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of Engineers
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REMR Management Systems—Navigation and Flood Control Structures

User's Software Manual for Inspection and Rating of Concrete in Gravity Dams, Retaining Walls, and Spillways

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Preface

The program documented herein was authorized by Headquarters, U.S. Army Corps of Engineers (HQUSACE), as part of the Operations Management problem area of the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program. The work was performed under Civil Works Research Unit 32673, "Maintenance and Repair Guidelines and Management Systems," for which Mr. Stuart D. Foltz (CECER-FL-P) is Principal Investigator. Mr. Harold Tohlen (CECW-O) is the REMR Technical Monitor for this study.

Dr. Tony Liu (CERD-C) is the REMR Coordinator at the Directorate of Research and Development, HQUSACE. Mr. Tohlen and Dr. Liu serve as the REMR Overview Committee. Mr. William F. McCleese (CEWES-SC-A), U.S. Army Engineer Waterways Experiment Station, is the REMR Program Manager. Mr. David T. McKay (CECER-FL-P) is the Problem Area Leader for the Operations Management problem area.

The REMR Tools software described in Chapters 3 and 4 was developed by the Automation Support Center, University of Illinois, under the technical supervision of Mr. Foltz. Mr. Foltz and Mr. John Elston (Contractor) used the REMR Tools Software to produce the Data Entry and Modification forms in Chapter 4. Software that computes the condition index was written by Mr. Elston. Documentation of the inspection and condition index rating rules for the concrete in gravity dams, retaining walls, and spillways was provided in a separate technical report. Mr. Elston was responsible for bringing the various software segments together to form a complete operational program.

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1 Introduction

Background

The U.S. Army Corps of Engineers operates approximately 270 navigation dams constructed of plain or reinforced concrete. The Corps of Engineers also operates more than 350 reservoir dams, most of which are either concrete gravity structures or embankment structures with accompanying attachments and appurtenances constructed of plain or reinforced concrete. Many of these structures require, or will require, significant repairs to ensure safe and efficient operations. The Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program was created to identify and develop effective and affordable technology for maintaining and extending the service life of existing Corps Civil Works structures.

Modern engineering technology is providing procedures for performing condition surveys, consistent and quantitative condition assessment, and database management. Combined with economic analyses, these procedures afford efficient maintenance and repair (M&R) budget planning through evaluation of the current condition and comparison of various M&R alternatives based on life-cycle costs. Collectively, these procedures are called the REMR Management Systems. By using the REMR Management Systems, many of the subjective elements in the decision-making process are removed from M&R planning.

Purpose

The purpose of this user's manual is to describe use of the software associated with the REMR Management Systems. The technical background of the inspection process and condition index (CI) rules are provided in *Condition Rating Procedures for Concrete in Gravity Dams, Retaining Walls, and Spillways*, Technical Report REMR-OM-16 (Bullock and Foltz 1995).

The user's manual describes how to use software associated with one REMR Management System. The manual documents the use of the Maintenance Management System for the Concrete in Gravity Dams, Retaining Walls, and Spillways. Users familiar with Maintenance Management System software for other Civil Works Structures monoliths will find this program very similar.

System Requirements

The REMR Maintenance Management System was developed for operation on an IBM-compatible personal computer (PC) that runs MS-DOS* version 5.0 or higher. A hard disk drive is required with at least 20 MB of available storage capacity recommended. Memory of 640k RAM** is also required.

If the computer has memory-resident utilities, such as PC Tools, unload them before running the Maintenance Management System. Maximizing free memory greatly affects program speed.

Chapter 2 discusses system configuration and installation and startup of the module.

Maintenance Management System

The software for the Maintenance Management System is a microcomputer-based application. As in most database-oriented programs, the software performs database administration and calculations, and generates reports. The fundamental activities of Inventory and Condition Assessment are briefly described below.

Inventory

The program stores an inventory of all waterway systems and navigation and reservoir dam structures and monoliths contained within any given Corps of Engineers Division.

When condition inspection data are first entered for a given monolith, the software prompts the user to select it from a list of the structures in a Division, organized by District or by both District and river. The user is required to identify the monoliths being inspected before inspection data can be input. This one-time process ensures that monolith identification will remain consistent for different inspection teams.

* MS-DOS = Microsoft disk operating system.

** RAM = random access memory.

Condition Assessment

Condition inspection data are gathered by visual observation and by performing simple measurements. The inspector catalogs such items as movement, cracks, and volume loss. Other forms of distress such as leaks, deposits, corrosion, and disintegration are also noted. The data are accepted and stored by the management system software, which uses an algorithm to produce a CI for each monolith. The CI ranges from 0 to 100, with 100 reflecting an "as-built" condition. The CI algorithm is designed to produce CIs that reflect those conditions shown in Table 1. Engineering and management actions associated with the CI are described in the same table. Great care is taken in the development of the algorithm and inspection procedure to ensure that the results are consistent and repeatable. Such uniformity allows an objective comparison of the condition of one monolith to that of another.

Software Access

Software is available through the Internet at <http://www.cecer.army.mil/fl/remr/remr.html>. Software disks are available from the U.S. Army Construction Engineering Research Laboratories (USACERL), ATTN: CECER-FL-P, P.O. Box 9005, Champaign, IL 61826-9005 (telephone 217/352-6511, ext. 7301 or 7375) or from the U.S. Army Engineer Waterways Experiment Station (WES), ATTN: CEWES-IM-DS, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199 (telephone 601/634-2512).

Table 1. Condition index scale.

Zone	Condition Index	Condition Description	Recommended Action
1	85 to 100	Excellent: No noticeable defects. Some aging or wear may be visible.	Immediate action is not required.
	70 to 84	Good: Only minor deterioration or defects are evident.	
2	55 to 69	Fair: Some deterioration or defects are evident, but function is not significantly affected.	Economic analysis of repair alternatives is recommended to determine appropriate action.
	40 to 54	Marginal: Moderate deterioration. Function is still adequate.	
3	25 to 39	Poor: Serious deterioration in at least some portions of the structure. Function is inadequate.	Detailed evaluation is required to determine the need for repair, rehabilitation, or reconditioning. Safety evaluation is recommended.
	10 to 24	Very Poor: Extensive deterioration. Barely functional.	
	0 to 9	Failed: No longer functions. General failure or a complete failure of a major structural monolith.	

2 Using the Maintenance Management System

This chapter explains the steps required before entering the inspection data into the Maintenance Management System.

Typographical Conventions

Throughout this manual, the following typographical conventions will be used:

BOLD	indicates	User input
		Type CONCDAM
		Press Ctrl-Alt-Del
		Press Enter
		Select menu option Database Related Reports
ALL CAPS	indicates	Directory, file name, or command
		D:\CONCDAM
		CONFIG.SYS
		CHKDSK

Using the Maintenance Management System

The following operating conventions are used throughout the manual:

- Most entries must be followed by pressing **Enter**. If an input field is filled with the maximum number of characters, the cursor will automatically advance to the next input field.

- The information box at the bottom of the screen provides, when applicable, a short description of the current highlighted entry or explains the function of the keys available for that menu.
- Some data fields may be optional; however, most must be completed for the CI calculation to be valid. All data entry fields to be used in the CI calculation must be completed before the data can be saved.
- Use the **Ctrl-Enter** combination to save all data entered on each screen. Use the **Esc** key at any time during program operation to exit the current process and escape to a previous menu. Be aware that the Escape key generally will not save data entries or prompt you to save the data.

Setting the Proper Configuration

The configuration steps below will probably be unnecessary for Windows®95 and Windows®NT operating systems.

For the system to run properly, a CONFIG.SYS file must be present in the root directory of the PC with the following commands:

```
BUFFERS=30
```

```
FILES=30
```

```
DEVICE=path\ANSI.SYS
```

where "path" is the directory where the DOS files are located.

The CONFIG.SYS file can be detected by typing **DIR CONFIG.SYS** in the root directory. If the file exists, the PC will list the file name, size, and date created. If a CONFIG.SYS file does not exist, create one using a text editor (not a word processor, unless the information can be saved in an ASCII DOS text format). Include the above commands, and place the file in the root directory. After creating a new CONFIG.SYS file or editing an existing CONFIG.SYS file, reboot the PC by pressing **Ctrl-Alt-Del**. To ensure that the PC has at least 640k of available RAM, type the command **CHKDSK** to receive a disk and memory status report. The last two lines displayed on the screen are those to check. They should read:

```
# BYTES TOTAL MEMORY
```

```
# BYTES FREE
```

The number of bytes total memory should be 640k or greater. The number of bytes free should be 570k or greater; if fewer bytes are available, check for and unload any memory-resident utility. Maximizing the number of bytes free significantly increases the program speed. For further explanation of CONFIG.SYS, BUFFERS, DEVICE, and FILES commands, consult a DOS manual.

Maintenance Management System Installation

The systems for each monolith are available in two formats: (1) a 1.2 Mb, 5.25-in. diskette or (2) a 1.44 Mb, 3.5-in. diskette. The program is distributed in compressed files. The installation routine will copy the files to the specified disk drive and then expand them. The installation routine will also create the necessary directory and subdirectory structure for program operation and data storage. The installation routine will copy the program files to the drive path specified in the SETUP command. Typically, the user would install the program directly off the root directory of a disk drive (i.e., the C: drive). However, you can install the program in a deeper level directory by including the path to that directory in the SETUP command.

To begin the installation procedure:

Insert the program disk in the floppy disk source drive, and change the system to the source drive. Type **INSTALL**, and press **Return** or **Enter** to begin program installation. The monitor will display directions to guide you in specifying:

- the target drive for the installed program (i.e., C, D, F)
- an optional deeper level directory, which does not need to be specified if the program will not be installed into a deeper level directory.

The directions on the monitor screen direct the user to issue a **SETUP** command at the system prompt and include the three parameters in the command line string. The format for the command line string is shown in the following example:

Type: **SETUP C [dir]**

where **C** is the target drive, and
 [dir] is the optional subdirectory.

Press **Return** or **Enter** to continue the program installation. The program then copies the files to the C drive.

Remove and save the program disk and proceed to run the program. No need to install a monitor or printer; the program will detect a color monitor and will default to a draft mode printer.

Maintenance Management System Accession

To access the system, the user must be in the CONCDAM directory. To change to the CONCDAM directory, type CD\CONCDAM at the C: prompt and press **Enter**. After the system prompt C:\CONCDAM>, type CONCDAM to run the program.

Getting Started With the Maintenance Management System

When accessing the Maintenance Management System for the first time, the program will initialize the databases. After this momentary delay, a list of Division and Districts will appear, and an initial database will need to be chosen. Next, the program will provide the user an opportunity to enter default information that will be preloaded when a dam is chosen for data entry. The final "first time only" screen asks the user to choose whether the Division/District dams should be listed alphabetically or according to which river they are on. The information and options chosen from these three screens can be changed later from a program menu.

