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Design and Analysis of Bridge at Kolathur

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ABSTRACT: The principle ideal of this project is to design and analysis of a bridge at Kolathur and structural region of the bridge. Bridges is a structure aimed to carry the road traffic or other moving cargo to pass through the obstacles. Need for the bridge and the type of traffic to which it will be subjected to future and various available alternatives and restrictions and constraints regarding selection of site as well as type of bridge The bridge may be thruway bridge, road bridge, a conduit, channels, etc. the main obstacles can be river, valley, and others. Bridges are veritably important in the modern roads and road transportation system, generally serving as social structure system. During constructing bridge there are three main factors of the ground, and they are (substructure, superstructure, bearing), Etc. this study is concerned about the analysis and design of the bridge, it's constructed for the purpose of providing way over the obstacles. The bridge at Kolathur has nearly completed its duration and is in the verge of failure so this project deals with design and analysis of a new bridge

KEYWORDS: Analysis, Structural Parts, Transportation System, Sub Structure, Super Structure

I. INTRODUCTION

Bridges are essential structures that connect people and places, allowing for the transportation of goods and people. The design and analysis of a bridge are crucial to ensure its safety, durability, and functionality. The process of designing and analyzing a bridge involves several stages, including planning, design, construction, and maintenance. During the planning stage, engineers and architects determine the bridge's purpose, location, and budget. In the design stage, the bridge's structural elements, such as beams, columns, and foundations, are designed using software and refined analysis methods. The design must consider the bridge's load capacity, environmental factors, and aesthetics. The construction stage involves the actual building of the bridge, and the maintenance stage ensures the bridge's longevity and safety. In conclusion, the design and analysis of a bridge are complex processes that require careful planning, design, construction, and maintenance to ensure the bridge's safety, durability, and functionality.

Paper is organized as follows. Section II describes about the objective and scope of this project. The proper reference and guidance incompleting the design and investigation of bridge which is described in Section III. Section IV presents the proposed design of the bridge



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II. OBJECTIVES AND SCOPE

The objective of the project is to design and analyse a bridge that meets the required specifications and standards. The scope of the project includes the following:

1. Conducting a comprehensive analysis of the proposed bridge structure to ensure it meets the required safety and performance standards.
2. Preparing detailed bridge plans that include all necessary design elements, such as the bridge deck, piers, abutments, and foundations.
3. To be familiar with the different types of bridge and its design principles
4. To be familiar with the design standards and code specifications of bridge
5. To know about various type of loading and their forms of application

III. METHODOLOGY

The design and analysis of a bridge is a complex process that requires careful planning and execution. The following methodology outlines the key steps involved in this process:

1. Define the project scope: The first step is to define the project scope, which includes the purpose of the bridge, the location, and the expected traffic load. This information will help determine the type of bridge that is most suitable for the project.
2. Conduct a site survey: A site survey is necessary to gather information about the site conditions, including the topography, soil type, and water flow. This information will help determine the foundation type and the bridge alignment.
3. Develop a conceptual design: Based on the project scope and site survey, a conceptual design is developed. This design includes the bridge type, span length, and structural system. The conceptual design is reviewed and refined until a suitable design is achieved.
4. Perform structural analysis: Once the conceptual design is finalized, a structural analysis is performed to determine the loads that the bridge will be subjected to and the resulting stresses and deflections. This analysis is critical to ensure that the bridge is safe and meets the required design standards.
5. Detail design: The detailed design includes the selection of materials, the sizing of structural members, and the development of construction drawings.

IV. COLLECTION OF DATA

For the collection of data we had to enquire with several members of the bridge sub divisional office manjeri. They helped us with the site details as well as given us several information regarding our project and guided us.

Table.1 Test results of soil and the bore log of bore hole- 1-3

Description of Soil	Thickness of soil layers		
	1	2	3
Morum soil	3	3	3.5
Laterite clay	3.0	3.25	2.80
Clay	1.0	-	-
Soft rock	1.8	2.35	2.10
Hard rock	2.0	2.00	2.00



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TOPOGRAPHICAL SURVEY:

Topographical survey was carried out for detailed engineering survey of the proposed bridge

The following are the collected details :

- Length = 12 m
- Width = 13.5 m
- Type = Solid slab
- Span = 1Nos

Foundation = Pile foundation

HYDROLOGICAL SURVEY:

- Discharge at bridge site = 5.096 m³/s
- Discharge at upstream = 51.848 m³/s
- Discharge at downstream = 115.628 m³/s
- Average quantity = 57.524 m³/s
- Average velocity = 1.805 m/s
- Total area = $Q/V = 57.524/1.805$
= 31.869 m²
- High flood level = 94.418
- Bed level = 91.898
- Depth of flow = 2.520 m

