APPRAISAL & CONCEPTION OF RCC T GIRDER BRIDGE IMPLANTED BY TOPOGRAPHICAL AREA

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ABSTRACT:
During project work considerable efforts have been endured upon analysis and design of Reinforced Concrete Girder Bridge. In this project work the reinforced concrete girder bridge, already constructed near khamman on motorway, is selected for analysis and design work with slight variation in data. Standard AASHTO HL-93 traffic loading is followed for the analysis of bridge reinforced concrete girder as it is widely used for the design of reinforced concrete girder bridges. Detailed analysis and design of reinforced concrete girder is presented in this thesis in an organized way. The reinforced concrete deck slab has been designed by employing imperial design method. It is expected that this design work will give a true picture of design process the beginners and practicing engineers.

Keywords: Analysis, bridge, traffic loading, girder bridges.

1. INTRODUCTION

A Bridge is a structure providing passage over an obstacle without closing the way beneath. The required passage may be for a road, a railway, pedestrians, a canal or a pipeline. The obstacle to be crossed may be a river, a road, railway or a valley. Bridges range in length from a few metre to several kilometre. They are among the largest structures built by man. The demands on design and on materials are very high. A bridge must be strong enough to support its own weight as well as the weight of the people and vehicles that use it. The structure also must resist various natural occurrences, including earthquakes, strong winds, and changes in temperature. Most bridges have a concrete, steel, or wood framework and an asphalt or concrete road way on which people and vehicles travel. The T-beam Bridge is by far the Most commonly adopted type in the span range of 10 to 25 M. The structure is so named because the main longitudinal girders are designed as T-beams integral with part of the deck slab, which is cast monolithically with the girders. Simply supported T-beam span of over 30 M are rare as the dead load then becomes too heavy. The basic function of a bridge superstructure is to permit uninterrupted smooth passage of traffic over it and to transmit the loads and to transmit the load and forces to the substructure safely through the bearings. Although it is difficult to stipulate the aesthetic requirements, it should, however, be ensured that the type of superstructure adopted is simple, pleasing to the eye, and blends with the environment. No hard and fast rules can be laid regarding the economy in cost. The designer should, however, be able to evolve the most economical type of superstructure based on his judgment and experience given the particular conditions prevailing at the particular site at the particular time.

I. First of all the required formation level is found out. On knowing this the permissible structural depth is established. This is done after taking into account the following two things: Minimum vertical clearance required taking into account the difference between the affluxed high flood level and the soffit of the deck. Thickness of wearing coat required below the formation level.
II. Considering the depth of foundations, the height of deck above the bed level and low water level, average depth of water during construction season, the type of bridge, span lengths, type of foundations, cross section of the deck, method of construction and loading sequence.

III. Trial cross sections of the deck, sizes of various elements of the substructure and superstructure are decided upon and drawn to arrive at the preliminary general arrangement of the bridge. Various trials lead to a structural form with optimum placements of its load masses. Relative proportions and sizes of certain members as well as their shapes are decided upon and drawn to a certain scale on this drawing. The type of bearing to be used along with their locations depending the support system is also established. The main basis of the general arrangement drawing of a bridge structure is a quick preliminary analysis and design of the member sections. This is essential for forming the basis of the detailed to be carried later on depending upon the requirements of the project.

2. RELATED STUDY

Analyse and design the transverse-deck-slab and its cantilever portions, unless the superstructure is purely longitudinally reinforced solid slab with no cantilevering portions. This is necessitated so as to decide the top flange thickness of the deck section which is essential to work out the deck section properties for the subsequent longitudinal design. Compute the dead load and live load bending moments at each critical section. In order to determine the maximum and minimum live load effects that a particular longitudinal can receive, carry out the transverse load distribution for live load placed in various lanes. This may be done by Courbon's method, Little and Morice's method, Hendry and Jaeger methods. Alternatively, use may be made to the Plane-Grid method which involves using one of the many standard computer programs (.e.g. STAAD program). The Plan Grid method is basically a finite element method. Though time consuming in writing the input data, it is nevertheless very useful for the purpose of analysis. For wide and multi-cell boxes and transverse live load distribution may be studied by the finite element method but it is time consuming. Design against bending of critical sections, in reinforced or in prestressed concrete as the case may be. Work out dead load and live load shear forces at each critical section in the longitudinals of the deck and design the sections and reinforcements for effects of torsion and shear, if required.