After the "first time only" screens, the title screen shows the program has been initiated. The title screen includes version, version date, authorship information, and the Corps of Engineer Division data set that is currently accessible. The structure data set distributed with the program is currently limited to a Division or District. Press any key to continue to the acknowledgment screen. The third screen is the **Main Menu**. The system is menu-driven, so all options begin at this menu.

Editing Keys

The editing keys are used to edit data being entered into the system. The following keys are used:

Backspace Key	-	Backspace one space (destructive).
Delete Key	Del	Deletes the character at the cursor position.
Insert Key	Ins	Toggles the Insert Mode on/off.
Left Arrow Key	-	Backspace one space (nondestructive).
Right Arrow Key	-	Forward one space (nondestructive).

Data Entry Keys

The data entry sections of the system use a number of keys for cursor movement, data selection, and special functions. Key availability and function is displayed in a box at the bottom of the screen or at the bottom of a window. The data entry keys are:

Return Key/ Left Mouse Button	Enter	Accepts the data and moves the cursor to the next data field.
Escape Key/ Right Mouse Button	Esc	Exits the current process and returns to the previous screen.
Ctrl-Enter	Ctrl-Enter	Pressing these two keys concurrently saves the data, exits the current process, and returns to the previous screen.
Tab Key	-	Advances the cursor to the next data entry field without updating the current data entry field.
Shift-Tab	sh->	Moves cursor to the previous field.
Space Bar	Space	Toggles between field entries.

Up Arrow Key	↑	Places the cursor on the data entry field above the current field.
Down Arrow Key	↓	Places the cursor on the data entry field below the current field.
Right Arrow Key	→	Places the cursor on the next data entry field. Scrolls down lists.
Left Arrow Key	←	Places the cursor on the previous data entry field.

3 Data Entry and Modification

Types of Data Entry

This chapter details the processes by which data are entered and modified by the system. The process of calculating a CI for a monolith requires the system to store historical and inspection data.

Historical Data To handle inspection data properly, historical data should be collected before the site visit. This historical information may be useful in collecting the inspection data.

Inspection Data The field inspection data are collected during an inspection of the monolith. Some information such as monolith sizes and structural information is available from drawings and should be available during the site inspection to be verified or changed during the inspection.

Inventory-related Data Entry

If information common to many or all dams is to be entered, it should be done before selecting an inspection date as directed in the following paragraph. It should also be done before any information has been entered by using **Edit Active Site Information**. Use the menu choice **Edit System Default Values** under the **Main Menu** option **System Management** (see Chapter 5) to enter any common information.

Before inspection information can be entered the first time for a structure, a number of required and optional data fields are presented to record reference information. From the **Main Menu**, select **Concrete Dam/Ret Wall/Spillway Data Entry** (Figure 1). Next, choose the option **Enter/Modify Inspection Data** (Figure 2), which will produce a screen list of dams in the selected Division/District (Figure 3). This list can be further divided into separate rivers (Figure 4) by changing the selection method. This subdivision is done under the **Main Menu** option **System Management** (see Change River/Dam Selection Method in

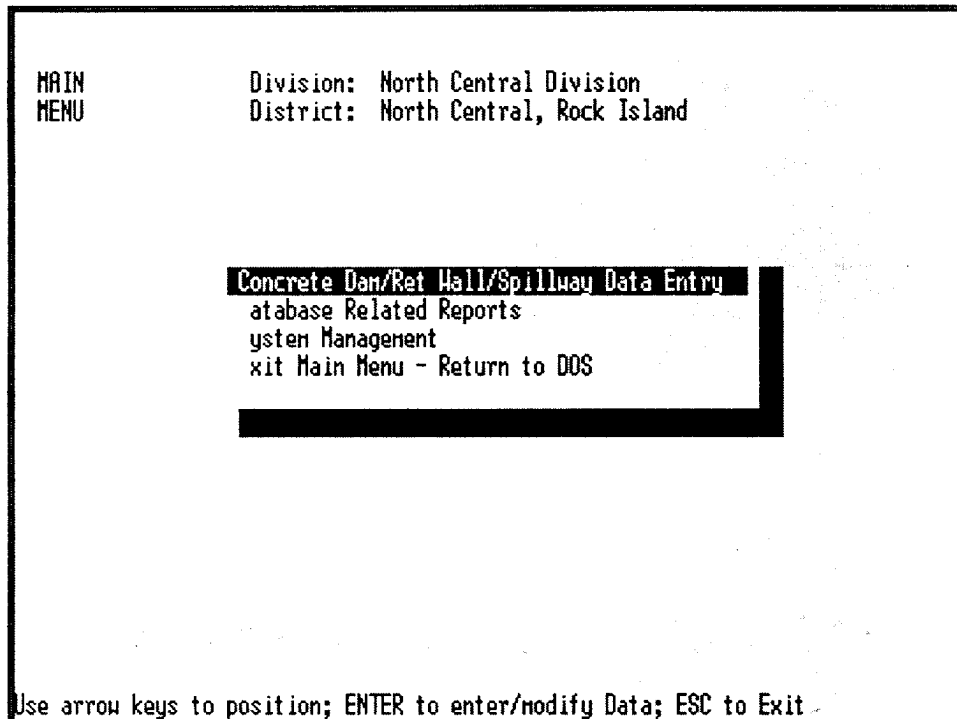


Figure 1. Select Concrete Dam/Ret Wall/Spillway Data Entry from Main Menu.

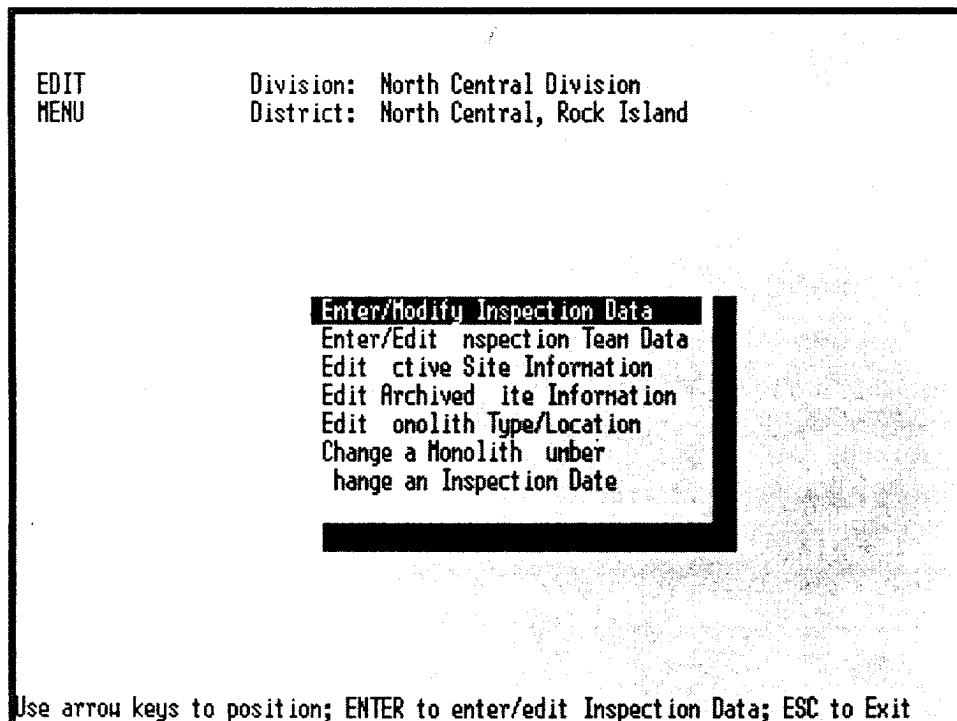


Figure 2. Select Enter/Modify Inspection Data.

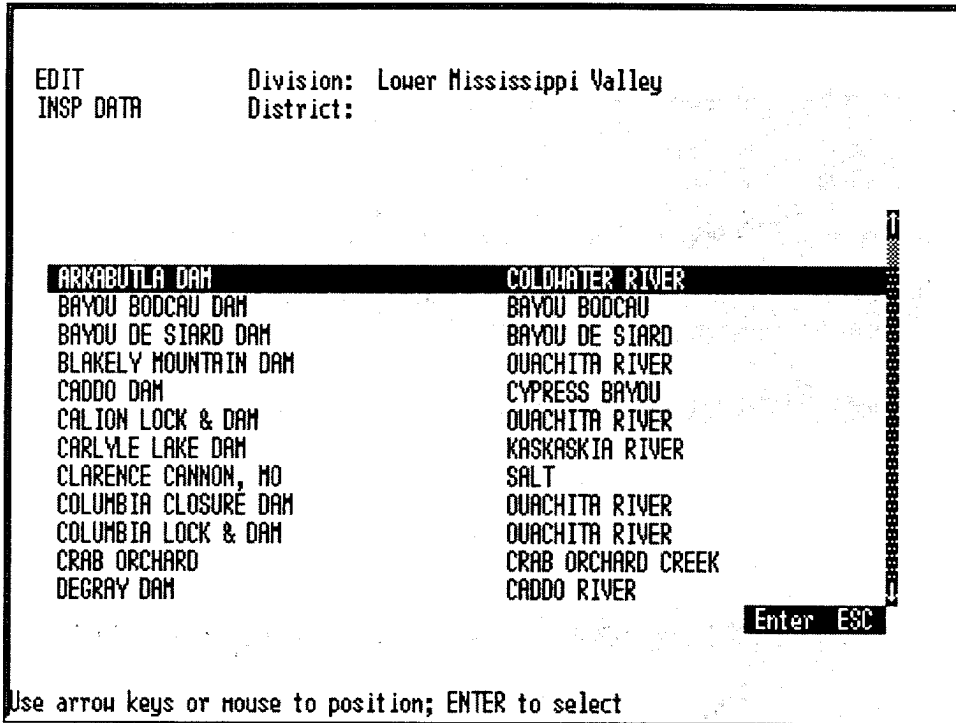


Figure 3. List of dams in the selected Division/District.

