PROGRAM DESCRIPTION I

Program Title ROCK RIPRAP GRADATION FOR STREAM CHANNEL STABILIZATION

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Address

City **State/Country** **Zip Code**

Program Description, Equations, Variables

Using the procedures from Far West States-Engineering Design Standards, this method calculates the gradation of rock riprap needed for protection of channel banks and bottoms. For bank protection, user must input values for curves, channel width, side slopes to be used. Gradation information used in calculating the required range of rock sizes comes from Bureau of Rec., and Corps of Engineers recommendations.

Necessary Accessories Printer

Operating Limits and Warnings Calculator in User Mode

Reference(s)

USER INSTRUCTIONS

SIZE: (HP-41C)

STEP	INSTRUCTIONS	INPUT	FUNCTION	DISPLAY
1	XEQ "ROCK2"			SP. WT. FL=
2	Specific Weight of Fluid Usually62.4		R/S	H2O DEPTH=
3	Water depth in Channel, feet		R/S	Chan Slope =
4	Slope of channel, feet		R/S	ROCK Z =
5	Horizontal component of bank slope Calculates and prints K-value		R/S	CURVE RADIUS=
6	Radius of curve of channel, feet		R/S	WAT SUR WID =
7	Width of water surface, feet Calculates and prints, C-value		R/S	
8	If user wants to find riprap of Bank Protection, Press A If user wants to find riprap for channel bottom protection, Press B (BE SURE CALCULATOR IS IN USER MODE)			
9	Calculates and prints D75 rock size			SAFE FACT =
10	Input Desired Safety Factor		R/S	D75 DESIGN =
11	Input Desired D75 for Design Calc. Calculates envelope curve for gradation of the Rock Riprap.		R/S	

PROGRAM DESCRIPTION II

Sample Problem (Sketch if Desired)

Given Stream Channel Data at location needing protection::

Design Water Depth = 6.0 feet; Channel slope = 0.0040 ft/ft; Curve radius = 600 feet; Water Surface Width = 70 feet; Slope of bank = 2:1; Specific gravity of water = 62.4 #/cu.ft.

Find:

Required rock riprap gradation for protection of both bank and channel bottom.

SOLUTION:

ROCK RIPRAP DESIGN - FAR WEST STATES DESIGN STDS

SP WT FL=62.4
H2O DEPTH=6.0
CHAN SLOPE=0.0040
ROCK Z =2.00
CONSTANT K=0.72
CURVE RADIUS=600.
WAT SUR WID=70.
RATIO CR:WSW=8.57
CONSTANT C=0.75

BANK ROCK
ROCK D75=9.71
SAFE FACT=1.25
NEW ROCK D75=12.1

D75 DESIGN=12.0

GRADATION
D100 MAX=24.0
D100 MIN=16.0
D75 MAX=20.0
D75 MIN=12.0
D50 MAX=14.0
D50 MIN=8.0
D25 MAX=9.2
D25 MIN=4.0
D0 MAX =4.0

BOTTOM ROCK
ROCK D75=5.0
SAFE FACT=1.3
NEW ROCK D75=6.2

D75 DESIGN=6.5

GRADATION
D100 MAX=13.0
D100 MIN=8.7
D75 MAX=10.8
D75 MIN=6.5
D50 MAX=7.6
D50 MIN=4.3
D25 MAX=5.0
D25 MIN=2.2
D0 MAX =2.2