3. AN OVERVIEW OF PROPOSED SYSTEM

For reaction factors we considered the moment or shifting of loads in transverse direction. For finding the maximum B.M., however we have to consider the movement of the loads along the span. For maximum B.M. at a given section: The maximum B.M. at any section of a simply supported beam due to a given system of point loads crossing the beam occurs when the average loading on the portion left is equal to the average loading to the right of it, when section divides the load in the same ratio as it divides the span. To get the maximum B.M. at a given section, one of the wheel loads should be placed at the section. We shall try these rules for both Class A loading as well as Class AA Tracked loading.

Since the length of the track is 3.6M Maximum shear will occur when the C.G. of load is 1.8M away from support A of the girder. The load will be confined between the end and the first stiffener. Along width of the bridge, the track will be so placed that it maintains a maximum clearance of 1.2M. Hence distance of C.G. of load from kerb = 1.2+0.425 = 1.625M

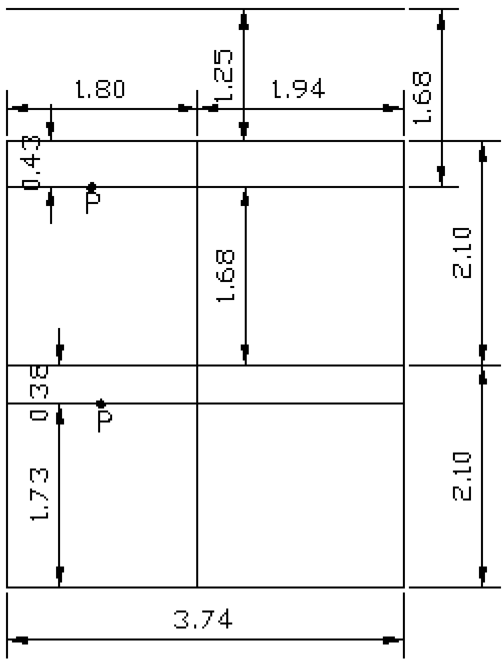

Fig 5.3: Class AA tracked Wheel load position for Live loaf shear force

$$P1 = \frac{1.675}{2.1} P = 0.8P$$

$$P2 = \frac{0.425}{2.1} + \frac{1.725}{2.1} = 1.03P$$

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$$P3 = \frac{0.375}{2.1}P = 0.18P$$

Reactions at end of each Longitudinal Girder due to transfer of these loads at 1.8M from left support

$R_{A'} =$ 0.374P $\quad$ $R_{D'} =$ 0.347P

$R_{B'} =$ 0.535P $\quad$ $R_{E'} =$ 0.495P.

$R_{C'} =$ 0.093P $\quad$ $R_{F'} =$ 0.087P.

Section Design:
Total depth = 1500MM, Effective Depth = 1440MM
A_st= (297×〖10〗^6)/(200×0.9×1440)=1146MM^2
Hence provide 3nos of 25MM Diameter bars, ∴〖Provide A〗_(st)=1473MM^2
Shear Design:
Nominal Shear τ_v=v/bd= (214×〖10〗^3)/(300×1440)
=0.49N/MM^2< τ_max
∴ok
But τ_c = 0.34N/(MM^2), hence provide shear reinforcement.
∴S_v=(2×78.5×200×1440)/(214×〖10〗^3)=211.28MM
∴Provide 2L-10MM diameter bars at 200MM C/C both at intermediate and ends.

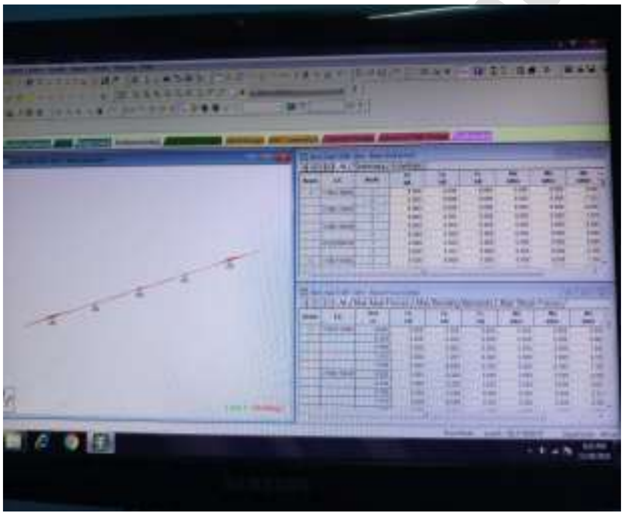
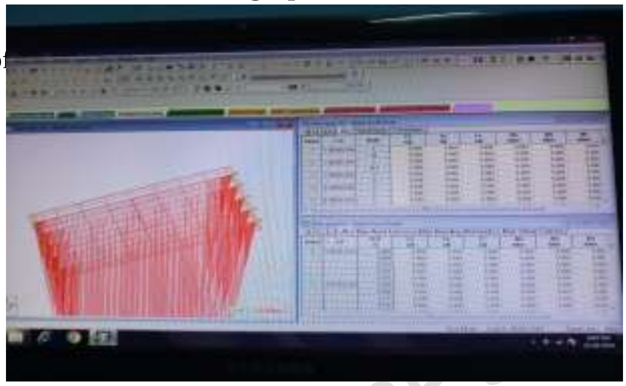


