

Review of the Analysis and Design of Foot Over Bridge by Using Steel Truss and Girder for Seismic and Wind Conditions with Identifications of Software Applications

Tanvi Dilip Dongare^{1*}, Prof. Jaydeep Chougale², Dr. Ajay Radke³

¹ PG Student - Structural Engineering, Mumbai University, Mumbai, Maharashtra, India.

² Assistant Professor, Structural Engineering, Mumbai University, Mumbai, Maharashtra, India.

³ Professor, Structural Engineering, Mumbai University, Mumbai, Maharashtra, India.

Emails: tanvi.m220068201@vcet.edu.in¹, jaydeep.chougale@vcet.edu.in², ajayradke@gmail.com³

***Corresponding Author Orcid ID:** <https://orcid.org/0009-0009-3340-8487>

Abstract

A bridge is a structure that crosses a river, a valley, or a railway to connect one location to another. There are numerous kinds of bridges, including cantilever, cable-stayed, suspension, girder, deck slab, arch, and truss bridges. In any design, starting with a preliminary and detailed survey regarding bridge data, the loads that are primarily taken into account are dead load, live load, wind load, and seismic load. The methodologies that are accepted in software are modelling, material and section properties defined in software, assigning the material properties and section, boundary conditions applied, applied loading, analysis, and design. The software displays displacement, shear force, and moments. Starting with the deck slab, the loading mechanism moves up to the girder or steel truss, pier, and footing. There are various truss types accessible for design, including the K type, Howe, Pratt, and Warren. The review concludes that, while there are numerous materials available for bridge design, using cold-formed steel will lower project costs and FRP material, which will increase stiffness while reducing weight and strain. This review article applies to any study on the design of foot-over bridges, steel truss bridges, girders, and steel-truss bridges, materials suitable for bridges and their properties with experimental studies, software and load knowledge with codes, and additional research on this subject. The conclusion is that the steel truss may be replaced with a girder bridge when the steel truss is made with a tubular section and a Warren-type truss with material changes.

Keywords: Design, Analysis, Bridge, Girder, Steel truss, STAAD PRO, Pedestrian

1. Introduction

There are numerous kinds of bridges, including cantilever, cable-stayed, suspension, girder, deck slab, arch, and truss bridges using different materials. These days, innovative materials are developed and utilized in bridge construction, such as glass, Fiber-reinforced polymer [52], pre-tensioned or post-tensioned cable [6, 22], stainless steel [9], cold-formed steel [32], corrugated steel [15, 22], and certain chemicals employed in concrete. The component abutment, pier, and foundation comprise

the substructure, while the deck, girder, truss, handrail, parapet, and expansion joint comprise the superstructure [26]. Load, location, geometry, climate, topography, soil property, span length, kind of bridge, [2] material used and availability, project cost, and other factors are taken into consideration when designing a bridge. The loads are mostly considered dead load and live load, with some time considering dynamic conditions also with dead load and live load [5, 29, 34, and 51].

Steel-truss bridges are defined as bridges in which the truss resists the loads from the deck slab. The material mostly used for truss bridges is steel [13, 14, 21, 29, 30, 31, 38, 45, 46, 48, and 51]. The different types of trusses available and examples are Warren Truss [13], Pratt Truss [13, 30], Howe Truss [13], Fink [30], Arch [30], PEB Steel [30], Parallel chord truss [30], etc. The steel truss bridge is mostly used for pedestrian purposes [45, 37, 33, and 16] and vehicular purposes [13]. Steel trusses are applied below or above the deck slab. The cross-section of a steel truss may be tubular or conventional [31]. The steel truss member is resisted only by axial loads [12], which may be tension or compression in nature. The girder bridge is defined as the bridge in which the girder resists the load from the deck slab. RCC [1, 3], prestressed cable [4, 5, 6, 40], and steel materials [3, 9] are mostly used for girders as materials. The shear force and bending moment were withstood by the girder that was loaded. It could be steel, prestressed material, or reinforcement, which is a cast material designed to withstand bending moments and shear forces. For foot-over bridges, the most commonly used materials are steel, concrete, timber, and cables [17, 18, and 19]. The bridge faces inefficiencies during the implementation of the steel girder. Transportation expenses during the transportation of the girder are a factor responsible for elevated overall development costs for composite bridges. To mitigate these issues, there is a demand for more adaptable steel girders that need to be replaced with steel trusses, and this study is mostly for foot-over-bridge purposes.

