REVIEW PAPER ON "HYDRAULIC AND HYDROLOGICAL IMPACT ON BRIDGE"

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Abstract - *This study describes hydrological and hydraulic bridge/culvert studies to estimate 100-year water levels at specific project sites. Bridges (and sometimes very large culverts) are very expensive hydraulic structures that typically have a lifespan of 100 years. Most bridges collapse due to flooding. In Pakistan, this important study is routinely ignored, resulting in bridges collapsing before their design deadlines. In the current scenario, especially after the destruction of bridges by the recent floods (July 2010) in Pakistan, the importance of this study cannot be denied. This study focuses on different hydrological and hydraulic methods for calculating 100-year flood discharges at the Long Branch culvert site under the Guinea Road, Virginia, USA. To do this, we used Anderson's method to estimate discounts for different payback periods. The bridge builder can modify the culvert road level to account for the appropriate freeboard value. Such structures do not block 100-year cycle floods.*

***Key Words*:** Hyrological modeling, hydraulic bridge, bridge

1. INTRODUCTION

Bridges are very expensive structures. Millions of rupees are spent on bridges in Pakistan but most of them because hydrological and hydraulic studies are not done at all or if studies are done they are not done properly does not last very long. Therefore, the free food provided is insufficient to calculate flooding at different times. Therefore, the bridge overturns and the structural integrity of the bridge is compromised. Hydrological and hydraulic studies should be performed on bridges/culverts and all findings from the studies should be transferred to real scenarios. The project includes conducting hydrological and hydraulic studies of bridges and culverts. Various hydrological and hydraulic methods are used to determine flood water levels with different return periods at bridge and culvert locations. This research ensures that the structure does not collapse throughout its life and remains intact and safe during use. Each bridge must be designed to withstand 100 years of flooding without compromising its structural integrity. In most cases, bridges collapse due to flooding .Therefore, bridges must be designed to allow enough space for floodwaters to pass safely without overturning the bridge.

2. LITERATURE REVIEEW

The earliest cultures known to have used bridges were the Sumerians and Egyptians of Mesopotamia, who used stone haunches for tomb vaults (Brown 1993). 5th century BC. Herodotus was a Greek historian who lived from 490 to 425 BC. (Brown 1993), Ancient History. His account of the city of Babylon includes a description of the achievements of Queen Nitocris, who built a bridge over the Euphrates with embankments and stone-walled piers and wooden decks. The bridge is believed to have been built around 780 BC. (Troitsky 1994), constructed as described below (Greene 1987, p. 118).

Herodotus' account says nothing about the construction of this bridge, leaving much room for imagination as to what it might have actually been like. But his second description of the bridge gives us more insight. His floating pontoon bridge was used by the Persian King Xerxes in 480 BC. Crossing the Hellespont with his large army (Brown 1993). Herodotus describes the bridge in detail (Greene 1987, p. 482f).

If Herodotus' account is correct, the bridge must have been a very impressive structure, and had no equal at the time. In particular, the description of how the pontoons were secured demonstrates a good understanding of the principles of construction. The use of bridges for military purposes was not uncommon in ancient times. Gaius Iulius Caesar (100 BC-44 BC) is one of the authors who left a very clear description of the early bridges. in his 51 or 50 BC. In his De Bello Gallico, written in BC, he mentions several bridges that he had his army build during the conquest. His fourth book describes a famous wooden bridge built in 55 BC. Built across the Rhine. This type of bridge was actually rebuilt for his second time during the Conquest. His description of the structure was very detailed, and several attempts were made to reconstruct it, reflecting the level of knowledge the engineering profession had grown to by that time (Wiseman and Wiseman 1990). , pp. 78-80).

3. METHODOLOGY

Hydraulic design should be illustrated using a combination of drawings. Hydraulic data sheets and instructions. Channel openings for existing and proposed bridge designs are shown on drawings accompanying the hydraulic report. The report should contain the following information

• Description of existing bridges and drainage areas.

• Design Flood, Baseline Flood, Maximum Flood Data, and Road Overhang (if applicable).

• Sloping position of the bridge to the creek. • Water levels downstream, upstream, and downstream of the bridge during design flood.

• Width and area of channel downstream of bridge in design flood.

• Average velocity downstream of open bridge during design flood.

Bridge narration typically includes the following information:

• Recommended minimum bottom of beam height.

• Abutment types (vertical and split) terminate embankments of channels.

Area and opening (if the bridge is crooked it should be noted whether these measurements are available)

Perpendicular to waterway centerline or parallel to lane centerline.)

• Number and type of columns.

• If the bridge is in siphon flow during design flood, the lower girder elevation should be listed.

3.2 Hydrological impact on Bridge

3.2.1 Action Mechanism of the Water Current Loads on the Bridge Piers

When abutments are subject to flooding, another research topic is calculating the dynamic response and pressure of the flow, taking into account fluid-structure interactions. Michael and Buanani [19] proposed a practical formulation for studying the dynamic response of a structure vibrating on one or both sides in contact with water, and proposed the vibration period of the structure and water, the hydrodynamic load , and developed a simplified method for practical assessment of seismic responses. A system with a higher modal effect. However, relatively few systematic studies have been conducted on piers with water pressure, considering impact effects, especially fluid-structure interactions.

