Destroy this report when no longer needed. Do not return it to the originator.

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Geotechnical Application Programs for CADD (Computer-Aided Design and Drafting) Systems

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

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.
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 autonomies 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
- Initiating studies
- Promoting communications
- Evaluating products
- Providing advisory teams
- Distributing products

ORGANIZATIONAL CHART

FUNCTIONAL CHART

CADD Center

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"GUIDED BY THE FIELD"

US Army Corps of Engineers
CADD Center
Information Technology Laboratory
Waterways Experiment Station
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Vicksburg, Mississippi 39180-6199

Office Symbol: CEWES-IM-DA
Ontyme: CEWES-IM-DA
(601) 634-4109
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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

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B4.................... SOIL CLASSIFICATIONS
B5.................... MODIFICATIONS

APPENDIX C .............. LABORATORY LOG

APPENDIX D .............. WATER CONTENT

APPENDIX E .............. VALIDATION ERRORS (example)

APPENDIX F .............. TECHNICAL DOCUMENTATION

APPENDIX G .............. PLOT DATA FILE FORMAT

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
BORSCHR.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 Database 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.

<table>
<thead>
<tr>
<th>Boring No. TC-22-87U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Date Taken</td>
</tr>
<tr>
<td>Project TOWN CREEK</td>
</tr>
<tr>
<td>G. S. Elevation</td>
</tr>
<tr>
<td>Clasifier Recorder</td>
</tr>
<tr>
<td>Checker</td>
</tr>
<tr>
<td>Field Book No.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Remark</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| RM - Rotary Mud | RNM - Rotary without Mud | AUG - Auger | HDA - Hand Auger |
| FT4 - 1" 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.

<table>
<thead>
<tr>
<th>Boring No. TC-1-87U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 6' FROM TOP BK</td>
</tr>
<tr>
<td>Date Taken 16 Jun 87</td>
</tr>
<tr>
<td>Project TOWN CREEK</td>
</tr>
<tr>
<td>G. S. Elevation 313.7</td>
</tr>
<tr>
<td>Classifier Recorder Checker</td>
</tr>
<tr>
<td>JDC BB</td>
</tr>
<tr>
<td>Field Book No. 7228</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Date Analysed 15 Jun 87</td>
</tr>
<tr>
<td>Remark</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Project: TOWN CREEK</th>
<th>Sample Number: 1</th>
</tr>
</thead>
</table>
| Boring Number: TC-1-87U | Scratched: |}

<table>
<thead>
<tr>
<th>SAMPLE FROM</th>
<th>TO</th>
<th>WATER CONTENT</th>
<th>WET WEIGHT</th>
<th>STRATUM CHANGE</th>
<th>SYM</th>
<th>NOTES MOD</th>
<th>TARE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSISTENCY</th>
<th>COLOR</th>
<th>MODIFICATION SYMBOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BLOWS PER FOOT</th>
<th>UCT</th>
<th>ATTERBERG</th>
<th>TESTS WATER</th>
<th>SECOND TESTS</th>
<th>CONTENT</th>
<th>UCT</th>
<th>ASSIGNED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**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.

![Sample Data Input Screen](image)

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.

<table>
<thead>
<tr>
<th>Project: TOWN CREEK</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring Number: TC-1-87U</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>WATER</th>
<th>WET</th>
<th>STRATUM</th>
<th>FROM</th>
<th>TO CONTENT</th>
<th>WEIGHT</th>
<th>CHANGE</th>
<th>S</th>
<th>CONSIS-</th>
<th>TENCY</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.8</td>
<td>6.0</td>
<td>19</td>
<td>0.0</td>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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 an 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
BORING NO.: TC-1-87U
LOCATION: 6' FROM TOP BK

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

The first screen contains general information about a boring.
### BORING LOG DATABASE SYSTEM

**Page 14**

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

<table>
<thead>
<tr>
<th>TESTS ASGN</th>
<th>SAMPLE NO.</th>
<th>SAMPLE FROM</th>
<th>TO</th>
<th>WATER CONTENT</th>
<th>STRATUM CHANGE</th>
<th>SYM</th>
<th>CONSISTENCY</th>
<th>COLOR</th>
<th>MODIFICATION SYMBOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSN</td>
<td>0.0 1.0</td>
<td>1.0</td>
<td></td>
<td>1.0</td>
<td>SP</td>
<td>BR</td>
<td>G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>1A</td>
<td>5.0 5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>5.8 6.0</td>
<td>19</td>
<td>8.0</td>
<td>ML</td>
<td>BR</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>2A</td>
<td>10.0 10.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10.8 11.0</td>
<td>41</td>
<td>13.0</td>
<td>ML</td>
<td>CS</td>
<td>BR</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15.0 16.0</td>
<td></td>
<td>18.0</td>
<td>SM</td>
<td>GR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>20.0 21.0</td>
<td>18</td>
<td>23.0</td>
<td>CL</td>
<td>LGR</td>
<td>ISS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>25.0 26.0</td>
<td></td>
<td></td>
<td>SP</td>
<td>BR</td>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**

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

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.

<table>
<thead>
<tr>
<th>Plot Option Card Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only 2 Vertical Staffs per Plate</td>
</tr>
<tr>
<td>No horizontal staff</td>
</tr>
<tr>
<td>Left and right vertical staffs</td>
</tr>
<tr>
<td>Modifications with written descriptions</td>
</tr>
<tr>
<td>Vertical Caption: 'ELEVATION IN FEET M.S.L.'</td>
</tr>
<tr>
<td>Written descriptions in upper case</td>
</tr>
<tr>
<td>Maximum staff is 22&quot;, plate is 37&quot; wide</td>
</tr>
<tr>
<td>0 lines of notes</td>
</tr>
</tbody>
</table>

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.

