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Review on Comparative Analysis of PSC Box Girder Bridge and PSC Precast I Girder Bridge Structure

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Abstract: Bridge is the structure that provide passage over an obstacle. There are different types of bridge structure base on material & geometric parameters, from which prestress concrete I girder bridge and box girder bridge are widely used for medium to long span rang. Box girder bridge are the bridge where the main beam consist of girder in hollow shape, where as in I girder bridge main beam consist of I-shape girder are used as main girder beam.
In this review article study about dynamic analysis of PSC precast I-girder bridge and PSC box girder bridge for different parametric variation and different span range have been studied by various researchers. The parameters are geometric parameters, span range, mending moment, shear force, displacement, base shear, base moment, time period, natural frequency, and method of analysis based on different codes. On the above parameters base reaction, base moment, time period, natural frequency, absolute displacement and girder forces of bridge is essential and major concern for the analysis of bridge structure.
Keywords: Box girder, Prestressed concrete, PSC I girder, CSI Bridge.

I. INTRODUCTION

Bridges are the structure that provide passage over an obstacle. There are different types of bridge structure base on material & geometric parameters, from which prestress concrete I girder bridge and box girder bridge are widely used for medium to long span rang. Analysis of box girder and PSC I girder in a systematic manner is very necessary in the present condition. So far there are many journals published on analysis of box girder & PSC I girder on different aspects. There are papers published on parametric study, & performance analysis alone. In this research, analysis of box girder & PSC I girder bridge is carried down in a systematic manner. finally, a Response spectrum for various span has done. Box girders are known for their structural efficiency. Major add-ons of using box girders are that they have high stability, high aesthetic beauty, high serviceability and better economy in construction. Analysis of box girders is complex due to bending, torsion and distortion in both transverse and longitudinal direction. Box girders can be classified under different basis such as shape, use, method of construction.
The present study focus on comparative analysis of PSC I girder bridge and PSC box girder bridge for different span range. Response spectrum analysis have been used as per IS 1893:2016 & IRC 112:2011 for earthquake zone V and soil type II. Loading condition are based on IRC 6:2016. IRC class A and IRC class AA wheel vehicle have been used.

II. LITERATURE REVIEW

By Paul J. Barr, Marc O. Eberhard, and John F. Stanton (2001) This paper presents an evaluation of flexural live-load distribution factors for a series of three span prestressed concrete girder bridges. The response of one bridge, measured during a static live-load test, was used to evaluate the reliability of a finite-element model scheme. Twenty-four variations of this model were then used to evaluate the procedures for computing flexural live-load distribution factors that are embodied in three bridge design codes. The finite-element models were also used to investigate the effects that lifts, intermediate diaphragms, end diaphragms, continuity, skew angle, and load type have on distribution factors.
A detailed modeling strategy of the bridge using frame elements, shell elements, and rigid constraints accurately reproduced the moments calculated from strains measured during a live-load test. The calculated maximum mid span moment for each girder was within 6% of the measured moment. Distribution factors calculated for lane loading were consistently lower than those calculated for truck loading, the average decrease was 10%.

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P.K. Gupta*, K K Singh and A. Mishra (2010) A detailed study of box girder bridge cross-sections namely Rectangular, Trapezoidal and Circular has been carried out in the present investigation. Commercially available software SAP-2000 has been used to carryout linear Analysis of these box girders. The linear analysis has been carried out for the Dead Load (Self Weight) and Live Load of Indian Road Congress Class 70R loading, for zero eccentricity as well as maximum eccentricity at mid-span. The paper presents a parametric study for deflections, longitudinal and transverse bending stresses and shear lag for these cross-sections. It is found that the rectangular section is superior to other two sections.

Chen Cheng, Kaiyin Zhang (2011) This paper introduces the establishment and simplification of the temperature field and the general calculation method of temperature stress of the prestressed concrete box girders. Three kinds of sunshine temperature gradient models were loaded to a real bridge respectively, and got stress and displacement curves. Research data of several prestressed concrete box girders were selected from different regions of China to compare the relative error of the calculated and measured value.

Bhruguli Gandhi , Dr.B.J.Shah(2012) his paper presents related aspects of performance based seismic design of new bridges. Performance critarea prescribed by various agencies of advanced countries in the form of codes and guidelines are discussed in this paper. Nonlinear static pushover analysis is used to determine the capacity of section during earthquake loading. Both ordinary and important bridges are designed as per PBD approach considering different seismic parameters like zone factor and soil types and various design parameters like base shear, base moments, % of reinforcement in the pier etc. are determined and comparison is made in the form of charts and tables.

