डेडीकेटेड फ्रेट कोरीडोर

DESIGN AND CONSTRUCTION OF CIVIL, STRUCTURES AND TRACK WORKS, INVOLVING FORMATION IN EMBANKMENT /CUTTING, BALLAST ON FORMATION, TRACK WORKS, BRIDGES, STRUCTURES, BUILDINGS, YARDS & INTEGRATION WITH INDIAN RAILWAY'S EXISTING RAILWAY SYSTEM AND TESTING & COMMISSIONING ON DESIGN-BUILD LUMP SUM BASIS OF KHURJA-PILKHANI SECTION (APPROXIMATELY 222 ROUTE KM OF SINGLE LINE) OF EASTERN DEDICATED FREIGHT CORRIDOR

CIVIL, STRUCTURES AND TRACK WORKS

CONTRACT PACKAGE NO: 303

ICB No.: **HQ/EN/EC/D-B/Khurja-Pilkhani Section**

PART-4 – REFERENCE DOCUMENT

HYDRAULIC DATA – VOLUME 4

KHURJA TO PILKHANI

From Km. 1367.0 (ALJN-GZB) to Km 187.5 (SRE-UMB)

HYDRAULIC DATA

(MUZZAFARNAGAR DETOUR)

PART. 3/3

EMPLOYER: DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LTD
(A GOVERNMENT OF INDIA ENTERPRISE)
MINISTRY OF RAILWAYS

COUNTRY: **INDIA**

KHURJA - PILKHANI SECTION
HYDRAULIC DATA
MUZZAFARNAGAR DETOUR

Sr. No.	Bridge No	DFCC Chainage	Page No.	
			From	To
		Major Bridges		
1	D/MOZ 4	1980	1	7
2	D/MOZ 12	6550	8	14
3	D/MOZ 59	25880	15	20
4	D/MOZ 61	26285	21	25
5	D/MOZ 81	29985	26	30
6	D/MOZ 90	32300	31	35
7	D/MOZ 104	34600	36	40
		Minor Bridges		
8	D/MOZ 4B	2451.46	41	44
9	D/MOZ 17	8810	45	48
10	D/MOZ 18	9061.033	49	52
11	D/MOZ 19	9679.03	53	56
12	D/MOZ 20A	10001.21	57	60
13	D/MOZ 21	10204	61	64
14	D/MOZ 24	10988	65	68
15	D/MOZ 27	12991.395	69	72
16	D/MOZ 29	13783	73	76
17	D/MOZ 31A	14542.15	77	80
18	D/MOZ 31B	14940.55	81	84
19	D/MOZ 33A	16137.4	85	88
20	D/MOZ 34	16528	89	92
21	D/MOZ 38	18380	93	96
22	D/MOZ 39	18662	97	100
23	D/MOZ 40	18900	101	104
24	D/MOZ 42	19486	105	108
25	D/MOZ 44	20353.249	109	112
26	D/MOZ 46	20673.163	113	116
27	D/MOZ 48	20798.295	117	120
28	D/MOZ 49	21360	121	124
29	D/MOZ 51A	22588.95	125	128
30	D/MOZ 52A	23718.1	129	132
31	D/MOZ 54	23915	133	136
32	D/MOZ 58	25337.094	137	140
33	D/MOZ 60	26179.517	141	144
34	D/MOZ 62	26446.936	145	148
35	D/MOZ 63	26622.833	149	152
36	D/MOZ 64	26761.669	153	156
37	D/MOZ 66	27187.608	157	160
38	D/MOZ 67	27493	161	164
39	D/MOZ 69	27648.655	165	168
40	D/MOZ 70	27854	169	172
41	D/MOZ 72	28278	173	176
42	D/MOZ 73	28711.462	177	180
43	D/MOZ 75	29125	181	184
44	D/MOZ 76	29300	185	188
45	D/MOZ 79	29684	189	192
46	D/MOZ 83	30371.543	193	196
47	D/MOZ 85	30848	197	200
48	D/MOZ 86	31424	201	204
49	D/MOZ 87	31715	205	208
50	D/MOZ 89	31991.073	209	212
51	D/MOZ 91A	32584	213	216
52	D/MOZ 92	32620	217	220
53	D/MOZ 93	32875	221	224
54	D/MOZ 95	33025.486	225	228
55	D/MOZ 96	33305	229	232
56	D/MOZ 98	33734	233	236
57	D/MOZ 99	33990	237	240
58	D/MOZ 100	34254	241	244
59	D/MOZ 102	34305	245	248
60	D/MOZ 103	34524	249	252
61	D/MOZ 106	35262	253	256
62	D/MOZ 108	35707.15	257	260
63	D/MOZ 113	37208	261	264
64	D/MOZ 115	37680	265	268
65	D/MOZ 116	37826	269	272
66	D/MOZ 117	37937	273	276
67	D/MOZ 121	39260	277	280
68	D/MOZ 123	39896	281	284
69	D/MOZ 125	40100	285	288
70	D/MOZ 125A	40386	289	292
71	D/MOZ 127	40670	293	296
72	D/MOZ 129	41048.528	297	300

73	D/MOZ 130	41164	301	304
74	D/MOZ 131	41374	305	308
75	D/MOZ 133	41614	309	312
76	D/MOZ 134	41874	313	316

MAJOR BRIDGES

D/MOZ Br. N0. 4 CH 1/980.000

I. Physiographic Parameters:

1	Catchment area	A	=	285.080538	sq.km
2	Length of Longest stream from source to bridge site (L)	L	=	23.206	km
3	Bed Level	BL	=	234.74	m
4	Level at the farthest point:		=	251.00	m
5	Height of the farthest point along the point of interest along river	H	=	16.26	m
6	Observed HFL		=	236.67	m
7	Soil		=	Red soil/ clayey loam	
8	Sub zone		=	1(e)	
9	Proposed formation level		=	249.16	m

II Calculation of Equivalent Stream Slope (S)

Equivalent slope (S) = $L_i \times (D_{i-1}+D_i)/L^2$

S. No.	Distance (Km)	Reduced level (m)	Segment length (L_i)	Height above Datum (D_i)	$D_{i-1}+D_i$	$L_i \times (D_{i-1}+D_i)$
1	0.000	233.140	0.00	0.000	0.000	0
2	5.000	234.000	5.000	0.860	0.860	4.3
3	10.000	236.000	5.000	2.860	3.720	18.6
4	15.000	238.000	5.000	4.860	7.720	38.6
5	20.000	239.000	5.000	5.860	10.720	53.6
6	23.106	239.000	3.106	5.860	11.720	36.40232
	23.106					151.50232

Equivalent Slope S = 0.2837721 m/km

III Calculation of Synthetic Unit Hydrograph Parameters

(i)	Ratio of L/sqrt S	L/sqrt S	=	43.3750408	
(ii)	Peak Discharge of Unit Hydrograph per catchment area	q_p	=	$2.030/(L/\sqrt{S})^{0.649}$	
			=	0.175762955	cumec/sq.km
(xi)	Peak Discharge of Unit Hydrograph	Q_p	=	q_pXA	
			=	50.10659774	cumec
(iii)	Time from center of unit excess rainfall duration t peak of unit hydrograph	t_p	=	$1.858/q_p^{1.038}$	
	Round this value to nearer 0.5 value		=	11.3	hrs.
			=	12	
(iv)	Width of the 50% Discharge Ordinate of Unit Hydrograph	W_{50}	=	$2.217/q_p^{0.990}$	
			=	12.39617279	hrs.
(v)	Width of the 75% Discharge Ordinate of Unit Hydrograph	W_{75}	=	$1.477/q_p^{0.876}$	
			=	6.77	hrs.
(vi)	Width of rising side Discharge Ordinate of 50% Unit Hydrograph	W_{R50}	=	$0.812/q_p^{0.907}$	
			=	3.9301301	hrs.
(vii)	Width of rising side Discharge Ordinate of 75% Unit Hydrograph	W_{R75}	=	$0.606/q_p^{0.791}$	
			=	2.397370153	hrs.
(viii)	Base width of the Unit Hydrograph	T_B	=	$7.744Xt_p^{0.779}$	
			=	53.65961285	hrs.
			=	54	hrs.
(ix)	Unit Duration of Unit Hydrograph	T_r	=	2.0 hrs.	
(x)	Time to start of rise to the peak of Unit Hydrograph	T_m	=	$t_p + t_r/2$	
			=	13	hrs.

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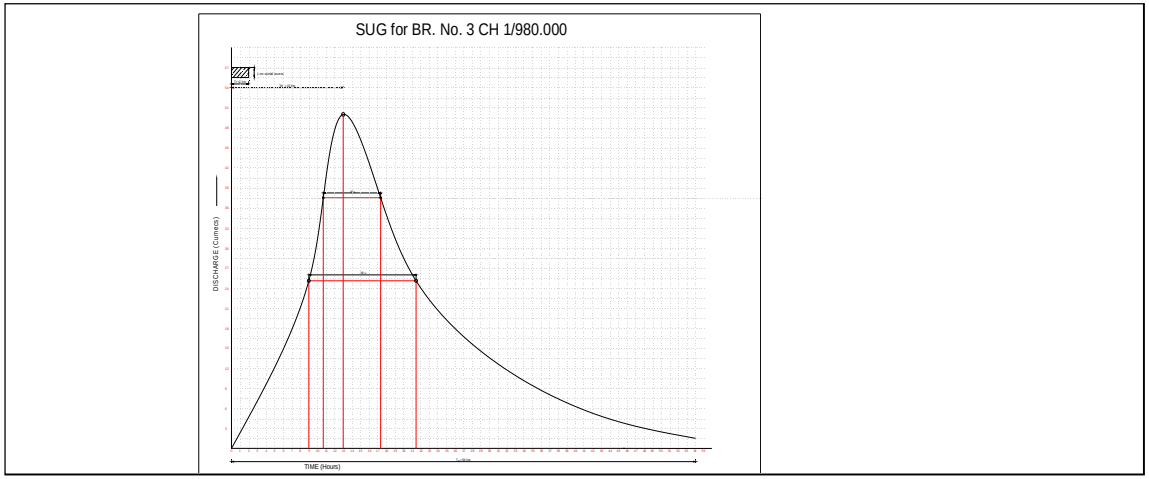
The Plotted papers were joined to draw synthetic unit hydrograph



The summation of Discharge Ordinates of Unit Hydrograph of 1hr interval
Theoretically equal to

$Q = (A \times d)/(0.36 \times t_r)$ where A = Catchment area

d = 1.0cm Depth

Theoretical Discharge t_r = 1.0 hrs. Q = 395.95 m^3/s

Revise the ordinates of Hydrograph equal to theoretical Discharge

IV. Estimation of Design Storm — Refer Flood Estimation Report for 1e sub zone

(a) Design Storm Duration

The Design Storm Duration $T_D = 1.1xt_p$ T_D = 13.2 hrs.
= 14.0 hrs.

