THE HOUSEL MODEL FOR SLOPE STABILITY ANALYSIS

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

THE HOUSEL MODEL FOR SLOPE STABILITY ANALYSIS

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John P. Woodford, Director
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INTRODUCTION

In a letter dated January 13, 1972, Mr. K. A. Allemeier, then Engineer of Soils, requested the Research Laboratory to produce a computer model of the Housel method for the analysis of slope stability.

The Housel method, as presented in the MDSHT "Manual of Soil Engineering" (1970), can be used quite easily with a desk calculator or a slide rule to calculate for the length of the critical plane of sliding (L) when the overload ratio (R) is known. However, when L is given and R is the dependent variable, the calculation runs into a higher degree equation requiring a series of approximations for the solution. The procedure, which becomes a tedious process with a desk calculator, takes only a few seconds of run time on an electronic data processing system.

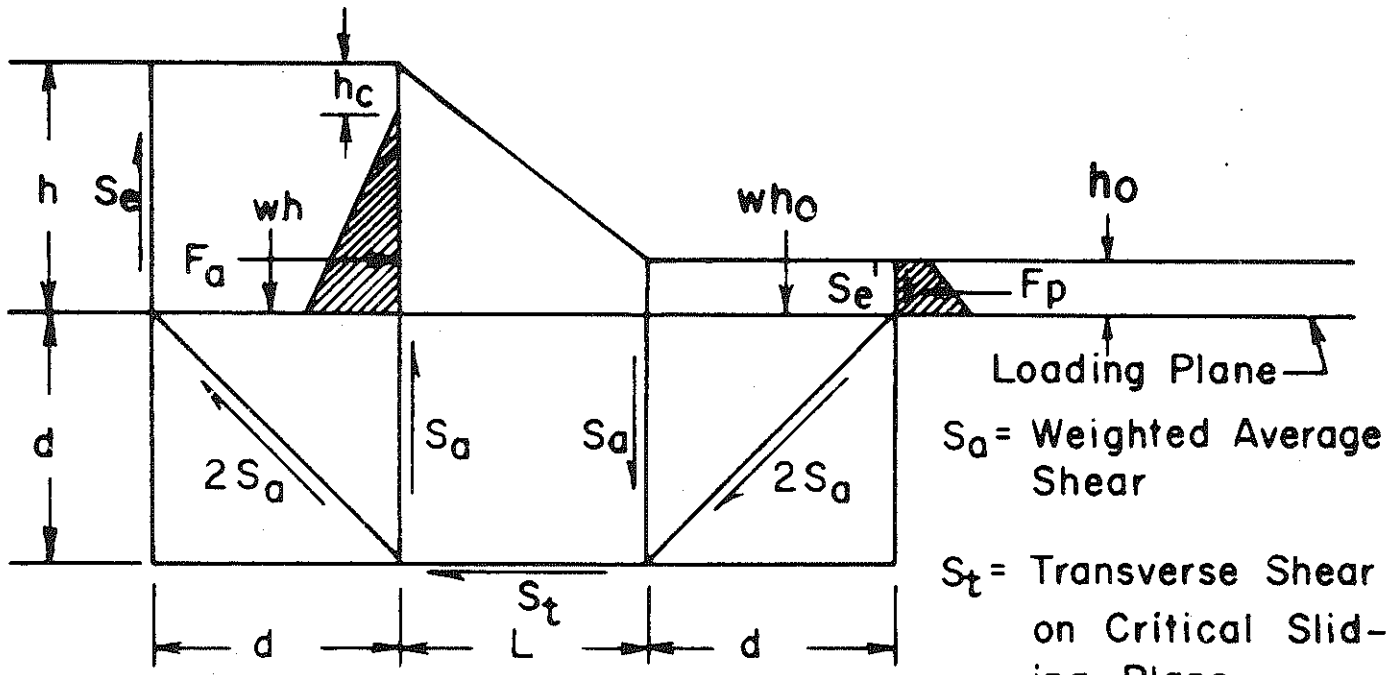
The computer model, as requested, is written in FORTRAN and has been set up for time-sharing to make it accessible in District offices having remote units. Mr. L. K. Heinig of the Soils Section provided the sample problems and solutions. He also contributed valuable ideas toward inclusion of some run options that will prove helpful to users of the computer model.

DESCRIPTION

Program Q12077 is an operational time-sharing computer program for slope stability analysis using Housel's shearing resistance method as described in the 1970 "Field Manual of Soil Engineering" of the Michigan Department of State Highways and Transportation.

The slope stability analysis consists, essentially, of relating the value of the overload ratio (R) with the length of the critical plane of sliding (L), given a combination of active and passive driving forces on the one hand and soil resistance components on the other.

The diagram and stability equation (Fig. 1) show the shear factors and the driving and resistance forces which together determine the stability of an embankment or an excavation.



EQUATION 10

Active Static Surcharge	Active Lateral Pressures	(*)	Developed Pressure	Lateral Distribution Below Load Plane	Tangential Resistance	Passive Static Forces	Uplift Resistance

$$wh + \frac{F_a}{d} - \frac{S_e R\, h}{h \text{ or } d} - 4S_a R - 2S_a R - \frac{S_t R\, L}{d} - who - \frac{F_p}{d} - \frac{S_e' Rho}{ho \text{ or } d} = 0$$

*Weight Transfer Above the Loading Plane.
Use h or d, whichever is larger.

The symbols stand for the following:

h - Total height of soil layers in the active zone.
h_o - Total height of soil layers in the passive zone.
d - Critical depth, or depth from loading plane to critical plane of sliding
L - Length of critical plane of sliding
W - Unit weight of soil
S_t - Horizontal shearing resistance available at critical plane of sliding
S_e - Shear developed on the vertical plane. It is limited by S_t and must be less than, but may be equal to, the available shear resistance on that plane. If h is less than d, S_e is less than or equal to S_t x $\frac{d}{h}$. If h is greater than d, S_e is less than or equal to S_t.
S_a - Weighted average shear
R - Overload ratio

The advantages of using an electronic data processing unit to calculate for R in the Housel equation are easily seen.

Program Q12077/QTSS is written in FORTRAN. At the present time, it is accessible only through one of the remote units in the Highway Building, the Testing and Research Laboratories, and some District offices. It had been decided that card input not only takes time to prepare for the initial run, but also requires a resubmitting of the cards if some reworking of the data becomes necessary. It is this time requirement which makes card input non-feasible for use outside of the Highway Building.

The conversational mode in which Program Q12077 is written allows the user considerable flexibility to:

1. Induce various combinations of simulated loading and soil layer conditions.

2. Modify data on line and have calculations reworked until he is satisfied with the results.

3. Obtain a neat print-out of both input and answers.

All input instructions are displayed on the remote unit, a convenience for those who use the program infrequently. Schedule files may be built by users who intend to terminate their run after the initial solution, or by those who know beforehand how they wish to rework their data. Schedule files

are especially helpful to users who do not have the time to sit at the remote unit and wait to enter input data between instruction print-outs and intermediate calculations.

CAPABILITIES

The program can handle a maximum of 25 initial soil layers, and can perform an almost unlimited amount of reworking. If R is the dependent variable, the program uses a 10-step approximation process to arrive at an L value within 0.04 of the given L. Either the metric or English system of units may be used, provided all the data in a given problem are consistent within one system.

The rework options available are:

1. Change elevations of the active top, passive top, and load plane
2. Change value of critical depth (D), length of critical plane of sliding (L), or trial overload ratio (R)
3. Change the amount of surcharge
4. Zero out Fa and Fp
5. Delete or revise zone layers.

Also available are:

1. A recovery procedure which allows the user to retrieve his original layer data after he has made some revisions on it.

2. A back-tracking procedure which enables user to correct data which had been entered erroneously for any reason.

3. A procedure which enables the user to terminate a run at any input location other than the normal end of job.

Appendix A is a listing of the computer program Q12077/QTSS.

Details of input, rework options, and the above procedures are given in the User's Guide (Appendix B).

APPENDIX A

USER'S GUIDE - PROGRAM Q12077
HOUSEL'S METHOD OF SLOPE STABILITY ANALYSIS

Description

The input mode of the program is conversational, that is, statements calling for the appropriate input entries are displayed, after which a question mark is displayed to indicate that the program is ready to accept the data entry. Rework, termination, and back-tracking options are available. A schedule file may be created to have the run scheduled and the output file retrieved later in the day. An option to send output to the printer unit may be elected at the beginning of each run.

Program Q12077/QTSS can be accessed from any MDSHT computer user code. A single run without rework takes about 7 minutes elapsed time at the remote unit under normal conditions. Simple rework such as changing surcharge, zeroing out Fa or Fp will add 1 or 2 minutes each to the total time. Larger rework procedures such as adjusting active and passive tops and load plane elevations or changing soil layers add about 4 to 6 minutes.

Scheduling takes about 5 minutes of terminal time. To print the output file, allow 3 minutes for every 72 records of output (one foot length of printed paper). Executing the program on line does not require much more time than scheduling the subsequent printing of output, but scheduling has definite advantages when the remote unit time available is limited. However, execution on line offers the user the advantage of being able to rectify input errors as soon as they are spotted.

Capabilities

Program Q12077/QTSS can handle a maximum of 25 soil layers. After the initial run, the rework option may be entered any number of times, limited only by the amount of time available to the user to spend at the remote unit. When the overload ratio (R) is entered as the dependent variable, the program requires entry of a trial value for R which it uses in a 10-step approximation process to arrive at an L (length of critical plane of sliding) value within 0.04 of the given L. An option for an additional 10-step approximation may be elected. However, if the L value shows no sign of being approached by approximation, the user is re-routed to enable him to re-enter a new trial R or a new L-R combination.

An option at the beginning of the run allows the user who plans to schedule his run to send the output to the printer unit downtown. This option is especially useful if the remote unit is kept so busy that the user has very little chance of getting back on to print his output file. It does not exclude the user from printing his output file on the remote unit when he has a chance to do so.

The program can handle either metric or English units but all input for a problem must be consistent within one system of units.

Procedure

Except for names, identification, and titles, all input items are entered free field, separated by commas. On schedule files, each line, except the first 2 or 3 lines, must end with a comma. The following are the input items in the order given:

? YES or NO
(YES to send output to printer unit, NO otherwise)

? Name, Division, Office Phone - 72 characters maximum
(Where to send printer output if first input is Yes. If first input is No, this entry is omitted.)

? Project and other identification - 72 characters maximum

? Soil layer data (may consist of several lines, 5 items each)
The items are: Layer number, elevation of top of layer, unit weight, yield shearing resistance, angle of pressure transmission Θ.
The last line must consist of the following:
99, bottom of elevation of lowest layer, 0, 0, 0,

? Elevations of active top, passive top, loading plane

? Depth from loading plane to critical plane of sliding
Four nines (9999) entered here forces the program to compute the maximum value of depth from the given data.

? Options to correct or change layer data just presented
Enter 0 (zero) if layer data needs no change.
Enter 1 if some of the layers have to be deleted.
Enter 2 if layers have to be corrected or replaced.

? Live load surcharge

? Length of critical plane of sliding and overload ratio R. One of these must be the dependent variable and must be entered as 9999.

? Trial overload ratio R

Options

When the initial solution has been completed, the user is presented with three options:

1. Terminate the run, in which case he enters a 0 (zero), to be followed by another 0 (zero) after the next question mark is displayed.