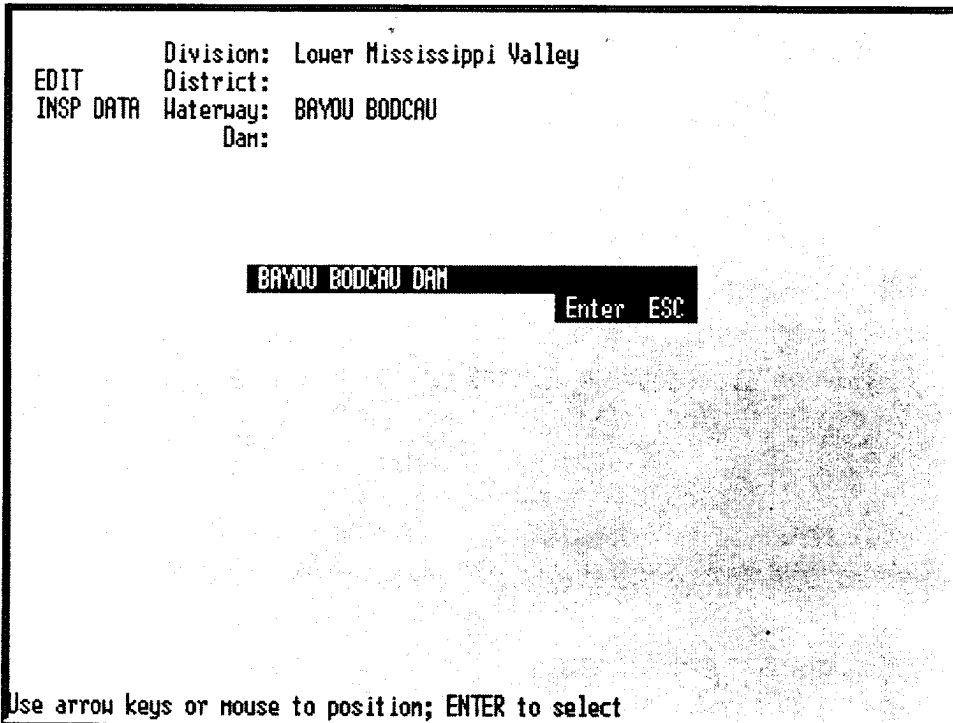


Figure 4. The list of dams subdivided into an individual waterway.

Chapter 5). Select a structure by using the mouse, arrow keys, or typing in the first few letters of the name to highlight the desired structure and pressing **Enter**. The first data entry screen, "Inspection Date" will appear (Figure 5). The field defaults to the current date. Modify the field as necessary and press **Ctrl-Enter** to record the inspection date.

For each dam, for the first inspection date only, the next screen will display **Edit Site Information** (Figure 6), which refers to the active site information. This screen is more fully discussed under the **Edit Active Site Information** section later in this chapter.

The program next asks for the **Inspection Team** information (Figure 7). This data entry screen is optional. To bypass this screen, press **Esc**. **Esc** is also used to proceed to the next data entry screen after all inspector records are entered. To enter inspection team information press **Ins**. The data entry field is 60 characters (see Figure 8). It is an open field so multiple inspectors can be listed on one field or each inspector can be entered in a separate field. This second option will leave additional space in the fields for other relevant information such as title/specialty, office symbol, or phone numbers. The Inspection Team data entry screen will only appear under the **Enter/Modify Inspection Data** menu option when a new inspection date is selected. Modifications to the inspection team for previous inspection dates can be made from the second (Figure 2) menu option **Enter/Edit Inspection Team Data**.

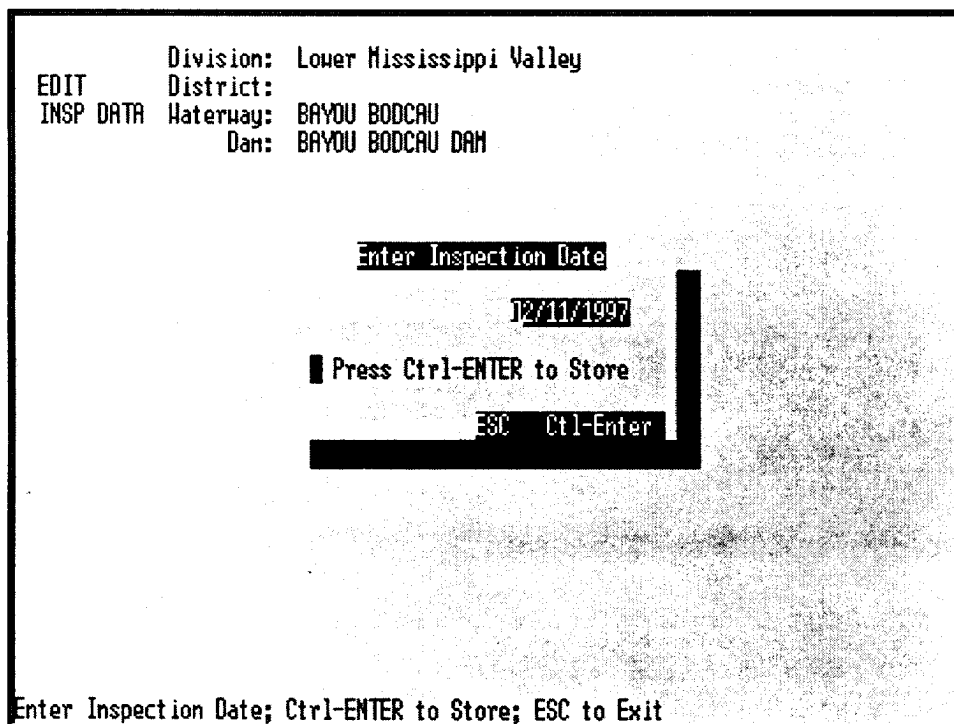


Figure 5. Enter Inspection Date screen.

```

Enter Site Information
Dan ID: MS01496
EDIT Lake: ARKABUTLA DAM
INSP River: ARKABUTLA LAKE
City: COLDWATER RIVER State: MS
City: TUNICA MISSISSIPPI
Division: LMV Lower Mississippi Valley
District: LMK Lower Mississippi, Vicksburg
Year Constructed: 1943 Inspection Cycle: 5 Years
Last Inspection: 11/29/1995 Next Inspection: 11/29/2000
Database Creation Date For This Site: 10/31/1995
Point of Contact:
Address:
Phone Number:
Fax Number:
E-Mail Address:
Alternate POC:
Alternate Phone:
Press Ctrl-ENTER to Store
Enter ESC Ctrl-Enter

```

Figure 6. The Edit Site Information screen for the first inspection date.

```

Division: Lower Mississippi Valley
EDIT District:
INSP DATA Waterway: COLDWATER RIVER
Dan: ARKABUTLA DAM
Ins Del Enter ESC

```

Press INS to enter one Inspection Team entry at a time. Each entry can contain information such as inspector name, office symbol, phone number, etc. Use any consistent format.

This information may be entered or edited at a later time through the Enter/Edit Inspection Team option on the Data Entry/Modification menu.

INSERT to enter Inspection Team Data; ESC to Exit

Figure 7. Inspection Team information screen.

```

EDIT      Division: Lower Mississippi Valley
INSP DATA District:
          Waterway: COLDWATER RIVER
          Dam:      ARKABUTLA DAM
          Inspection Date: 11/29/1995  Monolith #: 3  CI: Unk
          [REDACTED]
          Enter Inspection Team
          [REDACTED]
          Press Ctrl-Enter to Store
          [REDACTED]
          ESC  Ctrl-Enter
          Edit Inspection Team
          Display Distress Summary
          Force Condition Index Recalculation
          [REDACTED]
Enter Inspection Team Data: Ctrl-Enter to Store; ESC to Exit

```

Figure 8. The Enter Inspection Team data screen.

The final database of information required before entering the actual inspection data is the monolith identifications. The organization of this information is not immediately apparent to most new users. There is a **Current Inspection Monolith List** (Figure 9) and a **Catalogued Monolith Information** list (Figure 10), which is a master list for the dam. From the current list, press **Ins** to get the catalog list. Press **Ins** again to enter information for a particular monolith. Information can be entered for only those monoliths that will be inspected, or the catalog list can include all monoliths for the structure. After entering the monolith information into the catalog list, the monoliths inspected on a particular inspection date can be selected from this list one at a time by pressing **Enter**. They will be put on the **Current Inspection Monolith List**.

Data Entry/Modification

These menu options may be used after an inventory of monoliths has been created: **Enter/Modify Inspection Data**, **Enter/Edit Inspection Team Data**, **Edit Active Site Information**, **Edit Archived Site Information**, **Edit Monolith Type/Location**, **Change a Monolith Number**, and **Change an Inspection Date**. Figure 2 shows these options on the selection screen.

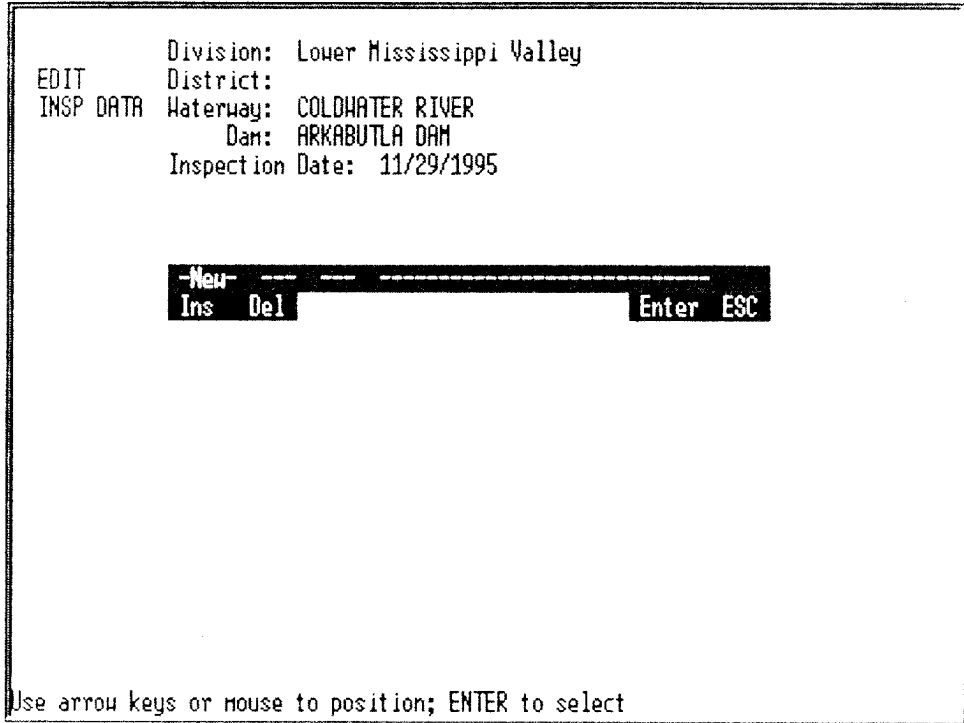


Figure 9. Current Inspection Monolith List screen.

