

FOR REFERENCE

NOT TO BE TAKEN FROM THIS ROOM

GEOTECHNICAL EVALUATIONS OF
HALIÇ'S SEDIMENTARY LAYERS

by

MAHIR KÖSELER

B.S in C.E. , Boğaziçi University , 1982

Submitted to the Institute for Graduate
Studies in Science and Engineering
in Partial Fullfillment of
the Requirements for the Degree of
Master of Science
in
Civil Engineering

Bogazici University Library



39001100315350

14

BOGAZIÇI UNIVERSITY

1984

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Doç. Dr. Erol GÜLER for his invaluable suggestions , guidance and encouragements throughout the course of my study.

I wish to thank my wife, Nuran KÖSELER, for helping me in preparing my thesis.

Mahir KÖSELER

Istanbul, April 1984

ÖZET

Haliçteki yumuşak zemin tabakalarının varlığı, dip çamurunun taranması esnasında büyük boyutlarda geoteknik problemler ortaya çıkarır. Bu yüzden bu tabakaların taranması esnasında oluşabilecek kritik durumları önlemek için bazı geoteknik hesaplamalar yapmak zorunludur.

Bu tezde ilk olarak Haliç'in genel jeolojisi ve zemin durumları incelenir. Haliç boyunca I2 kesit halinde jeolojik oluşum(zemin durumu) verilir. Ayrıca bu tabakalarla ilgili geoteknik özellikler verilir. Haliç ve çevresindeki çevre problemleri ve Haliç'in taranması durumu araştırılır. Haliç'teki tabakaların çok yumuşak ve zayıf olmasından dolayı, kıyıların stabilitesi taranma yapılmadan önce araştırılması gerekir. Bu sebeple şev stabilitesi hakkında kısa bilgi ve bununla ilgili computer program(KÖSELER-I) geliştirildi.

Sonuç olarak, bazı jeolojik ve geoteknik sonuçlar ve taranma esnasında ve öncesinde oluşabilecek kritik durumları önlemek için neler yapabiliriz hakkında bazı tavsiyelerde bulunulacaktır.

ABSTRACT

GEOTECHNICAL EVALUATIONS OF HALIÇ'S SEDIMENTARY LAYERS

The presence of soft layers in Haliç create a great deal of geotechnical problems during the dredging of Haliç. It is necessary to make geotechnical evaluations to prevent critical situations during dredging.

The general geology and soil conditions in the area are studied. Geological formation along Haliç is given by geological cross-sections. Geotechnical properties of these layers are documented. The environmental problems in the vicinity of Haliç and dredging of Haliç are investigated. Since the layers (bottom sludge and underlying clay formation) are very soft and weak, stability of the shores should be considered before dredging. So stability of slopes is studied and the computer program for slope stability (KÖSELER-I) are given.

Some geological and geotechnical conclusions and recommendations such as what can we do to prevent critical situations that may arise before dredging and during dredging are given.

TABLE OF CONTENTS

	Page
CHAPTER 1 : INTRODUCTION	I
CHAPTER 2 : GEOLOGY AND SOIL CONDITIONS	5
2.1 Introduction	5
2.2 Geology	5
A. Upper Paleozoic	7
B. Middle and Upper Miocene	8
C. Quaternary and Current Sediments	9
2.3 Soil Conditions	10
A. Bedrock Formation	13
B. Sedimentary Layers	16
CHAPTER 3 : WATER POLLUTION AND DREDGING OF BOTTOM SLUDGE	27
3.1 Water Pollution	27
3.2 Dredging of Bottom Sludge	31
CHAPTER 4 : SLOPE STABILITY	34
4.1 Introduction	34
4.2 Slides in Cohesive Soils	34
4.3 Procedure for Investigating Stability of Slopes	36
4.4 Slopes on Soft Clay	37
4.5 The Use of the Clip Circle	39

	Page
in the stability Analysis of slopes	
A. Above Water Table	39
B. Partially Submerged	43
4.6 Computer Program for the Slope Stability	46
4.7 Operation of the Computer Program	48
4.8 List of Program	51
CHAPTER 5 : RESULTS AND RECOMMENDATIONS	56
5.1 Results from the Computer	56
A. For Existing soil Profile	56
B. After Dredging of Bottom Sludge	114
5.2 Conclusions and Recommendations	160
APPENDIX	175
REFERENCES	193

LIST OF FIGURES

	Page
FIGURE 1.1 General View from Azapkapı	2
1.2 Historical View from Eyüp	2
1.3 and 1.4 News from Turkish Newspapers about Sliding of Haliç Shores	4
FIGURE 2.1 Geological Map of Haliç and Its Vicinity	6
2.2 Geological cross-section between Rami-Taşkızak	8
2.3 Geotechnical borings Located in the Vicinity of Haliç	12
2.4 Borings Obtained from Haliç Shipyard	17
2.5 " " " Taşkızak "	19
2.6 Unkapanı, Properties of Samples	22
FIGURE 3.1 Domestic Wastes on the Shore at Eyüp	29
3.2 Sedimentation in Haliç	30
3.3 An abandoned Wreck on the Shore	31
FIGURE 4.1 Position of Critical Circle	35
4.2 Slope Failure	36
4.3 Relation Between Slope Angle and Stability Factor, N_s	38

		Page
FIGURE	4.4 Method of Slices for Investigating Equilibrium of Slope Located Above W.T	40
	4.5 Chart for Evaluating m_s	42
	4.6 Method of Slices for Investigating Eq. of Slope for Partially Sub. Slopes	43
FIGURE	5.I Spreading Layers of sand for Stabilization of I.T.O. Shores	163

LIST OF TABLES

	Page
TABLE 2.I List of Geotechnical Borings Located in the Vicinity of Haliç	II
2.2 Strength and Index Properties of Graywacke	I4
2.3 Deformation Properties of Graywacke Formation	I4
2.4 Strength Test on Graywacke Samples	I6
2.5 Lab. Reports Obtained from Haliç Shipyard Borings	I8
2.6 "	I8
2.7 Lab. Reports Obtained from Taşkızak Shipyard Borings	20
2.8 Properties of Samples from Silahtarğa Power Plant	23
2.9 Lab. Results on Samples Obtained from Hasköy Şark Mills	24
2.I0 Average Properties of Samples Obtained at Various Sites	25
2.II Lab. Reports from Taşkızak Shipyard	26
TABLE 3.I Values of Basic Parameters on Water Pollution	28

TABLE 3.2 Volume and Location of Previous
Dredgings in Haliç

CHAPTER 1

INTRODUCTION

Geotechnical problems ,having serious effects on people and buildings,generally require alarge amount of investment and have to be handled urgently. On the other hand,the nature of the problems varies depending on the type of the sources and environmental conditions,and that variations mostly makes necessary to study geological study and the geotechnical properties of the site.

Generally,environmental problems are to be handled and solved together with geoteehcnical problem.In fact,each geotechnical problem at the inhabited sites,has a tendency to be an environmental problem. The outcomes of geotechnical problems such as erosion,slope stability and dredging have an importance for people.The large amount of investment and urgency is necessary for the solution of such kind of problem

Haliç is 7.5 kilometers long natural inlet of the Bosphorous strait.The maximum width is 900 meters at the mounth,which is between Sarayburnu and Tophane Mosque,and the minimum width is 150 meters on the upstream side at the outlet of Alibey and Kağıthane Creeks.Its surface area is a total of 2.6 million square meters.Maximum depth in Haliç is 36 meters and it shallows down to a few meters deep near Kağıthane Cre

Haliç has been a center of attraction and recreation in former times.It has a very significant historical back ground, and is surrounded by buildings dating from Ottoman and Roman days.



FIG. I.I General view from Azapkapı

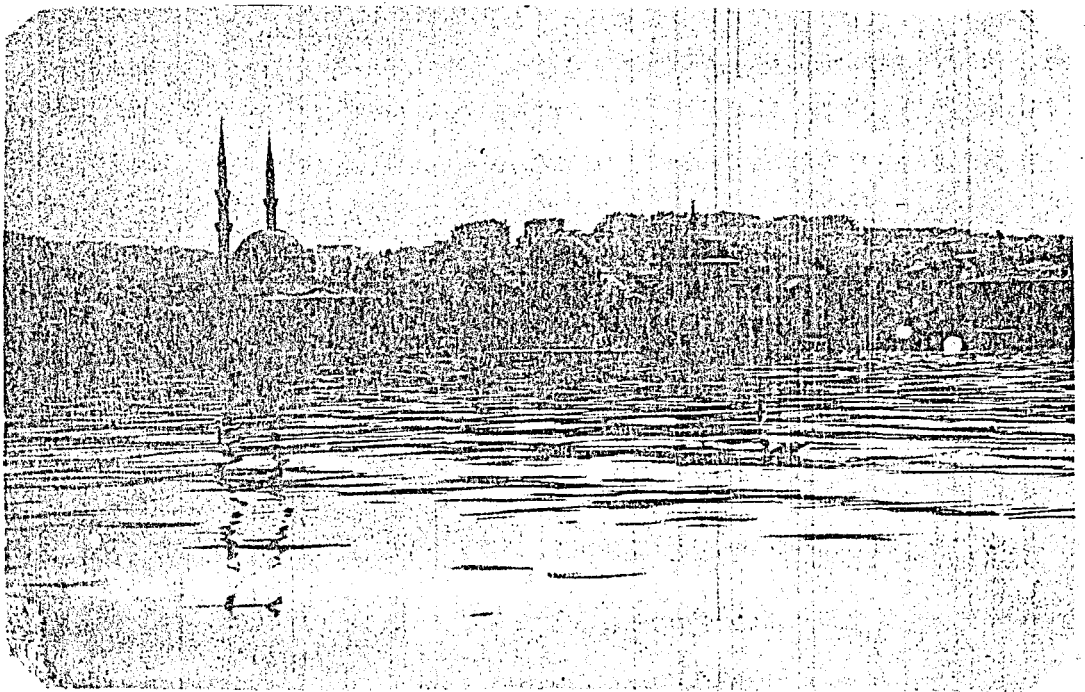


FIG.I.2 Historical view from Eyüp

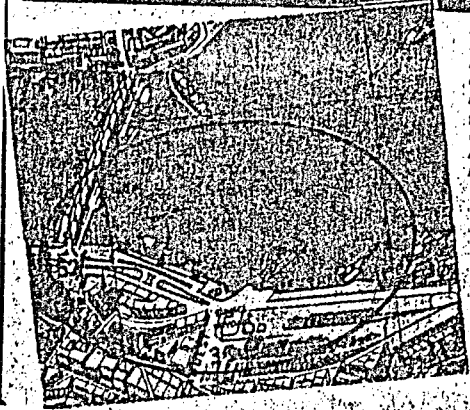
Over the years, industrial and domestic wastes, erosion, uncontrolled fill and garbage, shipyard wastes and sewage have polluted Haliç. So it has developed into an unbearable and unhealthy condition. Additionally, soft layers encountered in the vicinity of Haliç create special geotechnical problems to the area.

The soil conditions in Haliç will cause some geotechnical problems during dredging. Therefore, prior to any construction, development, alteration of conditions and dredging the existing soil conditions and soil properties should be determined in chapter II, the general geology of the area is documented. All previous borings drilled in the area are given. The soil conditions are determined based on the available informations. The average soil properties are estimated based on many measurements reported previously.

In chapter III, environmental problems of Haliç and water pollution is summarized. Also volume and location of previous dredgings and types are given.

The presence of soft fills brings a great deal of geotechnical problems to the area. The considerable amount of increase in thickness of this formation towards the sea causes stability problems, (Fig. I.3 , Fig. I.4). The geotechnical conditions in the vicinity of Haliç make necessary for a preliminary study of slopes before and during dredging. In chapter 4, stability of slopes are studied. Also computer program for slope stability (KÖSELER-I) is developed. It makes easier to solve and compute problems.

Based on the findings and the results of this study recommendations for future construction and to prevent critical situations during dredging are summarized in chapter 5.



Haliç'in, planda gösterildiği gibi, özellikle Eminönü ile Sirkeci arasındaki bölümlerdeki kayma daha belirgin şekilde oluyor. Sirkeci'deki arabalı vapur iskelelerinden birinde kayma yüzünden büyük çatlamlar meydana geldi. İstanbul Üniversitesi Yer Bilimleri Fakültesi öğretim üyesi Prof. Dr. Mehmet Akartuna, kullanılmaz duruma gelen iskelede incelemeler yaptı (yukarıda). (Ali BOSTANCI)

Haliç kıyıları denize kayıyor

Piza kulesi
gibi
binalar



Haliç'in Eminönü kıyısında bulunan ve "Yağ iskelesi" olarak bilinen kesimdeki 100'e yakın binanın denize kaydığı bildirildi. Duvarlarında derin çatlaklar meydana gelen ve denize eğilerek Piza Kulesini andıran binalarda oturulamayacağı ileri sürüldü.

Yağ iskelesinin denize kaydığı tespit edildi

HALIÇ YUTUYOR!

Fig.1.3 , 1.4 News from Turkish Newspapers about sliding of Haliç shores. (Milliyet, 1981 and Hürriyet, 1980)

CHAPTER II

GEOLOGY AND SOIL CONDITIONS

2 . I INTRODUCTION

In following chapters, the environmental problems and the relations with geotechnical problems in the vicinity of Haliç will be explained. In order to find reasonable solutions of the stability problems and to make reliable investments, geological conditions should be known. In this chapter geological conditions and geotechnical considerations in the vicinity of Haliç will be given. The extend of soil layering along Haliç will be given. Also geotechnical properties of each soil layer will be summarized.

2 . 2 GEOLOGY

The geology in the vicinity of Haliç has been studied by many investigators. One of them, Penck (1919), was first to recognize the graywackes, "Thrace series", as the oldest formations in the area. They belong to the Lower Devonian to Upper Devonian periods of Paleozoic era. After that Packelman (1925) changed that as upper Devonian. But the existence of various litological and paleontological zones in the Thrace series was indicated by later research. They belonged to the Lower Carboniferous (Upper Paleozoic) period of the same era.

Recently, a complete geological map of Haliç and its vicinity was given by Sayer (1976), Figure 2.1. It is seen from this figure that the oldest rocks in the area, in Upper Paleozoic (Lower Carboniferous) age and consist of shales and graywackes.

LÇEK SCALE

0 1000 1500 2000 m.

ARETİLER
e g e n d

-  Fay Fault
-  Doğrultu ve eğim Strike and dip
-  Alüvyon ve dolgu Alluvium and fill
-  Mactra'lı kalker Mactra limestone
-  Kil, marn Clays and marls
-  Kum, çakıl Sands and gravels
-  Kumtaşı, kil, marn Sandstones, clays, marls
-  Kalker, Grovak, Killişist Limestone, Gryw., Shales
-  Killişist, Grovak Shales and greywackes
-  Silisli gışt Silicified shales
-  Andezit, Diabaz Andesite, Diabase

Bakarköy Formasyonu Bakarköy Formation	SARMASİEN Sarmatian
Güngören Formasyonu Güngören Formation	
Çukurçeşme Formasyonu Çukurçeşme Formation	
Çamurluhan Formasyonu Çamurluhan Formation	TORTONİEN Tortonian
Cebeciköy Kalk., Gümüş D.Fm. Cebeciköy Lmst., Gümüş D.Fm.	DİNANSİEN Dinansian
Trakya Formasyonu Thrace Formation	
Baltalimanı Formasyonu Baltalimanı Formation	

Fig.2.1 Geological map of Halic and its vicinity (Sayar, 1976)

7

At the southern part of Haliç on the top of the Paleozoic formations the middle and upper Miocene formations of sand and gravels, clays and marls matrix limestones are encountered. Along the shore lines and below the water of Haliç and Creeks however, the Quaternary alluviums are found.

A . UPPER PALEOZOIC (Lower carboniferous)

Most of the information concerning this information is obtained from comparatively shallow borings and excavations a few meters deeps at various places in the Istanbul Area. In the detailed studied of recent years , the paleozoic formations in the vicinity of Haliç are classified.

Baltalimanı Formation :

This formation is observed at both sides of Northern part of the Bosphorus and around İçerenkoy. It consists of black silicified and intensively folded shales.

Trakya Formation :

Found in a large part of the area and consist of graywackes and shales. Some parts are decomposed by atmospheric effects taking on a green - grey or yellow-brown colour. The alternation of layers of coarse and fine grains shows the sedimentary structures such as cross-bedding, slumping etc.

Cebeciköy Limestone:

This formation found on top of Trakya Formation covers an area of about 1,000,000 square meters around Cebeciköy. It consists of crystallized massive limestones and dolomitic limestones containing numerous calcite veins.

Gümüşdere Formation :

It is observed that near Cebeciköy Formation and consist of shales, silicified shales and tuff.

B . MIDDLE AND UPPER MIOCENE

The formations belonging to the middle and upper Miocene are not common in the vicinity of Haliç. But middle Miocene (Tortonien) formation is encountered in a limited area near Çamurhan, 7 to 8 kilometers from Eyüp. The formation consists of grey coloured marls, sands, yellow coloured clays, micaons sand stones, and grenish sandy clays. The thickness of the formations was found to be 30 to 40 meters.

To the south and south west of Haliç the Paleozoic base is overlain by a thick upper Miocene (Sarmacien) formation. It is thickness reaches 150 meters at places. Upper Miocene was divided into three units by Sayar (1976). Each unit has the name of the area where the characteristics of the unit is observed.

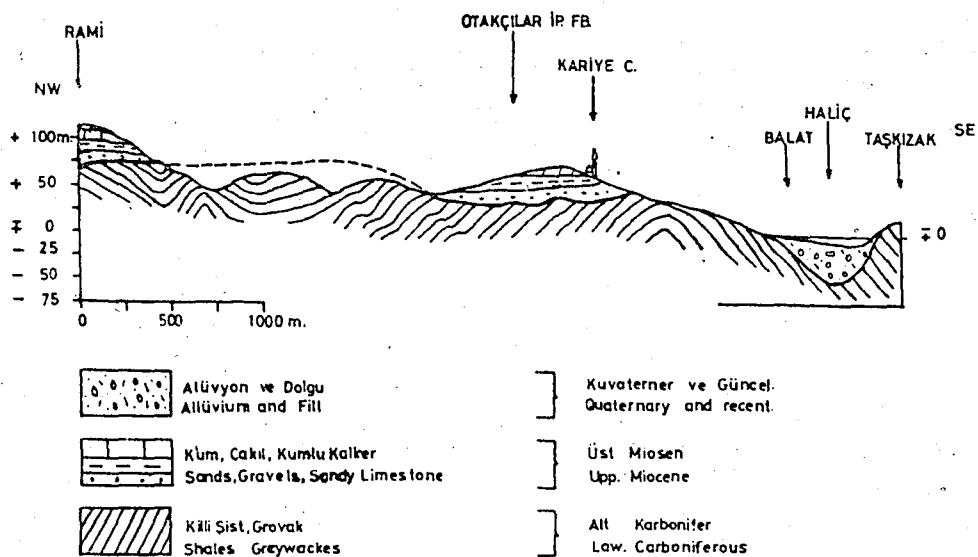


Fig 2.2 Geological cross-section between Rami-Taşkızak(Sayar,1976)

1) Sand and gravel beds of Çukurçeşme formation consists of fine sand bands and lenses.

2) Marl and green clay beds of Güngören formation are generally found on top of the sand and gravel beds. At the western part of the walled city marl and clay bed are overlain by limestone beds. Güngören formation consist of vertebrate and mollusc fossils.

3) Limestone beds of Bakırköy formation may easily be recognized by the variety of macra species they contain. Thick beds of limestone exist in the Bakırköy area.

C. QUATERNARY AND CURRENT SEDIMENTS (Recent) :

The youngest geological formations in the area are alluviums in the beds of creeks and sediments at the shore of Haliç and the bottom of the sea. Artificial fills along the shore will be classified in this group also. These may be classified according to their characteristics as follows:

a) River Alluviums (Flood-plain deposits):

They are observed in the bottoms of the valleys of Alibey and Kağıthane Creeks. They are commonly consist of continuous layers of sand and clay laid down during the high-water season.

b) Marine Deposits :

At the shores and the bottom of Haliç on the paleozoic base a silty-clay layer containing marine organism is found. The extent of these sediments might be overlooked since the coast line has been greatly changed over the years. The thickness of this layer varies from 1 to 12 meters at the shores and 40 to 50 meters at the bottom of Haliç.

c) Bottom Sludge (Recent) :

Borings carried out in the middle part of Haliç showed the existence of a mud layer. The thickness of the bottom sludge decreases near the shores. It is formed by sedimentation of eroded materials and pollutant in the water. It is also explained in chapter III.

d) Artificial fills (Recent):

They are found at the shores and around Haliç just below the ground level. They consist of stones, bricks, pieces of concrete, wood, rubble, etc. The thickness of that decreases away from the shore line. Between Galata and Unkapanı Bridges, the thickness of artificial fills are 30 - 40 meters.

2 . 3 SOIL CONDITIONS

There have been many geotechnical investigations related to various constructions at the vicinity of Haliç. The locations of some of the boreholes drilled for the determination of soil condition in these investigations are shown in Fig. 2. and table 2.I

These boreholes are shown in Appendix A.

Also a list of these borings with their references are given in table 2.I. 12 typical geotechnical cross-sections, along Haliç, determined from the results of these borings are given^{as} Figures in Appendix.

TABLE 2.1

LIST OF GEOTECHNICAL BORINGS LOCATED IN THE VICINITY
OF HALIÇ

Boring Group No	LOCATION	REFERENCE
I	Silahtaraga Power Plant	Peynircioğlu, 1975
2	Istanbul Mill , Sütluçe	Peynircioğlu, 1965
3	Golden Horn Bridge	S. Maden, 1975
4	Istanbul Sewage Project	Temel Araştırma, 1982
5	Istanbul Sewage Project	CAMP-TEK-SER-1974
6	Taşkızak Shipyard, Hasköy	Special Report
7	Camialtı Shipyard, Kasımpaşa	Special report
8	Haliç Shipyard, Azapkapı	Special report
9	Draper Market, Unkapani	Sayar, 1962
IO	Social Security Department Complex, Unk.	Peynircioğlu, 1973
II	Chamber of Commerce House, Eminönü	Peynircioğlu, 1973
I2	Preliminary Subway Study	Sayar, 1962
I3	Preliminary Subway Study (1978)	General Dir.Of Highway
I4	Silahtaraga Stell Plant, Alibeyköy	Special Report

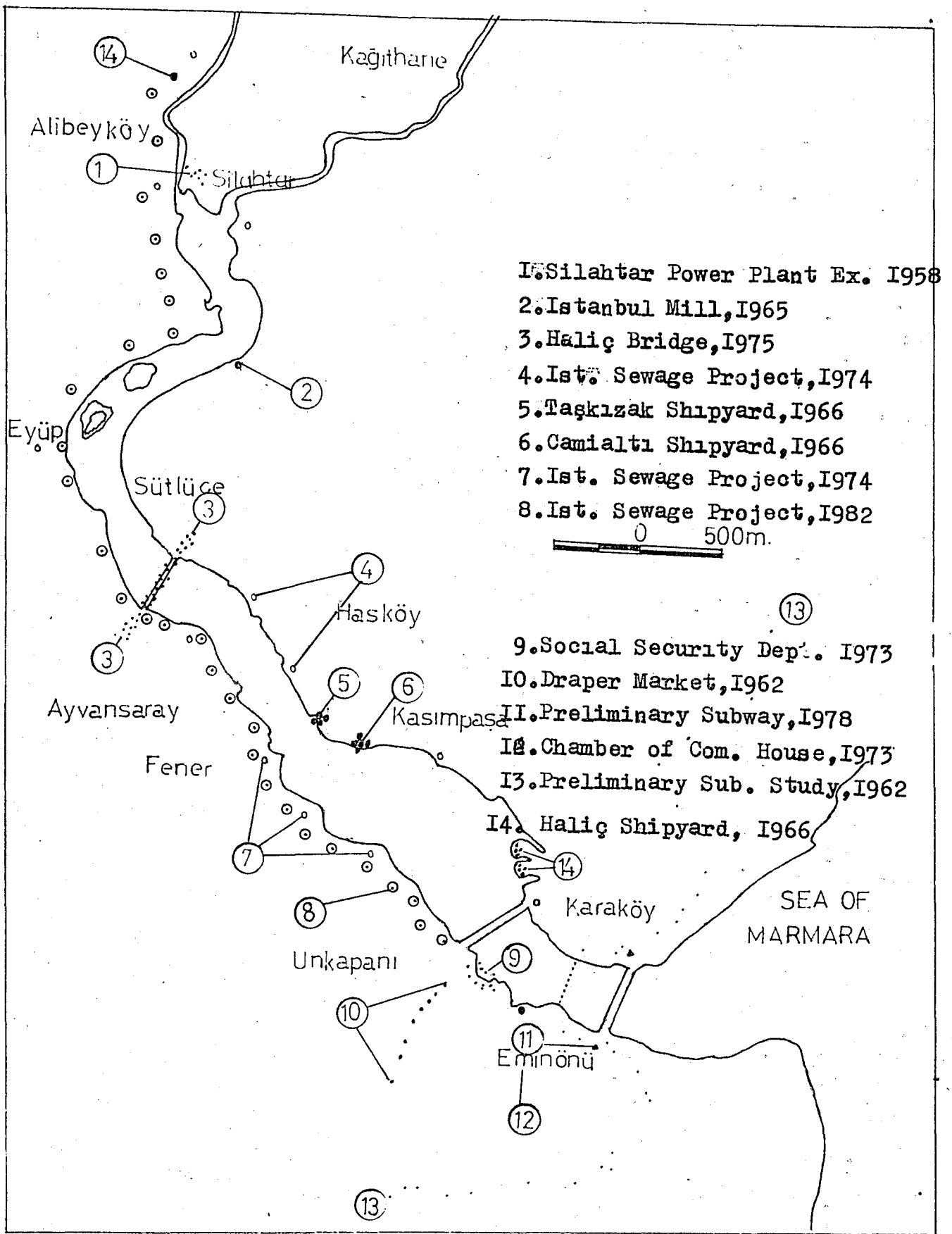


Fig.2.3 Geotechnical Borings Located In
The vicinity of Haliç

A. BEDROCK FORMATION

It is seen from cross-sections the depth of the bedrock formation varies considerably at various locations and the dipping of the bedrock surface towards the sea varies between 20 and 45 degrees. This steep slope is the main cause of lateral movements across the shore.

The graywackes and shales contain local fault zones with various strike planes and dip angles. The layers which are close to the surface are highly weathered and fractured. The colour of the weathered parts are yellow and brown.

The thickness of the weathered zone of the graywackes and shales is not homogenous, but varies from place to place. The thickness of the weathered zone of the graywacke, in Eminönü, 30 meters. (Sayar, 1975) It decreases along upper part of Haliç. As a result, the graywacke formation is mainly fissured and upper part is decomposed.

The engineering properties of the graywackes and shales have been investigated by many researchers. The engineering properties and unconfined compressive strengths of graywacke samples, from two different locations, are given table 2.2, (Togrol, 1975).

Table 2.4

STRENGTH TEST ON GRAYWACKE SAMPLES (Togrol, 1975)

	Zeyrek Under-ground Passage Construction	Test pit near Istanbul Technical Univers.	Zincirlikuyu Office Building Construction
Depth, m	4-6	0-2	6-10
γ_n , gr/cm ³	2.36-2.46	2.38-2.54	2.42-2.54
γ_s , gr/cm ³	2.74	2.78-2.82	2.78-2.80
w, %	7.3-8.3	2.31-8.05	5.92-7.23
n, %	0.175-0.185	0.142-0.170	0.142-0.195
e, %	0.212-0.227	0.166-0.205	0.170-0.242
γ_{dry} , gr/cm ³	2.23-2.26	2.32-2.40	2.26-2.40
s, %	98.5-100.0	32.5-100.0	83.5-97.6
γ_n , Natural Unit Weight γ_s , Unit Weight of solid particul. n, Porosity e, Void Ratio s, Degree of Saturation w, Water Content			

B . SEDIMENTARY LAYERS-QUATERNARY AND RECENT
ALLUVIUMS

I) Artificial fills:

The thickness of such fills decreases with increasing distance from the shore. Along Haliç shores, artificial fills vary in thickness from a few meters to almost 40 meters. The artificial fill contains gravels, sand, boulders, silt, shells, wooden pieces, concrete and all kind of city debris.

The existence of this uncontrolled fill is very important from various points:

i) The thickness of the fill increases towards the sea. Therefore, it causes uneven settlements for buildings constructed on top of the fill layer.

ii) The properties of this fill is not known and varies considerably from one point to another. The properties of some of them are given in table 2.5.

iii) The existence of this layer in land alter the grey silty clay properties due to consolidation of silty clay under the the weight of the fill.

Fig. 2.4 Borings taken from Haliç Shipyard (special report, 1966)

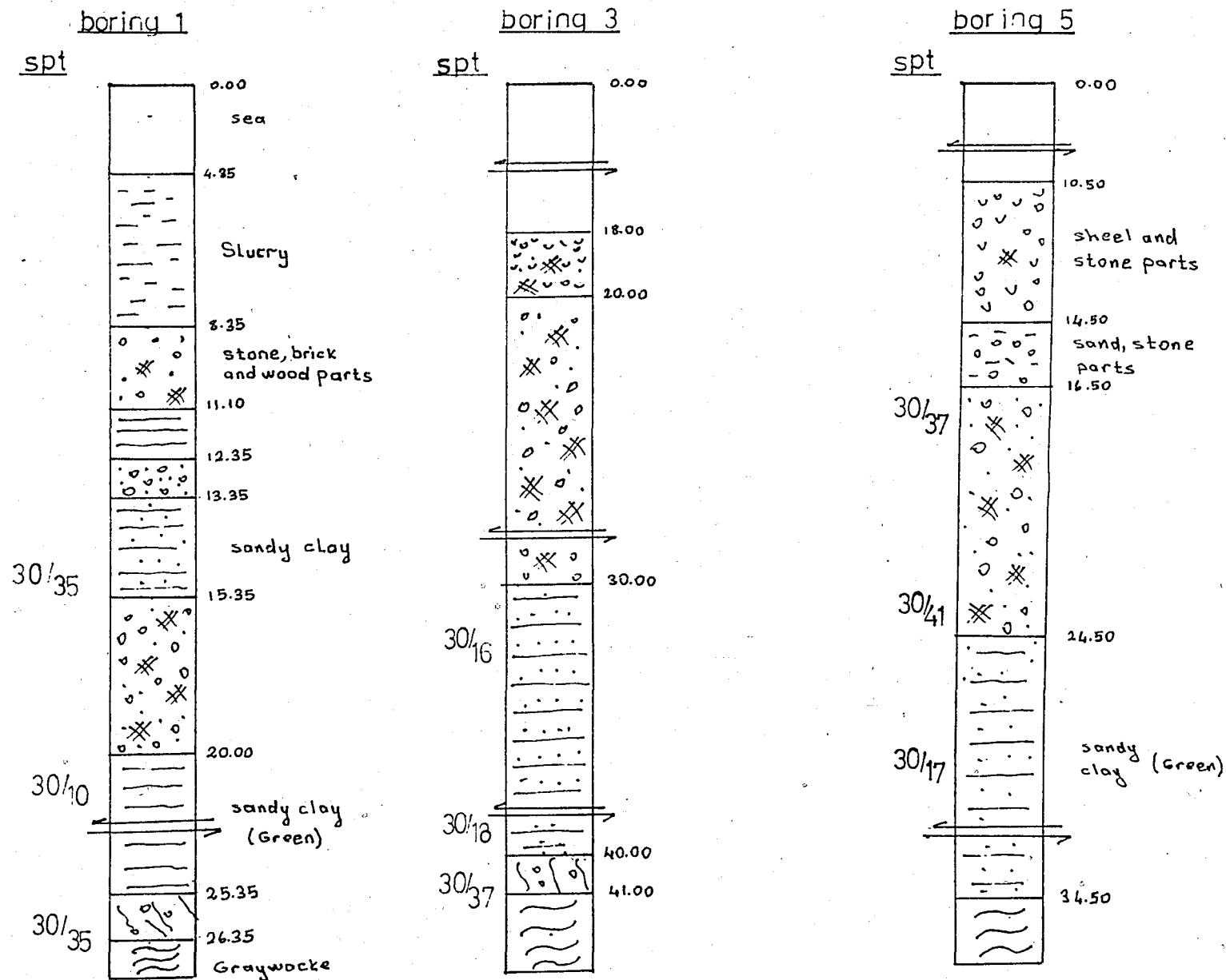


Table 2.5

LAB. REPORTS TAKEN FROM HALIÇ SHIPYARD BORINGS
(Special Report, 1966)

Boring No:	Depth, m.	W_L	W_p	I_p	W_n	γ_s
I	18.00	35	21.7	13.3	36.9	2.7
3	23.00	-	-	-	-	2.78
5	18.00	61	30.3	30.7	33.4	2.73
W_L , Liquid Limit W_p , Plastic Limit I_p , Plasticity Index W_n , Natural Water Content γ_s , Unit Weight of Solids γ_n , Natural Unit Weight						

Table 2.6

Boring No:	q_u , kg/cm ²	γ_n , t/m ³
I	0.06	1.73
q_u , Unconfined Compressive Strength		

Fig.2.5 Borings taken from Taskızak Shipyard (special report, 1980)

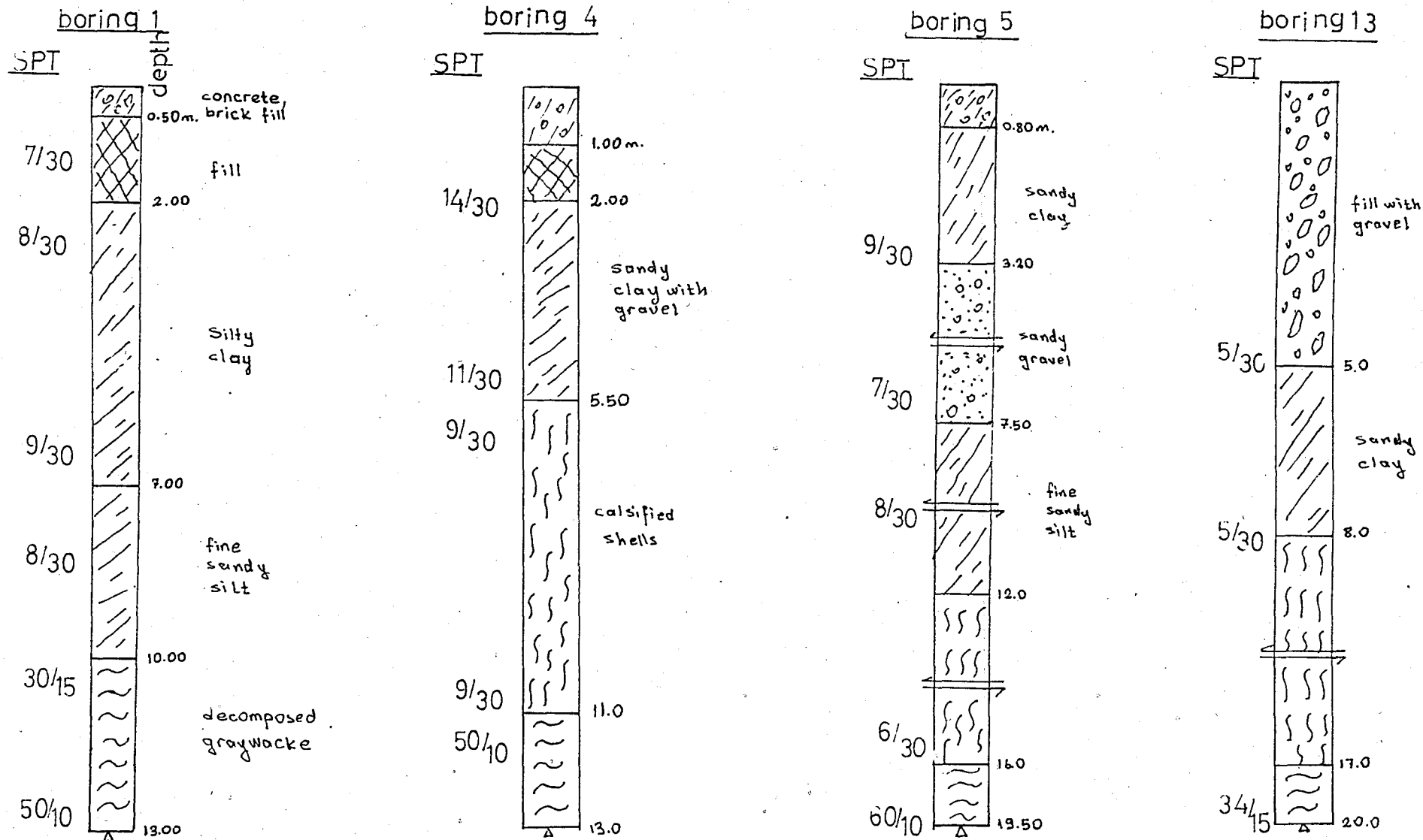


Table 2.7

LAB. REPORTS TAKEN FROM TAŞKIZAK SHIPYARD BORINGS

(Special Report, 1980)

	Boring No:1 (Depth 3m.)	Boring No:4 (Depth 3m.)	Boring No:5 (Depth 3m.)	Boring No:13 (Depth 3m.)
W_n (%)	21.4	18.4	21.3	22.0
W_l (%)	30.9	28.0	27.1	32.7
W_p (%)	19.0	15.00	19.6	22.3
I_p (%)	11.9	13.4	7.5	10.4
I_c (%)	0.85	0.74	0.77	1.03
ϕ_u (°)	12 (.)	7 (..)	-	27 (.)
c_u	0.60 (.)	0.30 (..)	-	0.20 (.)
W_n (%)	20.4 (.)	20 (..)	-	20.60 (.)
γ_n	1.97(.)	2.07(..)	-	1.97(.)

(.) Quick Shear Test

(..) Triaxial Test

2) Sedimentary Layers :

The sedimentary layers which are found under the artificial fill consists of sandy, clayey silts, contain large amount of organic matter and shells. The thickness of this layer varies from 6.0 meters, near Galata Bridge, up to 35.0 meters, near the Creek outlets. (Kumbasar and Ülker, 1975)

This formation contains organic matters in high percentage and the water content is around Liquid Limit.

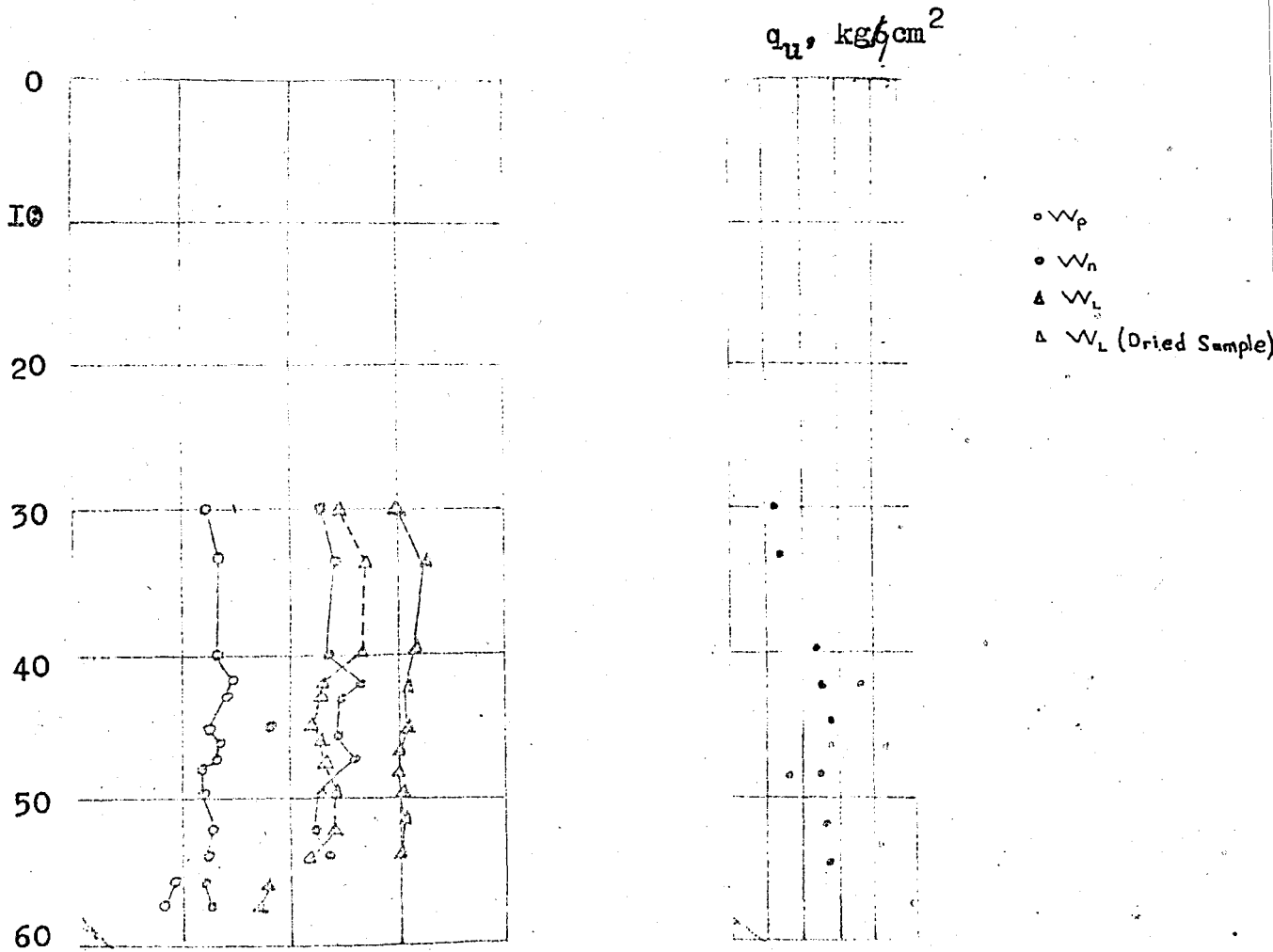


Fig Unkapanı, Properties of samples (Peynircioğlu, 1961)

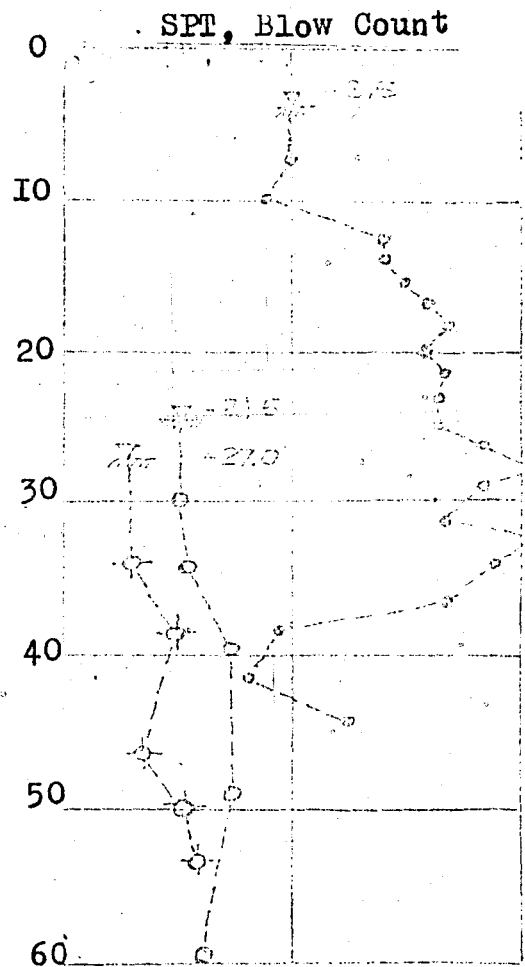
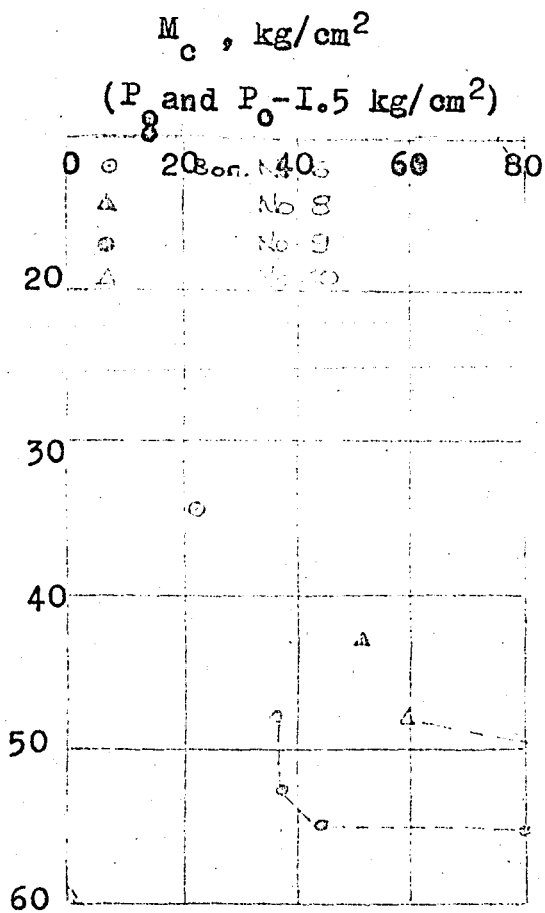


Fig. 2.6 Unkapanı, Properties of samples (Peynircioğlu, 1961)

Borings which were carried out at Silahtaraga Power Plant shows that Natural Water Content is nearly equal to liquid limit. (Table 2.8)

Table 2.8

Properties of samples taken from Silahtaraga
Power Plant, Toğrol, 1967

Sample	Depth, m	W_n (%)	W_l (%)	c , kg/cm ²
3/6	9	82	96	0.10
3/10	17	79	94	0.10
4/1	5	88	91	0.13
9/7	20	67	83	0.10
9/6	18	73	77	0.10
7/8	18	61	61	0.10
7/6	14	60	60	0.10
16/4	8	92	56	0.05
7/5	12	61	55	0.12
9/3	12	46	51	0.20
7/1	4	55	45	0.45
1/1	2	39	38	0.40

Also, typical variation of test results on samples obtained from boring No: I at Hasköy Şark Değirmenleri site is given in Table 2.9 . (Toğrol, 1967)

Table 2.9						
Laboratory Test Result on Samples Obtained From Hasköy Şark Mills (Toğrol, 1967)						
No.of Samp.	Depth (m.)	W_L (%)	W_p (%)	I_p (%)	W_n (%)	q_u kg/cm ²
I	I3	68	34	34	54	0.7
2	I6	73	35	39	53	0.7
3	I8	72	35	32	53	0.7
4	20	75	37	40	60	0.4
5	22	72	35	35	61	0.6
6	24	77	35	42	62	0.3
7	26	76	36	40	61	0.7
8	28	70	36	34	55	0.8
9	30	63	32	31	50	0.8
I0	33	64	34	30	50	I.0

There are great amount of information related to the properties of sedimentary layer. These values from various sources are systematically compiled and represented in Table 2.10 .

