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Analysis of Cable Stayed Bridge (Raja Bhoj Setu) Using "A", "H" and "Y" Types of Pylon for I.R.C. Loading

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Abstract

A bridge is a structure, which connects two ends of obstacle such as a river, valley, and other road or railway line for the purpose of providing smallest rout as possible and safe journey. A typical cable stayed bridge consists of cable, deck, pylons and foundation. In this project work, live task of link stayed connect for example (Raja Bhoj Setu), Bhopal is considered. It is situated at V.I.P. Street. It has been structured, built considering subtleties and water driven information according to site. In this investigation, examinations of various kinds of arch in link stayed connect for example H-type, A-type and Y-type is displayed to decide the most reasonable sort and contrast it and the executed H-type arch.

Keywords: *Bridge, pylons, cost analysis, staad.pro, structure analysis, I.R.C. loading*

INTRODUCTION

Bridge is a significant structure required for the transportation network. Now, per day with the quick advancement in innovation the regular extensions have been replaced by the cost effective structured system.

In this research, live project data and details (I.R.C. class 70R loading) are assigned using different shapes pylon (A-type, Y-type and H-type).

With the help of finite element technique includes subdividing the genuine structure

into a reasonable number of sub-locales that are called limited components. The convergence between the components is called nodal.

In this research work, we are using Staad.pro analysis tool which is based on finite element method.

After analyzing these critical loads, the results will be compared in terms of forces, deflection, reactions to determine the most suitable, stable and economical section.

Pylon is the load bearing compression member of the bridge. Function of Pylon is to support the cable system and transfer the forces to foundation.

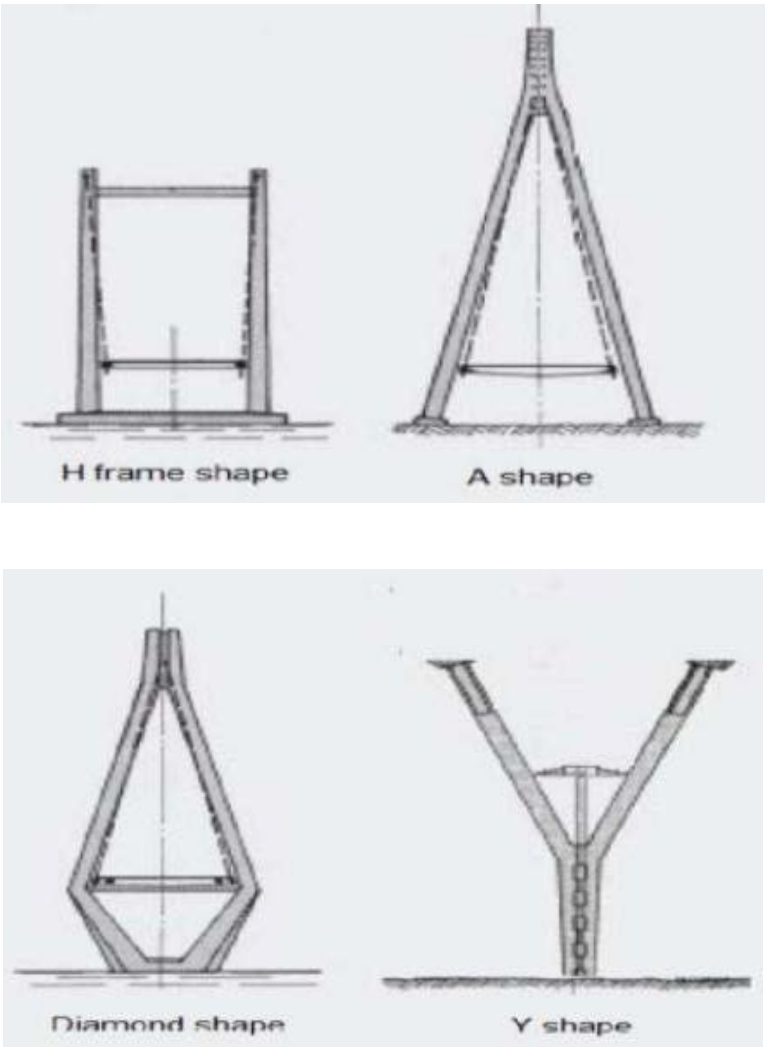

Figure 1: Types of pylon

LITERATURE REVIEW

Shekhar S Patil et. al. llustrated that cable stayed bridge are getting more prominent nowadays in view of good steadiness and richness for long range bridges contrasted with different sorts of bridges. A cable stayed bridge is a bridge in which the heaviness of the deck is bolstered by various cables running specifically to at least one towers. Here spotlight is given on the impact of different states of pylons, for example, Single pylon, a sort pylon and Inverted Y type pylon on the seismic reaction of cable stayed bridge.

