

APPENDIX

RESEARCH REPORT 15-2F

COST-EFFECTIVENESS EVALUATION
OF ROADSIDE SAFETY IMPROVEMENTS
ON TEXAS HIGHWAYS

APPENDIX

COST-EFFECTIVENESS ANALYSIS MODEL

The computer analysis model, written in Fortran computer language, makes use of thirty-nine subroutines and a main program. Use of subroutines, in addition to simplifying the logic and model validation, provides the necessary flexibility in modifying or extending the analysis procedure to accommodate unique situations that may be encountered in the field.

Core storage requirements for program execution from a source deck are approximately 380 bytes. Using an object (hexadecimal) input deck, program execution requires approximately 170 bytes.

Presented in this appendix are descriptions of the computer variables assigned to each data entry source on the hazard inventory and improvement forms, a functional description of the subroutines that constitute the analysis model, descriptions of tabular data input and a program operational flow chart. A listing of the complete computer program is included also.

The computer analysis model is documented in considerable detail in a previously published report (9) in which are included flow charts depicting the program logic, discussion of assumptions and idealizations, and definition of variables. Copies of the previous documentation manual as well as other previous reports on the three studies reported herein and tapes of the program may be obtained from the Texas State Department of Highways and Public Transportation, the Texas Transportation Institute or the Federal Highway Administration upon request.

Computer Variables

Each data input source (numbered space) on the hazard inventory and improvement form has been assigned a computer variable name. These data sources describe the factors that are unique to a particular obstacle or improvement (location, size, offset, costs, etc.). Other necessary information such as expected encroachment frequency, severity indices for each obstacle, etc., are incorporated into the analysis model and retrieved from core storage as required.

The computer variable names assigned to the existing roadside hazards are shown on the roadside hazard inventory form in Figure A-1. Hazard input data are read in subroutine INVTRY in a two-dimensional array as:

$$\text{Hazard Name} = H_n(I, J)$$

where

n = hazard descriptor (i.e., n=1 ... hazard number)

I = hazard number in a group ($1 \leq I \leq 15$)

J = 1

The computer variable names assigned to a roadside improvement are shown on the roadside hazard improvement form in Figure A-2. Improvement data are read in subroutine INVTRY in a two-dimensional array as:

$$\text{Improvement Name} = C_n(I, J)$$

where

n = hazard descriptor

I = hazard number in a group ($1 \leq I \leq 15$)

J = improvement alternative in a group ($2 \leq J \leq 5$)

Computer Variables

Each data input source (numbered space) on the hazard inventory and improvement form has been assigned a computer variable name. These data sources describe the factors that are unique to a particular obstacle or improvement (location, size, offset, costs, etc.). Other necessary information such as expected encroachment frequency, severity indices for each obstacle, etc., are incorporated into the analysis model and retrieved from core storage as required.

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J = 1

The computer variable names assigned to a roadside improvement are shown on the roadside hazard improvement form in Figure A-2. Improvement data are read in subroutine INVTRY in a two-dimensional array as:

$$\text{Improvement Name} = C_n(I, J)$$

where

n = hazard descriptor

I = hazard number in a group ($1 \leq I \leq 15$)

J = improvement alternative in a group ($2 \leq J \leq 5$)

ROADSIDE HAZARD INVENTORY

Inventory Conducted by _____ Date _____ Hazard Description _____



HIGHWAY																							
H8		H2				H9		H3			H4			H5		H5I		H7		H6			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
Highway Type		Highway Number				Classification			County Code			County Number		Section Number		Total Width		AUX Lanes Both		Inventory Code			
08 IM						Full Control Access										Center Line to Shoulder on		Inventory Code		Handling Direction			
01 US						1. Interstate														1. With Milepost			
02 SA						7. Non-Interstate														2. Against Milepost			
06 FM-RM						Non Control Access																	
						3. Two Lane																	
						4. Multilane Divided																	
						5. Multilane Undivided																	



HAZARD CLASSIFICATION										MILE POINT AT HAZARD																	
H1		H11		H12		H13		H15		H16		H17				H18											
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Hazard Number				Identification Code		Descriptor Code		Offset Code		Median Width (ft)		Grouping Number		Beginning				End (Except for Point Hazard)									
								1. Right 2. Median or Left Side		1. Lane Blank if Median inventoried on Near Side Only																	



POINT HAZARDS											
H19		H20		H23		H24		H21		H22	
51	52	53	54	55	56	57	58	59	60	61	62
Hazard Offset, D (ft)			Width (ft)		Length (ft)		Height (ft)		Depth (ft)		



LONGITUDINAL HAZARDS (Curbs, Bridgerails, Barriers, Guardrails, Ditches, and Retaining Walls)													
H19		H25		H26		H27		H28		H29		H30	
51	52	53	54	55	56	57	58	59	60	61	62	63	64
Hazard Offset, D (ft)		Beginning		End		Height (ft) or Depth (ft)		Width (ft)		Guardrail Only		END TREATMENT	
										1. Not Beginning at Structure - Safety Treated		1. Not Ending at Structure - Safety Treated	
										2. Not Beginning at Structure - Not Safety Treated		2. Not Ending at Structure - Not Safety Treated	
										3. Beginning at Structure - Full-Beam Connection		3. Ending at Structure - Full-Beam Connection	
										4. Beginning at Structure - Not Full-Beam Connection		4. Ending at Structure - Not Full-Beam Connection	



SLOPES																	
FRONT SLOPE																	
H19		H31		H32		H33		H34		H35		H36		H37		H38	
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	
Hinge Point Offset, D ₀ (ft)		Beginning		End		Slopes		End		Beginning		End		Slope Face Erosion Code		Slope Direction	
														1. Positive 2. Severe (Rats > 1ft)		1. Positive 2. Negative	



2nd or BACK SLOPE (Except for Level Terrain)											
H39		H40		H41		H42		H43		H44	
66	67	68	69	70	71	72	73	74	75		
Beginning		End		Beginning		End		Slope Face Erosion Code		Slope Direction	
								1. Slight or None 2. Severe (Rats > 1ft)		1. Positive 2. Negative	



Card Type
77

Recommendations: _____

Figure A-1. Computer variables--Roadside hazard inventory form.

BOX 1
BOX 2
BOX 3
BOX 4
BOX 5

Subroutine Descriptions

The computer analysis model, to be responsive to the extremely large number of possible alternatives, is composed of thirty-nine subroutines and a main program. The program execution keys from three primary subroutines: (1) subroutine PTHAZ, (2) subroutine LGHAZ, or (3) subroutine SLHAZ after being directed to one of these three subroutines from subroutine HAZARD. The primary category into which each hazard is classified on the inventory form is identified in subroutine HAZARD from which execution is then directed to the appropriate primary subroutine. The sequence of subroutines which the analysis then takes is dependent upon the improvement recommended. The primary subroutines channel the analysis to those analysis operations required for each possible improvement alternative for the particular hazard type. Table A-1 presents a description of each subroutine function.

The previously published documentation manual (9) presents cross-reference listings of all subroutines and descriptions of the major computer variables in each subroutine.

Program Operational Description

An overall systems flow chart depicting the operation of the cost-effectiveness model on the Texas SDHPT computer facilities is shown in Figure A-3.

TABLE A-1

LIST OF SUBROUTINES

<u>Number</u>	<u>Subroutine Name</u>	<u>Description of Subroutine</u>
1	SLIST	Listing of subroutines.
2	HWY	Subroutine contains description of highway (type and classification).
3	DIST	Subroutine reads and stores information on the relationship between county and district numbers.
4	ERROR	Subroutine contains error or flag messages that are built into the computer program.
5	SEVRTY	Subroutine to read and store severity-indices obtained from THD. These indices are adjusted to take into consideration the higher damage costs associated with fixed hazards such as a bridge pier.
6	ADJUST	Subroutine to adjust severity indices calculated in subroutine VDITCH
7	INVTRY	Subroutine reads and stores hazard and improvement data obtained in field. Maximum number of hazards per group is 15. Maximum number of improvement alternatives per hazard is 4.
8	ORDER1	Subroutine to re-arrange the hazards in ascending order based on lateral offset distance from edge of travelled lane.
9	ORDER2	Subroutine to rearrange hazards longitudinally to define beginning and end boundaries of a group of point hazards for protection by single G.R. or hazard groups of successive bridges
10	CONST1	Subroutine to compute constant values.

TABLE A-1, CONTINUED

<u>Number</u>	<u>Subroutine Name</u>	<u>Description of Subroutine</u>
11	HAZARD	Subroutine calls up the appropriate primary subroutine for one of the three defined type hazards (point, longitudinal, and slope). Except for several special cases, the severity-indices for the hazard are obtained from storage arrays.
12	PTHAZ	Point hazard subroutine. (Primary subroutine)
13	LGHAZ	Longitudinal hazard subroutine (primary subroutine).
14	SLHAZ	Slope hazard subroutine (primary subroutine).
15	CMBPT	Point hazard improvement subroutine. Protect hazard with concrete median barrier (CMB).
16	SOFT	Point hazard improvement subroutine. Protect hazard with energy attenuation system.
17	ZERO	Point hazard improvement subroutine. Alleviate hazard. Severity-index assumed to be equal to a value of zero.
18	RAIL	Longitudinal hazard improvement subroutine where guardrail is used.
19	RAIL1	Longitudinal hazard improvement subroutine. Remove existing guardrail.
20	RAIL2	Longitudinal hazard improvement subroutine. (1) Upgrade guardrail to full safety standards, or (2) Upgrade guardrail to full safety standards and close-up gap, or (3) Close-up gap between existing guardrail or (4) Safety treat guardrail, free-end only.
21	RAIL6	Longitudinal hazard improvement subroutine. Anchor existing guardrail to bridge structure.

TABLE A-1, CONTINUED

<u>Number</u>	<u>Subroutine Name</u>	<u>Description of Subroutine</u>
22	PTRAIL	Point hazard improvement subroutine. Protect hazard with guardrail. Hazard not on critical slope (3.5 to 1 or steeper). Guardrail length needed based on THD criteria.
23	DTRAIL	Subroutine to install guardrail to protect a washout or runoff ditch only.
24	SLRAIL	Longitudinal hazard improvement subroutine. Install guardrail to protect slope not at bridge--may include point hazards.
25	CURB	Longitudinal hazard improvement subroutine -- curbs.
26	BRIDGE	Longitudinal hazard improvement subroutine -- bridgerail.
27	BRGR	Longitudinal hazard improvement subroutine. Install guardrail at bridge approach, or install guardrail departing bridge.
28	BRGR1	Subroutine used to place guardrail between successive bridges in line. Program permits up to 5 bridges in one group.
29	SLOPE1	Subroutine to compute geometric properties of slopes such as the horizontal offset distances and slope angles.
30	VDITCH	Subroutine to calculate the severity index, SI, for the V-DITCH or intersection of the front and back slopes located within 30 feet of the traveled way. In addition, the width, W, of the imaginary longitudinal hazard is assigned.
31	DITCH	Longitudinal hazard improvement subroutine -- ditches.
32	WASOUT	Subroutine to compute the severity-index of a ditch or washout.

TABLE A-1, CONTINUED

<u>Number</u>	<u>Subroutine Name</u>	<u>Description of Subroutine</u>
33	FLATEN	Slope hazard improvement subroutine -- flatten slopes.
34	GRAIL	Subroutine locates the position of existing guardrail. NGR = 1 no guardrail IGR = 0 no guardrail on right side of roadway or on one side of median IGR = 1 guardrail on both sides of median.
35	HINDEX	Hazard-index subroutine. Hazard-index is defined as the number of fatal or non-fatal accidents per year associated with a one directional roadway. For median analysis, the hazard-index is computed for each roadway separately, and the two measures are added. Refer to equation 3 on pages 19 and 20 in NCHRP Project 20-7, Task Order 1/1, TTI Report RF 625 (11).
36	PROB	Subroutine to compute probability of a vehicle lateral displacement greater than some offset distance. Encroachment angle equal to 11 degrees. (Figure 4 in NCHRP 20-7) (11).
37	FREQ	Subroutine to compute the encroachment frequency expressed as the number of roadside encroachments per mile per year. (Figure 2 in NCHRP 20-7) (11).
38	COSTS	Subroutine to compute annualized costs taking into consideration (1) first costs of improvement, (2) normal maintenance costs of hazard and improvement, and (3) repair costs of hazard and improvement following a collision. Compound interest is used with an assumed interest rate of 8 percent and a 20 year life. Refer to the equation on pages 49 and 50 in NCHRP Project 20-7, Task Order 1/1, TTI Report RF 625 (11).
39	OUTPUT	Subroutine to print the output from the computer program.

Start of PGM
 ISAVE ← 0
 ISTART ← 0
 IEND ← 0

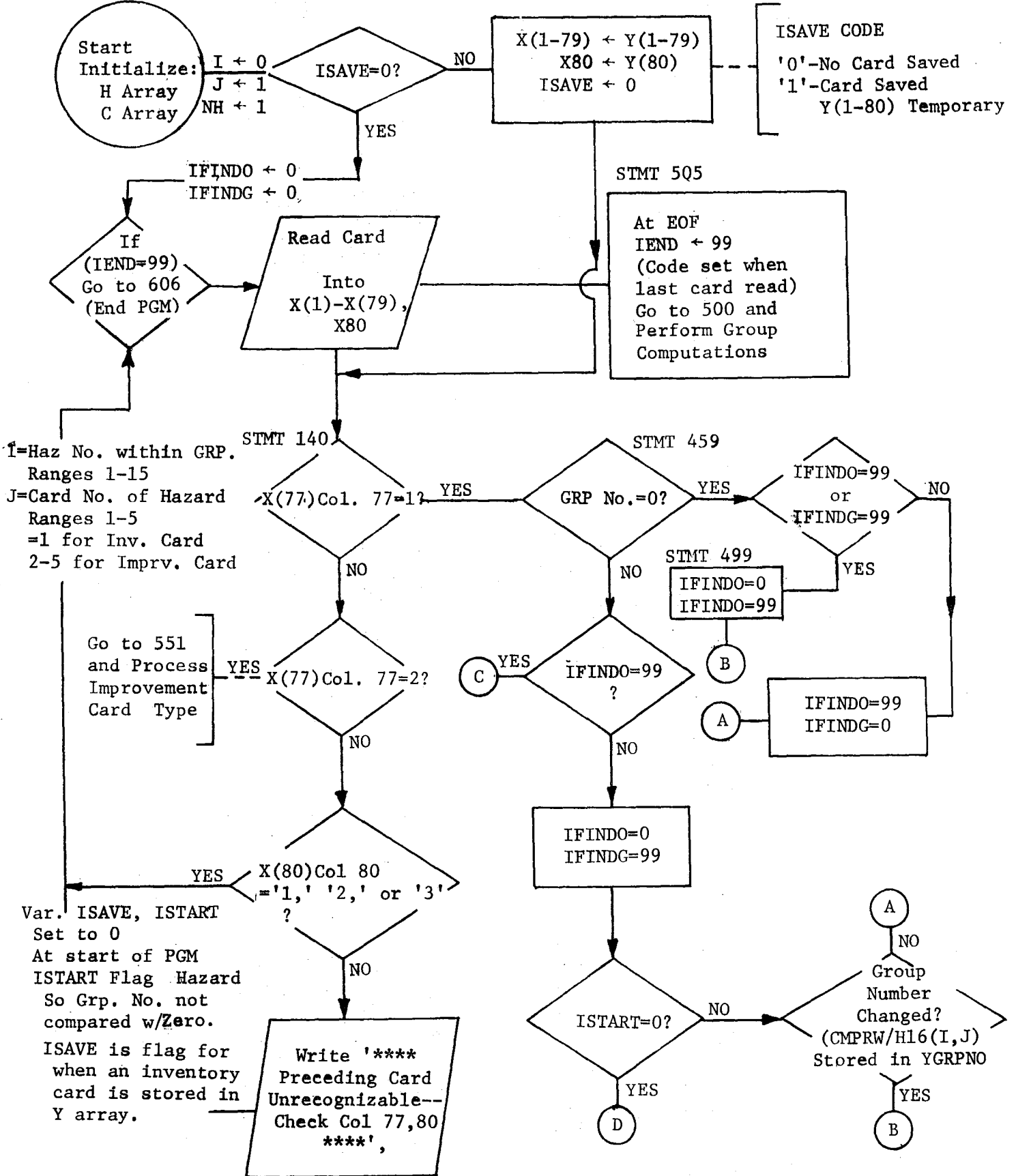
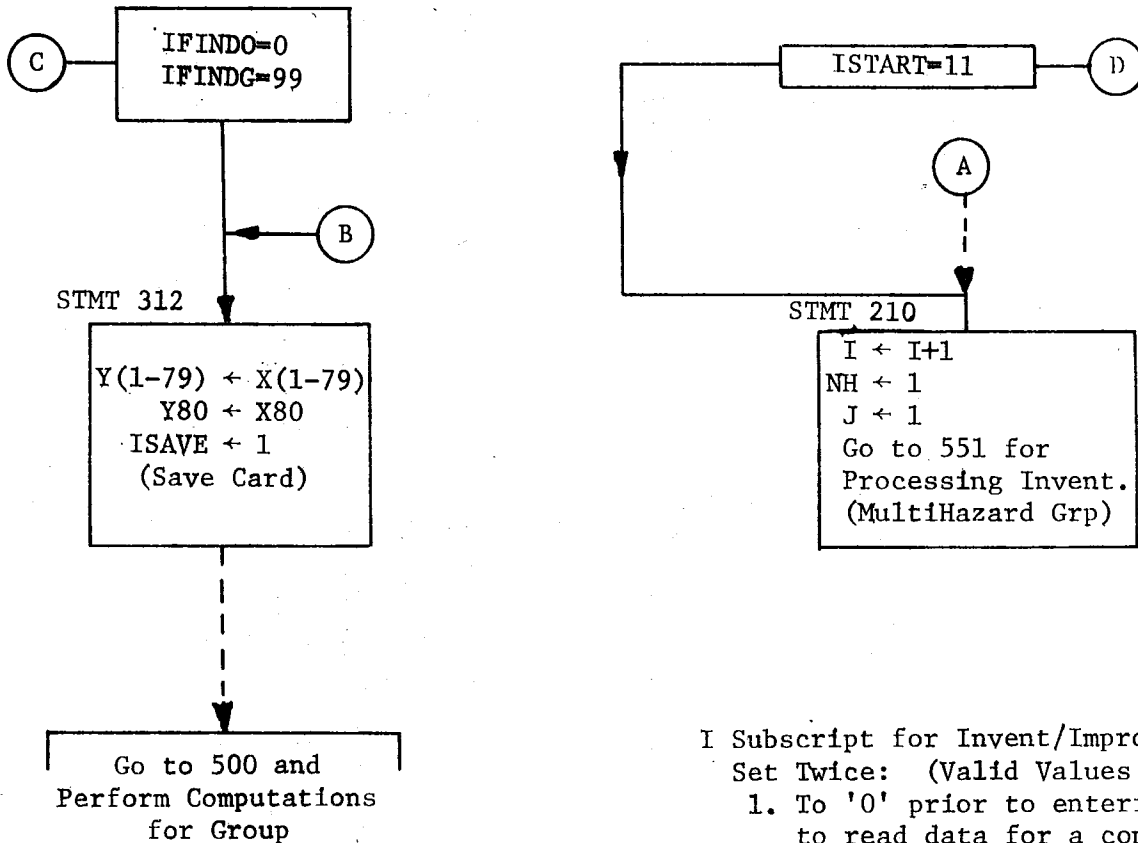


Figure A-3. Cost-Effectiveness Computer Model Systems Flow Chart (1 of 3)



- I Subscript for Invent/Improv Cards-
Set Twice: (Valid Values 1-15)
1. To '0' prior to entering routine to read data for a complete group
 2. To I+1 for each successive hazard within group number
- 1-Haz Subs. 2-5 Imprv. Subs.

Var. 'IFINDO' - Code set to 99
When a Grp No.=0 Found
(Single Haz Grp). Used to
Branch to Computation &
Store Inv Card for ≥ 2 such
Haz in Succession. Set to
0 if Multi-Haz Grp.

'IFINDG' - Code set to 99
when a Grp No \neq 0 Found.

- J Subscript for Hazard Number Within Grp
Set (Valid Values 1-5)
1. To '1' prior to entering routine to read data for a complete group
 2. To '2' after invent. card processed
 3. To J+1 after Imprv Card Processed
 4. To '1' after reading another hazard with same grp no.

Figure A-3. Cost-Effectiveness Computer Model Systems Flow Chart (2 of 3)

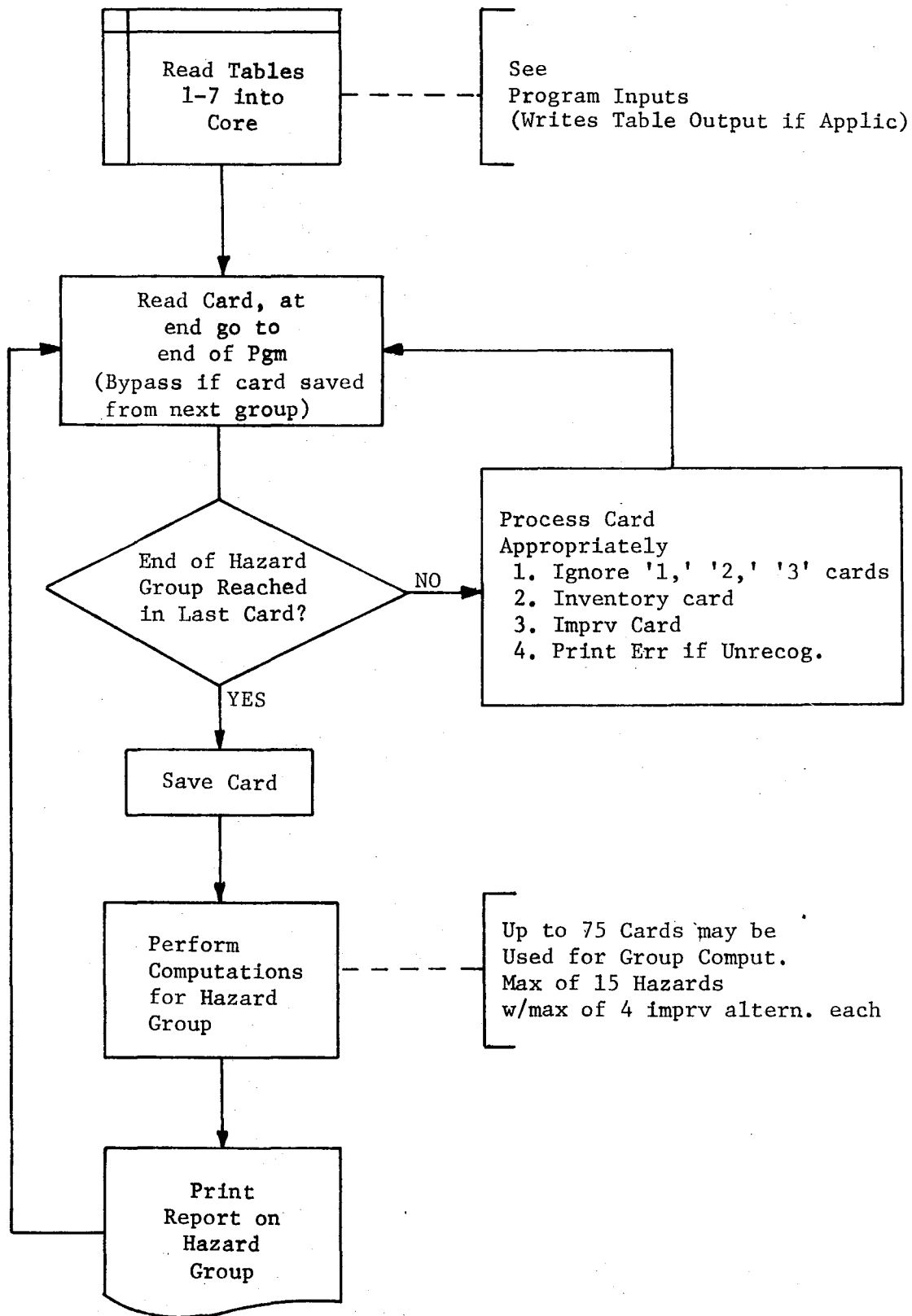


Figure A-3. Cost-Effectiveness Computer Model Systems Flow Chart (3 of 3)

Figure A-4 illustrates table input data. The program read structure is such that the table-ordering shown must be adhered to precisely. Although interpreted as "data," the seven tables are not input with field inventory data; rather, they are incorporated in the program and called prior to execution.