Table 2.10

Average Properties of Samples

Obtained at Various Sites

Location	Depth (m.)	W_L (%)	W_P (%)	W_n (%)	q_u (kg/cm ²)	Reference
Eyüp, Hasköy, Süt lülce	0-60	60-80	30-40	50-75	0.15-1.	Peynirci, 1962
Sütülce, Ist. Mill	-	85-90	40-45	60	0.2-0.3	Toğrol, 1975
Taşkızak Shipy.	12-35	50	27	50-66	0.64	Spe. Report
Unk., Old Found.	30-60	50-60	25	50	0.2-1.	Peynirci, 1961
Silahtarğa Power Plant	0-30	40-95	31	70	0.2-1.	Peynirci, 1961
3. Haliç Bridge	0-60	50-65	20-27	50-65	0.4-0.8	Dada, 1970
Extension of Power Plant	-	67	31	67	0.1-0.2	Toğrol, 1975
Hasköy Şark Mills	0-50	70-80	35	50-60	0.5-1.0	Peynirci, 1965

 W_n , Natural Water Content W_L , Liquid Limit W_P , Plastic Limit q_u , Unconfined Compressive Strength

The oedometer tests indicate that the clay is in a Normally Consolidated state. The sensitivity of the clay ranges between 3 and 6 which indicates that a large deformation of the clay can cause a decrease in the strength of the soil layer (Toğrol, 1975).

Also, Tests conducted on the samples obtained from Taşkızak Shipyard Borings are seen in table 2.II .

Table 2.II				
Laboratory Test Results on Samples Obtained from Taşkızak Shipyard, (Special Report, 1980)				
	Boring I (10.90)	Boring 4 (5.00m.)	Boring 5 (16.50m.)	Boring I3 (18.50m.)
w_n	15.0	21.5	22.9	20.7
w_l	32.3	34.3	37.0	34.2
w_p	21.7	18.8	18.6	17.6
I_p	10.6	15.5	18.4	16.6
I_c	1.63	0.83	0.77	0.81
γ_s	-	-	2.86	-
$\phi_u (.)$	-	-	0	1
$c_u (.)$	-	-	0.50	0.68
$\gamma_n (.)$	-	-	2.06	2.1
$\phi_u (..)$	-	-	21	27
$c_u (..)$	-	-	0.50	0.20
$\gamma_n (..)$	-	-	1.74	1.97

CHAPTER III

WATER POLLUTION AND DREDGING OF BOTTOM SLUDGE

3.1 WATER POLLUTION

The history of the water pollution in the vicinity of Haliç goes back to 15th century. The problem was erosion on the hills of Kağıthane and Alibeyköy Creeks and accumulation of eroded material on the bottom of Haliç. After 1950, industrial settlements have started in the vicinity of Haliç and environmental pollution has been observed.

The water body in Haliç is the mostly polluted part of vicinity. The rate of pollution increased by increase of population and industrial settlement and the problem developed into an unbearable and unhealthy conditions.

The main causes of the water pollution may be stated as follows:

I. Industrial Wastes: About hundred plants are giving their wastes directly to Haliç and Creeks. The water pollution due to industrial activities is equal to the pollution due to 3 million population, (Kor, 1975). Industrial wastes are polluting Haliç physically, chemically, chemically, and biologically. Values of basic parameters of water pollution at certain locations in Haliç are given in table 3.1 Karpuzcu (1974), Baykut (1946) and Kor (1963) .

Table 3.I

VALUES OF BASIC PARAMETERS ON WATER POLLUTION

Location	Water Depth	Turbidity (cm)	Temperature in April	Dissolved Oxygen (mgr/lt)	Heavy Metals		BOD (mgr/lt)
					Zn	Cd	
Kağıthane Creek	1.0	20	20	1.1	0.21-.73	0.0	-
Alibeyköy Creek	0.9	24	24	1.4	0.03-.11	0.0	10.0
Eyüp-Sütlüce	3.1	20	18	0.35	-	-	15.0
Haliç Bri.	3.3	22	18	0.30	0.05-.07	0.05	8.5
Atatürk Bridge	27.5	100	15	1.9	-	-	-
Galata Bridge	26.0	130	14	4.0	0.02	0.05	3.5

2. Domestic Wastes : The other important pollutant of the water in Haliç is domestic wastes of 600.000 population in the vicinity. Most of the districts in the vicinity are in lack of a proper sewage system. A new sewage system is designed by DAMOC (1971) and it is modified by CAMP-TEKSER (1975). The wastes which cannot be treated biologically must be treated previously in discharging plants. Haliç district has the third priority in the construction schedule of the project. Therefore, the water pollution by domestic wastes will continue for a period of time, (Fig. 3.I) .

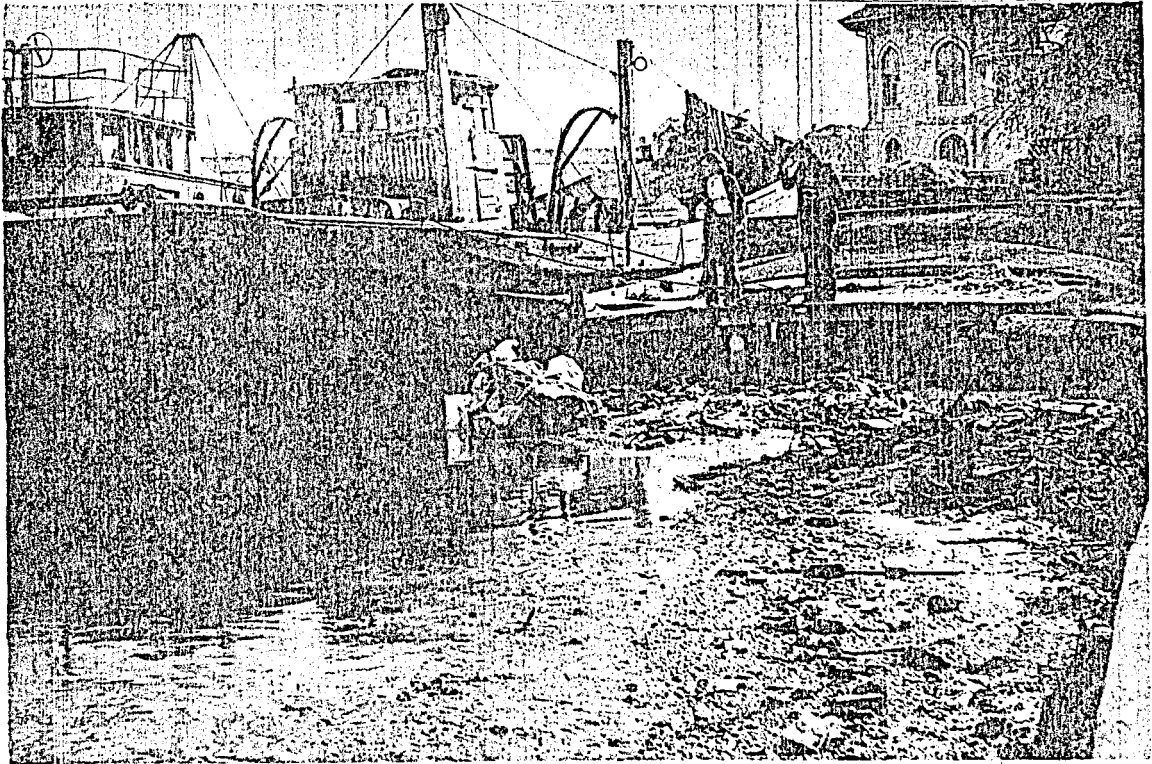


Fig. 3.I Domestic wastes on the shore at Eyüp

3. Erosion and Sedimentation : Fine materials of the steep hills of Alibey and Kagithane Creeks are transported during rainy seasons and sedimented at the bottom of Haliç at a rate of 10 cm. per year and constitute almost all of the sedimented material. These sediments are called Bottom Sludge and contains organic materials and heavy metals. These contents contribute also to the pollution of the water and the geotechnical problems of the area, (Fig.3.2).

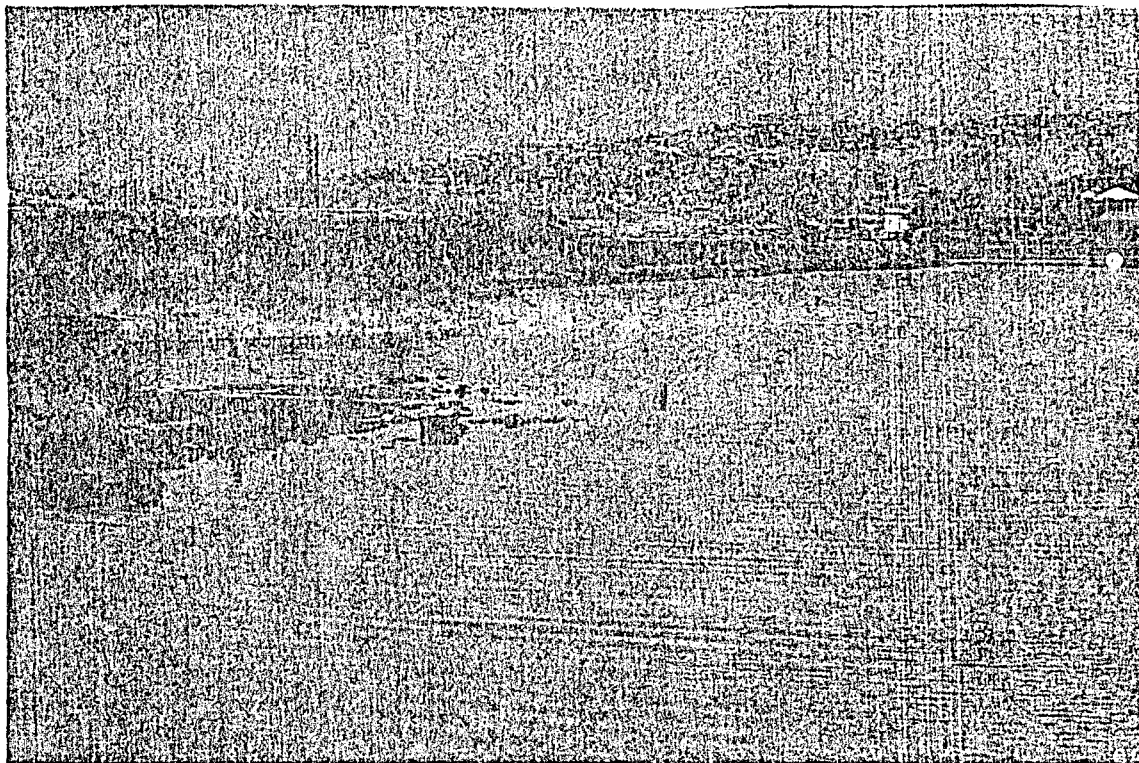


Fig.3.2 Sedimentation in Haliç, near Sötlüce

4. Ships and Wrecks: Ships are polluting the water by their wastes and abandoned wrecks impede the circulation of water in Haliç, (Fig.3.3).

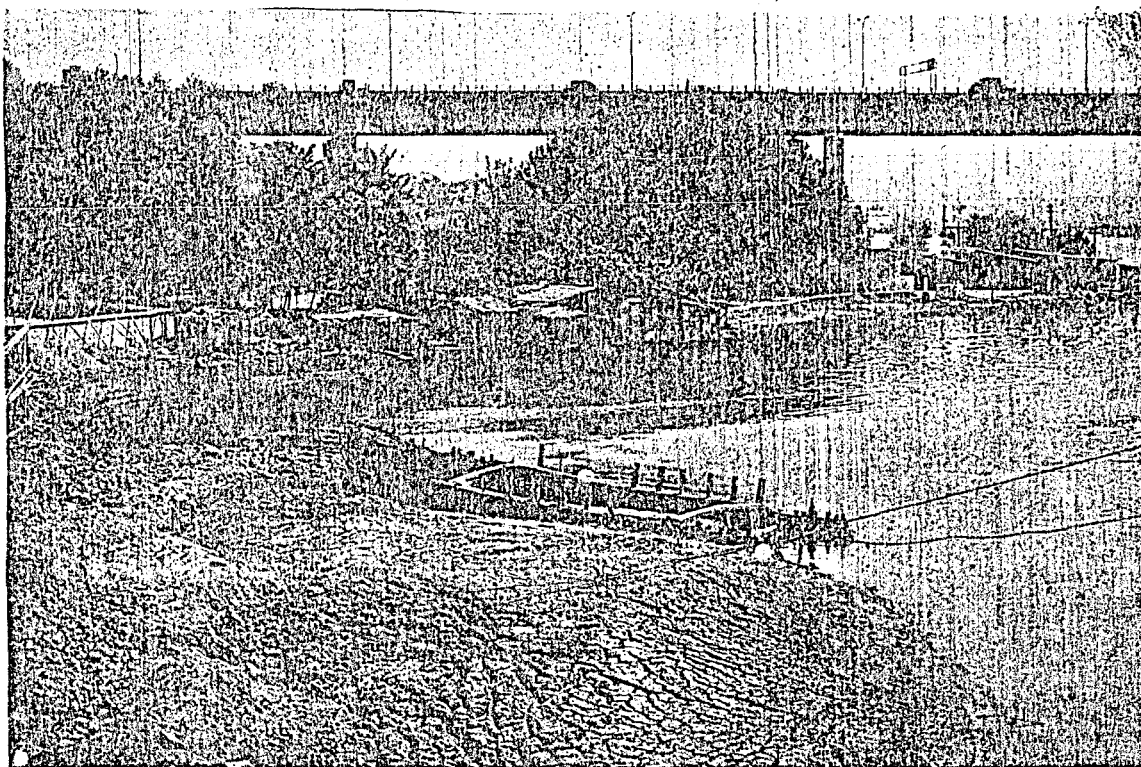


Fig. 3.3 An abandoned wreck on the shore

3.2 DREDGING OF BOTTOM SLUDGE

Based on numerous measurements at various times it has been determined that sedimentation of fine materials is on the order of 10 cm. per year. Therefore, it may be concluded that due to sediments a total of 260.000 m^3 of fine material is transported by the creeks to Haliç every year.

The bottom sediments have basically three undesired features :

1. They contribute to the pollution of the water.
2. They impede sea transportation to the area.
3. They contribute a great deal to the geotechnical problems of the area.

These sediments are almost in a liquid state in the upper 5 to 7 meters zone and have unit weight of $\gamma = 1.10$ to 1.15 t/m^3 (Becan, 1974)

The geographical location of Haliç is providing many facilities in the sea transportation if the industrial plants keep their existence in the area, the sea transportation on Haliç will be the cheapest way for the transportation of raw materials and goods.

The present conditions are not suitable for an efficient sea transportation in Haliç. So the dredging of bottom sludge to obtain sufficient depth and to prevent pollution of water are necessary. But the geotechnical conditions in the vicinity of Haliç makes a preliminary study about stability of shores necessary.

There are many types of dredging equipment for different materials to be dredged. Over $1.000.000 \text{ m}^3$ of dredging was done in previous years in Haliç, (Table 3.2).

The amount of accumulation of sedimented material will decrease to 200.000 m^3 per year after the completion of Alibeyköy Dam construction. The amount of material to be dredged is about 2.5 million m^3 in Haliç, (Arıcan, 1976). Therefore, total volume of material will be 3.5 million m^3 at the end of the next four years.

Table 3.2		
Volume and Location of Previous dredgins in Haliç (Arıcan, 1976)		
Location	Year	Volume, m ³
Sütlüce-Silahtar	1961	494.000
Hasköy-Halıcıoğlu	1965	250.000
Alibey Creek	1965	25.000
Eyüp - Silahtar	1974	330.000
TOTAL	-	1.094.000

Since the bottom sludge and underlying clay formation are very soft and very weak, stability of these formations should be evaluated. Also the stability of shores should be considered before dredging, (See chapter 4 and 5).

CHAPTER 4

SLOPE STABILITY

4.1 INTRODUCTION

Every mass of soil located beneath a sloping ground surface or beneath the sloping sides has tendency to move downward and outward under the influence of gravity. If this tendency is counteracted by shearing resistance of the soil, the slope is stable. Otherwise a slide occurs.

The failure of a mass of soil located beneath a slope is called a "Slide". Usually, slides are due to excavation or to undercutting the foot of an existing slope. Slides may occur in almost every conceivable manner, slowly or suddenly.

4.2 SLIDES IN COHESIVE SOILS

A cohesive material having a shearing resistance, s ,

$$s = c + p \tan \phi \quad \dots\dots\dots(4.1)$$

where c denotes cohesion

p denotes normal stress

ϕ denotes angle of shearing resistance.

can stand with a vertical slope at least for a short time, pro-

vided the height of the slope is somewhat less than critical height, H_c . If the height of a slope is greater than H_c , the slope is not stable unless it makes an angle with the vertical. If the height is very great compared to H_c , the slope will fail unless the slope angle is equal to or less than ϕ .

If the failure occurs along a surface of sliding that intersects the slope at or above its toe (Fig. 4.1a), the slide is known as a "Slope Failure". On the other hand, if the soil beneath the level of the toe of the slope is unable to sustain the weight of the overlying material, the failure occurs along a surface that passes at some distance below the toe of the slope. A failure of this type is known as "Base failure", Fig(4.1b).

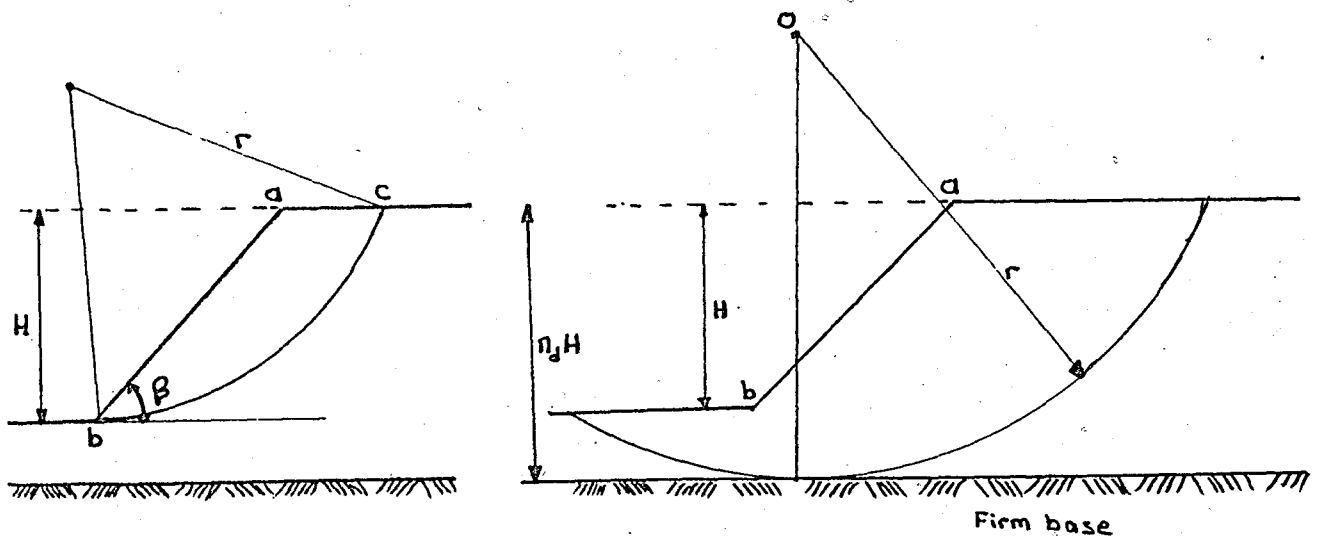


Fig. 4.1 Position of critical circle for (a) slope failure (b) Base failure

4.3 PROCEDURE FOR INVESTIGATING STABILITY OF SLOPES

The general procedure is to determine the position of the surface of the sliding; to estimate the weights of the various parts of the sliding mass that tended to procedure or to oppose the slide; and to compute the avarage shearing resistance,s,of the soil necessary to satisfy the conditions for equilibrium of the mass.

In order to investigate whether or not a slope on soil with known shear characteristics will be stable, it is necessary to determine the diameter and position of the circle that represent the surface along which sliding will occurs. This circle known as the " Critical Circle ", must satisfy the requirement that the ratio between the shearing strength of the soil along the surface of sliding and the shearing force tending to produce the sliding must be a minimum.

After the diameter and position of the critical circle have been determined, The Factor of Safety, F , of the slope with respect to failure may be computed.

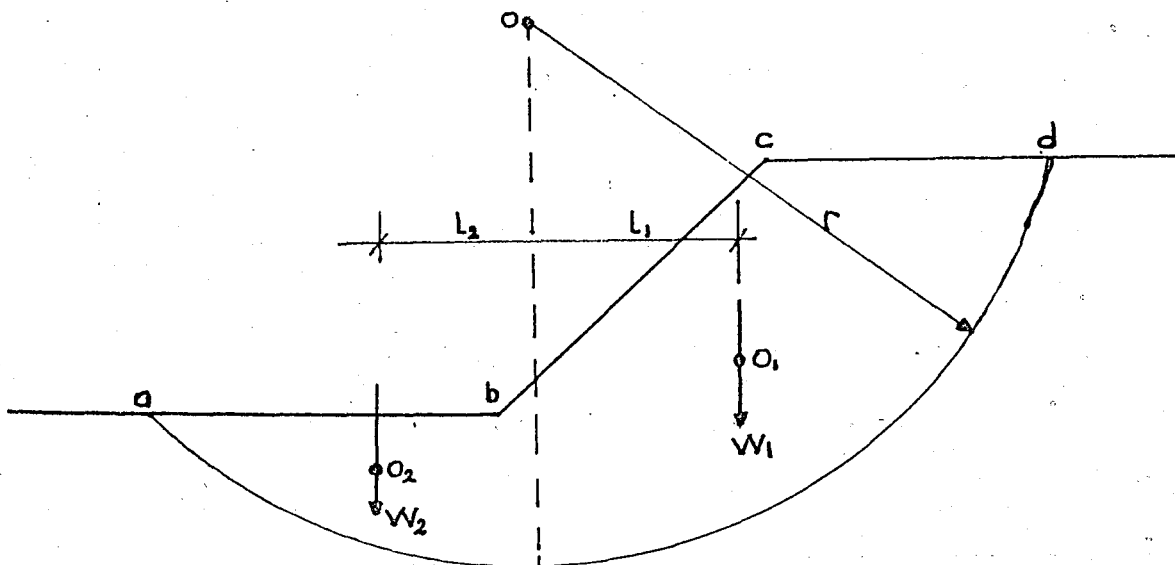


Fig. 4.2 Slope Failure

$$F = \frac{sr \widehat{da}}{W_1 l_1 - W_2 l_2} \dots\dots\dots(4.2)$$

Where r denotes the radius of the critical circle

$\widehat{da}$ denotes the length of the surface of sliding.

The slope stability may be investigated by trial. To make the investigation by trial, different circles are selected, each representing a potential surface of sliding. For each circle, the value of F (Eq.4.2) is computed. The minimum value represents the factor of safety of the slope with respect to sliding, and the corresponding circle is the critical circle.

4.4 SLOPES ON SOFT CLAY

The average shearing resistance, s , per unit of area of a potential surface of sliding in homogenous clay under undrained conditions ($\phi = 0$) :

$$s = \frac{1}{2} q_u = c \dots\dots\dots(4.3)$$

q_u denotes Unconfined Compressive Strength

c denotes Cohesion.

If c is known, the critical height H_c of slope having a given slope angle β can be expressed by the equation,

$$H_c = N_s \frac{c}{\gamma} \dots\dots\dots(4.4)$$

where N_s denotes stability factor.

N_s is a pure number. Its value depends only on the slope angle β and on the depth factor n_d (Fig.4.1b) which express the

depth at which the clay rests on a firm base. If a slope failure occurs, the critical circle is usually a " Toe Circle " that passes through the toe of the slope. However, if the firm base is located at a short distance below base the level of toe , the critical circle may be a " Slope Circle " that is tangent to the firm base and that intersects the slope above the toe.

The position of the critical circle with reference to a given slope depends on the slope angle β and the depth factor n_d .

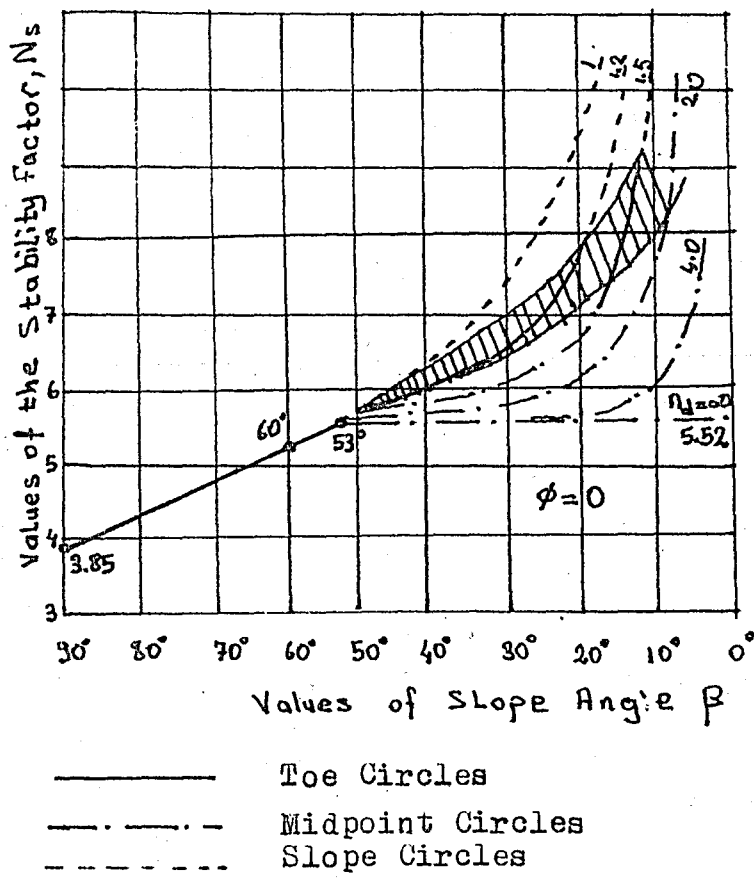


Fig. 4.3 Relation between slope angle and stability factor N_s , for different values of depth factor n_d (After Taylor, 1937)

According to fig.4.3 , the failure of all slopes rising at an angle of more than 53° occurs along a toe circle. If β is smaller than 53° , the type of failure depends on the value of the depth factor n_d and, at low values of n_d , also on the slope angle β . If n_d is equal to 1.0 , failure occurs along a slope circle.

If n_d is greater than about 4.0 , the slope fails along a midpoint circle tangent to the firm base. If n_d is intermediate in value between 1.0 and 4.0 , failure occurs along a slope circle if the point representing the values of n_d and β lies above shaded area in Fig. 4.3 . If the point lies within the shaded area, failure occurs a toe circle.

4.5 THE USE OF THE SLIP CIRCLE IN THE STABILITY ANALYSIS OF SLOPES

A. If slope is located above water table:

If a slope has an irregular surface that cannot be represented by a straight line , or if the surface of sliding is likely to pass through several materials with different values of c and ϕ , the stability can be investigated conveniently by the " Method of Slices " . According to this procedure , a trial circle is selected, (fig 4.4), and the sliding mass subdivided into a number of vertical slices 1,2,3 etc.

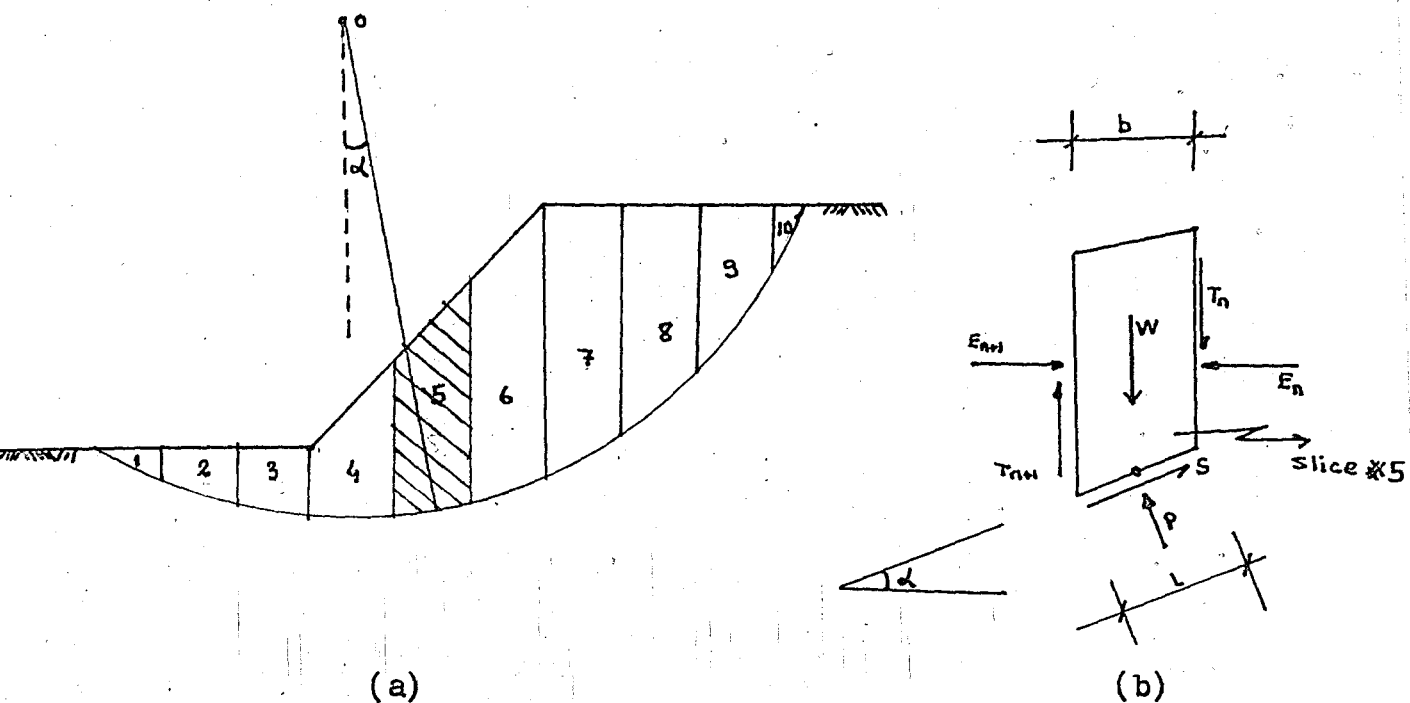


Fig 4.4 Method of slices for investigating equilibrium of slope located above water table

Each slice , such as slice 5 shown Fig 4.4b, is acted upon by its weight W , by shear forces T and normal forces E on its sides, and by a set of forces on its bases. These include the shearing force S and the normal force P .

The forces on each slice must satisfy the conditions of equilibrium. However, the forces T and E depend on the deformation and the stress-strain characteristics of the slice material and cannot be evaluated rigorously. They can be approximated with sufficient accuracy for practical purposes. The simplest approximation consists of setting these forces equal to zero. Under these circumstances, if the entire trial circle is located above water table and there no excess pore pressures?

The equilibrium of the entire sliding mass requires that

$$r \leq W \sin \alpha = r \leq S \quad \dots\dots\dots(4.5)$$

If s is the shearing strength of the soil along t , then

$$S = \frac{s}{F} L = \frac{s}{F} \frac{b}{\cos \alpha} \quad \dots\dots\dots(4.6)$$

and

$$r \leq W \sin \alpha = \frac{r}{F} \leq \frac{s b}{F \cos \alpha} \quad \dots\dots\dots(4.7)$$

Whence

$$F = \frac{\leq (s b / \cos \alpha)}{\leq W \sin \alpha} \quad \dots\dots\dots(4.8)$$

The shearing strength s , however, is determined by

$$s = c + p \tan \phi \quad \dots\dots\dots(4.9)$$

Where p is the normal stress across the surface of sliding l .

To evaluate p we consider the vertical equilibrium of the slice (Fig 4.4b), whence

$$W = S \sin \alpha + P \cos \alpha \quad \dots\dots\dots(4.10)$$

$$P = \frac{P}{L} = \frac{P \cos \alpha}{b} = \frac{W}{b} - \frac{S}{b} \sin \alpha \quad \dots\dots\dots(4.11)$$

therefore

$$s = c + \left(\frac{W}{b} - \frac{S}{b} \sin \alpha \right) \tan \phi = c + \left(\frac{W}{b} - \frac{S}{F} \tan \alpha \right) \tan \phi \quad \dots\dots\dots(4.12)$$

and

$$S = \frac{c + (W/b) \tan \phi}{1 + (\tan \alpha \tan \phi) / F} \quad \dots\dots\dots(4.13)$$

Let

$$m_{\alpha} = \left(\frac{F + \tan \alpha \cdot \tan \phi}{F} \right) \cos \alpha \dots \dots \dots (4.I4)$$

Then

$$F = \frac{\frac{[c + (w/b) \tan \phi] b}{m_{\alpha}}}{\sum W \sin \alpha} \dots \dots \dots (4.I5)$$

Equation 4.I5, which gives the factor of safety, F , for the trial circle under investigation contains on the right-hand side the quantity m_{α} (Eq.4.I4) which is itself a function of F . Therefore Eq.4.I5 must be solved by successive approximations in which a value of $F = F_I$ is assumed and used for calculation of m_{α} , whereupon F is then computed. If the value of F differs significantly from F_I , the calculation is repeated. The calculations are facilitated by the chart from which values of m_{α} can be taken, (Janbu, 1956)

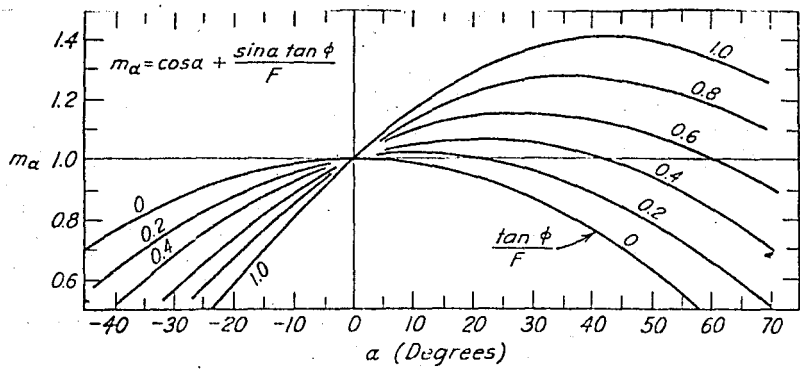


Fig 4.5 Chart for evaluating factor m_{α}

B. If the slope is partly submerged :

In general, the slope may be partly submerged and there will be pore pressures acting along the trial circle , (Fig 4.6)

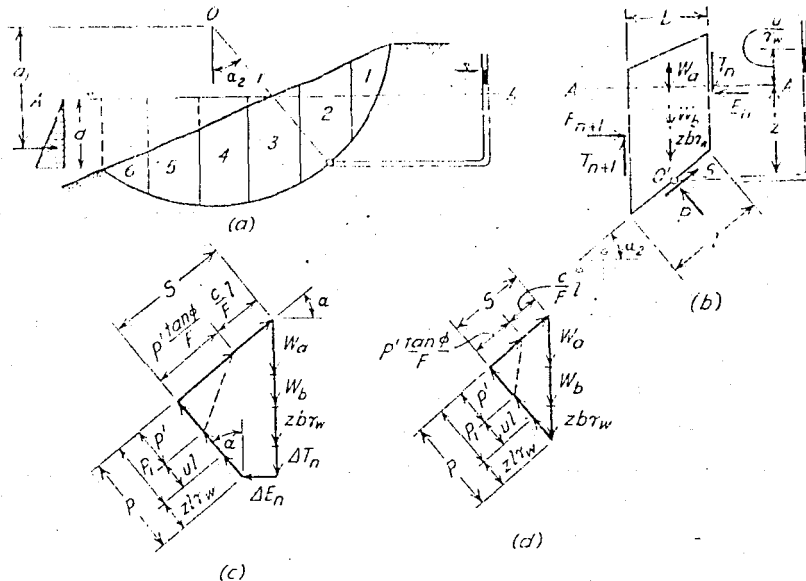


Fig 4.6 Method of slices for investigating equilibrium of slope for partly submerged slopes (d) Force polygon for slice 2 if forces T and E on sides of slice are considered to be zero.

The magnitudes of the pore pressures depend upon the conditions of the problem. In some instances they may be estimated by means of a flow net or field observations. If the level of external water surface is denoted by A-A , the weight, W, of the slice may be written as,

$$W = W_a + W_b + z b \gamma_w \dots\dots\dots(4.16)$$

where W_a is the weight of that part below A-A , And W_b is the submerged weight of the part below A-A and $z b \gamma_w$ is the

weight of a volume of water equal to submerged portion of the slope. If entire slice is located beneath the water level, as slice 3, the weight of the water above the slice must be included in $z b \gamma_w$. The pore pressure at the midpoint O^A of the base of the slice is $z \gamma_w + u$, where u is the excess pore pressure with respect to external water level. If the external water level A-A is located below O' on the base of the slice, the pore pressure at O^A is h/γ_w , where h is the height to which the water would rise in a piezometer at O' . If the pore pressure is due to capillarity, h is negative. The shearing stress, t , along the surface of sliding is,

$$t = \frac{s}{F} = \frac{1}{F} (c + \bar{p} \tan \phi) = \frac{1}{F} \left[c + \left(\frac{P}{L} - z \gamma_w - u \right) \tan \phi \right]$$

whence

$$S = t \cdot L = \frac{1}{F} [cL + (P - zL\gamma_w - uL) \tan \phi] = \frac{1}{F} (cL + P' \tan \phi)$$

Equilibrium of the entire slide with respect to moments about the centre of the trial circle requires that

$$\begin{aligned} \sum (W_a + W_b + z b \gamma_w) r \sin \alpha &= \sum S \cdot r + \frac{1}{2} \gamma_w d^2 a_1 \\ &= \frac{1}{F} \sum (cL + P' \tan \phi) r + \frac{1}{2} \gamma_w d^2 a_1 \dots\dots\dots(4.19) \end{aligned}$$

However, the water below level A-A is in equilibrium,

whence

$$\sum z_b \gamma_w r \sin \alpha = \frac{1}{2} \gamma_w d^2 a_1 \dots\dots\dots(4.20)$$

Therefore,

$$\sum (W_a + W_b) r \sin \alpha = \frac{1}{F} \sum (cL + P' \tan \phi) r \dots(4.21)$$

And

$$F = \frac{\sum (cL + P' \tan \phi)}{\sum (W_a + W_b) \sin \alpha} \dots\dots\dots(4.22)$$

$$W_a + W_b + z_b \gamma_w = [zL \gamma_w + P' + uL] \cos \alpha + \left(P' \frac{\tan \phi}{F} + \frac{cL}{F} \right) \sin \alpha \dots\dots\dots(4.23)$$

and

$$P' = \frac{W_a + W_b - u_b - \frac{cL}{F} \sin \alpha}{M_\alpha} \dots\dots\dots(4.24)$$

Substitution of eq. 4.24 in to 4.22

$$F = \frac{\sum [cb + (W_a + W_b - u_b) \tan \phi]}{\sum (W_a + W_b) \sin \alpha} \dots\dots\dots(4.25)$$

It may be noted that the influence of the external water level is fully taken into account by the use of the submerged weight, W_b , and that the excess pore pressure, u , is calculated for the base of each slice. The procedure described in the preceding paragraphs may be modified to take into account the forces T and E between the slices (Bishop, 1955).

4.6 COMPUTER PROGRAM FOR SLOPE STABILITY

This computer program (KÖSELER-I) is developed using Bishop's (1955) Modified Procedure. The program uses a circular -arc failure surface. First the intersection coordinates of soil layers and the potential failure surface are found then the areas, angles, etc., can be calculated.

The program will solve any slope stability problem where the ground surface can be described by a series of straight lines. Any number of lines and soil types can be used. The program allows for describing the pore pressure by use of saturated soil unit weights. The program computes both the total and effective slice weights;

It is necessary in using this program to :

I. Number all line intersections in increasing X

coordinates from left to right.

2. Number the upper external (closest to arc center) soil lines first in order from left to right. Interior soil lines may be numbered in any order.

3. The different soils in the mass may be numbered in any order.

4. Compute all line intersections accurately to 0.005 to SMLNO=0.01 will properly test coordinates.

The program locates all line intersections inside the trial arc including those lines intersecting the arc. A slice is located on every intersection point. Distances between intersection points are divided according to the slice-width specification (SWIDTH)?

