LITERATURE REVIEW ON ANALYSIS & DESIGN GIRDER BRIDGE BY USING CSI BRIDGE

Mohd Junaid Mohd Zubair[1], Prof. Arvind B. Vawale[2], Prof. Nitin S. Vaidkar[3]

Prof. Dr. Pradeep Sudhakar Bhalage[4]

[1] M.Tech. Structural Engineering (Student)

[2] Associate Professor, Shreeyash College of Engineering and Technology, Aurangabad

[3] Associate Professor, Shreeyash College of Engineering and Technology, Aurangabad

[4] Professor and Head of Department, Shreeyash College of Engineering and Technology, Aurangabad.

Abstract— For important and significant reasons, the design of bridges has become very important. Bridges are in favour of improving the road network. Bridges not only help in the flow of traffic without interruption but also maintain the safety of the roads. To check the weather adopted section will perform safely and satisfactorily during the life time of the structure. The bridge designs are compared with different countries design codes and determined which is better and economical. The study shows combination of various loads and sections of girders used to distribute load. the depth of beam decreases, the prestressing force decreases and no of cables decreases attributable to prestressing, additional strength of concrete is used and additionally well governs usefulness.

Keywords— Interruption, satisfactorily, attributable, governs

I. INTRODUCTION

A bridge is a structure designed to cross physical barriers, such as water, a water body, a valley, or a highway. Bridge designs vary depending on the function of the bridge, the nature of the land on which the bridge is built and established, the materials used to build it, and the funds available for its construction. Building a bridge is of global importance today. Bridges are the key elements in any road network and use of prestress girder type bridges gaining popularity in bridge engineering fraternity because of its better stability, serviceability, economy, aesthetic appearance and structural efficiency. Bridges are nation's lifelines and backbones in the event of war. These include barriers that divide people, societies, and nations, and bring them closer together. They shorten distances, speed transportation and facilitate commerce. Building bridges is very important in communication and an important element in the development of civilization. Bridges stand as an illustration of the work of civil engineers. In order to supply safer and larger speed of traffic, the route is made as straight as possible. Box girder bridges have gained wide acceptance in superhighway and bridge systems owing to their structural potency, higher stability, useableness, economy of construction and pleasing aesthetics.

In U.S, Bridge Engineers use the code of AASHTO "American Association of state highway and Transportation Officials"; this code will be adopted for style of the highway bridges with special needs. Similarly, Indian bridge engineers seek advice from the IRC (Indian Road Congress) commonplace to try to the planning. But the AASHTO commonplace Specification is adopted by several countries because the typically accepted code for bridge styles. The design parameters are check and verify by the structural analysis program (Cosi BRIDGE). Design is a very important part of the bridge that determines the safety of the general context and the basic cost of the project. Therefore, the choice of the correct and appropriate code will save a high value of the cost of construction, in addition to the safe and successful design.

To decide the size (dimension) of the member and the amount of reinforcement required. To check the weather adopted section will perform safely and satisfactorily during the life time of the structure. Design philosophy, loading and unloading patterns and safety factors. Shear force and Bending Moment induced in the components, Reinforcement required for each design, from these comparative studies, we can have idea about the best design standards.

II. LITERATURE REVIEW

Jerome F. Hajjar et al (1) In this paper give a brief statement of the main points of measured versus computed results from field test with heavy live load conducted on a multi-span, horizontally curved composited steel I-girder bridge in Duluth, Minnesota. In this paper total eight trucks 320KN are placed on the bridge which have 43 static and 13 dynamic loading configurations after that the final result were compared to the linear elastic grillage analysis. In the give a summary of a comparison of final results from the grillage computational model to field tests due to live loading of the

ISSN No.: 2394-3696, Website: ijiert.org, Held on 15th and 16th June 2020.

bridge. A two-girder five span continuous horizontally curved composite steel and 13 dynamic tests has been conducted with eight trucks 320KN with measured axle weight as soon as dynamic impact factors which have obtained in the field study that is slightly higher and more than the code specified values.

A. Ghani Razaqpur et al (2) In the paper determined distribution factor experimentally for the model total bridge, and compare with Canadian highway bridge based calculated values. The code values as per design standard is found to overestimate the maximum moment in the interior loaded girder about 22% and 33% at the elastic and inelastic states, respectively Conclusion of the study in this paper. Slightly higher deformation of the time if loaded girder than all the stage of loading except close to the ultimate load when the time of unloaded girder. The three girders at any section along the bridge become nearly equal which indicated the formation of plastic hinge at mid-span in all three girders at the time of near the ultimate had. The calculation moment by the loaded girder based on the CSA standards. In the observation that the CSA S6 standard give values and caution about charge or innovation estimate of the moment carried by the loaded girder.

