Instruction Report CERC-94-1
March 1994

US Army Corps of Engineers
Waterways Experiment Station

BFM: Beach Fill Module

Report 1
Beach Morphology Analysis Package (BMAP) — User's Guide

by Barry G. Sommerfeld, John M. Mason
Coastal Engineering Research Center

Nicholas C. Kraus
Texas A&M University – Corpus Christi

Magnus Larson
University of Lund, Sweden

WES

Approved For Public Release; Distribution Is Unlimited

Prepared for Headquarters, U.S. Army Corps of Engineers

Instruction Report CERC-94-1
March 1994

BFM: Beach Fill Module

Report 1
Beach Morphology Analysis Package (BMAP)—User's Guide

by Barry G. Sommerfeld, John M. Mason
Coastal Engineering Research Center

U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Nicholas C. Kraus

Conrad Blucher Institute for Surveying and Science
Texas A&M University – Corpus Christi
6400 Ocean Drive
Corpus Cristi, TX 78412-5599

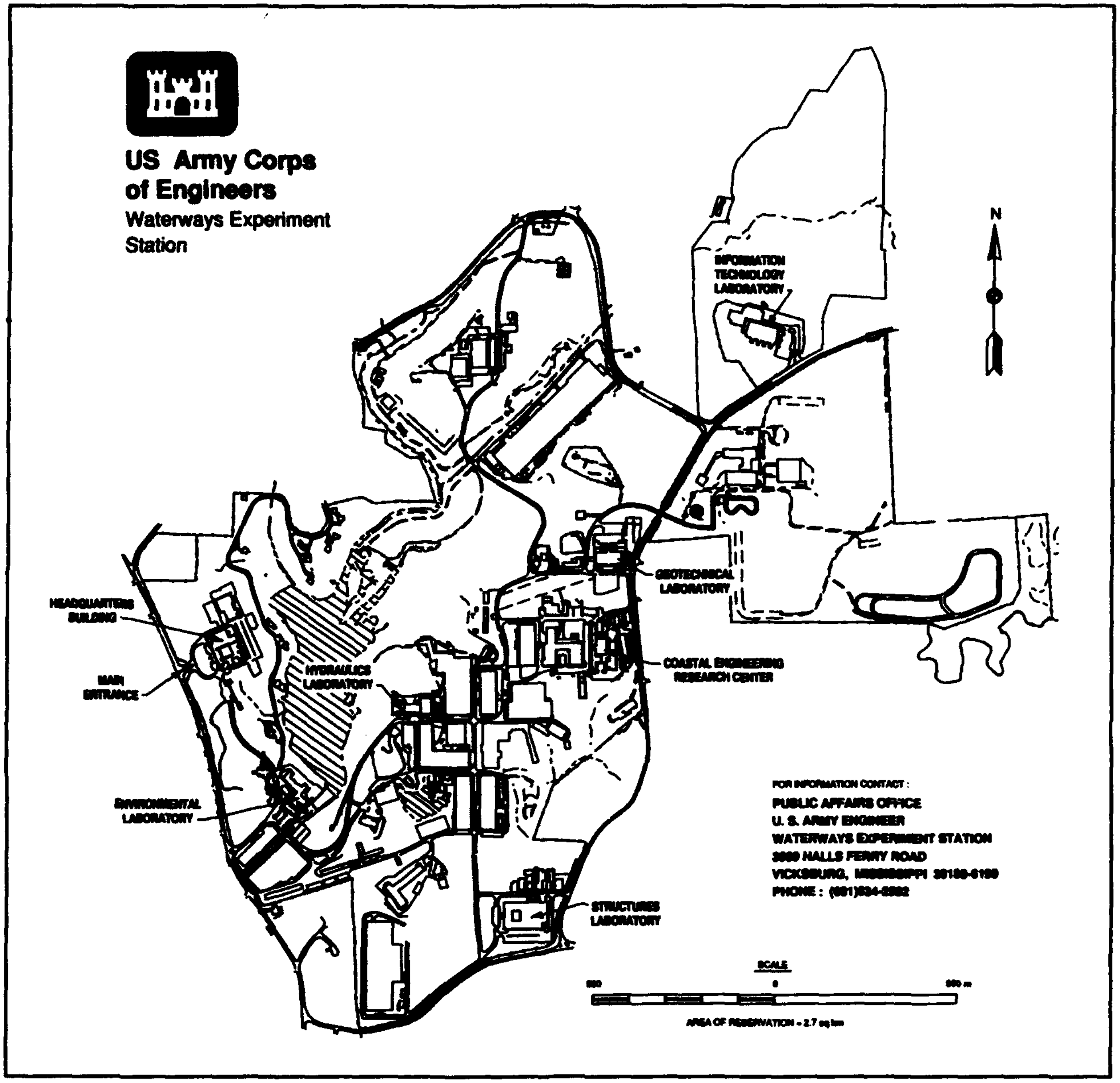
Magnus Larson

Department of Water Resources Engineering
Institute of Technology
University of Lund
Box 118, Lund S-22100, Sweden

Final report

Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000

Under Work Unit 32801



Waterways Experiment Station Cataloging-in-Publication Data

BFM : Beach Fill Module. Report 1, Beach Morphology Analysis Pac'-age (BMAP)—user's guide / by Barry G. Sommerfeld ... [et al.], Coastal Engineering Research Center ; prepared for U.S. Army Corps of Engineers.

86 p. : ill. ; 28 cm. — (Instruction report ; CERC-94-1 rept. 1)

Includes bibliographical references.

1. Coast changes — Computer programs — Handbooks, manuals, etc. 2. Shore protection — Computer programs. 3. Geomorphology — Data processing. I. Sommerfeld, Barry G. II. United States. Army. Corps of Engineers. III. Coastal Engineering Research Center (U.S.) IV. U.S. Army Engineer Waterways Experiment Station. V. Title: BFM, Beach Fill Module. Report 1, Beach Morphology Analysis Package (BMAP) — user's guide. VI. Beach Morphology Analysis Package (BMAP) — user's guide. V. Series: Instruction report (U.S. Army Engineer Waterways Experiment Station) ; CERC-94-1 rept. 1.

TA7 W34i no.CERC-94-1 rept.1

Contents

List of Figures

Preface

The work described herein was authorized as a part of the Civil Works Research and Development Program by Headquarters, U.S. Army Corps of Engineers (HQUSACE). Work was performed under the Beach Fill Engineering Work Unit 32801 of the Shore Protection and Restoration Program at the Coastal Engineering Research Center (CERC), U.S. Army Engineer Waterways Experiment Station (WES). Messrs. John H. Lockhart, Jr., John G. Housley, and Barry W. Holliday were HQUSACE Technical Monitors. Ms. Carolyn M. Holmes, CERC, was Program Manager.

This report was written by Mr. Barry G. Sommerfeld, Contract Computer Scientist, Coastal Processes Branch (CPB), Research Division (RD), CERC; Mr. John M. Mason, ASCI Corporation Contract Computer Scientist for CPB, RD; Dr. Nicholas C. Kraus, Director, Conrad Blucher Institute for Surveying and Science, Texas A&M University - Corpus Christi; and Dr. Magnus Larson, Associate Professor, Department of Water Resources Engineering, University of Lund, Sweden. Most of the analysis programs described in this report were written by Drs. Larson and Kraus as part of numerical modeling activities. Messrs. Sommerfeld and Mason modified these programs for use on desktop microcomputers and developed the operating shell and graphics routines. Mr. W. Gray Smith, CPB, RD, assisted in debugging of the software package and report preparation. Ms. Allison Abbe, CPB, RD, and Ms. Peggy T. Brown, CPB, Office of the Senior Scientist, CERC, assisted in text entry and formatting. The operating shell was designed by all of the authors. This study was performed under the administrative supervision of Dr. James R. Houston, Director, CERC; Mr. Charles C. Calhoun, Jr., Assistant Director, CERC; Mr. H. Lee Butler, Chief, RD; and Mr. Bruce A. Ebersole, Chief, CPB. Dr. Kraus was the Principal Investigator, Work Unit 32801 during the majority of the development of the software package, and Mr. Smith was the Principal Investigator at the time of publication.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

1 Introduction

Background

As part of ongoing research activities, the Beach Fill Engineering work unit of the Shore Protection and Restoration program is developing a microcomputer and work-station-based analysis software package called the Beach Fill Module (BFM). The BFM is an integrated system of analysis and graphics programs that incorporates major engineering and planning functions required in beach fill design as performed by the U.S. Army Corps of Engineers. A series of reports is planned to document the BFM and associated analysis programs.

This report is the first in the BFM series and is a user's guide for the Beach Morphology Analysis Package (*BMAP*), consisting of automated and interactive procedures to analyze morphologic and dynamic properties of beach profiles. The *BMAP* can be called from within the BFM or run as a stand-alone program. This guide provides information to operate *BMAP* as a stand-alone program under the Disk Operating System (DOS) running on a personal computer (PC).

Cross-shore modeling of storm-induced beach erosion is a central component of modern shore-protection planning. The *BMAP* is a computation utility developed at the Coastal Engineering Research Center (CERC), U.S. Army Engineer Waterways Experiment Station, to support desktop computer simulation studies of cross-shore modeling of storm-induced beach erosion for beach fill design.

Originally, *BMAP* was conceived to simplify and automate the numerical modeling work flow through analysis of the input data and results of computations from CERC's Storm-induced BEACH change model (SBEACH) (Larson and Kraus 1989; Larson, Kraus, and Byrnes 1990). Because of its utility and convenience, it has evolved to incorporate functions to inspect and analyze beach profiles and beach profile change. The *BMAP* graphical interface produces on-screen plots of user-selected profiles and calculation results that are easily exported to a printer. The present report covers Version 1 of *BMAP*, which is capable of two-dimensional analysis; that is, analysis of beach profiles. Further *BMAP* versions are planned to extend the profile analysis capabilities, the shell interface, and to perform three-dimensional analysis of beach morphology.

The *BMAP* supplies the coastal engineer and scientist, in one compact and convenient software package, with a multitude of capabilities in support of beach profile analysis and cross-shore modeling activities of storm-induced beach erosion. The objective of this report is to describe the features and operation of *BMAP*.

Chapter 7 is included to exercise and demonstrate *BMAP*. Profile survey data used in these examples were taken from two sources. One set of data was generated in a field monitoring study at Ocean City, Maryland, site of a major beach fill project. The project and data set are described in Stauble et al. (1993). The other data set pertains to the SUPERTANK Laboratory Data Collection project that was conducted with a large wave tank. The SUPERTANK project is described in Kraus, Smith, and Sollitt (1992).

Scope of Report

This report is intended to serve as a user's guide and tutorial for operating *BMAP*. All major features of *BMAP* version 1.0 are described. Chapter 1 gives the background of *BMAP*. Chapter 2 gives an overview of the functions in *BMAP*. Chapter 3 begins step-by-step tracing of *BMAP* functions with a discussion on the **Project Options Menu**. Chapter 4 contains a discussion of the various options in the **Main Menu**. Chapter 5 begins the discussion on the analysis capability of *BMAP*, continued in Chapter 6 with an explanation of synthetic profiles and how they are generated and used. Chapter 7 leads the user through a test run of *BMAP* using authentic data collected at Ocean City, Maryland, and in the SUPERTANK project. Appendix A describes the particular format of profile survey data required for use with *BMAP* and contains the data corresponding to the worked examples. Appendix B provides instructions on how to install and execute *BMAP*. Appendix C describes the conversion between the two *BMAP* profile survey data formats. Appendix D contains mathematical notation used in this report.

Name Convention

In this manual, names of keys on the PC console or keyboard are written in capital letters and enclosed in triangular brackets. Menus in *BMAP* are written in bold Roman script in reference to the menu itself or its functioning, whereas if a menu name refers to a chapter title, it is italicized.

Updates to Manual

Located on the distribution diskette is a file called README.TXT. This file contains information about modifications to *BMAP* after the printing of the manual. Please consult this file before starting *BMAP*.

2 Overview

The *BMAP* complements and is file-compatible with the Interactive Survey Reduction Program (ISRP) (Birkemeier 1984), widely used by U.S. Army Corps of Engineers personnel dealing with coastal processes and beach profile change. The ISRP was developed as an aid to beach profile survey parties and permits "...interactive reduction, editing, and plotting of field survey notes and the corrections of previously entered data" (Birkemeier 1984). In contrast, the *BMAP* is a stand-alone program that can be executed independently in support of a wide range of beach profile analysis objectives and numerical modeling studies of profile change. The *BMAP* does not contain utilities (as does ISRP) for assisting survey parties directly, but, rather, provides comprehensive data analysis capability for office studies once reduction and checking of the profile data have been completed.

Capabilities

Capabilities of BMAP 1.0 include:

a. On-screen color plotting and black and white hard copies of multiple profile surveys from one or more input files.

b. Average of multiple profile surveys between a given spatial range. Included within this option is the ability to display the standard deviation and envelope of profile change.

c. Calculation of cut and fill cells giving changes in volume between two profile surveys.

d. Fitting of an equilibrium profile for a single grain size.

e. Calculation of a cross-shore sand transport rate.

f. Calculation of bar properties, including volume, location, and height. These calculations may be performed with or without a reference profile.

g. Calculation of profile volume with respect to specified reference elevation and/or segment along the profile, with the capability to compare two profiles.

h. Specification of user-defined synthetic profiles (four different types) to be used for comparison and analysis with measured profiles.

i. Vertical and horizontal shifting of profiles.

j. Alignment of the profile origin to a specified elevation.

k. A utility to convert ISRP data files to and from free format (two-column format).

l. On-line, context-sensitive help obtained by pressing <F1>.

Calculation and graphical manipulation procedures are presently being developed for aiding beach fill design. A planned upgrade will allow mouse-controlled manual construction and modification of beach fill profile shape, from which added volume may be calculated by *BMAP* to develop optimal profile cross-section design and support advanced beach profile analysis.

Projects

The package has the option of storing data and associated parameters into uniquely named files called "projects," allowing different users to access *BMAP* on the same computer system in analysis of the same or a different project with a common or different subset of a database. Projects would usually contain particular profile surveys for a specific location and different times in the case of field data. In analysis of laboratory data, such as for SUPERTANK, a project might correspond to a single test involving surveys of profiles generated under the same wave conditions and water level. The advantage of defining projects is that one may have a data file which contains a large amount of data with some profile surveys unrelated to other profiles within the same file; definition of projects readily gives accessibility to a subset of the large file, hence allowing the user to functionally separate the file and group profiles for like locations, times, or test.

Each project must consist of a project file name, the input file name, the length unit, and multipliers related to the number of significant digits for the horizontal and vertical coordinates. Typically, the project consists of one or more profiles from the input data file. The project may also contain output profiles that have been generated by *BMAP* and may be saved to disk.

Keyboard Functions

The *BMAP* is operated through a series of menu screens and data edit screens. The *BMAP*'s menu structure is described at length in Chapters 2 through 6. The most widely used keys that control the system are now reviewed.

ESCape

Perhaps the most often used key in *BMAP* is the ESCape key, <ESC>. Pressing the ESCape key on a menu returns the user to the previous menu. The ESCape key also provides the method of exiting *BMAP*. When the current menu is the **Project Options Menu** (described in subsequent chapters), and the user presses <ESC>, *BMAP* prompts for confirmation of the request to exit.

ALT-S and ALT-X

In most data edit screens, i.e., screens where data are entered by the user, the <ALT-X> key terminates the current process without saving changes and takes the user to the previous menu screen, distinguishing it in function with the <ALT-S> key in such screens. The <ALT-S> key exits the data edit screen and saves all changes before performing the next task.

ENTER

In menu screens, the <ENTER> key is pressed to make a selection. In most data edit screens, the <ENTER> key moves the cursor to the next field, if it is not the last field. If the cursor already rests upon the last field, pressing the <ENTER> key usually saves the data entered and performs the corresponding calculations.

ALT-I, ALT-D, ALT-M, TAB

Some keys are unique to the data edit screens, e.g., the **Load Profile Menu** discussed in a later chapter. In these screens, <ALT-D> deletes the current line, <ALT-I> inserts a line, <TAB> moves one column to the right, <SHFT-TAB> moves one column to the left, down arrow moves one line down, and up arrow moves one line up. The <ALT-M> key toggles how *BMAP* handles the command to insert a line (<ALT-I>). Upon entering the **Load Profile Menu**, pressing <ALT-I> causes *BMAP* to insert a line before the current line. Pressing <ALT-M> causes lines to be inserted after the current line when <ALT-I> is pressed. These conventions are consistent for all data edit screens except for the **Output Profile Menu** where <ALT-I> and <ALT-M> are deactivated because all output profiles are generated by *BMAP*.

<ALT-P>

Whenever a graph appears on the screen, the user has the option of obtaining a hardcopy of the graph to an HP Laserjet II-compatible printer. Pressing <ALT-P> on such screens plots the graph to the printer.

<ALT-R>

Whenever data result from calculations, *BMAP* allows the user to save the data to a file or print a copy on the attached printer. If the user presses <ALT-R> in such a case, *BMAP* prompts the user of the destination, i.e., file or printer. If the user chooses file, *BMAP* requests that the user enter the file name. This file name must be a valid DOS file name. No directory should be entered, however. *BMAP* automatically saves all output to the project's data directory specified in the **Project Parameters** screen. If the user chooses printer as the destination, the results immediately are sent to the printer.

<F1>

BMAP is equipped with on-line, context-sensitive help. To obtain help for any option in *BMAP*, you should press <F1>, and a help screen pertaining to the current function will be displayed. For more general help, press <F1> again.

Output Profiles

Whenever calculations are performed and a profile is generated from those calculations, the user may wish to save that profile for later inspection. The *BMAP* provides a way of saving output profiles. Figure 1 shows a sample of the message displayed by *BMAP* after output data have been generated by some means. *BMAP* automatically assigns to all generated graphs a two-letter descriptor followed by a number that is incremented by one for each graph of the same type. Following are the two-letter descriptors and the respective option that generates these output data:

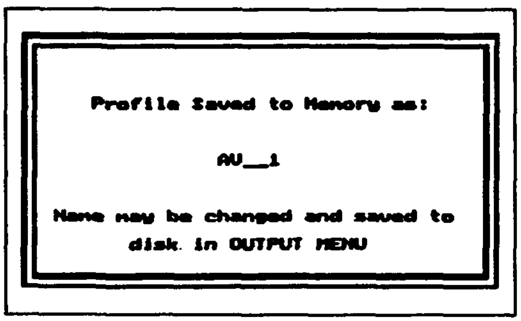


Figure 1. Output profile saved screen

a. ZM - **Zoom Profiles.**

b. AV - **Averaging.**

c. EV - Envelope of profile change (generated by **Averaging** routine).

d. SD - Standard deviation (generated by **Averaging** routine).

e. HA - **Horizontal Alignment.**

f. LS - **Least-Square Estimate.**

g. TL - **Translation.**

h. TR - **Transport Rate.**

i. EP - **Equilibrium Profile.**

j. IP - **Interpolated Profile.**

k. MP - **Modified Equilibrium Profile.**

l. PS - **Plane-Sloping Profile.**

Consult the section entitled *Output Profiles Menu* for more information about output profiles and the way they are stored.

Data Format

BMAP input files presently must be formatted to the specifications associated with ISRP, a format more commonly known as "ISRP format." If output profiles are stored to disk, they are also saved in ISRP format so they may be loaded into *BMAP* as input. See Appendix A for an explanation of ISRP format. A conversion utility allows *BMAP* to access and convert between ISRP and two-column free format files. See Appendix C for a discussion of the conversion utility and the format of these files.

BMAP Menus

The *BMAP* operates through a series of self-explanatory menus. One chapter of this report is devoted to each of the individual menus.

As an overview, Figure 2 shows the hierarchy of menus. The **Project Options Menu** is the initial menu encountered and serves as *BMAP*'s internal file handling system, performing such basic functions as loading data, and

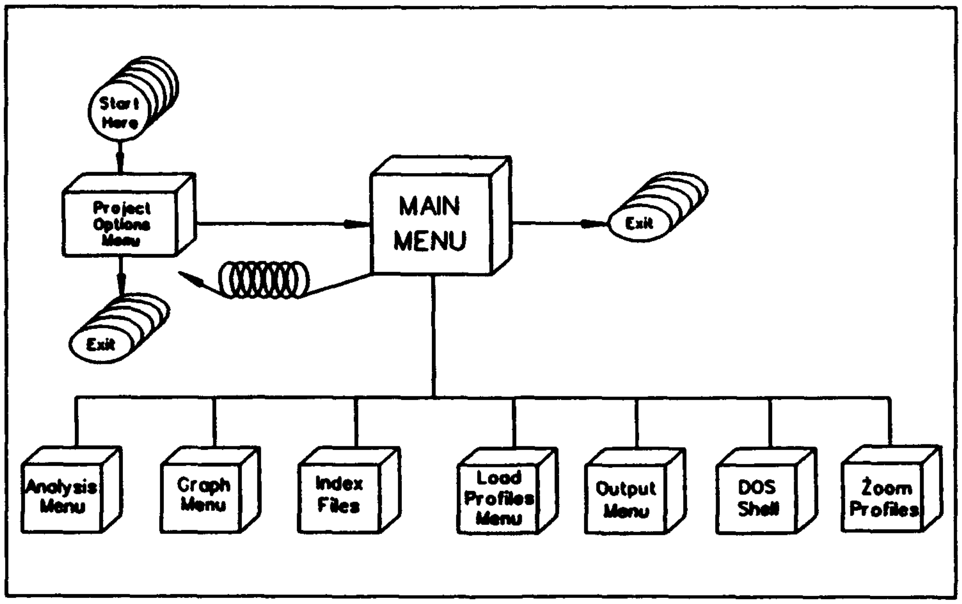


Figure 2. Menu structure of the *BMAP*

creating, copying, and deleting work projects. The **Main Menu** is the "control center" that leads to the possible routes of analysis, graphics, and input and output of data. *BMAP* is also exited through the **Main Menu** and the **Project Options Menu**.

The remainder of this report concerns the functioning of all selections or capabilities listed on the menus.

3 Project Options

The concept of "Projects" was discussed in the previous chapter. In this section, the user will learn how to create and manipulate projects.

Creating Projects

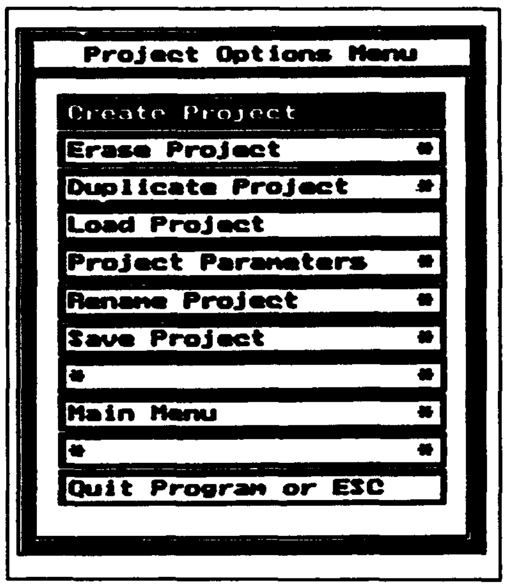


Figure 3. Project Options Menu

After typing *BMAP* from the DOS command line, the **Project Options Menu** appears, as shown in Figure 3. Several selections or options are displayed; however, because you have just entered *BMAP*, only two options are available, **Create Project** or **Load Project**. If you are planning to begin a new project, or if this is the first time you have entered *BMAP*, you will probably wish to create a project.

Once **Create Project** has been selected, you are prompted to enter the project name. This name should be no longer than eight characters and must be a valid DOS file name. Do not enter an extension, however, because *BMAP* automatically appends the extension ".prj" to all project names for storing to your hard disk.

Parameters

After entering the project name, the **Parameters** menu is displayed (Figure 4). The first field of this menu is the data directory field. This directory should be the directory where *all* input data files for this project reside. This is also the directory to which *BMAP* saves all output information. The next

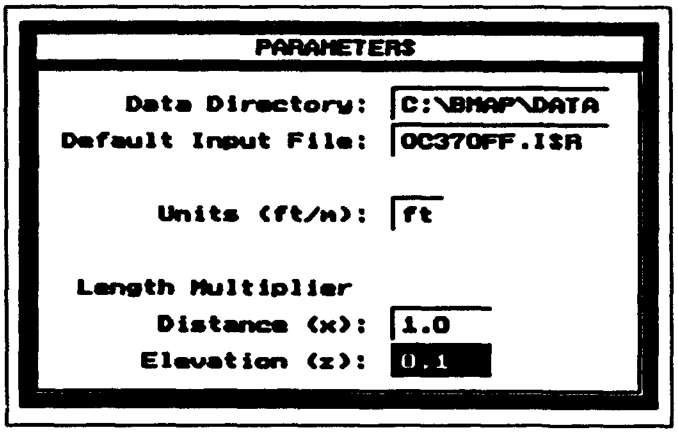


Figure 4. Sample **Project Parameters** screen

field is the *default* input file. This is helpful if most or all of the profiles for this project come from the same data file. Entering the name of the valid *ISRP* file here will avoid retyping the file many times when loading the profiles. No directory should be entered here as the file must be in the data directory specified above. If this is the first time *BMAP* has accessed this file, the file is indexed. Depending upon the size of the data file, indexing may take a while, but this one-time wait will save much time in future calculations to be performed. In the units field, tell *BMAP* whether project data were recorded in meters or in feet[1]. Enter the horizontal (distance, x) and vertical (elevation, z) length multipliers in the next two fields. These multipliers allow flexibility in precision. Standard *ISRP* format allows no significant digits for x and one significant digit for z. The default multipliers corresponding to standard ISRP format are 1.0 for x and 0.1 for z. In many applications, greater precision is available, so *BMAP* allows user-specified multipliers. For example, if profile data are stored with one significant digit for x and two significant digits for z, enter 0.1 for x and 0.01 for z.

Loading profiles

Following the **Parameters** screen is the **Load Profile Menu** (Figure 5). This menu allows you to enter the unique identification information for each profile from the input file.

Each profile is identified by four external attributes: file name, identification (ID) (five characters), date, and time. By pressing <ALT-L>, you are able to view these attributes for all the profiles in the file (Figure 6). You may then scroll with your cursor keys and tag each profile you wish to load by pressing <ALT-T>. Pressing <ALT-T> twice on the same profile untags it. When you have completed making your selection, press <ALT-S> to return to the **Load Profile Menu**. BMAP automatically copies the tagged information to the **Load Profile Menu**. Pressing <ALT-X> returns the user to the **Load Profile Menu** without copying the information. Change to a different file by changing the name of the file on an empty line. Pressing <ALT-L> after

[1] One foot in American customary units equals 0.3048 meter in metric units.

