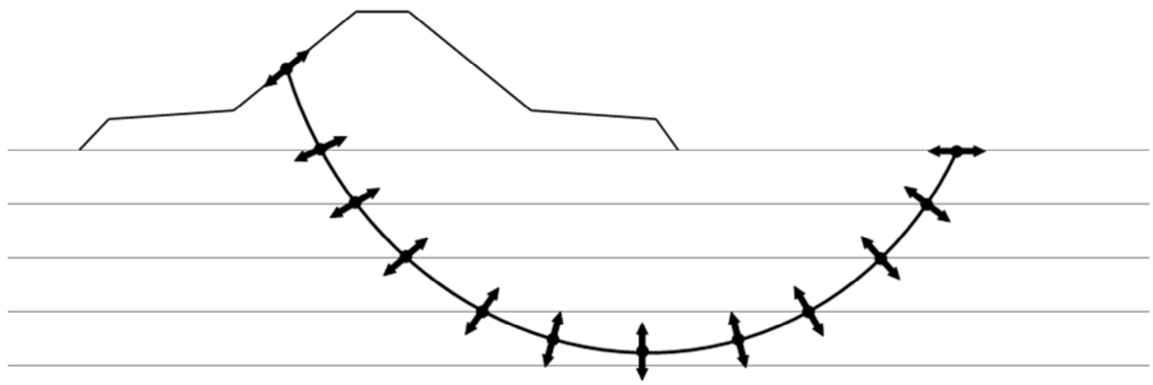


Figure 7.3: Points shifted and shift direction for each point in the Type 1 search with the critical circle.

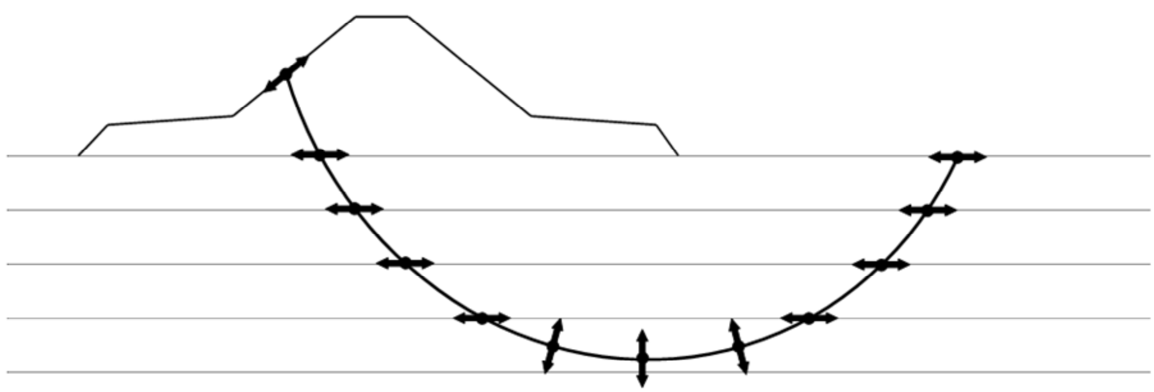


Figure 7.4: Points shifted and shift direction for each point in the Type 2 search with the critical circle.

For both the Type 1 and Type 2 searches, a seven (7) "step" process was followed to locate a critical noncircular slip surface. In the first "step", a search was performed and each point on the slip surface was allowed to move an initial distance of 20 feet and a final distance of 2 feet in the appropriate direction. The slip surface that resulted from the search in the first "step" was used for the starting location for the search in the second "step." The second "step" involved performing a search by allowing each point to move an initial distance of 15 feet and a final distance of 1.5 feet in the appropriate direction. The searches in all subsequent "steps" were performed using the refined slip surface from the search in the previous "step" as a starting location. The initial and final shift distances for the search associated with each "step" are summarized in Table 7.1.

Table 7.1: Initial and final shift distances for Type 1 and Type 2 searches.

"Step" No.	Initial shift distance (ft)	Final shift distance (ft)
1	20	2
2	15	1.5
3	10	1
4	6	0.5
5	4	0.3
6	2	0.15
7	1	0.05

7.2.2. Searches starting with the Location of the Critical Slip Surface from the Method of Planes

Two separate searches were performed using the critical slip surfaces from the Method of Planes as a starting point. In each case, points were once again defined where the slip surface intersected layer boundaries and the ground surface. Also, as was the case with searches using the critical circle as a starting point, two different searches were performed using the slip surface from the Method of Planes as a starting point:

1. Type 1 search. The Type 1 search was performed by shifting every point along the slip surface in a direction approximately normal to the slip surface. Additional points were defined along the base of the central

block. The shift direction of each point in the Type 1 search is shown in Figure 7.5.

2. Type 2 search. In the Type 2 search, each point along the slip surface was shifted in the horizontal direction, which is illustrated in Figure 7.6. Points were only defined at layer boundaries.

The same seven "step" process used to locate a critical noncircular slip surface with searches using the location of the critical circle as a starting point was followed for both the Type 1 and 2 searches with the slip surface from the Method of Planes.

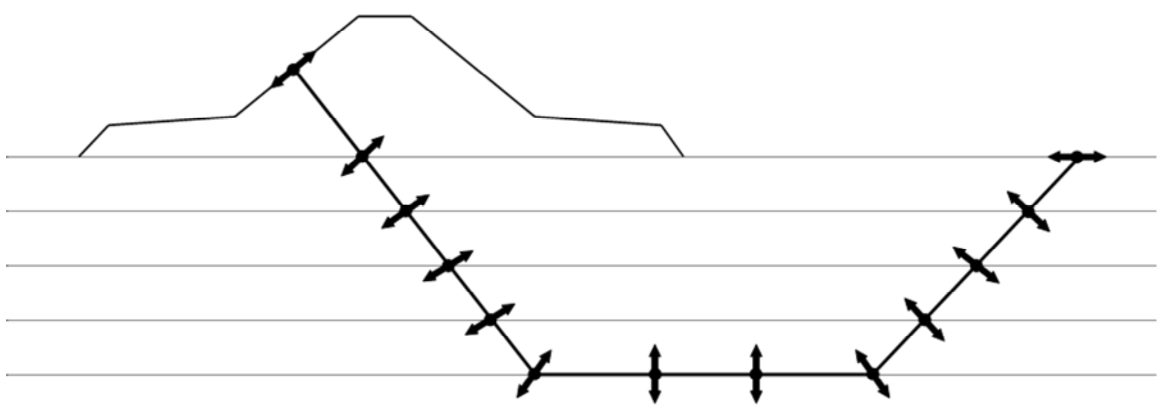


Figure 7.5: Shift direction for each point in the Type 1 search with the Method of Planes slip surface.

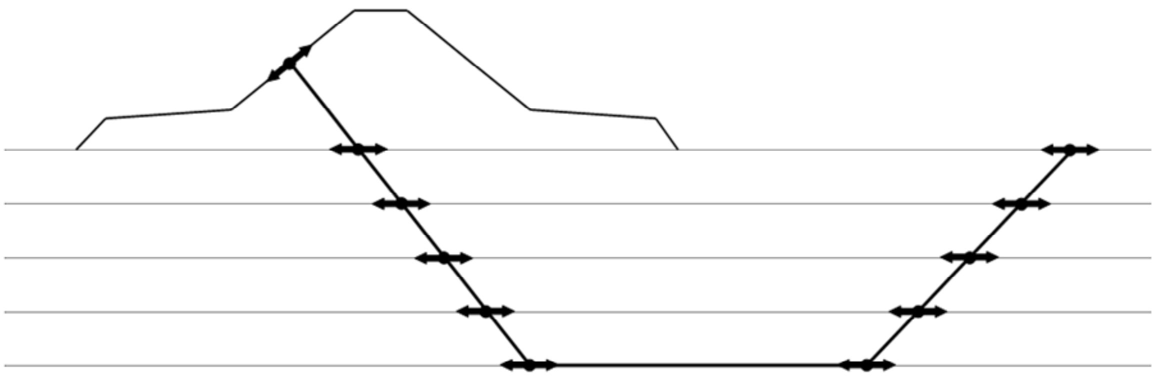


Figure 7.6: Shift direction for each point in the Type 2 search with the Method of Planes slip surface.

7.2.3. Searches with the Ardaman (2008) Procedure

In 2008, Ardaman & Associates, Inc. presented a draft guidance memorandum to the USACE that contained a systematic search procedure which could be used in conjunction with UTEXAS4 to locate critical noncircular slip surfaces. The steps in the procedure described by Ardaman & Associates, Inc. are as follows:

1. Define an initial trial noncircular slip surface using 4 points.
2. Perform a search using initial and final shift distances of 10 ft and 2 ft, respectively. Restrict the shift direction of each point to the horizontal direction.
3. Use the slip surface from step 2 as the starting point for another search. Add two additional points to the "active wedge surface" and the "passive surface." If possible, locate the new points where the slip surface intersects layer boundaries.

4. Perform a second search with the slip surface from step 3 as a starting point using initial and final shift distances of 4 ft and 1 ft, respectively. Restrict the movement of each point to the horizontal direction.
5. Use the slip surface from step 4 as the starting point for yet another, third search. Add three more points to both the "active wedge surface" and "passive surface" between existing points.
6. Set the slip surface from step 5 as the starting point for the third search, and allow each point to move an initial shift distance of 1 ft and a final shift distance of 0.2 ft, limiting the movement of each point to the horizontal direction.
7. Repeat steps 1 – 6 for "multiple sliding wedge base elevations" until the noncircular slip surface with the minimum factor of safety is located.
8. Select "two or more" slip surfaces with the lowest factors of safety from the slip surfaces identified in step 7. Repeat steps 2 – 6 for each of the slip surfaces with the lowest factors of safety until the noncircular slip surface with the minimum factor of safety is identified. In repeating steps 2 – 6, do not add points to the slip surface and allow each point on the slip surface to move in a direction approximately normal to the slip surface.

7.3. Results of Analyses Using Noncircular Searches

Results of the analyses using Spencer's procedure and the noncircular searches discussed in the previous section are summarized in Table 7.2. The minimum factor of safety for each site is underlined and shown in bold type face in Table 7.2. The relative difference between the overall minimum factor of safety and the factor of safety from each search is presented to illustrate how effective each search was in locating the noncircular slip surface with the minimum factor of safety. The critical noncircular slip surface is plotted for each cross section in Appendix F.

For more than half the cases presented in Table 7.2, the critical noncircular slip surface was found with the Type 1 search using the critical circle as a starting point and the Ardaman procedure. Factors of safety obtained from noncircular searches using the critical circle as a starting point and the Aradman procedure were within about 5% of the minimum factor of safety in all cases except for the analyses of the flood side of the Jefferson Parish Lakefront – Reach C cross section. In this case, the minimum factor of safety from searches with the critical circle and the Ardaman procedure were about 10% higher than the minimum factor of safety. The Type 1 search using the critical slip surface from the Method of Planes as a starting point yielded the minimum factor of safety because searches with the critical circle failed to locate relatively weaker layers at a shallower depth (Figure 7.7).

While the overall minimum factor of safety was generally obtained with searches using the critical circle as a starting point and the Ardaman procedure, the minimum factors of safety from analyses using all the various starting conditions for searches were within about 10% of the overall minimum factor of safety.

Table 7.2: Comparison of factors of safety for analyses with different noncircular searches.

Location	Flood/Protected Side Analysis	Results of searches with critical circle as a starting location: Type 1 Search	$(FS_{T1,Circle} - FS_{MIN})/FS_{T1,Circle}$ - %	Type 2 Search	$(FS_{T2,Circle} - FS_{MIN})/FS_{T2,Circle}$ - %	Results of searches with MOP slip surface as a starting location: Type 1 Search	$(FS_{T1,MOP} - FS_{MIN})/FS_{T1,MOP}$ - %	Type 2 Search	$(FS_{T2,MOP} - FS_{MIN})/FS_{T2,MOP}$ - %	Ardaman Procedure	$(FS_{Ard} - FS_{MIN})/FS_{Ard}$ - %
Citrus Back Levee	Protected	1.35	2.2	1.35	2.2	1.36	2.9	1.36	2.9	**1.32**	0.0
G.I.W.W. - Michoud Canal	Flood	**1.37**	0.0	1.38	0.7	1.42	3.5	1.40	2.1	1.40	2.1
	Flood	**1.29**	0.0	**1.29**	0.0	**1.29**	0.0	**1.29**	0.0	**1.29**	0.0
City Price to Venice	Protected	**1.31**	0.0	1.32	0.8	1.38	5.1	1.41	7.1	1.34	2.2
Phoenix to Bohemia	Protected	1.52	2.0	1.54	3.2	1.56	4.5	1.54	3.2	**1.49**	0.0
South Point to G.I.W.W.	Protected	1.42	0.7	1.43	1.4	1.46	3.4	1.43	1.4	**1.41**	0.0
City Price to Tropical Bend	Flood	**1.04**	0.0	1.05	1.0	1.08	3.7	1.07	2.8	1.07	2.8
Orleans Parish Lakefront	Protected	1.46	2.7	1.48	4.1	1.44	1.4	1.43	0.7	**1.42**	0.0
Jefferson Parish Lakefront - Reach B	Protected	**1.02**	0.0	1.03	1.0	1.05	2.9	1.03	1.0	1.03	1.0
Citrus Lakefront	Flood	**1.87**	0.0	**1.87**	0.0	1.99	6.0	2.27	17.6	1.93	3.1
Along MRGO - Violet Line	Flood	**1.39**	0.0	1.40	0.7	1.41	1.4	1.41	1.4	**1.39**	0.0
Harvey Canal	Flood	1.38	1.4	1.38	1.4	1.41	3.5	1.40	2.9	**1.36**	0.0
New Orleans Lakefront Airport	Protected	3.17	0.3	3.20	1.3	3.28	3.7	3.45	8.4	**3.16**	0.0
South Point to G.I.W.W. (2)	Flood	**1.45**	0.0	**1.45**	0.0	1.49	2.7	1.46	0.7	**1.45**	0.0
City Price to Tropical Bend (2)	Flood	**1.34**	0.0	**1.34**	0.0	1.36	1.5	1.36	1.5	**1.34**	0.0
Orleans Parish Lakefront (2)	Protected	1.00	1.0	**0.99**	0.0	1.02	2.9	1.03	3.9	1.07	7.5
Along MRGO - Violet Line (2)	Flood	1.68	4.2	1.68	4.2	1.62	0.6	1.62	0.6	**1.61**	0.0
Westminster	Protected	1.45	2.8	1.45	2.8	1.43	1.4	1.43	1.4	**1.41**	0.0
Bayou St. John	Flood	1.67	0.6	1.68	1.2	**1.66**	0.0	**1.66**	0.0	1.67	0.6
	Protected	**1.20**	0.0	**1.20**	0.0	**1.20**	0.0	**1.20**	0.0	1.21	0.8
Jefferson Parish Lakefront - Reach A	Flood	1.41	1.4	1.42	2.1	1.42	2.1	1.41	1.4	**1.39**	0.0
Jefferson Parish Lakefront - Reach B	Flood	0.90	1.1	0.90	1.1	0.93	4.4	**0.89**	0.0	0.92	3.3
	Protected	**0.93**	0.0	**0.93**	0.0	**0.93**	0.0	**0.93**	0.0	0.95	2.1
Jefferson Parish Lakefront - Reach C	Flood	1.29	10.9	1.29	10.9	**1.15**	0.0	1.19	3.4	1.26	8.7

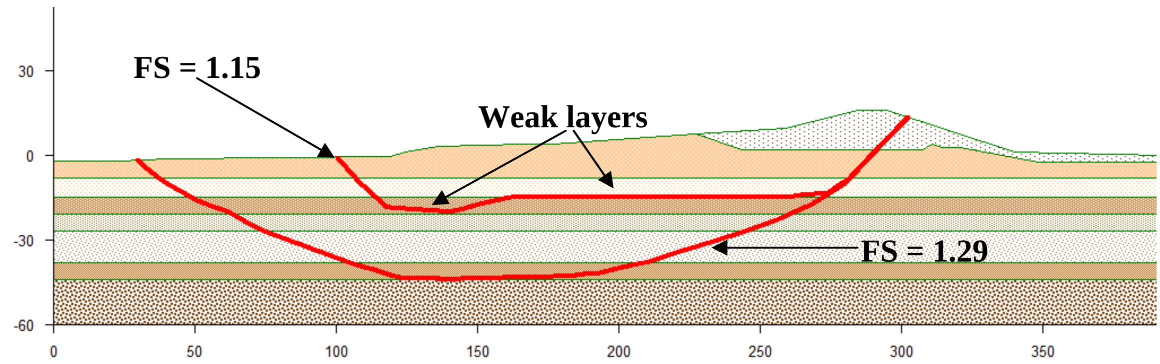


Figure 7.7: Noncircular slip surfaces from searches using the critical slip surface from the Method of Planes as a starting point (F.S. = 1.15) and the critical circle as a starting point (F.S. = 1.29)

7.4. COMPARISON OF RESULTS FROM SPENCER'S PROCEDURE FOR CIRCULAR AND NONCIRCULAR SLIP SURFACES

The factor of safety for the critical noncircular slip surface is compared with the factor of safety for the critical circle in Table 7.3. The relative difference in the factor of safety for the critical noncircular slip surface and the critical circle ranged from 1% to 17%, although the relative difference in the factor of safety was less than 10% for all but three locations.

Table 7.3: Comparison of factors of safety from Spencer's procedure for the critical circular and noncircular slip surfaces.

Location	Flood/Protected Side Analysis	Critical Noncircular Slip Surface	Critical Circle	$(FS_{Noncircular}-FS_{Circular})/FS_{Noncircular}$ - (%)
Citrus Back Levee	Protected	1.32	1.36	-3.0
G.I.W.W. - Michoud Canal	Flood	1.37	1.40	-2.2
City Price to Venice	Flood	1.29	1.32	-2.3
	Protected	1.31	1.41	-7.6
Phoenix to Bohemia	Protected	1.49	1.54	-3.4
South Point to G.I.W.W.	Protected	1.41	1.46	-3.5
City Price to Tropical Bend	Flood	1.04	1.05	-1.0
Orleans Parish Lakefront	Protected	1.42	1.51	-6.3
Jefferson Parish Lakefront - Reach B	Protected	1.02	1.09	-6.9
Citrus Lakefront	Flood	1.87	1.93	-3.2
Along MRGO - Violet Line	Flood	1.39	1.41	-1.4
Harvey Canal	Flood	1.36	1.46	-7.4
New Orleans Lakefront Airport	Protected	3.16	3.16	0.0
South Point to G.I.W.W. (2)	Flood	1.45	1.48	-2.1
City Price to Tropical Bend (2)	Flood	1.34	1.43	-6.7
Orleans Parish Lakefront (2)	Protected	0.99	1.16	-17.2
Along MRGO - Violet Line (2)	Flood	1.61	1.68	-4.3
Westminster	Protected	1.41	1.50	-6.4
Bayou St. John	Flood	1.66	1.76	-6.0
Jefferson Parish Lakefront - Reach A	Protected	1.20	1.26	-5.0
	Flood	1.39	1.43	-2.9
Jefferson Parish Lakefront - Reach B	Flood	0.89	0.98	-10.1
Jefferson Parish Lakefront - Reach C	Protected	0.93	1.00	-7.5
	Flood	1.15	1.32	-14.8

The three cases where the relative difference was greater than 10% were the Orleans Parish Lakefront (2) and Jefferson Parish Lakefront – Reaches B and C. In these cases the critical noncircular slip surface had a noticeably different shape than the critical circle. The presence of a relatively weak layer at depth was responsible for the shape of the critical noncircular slip surface in those cases. For the case of the Orleans Parish Lakefront (2) cross section, a tension crack was introduced to eliminate tensile stresses near the crest of the slope. The Orleans Parish Lakefront (2) cross section was the only case where a tension crack was considered. The critical noncircular slip surface and the critical circle for Orleans Parish Lakefront (2) and Jefferson Parish Lakefront – Reaches B and C are included in Figures 7.8 – 7.10, respectively.

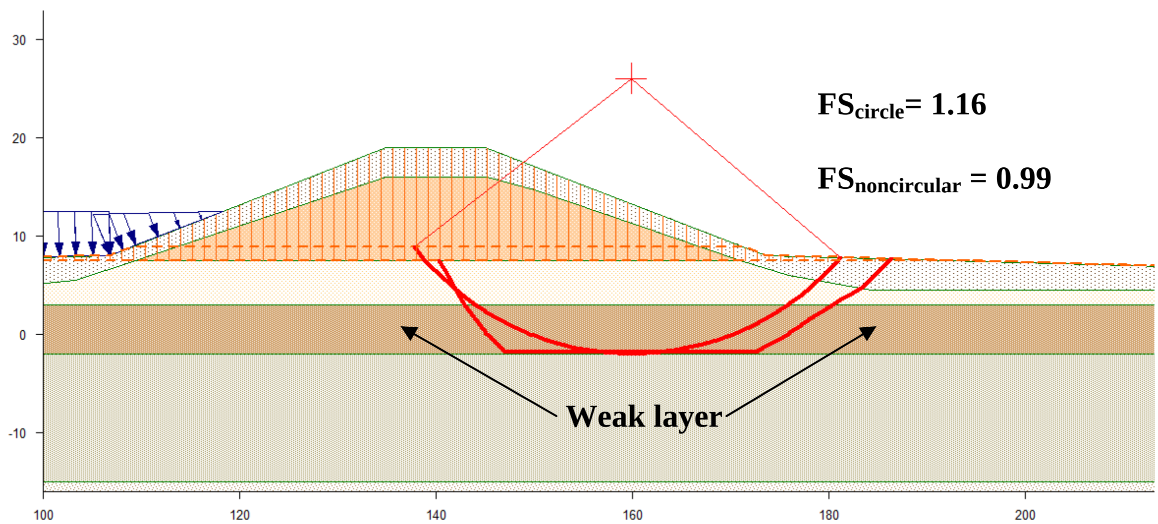


Figure 7.8: Critical circle and critical noncircular slip surface for Orleans Parish Lakefront (2).

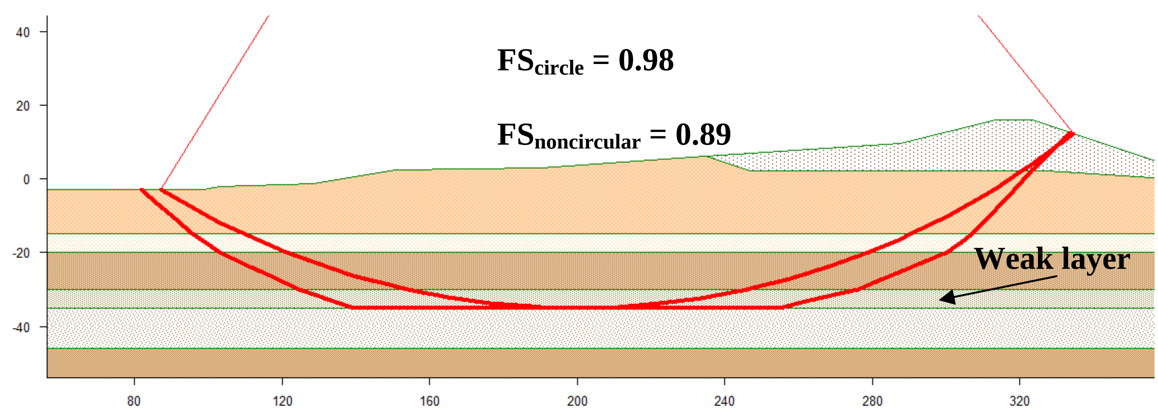


Figure 7.9: Critical circle and critical noncircular slip surface from the flood side analyses of Jefferson Parish Lakefront – Reach B.

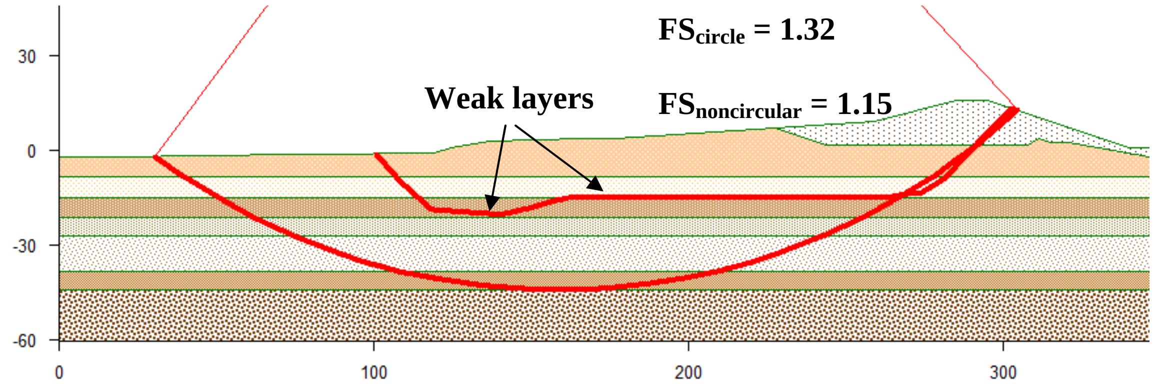


Figure 7.10: Critical circle and critical noncircular slip surface from the flood side analyses of Jefferson Parish Lakefront – Reach C.

7.4. COMPARISON OF THE MINIMUM FACTORS OF SAFETY FROM THE METHOD OF PLANES FOR THE THREE-PART "WEDGE" AND SPENCER'S PROCEDURE FOR THE CRITICAL NONCIRCULAR SLIP SURFACE

The factor of safety from Spencer's procedure for the critical noncircular slip surface is compared with the factor of safety for the three-part "wedge" from the Method of Planes in Table 7.4. The factors of safety from Spencer's procedure for the critical circle and the slip surface from the Method of Planes are also included in Table 7.4. For all but four cases presented in Table 7.4, the minimum factor of safety from the Method of Planes is lower than the factor of safety for the critical noncircular slip surface. When the minimum factor of safety from the Method of Planes is lower than the factor of safety for the critical noncircular slip surface, the relative differences in the factor of safety range from 1% to 12%.

There were four cases where the factor of safety for the critical noncircular slip surface was less than or equal to the minimum factor of safety from the Method of Planes. For each site where the factor of safety for the critical noncircular slip surface is less than or equal to the minimum factor of safety from the Method of Planes, the critical noncircular slip surface had a distinctly different shape than the shape of the slip surface from the Method of Planes (Figures 7.11 – 7.14). While the differences in the factors of safety from Spencer's procedure and the Method of Planes shown in Table 7.4 are large (as high as 33%) when the three-part wedge from the Method of Planes is analyzed, the differences are much smaller when a search is performed with Spencer's procedure to identify a more critical shape for the slip surface.

In the case of the Orleans Parish Lakefront (2) cross section, the difference in the factor of safety was 30% because a tension crack was introduced to eliminate tension near the crest of the slope. The Orleans Parish Lakefront (2) cross section was the only case where a tension crack was introduced because it was shown by the results in Chapter 5 that the Orleans Parish Lakefront (2) cross section was the only case where introducing a tension crack had a significant effect on the factor of safety from Spencer's procedure.

Table 7.4: Minimum factor of safety from the Method of Planes and factors of safety from Spencer's procedure for the critical slip surface from the Method of Planes, critical circle, and critical noncircular slip surface.

Location	Flood/Protected Side Analysis	UT Austin Analysis w/ Method of Planes	MOP Slip Surface: Spencer's procedure	Critical Circle: Spencer's procedure	Noncircular Slip Surface: Spencer's procedure	$(FS_{Noncircular} - FS_{MOP})/FS_{Noncircular}$ - (%)
Citrus Back Levee	Protected	1.27	1.40	1.36	1.32	3.8
G.I.W.W. - Michoud Canal	Flood	1.32	1.50	1.40	1.37	3.6
City Price to Venice	Flood	1.24	1.37	1.32	1.29	3.9
	Protected	1.31	1.49	1.41	1.31	0.0
Phoenix to Bohemia	Protected	1.31	1.62	1.54	1.49	12.1
South Point to G.I.W.W.	Protected	1.34	1.64	1.46	1.41	5.0
City Price to Tropical Bend	Flood	0.95	1.22	1.05	1.04	8.7
Orleans Parish Lakefront	Protected	1.32	1.51	1.51	1.42	7.0
Jefferson Parish Lakefront - Reach B	Protected	0.97	1.06	1.09	1.02	4.9
Citrus Lakefront	Flood	1.78	2.65	1.93	1.87	4.8
Along MRGO - Violet Line	Flood	1.39	1.87	1.41	1.39	0.0
Harvey Canal	Flood	1.30	1.46	1.46	1.36	4.4
New Orleans Lakefront Airport	Protected	2.97	4.07	3.16	3.16	6.0
South Point to G.I.W.W. (2)	Flood	1.35	1.55	1.48	1.45	6.9
City Price to Tropical Bend (2)	Flood	1.30	1.53	1.43	1.34	3.0
Orleans Parish Lakefront (2)	Protected	1.29	1.13	1.16	0.99	-30.3
Along MRGO - Violet Line (2)	Flood	1.50	1.73	1.68	1.61	6.8
Westminster	Protected	1.30	1.46	1.50	1.41	7.8
Bayou St. John	Flood	1.50	1.70	1.76	1.66	9.6
Jefferson Parish Lakefront - Reach A	Protected	1.09	1.28	1.26	1.20	9.2
	Flood	1.36	1.61	1.43	1.39	2.2
Jefferson Parish Lakefront - Reach B	Flood	0.88	0.95	0.98	0.89	1.1
Jefferson Parish Lakefront - Reach C	Protected	0.89	0.97	1.00	0.93	4.3
	Flood	1.15	1.21	1.32	1.15	0.0

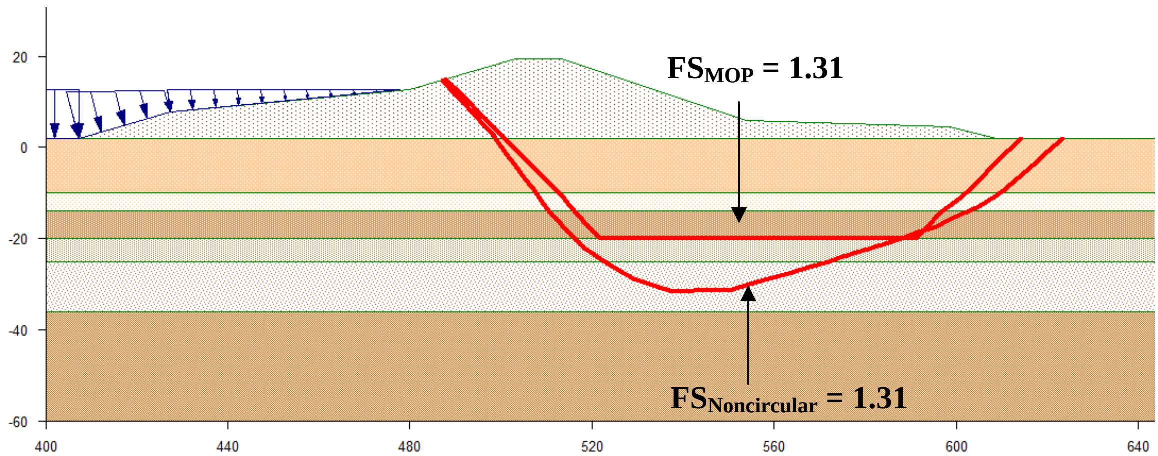


Figure 7.11: Method of Planes slip surface and critical noncircular slip surface from the protected side analyses of City Price to Venice.

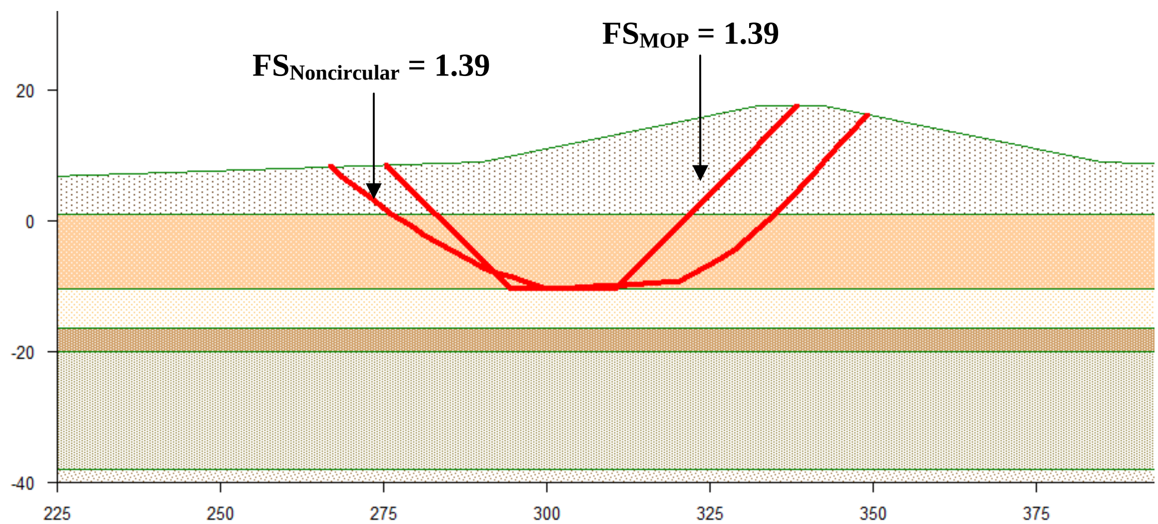


Figure 7.12: Method of Planes slip surface and critical noncircular slip surface from Along MRGO – Violet Line.

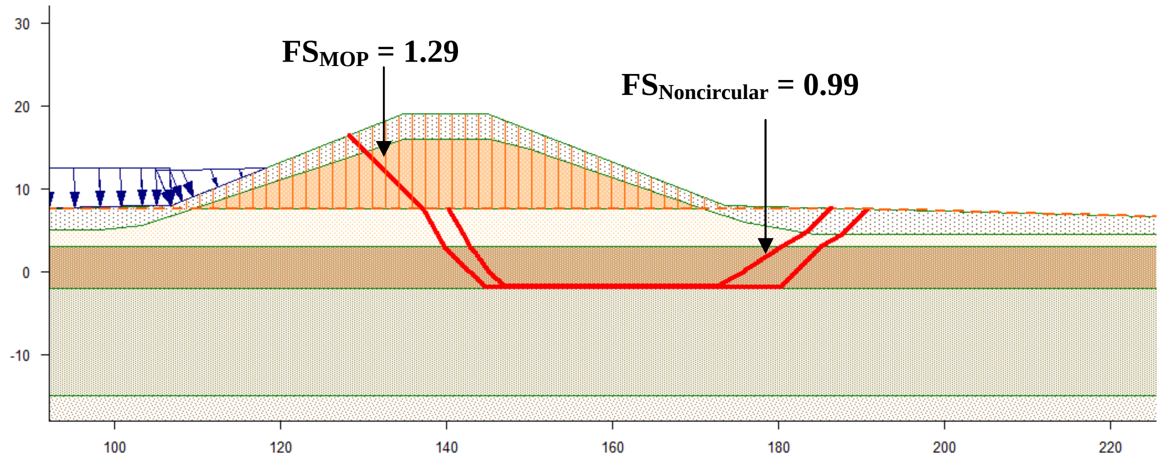


Figure 7.13: Method of Planes slip surface and critical noncircular slip surface for Orleans Parish Lakefront (2).

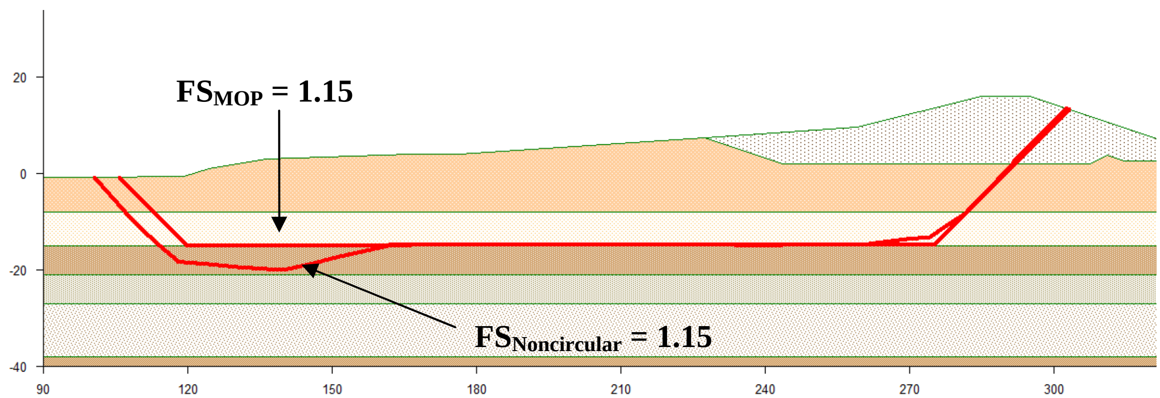


Figure 7.14: Method of Planes slip surface and critical noncircular slip surface from the flood side analyses of Jefferson Parish Lakefront – Reach C.

7.3. SUMMARY

Generally the best results for locating a critical noncircular slip surface using UTEXAS4 were obtained with searches that used the critical circle as a starting point and the Ardaman procedure; however, the other searches discussed in this chapter produced similar results. Overall, searches with the Ardaman procedure were very effective in locating the critical noncircular slip surface. The greatest difference in the factors of safety for noncircular slip surfaces with the minimum factor of safety and the critical slip surface discovered using the Ardaman procedure was less than 10%.

For all but three cases analyzed, the difference in the factor of safety from Spencer's procedure for the critical circle and the critical noncircular slip surface varied from 1% to 9%. The few cases where the differences in the factor of safety were larger the differences ranged from 10% to 17%. In those cases, the differences in the factors of safety and the noticably noncircular shape of the slip surface were a result of a relatively weaker layer at depth.

The factor of safety for the critical noncircular slip surface from Spencer's procedure was usually higher – 1% to 12% – than the minimum factor of safety from the Method of Planes. However, in four of the twenty-four cases examined, the factor of safety for the critical noncircular slip surface was less than or equal to the minimum factor of safety from the Method of Planes. These results show that finding a critical noncircular slip surface can result in small (<10%) differences in the factors of safety from Spencer's procedure and the Method of Planes.

Chapter 8: Analyses for Levees with Reinforcement and Comparison with Solutions from the Method of Planes

Various reaches of levee in the New Orleans hurricane protection system are constructed on foundations consisting of layers of very soft clays with undrained shear strengths as low as 150 psf. Consequently, geosynthetic reinforcement is sometimes necessary to achieve the desired factors of safety. This chapter addresses stability analyses for such reinforced levees.

A design procedure used by the USACE to design reinforcement in levees is discussed first in this chapter. To better understand the results from the Method of Planes for cases when reinforcement is present, the results from the USACE's design procedure are then compared with the results from analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure. Analyses with Spencer's procedure included searches for the critical circular and noncircular slip surfaces. A comparison is also made between the factors of safety from Spencer's procedure for the critical circle and critical noncircular slip surface to see if a more critical shape of slip surface than a circle exists when reinforcement is present.

8.1. USACE DESIGN PROCEDURE

A procedure followed by the USACE in designing reinforcement for levees is described in the appendix of a design memorandum for the Jefferson Parish Lakefront (1987). The procedure is described in Table 8.1. The reinforcement design is governed by the critical slip surface from analyses with the Method of Planes when no reinforcement is present. Application of the USACE’s design procedure to the cases where reinforcement was considered is described below.

Table 8.1: Summary of USACE design procedure (1987) for levees with reinforcement.

Step No.	Description
1	Perform stability analysis with the Method of Planes with no reinforcement present. Reinforcement is required in cases where the minimum factor of safety is less than the USACE's design factor of safety of 1.30.
2	Calculate the *required reinforcement force*. The required reinforcement force is computed by introducing an additional "resisting" force (T) in the numerator of the factor of safety equation for Method of Planes: $F.S. = \frac{R_a+R_b+R_p+T}{D_a-D_p}$ (8.1) The factor of safety in Eq. 8.1 is set to 1.30 and Eq. 8.1 is rearranged to calculate the required reinforcement force as follows: $T = \frac{1.30(D_a-D_p)-R_a-R_b-R_p}{12}$ (8.2) where, T = required tensile strength of reinforcement (lbs/in) "at 5% strain and less than 40% of ultimate" $R_a, R_b, R_p, D_a,$ and D_p = "resisting" and "driving" forces (lbs/ft[4]) corresponding to the critical slip surface found in step 1.
3	Determine the *reinforcement length*. The length of the reinforcement is determined by considering an embedment length which is computed using Eq. 8.3. Eq. 8.3 is attributed to Koerner (1986) in the design memorandum. $L = \frac{T}{z[(\gamma_1 \tan(\phi_1)+c_1)+(\gamma_2 \tan(\phi_2)+c_2)]}$ (8.3) where, T = required tensile strength of the reinforcement z = depth from the ground surface to the reinforcement Subscript "1" represents soil parameter above geotextile Subscript "2" represents soil parameter below geotextile If no frictional material is present, Eq. 8.3 reduces to Eq. 8.4. $L = \frac{T}{c_1+c_2}$ (8.4) The reinforcement length is chosen such that the reinforcement is embedded a length "L" into the stable soil mass, and it is embedded the same distance "L" into the critical active wedge (Figure 8.1).
4	Determine the *location of the reinforcement*. While the position of the critical active wedge influences the horizontal location of the reinforcement, no computations or explanations were presented in the design memorandum regarding the *elevation* at which the reinforcement is to be placed.

[4] The constant "12" in Eq. 8.2 is to convert from feet to inches.

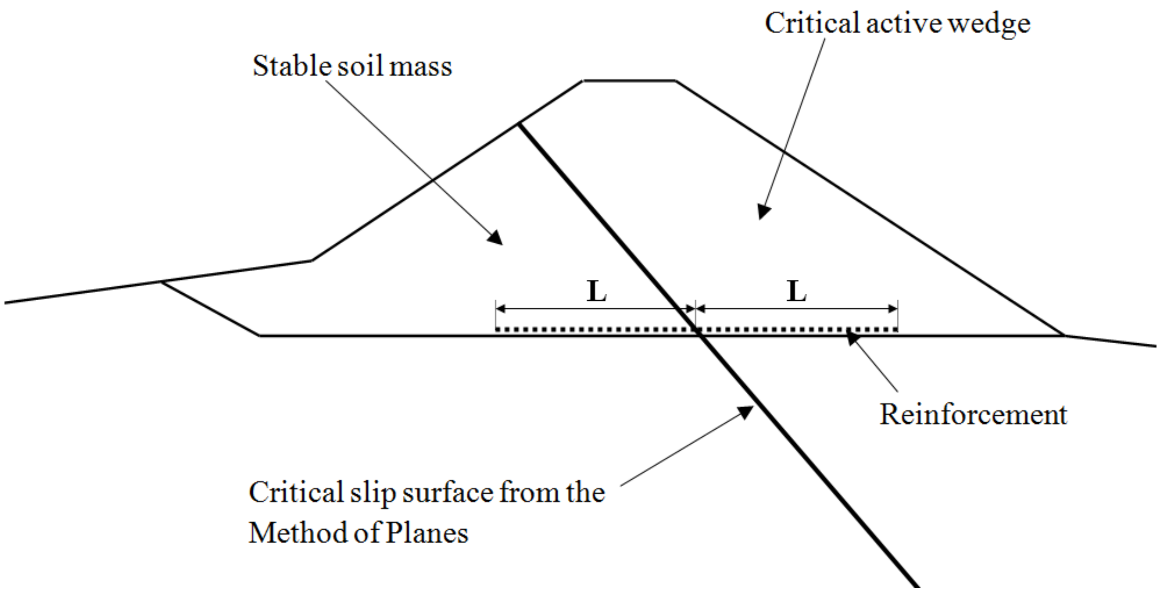


Figure 8.1: Reinforcement embedded a length "L" into the stable soil mass and the critical active wedge.

8.1.1. Application of USACE Design Procedure

Reinforcement was considered in three (3) of the twenty cross sections examined in this study. The three cross sections containing reinforcement are from the Jefferson Parish Lakefront area, and the location of the Jefferson Parish Lakefront is identified in Figure 8.2.

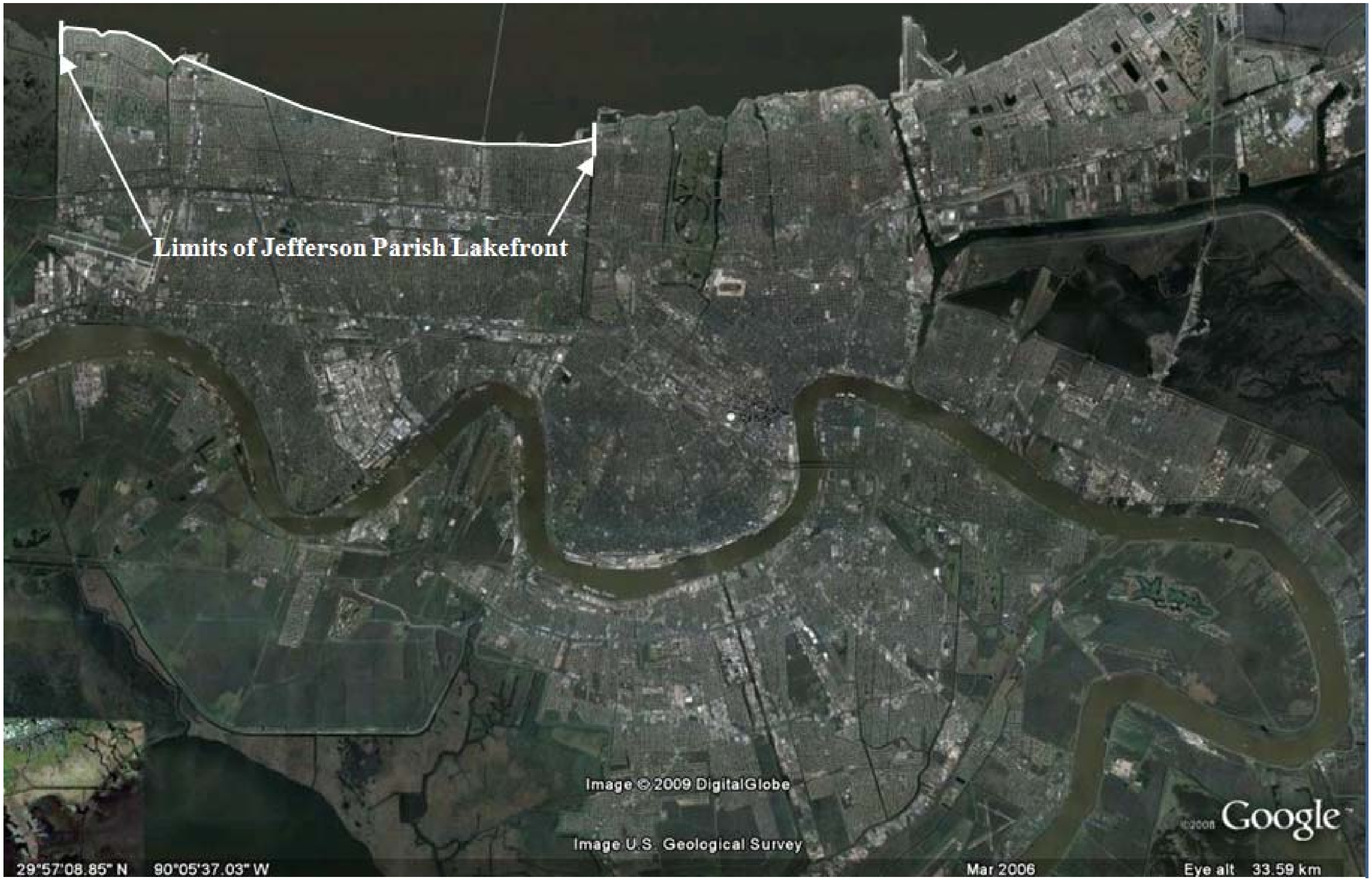


Figure 8.2: Jefferson Parish Lakefront (Google Earth).

The minimum factor of safety obtained by the USACE with the Method of Planes in each of the six cases when reinforcement was not present ("Step 1") is included in Table 8.2, along with the required reinforcement force computed using Eq. 8.2 ("Step" 2). The required (governing) reinforcement force for each reach is in bold font and underlined.

Table 8.2: Minimum factors of safety from the Method of Planes when reinforcement was not present and required reinforcement forces.

Location	Flood/Protected Side Analysis	USACE Analysis w/ Method of Planes	Required Reinforcement Force (lbs/in)
Jefferson Parish Lakefront - Reach A	Protected	1.09	**<u>989</u>**
	Flood	1.36	n/a
Jefferson Parish Lakefront - Reach B	Protected	0.97	2,056
	Flood	0.88	**<u>3,077</u>**
Jefferson Parish Lakefront - Reach C	Protected	0.89	**<u>3,064</u>**
	Flood	1.14	934

No frictional material was present adjacent to the reinforcement in any of the cases analyzed; therefore, the USACE used Eq. 8.4 in determining the reinforcement lengths. The reinforcement lengths determined by the USACE ("Step 3") are included in Table 8.3, along with the tensile strength of the reinforcement used and the corresponding elevation at which the reinforcement was placed ("Step 4"). Multiple layers of reinforcement were used to achieve the required reinforcement forces in Reaches B and C. In Reaches A, B, and C, the reinforcement was placed in the material composing the levee. The location of the reinforcement in Reaches A, B, and C is given in Figures 8.3, 8.4, and 8.5, respectively.

Table 8.3: Details of reinforcement placed in Reaches A, B, and C.

Location	USACE Analysis w/ Method of Planes	Required Reinforcement Force (lbs/in)	Tensile Strength of Reinforcement (lbs/in)	Length of Reinforcement (ft)	Elevation of Reinforcement (ft)
Jefferson Parish Lakefront - Reach A	1.09	989	1,000	30	+6.0
Jefferson Parish Lakefront - Reach B	0.88	3,077	1,000	36	+5.0
			2,080	89.5	+2.0
Jefferson Parish Lakefront - Reach C	0.89	3,064	1,500	45	+5.0
			2,110	70	+2.0

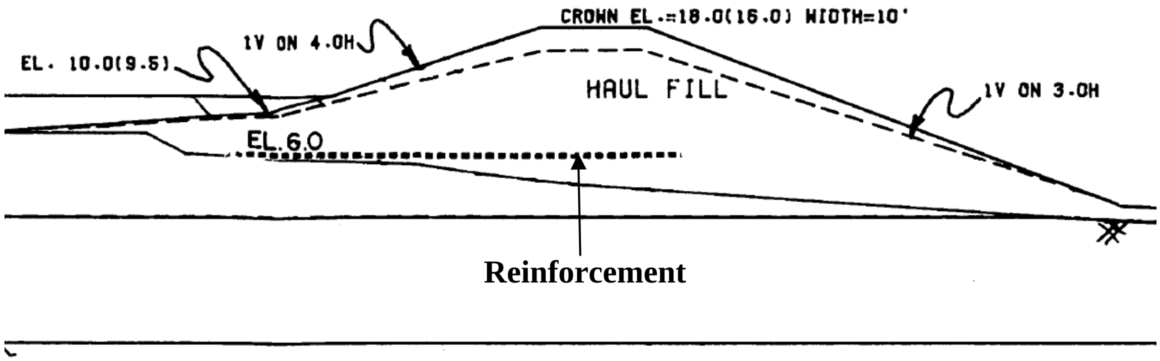


Figure 8.3: Reinforcement in Reach A.

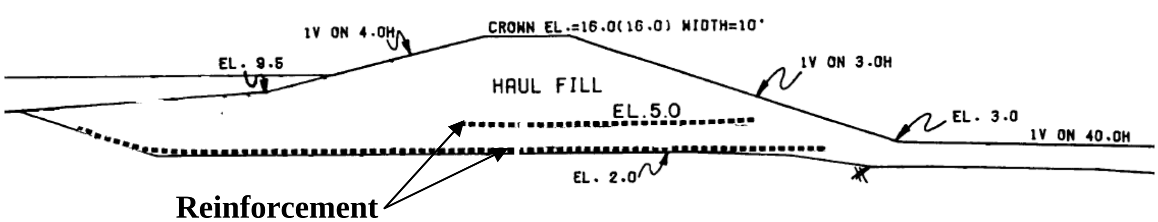


Figure 8.4: Reinforcement in Reach B.

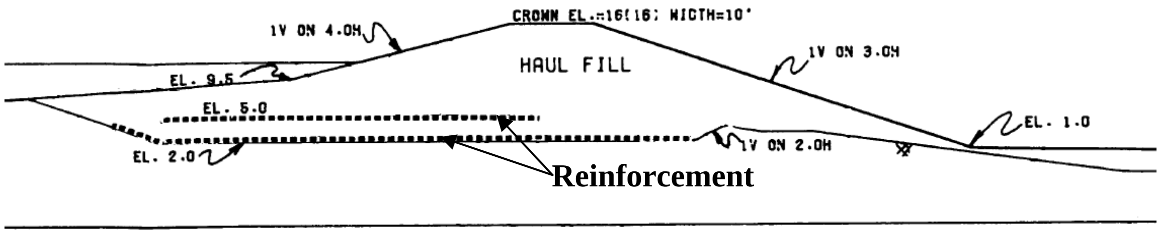


Figure 8.5: Reinforcement in Reach C.

The USACE directly computed the factor of safety for the cases when reinforcement was present using Eq. 8.1 and the tensile strength of the reinforcement given in Table 8.3. The results of the USACE's computations are presented in Table 8.4. Two factors of safety are given for both the flood and protected side analysis of each cross section. The first factor of safety for no reinforcement, and the other factor of safety is with reinforcement based on Eq. 8.1. In each case, the presence of reinforcement increased the minimum factor of safety to a value that was greater than or equal to the USACE's design factor or safety (1.30).

In some cases, the factor of safety when reinforcement was considered was greater than the design factor of safety. In these cases, the factor of safety was larger because the USACE assigned tensile strengths to the reinforcement that were slightly greater than the required reinforcement forces. In the case of the flood side analysis for Reach C, the factor of safety with reinforcement was much larger than the design factor of safety because the flood side analysis in that case was not the critical case governing the design of the reinforcement.

Table 8.4: Results of calculations performed by the USACE for the factors of safety.

Location	Flood/Protected Side Analysis	FS without reinforcement	FS with reinforcement
Jefferson Parish Lakefront - Reach A	Protected	1.09	1.30
	Flood	1.36	1.36
Jefferson Parish Lakefront - Reach B	Protected	0.97	1.30
	Flood	0.88	1.34
Jefferson Parish Lakefront - Reach C	Protected	0.89	1.37
	Flood	1.14	1.77

8.1.2. Alternative Definitions for the Factor of Safety

The factor of safety in the USACE's design procedure is defined using Eq. 8.1. If Eq. 8.1 is rearranged, Eq.8.5 results.

$$D_a - D_p = \frac{R_p + R_b + R_p + T}{F.S.} \tag{8.5}$$

Eq. 8.5 suggests that the driving forces are equated to the resisting forces from the soil and the reinforcement, both of which are reduced by a factor of safety. In other words, the factor of safety is applied equally to the resisting forces from the soil and the reinforcement. The factors of safety computed by the USACE (Table 8.4) for the cases where reinforcement was present were defined in this manner.

Alternatively, if the factor of safety is *only* applied to the shear strength of the soil, Eq. 8.5 takes the form,

$$D_a - D_p = \frac{R_a + R_b + R_p}{F.S.} + T \tag{8.6}$$

this, in turn, can also be written as,

$$F.S. = \frac{R_a + R_b + R_p}{D_a - D_p - T} \tag{8.7}$$

If the reinforcement forces represent the allowable values and have already been reduced by some factor of safety, Eq. 8.7 probably represents a more reasonable definition of the factor of safety. To illustrate the differences between Eq. 8.1 and Eq. 8.7, the factors of safety presented in Table 8.4 were recalculated using Eq. 8.7, and the results of the calculations are summarized in Table 8.5.

The shear strength of the soil and the reinforcement forces used in the stability analyses have different sources and magnitudes of uncertainty. If the shear strength of the soil and the reinforcement forces are factored separately, the differences in the uncertainties can be taken into account.

Table 8.5: Factors of safety computed using different definitions for the factor of safety.

Location	Flood/Protected Side Analysis	FS applied only to soil shear strength	FS applied to soil shear strength & reinforcement force
Jefferson Parish Lakefront - Reach A	Protected	1.39	1.30
	Flood	1.36	1.36
Jefferson Parish Lakefront - Reach B	Protected	1.45	1.30
	Flood	1.64	1.34
Jefferson Parish Lakefront - Reach C	Protected	1.72	1.37
	Flood	3.03	1.77

8.2. Comparison of Method of Planes Solutions with the Results from the Force Equilibrium Procedure with Horizontal Side Forces and Spencer's Procedure

In order to compare the results from the USACE procedure using the Method of Planes with results from more conventional limit equilibrium analysis procedures, the force equilibrium procedure with horizontal side forces and Spencer's procedure were used to analyze the cross sections with reinforcement. The results of the analyses with the force equilibrium and Spencer's procedures are presented in this section. The reinforcement was modeled in the analyses with both procedures using the details provided in Table 8.3.

First, the critical slip surfaces reported by the USACE for the Method of Planes were analyzed with UTEXAS4 using both the force equilibrium procedure with horizontal side forces and Spencer's procedure. Additional analyses were then performed with Spencer's procedure to locate the critical circular and noncircular slip surfaces.

8.2.1. Analyses for the Critical Slip Surfaces from the Method of Planes

The results of analyses with the force equilibrium procedure with horizontal side forces and Spencer's procedure for the critical slip surfaces by the Method of Planes are presented in Table 8.6. A factor of safety was applied only to the shear strength of the soil in the analyses performed with the force equilibrium and Spencer's procedures in this chapter. This approach is typically followed in practice, and it is the default approach used by UTEXAS4 in analyzing reinforced slopes.

Table 8.6: Results of analyses for the critical slip surfaces from the Method of Planes.

Location	Flood/Protected Side Analysis	USACE Analysis with Method of Planes (FS applied only to soil shear strength)	Force Equilibrium procedure with horiz. side forces	Spencer's procedure
Jefferson Parish Lakefront - Reach A	Protected	1.39	1.38	1.36
	Flood	1.36	1.36	1.62
Jefferson Parish Lakefront - Reach B	Protected	1.45	1.46	1.34
	Flood	1.64	1.64	1.49
Jefferson Parish Lakefront - Reach C	Protected	1.72	1.72	1.33
	Flood	3.03	3.11	2.77

The factors of safety from the Method of Planes and the force equilibrium procedure with horizontal side forces agree very well. However, the factors of safety computed by Spencer's procedure are lower than those computed by the Method of Planes and the force equilibrium procedure in all but one case (Reach A – flood side analysis). In every case where a lower factor of safety was computed with Spencer's procedure, the slip surface intersected a layer of reinforcement. Whenever the slip surface intersected a layer of reinforcement, a negative inclination for the side forces was calculated by Spencer's procedure (Table 8.7). For the majority of the cases analyzed in this section, the reinforcement caused the inclination of the side forces to become negative. As a result, Spencer's procedure computed a lower factor of safety than the Method of Planes.

For the flood side analyses for Reach A, a higher factor of safety was calculated with Spencer's procedure because the critical slip surface slip surface from the Method of Planes did not intersect a layer of reinforcement. In this case, the slip surface did not intersect the reinforcement because the protected side analyses governed the reinforcement design for this site.

Table 8.7: Results of analyses for the slip surfaces from the Method of Planes with side force inclinations from Spencer's procedure.

Location	Flood/Protected Side Analysis	Force Equilibrium procedure with horiz. side forces	Spencer's procedure	Inclination of Side Forces from Spencer's procedure (°)
Jefferson Parish Lakefront - Reach A	Protected	1.38	1.36	-0.49
	Flood	1.36	1.62	3.68
Jefferson Parish Lakefront - Reach B	Protected	1.46	1.34	-1.50
	Flood	1.64	1.49	-1.70
Jefferson Parish Lakefront - Reach C	Protected	1.72	1.33	-3.72
	Flood	3.11	2.77	-1.44

8.2.2. Analyses for the Critical Circular Slip Surface

Additional analyses were performed with Spencer's procedure to locate the critical circular slip surface. The results of the analyses are summarized in Table 8.8. For every case presented in Table 8.8, the critical circle circumvented the reinforcement. As a result, the factor of safety for the critical circle was significantly less than the minimum factor of safety computed by the Method of Planes for all but two cases. An example of a case where the critical circle went outside the reinforcement while the slip surface from the Method of Planes intersected the reinforcement is provided in Figure 8.6. When the factor of safety for the critical circle was lower than the factor of safety for the Method of Planes, the difference in the factors of safety varied from about 15% to well over 100%.

While the critical circle went outside the reinforcement in the analyses for Reach A, the factor of safety from Spencer's procedure was still higher than the minimum factor of safety from the Method of Planes, although the differences were only about 5%.

Searches and analyses for the critical circle were also performed with the force equilibrium procedure with horizontal side forces, and the results are also presented in the last column of Table 8.8. As was the case for analyses with Spencer's procedure, the critical circle determined by the force equilibrium procedure went outside the reinforcement in every case. Also in each case the factor of safety from the force equilibrium procedure was less than that from Spencer's procedure. This finding shows the force equilibrium procedure with horizontal side forces still calculates a lower factor of safety than Spencer's procedure, provided that the critical slip surface is identified.

Table 8.8: Comparison of minimum factors of safety from the Method of Planes and the factors of safety from Spencer's procedure for the critical circles.

Location	Flood/Protected Side Analysis	USACE Analysis with Method of Planes (FS applied only to soil shear strength)	Critical Circle: Spencer's procedure	$(FS_{Spencer} - FS_{MOP})/FS_{Spencer}$ (%)	Critical Circle: Force Eq. with horiz. side forces
Jefferson Parish Lakefront - Reach A	Protected	1.39	1.42	2.4	1.32
	Flood	1.36	1.43	4.9	1.33
Jefferson Parish Lakefront - Reach B	Protected	1.45	1.28	-13.7	1.21
	Flood	1.64	1.15	-42.6	1.09
Jefferson Parish Lakefront - Reach C	Protected	1.72	1.12	-53.7	1.07
	Flood	3.03	1.39	-118.3	1.32

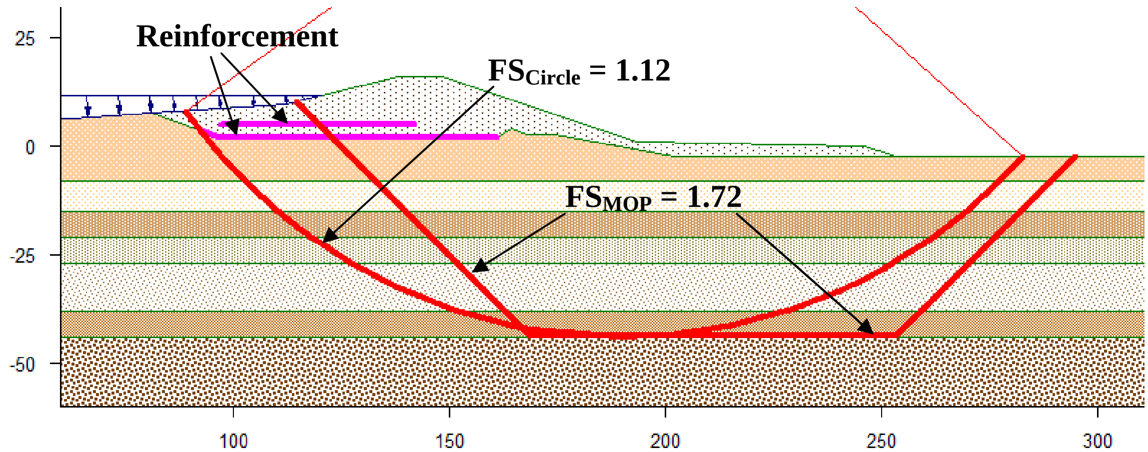


Figure 8.6: Critical circle and critical slip surface from the Method of Planes for the protected side analysis of Reach C.

8.2.3. Analyses for Noncircular Slip Surfaces

Analyses were also performed for noncircular slip surfaces using the same search procedures presented in Chapter 7, except that only the critical circles were used as the starting point for searches. The purpose of the analyses was to see if a slip surface existed that was significantly more critical than a circular slip surface. Analyses were performed for each of the Reaches along the Jefferson Parish Lakefront with Spencer's procedure, and the results of the analyses are included in Table 8.9.

