COMPUTERIZED SLOPE STABILITY ANALYSIS; A SLIDING BLOCK MODEL

NOVEMBER 1972 - NUMBER 43

BY

ADITYA MOHAN

JHRP

JOINT HIGHWAY RESEARCH PROJECT

PURDUE UNIVERSITY AND
INDIANA STATE HIGHWAY COMMISSION

Final Report

COMPUTERIZED SLOPE STABILITY ANALYSIS; A SLIDING BLOCK MODEL

TO: J. F. McLaughlin, Director November 9, 1972
Joint Highway Research Project
FROM: H. L. Michael, Associate Director Project: C-36-36J
Joint Highway Research Project File: 6-14-10

The attached Final Report "Computerized Slope Stability Analysis; A Sliding Block Model" is submitted on the approved JHRP Research Study of similar title. The Report has been authored by Mr. Aditya Mohan, Graduate Assistant in Research, from research performed by him and Mr. C. A. Mendez, also a Graduate Assistant in Research. Professor C. W. Lovell, Jr. directed the research.

The Report presents a computer program for a common type of analysis of slope stability problems, viz., the possibility of slope failure by translation of a massive block of soil along a weak layer of soil. The program will be useful to the ISHC in evaluation of both natural and man-made slopes encountered in highway construction. Hopefully, the program will enable a designer to check against this mode of instability when there is any reason to suspect it might occur.

The Report is submitted for acceptance as fulfillment of the objectives of this study.

Respectfully submitted,

Harold L. Michael
Associate Director

HLM:ms

cc: W. L. Dolch	M. L. Hayes	C. F. Scholer
R. L. Eskew	C. W. Lovell	M. B. Scott
W. H. Goetz	G. W. Marks	J. A. Spooner
M. J. Gutzwiller	R. D. Miles	N. W. Steinkamp
G. K. Hallock	J. W. Miller	H. R. J. Walsh
R. H. Harrell	G. T. Satterly	E. J. Yoder

Digitized by the Internet Archive
in 2011 with funding from
LYRASIS members and Sloan Foundation; Indiana Department of Transportation

Final Report
COMPUTERIZED SLOPE STABILITY ANALYSIS; A SLIDING BLOCK MODEL

by
Aditya Mohan
Graduate Assistant in Research

Joint Highway Research Project

Project No.: C-36-36J

File No.: 6-14-10

Conducted by
Joint Highway Research Project
Engineering Experiment Station
Purdue University

In Cooperation With
Indiana State Highway Commission

Purdue University
West Lafayette, Indiana
November 9, 1972

ACKNOWLEDGEMENTS

The writer wishes to express his gratitude to Dr. C. W. Lovell, Jr., Professor in Civil Engineering, Purdue University, for his valuable assistance and guidance throughout the time the writer was associated with the project.

Financial assistance for this project is being provided by Joint Highway Research Project between the Indiana State Highway Commission and Purdue University, J. F. McLaughlin, Director.

The writer also wishes to express sincere thanks to Mr. Carlos Mendez, for his start on the project and useful work done by him during his stay at Purdue University, as Graduate Research Assistant.

Special thanks are due to Mr. W. J. Sisiliano, Soils Engineer, Indiana State Highway Commission, for his useful discussion during the course of research.

Finally, the writer wishes to thank Mrs. Cathy Russell, for her drafting difficult drawings and various other help.

TABLE OF CONTENTS

	Page
Acknowledgements	i
List of Table	iv
List of Figures	v
Abstract	vi
Introduction	1
Slope Failure by Sliding	4
A General Solution of Sliding Block Problem	5
Analytical Equations for Forces in Three Cases	8
Case 1	8
1. Analysis of Active Forces on Block, Case 1	9
2. Analysis of Passive Forces on Block, Case 1	9
3. Analysis of Forces on Block and Factor of Safety for Case 1	12
Case 2	14
1. Analysis of Active Forces on Block, Case 2	16
2. Analysis of Passive Forces on Block, Case 2	16
3. Analysis of Forces on Block and Factor of Safety, Case 2	19
Case 3	22
1. Analysis of Active Forces on Block, Case 3	22
2. Analysis of Passive Forces on Block, Case 3	25
3. Analysis of Forces on Block and Factor of Safety, Case 3	27
Computer Program For Stability Analysis of Sliding Block	30

TABLE OF CONTENTS (cont'd)

	Page
A. Brief Description of Computer Program	30
B. Capabilities of Present Block Program	33
Illustration Problems	34
Illustration Problem No. 1	34
Illustration Problem No. 2	34
Conclusions and Recommendations	38
List of References	40
Appendix A: Block Program's Description of Variables and User's Manual	A-1
Appendix B: Program Listing	B-1
Appendix C: Input Data for Illustration Problems	C-1
Appendix D: Output of Illustration Problem	D-1

LIST OF TABLE

Table	Page
1. Summary of Results for Two Illustration Problems . . .	37

LIST OF FIGURES

Figure	Page
1. Slope in Stratified Soil Profile	2
2. General Problem of Sliding Block with Deep Water Surface (Case 1)	6
3. Analysis of Active Wedge (Case 1)	10
4. Analysis of Passive Wedge (Case 1)	11
5. Forces on Sliding Block (Case 1)	13
6. General Problem of Sliding Block with Submerged Water Surface (Case 2)	15
7. Analysis of Forces on Active Wedge (Case 2)	17
8. Analysis of Forces on Passive Wedge (Case 2)	18
9. Forces on Sliding Block (Case 2)	20
10. General Problem of Sliding Block with Water Surface Inside the Slope Profile (Case 3)	23
11. Analysis of Forces on Active Wedge (Case 3)	24
12. Analysis of Forces on Passive Wedge (Case 3)	26
13. Forces on Sliding Block (Case 3)	28
14. Flow Chart of Block Program	31
15. Illustration Problem No. 1	35
16. Illustration Problem No. 2	36

ABSTRACT

This report presents a computer program for a common type of analysis of the slope stability problem, viz., the possibility of slope failure by translation of a massive block along a weak layer of soil. The problem, which can occur in either natural or man-made slopes, is most generally referred to as the "sliding block problem".

Variation in the water surface position requires three subroutines or cases. The program automatically sequences selected potential sliding surfaces one by one, then selects the desired water surface case, and finally computes the factor of safety against sliding along the base of the central block.

The analysis is based on total unit weights and boundary forces. It is possible to consider ten different soil types having very different soil parameters, viz., unit weight, Mohr-Coulomb cohesion intercept and Mohr-Coulomb angle of friction. A maximum of twelve soil profile boundaries at any inclination can be considered in the present program. A total of ten vertical strip loads of different intensities can be placed on the ground surface anywhere below the toe and above the crest. Finally, with all the above information, ten sliding surfaces can be concurrently analyzed for the factor of safety. Said factor is applied to the strength of the soil at the base of the central block, assuming limiting equilibrium for the active and passive earth pressure forces at the ends of the central block.

The report is complete with a flow chart, program listing, user's manual and two illustration problems.

INTRODUCTION

The stability of man-made and natural slopes has always been an important topic in the field of civil engineering. Yet, failure of man-made fills and cuts probably occurs more frequently than all other failures of civil engineering structures combined. Although an understanding of the major factors which contribute to the failure of slopes has improved considerably, our predictive ability remains less than satisfactory.

The object of this research is the development of a computer assisted system of stability analysis for the "sliding block problem", i.e., an essentially rigid mass sliding in a weak layer. At first glance, this seems to be a rather simple problem. But when practical variations in soil profile are considered, as well as water levels, boundary geometries and loadings, and uncertainties of position and shape of the most critical sliding surface, the solutions require reasonably large computer systems.

When a slope is underlain by one or more strata of very soft or loose materials, the most critical sliding surface may not be even approximately circular, as shown in Figure 1. Rather there is a 3-plane surface of potential sliding in which a maximum amount of the surface lies within the weak material.

An initial programmed solution by Mendez (1972) was quite general with respect to the shape of the 3-plane surface, but to accommodate this feature the profile was simplified to two soil layers, viz., a strong soil over a weak one. The program reported here was developed after consultation with the ISHC, and hopefully makes an effective contribution to its analytical requirements. This latter program does

Location of failure surface depends on relative strength and orientation of layers.

FIGURE 1. SLOPE IN STRATIFIED SOIL PROFILE

make simplifying assumptions with respect to the shape of the sliding surface, but is quite versatile with respect to the potential complexity of the subsurface.

SLOPE FAILURE BY SLIDING

The type of failure usually assumed in slope stability analysis is the one piece slide (HRB (1958)). The failure is one in which the moving body is essentially rigid and the failing mass is separated from the unmoved one by a surface of assumed shape. Where the soil is grossly homogeneous it seems logical that the failure surface would be roughly circular, and in the interest of simplicity it is usually made exactly so. A recent overview of the circular type analysis, by the well known methods of slices, is contained in Carter, Lovell and Harr (1971).

Where there is evidence of definite differences in shearing resistance in the soil profile, it is well to consider potential failure surfaces which follow the surfaces of weakness. Several methods of handling irregular surfaces are reported by Morgenstern and Price (1965), Carter, Lovell and Harr (1971), and Mohan (1971).

A special case of the irregular sliding surface has been shown in Figure 1, where the potential failure planes have a maximum length in the weaker materials. The potential failing block is actually a combination of active and passive wedges, with a central trapezoidal block based in a weak layer. Examples of simplified solutions to this problem are given in Department of the Navy (1971) and United States Steel (1972), as well as Mendez (1972).

A GENERAL SOLUTION TO THE SLIDING
BLOCK PROBLEM

Figure 2 shows the free body diagram with a full quota of complexities in boundary geometries and forces, i.e., these could be more simple in a given instance. Incorporation of a water surface and associated water forces into the problem makes it convenient to consider three cases, each with its appropriate subroutine in the computer solution. The upper boundary slopes, reading left to right in Figure 2 are referred to as the "down slope", the "middle slope", or simply the "slope" and the "upper slope". The cases are:

- Case 1. When the water surface is below the trial sliding surface.
- Case 2. When the water surface is partly above and partly below the ground surface, but above the trial sliding surface.
- Case 3. When the water surface is anywhere below the ground surface, but above the trial sliding surface.

It is assumed that the right hand wedges are in a state of limiting active earth pressure and the left hand wedges are in a state of limiting passive earth pressures. Simplifying assumptions are employed with respect to the inclinations of the wedge surfaces and the directions of the earth pressure forces. Although the right-hand and left-hand wedges are assumed to be on the verge of sliding, there is in general, an incomplete mobilization of the shearing resistance along the base of the block, i.e., the factor of safety is defined with respect to the shearing resistance-shearing force ratio along this surface.

The wedge inclination and earth pressure force direction assumptions are those which apply for a simple Rankine case. They are employed by

FIGURE 2. GENERAL PROBLEM OF SLIDING BLOCK
WITH DEEP WATER SURFACE (CASE I)

others (Dept. of the Navy (1971)), and have been shown to be good approximations of the most critical values, for a number of cases tested by Mendez (1972).

To be certain that all assumptions inherent to the solution are understood, they are listed in detail below.

1. Problem is two dimensional.
2. The ground surface is defined by three slopes, and a well defined toe and crest.
3. Soil strata are laterally continuous.
4. Soil properties in layers are defined by γ , c , and ϕ (where c or ϕ can be equal to zero).
5. Sliding surface at the base of the block and between the slide wedges is a plane.
6. All lateral forces on vertical wedge boundaries are normal to these boundaries, i.e., there are no shear forces on these boundaries.
7. The factor of safety is figured for the base of the sliding block only. The movement required to mobilize limiting active and passive pressures is smaller than the movement required to mobilize the shearing strength of the weak soil strata.
8. The wedge slip surfaces are at $(45 + \phi/2)$ and $(45 - \phi/2)$ with the horizontal for active and passive wedges, respectively.
9. The active and passive forces are computed by satisfying static equilibrium and after assumptions 6 and 8.
10. Seepage, if any, is in a steady state. However, water pressures are calculated at any point as if they were hydrostatic.

In all of the three cases, the analysis is divided into three parts, namely:

- (1) calculation of total forces on central block due to active wedge;
- (2) calculation of total forces on central block due to passive wedge; and
- (3) calculation of base forces on the central block and of the factor of safety against sliding along this base.

Analytical Equations for Forces in Three Cases

Case 1. Water surface is far below the trial sliding surface;
see Figure 2.

A general section is shown in Figure 2, consisting of multiple soil layers at variable inclinations and with very different soil properties. The active and passive wedges are divided into smaller wedges, depending upon the intersections of soil boundaries and slip surfaces. Each of these smaller wedges is analyzed for force equilibrium, and an incremental force on the adjacent wedge is calculated. This procedure is repeated for all the small wedges, until the resultant force on the central sliding block has been calculated. This is done for both resultant active and resultant passive forces on the block. Finally, a factor of safety against sliding along the base of the block as defined by a particular sliding surface is computed.

1. Analysis of Active Forces on Block, Case 1.

Figure 3 shows an active wedge removed from the section shown in Figure 2. Also shown in Figure 3 are force polygons for each of the smaller active wedges. As can be seen from the force polygon for wedge 4, the resultant active force will be the sum of incremental active forces on the adjacent wedges.

Consider a typical polygon of forces for an n th wedge in Figure 3, and sum all forces in the direction of the x and y coordinate axes.

$$\sum F_x = 0$$

$$PA_n + CA_n \cos (45 + \phi_n/2) - NA_n \sin (45 - \phi_n/2) = 0 \quad (1)$$

$$\sum F_y = 0$$

$$WA_n + CA_n \sin (45 + \phi_n/2) + NA_n \cos (45 - \phi_n/2) = 0 \quad (2)$$

Elimination of NA_n from equations (1) and (2) yields an expression for the incremental active force for the n th wedge,

$$PA_n = WA_n \tan (45 - \phi_n/2) - 2 CA_n \cos (45 + \phi_n/2) \quad (3)$$

2. Analysis of Passive Forces on Block, Case 1

Figure 4 shows the passive wedge removed from the section shown in Figure 2.

ACTIVE WEDGE

FIGURE 3. ANALYSIS OF ACTIVE WEDGE (CASE 1)

FIGURE 4. ANALYSIS OF PASSIVE WEDGE (CASE I)

Considering a typical force polygon for an nth wedge in Figure 4, and summing all forces in the direction of x and y coordinate axes, the following equations are obtained:

$$\sum F_x = 0$$

$$CP_n \cos (45 - \phi_n/2) + NP_n \sin (45 + \phi_n/2) = PP_n \quad (4)$$

$$\sum F_y = 0$$

$$-WP_n + CP_n \sin (45 - \phi_n/2) + NP_n \cos (45 + \phi_n/2) = 0 \quad (5)$$

Elimination of NP_n from equations (4) and (5) yields an expression for the incremental passive force due to the nth wedge,

$$PP_n = WP_n \tan (45 + \phi_n/2) + 2 CP_n \cos (45 - \phi_n/2) \quad (6)$$

3. Analysis of Forces on Block and Factor of Safety for, Case 1.

Figure 5 shows the sliding central block from Figure 2 as a free body. The strength reduction factor (FS), usually called the factor of safety, is introduced and becomes the dependent variable. The trial sliding surface can have the three possible inclinations shown in Figure 5, viz., $\theta +$, $\theta -$, $\theta = 0$. Force equilibrium is considered along (tangent to) the sliding surface and normal to the sliding surface.

FIGURE 5. FORCES ON SLIDING BLOCK (CASE 1)

For $\theta +$ (positive slope):

$$\sum F_n = 0$$

$$NB + PAA \sin \theta - PPP \sin \theta - WB \cos \theta = 0 \quad (7)$$

$$\sum F_\theta = 0$$

$$\frac{CB}{FS} + \frac{NB \tan \phi}{FS} + PPP \cos \theta - PAA \cos \theta - WB \sin \theta = 0 \quad (8)$$

Elimination of NB from equations (7) and (8) yields an expression for FS

$$FS = \frac{CB + [WB \cos \theta - (PAA - PPP) \sin \theta] \tan \phi}{(PAA - PPP) \cos \theta + WB \sin \theta} \quad (9)$$

For $\theta -$ (negative slope):

$$FS = \frac{CB + [WB \cos \theta + (PAA - PPP) \sin \theta] \tan \phi}{(PAA - PPP) \cos \theta - WB \sin \theta} \quad (10)$$

For $\theta = 0$ (Horizontal):

$$FS = \frac{CB + WB \tan \phi}{(PAA - PPP)} \quad (11)$$

Case 2. When the water surface is partly above and partly below the ground surface but above the trial sliding surface.

Figure 6 shows a general problem section with multiple soil layers at variable inclinations and with very different soil properties. This section also includes a static water surface. The analysis follows the same procedure as for Case 1, except that it will include the effect of water forces.

Figure 6 . General Problem of Sliding Block With Submerged Water (Case 2)

1. Analysis of Active Forces on Block, Case 2.

Figure 7 shows the active wedge removed from the section shown in Figure 6. The wedge is further divided into smaller ones, depending upon the intersection of slip surfaces and soil boundaries.

Consider a typical force polygon for any nth wedge in Figure 7. Summation of forces in the direction of the x and y coordinate axes yields the following equations:

$$\sum F_x = 0$$

$$\begin{aligned} PA_n = & -CA_n \cos (45 + \phi_n/2) - UAL_n + UAR_n + UA_n \cos (45 - \phi_n/2) \\ & + NA'_n \cos (45 + \phi_n/2) \end{aligned} \quad (12)$$

$$\sum F_y = 0$$

$$WA_n = CA_n \sin (45 + \phi_n/2) + UA_n \sin (45 - \phi_n/2) + NA'_n \sin (45 + \phi_n/2) \quad (13)$$

Elimination of NA'_n from equations (12) and (13) yields an expression for the incremental active force for the nth wedge,

$$\begin{aligned} PA_n = & WA_n \tan (45 - \phi_n/2) - 2 CA_n \cos (45 + \phi_n/2) \\ & + (UAR_n - UAL_n) + UA_n \left\{ \cos (45 - \phi_n/2) - \tan (45 - \phi_n/2) \sin (45 - \phi_n/2) \right\} \end{aligned} \quad (14)$$

2. Analysis of Passive Forces on Block, Case 2.

Figure 8 shows the passive wedge removed from the section shown in Figure 6. The section is further divided into small wedges, depending upon the intersection of slip surface and soil boundaries.

Active Wedge

Figure 7. Analysis of Forces on Active Wedge (Case 2)

Figure 8 . Analysis of Forces on Passive Wedge (Case 2)

Consider a typical polygon of forces for an nth passive wedge in Figure 8, and sum forces in the direction of the x and y coordinate axes. The following equations are obtained:

$$\sum F_x = 0$$

$$\begin{aligned} PP_n = & U\beta_n \sin \beta_1 + CP_n \cos (45 - \phi_n/2) + UL_n + UP_n \cos (45 + \phi_n/2) \\ & - UR_n + NP'_n \cos (45 - \phi_n/2) \end{aligned} \quad (15)$$

$$\sum F_y = 0$$

$$\begin{aligned} NP'_n \sin (45 - \phi_n/2) = & WP_n + U\beta_n \cos \beta_1 + CP_n \sin (45 - \phi_n/2) \\ & - UP_n \sin (45 + \phi_n/2) \end{aligned} \quad (16)$$

Elimination of NP'_n from equations (15) and (16) yields an expression for the incremental passive force for the nth wedge,

$$\begin{aligned} PP_n = & WP_n \tan (45 + \phi_n/2) + 2 CP_n \cos (45 - \phi_n/2) \\ & + U\beta_n \left\{ \sin \beta_1 + \cos \beta_1 \tan (45 + \phi_n/2) \right\} \\ & + (UL_n - UR_n) + UP_n \left\{ \cos (45 + \phi_n/2) - \sin (45 + \phi_n/2) \tan (45 + \phi_n/2) \right\} \end{aligned} \quad (17)$$

3. Analysis of Forces on Block and Factor of Safety, Case 2.

Figure 9 shows the sliding central block from Figure 6 as a free body. The same procedure is followed as in Case 1 and the following expressions for the three inclinations of sliding surfaces are obtained:

FIGURE 9. FORCES ON SLIDING BLOCK (CASE 2)

For $\theta +$ (positive slope):

$$\sum F_n = 0$$

$$\begin{aligned} NB' + UBP &= PPP \sin \theta - PAA \sin \theta + WB \cos \theta \\ &+ UBH \cos \beta_2 \cos \theta + UBL \sin \theta - UBR \sin \theta \\ &+ UBH \sin \beta_2 \sin \theta \end{aligned} \quad (18)$$

$$\sum F_\theta = 0$$

$$\begin{aligned} \frac{CB}{FS} + \frac{NB' \tan \phi}{FS} + PPP \cos \theta - PAA \cos \theta \\ - WB \sin \theta - UBH \cos \beta_2 \sin \theta + UBH \sin \beta_2 \cos \theta \\ + UBL \cos \theta - UBR \cos \theta = 0 \end{aligned} \quad (19)$$

Elimination of NB' from equations (18) and (19) yields an expression for the factor of safety for a particular trial sliding surface.

$$\begin{aligned} FS = \frac{CB + (PPP \sin \theta - PAA \sin \theta + WB \cos \theta + UBH \cos \beta_2 \cos \theta \\ + UBL \sin \theta - UBR \sin \theta - UBP + UBH \sin \beta_2 \sin \theta) \tan \phi}{(PAA - PPP) \cos \theta + WB \sin \theta + UBH \cos \beta_2 \sin \theta \\ - UBH \sin \beta_2 \cos \theta - UBL \cos \theta + UBR \cos \theta} \end{aligned} \quad (20)$$

For $\theta -$ (negative slope):

$$\begin{aligned} FS = \frac{CB + (PAA \sin \theta - PPP \sin \theta + WB \cos \theta + UBH \cos \beta_2 \cos \theta \\ - UBL \sin \theta + UBR \sin \theta - UBP - UBH \sin \beta_2 \sin \theta) \tan \phi}{(PAA - PPP) \cos \theta - WB \sin \theta - UBH \cos \beta_2 \sin \theta \\ - UBH \sin \beta_2 \cos \theta - UBL \cos \theta + UBR \cos \theta} \end{aligned} \quad (21)$$

For $\theta = 0$ (horizontal slope):

$$FS = \frac{CB + (WB - UBP + UBH \cos \beta_2) \tan \phi}{(PAA - PPP) - UBH \sin \beta_2 - UBL + UBR} \quad (22)$$

Case 3. Water surface is anywhere below the ground surface and above the trial sliding surface.

Figure 10 shows a general problem section consisting of multiple soil layers at variable inclinations and of very different soil properties. This section includes a water surface below the ground surface and above the sliding surface. Following the same procedure as in the two above cases, expressions for active and passive forces and factor of safety are derived below.

1. Analysis of Active Forces on Block, Case 3.

Figure 11 shows the active wedge removed from the section of Figure 10. The section is further divided into small wedges, depending upon intersections of slip surfaces and boundaries. Consider a typical force polygon for an nth wedge in Figure 11. Summation of all forces in the direction of the x and y coordinates axes gives the following equations:

$$\sum F_x = 0$$

$$\begin{aligned} PA_n = & - CA_n \cos (45 + \phi_n/2) - UAL_n + UAR_n \\ & + UA_n \cos (45 - \phi_n/2) + NA'_n \cos (45 + \phi_n/2) \end{aligned} \quad (23)$$

$$\sum F_y = 0$$

$$NA'_n \sin (45 + \phi_n/2) = \left\{ \begin{aligned} & WA_n - CA_n \sin (45 + \phi_n/2) \\ & - UA_n \sin (45 - \phi_n/2) \end{aligned} \right\} \quad (24)$$

Figure 10. General Problem of Sliding Block With Water Surface Inside The Slope Profile (Case 3)

Active Wedge

Figure 11. Analysis of Force on Active Wedge (Case 3)

Elimination of NA'_n from equations (23) and (24) yields an expression for the incremental active force due to the nth wedge,

$$PA_n = WA_n \tan(45 - \phi_n/2) - 2 CA_n \cos(45 + \phi_n/2) + (UAR_n - UAL_n) + UA_n \left\{ \cos(45 - \phi_n/2) - \tan(45 - \phi_n/2) \sin(45 - \phi_n/2) \right\} \quad (25)$$

2. Analysis of Passive Forces on Block, Case 3

Figure 12 shows the passive wedge removed from the section shown in Figure 10. The section is further divided into small wedges, depending upon the intersections of slip surfaces and soil boundaries.