This program will compute in either metric or fps units. Use meters and kilonewtons or feet and pounds. The unit card contains three entries:

M	CM	9.807
FT	IN	62.500

4.7 OPERATION OF COMPUTER PROGRAM

LINE	OPERATION
I-5	Bookkeeping
6	READ TITLE and work units(Two cards)
I3	READ(I5I5) NOL: total number of soil lines NLIT: total number of line intersections(The end of any line whether or not intersected by another line is a line intersection) NOS: number of soil lines in mass(Same soil submerged is counted twice) NOLE: number of top external soil lin ITX-ITY: number of circle centre points in X,Y direc- tions to be analyzed for a single entrance point PCODE:plot subroutine used if > 0 NP:plot control coun- ter DIMEN:control number of slices as 75,80,90 ,etc. LIST:control to obtain extra output(after test run use 0 to converse paper)
I4	READ(5,*) CX,CY:initial trial circle centre coordinates ENTX ENTY:trial circle entrance coordinates DELX,DELY: centre X,Y coordinates increments for each trial SWIDTH: initial slice width(DIMEN may increase va- lue
I5	READ(5,*) SCALE: plotting scale as 20,30 for I inch. HAH : top X coordinates of slope YAY : distributed load on soil($q = 2t/m$)

LINE	OPERATION
27-52	READ problem data on line intersections, soils , etc., and forms arrays for later use, also writes data for checking
28	READ NLI:number of line intersections of each line in turn one entry per card
29	READ (C(I,J),NOLIT(I,N),N=1,NLI) C(I,J) : line data including line number , number of line intersections for the lines, the X,Y coordinates of the end points left to right(6 entries) NOLIT(I,N): all the line intersection numbers on the i th line including the end values(NLI entries)
30	Gives vertical lines the slope value of BIGNO so computer doesnot divide by 0.0
39-40	READ INTAR(J,K) INTAR(J,K): line intersection X,Y coordinates in increasing intersection numbers
47	READ soil data on DO loop NSLIN(I): number of soil lines defining the boundary of the soil. Include lines terminating at a joint. If a line intersection a soil-boundary between the ends count the soil boundary between the ends, twice G(I): unit weight either saturated or wet PHI(I): ϕ angle COHES(I): cohesion SAT: 1.if saturated,0.if wet
52	READ LINSOL: soil line number , INTL-INTR: intersection number on left and right and of line(if a soil line ter-

LINE	OPERATION
	minates ta a joint on a soil boundary, that line is included, the joint number is used for both INTL and INTR.
62	Begins DO to test circles
69-I40	Computes trial circle , line intersections, find lines not used LNU(I) , those in circle but not intersected by circle
I4I-I96	Sets up arc intersection array ARCINT
I97-22I	Find slice width and checks total number of slices against DIMEN and increments slice width if necessary
222-285	Finds coordinates of all line intersecting slices in slice array SLIC (I,J,K). Note that lines not intersected in a slice are given same coordinates as last line intersected and stacked at a point. This so routine for both coordinates test and area computations can be used using all lines. SLIC array is sorted for decreasing Y coordinates.
286-352	Computes areas of slice parts and weights, both effective and total, sums slice weights, finds ϕ and c for soil touching arc surface
353-39I	Computes safety factor

```

1) 7GUL
DIMENSION C(15,6),NOLIT(15,0),SLOPE(15),INTAR(15,2),EFFWT(100
& NSLIN(10),G(10),PHI(10),COHES(10),SLICX(76),SOIL(8,9,4),SAT(10
& ARCLNT(20,3),LNU(15),CO(100),ALPHA(100),TITLE(20),SLIC(76,10,2
& P(100),B(100),AREA(100),WEIGH(100),ALLINT(30,3),IBUF(1000)
INTEGER PCODE,DIMEN
REAL INTAR,METER
SIGNO=99999999
SMLNO=0
1000 READ(5,1000)TITLE,UT1,UT2,FU4
FORMAT(20A4/A4,6X,A4,6X,F10.4)
2000 WRITE(6,2000)TITLE
FORMAT(1,T5,20A4,/)
READ(5,*)NOL,NLIT,NOS,NOLE,ITX,ITY,PCODE,NP,DIMEN,LIST
READ(5,*)CX,CY,ENTX,ENTY,DELX,DELY,SWIDTH
WHOLD=SWIDTH
NOSPI=NOS+1
2001 WRITE(6,2001)NOL,NLIT,NOS,NOLE,ITX,ITY,SWIDTH,UT1
FORMAT(15,'NO OF LINES',I3,5X,'NO OF LINE INTERSECT=',I3,/,T5
& 'NO OF SOILS=',I3,5X,'NO OF EXTERNAL SOIL LINES=',I3,/,T5,
& 'NO OF X INCREMENTS=',I3,5X,'NO OF Y INCREMENTS=',I3,/,T10,'I
& ITIAL SLICE WIDTH=',F5.4,X,A2//)
2003 WRITE(6,2003)
FORMAT(15,'THE LINE END COORD MATRIX',/,T4,'LINE NO',T12,'NO I
& T21,'X',8X,'Y',8X,'X2',8X,'Y2',6X,'SLOPE',5X,'LINE INTER NO'
DO 333 I=1,NOL
NLI=NO OF INTERSECT ON ANY LINE MUST HAVE AT LEAST 2 VALUES
READ(5,*)NLI
READ(5,*)(C(I,J),J=1,6),(NOLIT(I,N),N=1,NLI)
SLOPE(I)=SIGNO
IF(ABS(C(I,5)-C(I,3))LE.0.0001)GO TO 333
SLOPE(I)=(C(I,6)-C(I,4))/(C(I,5)-C(I,3))
333 WRITE(6,2004)(C(I,J),J=1,6),SLOPE(I),(NOLIT(I,KK),KK=1,NLI)
2004 FORMAT(16,F3.0,3X,F3.0,T15,4(2X,F8.2),G13.6,1X,6I5)
C READ X AND Y COORDINATES TO BUILD LINE INTERSECT ARRAY (INTAR)
WRITE(6,2005)
2005 FORMAT(1,T5,'LINE INTERSECT ARRAY',/,T4,'INT NO',T16,'X',T28,
DO 2 J=1,NLI
READ(5,*)(INTAR(J,K),K=1,2)
WRITE(6,2006)J,(INTAR(J,K),K=1,2)
2006 FORMAT(16,I3,T12,F10.2,2X,F10.2)
C BUILD SOIL INTERSECTION ARRAY USING (INTNO)
WRITE(6,2008)
2008 FORMAT(1,T5,'SOIL DATA ARRAY',/,T4,'SOIL NO',T13,'LINE #',T21
& 'LEFT INT',3X,'RT INT',3X,'SAT',3X,'UNIT WT',3X,'PHI',3X,'COH
& ON')
C NUMBER SOILS IN ANY ORDER
DO 5 I=1,NOS
READ(5,*)NSLIN(I),G(I),PHI(I),COHES(I),SAT(I)
NS=NSLIN(I)
DO 5 K=1,NS
READ(5,*)LINSOL,INTL,INTR
SOIL(I,K,1)=LINSOL
SOIL(I,K,2)=INTL
SOIL(I,K,3)=INTR
SOIL(I,K,4)=SAT(I)
5 WRITE(6,2009)I,(SOIL(I,K,MM),MM=1,4),G(I),PHI(I),COHES(I)
2009 FORMAT(15,I3,6X,F3.0,7X,F3.0,6X,F3.0,6X,F2.0,5X,F6.1,3X,F4.1,3
& J)
PCOUN=0
C BEGIN LOOP TO TEST TRIAL CIRCLES
100 DO 350 IY=1,ITY
IF(IY,GT.1)CY=CY+DELY
DO 360 IX=1,ITX
PCOUN=PCOUN+1
NCOUN=PCOUN
SWIDTH=WHOLD
IF(IX,GT.1)CX=CX+DELX
C COMPUTE RADIUS OF TRIAL CIRCLE
R=SQRT((ENTX-CX)**2+(CY-ENTY)**2)
WRITE(6,212)NCOUN,CX,CY,ENTX,ENTY,R
212 FORMAT(1,T5,'TRIAL CIRCLE NO',I3,/,T5,'CIRCLE CTR COORDS:',2X
& ',2X,'X=',F10.2,2X,'Y=',F10.2,/,T5,'ENTRANCE PT. COORDS:',2X,
& ',F10.2,2X,'Y=',F10.2,/,T10,'TRIAL ARC RADIUS=',F10.3,/)
X1=0
DO 8 I=1,NOL
LNU(I)=0
IF(ABS(SLOPE(I))LE.0.0001)GO TO 9
CON=C(I,3)-C(I,4)/SLOPE(I)
AA=1.0/SLOPE(I)**2+1.0
BB=2.0*CON/SLOPE(I)-2.0*CX/SLOPE(I)-2.0*CY
CC=CON**2-2.0*CX*CON+CX**2+CY**2-R**2

```

```

DIFF=BB**2-4*AA*CC
IF (DIFF.LT.0) GO TO 20
YPR=(BB+SQRT(DIFF))/(2*AA)
YNR=(BB-SQRT(DIFF))/(2*AA)

```

```

C THIS PART COMPUTE X COORDS
XPR=YPR/SLOPE(I)+CON
XNR=YNR/SLOPE(I)+CON

```

```

C FOLLOWING STEPS USED FOR HORIZONTAL LINES

```

```

9 DIFF=R**2-(CY-C(I,4))**2
IF (DIFF.LT.0) GO TO 20

```

```

XPR=CX+SQRT(DIFF)
XNR=CX-SQRT(DIFF)

```

```

YPR=C(I,4)
YNR=C(I,4)

```

```

J1=0
J2=0

```

```

IF (ABS(SLOPE(I)) GE. BIGNO) GO TO 11
IF (XPR GE. C(I,3) AND XPR LE. C(I,5)) J1=1
IF (XNR GE. C(I,3) AND XNR LE. C(I,5)) J2=1

```

```

GO TO 12
IF (SLOPE(I)) 66,66,666

```

```

66 IF (YPR GE. C(I,6) AND YPR LE. C(I,4)) J1=1
IF (YNR GE. C(I,6) AND YNR LE. C(I,4)) J2=1

```

```

GO TO 12
IF (YPR GE. C(I,4) AND YPR LE. C(I,6)) J1=1
IF (YNR GE. C(I,4) AND YNR LE. C(I,6)) J2=1

```

```

666 IF (YPR GE. C(I,4) AND YPR LE. C(I,6)) J1=1
IF (YNR GE. C(I,4) AND YNR LE. C(I,6)) J2=1

```

```

12 IF (J2 EQ. 0) GO TO 13
K1=K1+1

```

```

ARCINT(K1,1)=I
ARCINT(K1,2)=XNR
ARCINT(K1,3)=YNR

```

```

13 IF (J1 EQ. 0) GO TO 7
K1=K1+1

```

```

ARCINT(K1,1)=I
ARCINT(K1,2)=XPR
ARCINT(K1,3)=YPR

```

```

GO TO 8
IF (J1 NE. 0 OR J2 NE. 0) GO TO 8

```

```

7 END OF LOOP FOR ARCLINE INTERSECTIONS

```

```

C LNU(I)=I

```

```

20 WRITE(6,240) I

```

```

2101 FORMAT(/,T5,'XXX LINE',I3,'NOT INTERSECTED BY TRIAL CIRCLE')

```

```

8 CONTINUE

```

```

DO 400 I=1,NOL

```

```

IF (LNU(I) EQ. 0) GO TO 400

```

```

R1=SQRT((CX-C(I,3))**2+(CY-C(I,4))**2)

```

```

R2=SQRT((CX-C(I,5))**2+(CY-C(I,6))**2)

```

```

IF (R1 LT. R2 AND R1 LT. R2) GO TO 400

```

```

LNU(I)=0
IF (SLOPE(I) EQ. BIGNO) LNU(I)=I

```

```

IF (SLOPE(I) EQ. BIGNO) WRITE(6,403) LNU(I)

```

```

403 FORMAT(/,T5,'*** LINE',I3,'IS IN ARC BUT VERT AND NOT USED')

```

```

WRITE(6,401) I

```

```

401 FORMAT(/,T5,'*** LINE',I3,'IS NOT INTERSECTED BUT IS IN ARC')

```

```

400 CONTINUE

```

```

C FIND WIDTH OF K=TOTAL ENTRIES IN CIRCLE LINE INT. ARRAY

```

```

K1M=K1-1

```

```

24 DO 26 KY=1,K1M

```

```

IF (ARCINT(KY,2) LE. ARCINT(KY+1,2)) GO TO 26

```

```

DO 26 KX=1,3

```

```

SAVE=ARCINT(KY,KX)

```

```

ARCINT(KY,KX)=ARCINT(KY+1,KX)

```

```

ARCINT(KY+1,KX)=SAVE

```

```

25 CONTINUE

```

```

GO TO 24

```

```

26 CONTINUE

```

```

WRITE(6,2112)

```

```

2112 FORMAT(/,T5,'ARC INTERSECT WITH LINE ARRAY',/ ,T4,'LINE NO'

```

```

, T19, 'X', T32, 'Y')

```

```

WRITE(6,2114) ((ARCINT(KZ,JJ),JJ=1,3),KZ=1,K1)

```

```

2114 FORMAT(T5,F3.0,T13,F10.3,2X,F3.0,T2)

```

```

LINE=ARCINT(1,1)

```

```

S1=ARCINT(1,2)

```

```

S2=ARCINT(1,3)

```

```

WRITE(6,8053)

```

```

8053 FORMAT(/,T5,'THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:')

```

```

ICOUV=0

```

```

K=1

```

```

KK=0

```

```

LL=NLIT+K

```

```

C COMBINE ARCINT AND INTAR IN ORDER OF INC. X VALUES

```

```

DO 70 I=1,LL
KK=KK+1
DO 75 J=1,2
ALLINT(I,J)=INTAR(KK,J)
75 IF(I.NE.1.AND.ALLINT(I,1).EQ.INTAR(KK,1))GO TO 70
IF(ARCINT(K,2).GE.INTAR(KK,2))GO TO 70
IF(ICOUN.GT.0)GO TO 70
72 DO 73 L=1,2
73 ALLINT(I,L)=ARCINT(K,L+1)
IF(K.EQ.K1)ICOUN=1
K=K+1
IF(K.GT.K1)K=K1
KK=KK+1
70 WRITE(6,8051)I,(ALLINT(I,J),J=1,2),K,KK
8051 FORMAT(15,'I=',I3,2X,2F12,3,2X,'K=',I3,2X,'KK=',I3)
WRITE(6,8052)
8052 FORMAT(//,T5,'THE APPLICABLE ARRAY ARCINT FOLLOWS:')
LAL=0
DO 77 I=1,LL
R2=SQRT((CX*ALLINT(I,1))**2+(CY*ALLINT(I,2))**2)
IF(R2.GT.(R*SMLNO))GO TO 77
LAL=LAL+1
DO 78 K=1,2
78 ARCINT(LAL,K)=ALLINT(I,K)
WRITE(6,8053)LAL,(ARCINT(LAL,J),J=1,2),I,LAL
77 CONTINUE
C CALCULATE THE WIDTH BETWEEN EACH INT. POINT
33 SLICX(1)=S1
SLIC(1,1,1)=S2
SLIC(1,1,2)=LINE1
C DIVIDE WIDTH(L) INTO SLICES OF SIZE
WRITE(6,8057)
8057 FORMAT(//,T5,'FIND SLICE WIDTH AND NO OF SLICES')
98 N=1
NOSLIC=1
KM=1
K=LAL
DO 45 L=1,K
45 MM=1
IF((ARCINT(L+1,1)-ARCINT(L,1)).LE.SWIDTH)GO TO 46
DO 47 MM=1,100
47 AM=MM
WIDTH=(ARCINT(L+1,1)-ARCINT(L,1))/AM
IF(WIDTH.LE.SWIDTH)GO TO 49
CONTINUE
46 WIDTH=ARCINT(L+1,1)-ARCINT(L,1)
49 NOSLIC=NOSLIC+MM
C CONTROL FOR DIMENSION OF 75 SPACES IN
IF(NOSLIC.LT.DIMEN)GO TO 99
SWIDTH=SWIDTH+0.5
WRITE(6,9999)SWIDTH
9999 FORMAT('0',T5,'*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTE
DO TO',F5.2,1X,A2)
GO TO 98
99 NSM=NOSLIC
DO 51 I=N,NOLE
51 IF(LNU(I).EQ.I)GO TO 51
DO 52 JJ=KM,NSM
101 SLICX(JJ+1)=SLICX(JJ)+WIDTH
SLIC(JJ+1,1,1)=SLIC(JJ,1,1)+WIDTH*SLOPE(I)
SLIC(JJ+1,1,2)=I
52 DIFF=SLICX(JJ+1)-C(I,5)
IF(ABS(DIFF).GT.0.50,50,48)
50 N=I+1
48 KM=NOSLIC
GO TO 45
51 CONTINUE
45 CONTINUE
C COMPLETE SLICE ARRAY
NOLP=NOL+1
NOLE=NOLE+1
DO 60 I=1,NOSLIC
N=2
ARCY=CY*SQRT(R**2*(CX*SLICX(I))**2)
DO 59 J=NOL,P,NOL
59 IF(LNU(J).EQ.J)GO TO 59
SLIC(I,N,2)=J
SLIC(I,N,1)=C(J,4)+(SLICX(I)-C(J,3))*SLOPE(J)
IF(SLICX(I).LT.(C(J,3)+SMLNO).OR.SLICX(I).GT.(C(J,5)+SMLNO))SLI
E(I,N,1)=0
IF(SLIC(I,N,1).GT.(SLIC(I,1,1)+SMLNO).OR.SLIC(I,N,1).LT.(ARCY
+SMLNO))SLIC(I,N,1)=0
57 N=N+1

```

```

59 CONTINUE
60 SLIC(I,N,1)=ARCY
60 SLIC(I,N,2)=NOLP1
C SORT SLICE ARRAY IN DECREASING ORDER
IF (LIST.NE.0) WRITE(6,21,6)
21,16 FORMAT(T6,'SLICE#',2X,'X-COORD',4(2X,'LINE NO',2X,'Y-COORD',
E))
MCOUN=N
N=MCOUN-1
DO 81 KZ=1,NOSLIC
84 NUM=1
DO 85 KY=1,N
IF (SLIC(KZ,KY,1).LE.9.50) GO TO 82
IF ((SLIC(KZ,KY,1)+SMLNO).GE.SLIC(KZ,KY+1,1)) GO TO 85
SAVE=SLIC(KZ,KY,1)
SLIC(KZ,KY,1)=SLIC(KZ,KY+1,1)
SLIC(KZ,KY+1,1)=SAVE
SAVE=SLIC(KZ,KY,2)
SLIC(KZ,KY,2)=SLIC(KZ,KY+1,2)
SLIC(KZ,KY+1,2)=SAVE
GO TO 85
82 SLIC(KZ,KY,1)=SLIC(KZ,KY+1,1)
SLIC(KZ,KY,2)=SLIC(KZ,KY+1,2)
85 IF (KY.NE.1.AND.SLIC(KZ,KY,1).SMLNO.LE.SLIC(KZ,KY+1,1)) NUM=NUM
E+1
IF (NUM.NE.N) GO TO 84
81 IF (LIST.NE.0) WRITE(6,3) KZ,SLICX(KZ),(SLIC(KZ,KY,2),SLIC(KZ
E,KY,1),KY=1,MCOUN)
3 FORMAT(T6,T5,9F9.2,/,T20,8F9.2,/,T20,8F9.2,/,T20,8F9.2)
DO 306 I=1,NSM1
SAREA=0.0
WEIGHT=0.0
EFWT=0.0
ISOIL=0
NN=MCOUN
IF (LIST.NE.0) WRITE(6,350) I
350 FORMAT(7,T5,'SLICE LINE NUMBER',I4)
DO 303 J=1,NN
DA=(SLIC(I,J,1)+SLIC(I+1,J,1)+SLIC(I,J+1,1)+SLIC(I+1,J+1,1))*
E(SLICX(I+1)+SLICX(I))/2.0
IF (DA.LE.SMLNO) GO TO 303
DO 305 II=1,NOSP1
IF (II.EQ.NOSP) GO TO 308
IF (ISOIL.EQ.II) GO TO 305
N=NSLIN(II)
ICOUNT=0
JCOUNT=0
311 DO 304 JJ=1,N
IF (JCOUNT.EQ.2) GO TO 305
INTL=SOIL(II,JJ,2)
INTR=SOIL(II,JJ,3)
IF (ICOUNT.EQ.1) GO TO 310
IF (SLIC(I,J,2).NE.SOIL(II,JJ,2)) GO TO 304
ICOUNT=1
JSOIL=II
IF ((SLICX(I)+SMLNO).GE.INTAR(INTL,1).AND.(SLICX(I)+SMLNO).LE
EINTAR(INTR,1)) GO TO 310
ICOUNT=0
GO TO 304
310 IF (SLIC(I+1,J,2).NE.SOIL(II,JJ,2)) GO TO 304
IF ((SLICX(I+1)+SMLNO).LT.INTAR(INTL,1).OR.(SLICX(I+1)+SMLNO).G
EINTAR(INTR,1)) GO TO 304
ICOUNT=2
IF (JSOIL.NE.II) GO TO 305
ISOIL=II
302 SAREA=SAREA+DA
308 GSUB=G(ISOIL)
IF (SAT(ISOIL).GT.0.7) GSUB=G(ISOIL)*FU4
EFWT=EFWT+DA*GSUB
WEIGHT=WEIGHT+DA*G(ISOIL)
IF (LIST.EQ.0) GO TO 9092
WRITE(6,351) J,I,DA
351 FORMAT(T10,'DSLICE NO',I2,'OF SLICE ',I3,'WITH DA OF',F10.3)
WRITE(6,352) ISOIL,J,SAREA,WEIGHT,EFWT
352 FORMAT(T15,'SOIL ',I3,'LIES IN DSLICE ',I3,/,T15,'TOTAL AREA
E=',F10.3,3X,'TOTAL WEIGHT=',G10.3,5X,'EFFECT WT=',G10.3)
9092 GO TO 303
304 CONTINUE
IF (ICOUNT.EQ.1) JCOUNT=JCOUNT+1
IF (ICOUNT.EQ.2) GO TO 311
305 CONTINUE
303 CONTINUE
ALPHA(I)=ARSIN(ABS(CX((SLICX(I+1)-SLICX(I))/2.0+SLICX(I)))/R)

```

```

AREA(I)=SAREA
WEIGH(I)=WEIGHT
CO(I)=COHES(ISOIL)
306 P(I)=PHI(ISOIL)
IF(LIST, EQ, 0) GO TO 365
WRITE(6, 354)
354 FORMAT(T5, 'SLICE#', 3X, 'AREA', 3X, 'WEIGHT', 4X, 'COHESION', 3X, 'P
      6-1', 3X, 'ALPHA')
DO 307 I=1, NSMT
IF(AREA(I).LE.SMLNO) GO TO 362
WRITE(6, 353) I, AREA(I), WEIGH(I), CO(I), P(I), ALPHA(I)
GO TO 307
352 WRITE(6, 353) I, AREA(I), WEIGH(I)
353 FORMAT(T7, I2, 2X, 3F10.3, F6.2, F9.4)
307 CONTINUE
      SUM OVERTURN MOMENT
365 DO 367 I=1, NSMT
IF(AREA(I).LE.SMLNO) P(I)=0.00
IF(AREA(I).LE.SMLNO) CO(I)=0.00
367 P(I)=P(I)/57.2928
FI=1.0
387 ZUM=0.0
TF=0.0
DO 392 K=1, NSMT
CENTR=(SLICX(K+1)-SLICX(K))/2.0+SLICX(K)
IF((CENTR-CX).LT.0.0) T=WEIGH(K)*SIN(ALPHA(K))
IF((CENTR-CX).EQ.0.0) T=0.0
IF((CENTR-CX).GT.0.0) T=WEIGH(K)*SIN(ALPHA(K))
IF(CENTR-GEORAH) T=T+YAY*(SLICX(K+1)-SLICX(K))
394 TF=TF+T
IF((CENTR-CX).LT.0.0) A=-1.0*SIN(ALPHA(K))
A=SIN(ALPHA(K))
B(K)=(SLICX(K+1)-SLICX(K))/COS(ALPHA(K))
Z=(CO(K)*B(K)+EFFWT(K)*TAN(P(K)))/(COS(ALPHA(K))+TAN(P(K))*A/FI
382 ZUM=ZUM+Z
FO=ZUM/TF
WRITE(6, 116) FI, FO
116 FORMAT(20X, 'FI=', F10.5, 3X, 'FO=', F10.5)
IF(A3S(FI, FO).EQ.1) 385, 385, 383
385 WRITE(6, 108) NCOUN, FO
108 FORMAT('0', 15X, 'THE SAFETY FACTOR FOR POINT', I3, 'IS', F10.5)
GO TO 360
383 FI=FO
GO TO 387
389 IF(PCODE, EQ, 0 OR, RTGE, CY) GO TO 360
IF(NCOUN, GT, 1) GO TO 405
XAXIS=12.
YAXIS=9.
PSCALE=SCALE
DATA METER/'M'/
IF(UT, NE, METER) GO TO 405
XAXIS=15.
YAXIS=12.
PSCALE=SCALE*2
405 IF(NCOUN, NE, 1, AND, (NCOUN/NP*NP, NE, NCOUN), AND, NCOUN, NE, ITX*IT
      Y) GO TO 360
360 IF(IX, EQ, ITX) CX=CX-(IX-1)*DELX
      STOP
      END

```

E*NE*GUL

CHAPTER 5

RESULTS AND RECOMMENDATIONS

5.I RESULTS FROM THE COMPUTER PROGRAM

5.I.I Slope Stability Analysis For Existing Soil Profile

Results from the computer program and figures showing various cross-sections are given in figures and tables.

In cross-section (3-3)A , soil I is artificial fill, the thickness of these fills decreases with increasing distance from the shore. The artificial fill contains boulders, gravel, sand, silt, shells, wooden pieces, pieces of concrete, mortar and all kinds of city debris. The determination of engineering characteristics of such fills is very difficult. So soil parameters may be taken as : (Aras, 1978 and Ünlü, 1982)

$$\gamma_n : 1.8 \text{ t/m}^3$$

$$\phi : 20^\circ$$

$$c : 2 \text{ t/m}^2$$

Soil II is a sedimentary layer. The sedimentary layers which are found under the artificial fill layer consists of sandy, clayey silts which contain large amount of organic matter and

shells.

To find characteristic parameters for such soils, we will make the following consideration accepting the soil to be normally consolidated. The value of ratio $c_u/\bar{p}$ is found by the formula:

$$s_u/\bar{p} = 0.11 + 0.0037 \text{ PI}$$

given by Skempton(1975), where s_u denotes the undrained shear strength at a depth where the effective overburden pressure is equal to $\bar{p}$. PI denotes the plasticity index. The average value of PI may be obtained from table 2.10 to be 35. When this average value is substituted in the equation, $s_u/\bar{p}$ ratio is found as:

$$s_u/\bar{p} = 0.11 + 0.0037 \times 35$$

$$s_u/\bar{p} = 0.24$$

For various depths :

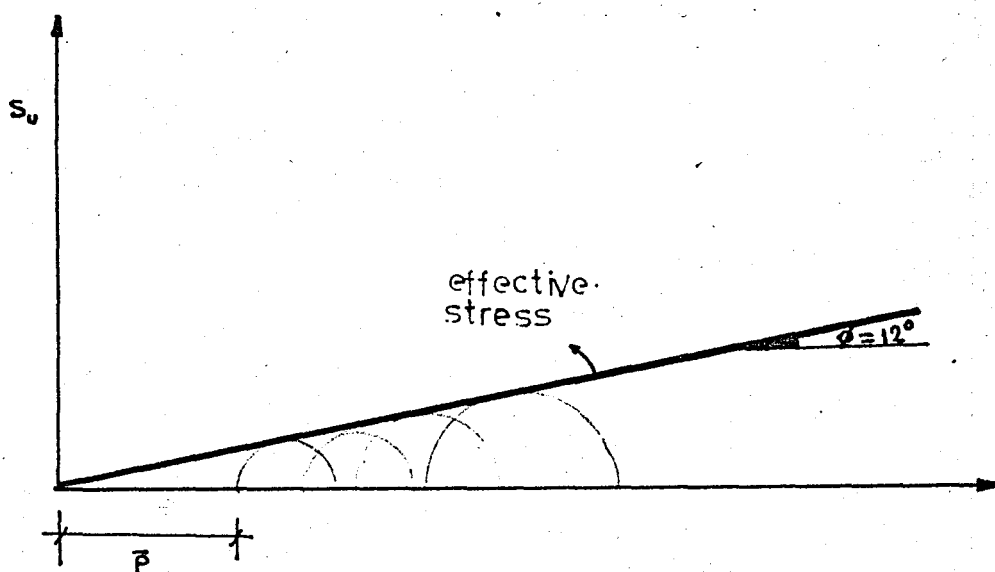
$$30\text{m.} \dots\dots\dots s_u = 0.24 \times 30 \times 0.8 = 5.76 \text{ t/m}^3$$

$$40\text{m.} \dots\dots\dots s_u = 0.24 \times 40 \times 0.8 = 7.68 \text{ t/m}^3$$

$$50\text{m.} \dots\dots\dots s_u = 0.24 \times 50 \times 0.8 = 9.60 \text{ t/m}^3$$

$$60\text{m.} \dots\dots\dots s_u = 0.24 \times 60 \times 0.8 = 11.52 \text{ t/m}^3$$

If we plot these values, we will obtain the angle of friction, $\phi = 12$ and the cohesion $c = 0$.

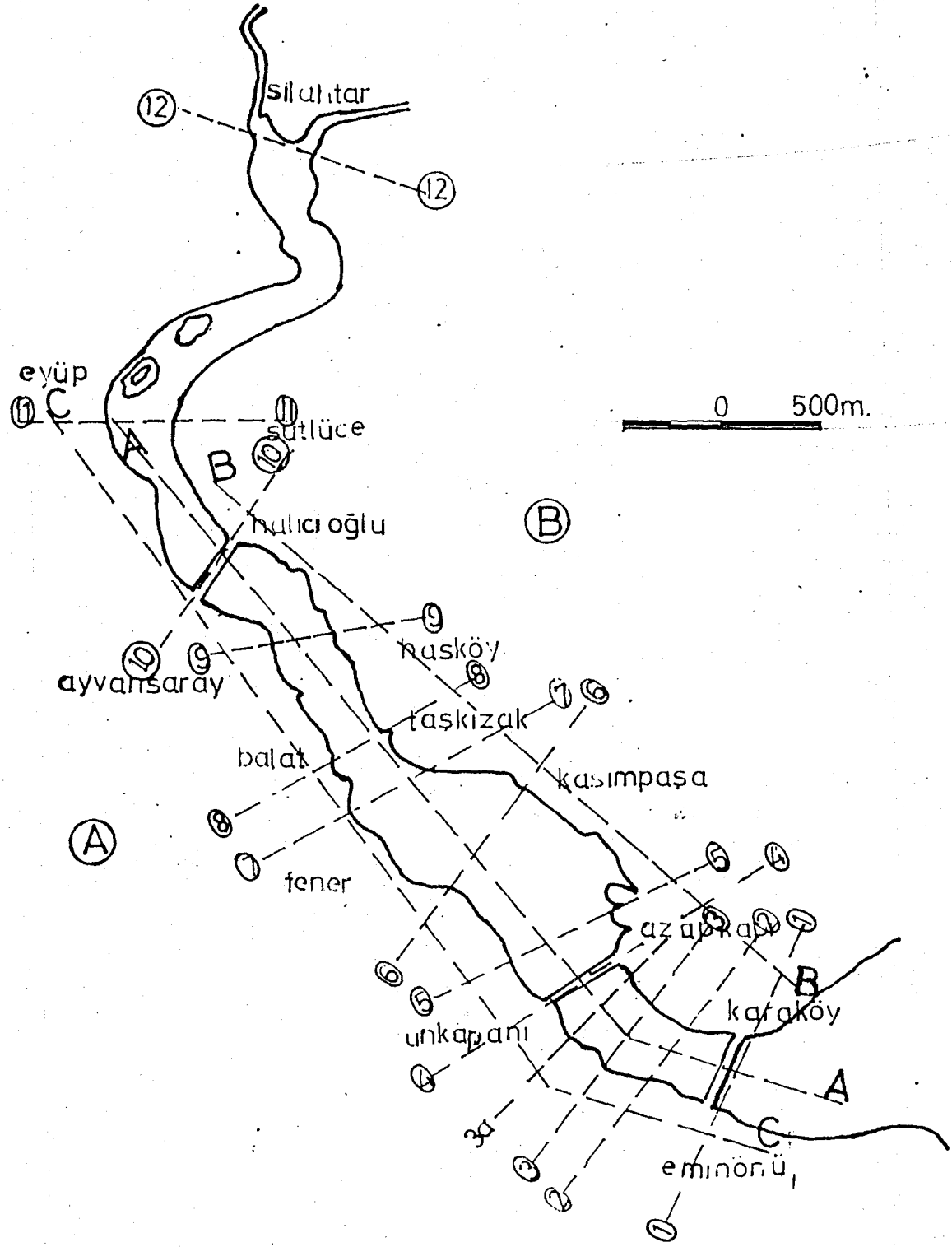


Soil III is decomposed graywacke. The engineering characteristics of this layer is given in table 2.2 .

As was stated before when a circle center and a entrance point is given as data to the computer program, it analysis further 8 potential failure circles by keeping the position of the entrance point constant , and changing the center of the circle in the X and Y directions. In the table only the slope circle which gives the minimum factor of safety for this set is given. So altogether $12 \times 9 = 108$ circles have been investigated.

If we run the computer program for cross-section (3-3)A , We will obtain the following results:

Circle NO	Circle center Coord		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	122	138	217	105	1.73
b	84	119	134	105	1.42
c	94	126	143	105	1.60
d	106	125	169	105	2.00
e	89	135	151	105	1.50
f	114	147	202	105	2.30
g	106	137	161	105	2.10
h	95	153	197	105	1.55
j	98	135	189	105	1.50
k	80	148	180	105	1.54
l	80	128	168	105	1.52
m	73	116	155	105	1.61
w	61	130	140	105	1.60
o	74	138	152	105	1.49
z	69	125	145	105	1.61
t	88	125	186	105	1.30
r	100	104	162	105	1.56
p	84	107	145	105	1.76
y	73	103	140	105	1.40



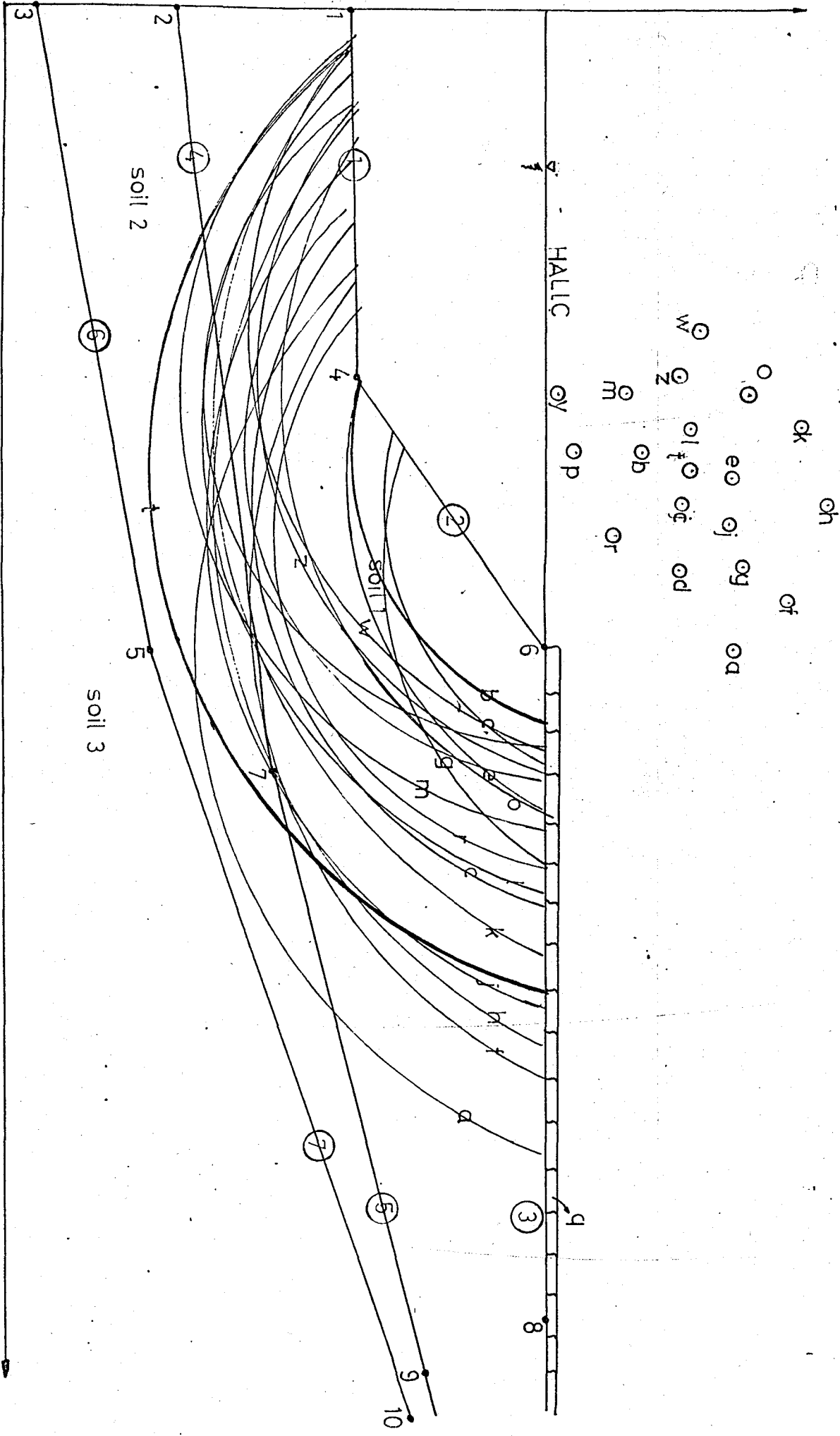


Fig : (3-3)A

WALTER ROSELLER THEATRE

LINE END COORD MATRIX

O	X	Y
	30	57
	00	30
	00	10
	00	10
70	10	67
145	10	28
120	10	105
143	10	54
230	10	105
235	10	80
240	10	66

DATA ARRAY

L_CIRCLE NO 7

INE 2 IS NOT INTERSECTED BUT IS IN ARC

NO	PERCENT	WITH	LINE	MARK
	3	777		5898
	40	849		3696
	164	763		6007
	186	111		2551

ARRAY WITH ALL INTERSECTIONS FOLLOWS:

5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

THE APPLICABLE ARRAY ARCINT FOLLOWS:

1	3	0	77	58	9	76	K=	4	KK=	1
2	40	8	49	36	9	62	K=	5	KK=	2
3	70	3	1	67	7	1	K=	6	KK=	3
4	20	3	1	05	3	1	K=	8	KK=	4
5	43	3	1	54	3	1	K=	9	KK=	5
6	64	0	63	60	7	0	K=	0	KK=	6
7	86	0	1	05	7	1	K=	1	KK=	7

IND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50

FI=	300000	FO=	25393
FI=	25393	FO=	29647
FI=	29647	FO=	30238
FI=	30238	FO=	30318

THE SAFETY FACTOR FOR POINT 11S 1.30318

TRIAL CIRCLE NO 2

CIRCLE CTR COORDS: X= 97.082 Y= 253.1

ENTRANCE PT COORDS: X= 86.41 Y= 205.1

TRIAL ARC RADIUS= 97.082

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	97.232	59.85
4	47.947	38.52
5	162.836	59.69
3	185.111	05.1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

1	0	0	57	1	1	KK=	1
2	0	0	30	1	1	KK=	2
3	0	0	1	1	1	KK=	3
4	19	232	59	8	54	KK=	3
5	47	947	38	5	52	KK=	3
6	70	3	67	7	1	KK=	4
7	15	3	28	7	1	KK=	5
8	20	3	05	3	1	KK=	6
9	43	3	54	3	1	KK=	7
10	62	836	59	6	86	KK=	7
11	86	0	05	7	1	KK=	7
12	230	3	05	7	1	KK=	9
13	235	3	05	7	1	KK=	9
14	240	3	66	7	1	KK=	0

THE APPLICABLE ARRAY ARCINT FOLLOWS:

1	19	232	59	8	54	K=	4	KK=	1
2	47	947	38	5	52	K=	5	KK=	2

5	54	59	K=	9	KK=	5
6	52	58	K=	7	KK=	6
7	86	05	K=	1	KK=	7

ND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	00000	FO=	25872
FI=	25872	FO=	30167
FI=	30167	FO=	30777
FI=	30777	FO=	30860

THE SAFETY FACTOR FOR POINT 2 IS 1.30860

TRIAL CIRCLE NO 3
 ARC CTR COORDS: X= 887.1 Y= 1287.1
 TRIAL ARC RADIUS= 100.663

X LINE 2 NOT INTERSECTED BY TRIAL CIRCLE

X LINE 6 NOT INTERSECTED BY TRIAL CIRCLE

X LINE 7 NOT INTERSECTED BY TRIAL CIRCLE

*LINE 2 IS NOT INTERSECTED BUT IS IN ARC

C INTERSECT WITH LINE ARRAY

X	Y
14723	59221
44211	37553
161622	59342
186111	05111

E ARRAY WITH ALL INTERSECTIONS FOLLOWS:

1	0000	57111	K=	1	KK=	1
2	0000	30111	K=	1	KK=	2
3	0000	22111	K=	1	KK=	3
4	14723	59221	K=	2	KK=	3
5	44211	37553	K=	3	KK=	3
6	70111	67111	K=	3	KK=	4
7	11511	28111	K=	3	KK=	5
8	12011	05111	K=	3	KK=	6
9	14311	54111	K=	3	KK=	7
10	161622	59342	K=	4	KK=	7
11	186111	05111	K=	4	KK=	7
12	23011	80111	K=	4	KK=	8
13	23511	05111	K=	4	KK=	9
14	24011	66111	K=	4	KK=	0

E APPLICABLE ARRAY ARCINT FOLLOWS:

1	14723	59221	K=	4	KK=	1
2	44211	37553	K=	5	KK=	2
3	70111	67111	K=	6	KK=	3
4	12011	05111	K=	8	KK=	4
5	14311	54111	K=	9	KK=	5
6	161622	59342	K=	0	KK=	6
7	186111	05111	K=	1	KK=	7

ND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	00000	FO=	24127
FI=	24127	FO=	28123
FI=	28123	FO=	28575
FI=	28575	FO=	28750

THE SAFETY FACTOR FOR POINT 3 IS 1.28750

45678901234567890123456789012345678901234567890123456789012345

In cross-section(3-3) B soil types are given as:

Soil I : Artificial Fill

Soil II : Sedimentary Layer

Soil III : Decomposed Graywacke

The results taken from the computer for cross-section(3-3) B are:

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	I05	I48	I83	I07	I.29
b	96	I39	I60	I07	I.65
c	I06	I39	I67	I07	I.80
d	II7	I46	I73	I07	2.20
e	99	I46	I8I	I07	I.I3
f	III	I55	I88	I07	I.36
h	I27	I49	200	I07	I.50
j	II9	I63	I88	I07	2.I2
k	86	I4I	I80	I07	I.I2
l	83	I50	I74	I07	I.I9
m	82	I6I	I92	I07	I.35
n	95	I60	I89	I07	I.II6



OPEN STABILITY FOR UNKAP(II) M.K. THESIS

OF LINES 9 NO OF LINE INTERSECT= 12
 OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 IN ITIAL SLICE WIDTH= 200

LINE END COORD MATRIX

LINE NO	END NO	COORD	MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INTER
1	2	74	00	64	74	69	67	4664	1
2	3	44	00	36	44	23	54	2857	7
3	4	00	00	00	00	00	00	0000	0
4	5	86	00	50	86	50	16	2581	2
5	6	94	00	50	94	04	40	7407	6
6	7	00	00	10	00	23	16	2791	9
7	8	84	00	27	84	27	20	2114	3
8	9	88	00	73	88	73	44	2308	5
9	10	00	00	24	00	90	30	3571	8

INTERSECT ARRAY

LINE NO	X	Y
1	00	64
2	00	36
3	00	00
4	74	50
5	86	50
6	94	04
7	00	10
8	84	27
9	88	73
10	00	24

IL DATA ARRAY

LINE NO	LINE #	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESI ON
1	2	4	4	0	7.8	20.0	19.6
2	3	7	7	0	7.8	20.0	19.6
3	4	6	6	0	7.8	20.0	19.6
4	5	6	6	0	7.8	20.0	19.6
5	6	9	9	0	7.8	20.0	19.6
6	7	2	2	0	7.8	12.0	19.6
7	8	3	3	0	7.8	12.0	19.6
8	9	5	5	0	7.8	12.0	19.6
9	10	8	8	0	7.8	12.0	19.6
10	11	3	3	0	7.8	12.0	19.6
11	12	5	5	0	7.8	12.0	19.6
12	13	8	8	0	7.8	12.0	19.6
13	14	3	3	0	7.8	12.0	19.6
14	15	5	5	0	7.8	12.0	19.6
15	16	8	8	0	7.8	12.0	19.6
16	17	3	3	0	7.8	12.0	19.6
17	18	5	5	0	7.8	12.0	19.6
18	19	8	8	0	7.8	12.0	19.6
19	20	3	3	0	7.8	12.0	19.6
20	21	5	5	0	7.8	12.0	19.6
21	22	8	8	0	7.8	12.0	19.6
22	23	3	3	0	7.8	12.0	19.6
23	24	5	5	0	7.8	12.0	19.6
24	25	8	8	0	7.8	12.0	19.6

IAL CIRCLE NO 1

CIRCLE CTR COORDS: X= 95.1 Y= 60.1
 TRANCE PT. COORDS: X= 89.1 Y= 07.1
 TRIAL ARC RADIUS= 107.9

X LINE 2 NOT INTERSECTED BY TRIAL CIRCL

X LINE 4 NOT INTERSECTED BY TRIAL CIRCL

X LINE 6 NOT INTERSECTED BY TRIAL CIRCL

X LINE 7 NOT INTERSECTED BY TRIAL CIRCL

X LINE 8 NOT INTERSECTED BY TRIAL CIRCL

*LINE 9NOT INTERSECTED BY TRIAL CIRCL

*LINE 2IS NOT INTERSECTED BUT IS IN ARC

C INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	40.798	66.86
2	91.393	52.26
3	73.137	85.57
4	189.1	07.1

E ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	0000	64.1	1	1
2	0000	36.1	1	2
3	0000	10.1	1	3
4	40.798	66.863	2	3
5	74.1	69.1	2	4
6	84.1	27.1	2	5
7	86.1	50.1	2	6
8	91.393	52.263	3	6
9	144.1	07.1	3	7
10	73.137	85.566	4	7
11	88.1	73.1	4	8
12	89.1	07.1	4	8
13	94.1	07.1	4	9
14	233.1	07.1	4	0
15	237.1	00.1	4	1
16	244.1	90.1	4	2

E APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	40.798	66.863	4	1
2	74.1	69.1	5	2
3	91.393	52.263	8	3
4	84.1	27.1	9	4
5	73.137	85.566	0	5
6	189.1	07.1	2	6

ND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTE

D TO 2.50

FI	FO
00000	0345
0345	1504
1504	1623
1623	1635

THE SAFETY FACTOR FOR POINT 1IS 1.1635

IAL CIRCLE NO 2

RCLE CTR COORDS: X= 98.1 Y= 60.1

TRANCE PT COORDS: X= 89.1 Y= 07.1

TRIAL ARC RADIUS= 105.309

X LINE 2NOT INTERSECTED BY TRIAL CIRCL

X LINE 4NOT INTERSECTED BY TRIAL CIRCL

X LINE 6NOT INTERSECTED BY TRIAL CIRCL

X LINE 7NOT INTERSECTED BY TRIAL CIRCL

X LINE 8NOT INTERSECTED BY TRIAL CIRCL

X LINE 9NOT INTERSECTED BY TRIAL CIRCL

*LINE 2IS NOT INTERSECTED BUT IS IN ARC

C INTERSECT WITH LINE ARRAY

NO	X	Y
48	230	67
97	628	54
172	048	85
189	111	07

ARRAY	WITH	ALL	INTERSECTIONS	FOLLOWS:
1	0000	64	11	KK= 1
2	0000	36	11	KK= 2
3	0000	10	11	KK= 3
4	48	230	67	KK= 4
5	74	111	69	KK= 5
6	84	111	27	KK= 6
7	86	111	50	KK= 7
8	97	628	54	KK= 8
9	44	111	07	KK= 9
10	72	048	85	KK= 10
11	89	111	07	KK= 11
12	94	111	94	KK= 12
13	233	111	07	KK= 13
14	237	111	07	KK= 14
15	244	111	90	KK= 15
16	244	111	90	KK= 16

APPLICABLE	ARRAY	ARC	INT	FOLLOWS:
1	48	230	67	KK= 4
2	74	111	69	KK= 5
3	97	628	54	KK= 8
4	44	111	07	KK= 9
5	72	048	85	KK= 10
6	89	111	07	KK= 11