The differences in the minimum factors of safety for circles and noncircular slip surfaces range from 2% to slightly more than 14%. The error, which is defined as the absolute value of the relative difference in Table 8.9, associated with using the critical circle rather than the critical noncircular slip surface exceeded 10% for Reaches B and C. For analysis of the protected side of Reach C, the error was in excess of 14%. Also by performing analyses for noncircular slip surfaces along Reaches B and C the minimum factor of safety would be reduced to approximately one. The critical circular and noncircular slip surfaces for the protected side analysis of Reach C are presented in Figure 8.7, because the greatest difference in the factor of safety was obtained in this case.

The differences in the factors of safety for the critical circular and noncircular slip surfaces when reinforcement was present were similar to the differences observed in Chapter 7 (about 15%) where comparisons were made for cases with no reinforcement. Although the differences in the factors of safety reported are about the same for cases with and without reinforcement, the results are based on the analyses of only six cases with reinforcement. The differences in the factor of safety for the critical circular and noncircular slip surfaces when reinforcement is present could be greater if more cases are investigated.

Table 8.9: Comparison of factors of safety from Spencer's procedure for the critical circular and noncircular slip surfaces.

Location	Flood/Protected Side Analysis	Critical Circle	Critical Noncircular Slip Surface	$(FS_{Circle} - FS_{Noncircular})/FS_{Noncircular}$ (%)	Error (%)
Jefferson Parish Lakefront - Reach A	Protected	1.42	1.30	-9.2	9.2
	Flood	1.43	1.40	-2.1	2.1
Jefferson Parish Lakefront - Reach B	Protected	1.28	1.16	-10.3	10.3
	Flood	1.15	1.07	-7.5	7.5
Jefferson Parish Lakefront - Reach C	Protected	1.12	0.98	-14.3	14.3
	Flood	1.39	1.35	-3.0	3.0

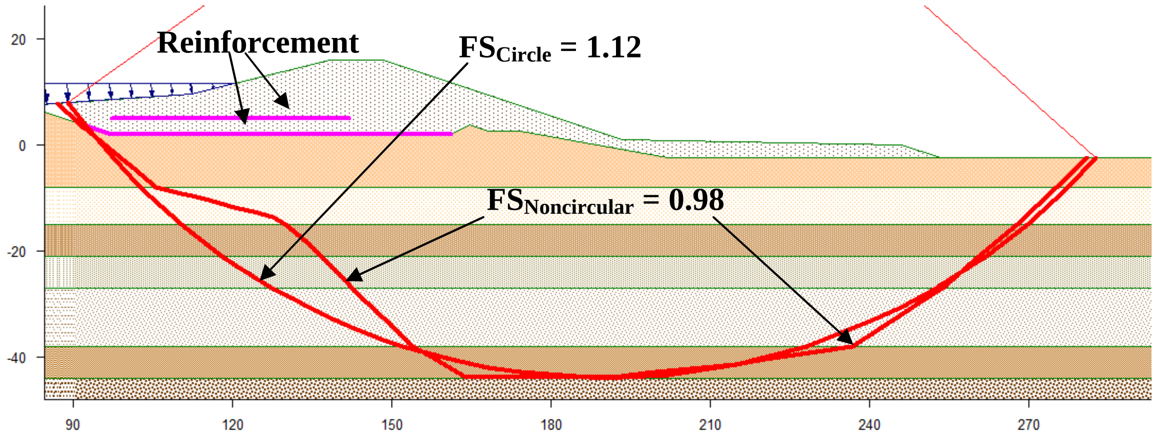


Figure 8.7: Critical circle and noncircular slip surface with the minimum factor of safety for the protected side analysis of Reach C.

The critical noncircular slip surface shown in Figure 8.7 had an unusual shape, and this unusual shape may be better understood by examining Figure 8.8. Figure 8.8 includes the critical circle for the protected side of Reach C when no reinforcement was present and the critical noncircular slip surface when reinforcement was present. The shape of the noncircular slip surface takes on a shape very similar to that of the circle for no reinforcement, except near the "head" of the slip surface where the noncircular slip surface deviates from the circle to avoid passing through the reinforcement. An odd "kink" is present in the slip surface when the slip surface passes through the layer between elevations -8 ft and -15 ft, and the "kink" in the slip surface is the result of the relatively low undrained shear strength of the layer in which the "kink" lies. The elevation of points along the critical noncircular slip surface and the undrained shear strength mobilized along the slip surface is plotted versus horizontal distance in Figure 8.9. The horizontal lines at elevations -8 ft and -15 ft represent the boundaries of the weak layer. The noticeable decrease in the mobilized undrained shear strength corresponds to the same location as the “kink” in the critical noncircular slip surface, explaining why the slip surface has an unusual shape in that region.

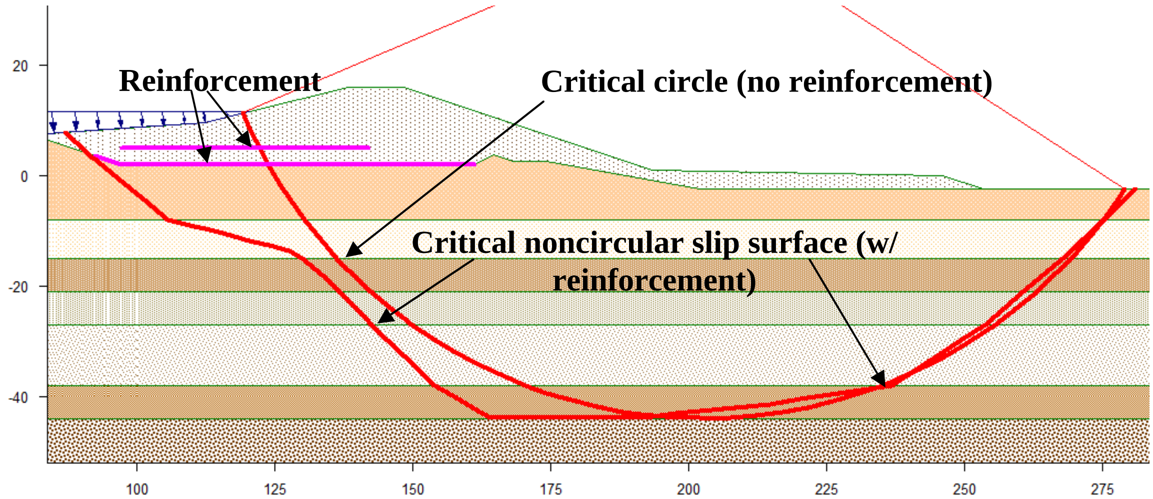


Figure 8.8: Slip surfaces from analyses for Reach C – protected side.

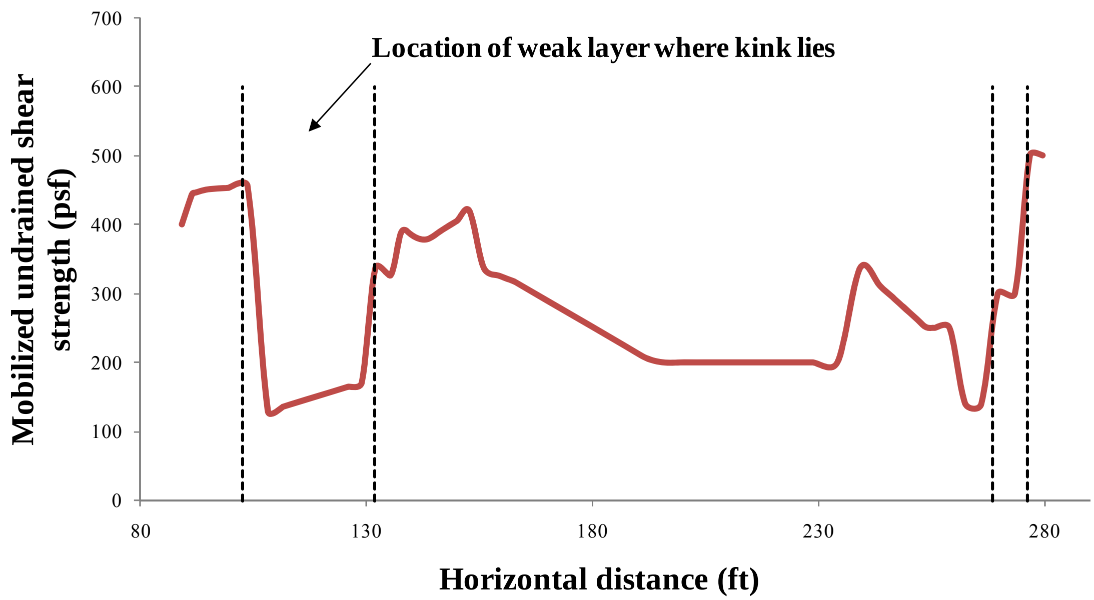


Figure 8.9: Mobilized undrained shear strength and elevation of critical noncircular slip surface plotted versus horizontal distance.

8.3. SUMMARY

While the Method of Planes was shown in previous chapters to be conservative for unreinforced slopes, the Method of Planes and the USACE procedure (1987) for analysis of reinforced slopes does not generally appear to be conservative for reinforced slopes. It is shown by the results presented in this chapter that the Method of Planes is capable of overestimating the minimum factor of safety by a substantial (>100%) amount when reinforcement is present. This result is mainly due to restriction on the shape of the slip surface in the Method of Planes. For the few cases examined, the critical slip surface from the USACE procedure (1987) always intersected the reinforcement. In contrast, when searches for both critical circular and noncircular slip surfaces were performed with Spencer's procedure, the critical slip surface always circumvented the reinforcement. The resulting factor of safety was lower than the minimum factor of safety from the Method of Planes in all but two cases.

When searches were performed with Spencer's procedure to locate the critical noncircular slip surface, it was discovered that the differences in the factor of safety for the critical circle and critical noncircular slip surface were in excess of 14%. The difference in the factor of safety could presumably be even larger, as this finding is based on the results of analyses from only six cases where reinforcement was present.

Chapter 9: Summary, Conclusions, and Recommendations

The objective of the study was to quantify and gain a better understanding of the differences in the factors of safety determined by the Method of Planes and more conventional limit equilibrium analysis procedures. This was done by performing parametric analyses for twenty cross sections using the Method of Planes, a force equilibrium procedure with horizontal side forces, and Spencer's procedure.

9.1. SUMMARY

Slope stability analyses were performed for twenty earthen levee cross sections believed to represent the various levee configurations and subsurface conditions in southeastern Louisiana. The cross sections were taken from design memoranda compiled by the U.S. Army Corps of Engineers, and the results of stability analyses performed by the USACE with the Method of Planes were included on each cross section. In order to properly compare the results from the Method of Planes with other limit equilibrium analyses, the results from the USACE's analyses with the Method of Planes were duplicated to confirm that the data (e.g., soil properties) from the cross sections were interpreted correctly. After analyses were performed with the Method of Planes, analyses were conducted with Spencer's procedure and a force equilibrium procedure that assumed a horizontal inclination for the side forces. The UTEXAS4 slope stability analysis software (Wright, 1999) performed the calculations for Spencer's procedure and the force equilibrium procedure with horizontal side forces.

The first series of analyses consisted of analyzing the critical slip surfaces from the Method of Planes with the force equilibrium procedure with horizontal side forces and Spencer's procedure. The results from both procedures were compared with the results from the Method of Planes. Another series of analyses was performed to evaluate how the factors of safety from the force equilibrium and Spencer's procedures compared with the solutions from the Method of Planes when tension cracks were introduced in the analyses with the Spencer's procedure and the force equilibrium procedure with horizontal side forces.

Searches and analyses were next performed with Spencer's procedure for critical circular and noncircular slip surfaces. The results of these analyses were compared with the minimum factor of safety from the Method of Planes. This was done to observe how the minimum factor of safety from the Method of Planes compared with that from Spencer's procedure when a more critical shape for the slip surface located. The results of searches for the critical circle were compared with results of searches for the noncircular slip surface with the minimum factor of safety to see if a more critical shape of the slip surface, than that for the circle, was found.

Finally, analyses were performed for six cases where geosynthetic reinforcement was present. The critical slip surface for the Method of Planes was analyzed with Spencer's procedure and the force equilibrium procedure with horizontal side forces, and the results were compared with the solutions from the Method of Planes. Searches and analyses were also performed with Spencer's procedure for the critical circular and noncircular slip surfaces, and the results from those analyses were compared with the minimum factor of safety from the Method of Planes.

9.2. CONCLUSIONS

The following conclusions are drawn from this study:

- The force equilibrium procedure with horizontal side forces is identical to the Method of Planes for a given slip surface and $\phi = 0°$. As a result, it was determined the force equilibrium procedure with horizontal side forces could be used in place of the Method of Planes to analyze slip surfaces with shapes other than those assumed by the Method of Planes. Small difference (<10%) in the factors of safety from the force equilibrium procedure and the Method of Planes appeared when frictional material was present.

- The Method of Planes can overestimate the factor of safety by a noticeable amount when a tension crack is introduced to eliminate significant tension near the crest of the slope. Introducing tension cracks in analyses with Spencer's procedure and the force equilibrium procedure with horizontal side forces had a minor effect on the computed factor of safety for most of the cases analyzed in this study. However, the Method of Planes overestimated the factor of safety by nearly 30% for one case where a tension crack was introduced to eliminate a large amount of tension near the crest of the slope.
- The shape of the assumed slip surface had a significant effect on the differences in the factors of safety from Spencer's procedure and the Method of Planes. When the critical slip surfaces from the Method of Planes were analyzed, Spencer's procedure computed a greater factor of safety and the differences were as high as 30%. However, when Spencer's procedure was used to find a more critical shape for the slip surface, the differences in the factors of safety were smaller. When searches were performed for the critical circle with Spencer's procedure, the differences in the minimum factors of safety from the Method of Planes and Spencer's procedure ranged from 1% to 15%. The differences in the minimum

factors of safey were smaller (2% to 11%) for analyses with the critical noncircular slip surface from Spencer's procedure.

- Noncircular searches performed using the critical circle as a starting point and by following the Ardaman (2008) procedure were both very effective in locating the noncircular slip surface with the minimum factor of safety. Although searches starting with the critical circle and the Ardaman procedure were generally the most effective in locating the critical noncircular slip surface, the other search procedure used also worked well in identifying the noncircular slip surface with the minimum factor of safety.
- The difference in the factor of safety for critical circular and noncircular slip surfaces was generally less than 10%. The only cases where the critical noncircular slip surface had a distinctly different shape than the critical circle was when relatively weak layers were present at depth.
- The Method of Planes does not generally appear to be conservative for reinforced slopes, and this is mainly due to the restriction on the shape of the slip surface. In the few cases analyzed, the critical slip surface from the Method of Planes always intersected the reinforcement, while the critical slip surface from Spencer's procedure always circumvented the reinforcement, resulting in Spencer' procedure producing noticeably lower factors of safety than the Method of Planes.

9.3. RECOMMENDATIONS

The U.S. Army Corps of Engineers should adopt a slope stability analysis procedure that fully satisfies static equilibrium and is capable of analyzing slip surfaces with a variety of shapes. While the Method of Planes was found to be conservative is this study, the degree to which the procedure was conservative varied widely. For critical cases, it is recommended that more than one procedure be used, as well as performing a full suite of searches and analyses to identify the critical slip surface.

Appendix A: Earthen Levee Cross Sections

Twenty earthen levee cross sections were analyzed in this study. The "plates" containing the cross sections are presented in this Appendix. The plates were extracted from the U.S. Army Corps of Engineers's design memoranda, which were made available to the public by way of an Internet website (https://ipet.wes.army.mil/). The location of each cross section is presented in Table A.1, along with the corresponding figure number in this Appendix.

Table A.1: Figure numbers for each cross section in Appendix A.

Location	Figure No.
Citrus Back Levee	A.1
G.I.W.W. - Michoud Canal	A.2
City Price to Venice	A.3
Phoenix to Bohemia	A.4
South Point to G.I.W.W.	A.5
City Price to Tropical Bend	A.6
Orleans Parish Lakefront	A.7
Jefferson Parish Lakefront - Reach B (protected side analysis)	A.8
Citrus Lakefront	A.9
Along MRGO - Violet Line	A.10
Harvey Canal	A.11
New Orleans Lakefront Airport	A.12
South Point to G.I.W.W. (2)	A.13
City Price to Tropical Bend (2)	A.14
Orleans Parish Lakefront (2)	A.15
Along MRGO Violet Line (2)	A.16
Westminster	A.17
Bayou St. John	A.18
Jefferson Parish Lakefront - Reach A (protected side analysis)	A.19
Jefferson Parish Lakefront - Reach A (flood side analysis)	A.20
Jefferson Parish Lakefront - Reach B (flood side analysis)	A.21
Jefferson Parish Lakefront - Reach C (protected side analysis)	A.22
Jefferson Parish Lakefront - Reach C (flood side analysis)	A.23

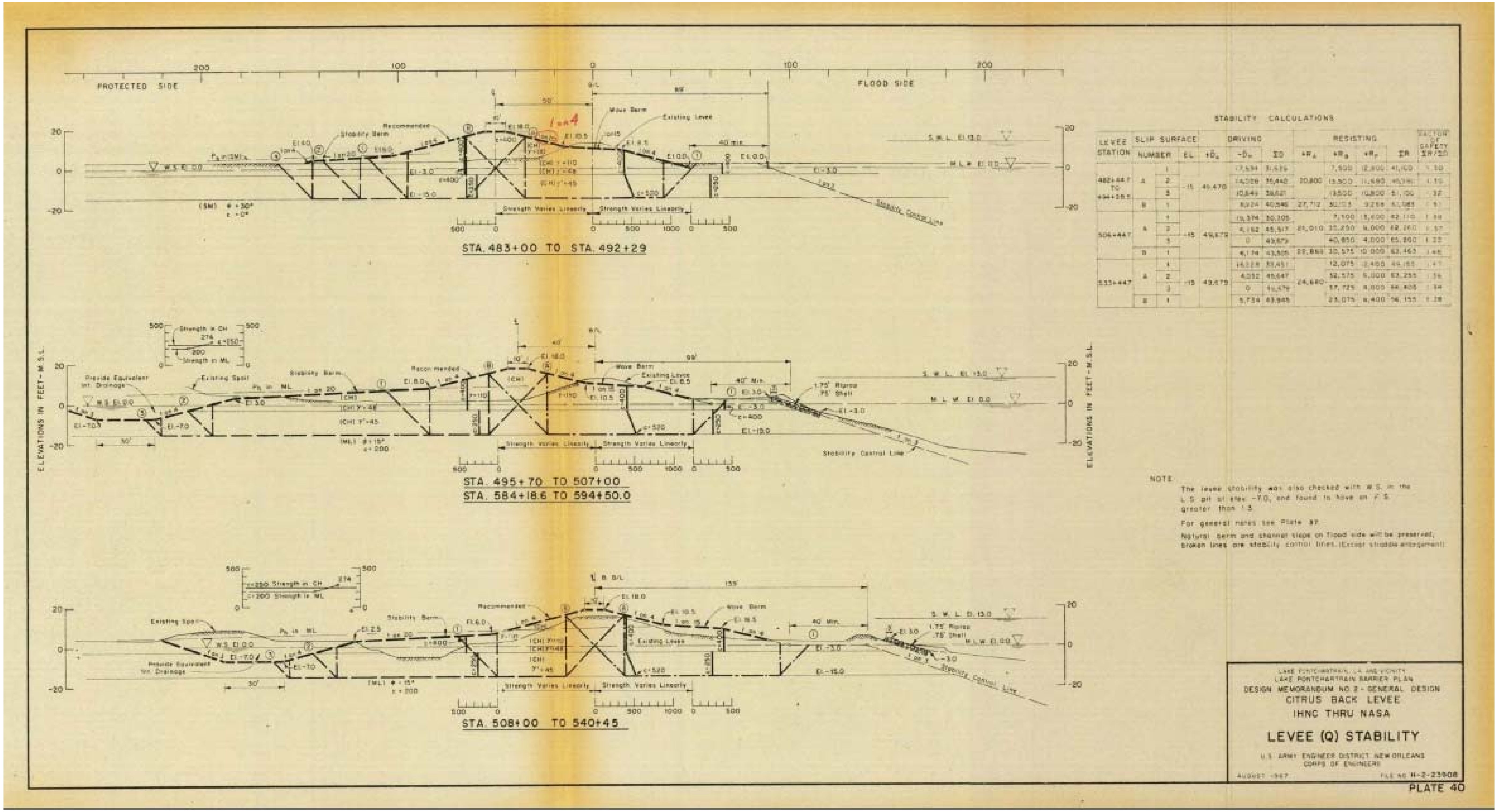
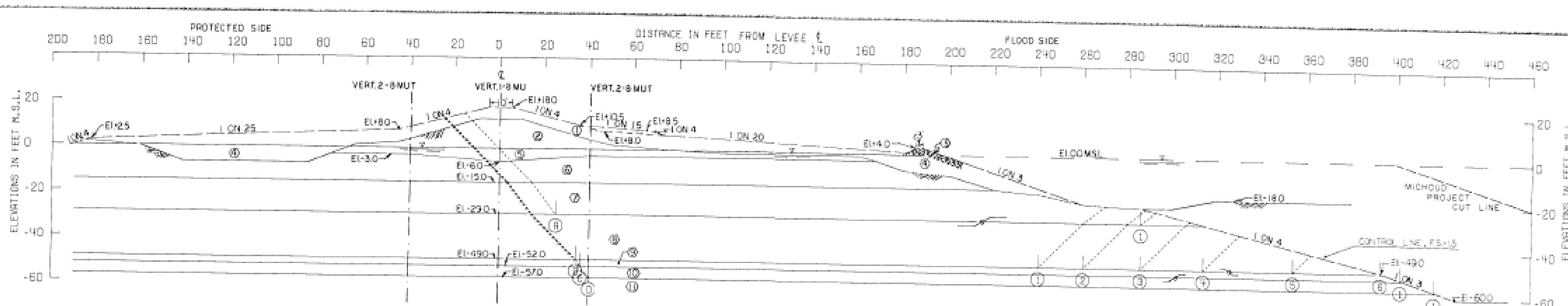


Figure A.1: Citrus Back Levee



STA. 507+44.6 TO STA.540+00

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F. VERT. 1	EFFECTIVE UNIT WT. P.C.F. VERT. 2	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 2	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 1	C - UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE DEGREES
1	FILL	110.0	110.0	250.0	250.0	250.0	250.0	0.
2	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.
3	RIPRAP	110.0	110.0	0.	0.	0.	0.	0.
4	FILL	40.0	40.0	200.0	200.0	200.0	200.0	0.
5	CH	40.0	40.0	300.0	200.0	300.0	200.0	0.
6	CH	40.0	40.0	400.0	200.0	400.0	200.0	0.
7	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
8	CH	45.0	45.0	500.0	500.0	500.0	500.0	0.
9	SP	60.0	60.0	0.	0.	0.	0.	33.0
10	CH	60.0	60.0	800.0	800.0	800.0	800.0	0.
11	CH	60.0	60.0	800.0	800.0	800.0	800.0	0.

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY
A	1	-29.00	40171	121463	3461	84655	1015	165096	83640	1.974
B	1	-49.00	60627	103000	25165	150911	22840	188793	128071	1.474
B	2	-49.00	60627	113000	24256	150911	18680	197883	132231	1.496
B	3	-49.00	60627	126000	20844	150911	14027	207471	136883	1.516
B	4	-49.00	60627	140000	16000	150911	7196	216627	143715	1.507
B	5	-49.00	60627	157045	8000	150911	1798	225673	149113	1.513
B	6	-49.00	60627	162986	200	150911	1	223714	150910	1.482
C	1	-52.00	68119	255104	4	161335	2	323229	161333	2.003
D	1	-57.00	76018	301600	400	180404	2	378018	180401	2.096

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS 8-MU AND 8-MUT. SEE BORING DATA PLATES 25 & 26.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STATIONING ALONG CITRUS BACK LEVEE.

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

○ STRATUM NUMBER
○ WEDGE NUMBER

MISSISSIPPI RIVER – GULF OUTLET
MICHOUD CANAL, LA.

DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN

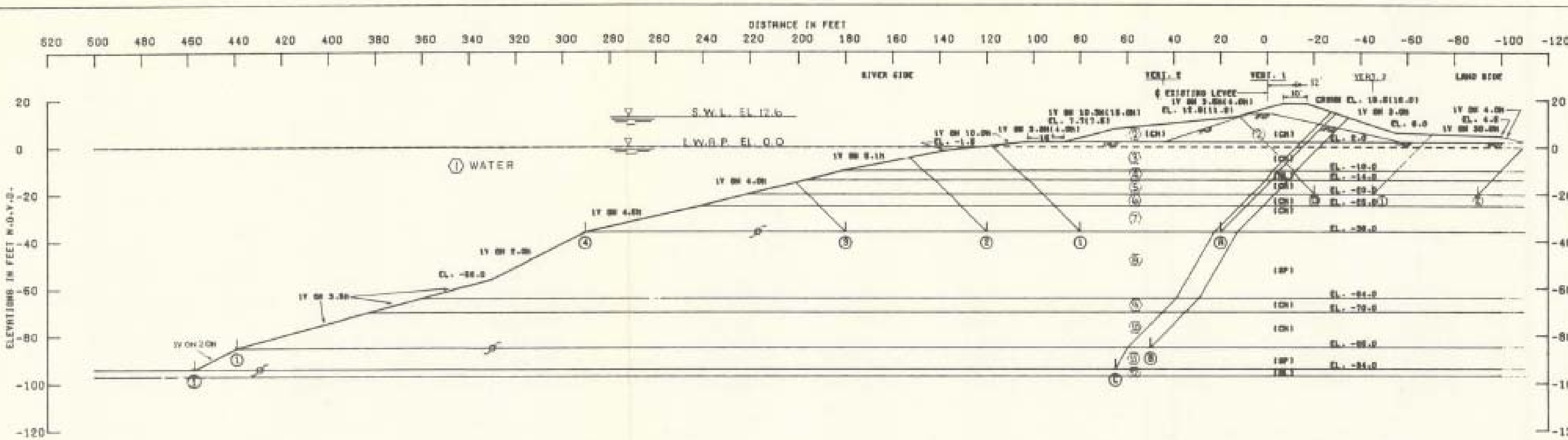
(Q) LEVEE STABILITY ANALYSIS FLOODSIDE
STA. 507+44.6 TO STA. 540+00

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

JUNE 1973 FILE NO. H-2-25340

PLATE 9

Figure A.2: G.I.W.W. – Michoud Canal.



STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F. VERT. 1	EFFECTIVE UNIT WT. P.C.F. VERT. 2	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	CENTER OF STRATUM VERT. 2	BOTTOM OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE DEGREES
1	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.0
3	CH	105.0	105.0	300.0	350.0	300.0	350.0	0.0
4	ML	117.0	117.0	200.0	200.0	200.0	200.0	15.0
5	CH	105.0	105.0	300.0	350.0	300.0	350.0	0.0
6	CH	105.0	105.0	325.0	350.0	350.0	350.0	0.0
7	CH	105.0	105.0	385.0	385.0	420.0	420.0	0.0
8	SP	122.0	122.0	0.0	0.0	0.0	0.0	30.0
9	CH	105.0	105.0	760.0	760.0	800.0	800.0	0.0
10	CH	105.0	105.0	800.0	800.0	800.0	800.0	0.0
11	SP	122.0	122.0	0.0	0.0	0.0	0.0	30.0
12	CH	117.0	117.0	200.0	200.0	200.0	200.0	15.0

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. FOR C/L PROPERTIES SEE BORING 9-UH. FOR TOE PROPERTIES SEE BORING 9-UHT.

SHEAR STRENGTHS BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED AT EACH LOCATION.

LEVEE AND BERM ELEVATIONS AND SLOPES LISTED AS GROSS(NET).

ASSUMED FAILURE SURFACE NO.	ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
R 1	-36.0	36396	26200	26727	146137	76409	90323	69638	1.30
R 2	-36.0	36396	42000	21887	146137	66825	103283	79617	1.30
R 3	-36.0	36396	67200	14897	146137	52642	121283	93495	1.30
R 4	-36.0	36396	97661	-3	146137	40495	137056	105639	1.30
B 1	-65.0	140259	260283	12	533961	225775	400534	308186	1.30
C 1	-94.0	171818	391827	0	829102	276117	563645	351985	1.60
[illegible] 1	-20.0	26424	7594	17520	74884	34645	51546	39539	1.30
[illegible] 2	-20.0	26424	21537	14727	74384	26292	62685	48092	1.30

Applies to Stations
1313+77 to 1367+19

PIEZOMETRIC HEAD LINE USED FOR FLOODSIDE ANALYSIS IS L.W.R.P. EL. 0.0.
PIEZOMETRIC HEAD LINE USED FOR PROTECTED SIDE ANALYSIS IS FROM S.W.L. TO PROTECTED SIDE LEVEE TOE.

GROSS GRADE TO BE ACHIEVED IN A SINGLE LIFT.

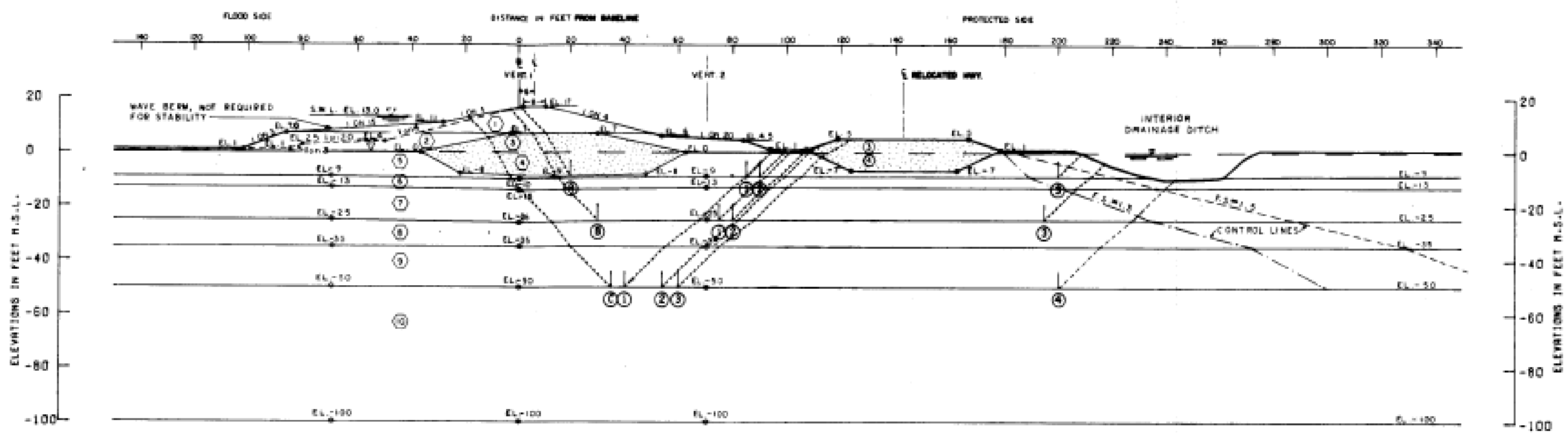
NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 6
WEST BANK MISSISSIPPI RIVER LEVEE
CITY PRICE TO VENICE, LA.
TYPICAL LAND SIDE ENLARGEMENT
REACH T-2
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: MARCH 1987
FILE NO. H-2-30052
PLATE 75

Figure A.3: City Price to Venice.



<u>GENERAL NOTES</u>

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

VERT. 1 = BORING 8-CU
VERT. 2 = BORING 8-CUTP

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	95.0	95.0	200.0	200.0	200.0	200.0	0.0
2	CH	95.0	95.0	300.0	300.0	300.0	300.0	0.0
3	SP(F)	122.0	122.0	0.0	0.0	0.0	0.0	30.0
4	SP(F)	60.0	60.0	0.0	0.0	0.0	0.0	30.0
5	CHO	20.0	20.0	300.0	300.0	300.0	300.0	0.0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
7	CH	40.0	40.0	500.0	350.0	500.0	350.0	0.0
8	ML	55.0	65.0	200.0	200.0	200.0	200.0	15.0
9	CH	40.0	40.0	500.0	600.0	500.0	500.0	0.0
10	CH	40.0	40.0	750.0	750.0	750.0	750.0	0.0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	-9.00	21290	19600	6000	31036	3057	46790	27979	1.672
A	2	-9.00	21290	21000	6000	31036	1977	48290	29058	1.662
A	3	-9.00	21290	52954	5224	31036	1471	79468	29564	2.688
B	1	-25.00	37580	17658	17968	70676	16737	73206	53938	1.357
B	2	-25.00	37580	19445	18052	70676	15063	75077	55612	1.350
B	3	-25.00	37580	59704	14336	70676	10284	111620	60391	1.848
C	1	-50.00	65729	2500	50913	152465	79007	119142	73459	1.622
C	2	-50.00	65729	9500	49105	152465	86760	124333	85705	1.434
C	3	-50.00	65729	12500	51457	152465	64723	129686	87743	1.478
C	4	-50.00	65729	62500	37739	152465	42624	165968	109842	1.693

<u>NOTES</u>

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

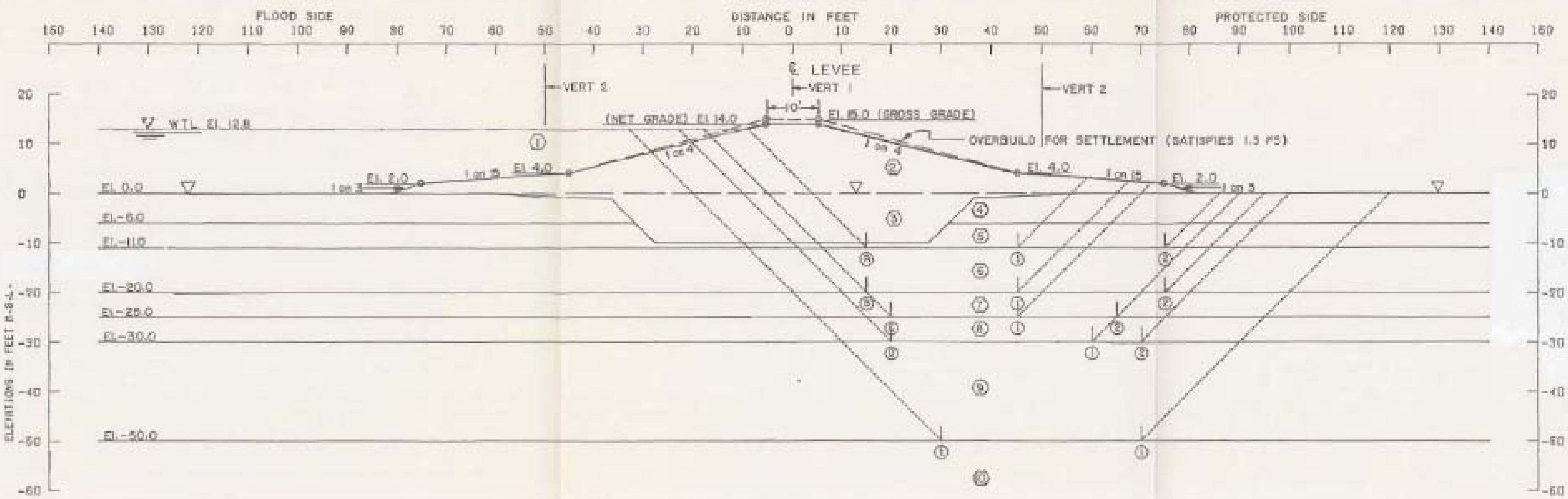
$$FS = \text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{\Sigma R}{\Sigma D}$$

(2) WEDGE NUMBER
(3) STRATUM NUMBER

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 5
REACH C – PHOENIX TO BOHEMIA
LEVEE – PROTECTED SIDE
(Q) STABILITY ANALYSIS
STA. 159+00 TO STA. 495+00
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MARCH 1972
FILE NO. H-2-25587

PLATE 39

Figure A.4: Phoenix to Bohemia.



LEVEE TO BE CONSTRUCTED TO EL. 13.0, EL. 13.5, AND EL. 14.0 (NET GRADES) BETWEEN STA. 939+60 TO STA. 1101+90.
HOWEVER, ONLY THE STABILITY OF THE LEVEE TO EL. 14.0 (THE MOST CRITICAL) IS PRESENTED.
USING THE LOWEST SHEAR STRENGTH TREND FROM THE REACH STA. 965+00 TO STA. 1101+90.

GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORINGS 1-USP & 1-USPT DATA PLATES 23 & 22 RESPECTIVELY.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	WATER	62.5	62.5	0.0	0.0	0.0	0.0	0.0
2	CH	117.0	117.0	400.0	400.0	400.0	400.0	0.0
3	CH	55.0	55.0	400.0	400.0	400.0	400.0	0.0
4	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
5	CH	30.0	30.0	400.0	350.0	400.0	350.0	0.0
6	CH	40.0	40.0	400.0	350.0	400.0	350.0	0.0
7	CH	45.0	45.0	400.0	375.0	400.0	400.0	0.0
8	CH	45.0	45.0	425.0	425.0	450.0	450.0	0.0
9	CH	40.0	40.0	550.0	550.0	550.0	550.0	0.0
10	SP	50.0	60.0	0.0	0.0	0.0	0.0	33.0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	-11.00	19171	11100	10212	31063	7682	40483	23381	1.731
A	2	-11.00	19171	21813	7700	31063	2994	48484	28069	1.728
B	1	-20.00	24760	11100	16017	51087	15742	51877	35345	1.468
B	2	-20.00	24760	21813	14000	51087	8123	60573	42966	1.405
C	1	-25.00	28673	10000	19515	62712	21429	58188	41284	1.409
C	2	-25.00	28673	18000	17750	62712	16172	64423	47540	1.355
D	1	-30.00	32248	18000	22000	76048	22276	72248	53772	1.344
D	2	-30.00	32248	22500	22000	76048	19140	76748	56908	1.349
E	1	-50.00	52688	26000	44000	136378	51137	122688	84241	1.457

NOTES

Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 5
NEW ORLEANS EAST LEVEE
SOUTH POINT TO G.I.W.W.
LEVEE (Q) SHEAR STABILITY ANALYSIS
PROTECTED SIDE
STA. 939+60 TO STA. 1101+90
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1973
FILE NO. H-2-25016

PLATE 47

Figure A.5: South Point to G.I.W.W.

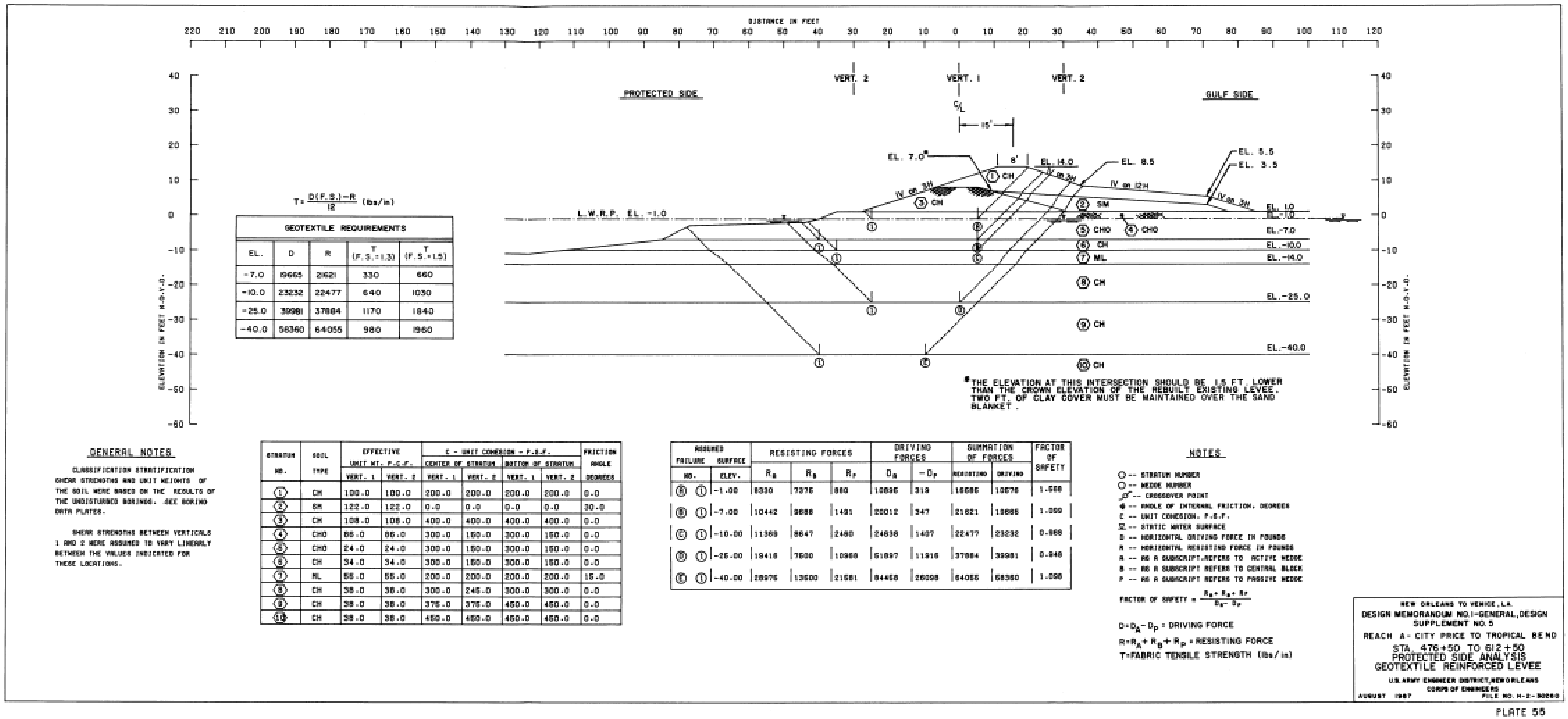
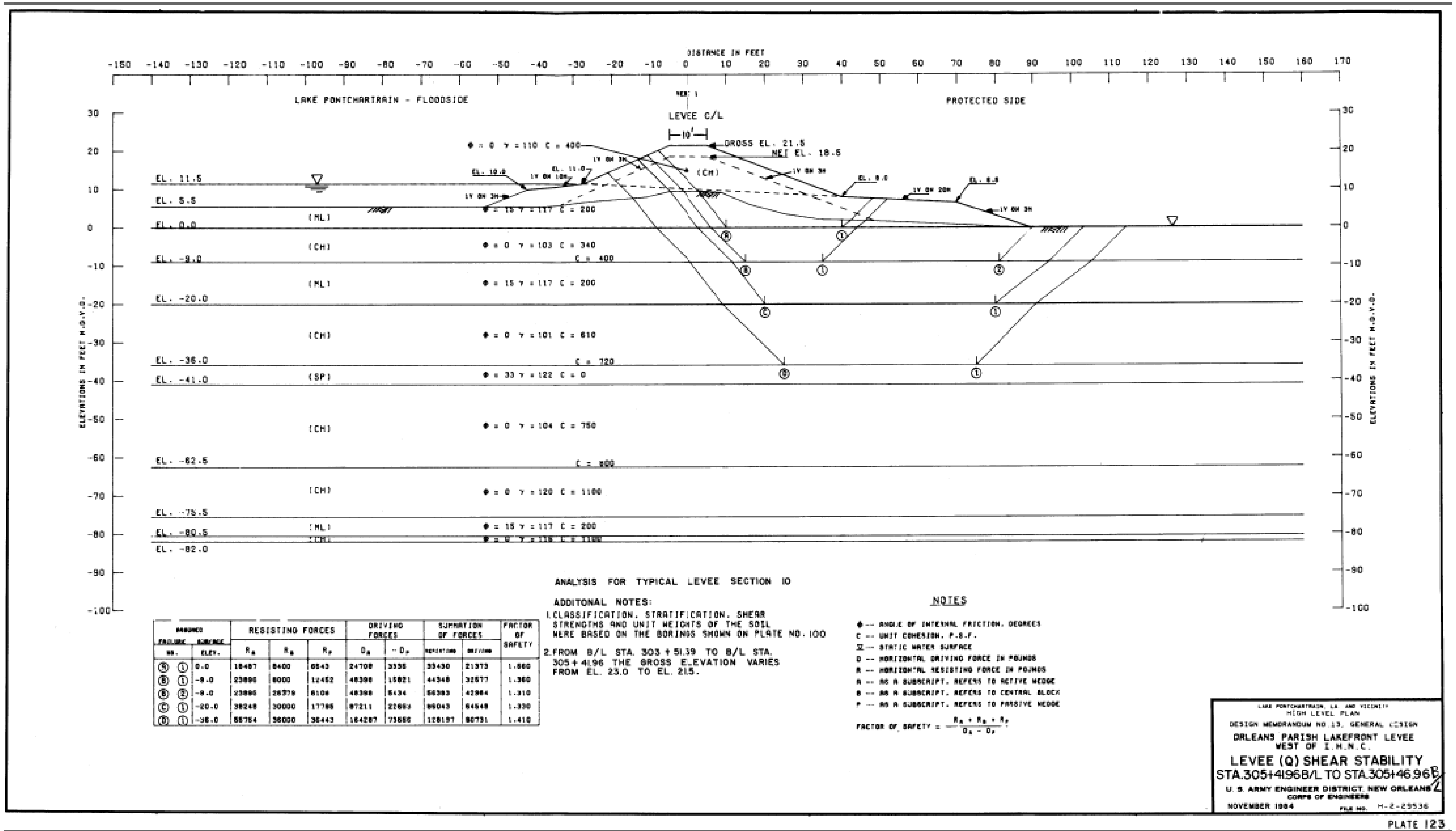


Figure A.6: City Price to Tropical Bend.



Assumed Failure No.		Surface Elev.	Resisting Forces R_A	R_B	R_P	Driving Forces D_A	$-D_P$	Summation of Forces Resisting	Driving	Factor of Safety
S	1	0.0	18487	8400	6543	24708	3335	33430	21373	1.560
B	1	-9.0	23896	8000	12452	48398	15821	44348	32577	1.360
B	2	-9.0	23896	26379	6108	48398	5434	56383	42964	1.310
C	1	-20.0	38248	30000	17795	87211	22663	86043	64548	1.330
D	1	-36.0	55754	36000	36443	164287	73556	128197	90731	1.410

Figure A.7: Orleans Parish Lakefront.

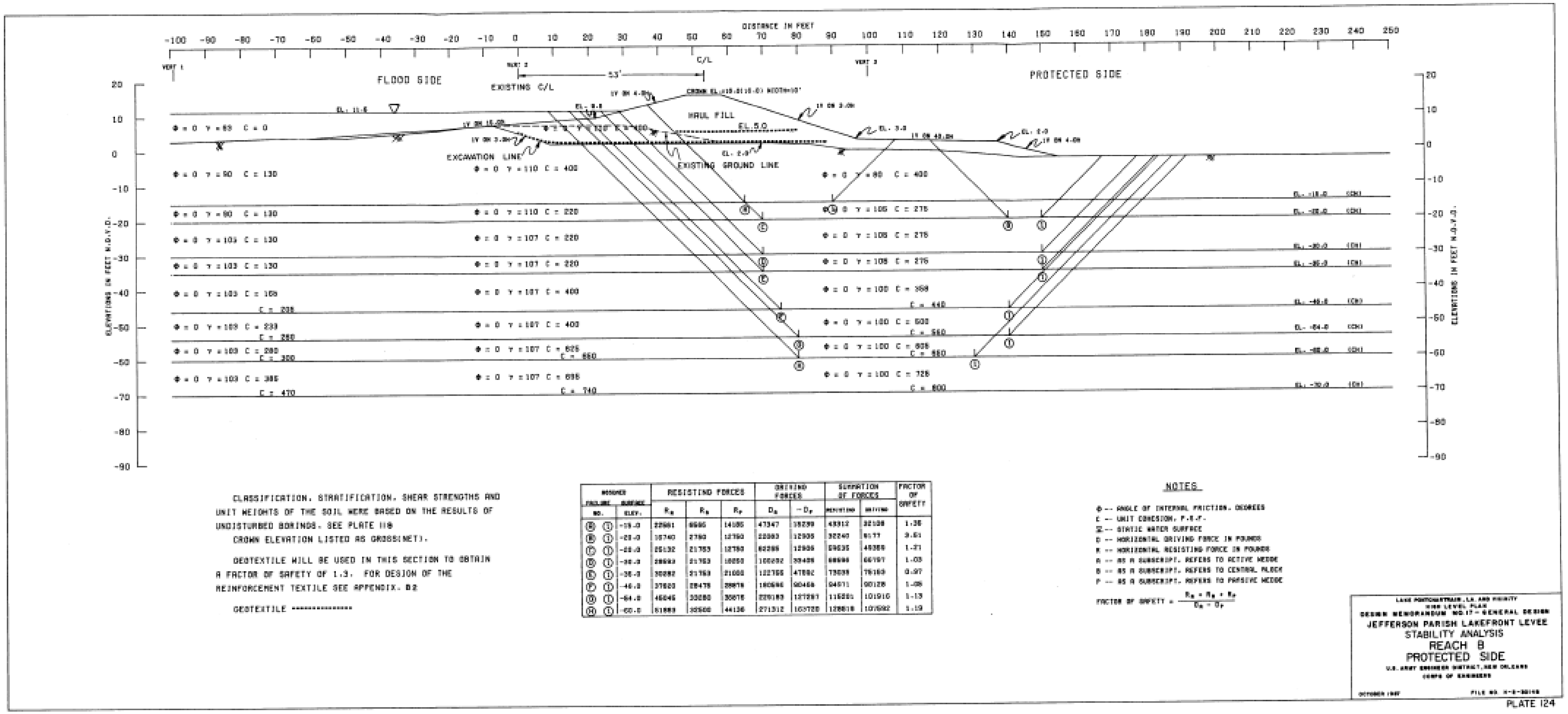
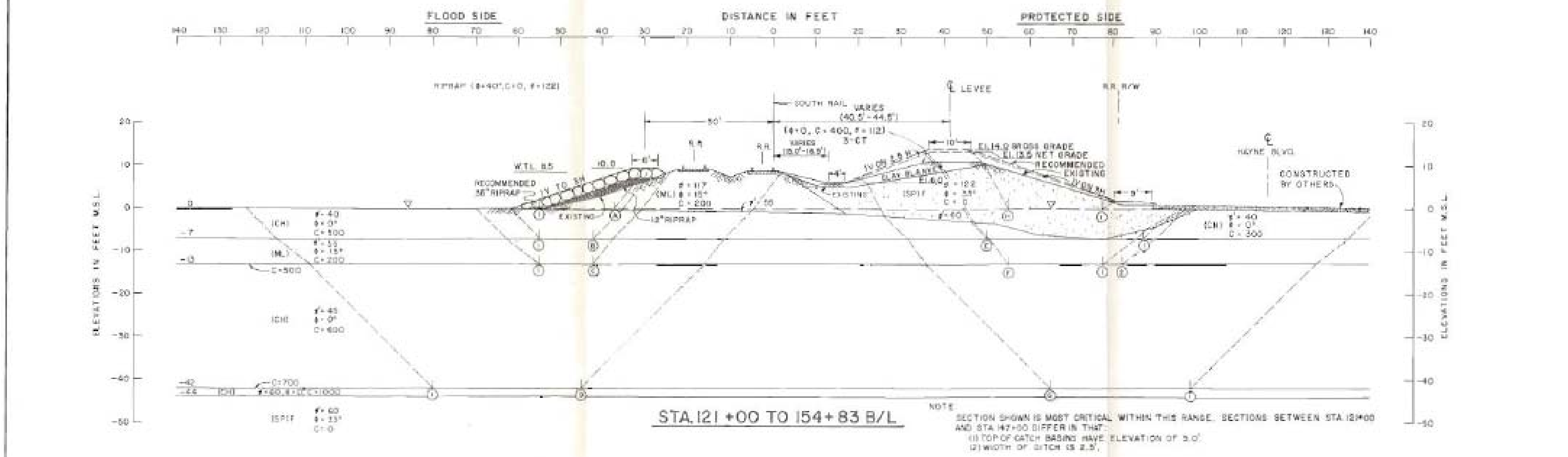


Figure A.8: Jefferson Parish Lakefront – Reach B (protected side analysis).



WAVE WASH PROTECTION

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A–I	0	4899	178	4721	4076	5349	639	10064	2.132
B–I	−7	12449	1894	10555	8562	3900	4200	16662	1.579 ←
C–I	−13	21111	4350	16761	13965	6480	9682	30127	1.798
D–I	−42	86514	40258	46256	48526	24500	43992	117018	2.530

LEVEE

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
[illegible]	−7	23895	2543	21352	18867	16751	4361	39959	1.871
[illegible]	−13	35118	7545	27573	25321	12615	11456	49392	1.791
[illegible]	−13	35118	6806	28312	25321	14954	10194	50469	1.783
[illegible]	−42	109148	42578	66570	54172	19800	44213	118185	1.775 ←
[illegible]	0	8906	336	8570	6756	5202	439	12397	1.446 *

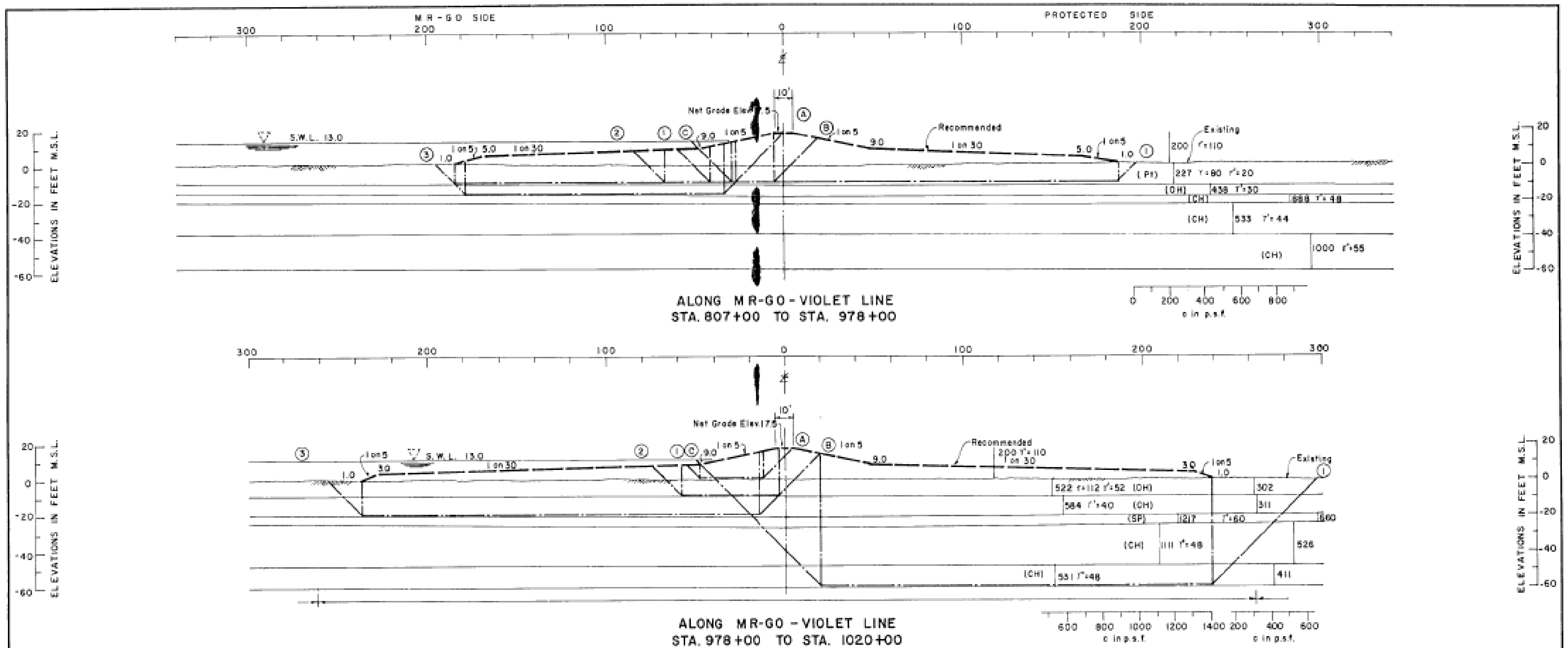
NOTE:

SEE PLATE NO. 47 FOR GENERAL NOTES.
B/L – BASELINE
SEE PLATE NO. 49 FOR STEADY SEEPAGE NOTE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
DESIGN SECTION AND LEVEE
(Q) SHEER STABILITY
STA. 121+00 B/L TO STA. 154+83 B/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1975 FILE NO. H-2-26533

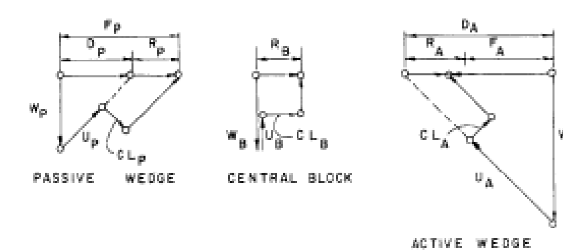
PLATE 51

Figure A.9: Citrus Lakefront.



SECTION	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	No.		El.	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
ALONG MR-GO VIOLET LINE STA. 978+00 TO 1020+00	A	1	+0.5	15,356	3,873	11,483	6,800	6,950	3,300	17,050	1.48
	B	2	-9.0	35,735	17,259	18,476	15,196	23,551	12,906	51,653	2.80
		3	-19.5	71,344	22,904	48,440	27,253	129,940	15,010	172,203	3.55
	C	1	-59.5	295,420	195,363	100,057	99,479	114,961	66,710	281,150	2.81
ALONG MR-GO VIOLET LINE STA. 807+00 TO STA. 978+00	A	1	-10.4	36,353	19,363	16,990	11,524	4,150	7,918	23,592	1.39
		2	-10.4	36,353	17,801	18,552	11,524	9,076	7,657	28,257	1.52
		3	-16.4	51,628	13,749	37,879	15,943	64,401	9,934	90,278	2.38
	B	3	-10.4	39222	5,821	33,401	10,307	41,246	5,074	56,627	1.70
	C	1	-10.4	27,025	5,821	21,204	8,131	48,850	5,074	62,055	2.93

LEVEE STABILITY CALCULATIONS



Surface B-2

F.S. with respect to shear strength $= \frac{R_A + R_B + R_P}{D_A - D_P} = \frac{51,653}{18,476} = 2.80$

VECTOR DIAGRAM
(Method of planes)

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN

STABILITY ANALYSIS

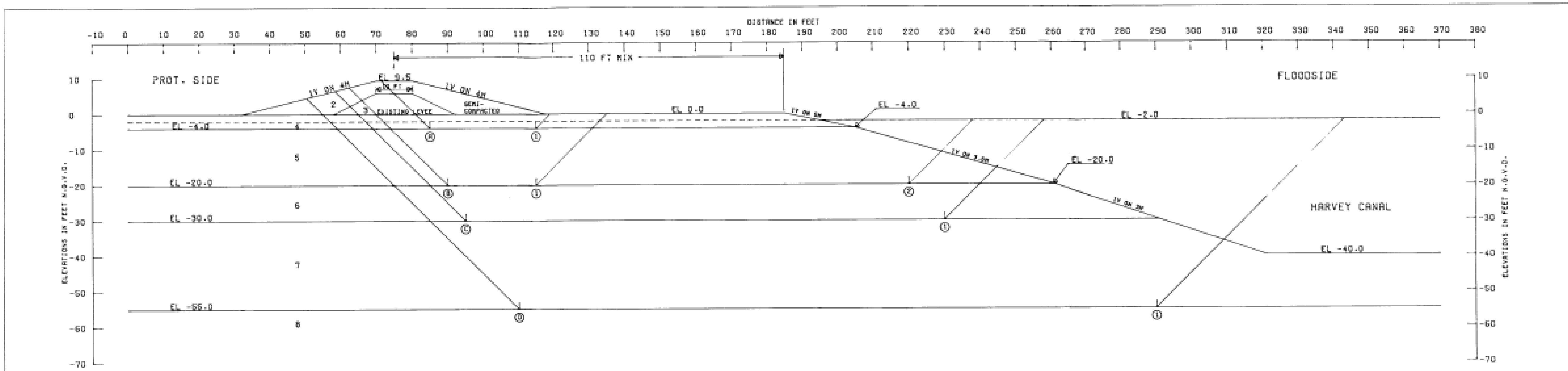
SCALES AS SHOWN

DATE NOVEMBER 1966

FILE NO. H-2-23820

PLATE NO. 43

Figure A.10: Along MRGO – Violet Line.



STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C = UNIT COHESION = P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	WATER	62.5	0.0	0.0	0.0	0.0	0.0	0.0
2	(CH)	110.0	0.0	400.0	0.0	400.0	0.0	0.0
3	(CH)	104.0	0.0	500.0	0.0	500.0	0.0	0.0
4	(CH)	104.0	0.0	170.0	0.0	180.0	0.0	0.0
5	(CH)	95.0	0.0	215.0	0.0	250.0	0.0	0.0
6	(CH)	100.0	0.0	275.0	0.0	300.0	0.0	0.0
7	(CH)	100.0	0.0	400.0	0.0	500.0	0.0	0.0
8	(CH)	100.0	0.0	500.0	0.0	500.0	0.0	0.0

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A 1	-4.0	10160	5400	1360	9416	956	16920	8460	2.00
B 1	-20.0	15121	6250	8240	42489	19771	29611	22728	1.30
B 2	-20.0	15121	32500	3917	42489	11858	51538	30641	1.68
C 1	-30.0	19489	40500	7506	74168	29242	67498	44926	1.50
D 1	-55.0	37423	90000	15199	191319	96802	142622	94517	1.51

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

WESTWEGO TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

HARVEY CANAL LEVEE
STA. 817+20 TO 1014+25 B/L
FLOODSIDE ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: FEB. 90 FILE NO. H-2-30946

PLATE F129

Figure A.11: Harvey Canal.