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

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:BORSTRE.dbf
Number of data records: 0
Date of last update: 06/29/87

<table>
<thead>
<tr>
<th>Field</th>
<th>Field Name</th>
<th>Type</th>
<th>Width</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BOR_NUM</td>
<td>Character</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TERT_DEPTH</td>
<td>Numeric</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>LOCN_1</td>
<td>Character</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>LOCN_2</td>
<td>Character</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>LOCN_3</td>
<td>Character</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>LOC_NS</td>
<td>Numeric</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>LOC_EW</td>
<td>Numeric</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>DATE_TAKEN</td>
<td>Date</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>WTAB_DATE</td>
<td>Date</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>WTAB_DEPTH</td>
<td>Numeric</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>METH_DRILL</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GEN_SAMPLE</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>UND_SAMPLE</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>PROJECT</td>
<td>Character</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>CLASSIFIER</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>RECORDER</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>17</td>
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<tr>
<td>18</td>
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<td>Date</td>
<td>8</td>
<td></td>
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<tr>
<td>19</td>
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<td>Date</td>
<td>8</td>
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<tr>
<td>20</td>
<td>EBOOK_NOS</td>
<td>Character</td>
<td>15</td>
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<tr>
<td>21</td>
<td>G.S._ELEV</td>
<td>Numeric</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>22</td>
<td>REMARK</td>
<td>Character</td>
<td>60</td>
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</table>

** Total ** 296
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</thead>
<tbody>
<tr>
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<td>31</td>
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</tr>
<tr>
<td>2</td>
<td>TST_ASGN</td>
<td>Character</td>
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</tr>
<tr>
<td>3</td>
<td>SFROM</td>
<td>Numeric</td>
<td>5</td>
<td>1</td>
</tr>
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<td>4</td>
<td>STO</td>
<td>Numeric</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>WATERS_CONT</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td>WET_WGT</td>
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<td>1</td>
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<td>7</td>
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<td>5</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>SYM</td>
<td>Character</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ROCK1</td>
<td>Character</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ROCK2</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GRAD_TARE</td>
<td>Character</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>CONSIS</td>
<td>Character</td>
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<td></td>
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<td>13</td>
<td>COLOR1</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>COLOR2</td>
<td>Character</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>COLOR3</td>
<td>Character</td>
<td>3</td>
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<tr>
<td>16</td>
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<td>18</td>
<td>MSYM3</td>
<td>Character</td>
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<td></td>
</tr>
<tr>
<td>19</td>
<td>MSYM4</td>
<td>Character</td>
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<td></td>
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<td>20</td>
<td>BLOWS_FT</td>
<td>Character</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>UCT</td>
<td>Numeric</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>ATLLM_LL</td>
<td>Numeric</td>
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</tr>
<tr>
<td>24</td>
<td>D10_SIZE</td>
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<td>7</td>
<td>4</td>
</tr>
<tr>
<td>25</td>
<td>TWAT_CONT</td>
<td>Numeric</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>SECOND_UCT</td>
<td>Numeric</td>
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<tr>
<td>27</td>
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<td>28</td>
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</tr>
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</table>

**Total** 125
Structure for database: C:BORSTRR.dbf
Number of data records: 0
Date of last update: 06/25/90
<table>
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<th>Type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SAMPLE_NO</td>
<td>Character</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>REMARK</td>
<td>Character</td>
<td>60</td>
</tr>
</tbody>
</table>
** Total ** 97

Structure for database: C:abrev.dbf
Number of data records: 14
Date of last update: 11/18/87
<table>
<thead>
<tr>
<th>Field</th>
<th>Field Name</th>
<th>Type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ABR</td>
<td>Character</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>NAME</td>
<td>Character</td>
<td>25</td>
</tr>
</tbody>
</table>
** Total ** 29

Structure for database: C:plot.dbf
Number of data records: 17
Date of last update: 10/25/90
<table>
<thead>
<tr>
<th>Field</th>
<th>Field Name</th>
<th>Type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>REC80</td>
<td>Character</td>
<td>80</td>
</tr>
</tbody>
</table>
** Total ** 81

Structure for database: C:plotbors.dbf
Number of data records: 1
Date of last update: 10/25/90
<table>
<thead>
<tr>
<th>Field</th>
<th>Field Name</th>
<th>Type</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BNAME</td>
<td>Character</td>
<td>26</td>
</tr>
</tbody>
</table>
** Total ** 27
# Boring Log Database System

