USER'S MANUAL FOR

FIELD CHECK OF CAMBER
(CAMBER)

pennsylvania
DEPARTMENT OF TRANSPORTATION

Version 2.0.0.0

USER'S MANUAL FOR
COMPUTER PROGRAM CAMBR
FIELD CHECK OF CAMBER
Version 2.0.0.0

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1 GENERAL DESCRIPTION

1.1 PROGRAM IDENTIFICATION

Program Title: Field Check of Camber

Program Name: CAMBR

Version: 2.0.0.0

Subsystem: Structure Design - Geometry

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ABSTRACT:

The Field Check of Camber program enables the field engineer to select the minimum slab thickness for the bridge, after determining whether adjustments must be made to the design deck elevations of a bridge. The program is limited to bridges, with simple spans. The program can be used for bridges with horizontal geometry, which falls entirely on a tangent or curve, including spiraled curve, or on a combination of tangent and curved sections. The bridge may also fall entirely or partially on a vertical curve. The program allows the data to be entered in a command type free field format and accepts the data in metric (SI) or US customary units.

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2 PROGRAM DESCRIPTION

2.1 PROGRAM OVERVIEW

The Metric Field Check of Camber program will aid the field engineer in determining whether or not adjustments must be made to the design deck elevations of a bridge in order to obtain the minimum slab thickness (as required by design). Using bridge data, height of instrument and rod readings at desired points, the resulting slab thickness and correction or adjustment is computed. If rod readings have not been taken, they may be omitted and a theoretical top of beam elevation is computed. Elevations are computed at either quarter, eighth, tenth or twentieth points of each girder.

The description of the bridge must be provided in the form of data input. This consists of the horizontal and vertical alignment geometry, bridge deck cross sections, bearing line descriptions (distances and skew angles), cambers, slab depth, and girder offsets.

2.2 PROGRAM ASSUMPTIONS AND LIMITATIONS

The program will accommodate various bridge configurations with some limitations. The bridge may be entirely on a tangent or curve, including a spiraled curve, or a combination of tangent and curved sections. The bridge may also fall partially or entirely on a vertical curve, but only one vertical curve may be input. The bridge may be referenced from the profile grade line or a tangent to the profile grade line. There may be superelevation transitions on the bridge. Curved girders are not permitted and vertically placed girders are assumed. The program assumes continuous stationing and will not handle station equations.

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3 METHOD OF SOLUTION

3.1 REFERENCE

A reference point is chosen along the profile grade line. Zero coordinates are assigned to this reference point. Bearing lines and girders are then referenced from this point along the profile grade line or a tangent to the profile grade line. Distances and skews for the bearing lines and offsets to the girders are defined. Refer to Figure 3.1.1 on page 3-2.

The sequence of computations for each span is as follows:

1. Coordinates are computed for the intersections of the bearing lines with the profile grade line or tangent to the profile grade line.
2. Using the input skew angle and girder offsets, coordinates are computed for the intersections of the girder lines with the bearing lines.
3. Radial offsets and the corresponding profile grade line stations are computed for the intersections of girder and bearing lines.
4. The elevation at the top of slab is computed at each of the above intersections. Each elevation is a function of profile grade elevation and bridge deck cross section.
5. The radial offsets, corresponding profile grade station, and elevation at the top of slab are computed for intermediate points along the girders.
6. The expected deflection at each intermediate point due to the dead load of the slab is calculated from the input Camber data. If rod readings are entered, the deflections are subtracted from the calculated field elevations along each girder to obtain the final girder elevations.
7. When height of instrument and rod readings are given, the resulting slab thickness is obtained by subtracting the final girder elevations from the calculated deck elevations. Correction or adjustment to the deck elevation is found by computing the difference between the resulting slab thickness and the design slab thickness.
8. If height of instrument and rod readings are not given, the design slab thickness is subtracted from the calculated Deck elevation. The amount of camber is then added at each intermediate point to obtain the theoretical top of girder elevation.

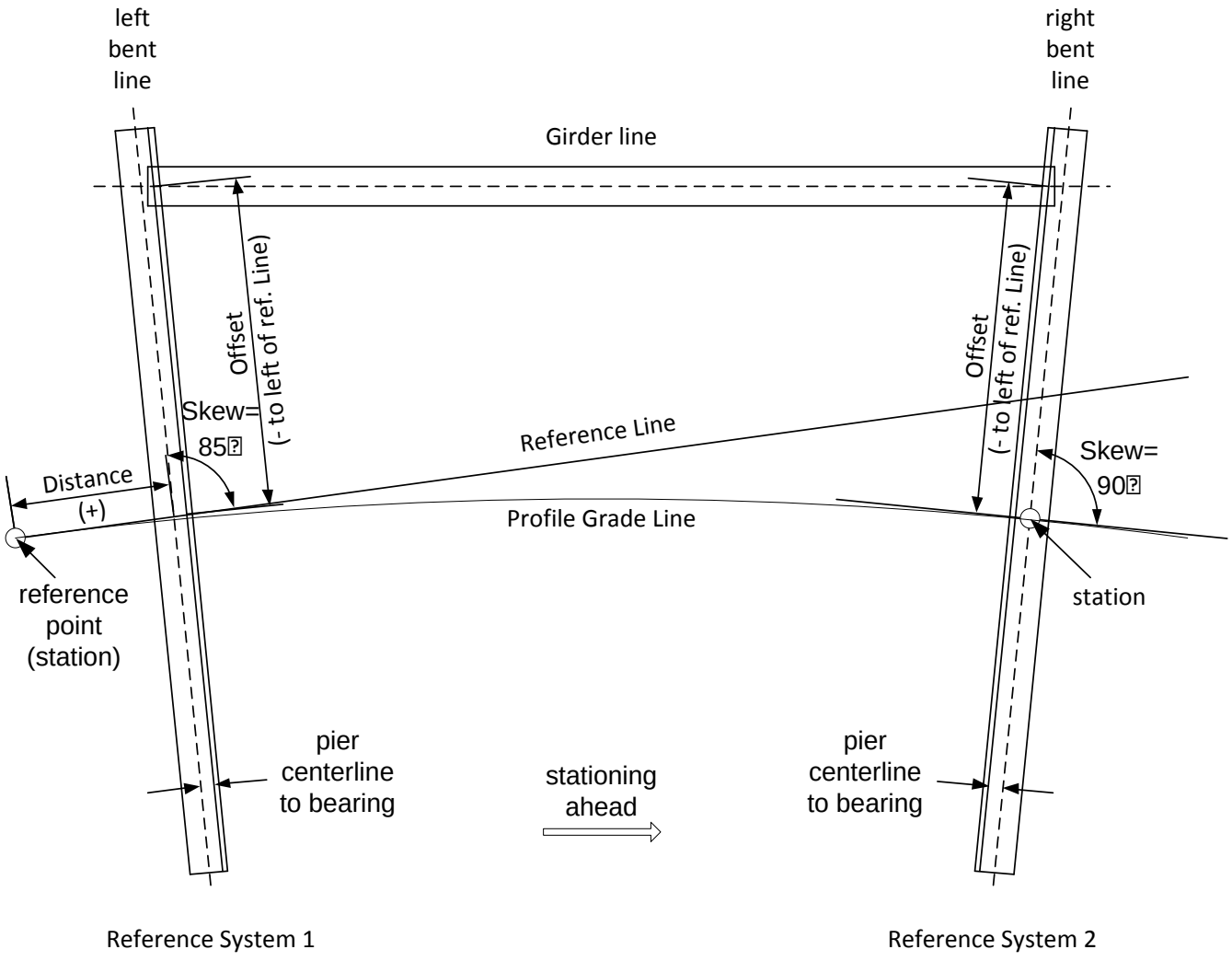

Figure 3.1.1 Bridge Reference System

3.2 FLOW CHART

Refer to Figure 3.2.1 Flow Chart on below.

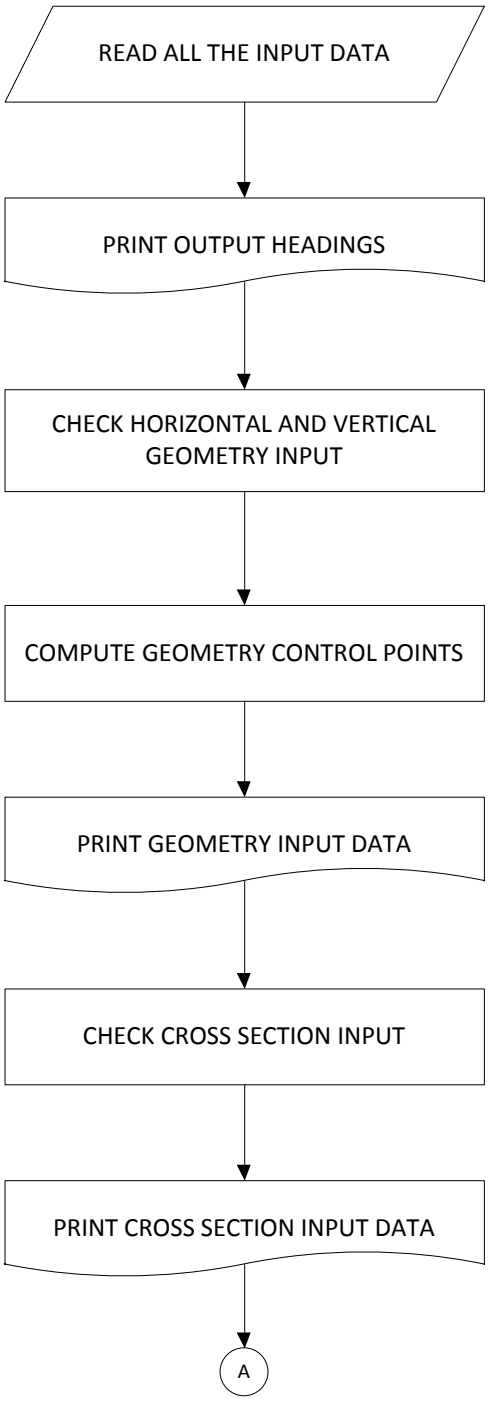

Figure 3.2.1 Flow Chart

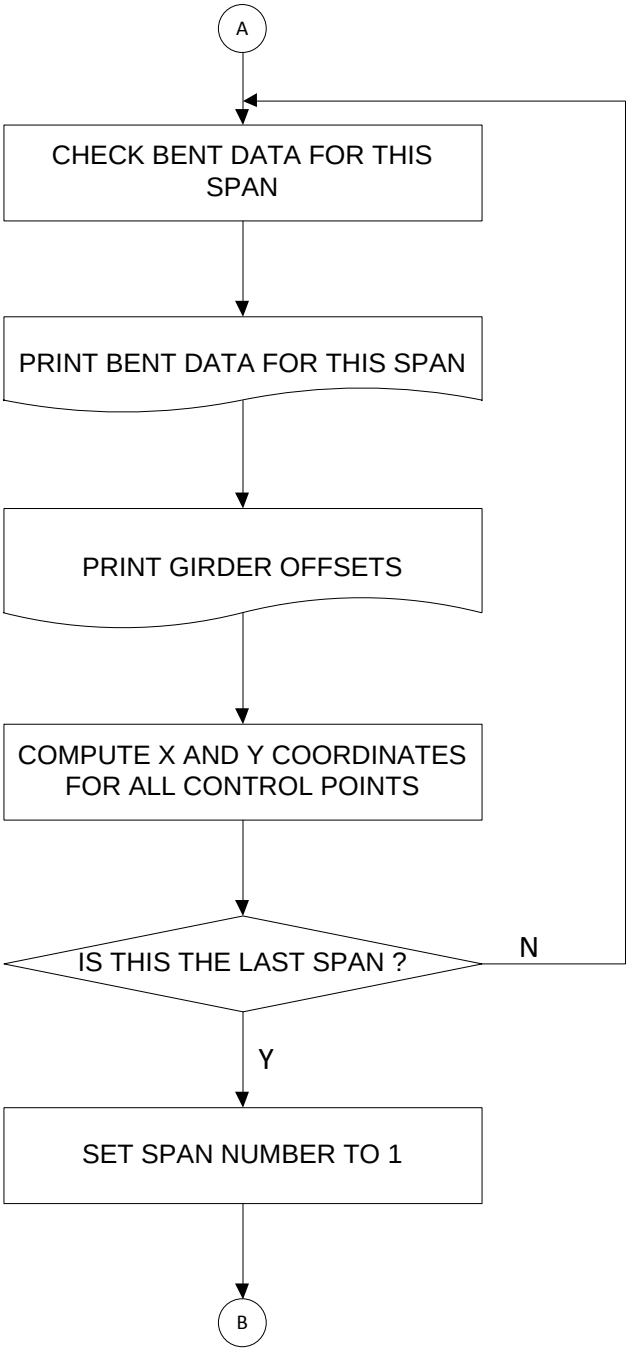

Figure 3.2.1 Flow Chart (cont)