2. Start a new problem (enter 1).

3. Rework the problem with changes in data (enter 2).

If the rework option is elected, one of the following codes must be entered next:

3 or 13 To change elevations of active top, passive top, and load plane.
4 or 14 To change the value of D
5 or 15 To change the value of L or R or both
6 or 16 To change the value of trial R
7 or 17 To zero out F active or F passive
8 or 18 To revise soil layers
9 or 19 To change the value of surcharge

The corresponding codes 13 to 19 are entered when the user is preparing to rework a set of soil layers which are a result of previous soil layer changes in the same problem. However, if the user wishes to get back to his original soil layers of the initial run, he should enter codes 3 to 9.

Back-Tracking to Correct Input

There are instances when the user executing the program on line becomes aware of an input error after he is several entries ahead, or just after he has depressed the left-arrow key. When this situation occurs, inputting 99999999 (eight nines) for the first item of the next entry, zero-filling the data line as necessary, will cause the program to jump back to the previous input location point, thus enabling the user to enter the correct data

this time. By successive back-tracking, this routine can be used to correct erroneous data several lines behind the point of discovery.

Terminating a Run At Any Input Location

If the user desires to terminate a run at any input location, he must enter 9999999999 (ten nines) for the first item of that input entry, zero-filling as necessary. This procedure will send the program to the routine for normal termination of job.

Building a Data File

After the user has become comfortable with the sequence of data entries, he may wish to build a schedule data file. Schedule files consist of a command to execute a program, followed by the data in the same order that they would occur if they were input on line. The file is then scheduled to an output file and the user is free to leave the remote unit or perform other computer work on the terminal. After some time, and before 4:30 p.m., the output file (containing the solution) may be accessed and printed.

Assistance

Q12077/QTSS is a new program and, although the testing has been thorough, is still sensitive to unforeseen option combinations. Because some changes in the program may need to be made from time to time, the listing which is attached may not be the latest version. However, a copy of the current listing will be available upon request. For assistance in building a schedule file, or assistance in running the program, or if a run is yielding wrong or weird answers, please get in touch with Josette Portigo, Soils Research Unit, Research Laboratory, Lansing, Michigan, Telephone 1-517-373-7598.

OVERLOAD RATIO (R) KNOWN.
LENGTH OF CRITICAL PLANE OF SLIDING (L) IS CALCULATED IN ONE STEP.
SURCHARGE REWORK IS ALSO SHOWN.

```
R Q12077/QTSS←
 RUNNING


  DØ YØU WANT ØUTPUT SENT TØ PRINTER -- YES, NØ
? NØ←


  ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
? SAMPLE 01 - R KNØWN, REWØRK SURCHARGE←

  ENTER LAYER DATA: NØ., TØP ELEV, GAMMA, SHEAR, THETA
  LAST LINE ENTER 99, LAST LAYER BØTTØM ELEV, 0, 0, 0,
? 1,603,130,300,45,←
? 2,591,130,160,45,←
? 99,543,0,0,0,←

     LAYER   TØP ELEV    GAMMA     SHEAR      H     BØTM ELEV    THETA

       1      603.00    130.00    300.00    12.00     591.00     45.00
       2      591.00    130.00    160.00    48.00     543.00     45.00


  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 603,588,572,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
? 9999,←

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      603.00    130.00    300.00    12.00     591.00     45.00
       2      591.00    130.00    160.00    19.00     572.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      588.00    130.00    160.00    16.00     572.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      572.00    130.00    160.00    29.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
?0,←

  ENTER LL SURCHARGE
?0,←
```

```
  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?9999, 1.9,←

  AT RATIØ =    1.900,  L =   27.769

  ACTIVE STATIC SURCHARGE = 116870.00
  FA =  42231.46      FP =   26368.00      D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =       160.00
  WT. TRANS ABØVE L.P. =      6211.61    SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  52896.00
  PASSIVE STATIC FØRCES =    60320.00  UPLIFT RESISTANCE =  4864.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?2,←

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  ENTER REWØRK ØPTIØN:

     3              TØ REVISE ACTIVE,PASSIVE TØPS, LØAD PLANE ETC.
     4, 5, ØR 6     FØR NEW D,  NEW L AND R,    NEW TRIAL RATIØ
     7, 8, ØR 9     FØR ZERØ FA & FP,   CHANGE LAYERS,   CHANGE SURCHARGE.
? 9,←


  ENTER SURCHARGE INCREASE ØR DECREASE(NEG.)
? 200,←

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?9999,2.2,←

  AT RATIØ =    2.200,  L =   15.989

  ACTIVE STATIC SURCHARGE = 122670.00
  FA =  44273.61      FP =   27904.00      D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =       160.00
  WT. TRANS ABØVE L.P. =      6211.61    SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  61248.00
  PASSIVE STATIC FØRCES =    60320.00  UPLIFT RESISTANCE =  5632.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?2,←

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  DØ YØU WANT ØPTIØN CØDES PRINTED? 1 IF YES,ELSE ENTER REWØRK ØPTIØN.
?5,←
```

```
  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?9999,2.0,←

  AT RATIØ =    2.000,  L =   45.030

  ACTIVE STATIC SURCHARGE = 122670.00
  FA =  45951.15      FP =   26880.00      D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =       160.00
  WT. TRANS ABØVE L.P. =      6211.61    SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  55680.00
  PASSIVE STATIC FØRCES =    60320.00  UPLIFT RESISTANCE =  5120.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?0,←

  ARE YØU SURE THIS IS WHAT YØU WANT TØ DØ? - REENTER ØPTIØN CØDE.
?0,←

  CALCULATIØNS HAVE BEEN CØMPLETED.

  END ØF JØB. ELAPSED TIME =  10 MINUTES,  0.8 SECØNDS

     PRØGRAM Q12077/QTSS, SLØPE STABILITY-HØUSEL
     RUN DATE:  9-27-74


 END Q12077 3.6 SEC.
```

L KNOWN.
R IS CALCULATED BY APPROXIMATION.
TWO REWORK OPTIONS SHOWN.

```
R Q12077/QTSS←
 RUNNING

  DØ YØU WANT ØUTPUT SENT TØ PRINTER -- YES, NØ
? NØ←


  ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
? SAMPLE 02 - L KNØWN, REWØRK TØ ZERØ ØUT FA,FP;REWØRK R←

  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
? 1,603,130,300,45,←
? 2,591,130,160,45,←
? 99, 543,0,0,0,←
```

LAYER	TØP ELEV	GAMMA	SHEAR	H	BØTM ELEV	THETA
1	603.00	130.00	300.00	12.00	591.00	45.00
2	591.00	130.00	160.00	48.00	543.00	45.00

```
  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 603,588,572,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?9999,←

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      603.00    130.00    300.00    12.00     591.00     45.00
       2      591.00    130.00    160.00    19.00     572.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      588.00    130.00    160.00    16.00     572.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      572.00    130.00    160.00    29.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
? 0,←

  ENTER LL SURCHARGE
? 0,←

  ENTER L, R , USING 9999 FØR DEPENDENT VARIABLE.
? 30,9999,←

  ENTER TRIAL RATIØ
? 1.6,←

  AT RATIØ =     1.600,   L =    84.484
  STEP = 1

  AT RATIØ =     2.000,   L =    12.818
  STEP = 2

  AT RATIØ =     1.904,   L =    27.124
  STEP = 3

  AT RATIØ =     1.885,   L =    30.186
  STEP = 4

  AT RATIØ =     1.886,   L =    30.001
  RATIØ = 1.89

  ACTIVE STATIC SURCHARGE = 116870.00
  FA =   42344.07       FP =   26296.27       D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
  WT. TRANS ABØVE L.P. =       6211.61     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  52504.98
  PASSIVE STATIC FØRCES =     60320.00   UPLIFT RESISTANCE =   4828.14
```

```
  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?2,←

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  ENTER REWØRK ØPTIØN:

     3              TØ REVISE ACTIVE,PASSIVE TØPS, LØAD PLANE ETC.
     4, 5, ØR 6     FØR NEW D,  NEW L AND R,    NEW TRIAL RATIØ
     7, 8, ØR 9     FØR ZERØ FA & FP,   CHANGE LAYERS,   CHANGE SURCHARGE.
? 7,←

  ZERØ ØUT FA,FP.

  ENTER TRIAL RATIØ
? 1.7,←

  AT RATIØ =     1.700,   L =    -4.932
  STEP = 1

  AT RATIØ =     1.300,   L =    52.875
  STEP = 2

  AT RATIØ =     1.458,   L =    25.747
  STEP = 3

  AT RATIØ =     1.433,   L =    29.481
  STEP = 4

  AT RATIØ =     1.430,   L =    30.010
  RATIØ = 1.43

  ACTIVE STATIC SURCHARGE = 116870.00
  FA =       0.00       FP =        0.00       D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =         160.00
  WT. TRANS ABØVE L.P. =       6211.61     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  39811.11
  PASSIVE STATIC FØRCES =     60320.00   UPLIFT RESISTANCE =   3660.84

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
? 2,←

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  DØ YØU WANT ØPTIØN CØDES PRINTED? 1 IF YES,ELSE ENTER REWØRK ØPTIØN.
?6,←
```

```
  ENTER TRIAL RATIØ
? 1.3,←

  AT RATIØ =     1.300,   L =   169.437
  STEP = 1

  AT RATIØ =     1.700,   L =    63.253
  STEP = 2

  AT RATIØ =     1.825,   L =    40.076
  STEP = 3

  AT RATIØ =     1.880,   L =    31.009
  STEP = 4

  AT RATIØ =     1.886,   L =    30.031
  RATIØ = 1.89

  ACTIVE STATIC SURCHARGE = 116870.00
  FA =   42345.75       FP =   26295.20       D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
  WT. TRANS ABØVE L.P. =       6211.61     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  52500.11
  PASSIVE STATIC FØRCES =    60320.00   UPLIFT RESISTANCE =   4827.60

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?2 0,←

  ARE YØU SURE THIS IS WHAT YØU WANT TØ DØ? - REENTER ØPTIØN CØDE.
? 0,←

  CALCULATIØNS HAVE BEEN CØMPLETED.

  END ØF JØB. ELAPSED TIME =  11 MINUTES, 15.8 SECØNDS

     PRØGRAM Q12077/QTSS, SLØPE STABILITY-HØUSEL
     RUN DATE:  9-27-74


 END Q12077 4.9 SEC.
```