SLICE	WIDTH	AND	NO	OF	SLICES
FI	00000	FO	1025		
FI	1025	FO	224		
FI	224	FO	2363		
FI	2363	FO	2375		

THE SAFETY FACTOR FOR POINT 2IS 1.12375

AL CIRCLE NO 3
 CLE CTR COORDS: X= 95 Y= 63
 RANCE PT COORDS: X= 89 Y= 07
 TRIAL ARC RADIUS= 109.4

LINE 2NOT INTERSECTED BY TRIAL CIRCL
 LINE 4NOT INTERSECTED BY TRIAL CIRCL
 LINE 6NOT INTERSECTED BY TRIAL CIRCL
 LINE 7NOT INTERSECTED BY TRIAL CIRCL
 LINE 8NOT INTERSECTED BY TRIAL CIRCL
 LINE 9NOT INTERSECTED BY TRIAL CIRCL
 LINE 2IS NOT INTERSECTED BUT IS IN ARC

NO	X	Y
42	817	67
94	907	53
171	720	84
189	111	07

ARRAY	WITH	ALL	INTERSECTIONS	FOLLOWS:
1	0000	64	11	KK= 1

4	42	817	67	000	K=	7	KK=	3
5	74	111	69	111	K=	2	KK=	4
6	84	111	27	111	K=	2	KK=	5
7	86	111	50	111	K=	2	KK=	6
8	94	907	53	695	K=	3	KK=	6
9	44	111	07	111	K=	3	KK=	7
10	71	720	84	989	K=	4	KK=	7
11	88	111	73	111	K=	4	KK=	8
12	189	111	07	111	K=	4	KK=	8
13	194	111	94	111	K=	4	KK=	9
14	233	111	07	111	K=	4	KK=	0
15	237	111	00	111	K=	4	KK=	1
16	244	111	90	111	K=	4	KK=	2

THE APPLICABLE ARRAY ARC INT FOLLOWS:

2	42	817	67	000	K=	4	KK=	1
3	74	111	69	111	K=	5	KK=	2
4	94	907	53	695	K=	8	KK=	3
5	44	111	07	111	K=	9	KK=	4
6	71	720	84	989	K=	0	KK=	5
	89	111	07	111	K=	2	KK=	6

IND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	00000	FO=	1353
FI=	1353	FO=	2597
FI=	2597	FO=	2720
FI=	2720	FO=	2733

THE SAFETY FACTOR FOR POINT 3 IS 1.12733

TRIAL CIRCLE NO 4

CIRCLE CTR COORDS: X= 987.7 Y= 635.1

ENTRANCE PT. COORDS: X= 897.7 Y= 607.1

TRIAL ARC RADIUS= 106.850

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCLE

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

ARC NO	X	Y
1	50.387	67.51
5	101.324	56.31
5	170.448	84.47
3	189.111	07.1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

1	000	64	111	K=	1	KK=	1
2	000	36	111	K=	1	KK=	2
3	000	10	111	K=	1	KK=	3
4	50.387	67.51	0	K=	2	KK=	3
5	74.111	69.111	0	K=	2	KK=	4
6	84.111	27.111	0	K=	2	KK=	5
7	86.111	50.111	0	K=	2	KK=	6
8	0.324	56.309	0	K=	3	KK=	6

I=	10	70	448	84	47	K=	4	KK=	7
I=	11	88	111	73	11	K=	4	KK=	8
I=	12	89	111	07	11	K=	4	KK=	9
I=	13	94	111	94	11	K=	4	KK=	0
I=	14	233	111	07	11	K=	4	KK=	1
I=	15	237	111	00	11	K=	4	KK=	2
I=	16	244	111	90	11	K=	4	KK=	2

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	50	387	67	510	K=	4	KK=	1
I=	2	74	111	69	111	K=	5	KK=	2
I=	3	01	324	56	309	K=	8	KK=	3
I=	4	44	111	07	111	K=	9	KK=	4
I=	5	70	448	84	47	K=	0	KK=	5
I=	6	89	111	07	111	K=	2	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.00000	FO=	2758
FI=	1.2758	FO=	434
FI=	1.434	FO=	4267
FI=	1.4267	FO=	4280

THE SAFETY FACTOR FOR POINT 4 IS 1.14280

ARKPT PRINT

The results taken from the computer program for cross-section
(4-4) A are:

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	85	115	137	85	1.83
b	92	111	150	85	1.40
c	86	110	139	85	1.83
d	92	117	163	85	1.21
e	107	119	174	85	1.71
f	77	119	134	85	1.74
g	81	112	130	85	1.83
h	83	127	144	85	1.80
i	101	115	180	85	1.35
j	74	104	140	85	1.20
k	68	118	154	85	1.16

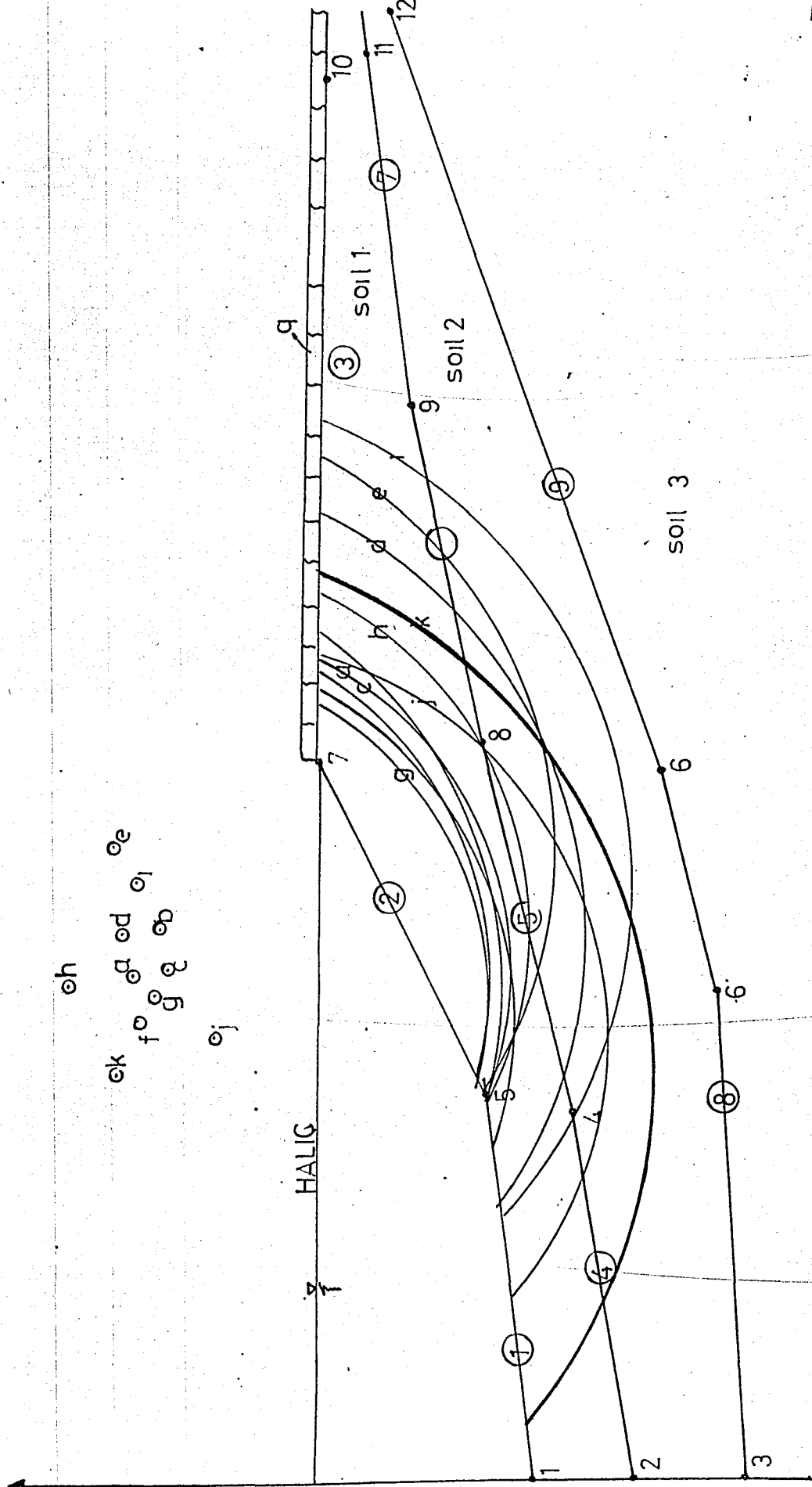


Fig : (4-4) A

OF LINES 9 NO OF LINE INTERSECT= 12
 OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
 IN ITIAL SLICE WIDTH= 200

LINE NO	END NO	COORD	MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INTER
1	2	63	00	49	55	63	55	950706	5
2	2	12	00	55	85	239	85	57241	7
3	2	6	00	32	4	6	41	000000	2
4	2	25	00	45	57	25	57	47273	4
5	2	18	00	69	77	240	77	250000	8
6	2	20	00	13	25	242	25	214286	9
7	2	20	00	25	25	242	73	155593	8
8	2	20	00	25	25	242	73	999076	3
9	2	20	00	25	25	242	73	393443	6

VE INTERSECT ARRAY

NO	X	Y
1	00	49
2	00	32
3	00	32
4	61	41
5	63	55
6	22	55
7	11	85
8	11	57
9	11	69
10	23	85
11	24	77
12	24	73

IL DATA ARRAY

NO	LINE	LEFT INT	PT INT	SAT	UNIT	WT	PHI	COHESI ON
1	2	5	5	00	7	8	20	19
2	2	7	7	00	7	8	20	19
3	2	4	4	00	7	8	20	19
4	2	8	8	00	7	8	20	19
5	2	9	9	00	7	8	20	19
6	2	4	4	00	7	8	20	19
7	2	2	2	00	7	8	20	19
8	2	8	8	00	7	8	20	19
9	2	3	3	00	7	8	20	19
10	2	6	6	00	7	8	20	19
11	2	3	3	00	7	8	20	19
12	2	6	6	00	7	8	20	19

IAL CIRCLE NO 1
 RCLE CTR COORDS: X= 68.11 Y= 18.11
 RANCE PT COORDS: X= 54.11 Y= 85.11
 TRIAL ARC RADIUS= 92.14

X LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 X LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 X LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 X LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 X LINE 9 NOT INTERSECTED BY TRIAL CIRCL

*LINE 5 IS NOT INTERSECTED BUT IS IN ARC

INTERSECT WITH LINE ARRAY

NO	X	Y
6	405	49772
26	374	36700
139	790	6026
154	111	851

ARRAY WITH ALL INTERSECTIONS FOLLOWS:

NO	X	Y	K	KK	NO
2	0000	49772	1	KK	1
3	0000	32711	1	KK	2
4	0000	13711	1	KK	3
6	405	49772	2	KK	3
26	374	35995	3	KK	3
6	111	41111	3	KK	4
6	374	55111	3	KK	5
20	111	25111	3	KK	6
22	511	85111	3	KK	7
25	111	57111	3	KK	8
39	790	60256	4	KK	8
54	111	85111	4	KK	9
83	111	69111	4	KK	0
23	911	85111	4	KK	0
24	011	77111	4	KK	1
24	211	73111	4	KK	2

E APPLICABLE ARRAY ARCINT FOLLOWS:

NO	X	Y	K	KK	NO
6	405	49772	4	KK	1
26	374	35995	5	KK	2
6	111	41111	6	KK	3
6	374	55111	7	KK	4
22	511	85111	9	KK	5
25	111	57111	10	KK	6
39	790	60256	11	KK	7
54	111	85111	12	KK	8

ND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI	FO
00000	18874
18874	21567
21567	21898
21898	21938

THE SAFETY FACTOR FOR POINT IIS 1.21938

IAL CIRCLE NO 2

RCLE CTR COORDS: X= 72711 Y= 18311

TRANCE PT COORDS: X= 54711 Y= 85311

TRIAL ARC RADIUS= 88391

X LINE 2 NOT INTERSECTED BY TRIAL CIRCL

X LINE 5 NOT INTERSECTED BY TRIAL CIRCL

X LINE 7 NOT INTERSECTED BY TRIAL CIRCL

X LINE 8 NOT INTERSECTED BY TRIAL CIRCL

X LINE 9 NOT INTERSECTED BY TRIAL CIRCL

*LINE 2 IS NOT INTERSECTED BUT IS IN ARC

*LINE 5 IS NOT INTERSECTED BUT IS IN ARC

LINE NO	X	Y
1	50.755	1.7
2	37.42	3.3
3	60.03	7.4
4	85.1	1.1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	50.755	1.7	1	1
2	37.42	3.3	1	2
3	60.03	7.4	1	3
4	85.1	1.1	2	3
5	50.755	1.7	3	3
6	37.42	3.3	3	4
7	60.03	7.4	3	5
8	85.1	1.1	3	6
9	50.755	1.7	3	7
10	37.42	3.3	3	8
11	60.03	7.4	4	8
12	85.1	1.1	4	8
13	50.755	1.7	4	9
14	37.42	3.3	4	10
15	60.03	7.4	4	11
16	85.1	1.1	4	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	50.755	1.7	4	1
2	37.42	3.3	5	2
3	60.03	7.4	6	3
4	85.1	1.1	7	4
5	50.755	1.7	9	5
6	37.42	3.3	10	6
7	60.03	7.4	11	7
8	85.1	1.1	12	8

IND SLICE WIDTH AND NO OF SLICES

FI	FO
1.00000	6084
1.16084	8404
1.18404	8694
1.18694	873

THE SAFETY FACTOR FOR POINT 2IS 1.18731

TRIAL CIRCLE NO 3
 CIRCLE CTR COORDS: X= 76.11 Y= 18.11
 ENTRANCE PT COORDS: X= 54.11 Y= 85.11
 TRIAL ARC RADIUS= 84.694

XX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9NOT INTERSECTED BY TRIAL CIRCL

**LINE 2IS NOT INTERSECTED BUT IS IN ARC

**LINE 5IS NOT INTERSECTED BUT IS IN ARC

RC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	23.948	5.39
2	46.124	38.90
3	137.502	59.77
4	154.111	85.1

THE ARRAY WITH ALL INTERSECTIONS		FOLLOWS:	
1	0000	49	1
2	0000	32	1
3	0000	13	1
4	23948	51	2
5	46324	38	3
6	63311	90	4
7	63311	41	3
8	22011	55	3
9	22511	25	3
10	22511	85	3
11	23750	57	3
12	54111	59	4
13	81111	85	4
14	23948	69	4
15	24011	85	4
16	24211	77	4
		73	4

THE APPLICABLE ARRAY ARCINT		FOLLOWS:	
1	23948	51	4
2	46324	38	5
3	63311	90	6
4	63311	41	7
5	22011	55	9
6	22511	25	0
7	22511	85	0
8	54111	59	1
		85	2

FIND SLICE WIDTH AND NO OF SLICES			
FI=	00000	FO=	4429
FI=	4429	FO=	6527
FI=	6527	FO=	6798
FI=	6798	FO=	6833

THE SAFETY FACTOR FOR POINT 3IS 1.16833

TRIAL CIRCLE NO 4
 CIRCLE CIR COORDS: X= 68.7 Y= 22.1
 ENTRANCE PT COORDS: X= 54.7 Y= 85.1
 TRIAL ARC RADIUS= 93.622

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC
 ***LINE 5IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY	
LINE NO	X
1	8.501
2	30.115
3	138.061
4	154.111

THE ARRAY WITH ALL INTERSECTIONS		FOLLOWS:	
1	0000	49	1
2	0000	32	1
3	0000	13	1
4	8.501	49	2

In cross-section (4-4) B soil types are given as :

Soil I : Artificial fill

Soil II : Sedimentary Layer

Soil III: Decomposed Graywacke

The results taken from the computer for cross-section

(4-4) B are :

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	85	I23	I42	90	I.90
b	82	II6	I35	90	I.94
c	99	II8	I59	90	I.60
d	89	II7	I50	90	I.I6
e	85	II2	I28	90	2.00
f	79	I23	I32	90	I.85
g	I05	I28	I59	90	I.95
h	92	I4I	I69	90	I.I8
j	72	II0	I37	90	I.I6
k	66	I27	I45	90	I.I4

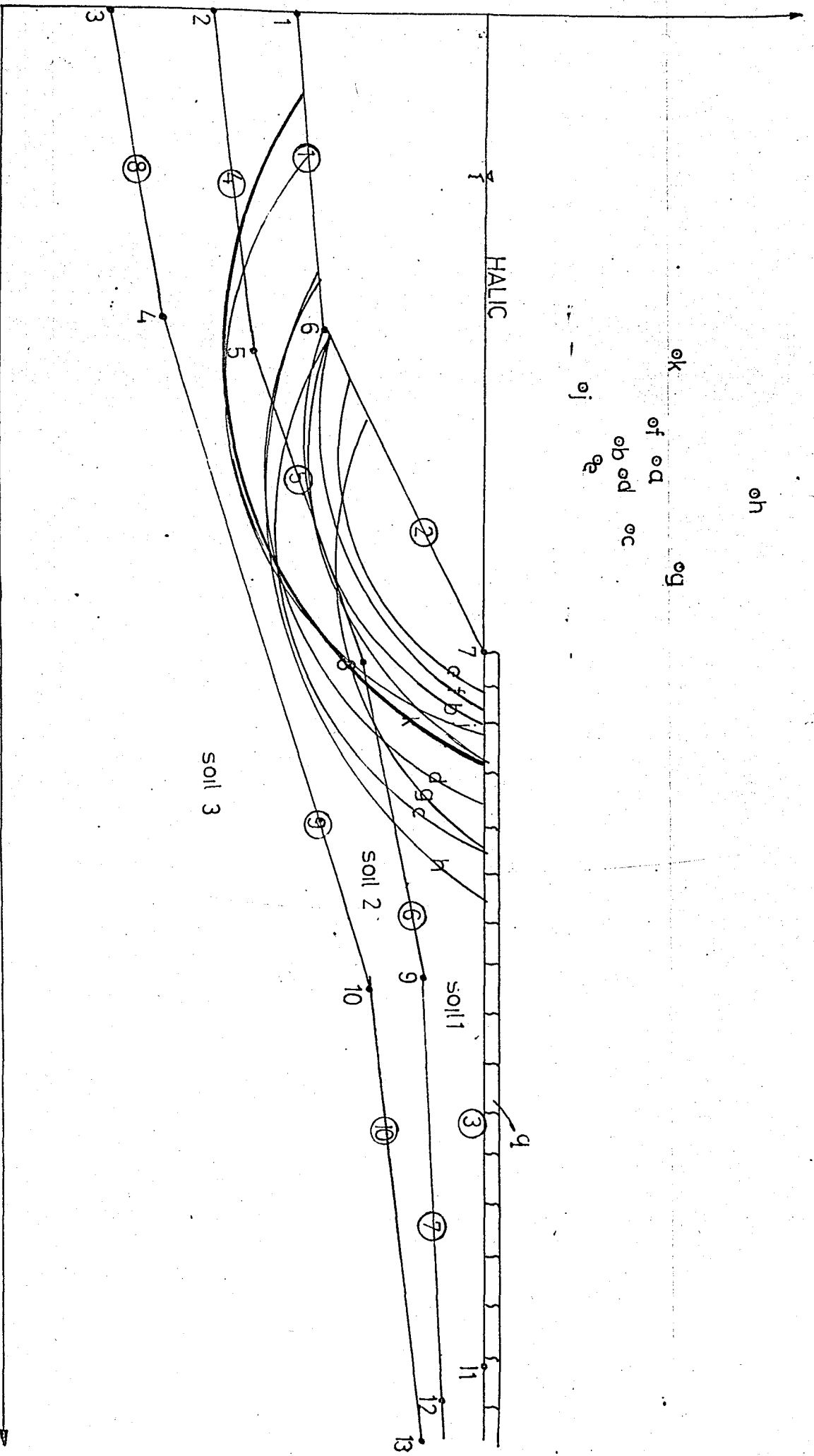


Fig : (4-4) B

NO OF LINES= 20 NO OF LINE INTERSECT= 13
 NO OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 NO OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
 INITIAL SLICE WIDTH= 200

LINE COORD. MATRIX

LINE NO	END NO	INT	X1	Y1	X2	Y2	SLOPE	LINE INTE
1	2	00	60	55	60	60	831795	1
2	2	00	60	60	60	90	491803	6
3	2	00	60	90	60	90	000000	7
4	2	00	60	40	60	46	101504	2
5	2	00	59	46	67	67	328125	5
6	2	00	23	67	79	79	206897	8
7	2	00	8	79	22	82	652174	9
8	2	00	8	20	25	30	175098	3
9	2	00	57	30	82	69	312000	4
10	2	00	82	69	23	80	229157	10

LINE INTERSECT ARRAY

LINE NO	X	Y
1	00	55
2	00	60
3	00	90
4	57	40
5	59	46
6	60	67
7	12	90
8	12	67
9	18	79
10	18	20
11	22	25
12	22	30
13	23	82

SOIL DATA ARRAY

LINE NO	LINE #	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESION
1	2	6	6	00	7.8	20.0	19.6
2	2	7	11	00	7.8	20.0	19.6
3	2	5	5	00	7.8	20.0	19.6
4	2	5	8	00	7.8	20.0	19.6
5	2	9	2	00	7.8	20.0	19.6
6	2	5	5	00	7.8	12.0	19.6
7	2	5	8	00	7.8	12.0	19.6
8	2	9	2	00	7.8	12.0	19.6
9	2	3	4	00	7.8	12.0	19.6
10	2	4	3	00	7.8	12.0	19.6
11	2	3	4	00	7.8	12.0	19.6
12	2	4	3	00	7.8	12.0	19.6
13	2	3	4	00	7.8	12.0	19.6
14	2	4	3	00	7.8	12.0	19.6
15	2	3	4	00	7.8	12.0	19.6
16	2	4	3	00	7.8	12.0	19.6
17	2	3	4	00	7.8	12.0	19.6
18	2	4	3	00	7.8	12.0	19.6
19	2	3	4	00	7.8	12.0	19.6
20	2	4	3	00	7.8	12.0	19.6

TRIAL CIRCLE NO 1
 CIRCLE CTR COORDS: X= 66.1 Y= 27.1
 ENTRANCE PT. COORDS: X= 45.1 Y= 90.1
 TRIAL ARC RADIUS= 87.235

XX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE
 XX LINE 5 NOT INTERSECTED BY TRIAL CIRCLE
 XX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE
 XX LINE 8 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 ***LINE 2 IS NOT INTERSECTED BUT IS IN ARC
 ***LINE 5 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
 LINE NO X Y
 1 5072 5636
 4 39295 4400
 6 130937 6873
 3 1451 9071

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE	X	Y	K	KK	LINE
1	5072	5636	4	KK	1
2	5072	5636	4	KK	2
3	5072	5636	4	KK	3
4	39295	4400	4	KK	4
5	39295	4400	4	KK	5
6	130937	6873	4	KK	6
7	130937	6873	4	KK	7
8	130937	6873	4	KK	8
9	130937	6873	4	KK	9
10	130937	6873	4	KK	10
11	130937	6873	4	KK	11
12	130937	6873	4	KK	12
13	130937	6873	4	KK	13
14	130937	6873	4	KK	14
15	130937	6873	4	KK	15
16	130937	6873	4	KK	16
17	130937	6873	4	KK	17

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	X	Y	K	KK	LINE
1	5072	5636	4	KK	1
2	5072	5636	4	KK	2
3	5072	5636	4	KK	3
4	39295	4400	4	KK	4
5	39295	4400	4	KK	5
6	130937	6873	4	KK	6
7	130937	6873	4	KK	7
8	130937	6873	4	KK	8

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
FI= 00000	FO= 2133
FI= 3833	FO= 3825
FI= 3825	FO= 4039
FI= 4039	FO= 4065

THE SAFETY FACTOR FOR POINT 1 IS 1.14065

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= 7071 Y= 2771
 ENTRANCE PT COORDS: X= 451 Y= 9071
 TRIAL ARC RADIUS= 83630

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 1 NOT INTERSECTED BY TRIAL CIRCL

**LINE 2 IS NOT INTERSECTED BUT IS IN ARC

**LINE 5 IS NOT INTERSECTED BUT IS IN ARC

RC INTERSECT WITH LINE ARRAY

LINE NO	X	Y	LINE NO	X	Y
1	24	316	57	134	3
2	52	237	45	413	7
3	129	751	68	485	1
4	145	111	90	111	1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	LINE NO	X	Y	K	KK
1	24	316	57	134	3	1	1
2	52	237	45	413	7	1	2
3	129	751	68	485	1	1	3
4	145	111	90	111	1	2	3
5	24	316	57	134	3	3	3
6	52	237	45	413	7	3	4
7	129	751	68	485	1	3	5
8	145	111	90	111	1	3	6
9	24	316	57	134	3	3	7
10	52	237	45	413	7	3	8
11	129	751	68	485	1	4	8
12	145	111	90	111	1	4	8
13	24	316	57	134	3	4	9
14	52	237	45	413	7	4	11
15	129	751	68	485	1	4	12
16	145	111	90	111	1	4	13
17	24	316	57	134	3	4	13

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	LINE NO	X	Y	K	KK
1	24	316	57	134	3	4	1
2	52	237	45	413	7	5	2
3	129	751	68	485	1	7	3
4	145	111	90	111	1	8	4
5	24	316	57	134	3	9	5
6	52	237	45	413	7	10	6
7	129	751	68	485	1	11	7
8	145	111	90	111	1	12	8

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
1946	1946
3620	3620
3832	3832
3858	3858

THE SAFETY FACTOR FOR POINT 2 IS 1.13858

TRIAL CIRCLE NO 3

CIRCLE CTR COORDS: X= 74.71 Y= 27.21

ENTRANCE PT. COORDS: X= 45.11 Y= 90.11

TRIAL ARC RADIUS= 87.062

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
33	822	57.92
63	944	47.70
123	315	68.79
145	111	90.51

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=			K=	KK=
2	0000	55.11	1	1
3	0000	40.11	1	2
4	0000	20.11	1	3
5	33.822	57.924	2	3
6	59.11	30.11	2	4
7	60.11	46.11	2	5
8	63.944	60.11	2	6
9	63.944	47.697	3	6
10	123.315	90.511	3	7
11	123.315	67.11	3	8
12	128.315	68.798	4	8
13	145.11	90.511	4	8
14	145.11	79.11	4	9
15	225.11	69.11	4	7
16	227.11	90.511	4	1
17	230.11	82.11	4	2
		80.11	4	3

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=			K=	KK=
2	33.822	57.924	4	1
3	60.11	40.11	7	2
4	63.944	47.697	8	3
5	123.315	90.511	9	4
6	123.315	67.11	10	5
7	128.315	68.798	11	6
	145.11	90.511	12	7

FIND SLICE WIDTH AND NO OF SLICES

F1=	000000	F0=	2695
F1=	2695	F0=	4467
F1=	4467	F0=	4689
F1=	4689	F0=	4716

THE SAFETY FACTOR FOR POINT 3 IS 1.14716

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= 66.11 Y= 31.11
ENTRANCE PT COORDS: X= 45.11 Y= 90.51
TRIAL ARC RADIUS= 89.086

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

***LINE 5 IS NOT INTERSECTED BUT IS IN ARC

INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	7.481	56.57
2	44.904	44.67
3	129.254	68.38
4	145.111	90.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	7.481	56.57	4	KK
2	44.904	44.67	5	KK
3	129.254	68.38	7	KK
4	145.111	90.11	8	KK
5	17.481	56.57	9	KK
6	44.904	44.67	10	KK
7	129.254	68.38	11	KK
8	145.111	90.11	12	KK
9	17.481	56.57	13	KK
10	44.904	44.67	14	KK
11	129.254	68.38	15	KK
12	145.111	90.11	16	KK
13	17.481	56.57	17	KK
14	44.904	44.67	18	KK
15	129.254	68.38	19	KK
16	145.111	90.11	20	KK
17	17.481	56.57	21	KK

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	7.481	56.57	4	KK
2	44.904	44.67	5	KK
3	129.254	68.38	7	KK
4	145.111	90.11	8	KK
5	17.481	56.57	9	KK
6	44.904	44.67	10	KK
7	129.254	68.38	11	KK
8	145.111	90.11	12	KK

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
1.00000	2465
1.2465	4.77
1.4777	4.389
1.777	4.415

THE SAFETY FACTOR FOR POINT 4IS 1.14415

TRIAL CIRCLE NO 5

CIRCLE CTR COORDS: X= 70.71 Y= 31.71

ENTRANCE PT. COORDS: X= 145.11 Y= 90.11

TRIAL ARC RADIUS= 85.475

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LTNE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	25.921	57.35
2	59.329	46.28
3	127.358	68.09
4	145.111	90.11

In cross-section (8-8) A soil types are given as :

Soil I is Bottom Sludge? It has been determined that it is formed by sedimentation of eroded materials and pollutant in water. The engineering characteristics has been taken as :

γ : 1.15 t/m³

ϕ : 12

c : 0

Soil II : Artificial Fill

Soil III : Sedimentary Layer

Soil 4 : Decomposed Graywacke

The results taken from the computer for cross-section (8-8)A are

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	86	111	135	81	1.18
b	83	105	118	81	1.14
c	91	108	124	81	1.50
d	98	123	165	81	1.60
e	101	113	153	81	1.60
f	84	120	127	81	1.14
g	82	93	133	81	1.30
m	72	108	136	81	1.24
n	74	117	136	81	1.13
p	81	128	157	81	1.35

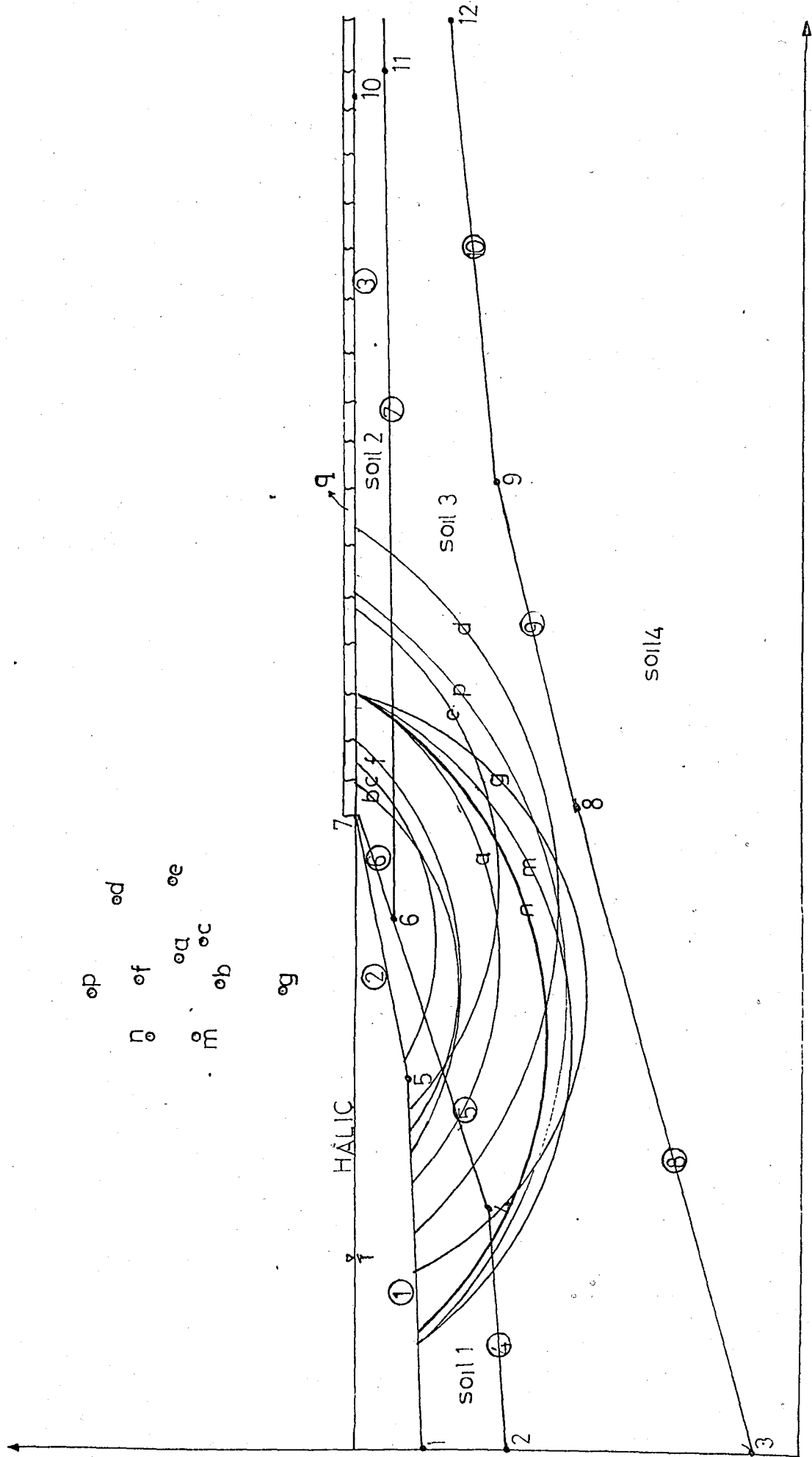


Fig : (8-8) A

SLOPE STABILITY FOR TASKIZAK(I) MAHIR KOSELER THESIS.

NO OF LINES 10 NO OF LINE INTERSECT= 12
 NO OF SOILS= 4 NO OF EXTERNAL SOIL LINES= 3
 NO OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
 INITIAL SLICE WIDTH= 270

THE LINE END COORD MATRIX

LINE NO	END NO	COORD X	COORD Y	X2	Y2	SLOPE	LINE INT
1	2	55	00	68	00	460752	001
2	3	113	00	74	00	208333	001
3	4	40	00	53	00	000000	001
4	5	95	00	55	00	499861	001
5	6	95	00	74	00	345405	001
6	7	15	00	74	00	388889	001
7	8	75	00	81	00	204082	001
8	9	15	00	41	00	285690	001
9	10	75	00	54	00	216557	001
10	11	75	00	66	00	173913	001

LINE INTERSECT ARRAY

LINE NO	INTERSECT X	INTERSECT Y
1	00	68
2	00	53
3	00	81
4	00	55
5	00	71
6	00	74
7	00	81
8	00	41
9	00	54
10	00	81
11	00	66

SOIL DATA ARRAY

SOIL NO	LINE #	LEFT INT	RIGHT INT	SAT	UNIT WT	PHI	COHESION
1	2	55	68	00	1.5	12	00
1	3	113	74	00	1.5	12	00
1	4	40	53	00	1.5	12	00
1	5	95	55	00	1.5	12	00
1	6	95	74	00	1.5	12	00
1	7	15	74	00	1.5	12	00
1	8	75	81	00	1.5	12	00
1	9	15	41	00	1.5	12	00
1	10	75	54	00	1.5	12	00
1	11	75	66	00	1.5	12	00

TRIAL CIRCLE NO

ENTRANCE PT. COORDS: X= 84.711 Y= 20.711
 TRIAL ARC RADIUS= 58.052

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

***LINE 21S NOT INTERSECTED BUT IS IN ARC

***LINE 61S NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	53.816	70.59
5	67.367	64.53
7	120.171	74.62
3	127.111	8.54

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE	X	Y	K	KK	LINE
1	53.816	70.59	1	KK	1
2	53.816	70.59	1	KK	2
3	53.816	70.59	1	KK	3
4	53.816	70.59	1	KK	4
5	67.367	64.53	2	KK	4
6	67.367	64.53	2	KK	5
7	67.367	64.53	3	KK	5
8	67.367	64.53	3	KK	6
9	67.367	64.53	3	KK	7
10	67.367	64.53	3	KK	8
11	67.367	64.53	4	KK	8
12	67.367	64.53	4	KK	8
13	67.367	64.53	4	KK	9
14	67.367	64.53	4	KK	10
15	67.367	64.53	4	KK	11
16	67.367	64.53	4	KK	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	X	Y	K	KK	LINE
1	53.816	70.59	5	KK	1
2	67.367	64.53	6	KK	2
3	67.367	64.53	7	KK	3
4	67.367	64.53	8	KK	4
5	67.367	64.53	9	KK	5
6	67.367	64.53	1	KK	6
7	67.367	64.53	12	KK	7

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
1.00000	1.3258
1.3258	1.4675
1.4675	1.4811
1.4811	1.4823

THE SAFETY FACTOR FOR POINT 1 IS 1.14823

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 88.711 Y= 120.511
ENTRANCE PT COORDS: X= 27.511 Y= 81.511
TRIAL ARC RADIUS= 55.754

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XX LINE 10NOT INTERSECTED BY TRIAL CIRCL

**LINE 2IS NOT INTERSECTED BUT IS IN ARC

**LINE 6IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO		
1	52.983	73.501
2	73.958	66.804
3	119.266	74.604
4	127.111	81.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:			
LINE	NO	INTERSECTIONS	FOLLOWS:
1	1	0000	KK= 1
2	2	0000	KK= 2
3	3	0000	KK= 3
4	4	40.111	KK= 4
5	5	52.983	KK= 5
6	6	55.111	KK= 6
7	7	73.958	KK= 7
8	8	95.111	KK= 8
9	9	113.111	KK= 9
10	10	115.111	KK= 10
11	11	119.266	KK= 11
12	12	127.111	KK= 12
13	13	175.111	KK= 13
14	14	240.111	KK= 14
15	15	242.111	KK= 15
16	16	244.111	KK= 16

THE APPLICABLE ARRAY ARCINT FOLLOWS:			
LINE	NO	ARCINT	FOLLOWS:
1	1	52.983	KK= 1
2	2	65.111	KK= 2
3	3	73.958	KK= 3
4	4	95.111	KK= 4
5	5	113.111	KK= 5
6	6	119.266	KK= 6
7	7	127.111	KK= 7

FIND SLICE WIDTH AND NO OF SLICES			
FI	FO	FI	FO
1.00000	1.22606	1.22606	1.25385
1.22606	1.25385	1.25385	1.25407
1.25385	1.25407	1.25407	

THE SAFETY FACTOR FOR POINT 2IS 1.25407

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= 92.111 Y= 120.111
ENTRANCE PT. COORDS: X= 127.111 Y= 81.111
TRIAL ARC RADIUS= 52.402

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

***LINE 6 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY			
LINE NO	X	Y	
2	70.711	72.28	
5	80.409	69.03	
7	113.238	74.58	
3	127.111	81.11	

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:					
I=1	0000	68.111	K=1	KK=1	1
I=2	0000	53.111	K=1	KK=1	2
I=3	0000	8.111	K=1	KK=1	3
I=4	40.111	55.111	K=1	KK=1	4
I=5	65.111	71.111	K=1	KK=1	5
I=6	70.711	72.278	K=2	KK=1	5
I=7	80.409	69.032	K=3	KK=1	5
I=8	95.111	74.111	K=3	KK=1	6
I=9	113.111	8.111	K=3	KK=1	7
I=10	115.111	4.111	K=3	KK=1	8
I=11	118.038	74.579	K=4	KK=1	8
I=12	127.111	81.111	K=4	KK=1	8
I=13	175.111	54.111	K=4	KK=1	9
I=14	240.111	8.111	K=4	KK=1	0
I=15	242.111	77.111	K=4	KK=1	1
I=16	244.111	66.111	K=4	KK=1	2

THE APPLICABLE ARRAY ARCINT FOLLOWS:					
I=1	70.711	72.278	K=6	KK=1	1
I=2	80.409	69.032	K=7	KK=1	2
I=3	95.111	74.111	K=8	KK=1	3
I=4	113.111	8.111	K=9	KK=1	4
I=5	118.038	74.579	K=11	KK=1	5
I=6	127.111	81.111	K=12	KK=1	6

FIND SLICE WIDTH AND NO OF SLICES				
FI=	000000	FO=	40689	
FI=	240689	FO=	45530	
FI=	245530	FO=	45948	
FI=	245948	FO=	45984	

THE SAFETY FACTOR FOR POINT 3 IS 1.45984

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= 84.711 Y= 124.711
ENTRANCE PT. COORDS: X= 127.111 Y= 81.111
TRIAL ARC RADIUS= 60.811

- XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
- XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
- XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL
- XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
- XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL
- XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

***LINE 6 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
LINE NO X Y

5	55	127	70	65
5	69	194	65	66
7	119	422	74	61
3	127	111	8	61

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	0000	68	1	K=	1	KK=	1
I=	2	0000	53	1	K=	1	KK=	2
I=	3	0000	8	1	K=	1	KK=	3
I=	4	40	55	1	K=	1	KK=	4
I=	5	55	70	65	K=	2	KK=	4
I=	6	65	7	1	K=	2	KK=	5
I=	7	69	65	58	K=	3	KK=	5
I=	8	95	74	1	K=	3	KK=	6
I=	9	13	8	1	K=	3	KK=	7
I=	10	15	4	1	K=	3	KK=	8
I=	11	19	74	607	K=	4	KK=	8
I=	12	27	8	1	K=	4	KK=	9
I=	13	75	54	1	K=	4	KK=	9
I=	14	240	8	1	K=	4	KK=	10
I=	15	242	77	1	K=	4	KK=	11
I=	16	244	66	1	K=	4	KK=	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	55	127	70	65	K=	5	KK=	1
I=	2	65	11	7	1	K=	6	KK=	2
I=	3	69	94	65	58	K=	7	KK=	3
I=	4	95	1	74	1	K=	8	KK=	4
I=	5	13	1	8	1	K=	9	KK=	5
I=	6	19	422	74	607	K=	1	KK=	6
I=	7	27	1	8	1	K=	2	KK=	7

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	6048
FI=	116048	FO=	7765
FI=	117765	FO=	7925
FI=	117925	FO=	7940

THE SAFETY FACTOR FOR POINT 4IS 1.17940

TRIAL CIRCLE NO 5
 CIRCLE CTR COORDS: X= 88.1 Y= 24.1
 ENTRANCE PT COORDS: X= 127.1 Y= 81.1
 TRIAL ARC RADIUS= 58.052

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

***LINE 6IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	64.490	7.208
5	75.593	67.40
7	118.391	74.59
3	127.111	81.1

In cross-section (8-8) B soil types are given as :

Soil I : Bottom Sludge (Slurry)

Soil II : Artificial Fill

Soil III : Sedimentary Layer

Soil 4 : Decomposed Graywacke

The results taken from the computer for cross-section (8-8)B a

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	101	110	143	64	1.67
b	97	103	133	64	3.11
c	107	101	139	64	3.62
d	93	108	136	64	1.54
e	109	108	152	64	1.67
f	86	111	133	64	1.44
g	88	103	139	64	1.16

of od oe od
ob oc
og

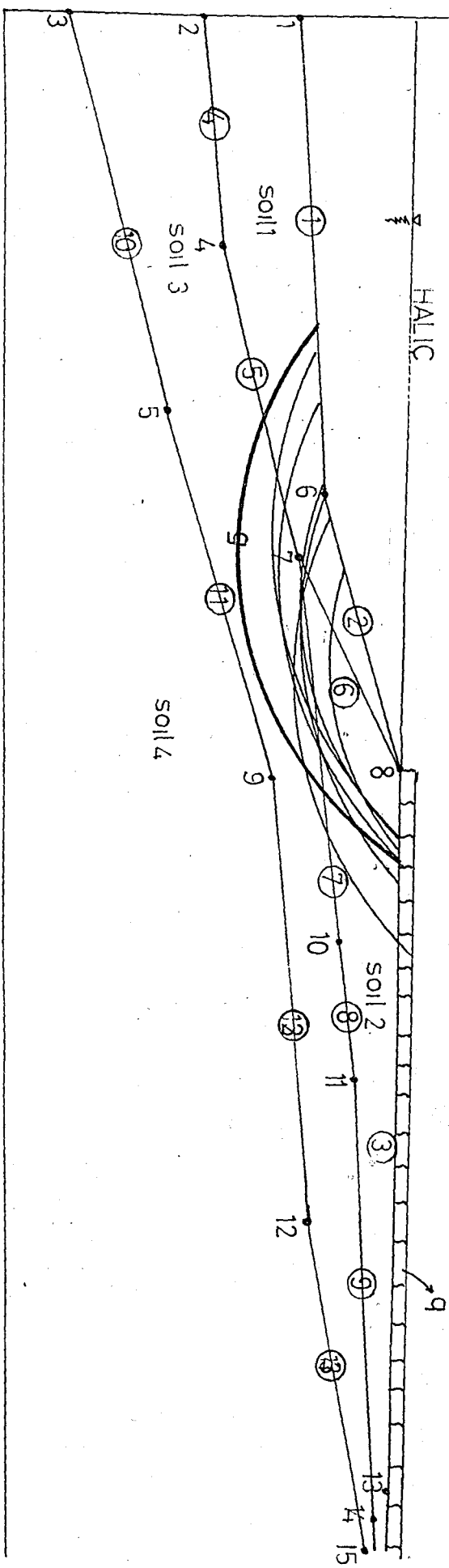


Fig : (8-8) B

OF LINES 13 NO OF LINE INTERSECT= 15
OF SOILS= 4 NO OF EXTERNAL SOIL LINES= 3
OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
IN INITIAL SLICE WIDTH= 250

LINE	END	COORD	MATRIX	LINE	INTER
NO	NO	INT	X1	X2	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102

E	NO	INTERSECT	ARRAY		Y
		X			
1	1	30	00		50
2	2	30	00		33
3	3	30	00		33
4	4	36	00		36
5	5	64	00		26
6	6	77	00		29
7	7	89	00		44
8	8	24	00		64
9	9	28	00		44
0	0	44	00		44
1	1	77	00		55
2	2	99	00		66
3	3	99	00		44
4	4	22	00		66
5	5	22	00		55
		22	00		56

