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A Review on Comparative Study between Girder Bridge and Extradosed Bridge by using Staad.pro Software

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Abstract - *Extra dosed bridges are similar to cable stayed bridges. The stay cables are used for strengthening. This new type of bridges has been constructed in Japan. This concept is introduced by J.Mathivat. This paper shows some example and difference between Extra dosed and cable stayed bridges in structural aspects. The structural behavior of Extra dosed bridge differs from that of cable stayed bridge. The paper shows the free vibration and forced vibration behavior of Extra dosed bridge.*

There are various types of girder bridges like box-girder, plate girder, I-beam, T-beam etc. Plate girder bridges are the most common type of steel bridges generally used for railway crossing of streams and rivers. It consists of a girder made up of steel plates which are connected by welds or rivets. This type of girder is used for continuous spans up to 250m and for simply supported spans in the range of 20 to 50m. The design of plate girder involves the section of the cross section and design of connection between flanges and web together with the design of intermediate and bearing stiffeners and their connections of the web of the plate girder. Box girders can be universally applied from the point of view of load carrying, to their indifference as to whether the bending moments are positive or negative and to their torsional stiffness; from the point of view of economy. T-beam bridges are one of the most commonly used type of bridge. From the point of view of structural aspect they are simple to construct and maintain. When there is a need to connect shorter distances, this type of bridges are preferred over other types of bridges.

Key Words: Staad.pro, Cable-stayed Bridge, Extra dosed bridge, Bending moment, Shear force, Pylon, Static behavior, Plate Girder Bridge, T-beam Bridge, Box Girder Bridge, Elastic foundation, Equivalent modulus, Vibrations of cable.

1. INTRODUCTION

The Extradosed Bridge is a relatively new type of structure that has been developed since the 1990. The first such structure was the ODWARA blue way bridge which was designed and constructed in JAPAN .The extra dosed bridge can be defined as the structure being between the girder bridge and cable stayed bridge.

1.1 Stability

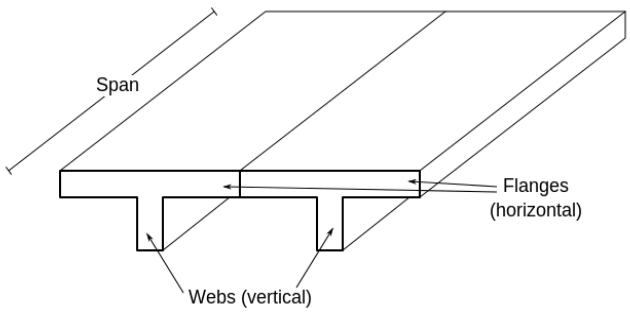
Stability of cable stayed bridges have been carries out many researchers .SHU and WANG investigated the stability characteristics of cable stayed bridge by studying 3 dimensional finite elements method. They contain design parameters such as main span length, cable arrangement, types of pylon. The excessively large buckling length in some girders members can be minimized by introducing concept of fictitious, axial force to obtain buckling length of steel girder members in cable stayed bridges.

1.2 Safety Factors

The safety factors of stay cables are stipulated differently by Japanese specification suggests safety factors of 1.67 and 2.5 for the design of extra dosed and cable stayed bridges. Due to variations in live load it is difficult to precisely examine the safety of this kind of flexible structure.

2. TYPES OF BRIDGES

A box girder bridge is a bridge in which the main beams comprise girders in the shape of a hollow box. The box girder normally comprises either prestressed concrete, structural steel, or a composite of steel and reinforced concrete. The box is typically rectangular or trapezoidal in cross-section. Box girder bridges are commonly used for highway flyovers and for modern elevated structures of light rail transport. A T-beam used in construction is a load-bearing structure of reinforced concrete, wood or metal, with a t-shaped cross section. The top of the t-shaped cross section serves as a flange or compression member in resisting compressive stresses. The web (vertical section) of the beam below the compression flange serves to resist shear stress and to provide greater separation for the coupled forces of bending.



3. LITERATURE REVIEW

Cable-stayed bridges have extended the competitive span range of concrete bridge construction to dimensions that had previously been considered impossible and reserved for structural steel. With technology of prefabrication, pre-stressing, and segmental cantilever construction, it is obvious that cable-stayed bridges are extending the competitive span range of concrete bridges to dimensions that had previously been considered impossible and in a range which had previously been the domain of structural steel. The technological means exist, they only require implementation. The author of this literature review M.V. Sardesai and Dr. A.K. Desai.