Fig.3.1.Output graphs.



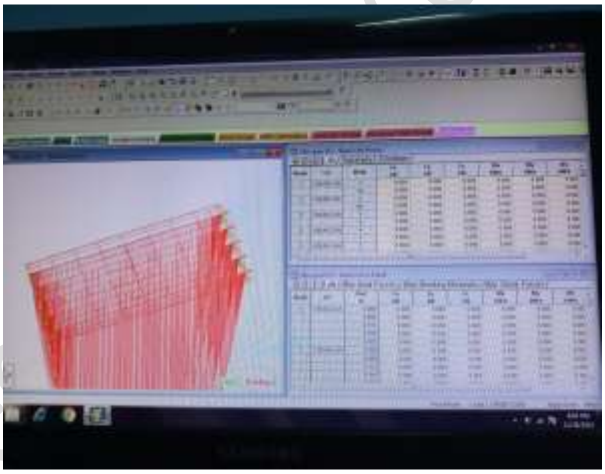


Fig.3.3. With heavy loads.

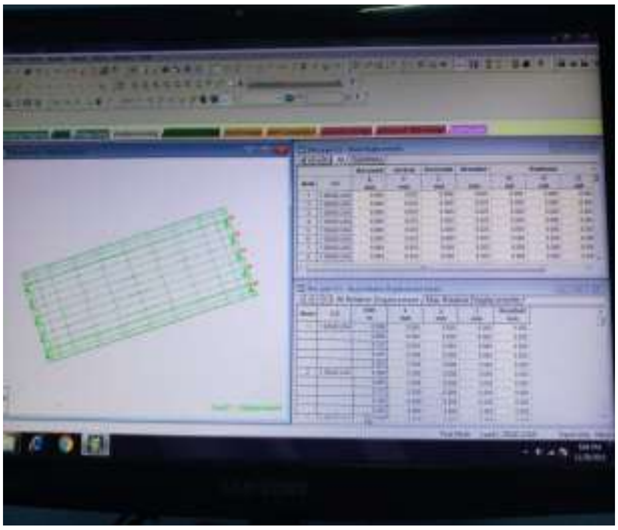


Fig.3.4. With Live loads.

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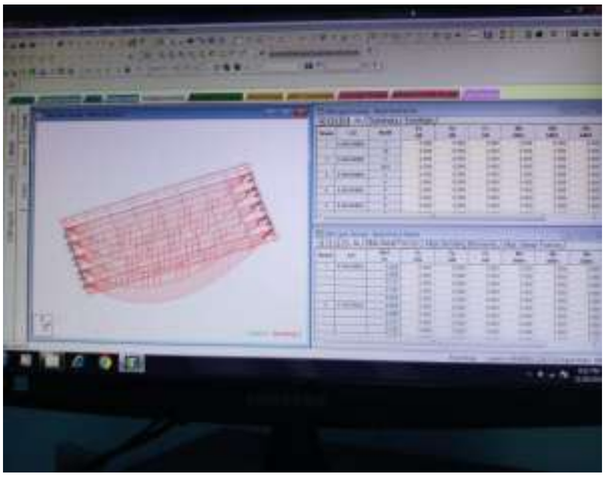

Fig.3.5. With high lateral loads

4. CONCLUSION

The analysis and design of Deck slab and T-Beam of a Bridge has been carried out manually as per IRC guidelines and the following results have been noted. Live Load due to Class AA Wheeled Vehicle produces the severest effect. Shear Force due to Class AA Wheeled Vehicle is very high. Bending Moment in the Inner girder is lesser than the Outer girder hence lesser reinforcement in inner girder when compared to outer girder. The design of the deck slab and T- beam has been manually done keeping in view the above results.

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