Vikash Khatri, Pramod Kumar Singh and P.R.Maiti(2012) This study has presented the comparison of the total area of steel girder and prestressing force required in the cables, and stresses in the deck slab using various span lengths and girder spacing's.The result concludes that 4-girder system is found to be beneficial and economical in bridge design as compared to 5-girder system for all the span length bridges. In all cases, the 4-girder bridge case resulted in approximately 20% lower girder area (or weight) than the 5-girder bridge case, and In all cases, the prestressing force required in the 4-girder system bridge is little lower than that of 5- girder bridge system.

Durgesh C. Rai, M.ASCE ; Srinaganjaneyulu Komaraneni ; and Tripti Pradhan(2013) This paper discusses a case study of a PSC box girder that developed early damage to the deck because of the poor placement of concrete at the time of construction as established by in situ nondestructive and core tests. The possibility of total replacement of the top deck was ruled out because of the disruptive and tedious nature of the process, which could have endangered the overall stability of the box girder. Strengthening of the deck was performed by installing a series of steel joists at the underside of the deck slab and adding a thin overlay of concrete at the top to restore it to the requisite strength. This approach was best suited, for it not only improved the stress distribution in the deck, but also maintained the original load resistance mechanism provided by the prestressing arrangement in the girder.

Amit Saxena, Dr.Savita maru(2013**)** Selection of structural system for span is always a scope for research. Structure systems adopted are influence by factor like economy and complexity in construction. The purpose of present study is the design of bridge structure for 25 m of span. The most obvious choice of this span is T- Beam and Box Girder. In this study a two lane simply supported RCC T- Beam Girder and RCC Box Girder Bridge was analyse for dead load and IRC moving load. The dead load calculation has been done manually and for live load linear analysis is done on Staad Pro. From this study It has been conclude that Service Dead load bending moments and Shear force for T-beam girder are lesser than two cell Box Girder Bridge. Which allow designer to have lesser heavier section for T-Beam Girder than Box Girder for 25 m span.

Vishal U. Misal, N. G. Gore, P. J. Salunke(2014) In this present study, cost analysis and design of prestressed concrete girder and reinforced concrete girder is presented. The aim and objective can be summarized as to analyze and design the concrete girder under a IRC class 70 R loading. To formulate the entire problem for a couple of span under the loading mentioned above to obtain shear force and bending moment at regular intervals along the beam. To use the software STAAD PRO for the analysis and design of prestressed concrete girders. Before using the software for analysis it will be validated by comparing its results with the corresponding classical theory result. To carry out the parametric analysis for prestressed concrete I girder and reinforced concrete girder. To calculate the quantities of concrete and steel required as per the analysis and design carried out for the girders and to carry out the comparative study for the same.

Rajesh F. Kale, N.G.Gore, P.J.Salunke(2014) In this present study, cost optimization approach of R.C.C. T-beam girder is presented. The main objective function is to minimize the total cost in the design process of the bridge system considering the cost of materials. The cost of each structural element covers that of material and labore cost for reinforcement, concrete and formwork. For a particular girder span and bridge width, the design variables considered for the cost minimization of the bridge system, are deck slab depth, width of web of girder and, girder depth, (i.e. X1, X2, X3 resp.)

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Design constraints for the optimization are considered according to IRC-21:2000 (Indian road congress) Standard Specifications. The optimization process is done for different grade of concrete and steel. The comparative results for different grade of concrete and steel is presented in tabulated form. The optimization problem is characterized by having a combination of continuous, discrete and integer sets of design variables. The structure is modeled and analyzed using the direct design method. Optimization problem is formulated is in nonlinear programming problem (NLPP) by SUMT. The model is analyzed and designed for an optimization purpose by using Matlab Software with SUMT (Sequential Unconstrained Minimization Technique), and it is capable of locating directly with high probability the minimum design variables. Optimization for reinforced concrete R.C.C. T-beam girder system is illustrated and the results of the optimum and conventional design procedures are compared.