Prajwal Raj and Mr. Vasantha.D (3) Design and Analysis of post tensioned look girder bridges of single cell and four cell type is compared IRC and AASHTO Loading using the software CSi bridge design. In this software structural behaviour decide which code of practice is better by comparing the results and also know about the modelling pattern of the software and the detail study about the single cell and four cell box girders under IRC & AASHTO loading. As per the result of CSi bridge software the depth of beam decreased the prestressing force decrease and number of cables decreases. Results shows that the single cell prestressed concrete beam is most fitted and economical crosswise for double lane Indian national IRC is not more safety as compared to AASHTO code safety. In the comparative study between IRC and AASHTO code clear that the AASHTO code economical.

R.L. Pedro et al (4) The design of steel concrete I-girder bridges tow stage optimization approach. To refine and improve the optimization in finite element model. Five well know metaheuristic algorithms is used to conduct the first stage optimization. Imperialist competitive Algorithm (ICA) Back tracking search Algorithm (BSA) Search group Algorithm (SGA). In the final conclusion is that another contribution was the estimation of five modern optimization algorithms addition information to properly select the best algorithm for the study.

Rohit M and Dr. J. Jegan (5) In this paper Made up of prestressed concrete box girder which is analyzed for moving loads by wing of Indian road congress (IRC:6) and code of practice for concrete bridges (IRC:1/2) specifications. Using CSi bridge wizard analysis of box girder bridge. Found the result the dead load, shear force and bending moment is higher as compared to other loading One lone of IRC 70R and class A under the live load analysis is found to be more critical than 3 lane of class A. After the testing deflection obtained due to various loading conditions (Different loading conditions) is well within permissible limits as per IRC. It is found that near mid-span of the girder vertical deflection is maximum.

Radek Wooziness et al (6) In this paper inspect in detail to determine their nature and the effect of various parameters on the free vibration response of curved composite-steel girder bridges. Determine corresponding mode shapes, an extensive parametric their fundamental frequency all study is conducted on 336 straight and curved bridges. The numerical simulation for the considered bridges in order to obtain the fundamental frequencies by the use of ABAQUS software. If increase in curvature ratio or with an increase in span length the fundamental frequency decreases. In the fundamental frequency the girder spacing and the number of girders have a less pronounced effect. But in general increase in spacing and number of girders the fundamental frequency decreases. A point is reached where increase in number of girder results in increase in fundamental frequency with an increase in span and curvature ratio.

Md Tautened Riyaz and Syed Nikhat Fathima (7) In the paper study and analysis of compare between two standards specifically AASHTO and IRC followed in the construction of super structure of bridge and applying serious load for 2 sorts of examples specifically beam with single cell and four cell and comparison bet them. IRC category AA loading in load combination is followed in style of box girder superstructures. And the AASHTO code is applied. And the AASHTO code is applied because of its safety then IRC. The prestressing force decrease and number of cables decrease as the depth of beam decreases. It is clear that the AASHTO code is more economical than the IRC.

Jun Shi and Weitao Li (8) In this paper study of a large curvature continuous steel box-girder bridge model to viewers it's behaviour characteristics and noticed failure mechanism based on the theory and conducts the experimental investigation into the whole working process of the bridge.

Ghafur H. Ahmad and Omar Q. Aziz (9) In this paper study series of the series of specimens with epoxied joints, were tested to evaluate shear behaviour of box girder segmental bridges, under direct shear loading. To the study confining stress level, concrete compressive strength and prestressing eccentricity. As well as we investigated shear behaviour, crack pattern of joints and shear capacity. The AASHTO formula estimate that value shear capacity values for epoxied keyed joints 11.3% is the average value. The Inexperienced shear capacity is more compared to estimate shear capacity by 4.6%, 15.7% and 26.9% for confining stress levels of 1MPa, 3MPa and 5MP respectively. Underestimated by the ultimate shear strength of a joint is 14.4% and 0.1% respectively for a concrete with 40MPa, 80MPa and 120MPa of compression strength.

Quang-Viet Vuet al (10) In this paper aninvestigation open steel box section into the toad carrying capacity of a steel-concrete composite box girder bridge. In the paper study analyzed three-dimensional finite element model of steel-concrete composite box girder by using software ABAQUS. The intermediate diaphragms significantly affect the load carrying capacity of the girder under the strength load combination, but not the strength load combination 3. For steel concrete structure 30 to 60m in length for the box girder, it is advisable to place an intermediate membrane in the diddle of the crossbar to prevent loss of bearing capacity.

