Georgia Department of Transportation

COMPUTER MANUAL FOR METRIC BAR REINFORCING STEEL QUANTITES AND TABLES

BRMRBAR

ORIGINAL FORTRAN IV
GLENN H. SIKES, P.E.

METRIC VERSION
EDWARD J. STROUGAL, JR., P.E.

OFFICE OF BRIDGE AND STRUCTURAL DESIGN

ATLANTA, GEORGIA
JANUARY 1998

FOREWORD

"A Method of Extending and Listing Bar Reinforcing Steel" presented in this report is a problem-oriented computer program that can be used effectively in the detailing of reinforcing bars, and computation of bar reinforcing quantities. This program is actually the third in a series of bar reinforcing steel programs. The first program was written in 1959 for use on an IBM 650 computer. Since this program proved so successful, the program was rewritten with additional capacities in 1963 for use on an IBM 1620. The computer oriented Symbolic Programming System (SPS) was used to code the IBM 1620 program; whereas, the IBM 650 program was coded in a machine language. Now the program has been rewritten using Fortran IV programming language. This makes the program computer independent with only minor modifications required for operation on any third-generation computer system. In addition, the program has been made more versatile with new features.

This write-up is primarily a user's manual and does not include flow charts or a program listing. However, a listing can be obtained directly from the Fortran file or the Fortran tape. In addition, since the program is written in Fortran IV programming language and contains numerous comment lines that describe the program functions, the flow charts are not really essential in order to understand the procedure of the program solution. The reader is assumed to be familiar with the standard terminology of bar reinforcing steel and such terms as bar size, standard hook, etc., are not defined in this report.

This report, then, explains in detail the function of the program and how the program can be effectively applied in the detailing and extending of bar reinforcing steel used in highway bridges, culverts, retaining walls, etc.

Glenn H. Sikes, P.E.
Atlanta, Georgia
August 1, 1969

FOREWORD
METRIC VERSION

The requirement to detail bridge plans in metric units has brought about the need to update the Bar Reinforcement program and computer manual as used by the GDOT. The original FORTRAN IV program written by Glenn H. Sikes has remained essentially the same. The changes consist only of modifying the bar series to metric and converting input and output units to a metric format.

The metrication of the program consists of utilizing the 10, 13, 16, 19, 22, 25, 29, 32, 36, 43 and 57 series of soft-converted metric reinforcing bars. The ASTM A615M Specification governs the bar designations and sizes while the Concrete Reinforcing Steel Institute provides the specifications for bar hooks.

The revisions to the computer manual consist of metricating the different sections of the manual, revising the input form and rewriting the example problem in metric format. In addition, all references to old IBM cards have been eliminated and computer terminology has been updated to reflect the changes in technology that have occurred since the original program was written.

Edward J. Strougal, Jr, P.E.
Atlanta, Georgia
January 15, 1998

DISCLAIMER

Although this program has been subjected to many rigorous tests - all with excellent results - no warranty, expressed or implied is made by the Georgia Department of Transportation as to the accuracy and functioning of the program, nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the Georgia Department of Transportation in any connection therewith.

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I. DESCRIPTION OF THE PROGRAM

In the past, a considerable amount of the Bridge Engineer's time has been spent in the routine computation of bar reinforcing quantities and the detailing of each reinforcing bar. Because of the large volume of work required by the Interstate and other highway programs, an attempt was made to decrease the amount of time required for these routine tasks. The program presented here is a product of this attempt.

The Bar Reinforcing Steel computer program is designed to assist Bridge Engineers in the tabulation and estimation of bar reinforcing steel quantities. Thus, this program eliminates the detailing of reinforcing bars on bridge plans and the longhand computations of bar lengths and weights. This results in the saving of a considerable number of design hours per bridge.

The input data to the program is a list of all reinforcing bars (plus miscellaneous items) for a particular bridge, culvert, etc. This data is listed on an input data form and contains the bar dimensions, number, hook styles, type and bar designation. The input data (bar dimensions, etc.) is entered on the input data form by referring to a standard bar bending details sheet along with the detail sheet (Bridge sheet) from which the reinforcing bar data is being obtained. In Georgia, the standard bar bending details is Georgia Standard 3901, "Bar Bending Details (Metric)". Note that the length of the bar is not required as input since the program has the capacity to compute the bar lengths from the data given. After the bar length is computed, the weight of the bar is computed. The weights of all bars in a particular unit (pier, span, etc.) are summed for presentation in the output of quantities. Also included in the output of quantities is the estimated cost of the reinforcing steel.

It should be clearly noted that the reinforcing bars are not detailed (dimensioned) on the bridge plans. The bridge plans will contain only a bar schedule (made from the output of this program) which includes the bar mark, location, length, number, type, and dimensions of all bars. The reinforcing steel fabricator uses the bar schedule from the bridge plans and Georgia Standard 3901, "Bar Bending Details (Metric)", to fabricate the reinforcing bars.