The impact of different statures of pylons on the seismic reaction of cable stayed bridge additionally considered for study. The bridge range measurements and different parameters are kept steady and just variety fit as a fiddle and tallness of pylon is improved the situation similar investigation of pylon. Single pylon is more grounded longitudinal way in opposing earthquake drive while Inverted Y type pylon is more grounded sidelong way in opposing earthquake constrain.

Hussain Hararwala et al. [8] stated that the linear static analysis of cable stayed bridges with different shapes of pylons under its own weight.

It is concluded the following points regarding to the study of pylons such as the axial force in pylon, bending moment in pylon, and shear force in pylon and deflection at the top of pylon. This study will be helpful for make a choice for the shape of pylon used for cable stayed bridge in particular conditions.

Raut et al. [9] studied that finite element approach for the geometric nonlinear aerostatic analysis of self-anchored cable-stayed bridges with different pylon configurations along with vehicular interaction. An optimum design of a cable-stayed bridge with minimum cost while achieving strength and serviceability requirements is a challenging task.

OBJECTIVES

The main objectives are as follows:

- Study of cable stayed bridge with different pylon types under dynamic loading condition.
- To determine the most suitable type of pylon for cable stayed bridge located at V.I.P. Bhopal.
- To determine the effect of pylon on deck of bridge.

- To calculate vehicular load as per I.R.C. 70R.

METHODOLOGY

- **Step-1:** First step is collection of data related to cable stayed bridge considering to software implementation and vehicular load.
- **Step-2:** Second step is to select cases and model it in staad.pro v8i 2017.
- **Step-3:** To assign section data and material properties.
- **Step-4:** To assign support conditions.
- **Step-5:** To assign vehicle loading as per IRC 70R Loading.
- **Step-6:** To perform finite element analysis.
- **Step-7:** To prepare comparative result in M.S. excel.
- **Step-8:** To provide conclusion as per results.