2. Literature Reviews

2.1 Steel Truss Bridge

Saket, P. et al. [2020], in this research, the author performed the analysis for steel trusses of various types by using ANSYS software. A steel truss is considered a pinned joint for analysis. [27, 36] The assumption made was that the member takes only the axial load applied to the truss at the joint. Researchers conclude that steel trusses are more economical than RCC bridges, and steel trusses are a suitable type for pedestrian bridges, but precautions should be taken regarding corrosion. [12] V.R. Shinde et al. [2021],

analyzed steel trusses for Warren Truss, Howe Truss, and Pratt Truss using STAAD PRO software for vehicle loads of class AA, A, B, and 70R. Analysis was performed with variations in vehicle loads as well as steel truss types. The author also compared shear force, displacement, torsion, and support reaction while designing the truss and concluded that the Pratt truss experienced the maximum torsion, [8] the Warren truss experienced the maximum displacement, and the Howe truss experienced the maximum shear force and support reaction. [13] Yiyan Chen et al. [2020], In this paper the author designed for a bridge of composite material with an RCC deck slab and steel truss shown in Figure 1 The truss is laid down in a horizontal direction parallel to the deck slab. The deck slab is connected to the corrugated steel web, which first connects with the deck slab, then with the steel tube, and finally with the steel tube attached to the steel truss. [25, 39] The steel tube was filled with and without concrete to investigate the effect of the corrugated steel web and truss on the efficiency and structural behavior of the bridge. The observations made during bending show that the hollow steel tube is quite much better than the steel tube filled with concrete. The strain result shows the section is satisfied by "plane section assumptions". [10] It means the section behaves like a composite section, with the neutral axis shifting from the web to the concrete slab. The steel tube with the lower edge attained more yield than the upper edge. Also found that the most experienced load in the whole section is stress in compression, but in the plastic stage, the stressed concrete slab changes compression to tension due to composite action. [15] Endah Wahyuni et al. [2016], this research is based on non-linear analysis for steel truss bridges using push-over analysis. The researcher prepared 6 models of bridges, those 3 models for the single-span bridge and 3 models for the continuous-span bridge, and observed the behavior of the bridge when it was cast with a single-span or continuous-span. the author concludes that the three models, in which one has more span (which is a single span),

recorded more displacement, and the other three models (which is a continuous span), in which the supports were placed more apart from each other, recorded more displacement [21].

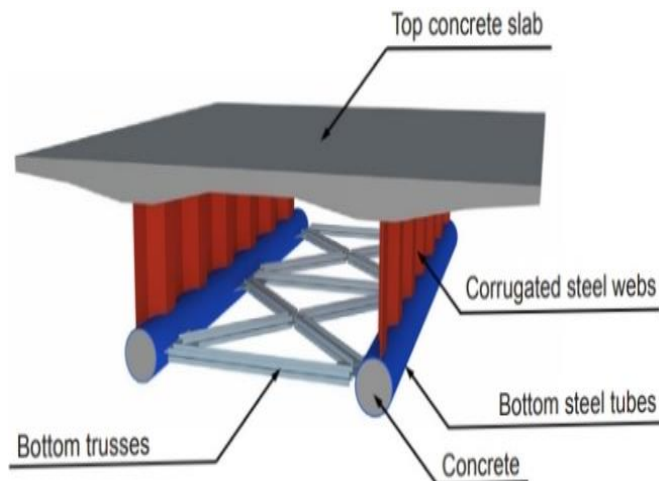


Figure 1 Composite Bridge with the Use of Corrugated Steel Web and Steel Truss [15]

