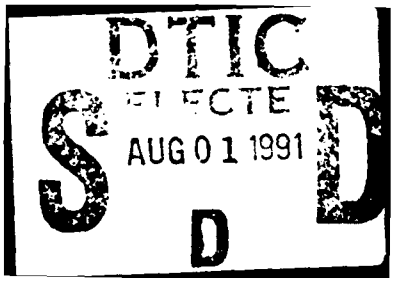
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13. ABSTRACT (Maximum 200 words)

This report presents three programs for the geotechnical engineer for the management and presentation of boring log data and other geotechnical details. Unit I contains a boring log database system. The program is a menu-driven collection of routines for data entry, editing, and reporting of boring log information. The package is written in dBase III Plus and this software must be available for the program to operate. Unit II is a Boring Log Plotting program which works in conjunction with the boring log database to generate CADD design files for display of the logs. The package extracts user-defined boring logs and displays them in a design file either singly or in a definable matrix. Unit III is a cell library and matrix menu. The cells used in the matrix menu are those contained in the CADD Standards Manual (EM 1110-1-1807). This system offers a quick and easy way to generate geotechnical details such as boring log and pavement details. Instructions for installation, use, and maintenance of these packages are included in the individual units.

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Pavements--Data processing.

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DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

CEWES-IM-DA

14 September 1990

MEMORANDUM THRU Chiefs, Engineering Division

FOR Chiefs, Geotechnical Branch

Subject: dBase and CADD Boring Log Programs

1. Enclosed is a Lessons Learned Report presenting three programs for the geotechnical engineer for the management and presentation of boring log data and other geotechnical details. These packages are presented jointly by the Computer Application in Geotechnical Engineering (CAGE) Computer-Aided Design and Drafting (CADD) Support Task Group and the CADD Center Geotechnical Single Discipline Task Group (SDTG). Much of the coordination for this document was performed by Mr. Earl Edris, principal investigator for CAGE and chairman of the Geotechnical CADD SDTG.

2. Unit I contains a boring log database system developed by the Vicksburg District under the direction of Mr. Chris Dixon and Mr. Ed Templeton. The program is a menu-driven collection of routines for data entry, editing, and reporting of boring log information. The package is written in dBase III Plus and this software must be available for the program to operate.

3. Unit II is a Boring Log Plotting program which works in conjunction with the boring log database to generate CADD design files for display of the logs. The package extracts user-defined boring logs and displays them in a design file either singly or in a definable matrix.

4. Unit III is a cell library and matrix menu developed by Seattle District under the direction of Mr. Steve Meyerholtz through funding by both the CAGE and CADD Task Groups. The cells used in the matrix menu are those contained in the CADD Standards Manual. This system offers a quick and easy way to generate geotechnical details such as boring log and pavement details.

5. Instructions for installation, use, and maintenance of these packages are included in the individual units. If you have any questions please contact Earl Edris, 601/634-3378, or Al Williamson, 601/634-2468.

CARL S. STEPHENS, PE
Chief, Computer-Aided Design
and Drafting Center

COMPUTER-AIDED DESIGN and DRAFTING (CADD) CENTER

MISSION

To enable the Corps of Engineers to achieve the best use of CADD within the shortest time frame.

PURPOSE

The CADD Center is the Corps vehicle for sharing information and development work and minimizing duplication of effort while retaining local automonies and decentralized organizational structures.

MODE OF OPERATION

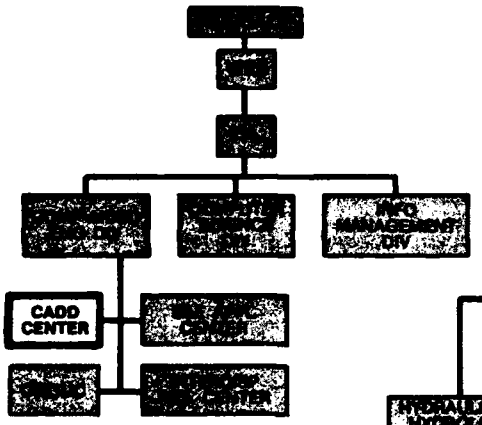
The Center is an end-user driven, technology transfer oriented organization. Single-Discipline Task Groups (SDTG) and Special Advisory Task Groups (SATG) are formed under headquarters guidance to get field office grass roots input into CADD activities. A Field Technical Advisory Group (FTAG) provides the guidance to the Center.

OBJECTIVE

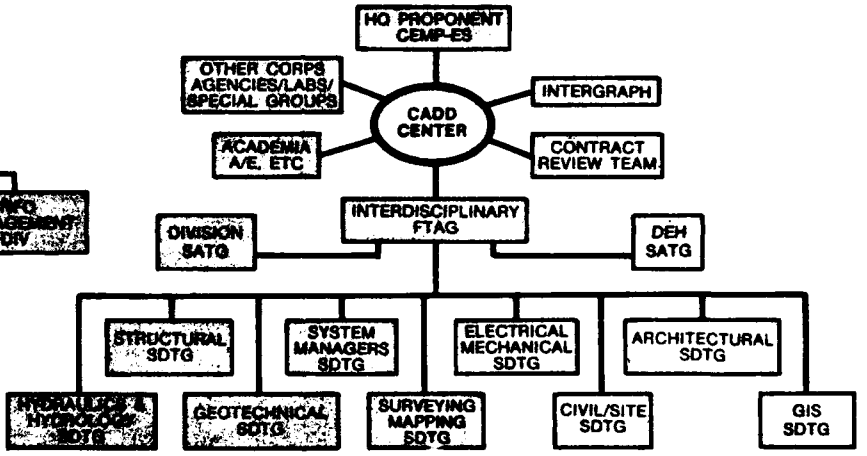
To integrate and implement CADD by:

- Furnishing technical advice
- Conducting training
- Evaluating products
- Providing advisory teams
- Initiating studies
- Promoting communications
- Distributing products

ORGANIZATIONAL CHART



FUNCTIONAL CHART



FTAG - FIELD TECHNICAL ADVISORY GROUP

SDTG - SINGLE DISCIPLINE TASK GROUP

SATG - SPECIAL ADVISORY TASK GROUP

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PREFACE

This document describes methods available to the geotechnical engineer for the production of boring log and other geotechnical details on computer-aided design and drafting (CADD) equipment. It contains all the required documentation and electronic data required to develop, maintain and display boring log information.

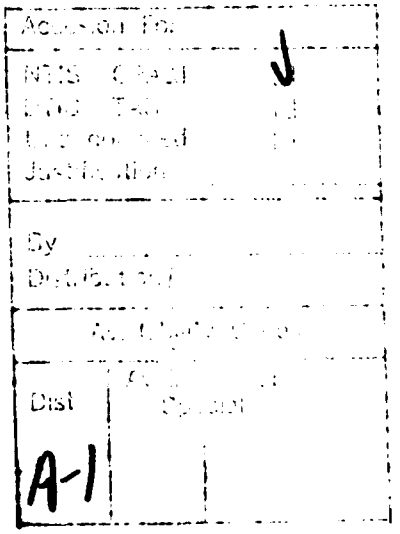
The boring log data base programs were developed by the Vicksburg District Corps of Engineers through a contractor funded by the District. A special thanks is given to the District and Mr. Ed Templeton and Mr. Chris Dixon for their efforts leading to successful completion of this project.

The geotechnical matrix menus were developed by the Seattle District Corps of Engineers under the direction of Mr. Steve Meyerholtz through funding by the Computer Application in Geotechnical Engineering (CAGE) project and Geotechnical Single Discipline Task Group (SDTG). A special thanks to the Seattle District and Mr. Meyerholtz.

A very special thanks is given to Mr. Earl Edris, Soil and Rock Mechanics Division, Geotechnical Laboratory, USAE Waterways Experiment Station (USAEWES). Mr. Edris is the chairman of both CAGE and the Geotechnical SDTG's. He has coordinated and provided substantial input for both of these programs and production of this report.

This report was prepared by Mr. Steven D. Hatton, under the direction of Dr. Edward E. Middleton, Chief, Computer Aided Engineering Division and Mr. Carl S. Stephens, Chief, CADD Center, Information Technology Laboratory (ITL) US Army Engineer Waterways Experiment Station (WES). General supervision was provided by Dr. N. Radhakrishnan and Mr. Paul K. Senter, Chief and Assistant Chief, ITL, respectively.

Commander and Director of WES during the conduct of this work and preparation of this report was COL Larry B. Fulton, EN. Dr. Robert W. Whalin was Technical Director.



UNIT I

BORING LOG DATABASE SYSTEM

BORING LOG DATABASE SYSTEM

TABLE OF CONTENTS

BORING LOG DATABASE SYSTEM

APPENDIXES

CODE LISTINGS

BORING.PRG
BORBADD.PRG
BORBUPD.PRG
BORSADD.PRG
ADDMENU.PRG
COL_WIN.PRG
ROC_WIN.PRG
SOIL_WIN.PRG
MOD_WIN.PRG
CONS_WIN.PRG
BORPRINT.PRG
SHOWBOR.PRG
BORSCR.PRG
DETOUR.PRG
BORPLOT.PRG
PLOTIT.PRG
PLATCHAR.PRG
PLOTITLE.PRG
GRADLAB.PRG
WATCONT.PRG
BORTRANS.PRG
BOREDIT.PRG
FIXDATE.PRG

OVERVIEW

The Boring Log Database System is a menu driven collection of routines providing data entry, editing, reporting, and plot file generation capabilities. The routines are written in dBase III Plus. Boring Log data are input in the soils lab as samples arrive. Information about each log is entered and then data for each sample in that log. It is not necessary to enter all information requested as the samples arrive. The user may store tare numbers and wet weight and later generate gradation form labels and compute water content. As test results are available each sample or log record may be retrieved and edited. Lab log report forms may be generated for each log. When all information for a project has been entered into a database, the analytical section may then generate plot files to be transferred to the Harris.

HARDWARE/SOFTWARE REQUIREMENTS

IBM PC/AT compatible with hard disk drive
640k memory
color graphics monitor
dot matrix printer
1200 baud modem
dBase III software
communications package (CrossTalk, etc.)

STARTUP PROCEDURE

Make sure that the DOS, dBase, and Crosstalk subdirectories are in your path.
Copy the Boring Log Dababase System into the subdirectory you desire to work in.
Make this directory your current directory.
This directory is also the directory that will contain your databases.
Start dBase and enter the command "DO BORING".

A "Boring Log Boot diskette" is available that performs the above.

GENERAL OPERATION

Type in information requested. Generally a boring number and/or sample number is required to add, edit or display data. Enter a blank to return to the previous menu. To accept information currently displayed in a field just press return. Numbers are automatically right justified.

SPECIAL KEYS:

up arrow, down arrow	move to the previous or next field
page down	to quit entering data on a screen
backspace	delete previous character
delete	delete current character
home	move to beginning of current field
end	move to end of word or current field
enter	move to next field

Data entered is either numeric (strictly numbers); alphanumeric (numbers and letters); or logical (true or false). See pages A-1 for boring data and A-2 for sample data. For valid codes for soils, consistency, rocks, colors and drilling types, see Appendix B. All dates should be entered in the format: nn MON yy (i.e. 23 JUL 87).

RUNNING THE PROGRAM

DO BORING

```
----------------------------
| BORING LOG INPUT SYSTEM |
----------------------------

        07/20/87

Enter database file name: newfile
```

The file name you choose must be 7 characters or less. It is suggested that the name relate to the project you are working on. If the database does not exist the user will be asked if he wants to create it.

```
File does not exist!
Do you wish to create a new database (y/n) ? y
```

At this point the program generates the necessary files and returns to the above prompt. To begin entering data into the new database, press **ENTER** at this time.

```
Enter Project: NEW PROJECT
```

If the project is not currently defined, the user will be asked to provide pertinent information about it.

This project is not in the database.

Do you wish to add this project ? **y**

Enter latitude of project site reference point:
Degrees: **0** Minutes: **0** Seconds: **0.000**

Enter Longitude of project site reference point:
Degrees: **0** Minutes: **0** Seconds: **0.000**

If you don't know the latitude and longitude of the project, just press return and skip through the fields.

Now you are into the system using a specified database. The Main Menu is displayed on the screen. The project you specified will be the default project name in all borings you enter. You may change projects on different borings if so desired, but this is not generally recommended.

MAIN MENU

BORING LOG INPUT SYSTEM OPTIONS
==========

1 - ADD A NEW BORING

2 - CHANGE AN EXISTING BORING

3 - ADD OR MODIFY SAMPLE FOR AN EXISTING BORING

4 - PRINT BORING/SAMPLE

5 - LIST EXISTING BORINGS TO SCREEN

6 - DISPLAY BORING/SAMPLES

7 - CREATE NEW BORING DATABASE

8 - GENERATE PLOT FILES

9 - MISCELLANEOUS

0 - VALIDATE DATABASE

Q - EXIT THIS PROGRAM

CHOOSE AN OPTION --> ____

OPTION 1 - ADD A NEW BORING

To add a boring to the database choose Option 1, when the following screen appears type in the assigned boring log number and press return. The system will not allow entry of duplicate boring numbers. A message to that effect will appear on the screen. After pressing return, the user may enter another number. Some of the valid abbreviations for drilling method are listed at the bottom of the screen. See Appendix B for other codes. Note that the current default project automatically is displayed. Simply press ENTER to accept it or you may change the project by typing over it. When you are finished entering information about a boring, either press the Page Down key or press return to skip through the remaining fields.