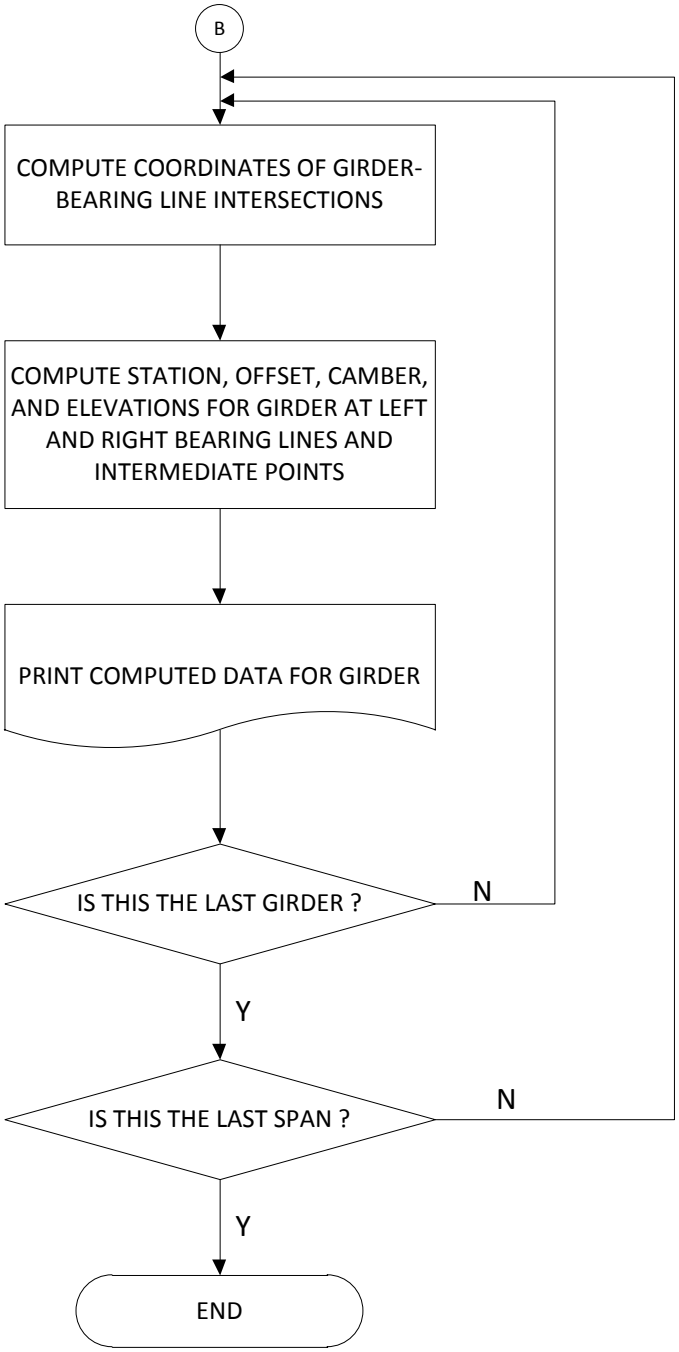

Figure 3.2.1 Flow Chart (cont.)

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4 GETTING STARTED

4.1 INSTALLATION

This program is delivered via download from the Department's website. Once payment has been received by PennDOT, you will receive a confirmation e-mail with instructions on how to download the software. The download file is a self-extracting installation file for the licensed PennDOT engineering software. The engineering program runs as a 32-bit application and is supported on Windows Vista, Windows 7 (32 and 64 bit versions), and Windows 8 (32 and 64 bit versions) operating systems.

Your license number, license key and registered company name, found in the e-mail received from the Department, are required to be entered when installing the program and must be entered exactly as shown in the e-mail. The license number, license key and registered company name will also be needed when requesting future versions of the program (i.e., enhancements, modifications, or error corrections), and requesting program support. A backup copy of the program download and e-mail instructions should be made and used for future installations. You may want to print the software license agreement, record the license number, license key and registered company name and keep it in a safe place.

To install the program, follow the installation instructions provided with the original e-mail from the Department.

The following files will be installed in the program destination folder, which defaults to “C:\Program Files\PennDOT\ CAMBR v<version_number>\” or "C:\Program Files (x86)\PennDOT\ CAMBR v<version number>\" for 64-bit operating systems:

1. CAMBR.exe, CAMBR_DLL.dll – Executable program and Dynamic Link Library.
2. CAMBR.pd – Parameter definition file.
3. CAMBRUser Manual.pdf – Program User’s Manual (PDF Format).
4. CAMBR RevisionRequestForm.dotx – Revision Request form (MS WORD template).
5. GettingStarted.pdf – A document describing installation and running of the program.
6. LicenseAgreement.pdf – The program license agreement.
7. MSVCR71.dll – Runtime Dynamic Link Library.

The program exam CAMBR ple problem files (ex*.dat) will be installed in the program example folder, which defaults to "C:\PennDOT\ CAMBR v<*version_number*> Examples\". Users must have write access to this folder in order to run the input files from this folder.

4.2 PREPARING INPUT

The program requires an ASC**II** input file. The input file consists of a series of command lines. Each command line defines a set of input parameters that are associated with that command. A description of the input commands can be found in Chapter 5 of the User's Manual. The input can be created using Engineering Assistant, described below, or any text editor.

4.3 ENGINEERING ASSISTANT

The Engineering Assistant (EngAsst) is a Windows application developed by the Pennsylvania Department of Transportation (PennDOT) to provide a graphical user interface (GUI) for PennDOT's engineering programs. The data for the input to the engineering program is presented in a user-friendly format, reflecting the implied structure of the data, showing each record type on a separate tab page in the display and showing each field on each record with a defining label.

With EngAsst the user can create a new input file, modify an existing input file, import input files, run the associated engineering program and view the output in a Windows environment. The help and documentation are provided, including text descriptions of each field, relevant images, and extended help text at both the record/tab level and the field level. The entire Engineering Program User's Manual is also accessible within EngAsst.

EngAsst is not included with this software. It requires a separate license that can be obtained through the Department's standard Engineering software licensing procedures. Order forms can be obtained from the software support website at http://penndot.engrprograms.com.

4.4 RUNNING THE PROGRAM WITHOUT ENGINEERING ASSISTANT

The engineering programs are FORTRAN console application programs. They may be run from a command window, by double-clicking on the program icon from Windows Explorer, by selecting the shortcut from the Start menu under Programs\PennDOT, or by double-clicking the shortcut icon on the desktop. To run the program in a command window, the user must specify the directory in which the program has been installed or change to the directory.

The program will prompt for an input file name, and the user should then enter the appropriate input file name.

The input file must be created before running the program. The program will then prompt for whether the output should be reviewed on the screen. The user should enter Y if the output is to be reviewed on the screen after execution or N if the output is not to be reviewed on the screen. The program will then prompt for the name of the output file in which the output is to be stored, and the user should then enter the desired output file name. If a file with the specified output file name already exists, the program will ask the user whether to overwrite the existing file. The user should enter Y if the existing file is to be overwritten or N if the existing file is not to be overwritten. If the user enters N to specify that the existing file is not to be overwritten, the program will prompt the user for another output file name. The program will then execute.

To cancel the program during execution, press <Ctrl C> or <Ctrl Break>, and then press <Enter>.

When the program completes execution, the user is prompted to “Press <ENTER> to exit program.” This allows the user to view the last messages written to the screen when the program was started by double-clicking on the program icon from Windows Explorer.

The user can view the *.OUT output file with a text editor and the *.PDF output file (for those programs that produce it) with Adobe Acrobat.

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5 INPUT DESCRIPTION

5.1 INPUT DATA REQUIREMENTS

Before running the Field Check of Camber program, the user must create an input file. The input file consists of a series of command lines and comment lines. Each command line defines a set of input parameters that are associated with that command. The program interprets each command line and checks the input parameters to insure that the input data is of the correct type and within the allowable ranges set by the program. A comment line is designated by an exclamation point (!) in the first column of the line. Comment lines are ignored by the program. Any number of comment lines may be added to the input file by the user to clarify the information being entered.

The syntax of a command line is given as:

KWD parm1, parm2, , , parm5, ,

where, KWD is a 3 character keyword representing a command and,
parm1, parm2... are the parameter values associated with KWD.

A command line must not exceed 256 characters in length. Command lines can be continued on any number of data lines in the input file by placing a hyphen (-) at the end of each data line to be continued, and by placing any remaining parameters on the following lines starting in column 4 of each continuation line. The limit of 256 characters includes all characters and parameters on all continuation lines of a given command line. Some commands are repeatable and some commands have parameters or groups of parameters that are repeatable. When parameters are repeatable, the user has the option of repeating the parameters in a single command or repeating the command. For example, the GOL (Girder Offsets Left) command has Girder Number and Offset as repeatable parameters. The user could enter the Girder Number and Offset three times on one command and four times on another command, or seven times on a single command.

```
GOL  1,   1, -7.5,    2, -5.0,      3, -2.5
GOL  1,   4,  0.0,    5, 2.5,       6, 5.0,       7, 7.5
```

or

```
GOL  1,   1,-7.5,     2, -5.0,      3, -2.5,      4,  0.0,      5, 2.5,       6, 5.0,       7, 7.5
```

Groups of repeatable parameters, such as Girder Number and Offset, must stay together in a command line unless a continuation character (-) is used. That is, a command cannot end with a Girder Number input and continue using another GOL command having the Offset input. When a continuation character is used, the repeatable data can be separated on two lines. The program reads all continuation lines as one command. For example,

Correct input:

```
GOL  1,   1, -7.5,      2, -5.0,      3, -2.5
GOL  1,   4,  0.0,      5, -
              2.5,      6, 5.0,       7, 7.5
```

Incorrect input:

```
GOL  1,   1, -7.5,      2, -5.0,      3
               -2.5,    4,  0.0,      5, 2.5,      6, 5.0,      7, 7.5
```

The first three columns of each command line are reserved for keywords that define the command type. Columns 4 through 256 are to be used to input the parameters associated with a command. One or more spaces are recommended between the keyword and the input parameters to improve readability.

