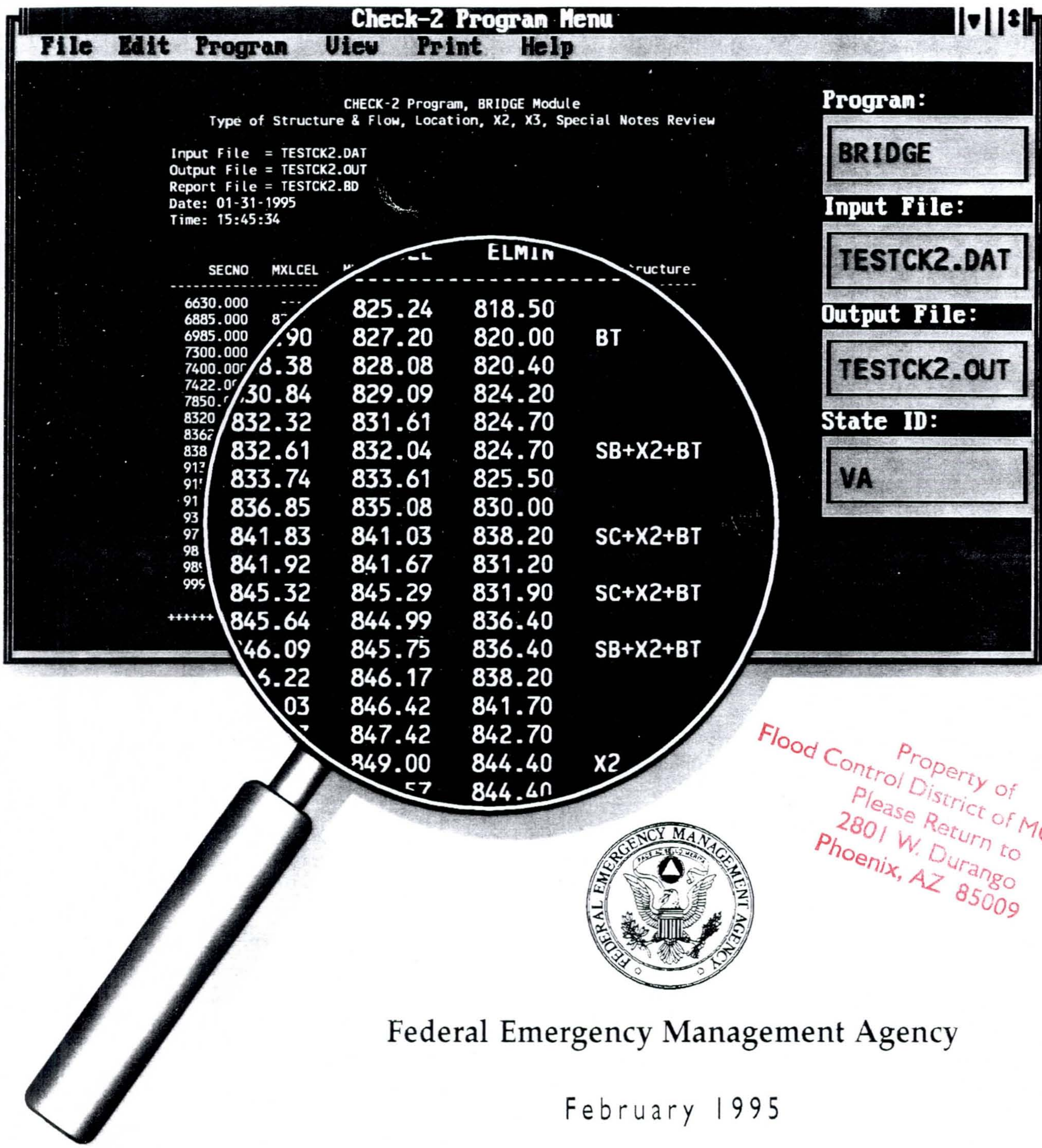
CHECK - 2

Automated HEC-2 Review Program



Federal Emergency Management Agency

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CHECK-2

HEC-2 Input and Output Checking Program

User's Guide

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Chapter 1: Introduction

Overview

The CHECK-2 is a program designed to verify the validity of an assortment of parameters found in HEC-2 (U.S. Army Corps of Engineers' step-backwater computer program) input and output files.

This chapter presents the following topics:

- What is CHECK-2 ?
- How to Use this User's Guide.

What is CHECK-2?

CHECK-2 is a collection of both checking programs and public domain programs.

1. The checking programs are:
   - J3 Program
   - NT Check Program
   - XSEC Check Program
   - Bridge Check Program
   - Floodway Check Program

   Each program is independent and emphasizes a different subject.

2. The public domain programs include the following:
   - COED (U.S. Army Corps of Engineers Screen Edit Program)
   - HEC-2 (Water Surface Profiles Program)
   - LIST (File Viewing Program)
   - PLOT-2 (Profile and Cross Section Plotting Program)

   CHECK-2 is structured so that users can access all four programs to view, edit, and run HEC-2 input and output files without having to exit the CHECK-2 program. CHECK-2 also allows users to use the U.S. Army Corps of Engineers PLOT-2 program to view and plot HEC-2 cross sections and water surface profiles.

How to Use this User's Guide

This User's Guide contains the instructions and specifications users need to run CHECK-2 successfully. It also provides users with a few basic commands for the four public domain programs that run within CHECK-2. This CHECK-2 User's Guide is not intended to be used as a guide on how to use the HEC-2 program. A basic knowledge of HEC-2, and familiarity with the HEC-2 User's Manual is necessary to understand the error and warning messages CHECK-2 provides. Prior to running CHECK-2 for the first time, users should:

- have a good understanding of stream hydraulics,
- be familiar with the USACE's HEC-2 program and its User's Manual,
- have a basic understanding of MS-DOS, and
- read this Guide.

PLEASE NOTE ...

CHECK-2 is <u>not</u> intended for first-time users of the HEC-2 program

An assortment of HEC-2 records, input and output variables and parameters will be referenced throughout this Guide without providing a complete description. For a complete description of HEC-2 records please refer to the U.S. Army Corps of Engineers, Hydrologic Engineering Center, *HEC-2, Water Surface Profiles, User's Manual,* September 1990 (revised: February 1991), Davis, California.

Chapter 2: Using CHECK-2

Overview

CHECK-2 is a menu-driven program written in MS-DOS Visual BASIC. As stated in Chapter 1, it links several internal and external modular programs running under one menu.

CHECK-2 allows users to examine a variety of parameters from HEC-2 input and output files, and generate, view and print error reports for each of the four checks. In addition, errors identified by each of the four check modules can be referenced by using the HELP message database. The use of the HELP message database is explained in detail in Appendix D.

This chapter contains the following sections:

- Program Specifications
- System Requirements
- Installation

Program Specification

CHECK-2 is a DOS-based program. It comes with two 3½" High Density floppy diskettes, the Program Disk and the Utility Disk.

System Requirements

Hardware Requirements

- An IBM compatible PC computer (a 386 or higher processor and greater than 2Mb memory is recommended)
- A mouse
- A printer (optional)

Software Requirement

- Microsoft Disk Operating System (MS-DOS) Version 3.0 or later
- CHECK-2 must be installed (see below for installation details).

Installation

To install the CHECK-2 program, the steps described below should be followed:

1. Insert the CHECK-2 Program Disk in the floppy disk drive used for 3½" floppy diskettes (usually either A: or B:)

2. Type the following command at the DOS prompt:

   A:\setup (if drive A: is selected)

   or **B:\setup** (if drive B: is selected)

3. Follow the instructions on the installation menu

4. Restart computer

Chapter 3: Running CHECK-2

Overview

CHECK-2 runs from the DOS prompt. It displays a series of menus and dialog boxes. Users then specify the HEC-2 input and output files to be examined. Also, users are required to specify the two letter state abbreviation, referred to in the CHECK-2 program as "State ID." The State ID is used by the Floodway program to determine if the surcharge values for the floodway of the selected stream meet not only FEMA's criteria but also those of the state where the stream is located (when the state's criteria is more stringent than FEMA's).

The CHECK-2 program requires that only two profiles be computed in the HEC-2 files, and that they be arranged in the following manner:

- The first profile must correspond to the 100-year flood reflecting unencroached conditions
- The second profile must correspond to the 100-year encroached (with floodway) conditions

In addition, the following precautions should be taken before the checking programs are run within the CHECK-2 program:

- The cross section identification numbers (HEC-2 variable SECNO) must be unique, i.e. duplicate SECNOs must not be used. SECNOs cannot have more than three decimal places
- The HEC-2 program must be run within the CHECK-2 program before using the checking programs

In general, follow these steps to run CHECK-2:

1. Start from the directory where HEC-2 input data is located
2. Type ***check2*** to run the CHECK-2 program
3. Select ***File*** menu to select HEC-2 input file, HEC-2 output file, and State ID
4. Select ***Edit*** menu to run HEC-2, edit HEC-2 input file or run Plot-2
5. Select ***Program*** menu to select the desired CHECK-2 program to run

6. Select ***View or Print*** menu to view or print CHECK-2 error reports

7. Select ***Help*** menu to query error message database

This process is described in detail below:

Step 1: Selecting the File Menu Option

The ***File*** menu option allows users to select the HEC-2 input and output files to examine using the CHECK-2 program. The three Menu options are:

1. Select Input File menu

   Input File allows users to select a HEC-2 input file from the file list window. Users can change drive or directory or use wild card (e.g. *.dat) to find an input file. A HEC-2 input file must already exist prior to running CHECK-2.

2. Select Output File menu

   Output File allows users to select an existing HEC-2 output file from the file list window. If no HEC-2 output file exists, then a new name can be entered in the file name window to create a new output file.

3. Select State ID menu

   State ID is used to specify the State where the stream is located. Users are prompted to specify the two letter state abbreviation. Each State ID will correspond with a maximum surcharge value. Users can locate the maximum surcharge value corresponding with each state by clicking the help icon in the dialog box.

Step 2: Selecting the Edit Menu Option

The ***Edit*** menu option provides access to various public-domain programs that allow users to modify the HEC-2 input file, generate a new HEC-2 output file, and plot cross sections and water-surface profiles.

1. Select Run HEC-2 menu

   If the program runs successfully, users can go to Program Menu (see step 3). Otherwise, users need to write down any message that appears on the screen and select the Edit Input menu to change the input file, and run HEC-2 again until no error occurs. CHECK-2 users should have a complete HEC-2 file that ran successfully before running CHECK-2.

The ***Run HEC-2*** menu is used to standardize the format of the HEC-2 input file and generate a new HEC-2 input and output file. Main functions are summarized as below:

- Standardize HEC-2 input file

  CHECK-2 error/warning messages will be provided if more than two profiles are specified in the HEC-2 input file's J2 records. Also, if only one profile is specified in the HEC-2 input file's J2 record, a message will be printed by CHECK-2 indicating that the Floodway check will not be performed.

- Remove any existing J3 records and replace with four new J3 records or insert J3 record

  To be able to produce four special summary tables in output file.

- Remove any existing J5 cards

  To be able to create a detail summary table in output file.

- Rerun the HEC-2 program

  Generate a new output file with special summary tables and detailed printout

- Produce customized summary table files

  To extract three special summary tables from the new HEC-2 output file and append them into one special summary file.

FOR YOUR INFORMATION ...

The J3 Program

In order to retrieve certain specific information for each check, it was necessary to create a program that would insert "customized" J3 records into a HEC-2 input file and produce new output files with the customized summary tables. There are three specific summary tables that the program will create in order to retrieve the appropriate data to perform the checks. The fourth summary table is standard HEC-2 Table 200, channel improvement data. The variables under each table are:

SECNO	**CLASS**	**XLCH**	**CWSEL**	**HV**	**EG**	**QLOB**	**QCH**	**QROB**	**EGLWC**	**EGPRS**	**EGOC**	**EGIC**
SECNO	**QPR**	**QWEIR**	**QCULV**	**Q**	**QCH**	**ELMIN**	**K*XNCH**	**XLBEL**	**RBEL**	**ELLC**	**ELTRD**	**KRATIO**
SECNO	**DIFKWS**	**CRIWS**	**TOPWID**	**10*KS**	**TELMX**	**SSTA**	**STENCL**	**STCHL**	**STCHR**	**STENCR**	**ENDST**	**AREA**

This program also deletes any J5 records in the HEC-2 input file. Note that the J3 Program performs all these functions automatically.

2. If there is any error message when users run previous step, users must change the input file by choosing Edit Input menu.

   Edit Input allows users to edit the HEC-2 input file by using an external program - COED (Corps of Engineers Editor). COED contains full-screen editing capabilities, along with the HEC-2 help program, which provides data variable names and definitions identified by the cursor location. Users can refer to Appendix B for the main functions in the COED Program.

3. To check the HEC-2 input file by viewing the stream profile, users can select Plot-2 menu.

   Plot-2 can be used to view cross section and stream profile plots using both the HEC-2 input and TAPE95 binary (*.T95) file. Plot-2 is designed to aid users in visually examining the data input and output file. The Plot-2 program provides the user a wide number of options to select, display, and plot cross sections and stream profiles. Users can refer to Appendix C for the main functions in Plot-2.

Step 3: Selecting the Program Menu Option

The ***Program*** menu option is the core of the CHECK-2 program. There are four programs, NT check, XSEC check, Bridge check, and Floodway check. Users can select any of these four programs or all of them (but not all at once) for examination. When users run each program, CHECK-2 will generate an error report. The name of each error report will follow the name convention of input filename plus file name extension consisting of the first two letters of each program. Thus, if your input file is named TEST.DAT, the NT check program will generate a file named TEST.NT, the XSEC check will generate a file named TEST.XS, the Bridge check program will generate a TEST.BR file, and the Floodway check program will generate a TEST.FL file report.

Each error report can be viewed by selecting View menu or printed by selecting the Print menu (see Step 4 for details).

Each error message in the error report file has an error code ID. Users can select the Help Menu to obtain the CHECK-2 program's recommendation or obtain help for solving the identified problem (see Step 5 for details).

The subjects and conditions of each check program will be discussed in detail in Chapter 4 of this User's Guide. Users should read this chapter and understand the concept and process of each program.

The main program functions are summarized below:

1. NT Check Program

   - Generates Summary Table
   - Generates Summary of Statistics Table
   - Checks roughness coefficient at cross sections
   - Checks starting NC record
   - Checks NC and NH records
   - Checks for NV records
   - Checks transition coefficients
   - Checks roughness coefficients at structures

2. XSEC Check Program

   - Generates Summary Table
   - Checks distance between cross sections
   - Checks variation in channel width
   - Checks ineffective flow areas
   - Checks location of cross section
   - Checks location of discharges
   - Checks starting water-surface elevation

3. Bridge Check

   - Generates Summary Table

- Checks BT Records
- Checks X2 Elevations
- Checks X3 Elevations
- Checks Special Bridge, Low Flow
- Checks Special Bridge, Pressure Flow
- Checks Special Bridge, Weir Flow
- Checks Normal Bridge
- Checks Special Culvert, Inlet Control
- Checks Special Culvert, Outlet Control
- Checks Special Culvert, Outlet & Weir
- Checks Special Culvert,Inlet & Weir
- Checks for HEC-2 Special Notes and Messages

4. Floodway Check

- Generates Summary Table
- Checks encroachment method
- Checks starting water surface elevation of floodway profile
- Scans HEC-2 file for X5 Record(s)
- Checks floodway widths
- Checks surcharge values
- Checks floodway discharges

Step 4: Selecting the View Menu or Print Menu Options

The ***View*** menu option is designed to view CHECK-2 error reports using an external program called LIST.EXE. After each program is run, an error report is generated. Users can select the View menu to view each of the reports.

The ***Print*** menu option is designed to print an error report.

Step 5: Selecting the Help Menu Option

The ***Help*** menu option provides users with an access to a database query system, which is designed to aid users in selecting help for each of the specific subjects for each program's error report messages.

Chapter 4: Program

There are four checking programs in the CHECK-2 program. They are:

- NT Check,
- XSEC Check,
- Bridge Check, and
- Floodway Check.

The NT Check program evaluates the roughness (Manning's "n") and transition loss coefficients. The XSEC Check program evaluates the distances, channel widths, ineffective flow areas, location of cross sections, placement of discharges and starting water-surface elevation. The Bridge Check program evaluates the BT data, X2 elevations, X3 elevations, special bridge routine, normal bridge routine, special culvert routine, and special notes and messages. The Floodway Check program evaluates the encroachment method, starting water-surface elevation, X5 record, floodway widths, surcharge value, and floodway discharge.

Each check is discussed in detail in the following paragraphs.

NT Check

Summary Table

A Summary Table is created by the NT Check Program consisting of 7 columns. They are: section number, left overbank "n" value, right overbank "n" value, channel "n" value, contraction loss coefficient, expansion loss coefficient, and type of bridge modeling. When NH record is used and the left overbank, right overbank, and channel "n" values are specified by more than one value, each "n" value is shown on one line such that it can be easily seen from the table that multiple "n" values are used at that section.

Summary of Statistics Table

This table is also generated by the NT Check Program and includes the maximum and minimum values for roughness coefficients of the left and right overbanks and the channel from all cross sections in the input file. It also shows the maximum and minimum values of contraction and expansion loss coefficients.

Roughness coefficients at the cross section

The following checks evaluate roughness coefficient values used at cross sections that are not at structures. A detailed explanation of these checks can be found under the Help menu.

1. Checks whether left and right overbank "n" values at each cross section are between 0.040 and 0.200.

2. Checks whether channel "n" values at each cross section are between 0.025 and 0.075.

3. When an NH record is used, the NT Check module checks each cross section to determine whether the channel portion is subdivided.

NC and NH record

1. Checks whether the first NC record with zero values in Fields 1, 2, and 3, and whether it is placed after an NH record.

2. Checks whether an NC record exists immediately after an NH record.

3. Checks whether an NC record is placed at a repeated cross section in the HEC-2 input file, when the previous cross section has an NH record.

4. Checks whether there is an NH or NC record at a non-repeated cross section when the previous cross section has an NH record.

NV record

Checks the HEC-2 input file to determine if any NV records are used.

Transition Loss Coefficients

The following checks evaluate transition loss coefficient values used at all cross sections in the HEC-2 input file. A detailed explanation for each of these checks can be found under the Help menu.

1. Checks whether the contraction loss coefficient is equal to 0.3 and the expansion loss coefficient is equal to 0.5 at Section 2 of the special bridge, special culvert and normal bridge routine.

2. Checks whether the contraction loss coefficient is changed to 0.1 and the expansion loss coefficient is changed to 0.3 at section 5 of the special bridge and special culvert routines, and at section 7 of the normal bridge routine.

3. Checks that the transition loss coefficients used are .1 and .3 or .3 and .5.

4. Checks when the transition loss coefficients used are .3 and .5, that they be at bridge sections.

Roughness coefficient check at structures

1. Checks whether the channel "n" values specified at Sections 2 and 3 of the special bridge and special culvert routines are equal to Sections 1 and 4, respectively. The NT Check program also checks whether the "n" values is less than 0.025.

2. Checks whether the channel "n" values at Sections 2 and 5 of normal bridge routine are equal to the channel "n" values at cross sections 1 and 6, respectively. The NT Check program also checks whether the channel "n" values at Sections 2 and 5 of the normal bridge routine is less than 0.025.

XSEC Check

Summary Table

The summary table generated by the XSEC Check Program consists of 8 columns. They are: section number, left overbank distance, right overbank distance, channel distance, channel width, water-surface topwidth, type of bridge modeling, and flow codes. The flow codes are represented by C for critical depth, D for divided flow, E for extended cross section, and 5 for X5 record.

Reach Distances

1. Checks whether both the left and right overbank distances at each cross section are greater than the channel distance.

2. Checks the left overbank, right overbank, and channel distance specified at each cross section to determine if a value of zero is specified. The program also checks whether a ratio of 5:1 is exceeded at any cross section between the right overbank and the channel distance and the left overbank and the channel distance.

3. Checks whether the channel distance at Section 3 of the special bridge and special culvert is less than 10 feet.

4. Checks whether the channel distance at Sections 3, 4, and 5, of the normal bridge routine is less than 10 feet.

Channel width check

1. Checks whether the channel bank stations are also stations identified on the GR records at each cross section.

2. Checks whether the left channel bank station is greater that the right channel bank station.

3. Checks whether the channel width at any cross section exceeds a ratio of 2:1 or 1:2 when compared to the cross section immediately downstream.

4. When the normal bridge routine is used and a low flow condition exists, the program checks that the channel width at Sections 2 and 5 equal the channel width at Sections 3 and 4, respectively.

5. When the special bridge routine is used and a low flow condition exists, the program compares the channel width at Sections 2 and 3 against the trapezoidal top width (as specified in the SB record).

Cross Section Spacing

1. The program checks the following four variables for each cross section:

   a. Change in velocity head (HV) value exceeds 0.5,
   b. Conveyance change (Kratio) is outside the range of 0.7 and 1.4,
   c. the water-surface elevation (CWSEL) change exceeds 1 foot, and
   d. the floodplain topwidth (TOPWID) varies by a factor of 2.

2. Checks whether the variable in field 7 of J1 record is used.

Ineffective flow area check

1. Checks whether ET records are used in the 100-year flood natural (unencroached) profile.

2. For cross sections where divided flow occurs, the program prints a letter "D" in the XSEC Program Summary Table.

3. For cross sections where the computed water surface elevation exceeds the elevation of the starting and end stations specified in the GR record, the program prints a letter "E" in the XSEC Program Summary Table.

4. For cross sections where critical depth occurs, the program prints a letter "C" in the XSEC Program Summary Table.

Location

Checks whether the cross section upstream of a critical depth cross section is located at a distance no greater than the topwidth of the critical depth cross section.

Discharge

1. Checks whether discharges in the QT records decrease in the downstream direction.

2. Checks whether the same discharge is used at the downstream and upstream side of a structure.

3. Checks whether a value of zero discharge shifts between the left and right overbanks between any two consecutive cross sections.

Starting water-surface elevation

1. Checks whether a J6 record is used to select a friction slope method other than the default method in the HEC-2 program (i.e. average conveyance equation).

2. Checks whether a known water-surface is specified on field 9 of first J1 record.

3. Checks whether both slope and approximate starting water-surface elevation are specified on fields 5 and 9 of first J1 record, respectively.

Bridge Check

Summary Table

A Summary Table is created by the Bridge Check Program that consists of 7 columns. They are: section number, maximum low chord elevation, minimum road elevation, energy gradient elevation, water-surface elevation, minimum elevation, and type of bridge modeling.

BT records

1. Checks whether BT stations include the left and right channel bank stations specified in the GR records.

2. Checks whether the left and right channel bank stations coincide with stations specified in the GR records.

X2 elevations

1. When the special bridge and special culvert routines are used, the program checks whether the maximum low chord elevation between channel bank stations specified on the BT records is equal to the low chord elevation (ELLC) value specified in field 4 of the X2 record.

2. When the special bridge and special culvert routines are used, the program checks whether the minimum road elevation along the road profile is equal to the top of the road elevation (ELTRD) value specified in field 5 of the X2 record.

3. When the special bridge routine is used, the program checks whether a value of 1 is specified in field 3 of X2 record.

4. When the special culvert routine is used, the program checks whether a value of 2 is specified in field 3 of X2 record.

X3 elevations

1. When an X3 record is used with a value of 10 in the first field, the program checks whether a left limiting elevation is specified in field 8 and the right limiting elevation is specified in field 9.

2. Checks whether an X3 record is specified at Sections 2 and 3 of the special bridge and special culvert routines.

3. Checks whether an X3 record is specified at Sections 2 and 5 of the normal bridge routine.

4. At Section 2, the Bridge Check Program checks whether the left limiting elevation is between the maximum low chord elevation and the minimum left road elevation, if the minimum left road elevation is higher than the maximum low chord elevation.

5. At Section 2, the Bridge Check Program checks whether the right limiting elevation is between the maximum low chord elevation and the minimum right road elevation, if the minimum right road elevation is higher than the maximum low chord elevation.

6. At Section 3 of the special bridge and special culvert routines and Section 5 of the normal bridge routine, the Bridge Check Program checks whether the left limiting elevation is equal to the left minimum road elevation, and right limiting elevation is equal to the right minimum road elevation.

7. Checks whether X3 record with values on fields 4, 5, 6, and 7 exist.

8. Checks the X3 elevations and compares it with the type of flow through the structure.

Special bridge, low flow

1. Checks whether the water surface elevation is lower than the maximum low chord elevation.

2. Checks whether the trapezoidal topwidth specified in the input data is equal to the channel width.

3. Compares the computed trapezoidal area value to ensure that it is within 10 percent of the BAREA variable specified in the SB record.

4. Checks whether the XK value on the SB record is between 0.9 and 1.25.

5. Checks whether the ELCHU and ELCHD values are specified on the SB record.

6. Checks whether negative side slopes are used on the SB record.

7. Provides a message if the special bridge reverts back to normal bridge routine.

Special bridge, pressure flow

1. Checks whether the water surface elevation is lower than the maximum low chord elevation.

2. Computes an orifice flow coefficient (XKOR) and compares it to the coefficient specified in the SB record. The computed XKOR value is based on the following equation:

$$XKOR = 1 + K_e + K_f + K_o$$

Please refer to Help Menu on how to determine the above coefficients. Note that an XKOR value should normally be greater than 1.56.

Special bridge, weir flow

1. Checks whether the water surface elevation is lower than the minimum road elevation.

2. Checks whether the weir length is equal to the top width at Section 3.

3. Checks whether the topwidths at Sections 2 and 3 are narrower that the topwidths at Sections 1 and 4, respectively, when weir flow occurs.

Normal bridge

Checks that the normal bridge routine is used when low flow, and low and weir flow situations exist.

Special culvert

1. When inlet control and weir flow, or outlet control and weir flow occur, the program checks whether the water-surface elevation is lower than the minimum road elevation.

2. Checks whether the topwidths at Sections 2 and 3 are narrower than the topwidths at Sections 1 and 4, respectively, when weir flow occurs.

Special notes and messages

Checks whether the following messages appear in the HEC-2 output file:

1. 6870: D.S. Energy of ;Eg; is higher than the computed energy of ;Eg;.

2. 6790: Possible invalid solution, 20 trials of EG not enough.

3. 4677: Bridge deck definition error at Stations X and Y.

4. 5150: EG of ;Eg3; less than EG of ;Eg2;.

5. 5155: 20 Trials of QWEIR not enough; Possibly invalid

<u>Floodway Check</u>

Summary Table

The summary table generated by the Floodway Check Program consists of 8 columns. They are: section number, encroachment method, surcharge values, natural water-surface top width, floodway water-surface top width, floodway width (from floodway data table), channel width, and type of bridge modeling.

Encroachment method

1. Checks whether the equal conveyance reduction concept (encroachment method 4) is used to compute the floodway encroachment stations.

2. Checks whether a proportional reduction of conveyance (i.e. a negative value specified in the ET record) is used.

3. Checks whether a surcharge target value greater than one foot (or the

maximum allowable surcharge value for the state where the stream is located) is specified at any cross section.

4. Checks whether encroachment method is specified at the cross section immediately following a cross section where method 1 encroachment is specified.

5. Checks whether the encroachment method is appended by a value of 1 at Section 3 of special bridge and special culvert routines. (For example 10.41).

6. Checks whether the road profile is represented by road length value (RDLEN) on SB or SC record.

Starting water-surface elevation

1. Checks whether the starting water-surface elevation of the floodway profile is equal to the computed water-surface elevation of the natural profile plus the specified surcharge value on the first ET record, if method 4 encroachment is used.

2. Checks whether the starting water surface elevation of the floodway profile is equal to the computed water surface elevation of the natural profile plus the allowable surcharge, if encroachment method 1 is used.

3. Checks whether the friction slope for the floodway profile is the same as the friction slope for the natural profile, when encroachment method 1 is used.

X5 record

Checks whether X5 records exist in either the natural or floodway profiles.

Floodway width

1. Checks whether the floodway top width is wider than the natural top width.

2. Checks whether encroachment stations are specified within the channel bank stations.

3. Checks whether channel bank stations are selected such that relatively flat overbank exists outside of the channel bank stations.

4. Checks whether the X3 record has values specified on fields 4, 5, 6, and 7, because X3 record will override the ET record.

Surcharge value

1. Checks whether negative surcharge values exist in the floodway computations.

2. Checks whether the computed surcharge value exceeds the maximum allowable surcharge value at any cross section.

Floodway Discharge

The Floodway Program checks that the total discharge in the natural and floodway profiles are the same at every cross section.

APPENDIX A

CHECK-2 TUTORIAL

This CHECK-2 tutorial is a step-by-step guide to a typical CHECK-2 execution.

Running CHECK-2

- At the DOS prompt, enter **CHECK2** from any directory or disk drive. A screen such as the one below will appear. Note that it will takes less steps later if you start from the directory or drive where the HEC-2 input data file exists.

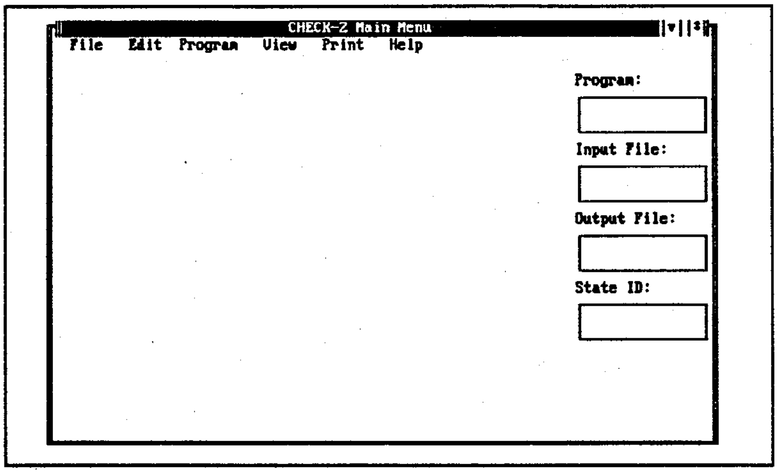


Figure 1 - CHECK-2 Main Menu Screen

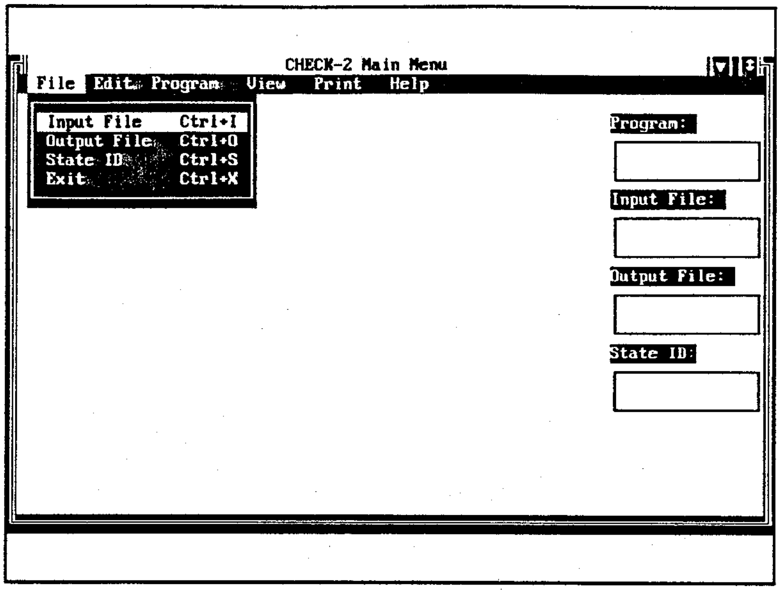
The language in this tutorial is tailored to the user equipped with a mouse, although CHECK-2 can be used if a mouse is not available. If you will not be using a mouse, read the next section. If you will be using a mouse, skip to the section entitled, "Selecting a HEC-2 File".