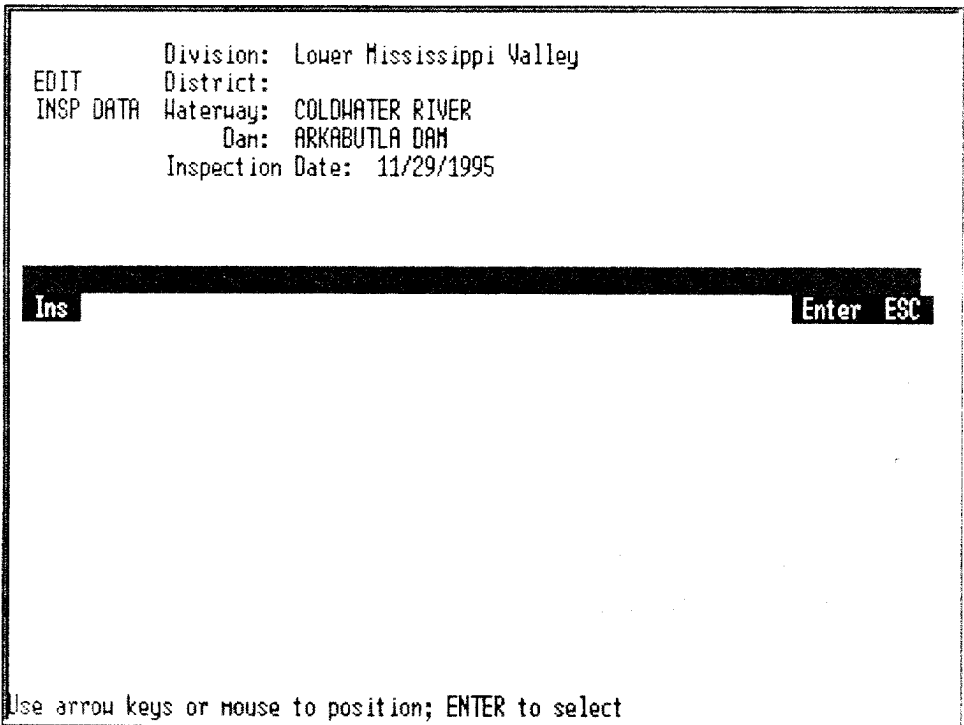


Figure 10. Catalogued Monolith Information list screen.

Enter/Modify Inspection Data

Technical Report REMR-OM-16, *Condition Rating Procedures for Concrete in Gravity Dams, Retaining Walls, and Spillways* (Bullock and Foltz 1995), contains guidance for collecting inspection data. To begin inspection data entry, select a monolith from the **Current Inspection Monolith List**. This selection will display the **Dam Monolith Inspection Data** menu (Figure 11). The first five menu options show, in order, parts of the two page written inspection form. The sixth choice, **Monolith Misalignment**, is also information on the inspection form.

The first **Dam Monolith Inspection Data** menu option is **Enter Cracking Distresses** (Figure 12). Pressing **Enter** on this choice will produce a list of cracking distresses. Pressing **Ins** will display the crack distress data entry screen. Choose the type of crack. The crack **width** is required for all distresses entered on this screen. Enter the width in hundredths of an inch or millimeters. The next field toggles between inches and millimeters. The **load** is usually lateral, but parts of a monolith, such as bridge piers, may have predominate axial loads. A crack may have multiple locations, but enter only one under **Loc**. Other surfaces in which the same crack is visible can be listed under **remarks**. Do not list the other locations for the same crack as additional distresses. **Raveling** is only required for horizontal surfaces, but may be entered for other surfaces if the information has value to the user. **Ponding** is only used for horizontal surfaces.

```
EDIT      Division: Lower Mississippi Valley
INSP DATA District:
          Waterway: COLDWATER RIVER
          Dam: ARKABUTLA DAM
          Inspection Date: 11/29/1995  Monolith #: 3  CI: Unk

          Cracking Distress
          Volume Loss Type Cracking / Deterioration
          Steel Distresses
          Other Distresses
          General Monolith Comments
          Monolith Misalignment
          Edit Monolith Type/Location
          Edit Inspection Team
          Display Distress Summary
          Force Condition Index Recalculation

Use arrow keys to position; ENTER to enter/edit Cracking data; ESC to Exit
```

Figure 11. Dam Monolith Inspection Data menu.

```

Division: Lower Mississippi Valley
EDIT      District:
INSP DATA Waterway: COLDWATER RIVER
                Enter Cracking Distresses

Category: 24-Horizontal      1.00 In Load: Lateral Loc: Upstream
Raveling: No

Remarks: <ENTER>
                Crack Deduct: 0
                Raveling Deduct: 0

■ Press Ctrl-ENTER to Store

                ESC  Ctrl-Enter

```

Enter Cracking Distress Data; Ctrl-Enter to store; ESC to Exit

Figure 12. Enter Cracking Distresses screen.

The **Enter Volume Loss Type Cracking / Deteriorations** menu option is shown in Figure 13. Choose the distress category. **Loading** and **Location** are the same as for cracking distresses. Distress width and depth can be entered as a percentage of the total or as a measured depth. The **height** is the elevation of the largest percentage volume loss for the monolith. Be sure to add volume loss distresses at the same elevation from upstream and downstream faces. For volume loss deck distresses, **% deck affected** is required. **Elevation** is a remark field to list the range of heights where the distress occurs. The **section: width: and depth:** information is only needed if a vertical or sloping surface volume loss distress is entered as a measured depth and not a percentage depth. The **raveling** and **ponding** fields are used for deck distresses only.

Steel Distresses is the next menu option (Figure 14). Pressing **Enter** on this choice will produce a list of steel distresses. Pressing **Ins** will display the steel distress data entry screen. The **category** can be toggled between prestressing and reinforcing. **Loc** allows one of 10 different distress locations to be selected. A percentage can be entered in **%Exp/Corr**. **Remarks** allows an optional remark to be entered for the distress. Pressing **Ctrl-Enter** stores the data and displays the distress.

```

EDIT      Division: Lower Mississippi Valley
          District:
          Enter Volume Loss Type Cracking / Deteriorations

Category: 21-Checking      lateral      Location: Upstream

Distress: Width: 0.00 %      Depth: 0.00 %      Height: 0.00 Ft

X Deck Affected: 0      Elev(s):                     

Section: Width: 0.00 Ft      Depth: 0.00 Ft (at elevation of distress)

Raveling: No      Ponding: No

Remarks: <ENTER>
          Volume Deduct: 0
          Raveling/Ponding Deduct: 0

■ Press Ctrl-ENTER to Store

          ESC  Ctrl-Enter

```

Enter Volume Distress Data; Ctrl-Enter to store; ESC to Exit

Figure 13. The Enter Volume Loss Type Cracking/Deteriorations screen.

```

EDIT      Division: Lower Mississippi Valley
INSP DATA District:
          Waterway: RAYON BOBCAN
          Enter Steel Distresses

2-Reinforcing      Loc: Upstream      X Exp/Corr: 0

Remarks: <ENTER>
          Deduct: 0

■ Press Ctrl-ENTER to Store

          ESC  Ctrl-Enter

```

Enter Steel Distress Data; Ctrl-Enter to store; ESC to Exit

Figure 14. The Enter Steel Distresses menu option.

The **Enter Other Distresses** menu option is shown in Figure 15. Choose the distress category. **Location** includes the same options as for cracking distresses. Severity **Level** can be toggled between the choices for these distresses. Not all levels are valid for each distress type.

The **General Monolith Comments** option is available to enter comments felt to be important to the monolith. Pressing **Ins** will display a box where the comment can be entered with basic text entry. No word processing tools are available.

The **Monolith Misalignment** menu option is shown in Figure 16. Toggle between yes and no with the spacebar. Monolith misalignment can be relative to adjacent monoliths or between the monolith concrete on different sides of a structural crack. This distress is very serious, and an engineering evaluation should investigate the cause of movement and the stability of the structure.

To quickly view the distress in information entered, use the **Display Distress Summary** menu option. The screen shown in Figure 17 will display. The CI is not immediately updated to reflect newly added or edited distresses. Pressing **Esc** to return to the list of dams or farther back will cause the software to recalculate the index. Otherwise, the last menu option, **Force Condition Index Recalculation**, can be used to update the CI.

```
EDIT      Division: Lower Mississippi Valley
INSP DATA District:
          Waterway: COLDWATER RIVER
          Enter Other Distresses

Category: 36-Spalled Joint  Location: Upstream  Level: Light

Remarks: 
          Deduct: 0

Press Ctrl-ENTER to Store

ESC Ctrl-Enter

Enter Other Distress Data; Ctrl-Enter to store; ESC to Exit
```

Figure 15. The Enter Other Distresses screen.

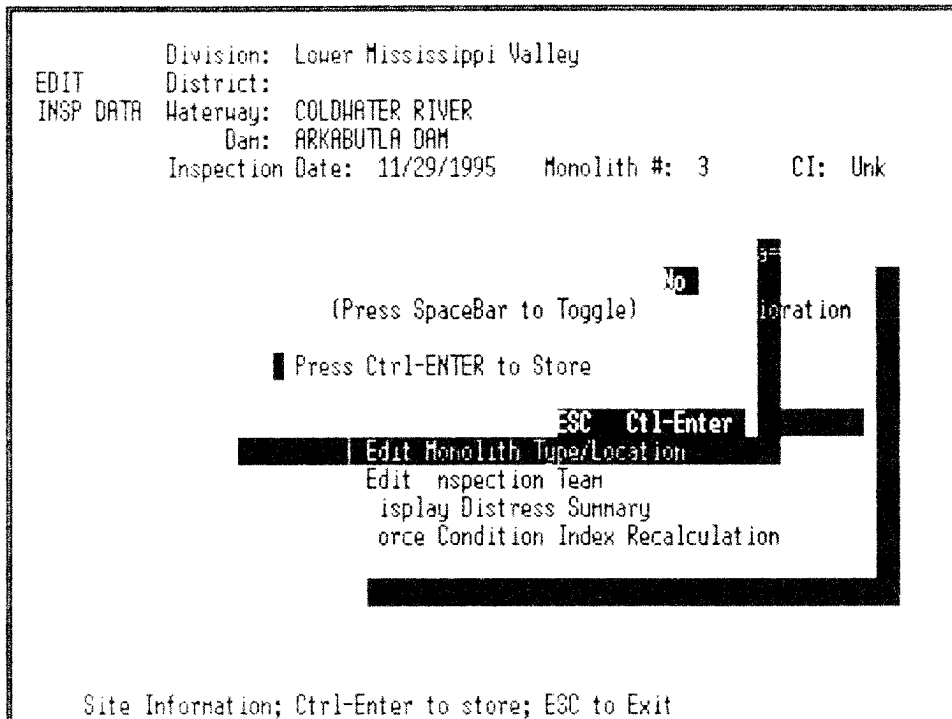


Figure 16. The Monolith Misalignment menu option.