Boring No. TC-22-87U	
Location	Tertiary Depth 0.0
	Water Table Date
	Water Table Depth 0.0
Date Taken	
Project TOWN CREEK	Method of Drilling
	General Samples
G. S. Elevation 0.0	Undisturbed Samples
Classifier Recorder Checker	North/South Location 0.00
	East/West Location 0.00
Field Book No.	Date Analysed
	Date Checked
Remark	

RM - Rotary Mud	RNM - Rotary without Mud	AUG - Auger	HDA - Hand Auger
FT4 - 4" Fishtail	D25 - 2.5" Drive Tube	DEN - Denison	RRB - Rock Bit
FT6 - 6" Fishtail	VST - Vacuum Shelby Tube	SSS - Split Spoon	COR - Core

OPTION 2 - CHANGE AN EXISTING BORING

To change an existing boring, enter the boring number. This will call up information previously entered on this boring. If the boring is not in the database, a message will appear and the user may try a different number. Once the boring input form is displayed on the screen, the user must choose to either modify or delete the boring or return to the main menu. If the user chooses to delete the boring, ALL SAMPLE DATA ASSOCIATED WITH THAT BORING WILL BE DELETED! If the user chooses to modify the boring, he may modify any field by using the up and down arrow keys to move between fields. Only the boring id may not be changed.

```
                         Boring No. TC-1-87U

 Location 6' FROM TOP BK                 Tertiary Depth      0.0

                                         Water Table Date  16 Jun 87
                                         Water Table Depth   25.0
 Date Taken  16 Jun 87

 Project TOWN CREEK                      Method of Drilling RM
                                         General Samples D25
 G. S. Elevation  313.7                  Undisturbed Samples VST

 Classifier  Recorder  Checker           North/South Location   0.00
  JDC          BB        BB              East/West Location     0.00

 Field Book No.  7228                    Date Analysed 15 Jun 87
                                         Date Checked  26 Jun 87

 Remark

Is this record to be Updated, Deleted, or Neither (U,D,N)?
```

OPTION 3 - ADD OR MODIFY SAMPLE FOR AN EXISTING BORING

To add sample data, the boring record must have previously been entered into the database. Type in the boring number and the program will ask for a sample number. The format of the sample number is 3 digits + 1 digit + 1 digit. The first three digits are a number or NSN (no sample number); the letter "A" in the next digit indicates an undisturbed sample; the last digit is used to sequence rock notes with the first being "A", second "B", and so on.

```
        The current boring is

        Type a carriage return to accept it or
           enter the name of the desired boring.
                                      No. U Rock
        Sample Number:

        Enter blanks to return to menu.
```

The sample data input screen is displayed below along with descriptions of valid inputs.

```
Project:  TOWN CREEK                              Sample Number:    1
Boring Number:   TC-1-87U                         Scratched:

   SAMPLE        WATER   WET      STRATUM            ROCK     GRAD.
 FROM    TO     CONTENT WEIGHT   CHANGE    SYM  NOTES MOD   TARE

            CONSIS-                          MODIFICATION
             TENCY          COLOR              SYMBOLS

  BLOWS                ATTERBERG              TESTS WATER  SECOND   TESTS
PER FOOT    UCT       LL      PL  D10 SIZE     CONTENT      UCT   ASSIGNED

COMMENTS:

                    Press <PgDN> for COMMANDS
```

SCRATCHED - either **T** or **F**, indicates whether or not that sample is to be used in the plot routines.

SAMPLE FROM and TO - beginning and ending depths of sample.

WATER CONTENT - if preceded by a letter (**M24**) indicates a tare number and you should enter a WET WEIGHT. Later the user may enter dry weights in a batch mode and the program will calculate the water content. If not preceded by a letter, the program assumes the actual water content is entered.

WET WEIGHT - in grams, only used when a tare number is entered for the water content.

STRATUM CHANGE - enter this when there is a stratum change before the next sample.

ROCK NOTES - contains the symbol **RO** when rock notes are desired for the sample. The sample number should end in a letter (i.e. 231 A).

ROCK MOD - contains the rock symbol or a modification that prints in the log on the plot program. Only **SLF F M C O CS SIS SS** modifications are allowed in the log.

GRAD. TARE - tare number for gradation tests. Program will later generate labels for particle size test forms.

CONSISTENCY - see Appendix B for allowable codes.

COLOR - see Appendix B for allowable codes.

MODIFICATION SYMBOLS - see Appendix B for allowable codes. There are some restrictions as to which modifications may be used with certain soils or other modifications:

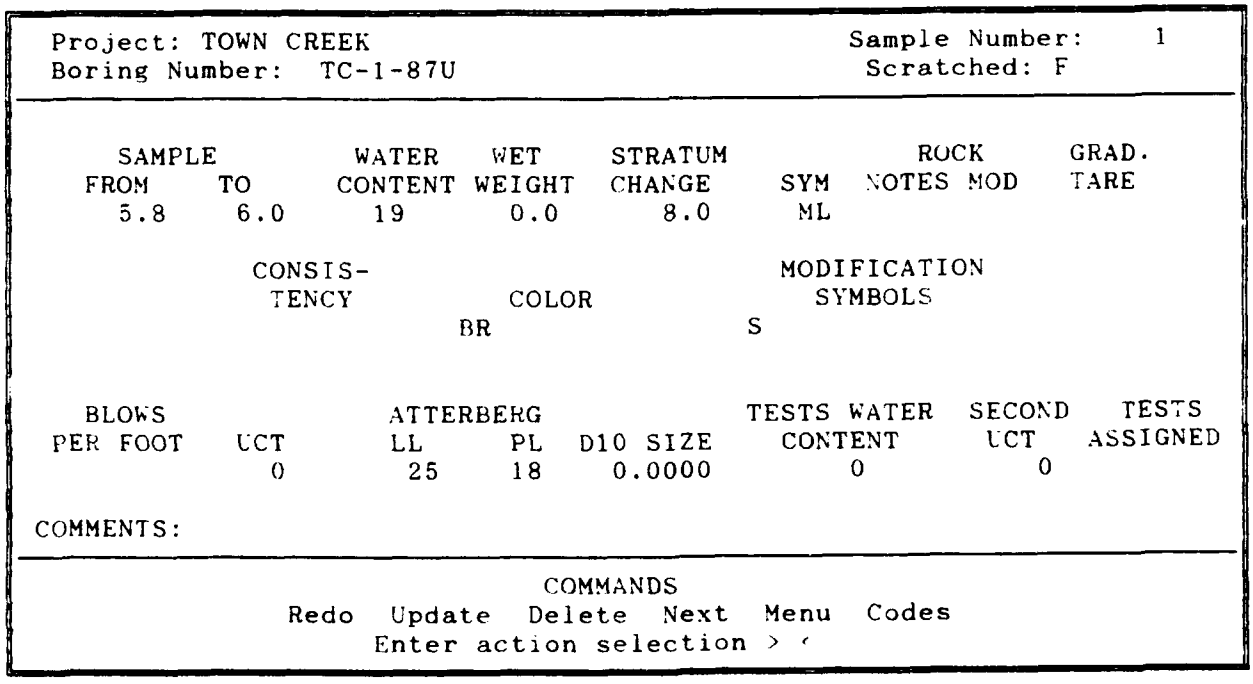
F M C VD D LO - only used with sand soils (SW or SP)
CR SL - only used with clay soils (CL or CH)
TR must be followed by G
two letter modifications should be left justified
one letter modifications should be centered

BLOWS PER FOOT - this is a character field that should only contain numbers and/or the symbol '+'. If '100+' is entered '101' is sent to the plot program.

D10 SIZE - may either be n.nnn or .nnnn significant digits

UCT, ATTERBERG LIMITS, TESTS WATER CONTENT, SECOND UCT, and TESTS ASSIGNED are self-explanatory.

The COMMANDS menu for the sample data input screen may be accessed at any time by pressing the <PageDown> key. The menu appears at the bottom of the screen.



To execute any of the commands, press the letter key corresponding to the first letter of the command.

SAMPLE SCREEN COMMAND MENU

R - Redo	Repaints Sample Screen and allows user to continue editing record.
U - Update	Adds sample to database if new sample or updates information in database record if old sample.
D - Delete	Deletes sample from database.
N - Next	Displays next sample in the database.
M - Menu	Returns program to main menu.
C - Codes	Displays available codes on the screen for user and returns to proper place on Sample Screen. C - Color codes. M - Modification codes. S - Soil codes. R - Rock codes. T - consisTency codes.

NOTE: You MUST UPDATE to make any addition and/or change to the database!

You may not modify the sample number. To correct this simply delete the incorrect sample number and add a correct one and its associated data.

```
Project: TOWN CREEK                                  |  COLOR  | 1
Boring Number:  TC-1-87U                             |---------|
                                                     | T   Tan |
                                                     | Y   Yellow
    SAMPLE          WATER   WET     STRATUM          | R   Red
  FROM    TO      CONTENT WEIGHT  CHANGE     S      | BK  Black
   5.8    6.0       19      0.0      8.0            | GR  Gray
                                                     | LGR Light Gray
          CONSIS-                                  M | DGR Dark Gray
           TENCY          COLOR                     | BR  Brown
                      BR                        S    | LBR Light Brown
                                                     | DBR Dark Brown
                                                     | GN  Green
  BLOWS                ATTERBERG                 TES | BL  Blue      | STS
PER FOOT   UCT       LL      PL   D10 SIZE       C   | WH  White     | GNED
             0       25      18    0.0000           | MOT Mottled
                                                     | BRG Brownish-gray
COMMENTS:                                            | GYB Grayish-brown
                                                     | GNG Greenish-gray |
                                                     | GYG Grayish-Green
                        CODES                        | BLG Blue-Green
            Color  Modifications  Soils  R           | RD  Reddish
                   Enter action selection            |
```

Press any key: >

The above is an example of displaying allowable color codes while editing a sample. This screen was reached by the following keystrokes: <PageDown> C C

Control will be returned to the first COLOR blank on the Sample Screen when the user presses a key.

OPTION 4 - PRINT BORING/SAMPLE

This option prints the boring log. The printout includes the information associated with the boring record and the detailed information associated with each sample. It is recommended that the user print the boring log after entering sample data for each boring. See Appendix C for and example of the boring log printout.

OPTION 5 - LIST EXISTING BORINGS TO SCREEN

This option displays on the screen the boring ID's of all borings entered into the database.

OPTION 6 - DISPLAY BORING/SAMPLES

This option displays on the screen the same information printed in the boring log report. The first screen contains the information associated with the boring record. The second screen contains the sample information through the modifications. Optionally, the user may view the remaining sample information or move on to the rest of the samples.

```
                              LABORATORY LOG
                              --------------

PROJECT NAME: TOWN CREEK                        FIELD BOOK NOS.  7228
BORING NO.    TC-1-87U                          DATE TAKEN    16 Jun 87
LOCATION      6' FROM TOP BK


G. S. ELEVATION   313.7              TERTIARY DEPTH
WATER TABLE DATE: 16 Jun 87  WATER TABLE DEPTH:    25.0
METHOD OF DRILLING: Rotary Mud          LOCAL N-S COORD. :    0.00
GENERAL SAMPLES: 2.5" Drive Tube        LOCAL E-W COORD. :    0.00
UNDISTURBED SAMPLES: Vacuum Type Shelby Tube
CLASSIFIER:  JDC          RECORDER: BB              CHECKER: BB
DATE ANALYZED:  15 Jun 87       DATE CHECKED:    26 Jun 87


        Press any key to continue...
```

The first screen contains general information about a boring.

PROJECT NAME: TOWN CREEK BORING NO. TC-1-870

TESTS ASGN	SAMPLE NO.	SAMPLE FROM	SAMPLE TO	WATER CONT	STRATUM CHANGE	SYM	CONSIS-TENCY	COLOR	MODIFICATION SYMBOLS
	NSN	0.0	1.0		1.0	SP		BR	G
S	1A	5.0	5.8						
	1	5.8	6.0	19	8.0	ML		BR	S
S	2A	10.0	10.8						
	2	10.8	11.0	41	13.0	ML	CS	BR	
	3	15.0	16.0		18.0	SM		GR	
	4	20.0	21.0	18	23.0	CL		LGR	ISS
	5	25.0	26.0			SP		BR	F

Press C to see the rest of the data on these borings or any other key to go on

The second screen displays partial data for samples. Optionally the user may continue <**C**> viewing information for the above samples or press any other key to move on to the remaining samples for this boring.

PROJECT NAME: TOWN CREEK BORING NO. TC-1-870

TESTS ASGN	SAMPLE NO.	SAMPLE FROM	SAMPLE TO	BLOWS PER FOOT	UCT	ATTERBERG LIMIT LL	ATTERBERG LIMIT PL	D10 SIZE	TEST WATER CONTENT	SECOND UCT
	NSN	0.0	1.0							
S	1A	5.0	5.8							
	1	5.8	6.0			25	18			
S	2A	10.0	10.8							
	2	10.8	11.0			40	31			
	3	15.0	16.0							
	4	20.0	21.0							
	5	25.0	26.0							

Press P to go back to previous screen or any other key to go on

Remaining information about the samples shown in the prior screen.