The output data of the program contains the weight and cost for each unit with subtotals and grand totals for any and all units. The values can be easily transferred to the summary of quantities on the detail sheets and cost estimate form. The tabulation of the bars including the lengths is made on a special form in a computer file. This list can then be placed on a sheet to be included in the bridge plans.

II. PREPARING THE INPUT DATA

The input data to the Bar Reinforcing Steel computer program is entered on a special input form. This form is used to define all bar reinforcing steel in the structure and other miscellaneous items. Any number of input sheets can be used to describe the reinforcing steel. In order to define the reinforcing steel, the Engineer must have Georgia Standard 3901, "Bar Bending Details (Metric)", in addition to the bridge detail sheets.

The term "Unit" used in this write-up defines a unit of construction. For example: a bent, pier, abutment, span, pour, continuous unit, retaining wall, culvert, etc. could be defined as a "Unit".

The term "col." used in this write-up is the abbreviation for column.

In the following discussion, refer to the blank input data form on page 12.

A. IDENTIFICATION LINE (* in col. 1)

The first line of each problem must be the Identification of that job. This line of the input form must always contain data when beginning a new problem. Whenever more than one sheet is used with a problem, the Identification is given with the first sheet only; that is, all Identification Lines are left blank on the subsequent sheets. The asterisk, "*", in column 1 is used as identification. Only one line of this type can be used with each problem. The Identification data is entered on the input form as follows:

1. PROBLEM NUMBER (col. 5-8)

   The Problem Number should be used by the Engineer to enter a number or code to identify the problem. The Problem Number will appear in the output of quantities for identification purposes. However, the Problem Number is not listed on the tabulation of the bar reinforcing steel.

2. PRICE (col. 9-12) Format: XX.XX $/kg

   Enter in columns 9-12 the estimated cost of the bar reinforcing steel. If the cost varies from unit to unit, enter the cost of the largest number of units with the same cost. The costs of the remaining units can be given when defining the unit as explained on subsequent pages. The Price may have a value of zero or be left blank. The Price will be shown in the output of quantities, but not on the bar tabulation.

3. PROJECT NUMBER, COUNTY, etc. (col. 13-80)

This space of the Identification Line should contain the Project Number, County, Name of person submitting job, Date, and any other pertinent remarks.

B. UNIT LINE (U in col. 1)

The program has the capacity to process any number of units in a job (problem). Each unit is defined by entering the required information in a Unit Line. The input form is formatted for one unit per sheet. However, more than one unit can be defined on one sheet (by defining additional units on Bar Reinforcing Lines); or, several sheets of input data may be used to define the reinforcing steel in one unit (in this case the Unit Line on subsequent sheets must be left blank).

For simplicity in entering the input data, it is suggested that no more than one unit be defined on an input data sheet.

Following is a list showing the order of the input data for a job:

Identification Line
Unit A Line
Reinforcing Bar Lines for Unit A
Unit B Line
Reinforcing Bar Lines for Unit B
Etc.

The letter "U" in column 1 defines the Unit Line. If a unit is defined on a Reinforcing Bar Line, the letter "U" must be entered in column 1 of that line. Note that the Unit format must be used instead of the Reinforcing Bar Line format in this case. The data required to define a unit is entered on the input form as follows:

1. NAME OF UNIT (col. 2-17)

The Name of the unit being defined should be entered in these columns. For example: "Bent 2" or "Span 4". This Name will appear in the output of quantities (for identification purposes) and also appear on the bar listing (tabulation).

2. NUMBER OF UNITS (col. 18, 19) Format: XX

Enter in this space the Number of units that are being defined, i.e., exactly alike. For example, if the reinforcing steel in spans 2 and 3 were identical, it would be unnecessary to define the reinforcing steel of each span separately. In this instance, the unit is defined by the Name, "Span 2 or 3", and the Number of units given as two (2). Instead of having to define the reinforcing bars twice, the reinforcing bars would be defined once.

3. PRICE (col. 20-23) Format: XX.XX $/kg

If the cost of the reinforcing steel in the unit being defined is different from the Price given in the Identification Line, enter the price (or cost) of the reinforcing steel in the unit in this data column of the Unit Line. However, if the Price is the same, this space should be left blank. The Price of reinforcing steel for each unit will be shown in the output of quantities. The Price is not shown on the bar listing.

4. UNIT REMARKS (col. 24-80)

Enter in this space any remarks that you wish to appear on the tabulation of bar reinforcing steel. These remarks will not appear in the output of quantities and costs.

C. REINFORCING BAR LINES

The bar reinforcing steel is defined by detailing each bar type (Mark) on one line of the input form. Any number of bar types may be entered; that is, there is no limit to the number of lines that can be used. Additional pages can be used when required to define all the reinforcing steel in a unit. The Reinforcing Bar Lines can also be used to enter miscellaneous types of data. A discussion of the miscellaneous types of data will be given on subsequent pages.

Following is a discussion of the Reinforcing Bar Line format and the data required to define a reinforcing bar.

