U.S. Department
Of Transportation

Federal Highway Administration

Culvert Management System

Users Manual

Local Technical Assistance Program

Report No. FHWA-LT-02-001 **October 2001**

Foreword

The Culvert Management System (CMS) has been developed by the Federal Highway Administration (FHWA) under the Local Technical Assistance Program (LTAP) to assist road agencies to manage their programs of culvert inventory, condition assessment and improvement. The CMS User Manual in text and CD format and program installation software are being distributed to Federal, State and local agencies having responsibility for construction and maintenance of drainage structures.

CMS computer requirements are given in Chapter 1. System installation procedures are given in Appendix A.

Copies of the User Manual, CD and System software are available from:

Local Technical Assistance Program Clearinghouse
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CULVERT MANAGEMENT SYSTEM

User Manual

Prepared for

The Federal Highway Administration
U.S. Department of Transportation

October, 2001

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CHAPTER I
INTRODUCTION

Chapter I
INTRODUCTION

PURPOSE

The purpose of the Culvert Management System (CMS) is to provide a tool to facilitate the coordination of maintenance and repair or replacement operations on a system-wide basis. It is the goal of any administrator to manage proactively rather than simply to react to an immediate or impending crisis.

BENEFITS

The CMS formalizes and automates functions already performed by many agencies responsible for culverts. In particular the CMS allows the agency to:

- know the number and location of culverts for which the agency is responsible;
- know the condition of the culverts;
- know what repairs are necessary to fix the culverts;
- assist in developing a long term plan for repairs over the next five years; and
- assist in developing a schedule of work to be performed during the next year.

In addition to formalizing the planning process, the agency also can analyze the type and size of pipe. By comparing different types of pipe used, the agency can determine if a certain type requires more frequent maintenance or is more costly to repair. This could indicate that future pipe replacement or new pipes should not use a certain type of pipe. The pipe size also can affect the repair frequency or ease of maintenance. As an example, one local agency has regulated a minimum size pipe of 18 inches to reduce the frequency and effort required to clean the pipe.

COMPUTER REQUIREMENTS

The CMS requires:

- A personal or multimedia computer with a 486 or higher processor
- One of the following operating systems:
  - Microsoft Windows 95, 98
  - Microsoft Windows NT server or workstation version 3.51 with Service Pack 5
  - Microsoft Windows NT server or workstation version 4.0 with Service Pack 2
  - Microsoft Windows 2000 Professional with Service Pack 2
- Random Access Memory (RAM)
  - 12 (megabytes) MB of RAM required to run on Microsoft Windows 95
  - 16 (megabytes) MB of RAM to run on Microsoft Windows NT
  - More memory may be required to run additional applications simultaneously
- CD-ROM drive
- VGA resolution or higher video adapter. Super VGA (SVGA) 256-color is recommended.
- Microsoft Mouse, Microsoft IntelliMouse, or compatible pointing device

The CMS was written using Microsoft's Access 97 and Visual Basic 5.0. The programs have been saved in a runtime version that does not require MS Access or Visual Basic to operate. A copy of Access 97 and/or Visual Basic 5.0 is required for those agencies that desire to modify the system for their particular requirements. The file structures, screen inputs and reports can be modified by calling up the CMS in Access 97 and making the desired changes. To modify the Schedule, Work Funding and Work Projection processes, it is necessary to modify the Visual Basic programs that perform these functions. Only those individuals familiar with these programming languages should perform modifications.

MANUAL LAYOUT

The manual is divided into seven chapters.

Chapter 1 – Introduction

Chapter 1 provides:

- a brief discussion on what the CMS is,
- how it will benefit the user agency,

- a description of each of the modules, and
- a description of the content of each of the remaining chapters.

Chapter 2 - System Layout

Chapter 2 provides:

- a brief discussion on the layout of the Culvert Management System,
- a description of each of the modules,
- a discussion on the menu structure of the system including how the user can go to any area of the CMS,
- a general description of the types of reports and queries that the system provides, and
- a brief overview of how the screens have been laid out.

Chapter 3 - Inventory Module

Chapter 3 provides:

- detailed information on how to use the inventory module,
- instructions on how to input information needed in the module, and
- instructions on how to produce reports and interpret the reports.

Actual screens and reports are displayed to assist the user in understanding the instructions.

Chapters 4 - Condition Module

Chapter 4 provides detailed information on:

- how to use the condition module,
- how to input condition information needed in the module,
- instructions on how to produce reports, and
- how to interpret the reports.

Actual screens and reports are displayed to assist the user in understanding the instructions.

Chapters 5 - Work Needs Module

Chapter 5 provides detailed information on:

- how to use the work needs module,

- how to input maintenance and repair activities and repair types needed in the module,
- instructions on how to produce reports, and
- how to interpret the work needs reports.

Actual screens and reports are displayed to assist the user in understanding the instructions.

Chapters 6 - Work Funding Module

Chapter 6 provides:

- detailed information on how to use the work funding module,
- how to input budget and deterioration information needed in the module,
- instructions on how to produce budgets and reports, and
- how to interpret the reports.

Actual screens and reports are displayed to assist the user in understanding the instructions.

Chapter 7 - Schedule Module

Chapter 7 provides:

- detailed information on how to use the schedule module,
- how to input information needed in the module,
- instructions on how to produce reports, and
- how to interpret the reports.

Actual screens and reports are displayed to assist the user in understanding the instructions.

Appendices

The appendices contain the following information:

Appendix A - System Installation: Instructions on how to install the CMS.

Appendix B - Files Layout: Layout of the files including size and type for each field.

CHAPTER II
SYSTEM LAYOUT

Chapter II
SYSTEM LAYOUT

INTRODUCTION

The Culvert Management System (CMS) has been divided into five modules:

- Inventory
- Condition
- Work Needs
- Work Funding
- Schedule

The **Inventory Module** includes information about each of the culverts under the jurisdiction of your agency. The **Condition Module** maintains a record of the condition of each of the culverts. The **Schedule Module** allows the development of an annual schedule of the work to be done for the year. The **Work Needs Module** allows the agency to define the allowable maintenance and rehabilitation options that can be performed on the culverts, applies costs to the work needs identified in the condition inspection, and ranks the work by work type and priority. The **Work Funding Module** develops the long-term (up to five years) work program required for the work identified on the culverts through the use of economic analysis. The module analyzes the future work needs by projecting the deterioration of the culverts over time and determining the future needs based on both scheduled work and future deterioration. Exhibit 2-1 shows the relationship between each of the modules.

The local agency can choose to utilize some or all of the five modules. The agency can also implement the modules one or two at a time so that the effort needed to install and learn the system can be spread out over a greater period of time. For example, in the first year the agency might implement the **Inventory Module** and collect and load information on all of the culverts within their jurisdiction. The next year they might implement the next two modules, the **Condition Module** and the **Work Needs Module**, and perform the condition inspection and

use the condition data to produce the total work needs and their associated costs. It is also possible to implement the **Schedule Module** at the same time. This will allow the agency to establish the amount of work that can be accomplished in the budget year and when, during the year, the work will be performed.

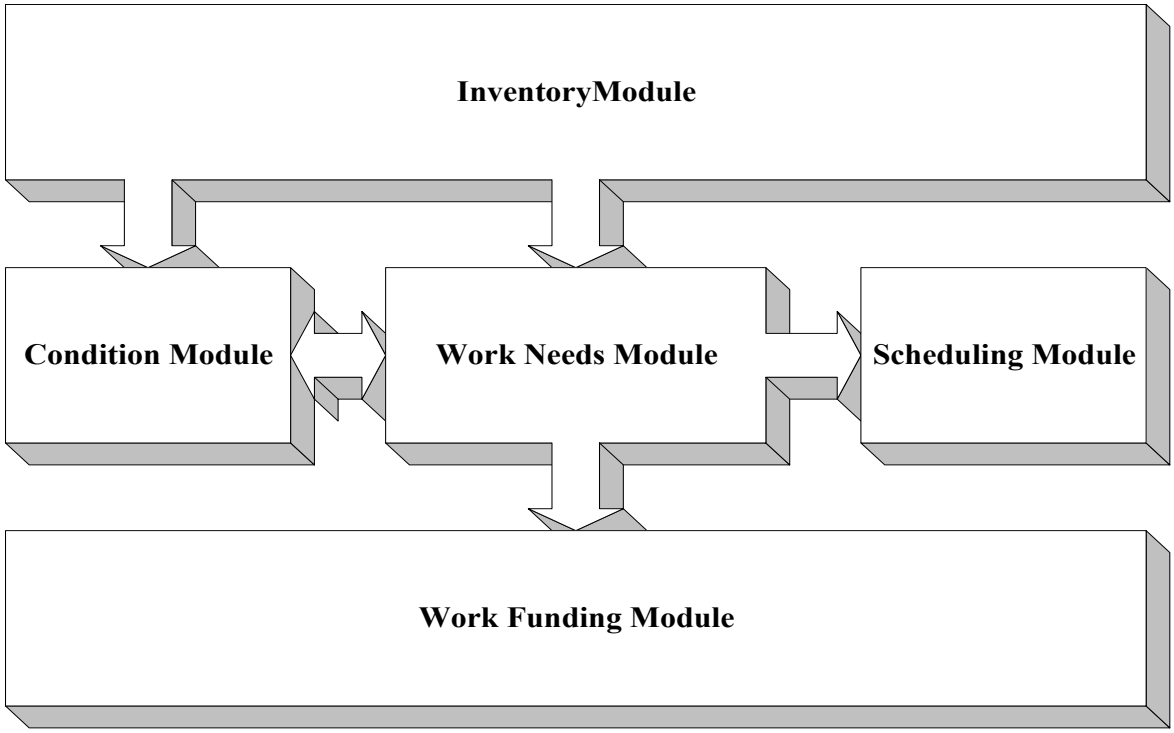


Exhibit 2-1. Module relationships in the CMS.

The third year the **Work Funding Module** can be implemented. This will allow the agency to determine the proper point in time to perform the work as well as the most appropriate type of repair based on economic and other analysis. This module will require the user agency to devote a fair amount of time to developing the model factors used in the economic analysis. Many agencies may not choose to implement this module or may choose instead to work with other agencies, possibly through technology transfer or local colleges, to develop the necessary input information.

DESCRIPTION OF THE MODULES

Inventory Module

The Inventory Module is a simple database storage and retrieval tool used primarily to supply information to other modules in the CMS and directly to users of the system. Only a small portion of the information in the database is used in the CMS. Most of the information in the system is for use by the agency for other analysis purposes and to answer such questions as:

- How many culverts do we have?
- What size are they?
- What is the structural type and material composition?
- Where are they located?

The user can view the inventory information on the screen or produce a report of all or selected culverts in the CMS.

Condition Module

The Condition Module is used to store information related to the condition of the culverts within the jurisdiction of the local agency. The first task is to prepare the inspection and inventory update forms for the culverts to be inspected. Each form then will be taken to the field inspection site to record the current condition of each culvert.

The condition rating includes rating seventeen distinct items within three general condition groups. The inspection also includes identifying the maintenance and rehabilitation activity that needs to be performed to correct the condition as well as the quantity of work required. To assist in determining work needs and priorities the inspector(s) would also provide an overall rating of the culvert condition, the repair types proposed, and the priority ranking for each general condition group.

The module also allows the user to view the information entered into the system. This can be produced in the form of a standard report or by query. The query report can be used to select specific culverts by identifier or condition as well as to provide summary information as selected by the user.

Work Needs Module

The Work Needs Module has two parts: (l) definition of the work performed, and (2) development of the work needs. In the first part, the maintenance and rehabilitation (M&R) activities and repair types are defined and entered into the system. These activities and work types must be defined and entered into the system before the condition inspection is entered into the system. The second part of the module takes the condition information resulting from the inspection and applies unit costs to the activity work quantity to produce the work needs and costs for all culverts within the local government's jurisdiction.

The system allows the user to enter information on unit cost and the months in which the activity is usually performed. At least one activity must be defined for each of the seventeen condition items that will be inspected. As with the Inventory Module the user can add new activities, modify existing activities, and delete activities. The user also can review all or selected activities on the screen or produce a printout.

The second part of defining the activities is to place each of the Maintenance and Rehabilitation (M&R) activities into one or more repair types. The repair types are the general strategies that are performed on culverts. These might include do nothing, routine maintenance, preventive maintenance, rehabilitation, and replacement.

Once the activities have been placed into the system, the user will input information on each repair type, including the activities that are assigned to them. It is possible to have an M&R activity assigned to more than one repair type. The assignment should be based on the type of work that would generally be done when a particular work type is performed. The system allows the user to add new repair types as well as modify and delete existing ones. Information on repair types and activity assignments can also be reviewed.

Work Funding Module

This module takes the work needs developed in the **Work Needs Module** and develops a multi-year list of funded projects prioritized by repair type. The procedure uses a series of factors, defined by the user that takes into account such items as priority, cost, remaining life, traffic, and

hydraulic capacity to rank projects. Using available funds, the module determines which projects can be performed by year. It also indicates which projects cannot be undertaken due to a lack of funding. The work projection builds on the current work needs to develop the future work needs. Future work needs includes both the work funded and the projection of future work that must occur if deterioration is not corrected. The procedure uses a model of deterioration rates for the various conditions to determine what the condition will be next year based on whether the recommended work is performed or not performed. This model is based on the experience of the agency and will require at least 5 years worth of experience related information before it will be useable.

Schedule Module

The schedule module allows the user to schedule the programmed work for the year. The scheduling process takes the work programmed from the **Work Funding Module** and, using the constraints of labor, dollars and pre-scheduled projects input by the user, establishes when the various culvert repair projects can be performed. In the scheduling process, all of the activities within a designated project will be performed at the same time. This means that all of the activities within the project must be capable of being performed within the month selected for the project implementation.

PROGRAM OPERATION

The program has been developed using a menu system that allows the user to operate the CMS with little knowledge of computers.

1. Begin the program by double clicking on the **FHWA Culvert Management System** icon, located in the Project Manager Window. This will bring up the FHWA Culvert Management System Program Group that includes an icon labeled **Culverts**.
2. Double click on the **Culvert** icon to begin the CMS program. When the system begins, a main menu appears that allows the user to select one of the five modules or the System Utilities option. The program will begin by displaying a welcome screen followed by the main menu screen. Exhibit 2-2 shows the main menu screen.

3. Select the module to run by clicking the button to the left of the module name. To return to the Program Manager window select the **Windows** logo button. When the **Exit to Windows** button is selected, another window will appear asking if you really wish to leave the CMS program. If the answer is yes, the program is terminated and you are returned to the Program Manager window. If no is indicated, you are returned to the CMS main menu.

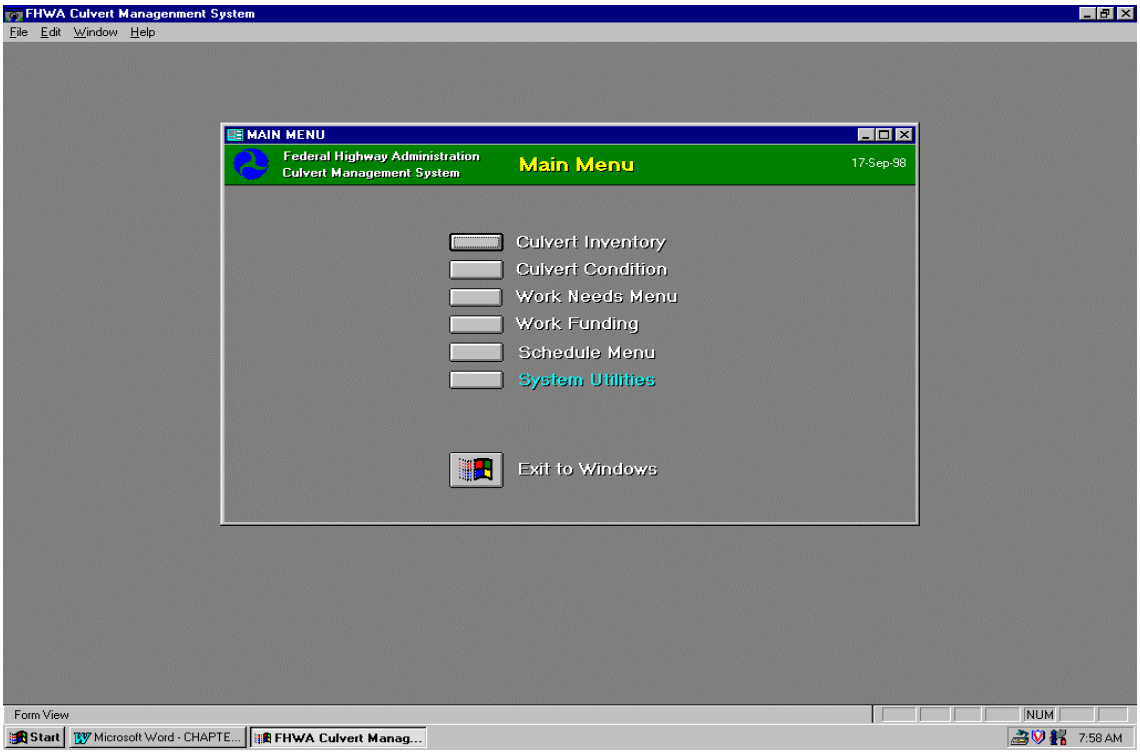


Exhibit 2-2. Main Menu

The CMS program has a number of symbols that are used throughout the program. These include:

 - Returns you to the previous menu or screen.

REPORT - Displays the standard report for the portion of the module you are in.

 - Performs the analysis calculations.

 - Adds a new record.

 - Deletes a record.

REPORTS

The CMS allows the production of both standard and query reports. For each of the modules, one or more reports have been developed to provide information related to the work being performed within the module. In addition, several of the modules in the CMS allow selection of specific records to be shown on the reports. In addition, the CMS can produce reports by using a database system program such as Access to call up the database and produce special reports that display the information desired. Familiarity with the database programming system is required to perform this final process.

SYSTEM UTILITIES OPTION

Selecting **System Utilities** will bring up the System Utilities Menu. Exhibit 2-3 shows the System Utilities menu screen. This menu allows you to modify the pick-lists that are used in various modules within the CMS. The pick-lists allow you to predefine a selected inventory or budgeting item before you begin to enter data into the CMS. To insert items into a pick-list you select the item you wish to define or modify and then complete the table that is displayed. Exhibit 2-4 shows a typical pick-list table. Use the **Tab** key on your keyboard to move between each cell on the table. Use the **shift-Tab** keys when you wish to move back one or more cells in the table. When you have finished updating the table, click on the **X** in the upper right corner of the table window or double click on the symbol in the upper left corner of the window. When you have finished with all of the pick-list tables you wish to modify, click on the **red arrow** at the bottom of the pick-list window to return to the main menu.

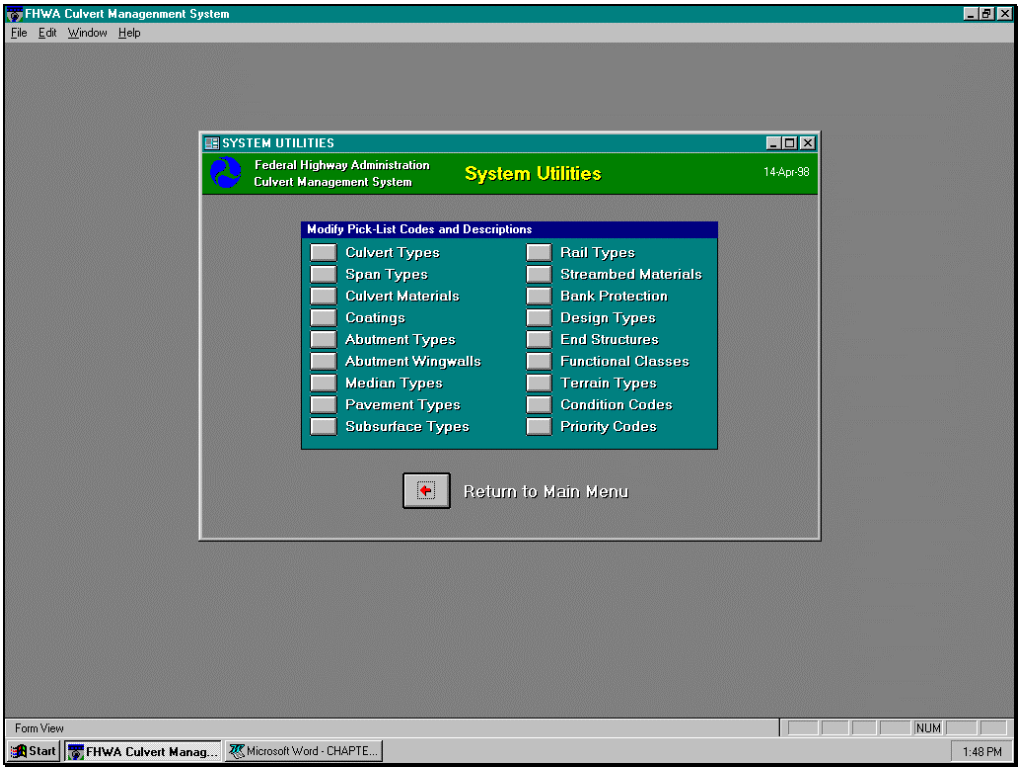


Exhibit 2-3. System Utilities Menu.

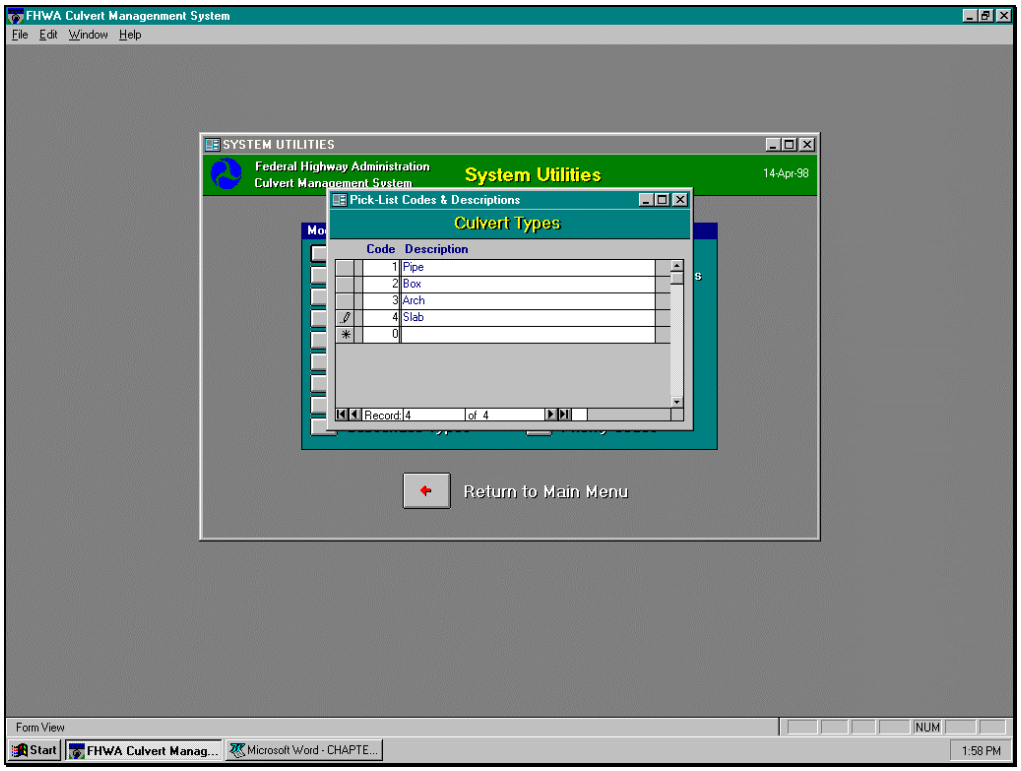


Exhibit 2-4. Typical pick-list table.

CHAPTER III
INVENTORY MODULE

Chapter III
INVENTORY MODULE

INTRODUCTION

The Inventory Module is a simple database storage and retrieval tool used primarily to supply information directly to users of the system and to other modules in the CMS. Only a small portion of the information in the database is used in the CMS. Most of the information in the system is for use by the agency for other analysis purposes.

The information used in this module initially will be collected from the review of records and plans stored in various locations within the agency or possibly the State Department of Transportation (DOT). If the plans are not available, the inventory will need to be collected in the field. The information will then be verified in the field where possible during subsequent inspections. After the initial inventory any repairs or replacements to the culvert should include documentation that can be used to update the database. Documentation also should include any new culverts to keep the database current.