Consider a typical polygon of forces for the nth passive wedge in Figure 12, and summing forces in the direction of the x and y coordinate axes produces the following equations:

$$\begin{aligned} \sum F_x &= 0 \\ PP_n &= CP_n \cos(45 - \phi_n/2) + UL_n + UP_n \cos(45 + \phi_n/2) \\ &\quad - UR_n + NP'_n \cos(45 - \phi_n/2) \end{aligned} \quad (26)$$

$$\begin{aligned} \sum F_y &= 0 \\ NP'_n \sin(45 - \phi_n/2) &= \left\{ WP_n + CP_n \sin(45 - \phi_n/2) \right. \\ &\quad \left. - UP_n \sin(45 + \phi_n/2) \right\} \end{aligned} \quad (27)$$

Elimination of NP'_n from equations (26) and (27) yields an expression for the incremental passive pressure due to the nth wedge,

$$PP_n = WP_n \tan(45 + \phi_n/2) + 2 CP_n \cos(45 - \phi_n/2) + (UL_n - UR_n) + UP_n \left\{ \cos(45 + \phi_n/2) - \sin(45 + \phi_n/2) \tan(45 + \phi_n/2) \right\} \quad (28)$$

Passive Wedge

Figure 12. Analysis of Forces on Passive Wedge (Case 3)

3. Analysis of Forces on Block and Factor of Safety, Case 3.

Figure 13 is the sliding central block free body. The sum of all the forces along the sliding surface and normal to it are equated to zero. The following expressions for the three possible inclinations of the sliding surface are obtained,

For $\theta +$ (positive slope):

$$\sum F_n = 0$$

$$\begin{aligned} NB' + UBP &= PPP \sin \theta - PAA \sin \theta + WB \cos \theta \\ &+ UBL \sin \theta - UBR \sin \theta \end{aligned} \quad (29)$$

$$\sum F_\theta = 0$$

$$\begin{aligned} \frac{CB}{FS} + \frac{NB' \tan \phi}{FS} + PPP \cos \theta - PAA \cos \theta - WB \sin \theta \\ + UBL \cos \theta - UBR \cos \theta = 0 \end{aligned} \quad (30)$$

Elimination of NB' from equations (29) and (30) yields an expression for the factor of safety for a particular trial sliding surface,

$$FS = \frac{CB + (PPP \sin \theta - PAA \sin \theta + WB \cos \theta + UBL \sin \theta - UBR \sin \theta - UBP) \tan \phi}{(PAA - PPP) \cos \theta + WB \sin \theta - UBL \cos \theta + UBR \cos \theta} \quad (31)$$

For $\theta -$ (negative slope):

$$FS = \frac{CB + (PAA \sin \theta - PPP \sin \theta + WB \cos \theta - UBL \sin \theta + UBR \sin \theta - UBP) \tan \phi}{(PAA - PPP) \cos \theta - WB \sin \theta - UBL \cos \theta + UBR \cos \theta} \quad (32)$$

FIGURE 13. FORCES ON SLIDING BLOCK (CASE 3)

For $\theta = 0$ (horizontal slope):

$$FS = \frac{CB + (WB - UBP) \tan \phi}{(PAA - PPP) - UBL + UBR} \quad (33)$$

COMPUTER PROGRAM FOR STABILITY ANALYSIS
OF SLIDING BLOCK

A. Brief Description of Computer Program

The flow chart of the program is shown in Figure 14. The program has been written in FORTRAN IV language, and at present it is workable on the CDC 6500 computer at Purdue University. The program is divided into a main routine and six supporting subroutines. A brief description of each part is given below.

1. Main Program.

The purpose of the main program is to read and store the program control information: geometry of problem, soil properties in each layer, trial sliding surfaces, and location of water surface. With this information, the program calculates and stores all the intersection points of the slip surface and soil boundaries, for each sliding surface. The program automatically eliminates the soil boundaries which will not influence the calculation of active and passive forces on the sliding block. Depending upon the location of the water surface, the program selects the case to be analyzed and calls appropriate subroutines for computation of resultant active and passive forces on the block. Finally, in the main program, a factor of safety is calculated. All desired output information is written out at the end of the calculations.

2. SUBROUTINE ACTT1.

This subroutine is used in Case 1 to calculate the resultant active force on the sliding block.

FIGURE 14. FLOW CHART OF BLOCK PROGRAM.

3. SUBROUTINE PASS1.

This subroutine is used in Case 1 to calculate the resultant passive force on the sliding block.

4. SUBROUTINE ACTT2.

This subroutine is used in Case 2 to calculate the resultant active force on the sliding block.

5. SUBROUTINE PASS2.

This subroutine is used in Case 2 to calculate the resultant passive force on the sliding block.

6. SUBROUTINE ACTT3.

This subroutine is used in Case 3 to calculate the resultant active force on the sliding block.

7. SUBROUTINE PASS3.

This subroutine is used in Case 3 to calculate the resultant passive force on the sliding block.

A listing of computer program is given in Appendix B of this report. A detail description of variables and a user's manual is given in Appendix A.

B. Capabilities of Present Block Program

The block stability program, as currently developed, is capable of handling the following variables representing possible field conditions:

- (1) Multiple continuous soil layers at any inclination.
Each soil boundary is defined by two end coordinate points (maximum of 12 boundaries allowed).
- (2) Top ground surface is made up of three slopes, and well defined toe and crest points.
- (3) Soil properties are defined by γ , c and ϕ (maximum number of soils allowed is 10).
- (4) Uniform strip loads on the ground surface (maximum number of different intensities allowed is 10).
- (5) Water surface can be anywhere in the section of the problem. The water surface is either defined by continuous straight lines, or by points in a curved portion (maximum number of points allowed is 7).
- (6) Trial sliding surfaces at the bottom of the block in the weak soil layer can be at any inclination (maximum of 10 sliding surfaces allowed).

The program calculates a factor of safety against sliding of the central block along any trial surface lying in a single soil layer. In the process it also calculates active and passive forces on the sides of the block, with respect to each sliding surface. This feature of the program is potentially useful for the calculation of active and passive forces on retaining structures in multilayered systems.

ILLUSTRATION PROBLEMS

The purpose of the illustration problems is three fold:

(1) to demonstrate the use of the computer program; (2) to show the versatility and several options of the program; and (3) to serve as a check for duplicated decks. Two separate hypothetical problems are chosen for this purpose.

Illustration Problem No. 1

This first illustration problem involves a simple soil profile shown in Figure 15. Solutions are obtained for three central block sliding surfaces and for three location of the water surface for each sliding surface. The results are given in Table 1. The computer input and output are given in Appendix C and D, respectively.

Illustration Problem No. 2

This second problem is more complex and is shown in Figure 16. This problem is also solved for three slopes of sliding surfaces in combination with three locations of the water surface for each sliding surface. The results are again shown in Table 1, and inputs and outputs are in Appendices C and D.

FIGURE 15. ILLUSTRATION PROBLEM NO. 1

FIGURE 16. ILLUSTRATION PROBLEM NO. 2

TABLE 1

Summary of Results for Two Illustration Problems

Case Analyzed	Number and Slope of Sliding Surface	Factor of Safety	
		Problem No. 1	Problem No. 2
Case 1	1. $\theta +$	1.94	2.07
	2. $\theta = 0$	1.87	2.24
	3. $\theta -$	1.83	2.42
Case 2	1. $\theta +$	1.66	1.83
	2. $\theta = 0$	1.65	1.98
	3. $\theta -$	1.64	2.12
Case 3	1. $\theta +$	1.84	1.84
	2. $\theta = 0$	1.52	1.81
	3. $\theta -$	1.66	1.75

CONCLUSIONS AND RECOMMENDATIONS

The primary objective of this research was the development of a computer-assisted system for rapid prediction of the factor of safety of slopes where the mode of failure is a sliding block. The resulting program is sufficiently versatile to accommodate a 3-slope ground surface and a subsurface profile with spatial variations in material properties, a steady state flow domain, and uniform strip ground surface loadings. Up to ten trial sliding surfaces can be analyzed concurrently, with the base of the central wedge at any inclination in any selected soil layer. The program automatically sequences the trial sliding surfaces, computing a factor of safety for each. Since many sliding surfaces may have to be examined, i.e., there is no systematic search technique which assures identification of a minimum, this is a most important feature.

It was desired to develop a system which could be used on smaller computers. Consequently, the program uses a small storage and short computation time.

Hopefully, the program will enable a designer to check against this mode of instability for any slope where there is reason to suspect that it may occur. Such suspicion would ordinarily accrue from study of boring logs and profiles. Sliding blocks can be based in any soil stratum of below-average strength. When there is no evidence of weak layers, it is likely that some common form of the circular or rotational slump analysis will be employed. In questionable cases, both types of analysis may be undertaken and factors of safety compared.

Any computer program should be tested for reliability by generation of solutions to common problems through different programs or manual calculations. Unfortunately, this is usually possible for only simple examples, since the motivation for development of the new programs is an inability of old ones to accommodate the desired level of physical complexity.

LIST OF REFERENCES

1. Bell, J. M. (1968), "General Slope Stability Analysis", Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 94, No. SM6.
2. Bell, J. M. (1969), "Noncircular Sliding Surfaces", Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 95, No. SM3.
3. Bishop, A. W. (1955), "The Use of the Slip Circle in the Stability Analysis of Slopes", Geotechnique, Vol. 5.
4. Carter, R. K., Lovell, Jr., C. W., and Harr, M. E. (1971), "Computer Oriented Stability Analysis of Reservoir Slopes", Purdue University Water Resources Research Center, Technical Report No. 17.
5. Department of the Navy (1971), Design Manual; Soil Mechanics, Foundations & Earth Structures, NAVDOCKS DOCKS DM-7.
6. United States Steel (1972), Steel Sheet Piling, Design Manual, ADUSS 25-3848-03.
7. Fellenius, W. (1927), "Erdstatische Berechnungen mit Reibung und Kohasion (Adhasion)", Ernst, Berlin, Germany.
8. Hamel, J. F., and Flint, M. K., (1972), "Failure of Colluvial Slope", Journal of the Soil Mechanics & Foundations Division, ASCE, Vol. 98.
9. Highway Research Board (1953), "Landslides and Engineering Practice", Special Report 29, Publication 544, Washington, D.C.

10. Little, A. L. and Price, V. E. (1958), "The Use of an Electronic Computer for Slope Stability Analysis", Geotechnique, Vol. 15.
11. Mendez, Carlos (1972), "Computerized Slope Stability; the Sliding Block Problem," Technical Report No. 21, Purdue University Water Resources Research Center, Lafayette, Indiana.
12. Mohan, A. (1971), "Computerized Slope Stability; Slip Surface Defined by a Polynomial of Any Degree", Internal Report No. 11, Soil Engineering, Civil Engineering, Purdue University.
13. Morgenstern, N. R. and Price, V. E. (1965), "The Analysis of the Stability of General Slip Surface", Geotechnique, Vol. 15.
14. Taylor, D. W. (1940), "Stability of Earth Slopes", Contributions to Soil Mechanics 1925-1940, Boston Society of Civil Engineers, Boston, Massachusetts.
15. Terzaghi, T. (1950), "Mechanism of Landslides", Application of Geology to Engineering Practice, Berkey Volume, Geological Society of America, pp. 83-123, Reprinted in From Theory to Practice in Soil Mechanics, John Wiley and Sons, New York, 1960, pp. 202-245.
16. Terzaghi, K., (1965), Theoretical Soil Mechanics, John Wiley and Sons, New York.

APPENDIX A

BLOCK PROGRAM'S DESCRIPTION OF VARIABLES
AND USER'S MANUAL

A.1 Description of Program

The Block program is written entirely in FORTRAN IV language and makes use of common storage to optimize usage of high speed core and minimum computation time. The program consists of a main program and six supporting subroutines. The flow chart of the program is shown in Figure 14. The listing of the program is given in Appendix B. The program is presently operational on the CDC 6500, using the Purdue MACE operating system.

A.2 Data Deck Setup

The following description of the data deck setup assumes that, in general, all numbers are right-oriented in their fields. Generally all floating point data are entered in a 10 column field. The total data in the program are read into the main Block program.

<u>CARD</u>	<u>VARIABLE</u>	<u>FORMAT</u>
1.1	TITLE = Problem Descriptor to be printed as output, up to 60 characters	(10A6)
2.1	NBND, NTOP, NSOIL, NUFA, NUFP, XTOE, YTOE, XTOP, YTOP, IPRINT NBND = Number of total boundaries (≤ 12) NTOP = Number of total top boundaries ($= 3$) NSOIL = Total number of soil types (≤ 10) NUFA = Total number of strip loads on active wedge (≤ 5) NUFP = Total number of strip loads on passive wedge (≤ 5)	(5I2,4F10.3,I2)

CARDVARIABLEFORMAT

XTOE = x-coordinate of toe of slope

YTOE = y-coordinate of toe of slope

XTOP = x-coordinate of crest of slope

YTOP = y-coordinate of crest of slope

IPRINT = Counter for printout
of program

= 0, no intermediate printout
other than input data,
active and passive
pressures on block and
factor of safety for a
particular sliding surface.

= 1, Print all input and
intermediate output
along with final active and
passive forces and factor of
safety for a particular
sliding surface.

3.1 (BNDS(I,J),J = 1,4), ITP(I),I=1,NBND (4F10.3,I2)

BNDS(I,1) = Left x-coordinate of
Ith boundary.

BNDS(I,2) = Left y-coordinate of
Ith boundary.

BNDS(I,3) = Right x-coordinate of
Ith boundary.

BNDS(I,4) = Right y-coordinate of Ith
boundary.

ITP(I) = Soil type below Ith boundary,
defined by integer number.

NOTE: Card 3.1 repeated NBND time.

<u>CARD</u>	<u>VARIABLE</u>	<u>FORMAT</u>
4.1	<p>(GAMMA(I), C(I), PHI(I), I=1, NSOIL)</p> <p>GAMMA(I) = Unit weight of material (pcf)</p> <p>C(I) = Value of cohesion (psf) for two dimensional Mohr-Coulomb material</p> <p>PHI(I) = Friction angle (in degrees) for two dimensional Mohr-Coulomb material.</p> <p>NOTE: Card 4.1 repeated NSOIL times.</p>	(3F10.3)
5.1	<p>(QA(I), XQAL(I), XQAR(J), I=1, NUFA)</p> <p>QA(I) = Vertical Ith strip load pressure (psf) applied to the side of active wedge.</p> <p>XQAL(I) = Left x-coordinate of Ith strip load on active wedge.</p> <p>XQAR(I) = Right x-coordinates of Ith strip load on active wedge.</p> <p>NOTE: Cards 5.1 an repeated NUFA times. If NUFA = 0 cards 5.1 are omitted.</p>	(3F10.3)
6.1	<p>(QP(I), XQPL(I), XQPR(I), I=1, NUFP)</p> <p>QP(I) = Vertical Ith strip load pressure (psf) applied to the side of passive wedge.</p> <p>XQPL(I) = Left x-coordinate of Ith stripload on passive wedge.</p> <p>XQPR(I) = Right x-coordinate of Ith strip load on passive wedge.</p> <p>NOTE: Card 5.1 are repeated NUFP times. If NUFP = 0 cards 6.1 are omitted.</p>	(3F10.3)

<u>CARD</u>	<u>VARIABLE</u>	<u>FORMAT</u>
7.1	NSURF	(I2)
	NSURF = total number of sliding surfaces to be analyzed (≤ 10).	
8.1	(XSURFL(I), YSURFL(I), XSURFR(I), YSURFR(I), I = 1, NSURF)	(4F10.3)
	XSURFL(I) = Left x-coordinate of Ith sliding surface.	
	YSURFL(I) = Left y-coordinate of Ith sliding surface.	
	XSURFR(I) = Right x-coordinate of Ith sliding surface.	
	YSURFR(I) = Right y-coordinate of Ith sliding surface.	
	NOTE: Cards 8.1 are repeated NSURF times.	
9.1	WLX, WLY, WRX, WRY	(4F10.3)
	WLX = Left x-coordinate of water surface.	
	WLY = Left y-coordinate of water surface.	
	WRX = Right x-coordinate of water surface.	
	WRY = Right y-coordinate of water surface.	
	Note: If water surface is to be defined for Case 2 then card 9.1 should be read for the portion on active wedge side only.	

<u>CARD</u>	<u>VARIABLE</u>	<u>FORMAT</u>
10.1	NWSPT	(I2)
	NWSPT = Total number of points on water surface portion in the slope between toe and crest (≤ 7)	
11.1	(XWS(I), YWS(I), I=1, NWSPT)	(7F10.3)
	XWS(I) = x-coordinate of Ith point on water surface portion in the slope between toe and crest.	
	YWS(I) = y-coordinate of Ith point on water surface portion in the slope between toe and crest.	
	NOTE: Cards 10.1 & 11.1 are omitted when water surface is not of Case 2.	
12.1	PWLX, PWLY, PWRX, PWRY	(4F10.3)
	PWLX = Left x-coordinate of water surface on the side of passive wedge.	
	PWLY = Left y-coordinate of water surface on the side of passive wedge.	
	PWRX = Right x-coordinate of water surface on the side of passive wedge.	
	PWRY = Right y-coordinate of water surface on the side of passive wedge.	
	NOTE: Card 10.1 is omitted where water surface is note of Case 2.	

APPENDIX B

PROGRAM LISTING

PROGRAM BLOCK (INPUT,CUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)	BSA	2
PURPOSE OF PROGRAM	BSA	4
	BSA	6
	BSA	8
TO ANALYSE A SLOPE PROFILE FOR A COMPOSIT TYPE OF	BSA	10
FALURE SURFACE USING THE METHOD OF SLIDING BLOCK	BSA	12
AND DETERMINE POTENTIAL SLIDING SURFACE AND CORRESPONDING	BSA	14
FACTOR OF SAFETY	BSA	16
	BSA	18
LIST OF VARIABLES USED IN PROGRAM	BSA	20
	BSA	22
TITLE(1)***** TITLE OF PROBLEM	BSA	24
NRND TOTAL NUMBER OF SOIL PROFILES	BSA	26
NTOP TOTAL NUMBER OF TOP BOUNDARY	BSA	28
NSOIL TOTAL NUMBER OF SOIL TYPE	BSA	30
NUFA TOTAL NUMBER OF UNIFORM LOADING ON ACTIVE PRESSURE	BSA	32
NUFP TOTAL NUMBER OF UNIFORM LOADING ON PASSIVE PRESSURE	BSA	34
XTOE X COORDINATE OF TOE	BSA	36
YTOE Y COORDINATE OF TOE	BSA	38
XTOP X COORDINATE OF CREST	BSA	40
YTOP Y COORDINATE OF CREST	BSA	42
IPRINT CODE FOR PRINTING OUTPUT	BSA	44
BNDS(1,1) X COORDINATE OF LEFT SIDE OF BOUN POINT	BSA	46
BNDS(1,2) Y COORDINATE OF LEFT SIDE OF BOUN POINT	BSA	48
BNDS(1,3) X COORDINATE OF RITE SIDE OF BOUN POINT	BSA	50
BNDS(1,4) Y COORDINATE OF RITE SIDE OF BOUN POINT	BSA	52
ITP(1) SOIL TYPE JUST BELOW I TH. BOUNDARY	BSA	54
RBND(M,1) REVERSE ORDER OF BOUNDARY BNDS(1,1)	BSA	56
RBND(M,2) REVERSE ORDER OF BOUNDARY BNDS(1,2)	BSA	58
RBND(M,3) REVERSE ORDER OF BOUNDARY BNDS(1,3)	BSA	60
RBND(M,4) REVERSE ORDER OF BOUNDARY BNDS(1,4)	BSA	62
IRBND(M,1) SOIL TYPE BELOW M TH. BOUNDARY	BSA	64
RBND(M,6) SLOPE OF BOUNDARY WITH X- AXIS	BSA	66
RBND(M,7) INTERCEPT OF MTH. BOUNDARY WITH Y AXIS	BSA	68
XSURFL(1) LEFT X COORDINATE OF SLIDING I TH. SURFACE	BSA	70
YSURFL(1) LEFT Y COORDINATE OF SLIDING I TH. SURFACE	BSA	72
XSURFR(1) RIGHT COORDINATE OF SLIDING I TH. SURFACE	BSA	74
YSURFR(1) RIGHT COORDINATE OF SLIDING I TH. SURFACE	BSA	76
SSA(M,1) ACTIVE PRESSURE SIDE X COORDINATE	BSA	78
	BSA	80
SSA(M,2) ACTIVE PRESSURE SIDE Y COORDINATE	BSA	82
	BSA	84
SSP(M,1) PASSIVE PRESSURE SIDE X COORDINATE	BSA	86
	BSA	88
SSP(M,2) PASSIVE PRESSURE SIDE Y COORDINATE	BSA	90
	BSA	92
ISAP(M,1) SOIL TYPE BELOW BOUNDARY M TH.	BSA	94
SAP(M,1) SLOPE OF BOUNDARY M TH. BOUNDARY WITH X AXIS	BSA	96
SAP(M,2) INTERSECTION OF BOUNDARY WITH Y AXIS	BSA	98
SSAA(1) SLOPE OF ACTIVE SLIDING SURFACE	BSA	100
	BSA	102

	TAN(45 + PHI(1)/2)	BSA	104	
SSAP(1)	SLOPE OF PASSIVE SLIDING SURFACE	BSA	106	
		BSA	108	
		BSA	110	
	TAN(45 - PHI(1)/2)	BSA	112	
		BSA	114	
GAMMA(1)	TOTAL UNIT WEIGHT OF SOIL BELOW 1 TH. BOUNDARY	BSA	116	
C(1)	MOHR COLUMB COHESION	BSA	118	
PHI(1)	MOHR COLUMB ANGLE OF INTERNAL FRICTION	BSA	120	
QA(1)	INTENSITY OF UNIFORM LINE LOAD ON ACTIVE WEDGE	BSA	122	
XQAL(1)	LEFT X COORDINATE OF UNIFORM LOAD ON ACTIVE WEDGE	BSA	124	
XUAR(1)	RIGHT X COORDINATE OF UNIFORM LOAD ON ACTIVE WEDGE	BSA	126	
QP(1)	INTENSITY OF UNIFORM LINE LOAD ON PASSIVE WEDGE	BSA	128	
XQPL(1)	LEFT X COORDINATE OF UNIFORM LOAD ON PASS. WEDGE	BSA	130	
XQPR(1)	RIGHT X COORDINATE OF UNIFORM LOAD ON PASS. WEDGE	BSA	132	
NSURF	TOTAL NUMBER OF SLIDING SURFACES	BSA	134	
	TO BE ANALYSED	BSA	136	
SR(1,1)	SLOPE OF 1 TH. BOUNDARY WITH X AXIS	BSA	138	
SR(1,2)	INTERCEPT OF BOUNDARY 1 TH. WITH Y AXIS	BSA	140	
WLX	LEFT X COORD. OF WATER SURFACE	BSA	142	
WLY	LEFT Y COORD. OF WATER SURFACE	BSA	144	
WRX	RIGHT X COORD. OF WATER SURFACE	BSA	146	
WRY	RIGHT Y COORD. OF WATER SURFACE	BSA	148	
NWSPT	NO. OF POINTS ON WATER SURFACE IN CENTER SLOPE	BSA	150	
XWS(1)	X- COORD. OF POINT ON WATER SURFACE IN CENTER SLOPE	BSA	152	
YWS(1)	Y- COORD. OF POINT ON WATER SURFACE IN CENTER SLOPE	BSA	154	
PWLX	LEFT X COORD. OF WATER SURFACE ON PAS. WEDGE SIDE	BSA	156	
PWLY	LEFT Y COORD. OF WATER SURFACE ON PAS. WEDGE SIDE	BSA	158	
PWRX	RIGHT X COORD. OF WATER SURFACE ON PAS. WEDGE SIDE	BSA	160	
PWRY	RIGHT Y COORD. OF WATER SURFACE ON PAS. WEDGE SIDE	BSA	162	
		BSA	164	
	INPUT INFORMATION DESIRED FOR BLOCK PROGRAM	BSA	166	
		BSA	168	
	UNITS USED IN PROGRAM	BSA	170	
		BSA	172	
	LENGTH IN FEET	BSA	174	
	FORCE IN POUNDS	BSA	176	
	ANGLES IN DEGREES	BSA	178	
	PROBLEM TITLE(1) CARD	BSA	180	
TITLE(1)	COL (1- 60) ALPHA NUMERIC NAME OF PROBLEM	BSA	182	
	OR ANY OTHER DETAIL OF PROBLEM	BSA	184	
NEND	COL(1- 2)	TOTAL NUMBER OF BOUNDARY	BSA	186
NTOP	COL(3- 4)	TOTAL NUMBER OF TOP BOUNDARIES	BSA	188
NSOIL	COL(5-6)	TOTAL NUMBER OF SOIL TYPE	BSA	190
NUFA	COL(7-8)	TOTAL NUMBER OF UNIF. LOAD	BSA	192
		ON ACTIVE WEDGE	BSA	194
NUFP	COL(9-10)	TOTAL NUMBER OF UNIF. LOAD	BSA	196
		ON PASSIVE WEDGE	BSA	198
XTOE	COL(11-20)	X COORD. OF TOE	BSA	200
YTOE	COL(21-30)	Y COORD. OF TOE	BSA	202
XTOP	COL(31-40)	X COORD. OF CREST	BSA	204
YTOP	COL(41-50)	Y COORD. OF CREST	BSA	206
IPRINT	COL(51-52)	CODE FOR PRINTOUT DESIRED	BSA	208
		BSA	210	
		BSA	212	
	BOUNDARY CARDS			
	ONE CARD FOR EACH BOUNDARY DEFINED BY X-Y COORD.	BSA	214	
RNDS(1,1)	COL(1-10)	LEFT X COORD.	BSA	216
RNDS(1,2)	COL(11-20)	LEFT Y COORD.	BSA	218
RNDS(1,3)	COL(31-40)	RIGHT X COORD.	BSA	220
RNDS(1,4)	COL(41-50)	RIGHT Y COORD.	BSA	222
ITP(1)	COL(41-42)	SOIL TYPE CODE BELOW BOUND.	BSA	224