M.G. Kalyansheti et al. [2012], studied the comparison between tubular and conventional cross-sections used for steel structures. The tubular sections used are rectangular, circular, and square in shape for analysis purposes. The author focused more on the differences between cross-sections and what cross-section has superior capability when both have been options for design. whole analysis performed by STAAD PRO software with consideration of dead load, live load, and wind load by helping with IS-800 for steel structure, IS-875 for wind load calculation, and IS-806 for steel tube structure and conclude that tubular sections are more economical than conventional steel members due to dead loads and mostly refer to square and rectangular tubular sections due to connection difficulties. [29] Gaurav Shinde et al. [2019], studied different types of trusses, namely Pratt, Fink, Arch, PEB steel, and parallel chord trusses, and designed for the limit state and working state methods. The span selected for study is 25 meters with a 4-meter rise for the truss. AUTOCAD software is used for modelling, and STAAD PRO software is used for analysis. The dead load, live load, and wind load have been considered

for analysis in the software by using IS 875 (parts 1, 2, and 3). The conclusion is that the limit-state method is more economical than the working-state method [30]. Salunke Rohit Ram et al. [2020], designed a temporary foot-over steel trusses bridge for triangular and tetrahedron noses to study the effect of variation on the behavior of the bridge by using STAAD PRO software for steel truss bridges at the location of the mountain. The steel member was provided with a hollow section. The analysis concluded that the tetrahedron nose bridge structure's counted deflection is 66.57 mm as compared to other structures' counted deflection of 87.44 mm [38]. Naveen Ram Kumar R et al. [2021], research deals with the design of pedestrian bridges that are re-built for the capacity of pedestrians, [20] which is not sufficient to resist pedestrian load, the design is finalized with STAAD PRO software. The bridge was designed to have a span of 86 meters and Warren type. The materials used are Fe415 and M20 steel and concrete, respectively. All members of the truss, inclined bracing, and horizontal bracing are designed for the ISA section; for the girder, the ISMB section; and for the column, the ISMB section. The manual design was performed for the footing design. [45] Kausar T. Shaikh et al. [2023], in this, the author analyzed the concept of changing the bay width of steel trusses and learned about the comparison between the RCC and steel material used as bridge material. They are considered to have a bay width of 2 meters, 3 meters, 4 meters, or 5 meters. With changing the bay width, there are also variations in span lengths. The researcher performed an analysis of how bay width changes with changing span length for pedestrian bridges. The author observed that a steel structure is more economical than an RCC structure. [46]

2.2 Steel-Girder Bridge

Ravikant et al. [2019], This research deals with designing using three codes, which are the Euro code, the AASHTO code, and the IRC code, using the Staad Pro software for a 25-meter span of RCC Girder type and steel Girder type for analysis and design. The comparison between the three codes is

according to their bending moment, shear force, and deflection. The result shows for the RCC girder type bridge that the Euro code is not suitable for designing, which gives more shear force, bending moment, and deflection for the live load. The live load deflection value for IRC is the same as that of AASHTO. Secondly, the steel girder bridge result shows that the euro code consumes more steel in design than AASHTO and IRC. The conclusion is that IRC is preferably an economical and safer design than the other two codes. [3] Prof. Ancy Joseph et al. [2015] designed a bridge that was constructed for a religious region and connected to Kerala State. The design includes a prestressed girder bridge and an RCC deck slab by using SAP-2000 software for vehicle load 70-R. The dead load and vehicle load are shifted to the girder and the moment value gives the prestressing force, which gives how many cables are required for the girder. The conclusion is that the design is safe, and all checks are okay [4]. Irpan Hidayat et al. [2022], study focuses on the analysis of the Box Girder Bridge for dynamic conditions and also considers the finite element method by using software for a span of 198 meters. The modelling is done using MIDAS. The dynamic loads that they used were light rail transient loads with self-weight, tendon loads, and parapet loads. They aim to find out the natural frequency. The conclusion of the natural frequency obtained by the finite method is 2.567% lower than that of the field dynamic method [5]. M. Jagandatta [2021], this paper mentions the method of analysis and design for a single span of length 28 meters with a prestressed girder by using Midas software. The author used the method for analysis and design in software, which is modelling, defining the materials and section properties, [28] assigning the properties, applying boundary conditions, putting the loads and combinations, running analysis, and designing. Two approaches are utilized, where analysis and design are performed for only the basic condition (no seismic load) and the seismic condition. They concluded that Midas software is easily used and safer for design purposes regarding the prestressing-type bridge [6]. Shubham Sirse et al. [2020], focused on a comparison between the T-beam