ACCESSING THE INVENTORY MODULE

From the Main Menu, click on **Culvert Inventory** selection**.** This will bring up the first window used to enter and review data on the culverts in your jurisdiction. Exhibit 3-1 shows the first **Inventory** window. This window contains information on:

- Control
- Location
- Administration
- Safety Items
- Posting Items

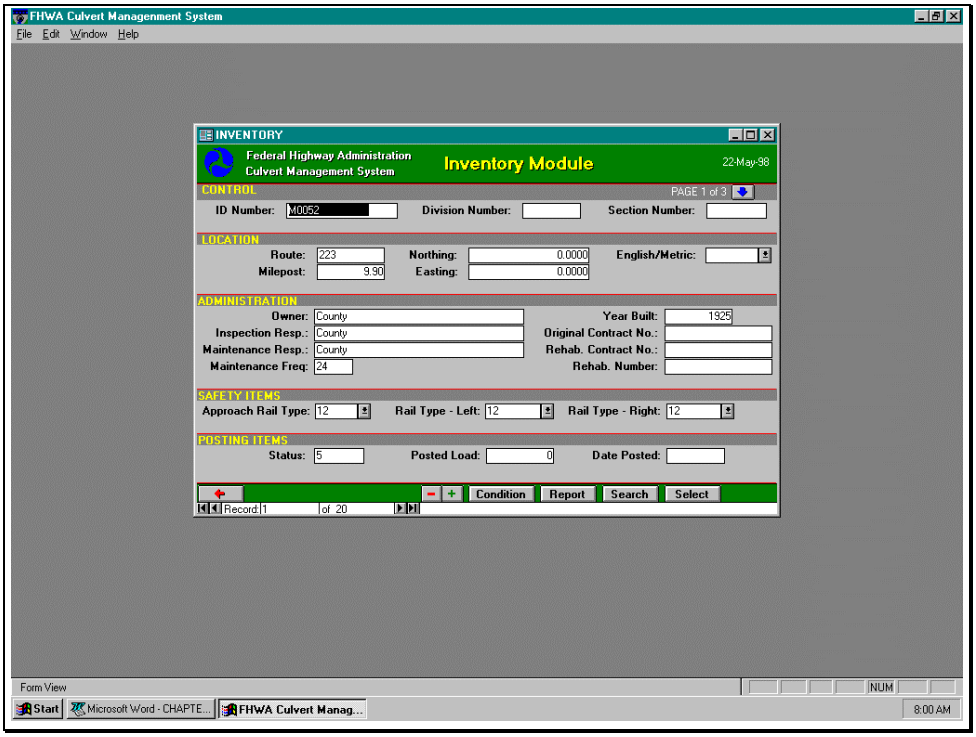


Exhibit 3-1. First **Inventory** window.

Information is stored for culverts on two additional screens. The next group of information is accessed by clicking on the **blue down arrow** located near the upper right corner of the **Inventory** window next to the notation 'PAGE 1 of 3'. Exhibit 3-2 shows the second **Inventory** window. This window contains information on:

- Structural Items

The remaining information is accessed by again clicking the button with the **blue down arrow** located near the upper right corner of the Inventory window next to the notation 'PAGE 2 of 3'. Exhibit 3-3 shows the third **Inventory** window. This window contains information on:

- Feature Carried
- Feature Intersected

Detailed descriptions of the inventory items included in the CMS are provided in **Appendix B**. To go back to previous windows, click on the **blue up arrow** located near the upper right corner of the Inventory window.

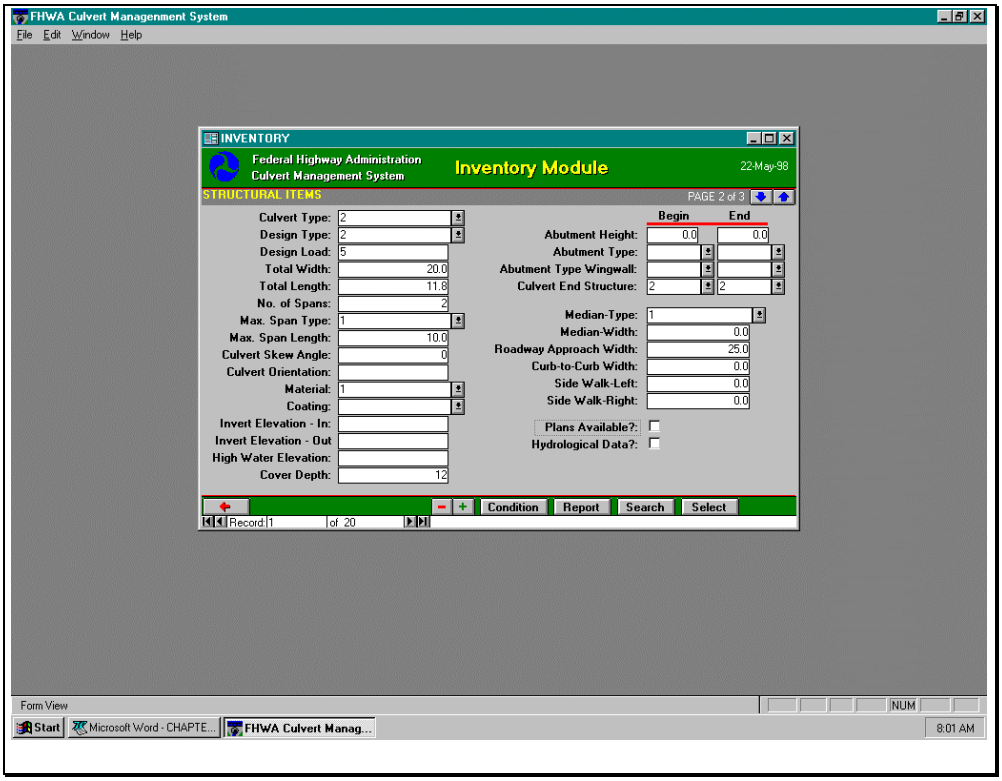


Exhibit 3-2. Second **Inventory** window.

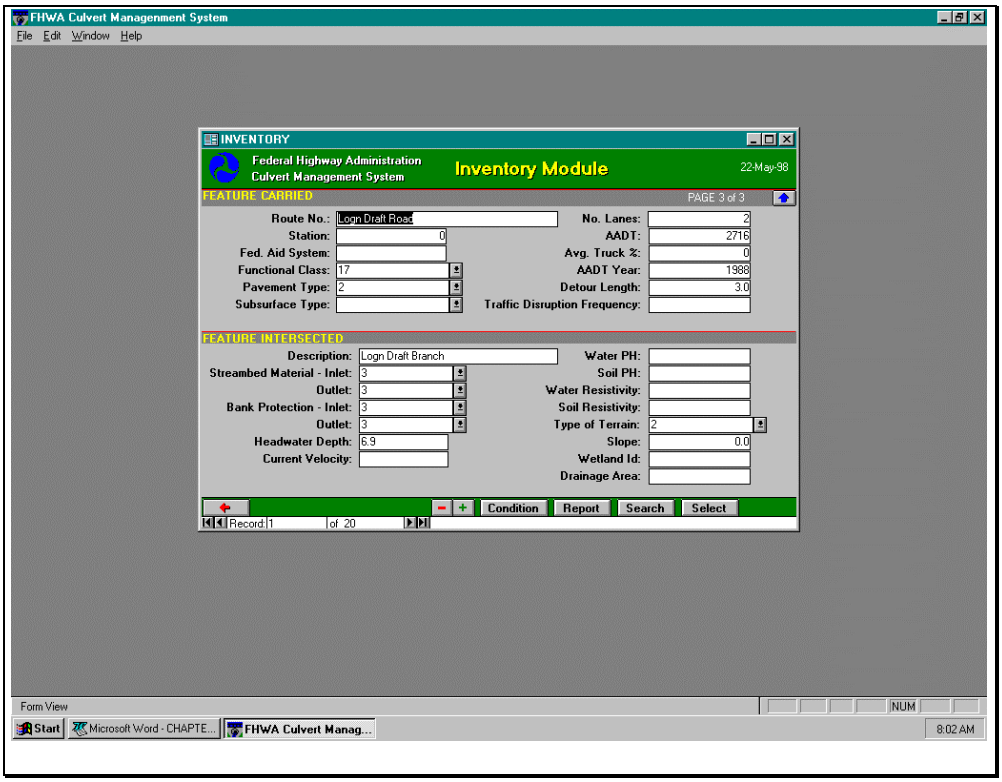


Exhibit 3-3. Third **Inventory** window

USING THE INVENTORY MODULE

Adding a New Culvert

To add a new culvert, click on the **green plus sign** near the bottom of the **Inventory** window. A new window will appear over the **Inventory** window called **Form: Get ID Inventory** as shown in Exhibit 3-4. To add a new culvert, type in the ID number for the culvert, hit the **Enter** key, then click on **Add New Record**. A blank data screen will be displayed for entering the data on the new culvert. If you do not wish to enter a new culvert, click on the **open door and blue arrow**. This will return you to the **Inventory** Window.

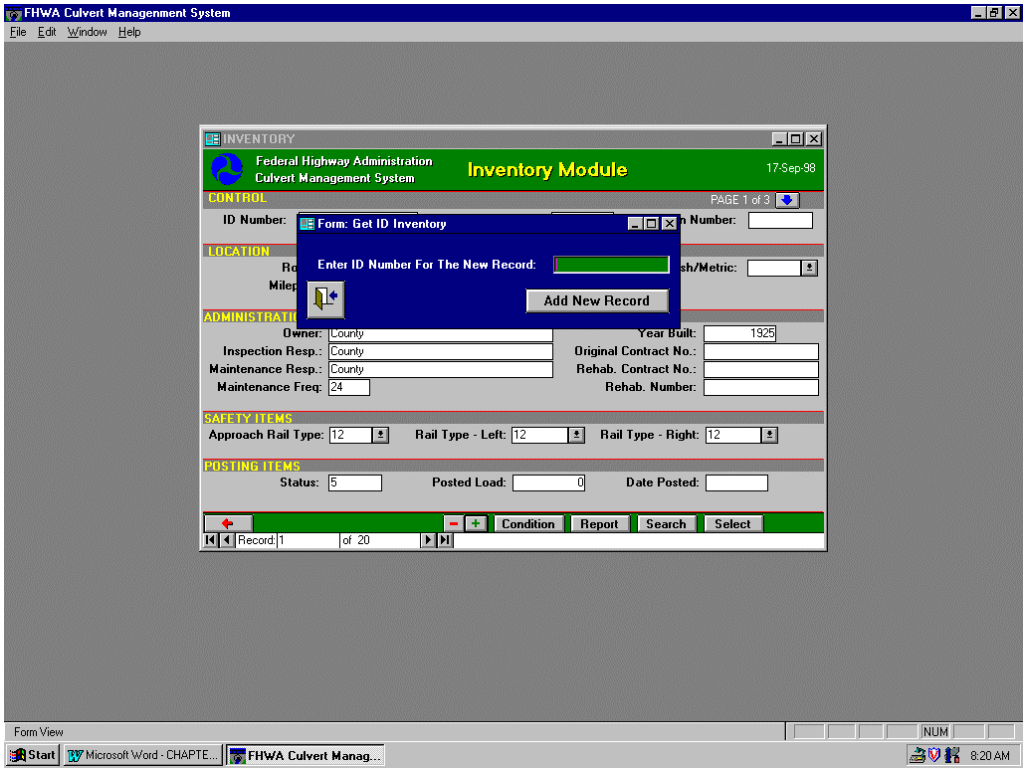


Exhibit 3-4. Enter new culvert ID number.

Locating an Existing Culvert

To find an existing culvert, click on the **Search** button located on the bottom of the Inventory window. A new window will appear over the **Inventory** window called **Locate Record,** as shown in Exhibit 3-5. To locate a culvert, type in the ID number for the culvert, hit the **Enter** key and click on **Find Record**. The system will then display the information on the desired

culvert for review or editing. If you do not wish to locate a culvert, click on the **open door and blue arrow** to the left of the screen. This will return you to the **Inventory** window.

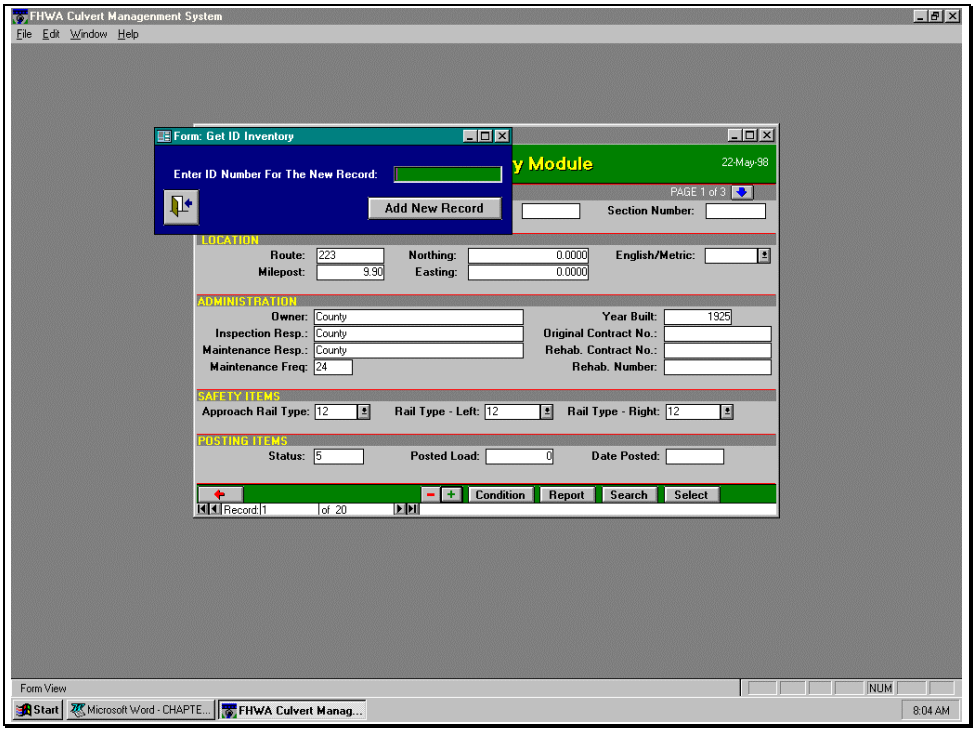


Exhibit 3-5. **Locate Record** window.

Deleting an Existing Culvert

To delete an existing culvert, first locate the culvert to be deleted using the **Search** button as described above. Click on the **red minus sign** located at the bottom center of the window. A new window is then displayed that asks if you wish to delete the record. If you want to delete the record, click on the **OK** button. If you do not want to delete the culvert, click on **Cancel**, which will undo the deletion. Exhibit 3-6 shows the **Verification** window.

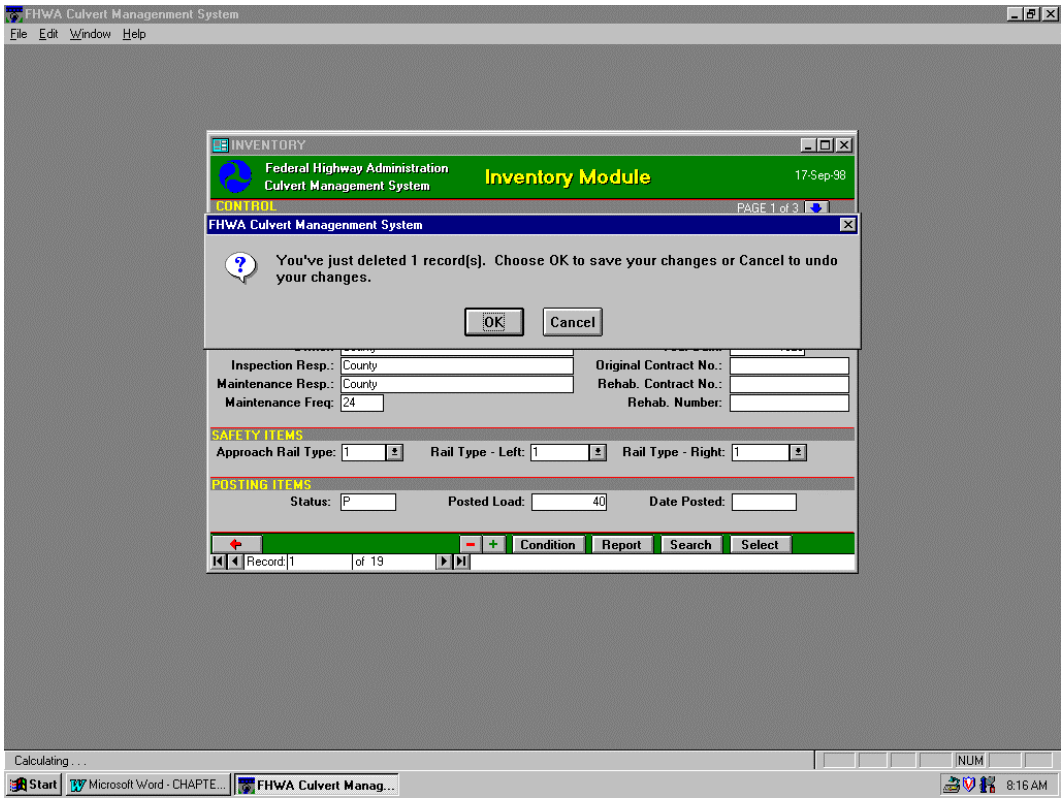


Exhibit 3-6. **Verification** Window.

Searching for Selected Culverts

The CMS allows you to select one or more of the culverts that meets criteria that you define. The selection criteria includes:

- Culvert ID
- Route
- Design Type
- Year Built
- Culvert Width

To search for a group of culverts based on a certain criteria click on **Select**. This will bring up the **Selection Criteria** window as shown in Exhibit 3-7.

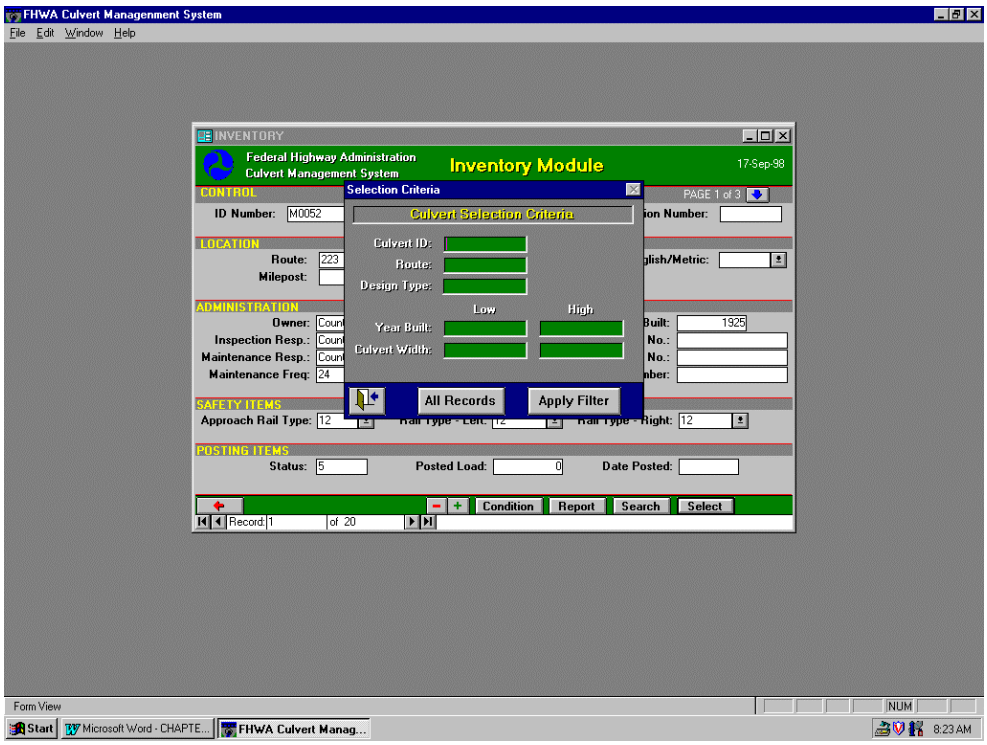


Exhibit 3-7. **Selection Criteria** window.

The culvert ID selection allows you to select a group of culverts that have a portion of their ID that is the same. As an example you might have all culverts that were constructed within a single construction project start with the same several digits, so you would type in the first several digits followed by an asterisk (*), which would select only those culverts with matching IDs. The route selection allows you to enter a route designation, such as a highway number or name, and the CMS will then select all culverts on that route. The **Design Type** functions in the same way where you provide a design type, such as concrete pipe or box culvert. The CMS will select all culverts that match the criteria. The **Year Built** selection criteria field allows you to put in a range of dates that you wish to review. The CMS will then display those culverts that match the criteria. The same is true of the **Culvert Width** selection criteria field, which allows you to put in a range of widths that you wish to review. The CMS will then display those culverts that match the criteria.

Obtaining Reports

To produce a report that displays the inventory, click on **Report**, located at the bottom of the window. The system will then display the **Detailed Culvert Description** report on the screen. The complete report can be viewed by maximizing the report window and clicking on **Report**. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report. Exhibit 3-8 shows how the report screen will look.

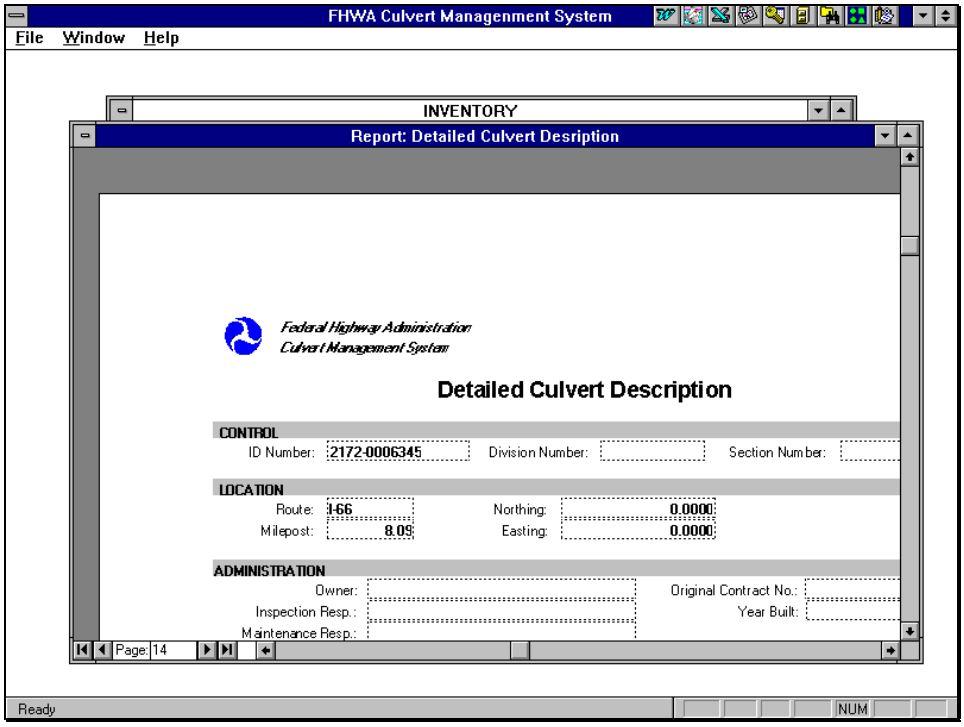


Exhibit 3-8. **Detailed Culvert Description** window.

To get a hard copy of the report click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Exhibit 3-9 shows how this window looks. Clicking on the **Print Setup** option allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer. To obtain a report for an individual culvert or selected group of culverts you first use the **Select** or **Search** options discussed previously then use **Report** to get the report for the selected culverts.

Returning to the Main Menu

To return to the main menu click on the **red arrow pointing to the left** located in the lower left corner of the **Inventory** window.

