

DISCHARGE CALCULATION FOR BOX CULVERT AT CH. 5.20KM

1.0 Ryve's Method :

From Ryve's formula, Q	=	C * A ^{2/3}	As per eq-4.3 on Page-7 of IRC-SP:13-2004
Catchment Area, A	=	103.850 km ²	From Top-Sheet Annex-3
Ryve's Co-efficient, C	=	10.000	As per eq-4.3 on Page-7 of IRC-SP:13-2004
Discharge, Q	=	220.938 m ³ /sec	

2.0 Dickens Formula

Q	=	C * M ^{3/4}	As per eq-4.2 on Page-13 of IRC-SP:13-2004
Catchment Area, M	=	103.850 km ²	From Top-Sheet Annex-3
Dickens Co-efficient, C	=	11.000	As per eq-4.2 on Page-13 of IRC-SP:13-2004
Discharge, Q	=	357.847 m ³ /sec	

Assumed Velocity, V	=	1.500 M/s
Area Required, A	=	Q/V
A	=	238.565 Sq.m

Span Arrangement :

No. of Spans	=	8 Nos.
Clear Vent Size	=	6.000 m
	=	5.100 m
Area Provided	=	244.800 Sq.m

Area Required < Area Provided Hence OK

Outer wall Thickness	=	0.600 m
Inner wall Thickness	=	0.550 m
Provided Linear Water Way, L	=	53.700 m

Provided Discharge Calculation

Design Discharge

Provided Discharge Calculation

357.85 m ³ /sec	
387.286 m ³ /sec	
Safe	

Check

q=Discharge

(IRC:SP:13-2004, Pg.no:76, CL:19.2.8)

$\lambda = \text{Conveyance factor}$

(IRC:SP:13-2004, Pg.no:76, CL:19.2.8)

Ke=For Rectangular bevelled entry

(IRC:SP:13-2004, Pg.no:76, CL:19.2.8,

$\lambda \sqrt{2 * g * H}$

48.411

$A / ((1 + K_e + K_f)^{(1/2)})$

28.219

0.05

$$K_f = \text{For Rectangular bevelled entry} = \frac{0.0035xL}{(R \wedge 1.25)} = \frac{0.13}{}$$

(IRC:SP:13-2004, Pg.no:76, CL:19.2.8,

DISCHARGE CALCULATION FOR BOX CULVERT

CULVERT CHAINAGE	TYPE OF STRUCTURE	FRL AT C/L OF CARRIAGE WAY (m)	BED LVL IN (m)	INVERT LVL IN (m)	Flow Direction	Length of the Culvert (m)
5.20km	Box Culvert	104.025	96.90	97.500	R-L	53.700

CARRIAGE WAY	AREA OF BOX 'A' (sqm)	PERIMETER 'P' (m)	R=A\P (m)	Ke (m)	Kf	Operating head 'H' (m)	λ	Discharge 'q' provided c	No of pipes/box vents No's	Dimension Breadth	Height	HFL	Velocity
12.00	30.60	22.20	1.378	0.05	0.13	0.15	28.22	387.29	8.00	6.00	5.10	102.60	1.58

IV. Vertical Clearance

Minimum Vertical Clearance required = 0.900 m

H_f, F.L. : = 102.600 m

Formation Road Level = A.H.F.L. + V.C. + Deck Thk. + W.C. Thk.

Top slab Depth = 0.450 m

Wearing Coat Thickness = 0.075 m

Therefore, F.R.L. Required = 104.025 m

Provide FRL = 104.025 m

As per Cl-106.2.1 on Page-16 of IRC:5-1998

VII. Scour Depth Calculations

Providing Linear Water Way = 53.700 m

Design Discharge (for Scour Calculation), Q_{ds} = Q_d X 1.30

= 465.201 m³/sec

Mean Scour Depth, d_{sm} = 1.34 (D_b² / K_{sf})^{1/3}

D_b = Q_d / L

= 4.114 m

Silt Factor, K_{sf} = 2.460

d_{sm} = 2.549 m

As per CI-703.1.1 on Page-9 of IRC:78-2000