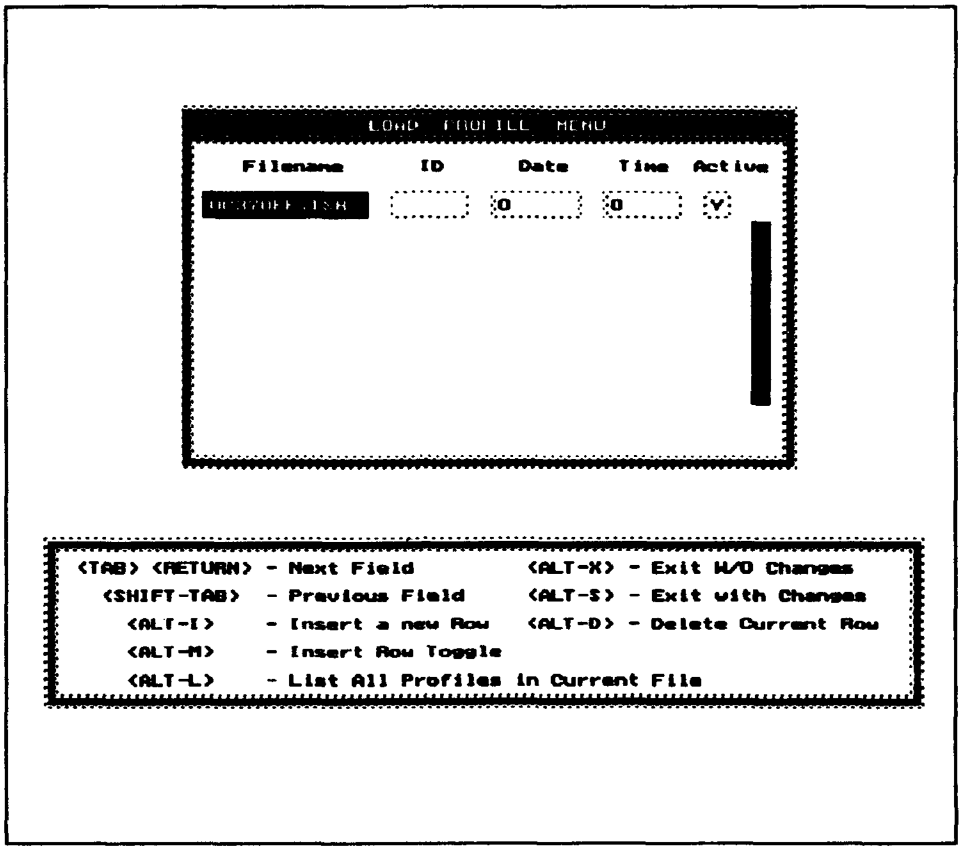


Figure 5. **Load Profile Menu**

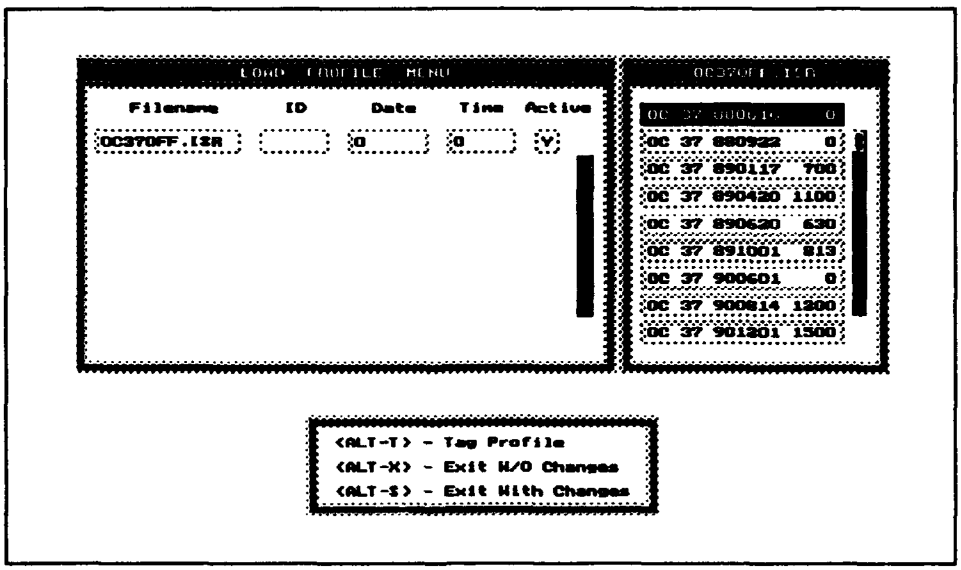


Figure 6. Example of profile listing

making that change causes *BMAP* to display the profile information of the new file.

There is another field attribute, internal to your particular *BMAP* session and attached to each profile, called **Active** or **Activate**. In many *BMAP* analysis procedures, you are given the option of performing calculations with selected profiles (called "active profiles"). It is in the **Load Profile Menu** that you are able to activate them, thereby allowing you to isolate work to a subset of your larger project data set.

Within the **Load Profile Menu**, the following keystrokes apply:

a. <ALT-D> - Delete current row.

b. <ALT-I> - Insert row.

c. <ALT-M> - Toggle insert mode (initially, a row is inserted after current row when <ALT-I> is pressed. Pressing <ALT-M> toggles the insertion point to be before the current row.).

d. <TAB>
or <RETURN> - Move right one field.

e. <SHFT-TAB> - Move left one field.

f. <Up Arrow> - Move up one row.

g. <Down Arrow> - Move down one row.

h. <ALT-X> - Exit without saving changes.

i. <ALT-S> - Save and exit.

j. <ALT-L> - List profiles in current data file.

k. <ALT-T> - Tag current profile in the profile listing.

After all requested profiles have been loaded and activated as required, *BMAP* places you in the **Main Menu**, ready to perform calculations and to plot profiles.

Erase Project

When you choose this option within the **Project Options Menu**, the current project is erased from the disk and is removed from the *BMAP* session. After the project has been erased, you must either load a new project or create a new project before proceeding.

Note: Only the project file is erased with this option. Because input files and their associated index file are used for multiple projects, these files are not erased. Output files associated with the erased project will likewise remain on the hard drive, as it is not uncommon for output files to be used to produce graphs external to BMAP.

Duplicate Project

This option allows you to copy the contents of the current project into another project file. When prompted for the file name, you should enter a maximum of eight characters. The name must be a valid DOS file name, but no extension should be given, as *BMAP* automatically appends the extension ".prj" to all projects. This aids in quick creation of a new project that has parameters similar to those of another, existing project.

Load Project

This option displays all projects in the current directory. You may then use your cursor keys (or mouse) to choose the project you wish to load. If you have not saved the project on which you have been working, you are queried as to whether or not you wish to save the project and/or the output profiles, if any. **Load Project** loads all the previously saved parameters of the associated project and places you in the **Main Menu** ready for calculations.

Rename Project

This option allows you to rename the current project. The name of the project should be no more than eight characters long and must be a valid DOS file name. No extension should be added, as *BMAP* automatically appends the extension ".prj" to all project names.

Save Project

The **Save Project** option saves the project currently in memory to disk. It is stored on disk as the name of the project (already specified) with the extension ".prj." If output profiles have been generated in the current session, but have not been saved to disk, *BMAP* allows you to do so at this time before the project is saved. If output profiles are not stored on disk, they are not kept within the project file when saving the project.

4 Main Menu

After a project has been created or loaded into memory, you are ready to start performing calculations and other tasks such as viewing and cleaning data and making graphical comparisons. At this point you are brought to the **Main Menu** (Figure 7). The **Main Menu** serves as an intersection and junction to other menus and basic operations.

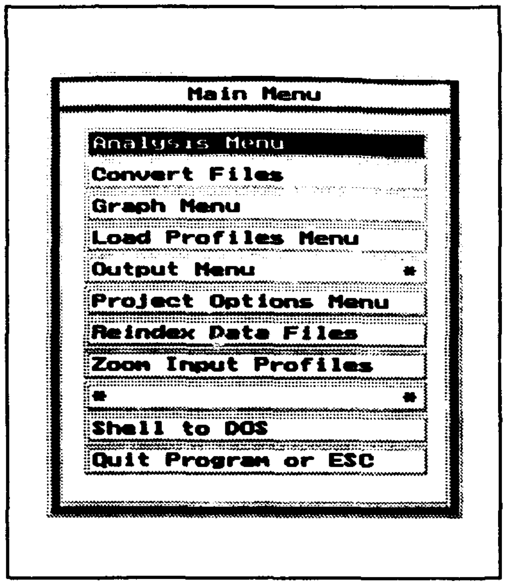


Figure 7. **Main Menu**

Analysis Menu

Choosing this option places you in the **Analysis Menu**, where all calculations are performed. For an extended discussion on available calculations, see Chapter 5, "Analysis."

Convert Files

BMAP allows the user to conveniently convert free format files to *ISRP* files so that they may be used in *BMAP*. The user may also convert *ISRP* files to free format so that they may be used in other applications such as spreadsheet packages. When the user chooses **Convert Files** from the **Main Menu,** the **Convert Files** screen is displayed (Figure 8). The user chooses the option desired. *BMAP* then allows the user to enter the respective file names. If *BMAP* successfully converts the file, it displays a message. If there is an error, *BMAP* notifies the user. Errors typically occur if the free format file is not consistent with *BMAP*'s free format. See Appendix C for an explanation of the *BMAP* free format.

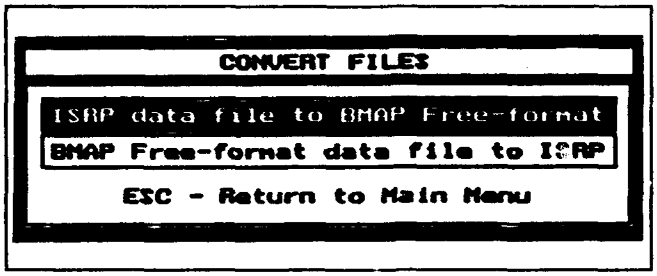


Figure 8. **Convert Files** screen

Graph Menu

Choosing this option places you in the **Graph Menu,** which provides various options for graphing the profiles in memory. *BMAP* offers four options for graphing profiles (Figure 9). Choosing **All Profiles** displays all input profiles (both active and inactive) and all output profiles located in memory. Choosing **Input Profiles** displays all input profiles (both active and inactive). To display only the output profiles, you should choose **Output Profiles.** By choosing Active Input Profiles, you receive a graph of all input profiles that have been tagged as active in the **Load Profile Menu.**

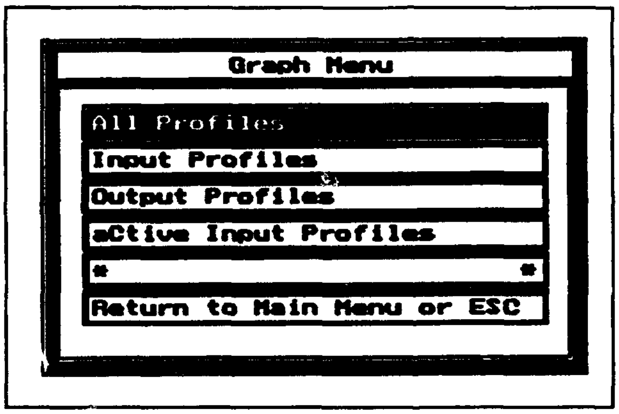


Figure 9. **Graph Menu**

Load Profile Menu

This option allows you to load the profile data into memory. For an extended discussion on loading profiles, see the section entitled *Loading Profiles* in Chapter 3, "Project Options."

Output Menu

After a calculation is performed and a new profile results, *BMAP* stores the profile (called an "output profile") to memory under a unique name. The data associated with this profile are stored only to memory. In order to store such profiles to the hard drive you must select **Output Menu** from the **Main Menu.** Figure 10 shows a sample session with the **Output Menu** selected.

Figure 10 displays the **Output Profile** screen before any editing has been done. Note that the names (file names if stored to disk) are blank at this time, and the ID information has limited meaning apart from the fact that each calculated profile has a unique two-letter prefix. In this case there are five

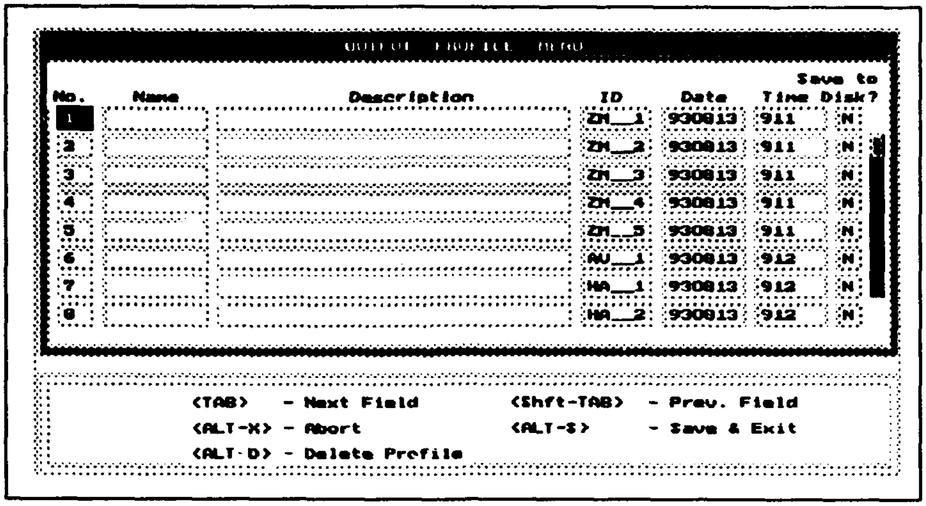


Figure 10. Sample **Output Profile Menu**

"zoomed profiles" (profile data calculated by zooming on the input profiles), an "average profile" (profile data calculated by averaging one or more input profiles), and three "horizontally aligned profiles" (profile data produced by requested alignment of input profiles). For a listing of each two-letter identification and its corresponding function, consult the section entitled *Output Profiles* in Chapter 2. All file names may be changed in this menu to be more descriptive to the user. The file name must be a valid DOS file name. No extension should be entered as *BMAP* automatically appends the extension "prf" to output data files. The user should not enter a directory as *BMAP* stores all output data to the data directory of the project. A description may also be included. All parameters here are saved to an ISRP data file. The descriptions are saved to the project file if the project is saved. Figure 11 shows the same set of output profiles, but the descriptive information has now been changed.

Output profiles may also be deleted from the list, as well as from memory, by pressing <ALT-D>. Figure 12 shows the same set of output profiles, but this time "AV__1" (No. 6) has been deleted, not being required by the user.

To exit this menu, saving all modifications to disk, press <ALT-S>. To abort without saving any changes, press <ALT-X>.

Project Options Menu

The **Project Options Menu** allows you to enter all associated parameters pertaining to a project and to save these parameters. You may also erase, duplicate, and rename projects in this menu. For a detailed discussion on the **Project Options Menu**, see Chapter 3, "Project Options."

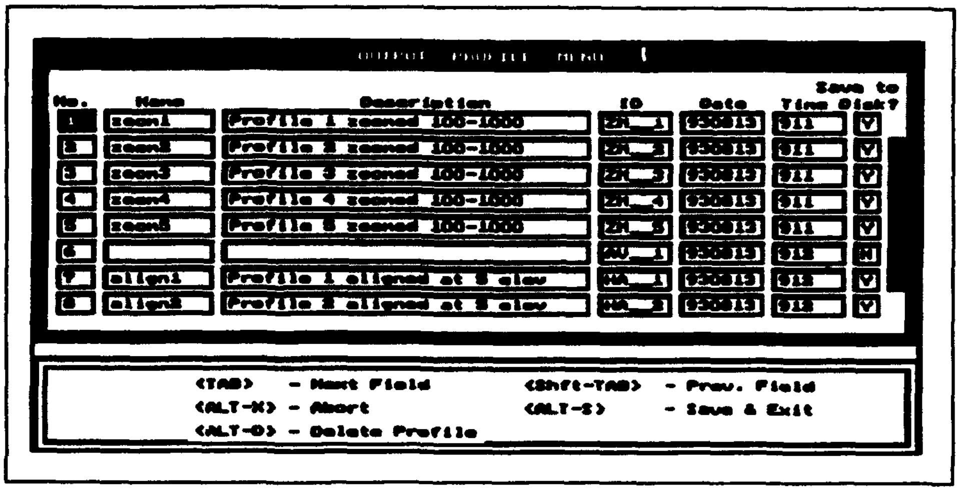


Figure 11. Modified **Output Profile Menu**

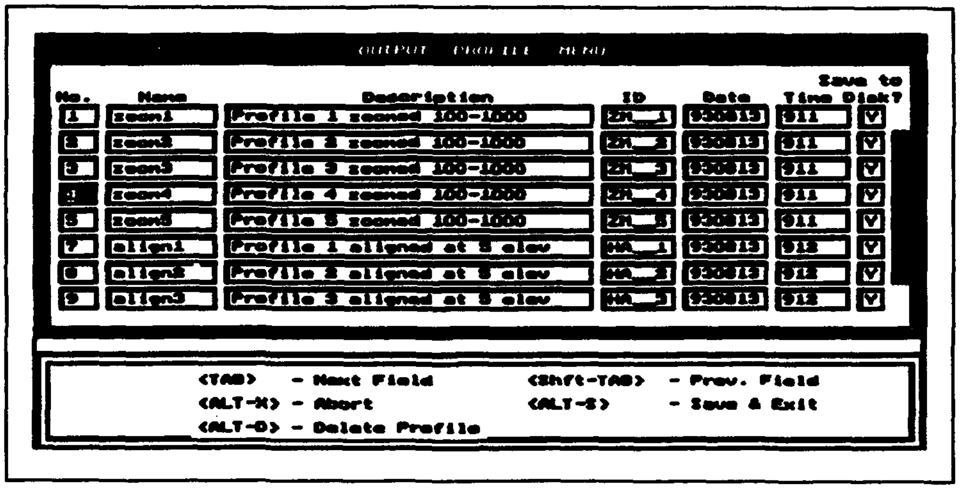


Figure 12. Profile deleted from **Output Profile Menu**

Reindex Data Files

The *BMAP* makes use of index files to reduce time spent reading from and writing to the hard drive. Each data file that is used by *BMAP* has an associated index file. Occasionally, these files may become invalid due to the addition or deletion of profiles from the input or output files. If you are experiencing problems with profiles seeming incorrect, you should re-index your files before proceeding.

Shell to Operating System

This option allows you to go to DOS and perform DOS applications without exiting *BMAP*, while keeping all current parameters in memory. When you have completed your DOS tasks, you may type "exit" at the command prompt, which brings you back in the **Main Menu** of *BMAP* where you left off.

Zoom Profiles

Occasionally the user wishes to inspect more closely a section of a plot of profiles in order to make better decisions. The **Zoom Profiles** option has been included in *BMAP* specifically for that purpose.

Upon choosing **Zoom Profiles**, you are presented with a graph of all active input profiles. A screen to the right of the graph requests you to enter values for the parameters XON and XOFF. These are the beginning and ending points on the horizontal axis. After these values have been entered, *BMAP* shows this section on the graph, i.e., every data pair whose x-value is greater than or equal to XON and less than or equal to XOFF. No interpolation is performed for this option. Note that the value of XON must be less than the value of XOFF. Any of the **Zoom Profiles** may be saved to disk within the **Output Menu**.

5 Analysis

After you have selected **Analysis Menu** (Figure 13) from the **Main Menu**, you are ready to begin calculating with the active profiles. You should now make your choice as to which type of calculation procedure you would like to access.

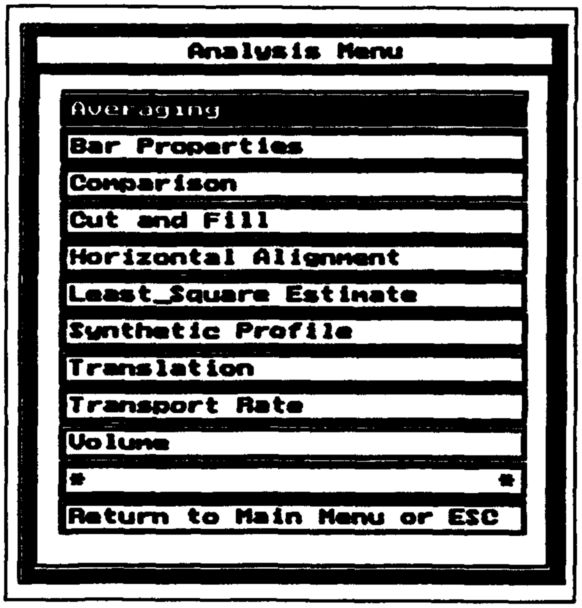


Figure 13. Analysis Menu

Averaging

This option averages all active profiles, creating one output profile that is given the temporary name "AV###," where ### is the sequential number in the order of averaged profiles created. (For an explanation of Active Profiles, see section entitled *Loading Profiles* in Chapter 3, "Project Options."). Once you select this option, plots of all active profiles are displayed on the screen, and *BMAP* prompts you to enter **Xon**, **Xoff**, and **Dx**. **Xon** is the position on the *x*-axis where you wish to begin averaging; **Xoff** is the position on the *x*-axis where you wish to terminate averaging; and **Dx** is the interval increment for the calculation of the average profile and determines the number of points that will be contained in the output (average) profile. As at any time in *BMAP* when a graph appears on screen, you have the option of printing the graph to your printer. By pressing <ALT-P>, you will receive a hard copy of the screen graph. You are now ready to enter the parameters.

Average, Envelopes, and Standard Deviation

After you have entered values for the parameters, and calculations have been performed, *BMAP* displays the output profile. You now have six options. First, you may redisplay the original input profiles. You may display the input profiles with the standard deviation. The average profile may also be displayed. The user may plot the average profile along with the standard deviation, minimum and maximum envelopes, or both. Once again, for any of these plots you may either press <ALT-P> to obtain a hard copy of the profiles, or you may press <ESC> to return to the **Analysis Menu**. Once you press <ESC>, *BMAP* informs you that it has saved the output profiles to memory. It also displays the default names to which they have been saved. For a listing of each two-letter identification and its corresponding function, consult the section entitled *Output Profiles* in Chapter 2. You may later wish to change the default names as well as save them to your hard disk. This can be done in the **Output Menu**. Consult the *Output Menu* section in Chapter 4, "Main Menu" for instructions on output profiles.

Bar Properties

In this section, you are able to determine various properties pertaining to a bar including minimum depth and location, maximum height and location, volume, and the distance to the center of mass.

The *BMAP* provides two different ways to calculate bar properties. If you have an adequate equilibrium profile associated with the profile containing the bar, you may wish to perform calculations with the equilibrium profile as the reference profile (Larson and Kraus 1992). Choose **With a Reference Profile** from the **Bar Properties Menu** (Figure 14). If you do not have an adequate equilibrium profile associated with the profile containing the bar, choose **Without a Reference Profile**. This option requires you to estimate beginning and ending points of the bar.

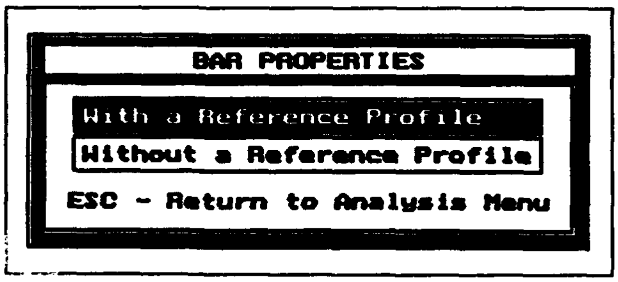


Figure 14. **Bar Properties Menu**

Using a reference profile

If you choose to use the reference profile, you are prompted to specify the source of this profile (Figure 15). If the profile has been loaded from your input file, choose **Input File**; if it has been generated by *BMAP*, e.g., a Dean equilibrium profile (Dean 1977), choose **Output File**.

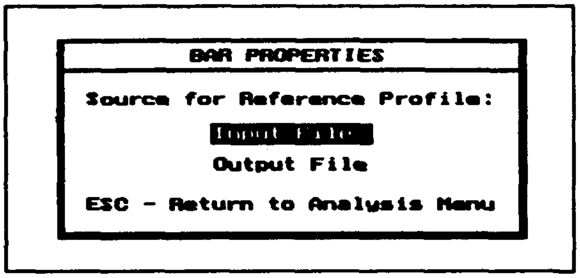


Figure 15. **Reference Profile Source Menu**

Once the source file for the profile is chosen, *BMAP* graphically displays all the profiles (either input or output) which it has loaded into memory. Inform *BMAP* of your choice by moving the box to the correct profile and pressing <ENTER>. You must perform the same operation for the profile containing the bar (specific profile).

Once you have chosen both profiles, *BMAP* plots them to the screen and displays a menu of crossing points from which you may choose **Xon** (shoreward crossing point) and **Xoff** (seaward crossing point). In order to locate these cross pairs, *BMAP* has found where the target profile intersects the reference profile such that the elevation of the next point is greater than the reference profile's elevation at the next point. However, before this intersection is included in the list of cross pairs, there must be a corresponding second intersection where the target profile's elevation at the next point is less than that of the reference profile. These two intersections define a bar and therefore may be considered a valid pair. It is common for multiple pairs to occur on the lower portion of the profile survey, and the plot on the screen allows one to recognize the pair corresponding to a well-defined bar. When you have found the corresponding pair, use the cursor key to move the selection bar to that pair and press enter. The *BMAP* proceeds to perform the calculations and returns results.

Omitting the reference profile

If an adequate equilibrium profile is not available for the corresponding profile containing the bar, or manual definition is desired, *BMAP* provides the opportunity of specifying the starting and ending positions of a bar. This is done by visual estimation.

Upon selecting **Without a Reference Profile**, you must choose your profile containing the bar (specific profile). See note above under *Using a reference profile* concerning choosing profiles.

Once you have chosen the profile, *BMAP* displays it on the screen, and you must now enter the starting and ending points of the bar (**Xon** and **Xoff**). Bar volume will be calculated with respect to a straight line connecting the two points (Keulegan 1948). The *BMAP* then plots the resulting reference line under the bar so you may determine the reasonability of the calculations. It also returns all other results. If you wish to save this information, you may press <ALT-R> for a report. The *BMAP* asks if you wish to send the report to a file or a printer. If you choose file, you must enter the file name. You should not enter the directory because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer.

If the requested **Xon** and **Xoff** positions do not seem reasonable, you may press <ENTER>, and *BMAP* gives you the opportunity to try again. When you have finished, you should press <ESC> to return to the **Analysis Menu**.

Cut and Fill

The **Cut and Fill** option is similar to that found in ISRP and calculates losses and gains, respectively, in volume. Cut and fill areas are determined with respect to distance across shore in cells defined by successive intersections of two profiles, or by the most landward and most seaward common points of survey data along the profiles for the first and last cells if there is no intersection at the beginning and end of the profiles. Two profiles must be chosen to perform the cut and fill calculation. Refer to the subsection in this chapter entitled *Using a reference profile* under the section entitled *Bar Properties* for instructions on how to choose profiles.

Once the two profiles are chosen, *BMAP* calculates and displays the results in two windows. The window on the right side of the screen contains the most landward and most seaward distances common to both profiles, called **Xon** and **Xoff**, volume change above and below the datum taken to be 0, change in shoreline position at the datum, and the starting and ending positions of the zero-depth contour. The bottom window displays the following information for each cut and fill cell: distance to the seaward end of the cell, elevation of the seaward end of the cell, cell volume (including a sign), average cell thickness (including a sign), cumulative volume, and gross volume. If there are more than three cells, additional cells are viewed by scrolling through the window with the UP and DOWN arrow keys. The cumulative volume at the last cell would be zero if there were sand conservation across shore; that is, if the sum of all cut volumes equalled the sum of all fill volumes. The gross volume, which is the sum of the absolute values of all cut and fill volumes, gives an indication of profile change or "activity" of the profile. If you wish to save the information, press <ALT-R> for a report. The *BMAP* asks for the target device as a file on disk or a printer. If you choose file, a file name is required. The directory should not be entered because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Profile Comparison

Profile comparison calculates volume change and contour change between two profiles given specified contour elevations. You must first choose the profiles for comparison. See the subsection entitled *Using a reference profile* under the section *Bar Properties* above for instructions on how to choose profiles.

Once the profiles are chosen, the contours to be compared should be specified. You may enter multiple contours. Enter the first contour, and, if you desire to enter a second, press <ALT-I> to insert another row. When you have entered the last requested contour, press <ALT-S> to begin calculating. *BMAP* displays the volume and contour change of each contour. If you wish to save this information, press <ALT-R> for a report. *BMAP* asks if you wish to send the report to a file or a printer. If you choose file, you must enter the file name. Do not enter the directory because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Horizontal Alignment

Sometimes it becomes necessary to shift profiles back and forth so that they cross at a specific elevation (the most shoreward elevation is used if the chosen elevation occurs several times along the profile). For example, a natural elevation on which to align profiles would be zero elevation, i.e., the shoreline or datum plane. After selecting an alignment elevation, the horizontal (distance) coordinate will begin at the profile elevation chosen for the alignment. The horizontal alignment location may be selected from the profiles or assigned as required. The *BMAP* offers this option in **Horizontal Alignment**.