Strict adherence to the format, which differs for individual tables, is necessary for correct reading. The table data are read in the subroutines listed in Figure A-4, the subroutines being called in the MAIN program.

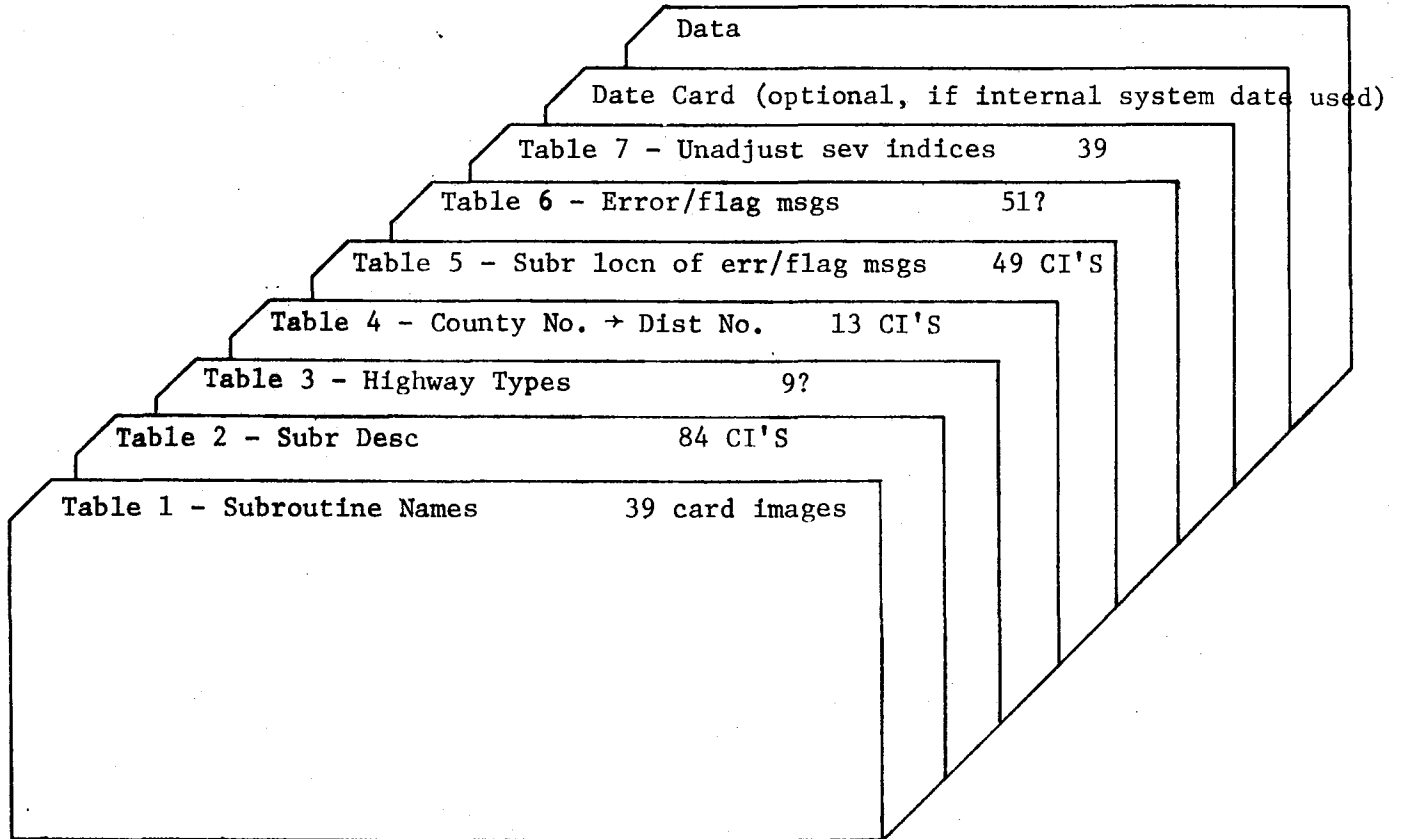
Severity Indices

Table A-2 presents a listing of severity indices used in the computer program. The identification and descriptor codes agree with those listed in Table 1 of this document.

Program Listing

A listing of the complete computer program is presented in Figures A-5 through A-44.

I. FT05F001 Card Images
 (Normally //GO.SYSIN when executed from standard JCL procedure)



II. FT12F001 Card Images (If Applic) Read by
 'PRINT' or 'SUPPR' - Optional Error/Flag Msgs - Subr ERROR
 'PRINT' or 'SUPPR' - Optional Sever Ind. List - Subr SEVRTY

Location of Read Statements

Table 1	Subroutine	SLIST
2		SLIST
3		HWY
4		DIST
5		ERROR
6		ERROR
7		SEVRTY
Date		MAIN
Data		INVTRY

Figure A-4. Table Input Data

TABLE A-2

SEVERITY INDICES

Identification Code	Descriptor Code	End Treatment Code Beginning	Code Ending	Severity-Survey	Index Adjusted
1. Utility Pole					
1	0	-	-	7.1	27.5
2. Trees					
2	0	-	-	8.0	50.0
3. Rigid Signpost					
3	1	-	-	4.7	8.9
3	2	-	-	7.2	30.0
3	3	-	-	7.2	30.0
3	4	-	-	7.2	30.0
3	5	-	-	8.1	52.5
4. Rigid Base Luminaire Support					
4	0	-	-	7.5	37.5
5. Curbs					
5	1	-	-	2.4	2.4
5	2	-	-	4.1	4.7
5	3	-	-	3.7	3.7
6. Guardrail or Median Barrier					
6	1	1	1	3.7	3.7
6	1	1	2	4.0	4.0
6	1	1	3	3.6	3.6
6	1	1	4	4.5	7.5
6	1	2	1	5.6	15.2
6	1	2	2	5.7	15.9
6	1	2	3	5.3	13.1
6	1	2	4	5.7	15.9
6	1	3	1	3.3	3.3
6	1	3	2	3.3	3.3
6	1	3	3	3.3	3.3
6	1	3	4	4.6	8.2
6	1	4	1	4.5	7.5
6	1	4	2	4.7	8.9
6	1	4	3	4.5	7.5
6	1	4	4	5.0	11.0
6	2	1	1	3.9	3.9
6	2	1	2	4.2	5.4
6	2	1	3	3.8	3.8

TABLE A-2, CONTINUED

Identification Code	Descriptor Code	End Treatment Code		Severity-Index	
		Beginning	Ending	Survey	Adjusted
6	2	1	4	4.7	8.9
6	2	2	1	5.8	16.6
6	2	2	2	5.9	17.3
6	2	2	3	5.5	14.5
6	2	2	4	5.9	17.3
6	2	3	1	3.5	3.5
6	2	3	2	3.5	3.5
6	2	3	3	3.5	3.5
6	2	3	4	4.8	9.6
6	2	4	1	4.7	8.9
6	2	4	2	4.9	10.3
6	2	4	3	4.7	8.9
6	2	4	4	5.0	11.0
6	3	1	1	3.7	3.7
6	3	1	2	4.0	4.0
6	3	1	3	3.3	3.3
6	3	1	4	4.5	7.5
6	3	2	1	5.6	15.2
6	3	2	2	5.0	11.0
6	3	2	3	3.9	3.9
6	3	2	4	5.0	11.0
6	3	3	1	3.2	3.2
6	3	3	2	3.2	3.2
6	3	3	3	3.2	3.2
6	3	3	4	4.4	6.8
6	3	4	1	4.0	4.0
6	3	4	2	4.5	7.5
6	3	4	3	3.9	3.9
6	3	4	4	4.7	8.9
6	4	1	1	3.7	3.7
6	4	1	2	4.0	4.0
6	4	1	3	3.6	3.6
6	4	1	4	4.5	7.5
6	4	2	1	5.6	15.2
6	4	2	2	5.7	15.9
6	4	2	3	5.3	13.1
6	4	2	4	5.7	15.9
6	4	3	1	3.3	3.3
6	4	3	2	3.3	3.3
6	4	3	3	3.3	3.3
6	4	3	4	4.6	8.2
6	4	4	1	4.5	7.5
6	4	4	2	4.7	8.9

TABLE A-2, CONTINUED

Identification Code	Descriptor Code	End Treatment Code		Severity-Index	
		Beginning	Ending	Survey	Adjusted
6	4	4	3	4.5	7.5
6	4	4	4	5.0	11.0
6	5	1	1	3.9	3.9
6	5	1	2	3.9	3.9
6	5	1	3	3.9	3.9
6	5	1	4	3.9	3.9
6	5	2	1	3.9	3.9
6	5	2	2	3.9	3.9
6	5	2	3	3.9	3.9
6	5	2	4	3.9	3.9
6	5	3	1	3.9	3.9
6	5	3	2	3.9	3.9
6	5	3	3	3.9	3.9
6	5	3	4	3.9	3.9
6	5	4	1	3.9	3.9
6	5	4	2	3.9	3.9
6	5	4	3	3.9	3.9
6	5	4	4	3.9	3.9
6	6	1	1	4.4	6.8
6	6	1	2	4.4	6.8
6	6	1	3	4.4	6.8
6	6	1	4	5.0	11.0
6	6	2	1	5.6	15.2
6	6	2	2	5.7	15.9
6	6	2	3	5.3	13.1
6	6	2	4	5.7	15.9
6	6	3	1	4.0	4.0
6	6	3	2	4.4	6.8
6	6	3	3	4.0	4.0
6	6	3	4	4.6	8.2
6	6	4	1	4.5	7.5
6	6	4	2	4.7	8.9
6	6	4	3	4.5	7.5
6	6	4	4	5.0	11.0
6	7	1	1	4.2	5.4
6	7	1	2	4.2	5.4
6	7	1	3	4.2	5.4
6	7	1	4	4.2	5.4
6	7	2	1	4.2	5.4
6	7	2	2	4.2	5.4
6	7	2	3	4.2	5.4
6	7	2	4	4.2	5.4
6	7	3	1	4.2	5.4

TABLE A-2, CONTINUED

Identification Code	Descriptor Code	End Treatment Code Beginning	Code Ending	Severity-Index Survey	Adjusted
6	7	3	2	4.2	5.4
6	7	3	3	4.2	5.4
6	7	3	4	4.2	5.4
6	7	4	1	4.2	5.4
6	7	4	2	4.2	5.4
6	7	4	3	4.2	5.4
6	7	4	4	4.2	5.4
7. Roadside Slope					
7	1	-	-	3.0	3.0
7	2	-	-	3.0	3.0
7	3	-	-	2.5	2.5
7	4	-	-	2.5	2.5
7	5	-	-	5.1	11.7
7	6	-	-	5.1	11.7
8. Ditch					
8	0	-	-	0.0	0.0
9. Culverts					
9	1	-	-	7.9	47.5
9	2	-	-	5.5	14.5
9	3	-	-	3.3	3.3
9	4	-	-	7.7	42.5
10. Inlets					
10	1	-	-	5.7	15.9
10	2	-	-	3.1	3.1
10	3	-	-	3.3	3.3
11. Roadway Under Bridge Structure					
11	1	-	-	9.3	82.5
11	2	-	-	9.3	82.5
11	3	-	-	2.5	2.5
12. Roadway Over Bridge Structure					
12	1	-	-	7.2	30.0
12	2	-	-	5.5	14.5
12	3	-	-	3.3	3.3
12	4	-	-	3.0	3.0
12	5	-	-	9.3	82.5
12	6	-	-	9.3	82.5

TABLE A-2, CONTINUED

Identification Code	Descriptor Code	End Treatment Code		Severity-Index	
		Beginning	Ending	Survey	Adjusted
13. Retaining Wall					
13	1	-	-	3.3	3.3
13	2	-	-	9.3	82.5
14. Miscellaneous Point Hazards					
14	1	-	-	7.5	37.5
14	2	-	-	9.3	82.5
14	3	-	-	7.5	37.5
14	4	-	-	9.3	82.5

```

C *****
C
C MAIN PROGRAM
C *****
C
C PROGRAM CONTAINS 39 SUBROUTINES. PROGRAM IS STOPPED AFTER
C 100 ERROR MESSAGES ARE OBTAINED FOR ANY ONE RUN
C
C
COMMON / TITLE / LIST
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / DIST1 / IDIST
COMMON / ERROR1 / MG, NMES
COMMON / SEVERE / S
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
*
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
*
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
*
* C30, C31, C48, C49
COMMON / HASCND / NCRDR
COMMON / CCNSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / SIDENF / NSGR, FSGR
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / H11, H12, SI, S11, SI2, R, P, UPAY, PSUM, HIB,
*
* HIA
COMMON / PTHZGR / NPTGR, HLGTH
COMMON / BRSLGR / NBR1
COMMON / RAILS / IRAIL1
COMMON / OUTPT1 / UPMT, PVAL, CE, LC1, IPRINT
COMMON / MCONHWY / MCONTR, MCONTH, NYEAR
COMMON / SAVCRD / ISAVE, ISTART, IEND
C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
*
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR
INTEGER UPMT, PVAL, CE
C
DIMENSION MG(60,20), IDIST(255)
DIMENSION S(14,7,4,4)
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
*
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
*
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)

```

Figure A-5 MAIN Program (1 of 4)

```

DIMENSION H23(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION NORDER(15)
DIMENSION YLAT(15,5), FLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)
DIMENSION UPMT(15,5), PVAL(15,5), CE(15,5)

C
C
LC1=1
LIST=0

C
CALL OUTPUT
CALL SLIST
CALL FWY
CALL DIST
CALL ERROR
CALL SFVRTY
READ(5,200) MCNTH, NYEAR
200 FORMAT(2I2)

C
LIST=1
ISTART = C
ISAVE = C
IEND = 0
100 CONTINUE
MES = 0

C
CALL INVTRY

C
IF(MES .EQ. 27) GO TO 24

C
CALL ORDER1

C
DO 30 L=1,LP1
C L IS THE NUMBER OF THE IMPROVEMENT ALTERNATIVE
J = L+1
MES=0
MES1=0
MES2=0
NCONTR=C
IPRINT = 0
UPAY = 0.0

```

Figure A-5 MAIN Program (2 of 4)

```

PSUM = 0.0
HIB = 0.0
HIA = 0.0
IGAP = 0
MGR = 0
ICRSL = 0
IRAIL1=C
NPTGR=C
HLGTH=C.0
99 CONTINUE
C HAZARD GROUP COMPUTATIONS FOR EACH IMPROVEMENT ALTERNATIVE. NH IS THE
C NUMBER OF HAZARDS WITHIN THE GROUP
DO 12 ILOOP=1,NH
I=ILOOP
MES=0
SI(I) = 0.0
SI1(I,1) = 0.0
SI2(I,J) = 0.0
HI1(I,1) = 0.0
HI1(I,2) = 0.0
HI2(I,1) = 0.0
HI2(I,2) = 0.0
C
CALL HAZARD
C
IF( NCCNTR .EQ. 1 ) GO TO 98
IF(MES.EQ.22) MES2=MES
IF(MES.NE.0) MES1=MES1+1
IF(MES1.NE.0 .AND. I.EQ.NH) GO TO 11
GO TO 15
11 CONTINUE
IPRINT=2
GO TO 20
15 CONTINUE
IF(I .FC. NH) GO TO 13
C
CALL OUTPLT
C
98 CONTINUE
12 CONTINUE
13 CONTINUE
HINDX = HIB - HIA
IF(HINDX .LT. 0.03) GO TO 10
GO TO 14
10 CONTINUE
MES=30
GO TO 20
14 CONTINUE
CF(I,J) = UPAY/HINDX
IPRINT=1
C

```

Figure A-5 MAIN Program (3 of 4)


```
20 CONTINUE
   IF(H9(I,1) .EQ. 3 .OR. H9(I,1) .EQ. 5 .OR. H9(I,1) .EQ. 7)
   *   NCCNTR = NCONTR + 1
   IF(NCCNTR.EQ.1.AND.MES.EQ.0) GO TO 99
   IF(NCCNTR.EQ.1.AND.MES.EQ.30) GO TO 99
C
   CALL OUTPUT
C
   IF(MES2.EQ.23) GO TO 24
30 CONTINUE
   GO TO 100
24 CCNTINUE
   CALL OUTPUT
C
   STOP
   END
```

Figure A-5 MAIN Program (4 of 4)

```

C *****
C
C   SUBROUTINE  INVTY
C
C *****
C
C   SUBROUTINE READS AND STORES HAZARD AND IMPROVEMENT DATA OBTAINED IN
C   FIELD.  MAXIMUM NUMBR OF HAZARDS PER GROUP IS 15.  MAXIMUM NUMBER
C   OF IMPROVEMENT ALTERNATIVES PER GROUP IS 4.
C
C
C   COMMON / INVENT / I, J, NH, LP1, LL, MES
C   COMMON / COUNT / NC
C   COMMON / HINVNT / F1, F2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
*                   H13, H15, H16, H17, H18, H19, H20, H21, H22,
*                   H23, H24, H25, H26, H27, H28, H29, H30, H31,
*                   H32, H33, H34, H35, H36, H37, H38, H39, H40,
*                   H41, H42, H43, H44, H50, H51
C   COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
*                   C13, C14, C15, C16, C17, C18, C20, C21, C24,
*                   C25, C26, C27, C28, C29, C34, C35, C36, C37,
*                   C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
*                   , C30, C31, C48, C49
C   COMMON / SAVCRD / ISAVE, ISTART, IEND
C
C   INTEGER  F1, H2, F3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
*           H29, H30, H37, H38, H43, H44
C   INTEGER  C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
C   INTEGER  NC, X8C, Y8C
C
C   DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
*            H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
*            H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
*            H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
*            H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
*            H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C   DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
*            H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
*            H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C   DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
*            C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
*            C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
*            C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
*            C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
*            C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
C   DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*            C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*            , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
C   DIMENSION NC(15), X(75), Y(79), PART(20)
C
C
C   INITIALIZE ARRAYS

```

Figure A-6 Subroutine INVTY (1 of 7)

```

N=1
DO 25 M=1,15
  H1(M,N) = 0.0
  H2(M,N) = 0.0
  H3(M,N) = 0.0
  H4(M,N) = 0.0
  H5(M,N) = 0.0
  H6(M,N) = 0.0
  H7(M,N) = 0.0
  H8(M,N) = 0.0
  H9(M,N) = 0.0
  H11(M,N) = 0.0
  H12(M,N) = 0.0
  H13(M,N) = 0.0
  H15(M,N) = 0.0
  H16(M,N) = 0.0
  H17(M,N) = 0.0
  H18(M,N) = 0.0
  H19(M,N) = 0.0
  H20(M,N) = 0.0
  H21(M,N) = 0.0
  H22(M,N) = 0.0
  H23(M,N) = 0.0
  H24(M,N) = 0.0
  H25(M,N) = 0.0
  H26(M,N) = 0.0
  H27(M,N) = 0.0
  H28(M,N) = 0.0
  H29(M,N) = 0.0
  H30(M,N) = 0.0
  H31(M,N) = 0.0
  H32(M,N) = 0.0
  H33(M,N) = 0.0
  H34(M,N) = 0.0
  H35(M,N) = 0.0
  H36(M,N) = 0.0
  H37(M,N) = 0.0
  H38(M,N) = 0.0
  H39(M,N) = 0.0
  H40(M,N) = 0.0
  H41(M,N) = 0.0
  H42(M,N) = 0.0
  H43(M,N) = 0.0
  H44(M,N) = 0.0
  H50(M,N)=0.0
  H51(M,N)=0.0
25 CONTINUE

```

C

```

DO 20 M=1,15
DO 20 N=1,5
  C1(M,N) = 0.0
  C2(M,N) = 0.0
  C3(M,N) = 0.0
  C4(M,N) = 0.0
  C5(M,N) = 0.0
  C7(M,N) = 0.0
  C8(M,N) = 0.0
  C9(M,N) = 0.0

```

Figure A-6 Subroutine INVTRY (2 of 7)

```

C10(M,N) = 0.0
C11(M,N) = 0.0
C12(M,N) = 0.0
C13(M,N) = 0.0
C14(M,N) = 0.0
C15(M,N) = 0.0
C16(M,N) = 0.0
C17(M,N) = 0.0
C18(M,N) = 0.0
C20(M,N) = 0.0
C21(M,N) = 0.0
C24(M,N) = 0.0
C25(M,N) = 0.0
C26(M,N) = 0.0
C27(M,N) = 0.0
C28(M,N) = 0.0
C29(M,N) = 0.0
C30(M,N) = 0.0
C31(M,N) = 0.0
C34(M,N) = 0.0
C35(M,N) = 0.0
C36(M,N) = 0.0
C37(M,N) = 0.0
C38(M,N) = 0.0
C39(M,N) = 0.0
C40(M,N) = 0.0
C41(M,N) = 0.0
C42(M,N) = 0.0
C43(M,N) = 0.0
C44(M,N) = 0.0
C45(M,N) = 0.0
C46(M,N) = 0.0
C47(M,N) = 0.0
C48(M,N)=0.0
C49(M,N)=0.0

```

C

20 CONTINUE

C

C

```

I=0
J=1
NH=1
IFINDO = 0
IFINDG = 0

```

C

559 CONTINUE

```

IF ( ISAVE .EQ. 0 ) GO TO 120
DO 315 II = 1,79
315 X(II) = Y(II)
X80 = Y80
ISAVE = 0
GO TO 140
120 IF ( IEND .EQ. 99 ) GO TO 606
READ (5,306,END=505) ( X(L),L=1,79 ), X80
140 IF ((X(77) .GT. .9) .AND. (X(77) .LT. 1.1)) GO TO 160
IF ((X(77) .GT. 1.9) .AND. (X(77) .LT. 2.1)) GO TO 551
IF ( ( ( X80.GT.0.9 ) .AND. ( X80.LT.1.1 ) ) .OR.
1 ( ( X80.GT.1.9 ) .AND. ( X80.LT.2.1 ) ) ) .OR.