When a flood hits an abutment, the impact process on the abutment caused by the flow can be divided into two parts: The moment the flood hits the abutment and the movement of the water flowing around the abutment after the collision.

3.2.2 Influence of Fluid –Structure on the Dynamic Water Pressure after the Moment Impact

Calculate and investigate the amount of abutment to further investigate the effects of fluid-structure interaction on the water flow pressure acting on the abutment, the maximum displacement at the top of the abutment, and the maximum stress at the bottom when the flood acts on the abutment in steady state The survey volume is the abutment. Variation of the fluid-structure interaction coefficient (F-Sc) as a function of flow velocity. F-Sc is defined as the ratio of the numerical response of the abutment under flowing water pressure to the bridge response. Abutment-structural coupling under water pressure without fluid influence.

4. DATA COLLECTION

Sr No		At Defined c/s (130 m u/s)	At Existing c/s
1	Catchment area		1.74 Curas mail
2	Hydralur Gradent	1.223.73	
3	H.F.L Talled at side	98.250	97.670
4	L.B.L @ Site	96.220	95.815
5	Proposed RTL	99.205	98.685
6	Bed width @ Site	10.00 m	12.00 m
7	Bank width @ Site	15.00 m	28.00 m
8	Foundation	Open	Open
9	% obstruction at H.F.L	28.65 %	-
10	% obstruction at 0.FL	16.35 %	-
11	Required water way at H.F.L	13.06 m	-
12	Waterway Provided	14.00 m	-
13	Angle of site	30*	-
14	Proposal		7.00 m che 2 gale

4.1 General Data

Name of Work :- Construction of Minor Bridge in Km 7/700 On Nandgaon

Kh. Mokhad Savner Mhasala Dadapur to Tahashil Boundry M.D.R 75

Necessity :- At Present there is a H.P culvert having 3 rows of 900 mm dia C.C Pipe at

This crossing This H.P Culvert is located in Ch. 7/721 having very

Insufficient wasterway causing damages to structure. Hence high level

Crossing bridge is necessary.

Selection of Site :- Actually the nalla meets to road crossing at Ch. 7/625. Then it flows

parallel to road upto Ch. 7/721 on U/S side causing heavy damages to

exising B.T road to overcome this problem new bridge site is proposed in

Ch. 7/625 where nalla crossing the road with skew angle 30 degree

Also a slab culvert having 2.0 m clear span is proposed at existing

Crossing to flow out water from road side gutter and water from village

Hydraulics :- Hydraulic details are separately attached. High level minor bridge clearing

the H.F.L with a provision of affiux and nominal clearance.

Proposal :- Span arrangement - **High level submersible Minor bridge** **2 Spans of 7.00 M. C/C**

Type Of Foundation - Open Foundation

4.2 HYDRAULIC DATA

S.N	Particulars	X section	
		Define at 130M U/S	Existing

1 Catchment Area 1.740 SQ Miles

2 Bed Width 10.00 M 12.00 M.

3 Bank Width 15.00 M 28.00 M

4 L. B. L 96.220 95.815 M

5 O.F.L (designed) 97.250 96.670 M

O.F.L (observed) 97.250 96.670 M

6 H.F.L (Designed & Tallied with English) 98.250 97.670 M

H.F.L (Observed) 98.250 97.670 M

7 Hydraulic gradient 1 in 223.73 0.00447

8 Nature of crossing skew – 30 u

9 Nature of bed medium gravels with murum

10 Nature of Bank Firm

11 Rugosity coeff.

Compartment No 1 0.035

No 2 0.030

No 3 0.035

12 Angle of Skew Skew 30

13 Type of Bridge High level submersible bridge with Open

Foundation

14 Slit Factor 4.75 (assumed)

15 Linear Water at O.F.L 9.15 M.

16 Linear Water at H.F.L 13.06 M.

17 Inglish Discharge 92.533 Cumec

18 Manning Discharge 91.176 Cumec

19 Velocity Of H.F.L 3.402 M/sec

20 Velocity Of O.F.L 2.133 M/sec

21 Obstruction at HFL 28.65 %

22 Obstruction at OFL 16.35 %

PROPOSAL :- Type of Bridge - High level Submiersible Minor Bridge

Span Arrangement – 2 spans of 7.0 m c/c

Width Of Bridge - 7.50 M Wide.

Type of Foundation - Open Foundation

RTL proposed - 98.685

Height Of Bridge (RTL –LBL) 2.870 M

(98.685 – 95.815)

5. CONCLUSIONS

Based on the results of this study, the following conclusions were drawn:

1. Based on this study, it can be assumed that channel narrowing could lead to an increase in expected levee erosion and erosion. To avoid such situations, river improvement works from 1km upstream to 1km downstream are recommended and continuous monitoring should be carried out during and after the construction of such structures under certain circumstances.

2. The only results of the survey were changes in ground elevation and coastal erosion. There was also a difference in water level and flow speed. The survey results are based on the current situation of the Nara River. The approach can be the same for all flows, but may deviate for other initial conditions and other flows. In addition, the results will vary depending on the seafloor conditions, current velocity, wave effects, tides, surface runoff, and other factors.

3. The project found that many river bridges over 40 years old collapsed during floods, shrinking and causing a sharp increase in local erosion.

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