REWORKING ELEVATIONS OF ACTIVE TOP, PASSIVE TOP, AND LOAD PLANE.

```
  R Q12077/QTSS←
   RUNNING

    DØ YØU WANT ØUTPUT SENT TØ PRINTER -- YES,NØ
  ? NØ←

    ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
  ? SAMPLE 03 - L-KNØWN,REWØRK ACTIVE,PASSIVE TØPS AND LØAD PLANE←
```

```
  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
? 1,603,130,300,45,←
? 2,591,130,160,45,←
? 99,543,0,0,0,←

     LAYER   TØP ELEV    GAMMA     SHEAR      H      BØTM ELEV    THETA

       1      603.00    130.00    300.00    12.00     591.00     45.00
       2      591.00    130.00    160.00    48.00     543.00     45.00

  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 601,590,580,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
? 9999,←

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      601.00    130.00    300.00    10.00     591.00     45.00
       2      591.00    130.00    160.00    11.00     580.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      590.00    130.00    160.00    10.00     580.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      580.00    130.00    160.00    37.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
?0,←

  ENTER LL SURCHARGE
?0,←

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
? 30,9999,←

  ENTER TRIAL RATIØ
? 1.8,←

  AT RATIØ =     1.800,   L =  -51.774
  STEP = 1

  AT RATIØ =     1.400,   L =   14.522
  STEP = 2

  AT RATIØ =     1.307,   L =   36.151
  STEP = 3

  AT RATIØ =     1.333,   L =   29.683
  STEP = 4
```

```
 AT RATIØ =    1.332,   L =   29.992
 RATIØ = 1.33

 ACTIVE STATIC SURCHARGE = 101010.00
 FA =  18441.76      FP =   10761.97      D = 37.00
 TRANSV SHEAR ØN CRIT. SLIDING PLANE =       160.00
 WT. TRANS ABØVE L.P. =      4760.00    SA = 160.00
 DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  47307.58
 PASSIVE STATIC FØRCES =    48100.00  UPLIFT RESISTANCE =  2130.99

 ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
? 2,←

 YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

 ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
      13-19 TØ REWØRK LAST REPLACEMENT LAYERS.


 ENTER REWØRK ØPTIØN:

    3            TØ REVISE ACTIVE,PASSIVE TØPS, LØAD PLANE ETC.
    4, 5, ØR 6   FØR NEW D,  NEW L AND R,    NEW TRIAL RATIØ
    7, 8, ØR 9   FØR ZERØ FA & FP,   CHANGE LAYERS,   CHANGE SURCHARGE.
? 3,←

 ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 603, 588, 588,←

 ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
? 9999,←

 NØ. ØF LAYERS IN ACTIVE ZØNE = 2
      1     603.00   130.00   300.00   12.00    591.00    45.00
      2     591.00   130.00   160.00    3.00    588.00    45.00

 NØ. ØF LAYERS IN PASSIVE ZØNE = 0

 NØ. ØF LAYERS BELØW LØAD PLANE = 1
      1     588.00   130.00   160.00   45.00    543.00    45.00

 PLEASE CHECK LAYERS JUST PRINTED.
 ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
? 0,←

 ENTER LL SURCHARGE
? 0,←

 ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
? 30,9999,←

 ENTER TRIAL RATIØ
? 1.6,←
```

```
 AT RATIØ =     1.600,   L =    76.811
 STEP = 1

 AT RATIØ =     2.000,   L =     3.480
 STEP = 2

 AT RATIØ =     1.855,   L =    26.181
 STEP = 3

 AT RATIØ =     1.831,   L =    30.370
 STEP = 4

 AT RATIØ =     1.833,   L =    29.995
 RATIØ = 1.83

 ACTIVE STATIC SURCHARGE =  87750.00
 FA =    4319.41       FP =        0.00       D = 45.00
 TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
 WT. TRANS ABØVE L.P. =       4080.00     SA = 160.00
 DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  79191.76
 PASSIVE STATIC FØRCES =         0.00   UPLIFT RESISTANCE =      0.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
? 0,←

  ARE YØU SURE THIS IS WHAT YØU WANT TØ DØ? - REENTER ØPTIØN CØDE.
?0,←

  CALCULATIØNS HAVE BEEN CØMPLETED.

  END ØF JØB. ELAPSED TIME =   9 MINUTES, 58.3 SECØNDS

     PRØGRAM Q12077/QTSS, SLØPE STABILITY-HØUSEL
     RUN DATE:  9-27-74


END Q12077 5.3 SEC.
```

REWORKING SOIL LAYER DATA.
BACK-TRACKING AND CORRECTING INPUT ERRORS ALSO SHOWN.

```
R Q12077/QTSS←
 RUNNING


  DØ YØU WANT ØUTPUT SENT TØ PRINTER -- YES,NØ
? NØ←


  ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
? SAMPLE 04 - L KNØWN, REWØRK TØ CHANGE LAYERS←
```

```
  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
? 1,603,130,300,45,←
? 2,591,130,160,45,←
? 99,543,0,0,0,←

     LAYER   TØP ELEV    GAMMA     SHEAR      H      BØTM ELEV    THETA

       1      603.00    130.00    300.00    12.00     591.00      45.00
       2      591.00    130.00    160.00    48.00     543.00      45.00

  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 601,590,590,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
? 9999,←

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      601.00    130.00    300.00    10.00     591.00      45.00
       2      591.00    130.00    160.00     1.00     590.00      45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 0

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      590.00    130.00    160.00    47.00     543.00      45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER  0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
? 0,←

  ENTER LL SURCHARGE
? 0,←

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
? 30,9999,←

  ENTER TRIAL RATIØ
? 1.6,←

  AT RATIØ =     1.600,   L =   -26.736
  STEP = 1

  AT RATIØ =     1.200,   L =    63.442
  STEP = 2

  AT RATIØ =     1.348,   L =    23.523
  STEP = 3

  AT RATIØ =     1.324,   L =    29.369
  STEP = 4
```

```
  AT RATIØ =    1.322,   L =   30.018
  RATIØ = 1.32

  ACTIVE STATIC SURCHARGE =  67210.00
  FA =   1930.70       FP =       0.00       D = 47.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
  WT. TRANS ABØVE L.P. =      3160.00     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  59632.87
  PASSIVE STATIC FØRCES =        0.00   UPLIFT RESISTANCE =      0.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
? 2,←

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  ENTER REWØRK ØPTIØN:

     3              TØ REVISE ACTIVE,PASSIVE TØPS, LØAD PLANE ETC.
     4, 5, ØR 6     FØR NEW D,  NEW L AND R,     NEW TRIAL RATIØ
     7, 8, ØR 9     FØR ZERØ FA & FP,   CHANGE LAYERS,   CHANGE SURCHARGE.
? 8,←

  ENTER LAYER REPLACEMENT DATA -
  (ZØNE CØDES 1,2,3 FØR ACTIVE,PASSIVE,BELØW L.P.)
  ZØNE CØDE,LAYER,TØP EL,GAMMA,S,H,THETA
  END WITH ZØNE CØDE = 99 FØLLØWED BY ZERØES
? 1,1,603,130,300,12,45,←
? 1,2,591,130,160,19,45,←
? 2,1,588,130,160,16,45,←
? 3,1,572,130,160,29,45,←
? 99,0,0,0,0,0,0,←

  ENTER NEW ACTIVE,PASSIVE TØPS AND LØAD PLANE, ELSE 0,0,0,
? 603,588,572,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?9999,←

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      603.00    130.00    300.00    12.00     591.00     45.00
       2      591.00    130.00    160.00    19.00     572.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      588.00    130.00    160.00    16.00     572.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      572.00    130.00    160.00    29.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
? 0,←
```

```
  ENTER LL SURCHARGE
? 0,←

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?30,9999,←

  ENTER TRIAL RATIØ
? 1.8,←

  AT RATIØ =     1.800,   L =    44.478
  STEP = 1

  AT RATIØ =     2.200,   L =   -12.770
  STEP = 2

  AT RATIØ =     1.901,   L =    27.589
  STEP = 3

  AT RATIØ =     1.883,   L =    30.429
  STEP = 4

  AT RATIØ =     1.886,   L =    29.996
  RATIØ = 1.89

  ACTIVE STATIC SURCHARGE = 116870.00
  FA =   42343.97      FP =   26296.33       D = 29.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
  WT. TRANS ABØVE L.P. =       6211.61     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  52506.21
  PASSIVE STATIC FØRCES =     60320.00   UPLIFT RESISTANCE =   4828.17

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
? 1,←


  ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
? SAMPLE 05 - REVISE LAYERS TØ CØRRECT INPUT ERRØR.BACKTRACKING←

  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
? 1,603,130,300,45,←
? 2,592,130,260,45,←
? 99,543,0,0,0,←

     LAYER   TØP ELEV    GAMMA     SHEAR      H     BØTM ELEV    THETA

       1      603.00    130.00    300.00    11.00     592.00     45.00
       2      592.00    130.00    260.00    49.00     543.00     45.00

  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
?99999999,0,0,←
```

```
  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
? 1,603,130,300,45,←
 2,592,130,160,45,←
?? 99,543,0,0,0,←

     LAYER   TØP ELEV    GAMMA     SHEAR      H     BØTM ELEV    THETA

       1      603.00    130.00    300.00    11.00     592.00     45.00
       2      592.00    130.00    160.00    49.00     543.00     45.00

  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 605,588,572,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?9999,←

  TØPLINE ENTERED IS UP IN THE AIR ABØVE TØPMØST LAYER.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
? 603,588,572,←

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?9999,←


  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      603.00    130.00    300.00    11.00     592.00     45.00
       2      592.00    130.00    160.00    20.00     572.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      588.00    130.00    160.00    16.00     572.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      572.00    130.00    160.00    29.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
? 0,←

  ENTER LL SURCHARGE
? 300,←

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
? 30,9999,←

  ENTER TRIAL RATIØ
?1.8 ,←

  AT RATIØ =     1.800,   L =   101.730
  STEP = 1
```

```
 AT RATIØ =     2.200,   L =    32.818
 STEP = 2

 AT RATIØ =     2.216,   L =    30.558
 STEP = 3

 AT RATIØ =     2.220,   L =    30.003
 RATIØ = 2.22

 ACTIVE STATIC SURCHARGE = 125570.00
 FA =  46997.98       FP =   28008.43       D = 29.00
 TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
 WT. TRANS ABØVE L.P. =       6080.65     SA = 160.00
 DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  61815.56
 PASSIVE STATIC FØRCES =     60320.00   UPLIFT RESISTANCE =   5684.21

 ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?0,←

 ARE YØU SURE THIS IS WHAT YØU WANT TØ DØ? - REENTER ØPTIØN CØDE.
?0,←

 CALCULATIØNS HAVE BEEN CØMPLETED.

 END ØF JØB. ELAPSED TIME =   7 MINUTES, 18.5 SECØNDS

    PRØGRAM Q12077/QTSS, SLØPE STABILITY-HØUSEL
    RUN DATE:  9-27-74


END Q12077 8.3 SEC.
```