```

Figure A-6 Subroutine INVTY (3 of 7)

```

2      ( ( >8C.GT.2.9 ).AND.( X80.LT.3.1 ) ) ) GO TO 120
WRITE (6,190)
190   FCRMAT (//, ' *****PRECEDING CARD UNRECCGNIZABLE - CHECK COLS 77 AN
1D 80*****')
GO TO 120
160   YGRPNO = XGRPNC
XGRPNC = 1000.*X(35) + 100.*X(36) + 10.*X(37) + X(38) + 0.01
IF ( XGRPNO .LT. 0.1 ) GO TO 549
IF ( IFINDO .EQ. 99 ) GO TO 317
IFINDC = C
IFINDG = 99
IF ( ISTART .EQ. C ) GO TO 209
IF ( ABS(XGRPNO-YGRPNO) .LT. 0.1 ) GO TO 210
312   DO 313 II = 1,79
313   Y(II) = X(II)
Y80 = X80
ISAVE = 1
GO TO 500
317   IFINDC = C
IFINDG = 99
GO TO 312
505   IEND = 99
GO TO 500
209   ISTART = 1
210   I = I + 1
NH = I
J = 1
GO TO 551
C
549   IF ( (IFINDO .EQ. 99) .OR. (IFINDG .EQ. 99) ) GO TO 499
IFINDO = 99
IFINDG = C
GO TO 210
499   IFINDG = C
IFINDO = 99
GO TO 312
551  CONTINUE
IF (J .NE. 1) GO TO 552
C
H1(I,J)=1000.*X(22)+100.*X(24)+10.*X(25)+X(26)+.1
H2(I,J)=1000.*X(3)+100.*X(4)+10.*X(5)+X(6)+.1
H3(I,J)=100.*X(8)+10.*X(9)+X(10)+.1
H4(I,J)=1000.*X(11)+100.*X(12)+10.*X(13)+X(14)+.1
H5(I,J)=10.*X(15)+X(16)+.1
H6(I,J)=X(22)+.1
H7(I,J)=100.*X(19)+10.*X(20)+X(21)
H8(I,J)=10.*X(1)+X(2)+.1
H9(I,J)=X(7)+.1
H11(I,J)=10.*X(27)+X(28)+.1
H12(I,J)=10.*X(29)+X(30)+.1
H13(I,J)=X(31)+.1
H15(I,J)=100.*X(32)+10.*X(33)+X(34)
H16(I,J)=1000.*X(35)+100.*X(36)+10.*X(37)+X(38)+.1
H17(I,J)=100.*X(39)+10.*X(40)+X(41)+.1*X(42)+.01*X(43)+.001*X(44)
H18(I,J)=100.*X(45)+10.*X(46)+X(47)+.1*X(48)+.01*X(49)+.001*X(50)
H51(I,J)=10.*X(17)+X(18)
H19(I,J)=X(51)+.1

```

Figure A-6 Subroutine INVTRY (4 of 7)

```
IH19=H19(I,J)
GO TO ( 553, 554, 555 ), IH19
```

```
C
C IDENTIFICATION
```

```
C
C IF19 = 1 POINT HAZARDS
C IF19 = 2 LONGITUDINAL HAZARDS
C IF19 = 3 SLOPES
```

```
C
553 CONTINUE
```

```
H20(I,J)=10.*X(52)+X(53)
H21(I,J)=10.*X(60)+X(61)+.1*X(62)
H22(I,J)=10.*X(63)+X(64)+.1*X(65)
H23(I,J)=100.0*X(54)+10.0*X(55)+X(56)
H24(I,J)=100.0*X(57)+10.0*X(58)+X(59)
J=2
GO TO 559
```

```
C
554 CONTINUE
```

```
H25(I,J)=10.*X(52)+X(53)
H26(I,J)=10.*X(54)+X(55)
H27(I,J)=10.*X(56)+X(57)+.1*X(58)
H28(I,J)=10.*X(59)+X(60)
H29(I,J)=X(61)+.1
H30(I,J)=X(62)+.1
```

```
C
J=2
GO TO 559
```

```
C
555 CONTINUE
```

```
H31(I,J)=10.*X(52)+X(53)
H32(I,J)=10.*X(54)+X(55)
H33(I,J)=X(56)+.1*X(57)
H34(I,J)=X(58)+.1*X(59)
H35(I,J)=10.*X(60)+X(61)
H36(I,J)=10.*X(62)+X(63)
H37(I,J)=X(64)+.1
H38(I,J)=X(65)+.1
H39(I,J)=X(66)+.1*X(67)
H40(I,J)=X(68)+.1*X(69)
H41(I,J)=10.*X(70)+X(71)
H42(I,J)=10.*X(72)+X(73)
H43(I,J)=X(74)+.1
H44(I,J)=X(75)+.1
J=2
GO TO 559
```

```
C
552 CONTINUE
```

```
C1(I,J)=1000.*X(1)+100.*X(2)+10.*X(3)+X(4)+.1
C2(I,J)=1000.*X(5)+100.*X(6)+10.*X(7)+X(8)+.1
C3(I,J)=100.*X(9)+10.*X(10)+X(11)+.1
C4(I,J)=1000.*X(12)+100.*X(13)+10.*X(14)+X(15)+.1
C5(I,J)=10.*X(16)+X(17)+.1
C7(I,J)=100000.*X(18)+10000.*X(19)+1000.*X(20)+100.*X(21)+
* 10.*X(22)+X(23)
C8(I,J)=1000.*X(24)+100.*X(25)+10.*X(26)+X(27)
C9(I,J)=1000.*X(28)+100.*X(29)+10.*X(30)+X(31)
C10(I,J)=1000.*X(32)+100.*X(33)+10.*X(34)+X(35)
```

Figure A-6 Subroutine INVTRY (5 of 7)

```

C11(I,J)=1000.*X(36)+100.*X(37)+10.*X(38)+X(39)
C12(I,J)=X(40)+.1
C
  IC12=C12(I,J)
  GO TO (556,557,558,580),IC12
C
C IDENTIFICATION
C
C IC12 = 1 POINT HAZARD IMPROVEMENT
C IC12 = 2 LONGITUDINAL HAZARD IMPROVEMENT
C IC12 = 3 SLOPE IMPROVEMENT
C IC12 = 4 NO IMPROVEMENT
C
580 CONTINUE
  NC(I)=J-1
  J=J+1
  GO TO 559
C
556 CONTINUE
  C13(I,J)=X(41)+.1
  C14(I,J)=10.*X(42)+X(43)
  C15(I,J)=100.*X(42)+10.*X(43)+X(44)
  C16(I,J)=10.*X(45)+X(46)
  C17(I,J)=10.*X(47)+X(48)
  C20(I,J)=X(42)+0.1
  C48(I,J)=10.*X(42)+X(43)
  C49(I,J)=10.*X(44)+X(45)
  NC(I)=J-1
  J=J+1
  GO TO 559
C
557 CONTINUE
  C18(I,J)=X(41)+0.1
  C20(I,J)=X(42)+.1
  C21(I,J)=X(43)+.1
  C24(I,J)=10.*X(44)+X(45)
  C25(I,J)=10.*X(46)+X(47)
  C26(I,J)=1000.*X(43)+100.*X(44)+10.*X(45)+X(46)
  C27(I,J)=1000.*X(47)+100.*X(48)+10.*X(49)+X(50)
  C28(I,J)=1000.*X(51)+100.*X(52)+10.*X(53)+X(54)
  C29(I,J)=1000.*X(55)+100.*X(56)+10.*X(57)+X(58)
  C30(I,J)=10.*X(48)+X(49)
  C31(I,J)=10.*X(50)+X(51)
  NC(I)=J-1
  J=J+1
  GO TO 559
C
558 CONTINUE
  C18(I,J)=X(41)+0.1
  C24(I,J)=10.*X(44)+X(45)
  C25(I,J)=10.*X(46)+X(47)
  C30(I,J)=10.*X(48)+X(49)
  C31(I,J)=10.*X(50)+X(51)
  C34(I,J)=100.*X(64)+10.*X(65)+X(66)+.1*X(67)+
* .01*X(68)+.001*X(69)
  C35(I,J)=100.*X(70)+10.*X(71)+X(72)+.1*X(73)+
* .01*X(74)+.001*X(75)
  C36(I,J)=10.*X(42)+X(43)

```

Figure A-6 Subroutine INVTRY (6 of 7)

```

C37(I,J)=10.*X(44)+X(45)
C38(I,J)=X(46)+.1*X(47)
C39(I,J)=X(48)+.1*X(49)
C40(I,J)=10.*X(50)+X(51)
C41(I,J)=10.*X(52)+X(53)
C42(I,J)=X(54)+.1
C43(I,J)=X(55)+.1*X(56)
C44(I,J)=X(57)+.1*X(58)
C45(I,J)=10.*X(59)+X(60)
C46(I,J)=10.*X(61)+X(62)
C47(I,J)=X(63)+.1
NC(I)=J-1
J=J+1
GO TO 559
C
500 CONTINUE
LP1=NC(I)
RETURN
C
606 CONTINUE
MES = 27
RETURN
C
306 FORMAT (7SF1.0, I1)
C
END

```

Figure A-6 Subroutine INVTRY (7 of 7)


```

C *****
C
C SUBROUTINE ORDER1
C
C *****
C SUBROUTINE TO RE-ARRANGE THE HAZARDS IN ASCENDING ORDER BASED ON LATE
C OFFSET DISTANCE FROM EDGE OF TRAVELLED LANE
C
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / HASCND / NCRDR
INTEGER A1, A2, A3, A4, A5, A6, A8, A9, A11, A12, A13, A16, A19, A29, A30, A37,
* A38, A43, A44
INTEGER B1, B2, B3, B4, B5, B12, B13, B18, B20, B21, B42, B47

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSERS, BSERS

DIMENSION NC(15)
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)

```

Figure A-7 Subroutine ORDER1 (1 of 7)

```

*      , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION A1(15,5), A2(15,5), A3(15,5), A4(15,5), A5(15,5),
*
*      A7(15,5), A8(15,5), A9(15,5), A10(15,5), A11(15,5),
*
*      A12(15,5), A13(15,5), A14(15,5), A15(15,5), A16(15,5),
*
*      A17(15,5), A18(15,5), A20(15,5), A21(15,5), A24(15,5),
*
*      A25(15,5), A26(15,5), A27(15,5), A28(15,5), A29(15,5),
*
*      A34(15,5), A35(15,5), A36(15,5), A37(15,5), A38(15,5)
DIMENSION A39(15,5), A40(15,5), A41(15,5), A42(15,5), A43(15,5),
*
*      A44(15,5), A45(15,5), A46(15,5), A47(15,5),
*
*      A50(15,5), A51(15,5)
DIMENSION A6(15,5), A9(15,5), A22(15,5), A23(15,5), A30(15,5),
*
*      A31(15,5), A32(15,5), A33(15,5)
DIMENSION B1(15,5), B2(15,5), B3(15,5), B4(15,5), B5(15,5), B7(15,5),
*
*      B8(15,5), B9(15,5), B10(15,5), B11(15,5), B12(15,5),
*
*      B13(15,5), B14(15,5), B15(15,5), B16(15,5), B17(15,5),
*
*      B18(15,5), B20(15,5), B21(15,5), B24(15,5), B25(15,5),
*
*      B26(15,5), B27(15,5), B28(15,5), B29(15,5), B34(15,5)
DIMENSION B35(15,5), B36(15,5), B37(15,5), B38(15,5), B39(15,5),
*
*      B40(15,5), B41(15,5), B42(15,5), B43(15,5), B44(15,5),
*
*      B45(15,5), B46(15,5), B47(15,5), B30(15,5),
*
*      B31(15,5), B48(15,5), B49(15,5)
DIMENSION NORDER(15)
DIMENSION HOFF(15,1), NCOUNT(15), MM(15)

```

C

```

IF(NH.EQ.1) GO TO 14
DO 10 L=1,NH
NCOUNT(L)=1
IH19=H19(L,1)
GO TO ( 100, 101, 102 ), IH19

```

C

```

100 CONTINUE
HOFF(L,1)=H20(L,1)
MM(L)=L
GO TO 10

```

C

```

101 CONTINUE
HOFF(L,1)=.5*(H25(L,1)+H26(L,1))
MM(L)=L
GO TO 10

```

C

```

102 CONTINUE
K = L
LL=1

```

C

```

CALL SLOPE1

```

C

```

HOFF(L,1)=FSOFF
MM(L)=L

```

C

```

10 CONTINUE

```

C

```

N1=NH-1
DO 12 N=1,N1
IPI=N+1
DO 12 K=IPI,NH
IF(HOFF(N,1).LE.HOFF(K,1)) GO TO 12
TEMP = HOFF(N,1)
HOFF(N,1)=HOFF(K,1)
HOFF(K,1)=TEMP

```

Figure A-7 Subroutine ORDER1 (2 of 7)

```
ITEMP=MM(N)
MM(N)=MM(K)
MM(K)=ITEMP
12 CONTINUE
```

C
C

```
DO 55 M=1,NH
K=MM(M)
A1(M,1) = H1(K,1)
A2(M,1) = H2(K,1)
A3(M,1) = H3(K,1)
A4(M,1) = H4(K,1)
A5(M,1) = H5(K,1)
A6(M,1) = H6(K,1)
A7(M,1) = H7(K,1)
A8(M,1) = H8(K,1)
A9(M,1) = H9(K,1)
A11(M,1) = H11(K,1)
A12(M,1) = H12(K,1)
A13(M,1) = H13(K,1)
A15(M,1) = H15(K,1)
A16(M,1) = H16(K,1)
A17(M,1) = H17(K,1)
A18(M,1) = H18(K,1)
A19(M,1) = H19(K,1)
A50(M,1) = H50(K,1)
A51(M,1) = H51(K,1)
```

C

```
IH19=H19(K,1)
GO TO(50,51,52),IH19
```

C

```
50 CONTINUE
A20(M,1) = H20(K,1)
A21(M,1) = H21(K,1)
A22(M,1) = H22(K,1)
A23(M,1) = H23(K,1)
A24(M,1) = H24(K,1)
GO TO 55
```

C

```
51 CONTINUE
A25(M,1) = H25(K,1)
A26(M,1) = H26(K,1)
A27(M,1) = H27(K,1)
A28(M,1) = H28(K,1)
A29(M,1) = H29(K,1)
A30(M,1) = H30(K,1)
GO TO 55
```

C

```
52 CONTINUE
A31(M,1) = H31(K,1)
A32(M,1) = H32(K,1)
A33(M,1) = H33(K,1)
A34(M,1) = H34(K,1)
A35(M,1) = H35(K,1)
A36(M,1) = H36(K,1)
A37(M,1) = H37(K,1)
A38(M,1) = H38(K,1)
A39(M,1) = H39(K,1)
```

Figure A-7 Subroutine ORDER1 (3 of 7)

```
HTOUBV17 = HTOUBV17  
A41(M,1) = H41(K,1)  
A42(M,1) = H42(K,1)  
A43(M,1) = H43(K,1)  
A44(M,1) = H44(K,1)  
55 CONTINUE
```

C

```
DO 35 M=1,NH  
K=M  
H1(M,1) = A1(K,1)  
H2(M,1) = A2(K,1)  
H3(M,1) = A3(K,1)  
H4(M,1) = A4(K,1)  
H5(M,1) = A5(K,1)  
H6(M,1) = A6(K,1)  
H7(M,1) = A7(K,1)  
H8(M,1) = A8(K,1)  
H9(M,1) = A9(K,1)  
H11(M,1) = A11(K,1)  
H12(M,1) = A12(K,1)  
H13(M,1) = A13(K,1)  
H15(M,1) = A15(K,1)  
H16(M,1) = A16(K,1)  
H17(M,1) = A17(K,1)  
H18(M,1) = A18(K,1)  
H19(M,1) = A19(K,1)  
H50(M,1) = A50(K,1)  
H51(M,1) = A51(K,1)
```

C

```
IH19=A19(K,1)  
GO TO(40,41,42),IH19
```

C

```
40 CONTINUE  
H20(M,1) = A20(K,1)  
H21(M,1) = A21(K,1)  
H22(M,1) = A22(K,1)  
H23(M,1) = A23(K,1)  
H24(M,1) = A24(K,1)  
GO TO 35
```

C

```
41 CONTINUE  
H25(M,1) = A25(K,1)  
H26(M,1) = A26(K,1)  
H27(M,1) = A27(K,1)  
H28(M,1) = A28(K,1)  
H29(M,1) = A29(K,1)  
H30(M,1) = A30(K,1)  
GO TO 35
```

C

```
42 CONTINUE  
H31(M,1) = A31(K,1)  
H32(M,1) = A32(K,1)  
H33(M,1) = A33(K,1)  
H34(M,1) = A34(K,1)  
H35(M,1) = A35(K,1)  
H36(M,1) = A36(K,1)  
H37(M,1) = A37(K,1)  
H38(M,1) = A38(K,1)
```

Figure A-7 Subroutine ORDER1 (4 of 7)

```
H39(M,1) = A39(K,1)
H40(M,1) = A40(K,1)
H41(M,1) = A41(K,1)
H42(M,1) = A42(K,1)
H43(M,1) = A43(K,1)
H44(M,1) = A44(K,1)
35 CONTINUE
```

C
C

```
N1 = LP1 + 1
DO 60 M=1,NH
DO 60 N=2,N1
K=MM(M)
B1(M,N) = C1(K,N)
B2(M,N) = C2(K,N)
B3(M,N) = C3(K,N)
B4(M,N) = C4(K,N)
B5(M,N) = C5(K,N)
B7(M,N) = C7(K,N)
B8(M,N) = C8(K,N)
B9(M,N) = C9(K,N)
B10(M,N) = C10(K,N)
B11(M,N) = C11(K,N)
B12(M,N) = C12(K,N)
```

C

```
IB12=B12(M,N)
GO TO(64,65,66,6C),IB12
```

C

```
64 CONTINUE
B13(M,N) = C13(K,N)
B14(M,N) = C14(K,N)
B15(M,N) = C15(K,N)
B16(M,N) = C16(K,N)
B17(M,N) = C17(K,N)
B20(M,N) = C20(K,N)
B48(M,N) = C48(K,N)
B49(M,N) = C49(K,N)
GO TO 6C
```

C

```
65 CONTINUE
B18(M,N) = C18(K,N)
B20(M,N) = C20(K,N)
B21(M,N) = C21(K,N)
B24(M,N) = C24(K,N)
B25(M,N) = C25(K,N)
B26(M,N) = C26(K,N)
B27(M,N) = C27(K,N)
B28(M,N) = C28(K,N)
B29(M,N) = C29(K,N)
B30(M,N) = C30(K,N)
B31(M,N) = C31(K,N)
GO TO 60
```

C

```
66 CONTINUE
B18(M,N) = C18(K,N)
B24(M,N) = C24(K,N)
B25(M,N) = C25(K,N)
B30(M,N) = C30(K,N)
```

Figure A-7 Subroutine ORDER1 (5 of 7)

```

B31(M,N) = C31(K,N)
B34(M,N) = C34(K,N)
B35(M,N) = C35(K,N)
B36(M,N) = C36(K,N)
B37(M,N) = C37(K,N)
B38(M,N) = C38(K,N)
B39(M,N) = C39(K,N)
B40(M,N) = C40(K,N)
B41(M,N) = C41(K,N)
B42(M,N) = C42(K,N)
B43(M,N) = C43(K,N)
B44(M,N) = C44(K,N)
B45(M,N) = C45(K,N)
B46(M,N) = C46(K,N)
B47(M,N) = C47(K,N)

```

60 CONTINUE

C
C

```

N1 = LP1 + 1
DO 30 M=1,NH
DO 30 N=2,N1
K=M

```

```

C1(M,N) = B1(K,N)
C2(M,N) = B2(K,N)
C3(M,N) = B3(K,N)
C4(M,N) = B4(K,N)
C5(M,N) = B5(K,N)
C7(M,N) = B7(K,N)
C8(M,N) = B8(K,N)
C9(M,N) = B9(K,N)
C10(M,N) = B10(K,N)
C11(M,N) = B11(K,N)
C12(M,N) = B12(K,N)

```

C

```

IC12=C12(M,N)
GO TO(44,45,46,30),IC12

```

C

44 CONTINUE

```

C13(M,N) = B13(K,N)
C14(M,N) = B14(K,N)
C15(M,N) = B15(K,N)
C16(M,N) = B16(K,N)
C17(M,N) = B17(K,N)
C20(M,N) = B20(K,N)
C48(M,N) = B48(K,N)
C49(M,N) = B49(K,N)
GO TO 30

```

C

45 CONTINUE

```

C18(M,N) = B18(K,N)
C20(M,N) = B20(K,N)
C21(M,N) = B21(K,N)
C24(M,N) = B24(K,N)
C25(M,N) = B25(K,N)
C26(M,N) = B26(K,N)
C27(M,N) = B27(K,N)
C28(M,N) = B28(K,N)
C29(M,N) = B29(K,N)

```

Figure A-7 Subroutine ORDER1 (6 of 7)

```
      C30(M,N) = B20(K,N)
      C31(M,N) = B31(K,N)
      GO TO 30
C
46 CONTINUE
      C18(M,N) = B18(K,N)
      C24(M,N) = B24(K,N)
      C25(M,N) = B25(K,N)
      C30(M,N) = B30(K,N)
      C31(M,N) = B31(K,N)
      C34(M,N) = B34(K,N)
      C35(M,N) = B35(K,N)
      C36(M,N) = B36(K,N)
      C37(M,N) = B37(K,N)
      C38(M,N) = B38(K,N)
      C39(M,N) = B39(K,N)
      C40(M,N) = B40(K,N)
      C41(M,N) = B41(K,N)
      C42(M,N) = B42(K,N)
      C43(M,N) = B43(K,N)
      C44(M,N) = B44(K,N)
      C45(M,N) = B45(K,N)
      C46(M,N) = B46(K,N)
      C47(M,N) = B47(K,N)
30 CONTINUE
14 CONTINUE
      RETURN
C
      END
```

Figure A-7 Subroutine ORDER1 (7 of 7)

```

C *****
C
C SUBROUTINE ORDER2
C *****
C SUBROUTINE REARRANGES HAZARDS LONGITUDINALLY WITHIN A GROUP
C FOR INSTALLATION OF A SINGLE LENGTH OF GUARDRAIL TO PROTECT THE GROUP
C
C COMMON / INVENT / I, J, NH, LP1, LL, MES
C COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
C COMMON / PTHZGR / NPTGR, HLGTH
C COMMON / BRGR2 / MM
C
C INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
C
C DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C DIMENSION MM(15)
C
C DO 5 N=1,NH
C MM(N)=N
C 5 CONTINUE
C IH6=H6(I,1)
C GO TO ( 10, 12 ), IH6
C
C 10 CONTINUE
C N1=NH-1
C DO 14 N=1,N1
C IP1=N+1
C DO 14 K=IP1,NH
C IF ( H17(N,1) .LE. H17(K,1) ) GO TO 14
C ITEMP=MM(N)
C MM(N)=MM(K)
C MM(K)=ITEMP
C 14 CONTINUE
C II=MM(1)

```

Figure A-8 Subroutine ORDER2 (1 of 2)


```
JJ=MM(NH)  
HLGTH=ABS(H17(II,1)-H17(JJ,1))+H24(JJ,1)  
GO TO 16
```

C

```
12 CONTINUE  
N1=NH-1  
DO 18 N=1,N1  
IP1=N+1  
DO 18 K=IP1,NH  
IF ( H17(N,1) .GE. H17(K,1) ) GO TO 18  
ITEMP=MM(N)  
MM(N)=MM(K)  
MM(K)=ITEMP  
18 CONTINUE  
II=MM(1)  
JJ=MM(NH)  
HLGTH=ABS(H17(II,1)-H17(JJ,1))+H24(JJ,1)  
16 CONTINUE  
RETURN
```

C

```
END
```

```

C *****
C
C SUBROUTINE HINDEX
C *****
C HAZARD-INDEX SUBROUTINE. HAZARD-INDEX IS DEFINED AS THE NUMBER OF FA
C OR NCN-FATAL ACCIDENTS PER YEAR ASSOCIATED WITH A ONE DIRECTIONAL
C ROADWAY. FOR MEDIAN ANALYSIS, THE HAZARD-INDEX IS COMPUTED FOR EACH
C ROADWAY SEPARATELY, AND THE TWO MEASURES ARE ADDED. REFER TO EQUATIO
C PAGES 19 AND 20 IN NCHRP PROJECT 20-7 BY MR. J.C. GLENNON FORMERLY OF
C
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / FINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CCNSNT / C, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / FAZRDS / H11, H12, SI, SI1, SI2, R, P, UPAY, PSUM, H18,
* H1A
COMMON / FRCNCY / ADT, EF
COMMON / PROBTY / Y, PP
COMMON / NONHWY / NCCNTR, MCNTH, NYEAR

C
C INTEGER F1, F2, F3, F4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44

C
C DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
C DIMENSION SI(15), H11(15,2), H12(15,2), SI2(15,5), SI1(15,1)

C
C IF(NCCNTR.EQ.0) GO TO 404
C IF(F9(I,1) .EQ. 3 .OR. H9(I,1) .EQ. 5 .OR. H9(I,1) .EQ. 7)
* GO TO 402
C GO TO 404
402 CONTINUE