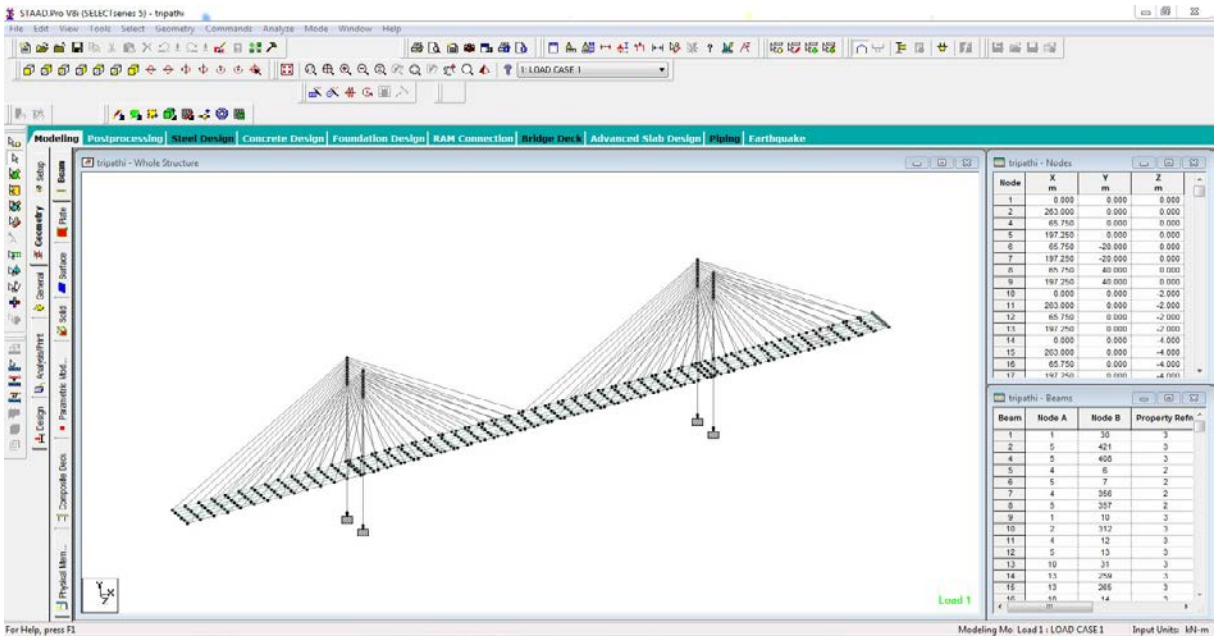

Figure 2: Analysis of H type pylon

R.C.C. bridge frame is modeled in analysis tool staad.pro in which bridge is analyzed and optimized, and vehicle loading (70R+A class) is considered as per I.R.C. specifications, dead load as per 875 part-1 and superimposed live load as per 875 part-2 is calculated and applied.

Three cases have been considered for comparative analysis for cable diameter as 50, 60 and 70 mm:

- First cable stayed bridge with H-type pylon.
- Second cable stayed bridge with A-type pylon.
- Third cable stayed bridge with Y-type pylon.

Table 1: Description: loading condition of H pylon

S.NO	Description	Value
1	Length of Bridge	262 m.
2	Number of bays in X direction	52
3	Number of bays in Z direction	32 m
4	Width of the bridge section	15.90 m
5	Bay width in Z direction	3 m
6	Support type	Fixed support