SOIL PROPERTY CARDS			BSA 226
ONE CARD PER SOIL TYPE			BSA 228
GAMMA(1)	COL(1-10)	TOTAL UNIT WEIGHT	BSA 230
C(1)	COL(11-20)	COHESION OF SOIL	BSA 232
PHI(1)	COL(21-30)	ANGLE OF INTERNAL FRICTION	BSA 234
UNIFORM LINE LOAD			BSA 236
QA(1)	COL(1-10)	LOAD LB./ SQ. FT. ON ACT. WEDGE	BSA 238
XQAL(1)	COL(11-20)	LEFT X COORD. OF LOAD	BSA 240
XQAR(1)	COL(21-30)	RIGHT X COORD. OF LOAD	BSA 242
			BSA 244
NUMBER OF CARDS = NUFA			BSA 246
			BSA 248
IF NUFA = 0 NO NEED OF THESE CARDS			BSA 250
QP(1)	COL(1-10)	LOAD LB./ SQ. FT. ON PAS. WEDGE	BSA 252
XQAPL(1)	COL(11-20)	LEFT X COORD. OF LOAD	BSA 254
XQARL(1)	COL(21-30)	RIGHT X COORD. OF LOAD	BSA 256
NUMBER OF CARDS = NUFP			BSA 258
NSURF	COL(1-2)	TOTAL NUMBER OF SURFACE TO BE ANALYSED	BSA 260
			BSA 262
XSURFL(1)	COL(1-10)	LEFT X COORD. OF SLIDING SURFACE	BSA 264
YSURFL(1)	COL(11-20)	LEFT Y COORD. OF SLIDING SURFACE	BSA 266
XSURFR(1)	COL(21-30)	RT. X COORD. OF SLIDING SURFACE	BSA 268
YSURFR(1)	COL(31-40)	RT. Y COORD. OF SLIDING SURFACE	BSA 270
			BSA 272
			BSA 274
IF CASE = 1 (WHEN WATER SURFACE IS BELOW SLIDING SURFACE)			BSA 276
WLX	COL(1-10)	LEFT X COORD. OF WATER SURFACE	BSA 278
WLY	COL(11-20)	LEFT Y COORD. OF WATER SURFACE	BSA 280
WRX	COL(21-30)	RIGHT X COORD. OF WATER SURFACE	BSA 282
WRY	COL(31-40)	RIGHT Y COORD. OF WATER SURFACE	BSA 284
IF CASE = 2 (WHEN WATER SUR IS ABOVE FIRST SLOPE AND BELOW SECOND AND THIRD TOP SLOPES)			BSA 286
			BSA 288
WLX	COL(1-10)	LEFT X COORD. OF WATER SUR BETWEEN BLOCK AND ACTIVE WEDGE	BSA 290
			BSA 292
WLY	COL(11-20)	LEFT Y COORD. OF WATER SUR BETWEEN BLOCK AND ACTIVE WEDGE	BSA 294
			BSA 296
WRX	COL(21-30)	RIGHT X COORD. OF WATER SUR BETWEEN BLOCK AND ACTIVE WEDGE	BSA 298
			BSA 300
WRY	COL(31-40)	RIGHT Y COORD. OF WATER SUR BETWEEN BLOCK AND ACTIVE WEDGE	BSA 302
			BSA 304
NWSPT	COL(1-2)	TOTAL NO. OF POINTS ON WATER SUR IN CENTER SLOPE (MAXIMUM 10 POINTS ALLOWED)	BSA 306
			BSA 308
XWS(1),YWS(1)	COL(1-70)	X AND Y COORD. OF WATER SUR IN CENTER	BSA 310
PWLX	COL(1-10)	LEFT X COORD OF WATER SURFACE BETWEEN BLOCK AND PASSIVE WEDGE	BSA 312
			BSA 314
PWLY	COL(11-20)	LEFT Y COORD OF WATER SUR BETWEEN BLOCK AND PASSIVE WEDGE	BSA 316
			BSA 318
PWRX	COL(21-30)	RIGHT X COORD OF WATER SUR BETWEEN BLOCK AND PASSIVE WEDGE	BSA 320
			BSA 322
PWRY	COL(31-40)	RIGHT Y COORD OF WATER SUR BETWEEN BLOCK AND PASSIVE WEDGE	BSA 324
			BSA 326
IF CASE = 3 (WHEN WATER SURFACE IS BELOW SLOPES 1,2,3 AND ABOVE SLIDING SURFACE TO BE ANALSED)			BSA 328
			BSA 330
WLX	COL(1-10)	LEFT X COORD. OF WATER SURFACE	BSA 332
WLY	COL(11-20)	LEFT Y COORD. OF WATER SURFACE	BSA 334
WRX	COL(21-30)	RIGHT X COORD. OF WATER SURFACE	BSA 336
WRY	COL(31-40)	RIGHT Y COORD. OF WATER SURFACE	BSA 338
			BSA 340
COMMON NBNB,NTOP,NSOIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,11,BNDS			BSA 342
1(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),QA(5),XQAL(5),XQAR(5),XQABSA			BSA 344
PR(5),SW,CW,PSW,PCW,QP(5),XQPL(5),XQPR(5),XSURFL(10),YSURFL(10),XSURBSA			BSA 346

3RFR(10),YSURF(10),SB(12,2),RBNDS(12,6),IRBND(12,1),SSAA(12),SSAP(BSA	348
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPBSA	350
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),PAA(10),PEP(10),BKRBSA	352
6Y(12),BKLY(12)	BSA 354
DIMENSION WRB(10), WB(12), XWS(10), YWS(10), YWSS(10), YYWS(10)	BSA 356
DATA PI/3.14159265/	BSA 358
DATA GAMW/62.4/	BSA 360
*** READ INPUT OF PROBLEM TO BE ANALYSED	BSA 362
	BSA 364
	BSA 366
102 WRITE (6,266)	BSA 368
READ (5,268) (TITLE(I),I=1,10)	BSA 370
READ (5,270) NBND,NTOP,NSOIL,NUFA,NUFP,XTOE,YTOE,XTOP,YTOP,IPRINT	BSA 372
READ (5,272) ((BNDS(I,J),J=1,4),ITP(I),I=1,NBND)	BSA 374
READ (5,274) (GAMMA(I),C(I),PHI(I),I=1,NSOIL)	BSA 376
IF (NUFA) 106,106,104	BSA 378
104 READ (5,276) (QA(I),XQAL(I),XQAR(I),I=1,NUFA)	BSA 380
106 IF (NUFP) 110,110,108	BSA 382
108 READ (5,278) (QP(I),XQPL(I),XQPR(I),I=1,NUFP)	BSA 384
110 IK=3	BSA 386
READ (5,280) NSURF	BSA 388
READ (5,282) (XSURFL(I),YSURFL(I),XSURFR(I),YSURFR(I),I=1,NSURF)	BSA 390
READ (5,284) WLX,WLY,WRX,WPY	BSA 392
	BSA 394
*** WRITE INPUT OF THE PROBLEM TO BE ANALYSED	BSA 396
	BSA 398
WRITE (6,286) (TITLE(I),I=1,10)	BSA 400
WRITE (6,290)	BSA 402
WRITE (6,288)	BSA 404
WRITE (6,290)	BSA 406
WRITE (6,292)	BSA 408
WRITE (6,294) NBND,NTOP,NSOIL,NUFA,NUFP,XTOE,YTOE,XTOP,YTOP,IPRINT	BSA 410
WRITE (6,296)	BSA 412
WRITE (6,290)	BSA 414
WRITE (6,298)	BSA 416
WRITE (6,300) ((BNDS(I,J),J=1,4),ITP(I),I=1,NBND)	BSA 418
WRITE (6,292)	BSA 420
WRITE (6,302) NSOIL	BSA 422
WRITE (6,304)	BSA 424
DO 112 I=1,NSOIL	BSA 426
WRITE (6,306) I,GAMMA(I),C(I),PHI(I)	BSA 428
PHI(I)=PHI(I)*PI/180.0	BSA 430
112 CONTINUE	BSA 432
WRITE (6,292)	BSA 434
WRITE (6,308) NUFA	BSA 436
IF (NUFA) 116,116,114	BSA 438
114 WRITE (6,310)	BSA 440
WRITE (6,312) (I,QA(I),XQAL(I),XQAR(I),I=1,NUFA)	BSA 442
WRITE (6,292)	BSA 444
116 WRITE (6,314) NUFP	BSA 446
IF (NUFP) 120,120,118	BSA 448
118 WRITE (6,310)	BSA 450
WRITE (6,312) (I,QP(I),XQPL(I),XQPR(I),I=1,NUFP)	BSA 452
WRITE (6,292)	BSA 454
120 WRITE (6,316) IK	BSA 456
WRITE (6,292)	BSA 458
WRITE (6,318) NSURF	BSA 460
WRITE (6,290)	BSA 462
WRITE (6,292)	BSA 464
WRITE (6,320)	BSA 466
WRITE (6,322) (I,XSURFL(I),YSURFL(I),XSURFR(I),YSURFR(I),I=1,NSURFBSA	468

1)		BSA	470
WRITE (6,292)		BSA	472
WRITE (6,324)		BSA	474
WRITE (6,290)		BSA	476
WRITE (6,292)		BSA	478
WRITE (6,326)		BSA	480
WRITE (6,292)		BSA	482
WRITE (6,328) WLX,WLY,WRX,WRY		BSA	484
WRITE (6,292)		BSA	486
		BSA	488
***	CALCULATE SLOPE AND INTERCEPT WITH Y AXIS	BSA	490
		BSA	492
DWY=(WRY-WLY)		BSA	494
DWX=(WRX-WLX)		BSA	496
IF (DWY.EQ.0.0) GO TO 122		BSA	498
SW=DWY/DWX		BSA	500
GO TO 124		BSA	502
122 SW=0.0		BSA	504
CW=WLY		BSA	506
124 CW=WLY-SW*WLX		BSA	508
DO 134 I=1,NBND		BSA	510
HD=BNDS(I,4)-BNDS(I,2)		BSA	512
IF (HD) 128,126,128		BSA	514
126 SB(I,1)=0.0		BSA	516
GO TO 130		BSA	518
128 SB(I,1)=HD/(BNDS(I,3)-BNDS(I,1))		BSA	520
GO TO 132		BSA	522
130 SB(I,2)=BNDS(I,2)		BSA	524
GO TO 134		BSA	526
132 SB(I,2)=BNDS(I,2)-SB(I,1)*BNDS(I,1)		BSA	528
134 CONTINUE		BSA	530
		BSA	532
****	INVERT THE ORDER OF SOIL AND SLOPE BOUNDARIES	BSA	534
		BSA	536
DO 136 I=1,NBND		BSA	538
M=NBND-I+1		BSA	540
BNDS(M,1)=BNDS(I,1)		BSA	542
BNDS(M,2)=BNDS(I,2)		BSA	544
BNDS(M,3)=BNDS(I,3)		BSA	546
BNDS(M,4)=BNDS(I,4)		BSA	548
IRBND(M,1)=ITP(1)		BSA	550
BNDS(M,5)=SB(I,1)		BSA	552
BNDS(M,6)=SB(I,2)		BSA	554
136 CONTINUE		BSA	556
		BSA	558
****	CALCULATE INTERSECTION OF SLIP SUR AND SOIL BOUNDARIES	BSA	560
****	WITH RESPECT TO SLIDING SURFACES	BSA	562
		BSA	564
DO 264 II=1,NSURF		BSA	566
XRR(1)=XSURF(II)		BSA	568
YPR(1)=YSURF(II)		BSA	570
XLL(1)=XSURFL(II)		BSA	572
YLL(1)=YSURFL(II)		BSA	574
DO 138 I=1,NBND		BSA	576
SSA(I,1)=0.0		BSA	578
SSA(I,2)=0.0		BSA	580
SSP(I,1)=0.0		BSA	582
SSP(I,2)=0.0		BSA	584
ISAP(I,1)=IRBND(I,1)		BSA	586
SAP(I,1)=BNDS(I,5)		BSA	588
SAP(I,2)=BNDS(I,6)		BSA	590

138	CONTINUE	BSA	592
	DO 172 J=1,NBND	BSA	594
	JRB=NBND-J+1	BSA	596
	MB=IRBND(J,1)	BSA	598
	MA=IRBND(J+1,1)	BSA	600
	SSAA(J)=TAN(PI/4.0+0.5*PHI(MB))	BSA	602
	SSAP(J)=-TAN(PI/4.0-0.5*PHI(MB))	BSA	604
	YAA(J)=RBND(J,5)*XRR(J)+RBND(J,6)	BSA	606
	YPP(J)=RBND(J,5)*XLL(J)+RBND(J,6)	BSA	608
	IF (J+1.GT.NBND) GO TO 140	BSA	610
	SSAAA(J)=TAN(PI/4.0+0.5*PHI(MA))	BSA	612
	SSAPP(J)=-TAN(PI/4.0-0.5*PHI(MA))	BSA	614
	GO TO 142	BSA	616
140	SSAAA(J)=1.0	BSA	618
	SSAPP(J)=-1.0	BSA	620
142	MM=NBND-J+1	BSA	622
	IF (MM.EQ.1.AND.IK.FQ.3) GO TO 148	BSA	624
	IF (MM.EQ.2) GO TO 146	BSA	626
	IF (MM.EQ.3) GO TO 144	BSA	628
	IF (MM.GE.4) GO TO 150	BSA	630
144	SSP(J,1)=RBND(J,1)	BSA	632
	SSP(J,2)=RBND(J,2)	BSA	634
	GO TO 158	BSA	636
146	SSP(J,1)=RBND(J,1)	BSA	638
	SSP(J,2)=RBND(J,2)	BSA	640
	SSA(J,1)=RBND(J,3)	BSA	642
	SSA(J,2)=RBND(J,4)	BSA	644
	GO TO 166	BSA	646
148	JJ=NBND-IK	BSA	648
	XLL(J)=SSP(JJ,1)	BSA	650
	YLL(J)=SSP(JJ,2)	BSA	652
	GO TO 156	BSA	654
150	IF (YPP(J)-YLL(J)) 158,152,156	BSA	656
152	IF (RBND(J,5)-SSAPP(J)) 158,154,158	BSA	658
154	SSP(J,1)=RBND(J,1)	BSA	660
	SSP(J,2)=RBND(J,2)	BSA	662
	GO TO 158	BSA	664
156	SSP(J,1)=(YLL(J)-RBND(J,2)+RBND(J,5)*RBND(J,1)-XLL(J)*SSA	BSA	666
1	P(J))/(RBND(J,5)-SSAP(J))	BSA	668
	SSP(J,2)=RBND(J,2)+RBND(J,5)*(SSP(J,1)-RBND(J,1))	BSA	670
	IF (MM.EQ.1) GO TO 162	BSA	672
158	IF (YAA(J)-YRR(J)) 168,160,164	BSA	674
160	IF (RBND(J,5)-SSAAA(J)) 168,162,168	BSA	676
162	SSA(J,1)=RBND(J,3)	BSA	678
	SSA(J,2)=RBND(J,4)	BSA	680
	GO TO 166	BSA	682
164	SSA(J,1)=(RBND(J,6)-YRR(J)+XRR(J)*SSAA(J))/(SSAA(J)-RBND(J,5))	BSA	684
1		BSA	686
	SSA(J,2)=RBND(J,6)+RBND(J,5)*SSA(J,1)	BSA	688
	XLL(J+1)=SSP(J,1)	BSA	690
	YLL(J+1)=SSP(J,2)	BSA	692
	XRR(J+1)=SSA(J,1)	BSA	694
	YRR(J+1)=SSA(J,2)	BSA	696
166	ISAP(J,1)=IRBND(J,1)	BSA	698
	SAP(J,1)=RBND(J,5)	BSA	700
	SAP(J,2)=RBND(J,6)	BSA	702
	GO TO 170	BSA	704
168	XLL(J+1)=XLL(J)	BSA	706
	YLL(J+1)=YLL(J)	BSA	708
	XRR(J+1)=XRR(J)	BSA	710
	YRR(J+1)=YRR(J)	BSA	712

	IF (IPRINT.EQ.0) GO TO 172	BSA 714
	WRITE (6,330) JRB ,	BSA 716
	GO TO 172	BSA 718
170	IF (IPRINT.EQ.0) GO TO 172	BSA 720
	WRITE (6,332) JRB,ISAP(J,1),SAP(J,1),SAP(J,2),SSA(J,1),SSA(J,2),SSP(J,1),SSP(J,2)	BSA 722
1		BSA 724
172	CONTINUE	BSA 726
	*** SLOPE AND Y- INTERCEPT OF SLIDING SURFACES	BSA 728
		BSA 730
		BSA 732
	SM=(YSURFR(II)-YSURFL(II))/(XSURFR(II)-XSURFL(II))	BSA 734
	SC=(YSURFL(II)*(XSURFR(II)-XSURFL(II))-XSURFL(II)*(YSURFR(II)-YSURFL(II)))/(XSURFR(II)-XSURFL(II))	BSA 736
1		BSA 738
	*** SLOPE AND Y- INTERCEPT OF WATER SURFACES	BSA 740
		BSA 742
		BSA 744
	WYL=XSURFL(II)*SW+CW	BSA 746
	WYR=XSURFR(II)*SW+CW	BSA 748
*****		BSA 750
*****	DECIDE CASE TO BE ANALYSED	BSA 752
		BSA 754
	IF (WYL.LT.YSURFL(II).AND.WYR.LT.YSURFR(II)) ICASE=1	BSA 756
	IF (WYL.GT.YSURFL(II).AND.WYL.GT.YTOE) ICASE=2	BSA 758
	IF (WYL.GT.YSURFL(II).AND.WYL.LT.YTOE) ICASE=3	BSA 760
	WRITE (6,334) ICASE	BSA 762
	WRITE (6,292)	BSA 764
	IF (ICASE.NE.2) GO TO 180	BSA 766
	IF (II.NE.1) GO TO 180	BSA 768
	READ (5,336) NWSPT	BSA 770
	READ (5,338) (XWS(I),YWS(I),I=1,NWSPT)	BSA 772
	WRITE (6,340)	BSA 774
	WRITE (6,342)	BSA 776
	DO 174 I=1,NWSPT	BSA 778
	WRITE (6,344) I,XWS(I),YWS(I)	BSA 780
174	CONTINUE	BSA 782
	READ (5,282) PWLX,PWLY,PWRX,PWRY	BSA 784
	WRITE (6,346)	BSA 786
	WRITE (6,290)	BSA 788
	WRITE (6,292)	BSA 790
	WRITE (6,326)	BSA 792
	WRITE (6,292)	BSA 794
	WRITE (6,328) PWLX,PWLY,PWRX,PWRY	BSA 796
	WRITE (6,292)	BSA 798
	PDWY=(PWRY-PWLY)	BSA 800
	PDWX=(PWRX-PWLX)	BSA 802
	IF (PDWY.EQ.0.0) GO TO 176	BSA 804
	PSW=PDWY/PDWX	BSA 806
	GO TO 178	BSA 808
176	PSW=0.0	BSA 810
	PCW=PWLY	BSA 812
178	PCW=PWLY-PSW*PWLX	BSA 814
		BSA 816
*****	MAXIMUM AND MINIMUM BOUNDARY IN ACTIVE WEDGE ANALYSIS	BSA 818
		BSA 820
180	DO 182 I=1,NBND	BSA 822
	MAXA=NBND-2	BSA 824
	MINA=NBND-MAXA+1	BSA 826
	IF (SSA(I,1).GT.XSURFR(II)) GO TO 184	BSA 828
182	CONTINUE	BSA 830
184	MINA=I	BSA 832
	MMAXA=NBND-MINA+1	BSA 834

IF (IPRINT.EQ.0) GO TO 186		BSA 836
WRITE (6,348) MMAXA,MMINA		BSA 838
		BSA 840
***** MAXIMUM AND MINIMUM BOUNDARY IN PASSIVE WEDGE ANALYSIS		BSA 842
		BSA 844
186	DO 188 I=1,NBND	BSA 846
	MAXP=NBND	BSA 848
	MMINP=NBND-MAXP+1	BSA 850
	IF (SSP(I,2).GT.YSURFL(II)) GO TO 190	BSA 852
188	CONTINUE	BSA 854
190	MINP=I	BSA 856
	MMAXP=NBND-MINP+1	BSA 858
	IF (IPRINT.EQ.0) GO TO 192	BSA 860
	WRITE (6,350) MMAXP,MMINP	BSA 862
		BSA 864
***** CALL APPROPRIATE ACTIVE PRESSURE SUBROUTINE		BSA 866
		BSA 868
192	GO TO (194,196,198), ICASE	BSA 870
194	CALL ACTT1	BSA 872
	GO TO 200	BSA 874
196	CALL ACTT2	BSA 876
	GO TO 200	BSA 878
198	CALL ACTT3	BSA 880
		BSA 882
***** CALL APPROPRIATE PASSIVE PRESSURE SUBROUTINE		BSA 884
		BSA 886
200	GO TO (202,204,206), ICASE	BSA 888
202	CALL PASS1	BSA 890
	GO TO 208	BSA 892
204	CALL PASS2	BSA 894
	GO TO 208	BSA 896
206	CALL PASS3	BSA 898
		BSA 900
***** FIND RIGHT INTERSECTION OF SOIL BOUNDARIES AND		BSA 902
***** VERTICAL SIDES OF SLIDING BLOCK		BSA 904
		BSA 906
208	DO 210 L=MINA,MAXA	BSA 908
	LRA=NBND-L+1	BSA 910
	IF (IPRINT.EQ.0) GO TO 210	BSA 912
	WRITE (6,352) LRA,BKRY(L)	BSA 914
210	CONTINUE	BSA 916
	WRITE (6,292)	BSA 918
		BSA 920
***** FIND LEFT INTERSECTION OF SOIL BOUNDARIES AND		BSA 922
***** VERTICAL SIDES OF SLIDING BLOCK		BSA 924
		BSA 926
	DO 212 L=MINP,MAXP	BSA 928
	LRP=NBND-L+1	BSA 930
	IF (IPRINT.EQ.0) GO TO 212	BSA 932
	WRITE (6,354) LRP,BKLY(L)	BSA 934
212	CONTINUE	BSA 936
		BSA 938
***** CALCULATE FACTOR OF SAFETY AGAINST SLIDING		BSA 940
		BSA 942
	WBR(II)=0.0	BSA 944
	BLX=XSURFR(II)-XSURFL(II)	BSA 946
	GO TO (214,216,220), ICASE	BSA 948
214	RWPY=0.0	BSA 950
	RWRX=0.0	BSA 952
	RWLY=0.0	BSA 954
	RWLX=0.0	BSA 956