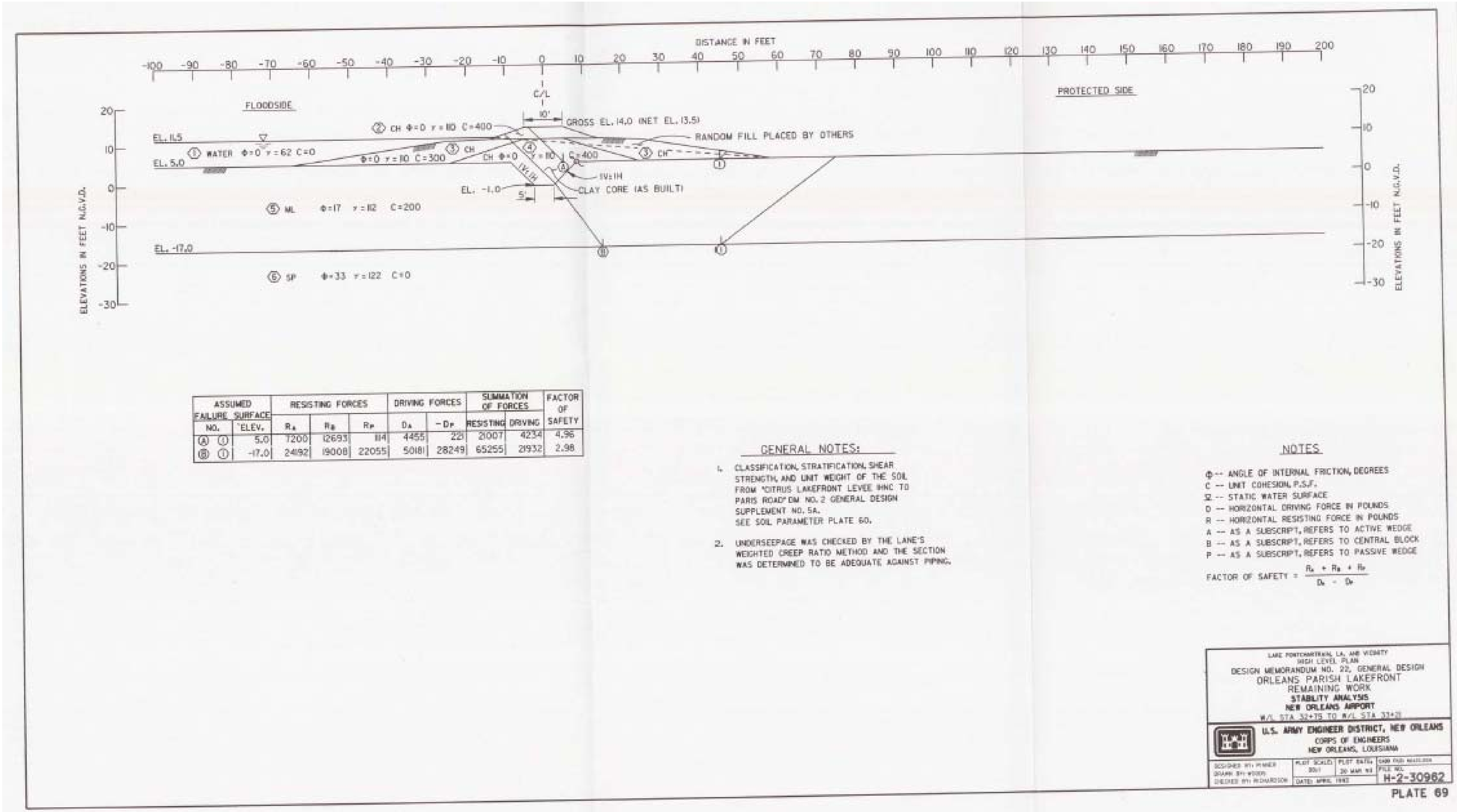
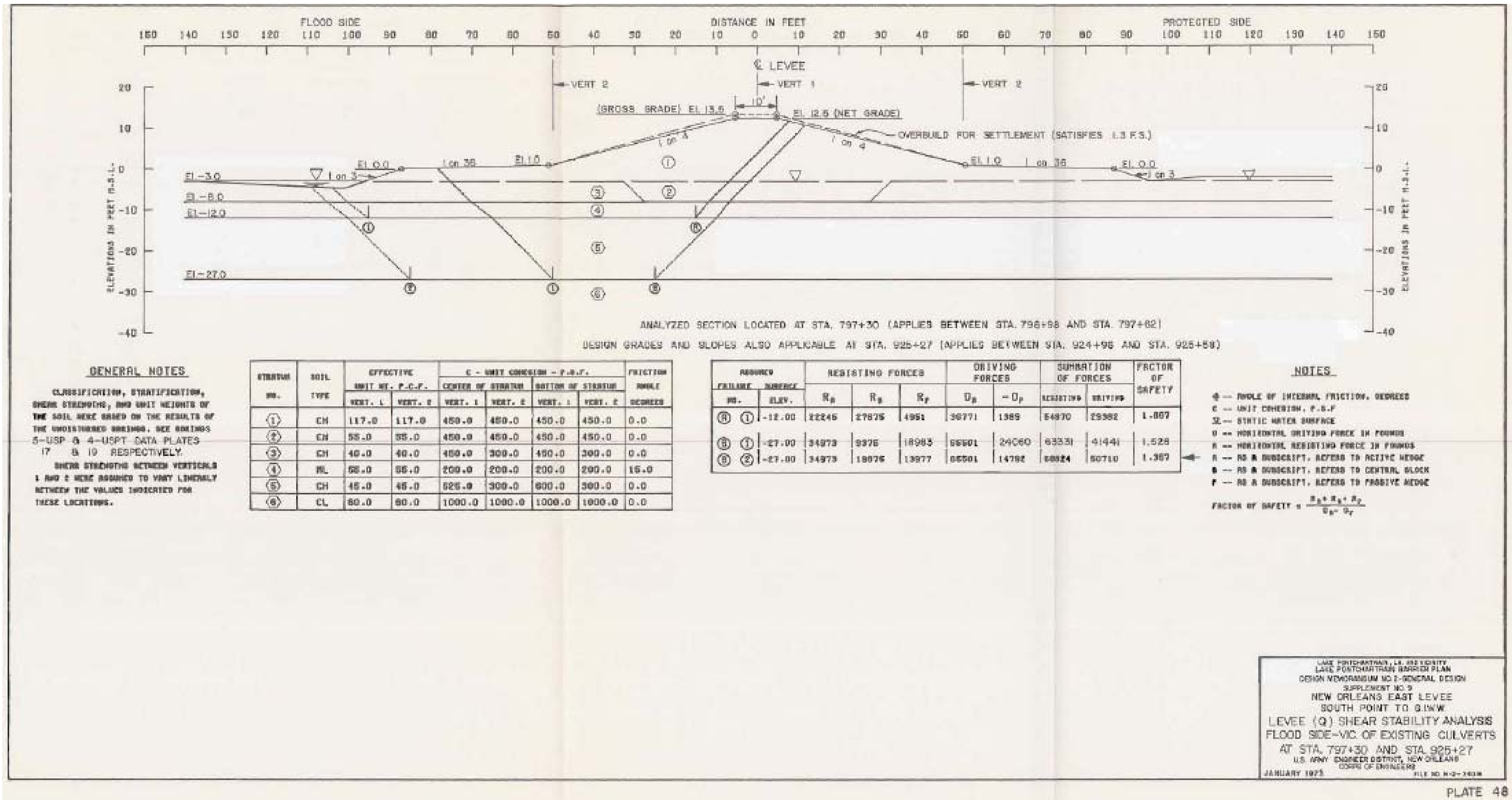


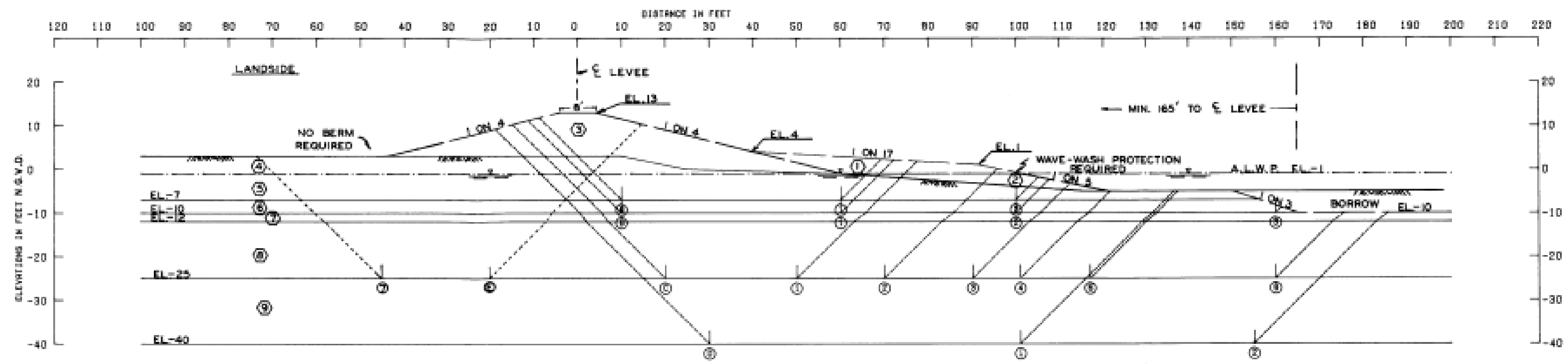
Figure A.12: New Orleans Lakefront Airport.



STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F. VERT. 1	EFFECTIVE UNIT WT. P.C.F. VERT. 2	C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	CENTER OF STRATUM VERT. 2	BOTTOM OF STRATUM VERT. 1	BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE DEGREES
1	CH	117.0	117.0	450.0	450.0	450.0	450.0	0.0
2	CH	55.0	55.0	450.0	450.0	450.0	450.0	0.0
3	CH	40.0	40.0	450.0	300.0	450.0	300.0	0.0
4	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
5	CH	45.0	45.0	525.0	300.0	600.0	300.0	0.0
6	CL	60.0	60.0	1000.0	1000.0	1000.0	1000.0	0.0

ASSUMED FAILURE NO.	SURFACE ELEV.	RESISTING FORCES R_A	R_B	R_P	DRIVING FORCES D_A	$-D_P$	SUMMATION OF FORCES RESISTING	DRIVING	FACTOR OF SAFETY
R 1	-12.00	22245	27875	4951	30771	1389	54970	29382	1.867
B 1	-27.00	34973	9376	18983	65501	24060	63331	41441	1.528
B 2	-27.00	34973	19076	13977	65501	14792	68024	50710	1.357

Figure A.13: South Point to G.I.W.W. (2).



GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

VERT. 1 = VERT. 2 = BORS.:
A-9-U, A-10-U, 33-AU, 32-AU, & A-10-BU.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	CH	100.0	100.0	200.0	200.0	200.0	200.0	0.0
2	CH	38.0	38.0	200.0	200.0	200.0	200.0	0.0
3	CH	110.0	110.0	400.0	400.0	400.0	400.0	0.0
4	CHO	86.0	86.0	200.0	200.0	200.0	200.0	0.0
5	CHO	24.0	24.0	200.0	200.0	200.0	200.0	0.0
6	CH	34.0	34.0	200.0	200.0	200.0	200.0	0.0
7	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
8	CH	38.0	38.0	235.0	235.0	300.0	300.0	0.0
9	CH	38.0	38.0	375.0	375.0	450.0	450.0	0.0
10	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	-7.00	11040	10000	3711	18800	3204	24751	15596	1.587
A	2	-7.00	11040	18000	2067	18800	552	31107	18248	1.705
B	1	-10.00	11760	10000	4844	23222	4768	26604	18454	1.442
B	2	-10.00	11760	18000	3067	23222	1148	32827	22074	1.487
B	3	-10.00	11760	30000	500	23222	35	42260	23187	1.823
C	1	-25.00	19143	9000	12797	49387	18915	40941	30472	1.344
C	2	-25.00	19143	15000	11968	49387	15967	46111	33421	1.380
C	3	-25.00	19143	21000	10294	49387	11015	50437	38372	1.314
C	4	-25.00	19143	24300	9499	49387	8736	52942	40651	1.302
C	5	-25.00	19143	29100	9439	49387	7404	57682	41984	1.374
C	6	-25.00	19143	42000	7229	49387	4890	68372	44497	1.537
D	1	-40.00	29844	31950	20689	81232	24345	82292	56887	1.446
D	2	-40.00	29844	56250	18479	81232	18646	104373	62586	1.668
E	7	-25.00	19143	7500	13654	49147	18400	40297	30747	1.311

NOTES

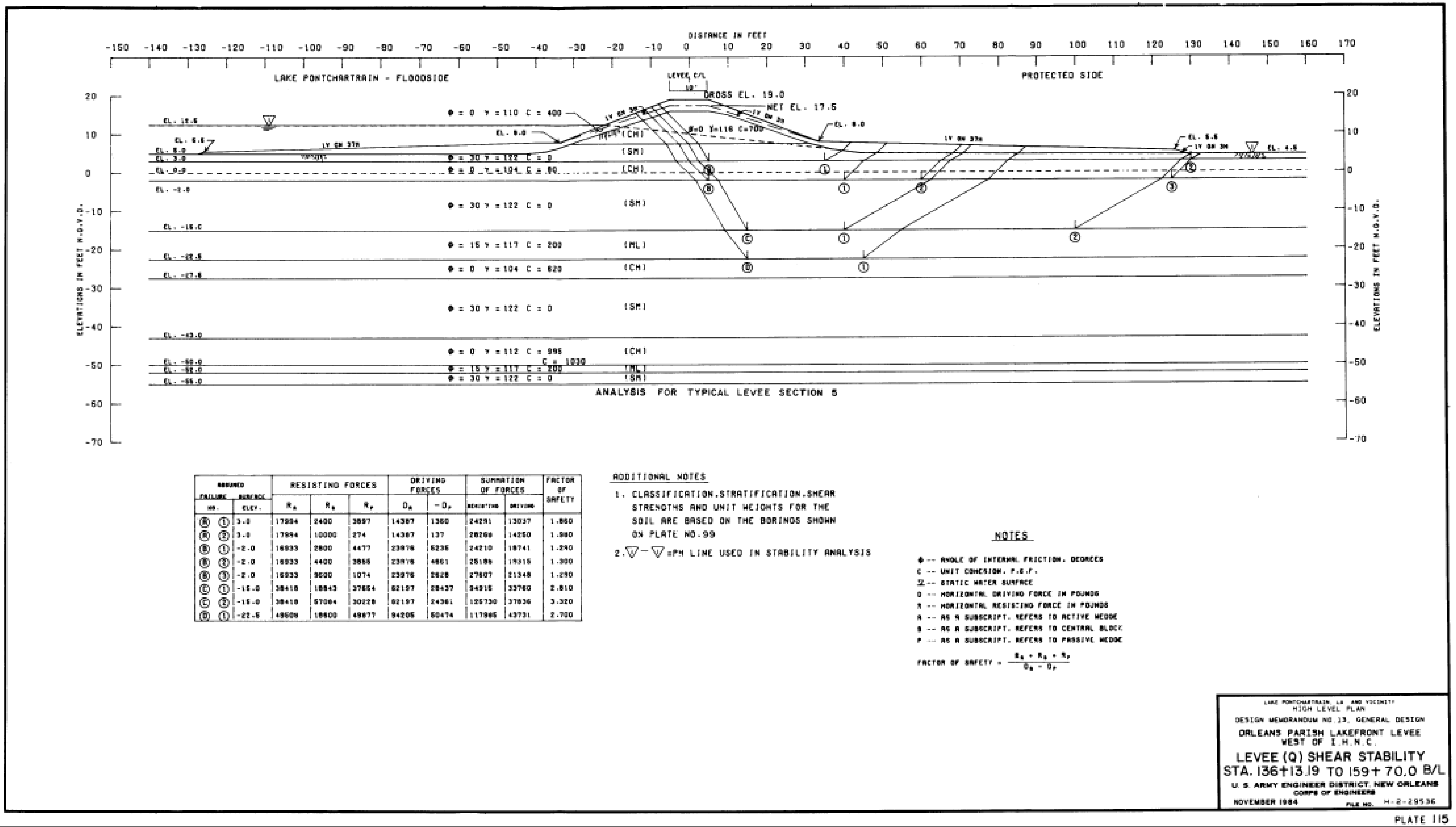
φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 5
REACH A - CITY PRICE TO TROPICAL BEND
STA. 245+00 TO 253+02
FINAL SECTION – ALL CLAY
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
AUGUST 1987
FILE NO. H-2-30260

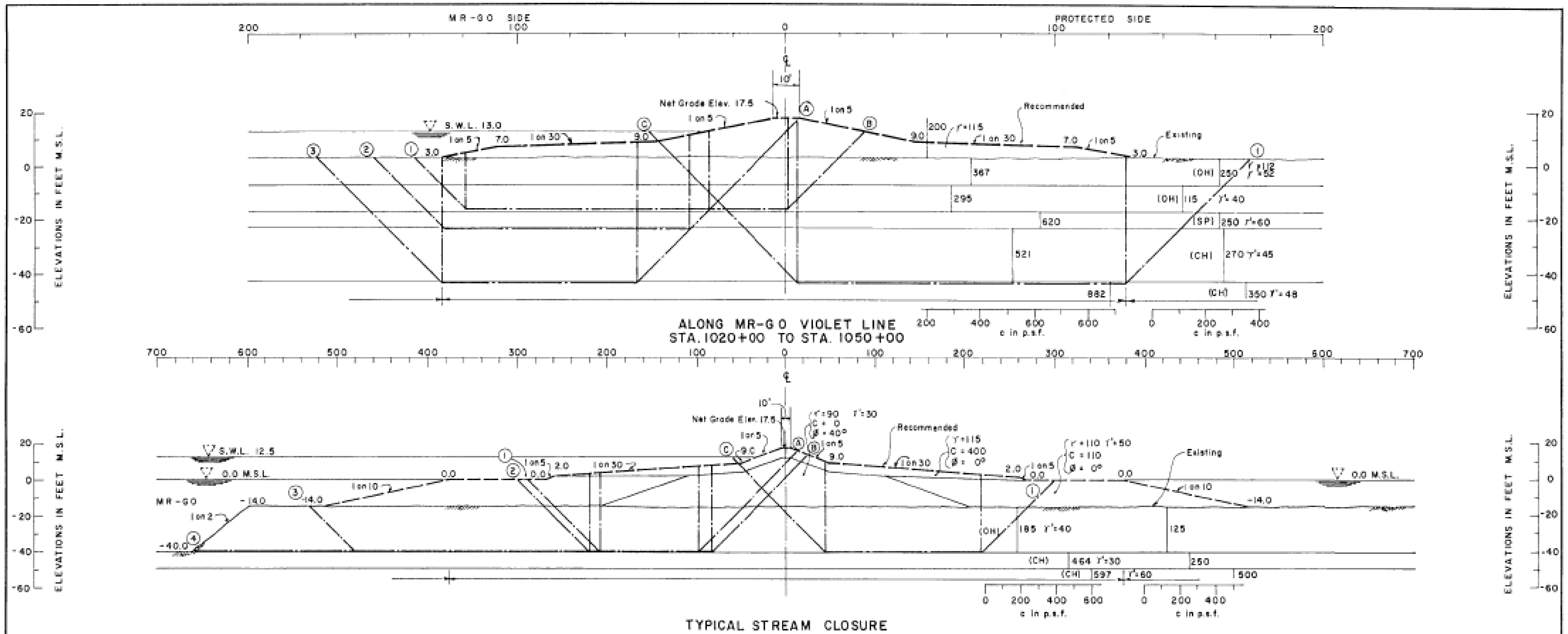
PLATE 42

Figure A.14: City Price to Tropical Bend (2).



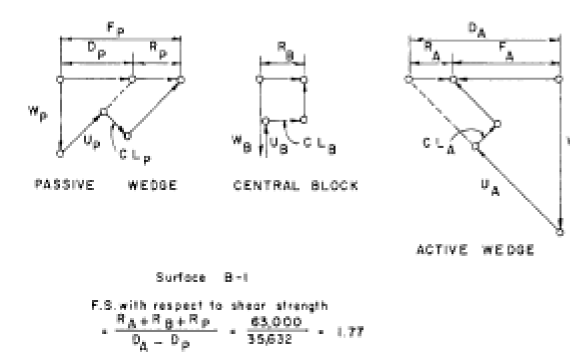
ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A 1	3.0	17994	2400	3897	14387	1360	24291	13027	1.860
A 2	3.0	17994	10000	274	14387	137	28268	14250	1.980
B 1	-2.0	16933	2800	4477	23976	5235	24210	18741	1.290
B 2	-2.0	16933	4400	3853	23976	4661	25186	19315	1.300
B 3	-2.0	16933	9600	1074	23976	2628	27607	21348	1.290
C 1	-15.0	38418	18843	37654	62197	28437	94915	33760	2.810
C 2	-15.0	38418	57084	30228	62197	24361	125730	37836	3.320
D 1	-22.5	49508	18600	49877	94205	50474	117985	43731	2.700

Figure A.15: Orleans Parish Lakefront (2).



SECTION	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	No.		El.	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
ALONG MR-GO VIOLET LINE	A	1	-16.9	60,317	22,907	37,410	19,413	26,166	10,571	56,150	1.50
		2	-23.1	82,333	38,154	44,179	27,016	43,920	16,920	87,856	1.99
		3	-43.1	176,365	116,224	60,141	47,928	62,885	25,022	135,835	2.26
	B	1	-16.9	58,539	22,907	35,632	17,413	35,016	10,571	63,000	1.77
	C	1	-43.1	182,549	116,224	66,325	44,528	107,867	25,022	177,417	2.67
TYPICAL STREAM CLOSURE	A	1	-39.9	152,544	87,154	65,390	43,698	41,296	12,663	97,657	1.49
	B	2	-39.9	150,305	84,835	65,470	39,591	45,168	12,663	97,422	1.49
		3	-39.9	150,305	63,758	86,547	39,591	87,718	6,475	133,784	1.55
		4	-39.9	150,305	49,671	100,634	39,591	117,688	0	157,279	1.56
	C	1	-39.9	132,840	84,835	48,005	31,724	51,198	12,663	95,585	1.99

LEVEE STABILITY CALCULATIONS



VECTOR DIAGRAM
(Method of planes)

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN

STABILITY ANALYSIS

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA. | U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE NOVEMBER 1966 FILE NO. H-2-23820

PLATE NO. 44

Figure A.16: Along MRGO – Violet Line (2).

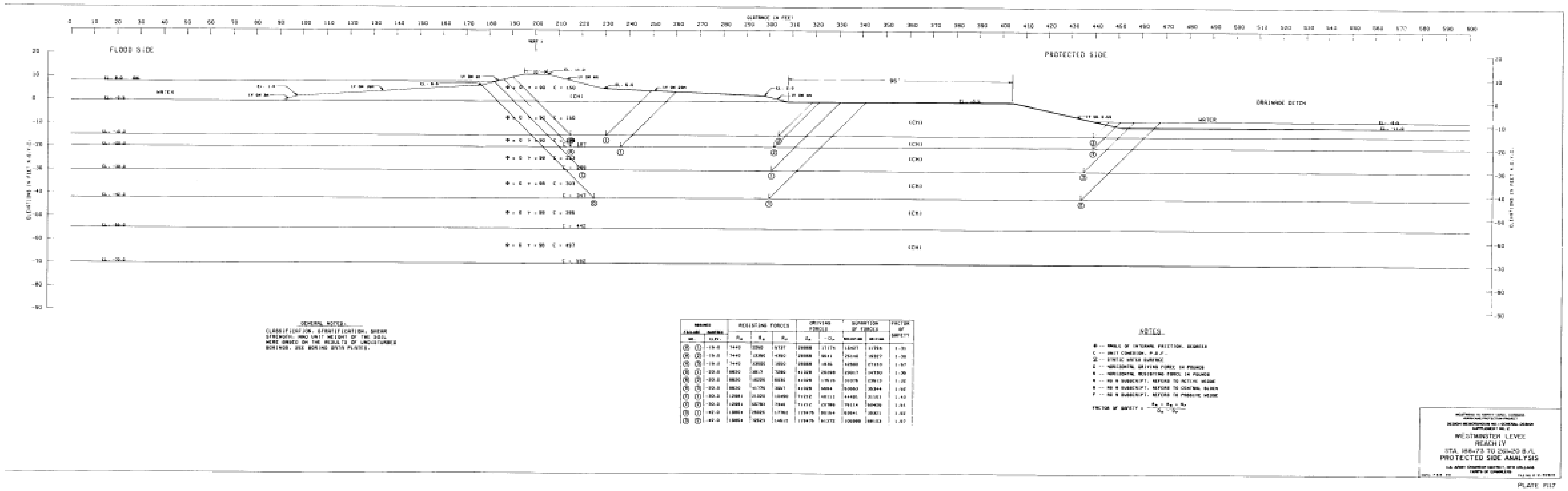


Figure A.17: Westminster.

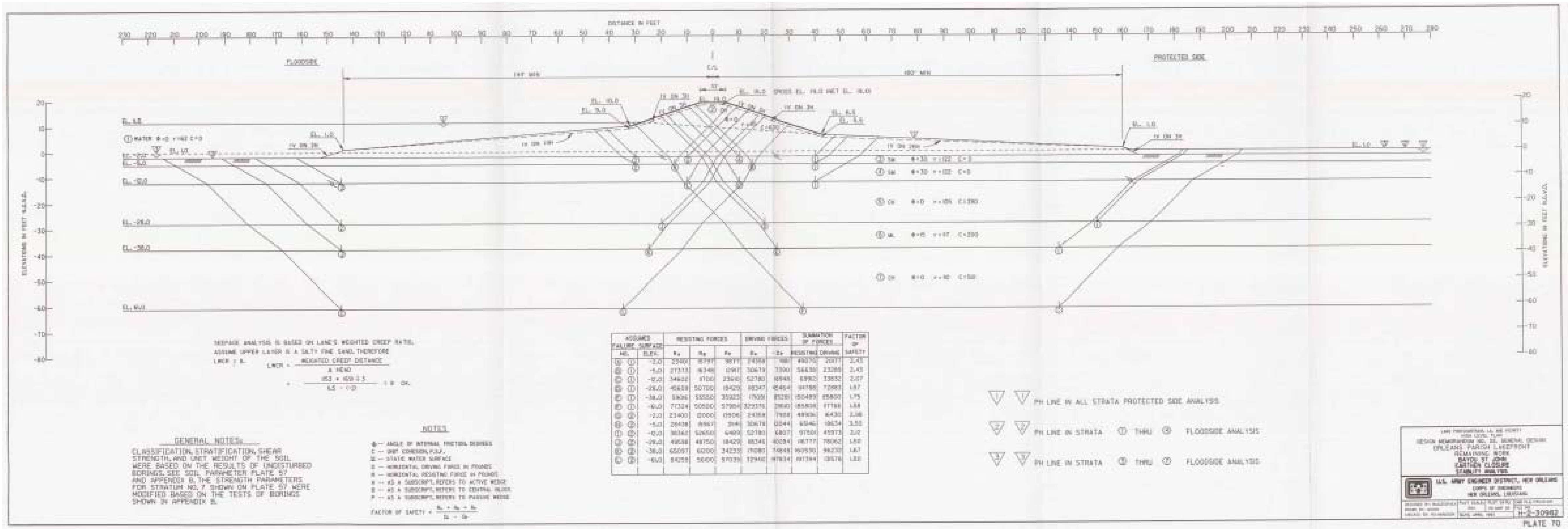
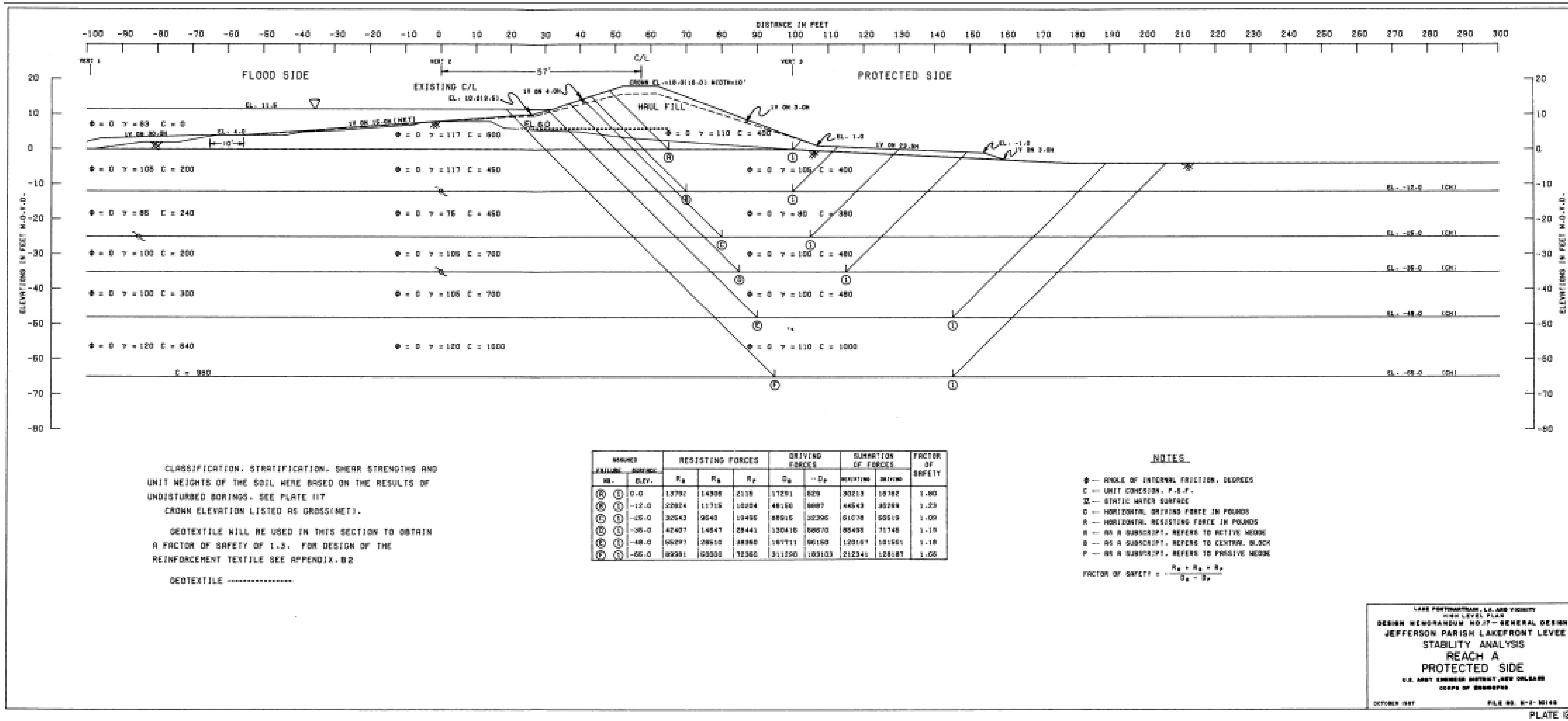


Figure A.18: Bayou St. John.



Failure No.		Surface Elev.	R_A	R_B	R_P	D_A	$-D_P$	Resisting	Driving	Factor of Safety
B	I	0.0	13792	14906	2115	17291	829	30213	16782	1.80
B	I	-12.0	22824	11715	10204	46150	8887	44543	35269	1.23
C	I	-25.0	32543	9540	19495	66915	32396	61078	55519	1.09
D	I	-35.0	42437	14547	28441	130418	58670	85495	71748	1.19
E	I	-48.0	66297	28610	38360	187711	86150	120161	101561	1.18
F	I	-65.0	89381	60000	72360	311290	183103	212341	128187	1.66

Figure A.19: Jefferson Parish Lakefront – Reach A (protected side analysis).

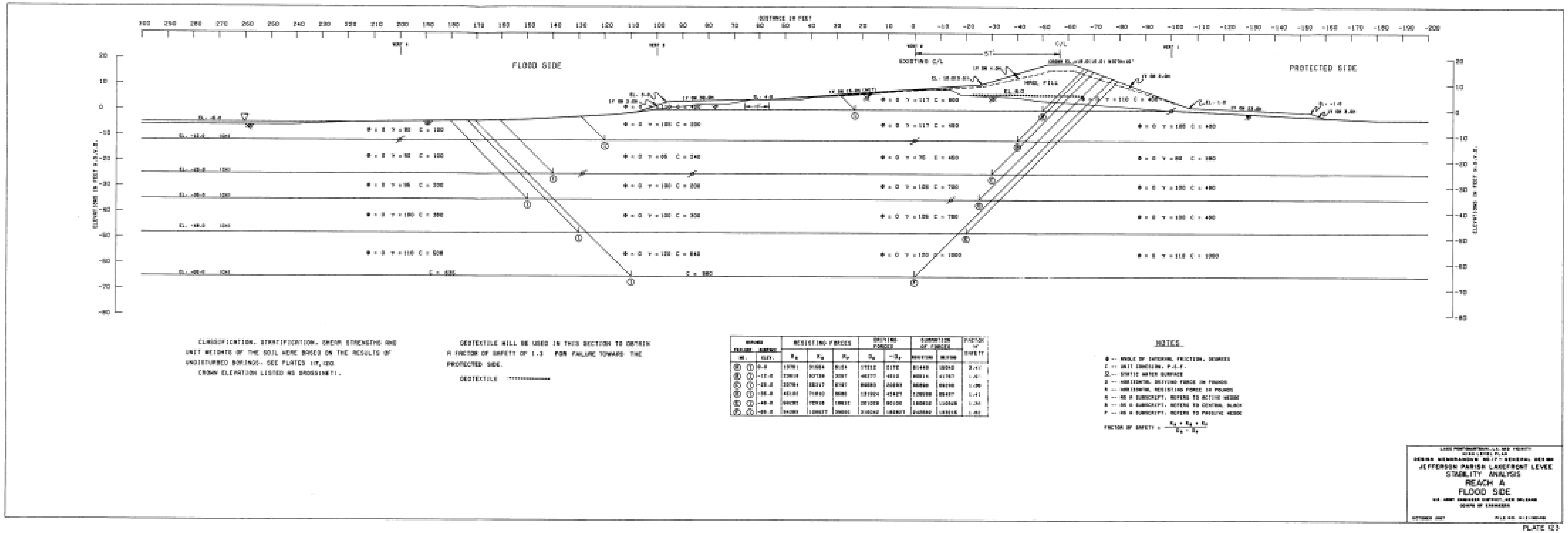


Figure A.20: Jefferson Parish Lakefront – Reach A (flood side analysis).

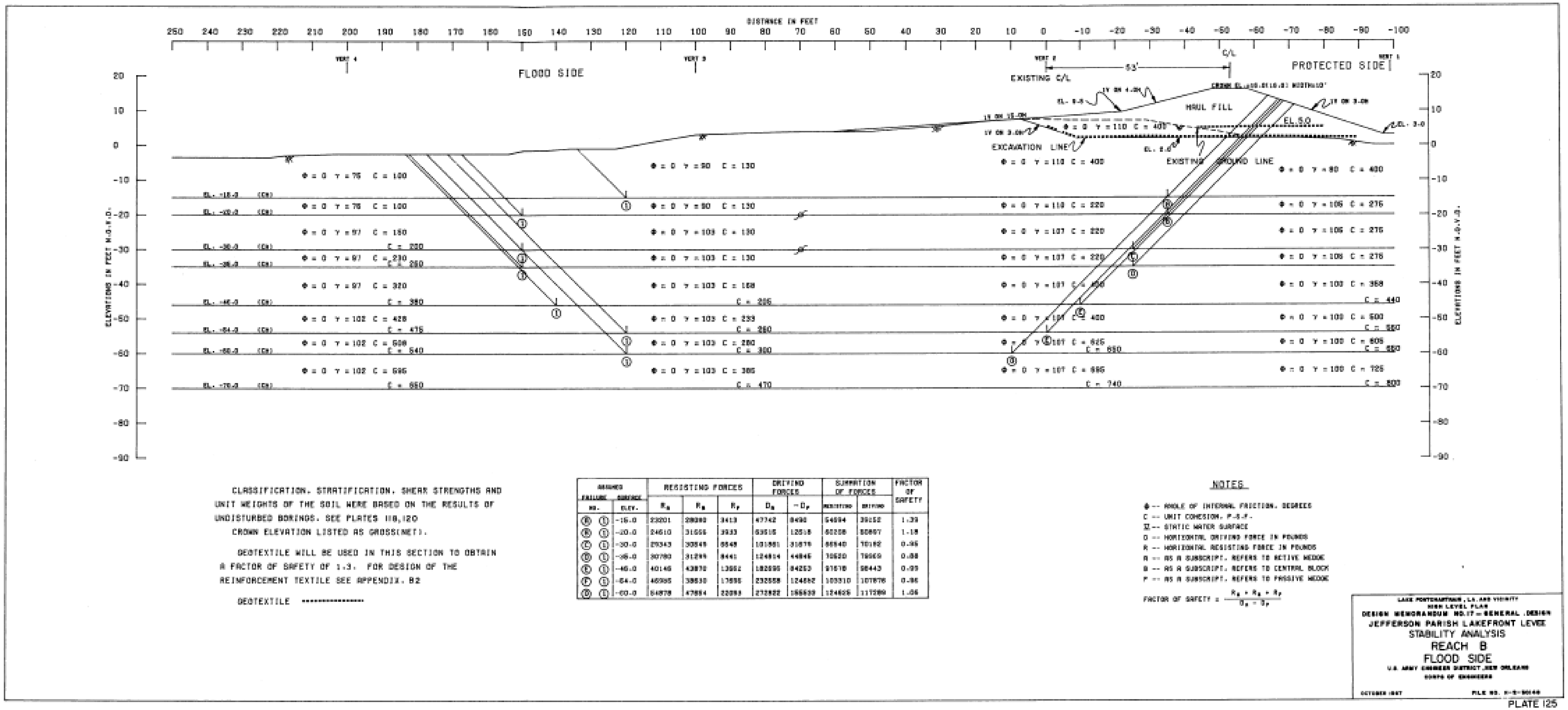


Figure A.21: Jefferson Parish Lakefront – Reach B (flood side analysis).

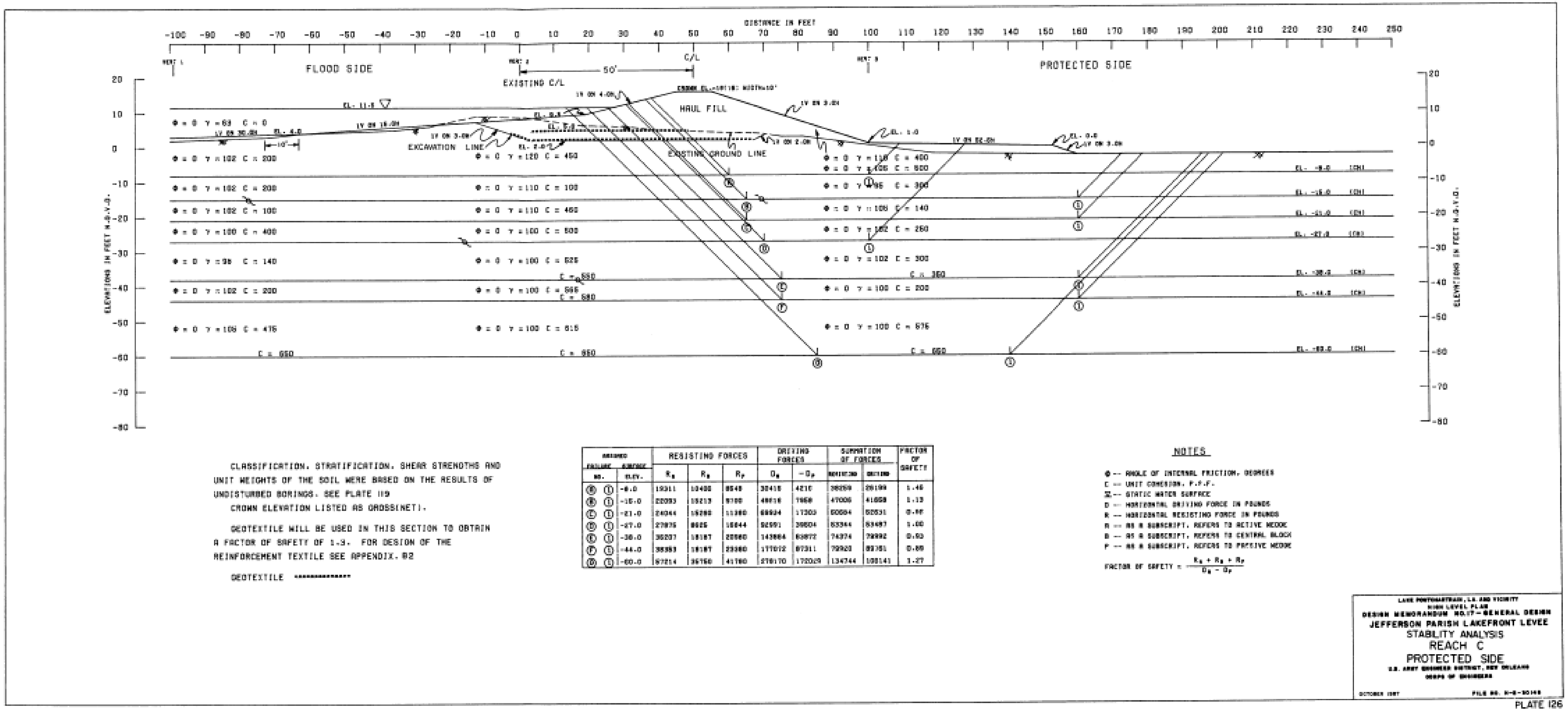


Figure A.22: Jefferson Parish Lakefront – Reach C (protected side analysis).

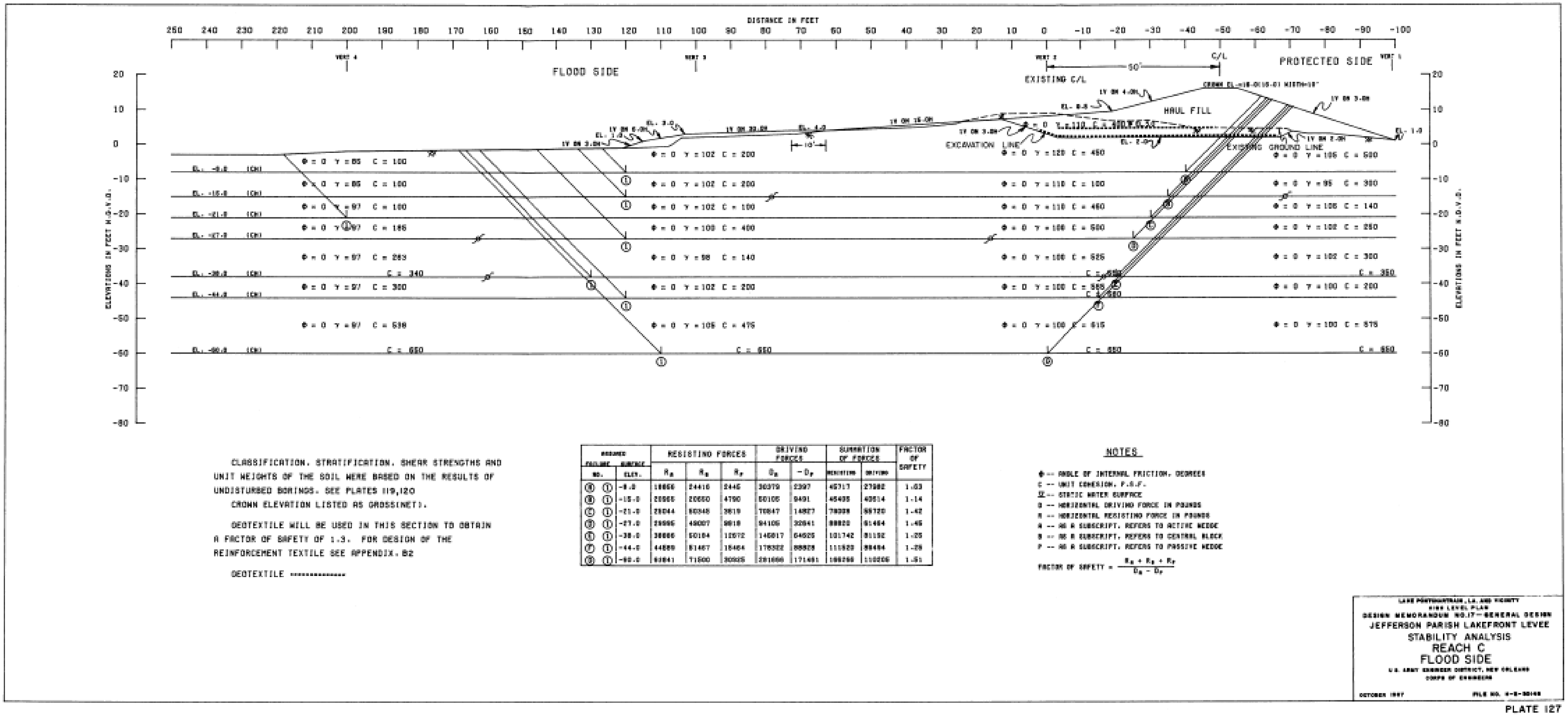


Figure A.23: Jefferson Parish Lakefront – Reach C (flood side analysis).

Appendix B: Input files for the Method of Planes Software

The Method of Planes Software was used in this study to verify data was properly extracted from each of the twenty cross sections considered in this study. The input file for the Method of Planes Software for each cross section is presented in this Appendix. The table number for the input file for each cross section is included in Table B.1.

Table B.1: Table numbers for each input file in Appendix B.

Location	Table No.
Citrus Back Levee	B.2
G.I.W.W. - Michoud Canal	B.3
City Price to Venice (flood side analysis)	B.4
City Price to Venice (protected side analysis)	B.5
Phoenix to Bohemia	B.6
South Point to G.I.W.W.	B.7
City Price to Tropical Bend	B.8
Orleans Parish Lakefront	B.9
Jefferson Parish Lakefront - Reach B (protected side analysis)	B.10
Citrus Lakefront	B.11
Along MRGO - Violet Line	B.12
Harvey Canal	B.13
New Orleans Lakefront Airport	B.14
South Point to G.I.W.W. (2)	B.15
City Price to Tropical Bend (2)	B.16
Orleans Parish Lakefront (2)	B.17
Along MRGO Violet Line (2)	B.18
Westminster	B.19
Bayou St. John	B.20
Jefferson Parish Lakefront - Reach A (protected side analysis)	B.21
Jefferson Parish Lakefront - Reach A (flood side analysis)	B.22
Jefferson Parish Lakefront - Reach B (flood side analysis)	B.23
Jefferson Parish Lakefront - Reach C (protected side analysis)	B.24
Jefferson Parish Lakefront - Reach C (flood side analysis)	B.25

Table B.2: Citrus Back Levee

```
"CITRUS BACK LEVEE - IHNC THRU NASA"
"STA. 483+00 TO STA. 492+29"
20 20 0.5 -320 1 0
5 3 2 1
190 240 290
0 62.5 0 0 62.5 0 0 62.5 0 0
0 110 400 400 110 400 400 110 400 400
0 107 250 250 107 400 400 107 250 250
0 107 250 250 107 460 520 107 250 250
30 122 0 0 122 0 0 122 0 0
0 13 265 13 285 18 295 18 343 6 383 4 387 3
500 3 9999.9 0
0 -20 91 -20 106 -15 142 -3 151 0 191 0 225 8.5 255 10.5
265 13 285 18 295 18 343 6 383 4 387 3 500 3 9999.9 0
0 -20 91 -20 106 -15 142 -3 500 -3 9999.9 0
0 -20 91 -20 106 -15 142 -3 500 -3 9999.9 0
0 -20 91 -20 106 -15 500 -15 9999.9 0
0 -30 500 -30 9999.9 0
0 13 265 13 343 6 383 4 387 3 500 3 9999.9 0
1 1 1 1 1 1 1 1 1 1
4 90306 -15 336.2 -15 2
336.2 360
```

Table B.3: G.I.W.W. – Michoud Canal

"MS RIVER - GULF OUTLET; MICHOUD CANAL, LA"
"STA. 507+44.6 to STA. 540+00"
20 20 0.5 -40 1 0
12 3 2 1
152.5 192.5 232.5
0 62.5 0 0 62.5 0 0 62.5 0 0
0 110 250 250 110 250 250 110 250 250
0 110 400 400 110 400 400 110 400 400
0 110 0 0 110 0 0 110 0 0
0 102 200 200 102 200 200 102 200 200
0 102 200 200 102 300 300 102 200 200
0 102 200 200 102 400 400 102 200 200
15 117 200 200 117 200 200 117 200 200
0 107 500 500 107 500 500 107 500 500
33 122 0 0 122 0 0 122 0 0
0 122 800 800 122 800 800 122 800 800
0 122 800 800 122 800 800 122 800 800
0 0 10 2.5 147.5 8 187.5 18 197.5 18 237.5 8 367.5 1.5
375 4 378 4 390 0 650 0 9999.9 0
0 0 10 2.5 147.5 8 187.5 18 197.5 18 237.5 8 367.5 1.5
375 4 378 4 390 0 399 -3 453 -21.25 490 -21.25 510 -18
650 -18 9999.9 0
0 0 29 0 128.5 0 130.5 1 150.5 3 183.5 14 201.5 14 234.5 3
267 0 363 0 367.5 1.5 375 4 378 4 390 0 399 -3 453 -21.25
490 -21 510 -18 650 -18 9999.9 0
0 0 29 0 128.5 0 267 0 363 0 367.5 1.5 375 4 378 4 390 0
399 -3 453 -21.25 490 -21.25 510 -18 650 -18 9999.9 0
0 0 29 0 128.5 0 267 0 363 0 373.6 0 388.3 -6 399 -3 453 -21.25
490 -21 510 -18 650 -18 9999.9 0
0 0 29 0 42 -6.5 115.5 -6.5 122.5 -3 128.5 0 267 0 343.2 -1
349.2 -3 362.4 -10 382 -10.5 395.5 -15 418.1 -17 453 -21.25
490 -21 510 -18 650 -18 9999.9 0
0 0 29 0 42 -6.5 115.5 -6.5 122.5 -3 152.5 -3 192.5 -6
232.5 -3 349.2 -3 362.4 -10 382 -10.5 395.5 -15 418.1 -17
453 -21.25 490 -21.25 510 -18 650 -18 9999.9 0
0 -15 395.5 -15 418.1 -17 453 -21.25 490 -21.25 510 -18
650 -18 9999.9 0
0 -29 650 -29 9999.9 0
0 -49 650 -49 9999.9 0
0 -52 650 -52 9999.9 0
0 -57 650 -57 9999.9 0

0 -70 650 -70 9999.9 0
0 0 29 0 128.5 0 267 0 363 0 390 0 650 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
9 90226.2 -49 432.2 -49 1
432.2

Table B.4: City Price to Venice (flood side analysis)

"City Price to Venice, LA"
"Reach T-2"
20 20 0.5 160 1 1
14 3 2 1
109.81 153.62 196.48
0 62.4 0 0 62.4 0 0 62.4 0 0
0 110 400 400 110 400 400 110 400 400
0 105 350 350 105 300 300 110 350 350
15 117 200 200 117 200 200 117 200 200
0 105 350 350 105 300 300 105 350 350
0 105 350 350 105 300 300 105 350 350
0 105 350 350 105 325 350 105 350 350
0 105 350 350 105 350 350 105 350 350
0 105 385 420 105 385 420 105 385 420
30 122 0 0 122 0 0 122 0 0
0 105 760 800 105 760 800 105 760 800
0 105 800 800 105 800 800 105 800 800
30 122 0 0 122 0 0 122 0 0
15 117 200 200 117 200 200 117 200 200
0 2 41.22 2 51.22 4.5 96.22 6 136.72 19.5 146.72 19.5
170.17 12.8 222.7 7.7 242.65 2 258.65 2 278.65 0
650 0 9999.9 0
0 2 41.22 2 51.22 4.5 96.22 6 136.72 19.5 146.72 19.5
170.17 12.8 222.7 7.7 242.65 2 258.65 2 278.65 0
293.65 -1.5 337 -10 353 -14 377 -20 397 -25 446.5 -36
486.5 -56 514.5 -64 535.5 -70 588 -85 606 -94
650 -94 9999.9 0
0 2 41.22 2 242.65 2 258.65 2 278.65 0 293.65 -1.5
337 -10 353 -14 377 -20 397 -25 446.5 -36 486.5 -56
514.5 -64 535.5 -70 588 -85 606 -94 650 -94 9999.9 0
0 -10 337 -10 337 -10 353 -14 377 -20 397 -25 446.5 -36
486.5 -56 514.5 -64 535.5 -70 588 -85 606 -94
650 -94 9999.9 0
0 -14 353 -14 377 -20 397 -25 446.5 -36 486.5 -56
514.5 -64 535.5 -70 588 -85 606 -94 650 -94 9999.9 0
0 -20 337 -20 377 -20 397 -25 446.5 -36 486.5 -56
514.5 -64 535.5 -70 588 -85 606 -94 650 -94 9999.9 0
0 -20 337 -20 377 -20 397 -25 446.5 -36 486.5 -56
514.5 -64 535.5 -70 588 -85 606 -94 650 -94 9999.9 0
0 -25 397 -25 446.5 -36 486.5 -56 514.5 -64 535.5 -70
588 -85 606 -94 650 -94 9999.9 0

0 -25 397 -25 446.5 -36 486.5 -56 514.5 -64 535.5 -70
588 -85 606 -94 650 -94 9999.9 0
0 -36 446.5 -36 486.5 -56 514.5 -64 535.5 -70 588 -85
606 -94 650 -94 9999.9 0
0 -64 514.5 -64 535.5 -70 588 -85 606 -94
650 -94 9999.9 0
0 -70 535.5 -70 588 -85 606 -94 650 -94 9999.9 0
0 -85 588 -85 606 -94 650 -94 9999.9 0
0 -94 606 -94 650 -94 9999.9 0
0 -98 650 -98 9999.9 0
0 0 278.65 0 650 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 90175.85 -36 446.5 -36 4
236.05 275.9 335.4 446.5
12 90207.3 -85 588 -85 1
588

Table B.5: City Price to Venice (protected side analysis)

```
"City Price to Venice, LA"
"Reach T-2"
20 20 0.5 160 1 1
14 3 2 1
453.52 496.38 540.19
0 62.4 0 0 62.4 0 0 62.4 0 0
0 110 400 400 110 400 400 110 400 400
0 105 350 350 105 300 300 110 350 350
15 117 200 200 117 200 200 117 200 200
0 105 350 350 105 300 300 105 350 350
0 105 350 350 105 300 300 105 350 350
0 105 350 350 105 325 350 105 350 350
0 105 350 350 105 350 350 105 350 350
0 105 385 420 105 385 420 105 385 420
30 122 0 0 122 0 0 122 0 0
0 105 760 800 105 760 800 105 760 800
0 105 800 800 105 800 800 105 800 800
30 122 0 0 122 0 0 122 0 0
15 117 200 200 117 200 200 117 200 200
0 12.6 477.77 12.6 479.83 12.8 503.28 19.5 513.28 19.5
553.78 6 598.78 4.5 608.78 2 650 2 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 297 -14 313 -10 356.35 -1.5 391.35 2
407.35 2 427.3 7.7 479.83 12.8 503.28 19.5 513.28 19.5
553.78 6 598.78 4.5 608.78 2 650 2 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 297 -14 313 -10 356.35 -1.5 391.35 2
407.35 2 608.78 2 650 2 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 297 -14 313 -10 650 -10 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 297 -14 650 -14 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 650 -20 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 273 -20 650 -20 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 650 -25 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
253 -25 650 -25 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 163.5 -56 203.5 -36
```

650 -36 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 135.5 -64 650 -64 9999.9 0
0 -94 44 -94 62 -85 114.5 -70 650 -70 9999.9 0
0 -94 44 -94 62 -85 650 -85 9999.9 0
0 -94 44 -94 650 -94 9999.9 0
0 -98 650 -98 9999.9 0
0 12.6 477.77 12.6 553.78 6 598.78 4.5 608.78 2
650 2 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 90522 -20 591 -20 2
548 591

Table B.6: Phoenix to Bohemia

"Reach C - Phoenix to Bohemia"
"STA. 159+00 to STA. 495+00"
20 20 0.5 -40 1 1
11 2 2 1
154.5 226
0 62 0 0 62 0 0
0 95 200 200 95 200 200
0 95 300 300 95 300 300
0 95 300 300 95 300 300
30 122 0 0 122 0 0
0 82 300 300 82 300 300
15 117 200 200 117 200 200
0 102 500 500 102 350 350
15 117 200 200 117 200 200
0 102 500 500 102 500 500
0 102 750 750 102 750 750
0 13 136.5 13 156.5 17 164.5 17 204.5 7 208.5 6 238.5 4.5 249 1
252 0 270 0 273 1 285 5 335 5 347 1 375 1 403.5 -8.5 423.5 -8.5
452 1 500 1 9999.9 0
0 1 48.5 1 66.5 7 126.5 11 136.5 13 156.5 17 164.5 17 204.5 7
208.5 6 238.5 4.5 249 1 252 0 270 0 273 1 285 5 335 5 347 1
375 1 403.5 -8.5 423.5 -8.5 452 1 500 1 9999.9 0
0 1 48.5 1 66.5 7 126.5 11 136.5 13 156.5 17 164.5 17 204.5 7
208.5 6 238.5 4.5 249 1 273 1 285 5 335 5 347 1 375 1 403.5 -8.5
423.5 -8.5 452 1 500 1 9999.9 0
0 1 48.5 1 66.5 7 150.5 7 183 7 204.5 7 208.5 6 238.5 4.5 249 1
252 0 270 0 273 1 285 5 335 5 347 1 375 1 403.5 -8.5 423.5 -8.5
452 1 500 1 9999.9 0
0 0 115.5 0 150.5 7 183 7 218 0 252 0 270 0 273 1 285 5 335 5
347 1 375 1 403.5 -8.5 423.5 -8.5 452 1 500 1 9999.9 0
0 0 115.5 0 130.5 -8 166 -9 201.5 -8 218 0 252 0 270 0 289.5 -7
329.5 -7 347 1 375 1 403.5 -8.5 423.5 -8.5 452 1
500 1 9999.9 0
0 -9 83.5 -9 154.5 -10 225.5 -9 500 -9 9999.9 0
0 -13 83.5 -13 154.5 -15 225.5 -13 500 -13 9999.9 0
0 -25 83.5 -25 154.5 -26 225.5 -25 500 -25 9999.9 0
0 -35 500 -35 9999.9 0
0 -50 500 -50 9999.9 0
0 -100 500 -100 9999.9 0
0 0 115.5 0 218 0 252 0 270 0 350 0 378 0 449 0 500 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1

1 1 1 1 1 1 1 1 1 1
8 90185 -25 243.5 -25 1
243.5

Table B.7: South Point to G.I.W.W.

```
"South Point to G.I.W.W."
"STA 939+60 TO STA 1101+90"
10 10 0.5 160 1 0
12 3 2 1
91 141 191
0 62.5 0 0 62.5 0 0 62.5 0 0
0 117 400 400 117 400 400 117 400 400
0 102 350 350 102 400 400 102.5 350 350
0 92 350 350 92 400 400 92.5 350 350
0 102 350 350 102 400 400 102 350 350
0 107 350 350 107 400 400 107 350 350
0 107 375 400 107 400 400 107 375 400
0 107 400 400 107 400 400 107 400 400
0 107 425 450 107 425 450 107 425 450
0 102 450 450 102 450 450 102 450 450
0 102 550 650 102 550 650 102 550 650
33 122 0 0 122 0 0 122 0 0
0 12.8 131.2 12.8 136 14 146 14 186 4 216 2 222 0
280 0 9999.9 0
0 0 60 0 66 2 96 4 131.2 12.8 136 14 146 14 186 4 216 2
222 0 280 0 9999.9 0
0 0 60 0 100 -1 109 -10.5 173 -10.5 182 -1 222 0 280 0 9999.9 0
0 -6 105 -6 109 -10.5 173 -10.5 177 -6 280 -6 9999.9 0
0 -11 280 -11 9999.9 0
0 -20 280 -20 9999.9 0
0 -20 280 -20 9999.9 0
0 -25 280 -25 9999.9 0
0 -25 280 -25 9999.9 0
0 -30 280 -30 9999.9 0
0 -30 280 -30 9999.9 0
0 -50 280 -50 9999.9 0
0 -60 280 -60 9999.9 0
0 0 60 0 222 0 280 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1
9 90161 -30 201.8 -30 1
201.8
```

Table B.8: City Price to Tropical Bend

```
"Reach A - City Price to Tropical Bend"
"STA. 476+50 to 612+50"
10 10 0.5 -240 1 1
12 3 2 1
70 100 130
0 62.5 0 0 62.5 0 0 62.5 0 0
0 100 200 200 100 200 200 100 200 200
30 122 0 0 122 0 0 122 0 0
0 108 400 400 108 400 400 108 400 400
0 86 150 150 86 300 300 86 150 150
0 96 150 150 96 300 300 96 150 150
15 117 200 200 117 200 200 117 200 200
0 100 190 190 100 300 300 100 190 190
0 100 245 300 100 300 300 100 245 300
0 100 300 300 100 300 300 100 300 300
0 100 375 450 100 375 450 100 375 450
0 100 450 450 100 450 450 100 450 450
0 1 15 1 28.5 5.5 64.5 8.5 81 14 89 14 107 8
128 1 135 1 141 -1 230 -1 9999.9 0
0 1 15 1 28.5 5.5 64.5 8.5 81 14 89 14 107 8
128 1 135 1 141 -1 144 -2.4 174 -3 182 -7 212 -10
222 -11 230 -11 9999.9 0
0 1 15 1 22 1 29.5 3.5 90.5 7 94.5 8 107 8 128 1
135 1 141 -1 144 -2.4 174 -3 182 -7 212 -10 222 -11
230 -11 9999.9 0
0 1 15 1 22 1 66.5 1 90.5 7 94.5 8 107 8 128 1 135 1
141 -1 144 -2.4 174 -3 182 -7 212 -10 222 -11
230 -11 9999.9 0
0 1 15 1 22 1 66.5 1 128 1 135 1 141 -1 144 -2.4 174 -3
182 -7 212 -10 222 -11 230 -11 9999.9 0
0 -7 182 -7 212 -10 222 -11 230 -11 9999.9 0
0 -10 212 -10 222 -11 230 -11 9999.9 0
0 -14 230 -14 9999.9 0
0 -14 230 -14 9999.9 0
0 -25 230 -25 9999.9 0
0 -25 230 -25 9999.9 0
0 -40 230 -40 9999.9 0
0 -50 230 -50 9999.9 0
0 -1 0 -1 141 -1 230 -1 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
```

9 90099.8 -25 124.8 -25 1
124.8

Table B.9: Orleans Parish Lakefront

"ORLEANS PARISH LAKEFRONT LEVEE"
"STA. 305+41.96 B/L TO STA. 305+46.96 B/L"
10 10 0.5 -160 1 0
14 1 2 1
147
0 62.4 0 0
0 110 400 400
15 117 200 200
0 103 280 280
0 103 340 400
15 117 200 200
0 101 500 500
0 101 610 720
33 122 0 0
0 104 700 700
0 104 750 800
0 120 1100 1100
15 117 200 200
0 116 1100 1100
0 11.5 112 11.5 142 21.5 152 21.5 192.5 8 222.5 6.5 242 0
300 0 9999.9 0
0 5.5 87 5.5 100.5 10 110.5 11 112 11.5 142 21.5 152 21.5
192.5 8 222.5 6.5 242 0 300 0 9999.9 0
0 5.5 87 5.5 104 5.5 135 7 142 9.2 152 9.2 155 8.7 167 7
177 4 187 2 242 0 300 0 9999.9 0
0 0 242 0 300 0 9999.9 0
0 0 242 0 300 0 9999.9 0
0 -9 300 -9 9999.9 0
0 -20 300 -20 9999.9 0
0 -20 300 -20 9999.9 0
0 -36 300 -36 9999.9 0
0 -41 300 -41 9999.9 0
0 -41 300 -41 9999.9 0
0 -62.5 300 -62.5 9999.9 0
0 -75.5 300 -75.5 9999.9 0
0 -80.5 300 -80.5 9999.9 0
0 -82 300 -82 9999.9 0
0 11.5 112 11.5 192.5 8 222.5 6.5 242 0
300 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1

5 90163.5 -9 234 -9 1
234

Table B.10: Jefferson Parish Lakefront – Reach B (protected side analysis)

"Jefferson Parish Lakefront Levee"
"Reach B"
10 10 0.5 110 1 0
10 3 2 1
0.01 115.5 215.5
0 63 0 0 63 0 0 63 0 0
0 110 400 400 110 400 400 110 400 400
0 90 130 130 110 400 400 80 400 400
0 90 130 130 110 220 220 105 275 275
0 103 130 130 107 220 220 105 275 275
0 103 130 130 107 220 220 105 275 275
0 103 168 205 107 400 400 100 358 440
0 103 233 260 107 400 400 100 500 560
0 103 280 300 107 625 650 100 605 650
0 103 385 470 107 695 740 100 725 800
0 11.5 145.5 11.5 163.5 16 173.5 16 212.5 3 252.5 2 270.5 -2.5
350 -2.5 9999.9 0
0 3 40 3 85 6 137.5 9.5 145.5 11.5 163.5 16 173.5 16 212.5 3
252.5 2 270.5 -2.5 350 -2.5 9999.9 0
0 3 40 3 85 6 97 2 177.5 2 209.5 0 235 -1 260 -2.5 270.5 -2.5
350 -2.5 9999.9 0
0 -15 350 -15 9999.9 0
0 -20 350 -20 9999.9 0
0 -30 350 -30 9999.9 0
0 -35 350 -35 9999.9 0
0 -46 350 -46 9999.9 0
0 -54 350 -54 9999.9 0
0 -60 350 -60 9999.9 0
0 -70 350 -70 9999.9 0
0 11.5 145.5 11.5 212.5 3 252.5 2 270.5 -2.5 350 -2.5 9999.9 0
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
6 187 -35 267 -35 1
267