```

Figure A-9 Subroutine HINDEX (1 of 2)

```

      YLAT(I,J)=YLAT(I,J)+F51(I,1)
404 CONTINUE
C
      CALL CCNST1
C
      ADT=H7(I,1)
C
      CALL FREQ
C
      Y=YLAT(I,LL)
      W=FWIC(I,LL)
      FL=PLENG(I,LL)
      IF ( ISLOPE .EQ. 1 ) GO TO 100
      C1=FL+D*RSIN+W*RTAN
C
      CALL PROB
C
      C4=C1*PP
      GO TO 102
100 CONTINUE
C
      CALL PROB
C
      P1=PP
      Y1=Y
      Y=Y1+D*.5
C
      CALL PROB
C
      P2=PP
      IF ( W .GT. 2.5 ) GO TO 104
      N=1
      Y=Y1+D+W*.5
C
      CALL PROB
C
      P3=PP
      GO TO 106
104 CONTINUE
      N=W/2.5
      P3=0.
      DO 10 L=1,N
      A1=W*(2*L-1)/(2*N)
      Y=Y1+C+A1
C
      CALL PROB
C
      P3=P3+PP
10 CONTINUE
106 CONTINUE
      C4=HL*P1+D*RSIN*P2+W*RTAN*P3/N
102 CONTINUE
      H=FF*SI(I)*C4/10560.
      RETURN
C
      END

```

Figure A-9 Subroutine HINDEX (2 of 2)

```

C *****
C
C      SUBROUTINE SLIST
C *****
C      SUBROUTINE PRINTS OUT A LISTING OF SUBROUTINE NAMES AND DESCRIPTIONS
C
C      DIMENSION NAME(40,2), IDESC(40,19), NC(40)
C
C      WRITE(6,95)
C      NSUB=39
C      WRITE(6,96)
C      DO 2 I=1,NSUB
C      READ(5,99) (NAME(I,J), J=1,2)
C      2 CONTINUE
C
C      K=1
C      DO 15 I=1,NSUB
C      8 CONTINUE
C      READ(5,100)(IDESC(I,N), N=1,19), J
C      IF(K .EQ. 1) GO TO 25
C      GO TO 26
C      25 CONTINUE
C      WRITE(6,105)I,(NAME(I,MM),MM=1,2),(IDESC(I,N),N=1,19)
C      GO TO 20
C      26 CONTINUE
C      WRITE(6,106) (IDESC(I,N),N=1,19)
C      20 CONTINUE
C      IF(J .EQ. 1) GO TO 16
C      K=K+1
C      GO TO 8
C      16 CONTINUE
C      K=1
C      WRITE(6,107)
C      15 CONTINUE
C
C      FORMAT STATEMENTS
C
C      95 FORMAT( 1H1 )
C      96 FORMAT(///, T46, 'L I S T O F S U B R O U T I N E S',///,
C      * T15, 'NUMBER', T25, 'SUBROUTINE', T63, 'DESCRIPTION OF SUBROUTINE
C      *',/, T28, 'NAME', //)
C      99 FORMAT( 2A4 )
C      100 FORMAT(19A4, I4)
C      105 FORMAT(T17,I2,T26,2A4,T39,19A4 )
C      106 FORMAT(T39,19A4)
C      107 FORMAT( /)
C
C      RETURN
C
C      END

```

Figure A-10 Subroutine SLIST (1 of 1)

```

C *****
C
C SUBROUTINE HWY
C *****
C SUBROUTINE CONTAINS DESCRIPTION OF HIGHWAY (TYPE AND CLASSIFICATION)
C
C COMMON / INFO / TYPE, CLASS
C
C DIMENSION TYPE(10,20), CLASS(10,20)
C
C DO 10 L=1,10
C READ(5,100)(TYPE(L,M),M=1,20)
10 CONTINUE
C
C DO 12 L=1,7
C READ(5,100)(CLASS(L,M),M=1,20)
12 CONTINUE
C
C 100 FORMAT(20A4)
C
C RETURN
C END

```

Figure A-11 Subroutine HWY (1 of 1)

```

C *****
C
C      SUBROUTINE DIST
C *****
C      SUBROUTINE READS AND STORES INFORMATION ON THE RELATIONSHIP
C      BETWEEN COUNTY AND DISTRICT NUMBERS.
C
C      COMMON / DIST1 / IDIST
C
C      DIMENSION IDIST(255)
C
C      READ ( 5,999 ) ( IDIST(I), I=1,255 )
999 FORMAT ( 20I4 )
C      RETURN
C
C      END

```

Figure A-12 Subroutine DIST (1 of 1)

```

C *****
C
C      SUBROUTINE ERROR
C
C      *****
C
C      SUBROUTINE CONTAINS ERROR OR FLAG MESSAGES THAT ARE BUILT INTO THE
C      COMPUTER PROGRAM. A LIST OF THESE MESSAGES IS PRESENTED LATER.
C
C
C      COMMON / ERROR1 / MG, NMES
C
C      DIMENSION  MG(60,20), NAME(60,4)
C
C
C      WRITE(6,95)
C      WRITE(6,100)
C      NMES=51
C      DO 2 I=1,NMES
C      READ(5,99) (NAME(I,J),J=1,4)
C 2 CONTINUE
C      DO 150 I=1,NMES
C      READ(5,340) (MG(I,J),J=1,20)
C      WRITE(6,350) I,(NAME(I,N),N=1,4),(MG(I,J),J=1,20)
C 150 CONTINUE
C
C      FORMAT STATEMENTS
C
C      95 FORMAT(1H1)
C      99 FORMAT(4A4)
C 100 FORMAT(///, T41, 'L I S T   O F   E R R O R   O R   F L A G   M E
C      * S S A G E S',///,T15, 'MESSAGE', T26, 'SUBROUTINES', T63,
C      * 'DESCRIPTION OF MESSAGE', /, T16, 'NAME', // )
C 340 FORMAT(20A4)
C 350 FORMAT( T17, I2, T25, 4A4, T42, 20A4, / )
C
C      RETURN
C      END

```

Figure A-13 Subroutine ERROR (1 of 1)

```

C *****
C
C SUBROUTINE SEVRTY
C *****
C SUBROUTINE TO READ AND STORE SEVERITY-INDICIES OBTAINED FROM THD.
C THESE INDICIES ARE ADJUSTED TO TAKE INTO CONSIDERATION THE HIGHER
C DAMAGE COSTS ASSOCIATED WITH FIXED HAZARDS SUCH AS A BRIDGE PIER.
C
C COMMON / SEVERE / S
C
C DIMENSION S(14,7,4,4)
C
C WRITE (6,100)
C
C J=0
C K=0
C L=0
C IJ=1
C IK=1
C IL=1
C
C DO 500 I=1,14
C GO TO ( 515, 515, 505, 515, 503, 520, 506, 515, 504, 503, 502,
C * 506, 507, 504), I
C
C IDENTIFICATION
C
C I=01 UTILITY POLES
C I=02 TREES
C I=03 RIGID SIGNPOST
C I=04 RIGID BASE LUMINAIRE SUPPORT
C I=05 CURBS
C I=06 GUARDRAIL OR MEDIAN BARRIER
C I=07 ROADSIDE SLOPE
C I=08 WASHOUT
C I=09 CULVERTS
C I=10 INLETS
C I=11 ROADWAY UNDER BRIDGE STRUCTURE
C I=12 ROADWAY OVER BRIDGE STRUCTURE
C I=13 RETAINING WALL
C I = 14 MISC PT HAZARDS
C
C 501 JJ=1
C GO TO 516
C 502 JJ=3
C GO TO 516

```

Figure A-14 Subroutine SEVRTY (1 of 3)


```

503 JJ=3
    GO TO 516
504 JJ=4
    GO TO 516
505 JJ=5
    GO TO 516
506 JJ=6
    GO TO 516
507 JJ = 2
    GO TO 516

```

C

```

515 CONTINUE
    READ (5,300) S(I,IJ,IK,IL)
    X=S(I,IJ,IK,IL)
    IF(X .LE. 4.0) GO TO 299
    IF(X .GT. 4.0 .AND. X .LE. 7.0) GO TO 301
    GO TO 302
301 S(I,IJ,IK,IL)=7.0*X-24.0
    GO TO 299
302 S(I,IJ,IK,IL)=25.0*X-150.0
299 CONTINUE
    WRITE(6,102) I,J,K,L,X,S(I,IJ,IK,IL)
    GO TO 525
516 CONTINUE
    READ (5,300) (S(I,J,IK,IL), J=1, JJ)
    DO 518 J=1, JJ
    X=S(I,J,IK,IL)
    IF(X .LE. 4.0) GO TO 304
    IF(X .GT. 4.0 .AND. X .LE. 7.0) GO TO 305
    GO TO 306
305 S(I,J,IK,IL)=7.0*X-24.0
    GO TO 304
306 S(I,J,IK,IL)=25.0*X-150.0
304 CONTINUE
518 WRITE(6,102) I,J,K,L,X,S(I,J,IK,IL)
    GO TO 525
520 CONTINUE
    DO 522 J=1,7
    DO 522 K=1,4
522 READ (5,300) (S(I,J,K,L), L=1,4)
    DO 523 J=1,7
    DO 523 K=1,4
    DO 523 L=1,4
    X=S(I,J,K,L)
    IF(X .LE. 4.0) GO TO 308
    IF(X .GT. 4.0 .AND. X .LE. 7.0) GO TO 309
    GO TO 310
309 S(I,J,K,L)=7.0*X-24.0
    GO TO 308
310 S(I,J,K,L)=25.0*X-150.0

```

Figure A-14 Subroutine SEVRTY (2 of 3)

```
308 CONTINUE
523 WRITE(6,102) I,J,K,L,X,S(I,J,K,L)
525 CONTINUE
    WRITE (6,103)
    J=0
    K=0
    L=0
500 CONTINUE
```

C

```
300 FORMAT (16F5.1)
100 FORMAT(1H1, //, T44, 'S E V E R I T Y   I N D I C E S',
*
*           ///, T18, 'IDENTIFICATION
* CODE', T42, 'DESCRIPTOR CODE', T62, 'END TREATMENT CODE', T87,
* 'SEVERITY-INDEX', /, T60, 'BEGINNING', T76, 'ENDING',
* T85, 'SURVEY', T95, 'ADJUSTED', //)
102 FORMAT(T27,I2,T48,I2,T64,I1,T78,I1,T86,F4.1,T96,F5.1)
103 FORMAT (//)
    RETURN
```

C

```
    END
```

Figure A-14 Subroutine SEVRTY (3 of 3)

```

C *****
C
C SUBROUTINE ADJUST
C *****
C SUBROUTINE TO ADJUST SEVERITY-INCIDIES
C CALCULATED IN SUBROUTINE VDITCH
C
COMMON / HDITCH / SD, W, WD, SDA
SD=SD*10.0
IF( SD .LE. 4.0 )GO TO 50
IF( SD .GT. 4.0 .AND. SD .LT. 7.0 )GO TO 51
SD=25.0 * SD - 150.0
GO TO 50
51 CONTINUE
SD= 7.0 * SD - 24.0
50 CONTINUE
SDA=SD
RETURN
END

```

Figure A-15 Subroutine ADJUST (1 of 1)

```

C *****
C
C SUBROUTINE CCNST1
C *****
C SUBROUTINE TO COMPUTE CCNSTANT VALUES
C
C COMMON / CCNSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
C
C D=6.
C RAD=3.1416/180.
C THETA=11.
C ANG=THETA*RAD
C RSIN=1./SIN(ANG)
C RTAN=1./TAN(ANG)
C LIFE=20
C RI=8.
C RETURN
C END

```

Figure A-16 Subroutine CONST1 (1 of 1)

```

C *****
C
C SUBROUTINE HAZARD
C
C *****
C
C SUBROUTINE CALLS UP THE APPROPRIATE MAIN SUBROUTINE FOR ONE OF
C THE THREE DEFINED TYPE HAZARDS (POINT, LONGITUDINAL, AND SLOPE).
C EXCEPT FOR SEVERAL SPECIAL CASES, THE SEVERITY-INDICIES FOR THE
C HAZARD ARE OBTAINED FROM STORAGE ARRAYS.
C
C
C COMMON / INVENT / I, J, NH, LP1, LL, MES
C COMMON / COUNT / NC
C COMMON / SEVERE / S
C COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
C COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
C COMMON / HAZRDS / H11, H12, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
C COMMON / NONHWY / NCONTR, MONTH, NYEAR
C
C INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
C INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
C
C DIMENSION NC(15)
C DIMENSION S(14,7,4,4)
C DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),

```

Figure A-17 Subroutine HAZARD (1 of 4)

```

*      C20(15,5), C21(15,5), C22(15,5), C23(15,5), C24(15,5),
*      C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*      C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*      , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

```

C
C
IF ( NH .EQ. 1 ) GO TO 604
IF ( HI(I,1) .NE. C1(I,J) .OR. H2(I,1) .NE. C2(I,J) .OR. H3(I,1)
*   .NE. C3(I,J) .OR. H4(I,1) .NE. C4(I,J) .OR. H5(I,1) .NE.
*   C5(I,J) ) GO TO 607
DO 602 L=2,NH
M1=L-1
IF ( NC(L) .NE. NC(M1) ) GO TO 605
IF(H13(L,1) .NE. H13(M1,1)) GO TO 606
602 CONTINUE
GO TO 604
605 CONTINUE
MES=28
RETURN
C
606 CONTINUE
MES=31
RETURN
C
607 CONTINUE
MES=24
RETURN
C
604 CONTINUE
C
IF(C7(I,J) .GT. 0.0) GO TO 60
IF(C12(I,J) .EQ. 4) GO TO 60
MES=34
RETURN
C
60 CONTINUE
C
IF(H11(I,1) .NE. 6) GO TO 50
IF(C12(I,J) .EQ. 4) GO TO 50
IF(C8(I,J) .EQ. 0.0 .OR. C10(I,J) .EQ. 0.0) GO TO 51
IF(C9(I,J) .EQ. 0.0 .OR. C11(I,J) .EQ. 0.0) GO TO 52
GO TO 50
51 CONTINUE
MES=35
RETURN
C
52 CONTINUE
IF(C18(I,J) .EQ. 3 .AND. C20(I,J) .EQ. 1) GO TO 50
MES=36
RETURN
C
50 CONTINUE
IF(H19(I,1) .EQ. 1) GO TO 40
IF(H18(I,1) .EQ. 0.0) GO TO 41
GO TO 40
41 CONTINUE

```

Figure A-17 Subroutine HAZARD (2 of 4)

```

MES=1
RETURN
C
40 CONTINUE
C
C HAZARD SEVERITY-INDEX COMPUTATIONS ( GENERAL )
C
I1=H11(I,1)
IF ( H12(I,1) .EQ. 0 ) GO TO 5
IF ( H11(I,1) .EQ. 6 ) GO TO 6
C
I2=H12(I,1)
I3=1
I4=1
GO TO 7
C
5 CONTINUE
I2=1
I3=1
I4=1
GO TO 7
C
6 CONTINUE
IF(H12(I,1) .EQ. 5) GO TO 35
IF(H29(I,1) .EQ. 0 .OR. H30(I,1) .EQ. 0) GO TO 31
35 CONTINUE
IF(H29(I,1) .GT. 4 .OR. H30(I,1) .GT. 4) GO TO 32
GO TO 30
31 CONTINUE
MES=32
RETURN
C
32 CONTINUE
MES=33
RETURN
C
30 CONTINUE
I2=H12(I,1)
I3=H29(I,1)
I4=H30(I,1)
C
7 CONTINUE
SI(I)=S(I1,I2,I3,I4)/10.
SI1(I,1)=10.*SI(I)
C
C SPECIAL CASE -- SEVERITY INDEX OF DROP INLETS WITH A RAISED HEIGHT OR
C DEPRESSED DEPTH GREATER THAN 1.0 FT
C
IF ( H11(I,1) .NE. 10 ) GO TO 10
IF ( H21(I,1) .GT. 1. ) GO TO 12
IF ( H22(I,1) .LE. 1. ) GO TO 10
C
SI(I)=11.0/10.0
SI1(I,1)=10.*SI(I)
GO TO 10
C
C SEVERITY INDEX FOR RAISED DROP INLET ASSUMED EQUAL TO THAT OF A BRIDGE

```

Figure A-17 Subroutine HAZARD (3 of 4)

```

12 CONTINUE
   SI(I)=S(11,1,1,1)/10.
   SI1(I,1)=10.*SI(I)
10 CONTINUE
   IH19=H19(I,1)
   IF ( IH19 .NE. 1 .AND. IH19 .NE. 2 .AND. IH19 .NE. 3 ) GO TO 14
   GO TO ( 16, 18, 20 ), IH19
C
16 CONTINUE
C
   CALL PTHAZ
   RETURN
C
18 CONTINUE
C
   CALL LGHAZ
   RETURN
C
20 CONTINUE
C
   CALL SLHAZ
   RETURN
C
14 CONTINUE
   MES=6
   RETURN
C
END

```

Figure A-17 Subroutine HAZARD (4 of 4)


```

DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), H11(15,2), H12(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```

HWID(I,1)=H23(I,1)
HLENG(I,1)=H24(I,1)
LL=1
YLAT1=0.0
YLAT2=0.0
IRAIL=0
ISL=0
DO 100 K=1,NH
IF ( H11(K,1) .EQ. 7 ) GO TO 102
100 CONTINUE
ISL=1
GO TO 104
102 CONTINUE

CALL SLOPE1

IF ( FSSTP .LE. 3.5 .AND. FSDIR .EQ. 2 ) GO TO 106
GO TO 104
106 CONTINUE
IF ( H20(I,1) .GT. OFFST1 ) GO TO 108
104 CONTINUE
ISLP1=1
ISLOPE=ISLP1
YLAT(I,1)=H20(I,1)
IF ( YLAT(I,1) .LE. 30.0 ) GO TO 110
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 112
YLAT1=YLAT(I,1)
GO TO 118
112 CONTINUE
MES=8
RETURN

108 CONTINUE
ISLP1=2
ISLOPE=ISLP1
IF ( FSOFF .GT. H20(I,1) ) GO TO 114
YLAT3=(H20(I,1)-FSOFF)+OFFST1
IF ( YLAT3 .LE. 30.0 ) GO TO 116
YLAT1=YLAT3
GO TO 118
114 CONTINUE
YLAT(I,1)=OFFST1
GO TO 110

```

C

Figure A-18 Subroutine PTHAZ (2 of 5)

```

116 CONTINUE
    YLAT(I,1)=YLAT3
110 CONTINUE
C
    CALL HINDEX
C
    HI1(I,1)=H
    YLAT1=YLAT(I,1)
118 CONTINUE
    IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 120
    IF ( ISL .EQ. 1 ) GO TO 122
    IF ( BSSTP .GT. 3.5 ) GO TO 122
    IF ( H20 (I,1) .GT. OFFST2 ) GO TO 122
    ISLP2=2
    ISLOPE=ISLP2
    OFFST3=H15(I,1)-OFFST2
    IF ( H20(I,1) .LE. FSOFF ) GO TO 124
    YLAT(I,1)=OFFST3
    GO TO 125
124 CONTINUE
    YLAT3=(FSOFF-H20(I,1))+OFFST3
    IF ( YLAT3 .LE. 30.0 ) GO TO 126
    YAT2=YLAT3
    GO TO 128
122 CONTINUE
    ISLP2=1
    ISLOPE=ISLP2
    YLAT(I,1)=H15(I,1)-H20(I,1)-H23(I,1)
125 CONTINUE
    IF ( YLAT(I,1) .LE. 30.0 ) GO TO 126
    YLAT2=YLAT(I,1)
    GO TO 128
126 CONTINUE
C
    CALL HINDEX
C
    HI1(I,2)=H
    YLAT2=YLAT(I,1)
128 CONTINUE
    IF ( YLAT1 .GT. 30.0 ) GO TO 130
    GO TO 132
130 CONTINUE
    IF ( YLAT2 .GT. 30.0 ) GO TO 134
    GO TO 132
134 CONTINUE
    MES=20
    RETURN
120 IF ( YLAT1 .LE. 30.0 ) GO TO 132
    MES=22
    RETURN
C
132 CONTINUE
    IF(NCONTR.EQ.1) GO TO 600
C
    CALL COSTS
C
    UPAY=UPAY-R
    PSUM=PSUM-P

```

Figure A-18 Subroutine PTHAZ (3 of 5)

```

600 CONTINUE
    LL=J
    IF ( C12(I,J) .EQ. 0 .OR. C12(I,J) .GT. 4 ) GO TO 136
    IF ( C12(I,J) .EQ. 4 ) GO TO 140
    IF ( C12(I,J) .EQ. 1 ) GO TO 142
    MES=2
    RETURN
C
136 CONTINUE
    MES=7
    RETURN
C
140 CONTINUE
    UPAY=UPAY+R
    PSUM=PSUM+P
    SI2(I,J)=SI1(I,1)
    HI2(I,1)=HI1(I,1)
    HI2(I,2)=HI1(I,2)
    DO 160 N=1,NH
    IF( H11(N,1).EQ.12 .AND. H12(N,1).NE.1 .AND.
*   H12(N,1).NE.2 .AND. H12(N,1).NE.6 ) GO TO 161
160 CONTINUE
    DO 170 N=1,NH
    IF( H11(N,1).EQ.7 ) GO TO 172
170 CONTINUE
    RETURN
172 CONTINUE
    IF( H13(N,1).EQ.1 .OR. H15(N,1).LT.0.01 ) GO TO 174
    GO TO 178
174 CONTINUE
    IF( C12(N,J).EQ.3 .AND. C18(N,J).EQ.1 ) GO TO 176
    RETURN
176 CONTINUE
    HIB=HI1(I,1)+HIB
    RETURN
178 CONTINUE
C
    CALL GRAIL
C
    IF( NGR.EQ.1 ) GO TO 180
    IF( IGR.EQ.1 ) RETURN
    L=NSGR(1)
    IF( I.GT.L ) GO TO 182
    HIB=HI1(I,1)+HIB
    RETURN
182 HIB=HI1(I,2)+HIB
    RETURN
180 HIB=HI1(I,1)+HI1(I,2)+HIB
    RETURN
161 CONTINUE
    NSL=0
    DO 199 N=1,NH
    IF( H11(N,1).EQ.7) GO TO 162
    GO TO 199
162 NSL=NSL+1
    IF( C12(N,J).EQ.3 .AND. C18(N,J).EQ.2 ) GO TO 163
    GO TO 199
163 IF( H6(I,1).EQ.1 ) GO TO 164

```

Figure A-18 Subroutine PTHAZ (4 of 5)