The parameters associated with each command must be entered in the order they appear in the command description tables. The user must place commas to separate the parameters on the command line. Blank spaces cannot be used to separate parameters. The parameter field width is not restricted, however, the total number of characters cannot exceed 256.

The default value for a parameter is assigned by the program by placing a comma without any value for the parameter. For example, in the command syntax example shown below, the default values will be assigned to parameters parm3 and parm4.

```
KWD parm1,    parm2,    ,    ,    parm5
```

If the user places a comma and there is no default value, the program will return an error status. If a comma is entered after the command keyword, the program will assign the default value to the first parameter. If the user does not enter all the parameters for a command, the program will assign default values for those parameters not entered. That is, the user is not required to place commas at the end of a command line. If the above example required 7 parameters, parm6 and parm7 would also be assigned default values by the program.

The default values are stored in a parameter file, which can be changed by the system manager. The parameter file stores the parameter description, type of data, units, upper limit, lower limit, error or warning status if the upper or lower limits are exceeded, and the default value for each parameter.

Any numerical value, within the upper and lower limits, can be entered for a parameter. The status codes, shown in parenthesis below the lower and upper limits, indicate the status if an input item exceeds the lower or upper limits. The status code, (E), indicates an error. The status code, (W), indicates a warning.

In the following sections, all available commands and associated parameters are described with two tables for each command. The first table contains the keyword for a particular command along with a description of the command. The second table gives all the parameters associated with the given command, parameter description, units, limits and default values.

The program will process all input and will check for errors and warnings. If the number of errors exceeds 25 during input processing, the program will terminate immediately. After all input is processed, the program checks if any errors were found. If an error was found, the program will terminate. If warnings are found, the program will continue to process. There is no limit on the number of warnings in a single run. The user should review all warnings in the output file to insure that the input data is correct. Warnings are an indication that the input value has exceeded normally acceptable limits for that parameter.

5.2 ORDER OF COMMANDS

If the user wants to control the number of lines printed on a page or the number of lines to be left blank at the top of each page, the CFG (configure) command should be the first command. The CFG command is optional and the program will use default values if the CFG command is not entered. The first required command is the TTL (title) command, which is printed in the header at the top of each output page. The first 10 TTL commands are printed on the first page of the output. The second required command after the title commands is the CTL (control) command. The CTL command is used to specify the system of units (SI or US) which is required for checking the range of the input data. The CTL command also includes other major control parameters. Other required commands are the HGM (horizontal geometry) command, VGM (vertical geometry) command, NCR (normal cross section) and/or SCR (superelevated cross section) command, BRL (bearing line) command, CBR (camber) command, GOL (girder offsets left) command and GOR (girder offsets right) command.

The ROD (rod readings) command is optional and is used to supply rod readings if they are to be used to determine actual top of beam elevations. The OUT (output) command is only required if the user wants to select output other than the standard output produced by the program.

The recommended order of commands is shown in Table 5.2.1 Recommended Order of Commands. The commands are shown in alphabetical order in Table 5.2-2 Commands in Alphabetical Order. Section in these tables refers to the section number of this chapter where these commands are described. Figure 5.2.1 on page 5-4 shows the overall view of the typical input file with these commands.

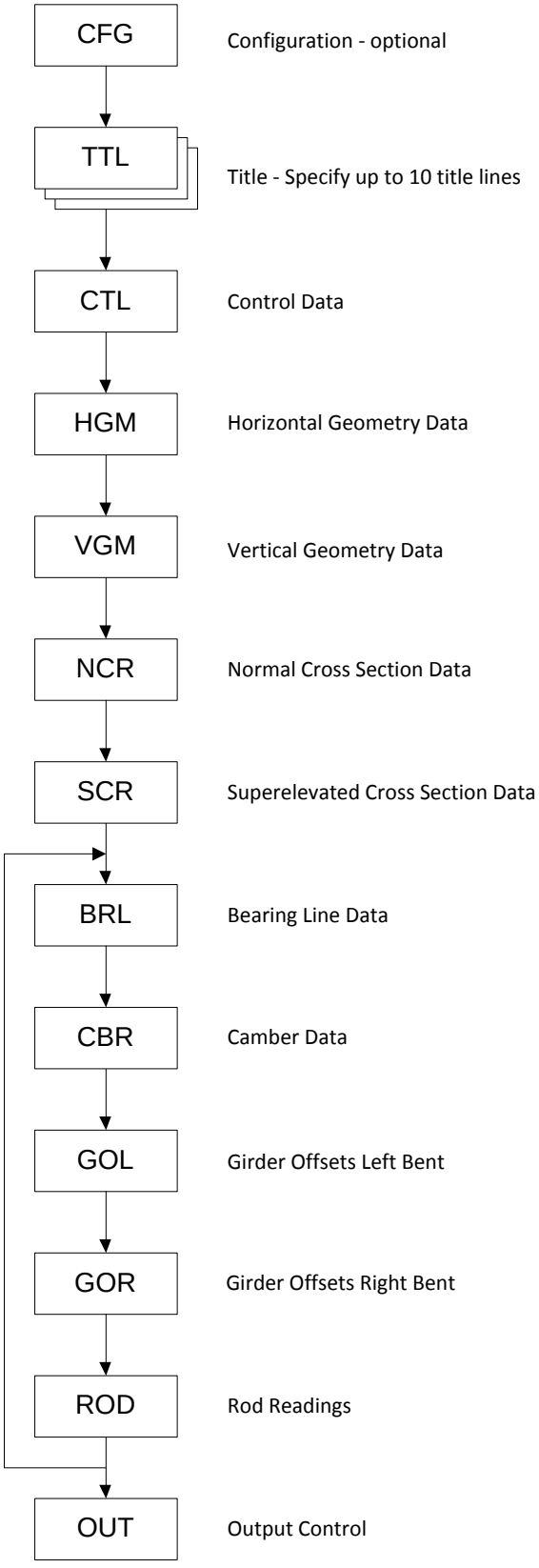


Figure 5.2.1 Overall View of Input File

Table 5.2.1 Recommended Order of Commands

Key-word	Command Description	Comments	Section
CFG	Configuration	Optional	5.3
TTL	Title	One TTL command required	5.4
CTL	Control	Required	5.5
HGM	Horizontal Geometry	Required	5.6
VGM	Vertical Geometry	Required	5.7
NCR	Normal Cross Section	Required	5.8
SCR	Superelevated Cross Section	Required	5.9
BRL	Bearing Line	Required	5.10
CBR	Camber	Required – One per span	5.11
GOL	Girder Offsets Left	Required – One per span	5.12
GOR	Girder Offsets Right	Required – One per span	5.13
ROD	Rod Readings	Optional	5.14
OUT	Output	Optional	5.15

Table 5.2-2 Commands in Alphabetical Order

Key-word	Command Description	Comments	Section
BRL	Bearing Line	Required	5.10
CBR	Camber	Required – One per span	5.11
CFG	Configuration	Optional	5.3
CTL	Control	Required	5.5
GOL	Girder Offsets Left	Required – One per span	5.12
GOR	Girder Offsets Right	Required – One per span	5.13
HGM	Horizontal Geometry	Required	5.6
NCR	Normal Cross Section	Required	5.8
OUT	Output	Required	5.15
ROD	Rod Readings	Optional	5.14
SCR	Superelevated Cross Section	Required	5.9
TTL	Title	One TTL command required	5.4
VGM	Vertical Geometry	Required	5.7

5.3 CFG - Configuration Command

KEYWORD	COMMAND DESCRIPTION
CFG	CONFIGURATION - This command is used for configuring the program at a remote site. Only one CFG command may be used. If this command is not entered, each parameter listed below will be automatically set to its default value.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Number of Lines Per Page	Enter the number of printable lines per output page.	-	50 (W)	100 (W)	60
2. Number of Top Blank Lines	Enter the number of lines to be left blank at the top of each output page.	-	0 (E)	5 (W)	0

5.4 TTL - Title Command

KEYWORD	COMMAND DESCRIPTION
TTL	TITLE - This command is used to place a title block in the output file. The input file must have at least one title command. The first title command is placed at the top of each output page. Use up to ten title commands as desired to describe the problem.

PARAMETER	DESCRIPTION
1. Title	Enter title information. Title information must be less than 77 characters in length. A maximum of 10 title commands can be entered. The input on the first title command will be displayed at the top of each output page. All remaining title information will be displayed on the first page of the output.

5.5 CTL - Control Command

KEYWORD	COMMAND DESCRIPTION
CTL	CONTROL - This command is used to set the control parameters for the input. An input file can have only one control command.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. System of Units	Enter type of units: SI - Metric (SI) units. US - US customary units.	-	SI,US (E)	-	SI
2. X-Sec Type	Enter “1” if only one typical cross section is input, either normal or superelevated (i.e., there is no transition area on the bridge). Enter “2” when normal and superelevated sections are both input.	-	1 (E)	2 (E)	-
3. No. of X-Sec Points	Typical normal and/or superelevated cross sections are input to define the bridge deck surface. This column is used to enter the number of points per cross section. Include every break in slope from the outer face of parapet on the left side of the bridge to the outer face of the right parapet, stationing ahead. A point must be included at the reference line, even if there is no break in slope at the line. When normal and superelevated cross sections are both input, the number of points on each must be the same.	-	5 (E)	30 (E)	-
4. No. of Spans	Enter the number of spans for which output is to be computed.	-	1 (E)	20 (E)	-
5. Class	Enter the class of roadway crossing the bridge.	-	1 (E)	5 (E)	1
6. Spiral	Enter "S" if bridge is partially or entirely on a spiral curve.	-	blank,S (E)	-	blank
7. Rod Readings	Enter "Y" if the rod readings are being input.	-	blank,Y (E)	-	blank
8. Reference System	The type of reference system to be used to describe the location of bent lines and girders. Enter "1" if the bent lines and girders are referenced from the profile grade line. Enter "2" if the bent lines and girders are referenced from the tangent to the profile grade line at the reference station.	-	1 (E)	2 (E)	-

5.6 HGM - Horizontal Geometry Command

KEYWORD	COMMAND DESCRIPTION
HGM	HORIZONTAL GEOMETRY - This command is used to specify the horizontal geometry for the roadway on the bridge.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Radius	Enter the radius of the curve, if the bridge is on a horizontal curve or transition area. Leave blank if the bridge is entirely on a tangent section.	ft m	-	-	blank
2. Curve	Indicate the direction of the curve looking ahead in stationing: R - Curve to the right. L - Curve to the left. Leave blank when a radius is not entered.	-	R,L (E)	-	-
3. Reference Station	Enter the chosen point on the profile grade line, which will be the origin of the coordinate system. This station can be off the structure. The "+" should not be included when entering this station.	ft m	-	-	-
4. PC or SC Station	Enter the PC station for a simple curve. Enter the SC station for a spiraled curve. The "+" should not be included when entering this station. See detailed input description.	ft m	-	-	-
5. PT or CS Station	Enter the PT station for a simple curve. Enter the CS station for a spiraled curve. The "+" should not be included when entering this station. See detailed input description.	ft m	-	-	-
6. Tangent Runout	If a RADIUS is entered and the bridge falls on a combination of tangent and curved sections enter the tangent runout distance for the superelevation transition.	ft m	-	-	-
7. Spiral Length	If Radius is entered and the curve is spiraled, enter the spiral length.	ft m	-	-	-