Table B.11: Citrus Lakefront

"CITRUS LAKEFRONT LEVEE"
"STA 121+00 TO 154+83 B/L
20 20 0.5 -40 1 0
11 1 2 1
100
0 62.4 0 0
0 112 400 400
40 122 0 0
33 122 0 0
15 117 200 200
0 102 300 300
15 117 200 200
0 107 500 500
0 107 600 700
0 122 1000 1000
33 122 0 0
0 8.5 104.34 8.5 108.84 10 114.84 10 116.65 8.6 119.33 9.75
127.16 9.75 131.72 8 135.67 9.35 143.31 9.35 154.76 6.6 158.76 6.6
180.96 14 190.96 14 226.96 2 235.96 1.5 236.46 1 242.5 1
280 1 9999.9 0
0 0 78.84 0 104.34 8.5 108.84 10 114.84 10 116.65 8.6 119.33 9.75
127.16 9.75 131.72 8 135.67 9.35 143.31 9.35 154.76 6.6 158.76 6.6
180.96 14 190.96 14 226.96 2 235.96 1.5 236.46 1 242.5 1
280 1 9999.9 0
0 0 78.84 0 104.34 8.5 108.84 10 114.84 10 116.65 8.6 119.33 9.75
127.16 9.75 131.72 8 135.67 9.35 143.31 9.35 149.67 4.8 161.06 4.8
191.81 10.19 223.68 1 242.5 1 280 1 9999.9 0
0 0 78.84 0 85.07 0 108.84 7.5 114.84 7.5 116.65 8.6 119.33 9.75
127.16 9.75 131.72 8 135.67 9.35 143.31 9.35 149.67 4.8 161.06 4.8
191.81 10.19 223.68 1 236.46 1 242.5 1 280 1 9999.9 0
0 0 78.84 0 85.07 0 108.84 7.5 114.84 7.5 116.65 8.6 119.33 9.75
127.16 9.75 131.72 8 135.67 9.35 143.31 9.35 149.67 4.8 158.98 -1.4
193.95 -3.7 203.8 -6.1 214.71 -7 220.27 -6.98 231.33 -4.58 241.38 0
242.5 1 280 1 9999.9 0
0 0 78.84 0 85.07 0 158.98 -1.4 193.95 -3.7 203.8 -6.1 214.71 -7
220.27 -6.98 231.33 -4.58 241.38 0 242.5 1 280 1 9999.9 0
0 -7 214.71 -7 220.27 -6.98 280 -7 9999.9 0
0 -13 280 -13 9999.9 0
0 -13 280 -13 9999.9 0
0 -42 280 -42 9999.9 0
0 -44 280 -44 9999.9 0

0 -50 280 -50 9999.9 0
0 0 280 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
9 90211.5 -42 233 -42 1
233

Table B.12: Along MRGO – Violet Line

```
"ALONG MRGO - VIOLET LINE"
"STA. 807+00 TO STA. 978+00"
20 20 0.5 380 1 1
6 1 2 1
150
0 110 200 200
0 80 227 227
0 90 438 438
0 108 888 888
0 104 533 533
0 115 1000 1000
0 1 155 1 175 5 295 9 337.5 17.5
347.5 17.5 390 9 510 5 530 1
680 1 9999.9 0
0 1 155 1 530 1 680 1 9999.9 0
0 -10.5 680 -10.5 9999.9 0
0 -16.4 680 -16.4 9999.9 0
0 -20 680 -20 9999.9 0
0 -38 680 -38 9999.9 0
0 -58 680 -58 9999.9 0
0 1 155 1 530 1 680 1 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
2 90369.5 -10.5 385.5 -10.5 1
385.5
```

Table B.13: Harvey Canal

```
"HARVEY CANAL LEVEE"
"STA. 817+20 TO 1014+25 B/L"
10 10 0.5 -30 1 0
12 1 2 1
75
0 62.5 0 0
0 110 400 400
0 104 500 500
0 104 160 160
0 104 170 180
0 95 180 180
0 95 215 250
0 100 250 250
0 100 275 300
0 100 300 300
0 100 400 500
0 100 500 500
0 0 32 0 70 9.5 80 9.5 118 0 185 0 195 -2 370 -2 9999.9 0
0 0 32 0 70 9.5 80 9.5 118 0 185 0 195 -2 205 -4 261 -20
291 -30 321 -40 370 -40 9999.9 0
0 0 32 0 58 0 70 6 80 6 92 0 118 0 185 0 195 -2 205 -4
261 -20 291 -30 321 -40 370 -40 9999.9 0
0 0 32 0 58 0 92 0 118 0 185 0 195 -2 205 -4 261 -20 291 -30
321 -40 370 -40 9999.9 0
0 0 32 0 58 0 92 0 118 0 185 0 195 -2 205 -4 261 -20 291 -30
321 -40 370 -40 9999.9 0
0 -4 205 -4 261 -20 291 -30 321 -40
370 -40 9999.9 0
0 -4 205 -4 261 -20 291 -30 321 -40
370 -40 9999.9 0
0 -20 261 -20 291 -30 321 -40 370 -40 9999.9 0
0 -20 261 -20 291 -30 321 -40 370 -40 9999.9 0
0 -30 291 -30 321 -40 370 -40 9999.9 0
0 -30 291 -30 321 -40 370 -40 9999.9 0
0 -55 370 -55 9999.9 0
0 -70 370 -70 9999.9 0
0 -2 195 -2 370 -2 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
7 90090 -20 114 -20 1
114
```

Table B.14: New Orleans Lakefront Airport

"New Orleans Airport"
"W/L STA 32+75 TO W/L STA 33+21"
10 10 0.5 100 1 0
6 1 2 1
100
0 63 0 0
0 110 400 400
0 110 300 300
0 110 400 400
17 112 200 200
33 122 0 0
0 11.5 88.24 11.5 95.04 14 105.1 14 113.68 11 125.27 10.5
157.33 5 300 5 9999.9 0
0 5 36.63 5 74.96 10.5 86.88 11 88.24 11.5 95.04 14 105.1 14
113.68 11 125.27 10.5 157.33 5 300 5 9999.9 0
0 5 36.63 5 74.96 10.5 86.88 11 95.07 11 105.44 11
113.68 11 125.27 10.5 157.33 5 300 5 9999.9 0
0 5 36.63 5 76.19 5 95.07 11 105.44 11 109.66 9.57 124.16 5
157.33 5 300 5 9999.9 0
0 5 36.63 5 76.19 5 91.6 5 97.6 -1 102.6 -1 108.6 5 124.16 5
157.33 5 300 5 9999.9 0
0 -17 300 -17 9999.9 0
0 -30 300 -30 9999.9 0
0 11.5 88.24 11.5 95.07 11 109.66 9.57 157.33 5
300 5 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
5 90115 -17 144.9 -17 1
144.9

Table B.15: South Point to G.I.W.W. (2)

```
"South Point to G.I.W.W."
"AT STA. 797+30 AND STA 925+27"
10 10 0.5 160 1 1
7 3 2 1
91 142 193
0 62.4 0 0 62.4 0 0 62.4 0 0
0 117 450 450 117 450 450 117 450 450
0 102 300 300 102 450 450 102 300 300
15 117 200 200 117 200 200 117 200 200
0 107 300 300 107 450 450 107 300 300
0 107 300 300 107 525 600 107 300 300
0 122 1000 1000 122 1000 1000 122 1000 1000
0 -3 46 -3 55 0 91 1 137 12.5 147 12.5 193 1 229 0
238 -3 283.25 -3 9999.9 0
0 -3 46 -3 55 0 91 1 137 12.5 147 12.5 193 1 229 0
238 -3 243.25 -4.75 283.25 -3 9999.9 0
0 -3 46 -3 110 -3 115 -8 171.5 -8 176.5 -3 238 -3
243.25 -4.75 283.25 -3 9999.9 0
0 -8 115 -8 171.5 -8 283.25 -8 9999.9 0
0 -12 283.25 -12 9999.9 0
0 -12 283.25 -12 9999.9 0
0 -27 283.25 -27 9999.9 0
0 -40 283.25 -40 9999.9 0
0 -3 46 -3 110 -3 176.5 -3 238 -3 283.25 -3 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 90162.8 -27 229.3 -27 1
229.3
```

Table B.16: City Price to Tropical Bend

"Reach A - City Price to Tropical Bend"
"STA. 245+00 TO 253+02"
10 10 0.5 120 1 0
11 1 2 1
100
0 62.4 0 0
0 100 200 200
0 110 400 400
0 86 200 200
0 96 200 200
15 117 200 200
0 100 170 170
0 100 235 300
0 100 300 300
0 100 375 450
15 117 200 200
0 3 55.71 3 95.71 13 103.71 13 139.71 4 190.71 1 200.71 -1
300 -1 9999.9 0
0 3 55.71 3 95.71 13 103.71 13 139.71 4 190.71 1 200.71 -1
220.71 -5 249.71 -5 255.71 -7 264.71 -10 300 -10 9999.9 0
0 3 55.71 3 95.71 13 103.71 13 139.71 4 159.71 -1 213.43 -5
220.71 -5 249.71 -5 255.71 -7 264.71 -10 300 -10 9999.9 0
0 3 55.71 3 109.14 3 123.43 0 159.71 -1 213.43 -5 220.71 -5
249.71 -5 255.71 -7 264.71 -10 300 -10 9999.9 0
0 -7 255.71 -7 264.71 -10 300 -10 9999.9 0
0 -10 264.71 -10 300 -10 9999.9 0
0 -12 300 -12 9999.9 0
0 -12 300 -12 9999.9 0
0 -25 300 -25 9999.9 0
0 -25 300 -25 9999.9 0
0 -40 300 -40 9999.9 0
0 -50 300 -50 9999.9 0
0 -1 159.71 -1 200.71 -1 300 -1 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
8 80 -25 200.3 -25 1
200.3

Table B.17: Orleans Parish Lakefront (2)

```
"ORLEANS PARISH LAKEFRONT LEVEE"
"STA. 136+13.19 TO 159+70.0 B/L"
10 10 0.5 -160 1 0
13 1 2 1
100
0 62.4 0 0
0 110 400 400
0 116 700 700
30 122 0 0
0 104 80 80
30 122 0 0
15 117 200 200
0 104 620 620
30 122 0 0
0 112 960 960
0 112 995 1030
15 117 200 200
30 122 0 0
0 12.5 118.39 12.5 134.93 19 145.03 19 173.69 8 265.83 5.5
268.68 4.5 300 4.5 9999.9 0
0 5 13.35 5 14.14 5.5 106.83 8 118.39 12.5 134.93 19 145.03 19
173.69 8 265.83 5.5 268.68 4.5 300 4.5 9999.9 0
0 5 13.35 5 98.39 5 103.37 5.5 109.48 7.5 134.93 16 145.29 16
150 14.7 171.03 7.5 175.94 6 184.3 4.5 268.68 4.5 300 4.5 9999.9 0
0 5 13.35 5 98.39 5 103.37 5.5 109.48 7.5 171.03 7.5 175.94 6
184.3 4.5 268.68 4.5 300 4.5 9999.9 0
0 3 300 3 9999.9 0
0 -2 300 -2 9999.9 0
0 -15 300 -15 9999.9 0
0 -22.5 300 -22.5 9999.9 0
0 -27.5 300 -27.5 9999.9 0
0 -43 300 -43 9999.9 0
0 -43 300 -43 9999.9 0
0 -50 300 -50 9999.9 0
0 -52 300 -52 9999.9 0
0 -55 300 -55 9999.9 0
0 0 300 0 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
5 90144.85 -2 180.17 -2 2
180.17 264.94
```

Table B.18: Along MRGO – Violet Line (2)

```
"ALONG MRGO - VIOLET LINE"
"STA. 1020+00 TO STA. 1050+00"
20 20 0.5 240 1 1
6 1 2 1
100
0 115 200 200
0 112 367 367
0 100 295 295
0 120 620 620
0 105 521 521
0 108 882 882
0 3 70 3 90 7 150 9 192.5 17.5 202.5 17.5 225 13
245 9 305 7 325 3 400 3 9999.9 0
0 3 70 3 325 3 400 3 9999.9 0
0 -7 400 -7 9999.9 0
0 -17 400 -17 9999.9 0
0 -23 400 -23 9999.9 0
0 -43 400 -43 9999.9 0
0 -50 400 -50 9999.9 0
0 3 70 3 325 3 400 3 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 90222.5 -17 315.1 -17 1
315.1
```

Table B.19: Westminster

```
"WESTMINSTER LEVEE - REACH IV"
"STA. 188+73 TO 261+20 B/L"
10 10 0.5 -20 1 0
12 1 2 1
200
0 62.4 0 0
0 90 150 150
0 90 151 151
0 90 169 187
0 98 187 187
0 98 223 259
0 98 259 259
0 98 303 347
0 98 348 348
0 98 395 442
0 98 442 442
0 98 497 552
0 8 183 8 195 11 205 11 229 5 298 2 308 -0.5 404 -0.5
440 -8.5 600 -8.5 9999.9 0
0 -0.5 91 -0.5 97 1.5 177 6.5 183 8 195 11 205 11 229 5
298 2 308 -0.5 404 -0.5 440 -8.5 451.25 -11 600 -11 9999.9 0
0 -15 600 -15 9999.9 0
0 -15 600 -15 9999.9 0
0 -20 600 -20 9999.9 0
0 -20 600 -20 9999.9 0
0 -30 600 -30 9999.9 0
0 -30 600 -30 9999.9 0
0 -42 600 -42 9999.9 0
0 -42 600 -42 9999.9 0
0 -55 600 -55 9999.9 0
0 -55 600 -55 9999.9 0
0 -70 600 -70 9999.9 0
0 -0.5 91 -0.5 308 -0.5 404 -0.5 440 -8.5 600 -8.5 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
2 90215 -15 304 -15 1
304
```

Table B.20: Bayou St. John

```
"BAYOU ST. JOHN EARTHEN CLOSURE"
"ORLEANS PARISH LAKEFRONT"
10 10 1 -250 1 1
7 1 2 2
230
0 115 600 600
30 122 0 0
30 122 0 0
0 105 390 390
15 117 200 200
0 110 510 510
30 122 0 0
0 -2 112.5 -2 118.5 0 121.5 1 239 6.5 276.5 19 286.5 19 313.5 10
425.5 1 428.5 0 434.5 -2 510 -2 9999.9 0
0 -2 112.5 -2 434.5 -2 510 -2 9999.9 0
0 -5 510 -5 9999.9 0
0 -12 510 -12 9999.9 0
0 -28 510 -28 9999.9 0
0 -38 510 -38 9999.9 0
0 -61 510 -61 9999.9 0
0 -80 510 -80 9999.9 0
0 1 121.5 1 425.5 1 434.5 -2 510 -2 9999.9 0
0 1 121.5 1 425.5 1 510 1 9999.9 0
1 1 1 1 1 1 2 2 2 2 2 2 2 2
4 90300 -28 424 -28 1
424
6 90323 -61 426.5 -61 1
426.5
```

Table B.21: Jefferson Parish Lakefront – Reach A (protected side analysis)

"Jefferson Parish Lakefront Levee"
"Reach A - Floodside"
10 10 0.5 100 1 0
9 3 2 1
1 110.5 209.5
0 63 0 0 63 0 0 63 0 0
0 110 400 400 110 400 400 110 400 400
0 117 600 600 117 600 600 117 600 600
0 105 200 200 117 450 450 105 400 400
0 85 240 240 75 450 450 80 380 380
0 100 200 200 105 700 700 100 480 480
0 100 300 300 105 700 700 100 480 480
0 120 300 300 120 1000 1000 110 1000 1000
0 120 640 980 120 1000 1000 110 1000 1000
0 11.5 140.18 11.5 161.3 18 171.3 18 216.35 1
263.35 -1 268.72 -2.8 290.51 -4.2 400 -4.2 9999.9 0
0 2.82 35.3 4 45.3 4 105.3 8 135.3 10 140.18 11.5 161.3 18
171.3 18 216.35 1 263.35 -1 268.72 -2.8 290.51 -4.2 400 -4.2 9999.9 0
0 2.82 35.3 4 45.3 4 105.3 8 122.8 8 126.37 6 130.3 6
147.8 4.9 203.87 0 268.72 -2.8 290.51 -4.2 400 -4.2 9999.9 0
0 0 203.87 0 268.72 -2.8 290.51 -4.2 400 -4.2 9999.9 0
0 -12 400 -12 9999.9 0
0 -25 400 -25 9999.9 0
0 -35 400 -35 9999.9 0
0 -48 400 -48 9999.9 0
0 -48 400 -48 9999.9 0
0 -65 400 -65 9999.9 0
0 11.5 140.18 11.5 216.35 1 263.35 -1 268.72 -2.8 290.51 -4.2
400 -4.2 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 90187.5 -25 214.5 -25 1
214.5

Table B.22: Jefferson Parish Lakefront – Reach A (flood side analysis)

```
"Jefferson Parish Lakefront Levee"
"Reach A - Floodside"
10 10 0.5 100 1 0
9 4 2 1
100 200 300 400
0 63 0 0 63 0 0 63 0 0 63 0 0
0 110 400 400 110 400 400 110 400 400 110 400 400
0 117 600 600 117 600 600 117 600 600 117 600 600
0 105 400 400 117 450 450 105 200 200 80 100 100
0 80 380 380 75 450 450 85 240 240 90 100 100
0 100 480 480 105 700 700 100 200 200 95 200 200
0 100 480 480 105 700 700 100 300 300 100 380 380
0 110 1000 1000 120 1000 1000 120 300 300 110 381 381
0 110 1000 1000 120 1000 1000 120 640 980 110 508 635
0 -2.8 40 -2.8 45.4 -1 92.4 1 137.45 18 147.45 18 173.45 10
203.45 8 263.45 4 293.45 3 302.45 0 305.45 -1 349.45 -4
412.45 -5 500 -5 9999.9 0
0 -2.8 40 -2.8 45.4 -1 92.4 1 137.45 18 147.45 18 173.45 10
203.45 8 263.45 4 293.45 3 302.45 0 305.45 -1 349.45 -4
412.45 -5 439.45 -6 500 -6 9999.9 0
0 -2.8 40 -2.8 104.85 0 160.92 4.9 178.42 6 182.35 6 185.92 8
203.45 8 263.45 4 293.45 3 302.45 0 305.45 -1 349.45 -4
412.45 -5 439.45 -6 500 -6 9999.9 0
0 -2.8 40 -2.8 104.85 0 302.45 0 305.45 -1 349.45 -4
412.45 -5 439.45 -6 500 -6 9999.9 0
0 -12 500 -12 9999.9 0
0 -25 500 -25 9999.9 0
0 -35 500 -35 9999.9 0
0 -48 500 -48 9999.9 0
0 -48 500 -48 9999.9 0
0 -65 500 -65 9999.9 0
0 -2.8 40 -2.8 104.85 0 302.45 0 305.45 -1 349.45 -4 412.45 -5
500 -5 9999.9 0
1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
7 90177 -48 327.5 -48 1
327.5
```

Table B.23: Jefferson Parish Lakefront – Reach B (flood side analysis)

```
"Jefferson Parish Lakefront Levee"
"Reach B - Floodside"
10 10 0.5 100 1 0
15 4 2 1
87.5 184.5 284.5 384.5
0 110 400 400 110 400 400 110 400 400 110 400 400
0 80 400 400 110 400 400 90 130 130 75 100 100
0 105 275 275 110 220 220 90 130 130 75 100 100
0 105 275 275 107 220 220 103 130 130 97 100 100
0 105 275 275 107 220 220 103 130 130 97 150 200
0 105 275 275 107 220 220 103 130 130 97 200 200
0 105 275 275 107 220 220 103 130 130 97 230 260
0 100 276 276 107 400 400 103 131 131 97 260 260
0 100 358 440 107 400 400 103 168 205 97 320 380
0 100 440 440 107 400 400 103 206 206 102 381 381
0 100 500 560 107 400 400 103 233 260 102 428 475
0 100 560 560 107 600 600 103 260 260 102 476 476
0 100 605 650 107 625 650 103 280 300 102 508 540
0 100 650 650 107 650 650 103 300 300 102 540 540
0 100 725 800 107 695 740 103 385 470 102 595 650
0 -2.5 29.5 -2.5 47.5 2 87.5 3 126.5 16 136.5 16 162.5 9.5 215 6
260 3 298.93 2.5 321.43 -1.4 346.79 -2.1 351.08 -2.9 414.65 -3
418.58 -3.5 450 -3.5 9999.9 0
0 -2.5 29.5 -2.5 40 -2.5 65 -1 90.5 0 122.5 2 203 2 215 6
260 3 298.93 2.5 321.43 -1.4 346.79 -2.1 351.08 -2.9 414.65 -3
418.58 -3.5 450 -3.5 9999.9 0
0 -15 350 -15 9999.9 0
0 -20 350 -20 9999.9 0
0 -20 350 -20 9999.9 0
0 -30 350 -30 9999.9 0
0 -30 350 -30 9999.9 0
0 -35 350 -35 9999.9 0
0 -35 350 -35 9999.9 0
0 -46 350 -46 9999.9 0
0 -46 350 -46 9999.9 0
0 -54 350 -54 9999.9 0
0 -54 350 -54 9999.9 0
0 -60 350 -60 9999.9 0
0 -60 350 -60 9999.9 0
0 -70 350 -70 9999.9 0
0 -2.5 29.5 -2.5 40 -2.5 65 -1 90.5 0 122.5 2 203 2 215 6
```

260 3 298.93 2.5 321.43 -1.4 346.79 -2.1 351.08 -2.9 414.65 -3
418.58 -3.5 450 -3.5 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 90 -35 335 -35 1
335

Table B.24: Jefferson Parish Lakefront – Reach C (protected side analysis)

```
"Jefferson Parish Lakefront Levee"
"Reach C - Protected Side"
10 10 0.5 -270 1 0
12 3 2 1
3.5 93.5 193.5
0 63 0 0 63 0 0 63 0 0
0 110 400 400 110 400 400 110 400 400
0 102 200 200 120 450 450 105 500 500
0 102 200 200 110 100 100 95 300 300
0 102 100 100 110 460 460 105 140 140
0 100 400 400 100 500 500 102 250 250
0 98 140 140 100 500 500 102 250 250
0 98 140 140 100 525 550 102 300 350
0 102 200 200 100 550 550 100 200 200
0 102 200 200 100 565 580 100 200 200
0 105 300 300 100 580 580 100 500 500
0 105 475 650 100 615 650 100 575 650
0 11.5 120.5 11.5 138.5 16 148.5 16 193.5 1 246 0
253.5 -2.5 375 -2.5 9999.9 0
0 3 30 4 81 7.4 112.5 9.5 120.5 11.5 138.5 16 148.5 16
193.5 1 246 0 253.5 -2.5 375 -2.5 9999.9 0
0 3 30 4 81 7.4 97.2 2 161.2 2 164.6 3.7 168.26 2.5
174.36 2.5 202.17 -2.5 253.5 -2.5 375 -2.5 9999.9 0
0 -8 375 -8 9999.9 0
0 -15 375 -15 9999.9 0
0 -21 375 -21 9999.9 0
0 -27 375 -27 9999.9 0
0 -27 375 -27 9999.9 0
0 -38 375 -38 9999.9 0
0 -38 375 -38 9999.9 0
0 -44 375 -44 9999.9 0
0 -44 375 -44 9999.9 0
0 -60 375 -60 9999.9 0
0 11.5 120.5 11.5 193.5 1 246 0 253.5 -2.5 375 -2.5 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1
10 90169 -44 253.5 -44 1
253.5
```

Table B.25: Jefferson Parish Lakefront – Reach C (flood side analysis)

```
"Jefferson Parish Lakefront Levee"
"Reach C - Floodside"
10 10 0.5 -270 1 0
11 4 2 1
60 160 260 360
0 110 400 400 110 400 400 110 400 400 110 400 400
0 105 500 500 120 450 450 102 200 200 85 100 100
0 95 300 300 110 100 100 102 200 200 85 100 100
0 105 140 140 110 460 460 102 100 100 97 100 100
0 102 250 250 100 500 500 100 400 400 97 185 185
0 102 250 250 100 500 500 98 140 140 97 186 186
0 102 300 350 100 525 550 98 140 140 97 263 340
0 100 200 200 100 550 550 102 200 200 97 300 300
0 100 200 200 100 565 580 102 200 200 97 300 300
0 100 500 500 100 580 580 105 300 300 97 426 426
0 100 575 650 100 615 650 105 475 650 97 538 650
0 -2.5 7.5 0 60 1 105 16 115 16 141 9.5 172.5 7.4
223.5 4 233.5 4 263.5 3 275.5 1 280.75 -0.75
358.85 -1.5 376.71 -2 400 -2 9999.9 0
0 -2.5 51.33 -2.5 79.14 2.5 85.24 2.5 88.9 3.7
92.3 2 156.3 2 172.5 7.4 223.5 4 233.5 4 263.5 3
275.5 1 280.75 -0.75 358.85 -1.5 376.71 -2
400 -2 9999.9 0
0 -8 400 -8 9999.9 0
0 -15 400 -15 9999.9 0
0 -21 400 -21 9999.9 0
0 -27 400 -27 9999.9 0
0 -27 400 -27 9999.9 0
0 -38 400 -38 9999.9 0
0 -38 400 -38 9999.9 0
0 -44 400 -44 9999.9 0
0 -44 400 -44 9999.9 0
0 -60 400 -60 9999.9 0
0 -8 400 -8 9999.9 0
1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1
3 90125 -15 280 -15 1
280
```

Appendix C: UTEXAS4 Input Files for Critical Slip Surface from the Method of Planes

UTEXAS4 performed the computations for both Spencer's procedure and the force equilibrium procedure with horizontal side forces. In this Appendix, the UTEXAS4 input files required in the analyses for the critical slip surfaces from the Method of Planes using the force equilibrium procedure with horizontal side forces are given. There is one input file for each of the cross sections considered in this study, and the table number and corresponding location for each case is provided in Table C.1

In cases where the USACE reported more than one critical slip surface, the input file for only one of the slip surfaces was included in this Appendix.

Table C.1: Table numbers for each input file in Appendix C.

Location	Table No.
Citrus Back Levee	C.2
G.I.W.W. - Michoud Canal	C.3
City Price to Venice (flood side analysis)	C.4
City Price to Venice (protected side analysis)	C.5
Phoenix to Bohemia	C.6
South Point to G.I.W.W.	C.7
City Price to Tropical Bend	C.8
Orleans Parish Lakefront	C.9
Jefferson Parish Lakefront - Reach B (protected side analysis)	C.10
Citrus Lakefront	C.11
Along MRGO - Violet Line	C.12
Harvey Canal	C.13
New Orleans Lakefront Airport	C.14
South Point to G.I.W.W. (2)	C.15
City Price to Tropical Bend (2)	C.16
Orleans Parish Lakefront (2)	C.17
Along MRGO Violet Line (2)	C.18
Westminster	C.19
Bayou St. John	C.20
Jefferson Parish Lakefront - Reach A (protected side analysis)	C.21
Jefferson Parish Lakefront - Reach A (flood side analysis)	C.22
Jefferson Parish Lakefront - Reach B (flood side analysis)	C.23
Jefferson Parish Lakefront - Reach C (protected side analysis)	C.24
Jefferson Parish Lakefront - Reach C (flood side analysis)	C.25

Table C.2. Citrus Back Levee

HEAding data follow -
Citrus Back Levee
I.H.N.C. thru NASA
Sta. 483+00 to Sta. 492+29

PROfile line data follow -
1 1 Levee (CH)

0.00	3.00
113.00	3.00
117.00	4.00
157.00	6.00
205.00	18.00
215.00	18.00
235.00	13.00
245.00	10.50
275.00	8.50
309.00	0.00
349.00	0.00
358.00	-3.00

2 2 CH (2)

0.00	-3.00
358.00	-3.00
394.00	-15.00

3 3 SM

0.00	-15.00
394.00	-15.00
409.00	-20.00
500.00	-20.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
107.00 = unit weight
Interpolate Strengths

250.00   520.00
No pore pressure
3 SM
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	3.00
113.00	3.00
117.00	4.00
157.00	6.00
235.00	13.00
500.00	13.00

INTerpolation data follows -
Shear strength values follow:

0.00	-3.00	250.00	2
0.00	-9.00	250.00	2
0.00	-15.00	250.00	2
210.00	-3.00	250.00	2
210.00	-9.00	250.00	2
210.00	-15.00	250.00	2
260.00	-3.00	400.00	2
260.00	-9.00	460.00	2
260.00	-15.00	520.00	2
310.00	-3.00	250.00	2
310.00	-9.00	250.00	2
310.00	-15.00	250.00	2
500.00	-3.00	250.00	2
500.00	-9.00	250.00	2
500.00	-15.00	250.00	2

DIStributed loads
1
ANALYSIS/COMPUTATION
NONCIRCULAR
143.48   5.32
151.80   -3.00

163.80 -14.99
194.00 -14.99
206.00   -3.00
224.60   15.60

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE

Table C.3: G.I.W.W. – Michoud Canal

HEAding data follow -
Mississippi River Gulf Outlet
Michoud Canal, LA
STA. 507+44.60 to STA. 540+00

PROfile line data follow -

1 1 Fill

0.00	0.00
10.00	2.50
147.50	8.00
187.50	18.00
197.50	18.00
237.50	8.00
367.50	1.50

2 2 CH

128.50	0.00
130.50	1.00
150.50	3.00
183.50	14.00
201.50	14.00
234.50	3.00
267.00	0.00

3 3 Rip Rap

367.50	1.50
375.00	4.00
378.00	4.00
390.00	0.00
399.00	-3.00

4 4 Fill (2)

29.00	0.00
128.50	0.00

5 4 Fill (2)

267.00	0.00
363.00	0.00
373.60	0.00
388.30	-6.00
399.00	-3.00

453.00 -21.25

6 5 CH (2)
122.50 -3.00
128.50 0.00
267.00 0.00
343.20 -1.00
349.20 -3.00

7 6 CH (3)
0.00 0.00
29.00 0.00
42.00 -6.50
115.50 -6.50
122.50 -3.00
152.50 -3.00
192.50 -6.00
232.50 -3.00
349.20 -3.00
362.40 -10.00
382.00 -10.50
395.50 -15.00

8 7 ML
0.00 -15.00
395.50 -15.00
418.10 -17.00
453.00 -21.25
490.00 -21.25
510.00 -18.00
650.00 -18.00

9 8 CH (4)
0.00 -29.00
650.00 -29.00

10 9 SP
0.00 -49.00
650.00 -49.00

11 10 CH (5)
0.00 -52.00
650.00 -52.00

MATerial property data follow -
1 Fill
110.00 = unit weight
Conventional shear strengths
250.00 0.00
No pore pressure
2 CH
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
3 Rip Rap
110.00 = unit weight
Conventional shear strengths
0.00 0.00
No pore pressure
4 Fill (2)
102.00 = unit weight
Conventional shear strengths
200.00 0.00
No pore pressure
5 CH (2)
102.00 = unit weight
Interpolate Strengths
200.00 300.00
No pore pressure
6 CH (3)
102.00 = unit weight
Interpolate Strengths
200.00 400.00
No pore pressure
7 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
8 CH (4)
107.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
9 SP

```
        122.00 = unit weight
        Conventional shear strengths
           0.00    33.00
        Piezometric Line
           1
    10 CH (5)
        122.00 = unit weight
        Conventional shear strengths
         800.00     0.00
        No pore pressure

PIEzometric line data follow -
     1 Piezometric Line
         0.00       0.00
       660.00       0.00


INTerpolation data follows -
     Shear strength values follow -
         0.00     0.00     200.00     5
         0.00    -6.00     200.00     5
       152.50     0.00     200.00     5
       152.50    -6.00     200.00     5
       192.50     0.00     300.00     5
       192.50    -6.00     300.00     5
       232.50     0.00     200.00     5
       232.50    -6.00     200.00     5
       660.00     0.00     200.00     5
       660.00    -6.00     200.00     5
         0.00    -3.00     200.00     6
         0.00   -15.00     200.00     6
       152.50    -3.00     200.00     6
       152.50   -15.00     200.00     6
       192.50    -3.00     400.00     6
       192.50   -15.00     400.00     6
       232.50    -3.00     200.00     6
       232.50   -15.00     200.00     6
       660.00    -3.00     200.00     6
       660.00   -15.00     200.00     6


DIStributed load data follow -
     1
ANALYSIS/COMPUTATION
```

```
NONCIRCULAR
  180.70    16.30
    212.00   -14.99
    259.00   -14.99
    279.88     5.88

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
  Corps of Engineers' Modified Swedish
  0

GRAPH
COMPUTE
```

Table C.4: City Price to Venice (flood side analysis)

HEAding data follow -
West Bank Mississippi River Levee
City Price to Venice, LA
Reach T-2

PROfile line data follow -
1 1 Levee (CH)

407.35	2.00
427.30	7.70
479.83	12.80
503.28	19.50
513.28	19.50
553.78	6.00
598.78	4.50
608.78	2.00

2 2 CH (2)

313.00	-10.00
356.35	-1.50
391.35	2.00
407.35	2.00
608.78	2.00
750.00	2.00

3 3 ML

297.00	-14.00
313.00	-10.00
750.00	-10.00

4 4 CH (3)

273.00	-20.00
297.00	-14.00
750.00	-14.00

5 5 CH (4)

253.00	-25.00
273.00	-20.00
750.00	-20.00

6 6 CH (5)

203.50	-36.00

253.00 -25.00
750.00 -25.00

7 7 SP
135.50 -64.00
163.50 -56.00
203.50 -36.00
750.00 -36.00

8 8 CH (6)
114.50 -70.00
135.50 -64.00
750.00 -64.00

9 9 CH (7)
62.00 -85.00
114.50 -70.00
750.00 -70.00

10 10 SP (2)
44.00 -94.00
62.00 -85.00
750.00 -85.00

11 11 ML (2)
0.00 -94.00
44.00 -94.00
750.00 -94.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
105.00 = unit weight
Interpolate Strengths
300.00 350.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths

200.00   15.00
Piezometric Line
1
4 CH (3)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
5 CH (4)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
6 CH (5)
105.00 = unit weight
Interpolate Strengths
350.00   420.00
No pore pressure
7 SP
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
8 CH (6)
105.00 = unit weight
Interpolate Strengths
720.00   800.00
No pore pressure
9 CH (7)
105.00 = unit weight
Conventional shear strengths
800.00   0.00
No pore pressure
10 SP (2)
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
11 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00

Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
750.00	0.00

INTerpolation data follows -
Shear strength values follow -

0.00	2.00	350.00	2
0.00	-10.00	350.00	2
453.52	2.00	350.00	2
453.52	-10.00	350.00	2
496.38	2.00	300.00	2
496.38	-10.00	300.00	2
540.19	2.00	350.00	2
540.19	-10.00	350.00	2
750.00	2.00	350.00	2
750.00	-10.00	350.00	2
0.00	-14.00	350.00	4
0.00	-20.00	350.00	4
453.52	-14.00	350.00	4
453.52	-20.00	350.00	4
496.38	-14.00	300.00	4
496.38	-20.00	300.00	4
540.19	-14.00	350.00	4
540.19	-20.00	350.00	4
750.00	-14.00	350.00	4
750.00	-20.00	350.00	4
0.00	-20.00	350.00	5
0.00	-22.50	350.00	5
0.00	-25.00	350.00	5
453.52	-20.00	350.00	5
453.52	-22.50	350.00	5
453.52	-25.00	350.00	5
496.38	-20.00	300.00	5
496.38	-22.50	325.00	5
496.38	-25.00	350.00	5
540.19	-20.00	350.00	5
540.19	-22.50	350.00	5
540.19	-25.00	350.00	5
750.00	-20.00	350.00	5

750.00	-22.50	350.00	5
750.00	-25.00	350.00	5
0.00	-25.00	350.00	6
0.00	-30.50	385.00	6
0.00	-36.00	420.00	6
453.52	-25.00	350.00	6
453.52	-30.50	385.00	6
453.52	-36.00	420.00	6
496.38	-25.00	350.00	6
496.38	-30.50	385.00	6
496.38	-36.00	420.00	6
540.19	-25.00	350.00	6
540.19	-30.50	385.00	6
540.19	-36.00	420.00	6
750.00	-25.00	350.00	6
750.00	-30.50	385.00	6
750.00	-36.00	420.00	6
0.00	-64.00	720.00	8
0.00	-67.50	760.00	8
0.00	-70.00	800.00	8
453.52	-64.00	720.00	8
453.52	-67.50	760.00	8
453.52	-70.00	800.00	8
496.38	-64.00	720.00	8
496.38	-67.50	760.00	8
496.38	-70.00	800.00	8
540.19	-64.00	720.00	8
540.19	-67.50	760.00	8
540.19	-70.00	800.00	8
750.00	-64.00	720.00	8
750.00	-67.50	760.00	8
750.00	-70.00	800.00	8

DIStributed load data follow -
1
ANALYSIS/COMPUTATION
NONCIRCULAR

376.25	0.49
386.74	-10.00
391.95	-14.00
397.95	-20.00
402.95	-25.00
413.95	-35.99

474.15	-35.99
485.15	-25.00
490.15	-20.00
496.15	-14.00
499.22	-10.00
511.22	2.00
524.86	15.64

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.5: City Price to Venice (protected side analysis)

HEAding data follow -
West Bank Mississippi River Levee
City Price to Venice, LA
Reach T-2

PROfile line data follow -
1 1 Levee (CH)

407.35	2.00
427.30	7.70
479.83	12.80
503.28	19.50
513.28	19.50
553.78	6.00
598.78	4.50
608.78	2.00

2 2 CH (2)

313.00	-10.00
356.35	-1.50
391.35	2.00
407.35	2.00
608.78	2.00
750.00	2.00

3 3 ML

297.00	-14.00
313.00	-10.00
750.00	-10.00

4 4 CH (3)

273.00	-20.00
297.00	-14.00
750.00	-14.00

5 5 CH (4)

253.00	-25.00
273.00	-20.00
750.00	-20.00

6 6 CH (5)

203.50	-36.00

253.00 -25.00
750.00 -25.00

7 7 SP
135.50 -64.00
163.50 -56.00
203.50 -36.00
750.00 -36.00

8 8 CH (6)
114.50 -70.00
135.50 -64.00
750.00 -64.00

9 9 CH (7)
62.00 -85.00
114.50 -70.00
750.00 -70.00

10 10 SP (2)
44.00 -94.00
62.00 -85.00
750.00 -85.00

11 11 ML (2)
0.00 -94.00
44.00 -94.00
750.00 -94.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
105.00 = unit weight
Interpolate Strengths
300.00 350.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths

200.00   15.00
Piezometric Line
1
4 CH (3)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
5 CH (4)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
6 CH (5)
105.00 = unit weight
Interpolate Strengths
350.00   420.00
No pore pressure
7 SP
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
8 CH (6)
105.00 = unit weight
Interpolate Strengths
720.00   800.00
No pore pressure
9 CH (7)
105.00 = unit weight
Conventional shear strengths
800.00   0.00
No pore pressure
10 SP (2)
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
11 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00

Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	12.60
477.77	12.60
553.78	6.00
598.78	4.50
608.78	2.00
750.00	2.00

INTerpolation data follows -
Shear strength values follow -

0.00	2.00	350.00	2
0.00	-10.00	350.00	2
453.52	2.00	350.00	2
453.52	-10.00	350.00	2
496.38	2.00	300.00	2
496.38	-10.00	300.00	2
540.19	2.00	350.00	2
540.19	-10.00	350.00	2
750.00	2.00	350.00	2
750.00	-10.00	350.00	2
0.00	-14.00	350.00	4
0.00	-20.00	350.00	4
453.52	-14.00	350.00	4
453.52	-20.00	350.00	4
496.38	-14.00	300.00	4
496.38	-20.00	300.00	4
540.19	-14.00	350.00	4
540.19	-20.00	350.00	4
750.00	-14.00	350.00	4
750.00	-20.00	350.00	4
0.00	-20.00	350.00	5
0.00	-22.50	350.00	5
0.00	-25.00	350.00	5
453.52	-20.00	350.00	5
453.52	-22.50	350.00	5
453.52	-25.00	350.00	5
496.38	-20.00	300.00	5
496.38	-22.50	325.00	5
496.38	-25.00	350.00	5

```
      540.19   -20.00    350.00     5
      540.19   -22.50    350.00     5
      540.19   -25.00    350.00     5
      750.00   -20.00    350.00     5
      750.00   -22.50    350.00     5
      750.00   -25.00    350.00     5
        0.00  -25.00    350.00    6
        0.00  -30.50    385.00    6
        0.00  -36.00    420.00    6
      453.52   -25.00    350.00     6
      453.52   -30.50    385.00     6
      453.52   -36.00    420.00     6
      496.38   -25.00    350.00     6
      496.38   -30.50    385.00     6
      496.38   -36.00    420.00     6
      540.19   -25.00    350.00     6
      540.19   -30.50    385.00     6
      540.19   -36.00    420.00     6
      750.00   -25.00    350.00     6
      750.00   -30.50    385.00     6
      750.00   -36.00    420.00     6
        0.00  -64.00    720.00    8
        0.00  -67.50    760.00    8
        0.00  -70.00    800.00    8
      453.52   -64.00    720.00     8
      453.52   -67.50    760.00     8
      453.52   -70.00    800.00     8
      496.38   -64.00    720.00     8
      496.38   -67.50    760.00     8
      496.38   -70.00    800.00     8
      540.19   -64.00    720.00     8
      540.19   -67.50    760.00     8
      540.19   -70.00    800.00     8
      750.00   -64.00    720.00     8
      750.00   -67.50    760.00     8
      750.00   -70.00    800.00     8


DIStributed load data follow -
   1
ANALYSIS/COMPUTATION
   NONCIRCULAR
      487.84     15.09
      500.93      2.00
```

512.93	-10.00
516.00	-14.00
522.00	-20.00
548.00	-20.00
554.00	-14.00
559.21	-10.00
571.51	2.00
574.81	5.30

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.6: Phoenix to Bohemia

HEAding data follow -
Reach C - Phoenix to Bohemia
Sta. 159+00 to Sta. 495+00

PROfile line data follow -

1 1 CH

66.50	7.00
126.50	11.00
136.50	13.00
156.50	17.00
164.50	17.00
204.50	7.00

2 2 CH (2)

0.00	1.00
48.50	1.00
66.50	7.00
150.50	7.00

3 2 CH (2)

183.00	7.00
204.50	7.00
208.50	6.00
238.50	4.50
249.00	1.00
252.00	0.00

4 2 CH (2)

249.00	1.00
273.00	1.00

5 3 SP (F)

115.50	0.00
150.50	7.00
183.00	7.00
218.00	0.00

6 3 SP (F)

270.00	0.00
273.00	1.00
285.00	5.00

335.00	5.00
347.00	1.00

7 4 CHO

0.00	0.00
115.50	0.00
130.50	-8.00
166.00	-9.00
201.50	-8.00
218.00	0.00
252.00	0.00
270.00	0.00
289.50	-7.00
329.50	-7.00
347.00	1.00
375.00	1.00
403.50	-8.50
423.50	-8.50
452.00	1.00
500.00	1.00

8 5 ML

0.00	-9.00
83.50	-9.00
154.50	-10.00
225.50	-9.00
500.00	-9.00

9 6 CH (3)

0.00	-13.00
83.50	-13.00
154.50	-15.00
225.50	-13.00
500.00	-13.00

10 7 ML (2)

0.00	-25.00
83.50	-25.00
154.50	-26.00
225.50	-25.00
500.00	-25.00

11 8 CH (4)

0.00	-35.00

500.00 -35.00

12 9 CH (5)
0.00 -50.00
500.00 -50.00

MATerial property data follow -
1 CH
95.00 = unit weight
Conventional shear strengths
200.00 0.00
No pore pressure
2 CH (2)
95.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
3 SP (F)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
4 Organic Clay - CHO
82.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
6 CH (3)
102.00 = unit weight
Interpolate Strengths
350.00 500.00
No pore pressure
7 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00

Piezometric Line
1
8 CH (4)
102.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
9 CH (5)
102.00 = unit weight
Conventional shear strengths
750.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 0.00
500.00 0.00

2 "Piezometric" Line for Flood Side Water Loads
0.00 13.00
136.50 13.00

INTerpolation data follows -
Shear strength values follows -

0.00	-13.00	500.00	6
0.00	-19.00	500.00	6
0.00	-25.00	500.00	6
154.50	-15.00	500.00	6
154.50	-20.50	500.00	6
154.50	-26.00	500.00	6
226.00	-13.00	350.00	6
226.00	-19.00	350.00	6
226.00	-25.00	350.00	6
500.00	-13.00	350.00	6
500.00	-19.00	350.00	6
500.00	-25.00	350.00	6

DIStributed Load data follow -
2
ANALYSIS/COMPUTATION
NONCIRCULAR
151.76 16.05

```
   160.81     7.00
   169.98    -8.89
   170.86    -9.77
   174.44   -14.44
   185.00   -24.99
   243.50   -24.99
   255.50   -13.00
   260.71    -9.00
   269.71     0.00
   270.71     1.00

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
   Corps of Engineers' Modified Swedish
   0

GRAPH
COMPUTE
```

Table C.7: South Point to G.I.W.W.

HEAding data follow -
Reach C - Phoenix to Bohemia
Sta. 159+00 to Sta. 495+00

PROfile line data follow -

1 1 CH

66.50	7.00
126.50	11.00
136.50	13.00
156.50	17.00
164.50	17.00
204.50	7.00

2 2 CH (2)

0.00	1.00
48.50	1.00
66.50	7.00
150.50	7.00

3 2 CH (2)

183.00	7.00
204.50	7.00
208.50	6.00
238.50	4.50
249.00	1.00
252.00	0.00

4 2 CH (2)

249.00	1.00
273.00	1.00

5 3 SP (F)

115.50	0.00
150.50	7.00
183.00	7.00
218.00	0.00

6 3 SP (F)

270.00	0.00
273.00	1.00
285.00	5.00

335.00	5.00
347.00	1.00

7 4 CHO

0.00	0.00
115.50	0.00
130.50	-8.00
166.00	-9.00
201.50	-8.00
218.00	0.00
252.00	0.00
270.00	0.00
289.50	-7.00
329.50	-7.00
347.00	1.00
375.00	1.00
403.50	-8.50
423.50	-8.50
452.00	1.00
500.00	1.00

8 5 ML

0.00	-9.00
83.50	-9.00
154.50	-10.00
225.50	-9.00
500.00	-9.00

9 6 CH (3)

0.00	-13.00
83.50	-13.00
154.50	-15.00
225.50	-13.00
500.00	-13.00

10 7 ML (2)

0.00	-25.00
83.50	-25.00
154.50	-26.00
225.50	-25.00
500.00	-25.00

11 8 CH (4)

0.00	-35.00

500.00 -35.00

12 9 CH (5)
0.00 -50.00
500.00 -50.00

MATerial property data follow -
1 CH
95.00 = unit weight
Conventional shear strengths
200.00 0.00
No pore pressure
2 CH (2)
95.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
3 SP (F)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
4 Organic Clay - CHO
82.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
6 CH (3)
102.00 = unit weight
Interpolate Strengths
350.00 500.00
No pore pressure
7 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00

Piezometric Line
1
8 CH (4)
102.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
9 CH (5)
102.00 = unit weight
Conventional shear strengths
750.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 0.00
500.00 0.00

2 "Piezometric" Line for Flood Side Water Loads
0.00 13.00
136.50 13.00

INTerpolation data follows -
Shear strength values follows -

0.00	-13.00	500.00	6
0.00	-19.00	500.00	6
0.00	-25.00	500.00	6
154.50	-15.00	500.00	6
154.50	-20.50	500.00	6
154.50	-26.00	500.00	6
226.00	-13.00	350.00	6
226.00	-19.00	350.00	6
226.00	-25.00	350.00	6
500.00	-13.00	350.00	6
500.00	-19.00	350.00	6
500.00	-25.00	350.00	6

DIStributed Load data follow -
2
ANALYSIS/COMPUTATION
NONCIRCULAR
151.76 16.05

160.81	7.00
169.98	-8.89
170.86	-9.77
174.44	-14.44
185.00	-24.99
243.50	-24.99
255.50	-13.00
260.71	-9.00
269.71	0.00
270.71	1.00

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.8: City Price to Tropical Bend

HEAding data follow -
Reach A - City Price to Tropical Bend
STA. 476+50 to STA. 612+50

PROfile line data follow -

1 1 CH

123.00	8.00
141.00	14.00
149.00	14.00
165.50	8.50
201.50	5.50
215.00	1.00

2 2 CH (2)

102.00	1.00
123.00	8.00
135.50	8.00
139.50	7.00
163.50	1.00

3 3 SM

139.50	7.00
200.50	3.50
208.00	1.00

4 4 CHO

48.00	-7.00
56.00	-3.00
86.00	-2.40
89.00	-1.00
95.00	1.00
102.00	1.00
163.50	1.00
208.00	1.00
215.00	1.00
300.00	1.00

5 5 CH (3)

18.00	-10.00
48.00	-7.00
300.00	-7.00

```
    6 6 ML
        0.00  -11.00
        8.00  -11.00
       18.00  -10.00
      300.00  -10.00

    7 7 CH (4)
        0.00  -14.00
      300.00  -14.00

    8 8 CH (5)
        0.00  -25.00
      300.00  -25.00

    9 9 CH (6)
        0.00  -40.00
      300.00  -40.00


MATerial property data follow -
    1 CH
      100.00 = unit weight
      Conventional shear strengths
        200.00    0.00
      No pore pressure
    2 CH (2)
      108.00 = unit weight
      Conventional shear strengths
        400.00    0.00
      No pore pressure
    3 SM
      122.00 = unit weight
      Conventional shear strengths
          0.00   30.00
      No pore pressure
    4 CHO
      86.00 = unit weight
      Interpolate Strengths
        150.00  300.00
      No pore pressure
    5 CH (3)
      96.00 = unit weight
      Interpolate Strengths
```

```
      150.00  300.00
    No pore pressure
  6 ML
    117.00 = unit weight
    Conventional shear strengths
      200.00   15.00
    Piezometric Line
      1
  7 CH (4)
    100.00 = unit weight
    Interpolate Strengths
      190.00  300.00
    No pore pressure
  8 CH (5)
    100.00 = unit weight
    Interpolate Strengths
      300.00  450.00
    No pore pressure
  9 CH (6)
    100.00 = unit weight
    Conventional shear strengths
      450.00    0.00
    No pore pressure

PIEzometric line data follow -
  1 Piezometric Line
       0.00     -1.00
      89.00     -1.00
     300.00     -1.00


INTerpolation data follow -
  Shear strength values follow:
       0.00     1.00     150.00    4
       0.00    -3.00     150.00    4
       0.00    -7.00     150.00    4
     100.00     1.00     150.00    4
     100.00    -3.00     150.00    4
     100.00    -7.00     150.00    4
     130.00     1.00     300.00    4
     130.00    -3.00     300.00    4
     130.00    -7.00     300.00    4
     160.00     1.00     150.00    4
     160.00    -3.00     150.00    4
```

160.00	-7.00	150.00	4
300.00	1.00	150.00	4
300.00	-3.00	150.00	4
300.00	-7.00	150.00	4
0.00	-7.00	150.00	5
0.00	-8.50	150.00	5
0.00	-10.00	150.00	5
100.00	-7.00	150.00	5
100.00	-8.50	150.00	5
100.00	-10.00	150.00	5
130.00	-7.00	300.00	5
130.00	-8.50	300.00	5
130.00	-10.00	300.00	5
160.00	-7.00	150.00	5
160.00	-8.50	150.00	5
160.00	-10.00	150.00	5
300.00	-7.00	150.00	5
300.00	-8.50	150.00	5
300.00	-10.00	150.00	5
0.00	-14.00	190.00	7
0.00	-19.50	245.00	7
0.00	-25.00	300.00	7
100.00	-14.00	190.00	7
100.00	-19.50	245.00	7
100.00	-25.00	300.00	7
130.00	-14.00	300.00	7
130.00	-19.50	300.00	7
130.00	-25.00	300.00	7
160.00	-14.00	190.00	7
160.00	-19.50	245.00	7
160.00	-25.00	300.00	7
300.00	-14.00	190.00	7
300.00	-19.50	245.00	7
300.00	-25.00	300.00	7
0.00	-25.00	300.00	8
0.00	-32.50	375.00	8
0.00	-40.00	450.00	8
100.00	-25.00	300.00	8
100.00	-32.50	375.00	8
100.00	-40.00	450.00	8
130.00	-25.00	300.00	8
130.00	-32.50	375.00	8
130.00	-40.00	450.00	8
160.00	-25.00	300.00	8

```
        160.00   -32.50    375.00    8
        160.00   -40.00    450.00    8
        300.00   -25.00    300.00    8
        300.00   -32.50    375.00    8
        300.00   -40.00    450.00    8


DIStributed loads
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
         81.48    -2.49
         85.99    -7.00
         88.99   -10.00
         94.20   -14.00
        105.20   -25.00
        130.20   -25.00
        141.20   -14.00
        144.27   -10.00
        147.27    -7.00
        155.27     1.00
        156.92     2.65
        158.79     5.89
        162.43     9.53

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
   Corps of Engineers' Modified Swedish
   0

GRAPH
COMPUTE
```

Table C.9: Orleans Parish Lakefront

HEAding data follow -
Orleans Parish Lakefront Levee
West of I.H.N.C
Sta. 305+41.96 B/L to Sta. 305+46.96 B/L

PROfile line data follow -
1 1 Levee (CH)

87.00	5.50
100.50	10.00
110.50	11.00
112.00	11.50
142.00	21.50
152.00	21.50
192.50	8.00
222.50	6.50
242.00	0.00

2 2 ML (1)

0.00	5.50
87.00	5.50
104.00	5.50
135.00	7.00
142.00	9.20
152.00	9.20
155.00	8.70
167.00	7.00
177.00	4.00
187.00	2.00
242.00	0.00

3 3 CH (2)

0.00	0.00
242.00	0.00
300.00	0.00

4 4 ML (2)

0.00	-9.00
300.00	-9.00

5 5 CH (3)

0.00	-20.00

```
    300.00   -20.00

  6 6 SP (1)
      0.00   -36.00
    300.00   -36.00

  7 7 CH (4)
      0.00   -41.00
    300.00   -41.00

  8 8 CH (5)
      0.00   -62.50
    300.00   -62.50

  9 9 ML (3)
      0.00   -75.50
    300.00   -75.50

 10 10 CH (6)
      0.00   -80.50
    300.00   -80.50


MATerial property data follow -
  1 Levee (CH)
     110.00 = unit weight
     Conventional shear strengths
      400.00     0.00
     No pore pressure
  2 ML (1)
     117.00 = unit weight
     Conventional shear strengths
      200.00    15.00
     Piezometric Line
      1
  3 CH (2)
     103.00 = unit weight
     Interpolate Strengths
      280.00   400.00
     No pore pressure
  4 ML (2)
     117.00 = unit weight
     Conventional shear strengths
      200.00    15.00
```

```
      Piezometric Line
        1
    5 CH (3)
      101.00 = unit weight
      Interpolate Strengths
        500.00   720.00
      No pore pressure
    6 SP (1)
      122.00 = unit weight
      Conventional shear strengths
          0.00    33.00
      Piezometric Line
        1
    7 CH (4)
      104.00 = unit weight
      Interpolate Strengths
        700.00   800.00
      No pore pressure
    8 CH (5)
      120.00 = unit weight
      Conventional shear strengths
       1100.00     0.00
      No pore pressure
    9 ML (3)
      117.00 = unit weight
      Conventional shear strengths
        200.00    15.00
      Piezometric Line
        1
   10 CH (6)
      116.00 = unit weight
      Conventional shear strenghts
       1100.00     0.00
      No pore pressure

PIEzometric line data follow -
    1 Piezometric Line
       0.00    11.50
     112.00    11.50
     192.50     8.00
     222.50     6.50
     242.00     0.00
     300.00     0.00
```

INTerpolation data follow -
Shear strength values follow:

0.00	0.00	280.00	3
0.00	-4.50	340.00	3
0.00	-9.00	400.00	3
150.00	0.00	280.00	3
150.00	-4.50	340.00	3
150.00	-9.00	400.00	3
300.00	0.00	280.00	3
300.00	-4.50	340.00	3
300.00	-9.00	400.00	3
0.00	-20.00	500.00	5
0.00	-28.00	610.00	5
0.00	-36.00	720.00	5
150.00	-20.00	500.00	5
150.00	-28.00	610.00	5
150.00	-36.00	720.00	5
300.00	-20.00	500.00	5
300.00	-28.00	610.00	5
300.00	-36.00	720.00	5
0.00	-41.00	700.00	7
0.00	-51.75	750.00	7
0.00	-62.50	800.00	7
150.00	-41.00	700.00	7
150.00	-51.75	750.00	7
150.00	-62.50	800.00	7
300.00	-41.00	700.00	7
300.00	-51.75	750.00	7
300.00	-62.50	800.00	7

DIStributed loads
1
ANALYSIS/COMPUTATION
NONCIRCULAR

136.85	19.79
147.44	9.20
154.50	0.00
163.50	-8.99
196.49	-8.99
196.51	-9.00
234.00	-9.00
243.00	0.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE

Table C.10: Jefferson Parish Lakefront – Reach B (protected side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach B

PROfile line data follow -
1 1 Levee (CH)

85.00	6.00
137.50	9.50
145.50	11.50
163.50	16.00
173.50	16.00
212.50	3.00
252.50	2.00
270.50	-2.50

2 2 CH (2)

0.00	3.00
40.00	3.00
85.00	6.00
97.00	2.00
177.50	2.00
209.50	0.00
235.00	-1.00
260.00	-2.50
270.50	-2.50
350.00	-2.50

3 3 CH (3)

0.00	-15.00
350.00	-15.00

4 4 CH (4)

0.00	-20.00
350.00	-20.00

5 5 CH (5)

0.00	-30.00
350.00	-30.00

6 6 CH (6)

0.00	-35.00

350.00 -35.00

7 7 CH (7)
0.00 -46.00
350.00 -46.00

8 8 CH (8)
0.00 -54.00
350.00 -54.00

9 9 CH (9)
0.00 -60.00
350.00 -60.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
varying unit weight
0.00 90.00
115.50 110.00
215.50 80.00

Interpolate Strengths
130.00 400.00
No pore pressure
3 CH (3)
varying unit weight
0.00 90.00
115.50 110.00
215.50 105.00

Interpolate Strengths
130.00 275.00
No pore pressure
4 CH (4)
varying unit weight
0.00 103.00
115.50 107.00
215.50 105.00

Interpolate Strengths
130.00 275.00
No pore pressure
5 CH (5)
Varying unit weight
0.00 103.00
115.50 107.00
215.50 105.00

Interpolate Strengths
130.00 275.00
No pore pressure
6 CH (6)
Varying unit weight
0.00 103.00
115.50 107.00
215.50 100.00

Interpolate Strengths
131.00 440.00
No pore pressure
7 CH (7)
Varying unit weight
0.00 103.00
115.50 107.00
215.50 100.00

Interpolate Strengths
206.00 560.00
No pore pressure
8 CH (8)
Varying unit weight
0.00 103.00
115.50 107.00
215.50 100.00

Interpolate Strengths
260.00 650.00
No pore pressure
9 CH (9)
Varying unit weight
0.00 103.00
115.50 107.00

215.50 100.00

Interpolate Strengths
300.00 800.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	11.50
145.50	11.50
212.50	3.00
252.50	2.00
270.50	-2.50
350.00	-2.50

INTerpolation data follow -
Shear strength values follow:

0.00	6.00	130.00	2
0.00	-4.50	130.00	2
0.00	-15.00	130.00	2
115.50	6.00	400.00	2
115.50	-4.50	400.00	2
115.50	-15.00	400.00	2
215.50	6.00	400.00	2
215.50	-4.50	400.00	2
215.50	-15.00	400.00	2
350.00	6.00	400.00	2
350.00	-4.50	400.00	2
350.00	-15.00	400.00	2
0.00	-15.00	130.00	3
0.00	-17.50	130.00	3
0.00	-20.00	130.00	3
115.50	-15.00	220.00	3
115.50	-17.50	220.00	3
115.50	-20.00	220.00	3
215.50	-15.00	275.00	3
215.50	-17.50	275.00	3
215.50	-20.00	275.00	3
350.00	-15.00	275.00	3
350.00	-17.50	275.00	3
350.00	-20.00	275.00	3
0.00	-20.00	130.00	4
0.00	-25.00	130.00	4

0.00	-30.00	130.00	4
115.50	-20.00	220.00	4
115.50	-25.00	220.00	4
115.50	-30.00	220.00	4
215.50	-20.00	275.00	4
215.50	-25.00	275.00	4
215.50	-30.00	275.00	4
350.00	-20.00	275.00	4
350.00	-25.00	275.00	4
350.00	-30.00	275.00	4
0.00	-30.00	130.00	5
0.00	-32.50	130.00	5
0.00	-35.00	130.00	5
115.50	-30.00	220.00	5
115.50	-32.50	220.00	5
115.50	-35.00	220.00	5
215.50	-30.00	275.00	5
215.50	-32.50	275.00	5
215.50	-35.00	275.00	5
350.00	-30.00	275.00	5
350.00	-32.50	275.00	5
350.00	-35.00	275.00	5
0.00	-35.00	131.00	6
0.00	-40.50	168.00	6
0.00	-46.00	205.00	6
115.50	-35.00	400.00	6
115.50	-40.50	400.00	6
115.50	-46.00	400.00	6
215.50	-35.00	276.00	6
215.50	-40.50	358.00	6
215.50	-46.00	440.00	6
350.00	-35.00	276.00	6
350.00	-40.50	358.00	6
350.00	-46.00	440.00	6
0.00	-46.00	206.00	7
0.00	-50.00	233.00	7
0.00	-54.00	260.00	7
115.50	-46.00	400.00	7
115.50	-50.00	400.00	7
115.50	-54.00	400.00	7
215.50	-46.00	440.00	7
215.50	-50.00	500.00	7
215.50	-54.00	560.00	7
350.00	-46.00	440.00	7

```
  350.00   -50.00    500.00    7
  350.00   -54.00    560.00    7
    0.00   -54.00    260.00    8
    0.00   -57.00    280.00    8
    0.00   -60.00    300.00    8
  115.50   -54.00    600.00    8
  115.50   -57.00    625.00    8
  115.50   -60.00    650.00    8
  215.50   -54.00    560.00    8
  215.50   -57.00    605.00    8
  215.50   -60.00    650.00    8
  350.00   -54.00    560.00    8
  350.00   -57.00    605.00    8
  350.00   -60.00    650.00    8
    0.00   -60.00    300.00    9
    0.00   -65.00    385.00    9
    0.00   -70.00    470.00    9
  115.50   -60.00    650.00    9
  115.50   -65.00    695.00    9
  115.50   -70.00    740.00    9
  215.50   -60.00    650.00    9
  215.50   -65.00    725.00    9
  215.50   -70.00    800.00    9
  350.00   -60.00    650.00    9
  350.00   -65.00    725.00    9
  350.00   -70.00    800.00    9


DIStributed loads
  1
ANALYSIS/COMPUTATION
  NONCIRCULAR
    141.50    10.50
    150.00     2.00
    167.00   -15.00
    172.00   -20.00
    182.00   -30.00
    187.00   -34.99
    267.00   -34.99
    272.00   -30.00
    282.00   -20.00
    287.00   -15.00
    299.50    -2.50
```

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE

Table C.11: Citrus Lakefront

HEAding data follow -
Citrus Lakefront Levee
I.H.N.C. to Paris Road
Sta. 121+00 B/L to Sta. 154+83 B/L

PROfile line data follow -

1 1 Clay Blanket

143.31	9.35
154.76	6.60
158.76	6.60
180.96	14.00
190.96	14.00
226.96	2.00
235.96	1.50
236.46	1.00

2 2 Rip Rap

78.84	0.00
104.34	8.50
108.84	10.00
114.84	10.00
116.65	8.60

3 3 (SP)F

149.67	4.80
161.06	4.80
191.81	10.19
223.68	1.00
236.46	1.00
242.50	1.00

4 4 ML

85.07	0.00
108.84	7.50
114.84	7.50
116.65	8.60
119.33	9.75
127.16	9.75
131.72	8.00
135.67	9.35
143.31	9.35

```
    149.67    4.80
    158.98   -1.40

 5 5 CH
      0.00    0.00
     78.84    0.00
     85.07    0.00
    158.98   -1.40
    193.95   -3.70
    203.80   -6.10
    214.71   -7.00
    220.27   -6.98
    231.33   -4.58
    241.38    0.00
    242.50    1.00
    280.00    1.00

 6 6 ML (2)
      0.00   -7.00
    214.71   -7.00
    280.00   -7.00

 7 7 CH (2)
      0.00  -13.00
    280.00  -13.00

 8 8 CH (3)
      0.00  -42.00
    280.00  -42.00

 9 9 (SP)F (42)
      0.00  -44.00
    280.00  -44.00


MATerial property data follow -
 1 Clay Blanket
    112.00 = unit weight
    Conventional shear strengths
      400.00     0.00
    No pore pressure
 2 Rip Rap
    122.00 = unit weight
    Conventional shear strengths
```