```

        IF( H17(I,1).GT.H18(N,1) .AND. H17(I,1).LT.H17(N,1) )
    *      GO TO 165
167 IF( NSL.EQ.2 ) RETURN
    GO TO 199
164 IF( H17(I,1).GT.H17(N,1) .AND. H17(I,1).LT.H18(N,1) )
    *      GO TO 165
    GO TO 167
165 HIB=H11(I,1)+HIB
    RETURN
199 CONTINUE
    RETURN
C
142 CONTINUE
    IF ( C13(I,J) .EQ. 1 ) GO TO 144
    IF ( C13(I,J) .EQ. 2 ) GO TO 146
    IF ( C13(I,J) .EQ. 3 ) GO TO 148
    IF ( C13(I,J) .EQ. 4 ) GO TO 150
    MES=3
    RETURN
C
150 CONTINUE
    CALL SOFT
    RETURN
C
148 CONTINUE
    CALL CMBPT
    RETURN
C
146 CONTINUE
    IF ( NPTGR .EQ. 0 ) GO TO 152
    RETURN
C
152 CONTINUE
    CALL PTRAIL
    RETURN
C
144 CONTINUE
    SI(I)=1.0
    SI2(I,J)=0.0
    IF(NCONTR.EQ.1) GO TO 602
C
    CALL COSTS
C
    UPAY=UPAY+R
    PSUM=PSUM+P
602 CONTINUE
    CALL ZERO
    RETURN
C
    END

```

Figure A-18 Subroutine PTHAZ (5 of 5)

C
C
C
C
C
C

SUBROUTINE LGHAZ

```

COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
*           H13, H15, H16, H17, H18, H19, H20, H21, H22,
*           H23, H24, H25, H26, H27, H28, H29, H30, H31,
*           H32, H33, H34, H35, H36, H37, H38, H39, H40,
*           H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
*           C13, C14, C15, C16, C17, C18, C20, C21, C24,
*           C25, C26, C27, C28, C29, C34, C35, C36, C37,
*           C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
*           , C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / #AT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / H11, H12, SI, S11, SI2, R, P, UPAY, PSUM, HIB,
*           HIA
COMMON / CCNSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
*           FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
*           FSDIS, BSDIS
COMMON / HDITCH / SD, W, WD, SDA
COMMON / SIDENF / NSGR, FSGR
COMMON / RDITCH / DT, RTL
COMMON / PTHZGR / NPTGR, HLGTH
COMMON / NONHWY / NCONTR, MONTH, NYEAR

```

C

```

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
*       H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSFRS, BSERS
INTEGER NSGR, FSGR

```

C

```

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
*         H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
*         H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
*         H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
*         H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
*         H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
*         H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
*         H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),

```

Figure A-19 Subroutine LGHAZ (1 of 6)

```

*       C7(15,5), C8(15,,), C9(15,5), C10(15,5), C11(15,5),
*       C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
*       C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
*       C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
*       C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*       C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*       , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), H11(15,2), H12(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```

BREND=1.0
LL=1
NOSL=0
YLAT1=0.0
YLAT2=0.0
DO 170 L=1,NH
  IF ( H11(L,1) .EQ. 12 ) GO TO 172
170 CONTINUE
  GO TO 176
172 CONTINUE
  IF ( H12(L,1) .EQ. 3 .OR. H12(L,1) .EQ. 4 .OR. H12(L,1) .EQ. 5 )
  * GO TO 174
  GO TO 176
174 CONTINUE
  DO 178 L=1,NH
  IF ( H11(L,1) .EQ. 6 ) GO TO 180
178 CONTINUE
  GO TO 182
180 CONTINUE
  IF ( H12(L,1) .EQ. 3 .OR. H12(L,1) .EQ. 4 ) GO TO 184
182 CONTINUE
  SI(I)=50.0
  GO TO 186
184 CONTINUE
  IF ( H30(L,1) .EQ. 4 ) GO TO 188
  BREND=0.6
  GO TO 176
188 CONTINUE
  SI(I)=30.0
186 CONTINUE
  HLENG(I,1)=6.0
  HWID(I,1)=2.0
  YLAT(I,1)=H26(I,1)
C
  CALL HINDEX
C
  HIB=H
176 CONTINUE
  HLENG(I,1)=ABS(H17(I,1)-H18(I,1))*5280.0
  OFFSET=(H25(I,1)+H26(I,1))/2.0
  HWID(I,1)=H28(I,1)
  IF ( H11(I,1) .EQ. 8 ) GO TO 100
  GO TO 102
100 CONTINUE

```

Figure A-19 Subroutine LGHAZ (2 of 6)

```

IF ( HLENG(I,1) .LT. 0.01 ) GO TO 104
IF ( HLENG(I,1) .LT. 6.0 ) GO TO 106
WD=H28(I,1)
DT=0.5*H25(I,1)+H26(I,1)
DTL=HLENG(I,1)
C
CALL WASOUT
C
FSDIR=H38(I,1)
GO TO 108
104 CONTINUE
HLENG(I,1)=3.0
WD=3.0
GO TO 110
106 CONTINUE
WD=HLENG(I,1)
110 CONTINUE
C
CALL WASOUT
C
FSDIR=H38(I,1)
HWID(I,1)=H28(I,1)
DTL=WD
DT=H25(I,1)
IF ( HWID(I,1) .GT. 30.0 ) HWID(I,1)=30.0
108 CONTINUE
SI(I)=SD/10.0
SI1(I,1)=SI(I)*10.0
102 CONTINUE
DO 112 K=1,NH
IF ( H11(K,1) .EQ. 7 ) GO TO 114
112 CONTINUE
NOSL=1
GO TO 116
114 CONTINUE
C
CALL SLOPE1
C
IF ( FSSTP .LE. 3.5 .AND. FSDIR .EQ. 2 ) GO TO 118
GO TO 116
118 CONTINUE
IF ( OFFSET .GT. OFFST1 ) GO TO 120
116 CONTINUE
ISLP1=1
ISLOPE=ISLP1
YLAT(I,1)=OFFSET
IF ( YLAT(I,1) .LE. 30.0 ) GO TO 122
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 124
GO TO 126
124 CONTINUE
MES=16
RETURN
C
120 CONTINUE
ISLP1=2
ISLOPE=ISLP1
IF ( FSOFF .GT. OFFSET ) GO TO 128
YLAT3=(OFFSET-FSOFF)+OFFST1

```

Figure A-19 Subroutine LGHAZ (3 of 6)


```

        IF ( YLAT3 .LE. 30.0 ) GO TO 130
        YLAT1=YLAT3
        GO TO 132
130 CONTINUE
        YLAT(I,1)=YLAT3
        GO TO 122
128 CONTINUE
        YLAT(I,1)=OFFST1
122 CONTINUE
C
        CALL HINDEX
C
        HI1(I,1)=BREND*H
126 CONTINUE
        YLAT1=YLAT(I,1)
132 CONTINUE
        IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 134
        IF( NOSL .EQ. 1 ) GO TO 136
        IF ( BSSTP .GT. 3.5 ) GO TO 136
        IF ( OFFSET .GT. OFFST2 ) GO TO 136
        ISLP2=2
        ISLOPE=ISLP2
        OFFST3=H15(I,1)-OFFST2
        IF ( OFFSET .LE. FSOFF ) GO TO 138
        YLAT(I,1)=OFFST3
        GO TO 139
138 CONTINUE
        YLAT3=(FSOFF-OFFSET)+OFFST3
        IF ( YLAT3 .LE. 30.0 ) GO TO 140
        YAT2=YLAT3
        GO TO 142
136 CONTINUE
        ISLP2=1
        ISLOPE=ISLP2
        YLAT(I,1)=H15(I,1)-OFFSET-H28(I,1)
139 CONTINUE
        IF ( YLAT(I,1) .LE. 30.0 ) GO TO 140
        GO TO 144
140 CONTINUE
        IF ( H11(I,1) .EQ. 6 ) GO TO 141
        GO TO 143
141 CONTINUE
        SI(I)=30.0
143 CONTINUE
C
        CALL HINDEX
C
        SI(I)=SI1(I,1)/10.0
        HI1(I,2)=H
144 CONTINUE
        YLAT2=YLAT(I,1)
142 CONTINUE
        IF ( YLAT1 .GT. 30.0 ) GO TO 146
        GO TO 148
146 CONTINUE
        IF ( YLAT2 .GT. 30.0 ) GO TO 150
        GO TO 148
150 CONTINUE

```

Figure A-19 Subroutine LGHAZ (4 of 6)

```

MES=10
RETURN
C
134 CONTINUE
IF ( YLAT1 .LT. 30.0 ) GO TO 148
MES=37
RETURN
C
148 CONTINUE
IF(NCONTR.EQ.1) GO TO 600
C
CALL COSTS
C
UPAY=UPAY-R
PSUM=PSUM-P
600 CONTINUE
LL=J
IF(C12(I,J).EQ.0.OR.C12(I,J).GT.4) GO TO 162
IF(C12(I,J).EQ.1 .OR. C12(I,J).EQ.3) GO TO 162
IF ( C12(I,J) .EQ. 4 ) GO TO 152
IF ( C18(I,J) .EQ. 1 ) GO TO 154
IF ( C18(I,J) .EQ. 2 ) GO TO 156
IF ( C18(I,J) .EQ. 3 ) GO TO 158
IF ( C18(I,J) .EQ. 4 ) GO TO 160
MES=45
RETURN
C
154 CONTINUE
IF(H11(I,1).NE.5) GO TO 10
CALL CURB
RETURN
C
156 CONTINUE
IF(H11(I,1).NE.12) GO TO 11
IF(H12(I,1).NE.3 .AND. H12(I,1).NE.4 .AND. H12(I,1).NE.5) GO TO 11
CALL BRIDGE
RETURN
C
158 CONTINUE
IF(H11(I,1).NE.6) GO TO 12
CALL RAIL
RETURN
C
160 CONTINUE
IF(H11(I,1).NE.8) GO TO 13
CALL DITCH
RETURN
C
152 CONTINUE
IF(NCONTR.EQ.1) GO TO 604
UPAY=UPAY+R
PSUM=PSUM+P
604 CONTINUE
C
HI2(I,1)=HI1(I,1)
HI2(I,2)=HI1(I,2)
SI2(I,J)=SI1(I,1)
CALL GRAIL

```

Figure A-19 Subroutine LGHAZ (5 of 6)

```

IF(H13(I,1).EQ.1 .OR. H45(I,1).LT.0.01) GO TO 300
IF(NGR.EQ.1) GO TO 302
IF(IGR.EQ.1) RETURN
IF(H11(I,1).NE.8) RETURN
L=NSGR(KK1)
IF(L.LT.I) GO TO 304
HIB=HI1(I,1)+HIB
RETURN
304 CONTINUE
HIB=HI1(I,2)+HIB
RETURN
300 CONTINUE
IF(NGR.NE.1) RETURN
IF(H11(I,1).NE.8) RETURN
HIB=HI1(I,1)+HIB
RETURN
302 CONTINUE
IF(H11(I,1).NE.8) RETURN
HIB=HI1(I,1)+HI1(I,2)+HIB
RETURN
C
162 CONTINUE
MES=49
RETURN
C
10 CONTINUE
MES=18
RETURN
C
11 CONTINUE
MES=25
RETURN
C
12 CONTINUE
MES=26
RETURN
C
13 CONTINUE
MES=43
RETURN
C
END

```

Figure A-19 Subroutine LGHAZ (6 of 6)

C
C
C
C
C
C

SUBROUTINE SLHAZ

```
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, P
COMMON / HAZRDS / H11, H12, SI, S11, SI2, R, P, PLY, PSUM, H1B,
* H1A
COMMON / CONSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSUFF, DELTA,
* FSDIS, BSDIS
COMMON / SIDENF / NSGR, FSGR
COMMON / PTHZGR / NPTGR, HLGTH
COMMON / RDITCH / DT, DTL
COMMON / HDITCH / SD, W, WD, SDA
COMMON / NONHWY / NCONTR, MONTH, NYEAR
```

C

```
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSERS, BSERS
INTEGER NSGR, FSGR
```

C

```
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
```

Figure A-20 Subroutine SLHAZ (1 of 5)

```

*          C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,,),
*          C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5).
*          C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*          C44(15,5), C45(15,5), C46(15,5), C47(15,5),
*          C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

C
C
LL=1
IF( C34(I,J).GT.0.01) GO TO 101
HLSL=ABS(H17(I,1)-H18(I,1))*5280.0
GO TO 103
101 CONTINUE
HLSL=ABS( C34(I,J)-C35(I,J) )*5280.0
103 CONTINUE

C
CALL CONST1

C
CORNER=D*RSIN
K=I

C
CALL SLOPE1

C
CALL VDITCH

C
CALL ADJUST

C
IF ( FSERS .EQ. 2 ) GO TO 100
SIF=1.0
GO TO 102
100 CONTINUE
SIF=1.2
102 CONTINUE
SI(I)=SIF*SD / 10.0
SI1(I,1)=10.0*SI(I)
HWID(I,1)=W
HLGTH=0.0
C CHECK FOR POINT HAZARDS ON FRONT SLOPE
DO 104 N=1,NH
IF ( H19(N,1) .EQ. 1 ) GO TO 106
GO TO 104
106 CONTINUE
IF ( H20(N,1) .LE. FSOFF ) GO TO 108
GO TO 104
108 CONTINUE
IF ( H6(N,1) .EQ. 1 ) GO TO 800
IF ( H17(N,1) .LT. H17(I,1) .AND. H17(N,1) .GT. H18(I,1) )
* GO TO 802
GO TO 104
800 CONTINUE
IF ( H17(N,1) .GT. H17(I,1) .AND. H17(N,1) .LT. H18(I,1) )
* GO TO 802
GO TO 104
802 CONTINUE

```

Figure A-20 Subroutine SLHAZ (2 of 5)

```

        SHLGT=H24(N,1)+CORNER+H23(N,1)/TAN(ANG)
        HLGTH=SHLGT+HLGTH
104  CONTINUE
        IF ( FSSTP .GT. 3.5 ) GO TO 110
        ISLOPE=2
        YLAT(I,1)=OFFST1
        GO TO 112
110  CONTINUE
        ISLOPE=1
        YLAT(I,1)=FSOFF
112  CONTINUE
        HLENG(I,1)=HLSL-HLGTH
        IF ( HLENG(I,1) .LE. 0.0 ) GO TO 114
C
        CALL HINDEX
C
        HI1(I,1)=H
114  CONTINUE
        IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 116
        IF ( BSERS .EQ. 2 ) GO TO 118
        SIF=1.0
        GO TO 120
118  CONTINUE
        SIF=1.2
120  CONTINUE
        SI(I)=SIF*SD / 10.0
        SI1(I,1)=10.0*SI(I)
        HLGTH=0.0
C  CHECK FOR POINT HAZARDS ON BACK SLOPE IN MEDIAN
        DO 122 N=1,NH
        IF ( H19(N,1) .EQ. 1 ) GO TO 124
        GO TO 122
124  CONTINUE
        IF ( H20(N,1) .GE. FSOFF ) GO TO 126
        GO TO 122
126  CONTINUE
        IF ( H6(N,1) .EQ. 1 ) GO TO 810
        IF ( H17(N,1) .LT. H17(I,1) .AND. H17(N,1) .GT. H18(I,1) )
* GO TO 812
        GO TO 122
810  CONTINUE
        IF ( H17(N,1) .GT. H17(I,1) .AND. H17(N,1) .LT. H18(I,1) )
* GO TO 812
        GO TO 122
812  CONTINUE
        SHLGT=H24(N,1)+CORNER+H23(N,1)/TAN(ANG)
        HLGTH=SHLGT+HLGTH
122  CONTINUE
        IF ( BSSTP .GT. 3.5 ) GO TO 128
        ISLOPE=2
        OFFST3=(H15(I,1)-OFFST2)
        YLAT(I,1)=OFFST3
        GO TO 130
128  CONTINUE
        ISLOPE=1
        YLAT(I,1)=H15(I,1)-FSOFF
130  CONTINUE
        HLENG(I,1)=HLSL-HLGTH

```

Figure A-20 Subroutine SLHAZ (3 of 5)

```

C      IF ( HLENG(I,1) .LE. 0.0 ) GO TO 116
C      CALL HINDEX
C      HI1(I,2)=H
116 CONTINUE
      IF(NCONTR.EQ.1) GO TO 600
C      CALL COSTS
C      UPAY=UPAY-R
      PSUM=PSUM-P
600 CONTINUE
C      IMPROVEMENT COMPUTATIONS FOLLOWS
C
      LL=J
      IF ( C12(I,J) .EQ. 3 .AND. C18(I,J) .EQ. 1 ) GO TO 132
      IF ( C12(I,J) .EQ. 3 .AND. C18(I,J) .EQ. 2 ) GO TO 140
      IF ( C12(I,J) .EQ. 3 .AND. C18(I,J) .EQ. 3 ) GO TO 134
      IF ( C12(I,J) .EQ. 3 .AND. C18(I,J) .EQ. 4 ) GO TO 135
      IF ( C12(I,J) .EQ. 4 ) GO TO 136
      MES=47
      RETURN
C
140 CONTINUE
      CALL BRGR
      RETURN
C
C
132 CONTINUE
      CALL SLRAIL
      RETURN
C
134 CONTINUE
      CALL BRGR1
      RETURN
C
135 CONTINUE
      CALL FLATEN
      RETURN
C
136 CONTINUE
      IF(NCONTR.EQ.1) GO TO 604
      UPAY=UPAY+R
      PSUM=PSUM+P
604 CONTINUE
      SI2(I,J)=SI1(I,1)
      HI2(I,1)=HI1(I,1)
      HI2(I,2)=HI1(I,2)
      CALL GRAIL
      IF(HI3(I,1).EQ.1 .OR. H15(I,1).LT.0.01) GO TO 300
      IF(NGR.EQ.1) GO TO 302
      IF(IGR.EQ.1) RETURN
      L=NSGR(KK1)
      IF(L.LT.I) GO TO 304
      HIB=HI1(I,1)+HIB
      RETURN

```

Figure A-20 Subroutine SLHAZ (4 of 5)

```
304 CONTINUE
    HIB=HI1(I,2)+HIB
    RETURN
300 CONTINUE
    IF(NGR.NE.1) RETURN
    HIB=HI1(I,1)+HIB
    RETURN
302 CONTINUE
    HIB=HI1(I,1)+HI1(I,2)+HIB
    RETURN
```

C

```
END
```



```

*****
SUBROUTINE CMBPT
*****

COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, IRAIL
COMMON / SIDENF / NSGR, FSGR
COMMON / NONHWY / NCONTR, MONTH, NYEAR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)

```

Figure A-21 Subroutine CMBPT (1 of 3)

```

DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```

XLGTH=2.0*35.0
HWID(I,J)=27.0/12.0
SM=0.8
ISLOPE=1
IF ( HI1(I,1) .EQ. 11 .AND. HI2(I,1) .EQ. 1 ) GO TO 100
YLAT(I,J)=C48(I,J)
GO TO 102

```

```

100 CONTINUE
YLAT(I,J)=H20(I,1)-HWID(I,J)/2.0
102 CONTINUE
HLENG(I,J)=XLGTH+H24(I,1)
SI(I)=SM*S(12,3,1,1)/10.0
SI2(I,J)=SI(I)*10.0

```

C
C

```

CALL HINDEX

```

```

HI2(I,1)=H
IF ( HI3(I,1) .EQ. 1 .OR. HI5(I,1) .LT. 0.01 ) GO TO 104
OFFST4=HI5(I,1)-H20(I,1)-H23(I,1)-HWID(I,J)/2.0
IF ( OFFST4 .LE. 30.0 ) GO TO 106
GO TO 104

```

```

106 CONTINUE
YLAT(I,J)=OFFST4
CALL HINDEX
HI2(I,2)=H
104 CONTINUE
IF(NCONTR.EQ.1) GO TO 602

```

C
C

```

CALL COSTS

```

```

UPAY=UPAY+R
PSUM=PSUM+P

```

```

602 CONTINUE
DO 108 N=1,NH
IF ( HI1(N,1) .EQ. 6 ) GO TO 110
108 CONTINUE
HIB=HI1(I,1)+HI1(I,2)+HIB
HIA=HI2(I,1)+HI2(I,2)+HIA
RETURN

```

C
C
C
C

```

110 CONTINUE
IF ( HI3(I,1) .EQ. 1 .OR. HI5(I,1) .LT. 0.01 ) GO TO 112

```

```

CALL GRAIL

```

```

IF ( IGR .EQ. 1 ) GO TO 114
IF ( H25(N,1) .LE. H20(I,1) ) GO TO 116
HIB=HI1(I,1)+HIB
HIA=HI2(I,1)+HI2(I,2)+HIA
RETURN

```

Figure A-21 Subroutine CMBPT (2 of 3)

```
C
116 CONTINUE
   HIB=HI1(I,2)+HIB
   HIA=HI2(I,1)+HI2(I,2)+HIA
   RETURN
C
114 CONTINUE
   HIB=HIB
   HIA=HI2(I,1)+HI2(I,2)+HIA
   RETURN
C
112 CONTINUE
   HIB=HIB
   HIA=HI2(I,1)+HI2(I,2)+HIA
   RETURN
C
   END
```

Figure A-21 Subroutine CMBPT (3 of 3)

```

C *****
C
C SUBROUTINE SCFT
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SIDENF / NSGR, FSGR
COMMON / NONHWY / NCONTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

Figure A-22 Subroutine SOFT (1 of 3)

```

YLAT(I,J)=C17(I,J)
HWID(I,J)=C16(I,J)
HLENG(I,J)=C15(I,J)+H24(I,1)
SV=1.0
ISLOPE=1
SI(I)=SV/10.0
SI2(I,J)=SI(I)*10.0
C
CALL HINDEX
C
HI2(I,1)=H
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 100
OFFST4=H15(I,1)-H20(I,1)-H23(I,1)
IF ( OFFST4 .LE. 30.0 ) GO TO 102
GO TO 100
102 CONTINUE
C7(I,J)=2.0*C7(I,J)
C11(I,J)=2.0*C11(I,J)
HLENG(I,J)=C15(I,J)
C
CALL HINDEX
C
HI2(I,1)=HI2(I,1)+H
YLAT(I,J)=H15(I,1)-C16(I,J)-C17(I,J)
HLENG(I,J)=2.0*C15(I,J)+H24(I,1)
C
CALL HINDEX
C
HI2(I,2)=H
100 CONTINUE
IF(NCONTR.EQ.1) GO TO 602
C
CALL COSTS
C
UPAY=UPAY+R
PSUM=PSUM+P
602 CONTINUE
DO 104 N=1,NH
IF ( H11(N,1) .EQ. 6 ) GO TO 106
104 CONTINUE
HIB=HI1(I,1)+HI1(I,2)+HIB
HIA=HI2(I,1)+HI2(I,2)+HIA
RETURN
C
106 CONTINUE
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 108
C
CALL GRAIL
C
IF ( IGR .EQ. 1 ) GO TO 110
IF ( H25(N,1) .LE. H20(I,1) ) GO TO 112
HIB=HI1(I,1)+HIB
HIA=HI2(I,1)+HI2(I,2)+HIA
RETURN

```

Figure A-22 Subroutine SOFT (2 of 3)

```
112 CONTINUE
    HIB=HI1(I,2)+HIB
    HIA=HI2(I,1)+HI2(I,2)+HIA
    RETURN
C
110 CONTINUE
    HIB=HIB
    HIA=HI2(I,1)+HI2(I,2)+HIA
    RETURN
C
108 CONTINUE
    HIB=HIB
    HIA=HI2(I,1)+HI2(I,2)+HIA
    RETURN
C
    END
```

Figure A-22 Subroutine SOFT (3 of 3)

```

C *****
C
C SUBROUTINE ZERO
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / SIDENF / NSGR, FSGR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

Figure A-23 Subroutine ZERO (1 of 4)

