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DESIGN AND ANALYSIS OF K.T. WEIR

Manali Mhase[1], Satyam Chaugule[2], Tejal Mirgal[3], Vishwajit Kamble[4], Aniruddha Chavan[5], Dr. S.R. Bhagat[6]

[1,2,3,4]B. Tech Students, Department of Civil Engineering
[5]Asst. Professor, Department of Civil Engineering
[6]Head of Department and Associate Professor, Department of Civil Engineering, Dr. Babasaheb Ambedkar Techological University, Lonere 402103, Maharashtra, India

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Abstract - *Water shortage has been a major problem in our country, especially in the rural areas. To overcome such problems, various techniques and methods have been used for the collection and storage of water. One such technique is the construction of K.T weir across the dams or rivers that usually helps in regulating the water flow and provides storage options thereafter serving various purposes. This paper deals with the design of the K.T weir and analyzing it thoroughly by using the necessary data required.*

Key Words*: *Water shortage, storage, technique, K.T weir, design, analysis.

1. INTRODUCTION

Water shortage has been a major problem in our country, especially in the rural areas. To overcome such problems, various techniques and methods have been used for the collection and storage of water. One such technique is the construction of K.T weir across the dams or rivers that usually helps in regulating the water flow and provides storage options thereafter serving various purposes. A site in the rural area of Moolgaon, Raigad in the state of Maharashtra was considered for the purpose of design and analysis of the K.T weir.

2. K.T WEIR IN BRIEF

K.T (Kolhapur-Type) weir, also called as bridge-cum-bandhara, origins from the state of Kolhapur hence the name. It serves the dual purpose of storing or trapping the post monsoon water as well as that of a bridge. Thus, it helps to move the traffic and also helps in fulfilling the water demands in the nearby areas.

3. APPROACH TO DESIGN

The K.T weir consists of two structures i.e. the bridge and the bandhara. It is up to consideration of the individual to decide whether it should be a composite structure or two independent structures. This decision should be made by the designer depending upon various factors such as, cost of construction, material requirement and availability, budget, geography of site etc. The clear span between two piers should be decided by the availability of the gates to be installed and dimensional sizes of the gates available or special order must be given for different sizes of gates as per the clear span considered for the design.

Optimum selection of the type of material for gates should be made considering the following factors of a gate:

- Strength
- Weight
- Cost of gate
- Maintenance cost
- Life expectancy
- Resale value

4. LOAD ANALYSIS AND DESIGN

A. Design of Bandhara:
1. Pier:
Loads acting on pier (As per IRC 6: 2016):

Table -1: Loads acting on a Pier

Sr. No.	Type of load	Nature of load
1	Dead load	Axial (Compressive)
2	Buoyancy	Axial (Tensile)
3	Water current	Horizontal

Design process for pier:

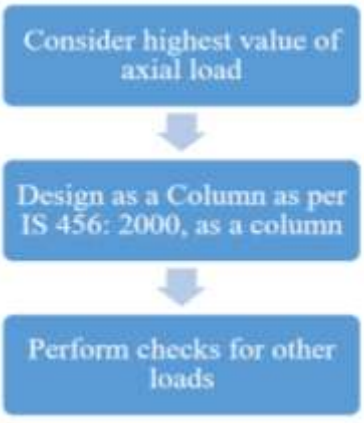

Fig -1: Design process for pier

$$\text{No of piers required} = \frac{\text{Total span}}{\text{Effective span between two piers}} + 1$$

2. Foundation:
Loads acting on foundation:

- Self-weight.
- Dead load of piers
- Static water pressure
- Uplift Pressure

Design process for raft foundation:

Fig -2: Design process of raft foundation

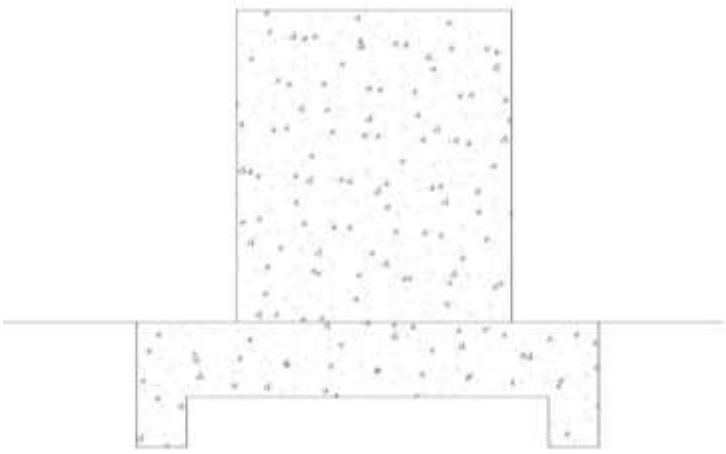

Fig -3: Typical section of a Bandhara

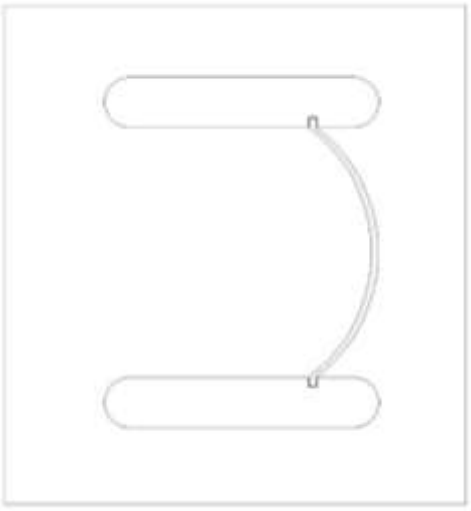

Fig -4: Plan of Bandhara piers with gate

B. Design of Bridge:
1. Deck slab:
A deck slab bridge is the simplest type of construction, adopted mostly for small Bridges and culverts.

Loads acting on deck slab:

Table -2: Loads acting on deck slab

Sr. No.	Types of Loads	Nature
1	Dead Load	Compressive
2	Live Load	Compressive

Design steps: [Reference: Design of bridges by T.R. Jagadeesh & M. A. Jayaram]:

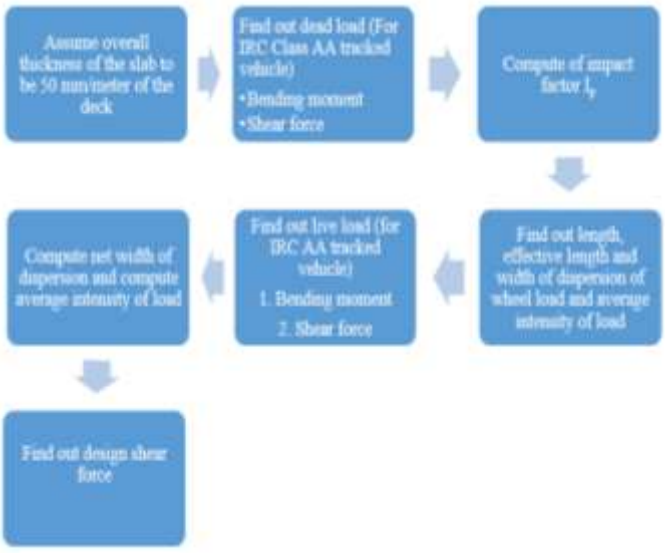

Fig -5: Steps for design of deck slab

2. Pier:
Piers being the intermediate support of the bridge are generally constructed using concrete.

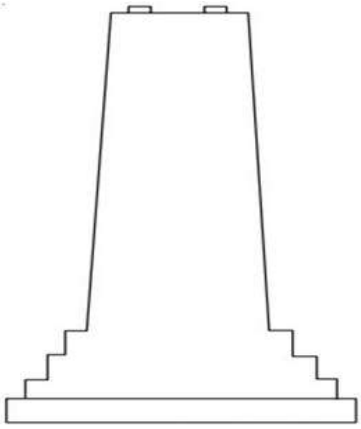

Fig -6: General pier

Loads acting on a bridge pier:

Table -3: Loads acting on bridge Pier

Sr No.	Loads acting on bridge pier	Nature of the force
1	Dead Load of the superstructure. • Dead load of parapet wall • Dead load of deck slab	Compressive
2	Live load	Compressive
3	Impact effect	Compressive
4	Buoyancy effect	Tensile
5	Longitudinal forces	Compressive
6	Water current	Compressive

Design steps: [Reference: Design of bridges by T.R Jagadeesh and M.A.Jayaram

Fig -7: Design process of flowchart

1. Abutment:
An abutment being the end support of the bridge, connects the deck, or surface of the bridge, to the ground and help support its weight both horizontally and vertically. Selection of a particular form depends of the size, shape and geometry of the bridge.