0.00   40.00
Piezometric Line
1
3 (SP)F
122.00 = unit weight
Conventional shear strengths
0.00   33.00
Piezometric Line
1
4 ML
117.00 = unit weight
Conventional shear strengths
200.00   15.00
Piezometric Line
1
5 CH
102.00 = unit weight
Conventional shear strengths
300.00   0.00
No pore pressure
6 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00
Piezometric Line
1
7 CH (2)
107.00 = unit weight
Interpolate Strengths
500.00   700.00
No pore pressure
8 CH (3)
122.00 = unit weight
Conventional shear strengths
1000.00   0.00
No pore pressure
9 (SP)F (2)
122.00 = unit weight
Conventional shear strengths
0.00   33.00
Piezometric Line
1

PIEzometric line data follow -

```
    1 Piezometric Line
         0.00       0.00
       280.00       0.00


INTerpolation data follows -
    Shear strength values follow:
         0.00    -13.00     500.00     7
         0.00    -27.50     600.00     7
         0.00    -42.00     700.00     7
       140.00    -13.00     500.00     7
       140.00    -27.50     600.00     7
       140.00    -42.00     700.00     7
       280.00    -13.00     500.00     7
       280.00    -27.50     600.00     7
       280.00    -42.00     700.00     7


DIStributed Load data follow -
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
       165.82   8.95
       173.24  -2.34
       177.90  -7.00
       182.50 -13.00
       211.50 -42.00
       233.00 -42.00
       262.00 -13.00
       269.82  -7.00
       277.82   1.00

SINgle-stage computations
RIGHT Face of Slope
PROcedure for computation of Factor of Safety
   Corps of Engineers' Modified Swedish
   0

GRAPH
COMPUTE
```

Table C.12: Along MRGO – Violet Line
HEAding data follow -
Along Mississippi River Gulf Outlet - Violet Line
Sta. 807+00 to Sta. 978+00

PROfile line data follow -
1 1 Levee (CH)

150.00	1.00
170.00	5.00
290.00	9.00
332.50	17.50
342.50	17.50
385.00	9.00
505.00	5.00
525.00	1.00

2 2 Peat (Pt)

0.00	1.00
150.00	1.00
525.00	1.00
680.00	1.00

3 3 Organic Clay (OH)

0.00	-10.50
680.00	-10.50

4 4 CH (2)

0.00	-16.40
680.00	-16.40

5 5 CH (3)

0.00	-20.00
680.00	-20.00

6 6 CH (4)

0.00	-38.00
680.00	-38.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
200.00 0.00

No pore pressure
2 Peat (pt)
80.00 = unit weight
Conventional shear strengths
227.00   0.00
No pore pressure
3 Organic Clay (OH)
90.00 = unit weight
Conventional shear strengths
438.00   0.00
No pore pressure
4 CH (2)
108.00 = unit weight
Conventional shear strengths
888.00   0.00
No pore pressure
5 CH (3)
104.00 = unit weight
Conventional shear strengths
533.00   0.00
No pore pressure
6 CH (4)
115.00 = unit weight
Conventional shear strengths
1000.00   0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00   1.00
150.00   1.00
525.00   1.00
680.00   1.00

ANALYSIS/COMPUTATION
NONCIRCULAR
275.48   8.52
283.00   1.00
294.50   -10.49
310.50   -10.49
322.00   1.00
338.50   17.50

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE

Table C.13: Harvey Canal

HEAding data follow -
Harvey Canal Levee
Sta. 817+20 to 1014+25 B/L

PROfile line data follow -
1 1 Semi-Compacted Fill (CH)

32.00	0.00
70.00	9.50
80.00	9.50
118.00	0.00

2 2 Existing Levee (CH)

58.00	0.00
70.00	6.00
80.00	6.00
92.00	0.00

3 3 CH (3)

0.00	0.00
32.00	0.00
58.00	0.00
92.00	0.00
118.00	0.00
185.00	0.00
195.00	-2.00
205.00	-4.00

4 4 CH (4)

0.00	-4.00
205.00	-4.00
261.00	-20.00

5 5 CH (5)

0.00	-20.00
261.00	-20.00
291.00	-30.00

6 6 CH (6)

0.00	-30.00
291.00	-30.00
321.00	-40.00

370.00 -40.00

7 7 CH (7)
0.00 -55.00
370.00 -55.00

MATerial property data follow -
1 Semi-Compacted Fill (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 Existing Levee (CH)
104.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
3 CH (3)
104.00 = unit weight
Interpolate Strengths
160.00 180.00
No pore pressure
4 CH (4)
95.00 = unit weight
Interpolate Strengths
180.00 250.00
No pore pressure
5 CH (5)
100.00 = unit weight
Interpolate Strengths
250.00 300.00
No pore pressure
6 CH (6)
100.00 = unit weight
Interpolate Strengths
300.00 500.00
No pore pressure
7 CH (7)
100.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	-2.00
195.00	-2.00
370.00	-2.00

INTerpolation data follow -
Shear strength values follow:

0.00	0.00	170.00	3
0.00	-2.00	160.00	3
0.00	-4.00	180.00	3
185.00	0.00	160.00	3
185.00	-2.00	170.00	3
185.00	-4.00	180.00	3
370.00	0.00	160.00	3
370.00	-2.00	170.00	3
370.00	-4.00	180.00	3
0.00	-4.00	180.00	4
0.00	-12.00	215.00	4
0.00	-20.00	250.00	4
185.00	-4.00	180.00	4
185.00	-12.00	215.00	4
185.00	-20.00	250.00	4
370.00	-4.00	180.00	4
370.00	-12.00	215.00	4
370.00	-20.00	250.00	4
0.00	-20.00	250.00	5
0.00	-25.00	275.00	5
0.00	-30.00	300.00	5
185.00	-20.00	250.00	5
185.00	-25.00	275.00	5
185.00	-30.00	300.00	5
370.00	-20.00	250.00	5
370.00	-25.00	275.00	5
370.00	-30.00	300.00	5
0.00	-30.00	300.00	6
0.00	-42.50	400.00	6
0.00	-55.00	500.00	6
185.00	-30.00	300.00	6
185.00	-42.50	400.00	6
185.00	-55.00	500.00	6
370.00	-30.00	300.00	6
370.00	-42.50	400.00	6

```
     370.00   -55.00    500.00    6


DIStributed loads
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
          62.40        7.60
          70.00        0.00
          74.00       -4.00
          90.00      -20.00
         114.00      -20.00
         130.00       -4.00
         134.00        0.00

SINgle-stage computations
CRIGht Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE
```

Table C.14: New Orleans Lakefront Airport

HEAding data follow -
Orleans Parish Lakefront
New Orleans Airport
W/L Sta. 32+75 to W/L Sta. 33+21

Profile line data follow

1 1 CH (1)

86.88	11.00
88.24	11.50
95.04	14.00
105.10	14.00
113.68	11.00

2 2 Random Fill Placed By Others (CH)

36.63	5.00
74.96	10.50
86.88	11.00
95.07	11.00

3 2 Random Fill Placed By Others (CH)

105.44	11.00
113.68	11.00
125.27	10.50
157.33	5.00

4 3 Clay Core (CH)

76.19	5.00
95.07	11.00
105.44	11.00
124.16	5.00

5 4 ML

0.00	5.00
36.63	5.00
76.19	5.00
91.60	5.00
97.60	-1.00
102.60	-1.00
108.60	5.00
124.16	5.00
157.33	5.00

```
      300.00      5.00

    6 5 SP
        0.00    -17.00
      300.00    -17.00


MATerial property data follow -
    1 CH (1)
      110.00 = unit weight
      Conventional shear strengths
        400.00    0.00
      No pore pressure
    2 Random Fill Placed By Others (CH)
      110.00 = unit weight
      Conventional shear strengths
        300.00    0.00
      No pore pressure
    3 Clay Core (CH)
      110.00 = unit weight
      Conventional shear strengths
        400.00    0.00
      No pore pressure
    4 ML
      112.00 = unit weight
      Conventional shear strengths
        200.00   17.00
      Piezometric Line
        1
    5 SP
      122.00 = unit weight
      Conventional shear strengths
          0.00   33.00
      Piezometric Line
        1

PIEzometric line data follow -
    1 Piezometric Line
          0.00   11.50
         88.24   11.50
        157.33    5.00
        300.00    5.00
```

```
DIStributed loads
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
         90.32   12.26
        103.09   -0.51
        115.00  -16.99
        144.90  -16.99
        174.63    5.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE
```

Table C.15: South Point to G.I.W.W. (2)

Heading data follow -
New Orleans East Levee
South Point to G.I.W.W.
At Sta. 797+30 & Sta. 925+27

Profile line data follow -
1 1 Levee (CH)
45.25 -3.00
54.25 0.00
90.25 1.00
136.25 12.50
146.35 12.50
192.25 1.00
228.25 0.00
237.25 -3.00

2 2 CH (2)
0.00 -3.00
40.00 -4.75
45.25 -3.00
106.75 -3.00
111.75 -8.00

3 2 CH (2)
168.25 -8.00
173.25 -3.00
237.25 -3.00
283.25 -3.00

4 3 ML
0.00 -8.00
111.75 -8.00
168.25 -8.00
283.25 -8.00

5 4 CH (3)
0.00 -12.00
283.25 -12.00

6 5 CL
0.00 -27.00

283.25 -27.00

MATerial property data follow -
1 Levee (CH)
117.00 = unit weight
Conventional shear strengths
450.00 0.00
No pore pressure
2 CH (2)
102.00 = unit weight
Interpolate Strengths
300.00 450.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
4 CH (3)
107.00 = unit weight
Interpolate Strengths
300.00 600.00
No pore pressure
5 CL
122.00 = unit weight
Convention shear strengths
1000.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 -3.00
45.25 -3.00
237.25 -3.00
283.25 -3.00

INTerpolation data follows -
Shear strength values follow:
0.00 -3.00 300.00 2
0.00 -5.50 300.00 2
0.00 -8.00 300.00 2

90.25	-3.00	300.00	2
90.25	-5.50	300.00	2
90.25	-8.00	300.00	2
141.25	-3.00	450.00	2
141.25	-5.50	450.00	2
141.25	-8.00	450.00	2
192.25	-3.00	300.00	2
192.25	-5.50	300.00	2
192.25	-8.00	300.00	2
283.25	-3.00	300.00	2
283.25	-5.50	300.00	2
283.25	-8.00	300.00	2
0.00	-12.00	300.00	4
0.00	-19.50	300.00	4
0.00	-27.00	300.00	4
90.25	-12.00	300.00	4
90.25	-19.50	300.00	4
90.25	-27.00	300.00	4
141.25	-12.00	450.00	4
141.25	-19.50	525.00	4
141.25	-27.00	600.00	4
192.25	-12.00	300.00	4
192.25	-19.50	300.00	4
192.25	-27.00	300.00	4
283.25	-12.00	300.00	4
283.25	-19.50	300.00	4
283.25	-27.00	300.00	4

DIStributed Load data follow -
1
ANALYSIS/COMPUTATION
NONCIRCULAR

30.06	-4.32
33.74	-8.00
38.95	-12.00
53.95	-26.99
120.45	-26.99
135.45	-12.00
138.52	-8.00
156.47	9.95

SINgle-stage computations
LEFt Face of Slope

PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.16: City Price to Tropical Bend (2)

Heading data follow -

Reach A - City Price to Tropical Bend
Sta. 245+00 to 253+02

PROfile line data follow -

1 1 Berm (CH)
139.71 4.00
190.71 1.00
200.71 -1.00
220.71 -5.00

2 2 Levee - CH (2)
55.71 3.00
95.71 13.00
103.71 13.00
139.71 4.00
159.71 -1.00

3 3 CHO
0.00 3.00
55.71 3.00
109.14 3.00
123.43 0.00
159.71 -1.00
213.43 -5.00
220.71 -5.00
249.71 -5.00
255.71 -7.00

4 4 CH (3)
0.00 -7.00
255.71 -7.00
264.71 -10.00

5 5 ML
0.00 -10.00
264.71 -10.00
300.00 -10.00

6 6 CH (4)
0.00 -12.00

300.00 -12.00

7 7 CH (5)
    0.00 -25.00
300.00 -25.00

8 8 ML (2)
    0.00 -40.00
300.00 -40.00

MATerial property data follow -
1 Berm (CH)
  100.00 = unit weight
  Conventional shear strengths
    200.00   0.00
  No pore pressure
2 Levee - CH (2)
  110.00 = unit weight
  Conventional shear strengths
    400.00   0.00
  No pore pressure
3 CHO
  86.00 = unit weight
  Conventional shear strengths
    200.00   0.00
  No pore pressure
4 CH (3)
  96.00 = unit weight
  Conventional shear strengths
    200.00   0.00
  No pore pressure
5 ML
  117.00 = unit weight
  Conventional shear strengths
    200.00   15.00
  Piezometric Line
    1
6 CH (4)
  100.00 = unit weight
Interpolate Strengths
    170.00 300.00
No pore pressure
7 CH (5)

```
        100.00 = unit weight
        Interpolate Strengths
          300.00  450.00
     No pore pressure
     8 ML (2)
        117.00 = unit weight
        Conventional shear strengths
          200.00   15.00
     Piezometric Line
          1

PIEzometric Line data follow -
     1 Piezometric Line
            0.00   -1.00
       159.71   -1.00
       200.71   -1.00
       300.00   -1.00


INTerpolation data follow -
     Shear strength values follow:
          0.00    -12.00    170.00    6
          0.00    -18.50    235.00    6
          0.00    -25.00    300.00    6
        150.00    -12.00    170.00    6
        150.00    -18.50    235.00    6
        150.00    -25.00    300.00    6
        300.00    -12.00    170.00    6
        300.00    -18.50    235.00    6
        300.00    -25.00    300.00    6
          0.00    -25.00    300.00    7
          0.00    -32.50    375.00    7
          0.00    -40.00    450.00    7
        150.00    -25.00    300.00    7
        150.00    -32.50    375.00    7
        150.00    -40.00    450.00    7
        300.00    -25.00    300.00    7
        300.00    -32.50    375.00    7
        300.00    -40.00    450.00    7


DIStributed loads
     1
ANALYSIS/COMPUTATION
```

```
NONCIRCULAR
     85.12    10.35
  92.47     3.00
 102.47    -7.00
 105.47   -10.00
 107.00   -12.00
 120.00   -25.00
 200.30   -25.00
 213.30   -12.00
 215.91   -10.00
 218.91    -7.00
 220.91    -5.00
```

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
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GRAPH
COMPUTE

Table C.17: Orleans Parish Lakefront (2)

HEAding data follow -
Orleans Parish Lakefront Levee
West of I.H.N.C.
Sta. 136+13.19 to Sta. 159+70.0 B/L

PROfile line data follow -

```
 1 1 CH
    13.35   5.00
 14.14   5.50
106.83   8.00
118.39  12.50
134.93  19.00
145.03  19.00
173.69   8.00
265.83   5.50
268.68   4.50

 2 2 CH (2)
   109.48   7.50
134.93  16.00
145.29  16.00
150.00  14.70
171.03   7.50

 3 3 SM
     0.00   5.00
 13.35   5.00
 98.39   5.00
103.37   5.50
109.48   7.50
171.03   7.50
175.94   6.00
184.30   4.50
268.68   4.50
300.00   4.50

 4 4 CH (3)
     0.00   3.00
300.00   3.00

 5 5 SM (2)
```

0.00 -2.00
300.00 -2.00

6 6 ML
0.00 -15.00
300.00 -15.00

7 7 CH (4)
0.00 -22.50
300.00 -22.50

8 8 SM (3)
0.00 -27.50
300.00 -27.50

9 9 CH (5)
0.00 -43.00
300.00 -43.00

10 10 ML (2)
0.00 -50.00
300.00 -50.00

11 11 SM (4)
0.00 -52.00
300.00 -52.00

MATerial property data follow -
1 CH
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
116.00 = unit weight
Conventional shear strengths
700.00 0.00
No pore pressure
3 SM
122.00 = unit weight
Conventional shear strengths
0.00 30.00
No pore pressure

4 CH (3)
  104.00 = unit weight
  Conventional shear strengths
      80.00   0.00
  No pore pressure
5 SM (2)
  122.00 = unit weight
  Conventional shear strengths
      0.00   30.00
  Piezometric Line
      1
6 ML
  117.00 = unit weight
  Conventional shear strengths
      200.00   15.00
  Piezometric Line
      1
7 CH (4)
  104.00 = unit weight
  Conventional shear strengths
      620.00   0.00
  No pore pressure
8 SM (3)
  122.00 = unit weight
  Conventional shear strengths
      0.00   30.00
  Piezometric Line
      1
9 CH (5)
  112.00 = unit weight
  Interpolate Strengths
      960.00 1030.00
  No pore pressure
10 ML (2)
  117.00 = unit weight
  Conventional shear strengths
      200.00   15.00
  Piezometric Line
      1
11 SM (4)
  122.00 = unit weight
  Conventional shear strengths
      0.00   30.00
  Piezometric Line

1

PIEzometric line data follow -
1 Piezometric Line
0.00 0.00
300.00 0.00

2 "Piezometric Line for Water Loads
0.00 12.50
118.39 12.50

INTerpolation data follow -
Shear strength values follow:

0.00	-43.00	960.00	9
0.00	-46.50	995.00	9
0.00	-50.00	1030.00	9
150.00	-43.00	960.00	9
150.00	-46.50	995.00	9
150.00	-50.00	1030.00	9
300.00	-43.00	960.00	9
300.00	-46.50	995.00	9
300.00	-50.00	1030.00	9

DIStributed Load data -
2
ANALYSIS/COMPUTATION
NONCIRCULAR
128.34 16.41
137.25 7.49
139.85 3.00
144.85 -1.99
180.17 -1.99
185.17 3.00
187.77 4.50
190.80 7.53

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.18: Along MRGO – Violet Line (2)

HEAding data follow -
Along MRGO Violet Line
Sta. 1020+00 to Sta. 1050+00

PROfile line data follow -
1 1 Levee (CH)
75.00 3.00
95.00 7.00
155.00 9.00
175.00 13.00
197.50 17.50
207.50 17.50
250.00 9.00
310.00 7.00
330.00 3.00

2 2 OH
0.00 3.00
75.00 3.00
330.00 3.00
400.00 3.00

3 3 OH (2)
0.00 -7.00
400.00 -7.00

4 4 "SP"
0.00 -17.00
400.00 -17.00

5 5 CH (2)
0.00 -23.00
400.00 -23.00

6 6 CH (3)
0.00 -43.00
400.00 -43.00

MATerial property data follow -
1 Levee (CH)

115.00 = unit weight
Conventional shear strengths
200.00 0.00
No pore pressure
2 OH
112.00 = unit weight
Conventional shear strengths
367.00 0.00
No pore pressure
3 OH (2)
100.00 = unit weight
Conventional shear strengths
295.00 0.00
No pore pressure
4 "SP"
120.00 = unit weight
Conventional shear strengths
620.00 0.00
No pore pressure
5 CH (2)
105.00 = unit weight
Conventional shear strengths
521.00 0.00
No pore pressure
6 CH (3)
108.00 = unit weight
Conventional shear strengths
882.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 3.00
75.00 3.00
330.00 3.00
400.00 3.00

ANALYSIS/COMPUTATION
NONCIRCULAR
64.90 3.00
74.90 -7.00
84.90 -16.99
177.50 -16.99

187.50	-7.00
197.50	3.00
211.25	16.75

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
    Corps of Engineers' Modified Swedish
    0

GRAPH
COMPUTE

Table C.19: Westminster

HEAding data follow -
Westminster Levee
Reach IV
Sta. 188+73 to 261+20 B/L

PROfile line data follow
1 1 Levee (CH)
91.00 -0.50
97.00 1.50
177.00 6.50
183.00 8.00
195.00 11.00
205.00 11.00
229.00 5.00
298.00 2.00
308.00 -0.50

2 2 CH (2)
0.00 -0.50
91.00 -0.50
308.00 -0.50
404.00 -0.50
440.00 -8.50
451.25 -11.00
600.00 -11.00

3 3 CH (3)
0.00 -15.00
600.00 -15.00

4 4 CH (4)
0.00 -20.00
600.00 -20.00

5 5 CH (5)
0.00 -30.00
600.00 -30.00

6 6 CH (6)
0.00 -42.00
600.00 -42.00

7 7 CH (7)
0.00 -55.00
600.00 -55.00

MATerial property data follow -
1 Levee (CH)
90.00 = unit weight
Conventional shear strengths
150.00 0.00
No pore pressure
2 CH (2)
90.00 = unit weight
Conventional shear strengths
150.00 0.00
No pore pressure
3 CH (3)
90.00 = unit weight
Interpolate Strengths
151.00 187.00
No pore pressure
4 CH (4)
98.00 = unit weight
Interpolate Strengths
187.00 259.00
No pore pressure
5 CH (5)
98.00 = unit weight
Interpolate Strengths
259.00 347.00
No pore pressure
6 CH (6)
98.00 = unit weight
Interpolate Strengths
348.00 442.00
No pore pressure
7 CH (7)
98.00 = unit weight
Interpolate Strengths
442.00 552.00
No pore pressure

PIEzometric line data follow -

1 Piezometric Line

0.00	8.00
183.00	8.00
229.00	5.00
298.00	2.00
308.00	-0.50
404.00	-0.50
440.00	-8.50
600.00	-8.50

INTerpolation data follow -

Shear strength values follow:

0.00	-15.00	151.00	3
0.00	-17.50	169.00	3
0.00	-20.00	187.00	3
300.00	-15.00	151.00	3
300.00	-17.50	169.00	3
300.00	-20.00	187.00	3
600.00	-15.00	151.00	3
600.00	-17.50	169.00	3
600.00	-20.00	187.00	3
0.00	-20.00	187.00	4
0.00	-25.00	223.00	4
0.00	-30.00	259.00	4
300.00	-20.00	187.00	4
300.00	-25.00	223.00	4
300.00	-30.00	259.00	4
600.00	-20.00	187.00	4
600.00	-25.00	223.00	4
600.00	-30.00	259.00	4
0.00	-30.00	259.00	5
0.00	-36.00	303.00	5
0.00	-42.00	347.00	5
300.00	-30.00	259.00	5
300.00	-36.00	303.00	5
300.00	-42.00	347.00	5
600.00	-30.00	259.00	5
600.00	-36.00	303.00	5
600.00	-42.00	347.00	5
0.00	-42.00	348.00	6
0.00	-48.50	395.00	6
0.00	-55.00	442.00	6
300.00	-42.00	348.00	6

```
        300.00   -48.50   395.00    6
        300.00   -55.00   442.00    6
        600.00   -42.00   348.00    6
        600.00   -48.50   395.00    6
        600.00   -55.00   442.00    6
          0.00   -55.00   442.00    7
          0.00   -62.50   497.00    7
          0.00   -70.00   552.00    7
        300.00   -55.00   442.00    7
        300.00   -62.50   497.00    7
        300.00   -70.00   552.00    7
        600.00   -55.00   442.00    7
        600.00   -62.50   497.00    7
        600.00   -70.00   552.00    7


DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR
        190.20     9.80
        200.50    -0.50
        215.00   -14.99
        304.00   -14.99
        318.50    -0.50

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Table C.20: Bayou St. John

HEAding data follow -

Orleans Parish Lakefront
Bayou St. John
Earthen Closure

PROfile line data follow

1 1 Levee (CH)

```
   75.50   -2.00
 81.50    0.00
 84.50    1.00
196.50   10.00
223.50   19.00
233.50   19.00
271.00    6.50
388.50    1.00
391.50    0.00
397.50   -2.00
```

2 2 SM

```
    0.00   -2.00
   75.50   -2.00
397.50   -2.00
510.00   -2.00
```

3 3 SM (2)

```
    0.00   -5.00
510.00   -5.00
```

4 4 CH (2)

```
    0.00  -12.00
510.00  -12.00
```

5 5 ML

```
    0.00  -28.00
510.00  -28.00
```

6 6 CH (3)

```
    0.00  -38.00
510.00  -38.00
```

7 7 SM (3)

0.00 -61.00
510.00 -61.00

MATerial property data follow -
1 Levee (CH)
115.00 = unit weight
Conventional shear strengths
600.00 0.00
No pore pressure
2 SM
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
3 SM (2)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
4 CH (2)
105.00 = unit weight
Conventional shear strengths
390.00 0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
2
6 CH (3)
110.00 = unit weight
Conventional shear strengths
510.00 0.00
No pore pressure
7 SM (3)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
2

```
PIEzometric line data follow -
        1 Piezometric Line for Materials 1 - 3
            0.00    -2.00
           75.50    -2.00
           84.50     1.00
          388.50     1.00
          510.00     1.00

        2 Piezometric Line for Materials 4 - 7
                0.00     1.00
           84.50     1.00
          388.50     1.00
          510.00     1.00


ANALYSIS/COMPUTATION
        NONCIRCULAR
              48.56    -2.00
           54.99    -5.00
           70.00   -12.00
           86.00   -27.99
          210.00   -27.99
          226.00   -12.00
          230.04    -5.00
          231.77    -2.00
          247.95    14.18

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Table C.21: Jefferson Parish Lakefront – Reach A (protected side analysis)

```
HEAding data follow -
   Jefferson Parish Lakefront Levee
   Reach A - Protected Side

PROfile line data follow -
        1 1 Levee (CH)
          105.30    8.00
          135.30   10.00
          140.18   11.50
          161.30   18.00
          171.30   18.00
          216.35    1.00
          263.35   -1.00
          268.72   -2.80

        2 2 CH (2)
            0.00    2.82
           35.30    4.00
           45.30    4.00
          105.30    8.00
          122.80    8.00
          126.37    6.00
          130.30    6.00
          147.80    4.90
          203.87    0.00

        3 3 CH (3)
            0.00    0.00
          203.87    0.00
          268.72   -2.80
          290.51   -4.20
          400.00   -4.20

        4 4 CH (4)
            0.00  -12.00
          400.00  -12.00

        5 5 CH (5)
            0.00  -25.00
          400.00  -25.00
```

6 6 CH (6)
0.00 -35.00
400.00 -35.00

7 7 CH (7)
0.00 -48.00
400.00 -48.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
117.00 = unit weight
Conventional shear strengths
600.00 0.00
No pore pressure
3 CH (3)
Varying unit weight
1.00 105.00
110.50 117.00
209.50 105.00

Interpolate Strengths
200.00 450.00
No pore pressure
4 CH (4)
Varying unit weight
1.00 85.00
110.50 75.00
209.50 80.00

Interpolate Strengths
240.00 450.00
No pore pressure
5 CH (5)
Varying unit weight
1.00 100.00
110.50 105.00
209.50 100.00

Interpolate Strengths
200.00 700.00
No pore pressure
6 CH (6)
Varying unit weight
1.00 100.00
110.50 105.00
209.50 100.00

Interpolate Strengths
300.00 700.00
No pore pressure
7 CH (7)
Varying unit weight
1.00 120.00
110.50 120.00
209.50 110.00

Interpolate Strengths
300.00 1000.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 11.50
140.18 11.50
216.35 1.00
263.35 -1.00
268.72 -2.80
290.51 -4.20
400.00 -4.20

INTerpolation data follow -
Shear strength values follow:
0.00 0.00 200.00 3
0.00 -12.00 200.00 3
1.00 0.00 200.00 3
1.00 -12.00 200.00 3
110.50 0.00 450.00 3
110.50 -12.00 450.00 3
209.50 0.00 400.00 3
209.50 -12.00 400.00 3
400.00 0.00 400.00 3

400.00	-12.00	400.00	3
0.00	-12.00	240.00	4
0.00	-25.00	240.00	4
1.00	-12.00	240.00	4
1.00	-25.00	240.00	4
110.50	-12.00	450.00	4
110.50	-25.00	450.00	4
209.50	-12.00	380.00	4
209.50	-25.00	380.00	4
400.00	-12.00	380.00	4
400.00	-25.00	380.00	4
0.00	-25.00	200.00	5
0.00	-35.00	200.00	5
1.00	-25.00	200.00	5
1.00	-35.00	200.00	5
110.50	-25.00	700.00	5
110.50	-35.00	700.00	5
209.50	-25.00	480.00	5
209.50	-35.00	480.00	5
400.00	-25.00	480.00	5
400.00	-35.00	480.00	5
0.00	-35.00	300.00	6
0.00	-48.00	300.00	6
1.00	-35.00	300.00	6
1.00	-48.00	300.00	6
110.50	-35.00	700.00	6
110.50	-48.00	700.00	6
209.50	-35.00	480.00	6
209.50	-48.00	480.00	6
400.00	-35.00	480.00	6
400.00	-48.00	480.00	6
0.00	-48.00	300.00	7
0.00	-56.50	640.00	7
0.00	-65.00	980.00	7
1.00	-48.00	300.00	7
1.00	-56.50	640.00	7
1.00	-65.00	980.00	7
110.50	-48.00	1000.00	7
110.50	-56.50	1000.00	7
110.50	-65.00	1000.00	7
400.00	-48.00	1000.00	7
400.00	-56.50	1000.00	7
400.00	-65.00	1000.00	7

```
DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR
          148.46    14.05
          187.50   -24.99
          214.50   -24.99
          239.50     0.01

SINgle-stage computations
RIGHt face of slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Table C.22: Jefferson Parish Lakefront – Reach A (flood side analysis)

```
HEAding data follow -
    Jefferson Parish Lakefront Levee
    Reach A - Protected Side

PROfile line data follow -
          1 1 Levee (CH)
            105.30     8.00
            135.30    10.00
            140.18    11.50
            161.30    18.00
            171.30    18.00
            216.35     1.00
            263.35    -1.00
            268.72    -2.80

          2 2 CH (2)
              0.00     2.82
             35.30     4.00
             45.30     4.00
            105.30     8.00
            122.80     8.00
            126.37     6.00
            130.30     6.00
            147.80     4.90
            203.87     0.00

          3 3 CH (3)
              0.00     0.00
            203.87     0.00
            268.72    -2.80
            290.51    -4.20
            400.00    -4.20

          4 4 CH (4)
              0.00   -12.00
            400.00   -12.00

          5 5 CH (5)
              0.00   -25.00
            400.00   -25.00
```

6 6 CH (6)
0.00 -35.00
400.00 -35.00

7 7 CH (7)
0.00 -48.00
400.00 -48.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
117.00 = unit weight
Conventional shear strengths
600.00 0.00
No pore pressure
3 CH (3)
Varying unit weight
1.00 105.00
110.50 117.00
209.50 105.00

Interpolate Strengths
200.00 450.00
No pore pressure
4 CH (4)
Varying unit weight
1.00 85.00
110.50 75.00
209.50 80.00

Interpolate Strengths
240.00 450.00
No pore pressure
5 CH (5)
Varying unit weight
1.00 100.00
110.50 105.00
209.50 100.00

Interpolate Strengths
200.00 700.00
No pore pressure
6 CH (6)
Varying unit weight
1.00 100.00
110.50 105.00
209.50 100.00

Interpolate Strengths
300.00 700.00
No pore pressure
7 CH (7)
Varying unit weight
1.00 120.00
110.50 120.00
209.50 110.00

Interpolate Strengths
300.00 1000.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 11.50
140.18 11.50
216.35 1.00
263.35 -1.00
268.72 -2.80
290.51 -4.20
400.00 -4.20

INTerpolation data follow -
Shear strength values follow:
0.00 0.00 200.00 3
0.00 -12.00 200.00 3
1.00 0.00 200.00 3
1.00 -12.00 200.00 3
110.50 0.00 450.00 3
110.50 -12.00 450.00 3
209.50 0.00 400.00 3
209.50 -12.00 400.00 3
400.00 0.00 400.00 3

400.00	-12.00	400.00	3
0.00	-12.00	240.00	4
0.00	-25.00	240.00	4
1.00	-12.00	240.00	4
1.00	-25.00	240.00	4
110.50	-12.00	450.00	4
110.50	-25.00	450.00	4
209.50	-12.00	380.00	4
209.50	-25.00	380.00	4
400.00	-12.00	380.00	4
400.00	-25.00	380.00	4
0.00	-25.00	200.00	5
0.00	-35.00	200.00	5
1.00	-25.00	200.00	5
1.00	-35.00	200.00	5
110.50	-25.00	700.00	5
110.50	-35.00	700.00	5
209.50	-25.00	480.00	5
209.50	-35.00	480.00	5
400.00	-25.00	480.00	5
400.00	-35.00	480.00	5
0.00	-35.00	300.00	6
0.00	-48.00	300.00	6
1.00	-35.00	300.00	6
1.00	-48.00	300.00	6
110.50	-35.00	700.00	6
110.50	-48.00	700.00	6
209.50	-35.00	480.00	6
209.50	-48.00	480.00	6
400.00	-35.00	480.00	6
400.00	-48.00	480.00	6
0.00	-48.00	300.00	7
0.00	-56.50	640.00	7
0.00	-65.00	980.00	7
1.00	-48.00	300.00	7
1.00	-56.50	640.00	7
1.00	-65.00	980.00	7
110.50	-48.00	1000.00	7
110.50	-56.50	1000.00	7
110.50	-65.00	1000.00	7
400.00	-48.00	1000.00	7
400.00	-56.50	1000.00	7
400.00	-65.00	1000.00	7

```
DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR
          148.46    14.05
          187.50   -24.99
          214.50   -24.99
          239.50     0.01

SINgle-stage computations
RIGHt face of slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Table C.23: Jefferson Parish Lakefront – Reach B (flood side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach B - Floodside Analysis

PROfile line data follow -
1 1 Levee (CH)

235.00	6.00
287.50	9.50
313.50	16.00
323.50	16.00
362.50	3.00
402.50	2.00
420.50	-2.50

2 2 CH (2)

0.00	-3.50
31.42	-3.50
35.35	-3.00
98.92	-2.90
103.21	-2.10
128.57	-1.40
151.07	2.50
190.00	3.00
235.00	6.00
247.00	2.00
327.50	2.00
360.00	0.00
385.00	-1.00
410.00	-2.50
420.50	-2.50
450.00	-2.50

3 3 CH (3)

0.00	-15.00
450.00	-15.00

4 4 CH (4)

0.00	-20.00
450.00	-20.00

5 5 CH (5)

0.00 -30.00
450.00 -30.00

6 6 CH (6)
0.00 -35.00
450.00 -35.00

7 7 CH (7)
0.00 -46.00
450.00 -46.00

8 8 CH (8)
0.00 -54.00
450.00 -54.00

9 9 CH (9)
0.00 -60.00
450.00 -60.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
Varying unit weight
65.50 75.00
165.50 90.00
265.50 110.00
362.50 80.00

Interpolate Strengths
100.00 400.00
No pore pressure
3 CH (3)
Varying unit weight
65.50 75.00
165.50 90.00
265.50 110.00
362.50 105.00

Interpolate Strengths

100.00 275.00
No pore pressure
4 CH (4)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 105.00

Interpolate Strengths
100.00 275.00
No pore pressure
5 CH (5)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 105.00

Interpolate Strengths
130.00 275.00
No pore pressure
6 CH (6)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
131.00 440.00
No pore pressure
7 CH (7)
Varying unit weight
65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
206.00 560.00
No pore pressure
8 CH (8)
Varying unit weight

65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
260.00 650.00
No pore pressure
9 CH (9)
Varying unit weight
65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
300.00 800.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 -15.00
450.00 -15.00

INTerpolation data follow -
Shear strength values follow:

0.00	6.00	100.00	2
0.00	-4.50	100.00	2
0.00	-15.00	100.00	2
65.50	6.00	100.00	2
65.50	-4.50	100.00	2
65.50	-15.00	100.00	2
165.50	6.00	130.00	2
165.50	-4.50	130.00	2
165.50	-15.00	130.00	2
265.50	6.00	400.00	2
265.50	-4.50	400.00	2
265.50	-15.00	400.00	2
362.50	6.00	400.00	2
362.50	-4.50	400.00	2
362.50	-15.00	400.00	2
450.00	6.00	400.00	2
450.00	-4.50	400.00	2

450.00	-15.00	400.00	2
0.00	-15.00	100.00	3
0.00	-17.50	100.00	3
0.00	-20.00	100.00	3
65.50	-15.00	100.00	3
65.50	-17.50	100.00	3
65.50	-20.00	100.00	3
165.50	-15.00	130.00	3
165.50	-17.50	130.00	3
165.50	-20.00	130.00	3
265.50	-15.00	220.00	3
265.50	-17.50	220.00	3
265.50	-20.00	220.00	3
362.50	-15.00	275.00	3
362.50	-17.50	275.00	3
362.50	-20.00	275.00	3
450.00	-15.00	275.00	3
450.00	-17.50	275.00	3
450.00	-20.00	275.00	3
0.00	-20.00	100.00	4
0.00	-25.00	150.00	4
0.00	-30.00	200.00	4
65.50	-20.00	100.00	4
65.50	-25.00	150.00	4
65.50	-30.00	200.00	4
165.50	-20.00	130.00	4
165.50	-25.00	130.00	4
165.50	-30.00	130.00	4
265.50	-20.00	220.00	4
265.50	-25.00	220.00	4
265.50	-30.00	220.00	4
362.50	-20.00	275.00	4
362.50	-25.00	275.00	4
362.50	-30.00	275.00	4
450.00	-20.00	275.00	4
450.00	-25.00	275.00	4
450.00	-30.00	275.00	4
0.00	-30.00	200.00	5
0.00	-32.50	230.00	5
0.00	-35.00	260.00	5
65.50	-30.00	200.00	5
65.50	-32.50	230.00	5
65.50	-35.00	260.00	5
165.50	-30.00	130.00	5

165.50	-32.50	130.00	5
165.50	-35.00	130.00	5
265.50	-30.00	220.00	5
265.50	-32.50	220.00	5
265.50	-35.00	220.00	5
362.50	-30.00	275.00	5
362.50	-32.50	275.00	5
362.50	-35.00	275.00	5
450.00	-30.00	275.00	5
450.00	-32.50	275.00	5
450.00	-35.00	275.00	5
0.00	-35.00	260.00	6
0.00	-40.50	320.00	6
0.00	-46.00	380.00	6
65.50	-35.00	260.00	6
65.50	-40.50	320.00	6
65.50	-46.00	380.00	6
165.50	-35.00	131.00	6
165.50	-40.50	168.00	6
165.50	-46.00	205.00	6
265.50	-35.00	400.00	6
265.50	-40.50	400.00	6
265.50	-46.00	400.00	6
362.50	-35.00	276.00	6
362.50	-40.50	358.00	6
362.50	-46.00	440.00	6
450.00	-35.00	276.00	6
450.00	-40.50	358.00	6
450.00	-46.00	440.00	6
0.00	-46.00	381.00	7
0.00	-50.00	428.00	7
0.00	-54.00	475.00	7
65.50	-46.00	381.00	7
65.50	-50.00	428.00	7
65.50	-54.00	475.00	7
165.50	-46.00	206.00	7
165.50	-50.00	233.00	7
165.50	-54.00	260.00	7
265.50	-46.00	400.00	7
265.50	-50.00	400.00	7
265.50	-54.00	400.00	7
362.50	-46.00	440.00	7
362.50	-50.00	500.00	7
362.50	-54.00	560.00	7

450.00	-46.00	440.00	7
450.00	-50.00	500.00	7
450.00	-54.00	560.00	7
0.00	-54.00	476.00	8
0.00	-57.00	508.00	8
0.00	-60.00	540.00	8
65.50	-54.00	476.00	8
65.50	-57.00	508.00	8
65.50	-60.00	540.00	8
165.50	-54.00	260.00	8
165.50	-57.00	280.00	8
165.50	-60.00	300.00	8
265.50	-54.00	600.00	8
265.50	-57.00	625.00	8
265.50	-60.00	650.00	8
362.50	-54.00	560.00	8
362.50	-57.00	605.00	8
362.50	-60.00	650.00	8
450.00	-54.00	560.00	8
450.00	-57.00	605.00	8
450.00	-60.00	650.00	8
0.00	-60.00	540.00	9
0.00	-65.00	595.00	9
0.00	-70.00	650.00	9
65.50	-60.00	540.00	9
65.50	-65.00	595.00	9
65.50	-70.00	650.00	9
165.50	-60.00	300.00	9
165.50	-65.00	385.00	9
165.50	-70.00	470.00	9
265.50	-60.00	650.00	9
265.50	-65.00	695.00	9
265.50	-70.00	740.00	9
362.50	-60.00	650.00	9
362.50	-65.00	725.00	9
362.50	-70.00	800.00	9
450.00	-60.00	650.00	9
450.00	-65.00	725.00	9
450.00	-70.00	800.00	9

ANALYSIS/COMPUTATION
NONCIRCULAR
82.93 -2.93

95.00	-15.00
100.00	-20.00
110.00	-30.00
115.00	-34.99
290.00	-34.99
295.00	-30.00
305.00	-20.00
310.00	-15.00
327.00	2.00
336.62	11.62

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
Corps of Engineers' Modified Swedish
0

GRAPH
COMPUTE

Table C.24: Jefferson Parish Lakefront – Reach C (protected side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach C - Protected side analysis

PROfile line data follow -
1 1 Levee (CH)
81.00 7.40
112.50 9.50
120.50 11.50
138.50 16.00
148.50 16.00
193.50 1.00
246.00 0.00
253.50 -2.50

2 2 CH (2)
0.00 3.00
30.00 4.00
81.00 7.40
97.20 2.00
161.20 2.00
164.60 3.70
168.26 2.50
174.36 2.50
202.17 -2.50
253.50 -2.50
375.00 -2.50

3 3 CH (3)
0.00 -8.00
375.00 -8.00

4 4 CH (4)
0.00 -15.00
375.00 -15.00

5 5 CH (5)
0.00 -21.00
375.00 -21.00

6 6 CH (6)

```
   0.00 -27.00
 375.00 -27.00

7 7 CH (7)
   0.00 -38.00
 375.00 -38.00

8 8 CH (8)
   0.00 -44.00
 375.00 -44.00
```

```
MATerial property data follow -
   1 Levee (CH)
      110.00 = unit weight
      Conventional shear strengths
           400.00     0.00
      No pore pressure
   2 CH (2)
      Varying unit weight
              3.50   102.00
             93.50   120.00
            193.50   105.00

      Interpolate Strengths
           200.00   500.00
      No pore pressure
   3 CH (3)
      Varying unit weight
              3.50   102.00
             93.50   110.00
            193.50    95.00

      Interpolate Strengths
         100.00   300.00
      No pore pressure
   4 CH (4)
      Varying unit weight
              3.50   102.00
             93.50   110.00
            193.50   105.00

      Interpolate Strengths
         100.00   460.00
```

No pore pressure
5 CH (5)
Varying unit weight
3.50 100.00
93.50 100.00
193.50 102.00

Interpolate Strengths
250.00 500.00
No pore pressure
6 CH (6)
Varying unit weight
3.50 98.00
93.50 100.00
193.50 102.00

Intepolate Strengths
140.00 550.00
No pore pressure
7 CH (7)
Varying unit weight
3.50 102.00
93.50 100.00
193.50 100.00

Interpolate Strengths
200.00 580.00
No pore prssure
8 CH (8)
Varying unit weight
3.50 105.00
93.50 100.00
193.50 100.00

Interpolate Strengths
300.00 650.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 11.50
120.50 11.50
193.50 1.00
246.00 0.00

253.50 -2.50
375.00 -2.50

INTerpolation data follow -
Shear strength values follow:

0.00	7.40	200.00	2
0.00	-8.00	200.00	2
3.50	7.40	200.00	2
3.50	-8.00	200.00	2
93.50	7.40	450.00	2
93.50	-8.00	450.00	2
193.50	7.40	500.00	2
193.50	-8.00	500.00	2
375.00	7.40	500.00	2
375.00	-8.00	500.00	2
0.00	-8.00	200.00	3
0.00	-15.00	200.00	3
3.50	-8.00	200.00	3
3.50	-15.00	200.00	3
93.50	-8.00	100.00	3
93.50	-15.00	100.00	3
193.50	-8.00	300.00	3
193.50	-15.00	300.00	3
375.00	-8.00	300.00	3
375.00	-15.00	300.00	3
0.00	-15.00	100.00	4
0.00	-21.00	100.00	4
3.50	-15.00	100.00	4
3.50	-21.00	100.00	4
93.50	-15.00	460.00	4
93.50	-21.00	460.00	4
193.50	-15.00	140.00	4
193.50	-21.00	140.00	4
375.00	-15.00	140.00	4
375.00	-21.00	140.00	4
0.00	-21.00	400.00	5
0.00	-27.00	400.00	5
3.50	-21.00	400.00	5
3.50	-27.00	400.00	5
93.50	-21.00	500.00	5
93.50	-27.00	500.00	5
193.50	-21.00	250.00	5
193.50	-27.00	250.00	5

375.00	-21.00	250.00	5
375.00	-27.00	250.00	5
0.00	-27.00	140.00	6
0.00	-32.50	140.00	6
0.00	-38.00	140.00	6
3.50	-27.00	140.00	6
3.50	-32.50	140.00	6
3.50	-38.00	140.00	6
93.50	-27.00	500.00	6
93.50	-32.50	525.00	6
93.50	-38.00	550.00	6
193.50	-27.00	250.00	6
193.50	-32.50	300.00	6
193.50	-38.00	350.00	6
375.00	-27.00	250.00	6
375.00	-32.50	300.00	6
375.00	-38.00	350.00	6
0.00	-38.00	200.00	7
0.00	-41.00	200.00	7
0.00	-44.00	200.00	7
3.50	-38.00	200.00	7
3.50	-41.00	200.00	7
3.50	-44.00	200.00	7
93.50	-38.00	550.00	7
93.50	-41.00	565.00	7
93.50	-44.00	580.00	7
193.50	-38.00	200.00	7
193.50	-41.00	200.00	7
193.50	-44.00	200.00	7
375.00	-38.00	200.00	7
375.00	-41.00	200.00	7
375.00	-44.00	200.00	7
0.00	-44.00	300.00	8
0.00	-52.00	475.00	8
0.00	-60.00	650.00	8
3.50	-44.00	300.00	8
3.50	-52.00	475.00	8
3.50	-60.00	650.00	8
93.50	-44.00	580.00	8
93.50	-52.00	615.00	8
93.50	-60.00	650.00	8
193.50	-44.00	500.00	8
193.50	-52.00	575.00	8
193.50	-60.00	650.00	8

```
            375.00   -44.00     500.00    8
            375.00   -52.00     575.00    8
            375.00   -60.00     650.00    8


DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR
        114.90     10.10
        123.00      2.00
        133.00     -8.00
        140.00    -15.00
        146.00    -21.00
        152.00    -27.00
        163.00    -38.00
        169.00    -43.99
        253.50    -43.99
        259.50    -38.00
        270.50    -27.00
        276.50    -21.00
        282.50    -15.00
        289.50     -8.00
        295.00     -2.50

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Table C.25: Jefferson Parish Lakefront – Reach C (flood side analysis)

HEAding data follow -
    Jefferson Parish Lakefront Levee
    Reach C - Floodside Analysis

PROfile line data follow -

1 1 Levee (CH)

227.50	7.40
259.00	9.50
285.00	16.00
295.00	16.00
340.00	1.00
392.50	0.00
400.00	-2.50

2 2 CH (2)

0.00	-2.00
23.29	-2.00
41.15	-1.50
119.25	-0.75
124.50	1.00
136.50	3.00
166.50	4.00
176.50	4.00
227.50	7.40
243.70	2.00
307.70	2.00
311.10	3.70
314.76	2.50
320.86	2.50
348.67	-2.50
400.00	-2.50

3 3 CH (3)

0.00	-8.00
400.00	-8.00

4 4 CH (4)

0.00	-15.00
400.00	-15.00

5 5 CH (5)

0.00 -21.00
400.00 -21.00

6 6 CH (6)
0.00 -27.00
400.00 -27.00

7 7 CH (7)
0.00 -38.00
400.00 -38.00

8 8 CH (8)
0.00 -44.00
400.00 -44.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
Varying unit weight
40.00 85.00
140.00 102.00
240.00 120.00
340.00 105.00

Interpolate Strengths
100.00 500.00
No pore pressure
3 CH (3)
Varying unit weight
40.00 85.00
140.00 102.00
240.00 110.00
340.00 95.00

Interpolate Strengths
100.00 300.00
No pore pressure
4 CH (4)
Varying unit weight

40.00 97.00
140.00 102.00
240.00 110.00
340.00 105.00

Interpolate Strengths
100.00 460.00
No pore pressure
5 CH (5)
Varying unit weight
40.00 97.00
140.00 100.00
240.00 100.00
340.00 102.00

Interpolate Strengths
185.00 500.00
No pore pressure
6 CH (6)
Varying unit weight
40.00 97.00
140.00 98.00
240.00 100.00
340.00 102.00

Interpolate Strengths
140.00 550.00
No pore pressure
7 CH (7)
Varying unit weight
40.00 97.00
140.00 102.00
240.00 100.00
340.00 100.00

Interpolate Strengths
200.00 580.00
No pore pressure
8 CH (8)
Varying unit weight
40.00 97.00
140.00 105.00
240.00 100.00
340.00 100.00

Interpolate Strengths
300.00 650.00
No pore pressure

INTerpolation data follow -
Shear strength values follow:

0.00	7.40	100.00	2
0.00	-8.00	100.00	2
40.00	7.40	100.00	2
40.00	-8.00	100.00	2
140.00	7.40	200.00	2
140.00	-8.00	200.00	2
240.00	7.40	450.00	2
240.00	-8.00	450.00	2
340.00	7.40	500.00	2
340.00	-8.00	500.00	2
400.00	7.40	500.00	2
400.00	-8.00	500.00	2
0.00	-8.00	100.00	3
0.00	-15.00	100.00	3
40.00	-8.00	100.00	3
40.00	-15.00	100.00	3
140.00	-8.00	200.00	3
140.00	-15.00	200.00	3
240.00	-8.00	100.00	3
240.00	-15.00	100.00	3
340.00	-8.00	300.00	3
340.00	-15.00	300.00	3
400.00	-8.00	300.00	3
400.00	-15.00	300.00	3
0.00	-15.00	100.00	4
0.00	-21.00	100.00	4
40.00	-15.00	100.00	4
40.00	-21.00	100.00	4
140.00	-15.00	100.00	4
140.00	-21.00	100.00	4
240.00	-15.00	460.00	4
240.00	-21.00	460.00	4
340.00	-15.00	140.00	4
340.00	-21.00	140.00	4
400.00	-15.00	140.00	4
400.00	-21.00	140.00	4
0.00	-21.00	185.00	5

0.00	-27.00	185.00	5
40.00	-21.00	185.00	5
40.00	-27.00	185.00	5
140.00	-21.00	400.00	5
140.00	-27.00	400.00	5
240.00	-21.00	500.00	5
240.00	-27.00	500.00	5
340.00	-21.00	250.00	5
340.00	-27.00	250.00	5
400.00	-21.00	250.00	5
400.00	-27.00	250.00	5
0.00	-27.00	186.00	6
0.00	-32.50	263.00	6
0.00	-38.00	340.00	6
40.00	-27.00	186.00	6
40.00	-32.50	263.00	6
40.00	-38.00	340.00	6
140.00	-27.00	140.00	6
140.00	-32.50	140.00	6
140.00	-38.00	140.00	6
240.00	-27.00	500.00	6
240.00	-32.50	525.00	6
240.00	-38.00	550.00	6
340.00	-27.00	250.00	6
340.00	-32.50	300.00	6
340.00	-38.00	350.00	6
400.00	-27.00	250.00	6
400.00	-32.50	300.00	6
400.00	-38.00	350.00	6
0.00	-38.00	300.00	7
0.00	-41.00	300.00	7
0.00	-44.00	300.00	7
40.00	-38.00	300.00	7
40.00	-41.00	300.00	7
40.00	-44.00	300.00	7
140.00	-38.00	200.00	7
140.00	-41.00	200.00	7
140.00	-44.00	200.00	7
240.00	-38.00	550.00	7
240.00	-41.00	565.00	7
240.00	-44.00	580.00	7
340.00	-38.00	200.00	7
340.00	-41.00	200.00	7
340.00	-44.00	200.00	7

```
    400.00   -38.00    200.00    7
    400.00   -41.00    200.00    7
    400.00   -44.00    200.00    7
  0.00   -44.00    426.00    8
  0.00   -52.00    538.00    8
    0.00   -60.00    650.00    8
 40.00   -44.00    426.00    8
 40.00   -52.00    538.00    8
   40.00   -60.00    650.00    8
140.00   -44.00    300.00    8
140.00   -52.00    475.00    8
  140.00   -60.00    650.00    8
240.00   -44.00    580.00    8
240.00   -52.00    615.00    8
  240.00   -60.00    650.00    8
340.00   -44.00    500.00    8
340.00   -52.00    575.00    8
  340.00   -60.00    650.00    8
400.00   -44.00    500.00    8
400.00   -52.00    575.00    8
  400.00   -60.00    650.00    8


ANALYSIS/COMPUTATION
        NONCIRCULAR
        105.88     -0.88
        113.00     -8.00
        120.00    -15.00
        161.70    -15.00
        275.00    -14.99
        282.00     -8.00
        292.00      2.00
        303.25     13.25

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
        Corps of Engineers' Modified Swedish
        0

GRAPH
COMPUTE
```

Appendix D: UTEXAS4 Input Files for Critical Noncircular Slip Surface from Spencer's Procedure

Searches and analyses were performed with Spencer's procedure to locate the critical noncircular slip surface for each cross secton, and the searches and the analyses were performed using UTEXAS4. The input files required for those analyses for each cross section are included in this Appendix. The geometry of the critical noncircular slip surface is included in each input file. The location of the cross section and the table number with the corresponding input file is given in Table D.1.

Table D.1: Table numbers for each input file in Appendix D.

Location	Table No.
Citrus Back Levee	D.2
G.I.W.W. - Michoud Canal	D.3
City Price to Venice (flood side analysis)	D.4
City Price to Venice (protected side analysis)	D.5
Phoenix to Bohemia	D.6
South Point to G.I.W.W.	D.7
City Price to Tropical Bend	D.8
Orleans Parish Lakefront	D.9
Jefferson Parish Lakefront - Reach B (protected side analysis)	D.10
Citrus Lakefront	D.11
Along MRGO - Violet Line	D.12
Harvey Canal	D.13
New Orleans Lakefront Airport	D.14
South Point to G.I.W.W. (2)	D.15
City Price to Tropical Bend (2)	D.16
Orleans Parish Lakefront (2)	D.17
Along MRGO Violet Line (2)	D.18
Westminster	D.19
Bayou St. John	D.20
Jefferson Parish Lakefront - Reach A (protected side analysis)	D.21
Jefferson Parish Lakefront - Reach A (flood side analysis)	D.22
Jefferson Parish Lakefront - Reach B (flood side analysis)	D.23
Jefferson Parish Lakefront - Reach C (protected side analysis)	D.24
Jefferson Parish Lakefront - Reach C (flood side analysis)	D.25

Table D.2: Citrus Back Levee

HEAding data follow -
Mississippi River Gulf Outlet
Michoud Canal, LA
STA. 507+44.60 to STA. 540+00

PROfile line data follow -

1 1 Fill

0.00	0.00
10.00	2.50
147.50	8.00
187.50	18.00
197.50	18.00
237.50	8.00
367.50	1.50

2 2 CH

128.50	0.00
130.50	1.00
150.50	3.00
183.50	14.00
201.50	14.00
234.50	3.00
267.00	0.00

3 3 Rip Rap

363.00	0.00
367.50	1.50
375.00	4.00
378.00	4.00
390.00	0.00
399.00	-3.00

4 4 Fill (2)

29.00	0.00
128.50	0.00

5 4 Fill (2)

267.00	0.00
363.00	0.00
373.60	0.00
388.30	-6.00

399.00 -3.00
453.00 -21.25

6 5 CH (2)
122.50 -3.00
128.50 0.00
267.00 0.00
343.20 -1.00
349.20 -3.00

7 6 CH (3)
0.00 0.00
29.00 0.00
42.00 -6.50
115.50 -6.50
122.50 -3.00
152.50 -3.00
192.50 -6.00
232.50 -3.00
349.20 -3.00
362.40 -10.00
382.00 -10.50
395.50 -15.00

8 7 ML
0.00 -15.00
395.50 -15.00
418.10 -17.00
453.00 -21.25
490.00 -21.25
510.00 -18.00
650.00 -18.00

9 8 CH (4)
0.00 -29.00
650.00 -29.00

10 9 SP
0.00 -49.00
650.00 -49.00

11 10 CH (5)
0.00 -52.00
650.00 -52.00

MATerial property data follow -
1 Fill
110.00 = unit weight
Conventional shear strengths
250.00 0.00
No pore pressure
2 CH
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
3 Rip Rap
110.00 = unit weight
Conventional shear strengths
0.00 0.00
No pore pressure
4 Fill (2)
102.00 = unit weight
Conventional shear strengths
200.00 0.00
No pore pressure
5 CH (2)
102.00 = unit weight
Interpolate Strengths
200.00 300.00
No pore pressure
6 CH (3)
102.00 = unit weight
Interpolate Strengths
200.00 400.00
No pore pressure
7 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
8 CH (4)
107.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure

9 SP
122.00 = unit weight
Conventional shear strengths
0.00   33.00
Piezometric Line
1
10 CH (5)
122.00 = unit weight
Conventional shear strengths
800.00   0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
660.00	0.00

INTerpolation data follows -
Shear strength values follow -

0.00	0.00	200.00	5
0.00	-6.00	200.00	5
152.50	0.00	200.00	5
152.50	-6.00	200.00	5
192.50	0.00	300.00	5
192.50	-6.00	300.00	5
232.50	0.00	200.00	5
232.50	-6.00	200.00	5
660.00	0.00	200.00	5
660.00	-6.00	200.00	5
0.00	-3.00	200.00	6
0.00	-15.00	200.00	6
152.50	-3.00	200.00	6
152.50	-15.00	200.00	6
192.50	-3.00	400.00	6
192.50	-15.00	400.00	6
232.50	-3.00	200.00	6
232.50	-15.00	200.00	6
660.00	-3.00	200.00	6
660.00	-15.00	200.00	6

DIStributed load data follow -
1

ANALYSIS/COMPUTATION
NONCIRCULAR

180.07	16.14
182.73	13.62
194.84	0.76
201.23	-5.27
206.66	-9.31
218.36	-14.60
228.11	-14.99
240.61	-14.54
249.67	-11.96
261.16	-7.30
269.66	-2.64
273.64	-0.03
280.66	5.84

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.3: G.I.W.W. – Michoud Canal

HEAding data follow -
Mississippi River Gulf Outlet
Michoud Canal, LA
STA. 507+44.60 to STA. 540+00

PROfile line data follow -

1 1 Fill

0.00	0.00
10.00	2.50
147.50	8.00
187.50	18.00
197.50	18.00
237.50	8.00
367.50	1.50

2 2 CH

128.50	0.00
130.50	1.00
150.50	3.00
183.50	14.00
201.50	14.00
234.50	3.00
267.00	0.00

3 3 Rip Rap

363.00	0.00
367.50	1.50
375.00	4.00
378.00	4.00
390.00	0.00
399.00	-3.00

4 4 Fill (2)

29.00	0.00
128.50	0.00

5 4 Fill (2)

267.00	0.00
363.00	0.00
373.60	0.00
388.30	-6.00

399.00 -3.00
453.00 -21.25

6 5 CH (2)
122.50 -3.00
128.50 0.00
267.00 0.00
343.20 -1.00
349.20 -3.00

7 6 CH (3)
0.00 0.00
29.00 0.00
42.00 -6.50
115.50 -6.50
122.50 -3.00
152.50 -3.00
192.50 -6.00
232.50 -3.00
349.20 -3.00
362.40 -10.00
382.00 -10.50
395.50 -15.00

8 7 ML
0.00 -15.00
395.50 -15.00
418.10 -17.00
453.00 -21.25
490.00 -21.25
510.00 -18.00
650.00 -18.00

9 8 CH (4)
0.00 -29.00
650.00 -29.00

10 9 SP
0.00 -49.00
650.00 -49.00

11 10 CH (5)
0.00 -52.00
650.00 -52.00

MATerial property data follow -
  1 Fill
    110.00 = unit weight
    Conventional shear strengths
      250.00   0.00
    No pore pressure
  2 CH
    110.00 = unit weight
    Conventional shear strengths
      400.00   0.00
    No pore pressure
  3 Rip Rap
    110.00 = unit weight
    Conventional shear strengths
        0.00   0.00
    No pore pressure
  4 Fill (2)
    102.00 = unit weight
    Conventional shear strengths
      200.00   0.00
    No pore pressure
  5 CH (2)
    102.00 = unit weight
    Interpolate Strengths
      200.00   300.00
    No pore pressure
  6 CH (3)
    102.00 = unit weight
    Interpolate Strengths
      200.00   400.00
    No pore pressure
  7 ML
    117.00 = unit weight
    Conventional shear strengths
      200.00   15.00
    Piezometric Line
      1
  8 CH (4)
    107.00 = unit weight
    Conventional shear strengths
      500.00   0.00
    No pore pressure

9 SP
122.00 = unit weight
Conventional shear strengths
0.00 33.00
Piezometric Line
1
10 CH (5)
122.00 = unit weight
Conventional shear strengths
800.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
660.00	0.00

INTerpolation data follows -
Shear strength values follow -

0.00	0.00	200.00	5
0.00	-6.00	200.00	5
152.50	0.00	200.00	5
152.50	-6.00	200.00	5
192.50	0.00	300.00	5
192.50	-6.00	300.00	5
232.50	0.00	200.00	5
232.50	-6.00	200.00	5
660.00	0.00	200.00	5
660.00	-6.00	200.00	5
0.00	-3.00	200.00	6
0.00	-15.00	200.00	6
152.50	-3.00	200.00	6
152.50	-15.00	200.00	6
192.50	-3.00	400.00	6
192.50	-15.00	400.00	6
232.50	-3.00	200.00	6
232.50	-15.00	200.00	6
660.00	-3.00	200.00	6
660.00	-15.00	200.00	6

DIStributed load data follow -
1

ANALYSIS/COMPUTATION
NONCIRCULAR

178.90	15.85
181.57	13.36
194.63	0.00
201.21	-5.35
210.99	-11.28
223.25	-14.91
254.23	-10.86
269.69	-3.00
273.69	0.00
280.61	5.84

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.4: City Price to Venice (flood side analysis)

HEAding data follow -
West Bank Mississippi River Levee
City Price to Venice, LA
Reach T-2

PROfile line data follow -
1 1 Levee (CH)

407.35	2.00
427.30	7.70
479.83	12.80
503.28	19.50
513.28	19.50
553.78	6.00
598.78	4.50
608.78	2.00

2 2 CH (2)

313.00	-10.00
356.35	-1.50
391.35	2.00
407.35	2.00
608.78	2.00
750.00	2.00

3 3 ML

297.00	-14.00
313.00	-10.00
750.00	-10.00

4 4 CH (3)

273.00	-20.00
297.00	-14.00
750.00	-14.00

5 5 CH (4)

253.00	-25.00
273.00	-20.00
750.00	-20.00

6 6 CH (5)

203.50	-36.00

253.00 -25.00
750.00 -25.00

7 7 SP
135.50 -64.00
163.50 -56.00
203.50 -36.00
750.00 -36.00

8 8 CH (6)
114.50 -70.00
135.50 -64.00
750.00 -64.00

9 9 CH (7)
62.00 -85.00
114.50 -70.00
750.00 -70.00

10 10 SP (2)
44.00 -94.00
62.00 -85.00
750.00 -85.00

11 11 ML (2)
0.00 -94.00
44.00 -94.00
750.00 -94.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
105.00 = unit weight
Interpolate Strengths
300.00 350.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths

200.00   15.00
Piezometric Line
1
4 CH (3)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
5 CH (4)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
6 CH (5)
105.00 = unit weight
Interpolate Strengths
350.00   420.00
No pore pressure
7 SP
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
8 CH (6)
105.00 = unit weight
Interpolate Strengths
720.00   800.00
No pore pressure
9 CH (7)
105.00 = unit weight
Conventional shear strengths
800.00   0.00
No pore pressure
10 SP (2)
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
11 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00

Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
750.00	0.00

INTerpolation data follows -
Shear strength values follow -

0.00	2.00	350.00	2
0.00	-10.00	350.00	2
453.52	2.00	350.00	2
453.52	-10.00	350.00	2
496.38	2.00	300.00	2
496.38	-10.00	300.00	2
540.19	2.00	350.00	2
540.19	-10.00	350.00	2
750.00	2.00	350.00	2
750.00	-10.00	350.00	2
0.00	-14.00	350.00	4
0.00	-20.00	350.00	4
453.52	-14.00	350.00	4
453.52	-20.00	350.00	4
496.38	-14.00	300.00	4
496.38	-20.00	300.00	4
540.19	-14.00	350.00	4
540.19	-20.00	350.00	4
750.00	-14.00	350.00	4
750.00	-20.00	350.00	4
0.00	-20.00	350.00	5
0.00	-22.50	350.00	5
0.00	-25.00	350.00	5
453.52	-20.00	350.00	5
453.52	-22.50	350.00	5
453.52	-25.00	350.00	5
496.38	-20.00	300.00	5
496.38	-22.50	325.00	5
496.38	-25.00	350.00	5
540.19	-20.00	350.00	5
540.19	-22.50	350.00	5
540.19	-25.00	350.00	5
750.00	-20.00	350.00	5

