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A REVIEW ON ANALYSIS AND DESIGN OF CABLE-STAYED BRIDGE

Kartik.K.Mandani[1],Hardik.G.Moradiya[2],Prof.Anuj.K.Chandiwala[3]

[1]*Civil Department, ChhotubhaiGopalbhai PatelInstituteof Technology, kartik.mandani847@gmail.Com*
[2]*Civil Department, Chhotubhai Gopalbhai Patel Institute of Technology, Hardikmrd@gmail.com*
[3]*Asst.Prof.atCivil Department,ChhotubhaiGopalbhai Patel Instituteof Technology, Anuj.chandiwala@utu.ac.in*

Abstract—*In the recent years cable stayed bridges have received more attention than any other bridge mainly, in the United States, Japan and Europe as well as in third-world counties due to their ability to cover large spans. Cable-stayed can cross almost 1000m (Tatara Bridge, Japan, Norman die Bridge, France)In India few of the cable stayed bridges are constructed and a couple of them are underway. Like Bandra-Worli sea link, Second Hoogly Bridge are the finest example of application of cable stayed bridge in India. Cable stayed bridges for road over bridge in Bangalore and Chennai have come up and a cable stayed road over bridge is proposed in various smaller emerging cities. There is still place for innovation in Cable-stayed bridge techniques.Here detail study of the cable stayed bridge is done. Historical facts, various components of the bridges, types of the pylon arrangements, type of the cable configuration arrangements has been done to give a brief idea about cable stayed bridge from the various literature surveyed.*

Keywords- : *cable-stayed bridge, parametric excitation*

I. INTRODUCTION

The achievement of man has been attributed to how large, long and tall he can create the structures around him. From the very beginning of the human race he has been trying to prove that he can create some very astonishing and amazing structures around him, like Pyramids of Egypt. The construction of cable stayed bridge of about 1000m span (Tatara Bridge, Japan) itself is an achievement in structural engineering. After end of World War II there was shortage of construction materials like steel and cement thereby need to obtain optimum structural performance from these materials became imperative. New systems and technologies were evolved to meet these requirements.

Cable stayed bridges are constructed along a structural system which comprises of a deck and continuous girders which are supported by stays in the form of cables attached to tower located at the main piers. Stiffness of the overall structure can be provided by stiff towers or can be stiffened by taking backstays to individual or by employing intermediate tension piers or combination of the stiffness of the main span, the tower and the back span.attributed to several advantages over suspension bridges, predominantly being associated with the relaxed foundation requirements, with the introduction of high-strength steel, development of welding technology and progress in structural analysis and new construction technique which is very much in vogue. The development and application of computers opened up new and practically unlimited possibilities for the exact solution of these highly statically indeterminate systems and for precise statically analysis of their three-dimensional performance. This leads to economic benefits which can favour cable-stayed bridges in free spans of up to 1000m.

II. LITERATURE REVIEW

A. N. D. Shah And Dr. J. A. Desai Nonlinear Aerostatic Analysis of Cable-Stayed Bridges Considering IRC Vehicular Loading, Proceedings of the 5th National Conference on Wind Engineering, SVNIT, 2009. :-

N. D. Shah And Dr. J. A. Desai States the importance of nonlinearity on cable stayed bridges is emphasized. Span of the cable-stayed bridge increases, the nonlinearities also go on increasing which is due to sag in the cable, axial force bending moment interaction in the girder and tower and due to large deformations of the overall structure. Further, the nonlinearity magnifies with the influence of wind loading. With the increase in bridge span, the diameter of the cable, the nonlinearwind structure interaction and the wind speed spatial non-uniformity increases, which have significant influence on the aerostatic behaviour of long span cable-stayed bridges. This paper presents finite element approach for the geometric nonlinear aerostatic analysis of cable-stayed bridges with vehicular interaction and the concept of longer span is elaborated here with help of parametric study. The effect of anchoring top cables of cable stayed bride i.e. bi-stayed concept is also compared. The authors concludes that the concept of spread pylon proved useful in reducing the cable tensile forces whereas the bi-stayed bridge concept is useful in reducing the forces in cable, girder and pylons.

B.C.E.N. Mazzilli, J.C. Andre, M.E.S. Soares, I.B. Ramos.A Simple Numerical Model for the Aero elasticAnalysis of Cable Stayed Bridge, Journal of Wind Engineering and Industrial Aerodynamics, SaJo Paulo, Brazil, 2000.

C.E.N. Mazzilli.In their paper on studies aerodynamic forces for the classical utter analysis. Reduction technique is applied to supply a set of two Coupled homogenous equation of motion about the equilibrium configuration. The aerodynamic load is modelled within the finite element and is assumed to be in conformity with classical utter analysis. The procedure is programmed using symbolic computation. For classical utter case the system is modelled by at least two degreeof freedom to account for typical model coupling. The aerodynamic model is assumedto have constant values for beam-element length l, the deck cross section with 2 C and wind velocity V along the span. The aerodynamic "stiffness" and "damping"nodal matrix are defined in terms of the vibration. The aerodynamic coefficient isdetermined in wind tunnel test. The presented method is applied to the determination of the critical wind velocity. Through the example the author concludes that with equivalent damping ratio (V) increase with V, the circular frequency remains constant. In the examples solved the critical condition is not reached so the utter phenomenon is not predicted in the selected wind velocity range this is because ofthe favourable geometrical characteristics of the bridge and short length of the deck and its cross section shape. The author further states that the same methodology to be applied to other structures which are more prone to flutter.

C.R.A. KHAN, T.K. DATTA, S. AHMAD,.SEISMIC RISK ANALYSIS OF MODIFIED FAN TYPE CABLE STAYED BRIDGES, ENGINEERING STRUCTURES, 2006.:-

Has discussed in their work about frequency domain spectral analysis is presented for the seismic analysis of cable-stayed bridges for the multi-component stationary random ground motion incident at an angle with the longitudinal axis of the bridge. The ground motion is represented by its power spectral density function and a spatial correlation function. The analysis duly takes into account the spatial variation of ground motions between the supports, the modal correlation between different modes of vibration and the quasi-static excitation. The author uses the proposed method for analysis. Then parametric study is conducted to investigate the behaviour of the cable-stayed bridge under the seismic excitation. The parameters include the spatial correlation of ground motion, the angle of incidence of the earthquake, the ratio between the three components of the earthquake, the number and nature of modes considered in the analysis, the inertia ratio between the tower and the deck, and the nature of the power spectral density function of the ground motion.

III. CONCLUSION

Literature review has been done to understand the current trends of research of work going on cable stayed bridge. The literature survey was limited to the basic understand of the cable stayed bridge under Dead Load, Live Load and on some advanced topics like the Aerostatic Effect and the Dynamic Response of the bridge.

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