(b) Estimation of point rainfall and Areal Rainfall for Storm Duration

R_{50} 24 hour point rainfall	(Refer Plate 9 of FER-Subzone-1(e))	=	250	mm
Conversion factor	(Refer Fig. 10 of FER- Subzone- 1(e))	=	0.85	
R_{50} 14 hour point rainfall		=	212.5	mm
Areal Reduction Factor for 285.0805 Sq. km catchment area		=	0.885	
R_{50} hour Areal rainfall		=	188.0625	mm

This 50 year design storm hour areal rainfall has been split in to 1-hour rainfall increments using time distribution coefficients given in Table-A-2 or fig- 12b of F.E.R-1(e)

Duration (hr)	Coefficient	Storm Rainfall (mm)	Rainfall Increment (mm)	Loss Rate/Hr (mm/hr)	2 hrs Effective Hourly Rainfall (cm)
2	0.46	86.51	86.51	3.0	8.050875
4	0.57	107.19563	20.69	3.0	1.4686875
6	0.68	127.8825	20.69	3.0	1.4686875
8	0.74	139.16625	11.28	3.0	0.528375
10	0.79	148.56938	9.40	3.0	0.3403125
12	0.84	157.9725	9.40	3.0	0.3403125
14	0.88	165.495	7.52	3.0	0.15225
16	0.90	169.25625	3.76	3.0	-0.223875
18	0.93	174.89813	5.64	3.0	-0.0358125
20	0.95	178.65938	3.76	3.0	-0.223875
22	0.98	184.30125	5.64	3.0	-0.0358125
24	1.0	188.0625	3.76	3.0	-0.223875

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Base Flow for the Catchment area = 0.045XA = 12.82862421 m^3/s

V. Estimation of Peak Discharge

For estimation of peak discharge, effective rainfall increments were arranged against ordinates in descending order. Sum of product of U.G ordinates and gives total direct surface run off and base flow gives total Peak Discharge

	Time (hours)	S.U.G Ordinates (m^3/s)	2-hr Ef. Rainfall (cm)	Direct Runoff (m^3/s)
	13	50.10	8.050875	403.34884
	15	46.50	1.4686875	68.293969
	11	39.80	1.4686875	58.453763
	17	39.20	0.528375	20.7123
	19	35.60	0.3403125	12.115125
	9	25.00	0.3403125	8.5078125
	21	25.50	0.15225	3.882375
TOTAL				575.31418

Peak Discharge = Direct surface runoff + base flow = 588.1428055 m^3/s

VIII Water way Calculation

1	Design discharge ass per synthetic Unit Hydrograph method	Q	=	588.14281	m^3/s
2	Velocity (Calculated from equivalent slope)	V	=	1.60	m/s
3	Required area of water way	A	=	367.58925	m^2
4	Proposed linear water way		=	122	m
5	Required Depth of water way		=	3.0130267	m
	Area of water way/ Proposed Linear water way				
	Observed HFL		=	236.67	m
6	Designed HFL		=	238.75	m
7	Required Vertical Clearance		=	1.0	m
	Provide Vertical Clearance		=	1.0	m
9	Minimum Free board Required		=	0.75	m
	Free board provided		=	1.0	m
10	formation level		=	249.16	m

Min. Formation Required =		B.L	+	Ht of water	+ Vertical Clearance	
	=	234.74		+3.013	+1.000	
	=	238.751	m			

Provided Formation Level is O.K.

Velocity for MOZ Br. NO 4

b	=	122		HFL	bed level
depth	=	1.932		236.67	234.74
A	=	235.704			
P	=	125.864			
R	=	1.872688			
RL of farthest point	=	251.00			
RL of point of interest	=	234.738			
Difference	=	16.26			
Length of Stream	=	23206			
slope	=	0.000701		1427.008	
n	=	0.025			
v	=	1.608757	m/s		
v	=	1.60	m/s		

D/MOZ Br. N0. 12 CH 6/550.000

I. Physiographic Parameters:

1	Catchment area	A	=	464.376042	sq.km
2	Length of Longest stream from source to bridge site (L)	L	=	87.949	km
3	Bed Level	BL	=	233.14	m
4	Level at the farthest point:	FL	=	270.00	m
5	Height of the farthest point along the point of interest along river	H	=	36.86	m
6	Observed HFL		=	238.22	m
7	Soil		=	Red soil/ clayey loam	
8	Sub zone		=	1(e)	
9	Proposed formation level		=	249.16	m

II Calculation of Equivalent Stream Slope (S)

Equivalent slope (S) = $\sum L_i \times (D_{i-1}+D_i)/L^2$

S. No.	Distance (Km)	Reduced level (m)	Segment length (L_i)	Height above Datum (D_i)	$D_{i-1}+D_i$	$L_i \times (D_{i-1}+D_i)$
1	0.000	233.140	0.00	0.000	0.000	0
2	5.000	234.000	5.000	0.860	0.860	4.3
3	10.000	236.000	5.000	2.860	3.720	18.6
4	15.000	238.000	5.000	4.860	7.720	38.6
5	20.000	239.000	5.000	5.860	10.720	53.6
6	25.000	239.000	5.000	5.860	11.720	58.6
7	30.000	240.000	5.000	6.860	12.720	63.6
8	35.000	242.000	5.000	8.860	15.720	78.6
9	40.000	244.000	5.000	10.860	19.720	98.6
10	45.000	244.000	5.000	10.860	21.720	108.6
11	50.000	246.000	5.000	12.860	23.720	118.6
12	55.000	247.000	5.000	13.860	26.720	133.6
13	60.000	248.000	5.000	14.860	28.720	143.6
14	65.000	253.000	5.000	19.860	34.720	173.6
15	70.000	255.000	5.000	21.860	41.720	208.6
16	75.000	257.000	5.000	23.860	45.720	228.6
17	80.000	261.000	5.000	27.860	51.720	258.6
18	85.000	265.000	5.000	31.860	59.720	298.6
19	87.949	270.000	2.949	36.860	68.720	202.65528
	87.949					2289.55528

Equivalent Slope S = 0.295998372 m/km

III Calculation of Synthetic Unit Hydrograph Parameters

(i)	Ratio of L/sqrt S	L/sqrt S	=	161.6539216	
(ii)	Peak Discharge of Unit Hydrograph per catchment area	q_p	=	$2.030/(L/\sqrt{S})^{0.649}$	
			=	0.1	cumec/sq.km
(xi)	Peak Discharge of Unit Hydrograph	Q_p	=	q_pXA	
			=	46.43	cumec
(iii)	Time from center of unit excess rainfall duration t peak of unit hydrograph	t_p	=	$1.858/q_p^{1.038}$	
	Round this value to nearer 0.5 value		=	21.0	hrs.
(iv)	Width of the 50% Discharge Ordinate of Unit Hydrograph	W_{50}	=	$2.217/q_p^{0.990}$	
			=	21.66	hrs.
(v)	Width of the 75% Discharge Ordinate of Unit Hydrograph	W_{75}	=	$1.477/q_p^{0.876}$	
			=	11.10	hrs.
(vi)	Width of rising side Discharge Ordinate of 50% Unit Hydrograph	W_{R50}	=	$0.812/q_p^{0.907}$	
			=	6.55	hrs.
(vii)	Width of rising side Discharge Ordinate of 75% Unit Hydrograph	W_{R75}	=	$0.606/q_p^{0.791}$	
			=	3.74	hrs.
(viii)	Base width of the Unit Hydrograph	T_B	=	$7.744Xt_p^{0.779}$	
			=	80	hrs.
(ix)	Unit Duration of Unit Hydrograph	T_r	=	2.0 hrs.	
(x)	Time to start of rise to the peak of Unit Hydrograph	T_m	=	$t_p + t_r/2$	
			=	22	hrs.

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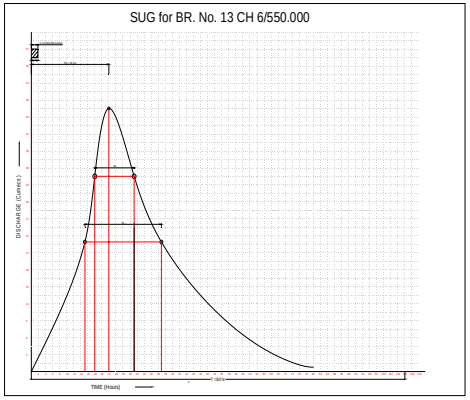
The Plotted papers were joined to draw synthetic unit hydrograph



The summation of Discharge Ordinates of Unit Hydrograph of 1hr interval
Theoretically equal to

$Q = (A \times d)/(0.36 t_r)$	where	A	=	Catchment area				
		d	=	1.0cm Depth				
Theoretical Discharge		t_r	=	1.0 hrs.	Q	=	645.10	m^3/s

Revise the ordinates of Hydrograph equal to theoretical Discharge

IV. Estimation of Design Storm — Refer Flood Estimation Report for 1e sub zone

(a) Design Storm Duration

The Design Storm Duration $T_D = 1.1 x t_p$ T_D = 23.0 hrs.