Table 2: Loadings condition on H type pylon

S. No.	Loading Type	Standard
1	Dead Load	I.S. 875-I
2	Live Load	I.S. 875-II
3	Vehicle Load	I.R.C. A-A Class Loading

RESULTS AND ANALYSIS

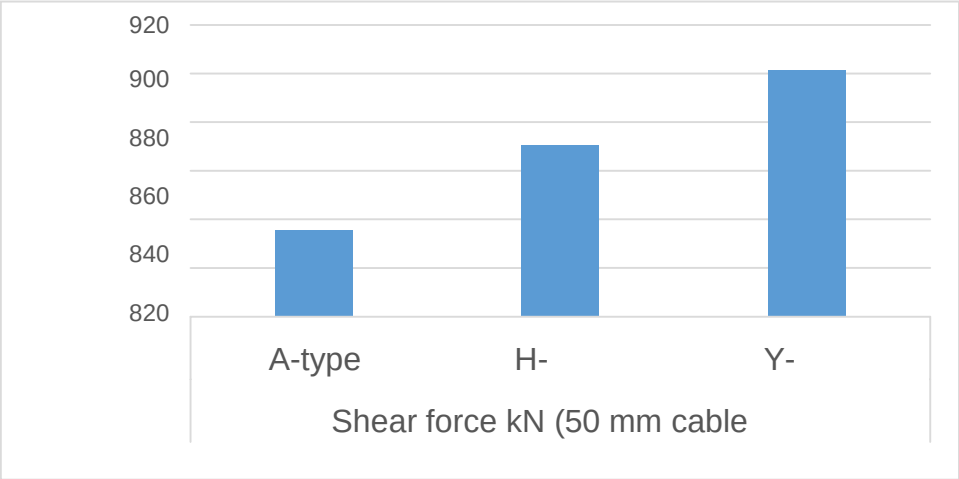

Figure 3: Shear force in different type of pylon

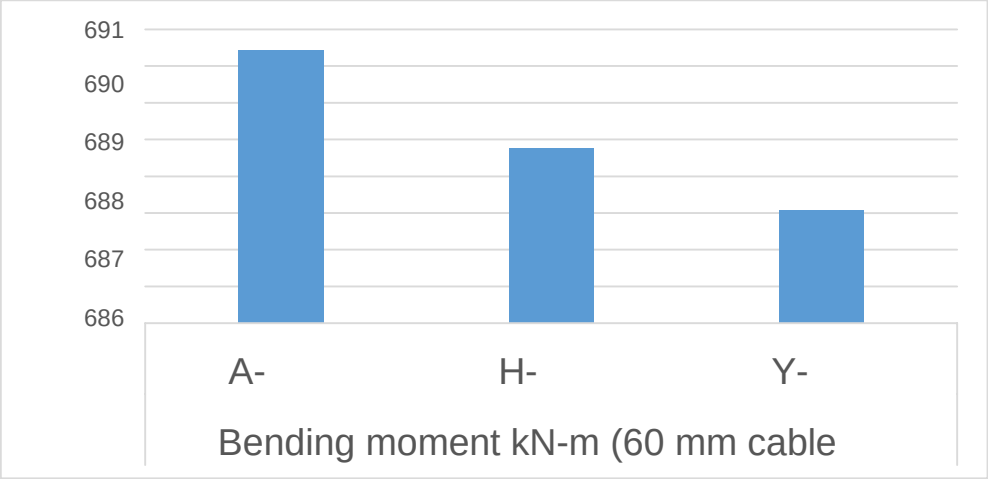

Figure 4: Bending moment in different type of pylon

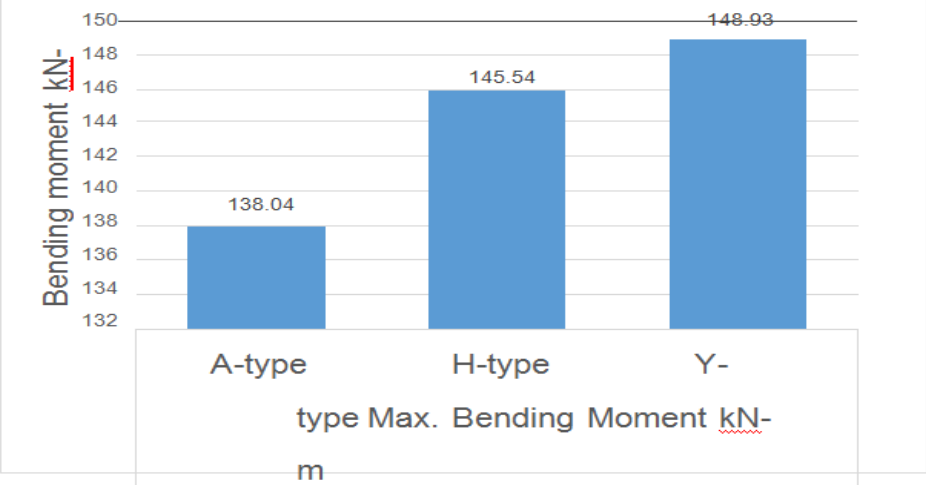

Figure 5: Maximum bending moment in different type of pylon

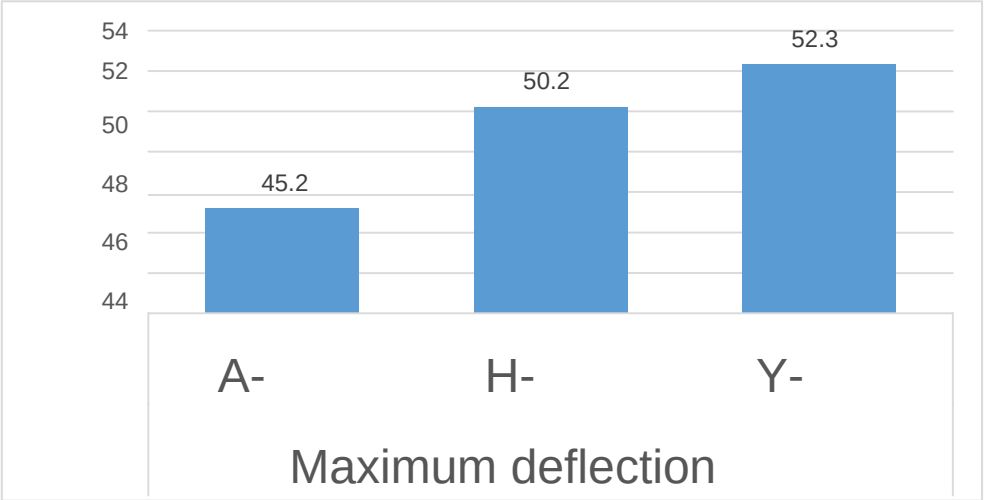

Figure 6: Maximum deflection in different type of pylon

CONCLUSION

In case of deflection, we observed in above chapter that maximum deflection is obtained in Y-type pylon 52.33 mm whereas, least is observed in A-type pylon 45.2 mm, which concludes that A-type pylon is most suitable and stable section in comparison.

In terms of bending moment, it is observed that maximum bending is in Y-type pylon i.e., 148.93 kN-m whereas minimum is observed in A-type pylon i.e., 138.04 kN-m which shows that A-type pylon is comparatively most economical in comparison as bending moment is directly proportional to reinforcement requirement. Shear force in known as the unbalance force observed due to transmission of load from beam to column, in our study maximum value is observed in Y-type pylon i.e. 357.12 kN, whereas minimum in A-type pylon i.e. 345.34 kN.

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