Rajamoori Arun Kumar, B. Vamsi Krishna (2014**)** the aim of this project is to know the behaviour of pre-stressed concrete beam, how they stressed, percentage of elongation, pressure applied to make beam stressed. This thesis completely going to do in a practical approach that on a major bridge having 299 m. span, 36 no's of PSC Beams & 8 no's of RCC Beams. My attempt is on PSC Beams, where the Beam post tensioning values, rate of elongation & behaviour can be defined after stressing. The main code that I follow in this course is IS: 1343 – 2012 and IS 456:2011

Ajith Kumar R., Dr. J. K. Dattatreya (2015) In this thesis work, a single cell post tensioned concrete box girder with simply supported ends has been analyzed using finite element method. SAP2000 software is used to carryout linear analysis using 4-noded thin shell element. Pre-stressing force and losses have been included in the modelling. A comparative study carried on longitudinal and transverse bending stress, shear stress, torsional shear stress both by SAP2000 software and manual calculation Simple beam theory is adopted for calculation of longitudinal flexural stress and shear stress across the section. Beam on elastic foundation analogy is used for analysis of transverse bending stress due to asymmetrical loading. A typical 40m rectangular concrete box girder bridge is considered in analysis and design. The load cases such as dead load, superimposed dead load and live load as per IRC specifications Class A-one lane, Class A-two lane and IRC 70R-one lane loading are considered in analysis and design. Box girder is designed by post tension method with straight and parabolic tendons, including prestress losses, checked for permissible stresses as per IRC: 18-2000. The percentage difference of results obtained between manual calculations and software for various types of stresses patterns are plotted, discussed and results are tabulated.

Payoshni Mali, Shilpa Kewate, Savita Lokare (2015) The typical sections of box girder normally used are rectangular and trapezoidal. This study deals with analysis and comparison of both sections of box girder and to shed light over the advantages of trapezoidal section. The objective of this paper is to analyze the rectangular and trapezoidal section for same span, loading and dimensional properties and compare both sections. According to this analysis the trapezoidal section of box girder is subjected to less shear force and bending moment than that of rectangular section for same loading, span and dimensional properties due to its geometry. Torsional moment developed in trapezoidal section is also less as compared to that of rectangular section.

B.Paval, Dr. G.MOHANKUMAR(2015) In this study, the prestressed concrete box girder bridge superstructure is designed and linear, non-linear, time history analysis is performed. The bridge superstructure is subjected to different IRC loadings. The study shows how variations in the bridge geometry, damage scenarios, member properties and bridge continuity affect the redundancy of the superstructure. Specifically, Time History Analysis is used to investigate the sensitivity of the structure to variations in various parameters including: a) boundary conditions; b) damage of prestressed members and damage scenarios; c) member capacity; d) non-linear effect. SAP 2000 V15 is used in this analysis work.The result concludes that among the both linear and non-linear analysis the deflection changes up to 30%-40% periodically. Comparison between linear and non-linear results shows that the results obtained from non-linear analysis is however more higher than linear analysis but they are quite much more accurate.

Chetan T Naik, Dr.M M Achar, K Lakshmi (2015) In the present work, analysis and design of box girder has been done. CSI-bridge modular software has been used for carrying out analysis. Multi-cell PSC box girder design has been performed at various locations along the span so as to consider maximum or critical locations of the PSC box girder due to various loading conditions, the post tensioning of cables is done for jacking load at 0.765 times the UTS and jacking is done at both ends of the PSC box girder simultaneously. Various losses that occur due to different phenomena such as elastic shortening, Creep, shrinkage, friction and wobble loss have been considered. The results obtained on the two sheathing pipes are compared and are tabulated and graph gas been plotted. Encouraging results have been obtained.

Pranathi Reddy , Karuna S (2015) this study attempt has been made to study the skew bridge comparing with the normal bridge for skew angle 10, 20, 30, 40, 50. The finite element analysis is carried out for single span, two span and three span deck for dead load and moving load (IRC class 70R) loading using software SAP2000 ver.14. The results are presented in terms of displacement, bending moment and shear force. The study shows that the deflection decreases with increase in skew angle in two or three span skew slab whereas in case of single span deflection increases with increase in skew angle.

This shows that the effect of deflection is more in single span skew deck slabs as the stiffness of slab is less. Bending moment has reduced with increase in skew angle under dead load in single, two and three spans deck. But under moving load there is slight reduction in bending moment up to 20° and then increased for 30° and further reduced for 40° skew angle only on single span deck. The magnitude of shear force has slightly reduced with increase in skew angle under dead load in two and three span deck, it was observed that the magnitude had increased under moving load.

