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Study on Parametric Behaviour of Box Girder Bridges under Different Radius of Curvature and Varying Span

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Abstract: A-box girder flyover is a transport system in an urban area with a high capacity, frequency and the grade separation from other traffic. Box girder flyover is used in crowded cities, crossover junctions, and metropolitan areas to transport large numbers of people. An elevated carriage way system is more preferred type of transport system due to ease of construction and also it makes urban areas more accessible without any construction difficulty. Here the present study focuses on the analysis of box girder, of an elevated box girder structural system.

1. Introduction: Urban cities in India, have experienced phenomenal growth in population in the last two decades. To meet the traffic demands, Flyovers, Tunnels & Elevated Highways etc. have been constructed. The viaduct of a bridge has box girders of single cell, double cell, multi cell etc. There are different structural elements for a typical box girder bridge. Box girders have gained wide acceptance in freeway and bridge systems due to their structural efficiency, ease of construction, better stability, serviceability, economy of construction and pleasing aesthetics. Analysis and design of box-girder bridges are very complex because of its 3D behaviours consisting of torsion, distortion and bending in longitudinal and transverse directions. **A** box girder is particularly well suited for use in curved bridge systems due to its high torsional rigidity. High torsional rigidity enables box girders to effectively resist the torsional deformations encountered in curved thin-walled beams. There are three box girder configurations commonly used in practice. Box girder webs can be vertical or inclined, which reduces the width of the bottom flange.

2. Dynamic analysis of railways bridges under high speed trains;

Ashish gupta; Amardeep singh ahuja.

In dynamic analysis, the structural damping is an important key parameter. The damping properties are important in dynamic analysis, but they are often not well known. The response of a bridge structure due to moving loads, and the magnitude of the vibrations of the structure, depends heavily on the structural damping capacity [3]. In risk of resonance, damping is especially important. Damping is a property of building material and structures, which usually reduces the dynamic response. Damping is dependent on the material of the railway bridge and on the state of the structure [4], for example presence of cracks and ballast. The magnitude of damping also depends on the amplitude of vibrations of the bridge. After passages of vehicles, or other excitations of bridges, damping causes the bridges to reach these states of equilibrium. Predicting the exact value of damping of new bridges is unfortunately not possible. In cases of designing new bridges, damping tables are used, which gives the lower limits of the percentage values of critical damping , based on number of past measurements. For already existing bridges, the damping values can be deduced by calculating the logarithmic decrement from free vibration measurements. It is almost impossible to take all sources of damping of vibrations of railway bridges into account in engineering calculations, because of the high number of them.

3. Pushover Analysis of Balance Cantilever Bridge

N SOBHANA[1], A RAMAKRISHNAIAH [2], P SOMUSEKHAR[3]

Pushover analysis is a magnitude of target displacement gives seismic accomplishment of structure. Target displacement shoes global dimension of the structure is expect to design the earthquake, Center of mass of roof displacement. The target displacement for the MODF structure has been evaluated. The equivalent SODF domain the shape factor, the assumption is always predicted. Under the non linear static a model show the inelastic response to target displacement, which result the force. Model is subjected to lateral forces until target displacement is increased. So, building collapses. In this way target displacement is experienced the architecture earthquake.

4. Dynamic Load Allowance for Reinforced Concrete Bridges

Jerry W. Wekezer[1*], Eduardo E. Taft[1]

Dynamic live loads are taken into account by using dynamic load allowances (DLA), which is a factor to scale up the magnitude of the static load. By using a DLA engineers usually ignore vibrations and other damaging effects induced by heavy vehicles into bridges.

Reinforced concrete bridges usually have a behavior that is hard to explain, and applying advanced structural analysis to this type of structure is not simple. With advances in computational power and methods in computational mechanics, newer methods to analyze complex structures like bridges are coming to light. This advances in computer technology and computational capabilities, followed by development of commercial finite element (FE) software have made 3-D dynamic analysis of bridge structures more effective.

Further development of FE software in material models, and different applications of constraint and damping allows the software to more accurately represent the actual behavior of the bridge structure. The vast variety of element and material types allow for a better representation of vehicle components like the suspension system, which is critical in the interaction between vehicle and bridge. All these advancements in FE model software provide a powerful tool for the assessment of complex structural and mechanical phenomena such as a wheel rolling on the pavement. Most important for this type of analysis is the dependence of moving live loads varying with time caused by dynamic interaction of masses for the vehicle and the bridge components.

5. Seismic Analysis of Box Girder Bridge

Firoz Ahmad M. A. Baig

In this study, we have taken 92 m long bridge deck with multiple spans. The value of peak ground acceleration PGA, peak ground velocity PGV, peak ground displacement of fault normal and fault parallel component are examined for determining of seismic response of box Girder Bridge. Non-linear time history analysis method is used in the current study to carry out the seismic response of box Girder Bridge.

There are various method to use to measure the seismic response of bridge structure. They are Equivalent static seismic force method, the response spectrum method, time history analysis method, and pushover analysis. We have used the time history analysis method in our study.