DATA LINE	RAY #	LEFT INT	RT. INT	SAT	UNIT	WT	PHI	COHESI	ON
1	1	8	6	0	1	5	1	0	0
2	2	8	8	0	1	5	2	0	0
3	3	4	8	0	1	5	3	0	0
4	4	7	4	0	1	5	4	0	0
5	5	7	7	0	1	5	5	0	0
6	6	8	8	0	1	5	6	0	0
7	7	7	7	0	1	5	7	0	0
8	8	8	8	0	1	5	8	0	0
9	9	7	7	0	1	5	9	0	0
10	10	8	8	0	1	5	10	0	0
11	11	7	7	0	1	5	11	0	0
12	12	8	8	0	1	5	12	0	0
13	13	7	7	0	1	5	13	0	0
14	14	8	8	0	1	5	14	0	0
15	15	7	7	0	1	5	15	0	0
16	16	8	8	0	1	5	16	0	0
17	17	7	7	0	1	5	17	0	0
18	18	8	8	0	1	5	18	0	0
19	19	7	7	0	1	5	19	0	0
20	20	8	8	0	1	5	20	0	0
21	21	7	7	0	1	5	21	0	0
22	22	8	8	0	1	5	22	0	0
23	23	7	7	0	1	5	23	0	0
24	24	8	8	0	1	5	24	0	0
25	25	7	7	0	1	5	25	0	0
26	26	8	8	0	1	5	26	0	0
27	27	7	7	0	1	5	27	0	0
28	28	8	8	0	1	5	28	0	0
29	29	7	7	0	1	5	29	0	0
30	30	8	8	0	1	5	30	0	0
31	31	7	7	0	1	5	31	0	0
32	32	8	8	0	1	5	32	0	0
33	33	7	7	0	1	5	33	0	0
34	34	8	8	0	1	5	34	0	0
35	35	7	7	0	1	5	35	0	0
36	36	8	8	0	1	5	36	0	0
37	37	7	7	0	1	5	37	0	0
38	38	8	8	0	1	5	38	0	0
39	39	7	7	0	1	5	39	0	0
40	40	8	8	0	1	5	40	0	0
41	41	7	7	0	1	5	41	0	0
42	42	8	8	0	1	5	42	0	0
43	43	7	7	0	1	5	43	0	0
44	44	8	8	0	1	5	44	0	0
45	45	7	7	0	1	5	45	0	0
46	46	8	8	0	1	5	46	0	0
47	47	7	7	0	1	5	47	0	0
48	48	8	8	0	1	5	48	0	0
49	49	7	7	0	1	5	49	0	0
50	50	8	8	0	1	5	50	0	0

AL CIRCLE NO. 1
CLE CTR COORDS: X= X= 88.41 Y= 03.11
RANCE PT. COORDS: X= 39.41 Y= 64.11

TRIAL ARC RADIUS= 64.203

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 12 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 13 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

***LINE 6 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	50.048	51.41
5	65.024	43.20
7	127.433	52.36
13	139.111	64.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	000	50	33	11	36	50	64	65	77	89	124	127	139	148	179	229	230	232	56
2	000	33	11	36	50	64	65	77	89	124	127	139	148	179	229	230	232	56	56
3	000	11	36	50	64	65	77	89	124	127	139	148	179	229	230	232	56	56	56
4	000	36	50	64	65	77	89	124	127	139	148	179	229	230	232	56	56	56	56
5	048	50	33	11	36	50	64	65	77	89	124	127	139	148	179	229	230	232	56
6	024	64	65	77	89	124	127	139	148	179	229	230	232	56	56	56	56	56	56
7	433	43	20	52	36	64	65	77	89	124	127	139	148	179	229	230	232	56	56
8	409	5	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	1	2	3	4	5	6	7
1	50	65	77	89	124	127	139
2	50	65	77	89	124	127	139
3	50	65	77	89	124	127	139
4	50	65	77	89	124	127	139
5	50	65	77	89	124	127	139
6	50	65	77	89	124	127	139
7	50	65	77	89	124	127	139

FIND SLICE WIDTH AND NO OF SLICES

LINE	1	2	3	4	5	6	7
1	000	000	000	000	000	000	000
2	000	000	000	000	000	000	000
3	000	000	000	000	000	000	000
4	000	000	000	000	000	000	000
5	000	000	000	000	000	000	000
6	000	000	000	000	000	000	000
7	000	000	000	000	000	000	000

THE SAFETY FACTOR FOR POINT TIS T.16188

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= X= 92.71 Y= 103.71
 ENTRANCE PT. COORDS: X= X= 39.71 Y= 64.71
 TRIAL ARC RADIUS= 61.074

XX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 11 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 12 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 13 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

***LINE 6 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	59.228	51.65
2	72.905	45.14
7	125.888	52.23
3	139.111	64.71

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE	ARRAY	WITH ALL INTERSECTIONS	FOLLOWS:	KK=	KK=
1	1	000	50	1	1
2	2	000	33	1	2
3	3	000	11	1	3
4	4	36	36	1	4
5	5	59.228	51.65	2	5
6	6	64.71	26	2	6
7	7	72.905	45.14	3	7
8	8	77	52	3	8
9	9	89	49	3	9
10	10	24	64	3	10
11	11	25	44	3	11
12	12	25.888	52.23	4	12
13	13	39	64	4	13
14	14	48	54	4	14
15	15	74	56	4	15
16	16	99	49	4	16
17	17	229	64	4	17
18	18	230	58	4	18
19	19	232	56	4	19

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	APPLICABLE ARRAY	ARCINT	FOLLOWS:	KK=	KK=
1	1	59.228	51.65	5	1
2	2	72.905	45.14	7	2
3	3	77	52	8	3
4	4	89	49	9	4
5	5	24	64	10	5
6	6	25	44	12	6
7	7	25.888	52.23	13	7

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	18968
FI=	18968	FO=	21496
FI=	21496	FO=	21784
FI=	21784	FO=	21876

THE SAFETY FACTOR FOR POINT 2IS T,21816

TRIAL CIRCLE NO 3
 CIRCLE CTR COORDS: X= X= 96.711 Y= 103.711
 ENTRANCE PT COORDS: X= 39.711 Y= 64.711
 TRIAL ARC RADIUS= 58.052

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 12NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 13NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

***LINE 6IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	68.783	51.89
5	80.882	47.809
7	123.78	52.804
3	139.11	64.8

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2000	50	K=	1	KK=	1
I=	2	2000	33	K=	1	KK=	2
I=	3	2000	12	K=	1	KK=	3
I=	4	36	36	K=	1	KK=	4
I=	5	64	26	K=	1	KK=	5
I=	6	68	52	K=	2	KK=	5
I=	7	77	52	K=	2	KK=	6
I=	8	80	47	K=	3	KK=	6
I=	9	89	49	K=	3	KK=	7
I=	10	123	52	K=	4	KK=	7
I=	11	124	64	K=	4	KK=	8
I=	12	125	44	K=	4	KK=	9
I=	13	139	64	K=	4	KK=	9
I=	14	148	54	K=	4	KK=	10
I=	15	174	56	K=	4	KK=	11
I=	16	199	49	K=	4	KK=	12
I=	17	229	64	K=	4	KK=	13
I=	18	230	58	K=	4	KK=	14
I=	19	232	56	K=	4	KK=	15

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	68.783	51.895	K=	6	KK=	1
----	---	--------	--------	----	---	-----	---

77	21	52	1	K=	7	KK=	2
80	88	47	09	K=	8	KK=	3
89	11	49	11	K=	9	KK=	4
123	718	52	04	K=	0	KK=	5
124	11	64	11	K=	1	KK=	6
139	11	64	11	K=	2	KK=	7

FIND SLICE WIDTH AND NO OF SLICES

F1=	1.0000	F0=	1.30652
F2=	1.30652	F0=	1.34951
F3=	1.34951	F0=	1.35422
F4=	1.35422	F0=	1.35472

THE SAFETY FACTOR FOR POINT 3IS 1.35472

TRIAL CIRCLE NO 4
 CIRCLE CTR COORDS: X= 88.711 Y= 407.11
 ENTRANCE PT. COORDS: X= 39.711 Y= 64.11
 TRIAL ARC RADIUS= 66.708

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 12NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 13NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

***LINE 6IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	51.356	51.44
5	67.249	43.75
7	126.049	52.24
3	139.11	64.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

1	0000	50	1	KK=	1
2	0000	33	2	KK=	2
3	0000	11	3	KK=	3
4	36	38	4	KK=	4
5	51.356	51.44	5	KK=	5
6	64	26	6	KK=	6
7	67.249	43.75	7	KK=	7
8	77	52	8	KK=	8
9	89	49	9	KK=	9
10	124	64	10	KK=	10
11	125	44	11	KK=	11
12	26	52	12	KK=	12
13	39	64	13	KK=	13
14	48	54	14	KK=	14
15	74	56	15	KK=	15
16	99	49	16	KK=	16

In cross-section (IO-IO)A soil types are given as :

Soil I : Bottom Sludge

Soil II : Artificial Fill

Soil III : Sedimentary Layer

Soil 4 : Decomposed Graywacke

The results taken from the computer for cross-section (IO-IO)A are

Circle NO	Circle Center Coordinates		Entrance Points		Factor Of Safety
	X	Y	X	Y	
a	II7	III	I4I	90	I.24
b	I25	II6	I59	90	I.58
c	III	II7	I49	90	I.3I
d	II9	I0I	I68	90	3.05
e	II9	I30	I82	90	2.77
f	II6	I43	I87	90	2.54
g	I08	I29	I6I	90	2.3I
h	I04	I52	I84	90	3.34
k	II9	I23	I45	90	I.54

OF LINES 11 NO OF LINE INTERSECT= 14
 OF SOILS= 4 NO OF EXTERNAL SOIL LINES= 5
 OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
 IN ITIAL SLICE WIDTH= 270

LINE END COORD MATRIX

LINE NO	END NO	INT	X1	Y1	X2	Y2	SLOPE	LINE INTE
1	2	2	67	87	67	88	749007	4
2	2	2	84	88	84	86	17647	5
3	2	2	22	86	22	86	000000	8
4	2	2	32	90	32	90	400000	10
5	2	2	1	78	1	80	000000	26
6	2	2	1	80	1	83	180000	9
7	2	2	25	87	25	87	476190	3
8	2	2	20	87	20	83	380952	7
9	2	2	75	47	75	47	999076	1
10	2	2	75	59	75	59	218182	1
11	2	2	75	60	75	60	75439	1

LINE INTERSECT ARRAY

LINE NO	X	Y
1	30	87
2	00	78
3	00	35
4	67	88
5	84	86
6	22	80
7	1	47
8	1	86
9	22	87
10	32	90
11	75	59
12	25	90
13	20	83
14	23	87
15	32	60

SOIL DATA ARRAY

LINE NO	LINE #	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESI ON
1	2	4	4	000	15	12	000
2	2	5	8	000	15	12	000
3	2	5	00	000	15	12	000
4	2	5	00	000	15	12	000
5	2	5	00	000	15	12	000
6	2	5	00	000	15	12	000
7	2	5	00	000	15	12	000
8	2	5	00	000	15	12	000
9	2	5	00	000	15	12	000
10	2	5	00	000	15	12	000
11	2	5	00	000	15	12	000
12	2	5	00	000	15	12	000
13	2	5	00	000	15	12	000
14	2	5	00	000	15	12	000
15	2	5	00	000	15	12	000
16	2	5	00	000	15	12	000
17	2	5	00	000	15	12	000
18	2	5	00	000	15	12	000
19	2	5	00	000	15	12	000
20	2	5	00	000	15	12	000
21	2	5	00	000	15	12	000
22	2	5	00	000	15	12	000
23	2	5	00	000	15	12	000
24	2	5	00	000	15	12	000
25	2	5	00	000	15	12	000
26	2	5	00	000	15	12	000
27	2	5	00	000	15	12	000
28	2	5	00	000	15	12	000
29	2	5	00	000	15	12	000
30	2	5	00	000	15	12	000
31	2	5	00	000	15	12	000
32	2	5	00	000	15	12	000
33	2	5	00	000	15	12	000
34	2	5	00	000	15	12	000
35	2	5	00	000	15	12	000
36	2	5	00	000	15	12	000
37	2	5	00	000	15	12	000
38	2	5	00	000	15	12	000
39	2	5	00	000	15	12	000
40	2	5	00	000	15	12	000
41	2	5	00	000	15	12	000
42	2	5	00	000	15	12	000
43	2	5	00	000	15	12	000
44	2	5	00	000	15	12	000
45	2	5	00	000	15	12	000
46	2	5	00	000	15	12	000
47	2	5	00	000	15	12	000
48	2	5	00	000	15	12	000
49	2	5	00	000	15	12	000
50	2	5	00	000	15	12	000
51	2	5	00	000	15	12	000
52	2	5	00	000	15	12	000
53	2	5	00	000	15	12	000
54	2	5	00	000	15	12	000
55	2	5	00	000	15	12	000
56	2	5	00	000	15	12	000
57	2	5	00	000	15	12	000
58	2	5	00	000	15	12	000
59	2	5	00	000	15	12	000
60	2	5	00	000	15	12	000

TRIAL CIRCLE NO 1
 CIRCLE CTR COORDS: X= 17.1 Y= 11.1
 ENTRANCE PT COORDS: X= 17.1 Y= 11.1
 TRIAL ARC RADIUS= 31.890

XX LINE NOT INTERSECTED BY TRIAL CIRCL

XX LINE NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 11 NOT INTERSECTED BY TRIAL CIRCL
 ***LINE 4 IS NOT INTERSECTED BUT IS IN ARC
 ***LINE 7 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
 LINE NO
 3 97.3 2 86.1
 6 109.7 40 80.09
 8 137.5 57 86.64
 9 141.1 1 90.1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
 I= 1 000 87.1 KK= 1
 I= 2 000 78.1 KK= 1
 I= 3 000 35.1 KK= 1
 I= 4 67.1 88.1 KK= 1
 I= 5 84.1 86.1 KK= 1
 I= 6 97.3 86.1 KK= 2
 I= 7 09.7 80.086 KK= 3
 I= 8 11.1 80.1 KK= 3
 I= 9 20.1 47.1 KK= 3
 I= 10 22.1 86.1 KK= 3
 I= 11 25.1 87.1 KK= 3
 I= 12 32.1 90.1 KK= 3
 I= 13 137.5 86.637 KK= 4
 I= 14 141.1 90.1 KK= 4
 I= 15 175.1 59.1 KK= 4
 I= 16 229.1 90.1 KK= 4
 I= 17 230.1 83.1 KK= 4
 I= 18 232.1 60.1 KK= 4

THE APPLICABLE ARRAY ARCINT FOLLOWS:
 I= 1 97.3 2 86.1 K= 6 KK= 1
 I= 2 109.7 40 80.086 K= 7 KK= 2
 I= 3 11.1 88.1 86.1 K= 8 KK= 3
 I= 4 122.1 86.1 K= 10 KK= 4
 I= 5 125.1 87.1 K= 11 KK= 5
 I= 6 132.1 90.1 K= 12 KK= 6
 I= 7 137.5 86.637 K= 13 KK= 7
 I= 8 141.1 90.1 K= 14 KK= 8

FIND SLICE WIDTH AND NO OF SLICES
 FI= 10000 FO= 21473
 FI= 121473 FO= 24381
 FI= 1224381 FO= 24711
 FI= 124711 FO= 24747

THE SAFETY FACTOR FOR POINT 11S 1.24747

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= 120.1 Y= 11.1
 ENTRANCE PT COORDS: X= 141.1 Y= 90.1
 TRIAL ARC RADIUS= 29.698

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

***LINE 4IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
3	104	080
7	114	836
8	136	967
5	141	111
	86	111
	81	88
	86	66
	90	111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=				K=	KK=	T
2	1000	87	111	3	KK=	1
3	1000	78	111	3	KK=	2
4	1000	35	111	3	KK=	3
5	67	88	111	3	KK=	4
6	84	86	111	3	KK=	5
7	104	86	111	3	KK=	5
8	114	80	111	3	KK=	6
9	120	88	111	3	KK=	6
10	122	47	111	3	KK=	7
11	122	86	111	3	KK=	8
12	132	87	111	3	KK=	9
13	136	90	111	3	KK=	00
14	136	86	659	4	KK=	00
15	141	90	111	4	KK=	00
16	229	59	111	4	KK=	00
17	230	90	111	4	KK=	23
18	232	83	111	4	KK=	3
		60	111	4	KK=	4

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=				K=	KK=	T
2	104	86	111	6	KK=	1
3	114	88	111	8	KK=	2
4	222	86	111	0	KK=	3
5	225	87	111	2	KK=	4
6	136	90	111	3	KK=	5
7	141	86	659	4	KK=	6
		90	111	4	KK=	7

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	37942
FI=	37942	FO=	43391
FI=	43391	FO=	43972
FI=	43972	FO=	44032

THE SAFETY FACTOR FOR POINT 2IS 1.44032

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= 23.71 Y= 90.11
ENTRANCE PT. COORDS: X= 41.21 Y= 90.11
TRIAL ARC RADIUS= 27.659

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

***LINE 4IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
2	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
3	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
4	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
5	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
6	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
7	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
8	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
9	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
10	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
11	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
12	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
13	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
14	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
15	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
16	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
17	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841
18	111	118	136	141	279	328	102	111	86	83	86	90	756	868	878	879	845	841

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	2	3	4	5	6	7
1	111	118	136	141	279	328	102
2	111	118	136	141	279	328	102
3	111	118	136	141	279	328	102
4	111	118	136	141	279	328	102
5	111	118	136	141	279	328	102
6	111	118	136	141	279	328	102
7	111	118	136	141	279	328	102

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	75605
FI=	75605	FO=	86865
FI=	86865	FO=	87845
FI=	87845	FO=	87926

THE SAFETY FACTOR FOR POINT 3IS 1.87926

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= 117.5 Y= 142.1
ENTRANCE PT COORDS: X= 14.5 Y= 90.1
TRIAL ARC RADIUS= 33.941

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

E 9NOT INTERSECTED BY TRIAL CIRCL
E 10NOT INTERSECTED BY TRIAL CIRCL
E 11NOT INTERSECTED BY TRIAL CIRCL

4IS NOT INTERSECTED BUT IS IN ARC

ERSECT WITH LINE ARRAY

X	Y
97.928	86.211
120.036	80.555
137.067	86.656
141.111	90.111

AY WITH ALL INTERSECTIONS FOLLOWS:

		K=	KK=	
0000	87.111	1	KK=	1
0000	78.111	1	KK=	2
0000	35.111	1	KK=	3
57.111	88.111	1	KK=	4
84.111	86.111	1	KK=	5
97.928	86.111	2	KK=	5
111.111	80.111	2	KK=	6
120.036	80.555	3	KK=	6
120.036	47.111	3	KK=	7
122.111	86.111	3	KK=	8
125.111	87.111	3	KK=	9
132.111	90.111	3	KK=	9
137.067	86.656	4	KK=	10
141.111	90.111	4	KK=	10
175.111	59.111	4	KK=	11
229.111	90.111	4	KK=	12
230.111	83.111	4	KK=	13
232.111	60.111	4	KK=	14

LICABLE ARRAY ARCINT FOLLOWS:

		K=	KK=	
97.928	86.211	6	KK=	1
120.036	80.555	8	KK=	2
122.111	86.111	1	KK=	3
125.111	87.111	1	KK=	4
132.111	90.111	2	KK=	5
137.067	86.656	3	KK=	6
141.111	90.111	4	KK=	7

ICE WIDTH AND NO OF SLICES

FI=	00000	FO=	128964
FI=	28964	FO=	132874
FI=	32874	FO=	133292
FI=	33292	FO=	133335

THE SAFETY FACTOR FOR POINT 4IS 1.33335

CIRCLE NO 5
CTR COORDS: X= 120.036 Y= 14.111
E PT COORDS: X= 14.111 Y= 90.111
IAL ARC RADIUS= 31.890

1NOT INTERSECTED BY TRIAL CIRCL
2NOT INTERSECTED BY TRIAL CIRCL
4NOT INTERSECTED BY TRIAL CIRCL
5NOT INTERSECTED BY TRIAL CIRCL
9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

***LINE 4 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	104	347	86	11
3	116	079	82	48
7	136	376	86	68
8	141	111	90	11
5				

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	000	87	1	K=	1	KK=	1
I=	2	000	78	1	K=	1	KK=	2
I=	3	000	35	1	K=	1	KK=	3
I=	4	67	88	1	K=	1	KK=	4
I=	5	84	86	1	K=	1	KK=	5
I=	6	104	86	2	K=	2	KK=	5
I=	7	116	80	2	K=	2	KK=	6
I=	8	136	82	3	K=	3	KK=	6
I=	9	120	47	3	K=	3	KK=	7
I=	10	122	86	3	K=	3	KK=	8
I=	11	125	87	3	K=	3	KK=	9
I=	12	132	90	3	K=	3	KK=	0
I=	13	136	86	4	K=	4	KK=	0
I=	14	141	90	4	K=	4	KK=	0
I=	15	75	59	4	K=	4	KK=	1
I=	16	229	90	4	K=	4	KK=	2
I=	17	230	83	4	K=	4	KK=	3
I=	18	232	60	4	K=	4	KK=	4

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	104	847	86	6	KK=	1
I=	2	116	079	82	8	KK=	2
I=	3	122	111	86	10	KK=	3
I=	4	125	111	87	11	KK=	4
I=	5	132	111	90	12	KK=	5
I=	6	136	376	86	13	KK=	6
I=	7	141	111	90	14	KK=	7

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	152322
FI=	52322	FO=	159756
FI=	59756	FO=	160466
FI=	60466	FO=	160531

THE SAFETY FACTOR FOR POINT SIS 1.60531

TRIAL CIRCLE NO 5
CIRCLE CTR COORDS: X= 1232.1 Y= 1142.1
ENTRANCE PT COORDS: X= 141.1 Y= 90.1
TRIAL ARC RADIUS= 30.000

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

In cross-section (IO-IO)B soil types are given as :

Soil I : Bottom Sludge

Soil II : Artificial Fill

Soil III : Sedimentary layer

Soil 4 : Decomposed Graywacke

The results taken from the computer for cross-section (IO-IO)B a

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	I23	II3	I47	9I	1.80
b	I29	II2	I49	9I	2.56
c	I25	I23	I58	9I	2.30
d	II6	I28	I57	9I	2.95
e	I2I	I37	I65	9I	2.78
f	I07	I52	I69	9I	3.07
g	I09	I37	I8I	9I	4.0I
h	II4	II5	I60	9I	4.47

of

og oe

od oc

oh o ob
d

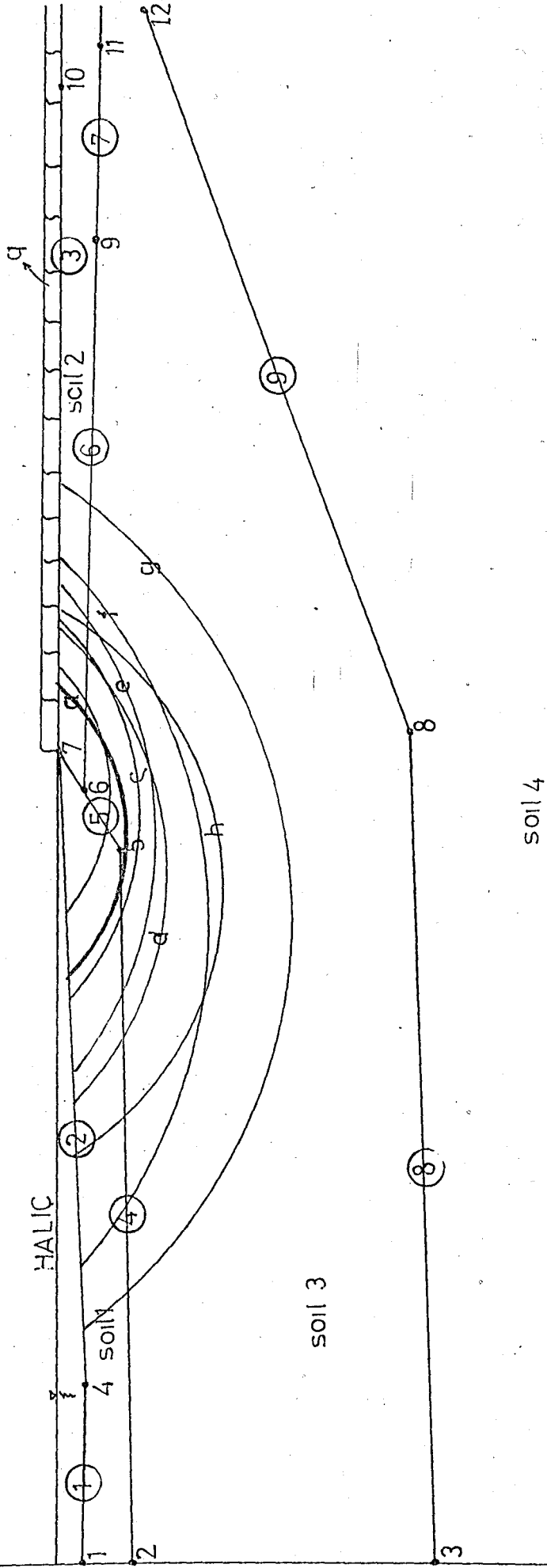


Fig : (10-10) B

LOPE STABILITY FOR HALIC KOPRU(II) NAHIR KOSELER THESIS

NO OF LINES 9 NO OF LINE INTERSECT= T2
 NO OF SOILS= 4 NO OF EXTERNAL SOIL LINES= 3
 NO OF X INCREMENTS= 3 NO OF Y INCREMENTS= 3
 INITIAL SLICE WIDTH= 200

LINE NO END COORD MATRIX

LINE NO	END COORD	X1	Y1	X2	Y2	SLOPE	LINE INTER
1	27	89	8	27	8	368	4
2	36	88	8	23	6	275	7
3	18	9	8	33	8	000	0
4	12	88	8	33	6	000	0
5	14	86	8	33	4	555	5
6	21	83	3	23	3	348	3
7	38	83	3	23	6	000	0
8	38	83	3	24	0	362	2
9	38	83	3	24	0	417	5

LINE INTERSECT ARRAY

LINE NO	INTERSECT	X	Y
1	00	89	8
2	00	88	8
3	00	9	8
4	00	88	8
5	27	88	8
6	12	86	8
7	14	83	3
8	21	83	3
9	38	83	3
10	22	83	3
11	23	99	8
12	36	83	3
13	24	83	3

SOIL DATA ARRAY

SOIL NO	LINE #	LEFT INT	RIGHT INT	SAT	UNIT WT	PHI	COHESION
1	1	4	4	0	1.5	12	0
2	2	7	7	0	1.5	12	0
3	3	2	5	0	1.5	12	0
4	4	5	7	0	1.5	12	0
5	5	6	7	0	1.5	12	0
6	6	7	7	0	1.5	12	0
7	7	6	7	0	1.5	12	0
8	8	6	7	0	1.5	12	0
9	9	7	7	0	1.5	12	0
10	10	2	5	0	1.5	12	0
11	11	3	6	0	1.5	12	0
12	12	3	6	0	1.5	12	0
13	13	3	6	0	1.5	12	0
14	14	3	6	0	1.5	12	0
15	15	3	6	0	1.5	12	0
16	16	3	6	0	1.5	12	0
17	17	3	6	0	1.5	12	0
18	18	3	6	0	1.5	12	0
19	19	3	6	0	1.5	12	0

TRIAL CIRCLE NO

CIRCLE CTR COORDS: X= X= 23.7 Y= 13.1
 ENTRANCE PT COORDS: X= 47.1 Y= 9.1
 TRIAL ARC RADIUS= 32.558

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

***LINE 5IS NOT INTERSECTED BUT IS IN ARC

ARC LINE NO	INTERSECT WITH X	LINE ARRAY Y
2	100.058	90.2
4	117.111	81.2
6	140.638	85.6
3	147.111	91.2

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:			
I=1	100.000	89.1	K=1 KK=1
I=2	100.000	81.2	K=1 KK=1
I=3	100.000	33.2	K=1 KK=1
I=4	27.1	88.2	K=1 KK=1
I=5	100.058	90.2	K=2 KK=1
I=6	117.111	81.2	K=3 KK=1
I=7	118.111	81.2	K=3 KK=1
I=8	128.111	86.2	K=3 KK=1
I=9	136.111	90.2	K=3 KK=1
I=10	133.111	85.6	K=3 KK=1
I=11	147.111	91.2	K=4 KK=1
I=12	214.111	83.2	K=4 KK=1
I=13	233.111	90.2	K=4 KK=1
I=14	233.111	83.2	K=4 KK=1
I=15	236.111	83.2	K=4 KK=1
I=16	240.111	73.2	K=4 KK=1

THE APPLICABLE ARRAY ARCINT FOLLOWS:			
I=1	100.058	90.2	K=5 KK=1
I=2	117.111	81.2	K=6 KK=1
I=3	118.111	81.2	K=7 KK=1
I=4	128.111	86.2	K=8 KK=1
I=5	136.111	90.2	K=9 KK=1
I=6	140.638	85.6	K=12 KK=1
I=7	147.111	91.2	K=12 KK=1

FIND SLICE WIDTH AND NO OF SLICES	
F1=	500000 F0= 568864
F2=	68864 F0= 79457
F3=	79457 F0= 80455
F4=	80455 F0= 80544

THE SAFETY FACTOR FOR POINT 1IS 1.80544

TRIAL CIRCLE NO 2
CIRCLE CIP COORDS: X= 126.711 Y= 137.111
ENTRANCE PT COORDS: X= 147.111 Y= 91.2
TRIAL ARC RADIUS= 30.44

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

ARC LINE NO	INTERSECT WITH X	LINE ARRAY Y
2	106.02	90.28
5	121.578	83.04
6	139.330	85.72
3	147.111	91.2

```

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
I= 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
   27 118 125 136 139 147
   000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
   89 83 33 88 90 86 83 85 91 83 91 83 73
   1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
   K= 1 1 1 1 2 3 3 4 4 4 4 4 4 4 4 4
   KK= 1 1 1 1 2 3 3 4 4 4 4 4 4 4 4 4
   1 2 3 4 5 5 6 7 8 8 9 10 11 12

```

```

THE APPLICABLE ARRAY ARCINT FOLLOWS:
I= 1 2 3 4 5 6
   106 121 128 136 139 147
   000 057 011 033 030 011
   90 83 86 91 85 91
   283 037 111 720 111
   K= 5 7 8 9 1 2
   KK= 1 2 3 4 5 6

```

```

FIND SLICE WIDTH AND NO OF SLICES
FI= 1 2 3 4 5 6 FO= 2 2 2 2 2 2
   000 000 000 000 000 000
   159 06 338 55 35 86 35 278

```

THE SAFETY FACTOR FOR POINT 21S 2.35278

```

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= 29.1 Y= 13.1
ENTRANCE PT COORDS: X= 47.1 Y= 9.1
TRIAL ARC RADIUS= 28.425

```

```

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

```

```

ARC INTERSECT WITH LINE ARRAY
LINE NO X Y
2 11 953 90 45
5 125 066 84 97
6 136 997 85 81
3 147 111 91 82

```

```

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
I= 1 2 3 4 5 6 7 8 9 10 11 12 13
   000 000 000 27 118 125 136 139 147
   000 000 000 111 053 066 099 011
   89 83 33 88 90 86 83 85 91 83 73
   1 1 1 1 1 1 1 1 1 1 1 1 1
   K= 1 1 1 1 2 3 3 4 4 4 4 4 4
   KK= 1 1 1 1 2 3 3 4 4 4 4 4 4
   1 2 3 4 4 5 5 6 7 7 8 8 9

```

THE APPLICABLE	ARRAY	ARC	INT	FOLLOWS:		
1	1	9	53	90	446	5
2	25	0	66	84	975	7
3	28	1	11	86	110	8
4	33	1	99	99	100	9
5	36	9	97	85	100	10
6	47	1	1	9	100	12

```

FIND SLICE WIDTH AND NO OF SLICES
FI= 1.000000 FO= 3.229465
FI= 3.229465 FO= 3.229465
FI= 3.229465 FO= 3.229465
FI= 3.229465 FO= 3.229465
FI= 3.229465 FO= 3.229465

```

THE SAFETY FACTOR FOR POINT 3 IS 3.64148

TRIAL CIRCLE NO. 4
CIRCLE CTR COORDS: X= 623.719 Y= 163.11
ENTRANCE PT. COORDS: X= 47.51 Y= 91.11
TRIAL ARC RADIUS= 34.655

XXX LINE NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

```

ARC INTERSECT WITH LINE ARRAY
LINE NO X Y
2 100 183 90
3 119 140 81
6 139 740 85
3 147 111 91

```

THE	ARRAY WITH	ALL	INTERSECTIONS	FOLLOWS:	
1	1	000	89	1	KK = 1
2	2	000	83	1	KK = 2
3	3	000	81	1	KK = 3
4	4	000	88	1	KK = 4
5	5	783	90	2	KK = 5
6	6	121	88	2	KK = 6
7	7	421	88	3	KK = 7
8	8	111	99	3	KK = 8
9	9	111	33	3	KK = 9
0	0	111	35	4	KK = 0
1	1	111	99	4	KK = 1
2	2	111	83	4	KK = 2
3	3	111	73	4	KK = 3
4	4	111	73	4	KK = 4
5	5	111	73	4	KK = 5
6	6	111	73	4	KK = 6

[illegible]

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.700000	FO=	1.788869
FI=	1.888869	FO=	2.002186
FI=	2.002186	FO=	2.003277
FI=	2.003277	FO=	2.003361

THE SAFETY FACTOR FOR POINT 4IS 2.03361

TRIAL CIRCLE NO 5
 CIRCLE CTR COORDS: X= X= 126.711 Y= 116.711
 ENTRANCE PT. COORDS: X= 147.111 Y= 91.111
 TRIAL ARC RADIUS= 32.650

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY
 LINE NO X Y
 2 106.134 90.229
 5 122.669 83.643
 6 138.151 85.767
 3 147.111 91.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	106.134	89.111	K=	1	KK=	1
I=	2	106.134	89.111	K=	1	KK=	2
I=	3	106.134	89.111	K=	1	KK=	3
I=	4	27.111	88.111	K=	1	KK=	4
I=	5	106.134	90.229	K=	2	KK=	4
I=	6	118.111	85.767	K=	2	KK=	5
I=	7	122.669	83.643	K=	3	KK=	5
I=	8	128.111	86.111	K=	3	KK=	6
I=	9	136.111	91.111	K=	3	KK=	7
I=	10	138.151	85.767	K=	3	KK=	8
I=	11	138.151	85.767	K=	4	KK=	8
I=	12	147.111	91.111	K=	4	KK=	8
I=	13	214.111	88.111	K=	4	KK=	9
I=	14	233.111	91.111	K=	4	KK=	10
I=	15	236.111	91.111	K=	4	KK=	11
I=	16	240.111	73.111	K=	4	KK=	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	106.134	90.229	K=	5	KK=	1
I=	2	122.669	83.643	K=	7	KK=	2
I=	3	128.111	86.111	K=	8	KK=	3
I=	4	136.111	91.111	K=	9	KK=	4
I=	5	138.151	85.767	K=	1	KK=	5
I=	6	147.111	91.111	K=	2	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.700000	FO=	2.52911
FI=	2.52911	FO=	2.75517
FI=	2.75517	FO=	2.76877
FI=	2.76877	FO=	2.76952

THE SAFETY FACTOR FOR POINT 5IS 2.76952

TRIAL CIRCLE NO 6
 CIRCLE CTR COORDS: X= X= 129.711 Y= 116.711
 ENTRANCE PT. COORDS: X= 147.111 Y= 91.111
 TRIAL ARC RADIUS= 30.806

5.1.2 Stability Analysis After Dredging

As mentioned in chapter III, the insufficient depth for navigation and contribution to the water pollution of bottom sludge make necessary dredging in Haliç.

Since the bottom and underlying clay formations are very soft and weak, stability of these formations should be evaluated.

Considering the sufficient depth for navigation, the height of dredging will be minimum 6.5 meters between Taşkızak and Haliç Bridge and 4.0 meters from the Haliç Bridge upstream, (Arıcan, 1976). At Taşkızak, The height of bottom sludge is nearly 15 meters. Around Haliç Bridge, it is 6-10 meters.

At Taşkızak, we first analyzed the condition when all of the bottom sludge is dredged and then the case when 6 meters of bottom sludge is dredged. Around Haliç Bridge, dredging of all bottom sludge is necessary for navigation.

So for these cases, stability analysis has been conducted. The conclusions of these results will be discussed in next section.

After dredging of bottom sludge of 10 meters :

The results taken from the computer for cross-section(3-3)B:

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
j (a)	99	146	181	107	1.09
k (b)	86	141	180	107	0.99
l (c)	83	150	174	107	1.06
m (d)	82	161	192	107	0.95
n (e)	95	160	189	107	1.07

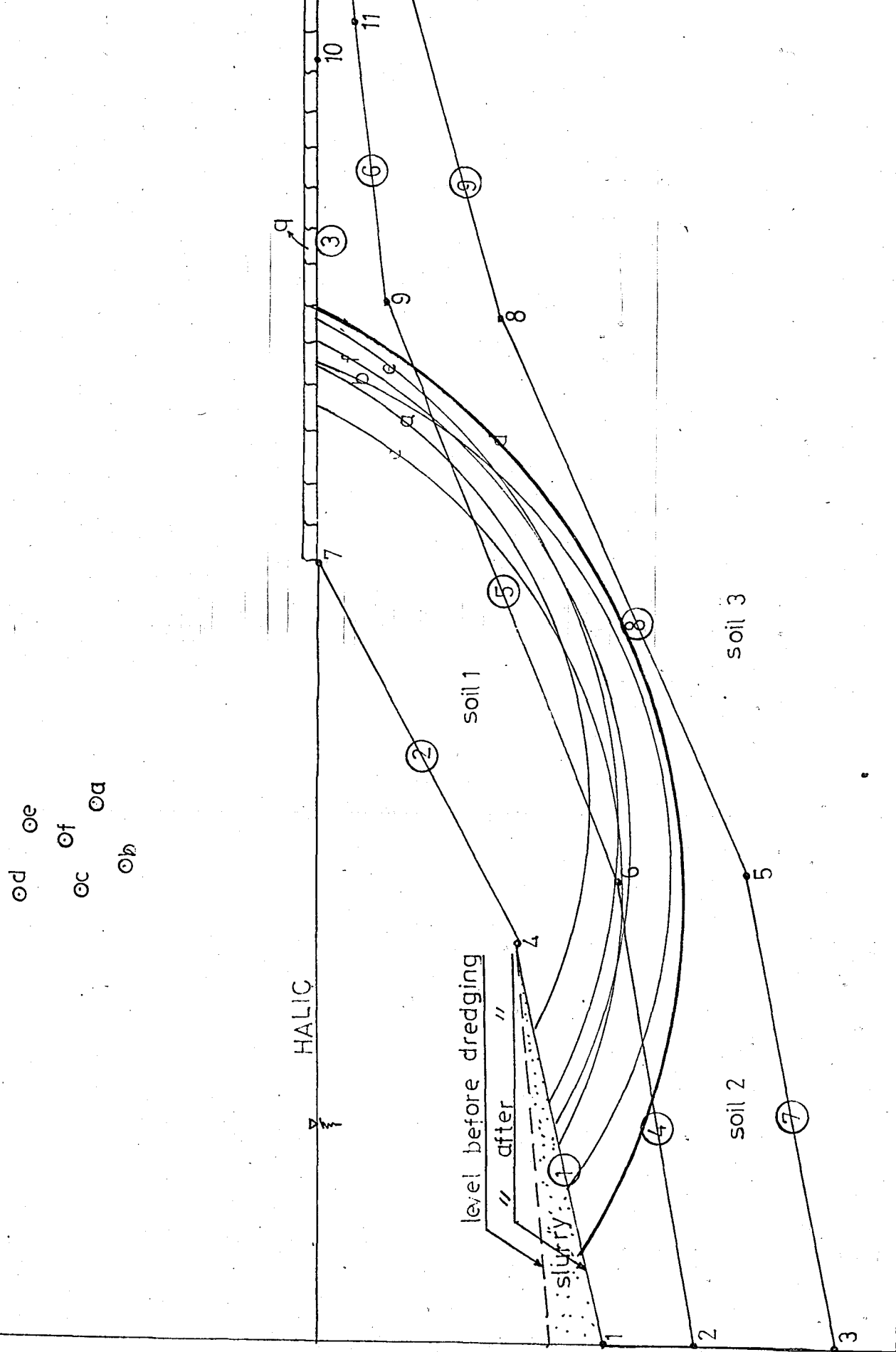


Fig: (3-3)B After dredging

SLOPE STABILITY FOR UNKAP (IT) EXCAVATION M.K. THESIS

NO OF LINES 9 NO OF LINE INTERSECT= 12
 NO OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 NO OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 IN ITIAL SLICE WIDTH= 2.0

THE LINE END COORD. MATRIX

LINE NO	NO	INT	X1	Y1	X2	Y2	SLOPE	LINE IN
1	2	2	74	54	74	69	202399	1
2	2	2	74	69	44	67	542857	4
3	2	2	44	67	233	67	16258	7
4	2	2	44	36	86	50	407407	6
5	2	2	86	50	94	94	162791	9
6	2	2	94	10	237	73	202174	3
7	2	2	94	27	84	27	442378	5
8	2	2	34	27	88	73	303571	8
9	2	2	38	73	244	90		

LINE INTERSECT ARRAY

LINE NO	X	Y
1	74	54
2	74	69
3	44	67
4	44	36
5	86	50
6	94	10
7	94	27
8	34	27
9	38	73

SOIL DATA ARRAY

SOIL NO	LINE	LEFT INT	PT INT	SAT	UNIT WT	PHI	COHESION
1	2	4	4	0	7.8	20.0	19.6
2	2	7	7	0	7.8	20.0	19.6
3	2	2	6	0	7.8	20.0	19.6
4	2	9	6	0	7.8	20.0	19.6
5	2	6	9	0	7.8	20.0	19.6
6	2	5	9	0	7.8	12.0	19.6
7	2	9	5	0	7.8	12.0	19.6
8	2	5	8	0	7.8	12.0	19.6
9	2	8	5	0	7.8	12.0	19.6
3	3	3	5	0	3.7	45.0	18.6
3	3	5	8	0	3.7	45.0	18.6
3	3	8	2	0	3.7	45.0	18.6

TRIAL CIRCLE NO 1
 CIRCLE CTR COORDS: X= 99.1 Y= 46.1
 ENTRANCE PT. COORDS: X= 18.1 Y= 207.1
 TRIAL ARC RADIUS= 90.802

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE
 XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCLE
 XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCLE
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCLE

3	74.711	69.711	K	6	KK	3
4	86.711	50.711	K=	8	KK=	4
5	44.711	70.711	K=	9	KK=	5
6	67.697	83.347	K=	0	KK=	6
7	80.711	07.711	K=	17	KK=	7

ND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50

FI=	00000	FO=	98488
FI=	98488	FO=	98289
FI=	98289	FO=	98262

THE SAFETY FACTOR FOR POINT 1 IS 0.98262

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= 89.711 Y= 44.711
 ENTRANCE PT. COORDS: X= 180.711 Y= 67.697
 TRIAL ARC RADIUS= 97.144

XX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

*LINE 2 IS NOT INTERSECTED BUT IS IN ARC

XC INTERSECT WITH LINE ARRAY

NO	X	Y
34	735	61.02
65	791	46.81
167	010	83.07
180	111	07.31

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:						
1	34	65	74	86	44	167
2	35	79	81	50	47	83
3	35	79	81	50	47	83
4	35	79	81	50	47	83
5	35	79	81	50	47	83
6	35	79	81	50	47	83
7	35	79	81	50	47	83
8	35	79	81	50	47	83
9	35	79	81	50	47	83
10	35	79	81	50	47	83
11	35	79	81	50	47	83
12	35	79	81	50	47	83
13	35	79	81	50	47	83
14	35	79	81	50	47	83
15	35	79	81	50	47	83
16	35	79	81	50	47	83

THE APPLICABLE ARRAY ARCINT FOLLOWS:						
1	34	65	74	86	44	167
2	35	79	81	50	47	83
3	35	79	81	50	47	83
4	35	79	81	50	47	83
5	35	79	81	50	47	83
6	35	79	81	50	47	83
7	35	79	81	50	47	83

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	00000	FO=	99209
FI=	99209	FO=	99004
FI=	99104	FO=	99090

THE SAFETY FACTOR FOR POINT 2IS 99090

TRIAL CIRCLE NO 3

CIRCLE CTR COORDS: X= 862.1 Y= 1442.1

ENTRANCE PT. COORDS: X= 802.1 Y= 1072.1

TRIAL ARC RADIUS= 107.2

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	29.4	607.7
2	61.5	462.2
3	166.4	82.8
4	180.1	107.1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:						
1	34	65	74	86	44	167
2	35	79	81	50	47	83
3	35	79	81	50	47	83
4	35	79	81	50	47	83
5	35	79	81	50	47	83
6	35	79	81	50	47	83
7	35	79	81	50	47	83
8	35	79	81	50	47	83

10	166	11	82	3	KK=	7
11	180	11	07	4	KK=	7
12	188	11	73	4	KK=	8
13	194	11	94	4	KK=	9
14	233	11	07	4	KK=	10
15	237	11	00	4	KK=	11
16	244	11	90	4	KK=	12