(b) Estimation of point rainfall and Areal Rainfall for Storm Duration

R_{50} 24 hour point rainfall (Refer Plate 9 of FER-Subzone-1(e)) = 250 mm

Conversion factor (Refer Fig. 10 of FER- Subzone- 1(e)) = 0.987

R_{50} 23 hour point rainfall b = 246.75 mm

Areal Reduction Factor for 464.376 Sq. km catchment area = 0.87

R_{50} hour Areal rainfall = 214 mm

This 50 year design storm hour areal rainfall has been split in to 1-hour rainfall increments using time distribution coefficients given in Table-A-2 or fig- 12b of F.E.R-1(e)

Duration (hr)	Coefficient	Storm Rainfall (mm)	Rainfall Increment (mm)	Loss Rate/Hr (mm/hr)	2 hrs Effective Hourly Rainfall (cm)
2	0.43	92.02	92.02	3.0	8.602
4	0.58	124.12	32.10	3.0	2.61
6	0.68	145.52	21.40	3.0	1.54
8	0.71	151.94	6.42	3.0	0.042
10	0.78	166.92	14.98	3.0	0.898
12	0.84	179.76	12.84	3.0	0.684
14	0.88	188.32	8.56	3.0	0.256
16	0.90	192.6	4.28	3.0	-0.172
18	0.93	199.02	6.42	3.0	0.042
20	0.95	203.3	4.28	3.0	-0.172
22	0.98	209.72	6.42	3.0	0.042
24	1.0	214	4.28	3.0	-0.172

Base Flow for the Catchment area = 0.045XA = 20.89692189 m^3/s

V. Estimation of Peak Discharge

For estimation of peak discharge, effective rainfall increments were arranged against ordinates in descending order. Sum of product of U.G ordinates and gives total direct surface run off and base flow gives total Peak Discharge

	Time (hours)	S.U.G Ordinates (m^3/s)	2-hr Ef. Rainfall (cm)	Direct Runoff (m^3/s)
	22	46.43	8.602	399.39086
	24	45.06	2.61	117.6066
	20	43.10	1.54	66.374
	26	41.16	0.042	1.72872
	28	37.24	0.898	33.44152
	30	33.12	0.684	22.65408
	32	29.24	0.256	7.48544
	34	26.30	0.042	1.1046
TOTAL				649.78582

Peak Discharge = Direct surface runoff + base flow = 670.682742 m^3/s

VIII Water way Calculation

1	Design discharge ass per synthetic Unit Hydrograph method	Q	=	670.6827419	m^3/s
2	Velocity	V	=	2.65	m/s
	(Calculated from equivalent slope)				
3	Required area of water way	A	=	253.0878271	m^2
4	Proposed linear water way		=	45	m
5	Required Depth of water way =		=	5.624173936	m
	Area of water way/ Proposed Linear water way				
	Observed HFL		=	238.22	m
6	Designed HFL		=	239.77	m
7	Required Vertical Clearance		=	1.0	m
	Provide Vertical Clearance		=	1.5	m
9	Minimum Free board Required		=	1.0	m
	Free board provided		=	1.0	m
10	formation level		=	249.16	m

Min. Formation Required =		B.L	+	Ht of water		+ Vertical Clearance
	=	233.14			+5.624	+1.500
	=	240.267	m			

Provided formation Level is O.K.

Velocity for MOZ Br. No. 12

b	=	45		HFL	bed level
depth	=	5.077		238.22	233.14
A	=	228.465			
P	=	55.154			
R	=	4.142311			
RL of farthest point	=	270.00			
RL of point of interest	=	233.143			
Difference	=	36.857			
Length of Stream	=	87949			
slope	=	0.000419		2386.222	
n	=	0.025			
v	=	2.112028	m/s		
v	=	2.12	m/s		

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/59 CH NO. 25/880.000

Catchment Area	3.687724	sq.km
Length of longest stream (L) (km)	17.156	
Height of furthest point (m)	251	
Height of point of intersection (m)	245.762	
Height Difference (H) (m)	5.82	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	248.381	
Observed H.F.L	247.984	
Proposed Formation Level	251.582	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/59 CH NO. 25/880.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

10.3210093 hr

10.3210093 hr *60

619.2605577 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/59 CH NO. 25/880.000

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/59 CH NO. 25/880.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**9.107636406**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/59 CH NO. 25/880.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **6.860674839 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **6.860674839** cum/sec

b Avg.Waterway Required = Q/V (V=1.10)

6.236977126 Sq.m

c Proposed opening 1X12.2

d Height of water = Avg. Waterway/total width

0.511227633 m

Min. Formation Required		B.L	+	Ht of water	+	free Board
		245.762	+	0.511227633		+0.7500
		247.023	**m**			
Proposed Formation Level		251.582	m			

Provided Formation Level is O.K.

Velocity for MOZ 59 Ch 25/880

b	=	12.2		HFL	bed level
depth	=	2.222		247.984	245.762
A	=	27.1084			
P	=	16.644			
R	=	1.628719			
RL of farthest point	=	251			
RL of point of interest	=	245.762			
Difference	=	5.238			
Length of Stream	=	17156			
slope	=	0.000305		3275.296	
n	=	0.025			
v	=	0.967532	m/s		
say		1.10	m/s		

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/61CH NO. 26/285.000

Catchment Area	4.34436056	sq.km
Length of longest stream (L) (km)	2.221	
Height of furthest point (m)	251	
Height of point of intersection (m)	247.119	
Height Difference (H) (m)	6.485	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.059	
Observed H.F.L	249.724	
Proposed Formation Level	253.604	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/61CH NO. 26/285.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

1.198296233 hr

1.198296233 hr *60

71.89777398 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/61CH NO. 26/285.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**78.44470959**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/61CH NO. 26/285.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **69.61330678 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **69.61330678** cum/sec

b Avg.Waterway Required = Q/V (V=2.03)

34.29226935 Sq.m

c Proposed opening 1X18.3

d Height of water = Avg. Waterway/total width

1.8738945 m

Min. Formation Required

B.L + Ht of water + free Board

247.119 1.8738945 +0.7500

249.742 m

Proposed Formation Level 253.604 m

Provided formation Level is O.K.

Velocity for MOZ 61 Ch 26/285

b	=	18.3		HFL	bed level
depth	=	2.605		249.724	247.119
A	=	47.67882			
P	=	23.5108			
R	=	2.027954			
RL of farthest point	=	251			
RL of point of interest	=	247.1186			
Difference	=	3.8814			
Length of Stream	=	2221			
slope	=	0.001748		572.2162	
n	=	0.033			
v	=	2.029604	m/s		

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/81CH NO. 29/985.000

Catchment Area	9.94962073	sq.km
Length of longest stream (L) (km)	11.110	
Height of furthest point (m)	253	
Height of point of intersection (m)	248.4872	
Height Difference (H) (m)	7.5585	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	250.744	
Observed H.F.L	251.325	
Proposed Formation Level	256.046	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/81CH NO. 29/985.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

6.015251125 hr

6.015251125 hr *60

360.9150675 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/81CH NO. 29/985.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 15.62694525 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/81CH NO. 29/985.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **31.76020954 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **31.76020954** cum/sec

b Avg.Waterway Required = Q/V (V=1.10)

28.87291776 Sq.m

c Proposed opening 1X12.2

d Height of water = Avg. Waterway/total width

2.366632604 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
248.4872		2.366632604		+0.7500

251.604 m

Proposed Formation Level 256.046 m

Provided formation Level is O.K.

Velocity for MOZ 81 Ch 29/985

b	=	12.2		HFL	bed level
depth	=	2.838		251.325	248.487
A	=	34.61872			
P	=	17.8752			
R	=	1.93669			
RL of farthest point	=	253			
RL of point of interest	=	248.4872			
Difference	=	4.5128			
Length of Stream	=	11110			
slope	=	0.000406		2461.886	
n	=	0.03			
v	=	1.043802	m/s		

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/90CH NO. 32/300.000

Catchment Area	1.3132027	sq.km
Length of longest stream (L) (km)	1.21264	
Height of furthest point (m)	254	
Height of point of intersection (m)	252.347	
Height Difference (H) (m)	7.569	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.1735	
Observed H.F.L	254.846	
Proposed Formation Level	259.916	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/90CH NO. 32/300.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.607287332 hr

0.607287332 hr *60

36.4372399 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/90CH NO. 32/300.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**154.7866967**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/90CH NO. 32/300.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **41.52103219 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **41.52103219** cum/sec

b Avg.Waterway Required = Q/V (V=1.80)

23.06724011 Sq.m

c Proposed opening 1X12.2

d Height of water = Avg. Waterway/total width

1.890757386 m

Min. Formation Required B.L + Ht of water + free Board

253.1735 1.890757386 +0.7500

255.814 m

Proposed Formation Level 259.916 m

Provided formation level is O.K.

Velocity for MOZ 90 Ch 32/300

b	=	12.2		HFL	bed level
depth	=	2.499		254.846	252.347
A	=	30.4878			
P	=	17.198			
R	=	1.772753			
RL of farthest point	=	254			
RL of point of interest	=	252.347			
Difference	=	1.653			
Length of Stream	=	1213			
slope	=	0.001363		733.8173	
n	=	0.03			
v	=	1.802396	m/s		

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ104 CH NO. 34/600.000

Catchment Area	22.657475	sq.km
Length of longest stream (L) (km)	12.546	
Height of furthest point (m)	259	
Height of point of intersection (m)	254.638	
Height Difference (H) (m)	5.768	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.819	
Observed H.F.L	257.024	
Proposed Formation Level	260.406	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ104 CH NO. 34/600.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

7.488576251 hr

7.488576251 hr *60

449.3145751 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ104 CH NO. 34/600.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**12.55245281**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ104 CH NO. 34/600.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **58.09554752 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **58.09554752** cum/sec

b Avg.Waterway Required = Q/V (V=1.50)

38.73036502 Sq.m

c Proposed opening 1X12.2

d Height of water = Avg. Waterway/total width

3.174620083 m

Min. Formation Required B.L + Ht of water + free Board

254.638 3.174620083 +0.7500

258.563 m

Proposed Formation Level 260.406 m

Provided formation Level is O.K.