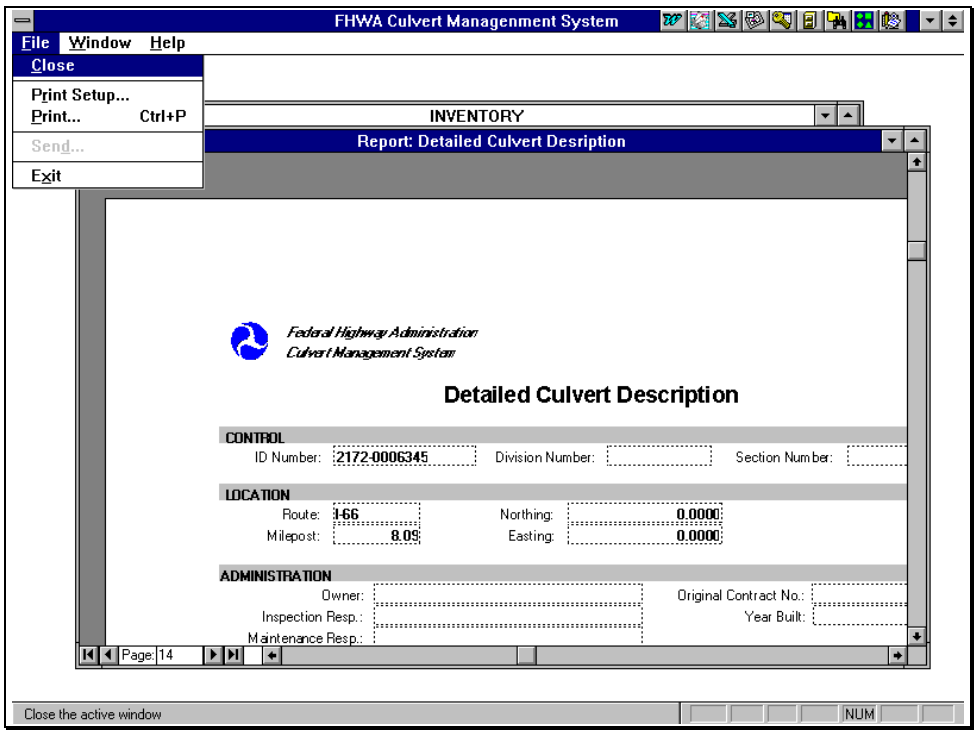


Exhibit 3-9. **Print** window.

CHAPTER IV
CONDITION MODULE

Chapter IV
CONDITION MODULE

INTRODUCTION

The Condition Module is used to enter and store information related to the condition of the culverts within the system. The information is used to develop work needs, costs, budgets and schedules.

The condition is rated on seventeen different items within three general condition groups. The inspection identifies the maintenance and rehabilitation activity to be performed to correct the condition. It also identifies the quantity of work required. The Condition Module allows the agency to provide:

- an overall rating of the culvert condition,
- the overall repair type proposed, and
- priority ranking for the repair.

ACCESSING THE CONDITION MODULE

From the Main Menu, click on the **Culvert Condition** selection**.** This will bring up the first window used to enter and review data about the condition of the culverts.

Exhibit 4-1 shows the first **Condition** window. This window contains information on:

- control,
- inspection,
- general condition, and
- inspection ratings for the roadway.

Each selection records the following data:

Control Information

- Culvert ID
- Whether or not the culvert is classified as a confined space

Inspection Information

- The date of the inspection
- The names or initials of the inspector(s)

General Condition Information

- An overall rating of the culvert condition
- The repair type proposed
- Hydraulic adequacy
- Priority ranking

Inspection Ratings - Roadway

- The condition of five elements of the roadway
- Overall condition of the roadway
- Maintenance and rehabilitation activity that should be performed to correct the condition of each element
- The quantity of work required

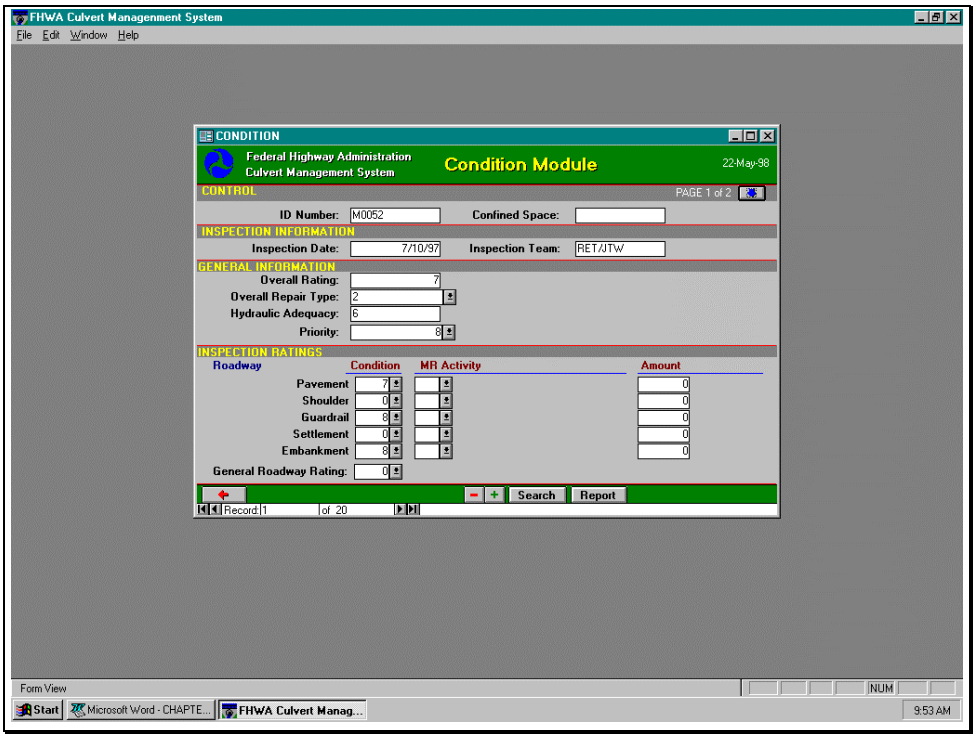


Exhibit 4-1. First **Condition** window.

The condition information continues on a second window. To access the next group of condition items click on the **blue down arrow** located near the upper right corner of the **Condition** window next to the notation 'PAGE 1 of 2'.

Inspection Ratings – Culvert Structure and Channel

Exhibit 4-2 shows the second **Condition** window. This window contains information on inventory ratings for the culvert structure and the channel.

- Information on the condition for six elements of the culvert structure
- Overall condition of the culvert structure
- Information on the condition for six elements of the channel
- Overall condition of the channel
- Maintenance and rehabilitation activity that should be performed to correct the conditions
- Quantity of work required

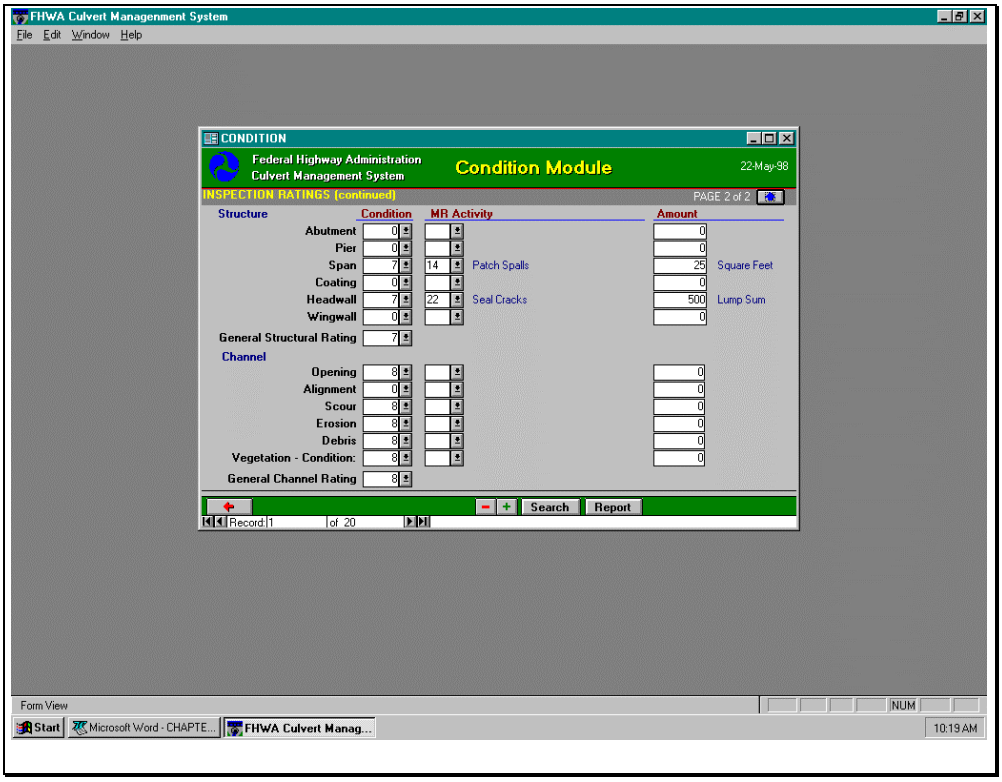


Exhibit 4-2. Second **Condition** Window.

USING THE CONDITION MODULE

Adding a New Culvert Condition

To add a new culvert condition, click on the **green plus sign** near the bottom of the **Condition** window. A new window will appear over the **Condition** window called **Form: Get ID Inventory** as shown in Exhibit 4-3. To add a new culvert condition, type in the ID number for the culvert, hit **Enter**, then click on **Add New Record**. A blank data screen will be displayed for entering the condition data on the culvert. If you do not wish to enter a new condition, click on the **open door and blue arrow**. This will return you to the **Condition** window.

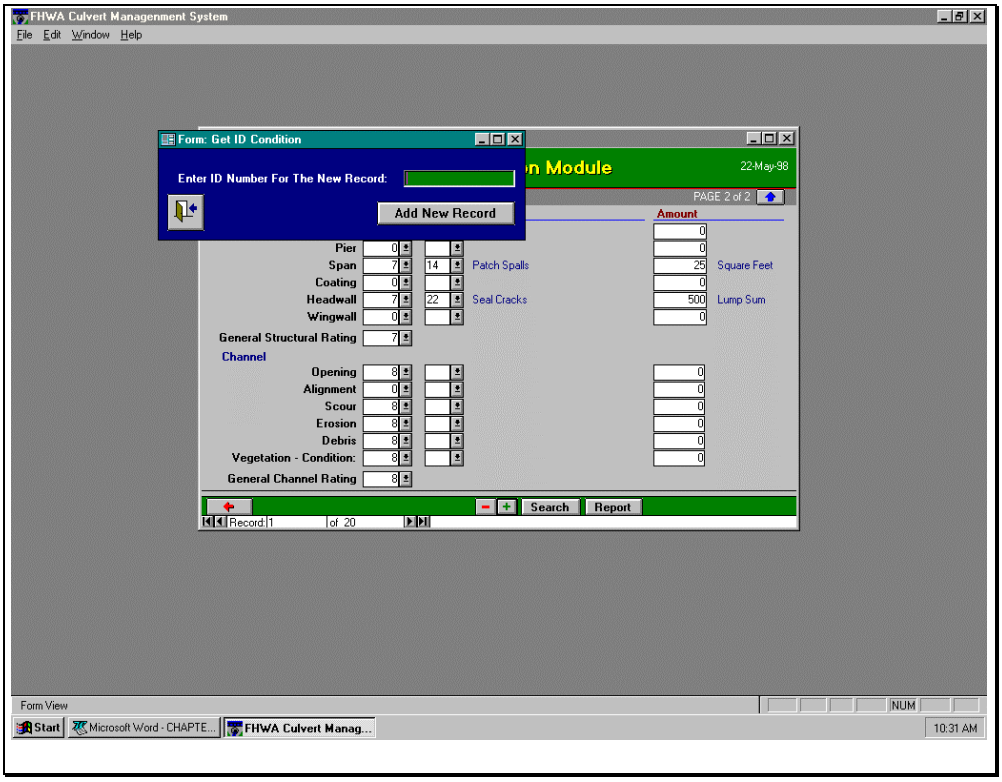


Exhibit 4-3. Enter new culvert ID number.

Locating an Existing Culvert Condition

To find an existing condition for a culvert click on **Search**, located on the bottom of the **Condition** window. A new window, called **Locate Record,** will appear over the **Condition** window**,** as shown in Exhibit 4-4. To locate a culvert, type in the ID number for the culvert, hit the **Enter** key, then click on **Find Record**. The system will then display the condition information on the desired culvert for review or editing. If you do not wish to locate a culvert, click on the **open door and blue arrow**. This will return you to the **Condition** window.

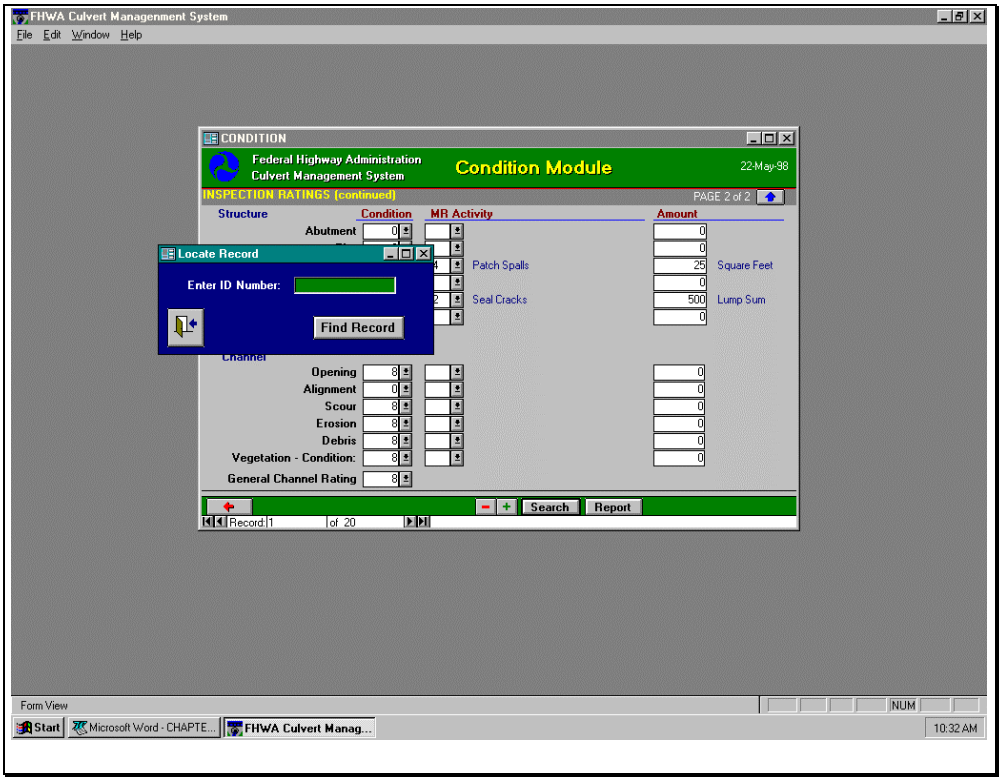


Exhibit 4-4. **Locate Record** window.

Deleting an Existing Culvert Condition

To delete an existing condition report for a culvert, locate the culvert using **Search** as described previously. Then click on the **red minus sign** located at the bottom center of the window. A new window is then displayed that asks if you wish to delete the record. If you want to delete the record, click on **OK**, as shown in Exhibit 4-5, the Verification window. If you do not want to delete the condition record, click on **Cancel**, which will undo the deletion.

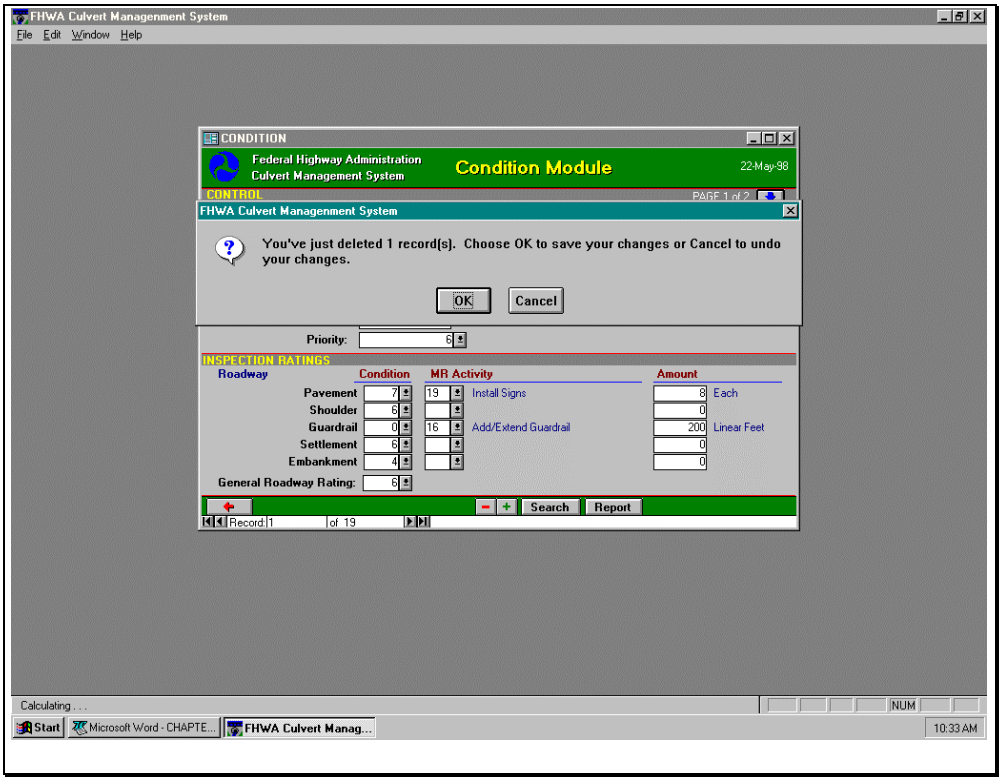


Exhibit 4-5. **Verification** window.

Obtaining Reports

To produce a report that displays the inventory, click on **Report**, located at the bottom of the window. The system will display the **Culvert Condition Description** report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. A second option is to use the **up and down arrows** located on the right side of the window and the **left and right arrows** at the bottom of the window to move around the report. Exhibit 4-6 shows how the report screen will look.

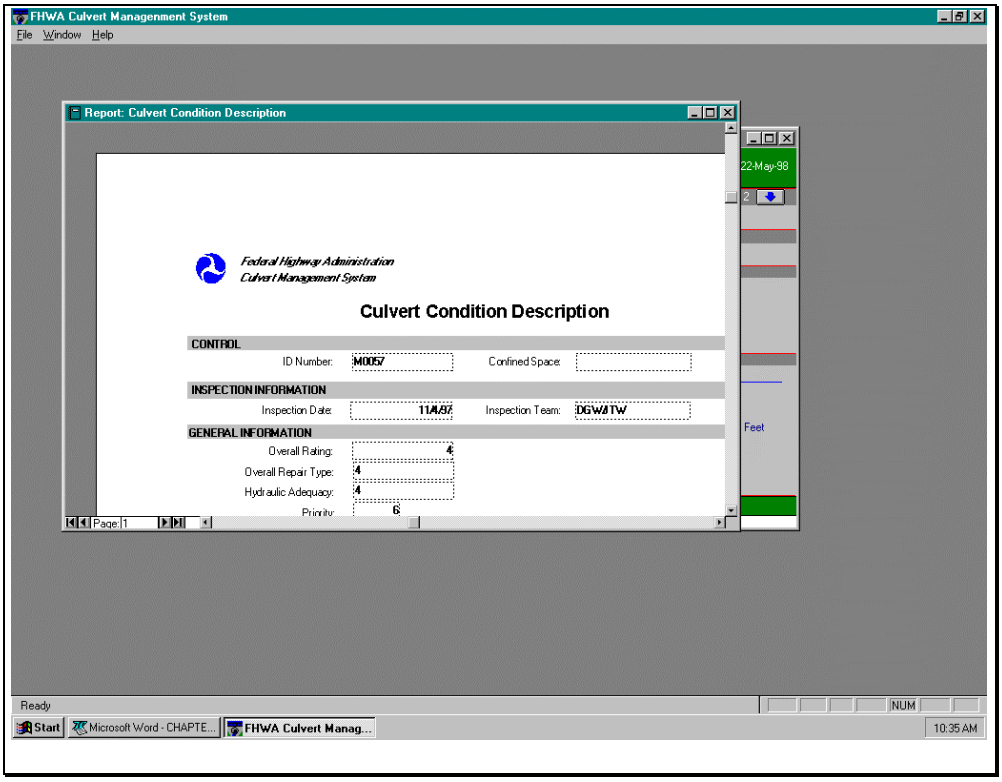


Exhibit 4-6. **Detailed Culvert Description** window.

To get a hard copy of the report, click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print** the report. Exhibit 4-7 shows how this window looks. Clicking on the **Print Setup** option allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer. Exhibit 4-8 shows a typical printout. To obtain a report for an individual culvert or selected group of culverts you first use the **Select** or **Search** options discussed previously, then use **Report** to get the report for the selected culverts.

Returning to the Main Menu

To return to the main menu click on the **red arrow pointing to the left** located in the lower left corner of the inventory window.

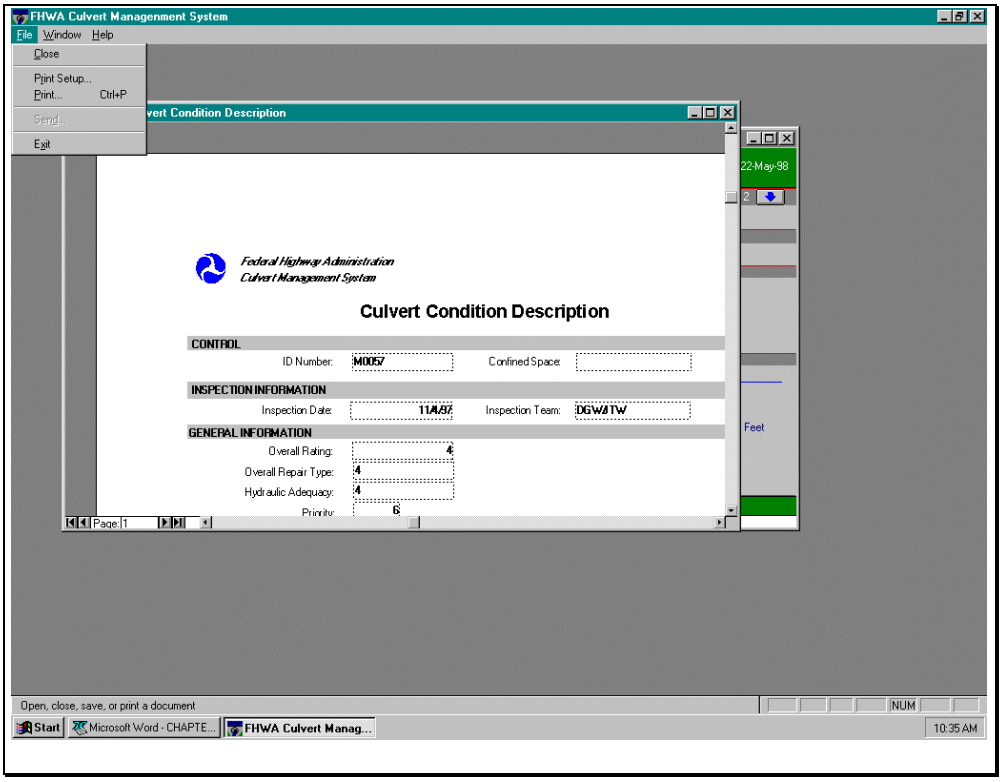
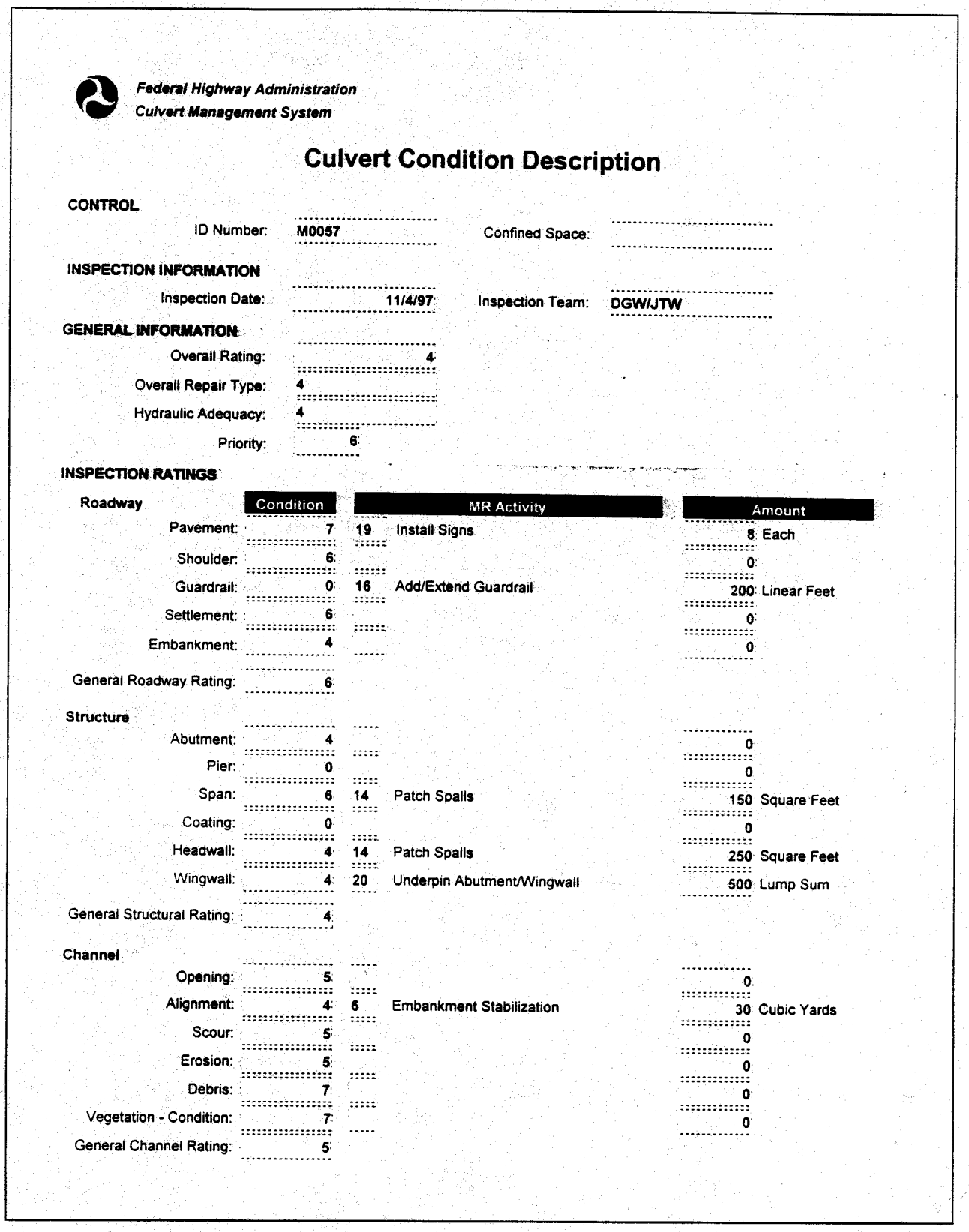


Exhibit 4-7. Print window.