```
        750.00   -22.50    350.00    5
        750.00   -25.00    350.00    5
          0.00   -25.00    350.00    6
          0.00   -30.50    385.00    6
          0.00   -36.00    420.00    6
        453.52   -25.00    350.00    6
        453.52   -30.50    385.00    6
        453.52   -36.00    420.00    6
        496.38   -25.00    350.00    6
        496.38   -30.50    385.00    6
        496.38   -36.00    420.00    6
        540.19   -25.00    350.00    6
        540.19   -30.50    385.00    6
        540.19   -36.00    420.00    6
        750.00   -25.00    350.00    6
        750.00   -30.50    385.00    6
        750.00   -36.00    420.00    6
          0.00   -64.00    720.00    8
          0.00   -67.50    760.00    8
          0.00   -70.00    800.00    8
        453.52   -64.00    720.00    8
        453.52   -67.50    760.00    8
        453.52   -70.00    800.00    8
        496.38   -64.00    720.00    8
        496.38   -67.50    760.00    8
        496.38   -70.00    800.00    8
        540.19   -64.00    720.00    8
        540.19   -67.50    760.00    8
        540.19   -70.00    800.00    8
        750.00   -64.00    720.00    8
        750.00   -67.50    760.00    8
        750.00   -70.00    800.00    8


DIStributed load data follow -
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
          332.77     -6.12
          339.21    -10.00
          346.91    -14.00
          359.66    -20.00
          371.95    -25.00
          410.72    -35.20
```

430.67	-35.37
479.01	-25.00
490.27	-20.00
498.37	-14.00
501.66	-10.00
511.98	2.00
524.81	15.66

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.5: City Price to Venice (protected side analysis)

HEAding data follow -
West Bank Mississippi River Levee
City Price to Venice, LA
Reach T-2

PROfile line data follow -

1 1 Levee (CH)

407.35	2.00
427.30	7.70
479.83	12.80
503.28	19.50
513.28	19.50
553.78	6.00
598.78	4.50
608.78	2.00

2 2 CH (2)

313.00	-10.00
356.35	-1.50
391.35	2.00
407.35	2.00
608.78	2.00
1000.00	2.00

3 3 ML

297.00	-14.00
313.00	-10.00
1000.00	-10.00

4 4 CH (3)

273.00	-20.00
297.00	-14.00
1000.00	-14.00

5 5 CH (4)

253.00	-25.00
273.00	-20.00
1000.00	-20.00

6 6 CH (5)

203.50	-36.00

253.00 -25.00
1000.00 -25.00

7 7 SP
135.50 -64.00
163.50 -56.00
203.50 -36.00
1000.00 -36.00

8 8 CH (6)
114.50 -70.00
135.50 -64.00
1000.00 -64.00

9 9 CH (7)
62.00 -85.00
114.50 -70.00
1000.00 -70.00

10 10 SP (2)
44.00 -94.00
62.00 -85.00
1000.00 -85.00

11 11 ML (2)
0.00 -94.00
44.00 -94.00
1000.00 -94.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
105.00 = unit weight
Interpolate Strengths
300.00 350.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths

200.00   15.00
Piezometric Line
1
4 CH (3)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
5 CH (4)
105.00 = unit weight
Interpolate Strengths
300.00   350.00
No pore pressure
6 CH (5)
105.00 = unit weight
Interpolate Strengths
350.00   420.00
No pore pressure
7 SP
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
8 CH (6)
105.00 = unit weight
Interpolate Strengths
720.00   800.00
No pore pressure
9 CH (7)
105.00 = unit weight
Conventional shear strengths
800.00   0.00
No pore pressure
10 SP (2)
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
11 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00

Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	12.60
477.77	12.60
553.78	6.00
598.78	4.50
608.78	2.00
1000.00	2.00

INTerpolation data follows -
Shear strength values follow -

0.00	2.00	350.00	2
0.00	-10.00	350.00	2
453.52	2.00	350.00	2
453.52	-10.00	350.00	2
496.38	2.00	300.00	2
496.38	-10.00	300.00	2
540.19	2.00	350.00	2
540.19	-10.00	350.00	2
1000.00	2.00	350.00	2
1000.00	-10.00	350.00	2
0.00	-14.00	350.00	4
0.00	-20.00	350.00	4
453.52	-14.00	350.00	4
453.52	-20.00	350.00	4
496.38	-14.00	300.00	4
496.38	-20.00	300.00	4
540.19	-14.00	350.00	4
540.19	-20.00	350.00	4
1000.00	-14.00	350.00	4
1000.00	-20.00	350.00	4
0.00	-20.00	350.00	5
0.00	-22.50	350.00	5
0.00	-25.00	350.00	5
453.52	-20.00	350.00	5
453.52	-22.50	350.00	5
453.52	-25.00	350.00	5
496.38	-20.00	300.00	5
496.38	-22.50	325.00	5
496.38	-25.00	350.00	5

```
540.19   -20.00    350.00    5
540.19   -22.50    350.00    5
540.19   -25.00    350.00    5
1000.00   -20.00    350.00    5
1000.00   -22.50    350.00    5
1000.00   -25.00    350.00    5
  0.00   -25.00    350.00    6
  0.00   -30.50    385.00    6
  0.00   -36.00    420.00    6
453.52   -25.00    350.00    6
453.52   -30.50    385.00    6
453.52   -36.00    420.00    6
496.38   -25.00    350.00    6
496.38   -30.50    385.00    6
496.38   -36.00    420.00    6
540.19   -25.00    350.00    6
540.19   -30.50    385.00    6
540.19   -36.00    420.00    6
1000.00   -25.00    350.00    6
1000.00   -30.50    385.00    6
1000.00   -36.00    420.00    6
  0.00   -64.00    720.00    8
  0.00   -67.50    760.00    8
  0.00   -70.00    800.00    8
453.52   -64.00    720.00    8
453.52   -67.50    760.00    8
453.52   -70.00    800.00    8
496.38   -64.00    720.00    8
496.38   -67.50    760.00    8
496.38   -70.00    800.00    8
540.19   -64.00    720.00    8
540.19   -67.50    760.00    8
540.19   -70.00    800.00    8
1000.00   -64.00    720.00    8
1000.00   -67.50    760.00    8
1000.00   -70.00    800.00    8
```

```
DIStributed load data follow -
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR SEARCH
      487.08            14.87
      497.82             3.27
```

```
       507.14          -9.16
       510.88         -14.35
       518.62         -22.31
       529.11         -28.86
       537.82         -31.45
       550.81         -31.16
       558.85         -28.82
       573.82         -24.46
       585.08         -21.06
       595.59         -17.37
       604.94         -13.05
       610.33          -9.59
       623.37           2.00

1         .05
SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
   SPENCER

GRAPH
COMPUTE
```

Table D.6: Phoenix to Bohemia

HEAding data follow -
Reach C - Phoenix to Bohemia
Sta. 159+00 to Sta. 495+00

PROfile line data follow -

1 1 CH

66.50	7.00
126.50	11.00
136.50	13.00
156.50	17.00
164.50	17.00
204.50	7.00

2 2 CH (2)

0.00	1.00
48.50	1.00
66.50	7.00
150.50	7.00

3 2 CH (2)

183.00	7.00
204.50	7.00
208.50	6.00
238.50	4.50
249.00	1.00
252.00	0.00

4 2 CH (2)

249.00	1.00
273.00	1.00

5 3 SP (F)

115.50	0.00
150.50	7.00
183.00	7.00
218.00	0.00

6 3 SP (F)

270.00	0.00
273.00	1.00
285.00	5.00

335.00 5.00
347.00 1.00

7 4 CHO
0.00 0.00
115.50 0.00
130.50 -8.00
166.00 -9.00
201.50 -8.00
218.00 0.00
252.00 0.00
270.00 0.00
289.50 -7.00
329.50 -7.00
347.00 1.00
375.00 1.00
403.50 -8.50
423.50 -8.50
452.00 1.00
500.00 1.00

8 5 ML
0.00 -9.00
83.50 -9.00
154.50 -10.00
225.50 -9.00
500.00 -9.00

9 6 CH (3)
0.00 -13.00
83.50 -13.00
154.50 -15.00
225.50 -13.00
500.00 -13.00

10 7 ML (2)
0.00 -25.00
83.50 -25.00
154.50 -26.00
225.50 -25.00
500.00 -25.00

11 8 CH (4)
0.00 -35.00

500.00 -35.00

12 9 CH (5)
0.00 -50.00
500.00 -50.00

MATerial property data follow -
1 CH
95.00 = unit weight
Conventional shear strengths
200.00   0.00
No pore pressure
2 CH (2)
95.00 = unit weight
Conventional shear strengths
300.00   0.00
No pore pressure
3 SP (F)
122.00 = unit weight
Conventional shear strengths
0.00   30.00
Piezometric Line
1
4 Organic Clay - CHO
82.00 = unit weight
Conventional shear strengths
300.00   0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00   15.00
Piezometric Line
1
6 CH (3)
102.00 = unit weight
Interpolate Strengths
350.00   500.00
No pore pressure
7 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00   15.00

Piezometric Line
1
8 CH (4)
102.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
9 CH (5)
102.00 = unit weight
Conventional shear strengths
750.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
500.00	0.00

2 "Piezometric" Line for Flood Side Water Loads

0.00	13.00
136.50	13.00

INTerpolation data follows -
Shear strength values follows -

0.00	-13.00	500.00	6
0.00	-19.00	500.00	6
0.00	-25.00	500.00	6
154.50	-15.00	500.00	6
154.50	-20.50	500.00	6
154.50	-26.00	500.00	6
226.00	-13.00	350.00	6
226.00	-19.00	350.00	6
226.00	-25.00	350.00	6
500.00	-13.00	350.00	6
500.00	-19.00	350.00	6
500.00	-25.00	350.00	6

DIStributed Load data follow -
2
ANALYSIS/COMPUTATION
NONCIRCULAR
146.66 15.03

151.01	10.72
155.43	4.95
168.76	-13.36
176.47	-19.04
191.13	-24.99
216.79	-24.99
239.13	-20.78
245.87	-17.93
257.76	-10.00
264.21	-5.42
269.63	-1.25
273.09	1.03

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.7: South Point to G.I.W.W.

HEAding data follow -
New Orleans East Levee
South Point to G.I.W.W.
Sta. 939+60 to Sta. 1101+90

PROfile line data follow -

1 1 Levee (CH)

60.00	0.00
66.00	2.00
96.00	4.00
131.20	12.80
136.00	14.00
146.00	14.00
186.00	4.00
216.00	2.00
222.00	0.00

2 2 CH (2)

0.00	0.00
60.00	0.00
100.00	-1.00
105.00	-6.00

3 2 CH (2)

177.00	-6.00
182.00	-1.00
222.00	0.00
280.00	0.00

4 3 CH (3)

0.00	-6.00
105.00	-6.00
109.00	-10.50
173.00	-10.50
177.00	-6.00
280.00	-6.00

5 4 CH (4)

0.00	-11.00
280.00	-11.00

6 5 CH (5)
0.00 -20.00
280.00 -20.00

7 6 CH (6)
0.00 -25.00
280.00 -25.00

8 7 CH (7)
0.00 -30.00
280.00 -30.00

9 8 SP
0.00 -50.00
280.00 -50.00

MATerial property data follow -
1 Levee (CH)
117.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
102.00 = unit weight
Interpolate Strengths
350.00 400.00
No pore pressure
3 CH (3)
92.00 = unit weight
Interpolate Strengths
350.00 400.00
No pore pressure
4 CH (4)
102.00 = unit weight
Interpolate Strengths
350.00 400.00
No pore pressure
5 CH (5)
107.00 = unit weight
Interpolate Strengths
350.00 400.00
No pore pressure
6 CH (6)

107.00 = unit weight
Interpolate Strengths
400.00 450.00
No pore pressure
7 CH (7)
102.00 = unit weight
Interpolate Strengths
450.00 650.00
No pore pressure
8 SP
122.00 = unit weight
Conventional shear strengths
0.00 33.00
Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line

0.00	0.00
60.00	0.00
222.00	0.00
280.00	0.00

2 "Piezometric" Line for Water Loads

0.00	12.80
131.20	12.80

INTerpolation data follows -
Shear strength values follow:

0.00	0.00	350.00	2
0.00	-3.00	350.00	2
0.00	-6.00	350.00	2
91.00	0.00	350.00	2
91.00	-3.00	350.00	2
91.00	-6.00	350.00	2
141.00	0.00	400.00	2
141.00	-3.00	400.00	2
141.00	-6.00	400.00	2
191.00	0.00	350.00	2
191.00	-3.00	350.00	2
191.00	-6.00	350.00	2
280.00	0.00	350.00	2
280.00	-3.00	350.00	2

280.00	-6.00	350.00	2
0.00	-6.00	350.00	3
0.00	-8.50	350.00	3
0.00	-11.00	350.00	3
91.00	-6.00	350.00	3
91.00	-8.50	350.00	3
91.00	-11.00	350.00	3
141.00	-6.00	400.00	3
141.00	-8.50	400.00	3
141.00	-11.00	400.00	3
191.00	-6.00	350.00	3
191.00	-8.50	350.00	3
191.00	-11.00	350.00	3
280.00	-6.00	350.00	3
280.00	-8.50	350.00	3
280.00	-11.00	350.00	3
0.00	-11.00	350.00	4
0.00	-15.50	350.00	4
0.00	-20.00	350.00	4
91.00	-11.00	350.00	4
91.00	-15.50	350.00	4
91.00	-20.00	350.00	4
141.00	-11.00	400.00	4
141.00	-15.50	400.00	4
141.00	-20.00	400.00	4
191.00	-11.00	350.00	4
191.00	-15.50	350.00	4
191.00	-20.00	350.00	4
280.00	-11.00	350.00	4
280.00	-15.50	350.00	4
280.00	-20.00	350.00	4
0.00	-20.00	350.00	5
0.00	-22.50	375.00	5
0.00	-25.00	400.00	5
91.00	-20.00	350.00	5
91.00	-22.50	375.00	5
91.00	-25.00	400.00	5
141.00	-20.00	400.00	5
141.00	-22.50	400.00	5
141.00	-25.00	400.00	5
191.00	-20.00	350.00	5
191.00	-22.50	375.00	5
191.00	-25.00	400.00	5
280.00	-20.00	350.00	5

280.00	-22.50	375.00	5
280.00	-25.00	400.00	5
0.00	-25.00	400.00	6
0.00	-27.50	425.00	6
0.00	-30.00	450.00	6
91.00	-25.00	400.00	6
91.00	-27.50	425.00	6
91.00	-30.00	450.00	6
141.00	-25.00	400.00	6
141.00	-27.50	425.00	6
141.00	-30.00	450.00	6
191.00	-25.00	400.00	6
191.00	-27.50	425.00	6
191.00	-30.00	450.00	6
280.00	-25.00	400.00	6
280.00	-27.50	425.00	6
280.00	-30.00	450.00	6
0.00	-30.00	450.00	7
0.00	-40.00	550.00	7
0.00	-50.00	650.00	7
91.00	-30.00	450.00	7
91.00	-40.00	550.00	7
91.00	-50.00	650.00	7
141.00	-30.00	450.00	7
141.00	-40.00	550.00	7
141.00	-50.00	650.00	7
191.00	-30.00	450.00	7
191.00	-40.00	550.00	7
191.00	-50.00	650.00	7
280.00	-30.00	450.00	7
280.00	-40.00	550.00	7
280.00	-50.00	650.00	7

DIStributed Load data follow -
2
ANALYSIS/COMPUTATION
NONCIRCULAR

119.08	9.77
129.77	0.07
139.98	-10.44
144.67	-14.99
150.40	-19.85
158.46	-24.77

173.60	-29.37
179.12	-29.35
195.39	-24.66
208.61	-19.82
219.26	-14.89
224.17	-11.06
232.20	-4.16
236.55	0.00

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.8: City Price to Tropical Bend

HEAding data follow -
Reach A - City Price to Tropical Bend
STA. 476+50 to STA. 612+50

PROfile line data follow -

1 1 CH

123.00	8.00
141.00	14.00
149.00	14.00
165.50	8.50
201.50	5.50
215.00	1.00

2 2 CH (2)

102.00	1.00
123.00	8.00
135.50	8.00
139.50	7.00
163.50	1.00

3 3 SM

139.50	7.00
200.50	3.50
208.00	1.00

4 4 CHO

48.00	-7.00
56.00	-3.00
86.00	-2.40
89.00	-1.00
95.00	1.00
102.00	1.00
163.50	1.00
208.00	1.00
215.00	1.00
300.00	1.00

5 5 CH (3)

18.00	-10.00
48.00	-7.00
300.00	-7.00

```
   6 6 ML
        0.00  -11.00
        8.00  -11.00
       18.00  -10.00
      300.00  -10.00

   7 7 CH (4)
        0.00  -14.00
      300.00  -14.00

   8 8 CH (5)
        0.00  -25.00
      300.00  -25.00

   9 9 CH (6)
        0.00  -40.00
      300.00  -40.00


MATerial property data follow -
   1 CH
      100.00 = unit weight
      Conventional shear strengths
        200.00    0.00
      No pore pressure
   2 CH (2)
      108.00 = unit weight
      Conventional shear strengths
        400.00    0.00
      No pore pressure
   3 SM
      122.00 = unit weight
      Conventional shear strengths
          0.00   30.00
      No pore pressure
   4 CHO
      86.00 = unit weight
      Interpolate Strengths
        150.00  300.00
      No pore pressure
   5 CH (3)
      96.00 = unit weight
      Interpolate Strengths
```

150.00 300.00
No pore pressure
6 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
7 CH (4)
100.00 = unit weight
Interpolate Strengths
190.00 300.00
No pore pressure
8 CH (5)
100.00 = unit weight
Interpolate Strengths
300.00 450.00
No pore pressure
9 CH (6)
100.00 = unit weight
Conventional shear strengths
450.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	-1.00
89.00	-1.00
300.00	-1.00

INTerpolation data follow -
Shear strength values follow:

0.00	1.00	150.00	4
0.00	-3.00	150.00	4
0.00	-7.00	150.00	4
100.00	1.00	150.00	4
100.00	-3.00	150.00	4
100.00	-7.00	150.00	4
130.00	1.00	300.00	4
130.00	-3.00	300.00	4
130.00	-7.00	300.00	4
160.00	1.00	150.00	4
160.00	-3.00	150.00	4

160.00	-7.00	150.00	4
300.00	1.00	150.00	4
300.00	-3.00	150.00	4
300.00	-7.00	150.00	4
0.00	-7.00	150.00	5
0.00	-8.50	150.00	5
0.00	-10.00	150.00	5
100.00	-7.00	150.00	5
100.00	-8.50	150.00	5
100.00	-10.00	150.00	5
130.00	-7.00	300.00	5
130.00	-8.50	300.00	5
130.00	-10.00	300.00	5
160.00	-7.00	150.00	5
160.00	-8.50	150.00	5
160.00	-10.00	150.00	5
300.00	-7.00	150.00	5
300.00	-8.50	150.00	5
300.00	-10.00	150.00	5
0.00	-14.00	190.00	7
0.00	-19.50	245.00	7
0.00	-25.00	300.00	7
100.00	-14.00	190.00	7
100.00	-19.50	245.00	7
100.00	-25.00	300.00	7
130.00	-14.00	300.00	7
130.00	-19.50	300.00	7
130.00	-25.00	300.00	7
160.00	-14.00	190.00	7
160.00	-19.50	245.00	7
160.00	-25.00	300.00	7
300.00	-14.00	190.00	7
300.00	-19.50	245.00	7
300.00	-25.00	300.00	7
0.00	-25.00	300.00	8
0.00	-32.50	375.00	8
0.00	-40.00	450.00	8
100.00	-25.00	300.00	8
100.00	-32.50	375.00	8
100.00	-40.00	450.00	8
130.00	-25.00	300.00	8
130.00	-32.50	375.00	8
130.00	-40.00	450.00	8
160.00	-25.00	300.00	8

```
     160.00   -32.50    375.00    8
     160.00   -40.00    450.00    8
     300.00   -25.00    300.00    8
     300.00   -32.50    375.00    8
     300.00   -40.00    450.00    8


DIStributed loads
   1
ANALYSIS/COMPUTATION
   NONCIRCULAR
     85.98          -2.40
     95.30          -7.60
    101.89          -9.44
    107.25          -9.98
    116.72          -9.97
    123.18          -9.97
    130.50          -8.29
    144.63           0.59
    148.52           4.66
    149.84           6.75
    155.03          11.99

SINgle-stage computations
LEFt Face of Slope
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   SPENCER

GRAPH
COMPUTE
```

Table D.9: Orleans Parish Lakefront

HEAding data follow -
Orleans Parish Lakefront Levee
West of I.H.N.C
Sta. 305+41.96 B/L to Sta. 305+46.96 B/L

PROfile line data follow -

1 1 Levee (CH)

87.00	5.50
100.50	10.00
110.50	11.00
112.00	11.50
142.00	21.50
152.00	21.50
192.50	8.00
222.50	6.50
242.00	0.00

2 2 ML (1)

0.00	5.50
87.00	5.50
104.00	5.50
135.00	7.00
142.00	9.20
152.00	9.20
155.00	8.70
167.00	7.00
177.00	4.00
187.00	2.00
242.00	0.00

3 3 CH (2)

0.00	0.00
242.00	0.00
300.00	0.00

4 4 ML (2)

0.00	-9.00
300.00	-9.00

5 5 CH (3)

0.00	-20.00

```
     300.00   -20.00

   6 6 SP (1)
       0.00   -36.00
     300.00   -36.00

   7 7 CH (4)
       0.00   -41.00
     300.00   -41.00

   8 8 CH (5)
       0.00   -62.50
     300.00   -62.50

   9 9 ML (3)
       0.00   -75.50
     300.00   -75.50

  10 10 CH (6)
       0.00   -80.50
     300.00   -80.50


MATerial property data follow -
   1 Levee (CH)
      110.00 = unit weight
      Conventional shear strengths
        400.00     0.00
      No pore pressure
   2 ML (1)
      117.00 = unit weight
      Conventional shear strengths
        200.00    15.00
      Piezometric Line
        1
   3 CH (2)
      103.00 = unit weight
      Interpolate Strengths
        280.00   400.00
      No pore pressure
   4 ML (2)
      117.00 = unit weight
      Conventional shear strengths
        200.00    15.00
```

Piezometric Line
1
5 CH (3)
101.00 = unit weight
Interpolate Strengths
500.00 720.00
No pore pressure
6 SP (1)
122.00 = unit weight
Conventional shear strengths
0.00 33.00
Piezometric Line
1
7 CH (4)
104.00 = unit weight
Interpolate Strengths
700.00 800.00
No pore pressure
8 CH (5)
120.00 = unit weight
Conventional shear strengths
1100.00 0.00
No pore pressure
9 ML (3)
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
10 CH (6)
116.00 = unit weight
Conventional shear strenghts
1100.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	11.50
112.00	11.50
192.50	8.00
222.50	6.50
242.00	0.00
300.00	0.00

```
INTerpolation data follow -
    Shear strength values follow:
        0.00     0.00     280.00    3
        0.00    -4.50     340.00    3
        0.00    -9.00     400.00    3
      150.00     0.00     280.00    3
      150.00    -4.50     340.00    3
      150.00    -9.00     400.00    3
      300.00     0.00     280.00    3
      300.00    -4.50     340.00    3
      300.00    -9.00     400.00    3
        0.00   -20.00     500.00    5
        0.00   -28.00     610.00    5
        0.00   -36.00     720.00    5
      150.00   -20.00     500.00    5
      150.00   -28.00     610.00    5
      150.00   -36.00     720.00    5
      300.00   -20.00     500.00    5
      300.00   -28.00     610.00    5
      300.00   -36.00     720.00    5
        0.00   -41.00     700.00    7
        0.00   -51.75     750.00    7
        0.00   -62.50     800.00    7
      150.00   -41.00     700.00    7
      150.00   -51.75     750.00    7
      150.00   -62.50     800.00    7
      300.00   -41.00     700.00    7
      300.00   -51.75     750.00    7
      300.00   -62.50     800.00    7


DIStributed loads
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
      134.71          19.07
      141.32          12.55
      148.31           4.40
      152.22           0.00
      156.72          -3.11
      163.40          -6.48
      173.24          -8.99
      225.85          -9.00
```

233.00	-7.31
235.32	-6.46
240.28	-3.74
243.82	-1.11
244.49	-0.56
245.16	0.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
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Table D.10: Jefferson Parish Lakefront – Reach B (protected side analysis)

HEAding data follow -
Orleans Parish Lakefront Levee
West of I.H.N.C
Sta. 305+41.96 B/L to Sta. 305+46.96 B/L

PROfile line data follow -

```
1 1 Levee (CH)
   87.00    5.50
  100.50   10.00
  110.50   11.00
  112.00   11.50
  142.00   21.50
  152.00   21.50
  192.50    8.00
  222.50    6.50
  242.00    0.00

2 2 ML (1)
    0.00    5.50
   87.00    5.50
  104.00    5.50
  135.00    7.00
  142.00    9.20
  152.00    9.20
  155.00    8.70
  167.00    7.00
  177.00    4.00
  187.00    2.00
  242.00    0.00

3 3 CH (2)
    0.00    0.00
  242.00    0.00
  450.00    0.00

4 4 ML (2)
    0.00   -9.00
  450.00   -9.00

5 5 CH (3)
    0.00  -20.00
```

450.00 -20.00

6 6 SP (1)
0.00 -36.00
450.00 -36.00

7 7 CH (4)
0.00 -41.00
450.00 -41.00

8 8 CH (5)
0.00 -62.50
450.00 -62.50

9 9 ML (3)
0.00 -75.50
450.00 -75.50

10 10 CH (6)
0.00 -80.50
450.00 -80.50

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 ML (1)
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
3 CH (2)
103.00 = unit weight
Interpolate Strengths
280.00 400.00
No pore pressure
4 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00

```
    Piezometric Line
      1
  5 CH (3)
    101.00 = unit weight
    Interpolate Strengths
      500.00   720.00
    No pore pressure
  6 SP (1)
    122.00 = unit weight
    Conventional shear strengths
        0.00    33.00
    Piezometric Line
      1
  7 CH (4)
    104.00 = unit weight
    Interpolate Strengths
      700.00   800.00
    No pore pressure
  8 CH (5)
    120.00 = unit weight
    Conventional shear strengths
     1100.00     0.00
    No pore pressure
  9 ML (3)
    117.00 = unit weight
    Conventional shear strengths
      200.00    15.00
    Piezometric Line
      1
 10 CH (6)
    116.00 = unit weight
    Conventional shear strenghts
     1100.00     0.00
    No pore pressure

PIEzometric line data follow -
  1 Piezometric Line
      0.00    11.50
    112.00    11.50
    192.50     8.00
    222.50     6.50
    242.00     0.00
    450.00     0.00
```

INTerpolation data follow -
Shear strength values follow:

0.00	0.00	280.00	3
0.00	-4.50	340.00	3
0.00	-9.00	400.00	3
150.00	0.00	280.00	3
150.00	-4.50	340.00	3
150.00	-9.00	400.00	3
450.00	0.00	280.00	3
450.00	-4.50	340.00	3
450.00	-9.00	400.00	3
0.00	-20.00	500.00	5
0.00	-28.00	610.00	5
0.00	-36.00	720.00	5
150.00	-20.00	500.00	5
150.00	-28.00	610.00	5
150.00	-36.00	720.00	5
450.00	-20.00	500.00	5
450.00	-28.00	610.00	5
450.00	-36.00	720.00	5
0.00	-41.00	700.00	7
0.00	-51.75	750.00	7
0.00	-62.50	800.00	7
150.00	-41.00	700.00	7
150.00	-51.75	750.00	7
150.00	-62.50	800.00	7
450.00	-41.00	700.00	7
450.00	-51.75	750.00	7
450.00	-62.50	800.00	7

DIStributed loads
1
ANALYSIS/COMPUTATION
NONCIRCULAR

131.62	18.04
135.97	13.96
138.30	11.51
139.80	9.83
141.54	7.70
143.81	4.74
146.42	1.58
149.21	-1.35

151.44	-3.34
153.57	-5.12
156.74	-7.52
158.61	-8.76
160.38	-10.21
163.60	-12.80
165.88	-14.51
168.26	-16.10
171.89	-18.37
174.94	-20.00
178.45	-20.79
181.16	-21.24
183.80	-21.54
186.47	-21.70
189.12	-21.76
191.91	-21.66
194.68	-21.49
198.89	-21.25
202.76	-21.07
206.57	-20.88
210.80	-20.73
215.01	-20.58
219.24	-20.50
221.93	-20.41
224.56	-20.30
226.89	-20.02
229.21	-19.52
233.32	-18.29
237.33	-16.71
240.69	-15.05
243.93	-13.15
247.57	-10.91
249.97	-9.43
252.21	-7.77
255.58	-5.14
258.86	-2.41
261.62	0.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
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Table D.11: Citrus Lakefront

HEAding data follow -
Citrus Lakefront Levee
I.H.N.C. to Paris Road
Sta. 121+00 B/L to Sta. 154+83 B/L

PROfile line data follow -

1 1 Clay Blanket

143.31	9.35
154.76	6.60
158.76	6.60
180.96	14.00
190.96	14.00
226.96	2.00
235.96	1.50
236.46	1.00

2 2 Rip Rap

78.84	0.00
104.34	8.50
108.84	10.00
114.84	10.00
116.65	8.60

3 3 (SP)F

149.67	4.80
161.06	4.80
191.81	10.19
223.68	1.00
236.46	1.00
242.50	1.00

4 4 ML

85.07	0.00
108.84	7.50
114.84	7.50
116.65	8.60
119.33	9.75
127.16	9.75
131.72	8.00
135.67	9.35
143.31	9.35

149.67 4.80
158.98 -1.40

5 5 CH
0.00 0.00
78.84 0.00
85.07 0.00
158.98 -1.40
193.95 -3.70
203.80 -6.10
214.71 -7.00
220.27 -6.98
231.33 -4.58
241.38 0.00
242.50 1.00
280.00 1.00
400.00 1.00

6 6 ML (2)
0.00 -7.00
214.71 -7.00
280.00 -7.00
400.00 -7.00

7 7 CH (2)
0.00 -13.00
280.00 -13.00
400.00 -13.00

8 8 CH (3)
0.00 -42.00
280.00 -42.00
400.00 -42.00

9 9 (SP)F (42)
0.00 -44.00
280.00 -44.00
400.00 -44.00

MATerial property data follow -
1 Clay Blanket
112.00 = unit weight
Conventional shear strengths

400.00 0.00
No pore pressure
2 Rip Rap
122.00 = unit weight
Conventional shear strengths
0.00 40.00
Piezometric Line
1
3 (SP)F
122.00 = unit weight
Conventional shear strengths
0.00 33.00
Piezometric Line
1
4 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
5 CH
102.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
6 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
7 CH (2)
107.00 = unit weight
Interpolate Strengths
500.00 700.00
No pore pressure
8 CH (3)
122.00 = unit weight
Conventional shear strengths
1000.00 0.00
No pore pressure
9 (SP)F (2)
122.00 = unit weight
Conventional shear strengths

```
         0.00    33.00
       Piezometric Line
         1

PIEzometric line data follow -
     1 Piezometric Line
         0.00       0.00
        280.00       0.00
        400.00       0.00


INTerpolation data follows -
     Shear strength values follow:
         0.00    -13.00     500.00     7
         0.00    -27.50     600.00     7
         0.00    -42.00     700.00     7
       140.00    -13.00     500.00     7
       140.00    -27.50     600.00     7
       140.00    -42.00     700.00     7
       280.00    -13.00     500.00     7
       280.00    -27.50     600.00     7
       280.00    -42.00     700.00     7
       400.00    -13.00     500.00     7
       400.00    -27.50     600.00     7
       400.00    -42.00     700.00     7


ANALYSIS/COMPUTATION
     NONCIRCULAR
       172.89            11.31
       177.03             7.23
       183.57            -3.01
       187.81            -6.52
       195.41           -13.53
       204.53           -18.02
       216.59           -19.79
       228.10           -16.88
       237.01           -12.39
       245.73            -7.01
       255.44             1.00

SINgle-stage computations
RIGHT Face of Slope
PROcedure for computation of Factor of Safety
```

SPENCER

GRAPH
COMPUTE

Table D.12: Along MRGO – Violet Line

HEAding data follow -
Along Mississippi River Gulf Outlet - Violet Line
Sta. 807+00 to Sta. 978+00

PROfile line data follow -
1 1 Levee (CH)
150.00 1.00
170.00 5.00
290.00 9.00
332.50 17.50
342.50 17.50
385.00 9.00
505.00 5.00
525.00 1.00

2 2 Peat (Pt)
0.00 1.00
150.00 1.00
525.00 1.00
680.00 1.00

3 3 Organic Clay (OH)
0.00 -10.50
680.00 -10.50

4 4 CH (2)
0.00 -16.40
680.00 -16.40

5 5 CH (3)
0.00 -20.00
680.00 -20.00

6 6 CH (4)
0.00 -38.00
680.00 -38.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight

Conventional shear strengths
200.00 0.00
No pore pressure
2 Peat (pt)
80.00 = unit weight
Conventional shear strengths
227.00 0.00
No pore pressure
3 Organic Clay (OH)
90.00 = unit weight
Conventional shear strengths
438.00 0.00
No pore pressure
4 CH (2)
108.00 = unit weight
Conventional shear strengths
888.00 0.00
No pore pressure
5 CH (3)
104.00 = unit weight
Conventional shear strengths
533.00 0.00
No pore pressure
6 CH (4)
115.00 = unit weight
Conventional shear strengths
1000.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 1.00
150.00 1.00
525.00 1.00
680.00 1.00

ANALYSIS/COMPUTATION
NONCIRCULAR
267.68 8.26
270.96 5.35
277.01 1.00
283.13 -3.00
287.68 -5.67

291.40	-7.76
299.98	-10.49
316.07	-10.49
327.89	-5.04
331.47	-2.31
337.80	3.51
342.48	8.47
345.91	12.23
350.11	15.98

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.13: Harvey Canal

HEAding data follow -
Harvey Canal Levee
Sta. 817+20 to 1014+25 B/L

PROfile line data follow
1 1 Semi-Compacted Fill (CH)
32.00 0.00
70.00 9.50
80.00 9.50
118.00 0.00

2 2 Existing Levee (CH)
58.00 0.00
70.00 6.00
80.00 6.00
92.00 0.00

3 3 CH (3)
0.00 0.00
32.00 0.00
58.00 0.00
92.00 0.00
118.00 0.00
185.00 0.00
195.00 -2.00
205.00 -4.00

4 4 CH (4)
0.00 -4.00
205.00 -4.00
261.00 -20.00

5 5 CH (5)
0.00 -20.00
261.00 -20.00
291.00 -30.00

6 6 CH (6)
0.00 -30.00
291.00 -30.00
321.00 -40.00

370.00 -40.00

7 7 CH (7)
0.00 -55.00
370.00 -55.00

MATerial property data follow -
1 Semi-Compacted Fill (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 Existing Levee (CH)
104.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure
3 CH (3)
104.00 = unit weight
Interpolate Strengths
160.00 180.00
No pore pressure
4 CH (4)
95.00 = unit weight
Interpolate Strengths
180.00 250.00
No pore pressure
5 CH (5)
100.00 = unit weight
Interpolate Strengths
250.00 300.00
No pore pressure
6 CH (6)
100.00 = unit weight
Interpolate Strengths
300.00 500.00
No pore pressure
7 CH (7)
100.00 = unit weight
Conventional shear strengths
500.00 0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line

0.00	-2.00
195.00	-2.00
370.00	-2.00

INTerpolation data follow -
Shear strength values follow:

0.00	0.00	170.00	3
0.00	-2.00	160.00	3
0.00	-4.00	180.00	3
185.00	0.00	160.00	3
185.00	-2.00	170.00	3
185.00	-4.00	180.00	3
370.00	0.00	160.00	3
370.00	-2.00	170.00	3
370.00	-4.00	180.00	3
0.00	-4.00	180.00	4
0.00	-12.00	215.00	4
0.00	-20.00	250.00	4
185.00	-4.00	180.00	4
185.00	-12.00	215.00	4
185.00	-20.00	250.00	4
370.00	-4.00	180.00	4
370.00	-12.00	215.00	4
370.00	-20.00	250.00	4
0.00	-20.00	250.00	5
0.00	-25.00	275.00	5
0.00	-30.00	300.00	5
185.00	-20.00	250.00	5
185.00	-25.00	275.00	5
185.00	-30.00	300.00	5
370.00	-20.00	250.00	5
370.00	-25.00	275.00	5
370.00	-30.00	300.00	5
0.00	-30.00	300.00	6
0.00	-42.50	400.00	6
0.00	-55.00	500.00	6
185.00	-30.00	300.00	6
185.00	-42.50	400.00	6
185.00	-55.00	500.00	6
370.00	-30.00	300.00	6
370.00	-42.50	400.00	6

```
      370.00    -55.00      500.00      6


DIStributed loads
   1
ANALYSIS/COMPUTATION
   NONCIRCULAR
      60.33          7.08
      63.98          3.80
      67.81          0.23
      74.78         -7.07
      82.44        -13.95
      87.99        -17.45
      96.01        -20.17
     105.82        -20.16
     113.36        -17.56
     118.30        -14.31
     124.82         -9.03
     129.23         -5.33
     132.56         -2.42
     135.23          0.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
   SPENCER

GRAPH
COMPUTE
```

Table D.14: New Orleans Lakefront Airport

HEAding data follow -
Orleans Parish Lakefront
New Orleans Airport
W/L Sta. 32+75 to W/L Sta. 33+21

Profile line data follow
1 1 CH (1)
86.88 11.00
88.24 11.50
95.04 14.00
105.10 14.00
113.68 11.00

2 2 Random Fill Placed By Others (CH)
36.63 5.00
74.96 10.50
86.88 11.00
95.07 11.00

3 2 Random Fill Placed By Others (CH)
105.44 11.00
113.68 11.00
125.27 10.50
157.33 5.00

4 3 Clay Core (CH)
76.19 5.00
95.07 11.00
105.44 11.00
124.16 5.00

5 4 ML
0.00 5.00
36.63 5.00
76.19 5.00
91.60 5.00
97.60 -1.00
102.60 -1.00
108.60 5.00
124.16 5.00
157.33 5.00

300.00 5.00

6 5 SP
0.00 -17.00
300.00 -17.00

MATerial property data follow -
1 CH (1)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 Random Fill Placed By Others (CH)
110.00 = unit weight
Conventional shear strengths
300.00 0.00
No pore pressure
3 Clay Core (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
4 ML
112.00 = unit weight
Conventional shear strengths
200.00 17.00
Piezometric Line
1
5 SP
122.00 = unit weight
Conventional shear strengths
0.00 33.00
Piezometric Line
1

PIEzometric line data follow -
1 Piezometric Line
0.00 11.50
88.24 11.50
157.33 5.00
300.00 5.00

```
DIStributed loads
    1
ANALYSIS/COMPUTATION
    NONCIRCULAR
       92.04          12.90
       94.86          10.35
       96.82           8.59
      101.41           4.24
      108.99          -1.66
      115.23          -4.01
      130.42          -7.44
      143.20          -7.25
      153.04          -4.28
      155.85          -2.87
      160.47           0.05
      163.43           2.07
      164.59           2.76
      167.58           5.00

SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
    SPENCER

GRAPH
COMPUTE
```

Table D.15: South Point to G.I.W.W. (2)

Heading data follow -

New Orleans East Levee
South Point to G.I.W.W.
At Sta. 797+30 & Sta. 925+27

Profile line data follow -

1 1 Levee (CH)

45.25	-3.00
54.25	0.00
90.25	1.00
136.25	12.50
146.35	12.50
192.25	1.00
228.25	0.00
237.25	-3.00

2 2 CH (2)

0.00	-3.00
40.00	-4.75
45.25	-3.00
106.75	-3.00
111.75	-8.00

3 2 CH (2)

168.25	-8.00
173.25	-3.00
237.25	-3.00
283.25	-3.00

4 3 ML

0.00	-8.00
111.75	-8.00
168.25	-8.00
283.25	-8.00

5 4 CH (3)

0.00	-12.00
283.25	-12.00

6 5 CL

0.00	-27.00

283.25   -27.00

MATerial property data follow -
1 Levee (CH)
117.00 = unit weight
Conventional shear strengths
450.00   0.00
No pore pressure
2 CH (2)
102.00 = unit weight
Interpolate Strengths
300.00   450.00
No pore pressure
3 ML
117.00 = unit weight
Conventional shear strengths
200.00   15.00
Piezometric Line
1
4 CH (3)
107.00 = unit weight
Interpolate Strengths
300.00   600.00
No pore pressure
5 CL
122.00 = unit weight
Convention shear strengths
1000.00   0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00   -3.00
45.25   -3.00
237.25   -3.00
283.25   -3.00

INTerpolation data follows -
Shear strength values follow:
0.00   -3.00   300.00   2
0.00   -5.50   300.00   2
0.00   -8.00   300.00   2

90.25	-3.00	300.00	2
90.25	-5.50	300.00	2
90.25	-8.00	300.00	2
141.25	-3.00	450.00	2
141.25	-5.50	450.00	2
141.25	-8.00	450.00	2
192.25	-3.00	300.00	2
192.25	-5.50	300.00	2
192.25	-8.00	300.00	2
283.25	-3.00	300.00	2
283.25	-5.50	300.00	2
283.25	-8.00	300.00	2
0.00	-12.00	300.00	4
0.00	-19.50	300.00	4
0.00	-27.00	300.00	4
90.25	-12.00	300.00	4
90.25	-19.50	300.00	4
90.25	-27.00	300.00	4
141.25	-12.00	450.00	4
141.25	-19.50	525.00	4
141.25	-27.00	600.00	4
192.25	-12.00	300.00	4
192.25	-19.50	300.00	4
192.25	-27.00	300.00	4
283.25	-12.00	300.00	4
283.25	-19.50	300.00	4
283.25	-27.00	300.00	4

DIStributed Load data follow -
1
ANALYSIS/COMPUTATION
NONCIRCULAR

30.65	-4.34
34.86	-8.32
39.88	-12.56
52.70	-21.31
72.16	-25.41
100.76	-27.00
120.24	-21.91
133.31	-12.94
138.20	-7.45
155.10	10.31

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.16: City Price to Tropical Bend (2)

Heading data follow -
Reach A - City Price to Tropical Bend
Sta. 245+00 to 253+02

PROfile line data follow -
1 1 Berm (CH)
139.71 4.00
190.71 1.00
200.71 -1.00
220.71 -5.00

2 2 Levee - CH (2)
55.71 3.00
95.71 13.00
103.71 13.00
139.71 4.00
159.71 -1.00

3 3 CHO
0.00 3.00
55.71 3.00
109.14 3.00
123.43 0.00
159.71 -1.00
213.43 -5.00
220.71 -5.00
249.71 -5.00
255.71 -7.00

4 4 CH (3)
0.00 -7.00
255.71 -7.00
264.71 -10.00

5 5 ML
0.00 -10.00
264.71 -10.00
300.00 -10.00

6 6 CH (4)
0.00 -12.00

300.00 -12.00

7 7 CH (5)
0.00 -25.00
300.00 -25.00

8 8 ML (2)
0.00 -40.00
300.00 -40.00

MATerial property data follow -
1 Berm (CH)
100.00 = unit weight
Conventional shear strengths
200.00   0.00
No pore pressure
2 Levee - CH (2)
110.00 = unit weight
Conventional shear strengths
400.00   0.00
No pore pressure
3 CHO
86.00 = unit weight
Conventional shear strengths
200.00   0.00
No pore pressure
4 CH (3)
96.00 = unit weight
Conventional shear strengths
200.00   0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00   15.00
Piezometric Line
1
6 CH (4)
100.00 = unit weight
Interpolate Strengths
170.00 300.00
No pore pressure
7 CH (5)

100.00 = unit weight
Interpolate Strengths
300.00 450.00
No pore pressure
8 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1

PIEzometric Line data follow -
1 Piezometric Line

0.00	-1.00
159.71	-1.00
200.71	-1.00
300.00	-1.00

INTerpolation data follow -
Shear strength values follow:

0.00	-12.00	170.00	6
0.00	-18.50	235.00	6
0.00	-25.00	300.00	6
150.00	-12.00	170.00	6
150.00	-18.50	235.00	6
150.00	-25.00	300.00	6
300.00	-12.00	170.00	6
300.00	-18.50	235.00	6
300.00	-25.00	300.00	6
0.00	-25.00	300.00	7
0.00	-32.50	375.00	7
0.00	-40.00	450.00	7
150.00	-25.00	300.00	7
150.00	-32.50	375.00	7
150.00	-40.00	450.00	7
300.00	-25.00	300.00	7
300.00	-32.50	375.00	7
300.00	-40.00	450.00	7

DIStributed loads
1
ANALYSIS/COMPUTATION

NONCIRCULAR

85.80	10.52
92.78	3.62
102.69	-7.77
106.37	-11.99
109.97	-14.52
129.75	-21.19
144.42	-19.91
168.27	-15.50
182.10	-13.89
201.77	-12.00
205.25	-10.14
209.88	-7.41
212.74	-5.56
215.13	-3.88

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.17: Orleans Parish Lakefront (2)

HEAding data follow -

Orleans Parish Lakefront Levee
West of I.H.N.C.
Sta. 136+13.19 to Sta. 159+70.0 B/L

PROfile line data follow -

```
 1 1 CH
    13.35   5.00
 14.14   5.50
106.83   8.00
118.39  12.50
134.93  19.00
145.03  19.00
173.69   8.00
265.83   5.50
268.68   4.50

 2 2 CH (2)
   109.48   7.50
134.93  16.00
145.29  16.00
150.00  14.70
171.03   7.50

 3 3 SM
     0.00   5.00
 13.35   5.00
 98.39   5.00
103.37   5.50
109.48   7.50
171.03   7.50
175.94   6.00
184.30   4.50
268.68   4.50
300.00   4.50

 4 4 CH (3)
     0.00   3.00
300.00   3.00

 5 5 SM (2)
```

0.00 -2.00
300.00 -2.00

6 6 ML
0.00 -15.00
300.00 -15.00

7 7 CH (4)
0.00 -22.50
300.00 -22.50

8 8 SM (3)
0.00 -27.50
300.00 -27.50

9 9 CH (5)
0.00 -43.00
300.00 -43.00

10 10 ML (2)
0.00 -50.00
300.00 -50.00

11 11 SM (4)
0.00 -52.00
300.00 -52.00

MATerial property data follow -
1 CH
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
116.00 = unit weight
Conventional shear strengths
700.00 0.00
No pore pressure
3 SM
122.00 = unit weight
Conventional shear strengths
0.00 30.00
No pore pressure

4 CH (3)
104.00 = unit weight
Conventional shear strengths
80.00 0.00
No pore pressure
5 SM (2)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
6 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
7 CH (4)
104.00 = unit weight
Conventional shear strengths
620.00 0.00
No pore pressure
8 SM (3)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
9 CH (5)
112.00 = unit weight
Interpolate Strengths
960.00 1030.00
No pore pressure
10 ML (2)
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
1
11 SM (4)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line

1

PIEzometric line data follow -
1 Piezometric Line
0.00 0.00
300.00 0.00

2 "Piezometric Line for Water Loads
0.00 12.50
118.39 12.50

INTerpolation data follow -
Shear strength values follow:

0.00	-43.00	960.00	9
0.00	-46.50	995.00	9
0.00	-50.00	1030.00	9
150.00	-43.00	960.00	9
150.00	-46.50	995.00	9
150.00	-50.00	1030.00	9
300.00	-43.00	960.00	9
300.00	-46.50	995.00	9
300.00	-50.00	1030.00	9

DIStributed Load data -
2
ANALYSIS/COMPUTATION
NONCIRCULAR SEARCH

140.25	7.50	0
142.79	3.00	0
145.12	0.00	0
147.13	-1.85	0
172.69	-1.86	0
175.92	0.00	0
180.44	3.00	0
183.30	4.62	0
186.43	7.65	

1.00 0.05
SINgle-stage computations
CRACK
7.50 Elevation
RIGHt Face of Slope

PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.18: Along MRGO – Violet Line (2)

HEAding data follow -
Along MRGO Violet Line
Sta. 1020+00 to Sta. 1050+00

PROfile line data follow -
1 1 Levee (CH)
75.00 3.00
95.00 7.00
155.00 9.00
175.00 13.00
197.50 17.50
207.50 17.50
250.00 9.00
310.00 7.00
330.00 3.00

2 2 OH
0.00 3.00
75.00 3.00
330.00 3.00
400.00 3.00

3 3 OH (2)
0.00 -7.00
400.00 -7.00

4 4 "SP"
0.00 -17.00
400.00 -17.00

5 5 CH (2)
0.00 -23.00
400.00 -23.00

6 6 CH (3)
0.00 -43.00
400.00 -43.00

MATerial property data follow -
1 Levee (CH)

115.00 = unit weight
Conventional shear strengths
200.00   0.00
No pore pressure
2 OH
112.00 = unit weight
Conventional shear strengths
367.00   0.00
No pore pressure
3 OH (2)
100.00 = unit weight
Conventional shear strengths
295.00   0.00
No pore pressure
4 "SP"
120.00 = unit weight
Conventional shear strengths
620.00   0.00
No pore pressure
5 CH (2)
105.00 = unit weight
Conventional shear strengths
521.00   0.00
No pore pressure
6 CH (3)
108.00 = unit weight
Conventional shear strengths
882.00   0.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00   3.00
75.00   3.00
330.00   3.00
400.00   3.00

ANALYSIS/COMPUTATION
NONCIRCULAR

59.08	3.00
63.29	-0.75
67.55	-4.50
72.85	-8.74

76.10	-11.21
79.18	-13.14
89.51	-16.99
176.46	-16.99
190.37	-10.75
197.00	-5.30
204.97	3.00
211.22	10.32
213.68	12.98
216.61	15.68

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.19: Westminster

HEAding data follow -
Westminster Levee
Reach IV
Sta. 188+73 to 261+20 B/L

PROfile line data follow
1 1 Levee (CH)
91.00 -0.50
97.00 1.50
177.00 6.50
183.00 8.00
195.00 11.00
205.00 11.00
229.00 5.00
298.00 2.00
308.00 -0.50

2 2 CH (2)
0.00 -0.50
91.00 -0.50
308.00 -0.50
404.00 -0.50
440.00 -8.50
451.25 -11.00
600.00 -11.00

3 3 CH (3)
0.00 -15.00
600.00 -15.00

4 4 CH (4)
0.00 -20.00
600.00 -20.00

5 5 CH (5)
0.00 -30.00
600.00 -30.00

6 6 CH (6)
0.00 -42.00
600.00 -42.00

7 7 CH (7)
0.00 -55.00
600.00 -55.00

MATerial property data follow -
1 Levee (CH)
90.00 = unit weight
Conventional shear strengths
150.00   0.00
No pore pressure
2 CH (2)
90.00 = unit weight
Conventional shear strengths
150.00   0.00
No pore pressure
3 CH (3)
90.00 = unit weight
Interpolate Strengths
151.00 187.00
No pore pressure
4 CH (4)
98.00 = unit weight
Interpolate Strengths
187.00 259.00
No pore pressure
5 CH (5)
98.00 = unit weight
Interpolate Strengths
259.00 347.00
No pore pressure
6 CH (6)
98.00 = unit weight
Interpolate Strengths
348.00 442.00
No pore pressure
7 CH (7)
98.00 = unit weight
Interpolate Strengths
442.00 552.00
No pore pressure

PIEzometric line data follow -

1 Piezometric Line

0.00	8.00
183.00	8.00
229.00	5.00
298.00	2.00
308.00	-0.50
404.00	-0.50
440.00	-8.50
600.00	-8.50

INTerpolation data follow -

Shear strength values follow:

0.00	-15.00	151.00	3
0.00	-17.50	169.00	3
0.00	-20.00	187.00	3
300.00	-15.00	151.00	3
300.00	-17.50	169.00	3
300.00	-20.00	187.00	3
600.00	-15.00	151.00	3
600.00	-17.50	169.00	3
600.00	-20.00	187.00	3
0.00	-20.00	187.00	4
0.00	-25.00	223.00	4
0.00	-30.00	259.00	4
300.00	-20.00	187.00	4
300.00	-25.00	223.00	4
300.00	-30.00	259.00	4
600.00	-20.00	187.00	4
600.00	-25.00	223.00	4
600.00	-30.00	259.00	4
0.00	-30.00	259.00	5
0.00	-36.00	303.00	5
0.00	-42.00	347.00	5
300.00	-30.00	259.00	5
300.00	-36.00	303.00	5
300.00	-42.00	347.00	5
600.00	-30.00	259.00	5
600.00	-36.00	303.00	5
600.00	-42.00	347.00	5
0.00	-42.00	348.00	6
0.00	-48.50	395.00	6
0.00	-55.00	442.00	6
300.00	-42.00	348.00	6

```
        300.00   -48.50   395.00    6
        300.00   -55.00   442.00    6
        600.00   -42.00   348.00    6
        600.00   -48.50   395.00    6
        600.00   -55.00   442.00    6
          0.00   -55.00   442.00    7
          0.00   -62.50   497.00    7
          0.00   -70.00   552.00    7
        300.00   -55.00   442.00    7
        300.00   -62.50   497.00    7
        300.00   -70.00   552.00    7
        600.00   -55.00   442.00    7
        600.00   -62.50   497.00    7
        600.00   -70.00   552.00    7


DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR SEARCH
     189.16          9.54
     194.37          4.03
     198.30         -0.50
     201.71         -4.23
     205.91         -8.27
     211.15        -12.19
     218.21        -14.99
     299.62        -14.99
     306.84        -11.79
     309.99         -9.49
     313.26         -6.92
     316.54         -4.35
     318.79         -2.42
     321.02         -0.50

        1         .2
SINgle-stage computations
RIGht Face of Slope
PROcedure for computation of Factor of Safety
        SPENCER

GRAPH
COMPUTE
```

Table D.20: Bayou St. John

HEAding data follow -
Orleans Parish Lakefront
Bayou St. John
Earthen Closure

PROfile line data follow
1 1 Levee (CH)
75.50 -2.00
81.50 0.00
84.50 1.00
196.50 10.00
223.50 19.00
233.50 19.00
271.00 6.50
388.50 1.00
391.50 0.00
397.50 -2.00

2 2 SM
0.00 -2.00
75.50 -2.00
397.50 -2.00
510.00 -2.00

3 3 SM (2)
0.00 -5.00
510.00 -5.00

4 4 CH (2)
0.00 -12.00
510.00 -12.00

5 5 ML
0.00 -28.00
510.00 -28.00

6 6 CH (3)
0.00 -38.00
510.00 -38.00

7 7 SM (3)

0.00 -61.00
510.00 -61.00

MATerial property data follow -
1 Levee (CH)
115.00 = unit weight
Conventional shear strengths
600.00 0.00
No pore pressure
2 SM
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
3 SM (2)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
1
4 CH (2)
105.00 = unit weight
Conventional shear strengths
390.00 0.00
No pore pressure
5 ML
117.00 = unit weight
Conventional shear strengths
200.00 15.00
Piezometric Line
2
6 CH (3)
110.00 = unit weight
Conventional shear strengths
510.00 0.00
No pore pressure
7 SM (3)
122.00 = unit weight
Conventional shear strengths
0.00 30.00
Piezometric Line
2

```
PIEzometric line data follow -
          1 Piezometric Line for Materials 1 - 3
               0.00    -2.00
              75.50    -2.00
              84.50     1.00
             388.50     1.00
             510.00     1.00

          2 Piezometric Line for Materials 4 - 7
                    0.00     1.00
              84.50     1.00
             388.50     1.00
             510.00     1.00


ANALYSIS/COMPUTATION
          NONCIRCULAR
       44.14           -2.00
       49.09           -5.00  0
       60.53          -12.00  0
       83.13          -27.99  0
      207.56          -27.99  0
      226.47          -12.00  0
      230.69           -5.00  0
      232.47           -2.00  0
      246.95           14.52

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
          SPENCER

GRAPH
COMPUTE
```

Table D.21: Jefferson Parish Lakefront – Reach A (protected side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach A - Protected Side

PROfile line data follow -

1 1 Levee (CH)

105.30	8.00
135.30	10.00
140.18	11.50
161.30	18.00
171.30	18.00
216.35	1.00
263.35	-1.00
268.72	-2.80

2 2 CH (2)

0.00	2.82
35.30	4.00
45.30	4.00
105.30	8.00
122.80	8.00
126.37	6.00
130.30	6.00
147.80	4.90
203.87	0.00

3 3 CH (3)

0.00	0.00
203.87	0.00
268.72	-2.80
290.51	-4.20
400.00	-4.20

4 4 CH (4)

0.00	-12.00
400.00	-12.00

5 5 CH (5)

0.00	-25.00
400.00	-25.00

```
6 6 CH (6)
    0.00   -35.00
  400.00   -35.00

7 7 CH (7)
    0.00   -48.00
  400.00   -48.00


MATerial property data follow -
    1 Levee (CH)
       110.00 = unit weight
       Conventional shear strengths
        400.00     0.00
       No pore pressure
    2 CH (2)
       117.00 = unit weight
       Conventional shear strengths
        600.00     0.00
       No pore pressure
    3 CH (3)
       Varying unit weight
           1.00   105.00
         110.50   117.00
         209.50   105.00

       Interpolate Strengths
        200.00   450.00
       No pore pressure
    4 CH (4)
       Varying unit weight
           1.00    85.00
         110.50    75.00
         209.50    80.00

       Interpolate Strengths
        240.00   450.00
       No pore pressure
    5 CH (5)
       Varying unit weight
           1.00   100.00
         110.50   105.00
         209.50   100.00
```

```
        Interpolate Strengths
          200.00   700.00
        No pore pressure
    6 CH (6)
        Varying unit weight
            1.00   100.00
          110.50   105.00
          209.50   100.00

        Interpolate Strengths
          300.00   700.00
        No pore pressure
    7 CH (7)
        Varying unit weight
            1.00   120.00
          110.50   120.00
          209.50   110.00

        Interpolate Strengths
          300.00  1000.00
        No pore pressure

PIEzometric line data follow -
    1 Piezometric Line
        0.00    11.50
      140.18    11.50
      216.35     1.00
      263.35    -1.00
      268.72    -2.80
      290.51    -4.20
      400.00    -4.20


INTerpolation data follow -
    Shear strength values follow:
            0.00    0.00    200.00   3
            0.00  -12.00    200.00   3
            1.00    0.00    200.00   3
            1.00  -12.00    200.00   3
          110.50    0.00    450.00   3
          110.50  -12.00    450.00   3
          209.50    0.00    400.00   3
          209.50  -12.00    400.00   3
          400.00    0.00    400.00   3
```

400.00	-12.00	400.00	3
0.00	-12.00	240.00	4
0.00	-25.00	240.00	4
1.00	-12.00	240.00	4
1.00	-25.00	240.00	4
110.50	-12.00	450.00	4
110.50	-25.00	450.00	4
209.50	-12.00	380.00	4
209.50	-25.00	380.00	4
400.00	-12.00	380.00	4
400.00	-25.00	380.00	4
0.00	-25.00	200.00	5
0.00	-35.00	200.00	5
1.00	-25.00	200.00	5
1.00	-35.00	200.00	5
110.50	-25.00	700.00	5
110.50	-35.00	700.00	5
209.50	-25.00	480.00	5
209.50	-35.00	480.00	5
400.00	-25.00	480.00	5
400.00	-35.00	480.00	5
0.00	-35.00	300.00	6
0.00	-48.00	300.00	6
1.00	-35.00	300.00	6
1.00	-48.00	300.00	6
110.50	-35.00	700.00	6
110.50	-48.00	700.00	6
209.50	-35.00	480.00	6
209.50	-48.00	480.00	6
400.00	-35.00	480.00	6
400.00	-48.00	480.00	6
0.00	-48.00	300.00	7
0.00	-56.50	640.00	7
0.00	-65.00	980.00	7
1.00	-48.00	300.00	7
1.00	-56.50	640.00	7
1.00	-65.00	980.00	7
110.50	-48.00	1000.00	7
110.50	-56.50	1000.00	7
110.50	-65.00	1000.00	7
400.00	-48.00	1000.00	7
400.00	-56.50	1000.00	7
400.00	-65.00	1000.00	7

```
DIStributed loads
        1
ANALYSIS/COMPUTATION
        NONCIRCULAR
     146.56          13.46
     155.08           4.86
     158.52           0.95
     169.00         -10.99
     176.35         -17.73
     195.70         -24.97
     213.07         -24.46
     230.22         -15.32
     238.65          -9.94
     249.55          -2.01
     251.37          -0.49

SINgle-stage computations
RIGHt face of slope
PROcedure for computation of Factor of Safety
        SPENCER

GRAPH
COMPUTE
```

Table D.22: Jefferson Parish Lakefront – Reach A (flood side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach A - Floodside

PROfile line data follow -
1 1 Levee (CH)

```
296.55    8.00
326.55   10.00
352.55   18.00
362.55   18.00
407.60    1.00
454.60   -1.00
460.00   -2.80
```

2 2 CH (2)

```
197.55    0.00
206.55    3.00
236.55    4.00
296.55    8.00
314.08    8.00
317.65    6.00
321.58    6.00
339.08    4.90
395.15    0.00
```

3 3 CH (3)

```
  0.00   -6.00
 60.55   -6.00
 87.55   -5.00
150.55   -4.00
194.55   -1.00
197.55    0.00
395.15    0.00
460.00   -2.80
500.00   -2.80
```

4 4 CH (4)