Horizontal Alignment plots all active profiles and prompts you to enter the alignment factor, the elevation to which the profiles will be aligned. Once this is entered, *BMAP* aligns all the profiles to that location and stores them temporarily in memory. You may later choose **Output Menu** from the **Main Menu** to store them to your hard drive. See section entitled *Output Menu* in Chapter 4, "Main Menu" for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Least-Square Estimate

This option generates a best-fit equilibrium profile to a given profile. The target profile must first be chosen to which the equilibrium profile will be fit. See the subsection entitled *Using a reference profile* under the section entitled

Bar Properties above for instructions on how to choose profiles. After you have chosen the profile, enter the beginning (**Xon**) and ending (**Xoff**) points of the generated profile. As a default, **Xon** is automatically computed as the location where the profile crosses the zero elevation. You have the option of changing this value. *BMAP* generates the best-fit profile and plots it on top of the reference profile. It also displays the *A*-parameter (shape parameter for the equilibrium profile), the correlation coefficient squared R^2, and the grain size d_{50}. The relation between A and d_{50} is calculated from data given by Moore (1982) as implemented by Hanson and Kraus (1989). The resulting best-fit profile is stored temporarily in memory. You may later choose **Output Menu** from the **Main Menu** to store it to your hard drive. See the section entitled *Output Menu* in Chapter 4, "Main Menu" for a discussion on storing output profiles. If you wish to save the other data relating to the least-square estimate, e.g., *A*-parameter, coefficient, and grain size, press <ALT-R> for a report. The *BMAP* asks if you wish to send the report to a file or a printer. If you choose file, you must enter the file name. Do not enter the directory because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Synthetic Profiles

The *BMAP* offers the option of generating synthetic profiles given certain parameters. This may be done in the Synthetic Profile Menu. See Chapter 6, "Synthetic Profiles," for detailed instructions concerning synthetic profiles.

Translation

Translation allows you to shift profiles vertically and horizontally a specified distance. The *BMAP* displays all active profiles and prompts you to enter the vertical and horizontal shift (for a discussion on active profiles see the section entitled *Loading Profiles* in Chapter 3, "Project Options"). The *BMAP* shifts all the profiles the specified distance and stores the results temporarily to memory. You may later choose **Output Menu** from the **Main Menu** to store them to your hard drive. See section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Transport Rate

This option computes the cross-shore transport rate from the starting point of two profiles to the ending point. The transport rate is calculated by integrating the equation for conservation of sand (Larson and Kraus 1989). First choose two profiles for calculations. See the subsection above entitled *Using a reference profile* in the section entitled *Bar Properties* for an explanation on choosing profiles. You are then prompted to enter **Dx** (horizontal increment factor) and the time difference, in decimal hours, between two profiles. A default time difference is automatically computed by *BMAP*, which looks at the dates and times of the profiles. You have the option to change this value if needed, e.g., if only dummy time information is contained in the header. A plot of the resulting transport rates is then displayed together with additional information on maximum and minimum transport rates and their locations. The *BMAP* also displays the transport rate at the most seaward point. The transport rate is stored temporarily to memory. You may later choose **Output Menu** from the **Main Menu** to store the rates to your hard drive. See section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. If you wish to save the other data relating to the transport rate, you may press <ALT-R> for a report. *BMAP* asks if you wish to send the report to a file or a printer. If you choose file, you must enter the file name. Do not enter the directory because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Volume

There are two options for *BMAP* to compute profile volume. You may specify a section of the profile along which *BMAP* computes the volume between the entered values of **Xon** and **Xoff**. Another option is to specify a contour above which you wish to compute volume. These options are illustrated schematically in Figure 16.

If you choose **From Xon to Xoff**, *BMAP* prompts you for three parameters: the starting point of the section (shoreward point or **Xon**), the ending point of the section (seaward point or **Xoff**), and zero elevation. If you choose instead **Above a Chosen Contour**, you are prompted to enter that contour. In either case *BMAP* computes the volume of each active profile and displays it, along with the contour location, if applicable, for each profile, in a data screen to the right of the graph, which you may scroll to view all volumes. If you wish to save this information, you may press <ALT-R> for a report. *BMAP* asks if you wish to send the report to a file or a printer. If you choose file, you must enter the file name. Do not enter the directory because *BMAP* automatically stores the file in the data directory of the project. If you choose printer, *BMAP* immediately begins to print the report to your connected printer. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

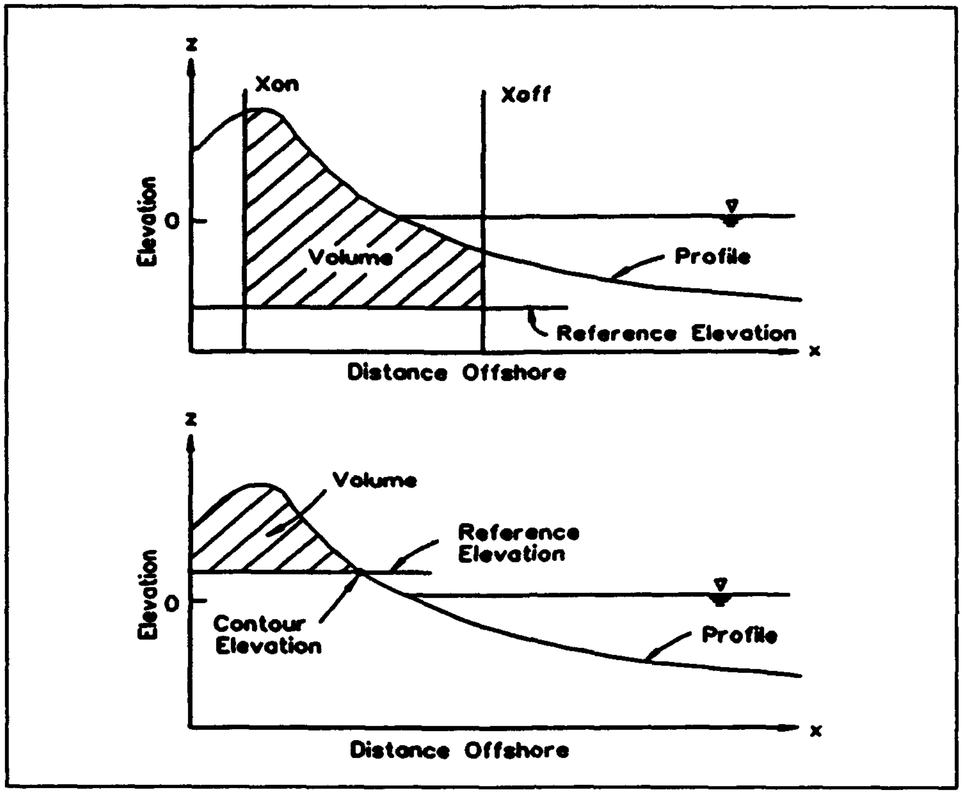


Figure 16. Definition sketch for the profile volume calculation

6 Synthetic Profiles

Not only does *BMAP* produce profile data generated from various calculations performed upon other profiles, but it also provides an option for creating artificial profiles defined by certain parameters. Here we discuss the available synthetic profiles and how they are generated.

Equilibrium Profile

The equilibrium profile has been made popular by Dean (1977, 1991) and is a concave monotonic profile given by the power-law relation

$$h = Ax^{2/3} \tag{1}$$

where h is water depth, A is the shape parameter, or simply, A-parameter, and x is distance offshore from the shoreline. The shoreline is defined as h=0 and x=0 by this simple equation. The A-parameter is a function of median grain size (Moore 1982). An equilibrium profile can be generated by specifying either A directly or by specifying the median grain size d_{50} from which *BMAP* determines the required value of A.

Upon choosing **Equilibrium Profile**, *BMAP* queries for the parameters needed to produce the equilibrium profile (Figure 17). These parameters are: **Xon** (the beginning horizontal position or shoreline), **Xoff** (the ending horizontal position), **Dx** (horizontal increment), choice between grain size (option G) or A-parameter (option A), and the median grain size value d_{50} or A-parameter value (whichever was chosen).

After all parameters have been entered, *BMAP* displays the generated equilibrium profile, which is stored to memory under the displayed name. You may later choose **Output Menu** from the **Main Menu** to store it to your hard drive. See section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

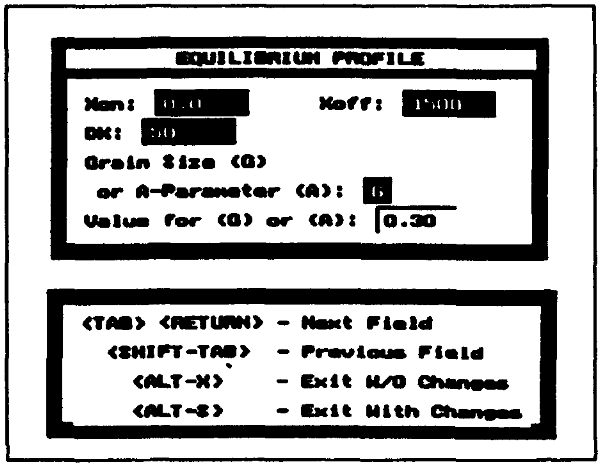


Figure 17. Sample equilibrium profile screen

Interpolated Profile

This option of *BMAP* allows you to interpolate a selected profile already in memory. After you have selected **Interpolated Profile**, you must choose the profile which is to be interpolated. For a discussion related to choosing profiles, see the subsection entitled *Using a reference profile* under the section entitled *Bar Properties* in Chapter 5, "Analysis."

The *BMAP* then plots that profile to the screen; you should then enter the horizontal starting point **Xon**, ending point **Xoff**, and the horizontal increment **Dx**. The *BMAP* displays the interpolated profile along with the original profile, and the interpolated profile is stored to memory under the displayed name. You may later choose **Output Menu** from the **Main Menu** to store it to your hard drive. See the section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Modified Equilibrium Profile

The modified equilibrium beach profile (Larson 1991) is a concave monotonic profile shape developed to describe beaches that may be steeper near to shore than in the offshore, corresponding to a decrease in grain size from coarser near the shoreline to finer in the offshore. The modified equilibrium profile depends on two empirical parameters (in addition to the *A*-parameter of the equilibrium profile). These are an energy dissipation ratio called D_{ratio} in *BMAP* and a parameter λ which controls change in grain size from coarser to finer. The modified equilibrium profile equation is

$$h = A\left[x + \frac{1}{\lambda}\left(D_{ratio} - 1\right)(1 - \exp(-\lambda x))\right]^{2/3} \qquad (2)$$

Values of D_{ratio} typically lie between 1 and 5, and values of λ typically lie between 0.005 and 0.03 m^{-1}.

The **Modified Equilibrium Profile** option requires entry of values for **Xon, Xoff**, and **Dx**. It also requires an *A*-parameter value (no choice of grain size). In addition, you must enter values for D_{ratio} and the coefficient λ.

After all parameters have been entered, *BMAP* displays the generated equilibrium profile, which is stored to memory under the displayed name. You may later choose **Output Menu** from the **Main Menu** to store it to your hard drive. See the section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

Plane-Sloping Profile

After you have made the choice to calculate a plane-sloping profile, *BMAP prompts you for the following parameters:* **Xon** (horizontal starting point), **Xoff** (horizontal ending point), **Dx** (horizontal increment), elevation at **Xon**, and elevation at **Xoff**.

After all parameters have been entered, *BMAP* displays the generated plane-sloping profile, which is stored to memory under the displayed name. You may later choose **Output Menu** from the **Main Menu** to store it to your hard drive. See the section entitled *Output Menu* in Chapter 4, "Main Menu," for a discussion on storing output profiles. Like all other screens in *BMAP* where a graph appears, you may obtain a hard copy of the graph by pressing <ALT-P>.

7 Examples

In Chapters 2 to 6, all functions implemented in *BMAP* Version 1.0 are discussed. This chapter presents two examples for which the options of *BMAP* are accessed, and you have the opportunity to view the screens as we proceed. Selected data for these examples are listed in Appendix A, and they are also included on the installation diskette. It is recommended that you read this chapter at your computer with *BMAP* running and follow the examples by operating *BMAP* along with us. If *BMAP* is not yet installed, consult Appendix B.

There are two example projects. Most of the options will be exercised using a small number of profile surveys from the Ocean City, Maryland, beach fill monitoring project (Kraus 1993, Stauble et al. 1993). The second example mainly concerns changes of length unit precision, and for this we use a small subset of the SUPERTANK profile survey data set (Kraus, Smith, and Sollitt 1992).

Ocean City

Create project

First, we will begin *BMAP* by typing **BMAP** at the DOS prompt from within our *BMAP* directory.

C:\BMAP>BMAP

The *BMAP* loads and the **Project Options Menu** is displayed (Figure 18). In order to begin, we must first create a project. The project will be called **OC_TEST** (Figure 19).

After we have told *BMAP* the name of the project, the **Project Parameters** screen is displayed (Figure 20). The first field required for this screen is the data directory. For our example, we have stored the data in the \BMAP\ DATA directory. If your data files are located in a different directory, enter the correct location here. *BMAP* asks for a default input file. This file name

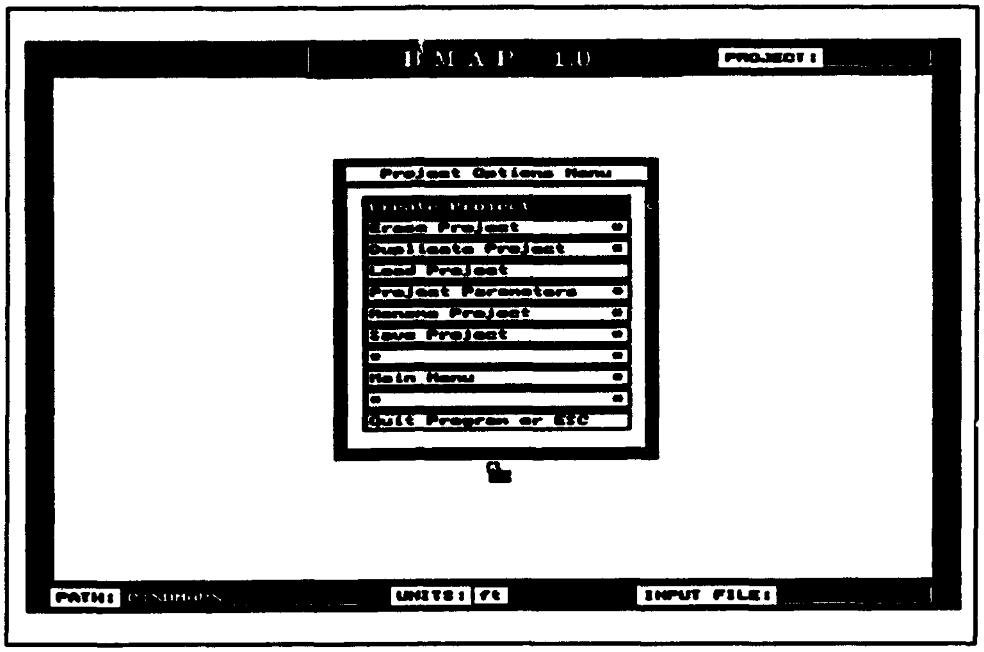


Figure 18. **Project Options Menu**

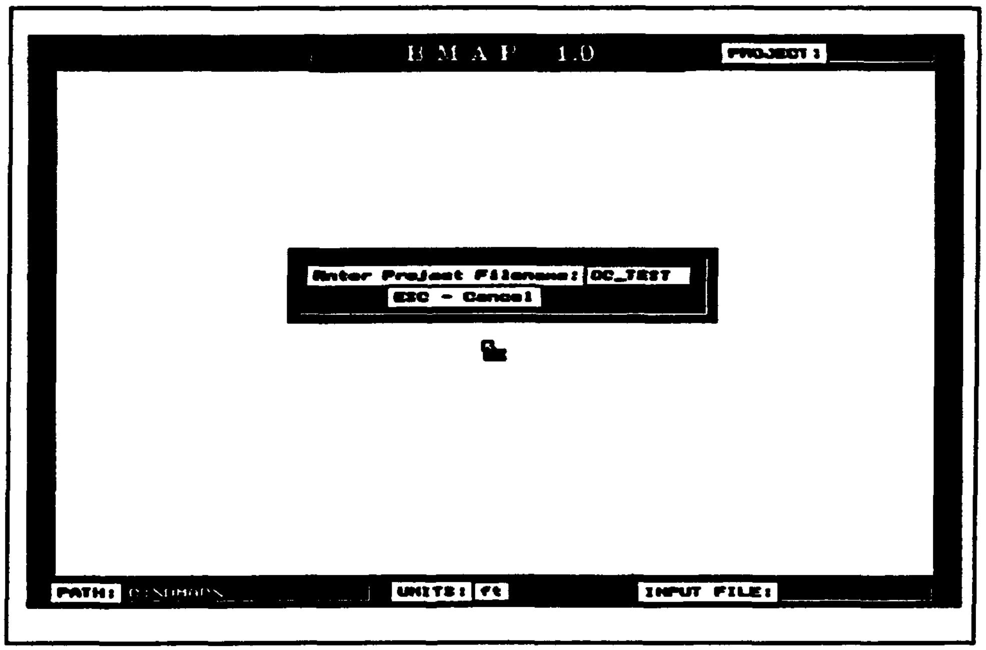


Figure 19. Entering project name, OC_TEST

automatically is displayed later in the **Load Profile Menu**. The data file associated with this project is **OC37OFF.ISR**. The profile survey data contained in this file were taken from ISRP-processed files from the Ocean City, Maryland, monitoring project. The profile elevation is referenced to National

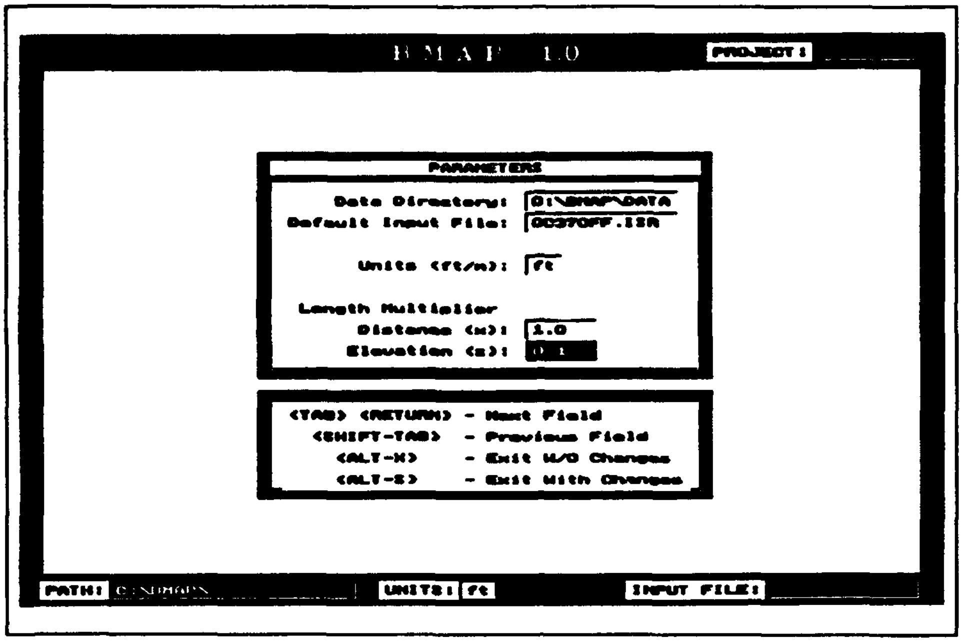


Figure 20. Input file name

Geodetic Vertical Datum (NGVD). Next we must tell *BMAP* the length multipliers and the units. Ocean City profile survey data are in standard ISRP format and are recorded in feet. So our length multipliers are 1.0 for distance and 0.1 for elevation, and the units are feet. Note that the project name appears on the upper right side of the screen, and the data directory, length units, and the default input file name are on the bottom of the screen.

Load profiles

The *BMAP* now displays the **Load Profile Menu** with the default file name in the left column of the first row (Figure 21). By pressing <ALT-L>, we obtain a listing of all the profiles in this file (Figure 22). Move the cursor to the desired profiles and press <ALT-T> to tag each profile. After tagging all desired profiles, you should press <ALT-S> to copy the profile information to the **Load Profile Menu**.

All profiles are active by default. If you wish to make some profiles inactive, move to the **Active** field and press "N." For our application we want all profiles to be active. Figure 23 shows the profiles we have chosen for our example.

We have told *BMAP* all the profiles we want to load from the input file. Press <ALT-S>, and *BMAP* will begin to load the profiles.

After the profiles have been loaded, you are returned to the **Main Menu** (Figure 24).

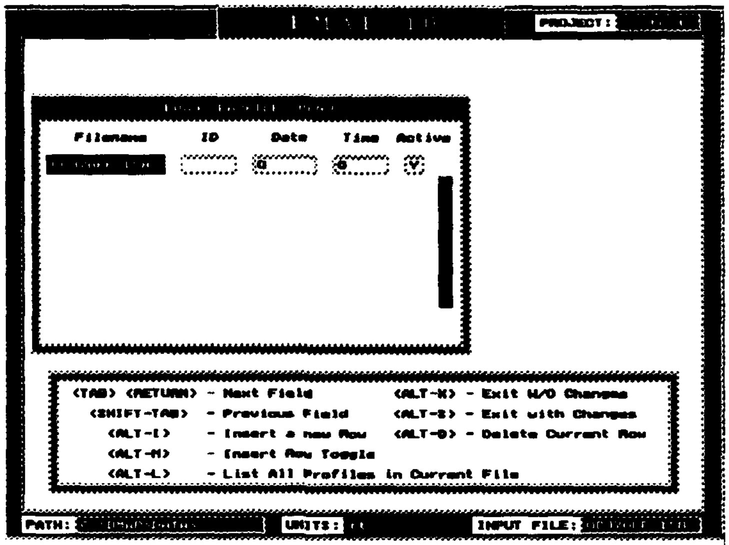


Figure 21. **Load Profile Menu**

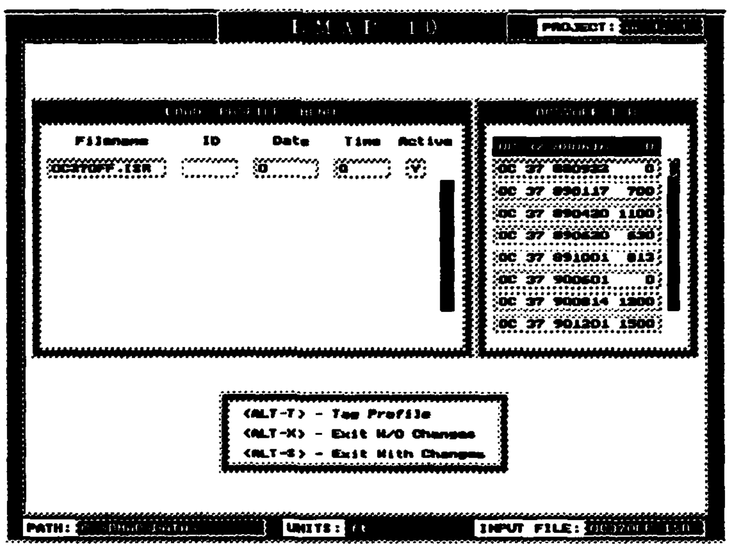


Figure 22. Listing profiles

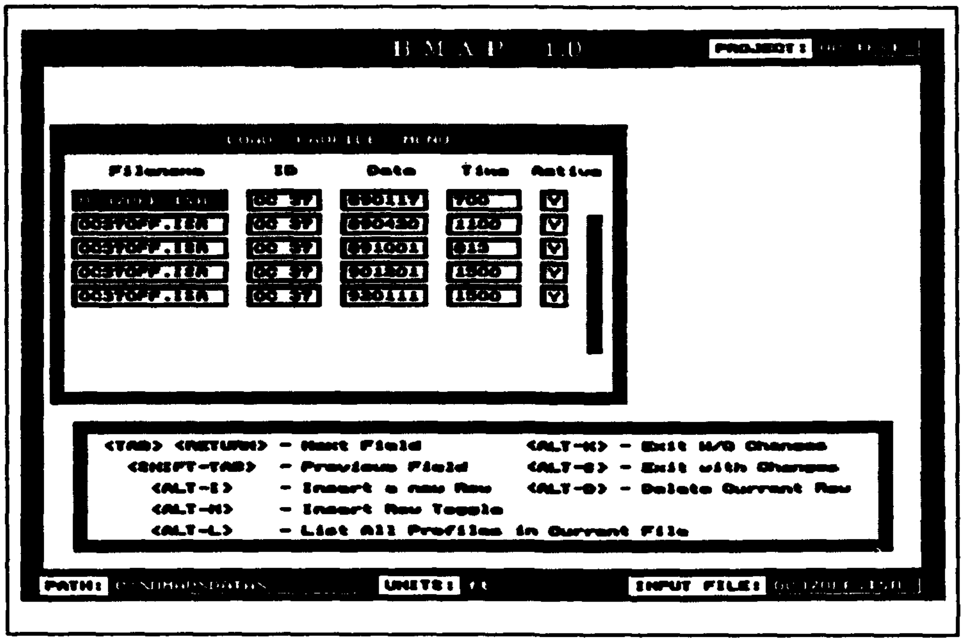


Figure 23. Activating profiles

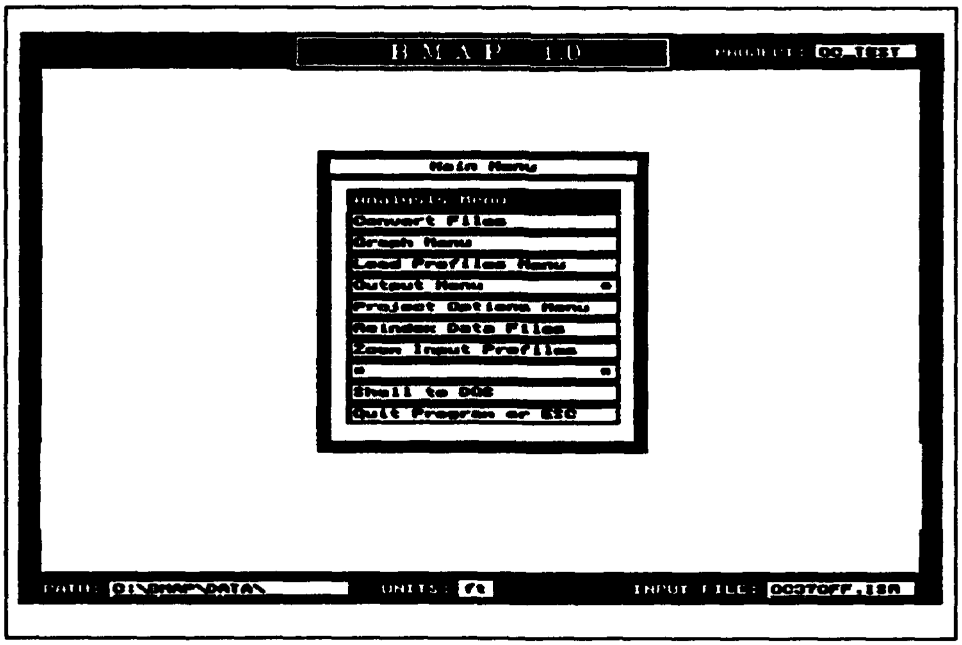


Figure 24. **Main Menu**; after loading profiles

Graph profiles

Before proceeding to analysis, visually inspect the data. To do this, choose **Graph Menu** and graph all the **Input Profiles** (Figure 25).