```

C      IF ( NH .EQ. 1 ) GO TO 100
C      CALL GRAIL
C      IF ( NGR .EQ. 1 ) GO TO 100
      IF ( IGR .EQ. 0 ) GO TO 102
      N1=1
      N2=1
      K1=NSGR(1)
      K2=FSGR(1)
      IF ( C18(K1,J) .EQ. 3 .AND. C18(K2,J) .EQ. 3 ) GO TO 104
      MES=21
      RETURN
C
104 CONTINUE
      IF ( C20(K1,J) .EQ. 1 .AND. C20(K2,J) .EQ. 1 ) GO TO 106
      IF ( C20(K1,J) .NE. 1 .AND. C20(K2,J) .NE. 1 ) GO TO 108
      IF ( C20(K1,J) .EQ. 1 .AND. C20(K2,J) .NE. 1 ) GO TO 110
      IF ( C20(K1,J) .NE. 1 .AND. C20(K2,J) .EQ. 1 ) GO TO 112
      MES=38
      RETURN
C
106 CONTINUE
      IF ( I .LT. K1 ) GO TO 114
      IF ( I .GT. K2 ) GO TO 116
      HIA=HI2(I,1)+HI2(I,2)+HIA
      RETURN
C
116 CONTINUE
      HIB=HI1(I,2)+HIB
      HIA=HI2(I,1)+HI2(I,2)+HIA
      RETURN
C
114 CONTINUE
      HIB=HI1(I,1)+HIB
      HIA=HI2(I,1)+HI2(I,2)+HIA
      RETURN
C
108 CONTINUE
      IF ( I .LT. K1 ) GO TO 118
      IF ( I .GT. K2 ) GO TO 120
      MES=39
      RETURN
C
120 CONTINUE
      HIB=HI1(I,2)+HIB
      HIA=HI2(I,2)+HIA
      RETURN
C
118 CONTINUE
      HIB=HI1(I,1)+HIB
      HIA=HI2(I,1)+HIA
      RETURN
C
110 CONTINUE
      IF ( I .LT. K1 ) GO TO 122
      IF ( I .LT. K2 ) GO TO 124
      HIB=HI1(I,2)+HIB

```

Figure A-23 Subroutine ZERO (2 of 4)


```

    HIA=HI2(I,2)+HIA
    RETURN
C
124 CONTINUE
    HIA=HI2(I,1)+HIA
    RETURN
C
122 CONTINUE
    HIB=HI1(I,1)+HIB
    HIA=HI2(I,1)+HIA
    RETURN
C
112 CONTINUE
    IF ( I .GT. K2 ) GO TO 126
    IF ( I .GT. K1 ) GO TO 128
    HIB=HI1(I,1)+HIB
    HIA=HI2(I,1)+HIA
    RETURN
C
128 CONTINUE
    HIA=HI2(I,2)+HIA
    RETURN
C
126 CONTINUE
    HIB=HI1(I,2)+HIB
    HIA=HI2(I,2)+HIA
    RETURN
C
102 CONTINUE
    DO 130 N=1, KK1
    K=NSGR(N)
    IF ( C18(K,J) .EQ. 3 .AND. C20(K,J) .EQ. 1 ) GO TO 132
    IF ( I .LT. K ) GO TO 134
130 CONTINUE
    IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 136
    HIB=HI1(I,2)+HIB
    HIA=HI2(I,2)+HIA
    RETURN
C
136 CONTINUE
    MES=39
    RETURN
C
134 CONTINUE
    HIB=HI1(I,1)+HIB
    HIA=HI2(I,1)+HIA
    RETURN
C
132 CONTINUE
    IF ( I .LT. K ) GO TO 138
    IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 140
    HIB=HI1(I,2)+HIB
    HIA=HI2(I,1)+HI2(I,2)+HIA
    RETURN
C
140 CONTINUE
    HIA=HI2(I,1)+HIA
    RETURN

```

Figure A-23 Subroutine ZERO (3 of 4)

```
138 CONTINUE  
    HIB=HI1(I,1)+HIB  
    HIA=HI2(I,1)+HI2(I,2)+HIA  
    RETURN
```

C

```
100 CONTINUE  
    HIB=HI1(I,1)+HI1(I,2)+HIB  
    HIA=HI2(I,1)+HI2(I,2)+HIA  
    RETURN
```

C

```
    END
```

```

C *****
C
C SUBROUTINE RAIL
C *****
C LONGITUDINAL HAZARD IMPROVEMENT SUBROUTINE WHERE GUARDRAIL IS USED.
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / CONSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / BRSLGR / NBRI
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / SIDENF / NSGR, FSGR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION NN(2)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)

```

Figure A-24 Subroutine RAIL (1 of 2)

```

DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```
IC20=C20(I,J)
```

C

```
IF(IC20 .EQ. 0 .OR. IC20 .GT. 6) GO TO 501
GO TO ( 100,101,101,101,102,101 ), IC20
```

C

```
100 CONTINUE
CALL RAIL1
RETURN
```

C

```
101 CONTINUE
CALL RAIL2
RETURN
```

C

```
102 CONTINUE
CALL RAIL6
RETURN
```

C

C

```
501 CONTINUE
MES = 14
RETURN
END
```

Figure A-24 Subroutine RAIL (2 of 2)

```

C *****
C
C SUBROUTINE RAIL1
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SIDENF / NSGR, FSGR
COMMON / RAILS / IRAIL1
COMMON / NONHWY / NCONTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

Figure A-25 Subroutine RAIL1 (1 of 3)

```

        IRAIL1=IRAIL1+1
        SI(I)=1.0
        SI2(I,J)=0.0
        IF(NCONTR.EQ.1) GO TO 602
C
        CALL CCSTS
C
        UPAY=UPAY+R
        PSUM=PSUM+P
602 CONTINUE
        IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 100
        IF ( NH .EQ. 1 ) GO TO 100
C
        CALL GRAIL
C
        IF ( IGR .EQ. 1 ) GO TO 102
100 CONTINUE
        HIB=HI1(I,1)+HI1(I,2)+HIB
        RETURN
C
102 CONTINUE
        N=NSGR(1)
        L=FSGR(1)
        IF ( C20(N,J) .EQ. 1 .AND. C20(L,J) .EQ. 1 ) GO TO 104
        IF ( C20(N,J) .EQ. 1 .AND. C20(L,J) .NE. 1 ) GO TO 106
        IF ( C20(N,J) .NE. 1 .AND. C20(L,J) .EQ. 1 ) GO TO 108
        MES=29
        RETURN
C
104 CONTINUE
        IF ( IRAIL1 .LE. KK2 ) GO TO 110
        GO TO 112
110 CONTINUE
        L=FSGR(IRAIL1)
        HIB=HI1(L,2)+HIB
112 CONTINUE
        IF ( IRAIL1 .LE. KK1 ) GO TO 114
        RETURN
C
114 CONTINUE
        N=NSGR(IRAIL1)
        HIB=HI1(N,1)+HIB
        RETURN
C
106 CONTINUE
        N=NSGR(IRAIL1)
        HIB=HI1(N,1)+HIB
        IF ( IRAIL1 .EQ. KK1 ) GO TO 116
        RETURN
C
116 CONTINUE
        DO 118 L=1,NH
        IF ( L .LE. KK2 ) GO TO 120
        RETURN
C
120 CONTINUE
        M=FSGR(L)

```

Figure A-25 Subroutine RAIL1 (2 of 3)

```

      HIA=HI1(M,1)+HIA
118 CONTINUE
      RETURN
C
108 CONTINUE
      M=FSGR(IRAIL1)
      HIB=HI1(M,2)+HIB
      IF ( IRAIL1 .EQ. KK2 ) GO TO 122
      RETURN
C
122 CONTINUE
      DO 124 L=1,NH
      IF ( L .LE. KK1 ) GO TO 126
      RETURN
C
126 CONTINUE
      N=NSGR(L)
      HIA=HI1(N,2)+HIA
124 CONTINUE
      RETURN
      END

```

```

C *****
C
C SUBROUTINE RAIL2
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / SIDENF / NSGR, FSGR
COMMON / NONHWY / NCONTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER NSGR, FSGR

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)

```

Figure A-26 Subroutine RAIL2 (1 of 3)


```

DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

```

C
C
HL1=ABS(H17(I,1)-H18(I,1))*5280.0
HL2=C26(I,J)+C27(I,J)
HL3=C28(I,J)+C29(I,J)
YL1=(H25(I,1)+H26(I,1))/2.0
C
CALL GRAIL
C
DO 100 L=1,NH
IF(HI1(L,1) .EQ. 12) GO TO 99
GO TO 100
99 CONTINUE
IF(HI2(L,1).EQ.3 .OR. HI2(L,1).EQ.4 .OR. HI2(L,1).EQ.5) GO TO 102
100 CONTINUE
IF ( C20(I,J) .EQ. 4 ) GO TO 104
IF ( C20(I,J) .EQ. 9 ) GO TO 106
M1=1
M2=1
M3=1
GO TO 108
106 CONTINUE
M1=HI2(I,1)
M2=1
M3=1
GO TO 108
104 CONTINUE
M1=HI2(I,1)
M2=H29(I,1)
M3=H30(I,1)
108 CONTINUE
SI(I)=S(6,M1,M2,M3)/10.0
SI2(I,J)=10.0*SI(I)
IF ( HI3(I,1) .EQ. 1 .OR. HI5(I,1) .LT. 0.01 ) GO TO 110
IF ( IGR .EQ. 0 ) GO TO 112
M=NSGR(KK1)
IF ( I .GT. M ) GO TO 114
GO TO 110
112 CONTINUE
H15D2=H15(I,1)/2.0
IF ( YL1 .GT. H15D2 ) GO TO 114
GO TO 110
114 CONTINUE
YLAT(I,J)=H15(I,1)-YL1
HWID(I,J)=1.5
HLENG(I,J)=HL1+HL2-HL3
ISLOPE=1
C
CALL HINDEX
C
HI2(I,2)=H
IF(NCONTR.EQ.1) GO TO 602
C
CALL COSTS

```

Figure A-26 Subroutine RAIL2 (2 of 3)

```

        UPAY=UPAY+R
        PSUM=PSUM+P
602  CONTINUE
        HIB=HI1(I,2)+HIB
        HIA=HI2(I,2)+HIA
        RETURN
C
102  CONTINUE
        IF ( H29(I,1) .EQ. 1 .OR. H29(I,1) .EQ. 2 ) GO TO 116
        SI(I)=S(6,1,3,1)/10.0
        SI2(I,J)=10.0*SI(I)
        GO TO 120
116  CONTINUE
        SI(I)=S(6,3,1,3)/10.0
        SI2(I,J)=10.0*SI(I)
120  CONTINUE
        IF ( C21(L,J) .EQ. 2 ) GO TO 122
110  CONTINUE
        YLAT(I,J)=YL1
        GO TO 124
122  CONTINUE
        YLAT(I,J)=(C24(L,J)+C25(L,J))/2.0
124  CONTINUE
        ISLOPE=1
        HWID(I,J)=1.5
        HLENG(I,J)=HL1+HL2-HL3
C
        CALL HINDEX
C
        HI2(I,1)=H
        IF(NCONTR.EQ.1) GO TO 604
C
        CALL CCSTS
C
        UPAY=UPAY+R
        PSUM=PSUM+P
604  CONTINUE
        HIB=HI1(I,1)+HIB
        HIA=HI2(I,1)+HIA
        RETURN
C
C
        END

```

Figure A-26 Subroutine RAIL2 (3 of 3)

```

C *****
C
C SUBROUTINE RAIL6
C *****
C LONGITUDINAL HAZARD IMPROVEMENT SUBRCUTINE.
C ANCHOR EXISTING GUARDTAIL TO BRIDGE STRUCTURE
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / NONHWY / NCONTR, MONTH, NYEAR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

Figure A-27 Subroutine RAIL6 (1 of 2)

```

ISLOPE = 1
M = H12(I,1)
IF(H30(I,1).EQ.4) GO TO 1
IF(H29(I,1).EQ.4) GO TO 2
MES = 15
RETURN
C
1 SI(I) = S(6,M,1,3)/10.0
SI2(I,J) = 10.0*SI(I)
GO TO 4
2 SI(I) = S(6,M,3,1)/10.0
SI2(I,J) = 10.0*SI(I)
4 YLAT(I,J) = (H25(I,1)+H26(I,1))*0.5
HLENG(I,J) = ABS(H17(I,1)-H18(I,1))*5280.0
HWID(I,J) = 1.5
C
CALL HINDEX
C
HI2(I,1) = H
IF(NCONTR.EQ.1) GO TO 602
C
CALL COSTS
C
UPAY = UPAY+R
PSUM = PSUM+P
602 CONTINUE
HIB = HI1(I,1)+HIB
HIA = HI2(I,1)+HIA
RETURN
C
END

```

Figure A-27 Subroutine RAIL6 (2 of 2)

```

C *****
C
C SUBROUTINE PTRAIL
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / CONSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / PTHZGR / NPTGR, HLGTH
COMMON / NONHWY / NCONTR, MONTH, NYEAR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

Figure A-28 Subroutine PTRAIL (1 of 3)

```

NPTGR=1
KORDER=0
SI(I)=S(6,1,1,1)/10.0
SI2(I,J)=SI(I)*10.0
YLAT(I,J)=C14(I,J)
HWID(I,J)=1.5
IF ( NH .EQ. 1 ) GO TO 100
DO 102 NNN=1,NH
IF ( C12(NNN,J) .EQ. 1 .AND. C13(NNN,J) .EQ. 2 ) GO TO 102
GO TO 100
102 CONTINUE
KORDER=1
CALL ORDER2
D1=H20(1,1)
D2=C14(I,J)
D3=H20(NH,1)+H23(NH,1)
D4=D1-D2
GO TO 106
100 CONTINUE
D1=H20(I,1)
D2=YLAT(I,J)
D3=D1+H23(I,1)
D4=D1-D2
106 CONTINUE
ISLPI=1
ISLOPE=ISLPI
110 CONTINUE
HL1=(400.0/D3)*(D3-D2)
IF ( D4 .LT. 6.0 ) GO TO 114
GO TO 116
114 CONTINUE
IF ( HL1 .LT. 150.0 ) GO TO 118
GO TO 116
118 CONTINUE
HL1=150.0
116 CONTINUE
IF ( KORDER .EQ. 1 ) GO TO 120
HLENG(I,J)=HL1+H24(I,1)+(2.0*25.0)
GO TO 122
120 CONTINUE
HLENG(I,J)=HL1+HLGTH+(2.0*25.0)
122 CONTINUE
CALL HINDEX
HI2(I,1)=H
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 124
D6=C49(I,J)
D7=D6-D2
D8=H15(I,1)-D6
D9=H15(I,1)-D1
HL2=(400.0/D9)*(D9-D8)
IF ( D4 .LT. 6.0 ) GO TO 126
GO TO 128
126 CONTINUE
IF ( HL2 .LT. 150.0 ) GO TO 130
GO TO 128

```

Figure A-28 Subroutine PTRAIL (2 of 3)

```

130 CONTINUE
  HL2=150.0
128 CONTINUE
  CALL CONST1
  HL3=D7/TAN(ANG)
  HL5=HL2+25.0
  HL6=HL3+25.0
  HL4=HL1+25.0
  IF ( HL5 .LE. HL6 ) GO TO 132
  YLAT(I,J)=D6
  HWID(I,J)=1.5
  A1=HL5-HL6
  HLENG(I,J)=A1
  SI(I)=30.0
  CALL HINDEX
  SI(I)=SI2(I,J)/10.0
  HI2(I,1)=HI2(I,1)+H
132 CONTINUE
  YLAT(I,J)=D8
  HWID(I,J)=1.5
  IF ( KCRDER .EQ. 1 ) GO TO 134
  GO TO 136
134 CONTINUE
  HLENG(I,J)=HL2+HLGTH+(2.0*25.0)
  GO TO 138
136 CONTINUE
  HLENG(I,J)=HL2+H24(I,1)+(2.0*25.0)
138 CONTINUE
  CALL HINDEX
  HI2(I,2)=H
  IF ( HL4 .LE. HL6 ) GO TO 124
  SI(I)=30.0
  YLAT(I,J)=D7+D8
  HWID(I,J)=1.5
  HLENG(I,J)=HL4-HL6
  CALL HINDEX
  HI2(I,2)=HI2(I,2)+H
124 CONTINUE
  HIB=HI1(I,1)+HI1(I,2)+HIB
  HIA=HI2(I,1)+HI2(I,2)+HIA
  IF(NCONTR.EQ.1) GO TO 602
  CALL COSTS
  UPAY=UPAY+R
  PSUM=PSUM+P
602 CONTINUE
  RETURN
  END

```

Figure A-28 Subroutine PTRAIL (3 of 3)

```

C *****:
C
C SUBROUTINE DTRAIL
C *****
C
C SUBROUTINE USED ONLY TO INSTALL GUARCRAIL TO PRCTECT A WASHOUT DITCH NO
C CRITICAL SLOPE.
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / RDITCH / DT, DTL
COMMON / NONHWY / NCONTR, MONTH, NYEAR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

Figure A-29 Subroutine DTRAIL (1 of 3)


```

K=I
HWID(K,1)=H28(I,1)
IF(HWID(K,1).GT.30.0) HWID(K,1)=30.0
ISLOPE=1
D1=DT
DLGTH=DTL
IF(C24(K,J).GT.0.01) GO TO 10
CALL GRAIL
IF(NGR.EQ.1) GO TO 20
GO TO 30
10 D2=(C24(K,J)+C25(K,J))/2.0
D3=D1+HWID(K,1)
D4=D1-D2
HL1=(400./D3)*(D3-D2)
IF(HL1.LE.150.0) HL1=150.0
HLENG(K,J)=HL1+50.0+DLGTH
SI(K)=S(6,1,1,1)/10.0
SI2(K,J)=SI(K)*10.0
YLAT(K,J)=D2
HWID(K,J)=1.5
CALL HINDEX
HI2(K,1)=H
GO TO 30
20 HIB=HI1(K,1)+HIB
HIA=HIA
GO TO 40
30 IF(HI3(K,1).EQ.1 .OR.HI5(K,1).LT.0.01) GO TO 50
IF(C24(K,J).GT.0.01) GO TO 60
HIB=HIB
HIA=HIA
GO TO 42
50 HIB=HI1(K,1)+HIB
HIA=HI2(K,1)+HIA
GO TO 80
60 HIB=HI1(K,1)+HIB
HIA=HI2(K,1)+HIA
42 CONTINUE
IF(C30(K,J).GT.0.01) GO TO 40
CALL GRAIL
IF(NGR.EQ.1) GO TO 90
HIB=HIB
HIA=HIA
RETURN
90 MES=46
RETURN
40 D6=(C30(K,J)+C31(K,J))/2.0
D9=H15(K,1)-DT
D8=H15(K,1)-D6
HL2=(400./D9)*(D9-D8)
IF(HL2.LE.150.0) HL2=150.0
HLENG(K,J)=HL2+50.0+DLGTH
SI(K)=S(6,1,1,1)/10.0

```

Figure A-29 Subroutine DTRAIL (2 of 3)

```
SI2(K,J)=SI(K)*10.0
YLAT(K,J)=D8
HWID(K,J)=1.5
CALL HINDEX
HI2(K,2)=H
70 HIB=HI1(K,2)+HIB
HIA=HI2(K,2)+HIA
80 CONTINUE
IF(NCONTR.EQ.1) GO TO 602
CALL COSTS
UPAY=UPAY+R
PSUM=PSUM+P
602 CONTINUE
RETURN
END
```

Figure A-29 Subroutine DTRAIL (3 of 3)

```

C *****
C
C SUBROUTINE SLRAIL
C *****
C
C SUBROUTINE INSTALLS GUARDRAIL TO PROTECT SLOPE
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / H11, H12, SI, S11, S12, R, P, UPAY, PSUM, H1B,
* H1A
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / NONHWY / NCONTR, MONTH, NYEAR

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),

```

Figure A-30 Subroutine SLRAIL (1 of 3)

```

*          C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
*          C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
*          C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
*          C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*          C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*          , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

C
C

```

K=I
ISLOPE=1
IF(C34(I,J).GT.0.01) GO TO 101
HLSL=ABS(HI7(I,1)-HI8(I,1))*5280.0
GO TO 103
101 CONTINUE
HLSL=ABS(C34(I,J)-C35(I,J))*5280.0
103 CONTINUE
IF(C24(K,J).GT.0.01) GO TO 10
CALL GRAIL
IF(NGR.EQ.1) GO TO 20
GO TO 30
10 D2=(C24(K,J)+C25(K,J))/2.0
D3=FSOFF
HL1=(400./D3)*(D3-D2)
IF(HL1.LE.150.0) HL1=150.0
HLENG(K,J)=HL1+50.+HLSL
SI(K)=S(6,1,1,1)/10.0
SI2(K,J)=SI(K)*10.0
YLAT(K,J)=D2
HWID(K,J)=1.5
CALL HINDEX
HI2(K,1)=H
GO TO 30
20 HIB=HI1(K,1)+HIB
HIA=HIA
GO TO 40
30 IF(HI3(K,1).EQ.1 .OR. HI5(K,1).LT.0.01) GO TO 50
IF(C24(K,J).GT.0.01) GO TO 60
HIB=HIB
HIA=HIA
GO TO 42
50 HIB=HI1(K,1)+HIB
HIA=HI2(K,1)+HIA
GO TO 80
60 HIB=HI1(K,1)+HIB
HIA=HI2(K,1)+HIA
42 CONTINUE
IF(C30(K,J).GT.0.01) GO TO 40
CALL GRAIL
IF(NGR.EQ.1) GO TO 90
HIB=HIB
HIA=HIA
RETURN
90 MES=46
RETURN

```

Figure A-30 Subroutine SLRAIL (2 of 3)

```

40 D6=(C30(K,J)+C31(K,J))/2.0
   D9=H15(K,1)-FSOFF
   D8=H15(K,1)-D6
   HL2=(400./D9)*(D9-D8)
   IF(HL2.LE.150.0) HL2=150.0
   HLENG(K,J)=HL2+50.0+HLSL
   SI(K)=S(6,1,1,1)/10.0
   SI2(K,J)=SI(K)*10.0
   YLAT(K,J)=D8
   HWID(K,J)=1.5
   CALL HINDEX
   HI2(K,2)=H
70 HIB=HI1(K,2)+HIB
   HIA=HI2(K,2)+HIA
80 CONTINUE
   IF(NCONTR.EQ.1) GO TO 602
   CALL COSTS
   UPAY=UPAY+R
   PSUM=PSUM+P
602 CONTINUE
   RETURN
   END

```

Figure A-30 Subroutine SLRAIL (3 of 3)

```

C *****
C
C SUBROUTINE CURB
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / NCNHWY / NCCNTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)

```

Figure A-31 Subroutine CURB (1 of 2)

```
ISLOPE=1
YLAT1=(H25(I,1)+H26(I,1))/2.0
IF ( C20(I,J) .EQ. 2 ) GO TO 100
IF ( C20(I,J) .EQ. 1 ) GO TO 102
MES=11
RETURN
```

```
C
102 CONTINUE
IF ( I .GT. 1 ) GO TO 104
HIB=HI1(I,1)+HIB
GO TO 106
104 CONTINUE
HIB=HI1(I,2)+HIB
106 CONTINUE
HI2(I,1)=0.0
HI2(I,2)=0.0
SI(I)=1.0
SI2(I,J)=0.0
GO TO 108
100 CONTINUE
SI(I)=0.9*S(5,1,1,1)/10.0
SI2(I,J)=SI(I)*10.0
IF ( I .GT. 1 ) GO TO 110
HIB=HI1(I,1)+HIB
YLAT(I,J)=YLAT1
GO TO 112
110 CONTINUE
HIB=HI1(I,2)+HIB
YLAT(I,J)=H15(I,1)-YLAT1
112 CONTINUE
HLENG(I,J)=ABS(H17(I,1)-H18(I,1))*5280.0
HWID(I,J)=H28(I,1)
```

```
C
CALL HINDEX
C
IF ( I .GT. 1 ) GO TO 114
HI2(I,1)=H
GO TO 108
```

```
114 CONTINUE
HI2(I,2)=H
108 CONTINUE
IF(NCONTR.EQ.1) GO TO 602
```

```
C
CALL COSTS
C
UPAY=UPAY+R
PSUM=PSUM+P
602 CONTINUE
HIA=HI2(I,1)+HI2(I,2)+HIA
RETURN
```

```
C
END
```

Figure A-31 Subroutine CURB (2 of 2)

