

REPORT

Name of the project :-	Consultancy Services for Preparation of Feasibility cum Detailed Project Report for proposed Bridge/High Level Bridge in Kohima Bypass connecting NH-39 (New NH-02), NH-150(New NH-02), NH-61(New NH-29) and NH-39 (New NH-02) on Engineering, Procurement and Construction (EPC) mode in the state of Nagaland
Location and Necessity	Proposed Bridge is located at Chainage 4+020 Km (Kohima Bypass)
T.B.M.	A Temporary Bench Mark of R.L. is m on Road side stone has been fixed. All the levels mentioned in this project are with reference to this T.B.M.
Hydraulic details	
a) Catchment area:	The total catchment area of the river up to proposed bridge site comes to 7.97 sq km . Vide. Topo sheet no - G76S05
b) High flood level:	After thorough enquiry from local people and personal verification of the existing flood marks on the bank of river H.F.L. was ascertained.H.F.L at proposed bridge site was found to be 1077.846 m
Linear Waterway :	The spread of waterway at HFL at proposed bridge site is 80 m. After considering all the aspects a waterway of 80m with span arrangement of may be adopted as linear waterway for the construction of bridge.
Proposal:-	It is proposed to construct a 1 x 80 m Steel Truss
Foundation:-	Open Foundation
Formation level:-	1080.000 m

DISCHARGE CALCULATION

(A) Discharge is calculated by Catchment Area method:-

As per Dicken's formula (Refer I.R.C. SP-13, page 7)

$$\begin{aligned} Q &= C \cdot M^{3/4} \\ Q &= \text{run-off in m}^3/\text{s} \\ M &= \text{Catchment (sq.km)} \\ C &= \text{A constant taken as this region} \\ &= 11 - 14 \text{ (for Annual rainfall 60-120cm)} \\ &= 14 - 19 \text{ (for Annual rainfall >120cm)} \\ &= 22 \text{ (for Western Ghats)} \\ C &= \mathbf{15} \\ M &= 7.97 \\ Q &= 71.152 \text{ Cumecs.} \end{aligned}$$

Discharge by Run-off Formula Method

As per run-off formula $Q = 0.028 \times P \times f \times A \times I_c$

Where,

- Q = Discharge in Cumec
- A = Catchment Area in Hectare
- I_c = Critical intensity of rainfall in Cm/hr
- P = Percentage coefficient of runoff for the Catchment characteristics
- f = Fraction depending upon the rainfall Over the Catchment area

Catchment area	=	7.97	sqkm	
Length of path from toposheet (L)	=	7.20	km	
Difference in levels from toposheet (H)	=	805.00	m	
Duration of storm (T)	=	1.00	hrs	
One hour rainfall (Io) $I_o = (F/T) \times (T+1)/(1+1)$	=	48.10	mm/hr	
Time of concentration $t_c = (0.87 \times L^3 / H)^{0.385}$	=	0.70	hrs.	(SP-13, page 12)
Critical rainfall intensity $I_c = I_o \times (2/(1+t_c))$	=	56.59	mm/hr	
Discharge $Q = 0.028 \times P \times f \times A \times I_c$				
(for steep, bare rock and also city pavements)				
(Ref. Table-4.1 Pg-13, I.R.C.:SP:13-2004)				
P	=	0.90		
f	=	0.98		
A	=	797.00	Hect.	
I_c	=	5.66	cm/hr	
Q	=	111.38	cum/sec	

FIXATION OF DISCHARGE

Discharge calculated by various methods is as below :-

1. Discharge by catchments area method:-

(using Dicken's Formula)

71.15 cumec

2. Discharge by run -off formula method:-

111.38 cumec

Highest Discharge

Q_1

111.384 cumec

Next higher Discharge

Q_2

71.152 cumec

1.5 x Q_2

106.727 cumec

Highest Discharge

Q_1

111.38 m^3/sec

Next higher Discharge

Q_2

71.15 m^3/sec

1.5 x Q_2

106.73 m^3/sec

Hence Design Discharge

Q_3

106.727

Design Discharge for Foundation = 1.3 x Q_3

138.75 m^3/sec

CALCULATION OF LINEAR WATERWAY

∴ Total Waterway Proposed

Regime width as per Lacey's theory	W	=	4.8Sqrt(Q)
(Refer IRC:5-2015, cl 104.3 or SP-13, page 23)	W	=	49.59

Total Waterway Proposed	=	80.00 m
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Proposed Span Arrangement	=	1 x 80
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(As 90% of Discharge passes through the proposed waterway and 10% spread over the open Land)

As per Site Condition there is Requirement of 80m span

CALCULATION OF NORMAL SCOUR DEPTH

Normal Discharge calculated	=	106.73 cumec		
Add 30% factor of safety for the purpose of design of foundation as per clause 703 of IRC 78	=	117.40 Cumec		
Design discharge 'Q' adopted	=	117.40 cum/sec		
HFL	=	1077.846 m	$D_b = Q/W$	1.47 m
Bed level	=	1076.346 m	$K_{sf} =$	0.60
Maximum scour depth For Pier	=	4.10 m	$d_{sm} =$	2.05 m
Maximum scour level For Pier	=	1073.74 m	$2d_{sm} =$	4.10 m
Maximum scour depth For Abutment	=	2.61 m	$1.27d_{sm} =$	2.61 m
Maximum scour level For Abutment	=	1075.24 m		

AFFLUX CALCULATION

As per Molesworth's equation (Refer IRC:5 and 89)

$$h = [V^2/17.88 + 0.015][(A/A_1)^2 - 1]$$

Where,

h	=	afflux	
V	=	Mean Velocity of flow	0.67 m/sec
A	=	Unobstructed Cross Sectional Area at bridge site	42.40 m ²
A ₁	=	Obstructed Cross Sectional Area at bridge site	33.92 m ²
Afflux	=	0.0226 m	

CALCULATION OF FORMATION LEVEL

R.L OF HFL at bridge site	#####	
Afflux provided	0.000	
Vertical Clearance	0.900	(From IRC 5 Clause 106.2.1)
Depth of Superstructure	1.075	
Wearing coat	0.065	
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TOTAL	#####	m

In view of the existing level of road and gradient of the approach a
Formation level of **1080.000** m is being proposed.