Instructions for Key Driven Execution

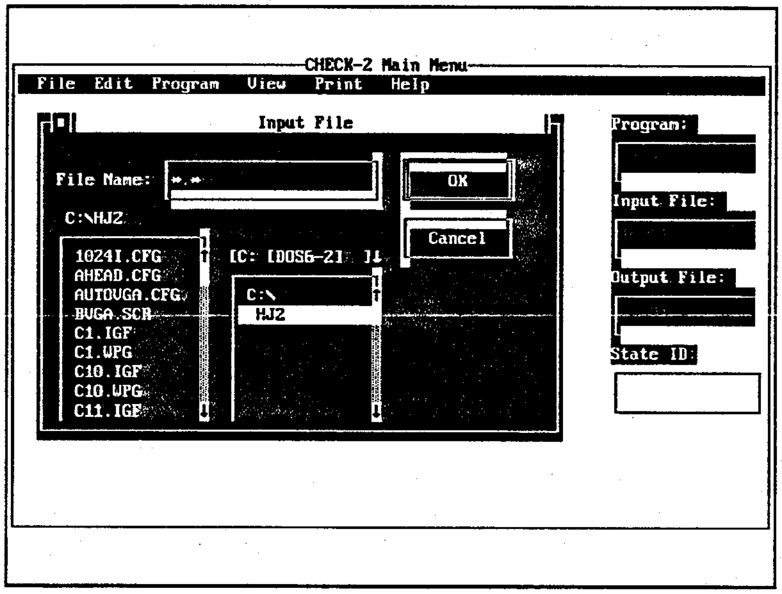
At this point, the CHECK-2 Main Menu Screen should be on the computer screen. Press the Alt key. Notice that a black cursor shows up in the menu bar at the top of the screen. That cursor can be moved with the arrow keys to make a selection. Once the cursor is resting on your choice, press Return to select. Also notice that one letter in each of the options at the top of the screen is a different color than the rest of the word. This letter is the key stroke that will choose that option. The selections within each menu also have these highlighted keys. Key strokes may be used instead of the cursor. To back out of a choice, press the Esc key. Please note that to choose the **Print** menu, the cursor has to be used, as there is not a unique key stroke for that function.

Selecting a HEC-2 Input File

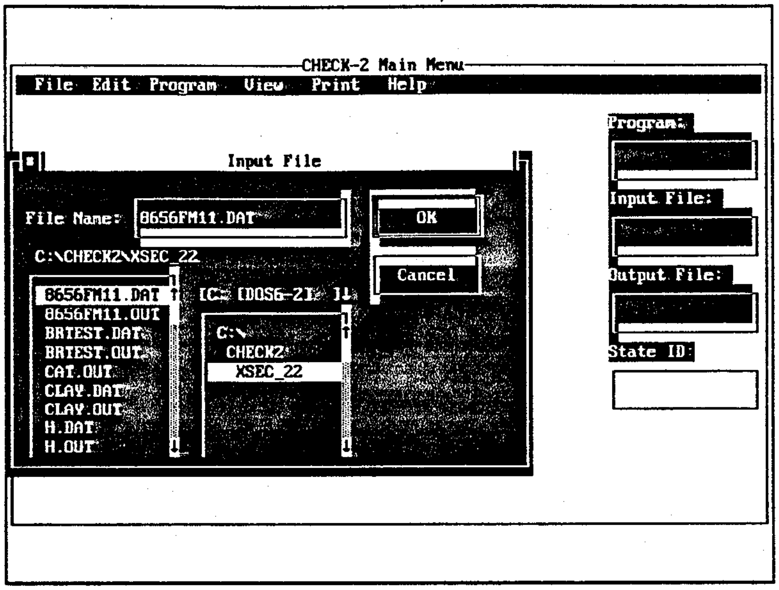
- Using the mouse, click on **File** menu, and beneath that, click on **Input File**, as shown on the screen below.



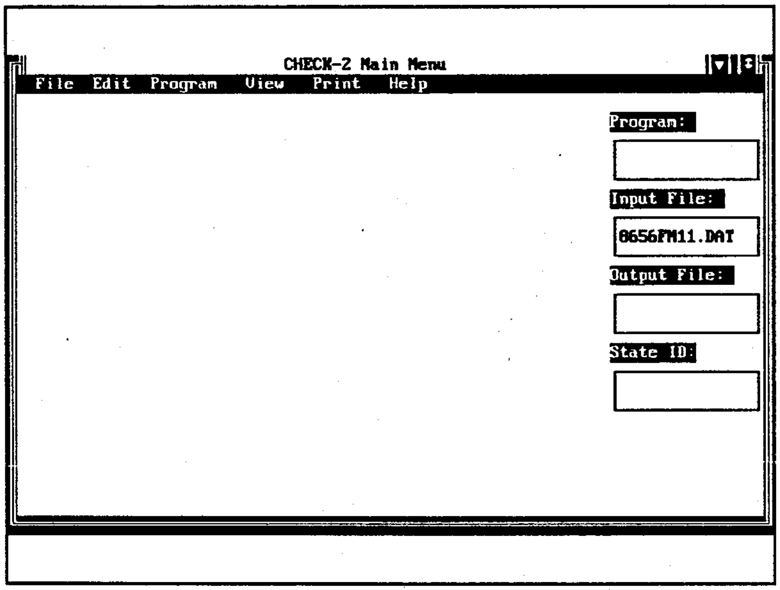
- Note that a window will appear that lists the current drive, directory, and DOS files in the current directory. The mouse can be used to browse through the different directories and drives and select the desired input file, wherever it is located.



- Click on the desired input file; in this example click on 8656FM11.DAT, and then click on the **OK** box.

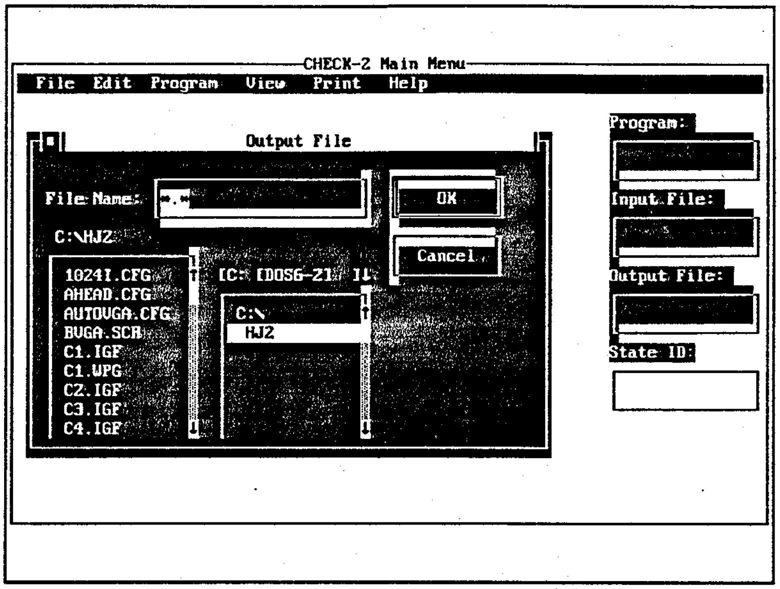


- Note that the Input File status box on the right side of the CHECK-2 Main Menu Screen displays the selected input file.

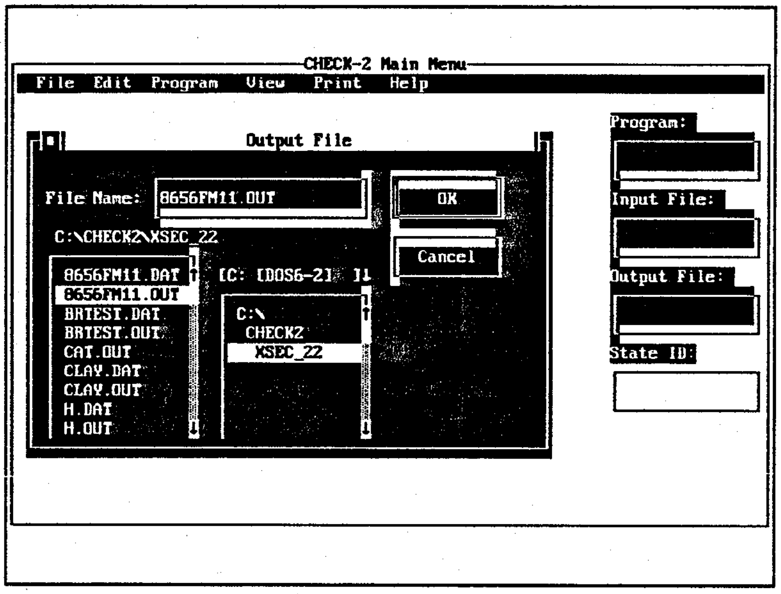


Selecting a HEC-2 Output File

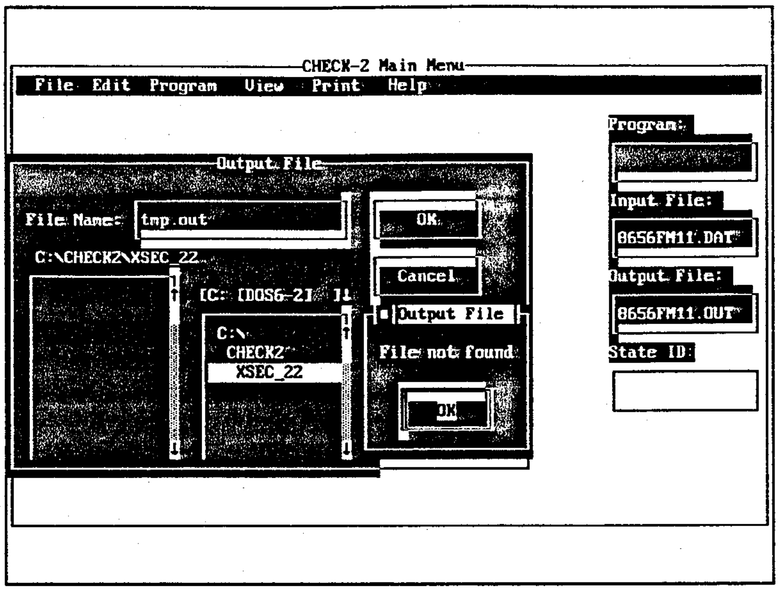
- Using the mouse, click on **File** menu again, and this time click on **Output File** as shown on the screen below. Note that a window will appear that lists the current drive, directory, and DOS files in the current directory. The mouse can be used to browse through and select the desired output file, wherever it is located.



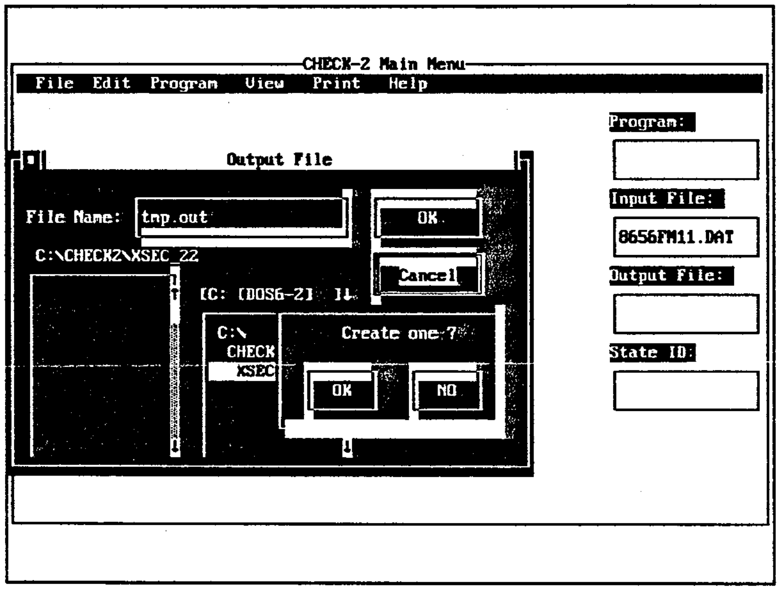
- Use mouse to click on File Name box and enter the desired output filename; in this example enter 8656FM11.OUT, and click on the **OK** button.



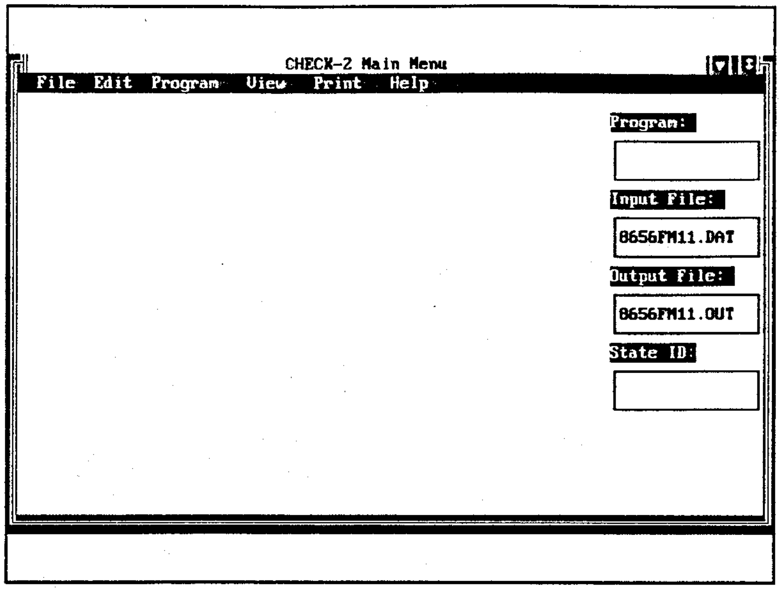
- If the file does not exist, then the program will beep and a window will appear indicating "File not Found." Click on the **OK** button.



- If the file does not exist, then a second window will appear prompting whether the user wishes to create one. Click on the **OK** button.

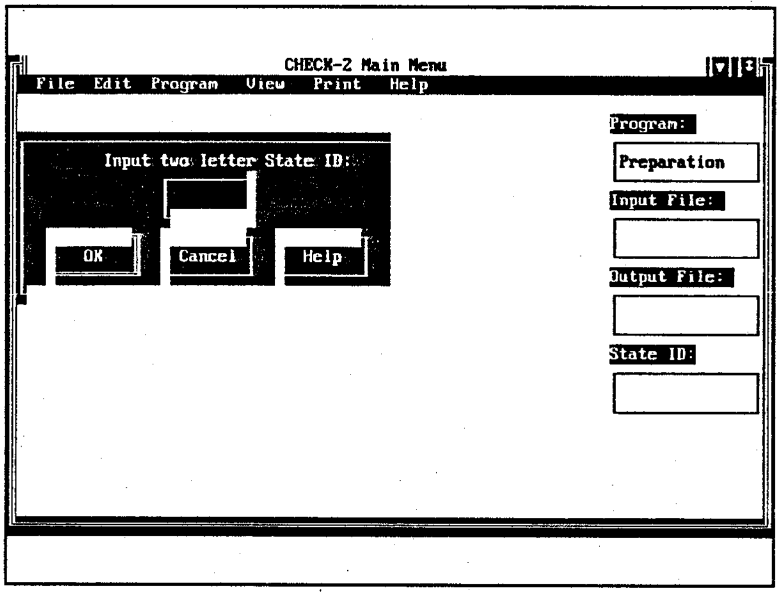


- Note that the Input and Output File status boxes on the right side of the CHECK-2 Main Menu screen displays the selected input and output files.

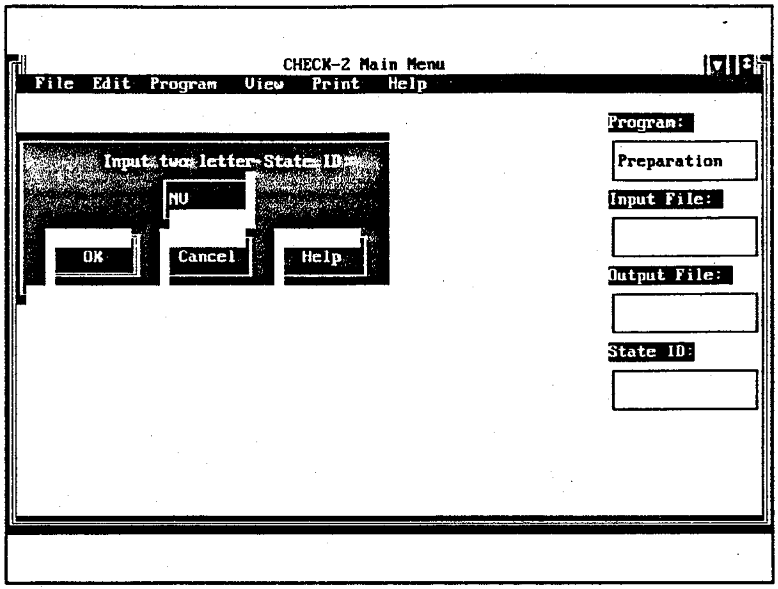


Identifying the State ID

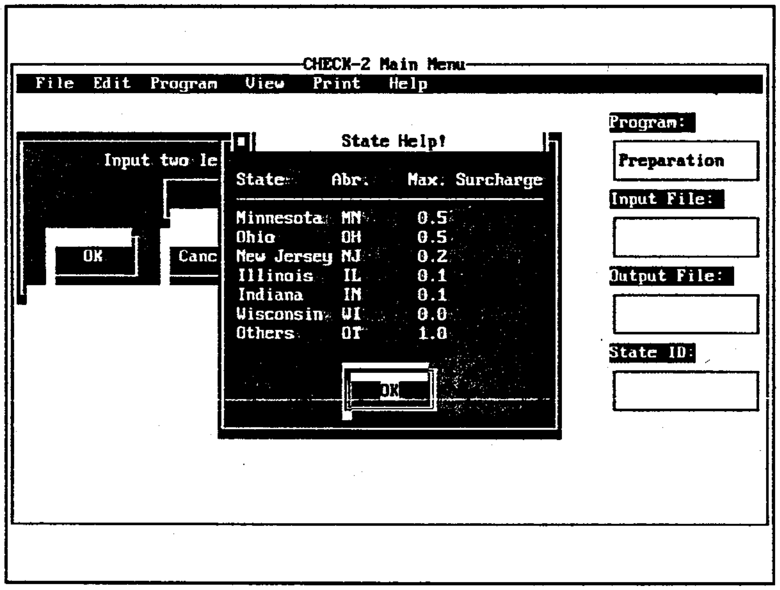
- Using the mouse, click on **File** menu again, and click on **State ID**. Note that a window will appear that requests that the user enter the two letter state abbreviation for the state where the stream is located.



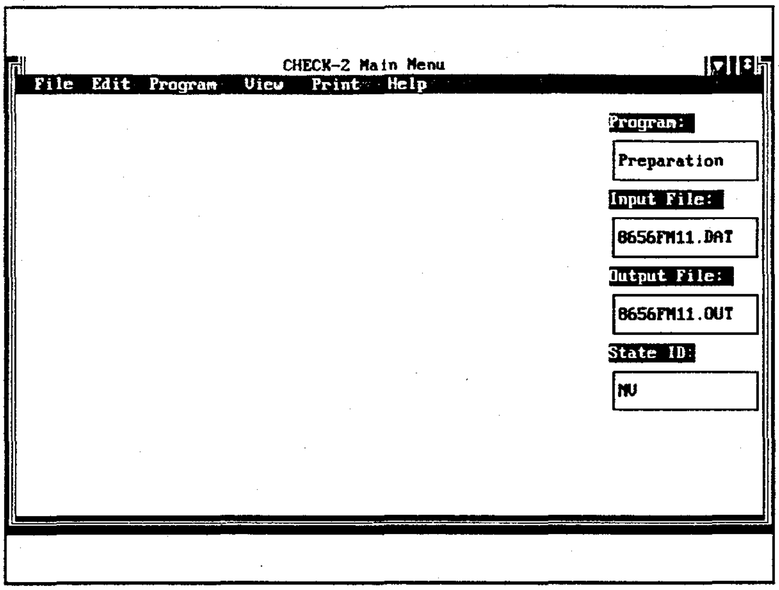
- Use the mouse to click on the box provided, and then click on the OK button.



- After entering the State ID, click on the OK button. When the Help option that appears in the State ID input box is accessed, it displays the surcharge values for all states. This surcharge is the value CHECK-2 will use to evaluate surcharges in the Floodway Check. The State Help window is shown below.

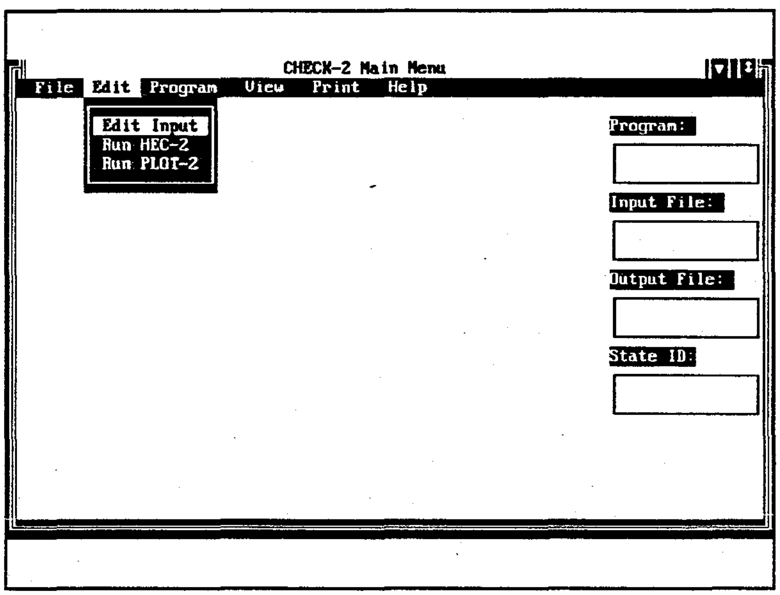


- Note that the Input and Output File and State ID status boxes on the right side of the CHECK-2 Main Menu screen display the selected input and output files and the two letter state abbreviation for the state in which the stream is located.



Editing the HEC-2 Input File

- If you want to edit your input file before rerunning HEC-2, click on **Edit** menu, and then on the **Edit Input** menu, as shown on the screen below.



- The U.S. Army Corps of Engineers Editor (COED) will display, in full-screen mode, the HEC-2 input file previously selected. Please refer to Appendix B of this Guide for more information on using COED.

- Press **Ctrl-F10** keys simultaneously to quit COED and the Return key to return to the CHECK-2 main menu.

Running HEC-2

If this is this first time a particular HEC-2 input file is being used for CHECK-2, even if output files already exist for the file, the HEC-2 program must be rerun within the CHECK-2 program. This properly formats the output so the checks can be performed.

- Using the mouse, click on **Edit** menu again, and then on **Run HEC-2** menu. CHECK-2 will execute two programs when this option is selected.

  They are:

  1. *The J3 Program*

     This program will modify the HEC-2 input data file as described in Chapter 4 of the User's Guide.

  2. *The HEC-2 Program*

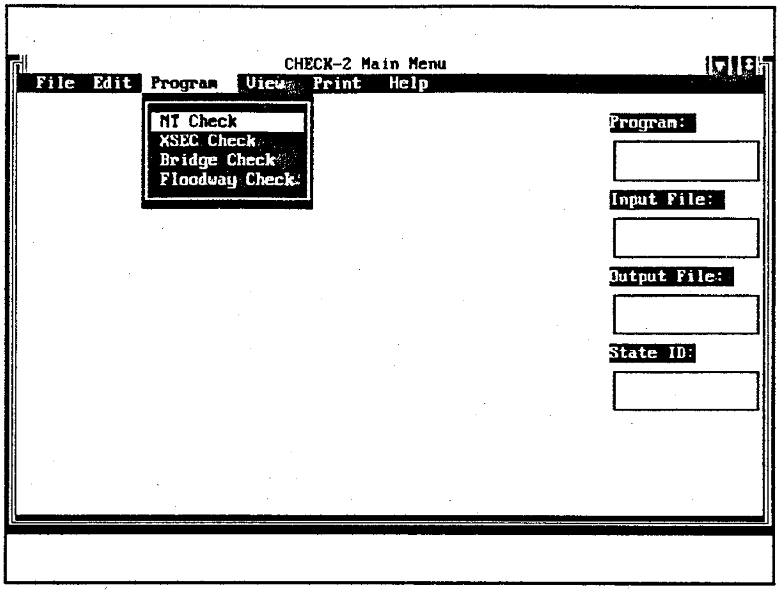
     The HEC-2 program will be automatically re-run using the modified input file.

The CHECK-2 Programs

There are four programs that make up the CHECK-2 program; the NT Value Check, XSEC Check, Bridge Check, and Floodway Check. The procedure for running the checks and viewing and printing the output files is the same for all four CHECK-2 modules. This tutorial uses the NT Check, as the example.

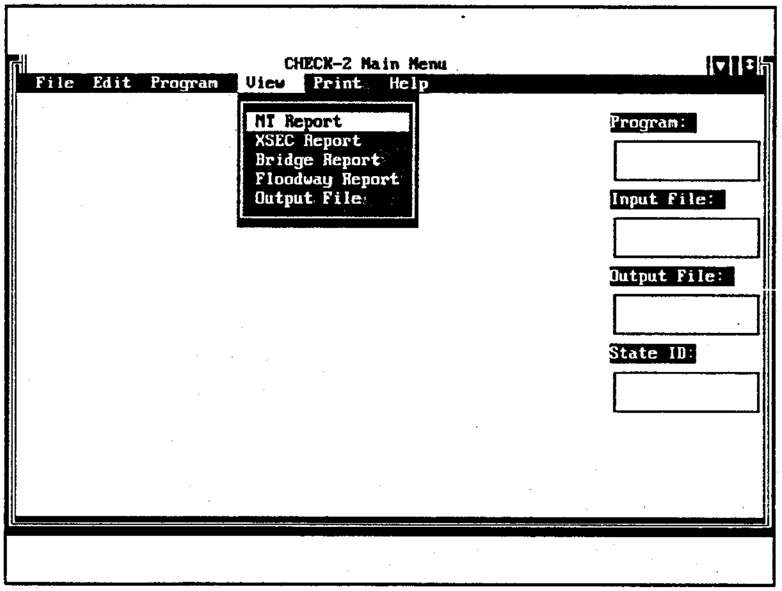
Running the CHECK-2 Program

- Click on the **Program** menu, and beneath that, click on the program you choose to run. On the screen below, the NT Check is chosen. While the program is running, the screen will display a check status. Once complete, CHECK-2 will return to the Main Menu Screen.



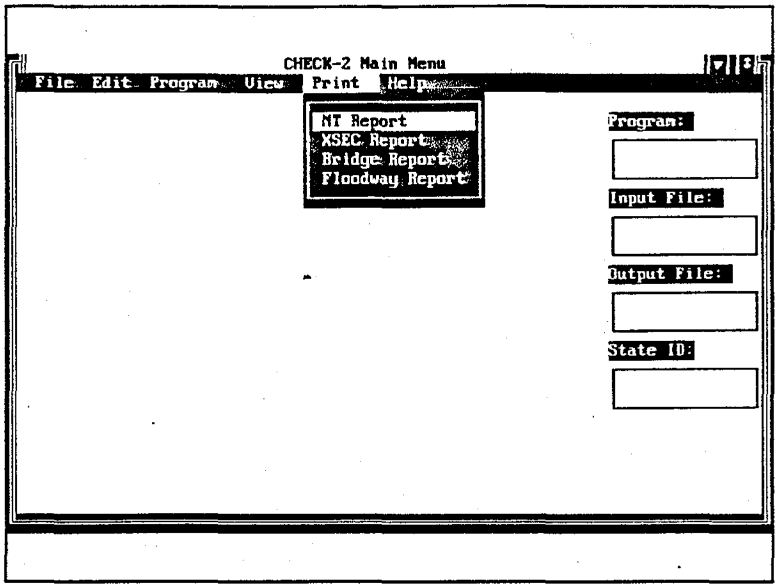
Viewing the CHECK-2 Report

- To view the error reports and summary tables generated by CHECK-2, go to the **View** menu. Click on the appropriate report. Once in the report, use the arrow keys and Page Up and Page Down keys to move within the report. To exit the report, press the Escape key.



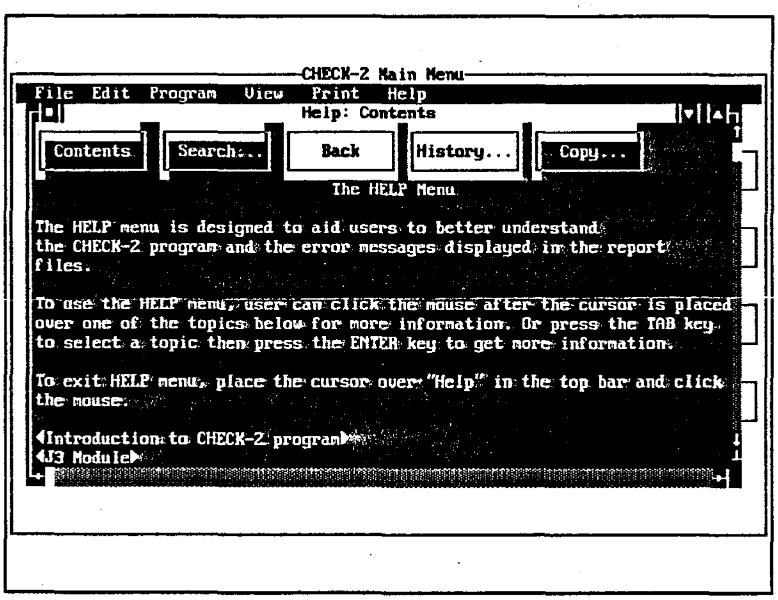
Printing the CHECK-2 Reports

- To print the CHECK-2 reports, click on the **Print** menu, and then the appropriate report.

