Analysis of a prestressed deck type bridge considering vehicle load using analysis tool SAP2000

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Abstract- *A Girder bridge is a bridge that utilizations braces as the methods for supporting the deck. A bridge comprises of three sections: Superstructure (Deck,Girder,Bearing), Substructure (Pier Cap,Abutment and Pier) , Foundation (Pile Cap and Pile). A Girder bridge is likely the most usually fabricated and used bridge. Its fundamental plan, in the most improved frame, can be contrasted with a log extending from one side to alternate over a stream or river.*

In this research work we are analyzing a girder bridge with the effect of Prestressed Concrete Bridge and compare it with general deck R.C.C. Bridge. In terms of finite elemental analysis, forces and cost analysis. Here it is concluded that implementation of prestressed deck is resulting in economical, stable and load resisting member.

Keywords- Bridge. Pretensioning, hydraulic area, IRC loading, vehicle, SAP2000, F.E.M, RCC.

I. INTRODUCTION

A Bridge is a structure built to span physical obstacles without closing the way underneath such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. There are many different designs that each serve a particular purpose and apply to different situations. Designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it.

The Finite Element Method involves subdividing the actual structure into a suitable number of sub-regions that are called finite elements. The intersection between the elements is called nodal.

Pretensioning provided another way to prestress the concrete. In pretensioning, the concrete is poured around the already-tensioned cables and allowed to harden and hold the cables in place. When the concrete is solid and cured, the ends of the tensioned cables are cut and the tension is released into the beam or slab.

II. LITERATURE REVIEW

C Neeladharan et. al. (2017) In this paper, All loading and unloading conditions is analysis and design as per codal specifications for Suspension Cable Bridge using SAP2000. The output of the software presents results including moments, axial loads, shear force and displacements. Moreover, moments and axial load at each node and at any point within the element can be easily obtained from the software output.

Rajesh F. Kale et.al. (2014) In present study optimization technique for R.C.C. T beam girder is presented and explained, similar technique can be implemented to any bridge superstructure in order to economies it. The cost of bridge superstructures increased rapidly with respect grade of concrete and grade of steel increases whereas cost reduces as the span of bridge shorten, also the cost of girder is directly proportional to grade of concrete.

Mulesh K. Pathak (2014) In this paper, various behaviours like bending, shear, axial & torsion are presented for horizontally curved RCC box bridges considering 3-D FEM using SAP software. This approach simplifies analysis & the preliminary design of curved bridge section and calculate bending moments, shear forces and axial forces which indicate that box section is having high torsional stiffness and is nonlinearly vary with degree of curvature.

Maher Qaqish and Eyad Fadda (2008) A simple span T-beam bridge was analyzed by using AASHTO specifications and Loadings as a one dimensional structure, then a three- dimensional structure was carried out by using finite element plate for the deck slab and beam elements for the main beam. The results were analyzed and it was found that the results obtained from the finite element model are smaller than the results obtained from one dimensional analysis, which means that the results obtained from one dimensional using AASHTO loadings are conservative.

III. OBJECTIVES

- To understand The Behavior of Prestressed Concrete Superstructure of Bridge under I.R.C. Vehicle Loading Condition.
- To Design Prestressed Concrete Superstructure Design with Indian standards and codes using SAP 2000 Software.
- To fix various sectional properties and dimension of Prestressed concrete superstructure of Bridge.
- To model the superstructure of the Prestressed concrete Bridge in SAP 2000 considering cost effectiveness.
- To analyze super structure Bridge considering mentioned load combination and find out maximum Bending Moment, Shear forces and Torsion for comparison.
- To Design the Prestressed Concrete Superstructure with maximum Bending Moment, Shear forces and Torsion
- To Perform Finite elemental analysis of two different bridges using Analysis tool.

III. METHODOLOGY

Following steps are required in a sequence for proper completion:

1. To determine the literature Survey related to our scope.
2. Hydraulic design to determine required bridge length and profile grade.
3. Modelling and Analysis in SAP-2000.
4. Comparative results are prepared in Excel.
5. Outcome Results & Conclusion.