	GO TO 222	BSA 958
216	BWRY=XSURFR(II)*SW+CW	BSA 960
	RWLY=XSURFL(II)*PSW+PCW	BSA 962
	RWIX=((CW-SB(2,2))/(SB(2,1)-SW))	BSA 964
	RWIY=SW*((CW-SB(2,2))/(SB(2,1)-SW))+SB(2,2)	BSA 966
	PBWIX=((PCW-SB(2,2))/(SB(2,1)-PSW))	BSA 968
	PBWIY=PSW*((SCW-SB(2,2))/(SB(2,1)-PSW))+SB(2,2)	BSA 970
	XLTB=SQRT((XTOE-PBWIX)**2+(YTOE-PBWIY)**2)	BSA 972
	RWHV=(BWLY-YTOE)	BSA 974
	RWTV=(RWLY-YSURFL(II))	BSA 976
	BWTP=(BWRY-YSURFR(II))	BSA 978
	YPW=0.0	BSA 980
	DO 218 K=1,NWSPT	BSA 982
	YWS(K)=SM*XWS(K)+SC	BSA 984
	YYWS(K)=(YWS(K)-YWS(K))	BSA 986
	YPW=YPW+YYWS(K)	BSA 988
218	CONTINUE	BSA 990
	XNWSPT=FLOAT(NWSPT)	BSA 992
	YYPW=YPW/XNWSPT	BSA 994
	UBL=0.5*(BWTV)**2*GAMW	BSA 996
	URR=0.5*(BWRY-YSURFR(II))**2*GAMW	BSA 998
	URBP=((RWTV+BWTP+YYPW)/3.0)*GAMW	BSA 1000
	URBH=0.5*XLTR*RWHV*GAMW	BSA 1002
	GO TO 222	BSA 1004
220	BWRY=XSURFR(II)*SW+CW	BSA 1006
	RWLY=XSURFL(II)*SW+CW	BSA 1008
	URL=(RWLY-YSURFL(II))**2*GAMW*0.5	BSA 1010
	URR=(BWRY-YSURFR(II))**2*GAMW*0.5	BSA 1012
	RLY=(RWLY-YSURFL(II))	BSA 1014
	RBY=(BWRY-YSURFR(II))	BSA 1016
	URBP=0.5*(RLY+RBY)*GAMW	BSA 1018
222	DO 224 M=MINA,MAXA	BSA 1020
	MR=NAND-M+1	BSA 1022
	MR=ISAP(M,1)	BSA 1024
	IF (M.EQ.MINA) GO TO 224	BSA 1026
	IF (M.EQ.MAXA) GO TO 226	BSA 1028
	GO TO 228	BSA 1030
224	BSL=SQRT((XSURFR(II)-XSURFL(II))**2+(YSURFL(II)-YSURFR(II))**2)	BSA 1032
1	TPHI=TAN(PHI(MR))	BSA 1034
	CB=C(MB)*BSL	BSA 1036
	WB(M)=0.5*GAMMA(MB)*((BKRY(M)+BKLY(M))-(YSURFR(II)+YSURFL(II)))	BSA 1038
1	)*BLX	BSA 1040
	GO TO 230	BSA 1042
226	WB(M)=0.5*GAMMA(MB)*BLX*(YTOE+YTOP-BKRY(M-1)-BKLY(M-1))	BSA 1044
	GO TO 230	BSA 1046
228	WB(M)=0.5*GAMMA(MB)*BLX*(BKRY(M)+BKLY(M)-BKRY(M-1)-BKLY(M-1))	BSA 1048
1		BSA 1050
230	IF (IPRINT.EQ.0) GO TO 232	BSA 1052
	WRITE (6,356) MK,MB,GAMMA(MB),C(MB),PHI(MB),BLX,BSL,CB,WB(M)	BSA 1054
232	WBR(II)=WBR(II)+WB(M)	BSA 1056
234	CONTINUE	BSA 1058
	WRITE (6,358) II,PAA(II),PPP(II),WBB(II),CB	BSA 1060
	IF (YSURFR(II)-YSURFL(II)) 236,252,244	BSA 1062
236	GO TO (238,240,242), ICASE	BSA 1064
238	THETA=ATAN((YSURFL(II)-YSURFR(II))/BLX)	BSA 1066
	BNUMF=CB+WBB(II)*COS(THETA)*TPHI+(PAA(II)-PPP(II))*SIN(THETA)*T	BSA 1068
1	PHI	BSA 1070
	BDEFN=WBB(II)*SIN(THETA)+(PAA(II)-PPP(II))*COS(THETA)	BSA 1072
	IF (BDEFN.LE.0.0) GO TO 262	BSA 1074
	FB=BNUMF/BDEFN	BSA 1076
		BSA 1078

	GO TO 260	BSA 1080
240	THETA=ATAN((YSURFL(11)-YSURFR(11))/BLX)	BSA 1082
	BETA2=ATAN(SB(2,1))	BSA 1084
	UBP=URPP*BSL	BSA 1086
1	BNUMF=CB+((PAA(11)-PPP(11)-URL+UBR-UBH*SIN(BETA2))*SIN(THETA)+(WBB(11)+UBH*COS(BETA2))*COS(THETA))*TPHI-UBP*TPHI	BSA 1088
	BDENF=(PAA(11)-PPP(11)-UBH*SIN(BETA2)-URL+UPR)*COS(THETA)-(WBB(11)+UBH*COS(BETA2))*SIN(THETA)	BSA 1090
1	IF (BDENF.LE.0.0) GO TO 262	BSA 1092
	FR=BNUMF/BDENF	BSA 1094
	GO TO 260	BSA 1096
242	THETA=ATAN((YSURFL(11)-YSURFR(11))/BLX)	BSA 1098
	UBP=URPP*BSL	BSA 1100
1	BNUMF=CB+((PAA(11)-PPP(11)-URL+UPR)*SIN(THETA)+WBB(11)*COS(THETA)+UBP*TPHI	BSA 1102
	BDENF=-WBB(11)*SIN(THETA)+(PAA(11)-PPP(11)-URL+UPR)*COS(THETA)	BSA 1104
	IF (BDENF.LE.0.0) GO TO 262	BSA 1106
	FR=BNUMF/BDENF	BSA 1108
	GO TO 260	BSA 1110
244	GO TO (246,248,250), ICASE	BSA 1112
246	THETA=ATAN((YSURFL(11)-YSURFR(11))/BLX)	BSA 1114
	BNUMF=CB+(WBB(11)*COS(THETA)-(PAA(11)-PPP(11))*SIN(THETA))*TPHI	BSA 1116
	BDENF=(PAA(11)-PPP(11))*COS(THETA)+WBB(11)*SIN(THETA)	BSA 1118
	IF (BDENF.LE.0.0) GO TO 262	BSA 1120
	FR=BNUMF/BDENF	BSA 1122
	GO TO 260	BSA 1124
248	THETA=ATAN((YSURFL(11)-YSURFR(11))/RLY)	BSA 1126
	BETA2=ATAN(SB(2,1))	BSA 1128
	UBP=URPP*BSL	BSA 1130
1	BNUMF=CB+((WBB(11)+UBH*COS(BETA2))*COS(THETA)+(PPP(11)-PAA(11)+UBL-UPR)*SIN(THETA)+UBP*TPHI	BSA 1132
	BDENF=(PAA(11)-PPP(11)-UBH*SIN(BETA2)-UBL+UPR)*COS(THETA)+(WBB(11)+UBH*COS(BETA2))*SIN(THETA)	BSA 1134
1	IF (BDENF.LE.0.0) GO TO 262	BSA 1136
	FR=BNUMF/BDENF	BSA 1138
	GO TO 260	BSA 1140
250	THETA=ATAN((YSURFL(11)-YSURFR(11))/RLX)	BSA 1142
	UBP=URPP*BSL	BSA 1144
1	BNUMF=CB+(WBB(11)*COS(THETA)+(PPP(11)-PAA(11)+UBL-UPR)*SIN(THETA)+UBP*TPHI	BSA 1146
	BDENF=(PAA(11)-PPP(11)-UBL+UPR)*COS(THETA)+WBB(11)*SIN(THETA)	BSA 1148
	IF (BDENF.LE.0.0) GO TO 262	BSA 1150
	FR=BNUMF/BDENF	BSA 1152
	GO TO 260	BSA 1154
252	GO TO (254,258,256), ICASE	BSA 1156
254	THETA=0.0	BSA 1158
	BNUMF=CB+WBB(11)*TPHI	BSA 1160
	BDENF=PAA(11)-PPP(11)	BSA 1162
	IF (BDENF.LE.0.0) GO TO 262	BSA 1164
	FR=BNUMF/BDENF	BSA 1166
	GO TO 260	BSA 1168
256	THETA=0.0	BSA 1170
	UBP=URPP*BSL	BSA 1172
	BNUMF=CB+(WBB(11))*TPHI-UBP*TPHI	BSA 1174
	BDENF=PAA(11)-PPP(11)-UBL+UPR	BSA 1176
	IF (BDENF.LE.0.0) GO TO 262	BSA 1178
	FR=BNUMF/BDENF	BSA 1180
	GO TO 260	BSA 1182
258	THETA=0.0	BSA 1184
	BETA2=ATAN(SB(2,1))	BSA 1186
	UBP=URPP*BSL	BSA 1188
	BNUMF=CB+((PAA(11)-PPP(11)-URL+UPR)*SIN(THETA)+WBB(11)*COS(THETA)+UBP*TPHI	BSA 1190
	BDENF=-WBB(11)*SIN(THETA)+(PAA(11)-PPP(11)-URL+UPR)*COS(THETA)	BSA 1192
	IF (BDENF.LE.0.0) GO TO 262	BSA 1194
	FR=BNUMF/BDENF	BSA 1196
	GO TO 260	BSA 1198
258	THETA=0.0	BSA 1200
	BETA2=ATAN(SB(2,1))	BSA 1202
	UBP=URPP*BSL	BSA 1204
	BNUMF=CB+((PAA(11)-PPP(11)-URL+UPR)*SIN(THETA)+WBB(11)*COS(THETA)+UBP*TPHI	BSA 1206
	BDENF=-WBB(11)*SIN(THETA)+(PAA(11)-PPP(11)-URL+UPR)*COS(THETA)	BSA 1208
	IF (BDENF.LE.0.0) GO TO 262	BSA 1210
	FR=BNUMF/BDENF	BSA 1212
	GO TO 260	BSA 1214

	BNUMF=CB+(WBB(11)+UBH*COS(BETA2))*TPHI-UBP*TPHI	BSA 1202
	BDENF=PAA(11)-PPP(11)-UBL+UBR-UBH*SIN(BETA2)	BSA 1204
	IF (BDENF.LE.0.0) GO TO 262	BSA 1206
	FB=BNUMF/BDENF	BSA 1208
260	WRITE (6,360) FB,11	BSA 1210
	WRITE (6,292)	BSA 1212
	WRITE (6,362)	BSA 1214
	WRITE (6,290)	BSA 1216
	WRITE (6,292)	BSA 1218
	GO TO 264	BSA 1220
262	WRITE (6,364) 11	BSA 1222
	WRITE (6,290)	BSA 1224
	WRITE (6,292)	BSA 1226
	WRITE (6,362)	BSA 1228
	WRITE (6,290)	BSA 1230
264	CONTINUE	BSA 1232
	WRITE (6,366)	BSA 1234
	GO TO 102	BSA 1236
		BSA 1238
266	FORMAT (1H1)	BSA 1240
268	FORMAT (10A6)	BSA 1242
270	FORMAT (5I2,4F10.3,12)	BSA 1244
272	FORMAT (4F10.3,12)	BSA 1246
274	FORMAT (3F10.3)	BSA 1248
276	FORMAT (3F10.3)	BSA 1250
278	FORMAT (3F10.3)	BSA 1252
280	FORMAT (12)	BSA 1254
282	FORMAT (4F10.3)	BSA 1256
284	FORMAT (4F10.3)	BSA 1258
286	FORMAT (10X,10A6////)	BSA 1260
288	FORMAT (5X, 50HINPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS,	BSA 1262
	1/)	BSA 1264
290	FORMAT (10X, 52H*****BSA 1266	
	1**)	BSA 1268
292	FORMAT (////)	BSA 1270
294	FORMAT (10X, 44HCONTROL INFORMATION FOR PROGRAM COMPUTATIONS,/,10XBSA 1272	
	1, 46H*****BSA 1274	
	2L NUMBE OF SOIL PROFILES-----,15/,15X, 40HTOTAL NUMBER OF TOPBSA 1276	
	3 BOUNDARIES-----,15/,15X, 47HTOTAL NUMBER OF SOIL TYPE-----BSA 1278	
	4-----,15/,15X, 64HTOTAL NUMBER OF UNIF. LOAD ON ACT. WEBSA 1280	
	5DGE-----,15/,15X, 64HTOTAL NUMBER OF UNIF. LOAD BSA 1282	
	6ON PAS. WEDGE -----,15/,15X, 46HX- COORDINATE OFPSA 1284	
	7 TOF-----,F10.3/,15X, 48HY- COORDINATE OF TOEBSA 1286	
	8-----,F10.3/,15X, 51HX - COORDINATE OF CRESBSA 1288	
	9T-----,F10.3/,15X, 41HY- COORDINATE OF CRESBSA 1290	
	*T-----,F10.3/,15X, 38HIPRINT CODE FOR PRINTOUT-----BSA 1292	
	*-----,15//)	BSA 1294
296	FORMAT (5X, 78HSOIL PROFILE , GEOMETRIC BOUNDARIES OF SLOPE , SPSA 1296	
	10IL TYPE BELOW THE BOUNDARY,//)	BSA 1298
298	FORMAT (2X, 78BOND NO,5X, 14HX- COORDINATE ,5X, 14HY- COORDINATE BSA 1300	
	1,5X, 13HX- COORDINATE,5X, 14HY- COORDINATE ,5X, 15HSOIL TYPE BELOWBSA 1302	
	2,//)	BSA 1304
300	FORMAT (5X,12,8X,F10.3,10X,F10.3,10X,F10.3,10X,F10.3,12X,12)	BSA 1306
302	FORMAT (10X, 24HNUMBER OF SOIL TYPES----,5X,12//)	BSA 1308
304	FORMAT (5X, 12HSOIL TYPE(1),10X, RHGAMMA(1),10X, 12HCOHESION(1) ,BSA 1310	
	110X, 31HANGLE OF INTERNAL FRICTION (1),//)	BSA 1312
306	FORMAT (8X,12,15X,F10.3,15X,F10.3,15X,F10.3)	BSA 1314
308	FORMAT (10X, 30HNUMBER OF UNIF. LOAD ON ACT . WEDGE----,5X,12//)	BSA 1316
310	FORMAT (10X, 11HNO. OF LOAD,5X, 17HINTENSITY OF LOAD,5X, 14HLEFT XBSA 1318	
	1- COORD ,5X, 15HRIGHT X- COORD ,//)	BSA 1320
312	FORMAT (10X,12,15X,F10.3,15X,F10.3,15X,F10.3)	BSA 1322

314	FORMAT (10X, 40HNUMBER OF UNIF. LOAD ON PAS. WEDGE----	,5X,(2//) BSA	1324
316	FORMAT (10X, 96HPROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BFTWPSA		1326
	1FFN TOP OF SLIDING BLOCK -----IK ALWAYS =	,12) BSA	1328
318	FORMAT (10X, 49HTOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED	,BSA	1330
	112)	BSA	1332
320	FORMAT (2X, 3HNO.,10X, 12HLEFT X- COOD,9X, 13HLEFT Y- COOD ,9X, 13H		1334
	13HRIGHT X-COOD ,9X, 14HRIGHT Y- COOD ,//)	BSA	1336
322	FORMAT (2X,12,5X,F10.3,15X,F10.3,15X,F10.3,15X,F10.3)	BSA	1338
324	FORMAT (15X, 49HDATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE)	BSA	1340
326	FORMAT (5X, 70HLEFT X COORD. LEFT Y COORD. RIGHT X COORD.	BSA	1342
	1 RIGHT Y COORD.)	BSA	1344
328	FORMAT (5X,4F15.3)	BSA	1346
330	FORMAT (15X, 43HBOUNDARY OUT OF ACTIVE AND PASSIVE WEDGES ,15/)	BSA	1348
332	FORMAT (15X, 51HNUMBER OF BOUNDARY -----	--BSA	1350
	1--15/,15X, 39HSOIL TYPE CODE BELOW THIS BOUNDARY-----	,15/,15X, 40HBSA	1352
	2SLOPE OF THIS BOUNDARY WITH X AXIS-----	,E15.5/,15X, 40HINTERCEPT BSA	1354
	3OF THIS BOUND. WITH Y AXIS----	,F15.5/,15X, 64HX- COORDINATE OF INTERS	1356
	4RSSECTION OF ACT. SUR. AND THIS BOUNDARY ---	,F15.5/,15X, 56HY COORD	BSA 1358
	5DINATE OF INTERSECTION SUR. AND THIS BOUNDARY ---	,F15.5/,15X, 68HBSA	1360
	6X COORDINATE OF INTERSECTION OF PAS. SLIP SUR. AND THIS BOUNDARY	--BSA	1362
	7--F15.5/,15X, 68HY COORDINATE OF INTERSECTION OF PAS. SLIP SUR.	ARSA	1364
	8ND THIS BOUNDARY ---,F15.5///)	BSA	1366
334	FORMAT (10X, 25HPOSITION OF WATER SURFACE,10X, 8HICASE=	,15) BSA	1368
336	FORMAT (12)	BSA	1370
338	FORMAT (7F10.3)	BSA	1372
340	FORMAT (10X, 40HWATER SURFACE DEFINED BY POINTS IN SLOPE)	BSA	1374
342	FORMAT (10X, 12HNO. OF POINT,5X, 8HX-COORD.,5X, 8HY-COORD.)	BSA	1376
344	FORMAT (10X,17,5X,F10.3,5X,F10.3)	BSA	1378
346	FORMAT (15X, 49HDATA FOR LOCATION OF WATER SURFACE ON PAS. WEDGE)	BSA	1380
348	FORMAT (10X, 48HMAXIMUM NUMBER OF BOUNDARY FOR ACTIVE WEDGE ----	,1BSA	1382
	15/,10X, 48HMINIMUM NUMBER OF BOUNDARY FOR ACTIVE WEDGE ----	,15///BSA	1384
	2)	BSA	1386
350	FORMAT (10X, 49HMAXIMUM NUMBER OF BOUNDARY FOR PASSIVE WEDGE ----	,BSA	1388
	115/,10X, 49HMINIMUM NUMBER OF BOUNDARY FOR PASSIVE WEDGE ----	,15//BSA	1390
	2//)	BSA	1392
352	FORMAT (10X, 28HINTERSECTION WITH BLOCK AND ,2X,15,2X, 22HBOUND.	OB	BSA 1394
	1N ACT. WEDGEF ,2X, 13HY COORDINATE ,F20.6/)	BSA	1396
354	FORMAT (10X, 28HINTERSECTION WITH BLOCK AND ,2X,15,2X, 22HBOUND.	OP	BSA 1398
	1N PAS. WEDGEF ,2X, 13HY COORDINATE ,F20.6/)	BSA	1400
356	FORMAT (15X, 22HNO. OF BOUNDARY -----	,15/,15X, 39H	BSA 1402
	1RFLOW THIS BOUNDARY ----	,15/,15X, 42HUNIT WEIGHT OF SOIL BELOW THIS	BSA 1404
	2S BOUNDARY --,F10.3/,15X, 39HCOHESION OF SOIL BELOW THIS BOUNDARY	BSA	1406
	3--F10.3/,15X, 40HANGLE OF FRICTION BELOW THIS BOUNDARY --	,F10.3/,BSA	1408
	415X, 28HHORIZONTAL WIDTH OF BLOCK --,F10.3/,15X, 28HSLOPING LENGTH	BSA	1410
	5 OF BLOCK ----,F10.3/,15X, 43HTOTAL COHESION FORCE AT BOTTOM OF	BL	BSA 1412
	6OCK ----,F10.2/,15X, 38HWEIGHT OF BLOCK BELOW THIS BOUNDARY --	,F20.BSA	1414
	76//)	BSA	1416
358	FORMAT (15X, 26HNO. OF SLIDING SURFACE ----	,15/,15X, 34HTOTAL ACTIVE	BSA 1418
	1F PRESSURE ON BLOCK ---,F20.6//,15X, 34HTOTAL PASSIVE PRESSUPE ON	BSA	1420
	2BLOCK --,F20.6//,15X, 25HTOTAL WEIGHT OF BLOCK ---,F20.6//,15X, 45BSA		1422
	3HCOHESIVE RESISTANCE ONTHE BOTTOM OF BLOCK ---,F20.6///)	BSA	1424
360	FORMAT (10X, 44HFACTOR OF SAFETY AGAINST SLIDING OF BLOCK =,F8.2,BSA		1426
	12X, 15HFOR SURFACE ,15///)	BSA	1428
362	FORMAT (10X, 40HEND OF CALCULATION --- START NEW SURFACE)	BSA	1430
364	FORMAT (10X, 57HINPRACTICABLE COMBINATION OF PROBLEM FOR SURFACE	BSA	1432
	1 ,15/)	BSA	1434
366	FORMAT (10X, 42HSTART OF NEW PROBLEM WITH NEW DATA*****)	BSA	1436
		BSA	1438
		BSA	1440

SUBROUTINE ACTT1		AC1	2
COMMON NBND,NTOP,NSOIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,II,BNDSAC1		AC1	4
1(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),QA(5),XQAL(5),XQAAC1		AC1	6
2R(5),SW,CW,PSW,PCW,QP(5),XQPL(5),XQPR(5),XSURFL(10),YSURFL(10),XSUAC1		AC1	8
3RFR(10),YSURFR(10),SB(12,2),RBNDS(12,6),IRBND(12,1),SSAA(12),SSAP(AC1		AC1	10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPAC1		AC1	12
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),PAA(10),PPP(10),BKRAC1		AC1	14
6Y(12),BKLY(12)		AC1	16
DIMENSION YA(12,10), XLA(10), AA(10), BB(10), CA(10), WA(10,12), BAC1		AC1	18
1A(10), QAA(10), PA(10)		AC1	20
DATA PI/3.14159265/		AC1	22
DATA GAMW/62.4/		AC1	24
DO 102 M=MINA,MAXA		AC1	26
K=1		AC1	28
YA(M,K)=XSURFR(II)*SAP(M,1)+SAP(M,2)		AC1	30
BKRY(M)=YA(M,K)		AC1	32
102	CONTINUE	AC1	34
DO 108 M=MINA,MAXA		AC1	36
XXA=SSA(M,1)		AC1	38
KK=M-MINA+2		AC1	40
DO 106 N=MINA,MAXA		AC1	42
YYA=XXA*SAP(N,1)+SAP(N,2)		AC1	44
IF (N.LT.KK) GO TO 104		AC1	46
YA(N,KK)=YYA		AC1	48
GO TO 106		AC1	50
104	YA(N,KK)=SSA(KK+1,2)	AC1	52
106	CONTINUE	AC1	54
108	CONTINUE	AC1	56
PAA(II)=0.0		AC1	58
IMAX=MAXA-MINA+2		AC1	60
NAWD=IMAX-1		AC1	62
DO 112 I=1,NAWD		AC1	64
PA(I)=0.0		AC1	66
OAA(I)=0.0		AC1	68
AA(I)=0.0		AC1	70
BB(I)=0.0		AC1	72
RA(I)=0.0		AC1	74
CA(I)=0.0		AC1	76
XLA(I)=0.0		AC1	78
DO 110 M=MINA,MAXA		AC1	80
WA(I,M)=0.0		AC1	82
110	CONTINUE	AC1	84
112	CONTINUE	AC1	86
DO 164 I=1,NAWD		AC1	88
DO 162 M=MINA,MAXA		AC1	90
MA=ISAP(M+1,1)		AC1	92
MR=ISAP(M,1)		AC1	94
K=M-MINA+2		AC1	96
IF (I.EQ.1.AND.M.EQ.MINA) GO TO 114		AC1	98
IF (I.EQ.1) GO TO 116		AC1	100
IF (K.LT.1) GO TO 142		AC1	102
IF (K.EQ.1) GO TO 134		AC1	104
GO TO 136		AC1	106
114	XLA(I)=SQRT((SSA(M,1)-XSURFR(II))*2+(SSA(M,2)-YSURFR(II))*AC1	AC1	108
1	2)	AC1	110
CA(I)=XLA(I)*C(MB)		AC1	112
WA(I,M)=(SSA(M,1)-XSURFR(II))*(YA(M,1)-YSURFR(II))*0.5*GAMMAAC1		AC1	114
1	(MR)	AC1	116
AA(I)=TAN(PI/4.0-PHI(MB)/2.0)		AC1	118
BB(I)=COS(PI/4.0+PHI(MB)/2.0)		AC1	120
GO TO 162		AC1	122