Comments

PROGRAM LISTING

☐ 67 ☐ 97 ☐ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
	01♦LBL "ROCK2"		
	02 SF 12		
	03 "ROCK RIPRAP"		
	04 AVIEW		
	05 "DESIGN - FAR"		
	06 AVIEW		
	07 "WEST STATES"		
	08 AVIEW		
	09 "DESIGN STDS"		
	10 AVIEW		
	11 CF 12		
	12 CLRG		
	13 ADV		
	14 FIX 1		
	15 "SP WT FL="		
	16 PROMPT		
	17 STO 00		
	18 XEQ 01		
	19 "H2O DEPTH="		
	20 PROMPT		
	21 STO 01		
	22 XEQ 01		
	23 FIX 4		
	24 "CHAN SLOPE="		
	25 PROMPT		
	26 STO 02		
	27 XEQ 01		
	28 FIX 2		
	29 "ROCK Z ="		
	30 PROMPT		
	31 STO 10		
	32 XEQ 01		
	33 RCL 10		
	34 1.63		
	35 X<=Y?		
	36 GTO 05		
	37 .5		
	38 STO 09		
	39 GTO 09		
	40♦LBL 05		
	41 RCL 10		
	42 1.87		
	43 X<=Y?		
	44 GTO 06		
	45 .63		
	46 STO 09		
	47 GTO 09		
	48♦LBL 06		
	49 RCL 10		
	50 2.26		
	51 X<=Y?		
	52 GTO 07		
	53 .72		
	54 STO 09		
	55 GTO 09		
	56♦LBL 07		
	57 RCL 10		
	58 2.76		
	59 X<=Y?		
	60 GTO 08		
	61 .8		
	62 STO 09		
	63 GTO 09		
	64♦LBL 08		
	65 RCL 10		
	66 .87		
	67 STO 09		
	68 GTO 09		
	69♦LBL 09		
	70 "CONSTANT K="		
	71 RCL 09		
	72 STO 03		
	73 XEQ 01		
	74 FIX 0		
	75 "CURVE RADIUS="		
	76 PROMPT		
	77 STO 04		
	78 XEQ 01		
	79 "WAT SUR WID="		
	80 PROMPT		
	81 XEQ 01		
	82 RCL 04		
	83 /		
	84 1/X		
	85 FIX 2		
	86 "RATIO CR:WSW="		
	87 STO 11		
	88 XEQ 01		
	89 RCL 11		
	90 6.1		
	91 X<=Y?		
	92 GTO 02		
	93 0.6		
	94 STO 12		
	95 GTO 10		
	96♦LBL 02		
	97 RCL 11		
	98 9.1		
	99 X<=Y?		
	100 GTO 03		
	101 .75		
	102 STO 12		
	103 GTO 10		
	104♦LBL 03		
	105 RCL 11		
	106 12.1		
	107 X<=Y?		
	108 GTO 04		
	109 .9		
	110 STO 12		
	111 GTO 10		
	112♦LBL 04		
	113 RCL 11		
	114 1		
	115 STO 12		
	116 GTO 10		
	117♦LBL 10		
	118 "CONSTANT C="		
	119 RCL 12		
	120 STO 06		
	121 XEQ 01		
	122 STOP		
	123♦LBL A		
	124 ADV		
	125 SF 12		
	126 "BANK ROCK"		
	127 PRA		
	128 CF 12		
	129 RCL 00		
	130 3.5		
	131 *		
	132 RCL 01		
	133 *		
	134 RCL 02		
	135 *		
	136 RCL 03		
	137 /		
	138 RCL 06		
	139 /		
	140 STO 07		
	141 "ROCK D75="		
	142 XEQ 01		
	143 "SAFE FACT="		
	144 PROMPT		
	145 XEQ 01		
	146 RCL 07		
	147 *		
	148 STO 05		
	149 FIX 1		
	150 "NEW ROCK D75="		
	151 XEQ 01		
	152 GTO C		
	153♦LBL B		
	154 ADV		
	155 SF 12		
	156 "BOTTOM ROCK"		
	157 PRA		
	158 CF 12		
	159 RCL 00		
	160 2.5		
	161 *		
	162 RCL 01		
	163 *		
	164 RCL 02		
	165 *		
	166 RCL 06		
	167 /		
	168 STO 13		
	169 "ROCK D75="		
	170 XEQ 01		
	171 "SAFE FACT="		
	172 PROMPT		
	173 XEQ 01		
	174 RCL 13		
	175 *		
	176 STO 05		
	177 FIX 1		
	178 "NEW ROCK D75="		
	179 XEQ 01		
	180 GTO C		
	181♦LBL C		
	182 ADV		
	183 "D75 DESIGN="		
	184 PROMPT		
	185 STO 05		
	186 XEQ 01		
	187 ADV		
	188 SF 12		

Note: Refer to "HP-41C OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for specific information on keystrokes. The Function Index is found at the very back of the Handbook. Refer to Appendix E in 67 or 97 "OWNER'S HANDBOOK AND PROGRAMMING GUIDE" for exact keystrokes.

PROGRAM LISTING

☐ 67 ☐ 97 ☐ 41C

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
	189 "GRADATION"		
	190 PRA		
	191 CF 12		
	192 RCL 05		
	193 1.5		
	194 /		
	195 STO 05		
	196 RCL 05		
	197 3		
	198 *		
	199 "D100 MAX="		
	200 XEQ 01		
	201 RCL 05		
	202 2.		
	203 *		
	204 "D100 MIN="		
	205 XEQ 01		
	206 RCL 05		
	207 2.5		
	208 *		
	209 "D75 MAX="		
	210 XEQ 01		
	211 RCL 05		
	212 1.5		
	213 *		
	214 "D75 MIN="		
	215 XEQ 01		
	216 RCL 05		
	217 1.75		
	218 *		
	219 "D50 MAX="		
	220 XEQ 01		
	221 RCL 05		
	222 "D50 MIN="		
	223 XEQ 01		
	224 RCL 05		
	225 1.15		
	226 *		
	227 "D25 MAX="		
	228 XEQ 01		
	229 RCL 05		
	230 .5		
	231 *		
	232 STO 08		
	233 "D25 MIN="		
	234 XEQ 01		
	235 RCL 08		
50			

STEP/ LINE	KEY ENTRY	KEY CODE (67/97 only)	COMMENTS
	236 "D0 MAX ="		
	237 XEQ 01		
	238 STOP		
	239*LBL 01		
	240 ARCL X		
	241 AVIEW		
	242 RTN		
	243 .END.		
70			
80			
90			
00			