NOTE: The "S" appearing in the first column indicates that the sample has been "Scratched".

Modifications to be placed in the log or ROCK symbols appear between SYM and CONSISTENCY.

OPTION 7 - CREATE NEW BORING DATABASE

Use this option to move some of the borings to another database. This may be done by individual boring ID's or by Project. First you must enter a filename for the new database:

Create a new database file.
New filenames maximum length is seven characters.
Enter the new name and press RETURN

New Filename: ▒▒▒▒▒▒▒▒

If the filename already exists:

Database already exists.
Do you wish to <**O**>verwrite it,
<**A**>ppend records,
or <**C**>hoose another file name?
Enter selection: ▒

If you choose to Overwrite - all existing records in that file will be ERASED!

If you choose to Append - records will be added to those in the existing file.

Boring Duplicates

1. Project
2. Location (not implemented)
3. Boring I.D.
4. Return to Main Menu

Choose an Option --> ▒

Project - all borings with the same project name will be copied to the new database. This is only helpful if you have used more than one project name in your current database.

Boring I.D. - copies one boring at a time until the user enters a blank boring ID to the new database.

OPTION 8 - GENERATE PLOT FILES

This option allows the user to create a standard ASCII file in the format expected by the boring plot routine. Borings may be selected by entering a range or by specifying up to 11 specific borings. Placement of logs on the plot is calculated according to the default placement tables.

First enter a filename for the ASCII file with no extension. The program will automatically append ".txt" to the name you enter. If the file already exists, the user may overwrite it (erasing previous data) or enter a different name. Then the user chooses a method of selecting borings:

Do you wish to :

1. Enter boring log numbers one at a time (up to 11 logs)
2. Enter beginning and ending log numbers
3. Return to menu

Enter choice from above

Choice 1:

Boring Log No. 1 : TC-1-87U
Boring Log No. 2 : TC-2-87U
Boring Log No. 3 : TC-3-87U
.
.
etc.
.
.
Boring log No. n :

Enter blank boring number to finish.

Choice 2:

Enter beginning Log number :

Enter ending Log Number :

Remember Log Numbers are sorted in alphabetical order so that TC-10-87U precedes TC-2-87U.

After choosing the logs to be plotted, the program reads through the log sample data and calculates the minimum and maximum ground surface elevation and the lowest depth. As this process proceeds the following screen appears:

```
working
      working
            working
     *** Boring not found : TC-3-87U
     Do you wish to continue ? y
                        working
                              working
```

The "*** Boring not found" message only occurs when the user has individually selected borings to be plotted and one of the borings is not in the database. When this occurs, the user may continue and the plot will contain one less boring than the user requested.

```
          logs to be plotted

     maximum ground surface elevation:  313.7

     minimum ground surface elevation:  300.0

     lowest vertical depth:  259.0
press any key to continue ...
```

When the above information appears on the screen, the user should make a note of the minimums and maximums in order to check for proper placement of individual logs on the plot.

The user is now given the option of modifying or accepting default values for plot options, plate characteristics, titles, and general notes.

Plot Option Card Defaults
Only 2 Vertical Staffs per Plate
No horizontal staff
Left and right vertical staffs
Modifications with written descriptions
Vertical Caption: 'ELEVATION IN FEET M.S.L.'
Written descriptions in upper case
Maximum staff is 22", plate is 37" wide
0 lines of notes

Do you wish to change any of the above defaults?

The above screen displays the Plot Option Card defaults.

If you wish to modify the Plot Option defaults, your cursor will appear flashing to the left of the options. Press the "x" key to toggle choices on all lines except the number of note lines. For that option use a "+" to increase the number of note lines and a "-" to decrease them.

Plot Option Card Defaults
Only 2 Vertical Staffs per Plate
No horizontal staff
Left and right vertical staffs
Modifications with written descriptions
Vertical Caption: 'ELEVATION IN FEET M.S.L.'
Written descriptions in upper case
Maximum staff is 22", plate is 37" wide
0 lines of notes

Use arrow keys to position and "x" to modify
Press <PgDn> when finished

The next screen displays the calculated Plate Characteristic Card values. Use the arrow keys to move the cursor and make any necessary modifications. When satisfied with the values, press the PageDown key.

Plate Characteristic Card	
Maximum distance of horizontal staff in feet	340.0
Upper vertical staff elevation 320.	
Lower Vertical staff elevation 300.	
Vertical scale 10.0	
Horizontal scale 10.0	
Size of plate factor 1.000	
Number of boring logs to plot 1	
Starting horizontal staff distance 0.00	
Percent to increase letter size in scaled plot	0.

Use arrow keys to position, press <PgDn> when finished.

The user will enter the titles for the plate and then the appropriate number of notes to appear beside the title block.

Title lines 1 - 3 may have up to 38 characters
Title line 4 has up to 19 characters
Title lines 5 - 6 may have up to 45 characters

Notes may have up to 45 characters per line.

The user may use the up and down arrows to make corrections in the titles until he presses the PageDown key. Titles should be left justified within the fields.

After entering the title and note lines, the program begins to generate the individual boring log plot data. For each boring to be plotted the following information will appear on the screen:

Boring Number : TC-1-87U Project: TOWN CREEK

Location: 6' FROM TOP BK GSE: 313.7
Tertiary: 223.4

Local N/S Coordinate: 0.00 Local E/W Coordinate: 0.00

Enter Distance from left vertical staff **60.00**

Enter ground surface elevation **313.7**

The user may accept the distance from the left vertical staff and the ground surface elevation by pressing return; or may modify one or both. A bell will sound when the next boring is displayed on the screen.

OPTION 9 - MISCELLANEOUS

1 - Gradations Labels

This option allows the user to print labels to be placed at the top of particle size forms. An example follows:

PROJECT: TOWN CREEK

Boring No. Sample No.
TC-2-87U 1

Depth: 1.5 TO 3.0 Tare: B35

Total Weight of Sample _____ Grams

2 - Water Content Forms

In this module, the user enters the dry weights for the tare numbers entered when soil samples came into the lab. The program computes the water content and places that number in place of the tare number in the database. At the same time a printout detailing calculations is generated. See Appendix D for an example of the printout.

3 - Ascii dump of databases

Dumps all information in database into ascii files delimited by quotes.

NOTE If you get to OPTION 9 by mistake, choose Number 1 (Gradations Labels) and enter a blank boring number to return to the Main Menu.

OPTION 0 - VALIDATE DATABASE

This module checks for errors in the database. Lab personnel should run this routine when finished entering data for a project before giving the data to the section that will plot it.

Checks are made for improper codes, missing stratum changes, and other missing data. If the user indicates that tertiary and water table data are available, warnings are issued if data are missing. See Appendix E for sample printout.

BACKING UP THE DATABASE

At the end of every day that the program has been used, make a backup of the databases used.

Enter "**Q**" at the main menu.
Exit dBase by typing **QUIT**
Place a formatted floppy diskette in drive B
Enter the copy command:
COPY filename*.* B:
Now a current copy of that database is saved on the floppy.
Label the floppy with the database name and the date.
After you have made 3 backups of the database on different days, you may copy onto the oldest of these diskettes.

FORMATTING NEW DISKETTES

Change the default drive to A:

A:

FORMAT B:

The program will prompt you to place a new floppy in drive B: and press ENTER to continue. When it is finished, the user has an option to format another.

BORING LOG DATABASE SYSTEM
A-1

Structure for database: A:BORSTRB.dbf
Number of data records: 0
Date of last update : 06/29/87

Field	Field Name	Type	Width	Dec
1	BOR_NUM	Character	26	
2	TERT_DEPTH	Numeric	6	1
3	LOCN_1	Character	32	
4	LOCN_2	Character	22	
5	LOCN_3	Character	22	
6	LOC_NS	Numeric	10	2
7	LOC_EW	Numeric	10	2
8	DATE_TAKEN	Date	8	
9	WTAB_DATE	Date	8	
10	WTAB_DEPTH	Numeric	6	1
11	METH_DRILL	Character	3	
12	GEN_SAMPLE	Character	3	
13	UND_SAMPLE	Character	3	
14	PROJECT	Character	30	
15	CLASSIFIER	Character	3	
16	RECORDER	Character	3	
17	CHECKER	Character	3	
18	DATE_ANAL	Date	8	
19	DATE_CHECK	Date	8	
20	FBOOK_NOS	Character	15	
21	GS_ELEV	Numeric	6	1
22	REMARK	Character	60	
** Total **			296	

BORING LOG DATABASE SYSTEM
A-2

Structure for database: C:BORSTRS.dbf
Number of data records: 0
Date of last update : 06/25/90

Field	Field Name	Type	Width	Dec
1	SAMPLE_NO	Character	31	
2	TST_ASGN	Character	3	
3	SFROM	Numeric	5	1
4	STO	Numeric	5	1
5	WATER_CONT	Character	3	
6	WET_WGT	Numeric	5	1
7	STRAT_CHG	Numeric	5	1
8	SYM	Character	2	
9	ROCK1	Character	2	
10	ROCK2	Character	3	
11	GRAD_TARE	Character	4	
12	CONSIS	Character	3	
13	COLOR1	Character	3	
14	COLOR2	Character	3	
15	COLOR3	Character	3	
16	MSYM1	Character	3	
17	MSYM2	Character	3	
18	MSYM3	Character	3	
19	MSYM4	Character	5	
20	BLOWS_FT	Character	4	
21	UCT	Numeric	1	
22	ATLIM_LL	Numeric	3	
23	ATLIM_PL	Numeric	3	
24	D10_SIZE	Numeric	7	4
25	TWAT_CONT	Numeric	3	
26	SECOND_UCT	Numeric	4	
27	REMARKS	Logical	1	
28	SCRATCH	Logical	1	
** Total **			125	

BORING LOG DATABASE SYSTEM
A-3

```
Structure for database: C:BORSTRR.dbf
Number of data records:        0
Date of last update    : 06/25/90
Field  Field Name  Type        Width     Dec
    1  SAMPLE_NO   Character      36
    2  REMARK      Character      60
** Total **                       97

Structure for database: C:abrev.dbf
Number of data records:       14
Date of last update    : 11/18/87
Field  Field Name  Type        Width     Dec
    1  ABR         Character       3
    2  NAME        Character      25
** Total **                       29

Structure for database: C:plot.dbf
Number of data records:       17
Date of last update    : 10/25/90
Field  Field Name  Type        Width     Dec
    1  REC80       Character      80
** Total **                       81

Structure for database: C:plotbors.dbf
Number of data records:        1
Date of last update    : 10/25/90
Field  Field Name  Type        Width     Dec
    1  BNAME       Character      26
** Total **                       27
```

BORING LOG DATABASE SYSTEM
B-1

DRILLING METHODS	
AUG	Auger
COR	Core
D25	2.5" Drive Tube
DEN	Denison Sampler
FT4	Fishtail 4"
FT6	Fishtail 6"
FT8	Fishtail 8"
HDA	Hand Auger
HVO	Hvorslev
RM	Rotary Mud
RNM	Rotary without Mud
SSS	Standard Split Spoon
VST	Vacuum Type Shelby Tube

ROCK CLASSIFICATIONS	
GRA	Grayacke
CLA	Indurated Clay or Claystone
CEM	Cemented Shale
COA	Coal
LIM	Limestone
DOL	Dolomite
MAR	Marble
DIO	Diorite
BAS	Basalt (Trap)
TUF	Tuff or Tuff Breccia
GNE	Gneiss
SCH	Schist
QUA	Quartzite
SOA	Soapstone and Serpentine
GAB	Gabbro
RHY	Rhyolite
AND	Andesite
SLA	Slate
GRN	Granite
SIL	Siltstone
COM	Compaction Shale
CHA	Chalk or Marl
SAN	Sandstone
CON	Conglomerate
AGG	Agglomerate Flow Breccia
NSP	Prevents Plotting of Rock Symbols

COLOR	
T	Tan
Y	Yellow
R	Red
BK	Black
GR	Gray
LGR	Light Gray
DGR	Dark Gray
BR	Brown
LBR	Light Brown
DBR	Dark Brown
GN	Green
BL	Blue
WH	White
MOT	Mottled
BRG	Brownish-gray
GYB	Grayish-brown
GNG	Greenish-gray
GYG	Grayish-Green
BLG	Blue-Green
RD	Reddish