```

C *****
C
C SUBROUTINE BRIDGE
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / NCNHWY / NCCNTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)

```

Figure A-32 Subroutine BRIDGE (1 of 2)


```

      IF ( C20(I,J) .EQ. 1 ) GO TO 100
      IF ( C20(I,J) .EQ. 2 ) GO TO 102
      MES=12
      RETURN
C
100 CONTINUE
      SI(I)=S(12,3,1,1)/10.0
      SI2(I,J)=SI(I)*10.0
      GO TO 104
102 CONTINUE
      SI(I)=S(12,4,1,1)/10.0
      SI2(I,J)=SI(I)*10.0
104 CONTINUE
      XH=H17(I,1)-H18(I,1)
      HLENG(I,J)=ABS(XH)*5280.0
      HWID(I,J)=0.0
      IBR=0
      IF ( C21(I,J) .EQ. 1 .OR. C21(I,J) .EQ. 3 ) GO TO 106
      IF ( C21(I,J) .EQ. 2 .OR. C21(I,J) .EQ. 4 ) GO TO 108
      MES=13
      RETURN
C
106 CONTINUE
      YLAT(I,J)=(H25(I,1)+H26(I,1))/2.0
      GO TO 110
108 CONTINUE
      YLAT(I,J)=(C24(I,J)+C25(I,J))/2.0
      IBR=1
110 CONTINUE
C
      CALL HINDEX
C
      HI2(I,1)=H
      IF ( IBR .EQ. 0 ) GO TO 112
      IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 112
      IF ( C21(I,J) .EQ. 4 ) GO TO 114
      IF ( C21(I,J) .EQ. 2 ) GO TO 112
      MES=41
      RETURN
C
114 CONTINUE
      HI2(I,2)=HI2(I,1)
112 CONTINUE
      IF(NCONTR.EQ.1) GC TO 602
C
      CALL COSTS
C
      UPAY=UPAY+R
      PSUM=PSUM+P
602 CONTINUE
      HIB=HI1(I,1)+HI1(I,2)+HIB
      HIA=HI2(I,1)+HI2(I,2)+HIA
      RETURN
C
      END

```

Figure A-32 Subroutine BRIDGE (2 of 2)

```

C *****
C
C SUBROUTINE BRGR
C *****
C
COMMON / INVENT / I, J, NH, LPI, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / NONHWY / NCONTR, MONTH, NYEAR
COMMON / BRGR2 / MM

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION MM(15), NN(15)

C
C K=I
C IF ( C24(K,J) .LT. 0.01 .AND. C31(K,J) .LT. 0.01 ) GO TO 100

```

Figure A-33 Subroutine BRGR (1 of 3)

```

CALL ORDER2
C
NBR = 0
DO 111 N=1,NH
L=MM(N)
IF( H11(L,1) .EQ. 12 ) GO TO 110
GO TO 111
110 CONTINUE
NBR = NBR + 1
NN(NBR) = L
111 CONTINUE
IF( H6(K,1) .EQ. 1 ) GO TO 102
IF( H18(K,1) .LT. H18(NN(NBR),1))GO TO 103
GO TO 104
102 CONTINUE
IF( H18(K,1) .GT. H18(NN(NBR),1))GO TO 103
GO TO 104
103 CONTINUE
IF( C30(K,J) .LT. 0.01 ) GO TO 99
GO TO 106
104 CONTINUE
IF( C24(K,J) .LT. 0.01 ) GO TO 99
GO TO 108
106 CONTINUE
D1 = C31(K,J)
X1 = H26(NN(NBR),1)
GO TO 128
108 CONTINUE
D1 = C24(K,J)
X1 = H25(NN(1),1)
128 CONTINUE
X=ABS(D1-X1)
IF ( X .GT. 8.0 ) GO TO 134
IF ( X .LE. 3.8 ) GO TO 136
Y=20.0*(X-3.8)+216.0
GO TO 138
136 CONTINUE
Y=38.6*(X-1.0)+108.0
138 CONTINUE
IF ( Y .LT. 150.0 ) GO TO 140
GO TO 142
140 CONTINUE
Y=150.0
GO TO 142
134 CONTINUE
Y=300.0
142 CONTINUE
HLENG(K,J)=Y+25.0
D2=(D1+X1)/2.0
IF ( C24(K,J) .LT. 0.01 ) GO TO 144
SI(K)=S(6,3,1,3)/10.0
SI2(K,J)=SI(K)*10.0
GO TO 146
144 CONTINUE
SI(K)=S(6,1,3,1)/10.0
SI2(K,J)=SI(K)*10.0
146 CONTINUE

```

Figure A-33 Subroutine BRGR (2 of 3)

```

YLAT(K,J)=D2
HWID(K,J)=1.5
ISLOPE=1
C
CALL HINDEX
C
HI2(K,1)=HI2(K,1)+H
IF(NCONTR.EQ.1) GO TO 602
C
CALL COSTS
C
UPAY=UPAY+R
PSUM=PSUM+P
602 CONTINUE
HIB = HI1(K,1) + HIB
HIA=HI2(I,1)+HIA
RETURN
C
99 CONTINUE
MES = 51
RETURN
C
100 CONTINUE
MES=44
RETURN
C
END

```

Figure A-33 Subroutine BRGR (3 of 3)

```

C *****
C
C SUBROUTINE BRGR1
C *****
C SUBROUTINE USED TO PLACE GUARDRAIL BETWEEN SUCCESSIVE BRIDGES IN LINE
C ( PROGRAM PERMITS UP TO 5 BRIDGES )
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / NONHWY / NCONTR, MONTH, NYEAR
COMMON / BRGR2 / MM

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47

DIMENSION S(14,7,4,4)
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)

```

Figure A-34 Subroutine BRGR1 (1 of 2)

```

*           , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION  YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION  SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION  MM(15), NN(15)

C
C
C
C
CALL ORDER2

NBR=0
DO 100 N=1,NH
L=MM(N)
IF ( HI1(L,1) .EQ. 12 ) GO TO 102
GO TO 100
102 CONTINUE
NBR=NBR+1
NN(NBR)=L
100 CONTINUE
NBRM1=NBR-1
DO 104 K=1,NBRM1
SLMID=(HI7(I,1)+HI8(I,1))/2.0
N1=NN(K)
N2=NN(K+1)
IF ( H6(I,1) .EQ. 1 ) GO TO 106
IF ( SLMID .LT. HI8(N1,1) .AND. SLMID .GT. HI7(N2,1) )
* GO TO 108
GO TO 104
106 CONTINUE
IF ( SLMID .GT. HI8(N1,1) .AND. SLMID .LT. HI7(N2,1) )
* GO TO 108
104 CONTINUE
MES=50
RETURN

C
108 CONTINUE
HLENG(I,J)=ABS(HI8(N1,1)-HI7(N2,1))*5280.0
HWID(I,J)=0.0
YLAT(I,J)=(H26(N1,1)+H25(N2,1))/2.0
SI(I)=S(6,1,3,3)/10.0
SI2(I,J)=10.0*SI(I)

C
CALL HINDEX

C
HI2(I,1)=H
HIB=HI1(I,1)+HIB
HIA=HI2(I,1)+HIA
IF ( NCONTR .EQ. 1 ) RETURN

C
CALL COSTS

C
UPAY=UPAY+R
PSUM=PSUM+P
RETURN

C
END

```

Figure A-34 Subroutine BRGR1 (2 of 2)

```

C *****
C
C SUBROUTINE SLOPE1
C *****
C SUBROUTINE TO COMPUTE PROPERTIES ASSOCIATED WITH SLOPES SUCH AS THE
C HORIZONTAL OFFSET DISTANCES AND SLOPE ANGLES. BACK SLOPE DATA ASSUME
C TO BE RELATIVELY FLAT IF DATA IS NOT FILLED IN ON HAZARD INVENTORY FO
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / CONSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI

INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSERS, BSERS

DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),

```

Figure A-35 Subroutine SLOPE1 (1 of 3)

```

*          C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
*          C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*          C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*          , C30(15,5), C31(15,5), C48(15,5), C49(15,5)

```

C
C
C
C
C
C

```
CALL CONST1
```

```
IF ( LL .NE. 1 ) GO TO 100
```

```
BACK SLOPE ASSUMED TO BE RELATIVELY FLAT
```

```
IF ( H39(K,1) .LT. 0.01 .AND. H40(K,1) .LT. 0.01 .AND.
*   H41(K,1) .LT. 0.01 .AND. H42(K,1) .LT. 0.01 .AND.
*   H43(K,1) .EQ. 0 .AND. H44(K,1) .EQ. 0 ) GO TO 90
```

```
GO TO 92
```

```
90 CONTINUE
```

```
H39(K,1)=9.9
H40(K,1)=9.9
H41(K,1)=50.0
H42(K,1)=50.0
H43(K,1)=1
H44(K,1)=1
```

```
92 CONTINUE
```

```
FSDIR=H38(K,1)
BSDIR=H44(K,1)
FSERS=H37(K,1)
BSERS=H43(K,1)
FSSTP=(H33(K,1)+H34(K,1))*0.5
IF(FSSTP .EQ. 0.0) FSSTP=0.1
BSSTP=(H39(K,1)+H40(K,1))*0.5
IF(BSSTP .EQ. 0.0) BSSTP=0.1
FSDIS=(H35(K,1)+H36(K,1))*0.5
BSDIS=(H41(K,1)+H42(K,1))*0.5
OFFST1=(H31(K,1)+H32(K,1))*0.5
FSANG=ATAN(1./FSSTP)
BSANG=ATAN(1./BSSTP)
GO TO 101
```

C

```
100 CONTINUE
```

```
FSDIR=C42(K,J)
BSDIR=C47(K,J)
FSSTP=(C38(K,J)+C39(K,J))*0.5
IF(FSSTP .EQ. 0.0) FSSTP=0.1
BSSTP=(C43(K,J)+C44(K,J))*0.5
IF(BSSTP .EQ. 0.0) BSSTP=0.1
FSDIS=(C40(K,J)+C41(K,J))*0.5
BSDIS=(C45(K,J)+C46(K,J))*0.5
OFFST1=(C36(K,J)+C37(K,J))*0.5
FSANG=ATAN(1./FSSTP)
BSANG=ATAN(1./BSSTP)
```

C

```
101 CONTINUE
```

```
IF ( ( FSDIR .EQ. 2 .AND. BSDIR .EQ. 1 ) .OR.
*   ( FSDIR .EQ. 1 .AND. BSDIR .EQ. 2 ) ) GO TO 102
IF ( ( FSDIR .EQ. 2 .AND. BSDIR .EQ. 2 ) .OR.
*   ( FSDIR .EQ. 1 .AND. BSDIR .EQ. 1 ) ) GO TO 103
```

Figure A-35 Subroutine SLOPE1 (2 of 3)


```
MES=17  
RETURN
```

C

```
102 CONTINUE  
DELTA=(FSANG+BSANG)/RAD  
GO TO 104
```

```
103 CONTINUE  
DELTA=ABS(FSANG-BSANG)/RAD
```

```
104 CONTINUE  
FSOFF = OFFST1 + FSDIS*COS(FSANG)  
OFFST2 = FSOFF + BSDIS*COS(BSANG)  
RETURN
```

C

```
END
```

```

C *****
C
C SUBROUTINE VDITCH
C *****
C THIS PROGRAM IS DESIGNED TO CALCULATE THE SEVERITY INDEX, SI, FOR
C THE V-DITCH OR INTERSECTION OF THE FRONT AND BACK SLOPES LOCATED
C WITHIN 30 FEET OF THE TRAVELED WAY. IN ADDITION, THE WIDTH, W,
C OF THE IMAGINARY LONGITUDINAL HAZARD IS ASSIGNED.
C
C COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
C COMMON / HDITCH / SD, W, WD, SDA
C
C INTEGER FSDIR, BSDIR, FSERS, BSERS
C
C MAXIMUM V-DITCH SEVERITY ASSIGNED FIRST THEN CHECKED
C
C SI=.80
C
C FRONT SLOPE CHECKED FOR DIRECTION
C
C IF(FSDIR-1) 10,10,20
10 IF(FSSTP.GE.6.) GO TO 600
IF(FSSTP.GE.4.) GO TO 610
IF(FSSTP.LT.4.) GO TO 620
20 IF(FSSTP.GE.6.) GO TO 100
IF(FSSTP.GE.5.) GO TO 200
IF(FSSTP.GE.4.) GO TO 300
IF(FSSTP.GE.3.6) GO TO 400
IF(FSSTP.GE.3.) GO TO 500
IF(FSSTP.LT.3.) GO TO 800
C
C 100 SERIES FOR SLOPES FLATTER THAN 6 TO 1
C
100 IF(DELTA.LT.19.) SI=.22
IF(DELTA.GE.19.0.AND.DELTA.LT.23.6) SI=.24
IF(DELTA.GE.23.6.AND.DELTA.LT.27.9) SI=.30
GO TO 800
C
C 200 SERIES FOR SLOPES FLATTER THAN 5 TO 1
C
200 IF(DELTA.LT.21.9) SI=.24
IF(DELTA.GE.21.9.AND.DELTA.LT.28.5) SI=.27
IF(DELTA.GE.28.5.AND.DELTA.LT.30.8) SI=.32
GO TO 800

```

Figure A-36 Subroutine VDITCH (1 of 2)

```

C      300 SERIES FOR SLOPES FLATTER THAN 4 TO 1
C
300   IF(DELTA.LT.23.6)  SI=.26
      IF(DELTA.GE.23.6.AND.DELTA.LT.28.2)  SI=.30
      IF(DELTA.GE.28.2.AND.DELTA.LT.32.5)  SI=.40
      GO TO 800

C
C      400 SERIES FOR SLOPES FLATTER THAN 3.6 TO 1
C
400   IF(DELTA.LT.25.1)  SI=.35
      IF(DELTA.GE.25.1.AND.DELTA.LT.29.7)  SI=.38
      IF(DELTA.GE.29.7.AND.DELTA.LT.34.0)  SI=.45
      GO TO 800

C
C      500 SERIES FOR SLOPES FLATTER THAN 3 TO 1
C
500   IF(DELTA.LT.27.9)  SI=.36
      IF(DELTA.GE.27.9.AND.DELTA.LT.32.5)  SI=.42
      IF(DELTA.GE.32.5.AND.DELTA.LT.36.8)  SI=.48
      GO TO 800

C
C      600 SERIES DETERMINES THE SEVERITY FOR A + FRONT SLOPE CONDITION
C
C      THE FOLLOWING THREE STATEMENTS ARE FOR A FRONT SLOPE OF 6 TO 1 OR
C      FLATTER
C
600   IF(DELTA.LE.3.0)  SI=.10
      IF(DELTA.LE.4.7)  SI=.15
      IF(DELTA.LE.9.0)  SI=.20
      GO TO 800

C
C      STATEMENT 610 IS FOR A FRONT SLOPE OF 4 TO 1 OR FLATTER
C
610   IF(DELTA.LE.2.0)  SI=.30
      GO TO 800

C
C      STATEMENTS 620 ARE FOR FRONT SLOPES STEEPER THAN 4 TO 1
C
620   IF(DELTA.LE.1.0)  SI=.36
      IF(DELTA.GT.1.0)  SI=.80

C
C      800 SERIES IS FOR DETERMINING THE WIDTH OF OBSTACLE
C
800   W=4.
      IF(FSDIR.EQ.1.AND.FSSTP.LE.3.5)  W=8.
      IF(FSDIR.EQ.2.AND.FSSTP.LT.3.0)  W=8.
      IF(FSOFF.LT.15.)  W=8.
      SD = SI
      RETURN

C
      END

```

Figure A-36 Subroutine VDITCH (2 of 2)

```

C *****
C
C SUBROUTINE DITCH
C *****
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / SEVERE / S
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / H11, H12, SI, S11, SI2, R, P, UPAY, PSUM, H1B,
* H1A
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SIDENF / NSGR, FSGR
COMMON / NONHWY / NCONTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSERS, BSERS
INTEGER NSGR, FSGR

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)

```

Figure A-37 Subroutine DITCH (1 of 3)

```

DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*          C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*          , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION S(14,7,4,4)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```

IF ( C20(I,J) .EQ. 1 .OR. C20(I,J) .EQ. 2 ) GO TO 100
IF ( C20(I,J) .EQ. 3 ) GO TO 102
MES=4
RETURN

```

C
C

102 CONTINUE

C
C

CALL DTRAIL

C
C

RETURN

C
C

100 CONTINUE

```

SI(I)=1.0
SI2(I,J)=0.0
HI2(I,1)=0.0
HI2(I,2)=0.0
IF(NCONTR.EQ.1) GO TO 602

```

C
C

CALL CCSTS

C
C

```

UPAY=UPAY+R
PSUM=PSUM+P

```

602 CONTINUE

```

IF ( NH .EQ. 1 ) GO TO 104

```

C
C

CALL GRAIL

C
C

```

IF ( NGR .EQ. 1 ) GO TO 104
IF ( IGR .EQ. 0 ) GO TO 106

```

```

L=NSGR(1)
K=FSGR(1)
IF ( I .LT. L ) GO TO 108
IF ( I .GT. K ) GO TO 110
HIB=HIB
HIA=HIA
RETURN

```

C
C

108 CONTINUE

```

HIB=HI1(I,1)+HIB
HIA=HIA
RETURN

```

C
C

110 CONTINUE

```

HIB=HI1(I,2)+HIB
HIA=HIA
RETURN

```

C
C

106 CONTINUE

```

L=NSGR(1)

```

Figure A-37 Subroutine DITCH (2 of 3)

```
IF ( H13(I,1) .EQ. 1 .OR. H15(I,1) .LT. 0.01 ) GO TO 112
IF ( I .LT. L ) GO TO 114
HIB=HI1(I,2)+HIB
HIA=HIA
RETURN
```

```
C
114 CONTINUE
HIB=HI1(I,1)+HIB
HIA=HIA
RETURN
```

```
C
112 CONTINUE
IF ( I .LT. L ) GO TO 116
IF ( C20(L,J) .EQ. 1 ) GO TO 118
MES=42
RETURN
```

```
C
118 CONTINUE
HIB=HIB
HIA=HIA
RETURN
```

```
C
116 CONTINUE
HIB=HI1(I,1)+HIB
HIA=HIA
RETURN
```

```
C
C
104 CONTINUE
HIB=HI1(I,1)+HI1(I,2)+HIB
HIA=HIA
RETURN
```

```
C
END
```

```

C *****
C
C SUBROUTINE WASOUT
C *****
C SUBROUTINE TO COMPUTE THE SEVERITY-INDEX OF A DITCH OR WASHOUT.
C
C COMMON / INVENT / I, J, NH, LP1, LL, MES
C COMMON / HINVNT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
C COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
C COMMON / HDITCH / SD, W, WD, SDA
C
C INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
C INTEGER FSDIR, BSDIR, FSERS, BSERS
C
C DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C
C THIS ROUTINE USES 'W' AND 'H' OF THE DITCH (AS SHOWN ON THE INVENT
C FORM) TO APPROXIMATE A V-DITCH TYPE OBSTACLE. VDITCH SUBROUTINE
C IS USED BY THIS PROGRAM.
C
C FFSTP IS THE STEEPNESS OF THE FRONT SLOPE (APPROXIMATED).
C WD IS 'AVERAGE' WIDTH OF THE DITCH.
C H IS THE 'AVERAGE' DEPTH OF THE DITCH.
C
C
C Z=H27(I,1)
C FFSTP = (WD/2.)/Z
C FSSTP=FFSTP
C
C DELTA IS THE ANGLE BETWEEN FRONT AND BACK SLOPES

```

Figure A-38 Subroutine WASOUT (1 of 2)

ANG = 3.1416/180.
FANG = ATAN(1./FFSTP)
DELTA = 2.*(FANG/ANG)

C
C
C
C
C
FSDIR (DIRECTION OF FRONT SLOPE IS ALWAYS NEGATIVE) WILL BE CODED
AS A TWO ON THE INVENTORY FROM.

FSDIR = 2

C
C
C
C
C
WILL COMPUTE THE SEVERITY WITH V-DITCH SUBROUTINE.

CALL VDITCH

CALL ADJUST

C
C
C
CHECK ON OBSTACLE WIDTH FOLLOWS
IF(W.LT.8.0.AND.WD.GT.W) W=8.0

RETURN

C
END


```

C *****
C
C SUBROUTINE FLATEN
C *****
C SLOPE HAZARD IMPROVEMENT SUBROUTINE -- FLATTEN SLOPES.
C
COMMON / INVENT / I, J, NH, LP1, LL, MES
COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
COMMON / CINVT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* C30, C31, C48, C49
COMMON / HZINDX / YLAT, HLENG, HWID, ISLOPE, H
COMMON / HAZRDS / H11, H12, SI, S11, S12, R, P, UPAY, PSUM, HIB,
* HIA
COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
COMMON / SIDENF / NSGR, FSGR
COMMON / SLOPES / K, FSDIR, BSDIR, FSERS, BSERS, FSSTP, BSSTP,
* FSANG, BSANG, OFFST1, OFFST2, FSOFF, DELTA,
* FSDIS, BSDIS
COMMON / HDITCH / SD, W, WD, SDA
COMMON / NONHWY / NCONTR, MONTH, NYEAR

C
INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
INTEGER FSDIR, BSDIR, FSERS, BSERS
INTEGER NSGR, FSGR

C
DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),

```

Figure A-39 Subroutine FLATEN (1 of 3)

```

*      C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
*      C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
*      C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*      C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*      , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION YLAT(15,5), HLENG(15,5), HWID(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION NSGR(15), FSGR(15)

```

C
C

```

K=I
CALL SLOPE1
CALL VDITCH
CALL ADJUST
SI(I)=SDA/10.0
SI2(I,J)=SDA
HWID(I,J)=W
IF ( FSSTP .GT. 3.5 ) GO TO 10
ISLOPE=2
YLAT(I,J)=CFFST1
GO TO 30
10 CONTINUE
ISLOPE=1
YLAT(I,J)=FSOFF
30 IF( C34(I,J).GT.0.01 ) GO TO 41
HLENG(I,J) = ABS( H17(I,1) - H18(I,1) ) * 5280.
GO TO 35
41 HLENG(I,J) = ABS( C34(I,J) - C35(I,J) ) * 5280.
35 CONTINUE
CALL HINDEX
HI2(I,1)=H
CALL GRAIL
IF(H13(I,1).EQ.1.OR.H15(I,1).LT.0.01) GO TO 40
IF ( BSSTP .GT. 3.5 ) GO TO 50
ISLOPE=2
YLAT(I,J)=H15(I,1)-OFFST2
GO TO 70
50 CONTINUE
ISLOPE=1
YLAT(I,J)=H15(I,1)-FSOFF
70 CONTINUE
CALL HINDEX
HI2(I,2)=H
IF ( NGR .EQ. 1 ) GO TO 80
IF ( IGR .EQ. 0 ) GO TO 120
N=NSGR(1)
IF ( C20(N,J) .EQ. 1 ) GO TO 190
HIB=HIB
HIA=HIA
GO TO 210
190 CONTINUE
HIB=HIB
HIA=HI2(I,1)+HIA
210 CONTINUE
N=FSGR(1)
IF ( C20(N,J) .EQ. 1 ) GO TO 220
HIB=HIB

```

Figure A-39 Subroutine FLATEN (2 of 3)