5.7 VGM - Vertical Geometry Command

KEYWORD	COMMAND DESCRIPTION
VGM	VERTICAL GEOMETRY - This command is used to specify the vertical geometry for the roadway on the bridge.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. PVI Station	Enter the PVI station if the bridge falls on a vertical curve, otherwise leave this field blank. The "+" should not be included when entering this station.	ft m	-	-	-
2. PVI Elevation	Enter the PVI elevation if the bridge falls on a vertical curve. Enter the elevation of the Reference Station if the bridge does not fall on a vertical curve.	ft m	-	-	-
3. Grade Ahead	Enter the ahead grade if the bridge falls on a vertical curve. Enter the profile grade if the bridge does not fall on a vertical curve. Looking ahead in stationing, a positive grade is upward and a negative grade is downward.	%	-	-	-
4.Grade Back	Enter the back grade if the bridge falls on a vertical curve. The grade is determined looking ahead in stationing. Leave this field blank if the bridge does not fall on a vertical curve.	%	-	-	-
5. Vertical Curve Length	Enter the length of vertical curve, if applicable.	ft m	-	-	-

5.8 NCR - Normal Cross Section Command

KEYWORD	COMMAND DESCRIPTION
NCR	NORMAL CROSS SECTION - Any normal cross section falling on the bridge must be described. If a superelevation or widening transition falls on the bridge, the normal and superelevated cross sections must both be described. If the bridge is entirely on tangent, only a normal cross section should be entered. For a bridge on a spiral or combination of tangent and curved sections, both a normal and a superelevated cross section should be entered. A cross section is REFERENCED horizontally and vertically to the profile grade line. Displacements are SIGNED with respect to the previous point while working RIGHT and LEFT from the profile grade line, stationing ahead. The parameters in this command are to be entered in a group and the group of parameters can be repeated as many times as practical. Enter as many commands as necessary to describe a cross section.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Point	Enter the point number of the cross section. A cross section is DESCRIBED by points representing every break in slope across the deck surface. Include a point at the profile grade line, even if there is no break in slope at the line. The cross section should be described starting with 1 at the extreme left of the cross section, at the outer edge of parapet, and proceeding right to the outer edge of the parapet with each point number incremented by one. Refer to 6.8 for detailed input description.	-	5 (E)	24 (E)	-
2. ΔX	Enter the X displacement. This parameter should be paired with ΔY and repeated for each point in this cross section.	ft m	-	-	-
3. ΔY	Enter the Y displacement. This parameter should be paired with ΔX and repeated for each point in this cross section.	ft m	-	-	-

5.9 SCR - Normal Cross Section Command

KEYWORD	COMMAND DESCRIPTION
SCR	SUPERELEVATED CROSS SECTION - Any superelevated cross section falling on the bridge must be described. If a superelevation transition falls on the bridge, both the normal and superelevated cross sections must be described. If the bridge is entirely on a simple curve, only a superelevated cross section should be entered. For a bridge on a spiral or combination of tangent and curved sections, both a normal and a superelevated cross section should be entered. A cross section is REFERENCED horizontally and vertically to the profile grade line. Displacements are SIGNED with respect to the previous point while working RIGHT and LEFT from the profile grade line, stationing ahead. The parameters in this command are to be entered in a group and the group of parameters can be repeated as many times as practical. Enter as many commands as necessary to describe a cross section.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Point	Enter the point number of the cross section. A cross section is DESCRIBED by points representing every break in slope across the deck surface. Include a point at the profile grade line, even if there is no break in slope at the line. The cross section should be described starting with 1 at the extreme left of the cross section, at the outer edge of parapet, and proceeding right to the outer edge of the parapet with each point number incremented by one. Refer to 6.8 for detailed input description.	-	5 (E)	24 (E)	-
2. ΔX	Enter the X displacement. This parameter should be paired with ΔY and repeated for each point in this cross section.	ft m	-	-	-
3. ΔY	Enter the Y displacement. This parameter should be paired with ΔX and repeated for each point in this cross section.	ft m	-	-	-

5.10 BRL - Bearing Line Command

KEYWORD	COMMAND DESCRIPTION
BRL	BENT LINE - This command must be completed for each span of the bridge. The parameters under LEFT BENT LINE apply to the bent line at the left end of the span (with stationing increasing to the right, in plan) while those under RIGHT BENT LINE apply to the bent line at the right end of the span. Refer to Figure 3.1-1 on page 3-2 for illustrations of these items.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Span No.	Enter the corresponding span number of the bridge.	-	1 (E)	20 (E)	-
2. Left Bent Line Distance or Station	If "1" is entered for Reference System on the Control Command, this is the station, given on plans, of the intersection of the centerline of pier or centerline of bent on an abutment with the profile grade line. The "+" should not be included when entering this station. If "2" is entered for Reference System on the Control Command, this is the distance, along the reference line, from the reference point to the intersection of the centerline of pier or centerline of bent on an abutment with the reference line. This value is positive for a distance ahead station from the reference point and negative for a distance back station from the reference point.	ft m	-	-	-
3. Left Bent Line Pier Center Line to Bent	Enter the normal distance between the centerline of pier and the centerline of bearing. Leave blank if these centerlines are the same.	ft m	-	-	-
4. Left Bent Line Skew Angle	The skew angle of the bent line, always measured counterclockwise. If "1" is entered for Reference System on the Control Command, the skew angle is measured from the tangent to the profile grade line at the bent line. If "2" is entered for Reference System on the Control Command, the skew angle is measured from the tangent to the profile grade line at the reference station.	DEG	-	-	-

5.10 BRL - Bearing Line Command (cont.)

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
5. Right Bent Line Distance or Station	If "1" is entered for Reference System on the Control Command, this is the station, given on plans, of the intersection of the centerline of pier or centerline of bent on an abutment with the profile grade line. The "+" should not be included when entering this station. If "2" is entered for Reference System on the Control Command, this is the distance, along the reference line, from the reference point to the intersection of the centerline of pier or centerline of bent on an abutment with the reference line. This value is positive for a distance ahead station from the reference point and negative for a distance back station from the reference point.	ft m	-	-	-
6. Right Bent Line Pier Center Line to Bent	Enter the normal distance between the centerline of pier and the centerline of bearing. Leave blank if these centerlines are the same.	ft m	-	-	-
7. Right Bent Line Skew Angle	The skew angle of the bent line, always measured counterclockwise. If "1" is entered for Reference System on the Control Command, the skew angle is measured from the tangent to the profile grade line at the bent line. If "2" is entered for Reference System on the Control Command, the skew angle is measured from the tangent to the profile grade line at the reference station.	DEG	-	-	-
8. No. of Girders	Enter the number of girders on the span.	-	1	24	-
9. Slab Depth	Enter the depth of the slab plus haunch.	ft mm	-	-	-
10. Height of Instrument	Enter the height of the instrument for the specified span.	ft m	-	-	-

5.11 CBR - Camber Command

KEYWORD	COMMAND DESCRIPTION
CBR	CAMBER - This command describes the camber of each girder at the center of each span. This command must be entered for each span of the bridge. These values are to be taken directly from the shop drawings. The parameters Girder No., A and C in this command are to be entered in a group and can be repeated as many times as practical. Enter as many commands as necessary to describe cambers of all girders for all spans.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Span No.	Enter the corresponding span number of the bridge.	-	1 (E)	20 (E)	-
2. Analysis Points	Enter "1" if field measurements are taken at tenth points. Enter "2" if field measurements are taken at twentieth points. Enter "4" if field measurements are taken at quarter points. Enter "8" if field measurements are taken at eighth points. The Rod Readings entered on the Beam Elevation Command should correspond with these points.	-	1,2,4,,8 (E)	-	4
3. Girder No.	Enter the girder number for the specified span. This field should be repeated as necessary for each span.	-	1 (E)	18 (E)	-
4. A	Enter the estimated total camber of beam, less, deflection due to the dead load of the beam. This field should be repeated as necessary to enter an A for each girder.	in m	-	-	-
5. C	"A" minus the deflection due to dead load of the slab, curb and parapet. This field should be repeated as necessary so as to enter a C for each girder.	in m	-	-	-

5.12 GOL - Girder Offsets Left Bent Command

KEYWORD	COMMAND DESCRIPTION
GOL	GIRDER OFFSETS LEFT BENT - This command describes the girder offsets for the bent to the left of the span. These are the distances from the profile grade line with reference system as "1", or reference line with reference system as "2", to each girder line. They are measured along the bent line and are signed plus (+) if measured to the right and minus (-) if measured to the left of the applicable line. Offsets are entered from left to right, stationing ahead. The parameters Girder No., and offset in this command are to be entered in a group and can be repeated as many times as necessary to describe offsets of all girders. Enter as many commands as necessary to describe girder offsets for all spans. If girder offsets are identical for all spans, enter only for first span.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Span Number	Enter the span number for this set of Girder Offsets Left.	-	1 (E)	20 (E)	-
2. Girder Number	Enter the girder number for this Offset. This field should be repeated as necessary to enter an offset for each girder on the left bent.	-	1 (E)	18 (E)	-
3. Offset	Enter the distance from the applicable line. This field should be repeated as necessary to enter an offset for each girder on the left bent.	ft m	-	-	-

5.13 GOR - Girder Offsets Right Command

KEYWORD	COMMAND DESCRIPTION
GOR	GIRDER OFFSETS RIGHT BENT - This command describes the girder offsets for the bent to the right of the span. These are the distances from the profile grade line with reference system as "1", or reference line with reference system as "2", to each girder line. They are measured along the bent line and are signed plus (+) if measured to the right and minus (-) if measured to the left of the applicable line. Offsets are entered from left to right, stationing ahead.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Span Number	Enter the span number for this set of Girder Offsets Right.	-	1 (E)	20 (E)	-
2. Girder Number	Enter the girder number for this Offset. This field should be repeated as necessary to enter an offset for each girder on the right bent.	-	1 (E)	18 (E)	-
3. Offset	Enter the distance from the applicable line. This field should be repeated as necessary to enter an offset for each girder on the right bent.	ft m	-	-	-

5.14 ROD - Rod Readings Command

KEYWORD	COMMAND DESCRIPTION
ROD	ROD READINGS - This command is used to supply rod readings, if they are used to determine actual top of beam elevations. If rod readings are not taken, do not use this command. If rod readings are taken, at least one ROD command must be entered for each span. The parameter Rod Reading can be repeated as many times as necessary depending upon the value entered for Analysis Points under the command CBR.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Span Number	Enter the corresponding span number of the bridge.	-	1 (E)	20 (E)	-
2. Girder Number	Enter the girder number for the specified span.	-	1 (E)	18 (E)	-
3. Rod Reading	The number of rod readings entered for each girder should correspond to the value entered for Analysis Points as described under the command CBR. For example, if Analysis Points is "1" for tenth points, there should be eleven rod readings entered for each girder. If Analysis Points is "2" for twentieth points, there should be twenty one rod readings entered for each girder, etc.	ft m	-	-	-

5.15 OUT - Output Command

KEYWORD	COMMAND DESCRIPTION
OUT	OUTPUT - This command is used to control the type of output reports, which can be requested by the user. This command is only necessary if the user wants to select output other than the standard output produced by the program. The standard output is indicated by the default values shown for each parameter in this command.