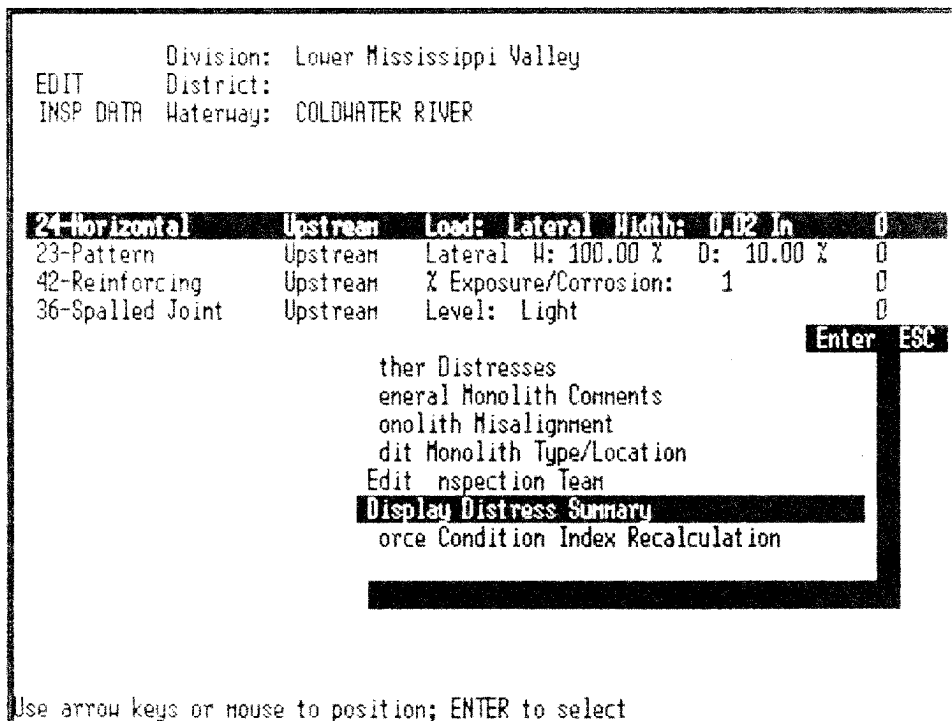


Figure 17. Distress Summary information screen.

The order in which the inspection data are entered into the system is optional; all the data need not be entered during one sitting. The program may be exited at any time during data entry. However, for greater efficiency, it is recommended that all data on both pages of the inspection sheet be entered in order and in one sitting. This practice decreases the chances of leaving an incomplete data field in the system. Always remember to save the data before exiting by pressing **Ctrl-Enter**.

Enter/Edit Inspection Team Data

This menu choice appears on two different menus. It is on the **Data Entry/Modification Menu** (Figure 2) and a submenu of that, **Enter/Modify Inspection Data** (Figure 11). On the submenu, it is called **Edit Inspection Team Data**, but it performs the same function. See the beginning of Chapter 3 for more information on inspection team data.

Edit Active Site Information

Active Site Information (Figure 6) is an optional database created to allow recording of reference information such as a point of contact, address, and phone numbers. The last inspection date is automatically reported in this database, and an expected inspection schedule can be entered. Default active site information can be entered from the **Main Menu** option, **System Management**.

Edit Archived Site Information

Archived Site Information (Figure 18) is an optional database of historical and reference information provided with the software. It includes approximately 50 fields of data. The information is provided without verification of its accuracy or completeness.

Edit Monolith Type/Location

This menu choice appears on two different menus. It is on the **Data Entry/Modification Menu** and a submenu of that, **Enter/Modify Inspection Data**. This function should be needed rarely. It is mainly for correcting data entry errors (Figure 19).

```

Edit Concrete Gravity Dam Information
Dam ID: MS01496      10600  Division: LHV District: LNK
Owner:  OREN LMK      State:  MS
County:  DESOTO
Dam Name:  ARKABUTLA DAM
Lake:  ARKABUTLA LAKE      River:  COLDWATER RIVER
Purpose:  RR      Type:  RE
Hydraulic Height:  85  Crest:  11500  Maximum Capacity:  1383100
Latitude:  34-45.4  Longitude:  190-07.4  Seismic Zone:  3

Last Inspection:  18/29/79  Next Inspection:  17/01/84
Year Completed:  1943  Category:  CORPS  Subcategory:  RESERVOIR
Upddate:  17/28/81  Start Date:  / /  Sched Comp Date:  / /
Cngdst1:  11  Region:  18  Basin:  13

Nearest City:  TUNICA MISSISSIPPI  Dist:  15  Pop:  1325

Structure Height:  96  Normal Capacity:  31500
Hazard Code:  1  SPILLWAY-[ Type:  ]  Width:  300  Dist:  89000 )
Volmat:  4700000  Number of Locks:  ]
Engr:  OREN LMK      Const:  OREN LMK
State 2:  0  Pow Install:  0.0  Pow Prop:  0.0
Lock Length:  0  Lock Width:  0
Miscode:  1  Cost:  0  Seepage:  HAS NOT
                                     ESC  Ctrl-Enter

```

Figure 18. Edit Archived Site Information screen.

```

Division:  Lower Mississippi Valley
EDIT      District:
INSP DATA  Waterway:  COLDWATER RIVER
            Dan:  ARKABUTLA DAM
            Inspection Date:  11/29/1995
            Enter Catalogued Monolith Information
            3
Monolith Type:  Gravity Monolith/Abutment
Location:  spillway monolith
Press Ctrl-ENTER to Store
                                     ESC  Ctrl-Enter
Enter General Monolith Information; Ctrl-Enter to store; ESC to Exit

```

Figure 19. Edit Catalogued Monolith Information screen.

Change a Monolith Number

This option should be needed rarely and used with great care to change an incorrect monolith number (Figure 20).

Change an Inspection Date

This option should be needed rarely and used with great care to change an incorrect inspection date (Figure 21).

```
CHANGE MONO NO.  Division: Lower Mississippi Valley
                  District:
                  Waterway: COLDWATER RIVER
                  Dam: ARKABUTLA DAM

Enter Change Monolith Number

Old Monolith Number: 3
                    3
Press Ctrl-ENTER to Store
                    ESC  Ctrl-Enter

Enter New Monolith Number; Press Ctrl-ENTER to Store; ESC to Exit
```

Figure 20. Enter Change Monolith Number screen.

Division: Lower Mississippi Valley
CHANGE District:
INSP DATE Waterway: COLDWATER RIVER
Dam: ARKABUTLA DAM

Enter Change Inspection Date

Old Inspection Date: 11/29/1995

11/29/1995

■ Press Ctrl-ENTER to Store

ESC Ctrl-Enter

Enter New Inspection Date; Press Ctrl-ENTER to Store; ESC to Exit

Figure 21. Enter Change Inspection Date screen.

4 Database-related Reports

Types of Reports

This chapter details the process by which reports are created by the management system. The seven different reports available to the user are as follows: (1) Inspection Data Report, (2) Condition Index Report, (3) List Inspection Dates, (4) Inspection Team Report, (5) List Active Site Information, (6) List Archived Site Information, and (7) Print Blank Inspection Form. All the reports will generate from the Division or District selected and will be shown at the top of the screen. The appendix shows excerpts from samples of the first five reports.

Inspection Data Report

This report includes summaries of distresses recorded for each monolith and each inspection date. The summaries are sorted first by monolith and then by date, from first to last. To run the report, select **Database Related Reports** from the **Main Menu** (Figure 1). Next choose the option **Inspection Data Report** (Figure 22), which will produce a screen with three options for arrangement of the report. These options are **Arranged by Deduct Value**, **Arranged by Distress Location**, and **Arranged by Distress Type** (Figure 23). The next screen allows the report parameters (see Report Generation Parameters below) to be edited, or default values can be used. Modify the parameters as necessary and press **Ctrl-Enter** to generate the report (Figure 24). The next screen will be dependent on the **Output [Printer/Screen/File]**.

The information on most of the reports is self-explanatory with one likely exception. On the **Inspection Data Report**, the Deduct Value is reported for each distress. Actually, two values are reported, and it may not be obvious what they are. The the “deduct” of the distress is shown in th first column. When used in the calculation of the monolith CI, only a portion of this deduct may be used, according to the algorithm given in Technical Report REMR-OM-16. This impact on the CI is shown in the second column after Deduct Value.

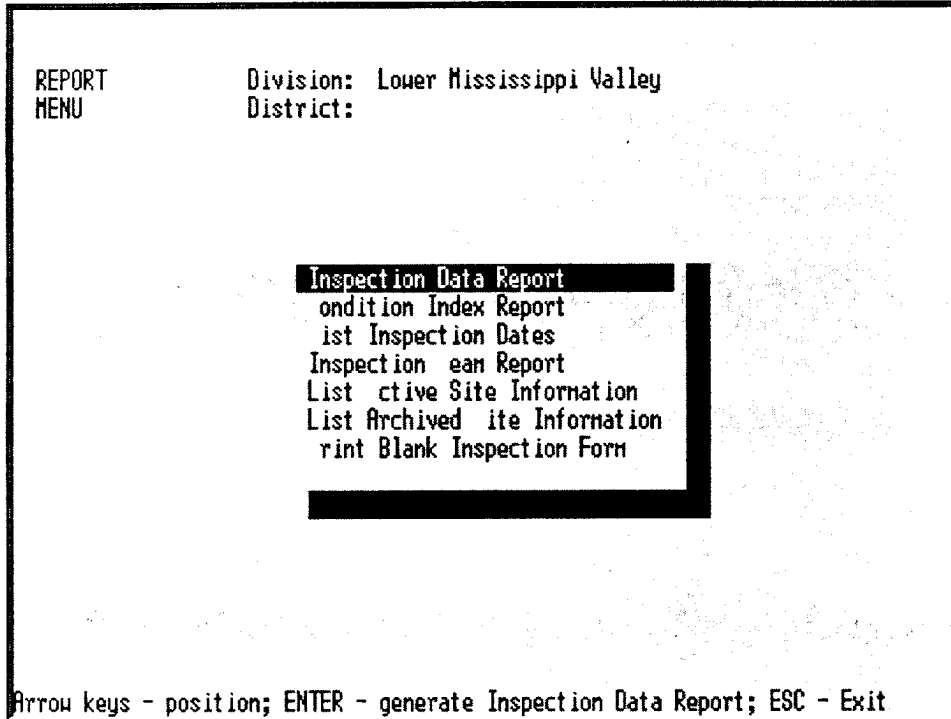


Figure 22. Select Inspection Data Report from Report Generation Menu.