CONSISTENCY	
VSO	Very Soft
SO	Soft
M	Medium
ST	Stiff
VST	Very Stiff
H	Hard

BORING LOG DATABASE SYSTEM
B-4

SOIL CLASSIFICATIONS	
GW	Gravel, Well Graded, Gravel-Sand Mixtures, Little or no Fines
GP	Gravel, Poorly Graded, Gravel-Sand Mixtures,Little or no Fines
GM	Silty Gravel, Gravel-Sand-Silt
GC	Clayey Gravel, Gravel-Sand-Clay
SW	Sand, Well-Graded,Gravelly Sands
SP	Sand,Poorly-Graded Gravelly Sand
SM	Silty Sand, Sand-Silt Mixtures
SC	Clayey Sand, Sand-Clay Mixtures
NS	No Sample
ML	Silt and Very Fine Sand, or Clayey Fine Sand or Silt with Slight plasticity
CL	Lean, Sandy, Silty Clay of Medium plasticity
OL	Organic Silts and Silty Clays of Low plasticity
MH	Silt, Fine Sandy or Silty Soil with High plasticity
CH	Fat, Inorganic Clay of High plasticity
OH	Organic Clays, Silts of Medium to High Plasticity
PT	Peat, other Highly Organic Soil
WD	Wood
SI	Shells
DB	Debris

MODIFICATIONS	
TR	Traces
F	Fine
M	Medium
C	Coarse
CC	Concretions
RT	Rootlets
LG	Lignite Fragments
SH	Shale Fragments
SDS	Sandstone Fragments
SLF	Shell Fragments
O	Organic Matter
CS	Clay Strata or Lenses
SIS	Silt Strata or Lenses
S	Sandy
G	Gravelly
B	Boulders
SL	Slickensides
WD	Wood
OX	Oxidized
SSI	Sandy Silt
ISS	Silty Sand
PGM	Poorly graded Silty Fine Gravel
WGM	Well Graded Silty Fine Gravel
PGC	Poorly Graded Clayey Fine Gravel
WGC	Well Graded Clayey Fine Gravel
PSM	Poorly Graded Silty Fine Sand
PSC	Poorly Graded Clayey Fine Sand
WSM	Well Graded Silty Fine Sand
WSC	Well Graded Clayey Fine Sand
LML	Silty Clay
VEG	Vegetation
SS	Sand Strata
SI	Shells
CR	Crumbly
W/	With
LO	Loose
VD	Very Dense
D	Dense

BORING LOG DATABASE SYSTEM
C-1

LABORATORY LOG Page 1

Project name: TOWN CREEK Field Book No. 7228
Boring no. TC-1-87D Date Taken 16 Jun 87
Location 6' FROM TOP BK

G. S. Elevation 313.7 Tertiary Depth
Water table date: 16 Jun 87 Water table depth: 25.0
Method of drilling: Rotary Mud LOCAL N-S COORD. : 0.00
General samples: 2.5" Drive Tube LOCAL E-W COORD. : 0.00
Undisturbed samples: Vacuum Type Shelby Tube
Classifier: JDC Recorder: BB Checker: BB
Date analyzed: 15 Jun 87 Date checked: 26 Jun 87

TESTS ASGN	SAMPLE NO.	SAMPLE FROM	SAMPLE TO	WATER CONT	STRATUM CHANGE	STM SYM	ROCK	CONSIS TENCY	COLOR	MODIFICATION SYMBOLS	BLOWS PER FOOT	DCT	ATTERBERG LIMIT LL	ATTERBERG LIMIT PL	D10 SIZE	TEST WATER CONTENT	SECOND DCT
	NSM	0.0	1.0		1.0	SP			BR	G							
S	1A	5.0	5.8														
	1	5.8	6.0	23	8.0	ML		H	BR	S			25	18			
S	2A	10.0	10.8														
	2	10.8	11.0	20	13.0	ML	CS		BR				40	31			
	3	15.0	16.0	19	18.0	SM			GR								
	4	20.0	21.0	11	23.0	CL			LGR	ISS							
	5	25.0	26.0	21		SP			BR	F					0.1820		
	6	30.0	31.0	18		SP			LGR	F					0.1940		
	7	35.0	36.0	28	38.0	SP			LGR	F					0.1770		
	8	40.0	41.0		41.0	SM			LBR	PSM					0.1020		

Boring complete at 41.0

BORING LOG DATABASE SYSTEM
D-1

WATER CONTENT - GENERAL

Date: 07/28/87

Project: TOWN CREEK

Boring No. TC-1-87U

Sample No.	1	2	3	4	5	6
Tare No.	M19	M20	M21	M22	M23	M30
Tare plus wet soil	123.0	230.0	187.5	200.0	120.0	222.2
Tare plus dry soil	100.0	192.0	157.0	180.0	99.0	189.0
Water (grams)	23.0	38.0	30.5	20.0	21.0	33.2
Water content (%)	23	20	19	11	21	18

Sample No.	7
Tare No.	M31
Tare plus wet soil	190.0
Tare plus dry soil	148.0
Water (grams)	42.0
Water content (%)	28

BORING LOG DATABASE SYSTEM
E-1

Project: TOWN CREEK 07/29/87

WARNING ... TC-1-87U	5	Water content and D-10 size on same sample
WARNING ... TC-1-87U	6	Water content and D-10 size on same sample
WARNING ... TC-1-87U	7	Water content and D-10 size on same sample
WARNING ... TC-10-87U	2	Sandy modification on non-sand sample
ERROR TC-10-87U	5	Bad Color code: LR
ERROR TC-10-87U	6	Bad Color code: LR
WARNING ... TC-13-87U		Missing Location.
ERROR TC-2-87U	1	Missing stratum change
**** ERROR ****TC-22-87U		Missing or zero G.S. Elev
WARNING ... TC-22-87U		Missing field book numbers.
WARNING ... TC-22-87U		Missing Date Taken.
WARNING ... TC-22-87U		Missing Location.
**** ERROR ****TC-22-87U		No samples for this boring.
**** ERROR ****TC-23-87U		Missing or zero G.S. Elev
WARNING ... TC-23-87U		Missing field book numbers.
WARNING ... TC-23-87U		Missing Date Taken.
WARNING ... TC-23-87U		Missing Location.
**** ERROR ****TC-23-87U		No samples for this boring.
ERROR TC-3-87U	NSN	Missing Symbol Code.
ERROR TC-3-87U	NSN	Missing stratum change
ERROR TC-3-87U	4	Missing stratum change
WARNING... TC-4-87U		Missing Location.
ERROR TC-4-87U	NSN	Missing Symbol Code.
ERROR TC-4-87U	NSN	Missing stratum change
ERROR TC-4-87U	2	Bad Modification Code: TRG
WARNING ... TC-5-87		Missing Location.
ERROR TC-5-87	NSN	Missing Symbol Code.
ERROR TC-5-87	NSN	Missing stratum change
ERROR TC-5-87	3	Bad Color code: LR
ERROR TC-5-87	4	Bad Color code: LR
ERROR TC-6-87U	2	Missing stratum change
ERROR TC-6-87U	6	Bad Modification Code: G.
ERROR TC-6-87U	6	"TR" mod not followed by "G"
ERROR TC-6-87U	8	Bad Color code: LR
WARNING ... TC-7-87U		Missing Location.
**** ERROR**** TC-7-87U		Tertiary depth > last stratum change
WARNING ... TC-8-87U		Missing Location.
WARNING ... TC-9-87U		Missing Location.
**** ERROR****TCA-1-87U		Missing or zero G.S. Elev
WARNING ... TCA-1-87U		Missing field book numbers.
WARNING ... TCA-1-87U		Missing Date Taken.
WARNING ... TCA-1-87U		Missing Location.
**** ERROR****TCA-1-87U		No samples for this boring.

BORING LOG DATABASE SYSTEM

TECHNICAL DOCUMENTATION

F-1

The Boring Log Database System operates in a dBase III Plus environment. It consists of 23 program modules, three support database files and three database files per project. Each time the user creates a new database by entering a seven character filename, the system actually generates three files:

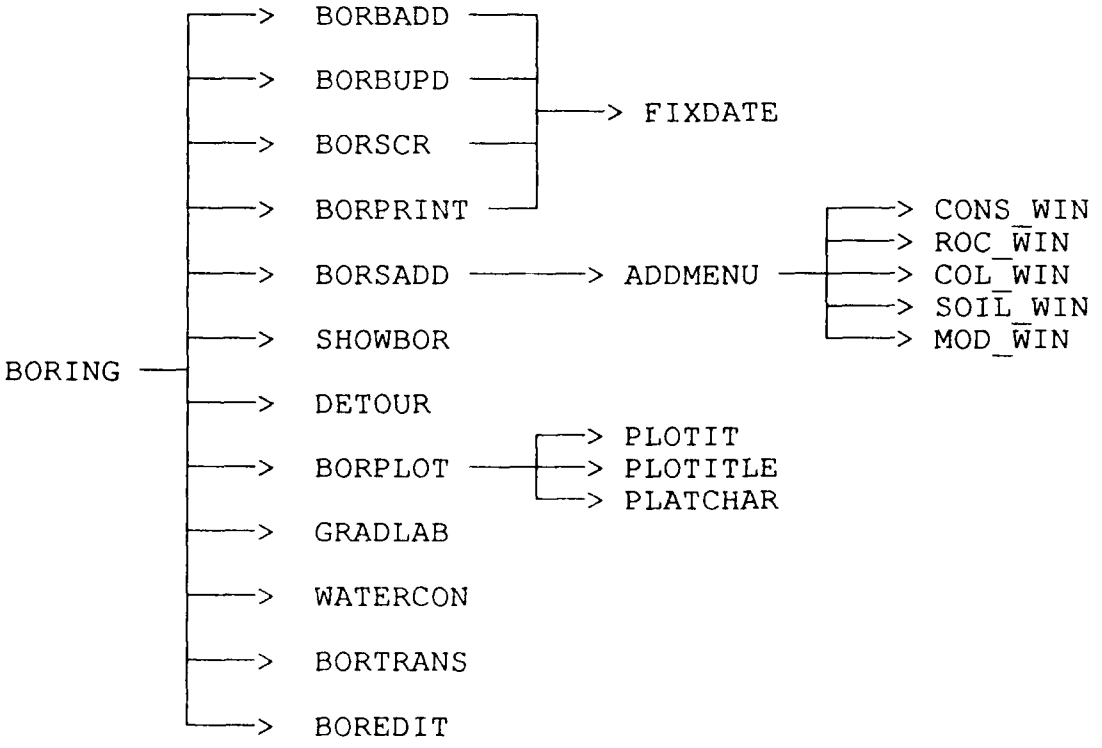
file**b**.dbf - a borings info file
indexed by boring ID (file**s**.ndx)
file**s**.dbf - a sample info file
indexed by boring ID + sample # + depth (file**s**.ndx)
or by boring ID + depth + sample # (file**d**.ndx)
file**r**.dbf - a sample remarks file
indexed by boring ID + sample # + depth (file**r**.ndx)

Support files include:

ABREV.DBF - abbreviations for drilling methods indexed by abbreviation
PLOT.DBF - a temporary file used to generate plot data
PLOTBORS.DBF - a temporary file used to save boring ID's to plot

Database structures for the above files are listed in Appendix A.

STRUCTURE DIAGRAM FOR PROGRAM MODULES



BORING.PRG

The main program is **BORING.PRG**. It solicits a database filename, creates it if it doesn't exist, opens the databases, and drives the main menu.

For each database name (up to 7 characters long) that the user enters, the system creates 3 database files and 4 index files by appending a character and the proper extension to the name.

Workarea 1 - general boring information - file**B**.dbf
indexed by boring ID
Workarea 2 - sample information - file**S**.dbf
indexed by boring ID + sample no. + depth or
by boring ID + depth + sample no.
Workarea 3 - remarks associated with samples - file**R**.dbf
indexed by boring ID + sample no. + depth

These workarea assignments remain constant throughout the system, except when creating a copy of part of the database.

When the database is opened, the system checks the first record for the project name to use for the default. If there is no project name, the user must enter one. The system then checks the master project file for the project name. If it is not there, the system solicits site coordinates and places the new project and current date in the database. Each time the project is accessed, the current date is placed in the last date used field.

After processing project and file information, the main program loops around the main menu until the user enters a "**Q**" to quit.

BORBADD.PRG

This module solicits a boring ID to add to the database. It checks workarea 1 to see if the ID already exists and will not allow duplicates. Then it presents a full-screen data entry screen to get information about the boring and adds the record to the database.

BORBUPD.PRG

The module allows the user to modify or delete a boring record in the database. The boring must exist. The user may not change the boring number. When the boring is deleted all samples are also deleted.

BORSADD.PRG

This module allows the user to view or modify and existing sample, or add a new sample to the database.

The sample number is entered as three variables: SN (3 characters), SU (1 character) and SR (1 character). SN is the number part and should be all numeric or "NSN" for no sample number. The program right justifies the number in SN. SU is used by lab usually to indicate an undisturbed sample. SR should be lettered sequentially for rock notes. If SR is not blank the program assumes a sample with a rock note is being entered.

The sample number is appended to the boring ID to create the variable SCHECK for the search condition to see if it is in the database. If it is not found, variables are set to blanks; otherwise, they are set to current values in the database.

LOOP2 is the full-screen data entry section. Control goes to various fields depending on whether the user has selected to view valid codes from the Sample Screen Menu. If the user requested to view colors, data entry will begin with the first color code.

LOOP1 is executed until the user selects "M" from the Sample Screen Menu to return to the Main Menu.