PARAMETER	DESCRIPTION	UNITS	LOWER LIMIT	UPPER LIMIT	Default
1. Input File Echo	0 - Do not print the echo of the input file 1 - Print the echo of the input file	-	0 (E)	1 (E)	0
2. Input Commands	0 - Do not print the summary of input commands 1 - Print the summary of input commands	-	0 (E)	1 (E)	0
3 Input Summary	0 - Do not print the tabular summary of input 1 - Print the tabular summary of input	-	0 (E)	1 (E)	1

6 DETAILED INPUT DESCRIPTION

This chapter provides detailed description of some of the input parameters, which were described in Chapter 5 but may need further explanation or commentary. The numbering scheme used here is as follows. The section number for a command name corresponds to the same section number in Chapter 5. The parameter being described is preceded by a number where the last extension number refers to the parameter number in a corresponding command in Chapter 5, e.g., 6.6.4 PC or SC Station corresponds to section 5.6 HGM – Horizontal Geometry Command, parameter 4. Only the commands and parameters for which detailed description is given are included here.

6.6 HGM - Horizontal Geometry Command

6.6.4 PC or SC Station

If a Radius is entered and the curve is spiraled (SPIRAL = "Y"), the SC station must be entered.

If a Radius is entered and the curve is simple, the PC station must be entered if:

1. Bearing lines and girders are referenced from the profile grade line (Reference System = 1) and the bridge falls on both the tangent roadway and curve. If the bridge falls entirely on the curve it is not necessary to enter the PC station.

   or

2. Bearing lines and girders are referenced from a tangent to the profile grade line (Ref. System = 2)

   and:

   a. The Reference Station lies on the tangent roadway and the bridge lies at least partially on the curve.

      or

   b. The Reference Station lies on the curve and the bridge lies at least partially on the tangent roadway. If the bridge falls entirely on the curve, it is not necessary to enter the PC station.

6.6.5 PT or CS Station

If a Radius is entered and the curve is spiraled (SPIRAL = "Y"), the CS station must be entered.

If a Radius is entered and the curve is simple, the PT station must be entered if:

1. Bearing lines and girders are referenced from the profile grade line (Reference System = 1) and the bridge falls on both the tangent roadway and curve. If the bridge falls entirely on the curve, it is not necessary to enter the PT station.

   or

2. Bearing lines and girders are referenced from a tangent to the profile grade line (Ref. System = 2)

   and:

   a. The Reference Station lies on the tangent roadway and the bridge lies at least partially on the curve.

      or

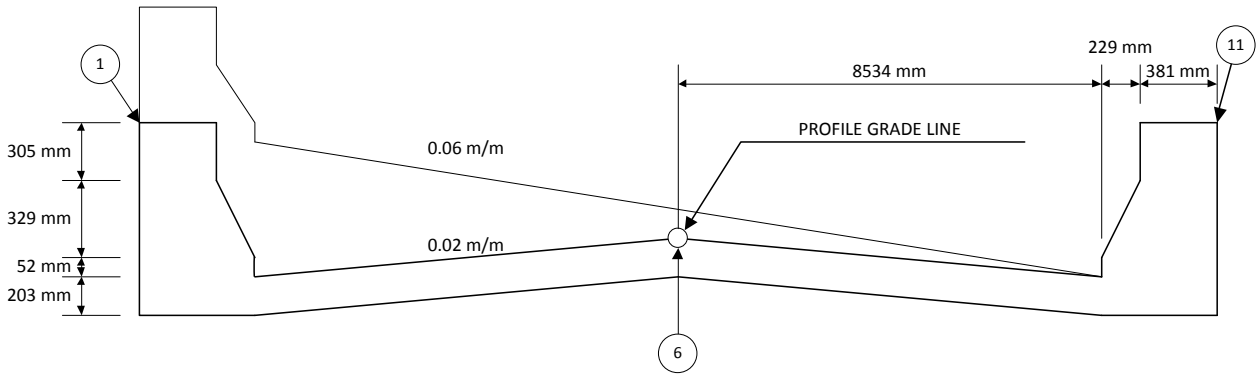
   b. The Reference Station lies on the curve and the bridge lies at least partially on the tangent roadway. If the bridge falls entirely on the curve it is not necessary to enter the PT station.

6.8 NCR - Normal Cross Section Command

Each cross section is described by entering displacements for each point from the previous point. Enter each cross section adhering to the following conventions:

1. A cross section is DESCRIBED by points representing every break in slope across the deck surface. Each point is located from the previous point by horizontal and vertical displacements, delta X and delta Y. Include a point at the centerline, even if there is no break in slope at the line.
2. A cross section is REFERENCED horizontally and vertically to the centerline. Delta X will always be zero for the point at the line. Delta Y will usually be zero for the point at the line. On a superelevated section of class 2 or greater, if the rate of superelevation is greater than the normal crown slope, delta Y will be greater than zero at this point.
3. Displacements are SIGNED with respect to the previous point while working RIGHT and LEFT from the centerline, stationing ahead. Delta X values carry a plus (+) sign when moving to the right, and a minus (-) sign when moving to the left. For delta Y, plus (+) is up and minus (-) is down, from the previous point.
4. The input is CODED starting at the extreme left of the cross section, at the outer edge of parapet, and proceeding right to the outer edge of the parapet.

When transitioning between normal and superelevated cross sections is desired, both cross sections must have the same number of points and the corresponding points on both cross sections (e.g. centerline, edges of pavement, etc.) must have the same cross section point number.



TYPICAL CROSS SECTION

POINT	DELTA X (m)	DELTA Y (m)		
1	-0.381	0.000		
2	0.000	0.305		
3	-0.229	0.329		
4	0.000	0.052		
5	-8.534	-0.171	(0.512)	DELTA Y VALUES FOR SUPERELEVATED CROSS SECTION
6	0.000	0.000	(0.341)	
7	8.534	-0.171	(-0.512)	
8	0.000	0.052		
9	0.229	0.329		
10	0.000	0.305		
11	0.381	0.000		

SLAB DEPTH = 204 mm

Figure 6.8.1 Typical Cross Section

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7 OUTPUT DESCRIPTION

7.1 GENERAL OUTPUT INFORMATION

This section of this chapter describes general information regarding the output. Information is provided for describing page format, page numbering and page header. In general, the page format is built into the program and cannot be changed by the user. The one exception is that the user can specify the number of blank lines to be printed at the top of the page before the page header is printed.

7.1.1 Page Format

There is a maximum of 79 columns in the output file. Column 80 is not used because it cannot be displayed on certain terminal devices. Columns 1, 2, 3 and 4 have been left blank to provide a margin on the left side of the page. This has been done to make the output file less dependent of the output device capabilities. The output is therefore limited to 75 characters, column 5 to 79. The user can specify the number of lines to be left blank at the top of the page with the CFG command.

7.1.2 Page Numbering

The program assigns page numbers and determines when a new page should begin. There are certain rules built into the program to determine when a new page should begin. Generally, the rules will try to keep small reports from being split onto different pages. Also, the rules are such that the report headers and the data appear on the same page.

7.1.3 Page Header

After the cover page, header information is shown at the top of each page. Header information is printed on every page. A sample header is shown in Figure 7.1.1.

```
 Field Check of Camber, Version 2.0.0.0                          PAGE   2
 Input File:  EX1.DAT                                 03/04/2015 11:06:47
-------------------------------------------------------------------------
                            Example Problem 1
                              INPUT SUMMARY
-------------------------------------------------------------------------
```

Figure 7.1.1 Page Header

Information printed in the header includes:

1. Program Title, Version Number - the program title and version number are located at the top left corner of the header.
2. Page number - the page number appears at the top right corner of the header.
3. Input File - the name of the input file is shown at the beginning of the second line.
4. Date and Time - the date and time are printed at the right side of the second line.
5. A separator line is printed between program specific header information and title line.
6. The next header line contains the report title line.
7. The final header line is a separator line.

7.2 COVER PAGE

The first page of the output is the cover page. The following information is shown at the top of the cover page:

1. Program Title – Field Check of Camber
2. Program Name - CAMBR
3. Version ii.nn - where ii represents the numeric designation for major revisions and enhancements to the program and nn represents the numeric designation for minor revisions.
4. Last Updated - this is the date the program was last revised.
5. Documentation - this is the date the User's Manual was last revised.
6. License Number - this is a unique number assigned to all licensees per the License Agreement.

The middle section of the cover page is reserved for the first ten lines of the TTL command input by the user. This information typically should describe the bridge, location, span lengths and any other information the user would need to identify the output.

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7.3 INPUT ECHO

The input data entered by the user is printed on the output based on the options entered for the Input parameters on the OUT command. The input data is printed on the output in the following three formats.

7.3.1 Echo of Input File

The echo of the input file is a listing of the ASCII input file containing the commands and comments as entered by the user. The user can refer to this section to trace input error and warnings by comparing the input data to the input descriptions provided in Chapter 5. The input file can contain 256 characters in a

single line but the output is limited to 76 characters on a single line. If the input file contains more than 76 characters, the echo of the input file will be wrapped to the next line. Other than this limitation, the echo of the input file should appear the same as the input data file.

7.3.2 Summary of Input Commands

The summary of input commands includes a detailed description of each input parameter for all commands entered by the user. The summary of input commands is in a vertical format. Two examples are shown in Figure 7.3.1.

```
COMMAND:  CTL
  SYSTEM OF UNITS                      SI
  X-SEC TYPE                            2
  NO. OF X-SEC POINTS                  13
  NO. OF SPANS                          3
  CLASS                                 1
  SPIRAL                                S
  ROD READINGS                          Y
  REFERENCE SYSTEM                      1

COMMAND:  HGM
  RADIUS                         698.550 m
  CURVE                                R
  REFERENCE STATION              426.720 m
  PC OR SC STATION               487.680 m
  PT OR CS STATION               731.520 m
  TANGENT RUNOUT                  30.480 m
  SPIRAL LENGTH                   60.960 m
```

Figure 7.3.1 Summary of Input Commands

The summary of input commands includes the following information:

1. Command keyword.
2. Input parameter description.
3. Value of input parameter as entered by the default value stored in the program. The value is displayed to the same number of significant figures as entered by the user. The word (default) is placed to the right of the units when default values are used. An asterisk (*) indicates the input value is optional.
4. Units (US or SI) if applicable.

Input may be optional or required. Required input is input that is entered by the user or set to the default value in the program. Default values are indicated with the text (default) placed to the right of the units. If

there is no default value stored in the program and the user does not enter a value, an error message is displayed.

Optional input does not need to be entered by the user. An asterisk (*) is printed for the value indicating the input value is optional. In some cases, when input is not entered the program sets the value. Some input is optional because it is not required for the particular problem being run. For more information regarding specific input requirements, refer to Chapter 5.