Design of Gravity abutment:

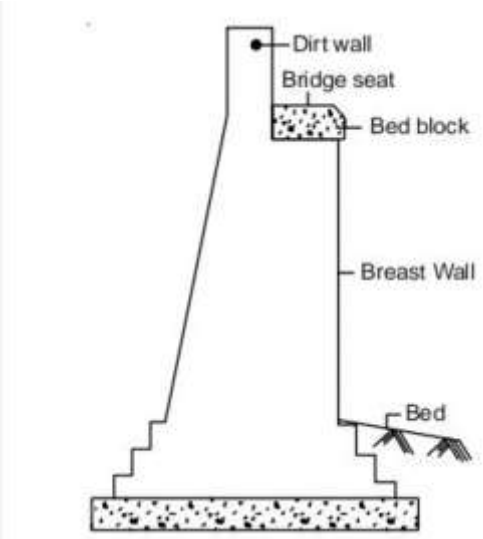

Fig -8: Typical abutment [Source: Design of Bridge Structures by T.R Jagadeesh and M.A. Jayaram]

Loads acting on abutment:

Table -4: Loads acting on abutment

Sr. No	Loads acting on Abutment
1	Dead Load of the superstructure. • Dead load of parapet wall • Dead load of deck slab
2	Live load

Design steps:

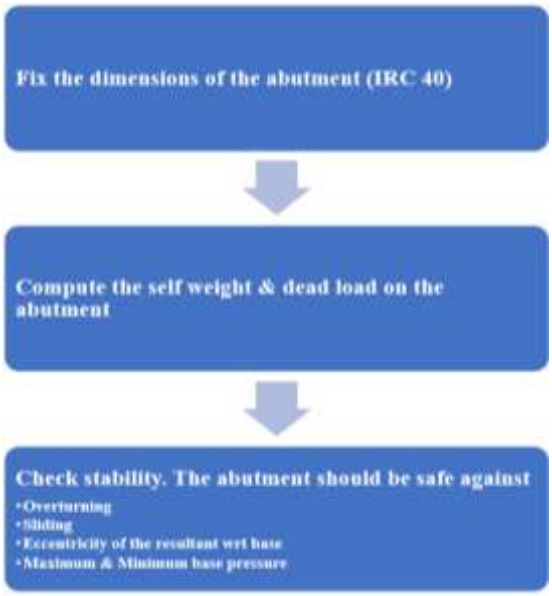

Fig -9: Design steps for Abutment

1. Wing Walls:

The wing walls are adjacent to the abutments and act as retaining walls.

Design for steps:

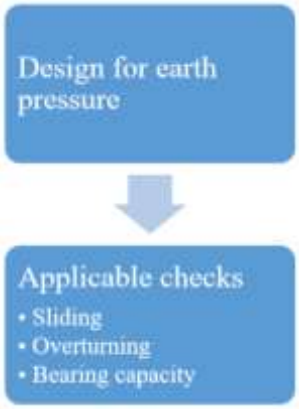

Fig -10: Design steps for Wing wall

2. Footing:

A footing is placed below the frost line and then the walls are added on top.

Design steps:

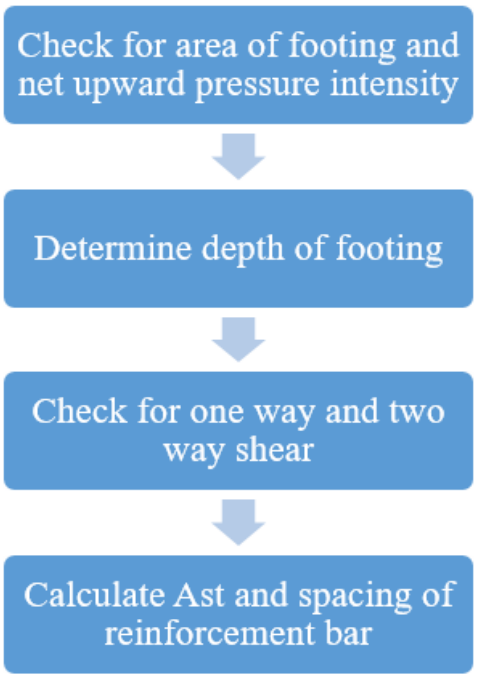

Fig -11: Design process of footing

5. CONCLUSION

K.T. Weir, also known as Bridge cum bandhara is an effective structure performing function of two structures singly. The design of the KT weir is much less complicated when designed in two phases and also it does not compromise the stability of the structure.

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