SCHEDULING A RUN AND RETRIEVING THE OUTPUT FILE ON THE REMOTE UNIT.

```
MAKE QHDATI←
FILE:QHDATI - TYPE:SEQ  -- CREATED
#
SEQ 10+10←
10 R Q12077/QTSS←
20 YES←
30 J DØE, T&R RESEARCH LAB, 37598←
40 TEST PRINTER ØPTIØN←
50 1,603,130,300,45,←
60 2,591,130,160,45,←
70 99,543,0,0,0,←
80 603,590,590,←
90 9999,←
100 0,←
110 0,←
120 30,9999,←
130 1.8,←
```

```
140 2,←
150 3,←
160 601,590,578,←
170 9999,←
180 0,←
190 300,←
200 30,9999,←
210 1.6,←
220 0,←
230 0,←
240←
#
SAVE←
 WAIT-

FILE:QHDAT1 - TYPE:SEQ  -- SAVED.

SCHEDULE QHDAT1  TØ QHDAT2←
 WAIT.

 END SCHEDUL 1.1 SEC.

STATUS QHDAT2←
SCHEDULED.


STATUS QHDAT2←
DØNE.
WHATS QHDAT2←
FILE QHDAT2, TYPE INFØ, 169 RECØRDS, CREATED 09/27/74 (1404) SF=2
#
P QHDAT2←

 R Q12077/QTSS
 RUNNING


  DØ YØU WANT ØUTPUT SENT TØ PRINTER -- YES,NØ
?? YES
  WHERE DØ YØU WANT PRINTER ØUTPUT SENT --
      ENTER NAME,DIVISIØN, ØFFICE PHØNE
?? J  DØE, T&R RESEARCH LAB, 37598


  ENTER TITLE TØ 72 PØSITIØNS MAXIMUM
?? TEST PRINTER ØPTIØN

  ENTER LAYER DATA: NØ.,TØP ELEV,GAMMA,SHEAR,THETA
  LAST LINE ENTER 99,LAST LAYER BØTTØM ELEV,0,0,0,
?? 1,603,130,300,45,
?? 2,591,130,160,45,
?? 99,543,0,0,0,
```

```
   LAYER   TØP ELEV    GAMMA     SHEAR      H      BØTM ELEV    THETA

     1      603.00    130.00    300.00    12.00     591.00      45.00
     2      591.00    130.00    160.00    48.00     543.00      45.00

  SØIL LAYERS ARE DEFINED.

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
?? 603,590,590,

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?? 9999,


  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
     1      603.00    130.00    300.00    12.00     591.00      45.00
     2      591.00    130.00    160.00     1.00     590.00      45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 0

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
     1      590.00    130.00    160.00    47.00     543.00      45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
?? 0,


  ENTER LL SURCHARGE
?? 0,

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?? 30,9999,

  ENTER TRIAL RATIØ
?? 1.8,

  AT RATIØ =     1.800,   L =  -12.538
  STEP = 1

  AT RATIØ =     1.400,   L =   69.968
  STEP = 2

  AT RATIØ =     1.594,   L =   24.613
  STEP = 3

  AT RATIØ =     1.571,   L =   29.392
  STEP = 4

  AT RATIØ =     1.568,   L =   30.010
  RATIØ = 1.57
```

```
  ACTIVE STATIC SURCHARGE =  79430.00
  FA =   2598.44       FP =       0.00       D = 47.00
  TRANSV SHEAR ØN CRIT. SLIDING PLANE =       160.00
  WT. TRANS ABØVE L.P. =      3760.00     SA = 160.00
  DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  70740.24
  PASSIVE STATIC FØRCES =        0.00   UPLIFT RESISTANCE =      0.00

  ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?? 2,

  YØU ARE WØRKING WITH ØRIGINAL SØIL LAYERS.

  ENTER 3-9 TØ REWØRK ØRIGINAL LAYERS,
       13-19 TØ REWØRK LAST REPLACEMENT LAYERS.

  ENTER REWØRK ØPTIØN:

     3              TØ REVISE ACTIVE,PASSIVE TØPS, LØAD PLANE ETC.
     4, 5, ØR 6     FØR NEW D,  NEW L AND R,    NEW TRIAL RATIØ
     7, 8, ØR 9     FØR ZERØ FA & FP,   CHANGE LAYERS,   CHANGE SURCHARGE.
?? 3,

  ENTER ELEV ØF ACTIVE TØP, PASSIVE TØP, LØAD PLANE
?? 601,590,578,

  ENTER 9999 TØ CØMPUTE D FRØM DATA, ELSE ENTER ACTUAL D.
?? 9999,

  NØ. ØF LAYERS IN ACTIVE ZØNE = 2
       1      601.00    130.00    300.00    10.00     591.00     45.00
       2      591.00    130.00    160.00    13.00     578.00     45.00

  NØ. ØF LAYERS IN PASSIVE ZØNE = 1
       1      590.00    130.00    160.00    12.00     578.00     45.00

  NØ. ØF LAYERS BELØW LØAD PLANE = 1
       1      578.00    130.00    160.00    35.00     543.00     45.00

  PLEASE CHECK LAYERS JUST PRINTED.
  ENTER 0,1,ØR 2 FØR NØ CHANGE, DELETE, REPLACE.
?? 0,

  ENTER LL SURCHARGE
?? 300,

  ENTER L, R, USING 9999 FØR DEPENDENT VARIABLE.
?? 30,9999,

  ENTER TRIAL RATIØ
?? 1.6,

  AT RATIØ =     1.600,   L =    38.431
  STEP = 1
```

```
 AT RATIØ =     2.000,   L =   -26.655
 STEP = 2

 AT RATIØ =     1.652,   L =    28.130
 STEP = 3

 AT RATIØ =     1.640,   L =    30.433
 STEP = 4

 AT RATIØ =     1.642,   L =    29.997
 RATIØ = 1.64

 ACTIVE STATIC SURCHARGE = 115150.00
 FA =  26406.92       FP =   15665.90       D = 35.00
 TRANSV SHEAR ØN CRIT. SLIDING PLANE =        160.00
 WT. TRANS ABØVE L.P. =       5080.00     SA = 160.00
 DEV. PRESSURE + LAT. DISTR. BELØW L.P. =  55176.41
 PASSIVE STATIC FØRCES =     54600.00   UPLIFT RESISTANCE =  3152.95

 ENTER 0,1,ØR 2 FØR EXIT, NEW PRØBLEM, ØR REWØRK.
?? 0,

 ARE YØU SURE THIS IS WHAT YØU WANT TØ DØ? - REENTER ØPTIØN CØDE.
?? 0,

 CALCULATIØNS HAVE BEEN CØMPLETED.

 END ØF JØB. ELAPSED TIME =   2 MINUTES, 35.2 SECØNDS

    PRØGRAM Q12077/QTSS, SLØPE STABILITY-HØUSEL
    RUN DATE:  9-27-74


END Q12077 5.4 SEC.


BYE
 C&E USE 1.0 SEC.
 EXECUTE 5.4 SEC.
 IØ TIME 7.6 SEC.
 GØØDBYE QTANDR
09/27/74


#
```