N. Loaiza et al (11) In-steel bridge girders, longitudinal reinforcement is mainly used to increase flexural and shear strength. The purpose of this article is to investigate the behaviour of longitudinal steel beams with long reinforcement: one-fifth of the beam depth in the patch load. A nonlinear elemental analysis is performed. Examine the interactions between geometric parameters that affect the resistance of the load patch. Finally, design recommendations for strict longitudinal beams are presented. In practice, long-term reinforcement is mainly used at b1 = 0.2 h to increase resistance to bending and shear.

Cameron D. Murraya and Mauricio Diaz Arancibiab (12) A limited amount of published information on previously stressed concrete bridge failures is collected by cutting and timing. A concrete bridge was built to investigate the behaviour of the final bridges with particular attention to the capacity of the structure after cracks and full depth. When the filled beam failed, the diaphragm beam connection broke. They were seen to cause cracks in the outer rays and were eroding the end diaphragm platforms that had turned off the bridge. In addition to the test bridge, 2D and 3D computer models were constructed to determine the elastic embroidery distribution (DF) factors and to compare them with the factors obtained during the bridge test. Some guidance is provided on developing a bridge model to find DF. The computer model presented here provided a better resolution than the other and compared the results of the test scale bridge. Grid models were relatively simple compared to 2D and 3D FEM, and appeared to be almost accurate. Although the grid method is at least computationally demanding of all modelling methods, it requires experience, judgment, assumptions, and modelling time when converting stage elements into frame elements. 2D models are comparatively efficient and give similar results to 3D models. The computer model presented here provided a better resolution than the other and compared the results of the test scale bridge. Grid models were relatively simple compared to 2D and 3D FEM, and appeared to be almost accurate. Although the grid method is at least computationally demanding of all modelling methods, it requires experience, judgment, assumptions, and modelling time when deliberating across frame elements of the stage. 2D models are comparatively efficient and give similar results to 3D models. This bi-directional behaviour possibly helps in reloading the bridge after beam failure. Additional tests are recommended to understand the behaviour of the diaphragm for a large bridge domain and the platform closest to the final load.

Iqra Zaffar and Priyanka Singh (13) Bridges are advocates of improvisation of lifelines and road networks. Bridges not only assist in the flow of traffic without interruption, but also maintain the safety of the roads. For this reason, the design of bridges has gained great importance. This document originally relates to the analysis and design of the Staad pro Deck Slab Bridge using IRC Loading. It consists of a section of 100 m X 16m and has a system of 4 beams. The objective is to verify the result for a particular input design, properties and parameters and the approach is derived from the AASHTO standard design. Nodal displacement, beam property, vehicle load details, concrete design can be easily found by performing analysis and design method. Staad pro can easily analyze and design deck slab bridges according to IRC code (load here IRC 70R). In relation to Staad pro Tantra is well understood. The resulting nodal displacement is for node 529; 0.015 mm in x, -51.203 mm in y and -0.287 mm in x.

Kalpana Mohan and S. P. Vijay Kumar (14) In this paper, we present the analysis and results of steel and reinforced steel bridge girders based on Staid pro analysis and manual analysis.

III. STEEL I SHAPE WITH BEAM

The analysis was performed between steel girders and reinforced concrete bridge girders. Based on the design calculations, the impact of each beam is analysed in relation to shear, bending moments, dead load, live load, deflection and most importantly the cost of each combination. A separate arrangement of the deck slabs was made with beams, the beams on the sides were taken as one-way slabs, and intermediate beams made the deck slabs bidirectional. The same analysis is done for different cases. The beam has a greater bending moment without the beam and one-way deck slabs. Similarly, a rectangular shaped beam of 0.4 x 0.8 m section has the same behaviour described above with different values. Comparing rectangular shaped beams 0.5 x 1m and 0.4 x 0.8m, 0.4 x 0.8m has more deflection, which is a disadvantage. In section I, the deviation is higher than that of a rectangular section of 0.5 x 1 m and an RCC section of 0.4 x 0.8 m. And Section I steel beams have less deflection than all types of beams. With a typical IRC load bridge with a distance of 2,850 m with a distance of 50 m, the work load at the moment of flexion is of the order of 1600–1800 KNm. And the values of shear force are on the order of 400–450 kN.