1. CODE (Blank, V, S or R in col. 1)

These are four codes that can be used to define a reinforcing bar. These are as follows:

a. Blank

Leave column 1 blank to define a reinforcing bar with a constant length and not appearing in a subsequent unit. This will be the most commonly used code; hence, the Blank Code. The reinforcing bar length is optional, i.e., not required.

b. V

Enter the letter "V" in column 1 to define a reinforcing bar with a varying length. When using the Vary Code (V), the average length must be computed by the Engineer and given as part of the input data. Also, when using this code, the reinforcing bar length should be given as "VARIES".

c. S

In order to eliminate the monotonous detailing of a reinforcing bar more than once, the Store Code "S" can be used. The Store Code (S) instructs the program to store the reinforcing bar for future reference in a subsequent unit. Therefore, the Store Code should be used the first time such a bar is detailed. When the bar is detailed again (in a subsequent unit), it can conveniently be Recalled. This code can be of considerable help when detailing "truss" bars in the bridge superstructure.

When using the Store Code, it should be noted that the reinforcing bars should be fully detailed, i.e., type, dimensions, etc. Note also that a bar with a varying length cannot be Stored for subsequent Recall. The reinforcing bar length is not required.

d. R

In order to Recall a reinforcing bar that has previously been defined, enter the letter "R" in column 1. The only data required with the Recall Code (R) is the Mark and Number of Bars. The type, hook styles and dimensions should be given only when this data is required to appear on the bar tabulation. In order to Recall a reinforcing bar, the bar must previously have been defined with the Store Code "S"

2. MARK (col. 2-6) Format: XXXXX

The bar Mark is made-up of the bar Size and bar Description. In essence, the Mark is the bar name or identification. The Size is the standard bar size notation, i.e., #16 (15.9 mm diameter round). The program will accept bar sizes 10, 13, 16, 19, 22, 25, 29, 32, 36, 43 and 57. Any other bar size will result in an "ERROR MESSAGE". The bar Size is entered in columns 2 and 3.

The bar Description consists of three characters (letters or numbers) which are used, in addition to the bar size, to identify the bar. This notation is entered in columns 4-6.

The reinforcing bar Mark is required with all types of reinforcing bar Codes.

3. LENGTH (col. 7-12) Format: XXXXXX mm

If the reinforcing bar Code is a blank or the letter "S", the length is optional. That is, the Engineer may compute the Length and enter the value on the input data form; or, the space for the bar length may be left blank, in which case the program will compute the bar length. The above is true only when the bar type (col. 23 and 24) is detailed on Georgia Standard 3901, "Bar Bending Details (Metric)". Otherwise, the bar length must be given in the input data.

If the Length of the reinforcing bar varies ("V" in col. 1), the word "VARIES" should be written in columns 7-12. The average length will be given in columns 17-22.

The bar Length should be left blank (not required) if the reinforcing bar code is Recall ("R" in col. 1).

If the program computes the bar Length, the Length is computed to the nearest five millimeters for calculating quantities and tabulation.

If the Length of the bar is given on the input data form, the dimension is entered in columns 7-12.

4. NUMBER OF BARS (col. 13-16) Format: XXXX

Enter in columns 13-16 the Number Of Bars required in the unit of the type (Mark) being defined. This Number is required for all reinforcing bar codes. If this data field is left blank or given a value of zero (0), an "ERROR MESSAGE" will result.

5. AVERAGE LENGTH (col. 17-22) Format: XXXXXX mm

When defining a reinforcing bar that has a varying length, enter the Average Length of the bar in millimeters in columns 17-22. Otherwise, these columns are left blank when defining a reinforcing bar.

6. TYPE (col. 23, 24)

When the program is to compute the bar length, the bar Type must be given in columns 23 and 24. However, if the bar is being Recalled ("R" in col. 1) the type is not required. The Type given in this data field refers to the bar bending type given on Georgia Standard 3901, "Bar Bending Details (Metric)". If a special bar Type is required (not shown on Georgia Standard 3901), the special type can be entered in the input field; however, the length must be computed by the Engineer and given in the Length data field.

7. A (col. 25) and G (col. 26)

The digit codes entered in these two columns identify the type (style) of standard bar hooks used with the bar type. The bar types shown on Georgia Standard 3901, "Bar Bending Details (Metric)", have two hooks, one hook or no hooks. When a hook is not shown on the bar bending type, the corresponding A or G data column is left blank. Following are the allowable A and G hook codes, and the corresponding hook styles, that are used to define the bar hooks.

ALLOWABLE HOOK CODES AND HOOK STYLES

A or G hook code (STYLE)	Type of standard hook (ALL GRADES)
1	180 degree hook
3	90 degree hook
4	90 degree stirrup hook for bar sizes 10, 13, 16, 19, 22 and 25 exclusively
5	135 degree stirrup hook for bar sizes 10, 13, 16, 19, 22 and 25 exclusively
6	Eliminate hook shown on bar type

Note that each hook must be identified by a digit code (1 or 3-6). The program will not assume a hook style by default. An "ERROR MESSAGE" will result if each hook is not defined with one of the following five digits: 1, 3, 4, 5 or 6. Note that a hook shown on the bar type can be eliminated by using a digit code of six (6). Note also that a hook shown on the standard can be changed from one type (style) to another. For example, the 90-degree hooks shown on bar type 25 can be changed to 135-degree hooks by entering the digit five (5) for the A and G hook styles.