APPENDIX B

```
100 C=     PLS RETURN LISTING TO J M PORTIGO, RESEARCH LAB
140 C=
180 C=        SLOPE STABILITY ANALYSIS, HOUSEL METHOD
220 C=        REF: MDSH (1970) FIELD MANUAL OF SOIL ENGINEERING
260 C=        BY J.M. PORTIGO, RESEARCH LAB
300 FILE  1 = 012JMP, UNIT = REMOTE
340 FILE  3 = QPJMP, UNIT = PRINTER
380       DIMENSION HED(12), DATA(5), SOIL(25,8),SOILA(25,8),
420 -      SOILP(25,8),SOILT(25,8),SOILB(25,8),PAL(25),DATR(8),
460 -     PAT(25),PPT(25),PPL(25),X(12),Y(12),HC(25)
500       DIMENSION SOILAT(25,8),SOILPT(25,8),SOILBT(25,8)
540       DIMENSION OSOILA(25,8), OSOILP (25,8), OSOILB(25,8)
544       DIMENSION SOILAR(25,8),SOILPR(25,8),SOILBR(25,8)
548       DIMENSION RSOILA(25,8),RSOILP(25,8),RSOILB(25,8)
552       DIMENSION JDEN(10)
580 C=         READ IN HEADER AND SOIL DATA
600 C=
604       WRITE(1,8910)
608  8910 FORMAT(2X, "DO YOU WANT OUTPUT SENT TO PRINTER -- YES,NO")
616       READ (1,10) PRNT
620       IF(PRNT .EQ. 6HNO     .OR. PRNT .EQ. 6H NO    .OR.
624 -        PRNT .EQ. 6H  NO   .OR. PRNT .EQ. 6H   NO ) GO TO 40
628       JPNT = 1
630       WRITE (1,6301)
632  6301 FORMAT(2X,"WHERE DO YOU WANT PRINTER OUTPUT SENT --",
634 -       /6X,"ENTER NAME,DIVISION, OFFICE PHONE"  )
636       READ (1,10) JDEN
640       WRITE (3,8930) JDEN
644  8930 FORMAT(4X,28HPLEASE RETURN PRINTOUT TO--  /8X,10A6//)
660    40 DO 44 M = 1,12
700    44 HED (M) = 6H
720       ATR = TIME(1)
740       WRITE(1,9000)
780  9000 FORMAT(//2X,36HENTER TITLE TO 72 POSITIONS MAXIMUM  )
820    50 READ(1,10) HED
840       IF (JPNT .GE. 1) WRITE (3,10) HED
860    10 FORMAT(12A6)
900    60 PDATA = 999999999.0
904       DO 62 KL = 1,25
908       DO 62 KM = 1,8
912    62 SOIL(KL,KM) = 0.0
940    64 WRITE(1,9001)
980  9001 FORMAT(/2X,42HENTER LAYER DATA: NO.,TOP ELEV,GAMMA,SHEAR  ,
1020 -     6H,THETA  ,
1060 -     /2X,48HLAST LINE ENTER 99,LAST LAYER BOTTOM ELEV,0,0,0,  )
1100    80 DO 120 I = 1,24
1140    82 READ /, (DATA(J), J=1,5)
1180 C=       LAST LINE OF DATA MUST HAVE 99 FOR LAYER NO., BOTTOM ELEV
1220 C=          OF LOWEST LAYER FOR ITEM 2, THEN 0, 0, 0,
1260  9003 FORMAT(I5,2X,7F9.3/(7X,7F9.3))
1264       IF(DATA(1) .GE. 9999999990) GO TO 1500
1268       IF(DATA(1) .GE. 99999990) GO TO 88
1300       IF (DATA(1) .GE. 98.0) GO TO 140
1340       IF(DATA(2) .LE. PDATA) GO TO 92
1380       I = 0
1420       WRITE(1,9004)
1424       IF(JPNT .GE. 1) WRITE (3,9004)
1460  9004 FORMAT(2X,32HELEV JUST GIVEN IS GREATER THAN  ,
1500 -     /2X,36HPREVIOUS ELEV. START SOIL DATA OVER.  )
1540       GO TO 60
1560    88 I = I - 1
1562       WRITE(1,89) I
1563       IF(JPNT .GE. 1) WRITE(3,89)I
1564    89 FORMAT(2X,21HREPLACE SOIL DATA NO. ,I2)
```

```
      IF( I .LE. 1) PDATA = 999999999.0
      IF( I .GT. 1) PDATA = SOIL(I-1,2)
      GO TO 82
   92 I9 = I
      DATA(1) = DATA(1) + 0.00009
      K = DATA(1)
      DO 100 IA = 1,4
      SOIL(K,IA) = DATA(IA)
  100 CONTINUE
      SOIL(K,7) = DATA(5)/57.29578
      SOIL(K,8) = 90.0/57.29578 - 2.0 * SOIL(K,7)
      PDATA = DATA(2)
      IF(K .LE. 1) GO TO 120
      SOIL (K-1,5) = SOIL(K-1,2) - SOIL(K,2)
      SOIL(K-1,6) = SOIL(K,2)
  120 CONTINUE
  140 SOIL(K,5) = SOIL(K,2) - DATA(2)
      SOIL(K,6) = DATA(2)
      SOIL(K+1,2) = 999999999.0
      WRITE(1,9005)
      IF(JPNT .GE. 1) WRITE (3,9005)
 9005 FORMAT(/5X,5HLAYER,2X,8HTOP ELEV ,3X,5HGAMMA ,4X,
     - 5HSHEAR ,5X,1HH,4X,9HBOTM ELEV ,3X,5HTHETA /)
      CALL RITE(I9,JPNT,SOIL)
 9035 FORMAT(6X,I2,2X,3F9.2,F8.2,1X,2F9.2)
      WRITE(1,9007)
      IF(JPNT .GE. 1) WRITE (3,9007)
 9007 FORMAT(/2X,24HSOIL LAYERS ARE DEFINED.  )
  160 NLRS = K
  170 WRITE(1,9008)
 9008 FORMAT(/2X, 21HENTER ELEV OF ACTIVE  ,
     - 28HTOP, PASSIVE TOP, LOAD PLANE  )
  172 READ /,TACTV,TPASV,PLOAD
      IF(TACTV .GE. 9999999990) GO TO 1500
      IF(TACTV .GE. 99999990) GO TO 60
  175 PACT = TACTV
      PPAS = TPASV
      PLP = PLOAD
  176 WRITE(1,9006)
 9006 FORMAT(/2X,23HENTER 9999 TO COMPUTE D  ,
     - 32H FROM DATA, ELSE ENTER ACTUAL D,  )
      READ /,D
      IF(D .GE. 9999999990) GO TO 1500
      IF(D .GE. 99999990) GO TO 170
      IF( D .GE. 9998) D = PLOAD - SOIL(NLRS,6)
      IF(D .LE. 0.0) IZERO = 1.0
      ICHK = 0
      CRIT = PLOAD - D
      IF(CRIT .GE. SOIL(NLRS,6) ) GO TO 184
      WRITE(1,178) CRIT
      IF(JPNT .GE. 1) WRITE (3,178) CRIT
  178 FORMAT(/2X,25HGIVEN D GOES BELOW LAYER   ,
     -  14HSYSTEM TO ELEV  , F7.2)
      GO TO 176
C-          DEFINE ACTIVE SOIL LAYERS INTO SOILA ARRAY.
  180 IF(TACTV .LE. SOIL(1,2)) GO TO 188
      WRITE(1,9804)
      GO TO 170
  188 CONTINUE
      DO 200 I = 1, NLRS
      I1 = I
      IF(TACTV .LE. SOIL(I1,2) .AND.
     -      TACTV .GT. SOIL(I1,6)) GO TO 220
  200 CONTINUE
```

```
      220 INDXA = I1
          IK = 0
          DO 260 I = I1,NLRS
          IK = IK + 1
          SOILA(IK,1) = IK
          DO 258 IB=2,8
      25R SOILA(IK,IB) = SOIL(I,IB)
          IF(IK .EQ. 1) SOILA (IK,2) = TACTV
          SOILA(IK,5) = SOILA(IK,2) - SOILA(IK,6)
          IF (SOILA(IK,6) .LE. PLOAD) GO TO 280
      260 CONTINUE
      280 NLRA = IK
          SOILA(IK,6) = PLOAD
          SOILA(IK,5) = SOILA(IK,2) - PLOAD
          CALL COMB (NLRA, SOILA)
          NORD = 1
          CALL CHEKL (NLRA,JPNT,SOILA,NORD)
C-            DEFINE PASSIVE SOILS INTO SOILP ARRAY
          DO 420 I = 1,NLRA
          I1 = I
          IF(TPASV .LE. SOILA(I1,2) .AND.
     -          TPASV .GT. SOILA(I1,6)) GO TO 440
      420 CONTINUE
      440 INDXP = INDXA + I - 1
          IK = 0
          DO 460 I = I1,NLRA
          IK = IK + 1
          SOILP(IK,1) = IK
          DO 458 IB = 2,8
      45R SOILP(IK,IB) = SOILA(I,IB)
          IF(IK .EQ. 1) SOILP(IK,2) = TPASV
          SOILP(IK,5) = SOILP(IK,2) - SOILP(IK,6)
      460 CONTINUE
          NLRP = IK
          CALL COMB (NLRP,SOILP)
          NORD = 2
          CALL CHEKL (NLRP,JPNT,SOILP,NORD)
          IF(0 .GT. 0.001) GO TO 540
          WRITE(1,532)
          IF(JPNT .GE. 1) WRITE (3,532)
      532 FORMAT(/2X,31HO=0, SOIL LAYERS BELOW L.P. ARE ,
     -        16H NOT CONSIDERED.  )
          GO TO 778
C-
C-            DEFINE LAYERS UNDER LOADING PLANE INTO SOILB
      540 CONTINUE
          DO 560 I = 1,NLRS
          I1 = I
          IF(PLOAD .LE. SOIL(I1,2) .AND.
     -          PLOAD .GT. SOIL(I1,6)) GO TO 568
      560 CONTINUE
      56R INDXB = I1
          IK = 0
          DO 580 I = I1,NLRS
          IK = IK + 1
          SOILB(IK,1) = IK
          DO 578 IB = 2,8
      57R SOILB(IK,IB) = SOIL(I,IB)
          IF(IK .EQ. 1) SOILB(IK,2) = PLOAD
          SOILB(IK,5) = SOILB(IK,2) - SOILB(IK,6)
          IF(SOILB(IK,6) .LE. CRIT) GO TO 600
      580 CONTINUE
      600 NLRB = IK
          SOILB(IK,6) = CRIT
```

```
7340        SOILB(IK,5) = SOILB(IK,2) * CRIT
7780        CALL COMB (NLRB,SOILB)
7784        NORD = 3
7820        CALL CHEKL (NLRB,JPNT,SOILB,NORD)
7980 C=         STORE SOILA,SOILP,SOILB IN OSOILA,OSOILP,OSOILB
8020        DO 694 KST = 1,25
8060        DO 694 KT = 1,8
8100        OSOILA(KST,KT) = SOILA(KST,KT)
8140        OSOILP(KST,KT) = SOILP(KST,KT)
8180   694  OSOILB(KST,KT) = SOILB(KST,KT)