Velocity for MOZ 104 Ch 34/600

b	=	12.2		HFL	bed level
depth	=	2.386		257.024	254.638
A	=	29.1092			
P	=	16.972			
R	=	1.715131			
RL of farthest poin	=	259			
L of point of intere	=	254.638			
Difference	=	4.362			
Length of Stream	=	14546			
slope	=	0.0003		3334.709	
n	=	0.025			
v	=	1.5015	m/s		

MINOR BRIDGES

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/4B CH NO. 2/451.460

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Catchment Area	0.055933733	sq.km
Length of longest stream (L) (km)	0.2667436	
Height of furthest point (m)	240.521	
Height of point of intersection (m)	240.137	
Height Difference (H) (m)	0.384	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	240.329	
Observed H.F.L	240.795	
Proposed Formation Level	247.444	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/4B CH NO. 2/451.460

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.354334162 hr

0.354334162 hr *60

21.26004975 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/4B CH NO. 2/451.460

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**265.286303**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/4B CH NO. 2/451.460

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.031037967 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.031037967** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.732021695 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.443351413 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
240.329		1.443351413		+0.5000

242.272 m

Proposed Formation Level 247.444 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/17 CH NO. 8/810.000

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Catchment Area	0.060950401	sq.km
Length of longest stream (L) (km)	0.3133568	
Height of furthest point (m)	239.4567	
Height of point of intersection (m)	239.1588	
Height Difference (H) (m)	0.2979	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	239.3078	
Observed H.F.L	239.7844	
Proposed Formation Level	244.9993	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/17 CH NO. 8/810.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.456926314 hr

0.456926314 hr *60

27.41557883 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/17 CH NO. 8/810.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**205.7224484**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/17 CH NO. 8/810.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.56130321 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.56130321** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.463601835 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.219668195 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
239.30775		1.219668195		+0.5000

241.027 m

Proposed Formation Level 244.9993 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/18 CH NO. 9/061.033

Catchment Area	0.037624253	sq.km
Length of longest stream (L) (km)	0.2364262	
Height of furthest point (m)	244.154	
Height of point of intersection (m)	243.814	
Height Difference (H) (m)	0.3397	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	243.984	
Observed H.F.L	244.413	
Proposed Formation Level	249.1029	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/18 CH NO. 9/061.033

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.326247344 hr

0.326247344 hr *60

19.57484063 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/18 CH NO. 9/061.033

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**288.1249512**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/18 CH NO. 9/061.033

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.214376672 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.214376672** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.265358098 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.054465082 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
243.98415		1.054465082		+0.5000

245.539 m

Proposed Formation Level 249.1029 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/19 CH NO. 9/679.030

Catchment Area	0.025082562	sq.km
Length of longest stream (L) (km)	0.1917783	
Height of furthest point (m)	241.78	
Height of point of intersection (m)	241.580	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	241.680	
Observed H.F.L	242.180	
Proposed Formation Level	248.338	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/19 CH NO. 9/679.030

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.315385772 hr

0.315385772 hr *60

18.92314633 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/19 CH NO. 9/679.030

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**298.0476873**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/19 CH NO. 9/679.030

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.527075084 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.527075084** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.872614334 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.727178612 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
241.68		0.727178612		+0.5000

242.907 m

Proposed Formation Level 248.338 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/20A CH NO. 10/001.210

Catchment Area	0.089579319	sq.km
Length of longest stream (L) (km)	0.3573821	
Height of furthest point (m)	238.989	
Height of point of intersection (m)	238.790	
Height Difference (H) (m)	0.199	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	238.8895	
Observed H.F.L	239.502	
Proposed Formation Level	246.729	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/20A CH NO. 10/001.210

2 Run off coefficient

	Description of the catchment	Formula for C
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.601711252 hr

0.601711252 hr *60

36.10267513 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/20A CH NO. 10/001.210

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**156.2211105**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/20A CH NO. 10/001.210

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.858579141 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.858579141** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.633473795 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.361228163 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
238.8895		1.361228163		+0.5000

240.751 m

Proposed Formation Level 246.729 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/21 CH NO. 10/203.000

Catchment Area	0.031969666	sq.km
Length of longest stream (L) (km)	0.2312158	
Height of furthest point (m)	240.9052	
Height of point of intersection (m)	240.7052	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	240.8052	
Observed H.F.L	241.3152	
Proposed Formation Level	246.9068	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/21 CH NO. 10/203.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.382739048 hr

0.382739048 hr *60

22.96434288 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/21 CH NO. 10/203.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**245.5981445**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/21 CH NO. 10/203.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.603858049 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.603858049** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.916490314 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.763741928 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
240.8052		0.763741928		+0.5000

242.069 m

Proposed Formation Level 246.9068 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/24 CH NO. 10/988.000

Catchment Area	0.032808269	sq.km
Length of longest stream (L) (km)	0.224876	
Height of furthest point (m)	243.8549	
Height of point of intersection (m)	243.6409	
Height Difference (H) (m)	0.214	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	243.7479	
Observed H.F.L	244.3641	
Proposed Formation Level	249.743	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/24 CH NO. 10/988.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.363302482 hr

0.363302482 hr *60

21.79814891 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/24 CH NO. 10/988.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 258.7375664 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/24 CH NO. 10/988.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.733985831 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.733985831** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.990849046 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.825707539 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
243.7479		0.825707539		+0.5000

245.074 m

Proposed Formation Level 249.743 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/27 CH NO. 12/991.395

Catchment Area	0.027284761	sq.km
Length of longest stream (L) (km)	0.1871869	
Height of furthest point (m)	244.287	
Height of point of intersection (m)	243.902	
Height Difference (H) (m)	0.3846	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	244.095	
Observed H.F.L	245.465	
Proposed Formation Level	250.9441	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/27 CH NO. 12/991.395

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.24545783 hr

0.24545783 hr *60

14.72746983 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/27 CH NO. 12/991.395

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 382.9578377 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/27 CH NO. 12/991.395

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.134390398 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.134390398** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.219651656 Sq.m

c Proposed opening 1X3.0X3.0

d Height of water = Avg. Waterway/total width

0.406550552 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
244.0947		0.406550552		+0.5000

245.001 m

Proposed Formation Level 250.9441 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/29 CH NO. 13/783.000

Catchment Area	0.014820695	sq.km
Length of longest stream (L) (km)	0.1504251	
Height of furthest point (m)	245.5488	
Height of point of intersection (m)	245.3488	
Height Difference (H) (m)	0.200	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	245.4488	
Observed H.F.L	245.9688	
Proposed Formation Level	251.0148	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/29 CH NO. 13/783.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.245285102 hr

0.245285102 hr *60

14.71710612 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/29 CH NO. 13/783.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 383.2275145 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/29 CH NO. 13/783.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.16018696 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.16018696** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.662963977 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.552469981 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
245.4488		0.552469981		+0.5000

246.501 m

Proposed Formation Level 251.0148 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31A CH NO. 14/542.150

Catchment Area	0.114738734	sq.km
Length of longest stream (L) (km)	0.3974363	
Height of furthest point (m)	245.584	
Height of point of intersection (m)	245.263	
Height Difference (H) (m)	0.321	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	245.4235	
Observed H.F.L	245.720	
Proposed Formation Level	250.977	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31A CH NO. 14/542.150

2 Run off coefficient

	Description of the catchment	Formula for C
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.569505154 hr

0.569505154 hr *60

34.17030921 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31A CH NO. 14/542.150

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**165.055574**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31A CH NO. 14/542.150

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.868503477 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.868503477** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.210573415 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.842144513 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
245.4235		1.842144513		+0.5000

247.766 m

Proposed Formation Level 250.977 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31B CH NO. 14/940.550

Catchment Area	0.219845431	sq.km
Length of longest stream (L) (km)	0.5433286	
Height of furthest point (m)	245.602	
Height of point of intersection (m)	245.262	
Height Difference (H) (m)	0.34	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	245.432	
Observed H.F.L	245.71	
Proposed Formation Level	250.977	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31B CH NO. 14/940.550

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.771666292 hr

0.771666292 hr *60

46.29997751 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31B CH NO. 14/940.550

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**121.814314**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/31B CH NO. 14/940.550

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **5.470392777 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **5.470392777** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

3.12593873 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

2.604948941 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
245.432		2.604948941		+0.5000

248.537 m

Proposed Formation Level 250.977 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/33A CH NO. 16/137.400

Catchment Area	0.098993277	sq.km
Length of longest stream (L) (km)	0.4078375	
Height of furthest point (m)	244.886	
Height of point of intersection (m)	244.562	
Height Difference (H) (m)	0.324	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	244.724	
Observed H.F.L	245.122	
Proposed Formation Level	250.977	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/33A CH NO. 16/137.400

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.583063933 hr

0.583063933 hr *60

34.98383599 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/33A CH NO. 16/137.400

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**161.217312**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/33A CH NO. 16/137.400

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.260018905 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.260018905** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.862867946 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.552389955 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
244.724		1.552389955		+0.5000

246.776 m

Proposed Formation Level 250.977 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/34 CH NO. 16/528.000

Catchment Area	0.060302554	sq.km
Length of longest stream (L) (km)	0.3065913	
Height of furthest point (m)	244.8232	
Height of point of intersection (m)	244.5732	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	244.6982	
Observed H.F.L	245.2082	
Proposed Formation Level	250.9774	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/34 CH NO. 16/528.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.474569822 hr

0.474569822 hr *60

28.47418932 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/34 CH NO. 16/528.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 198.0741203 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/34 CH NO. 16/528.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.439867175 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.439867175** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.394209814 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.161841512 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
244.6982		1.161841512		+0.5000

246.360 m

Proposed Formation Level 250.9774 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/38 CH NO. 18/385.000

Catchment Area	0.178755187	sq.km
Length of longest stream (L) (km)	0.5109905	
Height of furthest point (m)	239.412	
Height of point of intersection (m)	239.108	
Height Difference (H) (m)	0.304	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	239.260	
Observed H.F.L	239.704	
Proposed Formation Level	244.8741	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/38 CH NO. 18/385.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.752689554 hr

0.752689554 hr *60

45.16137322 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/38 CH NO. 18/385.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**124.885485**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/38 CH NO. 18/385.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **4.560089431 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **4.560089431** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.605765389 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

2.171471157 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
239.26		2.171471157		+0.5000

241.931 m

Proposed Formation Level 244.8741 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/39 CH NO. 18/662.000

Catchment Area	0.060302554	sq.km
Length of longest stream (L) (km)	0.3065913	
Height of furthest point (m)	246.9750	
Height of point of intersection (m)	246.7409	
Height Difference (H) (m)	0.2341	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	246.85795	
Observed H.F.L	247.3501	
Proposed Formation Level	253.3874	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/39 CH NO. 18/662.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.485451596 hr

0.485451596 hr *60

29.12709575 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/39 CH NO. 18/662.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**193.6341353**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/39 CH NO. 18/662.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.385175661 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.385175661** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.36295752 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.135797934 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
246.85795		1.135797934		+0.5000

248.494 m

Proposed Formation Level 253.3874 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/40 CH NO. 18/900.000

Catchment Area	0.038039524	sq.km
Length of longest stream (L) (km)	0.2337483	
Height of furthest point (m)	240.35	
Height of point of intersection (m)	240.005	
Height Difference (H) (m)	0.345	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	240.178	
Observed H.F.L	240.665	
Proposed Formation Level	246.78	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/40 CH NO. 18/900.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.320705988 hr

0.320705988 hr *60

19.2423593 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/40 CH NO. 18/900.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 293.1033514 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/40 CH NO. 18/900.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.277501126 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.277501126** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.301429215 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.084524346 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
240.1775		1.084524346		+0.5000