Bhawar P.D, Wakchaure M.R , Nagare P.N(2015) The objective is to minimize the total cost in the design process of the bridge system considering the cost of materials like steel, concrete, tendons etc. For a particular problem the design variables considered for the cost minimization of the bridge system, are depth of girder, various cross Sectional dimensions of the girder, number of tendons, A program is developed for analysis and designing an low cost prestressed girder in MATLAB R2010a software is used. The proposed cost optimization approach is compared with an existing project which leads to a considerable cost saving while resulting in feasible design.

From graph, for conventional and optimal design consideration; it shows that overall cost of structure can be reduced by using optimization technique with stability.

J.M. Jara, J.R. Reynoso, B.A. Olmos, M. Jara(2015) This paper presents the parametric study of irregular RC bridge structures subjected to strong seismic records. We determine the expected damages and the concentration demands on short piers of bridges with columns of unequal height located on soft and rigid soil sites. Medium length span bridges are analyzed using the most common structural configurations built in many countries with several height pier configurations. The structures were subjected to strong seismic ground motions recorded on soft and hard soils of earthquakes generated at subduction seismic sources. The parameters of interest in the study are the strength and stiffness characteristics of the substructure and the influence of the dynamic characteristics of the seismic records. Based on the evaluation of damages indexes, we determine the pier expected damages and the importance of the soil type, on the behaviour of irregular pier bridge substructures. It is also quantified the impact of the pier configuration in the global behaviour of the bridges and the influence of the shortest pier in the expected damages of the other piers.

Satwik Mohan Bhat, Ashwin K N and J K Dattatreya(2016) In the present study simply supported two lane, single cell concrete box girder bridge is analyzed for dead load and IRC: class 70R live load using Finite element Software SAP2000. The parameters investigated in this analytical study are shape (Rectangle and trapezoidal), span length and total depth of box girder. A total of 70 model of bridges subjected to Dead Load and IRC 70R loading are analyzed. In the first 35 models, rectangular Box girder Bridges are analyzed for different span length of 20m, 25m, 30m, 35m and 40m and also for different total depth of box girders 1.6m, 1.8m, 2.0m, 2.2m, 2.4m, 2.6m and 2.8m. In the second 35 models, Trapezoidal Box girder Bridges are analyzed for different span length of 20m, 25m, 30m, 35m and 40m and also for different total depth of box girders 1.6m, 1.8m, 2.0m, 2.2m, 2.4m, 2.6m and 2.8m. The maximum vertical deflection, bending moment, shear force and torsional moment are reported. Results indicate that increase in span causes increase in maximum top flange deflection values for both rectangular and trapezoidal box girder sections, however increase in total depth of box girder causes decrease in maximum top flange deflection values for both sections. Also for span 40m and total girder depth of 1.8m, maximum top flange deflection value for rectangular section is 3.01% lower than that of trapezoidal section having similar conditions and for rectangular section of span 40m and girder depth of 1.8m, maximum deflection value is within span/800 as per Indian codal provisions.

Punil Kumar M P, Shilpa B S (2016) Analyzing the PSC Box girder bridge, statically and dynamically is the basic aim of this dissertation. Here with and without application of dynamic loads, the performance of bridge is studied. The study of bridge with bearing between girder and top of pier are included. By applying moving load, vehicle (or) truck load, pre-stress and axial forces, the effects of bridge model is carefully studied. Determining the actual seismic demand of bridge depends on the behavior of these model and also the importance of bearing between girder and top of pier is taken into consideration. In our project we study the behavior of box girder bridges with respect to support reaction shear force, bending moment, torsion and axial force under standard IRC Class AA loading and the box girder bridges models analyzed by finite element method.

SANKET PATEL, UMANG PAREKH (2016**)** In this study the I girder bridge and box girder bridge with various span length 30m, 35m, and 40m, were design and modelled in CSI Bridge 2014. The motive behind present study is to prepare some useful interface for preliminary design of bridge system.Vehicle used for analysis is one lane full of class 70R Tracked vehicle and another is two lanes of Class-A vehicle as per suggested in IRC: 6-2014.After analysing Box Girder and Tee Girder we can conclude that as the span increases the box girder The aim shows better results for selecting between both girders. By the numbers of prestressing cables required to resist the load, box girder required less cables. Loads are almost similar in both the girders but for 40m span box girder is governing section. Box girder is governing but is has its own flaws too. It is having a complex shuttering and it's required more skilled labours to carry out that task but overall Box girder is preferable.