Structural behavior in such bridges depends on the interaction among each structural element involved therefore, provided that they share some morphological and constructive similarities with cable stayed and pre-stressed box-girder bridges. Biliszczuk et al. (2017), they presented examples of short-, medium-, and long-span extra dosed bridges designed and built in recent years in Poland.

Paper represents some details of design and construction of selected extra dosed bridges. They concluded this paper with geometrical parameters characterizing presented structures. The parameters were compared with values obtained for cable-stayed bridges and extra dosed bridges built worldwide. The name of author is Hiroshi Mutsuyoshi.

The literature survey for the topic has been carried out. Technical papers, magazines, articles, previous year thesis and books related to topic were studied and their reviews are presented below.

Miller and Juarez 1978: Gives an insight into the preliminary design of segmental precast box Girder Bridge using optimization. Decision about cross-sectional dimensions made during preliminary design can have a substantial influence on the final cost of bridge. To help the designer obtain an economical starting point for a final design, a program was written to determine the section dimensions and mid span and pier pre-stressing steel areas to give minimum cost. The optimization algorithm used was the generalized reduced gradient technique. Since a preliminary design is obtained, the analysis techniques and design criteria have been simplified to reduce computation. Because of simplification made in the analysis and design, the resulting design is intended to be used as starting point from which detailed design can be carried out. The program produced designs that appear realistic compared to those used in practice, although the results appear to indicate that somewhat shall over bridges than are currently used would be optimum. For the only problem which an actual design was compared, the program produced a design about 5%, less costly than the design that was built. The design produced by the program will satisfy American association of state highway and transportation officials (AASHTO) Specifications requirements and the recommendations of the precast concrete institute (PCI) bridge committee.

Walter Podolny 1979: Discuses the evolution and advantages of precast segmental bridge construction. It was observed that the first kind of precast segmental bridge was built on 1948 by the French scientist Eugene Freyysinet in Paris. Later on by 1950's the same appeared in the parts of Europe and United States. The advantages and disadvantages of precast segmental bridge construction is mentioned. Paper also discussed how precast segment can be incorporated to variety of bridge types such as cable-stayed, arches, rigid frames and girder type bridges. Examples of many of these construction procedure and equipment and bridge type have been described.

Precast segmental box Girder Bridge manual 1979: Is a complete design handbook on precast segmental box girder bridge. It deals about development of precast segmental bridge construction including types of precast segmental construction, advantages and its application worldwide. It also gives an insight into various considerations for segment design like principle dimensions of segments, pier and abutments segments, post tensioning tendons, shear keys, epoxy joints. Analysis of precast segmental bridge consists of longitudinal analysis, transverse analysis and correction to deformations.

4. SCOPE OF THE PAPER

In this paper, the behavior is studied for both bridge decks (cable-stayed bridge and extra dosed bridge) for various spans and 70R loading. The different deck models are prepared and analyzed using the software CSI Bridge. Further, the bridge analyzed is checked for class A and class AA loadings

5. METHODOLOGY

The research work comprises a study of response of bridge deck for both types of bridges (cable-stayed bridge and extra dosed bridge) for various different spans and 70R loading. The parametric study includes response of deck, deck moment, study of pylon, how the response of bridge varies span wise, from aesthetics point of view feasible bridge structure, pylon height and span length to thickness of girder ratio. Check the bridge analyzed for class A and class AA loading. The model will be developed using Staad.pro software.

6. CONCLUSIONS

CONCLUSION

From above literature review following points are concluded

- Extra dosed bridge can be adopted alternative to cable-stayed bridge when overall height is restricted.

- The lower tower height not only reduces the material consumed but also reduces construction difficulty.

- The technique of cable anchoring in extra dosed is simpler than anchoring technique used in cable-stayed bridge

- Extra dosed bridge option is more competitive under similar span lengths owing to the lower construction cost, better constructability and easier maintenance.

- Girder bridges are simple to construct as compared to extra-dosed bridges.

- Girder bridges are economical as compared to extra-dosed bridges.

- The structural behavior of the girder bridges is different as compare to Extradosed Bridge.

- The loading conditions are different for Girder bridges and Extra dosed bridges.

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