ADDMENU.PRG

This module displays the Sample Screen Menu and executes the selected function. It is called from BORSADD.PRG each time the read is executed from the full-screen get. The conditional REPLACE's were used to speed execution time. If the user wishes to view allowable codes the program calls one of the window programs:

COL_WIN.PRG - colors
ROC_WIN.PRG - rocks
SOIL_WIN.PRG - soils
CONS_WIN.PRG - consistency
MOD_WIN.PRC - modifications

BORPRINT.PRG

This module prints the Laboratory Log, a 132 character per line printout of a boring's general information and sample data. The sample index is set to fileD.ndx where depth is more significant than sample number. Device is set to print.

SHOWBOR.PRG

This module lists on the screen all boring numbers in the boring database. This does not ensure that each boring has a complete set of sample data.

BORSCR.PRG

This module does the same as BORPRINT but puts the information on the screen. The sample data is shown half at a time along with depth information. The user may toggle between the two screens.

DETOUR.PRG

This module will create another database file adding chosen borings' records to it. If the database already exists, the user may append or overwrite it. Workareas 4, 5, and 6 are used for the new database files corresponding to current workareas 1, 2, and 3. Because of limitations on the number of files opened and the necessity of using closed files for the "APPEND FROM" statements, the current database files are closed in this routine. They are reopened before returning to the main menu. The user may choose to select individual borings or all with the same project code to add to the new database.

BORPLOT.PRG

This module generates an ascii text file in the format expected by the plot program on the Harris minicomputer. A temporary database file, PLOT.dbf in Workarea 4 is used containing 80 character single field records. All data is placed in this file during execution. At the end of the routine a "COPY ... SDF" command copies it to the file selected by the user.

The program allows the user to enter a beginning and ending boring ID or enter up to 11 boring ID's to be plotted. If boring ID's are entered one at a time, they are stored in a temporary database file, PLOTBORS.dbf in Workarea 5 and are placed in the plot file in the ordered entered. After the user selects the desired borings, the program reads through all samples to be plotted and calculates the maximum ground surface elevation and the minimum depth to be plotted. These numbers are used in deciding the default scale in the Plate Characteristic module. This program calls three support modules:

PLOTIT.PRG - A routine to build the Plot Option "card" for the plot program. Default values are displayed on the screen. The user moves the cursor with the arrow keys or presses the "x" key to change the default. The PageDown key exits the routine. The number of notes is changed by using the "+" or "-" key. The routine is driven by a case statement based on which key is pressed; and by another case statement based on which row on the screen the cursor in on.

PLATCHAR.PRG - A routine to build the Plate Characteristic "card". Default values are displayed and the user may change them. The scale depends on the distance between the highest and lowest points to be plotted on the plate. The horizontal placement depends on the number of borings to be plotted. At this time the horizontal increment is also chosen based on the table available with the plot program documentation.

PLOTITLE.PRG - A routine that places title and notes records in the plot file.

For each boring several header "cards" are put in the plot file:

1 - ground surface elevation and horizontal placement
2 - boring ID and tertiary (if any)
3 - first location field from database
4 - second location field from database
5 - field book numbers
6 - date taken and water table depth (if any)

After these records are written to the plot file, all samples (except those that have been scratched) are written to the file. Some editing of data is done at this time such as :

centering single character modifications
left justifying two character modifications
changing +'s in blow counts to numeric data (1 plus the number given)
checking precision of d10_size - can only use 5 places (n.nnn or .nnnn)
checking for rock notes in order not to send more depth info

At the end of each boring's sample records, a record consisting of "999.9" is placed in the plot file.

See Appendix G for format of plot data file.

GRADLAB.PRG

This routine produces labels for the particle size test forms. The user enters a boring ID and the program reads through the samples for that boring and makes labels for those that have a tare number in the GRAD_TARE field.

WATERCON.PRG

This module reads through the samples for a particular boring ID; and if the WATER_CONT field begins with a letter, requests a dry weight from the user and calculates the water content percent. The formula for the water content is: (wet wgt - dry wgt) / wet wgt.

Values for sample number, wet weight, dry weight, tare number, water weight and percent water are stored in memory variables for up to 6 samples. When 6 have been calculated or the end of the boring is reached, they are printed across the page.

BORTRANS

This routine produces ascii files containing all information in the databases in comma separated fields.

BOREDIT

This routine performs most of the same data checks as BLOG9 does on the Harris to determine bad data for the plot program. The program checks for valid codes and combinations of codes. It also checks for missing stratum changes and incorrect depths. The conditional statements and error messages are pretty much self-explanatory.

FIXDATE

A routine to convert a string date in the format nn MON yy (23 JUL 87) to a dBase type date field. It is used by several of the modules.

BORING LOG DATABASE SYSTEM

PLOT DATA FILE FORMAT

G-1

PLOT OPTION CARD

cols 1 - 5	vertical staff option
cols 6 - 10	horizontal staff option
cols 11 - 15	horizontal & vertical staff option
cols 16 - 20	log modification option
cols 21 - 25	vertical staff caption option
cols 26 - 30	description caption option
cols 31 - 35	staff length and plate width option
cols 36 - 40	increase or decrease 4 notes by this number
cols 41 - 45	"1"

PLATE CHARACTERISTIC CARD

cols 1 - 10	maximum distance of horizontal staff
cols 11 - 15	lower vertical staff elevation
cols 16 - 20	upper vertical staff elevation
cols 21 - 25	vertical scale
cols 26 - 30	horizontal scale
cols 31 - 35	size of plate factor
cols 36 - 40	total number of logs
cols 41 - 50	starting horizontal staff distance
cols 51 - 55	percent to increase letter size
cols 56 - 60	"4"
cols 61 - 65	"7"

PLATE TITLE CARDS (6)

cards 1 - 3	maximum 38 characters
card 4	maximum 19 characters
cards 5 - 6	maximum 45 characters

GENERAL NOTES CARDS (4 +/- number from Plot Option card)
maximum 45 characters

REPEAT GROUP FOR EACH LOG:

BORING LOG PLACEMENT CARD

cols 1 - 10	distance from vertical staff
cols 11 - 20	ground surface elevation

LOG IDENTIFICATION CARDS (5)

1 -	cols 1 - 26	boring ID
	cols 35 - 39	tertiary depth
2 -	cols 1 - 35	location description
3 -	cols 1 - 22	location description
4 -	cols 1 - 22	field book number
5 -	cols 1 - 22	date taken
	cols 23 - 29	water table date
	cols 31 - 35	water table depth

BORING LOG DATABASE SYSTEM

PLOT DATA FILE FORMAT

G-2

SAMPLE DATA CARDS (varies)

cols 1 - 5	from depth
cols 6 - 10	to depth
cols 11 - 13	water content
cols 14 - 18	stratum change
cols 19 - 20	soil symbol
cols 21 - 22	rock note indicator
cols 23 - 25	log modification or rock code
cols 26 - 28	consistency
cols 29 - 31	color
cols 32 - 34	color
cols 35 - 37	color
cols 38 - 40	modification
cols 41 - 43	modification
cols 44 - 46	modification
cols 47 - 51	modification
cols 52 - 55	blows per foot
cols 56 - 59	uct
cols 60 - 62	blank
cols 63 - 65	Atterberg ll
cols 66 - 68	Atterberg pl
cols 69 - 73	d10 size
cols 74 - 76	test water content
cols 77 - 80	second uct

END OF LOG INDICATOR (999.9)

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	SYMBOL	TYPICAL NAMES
COARSE – GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No 4 sieve size.	CLEAN GRAVEL (Little or No Fines)	G W		GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
			G P		GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable Amount of Fines)	G M		SILTY GRAVEL, gravel-sand-silt mixtures
			G C		CLAYEY GRAVEL, gravel-sand-clay mixtures
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SAND (Little or No Fines)	S W		SAND, Well-Graded, gravelly sands
			S P		SAND, Poorly-Graded, gravelly sands
		SANDS WITH FINES (Appreciable Amount of Fines)	S M		SILTY SAND, sand-silt mixtures
			S C		CLAYEY SAND, sand-clay mixtures
FINE – GRAINED SOILS More than half the material is smaller than No. 200 sieve size.		SILTS AND CLAYS (Liquid Limit < 50)	M L		SILT & very fine sand, silty or clayey fine sand or clayey silt
			C L		LEAN CLAY; Sandy Clay; Silty Clay; of low to medium pla
			O L		ORGANIC SILTS and organic silty clays of low plasticity
		SILTS AND CLAYS (Liquid Limit > 50)	M H		SILT, fine sandy or silty soil with high plasticity
			C H		FAT CLAY, Inorganic clay of high plasticity
			O H		ORGANIC CLAYS of medium to high plasticity, organic sil
HIGHLY ORGANIC SOILS			Pt		PEAT, and other highly organic soil
WOOD			Wd		WOOD
NO SAMPLE					

NOTE: Soils possessing characteristics of two groups are designated by combinations of grou
A comma will be used between modification symbols. Example. So, Gr, w/SS, SIS, (CH)

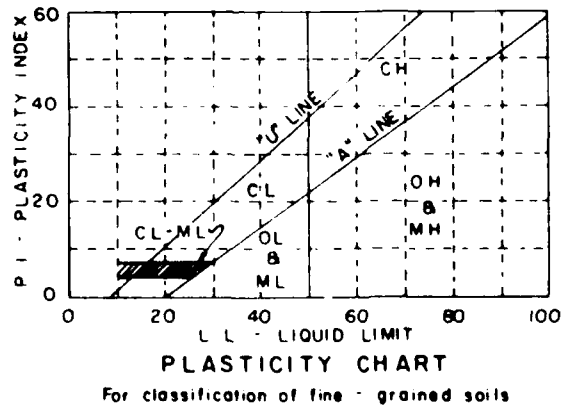
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	Bk
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH-GRAY	br Gr
GRAYISH-BROWN	gy Br
GREENISH-GRAY	gn Gr
GRAYISH-GREEN	gy Gn
GREEN	Gn
BLUE	Bl
BLUE-GREEN	BlGn
WHITE	Wh
MOTTLED	Mot
REDDISH	rd

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS/SQ FT FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	v So
SOFT	250 - 500	So
MEDIUM	500 - 1000	M
STIFF	1000 - 2000	St
VERY STIFF	2000 - 4000	v St
HARD	> 4000	H



PLASTICITY CHART

For classification of fine - grained soils

UNIFIED SOIL CLASSIFICATION

TYPE	LETTER SYMBOL	SYMBOL	TYPICAL NAMES
CLEAN GRAVEL (Little or No Fines)	G W		GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
	G P		GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
GRAVEL WITH FINES (Appreciable Amount of Fines)	G M		SILTY GRAVEL, gravel-sand-silt mixtures
	G C		CLAYEY GRAVEL, gravel-sand-clay mixtures
CLEAN SAND (Little or No Fines)	S W		SAND, Well-Graded, gravelly sands
	S P		SAND, Poorly-Graded, gravelly sands
SANDS WITH FINES (Appreciable Amount of Fines)	S M		SILTY SAND, sand-silt mixtures
	S C		CLAYEY SAND, sand-clay mixtures
SILTS AND CLAYS (Liquid Limit < 50)	ML		SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
	C L		LEAN CLAY; Sandy Clay; Silty Clay; of low to medium plasticity
	O L		ORGANIC SILTS and organic silty clays of low plasticity
SILTS AND CLAYS (Liquid Limit > 50)	M H		SILT, fine sandy or silty soil with high plasticity
	C H		FAT CLAY, Inorganic clay of high plasticity
	O H		ORGANIC CLAYS of medium to high plasticity, organic silts
SOILS	Pt		PEAT, and other highly organic soil
	Wd		WOOD

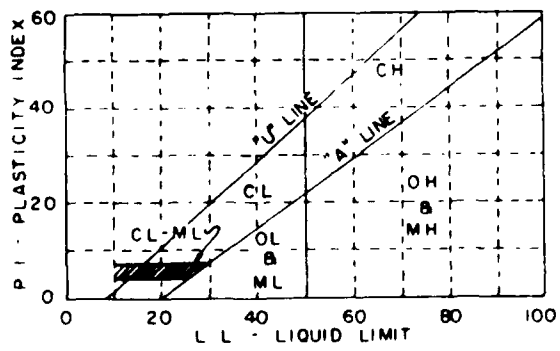
ossessing characteristics of two groups are designated by combinations of group symbols
ıa will be used between modification symbols. Example So,Gr,w/SS,SIS,(CH)

DESCRIPTIVE SYMBOLS

)LOR	SYMBOL
	T
	Y
	R
	Bk
	Gr
	lGr
	dGr
	Br
N	lBr
N	dBr
RAY	br Gr
ROWN	gy Br
RAY	gn Gr
EEN	gy Gn
	Gn
	Bl
N	BlGn
	Wh
	Mot
	rd

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS/SQ FT FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	v So
SOFT	250 - 500	So
MEDIUM	500 - 1000	M
STIFF	1000 - 2000	St
VERY STIFF	2000 - 4000	v St
HARD	> 4000	H