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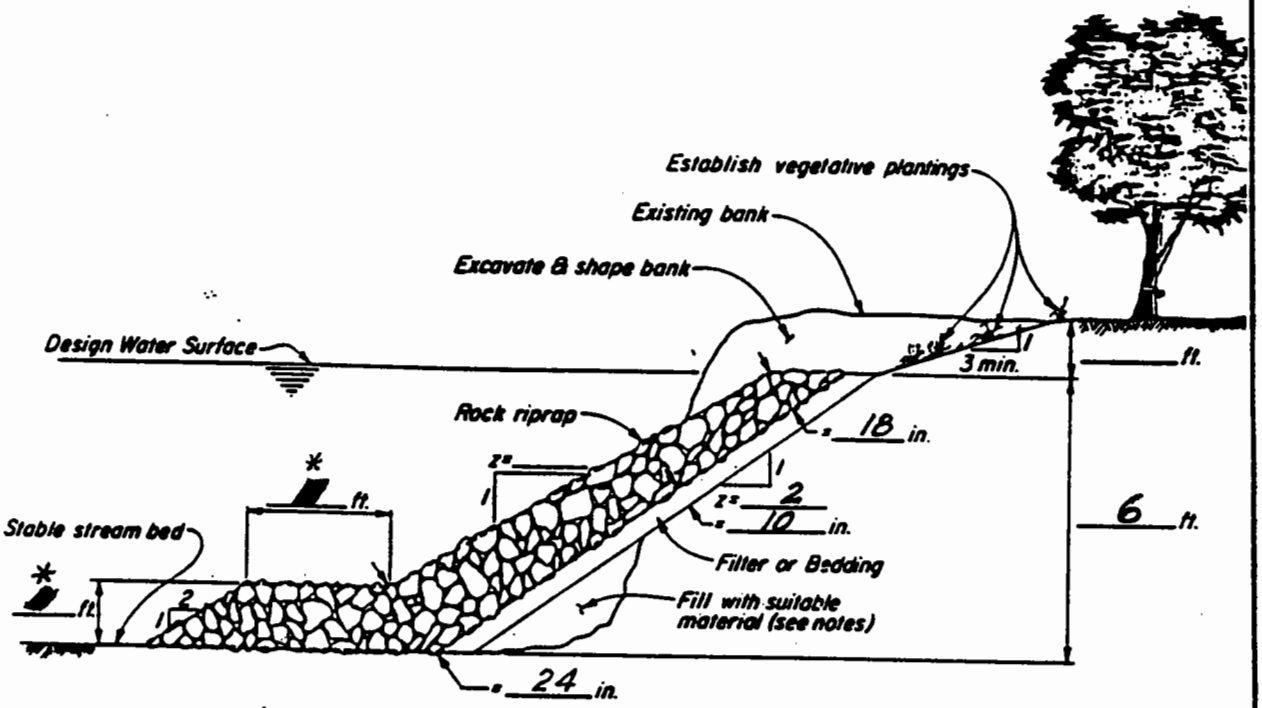
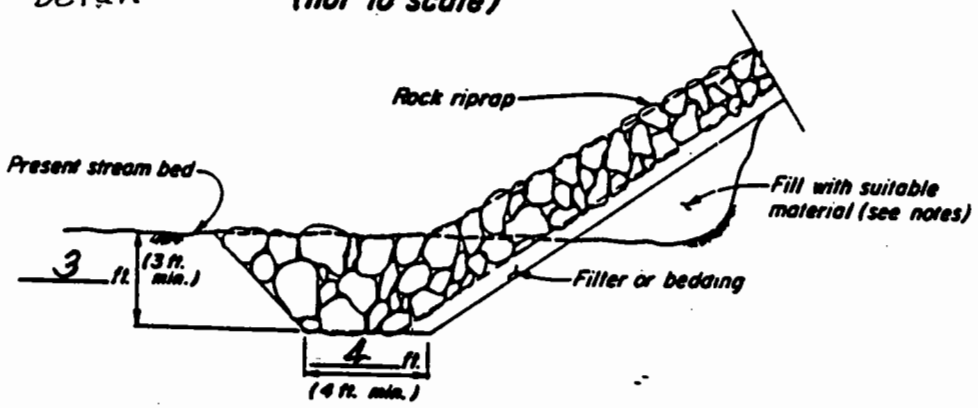


* See Alternate Detail

TYPICAL CROSS-SECTION
(not to scale)



ALTERNATE TOE CROSS-SECTION
(not to scale)

EXAMPLE PROBLEM

STREAM BANK STABILIZATION

TYPICAL ROCK RIPRAP

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Approved by
Drawn	Title
Traced	Title
Checked	Sheet No. of / Drawing No.

ROCK RIPRAP, FILTER OR BEDDING GRADATION

PROJECT EXAMPLE PROBLEM SCD _____

BY KDL DATE 11/20/91