241.762 m

Proposed Formation Level 246.78 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/42 CH NO. 19/486.000

Catchment Area	0.090839282	sq.km
Length of longest stream (L) (km)	0.411964	
Height of furthest point (m)	246.9397	
Height of point of intersection (m)	246.7397	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	246.8397	
Observed H.F.L	247.3797	
Proposed Formation Level	252.7057	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/42 CH NO. 19/486.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.695863396 hr

0.695863396 hr *60

41.75180375 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/42 CH NO. 19/486.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**135.0839842**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/42 CH NO. 19/486.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.506572639 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.506572639** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.432327222 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.193606019 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
246.8397		1.193606019		+0.5000

248.533 m

Proposed Formation Level 252.7057 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/44 CH NO. 20/353.249

Catchment Area	0.103650433	sq.km
Length of longest stream (L) (km)	0.3976923	
Height of furthest point (m)	248.2477	
Height of point of intersection (m)	248.0477	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	248.1477	
Observed H.F.L	248.6927	
Proposed Formation Level	253.8132	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/44 CH NO. 20/353.249

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.670928106 hr

0.670928106 hr *60

40.25568635 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/44 CH NO. 20/353.249

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**140.1044302**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/44 CH NO. 20/353.249

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.966372816 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.966372816** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.695070181 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.412558484 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
248.1477		1.412558484		+0.5000

250.060 m

Proposed Formation Level 253.8132 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/46 CH NO. 20/673.163

Catchment Area	0.050678267	sq.km
Length of longest stream (L) (km)	0.2903411	
Height of furthest point (m)	248.6824	
Height of point of intersection (m)	248.4324	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	248.5574	
Observed H.F.L	249.0824	
Proposed Formation Level	254.866	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/46 CH NO. 20/673.163

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.448560485 hr

0.448560485 hr *60

26.91362912 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/46 CH NO. 20/673.163

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**209.5592525**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/46 CH NO. 20/673.163

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.169358543 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.169358543** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.239633453 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.033027878 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
248.5574		1.033027878		+0.5000

250.090 m

Proposed Formation Level 254.866 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/48 CH NO. 20/798.295

Catchment Area	0.018800878	sq.km
Length of longest stream (L) (km)	0.1745514	
Height of furthest point (m)	248.8357	
Height of point of intersection (m)	248.5763	
Height Difference (H) (m)	0.2594	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	248.7060	
Observed H.F.L	249.1025	
Proposed Formation Level	254.9154	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/48 CH NO. 20/798.295

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.26155981 hr

0.26155981 hr *60

15.69358859 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/48 CH NO. 20/798.295

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 359.3824298 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/48 CH NO. 20/798.295

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.380186306 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.380186306** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.788677889 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.657231574 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
248.706		0.657231574		+0.5000

249.863 m

Proposed Formation Level 254.9154 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/49 CH NO. 21/360.000

Catchment Area	0.045379233	sq.km
Length of longest stream (L) (km)	0.2680902	
Height of furthest point (m)	249.541	
Height of point of intersection (m)	249.159	
Height Difference (H) (m)	0.382	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.350	
Observed H.F.L	249.745	
Proposed Formation Level	255.144	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/49 CH NO. 21/360.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.356827988 hr

0.356827988 hr *60

21.40967929 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/49 CH NO. 21/360.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 263.4322506 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/49 CH NO. 21/360.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.441905402 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.441905402** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.395374516 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.162812096 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.35		1.162812096		+0.5000

251.013 m

Proposed Formation Level 255.144 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/51A CH NO. 22/588.950

Catchment Area	0.117119575	sq.km
Length of longest stream (L) (km)	0.4403369	
Height of furthest point (m)	249.988	
Height of point of intersection (m)	249.666	
Height Difference (H) (m)	0.322	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.827	
Observed H.F.L	250.248	
Proposed Formation Level	255.621	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/51A CH NO. 22/588.950

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.632568094 hr

0.632568094 hr *60

37.95408563 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/51A CH NO. 22/588.950

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 148.6006027 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/51A CH NO. 22/588.950

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.555108022 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.555108022** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.031490298 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.692908582 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.827		1.692908582		+0.5000

252.020 m

Proposed Formation Level 255.621 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/52A CH NO. 23/718.100

Catchment Area	0.090894316	sq.km
Length of longest stream (L) (km)	0.3147994	
Height of furthest point (m)	249.457	
Height of point of intersection (m)	249.158	
Height Difference (H) (m)	0.299	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.3075	
Observed H.F.L	249.750	
Proposed Formation Level	256.060	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/52A CH NO. 23/718.100

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.458520252 hr

0.458520252 hr *60

27.51121511 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/52A CH NO. 23/718.100

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 205.0073025 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/52A CH NO. 23/718.100

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.806350689 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.806350689** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.175057536 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.812547947 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.3075		1.812547947		+0.5000

251.620 m

Proposed Formation Level 256.06 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/54 CH NO. 23/913.000

Catchment Area	0.01934385	sq.km
Length of longest stream (L) (km)	0.1420766	
Height of furthest point (m)	249.2253	
Height of point of intersection (m)	249.0253	
Height Difference (H) (m)	0.200	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.1253	
Observed H.F.L	249.6903	
Proposed Formation Level	256.1432	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/54 CH NO. 23/913.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.231209405 hr

0.231209405 hr *60

13.87256431 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/54 CH NO. 23/913.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 406.5578557 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/54 CH NO. 23/913.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.606452968 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.606452968** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.917973124 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.764977604 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.1253		0.764977604		+0.5000

250.390 m

Proposed Formation Level 256.1432 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/58 CH NO. 25/337.094

Catchment Area	0.02416697	sq.km
Length of longest stream (L) (km)	0.1966785	
Height of furthest point (m)	246.9874	
Height of point of intersection (m)	246.5357	
Height Difference (H) (m)	0.4517	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	246.7616	
Observed H.F.L	247.1205	
Proposed Formation Level	253.0371	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/58 CH NO. 25/337.094

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.24440782 hr

0.24440782 hr *60

14.6644692 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/58 CH NO. 25/337.094

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 384.6030787 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/58 CH NO. 25/337.094

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.898618471 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.898618471** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.08492484 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.904104034 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
246.76155		0.904104034		+0.5000

248.166 m

Proposed Formation Level 253.0371 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/60 CH NO. 26/179.517

Catchment Area	0.020239181	sq.km
Length of longest stream (L) (km)	0.1858645	
Height of furthest point (m)	246.924	
Height of point of intersection (m)	246.588	
Height Difference (H) (m)	0.3363	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	246.756	
Observed H.F.L	247.057	
Proposed Formation Level	253.0797	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/60 CH NO. 26/179.517

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.255209922 hr

0.255209922 hr *60

15.3125953 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/60 CH NO. 26/179.517

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**368.3242383**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/60 CH NO. 26/179.517

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.522740771 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.522740771** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.870137583 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.725114653 m

Min. Formation Required B.L + Ht of water + free Board

246.75585 0.725114653 +0.5000

247.981 m

Proposed Formation Level 253.0797 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/62 CH NO. 26/446.936

Catchment Area	0.03783012	sq.km
Length of longest stream (L) (km)	0.2637462	
Height of furthest point (m)	247.8786	
Height of point of intersection (m)	247.6786	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	247.7786	
Observed H.F.L	248.3767	
Proposed Formation Level	254.1654	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/62 CH NO. 26/446.936

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.43860379 hr

0.43860379 hr *60

26.31622739 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/62 CH NO. 26/446.936

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**214.3164336**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/62 CH NO. 26/446.936

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.65613576 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.65613576** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.946363292 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.788636076 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
247.7786		0.788636076		+0.5000

249.067 m

Proposed Formation Level 254.1654 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/63 CH NO. 26/622.833

Catchment Area	0.03143537	sq.km
Length of longest stream (L) (km)	0.2351082	
Height of furthest point (m)	247.1451	
Height of point of intersection (m)	246.9451	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	247.0451	
Observed H.F.L	247.6451	
Proposed Formation Level	254.6376	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/63 CH NO. 26/622.833

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.389409731 hr

0.389409731 hr *60

23.36458387 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/63 CH NO. 26/622.833

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 241.3909886 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/63 CH NO. 26/622.833

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.550038096 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.550038096** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.885736055 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.738113379 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
247.0451		0.738113379		+0.5000

248.283 m

Proposed Formation Level 254.6376 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/64 CH NO. 26/761.669

Catchment Area	0.02430567	sq.km
Length of longest stream (L) (km)	0.2513	
Height of furthest point (m)	249.1547	
Height of point of intersection (m)	248.9147	
Height Difference (H) (m)	0.24	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.0347	
Observed H.F.L	249.6097	
Proposed Formation Level	255.0103	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/64 CH NO. 26/761.669

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.391765644 hr

0.391765644 hr *60

23.50593862 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/64 CH NO. 26/761.669

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 239.9393656 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/64 CH NO. 26/761.669

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.191274501 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.191274501** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.680728286 Sq.m

c Proposed opening = 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.567273572 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.0347		0.567273572		+0.5000

250.102 m

Proposed Formation Level 255.0103 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/66 CH NO. 27/187.608

Catchment Area	0.034753102	sq.km
Length of longest stream (L) (km)	0.2003734	
Height of furthest point (m)	250.624	
Height of point of intersection (m)	250.318	
Height Difference (H) (m)	0.3062	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	250.471	
Observed H.F.L	250.897	
Proposed Formation Level	256.1538	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/66 CH NO. 27/187.608

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.284926393 hr

0.284926393 hr *60

17.09558359 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/66 CH NO. 27/187.608

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 329.909767 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/66 CH NO. 27/187.608

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.342024804 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.342024804** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.338299888 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.115249907 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
250.4709		1.115249907		+0.5000

252.086 m

Proposed Formation Level 256.1538 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/67 CH NO. 27/493.000

Catchment Area	0.027798768	sq.km
Length of longest stream (L) (km)	0.2158586	
Height of furthest point (m)	251.124	
Height of point of intersection (m)	250.731	
Height Difference (H) (m)	0.393	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	250.928	
Observed H.F.L	251.321	
Proposed Formation Level	256.9736	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/67 CH NO. 27/493.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.282357842 hr

0.282357842 hr *60

16.9414705 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/67 CH NO. 27/493.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**332.9108886**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/67 CH NO. 27/493.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.890411242 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.890411242** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.080234996 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.90019583 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
250.9275		0.90019583		+0.5000