PLASTICITY CHART

For classification of fine - grained soils

MODIFICATIONS		MODIFICATIONS	
MODIFICATION	SYMBOL	MODIFICATION	SYMBOL
Traces	Tr -	Sandy Silt strata	SSIS
Fine	F	Silty Sand strata	SISS
Medium	M	With	w/
Coarse	C	Dense	D
Concretions	cc	Very Dense	vD
Rootlets	rt		
Lignite fragments	lg		
Shale fragments	sh		
Sandstone fragments	sds		
Shell fragments	slf		
Organic matter	O		
Clay strata or lenses	CS		
Silt strata or lenses	SIS		
Sand strata or lenses	SS		
Sandy	S		
Gravelly	G		
Boulders	B		
Slickensides	SL		
Wood	Wd		
Oxidized	Ox		
Crumbly	Cr		
Loose	Lo		
Vegetation	Veg		

NOTES
FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D_{10}"
Are natural water contents in percent dry weight
When underlined denotes D_{10} size in mm *
FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"
Are liquid and plastic limits, respectively
SYMBOLS TO LEFT OF BORING
▽ Ground-water surface and date observed
(C) Denotes location of consolidation test **
(S) Denotes location of consolidated-drained direct shear test **
(R) Denotes location of consolidated-undrained triaxial compression test **
(Q) Denotes location of unconsolidated-undrained triaxial compression test **
(T) Denotes location of sample subjected to consolidation test and each of the above three types of shear tests **
FW Denotes free water
FIGURES TO RIGHT OF BORING
Are values of cohesion in lbs/sq ft from unconfined compression tests
In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler ($1\frac{3}{8}$" I.D., 2" O.D.) and a 140 lb driving hammer with a 30" drop
Where underlined with a solid line denotes laboratory permeability in centimeters per second of undisturbed sample
Where underlined with a dashed line denotes laboratory permeability in centimeters per second of sample remoulded to the estimated natural void ratio

* The D_{10} size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than size D_{10}

**Results of these tests are available for inspection in the U.S. Army Engineer District Office, if these symbols appear beside the boring logs on the drawings

GENERAL NOTES

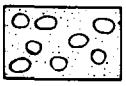
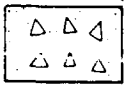
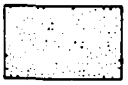
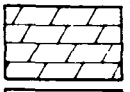
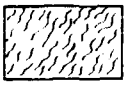
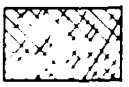
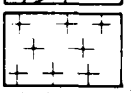
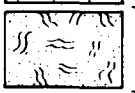
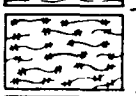
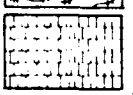
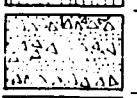
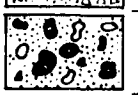
1. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract

2. Ground water elevations shown on the boring logs represent ground water surfaces encountered in such borings on the dates shown. Absence of water surface data on certain borings indicates that no ground water data are available from the boring but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of such borings

3. Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown

4. The detailed explanation of the Unified Soil Classification System is presented in MIL-STD-6198, 12 June 1968, entitled "Military Standard Unified Soil Classification System for Roads, Airfields, Embankments and Foundations"

CLASSIFICATION AND DESCRIPTION OF ROCKS

GROUP	SYMBOL	ROCK CLASSIFICATION
SEDIMENTARY ROCKS		CONGLOMERATE
		SANDSTONE
		GRAYWACKE
		SILTSTONE
		INDURATED CLAY OR CLAYSTONE
		COMPACTION SHALE
		CEMENTED SHALE
		COAL
		LIMESTONE
		DOLOMITE
		CHALK (OR MARL)
METAMORPHIC ROCKS		GNEISS
		SCHIST
		QUARTZITE
		MARBLE
		SOAPSTONE AND SERPENTINE
		SLATE
IGNEOUS ROCKS		GRANITE
		DIORITE
		GABBRO
		RHYOLITE
		ANDESITE
		BASALT (TRAP)
		TUFF OR TUFF BRECCIA
		AGGLOMERATE FLOW BRECCIA

KEY TO PHYSICAL PROPERTI

Bedding Characteristics
1 Massive
2 Thin to medium be
3 Fissile
4 Cross – bedded
5 Foliated
6 Platy
7 Fragmental

Lithologic Characteristics
8 Clayey
9 Shaly
10 Calcareous (limy
11 Siliceous
12 Sandy
13 Silty
14 Plastic seams
15 Carbonaceous
16 Fossiliferous
17 Ferruginous

Hardness and Degree of Cementation
18 Very soft or plastic
19 Soft – Can be scratch
20 Moderately hard – Ca with knife canno fingernail
21 Hard – Difficult to sc
22 Very hard – Cannot b
23 Poorly cemented
24 Cemented

Texture
25 Dense
26 Fine
27 Medium
28 Coarse

Structure
29 Bedding a
b
c
30 Fractures scattered
31 Fractures closely sp
32 Brecciated (sheared
33 Joints
34 Faulted
35 Slickensides

Degree of Weathering
36 Unweathered
37 Slightly weathered
38 Badly weathered

Solution and Void Conditions
39 Solid contains no vo
40 Vuggy (pitted)
41 Vesicular
42 Porous
43 Cavities
44 Cavernous

Swelling Properties
45 Non – swelling
46 Swelling

Slaking Properties
47 Non – slaking
48 Slakes slowly on exp
49 Slakes readily on ex

OF ROCKS

KEY TO PHYSICAL PROPERTIES OF ROCKS

erristics		1 Massive
		2 Thin to medium bedded
		3. Fissile
		4. Cross – bedded
		5 Foliated
		6. Platy
		7 Fragmental
cteristics		8. Clayey
		9 Shaly
		10. Calcareous (limy)
		11 Siliceous
		12. Sandy
		13. Silty
		14. Plastic seams
		15. Carbonaceous
		16. Fossiliferous
		17. Ferruginous
egree		18. Very soft or plastic
on		19 Soft – Can be scratched with fingernail
		20. Moderately hard – Can be scratched easily with knife, cannot be scratched with fingernail
		21. Hard – Difficult to scratch with knife
		22. Very hard – Cannot be scratched with knife
		23. Poorly cemented
		24. Cemented
		25. Dense
		26. Fine
		27 Medium
		28. Coarse
		29 Bedding a Flat; b Gently dipping; c Steeply dipping
		30 Fractures, scattered — a Open
		31 Fractures closely spaced — a Open
		32. Brecciated (sheared & fragmented) — b Cemented or tight
		33. Joints
		34. Faulted
		35. Slickensides
ering		36. Unweathered
		37 Slightly weathered
		38. Badly weathered
		39. Solid, contains no voids
		40. Vuggy (pitted)
		41 Vesicular
		42 Porous
		43 Cavities
		44. Cavernous
es		45 Non – swelling
		46 Swelling
		47 Non – slaking
		48 Slakes slowly on exposure
		49 Slakes readily on exposure

NOTE

WHILE THE BORINGS ARE REPRESENTATIVE OF SUB-SURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL MINOR VARIATIONS IN CHARACTERISTICS OF THE SUB-SURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND, IF ENCOUNTERED, SUCH VARIATIONS WILL NOT BE CONSIDERED AS DIFFERING MATERIALLY WITHIN THE PURVIEW OF CLAUSE 4 OF THE CONTRACT

GROUND-WATER ELEVATIONS SHOWN ON BORING LOGS REPRESENT GROUND-WATER SURFACES ENCOUNTERED ON THE DATES SHOWN. ABSENCE OF WATER SURFACE DATA ON CERTAIN BORINGS IMPLIES THAT NO GROUND-WATER DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUND WATER WILL NOT BE ENCOUNTERED AT THE LOCATIONS OR WITHIN THE VERTICAL REACHES OF THESE BORINGS

5 – 50## PRESSURE TEST RESULTS SHOWN AS 5 GALS / MIN AT 50 PSI

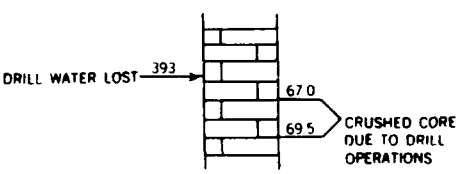
GROUND-WATER SURFACE AND DATE OBSERVED

CORE LOSS OR NO SAMPLE

393 SPECIAL FEATURE OR DRILLING OPERATION AT A SPECIFIC ELEVATION

67.0 / 69.5 SPECIAL FEATURE VERTICALLY DISTRIBUTED

EXAMPLES



REVISION	DATE	DESCRIPTION	BY

DRAWN BY H W
TRACED BY H W
CHECKED BY C A M B F H B
SUBMITTED
RECOMMENDED
APPROVED
DATE

ROCK BORING LEGEND

SHEET 1 OF 1 DRAWING NO

UNIT II

USERS GUIDE-AUTOMATED BORING LOG PROGRAM

PREFACE

This User Guide and the associated programs were prepared by FTN Associates, Ltd., Little Rock, AR (FTN) for the Vicksburg District, Corps of Engineers (COE) under contract No. DACW38-88-D-0055, Delivery Order No. 3. The purpose of the work was to develop a system to allow the COE to incorporate boring log data into the Intergraph IGDS Design File format.

Program design and development was performed by Mr. Keith Nash (FTN) and Ms. Brenda Scott (FTN) under the supervision of Dr. Dennis Ford, PE (FTN). This User Guide was written by Keith Nash and Brenda Scott. The work was overseen by Mr. Eddie Templeton and Mr. Chris Dixon, Foundation and Materials Branch, COE.

This updated User Guide and associated programs were prepared by FTN for the Vicksburg District, COE under contract No. CACW38-90-P-1847 and supersedes the version dated 5 July 1989. The associated work involved modifications to scale denotation, symbolology, and text placement.

TABLE OF CONTENTS

1.0 INTRODUCTION

BP (Boring log Plot/design file builder) is an Intergraph/Bentley Systems Inc. MicroStation utility developed to create design files containing boring logs. It uses as input the same ASCII data files used by the COE to generate CalComp plots on the Vicksburg District Harris 500 minicomputer. The main advantage of the system is that design files may be created and then modified interactively on PCs using the Intergraph MicroStation software. Once the information is arranged satisfactorily, a finished plot may be generated locally or from the COE IGDS VAX system (after uploading the design file).

2.0 INSTALLING BP

Installing BP is a straight-forward process involving: copying three executable files, copying a seed file and cell library, and modifying the MicroStation user environment. The following step-by-step instructions for each procedure assume the user has a basic understanding of DOS and MicroStation.

2.1 BP Executable Files

BP consists of three executable files: BP.EXE, BP_TEXT.EXE, and BP_PTRN.EXE. These three executable files must be located in a directory specified in the DOS PATH. A special directory for the programs may be created, or an existing directory (e.g., C:\BIN or C:\UTIL) may be used. Whichever approach is used, simply copy the three executable files into the desired directory and, if the directory is not already named in the DOS PATH, modify the AUTOEXEC.BAT so that it is.

2.2 BP Seed File and Cell Library

BP uses a seed file named BPSEED.DGN and a cell library named BPCELL.CEL. These two files should be copied into an appropriate directory (this directory's name will be needed in the next step).

2.3 Modifying the MicroStation User Environment

The BP programs make use of two MicroStation BSI environment variables: BP_SEED and BP_CELL. These environment variables must be set to give complete filename specifications for the BP seed and cell library files. MicroStation provides for such user environment variables by automatically loading whatever definitions it finds in the \USTATION\DATA\UCONFIG.DAT file. Thus the user need only modify this file to contain definitions for BP_SEED and BP_CELL.

As an example, suppose BPSEED.DGN and BPCELL.CEL are located in a directory named C:\USTATION\BP. Then the file named C:\USTATION\DATA\UCONFIG.DAT should be modified to contain the following lines:

```
BP_SEED=C:\USTATION\BP\BPSEED.DGN
BP_CELL=C:\USTATION\BP\BPCELL.CEL
```

Please note that the MicroStation environment may need to be enlarged to accomodate these variables. This may be done by using the MicroStation USCONFIG program, selecting "EDIT USER PREFERENCES", and increasing the environment table size. The maximum environment space needed by BP is approximately 150 bytes in addition to the MicroStation default environment table size.

2.4 Additional Considerations

As with all MicroStation utilities, the MicroStation resident system must be loaded before BP is executed. This may be done simply by running MicroStation before executing BP.