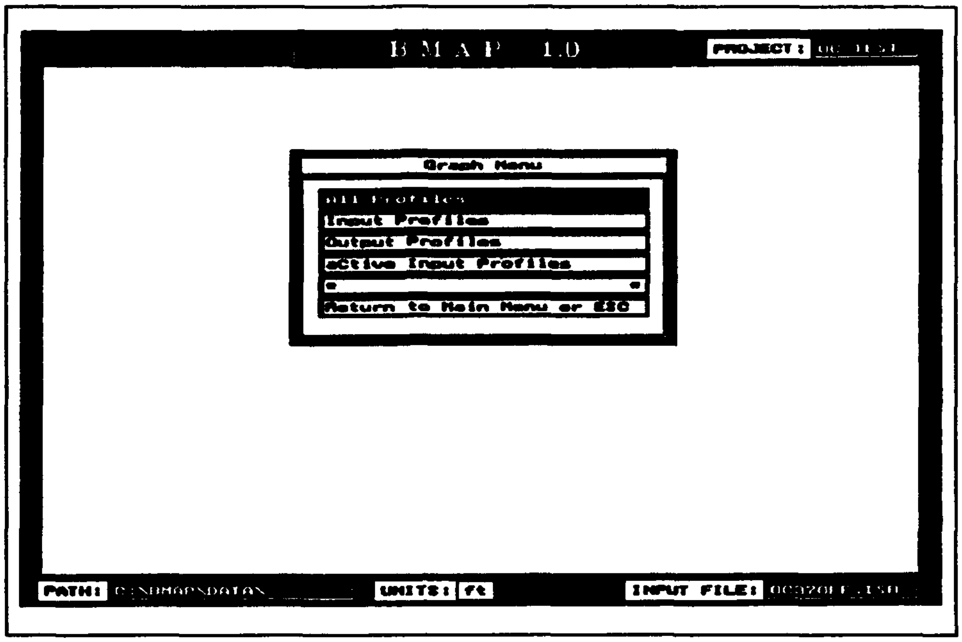


Figure 25. **Graph Menu**; select Input Profiles

The profile data are plotted, and the graph should look like Figure 26.

If you would like to place a mark (*) where each point is plotted to see the density of actual data points, press <DWN-ARROW> and the lines will be replaced with asterisks at the data points (Figure 27).

Press <ALT-P> to receive a hard copy of this graph. Press any other key to return to the **Graph Menu**. After returning to the **Graph Menu**, press <ESC> to return to the **Main Menu**.

You may notice that the **Output Menu** is invalid at the time, because we have not yet generated any output profiles. *BMAP* does not allow selection of this option until output data are generated.

Reindex data files

Another option included in the **Main Menu** is the **Reindex Data Files** option. This command re-indexes the input file. Spurious loss of indexing may be the cause of odd results. Use this option if you begin to have unexplained problems with the data.

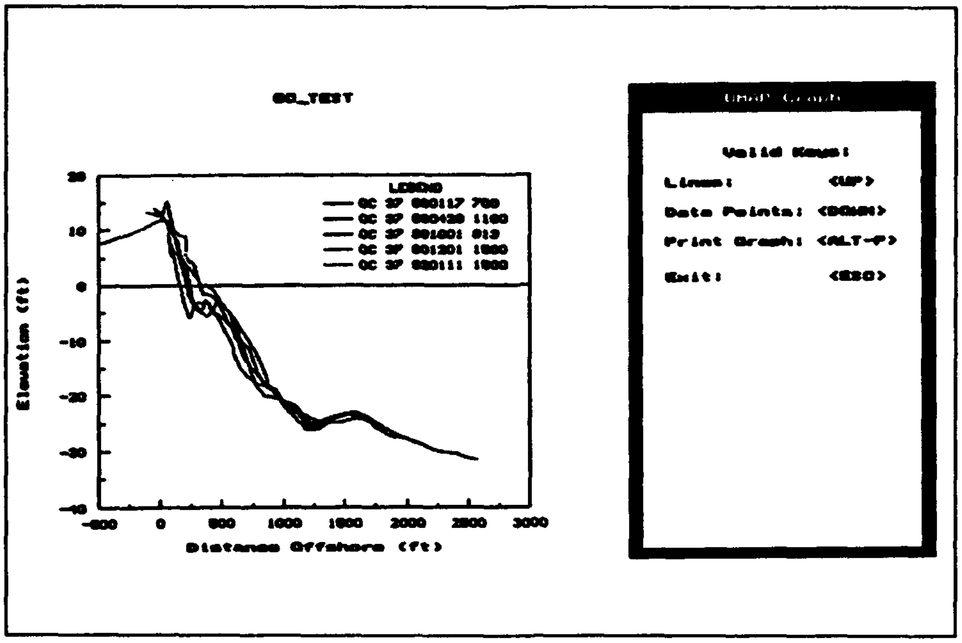


Figure 26. Graph of Ocean City active profiles

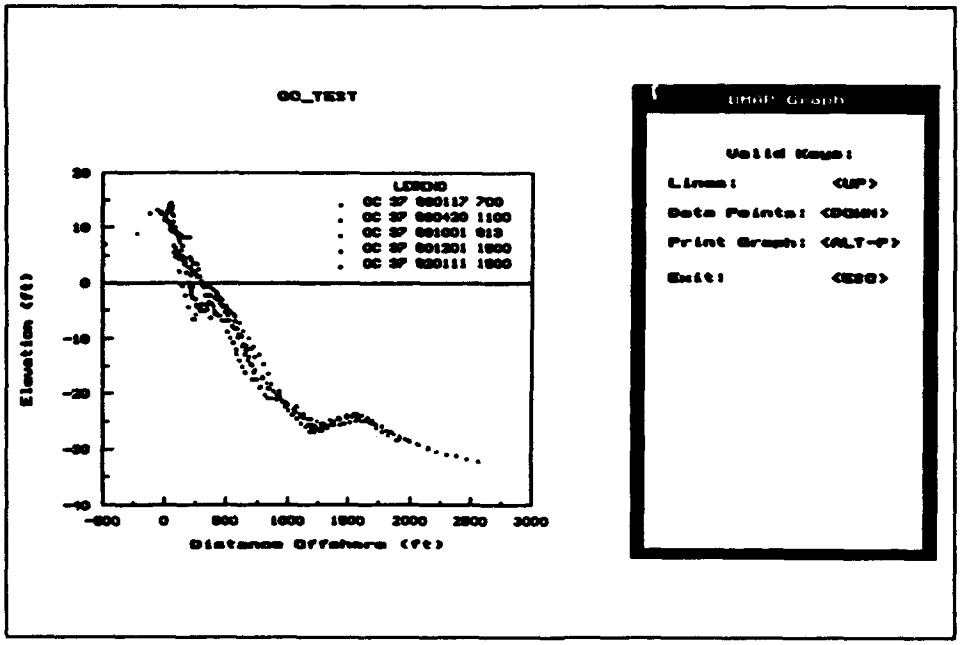


Figure 27. Graph of Ocean City test profiles; data points option

Zoom profiles

The **Zoom Profiles** option is included to assist you in zooming in on a certain part of the profiles to view things such as crossing points and bars. This option is displayed in Figures 28 and 29 for our example.

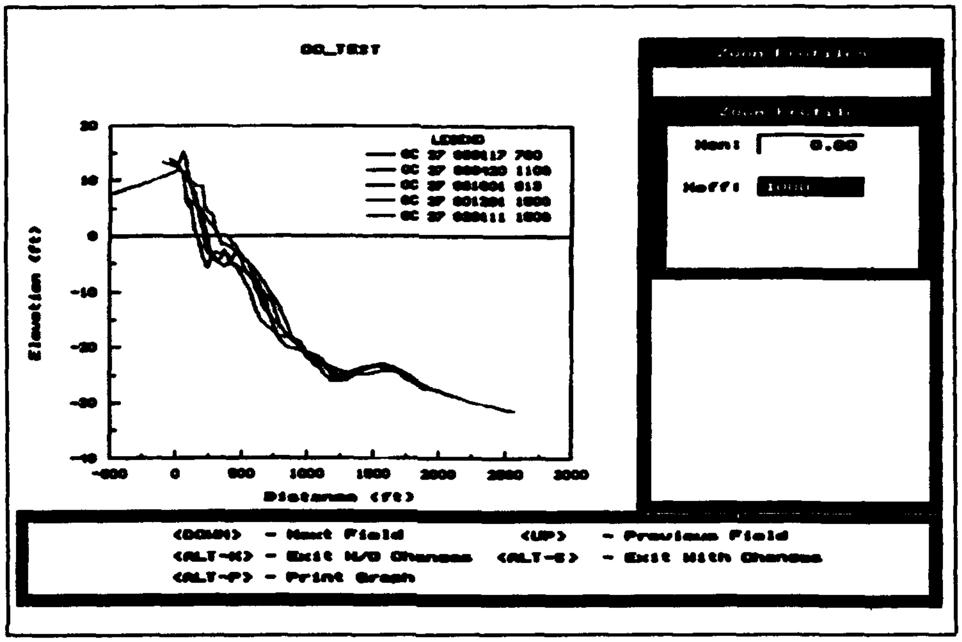


Figure 28. Selecting zoom between 0 and 1,000 ft

Averaging

Now that we have exercised the valid options in the **Main Menu**, we explore the analysis options. Choose the **Analysis Menu**, as shown in Figure 30.

Let's choose **Averaging** so that we may calculate the average profile for the five profiles we have loaded in memory (the active profiles). We will enter an **Xon** value of -500, an **Xoff** value of 2,500, and our **Dx** will be 50, as shown in Figure 31. After pressing <ENTER>, *BMAP* will use linear interpolation to produce an average profile at 50-ft increments starting from 500 ft behind the baseline (Figure 32). The averaging routine automatically adjusts if the number of lines changes at a given distance. For example, at 2500 ft, there is only one profile, so only one profile is used in the averaging process there. Notice that a menu appears in the right window with six options. Choosing one of these options displays the corresponding graph.

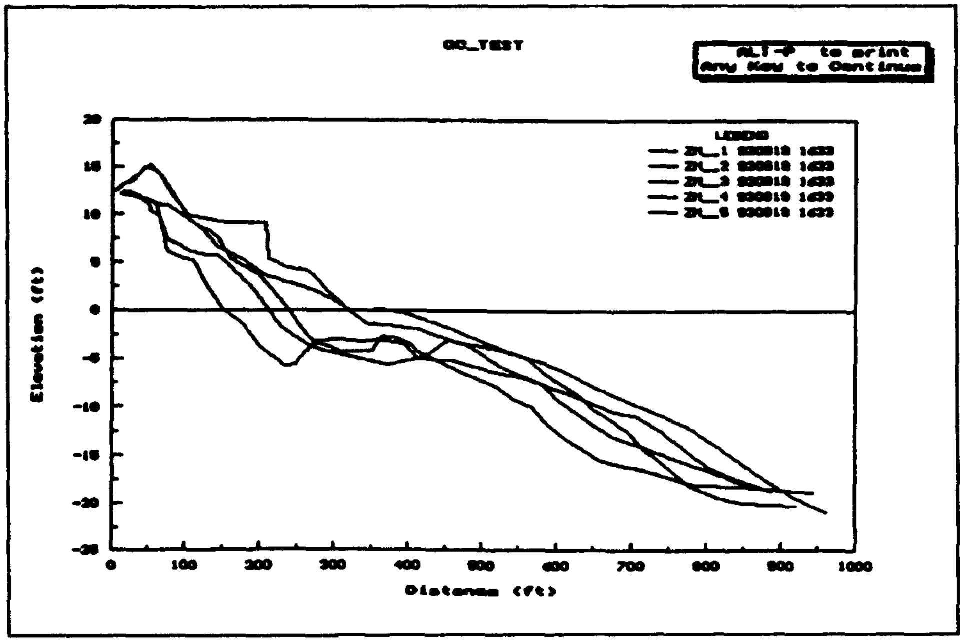


Figure 29. Zoomed profiles from Figure 28

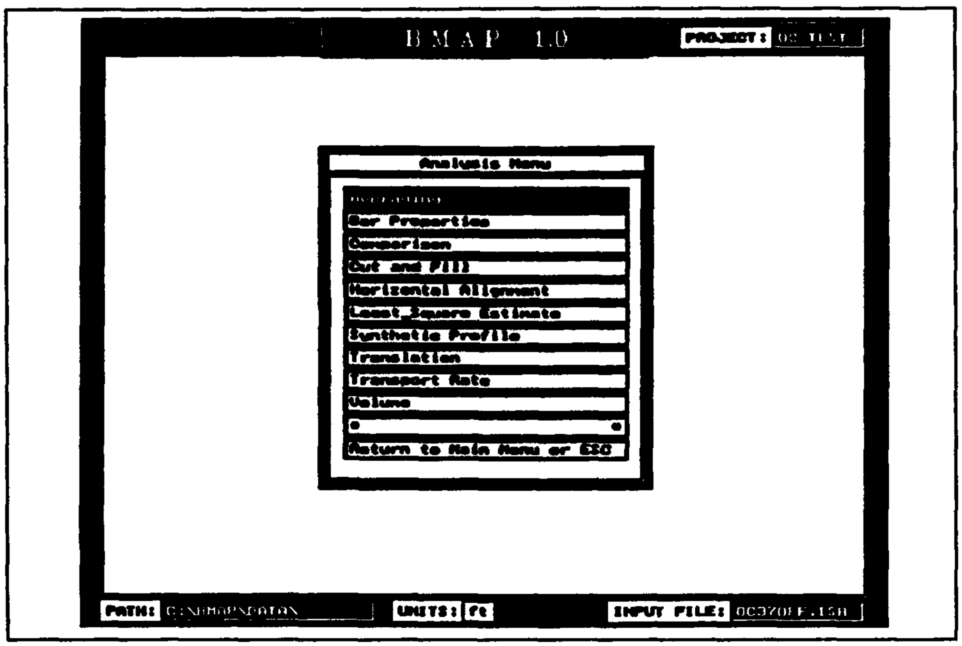


Figure 30. **Analysis Menu**; averaging selected

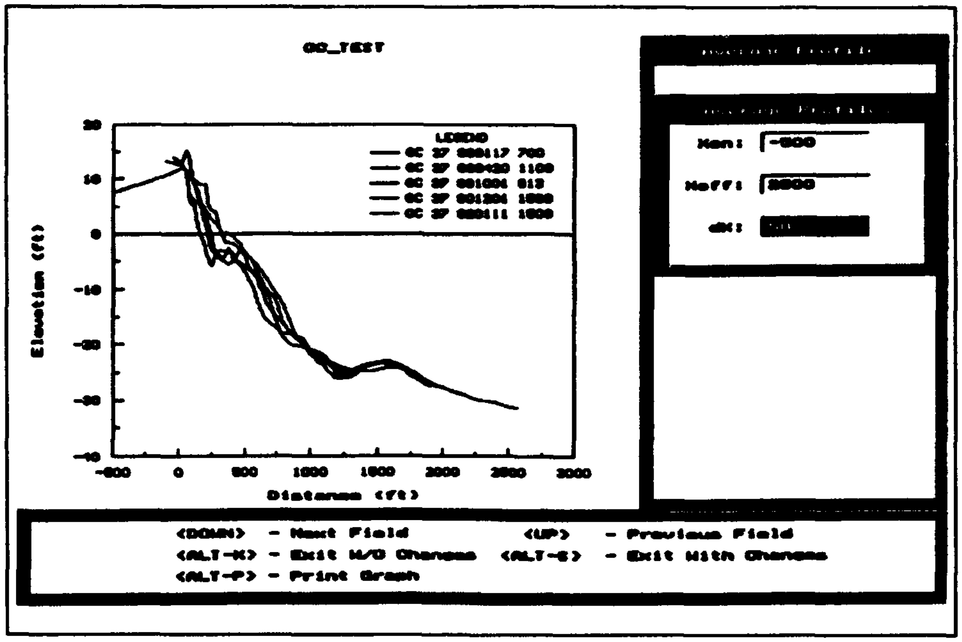


Figure 31. **Average Profiles** screen; averaging parameters selected

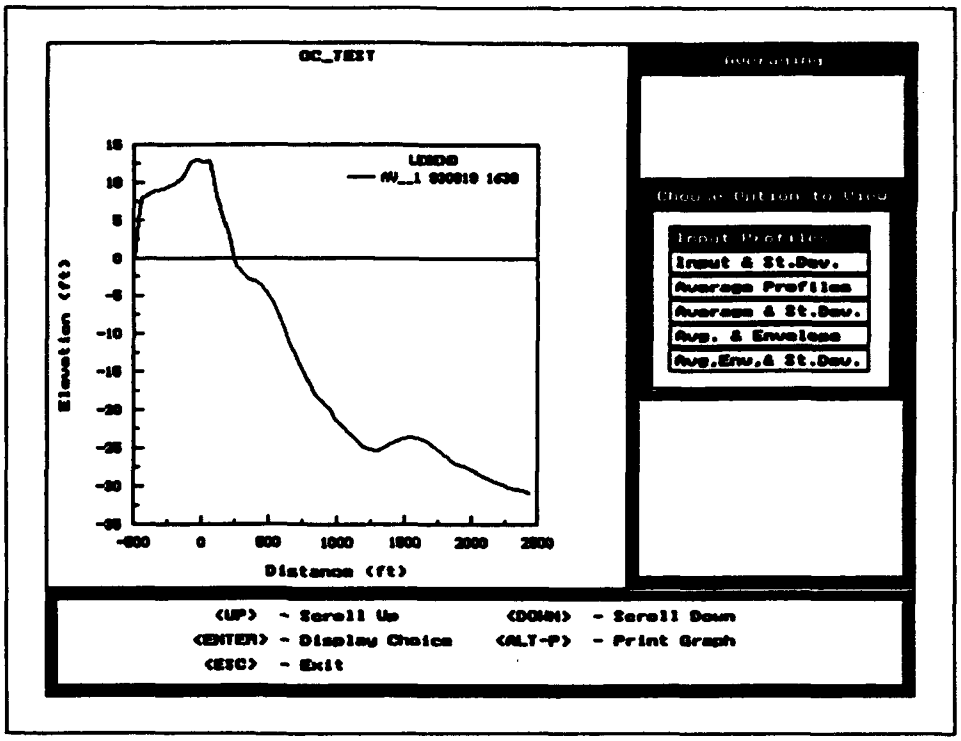


Figure 32. Average profile for the screen in Figure 31

Output profiles

After viewing the calculated profiles, press <ESC> and *BMAP* indicates the name it has assigned to these profiles (Figure 33). You may change these names, add descriptions, and save the profiles to disk in the **Output Menu**. Let's do that at this time.

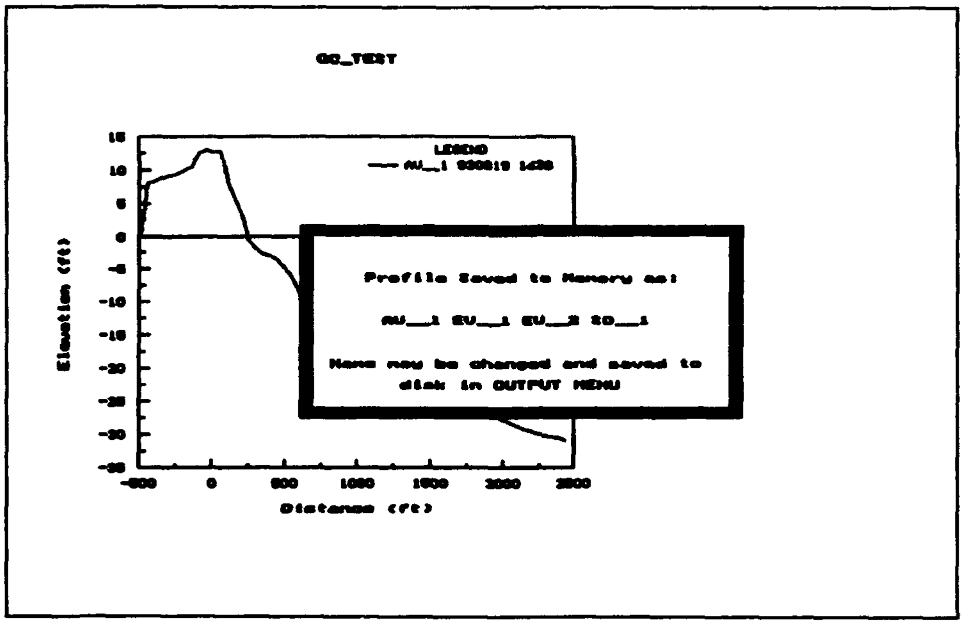


Figure 33. Average profile saved as an output profile

Press <ESC> twice to return to the **Main Menu**. Choose **Output Menu**. The first five rows include information about the profiles generated from the **Zoom Profiles** option (Figure 34). Scroll down the list until the profile AV__1 (No. 6) is selected. Insert OC37AVG to the first blank name field. This serves as the file name for the data. Change the ID and add a description to this profile (Figure 35). Save these changes by pressing <ALT-S>.

Bar properties; least-square estimate

The next option available on the **Analysis Menu** is **Bar Properties**. Generate a best-fit equilibrium profile to use in calculating bar properties. The option is **Least-Square Estimate**. So, before we invoke the **Bar Properties** option, we choose **Least-Square Estimate** to generate the equilibrium profile.

The **Least-Square Estimate** option generates a best-fit equilibrium profile with respect to a target profile. First tell *BMAP* the source of the input target profile. To determine the bar properties of one of our input profiles, we choose **Input File** as our source. The *BMAP* then graphically displays all the input profiles from which a selection is made (Figure 36). Choose Profile

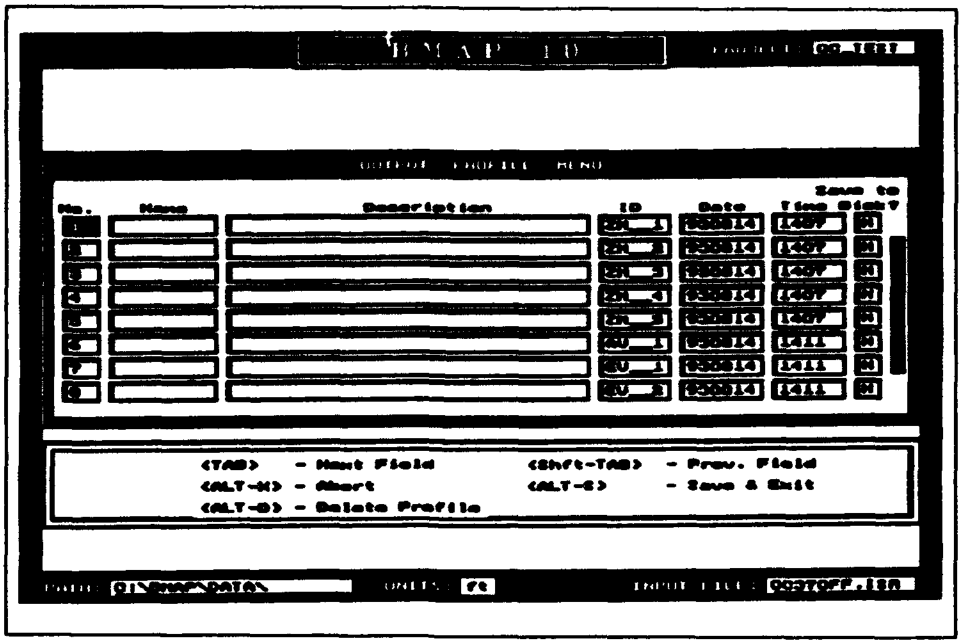


Figure 34. **Output Profile Menu**

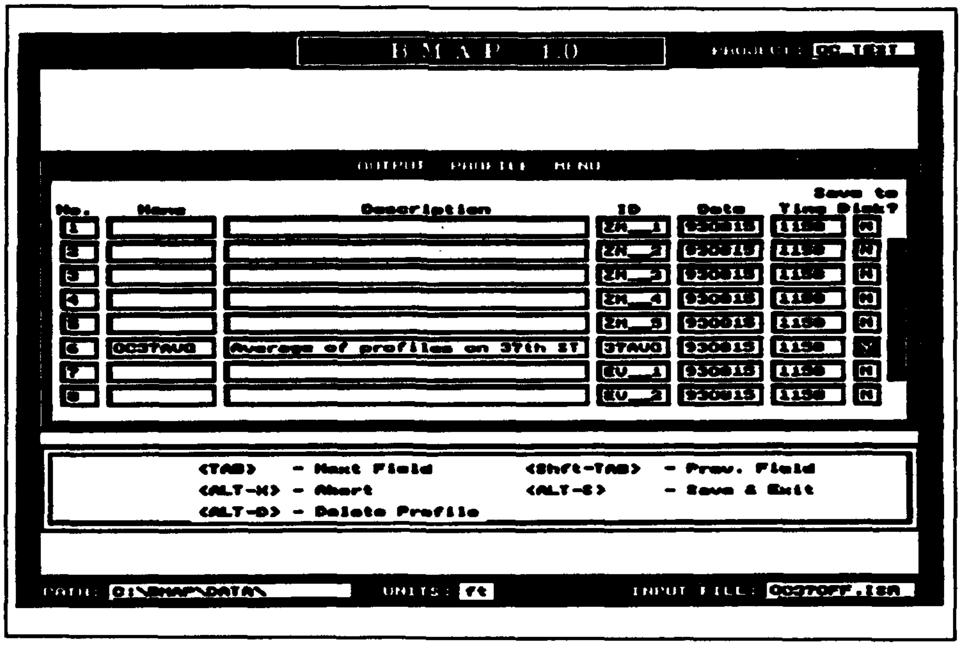


Figure 35. Average profile; new name assigned

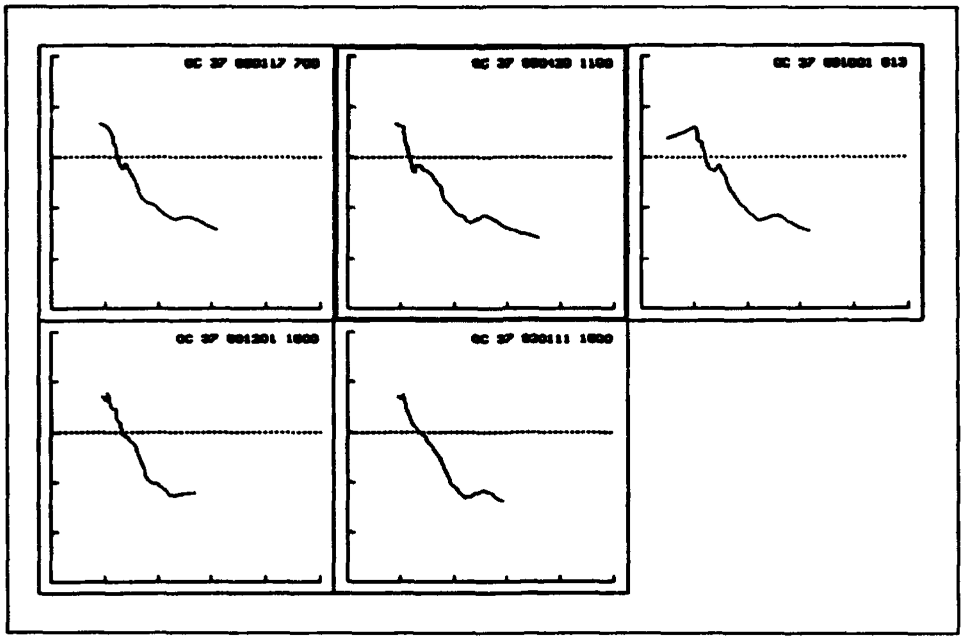


Figure 36. **Profile Display Menu**

OC 37 890420 1100 because it has a well-defined bar. Move the selection box to the desired profile and press <ENTER> to select. An alternative and preferred method would be to fit the equilibrium profile to the average profile that we have generated and saved as an output profile. We leave this as an exercise to the reader. Our aim here is to demonstrate the profile selection procedure of the **Profile Display Menu**.