Analysis of Prestressed bridge in sap 2000:

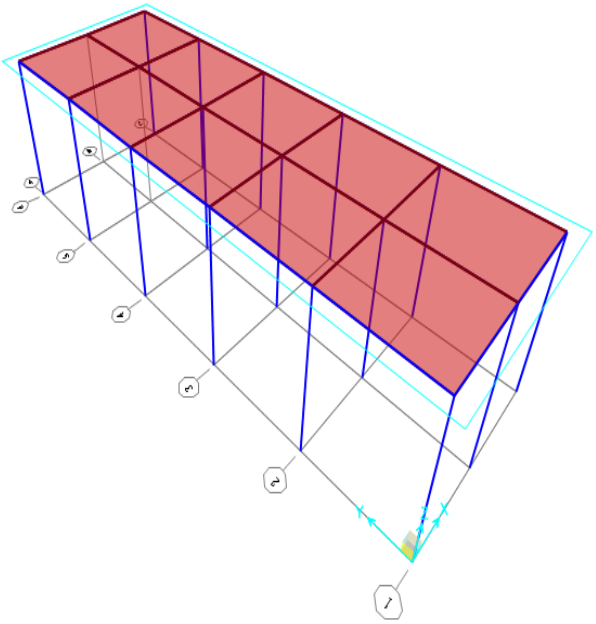

Fig 1: Modelling of bridge

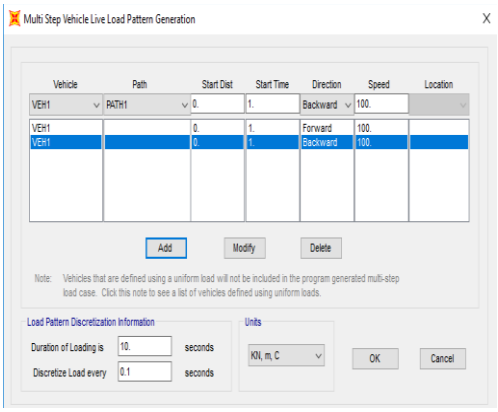

Fig 2: Load assignment

Result Analysis:

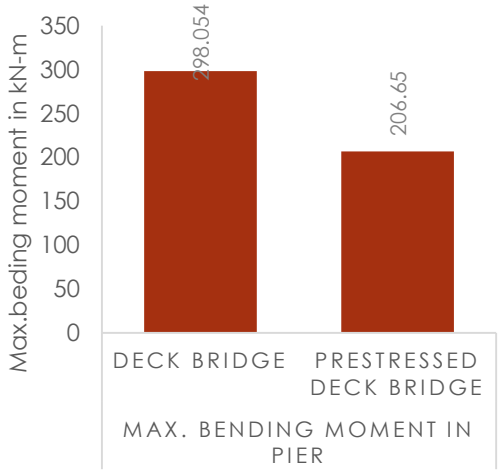

Fig 3: Max. bending moment

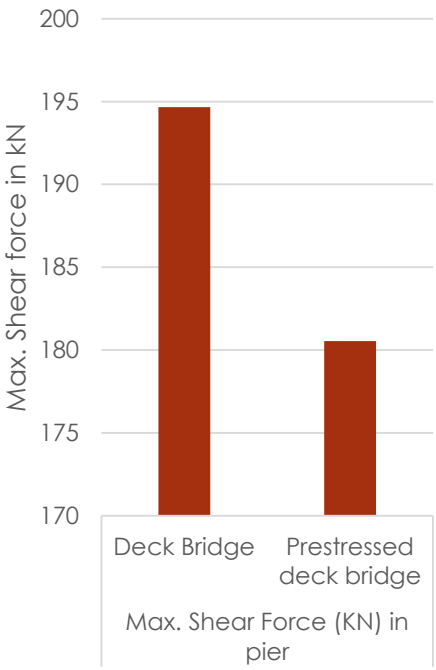

Fig 4: Max. shear force

Table 1: analysis result

S.no	Top Deck Slab	
	Deck bridge	Prestressed Deck Bridge
B.M. (KN-m)	38.34	26.87
S.F. (KN)	29.04	18.45
A.F. (KN)	28.95	20.12

IV. CONCLUSION

- In this comparative analysis it is clearly stated that Prestressed bridge is more stable in resisting load.
- In this study Hydraulic calculation is determined using topography sheet available as per Indian standard using dickens formulae.
- In this study we have manually calculate the total discharge and assigned it in software.
- It is concluded that in terms of cost Deck type bridge is comparatively costlier than Prestressed bridge.
- Here vehicle load using I.R.C. loading is applied to justify its implementation using SAP-2000
- In India, highway bridges are designed in accordance with IRC bridge code. IRC: 6 - 1966 – Section II gives the specifications for the various loads and stresses to be considered in bridge design.

FUTURE SCOPE

Following future aspects can be consider are as follows:

- In future Cable suspension bridge or any other type can be consider.
- In future seismic analysis can be proceed.
- In future AASHTO specification can be preferred instead of I.R.C.

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[6] IRC: 21 Section –III Cement Concrete (plain and reinforced) standard specifications and code of practicefor road bridges.