252.328 m

Proposed Formation Level 256.9736 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/69 CH NO. 27/648.655

Catchment Area	0.023724844	sq.km
Length of longest stream (L) (km)	0.1818316	
Height of furthest point (m)	251.501	
Height of point of intersection (m)	251.279	
Height Difference (H) (m)	0.222	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	251.3900	
Observed H.F.L	251.8645	
Proposed Formation Level	256.8842	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/69 CH NO. 27/648.655

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.28791614 hr

0.28791614 hr *60

17.27496842 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/69 CH NO. 27/648.655

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 326.4839543 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/69 CH NO. 27/648.655

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.582223934 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.582223934** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.904127962 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.753439968 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
251.39		0.753439968		+0.5000
252.643 m				

Proposed Formation Level 256.8842 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/70 CH NO. 27/854.000

Catchment Area	0.03513784	sq.km
Length of longest stream (L) (km)	0.2051216	
Height of furthest point (m)	251.6216	
Height of point of intersection (m)	251.4216	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	251.5216	
Observed H.F.L	252.0316	
Proposed Formation Level	256.7348	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/70 CH NO. 27/854.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.338124349 hr

0.338124349 hr *60

20.28746092 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/70 CH NO. 27/854.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**278.0042324**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/70 CH NO. 27/854.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.995396523 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.995396523** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.140226584 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.95018882 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
251.5216		0.95018882		+0.5000

252.972 m

Proposed Formation Level 256.7348 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/72 CH NO. 28/278.000

Catchment Area	0.01604429	sq.km
Length of longest stream (L) (km)	0.1495978	
Height of furthest point (m)	251.8258	
Height of point of intersection (m)	251.5758	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	251.7008	
Observed H.F.L	252.1958	
Proposed Formation Level	256.4263	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/72 CH NO. 28/278.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.225817859 hr

0.225817859 hr *60

13.54907156 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/72 CH NO. 28/278.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**416.2646847**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/72 CH NO. 28/278.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.364246389 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.364246389** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.779569365 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.649641138 m

Min. Formation Required

B.L + Ht of water + free Board

251.7008 0.649641138 +0.5000

252.850 m

Proposed Formation Level 256.4263 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/73 CH NO. 28/711.462

Catchment Area	0.074933884	sq.km
Length of longest stream (L) (km)	0.3488827	
Height of furthest point (m)	250.486	
Height of point of intersection (m)	250.177	
Height Difference (H) (m)	0.309	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	250.3315	
Observed H.F.L	252.5670	
Proposed Formation Level	256.1193	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/73 CH NO. 28/711.462

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.504240285 hr

0.504240285 hr *60

30.25441709 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/73 CH NO. 28/711.462

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 186.4190602 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/73 CH NO. 28/711.462

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.853456788 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.853456788** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.630546736 Sq.m

c Proposed opening 1X6.0X6.0

d Height of water = Avg. Waterway/total width

0.271757789 m

Min. Formation Required B.L + Ht of water + free Board

250.3315 0.271757789 +0.5000

251.103 m

Proposed Formation Level 256.1193 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/75 CH NO. 29/125.000

Catchment Area	0.022889	sq.km
Length of longest stream (L) (km)	0.1797014	
Height of furthest point (m)	249.5841	
Height of point of intersection (m)	249.3541	
Height Difference (H) (m)	0.23	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.4691	
Observed H.F.L	250.0041	
Proposed Formation Level	256.0858	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/75 CH NO. 29/125.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.280973045 hr

0.280973045 hr *60

16.85838271 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/75 CH NO. 29/125.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 334.5516648 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/75 CH NO. 29/125.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.564201712 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.564201712** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.893829549 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.744857958 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.4691		0.744857958		+0.5000

250.714 m

Proposed Formation Level 256.0858 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/76 CH NO. 29/300.000

Catchment Area	0.018702442	sq.km
Length of longest stream (L) (km)	0.160428	
Height of furthest point (m)	249.336	
Height of point of intersection (m)	249.1360	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	249.2360	
Observed H.F.L	250.6610	
Proposed Formation Level	256.078	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/76 CH NO. 29/300.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.262186078 hr

0.262186078 hr *60

15.73116467 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/76 CH NO. 29/300.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 358.5239948 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/76 CH NO. 29/300.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.369680541 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.369680541** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.782674595 Sq.m

c Proposed opening 1x3.0x3.0

d Height of water = Avg. Waterway/total width

0.260891532 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
249.236		0.260891532		+0.5000

249.997 m

Proposed Formation Level 256.078 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/79 CH NO. 29/684.000

Catchment Area	0.100365374	sq.km
Length of longest stream (L) (km)	0.3690321	
Height of furthest point (m)	249.124	
Height of point of intersection (m)	248.826	
Height Difference (H) (m)	0.298	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	248.975	
Observed H.F.L	249.458	
Proposed Formation Level	256.0597	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/79 CH NO. 29/684.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.541136438 hr

0.541136438 hr *60

32.46818628 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/79 CH NO. 29/684.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 173.708502 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/79 CH NO. 29/684.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.561293152 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.561293152** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.035024658 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.695853882 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
248.975		1.695853882		+0.5000

251.171 m

Proposed Formation Level 256.0597 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/83 CH NO. 30/371.543

Catchment Area	0.024529733	sq.km
Length of longest stream (L) (km)	0.2072567	
Height of furthest point (m)	251.154	
Height of point of intersection (m)	250.887	
Height Difference (H) (m)	0.267	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	251.021	
Observed H.F.L	251.497	
Proposed Formation Level	256.328	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/83 CH NO. 30/371.543

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.309342787 hr

0.309342787 hr *60

18.56056722 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/83 CH NO. 30/371.543

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**303.8700236**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/83 CH NO. 30/371.543

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.522591577 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.522591577** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.87005233 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.725043608 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
251.0205		0.725043608		+0.5000

252.246 m

Proposed Formation Level 256.328 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/85 CH NO. 30/848.000

Catchment Area	0.028838435	sq.km
Length of longest stream (L) (km)	0.2231065	
Height of furthest point (m)	252.347	
Height of point of intersection (m)	252.064	
Height Difference (H) (m)	0.283	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	252.206	
Observed H.F.L	252.724	
Proposed Formation Level	257.4093	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/85 CH NO. 30/848.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.327223007 hr

0.327223007 hr *60

19.6333804 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/85 CH NO. 30/848.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 287.2658648 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/85 CH NO. 30/848.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.692226351 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.692226351** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.966986486 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.805822072 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
252.2055		0.805822072		+0.5000

253.511 m

Proposed Formation Level 257.4093 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/86 CH NO. 31/424.000

Catchment Area	0.038861389	sq.km
Length of longest stream (L) (km)	0.2681995	
Height of furthest point (m)	253.987	
Height of point of intersection (m)	253.669	
Height Difference (H) (m)	0.318	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.828	
Observed H.F.L	254.258	
Proposed Formation Level	258.7125	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/86 CH NO. 31/424.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.380291516 hr

0.380291516 hr *60

22.81749093 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/86 CH NO. 31/424.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**247.1787988**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/86 CH NO. 31/424.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.962150335 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.962150335** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.121228763 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.934357303 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.828		0.934357303		+0.5000

255.262 m

Proposed Formation Level 258.7125 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/87 CH NO. 31/715.000

Catchment Area	0.037226845	sq.km
Length of longest stream (L) (km)	0.2327284	
Height of furthest point (m)	254.124	
Height of point of intersection (m)	253.876	
Height Difference (H) (m)	0.248	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.000	
Observed H.F.L	254.484	
Proposed Formation Level	259.3708	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/87 CH NO. 31/715.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.357769474 hr

0.357769474 hr *60

21.46616843 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/87 CH NO. 31/715.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**262.7390173**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/87 CH NO. 31/715.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.997945073 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.997945073** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.141682899 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.951402416 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254		0.951402416		+0.5000

255.451 m

Proposed Formation Level 259.3708 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/89 CH NO. 31/991.073

Catchment Area	0.064132204	sq.km
Length of longest stream (L) (km)	0.3377915	
Height of furthest point (m)	253.3501	
Height of point of intersection (m)	253.1501	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.2501	
Observed H.F.L	253.8151	
Proposed Formation Level	259.8498	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/89 CH NO. 31/991.073

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.566625446 hr

0.566625446 hr *60

33.99752674 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/89 CH NO. 31/991.073

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 165.8944206 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/89 CH NO. 31/991.073

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.173255008 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.173255008** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.241860004 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

1.034883337 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.2501		1.034883337		+0.5000

254.785 m

Proposed Formation Level 259.8498 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/91A CH NO. 32/584.000

Catchment Area	0.072487691	sq.km
Length of longest stream (L) (km)	0.3559149	
Height of furthest point (m)	253.504	
Height of point of intersection (m)	253.143	
Height Difference (H) (m)	0.361	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.3235	
Observed H.F.L	253.705	
Proposed Formation Level	259.983	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/91A CH NO. 32/584.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.487869087 hr

0.487869087 hr *60

29.27214524 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/91A CH NO. 32/584.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**192.6746384**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/91A CH NO. 32/584.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.852932936 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.852932936** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.630247392 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.358539493 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.3235		1.358539493		+0.5000

255.182 m

Proposed Formation Level 259.983 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/92 CH NO. 32/620.000

Catchment Area	0.071949568	sq.km
Length of longest stream (L) (km)	0.3313611	
Height of furthest point (m)	253.912	
Height of point of intersection (m)	253.619	
Height Difference (H) (m)	0.293	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.7655	
Observed H.F.L	254.124	
Proposed Formation Level	259.984	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/92 CH NO. 32/620.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.486903333 hr

0.486903333 hr *60

29.21419999 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/92 CH NO. 32/620.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 193.0568012 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/92 CH NO. 32/620.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.837370434 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.837370434** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.621354534 Sq.m

c Proposed opening = 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.351128778 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.7655		1.351128778		+0.5000

255.617 m

Proposed Formation Level 259.984 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/93 CH NO. 32/875.000

Catchment Area	0.028024864	sq.km
Length of longest stream (L) (km)	0.218876	
Height of furthest point (m)	254.148	
Height of point of intersection (m)	253.824	
Height Difference (H) (m)	0.324	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.986	
Observed H.F.L	254.435	
Proposed Formation Level	260.0384	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/93 CH NO. 32/875.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.306173113 hr