## B-1

### Drilling Methods

<table>
<thead>
<tr>
<th>Code</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUG</td>
<td>Auger</td>
</tr>
<tr>
<td>COR</td>
<td>Core</td>
</tr>
<tr>
<td>D25</td>
<td>2.5&quot; Drive Tube</td>
</tr>
<tr>
<td>DEN</td>
<td>Denison Sampler</td>
</tr>
<tr>
<td>FT4</td>
<td>Fishtail 4&quot;</td>
</tr>
<tr>
<td>FT6</td>
<td>Fishtail 6&quot;</td>
</tr>
<tr>
<td>FT8</td>
<td>Fishtail 8&quot;</td>
</tr>
<tr>
<td>HDA</td>
<td>Hand Auger</td>
</tr>
<tr>
<td>HVO</td>
<td>Hvorslev</td>
</tr>
<tr>
<td>RM</td>
<td>Rotary Mud</td>
</tr>
<tr>
<td>RNM</td>
<td>Rotary without Mud</td>
</tr>
<tr>
<td>SSS</td>
<td>Standard Split Spoon</td>
</tr>
<tr>
<td>VST</td>
<td>Vacuum Type Shelby Tube</td>
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<td>ROCK CLASSIFICATIONS</td>
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<tr>
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</tr>
<tr>
<td>GRA  Grayacke</td>
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</tr>
<tr>
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<tr>
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<tr>
<td>COA  Coal</td>
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<td>LIM  Limestone</td>
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<tr>
<td>GNE  Gneiss</td>
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<td>RHY  Rhyolite</td>
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<td>AND  Andesite</td>
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<td>GRN  Granite</td>
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<td>CHA  Chalk or Marl</td>
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<td>SAN  Sandstone</td>
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<td>CON  Conglomerate</td>
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<td>NSP  Prevents Plotting of Rock</td>
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<td>GP</td>
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<td>Silty Gravel, Gravel-Sand-Silt</td>
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<td>Clayey Gravel, Gravel-Sand-Clay</td>
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<td>Sand, Well-Graded, Gravelly Sands</td>
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<td>Lean, Sandy, Silty Clay of Medium plasticity</td>
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<td>Organic Silts and Silty Clays of Low plasticity</td>
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<td>MH</td>
<td>Silt, Fine Sandy or Silty Soil with High plasticity</td>
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<td>Fat, Inorganic Clay of High plasticity</td>
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<td>Peat, other Highly Organic Soil</td>
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## MODIFICATIONS

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<td>Shale Fragments</td>
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<td>SIS</td>
<td>Silt Strata or Lenses</td>
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<tr>
<td>S</td>
<td>Sandy</td>
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<tr>
<td>G</td>
<td>Gravelly</td>
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<td>Boulders</td>
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<td>Slickensides</td>
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<td>WD</td>
<td>Wood</td>
</tr>
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</tr>
<tr>
<td>SSI</td>
<td>Sandy Silt</td>
</tr>
<tr>
<td>ISS</td>
<td>Silty Sand</td>
</tr>
<tr>
<td>PGM</td>
<td>Poorly graded Silty Fine Gravel</td>
</tr>
<tr>
<td>WGM</td>
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<td>PGC</td>
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BORING LOG DATABASE SYSTEM
C-1

LABORATORY LOG

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<th>Field Book No. 7228</th>
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<td>Date Taken 16 Jun 87</td>
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<td>Location 6' FROM TOP BK</td>
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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  Check: BB
Date analyzed: 15 Jun 87 Date checked: 26 Jun 87

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<th>TESTS</th>
<th>SAMPLE</th>
<th>SAMPLE</th>
<th>WATER</th>
<th>STRATON</th>
<th>STN ROCK</th>
<th>CONSIS</th>
<th>COLOR</th>
<th>MODIFICATION</th>
<th>BLOWS</th>
<th>OCT</th>
<th>ATTERBERG</th>
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<td>TRECT</td>
<td>SYMBOLS</td>
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<td>1.0</td>
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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  

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<td>M20</td>
<td>M21</td>
<td>M22</td>
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<td>30.5</td>
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<td>20</td>
<td>19</td>
<td>11</td>
<td>21</td>
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<table>
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<tbody>
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### BORING LOG DATABASE SYSTEM

#### E-1

**Project:** TOWI CREEK 07/29/87

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<td>WARNING</td>
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<td>TC-1-87U</td>
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<td>WARNING</td>
<td>TC-1-87U 6 Water content and D-10 size on same sample</td>
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<td>Sandy modification on non-sand sample</td>
<td>WARNING</td>
<td>TC-10-87U 2 Sandy modification on non-sand sample</td>
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<td>TC-2-87U</td>
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<td>WARNING</td>
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<td>TC-6-87U 3 Bad Modification Code: G.</td>
</tr>
<tr>
<td>TC-6-87U</td>
<td>Bad Color code: LR</td>
<td>WARNING</td>
<td>TC-6-87U 4 Bad Color code: LR</td>
</tr>
<tr>
<td>TC-7-87U</td>
<td>Tertiary depth &gt; last stratum change</td>
<td>WARNING</td>
<td>TC-7-87U 1 Tertiary depth &gt; last stratum change</td>
</tr>
<tr>
<td>TC-8-87U</td>
<td>Missing Location.</td>
<td>WARNING</td>
<td>TC-8-87U 2 Missing Location.</td>
</tr>
<tr>
<td>TC-9-87U</td>
<td>Missing Location.</td>
<td>WARNING</td>
<td>TC-9-87U 3 Missing Location.</td>
</tr>
<tr>
<td>TC-1-87U</td>
<td>Missing or zero G.S. Elev</td>
<td>WARNING</td>
<td>TC-1-87U 1 Missing or zero G.S. Elev</td>
</tr>
<tr>
<td>TCA-1-87U</td>
<td>Missing Date Taken.</td>
<td>WARNING</td>
<td>TCA-1-87U 3 Missing Date Taken.</td>
</tr>
<tr>
<td>TCA-1-87U</td>
<td>Missing Location.</td>
<td>WARNING</td>
<td>TCA-1-87U 4 Missing Location.</td>
</tr>
<tr>
<td>TCA-1-87U</td>
<td>No samples for this boring.</td>
<td>WARNING</td>
<td>TCA-1-87U 5 No samples for this boring.</td>
</tr>
</tbody>
</table>

---

Note: Details are not visible in the image.
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:

- **fileb.dbf** - a borings info file
  - indexed by boring ID (files.ndx)

- **files.dbf** - a sample info file
  - indexed by boring ID + sample # + depth (files.ndx)
  - or by boring ID + depth + sample # (filed.ndx)

- **filer.dbf** - a sample remarks file
  - indexed by boring ID + sample # + depth (filer.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.
BORING LOG DATABASE SYSTEM

TECHNICAL DOCUMENTATION

F-2

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 - fileB.dbf
  indexed by boring ID
Workarea 2 - sample information - fileS.dbf
  indexed by boring ID + sample no. + deptn or
  by boring ID + depth + sample no.
Workarea 3 - remarks associated with samples - fileR.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.
BORING LOG DATABASE SYSTEM
TECHNICAL DOCUMENTATION

F-3

BORASADD.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.PRG - 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.
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 order desired. 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 is 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 dl0_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.
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.