THE APPLICABLE ARRAY ARC INT. FOLLOWS:	29	60	65	4	KK=	1
1	61	46	20	5	KK=	2
2	74	69	11	6	KK=	3
3	86	50	11	8	KK=	4
4	44	07	11	9	KK=	5
5	65	82	30	0	KK=	6
6	180	07	11	1	KK=	7

IND SLICE WIDTH AND NO OF SLICES

***MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	00000	FO=	98383
FI=	98383	FO=	98172
FI=	98172	FO=	98444

THE SAFETY FACTOR FOR POINT 3IS 98.44

TRIAL CIRCLE NO 4

CIRCLE CTR COORDS: X= 89.71 Y= 44.77

ENTRANCE PT. COORDS: X= 80.71 Y= 07.17

TRIAL ARC RADIUS= 98.234

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	36	088
4	70	733
5	165	629
3	180	111
	61	42
	47	67
	82	57
	07	11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

1	0000	54	1	KK=	2
2	0000	36	1	KK=	3
3	0000	70	1	KK=	3
4	36	088	6	KK=	3
5	70	733	4	KK=	3
6	74	111	6	KK=	4
7	84	111	2	KK=	5
8	86	111	3	KK=	6
9	44	111	3	KK=	7
10	65	629	3	KK=	7
11	180	111	4	KK=	7
12	188	111	4	KK=	8
13	194	111	4	KK=	9
14	233	111	4	KK=	10
15	237	111	4	KK=	11
16	244	111	4	KK=	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:					
I=1	36.088	6.1415	K=4	KK=1	
I=2	70.733	47.611	K=5	KK=2	
I=3	74.711	69.111	K=6	KK=3	
I=4	86.311	50.111	K=8	KK=4	
I=5	44.311	07.111	K=9	KK=5	
I=6	65.629	82.507	K=0	KK=6	
I=7	80.111	07.111	K=1	KK=7	

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50

FI=	1.00000	FO=	2.99654
FI=	2.99654	FO=	2.99609

THE SAFETY FACTOR FOR POINT 4 IS 2.99609

ID PROGRAM EXECUTION

After Dredging of All Bottom Sludge:

The results taken from the computer for cross-section(8-8)A:

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	86	111	135	81	1.09
b	83	105	118	81	1.03
c	91	108	124	81	1.19
d	98	123	165	81	1.48
e	101	113	153	81	1.52
f	84	120	127	81	1.05
g	82	93	133	81	1.17
m	72	108	136	81	1.02
n	74	117	136	81	0.97
p	81	128	157	81	1.16

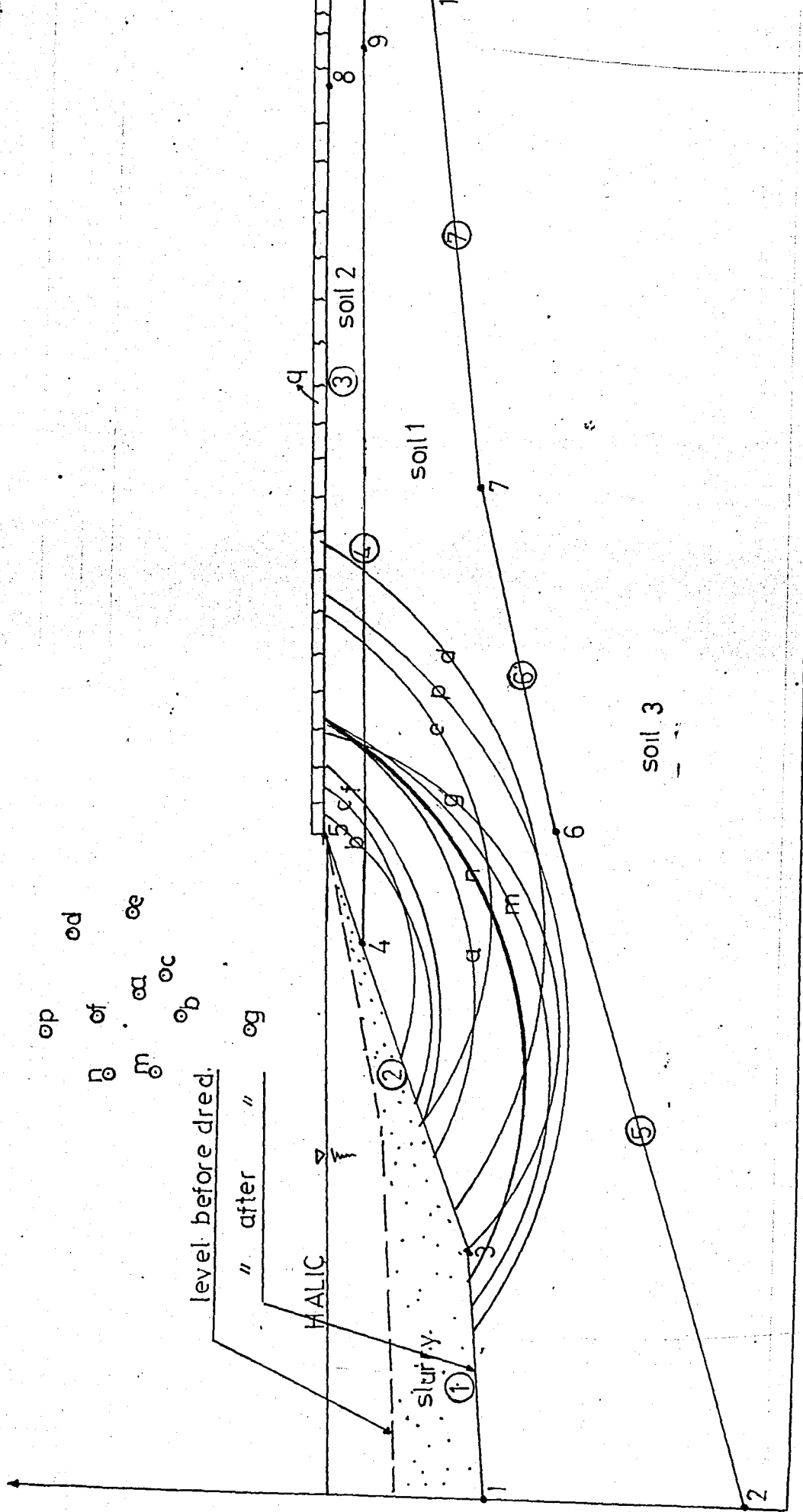


Fig: (8-8)A After dredging of all bottom sludge

PE STABILITY FOR TASKIZAK(I)EXCAVE MAHIR KOSELER THESIS

OF LINES 7 NO OF LINE INTERSECT= 10
 OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 IN ITIAL SLICE WIDTH= 2.0

LINE NO	END NO	COORD	MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INTER
1	2	40	00	53	1	40	1	498616	00
2	3	40	00	55	1	40	1	335616	00
3	4	95	00	74	1	24	0	000000	00
4	5	95	00	74	1	24	2	204082	00
5	6	15	00	8	1	15	1	285680	00
6	7	15	00	4	1	15	1	215657	00
7	8	75	00	54	1	24	4	173913	00

INTERSECT ARRAY

NO	X	Y
1	00	53
2	00	58
3	40	55
4	95	74
5	15	8
6	15	4
7	75	54
8	75	8
9	75	77
10	75	66

DATA ARRAY

LINE NO	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESI ON
1	3	4	00	7.8	12	00
2	4	9	00	7.8	12	00
3	4	6	00	7.8	12	00
4	6	7	00	7.8	12	00
5	6	0	00	7.8	12	00
6	7	5	00	7.8	20	00
7	7	8	00	7.8	20	00
8	7	9	00	7.8	20	00
9	7	6	00	7.8	45	00
10	7	0	00	7.8	45	00

IAL CIRCLE NO 1
 RCLE CTR COORDS: X= 74 Y= 17
 RANCE PT COORDS: X= 136 Y= 81
 TRIAL ARC RADIUS= 71.694

X LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC	INTERSECT WITH LINE ARRAY	
LINE NO	X	Y
1	38.270	55.002
2	132.033	74.886
3	136.111	81.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:				
I=1	0000	53	1	KK=1
I=2	0000	8	1	KK=1
I=3	38.270	55	2	KK=2
I=4	40.111	55	2	KK=2
I=5	95.111	74	2	KK=2
I=6	13.111	8	2	KK=2
I=7	13.111	4	2	KK=2
I=8	13.111	74	3	KK=3
I=9	13.111	8	3	KK=3
I=10	13.111	54	3	KK=3
I=11	13.111	8	3	KK=3
I=12	13.111	77	3	KK=3
I=13	24.4	66	3	KK=3

THE APPLICABLE ARRAY ARCINT FOLLOWS:				
I=1	38.270	55	3	KK=1
I=2	40.111	55	4	KK=2
I=3	95.111	74	5	KK=3
I=4	13.111	8	6	KK=4
I=5	13.111	74	8	KK=5
I=6	13.111	8	9	KK=6

FIND SLICE WIDTH AND NO OF SLICES	
FI=000000	FO=98907
FI=98907	FO=98806
FI=98806	FO=98796

THE SAFETY FACTOR FOR POINT TIS 98796

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 77.11 Y= 17.11
ENTRANCE PT. COORDS: X= 36.11 Y= 8.11
TRIAL ARC RADIUS= 69.116

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

ARC	INTERSECT WITH LINE ARRAY	
LINE NO	X	Y
2	43.941	56.47
4	131.807	74.886
3	136.111	81.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:				
I=1	0000	53	1	KK=1
I=2	0000	8	1	KK=2

I=	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	1490	1491	1492	1493	1494	1495	1496	1497	1498
----	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

ABRKPT PRINTS THE SAFETY FACTOR FOR POINT 4 IS 3.99259

After Dredging of 6m. of Bottom Sludge:

The results taken from the computer for cross-section
(8-8)A are:

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	86	III	I35	8I	0.99
b	83	I05	II8	8I	0.95
c	9I	I08	I24	8I	I.II
d	98	I23	I65	8I	I.45
e	I0I	II3	I53	8I	I.40
f	84	I20	I27	8I	I.I2
g	82	93	I33	8I	I.I9
m	72	I08	I36	8I	I.09
n	74	II7	I36	8I	I.00
p	8I	I28	I57	8I	I.I9

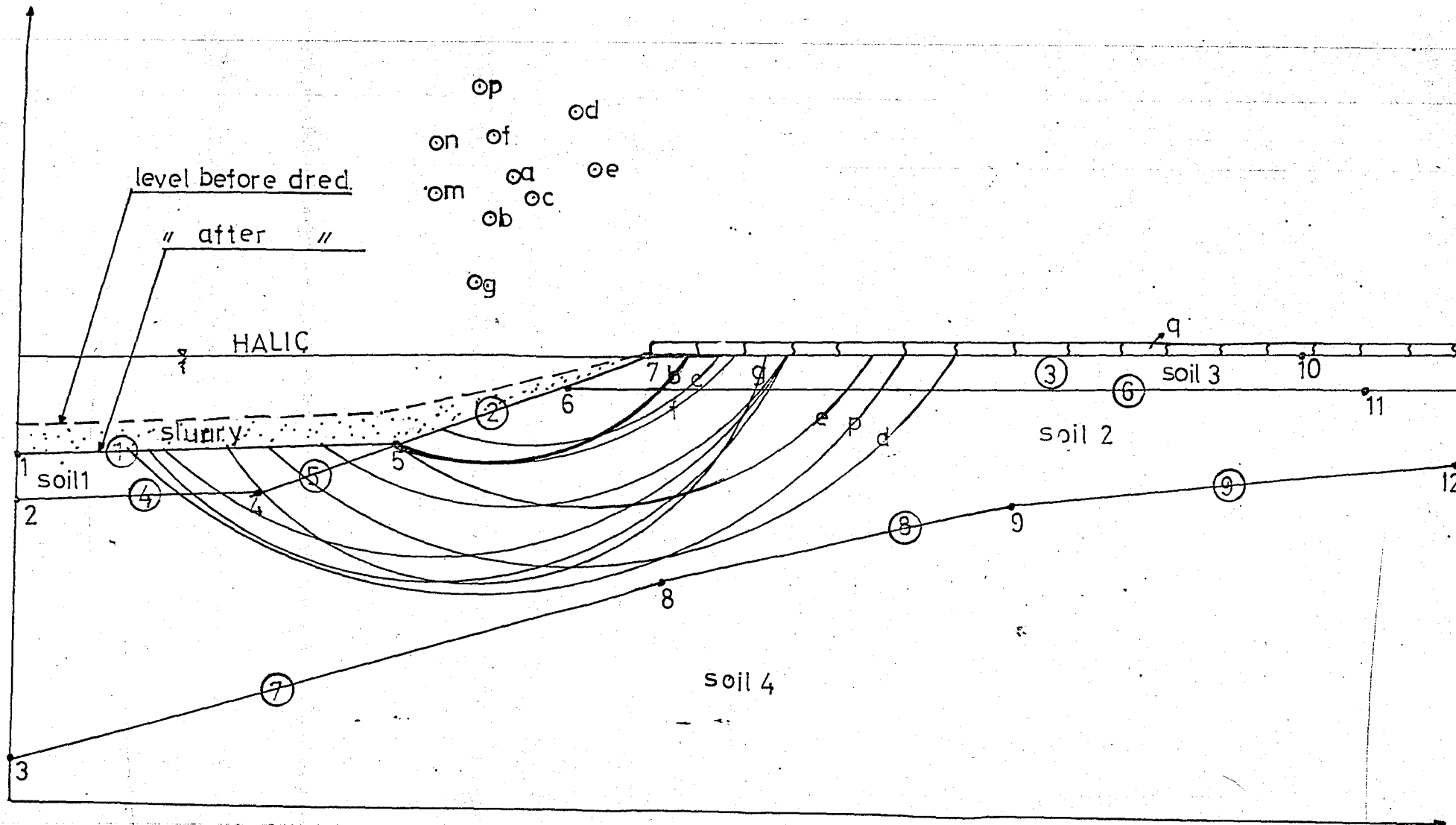


Fig : (8-8)A After Dredging of 6m. of Bottom Sludge

LOPE STABILITY FOR TASKIZAK(I)EXCAVA(2) MAHIR KOSELER THESIS

0 OF LINES 9 NO OF LINE INTERSECT= 12
 0 OF SOILS= 4 NO OF EXTERNAL SOIL LINES= 3
 0 OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 IN ITIAL SLICE WIDTH= 200

LINE NO	END INT	COORD MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INT
1	2	65	62	1	65	81	000000	5
2	3	113	62	1	13	81	395833	7
3	4	40	55	1	40	55	000000	2
4	5	95	55	1	95	77	280000	4
5	6	15	74	1	15	41	286680	3
6	7	75	54	1	75	54	173913	8
7	8			1				9

LINE INTERSECT ARRAY

LINE NO	X	Y
1	00	62
2	00	53
3	00	8
4	40	55
5	65	62
6	95	74
7	113	81
8	15	41
9	75	54
10	24	81
11	24	77
12	24	66

SOIL DATA ARRAY

IL NO	LINE #	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESI ON
1	1	5	5	00	1.55	12	00
2	2	2	4	00	1.55	12	00
3	3	4	5	00	1.55	12	00
4	4	5	6	00	1.55	12	00
5	5	6	7	00	1.55	12	00
6	6	7	8	00	1.55	12	00
7	7	8	9	00	1.55	12	00
8	8	9	10	00	1.55	12	00
9	9	10	11	00	1.55	12	00
10	10	11	12	00	1.55	12	00
11	11	12	13	00	1.55	12	00
12	12	13	14	00	1.55	12	00
13	13	14	15	00	1.55	12	00
14	14	15	16	00	1.55	12	00
15	15	16	17	00	1.55	12	00
16	16	17	18	00	1.55	12	00
17	17	18	19	00	1.55	12	00
18	18	19	20	00	1.55	12	00
19	19	20	21	00	1.55	12	00
20	20	21	22	00	1.55	12	00
21	21	22	23	00	1.55	12	00
22	22	23	24	00	1.55	12	00
23	23	24	25	00	1.55	12	00
24	24	25	26	00	1.55	12	00
25	25	26	27	00	1.55	12	00
26	26	27	28	00	1.55	12	00
27	27	28	29	00	1.55	12	00
28	28	29	30	00	1.55	12	00
29	29	30	31	00	1.55	12	00
30	30	31	32	00	1.55	12	00
31	31	32	33	00	1.55	12	00
32	32	33	34	00	1.55	12	00
33	33	34	35	00	1.55	12	00
34	34	35	36	00	1.55	12	00
35	35	36	37	00	1.55	12	00
36	36	37	38	00	1.55	12	00
37	37	38	39	00	1.55	12	00
38	38	39	40	00	1.55	12	00
39	39	40	41	00	1.55	12	00
40	40	41	42	00	1.55	12	00
41	41	42	43	00	1.55	12	00
42	42	43	44	00	1.55	12	00
43	43	44	45	00	1.55	12	00
44	44	45	46	00	1.55	12	00
45	45	46	47	00	1.55	12	00
46	46	47	48	00	1.55	12	00
47	47	48	49	00	1.55	12	00
48	48	49	50	00	1.55	12	00
49	49	50	51	00	1.55	12	00
50	50	51	52	00	1.55	12	00
51	51	52	53	00	1.55	12	00
52	52	53	54	00	1.55	12	00
53	53	54	55	00	1.55	12	00
54	54	55	56	00	1.55	12	00
55	55	56	57	00	1.55	12	00
56	56	57	58	00	1.55	12	00
57	57	58	59	00	1.55	12	00
58	58	59	60	00	1.55	12	00
59	59	60	61	00	1.55	12	00
60	60	61	62	00	1.55	12	00
61	61	62	63	00	1.55	12	00
62	62	63	64	00	1.55	12	00
63	63	64	65	00	1.55	12	00
64	64	65	66	00	1.55	12	00
65	65	66	67	00	1.55	12	00
66	66	67	68	00	1.55	12	00
67	67	68	69	00	1.55	12	00
68	68	69	70	00	1.55	12	00
69	69	70	71	00	1.55	12	00
70	70	71	72	00	1.55	12	00
71	71	72	73	00	1.55	12	00
72	72	73	74	00	1.55	12	00
73	73	74	75	00	1.55	12	00
74	74	75	76	00	1.55	12	00
75	75	76	77	00	1.55	12	00
76	76	77	78	00	1.55	12	00
77	77	78	79	00	1.55	12	00
78	78	79	80	00	1.55	12	00
79	79	80	81	00	1.55	12	00
80	80	81	82	00	1.55	12	00
81	81	82	83	00	1.55	12	00
82	82	83	84	00	1.55	12	00
83	83	84	85	00	1.55	12	00
84	84	85	86	00	1.55	12	00
85	85	86	87	00	1.55	12	00
86	86	87	88	00	1.55	12	00
87	87	88	89	00	1.55	12	00
88	88	89	90	00	1.55	12	00
89	89	90	91	00	1.55	12	00
90	90	91	92	00	1.55	12	00
91	91	92	93	00	1.55	12	00
92	92	93	94	00	1.55	12	00
93	93	94	95	00	1.55	12	00
94	94	95	96	00	1.55	12	00
95	95	96	97	00	1.55	12	00
96	96	97	98	00	1.55	12	00
97	97	98	99	00	1.55	12	00
98	98	99	100	00	1.55	12	00

TRIAL CIRCLE NO 1
 CIRCLE CTR COORDS: X= 83 Y= 05
 ENTRANCE PT COORDS: X= 18 Y= 8
 TRIAL ARC RADIUS= 42.438

XXX LINE NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

(X) LINE 8NOT INTERSECTED BY TRIAL CIRCL

(X) LINE 9NOT INTERSECTED BY TRIAL CIRCL

RC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
2	70.994	64.44
6	112.460	74.47
3	118.111	81.11

HE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	000	62.111	1	1
2	000	53.111	1	2
3	000	8.111	1	3
4	40.111	55.111	1	4
5	65.111	62.111	1	5
6	70.994	64.44	2	5
7	95.111	74.47	2	6
8	112.460	74.47	3	6
9	118.111	81.11	3	7
10	118.111	81.11	3	8
11	118.111	81.11	3	8
12	118.111	81.11	3	9
13	118.111	81.11	3	10
14	24.111	77.111	3	11
15	24.111	66.111	3	12

HE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	70.994	64.44	6	1
2	95.111	74.47	7	2
3	112.460	74.47	8	3
4	118.111	81.11	9	4
5	118.111	81.11	1	5

IND SLICE WIDTH AND NO OF SLICES

FI	FO
00000	9639
96394	95874
95874	95797

THE SAFETY FACTOR FOR POINT TIS 95797

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 86.111 Y= 405.111
ENTRANCE PT COORDS: X= 18.111 Y= 81.111
TRIAL ARC RADIUS= 40.000

XX LINE 1NOT INTERSECTED BY TRIAL CIRCL

XX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XX LINE 9NOT INTERSECTED BY TRIAL CIRCL

RC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
2	75.983	66.41
6	111.797	74.45
3	118.111	81.11

HE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	000	62.111	1	1
2	000	53.111	1	2

I=	3	000	8	1	K=	1	KK=	3
I=	4	40	55	1	K=	1	KK=	4
I=	5	65	62	1	K=	1	KK=	5
I=	6	75	66	1	K=	2	KK=	5
I=	7	95	74	1	K=	2	KK=	6
I=	8	113	74	1	K=	3	KK=	7
I=	9	115	8	1	K=	3	KK=	8
I=	10	118	4	1	K=	3	KK=	8
I=	11	115	4	1	K=	3	KK=	9
I=	12	175	54	1	K=	3	KK=	9
I=	13	240	8	1	K=	3	KK=	0
I=	14	242	77	1	K=	3	KK=	1
I=	15	244	66	1	K=	3	KK=	2

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	75	983	66	4	1	K=	6	KK=	1
I=	2	95	7	74	3	1	K=	7	KK=	2
I=	3	113	797	74	4	5	K=	8	KK=	3
I=	4	118	8	8	1	1	K=	9	KK=	4
I=	5	118	8	8	1	1	K=	1	KK=	5

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	04952
FI=	04952	FO=	05709
FI=	05709	FO=	05820
FI=	05820	FO=	05837

THE SAFETY FACTOR FOR POINT 2IS 1.05837

TRIAL CIRCLE NO 3
 CIRCLE CTR COORDS: X= X= 83.7 Y= 408.1
 ENTRANCE PT. COORDS: X= 18.1 Y= 8.1
 TRIAL ARC RADIUS= 44.204

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY

LINE NO	72	756	65	4
2	72	756	74	45
6	118	11	8	1
3	118	11	8	1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	000	62	1	K=	1	KK=	1
I=	2	000	53	1	K=	1	KK=	2
I=	3	000	8	1	K=	1	KK=	3
I=	4	40	55	1	K=	1	KK=	4
I=	5	65	62	1	K=	1	KK=	5
I=	6	72	65	3	K=	2	KK=	5
I=	7	95	74	1	K=	2	KK=	6
I=	8	113	74	4	K=	3	KK=	6
I=	9	115	8	1	K=	3	KK=	7
I=	10	118	4	1	K=	3	KK=	8
I=	11	115	4	1	K=	3	KK=	8
I=	12	175	54	1	K=	3	KK=	9
I=	13	240	8	1	K=	3	KK=	9
I=	14	242	77	1	K=	3	KK=	0
I=	15	244	66	1	K=	3	KK=	1

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	72.756	65.737	K=	6	KK=	1
I=	2	95.111	74.711	K=	7	KK=	2
I=	3	111.756	74.711	K=	8	KK=	3
I=	4	113.711	81.711	K=	9	KK=	4
I=	5	118.711	81.711	K=	1	KK=	5

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.00000	FO=	99844
FI=	99844	FO=	99821

THE SAFETY FACTOR FOR POINT 3IS 99821

TRIAL CIRCLE NO 4
 CIRCLE CTR COORDS: X= 86.711 Y= 108.711
 ENTRANCE PT COORDS: X= 18.711 Y= 81.711
 TRIAL ARC RADIUS= 41.869

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY

LINE NO	2	77.703	67.711
	6	110.981	74.711
	3	118.711	81.711

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	0000	62.711	K=	1	KK=	1
I=	2	0000	53.711	K=	1	KK=	2
I=	3	0000	8.711	K=	1	KK=	3
I=	4	40.711	55.711	K=	1	KK=	4
I=	5	65.711	62.711	K=	1	KK=	5
I=	6	77.703	67.711	K=	2	KK=	5
I=	7	95.711	74.711	K=	2	KK=	6
I=	8	110.981	74.711	K=	3	KK=	6
I=	9	113.711	81.711	K=	3	KK=	7
I=	10	118.711	81.711	K=	3	KK=	8
I=	11	115.711	81.711	K=	3	KK=	9
I=	12	113.711	81.711	K=	3	KK=	10
I=	13	110.981	81.711	K=	3	KK=	11
I=	14	108.711	81.711	K=	3	KK=	12
I=	15	106.444	81.711	K=	3	KK=	12

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	77.703	67.7095	K=	6	KK=	1
I=	2	95.111	74.711	K=	7	KK=	2
I=	3	110.981	74.711	K=	8	KK=	3
I=	4	113.711	81.711	K=	9	KK=	4
I=	5	118.711	81.711	K=	1	KK=	5

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.00000	FO=	1305
FI=	1305	FO=	3058
FI=	3058	FO=	3305
FI=	3305	FO=	3339

THE SAFETY FACTOR FOR POINT 4IS 1.13339

After Dredging of all Bottom Sludge:

The results taken from the computer for cross-section

(8-8)B are:

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	101	110	143	64	1.55
b	97	103	133	64	1.99
c	107	101	139	64	2.59
d	93	108	136	64	1.42
e	109	108	152	64	1.58
f	86	111	133	64	1.35
g	88	103	139	64	1.15

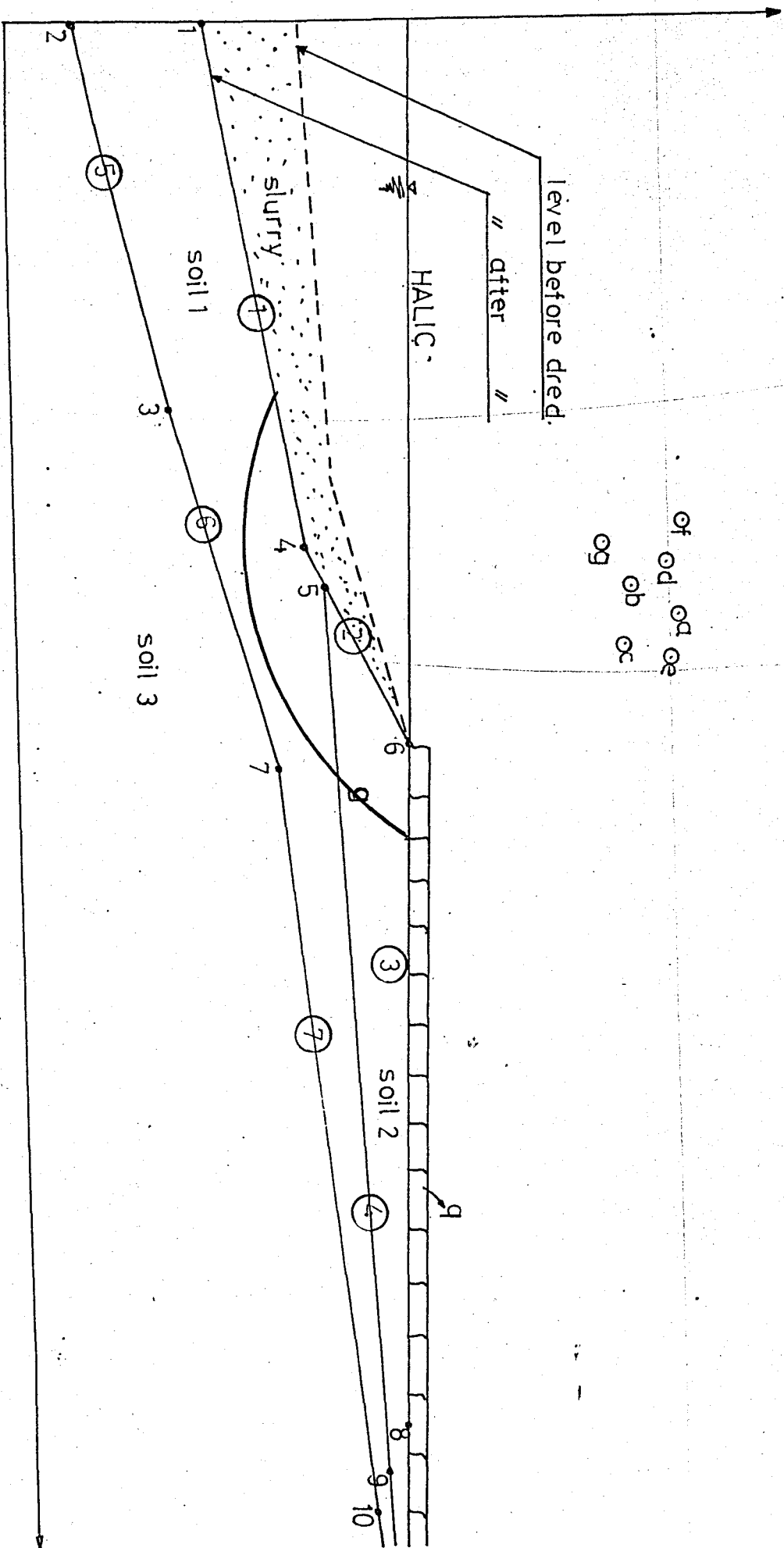


Fig : (8-8) B After Dredging of all bottom Sludge.

NO OF LINES 7 NO OF LINE INTERSECT= 10
 NO OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 NO OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 INITIAL SLICE WIDTH= 2.0

LINE NO	END NO	COORD	MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INT
1	2	89	100	33	4	89	49	17955	4
2	3	124	100	49	24	24	64	42857	6
3	4	94	100	64	22	29	64	00000	6
4	5	94	100	52	23	30	58	44117	5
5	6	64	100	28	64	26	44	23396	2
6	7	125	100	44	25	23	56	29508	3
7	2	125	100	44	23	32	56	11215	7

LINE NO	INTERSECT	ARRAY	X	Y
1	00	33	4	4
2	00	49	24	64
3	64	22	29	64
4	89	23	30	58
5	94	25	23	56
6	124	26	44	25
7	125	23	32	56

IL NO	LINE #	LEFT INT	RTS INT	SAT	UNIT WT	PHI	COHESI ON
1	1	4	4	00	7.8	12.0	00
2	2	5	5	00	7.8	12.0	00
3	3	6	6	00	7.8	12.0	00
4	4	7	7	00	7.8	12.0	00
5	5	8	8	00	7.8	12.0	00
6	6	9	9	00	7.8	12.0	00
7	7	10	10	00	7.8	12.0	00
8	8	11	11	00	7.8	12.0	00
9	9	12	12	00	7.8	12.0	00
10	10	13	13	00	7.8	12.0	00

TRIAL CIRCLE NO 1
 CIRCLE CTR COORDS: X= 88.1 Y= 03.1
 ENTRANCE PT. COORDS: X= 39.1 Y= 64.1
 TRIAL ARC RADIUS= 64.203

XX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 XX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XX LINE 6 NOT INTERSECTED BY TRIAL CIRCL
 XX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 **LINE 2 IS NOT INTERSECTED BUT IS IN ARC

RC INTERSECT	WITH LINE	ARRAY	X	Y
1	62	345	44	31
2	129	048	53	65
3	139	111	64	1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2	3	4	5	6	7	8	9	10	11	12	13
I=	62	345	44	305	26	2	4	2	4	2	4	2	4
I=	89	1	49	1	52	1	64	1	44	1	53	1	64
I=	94	1	52	1	64	1	44	1	53	1	64	1	58
I=	24	1	64	1	44	1	53	1	64	1	58	1	56
I=	125	1	44	1	53	1	64	1	58	1	56	1	56
I=	229	1	53	1	64	1	58	1	56	1	56	1	56
I=	230	1	58	1	56	1	56	1	56	1	56	1	56
I=	232	1	56	1	56	1	56	1	56	1	56	1	56

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	2	3	4	5	6
I=	62	345	44	305	26	2
I=	89	1	49	1	52	1
I=	94	1	52	1	64	1
I=	24	1	64	1	44	1
I=	125	1	44	1	53	1
I=	229	1	53	1	64	1
I=	230	1	58	1	56	1
I=	232	1	56	1	56	1

FIND SLICE WIDTH AND NO OF SLICES

FI=	FO=
FI= 00000	FO= 3250
FI= 3250	FO= 4830
FI= 4830	FO= 4999
FI= 4999	FO= 5016

THE SAFETY FACTOR FOR POINT TIS 1.15016

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= 9.39 Y= 403.71
 ENTRANCE PT. COORDS: X= 61.847 Y= 64.11
 TRIAL ARC RADIUS= 61.847

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL
 ***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	68.738	45.45
2	128.194	53.61
3	139.111	64.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2	3	4	5	6	7	8	9	10	11	12	13
I=	68	738	45	45	26	2	4	2	4	2	4	2	4
I=	89	1	49	1	52	1	64	1	44	1	53	1	64
I=	94	1	52	1	64	1	44	1	53	1	64	1	58
I=	24	1	64	1	44	1	53	1	64	1	58	1	56
I=	125	1	44	1	53	1	64	1	58	1	56	1	56
I=	229	1	53	1	64	1	58	1	56	1	56	1	56
I=	230	1	58	1	56	1	56	1	56	1	56	1	56
I=	232	1	56	1	56	1	56	1	56	1	56	1	56

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	2
I=	68	738
I=	89	1

I=	3	94	1	52	1	K=	6	KK=	3
I=	4	124	1	64	1	K=	7	KK=	4
I=	5	128	1	53	1	K=	9	KK=	5
I=	6	139	1	64	1	K=	0	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	5468
FI=	15468	FO=	7353
FI=	7353	FO=	7554
FI=	7554	FO=	7575

THE SAFETY FACTOR FOR POINT 2IS 1.17575

TRIAL CIRCLE NO 3
 CIRCLE CTR COORDS: X= 88.711 Y= 406.711
 ENTRANCE PT. COORDS: X= 39.711 Y= 64.711
 TRIAL ARC RADIUS= 66.068

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	63.995	44.60
2	128.227	53.62
3	139.111	64.71

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	0000	33	1	K=	1	KK=	1
I=	2	0000	11	1	K=	1	KK=	2
I=	3	0000	44	60	K=	2	KK=	3
I=	4	63.995	26	1	K=	2	KK=	4
I=	5	54.111	49	1	K=	2	KK=	5
I=	6	89.111	52	1	K=	2	KK=	6
I=	7	94.111	64	1	K=	2	KK=	7
I=	8	124.111	44	1	K=	2	KK=	8
I=	9	128.227	53	6	K=	3	KK=	7
I=	10	139.111	64	1	K=	3	KK=	8
I=	11	229.111	64	1	K=	3	KK=	9
I=	12	230.111	58	1	K=	3	KK=	9
I=	13	232.111	56	1	K=	3	KK=	0

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	63.995	44.60	K=	3	KK=	1
I=	2	89.111	49.1	K=	5	KK=	2
I=	3	94.111	52.1	K=	6	KK=	3
I=	4	124.111	64.1	K=	7	KK=	4
I=	5	128.227	53.6	K=	9	KK=	5
I=	6	139.111	64.71	K=	0	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	4.43
FI=	4.43	FO=	5831
FI=	5831	FO=	6010
FI=	6010	FO=	6029

THE SAFETY FACTOR FOR POINT 3IS 1.16029

TRIAL CIRCLE NO 4
 CIRCLE CTR COORDS: X= 91.711 Y= 406.711
 ENTRANCE PT. COORDS: X= 39.711 Y= 64.711
 TRIAL ARC RADIUS= 63.781

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
LINE NO X Y

1	70	467	45	76
2	127	276	53	57
3	139	111	64	1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	000	33	11	K=	1	KK=	1
I=	2	000	11	11	K=	1	KK=	2
I=	3	64	26	11	K=	1	KK=	3
I=	4	70	45	76	K=	2	KK=	3
I=	5	89	49	11	K=	2	KK=	4
I=	6	94	52	11	K=	2	KK=	5
I=	7	124	64	11	K=	2	KK=	6
I=	8	125	44	11	K=	2	KK=	7
I=	9	127	53	57	K=	3	KK=	7
I=	10	139	64	11	K=	3	KK=	7
I=	11	229	64	11	K=	3	KK=	8
I=	12	230	58	11	K=	3	KK=	9
I=	13	232	56	11	K=	3	KK=	10

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	70	45	76	K=	4	KK=	1
I=	2	89	49	11	K=	5	KK=	2
I=	3	94	52	11	K=	6	KK=	3
I=	4	124	64	11	K=	7	KK=	4
I=	5	127	53	57	K=	9	KK=	5
I=	6	139	64	11	K=	10	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	7563
FI=	7563	FO=	9711
FI=	9711	FO=	9937
FI=	9937	FO=	9961

BRKPT PRINTS

THE SAFETY FACTOR FOR POINT 4 IS 1.1996T

After dredging of 8m. of Bottom Sludge

The results taken from the computer for cross-section
(8-8)B are:

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	101	110	143	64	1.46
b	97	103	133	64	2.01
c	107	101	139	64	3.35
d	93	108	136	64	1.33
e	109	108	152	64	1.46
f	86	111	133	64	1.24
g	88	103	139	64	1.01

of od oa oe
ob oc
og

level before dred.

" after "

HALIC

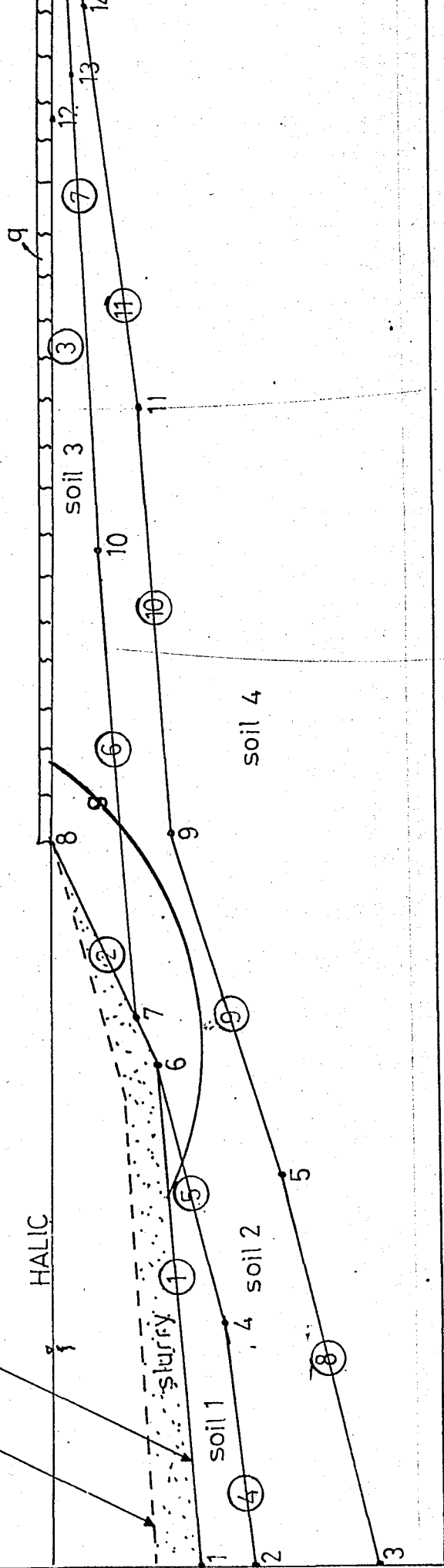


Fig : (8-8) B Dredging of 8m. of Bottom Sludge

E STABILITY FOR TASKIZAK(II)EXCAVA(2) MAHIR KOSELER THESIS

F LINES 11 NO OF LINE INTERSECT= 14
 F SOILS= 4 NO OF EXTERNAL SOIL LINES= 3
 F X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 IN ITIAL SLICE WIDTH= 200

LINE END COORD MATRIX

NO	LINE	INT	X1	Y1	X2	Y2	SLOPE	LINE INTER
2	1	00	42	33	48	64	673378	001
2	2	89	48	64	64	64	57143	001
2	2	124	64	64	64	64	000000	001
2	2	00	33	36	36	36	30772	001
2	2	36	36	36	36	36	226415	001
2	2	96	55	48	54	58	575923	001
2	2	148	55	48	54	58	487805	001
2	2	00	26	64	26	26	33969	001
2	2	64	26	64	26	26	295082	001
2	2	125	44	49	49	49	675676	001
2	2	99	49	32	56	56	12121	001

INTERSECT ARRAY

X	Y
00	42
00	33
00	48
36	64
64	64
89	64
96	55
124	48
125	55
148	48
199	26
229	64
230	58
232	56

DATA ARRAY

NO	LINE	#	LEFT INT	RT INT	SAT	UNIT	WT	PHI	COHESI ON
2	1	00	6	6	00	1	5	12	00
2	2	89	6	6	00	1	5	12	00
2	2	124	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	36	6	6	00	1	5	12	00
2	2	96	6	6	00	1	5	12	00
2	2	148	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99	6	6	00	1	5	12	00
2	2	00	6	6	00	1	5	12	00
2	2	64	6	6	00	1	5	12	00
2	2	125	6	6	00	1	5	12	00
2	2	99							

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC LINE	NO	X	Y
1	58	661	46706
5	65	928	42886
6	128	200	52996
3	139	111	64711

THE ARRAY WITH ALL INTERSECTIONS	FOLLOWS:
1 0000	42 1 1 KK= 1
2 0000	33 1 1 KK= 2
3 0000	1 1 1 KK= 3
4 36 1 1	36 1 1 KK= 4
5 58 661	46 06 2 KK= 5
6 65 928	26 86 2 KK= 6
7 65 928	42 86 2 KK= 7
8 89 111	48 11 1 KK= 8
9 96 111	5 11 1 KK= 9
10 124 200	64 11 1 KK= 10
11 128 200	44 11 1 KK= 11
12 139 111	52 96 2 KK= 12
13 139 111	64 11 1 KK= 13
14 139 111	54 11 1 KK= 14
15 139 111	49 11 1 KK= 15
16 229 111	64 11 1 KK= 16
17 230 111	58 11 1 KK= 17
18 232 111	56 11 1 KK= 18

THE APPLICABLE ARRAY ARCINT	FOLLOWS:
1 58 661	46 706 1 K= 5 KK= 1
2 65 928	42 862 2 K= 7 KK= 2
3 89 111	48 11 1 K= 8 KK= 3
4 96 111	5 11 1 K= 9 KK= 4
5 124 200	64 11 1 K= 10 KK= 5
6 128 200	52 962 2 K= 12 KK= 6
7 139 111	64 11 1 K= 13 KK= 7

FIND SLICE WIDTH AND NO OF SLICES

FI= 100000	FO= 101086
FI= 101086	FO= 101225
FI= 101225	FO= 101243

THE SAFETY FACTOR FOR POINT 1IS 1.01243

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 9771 Y= 103717
ENTRANCE PT. COORDS: X= 13971 Y= 64711
TRIAL ARC RADIUS= 61.847

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	66.072	46.56
2	72.099	44.26
3	127.229	52.97
4	139.111	64.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	0000	0000	0000	36	64	66	72	89	96	124	127	139	148	199	227	239	230	232
	42	33	1	36	26	46	44	48	5	64	44	52	64	54	49	64	58	56
K=	1	1	1	1	1	2	3	3	3	3	3	4	4	4	4	4	4	4
KK=	1	2	3	4	5	5	5	6	7	8	9	9	9	10	11	12	13	14

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	2	3	4	5	6	7
	66.072	72.099	89.111	96.111	124.111	127.229	139.111
	46.56	44.26	48.111	5.111	64.111	52.97	64.11
K=	6	7	8	9	10	12	13
KK=	1	2	3	4	5	6	7

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	003397
FI=	003397	FO=	003851
FI=	003851	FO=	003910

THE SAFETY FACTOR FOR POINT 2IS 1.03910

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= 88.711 Y= 106.711
ENTRANCE PT COORDS: X= 39.711 Y= 64.711
TRIAL ARC RADIUS= 66.068

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 11NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	60.319	46.727
2	67.721	43.227
3	127.285	52.911
4	139.111	64.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	60.319	46.727	1	1
2	67.721	43.227	1	1
3	127.285	52.911	1	1
4	139.111	64.111	1	1
5	60.319	46.727	2	2
6	67.721	43.227	2	2
7	127.285	52.911	3	3
8	139.111	64.111	3	3
9	60.319	46.727	3	3
10	67.721	43.227	3	3
11	127.285	52.911	4	4
12	139.111	64.111	4	4
13	60.319	46.727	4	4
14	67.721	43.227	4	4
15	127.285	52.911	4	4
16	139.111	64.111	4	4
17	60.319	46.727	4	4
18	67.721	43.227	4	4

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	60.319	46.727	5	5
2	67.721	43.227	7	7
3	127.285	52.911	8	8
4	139.111	64.111	9	9
5	60.319	46.727	10	10
6	67.721	43.227	12	12
7	127.285	52.911	13	13

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
1.00000	0.02236
1.02236	0.02525
1.02525	0.02561

THE SAFETY FACTOR FOR POINT 3IS 1.02561

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= 91.111 Y= 46.727
ENTRANCE PT. COORDS: X= 139.111 Y= 64.111
TRIAL ARC RADIUS= 63.781