After selecting Profile OC 37 890420 1100, we are ready to do our calculations. *BMAP* asks for **Xon** and **Xoff** for defining the equilibrium profile. As a default, **Xon** is automatically computed by *BMAP* as the location where the profile crosses the zero elevation. You have the option of changing this value. For our case, we will keep that contour and enter 2,500 for **Xoff**. Press <ENTER>, and Figure 37 shows the resulting equilibrium profile, together with the original profile.

In viewing Figure 37, we see at the right-hand box that the best-fit *A*-parameter was determined by *BMAP* to be 0.13 $ft^{1/3}$ with a corresponding median grain size d_{50} = 0.29 mm. This value of grain size is close to that determined by sediment samples in the nearshore (Stauble et al. 1993). If a visual appraisal of the resultant profile were deemed unacceptable, we could press any key and be in a position to enter different parameters. Instead we will press <ALT-S> and keep the equilibrium profile. *BMAP* has the capability to print a hard copy of the calculated data in the right window of the screen. To do this, press <ALT-R>. *BMAP* asks if you wish to send the information to the printer or to a file. If you choose printer, *BMAP* immediately begins to print the information. If you choose file, enter a valid DOS file name. Do not

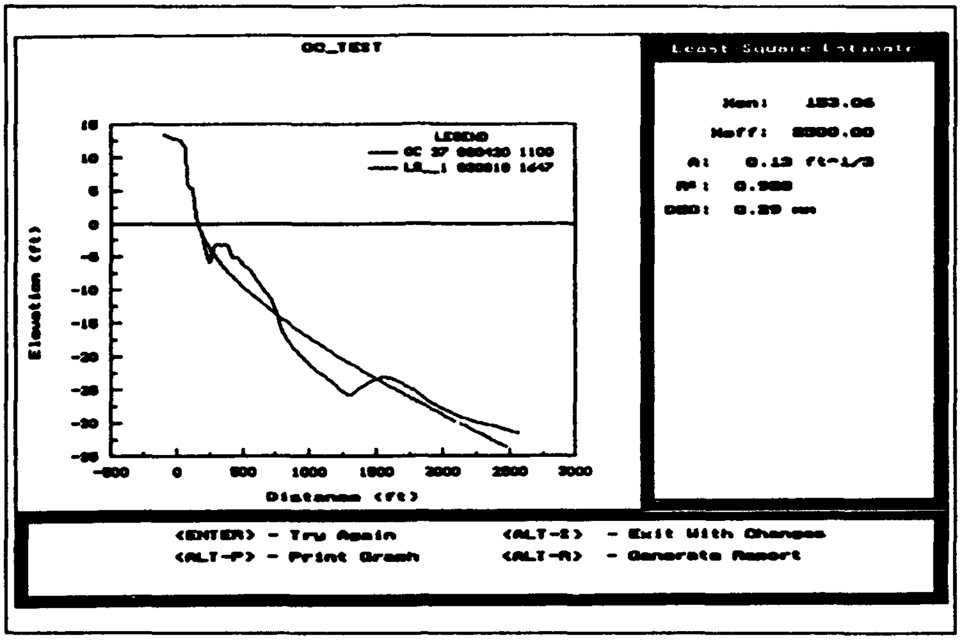


Figure 37. Best-fit equilibrium profile

include the directory because *BMAP* automatically saves the file in the data directory of the project.

Bar properties; with a reference profile

We now have an adequate equilibrium profile. Let's use that pıofile to determine bar properties. First, choose **Bar Properties** from the **Analysis Menu.** Because we have the equilibrium profile, choose **With a Reference Profile,** Figure 38. We will choose **Output file** as our source because the equilibrium (reference) profile was generated by *BMAP*. Choose the LS__1 profile (the generated equilibrium profile).

Choose **Input File** as the source for the specific target profile (Figure 39). Because we used Profile OC 37 890420 1100 to generate the equilibrium profile, let's choose it here as our specific profile.

The *BMAP* automatically computes the crossing pairs of the two profiles, indicating the presence of a bar (Figure 40) located from approximately 261 ft to 761 ft.

Choose the pair by pressing <ENTER>. The *BMAP* then computes the bar properties and displays them to the side of the screen, as shown in Figure 41.

According to Figure 41, the minimum depth (referenced to NGVD) over the bar, called the bar crest depth, was 3 ft, and the crest was located 307 ft from the shoreline. The maximum bar height with respect to the equilibrium profile

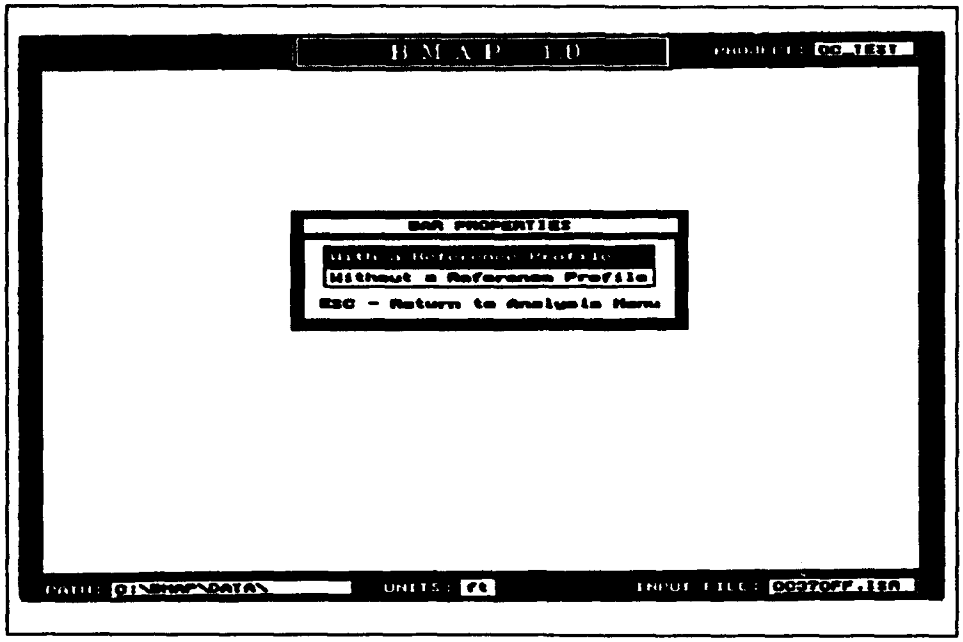


Figure 38. **Bar Properties Menu**

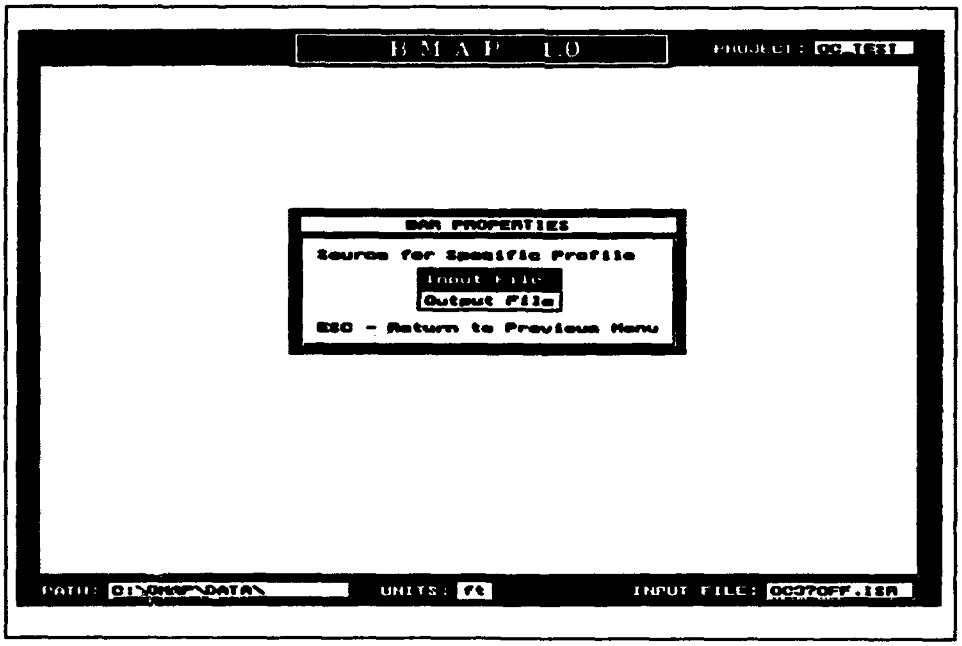


Figure 39. Source for specific profile

was 4 ft, located 394 ft from the shoreline. The volume of the bar was 50 yd^3/ft, and its length was 500 ft. The center of mass of the bar was located approximately 492 ft from shore. *BMAP* has the capability to print a hard copy of the calculated data in the right window of the screen. To do this,

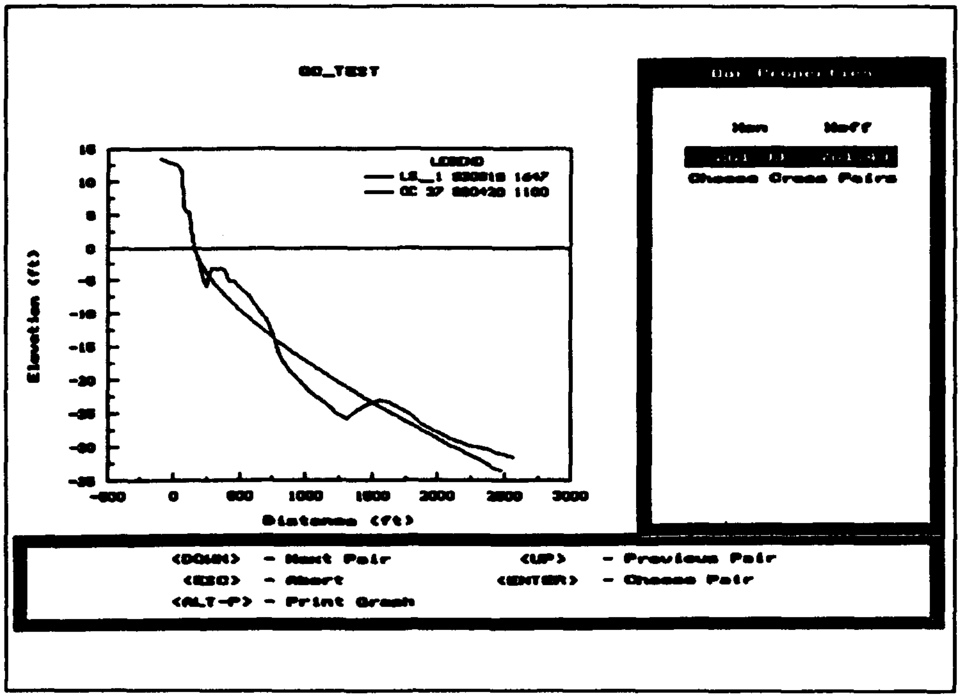


Figure 40. Bar defined by cross pair intersection

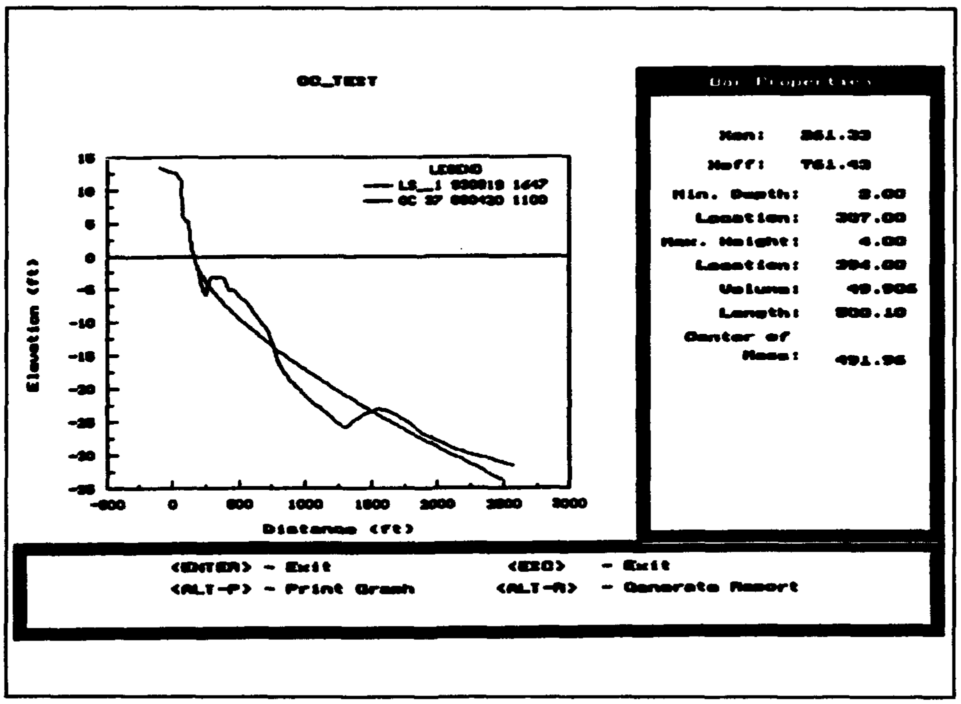


Figure 41. Results of bar properties calculation

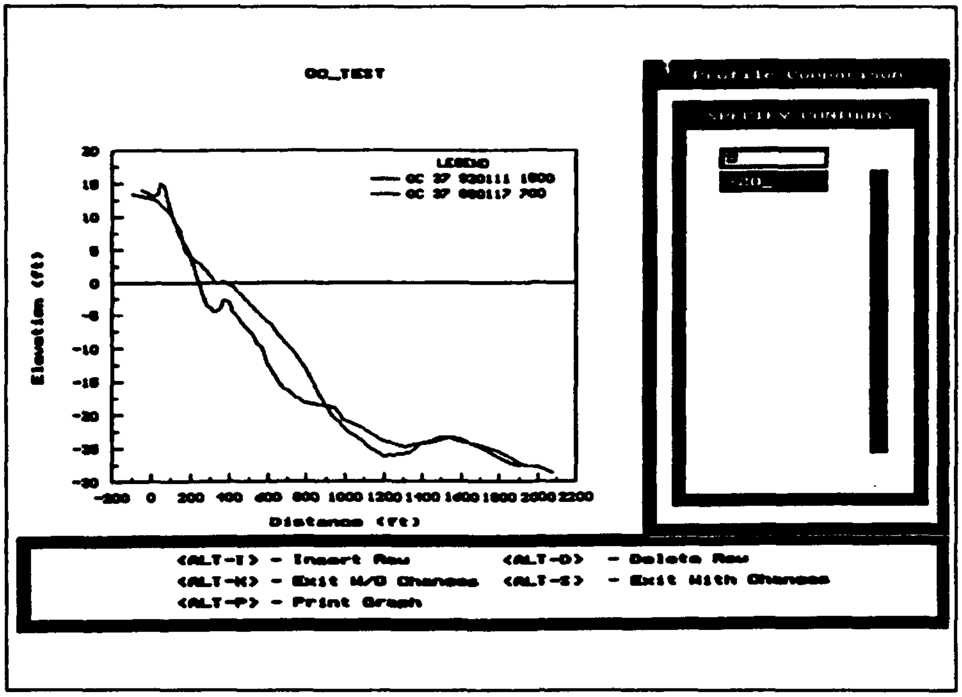


Figure 42. Specifying depth contours for comparison

press <ALT-R>. *BMAP* asks if you wish to send the information to the printer or to a file. If you choose printer, *BMAP* immediately begins to print the information. If you choose file, enter a valid DOS file name. Do not include the directory because *BMAP* automatically saves the file in the data directory of the project.

Compare profiles

Return to the **Analysis Menu** by pressing <ESC>. We are now going to compare two profiles. You already know how to choose profiles, so we will omit explanation of choosing profiles from here on. We chose Profiles OC 37 920111 1500 and OC 37 890117 700 from the input file (Figure 36) as the two target profiles to compare, using the **Comparison** option. After you have chosen the two profiles, *BMAP* displays them and prompts you to enter the contours between which the quantitative comparison will be made. Enter the first contour and press <ALT-I> to add a row for the next contour. Enter the contours that are written in Figure 42. When you have finished entering the contours, press <ALT-S> to compare, giving the results shown in Figure 43.

After the comparison has been made, *BMAP* displays the volume change and contour location for each profile in a scroll box (Figure 43). *BMAP* has the capability to print a hard copy of the calculated data in the right window of the screen. To do this, press <ALT-R>. *BMAP* asks if you wish to send the information to the printer or to a file. If you choose printer, *BMAP*

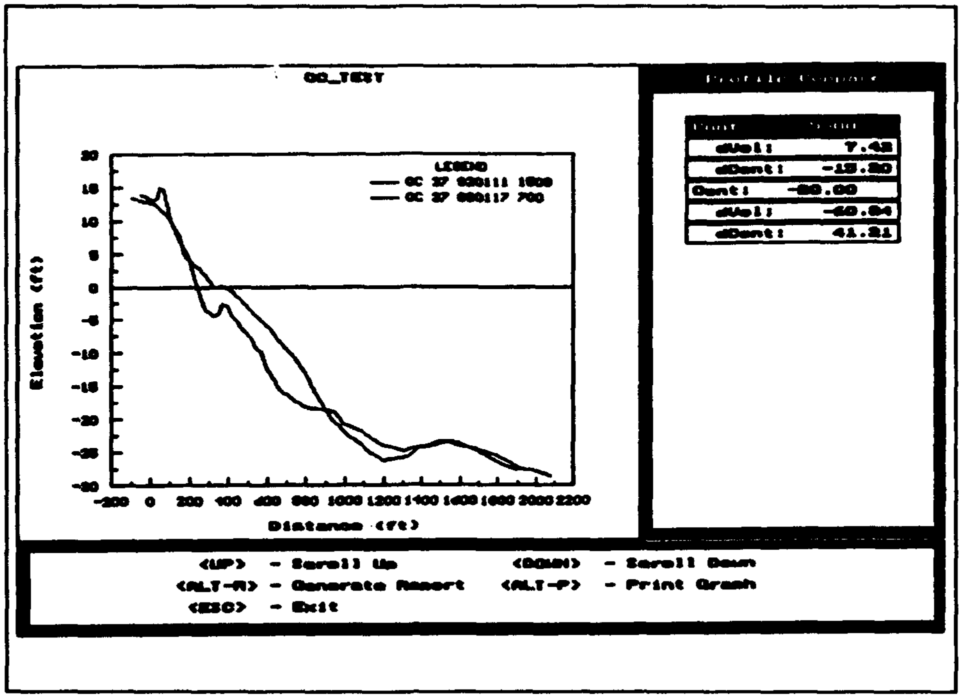


Figure 43. Profile comparison results

immediately begins to print the information. If you choose file, enter a valid DOS file name. Do not include the directory because *BMAP* automatically saves the file in the data directory of the project.

In the scroll box in Figure 43, the units of volume change are yd^3/ft for American customary units and m^3/m if the project data are in metric units.

Cut and Fill

For this example, Profiles OC 37 891001 813 and OC 37 890117 700 were chosen from the Input file list (Figure 36). The *BMAP* calculates and the results are displayed (Figure 44). Press the <DWN-ARROW> or <UP-ARROW> to scroll through the list of cells. As seen in the information box to the right, the cut and fill volumes were calculated between the most common location points having elevations, -108 ft as the landward starting point, and 2,092 ft as the most seaward point. If you would like a hard copy of the results or to save the results to a file, press <ALT-R>. If you choose to save the results to a file, enter a valid DOS file name without the directory. The *BMAP* automatically saves the file to the data directory of the project. Choosing printer as the destination immediately sends the output to the connected printer.

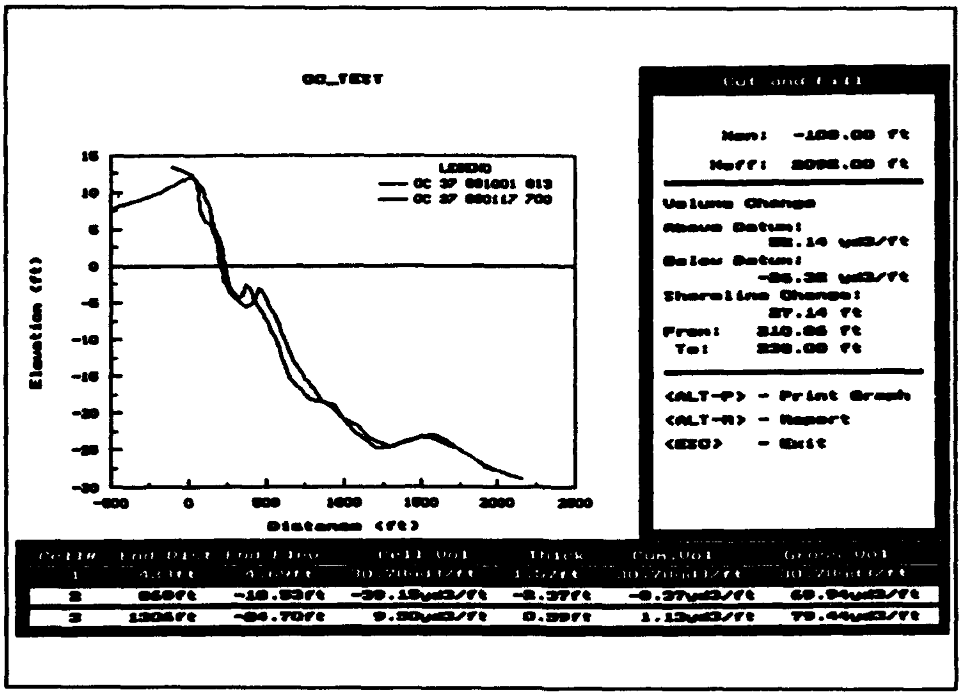


Figure 44. Cut and fill results

Horizontal Alignment

The next option is **Horizontal Alignment.** This option allows us to align all profiles to a specified location. The graph is displayed in Figure 45 after we have selected this option, and we will enter the 5-ft elevation as our location. Next the user specifies the horizontal position of the aligned profiles. This option allows the profiles to be aligned to other profile locations or zero. For this example choose an X-reference equal to 0 ft. All profiles are translated horizontally to coincide at the 5-ft elevation, as shown in Figure 46.

After you press a key, you may notice that the message informing you of the name of the saved profile is in a different form than earlier output profiles. You see that the name of the profile is **HA_##.** The symbols ## are inserted because more than one profile has been generated from a single option. The profiles are saved starting with the next value for **HA** and incremented by one for each generated profile. It is recommended that you change these names if you plan to use these output profiles later, because output profile data tend to accumulate in the course of analysis, and it is easy to forget what was done. For a listing of each two-letter identification and its corresponding function, consult the section entitled *Output Profiles* in Chapter 2.

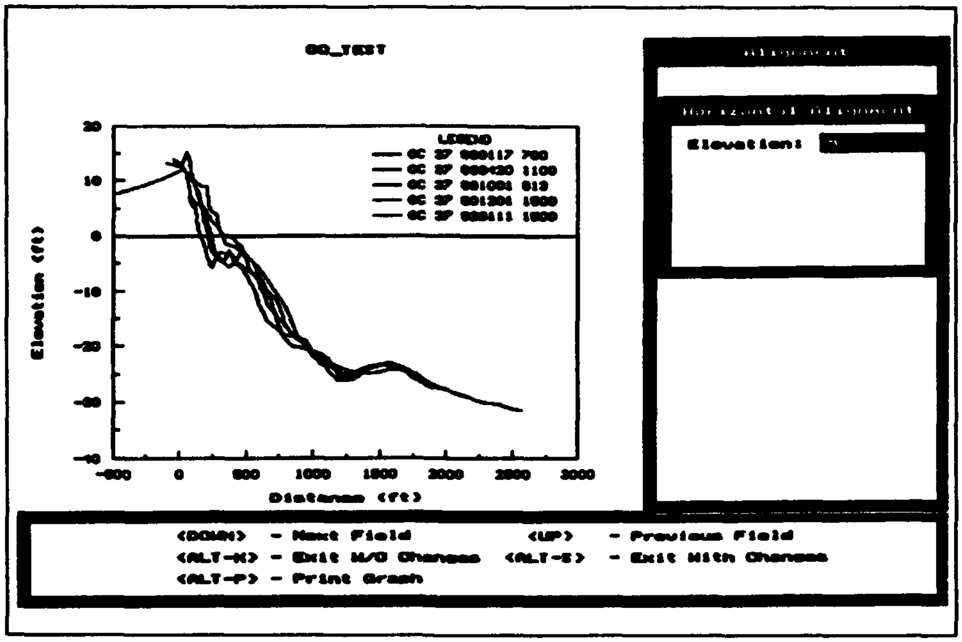


Figure 45. Profiles prior to horizontal alignment

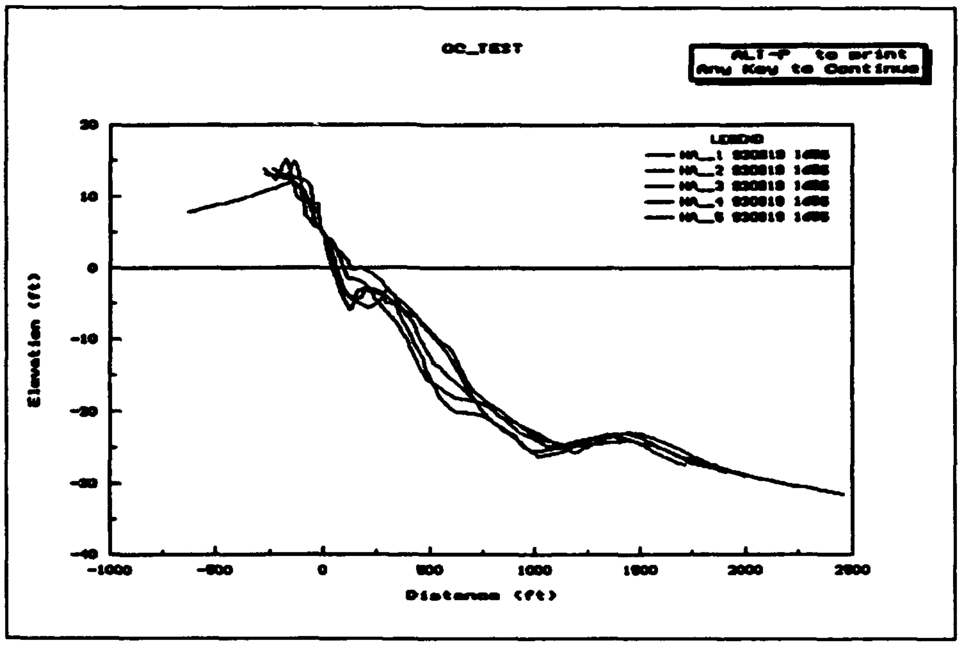


Figure 46. Profiles aligned at the 5-ft elevation

Translation

The next option we will discuss is **Translation**, having already discussed the **least-square fit** option and saving **synthetic profiles** for later. The **Translation** option is similar to **Horizontal Alignment** and may be confused with it. **Translation** shifts (or translates) all values of all profiles by specified horizontal and vertical amounts, whereas the **Alignment** option aligns all profiles at a certain elevation. When you select **Translation**, *BMAP* displays the profiles and prompts you to enter the horizontal and vertical shifts. These values are added to the profile data to shift the profiles the specified amount. Here we will enter -5 ft for the vertical shift and 100 ft for the horizontal shift (Figure 47). Figure 48 shows the results of translating the profiles. Note that as you exit, these profiles are saved as TL_##.