H. Thanushree and H. Siddesha (2016) In this study The effect of various span are studied using finite element software SAP2000 on RC bridge decks and PSC bridge decks are analysed for dead load, live load and their combination. In the present study, IRC class AA vehicle load is considered. The bridge deck models are analysed to compute longitudinal moment, transverse moment, torsional moment and longitudinal stresses.

Based on the results obtained from numerical analysis using SAP2000, the following conclusions are drawn.

1) The longitudinal moment increases with increase in span of the bridge deck. The maximum longitudinal moments occurs at the centre of span for both RCC and PSC bridges. The variation of longitudinal moment varies from 1.5% to 2%.
2) The transverse moment increases with increase in span of the bridge deck. The transverse moment varies from 3% to 4%.
3) The torsional moment is found to be maximum at the corner regions. The torsional moment varies 9% to 10%.
4) The longitudinal stresses increases with increase in span. It varies from 3% to 5%.

Jefeena Sali, Kashif Quamar Inqualabi, Reji P Mohan (2016) In this study a box girder curved in plan with trapezoidal cross section has been carried out in the present investigation. The analysis is carried under the dead load, super imposed dead load, live load of IRC Class A tracked vehicle and prestressed load. This paper focus on the parametric study of box girders with different radius of curvature by keeping the span, cross sectional shape and material properties constant. In this study it is observed that as radius of curvature of box girder increases the deflection, bending moment, torsion and longitudinal bending stress along the span decreases. There is no significant variation in bending moment, deflection longitudinal bending stresses under DL+SIDL, moving load and prestressed load for specific span length with different radii. The torsional moment increases greatly with decrease in radius of curvature under all loading conditions. There is more variation in torsion with span radius below 100m therefore it's better to avoid such sharp curves and if they are unavoidable then structural changes to cross sectional dimension, must be made to stabilize the box girders.

Sandesh Upadhyaya K. F. Sahaya Sachin (2016) The aim of this study was to determine the variation and suitability of two different configuration of the bridges namely, ordinary deck slab supported on girder and T beam configuration of deck slab. In this study they have consider span length of 20m, 24m, and 28m. The deck slab has been conventionally analysed for IRC class AA loading using Courbon's method. The process was made faster by formulating excel sheets for conventional design which gives maximum Bending Moment and Shear Force values arising due to dead load and live load for class AA wheeled vehicle. This study also takes into account all other components of a T-beam bridge such as cantilever slab, girders and cross beams. a complete FEM analysis of T-beam bridge with ordinary deck slab supported on girders was performed. FEM analysis was validated conventionally using Courbon's Method. FEM analysis for both the configurations of T beam bridges were extensively studied based on results of maximum Shear Force, maximum bending moment and maximum deflection value. From the study, T beam configuration of deck slab prove to be effective then ordinary deck slab supported on girders.

Phani Kumar.Ch D.Aditya Sai Ram(2016) In this thesis analysis and design of prestressed concrete bridges (Deck Slab, T-Girder and Box Girder) are carried out using IRC:112-2011. The unified concrete code (IRC:112) published by the Indian Road Congress in November 2011 combining the code for reinforced concrete and prestressed concrete structures represents a new generation code, which is significantly different as compared to previous codes (i.e. IRC:21 for RCC structures and IRC:18 for PSC structures). IRC:21 and IRC:18 stands withdrawn, with the publication of IRC:112. The fundamental difference between IRC:112 and old codes is that IRC:112 based on limit state theory while the previous codes were based on working stress design philosophy.

Ankush H. Patel and Spurti Mamadapur(2016) In the current dissertation a study is carried out to understand the behaviour of a two lane skew T-beam bridge and a skew box girder bridge for a fixed span of 20m and skew angles of 10°, 20°, 30°, 40°, 50° and 60°. The live load considered on the bridge are IRC Class AA Tracked and IRC Class A Train. Modelling and analysis of all the bridge models was performed in SAP2000 (Version 14) software after validating it with the values obtained by manual calculations. The analysis results for bending moment on girders/web, shear force on girder/web and bending moment on deck slab are obtained and compared with the results obtained for a normal bridge along with the comparison for different live loads.

Abrar Ahemad Prof. R.B. Lokhande (2017) The main objective of the work is to analyse and design the sections for different IRC vehicles. This has been done by analysing the structure by CSI bridge software and validating with manual results by developing the Microsoft Excel Sheets using Working Stress Method and by adopting Courbon's theory. It is found that the IRC 70R vehicle producing maximum effect on the sections. Cost comparison has Show that the T beam girder is suitable for spa up to 30m.