116	RA(I)=SSA(MINA,1)-XSURFR(I1)	AC1	124
1	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,1)+YA(M,2)-YA(M-1,1)-YA(M-1,2))+WA(I,M-1)	AC1	126
	IF (I.EQ.1.AND.M.EQ.MAXA) GO TO 118	AC1	128
	GO TO 162	AC1	130
118	IF (NUFA.EQ.0) GO TO 132	AC1	132
	DO 130 KK=1,NUFA	AC1	134
	FA=0.0	AC1	136
	FA=0.0	AC1	138
	DA=0.0	AC1	140
	IF (QA(KK).EQ.0.0) GO TO 126	AC1	142
	IF (XQAL(KK).GT.SSA(MINA,1)) GO TO 126	AC1	144
	IF (XQAR(KK).LT.SSA(MINA,1)) GO TO 120	AC1	146
	GO TO 122	AC1	148
120	FA=SSA(MINA,1)-XQAR(KK)	AC1	150
	GO TO 124	AC1	152
122	FA=0.0	AC1	154
124	IF (XQAL(KK).GT.XSURFR(I1)) DA=XQAL(KK)-XSURFR(I1)	AC1	156
	EA=BA(I)-(FA+DA)	AC1	158
	QAA(I)=QAA(I)+EA*QA(KK)	AC1	160
	GO TO 128	AC1	162
126	QAA(I)=0.0	AC1	164
	WA(I,M)=WA(I,M)+QAA(I)	AC1	166
128	CONTINUE	AC1	168
130	PA(I)=WA(I,M)*AA(I)-2.0*CA(I)*RR(I)	AC1	170
132	GO TO 162	AC1	172
134	IF (I.EQ.NAWD) GO TO 138	AC1	174
	XLA(I)=SQRT((SSA(M+1,1)-SSA(M,1))*2+(SSA(M+1,2)-SSA(M,2))*2)	AC1	176
1	2)	AC1	178
	CA(I)=XLA(I)*C(MA)	AC1	180
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC1	182
	RR(I)=COS(PI/4.0+PHI(MA)/2.0)	AC1	184
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC1	186
	XRAA=SSA(M+1,1)	AC1	188
	XLAA=SSA(M,1)	AC1	190
	GO TO 142	AC1	192
136	IF (I.EQ.NAWD) GO TO 140	AC1	194
	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,1)+YA(M,1+1)-YA(M-1,1)-YA(M-1,1+1))+WA(I,M-1)	AC1	196
1	IF (M.EQ.MAXA) GO TO 144	AC1	198
	GO TO 162	AC1	200
138	IF (I.EQ.NAWD.AND.I.NE.K) GO TO 140	AC1	202
	XLA(I)=SQRT((SSA(M+1,1)-SSA(M,1))*2+(SSA(M+1,2)-SSA(M,2))*2)	AC1	204
1	2)	AC1	206
	CA(I)=XLA(I)*C(MA)	AC1	208
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC1	210
	RR(I)=COS(PI/4.0+PHI(MA)/2.0)	AC1	212
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC1	214
	XRAA=SSA(M+1,1)	AC1	216
	XLAA=SSA(M,1)	AC1	218
	GO TO 142	AC1	220
140	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,1)-YA(M-1,1))	AC1	222
	IF (M.EQ.MAXA) GO TO 144	AC1	224
	GO TO 162	AC1	226
142	WA(I,M)=0.0	AC1	228
	GO TO 162	AC1	230
144	IF (NUFA.EQ.0) GO TO 160	AC1	232
	DO 158 KK=1,NUFA	AC1	234
	DA=0.0	AC1	236
	FA=0.0	AC1	238
	FA=0.0	AC1	240
	FA=0.0	AC1	242
	FA=0.0	AC1	244

	IF (QA(KK).EQ.0.0) GO TO 154	AC1 246
	IF (XQAR(KK).LT.XLAA) GO TO 154	AC1 248
	IF (XQAL(KK).GT.XRAA) GO TO 154	AC1 250
	IF (XQAL(KK).GT.XLAA) GO TO 146	AC1 252
	GO TO 148	AC1 254
146	DA=XQAL(KK)-XLAA	AC1 256
148	IF (XQAR(KK).GT.XRAA) GO TO 150	AC1 258
	FA=XRAA-XQAR(KK)	AC1 260
	GO TO 152	AC1 262
150	FA=0.0	AC1 264
152	EA=BA(I)-(FA+DA)	AC1 266
	QAA(I)=QAA(I)+EA*QA(KK)	AC1 268
	GO TO 156	AC1 270
154	QAA(I)=0.0	AC1 272
156	WA(I,M)=WA(I,M)+QAA(I)	AC1 274
158	CONTINUE	AC1 276
160	PA(I)=WA(1,M)*AA(I)-2.0*CA(I)*BB(I)	AC1 278
162	CONTINUE	AC1 280
	PAA(II)=PAA(II)+PA(I)	AC1 282
164	CONTINUE	AC1 284
	RETURN	AC1 286
		AC1 288
	END	AC1 290

SUBROUTINE PASS1		PA1	2
COMMON NBND,NTOP,NSOIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,11,BNDSPA1		PA1	4
1(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),QA(5),XQAL(5),XQAPA1		PA1	6
2R(5),SW,CW,PSW,PCW,QP(5),XQPL(5),XQPR(5),XSURFL(10),YSURFL(10),XSUPA1		PA1	8
3RFR(10),YSURFR(10),SB(12,2),RBND(12,6),IRBND(12,1),SSAA(12),SSAP(PA1		PA1	10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPPA1		PA1	12
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),PAA(10),PPP(10),BKRPAA1		PA1	14
6Y(12),BKLY(12)		PA1	16
DIMENSION YP(12,10), XLP(10), AP(10), BP(10), AB(10), CP(10), WP(1PA1		PA1	18
10,12), QPP(10), PP(10)		PA1	20
DATA PI/3.14159265/		PA1	22
DATA GAMW/62.4/		PA1	24
IMP=MAXP-1		PA1	26
INP=IMP-1		PA1	28
DO 104 M=MINP,MAXP		PA1	30
K=1		PA1	32
IF (M.EQ.IMP) GO TO 102		PA1	34
IF (M.EQ.INP) GO TO 102		PA1	36
YP(M,K)=XSURFL(11)*SAP(M,1)+SAP(M,2)		PA1	38
BKLY(M)=YP(M,K)		PA1	40
GO TO 104		PA1	42
102	YP(M,K)=0.0	PA1	44
BKLY(M)=YP(M,K)		PA1	46
104 CONTINUE		PA1	48
DO 116 M=MINP,MAXP		PA1	50
XXP=SSP(M,1)		PA1	52
IF (M.EQ.IMP) GO TO 116		PA1	54
IF (M.EQ.INP) GO TO 116		PA1	56
IF (M.EQ.MAXP) GO TO 106		PA1	58
KK=M-MINP+2		PA1	60
GO TO 108		PA1	62
106	KK=M-MINP	PA1	64
108 DO 114 N=MINP,MAXP		PA1	66
IF (M.EQ.MAXP) GO TO 110		PA1	68
YYP=XXP*SAP(N,1)+SAP(N,2)		PA1	70
IF (N.LT.KK) GO TO 112		PA1	72
YP(N,KK)=YYP		PA1	74
GO TO 114		PA1	76
110	YP(N,KK)=SSP(MAXP,2)	PA1	78
GO TO 114		PA1	80
112 YP(N,KK)=SSP(KK+1,2)		PA1	82
114 CONTINUE		PA1	84
116 CONTINUE		PA1	86
PPP(11)=0.0		PA1	88
IMAX=MAXP-MINP		PA1	90
NPWD=IMAX-1		PA1	92
DO 120 I=1,NPWD		PA1	94
XLP(I)=0.0		PA1	96
CP(I)=0.0		PA1	98
AP(I)=0.0		PA1	100
BP(I)=0.0		PA1	102
AB(I)=0.0		PA1	104
QPP(I)=0.0		PA1	106
PP(I)=0.0		PA1	108
DO 118 M=MINP,MAXP		PA1	110
WP(I,M)=0.0		PA1	112
118 CONTINUE		PA1	114
120 CONTINUE		PA1	116
DO 174 I=1,NPWD		PA1	118
DO 172 M=MINP,MAXP		PA1	120
MR=ISAP(M,1)		PA1	122

	MA=ISAP(M+1,1)	PA1 124
	IF (M.EQ.INP) GO TO 154	PA1 126
	IF (M.EQ.IMP) GO TO 154	PA1 128
	K=M-MINP+2	PA1 130
	IF (I.EQ.1.AND.M.EQ.MINP) GO TO 122	PA1 132
	IF (I.EQ.1) GO TO 124	PA1 134
	IF (K.LT.1) GO TO 154	PA1 136
	IF (K.EQ.1) GO TO 144	PA1 138
	GO TO 146	PA1 140
122	XLP(I)=SQRT((SSP(M,1)-XSURFL(I1))*2+(SSP(M,2)-YSURFL(I1))*2)	PA1 142
1	2)	PA1 144
	CP(I)=XLP(I)*C(MB)	PA1 146
	WP(I,M)=0.5*GAMMA(MB)*(XSURFL(I1)-SSP(M,1))*(YP(M,1)-YSURFL(I1))	PA1 148
1	I1))	PA1 150
	AP(I)=TAN(PI/4.0+PHI(MB)/2.0)	PA1 152
	BP(I)=COS(PI/4.0-PHI(MB)/2.0)	PA1 154
	GO TO 172	PA1 156
124	AB(I)=XSURFL(I1)-SSP(MINP,1)	PA1 158
	IF (M.EQ.MAXP) GO TO 126	PA1 160
1	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,1)+YP(M,2)-YP(M-1,1)-YP(M-1,2))+WP(I,M-1)	PA1 162
	GO TO 172	PA1 164
126	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,1)+YP(M,2)-YP(M-3,1)-YP(M-3,2))+WP(I,M-3)	PA1 166
1	IF (NUFP.EQ.0) GO TO 142	PA1 168
	DO 140 KK=1,NUFP	PA1 170
	FP=0.0	PA1 172
	FP=0.0	PA1 174
	OP=0.0	PA1 176
	IF (QP(KK).EQ.0.0) GO TO 136	PA1 178
	IF (XQPR(KK).LT.SSP(MINP,1)) GO TO 136	PA1 180
	IF (XQPL(KK).GT.SSP(MINP,1)) GO TO 128	PA1 182
	GO TO 130	PA1 184
128	DP=XQPL(KK)-SSP(MINP,1)	PA1 186
130	IF (XQPR(KK).GT.XSURFL(I1)) GO TO 132	PA1 188
	FP=XSURFL(I1)-XQPR(KK)	PA1 190
	GO TO 134	PA1 192
132	FP=0.0	PA1 194
134	FP=AB(I)-(FP+DP)	PA1 196
	QPP(I)=QPP(I)+FP*QP(KK)	PA1 198
	GO TO 138	PA1 200
136	QPP(I)=0.0	PA1 202
138	WP(I,M)=WP(I,M)+OPP(I)	PA1 204
140	CONTINUE	PA1 206
142	PP(I)=WP(I,M)*AP(I)+2.0*CP(I)*BP(I)	PA1 208
	GO TO 172	PA1 210
144	IF (I.EQ.NPWD) GO TO 150	PA1 212
1	XLP(I)=SQRT((SSP(M+1,1)-SSP(M,1))*2+(SSP(M+1,2)-SSP(M,2))*2)	PA1 214
	2)	PA1 216
	CP(I)=XLP(I)*C(MA)	PA1 218
	AP(I)=TAN(PI/4.0+PHI(MA)/2.0)	PA1 220
	BP(I)=COS(PI/4.0-PHI(MA)/2.0)	PA1 222
	XLPP=SSP(M+1,1)	PA1 224
	XRPP=SSP(M,1)	PA1 226
	AB(I)=XRPP-XLPP	PA1 228
	GO TO 154	PA1 230
146	IF (I.EQ.NPWD) GO TO 152	PA1 232
	IF (M.EQ.MAXP) GO TO 148	PA1 234
1	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,I)+YP(M,I+1)-YP(M-1,I)-YP(M-1,I+1))+WP(I,M-1)	PA1 236
	IF (M.EQ.MAXP) GO TO 156	PA1 238
		PA1 240
		PA1 242
		PA1 244

	GO TO 172	PA1 246
148	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,I)+YP(M,I+1)-YP(M-3,I)-YP(M-3,I+1))+WP(I,M-3)	PA1 248
1	IF (M.EQ.MAXP) GO TO 156	PA1 250
	GO TO 172	PA1 252
150	XLP(I)=SQRT((SSP(M+3,1)-SSP(M,1))**2+(SSP(M+3,2)-SSP(M,2))**2)	PA1 254
1	CP(I)=XLP(I)*C(MA)	PA1 256
	AP(I)=TAN(P/4.0+PHI(MA)/2.0)	PA1 258
	BP(I)=COS(P/4.0-PHI(MA)/2.0)	PA1 260
	AB(I)=SSP(M,1)-SSP(M+3,1)	PA1 262
	XLPP=SSP(MAXP,1)	PA1 264
	XRPP=SSP(MAXP-3,1)	PA1 266
	GO TO 154	PA1 268
152	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,I)-YP(M-3,I))+WP(I,M-3)	PA1 270
	IF (M.EQ.MAXP) GO TO 156	PA1 272
	GO TO 172	PA1 274
154	WP(I,M)=0.0	PA1 276
	GO TO 172	PA1 278
156	IF (NUFP.EQ.0) GO TO 170	PA1 280
	DO 168 KK=1,NUFP	PA1 282
	FP=0.0	PA1 284
	DP=0.0	PA1 286
	EP=0.0	PA1 288
	IF (QP(KK).EQ.0.0) GO TO 166	PA1 290
	IF (XQPR(KK).LT.XLPP) GO TO 166	PA1 292
	IF (XQPL(KK).GT.XRPP) GO TO 158	PA1 294
	IF (XQPL(KK).GT.XLPP) GO TO 158	PA1 296
	GO TO 160	PA1 298
158	DP=XQPL(KK)-XLPP	PA1 300
160	IF (XQPR(KK).GT.XRPP) GO TO 162	PA1 302
	FP=XRPP-XQPR(KK)	PA1 304
	GO TO 164	PA1 306
162	FP=0.0	PA1 308
164	FP=AB(I)-(FP+DP)	PA1 310
	QPP(I)=QPP(I)+FP*QP(KK)	PA1 312
166	WP(I,M)=WP(I,M-3)+QPP(I)	PA1 314
168	CONTINUE	PA1 316
170	PP(I)=WP(I,M)*AP(I)+2.0*CP(I)*BP(I)	PA1 318
172	CONTINUE	PA1 320
	PPP(I)=PPP(I)+PP(I)	PA1 322
174	CONTINUE	PA1 324
	RETURN	PA1 326
		PA1 328
		PA1 330
		PA1 332
		PA1 334
	FND	

SUBROUTINE ACTT2	AC2	2
COMMON NBND,NTOP,NSOIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,11,BNDSAC2		4
1(12,4),1TP(12),GAMMA(10),C(10),PHI(10),TITLE(10),QA(5),XQAL(5),XQAAC2		6
2R(5),SW,CW,PCW,PCW,QP(5),XQPL(5),XQPR(5),XSURFL(10),XSUAC2		8
3RFR(10),YSURFR(10),SS(12,2),RENLS(12,6),IREND(12,1),SSAA(12),SSAP(AC2		10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPAC2		12
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),PAA(10),PPP(10),BKRAC2		14
6Y(12),BKLY(12)	AC2	16
DIMENSION YA(12,10),XLA(10),AA(10),BB(10),CA(10),WA(10,12),BAC2		18
1A(10),QAA(10),PA(10),YWA(10),BB1(10),BB2(10),BBL(10),BBR(10)AC2		20
2),BSA(10),XWA(10)	AC2	22
DATA PI/3,14159265/	AC2	24
DATA GAMW/62.4/	AC2	26
DO 102 M=MINA,MAXA	AC2	28
K=1	AC2	30
YA(M,K)=XSURFR(11)*SAP(M,1)+SAP(M,2)	AC2	32
BKRY(M)=YA(M,K)	AC2	34
YWA(K)=XSURFR(11)*SW+CW	AC2	36
XWA(K)=XSURFR(11)	AC2	38
102 CONTINUE	AC2	40
DO 108 M=MINA,MAXA	AC2	42
XXA=SSA(M,1)	AC2	44
KK=M-MINA+2	AC2	46
DO 106 N=MINA,MAXA	AC2	48
YYA=XXA*SAP(N,1)+SAP(N,2)	AC2	50
IF (N,LT,KK) GO TO 104	AC2	52
YA(N,KK)=YYA	AC2	54
GO TO 106	AC2	56
104 YA(N,KK)=SSA(KK+1,2)	AC2	58
106 CONTINUE	AC2	60
108 CONTINUE	AC2	62
IWMAX=MAXA-1	AC2	64
DO 110 M=MINA,IWMAX	AC2	66
XXA=SSA(M,1)	AC2	68
KK=M-MINA+2	AC2	70
YWA(KK)=XXA*SW+CW	AC2	72
XWA(KK)=XXA	AC2	74
110 CONTINUE	AC2	76
MX=ISAP(MAXA,1)	AC2	78
INTP=MAXA-MINA+2	AC2	80
XM=TAN(PI/4.0+0.5*PHI(MX))	AC2	82
XWA(INTR)=(CW+XM*SSA(IWMAX,1)-SSA(IWMAX,2))/(XM-SW)	AC2	84
YWA(INTR)=SW*((CW+XM*SSA(IWMAX,1)-SSA(IWMAX,2))/(XM-SW))+CW	AC2	86
IF (YWA(INTR).GT.SSA(MAXA,2)) CALL EXIT	AC2	88
PAA(11)=0.0	AC2	90
IMAX=MAXA-MINA+2	AC2	92
NAWD=IMAX-1	AC2	94
DO 114 I=1,NAWD	AC2	96
PA(I)=0.0	AC2	98
QAA(I)=0.0	AC2	100
AA(I)=0.0	AC2	102
BB(I)=0.0	AC2	104
BA(I)=0.0	AC2	106
CA(I)=0.0	AC2	108
XLA(I)=0.0	AC2	110
BB1(I)=0.0	AC2	112
BB2(I)=0.0	AC2	114
BBL(I)=0.0	AC2	116
BBR(I)=0.0	AC2	118
BBA(I)=0.0	AC2	120
DO 112 M=MINA,MAXA	AC2	122

	WA(I,M)=0.0	AC2	124
112	CONTINUE	AC2	126
114	CONTINUE	AC2	128
	DO 166 I=1,NAWD	AC2	130
	DO 164 M=MINA,MAXA	AC2	132
	MA=ISAP(M+1,1)	AC2	134
	MR=ISAP(M,1)	AC2	136
	K=M-MINA+2	AC2	138
	IF (I.EQ.1.AND.M.EQ.MINA) GO TO 116	AC2	140
	IF (I.EQ.1) GO TO 118	AC2	142
	IF (K.LT.1) GO TO 144	AC2	144
	IF (K.EQ.1) GO TO 136	AC2	146
	GO TO 138	AC2	148
116	XLA(I)=SQRT((SSA(M,1)-XSURFR(I))**2+(SSA(M,2)-YSURFR(I))**2)	AC2	150
1	2)	AC2	152
	CA(I)=XLA(I)*C(MB)	AC2	154
	WA(I,M)=(SSA(M,1)-XSURFR(I))*(YA(M,1)-YSURFR(I))*0.5*GAMMA	AC2	156
1	(MR)	AC2	158
	AA(I)=TAN(PI/4.0-PHI(MB)/2.0)	AC2	160
	BB(I)=COS(PI/4.0+PHI(MB)/2.0)	AC2	162
	BB1(I)=COS(PI/4.0-PHI(MB)/2.0)	AC2	164
	BB2(I)=SIN(PI/4.0-PHI(MB)/2.0)	AC2	166
	BBL(I)=YWA(I)-YSURFR(I)	AC2	168
	BBR(I)=YWA(K)-SSA(M,2)	AC2	170
	BBA(I)=(BBL(I)+BBR(I))*0.5	AC2	172
	GO TO 164	AC2	174
118	BA(I)=SSA(MINA,1)-XSURFR(I)	AC2	176
	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,1)+YA(M,2)-YA(M-1,1)-YA(M-1,2))+WA(I,M-1)	AC2	178
1	1,2))+WA(I,M-1)	AC2	180
	IF (I.EQ.1.AND.M.EQ.MAXA) GO TO 120	AC2	182
	GO TO 164	AC2	184
120	IF (NUFA.EQ.0) GO TO 134	AC2	186
	DO 132 KK=1,NUFA	AC2	188
	FA=0.0	AC2	190
	FA=0.0	AC2	192
	DA=0.0	AC2	194
	IF (QA(KK).EQ.0.0) GO TO 128	AC2	196
	IF (XQAL(KK).GT.SSA(MINA,1)) GO TO 128	AC2	198
	IF (XQAR(KK).LT.SSA(MINA,1)) GO TO 122	AC2	200
	GO TO 124	AC2	202
122	FA=SSA(MINA,1)-XQAR(KK)	AC2	204
	GO TO 126	AC2	206
124	FA=0.0	AC2	208
126	IF (XQAL(KK).GT.XSURFR(I)) DA=XQAL(KK)-XSURFR(I)	AC2	210
	FA=BA(I)-(FA+DA)	AC2	212
	QAA(I)=QAA(I)+FA*QA(KK)	AC2	214
	GO TO 130	AC2	216
128	QAA(I)=0.0	AC2	218
130	WA(I,M)=WA(I,M)+QAA(I)	AC2	220
132	CONTINUE	AC2	222
134	PA(I)=WA(I,M)*AA(I)-2.0*CA(I)*BB(I)+0.5*GAMW*(BBR(I)**2-BBL(I)**2)+BBA(I)*(BB1(I)-AA(I)*BB2(I))*XLA(I)*GAMW	AC2	224
1	I)**2)+BBA(I)*(BB1(I)-AA(I)*BB2(I))*XLA(I)*GAMW	AC2	226
	GO TO 164	AC2	228
136	IF (I.EQ.NAWD) GO TO 140	AC2	230
	XLA(I)=SQRT((SSA(M+1,1)-SSA(M,1))**2+(SSA(M+1,2)-SSA(M,2))**2)	AC2	232
1	2)	AC2	234
	CA(I)=XLA(I)*C(MA)	AC2	236
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC2	238
	BB(I)=COS(PI/4.0+PHI(MA)/2.0)	AC2	240
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC2	242
	XRAA=SSA(M+1,1)	AC2	244

	XLAA=SSA(M,1)	AC2 246
	BR1(I)=COS(PI/4.0-PHI(MB)/2.0)	AC2 248
	BR2(I)=SIN(PI/4.0-PHI(MB)/2.0)	AC2 250
	BRL(I)=YWA(K)-SSA(M,2)	AC2 252
	BBR(I)=YWA(K+1)-SSA(M+1,2)	AC2 254
	BBA(I)=(BBL(I)+BBR(I))*0.5	AC2 256
	GO TO 144	AC2 258
138	IF (I.EQ.NAWD) GO TO 142	AC2 260
	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,I)+YA(M,I+1)-YA(M-1,I)-YA(M-1,I+1))+WA(I,M-1)	AC2 262
I		AC2 264
	IF (M.EQ.MAXA) GO TO 146	AC2 266
	GO TO 164	AC2 268
140	IF (I.EQ.NAWD.AND.I.NE.K) GO TO 142	AC2 270
	XLAI(I)=SQRT((SSA(M+1,1)-SSA(M,1))*2+(SSA(M+1,2)-SSA(M,2))*2)	AC2 272
1		AC2 274
	CA(I)=XLAI(I)*C(MA)	AC2 276
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC2 278
	BR(I)=COS(PI/4.0+PHI(MA)/2.0)	AC2 280
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC2 282
	BR1(I)=COS(PI/4.0-PHI(MA)/2.0)	AC2 284
	BR2(I)=SIN(PI/4.0-PHI(MA)/2.0)	AC2 286
	BBR(I)=0.0	AC2 288
	BRL(I)=YWA(K)-SSA(M,2)	AC2 290
	BBA(I)=BBL(I)/2.0	AC2 292
	XRAA=SSA(M+1,1)	AC2 294
	XLAA=SSA(M,1)	AC2 296
	XLAI(I)=SQRT((YWA(INTR)-SSA(M,2))*2+(XWA(INTR)-SSA(M,1))*2)	AC2 298
	GO TO 144	AC2 300
142	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,I)-YA(M-1,I))	AC2 302
	IF (M.EQ.MAXA) GO TO 146	AC2 304
	GO TO 164	AC2 306
144	WA(I,M)=0.0	AC2 308
	GO TO 164	AC2 310
146	IF (NUFA.EQ.0) GO TO 162	AC2 312
	DO 160 KK=I,NUFA	AC2 314
	DA=0.0	AC2 316
	FA=0.0	AC2 318
	EA=0.0	AC2 320
	IF (QA(KK).EQ.0.0) GO TO 156	AC2 322
	IF (XQAR(KK).LT.XLAA) GO TO 156	AC2 324
	IF (XQAL(KK).GT.XRAA) GO TO 156	AC2 326
	IF (XQAL(KK).GT.XLAA) GO TO 148	AC2 328
	GO TO 150	AC2 330
148	DA=XQAL(KK)-XLAA	AC2 332
150	IF (XQAR(KK).GT.XRAA) GO TO 152	AC2 334
	FA=XRAA-XQAR(KK)	AC2 336
	GO TO 154	AC2 338
152	FA=0.0	AC2 340
154	EA=BA(I)-(FA+DA)	AC2 342
	QAA(I)=QAA(I)+FA*QA(KK)	AC2 344
	GO TO 158	AC2 346
156	QAA(I)=0.0	AC2 348
158	WA(I,M)=WA(I,M)+QAA(I)	AC2 350
160	CONTINUE	AC2 352
162	PA(I)=WA(I,M)*AA(I)-2.0*CA(I)*BB(I)+0.5*GAMW*(BBR(I))*2-BBL(I)	AC2 354
I	I)**2)+BBA(I)*(BB1(I)-AA(I)*BB2(I))*XLAI(I)*GAMW	AC2 356
164	CONTINUE	AC2 358
	PAA(II)=PAA(II)+PA(I)	AC2 360
166	CONTINUE	AC2 362
	RETURN	AC2 364
		AC2 366
	END	AC2 368