and box girder bridges by using three software and codes that are SAP-2000, CSI Bridge, STAAD Pro, and IRC 21&2000 and IRC 112-2011 respectively. The result shows the T beam is mostly used to resist the bending moment and give rigidity. The box girder is used for aesthetic purposes and an economical section, as well as for increasing torsional stiffness, stability, and ductility. They conclude that the quality of steel, from a point of view, is more considered in IRC 112 than in IRC 21. IRC 112 saves the project cost and also saves concrete quantity up to 20 to 30%. [7] Imma Estrada et al. [2008], This is research based on the use of stainless steel as a steel material by using "Timosenko theory" for their analysis which gives the value of initial shear buckling stresses for steel web stiffeners (longitudinal and transverse). This study only related to how stainless steel behaves when used as a material for stiffeners. Two tests are performed during research: numerical and experimental. They included two conditions: [23] one is rigid, and the second is non-rigid. The conclusion is that the aspect ratio is equal to less than one for the rigid conditions obtained and more than one for the rigid and non-rigid conditions obtained. [9] Ahmad M. Itani et al. [2004], mention the study of the behavior of the bridge and damages faced by the bridge during seismic conditions and performed the experiments with and without the use of an end-cross frame for the bridge. They mentioned that the steel girder bridge suffers low to moderate types of damage as compared to the RCC Bridge, which faces significant damage. The results show that when the bridge is without an end cross frame, the bridge efficiency during seismic conditions is not as good as in the presence of an end cross Frame Bridge [20]. Rui Juan Jiang et al. [2014] designed, two deck slabs connected by a corrugated steel web with two numbers at the end of the flange, and the web is placed at an angle for the study of the flexural, shear, and torsional behavior of corrugated trapezoidal and circular steel web with the analysis method for local, global, and interactive buckling. Shown in Figure

2 the conclusion is that the shear resistance is not only performed by the web but is also a little bit resisted by the flange section. The corrugated circular section for steel webs is much better than the trapezoidal section. Torsional resistance is not well performed for corrugated steel webs. The limitation of this study is that they did not consider the seismic condition. [22]

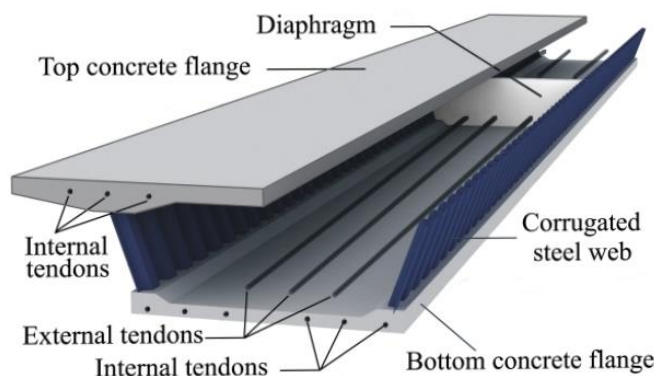


Figure 2 Design of Deck Slab with Corrugated Steel Web [22]