0.306173113 hr *60

18.37038678 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/93 CH NO. 32/875.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 307.0158549 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/93 CH NO. 32/875.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.757547454 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.757547454** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.004312831 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.836927359 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.986		0.836927359		+0.5000

255.323 m

Proposed Formation Level 260.0384 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/95 CH NO. 33/025.486

Catchment Area	0.055727354	sq.km
Length of longest stream (L) (km)	0.3184778	
Height of furthest point (m)	254.154	
Height of point of intersection (m)	253.846	
Height Difference (H) (m)	0.308	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.000	
Observed H.F.L	254.501	
Proposed Formation Level	260.0706	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/95 CH NO. 33/025.486

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.459342826 hr

0.459342826 hr *60

27.56056957 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/95 CH NO. 33/025.486

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 204.640183 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/95 CH NO. 33/025.486

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.329496598 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.329496598** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.331140913 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.109284094 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254		1.109284094		+0.5000

255.609 m

Proposed Formation Level 260.0706 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/96 CH NO. 33/305.000

Catchment Area	0.06011504	sq.km
Length of longest stream (L) (km)	0.3047915	
Height of furthest point (m)	253.8125	
Height of point of intersection (m)	253.5625	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.6875	
Observed H.F.L	254.1845	
Proposed Formation Level	260.1301	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/96 CH NO. 33/305.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.471686719 hr

0.471686719 hr *60

28.30120313 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/96 CH NO. 33/305.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 199.2848139 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/96 CH NO. 33/305.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.447147157 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.447147157** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.398369804 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

1.16530817 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.6875		1.16530817		+0.5000

255.353 m

Proposed Formation Level 260.1301 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/98 CH NO. 33/734.000

Catchment Area	0.026293383	sq.km
Length of longest stream (L) (km)	0.2173354	
Height of furthest point (m)	253.987	
Height of point of intersection (m)	253.637	
Height Difference (H) (m)	0.35	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	253.812	
Observed H.F.L	254.145	
Proposed Formation Level	260.1564	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/98 CH NO. 33/734.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.2959556 hr

0.2959556 hr *60

17.757336 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/98 CH NO. 33/734.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 317.6152099 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/98 CH NO. 33/734.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.70588795 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.70588795** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.974793114 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.812327595 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
253.812		0.812327595		+0.5000

255.124 m

Proposed Formation Level 260.1564 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/99 CH NO. 33/990.000

Catchment Area	0.023902387	sq.km
Length of longest stream (L) (km)	0.2093325	
Height of furthest point (m)	254.124	
Height of point of intersection (m)	253.879	
Height Difference (H) (m)	0.245	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.002	
Observed H.F.L	254.398	
Proposed Formation Level	260.2784	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/99 CH NO. 33/990.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.321961279 hr

0.321961279 hr *60

19.31767675 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/99 CH NO. 33/990.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 291.9605744 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/99 CH NO. 33/990.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.425503295 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.425503295** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.814573311 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.678811093 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.0015		0.678811093		+0.5000

255.180 m

Proposed Formation Level 260.2784 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/100 CH NO. 34/254.000

Catchment Area	0.07910844	sq.km
Length of longest stream (L) (km)	0.2605217	
Height of furthest point (m)	254.4614	
Height of point of intersection (m)	254.1299	
Height Difference (H) (m)	0.3315	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.29565	
Observed H.F.L	255.425	
Proposed Formation Level	260.3326	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/100 CH NO. 34/254.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.363773971 hr

0.363773971 hr *60

21.82643828 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/100 CH NO. 34/254.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 258.4022152 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/100 CH NO. 34/254.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **4.175627941 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **4.175627941** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.386073109 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

1.988394258 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.29565		1.988394258		+0.5000

256.784 m

Proposed Formation Level 260.3326 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/102 CH NO. 34/303.000

Catchment Area	0.04910844	sq.km
Length of longest stream (L) (km)	0.2585217	
Height of furthest point (m)	254.4614	
Height of point of intersection (m)	254.2614	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.3614	
Observed H.F.L	254.9424	
Proposed Formation Level	260.343	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/102 CH NO. 34/303.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.429614618 hr

0.429614618 hr *60

25.77687705 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/102 CH NO. 34/303.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**218.8007488**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/102 CH NO. 34/303.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.19486435 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.19486435** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.2542082 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

1.0451735 m

Min. Formation Required

B.L + Ht of water + free Board

254.3614 1.0451735 +0.5000

255.907 m

Proposed Formation Level 260.343 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/103 CH NO. 34/524.000

Catchment Area	0.022104238	sq.km
Length of longest stream (L) (km)	0.1913175	
Height of furthest point (m)	254.874	
Height of point of intersection (m)	254.536	
Height Difference (H) (m)	0.338	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.705	
Observed H.F.L	255.087	
Proposed Formation Level	260.3902	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/103 CH NO. 34/524.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.262506372 hr

0.262506372 hr *60

15.75038233 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/103 CH NO. 34/524.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 358.0865456 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/103 CH NO. 34/524.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.616837204 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.616837204** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.923906974 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.769922478 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.705		0.769922478		+0.5000

255.975 m

Proposed Formation Level 260.3902 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/106 CH NO. 35/262.000

Catchment Area	0.049715098	sq.km
Length of longest stream (L) (km)	0.2603141	
Height of furthest point (m)	254.325	
Height of point of intersection (m)	254	
Height Difference (H) (m)	0.325	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.1625	
Observed H.F.L	255.890	
Proposed Formation Level	259.900	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/106 CH NO. 35/262.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.365965674 hr

0.365965674 hr *60

21.95794043 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/106 CH NO. 35/262.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 256.8546908 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/106 CH NO. 35/262.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.608426139 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.608426139** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.490529222 Sq.m

c Proposed opening 1X6.0X6.0

d Height of water = Avg. Waterway/total width

0.248421537 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.1625		0.248421537		+0.5000

254.911 m

Proposed Formation Level 259.9 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/108 CH NO. 35/707.150

Catchment Area	0.052175962	sq.km
Length of longest stream (L) (km)	0.3043923	
Height of furthest point (m)	254.864	
Height of point of intersection (m)	254.561	
Height Difference (H) (m)	0.303	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.7125	
Observed H.F.L	255.118	
Proposed Formation Level	259.193	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/108 CH NO. 35/707.150

2 Run off coefficient

	Description of the catchment	Formula for C
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.440814766 hr

0.440814766 hr *60

26.44888595 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/108 CH NO. 35/707.150

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**213.2414957**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/108 CH NO. 35/707.150

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.272714734 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.272714734** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.298694134 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.082245111 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.7125		1.082245111		+0.5000

256.295 m

Proposed Formation Level 259.193 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/113 CH NO. 37/203.000

Catchment Area	0.009479158	sq.km
Length of longest stream (L) (km)	0.1401603	
Height of furthest point (m)	254.6876	
Height of point of intersection (m)	254.4376	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	254.5626	
Observed H.F.L	255.1206	
Proposed Formation Level	260.8902	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/113 CH NO. 37/203.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.211089967 hr

0.211089967 hr *60

12.66539799 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/113 CH NO. 37/203.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio x74	
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**445.3077593**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/113 CH NO. 37/203.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **0.862249134 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **0.862249134** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.492713791 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.410594826 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
254.5626		0.410594826		+0.5000

255.473 m

Proposed Formation Level 260.8902 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/115 CH NO. 37/680.000

Catchment Area	0.010294372	sq.km
Length of longest stream (L) (km)	0.1244027	
Height of furthest point (m)	256.1010	
Height of point of intersection (m)	255.9010	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.0010	
Observed H.F.L	257.4110	
Proposed Formation Level	261.266	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/115 CH NO. 37/680.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.201508561 hr

0.201508561 hr *60

12.09051364 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/115 CH NO. 37/680.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 466.4814224 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/115 CH NO. 37/680.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **0.980927559 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **0.980927559** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.560530034 Sq.m

c Proposed opening 1x3.0x3.0

d Height of water = Avg. Waterway/total width

0.186843345 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.001		0.186843345		+0.5000

256.688 m

Proposed Formation Level 261.266 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/116 CH NO. 37/826.000

Catchment Area	0.01945008	sq.km
Length of longest stream (L) (km)	0.1669934	
Height of furthest point (m)	255.4987	
Height of point of intersection (m)	255.2487	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	255.3737	
Observed H.F.L	256.7707	
Proposed Formation Level	261.3814	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/116 CH NO. 37/826.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.253048915 hr

0.253048915 hr *60

15.18293491 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/116 CH NO. 37/826.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 371.4696818 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/116 CH NO. 37/826.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.475867971 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.475867971** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.843353127 Sq.m

c Proposed opening 1x3.0x3.0

d Height of water = Avg. Waterway/total width

0.281117709 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
255.3737		0.281117709		+0.5000

256.155 m

Proposed Formation Level 261.3814 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/117 CH NO. 37/937.000

Catchment Area	0.06459884	sq.km
Length of longest stream (L) (km)	0.3169713	
Height of furthest point (m)	255.2376	
Height of point of intersection (m)	254.9876	
Height Difference (H) (m)	0.25	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	255.1126	
Observed H.F.L	256.5506	
Proposed Formation Level	261.3664	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/117 CH NO. 37/937.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.491209023 hr

0.491209023 hr *60

29.4725414 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/117 CH NO. 37/937.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 191.3645628 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/117 CH NO. 37/937.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.525160454 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.525160454** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.442948831 Sq.m

c Proposed opening 1x3.0x3.0

d Height of water = Avg. Waterway/total width

0.480982944 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
255.1126		0.480982944		+0.5000

256.094 m

Proposed Formation Level 261.3664 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/121 CH NO. 39/260.000

Catchment Area	0.064717301	sq.km
Length of longest stream (L) (km)	0.3328639	
Height of furthest point (m)	256.789	
Height of point of intersection (m)	256.492	
Height Difference (H) (m)	0.297	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.641	
Observed H.F.L	257.054	
Proposed Formation Level	262.211	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/121 CH NO. 39/260.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.486905922 hr

0.486905922 hr *60

29.21435532 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/121 CH NO. 39/260.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 193.0557748 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/121 CH NO. 39/260.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **2.552148473 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **2.552148473** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.458370556 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.215308797 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.6405		1.215308797		+0.5000

258.356 m

Proposed Formation Level 262.211 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/123 CH NO. 39/896.000