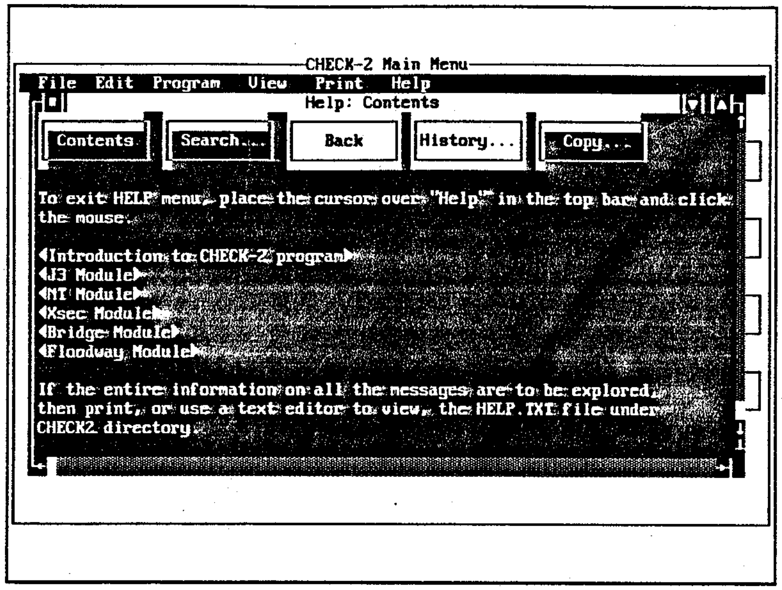


The CHECK-2 Help Menu

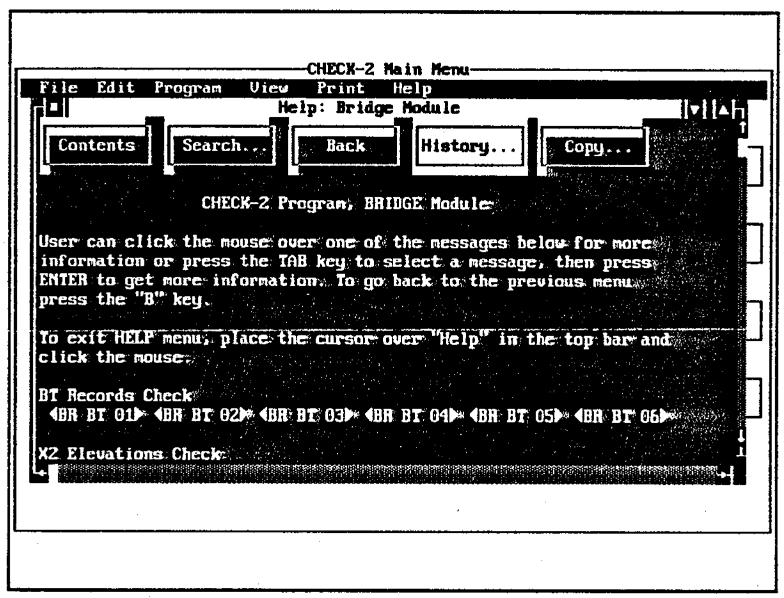
When the error reports generated by the four CHECK-2 programs are viewed, errors are listed, along with reference numbers. The Help Menu was created to provide suggestions on how to correct the errors that CHECK-2 identifies. To enter the Help Menu, click on **Help**. The screen that will appear is shown below.



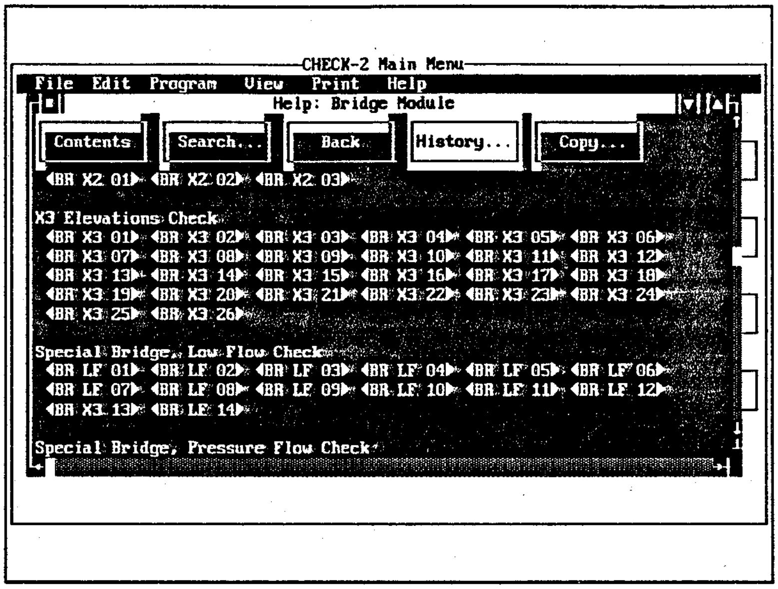
Choices within the Help Menu are surrounded with arrows, as shown on the screen below. Move the cursor to your selection and click the mouse.



In this example, the Bridge Module has been selected. The Help Menu lists all the checks performed in the Bridge Module, and under each check, the reference numbers for possible errors are listed.



As before, all options are surrounded with arrows. In this Bridge Module Example, under the X3 Elevations Check, there are 26 different errors identified. Click on the particular error found in your CHECK-2 run, and the Help Menu will display the error message and possible solutions to the problem.



Appendix B

COED Help Menu

By pressing the <F1> Key, the COED Help Menu will appear on the screen.

The following is a summary of the main functions of the COED full-screen editor:

Key	Function	Description
F1	Help	Request Help / Resume Editing
F2	Restore	Restore Line
F3	Delete Line	Delete Current Line
F4	Insert Line	Insert Line Mode (toggle)
F9	Command	Single Line Edit Command
F10	Line Edit	Go into Line Edit Mode
Ctrl-F2	PC Setup	Customize PC Setup
Ctrl-F10	Quit	Exit without Saving File
Shift-F3	Erase Field	Erase Characters in Field
Shift-F10	Save	Save File and Resume Edit
Alt-F1	Help Variable	Help Screen for HEC-2 Variable
Alt-F10	File	Save File and Exit COED

For a thorough description of all other COED functions/applications, please refer to the publication entitled *COED, Corps of Engineers Editor, User's Manual*, CPD-56, dated February 1987, published by the U.S. Army Corps of Engineers, Hydrologic Engineering Center.

Appendix C

PLOT2 Commands

This entire appendix is a reproduction of Chapter 9 of the publication entitled *Computing Water Surface Profiles with HEC-2 on a Personal Computer, Training Document No. 26,* TD-26, dated March 1992, published by the U.S. Army Corps of Engineers, Hydrologic Engineering Center.

Chapter 9

Plotting with PLOT2

Graphical displays are often the most effective method of presenting input data and computed results. Plots of the cross-sectional data can often provide helpful information for screening the input and for analysis of computed results. Profile plots of water surface elevation, or other variables, provide an overview of the results, distributed over the study reach in a way that tables of numbers cannot. The following chapter describes the capabilities of the PLOT2 program and the procedures for obtaining graphical displays of HEC-2 cross sections, computed profiles, and rating curves.

9.1 Purpose of PLOT2 Program

Computer program PLOT2 was developed to provide a quick and simple graphical display of cross-sectional data and computed results from HEC-2. The PLOT2 program provides the capability to plot cross-sectional data, including the changes to the section caused by the HEC-2 options that modify section data. Also, profiles and rating curves of the output variables, available on TAPE95, can be plotted. Default settings for options allow plotting with a minimum of effort. Plots can be displayed on the screen or directed to an HP 7475A (or equivalent) pen plotter. Screen displays of plots can be printed on DOS GRAPHICS compatible printers using the print screen <PrtSc> option. Files can also be created for use by word processors. The program was developed using GRAPHMATIC and PLOTMATIC subroutines by Microcompatibles, Inc.

9.2 Program Operation

Cross section plots can be developed from HEC-2 input data files. For cross section plots, the water surface elevation can also be plotted from the HEC-2 computed results on TAPE95. Profile plots and rating curves are developed from the TAPE95 file; therefore, **you must first run HEC-2 before plotting profiles with PLOT2.**

PLOT2 is called from MENU2 by moving the cursor to line **3.** and pressing the <SPACE BAR> until **Run PLOT2** is displayed; then press <ENTER>. To execute PLOT2 as a separate program, from the DOS prompt enter:

PLOT2

The program will respond with a PLOT2 Title Page. Press any key and the PLOT2 Menu will appear; see Figure 15. The PLOT2 Menu allows you to call the menus for the Profile, Cross-section, or Rating Curve plot routines. The up and down arrows move the cursor through the options. Pressing the <ENTER> key selects the highlighted option. Also, the number of the option can be entered to make a selection. The screen colors can be changed by using the function keys F9 and F10 for background and foreground colors, respectively.

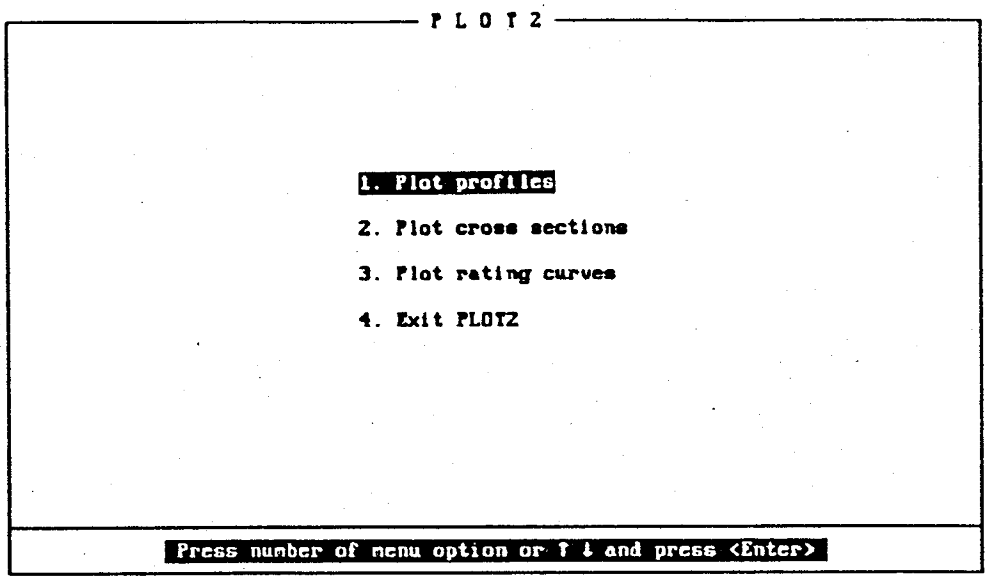


Figure 15
PLOT2 Main Menu

9.3 Output Devices

The graphic displays from PLOT2 can be directed to the screen or an HP 7475A pen plotter. Either of the following graphics cards (or their equivalent) is required: Color Graphics Adapter, or Enhanced Color Graphics Adapter, or Video Graphics Array. The plot device is set in the Plotting Options Menu, which can be called from the Profile, Cross-section, or Rating curve Menus (see Figure 19). The options are selected by using the <SPACE BAR> to toggle through the **Plot device** options. The choices are:

VIDEO GRAPHICS ARRAY
ENHANCED GRAPHICS ADAPTER
COLOR GRAPHICS ADAPTER for the console

and: **HP7470, 7475, 7550, 7580, 7585/86 Series Plotters**

A printed copy of the plot on the screen can be obtained, provided your printer is set to graphics mode. For IBM Graphics compatible printers, use the DOS **GRAPHICS** command prior to executing PLOT2. Also, there are several commercial programs to set your printer to graphics mode for high resolution graphics. Then generate the desired plot on the screen, and use the Print Screen <PrtSc> entry on your keyboard to copy the plot on your printer.

9.4 Pen Plotter Setup

Pen plotter graphics are directed to the plotter via COM1. The output port can be changed in the Plotting Options Menu by setting the **Plot device** to HP7475A and then moving the cursor to **Plot sent to** and using the <SPACE BAR> to toggle through the choices: two COM ports (COM1 or COM2) or an output file PLOT.HP. The PLOT.HP file allows you to create the plots on a computer without a plotter, and then transfer the file to another computer for plotting. Also, the plotter **Baud rate** default setting of 2400 can be set from 1200 to 9600. Just before the plots are written, the switch settings are displayed to the screen; see Figure 16. Press the <SPACE BAR> to plot, or press <Esc> to cancel the plot.

The plot operation uses PLOTMATIC routines from Microcompatibles, Inc. The following instructions for the printer settings are from their documentation. The plotter can be switched for certain parameters (e.g., BAUD rate, length of word, parity, programmed on state, paper dimensions) on the rear panel of the plotter, as described in the Operator's Manual. The switches should be set for a 2400 BAUD transmission rate, 8 bit word, one stop bit, no parity, programmed on state (Y/D switch set to D), and the US - A4 switch should be set to US (indicating 8.5 X 11 inch paper). The A4 size paper can still be used with your plotter even with the dip switch set to US. This switch just defines the active plotting region. Review the Operator's Manual for switch selection, and insure that the specified choices have been made.

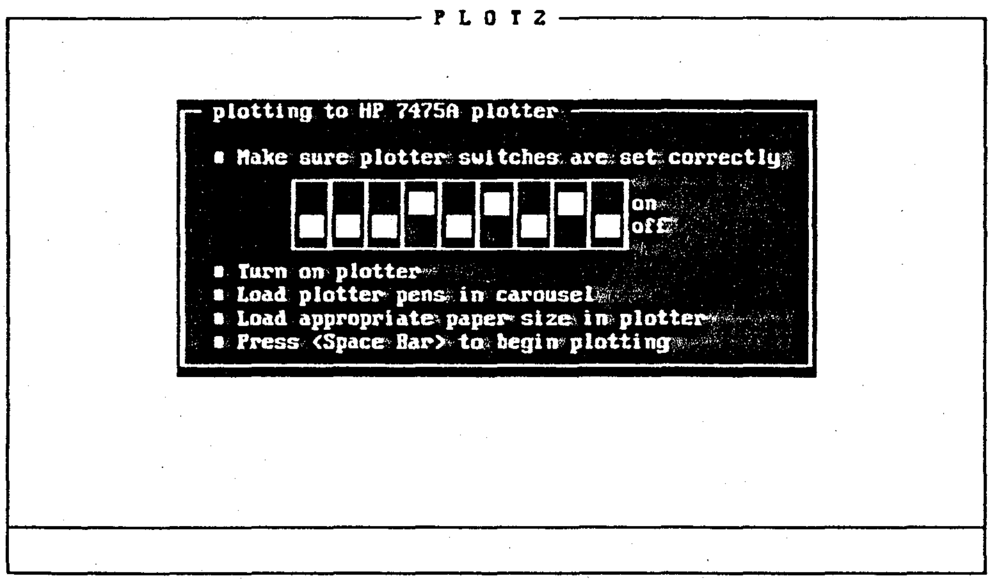


Figure 16
Pen Plotter Switch Setting

9.5 Profile Plots

Profile plots can be developed for any of the variables written to TAPE95. The default settings in the menus for profile plots assume that water surface profiles will be plotted. To develop profile plots, move the cursor to **1. Plot profiles** in the Main Menu, and press <ENTER>, or enter <1>. The Profile Plots Menu, shown in Figure 17, will appear.

There are two files indicated at the bottom of the Profile Plots Menu. The **HEC2 TAPE95 file name** is the HEC-2 program intermediate output file TAPE95, which is the input file for Profile Plots. The file name can be changed by entering a new file name in its place, or by entering a question mark <?>. The question mark entry will provide a menu of file names in the default directory. Use the cursor keys to highlight the desired file, and press <ENTER>. The selected file name will transfer into the Menu location. The **Landmark Label filename** has no default value. If this option is requested (see Figure 18. PLOT2 Profile Options Menu), then the file name must be entered.

The input file names should be defined before entering either options menu because data are obtained from the HEC-2 binary file to define default values for several options. To enter the **Profile options**, move the cursor to that location, and press <ENTER>.

The first line in the Profile Options Menu is for selecting the **Variable vs. distance** to plot. The default variable for this selection is CWSEL for Computed Water Surface Elevation. The variable code number is (1), as defined in the HEC-2 User's Manual Input description for the J3 record. To select a different variable to plot, the right and left cursor arrows may be used to toggle through the entire list of variables available. The variable name and code number are displayed for each variable.

Once the desired variable to plot is displayed, the up and down cursor keys can be used to move through the options in the menu. The **Plot invert profile** option has a default choice of **Yes**, which means that the invert profile will be plotted with the profile plot of the selected variable.

The **Plot landmark labels** option has a default choice of **No**. To change these options, move the cursor to the option, and use the <SPACE BAR> to toggle the choices between **Yes** and **No**.

The landmark label requires a file containing: distance, variable code number, and label. An example of the landmark file is shown below:

4000 1	{Distance Variable}
UNKNOWN BRIDGE	{Label to display}
6000 1	{Distance Variable}
USGS GAGE	{Label to display}

This file can be created with any text editor.

Mark cross section locations option has a default value of **No**. You can toggle to **Mark** or **Mark & number** using the <SPACE BAR> while the option is highlighted. The profile plot will then show arrow marks, or marks and numbers, at cross section locations.

Plot profile legend has a default value of **No**. If legends for the profile plots are desired, move the cursor to that option, and press the <SPACE BAR> to change the option to **Yes**. The cursor keys can then move the cursor to profile **1**:, etc. At each location enter the appropriate legend; up to eight characters are allowed. If the **Plot invert profile** option is set to **Yes**, the legend label **Invert** will be shown for the first profile.

The **Units of river distance** has a default value of **Feet**; but this can be changed to **Miles, Meters**, or **Kilometers** using the <SPACE BAR> to toggle through the choices. The 1988 version of HEC-2 reads the units and starting distance, if given, on TAPE95.

Starting river distance is set to **0.000**. A different starting value can be entered. The entered value is added to the channel reach lengths to define the horizontal distance along the profile plot. Care should be taken to ensure that the **Units of river distance** and **Starting river distance** are consistent with the units used for the model reach lengths.

```
P L O T 2

Profile plots

Profile options
Plotting options
Plot profiles
Return to main menu

HEC2 Tape95 file name ..... REDFOX.T95
Landmark Label file name .. (specify)

Press <Enter> to select | ↑ ↓ moves cursor
```

Figure 17
PLOT2 Profile Plots Menu

In the **Profile Plots Menu**, **Profile options** and **Plotting options** provide menus to specify what will be plotted, what options will be used, and to title and label your plot. The menus are called by moving the cursor to the choice desired and pressing <ENTER>. The menu for **Profile options** is shown in Figure 18, and the menu for **Plotting options** is shown in Figure 19.

```
P L O T 2

Profile options

Variable vs. distance .......... CWSEL   ( 1)
Plot invert profile ............ Yes
Plot landmark labels ........... No
Mark cross-section locations ... No
Plot profile legend ............ No
  1: Invert       6:            11:
  2: profile 1    7:            12:
  3: profile 2    8:            13:
  4: profile 3    9:            14:
  5:             10:            15:

Units of river distance ........ Feet
Starting river distance ........        .000
Begin profile # cross section ..       1.000
End profile # cross section ....       4.000

Return to previous menu

Press ← → to change parameter | ↑ ↓ moves cursor
```

Figure 18
PLOT2 Profile Options Menu

Begin profile @ cross section and **End profile @ cross section** options have the starting and ending cross section numbers for the data set (SECNO on the X1). The values are read from the binary output file, TAPE95. The default values provide a plot for the entire study reach. The starting and ending section numbers for the profile plot can be changed by using the vertical cursor arrow keys to the option and then using the horizontal cursor arrow keys to toggle through the section numbers. The program will not allow the starting section number to be equal, or upstream from the ending section number.

After all the profile options have been set, move the cursor to **Return to previous menu** and press <ENTER>. The **Profiles Plots Menu** will be displayed. The second option on the menu is **Plotting options**. Move the cursor to that option, and press <ENTER>. The Plotting Options Menu, shown in Figure 19, provides for two titles on the plot. The **Title 1:** displays the title information input on the third title record (T3), as read from TAPE95. The title can be edited, or replaced, depending on the insert mode setting; press <**Ins**> to change from insert to overwrite. **Title 2:** allows you to enter a second title.

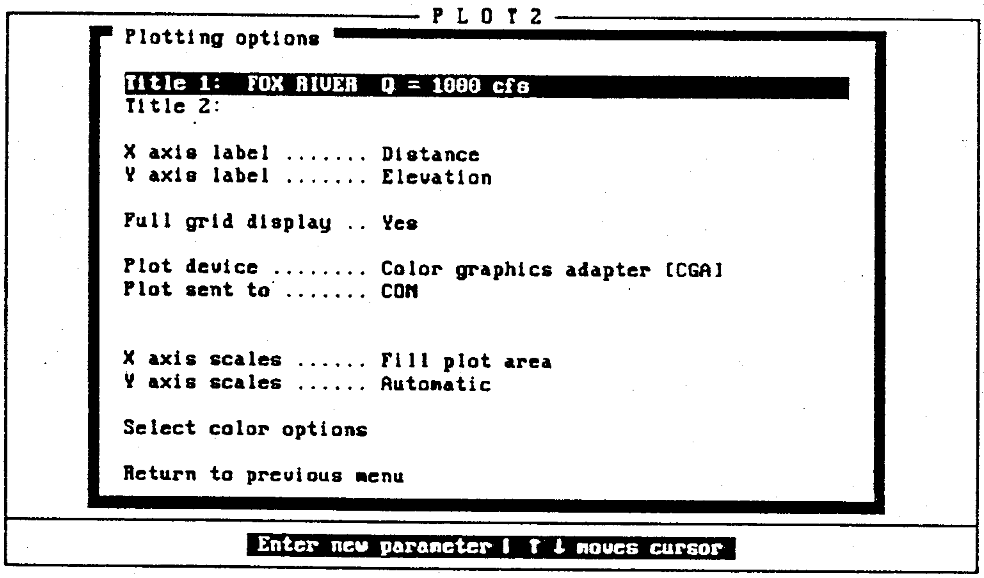


Figure 19
PLOT2 Plotting Options Menu

If the plot axes need a different label, move the cursor to the appropriate axis and enter, or edit, the label. A plotted grid can be added to the plot by moving the cursor to **Full grid display** and pressing the <Space Bar> to change the **No** to **Yes**.

The **Plot device** can be changed, as described in Section 9.3. For screen displays, the correct graphics adapter for your computer should be displayed. If it is not correct, the screen plot will appear as assorted characters. If an HP pen plotter is selected as the plot device, the **Plot sent to** will display **COM1**, the default. The output port can be toggled to **COM2**, by using the <SPACE BAR>. Also, a file **PLOT.HP** can be selected.

The **X axis scales** default is **Fill plot area**, while the **Y axis scales** are set to **Automatic** for each plot. Press the <SPACE BAR>, and the following options are provided: scales set to 1, 2, or 5 times a power of 10, Fill plot area, and Max scale for all. Fill plot area would normally be used for one scale while fixing the other scale. Max scale for all provides a fixed scale based on the maximum range of the data values.

Select color options provides a menu to set the pen number for pen plots and the line colors for **EGA color screen** displays. The **Color options** menu is shown in Figure 20. For profile plots, the options are for the Text, Axis, and the profiles to be plotted.

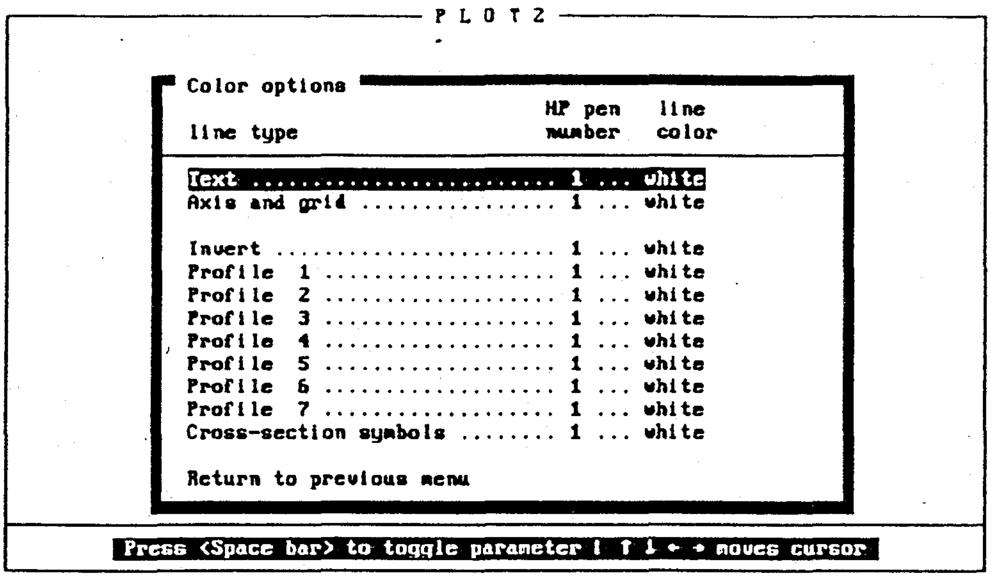


Figure 20
PLOT2 Profile Colors Options Menu

When complete, move the cursor to **Return to previous menu** and press <ENTER>. The Escape Key <Esc> will also return you to the previous menu. The Profile Plots Menu, shown in Figure 17, will be displayed.

When all desired options are set, move the cursor to **Plot profiles** to initiate the plot. The program will respond:

Plot all profiles (y/n)?

If yes, enter <y>, and the plot will go to the plot device defined in the Plotting Options Menu. If no, enter <n>, and a profile selection menu, as shown in Figure 21, will appear indicating the profiles available. The cursor location highlights the profile number. Use the cursor arrow keys to move through the choices, and press <ENTER> to select profile numbers to plot. The selected profile numbers will show an arrow marker. After selecting the desired profiles, press <c> to continue the plot.

If the **Plot profile legend** option was selected, a choice between the legend at the top or bottom of the plot is offered with the following:

Legend box top or bottom (t/b)

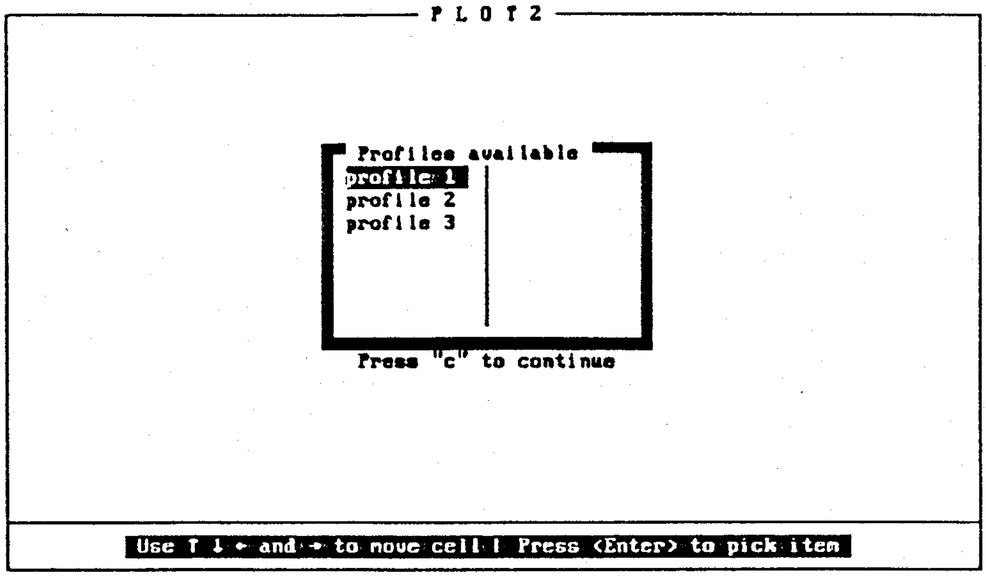


Figure 21
Profile Selection Menu

Enter your choice, and then the plot will be sent to the designate output device. If the plot is displayed to the screen, it will stay there until you press <ENTER>. If you want to copy the plot to your printer, press the Print Screen key <PrtSc> while the plot is on the screen. **Remember that you must enter the DOS GRAPHICS command** before entering PLOT2. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics. Figure 22 provides an example EGA graphics profile plot, with the legend on top.

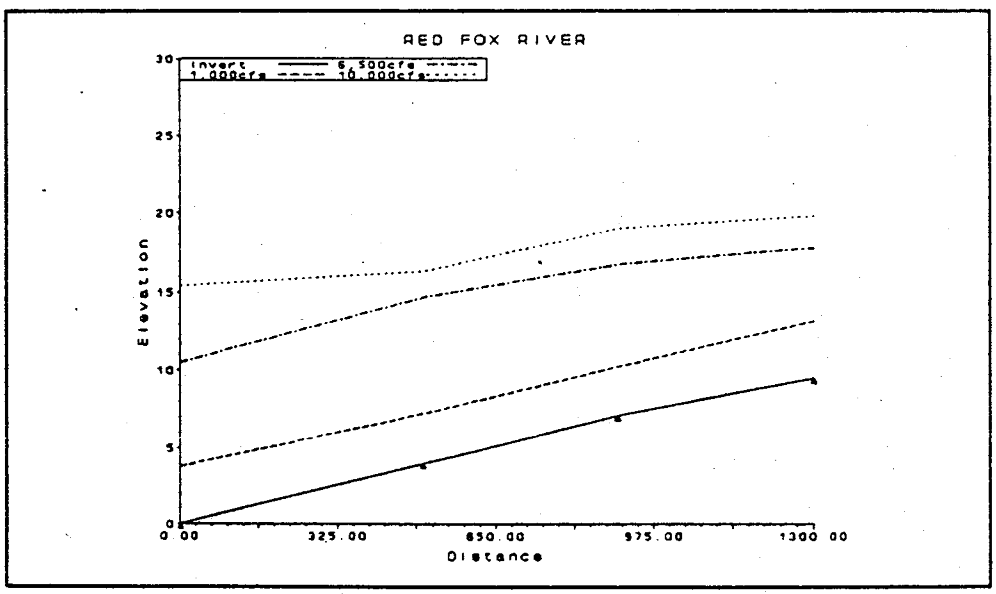


Figure 22
Example Profile Plot

When you have completed all the desired profile plots, return to the Main Menu by moving the cursor to that location and pressing <ENTER>. The Escape Key <Esc> will also return you to the Main Menu.

