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Review on Analysis and Comparison of Different Types of Cable Stayed Bridges using Staad Pro

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Abstract

Bridges are very much useful for the passage of vehicles. The bridges are constructed in different types. Cable stayed bridge is one of the bridges which is more economical, aesthetic and have good stability. A cable stayed bridge becomes more popular in usage as it is relatively looks attractive. A cable stayed bridge is constructed consisting of one or two towers connected with cables used to support the bridge deck. In cable stayed bridge, the cable bridge is of three different types namely fan shaped, modified fan shaped and harp shaped cable bridges. This paper deals with the review giving upon the view that the comparison of fan shaped Cable Bridge, modified fan Cable Bridge and harp shaped cable bridge which provides the best performance when the dead load, live load and wind load by the application of time history. The parameters like deflection, bending moments, bending stresses and cable axial forces are observed to select the better cable stayed bridge.

Keywords: Cable Stayed Bridge, Modified Fan Cable Stayed Bridge and Harp Cable Stayed Bridge, Pylon, Cables and Bridge Deck

I. INTRODUCTION

A Cable stayed bridge is designed whose deck is suspended by lot of cables. It was first developed in Germany. The main important components of the cable stayed bridge are deck, pylon and tower. In type of cable stayed bridges, the straight inclined cables carry the loads on the deck. The forces on the cables are transferred by the towers to the foundations through compression vertically. In the cable stayed bridges, towers are used to balance the bridge deck which is supported by the cables. Towers are designed by using either steel or concrete. The towers which are designed by steel have less weight when compared to the towers which are designed by concrete. The flexibility and ductile nature are more in steel towers than that of concrete towers. The steel towers need periodic maintenance. The concrete towers are used to bear the axial compression. The cable stayed bridge towers are made up of different shapes namely diamond shaped tower, H-shaped tower, inverted Y- shaped tower, A- shaped tower, double diamond shaped tower, single pylon shaped tower, hexagonal shaped tower, U-shaped tower. The stiffness of the structure depends upon the height of the pylon. The height of the pylon will be increased depending upon the increase in the angle of the cables to the pylon. This leads to the increase in the deflection in the deck. Bridge deck is the roadway surface used for the passage of the vehicles. The bridge deck is made up of concrete and steel. The weight of the bridge deck is an important factor to affect the cables and pylons. Cables are the important component in the cable stayed bridge used to bear the bridge deck. The increase in the number of cables is difficult to maintain. Cables are post tensioned to bear the bridge deck after the design. The arrangement of the cables to the pylon is of different types namely fan shaped, modified fan shaped and harp shaped.

There are different types of rigging on cable stayed bridge. The types are differentiated based on the cables connected to the top of the tower

- Fan stayed design
- Modified fan shaped design
- Harpdesign

A. Fan Shaped Design:

In fan shaped design, the cables are connected to the top of the tower .all the cables on the deck are all connected to the top to transfer the loads through cables.

B. Modified fan Shaped Design:

The modified fan shaped is also called as semi fan shaped is also called as semi fan shaped. In this type, more cables are necessary. In this, the cables are attached near the top of tower but are spaced from each other sufficiently. It is used for better termination improved environment protection and easy for maintenance.

C. *Harp Shaped Design:*

It is also known as parallel design. The cables are almost parallel to a line another .the height of the attachment of cables to tower is proportional to the distance from the tower to their mounting on the deck.

Time history analysis is the study of the response of structure if it may be dynamic or static under the application of the time, when the ground base is exposed to ground motion.

II. LITERATURE REVIEW

Madhuri Yadav and kaushik Mujundar[1] worked on behavior analysis of stayed bridge with different cable arrangement using STAADPRO. This study deals with the design and analysis for different arrangements of cables with the difference of pylons shapes in STAAD PRO. In this study, the pylon shapes considered are A –shape, y-shape and H-shape pylons. Ishitaarora,er.Rajenderesingh ,Aishwarya Parauram Pandit[2] worked on "a review on the study of cable stayed bridges ".In this study, the efficiency of the cable stayed bridges are studied. This study shows that the stiffness of the cable stayed bridge is high since the cables can tolerate even high pressure. Nitesh .K, Kirank.Shetty and Premanand Shenoy[3] worked on 'the performance of cable stayed bridge:. This study explained to find the initial shape of the cable stayed bridge under the application of dead loads. S.N Krishna kanth[4] worked on design and analysis of bridge design using STAAD PRO. Following a particular dimensions for the design of bridge, the bridge is modeled in STAAD PRO following all I.S codes. Yogesh B. kumar, Suresh MR[5] worked on; time –history analysis of a cable stayed bridge for various spans and pylon height.' The main objective of this study is to understand the behavior of cable stayed bridge under dynamic loads in terms of time –history. Thippeswamy AO and Dr.Sunil Kumar Tengali[6] worked on 'analysis of load optimization in cable stayed bridge using CSI bridge software'. The study deals with the analysation of load with different types of cable stayed bridges based on different cable arrangements. Thippeswamy AO and Dr.Sunil Kumartengali[7] worked on 'analysis of load optimization in cable stayed bridge using CSI bridge software'. Munotvaibhav, Shelkenagesh and Deosarkar Manoj[8] worked on 'study of cable stayed bridge subjected to ground motion using time –history method'. Zuber Ahmed and Esar Ahmed[9] worked on 'non-linear analysis of cable stayed bridge'. Shiva Shankar .M, T.sowmya and Amit Nagar[10] worked on 'dynamic analysis of cable stayed of bridge under moving loads with the effect of corrosion of cables'. This study gives that the loads are applied on the cable stayed bridge and also corrosion which gives the differential displacement of pylon and deck.

III. CONCLUSIONS

A. *Based on Cable Configuration to the Tower and the Deck:*

The harp and the fan shape configuration are more suitable than modified fan configuration. Because, harp configuration which has evenly spaced to the tower and deck can reduced the sag in the cables .Whereas the fan shape configuration has more less amount of sag when compared to harp shape but the outer cables in the fan configuration may attain more stress concentration, unless providing some dampers to the outer cables (i.e. far away from the tower) is the most suitable configuration. The bending stress is high for fan shaped model compared to modified fan and harp shaped models. The axial forces of the cables which are connected to the top position of the tower need high axial strength. The bending moment of the harp shaped model is low when compared to fan and modified fan models. The bending moment of the modified fan shaped model is high compared to all other fan and harp shaped models.

B. *Based on Cable Spacing:*

The fan shaped configuration with less spacing in the center of the pylons is more suitable than that of modified cable configuration and harp cable configuration. The bending moment of the modified fan shaped model with 12 meter spacing at it centre is high compared to other modified fan models.

The bending stress of the modified fan cable stayed bridge with center spacing 14m is high. The bending stress of the harp cable shaped bridge with spacing 12m on either side of the pylon is low.

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