Alessio Pipinato [2018] studied how to extend the steel bridge's life span by using the finite element method with Midas software. The observations are that the extended life span of the bridge was obtained with the design of making a composite deck from an existing non-composite deck, building an orthotropic deck, building a new concrete deck, and directly connecting the deck slab to the main trusses. The conclusion is that for the design of the bridge, use historical loads for design. The existing bridge is carrying actual live load but not reduced live load in design. A detailed analysis has been done whenever designing bridges [24]. Venkata Siva Reddy et al. [2014] studied the response of the box bridge span for a 70-meter continuous span by using Midas software and mentioned how the moving load affects the bridge. The two models are used: one is a box bridge with RCC material, and the other is a restressing material with both singular box-cell-like structures. The conclusion is that the RCC single box girder is resistant to less force, moment, and displacement, and it is suitable for heavy structures, whereas the PSC is used for metro-like structures. [35] Shreedhar et al. [2016], a comparative study of IRC 112-2011 and

IRC 18-2000 for restressed box girder vehicular bridges, focused on the L/D ratio by using SAP software and manual methods for limit state and working state, considering the Class AA type of vehicle. The conclusion is that concrete saves up to 5–12% for the limit state method. [11] In this case, the PSC Bridge was designed with the limit state method, and as per IRC 112, the L/D ratio is suggested 31 to 36. They suggested that when spanning 50 to 70 meters, the L/D ratio is used at 33 [40-44]. Pravin Jaiswal et al. [2022] mentioned the variations in span length and depth for the T-Beam deck Slab Bridge used for bridge analysis. The conclusion is that the maximum bending moment and maximum shear force increased with the increasing span from 10 to 15 meters. The maximum support reaction for increasing deck thickness from 150 to 300 mm. [47, 48]

2.3 Foot Over Bridge

Limje Mayur et al. [2019], Designed the pedestrian bridge by using the Staad Pro software, and a steel truss for a C shape is applied to the bridge at locations near Surat station. They examined how much intensity was required to cross the bridge and how much time was required for crossing. With consideration of dead load and live load for design, the Indian Standard 800-2007 is utilized for the steel design of bridges. The transfer of load from the deck slab to the steel truss, the column, and the footing. The conclusion is that the design is safe and all checks are okay [16]. Rajesh [2017] mentioned the design of a pedestrian bridge with the use of steel trusses and Staad Pro software for a span of 28 meters. The methodologies accepted for this were: gathering different types of data, reviewing the literature, conducting research on CODAL provision, location selection, and related data, using AutoCAD planning and modelling, Load, analysis, and design with a detailed design plan. The load is transferred from the steel truss to the gangway, then to the column, and lastly to the footing. The outcome demonstrates that every member—aside from Gangway—is cast by the ISA section and the ISMB section for Gangway. They concluded that the design was secure and all

checks were okay [50, 53]. Aishwarya Kulkarni et al. [2016] analyzed timber, steel, concrete, and advanced materials like cables as materials for bridges by using Staad Pro software and the finite element method. The observations indicate that cables are suitable options with RCC and steel girder-type bridges. The conclusion is that a cable-stayed bridge is the most suitable material for a bridge [17]. Rahul Kapse et al. [2023] designed foot-over bridges by using Staad Pro software with analysis using accidental loads and traffic intensity. They follow the following process: select a model, choose material and loading, investigate, interpret the result, investigate the 3-D structure in software, check for dynamic conditions and ISO requirements, and design life span requirements [18]. Umesh Rajeshirke [2013] mentions the present design of the pedestrian bridge, which is situated in Navi Mumbai, Kharghar. This design is made with the following parameters: ease of pedestrian use, safety, economy, and a lifespan of up to 20 years. The various cases of loads are considered to be half-span loaded, one-span loaded, and two-span loaded, considering dynamic conditions. The conclusion is that these bridges have the purpose of transiting pedestrians, and their design has a 1.02% peak acceleration considered for the dynamic resistance [33]. Mallikarjun I Pattanshetti et al. [2022], in this, the author performed the design for pedestrians by using the STAAD PRO software for steel truss bridges while considering the dynamic conditions. The methods of study used are a preliminary survey, a detailed survey, learning review papers, finding out the needs of research for the chosen topic, Data collections related to current research work, modelling in software, Define the properties, assigning properties, analyzing, design, interpret results, and draw conclusions. The conclusion is that a safe structure is designed with a high-intensity factor when considering wind and seismic conditions, due to the large opening-like structures in the steel bridge, which provide relief from wind [34]. Dr. Vinayak Vaidya [2023] mentioned the design for pedestrians in Staad Pro software for urban places. The methodology adopted is that the first step is to perform a survey, decide the