From the Main Menu, you can call cross-section plots or exit the program.

9.6 Cross-Section Plots

You enter cross-section plots from the Main Menu by moving the cursor to **2. Plot cross sections** and pressing <ENTER>, or by entering <**2**>. A sample **Cross-Section Plots Menu** is shown in Figure 23. From the menu you can call menus to define **Cross- section options** and **Plotting options**.

The **HEC2 Input file name** must be entered for cross-section plots. There is no default; the menu will display **(specify)**. (If you are operating from MENU2, the file names will be transferred to PLOT2.) The input file name can be entered from the keyboard or a question mark <**?**> can be entered. The question mark entry will provide a menu with the file names available in the directory. The cursor keys will move the cursor around the file names, and pressing <ENTER> will transfer the highlighted filename into the menu.

The **HEC2 Tape95 file name** is only required if the water surface elevation is to be plotted with the cross section. The default file name, TAPE95, can be changed, as described above for the input file name.

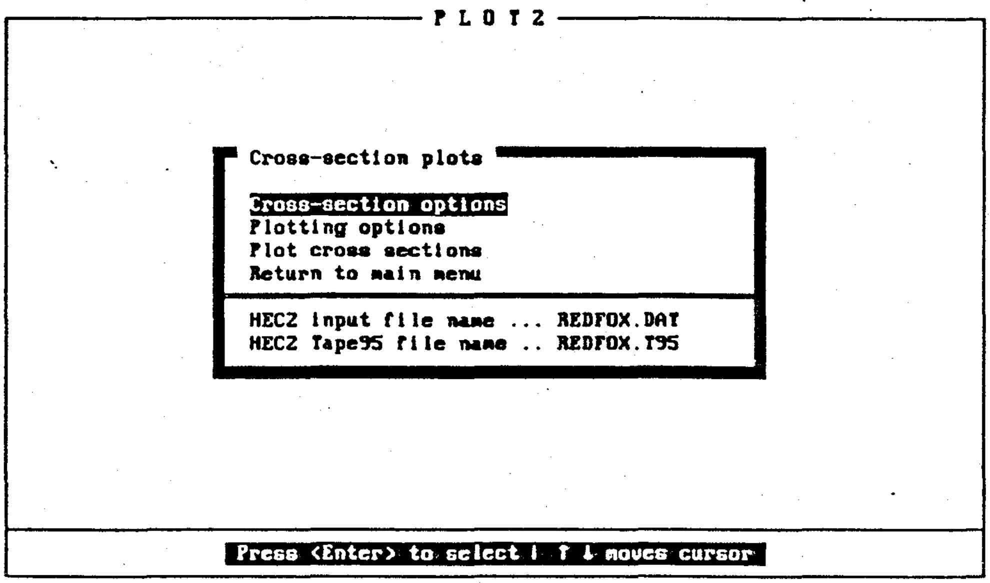


Figure 23
PLOT2 Cross-Section Plots Menu

Move the cursor to: **Cross-section options**, and press <ENTER> to select the items to plot. The **Cross-section Options Menu** is shown, with the default settings, in Figure 24. Use the up and down cursor keys to select an option, and press the <SPACE BAR> to toggle between **Yes** and **No**.

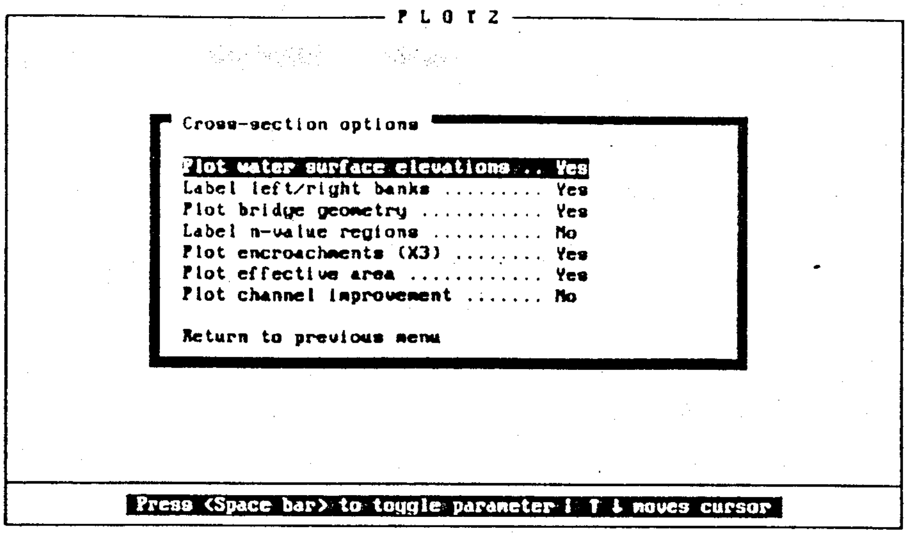


Figure 24
PLOT2 Cross-Section Options Menu

If channel improvement is to be plotted, there are five choices: Field 6 to Field 10. The field number defines the field of the CI record to obtain bottom width information. (See HEC-2 Input Description for the CI record for a complete description.)

When the plotting options are properly set, move the cursor to **Return to previous menu**, and press <ENTER>. Pressing <Esc> will also return you to the **Cross-section plots** menu.

In the **Cross-section plots** menu, move the cursor to **Plotting options**, and press <ENTER> to define titles, axes labels, and add a grid to the plot. Figure 25 shows the **Plotting options** menu with its default settings.

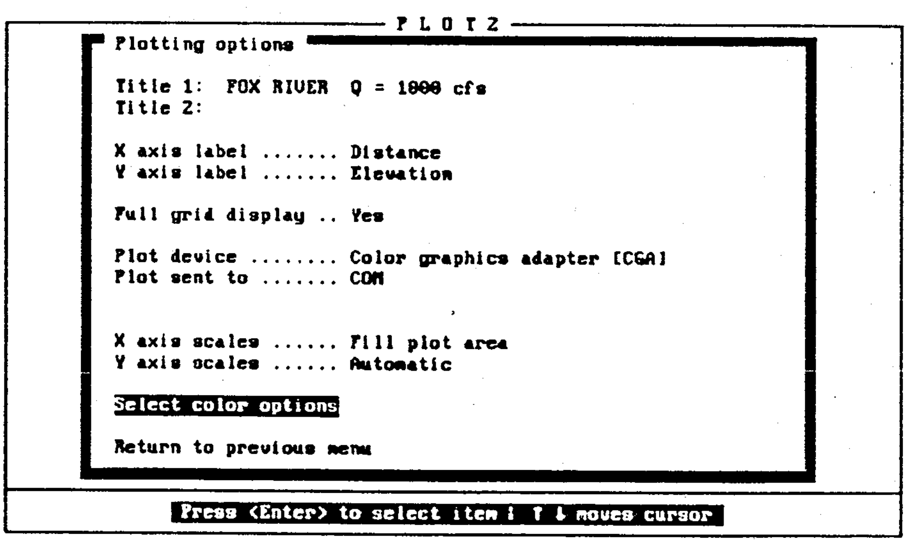


Figure 25
PLOT2 Plotting Options Menu

With the cursor positioned at **Title 1**:, type in the first title line. Then move the cursor to **Title 2**:, if desired, and enter the second title line. For **X axis label**, the default label **Distance** may be used, or an alternative label may be written over the default label. Units, if appropriate, can be added on the same line. Similarly, for the **Y axis label** the default label **Elevation** may be used, modified with units added, or replaced by entering a new label. A **Full grid display** is provided with the plot. To turn off the grid, move the cursor to that line, and press the <SPACE BAR> to toggle the choice from **Yes** to **No**.

As described in Section 9.4, options for graphics adapter and output device can be selected. For HP pen plotters, the output port can be set to COM1 or COM2, as appropriate.

The **X axis scales** default is **Fill plot area**, and the **Y axis scales** default is **Automatic** for each plot. To change the scale, press the <SPACE BAR> and the following options are provided: scales set to 1, 2, or 5 times a power of 10, Fill plot area, and Max scale for all. Fill plot area would normally be used for one scale while fixing the other scale. Max scale for all provides a fixed scale based on the maximum range of the data values.

Select color options provides a menu to set the pen number for pen plots and the line colors for EGA color screen displays. The **Color options** menu is shown in Figure 26. For cross-section plots, the options are for the Text, Axis, and the section features to be plotted.

```
                              P L O T 2

      Color options
                                          HP pen    line
      line type                           number    color

      Text ........................ 1 ... white
      Axis and grid ............... 1 ... white

      Cross-section geometry ....... 1 ... white
      Water surface elevation(s) ... 1 ... white
      Left/right overbank symbols .. 1 ... white
      Bridge geometry ............. 1 ... white
      n-values descriptions ....... 1 ... white
      Encroachments ............... 1 ... white
      Effective area .............. 1 ... white

      Return to previous menu

   Press <Space bar> to toggle parameter | ↑ ↓ ← → moves cursor
```

Figure 26
PLOT2 Cross-Section Color Options Menu

After the plotting options have been defined, move the cursor to **Return to previous menu** and press <ENTER>. Or press <Esc> to return.

In the Cross-section Plots menu, move the cursor to **Plot cross sections**, and press <ENTER>. If the input data file name is not defined correctly, the program will provide the following message:

PLOT2 cannot continue until the appropriate input files have been specified.

Press <ESC> to continue.

Return to the Cross-section Plots menu and check the file names. Remember to provide the drive and directory, if necessary. You can enter <?> to review the files in the default directory.

If the file names are correct, the program will provide the following message:

Plot all cross-sections (y/n)?

If all cross sections are to be plotted, enter <**y**>, or press <ENTER> and the program will start plotting with the first cross section in the data set. If you enter <**n**>, the program will provide a menu of cross sections available. The cursor arrow keys will move the cursor around the listing of cross-section numbers. To plot a cross section, press <ENTER> while the cursor is on the desired cross section. Figure 27 is an example cross-section plot with Manning's n values and water surface elevations plotted for three profiles.

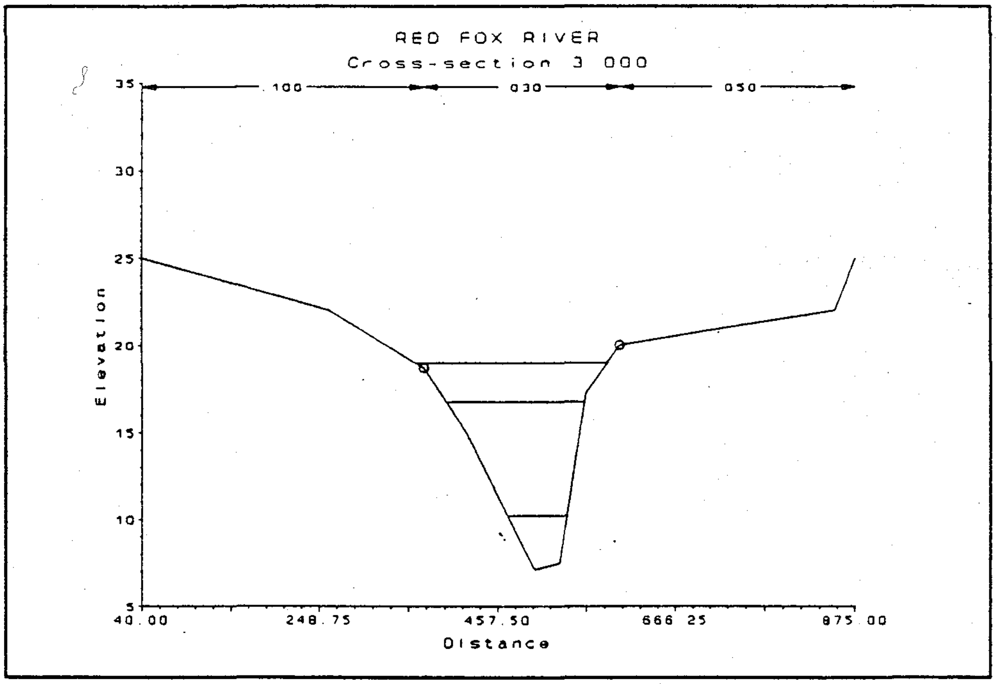


Figure 27
Example Cross-Section Plot

With the cross-section plot on the screen, you can obtain a printed copy of the display by entering <PrtSc>. Be sure that you have set your printer to graphic mode. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics. To clear the plot from the screen, press <ENTER>. If you are selecting cross sections to plot from the menu of available cross sections, the program will return to that menu. If you are plotting all cross sections, the program will plot the next section.

When plotting has been completed, press <Esc> to return to the Cross-section Plots menu. To return to the main menu, press <Esc> or move the cursor to **Return to previous menu** and press <ENTER>.

From the PLOT2 Main Menu, you can enter <4> or move the cursor to **4. Exit PLOT2** and press <ENTER> to leave the PLOT2 program. Or you can plot Rating curves by pressing <**3**>. The **Rating Curve Plot Menu**, shown in Figure 28, will appear.

```
------------------------------ P L O T 2 ------------------------------

          Rating curve plots
          
          Rating curve options
          Plotting options
          Plot rating curves
          Return to main menu
          
          HEC2 Tape95 file name .. REDFOX.T95

-----------------------------------------------------------------------
          Press <Enter> to select | ↑ ↓ moves cursor
```

Figure 28
PLOT2 Rating Curve Plot Menu

9.7 Rating Curve Plots

The rating curve option is called from the PLOT2 Main Menu by moving the cursor to **3. Plot rating curves** and pressing the <ENTER> key, or by entering <3>. The rating curve menu, shown below, appears. The two options menus have default values, so you can start plotting rating curves immediately. However, selecting **Rating curve options** will display the menu shown in Figure 29, with the default settings as shown.

```
------------------------------ P L O T 2 ------------------------------

          Rating curve options
          
          X axis variable ...... Q        (43)
          Y axis variable ...... CWSEL    ( 1)
          
          Mark points .......... Yes
          
          Minimum value added .. No
            X axis minimum value ..     .000
            Y axis minimum value .. ELMIN
          
          Return to previous menu

-----------------------------------------------------------------------
     Press <Space bar> to toggle parameter | ↑ ↓ moves cursor
```

Figure 29
PLOT2 Rating Curve Options Menu

The **Rating curve options** menu allows you to define the variables to plot, mark the computed points, and add a minimum value. Default minimum values are 0.0 for most variables and the minimum cross-section elevation (ELMIN) for elevation variables. The default variables to plot, shown in Figure 29, are flow (Q variable 43) versus computed water surface elevation (**CWSEL** variable 1). The variables can be changed by pressing the left cursor arrow to decrease, or the right cursor arrow to increase, the variable number. The sequential order of the variables is listed in the input description for the **J3** record. The order is the same as the order of the variables in TAPE95. Refer to the input description to see the sequential order of the variables.

Move the cursor down to **Mark points** by pressing the down arrow. The default is to mark the computed points with a circle. The option can be turned off by pressing the <SPACE BAR> to change **Yes** to **No**.

The minimum value can be added by moving the cursor down to **Minimum value added** and pressing the <SPACE BAR> to change **No** to **Yes**. The default is 0.00 for variables that would typically have a zero minimum. The zero minimum can be modified by entering a numeric value. The alternate default is the minimum cross-section elevation (**ELMIN**) for elevation variables like water surface and energy elevation.

If the default settings are acceptable, you can quickly return to the rating curve menu by pressing escape **<Esc>**. After setting the options, you can return by moving the cursor to **Return to main menu** and pressing <ENTER>. Pressing **<Esc>** does not save the changes you make.

The **Plotting options** menu is called by moving the cursor to that line and pressing <ENTER>. The menu shown in Figure 30 will appear.

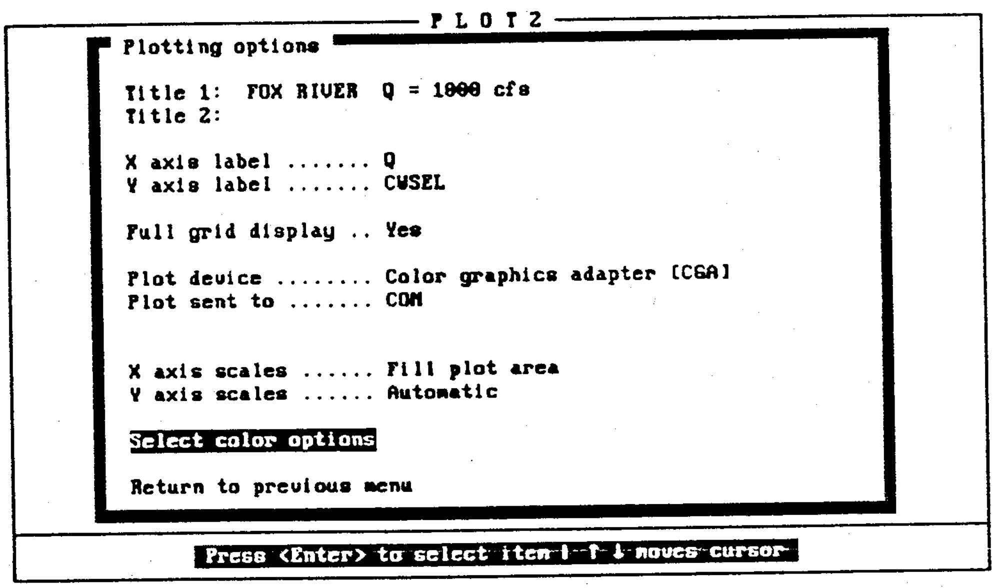


Figure 30
PLOT2 Rating Curve Plotting Options Menu

The rating curve **Plotting options** menu is similar to the other menus for plotting options. The default **Title 1:** is the title from the **T3** record, fields 2-4. The title can be edited using insert and delete keys, or replaced by typing over it.

The **X** and **Y axis labels** are set to the variable names selected for plotting in the rating curve options menu. The label can be changed by using the cursor to highlight the line, and entering a new label. For example, you may want to change **Q** to **Flow in cfs**.

A **Full grid display** is provided, by default. To eliminate the grid, highlight that option, and press the <SPACE BAR> to change **Yes** to **No**.

The **Plot device** and **Plot sent to** options are the same as described in Section 9.4. Also, the scales options are the same as previously described. The pen number, for pen plots, and the line color, for EGA color graphics display, can be set by moving the cursor to **Select color options** and pressing the <SPACE BAR>. The menu shown in Figure 31 will be displayed.

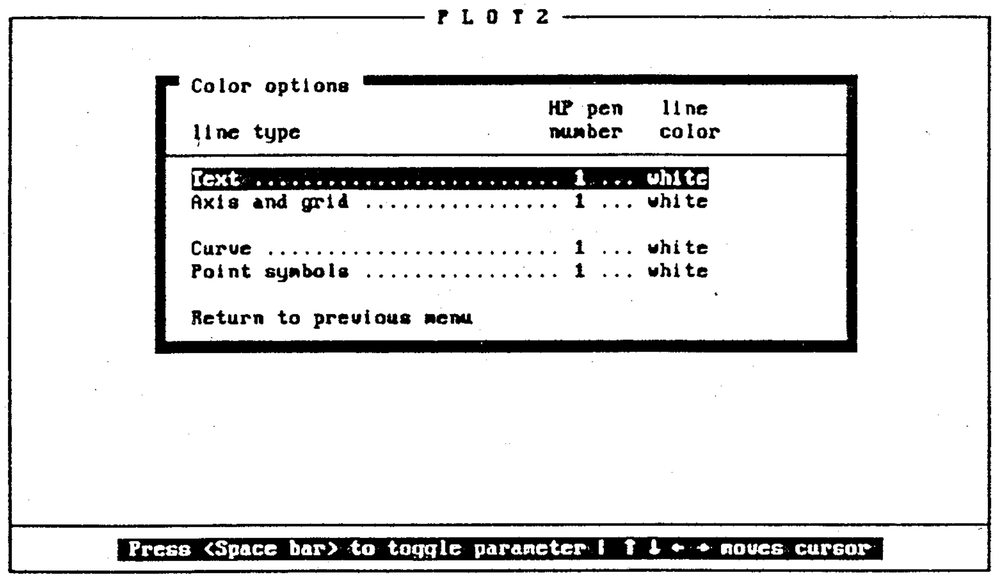


Figure 31
PLOT2 Rating Curve Color Options Menu

The cursor location is indicate by the highlighted line and a blinking marker. One column is for the pen number, and the other is the color of the plot lines for the screen display. The <SPACE BAR> is used to toggle through the choices. The left and right cursor arrows move the marker between columns, and the up and down arrows move the highlighted line.

Pressing escape <**Esc**> will return you to the **Plotting options** menu without any changes to the default color settings. If you change the settings, move the cursor to the bottom line, **Return to previous menu**, and press <ENTER>.

From the rating curve menu, move the highlighted line to **Plot rating curves** and press <ENTER>. The following message will be displayed:

Plot all cross-sections (y/n)?

Pressing <**y**> or <ENTER> will give you a rating curve for every cross section. Pressing <**n**> will give you a menu of available cross sections. Use the up and down cursor arrow keys to highlight the section numbers, and press <ENTER> to select the desired cross sections. When you have selected the desired section numbers, press <**c**> to start plotting. Figure 32 is an example of the EGA graphics plot. After each plot, press the <SPACE BAR> or <ENTER> to obtain the next plot. If you are plotting to the screen, you can use the print screen option <**PrtSc**> to obtain a copy of the plot on a graphics compatible printer set to graphics mode. Check your DOS manual, the GRAPHICS command may be limited to CGA graphics.

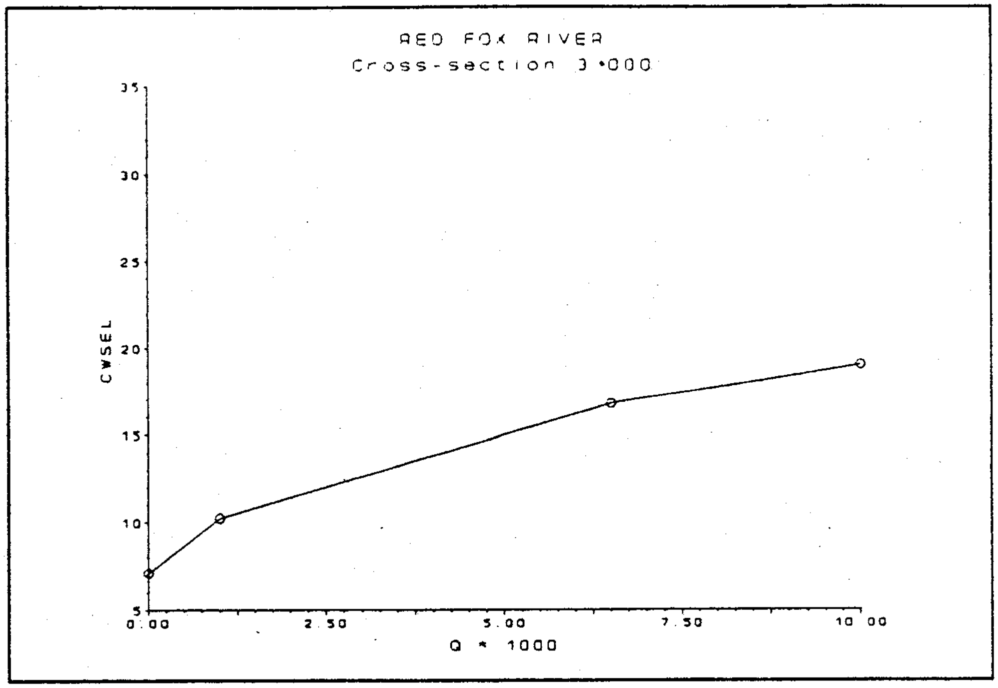


Figure 32
Example Rating Curve

After you have completed plotting, return to the PLOT2 main menu, and move the cursor to line **4. Exit PLOT2** and press <ENTER>, or simply press the <**4**> key. If you called PLOT2 from MENU2, you will be returned to MENU2. If you called PLOT2 from DOS, you will be returned to the DOS prompt.

Appendix D

Contents

The HELP Menu

The HELP menu is designed to aid users to better understand the CHECK-2 program and the error messages displayed in the report files.

To use the HELP menu, user can click the mouse after the cursor is placed over one of the topics below for more information. Or press the TAB key to select a topic then press the ENTER key to get more information.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

◂Introduction to CHECK-2 program▸
◂J3 Module▸
◂NT Module▸
◂Xsec Module▸
◂Bridge Module▸
◂Floodway Module▸

If the entire information on all the messages are to be explored, then print, or use a text editor to view, the HELP.TXT file under CHECK2 directory.

++

Introduction to CHECK-2 program

Introduction to CHECK-2 program

need text file here

++

J3 Module

CHECK-2 Program, J3 Module

User can click the mouse over one of the messages below for more information or press the TAB key to select a message, then press the ENTER key to get more information. To go back to the previous menu press the "B" key.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

◂J3 01▸ ◂J3 02▸ ◂J3 03▸ ◂J3 04▸ ◂J3 05▸ ◂J3 06▸

J3 01 Field 2 of first J1 record is equal to or less than zero.

Help: Field 2 of first J1 record must include the field number of QT record in which the 100-year discharge is specified.

J3 02 Field 1 of first J2 record is not equal to 1.

Help: Field 1 of first J2 record must be equal to 1, if more than one profile is to be analyzed. If only one profile is to be analyzed, then -1 must be specified.

J3 03 HEC-2 program will run only one profile from this file. Floodway analysis cannot be performed.

Help: The first field of first J2 record has -1. Or it has 1 and there is no other J1 and J2 records in the input file. In that case HEC-2 program will compute only one profile. If a floodway analysis needs to be performed, then -1 must be replaced with 1, and second set of J1 and J2 records must be inserted in the input file. Refer HEC-2 user's manual for arrangement of different records.

J3 04 Field 2 of second J1 record is equal to or less than zero.

Help: If the second field of first J1 record is equal to 1, then the Check-2 program will search for the second J1 record. If a floodway analysis is to be performed then the second field of second J1 record must include the field number of QT record in which the 100-year discharge is specified, and ET record in which the encroachment method is specified.

J3 05 Second J1 record is not in the input file.

Help: If the floodway analysis is to be performed then second set of J1 and J2 records must be inserted into the input file. Refer HEC-2 user's manual for arrangement of different records. If only one profile is to be analyzed, then the value in first field of first J2 record must be equal to -1.

J3 06 More than two sets of J1 and J2 records are in the input file.

Help: Check-2 program is designed to evaluate input and output files with single 100-year flood profile, or with two profiles. For the file with two profiles, the first profile must represent 100-year natural profile (unencroached) and the second profile must represent 100-year floodway profile (encroached). Multiple profiles file representing 10-, 50-, 100-, and 500-year profiles must not be used when applying Check-2 program.

J3 07 Second J2 record is not in the input file.

J3 08   QT record is not in the input file.

++

Floodway Module

CHECK-2 Program, FLOODWAY Module

User can click the mouse over one of the messages below for more information or press the TAB key to select a message, then press the ENTER key to get more information. To go back to the previous menu press the "B" key.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

Encroachment Method Check
◄FW EM 01► ◄FW EM 02► ◄FW EM 03► ◄FW EM 04► ◄FW EM 05► ◄FW EM 06►
◄FW EM 07► ◄FW EM 08►

Starting Water-Surface Elevation Check
◄FW SW 01► ◄FW SW 02► ◄FW SW 03► ◄FW SW 04►

X5 Record Check
◄FW X5 01►

Floodway Width Check
◄FW FW 01► ◄FW FW 02► ◄FW FW 03► ◄FW FW 04► ◄FW FW 05► ◄FW FW 06►
◄FW FW 07► ◄FW FW 08►

Surcharge Value Check
◄FW SC 01► ◄FW SC 02►

Floodway Discharge Check
◄FW FD 01►

Encroachment Method Check

FW EM 01   There is only one profile in the input file. In order to run the floodway module, there must be two profiles in the input file.

Help: Please add additional set of T1, T2, T3, J1, and J2 records in the input file after the EJ record.

FW EM 02   The INQ value is not specified on field 2 of J1 record.

Help: The INQ is the field number of the QT and ET records at which discharge and encroachment methods are specified.

FW EM 03 Encroachment method Y was used.

Help: The use of this encroachment method does not conform with FEMA Guidelines. Equal conveyance reduction method is recommended to establish the floodway. First, use encroachment method 4, which computes the floodway width based on the equal conveyance reduction principle. Then encroachment method 1 can be used to smooth out the flooodway.

Encroachment method 2 utilizes a fixed top width. Since this method is not based on the equal conveyance reduction principle it should not be used in the flood insurance studies.

Encroachment method 3 calculates encroachment stations for a specified percent reduction from the natural conveyance of each cross section. Since this method is not based on the equal conveyance reduction principle, it should not be used in the flood insurance studies.

Encroachment method 5 uses the equal percent reduction in conveyance from each overbank as the optimization scheme to obtain the desired target. However, in some cases, the program will not optimize surcharge value, and therefore the floodway width obtained will be too wide. To obtain consistent results for flood insurance studies, method 5 encroachment should not be used.

Encroachment method 6 operates in the same manner as method 5 except that the optimization is based on obtaining a target difference in energy grade line elevation between natural and encroached conditions. This method should not be used since unoptimized floodways can be obtained by this method.

Please use encroachment method 4 or 1 at all the cross-sections.

FW EM 04 Encroachment method -Y was used.

Help: A negative value in front of the X.Y number specifying the target and method of encroachment will use proportional reduction of conveyance. FEMA guidelines require that equal reduction of conveyance be used. First, use encroachment method 4, which computes the floodway width based on the equal conveyance reduction principle. Then encroachment method 1 can be used to smooth out the floodway. Do not use a negative sign in front of the method.