The A and G hook style is required only when the program is to compute the bar length. However, the style would normally be given for detailing purposes in any event.

8. B, C, D, E, F, H, J and K (col. 27-74) Format: XXXXXX mm

Enter in these data columns the bar dimensions per Georgia Standard 3901, "Bar Bending Details (Metric)". When a dimension does not exist, the corresponding data column should be left blank. If a dimension varies, the word "VARIES" should be entered in the appropriate data column beginning with the leftmost column of the data field.

9. N (col. 75-77) Format: XXX number or degrees

The data entered in this space of the input form depends on the bar type. The data will be either the number of beams or walls (bar type 42, 43 or 44), angle of bar bend (bar type 6, 7, 8 or 18) or the number of closed turns of a spiral (bar type 45).

10. θ (col. 78-80) Format: XXX degrees

Theta (θ) is normally the angle of bar bend in degrees.

D. MISCELLANEOUS LINES

In addition to the bar reinforcing data, other data or commands may be entered in the Reinforcing Bar Lines. Following is a discussion of each type of miscellaneous data, the format (not shown on input form) for this data, and the usage of the data.

1. LUMP WEIGHT LINE (W in col. 1)

If the Engineer wishes to add a known weight of reinforcing steel to the total weight of the unit, the Lump Weight miscellaneous line can be used. An example might be endpost reinforcing steel. The Code required to identify such an item is the letter "W" entered in column 1. The number of Lump Weights is entered in columns 13-16. The Lump Weight is entered in columns 17-22 in the format XXXXXX kg.

LUMP WEIGHT REQUIRED INPUT DATA

Item	Columns	Format
Code	1	W
Number of Lump Weights	13 – 16	XXXX
Lump Weight	17 – 22	XXXXXX kg

2. TOTAL LINE (T in col. 1)

The program will automatically give the grand total of all reinforcing steel in the entire problem or job. In addition to this total, the Engineer may instruct the program to give totals of related units. For example, the total of all reinforcing steel in the superstructure may be beneficial. This total can be obtained by entering the letter "T" in column 1. The name of the total is entered in columns 2-17, i.e. substructure sub-total, etc. The Total Code should be entered on the input data form immediately after the last reinforcing bar or lump weight of the last unit in the total. The total will be computed by summing the total weight of all preceding units to the beginning of the job or to a preceding Total. If a Total Line has been used previously, the summation is to that line rather than to the beginning of the job. The total name with the total weight and cost will be shown in the output of quantities. Following is an example showing the sequence and usage of the Total Line.

Identification Line (begin job)
Unit A Line
Reinforcing Bar Lines for Unit A
Unit B Line
Reinforcing Bar Lines for Unit B
Total Line (gives total of Unit A plus B)
Unit C Line
Reinforcing Bar Lines for Unit C
Unit D Line
Reinforcing Bar Lines for Unit D
Total Line (gives total of Unit C Plus D)

3. COMMENTS LINE (C in col. 1)

The Engineer may use the Reinforcing Bar Lines to enter comments that will be printed on the tabulation or bar list. The letter "C" entered in column 1 identifies such a line. The comments are entered in columns 2-80. The Comments Line can be used effectively to add notes to the bar reinforcing listing which give special instructions, etc. The Comment Line may be used at any place in the input data.

4. SKIP LINE (K in col. 1)

The Skip Line can be used if the user wishes the bar tabulation to contain blank lines or skips. The Skip Line is defined by entering the letter "K" in column 1, and the number of lines to be skipped is entered in columns 2 and 3. Any number of lines may be skipped. At least one line is always skipped when this code is used. The Skip Code may be used at any place in the input data.

5. END JOB LINE (Z in col. 1)

The last input data of the problem must be the End of Job Line. In addition, this indicates to the program that a Grand Total of all quantities in the job is desired. This line is coded by entering the letter "Z" in column 1.

E. INPUT DATA FORM

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PROGRAM	INPUT NUMBER	PRICE	IDENTIFICATION
			PROJECT NUMBER, COUNTY, COMMENTS, DESIGNER'S INITIALS
*B06			

	NAME OF UNIT	NO	PRICE	UNIT REMARKS
U				

CODES

S - STORE
R - RECALL BAR
K - SKIP LINE
U - UNIT
Z - END PROBLEM (GRAND TOTAL)