Rohit M and Dr. J. Jegan (2017) In this paper Made up of prestressed concrete box girder which is analysed for moving loads by wing of Indian road congress (IRC:6) and code of practice for concrete bridges (IRC:112:2011) 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.

Harish M K, Chethan V R, Ashwini B T(2017**)** This project discusses the Analysis of Box girder bridges under IRC loading of two different types Single1cell and Multi cell with IRC standard codes followed superstructures subjected to load of heavy vehicles using CSi Bridge software 2015 version to know its structural behaviour and to decide which standard code is better when comparing the results in determining the economical section in all aspects for the assumed problem statement. Also to know about the modelling pattern using CSi bridge and to know the structural behaviour1considering the bridge object responses and horizontal moments of both single cell and multi cell box girders under IRC loading conditions.

Najla Yas V, Priyanka Dilip P (2017) In this Paper Analysis of Box Girder using ANSYS software is done. In this paper analysis of different shapes of box girder is done A section of box girder is selected with a certain mass. Box girders of different cross sections such as Rectangle, Square, Trapezoidal and curved are modelled. Mass of all sections is kept constant so that it becomes comparable with each other. Analysis of these sections is done in ANSYS Software for results such as Moment, Stress, Deformation, Frequency and Time period. The results are compared to find a better sectional shape.

Balamurugan M Hemalatha N (2017) Generally bridge structures are subjected to two types of loads i.e. static and dynamic loads. however in the design of structures they are designed based only upon the static loads. The drawback of neglecting the dynamic loads in design stage will affect the structure particularly during the seismic loading conditions. In this research work the bridge deck is modelled as a simply supported T beam bridge deck spanning in one direction with two lanes of span 20m by using rational methods with IRC loadings. T beam bridge design is analysed using Finite Element Analysis through ANSYS. Finally the serviceability of the bridge responses are obtained.

Prajwal Raj, Mr.Vasantha.D(2017) this project focus, on the structural behaviour of post tensioned box girder bridge using the recently developed software called “CSI Bridge” version 2015. i.e. we analysed the post tensioned box girder bridges of single cell and four cell type for both IRC and AASHTO loading using the software for the specific design, to know its structural behaviour and to decide which code of practice is better by comparing the results, also to know about the modelling pattern of the software, and to know about the structural behaviour of single cell and four cell box girders under IRC and AASHTO loading.

Nidhi P. Tiwari Dr.P.Y.Pawade(2017) In thesis research work linear dynamic behaviour of T-beam girder and Trapezoidal box girder bridge deck and compares static as well as dynamic behaviour. Response spectrum analysis has been performed by using FEM based software in order to check the resonance criteria of bridge and to determine most favourable option from above two. The results show that response parameters for trapezoidal box girder such as bending moment, shear forces, deflection, time period, base reaction, longitudinal stresses and shear stresses are increases as the span length increases while fundamental frequency decreases. From the study it is finalized that trapezoidal box girder is the conservative solution as compared to T-beam girder bridge superstructure.

Ravikant, Jagdish Chand (2019) In this research work analysis and design of bridge girder is to be done under different code of practice. The present study considers the design of bridge girders both longitudinal girders and cross girders. The span of the bridge is taken as 25m in which girders are constructed. The size of longitudinal girders is taken as2000x500 mm and cross girders is 1500x250 mm. There are three longitudinal girders are considered having spacing 2600 mm c/c and cross girders are considered as 5000mm c/c. The design of girders is carried out using the software STAAD Pro. In this study of bridge girder design, three same models are prepared in the STAAD pro and then there loadings are changed according to IRC codes, Euro codes and AASHTO specifications respectively. According to these different loading we found the shear force, bending moment and area of steel in longitudinal girder as well as cross girder. The analysis is conducted in STAAD Pro and analysis results are compared with tables and graphs

K HEMALATHA (2020) In these project, a two-lane simply supported RCC Tee beam girder and prestressed concrete box girder bridge analysed and designed for dead load and IRC moving loads, where the considered moving load is of the tracked vehicle of class A-A loading. Courbon’s method adopted for analysis and designing. Dead load and live load calculations have done manually. Shear force and bending moment for a vehicular load have calculated. Piguead’s curves used for bending moment calculations.

RAO JANG SHER (2020) In this research work, analysis and design of T Beam and Box girder bridge has been performed using SAP2000 in order to find out the most suitable type of bridge superstructure. The main objective of this study is to compare the structural behaviour, optimization of materials used in each component and cost comparison of box and T beam girder bridge.