SUBROUTINE PASS2	PA2	2
COMMON NRND,NTOP,NSOIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,II,BNDSPA2	PA2	4
1(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),QA(5),XQAL(5),XOAPA2	PA2	6
2R(5),SW,CW,PSW,PCW,OP(5),XQPL(5),XOPR(5),XSURFL(10),YSURFL(10),XSUPA2	PA2	8
3RFR(10),YSURFR(10),SB(12,2),RBND(12,6),IRBND(12,1),SSAA(12),SSAP(PA2	PA2	10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPPA2	PA2	12
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),PAA(10),PPP(10),BKRPA2	PA2	14
6Y(12),BKLY(12)	PA2	16
DIMENSION YP(12,10),XLP(10),AP(10),BP(10),AR(10),CP(10),WP(1PA2	PA2	18
10,12),QPP(10),PP(10),YWP(10),YWH(10),XWH(10),XWP(10),RPL(10PA2	PA2	20
2),RPR(10),ABPA(10),ABPH(10),BBP1(10),BBP2(10),BPH1(10),BPH2PA2	PA2	22
3(10),DLPH(10)	PA2	24
DATA PI/3.14159265/	PA2	26
DATA GAMW/62.4/	PA2	28
IMP=MAXP-1	PA2	30
INP=IMP-1	PA2	32
DO 104 M=MINP,MAXP	PA2	34
K=1	PA2	36
YWP(K)=XSURFL(II)*PSW+PCW	PA2	38
XWP(K)=XSURFL(II)	PA2	40
YWH(K)=XSURFL(II)*SAP(MAXP,1)+SAP(MAXP,2)	PA2	42
XWH(K)=XSURFL(II)	PA2	44
IF (M.EQ.IMP) GO TO 102	PA2	46
IF (M.EQ.INP) GO TO 102	PA2	48
YP(M,K)=XSURFL(II)*SAP(M,1)+SAP(M,2)	PA2	50
BKLY(M)=YP(M,K)	PA2	52
GO TO 104	PA2	54
102 YP(M,K)=0.0	PA2	56
BKLY(M)=YP(M,K)	PA2	58
104 CONTINUE	PA2	60
DO 116 M=MINP,MAXP	PA2	62
XXP=SSP(M,1)	PA2	64
RETA1=ATAN(SAP(MAXP,1))	PA2	66
IF (M.EQ.IMP) GO TO 116	PA2	68
IF (M.EQ.INP) GO TO 116	PA2	70
IF (M.EQ.MAXP) GO TO 106	PA2	72
KK=M-MINP+2	PA2	74
YWP(KK)=XXP*PSW+PCW	PA2	76
XWP(KK)=XXP	PA2	78
YWH(KK)=XXP*SAP(MAXP,1)+SAP(MAXP,2)	PA2	80
XWH(KK)=XXP	PA2	82
GO TO 108	PA2	84
106 KK=M-MINP	PA2	86
YWP(KK)=XXP*PSW+PCW	PA2	88
XWP(KK)=XXP	PA2	90
YWH(KK)=XXP*SAP(MAXP,1)+SAP(MAXP,2)	PA2	92
XWH(KK)=XXP	PA2	94
DO 114 N=MINP,MAXP	PA2	96
IF (M.EQ.MAXP) GO TO 110	PA2	98
YYP=XXP*SAP(N,1)+SAP(N,2)	PA2	100
IF (N.LT.KK) GO TO 112	PA2	102
YP(N,KK)=YYP	PA2	104
GO TO 114	PA2	106
110 YP(N,KK)=SSP(MAXP,2)	PA2	108
GO TO 114	PA2	110
112 YP(N,KK)=SSP(KK+1,2)	PA2	112
114 CONTINUE	PA2	114
116 CONTINUE	PA2	116
PPP(II)=0.0	PA2	118
IMAX=MAXP-MINP	PA2	120
NPWD=IMAX-1	PA2	122

DO 120 I=1,NPWD	PA2 124
XLP(I)=0.0	PA2 126
CP(I)=0.0	PA2 128
AP(I)=0.0	PA2 130
RP(I)=0.0	PA2 132
AB(I)=0.0	PA2 134
QPP(I)=0.0	PA2 136
PP(I)=0.0	PA2 138
RPL(I)=0.0	PA2 140
RPR(I)=0.0	PA2 142
ABPA(I)=0.0	PA2 144
ABPH(I)=0.0	PA2 146
BBP1(I)=0.0	PA2 148
BBP2(I)=0.0	PA2 150
BPH1(I)=0.0	PA2 152
BPH2(I)=0.0	PA2 154
DLPH(I)=0.0	PA2 156
DO 118 M=MINP,MAXP	PA2 158
WP(I,M)=0.0	PA2 160
118 CONTINUE	PA2 162
120 CONTINUE	PA2 164
DO 174 I=1,NPWD	PA2 166
DO 172 M=MINP,MAXP	PA2 168
MB=ISAP(M,1)	PA2 170
MA=ISAP(M+1,1)	PA2 172
IF (M.EQ.IMP) GO TO 154	PA2 174
IF (M.EQ.INP) GO TO 154	PA2 176
K=M-MINP+2	PA2 178
IF (I.EQ.1.AND.M.EQ.MINP) GO TO 122	PA2 180
IF (I.EQ.1) GO TO 124	PA2 182
IF (K.LT.1) GO TO 154	PA2 184
IF (K.EQ.1) GO TO 144	PA2 186
GO TO 146	PA2 188
122 XLP(I)=SQRT((SSP(M,1)-XSURFL(11))*2+(SSP(M,2)-YSURFL(11))*2)	PA2 190
1 CP(I)=XLP(I)*C(MR)	PA2 192
WP(I,M)=0.5*GAMMA(MB)*(XSURFL(11)-SSP(M,1))*(YP(M,1)-YSURFL(11))	PA2 194
1 II))	PA2 196
1 AP(I)=TAN(PI/4.0+PHI(MB)/2.0)	PA2 198
RP(I)=COS(PI/4.0-PHI(MB)/2.0)	PA2 200
RPL(I)=YWP(K)-SSP(M,2)	PA2 202
BPR(I)=YWP(1)-YSURFL(11)	PA2 204
BBP1(I)=COS(PI/4.0+PHI(MB)/2.0)	PA2 206
BBP2(I)=SIN(PI/4.0+PHI(MB)/2.0)	PA2 208
BPH1(I)=YWP(1)-YWH(1)	PA2 210
BPH2(I)=YWP(K)-YWH(K)	PA2 212
ABPH(I)=(BPH2(I)+BPH1(I))*0.5	PA2 214
ABPA(I)=(BPR(I)+BPL(I))*0.5	PA2 216
DLPH(I)=SQRT((XWH(1)-XWH(K))*2+(YWH(1)-YWH(K))*2)	PA2 218
GO TO 172	PA2 220
124 AB(I)=XSURFL(11)-SSP(MINP,1)	PA2 222
IF (M.EQ.MAXP) GO TO 126	PA2 224
WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,1)+YP(M,2)-YP(M-1,1)-YP(M-1,2))+WP(I,M-1)	PA2 226
1 GO TO 172	PA2 228
126 WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,1)+YP(M,2)-YP(M-3,1)-YP(M-3,2))+WP(I,M-3)	PA2 230
1 IF (NUFP.EQ.0) GO TO 142	PA2 232
DO 140 KK=1,NUFP	PA2 234
FP=0.0	PA2 236
FP=0.0	PA2 238
	PA2 240
	PA2 242
	PA2 244

	DP=0.0	PA2	246
	IF (QP(KK),FO,0.0) GO TO 136	PA2	248
	IF (XQPR(KK),LT,SSP(MINP,1)) GO TO 136	PA2	250
	IF (XQPL(KK),GT,SSP(MINP,1)) GO TO 128	PA2	252
	GO TO 130	PA2	254
128	DP=XQPL(KK)-SSP(MINP,1)	PA2	256
130	IF (XQPR(KK),GT,XSURFL(1)) GO TO 132	PA2	258
	FP=XSURFL(1)-XQPR(KK)	PA2	260
	GO TO 134	PA2	262
132	FP=0.0	PA2	264
134	FP=AR(1)-(FP+DP)	PA2	266
	QPP(1)=QPP(1)+FP*QP(KK)	PA2	268
	GO TO 138	PA2	270
136	QPP(1)=0.0	PA2	272
138	WP(1,M)=WP(1,M)+QPP(1)	PA2	274
140	CONTINUE	PA2	276
142	PP(1)=WP(1,M)*AP(1)+2.0*CP(1)*BP(1)+ABPH(1)*DLPH(1)*GAMW*(S1	PA2	278
1	N(ETA1)+COS(BETA1)*AP(1)+GAMW*0.5*BPL(1)*BPL(1)-GAMW*0.5*BP	PA2	280
2	PR(1)*BPR(1)+ABPA(1)*GAMW*XLP(1)*(BBP1(1)-BBP2(1)*AP(1))	PA2	282
	GO TO 172	PA2	284
144	IF (1.EQ,NPWD) GO TO 150	PA2	286
	XLP(1)=SQRT((SSP(M+1,1)-SSP(M,1))**2+(SSP(M+1,2)-SSP(M,2))**2)	PA2	288
1	2)	PA2	290
	CP(1)=XLP(1)*C(MA)	PA2	292
	AP(1)=TAN(PI/4.0+PHI(MA)/2.0)	PA2	294
	BP(1)=COS(PI/4.0-PHI(MA)/2.0)	PA2	296
	XLPP=SSP(M+1,1)	PA2	298
	XRPP=SSP(M,1)	PA2	300
	AR(1)=XRPP-XLPP	PA2	302
	BBP1(1)=COS(PI/4.0+PHI(MB)/2.0)	PA2	304
	BBP2(1)=SIN(PI/4.0+PHI(MB)/2.0)	PA2	306
	BPR(1)=YWP(K)-SSP(M,2)	PA2	308
	BPL(1)=YWP(K+1)-SSP(M+1,2)	PA2	310
	BPH1(1)=YWP(K)-YWH(K)	PA2	312
	BPH2(1)=YWP(K+1)-YWH(K+1)	PA2	314
	ABPH(1)=(BPH2(1)+BPH1(1))*0.5	PA2	316
	ABPA(1)=(BPR(1)+BPL(1))*0.5	PA2	318
	DLPH(1)=SQRT((XWH(K)-XWH(K+1))**2+(YWH(K)-YWH(K+1))**2)	PA2	320
	GO TO 154	PA2	322
146	IF (1.EQ,NPWD) GO TO 152	PA2	324
	IF (M.EQ,MAXP) GO TO 148	PA2	326
	WP(1,M)=0.5*(GAMMA(MB)*AB(1)*(YP(M,1)+YP(M,1+1)-YP(M-1,1)-YP	PA2	328
1	M-1,1+1))+WP(1,M-1)	PA2	330
	IF (M.EQ,MAXP) GO TO 156	PA2	332
	GO TO 172	PA2	334
148	WP(1,M)=0.5*(GAMMA(MB)*AB(1)*(YP(M,1)+YP(M,1+1)-YP(M-3,1)-YP	PA2	336
1	M-3,1+1))+WP(1,M-3)	PA2	338
	IF (M.EQ,MAXP) GO TO 156	PA2	340
	GO TO 172	PA2	342
150	XLP(1)=SQRT((SSP(M+3,1)-SSP(M,1))**2+(SSP(M+3,2)-SSP(M,2))**2)	PA2	344
1	2)	PA2	346
	CP(1)=XLP(1)*C(MA)	PA2	348
	AP(1)=TAN(PI/4.0+PHI(MA)/2.0)	PA2	350
	BP(1)=COS(PI/4.0-PHI(MA)/2.0)	PA2	352
	AR(1)=SSP(M,1)-SSP(M+3,1)	PA2	354
	XLPP=SSP(MAXP,1)	PA2	356
	XRPP=SSP(MAXP-3,1)	PA2	358
	BBP1(1)=COS(PI/4.0+PHI(MA)/2.0)	PA2	360
	BBP2(1)=SIN(PI/4.0+PHI(MA)/2.0)	PA2	362
	BPR(1)=YWP(K)-SSP(M,2)	PA2	364
	BPL(1)=YWP(K+1)-SSP(M+3,2)	PA2	366

	RPH1(I)=YWP(K)-YWH(K)	PA2	368
	RPH2(I)=YWP(K+1)-YWH(K+1)	PA2	370
	ABPH(I)=(SPH2(I)+EPH1(I))*0.5	PA2	372
	ABPA(I)=(BPR(I)+BPL(I))*0.5	PA2	374
	DLPH(I)=SQRT((XWH(K)-XWH(K+1))**2+(YWH(K)-YWH(K+1))**2)	PA2	376
	GO TO 154	PA2	378
152	WP(I,M)=0.5*GAMMA(AB)*AB(I)*(YP(M,1)-YP(M-3,1))+WP(I,M-3)	PA2	380
	IF (M.EQ.MAXP) GO TO 156	PA2	382
	GO TO 172	PA2	384
154	WP(I,M)=0.0	PA2	386
	GO TO 172	PA2	388
156	IF (NUFP.EQ.0) GO TO 170	PA2	390
	DO 168 KK=1,NUFP	PA2	392
	EP=0.0	PA2	394
	DP=0.0	PA2	396
	FP=0.0	PA2	398
	IF (QP(KK).EQ.0.0) GO TO 166	PA2	400
	IF (XQPR(KK).LT.XLPP) GO TO 166	PA2	402
	IF (XQPL(KK).GT.XRPP) GO TO 158	PA2	404
	IF (XQPL(KK).GT.XLPP) GO TO 158	PA2	406
	GO TO 160	PA2	408
158	DP=XQPL(KK)-XLPP	PA2	410
160	IF (XQPR(KK).GT.XRPP) GO TO 162	PA2	412
	FP=XRPP-XQPR(KK)	PA2	414
	GO TO 164	PA2	416
162	EP=0.0	PA2	418
164	EP=AB(I)-(FP+DP)	PA2	420
	QPP(I)=QPP(I)+EP*QP(KK)	PA2	422
166	WP(I,M)=WP(I,M-3)+QPP(I)	PA2	424
168	CONTINUE	PA2	426
170	PP(I)=WP(I,M)*AP(I)+2.0*CP(I)*BP(I)+ABPH(I)*DLPH(I)*GAMW*(SIPA2	PA2	428
1	N(BETA1)+COS(BETA1)*AP(I))+GAMW*0.5*BPL(I)*BPL(I)-GAMW*0.5*BPA2	PA2	430
2	PR(I)*BPR(I)+ABPA(I)*GAMW*XLP(I)*(BBP1(I)-BBP2(I)*AP(I))	PA2	432
172	CONTINUE	PA2	434
	PPP(II)=PPP(II)+PP(I)	PA2	436
174	CONTINUE	PA2	438
	RETURN	PA2	440
		PA2	442
END		PA2	444

SUB ROUTINE ACTT3	AC3	2
COMMON REND,RTCT,RSOIL,NUPA,URF,RSURF,MAXA,MINA,MAXP,MINP,II,BIDSAC3	AC3	4
I(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),CA(5),XVAL(5),XUAC3	AC3	6
PA(5),SW,CW,PSW,PCW,SP(5),XUPL(5),XUPR(5),XSURFL(10),YSURFL(10),XSUAC3	AC3	8
3RFR(10),YSURFR(10),SB(12,2),REND5(12,6),IRBND(12,1),SSAA(12),SSAP(AC3	AC3	10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPR(12),SSAAA(12),SSAPAC3	AC3	12
PR(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),YAA(10),PRR(10),BRRAC3	AC3	14
BY(12),PKLY(12)	AC3	16
DIMENSION YA(12,10),XLA(10),AA(10),BB(10),CA(10),WA(10,12),BAC3	AC3	18
IA(10),GAA(10),PA(10),YWA(10),BB1(10),BB2(10),XWA(10),XXLA(1AC3	AC3	20
20),BBL(10),BBR(10),BBB(10)	AC3	22
DATA PI/3,14159265/	AC3	24
DATA GAMW/62.4/	AC3	26
DO 102 M=MINA,MAXA	AC3	28
K=1	AC3	30
YA(M,.)=XSURFR(11)*SAP(M,1)+SAP(M,2)	AC3	32
BKRY(M)=YA(M,K)	AC3	34
YWA(K)=XSURFR(11)*SW+CW	AC3	36
XWA(K)=XSURFR(11)	AC3	38
102 CONTINUE	AC3	40
DO 108 M=MINA,MAXA	AC3	42
XXA=SSA(M,1)	AC3	44
KK=M-MINA+2	AC3	46
DO 106 N=MINA,MAXA	AC3	48
YYA=XXA*SAP(N,1)+SAP(N,2)	AC3	50
YWA(KK)=XXA*SW+CW	AC3	52
XWA(KK)=XXA	AC3	54
IF (N.LT.KK) GO TO 104	AC3	56
YA(N,KK)=YYA	AC3	58
GO TO 106	AC3	60
104 YA(N,KK)=SSA(KK+1,2)	AC3	62
106 CONTINUE	AC3	64
108 CONTINUE	AC3	66
PAA(1)=0.0	AC3	68
IMAX=MAXA-MINA+2	AC3	70
NAWD=IMAX-1	AC3	72
DO 112 I=1,NAWD	AC3	74
PA(I)=0.0	AC3	76
GAA(I)=0.0	AC3	78
AA(I)=0.0	AC3	80
BB(I)=0.0	AC3	82
BA(I)=0.0	AC3	84
CA(I)=0.0	AC3	86
XLA(I)=0.0	AC3	88
BB1(I)=0.0	AC3	90
BB2(I)=0.0	AC3	92
XXLA(I)=0.0	AC3	94
BBL(I)=0.0	AC3	96
BBP(I)=0.0	AC3	98
BBA(I)=0.0	AC3	100
DO 110 M=MINA,MAXA	AC3	102
WA(I,M)=0.0	AC3	104
110 CONTINUE	AC3	106
112 CONTINUE	AC3	108
DO 176 I=1,NAWD	AC3	110
DO 176 M=MINA,MAXA	AC3	112
MA=ISAP(M+1,1)	AC3	114
MB=ISAP(M,1)	AC3	116
K=M-MINA+2	AC3	118
IF (I.EQ.1.AND.M.EQ.MINA) GO TO 114	AC3	120
IF (I.EQ.1) GO TO 122	AC3	122

	IF (K.LT.1) GO TO 156	AC3	124
	IF (K.EQ.1) GO TO 140	AC3	126
	GO TO 146	AC3	128
114	XLA(I)=SGRT((SSA(M,1)-XSURF(II))*2+(SSA(M,2)-YSURF(II))*AC3	AC3	130
1	2)	AC3	132
	CA(I)=XLA(I)*C(MB)	AC3	134
	WA(I,M)=(SSA(M,1)-XSURF(II))*(YA(M,1)-YSURF(II))*0.5*GAMMA	AC3	136
1	(MB)	AC3	138
	AA(I)=TAN(PI/4.0-PHI(MB)/2.0)	AC3	140
	BB(I)=COS(PI/4.0+PHI(MB)/2.0)	AC3	142
	BB1(I)=COS(PI/4.0-PHI(MB)/2.0)	AC3	144
	BB2(I)=SIN(PI/4.0-PHI(MB)/2.0)	AC3	146
	IF (YWA(1).LT.YSURF(II)) GO TO 116	AC3	148
	IF (YWA(K).GT.SSA(M,2)) GO TO 118	AC3	150
	MX=ISAP(M,1)	AC3	152
	XM=TAN(PI/4.0+0.5*PHI(MX))	AC3	154
	INTR=M-MINA+2	AC3	156
	XWA(INTR)=(CW+XM*SSA(M,1)-SSA(M,2))/(XM-SW)	AC3	158
	YWA(INTR)=SW*((CW+XM*SSA(M,1)-SSA(M,2))/(XM-SW))+CW	AC3	160
1	XXLA(I)=SGRT((XSURF(II)-XWA(INTR))*2+(YSURF(II)-YWA(INTR))	AC3	162
	)**2)	AC3	164
	GO TO 120	AC3	166
116	RBL(I)=0.0	AC3	168
	RBR(I)=0.0	AC3	170
	RBA(I)=0.0	AC3	172
	GO TO 176	AC3	174
118	BBL(I)=YWA(1)-YSURF(II)	AC3	176
	BBR(I)=YWA(K)-SSA(M,2)	AC3	178
	RBA(I)=(BBL(I)+BBR(I))*0.5	AC3	180
	XXLA(I)=XLA(I)	AC3	182
	GO TO 176	AC3	184
120	BBL(I)=YWA(1)-YSURF(II)	AC3	186
	BBR(I)=0.0	AC3	188
	RBA(I)=BBL(I)*0.5	AC3	190
	GO TO 176	AC3	192
122	BA(I)=SSA(MINA,1)-XSURF(II)	AC3	194
	WA(I,M)=0.5*GAMMA(ME)*BA(I)*(YA(M,1)+YA(M,2)-YA(M-1,1)-YA(M	AC3	196
1	1,2))+WA(I,M-1)	AC3	198
	IF (I.EQ.1.AND.M.EQ.MAXA) GO TO 124	AC3	200
	GO TO 176	AC3	202
124	IF (NUFA.EQ.0) GO TO 138	AC3	204
	DO 136 KK=1,NUFA	AC3	206
	EA=0.0	AC3	208
	FA=0.0	AC3	210
	DA=0.0	AC3	212
	IF (QA(KK).EQ.0.0) GO TO 132	AC3	214
	IF (XQAL(KK).GT.SSA(MINA,1)) GO TO 132	AC3	216
	IF (XQAR(KK).LT.SSA(MINA,1)) GO TO 126	AC3	218
	GO TO 128	AC3	220
126	FA=SSA(MINA,1)-XQAR(KK)	AC3	222
	GO TO 130	AC3	224
128	FA=0.0	AC3	226
130	IF (XQAL(KK).GT.XSURF(II)) DA=XQAL(KK)-XSURF(II)	AC3	228
	EA=BA(I)-(FA+DA)	AC3	230
	QAA(I)=QAA(I)+EA*QA(KK)	AC3	232
	GO TO 134	AC3	234
132	QAA(I)=0.0	AC3	236
134	WA(I,M)=WA(I,M)+QAA(I)	AC3	238
136	CONTINUE	AC3	240
138	PA(I)=WA(I,M)*AA(I)-2.0*CA(I)*BB(I)+0.5*GAMW*(BBL(I)**2-BBR	AC3	242
1	I)**2)+BBA(I)*(BB1(I)-AA(I)*BB2(I))*XXLA(I)*GAMW	AC3	244