7.3.3 Tabular Summary of Input

The tabular summary of input includes a summary of all input parameters in a horizontal format. The tabular summary of input also includes processed input. Processed input is input that is computed by the program based on other items. Two examples of the tabular summary of input are shown in Figure 7.3.2.

```
                          CONTROL INFORMATION
                          -------------------
System          No. of
  of     X-Sec   X-Sec   No. of                          Rod      Reference
 Units   Type    Points   Spans    Class   Spiral   Readings    System
  SI       1       13       2        2        S        Y           1


                          HORIZONTAL GEOMETRY
                          -------------------
                Reference      PC or SC      PT or CS   Tangent   Spiral
  Radius  Curve   Station       Station       Station    Runout    Length
    (m)             (km)          (km)          (km)       (m)       (m)
  698.550   R    0+426.720     0+487.680     0+731.520     0.000   60.960
```

Figure 7.3.2 Tabular Summary of Input

The tabular input summary contains the following information:

1. A description of the input data.
2. Input parameter header containing an abbreviated parameter description and units.
3. Input parameter values. The input values are shown to a fixed number of decimal places because of the tabular format. The actual input value may be rounded. Refer to the summary of input commands for the actual value input by the user.

7.4 COMPUTED OUTPUT

For each intermediate point (quarter, eighth, tenth or twentieth points) along each girder, the following computed values are printed.

STATION and OFFSET

The station and radial offset from the profile grade line, in kilometers and meters respectively.

DESIGN DECK ELEVATION

The resulting elevation calculated from the horizontal and vertical geometry of the bridge. This elevation is given on the surface of the superstructure, in meters.

CAMBER

The expected deflection at this point due to the dead load of the slab as calculated from the input camber data, in meters.

THEORETICAL TOP BEAM

The elevation that should occur, when top of beam elevations are taken, to give the required design slab thickness.

When the height of instrument and rod readings are given:

UNCORRECTED SLAB DEPTH

The slab thickness that will result using the design deck elevation with the existing placed beam as described in the input data, in meters.

CORRECTION

The adjustment of the deck elevation that should be made to obtain the required design slab thickness (plus minimum haunch) at the particular point in question, in meters. A positive value indicates that it should be raised. A negative value indicates that the slab thickness is adequate.

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8 SAMPLE OUTPUT

8.1 EXAMPLE PROBLEM

This example shows a bridge that is located entirely on a curve and is referenced to the profile grade line. A sketch of the horizontal geometry is shown in Figure 8.1.1. Figure 8.1.2 shows the roadway cross sections.

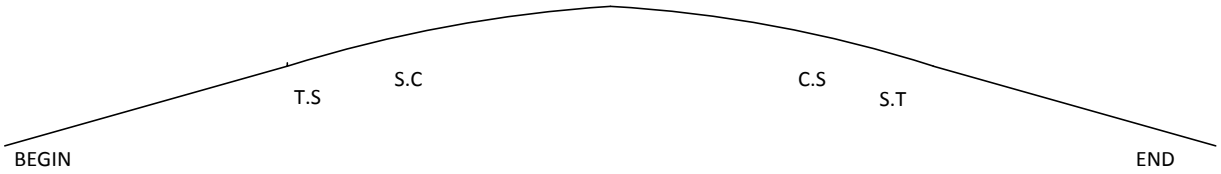
The bridge starts at station 0+495.000 km and ends at station 0+632.000 km and consists of two spans. The reference point is at station 0+426.000 km with an elevation of 152.0 m. The bridge does not fall on a vertical curve. The profile grade is +1.000%.

Since the bridge falls entirely on the curve portion of the spiraled curve, there is no transition, and only superelevated cross section is entered.

There are 7 girders on each span. The cambers at the center of all the girders on all spans are identical. The girder offsets are the same for each span. Output information is required at quarter points.

The height of instrument is entered for each span, and rod readings are entered at the quarter points of each girder.

The computed input data are shown in Figure 8.1.3. The output listing is given on Figure 8.1.4.



POINT	STATION (km)
BEGIN	0+152.400
T.S	0+426.720
S.C	0+487.680
C.S	0+731.520
S.T	0+792.480
END	1+097.280

Figure 8.1.1 Example Problem - Horizontal Geometry

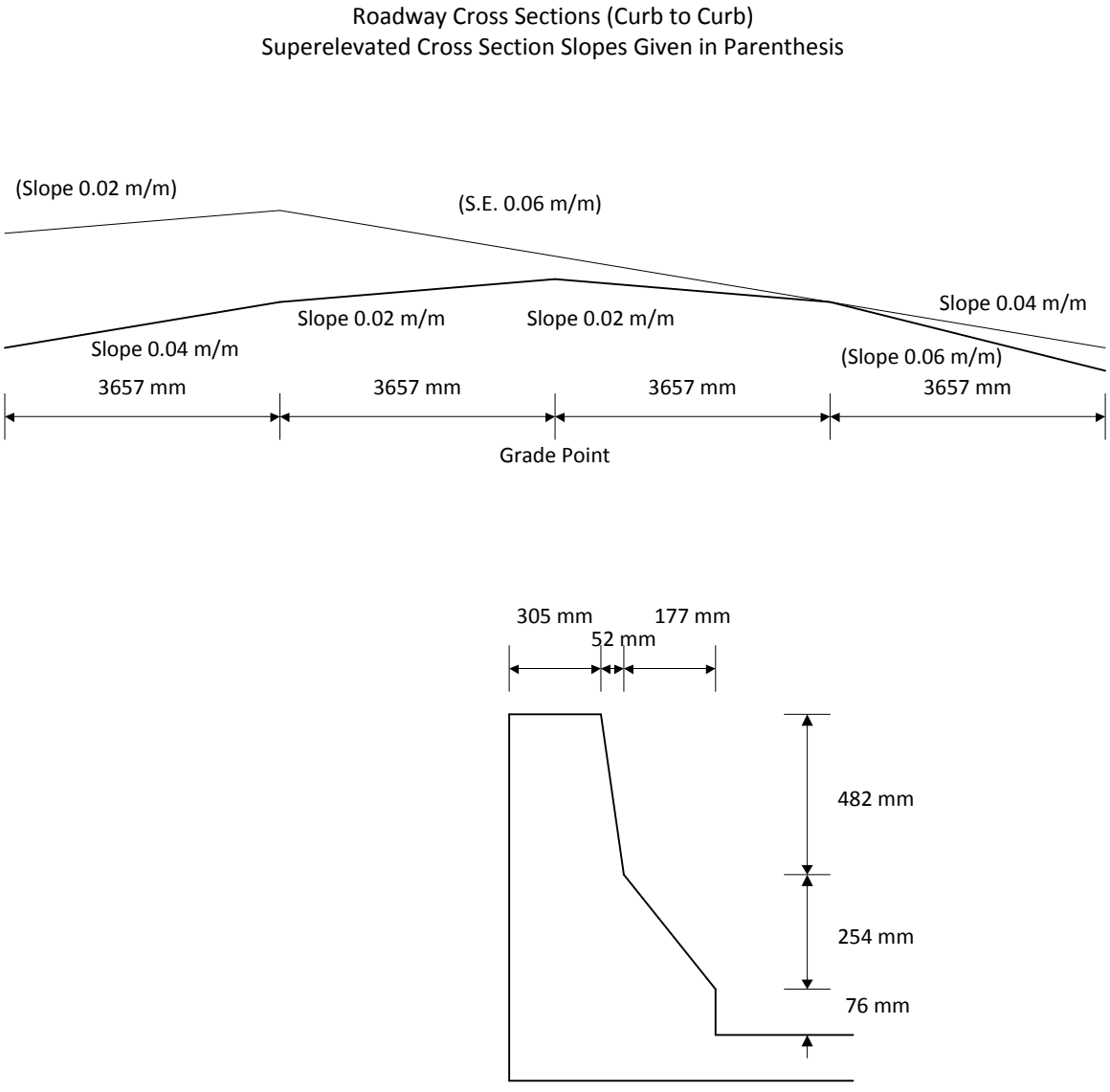


Figure 8.1.2 Example Problem - Roadway Cross Section

```
!
! ** Created by EngAsst **
! EngAsst Information: [Program=CAMBR] [Version=2.0.0.0]
! ** Data Records Start Here **
TTL SAMPLE RUN FOR FIELD CHECK OF CAMBER
CTL SI,1,13,2,2,S,Y,1
HGM 698.55,R,426.720,487.680,731.520,,60.960
VGM ,152.400,1.000
SCR 1,-0.305,0.000,2,-0.052,0.482,3,-0.177,0.253,4,0.000,0.076,5,-3.658,-
   -0.073,6,-3.658,0.220,7,0.000,0.146,8,3.658,-0.220
SCR 9,3.658,-0.220,10,0.000,0.076,11,0.177,0.253,12,0.052,0.482,13,0.305,-
   0.000
BRL 1,495.300,0.000,90.000,541.020,0.000,90.000,7,253,154.326
CBR 1,4,1,0.0678,0.0399,2,0.0678,0.0399,3,0.0678,0.0399,4,0.0678,0.0399,5,-
   0.0678,0.0399,6,0.0678,0.0399,7,0.0678,0.0399
GOL 1,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
GOR 1,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
ROD 1,1,1.204,1.076,0.972,0.866,0.750
ROD 1,2,1.152,1.049,0.972,0.835,0.713
ROD 1,3,1.219,1.122,1.015,0.875,0.759
ROD 1,4,1.366,1.247,1.116,1.021,0.899
ROD 1,5,1.506,1.399,1.314,1.183,1.052
ROD 1,6,1.640,1.521,1.451,1.289,1.198
ROD 1,7,1.792,1.667,1.594,1.454,1.353
BRL 2,541.020,0.000,90.000,586.740,0.000,90.000,7,253,154.762
CBR 2,4,1,0.0678,0.0399,2,0.0678,0.0399,3,0.0678,0.0399,4,0.0678,0.0399,5,-
   0.0678,0.0399,6,0.0678,0.0399,7,0.0678,0.0399
GOL 2,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
GOR 2,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
ROD 2,1,1.183,1.070,0.982,0.853,0.732
ROD 2,2,1.143,1.039,0.939,0.811,0.689
ROD 2,3,1.198,1.082,1.039,0.853,0.741
ROD 2,4,1.344,1.253,1.140,1.000,0.878
ROD 2,5,1.472,1.347,1.247,1.146,1.039
ROD 2,6,1.619,1.512,1.430,1.277,1.177
ROD 2,7,1.768,1.643,1.585,1.442,1.314
OUT 1,0,1
```