Detailed comparison shows that box girder is more suitable as compared to T beam girder even for shorter span in terms of structural stability and cost efficiency.

Rushikesh Vijaykumar Bandal, Prof. Dilip J. Chaudhari (2020) In its current form, it aims at achieving one or more predicted performance levels after pre-defined hazards, and is superior to force bdesased methods in terms of structural performance. General promise of Performance Based Design is to produce engineered structures with predictable performance during future earthquakes. This paper signifies on the application of Performance Based Seismic Design to T- section Girder Bridge and Box Girder Bridge, using Indian codal provisions. The bridges are modelled, analyzed and designed using CSI Bridge 20. The response of bridges is estimated using both non-linear static and non-linear dynamic analyses. Different seismic parameters like fundamental time period, base moment in pier, percentage of reinforcement and base shear are obtained and compared.

Preeti Agarwal, Priyaranjan Pal, Pradeep Kumar Mehta (2020) This paper deals with the study of a single-cell reinforced concrete (RC) skew-curved box-girder bridge under both dead and IRC live loads using the finite element method. An existing model is considered to validate the present results. A convergence study is carried out to decide the optimum mesh size. An exhaustive parametric study is carried out in which the effect of skewness and curvature on the maximum bending moment, shear force, torsional moment and vertical deflection in both the girders of a single-cell RC skew-curved box-girder bridge is investigated and the results are presented in comparison to a straight bridge. The curve angle varies from 0° to 60° at an interval of 12° and the skew angle varies from 0° to 60° at an interval of 10°. The highly skew-curved bridge is found to be more beneficial than the curved bridge because the bending moment and deflection are less in the skew-curved bridge than that in the curved bridge. The present study may be useful to the engineers in designing the skew-curved RC box-girder bridges.

Babita Sharma, Dr Rajan Suwal (2020) This paper presents the seismic vulnerability evaluation of simply supported multi span RCC bridge pier under different ground motions. To determine the seismic performance Nonlinear analysis has been done. Nonlinear static (Pushover) analysis was used to determine the capacity of the bridge pier and seismic demand of the pier was determined from Nonlinear time history analysis. in the time history analysis seismic inputs are given in the form of earthquake time history data. Four numbers of time history data recorded in peer strong motion database has been used. in this study damage on the pier was determined by using the output of Nonlinear time history analysis and Nonlinear static(Pushover) analysis. The probability of reaching or exceeding the different defined damage states with respect to the input ground motion was determined and the fragility curves are also developed by using the First Order Second Order method (FOSM). Using this fragility curves, it is concluded that there is no shear and flexural failure occurred in the bridge pier rather than shear cracking at PGA of 0.4g which is assumed as design PGA in this study for the seismic hazard level of 10% of probability of Exceeded in 50 years (475 years return period).

Aniket Deshpande, Subhash Deshpande, Prof. Chetan Patil(jan.2021) in this research work The seismic response of RC bridge in terms of base shear and displacement on three span and six span bridges with the help of pushover analysis is carried out. In this study the bridge is designed as per IS 456:2000, IS 1893:2016 and IRC 6 2016. The push over analysis is performed as per ATC 40 and FEMA 356.The main objective of this study is to compare the capacity of the two bridges of different spans with the help of Non-linear static pushover analysis. The pushover analysis of the bridge carried out using structural analysis and design software CSI Bridge (version 22).

Shilpa S, Thejashwini P T, Shruthi N P(April 2021) The aim of the Integral bridges has been found to outperform jointed bridges, decreasing maintenance costs, and enhancing the life expectancy of the superstructures and also has been a good choice for high speed railways. However, a standard design method for integral bridges does not exist. Several factors must still be investigated to gain a better understanding of the behaviour of integral bridges, and the factors that influence their analysis, design, detailing, and construction. Hence this paper presents the seismic analysis of this integral bridge and their behaviour for major earthquakes and to determine its suitability and safety in seismic regions especially for Bangalore region.

III. CONCLUSION

After studied the research article it can be conclude that prestress concrete box girder bridge is efficient and economical for large span.it has good tortional rigidity and provide good aesthetic appearance. With increasing span box girder section require less cables to resist the load compare to I girder or T girder bridge. Hence, in modern day's pre stressed concrete box girder is preferred for bridge construction, which saves the quantity of the high tensile steel used in girders and thus helps in reducing the overall cost. The study summarizes the box girder as more suitable structure in terms of stability and economy as compared to I girder bridge superstructure.