Federal Highway Administration
Culvert Management System

Culvert Condition Description

CONTROL

ID Number: M0057 Confined Space:

INSPECTION INFORMATION

Inspection Date: 11/4/97 Inspection Team: DGW/JTW

GENERAL INFORMATION

Overall Rating: 4
Overall Repair Type: 4
Hydraulic Adequacy: 4
Priority: 6

INSPECTION RATINGS

Roadway	Condition	MR Activity		Amount	
Pavement:	7	19	Install Signs	8	Each
Shoulder:	6			0	
Guardrail:	0	16	Add/Extend Guardrail	200	Linear Feet
Settlement:	6			0	
Embankment:	4			0	
General Roadway Rating:	6				
Structure					
Abutment:	4			0	
Pier:	0			0	
Span:	6	14	Patch Spalls	150	Square Feet
Coating:	0			0	
Headwall:	4	14	Patch Spalls	250	Square Feet
Wingwall:	4	20	Underpin Abutment/Wingwall	500	Lump Sum
General Structural Rating:	4				
Channel					
Opening:	5			0	
Alignment:	4	6	Embankment Stabilization	30	Cubic Yards
Scour:	5			0	
Erosion:	5			0	
Debris:	7			0	
Vegetation - Condition:	7			0	
General Channel Rating:	5				

Exhibit 4-8. **Typical Condition Report** Printout

CHAPTER V
WORK NEEDS MODULE

Chapter V
WORK NEEDS MODULE

INTRODUCTION

The **Work Needs Module** develops the total work needs and costs for all work identified in the **Condition Module** portion of the CMS. The module has two parts: (l) defining the work performed and (2) developing the work needs and costs. The first part is used to define the maintenance and rehabilitation activities (M&R) and repair types. The activities and work types must be defined and entered into the system before the work needs are entered into the Condition Module. The second part takes the work needs information input in the Condition Module and applies unit costs to the work quantity to produce the work needs and costs for all culverts within the local government's jurisdiction.

DEFINING THE WORK

To define the work performed it is first necessary to review the types of activities that generally are performed on culverts. The M&R activities can include:

- debris removal,
- flushing/sediment control,
- ditch cleaning and repair,
- scour hole repair,
- vegetation control,
- embankment stabilization,
- joint sealing,
- invert paving,
- streambed paving,
- repairing or replacing a section of culvert barrel,
- repairing/replacing a section of headwall or wingwall,
- lengthening of culvert, and
- replacing the culvert.

In addition to defining the activities, the system also allows the user to enter information on:

- measurement unit,
- unit cost,
- performed by in-house personnel or by contract,
- productivity,
- inflation, and
- the months when the activity is usually performed.

As with the Inventory Module, the user can add new activities, modify existing activities, and delete activities over time. The user can also review activities on the screen or have them printed out.

Once the activities are defined, they must be assigned into one or more repair types. The repair types are the general strategies that are normally performed on culverts. These repair types can include:

- do nothing,
- routine maintenance,
- preventive maintenance,
- rehabilitation, and
- replacement.

Once the activities have been placed into the system, the user will input information on each repair type, such as the repair type(s) to which activities are assigned. It is possible to have an M&R activity assigned to more than one repair type. The assignment should be based on the type of work that generally is done when a particular work type is performed. The system will allow the user to add new repair types or delete existing repair types. The activities assigned to each repair type also can be modified. Information on repair types and activity assignments can be reviewed on the screen or on a printout.

DEVELOPING THE WORK NEEDS COST5

The second half of this module is used to determine the work needs and costs for all culverts in the system. The general repair type information from the condition file is noted. The recommended M&R activities from the condition file are then read and compared to the repair type file. If the activity recommended is included for the repair type then the work quantity for the activity is multiplied by the unit cost for the activity in the M&R file to obtain the cost for the activity. This is repeated for all activities in the condition file. Once the costs for all of the activities have been calculated they are summarized to obtain the total cost for the repair type for the culvert. A work needs file is then produced that contains information by culvert that includes repair type, cost, priority and general location information as provided in the condition inspection.

The information can be reviewed for all or selected culverts. The standard report shows the culverts and their repair costs for each repair type, listed by priority.

ACCESSING THE WORK NEEDS MODULE

From the Main Menu, click on **Work Needs.** This will bring up the first window that contains the Work Needs menu. Exhibit 5-1 shows the Work Needs menu window. This menu contains information on:

- defining Maintenance and Repair Activities,
- defining Repair Types,
- calculating Current Work Needs, and
- reviewing the Current Work Needs.

USING THE WORK NEEDS MODULE

Maintenance and Repair Activities

To define, update, modify or delete Maintenance and Repair activities, click on **Maintenance and Repair Activities**. This will bring up the window used to work with Maintenance and Repair activities. Exhibit 5-2 shows the Maintenance and Repair Activities window.

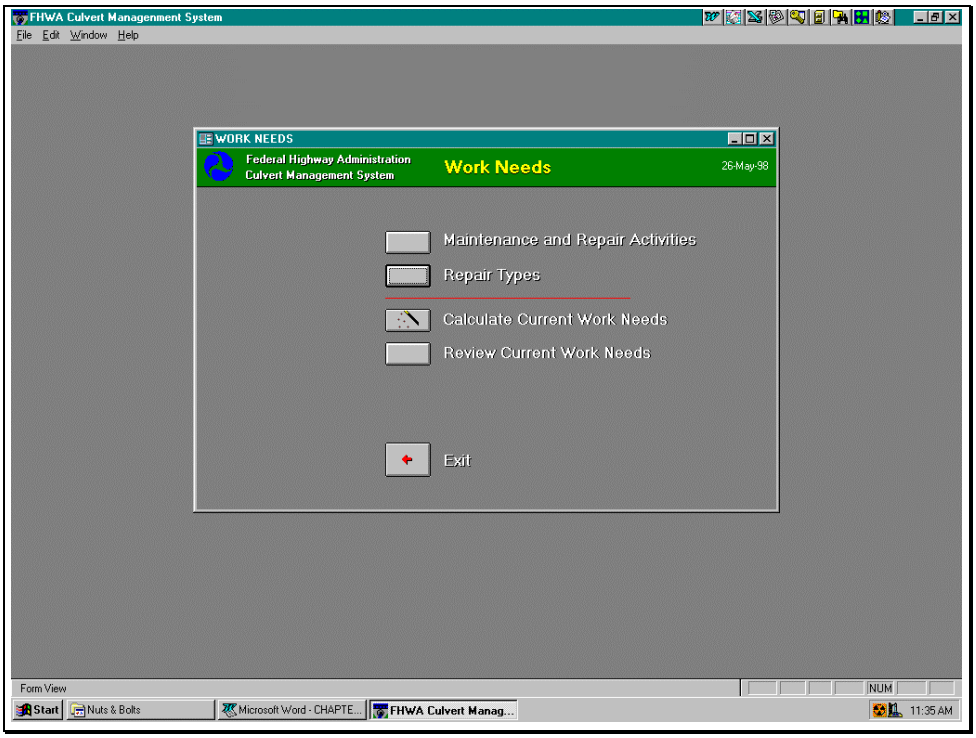


Exhibit 5-1. **Work Needs Menu** window.

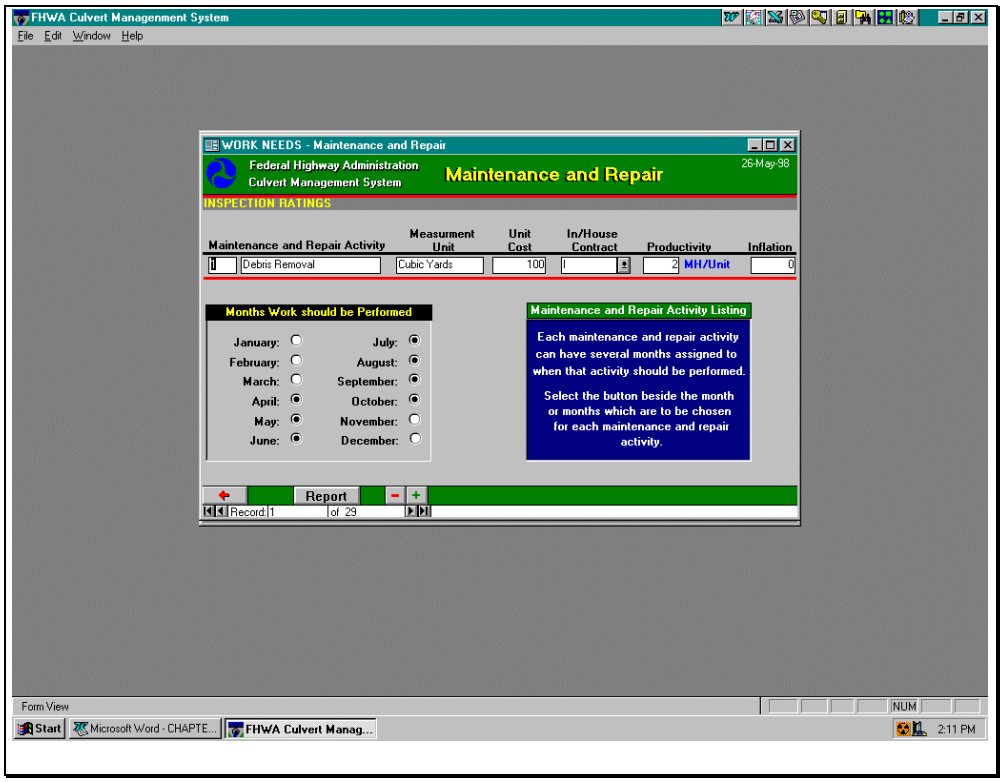


Exhibit 5-2. **Maintenance and Repair** Input Window.

The following information is entered on the screen:

- the number and title assigned for the activity,
- the measurement unit for the activity,
- the cost to perform a unit of work,
- whether the work is normally done by in-house forces or by contract,
- the average productivity in terms of man-hours to do a single unit of work,
- a normal inflation factor for costs associated for the activity, and
- the months the work is normally performed during the year.

Adding a new Maintenance and Repair activity - To add a new maintenance and repair activity, click on the **green plus sign** near the bottom of the Maintenance and Repair window. A new window will appear over the Maintenance and Repair window called **Form: Get ID UpdateMR** as shown in Exhibit 5-3. To add a new maintenance and repair activity, type in the ID number for the activity, hit the **Enter** key, and click on **Add New Record**. A blank data

screen will be displayed for entering the maintenance and repair activity data. If you do not wish to enter a new activity, click on the **open door and blue arrow**. This will return you to the **Maintenance and Repair** Window.

Locating an existing Maintenance and Repair activity - To find an existing maintenance and repair activity, click on the **left and right arrows** at the bottom left corner of the Maintenance and Repair window next to the boxes labeled Record: _____ of _____ until the desired record is displayed. The system will then display the information on the desired activity for review or editing.

Deleting an existing Maintenance and Repair activity - To delete an existing Maintenance and Repair activity, first locate the activity as described above. Click on the **red minus sign** located at the bottom center of the window. A new window is then displayed that asks if you wish to delete the activity. If you want to delete the activity, click on **OK**. If you do not want to delete the activity record, click on **Cancel,** which will undo the deletion. Exhibit 5-4 shows the Verification window.

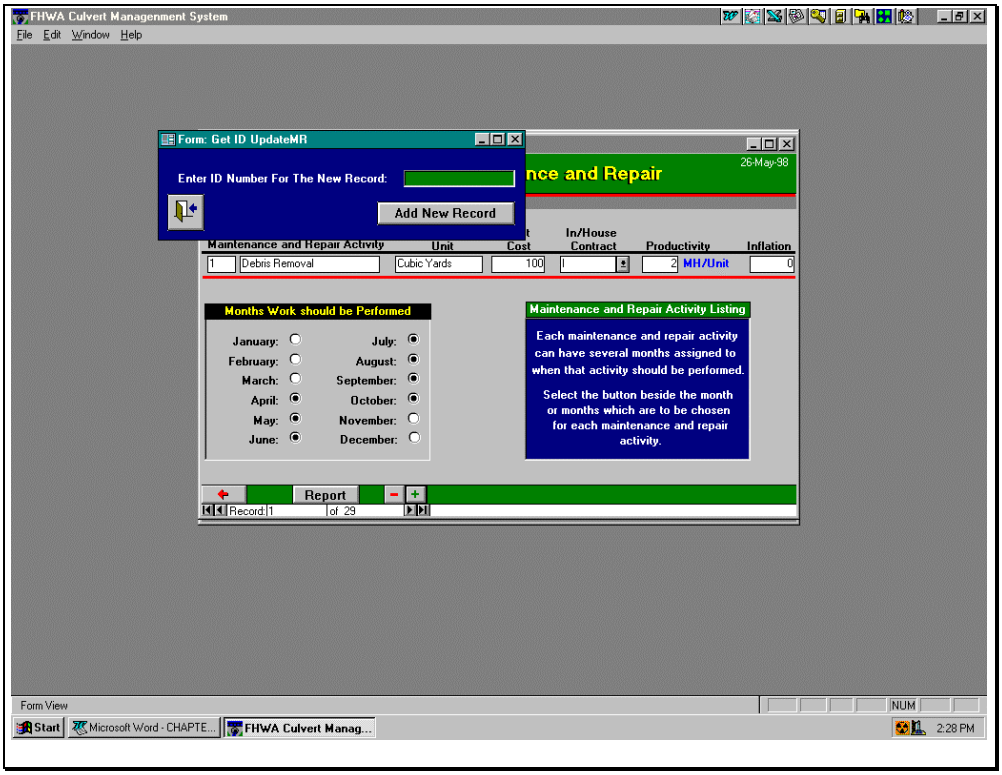


Exhibit 5-3. Enter new Maintenance and Repair activity.

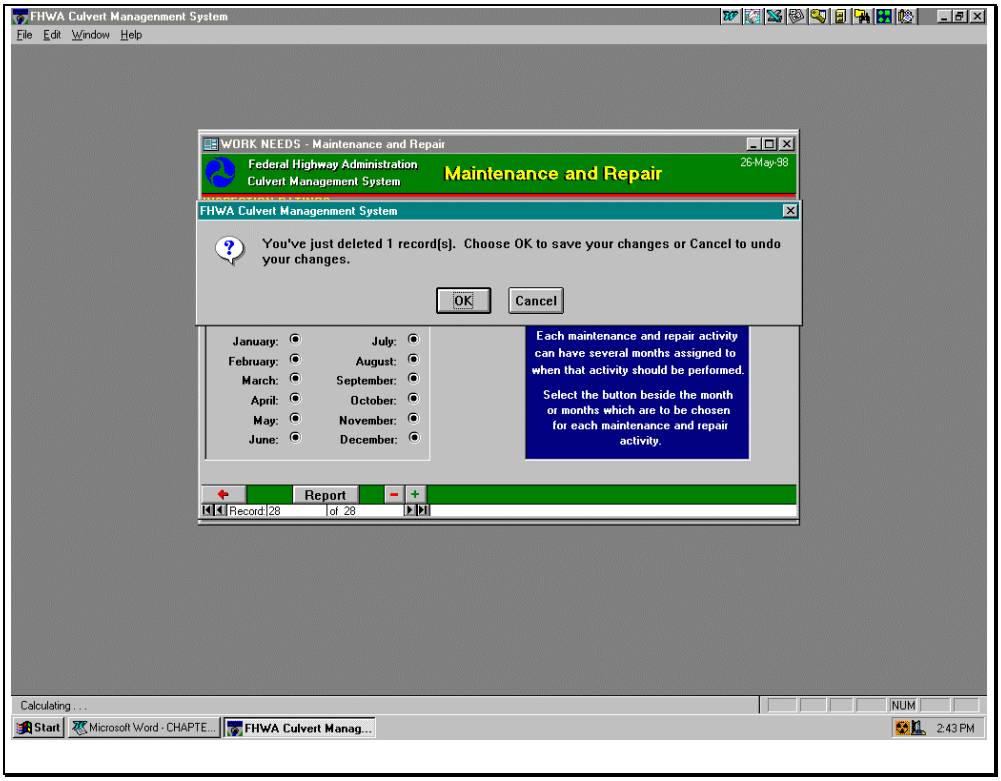


Exhibit 5-4. **Verification** window.

Obtaining reports - To produce a report that displays the Maintenance and Repair activities, click on **Report,** located at the bottom of the window. The system will display the Maintenance and Rehabilitation Activity Listing report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around the report. Exhibit 5-5 shows how the report screen will look.

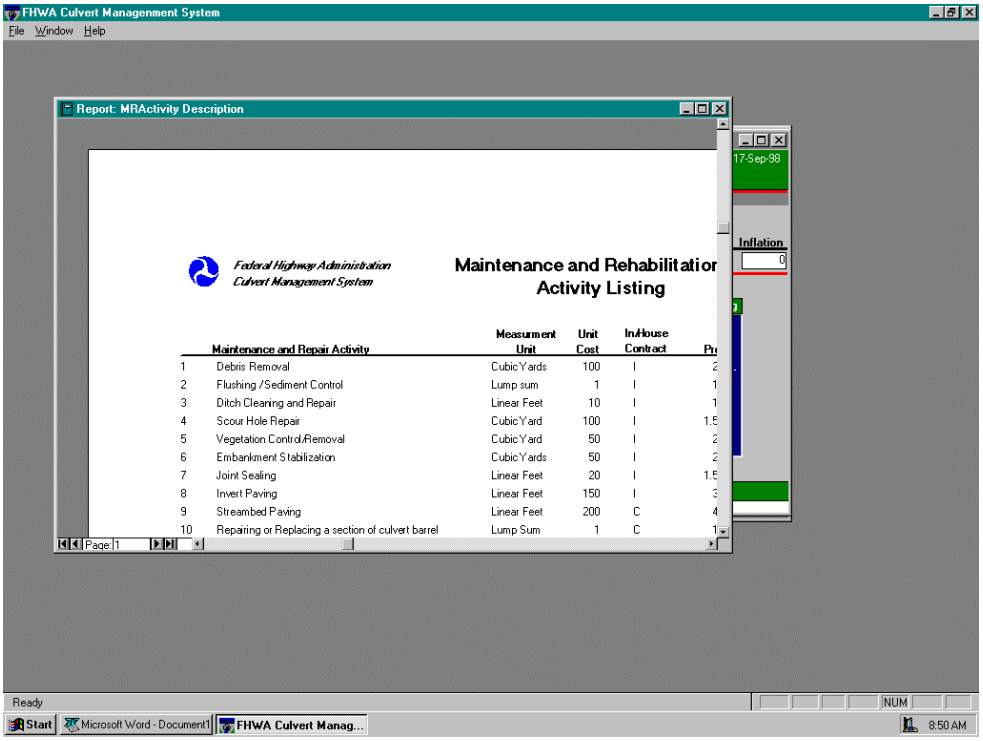


Exhibit 5-5. **Maintenance and Rehabilitation Activity Listing** window.

To get a hard copy of the report, click on the File menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Exhibit 5-6 shows how this window looks. Clicking on the **Print Setup** option allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer. Exhibit 5-7 shows a typical Maintenance and Rehabilitation Activity Listing printout.

Returning to the Work Needs menu - To return to the Work Needs menu click on the **red arrow** pointing to the left located in the lower left corner of the window.

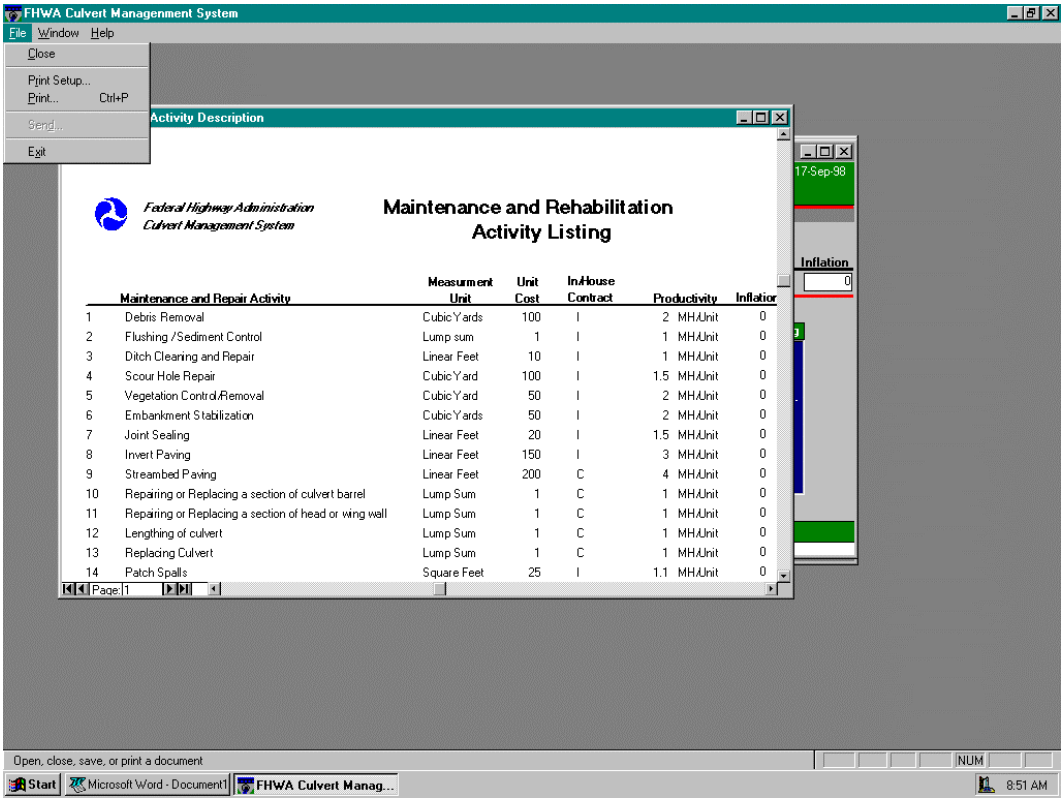


Exhibit 5-6. Print window.