Figure 8.1.3 Example Problem - Input File

```
*************************************************************************
*                                                                       *
*  Program Title       Field Check of Camber                            *
*  Program Name        CAMBR                                            *
*  Version             2.0.0.0                                          *
*  Last Updated        03/02/2015                                       *
*  Documentation       03/2015                                          *
*  License No.         (UNLICENSED)                                     *
*                                                                       *
*************************************************************************
*                                                                       *
*  SAMPLE RUN FOR FIELD CHECK OF CAMBER                                 *
*                                                                       *
*************************************************************************
*                                                                       *
*                          COPYRIGHT (C) 1996-2015                      *
*                       COMMONWEALTH OF PENNSYLVANIA                    *
*                       DEPARTMENT OF TRANSPORTATION                    *
*                                                                       *
*                            ALL RIGHTS RESERVED                        *
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*     THEIR QUALITY AND PERFORMANCE.                                    *
*                                                                       *
*     THE COMMONWEALTH WILL NOT BE LIABLE FOR ANY DIRECT, INDIRECT,     *
*     SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT         *
*     OF THE USE OR INABILITY TO USE THE SOFTWARE OR ANY                *
*     ACCOMPANYING DOCUMENTATION.                                       *
*                                                                       *
*     THE COMMONWEALTH WILL NOT BE LIABLE FOR ANY DIRECT, INDIRECT,     *
*     SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT         *
*     OF ANY DEFECT IN THE SOFTWARE OR ANY ACCOMPANYING DOCUMENTATION.  *
*                                                                       *
*************************************************************************
```

Figure 8.1.4 Example Problem - Output

```
Field Check of Camber, Version 2.0                                    PAGE   2
Input File: ex1.dat                                  08/21/2003  06:55:02
------------------------------------------------------------------------------
                    Sample run for Field Check of Camber
                              INPUT FILE ECHO
------------------------------------------------------------------------------

                                  ex1.dat
                                  -------

TTL Sample run for Field Check of Camber
CTL SI,1,13,2,2,S,Y,1
HGM 698.55,R,426.720,487.680,731.520,,60.960
VGM ,152.400,1.000
SCR 1,-0.305,0.000,2,-0.052,0.482,3,-0.177,0.253,4,0.000,0.076,5,-3.658,-
   -0.073,6,-3.658,0.220,7,0.000,0.146,8,3.658,-0.220
SCR 9,3.658,-0.220,10,0.000,0.076,11,0.177,0.253,12,0.052,0.482,13,0.305,-
   0.000
BRL 1,495.300,0.000,90.000,541.020,0.000,90.000,7,253,154.326
CBR 1,4,1,0.0678,0.0399,2,0.0678,0.0399,3,0.0678,0.0399,4,0.0678,0.0399,5,-
   0.0678,0.0399,6,0.0678,0.0399,7,0.0678,0.0399
GOL 1,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
GOR 1,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
ROD 1,1,1.204,1.076,0.972,0.866,0.750
ROD 1,2,1.152,1.049,0.972,0.835,0.713
ROD 1,3,1.219,1.122,1.015,0.875,0.759
ROD 1,4,1.366,1.247,1.116,1.021,0.899
ROD 1,5,1.506,1.399,1.314,1.183,1.052
ROD 1,6,1.640,1.521,1.451,1.289,1.198
ROD 1,7,1.792,1.667,1.594,1.454,1.353
BRL 2,541.020,0.000,90.000,586.740,0.000,90.000,7,253,154.762
CBR 2,4,1,0.0678,0.0399,2,0.0678,0.0399,3,0.0678,0.0399,4,0.0678,0.0399,5,-
   0.0678,0.0399,6,0.0678,0.0399,7,0.0678,0.0399
GOL 2,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
GOR 2,1,-7.087,2,-4.724,3,-2.362,4,0.000,5,2.362,6,4.724,7,7.087
ROD 2,1,1.183,1.070,0.982,0.853,0.732
ROD 2,2,1.143,1.039,0.939,0.811,0.689
ROD 2,3,1.198,1.082,1.039,0.853,0.741
ROD 2,4,1.344,1.253,1.140,1.000,0.878
ROD 2,5,1.472,1.347,1.247,1.146,1.039
ROD 2,6,1.619,1.512,1.430,1.277,1.177
ROD 2,7,1.768,1.643,1.585,1.442,1.314
OUT 1,0,1
```

Figure 8.1-4 Output (cont.)

```
Field Check of Camber, Version 2.0.0.0                          PAGE   3
Input File: ....\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat     03/04/2015  11:06:47
-------------------------------------------------------------------------
                  SAMPLE RUN FOR FIELD CHECK OF CAMBER
                              INPUT SUMMARY
-------------------------------------------------------------------------

                           CONTROL INFORMATION
                           -------------------
 System          No. of
   of     X-Sec   X-Sec    No. of                        Rod      Reference
  Units   Type    Points   Spans    Class   Spiral   Readings    System
   SI       1       13       2        2        S        Y           1

                           HORIZONTAL GEOMETRY
                           -------------------
                    Reference      PC or SC      PT or CS   Tangent   Spiral
   Radius  Curve     Station       Station       Station    Runout    Length
     (m)               (km)          (km)          (km)       (m)       (m)
   698.550   R     0+426.720     0+487.680     0+731.520     0.000   60.960

                           VERTICAL GEOMETRY
                           -----------------
                                                          Vertical
          PVI         PVI         Grade       Grade       Curve
        Station     Elevation     Ahead       Back        Length
          (km)        (m)          (%)         (%)         (m)
                    152.400       1.000

                      SUPERELEVATED CROSS SECTION
                      ---------------------------
Point      :      1        2        3        4        5        6        7
Delta X (m):   -0.305   -0.052   -0.177    0.000   -3.658   -3.658    0.000
Delta Y (m):    0.000    0.482    0.253    0.076   -0.073    0.220    0.146

Point      :      8        9       10       11       12       13
Delta X (m):    3.658    3.658    0.000    0.177    0.052    0.305
Delta Y (m):   -0.220   -0.220    0.076    0.253    0.482    0.000


                                BENT LINE
                                ---------
 Span                Left Bent                              Right Bent
  No.     Station    CL to Pier    Skew        Station      CL to Pier    Skew
           (km)         (m)       (deg)         (km)          (m)       (deg)
   1    0+495.300      0.000     90.000     0+541.020      0.000     90.000

                     No. of      Slab       Height of
                     Girders     Depth      Instrument
                                  (mm)         (m)
                        7         253.       154.326


                                 CAMBER
                                 ------
Span  1      Analysis Points : 4
Point      :      1        2        3        4        5        6        7
    A (m)  :   0.0678   0.0678   0.0678   0.0678   0.0678   0.0678   0.0678
    C (m)  :   0.0399   0.0399   0.0399   0.0399   0.0399   0.0399   0.0399
```

Figure 8.1-4 Output (cont.)

```
Field Check of Camber, Version 2.0.0.0                          PAGE   4
Input File: ....\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat     03/04/2015  11:06:47
-------------------------------------------------------------------------
                  SAMPLE RUN FOR FIELD CHECK OF CAMBER
                          INPUT SUMMARY (cont.)
-------------------------------------------------------------------------

                              GIRDER OFFSETS
                              --------------
Girder     :      1        2        3        4        5        6        7
Left  (m)  :   -7.087   -4.724   -2.362    0.000    2.362    4.724    7.087
Right (m)  :   -7.087   -4.724   -2.362    0.000    2.362    4.724    7.087


                              ROD READINGS
                              ------------
Girder           1        2        3        4        5
   1  (m)       1.204    1.076    0.972    0.866    0.750
   2  (m)       1.152    1.049    0.972    0.835    0.713
   3  (m)       1.219    1.122    1.015    0.875    0.759
   4  (m)       1.366    1.247    1.116    1.021    0.899
   5  (m)       1.506    1.399    1.314    1.183    1.052
   6  (m)       1.640    1.521    1.451    1.289    1.198
   7  (m)       1.792    1.667    1.594    1.454    1.353

                               BENT LINE
                               ---------
 Span              Left Bent                          Right Bent
  No.    Station   CL to Pier    Skew      Station    CL to Pier    Skew
          (km)        (m)       (deg)      (km)         (m)       (deg)
   2   0+541.020     0.000     90.000    0+586.740     0.000     90.000

                    No. of      Slab      Height of
                    Girders     Depth     Instrument
                                (mm)        (m)
                       7        253.      154.762


                               CAMBER
                               ------
Span  2      Analysis Points : 4
Point      :      1        2        3        4        5        6        7
    A (m)  :   0.0678   0.0678   0.0678   0.0678   0.0678   0.0678   0.0678
    C (m)  :   0.0399   0.0399   0.0399   0.0399   0.0399   0.0399   0.0399


                              GIRDER OFFSETS
                              --------------
Girder     :      1        2        3        4        5        6        7
Left  (m)  :   -7.087   -4.724   -2.362    0.000    2.362    4.724    7.087
Right (m)  :   -7.087   -4.724   -2.362    0.000    2.362    4.724    7.087


                              ROD READINGS
                              ------------
Girder           1        2        3        4        5
   1  (m)       1.183    1.070    0.982    0.853    0.732
   2  (m)       1.143    1.039    0.939    0.811    0.689
   3  (m)       1.198    1.082    1.039    0.853    0.741
```

Figure 8.1-4 Output (cont.)

```
Field Check of Camber, Version 2.0.0.0                          PAGE   5
Input File: ....\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat     03/04/2015  11:06:47
--------------------------------------------------------------------------------
                   SAMPLE RUN FOR FIELD CHECK OF CAMBER
                           INPUT SUMMARY (cont.)
--------------------------------------------------------------------------------

                           ROD READINGS (cont.)
                           --------------------
   4  (m)       1.344    1.253    1.140    1.000    0.878
   5  (m)       1.472    1.347    1.247    1.146    1.039
   6  (m)       1.619    1.512    1.430    1.277    1.177
   7  (m)       1.768    1.643    1.585    1.442    1.314
```

Figure 8.1-4 Output (cont.)

```
Field Check of Camber, Version 2.0.0.0                          PAGE   6
Input File: ....\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat     03/04/2015  11:06:47
-------------------------------------------------------------------------
                  SAMPLE RUN FOR FIELD CHECK OF CAMBER
                               OUTPUT
-------------------------------------------------------------------------

                         COMPUTED OUTPUT SPAN  1
                         ----------------------

* GIRDER 1

                                                          UNCORRECTED
                            DESIGN          THEORETICAL     SLAB     COR-
POINT    STATION  OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH    RECTION
           (km)     (m)       (m)      (m)      (m)         (m)       (m)
  1    0+495.300  -7.087    153.383  0.0000    153.130     0.261    -0.008
  2    0+506.727  -6.804    153.503  0.0209    153.271     0.274    -0.021
  3    0+518.160  -6.709    153.619  0.0279    153.394     0.293    -0.040
  4    0+529.593  -6.804    153.732  0.0209    153.500     0.293    -0.040
  5    0+541.020  -7.087    153.841  0.0000    153.588     0.265    -0.012

* GIRDER 2

                                                          UNCORRECTED
                            DESIGN          THEORETICAL     SLAB     COR-
POINT    STATION  OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH    RECTION
           (km)     (m)       (m)      (m)      (m)         (m)       (m)
  1    0+495.300  -4.724    153.431  0.0000    153.178     0.257    -0.004
  2    0+506.727  -4.442    153.550  0.0209    153.318     0.294    -0.041
  3    0+518.160  -4.348    153.667  0.0279    153.442     0.341    -0.088
  4    0+529.593  -4.442    153.779  0.0209    153.547     0.309    -0.056
  5    0+541.020  -4.724    153.888  0.0000    153.635     0.275    -0.022

* GIRDER 3

                                                          UNCORRECTED
                            DESIGN          THEORETICAL     SLAB     COR-
POINT    STATION  OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH    RECTION
           (km)     (m)       (m)      (m)      (m)         (m)       (m)
  1    0+495.300  -2.362    153.374  0.0000    153.121     0.267    -0.014
  2    0+506.727  -2.081    153.471  0.0209    153.239     0.288    -0.035
  3    0+518.160  -1.987    153.580  0.0279    153.355     0.297    -0.044
  4    0+529.593  -2.081    153.700  0.0209    153.468     0.270    -0.017
  5    0+541.020  -2.362    153.831  0.0000    153.578     0.264    -0.011

* GIRDER 4

                                                          UNCORRECTED
                            DESIGN          THEORETICAL     SLAB     COR-
POINT    STATION  OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH    RECTION
           (km)     (m)       (m)      (m)      (m)         (m)       (m)
  1    0+495.300  -0.000    153.232  0.0000    152.979     0.272    -0.019
  2    0+506.727   0.280    153.329  0.0209    153.097     0.271    -0.018
  3    0+518.160   0.374    153.438  0.0279    153.213     0.256    -0.003
  4    0+529.593   0.280    153.558  0.0209    153.326     0.274    -0.021
  5    0+541.020  -0.000    153.689  0.0000    153.436     0.262    -0.009
```