geometry of the bridge, make mathematical models, and apply load, analysis, and design. The conclusion with this foot-over bridge, which is being designed, is that this structure is suitable for safety criteria and fits in an urban place. [49]

Conclusion

The review paper is related to the design and analysis of girder bridges, steel truss bridges, and foot-over bridges with the use of software for considering various loads like dead load, live load, wind load, and seismic load with the application of various kinds of material in the bridge as bridge material and their experimental study and suitability. The review's study conclusion is that, the efficiency of steel trusses can be significantly enhanced by employing a Warren truss design with tubular sections, alongside minimizing wind factors through maximizing opening areas. This suggests a promising avenue for maximizing structural performance. Secondly, girder efficiency can be elevated by utilizing alternative materials such as stainless steel or corrugated steel with a cellular section for the web. Additionally, substantial cost savings can be achieved by adhering to IRC 112 standards over IRC 21, highlighting the economic advantages of this approach. This review article applies to any study on the design of foot-over bridges, steel truss bridges, girders, and steel-truss bridges, materials suitable for bridges and their properties with experimental studies, software and load knowledge with codes, and additional research on this subject. This review study contributed a body of knowledge of structural engineering to the design and analysis of various types of bridge structures.

References

- [1]. Augustinj, Asst. Prof. Alfrite. "Review for Comparative Analysis of R.C.C T-beam Bridge Girder". International Journal of Advances in Engineering and Management, Vol. 3, Issue 8, 2021.
- [2]. Harsh Singh, Himanshu Yadav. "Design of composite girder deck Type Bridge". International Journal of Creative