Please use encroachment method 4 or 1 at all the cross sections.

FW EM 05 A surcharge target value of ;x; is greater than the allowable surcharge value of ;s;.

Help: If the computed surcharge value is less than the allowable surcharge value, do not increase the surcharge target value higher than the allowable surcharge value before analyzing the floodplain. If the floodplain has considerable amount of storage, raising the surcharge target value may not raise the computed surcharge value. However, the increase in surcharge target value will decrease the floodway width. The narrowing of the floodway will reduce the floodplain storage, and consequently the discharges can be increased.

It is recommended to use a target value between allowable surcharge value [one foot (X = 10)] and one-tenth of a foot (X = 1) with encroachment method 4 so that the computed floodway elevation does not exceed the maximum allowable surcharge value.

FW EM 06 Method 1 encroachment was specified at the previous cross section. However, a floodway encroachment method was not selected at this section.

Help: Unlike method 4 encroachment, method 1 encroachment cannot carry over to the other cross sections. Method 1 encroachment is only applicable to one cross section. Therefore, if an encroachment method is not selected after a cross section with method 1 encroachment, the cross sections will not be encroached by the HEC-2 program.

Please insert the ET record with encroachment method 1 or 4 before the X1 record of this cross section. The field of the ET record in which the encroachment method should be entered is specified in field 2 of second J1 record in the current HEC-2 input file.

FW EM 07 ET record does not have a bridge encroachment option.

Help: Please append a "1" after Y on the encroachment option X.Y, where X is the surcharge target value and Y is the method of encroachment (i.e. X.Y1) so that the proper encroachment can be made at this road section.

Encroachment at a road does not mean that the fringe area over the road is allowed to be encroached. Since the fringe areas upstream and downstream of the bridge can be filled the roadway in the fringe area cannot be able to convey the flows. By using the bridge encroachment option the road profile is cutoff at the encroachment stations of the downstream cross section for method 4 encroachment to compute the effective weir length when weir flow occurs. It also assures that the same floodway width will be at downstream cross section and over the roadway. Therefore, it is imperative that the GR stations at section 2 must match with the GR and BT stations at section 3.

Bridge encroachment option will also make the HEC-2 program to compute the proper water-surface elevation at section 3 of special bridge and special culvert routine for floodway profile when the flow is low flow or pressure flow condition.

FW EM 08 There is no BT record. The road profile is represented by the road length of ;Rdlen; and not by the BT records.

Help: The road length variable, RDLEN, on field 4 of SB or SC record should not be used if the encroachment methods are specified, because the encroachment methods cannot encroach on RDLEN. In this case BT records must be used instead of RDLEN.

Starting Water-Surface Elevation Check

FW SW 01 The starting water surface elevation ;Cwsel; of the floodway profile is not equal to the computed water surface elevation ; Cwsel; of the natural profile plus the specified surcharge value ;X/10; on first ET record.

Help: Please correct the starting water surface elevation of the floodway profile so it meets the minimum Federal or State requirements. Please note that the following states have floodway requirements that are more stringent than FEMA's minimum requirements. They are:

STATE	Maximum Surcharge
Minnesota	0.5 foot
Ohio	0.5 foot
New Jersey	0.2 foot
Michigan	0.1 foot
Illinois	0.1 foot
Indiana	0.1 foot
Wisconsin	0.0 foot
Montana	0.5 foot
All Other States	1.0 foot

If the studied stream is the continuation of the detailed studied stream, the starting water-surface elevation and the floodway width at the starting section must be the same as the values from the previous studied stream.

However, if the friction slope of the floodway profile is the same as the friction slope of the natural profile, the above message can be ignored.

FW SW 02 The starting water surface elevation ;Cwsel; of the floodway profile is not equal to the allowable surcharge of ";surcharge.no;"foot plus the computed water surface elevation ;Cwsel; of the natural profile."

Help: Please correct the starting water surface elevation of the floodway profile so it meets the minimum Federal or State requirements. Please note that the following states have floodway requirements that are more stringent than FEMA's minimum requirements. They are:

STATE	Maximum Surcharge
Minnesota	0.5 foot
Ohio	0.5 foot
New Jersey	0.2 foot
Michigan	0.1 foot
Illinois	0.1 foot
Indiana	0.1 foot
Wisconsin	0.0 foot
Montana	0.5 foot
All Other States	1.0 foot

However, if the friction slope of the floodway profile is the same as the friction slope of the natural profile, the above message can be ignored.

FW SW 03 The starting friction slope for the floodway profile is different from the starting friction slope of the natural profile.

Help: Floodway width is established from the concept that the conveyance of a cross section for the 100-year flood will be maintained although the portions of the 100-year flood plain outside the main channel is being filled. Conveyance, K, is computed by Q/S^0.5, where Q is the total discharge, and S is the friction slope. If the total discharge at the starting section is the same for natural profile and floodway profile, and the conveyance of the starting cross section for the two profiles are to be the same, then the starting friction slopes for the two profiles should have the same value.

Please note that friction slope can only be specified for the floodway profile starting with method 1 encroachment. It must not be specified for the floodway profile when using method 4 encroachment. HEC-2 program will be in the infinite loop if the friction slope is specified for the floodway profile starting with the method 4 encroachment.

FW SW 04 Second J1 record is not in the input file.

Help: There is only one profile in the input file. In order to run the floodway module, there must be two profiles in the input file. Please insert second J1 record after the second set of T1, T2, and T3 records.

X5 Record check

FW X5 01 An X5 record was used.

Help: X5 record must not be used to specify the water-surface elevations for both natural and floodway profiles. If used, HEC-2 program will supersede the results from the backwater computations with the specified values on the X5 record at that section and the corresponding water-surface elevations may not be correct.

Water-surface elevations from the storage routing analysis must not be used as the known water-surface elevations on X5 record at a structure. The rating table in the storage routing analysis must come from HEC-2 computations. The routed discharge must be used in the HEC-2 model at the upstream and downstream of the structure. The computed water-surface elevation with the routed discharge from the HEC-2 run must be the same as the water-surface elevation obtained from the storage routing analysis upstream of the structure.

Please delete X5 record so that HEC-2 program will determine the water-surface elevations from backwater computations.

Floodway Width Check

FW FW 01 The floodway TOPWID is wider than natural TOPWID.

Help: The following conditions can cause the floodway TOPWID to be wider than the 100-year natural TOPWID.

1. The floodway is inside the channel.

   This will happen when the floodway water-surface elevation (WSEL) is lower than the channel bank elevations. Since the floodway WSEL is higher than the 100-year natural WSEL, the TOPWID of the floodway can be wider than the TOPWID at the 100-year natural WSEL.

2. There is high ground within the floodway widths.

   There are some GR points which has higher elevations than the 100-year WSEL within the floodway width. However, the starting and end stations of the 100-year floodplain are at or outside the encroachment stations.

3. There is no ET record or no encroachment method is specified on the ET record after the cross section with method 1 encroachment.

Encroachment method 1 is only applicable to one cross section. Unlike method 4 encroachment, it cannot be carried over to the next cross section. Floodway width is wider than the 100-year natural topwidth because no encroachment is made at this section.

4. Encroachment method 4 with zero target value is specified at this section (e.g. 0.4).

   Since the target value is zero, no additional depth is going to add to the 100-year natural water-surface elevation to determine the increase in conveyance, which will then be subtracted equally from the overbank conveyances. Since there is no incremental conveyance to be subtracted, encroachment stations are not computed at this cross section. And therefore, if the floodway water-surface is higher than the 100-year natural water-surface, the floodway top width will be wider than the natural top width. Do not use zero as the target value for method 4 encroachment.

5. X3 record overrides ET record.

   If the floodway WSEL is lower than the elevations specified on fields 8 and 9 of X3 record, the encroachment method specified by the ET record will be ignored and the natural and floodway topwidths will be at or within the channel width of the cross section.

   If the encroachment stations and elevations are specified on fields 4, 5, 6,and 7 of X3 record, encroachment method specified by the ET record will be ignored and the natural and floodway topwidths will be determined in accordance with the specified values on fields 4 through 7 of X3 record.

6. The method 1 encroachment is used and the encroachment stations are set wider than the 100-year natural topwidth.

Except for cases 1 and 2, please make necessary adjustments such that the floodway topwidth will be less than the natural topwidth.

FW FW 02 Computed encroachment stations are located within the channel bank stations.

Help: Floodway is defined as the waterway opening which includes the channel portion and adjacent floodplain that will pass the 100-year flood without increasing the 100-year natural water-surface elevation by the allowable surcharge value. By definition, floodways are not to be encroached into the channel portion.

The above message is printed because method 1 encroachment is used to specify the encroachment stations, which are within the channel bank stations. The encroachment stations should be redefined to be at least equal to the channel bank stations.

Please also check that the channel bank stations are located at the ground stations beyond which relatively flat overbank area exists. If the channel bank stations are not properly located, then the channel bank stations should be redefined. However, the encroachment stations must be at or outside the redefined channel bank stations.

Please revise either the channel bank station(s) or change the encroachment station(s) so that the defined channel is not encroached upon.

FW FW 03 Encroachment stations are not computed at this cross section.

Help:

1. There is no ET record or no encroachment method is specified on the ET record after the cross section with method 1 encroachment.

   Encroachment method 1 is only applicable to one cross section. Unlike method 4 encroachment, it cannot be carried over to the next cross section. Floodway width is wider than the 100-year natural topwidth because no encroachment is made at this section.

2. Encroachment method 4 with zero target value is specified at this section (e.g. 0.4).

   Since the target value is zero, no additional depth is going to add to the 100-year natural water-surface elevation to determine the increase in conveyance, which will then be subtracted equally from the overbank conveyances. Since there is no incremental conveyance to be subtracted, encroachment stations are not computed at this cross section. Do not use zero as the target value for method 4 encroachment.

FW FW 04 The left channel bank station may not be at the proper location.

Help: Channel bank stations must be selected such that relatively flat overbank area exists outside the channel banks. The channel banks should not be located at the bottom of the stream. For levees, the channel bank stations should be defined at the crest of the levee.

FW FW 05 Left channel bank station is repeated. GR stations must be increased.

Help: The same GR station is used twice as the channel bank station. In order to define the channel portion of a cross section properly, only one GR station should be used as the channel bank station and the second station should be increased by 0.01 feet (meter).

FW FW 06 The right channel bank station may not be at the proper location.

Help: Channel bank stations must be selected such that relatively flat overbank area exists outside the channel banks. The channel banks should not be located at the bottom of the stream. For levees, the channel bank stations should be defined at the crest of the levee.

FW FW 07 Right channel bank station is repeated. GR stations must be increased.

Help: The same GR station is used twice as the channel bank station. In order to define the channel portion of a cross section properly, only one GR station should be used as the channel bank station and the second station should be increased by 0.01 feet (meter).

FW FW 08 X3 record will override the encroachment method.

Help: If a cross section has an X3 record with stations on either field 4 or field 6, encroachment method on the ET record will not be used by the HEC-2 program. In order to establish the floodway in this case the following procedure should be followed.

X3 record must be removed to make the encroachment method on the ET record to be functional. However, depending upon the starting and ending stations at the 100-year WSEL, GR data may need to be adjusted.

If the starting (SSTA) and ending (ENDST) stations at the 100-year water-surface elevation of the natural profile are within the X3 stations, but not equal to them, then the 100-year water-surface does not reach the X3 stations. The GR data do not need to be adjusted in this case.

If the starting and ending stations at the 100-year WSEL are equal to the encroachment stations on X3 record, the area beyond the X3 stations and below the elevations on fields 5 and 7 of X3 record will not be used by the HEC-2 program in the backwater computations. In order to simulate the same situation without X3 records, GR stations beyond the X3 stations should be elevated to the elevations specified on fields 5 and 7 of X3 record.

When field 5 or 7 of the X3 record does not have an elevation value (i.e. assuming a vertical wall), elevations of the GR stations beyond the X3 stations should be raised above the 500-year elevation.

[However, the assumption of vertical wall will only be valid if the areas beyond the X3 stations are ineffective flow areas. Cluster of buildings such as subdivisions in urban development and non conveying areas such as bay area on a stream are examples of ineffective flow areas.]

After removing the X3 records and making adjustments to GR elevations, encroachment method 4 should be used to determine the floodway.

Next, a final floodway run should be performed using encroachment method 1 with encroachment stations obtained from the first floodway run with encroachment method 4. If the 100-year natural WSEL is below the elevations specified on the X3 record, the GR elevations from the first floodway run should then be changed back to the original GR elevations. The stations from the X3 record must also be specified on the ET record for the natural profile by using method 1 encroachment.

However, for the case when the 100-year WSEL is above the elevations specified on the X3 record, the GR elevations of the first floodway run should not be changed. The stations from the X3 record must not be used also for the natural profile.

If the effective study floodway was established using encroachment method 1 (mostly for revisions and restudies) then the first floodway run with method 4 encroachment may not be necessary. However, X3 record must be deleted and GR elevations must be adjusted as described above. If the duplicate effective model with encroachment method 1 will produce surcharge values more than the allowable value, a new floodway needs to be reestablished by using method 4 encroachment.

Surcharge Value Check

FW SC 01 The surcharge value is negative.

Help: Negative surcharge value normally occurs when the floodway width is too narrow. Narrow floodway width relates to smaller area and higher velocity head, which when subtracted from the energy grade elevation can give water-surface elevation (WSEL) lower than the 100-year natural WSEL. Negative surcharge values can also occur when there are errors in the bridge modeling, and when the floodway widths are too wide at the cross section downstream of the cross section with negative surcharge values.

Negative surcharge values are not accepted in floodway computations by FEMA. Widening narrow floodway widths, correcting bridge modeling, and narrowing wide non-optimized floodway widths may eliminate negative surcharge values.

FW SC 02 The surcharge value is greater than the maximum allowable value of ";surcharge.no;"foot.

Help: The following paragraphs will explain the conditions that can cause the surcharge value to be greater than the allowable value and possible solutions to the problem.

1. The difference in energy grade line elevation between the floodway profile and the natural profile at the downstream section from the first section with excess surcharge is more than the allowable surcharge value.

   This normally happens at a section with too narrow floodway width or at a cross section with critical depth. Floodway width at the downstream section from the section with excess surcharge or at critical depth cross section should be widened. The floodway width can be widened by reducing the surcharge target value in method 4 encroachment. However, for critical depth cross section method 1 encroachment can only be used to widen the floodway width.

2. There is no ET record after the section with method 1 encroachment.

   Since HEC-2 program will not encroach at the cross section the average velocity of the cross section will be reduced for the floodway profile and the floodway WSEL will be increased.

3. The encroachment stations are set in such a way that the effective weir length is too narrow.

   This message is applicable to special bridge and special culvert routines. The effective weir length should be widened by reducing the surcharge target value at section 2 if encroachment method 4 is used. The encroachment stations at section 3 should be redefined to widen the effective weir length if encroachment method 1 is used. Please make sure that the floodway width at section 3 is at least equal to the floodway width at section 2.

4. The conveyance of the floodway profile is less than the conveyance of the natural profile at this cross section or downstream cross section.

   This can cause the friction loss of the floodway profile to be higher than the natural profile. Floodway width at this cross section or the downstream cross section should be widened to increase the conveyance.

5. The floodway width is considered to be too wide at this cross section if the velocity head of the floodway profile is less than the velocity head of the natural profile.

   The floodway width should be reduced to increase the velocity head of the floodway profile.

Floodway Discharge Check

FW FD 01 The floodway discharge is not equal to the natural 100-year discharge.

Help: This situation can happen when a floodway is established through a storage area thus reducing the volume of storage. Decrease in storage attributes to increase in outflow discharge when the 100-year inflow hydrograph is routed through the storage area. Hydrologic models which reflect the with and without reduction in storage area should be reviewed.

The other condition is for the split flow area. For the 100-year natural profile the flow from the main stream may divert into another stream or other flow path of the same stream. For the floodway run the split flow area can be blocked and the split flow may not exist anymore. In that case the floodway discharge can be larger than the 100-year natural discharge. However, the surcharge value cannot be more than the allowable value. If it is more, the split flow area may need to be left open such that the discharges for the natural profile and encroachment profile will be the same.

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CHECK-2 Program, NT Module

User can click the mouse over one of the messages below for more information or press the TAB key to select a message, then press the ENTER key to get more information. To go back to the previous menu press the "B" key.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

Roughness Coefficient Check at the Cross Sections
◄NT RC 01► ◄NT RC 02► ◄NT RC 03► ◄NT RC 04► ◄NT RC 05► ◄NT RC 06►

NC and NH Record Check
◄NT NR 01► ◄NT NR 02► ◄NT NR 03► ◄NT NR 04► ◄NT NR 05►

NV Record Check
◄NT NV 01►

Transition Loss Coefficient Check
◄NT TL 01► ◄NT TL 02► ◄NT TL 03► ◄NT TL 04► ◄NT TL 05► ◄NT TL 06►
◄NT TL 07► ◄NT TL 08► ◄NT TL 09► ◄NT TL 10► ◄NT TL 11► ◄NT TL 12►
◄NT TL 13► ◄NT TL 14► ◄NT TL 15► ◄NT TL 16► ◄NT TL 17► ◄NT TL 18►
◄NT TL 19► ◄NT TL 20► ◄NT TL 21► ◄NT TL 22►

Roughness Coefficient Check at the Structures
◄NT RS 01► ◄NT RS 02► ◄NT RS 03► ◄NT RS 04► ◄NT RS 05► ◄NT RS 06►
◄NT RS 07► ◄NT RS 08► ◄NT RS 09► ◄NT RS 10► ◄NT RS 11► ◄NT RS 12►
◄NT RS 13► ◄NT RS 14► ◄NT RS 15► ◄NT RS 16► ◄NT RS 17► ◄NT RS 18►
◄NT RS 19► ◄NT RS 20► ◄NT RS 21►

Roughness Coefficient Check at the Cross Sections

NT RC 01 Left overbank n value is less than 0.04.

Help: The n value for the overbank area is usually larger than 0.04. If the value used is true, explanation about the roughness coefficient should be given on the comment record.

NT RC 02 Left overbank n value is more than 0.20.

Help: The n value for the overbank area is usually smaller than 0.20. If the value used is true, explanation about the roughness coefficient should be given on the comment record. The roughness coefficient higher than 0.20 may be used for overbank areas when the overbank area is considered as ineffective flow area.

NT RC 03 Right overbank n value is less than 0.04.

Help: The n value for the overbank area is usually larger than 0.04. If the value used is true, explanation about the roughness coefficient should be given on the comment record.

NT RC 04 Right overbank n value is more than 0.20.

Help: The n value for the overbank area is usually smaller than 0.20. If the value used is true, explanation about the roughness coefficient should be given on the comment record. The roughness coefficient higher than 0.20 may be used for overbank areas when the overbank area is considered as ineffective flow area.

NT RC 05 Channel n value is less than 0.025.

Help: The n value for the natural channel usually lies within 0.025 and 0.075. If the value used is true, explanation about the roughness coefficient should be given on the comment record. The roughness coefficient can be lower than 0.025 if the channel is lined with concrete.

NT RC 06 Channel n value is more than 0.075.

Help: The n value for the natural channel usually lies within 0.025 and 0.075. If the value used is true, explanation about the roughness coefficient should be given on the comment record. The roughness coefficient can be higher than 0.075 if the channel is obstructed severely.

NC and NH record Check

NT NR 01 NC record with zero n values is after the NH record. This is the first NC record.

Help: This normally happens when transition loss coefficients are to be specified at the starting section after assigning n values on the NH record. Since NC record is after the NH record, the n values on the NC record will override the n values on the NH record. In this case n values on the NC record are equal to zero, and HEC-2 program will assume a very small n value. This usually will cause the HEC-2 program to compute critical depth at this section. The starting water-surface elevation can be in error. Please recode the NC record before the NH record.

NT NR 02 NC record is after the NH record. The values on NH record will be overridden.

Help: NC record is coded after NH record at this cross section. The n values on the NC record will override the n values on the NH record. If the NC record has zero values on either fields 1, 2, or 3 the n values from the previous NC record will be used at this cross section for the fields with zero values. Those n values may not relate to the n values on the NH record. If the transition loss coefficients on fields 4 and 5 need to be changed, NC record must be coded before the NH record.

NT NR 03 This is a repeated section with NC record. The previous section has NH record. The values from the NC record will override the values on the NH record.

Help: This usually happens at bridge cross sections where the transition loss coefficients need to be changed, and the GR data from the previous cross section is going to be used at this cross section. To solve this problem, the NH record from the previous cross section should be repeated at this cross section, and the NC record should then be coded before the NH record.

NT NR 04 This section is not a repeated section. The previous section has NH record. There is no N record at this section.

Help: If there is no N record at this cross section HEC-2 program will use the n values from the previous NH record. Since it is not a repeated cross section GR data on this section and the GR data from the previous cross section can be different. The computed water-surface elevations can be in error. Please insert an NH or NC record at this section.

NT NR 05 The channel portion is subdivided by the NH record.

Help: More than one n value is specified between the channel bank stations. If the slope between the left channel bank station and the next GR station is steeper than 5H:1V, or the slope between the right channel bank station and the previous GR station is steeper than 5H:1V, the HEC-2 program will compute a composite n value for the channel portion. This option is available only for the HEC-2 program version 4.6.0 and later. The earlier versions of the HEC-2 program do not have this option. For revisions, when running the duplicate effective model, the water surface elevation between the duplicate effective model and the effective model can be different, because the effective model did not compute a composite n value. In that case duplicate model should be used as the new baseline model.

NV record Check

NT NV 01 NV record used.

Help: NV record is used when the channel portion has different n values for different water levels. Normally n values are smaller for the area below the mean water-surface elevation (WSEL) of a stream. The area between the mean WSEL and the channel banks are normally covered with vegetation and n values can be higher than the area below the mean WSEL. However, the area above the channel banks can have lower n values than the area between mean WSEL and the channel banks. Explanation should be given on the comment records how the n values are selected at this section.

Transition Loss Coefficient Check

NT TL 01 This is section 2 of Special Bridge routine. Contraction and expansion loss coefficients are ;Cc; and ;Ce;, respectively. They should be equal to 0.3 and 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 02 This is section 3 of Special Bridge routine. Contraction and expansion loss coefficients are ;Cc; and ;Ce;, respectively. They should be equal to 0.3 and 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 03 This is section 3 of Special Bridge routine. However, sections 4 and 5 are not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when sections 4 and 5 of downstream special bridge or special culvert overlap with sections 2 and 3 of any upstream structure, SECNOs will be assigned to sections 2 and 3 of upstream structure, and error message will be printed for sections 4 and 5.

Please add sections 4 and 5 at this structure. Section 5 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 04 This is section 4 of Special Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 05 This is section 3 of Special Bridge routine. However, section 5 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when sections 5 of downstream special bridge or special culvert overlap with section 2 or 3 of any upstream structure, SECNO will be assigned to section 2 or 3 of upstream structure, and error message will be printed for section 5.

Please add section 5 at this structure. Section 5 of this bridge can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 06 This is section 5 of Special Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.1. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.3.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 07 This is section 2 of Special Culvert routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 08 This is section 3 of Special Culvert routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 09 This is section 3 of Special Culvert routine. However, sections 4 and 5 are not at this structure.

Help: This situation occurs, when there is another bridge upstream. Please refer to message NT TL 03.

Please add sections 4 and 5 at this structure. Section 5 of this bridge can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 10 This is section 4 of Special Culvert routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 11 This is section 3 of Special Culvert routine. However, section 5 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

Please add section 5 at this structure. Section 5 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 12 This is section 5 of Special Culvert routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.1. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.3.

Help: For Special Bridge and Special Culvert routines, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 4 and 3. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 5.

NT TL 13 This is section 2 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 14 This is section 3 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 15 This is section 4 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 16 This is section 5 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 17 This is section 3 of Normal Bridge routine. However, sections 6 and 7 are not at this structure.

Help: This situation occurs, when there is another bridge upstream.

Please add sections 6 and 7 at this structure. Section 7 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 18 This is section 6 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.3. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.5.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 19 This is section 3 of Normal Bridge routine. However, section 7 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

Please add section 7 at this structure. Section 7 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT TL 20 This is section 7 of Normal Bridge routine. Contraction loss coefficient is equal to;Cc;. It should be equal to 0.1. Expansion loss coefficient is equal to;Ce;. It should be equal to 0.3.

Help: For Normal Bridge routine, expansion of flow occurs between sections 2 and 1, and contraction of flow occurs between sections 6 and 5. Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 should be specified at section 2 and the values should be changed back to contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 at section 7.

NT TL 21 Contraction loss coefficient of 0.3, and expansion loss coefficient of 0.5 were used. However, this cross section is not at the structure. Contraction loss coefficient of 0.1 and expansion loss coefficient of 0.3 should be used.

Help: The following contraction and expansion loss coefficients are recommended by the HEC-2 User's Manual.

	Contraction	Expansion
No transition loss computed	0.0	0.0
Gradual transitions	0.1	0.3
Bridge sections	0.3	0.5
Abrupt transitions	0.6	0.8

Since HEC-2 program used the gradually varied flow equation to compute the water-surface elevations, contraction coefficient of 0.1 and expansion coefficient of 0.3 should be used at the cross sections other than at the bridges. For special bridge and special culvert routines, contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used at sections 2, 3 and 4. For normal bridge routine, contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used at sections 2, 3, 4, 5, and 6. Without calibration runs, these suggested values should be used in the flood insurance studies.

NT TL 22 Contraction loss coefficient and expansion loss coefficient are ;Cc; and ;Ce;,respectively. Contraction loss coefficient and expansion loss coefficient should be 0.1 and 0.3, respectively.

Help: The following contraction and expansion loss coefficients are recommended by the HEC-2 User's Manual.

	Contraction	Expansion
No transition loss computed	0.0	0.0
Gradual transitions	0.1	0.3
Bridge sections	0.3	0.5
Abrupt transitions	0.6	0.8

Since HEC-2 program used the gradually varied flow equation to compute the water-surface elevations, contraction coefficient of 0.1 and expansion coefficient of 0.3 should be used at the cross sections other than at the bridges. For special bridge and special culvert routines, contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used at sections 2, 3 and 4. For normal bridge routine, contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used at sections 2, 3, 4, 5, and 6. Without calibration runs, these suggested values should be used in the flood insurance studies.

Roughness Coefficient Check at the Structures

NT RS 01 This is section 3 of special bridge routine. However, section 1 is not at this structure.

Help: This situation occurs, when there is another bridge downstream.

If the downstream structure is special bridge or special culvert, please add sections 4 and 5 to downstream structure, if section 1 of this structure overlaps with section 3 of downstream structure; and add section 5 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure.

If the downstream structure is normal bridge, please add sections 5, 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure; add sections 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 5 of downstream structure; and add section 7 to downstream structure, if section 1 of this structure overlaps with section 6 of downstream structure.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 02 This is section 2 of Special Bridge routine. NCH of;Nch2; at SECNO;Secno2; is not the same as NCH of ;Nch1; at SECNO;Secno1.

Help: The section 2 of Special Bridge or Special Culvert routine should be located at the downstream toe of the embankment or wing walls. If an energy dissipation structure exists downstream of the structure, section 2 should be located downstream of the energy dissipation structure.

The water-surface elevation at section 2 should reflect the tailwater elevation of the structure, which is controlled by the downstream floodplain conditions and not by the flow condition coming out of the structure or over the structure. The HEC-2 program does not compute the conjugate depths downstream of the structure, except for Special Bridge Low Flow condition. Although the HEC-2 program gives information for conjugate elevations for low flow conditions in a Special Bridge routine, it does not analyze whether the hydraulic jump is a free jump or a drowned jump. This problem is not only with the HEC-2 program but also with other backwater programs.

Before the detailed analysis of hydraulic jump downstream of the structure can be incorporated into the backwater programs the water-surface elevation at section 2 should be based upon the losses between sections 1 and 2. The losses to be considered are the transition loss and the friction loss. The friction loss shown in the HEC-2 printout at section 2 represents the friction loss for the reach between sections 1 and 2. The friction loss for the reach is computed by multiplying the average friction slope of sections 1 and 2 and the weighted reach length at section 2. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 2 should represent the roughness coefficient of the reach between sections 1 and 2. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure, or the energy dissipation structure, or the erosion protection downstream of the structure.

Since no other information is available, Check-2 program assumes that the roughness coefficient at section 2 should at least be equal to the roughness coefficient at section 1. If that is not the case, explanation should be given on the comment record at section 2 how the roughness coefficient is selected.

NT RS 03 This is section 2 of Special Bridge routine. Channel n value is less than 0.025.

Help: Sections 2 and 3 of Special Bridge and Special Culvert routines must not use the n values of the structures. The n values at these sections must represent the natural valley cross section because the friction loss at section 2 must correspond to the reach between sections 1 and 2, and the friction loss at section 4 must correspond to the reach between sections 3 and 4. The losses between sections 2 and 3 are computed from the information given on SB and SC records. The n value of the structure is considered in the friction loss coefficient when determining XKOR value. The XKOR value is on field 2 of SB record. The first field of SC record has the n value of the structure.

NT RS 04 This is section 3 of special bridge routine. However, section 4 is not at this structure.

Help: This situation occurs, when there is another bridge upstream. Please refer to message NT TL 03.

Please add sections 4 and 5 at this structure. Section 5 of this bridge can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 05 This is section 3 of Special Bridge routine. NCH of;Nch3; at SECNO;Secno3; is not the same as NCH of ;Nch4; at SECNO;Secno4.

Help: The section 3 of Special Bridge or Special Culvert routine should be located at the upstream toe of the embankment or wing walls.

The energy grade elevation at section 3 is computed from the bridge and culvert analyses, and the roughness coefficient of section 3 is not involved in the computation of losses between sections 2 and 3 (i.e. between downstream and upstream of the structure).

The friction loss shown in the HEC-2 printout at section 4 represents the friction loss for the reach between sections 3 and 4. The friction loss for the reach is computed by multiplying the average friction slope of sections 3 and 4 and the weighted reach length at section 4. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 3 should represent the roughness coefficient of the reach between sections 3 and 4. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure.

Since no other information is available, Check-2 program assumes that the roughness coefficient at section 3 should at least be equal to the roughness coefficient at section 4. If that is not the case, explanation should be given on the comment record at section 3 how the roughness coefficient is selected.

NT RS 06 This is section 3 of Special Bridge routine. Channel n value is less than 0.025.