V. PROPOSED DESIGN

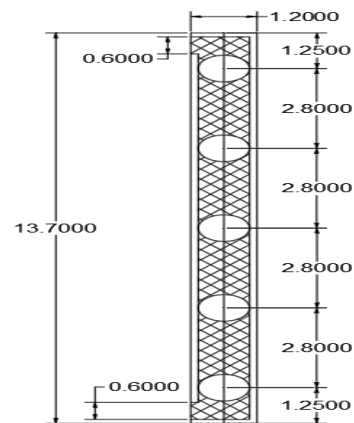
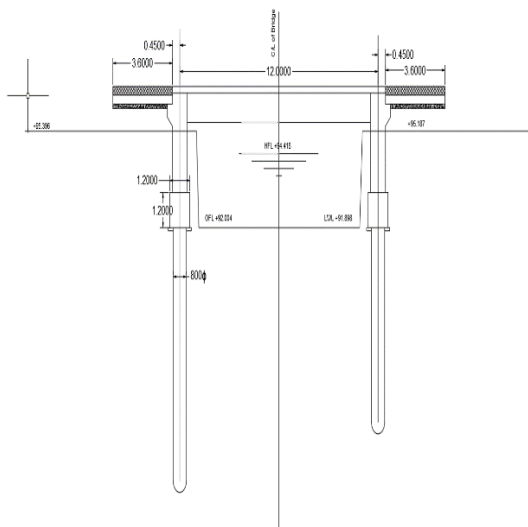


Fig 1. Longitudinal Elevation at Centre Line of Carriageway Fig 2. Foundation Plan At Abutment Points



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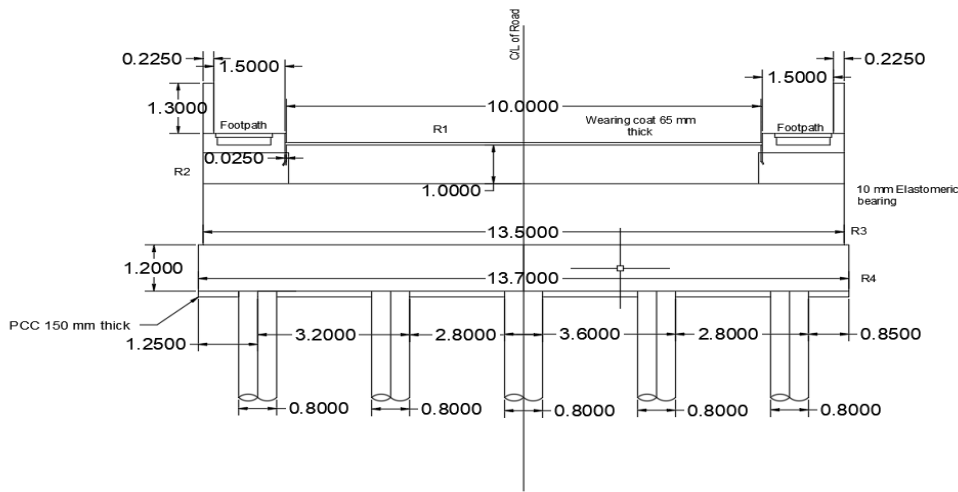


Fig.3. Typical Cross Section at Abutment Points

Fig 1, 2 & 3 shows the typical plan and longitudinal elevation of the bridge in detail, where as in fig 3 & 4 it gives a clear view of the foundation type and arrangement as well as the typical sectional elevation at abutment point in detail. All the measurements are in meters (m)

DESIGN OF SOLID SLAB

- Material constants

Use M35 grade concrete and HYSD steel bars of grade Fe 415

Clear span = 11.1 m

Clear width of road way = 10m

Average thickness of wearing coat = 65 mm

Assumed width of kerb = 1.5 m

Assumed depth of slab say (d)= 555 mm

Over all depth = depth + clear cover+ radius of bar eqn..... 1

= 555+25+12.5 = 592.5 mm

Effective span = 11.1+0.9 =12 m

Self-load = Area * density of concrete eqn2

= 0.5925*1*24= 14.20 kN/m

Dead load of wearing coat = 0.065*1*22= 1.43 kN/m

Total dead load = 15.63 KN/m

Dead load bending moment =(wl_e^2)/8 eqn3

= 281.34 KNm

Dead load shear force = wl/2 = 93.78 kN

Total area of steel = 5151.38 mm²

Provide 25 mm dia bars @ 95 mm c/c

Total area of steel for distribution reinforcement = 1010.26 mm²

Provide 20 mm dia bars @ 300 mm c/c

DESIGN OF ABUTMENT

Self-weight = 188.20 kN

Dead load from superstructure

DL = 2301kN

DL per abutment = 2301/2 = 1150.5 kN

DL per meter run of abutment = 1150.5/ 13 = 88.5 kN

Live load calculation

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According to IRC class A loading

Live load reaction = 965.6 kN

Therefore total load = $188.20 + 88.5 + 965.6 = 1242.308$ kN

Total earth pressure calculated using coulombs formula

i.e. the resultant = 1299.35 kN

Check against overturning :

Factor of safety against overturning = $16.75 > 2$ hence safe

Check against sliding :

factor of safety = $9.71 > 2$ hence safe

Check for minimum and maximum pressure :

$P_{\max} = 529.70$ kN/m²

$P_{\min} = 166.46$ kN/m²

Stresses are within the limit hence ok

VI. CONCLUSION

The span length may be influenced by the cost of superstructure and substructure (cost/pier). If the substructure cost is about 20% of total cost shorter span is more cost-effective. If the substructure cost is about 40% of total cost longer spans are more economical.

In conclusion, the design and analysis of a bridge is a complex process that requires careful consideration of various factors such as the span, load capacity, and materials used. The use of refined methods of analysis, such as those outlined in the Manual for Refined Analysis in Bridge Design and Evaluation, can help ensure the safety and durability of the bridge. This project was completed using various journals as references and by following the IS and IRC codes specifications and proper guidance.

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