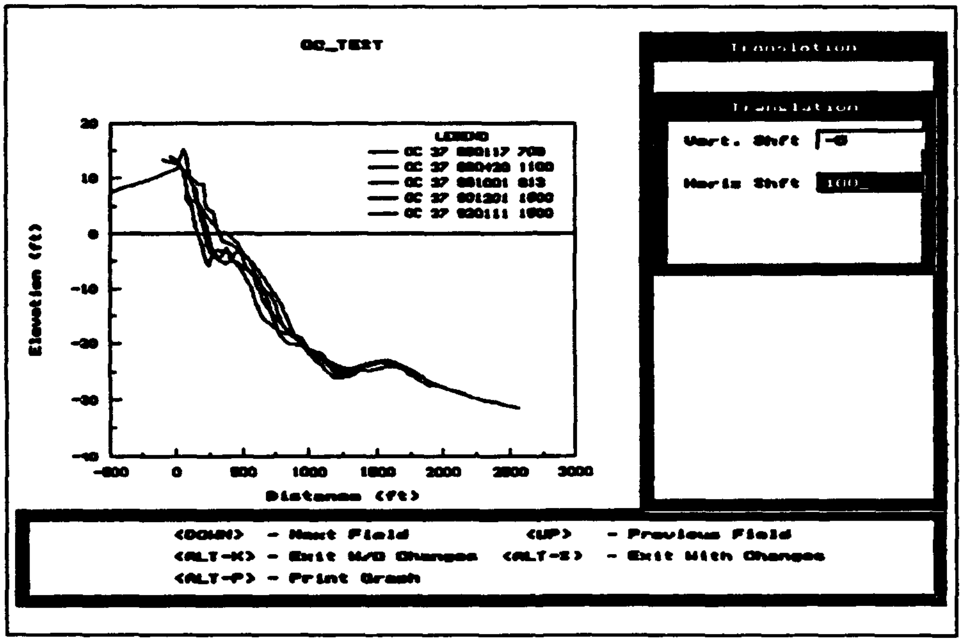


Figure 47. Before translating profiles

Transport rate

Let us now move to the **Transport Rate** option. To illustrate the **Transport Rate** option, we return to the **Load Profile Menu** to load the OC_37 survey of 911103, the last survey prior to the severe 4 January 1992 storm that impacted Ocean City. We will calculate the cross-shore transport rate between the profile surveys of 911103 and 920111, under the assumption that cross-shore transport was solely responsible for beach profile change during the approximately 2-month time interval. After you choose the profiles, *BMAP* plots them and prompts you to enter **Dx** (horizontal increment) and the time difference that has been automatically computed by *BMAP* from the time in

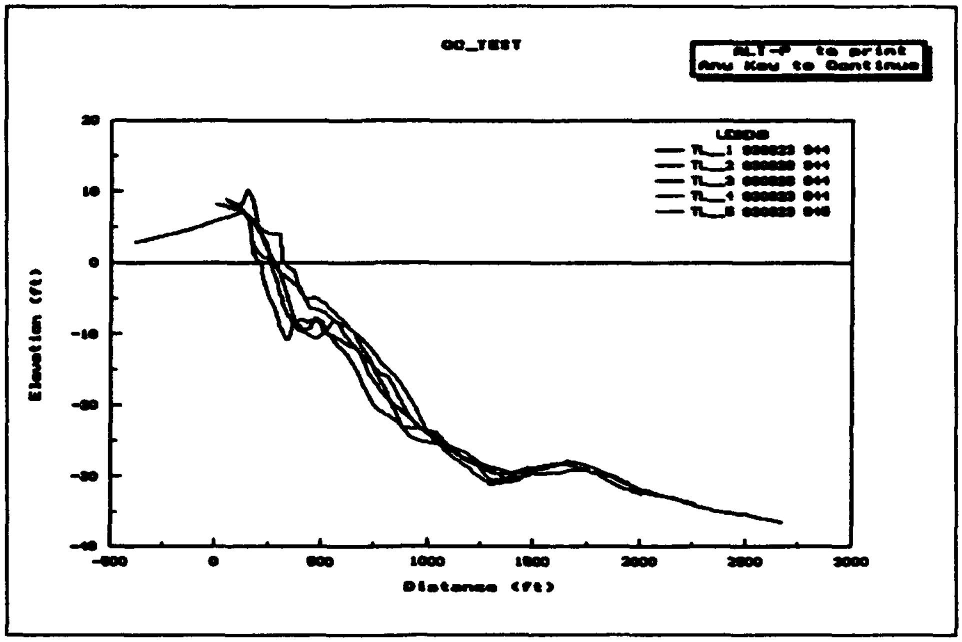


Figure 48. After translating profiles

the header of each profile (Figure 49). We have entered a value of 100 for the Dx and a value of 24 for the time difference under the assumption that the storm lasted 24 hr. After you have entered the values, *BMAP* plots a graph of

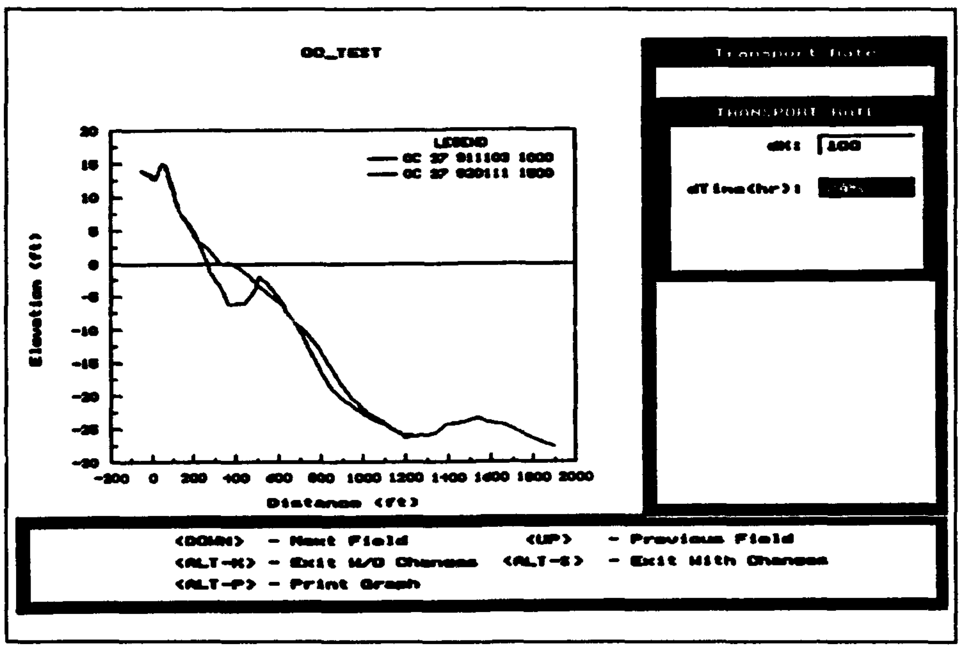


Figure 49. Entering values to calculate the transport rate

the cross-shore transport rate and displays basic information to the right (Figure 50).

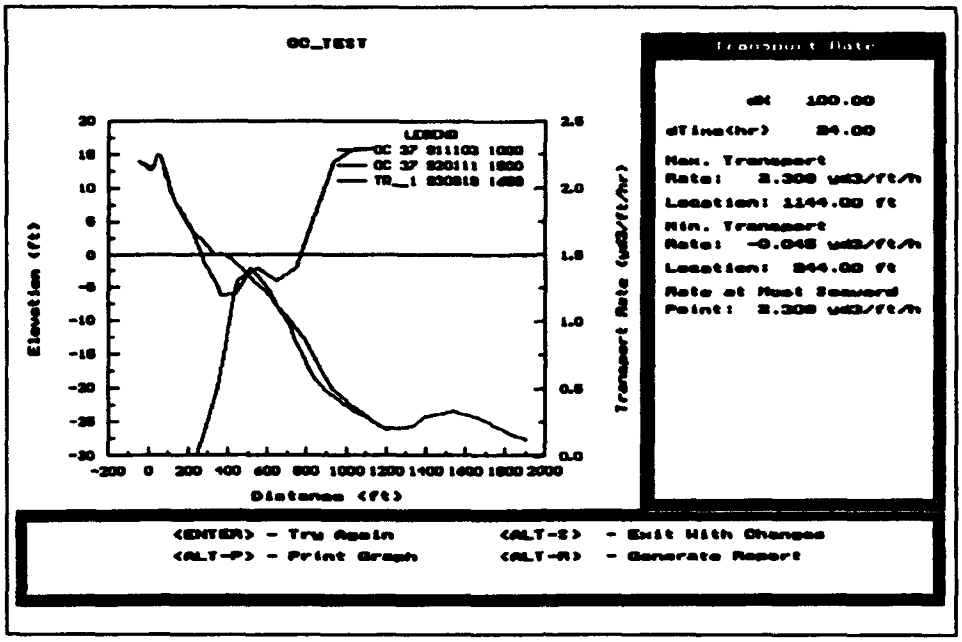


Figure 50. Results of transport rate calculation

Figure 50 shows that the cross-shore transport rate was positive, indicating offshore transport because the *x*-axis is positive directed offshore. Of course, during the time between surveys, longshore transport and other factors such as beach fill placement and artificial manipulation of the subaerial profile may have occurred, so that the resultant profile change was not solely a result of cross-shore transport. The calculated maximum and minimum transport rates shown in the information box have units of $m^3/m/hr$ if the project is in metric units and $yd^3/ft/hr$ if in American customary units as in our example.

BMAP has the capability to print a hard copy of the calculated data in the right window of the screen. To do this, press <ALT-R>. *BMAP* asks if you wish to send the information to the printer or to a file. If you choose printer, *BMAP* immediately begins to print the information. If you choose file, enter a valid DOS file name. Do not include the directory because *BMAP* automatically saves the file in the data directory of the project.

Volume

After **Volume** is chosen, you will notice that there are two options (Figure 51). We will first choose **From Xon to Xoff**. A graph appears with the prompt to enter **Xon, Xoff,** and **Zero elevation**. We shall enter 0 for **Xon**, 1000 for **Xoff**, and 0 for **Zero elevation** (Figure 52). The *BMAP* then displays

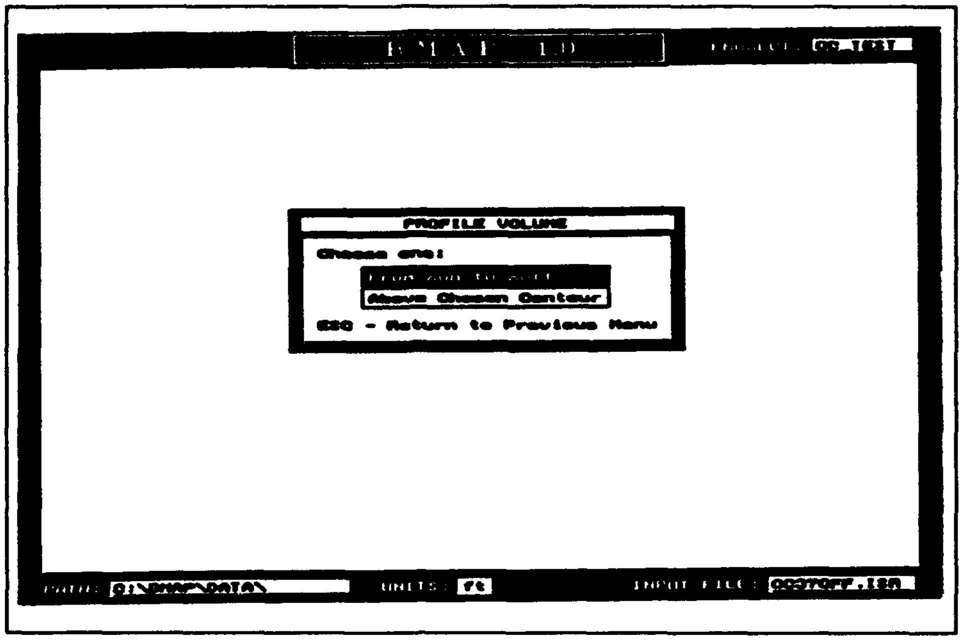


Figure 51. **Profile Volume Menu**

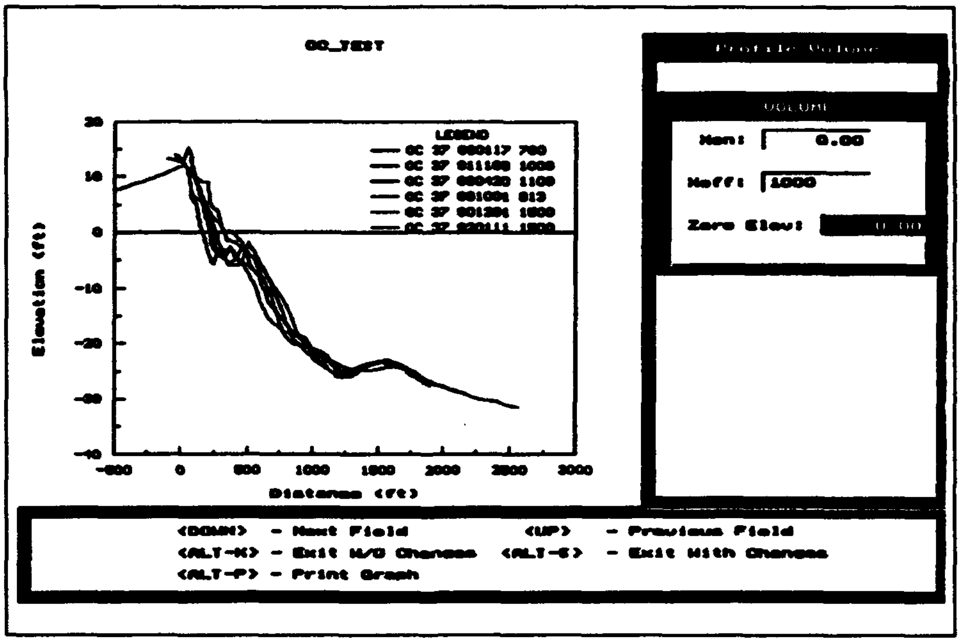


Figure 52. Entering values for profile volume calculation

a scroll screen with the volume of each profile over that distance with respect to zero elevation (Figure 53).

The results of the volume calculation are shown in the scroll box in the right-hand window of the screen. In metric units, the volume will be given in

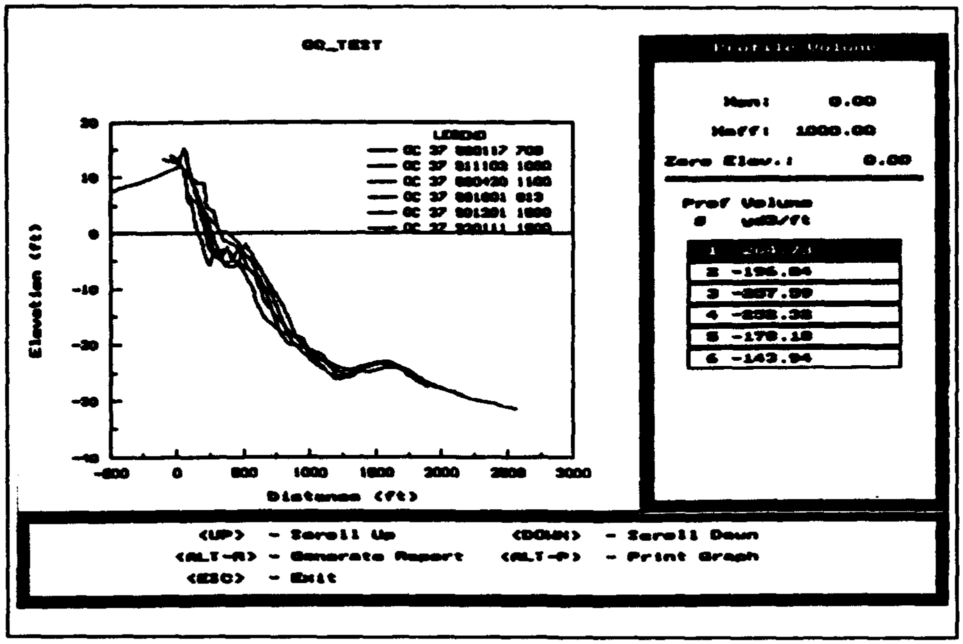


Figure 53. Results for profile volume calculation

m^3/m. For the present situation of American customary units, the output is in yd^3/ft.

ESCape from that screen and choose **Volume** again, but this time choose **Above a chosen contour**. The *BMAP* now waits for you to enter the contour, which we choose as -5 ft (Figure 54). *BMAP* shows a scroll screen with the volume of all of the profiles, and this time it displays the location of the -5 ft elevation contour (Figure 55). The *BMAP* has the capability to print a hard copy of the calculated data in the right window of the screen. To do this, press <ALT-R>. The *BMAP* asks if you wish to send the information to the printer or to a file. If you choose printer, *BMAP* immediately begins to print the information. If you choose file, enter a valid DOS file name. Do not include the directory because *BMAP* automatically saves the file in the data directory of the project.

Synthetic profiles

Now choose the option **Synthetic Profiles**, and we can discuss the four different types of artificial profiles that can be generated. Choose **Equilibrium Profile**. You are prompted to enter **Xon**, **Xoff**, **Dx**, and the *A*-parameter or grain size. Choose the values as entered in Figure 56. We selected the G-option, grain size, and entered 0.30 mm as a round value based on our best-fit equilibrium profile exercise performed previously. The *BMAP* now plots the equilibrium $x^{2/3}$ profile to the screen (Figure 57).

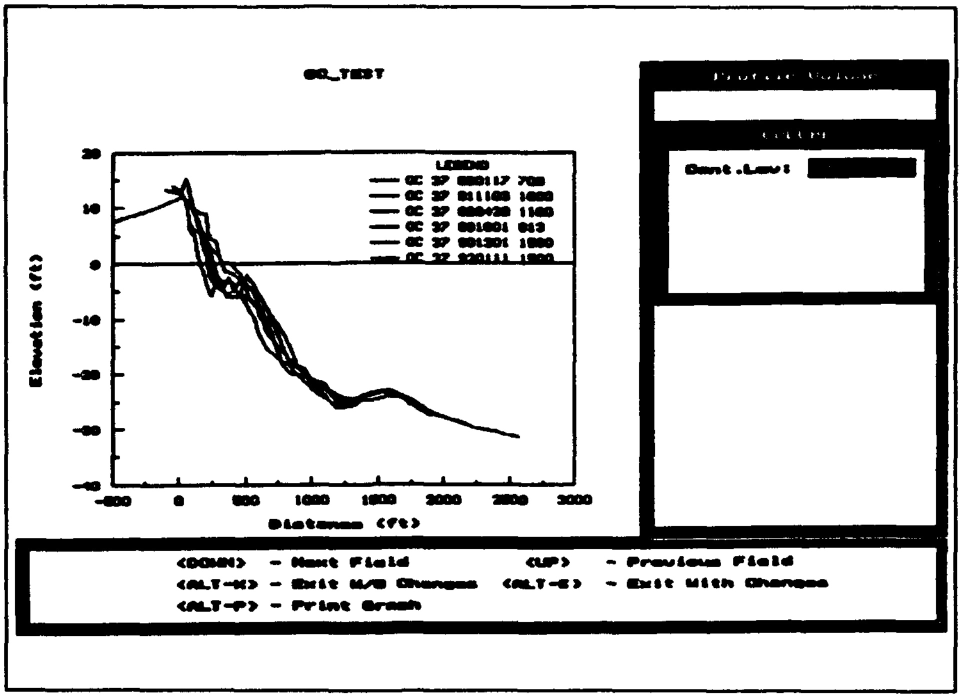


Figure 54. Entering contour for volume calculation

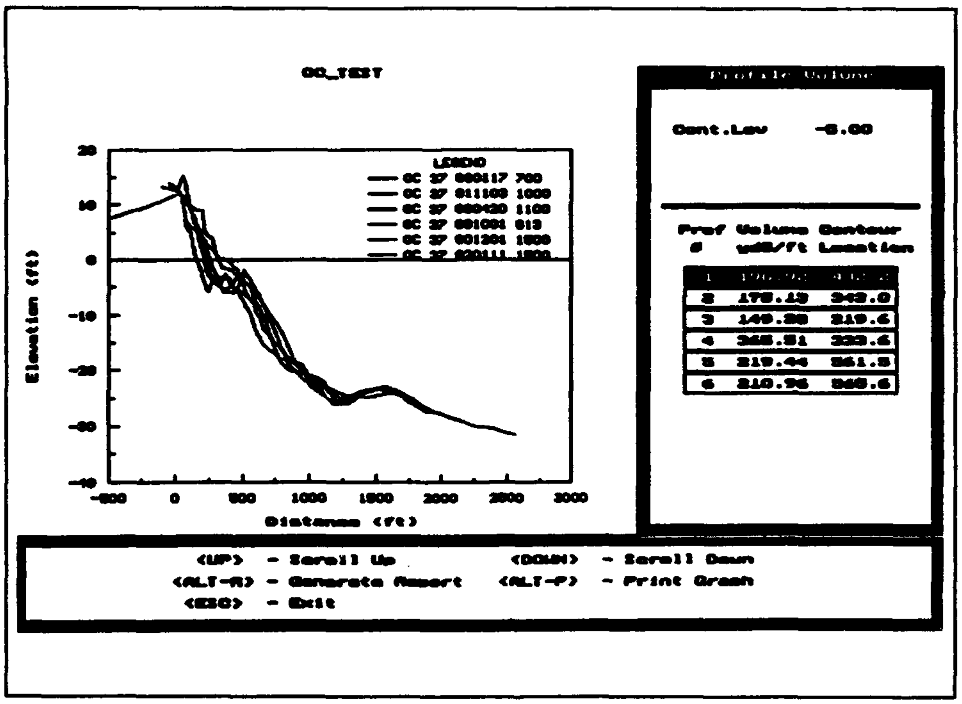


Figure 55. Results for profile volume above a chosen contour

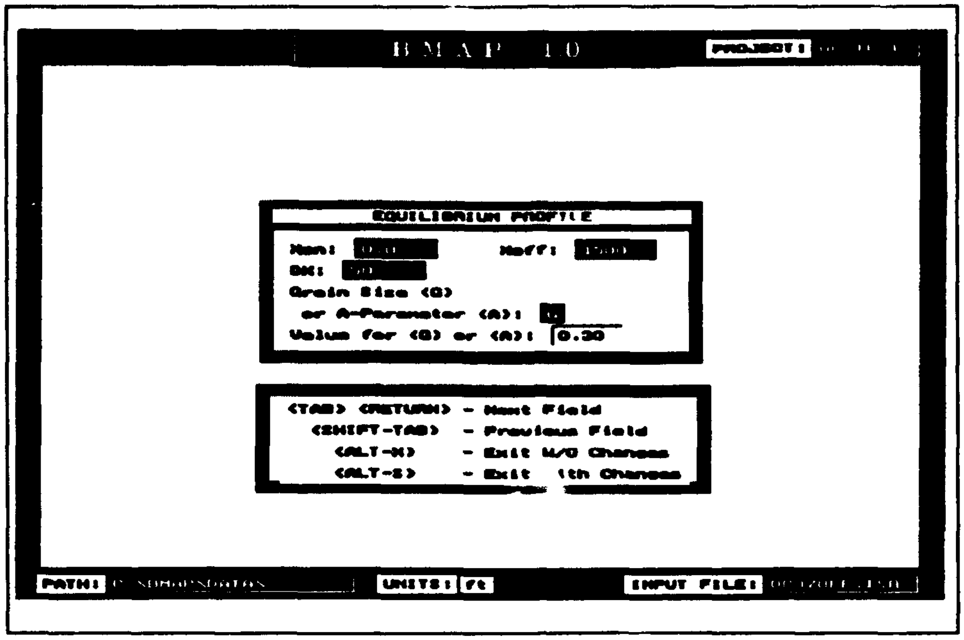


Figure 56. Entering values for Equilibrium Profile option

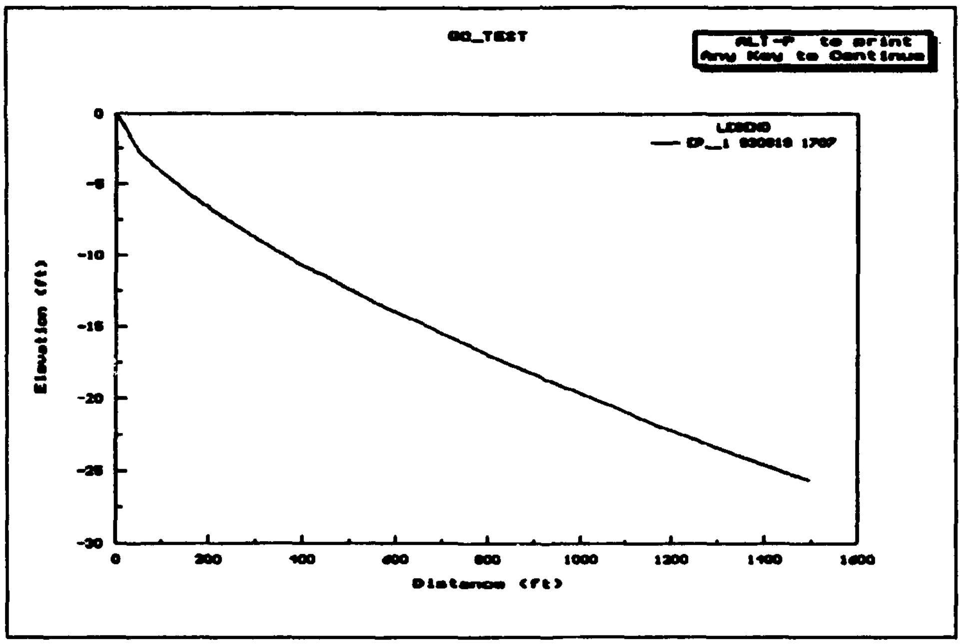


Figure 57. Generated equilibrium profile

ESCape back and we will now compute an interpolated profile. The **Inter polate Profile** option requires that we choose a profile to interpolate. We have chosen Profile OC 37 891001 813 from the input file (Figure 36). After you have chosen the profile, enter **Xon, Xoff,** and **Dx** (Figure 58). Enter 0 for **Xon,** 1500 for **Xoff,** and 100 for **Dx.** The *BMAP* then displays the

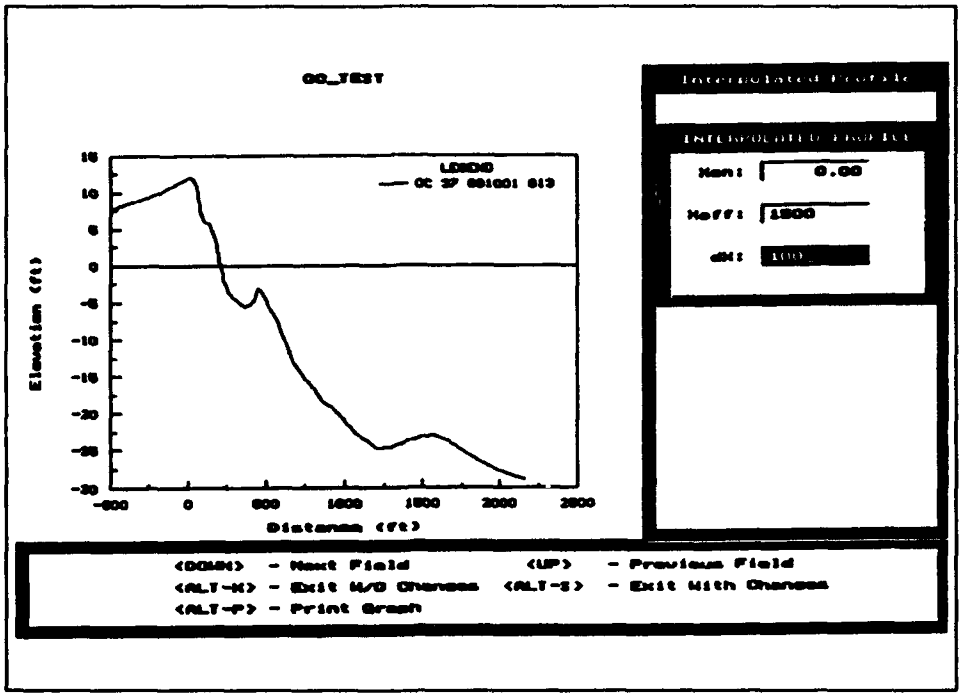


Figure 58. Entering values for Interpolated Profile option

interpolated profile (Figure 59). Note that the interpolated profile (IP__1) has lost some resolution of profile features as compared to the input profile, the actual profile based on measurements, because the interpolation interval of 100 ft typically spans (omits) several survey points.