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.

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

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.

A routine to convert a string date in the format nn MON yy (23 JUL 97) 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
cols 1 - 22  location description
3 - cols 1 - 22  field book number
4 - 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**
- **Typical Names**

#### Coarse - Grained Soils

<table>
<thead>
<tr>
<th>Major Division</th>
<th>Type</th>
<th>Letter Symbol</th>
<th>Typical Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than half of material is larger than No. 200 sieve</td>
<td>Clean Gravel</td>
<td>G</td>
<td>GRAVEL, well-graded, gravel-sand mixtures, little or no fines</td>
</tr>
<tr>
<td></td>
<td>Gravel with Fines</td>
<td>G</td>
<td>GRAVEL, poorly-graded, gravel-sand mixtures, little or no fines</td>
</tr>
<tr>
<td></td>
<td>Silty Gravel</td>
<td>G</td>
<td>CLAYEY GRAVEL, gravel-sand-clay mixtures</td>
</tr>
<tr>
<td></td>
<td>Sand, Well-graded, gravelly sands</td>
<td>S</td>
<td>SAND, well-graded, gravelly sands</td>
</tr>
<tr>
<td></td>
<td>Poorly-graded, gravelly sands</td>
<td>P</td>
<td>SAND, poorly-graded, gravelly sands</td>
</tr>
<tr>
<td></td>
<td>Silty Sand, sand-silt mixtures</td>
<td>S</td>
<td>SILTY SAND, sand-silt mixtures</td>
</tr>
<tr>
<td></td>
<td>Clayey Sand, sand-clay mixtures</td>
<td>C</td>
<td>CLAYEY SAND, sand-clay mixtures</td>
</tr>
</tbody>
</table>

#### Fine - Grained Soils

<table>
<thead>
<tr>
<th>Major Division</th>
<th>Type</th>
<th>Letter Symbol</th>
<th>Typical Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than half the material is finer than No. 200 sieve</td>
<td>Silts and Clays</td>
<td>ML</td>
<td>SILT &amp; very fine sand, silty or clayey fine sand or clayey silt</td>
</tr>
<tr>
<td></td>
<td>Lean Clay</td>
<td>CL</td>
<td>LEAN CLAY; Sandy Clay, Silty Clay, of low to medium plasticity</td>
</tr>
<tr>
<td></td>
<td>Organic Silts and Clays of Low Plasticity</td>
<td>OL</td>
<td>ORGANIC SILTS, and organic silty clays of low plasticity</td>
</tr>
<tr>
<td></td>
<td>Silt, Fine Sandy or Silty Soil with High Plasticity</td>
<td>MH</td>
<td>SILT, fine sandy or silty soil with high plasticity</td>
</tr>
<tr>
<td></td>
<td>Fat Clay, Inorganic Clay of High Plasticity</td>
<td>CH</td>
<td>FAT CLAY, inorganic clay of high plasticity</td>
</tr>
<tr>
<td></td>
<td>Organic Clays of Medium to High Plasticity, Organic Silt</td>
<td>OH</td>
<td>ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILT</td>
</tr>
</tbody>
</table>

#### Highly Organic Soils

<table>
<thead>
<tr>
<th>Type</th>
<th>Letter Symbol</th>
<th>Typical Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>Wd</td>
<td>WOOD</td>
</tr>
</tbody>
</table>

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

### DESCRIPTIVE SYMBOLS

#### Consistency for Cohesive Soils

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Coefficient in Lbs/Sq Ft from Unconfined Compression Test</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>&lt; 250</td>
<td>vS</td>
</tr>
<tr>
<td>Soft</td>
<td>250 - 500</td>
<td>S</td>
</tr>
<tr>
<td>Medium</td>
<td>500 - 1000</td>
<td>M</td>
</tr>
<tr>
<td>Stiff</td>
<td>1000 - 2000</td>
<td>S</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>2000 - 4000</td>
<td>vS</td>
</tr>
<tr>
<td>Hard</td>
<td>&gt; 4000</td>
<td>H</td>
</tr>
</tbody>
</table>