Help: Sections 2 and 3 of Special Bridge and Special Culvert routines must not use the n values of the structures. The n values at these sections must represent the natural valley cross section because the friction loss at section 2 must correspond to the reach between sections 1 and 2, and the friction loss at section 4 must correspond to the reach between sections 3 and 4. The losses between sections 2 and 3 are computed from the information given on SB and SC records. The n value of the structure is considered in the friction loss coefficient when determining XKOR value. The XKOR value is on field 2 of SB record. The first field of SC record has the n value of the structure.

NT RS 07 This is section 3 of special culvert routine. However, section 1 is not at this structure.

Help: This situation occurs, when there is another bridge downstream.

If the downstream structure is special bridge or special culvert, please add sections 4 and 5 to downstream structure, if section 1 of this structure overlaps with section 3 of downstream structure; and add section 5 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure.

If the downstream structure is normal bridge, please add sections 5, 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure; add sections 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 5 of downstream structure; and add section 7 to downstream structure, if section 1 of this structure overlaps with section 6 of downstream structure.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 08 This is section 2 of Special Culvert routine. NCH of;Nch2; at SECNO;Secno2; is not the same as NCH of ;Nch1; at SECNO; Secno1.

Help: The section 2 of Special Bridge or Special Culvert routine should be located at the downstream toe of the embankment or wing walls. If an energy dissipation structure exists downstream of the structure, section 2 should be located downstream of the energy dissipation structure.

The water-surface elevation at section 2 should reflect the tailwater elevation of the structure, which is controlled by the downstream floodplain conditions and not by the flow condition coming out of the structure or over the structure. The HEC-2 program does not compute the conjugate depths downstream of the structure, except for Special Bridge Low Flow condition. Although the HEC-2 program gives information for conjugate elevations for low flow conditions in a Special Bridge routine, it does not analyze whether the hydraulic jump is a free jump or a drowned jump. This problem is not only with the HEC-2 program but also with other backwater programs.

Before the detailed analysis of hydraulic jump downstream of the structure can be incorporated into the backwater programs the water-surface elevation at section 2 should be based upon the losses between sections 1 and 2. The losses to be considered are the transition loss and the friction loss. The friction loss shown in the HEC-2 printout at section 2 represents the friction loss for the reach between sections 1 and 2. The friction loss for the reach is computed by multiplying the average friction slope of sections 1 and 2 and the weighted reach length at section 2. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 2 should represent the roughness coefficient of the reach between sections 1 and 2. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure, or the energy dissipation structure, or the erosion protection downstream of the structure.

Since no other information is available, Check-2 program assumes that the roughness coefficient at section 2 should at least be equal to the roughness coefficient at section 1. If that is not the case, explanation should be given on the comment record at section 2 how the roughness coefficient is selected.

NT RS 09 This is section 2 of Special Culvert routine. Channel n value is less than 0.025.

Help: Sections 2 and 3 of Special Bridge and Special Culvert routines must not use the n values of the structures. The n values at these sections must represent the natural valley cross section because the friction loss at section 2 must correspond to the reach between sections 1 and 2, and the friction loss at section 4 must correspond to the reach between sections 3 and 4. The losses between sections 2 and 3 are computed from the information given on SB and SC records. The n value of the structure is considered in the friction loss coefficient when determining XKOR value. The XKOR value is on field 2 of SB record. The first field of SC record has the n value of the structure.

NT RS 10 This is section 3 of special culvert routine. However, section 4 is not at this structure.

Help: This situation occurs, when there is another bridge upstream. Please refer to message NT TL 03.

Please add sections 4 and 5 at this structure. Section 5 of this bridge can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 11 This is section 3 of Special Culvert routine. NCH of;Nch3; at SECNO;Secno3; is not the same as NCH of ;Nch4; at SECNO;Secno4.

Help: The section 3 of Special Bridge or Special Culvert routine should be located at the upstream toe of the embankment or wing walls.

The energy grade elevation at section 3 is computed from the culvert analyses, and the roughness coefficient of section 3 is not involved in the computation of losses between sections 2 and 3 (i.e. between downstream and upstream of the structure).

The friction loss shown in the HEC-2 printout at section 4 represents the friction loss for the reach between sections 3 and 4. The friction loss for the reach is computed by multiplying the average friction slope of sections 3 and 4 and the weighted reach length at section 4. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 3 should represent the roughness coefficient of the reach between sections 3 and 4. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure.

Since no other information is available, Check-2 program assumes that the roughness coefficient at section 3 should at least be equal to the roughness coefficient at section 4. If that is not the case, explanation should be given on the comment record at section 3 how the roughness coefficient is selected.

NT RS 12 This is section 3 of Special Culvert routine. Channel n value is less than 0.025.

Help: Sections 2 and 3 of Special Bridge and Special Culvert routines must not use the n values of the structures. The n values at these sections must represent the natural valley cross section because the friction loss at section 2 must correspond to the reach between sections 1 and 2, and the friction loss at section 4 must correspond to the reach between sections 3 and 4. The losses between sections 2 and 3 are computed from the information given on SB and SC records. The n value of the structure is considered in the friction loss coefficient when determining XKOR value. The XKOR value is on field 2 of SB record. The first field of SC record has the n value of the structure.

NT RS 13 The n value on the SC record is equal to;SCn;. However, field 8 of SC record indicates that the culvert is made of corrugated metal. Therefore n value should be between 0.024 and 0.033.

Help: The culverts are normally made of concrete or corrugated metal. The roughness coefficient of these materials range from 0.012 to 0.015 for concrete, and 0.024 to 0.033 for corrugated metal. If the assigned n value for the culvert is correct, please give explanation on the comment record.

NT RS 14 The n value on the SC record is equal to;SCn;. However, field 8 of SC record indicates that the culvert is made of concrete. Therefore n value should be between 0.012 and 0.015.

Help: The culverts are normally made of concrete or corrugated metal. The roughness coefficient of these materials range from 0.012 to 0.015 for concrete, and 0.024 to 0.033 for corrugated metal. If the assigned n value for the culvert is correct, please give explanation on the comment record.

NT RS 15 This is section 3 of normal bridge routine. However, section 1 is not at this structure.

Help: This situation occurs, when there is another bridge downstream.

If the downstream structure is special bridge or special culvert, please add sections 4 and 5 to downstream structure, if section 1 of this structure overlaps with section 3 of downstream structure; and add section 5 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure.

If the downstream structure is normal bridge, please add sections 5, 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure; add sections 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 5 of downstream structure; and add section 7 to downstream structure, if section 1 of this structure overlaps with section 6 of downstream structure.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 16 This is section 2 of Normal Bridge routine. NCH of;Nch2; at SECNO;Secno2; is not the same as NCH of ;Nch1; at SECNO;Secno1.

Help: The section 2 of Normal Bridge routine should be located at the downstream toe of the embankment or wing walls. If an energy dissipation structure exists downstream of the structure, section 2 should be located downstream of the energy dissipation structure.

The friction loss shown in the HEC-2 printout at section 2 represents the friction loss for the reach between sections 1 and 2. The friction loss for the reach is computed by multiplying the average friction slope of sections 1 and 2 and the weighted reach length at section 2. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 2 should represent the roughness coefficient of the reach between sections 1 and 2. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure, or the energy dissipation structure, or the erosion protection downstream of the structure.

NT RS 17 This is section 2 of Normal Bridge routine. Channel n value is less than 0.025.

Help: For Normal Bridge routine, the n values at sections 2 and 5 must represent the n values of natural valley cross section. The n value at sections 3 and 4 must represent the n value of the structure. Therefore, n value for the channel portion of sections 3 and 4 can be lower than 0.025.

NT RS 18 This is section 4 of Normal Bridge routine. NCH of;Nch4; at SECNO;Secno4; is not the same as NCH of ;Nch3; at SECNO;Secno3.

Help: The n values at sections 3 and 4 of Normal Bridge routine represent the n value of the structure. Section 3 is located just inside the downstream end of the structure and section 4 is located just inside the upstream end of the structure. Therefore, same n value should be used at sections 3 and 4. If different n values should be used, please provide the explanation on the comment record.

NT RS 19 This is section 3 of normal bridge routine. However, section 6 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

Please add sections 6 and 7 at this structure. Section 7 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

NT RS 20 This is section 5 of Normal Bridge routine. NCH of;Nch5; at SECNO;Secno5; is not the same as NCH of ;Nch6; at SECNO;Secno6.

Help: The section 5 of Normal Bridge routine should be located at the upstream toe of the embankment or wing walls.

The friction loss shown in the HEC-2 printout at section 6 represents the friction loss for the reach between sections 5 and 6. The friction loss for the reach is computed by multiplying the average friction slope of sections 5 and 6 and the weighted reach length at section 6. The friction slope is based on the roughness coefficient at a section. Therefore, the roughness coefficient at section 5 should represent the roughness coefficient of the reach between sections 5 and 6. It should not represent the roughness coefficient of the structure, or the apron of the wing wall structure.

NT RS 21 This is section 5 of Normal Bridge routine. Channel n value is less than 0.025.

Help: For Normal Bridge routine, the n values at sections 2 and 5 must represent the n values of natural valley cross section. The n value at sections 3 and 4 must represent the n value of the structure. Therefore, n value for the channel portion of sections 3 and 4 can be lower than 0.025.

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CHECK-2 Program, XSEC Module

User can click the mouse over one of the messages below for more information or press the TAB key to select a message, then press the ENTER key to get more information. To go back to the previous menu press the "B" key.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

Distance Check
◂XS DT 01▸ ◂XS DT 02▸ ◂XS DT 03▸ ◂XS DT 04▸ ◂XS DT 05▸ ◂XS DT 06▸

Channel Width Check
◄XS CW 01► ◄XS CW 02►

Spacing Check
◄XS SP 01► ◄XS SP 02►

Ineffective Flow Area Check
◄XS IF 01► ◄XS IF 02► ◄XS IF 03► ◄XS IF 04► ◄XS IF 05► ◄XS IF 06►

Location Check
◄XS LC 01►

Discharge Check
◄XS DC 01► ◄XS DC 02► ◄XS DC 03► ◄XS DC 04► ◄XS DC 05►

Starting Water-surface Elevation Check
◄XS SW 01► ◄XS SW 02► ◄XS SW 03► ◄XS SW 04► ◄XS SW 05► ◄XS SW 06►
◄XS SW 07► ◄XS SW 08► ◄XS SW 09► ◄XS SW 10► ◄XS SW 11►

Distance Check

XS DT 01 Both right and left overbank distances are longer than the channel distance.

Help: Normally channel distance is longer than the overbank distance for straight floodplain because channel distance is measured along the thalweg (locus of the lowest point on a cross section along a stream) which usually is a meandering channel. The overbank distance is measured from the centroid of the floodplain of the overbank area of the upstream cross section to the centroid of the floodplain of the overbank area of the downstream cross section as a straight distance.

If the floodplain is at a bend, then the overbank distance at the outer bend is normally greater than the channel distance; and the channel distance is normally greater than the overbank distance at the inner bend. The overbank distance is measured from centroid to centroid of the upstream and downstream floodplains of the overbank area following the curvature of the bend. Therefore, it is unlikely that both the overbank distances can be longer than the channel distance. The distances should be reexamined according to the above explanation. If the distances are unchanged a comment record should be included at this section explaining the situation.

XS DT 02 Channel distance is equal to zero.

Help: Probable typographic error.

XS DT 03 Right overbank distance is equal to zero.

Help: Probable typographic error.

XS DT 04 Left overbank distance is equal to zero.

Help: Probable typographic error.

XS DT 05 Right overbank distance is more than five times greater than the channel distance. Right overbank distance may be in error.

Help: Probable typographic error. Or the distances are not measured properly. Please refer to message XS DT 01.

XS DT 06 Left overbank distance is more than five times greater than the channel distance. Left overbank distance may be in error.

Help: Probable typographic error. Or the distances are not measured properly. Please refer to message XS DT 01.

Channel Width Check

XS CW 01 Left channel bank station is greater than the right channel bank station.

Help: Probable typographic error.

XS CW 02 Channel width changes by a factor of two when compared to the downstream cross section.

Help: Except at the structures, the channel width should be changed gradually from downstream to upstream section. Please check the location of the channel bank stations. Channel bank stations should be located at the ground stations beyond which a relatively flat overbank area exists. However, at the structures, the channel bank stations are normally set at the abutments and may not be at the natural channel banks.

Spacing Check

XS SP 01 Change in HV > 0.5; and ; 0.7 < Kratio > 1.4 ;
Floodplain TOPWID changes by more than a factor of 2 ;
(CWSEL2 - CWSEL1) > 1.0 foot;
Additional cross sections may need to be added between
Secno;Secno1; and Secno;Secno2.

Help: Water-surface profiles computations are based on the gradually varied flow equation. Conditions 1 and 2 indicate that the cross sections are not changing gradually in shape. Condition 3 assures that there is physical evidence on the plan view of the floodplain that the floodplain width changes by a factor of two. Condition 4 indicates that the difference in water-surface elevation between the two cross sections is more than 1 foot and that increase may be caused by non gradual change in shape of cross section. If all these conditions are true, additional cross section may need to be added between the two cross sections. This check is performed at non bridge cross sections.

XS SP 02 The variable in Field 7 of J1 record for profile;#; must be removed from the input file.

Help: If a value is specified in this field, HEC-2 program will automatically insert interpolated cross sections when the change in velocity head is more than the specified value. As explained under Message XS 3.1 four conditions should be satisfied to insert additional cross sections. For most of the flood insurance studies studied in detail, multiple profiles analysis and floodway analysis need to be analyzed. Since the velocity head difference between two cross sections for each profile can not be the same, HEC-2 program will then produce different interpolated cross sections for different profiles. This will create inconsistent analysis among different profiles. To be consistent in the backwater computations additional cross sections should not be generated automatically by the program but should be added by the user when all four conditions as explained under Message XS 3.1 is met.

Ineffective Flow Area Check

XS IF 01 The INQ value is not specified on field 2 of first J1 record.

Help: The INQ is the field number of QT and ET record from which discharge and encroachment method is determined for the first profile.

XS IF 02 Encroachment method ;ETValue; is used for the natural profile.

Help: Encroachment method 1 is used to limit the effective flow area. This approach is used to exclude the ineffective flow areas behind the levees and other non conveying areas. Explanation must be given on the comment record why encroachment method 1 was used for natural profile.

If the encroachment method 1 is used for the natural profile, the encroachment profile in the floodway run must also use encroachment method 1. However, before using encroachment method 1, equal conveyance reduction method, method 4, must be used to establish the floodway. When using method 4, the ground elevation of the ineffective flow areas must be raised first above the 500-year elevation to block the ineffective flow areas to be not included in the floodway determination.

After determining the floodway, a second floodway run should be performed by using encroachment method 1 for both natural and encroachment profiles. The encroachment stations for the natural profile will be at the limit of the ineffective flow area and the encroachment stations for the encroachment profile will be the same as the encroachment stations from the method 4 run. The ground elevations for the ineffective flow areas must be changed back to the original values.

XS IF 03 X3 record is used at this section.

Help: X3 record may be used to exclude the ineffective flow areas behind the levees and other non conveying areas. However, X3 record will override the encroachment method in a floodway analysis if the stations are specified on field 4 or 6 of X3 record. Please refer message FW FW 08 on how to handle the X3 record in floodway determination.

If X3 record with 10 on the first field is used, the limiting elevations on fields 8 and 9 should be equal to the channel bank elevations. If the values are zeroes, HEC-2 will use the channel bank elevations from the GR data. For a levee system channel bank stations should be at the crest of the levee.

If there is a depressional area on the overbank, then the elevations may need to be specified on field 5 or 7. The area below the elevation will not be considered in the conveyance computations. However, the n values for those areas should still be represented by the roughness of the ground cover and not by the water surface.

XS IF 04 Divided flow.

Help: Divided flow is denoted by D in the summary table. It happens when there are high grounds in the floodplain. If the symbol D occurs consecutively for three or four cross sections check whether the high ground is an island in the middle of the stream. If that is the case, a divided flow analysis may be performed to determine the water surface elevations on each branch of the stream.

If the high ground is a levee, the area protected by the levee should not be included in the backwater computations. The protected area can be excluded by using

X3 record in the multiple profile run and method 1 encroachment in the floodway run.

The area between the high grounds in the overbank areas can be treated as local depressions if that area is not connected by the flow paths to convey flow from upstream to downstream of the floodplain. In that case, local depressions can be excluded from backwater computations by using X3 record in the multiple profile run and method 1 encroachment in the floodway run.

Most of the times Divided Flow message can be ignored because the several flow paths created by the high grounds can be considered as one continuous floodplain.

XS IF 05 Cross section extended.

Help: Extended Cross Section message is denoted by E in the summary table. This message will occur when the starting station or end station of the GR points is lower than the computed water-surface elevation, CWSEL, and the HEC-2 program extends the cross section vertically at the starting and end stations. This can happen when the cross section is not wide enough to cover the entire floodplain. For flood insurance studies the cross section should cover the 100-year floodplain. The cross section may not need to cover the entire floodplain when the areas beyond the starting and end stations can be considered as ineffective flow areas.

XS IF 06 Critical Depth.

Help: Critical Depth message is denoted by C in the summary table. Critical depth will occur at a cross section when the total area is too small to carry the flow, when the "n" values are too small, and when the channel slope steepens abruptly. The smaller area is usually associated with the narrower width.

When critical depth occurs at a cross section, check that whether the cross section was cut off too narrow at the ineffective flow areas, or the sections 2 and 3 of Special Bridge routine and Special Culvert routine, and sections 2 and 5 of Normal Bridge routine are coded as the shape of the bridge opening (they must be coded as the natural valley cross section), or the channel "n" value at sections 2 and 3 of Special Bridge or Special Culvert routines and sections 2 and 5 of Normal Bridge routine are represented by the "n" value of the structure and can be too low (the channel "n" value at those sections must represent the "n" value of the natural valley cross section.) If the critical depth occurs at a cross section where there is an abrupt rise in minimum elevation of the channel, check from the topographic map that there is physical evidence for this rise, such as an existence of a weir or dam.

XS IF 07 X5 record.

Help: X5 record must not be used to fix the water-surface elevations of both the natural and floodway profiles.

Location Check

XS LC 01 This cross section is located too far upstream from the critical depth cross section.

Help: The friction slope at the critical depth cross section can be large. If a cross section is located too far upstream from the critical depth cross section the friction losses between the two cross sections can be computed too large. Critical depth normally occurs at constricted cross sections. The cross section upstream of the critical depth cross section should be located no further than one time the topwidth of the critical depth cross section for the 100-year flood. This criteria is based on the location of cross sections for the bridges, where the approach section is located one time the bridge opening upstream of the bridge.

Discharge Check

XS DC 01 Discharge decreases in the downstream direction.

Help: Normally, discharges should be increasing in the downstream direction. The discharges can be decreased if a flood hydrograph is routed through a reservoir, or some flows are diverted into another stream or other watershed. A hydrologic model should be available to compare the discharges and water-surface elevation at the reservoir in the HEC-2 model. The discharges and the water-surface elevation in the hydrologic model must be the same as the values in the HEC-2 model. The discharge downstream from the reservoir (outflow from the reservoir) in the hydrologic model must be used as the discharge at the downstream and upstream of the structure (such as, dam, weir, spillway), and the peak discharge of the inflow hydrograph from the hydrologic model should be used at the cross section in the HEC-2 model where the backwater from the structure no longer exist.

XS DC 02 Constant discharge used for the entire profile.

Help: If only one set of discharge is used then the discharge at the upstream portion of the stream may be too large. Discharge should be changed upstream of the confluence of a tributary and at locations where there is significant change in drainage area.

XS DC 03 Discharge is different between the upstream side and downstream side of the structure.

Help: The amount of flow goes through a structure should be the same at each end of the structure, except for long culverts with lateral inflows. The discharge values should be the same at sections 2 and 3 of Special Bridge and Special Culvert routines, and at sections 2, 3, 4 and 5 of Normal Bridge routine.

XS DC 04 There is no flow on the left overbank at the downstream cross section. There is no flow on the right overbank at this section.

Help: There should be gradual change in discharges for the overbank areas between two cross sections. In this case a cross section is located at a place where there is no flow on the left overbank and the next cross section is at a place where there is no flow on the right overbank. A cross section should be inserted between these two cross sections such that there will be flow on both the overbank areas at this section, and the discharges on the overbank areas will change gradually from one section to the other.

XS DC 05 There is no flow on the right overbank at the downstream cross section. There is no flow on the left overbank at this section.

Help: There should be gradual change in discharges for the overbank areas between two cross sections. In this case a cross section is located at a place where there is no flow on the right overbank and the next cross section is at a place where there is no flow on the left overbank. A cross section should be inserted between these two cross sections such that there will be flow on both the overbank areas at this section, and the discharges on the overbank areas will change gradually from one section to the other.

Starting Water-surface Elevation Check

XS SW 01 Default friction slope method was not used.

Help: J6 record is used to select equations for computations of friction losses. HEC-2 program uses average conveyance method as a default option. If the default option is used J6 record is not needed. J6 record can select other friction loss methods, namely, average friction slope, geometric mean friction slope, or harmonic mean slope. It can also select one of the above mentioned friction loss equations on a reach by reach basis depending on the type of backwater curve, if 1 is specified on field one of J6 record. If this option is chosen, computed friction slope at the same cross section for multiple profiles can be different. Before definitive conclusion can be made on which friction loss method should be considered in the backwater computations the default option, average conveyance method, should be used for HEC-2 program. However, when HEC-2 is used to emulate other computer programs, such as E431, J6 record must be used.

XS SW 02 Known water-surface elevation is specified on the first J1 record.

Help: The known water-surface elevation (WSEL) specified on field 9 of first J1 record must be equal to the 100-year WSEL from the output file of the multiple profile run.

Contiguous Study

If the known water-surface elevation is obtained from a contiguous community, check also that the minimum elevation of the starting cross section and the starting discharges are also the same.

Backwater Elevation

Backwater elevation from the main stream should not be used as the starting water-surface elevation for the tributary except for coincident peaks.

Coincident Peak

The coincident peak assumption can be accepted if the drainage area of the tributary is more than 0.6 times the drainage area of the main stream, and the time of concentration of the tributary is more than 0.8 times the time of concentration of the main stream.

If the coincident peak assumption is not valid, the starting water-surface elevation for the floodway profile can be too high. The slope/area method should be used to determine the 100-year natural WSEL.

Slope/Area Method

The slope/area method is based on the assumption that the uniform flow can be assumed at the starting point of the stream. For the uniform flow, channel bottom slope, water surface slope, and friction slope are parallel to one another. Therefore, channel bottom slope at the vicinity of the starting point of the stream can be used as the friction slope on field 5 of first J1 record.

If the water-surface slope is too steep or too flat compared to the channel bottom slope at the vicinity of the starting point, the starting water-surface elevation can be in error.

If the cause of steepness or flatness of the water-surface slope is not due to a structure downstream of the starting point, constricted cross section, or known water-surface elevation, friction slope specified on field 5 of J1 record should be the same as the channel bottom slope at the vicinity of the starting point. The channel bottom slope can be determined by the following methods.

1. For increasing slopes, determine from the profile, or from the printout by dividing the difference in minimum elevation (ELMIN) between the first two cross sections by the channel distance (XLCH) between them.

2. If the profile shows an adverse slope at the starting point, use average channel bottom elevations of the first two cross sections in lieu of the ELMIN value to determine the channel bottom slope. If this approach still gives an adverse slope, then use USGS quadrangle maps to determine the average channel bottom slope in the vicinity of the starting point.

3. If the channel bottom slope is very flat, start with different starting water-surface elevations for a given discharge from a distance far enough downstream that all the water-surface profiles will converge at the starting point of the study.

Mean Annual Flood Elevation

If the water-surface elevation obtained by the slope/area method for a tributary is lower than the mean annual flood elevation of the main stream, starting water-surface elevation for the tributary should be started from the mean annual flood elevation of the main stream.

Mean High Tide

If the mean high tide is used as the starting water-surface elevation, check with the values given in Tide Tables 19__, High and Low Water Predictions - East Coast of North and South America, including Greenland, U.S. Department of Commerce, NOAA. The year of the publication should be the same as the year the study is completed.

Rating Curve

If the starting water-surface elevation is obtained from a rating curve, the backup information should be obtained.

XS SW 03 Starting friction slope and approximate starting water-surface elevation are not specified on the first J1 record.

Help: HEC-2 program will start the starting water-surface elevation between the maximum and minimum ground elevations, and the starting water-surface elevation can be too low. Insert proper friction slope on field 5 of first J1 record. Please refer to Message XS SW 02 for proper selection of friction slope.

XS SW 08 The profile is computed as supercritical profile.

Help: This file has only one profile, and field 4 of J1 record is equal to 1. Supercritical profile may be analyzed for engineered channels. For natural channels subcritical profile should be analyzed. If the entire profile is not an engineered channel, a subcritical profile must be analyzed and the two profiles should be superimposed to determine the final profile.

The type of profile will be changed at a cross section after which a series of critical depth cross sections exist, starting from that section. Hydraulic jump or drawdown profiles are not acceptable for the flood insurance studies. At the cross section where the profile changes from supercritical to subcritical, subcritical water surface profile should be continued as horizontal line until it crosses the supercritical profile.

When reversing the files to run from one type of profile to another type, care must be taken in checking the n values, discharges, and bridge records (SB and SC) at each cross section. These values must be the same between the two profiles.

XS SW 09 The first profile is computed as supercritical profile, and second profile is computed as supercritical profile.

Help: This file has two profiles with field 4 of J1 record with a value of 1. HEC-2 program will compute as supercritical profiles.

Supercritical profile may be analyzed for engineered channels. For natural channels subcritical profile should be analyzed. If the entire profile is not an engineered channel, a subcritical profile must be analyzed and the two profiles should be superimposed to determine the final profile for the 100-year unencroached condition.

The type of profile will be changed at a cross section where a series of critical depth cross sections exist, starting from that section. Hydraulic jump or drawdown profiles are not acceptable for the flood insurance studies. At the cross section where the profile changes from supercritical to subcritical, subcritical water surface profile should be continued as horizontal line until it crosses the supercritical profile.

For floodway analysis (encroached condition), the results from supercritical flow and subcritical flow conditions should be combined to develop the floodway data table.

When reversing the files to run from one type of profile to another type, care must be taken in checking the n values, discharges, and bridge records (SB and SC) at each cross section. These values must be the same between the two profiles.

XS SW 10 The first profile is computed as supercritical profile. However, the second profile is computed as subcritical profile.

Help: For a floodway analysis, both profiles must analyze under same type of profile.

XS SW 11 The first profile is computed as subcritical profile. However, the second profile is computed as supercritical profile.

Help: For a floodway analysis, both profiles must analyze under same type of profile.

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Bridge Module

CHECK-2 Program, BRIDGE Module

User can click the mouse over one of the messages below for more information or press the TAB key to select a message, then press ENTER to get more information. To go back to the previous menu press the "B" key.

To exit HELP menu, place the cursor over "Help" in the top bar and click the mouse.

BT Records Check
◄BR BT 01► ◄BR BT 02► ◄BR BT 03► ◄BR BT 04► ◄BR BT 05► ◄BR BT 06►
◄BR BT 07►

Location Check
◄BR LC 01► ◄BR LC 02► ◄BR LC 03► ◄BR LC 04► ◄BR LC 05► ◄BR LC 06►
◄BR LC 07► ◄BR LC 08► ◄BR LC 09► ◄BR LC 10►

X2 Elevations Check
◄BR X2 01► ◄BR X2 02► ◄BR X2 03► ◄BR X2 04► ◄BR X2 05► ◄BR X2 06►
◄BR X2 07► ◄BR X2 08► ◄BR X2 09►

X3 Elevations Check
◄BR X3 00►
◄BR X3 01► ◄BR X3 02► ◄BR X3 03► ◄BR X3 04► ◄BR X3 05► ◄BR X3 06►
◄BR X3 07► ◄BR X3 08► ◄BR X3 09► ◄BR X3 10► ◄BR X3 11► ◄BR X3 12►
◄BR X3 13► ◄BR X3 14► ◄BR X3 15► ◄BR X3 16► ◄BR X3 17► ◄BR X3 18►
◄BR X3 19► ◄BR X3 20► ◄BR X3 21► ◄BR X3 22► ◄BR X3 23► ◄BR X3 24►
◄BR X3 25► ◄BR X3 26► ◄BR X3 27► ◄BR X3 28► ◄BR X3 29► ◄BR X3 30►
◄BR X3 31► ◄BR X3 32► ◄BR X3 33► ◄BR X3 34► ◄BR X3 35► ◄BR X3 36►
◄BR X3 37►

Special Bridge, Low Flow Check
◄BR LF 01► ◄BR LF 02► ◄BR LF 03► ◄BR LF 04► ◄BR LF 05► ◄BR LF 06►
◄BR LF 07► ◄BR LF 08► ◄BR LF 09► ◄BR LF 10► ◄BR LF 11► ◄BR LF 12►
◄BR LF 13►

Special Bridge, Pressure Flow Check
◄BR PF 01► ◄BR PF 02► ◄BR PF 03► ◄BR PF 04► ◄BR PF 05► ◄BR PF 06►

Special Bridge, Weir Flow Check
◄BR WF 01► ◄BR WF 02► ◄BR WF 03► ◄BR WF 04► ◄BR WF 05► ◄BR WF 06►
◄BR WF 07► ◄BR WF 08► ◄BR WF 09► ◄BR WF 10► ◄BR WF 11► ◄BR WF 12►
◄BR WF 13► ◄BR WF 14►

Normal Bridge Check
◄BR NB 01► ◄BR NB 02► ◄BR NB 03► ◄BR NB 04► ◄BR NB 05► ◄BR NB 06►
◄BR NB 07► ◄BR NB 08► ◄BR NB 09► ◄BR NB 10► ◄BR NB 11► ◄BR NB 12►
◄BR NB 13► ◄BR NB 14► ◄BR NB 15►

Special Culvert Check
◄BR SC 01► ◄BR SC 02► ◄BR SC 03► ◄BR SC 04► ◄BR SC 05► ◄BR SC 06►
◄BR SC 07► ◄BR SC 08► ◄BR SC 09► ◄BR SC 10► ◄BR SC 11►

Special Notes and Messages Check
◄BR NM 01► ◄BR NM 02► ◄BR NM 03► ◄BR NM 04► ◄BR NM 05►

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BT Records Check

BR BT 01 Left channel bank station is not on the BT records.