Where Staad pro 1390 and 440 seem appropriate according to the conditions. From the above discussions, it is concluded that the composite steel section is good compared to RCC, as the maintenance of the composite section is easy, construction time is fast and it also supports large amount of load.

METHODOLOGY

In the above reviewed papers, different types of methods and software are used for design and analysis of bridge. The bridge designs are compared with different countriesdesign codes and determined which is better and economical. The study shows combination of various loads and sections of girders used to distribute load. Use of sections under circumstantial loading is to be adopted using CSi bridge software and arrive at concluding.

DISCUSSION

The authors of the papers reviewed above have dedicatedly worked on the topics. Their work has brought forward the critical analysis of various extreme scenarios to overcome the economy. A number of load combinations are discussed to reach an outcome with parameters of safety as well. It is very much necessary to practically improve the modern-day technology with intense research in the field of construction for the safety of mankind.

FUTURE AND SCOPE

In this world of advanced research and technology, heavy structures are necessarily required to be designed with techno-economical solutions. Research in the field of bridges shall be encouraged by socio economic awareness at the academic and curriculum level. Generally innovative ideas of design lack due to the resources and infrastructure available, but these parameters shall be not be a constraint in development of nation. Possibilities of multidimensional sections shall be adopted in public and heavy structures.

IV. CONCLUSIONS

1. The varied span to depth quantitative relation is taken for the analysis of beam bridges, and for all the cases, deflection and stresses are at intervals the permissible limits.

2. A further study can be made where an examination of a working with different irregularities like positioning of piers and comparison can also be given for different bridge types namely I-girder bridge and box girders and simple supported girders and cantilever one.

3. As the depth of beam decreases, the prestressing force decreases and no of cables decreases attributable to prestressing, additional strength of concrete is used and additionally well governs usefulness.

4. Patch loading resistance can be significantly enhanced by placing a longitudinal stiffener close to the loaded flange, especially for thin webs.

5. Load latest distribution factors did not remain linear after cracking in the bridge for the single bridge tested in above studies.

REFERENCES

[1] R.L. Pedro "An efficient approach for the optimization of simply supported steel-concrete composite I-girder bridges" 11 June 2017.
[2] Edward Denison and Ian Stewaet "How to Read Bridge".
[3] Zhiwen Zhu "LES prediction of aerodynamics and coherence analysis of fluctuating pressure on box girders of long-span bridges" 22 September 2014.
[4] Van der Neut A., Post buckling behaviour of structures. Advisory Group For Aeronautical Research And Development Paris (France). 1956.
[5] Víctor Yepes "Multiobjective optimization of post-tensioned concrete box-girder road bridges considering cost, CO2 emissions, and safety" 08 July 2016.
[6] Galambos TV, Leon RT, French CM, Barker MG, Dishong BE. Inelastic rating procedures for steel beam and girder bridges. Rep. 352, Nat. Cooperative Hwy. Res. Program. Transportation Research Board, National Research Council, National Academy Press, Washington, D.C.; 1993.
[7] Prajwal Raj et al, "Structural behaviour of box girder bridge using CSi Bridge 2015" International Research Journal of Engineering and Technology, Volume: 04 (2017).
[8] Narendra Taly "Highway Bridge Superstructure Engineering".
[9] Rohit M "Transverse Analysis on PSC Box Girder Bridge" Volume.06 (5, May 2017).
[10] Radek Wodzinowsk "Free vibration analysis of horizontally curved composite concrete- steel I-girder bridges" Elsevier Science 14 October 2017.
[11] N. Loaiza "Design recommendations for patch loading resistance of longitudinally stiffened I-girders" Elsevier Science 5 June 2018.
[12] Cameron D. Murraya "Destructive testing and computer modelling of a scale prestressed concrete I-girder bridge, Elsevier Science 3 January 2019.
[13] Iqra Zaffar "Analysis and Design of Deck Slab Bridge" IJCIET, Volume 3 (06 April-June 2016).
[14] Kalpana Mohan, "Analysis of Bridge Girder with Beam and Without Beam" IJCIET, Volume 7 (05 September-October 2016).
[15] Victor Yepes "Heuristics in optimal detailed design of precast road bridges" 20 February 2016.
[16] AASHTO-PCI-ASBI. Segmental box girder standards for span-by-span and balanced cantilever construction. Segmental box girder standards. 1997.
[17] Tatiana García-Segura "Hybrid harmony search for sustainable design of post-tensioned concrete box-girder pedestrian bridges" 04 March 2015.