Repair Types

To define, update, modify or delete Repair Types, click on **Repair Types**. This will bring up the window used to work with Maintenance and Repair activities. Exhibit 5-8 shows the **Repair Type** window, which contains:

- the number and description assigned for the repair type,
- amount of improvement to the condition when the work is performed, and
- maintenance and repair activities performed in the repair type.

Federal Highway Administration
Culvert Management System

Maintenance and Rehabilitation
Activity Listing

	Maintenance and Repair Activity	Measurment Unit	Unit Cost	In/House Contract	Productivity	Inflation	Activity Performance Months J F M A M J J A S O N D
1	Debris Removal	Cubic Yards	100	I	2 MH/Unit	0	
2	Flushing / Sediment Control	Lump sum	1	I	1 MH/Unit	0	
3	Ditch Cleaning and Repair	Linear Feet	10	I	1 MH/Unit	0	
4	Scour Hole Repair	Cubic Yard	100	I	1.5 MH/Unit	0	
5	Vegetation Control/Removal	Cubic Yard	50	I	2 MH/Unit	0	
6	Embankment Stabilization	Cubic Yards	50	I	2 MH/Unit	0	
7	Joint Sealing	Linear Feet	20	I	1.5 MH/Unit	0	
8	Invert Paving	Linear Feet	150	I	3 MH/Unit	0	
9	Streambed Paving	Linear Feet	200	C	4 MH/Unit	0	
10	Repairing or Replacing a section of culvert barrel	Lump Sum	1	C	1 MH/Unit	0	
11	Repairing or Replacing a section of head or wing wall	Lump Sum	1	C	1 MH/Unit	0	
12	Lengthing of culvert	Lump Sum	1	C	1 MH/Unit	0	
13	Replacing Culvert	Lump Sum	1	C	1 MH/Unit	0	
14	Patch Spalls	Square Feet	25	I	1.1 MH/Unit	0	
15	Repair Guardrail	Linear Feet	20	I	2 MH/Unit	0	
16	Add/Extend Guardrail	Linear Feet	25	C	0.2 MH/Unit	0	
17	Repair Bit. Coating	Linear Feet	100	C	4 MH/Unit	0	
18	Replace Fill	Cubic Yards	50	I	1 MH/Unit	0	
19	Install Signs	Each	100	I	0.5 MH/Unit	0	
20	Underpin Abutment/Wingwall	Lump Sum	1	C	1 MH/Unit	0	
21	Place Rip Rap	Cubic Yards	50	I	2 MH/Unit	0	
22	Seal Cracks	Lump Sum	1	C	1 MH/Unit	0	
23	Repair Bridge Railing	Linear Feet	40	I	2 MH/Unit	0	
24	Remove Silt Buildup	Cubic Yards	50	I	1.2 MH/Unit	0	
25	Replace Missing Bolts	Lump Sum	1	I	1 MH/Unit	0	

1

Exhibit 5-7. Typical **Maintenance and Repair Activities Listing** Printout

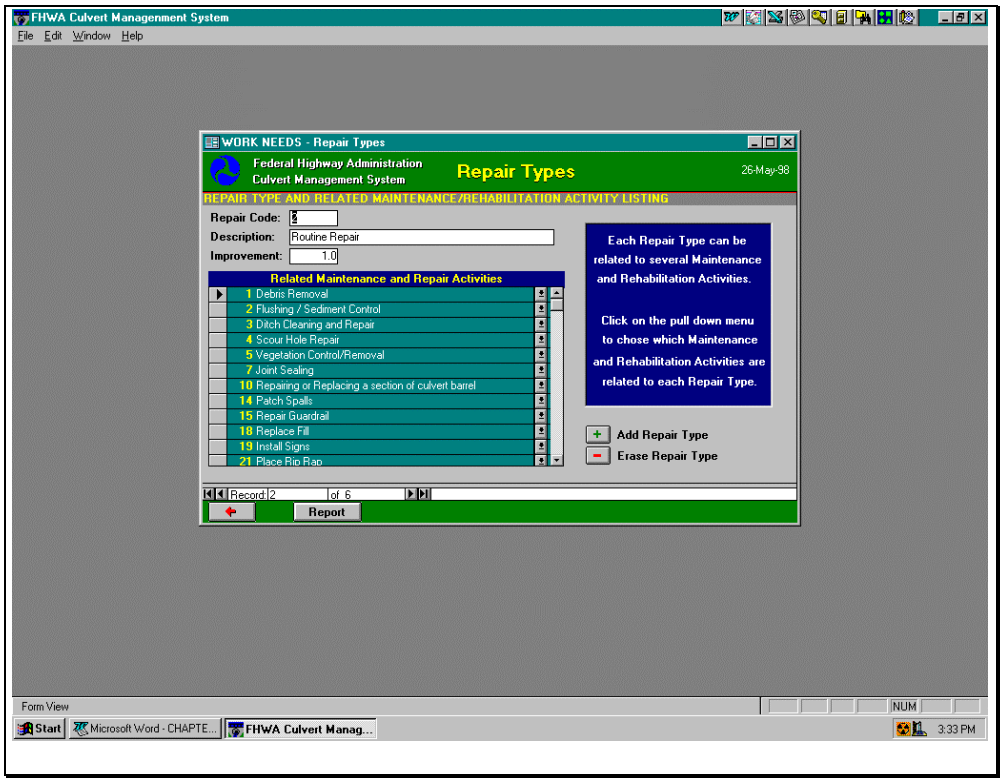


Exhibit 5-8 **Repair Type** input window.

Adding a new Repair Type - To add a new repair type click on the **green plus sign** near the bottom of the **Repair Type** window. A new window will appear over the **Maintenance and Repair** window called **Form: Get ID UpdateMR,** which is similar to that shown in Exhibit 5-3. To add a new repair type, type in the ID number for the repair type, hit the **Enter** key, and click on **Add New Record**. A blank data screen will be displayed for entering the repair type data. If you do not wish to enter a new repair type, click on the **open door and blue arrow**. This will return you to the **Repair Type** Window.

The **Repair Type Code** is any short code that is assigned to the repair type. It is used within CMS for listing order on reports. The **Description** is used by the system to describe the repair type.

The **Improvement** field is used to enter the amount of improvement expected in the overall condition of the culvert after the work has been performed. As an example, rehabilitation or

replacement would increase the current condition to a 9 or new condition. Other repair types would vary the amount of improvement from 0 for emergency repairs to 2 or 3 for preventive maintenance. The actual amount of improvement will depend on when the agency does the different repair types and what activities are associated with the repair type. This field is used in the **Work Funding Module** and is further explained in Chapter 6.

To select Maintenance and Repair Activities, click on the **down arrow** next to a blank line and then select an activity. The agency can select from one to all activities for a repair type. An activity can be assigned to more than one repair type.

Locating an existing Repair Type - To find an existing repair type, click on the **left and right arrows** at the bottom left corner of the Repair Type window next to the boxes labeled Record: _____ of _____ until the desired record is displayed. The system will then display the information on the desired repair type for review or editing.

Deleting an existing Repair Type - To delete an existing Repair Type, locate the repair type as described above. Then click on the **red minus sign** located at the bottom center of the window. A new window is then displayed that asks if you wish to delete the record. If you want to delete the repair type, click on **OK**. If you do not want to delete the repair type, click on **Cancel**, which will undo the deletion.

Obtaining reports - To produce a report that displays the Repair Type, click on **Report**, located at the bottom of the window. The system will then display the **Repair Type to Maintenance and Rehabilitation Activity Listing** report on the screen. Exhibit 5-9 shows a typical Repair type Listing printout. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report.

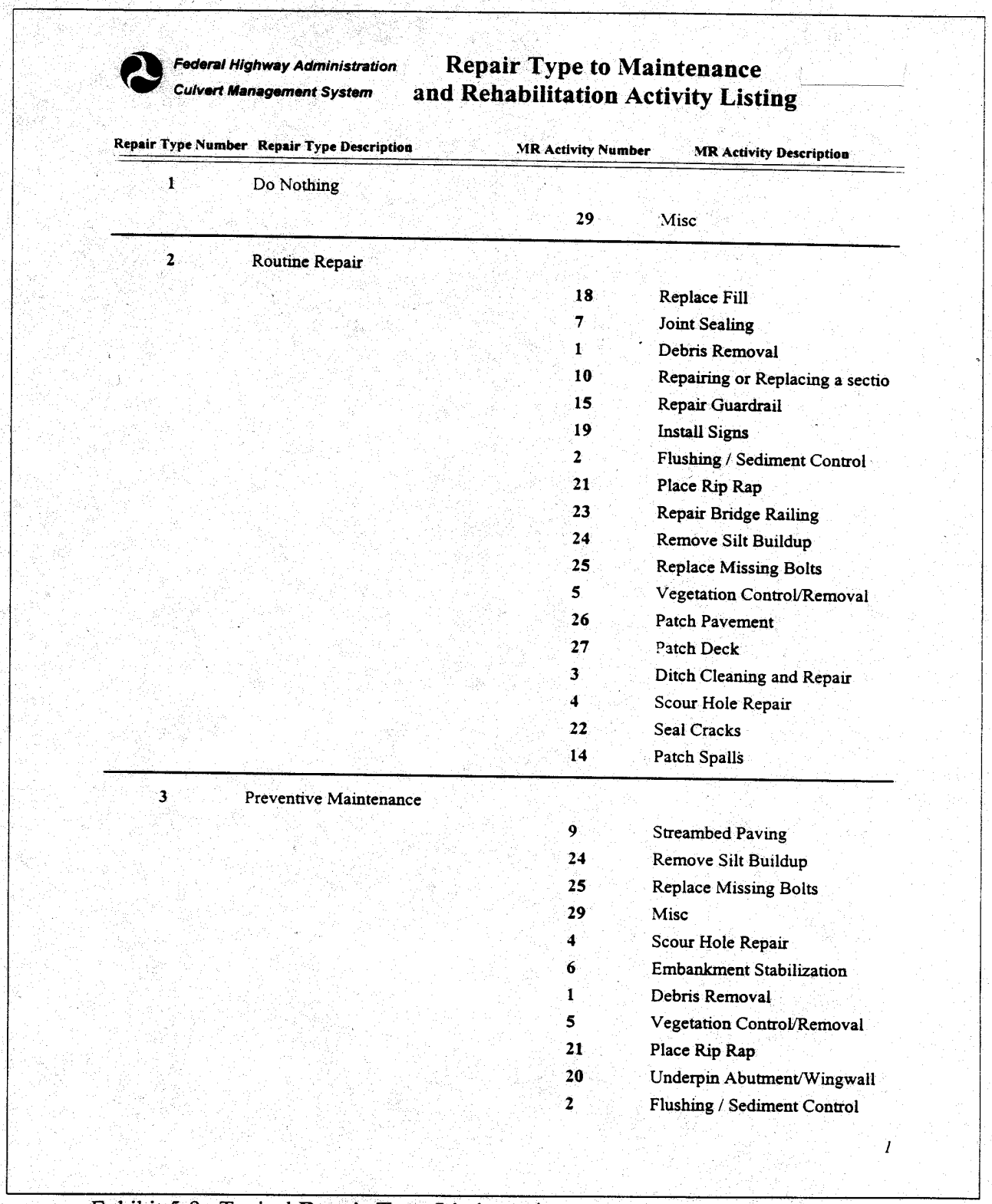
To get a hard copy of the report, click on the File menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print** the report. Clicking on the **Print Setup** option allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer.

Returning to the Work Needs Menu - To return to the Work Needs menu, click on the **red arrow** pointing to the left located in the lower left corner of the window.

Calculate the Current Work Needs - Once the culverts have been inspected, the condition data entered, and the M&R and repair types defined, then the CMS can develop the current work needs and costs. To perform this task, click on **Calculate Current Work Needs**. The CMS will calculate the current work needs. A message is displayed when the calculations are completed.

Review Current Work Needs - To review the current work needs, click on the **review current work needs** selection. This will bring up the window used to review the work needs by culvert. Exhibit 5-10 shows the **Current Work Needs Review** window. Within this window information by culvert is stored on:

- repair type (assigned),
- initial condition (from inspection data),
- estimated age (computed and used in the Work Funding Module),
- initial priority (from the inspection data),
- weighted priority (computed and used in the Work Funding Module), and
- cost.



Federal Highway Administration
Culvert Management System

Repair Type to Maintenance and Rehabilitation Activity Listing

Repair Type Number	Repair Type Description	MR Activity Number	MR Activity Description
1	Do Nothing		
		29	Misc
2	Routine Repair		
		18	Replace Fill
		7	Joint Sealing
		1	Debris Removal
		10	Repairing or Replacing a sectio
		15	Repair Guardrail
		19	Install Signs
		2	Flushing / Sediment Control
		21	Place Rip Rap
		23	Repair Bridge Railing
		24	Remove Silt Buildup
		25	Replace Missing Bolts
		5	Vegetation Control/Removal
		26	Patch Pavement
		27	Patch Deck
		3	Ditch Cleaning and Repair
		4	Scour Hole Repair
		22	Seal Cracks
		14	Patch Spalls
3	Preventive Maintenance		
		9	Streambed Paving
		24	Remove Silt Buildup
		25	Replace Missing Bolts
		29	Misc
		4	Scour Hole Repair
		6	Embankment Stabilization
		1	Debris Removal
		5	Vegetation Control/Removal
		21	Place Rip Rap
		20	Underpin Abutment/Wingwall
		2	Flushing / Sediment Control

1

Exhibit 5-9. Typical **Repair Type Listing** printout.

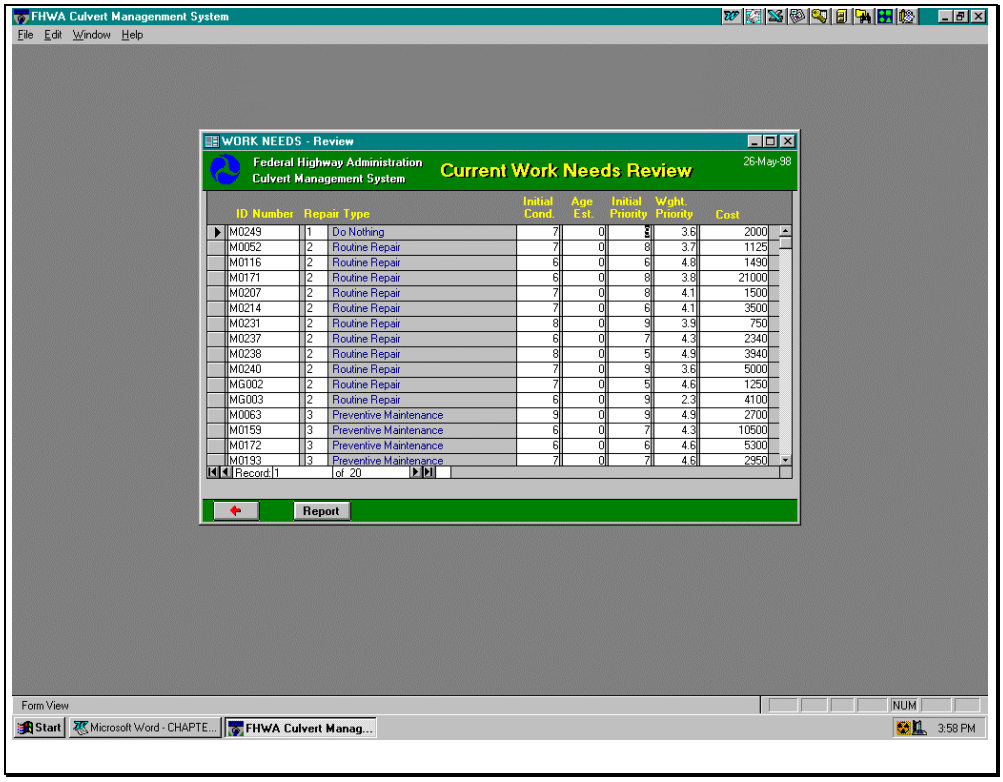


Exhibit 5-10. **Current Work Needs Review** window.

Obtaining Reports - To produce a report that displays the Work Needs, click on **Report**, located at the bottom of the window. The system will then display the **Work Needs** report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around the report.

To get a hard copy of the report, click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Clicking on **Print Setup** allows you to designate how and where the report will be printed. Clicking on **Print** sends the report to the printer. Exhibit 5-11 shows a typical Work Needs printout.

Returning to the Work Needs Menu - To return to the Work Needs menu, click on the **red arrow** pointing to the left located in the lower left corner of the window.

Returning to the Main Menu - To return to the Main Menu, click on the **red arrow** pointing to the left located in the lower left corner of the window.

Federal Highway Administration
Culvert Management System

Work Needs

Repair Type	Priority	ID Number	Culvert Description	Station	Cost
Do Nothing	3.6	M0249	Gold Leaf Drive	0	2,000
				TOTAL :	2,000
Routine Repair	2.3	MG003	Rabit Road	0	4,100
Routine Repair	3.6	M0240	Democracy Blvd	0	5,000
Routine Repair	3.7	M0052	Logn Draft Road	0	1,125
Routine Repair	3.8	M0171	Mont Village Ave	0	21,000
Routine Repair	3.9	M0231	Kinster	0	750
Routine Repair	4.1	M0207	Crabbs Branch Way	0	1,500
Routine Repair	4.1	M0214	Great Seneca Highway	0	3,500
Routine Repair	4.3	M0237	Democracy Blvd	0	2,340
Routine Repair	4.6	MG002	Bureau Drive	0	1,250
Routine Repair	4.8	M0116	Greenway Drive	0	1,490
Routine Repair	4.9	M0238	Airpark Road	0	3,940
				TOTAL :	45,995
Preventive Maintenance	4.3	M0159	Norwood Road	0	10,500
Preventive Maintenance	4.6	M0193	Shady Grove Road	0	2,950
Preventive Maintenance	4.6	M0232	Ranworth Drive	0	5,800
Preventive Maintenance	4.6	M0172	Mont. Village Ave	0	5,300
Preventive Maintenance	4.9	M0063	Sang Run Rd.		2,700
				TOTAL :	27,250
Rehabilitation	4	M0057	Oakland-Sang Run Rd.	1748	17,800
Rehabilitation	5	M0130	Woodfield School Rd.	0	90,500
Rehabilitation	5.6	M0093	Bonifant Road	0	10,850
				TOTAL :	119,150

Exhibit 5-11. Typical **Work Needs** printout

CHAPTER VI
WORK FUNDING MODULE

Chapter VI
WORK FUNDING MODULE

INTRODUCTION

The **Work Funding Module** uses the work needs and costs developed in the **Work Needs Module** to develop a multi-year list of funded projects prioritized by repair type. The procedure uses a series of factors, defined by the user that takes into account such items as priority, cost, remaining life, traffic, and hydraulic capacity to rank projects and, using available funds, determines the projects that can be performed by year. It will also indicate the projects that cannot be undertaken due to a lack of funding. To determine the work to be funded for the time period being analyzed, it is necessary to know the factors that are important to the agency in prioritizing the work. The funds available each year to perform the work must also be known.

The first step is to identify the funding cycle and have the system create the new files needed to use this module. The user agency then defines the factors that must be considered to determine project priority. These factors may include:

- repair type cost,
- remaining life,
- priority,
- hydraulic capacity,
- culvert history including flooding and repairs,
- traffic level of service,
- traffic volume, and
- detour length.

The agency then assigns a weighting value to each of the factors. As an example, the agency might apply weighting of 35% to priority, 25% to remaining life, 25% to hydraulic capacity and 15% to traffic. In order for the modeling to work more effectively, the factors are grouped into ranges.

PROCESSES PERFORMED

The other information required for the module is the amount of funds available by year and by repair type to maintain and repair the culverts. The system allows for the distribution of available funds between the different repair types. If the user agency wishes to emphasize keeping the culverts in good condition, then more money can be assigned to routine and preventive maintenance. If the agency has little or no capabilities in performing maintenance, then more funds can be allocated to performing the work by contract.

The next step is to produce the work funding for the years in the analysis period. First the appropriate files as indicated in the Factors File are read to get information for each of the culverts for the first repair type. This will include as a minimum the culvert ID and description, cost, priority, and remaining life from the Condition and Work Needs Files. It may also be necessary to read the Inventory File to get information on other factors needed in the analysis. The actual values are converted into the factor values based on the ranges located in the Factors File. The factor value is then multiplied by the weighting value for the factor to get a weighted factor value. The weighted factor values are then added up for the culvert to get a weighted priority for the culvert within the repair type. This is repeated for all culverts within the repair type. The culverts in the repair type are then sorted with the highest value being the highest priority.

The next step is to select projects for the analysis period. Select projects within a repair type at the beginning of the list until all the funds for the first year are assigned. It may be necessary to skip one or more projects in order to get as close as possible to the amount of the assigned funds without exceeding the limit. Repeat the step for the remaining years in the repair type. Repeat this procedure for each remaining repair type. Once this is done, update the Work Needs File to include the funding year. If a culvert project is not selected due to funding limitations, then the Work Needs File is updated with Not Funded (NF) projects for the funding year. Once the analysis has been completed, the user can review the results that can be displayed on the screen or on a printout.

ACCESSING THE WORK FUNDING MODULE

From the Main Menu you will click on **Work Funding.** This will bring up the Work Funding menu. Exhibit 6-1 shows the **Work Funding Menu** window. This window allows the user to:

- establish the funding cycle,
- define the model field weighting,
- calculate the initial weighted priority,
- review the current work needs,
- identify available funds,
- input deterioration curves,
- input deterioration factors,
- perform the funding analysis, and
- review the work funding.

USING THE WORK FUNDING MODULE

Establish the Funding Cycle

To define the funding cycle at the beginning of the budget analysis, click on **Establish Funding Cycle**. This will bring up the window used to enter the initial year. Exhibit 6-2 shows the **Establish Funding Cycle** window. Type in the initial year and click on the **open door and blue arrow**. This will return you to the Work Funding Menu window.

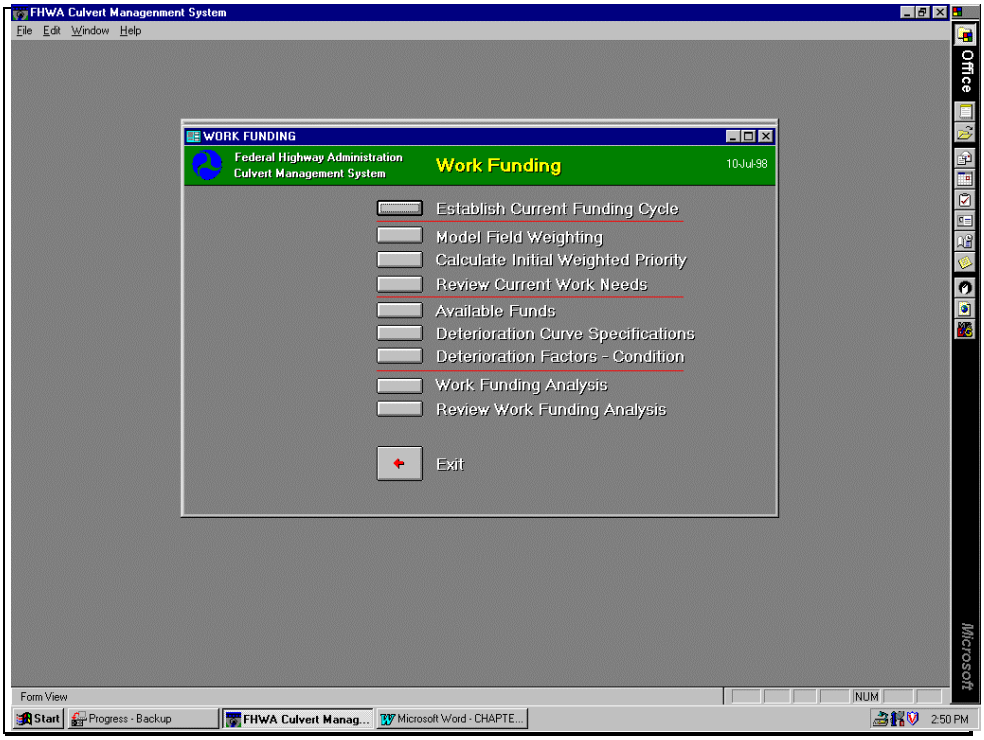


Exhibit 6-1. **Work Funding Menu** window.