Time history analysis method is very wide and complex field of study. There are two types of time history analysis method i.e. boundary non-linear time history analysis and inelastic time history analysis. Time history analysis is a dynamic analysis which considers material non-linearity of the structure. Considering the efficiency of the analysis, the non-linear element is used to represent important parts of the structure, and the remainder is assumed to behave elastically. Time history analysis method is applied for the determining the seismic behavior of bridge structure under dynamic loading of the earthquake.

6. An Integrated Finite Strip Solution for Box Girder Bridges and Slab- on-girder Bridges

Moe M. S. Cheung1, Zhenyuan Shen2 and Ben Y.B. Chan3 the quasi-static analysis approach in bridge design has been used for over a cen-tury. However, with the successful application of stiff and light-weight composite materials in recent years, the clear span length of bridges nowadays are increasing at a faster pace than ever. Consequently, the critical design criteria have shifted from the static ultimate and serviceability considerations to the dynamic driven failure mechanisms. It is becoming obvious that the dynamic characteristics of these structures have become significant and the conventional design approach is no longer appropriate. Nevertheless, the formulation of a FEM model and the setting up of boundary conditions of a three dimensional (3D) bridge for dynamic analysis is very complicated and time consuming, and this makes the dynamic analysis of long span bridges extremely difficult in real design process. Besides, the conver- gence rate of the conventional FEM in dynamic problems is usually slow, since the nonlinearities associated with the flexible bridge structures lead to a significant re- distribution of internal forces. One of the solutions for improving the convergence rate is to use very small elements throughout the structure, resulting in a large number of degrees of freedom. Although, some extended techniques, such as the mesh-free approach [Dang and Sankar (2008) and Hagihara (2007)], have been de-veloped recently to accelerate the FEM analysis, the difficulty for FEM to perform large-scale problem is still quite obvious. In this regard, two streams of technique were vigorously developed in recent years to reduce the computational demand: the Boundary Element Method (BEM) and the Finite Strip Method. The BEM takes advantage of the finite-part integrals to reduce the apparent dimension of the model. With its absolute generality and the extended solver developed in recent years [Heet. al. (2008), Liu (2007), Owatsiriwong et. Al. (2008), etc.], the application of BEM has been extended to shell problems [Albaguergue and Aliabodi (2008)] and three-dimensional interface problems [Wang and Yao (2005, 2008)]. In addition, BEM has also been proven to be able to perform crack and fracture analysis [Zhou et. Al. (2008), Shiah and Tan (2000)]. However, the formulation for the BEM problem is still quite complicated and is usually applied together with the FEM [Liu and Yu (2008)].

7. Government of India Ministry of Shipping, Road Transport & Highways (Department of Road Transport & Highways)

The basic approach is that the width of carriageway of all bridges irrespective of their lengths or location / terrain (rural, urban, plain) shal! be that:- for free flow of traffic from approaches to bridge, width of carriageway on bridge shall be equal to the carriageway width of immediate approaches plus paved shoulders even if presently not provided. For bridges on 2-lane NHs the carriageway width shall be 10.50m (paved shoulder and kerb shyness on either side taken as 1.50m and 0.25m respectively). Overall width of bridges will vary depending upon width of carriageway, footpath, safety kerbs, crash barriers, railings and provision for kerb shyness. Overall width of bridges for 2- lane NHs without footpath and with footpath are given in table in Annexure.

Formation width of the immediate approaches shall be equal to overall width between outermost faces of the railing / crash barrier of the bridge. In case the formation width of approaches is different than the overall width of the bridge as stipulated in (b) above, Wo- 2 formation shall be increased to the overall width of bridge in at least for 90 m on either side of bridge followed by a transition of 1: 20. 3. Existing Narrow bridges on NHs:

8. Conclusions

1. Vehicle suspension system: the very stiff suspension from FDOT resulted in the worst DLA factors in most of the cases.

2. Road surface condition: faults in the abutment joint and surface imperfections such as cracks and ruts; when compared to a flat surface result in a much higher DLA factor.

3. Loosely attached cargo which is able to bounce on top of the trailer: an additional pounding frequency is observed with a higher dynamic response on the bridge.

4. According to the above results, the value of the acceleration, displacement, velocity and base shear with respect to the time in the x-direction is higher than acceleration, displacement, velocity and base shear with respect to the time in the y-direction.

5. Acceleration response of the bridge deck depends on the characteristics of the bridge and applied ground motion.

6. Results show that the seismic response of the superstructure good agreements with recorded ground motion data in the term of the acceleration, base shear, velocity and displacement in both directions.

7. It also the indication that the base shear has played an important role in the seismic response of the bridge deck. It provides resistance to lateral load.

This study has introduced a framework for constructing a full bridge model in the finite strip environment, by formulating a new type of strip element for the modeling of piers, and developing a special transition section to combine strips of different orientation. The piers modeled by the proposed finite strip method precisely describe the bending behavior of the pier structures in a spline finite strip environ-ment. In addition, the full bridge model, constructed by combining the pier strip and the deck strip in a single finite strip formulation, can significantly reduce the input-output procedures and the computational effort required for both static and dynamic analysis. In this paper, the accuracy and efficiency of the proposed integrated finite strip solution has been demonstrated via two numerical examples the strip combination technique introduced in this study has overcome the obstacles for the development of FSM. This has opened the door for complex dynamic analysis to be performed in the finite strip environment and has brought this efficient and effective method into a new era.

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