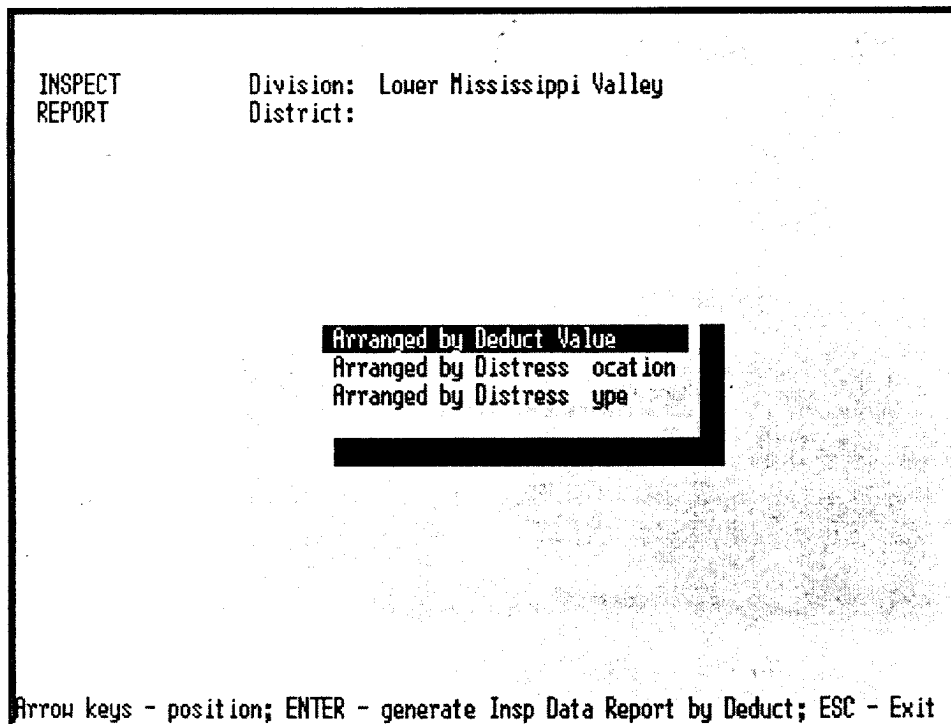


Figure 23. Inspection Data Report menu options.

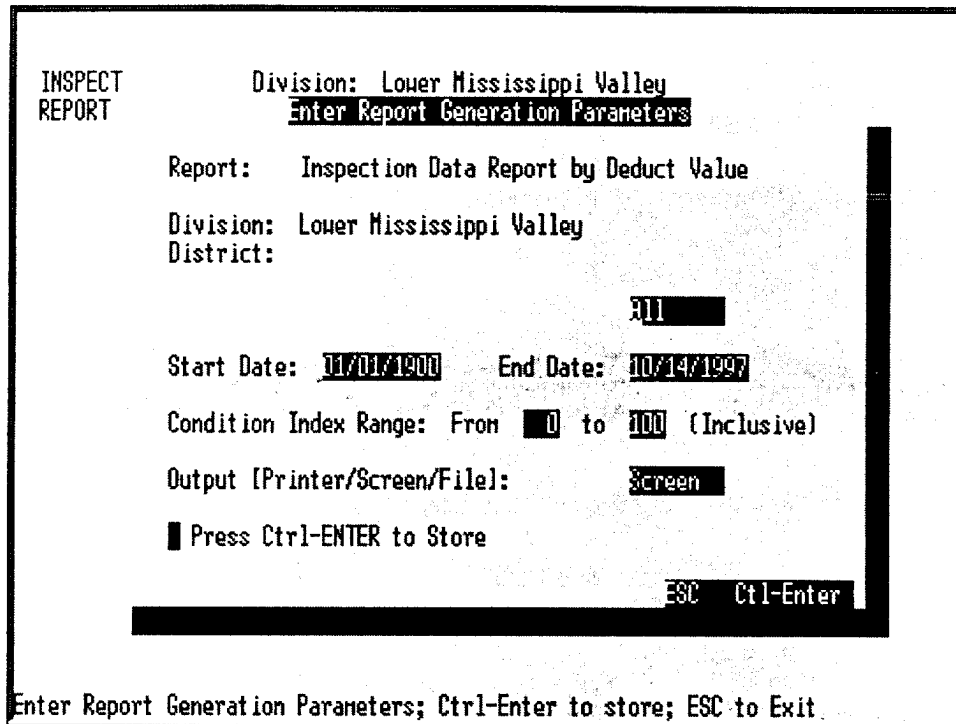


Figure 24. Enter Report Generation Parameters screen.

Condition Index Report

This report includes CIs for all monoliths and all inspection dates. It also includes some summary information on the CIs for each dam. Generating the CI report is very similar to the Inspection Data Report, except that after selecting **Condition Index Report** the options are to arrange by date or monolith number (Figure 25). After selecting the arrangement, the next screen of Report Generation Parameters is exactly the same as the screen for the **Inspection Data Report** (Figure 24). Once the parameters are satisfactory, press **Ctrl-Enter** to generate the report.

List Inspection Dates

This report will list the dates each structure was inspected, the inspection cycle, and next inspection date. It does not provide any information on the condition of the structure (Figure 26).

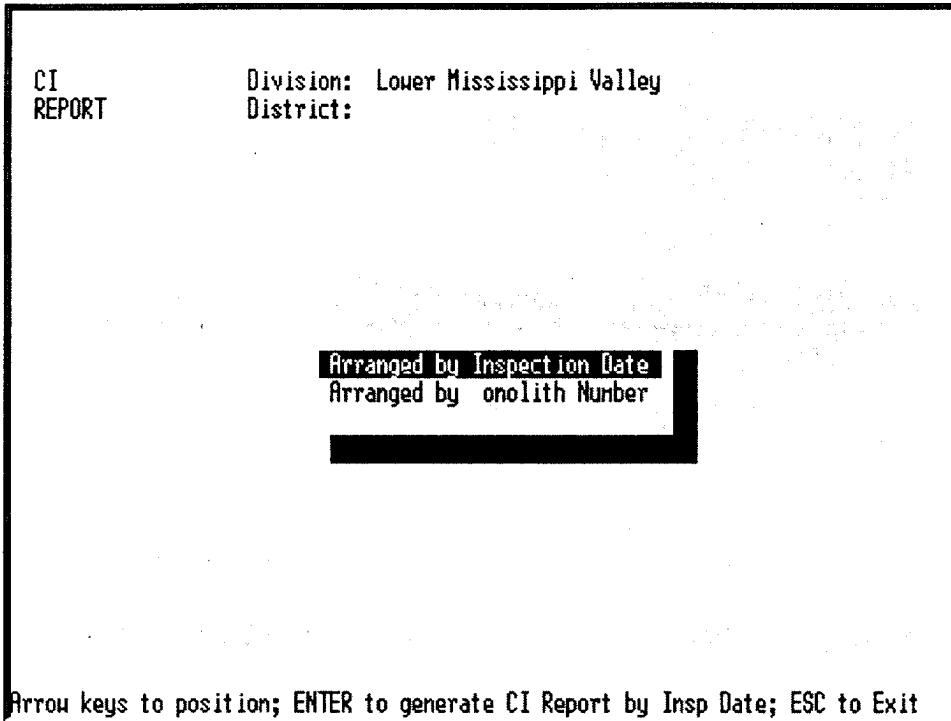


Figure 25. Select Condition Index Report arrangement.

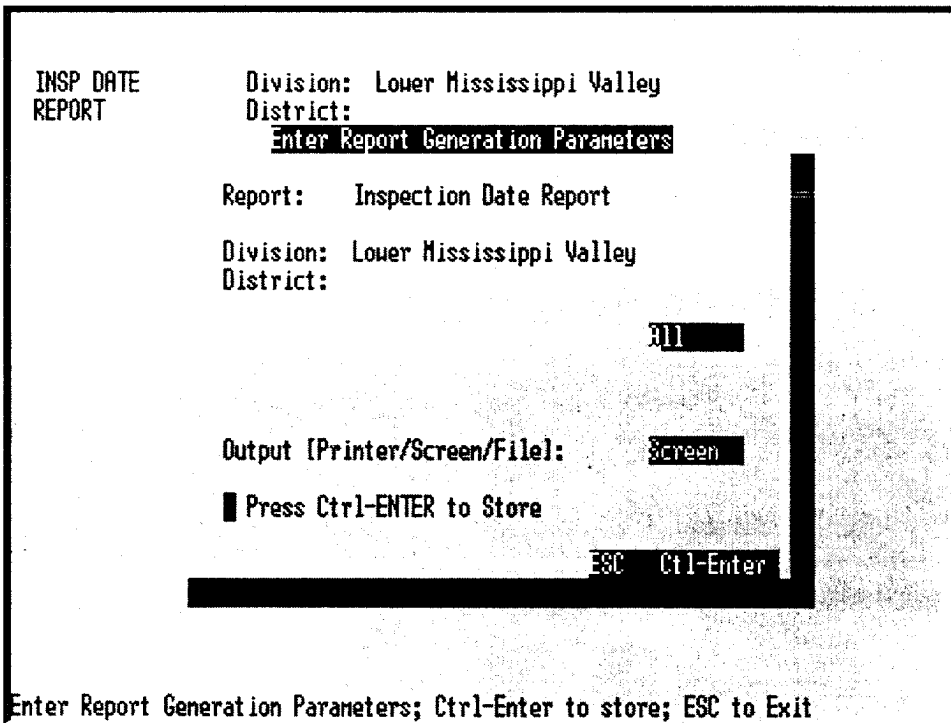


Figure 26. Report Generation Parameters screen for Inspection Date Report.

Inspection Team Report

This report lists the inspection team information for the applicable dam inspections (Figure 27). If no inspection team data have been entered, no information will be reported. If desired, go back and edit the **Inspection Team Data** by using the **Enter/Edit Inspection Team Data** function under the **Data Entry/Modification Menu**. See page 22 for more information on inspection team data.

List Active Site Information

This report lists all or selected dams for the current Division or District and finds all the active sites that have inspection data collected for them (Figure 28). The report includes some basic historical information and points of contact, but does not give the condition of the structures. It also give a POC for further investigation if needed.

List Archived Site Information

This report lists all the archived history for every dam in the currently selected Division or District. The report does not include any active site information.

The screenshot shows a terminal window with the following text:

```
INSP TEAM REPORT      Division: Lower Mississippi Valley
                        District:
                        Enter Report Generation Parameters

Report:  Inspection Team Report

Division: Lower Mississippi Valley
District:

                        311
Start Date: 11/01/1900   End Date: 12/01/1995
Output (Printer/Screen/Files): Screen
Press Ctrl-ENTER to Store

                        ESC  Ctrl-Enter
```

Enter Report Generation Parameters; Ctrl-Enter to Store; ESC to Exit

Figure 27. Report Generation Parameters for Inspection Team Report.