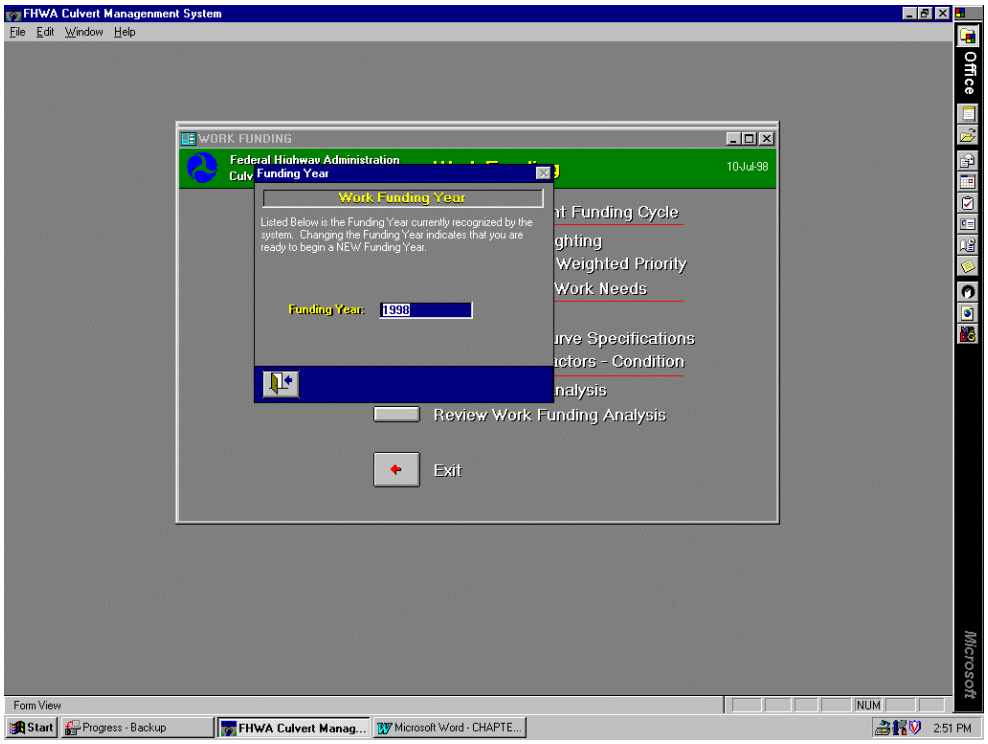


Exhibit 6-2. **Establish Funding Cycle** window

Define the Model Field Weighting

This describes the procedure for computing the weighted priority in ranking culvert repair work. The Model Field Weighting is accessed by clicking on **model field weighting**. This will bring up the window to enter the factors to be used in developing the weighted priority. Exhibit 6-3 shows the **Model Factor Information** window. This window allows you to input information on factors to be used in the priority weighting, the weighting portion for the factor, and the ranges to be used for the data within the factor.

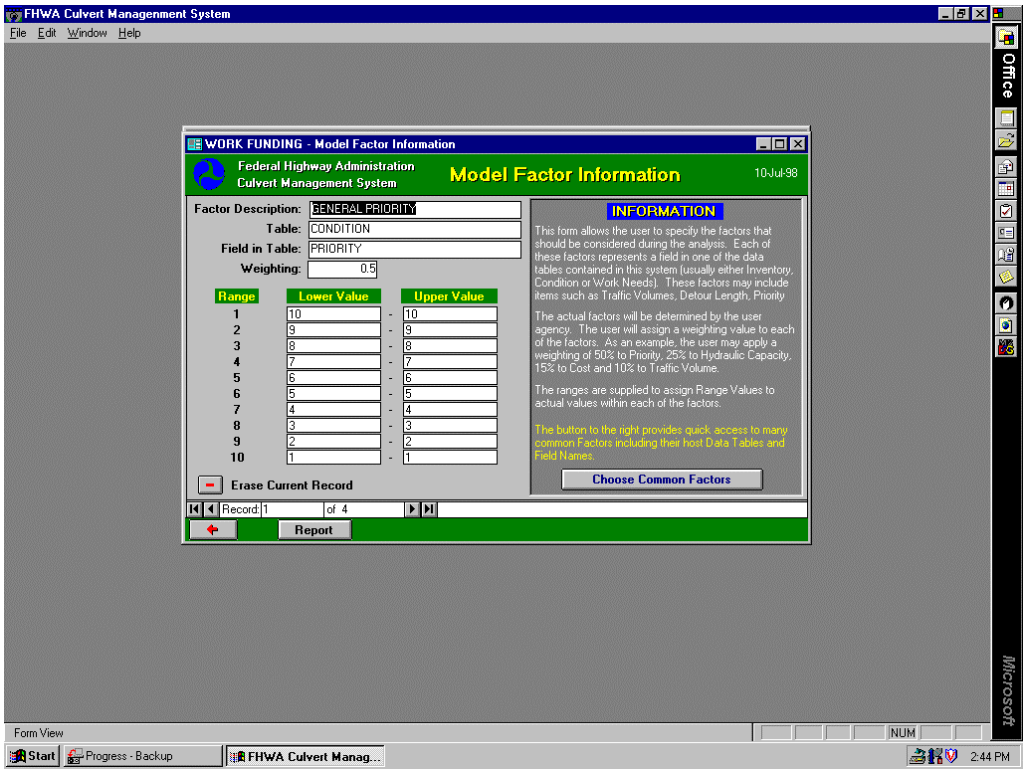


Exhibit 6-3. **Model Factor Information** window.

The factor is entered by clicking on **Choose Common Factors** in the lower right corner of the window. This will display a pull-down list from which to select your factors to be included. Use the **up and down arrows** to find the factor desired and hit the **Enter** key. This will fill in the **Factor Description**, **Table**, and **Field** in table fields on the screen. If you wish to use a factor that is not in the pull-down list, enter the name of the factor, the table where it is located and the field name in the table.

The bottom portion of the window is used to enter up to 10 data ranges for the factor identified. An example is the ADT that could be divided as follows:

Range	Lower	Upper
1	0	499
2	500	999
3	1,000	2,499
4	2,500	4,999
5	5,000	9,999
6	10,000	25,999
7	25,000	49,999
8	50,000	100,000

Calculate the Initial Weighted Priority

To compute the weighted priority, click on **calculate initial weighted priority**. The CMS will calculate the weighted priority for each of the culverts in the system.

Review the Current Work Needs

To produce a report that displays the current work needs and costs, click on **review current work needs** selection. The system will then display the Current Work Needs report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor you might not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report. Exhibit 6-4 shows how the report screen will look.

To get a hard copy of the report, click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Exhibit 6-5 shows how this window looks. Clicking on the **Print Setup** option allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer.

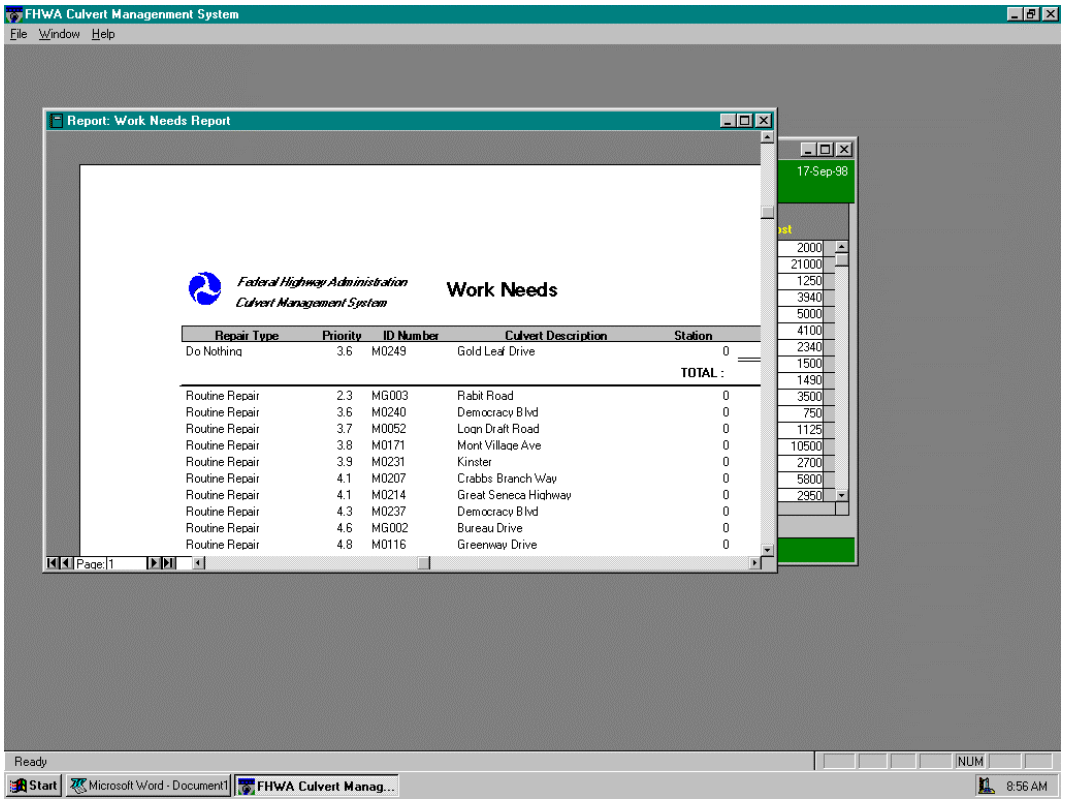


Exhibit 6-4. **Current Work Needs report** window.

Identify the Available Funds

This portion of the CMS is used to identify the amount of funds that are available by repair type for each of the five years in the budgeting cycle. Click on **Available Funds** to access the available funds routine. This will bring up the window to enter the funds to be used in developing the multi-year work funding. Exhibit 6-6 shows the **Available Funds** window. This window allows you to input cost information for each of the repair types for each of the five years in the budgeting timeframe. This allows the agency to vary the amount of money that will be placed in the various repair types and see how it affects the overall condition of the agencies culverts.

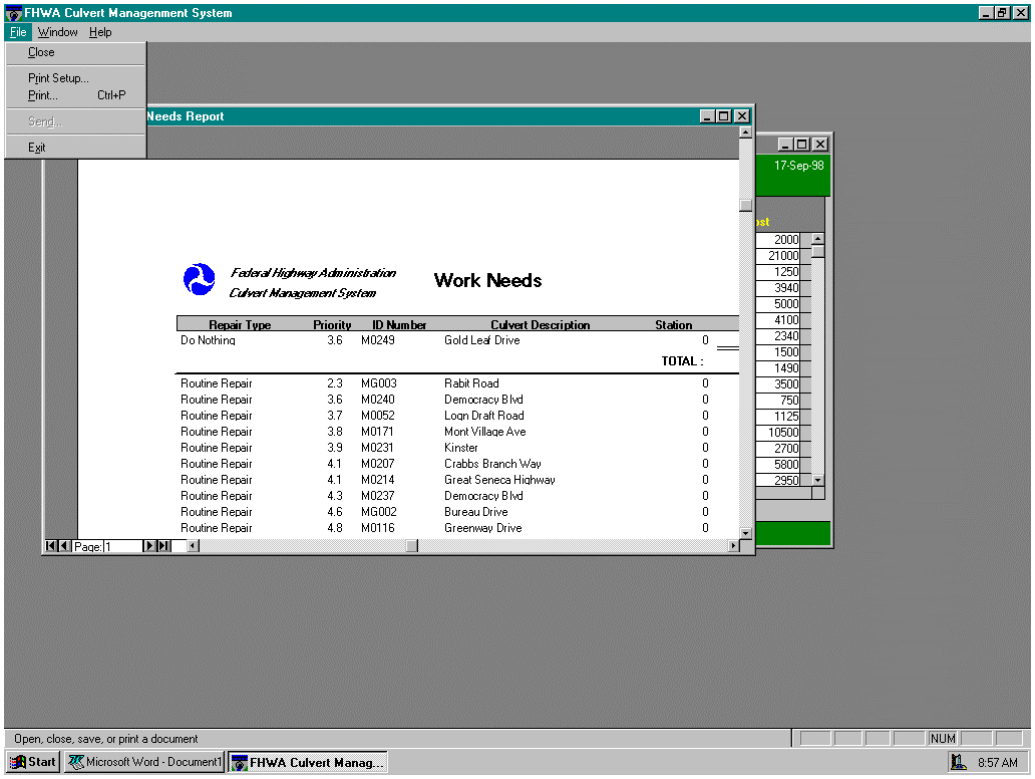


Exhibit 6-5. **Print** window.

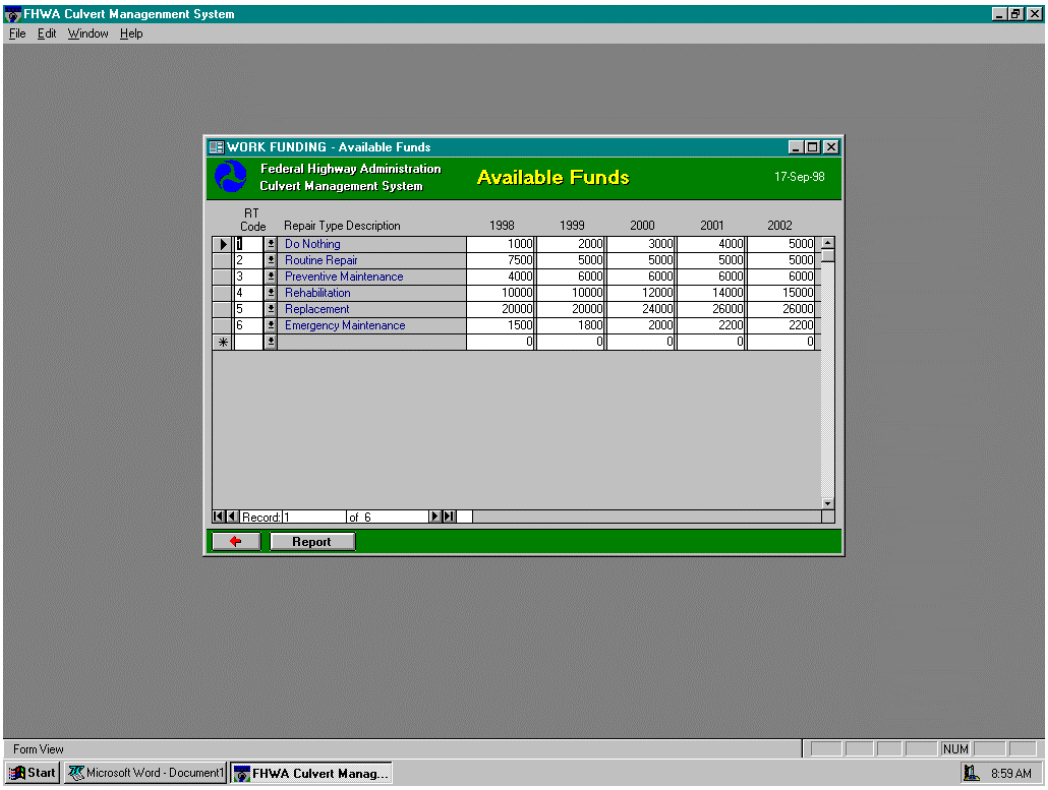


Exhibit 6-6. **Available Funds** window.

To produce a report that displays the available funds, click on **Report**, located at the bottom of the Available Funds window. The system will display the Available Funds report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around the report.

To get a hard copy of the report, click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Clicking on **Print Setup** allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer.

To return to the main menu click on the **red arrow pointing to the left** located in the lower left corner of the window.

Input Deterioration Curves

To define the deterioration rates for culverts, click on **Deterioration Curve Specifications.** This will bring up the window used to enter the deterioration curve equations. Exhibit 6-7 shows the Condition Deterioration Factors window. The CMS requires that an equation be input for each culvert type and culvert material. The general formula used in the system is:

$$\text{Condition} = \text{Constant} - (\text{Year Variation} * \text{Year}) - (\text{Year Square Variation} * \text{Year}^2)$$

The Constant, Year Variation and Year Square Variation are input by the agency. The actual formulas must be determined by the agency based on its own conditions.

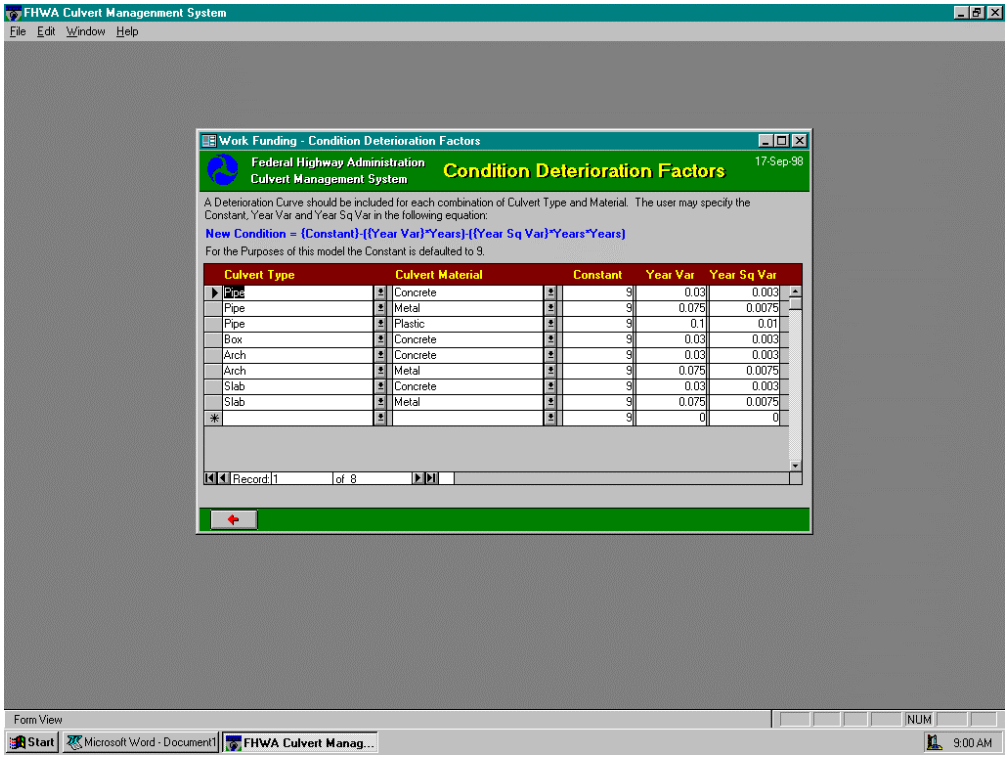


Exhibit 6-7. **Condition Deterioration Factors** window.

To return to the main menu click on the **red arrow pointing to the left** located in the lower left corner of the window.

Input Deterioration Factors

To define the deterioration factors for culverts, click on **Deterioration Factors**. This will bring up the window used to enter the deterioration factors. Exhibit 6-8 shows the **Condition Deterioration Factors** window. The agency needs to develop the amount of improvement, in terms of percent, that the condition will improve if the repair type is performed. The percent change needs to be developed for each culvert type, culvert material, repair type and each of the nine general conditions. The screen allows the agency to select existing culvert types, culvert materials and repair types from pull-down selection lists.

To return to the Main Menu, click on the **red arrow pointing to the left** located in the lower left corner of the window.

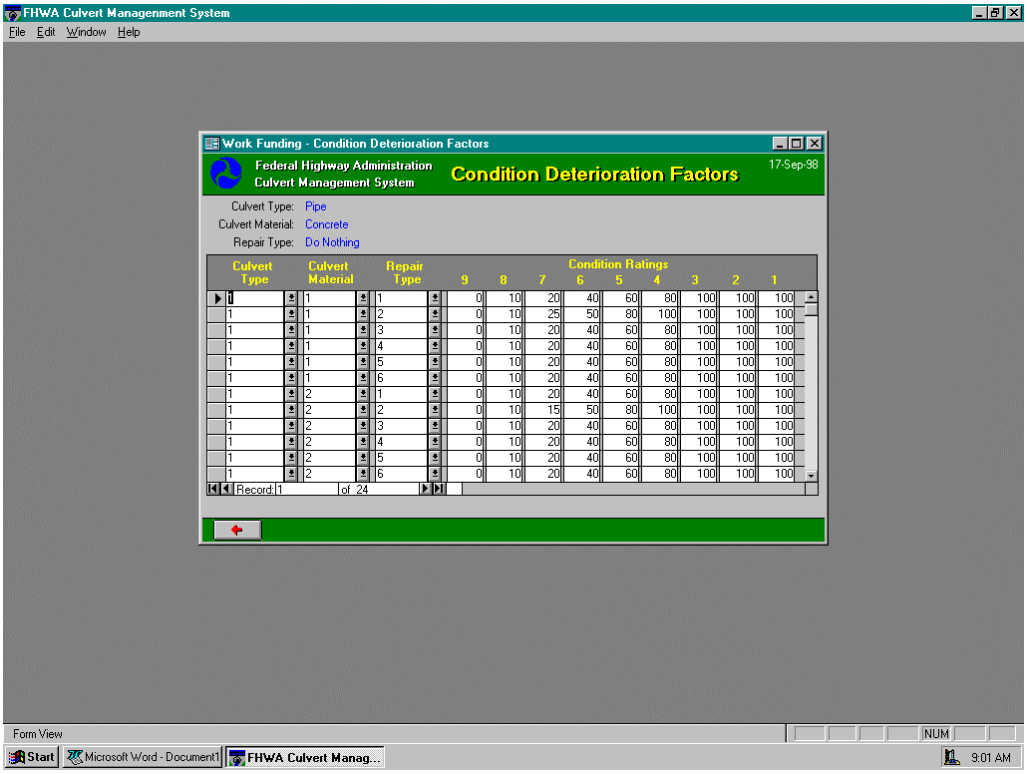


Exhibit 6-8. **Condition Deterioration Factors** – Percent Improvement window.

Perform the Funding Analysis

To perform the Funding Analysis, click on **Perform Funding Analysis**. The CMS will perform the funding analysis and produce a file containing the results.

Review the Work Funding

To produce a report that displays the current work funding, click on **Review Work Funding.** The system will then display the Work Funding report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around the report.

To get a hard copy of the report, click on the **File** menu selection at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Clicking on the **Print Setup** option allows you to designate how and where the report will be

printed. Clicking on the **Print** option sends the report to the printer. Exhibit 6-9 shows a sample of how this report will look.

Federal Highway Administration
Culvert Management System

1998 Work Funding

Repair Type	ID Number	Culvert Type	Culvert Material	Priority	Condition	Estimated Age	Cost
2 Routine Repair	MG003	1 Pipe	2 Metal	2.30	6.00	15	4.100
2 Routine Repair	M0052	2 Box	1 Concrete	3.70	7.00	21	1.125
2 Routine Repair	M0231	1 Pipe	2 Metal	3.90	8.00	7	750
2 Routine Repair	M0207	2 Box	1 Concrete	4.10	7.00	21	1.500
						Total:	7.475
3 Preventive Maintenance	M0193	2 Box	1 Concrete	4.60	7.00	21	2.950
						Total:	2.950
						Grand Total	10.425

Exhibit 6-9. Typical **Work Funding** printout

CHAPTER VII
SCHEDULE MODULE

Chapter VII
SCHEDULE MODULE

INTRODUCTION

The schedule module allows the user to schedule the programmed work for the year. The scheduling process takes the work programmed from the Work Funding Module and, using the constraints of labor, dollars and pre-scheduled projects input by the user, establishes when the various culvert projects can be performed. In the scheduling process all of the activities within a project will be performed at the same time. This means that all of the activities within the project may be performed within the month selected for the project.

In order to perform the yearly scheduling process, it is necessary to know the following:

- when activities can be performed during the year,
- if the work is to be done by in-house personnel or by contract,
- how long will the project take,
- how much money is available for the year,
- how many personnel are available to perform the in-house portion of the work, and
- what projects are pre-scheduled due to other work being performed by the agency.

The first two items are entered by the agency in the **Work Needs Module**. The length of time required to perform a unit of work for an in-house performed projects is computed based on the amount of work needed, by activity, and the labor necessary to perform the unit of work. The length of contract projects is provided by the agency. The last three criteria—dollars, available personnel, and pre-scheduled work—are entered by the agency. Once this information is available in the system, the CMS can develop a schedule.

PROCESSES PERFORMED

The schedule is developed in two parts: assigning the in-house projects to the various months in the year and assigning the contract work to the months.

To develop the in-house schedule, it is necessary to calculate the total labor hours required for the project. This is done by multiplying the amount of work for the activity in the project by the productivity factor for the activity. Next, the activity labor hours for all the activities are totaled together to get the total labor hours for the project. For work to be done by contract, the user will provide the estimated length of time to perform the project.