8220        NAST = NLRA
8260        NPST = NLRP
8300        NRST = NLRB
8340        GO TO 778
8380   698  JLAY = 1
8388        DO 699 NK = 1,25
8420        DO 699 MK = 1,8
8460        SOILAT(NK,MK) = SOILA(NK,MK)
8500        SOILPT(NK,MK) = SOILP(NK,MK)
8540   699  SOILBT(NK,MK) = SOILB(NK,MK)
8580   701  WRITE(1,702)
8620   702  FORMAT(/2X,31HENTER LAYER REPLACEMENT DATA = ,
8660 =      /2X,48H(ZONE CODES 1,2,3 FOR ACTIVE,PASSIVE,BELOW L.P.) ,
8700 =      /2X,38HZONE CODE,LAYER,TOP EL,GAMMA,S,H,THETA    ,
8740 =      /2X,42HEND WITH ZONE CODE = 99 FOLLOWED BY ZEROES  )
8780        NLAYER = NLAYER + 1
8820   704  READ /,IZONE,(DATR(KK),KK = 1,5),DATR(7)
8828        IF(IZONE .GE. 9999999990) GO TO 1500
8860        IF(IZONE .GE. 98) GO TO 7200
8900        IF(DATR(2) .GT. 0.0) GO TO 707
8940        GO TO (7052, 7055, 7058),IZONE
8980  7052  DO 7053 IX = 1,8
9020  7053  SOILAT(DATR(1),IX)=0.0
9060        NLRA = NLRA + 1
9100        GO TO 704
9140  7055  DO 7056 IX = 1,8
9180  7056  SOILPT(DATR(1),IX) = 0.0
9220        NLRP = NLRP + 1
9260        GO TO 704
9300  7058  DO 7059 IX = 1,8
9340  7059  SOILBT(DATR(1),IX) = 0.0
9380        NLRB = NLRB + 1
9420        GO TO 704
9460   707  DATR(6) = DATR(2) + DATR(5)
9500        DATR(7) = DATR(7)/57.29578
9540        DATR(8) = 90.0 /57.29578 - 2 * DATR(7)
9580        NR = DATR(1)
9620        GO TO (708,712,716),IZONE
9660   708  CALL REPL(IZONE, NLRA,JDEL,DATR,SOILAT)
10260       GO TO 704
10300  712  CALL REPL(IZONE,NLRP,JDEL,DATR,SOILPT)
10900       GO TO 704
10940  716  CALL REPL(IZONE,NLRB,JDEL,DATR,SOILBT)
11540       GO TO 704
11548  7200 DO 7208 JR = 1,25
11552       DO 7208 KR = 1,8
11556       SOILAR(JR,KR) = SOILAT(JR,KR)
11560       SOILPR(JR,KR) = SOILPT(JR,KR)
11564  7208 SOILBR(JR,KR) = SOILBT(JR,KR)
11580   724  CONTINUE
11584       DO 72408 JR = 1,25
11588       DO 72408 KR = 1,8
11592       SOILAT(JR,KR) = SOILAR(JR,KR)
11596       IF(SOILAT(JR,1) .GE. 0.01) NLRRA = JR
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11600       SOILPT(JR,KR) = SOILPR(JR,KK)
11604       IF(SOILPT(JR,1) .GE. 0.01) NLRRP = JR
11608       SOILBT(JR,KR) = SOILBR(JR,KK)
11612       IF(SOILBT(JR,1) .GE. 0.01) NLRRB = JR
11614  72408 CONTINUE
11616       IF(ICODE .EQ. 2) GO TO 730
11618   725 WRITE(1,726)
11620   726 FORMAT(/2X,39HENTER NEW ACTIVE,PASSIVE TOPS AND LOAD
11624     -     ,18HPLANE, ELSE 0,0,0,   )
11660       READ /,ACTV,PASV,ALOAD
11668       IF(ACTV .GE. 99999999990) GO TO 1500
11680       IF(ACTV .GE. 99999990) GO TO 701
11700       IF(ACTV .LE. 0) GO TO 730
11720       TACTV = ACTV
11724       TPASV = PASV
11728       PLOAD = ALOAD
11760   727 NLRRA = NLRA
11764       NLRRP = NLRP
11768       NLRRB = NLRB
11772       GO TO 730
11800  72712 WRITE (1,9008)
11820       READ /,TACTV,TPASV,PLOAD
11828       IF(TACTV .GE. 99999999990) GO TO 1500
11860       IF(TACTV .GE. 99999990) GO TO 701
11940   730 WRITE(1,9006)
11960       READ /,D
12000       IF( D .GE. 9999999990) GO TO 1500
12020       IF( D .GE. 99999990) GO TO 725
12060       IF(D .GE. 9998) D = PLOAD - SOILBT(NLRRB,6)
12068       IF(D .LE. 0.0) IZERO = 1.0
12100       CRIT = PLOAD - D
12108       IF(CRIT .GE. SOILBT(NLRRR,6)) GO TO 73040
12112       WRITE(1,178) CRIT
12116       GO TO 730
12180  73040 IF(TACTV .LE. SOILAT(1,2)) GO TO 73048
12200       WRITE(1,9804)
12220       GO TO 72712
12240  73048 DO 73056 IA = 1,NLRRA
12260       IG = IA
12280       IF(TACTV .LE. SOILAT(IG,2) .AND.
12300     -       TACTV .GT. SOILAT(IG,6)) GO TO 73060
12320  73056 CONTINUE
12340  73060 INDXRA = IG
12360       IK = 0
12380       DO 73064 JJ = IG,NLRRA
12400       IK  = IK + 1
12420       SOILA(IK,1) = IK
12440       DO 73062 JZ = 2,8
12460  73062 SOILA(IK,JZ) = SOILAR(JJ,JZ)
12480       IF(IK .EQ. 1) SOILA(IK,2) = TACTV
12500       SOILA(IK,5) = SOILA(IK,2) - SOILA(IK,6)
12520       IF(SOILA(IK,6) .LE. PLOAD) GO TO 73080
12540  73064 CONTINUE
12560  73068 NLRA = IK
12580       IF(SOILA(NLRA,6) .LE. PLOAD) GO TO 73082
12660  73072 DO 73076 JJ = 1, NLRRB
12680       IK = IK + 1
12700       SOILA(IK,1) = IK
12720       DO 73074 JZ = 2,8
12740  73074 SOILA(IK,JZ) = SOILBR(JJ,JZ)
12760       IF(SOILA(IK,6) .LE. PLOAD) GO TO 73080
12780  73076 CONTINUE
12800  73080 NLRA = IK
12820  73082 SOILA(IK,6) = PLOAD
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12840       SOILA(IK,5) = SOILA(IK,2) - PLOAD
12860  73088 CONTINUE
13040 C-       LAYERS WITH IDENTICAL GAMMA & SHEAR TO BE COMBINED
13060  7382 CALL COMB(NLRA,SOILA)
13080       NORD = 1
13100       CALL CHEKL (NLRA,JPNT,SOILA,NORD)
14100 C-            PASSIVE ZONE
14140       DO 7408 IP = 1,NLRRP
14160       IG = IP
14180       IF(TPASV .LE. SOILPR(IG,2) .AND.
14200      -        TPASV .GT. SOILPR(IG,6)) GO TO 7412
14220  7408 CONTINUE
14240  7412 INDXRP = IG
14260       IK = 0
14280       DO 7420 JJ = IG, NLRRP
14300       IK = IK + 1
14320       SOILP(IK,1) = IK
14340       DO 7418 JZ = 2,8
14360  7418 SOILP(IK,JZ) = SOILPR(JJ,JZ)
14380       IF(IK. EQ. 1) SOILP(IK,2) = TPASV
14400       SOILP(IK,5) = SOILP(IK,2) - SOILP(IK,6)
14420       IF(SOILP(IK,6) .LE. PLOAD) GO TO 7460
14440  7420 CONTINUE
14460  7428 NLRP = IK
14462       IF(SOILP(NLRP,6) .LE. PLOAD) GO TO 7462
14464  DO 7436 JJ = 1,NLRRB
14466       IK=IK+1
14468       SOILP(IK,1) = IK
14470       DO 7434 JZ = 2,8
14472  7434 SOILP(IK,JZ) = SOILBR(JJ,JZ)
14474       IF(SOILP(IK,6) .LE. PLOAD) GO TO 7460
14476  7436 CONTINUE
14478  7460 NLRP = IK
14480  7462 SOILP(IK,6) = PLOAD
14500       SOILP(IK,5) = SOILP(IK,2) - PLOAD
15288 C-       LAYERS WITH IDENTICAL GAMMAS AND SHEARS TO BE COMBINED
15300  7482 CALL COMB(NLRP,SOILP)
15320       NORD = 2
15340       CALL CHEKL (NLRP,JPNT,SOILP,NORD)
15540       IF(D .GT. 0.001) GO TO 752
15580       WRITE(1,532)
15620       GO TO 778
15660 C-              BELOW LOAD PLANE
15700   752 CONTINUE
15708  IF(PLOAD .GT. SOILBR(1,2)) GO TO 9812
15720       DO 75208 IB = 1,NLRRB
15740       IG = IB
15760       IF(PLOAD .LE. SOILBR(IG,2) .AND.
15780      -        PLOAD .GT. SOILBR(IG,6)) GO TO 75212
15800  75208 CONTINUE
15820  75212 INDXBR = IG
15840       IK = 0
15860       DO 75220 JJ = IG,NLRRB
15880       IK = IK + 1
15900       SOILB(IK,1) = IK
15920       DO 75218 JZ = 2,8
15940  75218 SOILB(IK,JZ) = SOILBR(JJ,JZ)
15942       IF(IK .EQ. 1) SOILB(IK,2) = PLOAD
15946       SOILB(IK,5) = SOILB(IK,2) - SOILB(IK,6)
15960       IF(SOILB(IK,6) .LE. CRIT) GO TO 75240
15980  75220 CONTINUE
16000  75240 NLRB = IK
16020       SOILB(IK,6) = CRIT
16040       SOILB(IK,5) = SOILB(IK,2) - CRIT
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1A11A C=      LAYERS WITH IDENTICAL GAMMAS AND SHEARS TO BE COMBINED
1A140  7AF9 CALL COME(NLRP,SOILP)
1A160       NORD = 3
1A180       CALL CHEKL (NLRP,JPNT,SOILP,NORD)
1A680   77A WRITE(1,77802)
1A7C0  77802 FORMAT(/2X,34HPLEASE CHECK LAYERS JUST PRINTED,
1A720 -     /2X,46HENTER 0,1,OR 2 FOR NO CHANGE, DELETE, REPLACE,   )
1A740       READ /,IREV
1A744       IF(IREV .GE. 9999999990) GO TO 1500
1A748       IF(IREV .GE. 99999990) GO TO 7818