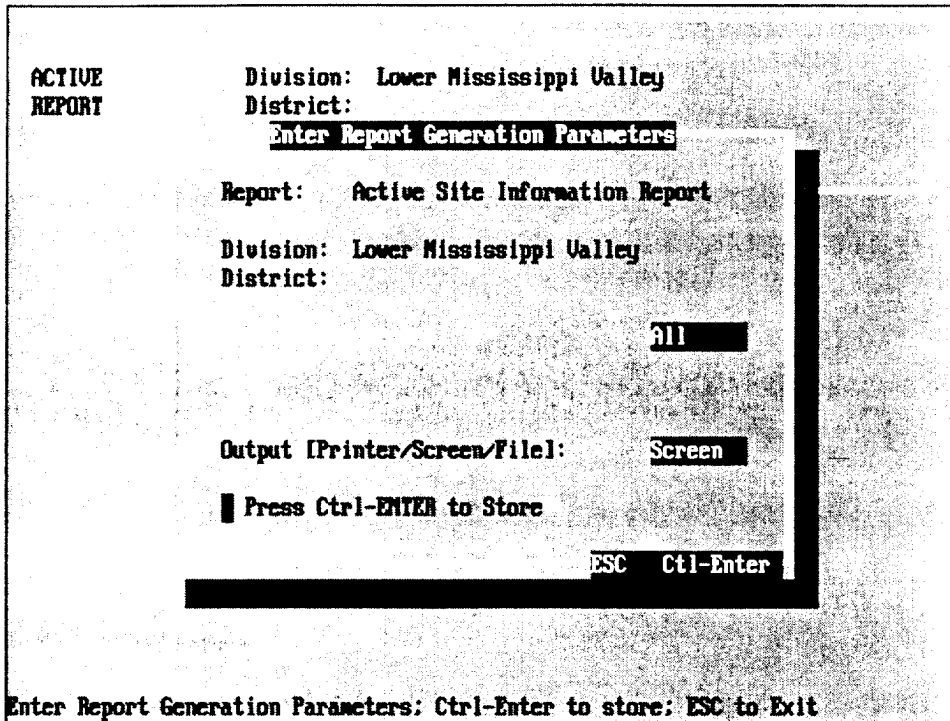


Figure 28. List Active Site Information Report.

Print Blank Inspection Form

This option allows a blank inspection form to be printed. Select the proper parameters (see next section), set up printer as described, and press **Ctrl-Enter** to print (Figure 29).

Report Generation Parameters

After selecting a report and how it is to be arranged, there are parameters for searching through and selecting appropriate data. The first parameter allows selection of specific dams for reporting. To select specific dam(s), toggle the **Dams [All/Selected]** option to **Selected**. The next screen will list all the dams in the Division or District (Figure 3). Multiple entries can be selected with **SPACE**, or one dam can be selected with **ENTER**. If dams are listed by river, selecting a river will tag all dams on that river. Another option is to discriminate by date. Select the **Start Date** and **End Date** or use the default values. By changing the **Condition Index Range**, the report will give results only on the dams within the range. The default is set to return all CI reports. It also prompts for the device where the report will be **Output [Printer/Screen/File]** so the report can be viewed and modified as necessary. All four parameters are available in

Inspection Data Report, Condition Index Report, and Inspection Team Report. List Inspection Dates, List Active Site Information, and List Archived Site Information only allow the **Dams [All/Selected]** and **Output [Printer/Screen/File]** options to be changed. The **Print Blank Inspection Form** report asks for **Graphics Characters**. The default selection is **IBM**, so toggle with **SPACE** to select either **ASCII** or **HP** if **IBM** is not applicable. Then **Number of Copies** may be changed to the desired number.

```
PRINT          Division: Lower Mississippi Valley
FORMS         District:

Enter Blank Inspection Form Printer
                IBM
Number of Copies: 1
Set Printer to 8 Lines Per Inch.
Press Ctrl-ENTER to Store
                ESC  Ctrl-Enter

Site Information; Ctrl-Enter to store; ESC to Exit
```

Figure 29. Print a blank inspection form from this screen.

5 System Management

The system management submenu (Figure 30) of the **Main Menu** allows a number of default choices to be made. These defaults can be chosen or changed at any time. The user is automatically asked the first two choices when the program is initially used after the software is installed.

Reselect Division/District

Users are limited to working with the structures in only one Division at a time. This restriction reduces problems caused by working with a large database. To reduce the size of structure pick lists and increase the speed of some functions, the user can further reduce the size of the active database by choosing the applicable district. Although users can also delete unneeded dams from the list, this is not advisable because of the limited benefit and the greater effort required to reverse the action. Users can reselect the active Division/District (Figure 31) at any time.

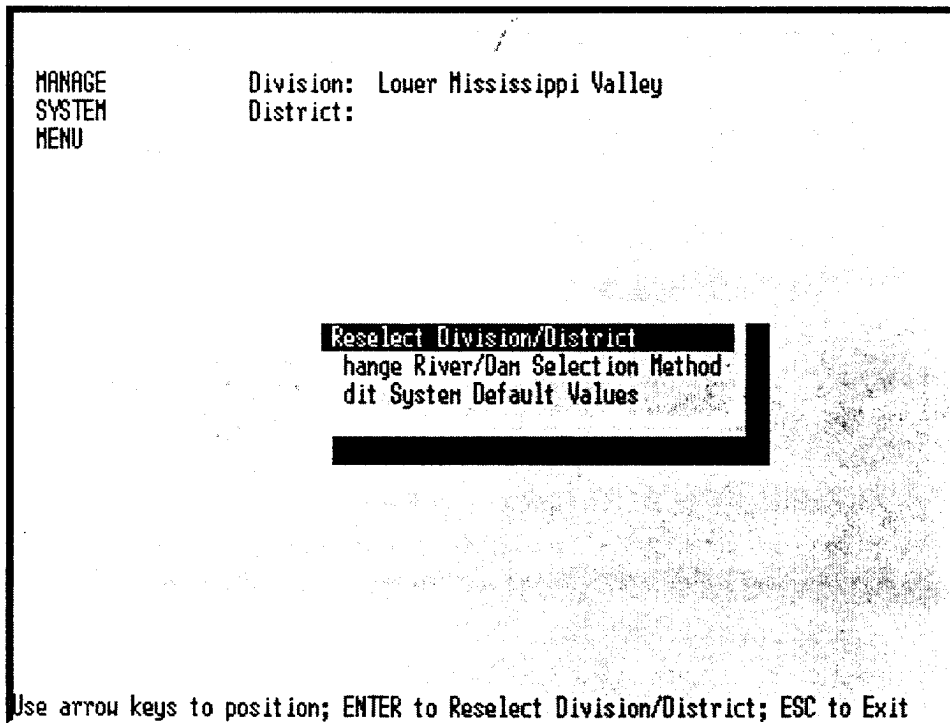


Figure 30. The System Management submenu.

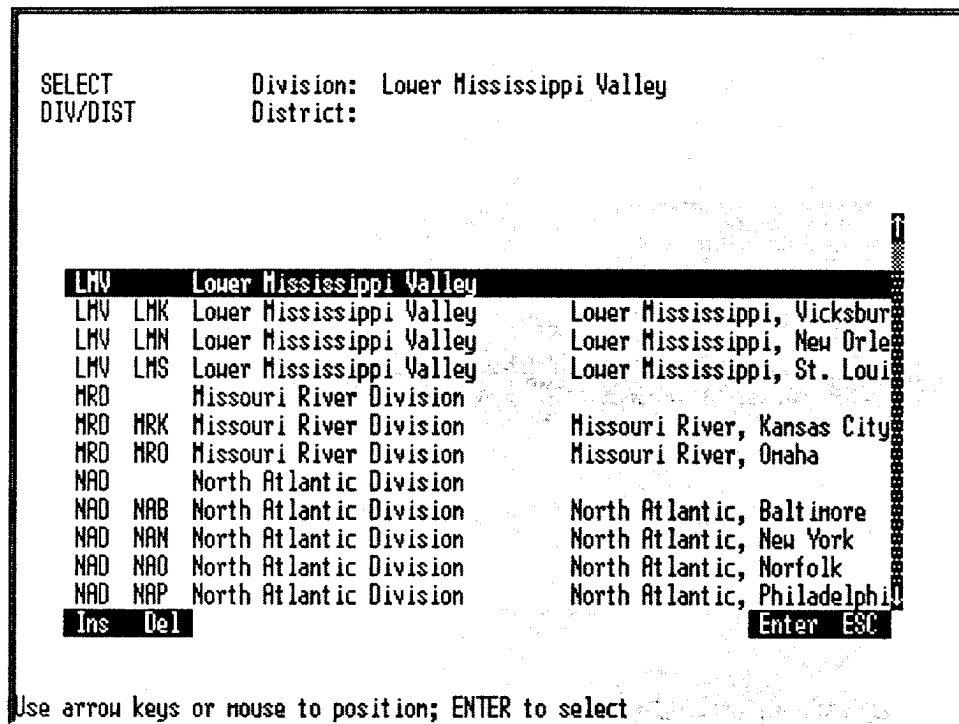


Figure 31. USACE Divisions and Districts list.

Change River/Dam Selection Method

This option allows the user to choose a “look and feel” more like that of other REMR management systems. Users for most other REMR management systems tend to work on a common or small number of navigable rivers. For this reason, the structures can most easily be chosen from the database through a sublisting by river. Few non-navigable rivers have more than one or two dams, so selecting by river is not preferable to many users. The option to select solely by dam name is provided for this reason. Users can reselect the river/dam selection method (Figure 32) at any time.

Edit System Default Values

This menu option (Figure 33) mainly affords the opportunity to create a default file for information that is applicable to the active site information for a number of dams. It allows the information to be pre-inserted into that database when the first inspection date for a dam is created or (if no inspection date exists) when **Active Site Information** is selected from the **Data Entry/Modification Menu**.

A default inspection interval can be set on this screen for scheduling future inspections. The default can be changed for specific dams using the **Active Site Information** screen. This database also allows the user an opportunity to select the printer port to which reports will be sent.

In version 1.0 of the Maintenance Management System software, a menu option for adding and editing rivers has not been included. This option will be added in the next software upgrade. A new dam on a new river can be added to the database, but this dam will only be on the list of dams under the dams selection method and cannot be selected through the rivers list. The dams/rivers selection method can be changed under **System Management, Change River/Dam Selection Method**.

References

Bullock, R., *A Rating System for the Concrete in Navigation Lock Monoliths*, Technical Report REMR-OM-4/ADA208304, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, May 1989.

Bullock, R., and S. Foltz, *Condition Rating Procedures for Concrete in Gravity Dams, Retaining Walls, and Spillways*, Technical Report REMR-OM-16/ADA303305, U.S. Army Construction Engineering Research Laboratories (USACERL), Champaign, IL, September 1995.

Greimann, L., J. Stecker, K. Rens, and M. Nop, *User's Manual for Inspection & Rating Software, Version 2.0*, Technical Report REMR-OM-15/ADA282219, USACERL, Champaign, IL, May 1994.

Appendix: Sample Reports

This appendix contains sample report output available from CONCDAM. The pages included are not complete reports. They are representative pages from a database to illustrate the content of each report type.

Inspection Data Report (p 39) - output file of summaries of distresses for each monolith and each inspection date.

Condition Index Report (p 49) - output file of condition indexes for all monoliths and all inspection dates.

Inspection Date Report (p 51) - output file of inspection dates, inspection cycle, and next inspection date.

Inspection Team Report (p 53) - output file of information about the inspection team for the applicable dam inspections.

Active Site Information Report (p 55) - output file of active sites with historical information and points of contact.