Next we come to **Modified Equilibrium Profile**, which is similar to **Equilibrium Profile**. Enter the values as they are shown in Figure 60. The *BMAP* then plots the resulting equilibrium profile (Figure 61).

The last-listed synthetic profile option included within *BMAP* is the plane-sloping profile. Here you need only enter **Xon**, **Xoff**, **Dx**, elevation at **Xon**, and elevation at **Xoff**. If you enter the values shown in Figure 62, the profile displayed in Figure 63 should result.

We have now covered all the options of *BMAP* and are ready to exit the program. To do this, return to the **Main Menu** (press ESCape until the **Main Menu** is displayed). Now press <Q> to quit. You will return to the screen as shown in Figure 64. Choose "YES" to exit. You will then be prompted with the screen shown in Figure 65. Choose "YES" to save the project. You will then be prompted with the screen shown in Figure 66. Choose "YES" again to prepare to save some of the output profiles from our session.

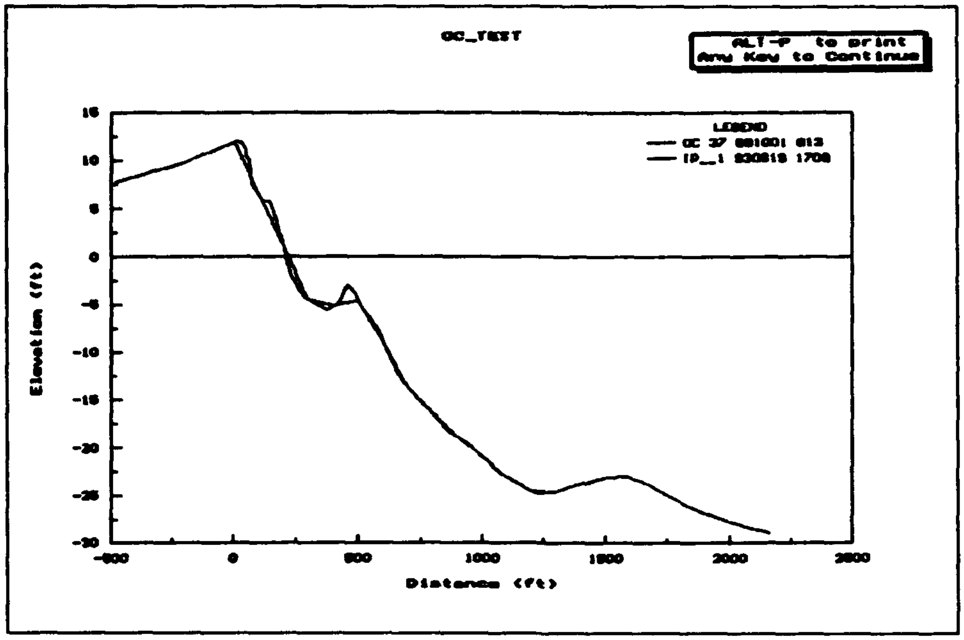


Figure 59. Interpolated profile, DX = 100

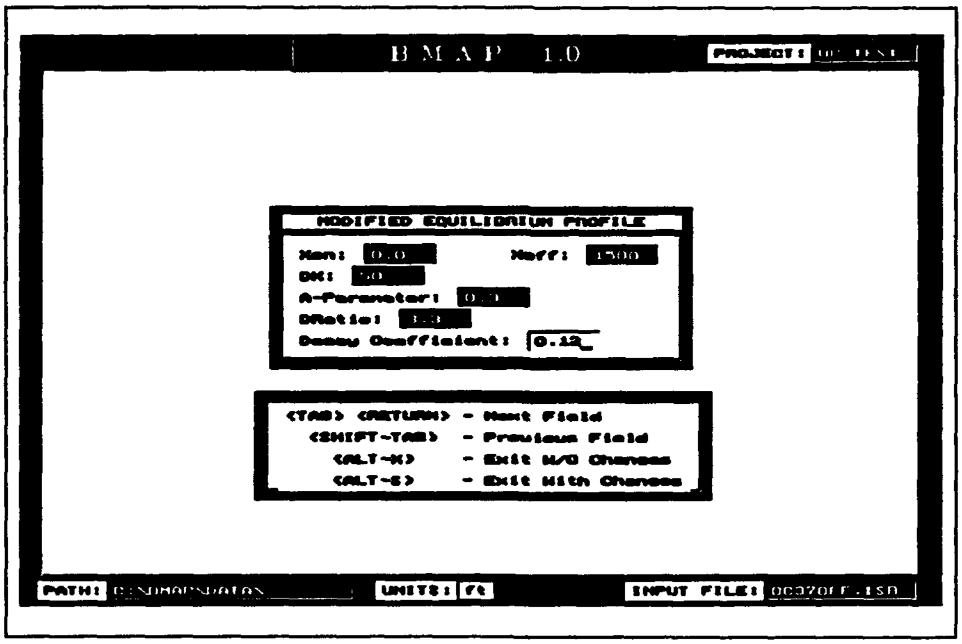


Figure 60. Entering values for modified equilibrium profile

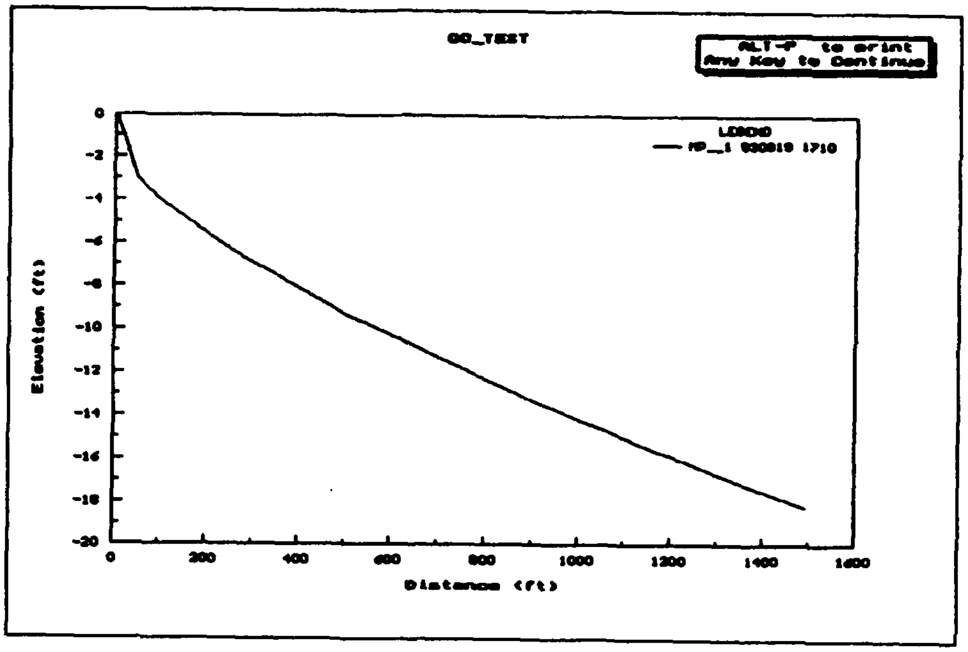


Figure 61. Generated modified equilibrium profile

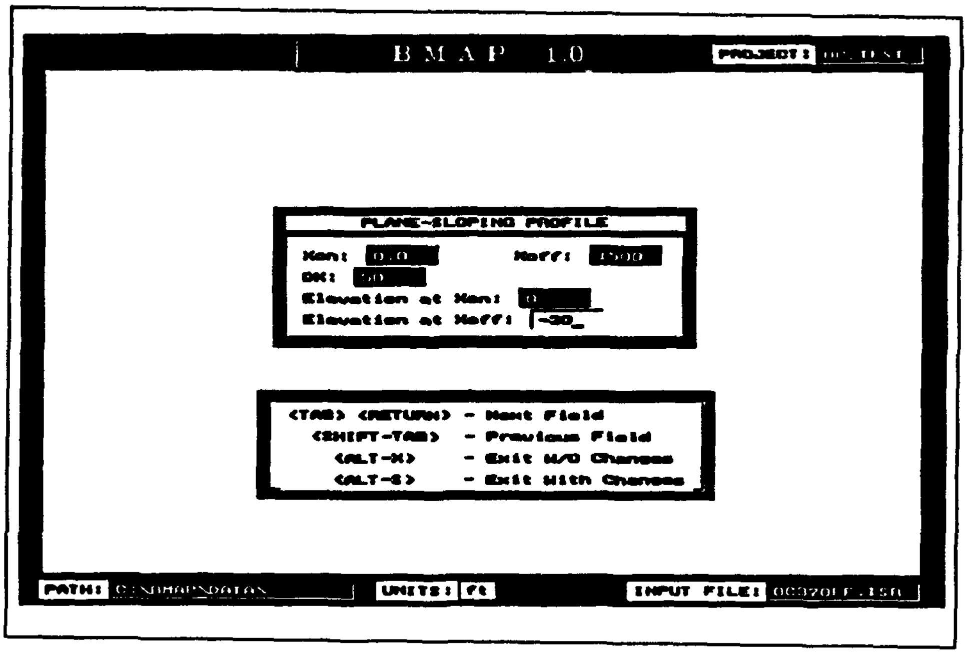


Figure 62. Entering values for plane-sloping profile

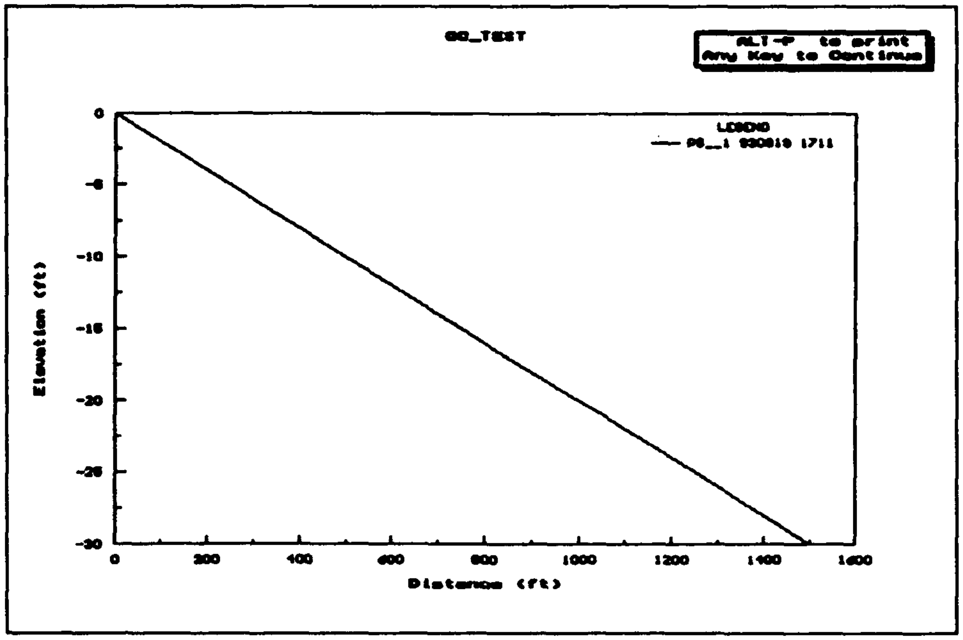


Figure 63. Generated plane sloping profile

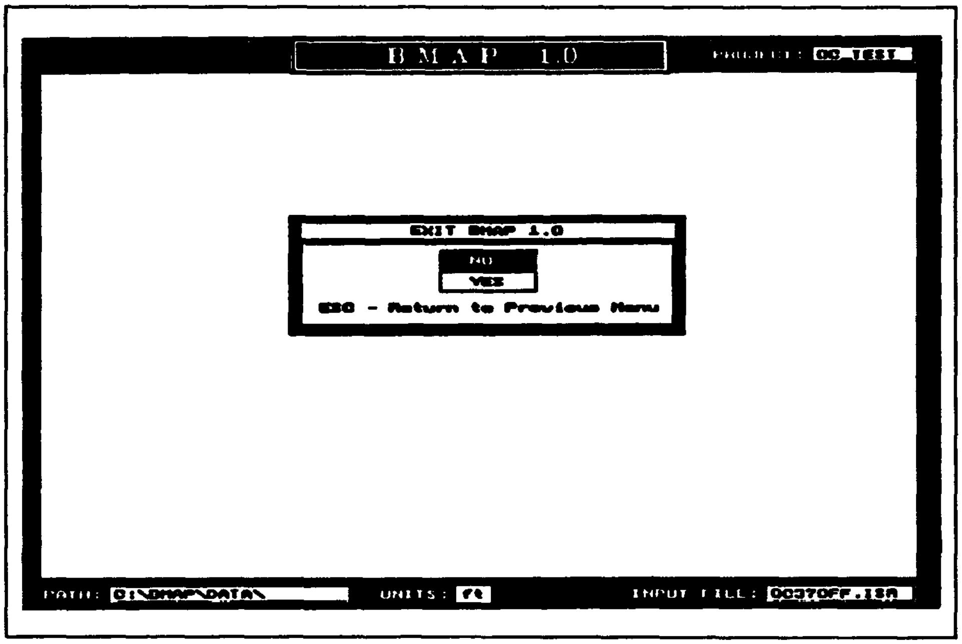


Figure 64. Exit confirmation

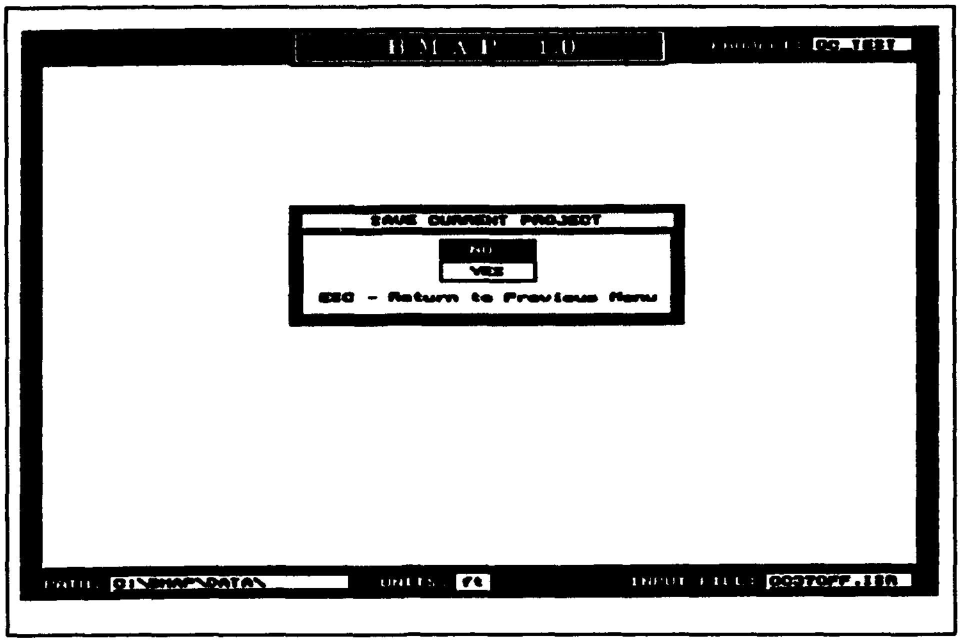


Figure 65. "Save Project" message

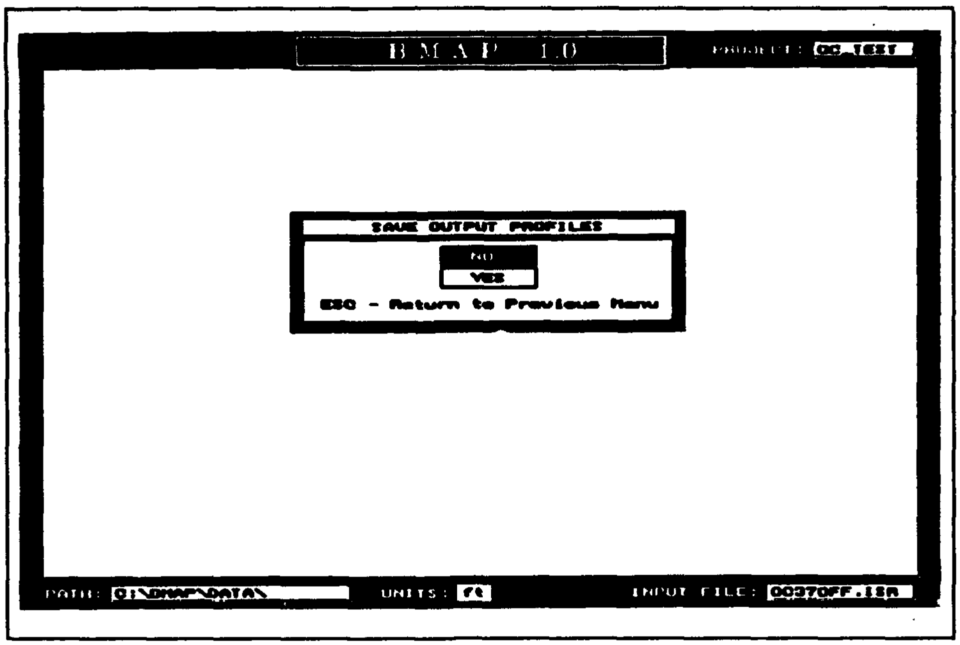


Figure 66. "Save Output Profiles" message

You are now in the **Output Profiles Menu**. Here you may change the names and descriptions of the output profiles. You also have the option to save the profiles to disk. The file you specify should contain no extension.

The *BMAP* automatically appends ".prf" to the file name. Figure 67 shows the profiles as we have saved them. You may or may not wish to save these profiles at this time.

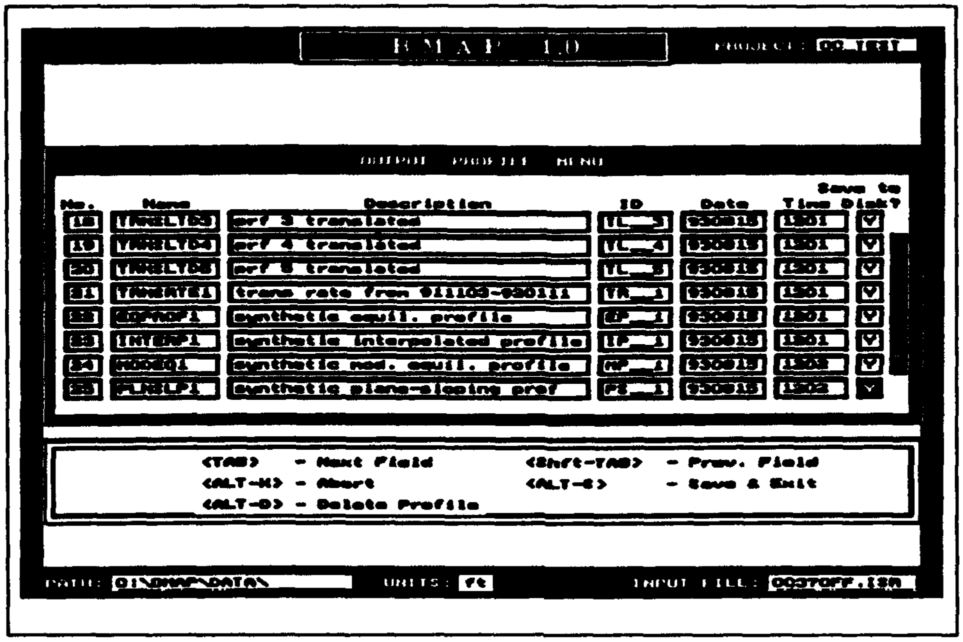


Figure 67. Saving output profiles

When completed renaming files and entering descriptions, press <ALT-S> to save the changes. You will be returned to the DOS prompt outside of *BMAP*.

This concludes our example using data from Ocean City. You may now wish to review the next example, which makes use of data from the SUPER-TANK Laboratory Data Collection Project involving a large wave tank.

SUPERTANK

In this example, we will only discuss a few operations that provide interesting differences from those of the Ocean City example. We have created a project for SUPERTANK and entitled it ST_TEST. The default input file, which is found on your installation diskette, is entitled ST_10.2D, which is a test with monochromatic waves. We will be calculating the bar properties for these profiles.

SUPERTANK data were recorded with a higher precision than standard ISRP, and, therefore, different length multipliers must be used. When creating the project, the **Project Parameters** screen is displayed (Figure 68). Change the distance and elevation multipliers to 0.01 to confirm how SUPERTANK

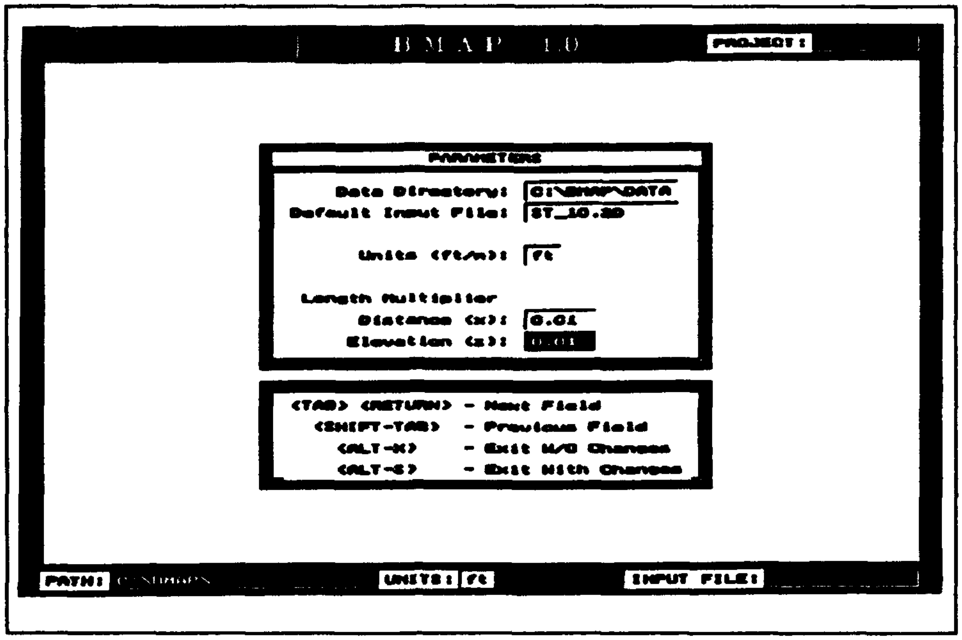


Figure 68. Entering length multipliers for SUPERTANK

profile survey data were recorded, which was to the 0.001 ft in horizontal distance and elevation.

The profiles that we have loaded for this test are listed in Figure 69. All five of the available profiles have been activated.

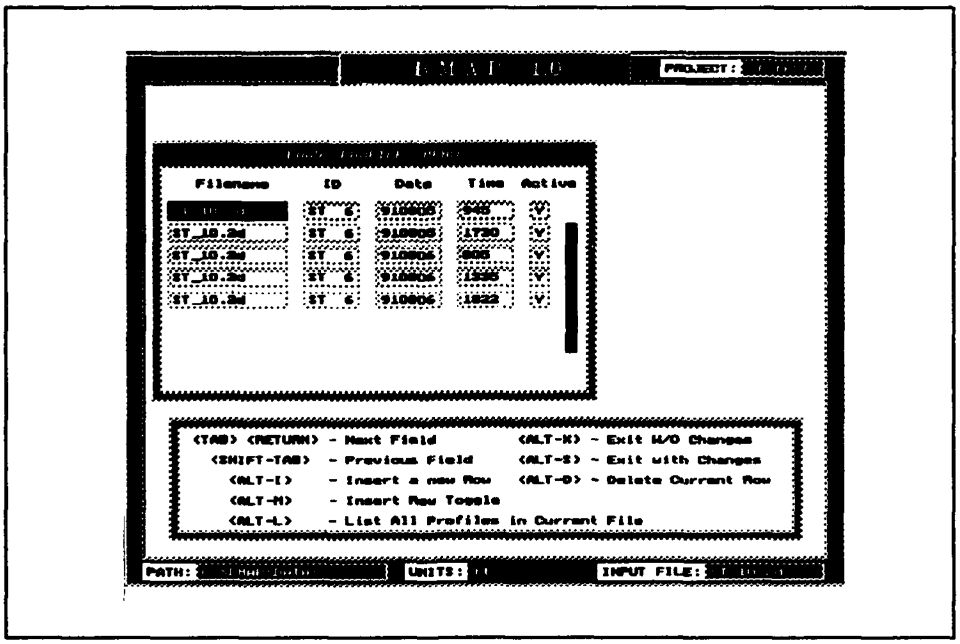


Figure 69. Profiles available in the file ST_TEST

Now we calculate bar properties. Enter on **Bar Properties** from the **Analysis Menu**, then choose **With a Reference Profile**. For this example, we chose Profile ST 6 910805 1005 for the reference and Profile ST 6 910808 1240 as the specific target profile. Figure 70 shows the two profiles and the crossing pairs, and Figure 71 shows the results of the calculations.