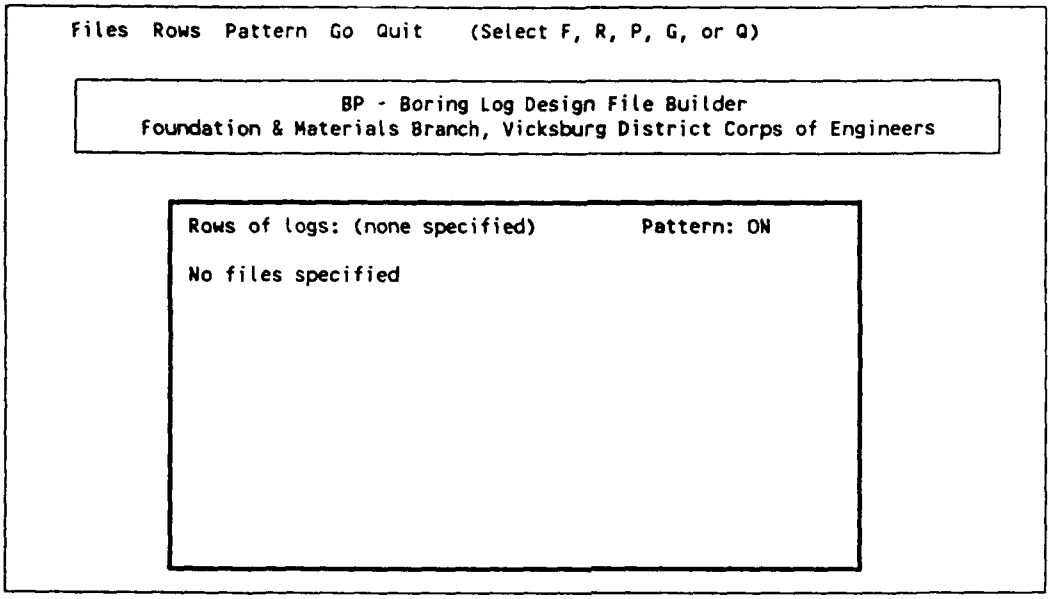
The BP system requires as much as 350 bytes of free space in the DOS environment. This space may be allocated by including an appropriate SHELL command in the CONFIG.SYS file. For example, the following SHELL command would allocate 1024 bytes of DOS environment space:

```
SHELL=C:\COMMAND C:\ /p /e:1024
```

Users should be careful about loading Terminate-and-Stay-Resident software (such as SideKick) when using MicroStation and BP. TSRs use DOS memory even when they are dormant and this memory is thus unavailable to MicroStation and BP, both of which have large memory requirements. Trial and error is the only method of determining which TSRs may or may not be used successfully with MicroStation and BP.

3.0 RUNNING THE PROGRAM

BP is executed by entering BP at the DOS prompt. The following screen then appears:



Each of the menu choices (F, R, P, G, and Q) will be explained in detail later in this section.

3.1 Files

Pressing F causes BP to prompt the user for input data filenames and the desired design file name.

One data file is required for each row that will appear in the design file. BP will inform the user if a specified file does not exist and will continue to prompt for filenames until existing files are selected for all rows. Users may enter a DOS wildcard filename specification in lieu of an explicit filename. BP will then display a list of files matching the wildcard pattern and allow the user to select one from the list.

BP will construct a design file name composed of the row one data filename with a .DGN extension. The user may use this default name, or enter whatever name is desired for the design file.

If the number of rows has not been previously indicated, BP will prompt the user for this item before allowing the user to enter filenames (see Section 3.2

below).

3.2 Rows

This command allows the user to select the number of rows of logs that will appear in the design file. One, two, or three rows of logs may be selected. Each row requires its own input data file.

BP uses title block and note text from the row one data file when more than one row of logs is requested.

3.3 Pattern

This command can be used to 'toggle' soil symbology patterning on and off. Turning off patterning considerably reduces the execution time of BP and is useful in determining whether the design file layout is correct. Simply press P to toggle patterning on and off.

3.4 Go

Pressing G begins processing with the number of rows and the data files specified. The BP_TEXT and BP_PTRN programs are automatically called to place the text and perform the patterning dictated by the specified data file(s).

If the number of rows has not been specified, BP will first prompt the user for this item (just as if the user had entered R). Similarly, if no input files have been defined, BP will prompt the user for this information (just as if the user had entered F).

BP writes plate size and log placement information, as well as any errors encountered, to a log file named BP.LOG.

3.5 Quit

Pressing Q causes BP to end execution and return to the DOS prompt.

4.0 GRAPHIC FILES

4.1 Seed File

BP was designed to work with the seed drawing file BPSEED.DGN. This seed file must be located in the directory specified by the environment variable BP_SEED. BPSEED.DGN was created with master units in square feet, sub-units of 10 inches and positional units of 1000.

4.2 Cell Library

BP utilizes a cell library containing symbols for patterning the plotted core boring logs. This cell library, named BPCELL.CEL, must be located in the directory specified by the environment variable BP_CELL. All cells were created using the Unified Soil Classification symbology supplied by the District. Pattern cells were created on level 1 using a 1 x 1 master unit area to ensure proper repeatability. Cells, cell names and descriptions are shown in Appendix D.

4.3 Drawing Files

BP creates the boring log design file using BPSEED.DGN and places it in the directory from which BP was invoked. Text is placed using fonts 1 and 3 with weights of two.

The element description, level and text size appear below.

Level	Text Size		Description
	Height	Width	
1	0.072	0.06	Boring log shape, patterning, major modifications
2	0.072	0.06	Consistency and modification text
3	0.096	0.08	Log descriptions and associated tic marks
4	0.072	0.06	Color text and dimension lines
5	0.096	0.08	Plastic and liquid limits, D10 and water content data and titles
6	0.20	0.20	Individual log identifications
	0.15	0.15	Log location, field book, date

Level	Text Size		Description
	Height	Width	
7	0.20	0.10	Ground surface elevation, tic marks along logs corresponding to staff increments
8	0.01	0.08	Tertiary depth and water table
9	0.01	0.08	Unified compression test and penetration resistance
10	0.12	0.12	Notes
60	0.15	0.15	Vertical staffs
61	0.15	0.15	Horizontal staffs
62	varies		Border and title block

5.0 POTENTIAL PROBLEMS AND REMEDIES

Most errors encountered in running BP have to do with log placement or plate size. These errors can usually be corrected by modifying the input file(s).

Each time BP is invoked, it writes a design file layout summary and any error information to a log file named BP.LOG. This file may be examined for detailed information about the placement of logs and as an aid in determining the cause of any detected errors.

5.1 Plate Size

BP uses the X and Y-axis ranges and scales specified in the data file to calculate the plate size. The X-axis size is determined by subtracting Xmin from Xmax, dividing the result by the X-axis scale factor, and adding a constant to allow for left and right margins. Similarly, the Y-axis size is determined by subtracting Ymin from Ymax, dividing the result by the Y-axis scale factor, and adding a constant to allow for margins at the top and bottom of the plate. Both calculations yield the number of Master Units necessary to place data at the desired scale (e.g., 1 inch = 50 feet). All calculations assume that 1 master unit is equal to 1 inch.

The maximum plate size allowed is 36" x 48" (ANSI 'E' size). If the calculated plate size exceeds these limits an error is returned and the user may choose either to abort the run or to continue with the larger plate size.

Users can control the plate size by adjusting the axis scale and/or the axis ranges. For examples of this procedure, see Appendix C.

5.2 Log Overlap

Errors occur when logs are too close together or when a boring log overwrites the title block. In either case the user may continue the run and edit the design file, or abort the run and change the offending log's horizontal coordinate by editing the appropriate input file.

5.3 Error Codes

The following error codes are returned by the BP program.

Error Code	Description
-1	Error invoking child process
5	Disk full
10	Video error
20	Environment variable BP_DGN not found
21	Environment variable BP_CEL not found
22	Environment variable BP_DAT not found
30	Unable to open log file
31	Unable to open sector/offset log file
32	Unable to open work file
33	Design file does not exist
34	Cell library does not exist
35	Unable to open design file
36	Unable to open input file
37	Error reading global data
38	Error buffering log to work file
40	Unable to size plot
50	Unable to place border and title block
51	Unable to place notes
52	Unable to place vertical axis
53	Unable to place horizontal axis
61	Error reading major modifications(text) Error reading strata (pattern)
62	Unable to place major modifications (text) Error placing log shape (pattern)
63	Error reading horizontal line depths
64	Unable to place horizontal lines
65	Error reading descriptive text
66	Unable to place descriptive text
67	Error reading colors
68	Unable to place colors
69	Error reading D10 and water content
70	Unable to place D10 and water content
71	Error reading liquid and plastic limits
72	Unable to place liquid and plastic limits
73	Error reading penetration resistance and UCT
74	Unable to place penetration resistance and UCT
75	Error reading consistency and modifications
76	Unable to place consistency and

	modifications
77	Unable to place incremental tic marks
78	Unable to place tertiary data
79	Unable to place individual log IDs
80	Unable to place individual log staffs

Error codes of 900 or greater are returned by MicroStation Customer Support Library (CSL) routines. These errors will cause the BP program to abort and an error message will be written to the log file (BP.LOG). Possible CSL errors are listed below.

Error Code	Description
904	Too few vertices in placing shape
905	Too many vertices in placing shape
925	Could not establish message queue
926	Could not get response from MicroStation
929	Not a valid TCB variable
930	Error converting to Radix-50 value
933	Illegal element definition
934	Illegal element format
936	Resident scanner not loaded
938	No cell library attached
939	Cell is not in cell library
940	Cell nesting error
941	Invalid cell or cell library
947	Invalid open type
948	Unable to open design file
949	Unable to open cell library
951	Security device not installed
952	'UCMVARS.DAT' or 'USTATION.RSC not found
960	Design file disk is full

5.4 Patterning

Boring log patterning is accomplished using cells found in BPCELL.CEL. Cells can be edited or created without causing errors, if the following steps are taken:

1. Always work in a drawing file that was created using BPSEED.DGN.
2. If editing an existing cell, always place the cell at an active scale of 1. This ensures the patterning will be placed at the proper spacing when running the program.
3. After an existing cell is placed, use the drop element command. This will prevent nesting errors while using BP.
4. Place the fence 1 master unit by 1 master unit when creating the cell.
5. Pattern cell names are limited to 3 characters.
6. Pattern cells must be created on level 1 to ensure proper patterning.

APPENDIX A:
Programmer's Guide

Programmer's Guide

The BP system is composed of three "C" programs and 43 FORTRAN subroutines. FORTRAN was used for a majority of the coding in order to facilitate porting the program to the VAX environment. "C" was used for the PC version because of its ability to spawn child programs and to provide a user-friendly interface.

BP.EXE, the main routine, is a shell that prompts the user for the number of rows, the data files for each row, and the design file. It also queries the MicroStation environment for the BP_SEED and BP_CELL variables, which give complete paths to the seed file and soil symbology cell library. All this information is communicated to the two child programs via the environment. BP.EXE then calls the child program BP_TEXT.EXE, which places text, followed by the BP_PTRN.EXE program, which does the patterning.

This approach of using a small parent to call two larger children was necessitated by memory model limitations imposed by the MicroStation Customer Support Library (CSL). The CSL uses the Medium memory model (i.e., unlimited code segments, one 64 kByte data segment). CSL programs must be linked with large stacks (16-32 kBytes) and this stack space is allocated from the default data segment, of which only one is available. This imposes a severe limitation of less than 32 kBytes of available user data space in the default data segment. Unfortunately, the CSL patterning routine alone uses nearly all of this available space. It was thus decided to break the program up into a main parent and two child processes, each of which would have its own data segment. In addition, overlay techniques were used with BP_PTRN.EXE in order to reduce the total load size of the program.

Modifying the BP programs requires the following items:

1) MicroSoft "C" version 5.1
2) MicroSoft FORTRAN version 4.1
3) MicroSoft LINK version 5.01.20
4) MicroSoft MAKE (any version)
5) Intergraph MicroStation Customer Support Library version 3.0 (MICROCSL.LIB)

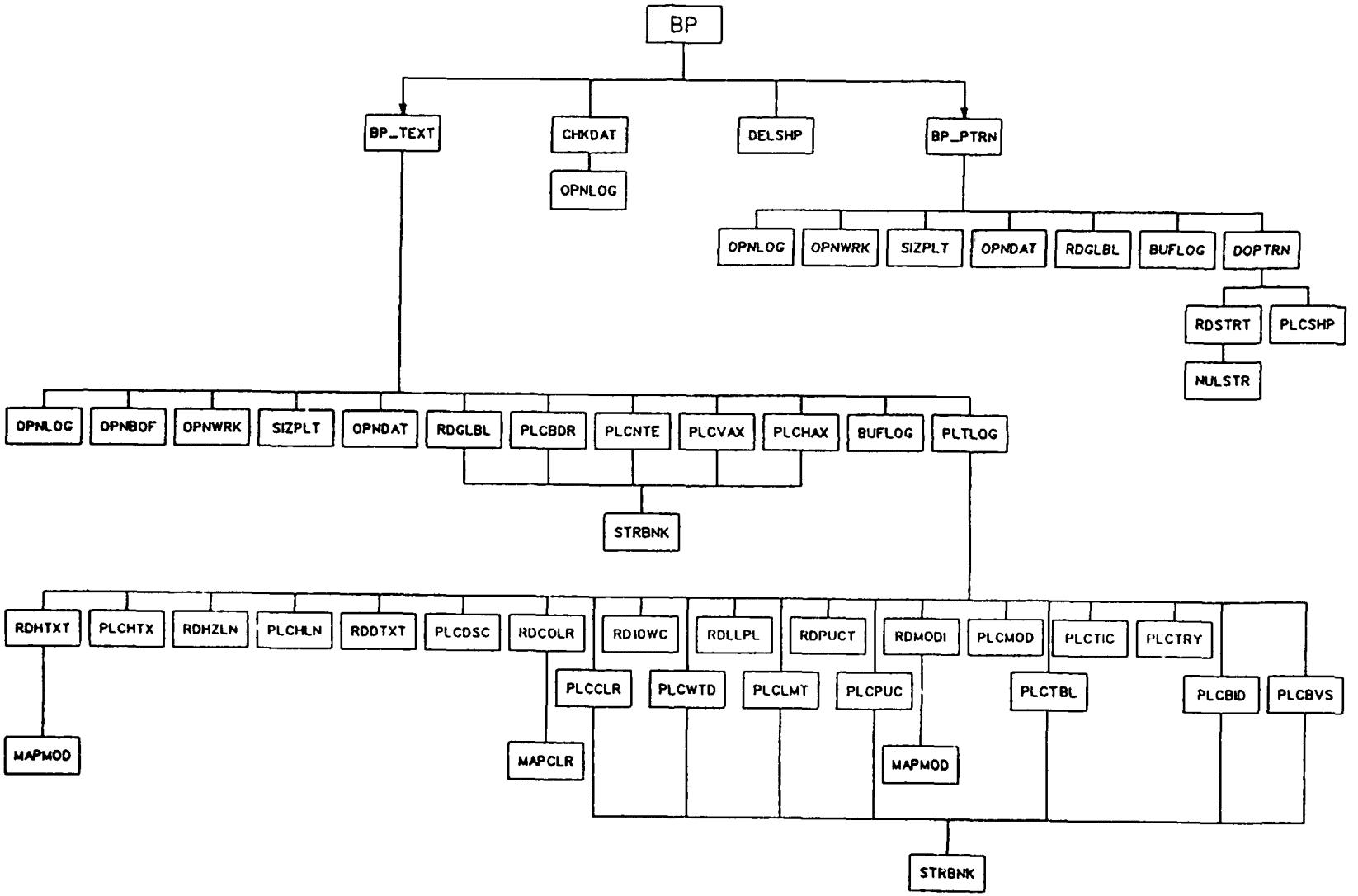
6) The FTN Utility Library and header files (MCUTIL7.LIB, CUTIL.H, SBUF.H)
7) The BP MAKE file (BP.MK)
8) The BP_PTRN link response file (BP_PTRN.NMS)
9) The BP FORTRAN source files (*.FOR and *.INC)
10) The BP "C" source files (BP*.C and BP.H)

