A CASE STUDY ON ANALYSIS AND DESIGN OF T-GIRDER BRIDGE

Khilendra Kumar[1], Mr. Vagesh Kumar[2]

[1]M. Tech. Scholar, Isbm University, Gariyaband, Chhattisgarh, India.

[2]Assistant Professor, Isbm University, Gariyaband, Chhattisgarh, India.

ABSTRACT

In this project, we aim to analyze and design a T-girder bridge using the theory of structures, bridge engineering and foundation engineering. The principles of foundation engineering for sub-structure recommended by the IRC and the principles of bridge engineering and live loading form the basis of our design. The analysis and design of this project requires knowledge of foundation engineering, influence lines and theory of structures. For design purpose IRC and IS code guidelines were preferred.

The superstructure (RC slab, T-beam girder and cross girder) and sub-structure (RCC abutments and piers) components are designed using working condition of design method under Class AA, 70R and Class A loading as prescribed by IRC . Pigoud's method was used in the analysis of the slab. The limit state method of design was used for the design of the pier shaft. Thus with the help of observation and available data and sources we have designed this T-girder bridge.

Key Words: - RC slab, T-beam girder and cross girder, civil engineering structures, Limit state method of design etc.

1. INTRODUCTION

Bridge, a civil engineering structure, is a structure that has been used since ancient times to cross any obstacle below it. Who would have imagined that a simple structure used to cross a barrier would be used in so many ways with so many materials that it would become such a huge area of study in this period? Today, the bridge is one of the most prominent civil engineering structures. Due to modern equipment and developed material science, various types of bridges are being built nowadays.

In the context of Nepal, being a hilly country with a lot of rivers and streams, we need many bridges to connect one part of the country to another. Therefore, we need to build many bridges to ease the expansion of the road network as well as carry out other development works in an efficient manner. Therefore, there is immense potential for bridge engineering in Nepal.

2. OBJECTIVES

The main objective is to analyze and design the bridge based on the working state method of design. Furthermore, before starting the work we came up with the following objectives:

To get the basic idea of bridge construction.

To become familiar with different types of bridges and their design principles.

To know about different types of loading and their forms of application.

To understand the various methods used in the design of bridge structural components and their limitations.

Become familiar with bridge design standards and code specifications

To be familiar with the standard specifications regarding bridge design.

SCOPE OF WORK & LIMITATIONS

The tasks performed while designing the proposed RC T-beam bridge design are:

Topographic, geological, hydrological, geotechnical and traffic studies of the bridge site. Preparation of site observation report including bridge site visit and verification of necessary data.

Preparing design and details of selected bridge type.

Appropriate bearing design.

Design of abutments and pier.

Foundation design.

To prepare detailed drawings of bridge superstructure with all components, abutments, piers, bearings and footings required for construction of selected bridge type.

LIMITATIONS

T-beam bridge is highly preferred but it has some limitations:

It is economical only for extensions less than 30 meters

Due to the presence of large girders and its arrangement, its appearance is less neat.

3. METHODOLOGY

ACQUISITION OF DATA

For the design of our bridge, the preliminary data needed was acquired after carrying out different surveys.

SITE SELECTION SURVEY

- Direct access to the river.
- Steady river flow without any turns and currents.
- A narrow channel with firm banks.
- Durable high banks above high flood level on each side.
- Rock or other hard, erodible layers near river bed level.
- Proximity to the direct alignment of the road to be connected.
- Lack of sharp curves in approaches.
- Lack of expensive river training works.
- Avoiding excessive underwater construction

4. IDEALIZATION AND ANALYSIS OF BRIDGE STRUCTURE

INFLUENCE LINE DIAGRAM

Structures are usually analyzed for loads that do not change their points of application on the structure. Often structures have to be analyzed for several parallel moving loads that change their position on the structure. In such cases the internal stress in the structure at any point, which depends on the position of the load, varies as the load takes different positions on the structure.

DESIGN OF DECK SLAB

Pigoud's method is used for analysis of slabs spanning in two directions for bridge design as the bridge design receives heavy patch loads.

Therefore, Pigoud's method is most suitable for the design of deck slabs.

DESIGN OF T- GIRDER

A very simple, popular and powerful method of analyzing girders for live loads in simply supported T-beam bridges is Courbon's method. Carbon's method is popular due to the simplicity of the calculations and is applicable when the following conditions are met: Ratio of bridge width to span greater than 2 but less than 4.The longitudinal girders are interconnected by at least 5 symmetrically spaced cross girders. The depth of the transverse beam should be at least 0.75 times the depth of the main beam.

METHOD OF DESIGN OF BRIDGE

Due to the abundant use, availability and recommendation of our supervisor in the construction of RCC bridges throughout Nepal, we used the working state method for the design of bridge components. However, for the design of piers, we used the limit state method because it was more convenient than the working state method.

5. RESULT AND CONCLUSION

The average particle size of soil particles was found to be 1 mm through sieve analysis with the following characteristics.

Summary of Soil Testing:

Water content = 11.94 %

Specific gravity = 2.645

Sieve analysis curve (depth 0.0-0.5m)

The bearing capacity of soil was adopted to be 350 KN/m^2 by observing the general soil properties and similar works done in the region.

6. REFERANCE

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