Once the time needed to perform the work is known, the projects already scheduled and selected, the labor hours needed for the work are assigned to the first available month. Any labor hours for the project remaining are then assigned to the next month. This is repeated until all the labor hours have been assigned to a month. Do this procedure for all of the pre-scheduled projects. The next step is to review the remaining projects to see if any can only be performed in a one-month period of time. These projects are scheduled the same as the pre-scheduled projects. The contract work is scheduled in a similar fashion but the distribution is based on the number of days and the dollars available for the month. The remaining projects are then selected by priority until all projects are scheduled. Reports can be prepared that show when each of the projects is scheduled to be performed by month. Reports can also be produced that show labor and cost requirements for each project by month.

ACCESSING THE SCHEDULE MODULE

From the Main Menu, click on **Schedule.** This will bring up the scheduling menu. Exhibit 7-1 shows the **Schedule Menu** window. This window allows the user to:

- enter the available resources,
- develop project information,
- review project information,
- schedule contract work,
- schedule projects,
- review in-house scheduled projects, and
- review contract scheduled projects.

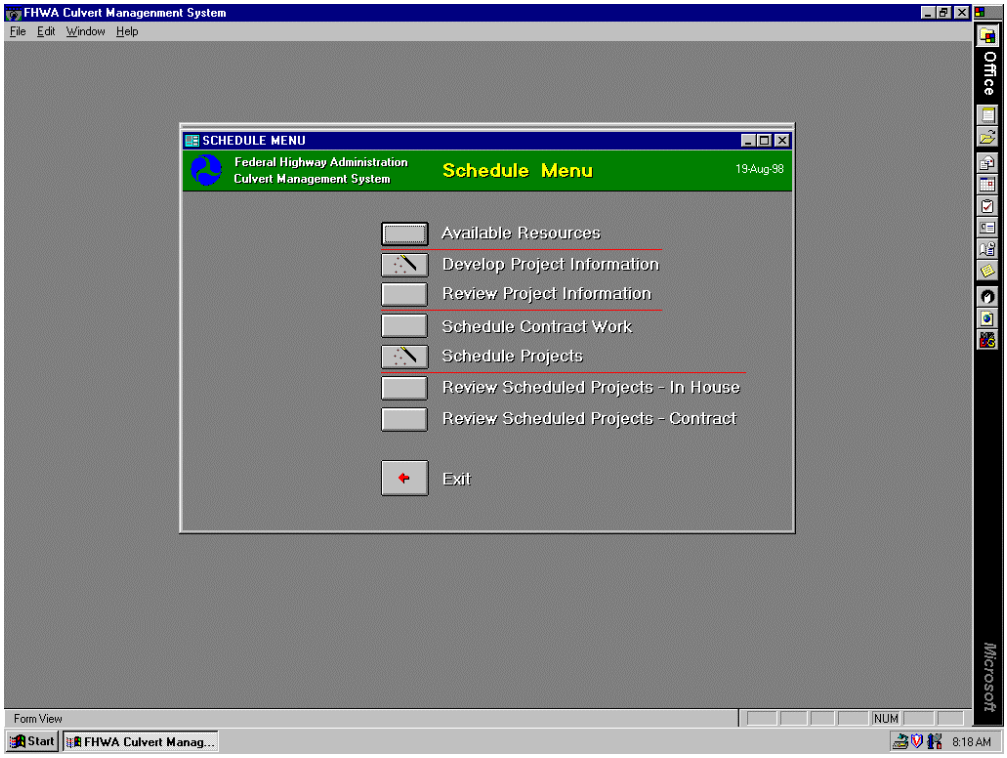


Exhibit 7-1. **Schedule Menu** window.

USING THE SCHEDULE MODULE

Enter the Available Resources

To identify the resources that are available by month for the year, click on **Available Resources**. This will bring up the window used to develop the schedule of work. Exhibit 7-2 shows the **Available Resources** window. This window allows you to input information on the number of personnel, number of work days and contract dollars available by month for the year.

Develop the Project Information

To develop the Project Information, click on **Develop Project Information**. The CMS will determine when each of the projects can be performed.

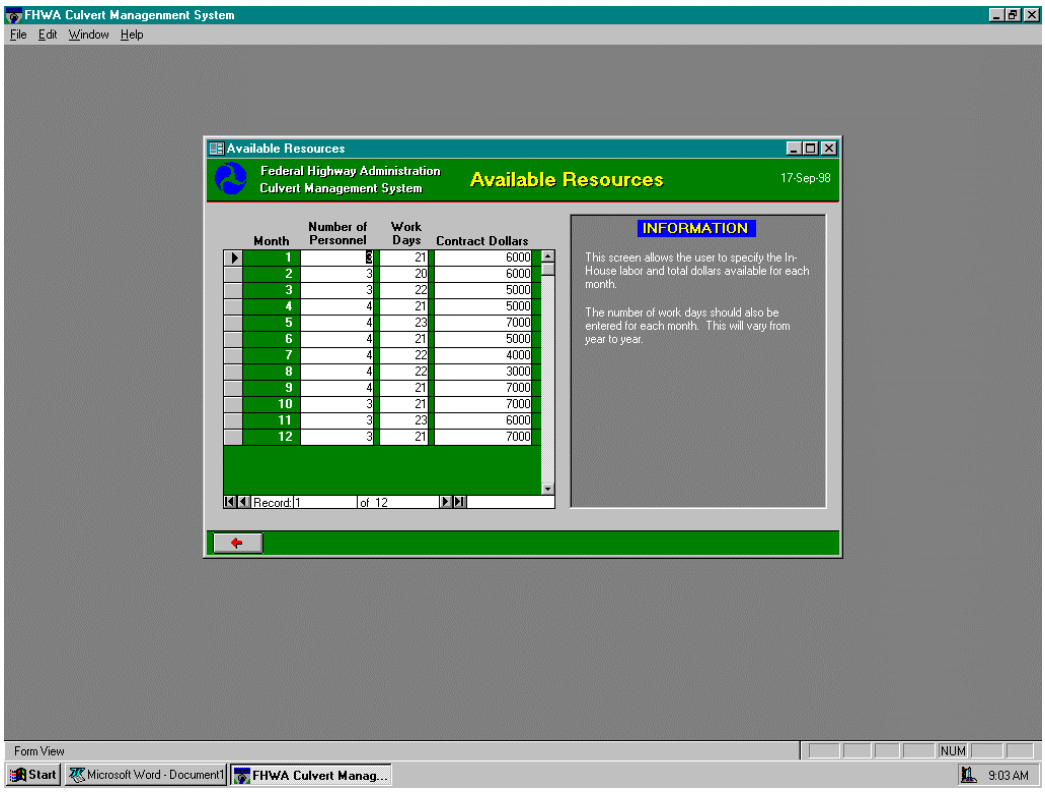


Exhibit 7-2. **Available Resources** window.

Review Project Information

To produce a report that displays the project information, click on **Review Project Information**. The system will display the Project Information Report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report. Exhibit 7-3 shows how the report screen will look.

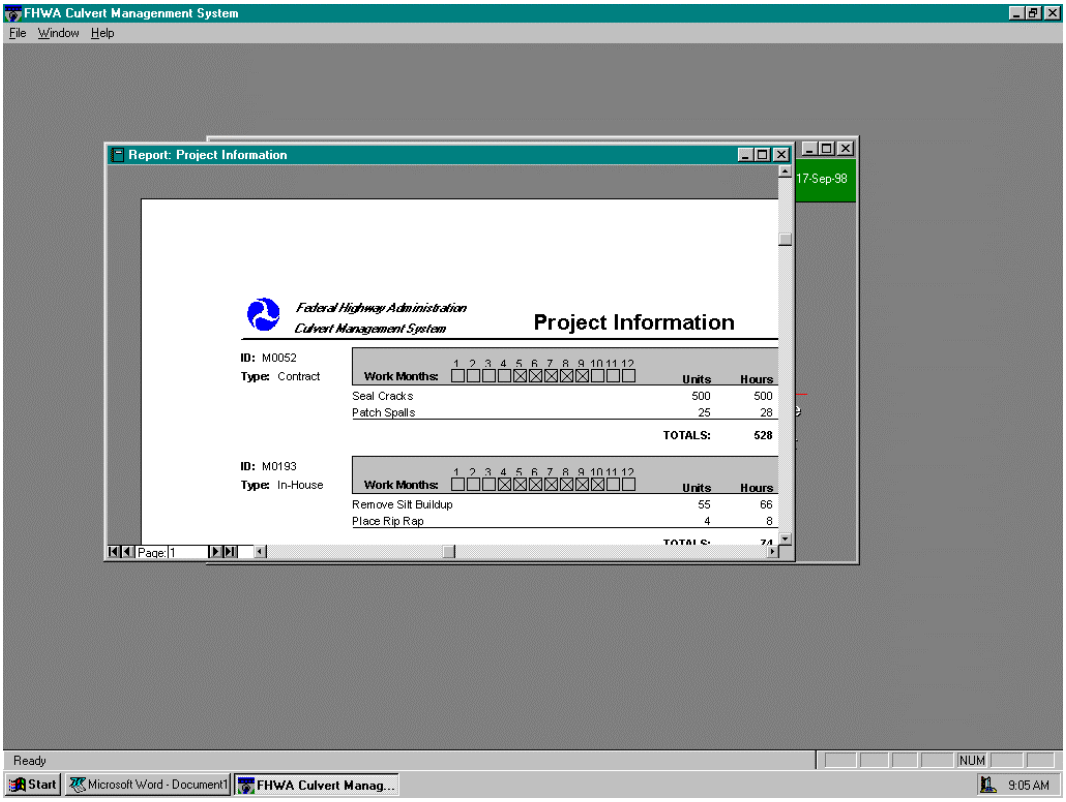


Exhibit 7-3. **Project Information Report** window.

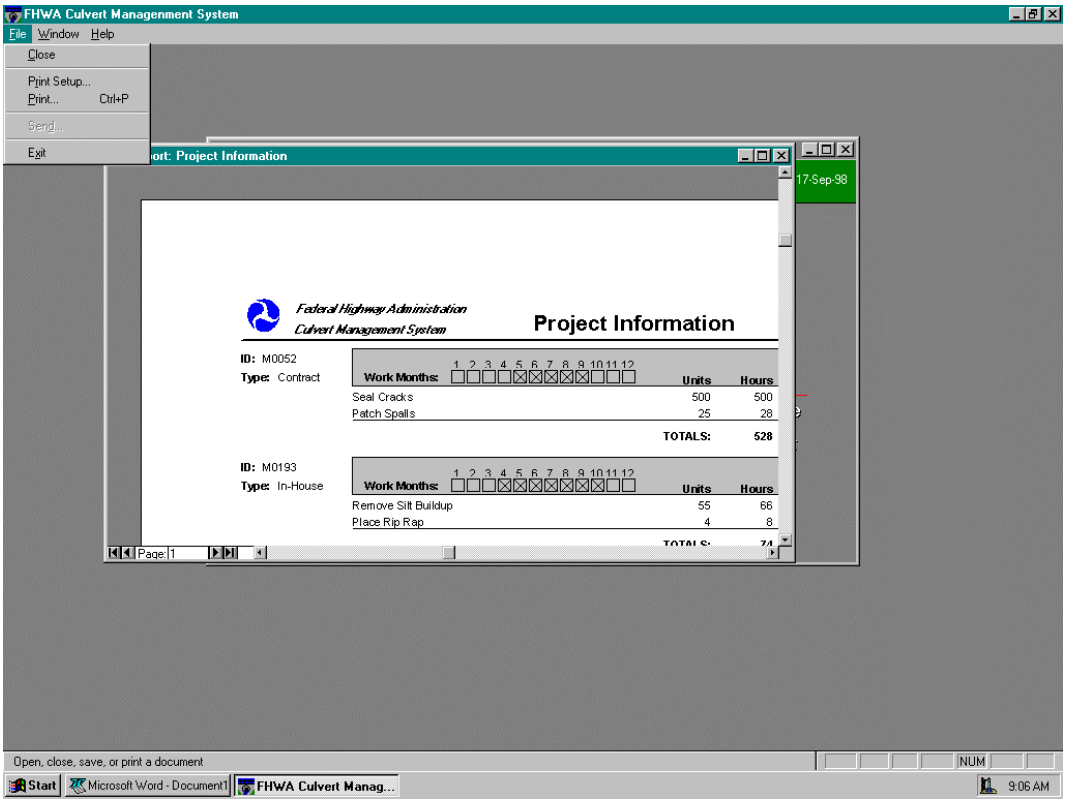


Exhibit 7-4. **Print** window.

To get a hard copy of the report, click on **File** at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Exhibit 7-4 shows how this window looks. Clicking on **Print Setup** allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer.

Enter Scheduled Contract Work

To identify contract work to be performed during the year, click on **Scheduled Contract Work**. This will bring up the **Schedule Module** window shown in Exhibit 7-5, used to enter information on which projects will be performed by contract during the year. This window allows you to input information on which projects are to be done by contract, the month the work is to begin, and the estimated length of the work in days. The Project Information Report can be used to find out information on when the project can begin and the length of time it will take to complete the work.

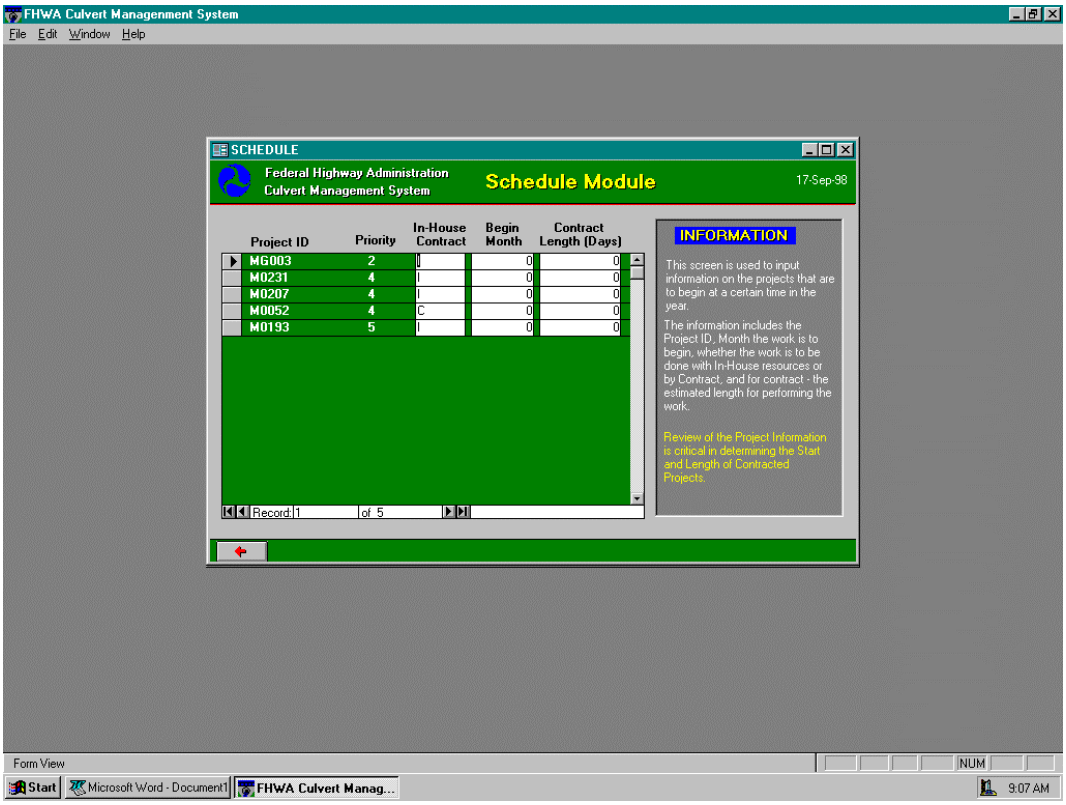


Exhibit 7-5. **Schedule Module** window.

Schedule Projects

To schedule the projects that can be performed for the year, click on **Schedule Projects** on the **Scheduling Menu,** Exhibit 7-1**.** The CMS will develop a schedule of the projects that can be done during the year based on priority, timing and available dollars.

Review In House Scheduled Projects

To produce a report that displays the scheduled in house projects, click on **Review Scheduled Projects – In House** selection. The system will display the in house scheduled projects report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report. Exhibit 7-6 shows how the report screen will look.

To get a hard copy of the report, click on **File** at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Clicking on **Print Setup** allows you to designate how and where the report will be printed. Clicking on **Print** sends the report to the printer.

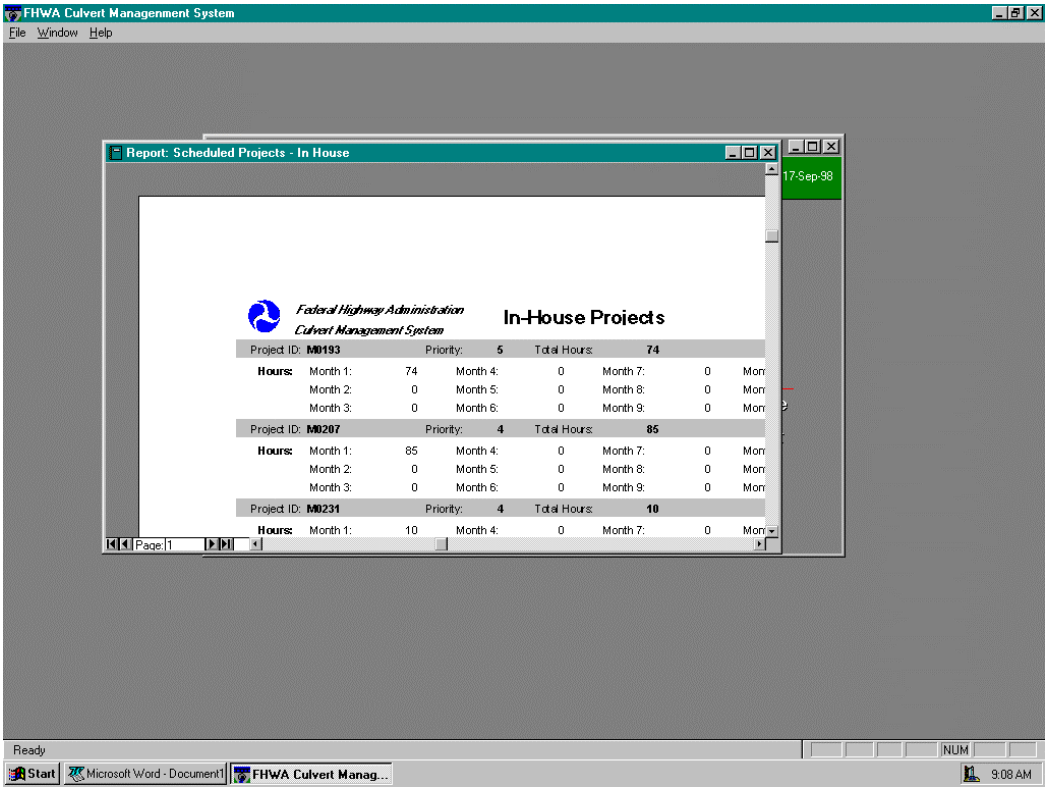


Exhibit 7-6. **In House Scheduled Projects Report** window.

Review Contract Scheduled Projects

To produce a report that displays the scheduled contract projects, click on **Review Scheduled Projects – Contract** on the **Schedule Menu**, Exhibit 7-1. The system will then display the scheduled contract projects report on the screen. The complete report can be viewed by maximizing the report window and clicking on the report. Depending on the size and resolution of your monitor, you may not be able to read the report on screen. Another option is to use the **up and down arrows** located on the left side of the window and the **left and right arrows** at the bottom of the window to move around in the report. Exhibit 7-7 shows how the report screen will look.

To get a hard copy of the report, click on **File** at the top of the **FHWA Culvert Management System** window. This will give you a choice of **Print Setup** or **Print**. Clicking on **Print Setup** allows you to designate how and where the report will be printed. Clicking on the **Print** option sends the report to the printer.

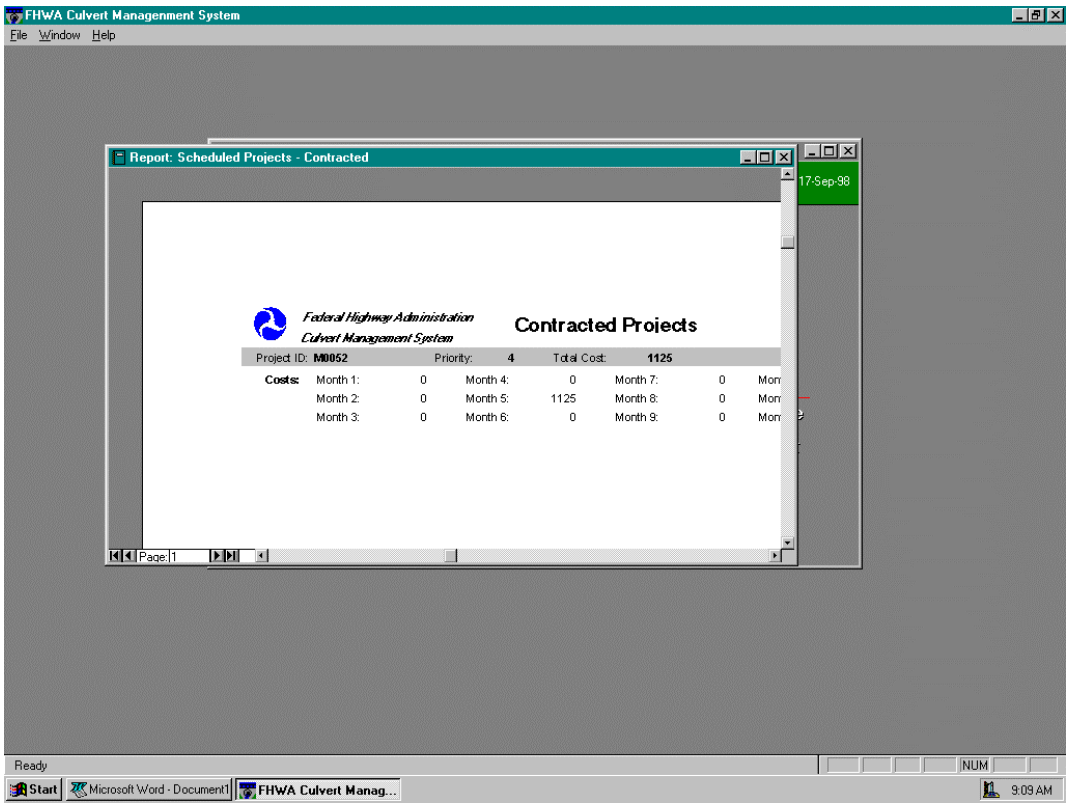


Exhibit 7-7. **Scheduled Contract Projects Report** window.

APPENDIX A

Appendix A
INSTALLING THE CULVERT MANAGEMENT SYSTEM

This report and the Culvert Management System are available on a CD without charge to local governments, universities and state transportation agencies. Requests should be directed to the Local Technical Assistance Program clearinghouse at the address given in the Foreward of this manual.

To install the Culvert Management System (CMS) you will perform the following steps.

- Insert the CD in the CD drive. CD will run automatically.
- Click on "Install Products" to install the CMS. Follow the instructions on the screen. After installation, CMS will run from Start/Programs/Culvert Management System unless a different start position was specified during the installation process.
- Click on "User Manual" to view the User Manual.

APPENDIX B

Appendix B
FILE LAYOUTS

This appendix provides the file layouts for all of the files used in the **Culvert Management System.**

Available Funds

This file is used to store the available funds for each repair type by each of the five years in the **Work Needs Module**.

Item	Description
Repair Type	This field stores the Repair Type code. All Repair types defined in the CMS should be stored in this file.
Year 1 Amount	This field is used to store the dollar amount budgeted for the Repair Type for year 1.
Year 2 Amount	This field is used to store the dollar amount budgeted for the Repair Type for year 2.
Year 3 Amount	This field is used to store the dollar amount budgeted for the Repair Type for year 3.
Year 4 Amount	This field is used to store the dollar amount budgeted for the Repair Type for year 4.
Year 5 Amount	This field is used to store the dollar amount budgeted for the Repair Type for year 5.

Columns

Name	Type	Size
Repair Type	Text	2
Year 1 Amount	Number (Long)	4
Year 2 Amount	Number (Long)	4
Year 3 Amount	Number (Long)	4
Year 4 Amount	Number (Long)	4
Year 5 Amount	Number (Long)	4

Available Resources

This file is used to store information on the dollars, number of personnel and the number of days by month for use in the Scheduling Module.