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
LINE NO
1 67.945 46.69
2 73.958 44.68
3 126.195 52.85
4 139.111 64.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
I= 1 000 42.11 K= 1 KK= 1
I= 2 000 33.11 K= 1 KK= 2
I= 3 000 11.11 K= 1 KK= 3
I= 4 36.11 35.11 K= 1 KK= 4
I= 5 64.11 26.11 K= 1 KK= 5
I= 6 67.945 46.68 K= 2 KK= 5
I= 7 73.958 44.68 K= 3 KK= 5
I= 8 89.11 48.11 K= 3 KK= 6
I= 9 96.11 51.11 K= 3 KK= 7
I= 10 124.11 64.11 K= 3 KK= 8
I= 11 126.195 52.85 K= 3 KK= 9
I= 12 139.111 64.11 K= 4 KK= 9
I= 13 48.11 54.11 K= 4 KK= 10
I= 14 199.11 49.11 K= 4 KK= 11
I= 15 229.11 64.11 K= 4 KK= 12
I= 16 230.11 58.11 K= 4 KK= 13
I= 17 232.11 56.11 K= 4 KK= 14

THE APPLICABLE ARRAY ARCINT FOLLOWS:
I= 1 67.945 46.68 K= 6 KK= 1
I= 2 73.958 44.68 K= 7 KK= 2
I= 3 89.11 48.11 K= 8 KK= 3
I= 4 96.11 51.11 K= 9 KK= 4
I= 5 124.11 64.11 K= 10 KK= 5
I= 6 126.195 52.85 K= 12 KK= 6
I= 7 139.111 64.11 K= 13 KK= 7

FIND SLICE WIDTH AND NO OF SLICES
FI= 1.00000 FO= 1.05852
FI= 1.05852 FO= 1.06642
FI= 1.06642 FO= 1.06744
FI= 1.06744 FO= 1.06757

ARKPT PRINTS THE SAFETY FACTOR FOR POINT 4 IS 1.06757

After Dredging of 9m. of Bottom Sludge:

The results taken from the computer for cross-section
(IO-IO) A are:

Circle NO	Circle Center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	II7	III	I4I	90	I.OI
b	I25	II6	I56	90	I.4I
c	III	II7	I49	90	I.33
d	II9	IOI	I68	90	2.58
e	II9	I30	I82	90	2.33
f	II6	I43	I87	90	2.44
g	I08	I29	I6I	90	I.82
h	I04	I52	I84	90	2.68
k	II9	I23	I45	90	I.35
l	II4	I20	I47	90	I.I7

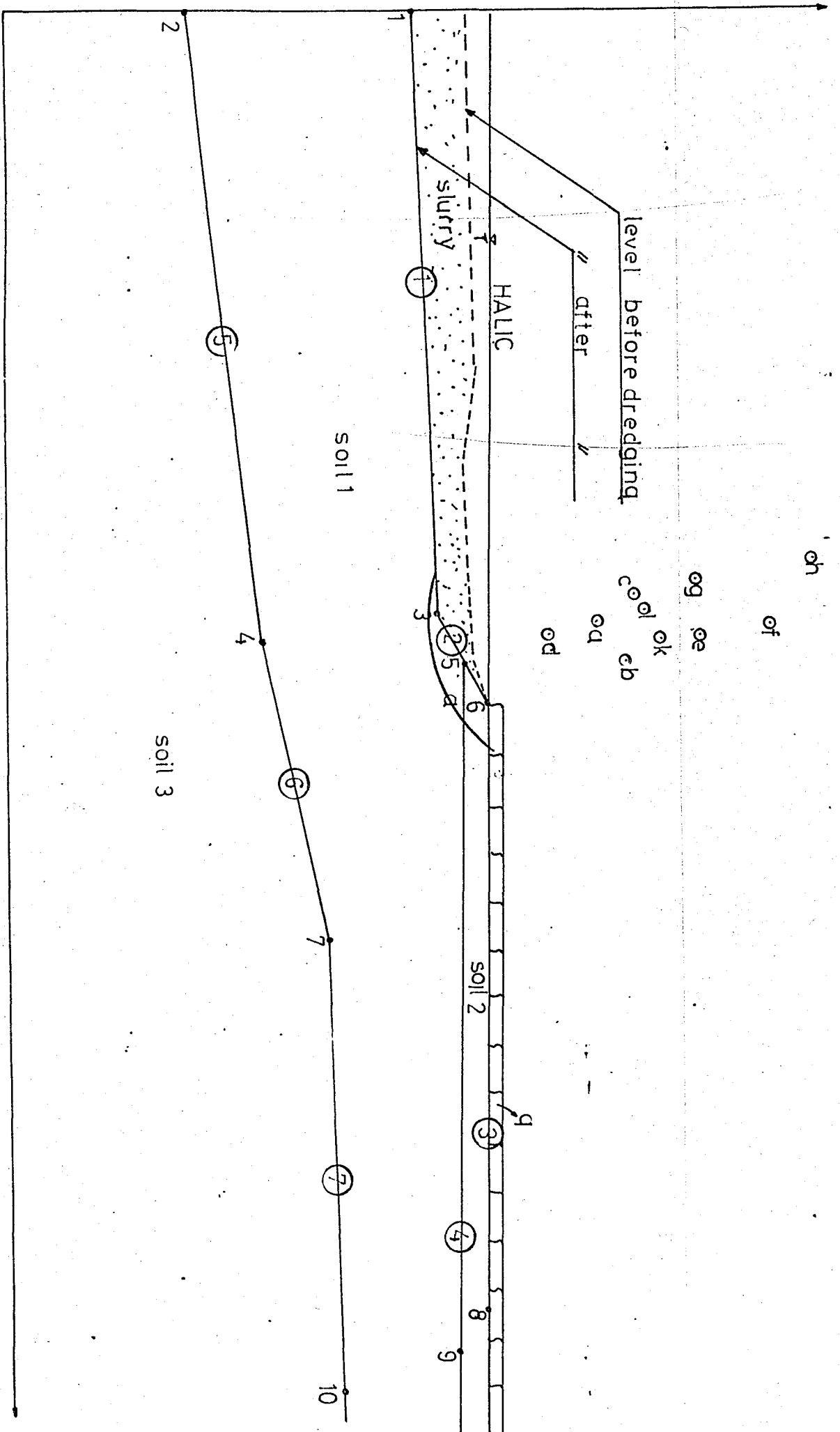


Fig (10-10)B After Dredging

OF LINES 7 NO OF LINE INTERSECT= 10
 OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
 OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
 INITIAL SLICE WIDTH= 2.0

LINE NO	END INT	COORD MATRIX	Y1	X2	Y2	SLOPE	LINE INTER
2	1	100	78	1	80	1800000	3
3	1	100	80	1	90	475190	5
2	1	132	90	1	83	000000	6
2	1	25	87	1	83	380952	9
2	1	100	35	1	47	999076	2
2	1	120	47	1	59	218182	4
2	1	175	59	1	60	175439	7

INTERSECT ARRAY

NO	X	Y
1	100	78
2	100	80
3	132	90
4	25	87
5	100	83
6	132	90
7	175	59
8	120	47
9	230	90
10	232	83

DATA ARRAY

NO	LINE #	LEFT INT	RT INT	SAT	UNIT	WT	PHI	COHESION
1	2	1	3	0	7	8	12	0
2	3	1	5	0	7	8	12	0
3	4	1	9	0	7	8	12	0
4	5	1	4	0	7	8	12	0
5	6	1	7	0	7	8	12	0
6	7	1	0	0	7	8	12	0
7	2	5	6	0	7	8	20	0
8	3	5	8	0	7	8	20	0
9	4	5	9	0	7	8	20	0
10	5	2	4	0	1	3	45	0
11	6	4	7	0	1	3	45	0

AL CIRCLE NO 1
 CLE CTR COORDS: X= 112.1 Y= 175.1
 RANCE PT COORDS: X= 49.1 Y= 90.1
 TRIAL ARC RADIUS= 46.65

LINE 2 NOT INTERSECTED BY TRIAL CIRCL

LINE 5 NOT INTERSECTED BY TRIAL CIRCL

LINE 6 NOT INTERSECTED BY TRIAL CIRCL

LINE 7 NOT INTERSECTED BY TRIAL CIRCL

LINE 2 IS NOT INTERSECTED BUT IS IN ARC

INTERSECT WITH LINE ARRAY

NO	X	Y
83	4.8	79.61
146	103	86.31
149	11	90.11

LINE	NO	X	Y	K	KK
I=	1	83.418	79.613	K=	1
I=	2	111.111	80.111	K=	2
I=	3	125.111	47.111	K=	2
I=	4	132.111	87.111	K=	2
I=	5	146.103	90.111	K=	2
I=	6	149.111	86.111	K=	3
I=	7	149.111	90.111	K=	3
I=	8	175.111	59.111	K=	3
I=	9	229.111	90.111	K=	3
I=	10	230.111	83.111	K=	3
I=	11	232.111	60.111	K=	3
I=	12				
I=	13				

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	NO	X	Y	K	KK
I=	1	83.418	79.613	K=	3
I=	2	111.111	80.111	K=	4
I=	3	125.111	47.111	K=	6
I=	4	132.111	87.111	K=	7
I=	5	146.103	86.111	K=	8
I=	6	149.111	90.111	K=	9

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
FI=	30000
FI=	30020
FI=	33068
FI=	33330

THE SAFETY FACTOR FOR POINT 1 IS 1.33330

TRIAL CIRCLE NO 2
 CIRCLE CTR COORDS: X= 147.1 Y= 177.1
 ENTRANCE PT COORDS: X= 149.1 Y= 90.1
 TRIAL ARC RADIUS= 44.204

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	90.513	79.74
2	145.828	86.32
3	149.111	90.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE	NO	X	Y	K	KK
I=	1	83.418	79.613	K=	1
I=	2	111.111	80.111	K=	1
I=	3	90.513	79.740	K=	2
I=	4	111.111	80.111	K=	2
I=	5	125.111	47.111	K=	2
I=	6	132.111	87.111	K=	2
I=	7	146.103	86.111	K=	2
I=	8	145.828	86.322	K=	3
I=	9	149.111	90.111	K=	3
I=	10	175.111	59.111	K=	3
I=	11	229.111	90.111	K=	3
I=	12	230.111	83.111	K=	3
I=	13	232.111	60.111	K=	3

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE	NO	X	Y	K	KK
I=	1	90.513	79.740	K=	3
I=	2	111.111	80.111	K=	4

I= 5 6 145.828 86.322 K= 7 8 KK= 4 5
I= 6 149.114 90.114 K= 9 KK= 6

FIND SLICE WIDTH AND NO OF SLICES
FI= 00000 FO= 18386
FI= 8386 FO= 20262
FI= 20262 FO= 20427
FI= 20427 FO= 20441

THE SAFETY FACTOR FOR POINT 2IS 1.20441

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= X= 112.11 Y= 20.11
ENTRANCE PT. COORDS: X= X= 49.11 Y= 90.11
TRIAL ARC RADIUS= 48.45

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL
***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY
LINE NO X Y
1 84.551 79.63
4 145.787 86.32
3 149.114 90.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
I= 1 0000 78.11 K= 1 KK= 1
I= 2 0000 35.11 K= 1 KK= 2
I= 3 84.551 79.633 K= 2 KK= 2
I= 4 111.11 80.11 K= 2 KK= 3
I= 5 120.11 47.11 K= 2 KK= 4
I= 6 125.11 87.11 K= 2 KK= 5
I= 7 132.11 90.11 K= 2 KK= 6
I= 8 145.787 86.323 K= 3 KK= 6
I= 9 149.114 90.11 K= 3 KK= 6
I= 10 175.11 59.11 K= 3 KK= 7
I= 11 229.11 90.11 K= 3 KK= 8
I= 12 230.11 83.11 K= 3 KK= 9
I= 13 232.11 60.11 K= 3 KK= 9

THE APPLICABLE ARRAY ARCINT FOLLOWS:
I= 1 84.551 79.633 K= 3 KK= 1
I= 2 111.11 80.11 K= 4 KK= 2
I= 3 125.11 87.11 K= 6 KK= 3
I= 4 132.11 90.11 K= 7 KK= 4
I= 5 145.787 86.323 K= 8 KK= 5
I= 6 149.114 90.11 K= 9 KK= 6

FIND SLICE WIDTH AND NO OF SLICES
FI= 00000 FO= 25794
FI= 25794 FO= 28340
FI= 28340 FO= 28544
FI= 28544 FO= 28560

THE SAFETY FACTOR FOR POINT 3IS 1.28560

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= X= 142.11 Y= 20.11
ENTRANCE PT. COORDS: X= X= 49.11 Y= 90.11
TRIAL ARC RADIUS= 46.098

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	91.830	79.76
2	145.481	86.33
3	149.111	90.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=			K=	KK=
1	000	78.111	1	1
2	000	35.111	1	2
3	91.830	79.764	2	3
4	111.111	80.111	2	4
5	120.111	47.111	2	5
6	125.111	87.111	2	6
7	132.111	90.111	3	6
8	145.481	86.335	3	7
9	149.111	90.111	3	8
10	175.111	59.111	3	9
11	229.111	90.111	3	9
12	230.111	83.111	3	9
13	232.111	60.111	3	0

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=			K=	KK=
1	91.830	79.764	3	1
2	111.111	80.111	4	2
3	125.111	87.111	6	3
4	132.111	90.111	7	4
5	145.481	86.335	8	5
6	149.111	90.111	9	6

FIND SLICE WIDTH AND NO OF SLICES

FI=		FO=
1	00000	5570
2	5570	7126
3	7126	7263
4	7263	7274

THE SAFETY FACTOR FOR POINT 4IS 1.17274
PROGRAM EXECUTION

After Dredging of Bottom Sludge:

The results taken from the computer for cross-section
(10-10)B are:

Circle NO	Circle center Coordinates		Entrance Points		FACTOR OF SAFETY
	X	Y	X	Y	
a	I23	II3	I47	9I	I.28
b	I29	II2	I49	9I	2.0I
c	I25	I23	I58	9I	I.32
d	II6	I28	I57	9I	I.46
e	I2I	I37	I65	9I	I.52
f	I07	I52	I69	9I	2.I9
g	I09	I39	I8I	9I	2.93
h	II4	II5	I60	9I	I.I9

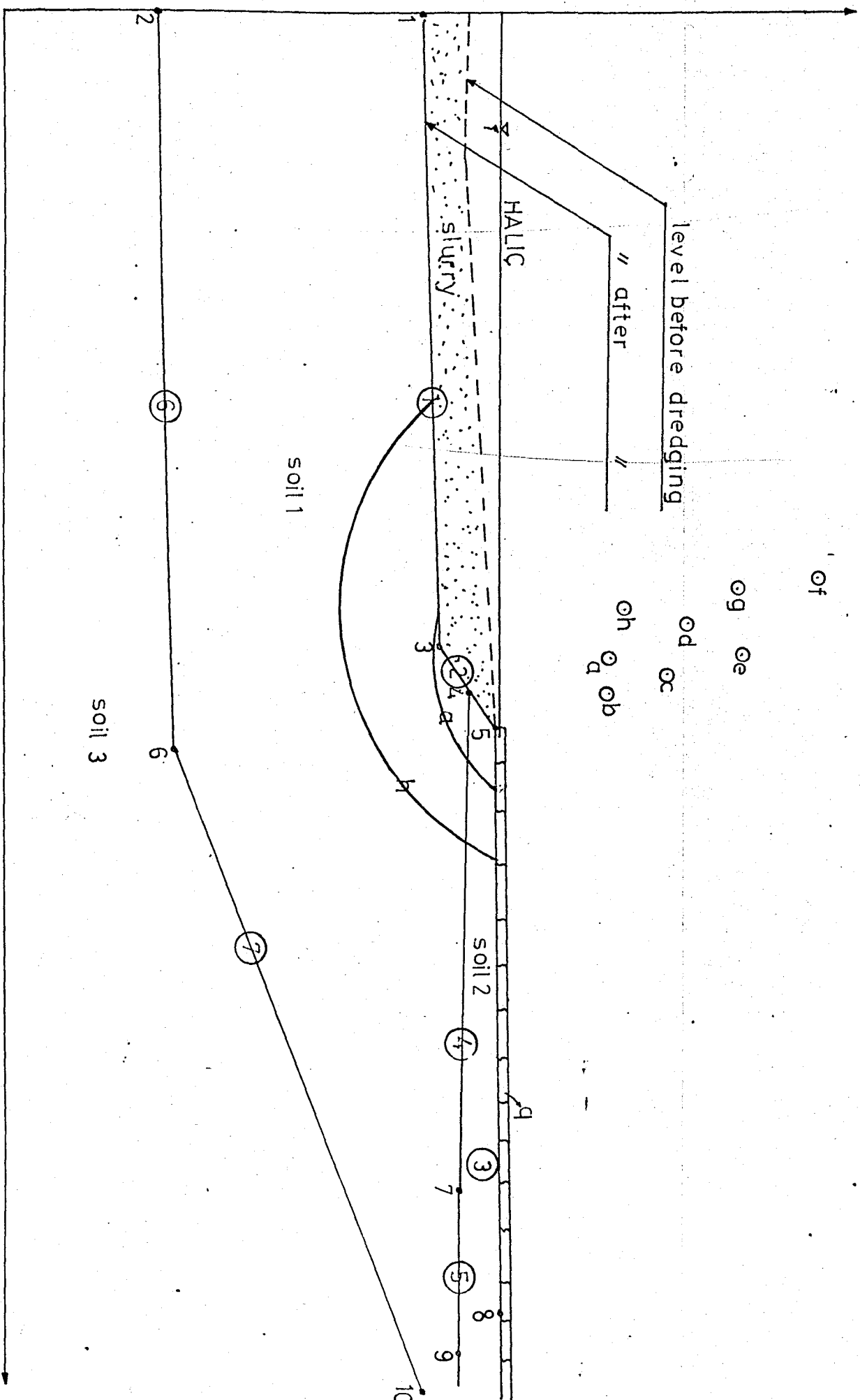


Fig (10-10) 8 After Dredging

OF LINES = 7 NO OF LINE INTERSECT = 10
OF SOILS = 3 NO OF EXTERNAL SOIL LINES = 3
OF X INCREMENTS = 3 NO OF Y INCREMENTS = 3
INITIAL SLICE WIDTH = 2.0

LINE NO	END NO	COORD INT	MATRIX X1	Y1	X2	Y2	SLOPE	LINE INTE
1	2	1	1.00	8.0	1.8	8.1	0.000000	1
2	3	2	1.36	8.4	2.36	9.1	0.555556	5
3	4	2	1.28	8.6	2.34	9.3	0.000000	4
4	5	2	1.14	8.3	2.38	8.3	0.000000	7
5	6	2	1.00	8.3	2.36	8.3	0.000000	2
6	7	2	0.38	3.0	2.40	7.5	4.11765	6

LINE NO	INTERSECT X	Y
1	0.00	8.1
2	0.00	3.1
3	1.8	8.4
4	1.29	8.6
5	1.36	9.1
6	1.38	3.3
7	2.14	3.3
8	2.33	9.1
9	2.36	8.3
10	2.40	7.5

SOIL DATA	LINE #	LEFT INT	RT INT	SAT	UNIT WT	PHI	COHESION
1	1	3.1	4.1	0.00	7.8	12.0	0.00
2	2	4.1	7.1	0.00	7.8	12.0	0.00
3	3	4.1	9.1	0.00	7.8	12.0	0.00
4	4	6.1	7.1	0.00	7.8	12.0	0.00
5	5	4.1	5.1	0.00	7.8	20.0	19.6
6	6	5.1	8.1	0.00	7.8	20.0	19.6
7	7	4.1	9.1	0.00	7.8	20.0	19.6
8	8	7.1	6.1	0.00	7.8	20.0	19.6
9	9	2.1	0.0	0.00	13.7	45.0	68.6
10	10	6.1	0.0	0.00	13.7	45.0	68.6

TRIAL CIRCLE NO 1
CIRCLE CTR COORDS: X= 1.14 Y= 1.15
ENTRANCE PT COORDS: X= 1.60 Y= 9.1
TRIAL ARC RADIUS= 5.884

XX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE
XX LINE 5 NOT INTERSECTED BY TRIAL CIRCLE
XX LINE 6 NOT INTERSECTED BY TRIAL CIRCLE
XX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE
*LINE 2 IS NOT INTERSECTED BUT IS IN ARC

LINE NO	INTERSECT X	Y
1	7.4	9.9
2	1.56	4.52
3	1.60	1.1

I=	2	000	3	1	K=	1	KK=	2
I=	3	74	8	2	K=	2	KK=	3
I=	4	18	8	3	K=	2	KK=	4
I=	5	28	8	4	K=	2	KK=	5
I=	6	36	9	5	K=	2	KK=	6
I=	7	38	3	6	K=	2	KK=	7
I=	8	56	8	7	K=	3	KK=	8
I=	9	50	9	8	K=	3	KK=	9
I=	10	214	8	9	K=	3	KK=	10
I=	11	233	9	9	K=	3	KK=	11
I=	12	236	8	9	K=	3	KK=	12
I=	13	240	7	3	K=	3	KK=	13

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	74	8	3	KK=	1
I=	2	18	8	4	KK=	2
I=	3	28	8	5	KK=	3
I=	4	36	9	6	KK=	4
I=	5	38	3	8	KK=	5
I=	6	56	8	9	KK=	6
I=	7	50	9			

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	88463
FI=	88463	FO=	98694
FI=	98694	FO=	99360
FI=	99360	FO=	99401

THE SAFETY FACTOR FOR POINT 1IS 1.99401

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 187.11 Y= 157.11
ENTRANCE PT. COORDS: X= 160.41 Y= 91.11
TRIAL ARC RADIUS= 48.374

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL
XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	83	702	8	1
1	156	077	8	5
3	160	111	9	1

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	000	8	1	K=	1	KK=	1
I=	2	000	3	1	K=	1	KK=	2
I=	3	83	8	2	K=	2	KK=	3
I=	4	18	8	3	K=	2	KK=	4
I=	5	28	8	4	K=	2	KK=	5
I=	6	36	9	5	K=	2	KK=	6
I=	7	38	3	6	K=	2	KK=	7
I=	8	56	8	7	K=	3	KK=	8
I=	9	50	9	8	K=	3	KK=	9
I=	10	214	8	9	K=	3	KK=	10
I=	11	233	9	9	K=	3	KK=	11
I=	12	236	8	9	K=	3	KK=	12
I=	13	240	7	3	K=	3	KK=	13

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	83	8	3	KK=	1
I=	2	18	8	4	KK=	2

I= 5
I= 6
156.077
160.111
85.435
91.111
K= 8
K= 9
KK= 5
KK= 6

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	63872
FI=	63872	FO=	77216
FI=	77216	FO=	77757
FI=	77757	FO=	77795

THE SAFETY FACTOR FOR POINT 2IS 1.71795

TRIAL CIRCLE NO 3
CIRCLE CTR COORDS: X= X= 122.111 Y= 15.111
ENTRANCE PT COORDS: X= 160.111 Y= 9.111
TRIAL ARC RADIUS= 44.944

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	92.717	81.111
2	155.615	85.111
3	160.111	91.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	000	81.111	K=	1	KK=	1
I=	2	000	31.111	K=	1	KK=	2
I=	3	000	31.111	K=	1	KK=	2
I=	4	92.717	81.111	K=	2	KK=	3
I=	5	18.111	81.111	K=	2	KK=	4
I=	6	128.111	86.111	K=	2	KK=	5
I=	7	136.111	91.111	K=	2	KK=	6
I=	8	138.111	91.111	K=	2	KK=	6
I=	9	155.615	85.111	K=	3	KK=	6
I=	10	160.111	91.111	K=	3	KK=	7
I=	11	214.111	83.111	K=	3	KK=	8
I=	12	233.111	91.111	K=	3	KK=	9
I=	13	236.111	83.111	K=	3	KK=	0
I=	14	240.111	73.111	K=	3	KK=	0

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	92.717	81.111	K=	3	KK=	1
I=	2	18.111	81.111	K=	4	KK=	2
I=	3	128.111	86.111	K=	5	KK=	3
I=	4	136.111	91.111	K=	6	KK=	4
I=	5	155.615	85.111	K=	8	KK=	5
I=	6	160.111	91.111	K=	9	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	00000	FO=	44986
FI=	44986	FO=	50.42
FI=	50.42	FO=	50566
FI=	50566	FO=	50599

THE SAFETY FACTOR FOR POINT 3IS 1.50599

TRIAL CIRCLE NO 4
CIRCLE CTR COORDS: X= X= 143.111 Y= 19.111
ENTRANCE PT COORDS: X= 160.111 Y= 9.111
TRIAL ARC RADIUS= 53.852

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	75.953	81.111
4	155.897	85.111
3	160.111	91.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

LINE NO	X	Y	K	KK
1	000	81.111	1	1
2	000	31.111	1	2
3	000	81.111	1	2
4	75.953	81.111	2	2
5	118.111	81.111	2	2
6	128.111	86.111	2	2
7	136.111	91.111	2	2
8	138.111	85.111	3	3
9	155.897	85.111	3	3
10	160.111	91.111	3	3
11	144.111	83.111	3	3
12	233.111	91.111	3	3
13	236.111	83.111	3	3
14	240.111	73.111	3	3

THE APPLICABLE ARRAY ARCINT FOLLOWS:

LINE NO	X	Y	K	KK
1	75.953	81.111	3	1
2	118.111	81.111	4	2
3	128.111	86.111	5	3
4	136.111	91.111	6	4
5	155.897	85.111	8	5
6	160.111	91.111	9	6

FIND SLICE WIDTH AND NO OF SLICES

FI	FO
00000	78490
78490	87092
87092	87647
87647	87681

THE SAFETY FACTOR FOR POINT 4 IS 1.87681

TRIAL CIRCLE NO 5
 ENTRANCE PT. COORDS: X= 118.111 Y= 19.111
 TRIAL ARC RADIUS= 50.478

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

THE	ARRAY	WITH	ALL	INTERSECTIONS	FOLLOWS:
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
11	11	11	11	11	11
12	12	12	12	12	12
13	13	13	13	13	13

THE APPLICABLE ARRAY ARCINT FOLLOWS:						
1	8	8	8	8	8	1
2	8	8	8	8	8	2
3	8	8	8	8	8	3
4	8	8	8	8	8	4
5	8	8	8	8	8	5
6	8	8	8	8	8	6

```

FIND SLICE WIDTH AND NO OF SLICES
FI= 000000 FO= 55968
FI= 55968 FO= 6209
FI= 6209 FO= 62537
FI= 62537 FO= 62569

```

THE SAFETY FACTOR FOR POINT 5 IS 1.62569

TRIAL CIRCLE NO. 6
CIRCLE CTR COORDS: X= X= 227.11 Y= 197.11
ENTRANCE PT. COORDS: X= 60.11 Y= 95.11
TRIAL ARC RADIUS= 47.202

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCLE

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
1	94	8
4	154	5
3	160	9

```

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
I= 1 000 8 1 1 K= 1 KK= 1
I= 2 000 3 1 1 K= 1 KK= 2
I= 3 94 8 1 1 K= 2 KK= 2
I= 4 18 8 1 1 K= 2 KK= 3
I= 5 28 8 6 1 K= 2 KK= 4
I= 6 36 9 9 1 K= 2 KK= 5
I= 7 39 3 7 6 K= 2 KK= 6
I= 8 54 8 5 7 6 K= 3 KK= 6
I= 9 60 9 3 7 6 K= 3 KK= 7
I= 10 14 8 3 7 6 K= 3 KK= 7
I= 11 21 9 3 7 6 K= 3 KK= 7
I= 12 33 9 1 1 K= 3 KK= 8

```

5.2 CONCLUSIONS AND RECOMMENDATIONS

The summary of the geological and geotechnical evaluations may be stated as follows:

1. The main formations in the vicinity of Haliç are Paleozoic graywacke, clayey shist and limestone. Surfaces of these fissured and folded formations are decomposed and their compressive strength and unit weight increase with depth.

2. The tertiary formations of sands and gravels are not common in the area. The sand and clay formations, which are cross-bedded and not cemented, are eroded and transported easily.

3. The quarternary clay formations are very common in the whole vicinity of Haliç and an artificial fill is encountered above sedimentary layer and fill are ^{not} uniform.

4. the eroded materials from all formations are transported to Haliç. These eroded materials are mostly decomposed graywacke and shales and consist of fine quarst sands, silts, clays, muscovite particles and organic materials?

5. The origin of the geotechnical problems in the vicinity of Haliç is soft sedimentary layer (usually contains soft silty clay) over the graywacke bedrock.

6. The natural water content of this silty clay formation is very high and the shear strength is very low.

7. In the transverse direction to the shore line, the thickness of clay layer increases in a considerably amount towards Haliç and causing differential settlement problems for the buildings which are located on the shore.

8. The steep slope of the bedrock surface towards Haliç causes stability problem for the clay formation.

9. From the evaluation of over 135 shear tests, it is determined that shear strength variation with depth is linear, (Akşit, 1977) and therefore it is concluded that the silty clay formation is Normally Consolidated.

10. It is determined that stability of shores is above dangerous limits. (In Fermececiler, between Azapkapı and Karaköy, minimum factor of safety for slope stability is found as 1.116) (See slope stability analysis for cross-section (3-3)B) Also, it is determined that shores dredging of bottom sludge can cause slides along the shores. (In cross-section (8-8)B, in Taşkızak, minimum factor of safety for slope stability after dredging is found as 0.95) So we have to take the necessary precautions. These precautions are explained in Recommendations.

For future geological and geotechnical studies and dredging of bottom sludge in vicinity of Haliç, the following recommendations are given:

1. Deeper boreholes should be drilled at certain locations and the samples should be kept for investigators to obtain detailed informations about soil properties.

2. The quantity of the materials transported and de-

posited by Creeks should be estimated.

3. The basic parameters and variation of these parameters with depth in artificial fill and sedimentary layer should be determined at various locations.

4. Because the stability of shores is above dangerous limits, great care has to be given, when constructing any major building along the shore. If possible the best solution is to leave a 100 to 200 meters wide band along the shore for parks, play grounds and pionic areas. This will contribute to the improvement of the touristic value of the area, and as well to the stability problem of the shores. Planted trees will help to decrease the water content of the soil and using this area as a park will reduce the distributed load which is present because of the existing structures. As an example the elimination of the surcharge will increase the Safety Factor from 1.116 to 1.21 at cross-section (3-3)B .

5. As it is seen from the results, during dredging, shores of Haliç may slide. To prevent sliding of shores, some precautions should be taken. Some methods used to prevent sliding are:

a) Loading on toe: (Masonry Wall)

The simplest way of toe loading is to built masonry wall. Better forms are to built reinforced retaining structure wood, concrete piles or palplanges^{shel p.l.}. These structures are useful if they are dimensioned conviniently and hammered down deeply enough and no excavations are made under these structures. On the other hand the depth of the critical slope circle should be known.

In the case of the stabilisation of Haliç's shore , difficulties such as working under sea water necessitates convenient equipment. This method may not be economical. The same result can also be achieved easily by spreading a layer of sand or rock material upon the slope.(Peynircioglu, 1961)

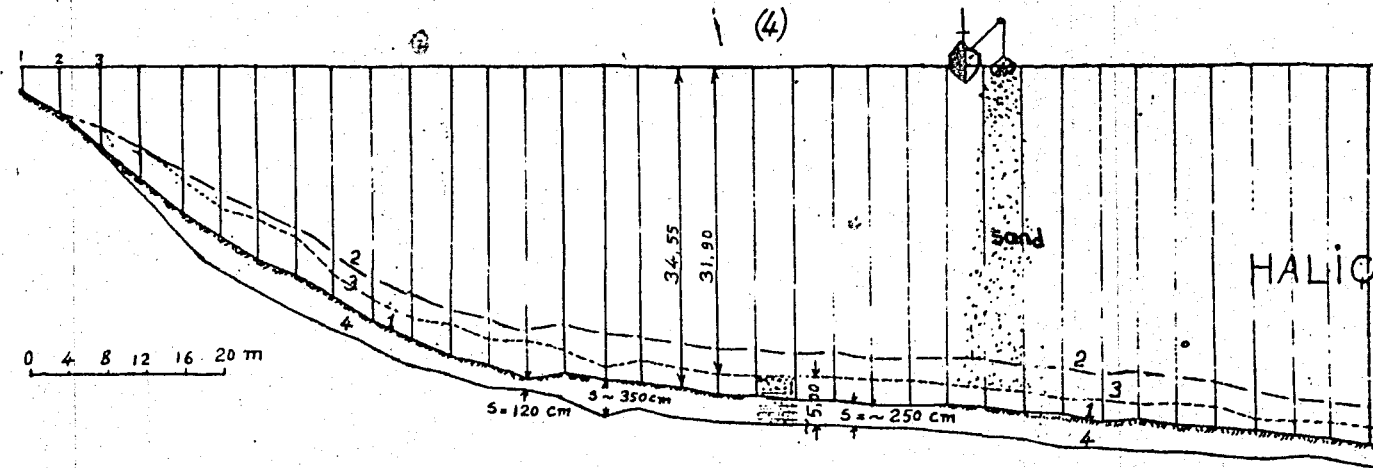


Fig. 5: Spreading layers of sand for stabilization of Ist. Commercial House's shore(Peynircioglu,1961)

The situation after spreading the layer of sand or rock material is controlled by means of computer program.(The unit weight for the material γ_n is taken as 2.2 t/m^3) It is observed that the factor of safety in the most critical region , Taşkızak (8-8)^A, changed from 0.95 to 1.01 after this procedure. This may be more economical than building a retaining wall.

XX LINE NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 10NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
24	65.169	66.65
67	70.994	64.44
74	112.460	74.47
3	118.111	8.11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	000	000	000	40	50	65	55	70	95	112	113	115	118	175	240	242	244
	62	53	8	55	62	66	64	74	74	8	4	8	54	8	77	66	
	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=	K=
	1	1	1	1	1	1	2	3	3	4	4	4	4	4	4	4	4
	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=	KK=
	1	2	3	4	5	6	6	7	7	8	9	9	0	1	2	3	

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	2	3	4	5	6
	65.169	70.994	95.111	112.460	113.111	118.111
	66.652	64.440	74.111	74.465	8.111	8.111
	K=	K=	K=	K=	K=	K=
	7	8	9	0	1	1
	KK=	KK=	KK=	KK=	KK=	KK=
	1	2	3	4	5	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	FO=
1.00000	1.02734
1.02734	1.02950
1.02950	1.02966

THE SAFETY FACTOR FOR POINT IS 1.02966

TRIAL CIRCLE NO 2

CIRCLE CTR COORDS: X= 86.111 Y= 05.111
ENTRANCE PT. COORDS: X= 118.111 Y= 81.111
TRIAL ARC RADIUS= 40.000

XXX LINE 1NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 4NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 5NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY
 LINE NO X Y
 2 70.532 68.27
 6 75.983 66.41
 7 11.797 74.45
 3 18.111 81.51

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:
 I= 1 0000 62.11 K= 1 KK= 1
 I= 2 0000 53.11 K= 1 KK= 2
 I= 3 0000 8.11 K= 1 KK= 3
 I= 4 40.11 55.11 K= 1 KK= 4
 I= 5 50.11 62.11 K= 1 KK= 5
 I= 6 65.11 62.11 K= 1 KK= 6
 I= 7 70.532 68.27 K= 2 KK= 6
 I= 8 75.983 66.41 K= 3 KK= 6
 I= 9 95.11 74.45 K= 3 KK= 7
 I= 10 11.797 74.45 K= 4 KK= 7
 I= 11 13.11 81.51 K= 4 KK= 8
 I= 12 15.11 81.51 K= 4 KK= 9
 I= 13 18.11 81.51 K= 4 KK= 9
 I= 14 75.11 54.11 K= 4 KK= 0
 I= 15 240.11 81.51 K= 4 KK= 2
 I= 16 242.11 77.11 K= 4 KK= 2
 I= 17 244.11 66.11 K= 4 KK= 3

THE APPLICABLE ARRAY ARCINT FOLLOWS:
 I= 1 70.532 68.27 K= 7 KK= 1
 I= 2 75.983 66.41 K= 8 KK= 2
 I= 3 95.11 74.45 K= 9 KK= 3
 I= 4 11.797 74.45 K= 0 KK= 4
 I= 5 13.11 81.51 K= 1 KK= 5
 I= 6 18.11 81.51 K= 13 KK= 6

FIND SLICE WIDTH AND NO OF SLICES
 FI= 00000 F0= 02768
 FI= 02768 F0= 02986
 FI= 02986 F0= 03003

THE SAFETY FACTOR FOR POINT 2IS 1.03003

TRIAL CIRCLE NO 3
 CIRCLE CTR COO DS: X= 83.71 Y= 08.71
 ENTRANCE PT. COORDS: X= 18.41 Y= 8.71
 TRIAL ARC RADIUS= 44.204

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY
 LINE NO X Y
 2 66.632 67.09
 6 72.756 65.14
 7 11.756 74.45
 3 18.111 81.51

I=	2	0000	53	1	K=	1	KK=	2
I=	3	0000	53	1	K=	1	KK=	3
I=	4	0000	53	1	K=	1	KK=	4
I=	5	0000	53	1	K=	1	KK=	5
I=	6	0000	53	1	K=	1	KK=	6
I=	7	0000	53	1	K=	1	KK=	6
I=	8	0000	53	1	K=	2	KK=	6
I=	9	0000	53	1	K=	3	KK=	6
I=	10	0000	53	1	K=	3	KK=	7
I=	11	0000	53	1	K=	4	KK=	7
I=	12	0000	53	1	K=	4	KK=	8
I=	13	0000	53	1	K=	4	KK=	9
I=	14	0000	53	1	K=	4	KK=	9
I=	15	0000	53	1	K=	4	KK=	0
I=	16	0000	53	1	K=	4	KK=	1
I=	17	0000	53	1	K=	4	KK=	2

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	2	66	632	67	093	K=	7	KK=	1
I=	3	72	756	65	337	K=	8	KK=	2
I=	4	95	111	74	451	K=	9	KK=	3
I=	5	113	756	74	451	K=	0	KK=	4
I=	6	118	111	81	111	K=	1	KK=	5
I=				81	111	K=	1	KK=	6

FIND SLICE WIDTH AND NO OF SLICES

FI=	1.00000	FO=	1.00414
FI=	1.00414	FO=	1.00446

THE SAFETY FACTOR FOR POINT 3IS 1.00446

TRIAL CIRCLE NO 4
 CIRCLE CTR COORDS: X= 86.711 Y= 408.711
 ENTRANCE PT COORDS: X= 118.711 Y= 81.511
 TRIAL ARC RADIUS= 41.869

XXX LINE 1 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 4 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 5 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL
 XXX LINE 10 NOT INTERSECTED BY TRIAL CIRCL

ARC INTERSECT WITH LINE ARRAY

LINE NO	X	Y
2	71.969	68.70
6	77.703	67.70
7	110.981	74.43
3	118.711	81.51

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	0000	62	1	K=	1	KK=	1
I=	2	0000	53	1	K=	1	KK=	2
I=	3	0000	53	1	K=	1	KK=	3
I=	4	0000	53	1	K=	1	KK=	4
I=	5	0000	53	1	K=	1	KK=	5
I=	6	0000	53	1	K=	1	KK=	6
I=	7	0000	53	1	K=	1	KK=	6
I=	8	0000	53	1	K=	2	KK=	6
I=	9	0000	53	1	K=	3	KK=	6
I=	10	0000	53	1	K=	3	KK=	7
I=	11	0000	53	1	K=	4	KK=	7
I=	12	0000	53	1	K=	4	KK=	8

I=14	240	54	K=4	KK=1
I=15	242	8	K=4	KK=2
I=16	244	77	K=4	KK=3
I=17		66	K=4	KK=3

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=1	71.969	68.703	K=7	KK=1
I=2	77.703	67.095	K=8	KK=2
I=3	95.111	74.111	K=9	KK=3
I=4	10.98	74.435	K=10	KK=4
I=5	113.111	81.111	K=11	KK=5
I=6	118.111	81.111	K=13	KK=6

FIND SLICE WIDTH AND NO. OF SLICES

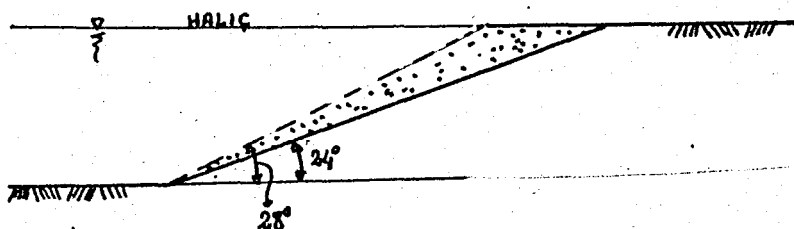
FI=1.00000	FO=1.00946
FI=1.00946	FO=1.01019

THE SAFETY FACTOR FOR POINT 4IS 1.01019

END PROGRAM EXECUTION

b) Rearranging of slopes:

Slope angle should be decreased in order to compensate for extra loading caused by dredging.



This has been analyzed with the computer program. The slope angle is decreased from 28 to 24. It is observed that the factor of safety, in cross-section (3-3)^B, changed from 0.95 to 1.006. This may be also economical.

c) Protection of slopes:

The application of this method is impossible for Haliç shores because bottom sludge and clay layer are very soft and weak.

OF LINES= 9 NO OF LINE INTERSECT= 12
OF SOILS= 3 NO OF EXTERNAL SOIL LINES= 3
OF X INCREMENTS= 2 NO OF Y INCREMENTS= 2
INITIAL SLICE WIDTH= 200

LINE NO	END NO	COORD	MATRIX	X1	Y1	X2	Y2	SLOPE	LINE INTER
1	2	00	54	74	69	74	69	202399	4
2	3	00	56	63	07	63	07	426966	7
3	4	00	36	86	50	86	50	000000	0
4	5	00	10	194	94	94	107	162581	6
5	6	00	27	84	237	84	237	407407	9
6	7	00	10	88	273	88	273	162581	1
7	8	00	73	244	90	244	90	202399	5
8	9	00	90					30357	8

IE INTERSECT ARRAY	X	Y
1	00	54
2	00	36
3	00	10
4	74	69
5	86	27
6	86	50
7	163	107
8	188	73
9	194	94
10	233	107
11	237	101
12	244	90

IL DATA ARRAY	NO	LINE #	LEFT INT	RT INT	SAT	UNIT	WT	PHI	COHESION
1	1	1	4	4	00	7	8	20	19
2	2	2	7	7	00	7	8	20	19
3	3	3	6	6	00	7	8	20	19
4	4	4	9	9	00	7	8	20	19
5	5	5	6	6	00	7	8	20	19
6	6	6	9	9	00	7	8	20	19
7	7	7	5	5	00	7	8	12	19
8	8	8	2	2	00	7	8	12	19
9	9	9	5	5	00	7	8	12	19
10	10	10	8	8	00	7	8	12	19
11	11	11	2	2	00	7	8	12	19
12	12	12	5	5	00	7	8	12	19

TRIAL CIRCLE NO 1
CENTRE COORDS: X= 82.11 Y= 161.11
PERIPHERY COORDS: X= 192.11 Y= 107.11
TRIAL ARC RADIUS= 122.540

- LINE 2 NOT INTERSECTED BY TRIAL CIRCL
- LINE 6 NOT INTERSECTED BY TRIAL CIRCL
- LINE 7 NOT INTERSECTED BY TRIAL CIRCL
- LINE 8 NOT INTERSECTED BY TRIAL CIRCL
- LINE 9 NOT INTERSECTED BY TRIAL CIRCL

ARC LINE	INTERSECT NO	WITH LINE X	ARRAY Y
1	16	698	57
4	46	906	43
5	181	026	88
3	192	111	107

THE ARRAY WITH ALL INTERSECTIONS	FOLLOWS:
I=1 16 698 57	K=1 KK=1
I=4 46 906 43	K=1 KK=2
I=5 181 026 88	K=2 KK=3
I=3 192 111 107	K=3 KK=3
I=2 16 698 57	K=3 KK=4
I=6 74 111 69	K=3 KK=3
I=7 84 111 27	K=3 KK=3
I=8 86 111 50	K=3 KK=3
I=9 63 111 07	K=3 KK=3
I=10 181 026 88	K=4 KK=4
I=11 192 111 107	K=4 KK=4
I=12 233 111 07	K=4 KK=4
I=13 237 111 00	K=4 KK=4
I=14 244 111 90	K=4 KK=4

THE APPLICABLE ARRAY ARCINT	FOLLOWS:
I=1 16 698 57	K=4 KK=1
I=4 46 906 43	K=5 KK=2
I=5 181 026 88	K=6 KK=3
I=3 192 111 107	K=8 KK=4
I=2 16 698 57	K=9 KK=5
I=6 74 111 69	K=0 KK=6
I=7 84 111 27	K=0 KK=6
I=8 86 111 50	K=0 KK=6
I=9 63 111 07	K=0 KK=6
I=10 181 026 88	K=0 KK=6
I=11 192 111 107	K=0 KK=6

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50
FI= 1.00000 FO= 1.00037

THE SAFETY FACTOR FOR POINT TIS T_{2.00037}

TRIAL CIRCLE NO 2
CIRCLE CTR COORDS: X= 85.71 Y= 61.71
ENTRANCE PT. COORDS: X= 92.11 Y= 107.11
TRIAL ARC RADIUS= 119.854

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCLE

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCLE

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC LINE	INTERSECT NO	WITH LINE X	ARRAY Y
1	22	802	58
4	55	114	45
5	180	524	88
3	192	111	107

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	5	22.802	58.726	K=	2	KK=	3
I=	6	55.114	45.071	K=	3	KK=	4
I=	7	74.111	69.111	K=	3	KK=	5
I=	8	84.111	27.111	K=	3	KK=	6
I=	9	86.111	50.111	K=	3	KK=	7
I=	10	63.111	07.111	K=	3	KK=	8
I=	11	180.524	88.575	K=	4	KK=	9
I=	12	180.524	73.111	K=	4	KK=	0
I=	13	163.111	07.111	K=	4	KK=	1
I=	14	192.111	88.575	K=	4	KK=	2
I=	15	237.111	07.111	K=	4	KK=	3
I=	16	24.111	90.111	K=	4	KK=	4

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	22.802	58.726	K=	4	KK=	1
I=	2	55.114	45.071	K=	5	KK=	2
I=	3	74.111	69.111	K=	6	KK=	3
I=	4	84.111	27.111	K=	8	KK=	4
I=	5	86.111	50.111	K=	9	KK=	5
I=	6	63.111	07.111	K=	0	KK=	6
I=	7	180.524	88.575	K=	1	KK=	7
I=	8	180.524	73.111	K=	2	KK=	8

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50

EI=	00000	FO=	00228
FI=	00228	FO=	00253

THE SAFETY FACTOR FOR POINT 2IS 1.00253

TRIAL CIRCLE NO 3
 CIRCLE CTR COORDS: X= 82.111 Y= 64.111
 ENTRANCE PT. COORDS: X= 192.111 Y= 07.111
 TRIAL ARC RADIUS= 123.891

XXX LINE 2NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9NOT INTERSECTED BY TRIAL CIRCL

***LINE 2IS NOT INTERSECTED BUT IS IN ARC

ARC INTERSECT WITH LINE ARRAY

I=	1	18.427	57.84
I=	2	50.498	44.32
I=	3	180.215	88.45
I=	4	192.111	07.111

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	1	0000	54.111	K=	1	KK=	1
I=	2	0000	36.111	K=	1	KK=	2
I=	3	0000	10.111	K=	1	KK=	3
I=	4	18.427	57.84	K=	2	KK=	3
I=	5	50.498	44.32	K=	3	KK=	3
I=	6	74.111	69.111	K=	3	KK=	4
I=	7	84.111	27.111	K=	3	KK=	5
I=	8	86.111	50.111	K=	3	KK=	6
I=	9	63.111	07.111	K=	3	KK=	7
I=	10	180.215	88.45	K=	4	KK=	7
I=	11	180.524	73.111	K=	4	KK=	8

I=	15	237	107	K=	4	KK=	0
I=	16	244	90	K=	4	KK=	1
							2

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	18	427	57	84	K=	4	KK=	1
I=	2	50	498	44	32	K=	5	KK=	2
I=	3	74	111	69	11	K=	6	KK=	3
I=	4	86	111	50	11	K=	8	KK=	4
I=	5	63	111	07	11	K=	9	KK=	5
I=	6	180	111	88	45	K=	0	KK=	6
I=	7	92	111	07	11	K=	2	KK=	7

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2750

FI=	100000	FO=	99844
FI=	99844	FO=	99826

THE SAFETY FACTOR FOR POINT 3 IS 99826.