	GO TO 176	AC3	246
140	IF (I.EQ,NAWD) GO TO 148	AC3	248
	XLA(I)=SQRT((SSA(M+1,1)-SSA(M,1))*2+(SSA(M+1,2)-SSA(M,2))*2)	AC3	250
1	CA(I)=XLA(I)*C(MA)	AC3	252
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC3	254
	BB(I)=COS(PI/4.0+PHI(MA)/2.0)	AC3	256
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC3	258
	XRAA=SSA(M+1,1)	AC3	260
	XLAA=SSA(M,1)	AC3	262
	RR1(I)=COS(PI/4.0-PHI(MB)/2.0)	AC3	264
	RR2(I)=SIN(PI/4.0-PHI(MB)/2.0)	AC3	266
	IF (YWA(K).LT.YSURF(I)) GO TO 142	AC3	268
	IF (YWA(K).LT.SSA(M,2)) GO TO 142	AC3	270
	IF (YWA(K+1).LT.SSA(M+1,2)) GO TO 144	AC3	272
	RRL(I)=YWA(K)-SSA(M,2)	AC3	274
	BBR(I)=YWA(K+1)-SSA(M+1,2)	AC3	276
	BBA(I)=(BBL(I)+BBR(I))*0.5	AC3	278
	XXLA(I)=XLA(I)	AC3	280
	GO TO 156	AC3	282
142	RRL(I)=0.0	AC3	284
	BBR(I)=0.0	AC3	286
	BBA(I)=0.0	AC3	288
	XXLA(I)=XLA(I)	AC3	290
	GO TO 156	AC3	292
144	MX=ISAP(M,1)	AC3	294
	XM=TAN(PI/4.0+PHI(MX)/2.0)	AC3	296
	INTR=K+1	AC3	298
	XWA(INTR)=(CW+XM*SSA(M,1)-SSA(M,2))/(XM-SW)	AC3	300
	YWA(INTR)=SW*((CW+XM*SSA(M,1)-SSA(M,2))/(XM-SW))+CW	AC3	302
	XXLA(I)=SQRT((SSA(M,1)-XWA(INTR))*2+(SSA(M,2)-YWA(INTR))*2)	AC3	304
1	BBL(I)=YWA(K)-SSA(M,2)	AC3	306
	BBR(I)=0.0	AC3	308
	BBA(I)=BBL(I)*0.5	AC3	310
	GO TO 156	AC3	312
146	IF (I.EQ,NAWD) GO TO 154	AC3	314
	WA(I,M)=0.5*(GAMMA(MB)*BA(I)*(YA(M,1)+YA(M,1+1)-YA(M-1,1)-YA(M-1,1+1))+WA(I,M-1))	AC3	316
1	IF (M.EQ,MAXA) GO TO 158	AC3	318
	GO TO 176	AC3	320
148	IF (I.EQ,NAWD.AND.I.NE,K) GO TO 154	AC3	322
	XLA(I)=SQRT((SSA(M+1,1)-SSA(M,1))*2+(SSA(M+1,2)-SSA(M,2))*2)	AC3	324
1	CA(I)=XLA(I)*C(MA)	AC3	326
	AA(I)=TAN(PI/4.0-PHI(MA)/2.0)	AC3	328
	BB(I)=COS(PI/4.0+PHI(MA)/2.0)	AC3	330
	BA(I)=SSA(M+1,1)-SSA(M,1)	AC3	332
	XRAA=SSA(M+1,1)	AC3	334
	XLAA=SSA(M,1)	AC3	336
	BB1(I)=COS(PI/4.0-PHI(MA)/2.0)	AC3	338
	BB2(I)=SIN(PI/4.0-PHI(MA)/2.0)	AC3	340
	IF (YWA(K).LT.YSURF(I)) GO TO 150	AC3	342
	IF (YWA(K).LT.SSA(M,2)) GO TO 150	AC3	344
	IF (YWA(K+1).LT.SSA(M+1,2)) GO TO 152	AC3	346
	GO TO 156	AC3	348
150	RRL(I)=0.0	AC3	350
	BBR(I)=0.0	AC3	352
	BBA(I)=0.0	AC3	354
	XXLA(I)=XLA(I)	AC3	356
	GO TO 156	AC3	358

152	MX=ISAP(M+1,1)	AC3	368
	XM=TAN(PI/4.0+PHI(MX)/2.0)	AC3	370
	INTR=K+1	AC3	372
	XWA(INTR)=(CW+X-I*SSA(M,1)-SSA(M,2))/(XM-SW)	AC3	374
	YWA(INTR)=SW*((CW+XM*SSA(M,1)-SSA(M,2))/(XM-SW))+CW	AC3	376
	XXLA(I)=SQRT((SSA(M,1)-XWA(INTR))**2+(SSA(M,2)-YWA(INTR))**2)	AC3	378
1	)	AC3	380
	BBL(I)=YWA(K)-SSA(M,2)	AC3	382
	BBR(I)=0.0	AC3	384
	BBA(I)=BBL(I)*0.5	AC3	386
	GO TO 156	AC3	388
154	WA(I,M)=0.5*GAMMA(MB)*BA(I)*(YA(M,1)-YA(M-1,1))	AC3	390
	IF (M.EQ.MAXA) GO TO 158	AC3	392
	GO TO 176	AC3	394
156	WA(I,M)=0.0	AC3	396
	GO TO 176	AC3	398
158	IF (NUFA.EQ.0) GO TO 174	AC3	400
	DO 172 KK=1,NUFA	AC3	402
	OA=0.0	AC3	404
	FA=0.0	AC3	406
	EA=0.0	AC3	408
	IF (OA(KK).EQ.0.0.0) GO TO 168	AC3	410
	IF (XQAR(KK).LT.XLAA) GO TO 168	AC3	412
	IF (XQAL(KK).GT.XRAA) GO TO 168	AC3	414
	IF (XQAL(KK).GT.XLAA) GO TO 160	AC3	416
	GO TO 162	AC3	418
160	OA=XQAL(KK)-XLAA	AC3	420
162	IF (XQAR(KK).GT.XRAA) GO TO 164	AC3	422
	FA=XRAA-XQAR(KK)	AC3	424
	GO TO 166	AC3	426
164	FA=0.0	AC3	428
166	EA=BA(I)-(FA+OA)	AC3	430
	QAA(I)=QAA(I)+EA*OA(KK)	AC3	432
	GO TO 170	AC3	434
168	QAA(I)=0.0	AC3	436
170	WA(I,M)=WA(I,M)+QAA(I)	AC3	438
172	CONTINUE	AC3	440
174	PA(I)=WA(I,M)*AA(I)-2.0*CA(I)*BB(I)+0.5*GAMW*(BBL(I)**2-BBR(I)	AC3	442
1	I)**2)+BBA(I)*(BB1(I)-AA(I)*BB2(I))*XXLA(I)*GAMW	AC3	444
176	CONTINUE	AC3	446
	PAA(II)=PAA(II)+PA(I)	AC3	448
178	CONTINUE	AC3	450
	RETURN	AC3	452
		AC3	454
	END	AC3	456

SUBROUTINE PASS3		PA3	2
COMMON NBND,NTCP,NSCIL,NUFA,NUFP,NSURF,MAXA,MINA,MAXP,MINP,II,BNDSPA3			4
1(12,4),ITP(12),GAMMA(10),C(10),PHI(10),TITLE(10),GA(5),XGAL(5),XUAPA3			6
2R(5),SW,CW,PSW,PCW,GP(5),XGPL(5),XGPR(5),XSURFL(10),YSURFL(10),XSUPA3			8
3RFR(10),YSURFR(10),SB(12,2),RBND(12,6),IRBND(12,1),SSAA(12),SSAPA3			10
412),XLL(12),YLL(12),XRR(12),YRR(12),YAA(12),YPP(12),SSAAA(12),SSAPPA3			12
5P(12),SSA(12,2),SSP(12,2),ISAP(12,1),SAP(12,2),FAA(10),PPA(10),BKPPA3			14
6Y(12),BKLY(12)		PA3	16
DIMENSION YP(12,10), XLP(10), AP(10), GP(10), AB(10), CP(10), WP(1PA3			18
10,12), GPP(10), PR(10), YWP(10), XWP(10), BBP1(10), BBP2(10), XXLPPA3			20
2(10), BPL(10), BPR(10), BPA(10)		PA3	22
DATA P1/3.14159265/		PA3	24
DATA GAMW/62.4/		PA3	26
IMP=MAXP-1		PA3	28
INP=IMP-1		PA3	30
DO 104 M=MINP,MAXP		PA3	32
K=1		PA3	34
IF (M.EQ.IMP) GO TO 102		PA3	36
IF (M.EQ.INP) GO TO 102		PA3	38
YP(M,K)=XSURFL(11)*SAP(M,1)+SAP(M,2)		PA3	40
YWP(K)=XSURFL(11)*SW+CW		PA3	42
BKLY(M)=YP(M,K)		PA3	44
GO TO 104		PA3	46
102	YP(M,K)=0.0	PA3	48
	BKLY(M)=YP(M,K)	PA3	50
104	CONTINUE	PA3	52
DO 116 M=MINP,MAXP		PA3	54
XXP=SSP(M,1)		PA3	56
IF (M.EQ.IMP) GO TO 116		PA3	58
IF (M.EQ.INP) GO TO 116		PA3	60
IF (M.EQ.MAXP) GO TO 106		PA3	62
KK=M-MINP+2		PA3	64
YWP(KK)=XXP*SW+CW		PA3	66
XWP(KK)=XXP		PA3	68
GO TO 108		PA3	70
106	KK=M-MINP	PA3	72
YWP(KK)=XXP*SW+CW		PA3	74
XWP(KK)=XXP		PA3	76
108	DO 114 N=MINP,MAXP	PA3	78
IF (M.EQ.MAXP) GO TO 110		PA3	80
YYP=XXP*SAP(N,1)+SAP(N,2)		PA3	82
IF (N.LT.KK) GO TO 112		PA3	84
YP(N,KK)=YYP		PA3	86
GO TO 114		PA3	88
110	YP(N,KK)=SSP(MAXP,2)	PA3	90
GO TO 114		PA3	92
112	YP(N,KK)=SSP(KK+1,2)	PA3	94
114	CONTINUE	PA3	96
116	CONTINUE	PA3	98
PPP(11)=0.0		PA3	100
IMAX=MAXP-MINP		PA3	102
NPWD=IMAX-1		PA3	104
DO 120 I=1,NPWD		PA3	106
XLP(I)=0.0		PA3	108
CP(I)=0.0		PA3	110
AP(I)=0.0		PA3	112
BP(I)=0.0		PA3	114
AB(I)=0.0		PA3	116
QPD(I)=0.0		PA3	118
PP(I)=0.0		PA3	120
BBP1(I)=0.0		PA3	122

	BBP2(1)=0.0	PA3 124
	BPL(1)=0.0	PA3 126
	BPR(1)=0.0	PA3 128
	BPA(1)=0.0	PA3 130
	XXLP(1)=0.0	PA3 132
	DO 118 M=MINP,MAXP	PA3 134
	WP(1,M)=0.0	PA3 136
118	CONTINUE	PA3 138
120	CONTINUE	PA3 140
	DO 188 I=1,NPWD	PA3 142
	DO 186 M=MINP,MAXP	PA3 144
	MB=ISAP(M,1)	PA3 146
	MA=ISAP(M+1,1)	PA3 148
	IF (M.EQ.1MP) GO TO 168	PA3 150
	IF (M.EQ.1NP) GO TO 168	PA3 152
	K=M-MINP+2	PA3 154
	IF (1.EQ.1.AND.M.EQ.MINP) GO TO 122	PA3 156
	IF (1.EQ.1) GO TO 130	PA3 158
	IF (K.LT.1) GO TO 168	PA3 160
	IF (K.EQ.1) GO TO 150	PA3 162
	GO TO 156	PA3 164
122	XLP(1)=SQRT((SSP(M,1)-XSURFL(11))*2+(SSP(M,2)-YSURFL(11))*2)	PA3 166
1	2)	PA3 168
	CP(1)=XLP(1)*C(MB)	PA3 170
	WP(1,M)=0.5*GAMMA(MB)*(XSURFL(11)-SSP(M,1))*(YP(M,1)-YSURFL(11))	PA3 172
1	11))	PA3 174
	AP(1)=TAN(P1/4.0+PHI(MB)/2.0)	PA3 176
	BP(1)=COS(P1/4.0-PHI(MB)/2.0)	PA3 178
	BBP1(1)=COS(P1/4.0+PHI(MB)/2.0)	PA3 180
	BBP2(1)=SIN(P1/4.0+PHI(MB)/2.0)	PA3 182
	IF (YWP(1).LT.YSURFL(11)) GO TO 124	PA3 184
	IF (YWP(K).GT.SSP(M,2)) GO TO 126	PA3 186
	MX=ISAP(M,1)	PA3 188
	XM=-TAN(P1/4.0-PHI(MX)/2.0)	PA3 190
	INTR=M-MINP+2	PA3 192
	XWP(INTR)=(CW+XM*SSP(M,1)-SSA(M,1))/(XM-SW)	PA3 194
	YWP(INTR)=SW*((CW+XM*SSP(M,1)-SSP(M,2))/(XM-SW))+CW	PA3 196
	XXLP(1)=SQRT((XSURFL(11)-XWP(INTR))*2+(YSURFL(11)-YWP(INTR))*2)	PA3 198
1	GO TO 128	PA3 200
	GO TO 128	PA3 202
124	BPL(1)=0.0	PA3 204
	BPR(1)=0.0	PA3 206
	BPA(1)=0.0	PA3 208
	GO TO 186	PA3 210
126	BPL(1)=YWP(K)-SSP(M,2)	PA3 212
	BPR(1)=YWP(1)-YSURFL(11)	PA3 214
	BPA(1)=(BPL(1)+BPR(1))*0.5	PA3 216
	XXLP(1)=XLP(1)	PA3 218
	GO TO 186	PA3 220
128	BPR(1)=YWP(1)-YSURFL(11)	PA3 222
	BPL(1)=0.0	PA3 224
	BPA(1)=BPR(1)*0.5	PA3 226
	GO TO 186	PA3 228
130	AB(1)=XSURFL(11)-SSP(MINP,1)	PA3 230
	IF (M.EQ.MAXP) GO TO 132	PA3 232
	WP(1,M)=0.5*GAMMA(MB)*AB(1)*(YP(M,1)+YP(M,2)-YP(M-1,1)-YP(M-2,1))+WP(1,M-1)	PA3 234
1	1,2))+WP(1,M-1)	PA3 236
	GO TO 186	PA3 238
132	WP(1,M)=0.5*GAMMA(MB)*AB(1)*(YP(M,1)+YP(M,2)-YP(M-3,1)-YP(M-4,1))+WP(1,M-3)	PA3 240
1	3,2))+WP(1,M-3)	PA3 242
	IF (NUFP.EQ.0) GO TO 148	PA3 244

	DO 146 KK=1,NUFP,	PA3 246
	EP=0.0	PA3 248
	FP=0.0	PA3 250
	DP=0.0	PA3 252
	IF (QP(KK).EQ.0.0) GO TO 142	PA3 254
	IF (XQPR(KK).LT.SSP(MINP,1)) GO TO 142	PA3 256
	IF (XQPL(KK).GT.SSP(MINP,1)) GO TO 134	PA3 258
	GO TO 136	PA3 260
134	DP=XQPL(KK)-SSP(MINP,1)	PA3 262
136	IF (XQPR(KK).GT.XSURFL(11)) GO TO 138	PA3 264
	FP=XSURFL(11)-XQPR(KK)	PA3 266
	GO TO 140	PA3 268
138	FP=0.0	PA3 270
140	EP=AB(1)-(FP+DP)	PA3 272
	QPP(1)=OPP(1)+EP*QP(KK)	PA3 274
	GO TO 144	PA3 276
142	QPP(1)=0.0	PA3 278
144	WP(1,M)=WP(1,M)+QPP(1)	PA3 280
146	CONTINUE	PA3 282
148	PP(1)=WP(1,M)*AP(1)+2.0*CP(1)*BP(1)+0.5*GAMW*(BPL(1)**2-BPR(PA3	284
1	1)**2)+BPA(1)*(BBP1(1)-BBP2(1)*AP(1))*GAMW*XXLP(1)	PA3 286
	GO TO 186	PA3 288
150	IF (1.EQ.NPWD) GO TO 160	PA3 290
1	XLPL(1)=SQRT((SSP(M+1,1)-SSP(M,1))**2+(SSP(M+1,2)-SSP(M,2))**2)	PA3 292
	CP(1)=XLPL(1)*C(MA)	PA3 296
	AP(1)=TAN(PI/4.0+PHI(MA)/2.0)	PA3 298
	BP(1)=COS(PI/4.0-PHI(MA)/2.0)	PA3 300
	XLPP=SSP(M+1,1)	PA3 302
	XRPP=SSP(M,1)	PA3 304
	AB(1)=XRPP-XLPP	PA3 306
	BBP1(1)=COS(PI/4.0+PHI(MB)/2.0)	PA3 308
	BBP2(1)=SIN(PI/4.0+PHI(MB)/2.0)	PA3 310
	IF (YWP(K).LT.YSURFL(11)) GO TO 152	PA3 312
	IF (YWP(K).LT.SSP(M,2)) GO TO 152	PA3 314
	IF (YWP(K+1).LT.SSA(M+1,2)) GO TO 154	PA3 316
	BPR(1)=YWP(K)-SSP(M,2)	PA3 318
	RPL(1)=YWP(K+1)-SSP(M+1,2)	PA3 320
	RPA(1)=(BPL(1)+BPR(1))*0.5	PA3 322
	XXLP(1)=XLPL(1)	PA3 324
	GO TO 168	PA3 326
152	RPL(1)=0.0	PA3 328
	BPR(1)=0.0	PA3 330
	RPA(1)=0.0	PA3 332
	XXLP(1)=XLPL(1)	PA3 334
	GO TO 168	PA3 336
154	MX=ISAP(M,1)	PA3 338
	XM=-TAN(PI/4.0-PHI(MX)/2.0)	PA3 340
	INTR=K+1	PA3 342
	XWP(INTR)=(CW+XM*SSP(M,1)-SSP(M,2))/(XM-SW)	PA3 344
	YWP(INTR)=SW*((CW+XM*SSP(M,1)-SSP(M,2))/(XM-SW))+CW	PA3 346
	XXLP(1)=SQRT((SSP(M,1)-XWP(INTR))**2+(SSP(M,2)-YWP(INTR))**2)	PA3 348
1	)	PA3 350
	BPR(1)=YWP(K)-SSP(M,2)	PA3 352
	BPL(1)=0.0	PA3 354
	RPA(1)=BPR(1)*0.5	PA3 356
	GO TO 168	PA3 358
156	IF (1.EQ.NPWD) GO TO 166	PA3 360
	IF (M.EQ.MAXP) GO TO 158	PA3 362
1	WP(1,M)=0.5*GAMMA(MB)*AB(1)*(YP(M,1)+YP(M,1+1)-YP(M-1,1)-YP(M-1,1+1))+WP(1,M-1)	PA3 364
		PA3 366

	IF (M.EQ.MAXP) GO TO 170	PA3	368
	GO TO 186	PA3	370
158	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,I)+YP(M,I+1)-YP(M-3,I)-YP(M-3,I+1))+WP(I,M-3)	PA3	372
1		PA3	374
	IF (M.EQ.MAXP) GO TO 170	PA3	376
	GO TO 186	PA3	378
160	XLP(I)=SQRT((SSP(M+3,1)-SSP(M,1))*2+(SSP(M+3,2)-SSP(M,2))*2)	PA3	380
1		PA3	382
	CP(I)=XLP(I)*C(MA)	PA3	384
	AP(I)=TAN(PI/4.0+PHI(MA)/2.0)	PA3	386
	BP(I)=COS(PI/4.0+PHI(MA)/2.0)	PA3	388
	AB(I)=SSP(M,1)-SSP(M+3,1)	PA3	390
	XLPP=SSP(MAXP,1)	PA3	392
	XRPP=SSP(MAXP-3,1)	PA3	394
	RRP1(I)=COS(PI/4.0+PHI(MA)/2.0)	PA3	396
	RRP2(I)=SIN(PI/4.0+PHI(MA)/2.0)	PA3	398
	IF (YWP(K).LT.YSURFL(I)) GO TO 162	PA3	400
	IF (YWP(K).LT.SSP(M,2)) GO TO 162	PA3	402
	IF (YWP(K+1).LT.SSP(M+3,2)) GO TO 164	PA3	404
	GO TO 168	PA3	406
162	BPL(I)=0.0	PA3	408
	BPR(I)=0.0	PA3	410
	BPA(I)=0.0	PA3	412
	XXLP(I)=XLP(I)	PA3	414
	GO TO 168	PA3	416
164	MX=ISAP(M+3,1)	PA3	418
	XM=-TAN(PI/4.0+PHI(MX)/2.0)	PA3	420
	INTR=K+1	PA3	422
	XWP(INTR)=(CW+XM*SSP(M,1)-SSP(M,2))/(XM-SW)	PA3	424
	YWP(INTR)=SW*((CW+XM*SSP(M,1)-SSP(M,2))/(XM-SW))+CW	PA3	426
	XXLP(I)=SQRT((SSP(M,1)-XWP(INTR))*2+(SSP(M,2)-YWP(INTR))*2)	PA3	428
1		PA3	430
	BPL(I)=0.0	PA3	432
	BPR(I)=YWP(K)-SSP(M,2)	PA3	434
	BPA(I)=BPR(I)*0.5	PA3	436
	GO TO 168	PA3	438
166	WP(I,M)=0.5*GAMMA(MB)*AB(I)*(YP(M,I)-YP(M-3,I))+WP(I,M-3)	PA3	440
	IF (M.EQ.MAXP) GO TO 170	PA3	442
	GO TO 186	PA3	444
168	WP(I,M)=0.0	PA3	446
	GO TO 186	PA3	448
170	IF (NUFP.EQ.0) GO TO 184	PA3	450
	DO 182 KK=1,NUFP	PA3	452
	FP=0.0	PA3	454
	DP=0.0	PA3	456
	EP=0.0	PA3	458
	IF (QP(KK).EQ.0.0) GO TO 180	PA3	460
	IF (XQPR(KK).LT.XLPP) GO TO 180	PA3	462
	IF (XQPL(KK).GT.XRPP) GO TO 172	PA3	464
	IF (XQPL(KK).GT.XLPP) GO TO 172	PA3	466
	GO TO 174	PA3	468
172	DP=XQPL(KK)-XLPP	PA3	470
174	IF (XQPR(KK).GT.XRPP) GO TO 176	PA3	472
	FP=XRPP-XQPR(KK)	PA3	474
	GO TO 178	PA3	476
176	EP=0.0	PA3	478
178	EP=AB(I)-(FP+DP)	PA3	480
	QPP(I)=QPP(I)+EP*QP(KK)	PA3	482
180	WP(I,M)=WP(I,M-3)+QPP(I)	PA3	484
182	CONTINUE	PA3	486
184	PP(I)=WP(I,M)*AP(I)+2.0*CP(I)*BP(I)+0.5*GAMW*(BPL(I))*2-BPR(I)	PA3	488

1	I)**2)+BPA(I)*(BPP1(I)-BBP2(I)*AP(I))*GAM**XXLP(I)	PA3	490
186	CONTINUE	PA3	492
	PPP(11)=PPP(11)+PP(1)	PA3	494
188	CONTINUE	PA3	496
	RETURN	PA3	498
		PA3	500
	END	PA3	502

APPENDIX C

INPUT OF ILLUSTRATION PROBLEMS

ILLUSTRATION PROBLEM (1) WATER SURFACE CASE 1

8	3	5	1	1	100.0	55.0	130.0	75.0	0
		0.0			60.0	100.0	55.0	1	
		100.0			55.0	130.0	75.0	1	
		130.0			75.0	195.0	50.0	1	
		0.0			53.0	195.0	53.0	2	
		0.0			47.5	195.0	43.5	3	
		0.0			37.5	195.0	40.5	4	
		0.0			36.0	195.0	37.5	5	
		0.0			35.0	195.0	35.0	5	
		120.0			0.0	30.0			
		110.0			800.0	0.0			
		115.0			50.0	10.0			
		115.0			100.0	15.0			
		115.0			100.0	10.0			
		500.0			130.0	155.0			
		50.0			85.0	100.0			

2

100.0	50.0	130.0	52.0
100.0	50.0	130.0	50.0
100.0	50.0	130.0	48.5
0.0	0.0	0.0	0.00

ILLUSTRATION PROBLEM (2) WATER SURFACE CASE 1

11	3	9	1	1	100.0	70.0	135.0	95.0	0
		50.0			73.5	100.0	70.0	1	
		100.0			70.0	135.0	95.0	1	
		135.0			95.0	195.0	99.0	1	
		50.0			64.0	195.0	74.0	2	
		50.0			63.0	195.0	70.0	3	
		50.0			61.5	195.0	67.5	4	
		50.0			60.5	195.0	64.5	5	
		50.0			56.5	195.0	50.0	6	
		50.0			47.5	195.0	47.5	7	
		50.0			42.0	195.0	44.5	8	
		50.0			30.0	195.0	30.0	9	
		120.0			0.0	25.0			
		115.0			50.0	20.0			
		115.0			50.0	15.0			
		115.0			100.0	10.0			
		110.0			1500.0	0.0			
		115.0			1600.0	0.0			
		115.0			1800.0	0.0			
		120.0			1000.0	10.0			
		120.0			1000.0	15.0			
		500.0			135.0	190.0			
		100.0			65.0	100.0			