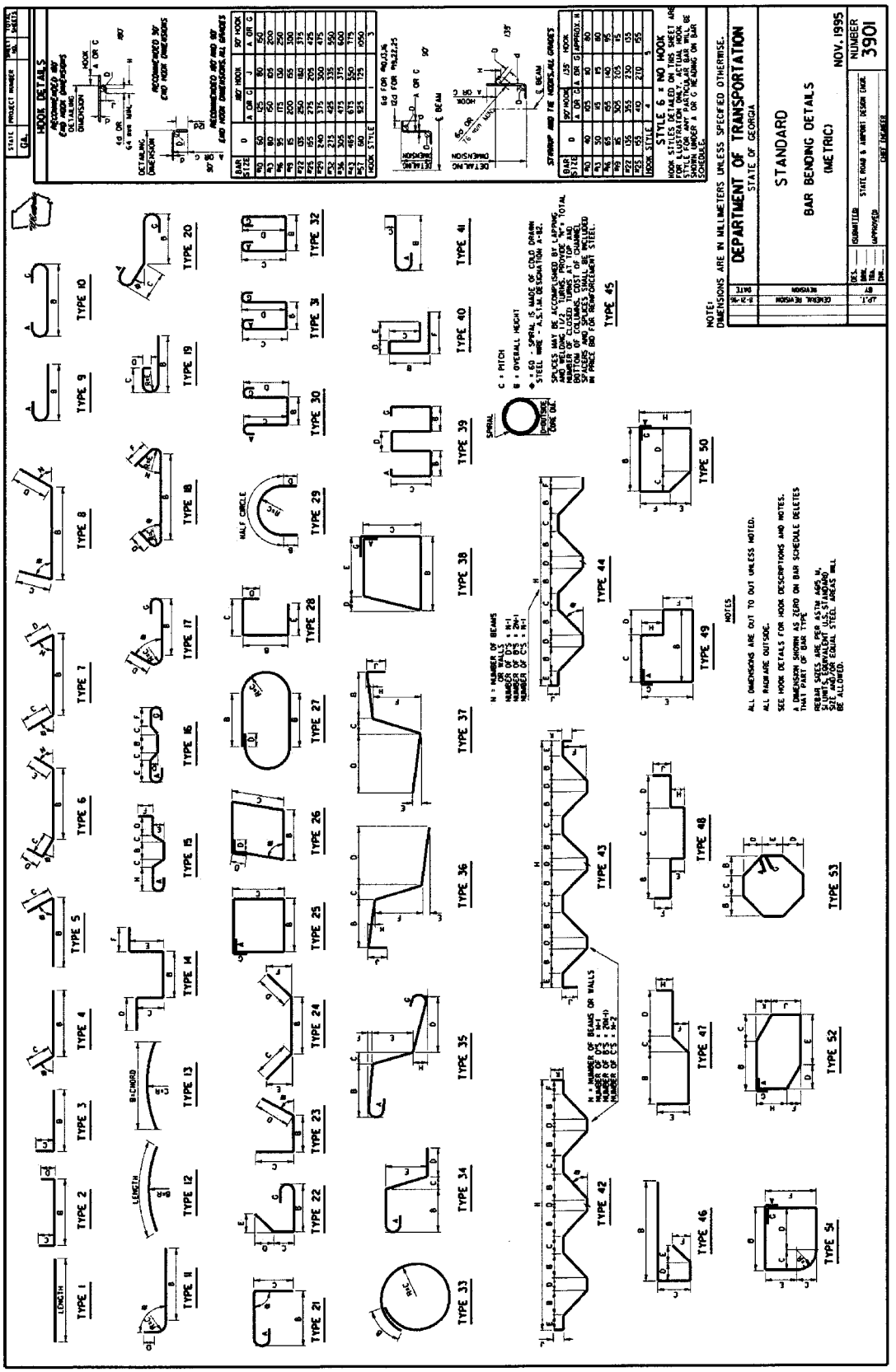
"BLANK" - BAR
C - COMMENTS
V - VARIABLE BAR
W - LUMP WEIGHT
T - TOTAL

← ENTER CODE

ENTER DIMENSIONS IN MILLIMETERS AND LUMP WEIGHTS IN KILOGRAMS.

	SIZE	DES.	LENGTH	NUMBER OF BARS	LUMP WEIGHT OR AVERAGE LENGTH	TYPE	HOOKS, DIMENSIONS AND ANGLES											
							A	G	B	C	D	E	F	H	J	K	N	θ

F. GEORGIA STANDARD 3901, "Bar Bending Details (Metric)"



III. THE OUTPUT DATA

The Bar Reinforcing Steel computer program produces two types of output data: quantities and a listing of all reinforcing bars. The quantities are given on the standard type of output paper, and the bars are listed in a special format for placement on sheets by the CAD operator. Following is a discussion of each type of output and its usage. Refer to the example problem output on pages 22 – 24.

A. QUANTITIES

The information given in the Identification Line will head the output of quantities. The following information will be given for each unit defined in the input data.

1. NAME OF UNIT

   The Name of each unit is listed with quantities of that unit for identification purposes. Note that the Name will appear exactly as given in the Unit Line.

2. WEIGHT/UNIT

   The total weight of all reinforcing bars plus lump weights in one unit is given in this column of the output data. The weight is given to the nearest kilogram.

3. NO. UNITS

   The Number of units given in the Unit Line is repeated in the output data. It is suggested that these numbers be compared to check the validity of the input data.

4. TOTAL WEIGHT

   The Total Weight is the product of the weight per unit and the number of units in kilograms.