The BP programs may then be re-compiled and re-linked with the BP.MK MAKE script using the following command line:

MAKE BP.MK

MAKE will compile any object files whose source files have been modified, update the object library BORPLT, and link the executable files BP.EXE, BP_TEXT.EXE, and BP_PTRN.EXE

HIERARCHY CHART - BP



APPENDIX B:
Input File Format

***** File Header

Record	Field	Columns	Range	Format	Description
1	1	(1-5)	-1	I5	Vertical staff to left of each log (Depth in Feet)
			1		Two vertical staffs, lt of first boring & rt of last
	2	(6-10)	-1	I5	Horizontal staff w/ Distance in Feet
			1		No horizontal staff
	3	(11-15)	-1	I5	All staffs omitted
			1		Left & right vertical staff plotted
			-2		Scale across top & +00 for stations
	4	(16-20)	-1	I5	No mods or written descriptions
			1		Mods and written descriptions
			-2		No written descriptions, permits log overlap(?)
	5	(21-25)	-1	I5	"DEPTH IN FEET" plotted next to vertical staffs
			1		"ELEVATION IN FEET MSL" plotted next to vertical staffs
	6	(26-30)	-1	I5	Written descriptions in upper case
			1		Written descriptions in lower case
	7	(31-35)	-1	I5	15" H x 25" W plate size
			1		19" H x 28" W plate size
			2		22" H x 37" W plate size
	8	(36-40)	*		No. of lines of notes (??)
	9	(41-45)	(always 1)		(?????)
2	1	(1-10)		RJ,F .	Maximum distance in feet
	2	(11-15)		I5	Lower vertical staff elevation
	3	(16-20)		I5	Upper vertical staff elevation
	4	(21-25)		F5.1	Vertical scale
	5	(26-30)		F5.1	Horizontal scale
	6	(31-35)		I5	Size of plate factor
	7	(36-40)		I5	No. of boring logs
3-5				CENTER	Title cards (max of 38 characters)
6				"	Title cards (max of 19 characters)
7-8				"	Title cards (max of 45 characters)
9-12				"	Notes (max of 45 char) plot next to title block

***** Boring Logs Header

1	1	(1-10)	F10.2	X-dist from horizontal staff origin
	2	(11-20)	F10.2	Vertical staff or ground surface elevation
2	1			Log ID (max=20 char) plotted above borings
	2			tertiary depth
3-4	1			Location cards
5	1			Field Book number
6	1			Sample date,
	2	(23-29)		(mwt_date) water table date, mo,day,yr
	3	(32-36)		(mwt_depth) water table depth

***** Log data format

7-end	1	(1- 5)	F5.1	(sfrom) Upper depth of sample (First log sample must be 0.0)
	2	(6-10)	F5.1	(sto) Lower depth of sample
	3	(11-13)	I3	(water_cont) Water content (% dry weight) (# of add'tl cards if

	4	(14-18)	F5.1	(strat_chg) Stratum change
	5	(19-20)	A2	(sym) Main class (CH,SM,PT)(NS=no sample)
	6	(21-22)	A2	(rock1) Usually blank - RO indicates special case
	7	(23-25)	A3	(rock2) Major modifications (SIS,SS,O,F,M,C) (centered)
	8	(26-28)	A3	(consis) Consistency
	9	(29-37)	3A3	(color1,2,3) Colors of sample
	10	(38-51)	3A3,A5(ctr)	(msym1,2,3,4) Modification symbols
	11	(52-55)	I4	(tblows_ft) Penetration resistance (blows/ft)
	12	(56-59)	I4	(uct) Unconfined compression test
	13	(60-62)	3X	Blank
	14	(63-65)	A3	(atlim_ll) Liquid limit
	15	(66-68)	A3	(atlim_pl) Plastic limit
	16	(69-73)	F5.4	(d10_size) D10 size in millimeters
	17	(74-76)	A3	(twat_cont) Water content
	18	(77-80)	A3	(second_uct) Second unconfined compression test

***** For rock1=RO continuation records:

???	1	(1-25)	25X	Blank
	???	(26-51)		Written description (may be more than 1 record) (consis,color1,color2,color3,msym1,msym2,msym3,msym4)
LAST		(1- 5)	999.9	End of log indicator record

APPENDIX C:
Controlling Plate Size

BP uses the minimum and maximum axis values (in feet) and the axis scale factor (in feet per inch) to determine the size of each axis. The axis size (in inches) is obtained by subtracting the minimum value from the maximum value and dividing by the scale factor. A constant is added to the result to allow for the left and right margins on the X-axis and the top and bottom margins on the Y-axis. These margins are 4.5 inches on the X-axis and 2.5 inches on the Y-axis, so 9.0 inches is added to the calculated X-axis size and 5.0 inches is added to the calculated Y-axis size. In addition, a constant 3.4 inches is added to the Y-axis size to allow for placement of the log IDs. This additional constant is added for each row of logs on the plate. If more than one row of logs appears on a plate, the row yielding the largest X-axis size determines the X-axis size of the plate.

Example:

Given a data set with a Y-axis range of 0 to 90 feet and a Y-axis scale factor of 10 feet per inch, calculate a new range yielding a plate which is as close as possible to 21 inches in length along the Y-axis.

$Ys = (Ymax - Ymin)/Ysf + K$

$K = 2 * 2.5$ (margins) + 3.4 (ID) = 8.4 inches

Ys = Size of Y-axis, inches

Ymax = Y-axis maximum, feet

Ymin = Y-axis minimum, feet

Ysf = Y-axis scale factor, feet per inch

Plate size using the original range:

$Ys = (90 - 0)/10 + 8.4 = 17.4$ inches

Solving for the necessary range:

$Ymax - Ymin = Ysf * (Ys - K) = 10 * (21 - 8.4) = 126$

Using a range (Ymin,Ymax) of (0,130) gives a plate size of $13+8.4=21.4$ inches.

APPENDIX D:
Cell Library

CELL LIBRARY - BPCELL		
CELL	CELL NAME	DESCRIPTION
	CH	FAT CLAY
	CL	LEAN CLAY
	GC	CLAYEY GRAVEL
	GM	SILTY GRAVEL
	GP	SANDY GRAVEL
	GW	WELL GRADED GRAVEL
	MH	INORGANIC SILT
	ML	SILT
	OH	ORGANIC CLAY
	OL	ORGANIC SILT
	PT	PEAT
	SC	CLAYEY SAND
	SM	SILTY SAND
	SP	POORLY GRADED SAND
	SW	WELL GRADED SAND
	WD	WOOD

CELL LIBRARY - BPCELL

CELL	CELL NAME	DESCRIPTION
	AGG	AGGLOMERATE FLOW BRECCIA
	AND	ANDESITE
	BAS	BASALT TRAP
	CEM	CEMENTED SHALE
	CHA	CHALK OR MARL
	CLA	CLAYSTONE
	COA	COAL
	CON	CONGLOMERATE
	DIO	DIORITE
	DOL	DOLOMITE
	LIM	LIMESTONE
	GAB	GABBRO
	GNE	GNEISS
	GRA	GRAYACKE
	GRN	GRANITE
	MAR	MARBLE

CELL LIBRARY - BPCELL

CELL	CELL NAME	DESCRIPTION
	QUA	QUARTZITE
	RHY	RHYOLITE
	SAN	SANDSTONE
	SCH	SCHIST
	SHA	COMPACTION SHALE
	SIL	SILTSTONE
	SLA	SLATE
	SOA	SOAPSTONE & SERPENTINE
	TUF	TUFF OR TUFF BRECCIA
	ARROW	DIMENSION ARROW
	WTRTB	WATER TABLE SYMBOL

UNIT III

CELL LIBRARY AND MATRIX MENU

Geotechnical Matrix Menu Installation Instructions

Two high density disks containing the geotechnical matrix menu, associated cell libraries and other files are enclosed. The following is a brief description of the contents of each disk along with general instructions concerning setup and configuration.

Disk #1, Cell Libraries: Five files are included on this disk; **G3GEO.CEL**, the master cell library, **G3SYSTEM.CEL**, the Seattle System cell library which is attached and used in conjunction with the AM=G3MENU,SB_ side bar menu located along the right edge of the menu, **MSMENU.CEL**, the cell library which contains the menu cell (see discussion below), and **two CDX** files, each associated with the matching cell libraries.

The **G35YSTEM.CEL** and **.CDX** files, containing the Seattle District master system cell library, may not be usable for all districts since each district using Intergraph may already have their own master system cell library. However, it is included and used in conjunction with the **G3MENU** side bar menu. The **MSMENU.CEL** and **.CDX** files are usable if the district receiving this set of floppies has not created their own menus. However, if in doubt it is safer to follow the instructions below explaining how to add a new menu cell to their own system.

The files **G3GEO.CEL**, **G35YSTEM.CEL**, and **G35YSTEM.CDX** should be located in the "cel" subdirectory. **MSMENU.CEL** and **MSMENU.CDX** are normally located in the "data" subdirectory. Please note that locations for all the files can be changed or adapted to your system simply by reconfiguring Microstation. The menus are accessed by using the Microstation ATTACH MENU (AM=) and ATTACH LIBRARY (RC=) commands.

Disk #2: This disk contains three subdirectories (DGN, UCM, and SBM). The subdirectory DGN contains **G3GEOMM.DGN** which is the design file which contains the menu. This file should be placed in the "dgn" subdirectory. As stated above, if no other menus have been attached to **MSMENU.CEL** then **G3GEOMM.DGN** is only needed to make copies of menus and to make future changes in the menu itself. However, it is safer to create your own cell of the menu so your copy of **MSMENU.CEL** is maintained.

Four levels are used in **G3GEOMM.DGN**; levels 1-3 and level 63. Levels 1-3 contain everything you see on your copy of the menu. Level 63 contains the information that the system needs to be able to read the menu. In order to create the cell first temporarily reconfigure Microstation so that cell libraries are located in the "data" subdirectory then attach MSMENU.CEL (RC=MSMENU); you may have to reboot first. Change the active level to 63 and turn off levels 1-62 (LV=63, OF=1-62). Fence all the text in the file, including the text node at the top, define the origin as the lower left hand corner, and create the cell (CC=G3GEO,geotech matrix menu,m). The information between the commas is merely a description and the m designates the cell as a matrix menu. Reconfigure Microstation so that cell libraries are located in the "cel" subdirectory and reboot.

The subdirectory UCM contains all user commands accessed by menu. Contents of disk should be copied into the "ucm" subdirectory.

The side bar menus are contained in the subdirectory SBM. These menus are accessed from menus or by keyins. GT is the menu which is the side bar version of the geotech menu. This menu could be used with a mouse, without a digitizer tablet. Seattle places these files in a "sb" subdirectory under the "ustation" directory; but they could go anywhere just so the Microstation configuration matches.

There are a few commands that don't work yet, such as the raster and stop drawing commands. These are not supported by Microstation yet, but they did work on the Vax based Intergraph. The menu can be modified simply by editing the text on level 63 of G3GEOMM.DGN and recreating the cell. Modifying the graphics on levels 1-3 changes the paper menu appearance. See Chapter 18 in the Microstation manual for more information on matrix menus. The G3 designation in many of the filenames relates to Seattle District; other districts have other designations. Files and menu commands can be edited if necessary.