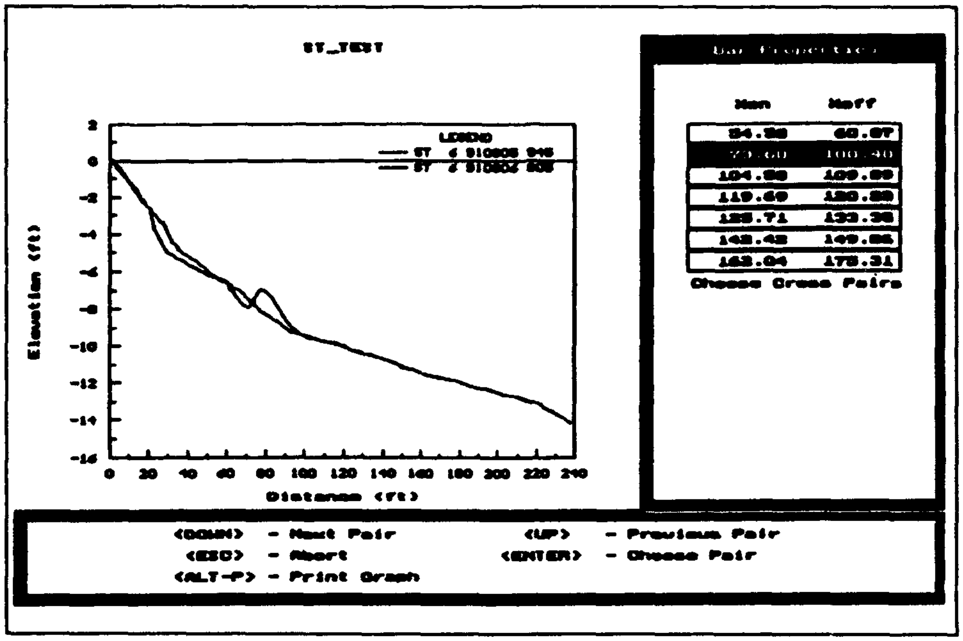


Figure 70. Choosing cross pairs for bar properties for ST_TEST

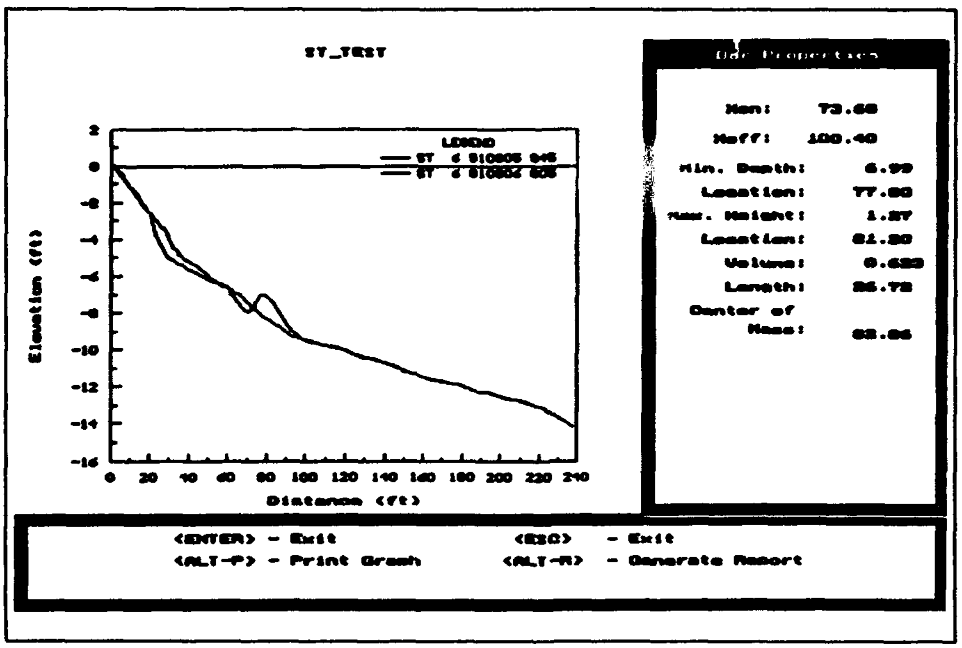


Figure 71. Results of bar properties for ST_TEST

In Figure 70, we see that several bars have been located. Some of these are observed on the graph to simply be large ripples generated by the monochromatic waves. There is only one large break-point bar, located in the region between 73.68 and 100.40 ft. Therefore, enter on this bar to calculate bar properties in Figure 71.

This concludes the example chapter. For more detailed instructions on running *BMAP*, consult Chapters 1 through 6 of this manual.

References

Birkemeier, W. A. (1984). "A user's guide to ISRP: The interactive survey reduction program," Instruction Report CERC-84-1, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Dean, R. G. (1977). "Equilibrium beach profiles: U.S. Atlantic and Gulf coasts," Ocean Engineering Report No. 12, Department of Civil Engineering, University of Delaware, Newark, DE.

__________. (1991). "Equilibrium beach profiles: Characteristics and applications," *Journal of Coastal Research* 7(1), 53-84.

Hanson, H., and Kraus, N. C. (1990). "GENESIS: Generalized model for simulating shoreline change: Report 1, Technical reference," Technical Report CERC-89-19, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Keulegan, G. H. (1948). "An experimental study of submarine sand bars," Technical Report No. 3, Beach Erosion Board, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Kraus, N. C. (1993). (Guest Editor). "The January 4, 1992 storm at Ocean City, Maryland," *Shore and Beach*, 61(1), collection of five papers.

Kraus, N. C., Smith, J. M., and Sollitt, C. K. (1992). "SUPERTANK Laboratory Data Collection Project." *Proceedings of 23rd Coastal Engineering Conference*. American Society of Civil Engineers.

Larson, M. (1991). "Equilibrium profile of a beach with varying grain size." *Proceedings Coastal Sediments '91*. American Society of Civil Engineers, 905-19.

Larson, M., and Kraus, N. C. (1989). "SBEACH: Numerical model for simulating storm-induced beach change; Report 1, Empirical foundation and model development," Technical Report CERC-89-9, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Larson, M., and Kraus, N. C. (1992). "Analysis of cross-shore movement of natural longshore bars and material placed to create longshore bars," Technical Report DRP-92-5, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Larson, M., Kraus, N. C., and Byrnes, M. R. (1990). "SBEACH: Numerical model for simulating storm-induced beach change; Report 2, Numerical formulation and model tests," Technical Report CERC-89-9, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Moore, B. D. (1982). "Beach profile evolution in response to changes in water level and wave height," M.S. thesis, Department of Civil Engineering, University of Delaware, Newark, DE.

Stauble, D. K., Garcia, A. W., Kraus, N. C., Grosskopf, W. G., and Bass, G. P. (1993). "Beach nourishment project response and design evaluation: Ocean City, Maryland; Report 1, 1988-1992, Technical Report CERC-93-13," U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Appendix A
Example Data and Format

This appendix reviews the Interactive Survey Reduction Program (ISRP) format (Birkemeier 1984)[1] and lists the survey data used in the examples given in the main text of the report.

ISRP Format

The ISRP format is summarized in Table A1. The format is defined by record line number, position on the line, and the content of the information. The Beach Morphology Analysis Package (*BMAP*) will look for profile survey information in exactly this format; errors in format may produce either run-time errors or spurious results. Examples of survey data in ISRP format are given in the next section.

Example Survey Data

The survey data for the Ocean City, Maryland, and SUPERTANK example projects are given respectively in Figures A1 and A2.

In Figure A1, the entry "OC_37" identifies the survey line as "Ocean City, profile line No. 37." The "41" leading the next entry indicates that this entry is "line 1 of card 4," is not necessary, and is not read by *BMAP*. The date of the survey is "890117" (17 January 1989). The entry "700" is the time of the survey (0700), and there are 59 coordinate (horizontal, elevation) pairs. The entry "-286" indicates that the minimum elevation is -28.6 ft. The entry "Ocean City" is optional material treated as blank space by *BMAP*. The next entry, "-108 134" is the first coordinate pair, indicating a horizontal distance of 108 ft behind the baseline, and a profile elevation of 13.4 ft. (These entries are in standard ISRP format with regard to precision.) The other entries follow similarly.

[1] References cited in this appendix can be found in the reference list at the end of the main text.

Table A1
Explanation of ISRP Data Format

Position	Description of Entry
	First Data Line in Each Record
1-5	Profile Location Number
6-10	Blank
11-16	Date of Survey (year, month, day)
17-21	Time of Survey (e.g., 1250 = 12:50)
22-24	Number of coordinate pairs in the survey
25-29	Minimum elevation in the survey (e.g., -258 = -25.8 units)
30-40	Blank
41-80	First four distance-elevation pairs Elevation values have one significant digit (e.g., 90 45 = Horizontal Distance 90 units, Elevation 4.5 units
	Following Data Lines in Each Record
1-10	Same as first data line
11-80	Seven distance-elevation pairs

Values of the coordinate pairs for the SUPERTANK example data set include an extra precision value which differs from standard ISRP format. Under the **Project Options Menu**, there is an option called **Units**, in which the length and elevation multipliers (cf, Chapter 2) can be changed to account for extra survey precision. For SUPERTANK, the distance length multiplier was 0.01 and the elevation length multiplier was 0.01. Therefore, the first coordinate-pair entry "10 -5" is read as horizontal distance of 0.10 ft from the baseline with an elevation of -.05 ft. Other header information in the first line follows standard ISRP format. The "ST__6" entry indicates Test 6 of the SUPERTANK series (Kraus, Smith, and Sollitt 1992), and the first survey shown in Figure A2 was done on 5 August 1991 at 0945. There are 130 coordinate pairs in the survey.

```
OC 37   41890117  700 59 -286OCEAN CITY  -108  134   14  125   29  121   44  117
OC 37   42   59  113   74  111   89  102  104   95  117   89  129   85  144   76
OC 37   43  159   54  178   45  197   38  217   21  238    0  258  -21  274  -34
OC 37   44  291  -37  310  -43  331  -43  351  -41  365  -26  386  -29  403  -34
OC 37   45  412  -43  438  -52  465  -61  523  -81  543  -92  568 -100  584 -115
OC 37   46  595 -122  614 -133  638 -145  660 -156  722 -168  790 -182  847 -184
OC 37   47  947 -190  998 -208 1087 -218 1148 -231 1203 -239 1254 -243 1318 -248
OC 37   48 1386 -243 1447 -239 1494 -235 1558 -235 1601 -237 1643 -241 1684 -246
OC 37   49 1731 -248 1794 -255 1858 -264 1930 -275 2017 -280 2092 -286

OC 37   51890420 1100 54 -317OCEAN CITY  -108  134   21  126   39  120   58  114
OC 37   52   75   62   95   54  110   53  126   28  150    2  176  -15  198  -37
OC 37   53  233  -58  249  -57  254  -49  276  -31  307  -30  336  -33  347  -31
OC 37   54  356  -30  394  -34  412  -50  457  -51  505  -61  559  -70  613  -86
OC 37   55  675 -105  710 -111  744 -127  805 -164  834 -174  893 -189  948 -199
OC 37   56 1011 -215 1065 -223 1119 -230 1179 -239 1249 -252 1306 -260 1375 -249
OC 37   57 1440 -240 1504 -236 1560 -230 1623 -233 1706 -241 1793 -252 1889 -267
OC 37   58 1978 -276 2088 -286 2172 -294 2249 -299 2328 -303 2410 -306 2492 -312
OC 37   59 2586 -317

OC 37   71891001  813 60 -291 Ocean City -483   79 -224   98   11  122   22  121
OC 37   72   32  120   49  112   51  109   51  105   63  100   74   75   86   71
OC 37   73   96   66  107   62  118   59  130   58  142   58  154   51  165   41
OC 37   74  184   27  202    9  210    1  216   -6  223  -12  231  -19  253  -31
OC 37   75  268  -37  289  -43  372  -56  421  -48  456  -30  486  -37  499  -45
OC 37   76  513  -52  528  -59  581  -76  604  -93  631 -108  659 -123  683 -133
OC 37   77  712 -141  742 -150  802 -166  867 -185  943 -196 1010 -213 1083 -229
OC 37   78 1148 -237 1216 -249 1295 -248 1363 -242 1435 -237 1506 -233 1589 -231
OC 37   79 1667 -237 1746 -249 1832 -261 1929 -272 2001 -278 2078 -284 2170 -291

OC 37  101901201 1500 66 -257                 -56  140  -25  134    2  126   15  132
OC 37  102   27  140   39  147   50  154   65  143   79  129   97  102  110   99
OC 37  103  123   97  138   95  151   92  166   92  179   92  193   92  206   92
OC 37  104  210   55  224   50  237   44  252   43  266   41  278   32  290   20
OC 37  105  304   12  318    2  343  -14  372  -15  410  -19  432  -24  465  -32
OC 37  106  501  -37  522  -40  560  -49  582  -63  606  -76  632  -88  652 -103
OC 37  107  676 -115  701 -128  717 -143  736 -155  756 -168  780 -183  824 -196
OC 37  108  854 -202  888 -203  924 -204  972 -206 1017 -214 1081 -226 1130 -234
OC 37  109 1184 -251 1203 -256 1248 -257 1290 -254 1335 -253 1371 -251 1401 -249
OC 37  10: 1441 -249 1486 -247 1532 -246 1574 -244 1625 -244 1669 -242

OC 37  141920111 1500 65 -277                 -56  140  -21  136   10  131   29  137
OC 37  142   43  151   60  147   71  135   82  119   93  109  104   96  124   83
OC 37  143  142   67  177   53  209   36  221   34  231   31  242   28  252   26
OC 37  144  263   23  273   20  298   11  322    0  341    0  361    2  379    0
OC 37  145  398   -4  419   -8  436  -13  464  -20  474  -24  507  -34  541  -44
OC 37  146  582  -54  616  -64  652  -79  693  -93  736 -107  779 -122  813 -140
OC 37  147  846 -157  880 -176  921 -195  942 -203  965 -210  990 -217 1021 -225
OC 37  148 1058 -232 1095 -240 1124 -248 1158 -255 1193 -262 1198 -264 1238 -262
OC 37  149 1284 -260 1340 -257 1398 -244 1448 -241 1547 -234 1593 -239 1653 -243
OC 37  14: 1705 -248 1746 -256 1793 -263 1842 -270 1914 -277
```

Figure A1. Ocean City, Maryland, test data set

```
ST  6   910805  945130                          10   -5   15   -5   16   -3  109    6
ST  6     215   -7  355  -21  489  -38  654  -57  818  -86  983 -107 1120 -122
ST  6    1244 -140 1405 -164 1641 -219 1642 -218 1645 -218 1646 -218 1646 -218
ST  6    1695 -211 1818 -238 2043 -256 2636 -340 2642 -339 2659 -337 3150 -440
ST  6    3153 -443 3285 -450 3444 -472 3478 -485 3482 -484 3484 -484 3484 -485
ST  6    3485 -484 3486 -484 3519 -483 3604 -487 3689 -500 3708 -505 3709 -505
ST  6    3709 -505 3709 -505 3710 -505 3710 -505 3712 -505 3713 -505 3721 -504
ST  6    3856 -507 4098 -524 4338 -544 4581 -562 4817 -582 5042 -605 5296 -622
ST  6    5558 -643 6189 -672 6211 -682 6212 -681 6228 -681 6370 -688 6548 -700
ST  6    6760 -719 7332 -772 7557 -794 7764 -820 7980 -831 8217 -847 8433 -862
ST  6    8661 -880 8882 -894 9108 -911 9337 -927 [illegible]545 -931 9772 -94010005 -950
ST  6   10166 -94910401 -95710634 -96810980 -97611206 -97911463 -98211685 -988
ST  6   11957-100012221-100912509-102412800-103713099-104513373-104813666-1050
ST  6   13968-106314243-108114501-108814764-109915055-111015329-112515805-1134
ST  6   16113-114916452-116416801-117117128-117817475-118417826-118618149-1197
ST  6   18485-121218815-122619130-123319452-123419761-124320092-125120422-1265
ST  6   20782-127221146-127721644-129321946-130422165-131322386-132122537-1333
ST  6   22541-133922541-133922541-133922542-133822542-133922542-133922542-1338
ST  6   22589-133922784-135023002-136223230-137223347-138223347-138223348-1382

ST  6   910805 1730119                           3  -12    9  -12    9  -12   12  -12
ST  6      15   -9   16   -9   20   -7  171  -16  378  -36  385  -40  863  -95
ST  6     866  -97  875 -106 1016 -114 1047 -131 1310 -155 1451 -193 1706 -231
ST  6    1807 -242 1928 -255 2011 -266 2056 -279 2074 -287 2079 -292 2080 -292
ST  6    2095 -297 2115 -307 2164 -358 2216 -370 2278 -384 2392 -411 2490 -432
ST  6    2607 -450 2869 -490 2871 -492 2943 -493 2968 -502 2969 -502 2972 -501
ST  6    3051 -502 [illegible] -511 3316 -521 3452 -531 3619 -541 3797 -553 3982 -562
ST  6    4180 -572 4381 -586 4581 -595 4844 -615 5039 -624 5237 -636 5439 -644
ST  6    5643 -651 5833 [illegible] 6010 -660 6179 -689 6251 -705 6365 -726 6542 -754
ST  6    6753 -785 6928 -801 7093 [illegible] 7193 -772 7458 -725 7548 -708 7695 -701
ST  6    7835 -707 7991 -713 8174 [illegible] 8407 -761 8665 -806 8935 -852 9243 -889
ST  6    9547 -919 9812 -93510050 -94510239 -95410406 -95410626 -96410858 -978
ST  6   11164 -98411383 -98611532 -99611578 -99911584 -99911793 -99512110-1009
ST  6   12458-101712804-102813126-104213481-105213836-106514187-107814561-1090
ST  6   14764-110815245-111815582-113315888-114416230-115816567-116416912-1174
ST  6   17269-118417650-119118012-119818385-121118765-122119175-123619550-1239
ST  6   19952-125120396-126120829-127421271-128521895-130122287-131722651-1342
ST  6   22992-136123277-137623430-1390

ST  6   910806  805108-1420                      2   -5    3    0  338  -36  660  -78
ST  6     932 -116 1121 -139 1253 -159 1254 -158 1262 -157 1627 -226 1628 -225
ST  6    1703 -21[illegible] 1790 -240 1994 -256 2044 -282 2045 -281 2046 -281 2047 -281
ST  6    2067 -286 [illegible]106 -301 2204 -365 2878 -488 2927 -504 2928 -504 2959 -501
ST  6    3146 -511 3367 -526 3543 -535 3763 -547 3949 -560 4104 -570 4203 -576
ST  6    4365 -583 4547 -591 4743 -602 4941 -618 5153 -625 5795 -646 6053 -658
ST  6    6216 -703 6235 -701 6359 -717 6573 -750 6850 -789 7105 -793 7260 -781
ST  6    7350 -777 7380 -775 7384 -768 7443 -744 7521 -728 7642 -708 7780 -699
ST  6    7926 -701 8120 -713 8303 -738 8481 -769 8664 -801 8893 -844 9134 -879
ST  6    9336 -899 9536 -915 9773 -93710019 -94910292 -95910518 -96011102 -980
ST  6   11436 -98611705 -99511998-100112298-101612453-102812519-102612722-1029
ST  6   12971-103813232-104513592-105413889-106614206-108014534-108614938-1102
ST  6   15106-112115681-113316096-115016526-116216975-117217428-118217873-1192
ST  6   18312-120818718-122219072-123119430-123719772-124720062-125320283-1259
ST  6   20559-126820838-127421209-128321607-129722178-130922579-133622861-1353
ST  6   23159-136923401-138323601-139423766-140623892-141723902-1420

ST  6   910806 1335112                          12    3  196  -18  452  -45  675  -64
ST  6     861  -80 1089 -108 1250 -158 1277 -148 1686 -214 1784 -234 1900 -246
ST  6    1922 -264 1923 -264 1925 -264 1954 -270 2008 -295 2024 -320 2105 -370
ST  6    2223 -412 2376 -447 2504 -470 2611 -484 2705 -488 2717 -494 2717 -494
ST  6    2731 -492 2857 -491 3034 -507 3228 -534 3386 -548 3438 -538 3619 -541
ST  6    3849 -571 4105 -589 4346 -581 4620 -592 4901 -611 5194 -648 5490 -662
ST  6    5734 -671 5957 -675 6157 -681 6157 -682 6157 -683 6158 -676 6158 -683
ST  6    6161 -683 6243 -680 6434 -684 6650 -701 6875 -746 7062 -797 7181 -828
ST  6    7345 -863 7448 -866 7540 -860 7576 -856 7584 -860 7619 -827 7679 -805
ST  6    7700 -803 7727 -779 7836 -759 7887 -726 7971 -698 8110 -685 8285 -680
ST  6    8486 -698 8723 -725 8963 -773 9440 -848 9757 -90110013 -91810337 -940
ST  6   10635 -96011006 -98311353 -99411703 -99911988-100812266-100512632-1030
ST  6   12893-103513155-104013481-105513809-106614026-105614101-107714118-1082
ST  6   14157-107514289-108014538-109214796-110815247-112015617-113516015-1144
ST  6   16408-116016826-117217244-117917656-118918069-119718484-120918943-1226
ST  6   19434-123619917-124520403-126520904-127121425-128621959-130522471-1323
ST  6   23159-135823563-139023806-1408

ST  6   [illegible].0806 1822 88                         6   -3   10   -3   72    0  162   -8
ST  6     255  -13  393  -25  530  -45  725  -67  850  -76 1164  -96 1172  -99
ST  6    1222  -89 1326 -112 1590 -211 2144 -386 2280 -408 2447 -439 2609 -463
ST  6    2773 -487 2943 -508 3114 -523 3282 -539 3456 -553 3635 -566 3840 -577
ST  6    4061 -587 4277 -600 4873 -626 4874 -628 5016 -628 5243 -635 5487 -654
ST  6    5745 -667 6003 -671 6247 -670 6522 -680 6809 -721 6984 -762 6997 -772
ST  6    7139 -779 7300 -802 7425 -809 7544 -797 7686 -787 7844 -785 8018 -802
ST  6    8179 -805 8223 -805 8354 -780 8411 -770 8447 -764 8624 -738 8873 -733
ST  6    9199 -771 9541 -84610044 -91310440 -94810859 -97511221 -99111641 -993
ST  6   12008-100312516-101813046-103713563-105314107-106814671-109415252-1118
ST  6   15804-113716349-115516918-117417486-118518046-120018857-121719436-1233
ST  6   19999-124520562-126521061-127621489-128821870-130022248-131822591-1334
ST  6   22873-135422909-136322937-136323016-136823469-138323679-139923696-1403
```

Figure A2. SUPERTANK test data set

Appendix B Installation of *BMAP*

This appendix describes system requirements for running the Beach Morphology Analysis Package (*BMAP*) and the installation procedure for transfer of the package from the distribution diskette to your computer.

System Requirements

System requirements for *BMAP* include at minimum a Disk Operating System (DOS) 386-compatible personal computer, Video Graphics Array (VGA) monitor, 1.5 Mb of hard drive space, and 640 K of memory. A mouse is recommended but not required. *BMAP* is supplied on a 3.5-in. (1.44-Mb) diskette. It is recommended that a backup copy of the *BMAP* distribution diskette be made prior to attempting installation.

If hard copy printouts of *BMAP* graphs are desired, the user must have a Hewlett-Packard LaserJet II compatible printer.

Installation

For installing the software package, it is recommended that *BMAP* be placed into a separate directory called BMAP. It will be assumed that your hard drive is the "C" drive. To create this directory and move to it, type:

```
C:\> MKDIR BMAP <ENTER>
C:\> CD BMAP <ENTER>
```

Insert the *BMAP* distribution diskette into the available 3.5-in. drive (A or B). To complete the installation for a target A drive, type:

```
C:\BMAP\> COPY A:*.* <ENTER>
```

BMAP is now installed on the hard drive. Please store the distribution diskette in a safe place.

Running *BMAP*

BMAP can only be started from within the BMAP directory, where BMAP.EXE is present. There are two ways to start *BMAP*. For method one, type:

C:\BMAP\> BMAP <ENTER>

BMAP will start and the **PROJECT OPTIONS** menu will be displayed.

To use the second method of starting *BMAP*, a project must already exist. Start *BMAP* with a project file (excluding extension) as a command line option. Following is an example using a project called OCEANCTY found in the current directory:

C:\BMAP\> BMAP OCEANCTY

Appendix C
Converting Files

This appendix describes the procedure for conversion between the Interactive Survey Reduction Program (ISRP) format files and the Beach Morphology Analysis Package (*BMAP*) Free-format (FRE) files. The arrangement of a FRE file and an example are given. The FRE format, which is basically a two-column format of distance elevation pairs, is convenient for entry to plotting packages. Two-column format data files are typically generated in numerical simulation models. In the FRE format, the first two lines of each record may be treated as headers for the file containing distance elevation data pairs in two-column format.

Convert Files

Converting profile data files, either to or from ISRP and FRE format, is accomplished through the **Main Menu** option **Convert Files**. At the **Convert Files** data entry screen, choose the first option for conversion of ISRP to FRE, or the second option for conversion of FRE to ISRP. When the next screen is displayed, enter the corresponding file names. If the ISRP or FRE data file is currently in another directory, precede the data file name with the complete path for each of the specified file names. *BMAP* will then proceed with the specified conversion.

BMAP Free-Format (FRE)

The FRE format is summarized in Table C1. The format is defined by record line number, position on the line, and the content of the information. The *BMAP* will look for profile survey information in exactly this format; errors in format may produce invalid or erroneous results. Examples of survey data in FRE format are given in the next section.

Table C1 Explanation of *BMAP* FRE Data Format	
Position	**Description of Entry**
	First Data Line in Each Record
1 - 5	Profile Location Number (ID)
6	Blank
7 - 11	Date of Survey (year, month, day)
12	Blank
13 - 18	Time of Survey (e.g., 1850 = 6:50 pm)
	Second Data Line in Each Record
1 - 3	Number of coordinate pairs in the survey
4	Blank
5 - 20	Minimum elevation in the survey
	Following Data Lines in Each Record
1 - EOL	One distance elevation pair (e.g., 10.24056 -28.634) delimited by a blank. EOL means end of line

Example Survey Data

Selected survey data for the Ocean City, Maryland, example project are given in Figure C1. In Figure C1, the entry "OC 37" identifies the survey line as "Ocean City, profile line No. 37." The entry "890117" is the date of the survey (year, month, day), and the "700" indicates the time of the survey (0700). The "59" on the second line of the first record indicates that there are 59 coordinate(distance, elevation) pairs, and the "-28.600000" indicates that the minimum elevation is -28.6 ft. The next entry, "-108.000000 13.400000" on the third line of the first record, is the first coordinate pair, indicating a

```
OC 37 890117  700
 59            -28.600000
-108.000000     13.400000
  14.000000     12.500000
  29.000000     12.100000
   ...            ...
   ...            ...
1930.000000    -27.500000
2017.000000    -28.000000
2092.000000    -28.600000
OC 37 890420 1100
 54             -31.700001
-108.000000      13.400000
  21.000000      12.600000
  39.000000      12.000000
   ...             ...
   ...             ...
2410.000000     -30.600000
2492.000000     -31.200000
2586.000000     -31.700000
```

Figure C1. Ocean City, Maryland, test data, set Records 1 and 2 horizontal distance of 108 ft behind the baseline, and a profile elevation of 13.4 ft. The other entries follow similarly.

Appendix D
Notation

A — Shape parameter describing the equilibrium beach profile, $m^{1/3}$ or $ft^{1/3}$

d_{50} — Median grain size, mm

D_{ratio} — Ratio of energy dissipation at the shoreline to energy dissipation in the offshore

Dx — Horizontal increment factor

h — Water depth

R^2 — Correlation coefficient squared

x — Horizontal coordinate, m or ft

z — Vertical coordinate or elevation, m or ft

λ — Spatial gradient at which the equilibrium energy dissipation the approaches dissipation in the offshore, m^{-1} or ft^{-1}

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 1994	Report 1 of a series

4. TITLE AND SUBTITLE
BFM: Beach Fill Module; Report 1, Beach Morphology Analysis Package (BMAP)-User's Guide

5. FUNDING NUMBERS

6. AUTHOR(S)
Barry G. Sommerfeld, John M. Mason, Nicholas C. Kraus, Magnus Larson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
See reverse

8. PERFORMING ORGANIZATION REPORT NUMBER
Instruction Report CERC-94-1

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers,
Washington, DC 20314-1000

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

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

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report is a user's guide for the Beach Morphology Analysis Package (*BMAP*), which consists of automated and interactive procedures to analyze morphologic and dynamic properties of beach profiles. The *BMAP* is a computation utility developed to support desktop computer simulation studies of cross-shore modeling of storm-induced beach erosion for beach fill design. The *BMAP* includes a graphical interface that produces on-screen plots of user-selected profiles and calculation results that are easily exported to a printer. The present report covers Version 1 of *BMAP* which is capable of two-dimensional analysis, that is, analysis of beach profiles. This guide provides information to operate *BMAP* as a stand-alone program under the Disk Operating System (DOS) running on a personal computer (PC).

14. SUBJECT TERMS

Beaches	Coastal morphology	Equilibrium profile
Beach profiles	Cross-shore transport	Longshore bars

15. NUMBER OF PAGES 86

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std Z39-18
298-102

7. (Concluded).

U.S. Army Engineer Waterways Experiment Station,
Coastal Engineering Research Center
3909 Halls Ferry Road, Vicksburg, MS 39180-6199
Department of Water Resources Engineering, Lund Institute of Technology,
University of Lund, Box 118, Lund, Sweden S-22100; Texas A&M University,
Corpus Christi, TX 78412-5599