DESIGN OF SUBMERSIBLE BRIDGE

Name Of Work :- Construction of Submersible Bridge on ON KHERWARA - JAWAS - SUVERI ROAD IN KM 9/000, ACROSS RIVER SOM

Hydraulic Calculation

Computation of Discharge

1 Flood calculation by Area Velocity Method (As per Article- 5 of IRC SP-13)

Q = A x V Where

A = 490.30 m2 — A = Cross sectional area in m^2

P = 190.71 m — P = Perimeter calculated in m

S = 1 IN 960 — S = Slope as per drain LS taken at Proposal site

n = 0.033 — n = Rugosity coefficient (As per IRC SP-13)

V = $I/nx (A/P)^{2/3} x(S)^{1/2}$ — V = Velocity in m/sec.

= 1.84 m/sec.

Q = 902.15 Cumecs

Linear Water Way Calculation

Regime Surface width of the stream is given by :- L = 4.8 (Q)1/2

= 144.18 m

Looking to the built up Urban area constraints adopt 12 Spans of 8 M each.

This will cause contraction and afflux. Calculation is done for the same to fix deck level.

Effective linear water way proposed = 12 x 8 = 96 M

Total 96 M

Scour Depth Calculation

(As per clause no. 703.2.2.1 of IRC : 78.1983)

$dsm = 1.34x (Db^2 /Ksf)^{1/3}$

Where

Db = The discharge in Cumecs per meter width

Ksf = the silt factor

= 1.5

Effective linear waterway = Width of waterway - Obstructed width of piper

= 94.80 - (11 x 1.2)

= 81.60 m

Db = 902.15 / 81.60

= 11.06 Cumecs per metre width

dsm = 5.82 m

As per Clause No. 703-2-3-1 of IRC 78-1983 considering Scour at the pier two times of calculated scour depth below the highest flood level. But hard rock is available in foundation so the foundation will be anchored in the rock as per IRC guidelines.

Afflux Calculation

As per IS: 7784 (Part -I) 1975

Molesworth Formula for Afflux

Afflux h = $((V^2/17.85) +0.0152)x(A^2/a^2-1)$

Where,

h = afflux in m,

v = Velocity in the unobstructed stream in m/s,

A = the unobstructed sectional area of the river in m^2

a = the obstructed sectional area of the river at the cross drainage work in m^2.

As per Annexure- 1

Unobstructed Area of Flow after Bridge Construction = 94.800 x 5.00 = 474 m^2

A = 490.30 m^2

V = 1.84 m/sec.

Computation of Area obstructed by Deck Slab

HFL : 100.600 m

Top Level of Deck slab : 101.600 m

Thickness of Slab and Wearing Coat 0.830 m

Length Of Slab 94.800 m

Height of Obstruction 0.830 m

Area obstructed by deck slab 94.800 x 0.83

= 78.68 m^2

Computation of Area obstructed by Piers

HFL : 100.600 m

Soffit of Deck slab : 100.770 m

Average river bed level = 96.600 m

Nos. of pier = 11

Height of Obstruction 100.600 - 96.600 = 4.000 m

Area obstructed by one pier : = 1.2 x 4.00

= 4.8 m^2

For 11 Nos. of piers = 11 x 4.8

A1 = 52.80 m^2

Computation of Area obstructed by Abutments

Average ground level =		96.600	m					
Height of Obstruction		100.600	=		96.600	=	4.000	m
Area obstructed by one Abutment : A2 =	(0.40+0.75)/2		x		4.00			
	=			2.30	m^2			
For two Abutments =		2	x		2.30			
	=			4.60	m^2			
Total area of obstruction due to slab,								
piers and abutments A	=		A0 +A1 + A2					
	=			78.68	+	52.80	+	4.60
	=			136.08	m^2			
Actual Area of flow a =		474.000	-		136.08			
	=			337.92	m^2			
Afflux h =		0.23	m					
Afflux flood level =		100.600	+		0.23	=	100.830	m
Obstructed Velocity	V		=	Q/a	-			
Obstructed Velocity	=			902.15	/	337.92		
	=			2.67	m/sec			
However we consider design velocity		2.67	m/sec.					

Afflux flood level	=	**100.830 M**
Top of deck slab	=	**101.600 M**

This is well above the Afflux flood level.

Though it is not a high level bridge; there shall be no hindrance to traffic during high floods.

Hence OK.