#### Plasticity Chart

For classification of fine-grained soils.
### UNIFIED SOIL CLASSIFICATION

<table>
<thead>
<tr>
<th>TYPE</th>
<th>LETTER</th>
<th>SYMBOL</th>
<th>TYPICAL NAMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAN GRAVEL</td>
<td>G</td>
<td>W</td>
<td>GRAVEL, Well Graded, gravel-sand mixtures, little or no fines</td>
</tr>
<tr>
<td>GRAVEL WITH FINES</td>
<td>G</td>
<td>M</td>
<td>Silty GRAVEL, gravel-sand-silt mixtures</td>
</tr>
<tr>
<td>CLEAN SAND</td>
<td>S</td>
<td>W</td>
<td>SAND, Well-Graded, gravelly sands</td>
</tr>
<tr>
<td>SANDS WITH FINES</td>
<td>S</td>
<td>M</td>
<td>SILTY SAND, sand-silt mixtures</td>
</tr>
<tr>
<td>CLAYEY SAND</td>
<td>C</td>
<td>M</td>
<td>CLAYEY SAND, sand-clay mixtures</td>
</tr>
<tr>
<td>SILTS AND CLAYS</td>
<td>L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLAYEY SAND</td>
<td>C</td>
<td>L</td>
<td>Le AN CLAY; Sandy Clay; Silty Clay; of low to medium plasticity</td>
</tr>
<tr>
<td>ORGANIC SILTS AND ORGANIC SILTY CLAYS</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt, fine sandy or silty soil with high plasticity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS</td>
<td>O</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>SOILS</td>
<td>P</td>
<td>T</td>
<td>PEAT, and other highly organic soil</td>
</tr>
<tr>
<td>Wd</td>
<td>WOOD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### DESCRIPTIVE SYMBOLS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>COLOR</th>
<th>CONSISTENCY FOR COHESIVE SOILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>VERY SOFT</td>
<td>COHESION IN LBS/SD FT FROM UNCONFINED COMPRESSION TEST</td>
</tr>
<tr>
<td>Y</td>
<td>SOFT</td>
<td>COHESION &lt; 250</td>
</tr>
<tr>
<td>R</td>
<td>MEDIUM</td>
<td>250 - 500</td>
</tr>
<tr>
<td>Bk</td>
<td>STIFF</td>
<td>500 - 1000</td>
</tr>
<tr>
<td>Gr</td>
<td>VERY STIFF</td>
<td>1000 - 2000</td>
</tr>
<tr>
<td>dGr</td>
<td>HARD</td>
<td>2000 - 4000</td>
</tr>
<tr>
<td>g</td>
<td></td>
<td>- 4000</td>
</tr>
</tbody>
</table>

### MODIFICATIONS

<table>
<thead>
<tr>
<th>MODIFICATION</th>
<th>SYMBOL</th>
<th>MODIFICATION</th>
<th>SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>traces</td>
<td>Tr</td>
<td>sandy silty sand</td>
<td>SS/sis</td>
</tr>
<tr>
<td>fine</td>
<td>F</td>
<td>silty sand</td>
<td>SS/sis</td>
</tr>
<tr>
<td>medium</td>
<td>M</td>
<td>sandy clay</td>
<td>CC/S</td>
</tr>
<tr>
<td>very soft</td>
<td>vS</td>
<td>silty clay</td>
<td>CC/s</td>
</tr>
<tr>
<td>soft</td>
<td>sS</td>
<td>dense</td>
<td>D</td>
</tr>
<tr>
<td>medium stiff</td>
<td>mS</td>
<td>very dense</td>
<td>vD</td>
</tr>
<tr>
<td>stiff</td>
<td>S</td>
<td>rootlets</td>
<td>rt</td>
</tr>
<tr>
<td>hard</td>
<td>H</td>
<td>lignite</td>
<td>lg</td>
</tr>
<tr>
<td>sandstone</td>
<td>ssd</td>
<td>shale fragments</td>
<td>shf</td>
</tr>
<tr>
<td>shell</td>
<td>sSf</td>
<td>clay lenses</td>
<td>cc</td>
</tr>
<tr>
<td>organic</td>
<td>O</td>
<td>gravel</td>
<td>G</td>
</tr>
<tr>
<td>clay fragments</td>
<td>CF</td>
<td>sand fragments</td>
<td>SF</td>
</tr>
<tr>
<td>silty sand</td>
<td>SS/sis</td>
<td>gravelly</td>
<td>G</td>
</tr>
<tr>
<td>sand sand</td>
<td>SS/sis</td>
<td>builders</td>
<td>B</td>
</tr>
<tr>
<td>silt sand</td>
<td>SS/sis</td>
<td>stiff shingles</td>
<td>SL</td>
</tr>
<tr>
<td>organic clay</td>
<td>OC</td>
<td>wood</td>
<td>Wd</td>
</tr>
<tr>
<td>oxidized</td>
<td>Ox</td>
<td>vegetation</td>
<td>veg</td>
</tr>
</tbody>
</table>

### PLASTICITY CHART

For classification of fine-grained soils
### NOTES

#### FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D10"

- Are natural water contents in percent dry weight.
- When underlined denotes D10 size in mm.

#### FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"

- Are liquid and plastic limits, respectively.

#### SYMBOLS TO LEFT OF BORING

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Ground-water surface and zone observed</td>
</tr>
<tr>
<td>C</td>
<td>Denotes location of consolidation test **</td>
</tr>
<tr>
<td>S</td>
<td>Denotes location of consolidated drained direct shear test **</td>
</tr>
<tr>
<td>h</td>
<td>Denotes location of consolidated undrained triaxial compression test **</td>
</tr>
<tr>
<td>U</td>
<td>Denotes location of unconsolidated undrained triaxial compression test **</td>
</tr>
<tr>
<td>*</td>
<td>Denotes location of sample subjected to consolidation test and each of the above three types of shear tests **</td>
</tr>
</tbody>
</table>

**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 1/2 in. OD & 2 0 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 D10 size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than size D10.