Help: BT stations must include the left and right channel bank stations from GR records, such that the maximum low chord elevation on the BT records between the channel bank stations can be determined accurately.

Encroachment stations from the GR data at section 2 is used as the bridge encroachment stations at section 3 for Special Bridge and Special Culvert routine for method 4 encroachment. If the GR and BT stations are not aligned properly then the weir length computed from the BT data will not be correct.

Therefore, GR data from both section 2 and section 3 of Special Bridge and Special Culvert must be aligned properly with the BT data by including the left and right channel bank stations on BT record.

BR BT 02 Right channel bank station is not on the BT records.

Help: BT stations must include the left and right channel bank stations from GR records.
Please also refer to Message BR BT 01.

BR BT 03 Left and right channel bank stations are not on the BT records.

Help: BT stations must include the left and right channel bank stations from GR records.
Please also refer to Message BR BT 01.

BR BT 04 Left channel bank station is outside the BT records.

Help: BT stations must include the left and right channel bank stations from GR records.
Please also refer to Message BR BT 01.

BR BT 05 Left channel bank station is outside the BT records and right channel bank station is not on the BT records.

Help: BT stations must include the left and right channel bank stations from GR records.
Please also refer to Message BR BT 01.

BR BT 06 Right channel bank station is outside the BT records.

Help: BT stations must include the left and right channel bank stations from GR records.
Please also refer to Message BR BT 01.

BR BT 07 Bridge station(s) is within the channel bank stations.
CHECK-2 PROGRAM CANNOT ANALYZE THIS STRUCTURE.

Help: The start and end stations of the BT data must at least be equal to the left and right channel bank stations, respectively, to form the shape of the opening of the structure. Check-2 program locates the channel bank stations on the BT data to determine the maximum low chord elevation. Since the start or end or both start and end BT stations are within the channel bank stations, CHECK-2 program cannot determine the maximum low chord elevation or minimum road elevation. Please recode the BT data.

Location Check

BR LC 01 Section 1 is not at this structure.

Help: This situation occurs, when there is another bridge downstream.

For proper bridge modeling, special bridge and special culvert routines require five sections, and normal bridge routine requires seven sections.

Special Bridge and Special Culvert

Special bridge or special culvert routine has five sections. Section 1 is the start section; section 2 is the downstream section; section 3 is the upstream section; section 4 is the approach section; and section 5 is the end section.

Section 1.

Section 1 is the start section. HEC-2 manual recommends to place section 1 at a distance four times the average side constriction from section 2. Side constriction is measured from the edge of the floodplain width upstream of the structure (section 3) to the abutment of the structure. The other backwater programs, such as WSPRO and WSP2, from other federal agencies recommend to locate section 1 at a distance equals to the width of the opening of the structure from section 2. Therefore, section 1 can be placed within these recommended distances. Contraction coefficient of 0.1 and expansion coefficient of 0.3 should be used.

Section 2

Section 2 is the downstream section. It is located at the foot of the downstream wing walls or toe of the embankment. If there is an energy dissipator (stilling basin), section 2 should be located downstream of it. Section 2 should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value must be equal to natural valley section n value, and structure n value must not be used. The X3 record must be inserted at section 2 with appropriate X3 elevations on fields 8 and 9, and a value of 10 on field 1. Please refer to message BR X3 00 for proper determination of X3 elevations.

Section 3

Section 3 is the upstream section. It is located at the foot of the upstream wing walls or toe of the embankment. It should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value must be equal to natural valley section n value, and structure n value must not be used. The X3 record must be inserted at section 3 with appropriate X3 elevations on fields 8 and 9, and a value of 10 on field 1. Please refer to message BR X3 16 for proper determination of X3 elevations.

Section 4

Section 4 is the approach section. It is located upstream of Section 3 at a distance equal to the width of the opening of the structure. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used.

Section 5

Section 5 is the end section. It is located upstream of section 4. It is a good modeling practice to include section 5. Contraction and expansion coefficients are changed back to 0.1 and 0.3, respectively, at Section 5.

Normal Bridge

The proper modeling of normal bridge routine requires seven sections. Section 1 is the start section; section 2 is the downstream section; section 3 is the outlet section; section 4 is the inlet section. section 5 is the upstream section; section 6 is the approach section; and section 7 is the end section.

Section 1.

Section 1 is the start section. HEC-2 manual recommends to place section 1 at a distance four times the average side constriction from section 2. Side constriction is measured from the edge of the floodplain width upstream of the structure (section 5) to the abutment of the structure. The other backwater programs, such as WSPRO and WSP2, from other federal agencies recommend to locate section 1 at a distance equals to the width of the opening of the structure from section 2. Therefore, section 1 can be placed within these recommended distances. Contraction coefficient of 0.1 and expansion coefficient of 0.3 should be used.

Section 2

Section 2 is the downstream section. It is located at the foot of the downstream wing walls or toe of the embankment. If there is an energy dissipator (stilling basin), section 2 should be located downstream of it. Section 2 should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value must be equal to natural valley section n value, and structure n value must not be used. The X3 record must be inserted at section 2 with appropriate X3 elevations at fields 8 and 9, and a value of 10 on field 1. Please refer to message BR X3 00 for proper determination of X3 elevations.

Section 3

Section 3 is the outlet section. It is located just inside the downstream end of the structure. GR and BT data or GR, X2 and X3 data are used to form the shape of the opening of the structure. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value(s) must represent the n value of the opening area of the structure.

Section 4

Section 4 is the inlet section. It is located just inside the upstream end of the structure. GR and BT data or GR, X2 and X3 data are used to form the shape of the opening of the structure. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value(s) must represent the n value of the opening area of the structure.

Section 5

Section 5 is the upstream section. It is located at the foot of the upstream wing walls or toe of the embankment. It should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used. Channel n value must be equal to natural valley section n value, and structure n value must not be used. The X3 record must be inserted at section 5 with appropriate X3 elevations on fields 8 and 9, and a value of 10 on field 1. Please refer to message BR X3 27 for proper determination of X3 elevations.

Section 6

Section 6 is the approach section. It is located upstream of Section 3 at a distance equal to the width of the opening of the structure. Contraction coefficient of 0.3 and expansion coefficient of 0.5 should be used.

Section 7

Section 7 is the end section. It is located upstream of section 6. It is a good modeling practice to include section 7. Contraction and expansion coefficients are changed back to 0.1 and 0.3, respectively, at Section 7.

A cross section is designated as section 3 by the CHECK-2 program when that cross section has BT data or X2 record. For special bridge and special culvert routines, two cross sections upstream of section 3 are assigned as sections 4 and 5, and two cross sections downstream of section 3 are assigned as sections 2 and 1. For normal bridge routine, four cross sections upstream of section 3 are assigned as sections 4, 5 , 6, and 7, and two cross sections downstream of section 3 are assigned as sections 2 and 1.

When structures are close to one another and when not all the sections are modeled at a structure, some of the sections from downstream structure can overlap (same SECNO) with the sections from upstream structure when CHECK-2 program assigns section numbers. CHECK-2 program will allow overlapping between section 1 of upstream structure with section 5 of downstream special bridge or special culvert, or section 7 of downstream normal bridge, because these sections have same contraction and expansion coefficients of 0.1 and 0.3, respectively. That means, same SECNO will be assigned to these overlapped sections. However, CHECK-2 program will not allow overlapping for other conditions.

For example, when section 1 of upstream structure overlaps with section 3 or 4 of downstream special bridge or special culvert, or section 4, 5 or 6 of downstream normal bridge, a SECNO will not assign to section 1 and above error message will be printed.

If the downstream structure is special bridge or special culvert, please add sections 4 and 5 to downstream structure, if section 1 of this structure overlaps with section 3 of downstream structure; and add section 5 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure.

If the downstream structure is normal bridge, please add sections 5, 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure; add sections 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 5 of downstream structure; and add section 7 to downstream structure, if section 1 of this structure overlaps with section 6 of downstream structure.

BR LC 02 Section 4 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when sections 4 and 5 of downstream special bridge or special culvert overlap with sections 2 and 3 of any upstream structure, SECNOs will be assigned to sections 2 and 3 of upstream structure, and error message will be printed for sections 4 and 5.

Please add sections 4 and 5 at this structure. Section 5 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

BR LC 03 Section 5 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when section 5 of downstream special bridge or special culvert overlaps with section 2 or 3 of any upstream structure, SECNO will be assigned to section 2 or 3 of upstream structure, and error message will be printed for section 5.

Please add section 5 at this structure. Section 5 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

BR LC 04 Channel distance at section 3 is less than 10 feet.

Help: Section 3 of Special Bridge is located at the foot of the upstream wing walls or toe of the embankment. Section 3 should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. The distance at Section 3 is measured to the downstream cross section, Section 2. Section 2 is located at the foot of the downstream wing walls or toe of the embankment. If there is an energy dissipator, Section 2 should be located downstream of it. Section 2 should be parallel to the roadway embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. The width of the roadway itself can be as wide as twelve feet for a single lane. Adding the stream length between the bridge structure and the toe of the embankment or the wing wall for both the upstream and downstream of the structure to the roadway width (bridge structure) can give a distance much larger than ten feet. The channel distance and also the overbank distances should be reevaluated. However, in some cases the structure may only be for the pipe crossing or foot bridge. In those cases the channel distance may be less than ten feet. A comment record should be included at this section and an explanation should be given about the situation. For the case of pipe crossing, a Normal Bridge routine is more suitable.

BR LC 05 Section 1 is not at this structure.

Help: This situation occurs, when there is another bridge downstream.

When structures are close to one another and when not all the sections are modeled at a structure, some of the sections from downstream structure can overlap (same SECNO) with the sections from upstream structure when CHECK-2 program assigns section numbers. CHECK-2 program will allow overlapping between section 1 of upstream structure with section 5 of downstream special bridge or special culvert, or section 7 of downstream normal bridge, because these sections have same contraction and expansion coefficients of 0.1 and 0.3, respectively. That means, same SECNO will be assigned to these overlapped sections. However, CHECK-2 program will not allow overlapping for other conditions.

For example, when section 1 of upstream structure overlaps with section 3 or 4 of downstream special bridge or special culvert, or section 4, 5 or 6 of downstream normal bridge, a SECNO will not assign to section 1 and above error message will be printed.

If the downstream structure is special bridge or special culvert, please add sections 4 and 5 to downstream structure, if section 1 of this structure overlaps with section 3 of downstream structure; and add section 5 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure.

If the downstream structure is normal bridge, please add sections 5, 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 4 of downstream structure; add sections 6 and 7 to downstream structure, if section 1 of this structure overlaps with section 5 of downstream structure; and add section 7 to downstream structure, if section 1 of this structure overlaps with section 6 of downstream structure.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

BR LC 06 Section 6 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when sections 6 and 7 of downstream normal bridge overlap with sections 2 and 3 of any upstream structure, SECNOs will be assigned to sections 2 and 3 of upstream structure, and error message will be printed for sections 6 and 7.

Please add sections 6 and 7 at this structure. Section 7 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

BR LC 07 Section 7 is not at this structure.

Help: This situation occurs, when there is another bridge upstream.

For special bridge and special culvert routines, sections 2 and 3 are the priority sections. For normal bridge routine, sections 2, 3, 4, and 5 are the priority sections. The priority sections are defined by CHECK-2 program as sections with X3, SB or SC, and BT or X2 records. If sections overlapped with one another, CHECK-2 program will assign SECNO to the priority sections and print error messages for non priority sections. Both priority sections and non priority sections must be included in bridge modeling.

For example, when sections 7 of downstream normal bridge overlaps with section 2 or 3 of any upstream structure, SECNO will be assigned to section 2 or 3 of upstream structure, and error message will be printed for section 7.

Please add section 7 at this structure. Section 7 of this structure can be used as section 1 of upstream bridge, because the same contraction and expansion loss coefficients of 0.1 and 0.3 are used at these sections.

Please refer to message BR LC 01 for location of bridge and culvert sections and assignment of section numbers by CHECK-2 program.

BR LC 08 Channel distance at section 3 is less than 10 feet.

Help: Section 3 of Normal Bridge routine is located just inside of the downstream end of the structure. Section 2 of Normal Bridge routine is located at the same location as Section 2 of Special Bridge routine. (Please review Message XS2.6.1.) The distance at Section 3 is measured to the downstream section, Section 2. This distance will be measured along the stream from downstream face of the structure to the toe of the embankment or wing walls or to the end of the stilling basin. Therefore the distance of ten feet may be too short. However, if the distance used in the model is measured as outlined above and the distance is still less than ten feet, an explanation should be given on the comment record at this cross section.

BR LC 09 Channel distance at section 4 is less than 10 feet.

Help: Section 4 of Normal Bridge routine is located just inside of the upstream end of the structure. The distance at Section 4 is measured to the downstream section, Section 3. This distance is normally equal to the length of the culvert or width of the bridge deck. If the length of the structure is less than ten feet, an explanation should be given on the comment record at this cross section.

BR LC 10 Channel distance at section 5 is less than 10 feet.

Help: Section 5 of Normal Bridge routine is located at the foot of the upstream wing walls or the toe of the embankment and must represent the natural valley cross section. It must not include the components of the structure or the embankment. The distance at section 5 is measured along the stream from the toe of the embankment or wing walls to the upstream face of the structure.

X2 Elevations Check

BR X2 01 Maximum low chord elevation between channel bank stations is not equal to the ELLC value on X2 record.

Help: ELLC value should be equal to the maximum low chord elevation.

BR X2 02 Minimum road elevation for the left overbank is equal to zero. Please verify.

Help: Road elevation is not coded for one of the BT stations. Please insert the appropriate road elevation. If the true road elevation is equal to zero elevation, then do not modify the BT data.

BR X2 03 Minimum road elevation for the right overbank is equal to zero. Please verify.

Help: Road elevation is not coded for one of the BT stations. Please insert the appropriate road elevation. If the true road elevation is equal to zero elevation, then do not modify the BT data.

BR X2 04 Minimum road elevation is equal to zero. Please verify.

Help: Road elevation is not coded for one of the BT stations. Please insert the appropriate road elevation. If the true road elevation is equal to zero elevation, then do not modify the BT data.

BR X2 05 Minimum road elevation along the road profile is not equal to ELTRD value on X2 record.

Help: Minimum road elevation is the minimum of the minimum left overbank road elevation and minimum right overbank road elevation. The minimum road elevation of the left overbank is determined between the starting station of the BT data and the right channel bank station on the BT record. The minimum road elevation of the right overbank is determined between the left channel bank station on the BT record and the end station of the BT data.

BR X2 06 SB record is at section 3. However, X2 record is not coded. CHECK-2 PROGRAM WILL NOT ANALYZE THIS BRIDGE.

Help: HEC-2 program will ignore SB record and will analyze as normal bridge if BT records exist. Otherwise, HEC-2 program will analyze as ordinary cross section.

Since the results from the HEC-2 run are not for the special bridge routine CHECK-2 program will not analyze the results.

Please insert X2 record with proper parameters on fields 3, 4 or 5.

BR X2 07 SC record is at section 3. However, X2 record is not coded. CHECK-2 PROGRAM WILL NOT ANALYZE THIS BRIDGE.

Help: HEC-2 program will ignore SC record and will analyze as normal bridge if BT records exist. Otherwise, HEC-2 program will analyze as ordinary cross section.

Since the results from the HEC-2 run are not for the special culvert routine CHECK-2 program will not analyze the results.

Please insert X2 record with proper parameters on fields 3, 4 or 5.

BR X2 08 Special bridge routine. However, the value on field 3 of X2 record is (0 or 2). It must be equal to 1.
HEC-2 PROGRAM WILL NOT ANALYZE AS SPECIAL BRIDGE.

Help: If the value on field 3 of X2 record is equal to 0, HEC-2 program will ignore the SB record and will analyze as normal bridge routine if BT records exist. Otherwise, HEC-2 program will analyze as ordinary cross section.

If the value on field 3 of X2 record is equal to 2, in some cases, HEC-2 program may compute as special culvert routine.

Insert 1 on field 3 of X2 record.

BR X2 09 Special culvert routine. However, the value on field 3 of X2 record is (0 or 1). It must be equal to 2.
HEC-2 PROGRAM WILL NOT ANALYZE AS SPECIAL CULVERT.

Help: If the value on field 3 of X2 record is equal to 0, HEC-2 program will ignore the SC record and will analyze as normal bridge routine if BT records exist. Otherwise, HEC-2 program will analyze as ordinary cross section.

If the value on field 3 of X2 record is equal to 1, in some cases, HEC-2 program may compute as special bridge routine.

Insert 2 on field 3 of X2 record.

X3 Elevations Check

BR X3 00 X3 record is not at Section 2. Insert the X3 record at that section and assign appropriate limiting elevations.

Help: X3 record with 10 on the first field should be used to specify the limiting elevations. Left limiting elevation is on field 8 of X3 record and right limiting elevation is on field 9 of X3 record.

X3 record with zero on first field and stations and elevations on fields 4, 5, 6, and 7 should not be used at the bridge cross sections.

Limiting elevations are used in the HEC-2 program such that one set of GR and BT data can be used to analyze different types of flow. For low flow and some pressure flow situation the flow should be confined between the abutments of the structure and only the area between the abutments is considered as effective flow area. For weir flow condition, the overbank areas are considered effective.

Limiting elevation ranges between the maximum low chord elevation within the channel banks and the minimum left road elevation and minimum right road elevation.

For special bridge and special culvert routines, CHECK-2 program determines the minimum left road elevation between starting station of the BT data and the BT station which corresponds to right channel bank station. Minimum right road elevation is determined between the BT station which corresponds to left channel bank station and the end station of the BT data. CHECK-2 program includes the road profile over the channel portion in computing minimum road elevation for both overbank areas because of the following reason.

As soon as the water overflows the road whether the minimum road elevation is within the channel portion or on the overbank areas, the area upstream of the road should be considered effective such that the computed velocity head will be small and the WSEL and the EG will be about the same at the upstream side of the road.

Left limiting elevation should be between the maximum low chord elevation and the minimum left road elevation if the minimum left road elevation is higher than the maximum low chord elevation. Otherwise, it should be equal to the minimum left road elevation.

Right limiting elevation should be between the maximum low chord elevation and the minimum right road elevation if the minimum right road elevation is higher than the maximum low chord elevation. Otherwise, it should be equal to the minimum right road elevation.

BR X3 01 BT record is not coded. Maximum low chord elevation and minimum left and right road elevations are set equal to ELLC and ELTRD values on X2 record, respectively.

Help: The road profile is defined by a road length on field 4 of SB record at a constant elevation specified on field 5 of X2 record. If the road profile does not have a constant road elevation, then BT record(s) must be used to define the road profile. In that case, ELLC and ELTRD values cannot not be used to approximate the limiting elevations. If a floodway is to be analyzed, then BT record must be used to define the road profile whether the road has constant elevation or not.

BR X3 02 Section 2. First field of X3 record is equal to zero. It should be equal to 10.

Help: Limiting elevations must be specified as explained under message BR X3 00.

BR X3 03 Section 2. Stations and elevations must not be specified on fields 4, 5, 6, 7 of X3 record.

Help: Limiting elevations must be specified as explained under message BR X3 00.

BR X3 04 Section 2. A vertical wall will be assumed at left encroachment station ;Stencl2;.

Help: X3 record with values on fields 4, 5, 6, and 7 should not be used at the bridge cross sections. Instead, X3 record with 10 on field 1 and limiting elevation values assigned on fields 8 and 9 should be used.

Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 05 Section 2. A vertical wall will be assumed at right encroachment station ;Stencr2;.

Help: X3 record with values on fields 4, 5, 6, and 7 should not be used at the bridge cross sections. Instead, X3 record with 10 on field 1 and limiting elevation values assigned on fields 8 and 9 should be used.

Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 06 Section 2. Left encroachment elevation ;Elencl2; will override the left bank limiting elevation ;Ellea2;.
Area below ;Elencl2; and beyond left encroachment station ;Stencl2; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 07 Section 2. Minimum left road elevation of ;LRdel.min; is lower than maximum low chord elevation of ;Xlcel.max;. However, the left encroachment elevation of ;Elencl2; is not equal to the minimum left road elevation.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 08 Section 2. Left encroachment elevation of ;Elencl2; is not within the maximum low chord elevation of ;Xlcel.max; and minimum left road elevation of ;LRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 09 Section 2. Minimum left road elevation of ;LRdel.min; is lower than maximum low chord elevation of ;Xlcel.max;. However, the left bank limiting elevation of ;Ellea2; is not equal to the minimum left road elevation.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 10 Section 2. Left bank limiting elevation of ;Ellea2; is not within the maximum low chord elevation of ;Xlcel.max; and minimum left road elevation of ;LRdel.min;

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 11 Section 2. Right encroachment elevation ;Elencr2; will override the right bank limiting elevation ; Elrea2;.
Area below ;Elencr2; and beyond right encroachment station ;Stencr2; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 12 Section 2. Minimum right road elevation of ;RRdel.min; is lower than maximum low chord elevation of ;Xlcel.max;. However, the right encroachment elevation of ;Elencr2; is not equal to the minimum right road elevation.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 13 Section 2. Right encroachment elevation of ;Elencr2; is not within the maximum low chord elevation of ;Xlcel.max; and minimum right road elevation of ;RRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 14 Section 2. Minimum right road elevation of ;RRdel.min; is lower than maximum low chord elevation of ;Xlcel.max;. However, the right bank limiting elevation of ;Elrea2; is not equal to the minimum right road elevation.

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 15 Section 2. Right bank limiting elevation of ;Elrea2; is not within the maximum low chord elevation of ;Xlcel.max; and minimum right road elevation of ;RRdel.min;

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 16 X3 record is not at Section 3. insert the X3 record at that section and assign appropriate limiting elevations.

Help: X3 record with 10 on the first field should be used to specify the limiting elevations. Left limiting elevation is on field 8 of X3 record and right limiting elevation is on field 9 of X3 record.

X3 record with zero on first field and stations and elevations on fields 4, 5, 6, and 7 should not be used at the bridge cross sections.

Left limiting elevation should be equal to the left minimum road elevation.

Right limiting elevation should be equal to the right minimum road elevation.

Please refer message BR X3 00 for the determination of limiting elevations.

BR X3 17 Section 3. First field of X3 record is equal to zero. It should be equal to 10.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 18 Section 3. Stations and elevations must not be specified on fields 4, 5, 6, 7 of X3 record.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 19 Section 3. A vertical wall will be assumed at left encroachment station ;Stencl3;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 20 Section 3. A vertical wall will be assumed at right encroachment station ;Stencr3;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 21 Section 3. Left encroachment elevation ;Elencl3; will override the left bank limiting elevation ;Ellea3;.
Area below ;Elencl3; and beyond left encroachment station ;Stencl3; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 22 Section 3. Left encroachment elevation of ;Elencl3; is not equal to the minimum left road elevation of ;LRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 23 Section 3. Left bank limiting elevation of ;Ellea3; is not equal to the minimum left road elevation of ;LRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 24 Section 3. Right encroachment elevation ;Elencr3; will override the right bank limiting elevation ; Elrea3;.
Area below ;Elencr3; and beyond right encroachment station ;Stencr3; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 25 Section 3. Right encroachment elevation of ;Elencr3; is not equal to the minimum right road elevation of ;RRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 26 Section 3. Right bank limiting elevation of ;Elrea3; is not equal to the minimum right road elevation of ;RRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 27 X3 record is not at Section 5. Insert the X3 record at that section and assign appropriate limiting elevations.

Help: X3 record with 10 on the first field should be used to specify the limiting elevations. Left limiting elevation is on field 8 of X3 record and right limiting elevation is on field 9 of X3 record.

X3 record with zero on first field and stations and elevations on fields 4, 5, 6, and 7 should not be used at the bridge cross sections.

Left limiting elevation should be equal to the left minimum road elevation.

Right limiting elevation should be equal to the right minimum road elevation.

Please refer message BR X3 00 for the determination of limiting elevations.

BR X3 28 Section 5. First field of X3 record is equal to zero. It should be equal to 10.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 29 Section 5. Stations and elevations must not be specified on fields 4, 5, 6, 7 of X3 record.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 30 Section 5. A vertical wall will be assumed at left encroachment station ;Stencl5;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 31 Section 5. A vertical wall will be assumed at right encroachment station ;Stencr5;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 32 Section 5. Left encroachment elevation ;Elencl5; will override the left bank limiting elevation ;Ellea5;.
Area below ;Elencl5; and beyond left encroachment station ;Stencl5; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 33 Section 3. Left encroachment elevation of ;Elencl3; is not equal to the minimum left road elevation of ;LRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 34 Section 3. Left bank limiting elevation of ;Ellea3; is not equal to the minimum left road elevation of ;LRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 35 Section 5. Right encroachment elevation ;Elencr5; will override the right bank limiting elevation ; Elrea5;.
Area below ;Elencr5; and beyond right encroachment station ;Stencr5; will not be considered in the backwater computations.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 36 Section 5. Right encroachment elevation of ;Elencr5; is not equal to the minimum right road elevation of ;RRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 37 Section 5. Right bank limiting elevation of ;Elrea5; is not equal to the minimum right road elevation of ;RRdel.min;.

Help: Limiting elevations must be specified as explained under Message BR X3 27.

BR X3 0 Limiting elevations are not specified on section 2. They are set equal to left channel bank elevation of ;XLBEL; and right channel bank elevation of ;RBEL;

Help: Limiting elevations must be specified as explained under Message BR X3 00.

BR X3 0 Left encroachment elevation ;Elencl2; will override the left limiting elevation ;Ellea2; at section 2.

Help: Please refer to Message BR X3 00.

BR X3 0 Right encroachment elevation ;Elencr2; will override the right limiting elevation ;Elrea2; at section 2.

Help: Please refer to Message BR X3 00.

BR X3 0 Limiting elevations are not specified on section 3. They are set equal to left channel bank elevation of ;XLBEL; and right channel bank elevation of ;RBEL;

Help: Limiting elevations must be specified as explained under Message BR X3 16.

BR X3 0 Left encroachment elevation ;Elencl3; will override the left limiting elevation ;Ellea3; at section 3.

Help: Please refer to Message BR X3 16.

BR X3 0 Right encroachment elevation ;Elencr3; will override the right limiting elevation ;Elrea3; at section 3.

Help: Please refer to Message BR X3 16.

BR X3 0 Left encroachment elevation ;Elencl5; will override the left limiting elevation ;Ellea5; at section 5.

Help: Please refer to Message BR X3 27.

BR X3 0 Right encroachment elevation ;Elencr5; will override the right limiting elevation ;Elrea5; at section 5.

Help: Please refer to Message BR X3 27.

Special Bridge, Low Flow

BR LF 01 Special Bridge. However, field 3 of X2 record is not equal to 1.

Help: The HEC-2 program will not consider as Special Bridge routine if field 3 of X2 record is not equal to 1. Please insert 1 at field 3 of X2 record.

BR LF 02 Special Bridge. However, there is no X2 record.

Help: The HEC-2 program will not consider as special bridge routine if X2 record is not coded. It will treat as normal bridge routine. Please insert X2 record and assign appropriate values on fields 3, 4 and 5 of X2 record.

BR LF 03 Topwidth of;TOPWID; at section 2 is greater than the trapezoidal topwidth of ;TRPWID;.

Help: For low flow condition, channel bank stations must be located at the abutments of the structure. The natural channel banks may not be at the abutments. In this case n values must be assigned for each segment of the channel portion on the NH record. Please also note that section 2 should represent the natural valley cross section and not the bridge opening section. Please refer message BR LC 01 for location of bridge cross sections.

Proper limiting elevations are assigned on fields 8 and 9 of X3 record, such that the total flow will be confined between the abutments (channel bank stations). Therefore, TOPWID should not be greater than the channel width at sections 2 and 3.

The trapezoidal topwidth (TRPWID) is computed from the following relationship.

TRPWID = BWC + 2 * SS * (ELLC - ELCHU)
h = ELLC - ELCHU

where, BWC = bottom width of the trapezoid (Field 5 of SB record)
SS = side slope of the trapezoid (Field 8 of SB record)
ELLC = low chord elevation (Field 4 of X2 record)
ELCHU = bottom elevation of the trapezoid (Field 9 of SB record)

According to the trapezoidal approximation computation (BR LF 08) TRPWID must be equal to channel width (CHWID). Since

TOPWID cannot be greater than the CHWID for low flow condition, TOPWID should not be greater than the TRPWID.

Select proper channel bank stations and also verify that trapezoid parameters are computed correctly. Please refer message BR LF 05 for the determination of trapezoid parameters.

Please also refer to message BR X3 00 and BR X3 16 for selecting appropriate X3 elevations.

BR LF 04 Topwidth of;TOPWID; at section 3 is greater than the trapezoidal topwidth of ;TRPWID;.

Help: Please refer to message BR LF 03.

BR LF 05 Trapezoidal topwidth of ;TRPWID; is greater than the channel width of ;CHWID; at section 2.

Help: The trapezoidal topwidth (TRPWID) is computed from the following relationship.

TRPWID = BWC + 2 * SS * (ELLC - ELCHU)
h = ELLC - ELCHU

where, BWC = bottom width of the trapezoid
SS = side slope of the trapezoid
ELLC = low chord elevation (Field 4 of X2 record)
ELCHU = bottom elevation of the trapezoid

And the channel width (CHWID) is computed from the following relationship.

CHWID = STCHR - STCHL

where, STCHR = right channel bank station (Field 3 of X1 record)
STCHL = left channel bank station (Field 4 of X1 record)

For the trapezoidal area approximation, TRPWID should be equal to CHWID and the above equation for TRPWID can be written as,

CHWID = BWC + 2 * SS * h
h = ELLC - ELCHU

Since the CHWID equation has two unknowns BWC and SS after assuming the ELCHU value, the following second equation should be used to solve the trapezoid parameters BWC and SS.

BAREA = (BWC + 2 * SS * h) * h - BWP * h

where, BAREA = net opening area of the structure (Field 7 of SB record)
h = ELLC - ELCHU

From the equations for CHWID and BAREA, the variables BWC and SS can be determined after assuming the ELCHU value. The value of ELLC is known (field 4 of X2 record) and the BWP is the average width of the piers. It can be obtained by dividing the total area of the piers by h.

Select proper channel bank stations and also verify that trapezoid parameters are computed correctly.

BR LF 06 Trapezoidal topwidth of ;TRPWID; is greater than the channel width of ;CHWID; at section 3.

Help: Please refer message BR LF 05.