1A760       IREV = IREV + 1
1A780       GO TO (780,77804,1560), IREV
1A8C0  77804 DO 77806 IJ = 1,25
1A820       DO 77806 IG = 1,8
1A840       SOILAT(IJ,IG) = SOILA(IJ,IG)
1A860       SOILPT(IJ,IG) = SOILP(IJ,IG)
1A880  77806 SOILBT(IJ,IG) = SOILB(IJ,IG)
1A8C0       NLAYER = 1
1A920       WRITE(1,77808)
1A940  77808 FORMAT(/2X,36HENTER ZONE AND LAYER TO BE DELETED.  ,
1A944 -       15H END WITH 99,0,  /2X,
1A948 -     45H(ZONE=1,2,OR 3 FOR ACTIVE,PASSIVE,BELOW L.P.)   )
1A9BC  77810 READ /,IZONE,IDEL
17000       IF(IZONE .GE. 98) GO TO 727
17020       DATA(1) = IDEL
17040       JDEL = 1
17060       IF(IZONE .EQ.1)CALL REPL(IZONE,NLRA,JDEL,DATR,SOILAT)
17080       IF(IZONE.EQ.2)CALL REPL(IZONE,NLRP,JDEL,DATR,SOILPT)
17100       IF(IZONE.EQ.3)CALL REPL(IZONE,NLRB,JDEL,DATR,SOILBT)
17520       GO TO 77810
17540   780 WRITE(1,781)
17560   781 FORMAT(/2X,19HENTER LL SURCHARGE     )
17580       READ /,WSUR
17588       IF(WSUR .GE. 9999999990) GO TO 1500
17600       IF(WSUR .LT. 99999990) GO TL 784
17608       GO TO 776
17612 C=      THIS DISPLACED ROUTINE BELONGS BETWEEN 77802 & 77804
17620  781A WRITE(1,782)
17640   782 FORMAT(/2X,20HENTER 1, 2, OR 3 TO   ,
17660 -     38HREENTER LAYERS, CHANGE ELEVS,CHANGE D.   )
17680       READ /,IKPT
17700       DO 783 JM = 1,25
17720       DO 783 JP = 1,8
17740       SOILAT(JM,JP) = SOILA(JM,JP)
17760       SOILPT(JM,JP) = SOILP(JM,JP)
17780   783 SOILBT(JM,JP) = SOILB(JM,JP)
17788       IF (IRPT .GE. 99999998) GO TO 176
17800       GO TO (701,727,727),IRPT
17804 C=        END DISPLACED ROUTINE
17820   784 IF(NLAYER .LE. 0) WSURT = WSUR
17840   786 WRITE(1,788)
17860   788 FORMAT(/2X,26HENTER L, R, USING 9999 FOR   ,
17880 -       20H DEPENDENT VARIABLE.   )
17900       READ /,GL,R
17902       IF(GL .LE. .001 .OR. R .LE. .001) GO TO 793
17908       IF( GL .GE. 9999999990) GO TO 1500
17920       IF(GL .GE. 99999990) GO TO 780
17940   792 IF(GL .LT. 9998.0) GO TO 796
17952       ICHK = 1
17960       GO TO 832
17970   793 WRITE(1,7932)
17972       IF (JPNT .GE. 1) WRITE (3,7932)
17974  7932 FORMAT(/2X,23HL OR R CANNOT BE ZERO.     )
17976       GO TO 1500
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17980   795 WRITE(1,7952)R
17982       IF(JPNT .GE. 1)WRITE(3,7952)R
17984  7952 FORMAT(/2X,8HTRIAL R= ,F5.2,14H IS TOO LARGE,  )
17986       GO TO 1500
18000   796 WRITE(1,9009)
18020  9009 FORMAT(/2X,17HENTER TRIAL RATIO   )
18040       READ /,R
18048       IF( R .GE. 9999999990) GO TO 1500
18060       IF(R .GE. 99999990) GO TO 786
18080       ICHK = 1
18300   832 CONTINUE
18340 C=                1. ASF = ACTIVE STATIC SURCHARGE
18380 C=                       = (SUMM(WA*HA)) * D
18420       HA = 0.0
18460       WAHA = WSUR
18500       DO 840 IA = 1,NLRA
18540       WAHA = WAHA + SOILA(IA,3) * SOILA(IA,5)
18580   840 HA = HA + SOILA(IA,5)
18620       ASF = WAHA * D
18660       ASD = ASF/100.0
18700 C=
18740 C=                2. ALP = ACTIVE LATERAL PRESSURE
18780 C=                       = FA OR SUMM(AVERAGE PA * (LAYER H = HC)
18820 C=          FIRST CAL P TOP AND BOTTOM OF EACH LAYER, THEN HC AND FA
18860 C=
18900   860 CONTINUE
18940       WNHN = WSUR
18980       FA = 0.0
19020       DO 920 IB = 1,NLRA
19060       IA = IB
19100       PAT(IA) = (WNHN +(2.0* SOILA(IA,4)* R)/
19140 =          (SIN(2.0* SOILA(IA,7))))*(TAN(SOILA(IA,7)))**2
19180       IF(PAT(IA) .LE. 0.0) PAT(IA) = 0.0
19220       WNHNT = WNHN
19260       WNHN = WNHN + SOILA(IA,3) * SOILA(IA,5)
19300       PAL(IA) = (WNHN + (2.0 * SOILA(IA,4) * R)/
19340 =          (SIN(2.0 * SOILA(IA,7))))*(TAN(SOILA(IA,7)))**2
19380       IF(PAL(IA) .LE. 0.0) PAL(IA) = 0.0
19420       HC(IA) = (2.0 * SOILA(IA,4)*R + WNHNT)/
19460 =          (SOILA(IA,3)+SIN(2.0*SOILA(IA,7)))
19500       IF(PAT(IA) .LE. 0.0 .AND. PAL(IA) .LE. 0.0) HC(IA) = 0.0
19540       IF(PAT(IA) .GT. 0.0 .AND. PAL(IA) .GT. 0.0) HC(IA) = 0.0
19580       FA = FA + (PAT(IA) + PAL(IA))*(SOILA(IA,5) - HC(IA))/2.0
19620   920 CONTINUE
19660       IF(IZERO .GE. 1) FA = 0.0
19700  1000 IF(D .GT. 0.0) GO TO 1020
19740       WTALP = 0.0
19780       DP = 0.0
19820       LDALP = 0.0
19860       CDP = 0.0
19900       GO TO 1120
19940 C=                3. WTALP = WEIGHT TRANSFER ABOVE LOADING PLANE,
19980 C=           CALC   WT1 = (H1* FA * TAN(PHI1)/(H1-HC)
20020 C=                  SME = SUMMATION(S * H) * R
20060 C=                  SHRH = WT1 + SME
20100 C=             FOR HA .LT. D, COMPARE SHRH/D WITH ST*D*R/D
20140 C=             FOR HA .GE. D, COMPARE SHRH/HA WITH ST*D*R/D
20180 C=              WHERE ST = TANGT SHEAR ON CRITICAL SLIDING PLANE,
20220 C=                 WTALP IS THE SMALLER IN THE COMPARE,
20260  1020 WT1 =(SOILA(1,5)*FA*TAN(SOILA(1,8)))/(SOILA(1,5)-HC(1))
20300       SME= 0
20340       DO 1028 KM = 1,NLRA
20380  1028 SME = SME + SOILA(KM,4) * SOILA(KM,5)
20420       SE = SME/HA
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      SHRH = WT1 + SME
      IF(HA .LT. D) STT = SHRH/D
      IF(HA .GE. D) STT = SHRH/HA
      STR = SOILB(NLRB,4) * R
      WTALP = AMIN1(STT,STR) * D
C=              4. DP = DEVELOPED PRESSURE = 4 * SA * R * D
C=                      WHERE SA = WTED AVERAGE SHEAR BELOW LOAD PLANE
C=
      HB = 0.0
      SAT = 0.0
      DO 1100 IB = 1, NLRB
      SAT = SAT + SOILB(IB,4) * SOILB(IB,5)
      HB = HB + SOILB(IB,5)
 1100 CONTINUE
      SA = SAT/HB
      DP = 4.0 * SA * R * D
C=              5. LDPLP =LATERAL DISTRIB BELOW LOADING PLANE
C=                      = 2*SA*R*D  OR HALF OF DP
      LDBLP = DP/2.0
      CDP = DP + LDBLP
C=              6. TR = TANGENTIAL RESISTANCE = ST * R * GIVEN L
C=         THIS TERM CONTAINS THE DEPENDENT VARIABLE.
 1120 CONTINUE
C=              7. PSF = PASSIVE STATIC FORCES
C=                      = (SUMM(WP * HP)) * D
      WPHP = 0.0
      HP = 0.0
      DO 1140 IP = 1, NLRP
      WPHP = WPHP + SOILP(IP,3) * SOILP(IP,5)
      HP = HP + SOILP(IP,5)
 1140 CONTINUE
      PSF = WPHP * D
C=              8. PLP = PASSIVE LATERAL PRESSURE
C=                      * FP OR SUMM(AVERAGE PP* LAYER H)
 1160 CONTINUE
      WNHN = 0.0
      FP = 0.0
      DO 1180 IP = 1, NLRP
      PPT(IP) = (WNHN + (2.0 * SOILP(IP,4) * R)/
     -(SIN(2.0 * SOILP(IP,7)))*(TAN(SOILP(IP,7)))**2
      WNHN = WNHN + SOILP(IP,3) * SOILP(IP,5)
      PPL(IP) = (WNHN + (2.0 * SOILP(IP,4) * R)/
     -(SIN(2.0 * SOILP(IP,7)))*(TAN(SOILP(IP,7)))**2
      FP = FP + 0.500 * (PPT(IP) + PPL(IP))* SOILP(IP,5)
      IF(IZERO .GE. 1) FP = 0.0
 1180 CONTINUE
 1188 FORMAT(/2X,25HACTIVE STATIC SURCHARGE = ,F10.2,
     -/2X,4HFA = ,F10.2,6X,4HFP = ,F11.2,6X,3HD = ,F6.2,
     -/2X,38HTRANSV SHEAR ON CRIT. SLIDING PLANE = ,5X,F7.2)
 1200 IF(D .GT. 0.0) GO TO 1208
      UR = 0.0
      GO TO 1300
C=              9. UR = UPLIFT RESISTANCE
C=         IF HP .LT. D:
C=            COMPUTE SE(PRIME) * R/D AND W(HP)**2/2*D
C=         IF HP .GE. D:
C=            COMPUTE SE(PRIME) * R/HP AND W(HP)**2/2*HP
C=         USE SMALLER OF COMPARE
 1208 SPR = 0.0
      DO 1220 IP= 1,NLRP
      SPR = SPR + SOILP(IP,4) * SOILP(IP,5)
 1220 CONTINUE
      IF(HP .GE. D) GO TO 1240
      URL = SPR*R/D
```