**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.

# Key to Physical Properties of Rocks

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massive</td>
<td>1</td>
</tr>
<tr>
<td>thin to medium</td>
<td>2</td>
</tr>
<tr>
<td>coarse</td>
<td>3</td>
</tr>
<tr>
<td>Cross-bedded</td>
<td>4</td>
</tr>
<tr>
<td>Fossilized</td>
<td>5</td>
</tr>
<tr>
<td>Platy</td>
<td>6</td>
</tr>
<tr>
<td>Fragmental</td>
<td>7</td>
</tr>
<tr>
<td>Massive</td>
<td>8</td>
</tr>
<tr>
<td>Clayey</td>
<td>9</td>
</tr>
<tr>
<td>Shaly</td>
<td>10</td>
</tr>
<tr>
<td>Calcareous clay</td>
<td>11</td>
</tr>
<tr>
<td>Silcreous</td>
<td>12</td>
</tr>
<tr>
<td>Sandy</td>
<td>13</td>
</tr>
<tr>
<td>Silly</td>
<td>14</td>
</tr>
<tr>
<td>Plastic seams</td>
<td>15</td>
</tr>
<tr>
<td>Carbonaceous</td>
<td>16</td>
</tr>
<tr>
<td>Fossiliferous</td>
<td>17</td>
</tr>
<tr>
<td>Very soft or plastic</td>
<td>18</td>
</tr>
<tr>
<td>Soft</td>
<td>19</td>
</tr>
<tr>
<td>Moderately hard</td>
<td>20</td>
</tr>
<tr>
<td>Hard</td>
<td>21</td>
</tr>
<tr>
<td>Very hard</td>
<td>22</td>
</tr>
<tr>
<td>Poorly cemented</td>
<td>23</td>
</tr>
<tr>
<td>Cemented</td>
<td>24</td>
</tr>
<tr>
<td>Dense</td>
<td>25</td>
</tr>
<tr>
<td>Fine</td>
<td>26</td>
</tr>
<tr>
<td>Medium</td>
<td>27</td>
</tr>
<tr>
<td>Coarse</td>
<td>28</td>
</tr>
<tr>
<td>Flat</td>
<td>29</td>
</tr>
<tr>
<td>Gently dipping</td>
<td>b</td>
</tr>
<tr>
<td>Steeply dipping</td>
<td>b</td>
</tr>
<tr>
<td>Fractures, scattered</td>
<td>a</td>
</tr>
<tr>
<td>Fractures closely spaced</td>
<td>a</td>
</tr>
<tr>
<td>Brecciated sheared &amp; fragmented</td>
<td>b</td>
</tr>
<tr>
<td>Joints</td>
<td>33</td>
</tr>
<tr>
<td>Faulted</td>
<td>34</td>
</tr>
<tr>
<td>Schistosities</td>
<td>35</td>
</tr>
<tr>
<td>Unweathered</td>
<td>36</td>
</tr>
<tr>
<td>Slightly weathered</td>
<td>37</td>
</tr>
<tr>
<td>Badly weathered</td>
<td>38</td>
</tr>
<tr>
<td>Solid contains no voids</td>
<td>39</td>
</tr>
<tr>
<td>Vugy spotted</td>
<td>40</td>
</tr>
<tr>
<td>Vesicular</td>
<td>41</td>
</tr>
<tr>
<td>Porous</td>
<td>42</td>
</tr>
<tr>
<td>Cavities</td>
<td>43</td>
</tr>
<tr>
<td>Cavernous</td>
<td>44</td>
</tr>
<tr>
<td>Non-swelling</td>
<td>45</td>
</tr>
<tr>
<td>Swelling</td>
<td>46</td>
</tr>
<tr>
<td>Non-pitting</td>
<td>47</td>
</tr>
<tr>
<td>Pitting</td>
<td>48</td>
</tr>
<tr>
<td>Stakes slowly on exposure</td>
<td>49</td>
</tr>
<tr>
<td>Stakes readily on exposure</td>
<td>49</td>
</tr>
</tbody>
</table>

**Note:** While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations in characteristics 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.

Ground-water elevations shown on boring logs represent ground-water surfaces encountered on the dates shown. Absence of 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.

<table>
<thead>
<tr>
<th>Pressure Test Results</th>
<th>5 gals/min at 50 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground-water Surface</td>
<td></td>
</tr>
<tr>
<td>Core loss or no sample</td>
<td></td>
</tr>
</tbody>
</table>

**Special Feature or Drilling Operation at a Specific Elevation**

**Special Feature Vertically Distributed**

**Examples**

**Drill Water Lost**

**Crushed Core Due to Drill Operations**
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.
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APPENDICES:

APPENDIX A: Programmer’s Guide
APPENDIX B: Input File Format
APPENDIX C: Controlling Plate Size
APPENDIX D: Cell Library
APPENDIX E: Source Code
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 accommodate 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:

```
Files Rows Pattern Go Quit  (Select F, R, P, G, or Q)

BP - Boring Log Design File Builder
Foundation & Materials Branch, Vicksburg District Corps of Engineers

Rows of logs: (none specified)  Pattern: ON
No files specified
```

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
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.

<table>
<thead>
<tr>
<th>Level</th>
<th>Text Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Height</td>
<td>Width</td>
</tr>
<tr>
<td>1</td>
<td>0.072</td>
<td>0.06</td>
</tr>
<tr>
<td>2</td>
<td>0.072</td>
<td>0.06</td>
</tr>
<tr>
<td>3</td>
<td>0.096</td>
<td>0.08</td>
</tr>
<tr>
<td>4</td>
<td>0.072</td>
<td>0.06</td>
</tr>
<tr>
<td>5</td>
<td>0.096</td>
<td>0.08</td>
</tr>
<tr>
<td>6</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Level</td>
<td>Text Size (Height, Width)</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>7</td>
<td>0.20 0.10</td>
<td>Ground surface elevation, tic marks along logs corresponding to staff increments</td>
</tr>
<tr>
<td>8</td>
<td>0.01 0.08</td>
<td>Tertiary depth and water table</td>
</tr>
<tr>
<td>9</td>
<td>0.01 0.08</td>
<td>Unified compression test and penetration resistance</td>
</tr>
<tr>
<td>10</td>
<td>0.12 0.12</td>
<td>Notes</td>
</tr>
<tr>
<td>60</td>
<td>0.15 0.15</td>
<td>Vertical staffs</td>
</tr>
<tr>
<td>61</td>
<td>0.15 0.15</td>
<td>Horizontal staffs</td>
</tr>
<tr>
<td>62</td>
<td>varies</td>
<td>Border and title block</td>
</tr>
</tbody>
</table>
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.