Item	Description
Month	This field is used to record the name of the month. The system has each of the names pre-coded in this field.
Available Dollars	This field is used to record the available dollars that can be spent for the month.
Number of Personnel	This field is used to record the number of personnel available for use in repairing culverts in the agency for the month.
Days	This field is used to record the number of work days available for the month.

Columns

Name	Type	Size
Month	Number (Double)	8
Available Dollars	Number (Long)	4
Number of Personnel	Number (Long)	4
Days	Number (Long)	4

Condition

This table is used to store information on the condition rating for each culvert in the CMS. It is used in the Condition, Work Needs, Work Funding and Scheduling Modules.

Item	Description
ID Number	Identification number assigned to the culvert.
Confined Space	Yes/No used to indicate if the culvert is considered a confined space.
Inspection Date	Date the condition inspection was performed.
Inspection Team	Identification of the inspection team. Can be names, initials or some other form of identification.
Pavement – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Pavement – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Pavement – Amount	The amount of maintenance activity repair that needs to be performed as

	indicated by the inspection team.
Shoulder – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Shoulder – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Shoulder – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Guardrail – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Guardrail – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Guardrail – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Settlement – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Settlement – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Settlement – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Embankment – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Embankment – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Embankment – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
General Rating – Roadway	The general rating assigned to the all the roadway elements as assigned by the inspection team.
Abutment – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Abutment – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Abutment – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Pier – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Pier – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Pier – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Span – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Span – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Span – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.

Coating – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Coating – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Coating – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Headwall – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Headwall – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Headwall – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Wingwall – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Wingwall – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Wingwall – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
General Rating – Structure	The general rating assigned to the all the structural elements as assigned by the inspection team.
Opening – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Opening – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Opening – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Alignment – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Alignment – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Alignment – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Scour – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Scour – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Scour – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Erosion – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Erosion – MR	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Erosion – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Debris – Condition	The condition rating of the culvert element from 0 to 9 as assigned by

	the inspection team.
Debris – MR activity	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Debris – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
Vegetation – Condition	The condition rating of the culvert element from 0 to 9 as assigned by the inspection team.
Vegetation – MR Activity	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Vegetation – Amount	The amount of maintenance activity repair that needs to be performed as indicated by the inspection team.
General Rating – Channel	The general rating assigned to all the channel elements as assigned by the inspection team.
Overall Rating	The general rating assigned to the culvert as assigned by the inspection team.
Overall Repair Type	The type of maintenance activity that needs to be performed on the culvert element as assigned by the inspection team.
Priority	The priority as assigned to the culvert by the inspection team.
Hydraulic Adequacy	The hydraulic adequacy value from 0 to 9 as assigned by the inspection team.

Columns

Name	Type	Size
ID NUMBER	Text	20
CONFINED SPACE	Text	1
INSPECTION DATE	Date/Time	8
INSPECTION TEAM	Text	10
PAVEMENT - CONDITION	Number (Integer)	2
PAVEMENT - MR ACTIVITY	Text	2
PAVEMENT - AMOUNT	Number (Long)	4
SHOULDER - CONDITION	Number (Integer)	2
SHOULDER - MR ACTIVITY	Text	2
SHOULDER - AMOUNT	Number (Long)	4
GUARDRAIL - CONDITION	Number (Integer)	2
GUARDRAIL - MR ACTIVITY	Text	2
GUARDRAIL - AMOUNT	Number (Long)	4
SETTLEMENT - CONDITION	Number (Integer)	2
SETTLEMENT - MR ACTIVITY	Text	2
SETTLEMENT - AMOUNT	Number (Long)	4
EMBANKMENT - CONDITION	Number (Integer)	2
EMBANKMENT - MR ACTIVITY	Text	2
EMBANKMENT - AMOUNT	Number (Long)	4
GENERAL RATING - ROADWAY	Number (Single)	4
ABUTMENT - CONDITION	Number (Integer)	2
ABUTMENT - MR ACTIVITY	Text	2

ABUTMENT - AMOUNT	Number (Long)	4
PIER - CONDITION	Number (Integer)	2
PIER - MR ACTIVITY	Text	2
PIER - AMOUNT	Number (Long)	4
SPAN - CONDITION	Number (Integer)	2
SPAN - MR ACTIVITY	Text	2
SPAN - AMOUNT	Number (Long)	4
COATING - CONDITION	Number (Integer)	2
COATING - MR ACTIVITY	Text	2
COATING - AMOUNT	Number (Long)	4
HEADWALL - CONDITION	Number (Integer)	2
HEADWALL - MR ACTIVITY	Text	2
HEADWALL - AMOUNT	Number (Long)	4
WINGWALL - CONDITION	Number (Integer)	2
WINGWALL - MR ACTIVITY	Text	2
WINGWALL - AMOUNT	Number (Long)	4
GENERAL RATING - STRUCTURE	Number (Single)	4
OPENING - CONDITION	Number (Integer)	2
OPENING - MR ACTIVITY	Text	2
OPENING - AMOUNT	Number (Long)	4
ALIGNMENT - CONDITION	Number (Integer)	2
ALIGNMENT - MR ACTIVITY	Text	2
ALIGNMENT - AMOUNT	Number (Long)	4
ALIGNMENT - UNITS	Text	50
SCOUR - CONDITION	Number (Integer)	2
SCOUR - MR ACTIVITY	Text	2
SCOUR - AMOUNT	Number (Long)	4
EROSION - CONDITION	Number (Integer)	2
EROSION - MR ACTIVITY	Text	2
EROSION - AMOUNT	Number (Long)	4
DEBRIS - CONDITION	Number (Integer)	2
DEBRIS - MR ACTIVITY	Text	2
DEBRIS - AMOUNT	Number (Long)	4
VEGETATION - CONDITION	Number (Integer)	2
VEGETATION - MR ACTIVITY	Text	2
VEGETATION - AMOUNT	Number (Long)	4
GENERAL RATING - CHANNEL	Number (Single)	4
OVERALL RATING	Number (Single)	4
OVERALL REPAIR TYPE	Text	2
PRIORITY	Number (Integer)	2
HYDRAULIC ADEQUACY	Text	1

Condition Deterioration Table

This file is used to store the condition deterioration table used in the Work Funding Module.

Item	Description
Culvert Type	The type of culvert as defined CMS by the agency from the pick lists.
Culvert Material	The culvert material as defined CMS by the agency from the pick lists.
Repair Type	The Repair Type as defined in the CMS by the agency in the Work Needs Module.
Factor Condition 9	The percent increase in condition if the current condition is 9 and the repair type is performed.
Factor Condition 8	The percent increase in condition if the current condition is 8 and the repair type is performed.
Factor Condition 7	The percent increase in condition if the current condition is 7 and the repair type is performed.
Factor Condition 6	The percent increase in condition if the current condition is 6 and the repair type is performed.
Factor Condition 5	The percent increase in condition if the current condition is 5 and the repair type is performed.
Factor Condition 4	The percent increase in condition if the current condition is 4 and the repair type is performed.
Factor Condition 3	The percent increase in condition if the current condition is 3 and the repair type is performed.
Factor Condition 2	The percent increase in condition if the current condition is 2 and the repair type is performed.
Factor Condition 1	The percent increase in condition if the current condition is 1 and the repair type is performed.

Columns

Name	Type	Size
Culvert Type	Text	2
Culvert Material	Text	1
Repair Type	Text	2
Factor Cond 9	Number (Integer)	2
Factor Cond 8	Number (Integer)	2
Factor Cond 7	Number (Integer)	2
Factor Cond 6	Number (Integer)	2
Factor Cond 5	Number (Integer)	2
Factor Cond 4	Number (Integer)	2
Factor Cond 3	Number (Integer)	2
Factor Cond 2	Number (Integer)	2
Factor Cond 1	Number (Integer)	2

Deterioration Curves

This file is used to store information on the deterioration curves used in the Work Funding Module. The general form of the formula is

Decrease in Condition = constant – (Variable $_a$ * Year) – (Variable $_b$ * Year * Year)

Where:

Variable $_a$ = Variable Year

Variable $_b$ = Variable Year Square

Item	Description
Culvert Type	The type of culvert as defined CMS by the agency from the pick lists.
Culvert Material	The culvert material as defined CMS by the agency from the pick lists.
Constant	The constant portion of the formula. The default is 9.
Variable Year	The constant assigned to the Year.
Variable Year Square	The constant assigned to the Year Squared.

Columns

Name	Type	Size
Culvert Type	Text	2
Culvert Material	Text	1
Constant	Number (Double)	8
Variable Year	Number (Double)	8
Variable Year Sq	Number (Double)	8

Deterioration Table

This table is not used in the system.

Columns

Name	Type	Size
Culvert Type	Text	50
Culvert Material	Text	50
Initial Year Condition	Text	50
Initial Year Priority	Text	50
Initial Year Repair Type	Text	50
Next Year Condition - Work	Text	50
Next Year Priority - Work	Text	50
Next Year Repair - Work	Text	50
Next Year Condition - NO	Text	50
Next Year Priority - NO	Text	50
Next Year Repair - NO	Text	50

Funding Year

This file is used to store the initial funding year in the **Work Funding Module**.

Item	Description
Funding Year	The year that the five (5) funding cycle begins.

Columns

Name	Type	Size
Funding Year	Text	4

Inventory File

This file is used to store information about the basic layout and make-up of each culvert stored in the CMS. For more complete descriptions, refer to the FHWA *Culvert Inspection Manual*.

Item	Description
ID Number	This field is used to record the unique identification number assigned to each culvert. The identification number can consist of letters and numbers.
Division Number	This field is used to record the identification number assigned to divisions within the local government agency. The identification number can consist of letters and numbers. This field is optional.
Section Number	This field is used to record the identification number assigned to a section within the local government agency. The identification number can consist of letters and numbers. This field is optional.
Route	This field is used to record the route designation assigned to the road where the culvert is located. The route designation can consist of letters and numbers.
Milepost	This field is used to record the milepost location for the route where the culvert is located. The number is entered to two decimal places (9999.99). This field is optional.
Northing	This field is used to record the northing coordinates for the location of the culvert. The number is entered to four decimal places (9999999999.9999). This field is optional.
Easting	This field is used to record the easting coordinates for the location of the culvert. The number is entered to four decimal places (9999999999.9999). This field is optional.
Owner	The name of the agency that owns the culvert.
Inspection Responsibility	The name of the agency that has the inspection responsibility for

	the culvert.
Maintenance Responsibility	The name of the agency that has the maintenance responsibility for the culvert.
Plans Available	Are the plans for the culvert available?
Hydrological	Is hydrological information on the culvert available?
Original Contract Number	The original contract number for the culvert.
Year Built	The year the culvert was originally built.
Rehabilitation Contract Number	The contract number for the latest rehabilitation performed on the culvert.
Rehabilitation Number	The number of rehabilitations performed on the culvert
Type of Maximum Span	The type of structure for the maximum span.
Material	The type of material used for the structure (i.e. concrete, steel, etc.) as defined in the culvert inspection manual.
Coating	The type of coating material on the structure if any is used as defined in the culvert inspection manual.
Design Type	
Number of Spans	The number of spans in the structure.
Length of Maximum Span	The length of the maximum span culvert measured along the centerline of the road.
Total Width	The width of the culvert for the majority of its length.
Total Length	The total length of the culvert measured along the centerline of the road.
Abutment Height – Begin	The height of the used as defined in the culvert inspection manual. Generally the south or west end of the structure.
Abutment Height – End	The height of the abutment at the end of the structure in reference to the roadway. Generally the north or east end of the structure.
Depth of Cover	The depth of cover over the culvert.
Culvert End Structure – Begin	The type of end structure on the culvert as defined in the culvert inspection manual at the beginning or upstream end of the culvert.
Culvert End Structure – End	The type of end structure on the culvert as defined in the culvert inspection manual at the end or downstream end of the culvert.
Culvert Skew Angle	The angle that the culvert is skewed from the roadway.
Culvert Orientation	
Design Load	The load for which the culvert is designed.
Roadway Approach Width	The roadway width at the approach to the culvert.
Curb-to-Curb Width	The width of the road over the culvert from curb face to curb face.
Sidewalk – Left	The width of the sidewalk on the left side of the road.
Sidewalk – Right	The width of the sidewalk on the right side of the road.
Median – type	The type of median as defined in the culvert inspection manual.
Median – Width	The width of the median over the culvert.
Abutment Type – Begin	The type of abutment on the culvert as defined in the culvert inspection manual used as defined in the culvert inspection manual. Generally the south or west end of the structure.
Abutment Type – End	The type of abutment on the culvert as defined in the culvert inspection manual used as defined in the culvert inspection

	manual. Generally the north or east end of the structure.
Abutment Wingwall – Begin	The type of abutment wingwall on the culvert as defined in the culvert inspection manual used as defined in the culvert inspection manual. Generally the south or west end of the structure.
Abutment Wingwall – End	The type of abutment wingwall on the culvert as defined in the culvert inspection manual used as defined in the culvert inspection manual. Generally the north or east end of the structure.
Type of Approach Rail	The type of railing on the roadway approach ends of the culvert as defined in the culvert inspection manual.
Type of Culvert Rail – Left	The type of railing on the left side of the roadway as defined in the culvert inspection manual.
Type of Culvert Rail – Right	The type of railing on the right side of the roadway as defined in the culvert inspection manual.
Status	The posting status of the culvert.
Posted Load	The posted load limit on the bridge.
Date Posted	The date the culvert was posted.
Description or Route Number	The description or route number of the road over the culvert.
Station	The station number on the road where the culvert is located.
Federal Aid System	The Federal Aid system number assigned to the road.
Functional System	The functional system code assigned to the road.
Detour Length	The length of the detour required if the road is closed.
Number of lanes	The number of lanes on the road.
AADT	The Annual Average Daily Traffic on the road.
Average Truck Percent	The percentage of trucks in the makeup of the AADT.
AADT Year	The year the AADT was taken.
Feature Description	The description of the features within the culvert.
Streambed Material – Inlet	The material that makes up the streambed at the upstream end of the culvert.
Streambed Material – Outlet	The material that makes up the streambed at the downstream end of the culvert.
Bank Protection – Inlet	The material used to protect the embankment at the inlet end of the culvert.
Bank Protection – Outlet	The material used t protect the embankment at the outlet end of the culvert.
Velocity of Current	The velocity of the water through the culvert.
Headwater Depth	The depth of the stream at the inlet end of the culvert.
Slope	The slope of the stream bed through the culvert.
Wetland Identification	The wetland identification (if any) associated with stream at the culvert.
Drainage Area	The drainage area identified as contributing to the culvert flow.
High Water Elevation	The elevation of the water at the high water level.
Invert Elevation – In	The invert elevation at the upstream end of the culvert.
Invert Elevation – Out	The invert elevation at the downstream end of the culvert.
Type of Terrain	The type of terrain surrounding the culvert.

Pavement Type	The type of pavement on the road over the culvert.
Subsurface Type	The type of subsurface under the road over the culvert.
Type of Culvert	The type of culvert.
Soil pH	The pH of the soil around the culvert.
Water pH	The pH of the water passing through the culvert.
Soil Resistivity	The resistivity of the soil surrounding the culvert.
Water Resistivity	The resistivity of the water passing through the culvert.
Maintenance Frequency	The frequency of the performance of maintenance.
Traffic Disruption Frequency	The frequency of the disruption of traffic due to maintenance of the culvert.
English – Metric	Indication of whether the units of measure are in English (feet/inches) or metric (meters).

Columns

Name	Type	Size
COUNTER	Number (Long)	4
ID NUMBER	Text	20
DIVISION NUMBER	Text	5
SECTION NUMBER	Text	5
ROUTE	Text	6
MILEPOST	Number (Double)	8
NORTHING	Number (Double)	8
EASTING	Number (Double)	8
OWNER	Text	20
INSPECTION RESPONSIBILITY	Text	20
MAINTENANCE RESPONSIBILITY	Text	20
PLANS AVAILABLE	Yes/No	1
HYDROLOGICAL	Yes/No	1
ORIGINAL CONTRACT NUMBER	Text	10
YEAR BUILT	Number (Integer)	2
REHABILITATION CONTRACT NUMBER	Text	10
REHABILITATION NUMBER	Text	10
TYPE OF MAXIMUM SPAN	Text	4
MATERIAL	Text	1
COATING	Text	1
DESIGN TYPE	Text	2
NUMBER OF SPANS	Number (Integer)	2
LENGTH OF MAXIMUM SPAN	Number (Double)	8
TOTAL WIDTH	Number (Double)	8
TOTAL LENGTH	Number (Double)	8
ABUTMENT HEIGHT-BEGIN	Number (Double)	8
ABUTMENT HEIGHT-END	Number (Double)	8
DEPTH OF COVER	Number (Integer)	2
CULVERT END STRUCTURE-BEGIN	Text	2

CULVERT END STRUCTURE-END	Text	2
CULVERT SKEW ANGLE	Number (Long)	4
CULVERT ORIENTATION	Text	4
DESIGN LOAD	Text	5
ROADWAY APPROACH WIDTH	Number (Long)	4
CURB-TO-CURB WIDTH	Number (Long)	4
SIDEWALK-LEFT	Number (Long)	4
SIDEWALK-RIGHT	Number (Long)	4
MEDIAN-TYPE	Text	2
MEDIAN-WIDTH	Number (Long)	4
ABUTMENT TYPE-BEGIN	Text	1
ABUTMENT TYPE-END	Text	1
ABUTMENT WINGWALL-BEGIN	Text	1
ABUTMENT WINGWALL-END	Text	1
TYPE OF APPROACH RAIL	Text	2
TYPE OF CULVERT RAIL-LEFT	Text	2
TYPE OF CULVERT RAIL-RIGHT	Text	2
STATUS	Text	1
POSTED LOAD	Number (Integer)	2
DATE POSTED	Date/Time	8
DESCRIPTION OR ROUTE NUMBER	Text	20
STATION	Number (Long)	4
FEDERAL AID SYSTEM	Text	2
FUNCTIONAL CLASS	Text	2
DETOUR LENGTH	Number (Long)	4
NUMBER OF LANES	Number (Integer)	2
AADT	Number (Long)	4
AVERAGE TRUCK PERCENT	Number (Integer)	2
AADT YEAR	Number (Long)	4
FEATURE DESCRIPTION	Text	25
STREAMBED MATERIAL-INLET	Text	1
STREAMBED MATERIAL-OUTLET	Text	1
BANK PROTECTION-INLET	Text	2
BANK PROTECTION-OUTLET	Text	2
VELOCITY OF CURRENT	Text	2
HEADWATER DEPTH	Text	3
SLOPE	Number (Long)	4
WETLAND IDENTIFICATION	Text	10
DRAINAGE AREA	Text	50
HIGH WATER ELEVATION	Text	50
INVERT ELEVATION - IN	Text	50
INVERT ELEVATION - OUT	Text	50
TYPE OF TERRAIN	Text	50
PAVEMENT TYPE	Text	50
SUBSURFACE TYPE	Text	50
TYPE OF CULVERT	Text	50

SOIL pH	Text	50
WATER pH	Text	50
SOIL RESISTIVITY	Text	50
WATER RESISTIVITY	Text	50
MAINTENANCE FREQUENCY	Text	50
TRAFFIC DISRUPTION FREQUENCY	Text	50
ENGLISH - METRIC	Text	50

Model Factors

This file is used to store information about the factors used to produce the priority weighting in the Work Funding Module.

Item	Description
Factor	Factor used in the Weighted Priority calculation.
File	File where Factor is located. If factor is selected from existing pull down list then this field is automatically filled in by the system.
Item in File	Name of factor in the file. If factor is selected from existing pull down list then this field is automatically filled in by the system.
Weighting	The percent portion that the factor is used in the weighting of the priority.
Range 1 – Low	The low end of the 1st range used in the weighting for the factor
Range 1 – High	The high end of the 1st range used in the weighting for the factor
Range 2 – Low	The low end of the 2nd range used in the weighting for the factor
Range 2 – High	The high end of the 2nd range used in the weighting for the factor
Range 3 – Low	The low end of the 3rd range used in the weighting for the factor
Range 3 – High	The high end of the 3rd range used in the weighting for the factor
Range 4 – Low	The low end of the 4th range used in the weighting for the factor
Range 4 – High	The high end of the 4th range used in the weighting for the factor
Range 5 – Low	The low end of the 5th range used in the weighting for the factor
Range 5 – High	The high end of the 5th range used in the weighting for the factor
Range 6 – Low	The low end of the 6th range used in the weighting for the factor
Range 6 – High	The high end of the 6th range used in the weighting for the factor
Range 7 – Low	The low end of the 7th range used in the weighting for the factor
Range 7 – High	The high end of the 7th range used in the weighting for the factor
Range 8 – Low	The low end of the 8th range used in the weighting for the factor
Range 8 – High	The high end of the 8th range used in the weighting for the factor
Range 9 – Low	The low end of the 9th range used in the weighting for the factor
Range 9 – High	The high end of the 9th range used in the weighting for the factor
Range 10 – Low	The low end of the 10th range used in the weighting for the factor
Range 10 – High	The high end of the 10th range used in the weighting for the factor

Columns

Name	Type	Size
Factor	Text	50
File	Text	50
Item in File	Text	50
Weighting	Number (Single)	4
Range 1 - Low	Text	10
Range 1 - High	Text	10
Range 2 - Low	Text	10
Range 2 - High	Text	10
Range 3 - Low	Text	10
Range 3 - High	Text	10
Range 4 - Low	Text	10
Range 4 - High	Text	10
Range 5 - Low	Text	10
Range 5 - High	Text	10
Range 6 - Low	Text	10
Range 6 - High	Text	10
Range 7 - Low	Text	10
Range 7 - High	Text	10
Range 8 - Low	Text	10
Range 8 - High	Text	10
Range 9 - Low	Text	10
Range 9 - High	Text	10
Range 10 - Low	Text	10
Range 10 - High	Text	10

Maintenance and Repair (MR) Activity

This file is used to store information on the maintenance and rehabilitation activities performed on the agency's culverts. The work can be performed by in-house personnel or by contract.

Item	Description
MR Activity	Number assigned to the MR activity.
MR Activity Description	Description of the MR Activity.
Measurement Unit	The measurement unit use for the MR Activity (i.e. Square Feet, Cubic Yards, Linear Feet, Etc.).
Cost	The unit cost to perform one unit of work.
In-House/Contract	Used to indicate where the work is performed by in-house personnel (I) or by contract (C).
Productivity	The amount of man-hours needed to perform one unit of work.
January	Indicates whether the activity can be performed during the month.

February	Indicates whether the activity can be performed during the month.
March	Indicates whether the activity can be performed during the month.
April	Indicates whether the activity can be performed during the month.
May	Indicates whether the activity can be performed during the month.
June	Indicates whether the activity can be performed during the month.
July	Indicates whether the activity can be performed during the month.
August	Indicates whether the activity can be performed during the month.
September	Indicates whether the activity can be performed during the month.
October	Indicates whether the activity can be performed during the month.
November	Indicates whether the activity can be performed during the month.
December	Indicates whether the activity can be performed during the month.
Inflation	Not used in the system

Columns

Name	Type	Size
MR Activity	Text	2
MR Activity Description	Text	55
Measurement Unit	Text	15
Cost	Number (Long)	4
In-House Contract	Text	1
Productivity	Number (Single)	4
January	Yes/No	1
February	Yes/No	1
March	Yes/No	1
April	Yes/No	1
May	Yes/No	1
June	Yes/No	1
July	Yes/No	1
August	Yes/No	1
September	Yes/No	1
October	Yes/No	1
November	Yes/No	1
December	Yes/No	1
Inflation	Number (Integer)	2

Repair Types

This file is used to store information on the repair types as defined by the agency. It is used in the Condition, Work Needs, Work Funding and Scheduling Modules.

Item	Description
Repair Type Number	Repair Type number assigned by agency
Repair Type Description	Description of Repair Type.
Repair Type Improvement	Not used at this time.

Columns

Name	Type	Size
Repair Type Number	Text	2
Repair Type Description	Text	25
Repair Type Improvement	Number (Long)	4

Repair Type (RT) and Maintenance and Rehabilitation (MR)

This file is used to store the relationship between the repair type and Maintenance and Rehabilitation activities developed in the Work Needs module.

Item	Description
Repair Type Number	Number of the Repair Type assigned to MR Activity
MR Activity Number	Number of MR Activity assigned to Repair Type

Columns

Name	Type	Size
Repair Type Number	Text	2
MR Activity Number	Text	2