=====
Division: North Central Division
District: North Central, Rock Island

Dam Name: BEAR CREEK DAM Monolith #: 2

Monolith Location: Center Monolith

Monolith Type: Gravity Monolith/Gated Section

Inspection Date: 04/16/1992 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 85

Category: 27-Diagonal Load: Lateral Loc: Upstream
Width: 0.01 In

Deduct Value: 15 15

Division: North Central Division
District: North Central, Rock Island

Dam Name: BEAR CREEK DAM Monolith #: 2

Monolith Location: Center Monolith

Monolith Type: Gravity Monolith/Gated Section

Inspection Date: 04/16/1997 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 73

Category: 27-Diagonal Load: Lateral Loc: Upstream
Width: 0.02 In

Deduct Value: 23 23

Category: 28-Random Load: Axial Loc: Deck
Width: 0.01 In

Deduct Value: 10 4

Division: North Central Division
District: North Central, Rock Island

Dam Name: BEAR CREEK DAM Monolith #: 3

Monolith Location: Left Abutment

Monolith Type: Gravity Monolith/Abutment

Inspection Date: 04/16/1992 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 55

Category: 42-Reinforcing Loc: Deck

% Exposure/Corrosion: 15

Deduct Value: 39 39

Category: 27-Diagonal Load: Lateral Loc: Deck

Width: 0.01 In

Deduct Value: 15 6

=====
Division: North Central Division
District: North Central, Rock Island

Dam Name: BEAR CREEK DAM Monolith #: 3

Monolith Location: Left Abutment

Monolith Type: Gravity Monolith/Abutment

Inspection Date: 04/16/1997 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 44

Category: 42-Reinforcing Loc: Deck
% Exposure/Corrosion: 20 Deduct Value: 42 42

Category: 27-Diagonal Load: Lateral Loc: Deck
Width: 0.03 In
Deduct Value: 32 13

Category: 36-Spalled Joint Loc: Upstream
Damage Level: Light Deduct Value: 5 1

Division: North Central Division
District: North Central, Rock Island

Dam Name: BIG CREEK BARRIER DAM Monolith #: 1

Monolith Location: Right Abutment

Monolith Type: Gravity Monolith/Abutment

Inspection Date: 04/17/1997 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? Yes

Condition Index: 40

Category: 42-Reinforcing Loc: Upstream

% Exposure/Corrosion: 2

Deduct Value: 31 31

Category: 24-Horizontal Load: Lateral Loc: Upstream

Width: 0.02 In

Deduct Value: 10 4

Category: 26-Vert&Long Load: Axial Loc: Upstream

Width: 0.01 In

Deduct Value: 5 1

Category: 31-Abrasion Load: Lateral Loc: Downstream

Distress: Width: 1.00 Ft Depth: 1.00 In

Height: 0.00 Ft Elev(s):

Section: Width: 40.00 Ft Depth: 12.00 Ft (at distress)

Deduct Value: 0

Division: North Central Division
District: North Central, Rock Island

Dam Name: BIG CREEK BARRIER DAM Monolith #: 2

Monolith Location: Right Gate Monolith

Monolith Type: Gravity Monolith/Gated Section

Inspection Date: 04/17/1997 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 90

Category: 36-Spalling	Load: Lateral	Loc: Upstream
Distress:	Width: 15.00 Ft	Depth: 7.00 In
	Height: 0.00 Ft	Elev(s):
Section:	Width: 45.00 Ft	Depth: 12.00 Ft (at distress)
		Deduct Value: 8 8

Category: 51-Leakage	Loc: Upstream
Damage Level: Light	Deduct Value: 5 2

=====
Division: North Central Division
District: North Central, Rock Island

Dam Name: BIG CREEK BARRIER DAM Monolith #: 3

Monolith Location: Left Gate Monolith

Monolith Type: Gravity Monolith/Gated Section

Inspection Date: 04/17/1997 Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 87

Category: 41-Corrosion Stain Loc: DownStream
Damage Level: Heavy Deduct Value: 10 10

Category: 26-Vert&Long Load: Axial Loc: Downstream
Width: 0.01 In
Deduct Value: 5 1

Category: 24-Horizontal Load: Lateral Loc: Upstream
Width: 0.01 In
Deduct Value: 5 2

Division: North Central Division

District: North Central, Rock Island

Dam Name: BIG CREEK BARRIER DAM

Monolith #: 4

Monolith Location: Left Abutment

Monolith Type: Gravity Monolith/Abutment

Inspection Date: 04/17/1997

Dam Inspection Cycle: 5 Years

Are there any indications of misalignment? No

Condition Index: 59

Category: 42-Reinforcing

Loc: Floor

% Exposure/Corrosion: 15

Deduct Value: 39 39

Category: 37-Disintegration Load: Lateral Loc: Upstream

Distress: Width: 100.00 %

Depth: 1.00 %

Height: 0.00 Ft

Elev(s):

Section: Width: 0.00 Ft

Depth: 0.00 Ft (at distress)

Deduct Value: 5 2

Division: North Central Division
 District: North Central, Rock Island
 Dam Name: BEAR CREEK DAM

Inspection Date	Monolith #	Condition Index
04/16/1992	1	97
	2	85
	3	55
04/16/1997	1	45
	2	73
	3	44

Condition Index Summary

Inspection Date	Total Monoliths	Average CI	Low CI
04/16/1992	3	79.0	55
04/16/1997	3	54.0	44

=====
 Division: North Central Division
 District: North Central, Rock Island
 Dam Name: BIG CREEK BARRIER DAM

Inspection Date	Monolith #	Condition Index
04/17/1997	1	40
	2	90
	3	87
	4	59

Condition Index Summary

Inspection Date	Total Monoliths	Average CI	Low CI
04/17/1997	4	69.0	40

=====
Division: North Central Division

District: North Central, Rock Island Dam Name: BEAR CREEK DAM

Inspection Cycle: 5 Year(s) Next Inspection Date: 04/16/2002

Inspection Date	Monolith(s)		
04/16/1992	1	2	3
04/16/1997	1	2	3

=====
Division: North Central Division

District: North Central, Rock Island Dam Name: BIG CREEK BARRIER DAM

Inspection Cycle: 5 Year(s) Next Inspection Date: 04/17/2002

Inspection Date Monolith(s)

04/17/1997 1 2 3 4

=====
Division: North Central Division
District: North Central, Rock Island

Dam Name: BEAR CREEK DAM

Inspection Team Summary

Inspection Date	Inspector
04/16/1992	Stuart Foltz 217-352-6511 ext 7301 Eric Greer 217-352-6511 ext 7593
04/16/1997	Stuart Foltz 217-352-6511 ext 7301 Eric Greer 217-352-6511 ext 7395

=====
Division: North Central Division
District: North Central, Rock Island

Dam Name: BIG CREEK BARRIER DAM

Inspection Team Summary

Inspection Date	Inspector
04/17/1997	Stuart Foltz 217-352-6511 ext 7301 Eric Greer 217-352-6511 ext 7593

=====

Dam Name: ALPINE DAM Dam ID: IL00109
Lake: RUEBEN ALDEEN PARK L
River: KEITH CREEK
City: State: IL
Division: NCD North Central Division
District: NCR North Central, Rock Island
DataBase Created for this Site: 04/16/1997
Year Completed: 1942 Inspection Cycle: 5 Years
Last Inspection: 04/16/1992 Next Inspection: 04/16/1997
Point of Contact: Stuart Foltz
Address: USACERL-flp
 Po box 9005
 Champaign, IL 61826
Phone Number: 217-352-6511 ext 7301
Fax Number: 217-373-6470
E-Mail Address: s-foltz@cecer.army.mil
Alternate POC: David McKay
Phone: 217-352-6511 ext 7375

Dam Name: BEAR CREEK DAM Dam ID: MO10977
Lake: BEAR CREEK LAKE
River: BEAR CREEK
City: HANNIBAL State: MO
Division: NCD North Central Division
District: NCR North Central, Rock Island
DataBase Created for this Site: 04/16/1997
Year Completed: 1962 Inspection Cycle: 5 Years
Last Inspection: 04/16/1997 Next Inspection: 04/16/2002
Point of Contact: Stuart Foltz
Address: USACERL-flp
 Po box 9005
 Champaign, IL 61826
Phone Number: 217-352-6511 ext 7301
Fax Number: 217-373-6470
E-Mail Address: s-foltz@cecer.army.mil
Alternate POC: David McKay
Phone: 217-352-6511 ext 7375

Dam Name: BIG CREEK BARRIER DAM Dam ID: IA00018
Lake: BIG CREEK PONDING AR
River: BIG CREEK
City: POLK CITY IOWA State: IA
Division: NCD North Central Division
District: NCR North Central, Rock Island
DataBase Created for this Site: 04/17/1997
Year Completed: 1974 Inspection Cycle: 5 Years
Last Inspection: 04/17/1997 Next Inspection: 04/17/2002
Point of Contact: Stuart Foltz
Address: USACERL-flp
 Po box 9005
 Champaign, IL 61826
Phone Number: 217-352-6511 ext 7301
Fax Number: 217-373-6470
E-Mail Address: s-foltz@cecer.army.mil
Alternate POC: David McKay
Phone: 217-352-6511 ext 7375

Dam Name: BIG CREEK TERMINAL DAM Dam ID: IA00015
Lake: BIG CREEK LAKE
River: BIG CREEK DIVERSION
City: SAYLORVILLE LAKE State: IA
Division: NCD North Central Division
District: NCR North Central, Rock Island
DataBase Created for this Site: 04/17/1997
Year Completed: 1972 Inspection Cycle: 5 Years
Last Inspection: 04/17/1997 Next Inspection: 04/17/2002
Point of Contact: Stuart Foltz
Address: USACERL-flp
 Po box 9005
 Champaign, IL 61826
Phone Number: 217-352-6511 ext 7301
Fax Number: 217-373-6470
E-Mail Address: s-foltz@cecer.army.mil
Alternate POC: David McKay
Phone: 217-352-6511 ext 7375

REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words) <p>The U.S. Army Corps of Engineers operates approximately 270 navigation dams constructed of plain or reinforced concrete. The Corps also operates more than 350 reservoir dams, most of which are either concrete gravity structures or embankment structures with attachments and appurtenances constructed of plain or reinforced concrete. Many of these structures will require significant repairs to ensure safe and efficient operations.</p> <p>Modern engineering technology provides procedures for performing condition surveys, consistent and quantitative condition assessments, and database management. Combined with economic analyses, these procedures afford efficient maintenance and repair (M&R) budget planning through evaluation of the current condition and comparison of various M&R alternatives based on life-cycle costs. Collectively, these procedures are called the REMR Management Systems.</p> <p>This user's manual describes use of the software associated with the REMR Management Systems. Users familiar with Maintenance Management System software for other Civil Works Structures monoliths will find this program for the Concrete in Gravity Dams, Retaining Walls, and Spillways very similar. The system was developed for operation on an IBM-compatible personal computer that runs MS-DOS version 5.0 or higher. A hard disk drive is required with at least 20 MB of available storage capacity recommended. Memory of 640k RAM is also required.</p>			
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