Catchment Area	0.021823736	sq.km
Length of longest stream (L) (km)	0.195397	
Height of furthest point (m)	256.587	
Height of point of intersection (m)	256.219	
Height Difference (H) (m)	0.368	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.403	
Observed H.F.L	256.798	
Proposed Formation Level	261.9083	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/123 CH NO. 39/896.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.260544866 hr

0.260544866 hr *60

15.63269198 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/123 CH NO. 39/896.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**360.7823917**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/123 CH NO. 39/896.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.608337451 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.608337451** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.919049972 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.765874977 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.403		0.765874977		+0.5000

257.669 m

Proposed Formation Level 261.9083 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125 CH NO. 40/100.000

Catchment Area	0.027456041	sq.km
Length of longest stream (L) (km)	0.2286941	
Height of furthest point (m)	256.612	
Height of point of intersection (m)	256.249	
Height Difference (H) (m)	0.363	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.431	
Observed H.F.L	256.805	
Proposed Formation Level	262.092	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125 CH NO. 40/100.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.308078292 hr

0.308078292 hr *60

18.48469755 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125 CH NO. 40/100.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 305.1172455 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125 CH NO. 40/100.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.711226165 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.711226165** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.977843523 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.814869602 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.4305		0.814869602		+0.5000

257.745 m

Proposed Formation Level 262.092 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125A CH NO. 40/386.000

Catchment Area	0.098145706	sq.km
Length of longest stream (L) (km)	0.383409	
Height of furthest point (m)	256.894	
Height of point of intersection (m)	256.514	
Height Difference (H) (m)	0.380	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.704	
Observed H.F.L	257.104	
Proposed Formation Level	262.357	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125A CH NO. 40/386.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.517684477 hr

0.517684477 hr *60

31.06106864 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125A CH NO. 40/386.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 181.5777836 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/125A CH NO. 40/386.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **3.640296489 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **3.640296489** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

2.080169422 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

1.733474519 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.704		1.733474519		+0.5000

258.937 m

Proposed Formation Level 262.357 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/127 CH NO. 40/670.000

Catchment Area	0.0232077	sq.km
Length of longest stream (L) (km)	0.178398	
Height of furthest point (m)	256.9456	
Height of point of intersection (m)	256.7456	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.8456	
Observed H.F.L	258.3456	
Proposed Formation Level	262.5615	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/127 CH NO. 40/670.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.292639726 hr

0.292639726 hr *60

17.55838358 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/127 CH NO. 40/670.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 321.2140783 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/127 CH NO. 40/670.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.522752831 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.522752831** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.870144475 Sq.m

c Proposed opening 1x3.0x3.0

d Height of water = Avg. Waterway/total width

0.290048158 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.8456		0.290048158		+0.5000

257.636 m

Proposed Formation Level 262.5615 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/129 CH NO. 41/048.528

Catchment Area	0.0098731	sq.km
Length of longest stream (L) (km)	0.113015	
Height of furthest point (m)	257.0320	
Height of point of intersection (m)	256.8320	
Height Difference (H) (m)	0.2	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	256.9320	
Observed H.F.L	257.5320	
Proposed Formation Level	262.8324	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/129 CH NO. 41/048.528

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.182448587 hr

0.182448587 hr *60

10.94691521 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/129 CH NO. 41/048.528

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 515.2136369 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/129 CH NO. 41/048.528

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.039067181 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.039067181** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.593752675 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.494793896 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
256.932		0.494793896		+0.5000

257.927 m

Proposed Formation Level 262.8324 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/130 CH NO. 41/164.000

Catchment Area	0.02219404	sq.km
Length of longest stream (L) (km)	0.1596069	
Height of furthest point (m)	257.5035	
Height of point of intersection (m)	257.2535	
Height Difference (H) (m)	0.250	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	257.3785	
Observed H.F.L	257.9385	
Proposed Formation Level	262.915	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/130 CH NO. 41/164.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.241473328 hr

0.241473328 hr *60

14.48839968 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/130 CH NO. 41/164.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 389.2769473 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/130 CH NO. 41/164.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.764809336 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.764809336** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

1.008462478 Sq.m

c Proposed opening 1x1.2x1.2

d Height of water = Avg. Waterway/total width

0.840385398 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
257.3785		0.840385398		+0.5000

258.719 m

Proposed Formation Level 262.915 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/131 CH NO. 41/374.000

Catchment Area	0.014470791	sq.km
Length of longest stream (L) (km)	0.1539959	
Height of furthest point (m)	257.784	
Height of point of intersection (m)	257.460	
Height Difference (H) (m)	0.324	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	257.622	
Observed H.F.L	257.980	
Proposed Formation Level	262.7017	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/131 CH NO. 41/374.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.212781541 hr

0.212781541 hr *60

12.76689248 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/131 CH NO. 41/374.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 441.7676432 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/131 CH NO. 41/374.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.30583684 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.30583684** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.74619248 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.621827067 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
257.622		0.621827067		+0.5000

258.744 m

Proposed Formation Level 262.7017 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/133 CH NO. 41/614.000

Catchment Area	0.031191627	sq.km
Length of longest stream (L) (km)	0.2448406	
Height of furthest point (m)	257.982	
Height of point of intersection (m)	257.687	
Height Difference (H) (m)	0.295	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	257.835	
Observed H.F.L	258.254	
Proposed Formation Level	262.2526	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/133 CH NO. 41/614.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.355145045 hr

0.355145045 hr *60

21.3087027 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/133 CH NO. 41/614.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a	tc h Ratio	=	0.470	From Fig. 10
b	1h Ratio =	=	0.370	From Fig. 10
c	Coefficient K	=	$\frac{\text{tc h Ratio}}{\text{1h Ratio}}$	
		=	1.27027027	
d				
I	R-50 (24)	=	200	mm
ii	R-50 (1)	=	R-50 (24) x 1 h to 24 h Rainfall Ratio.	
		=	74	mm
iii	R-50 (tc)	=	K x R-50 (1)	
		=	1h Ratio	x74
		=	94	mm
iv	Int. of rainfall (I)	=	$\frac{\text{R-50 (tc)}}{\text{tc}}$	
	I	**=**	**264.6805898**	**mm/hr**

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/133 CH NO. 41/614.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.68640882 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.68640882** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.963662183 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.803051819 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
257.8345		0.803051819		+0.5000

259.138 m

Proposed Formation Level 262.2526 m

Provided formation Level is O.K.

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/134 CH NO. 41/874.000

Catchment Area	0.013506725	sq.km
Length of longest stream (L) (km)	0.1528372	
Height of furthest point (m)	258.124	
Height of point of intersection (m)	257.802	
Height Difference (H) (m)	0.322	
Nature of soil	Red soil/clayey loam	
Avg.Bed Level	257.963	
Observed H.F.L	258.412	
Proposed Formation Level	261.6823	

Using Improved Rational Formula

Q-50 = 0.278 x C x I x A

Where

Q-50 = 50 Years Design Flood Discharge

C = Runoff Coefficient

I = 50 Years Rainfall Intensity lasting for tc hour duration where tc = time of concentration

A = Catchment Area

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/134 CH NO. 41/874.000

2 Run off coefficient

	Description of the catchment	**Formula for C**
a	Sandy Soil / Sandy Laom/ arid Areas	C = 0.249(R x F) ^ 0.2
b	Alluvium/silty/coastal area	C = 0.332(R x F) ^ 0.2
c	Red soil /Clayey loam/ gray or brown alluvium/ cultivated plains / tall crop / wooded areas	C = 0.415(R x F) ^ 0.2
d	Black Cotton/ clayey soil/lightly covered/ lightly wooded/Plain & Barren / sub mountaine &	C = 0.456(R x F) ^ 0.2
e	Hilly soil / plateau/barren	C = 0.498(R x F) ^ 0.2

Where

R = 50 Year 24 hour point rainfall (cm)

F = Areal Reduction factor depending upon catchment Area & duration rainfall from table below

Catchment Area in Sq. Km.	**Duration of Rainfall**		
	< 30 Min	30 to 60 min	60 To 100 min
< 2.5 Sq. Km	0.72	0.81	0.88
2.5 to 5.0 Sq. Km	0.71	0.8	0.87
5 to 13.0 Sq. Km	0.7	0.79	0.86
13.0 to 25.0 Sq. Km	0.68	0.78	0.85

Note:- Rainfall Duration shall be equal to the caculated tc for the cacthment

for estimating the time of concentration(tc) as per bhatnagar formula

$$tc = [L^3 / H]^{0.345}$$

0.211576201 hr

0.211576201 hr *60

12.69457205 Min

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/134 CH NO. 41/874.000

Nature of Soil is , Red soil /Clayey loam/gray or brown alluvium/cultivated plains /tall crop /wooded areas ,C = 0.415 (R x F) ^ 0.2

R	=	20	cm
F	=	0.87	
C	=	0.415(R x F) ^ 0.2	
C	**=**	**0.734781048**	

But as per Annexture 5.1.1.(a) 1. (Khosla), of "Flood Estimation Methods For Catchments Less Than 25 SqKm in Area", Bridges & Floods wing Report No. RBF - 16 , Coeff. Assumed for calculation is " 0.10 ".

3 Calculation of Intensity of Rainfall (I)

a tc h Ratio = 0.470 From Fig. 10

b 1h Ratio = = 0.370 From Fig. 10

c Coefficient K = $\frac{\text{tc h Ratio}}{\text{1h Ratio}}$

= 1.27027027

d

I R-50 (24) = 200 mm

ii R-50 (1) = R-50 (24) x 1 h to 24 h Rainfall Ratio.

= 74 mm

iii R-50 (tc) = K x R-50 (1)

= 1h Ratio x74

= 94 mm

iv Int. of rainfall (I) = $\frac{\text{R-50 (tc)}}{\text{tc}}$

I = 444.2843742 mm/hr

ESTIMATION OF DESIGN DISCHARGE FOR Bridge No. MOZ/134 CH NO. 41/874.000

4 Design Flood Discharge =

Q-50 = 0.278 x C x I x A

Q-50 = **1.225783691 cum/sec**

5 Checking for adequacy of Waterway Provided

a Discharge = **1.225783691** cum/sec

b Avg.Waterway Required = Q/V (V=1.75)

0.700447824 Sq.m

c Proposed opening 1X1.2X1.2

d Height of water = Avg. Waterway/total width

0.58370652 m

Min. Formation Required

B.L	+	Ht of water	+	free Board
257.963		0.58370652		+0.5000

259.047 m

Proposed Formation Level 261.6823 m

Provided formation Level is O.K.