```
  0.00  -12.00
500.00  -12.00
```

5 5 CH (5)

0.00 -25.00
500.00 -25.00

6 6 CH (6)
0.00 -35.00
500.00 -35.00

7 7 CH (7)
0.00 -48.00
500.00 -48.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
117.00 = unit weight
Conventional shear strengths
600.00 0.00
No pore pressure
3 CH (3)
Varying unit weight
100.00 80.00
200.00 105.00
300.00 117.00
400.00 105.00

Interpolate Strengths
100.00 450.00
No pore pressure
4 CH (4)
Varying unit weight
100.00 90.00
200.00 85.00
300.00 75.00
400.00 80.00

Interpolate Strengths
100.00 450.00
No pore pressure
5 CH (5)

Varying unit weight

100.00	95.00
200.00	100.00
300.00	105.00
400.00	100.00

Interpolate Strengths

200.00	700.00

No pore pressure

6 CH (6)

Varying unit weight

100.00	100.00
200.00	100.00
300.00	105.00
400.00	100.00

Interpolate Strengths

300.00	700.00

No pore pressure

7 CH (7)

Varying unit weight

100.00	110.00
200.00	120.00
300.00	120.00
400.00	110.00

Interpolate Strengths

300.00	1000.00

No pore pressure

PIEzometric line data follow -

1 Piezometric Line

0.00	-5.00
87.55	-5.00
150.55	-4.00
194.55	-1.00
197.55	0.00
395.15	0.00
460.00	-2.80
500.00	-2.80

INTerpolation data follow -

Shear strength values follow:

0.00	0.00	100.00	3
0.00	-12.00	100.00	3
100.00	0.00	100.00	3
100.00	-12.00	100.00	3
200.00	0.00	200.00	3
200.00	-12.00	200.00	3
300.00	0.00	450.00	3
300.00	-12.00	450.00	3
400.00	0.00	400.00	3
400.00	-12.00	400.00	3
500.00	0.00	400.00	3
500.00	-12.00	400.00	3
0.00	-12.00	100.00	4
0.00	-25.00	100.00	4
100.00	-12.00	100.00	4
100.00	-25.00	100.00	4
200.00	-12.00	240.00	4
200.00	-25.00	240.00	4
300.00	-12.00	450.00	4
300.00	-25.00	450.00	4
400.00	-12.00	380.00	4
400.00	-25.00	380.00	4
500.00	-12.00	380.00	4
500.00	-25.00	380.00	4
0.00	-25.00	200.00	5
0.00	-35.00	200.00	5
100.00	-25.00	200.00	5
100.00	-35.00	200.00	5
200.00	-25.00	200.00	5
200.00	-35.00	200.00	5
300.00	-25.00	700.00	5
300.00	-35.00	700.00	5
400.00	-25.00	480.00	5
400.00	-35.00	480.00	5
500.00	-25.00	480.00	5
500.00	-35.00	480.00	5
0.00	-35.00	380.00	6
0.00	-48.00	380.00	6
100.00	-35.00	380.00	6
100.00	-48.00	380.00	6
200.00	-35.00	300.00	6
200.00	-48.00	300.00	6
300.00	-35.00	700.00	6
300.00	-48.00	700.00	6

400.00	-35.00	480.00	6
400.00	-48.00	480.00	6
500.00	-35.00	480.00	6
500.00	-48.00	480.00	6
0.00	-48.00	381.00	7
0.00	-56.50	508.00	7
0.00	-65.00	635.00	7
100.00	-48.00	381.00	7
100.00	-56.50	508.00	7
100.00	-65.00	635.00	7
200.00	-48.00	300.00	7
200.00	-56.50	640.00	7
200.00	-65.00	980.00	7
300.00	-48.00	1000.00	7
300.00	-56.50	1000.00	7
300.00	-65.00	1000.00	7
400.00	-48.00	1000.00	7
400.00	-56.50	1000.00	7
400.00	-65.00	1000.00	7
500.00	-48.00	1000.00	7
500.00	-56.50	1000.00	7
500.00	-65.00	1000.00	7

DIStributed loads
1
ANALYSIS/COMPUTATION
NONCIRCULAR

86.97	-5.02
92.30	-9.27
101.39	-15.25
128.69	-26.39
147.42	-33.33
163.49	-40.26
190.90	-48.00
204.00	-48.00
273.58	-25.00
334.08	-18.31
347.52	-10.20
354.71	-3.15
362.68	5.91
371.14	14.76

SINgle-stage computations

LEFt face of slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.23: Jefferson Parish Lakefront – Reach B (flood side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach B - Floodside Analysis

PROfile line data follow -

1 1 Levee (CH)

235.00	6.00
287.50	9.50
313.50	16.00
323.50	16.00
362.50	3.00
402.50	2.00
420.50	-2.50

2 2 CH (2)

0.00	-3.50
31.42	-3.50
35.35	-3.00
98.92	-2.90
103.21	-2.10
128.57	-1.40
151.07	2.50
190.00	3.00
235.00	6.00
247.00	2.00
327.50	2.00
360.00	0.00
385.00	-1.00
410.00	-2.50
420.50	-2.50
450.00	-2.50

3 3 CH (3)

0.00	-15.00
450.00	-15.00

4 4 CH (4)

0.00	-20.00
450.00	-20.00

5 5 CH (5)

0.00   -30.00
450.00   -30.00

6 6 CH (6)
0.00   -35.00
450.00   -35.00

7 7 CH (7)
0.00   -46.00
450.00   -46.00

8 8 CH (8)
0.00   -54.00
450.00   -54.00

9 9 CH (9)
0.00   -60.00
450.00   -60.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00   0.00
No pore pressure
2 CH (2)
Varying unit weight
65.50   75.00
165.50   90.00
265.50 110.00
362.50   80.00

Interpolate Strengths
100.00 400.00
No pore pressure
3 CH (3)
Varying unit weight
65.50   75.00
165.50   90.00
265.50 110.00
362.50 105.00

Interpolate Strengths

100.00 275.00
No pore pressure
4 CH (4)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 105.00

Interpolate Strengths
100.00 275.00
No pore pressure
5 CH (5)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 105.00

Interpolate Strengths
130.00 275.00
No pore pressure
6 CH (6)
Varying unit weight
65.50 97.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
131.00 440.00
No pore pressure
7 CH (7)
Varying unit weight
65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
206.00 560.00
No pore pressure
8 CH (8)
Varying unit weight

65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
260.00 650.00
No pore pressure
9 CH (9)
Varying unit weight
65.50 102.00
165.50 103.00
265.50 107.00
362.50 100.00

Interpolate Strengths
300.00 800.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 -15.00
450.00 -15.00

INTerpolation data follow -
Shear strength values follow:

0.00	6.00	100.00	2
0.00	-4.50	100.00	2
0.00	-15.00	100.00	2
65.50	6.00	100.00	2
65.50	-4.50	100.00	2
65.50	-15.00	100.00	2
165.50	6.00	130.00	2
165.50	-4.50	130.00	2
165.50	-15.00	130.00	2
265.50	6.00	400.00	2
265.50	-4.50	400.00	2
265.50	-15.00	400.00	2
362.50	6.00	400.00	2
362.50	-4.50	400.00	2
362.50	-15.00	400.00	2
450.00	6.00	400.00	2
450.00	-4.50	400.00	2

450.00	-15.00	400.00	2
0.00	-15.00	100.00	3
0.00	-17.50	100.00	3
0.00	-20.00	100.00	3
65.50	-15.00	100.00	3
65.50	-17.50	100.00	3
65.50	-20.00	100.00	3
165.50	-15.00	130.00	3
165.50	-17.50	130.00	3
165.50	-20.00	130.00	3
265.50	-15.00	220.00	3
265.50	-17.50	220.00	3
265.50	-20.00	220.00	3
362.50	-15.00	275.00	3
362.50	-17.50	275.00	3
362.50	-20.00	275.00	3
450.00	-15.00	275.00	3
450.00	-17.50	275.00	3
450.00	-20.00	275.00	3
0.00	-20.00	100.00	4
0.00	-25.00	150.00	4
0.00	-30.00	200.00	4
65.50	-20.00	100.00	4
65.50	-25.00	150.00	4
65.50	-30.00	200.00	4
165.50	-20.00	130.00	4
165.50	-25.00	130.00	4
165.50	-30.00	130.00	4
265.50	-20.00	220.00	4
265.50	-25.00	220.00	4
265.50	-30.00	220.00	4
362.50	-20.00	275.00	4
362.50	-25.00	275.00	4
362.50	-30.00	275.00	4
450.00	-20.00	275.00	4
450.00	-25.00	275.00	4
450.00	-30.00	275.00	4
0.00	-30.00	200.00	5
0.00	-32.50	230.00	5
0.00	-35.00	260.00	5
65.50	-30.00	200.00	5
65.50	-32.50	230.00	5
65.50	-35.00	260.00	5
165.50	-30.00	130.00	5

165.50	-32.50	130.00	5
165.50	-35.00	130.00	5
265.50	-30.00	220.00	5
265.50	-32.50	220.00	5
265.50	-35.00	220.00	5
362.50	-30.00	275.00	5
362.50	-32.50	275.00	5
362.50	-35.00	275.00	5
450.00	-30.00	275.00	5
450.00	-32.50	275.00	5
450.00	-35.00	275.00	5
0.00	-35.00	260.00	6
0.00	-40.50	320.00	6
0.00	-46.00	380.00	6
65.50	-35.00	260.00	6
65.50	-40.50	320.00	6
65.50	-46.00	380.00	6
165.50	-35.00	131.00	6
165.50	-40.50	168.00	6
165.50	-46.00	205.00	6
265.50	-35.00	400.00	6
265.50	-40.50	400.00	6
265.50	-46.00	400.00	6
362.50	-35.00	276.00	6
362.50	-40.50	358.00	6
362.50	-46.00	440.00	6
450.00	-35.00	276.00	6
450.00	-40.50	358.00	6
450.00	-46.00	440.00	6
0.00	-46.00	381.00	7
0.00	-50.00	428.00	7
0.00	-54.00	475.00	7
65.50	-46.00	381.00	7
65.50	-50.00	428.00	7
65.50	-54.00	475.00	7
165.50	-46.00	206.00	7
165.50	-50.00	233.00	7
165.50	-54.00	260.00	7
265.50	-46.00	400.00	7
265.50	-50.00	400.00	7
265.50	-54.00	400.00	7
362.50	-46.00	440.00	7
362.50	-50.00	500.00	7
362.50	-54.00	560.00	7

450.00	-46.00	440.00	7
450.00	-50.00	500.00	7
450.00	-54.00	560.00	7
0.00	-54.00	476.00	8
0.00	-57.00	508.00	8
0.00	-60.00	540.00	8
65.50	-54.00	476.00	8
65.50	-57.00	508.00	8
65.50	-60.00	540.00	8
165.50	-54.00	260.00	8
165.50	-57.00	280.00	8
165.50	-60.00	300.00	8
265.50	-54.00	600.00	8
265.50	-57.00	625.00	8
265.50	-60.00	650.00	8
362.50	-54.00	560.00	8
362.50	-57.00	605.00	8
362.50	-60.00	650.00	8
450.00	-54.00	560.00	8
450.00	-57.00	605.00	8
450.00	-60.00	650.00	8
0.00	-60.00	540.00	9
0.00	-65.00	595.00	9
0.00	-70.00	650.00	9
65.50	-60.00	540.00	9
65.50	-65.00	595.00	9
65.50	-70.00	650.00	9
165.50	-60.00	300.00	9
165.50	-65.00	385.00	9
165.50	-70.00	470.00	9
265.50	-60.00	650.00	9
265.50	-65.00	695.00	9
265.50	-70.00	740.00	9
362.50	-60.00	650.00	9
362.50	-65.00	725.00	9
362.50	-70.00	800.00	9
450.00	-60.00	650.00	9
450.00	-65.00	725.00	9
450.00	-70.00	800.00	9

ANALYSIS/COMPUTATION

NONCIRCULAR

81.71 -2.93

95.78	-15.00	0
103.24	-20.00	0
124.70	-30.00	0
139.45	-34.99	0
254.91	-34.99	0
276.11	-30.00	0
300.46	-20.00	0
307.25	-15.00	0
323.16	2.00	0
333.92	12.53	

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.24: Jefferson Parish Lakefront – Reach C (protected side analysis)

HEAding data follow -
Jefferson Parish Lakefront Levee
Reach C - Protected side analysis

PROfile line data follow -

1 1 Levee (CH)

81.00	7.40
112.50	9.50
120.50	11.50
138.50	16.00
148.50	16.00
193.50	1.00
246.00	0.00
253.50	-2.50

2 2 CH (2)

0.00	3.00
30.00	4.00
81.00	7.40
97.20	2.00
161.20	2.00
164.60	3.70
168.26	2.50
174.36	2.50
202.17	-2.50
253.50	-2.50
375.00	-2.50

3 3 CH (3)

0.00	-8.00
375.00	-8.00

4 4 CH (4)

0.00	-15.00
375.00	-15.00

5 5 CH (5)

0.00	-21.00
375.00	-21.00

6 6 CH (6)

```
        0.00 -27.00
      375.00 -27.00

    7 7 CH (7)
        0.00 -38.00
      375.00 -38.00

    8 8 CH (8)
        0.00 -44.00
      375.00 -44.00


MATerial property data follow -
    1 Levee (CH)
        110.00 = unit weight
        Conventional shear strengths
              400.00     0.00
        No pore pressure
    2 CH (2)
        Varying unit weight
                3.50   102.00
               93.50   120.00
              193.50   105.00

        Interpolate Strengths
              200.00   500.00
        No pore pressure
    3 CH (3)
        Varying unit weight
                3.50   102.00
               93.50   110.00
              193.50    95.00

        Interpolate Strengths
           100.00   300.00
        No pore pressure
    4 CH (4)
        Varying unit weight
                3.50   102.00
               93.50   110.00
              193.50   105.00