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

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>904</td>
<td>Too few vertices in placing shape</td>
</tr>
<tr>
<td>905</td>
<td>Too many vertices in placing shape</td>
</tr>
<tr>
<td>925</td>
<td>Could not establish message queue</td>
</tr>
<tr>
<td>926</td>
<td>Could not get response from MicroStation</td>
</tr>
<tr>
<td>929</td>
<td>Not a valid TCB variable</td>
</tr>
<tr>
<td>930</td>
<td>Error converting to Radix-50 value</td>
</tr>
<tr>
<td>933</td>
<td>Illegal element definition</td>
</tr>
<tr>
<td>934</td>
<td>Illegal element format</td>
</tr>
<tr>
<td>936</td>
<td>Resident scanner not loaded</td>
</tr>
<tr>
<td>938</td>
<td>No cell library attached</td>
</tr>
<tr>
<td>939</td>
<td>Cell is not in cell library</td>
</tr>
<tr>
<td>940</td>
<td>Cell nesting error</td>
</tr>
<tr>
<td>941</td>
<td>Invalid cell or cell library</td>
</tr>
<tr>
<td>947</td>
<td>Invalid open type</td>
</tr>
<tr>
<td>948</td>
<td>Unable to open design file</td>
</tr>
<tr>
<td>949</td>
<td>Unable to open cell library</td>
</tr>
<tr>
<td>951</td>
<td>Security device not installed</td>
</tr>
<tr>
<td>952</td>
<td>'UCMVARS.DAT' or 'USTATION.RSC' not found</td>
</tr>
<tr>
<td>960</td>
<td>Design file disk is full</td>
</tr>
</tbody>
</table>
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, BPPTEXT.EXE, and BP_PTRN.EXE
APPENDIX B:
Input File Format
### File Header

<table>
<thead>
<tr>
<th>Record</th>
<th>Field</th>
<th>Columns</th>
<th>Range</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>(1-5)</td>
<td>-1</td>
<td>15</td>
<td>Vertical staff to left of each log (depth in feet)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Two vertical staffs, Lt of first boring &amp; rt of last</td>
</tr>
<tr>
<td>2</td>
<td>(6-10)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>Horizontal staff w/ Distance in Feet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No horizontal staff</td>
</tr>
<tr>
<td>3</td>
<td>(11-15)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>All staffs omitted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Left &amp; right vertical staff plotted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scale across top &amp; +00 for stations</td>
</tr>
<tr>
<td>4</td>
<td>(16-20)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>No mods or written descriptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mods and written descriptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No written descriptions, permits log overlap(?)</td>
</tr>
<tr>
<td>5</td>
<td>(21-25)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>&quot;DEPTH IN FEET&quot; plotted next to vertical staffs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&quot;ELEVATION IN FEET MSL&quot; plotted next to vertical staffs</td>
</tr>
<tr>
<td>6</td>
<td>(26-30)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>Written descriptions in upper case</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Written descriptions in lower case</td>
</tr>
<tr>
<td>7</td>
<td>(31-35)</td>
<td>-1</td>
<td>15</td>
<td></td>
<td>15&quot; H x 25&quot; W plate size</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19&quot; H x 28&quot; W plate size</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22&quot; H x 37&quot; W plate size</td>
</tr>
<tr>
<td>8</td>
<td>(36-40)</td>
<td>*</td>
<td>15</td>
<td></td>
<td>No. of lines of notes (??)</td>
</tr>
<tr>
<td>9</td>
<td>(41-45)</td>
<td>(always 1)</td>
<td>15</td>
<td>( ????? )</td>
<td></td>
</tr>
</tbody>
</table>

### Boring Logs

<table>
<thead>
<tr>
<th>Record</th>
<th>Field</th>
<th>Columns</th>
<th>Range</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>(1-10)</td>
<td>F10.2</td>
<td>X-dist from horizontal staff origin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(11-20)</td>
<td>F10.2</td>
<td>Vertical staff or ground surface elevation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>(11-15)</td>
<td>15</td>
<td>Lower vertical staff elevation</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>(16-20)</td>
<td>15</td>
<td>Upper vertical staff elevation</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>(21-25)</td>
<td>F5.1</td>
<td>Vertical scale</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>(26-30)</td>
<td>F5.1</td>
<td>Horizontal scale</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>(31-35)</td>
<td>15</td>
<td>Size of plate factor</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>(36-40)</td>
<td>15</td>
<td>No. of boring logs</td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td></td>
<td></td>
<td>CENTER</td>
<td>Title cards (max of 38 characters)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>&quot;</td>
<td>Title cards (max of 19 characters)</td>
<td></td>
</tr>
<tr>
<td>7-8</td>
<td></td>
<td></td>
<td>&quot;</td>
<td>Title cards (max of 45 characters)</td>
<td></td>
</tr>
<tr>
<td>9-12</td>
<td></td>
<td></td>
<td>&quot;</td>
<td>Notes (max of 45 char) plot next to title block</td>
<td></td>
</tr>
</tbody>
</table>

### Log data format

<table>
<thead>
<tr>
<th>Record</th>
<th>Field</th>
<th>Columns</th>
<th>Range</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-end</td>
<td>1</td>
<td>(1-5)</td>
<td>F5.1</td>
<td>(sfrom) Upper depth of sample (first log sample must be 0.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>(6-10)</td>
<td>F5.1</td>
<td>(sto) Lower depth of sample</td>
<td></td>
</tr>
</tbody>
</table>
|        | 3     | (11-13) | 13    | (water_cont) Water content (% dry weight) (# of add’lt cards if
4 (14-18) F5.1 (stratchg) 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_l) 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.