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      URR = SOILP(NLRP,3) + (HP**2)/(2.0 * D)
      GO TO 1260
 1240 URL = SPR*R / HP
      URR = SOILP(NLRP,3) + HP/2.0
 1260 UR = AMIN1(URL,URR) * D
 1282 FORMAT(2X,22HWT. TRANS ABOVE L.P. = ,F13.2,8X,4HSA = ,F7.2,
     -/2X,40HDEV. PRESSURE + LAT. DISTR. BELOW L.P. = ,F10.2,
     -/2X,23HPASSIVE STATIC FORCES = , F12.2,2X,
     - 19HUPLIFT RESISTANCE = ,F9.2)
C-                WITH ASSUMED R VALUES, CHECK SOLUTION FOR L
C-                AGAINST GIVEN L AND INCREASE OR DECREASE R AS
C-                NEEDED.  TL = TEMPORARY VALUE OF L
 1300 IF( D.GT. 0.0) GO TO 1308
      TL = (FA-FP)/(SOILA(NLRA,4)*R)
      GO TO 1316
 1308 TL = (ASF + FA - WTALP -DP-LDRLP -PSF-FP -UR)/
     -                (SOILB(NLRB,4) + R)
C-                NOTE:  REDUCING R WILL INCREASE TL
 1316 WRITE(1,9017) R,TL
      IF(JPNT .GE. 1) WRITE (3,9017) R,TL
 9017 FORMAT(/2X,10HAT RATIO = ,F9.3,6H,  L = ,F9.3)
      IF (ABS(TL-GL) -0.05) 1340,1340,1348
 1340 RATIO = R
      WRITE(1,9015)RATIO
      IF(JPNT .GE. 1) WRITE (3,9015) RATIO
 9015 FORMAT(2X,7HRATIO = ,F5.2)
      GO TO 1460
 134A CONTINUE
      IF(GL .GE. 9998.) GO TO 1460
      WRITE(1,9014) ICHK
      IF(JPNT .GE. 1) WRITE (3,9014) ICHK
 901A FORMAT(2X,6HSTEP =,I2)
      IF(ICHK .GE. 10) GO TO 1368
      KCHK = ICHK
      X(ICHK) = TL
      Y(ICHK) = R
      IF(KCHK .GT. 1) GO TO 1360
      IF(TL .GT. GL) R = R + 0.4
      IF(TL .LT. GL)R = R - 0.4
      IF(R .LT. 0.0) R = 0.10
      ICHK = ICHK + 1
      GO TO 832
 1360 XDIF = X(ICHK) - X(ICHK-1)
      YDIF = Y(ICHK)-Y(ICHK-1)
      R = Y(ICHK-1) - YDIF * (X(ICHK-1)-GL)/XDIF
      IF(R .GT. 20.0) GO TO 1380
      IF(R .LT. 0.0) R = 0.10
      ICHK = ICHK + 1
      GO TO 832
 136A WRITE(1,1369)
 1369 FORMAT(/2X,23HDO YOU WISH TO INCREASE ,
     -26H STEPS? 0 IF NO, 1 IF YES.    )
      READ /,INCR
      IF(INCR .LE. 0) GO TO 1500
      GO TO 796
 1380 WRITE(1,1381)
 1381 FORMAT(/2X,29HWOULD YOU LIKE TO CHECK YOUR  ,
     -25HDATA AND ELECT TO REWORK?  )
      GO TO 1500
 1460 IF(D .NE. 0.0)WRITE(1,1188) ASF,FA,FP,D,SOILA(NLRB,4)
      IF(D .NE. 0.0 .AND. JPNT .GE. 1) WRITE (3,1188) ASF,FA,FP,
     -     D,SOILB(NLRB,4)
      IF(D.EQ.0.0) WRITE(1,1188)ASF,FA,FP,D,SOILA(NLRA,4)
      IF(D .EQ. 0.0 .AND. JPNT .GE. 1) WRITE (3,1188) ASF,FA,FP,
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25188 -           D, SOILA(NLRA,8)
25220       WRITE(1,1282) WTALP,SA,CDP,PSF,UR
25224       IF(JPNT .GE. 1) WRITE (3,1282) WTALP, SA, CDP, PSF, UR
25260  1500 WRITE(1,1502)
25300  1502 FORMAT(/2X,24HENTER 0,1,OR 2 FOR EXIT,
25340 -         24H NEW PROBLEM, OR REWORK, )
25380       READ /,NEXT
25420       IF(NEXT .GT. 0) GO TO 1508
25460       WRITE(1,1504)
25500  1504 FORMAT(/2X,25HARE YOU SURE THIS IS WHAT    ,
25540 -     39H YOU WANT TO DO? - REENTER OPTION CODE.  )
25580       READ /,NEXT
25620  1508 IF(NEXT .GT. 2) NEXT = 2
25660       IF(NEXT .LE. 0) GO TO 1800
25700  IF(IZERO .GE.1) IZERO = 0
25740       GO TO (1700,1512),NEXT
25780  1512 IF(NLAYER .LE. 0) WRITE(1,1514)
25784       IF(NLAYER .LE. 0 .AND. JPNT .GE. 1) WRITE (3,1514)
25820       IF(NLAYER .GE. 1) WRITE(1,1516)
25824       IF(NLAYER .GE. 1 .AND. JPNT .GE. 1) WRITE(3,1516)
25860       WRITE(1,1517)
25864  1514 FORMAT(/2X,29HYOU ARE WORKING WITH ORIGINAL    ,
25900 -        13H SOIL LAYERS.     )
25940  151A FORMAT(/2X, "YOU ARE WORKING WITH ",
25980 -       20HREVISED SOIL LAYERS.  )
26020  1517 FORMAT(/2X,"ENTER 3-9 TO REWORK ORIGINAL LAYERS,"
26060 -       /7X, "13-19 TO REWORK LAST REPLACEMENT LAYERS,")
26100  1520 IF(IWRT .GE. 1) GO TO 1654
26140       IWPT = IWRT + 1
26180  1522 WRITE(1,9018)
26220  901A FORMAT(/2X,20HENTER REWORK OPTION:     ,
26260 -     //5X,1H3,12X,25HTO REVISE ACTIVE,PASSIVE ,
26300 -                 21HTOPS, LOAD PLANE ETC.     ,
26340 -     /5X,30H4, 5, OR 6   FOR NEW D,  NEW L  ,
26380 -      28H AND R,     NEW TRIAL RATIO    ,
26420 -     /5X,33H7, 8, OR 9   FOR ZERO FA & FP,     ,
26460 -      35HCHANGE LAYERS,   CHANGE SURCHARGE.     )
26500  152A READ /,ICODE
26520  152B IF(ICODE .GT. 19) GO TO 1580
26530       IF(NLAYER .GE. 1) GO TO 1532
26540 C-         NLAYER=0 MEANS WORKING WITH ORIGINAL LAYERS
26550       ICODE = ICODE - 2
26560       IF(ICODE .LT. 10) GO TO (1600,1600,786,796,1540,
26570 -             698,1640),ICODE
26580       NLAYER = 1
26590       ICODE = ICODE - 10
26600       DO 15292 JR = 1,25
26610       DO 15292 KR = 1,8
26620       OSOILA(JR,KR) = SOILA(JR,KR)
26630       SOILA(JR,KR) = RSOILA(JR,KR)
26640       IF(ICODE .LE. 2) SOILA(JR,KR) = SOILAR(JR,KR)
26650       OSOILP(JR,KR) = SOILP(JR,KR)
26660       SOILP(JR,KR) = RSOILP(JR,KR)
26670       IF(ICODE .LE. 2) SOILP(JR,KR) = SOILPR(JR,KR)
26680       OSOILB(JR,KR) = SOILB(JR,KR)
26690       SOILB(JR,KR) = RSOILB(JR,KR)
26700       IF(ICODE .LE. 2) SOILB(JR,KR) = SOILBR(JR,KR)
26710  15292 CONTINUE
26720       NAST = NLRA
26730       NPST = NLRP
26740       NBST = NLRB
26750       PACT = TACTV
26760       PPAS = TPASV
26770       PLP = PLOAD
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      WSURT = WSUR
      NLRA = NASTR
      NLRP = NPSTR
      NLRB = NBSTR
      TACTV = RACTV
      TPASV = RPASV
      PLOAD = RLOAD
      WSUR = RSUR
      GO TO (724,724,786,796,1540,698,1640),ICODE
C           NLAYER .GT. 1 MEANS WORKING WITH REPLACEMENT LAYER
1532  ICODE = ICODE - 2
      IF(ICODE .LT. 10) GO TO 1536
      NLAYER = 1
      ICODE = ICODE - 10
      GO TO (1600,1600,786,796,1540,698,1640),ICODE
1536  NLAYER = 0
      DO 1538 IR = 1,25
      DO 1538 IQ = 1,8
      RSOILA(IR,IQ) = SOILA(IR,IQ)
      SOILA(IR,IQ) = OSOILA(IR,IQ)
      RSOILP(IR,IQ) = SOILP(IR,IQ)
      SOILP(IR,IQ) = OSOILP(IR,IQ)
      RSOILB(IR,IQ) = SOILB(IR,IQ)
      SOILB(IR,IQ) = OSOILB(IR,IQ)
1538  CONTINUE
      NASTR = NLRA
      NPSTR = NLRP
      NBSTR = NLRB
      RACTV = TACTV
      RPASV = TPASV
      RLOAD = PLOAD
      RSUR = WSUR
      NLRA = NAST
      NLRP = NPST
      NLRB = NBST
      TACTV = PACT
      TPASV = PPAS
      PLOAD = PLP
      WSUR = WSURT
      GO TO (170,176,786,796,1540,698,1640),ICODE
1540  WRITE(1,1542)
1542  FORMAT(/2X, "ZERO OUT FA,FP. " )
      IZERO = 1
      FA = 0.0
      FP = 0.0
      GO TO 796
1560  JLAY = 1
      GO TO 698
1580  WRITE(1,1581)
      IF(JPNT .GE. 1) WRITE(3,1581)
1581  FORMAT(/2X,"OPTION MUST NOT EXCEED VALUE 19,",
     *       1X, "RE-ENTER OPTION." )
      IF(JPNT .GE. 1) WRITE (3,1542)
      GO TO 1524
1600  DO 1608 JM = 1,25
      DO 1608 JP = 1,8
      SOILAT(JM,JP) = SOILA(JM,JP)
      SOILPT(JM,JP) = SOILP(JM,JP)
1608  SOILBT(JM,JP) = SOILB(JM,JP)
      IF(IZERO .GT. 0) IZERO = 0
      IF(NLAYER .LE. 0) GO TO (170,176),ICODE
      IF(NLAYER .GT. 0) GO TO 724
1640  WRITE(1,1644)
      IF(JPNT .GE. 1) WRITE (3,1644)
```

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27500  1648 FORMAT(/2X,43HENTER SURCHARGE INCREASE OR DECREASE(NEG.)    )
27540       READ /,ADDLL
27580       WSUR = WSUR + ADDLL
27620       GO TO 786
27660  1654 WRITE(1,1656)
27664       IF(JPNT .GE. 1) WRITE (3,1656)
27700  1656 FORMAT(/2X,33HDO YOU WANT OPTION CODES PRINTED? ,
27740 -     35H 1 IF YES,ELSE ENTER REWORK OPTION.  )
27820       READ /,IPRT
27860       IF(IPRT .LE. 1) GO TO 1522
27864       ICODE = IPRT
27868       GO TO 1528
27980 C-            RESET VARIABLES TO ZERO
28020  1700 DO 1702 JJ = 1,25
28060       DO 1701 KJ = 1,8
28100       SOIL(JJ,KJ) = 0.0
28140       SOILA(JJ,KJ) = 0.0
28180       SOILP(JJ,KJ) = 0.0
28220       SOILB(JJ,KJ)  = 0.0
28260       SOILAT(JJ,KJ) = 0.0
28300       SOILPT(JJ,KJ) = 0.0
28340       SOILBT(JJ,KJ) = 0.0
28380       OSOILA(JJ,KJ) = 0.0
28420       OSOILP(JJ,KJ) = 0.0
28460       OSOILB(JJ,KJ) = 0.0
28464       RSOILA(JJ,KJ) = 0.0
28468       RSOILP(JJ,KJ) = 0.0
28472       RSOILB(JJ,KJ) = 0.0
28476       SOILAR(JJ,KJ) = 0.0
28480       SOILPR(JJ,KJ) = 0.0
28484       SOILBR(JJ,KJ) = 0.0
28500  1701 CONTINUE
28540       PAL(JJ) = 0.0
28580       PAT(JJ) = 0.0
28620       PPL(JJ) = 0.0
28660       PPT(JJ) = 0.0
28700  1702 CONTINUE
28720       IZERO = 0
28730       NLAYER = 0
28740       IZERO = 0
28780       JLAY = 0
28820       ICHG = 0
28860       ICHK = 0
28900       WSUF = 0.0
28940       IWRT = 0
28980       GO TO 40
29660  1800 WRITE(1,9019)
29664       IF(JPNT .GE. 1) WRITE (3,9019)
29700  9019 FORMAT(/2X,33HCALCULATIONS HAVE BEEN COMPLETED.    )
29740       GO TO 10000
29780  9800 WRITE(1,9804)
29784       IF(JPNT .GE. 1) WRITE(3,9804)
29820  9804 FORMAT(/2X,39HTOPLINE ENTERED IS UP IN THE AIR ABOVE  ,
29860 -     15HTOPMOST LAYER. )
29900       GO TO 1500
29904  9813 WRITE(1,9814) SOILBR(1,2)
29905       IF(JPNT .GE. 1) WRITE(3,9814) SOILBR(1,2)
29906  9814 FORMAT(/2X,"THE LAST REPLACEMENT LAYER SYSTEM IN STORE",
29908 -       /2X,"CANNOT TAKE LOAD PLANE INPUT GREATER THAN",
29910 -       F6.1,1X,"FT.",/2X,"USE REWORK OPTION TO RAISE",
29912 -       1X,"LOAD PLANE BY REPLACING",
29914 -       /2X,"TOP LAYER OF ZONE 3, OR CHANGE VALUE OF LOAD",
29916 -       1X,"PLANE,")
29920       GO TO 1500
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C=      TIMER ROUTINE REVISED AUGUST 30, 1974
 10000 ATE = TIME(1)
       TIME2 = (ATE-ATB)/60.0
       MTIME2 = TIME2/60.0
       TIME2 = AMOD(TIME2,60.)
       WRITE(1,9020) MTIME2,TIME2
       IF(JPNT .GE. 1) WRITE (3,9020) MTIME2,TIME2
 9020 FORMAT(/29H  END OF JOB. ELAPSED TIME = ,I3,9H MINUTES, ,
     -        F5.1, 8H SECONDS )
C                DATE ROUTINE
       N=TIME(0)
       IDAY1=AMOD(N,16)+AMOD(N/64,16)* 10
     -      +AMOD (N/4096,16) * 100
       IYR1=AMOD(N/2**18,16)+AMOD(N/(64*2**18),16)*10
       IF(MOD(IYR1,4).NE. 0 .AND. IDAY1 .GT. 59)
     -          IDAY1 = IDAY1 + 1
       IF(IDAY1 .LT. 61) GO TO 10090
       IDAY1 = IDAY1 + 2
       DO 10086 I = 2,5
       IF(IDAY1 .LT. 31*(9*I/4)) GO TO 10090
 10086 IDAY1 = IDAY1 + 1
 10090 MON1 = (IDAY1 + 30)/31
       IDAY1 = IDAY1 + 31 - MON1 * 31
       WRITE(1,9022) MON1, IDAY1, IYR1
       IF(JPNT .GE. 1) WRITE(3,9022) MON1,IDAY1,IYR1
 9022 FORMAT(/5X,20HPROGRAM Q12077/QTSS,
     -   24H SLOPE STABILITY-HOUSEL  ,
     -  /5X,10HRUN DATE: ,2(I2,1H-),I2)
       STOP
       END
C=
       SUBROUTINE REPL(IZONE,NLRT,JDEL,DATR,SOLTT)
C=
       DIMENSION DATR(6), SOLTT(25,8)
C=
       NR= DATR(1)
       IF(JDEL .GT. 0) GO TO 200
       IF(ABS(DATR(6)-SOLTT(NR,2)) .LT. 0.01) GO TO 108
       IF(DATR(6) .LE. SOLTT(NR,6)) GO TO 124
       SOLTT(NR,2) = DATR(6)
       SOLTT(NR,5) = SOLTT(NR,2) - SOLTT(NR,6)
  108 JRR = NLRT + 2
       DO 116 JR = NR,NLRT
       JRR = JRR -1
       SOLTT(JRR,1) = JRR
       DO 116 KR = 2,8
       SOLTT(JRR,KR)= SOLTT(JRR-1,KR)
  116 CONTINUE
       NLRT = NLRT + 1
  124 DO 136 KR = 1,8
  136 SOLTT(NR,KR) = DATR(KR)
       IF(NLRT .LT. NR) NLRT = NR
       RETURN
  200 DO 224 IX = 1,8
  224 SOLTT(NR,IX) = 0.0
       NLRT = NLRT - 1
       DO 236 JR = NR,NLRT
       SOLTT(JR,1) = JR
       DO 236 KR = 2,8
  236 SOLTT(JR,KR) = SOLTT(JR+1,KR)
       DO 248 KR=1,8
  248 SOLTT(NLRT+1, KR) = 0.0
       JDEL = 0
       RETURN
```

```
      END
      SUBROUTINE COMB (NLRR,SOILM)
C-
      DIMENSION SOILM(25,8)
C-
      IF(NLRR .LE. 1) GO TO 340
      IC=0
      NLRR = NLRR
      DO 200 J = 1,NLRR
      IF(MATCH .LE. 0) IC = IC+1
      IF(IC .GE. NLRR) GO TO 300
      IF(SOILM(IC,3) .NE. SOILM(IC+1,3) .OR.
     -     SOILM(IC,4) .NE. SOILM(IC+1,4))GO TO 180
      SOILM(IC,1) = IC
      SOILM(IC,6) = SOILM(IC+1,6)
      SOILM(IC,5) = SOILM(IC,2) - SOILM(IC,6)
      MATCH = 1
      MC = IC+1
      NLRR = NLRR - 1
      IF(MC .GE. NLRR) GO TO 300
      DO 140 JC = MC,NLRR
      SOILM(JC,1) = JC
      DO 140 LC = 2,8
  140 SOILM(JC,LC) = SOILM(JC+1,LC)
      GO TO 200
  180 MATCH = 0
  200 CONTINUE
  300 NF = NLRR + 1
      DO 320 K = NF,25
      DO 320 N = 2,8
      SOILM(K,N) = 0.0
  320 CONTINUE
  340 RETURN
      END
C-
      SUBROUTINE RITE(IW,JPNT,SOILW)
C-
      DIMENSION SOILW(25,8)
   10 FORMAT(6X,I2,2X,3F9.2,F8.2,1X,2F9.2)
      DO 100 KW = 1,IW
      ANGLE = FLOAT(IFIX(SOILW(KW,7)*57.29578 + 0.1))
      IF(JPNT .GE.1) WRITE(3,10)(SOILW(KW,K1),K1=1,6),ANGLE
  100 WRITE(1,10)(SOILW(KW,K1),K1=1,6),ANGLE
      CONTINUE
      RETURN
      END
C-
      SUBROUTINE CHEKL (NLRK,JPNT,SOILK,NORD)
C-
      DIMENSION SOILK (25,8)
      IF(NLRK .EQ. 1 .AND. SOILK(1,5) .LE. 0.44) NLRK = 0
      IF(NORD .EQ. 1) WRITE(1,1) NLRK
      IF(NORD .EQ. 2) WRITE(1,2) NLRK
      IF(NORD .EQ. 3) WRITE(1,3) NLRK
      IF(NORD .EQ. 1 .AND. JPNT .GE. 1) WRITE (3,1) NLRK
      IF(NORD .EQ. 2 .AND. JPNT .GE. 1) WRITE (3,2) NLRK
      IF(NORD .EQ. 3 .AND. JPNT .GE. 1) WRITE (3,3) NLRK
    1 FORMAT(/2X,30HNO. OF LAYERS IN ACTIVE ZONE =  ,I2)
    2 FORMAT(/2X,31HNO. OF LAYERS IN PASSIVE ZONE =  ,I2)
    3 FORMAT(/2X,32HNO. OF LAYERS BELOW LOAD PLANE =  ,I2)
      IF(NLRK .GE. 1) CALL RITE(NLRK,JPNT,SOILK)
      RETURN
      END
```