3

100.0	57.5	135.0	60.0
100.0	57.5	135.0	57.5
100.0	57.5	135.0	55.5
0.0	0.0	0.0	0.00

102.5	71.5	105.0	72.5	110.0	74.5	112.5
75.5	115.0	76.0	120.0	77.0	125.0	77.5
50.0	71.0	101.5	71.0			

ILLUSTRATION PROBLEM (1) WATER SURFACE CASE 3

8	3	5	1	1	100.0	55.0	130.0	75.0	0
					0.0	60.0	100.0	55.0	1
					100.0	55.0	130.0	75.0	1
					130.0	75.0	195.0	80.0	1
					0.0	53.0	195.0	53.0	2
					0.0	47.5	195.0	43.5	3
					0.0	37.5	195.0	40.5	4
					0.0	36.0	195.0	37.5	5
					0.0	35.0	195.0	35.0	5
					120.0	0.0	30.0		
					110.0	800.0	0.0		
					115.0	50.0	10.0		
					115.0	100.0	15.0		
					115.0	100.0	10.0		
					500.0	130.0	155.0		
					50.0	85.0	100.0		
3									
					100.0	50.0	130.0	52.0	
					100.0	50.0	130.0	48.5	
					100.0	50.0	130.0	50.0	
					0.0	53.5	195.0	55.50	

ILLUSTRATION PROBLEM (2) WATER SURFACE CASE 3

11	3	9	1	1	100.0	70.0	135.0	95.0	0
					50.0	73.5	100.0	70.0	1
					100.0	70.0	135.0	95.0	1
					135.0	95.0	195.0	99.0	1
					50.0	64.0	195.0	74.0	2
					50.0	63.0	195.0	70.0	3
					50.0	61.5	195.0	67.5	4
					50.0	60.5	195.0	64.5	5
					50.0	56.5	195.0	50.0	6
					50.0	47.5	195.0	47.5	7
					50.0	42.0	195.0	44.5	8
					50.0	30.0	195.0	30.0	9
					120.0	0.0	25.0		
					115.0	50.0	20.0		
					115.0	50.0	15.0		
					115.0	100.0	10.0		
					110.0	1500.0	0.0		
					115.0	1600.0	0.0		
					115.0	1800.0	0.0		
					120.0	1000.0	10.0		
					120.0	1000.0	15.0		
					500.0	135.0	190.0		
					100.0	65.0	100.0		
3									
					100.0	57.5	135.0	60.0	
					100.0	57.5	135.0	57.5	
					100.0	57.5	135.0	55.5	
					0.0	62.00	195.0	69.0	

APPENDIX D

COMPUTER OUTPUT OF ILLUSTRATION PROBLEMS

ILLUSTRATION PROBLEM (1) WATER SURFACE CASE 1

INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS

CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

```

*****
TOTAL NUMBER OF SOIL PROFILES----- A
TOTAL NUMBER OF TOP BOUNDARIES----- 3
TOTAL NUMBER OF SOIL TYPE----- 5
TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
X- COORDINATE OF TOE----- 100.000
Y- COORDINATE OF TOE----- 55.000
X- COORDINATE OF CREST----- 130.000
Y- COORDINATE OF CREST----- 15.000
IPRINT CODE FOR PRINTOUT----- 0

```

SOIL PROFILE • GEOMETRIC BOUNDARIES OF SLOPE • SOIL TYPE BELOW THE BOUNDARY

```

*****
BOND NO      X- COORDINATE      Y- COORDINATE      X- COORDINATE      Y- COORDINATE      SOIL TYPE BELOW
1            0.000          60.000          100.000          55.000          1
2          100.000          55.000          130.000          75.000          1
3          130.000          75.000          195.000          80.000          1
4            0.000          53.000          195.000          53.000          2
5            0.000          47.500          195.000          43.500          3
6            0.000          37.500          195.000          40.500          4
7            0.000          36.000          195.000          37.500          5
8            0.000          35.000          195.000          35.000          5

```

NUMBER OF SOIL TYPES---- 5

SOIL TYPE(I)	GAMMA(I)	COHESION(I)	ANGLE OF INTERNAL FRICTION (I)
1	120.000	0.000	30.000
2	110.000	800.000	0.000
3	115.000	50.000	10.000
4	115.000	100.000	15.000
5	115.000	100.000	10.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	130.000	155.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	50.000	85.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

NO.	LEFT X- COOD	LEFT Y- COOD	RIGHT X-COOD	RIGHT Y- COOD
1	100.000	50.000	130.000	52.000
2	100.000	50.000	130.000	50.000
3	100.000	50.000	130.000	48.500

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD.	LEFT Y COORD.	RIGHT X COORD.	RIGHT Y COORD.
---------------	---------------	----------------	----------------

0.000 0.000 0.000 0.000

POSITION OF WATER SURFACE ICASE= 1

NO. OF SLIDING SURFACE --- 1
 TOTAL ACTIVE PRESSURE ON BLOCK --- 15650.955140
 TOTAL PASSIVE PRESSURE ON BLOCK -- 6545.077408
 TOTAL WEIGHT OF BLOCK --- 49800.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24053.574205

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.94 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 1

NO. OF SLIDING SURFACE --- 2

TOTAL ACTIVE PRESSURE ON BLOCK --- 19377.378364
 TOTAL PASSIVE PRESSURE ON BLOCK -- 6545.077408
 TOTAL WEIGHT OF BLOCK --- 53100.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24000.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.87 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 1

NO. OF SLIDING SURFACE --- 3
 TOTAL ACTIVE PRESSURE ON BLOCK --- 22485.826729
 TOTAL PASSIVE PRESSURE ON BLOCK -- 6545.077408
 TOTAL WEIGHT OF BLOCK --- 55575.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24029.981273

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.83 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

 START OF NEW PROBLEM WITH NEW DATA*****

ILLUSTRATION PROBLEM (2) WATER SURFACE CASE 1

INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS*****
CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

```

*****
TOTAL NUMBER OF SOIL PROFILES----- 11
TOTAL NUMBER OF TOP BOUNDARIES----- 3
TOTAL NUMBER OF SOIL TYPE----- 9
TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
X- COORDINATE OF TOE----- 100.000
Y- COORDINATE OF TOE----- 70.000
X - COORDINATE OF CREST----- 135.000
Y- COORDINATE OF CREST----- 95.000
IPRINT CODE FOR PRINTOUT----- 0

```

SOIL PROFILE * GEOMETRIC BOUNDARIES OF SLOPE * SOIL TYPE BELOW THE BOUNDARY

```

*****
BOND NO      X- COORDINATE      Y- COORDINATE      X- COORDINATE      Y- COORDINATE      SOIL TYPE BELOW
1            50.000            73.500            100.000            70.000            1
2            100.000           70.000            135.000           95.000            1
3            135.000           95.000            195.000           90.000            1
4            50.000           64.000            195.000           74.000            2
5            50.000           63.000            195.000           70.000            3
6            50.000           61.500            195.000           67.500            4
7            50.000           60.500            195.000           64.500            5
8            50.000           56.500            195.000           50.000            6
9            50.000           47.500            195.000           47.500            7
10           50.000           42.000            195.000           44.500            8
11           50.000           30.000            195.000           30.000            9

```

NUMBER OF SOIL TYPES---- 9

SOIL TYPE(I)	GAMMA(I)	COHESION(I)	ANGLE OF INTERNAL FRICTION (I)
1	120.000	0.000	25.000
2	115.000	50.000	20.000
3	115.000	50.000	15.000

4	115.000	100.000	10.000
5	110.000	1500.000	0.000
6	115.000	1400.000	0.000
7	115.000	1800.000	0.000
8	120.000	1000.000	10.000
9	120.000	1000.000	15.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	135.000	190.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	100.000	65.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

NO.	LEFT X- COORD	LEFT Y- COORD	RIGHT X-COORD	RIGHT Y- COORD
1	100.000	57.500	135.000	60.000
2	100.000	57.500	135.000	57.500
3	100.000	57.500	135.000	55.500

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

0.000 0.000 0.000 0.000

POSITION OF WATER SURFACE TCASF= 1

NO. OF SLIDING SURFACE --- 1
 TOTAL ACTIVE PRESSURE ON BLOCK --- 42997.774721
 TOTAL PASSIVE PRESSURE ON BLOCK -- 24497.066597
 TOTAL WEIGHT OF BLOCK --- 97384.482759
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52633.768179

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 2.07 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE TCASF= 1

D-8

NO. OF SLIDING SURFACE --- 2
TOTAL ACTIVE PRESSURE ON BLOCK --- 47888.174481
TOTAL PASSIVE PRESSURE ON BLOCK -- 24497.066597
TOTAL WEIGHT OF BLOCK --- 102196.982759
COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52500.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 2.24 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICAE= 1

NO. OF SLIDING SURFACE --- 3
TOTAL ACTIVE PRESSURE ON BLOCK --- 52331.645238
TOTAL PASSIVE PRESSURE ON BLOCK -- 24497.066597
TOTAL WEIGHT OF BLOCK --- 104046.982759
COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52505.644429

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 2.42 FOR SURFACE 3

END OF CALCULATION --- START NEW SURFACE

START OF NEW PROBLEM WITH NEW DATA*****

ILLUSTRATION PROBLEM (1) WATER SURFACE CASE 2

 INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS

CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

 TOTAL NUMBER OF SOIL PROFILES----- 8
 TOTAL NUMBER OF TOP BOUNDARIES----- 3
 TOTAL NUMBER OF SOIL TYPE----- 5
 TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
 TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
 X- COORDINATE OF TOE----- 100.000
 Y- COORDINATE OF TOE----- 55.000
 X- COORDINATE OF CREST----- 130.000
 Y- COORDINATE OF CREST----- 130.000
 IPHINT CODE FOR PRINTOUT----- 0

SOIL PROFILE • GEOMETRIC BOUNDARIES OF SLOPE • SOIL TYPE BELOW THE BOUNDARY

BOND NO	X- COORDINATE	Y- COORDINATE	X- COORDINATE	Y- COORDINATE	SOIL TYPE BELOW
1	100.000	60.000	100.000	55.000	1
2	120.000	55.000	130.000	75.000	1
3	130.000	75.000	195.000	80.000	1
4	0.000	53.000	195.000	53.000	2
5	0.000	47.500	195.000	43.500	3
6	0.000	37.500	195.000	40.500	4
7	0.000	36.000	195.000	37.500	5
8	0.000	35.000	195.000	35.000	5

NUMBER OF SOIL TYPES----- 5

SOIL TYPE(I)	GAMMA(T)	COHESION(I)	ANGLE OF INTERNAL FRICTION (T)
1	120.000	0.000	30.000
2	110.000	800.000	0.000
3	115.000	50.000	10.000
4	115.000	100.000	15.000
5	115.000	100.000	10.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	130.000	155.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	50.000	85.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

NO.	LEFT X- COOD	LEFT Y- COOD	RIGHT X-COOD	RIGHT Y- COOD
1	100.000	50.000	130.000	52.000
2	100.000	50.000	130.000	50.000
3	100.000	50.000	130.000	48.500

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD.	LEFT Y COORD.	RIGHT X COORD.	RIGHT Y COORD.
---------------	---------------	----------------	----------------

130.000 70.000 195.000 70.000

POSITION OF WATER SURFACE IC&F= 2

WATER SURFACE DEFINED BY POINTS IN SLOPE

NO. OF POINT	X-COORD.	Y-COORD.
1	107.000	59.000
2	110.000	61.000
3	115.000	63.500
4	120.000	65.000
5	122.000	66.500
6	125.000	68.000
7	129.000	69.000

DATA FOR LOCATION OF WATER SURFACE ON PAS. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

0.000 57.000 195.000 59.000

NO. OF SLIDING SURFACE --- 1

TOTAL ACTIVE PRESSURE ON BLOCK --- 11553.355158

TOTAL PASSIVE PRESSURE ON BLOCK -- 5317.642695

TOTAL WEIGHT OF BLOCK --- 49800.000000

COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24053.274205

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.66 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 2

NO. OF SLIDING SURFACE --- 2
 TOTAL ACTIVE PRESSURE ON BLOCK --- 12908.578391
 TOTAL PASSIVE PRESSURE ON BLOCK --- 5317.642695
 TOTAL WEIGHT OF BLOCK --- 53100.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24000.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.65 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 2

NO. OF SLIDING SURFACE --- 3
TOTAL ACTIVE PRESSURE ON BLOCK --- 14074.826763
TOTAL PASSIVE PRESSURE ON BLOCK -- 5317.642695
TOTAL WEIGHT OF BLOCK --- 55575.000000
COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24029.981273

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.64 FOR SURFACE 3

END OF CALCULATION --- START NEW SURFACE

START OF NEW PROGRAM WITH NEW DATA*****

ILLUSTRATION PROBLEM (2) WATER SURFACE CASE 2

INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS

CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

```
*****
TOTAL NUMBER OF SOIL PROFILES----- 11
TOTAL NUMBER OF TOP BOUNDARIES----- 3
TOTAL NUMBER OF SOIL TYPE----- 9
TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
X- COORDINATE OF TOE----- 100.000
Y- COORDINATE OF TOE----- 70.000
X - COORDINATE OF CREST----- 135.000
Y- COORDINATE OF CREST----- 25.000
IPRINT CODE FOR PRINTOUT----- 0
```

SOIL PROFILE , GEOMETRIC BOUNDARIES OF SLOPE , SOIL TYPE BELOW THE BOUNDARY

```
*****
ROND NO   X- COORDINATE   Y- COORDINATE   X- COORDINATE   Y- COORDINATE   SOIL TYPE BELOW
1         50.000         73.500         100.000         70.000         1
2         100.000        70.000         135.000         25.000         1
3         135.000        95.000         195.000         90.000         1
4         50.000         64.000         195.000         74.000         2
5         50.000         63.000         195.000         70.000         3
6         50.000         61.500         195.000         67.500         4
7         50.000         60.500         195.000         64.500         5
8         50.000         56.500         195.000         50.000         6
9         50.000         47.500         195.000         47.500         7
10        50.000         42.000         195.000         44.500         8
11        50.000         30.000         195.000         30.000         9
```

```
NUMBER OF SOIL TYPES----- 9
```

SOIL TYPE(I)	GAMMA(T)	COHESION(I)	ANGLE OF INTERNAL FRICTION (T)
1	120.000	0.000	25.000
2	115.000	50.000	20.000
3	115.000	50.000	15.000

D-15

4	115.000	100.000	10.000
5	110.000	1500.000	0.000
6	115.000	1600.000	0.000
7	115.000	1800.000	0.000
8	120.000	1000.000	10.000
9	120.000	1000.000	15.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	135.000	100.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT Y- COORD	RIGHT X- COORD
1	100.000	65.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

No.	LEFT X- COORD	LEFT Y- COORD	RIGHT X-COORD	RIGHT Y- COORD
1	100.000	57.500	135.000	60.000
2	100.000	57.500	135.000	57.500
3	100.000	57.500	135.000	55.500

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

135.000 78.500 195.000 80.000

POSITION OF WATER SURFACE ICASE= 2

WATER SURFACE DEFINED BY POINTS IN SLOPE

NO. OF POINT	X-COORD.	Y-COORD.
1	102.500	71.500
2	105.000	72.500
3	110.000	74.500
4	112.500	75.500
5	115.000	76.000
6	120.000	77.000
7	125.000	77.500

DATA FOR LOCATION OF WATER SURFACE ON PAS. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

50.000 71.000 101.500 71.000

NO. OF SLIDING SURFACE --- 1
 TOTAL ACTIVE PRESSURE ON BLOCK --- 35323.606209
 TOTAL PASSIVE PRESSURE ON BLOCK -- 17325.543272

TOTAL WEIGHT OF BLOCK --- 97384.482759

COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52633.758179

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.83 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 2

NO. OF SLIDING SURFACE --- 2

TOTAL ACTIVE PRESSURE ON BLOCK --- 37111.628357

TOTAL PASSIVE PRESSURE ON BLOCK -- 17325.543272

TOTAL WEIGHT OF BLOCK --- 102196.982759

COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52500.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.98 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 2

NO. OF SLIDING SURFACE --- 3
 TOTAL ACTIVE PRESSURE ON BLOCK --- 38792.521569
 TOTAL PASSIVE PRESSURE ON BLOCK -- 17325.543272
 TOTAL WEIGHT OF BLOCK --- 106046.982759
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52585.644429

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 2.12 FOR SURFACE 3

END OF CALCULATION --- START NEW SURFACE

START OF NEW PROBLEM WITH NEW DATA*****

ILLUSTRATION PROBLEM (1) WATER SURFACE CASE 3

 INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS

CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

 TOTAL NUMBER OF SOIL PROFILES----- 8
 TOTAL NUMBER OF TOP BOUNDARIES----- 3
 TOTAL NUMBER OF SOIL TYPE----- 5
 TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
 TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
 X- COORDINATE OF TOE----- 100.000
 Y- COORDINATE OF TOE----- 55.000
 X - COORDINATE OF CREST----- 130.000
 Y- COORDINATE OF CREST----- 35.000
 PRINT CODE FOR PRINTOUT----- 0

SOIL PROFILE , GEOMETRIC BOUNDARIES OF SLOPE , SOIL TYPE BELOW THE BOUNDARY

BOUND NO	X- COORDINATE	Y- COORDINATE	X- COORDINATE	Y- COORDINATE	SOIL TYPE BELOW
1	0.000	60.000	100.000	55.000	1
2	100.000	55.000	130.000	75.000	1
3	130.000	75.000	195.000	80.000	1
4	0.000	53.000	195.000	53.000	2
5	0.000	47.500	195.000	47.500	3
6	0.000	37.500	195.000	40.500	4
7	0.000	36.000	195.000	37.500	5
8	0.000	35.000	195.000	35.000	5

NUMBER OF SOIL TYPES----- 5

SOIL TYPE(I)	GAMMA(I)	COHESION(I)	ANGLE OF INTERNAL FRICTION (I)
1	120.000	0.000	30.000
2	110.000	200.000	0.000
3	115.000	50.000	10.000
4	115.000	100.000	15.000
5	115.000	100.000	10.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	130.000	155.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	50.000	85.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

NO.	LEFT X- COORD	LEFT Y- COORD	RIGHT X-COORD	RIGHT Y- COORD
1	100.000	50.000	130.000	52.000
2	100.000	50.000	130.000	48.500
3	100.000	50.000	130.000	50.000

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

0.000 53.500 195.000 55.500

POSITION OF WATER SURFACE ICASF= 3

NO. OF SLIDING SURFACE --- 1
 TOTAL ACTIVE PRESSURE ON BLOCK --- 15972.538448
 TOTAL PASSIVE PRESSURE ON BLOCK -- 5769.049148
 TOTAL WEIGHT OF BLOCK --- 49800.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24053.214205

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.84 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASF= 3

NO. OF SLIDING SURFACE --- 2

D-22

TOTAL ACTIVE PRESSURE ON BLOCK --- 23811.206498
 TOTAL PASSIVE PRESSURE ON BLOCK -- 5769.049148
 TOTAL WEIGHT OF BLOCK --- 55575.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24029.921273

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.52 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASF= 3

NO. OF SLIDING SURFACE --- 3
 TOTAL ACTIVE PRESSURE ON BLOCK --- 20178.953047
 TOTAL PASSIVE PRESSURE ON BLOCK -- 5769.049148
 TOTAL WEIGHT OF BLOCK --- 53100.000000
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 24000.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.66 FOR SURFACE 3

END OF CALCULATION --- START NEW SURFACE

START OF NEW PROGRAM WITH NEW DATA*****

ILLUSTRATION PROBLEM (2) WATER SURFACE CASE 3

INPUT INFORMATION FOR BLOCK STABILITY CALCULATIONS

CONTROL INFORMATION FOR PROGRAM COMPUTATIONS

```

*****
TOTAL NUMBER OF SOIL PROFILES----- 11
TOTAL NUMBER OF TOP BOUNDARIES----- 3
TOTAL NUMBER OF SOIL TYPE----- 9
TOTAL NUMBER OF UNIF. LOAD ON ACT. WEDGE----- 1
TOTAL NUMBER OF UNIF. LOAD ON PAS. WEDGE----- 1
X- COORDINATE OF TOE----- 100.000
Y- COORDINATE OF TOE----- 70.000
X - COORDINATE OF CREST----- 135.000
Y- COORDINATE OF CREST----- 25.000
IPRINT CODE FOR PRINTOUT----- 0

```

SOIL PROFILE , GEOMETRIC BOUNDARIES OF SLOPE , SOIL TYPE BELOW THE BOUNDARY

```

*****
BOND NO      X- COORDINATE      Y- COORDINATE      X- COORDINATE      Y- COORDINATE      SOIL TYPE BELOW
1            50.000          73.500          100.000          70.000          1
2            100.000         70.000         135.000         95.000          1
3            135.000         95.000         195.000         90.000          1
4            50.000          64.000         195.000         74.000          2
5            50.000          63.000         195.000         70.000          3
6            50.000          61.500         195.000         67.500          4
7            50.000          60.500         195.000         64.500          5
8            50.000          56.500         195.000         50.000          6
9            50.000          47.500         195.000         47.500          7
10           50.000          42.000         195.000         44.500          8
11           50.000          30.000         195.000         30.000          9

```

NUMBER OF SOIL TYPES---- 9

```

SOIL TYPE(I)      GAMMA(I)      COHESION(I)      ANGLE OF INTERNAL FRICTION (I)
1                  120.000          0.000          25.000
2                  115.000          50.000          20.000
3                  115.000          50.000          15.000

```

4	115.000	100.000	10.000
5	110.000	1500.000	0.000
6	115.000	1600.000	0.000
7	115.000	1800.000	0.000
8	120.000	1000.000	10.000
9	120.000	1000.000	15.000

NUMBER OF UNIF. LOAD ON ACT. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	500.000	135.000	100.000

NUMBER OF UNIF. LOAD ON PAS. WEDGE---- 1

NO. OF LOAD	INTENSITY OF LOAD	LEFT X- COORD	RIGHT X- COORD
1	100.000	65.000	100.000

PROGRAM LIMITATION NO INTERMEDIATE SOIL LAYER BETWEEN TOP OF SLIDING BLOCK -----IK ALWAYS = 3

TOTAL NUMBER OF SLIDING SURFACES TO BE ANALYSED 3

NO.	LEFT X- COORD	LEFT Y- COORD	RIGHT X-COORD	RIGHT Y- COORD
1	100.000	57.500	135.000	60.000
2	100.000	57.500	135.000	57.500
3	100.000	57.500	135.000	55.500

DATA FOR LOCATION OF WATER SURFACE ON ACT. WEDGE

LEFT X COORD. LEFT Y COORD. RIGHT X COORD. RIGHT Y COORD.

0.000 62.000 195.000 69.000

POSITION OF WATER SURFACE ICASE= 3

NO. OF SLIDING SURFACE --- 1
 TOTAL ACTIVE PRESSURE ON BLOCK --- 44559.236000
 TOTAL PASSIVE PRESSURE ON BLOCK -- 22322.464020
 TOTAL WEIGHT OF BLOCK --- 97384.482759
 COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52613.758170

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.84 FOR SURFACE 1

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 3

D-26

NO. OF SLIDING SURFACE --- 2
TOTAL ACTIVE PRESSURE ON BLOCK --- 50713.117889
TOTAL PASSIVE PRESSURE ON BLOCK -- 22322.464020
TOTAL WEIGHT OF BLOCK --- 102196.982759
COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52500.000000

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.81 FOR SURFACE 2

END OF CALCULATION --- START NEW SURFACE

POSITION OF WATER SURFACE ICASE= 3

NO. OF SLIDING SURFACE --- 3
TOTAL ACTIVE PRESSURE ON BLOCK --- 56448.179448
TOTAL PASSIVE PRESSURE ON BLOCK -- 22181.155146
TOTAL WEIGHT OF BLOCK --- 106046.982759
COHESIVE RESISTANCE ON THE BOTTOM OF BLOCK --- 52585.644429

FACTOR OF SAFETY AGAINST SLIDING OF BLOCK = 1.75 FOR SURFACE 3

END OF CALCULATION --- START NEW SURFACE

START OF NEW PROBLEM WITH NEW DATA*****