TRIAL CIRCLE NO. 4
 CIRCLE COORDS: X= 85.71 Y= 164.71
 ENTRANCE PT. COORDS: X= 92.71 Y= 107.71
 TRIAL ARC RADIUS= 121.235

XXX LINE 2 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 6 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 7 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 8 NOT INTERSECTED BY TRIAL CIRCL

XXX LINE 9 NOT INTERSECTED BY TRIAL CIRCL

***LINE 2 IS NOT INTERSECTED BUT IS IN ARC

ARC NO INTERSECT WITH LINE ARRAY

1	24	557	59	08
4	59	046	45	71
5	79	657	88	22
3	92	111	07	11

THE ARRAY WITH ALL INTERSECTIONS FOLLOWS:

I=	2	0000	36	11	K=	1	KK=	1	
I=	3	0000	10	11	K=	1	KK=	2	
I=	4	0000	59	08	K=	2	KK=	3	
I=	5	24	557	59	08	K=	3	KK=	3
I=	6	59	046	45	71	K=	3	KK=	4
I=	7	74	111	69	11	K=	3	KK=	5
I=	8	86	111	27	11	K=	3	KK=	6
I=	9	63	111	50	11	K=	3	KK=	7
I=	10	180	111	07	11	K=	4	KK=	8
I=	11	92	111	88	22	K=	4	KK=	9
I=	12	111	07	11	K=	4	KK=	0	
I=	13	111	94	11	K=	4	KK=	1	
I=	14	111	07	11	K=	4	KK=	2	
I=	15	233	07	11	K=	4	KK=	2	
I=	16	244	90	11	K=	4	KK=	2	

THE APPLICABLE ARRAY ARCINT FOLLOWS:

I=	1	24	557	59	08	K=	4	KK=	1
I=	2	59	046	45	71	K=	5	KK=	2
I=	3	74	111	69	11	K=	6	KK=	3

I= 6 179.657 88.222 K= 10 KK= 6
I= 7 192.111 K= 12 KK= 7

FIND SLICE WIDTH AND NO OF SLICES

*****MAXIMUM SLICE WIDTH HAS BEEN INCREMENTED TO 2.50

FI= 1.00000 FO= 1.00348
FI= 1.000348 FO= 1.00387

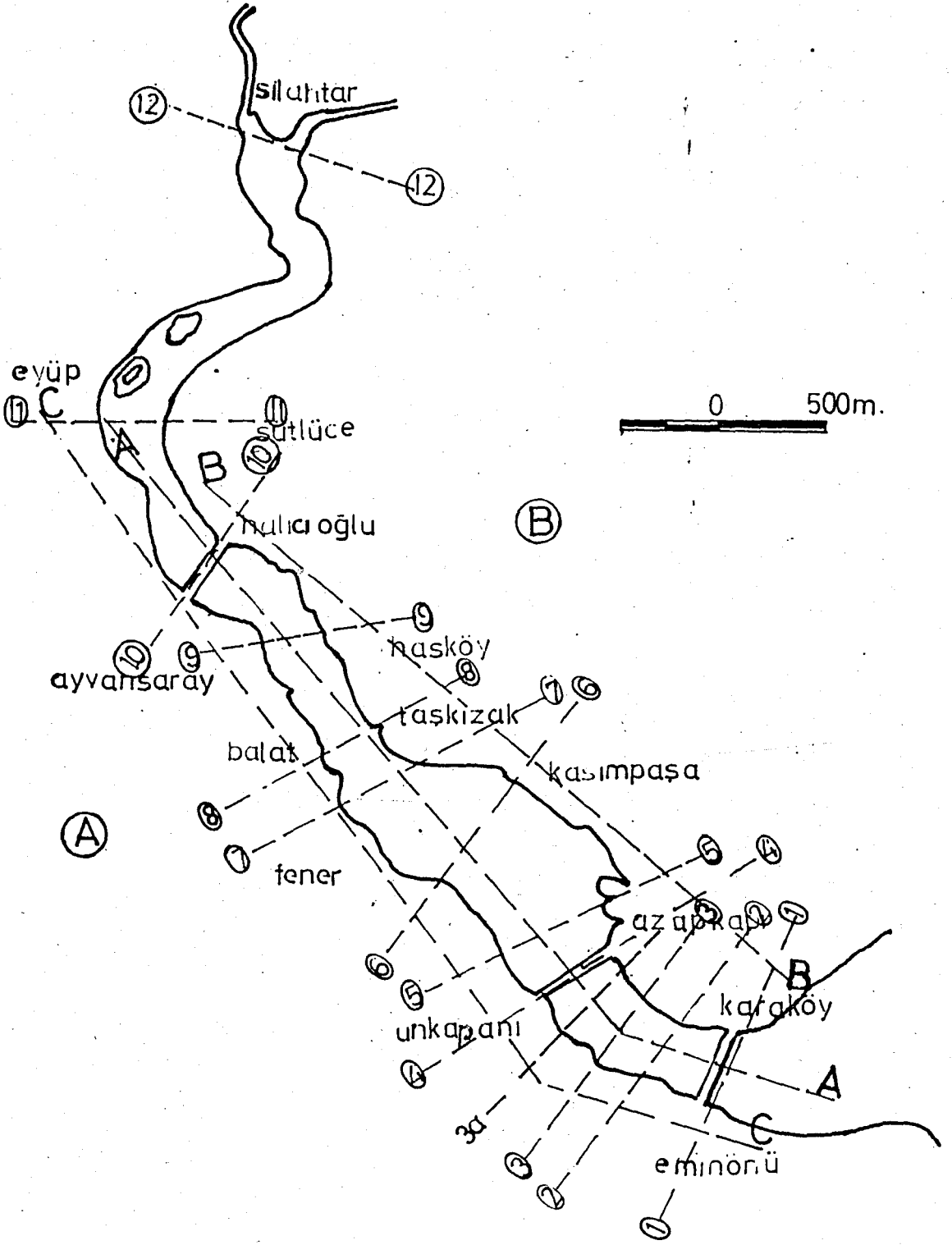
DBRPT PRINTS

THE SAFETY FACTOR FOR POINT 4IS 1.00387

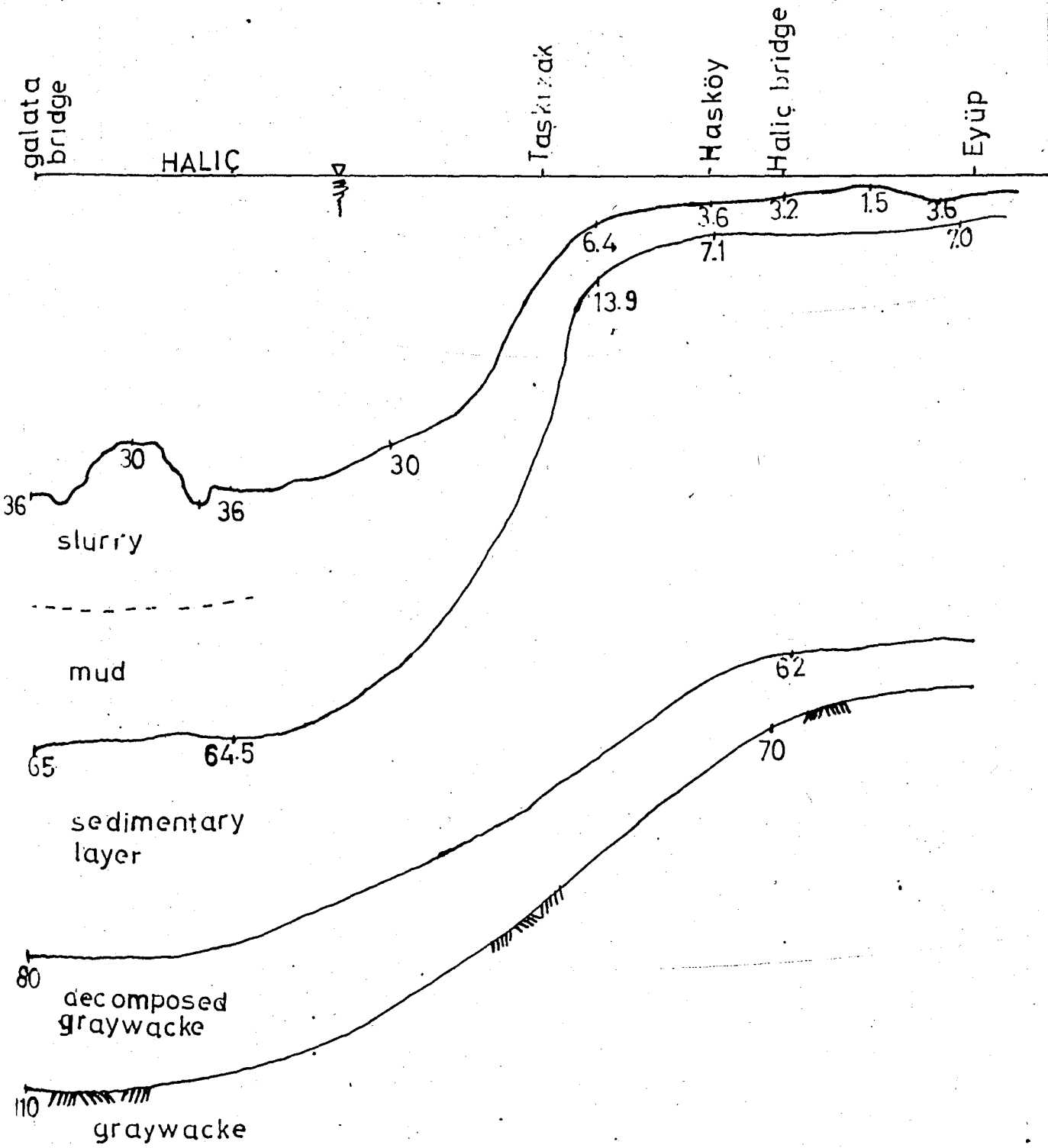
APPENDIX

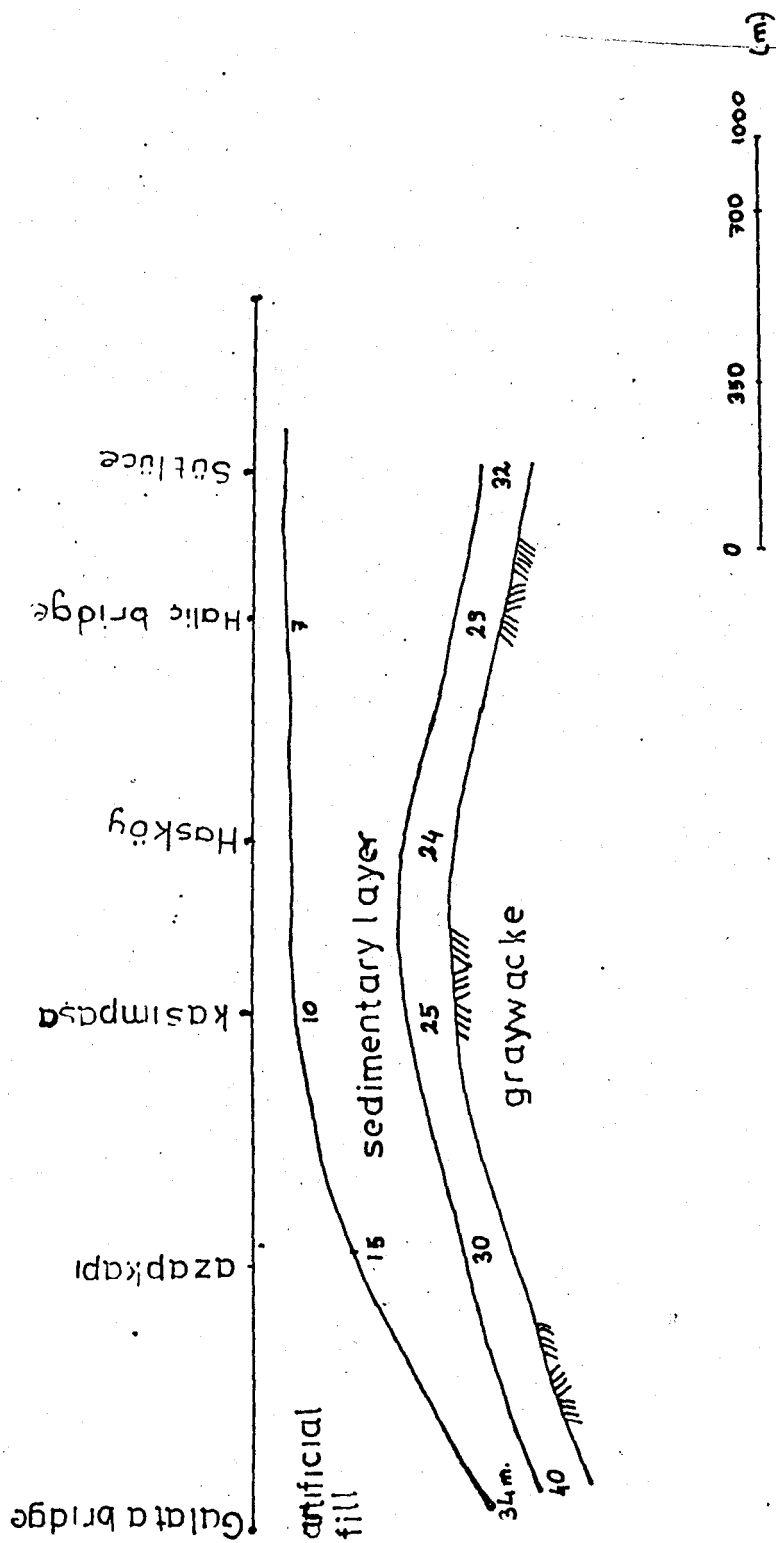
CROSS — SECTIONS

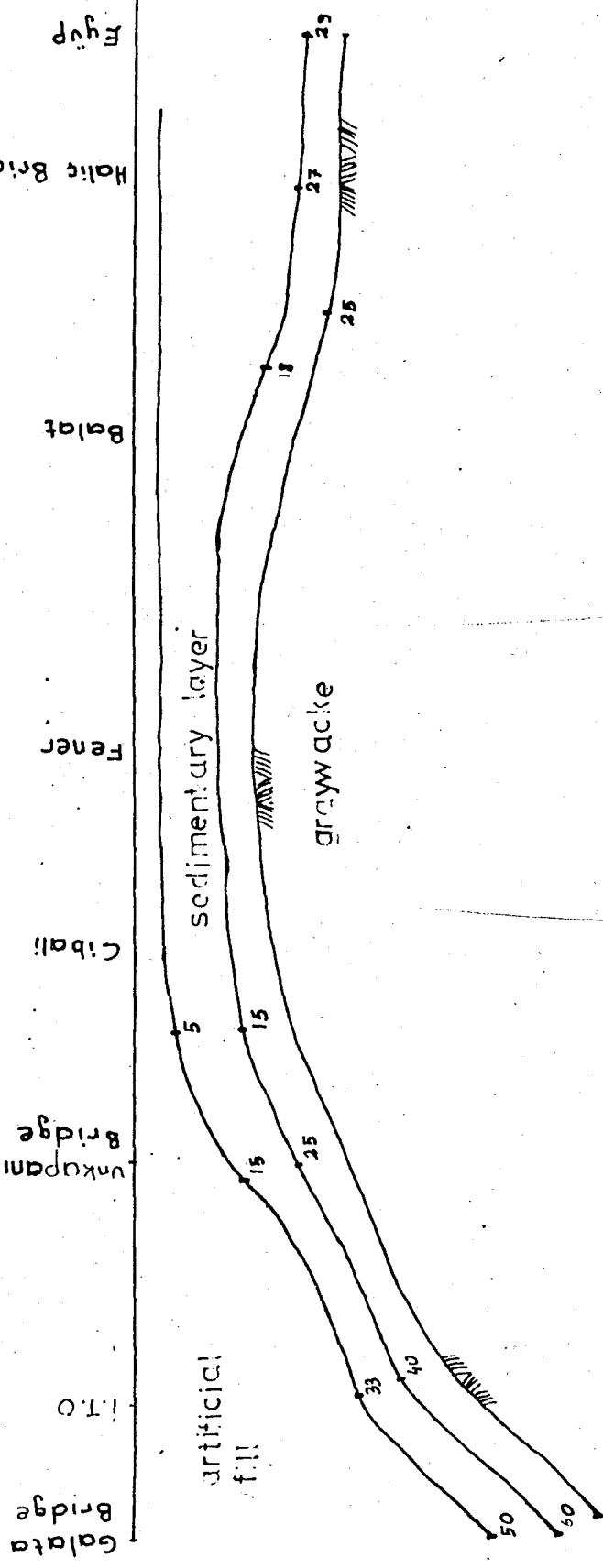
ALONG HALIC



(A) - (A)

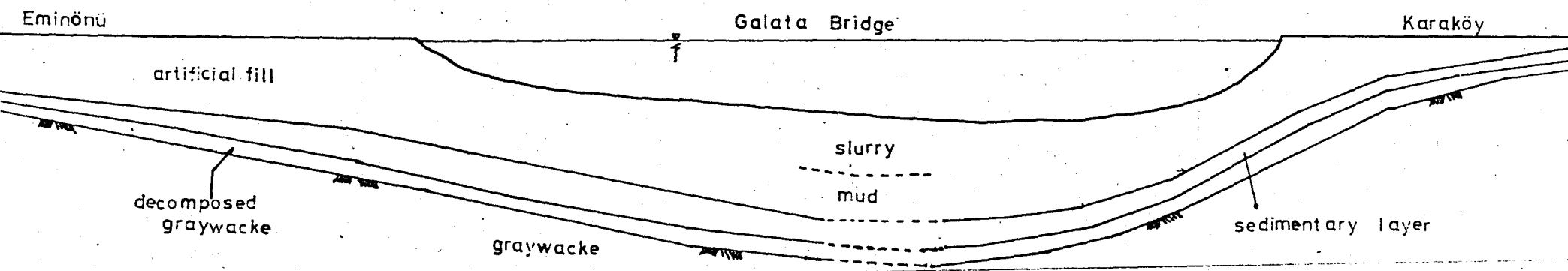






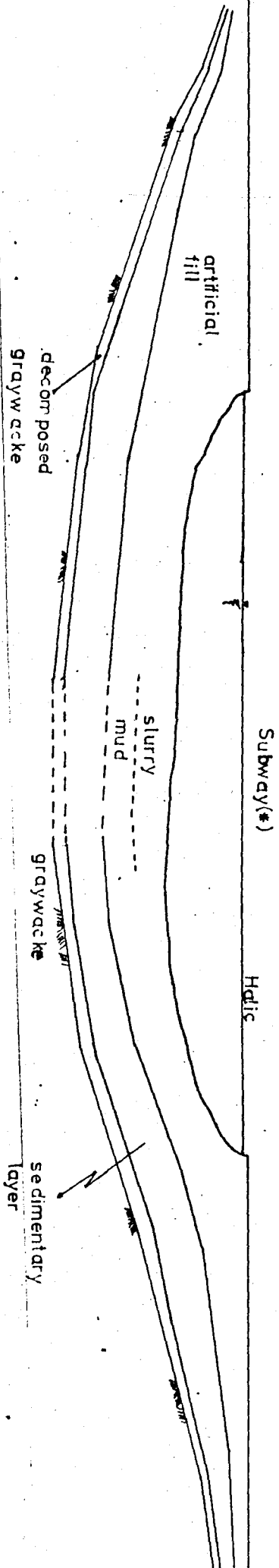
CC

(I-I)

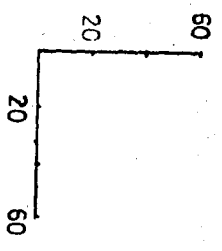


40 60 80

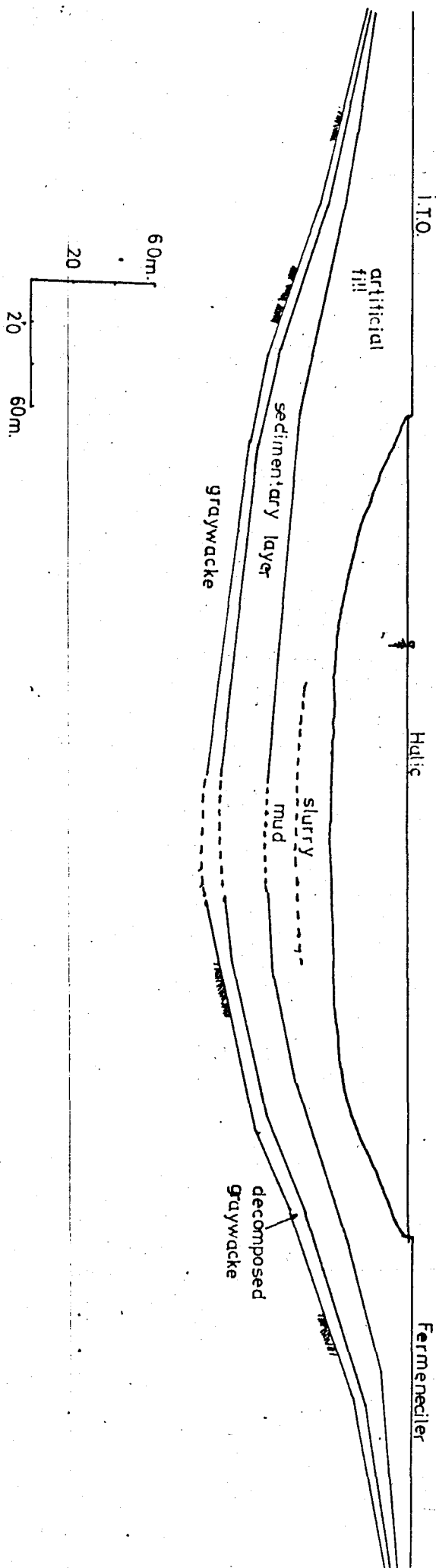
2-2



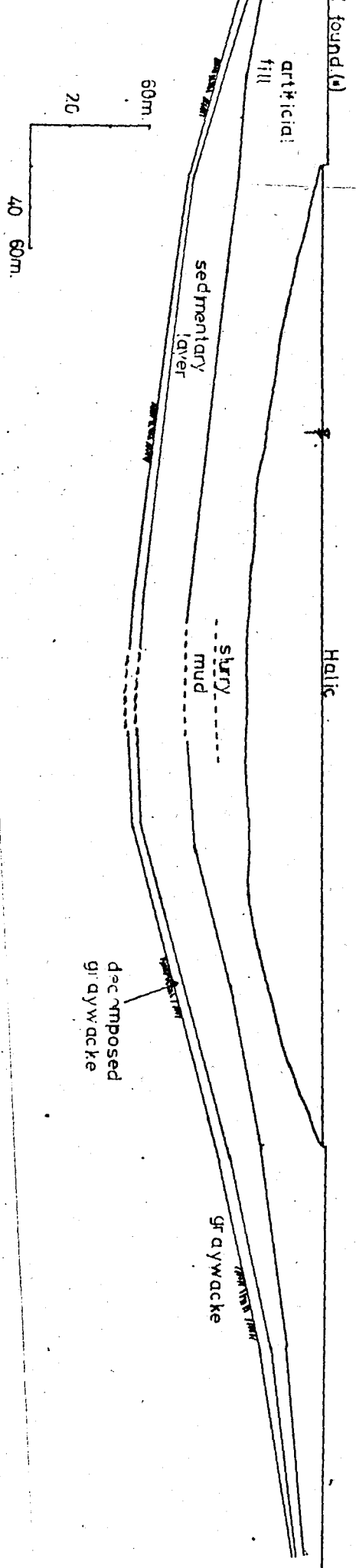
(*) Sayar, 1961



3-3

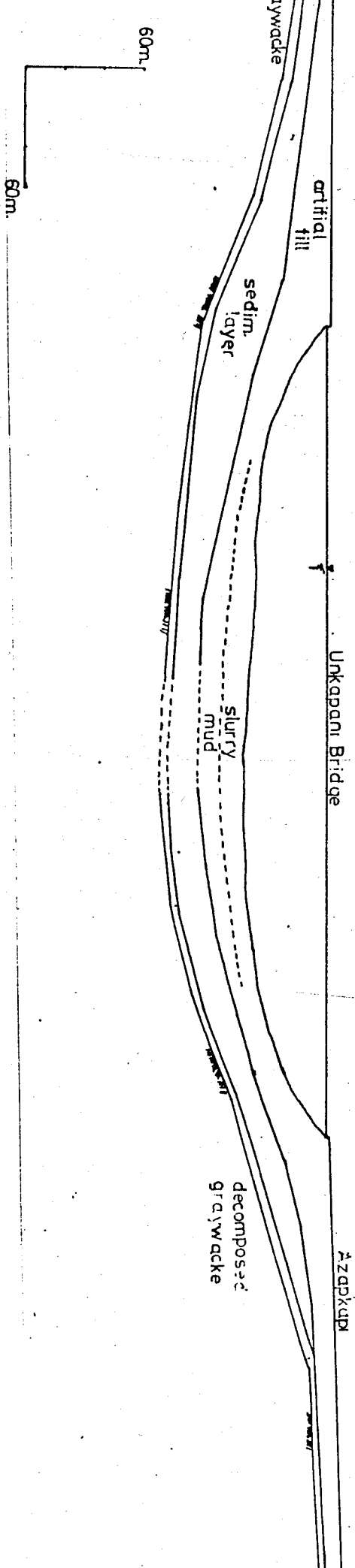


3a - 3a

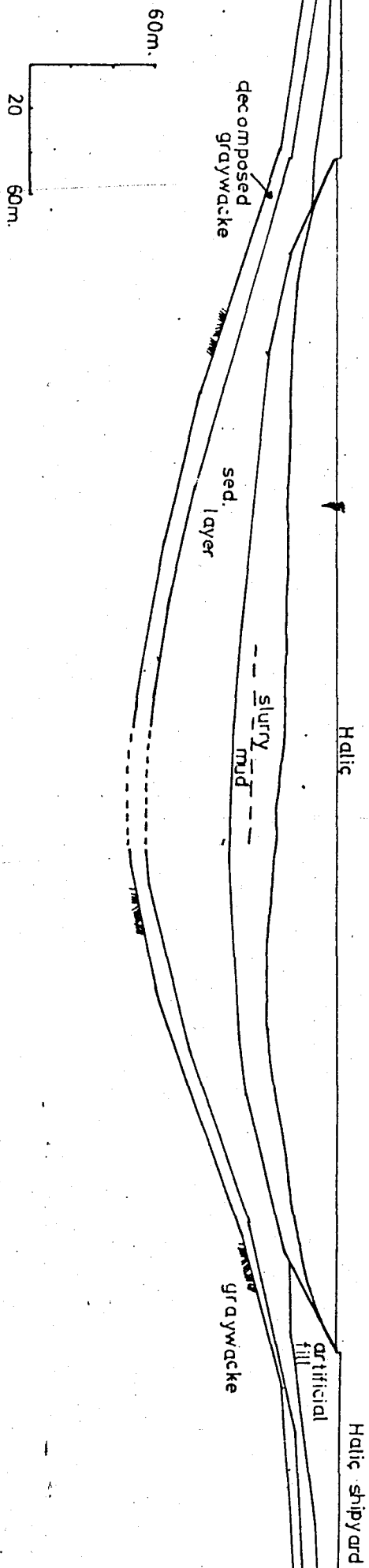


(v) Peynircioglu (1961)

4-4



5-5



7-7

sed. layer

graywacke

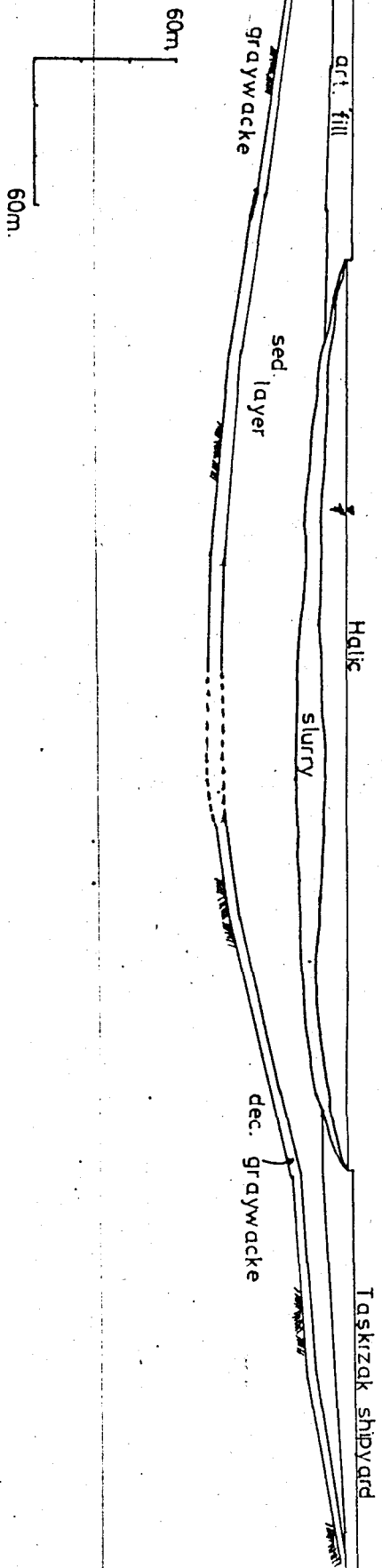
slurry
mud

decomposed
graywacke

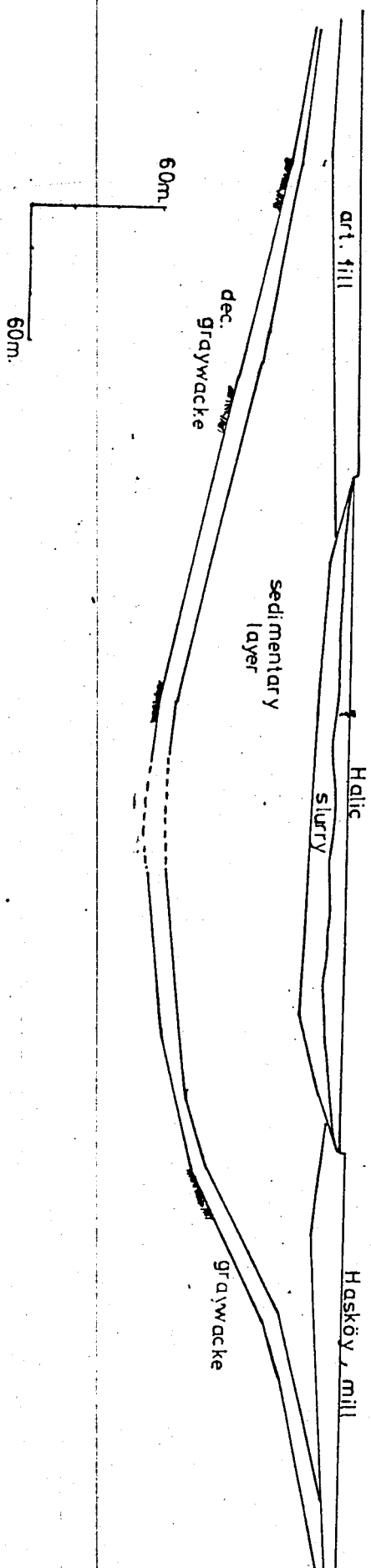
Halie

Camialti shipyard

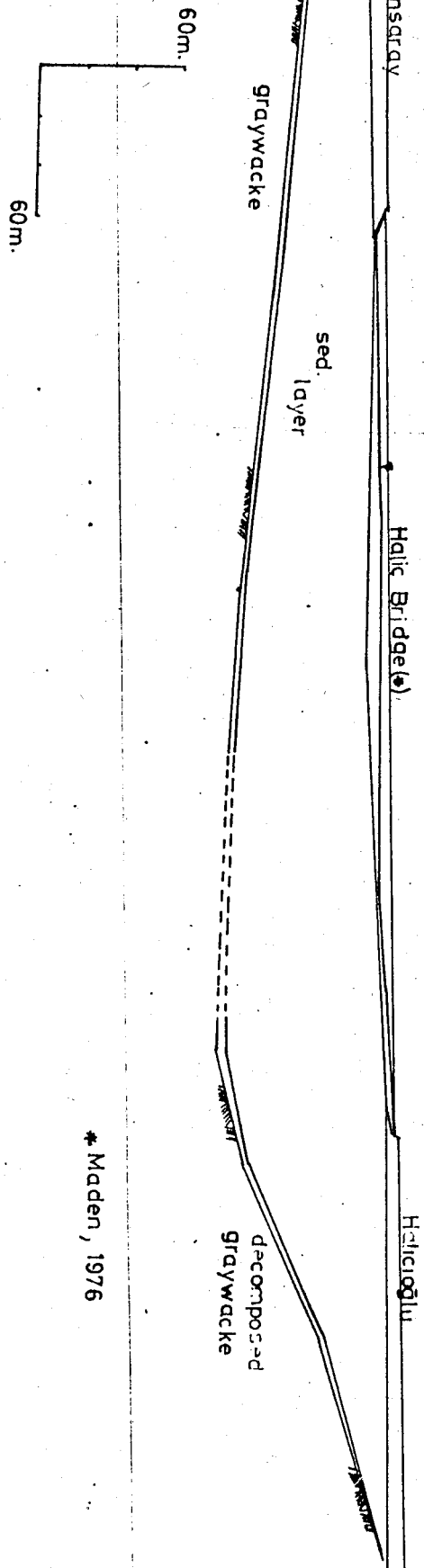
8-8



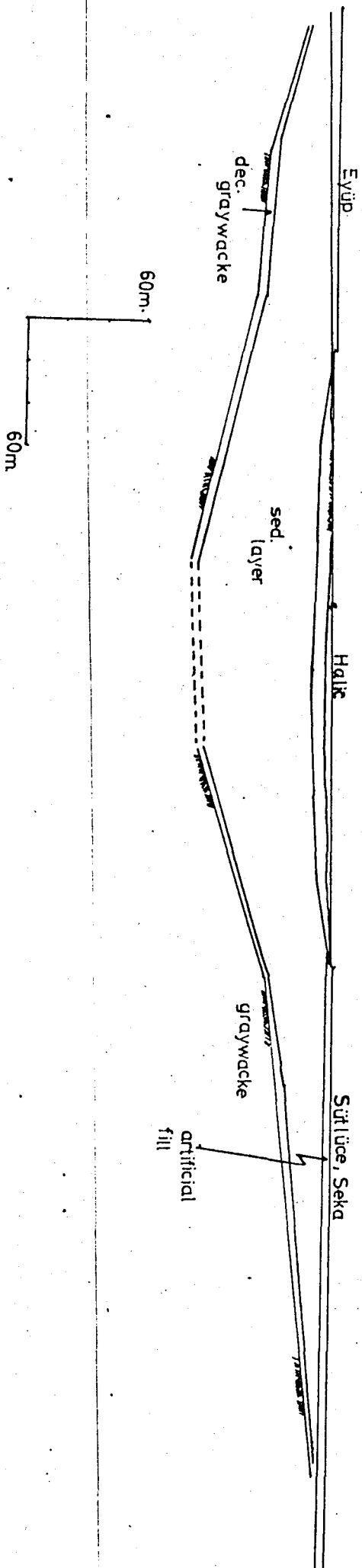
9-9



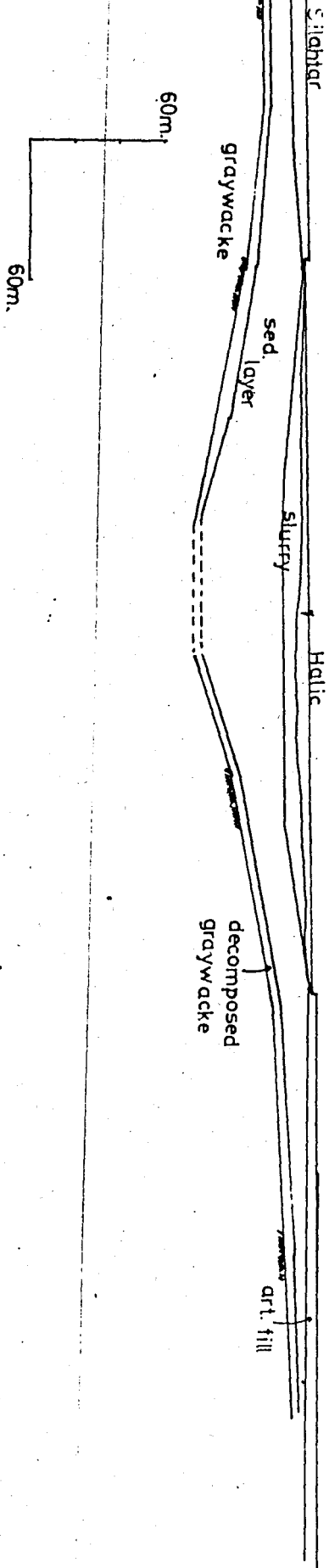
10-10



* Maden, 1976



12-12



REFERENCES

- Akşit, H. (1977), " Geotechnical Implications of Environmental Problems of the Golden Horn," thesis submitted to the B.Ü. in partial fulfillment of the requirements for degree of M.S
- Aras, o. (1978), "Meyva Hali ve Civarının Şev stabilitesi ile analizi" M.M.L.S. I.T.Ü
- Arıcan, G.(1976), " Haliç'in Taranıp Temizlenmesi" Haliç sorunları ve Çözüm Yolları Sempozyumu Tebliğleri , B.Ü. Istanbul
- Artüz, M.İ. and Korkmaz,K. (1975), " Haliç'in Su Kirlenmesinin bugünkü Durumu" Haliç Sempozyumu Tebliğleri, İ.T.Ü., Istanbul
- Balcı, A.N.(1976), "Haliç'in Dolması ve Kirlenmesinde Alibey ve Kağıthane Derelerinin Rolü," Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü., Istanbul
- Baykal,O.(1975), "Haliç Kıyısındaki Yapı Hareketlerine İki Örnek," Haliç Sempozyumu Tebliğleri, İ.T.Ü., Istanbul
- Bishop, A.W.(1954), "The use of the Slip Circle in the Stability of Slopes" Geotechnique, Vol.5
- DAMOC (1971), "Master Plan and Feasibility Report for Water Supply and Sewerage for the Istanbul Region," 16 Vols. WHO/

UNDP/SF/TUR-20 Los Angeles, California

- Durgunoğlu, H.T. (1976), "Geçmişte Haliç ile İlgili Faaliyet,"
Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğ-
leri, B.Ü., İstanbul
- Durgunoğlu, H.T. and Vardar, A.T. (1979), "Çekmece Gölleri Arasın-
daki Yörede Tabii Şev Stabilitesi" Zemin, Cilt I, Sayı I
- Durgunoğlu, H.T. and Tezcan, S. "Environmental Problems of Istanbul's
Golden Horn." Paper
- Erkek, C. (1975), "İstanbul Haliç'inde Kıyı ve Rıhtım Duvarı
Yapılarında Tip Seçimi Hakkında," Haliç Sempozyumu
Tebliğleri, İ.T.Ü., İstanbul
- Karpuzcu, M. and San, H.A. (1975), "Taban Çamurunun Bazı Su Kalitesi-
ne Tesiri; Haliç Taban Çamurunun Bazı Özellikleri,"
Haliç Sempozyumu Tebliğleri, İ.T.Ü., İstanbul
- Köknel, M. (1976), "Haliç'te Deniz Ulaşımı ve Aıyı Tanzimi" Haliç
Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü.
- Kumbasar, V. and Ülker, R. (1975), "Haliç Kıyısındaki Yapıların
Temellerinde Karşılaşılan Problemler," Haliç Sempo-
zyumu Tebliğleri, İ.T.Ü. İstanbul
- Kumbasar, V., Ülker, R. and Kip, F. (1976) "Haliç'te inşa olun-
muş bazı yapıların temel sistemleri" Haliç Sorunları
ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü., İstanbul
- Lee, I.K. (1983) "Stability of Slopes," Geotechnical Engineering,
Pitman Publishing Inc. Page 281
- Maden, S. (1975), "III? Haliç Köprüsünün Bulunduğu Yerde Haliç'in
Jeotecnik Özellikleri," Haliç Sempozyumu Tebliğleri,
B.Ü., İstanbul

Özaydın,K. and Erguvanlı,A. (1975) "Haliç'teki Dipsel Çamurun Temizlenmesi ile İlgili Geoteknik ve Çevresel Sorunlar" İ.T.Ü.,Haliç Sempozyumu

Peynircioğlu, H.(1961) "Settlements of Buildings in Istanbul," Proc. 5th Int. Conf. in Soil Mech. and Found. Engr. Paris, Vol.I

Peynircioğlu, H. (1975), "Haliç Sahillerinin Stabilitesi," Haliç Sempozyumu Tebliğleri, İ.T.Ü., İstanbul

Peynircioğlu, H. (1976) "Haliç sahillerinde Temel ve Stabilité Sorunları" Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü., İstanbul

Peynircioğlu,H.,Aksoy,İ.H.,and Özudoğru,K. (1978) "Eminönü Süleymaniye Unkapanı bölgesinin Geoteknik etüdü ve Yeni Camii temellerinin incelenmesi" İ.T.Ü.,İnş.Fak. Teknik Raporu No:31

Sayar,M. and Sayar,C.(1962)-"İstanbul'un Surlar İçi Kısımının Jeolojisi." İ.T.Ü., Maden Fakültesi Yayınları,İstanbul

Sayar,C.(1976),"Haliç ve civarının Jeolojisi" Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri,B.Ü.,İstanbul

Smith,G.N.(1973) "Stability of Slopes", Elements of Soil Mechⁿ for Civil and Mining Engineers. ,Granada Publishing Limited.,page 126

Tan,A.O.,(1976),"Haliç sahillerinin geotekniği ve uygulanan temel sistemleri," M.M.L.S. tezi, İ.T.Ü.,İstanbul

Terzaghi,K. and Peck,R.(1968),"Stability of Slopes" Soil Mech. in Engineering Practice.,John Wiley and Sons,Newyork

Tezcan, S.S., Durgunoğlu, H.T. and Acar, Y., (1977) "Sütlüce Canlı Hayvan Pavyonları Zemin Oturması Değerlendirme Raporu," B.Ü., Teknoloji ve Sistem Araştırmaları Enstitüsü,

Dahili Rapor No: 77-IT

Togrol, E. (1975), "Haliç'in Jeoteknik Sorunları," Haliç Sempozyumu Tebliğleri, İ.T.Ü., İstanbul

Unlü, N., (1982) "Türkiye'deki Tersanelerin Geoteknik Özellikleri", M.M.L.S. tezi, İ.T.Ü., İstanbul

Yurttagüler, S. (1976), "Haliç'in Dip Temizliği Çalışmaları ve Öneriler," Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü., İstanbul

Yücel, Ö. (1976), "Dip Taranması Yöntemi," Haliç Sorunları ve Çözüm Yolları Sempozyumu Tebliğleri, B.Ü., İstanbul