5. COST/kg

   The Cost or Price per kilogram is a repeat of the input data Price. This should be checked for accuracy of input.

6. TOTAL COST

The Total Cost is the product of the Total Weight and the Cost per kilogram. The output of Total Cost is given in dollars to the nearest cent.

The output data will contain a Total (actually a sub-total) for each Total Code given in the input data. The data given for each sub-total will consist of the Name of the sub-total, the Total Weight of all units in that sub-total, and the Total Cost of all units in that sub-total.

The Grand Total given in the output data consists of the Total Weight of all reinforcing steel in the problem or job, and the Total Cost of all the reinforcing steel in the job.

The Unit weights given in the output data can be entered (by hand) in the table of estimated quantities on the bridge plans, and the Total costs values can be used to assist in estimating the bridge cost. The output of quantities are usually incorporated into the design notes for permanent record.

B. BAR LISTING

The list of all reinforcing bars and units is placed in a computer file. The CAD operator places the file contents on a grid, fills in the title block and plots the sheets on paper or mylar. After the plans are completed, the sheets are archived for future reference. It is suggested that the bar list be compared to the input form to check the accuracy of the bar list.

C. ERROR MESSAGES

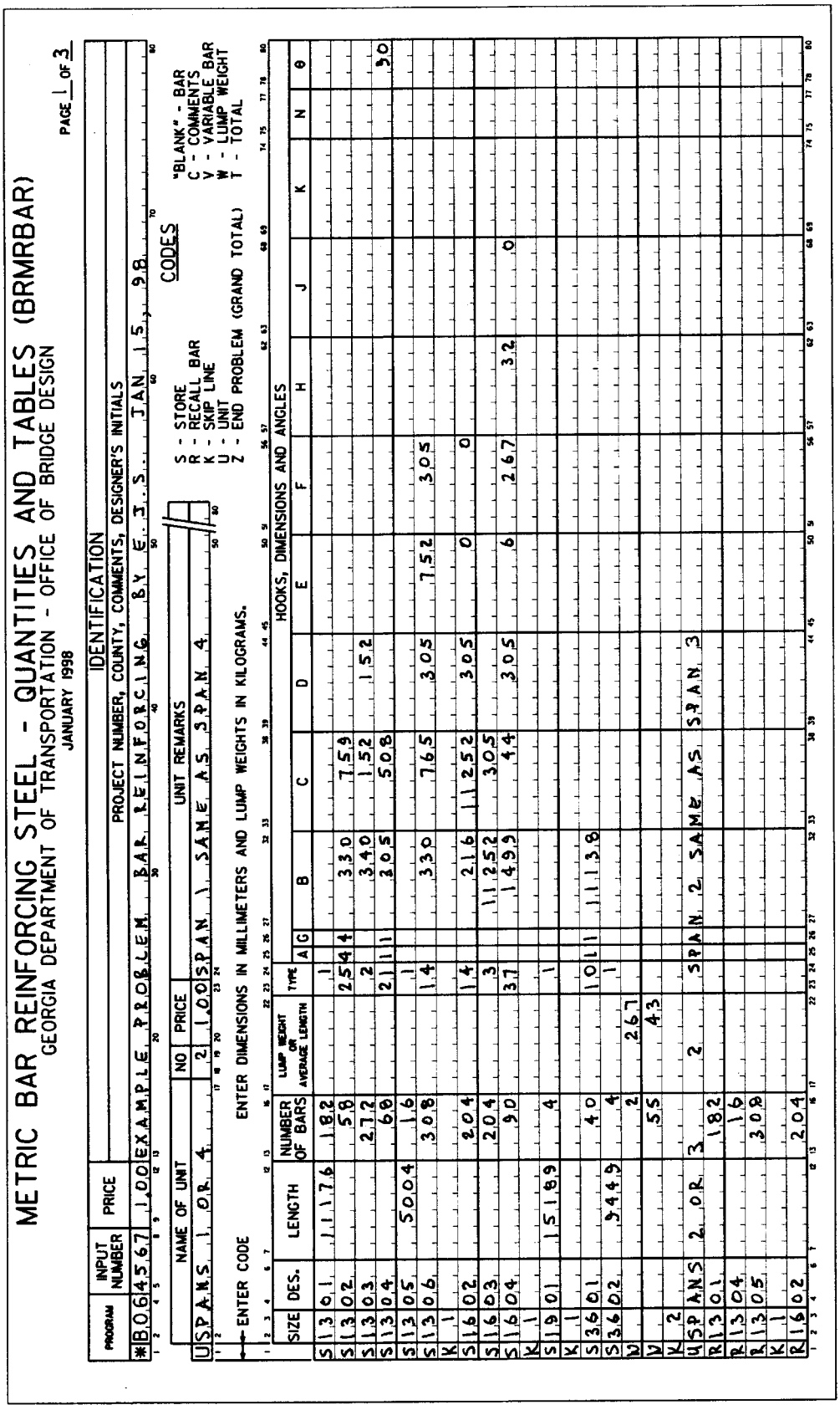
The program checks the validity of procedure used to enter the input data. In addition, certain types of data can be checked for accuracy of allowable range. For example, a number twelve (12) bar is treated as an error. When an error is detected, a message is printed which gives the cause and location of the error.