```

    HIA=HIA
    GO TO 100
220 CONTINUE
    HIB=HIB
    HIA=HI2(I,2)+HIA
    GO TO 100
120 CONTINUE
    N=NSGR(1)
    IF ( N .LT. I ) GO TO 140
    HIB=HI1(I,1)+HIB
    HIA=HI2(I,1)+HIA
    N=NSGR(1)
    IF ( C20(N,J) .EQ. 1 ) GO TO 170
    HIB=HIB
    HIA=HIA
    GO TO 100
170 CONTINUE
    HIB=HIB
    HIA=HI2(I,2)+HIA
    GO TO 100
140 CONTINUE
    HIB=HI1(I,2)+HIB
    HIA=HI2(I,2)+HIA
    N=NSGR(1)
    IF ( C20(N,J) .EQ. 1 ) GO TO 160
    HIB=HIB
    HIA=HIA
    GO TO 100
160 CONTINUE
    HIB=HIB
    HIA=HI2(I,1)+HIA
    GO TO 100
80 CONTINUE
    HIB=HI1(I,1)+HI1(I,2)+HIB
    HIA=HI2(I,1)+HI2(I,2)+HIA
    GO TO 100
40 CONTINUE
    IF ( NGR .EQ. 1 ) GO TO 240
    HIB=HIB
    GO TO 260
240 CONTINUE
    HIB=HI1(I,1)+HIB
260 CONTINUE
    HIA=HI2(I,1)+HIA
100 CONTINUE
    IF(NCONTR.EQ.1) GO TO 602
    CALL COSTS
    UPAY=UPAY+R
    PSUM=PSUM+P
602 CONTINUE
    RETURN
    END

```

Figure A-39 Subroutine FLATEN (3 of 3)

```

C *****
C
C SUBROUTINE GRAIL
C *****
C SUBROUTINE LOCATES THE POSITION OF EXISTING GUARDRAIL.
C NGR = 1 NO GUARDRAIL
C IGR = 0 GUARDRAIL CN RIGHT SIDE OF ROADWAY OR ON ONE SIDE OF MEDIAN
C IGR = 1 GUARDRAIL ON BOTH SIDES OF MEDIAN.
C
C COMMON / INVENT / I, J, NH, LP1, LL, MES
C COMMON / HINVT / H1, H2, H3, H4, H5, H6, H7, H8, H9, H11, H12,
* H13, H15, H16, H17, H18, H19, H20, H21, H22,
* H23, H24, H25, H26, H27, H28, H29, H30, H31,
* H32, H33, H34, H35, H36, H37, H38, H39, H40,
* H41, H42, H43, H44, H50, H51
C COMMON / KEYNUM / KK1, KK2, NGR, IGR, MGR, ICRSL
C COMMON / SIDENF / NSGR, FSGR
C
C INTEGER H1, H2, H3, H4, H5, H6, H8, H9, H11, H12, H13, H16, H19,
* H29, H30, H37, H38, H43, H44
C INTEGER NSGR, FSGR
C
C DIMENSION H1(15,1), H2(15,1), H3(15,1), H4(15,1), H5(15,1),
* H6(15,1), H7(15,1), H8(15,1), H9(15,1), H11(15,1),
* H12(15,1), H13(15,1), H15(15,1), H16(15,1), H17(15,1),
* H18(15,1), H19(15,1), H20(15,1), H21(15,1), H22(15,1),
* H23(15,1), H24(15,1), H25(15,1), H26(15,1), H27(15,1),
* H28(15,1), H29(15,1), H30(15,1), H31(15,1), H32(15,1)
C DIMENSION H33(15,1), H34(15,1), H35(15,1), H36(15,1), H37(15,1),
* H38(15,1), H39(15,1), H40(15,1), H41(15,1), H42(15,1),
* H43(15,1), H44(15,1), H50(15,1), H51(15,1)
C DIMENSION YDIST(15), M(15)
C DIMENSION NSGR(15), FSGR(15)
C
C N=0
C NGR=0
C IGR=0
C
C DO 10 L=1,NH
C IF ( H11(L,1) .NE. 6 ) GO TO 10
C N=N+1
C YDIST(N)=(H25(L,1)+H26(L,1))*0.5
C M(N)=L

```

Figure A-40 Subroutine GRAIL (1 of 2)

```

10 CONTINUE
  IF ( N .EQ. 0 ) GO TO 106
  L = 1
  KK1=1
  KK2=1
  IF ( N .EQ. 1 ) GO TO 108
100 CONTINUE
  L1=L
  L2=L+1
  D1=YDIST(L1)
  D2=YDIST(L2)+5.
  D3=YDIST(L2)-5.
  IF ( D1 .LT. D2 .AND. D1 .GT. D3 ) GO TO 102
  IGR=1
  NSGR(KK1)=M(KK1)
102 CONTINUE
  IF ( IGR .EQ. 0 ) GO TO 104
  FSGR(KK2)=M(L2)
  IF ( L2 .EQ. N ) RETURN
  KK2=KK2+1
  L=L+1
  GO TO 100
104 CONTINUE
  NSGR(KK1) = M(L1)
  IF ( L2 .EQ. N ) RETURN
  KK1=KK1+1
  L=L+1
  GO TO 100
106 CONTINUE
  NGR=1
  RETURN
108 CONTINUE
  NSGR(KK1)=M(L)
  RETURN
C
  END

```

Figure A-40 Subroutine GRAIL (2 of 2)

```

C *****
C
C SUBROUTINE  FREQ
C
C *****
C
C SUBROUTINE TO COMPUTE THE ENCROACHMENT FREQUENCY EXPRESSED AS THE NUM
C OF ROADSIDE ENCROACHMENTS PER MILE PER YEAR. ( FIGUTR 2 IN NCHRP 20-
C
C COMMON / FRQNCY / ADT, EF
C
C AVERAGE DAILY TRAFFIC FOR BOTH DIRECTIONS OF TRAFFIC
C
C ADT=ADT*1000.
C IF (ADT .LE. 3200.0) GO TO 400
C IF ( ADT .GT. 3200.0 .AND. ADT .LE. 5500.0) GO TO 402
C GO TO 404
C
C 400 EF = 0.001625 * ADT
C GO TO 406
C 402 EF = 5.2 - (0.001739 * (ADT - 3200.0))
C GO TO 406
C 404 EF = 1.2 + (0.0004113 * (ADT - 5500.0))
C
C 406 CONTINUE
C
C RETURN
C END

```

Figure A-41 Subroutine FREQ (1 of 1)

```

C *****
C
C SUBROUTINE PRCB
C
C *****
C SUBROUTINE TO COMPUTE PROBABILITY OF A VEHICLE LATERAL DISPLACEMENT
C GREATER THAN SOME OFFSET DISTANCE. ENCROACHMENT ANGLE EQUAL TO
C 11 DEG. (FIGURE 4 IN NCHRP 20-7).
C
C COMMON / PROBTY / Y, PP
C
C Y LATERAL OFFSET DISTANCE TO OBSTACLE (FT)
C IF ( Y .LE. 6. ) GO TO 400
C IF ( Y .GE. 44. ) GO TO 402
C
C Y LESS OR EQUAL 6. PP=1
C Y GREATER 44. PP=0
C
C Y2=Y**2
C Y3=Y**3
C
C PP=99.0826+.74597*Y-.161676*Y2+.0021346*Y3
C GO TO 404
C
C 400 PP = 100.0
C GO TO 404
C
C 402 PP = 0.0
C
C 404 CONTINUE
C PP = 0.01 * PP
C
C RETURN
C END

```

Figure A-42 Subroutine PROB (1 of 1)

```

C *****
C
C SUBROUTINE COSTS
C *****
C SUBROUTINE TO COMPUTE ANNUALIZED COSTS TAKING INTO CONSIDERATION (1)
C COSTS OF IMPROVEMENT, (2) NORMAL MAINTENANCE COSTS OF HAZARD AND IMPR
C AND (3) REPAIR COSTS OF HAZARD AND IMPROVEMENT FOLLOWING A COLLISION.
C COMPOUND INTEREST IS USED WITH AN ASSUMED INTEREST RATE OF 6 PERCENT
C AND A 20 YEAR LIFE. REFER TO EQUATION ON PAGES 49 AND 50 IN NCHRP PR
C 20-7 BY MR. J.C. GLENNON FORMERLY OF TTI.
C
C COMMON / INVENT / I, J, NH, LP1, LL, MES
C COMMON / CINVNT / C1, C2, C3, C4, C5, C7, C8, C9, C10, C11, C12,
* C13, C14, C15, C16, C17, C18, C20, C21, C24,
* C25, C26, C27, C28, C29, C34, C35, C36, C37,
* C38, C39, C40, C41, C42, C43, C44, C45, C46, C47
* , C30, C31, C48, C49
C COMMON / CONSNT / D, THETA, RAD, ANG, RSIN, RTAN, LIFE, RI
C COMMON / HAZRDS / HI1, HI2, SI, SI1, SI2, R, P, UPAY, PSUM, HIB,
* HIA
C
C INTEGER C1, C2, C3, C4, C5, C12, C13, C18, C20, C21, C42, C47
C
C DIMENSION C1(15,5), C2(15,5), C3(15,5), C4(15,5), C5(15,5),
* C7(15,5), C8(15,5), C9(15,5), C10(15,5), C11(15,5),
* C12(15,5), C13(15,5), C14(15,5), C15(15,5), C16(15,5),
* C17(15,5), C18(15,5), C20(15,5), C21(15,5), C24(15,5),
* C25(15,5), C26(15,5), C27(15,5), C28(15,5), C29(15,5),
* C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
C DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
* C44(15,5), C45(15,5), C46(15,5), C47(15,5)
* , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
C DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
C
C INTEREST FACTOR
C
C A1=(1.+RI*.01)**LIFE
C A3=RI*A1*.01
C A4=(A1-1.)/A3
C A5=1./A4
C
C IF ( LL .EQ. 1 ) GO TO 100
C
C ANNUALIZED COST OF IMPROVEMENT

```

Figure A-43 Subroutine COSTS (1 of 2)


```

        IF ( HI2(I,1) .GE. HI2(I,2) ) GO TO 102
        HINDX=HI2(I,2)
        GO TO 104
102 CONTINUE
        HINDX=HI2(I,1)
C
104 CONTINUE
        CI=C9(I,J)*A5*HINDX/SI(I)
        CF=C7(I,J)*A5
        R=CI+CF+C11(I,J)
        P=R*A4
        RETURN
C
C ANNUALIZED COST OF HAZARD
C
100 CONTINUE
        IF ( HI1(I,1) .GE. HI1(I,2) ) GO TO 106
        HINDX=HI1(I,2)
        GO TO 108
106 CONTINUE
        HINDX=HI1(I,1)
C
108 CONTINUE
        CO=C8(I,LL+1)*A5*HINDX/SI(I)
        R=CO+C10(I,LL+1)
        P=R*A4
        RETURN
C
        END

```

Figure A-43 Subroutine COSTS (2 of 2)


```

*      C34(15,5), C35(15,5), C36(15,5), C37(15,5), C38(15,5)
DIMENSION C39(15,5), C40(15,5), C41(15,5), C42(15,5), C43(15,5),
*      C44(15,5), C45(15,5), C46(15,5), C47(15,5)
*      , C30(15,5), C31(15,5), C48(15,5), C49(15,5)
DIMENSION SI(15), HI1(15,2), HI2(15,2), SI2(15,5), SI1(15,1)
DIMENSION MG(60,20), IDIST(255)
DIMENSION IH1(999), IH2(999), IH3(999), IH4(999), IH5(999),
*      IH6(999), IGRP(999), IH88(999), IH99(999), IH77(999)
DIMENSION IC1(15,5), IC2(15,5), IC3(15,5), IC4(15,5)
DIMENSION UPMT(15,5), PVAL(15,5), CE(15,5)
DIMENSION DISTRT(15,1)
DIMENSION TYPE(10,20), CLASS(10,20)

```

```

C
C
C REDEFINE HEADING OUTPUT VARIABLES FOR PRINT CONTROL USING LC1 AS
C A COUNTER
C

```

```

      IF(LIST .EQ. 0) GO TO 2
      GO TO 4
2 CONTINUE
      WRITE(6,99)
      WRITE(6,98)
      WRITE(6,97)
      MESSAGE=0
      IERROR=100
      RETURN
C
4 CONTINUE
      KEY=0
      IF(MES.EQ.27) GO TO 210
      IF(MES.EQ.23) GO TO 210
      IF(MES.EQ.0 .OR. MES.EQ.30) GO TO 5
      MESSAGE=MESSAGE+1
      IF(MESSAGE.NE.IERROR) GO TO 5
      MES=23
5 CONTINUE
      M = LC1
      N = LC1 - 1
      IGRP(M) = H16(I,1)
      IH2(M) = H2(I,1)
      IH3(M) = H3(I,1)
      NH3=H3(I,1)
      DIST=IDIST(NH3)
      IH1(M) = DIST
      IH4(M) = H4(I,1)
      IH5(M) = H5(I,1)
      IH6(M) = H6(I,1)
      IH77(M) = H7(I,1)
      IH88(M) = H8(I,1)
      IH99(M) = H9(I,1)
      DISTRT(I,1) = DIST
      IF ( LC1 .EQ. 1 ) GO TO 10
      IF ( IH2(M) .EQ. IH2(N) .AND. IH3(M) .EQ. IH3(N) .AND.
*      IH1(M) .EQ. IH1(N) .AND. IH4(M) .EQ. IH4(N) .AND.
*      IH77(M) .EQ. IH77(N) .AND. IH88(M) .EQ. IH88(N) .AND.
*      IH99(M) .EQ. IH99(N) .AND.
*      IH5(M) .EQ. IH5(N) .AND. IH6(M) .EQ. IH6(N)) GO TO 12
      IF(MES.EQ.24 .AND. NH.NE.1) GO TO 12

```

Figure A-44 Subroutine OUTPUT (2 of 6)

```

10 CONTINUE
  KEY=1
  IH7 = H7(I,1)
  IH8=H8(I,1)
  IF(IH8.EQ.0) IH8 = 10
  IH9=H9(I,1)
  WRITE(6,100) (TYPE(IH8,K),K=1,13), (CLASS(IH9,K),K=1,13),
*
*           H2(I,1), H3(I,1), DISTRT(I,1),
*           H4(I,1), H5(I,1), H6(I,1), IH7, LIFE, RI, MONTH,
*           NYEAR
  WRITE(6,101)
  WRITE(6,102)
12 CONTINUE
C
C IMPROVEMENT CODING
C
  ICODE1 = C12(I,J)
  GO TO ( 14, 15, 16, 17 ), ICODE1
14 CONTINUE
  ICODE2 = C13(I,J)
  GO TO ( 18, 19, 19, 19 ), ICODE2
18 ICODE3=C20(I,J)
  ICODE4 = 0
  GO TO 22
19 ICODE3 = 0
  ICODE4 = 0
  GO TO 22
15 CONTINUE
  ICODE2 = C18(I,J)
  ICODE3 = C20(I,J)
  GO TO ( 20, 21, 20, 20 ), ICODE2
20 ICODE4 = 0
  GO TO 22
21 ICODE4 = C21(I,J)
  GO TO 22
16 CONTINUE
  ICODE2=C18(I,J)
  ICODE3 = 0
  ICODE4 = 0
  GO TO 22
17 ICODE2=0
  ICODE3=0
  ICODE4=0
22 CONTINUE
  IC1(I,J) = ICODE1
  IC2(I,J) = ICODE2
  IC3(I,J) = ICODE3
  IC4(I,J) = ICODE4
  IF ( H6(I,1) .EQ. 1 ) GO TO 24
  IF ( H18(I,1) .EQ. 0.0 ) H18(I,1) = H17(I,1) - ( H24(I,1)/5280.)
  GO TO 25
24 IF ( H18(I,1) .EQ. 0.0 ) H18(I,1) = H17(I,1) + ( H24(I,1)/5280.)
25 UPMT(I,J) = UPAY
  PVAL(I,J) = PSUM
  IH16=H16(I,1)
  IF(LC1 .EQ. 1) GO TO 28
  IF(NH .EQ. 1 .AND. KEY .EQ. 0 .AND. LP1 .EQ. 1) GO TO 26
  IF(IGRP(M) .NE. IGRP(N) .AND. KEY .EQ. 0) GO TO 26

```

Figure A-44 Subroutine OUTPUT (3 of 6)

```

GO TO 28
26 CONTINUE
WRITE (6,103)
28 CONTINUE
IF ( H19(I,1) .EQ. 2 ) GO TO 40
H29(I,1)=0
H30(I,1)=0
40 CONTINUE
DO 50 L=1,NH
IF(C12(L,J) .NE. 4) GO TO 51
50 CONTINUE
IF(I .EQ. NH) GO TO 206
51 CONTINUE
IF(MES .EQ. 30) GO TO 202
DO 200 IN = 1,NMES
IF ( MES .EQ. IN ) GO TO 204
200 CONTINUE
IF ( IPRINT .EQ. 0 ) GO TO 203
IF ( IPRINT .EQ. 1 ) GO TO 201
IF(IPRINT .EQ. 2) GO TO 205
201 CONTINUE
IC7=C7(I,J)
M=J-1
WRITE (6,106) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J), SI2(I,J), IC7, PVAL(I,J),
* UPMT(I,J), CE(I,J)
LC1=LC1+1
RETURN
C
202 CONTINUE
IN=30
M=J-1
WRITE(6,107) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J), (MG(IN,IM),IM=1,20)
LC1=LC1+1
RETURN
C
C
203 CONTINUE
IC7=C7(I,J)
M=J-1
WRITE (6,108) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J), SI2(I,J), IC7, PVAL(I,J), UPMT(I,J)
LC1=LC1+1
RETURN
C
204 CONTINUE
M=J-1
C PRINT ***** ON ERROR MSG
IF( SI1(I,1).LT.0.1 ) SI1(I,1)=99999.9
WRITE (6,109) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J), IN
LC1=LC1+1
IF(I .EQ. NH) WRITE(6,103)

```

Figure A-44 Subroutine OUTPUT (4 of 6)

```

RETURN
C
205 CONTINUE
  IC7=C7(I,J)
  M=J-1
  WRITE (6,112) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J), SI2(I,J), IC7, PVAL(I,J), UPMT(I,J)
  LC1=LC1+1
  RETURN
C
206 CONTINUE
  M=J-1
  WRITE(6,113) H1(I,1), H11(I,1), H12(I,1), H29(I,1), H30(I,1),
* SI1(I,1), H13(I,1), H16(I,1), H17(I,1), H18(I,1), M, IC1(I,J),
* IC2(I,J), IC3(I,J), IC4(I,J)
  LC1 = LC1+1
  RETURN
C
210 CONTINUE
  WRITE ( 6,110 ) (MG(MES,IM), IM=1,20 )
  RETURN
C
C
C  FORMAT STATEMENTS
C
99 FORMAT(1H1, //,T46, 'A COST-EFFECTIVENESS PRIORITY APPROACH'
*,/,T64, 'FOR',/,T41, 'ROADSIDE SAFETY IMPROVEMENT PROGRAMS ON FREE
*WAYS',///,T60, 'AUGUST 1973',//,T25, 'RESEARCH SPONSOR AGENCIES--
*TEXAS HIGHWAY DEPARTMENT (PROJECT 011)',/, T53, 'FEDERAL HIGHWAY A
*DMINISTRATION (PROJECT 1-12)', //,T41, 'PROJECT MANAGERS
*-- MR. PAUL TUTT,P.E.', /, T60, 'MR. ED SMITH,P.E.',
* /, T60, 'MR. ED KRISTAPONIS,P.E. (FHWA)', //,T25, 'RESEAR
*CH CONDUCTED BY-- TEXAS TRANSPORTATION INSTITUTE (PROJECT 2011)',
* / )
98 FORMAT(T35, 'PRINCIPAL INVESTIGATOR-- DR. DONALD WOODS,P.E.'/,
* T41, 'STUDY SUPERVISOR-- MR. GRAEME WEAVER,P.E.',
* /, T35, 'COMPUTER PROGRAM LOGIC-- DR. EDWARD POST,P.E.',//,
* T37, 'COMPUTER PROGRAMMERS-- MR. SHING-TAK CHEUNG (C.E. GRADUATE
*STUDENT)',/,T60, 'MR. CHARLES HETHCOAT (C.E. GRADUATE STUDENT)',/,
* T60, 'MR. RICHARD PETERSON (C.E. GRADUATE STUDENT)',/)
97 FORMAT( T25, 'COMPUTER FACILITIES AND PROGRAM', //, T35, 'LOCATION
*-- TEXAS A&M UNIVERSITY', /, T35, 'TYPE-- IBM 360/65',
* /, T35, 'CORE REQUIRED-- 380K (OS WATFIV)',
* /, T35, 'COMPILE TIME (APPROX)',
* T59, '= 0.5 MINUTES',
* /, T35, 'EXECUTION TIME (APPROX)', T59,
* '= 0.01 MINUTES/HAZARD',
* /, T35, 'NUMBER OF SUBROUTINES', T59, '= 37' )
C
100 FORMAT( 1H1, T50, 'C O S T E F F E C T I V E N E S S P R O G
* R A M', //, T64, 'TYPE HIGHWAY =', T79, 13A4, /, T54,
* 'HIGHWAY CLASSIFICATION =', T79, 13A4,//,
* T65, 'HIGHWAY NO =', I5, /, T66, 'COUNTY NO =', I5,
*/,T64, 'DISTRICT NO =', I5, /, T65, 'CONTROL NO =', I5, /,
* T65, 'SECTION NO =', I5, //, T56, 'RECORDING DIRECTION =', I5,
* /, T65, 'ADT (1000) =', I5, /, T71, 'LIFE =', I5, '(YRS)',
* /,T67, 'INTEREST =', F5.1, '(PERCENT)',/,T71, 'DATE =', I3,
* T81, '- ', T82, I2, / )

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Figure A-44 Subroutine OUTPUT (5 of 6)

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101 FORMAT ( T26, 'H A Z A R D', T82, 'I M P R O V
* E M E N T' // T2, 'HAZARD', T10, 'IDENT', T17, 'DESC',
* T26, 'END', T33, 'SEVERITY', T43, 'OFFSET', T51, 'GROUP', T59,
* 'MILE-POINT', T78, 'IMPR', T84, 'IMPR', T90, 'SEVERITY', T100,
* 'FIRST', T107, 'PRESENT', T116, 'ANNUAL', T126, 'COST' )
C
102 FORMAT ( T4, 'NO', T11, 'CODE', T17, 'CODE', T23, 'TREATMENT',
* T34, 'INDEX', T44, 'CODE', T52, 'NC', T59, 'BEG', T67, 'END',
* T79, 'ALT', T84, 'CODE', T91, 'INDEX', T101, 'COST', T108,
* 'WORTH', T117, 'COST', T124, 'EFFECTIVE' / T23, 'BEG', T29,
* 'END', T126, 'VALUE' /, T101, '($)', T109, '($)', T116, '($/YR)'
* , / )
C
103 FORMAT( / )
C
106 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, F4.1, T99, I6, T107, I7, T116, I6,
* T124, I9, / )
C
107 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, I10A4, /, T92, I10A4, / )
C
108 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, F4.1, T99, I6, T107, I7, T116, I6,
* T126, 'GRCUP' )
C
109 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, '*****ERROR***** SEE ERROR MESSAGE NO.
* ', I2 )
C
110 FORMAT( ///, T50, I20A4, /// )
C
112 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, F4.1, T99, I6, T107, I7, T116, I6,
* T124, 'END GROUP', / )
C
113 FORMAT ( T3, I4, T11, I2, T18, I2, T24, I1, T30, I1, T35, F5.1,
* T45, I1, T51, I4, T57, F7.3, T65, F7.3, T80, I1, T83, I1, '-',
* I1, '-', I1, '-', I1, T92, '*****NO IMPROVEMENTS RECOMMENDED*****
* ', / )
C
END

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Figure A-44 Subroutine OUTPUT (6 of 6)