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IV. FUTURE SCOPE

From The study of different research papers related to dynamic analysis of bridge structure for various zone and various types of soil condition we analyse following gap for future work.

1) On the behalf of above analytical study the response spectrum analysis of long span prestress concrete box girder bridge is yet not Be perform by researcher as per Indian standard.

2) Earthquake analysis of bridge structure using partially base isolation has not performed yet which can be used for future research work.

3) Seismic analysis of integral bridge has not performed yet which can also use for future research work.

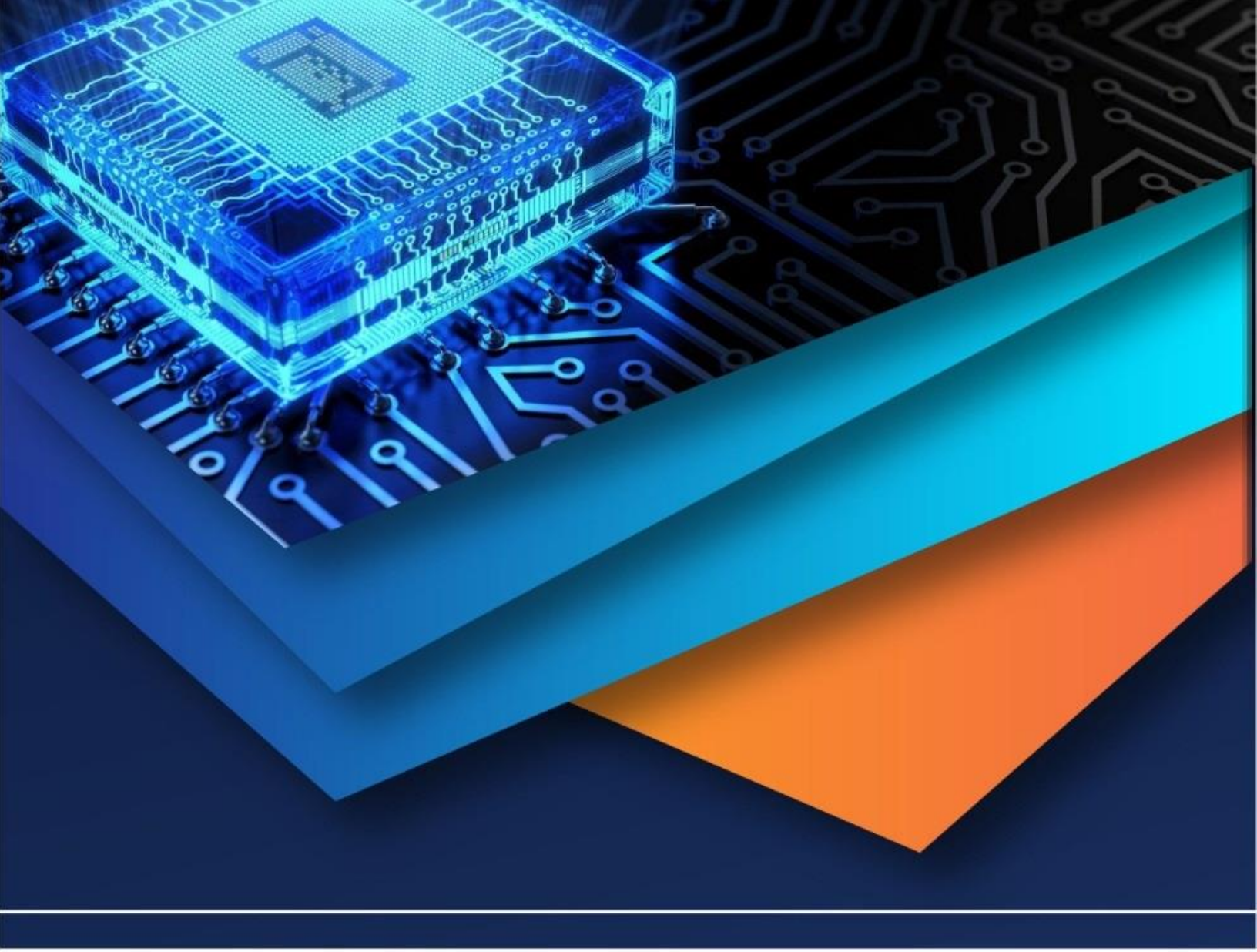
4) Capacity based design of bridge structure has not been performed yet which can also be used for future research work.

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