IV. EXAMPLE PROBLEM

An example problem is given on the following pages. This example is an actual four-span bridge and the data given is exactly as processed by the program, except that the Identification Line has been changed.

It should be noted that this example shows all features of the program.

A. COMPLETED INPUT DATA FORMS



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PROGRAM: * | INPUT NUMBER: B06457 | PRICE: 1.00

IDENTIFICATION
PROJECT NUMBER, COUNTY, COMMENTS, DESIGNER'S INITIALS
EXAMPLE PROBLEM BAR REINFORCING BY E.T.S. JAN 15, 98

NAME OF UNIT: USPANS 1 OR 4 | NO: 2 | PRICE: 1.00 | UNIT REMARKS: SPAN 1 SAME AS SPAN 4

ENTER CODE

ENTER DIMENSIONS IN MILLIMETERS AND LUMP WEIGHTS IN KILOGRAMS.

CODES
S - STORE
R - RECALL BAR
K - SKIP LINE
U - UNIT
Z - END PROBLEM (GRAND TOTAL)
"BLANK" - BAR
C - COMMENTS
V - VARIABLE BAR
W - LUMP WEIGHT
T - TOTAL

SIZE	DES.	LENGTH	NUMBER OF BARS	LUMP WEIGHT OR AVERAGE LENGTH	TYPE	HOOKS, DIMENSIONS AND ANGLES A	G	B	C	D	E	F	H	J	K	N	Θ
S	13 01	11176	182		1												
S	13 02		58		2	54	4	330	759								
S	13 03		272		2			340	152	152							
S	13 04		60		2	11	1	305	508								30
S	13 05	5004	16		1												
S	13 06		308		1	4		330	765	305	752	305					
K	1																
S	16 02		204		1	4		216	11252	305	0	0					
S	16 03		204		3			11252	305								
S	16 04		90		3	7		14993	44	305	6	267	32	0			
K	1																
S	19 01	15189	4		1												
K	1																
S	36 01		40		1	01	1	11138									
S	36 02	3449	4		1												
V			2	267													
V			55	43													
K	2																
USPANS		2 OR	3	2		SPAN 2 SAME AS SPAN 3											
R	13 01		182														
R	13 04		16														
R	13 05		308														
K	1																
R	16 02		204														

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PROGRAM	INPUT NUMBER	PRICE	IDENTIFICATION
			PROJECT NUMBER, COUNTY, COMMENTS, DESIGNER'S INITIALS
*B06			

	NAME OF UNIT	NO	PRICE	UNIT REMARKS
U				

ENTER CODE

ENTER DIMENSIONS IN MILLIMETERS AND LUMP WEIGHTS IN KILOGRAMS.

CODES

S - STORE
R - RECALL BAR
K - SKIP LINE
U - UNIT
Z - END PROBLEM (GRAND TOTAL)

"BLANK" - BAR
C - COMMENTS
V - VARIABLE BAR
W - LUMP WEIGHT
T - TOTAL

	SIZE	DES.	LENGTH	NUMBER OF BARS	LUMP WEIGHT OR AVERAGE LENGTH	TYPE	HOOKS, DIMENSIONS AND ANGLES A	G	B	C	D	E	F	H	J	K	N	θ
R	16	03		90														
K	1																	
R	19	01		4														
K	1																	
R	36	01		40														
W				14	176													
K	2																	
T																		
U	BENTS		1 OR	5	2 7	5	BENT 1 SAME AS BENT 5											
S	13	51		89		25	4	4	508	660								
V	13	52	VARIES	20	1905	32	5	5	660	VARIES	VARIES							
S	13	53		8		25	4	4	508	508								
K	1																	
S	19	51		3		24			1168	305	457	305	333					
K	1																	
S	36	51		4		4			7417	610								48
S	36	52	8890	4		1												
S	36	53		4		3			8890	457								
S	36	54		4		6			7112	305	610	610					42	48
K	2																	
U	BENTS		2 OR	4	2 7	5	BENT 2 SAME AS BENT 4											
R	13	51		86														
V	13	52	VARIES	16	1905	1												
K	2																	

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PROGRAM	INPUT NUMBER	PRICE	IDENTIFICATION
			PROJECT NUMBER, COUNTY, COMMENTS, DESIGNER'S INITIALS
*B06			

	NAME OF UNIT	NO	PRICE	UNIT REMARKS
U	BENT 3	1	75	

CODES

S - STORE
R - RECALL BAR
K - SKIP LINE
U - UNIT
Z - END PROBLEM (GRAND TOTAL)

"BLANK" - BAR
C - COMMENTS
V - VARIABLE BAR
W - LUMP WEIGHT
T - TOTAL

← ENTER CODE

ENTER DIMENSIONS IN MILLIMETERS AND LUMP WEIGHTS IN KILOGRAMS.