Figure 8.1-4 Output (cont.)

```
Field Check of Camber, Version 2.0.0.0                          PAGE   7
Input File: ....0.0)\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat 03/04/2015  11:06:47
--------------------------------------------------------------------------
                  SAMPLE RUN FOR FIELD CHECK OF CAMBER
                            OUTPUT (cont.)
--------------------------------------------------------------------------

                     COMPUTED OUTPUT SPAN  1 (cont.)
                     -------------------------------

* GIRDER 5

                                                          UNCORRECTED
                              DESIGN          THEORETICAL    SLAB    COR-
POINT    STATION   OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH   RECTION
           (km)      (m)       (m)      (m)      (m)         (m)      (m)
  1    0+495.300   2.362    153.090  0.0000    152.837     0.270   -0.017
  2    0+506.727   2.641    153.187  0.0209    152.955     0.281   -0.028
  3    0+518.160   2.735    153.296  0.0279    153.071     0.312   -0.059
  4    0+529.593   2.641    153.416  0.0209    153.184     0.294   -0.041
  5    0+541.020   2.362    153.547  0.0000    153.294     0.273   -0.020

* GIRDER 6

                                                          UNCORRECTED
                              DESIGN          THEORETICAL    SLAB    COR-
POINT    STATION   OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH   RECTION
           (km)      (m)       (m)      (m)      (m)         (m)      (m)
  1    0+495.300   4.724    152.948  0.0000    152.695     0.262   -0.009
  2    0+506.727   5.002    153.045  0.0209    152.813     0.261   -0.008
  3    0+518.160   5.095    153.154  0.0279    152.929     0.307   -0.054
  4    0+529.593   5.002    153.274  0.0209    153.042     0.258   -0.005
  5    0+541.020   4.724    153.405  0.0000    153.152     0.277   -0.024

* GIRDER 7

                                                          UNCORRECTED
                              DESIGN          THEORETICAL    SLAB    COR-
POINT    STATION   OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH   RECTION
           (km)      (m)       (m)      (m)      (m)         (m)      (m)
  1    0+495.300   7.087    152.806  0.0000    152.553     0.272   -0.019
  2    0+506.727   7.365    152.906  0.0209    152.674     0.268   -0.015
  3    0+518.160   7.457    153.020  0.0279    152.795     0.316   -0.063
  4    0+529.593   7.365    153.135  0.0209    152.903     0.284   -0.031
  5    0+541.020   7.087    153.263  0.0000    153.010     0.290   -0.037

                          COMPUTED OUTPUT SPAN  2
                          ----------------------

* GIRDER 1

                                                          UNCORRECTED
                              DESIGN          THEORETICAL    SLAB    COR-
POINT    STATION   OFFSET  DECK ELEV. CAMBER  TOP BEAM     DEPTH   RECTION
           (km)      (m)       (m)      (m)      (m)         (m)      (m)
  1    0+541.020  -7.087    153.841  0.0000    153.588     0.262   -0.009
  2    0+552.447  -6.804    153.960  0.0209    153.728     0.289   -0.036
  3    0+563.880  -6.709    154.077  0.0279    153.852     0.325   -0.072
  4    0+575.313  -6.804    154.189  0.0209    153.957     0.301   -0.048
  5    0+586.740  -7.087    154.298  0.0000    154.045     0.268   -0.015
```

Figure 8.1-4 Output (cont.)

SAMPLE RUN FOR FIELD CHECK OF CAMBER
OUTPUT (cont.)

COMPUTED OUTPUT SPAN 2 (cont.)

* GIRDER 2

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	-4.724	153.888	0.0000	153.635	0.269	-0.016
2	0+552.447	-4.442	154.008	0.0209	153.776	0.306	-0.053
3	0+563.880	-4.348	154.124	0.0279	153.899	0.329	-0.076
4	0+575.313	-4.442	154.236	0.0209	154.004	0.306	-0.053
5	0+586.740	-4.724	154.345	0.0000	154.092	0.272	-0.019

* GIRDER 3

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	-2.362	153.831	0.0000	153.578	0.267	-0.014
2	0+552.447	-2.081	153.928	0.0209	153.696	0.269	-0.016
3	0+563.880	-1.987	154.037	0.0279	153.812	0.342	-0.089
4	0+575.313	-2.081	154.157	0.0209	153.925	0.269	-0.016
5	0+586.740	-2.362	154.288	0.0000	154.035	0.267	-0.014

* GIRDER 4

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	-0.000	153.689	0.0000	153.436	0.271	-0.018
2	0+552.447	0.280	153.786	0.0209	153.554	0.298	-0.045
3	0+563.880	0.374	153.895	0.0279	153.670	0.301	-0.048
4	0+575.313	0.280	154.015	0.0209	153.783	0.274	-0.021
5	0+586.740	-0.000	154.146	0.0000	153.893	0.262	-0.009

* GIRDER 5

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	2.362	153.547	0.0000	153.294	0.257	-0.004
2	0+552.447	2.641	153.644	0.0209	153.412	0.250	0.003
3	0+563.880	2.735	153.753	0.0279	153.528	0.266	-0.013
4	0+575.313	2.641	153.873	0.0209	153.641	0.278	-0.025
5	0+586.740	2.362	154.004	0.0000	153.751	0.281	-0.028

Figure 8.1-4 Output (cont.)

Field Check of Camber, Version 2.0.0.0 PAGE 9
Input File: ....0.0)\CAMBR v.2.0.0.0\CAMBR\Bin\Ex1.dat 03/04/2015 11:06:47

SAMPLE RUN FOR FIELD CHECK OF CAMBER
OUTPUT (cont.)

COMPUTED OUTPUT SPAN 2 (cont.)

* GIRDER 6

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	4.724	153.405	0.0000	153.152	0.262	-0.009
2	0+552.447	5.002	153.502	0.0209	153.270	0.273	-0.020
3	0+563.880	5.095	153.611	0.0279	153.386	0.307	-0.054
4	0+575.313	5.003	153.731	0.0209	153.499	0.267	-0.014
5	0+586.740	4.724	153.862	0.0000	153.609	0.277	-0.024

* GIRDER 7

POINT	STATION (km)	OFFSET (m)	DESIGN DECK ELEV. (m)	CAMBER (m)	THEORETICAL TOP BEAM (m)	UNCORRECTED SLAB DEPTH (m)	COR-RECTION (m)
1	0+541.020	7.087	153.263	0.0000	153.010	0.269	-0.016
2	0+552.447	7.365	153.363	0.0209	153.131	0.265	-0.012
3	0+563.880	7.457	153.478	0.0279	153.252	0.328	-0.075
4	0+575.313	7.365	153.592	0.0209	153.360	0.293	-0.040
5	0+586.740	7.087	153.720	0.0000	153.467	0.272	-0.019

Figure 8.1-4 Output (cont.)

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9 TECHNICAL QUESTIONS AND REVISION REQUESTS

This chapter contains reply forms to make it easier for users to convey their questions, problems or comments to the proper unit within the Department. General procedures for using these forms are given. Users should keep the forms in the manual as master copies, which can be reproduced as needed. They are also included as a Word template on the disk that has been provided for the program.

9.1 TECHNICAL QUESTIONS

Technical questions related to the interpretations of the design specifications as implemented in this program, why certain assumptions are made, applicability and limitations of this program, and other questions not related to the operation of this program can be directed to the appropriate person in PennDOT using this form or the information provided on this form. Please review the information provided in this User's Manual and the references given in Chapter 1 before submitting this form for processing or calling for assistance. The completed form should be sent to the Bridge Quality Assurance Division (see form for complete address).

9.2 REVISION REQUESTS

This form is to be used to report suspected program malfunctions that may require revisions to the program. It can also be used to request revisions that may be required due to changes in specifications and for the enhancement of the program. Unexpected or incorrect output, rejection of input data, endless program cycling, and program abortion are examples of program malfunctions. Users are requested to review their input data and the program User's Manual before submitting this form for processing.

This form may also be used to submit suggestions for improving the User's Manual for this program. Suggestions might include typographical error correction, clarification of confusing sections, expansion of certain sections, changes in format, and the inclusion of additional information, diagrams, or examples.

The completed form should be sent to the Engineering Unit via mail, fax, or e-mail.

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CAMBR
TECHNICAL QUESTIONS

This form is to be used to ask questions on technical issues related to this engineering program. Questions on the interpretations of the design specifications as implemented in this program, why certain assumptions are made by the program and other questions not related to the operation of this program may be submitted using this form or by calling the telephone number listed in this form. Users are requested to read the User's Manual, LRFD Specifications and DM-4 before submitting this form or calling to ask questions.

CONTACT PERSON: _____ DATE: _____
ORGANIZATION: _____ PHONE: _____
E-MAIL ADDRESS: _____ FAX: _____
PROGRAM VERSION: _____

Clearly state your question(s) and attach documentation you feel would be helpful in answering your question(s). If you require more space, use additional 8½ x 11 sheets of plain paper.

FORWARD COMPLETED FORM TO: Pennsylvania Dept. of Transportation
Bridge Design and Technology Division
Commonwealth Keystone Building, 7th Floor
400 North Street
Harrisburg, PA 17120-0094
PHONE: (717) 787-2881
FAX: (717) 787-2882

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CAMBR
REVISION REQUEST

This form is to be used to report suspected program malfunctions, or to request revisions to the program or its documentation. Users are requested to review their input data and the program User's Manual before submitting this form.

CONTACT PERSON: _____ DATE: _____
ORGANIZATION: _____ PHONE: _____
E-MAIL ADDRESS: _____ FAX: _____
PROGRAM VERSION: _____

Define your problem and attach samples and/or documentation you feel would be helpful in correcting the problem. If the input data is more than 4 or 5 lines, Licensees should provide the input data file on a diskette. If you require more space, use additional 8½ x 11 sheets of plain paper.

FORWARD COMPLETED FORM TO:

Pennsylvania Department of Transportation
Bureau of Business Solutions and Services
Engineering Software Section
Commonwealth Keystone Building, 5th Floor
400 North Street
Harrisburg, PA 17120-0041
PHONE: (717) 787-8407 / (717) 783-8822
FAX: (717) 705-5529
E-MAIL: penndotbisengineer@pa.gov

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