BR LF 07 XK is equal to;XK; It should be between 0.9 and 1.25.

Help: According to the HEC-2 Users Manual, pier loss coefficient XK should be between 0.9 and 1.25.

BR LF 08 Trapezoidal Area is;TRAPA; BAREA is;BAREA; The difference between the two should not be more than 10%.

Help: The trapezoidal area is computed from the following relationship.

TRAPA = (BWC + 2 * SS * h) * h - BWP * h
h = ELLC - ELCHU

where, BWC = bottom width of the trapezoid (Field 5 of SB record)
SS = side slope of the trapezoid (Field 8 of SB record)
ELLC = low chord elevation (Field 4 of X2 record)
ELCHU = bottom elevation of the trapezoid (Field 9 of SB record)

BAREA is the net opening area of the structure and is obtained from field 7 of SB record.

If the difference in area between TRAPA and BAREA is more than 10%, then check the value of BAREA from structure dimensions and verify the trapezoid parameters.

Please refer message BR LF 05 for the determination of trapezoid parameters.

BR LF 09 ELCHU value is not given on SB record.

Help: The HEC-2 program will use the ELMIN value from section 2 as ELCHU value, and it may not be appropriate. Please insert the correct ELCHU value on field 9 of SB record.

BR LF 10 ELCHU value is not given on SB record. ELMIN will be used as ELCHU.
Trapezoidal Area is;TRAPA; BAREA is;BAREA; The difference between the two should not be more than 10%.

Help: If the difference in area between TRAPA and BAREA is more than 10%, then check the value of BAREA from structure dimensions and verify the trapezoid parameters.

Please refer message BR LF 05 for the determination of trapezoid parameters.

BR LF 11 Side slope on SB record is;-SS; It should be a positive value.

Help: Negative side slope should not be used on SB record.

BR LF 12 CWSEL of;CwselNa; is higher than ELLC of ;Ellc; However, the type of flow is Low Flow.

Help: HEC-2 program differentiates the type of flow by first comparing the EGLWC with ELLC. If EGLWC is higher than ELLC but lower than ELTRD, the program assumes that it is a pressure flow. It will then compute EGPRS. If EGPRS is less than EGLWC, it will compute maximum EG. Maximum EG is computed as 1.5 * (ELLC - ELCHU). If EGLWC is less than maximum EG the program decides that it is a low flow. Since the CWSEL is higher than ELLC, the flow should be pressure flow. Check that XKOR, ELLC, ELCHU, and X3 elevations are computed properly.

Please refer Message BR PF 03 for XKOR computation, refer Message BR X2 01 for selection of ELLC, refer Message BR LF 05 for ELCHU computation, and refer Messages BR X3 00 and BR X3 16 for appropriate selection of X3 elevations.

BR LF 13 Special bridge reverts back to normal bridge routine. The bridge should be remodeled as normal bridge routine.

Help: If the BWP value (Field 6) on SB record is equal to zero and the flow is low flow, HEC-2 program will use the BT and GR information at section 3 and analyze the flow through the structure as normal bridge routine.

This kind of modeling is done in the initial analysis of water-surface profiles computations for a stream, when the type of flow at a structure is not known. The shape of the opening of the structure is not necessary to code on the BT records if special bridge routine is used. The information about the opening is specified on the SB record and only the road profile needs to be coded on the BT records. Therefore, when HEC-2 reverts to normal bridge routine the BT and GR data at section 3 may not form the proper shape of the opening of the structure.

Even the BT and GR data at section 3 will form the shape of the opening of the structure, the proper losses through the structure cannot be computed with this option (revert to normal bridge routine).

The true normal bridge routine should at least have two cross sections (sections 3 and 4) with BT and GR data that will represent the structure. These two cross sections will form the shape of the opening at the downstream end and upstream end of the structure. The roughness coefficients representing the structure is assigned at these cross sections.

On the other hand, special bridge routine has only one cross section (section 3) with BT data. The roughness coefficient at section 3 represents the roughness coefficient of the natural valley cross section and does not represent the roughness coefficient of the structure.

Therefore, if special bridge reverts back to normal bridge routine, the structure must be remodeled as true normal bridge routine to obtain proper losses at the structure.

Special Bridge, Pressure Flow

BR PF 01 Computed flow is pressure flow. However, water-surface elevation at section 3 is lower than the maximum low chord elevation.

Help: HEC-2 program differentiates the type of flow by first comparing the EGLWC with ELLC. If EGLWC is higher than ELLC but lower than ELTRD, the program assumes that the type of flow is pressure flow. It will then compute EGPRS by using the orifice flow equation. If EGPRS is greater than EGLWC and is higher than ELLC but lower than ELTRD, the program decides that the flow is pressure flow. Then EG at section 3 is equal to EGPRS.

The energy at section 3 is transformed into computed water-surface elevation (CWSEL) by assuming a WSEL at section 3. If the assumed WSEL is lower than the X3 elevations, the flow area is computed between the X3 stations and below the assumed WSEL. If the assumed WSEL is higher than the X3 elevations the flow area is equal to the entire cross sectional area below the assumed WSEL. The average velocity is then computed by dividing the total discharge by the computed flow area. Then the velocity head is computed. If the assumed WSEL plus the velocity head is the same as computed EG at section 3 (EGPRS), HEC-2 decides that the assumed WSEL is the CWSEL at section 3.

However, in this case CWSEL at section 3 is lower than ELLC, and therefore the flow should not be considered as pressure flow. The following conditions may cause the CWSEL to be lower than ELLC value.

1. The X3 elevations at section 3 may be set too high. Please refer to Message BR X3 02 for appropriate selection of X3 elevations.

2. The cross section 3 must be represented by the natural valley cross section, and should not be coded as the bridge opening section with the overbank areas set along the road profile.

3. The n value for channel portion of section 3 was set too low. The n value for section 3 should represent the n value of the natural valley cross section and should not represent the structure n value. Please refer to Messages NT RS 05 and BR LC 01 for appropriate selection of n values and location of section 3.

If the CWSEL is still lower than the ELLC, even after the above measures are taken, it may be due to the concept of X3 elevations. HEC-2 program considers that the flow can only go through the opening of the structure as long as the flow is low flow and pressure flow. For Special Bridge and Special Culvert routines the flow is allowed to flow only through the abutments at sections 2 and 3 by using X3 records and setting the limiting elevations for the abutments at section 3 to be equal to the minimum road elevation on each overbank area. As long as the WSEL at section 3 is lower than the limiting elevations the flow is considered as low flow or pressure flow, and the areas outside the limiting elevations are considered as ineffective flow areas. Once the WSEL is above the limiting elevations (minimum road elevations) the flow will now be considered as pressure and weir flow or low and weir flow, and the entire section 3 below the WSEL is considered to be effective.

The conflict is in the criteria for determining different types of flow and the criteria for limiting the movement of flows by the HEC-2 program. The first criteria is based on the energy grade elevation and the second criteria is based on the water-surface elevation. The following is the suggestion to solve this conflict.

First, type of flows should be classified based on the water-surface elevation at section 3. If the water-surface elevation at section 3 is lower than maximum low chord elevation (MXLCEL) it is low flow. If the WSEL at section 3 is higher than MXLCEL but lower than minimum road elevation (MNREL) it is pressure flow. If the WSEL at section 3 is higher than MXLCEL and MNREL it is pressure and weir flow. If the WSEL at section 3 is lower than MXLCEL but higher than MNREL it is low and weir flow.

Second, the computation of the WSEL must be based on the energy principle. As an example, pressure flow condition will be investigated. HEC-2 program first computes the energy at section 3 by using the orifice flow equation for pressure flow condition. Then that energy is transformed into CWSEL by assuming the WSEL at section 3. If the assumed WSEL is lower than the X3 elevations, the flow area is computed between the X3 stations and below the assumed WSEL. The average velocity is then computed by dividing the total discharge by the computed flow area. Then the velocity head is computed. If the assumed WSEL plus the velocity head is the same as the computed EG, HEC-2 considers that WSEL as the final CWSEL. However, in some cases, lower assumed WSEL can produce smaller area, and the smaller area can produce higher velocity and higher velocity head which when added to the assumed WSEL can make the assumed energy to be equal to the computed energy. In that situation, the WSEL can be lower than the MXLCEL although the EG is above the MXLCEL.

For pressure flow conditions EG and CWSEL at section 3 should be about the same since all the energy should be transformed into potential energy (WSEL) to compensate for the losses through the structure and to provide the velocity head to pass the flow through the structure as pressure flow. The way to achieve this condition is to reduce the limiting elevations (X3 elevations) such that the assumed WSEL will cover the entire section 3, provided that section 3 represents the natural valley cross section. The larger area will produce smaller velocity and velocity head and therefore WSEL needs to be assumed as high as the computed EG such that the assumed EG will be the same as computed EG. So in this case if the CWSEL at section 3 cannot be related to type of flow, the rules for the X3 elevations may need to be changed.

BR PF.02 ELCHU value is not given on SB record.

Help: The HEC-2 program will use the ELMIN value from section 2 as ELCHU value, and it may not be appropriate. Please insert the correct ELCHU value on field 9 of SB record.

BR PF 03 The XKOR value on field 2 of SB record in the input file is equal to or less than 1.56.
Computed XKOR of ;Compute XKOR; is different from the XKOR of ;XKOR; on field 2 of SB record.
n = ;NCH; at section 3; A = ;a; P = ;p; R = ;r; Kf = ;kf;

Ke = ;ke;
If this data is correct, the XKOR in the input file should be changed.

Help: The total loss coefficient, XKOR, includes exit loss, entrance loss, friction loss, and other losses. The exit loss in XKOR value is considered as 1 by the HEC-2 program. The entrance loss for a typical bridge structure is normally equal to 0.5. When friction loss is considered, the total loss coefficient will be more than 1.5. If the XKOR value in the input file is equal to or less than 1.56, Check-2 program will compute the friction loss coefficient from the information given in the input file.

Experimental data from Bureau of Public Roads shows that the coefficient of discharge C varies from 0.7 to 0.9 for fully submerged bridges. HEC-2 user's manual recommends that in the absence of calibration data, a value of 1.56 for XKOR (C=0.8) would be applicable to most bridges and short culverts.

However, the recommended value of 1.56 should not be used in the Special Bridge routine except for the case when the computed XKOR is exactly equal to 1.56 because actual water-surface elevation (WSEL) and not the design WSEL is to be computed at each structure for the flood insurance studies. The XKOR value includes exit loss, entrance loss, friction loss, and other losses. These losses at each bridge can be different. Also, when a bridge is remodeled, the difference in losses between the existing bridge and the remodeled bridge needs to be determined when revising a flood insurance study.

If the XKOR value used in the input file is not going to be changed, a comment record should be provided and briefly describes the type, dimensions, entrance shape, roughness coefficient of the structure, and the loss coefficients used in the XKOR.

The XKOR value is specified on field 2 of SB record. It is computed by the following relationship.

XKOR = 1 + Ke + Kf + Ko

where, Ke = entrance loss coefficient. An entrance loss coefficient of 0.5 is assumed by the Check-2 program because of lack of information.

However, the user must use the entrance loss coefficient for different entrance conditions from the HEC-2 user's manual.

Kf = friction loss coefficient. It is computed by the following relationship.

Kf = (29 * n**2 * L) / R**1.333

where, n = roughness coefficient of the structure. Because of lack of information, Check-2 program uses the channel n value of section 3 as the n value.

L = length of the structure. Because of lack of information, Check-2 program uses the channel distance at section 3 as L.

R = hydraulic radius. Because of lack of information Check-2 program computes R from the information on the SB record.It is computed by dividing the trapezoidal area, TRAPA, by the wetted perimeter, P of the trapezoidal area.

TRAPA = (BWC + SS*h)*h - BWP*h
P = 2(BWC - BWP + h(1+SS+(1+SS**2)**0.5))
h = ELLC - ELCHU

However, the user must use the correct n value of the structure, length of the structure, and the hydraulic radius of the structure to compute the Kf value.

Ko = other losses, such as bend loss, junction loss, trash rack loss. Because of lack of information Check-2 program consider Ko as zero.

However, the user must add the additional losses if they exist.

BR PF 04 Computed XKOR of ;Compute XKOR; is different from the XKOR of ;XKOR; on field 2 of SB record.
n = ;NCH; at section 3; A = ;a; P = ;p; R = ;r; Kf = ;kf; Ke = ;ke;
If this data is correct, the XKOR in the input file should be changed.

Help: This message is provided to the user to check the data used in the XKOR computations. Please refer to Message BR PF 02 on the discussion of XKOR value.

If the XKOR value used in the input file is not going to be changed, a comment record should be provided and briefly describes the type, dimensions, entrance shape, roughness coefficient of the structure, and the loss coefficients used in the XKOR.

BR PF 05 Trapezoidal area is ;A; BAREA is ;BAREA;. The difference between the two should not be more than 10%.

Help: The computation of the opening area and wetted perimeter are based on the parameters for the trapezoid specified on the SB record and are used in the computation of Kf value. The trapezoid area thus computed should be equal to the BAREA on field 7 of SB record. If they are differed by more than 10%, the variables need to be checked.

BR PF 06 Special Bridge. However, X2 record is not coded.

Help: The HEC-2 program will not consider as Special Bridge routine if X2 record is not coded. It will treat as Normal Bridge routine. Please insert X2 record and assign appropriate values on fields 3, 4 and 5 of X2 record.

Special bridge, Weir Flow

BR WF 01 Computed flow is pressure and weir flow. However, water surface elevation at section 3 is lower than the maximum low chord elevation.

Help: This condition can happen because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these problems exist then investigate why the water-surface is lower than the maximum low chord elevation and explain on the comment record.

Please also refer to Messages BR X3 00 and BR X3 16 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR WF 02 Computed flow is pressure and weir flow. However, water surface elevation at section 3 is lower than the minimum road elevation.

Help: Please refer to Message BR WF 01.

BR WF 03 Computed flow is low and weir flow. However, water surface elevation at section 3 is higher than maximum low chord elevation.

Help: Please refer to Message BR WF 01.

BR WF 04 Computed flow is low and weir flow. However, water surface elevation at section 3 is lower than the minimum road elevation.

Help: Please refer to Message BR WF 01.

BR WF 05 WRLEN is wider than the TOPWID at section 3.

Help: When weir flow occurs the weir length should be approximately equals to the water-surface top width at the upstream of the structure which is at section 3. Weir length may be wider than the top width for the following situations. Appropriate adjustment to the weir length should be made in these cases.

The road profile might cut through the ground points. In this case the road profile should represent the ground profile for the portions where the road cuts through the ground.

The road profile is coded longer than the distance between starting and end station of the GR data. In this case GR data can be extended or the BT data can be cutoff.

The section 3 was coded as narrow as the bridge opening section.

BR WF 06 WRLEN is narrower than the TOPWID at section 3.

Help: Only part of the road may have been coded. In this case the WRLEN should be recoded to include the road profile covering the effective overbank areas.

BR WF 07 Pressure and weir flow. However, TOPWID of ;Topwid2; at section 2 is narrower than the TOPWID of ;Topwid1; at section 1.

Help: When there is weir flow the entire section 2 should be effective. The top width at section 2 should be about the same as the top width at section 1. The top width at section 2 is narrower because of the following conditions.

The X3 elevations are set too high at section 2 and the flow is limited between the channel bank stations or the encroachment stations. X3 elevations should be readjusted.

Section 2 is coded as narrow as the bridge opening section. Section 2 should be recoded to represent the natural valley cross section. Please refer to message BR LC 01 for the description of section 2.

BR WF 08 Pressure and weir flow. However, TOPWID of ;Topwid3; at section 3 is narrower than the TOPWID of ;Topwid4; at section 4.

Help: When there is weir flow the entire section 3 should be effective. The top width at section 3 should be about the same as the top width at section 4. The top width at section 3 is narrower because of the following conditions.

The X3 elevations are set too high at section 3 and the flow is limited between the channel bank stations or the encroachment stations. X3 elevations should be readjusted.

Section 3 is coded as narrow as the bridge opening section. Section 3 should be recoded to represent the natural valley cross section. Please refer to message BR LC 01 for the description of section 3.

BR WF 09 Pressure and weir flow. However, critical depth occurs at section 2.

Help: Critical depth occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist then investigate why critical depth occurs at this cross section and explain on the comment record.

Please also refer to Messages BR X3 00 and BR X3 16 on the discussion of X3 record, message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR WF 10 Pressure and weir flow. However, critical depth occurs at section 3.

Help: Critical depth occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist then investigate why critical depth occurs at this cross section and explain on the comment record.

Please also refer to Messages BR X3 00 and BR X3 16 on the discussion of X3 record, message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR WF 11 Low and weir flow. However, TOPWID of ;Topwid2; at section 2 is less than the TOPWID of ;Topwid1; at section 1.

Help: When there is weir flow the entire section 2 should be effective. The top width at section 2 should be about the same as the top width at section 1. The top width at section 2 is narrower because of the following conditions.

The X3 elevations are set too high at section 2 and the flow is limited between the channel bank stations or the encroachment stations. X3 elevations should be readjusted.

Section 2 is coded as narrow as the bridge opening section. Section 2 should be recoded to represent the natural valley cross section. Please refer to message BR LC 01 for the description of section 2.

BR WF 12 Low and weir flow. However, TOPWID of ;Topwid3; at section 3 is less than the TOPWID of ;Topwid4; at section 4.

Help: When there is weir flow the entire section 3 should be effective. The top width at section 3 should be about the same as the top width at section 4. The top width at section 3 is narrower because of the following conditions.

The X3 elevations are set too high at section 3 and the flow is limited between the channel bank stations or the encroachment stations. X3 elevations should be readjusted.

Section 3 is coded as narrow as the bridge opening section. Section 3 should be recoded to represent the natural valley cross section. Please refer to message BR LC 01 for the description of section 3.

BR WF 13 Low and weir flow. However, critical depth occurs at section 2.

Help: Critical depth occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist then investigate why critical depth occurs at this cross section and explain on the comment record.

Please also refer to Messages BR X3 00 and BR X3 16 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR WF 14 Low and weir flow. However, critical depth occurs at section 3.

Help: Critical depth occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist then investigate why critical depth occurs at this cross section and explain on the comment record.

Please also refer to Messages BR X3 00 and BR X3 16 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

Normal Bridge

BR NB 01 Low Flow because CWSEL ;Cwsel5; at section 5 is lower than MXLCEL at section 4 ;Xlcel4.max; and lower than MNREL at section 4 ;Rdel4.min;.

Help: Normal bridge routine is suitable for low flow and low and weir flow condition. Section 5 is at the upstream side of the structure. CHECK-2 program assumes that the type of flow is low flow if the water-surface elevation at section 5 is lower than maximum low chord elevation (MXLCEL) and lower than minimum road elevation (MNREL), as long as the energy gradient elevation at section 5 is lower than MXLCEL and MNREL.

BR NB 02 Low Flow because CWSEL ;Cwsel5; at section 5 is lower than MXLCEL at section 4 ;Xlcel4.max; and lower than MNREL at section 4 ;Rdel4.min;. However, EG at section 5 is higher than MXLCEL and MNREL. Normal Bridge routine may not be suitable.

Help: Special bridge and special culvert differentiates the type of flow by comparing the energy gradient elevation (EG) at the upstream side of the structure to the maximum low chord elevation (MXLCEL) and minimum road elevation (MNREL). If EG is higher than MXLCEL the type of flow is pressure flow. If EG is higher than MNREL the type of flow is weir flow. Normal bridge routine may not be suitable for these cases and the structure should be modeled using special bridge or special culvert routines.

BR NB 03 Normal bridge, low flow. However, topwidth is greater than channel width at section 2.

Help: For low flow condition, channel bank stations must be located at the abutments of the structure. The natural channel banks may not be at the abutments. In this case n values must be assigned for each segment of the channel portion on the NH record. Please also note that section 2 should represent the natural valley cross section and not the bridge opening section. Please refer message BR LC 01 for location of bridge cross sections.

Proper limiting elevations are assigned on fields 8 and 9 of X3 record, such that the total flow will be confined between the abutments (channel bank stations). Therefore, TOPWID should not be greater than the channel width at section 2.

BR NB 04 Normal bridge, low flow. However, channel widths at section 2 and section 3 are not the same.

Help: Channel bank stations at section 2 should be at the abutments of the structure for low flow condition. The channel bank stations at section 3 should also be at the abutments of the structure. Proper X3 elevations should be selected at Section 2 such that the total flow will be within the channel bank stations at section 2. Proper BT and GR data should be selected at section 3 such that the total flow will be within the abutments at section 3.

BR NB 05 Normal bridge, low flow. However, channel width at section 3 is not equal to channel width at section 4.

Help: If the dimension of the structure does not change between section 3 and section 4, the channel widths at these sections must be the same. Check that BT, GR and X3 data and the channel bank stations are selected properly at these sections.

BR NB 06 Normal bridge, low flow. However, channel widths at section 5 and section 4 are not the same.

Help: Channel bank stations at section 5 should be at the abutments of the structure for low flow condition. The channel bank stations at section 4 should be at the abutments of the structure. Proper X3 elevations should be selected at section 5 such that the total flow will be within the channel bank stations at section 5. Proper BT and GR data should be selected at section 4 such that the total flow will be within the abutments at section 4.

BR NB 07 Normal bridge, low flow. However, topwidth is greater than channel width at section 5.

Help: For low flow condition, channel bank stations must be located at the abutments of the structure. The natural channel banks may not be at the abutments. In this case n values must be assigned for each segment of the channel portion on the NH record. Please also note that section 5 should represent the natural valley cross section and not the bridge opening section. Please refer message BR LC 01 for location of bridge cross sections.

Proper limiting elevations are assigned on fields 8 and 9 of X3 record, such that the total flow will be confined between the abutments (channel bank stations). Therefore, TOPWID should not be greater than the channel width at section 5.

BR NB 08 Low and weir flow because CWSEL ;Cwsel5; at section 5 is lower than MXLCEL at section 4 ;Xlcel4.max; and higher than MNREL at section 4 ;Rdel4.min;.

Help: Normal bridge routine is suitable for low and weir flow condition.

BR NB 09 Normal bridge, low and weir flow. However, topwidths at section 2 and section 3 are not the same.

Help: Topwidth at section 2 can be smaller than the topwidth at section 3 if the X3 elevations are set too high.

Topwidth at section 3 can be smaller than the topwidth at section 2 if GR and BT data do not cover the entire floodplain.

Verify the X3 elevations and GR and BT data.

BR NB 10 Normal bridge, low and weir flow. However, topwidths at section 5 and section 4 are not the same.

Help: Topwidth at section 5 can be smaller than the topwidth at section 4 if the X3 elevations are set too high.

Topwidth at section 4 can be smaller than the topwidth at section 5 if GR and BT data do not cover the entire floodplain.

Verify the X3 elevations and GR and BT data.

BR NB 11 Pressure flow because CWSEL ;Cwsel5; at section 5 is higher than MXLCEL at section 4 ;Xlcel4.max; and higher than MNREL at section 4 ;Rdel4.min;. Normal Bridge routine may not be suitable.

Help: Normal bridge routine is suitable for gradually varied flow condition. Pressure flow is considered as rapidly varied flow and the normal bridge routine may not be suitable.

BR NB 12 Pressure and weir flow because CWSEL ;Cwsel5; at section 5 is higher than MXLCEL at section 4 ;Xlcel4.max; and MNREL at section 4 ;Rdel4.min;. Normal Bridge routine may not be suitable.

Help: Normal bridge routine is suitable for gradually varied flow condition. Pressure and weir flow is considered as rapidly varied flow and the normal bridge routine may not be suitable.

BR NB 13 Pressure and weir flow because CWSEL ;Cwsel5; at section 5 is higher than MXLCEL at section 4 ;Xlcel4.max; and higher than MNREL at section 4 ;Rdel4.min;. However, the energy grade elevation difference between section 5 and section 2 is less than 0.5 ft.

Help: Normal bridge routine is suitable for gradually varied flow condition. Pressure and weir flow is considered as rapidly varied flow and the normal bridge routine may not be suitable. However, for highly submerged condition gradually varied flow assumption may be valid. CHECK-2 program assumes that if the energy gradient elevation difference between section 5 and 2 is less than 0.5 foot the structure is highly submerged and normal bridge routine may be used.

BR NB 14 Normal bridge, pressure and weir flow. However, topwidths at section 2 and section 3 are not the same.

Help: Pressure and weir flow condition may exist because of the modeling error.

Topwidth at section 2 can be smaller than the topwidth at section 3 if the X3 elevations are set too high.

Topwidth at section 3 can be smaller than the topwidth at section 2 if GR and BT data do not cover the entire floodplain.

Verify the X3 elevations and GR and BT data.

BR NB 15 Normal bridge, pressure and weir flow. However, topwidths at section 5 and section 4 are not the same.

Help: Pressure and weir flow condition may exist because of the modeling error.

Topwidth at section 5 can be smaller than the topwidth at section 4 if the X3 elevations are set too high.

Topwidth at section 4 can be smaller than the topwidth at section 5 if GR and BT data do not cover the entire floodplain.

Verify the X3 elevations and GR and BT data.

Special Culvert

BR SC 01 Upstream invert elevation of ;Elchu; of the culvert is different from minimum elevation of ;Elmin; of SECNO ;Secno; (section 3).

Help: ELCHU of the culvert should be about the same as the ELMIN of section 3.

BR SC 02 The computed type of flow is weir flow and inlet control. However, water-surface elevation at section 3 is lower than the minimum road elevation.

Help: The water-surface is lower at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist, then investigate why the water-surface is lower than the minimum road elevation at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR SC 03 The computed type of flow is weir flow and outlet control. However, water surface elevation at section 3 is lower than the minimum road elevation.

Help: Please refer to Message BR SC 02.

BR SC 04 Inlet control and weir flow. However, TOPWID of ;Topwid2; at section 2 is less than the TOPWID of ;Topwidl; at section 1.

Help: This condition occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section. Please correct these problems. If none of these conditions exist, then investigate why this condition occurs at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, and Message BR LC 01 on the location of bridge cross sections.

BR SC 05 Inlet control and weir flow. However, TOPWID of ;Topwid3; at section 3 is less than the TOPWID of ;Topwid4; at section 4.

Help: Please refer to Message BR SC 04.

BR SC 06 Outlet control and weir flow. However, TOPWID of ;Topwid2; at section 2 is less than the TOPWID of ;Topwid1; at section 1.

Help: Please refer to Message BR SC 04.

BR SC 07 Outlet control and weir flow. However, TOPWID of ;Topwid3; at section 3 is less than the TOPWID of ;Topwid4; at section 4.

Help: Please refer to Message BR SC 04.

BR SC 08 Inlet control and weir flow. However, critical depth occurs at section 2.

Help: Critical depth occurs at this section because X3 elevations are set too high, or the cross section is coded as narrow as the bridge opening section, or roughness coefficient used at this cross section is too small. Please correct these problems. If none of these conditions exist then investigate why critical depth occurs at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR SC 09 Inlet control and weir flow. However, critical depth occurs at section 3.

Help: Please refer to Message BR SC 08.

BR SC 10 Outlet control and weir flow. However, critical depth occurs at section 2.

Help: Please refer to Message BR SC 08.

BR SC 11 Outlet control and weir flow. However, critical depth occurs at section 3.

Help: Please refer to Message BR SC 08.

Notes and Messages Check

BR NM 01 6870: D.S. Energy of ;Eg; is higher than the computed energy of ;Eg;

Help: This message may occur at section 3 of special bridge routine if one or all of the following conditions exist.

1. X3 elevations are set too high.

2. Sections 2 and 3 are coded as narrow as the bridge opening section.
3. Manning's roughness coefficient "n" used at section 2 is too small. It does not represent the natural channel n value.

Please correct these problems.

If none of these conditions exist then investigate why this message occurs at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR NM 02 6790: Possible invalid solution, 20 trials of EG not enough.

Help: This message may occur at section 3 of special bridge routine if one or all of the following conditions exist.

1. X3 elevations are not set properly at sections 2 and 3 of special bridge routine.
2. The channel bank stations are not located at the abutments of the structure.
3. The channel width at section 2 is not equal to the channel width at section 3.
4. ELCHU is not the same as ELMIN of section 3 and ELCHD is not the same as ELMIN of section 2.
5. The XKOR value is not computed correctly.
6. The difference in area between trapezoidal area and BAREA is more than 10%.

Please correct these problems.
If none of these conditions exist, then investigate why this message occurs at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, Message NT RS 05 on roughness coefficients at bridge cross sections, Message BR LF 05 on the determination of the variables for the trapezoidal approximation, and Message BR PF 03 on the computation of XKOR value.

BR NM 03 4677: Bridge deck definition error at Stations X and Y.

Help: If the GR line crosses low chord line or top of the road line, this message will appear. This message will show only at the last station on the BT record where this error occurs. Please check at other areas whether this error may exist by viewing the plotted cross section.

BR NM 04 5150: EG of ;Eg3; less than EG of ;Eg2;

Help: This message may occur at section 3 of special culvert routine if one or all of the following conditions exist.

1. X3 elevations are set too high.
2. Sections 2 and 3 are coded as narrow as the bridge opening section.
3. Manning's roughness coefficient "n" used at section 2 is too small. It does not represent the natural channel n value.

Please correct these problems.

If none of these conditions exist then investigate why this message occurs at this cross section and explain on the comment record.

Please also refer to Message BR X3 00 on the discussion of X3 record, Message BR LC 01 on the location of bridge cross sections, and Message NT RS 05 on roughness coefficients at bridge cross sections.

BR NM 05 5155: 20 trials of QWEIR not enough; Possibly invalid

Help: This message may occur at section 3 of special culvert routine, if one or all of the following conditions exist.

1. Minimum road elevation is not specified correctly on the X2 record.
2. Channel n values at sections 2 and 3 do not represent natural channel n values.
3. Sections 2 and 3 do not represent the natural valley cross section.
4. Entire road profile spanning across the floodplain is not coded on the BT records.
5. Entrance loss coefficient on field 2 of SC record is not compatible with the configuration of entrance condition as specified by chart and scale numbers on field 8 of SC record.
6. The 100-year natural floodplain is limited using method 1 encroachment or X3 record with stations specified on fields 4 and 6.

Please correct all the above conditions if they exist.

If the above message is not resolved even after correcting all the above conditions, and the culvert is inlet control, and there is message 5140 : normal depth exceeds culvert height, the culvert analysis should be performed using special bridge routine.

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