\[ \text{Ys} = \frac{(\text{Ymax} - \text{Ymin})}{\text{Ysf}} + \text{K} \]

\[ \text{K} = 2 \times 2.5 \text{ (margins)} + 3.4 \text{ (ID)} = 8.4 \text{ inches} \]

\[ \text{Ys} = \text{Size of Y-axis, inches} \]

\[ \text{Ymax} = \text{Y-axis maximum, feet} \]

\[ \text{Ymin} = \text{Y-axis minimum, feet} \]

\[ \text{Ysf} = \text{Y-axis scale factor, feet per inch} \]

Plate size using the original range:

\[ \text{Ys} = \frac{(90 - 0)}{10} + 8.4 = 17.4 \text{ inches} \]

Solving for the necessary range:

\[ \text{Ymax} - \text{Ymin} = \text{Ysf} \times (\text{Ys} - \text{K}) = 10 \times (21 - 8.4) = 126 \]

Using a range (Ymin, Ymax) of (0,130) gives a plate size of 13 + 8.4 = 21.4 inches.
APPENDIX D:
Cell Library
<table>
<thead>
<tr>
<th>CELL</th>
<th>CELL NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>FAT CLAY</td>
<td></td>
</tr>
<tr>
<td>CL</td>
<td>LEAN CLAY</td>
<td></td>
</tr>
<tr>
<td>GC</td>
<td>CLAYEY GRAVEL</td>
<td></td>
</tr>
<tr>
<td>GM</td>
<td>SILTY GRAVEL</td>
<td></td>
</tr>
<tr>
<td>GP</td>
<td>SANDY GRAVEL</td>
<td></td>
</tr>
<tr>
<td>GW</td>
<td>WELL GRADED GRAVEL</td>
<td></td>
</tr>
<tr>
<td>MH</td>
<td>INORGANIC SILT</td>
<td></td>
</tr>
<tr>
<td>ML</td>
<td>SILT</td>
<td></td>
</tr>
<tr>
<td>OH</td>
<td>ORGANIC CLAY</td>
<td></td>
</tr>
<tr>
<td>OL</td>
<td>ORGANIC SILT</td>
<td></td>
</tr>
<tr>
<td>PT</td>
<td>PEAT</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>CLAYEY SAND</td>
<td></td>
</tr>
<tr>
<td>SM</td>
<td>SILTY SAND</td>
<td></td>
</tr>
<tr>
<td>SP</td>
<td>POORLY GRADED SAND</td>
<td></td>
</tr>
<tr>
<td>SW</td>
<td>WELL GRADED SAND</td>
<td></td>
</tr>
<tr>
<td>WD</td>
<td>WOOD</td>
<td></td>
</tr>
<tr>
<td>CELL</td>
<td>CELL NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>AGG</td>
<td>AGG</td>
<td>AGGLOMERATE FLOW BRECCIA</td>
</tr>
<tr>
<td>AND</td>
<td>AND</td>
<td>ANDESITE</td>
</tr>
<tr>
<td>BAS</td>
<td>BAS</td>
<td>BASALT TRAP</td>
</tr>
<tr>
<td>CEM</td>
<td>CEM</td>
<td>CEMENTED SHALE</td>
</tr>
<tr>
<td>CHA</td>
<td>CHA</td>
<td>CHALK OR MARL</td>
</tr>
<tr>
<td>CLA</td>
<td>CLA</td>
<td>CLAYSTONE</td>
</tr>
<tr>
<td>COA</td>
<td>COA</td>
<td>COAL</td>
</tr>
<tr>
<td>CON</td>
<td>CON</td>
<td>CONGLOMERATE</td>
</tr>
<tr>
<td>DIO</td>
<td>DIO</td>
<td>DIORITE</td>
</tr>
<tr>
<td>DCL</td>
<td>DCL</td>
<td>DOLOMITE</td>
</tr>
<tr>
<td>LIM</td>
<td>LIM</td>
<td>LIMESTONE</td>
</tr>
<tr>
<td>GAB</td>
<td>GAB</td>
<td>GABBRO</td>
</tr>
<tr>
<td>GNE</td>
<td>GNE</td>
<td>GNEISS</td>
</tr>
<tr>
<td>GRA</td>
<td>GRA</td>
<td>GRAYACKE</td>
</tr>
<tr>
<td>GRN</td>
<td>GRN</td>
<td>GRANITE</td>
</tr>
<tr>
<td>MAR</td>
<td>MAR</td>
<td>MARBLE</td>
</tr>
<tr>
<td>CELL</td>
<td>CELL NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>QUA</td>
<td>QUARTZITE</td>
<td></td>
</tr>
<tr>
<td>RHY</td>
<td>RHYOLITE</td>
<td></td>
</tr>
<tr>
<td>SAN</td>
<td>SANDSTONE</td>
<td></td>
</tr>
<tr>
<td>SCH</td>
<td>SCHIST</td>
<td></td>
</tr>
<tr>
<td>SHA</td>
<td>COMPACTION SHALE</td>
<td></td>
</tr>
<tr>
<td>SIL</td>
<td>SILTSTONE</td>
<td></td>
</tr>
<tr>
<td>SLA</td>
<td>SLATE</td>
<td></td>
</tr>
<tr>
<td>SOA</td>
<td>SOAPSTONE &amp; SERPENTINE</td>
<td></td>
</tr>
<tr>
<td>TUF</td>
<td>TUFF OR TUFF BRECCIA</td>
<td></td>
</tr>
<tr>
<td>ARROW</td>
<td>DIMENSION ARROW</td>
<td></td>
</tr>
<tr>
<td>WTRTB</td>
<td>WATER TABLE SYMBOL</td>
<td></td>
</tr>
</tbody>
</table>
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 G3SYSTEM.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, G3SYSTEM.CEL, and G3SYSTEM.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 G3GEOOMM.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.