	SIZE	DES.	LENGTH	NUMBER OF BARS	LUMP WEIGHT OR AVERAGE LENGTH	TYPE	HOOKS, DIMENSIONS AND ANGLES											
							A	G	B	C	D	E	F	H	J	K	N	θ
R	13	51		96														
V	13	52	VARIES	16	1905	1												
K	2																	
T																		
Z																		

```
*B064567 100EXAMPLE PROBLEM  BAR REINFORCING STEEL  BY E.J.S.  JAN 15, 98
USPANS 1 OR 4      2    SPAN 1 SAME AS SPAN 4
S1301  11176 182        1
S1302          58      2544   330   759
S1303         272        2     340   152   152
S1304          68      2111   305   508                                    90
S1305   5004  16         1
S1306         308       14     330   765   305   752   305
K 1
S1602         204       14     216 11252   305     0     0
S1603         204        3   11252   305
S1604          90       37    1499    44   305     6   267    32     0
K 1
S1901  15189    4         1
K 1
S3601          40       1011 11138
S3602   9449    4         1
W               2    267
W              55     43
K 2
USPANS 2 OR 3      2    SPAN 2 SAME AS SPAN 3
R1301         182
R1304          16
R1305         308
K 1
R1602         204
R1603          90
K 1
R1901           4
K 1
R3601          40
W              14    176
K 2
T
UBENTS 1 OR 5      2  75BENT 1 SAME AS BENT 5
S1351          89       2544   508   660
V1352 VARIES   20  19053255   660VARIESVARIES
S1353           8       2544   508   508
K 1
S1951           3       24    1168   305   457   305   333
K 1
S3651           4        4    7417   610                                    48
S3652   8890    4        1
S3653           4        3    8890   457
S3654           4        6    7112   305   610   610                      42 48
K 2
UBENTS 2 OR 4      2  75BENT 2 SAME AS BENT 4
R1351          86
V1352 VARIES   16  1905 1
K 2
UBENT 3            1  75
R1351          86
V1352 VARIES   16  1905 1
K 2
T
Z
```

Metric Bar Reinforcing Steel - Quantities and Tables

Input Number 4567

GEORGIA DEPARTMENT OF TRANSPORTATION
OFFICE OF BRIDGE DESIGN
January 1998

15-JAN-98
09:56:30

EXAMPLE PROBLEM BAR REINFORCING STEEL BY E.J.S. JAN 15, 98

Name of Unit	Lump Weight Ave. Length		Number Units		Total Weight		Cost/kg		Total Cost
LUMP WEIGHT	267 kg	x	2						
LUMP WEIGHT	43 kg	x	55						
SPANS 1 OR 4	18065 kg	x	2	=	36130 kg	at	1.00	= $	36130.00
LUMP WEIGHT	176 kg	x	14						
SPANS 2 OR 3	15335 kg	x	2	=	30670 kg	at	1.00	= $	30670.00
		SUBTOTAL		=	66800 kg			$	66800.00
VARY BAR 1352	1905 mm	x	20						
BENTS 1 OR 5	1399 kg	x	2	=	2798 kg	at	0.75	= $	2098.50
VARY BAR 1352	1905 mm	x	16						
BENTS 2 OR 4	250 kg	x	2	=	500 kg	at	0.75	= $	375.00
VARY BAR 1352	1905 mm	x	16						
BENT 3	250 kg	x	1	=	250 kg	at	0.75	= $	187.50
		SUBTOTAL		=	3548 kg			$	2661.00
		GRAND TOTAL		=	70348 kg			$	69461.00

SPANS 1 OR 4 2 SPAN 1 SAME AS SPAN 4

1301	11176	182	1										
1302	2410	58	25	4	4	330	759						
1303	645	272	2			340	152	152					
1304	965	68	21	1	1	305	508						90
1305	5004	16	1										
1306	2455	308	14			330	765	305	752	305			
1602	11775	204	14			216	11252	305	0	0			
1603	11555	204	3			11252	305						
1604	2075	90	37			1499	44	305	6	267	32	0	
1901	15189	4	1										
3601	12090	40	10	1	1	11138							
3602	9449	4	1										

SPANS 2 OR 3 2 SPAN 2 SAME AS SPAN 3

1301	11176	182
1304	965	16
1305	5004	308
1602	11775	204
1603	11555	90
1901	15189	4
3601	12090	40

BENTS 1 OR 5 2 BENT 1 SAME AS BENT 5

1351	2565	89	25	4	4	508	660

	1352	VARIES	20	32	5	5	660	VARIES	VARIES					
	1353	2260	8	25	4	4	508	508						
	1951	1930	3	24			1168	305	457	305	333			
	3651	8025	4	4			7417	610						48
	3652	8890	4	1										
	3653	9345	4	3			8890	457						
	3654	8635	4	6			7112	305	610	610			42	48
BENTS 2 OR 4	2							BENT 2 SAME AS BENT 4						
	1351	2565	86											
	1352	VARIES	16	1										
BENT 3	1													
	1351	2565	86											
	1352	VARIES	16	1										