        Interpolate Strengths
           100.00   460.00
```

No pore pressure
5 CH (5)
Varying unit weight
3.50 100.00
93.50 100.00
193.50 102.00

Interpolate Strengths
250.00 500.00
No pore pressure
6 CH (6)
Varying unit weight
3.50 98.00
93.50 100.00
193.50 102.00

Intepolate Strengths
140.00 550.00
No pore pressure
7 CH (7)
Varying unit weight
3.50 102.00
93.50 100.00
193.50 100.00

Interpolate Strengths
200.00 580.00
No pore prssure
8 CH (8)
Varying unit weight
3.50 105.00
93.50 100.00
193.50 100.00

Interpolate Strengths
300.00 650.00
No pore pressure

PIEzometric line data follow -
1 Piezometric Line
0.00 11.50
120.50 11.50
193.50 1.00
246.00 0.00

253.50 -2.50
375.00 -2.50

INTerpolation data follow -

Shear strength values follow:

0.00	7.40	200.00	2
0.00	-8.00	200.00	2
3.50	7.40	200.00	2
3.50	-8.00	200.00	2
93.50	7.40	450.00	2
93.50	-8.00	450.00	2
193.50	7.40	500.00	2
193.50	-8.00	500.00	2
375.00	7.40	500.00	2
375.00	-8.00	500.00	2
0.00	-8.00	200.00	3
0.00	-15.00	200.00	3
3.50	-8.00	200.00	3
3.50	-15.00	200.00	3
93.50	-8.00	100.00	3
93.50	-15.00	100.00	3
193.50	-8.00	300.00	3
193.50	-15.00	300.00	3
375.00	-8.00	300.00	3
375.00	-15.00	300.00	3
0.00	-15.00	100.00	4
0.00	-21.00	100.00	4
3.50	-15.00	100.00	4
3.50	-21.00	100.00	4
93.50	-15.00	460.00	4
93.50	-21.00	460.00	4
193.50	-15.00	140.00	4
193.50	-21.00	140.00	4
375.00	-15.00	140.00	4
375.00	-21.00	140.00	4
0.00	-21.00	400.00	5
0.00	-27.00	400.00	5
3.50	-21.00	400.00	5
3.50	-27.00	400.00	5
93.50	-21.00	500.00	5
93.50	-27.00	500.00	5
193.50	-21.00	250.00	5
193.50	-27.00	250.00	5

375.00	-21.00	250.00	5
375.00	-27.00	250.00	5
0.00	-27.00	140.00	6
0.00	-32.50	140.00	6
0.00	-38.00	140.00	6
3.50	-27.00	140.00	6
3.50	-32.50	140.00	6
3.50	-38.00	140.00	6
93.50	-27.00	500.00	6
93.50	-32.50	525.00	6
93.50	-38.00	550.00	6
193.50	-27.00	250.00	6
193.50	-32.50	300.00	6
193.50	-38.00	350.00	6
375.00	-27.00	250.00	6
375.00	-32.50	300.00	6
375.00	-38.00	350.00	6
0.00	-38.00	200.00	7
0.00	-41.00	200.00	7
0.00	-44.00	200.00	7
3.50	-38.00	200.00	7
3.50	-41.00	200.00	7
3.50	-44.00	200.00	7
93.50	-38.00	550.00	7
93.50	-41.00	565.00	7
93.50	-44.00	580.00	7
193.50	-38.00	200.00	7
193.50	-41.00	200.00	7
193.50	-44.00	200.00	7
375.00	-38.00	200.00	7
375.00	-41.00	200.00	7
375.00	-44.00	200.00	7
0.00	-44.00	300.00	8
0.00	-52.00	475.00	8
0.00	-60.00	650.00	8
0.00	-70.00	650.00	8
3.50	-44.00	300.00	8
3.50	-52.00	475.00	8
3.50	-60.00	650.00	8
3.50	-70.00	650.00	8
93.50	-44.00	580.00	8
93.50	-52.00	615.00	8
93.50	-60.00	650.00	8
93.50	-70.00	650.00	8

193.50	-44.00	500.00	8
193.50	-52.00	575.00	8
193.50	-60.00	650.00	8
193.50	-70.00	650.00	8
375.00	-44.00	500.00	8
375.00	-52.00	575.00	8
375.00	-60.00	650.00	8
375.00	-70.00	650.00	8

DIStributed loads
1
ANALYSIS/COMPUTATION
NONCIRCULAR

114.45	9.99
123.66	2.02
131.93	-6.65
137.69	-13.62
143.07	-20.14
149.37	-27.44
167.88	-41.90
178.90	-43.99
198.32	-43.92
207.68	-42.60
225.79	-39.72
235.25	-38.01
254.96	-26.13
262.21	-20.07
268.70	-14.64
275.35	-8.43
281.52	-2.50

SINgle-stage computations
RIGHt Face of Slope
PROcedure for computation of Factor of Safety
SPENCER

GRAPH
COMPUTE

Table D.25: Jefferson Parish Lakefront – Reach C (flood side analysis)

HEAding data follow -

Jefferson Parish Lakefront Levee
Reach C - Floodside Analysis

PROfile line data follow -

1 1 Levee (CH)

227.50	7.40
259.00	9.50
285.00	16.00
295.00	16.00
340.00	1.00
392.50	0.00
400.00	-2.50

2 2 CH (2)

0.00	-2.00
23.29	-2.00
41.15	-1.50
119.25	-0.75
124.50	1.00
136.50	3.00
166.50	4.00
176.50	4.00
227.50	7.40
243.70	2.00
307.70	2.00
311.10	3.70
314.76	2.50
320.86	2.50
348.67	-2.50
400.00	-2.50

3 3 CH (3)

0.00	-8.00
400.00	-8.00

4 4 CH (4)

0.00	-15.00
400.00	-15.00

5 5 CH (5)

0.00 -21.00
400.00 -21.00

6 6 CH (6)
0.00 -27.00
400.00 -27.00

7 7 CH (7)
0.00 -38.00
400.00 -38.00

8 8 CH (8)
0.00 -44.00
400.00 -44.00

MATerial property data follow -
1 Levee (CH)
110.00 = unit weight
Conventional shear strengths
400.00 0.00
No pore pressure
2 CH (2)
Varying unit weight
40.00 85.00
140.00 102.00
240.00 120.00
340.00 105.00

Interpolate Strengths
100.00 500.00
No pore pressure
3 CH (3)
Varying unit weight
40.00 85.00
140.00 102.00
240.00 110.00
340.00 95.00

Interpolate Strengths
100.00 300.00
No pore pressure
4 CH (4)
Varying unit weight

40.00 97.00
140.00 102.00
240.00 110.00
340.00 105.00

Interpolate Strengths
100.00 460.00
No pore pressure
5 CH (5)
Varying unit weight
40.00 97.00
140.00 100.00
240.00 100.00
340.00 102.00

Interpolate Strengths
185.00 500.00
No pore pressure
6 CH (6)
Varying unit weight
40.00 97.00
140.00 98.00
240.00 100.00
340.00 102.00

Interpolate Strengths
140.00 550.00
No pore pressure
7 CH (7)
Varying unit weight
40.00 97.00
140.00 102.00
240.00 100.00
340.00 100.00

Interpolate Strengths
200.00 580.00
No pore pressure
8 CH (8)
Varying unit weight
40.00 97.00
140.00 105.00
240.00 100.00
340.00 100.00

Interpolate Strengths
300.00 650.00
No pore pressure

INTerpolation data follow -
Shear strength values follow:

0.00	7.40	100.00	2
0.00	-8.00	100.00	2
40.00	7.40	100.00	2
40.00	-8.00	100.00	2
140.00	7.40	200.00	2
140.00	-8.00	200.00	2
240.00	7.40	450.00	2
240.00	-8.00	450.00	2
340.00	7.40	500.00	2
340.00	-8.00	500.00	2
400.00	7.40	500.00	2
400.00	-8.00	500.00	2
0.00	-8.00	100.00	3
0.00	-15.00	100.00	3
40.00	-8.00	100.00	3
40.00	-15.00	100.00	3
140.00	-8.00	200.00	3
140.00	-15.00	200.00	3
240.00	-8.00	100.00	3
240.00	-15.00	100.00	3
340.00	-8.00	300.00	3
340.00	-15.00	300.00	3
400.00	-8.00	300.00	3
400.00	-15.00	300.00	3
0.00	-15.00	100.00	4
0.00	-21.00	100.00	4
40.00	-15.00	100.00	4
40.00	-21.00	100.00	4
140.00	-15.00	100.00	4
140.00	-21.00	100.00	4
240.00	-15.00	460.00	4
240.00	-21.00	460.00	4
340.00	-15.00	140.00	4
340.00	-21.00	140.00	4
400.00	-15.00	140.00	4
400.00	-21.00	140.00	4
0.00	-21.00	185.00	5

0.00	-27.00	185.00	5
40.00	-21.00	185.00	5
40.00	-27.00	185.00	5
140.00	-21.00	400.00	5
140.00	-27.00	400.00	5
240.00	-21.00	500.00	5
240.00	-27.00	500.00	5
340.00	-21.00	250.00	5
340.00	-27.00	250.00	5
400.00	-21.00	250.00	5
400.00	-27.00	250.00	5
0.00	-27.00	186.00	6
0.00	-32.50	263.00	6
0.00	-38.00	340.00	6
40.00	-27.00	186.00	6
40.00	-32.50	263.00	6
40.00	-38.00	340.00	6
140.00	-27.00	140.00	6
140.00	-32.50	140.00	6
140.00	-38.00	140.00	6
240.00	-27.00	500.00	6
240.00	-32.50	525.00	6
240.00	-38.00	550.00	6
340.00	-27.00	250.00	6
340.00	-32.50	300.00	6
340.00	-38.00	350.00	6
400.00	-27.00	250.00	6
400.00	-32.50	300.00	6
400.00	-38.00	350.00	6
0.00	-38.00	300.00	7
0.00	-41.00	300.00	7
0.00	-44.00	300.00	7
40.00	-38.00	300.00	7
40.00	-41.00	300.00	7
40.00	-44.00	300.00	7
140.00	-38.00	200.00	7
140.00	-41.00	200.00	7
140.00	-44.00	200.00	7
240.00	-38.00	550.00	7
240.00	-41.00	565.00	7
240.00	-44.00	580.00	7
340.00	-38.00	200.00	7
340.00	-41.00	200.00	7
340.00	-44.00	200.00	7

400.00	-38.00	200.00	7
400.00	-41.00	200.00	7
400.00	-44.00	200.00	7
0.00	-44.00	426.00	8
0.00	-52.00	538.00	8
0.00	-60.00	650.00	8
40.00	-44.00	426.00	8
40.00	-52.00	538.00	8
40.00	-60.00	650.00	8
140.00	-44.00	300.00	8
140.00	-52.00	475.00	8
140.00	-60.00	650.00	8
240.00	-44.00	580.00	8
240.00	-52.00	615.00	8
240.00	-60.00	650.00	8
340.00	-44.00	500.00	8
340.00	-52.00	575.00	8
340.00	-60.00	650.00	8
400.00	-44.00	500.00	8
400.00	-52.00	575.00	8
400.00	-60.00	650.00	8

ANALYSIS/COMPUTATION

NONCIRCULAR

100.68	-0.93
109.98	-11.09
118.26	-18.52
140.15	-20.18
161.69	-14.99
180.00	-14.99
200.00	-14.97
220.00	-14.99
240.00	-15.00
260.02	-14.98
274.23	-13.20
282.06	-7.99
291.74	2.28
302.66	13.45

SINgle-stage computations
LEFt Face of Slope
PROcedure for computation of Factor of Safety

SPENCER

GRAPH
COMPUTE

Appendix E: Critical Slip Surfaces for the Method of Planes and Critical Circles from Spencer's Procedure

The critical circle determined by Spencer's procedure and the critical slip surface(s) from the Method of Planes are plotted for each cross section in Appendix E. In cases where the USACE reported more than one critical slip surface, each of the critical slip surfaces were plotted. The location and corresponding figure number for each cross section in Appendix E is given in Table E.1.

Table E.1: Figure numbers for each cross section in Appendix E.

Location	Figure No.
Citrus Back Levee	E.1
G.I.W.W. - Michoud Canal	E.2
City Price to Venice (flood side analysis)	E.3
City Price to Venice (protected side analysis)	E.4
Phoenix to Bohemia	E.5
South Point to G.I.W.W.	E.6
City Price to Tropical Bend	E.7
Orleans Parish Lakefront	E.8
Jefferson Parish Lakefront - Reach B (protected side analysis)	E.9
Citrus Lakefront	E.10
Along MRGO - Violet Line	E.11
Harvey Canal	E.12
New Orleans Lakefront Airport	E.13
South Point to G.I.W.W. (2)	E.14
City Price to Tropical Bend (2)	E.15
Orleans Parish Lakefront (2)	E.16
Along MRGO Violet Line (2)	E.17
Westminster	E.18
Bayou St. John	E.19
Jefferson Parish Lakefront - Reach A (protected side analysis)	E.20
Jefferson Parish Lakefront - Reach A (flood side analysis)	E.21
Jefferson Parish Lakefront - Reach B (flood side analysis)	E.22
Jefferson Parish Lakefront - Reach C (protected side analysis)	E.23
Jefferson Parish Lakefront - Reach C (flood side analysis)	E.24

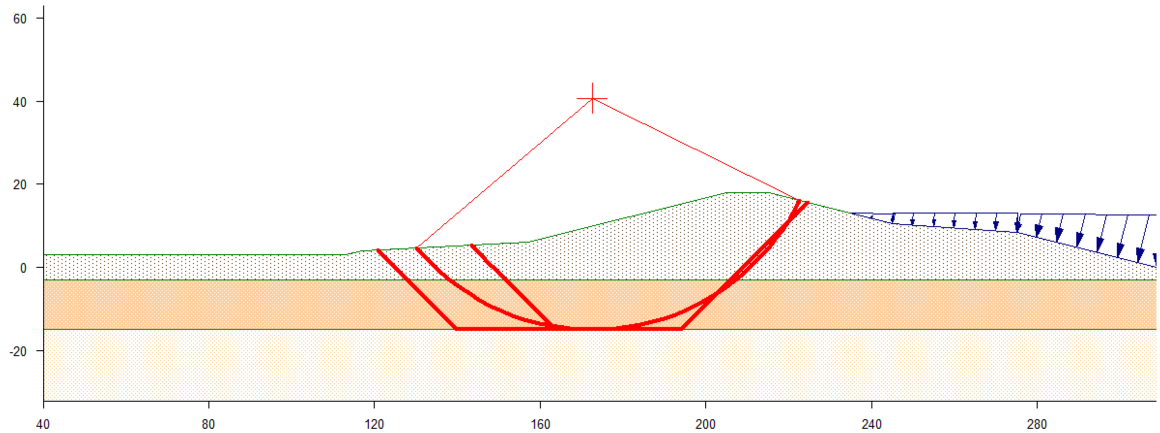

Figure E.1: Citrus Back Levee

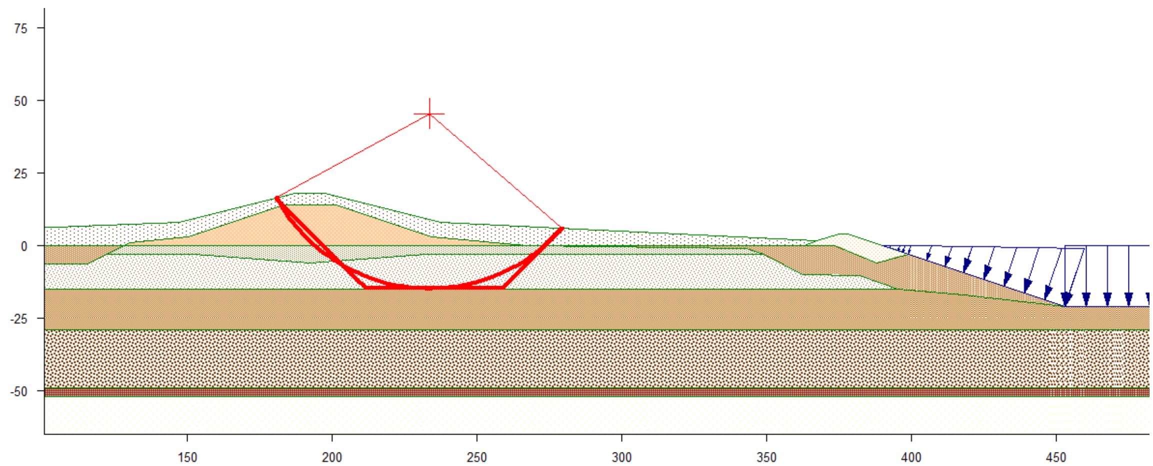

Figure E.2: G.I.W.W. – Michoud Canal

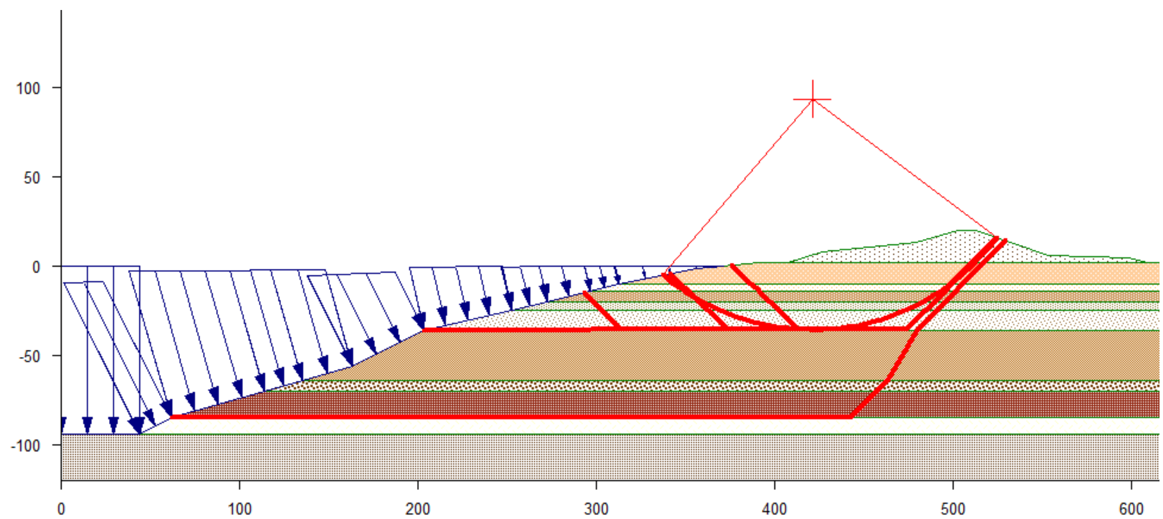

Figure E.3: City Price to Venice (flood side analysis)

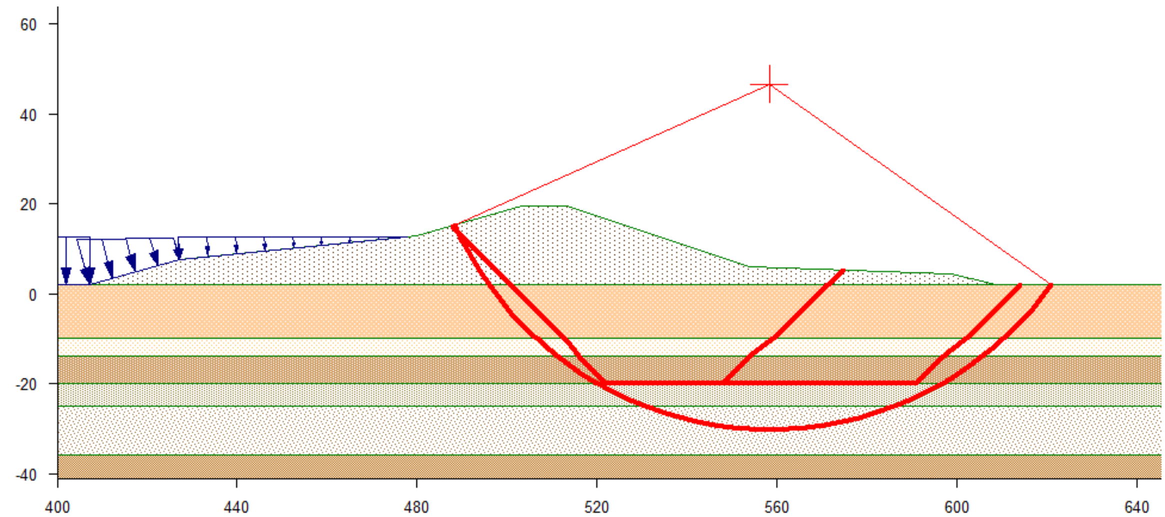

Figure E.4: City Price to Venice (protected side analysis)

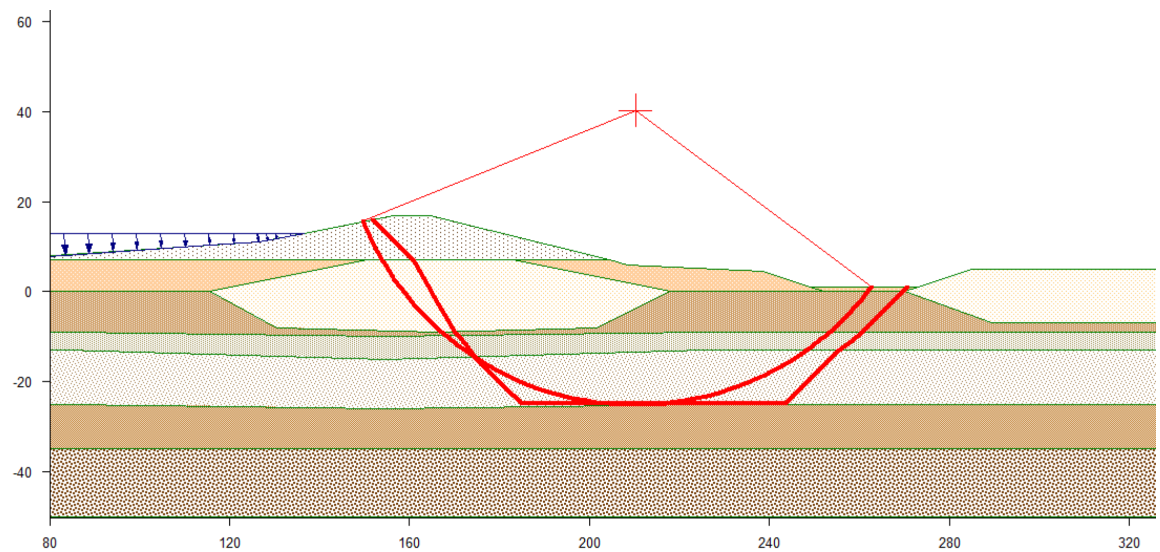

Figure E.5: Phoenix to Bohemia

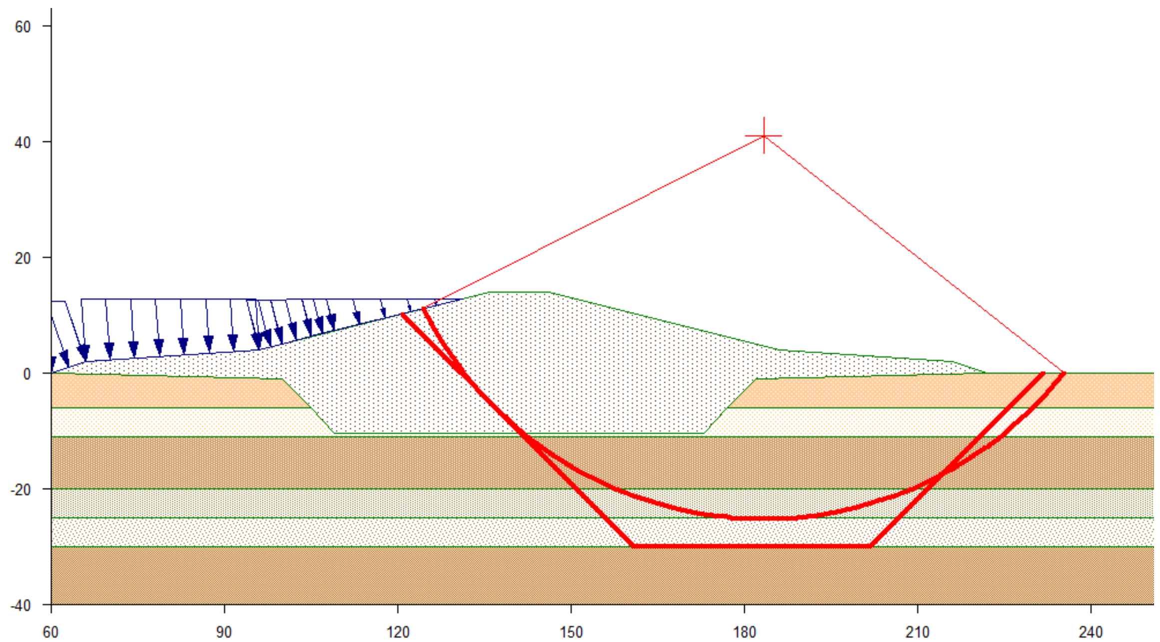

Figure E.6: South Point to G.I.W.W.

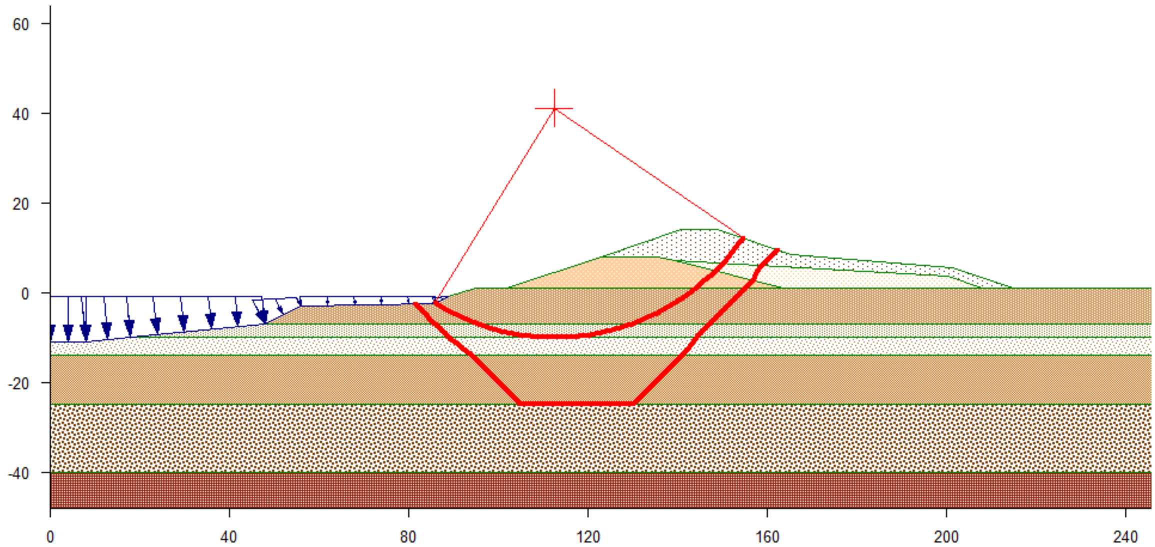

Figure E.7: City Price to Tropical Bend

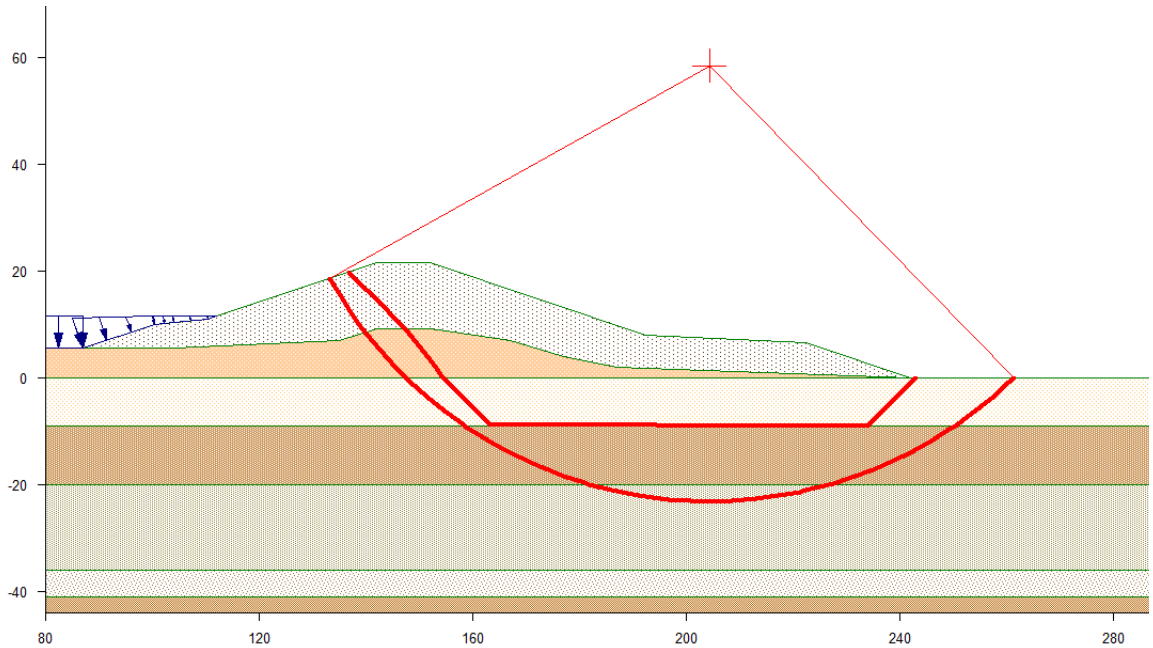

Figure E.8: Orleans Parish Lakefront

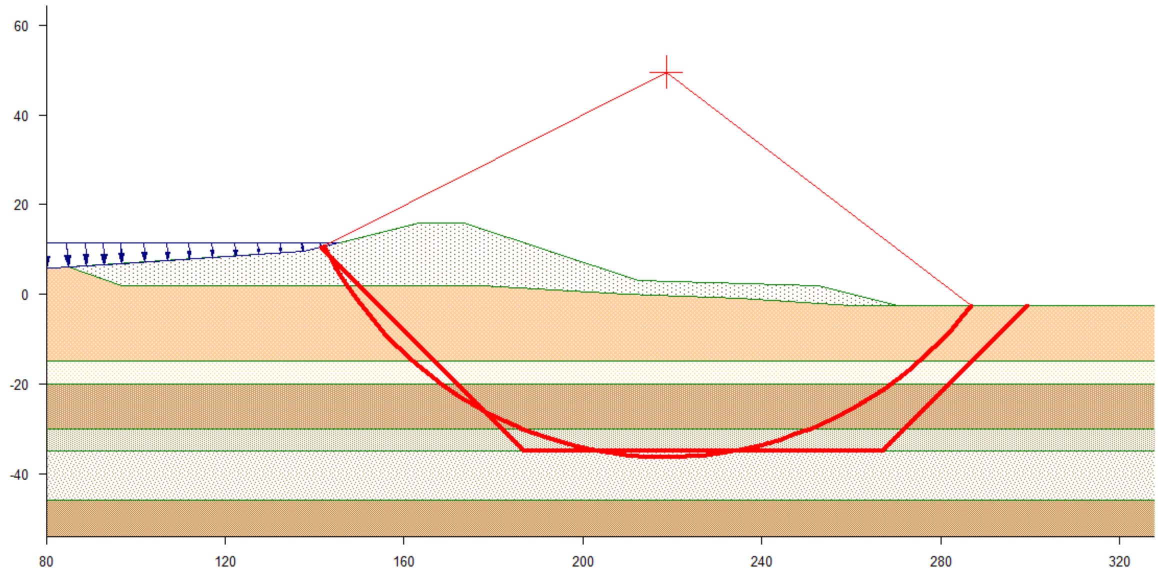

Figure E.9: Jefferson Parish Lakefront – Reach B (protected side analysis)

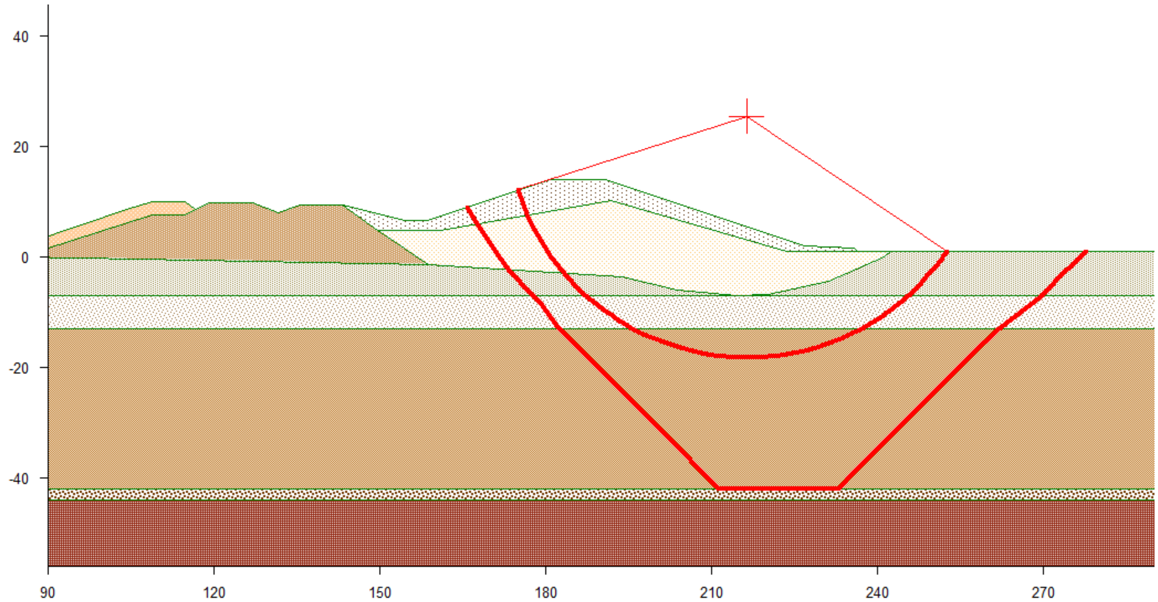

Figure E.10: Citrus Lakefront

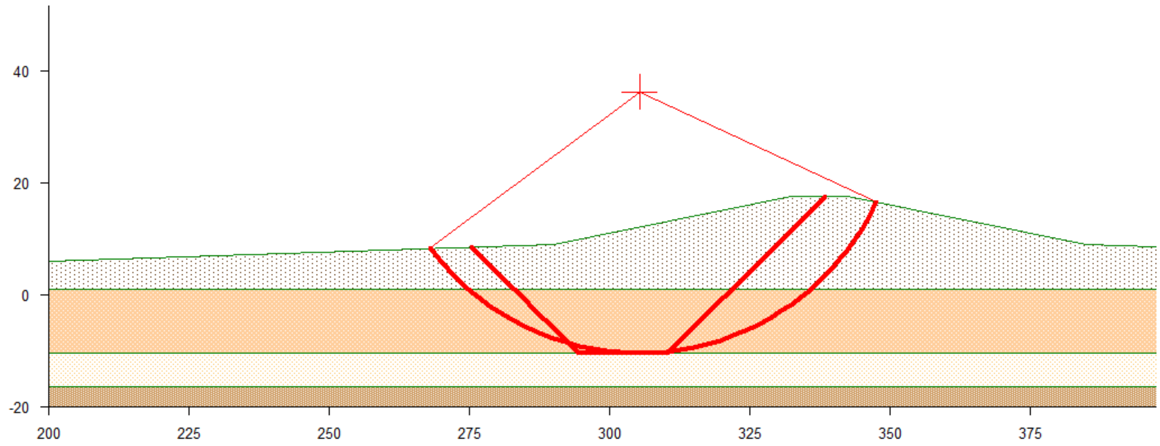

Figure E.11: Along MRGO – Violet Line

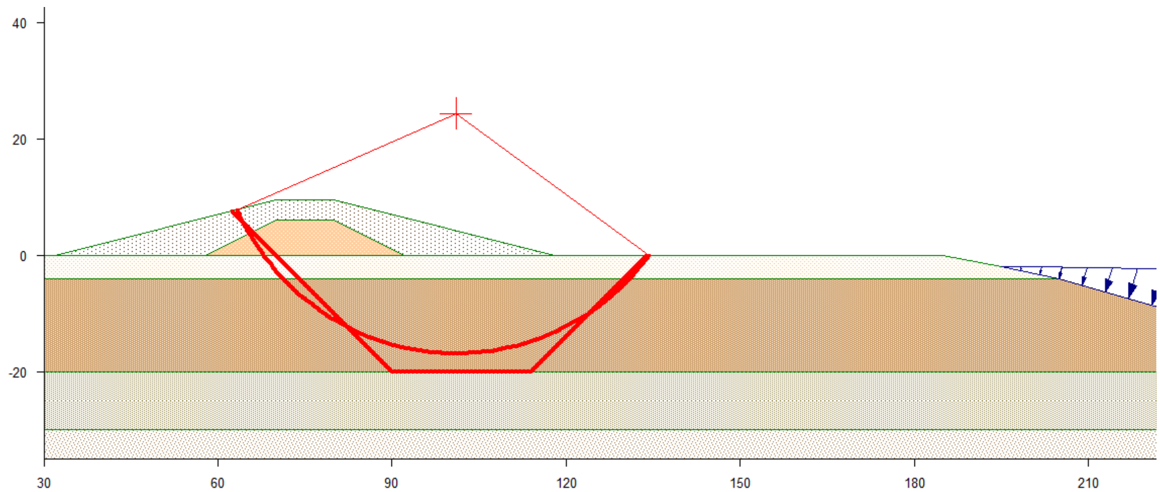

Figure E.12: Harvey Canal

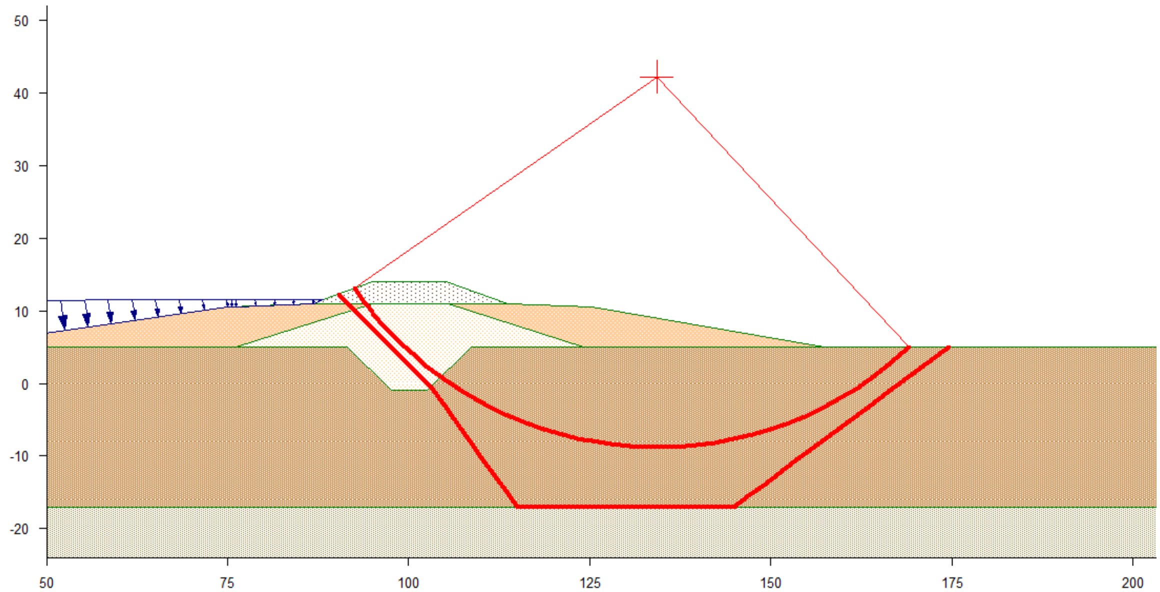

Figure E.13: New Orleans Lakefront Airport

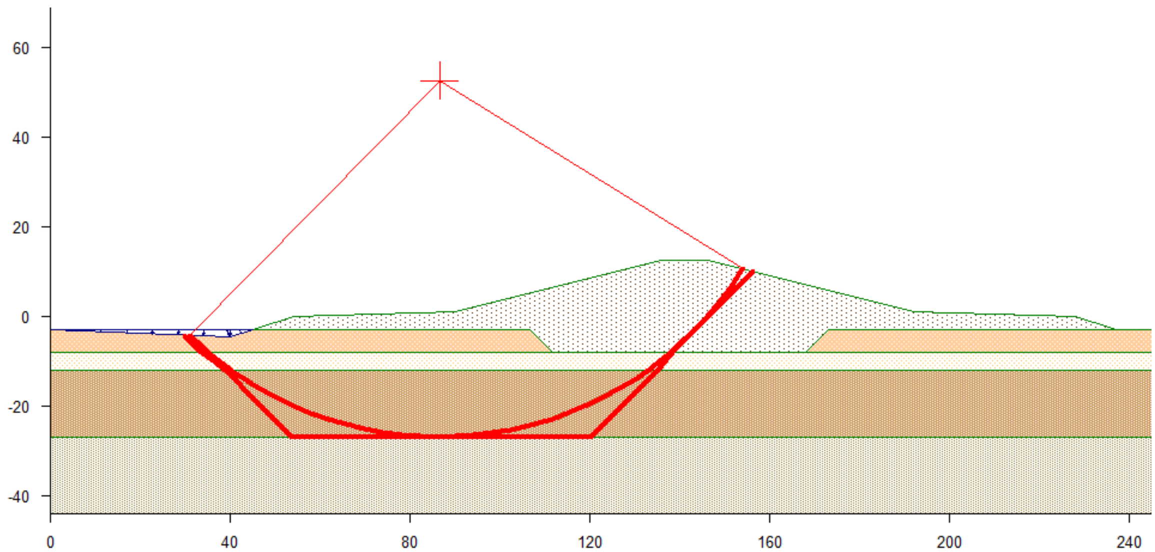

Figure E.14: South Point to G.I.W.W. (2)

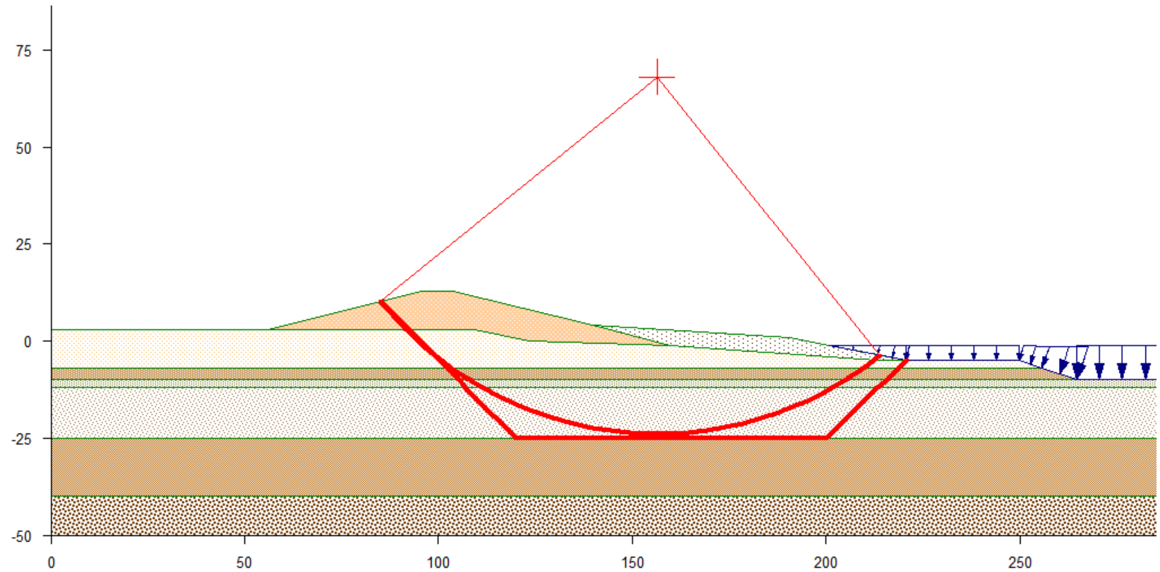

Figure E.15: City Price to Tropical Bend (2)

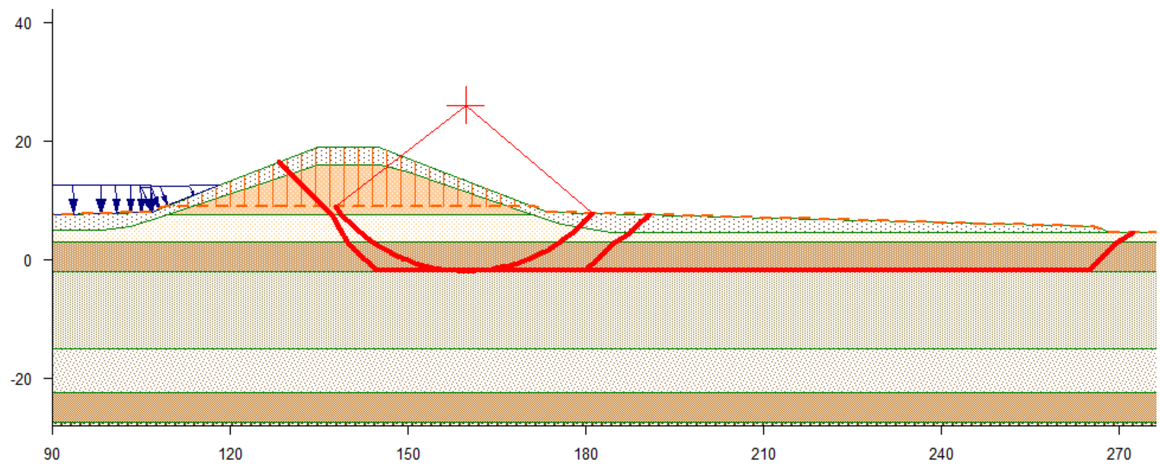

Figure E.16: Orleans Parish Lakefront (2)

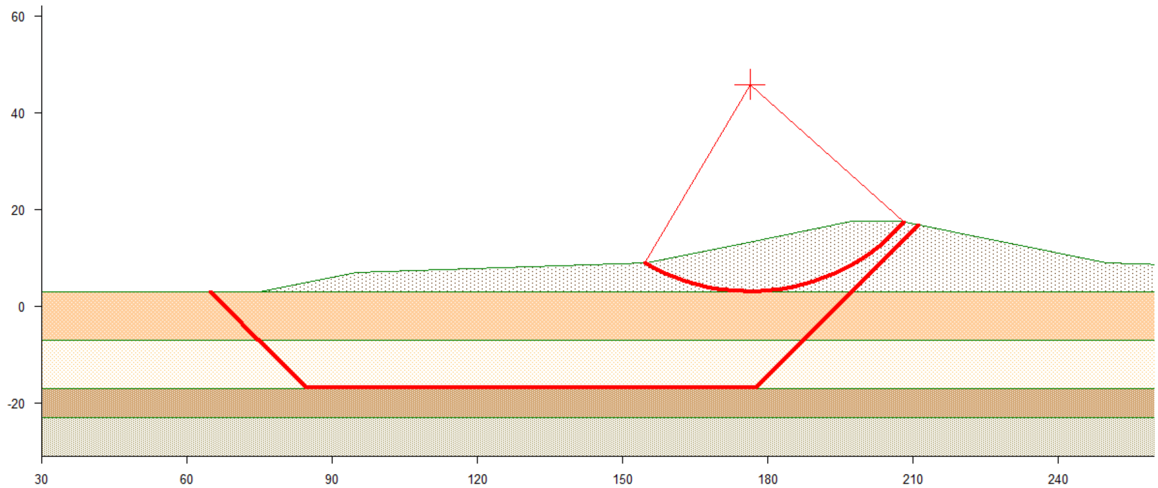

Figure E.17: Along MRGO – Violet Line (2)

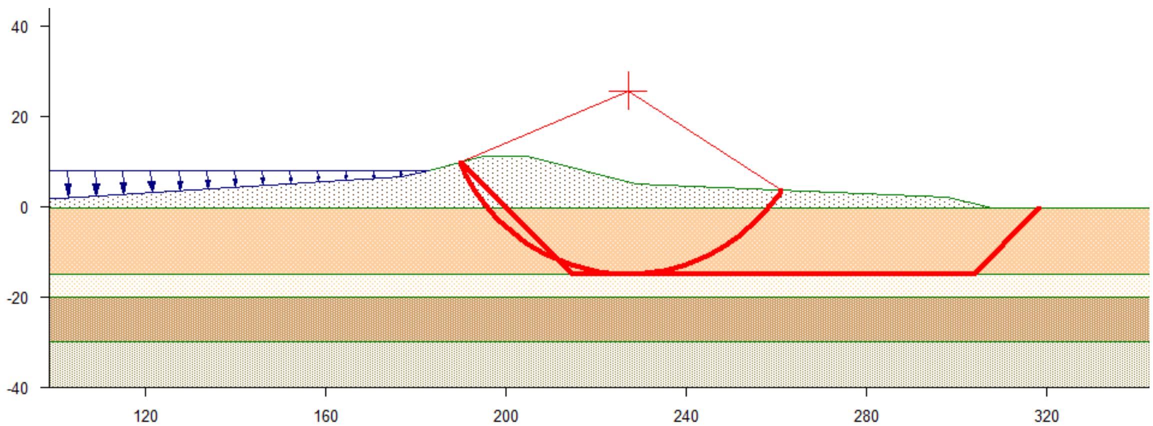

Figure E.18: Westminster

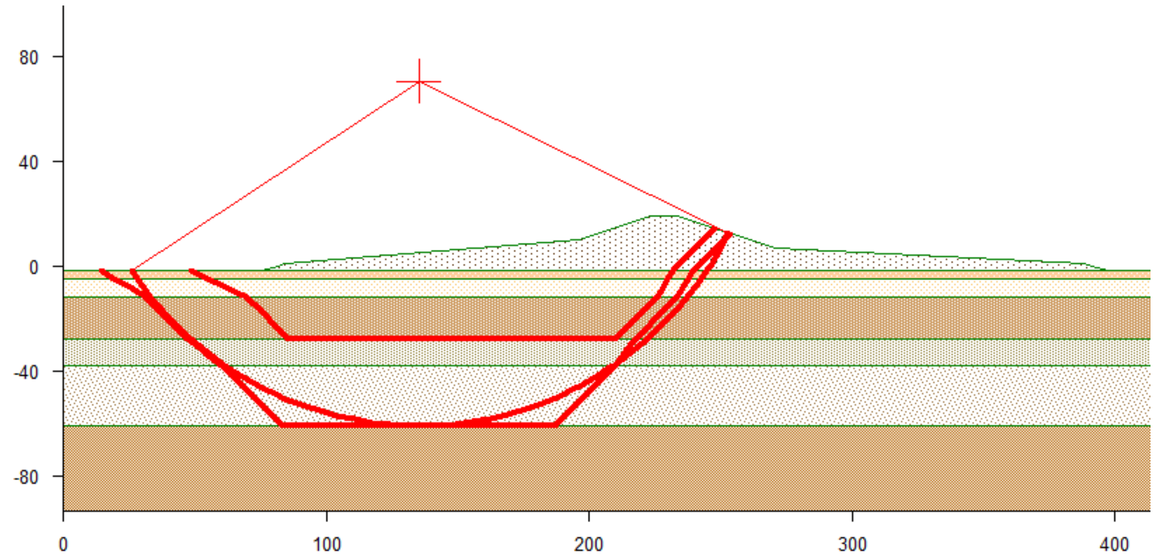

Figure E.19: Bayou St. John

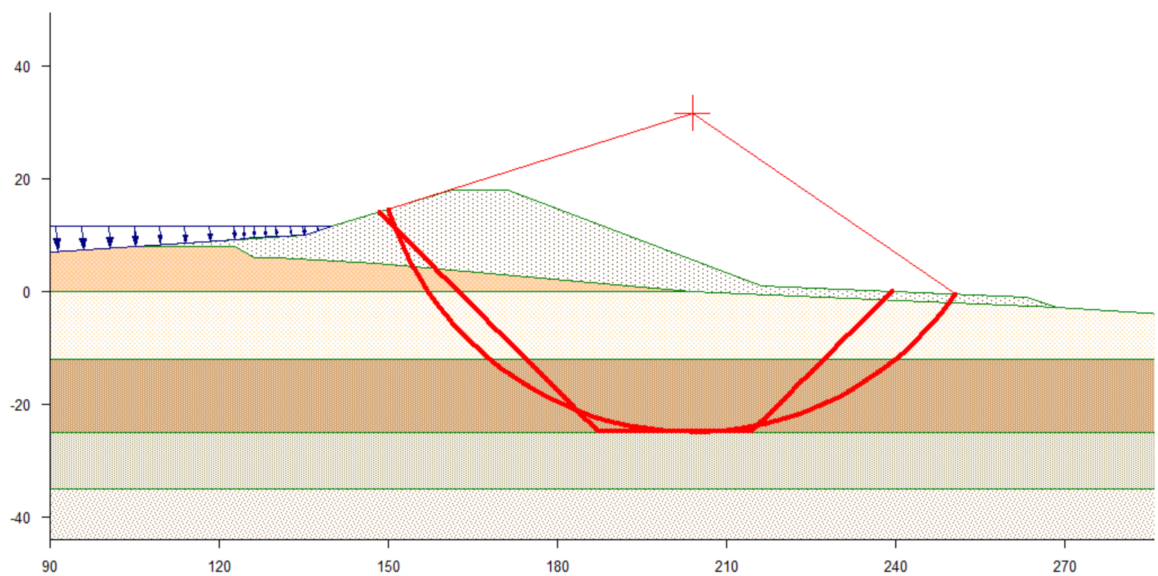

Figure E.20: Jefferson Parish Lakefront – Reach A (protected side analysis)

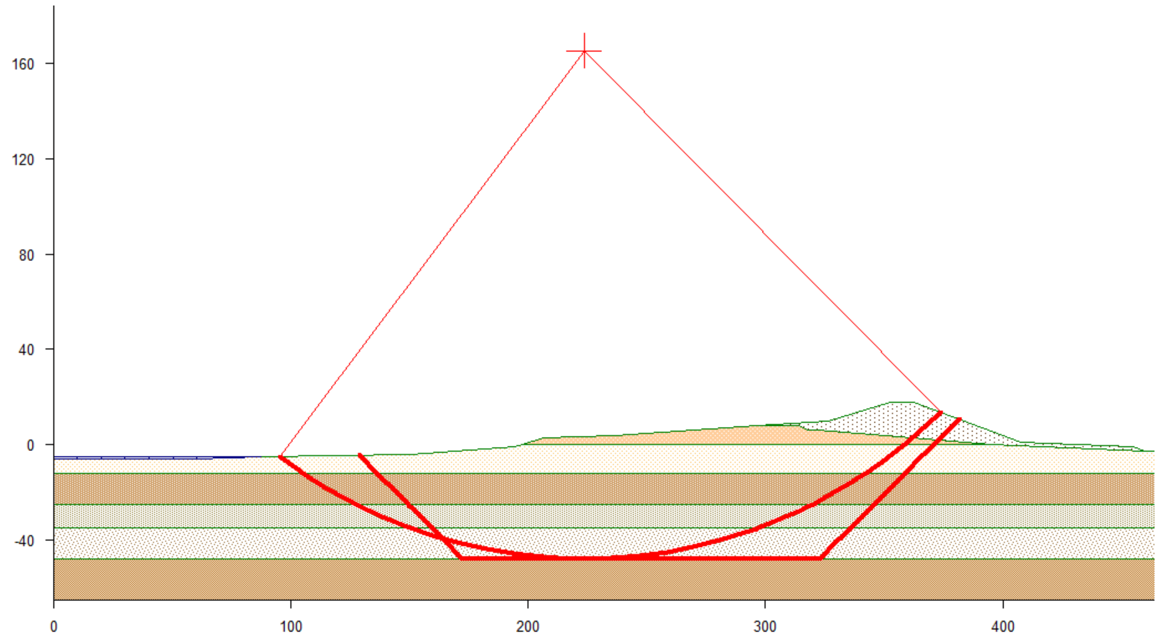

Figure E.21: Jefferson Parish Lakefront – Reach A (flood side analysis)

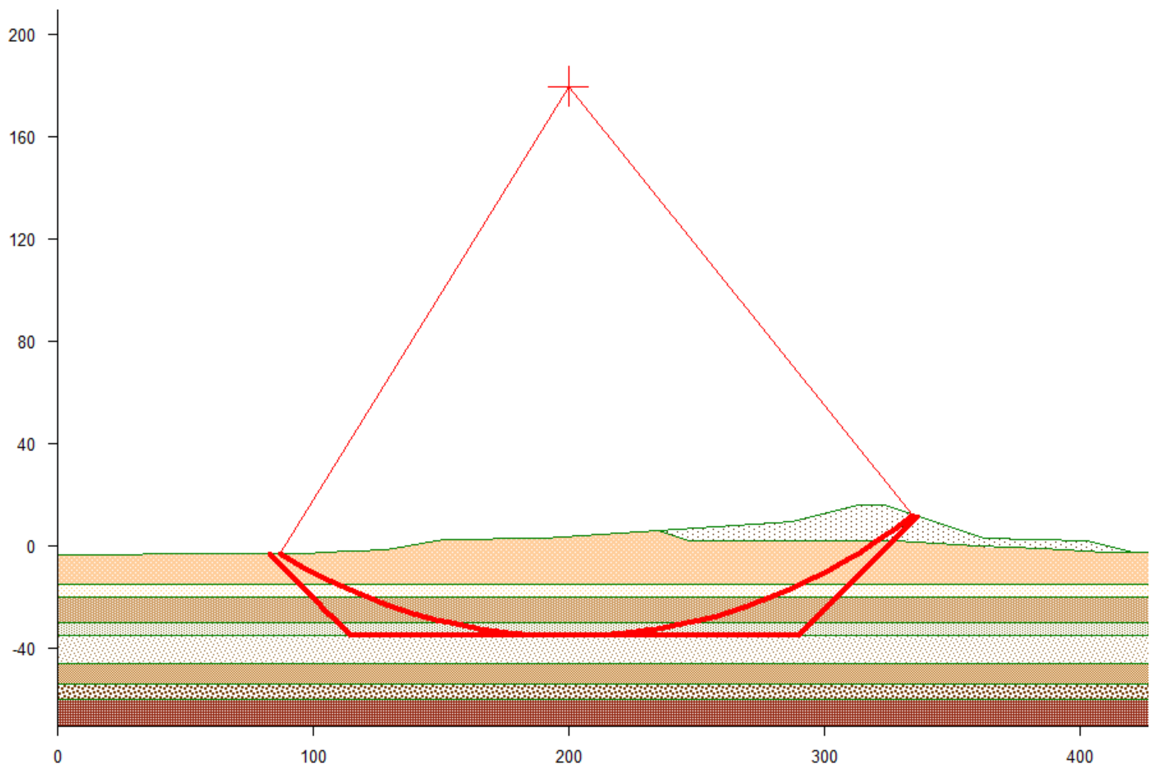

Figure E.22: Jefferson Parish Lakefront – Reach B (flood side analysis)

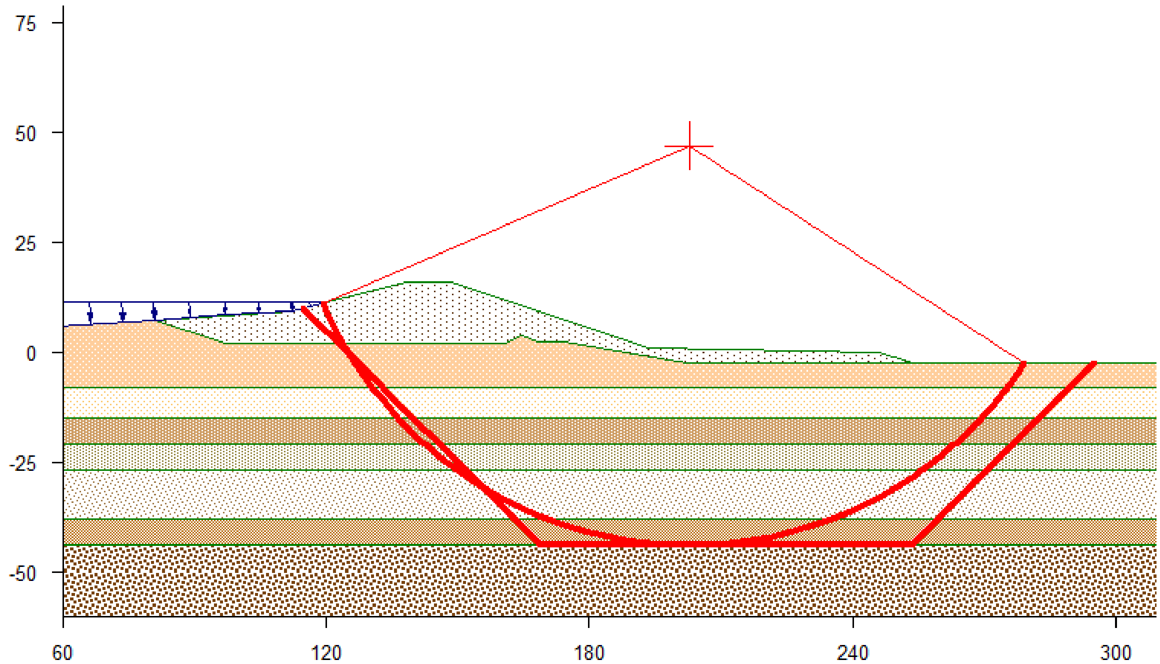

Figure E.23: Jefferson Parish Lakefront – Reach C (protected side analysis)

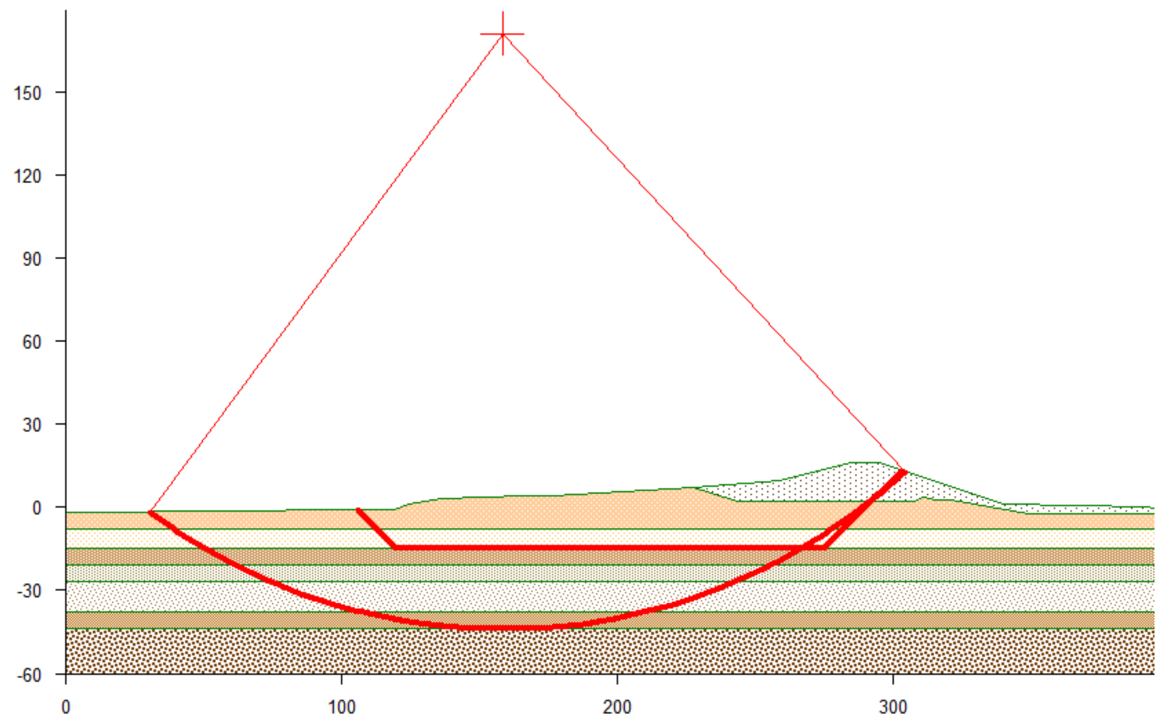

Figure E.24: Jefferson Parish Lakefront – Reach C (flood side analysis)

Appendix F: Critical Noncircular Slip Surfaces from Spencer's Procedure

The *critical noncircular slip surface* determined by Spencer's procedure is plotted for each cross section in Appendix F. The location of each cross section is given in the name of the figure, and the figure number for each location is given in Table F.1.

Table F.1: Figure numbers for each cross section in Appendix F.

Location	Figure No.
Citrus Back Levee	F.1
G.I.W.W. - Michoud Canal	F.2
City Price to Venice (flood side analysis)	F.3
City Price to Venice (protected side analysis)	F.4
Phoenix to Bohemia	F.5
South Point to G.I.W.W.	F.6
City Price to Tropical Bend	F.7
Orleans Parish Lakefront	F.8
Jefferson Parish Lakefront - Reach B (protected side analysis)	F.9
Citrus Lakefront	F.10
Along MRGO - Violet Line	F.11
Harvey Canal	F.12
New Orleans Lakefront Airport	F.13
South Point to G.I.W.W. (2)	F.14
City Price to Tropical Bend (2)	F.15
Orleans Parish Lakefront (2)	F.16
Along MRGO Violet Line (2)	F.17
Westminster	F.18
Bayou St. John	F.19
Jefferson Parish Lakefront - Reach A (protected side analysis)	F.20
Jefferson Parish Lakefront - Reach A (flood side analysis)	F.21
Jefferson Parish Lakefront - Reach B (flood side analysis)	F.22
Jefferson Parish Lakefront - Reach C (protected side analysis)	F.23
Jefferson Parish Lakefront - Reach C (flood side analysis)	F.24

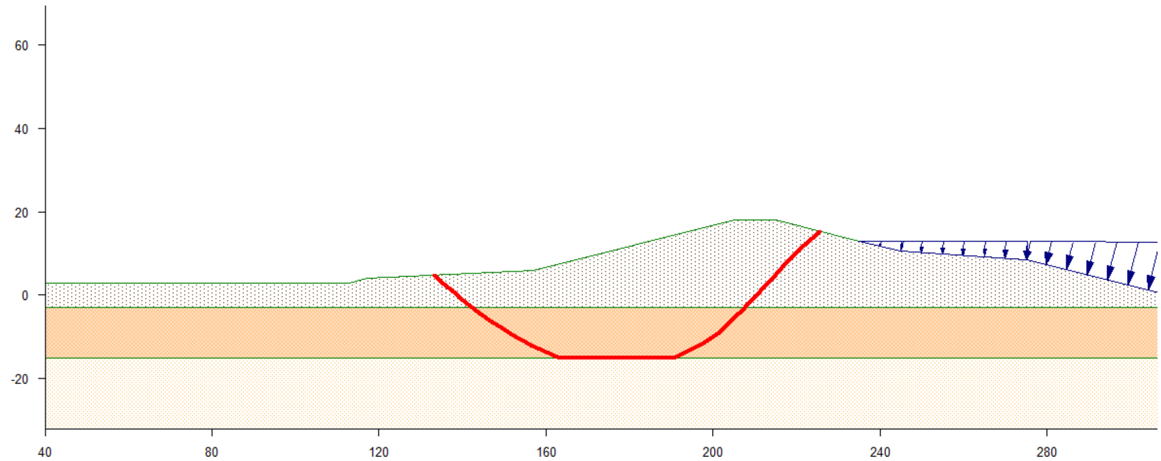

Figure F.1: Citrus Back Levee

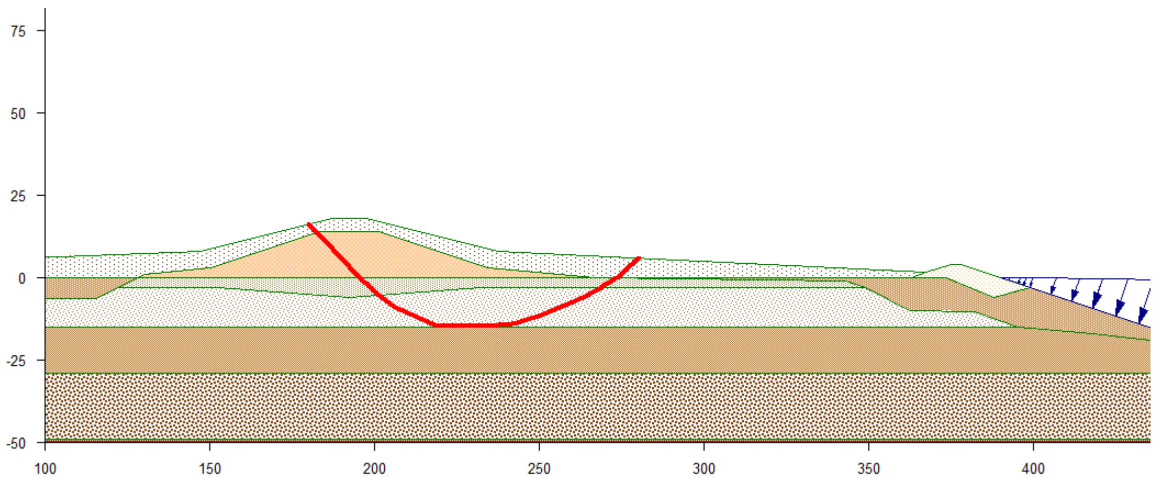

Figure F.2: G.I.W.W. – Michoud Canal

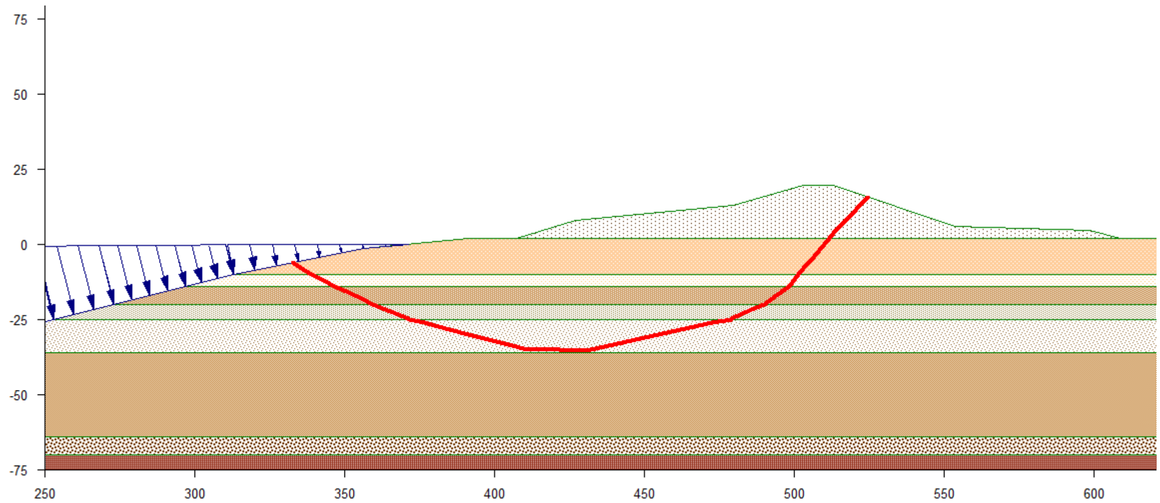

Figure F.3: City Price to Venice (flood side analysis)

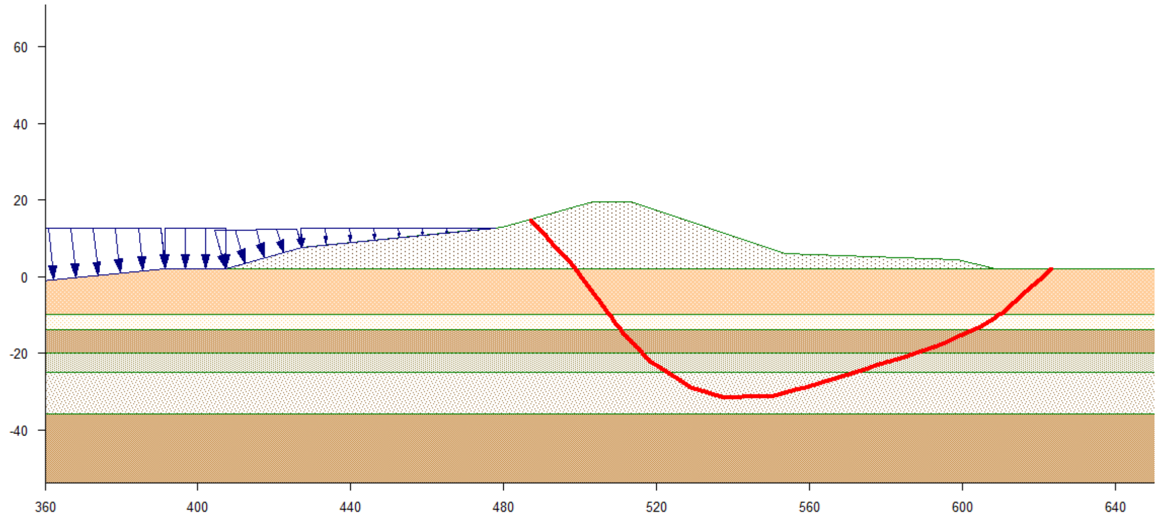

Figure F.4: City Price to Venice (protected side analysis)

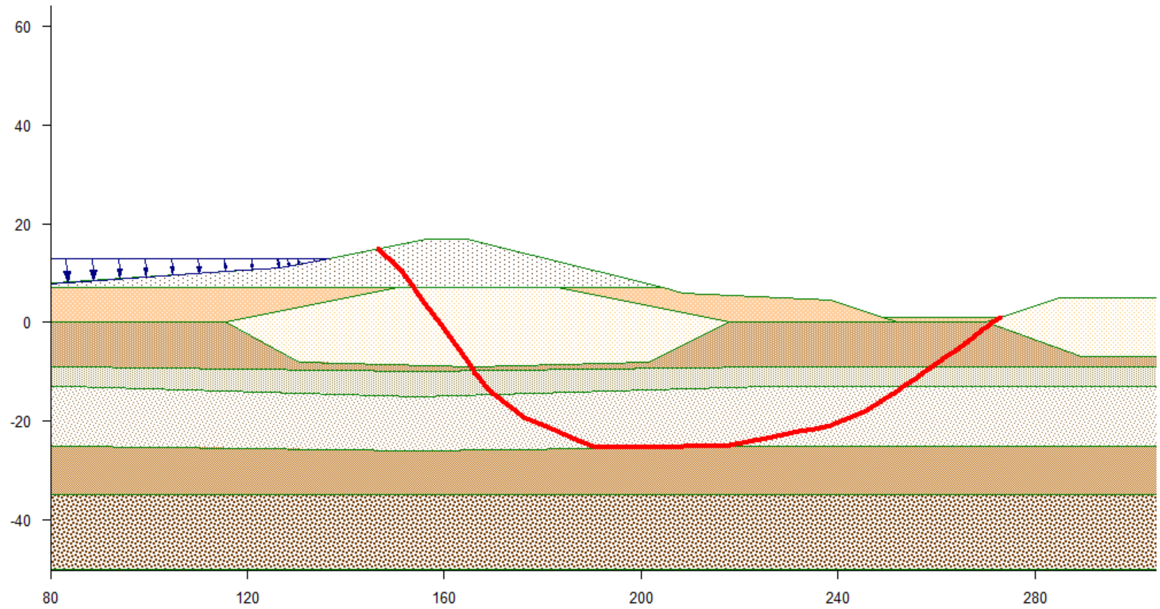

Figure F.5: Phoenix to Bohemia

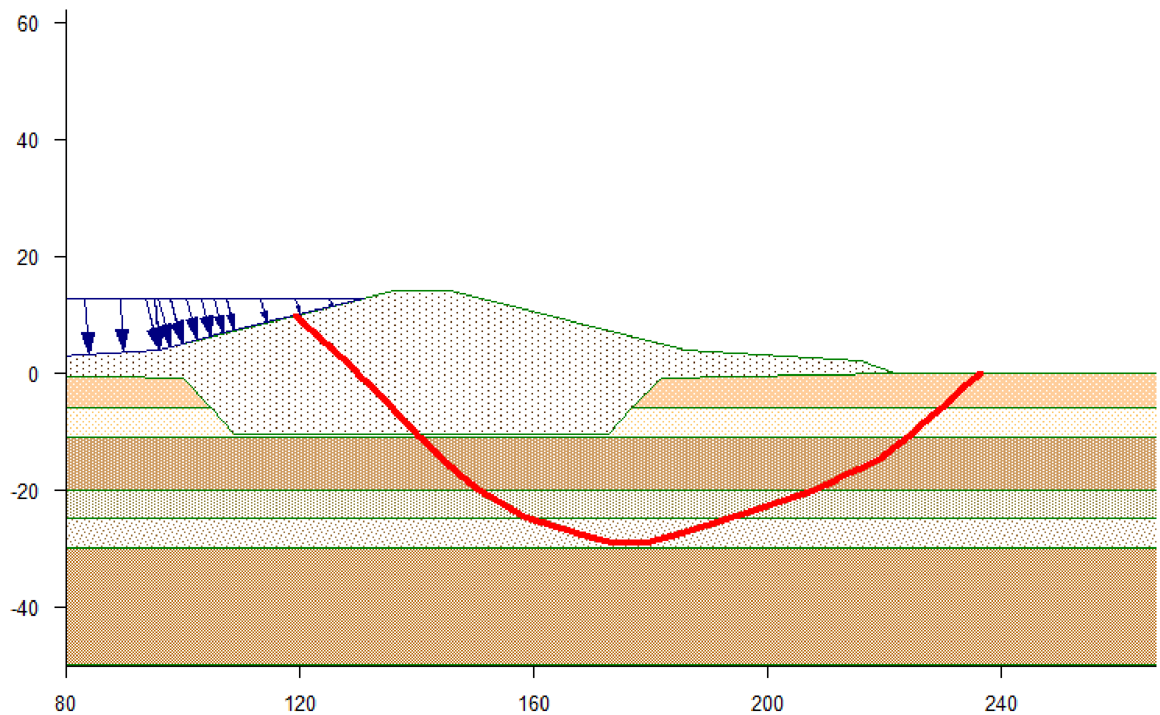

Figure F.6: South Point to G.I.W.W.

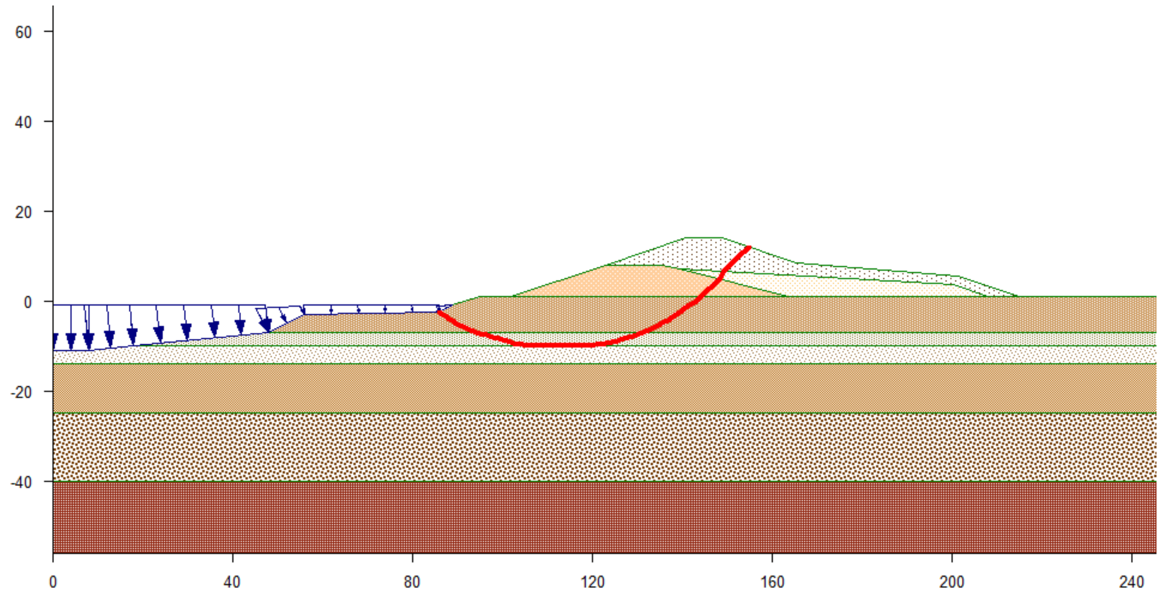

Figure F.7: City Price to Tropical Bend

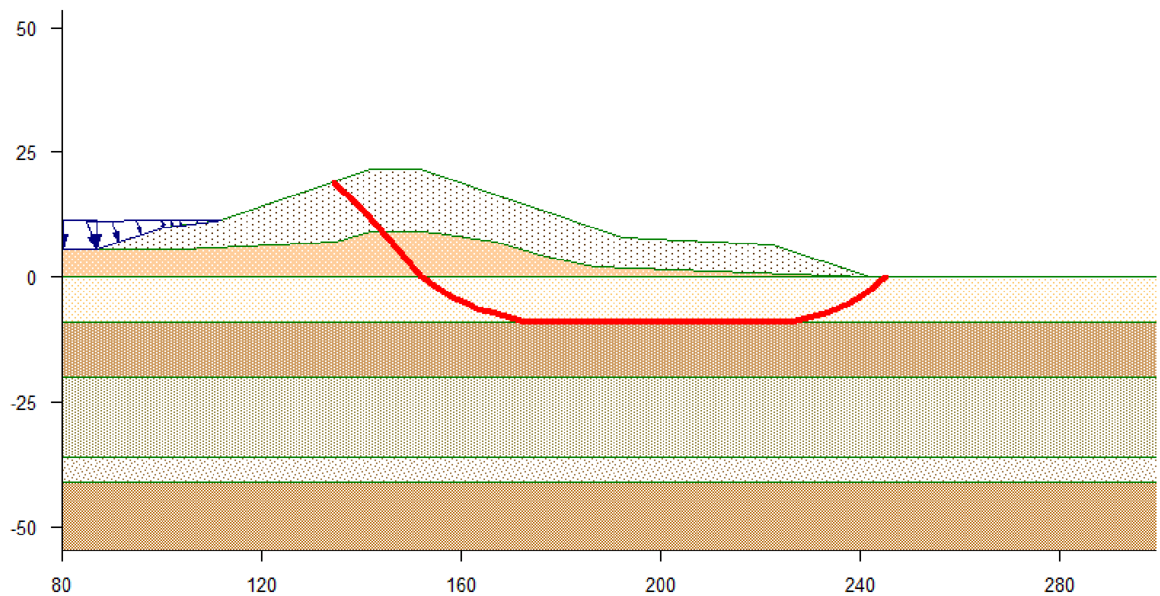

Figure F.8: Orleans Parish Lakefront

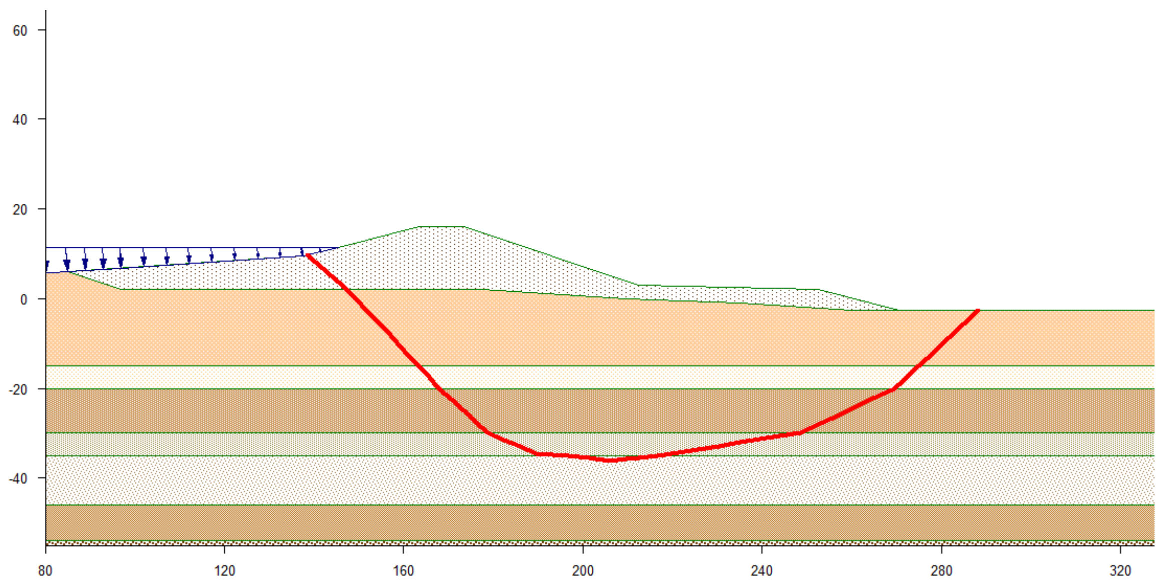

Figure F.9: Jefferson Parish Lakefront – Reach B (protected side analysis)

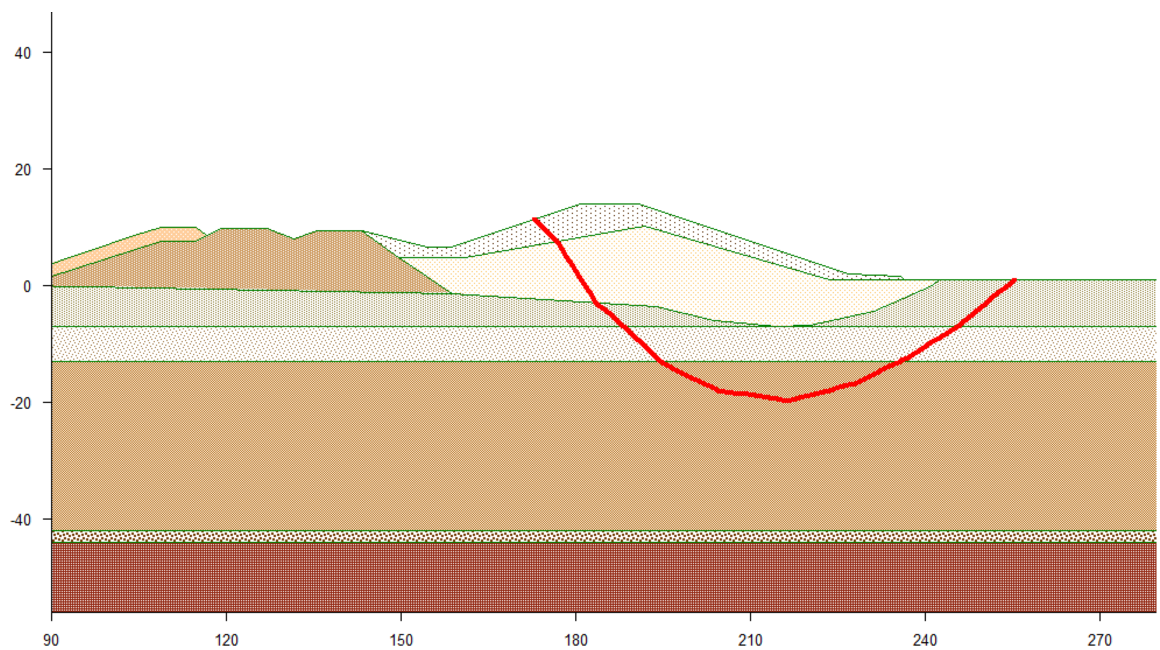

Figure F.10: Citrus Lakefront

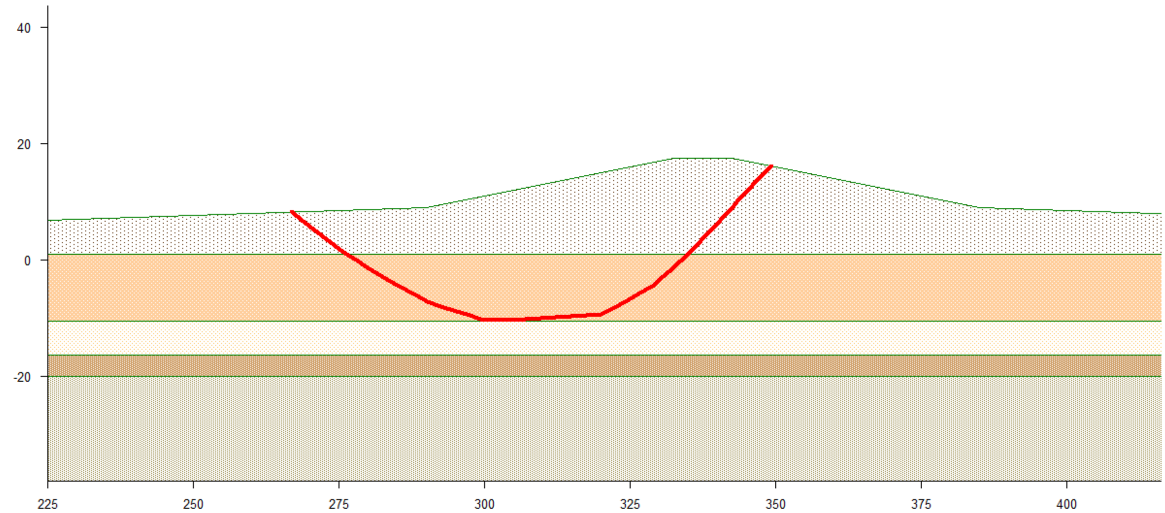

Figure F.11: Along MRGO – Violet Line

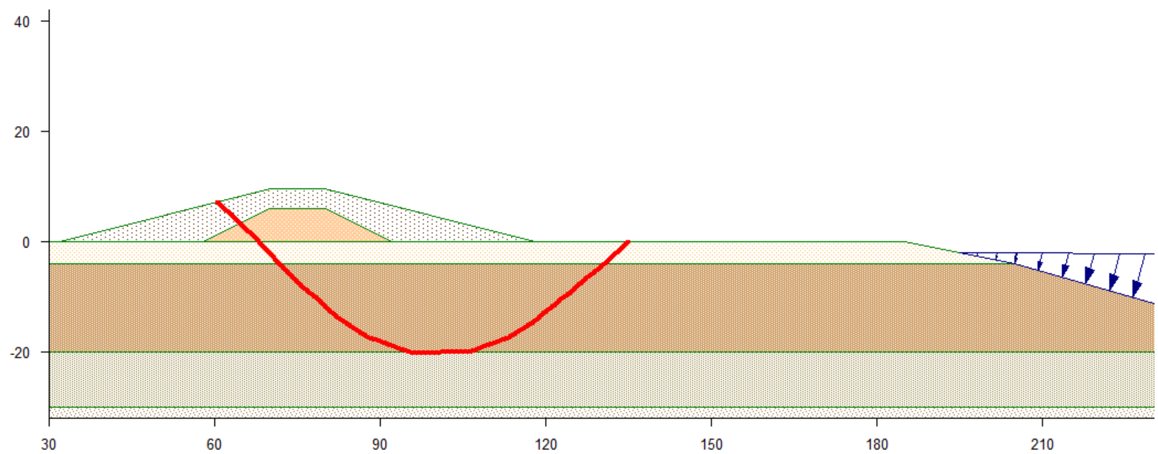

Figure F.12: Harvey Canal

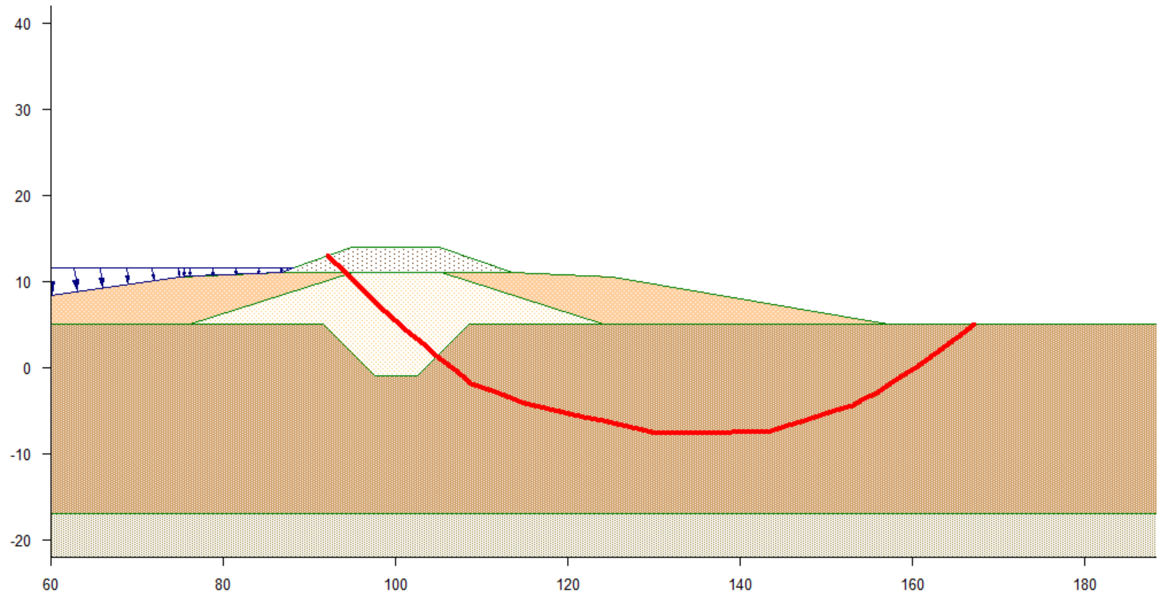

Figure F.13: New Orleans Lakefront Airport

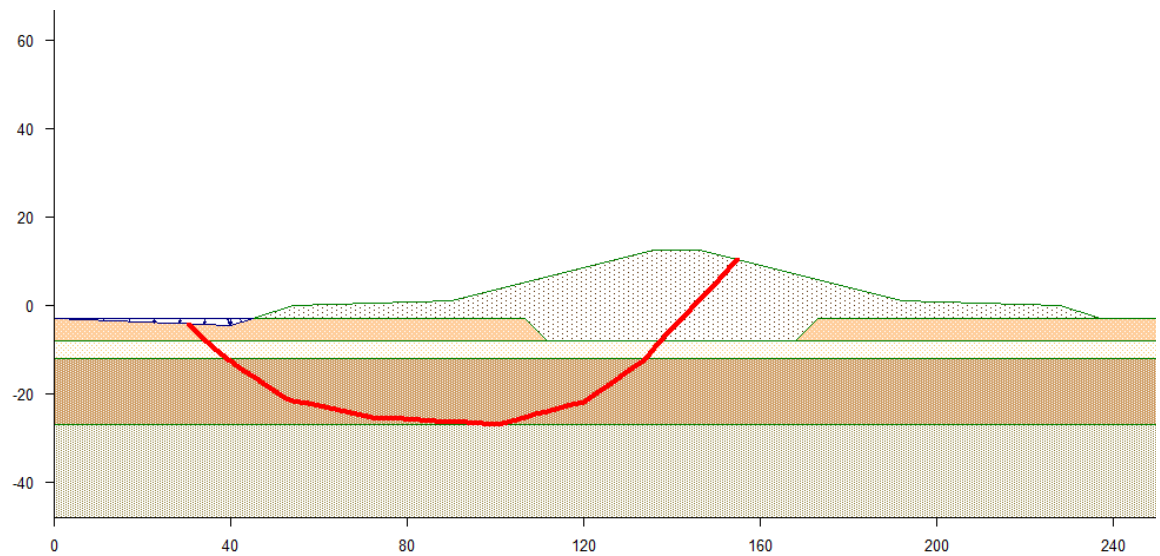

Figure F.14: South Point to G.I.W.W.

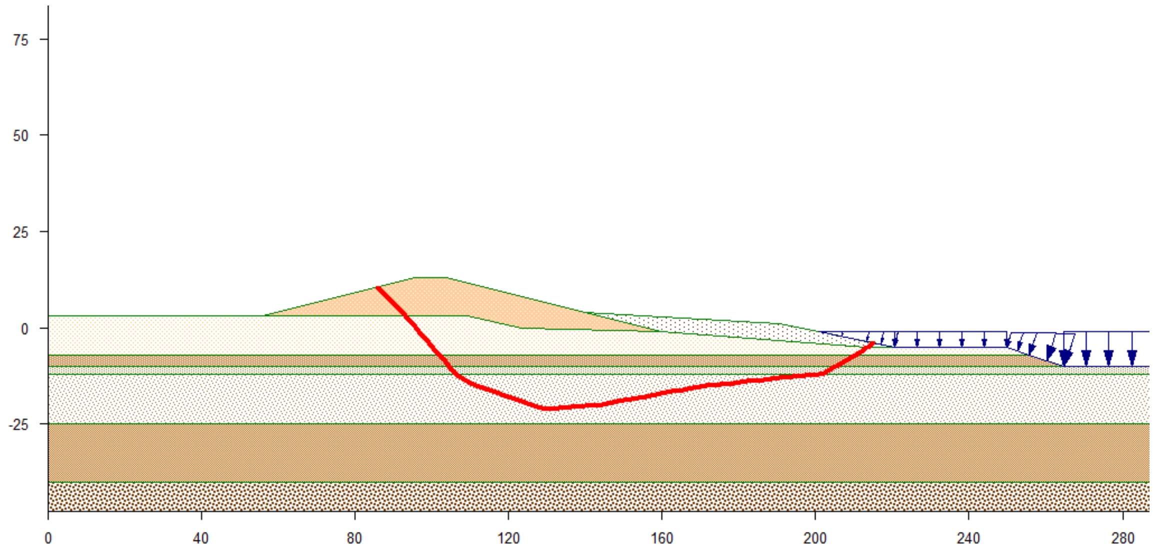

Figure F.15: City Price to Tropical Bend (2)

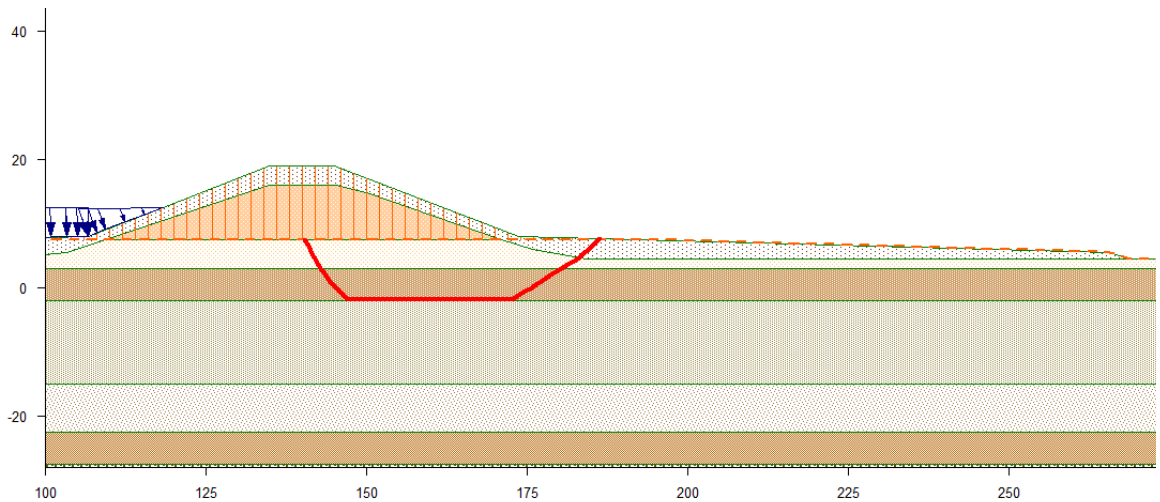

Figure F.16: Orleans Parish Lakefront (2)

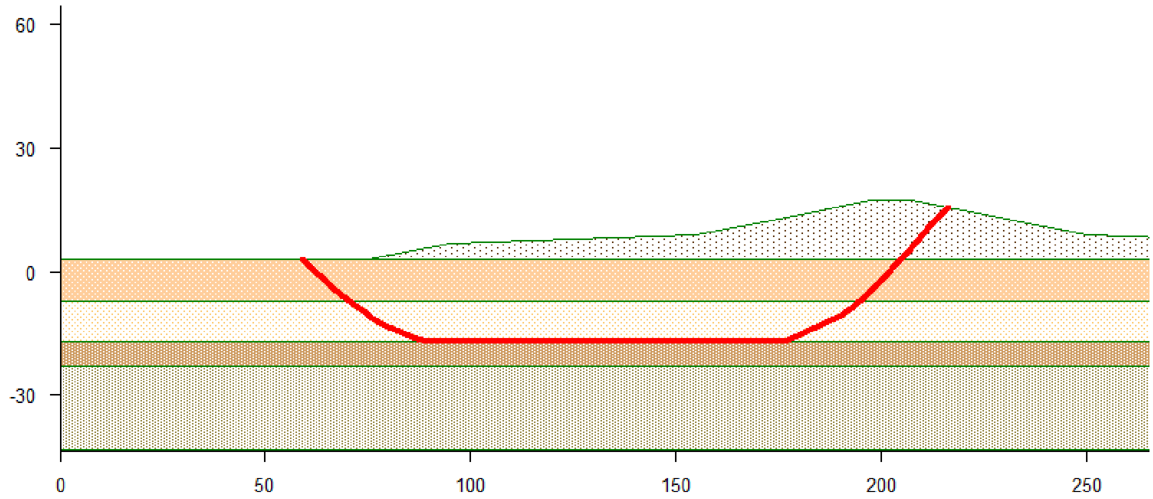

Figure F.17: Along MRGO – Violet Line (2)

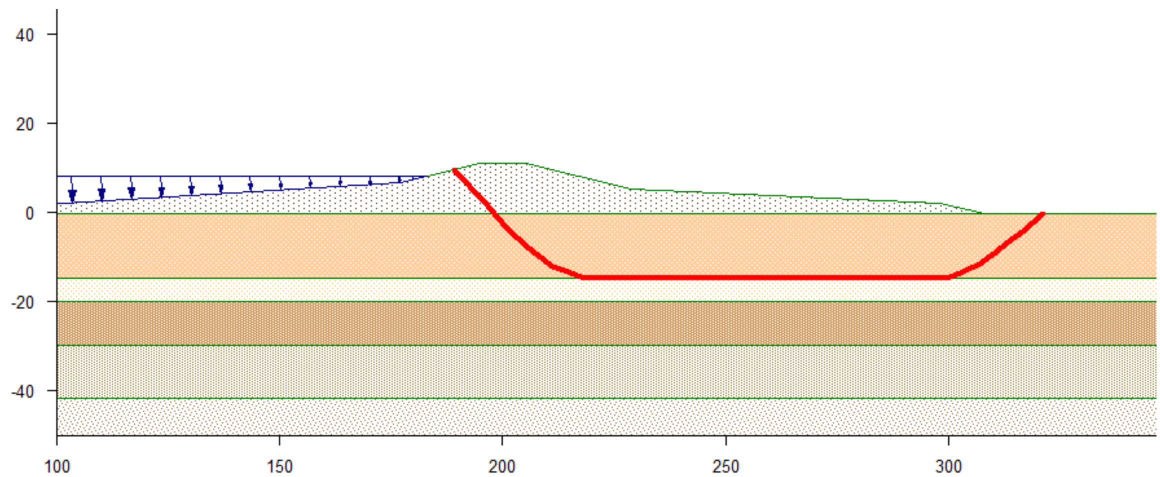

Figure F.18: Westminster

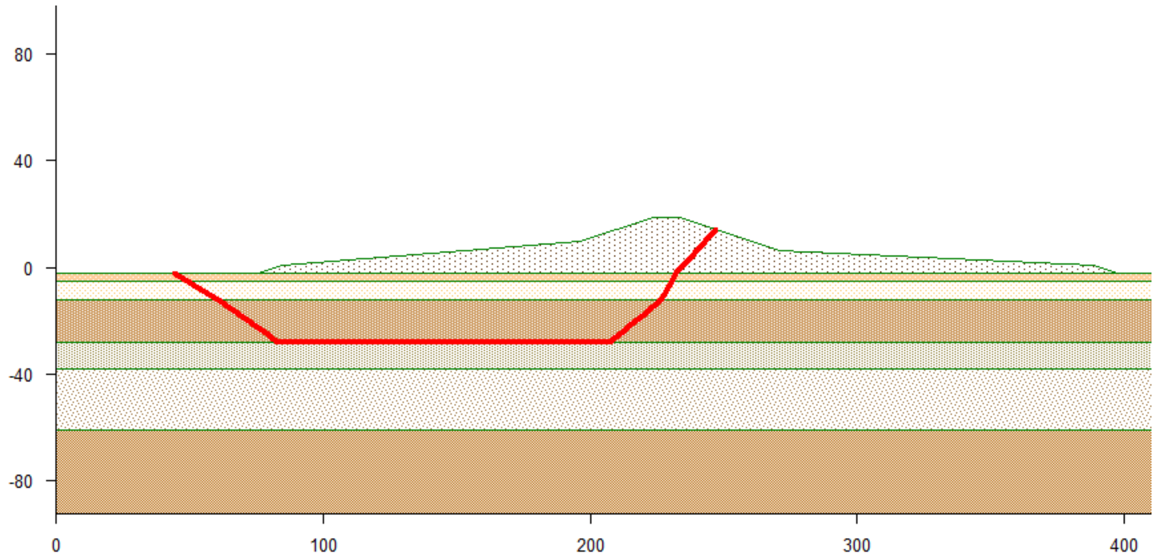

Figure F.19: Bayou St. John

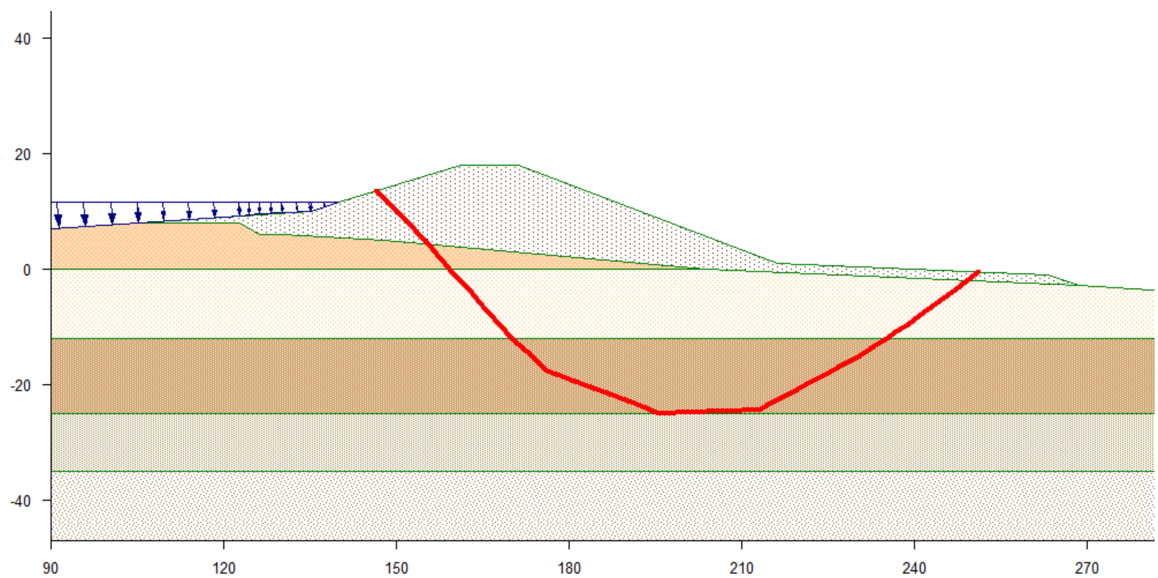

Figure F.20: Jefferson Parish Lakefront – Reach A (protected side analysis)

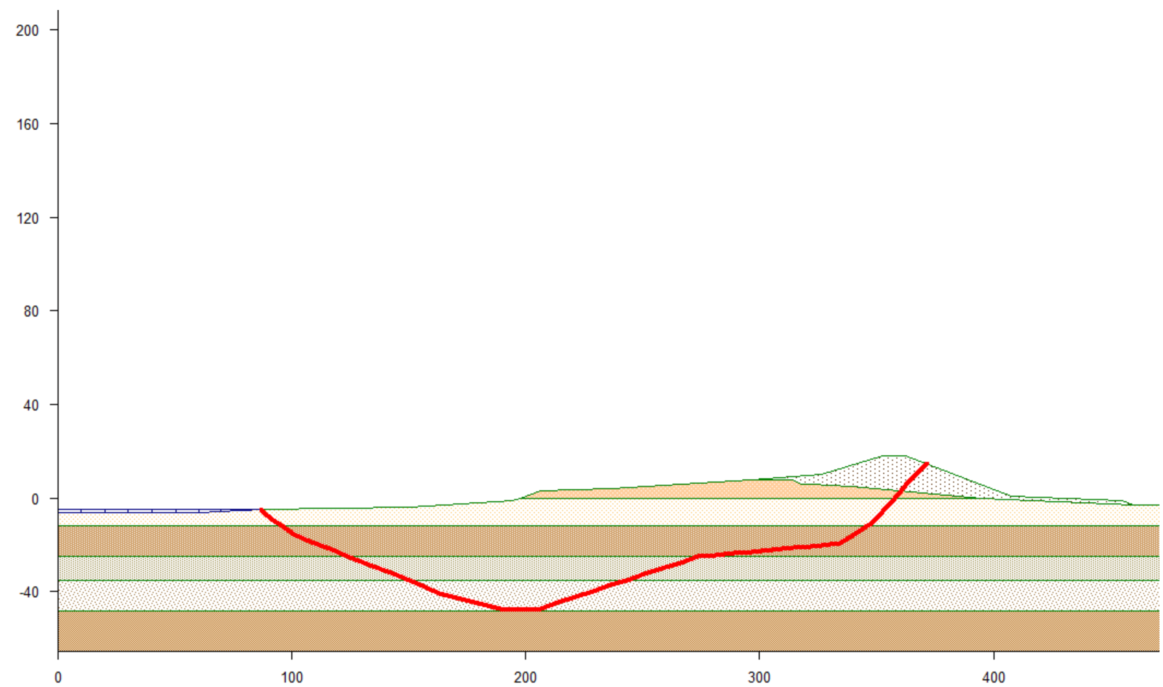

Figure F.21: Jefferson Parish Lakefront – Reach A (flood side analysis)

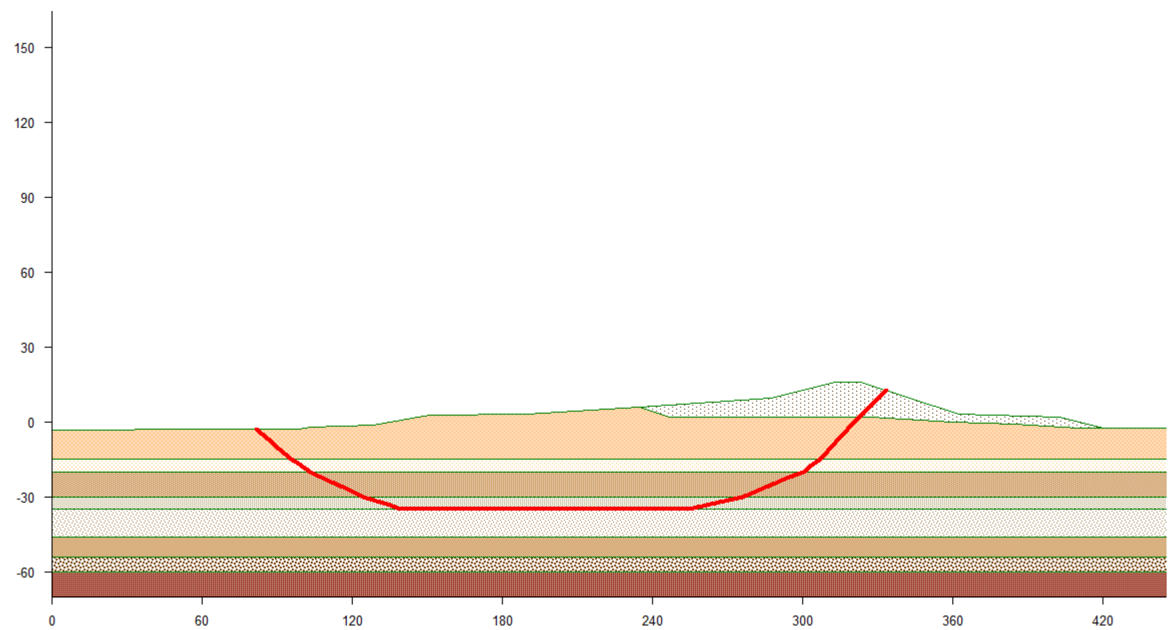

Figure F.22: Jefferson Parish Lakefront – Reach B (flood side analysis)

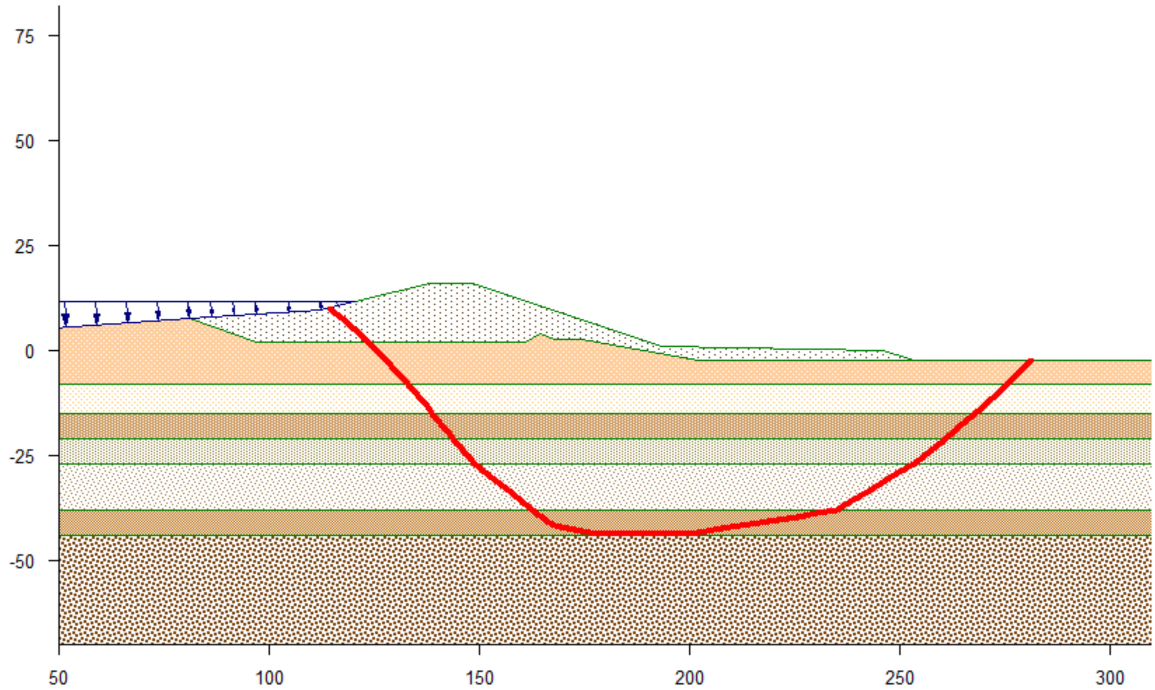

Figure F.23: Jefferson Parish Lakefront – Reach C (protected side analysis)

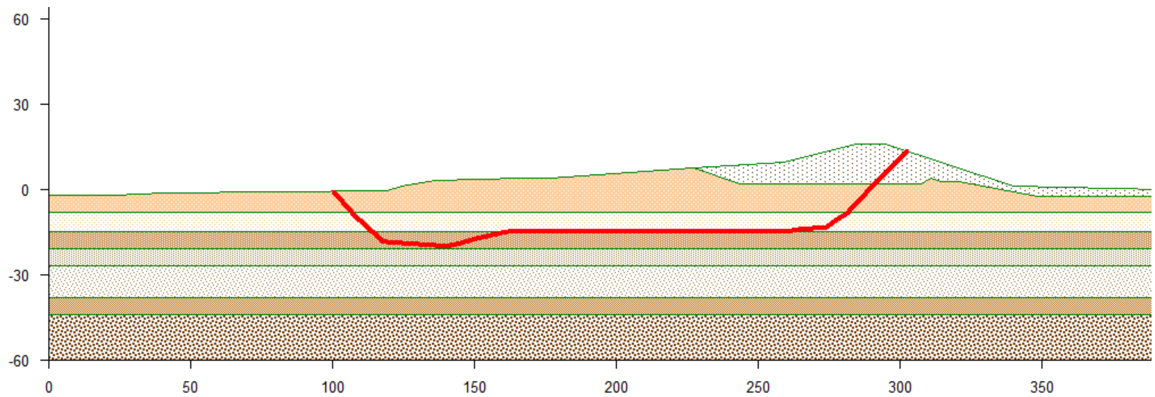

Figure F.24: Jefferson Parish Lakefront – Reach C (flood side analysis)

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Vita

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