- Thoughts, Vol. 8, Issue 6, 2022.
- [3]. Ravikant, Jagdish Chand. "Design and Analysis of Bridge Girders Using Different Codes". International Journal of Engineering Research and Technology, Vol8, Issue 7, 2019.
- [4]. Prof. Ancy Joseph, Elsa Babu, Karthika Babu, Lakshmi G, Meera R Krishna. "Analysis and Design of Railway Over Bridge at Kumaranellur". International Journal of Civil and Structural Engineering Research, Vol. 2, Issue 2, 2015.
- [5]. Irpan Hidayat, Febrian Suryatama. "Dynamic analysis of continuous box Girder Bridge". IOP Conference Series: Earth and Environment Science, Vol.1169, 2022.
- [6]. Jagandatta. M. "Analysis and Design of Composite Single Span PSC-I Girder Bridge Using Midas Civil". IOP Conference Series: Earth and Environment Science, Vol. 982, 2021.
- [7]. Shubham Sirse, Dr. Kuldeep R. Dabhekar, (2020). "Review of Design and Analysis of Box Girder Bridges and T-beam Bridges Using IRC codes". International Journal of Scientific Research in science and technology, Vol. 7, Issue 3.
- [8]. Brahim Benmokrane, Enab Salakawy. "Designing and Testing of Concrete Bridge Decks Reinforced with Glass FRP Bars". Journal of bridge engineering, vol. 11, no. 2, 2006.
- [9]. Imma Estrada, Esther Real, Enrique Mirambell. "Shear resistance in stainless steel plate girders with transverse and longitudinal stiffening". Journal of Construction Steel Research, Vol. 64, Issue 11, 2008.
- [10]. Hemaltha. K, Chippymol James, L Narayan, V. Swamynadh. "Analysis of RCC T-beam and prestressed concrete box girder Bridges superstructure under different span conditions". Elsevier, Vol. 37, part.2, 2021.
- [11]. WB Geng, Q Yi, YH Yang, C Li, YB Kang, PP Cui. "Design and static analysis of Long-Span steel truss Suspension Bridge". Journal of Physics: Conference Series, Vol.2476, 2023.
- [12]. Poonam Saket, Asst. Prof. Kuldeep Pathak. "Review study on pedestrian Bridge Truss Structure for Low Traffic Volume". Journal of Engineering Technologies and Innovative Research, vol.7, Issue 3, 2020.
- [13]. Shinde .V. R, Prof. A.S. Patil, Prof. U.A. Mahadik. "Comparative Analysis of Truss bridge". International Journal of Engineering and Technology, Vol. 10, Issue 01, 2021.
- [14]. Bin Cheng, Haitao Sun. "Steel Truss with Welded Box-Section members and bowknot integral joints". Journal of Constructional Steel Research, Vol. 80, 2013.
- [15]. Yiyang Chen, Jucan Dong, Zhaojie Tong, Rujian Jiang, Ying Yue. "Flexural behavior of composite box girder with corrugated steel web and trusses". Elsevier- Engineering Structures, Vol. 209, 2020.
- [16]. Limje Mayur, Solanki Dharmendra, Patel Darshan, Patel Neel, Patel Hiren, Dixit. "Appraisal and Design of Foot Over Bridge". International Research Journal of Engineering and Technology, Vol. 6, Issue 4, 2019.
- [17]. Aishwarya Kulkarni, Priyanka Kumbhar, Pooja Mandge. "Material for Foot Over Bridge". International Research Journal of Engineering and Technology, Vol. 3, Issue 4, 2016.
- [18]. Rahul Kapse, Dr. R.A. Dubal, Prof. B.V. Mahajan. "Review on Design and Analysis of Foot Over Bridge Using Plated Fabricated Steel Member". International Journal for Research in Applied Science and Engineering Technology, Vol, 11, Issue 2, 2023.
- [19]. Akhilesh Kumar Maurya. "Study of Pedestrian Movements Over Foot Over

- Bridge”. The International Daily Journal, 2015.
- [20]. Ahmad M. Itani, Michel Bruneau, Lyle Carden, and Ian G. Buckle. “Seismic Behavior of Steel Girder Bridge Superstructure”. Journal of Bridge Engineering, Vol. 9, No.3, 2004.
- [21]. Endah Wahyuni, Heri Istiono, Data Iranata and Indra Komara. “Non-Linear Analysis of Failure Mechanism of Steel Truss Bridge”. ARPN Journal of Engineering and Applied Science, Vol. 11, No.24, 2016.
- [22]. Rui Juan Jiang, Francis Tat Kwong Au, and Yu Feng Xiao. “Prestressed Concrete Girder Bridges with Corrugated Steel Web”. Journal of Structural Engineering @ ASCE, Vol. 141, Issue 2, 2014.
- [23]. Erin Santini Bell, Paul J. Lefebvre. “Objective Load Rating of Steel-Girder Bridge Using Structural Modelling and Health Monitoring”. Journal of Structural Engineering@ ASCE, Vol. 139, No.10, 2013.
- [24]. Alessio Pipinato. “Extending the Lifetime of Steel Truss Bridges by Cost-Efficient Strengthening Interventions”. Structure and Infrastructure Engineering, Vol. 14, Issue 12, 2018.
- [25]. Madhuri Yadav, Kaushik Majumdar. “Behavior Analysis of Stayed Bridge with Different Cable Arrangement Using Staad Pro”. International Journal of Engineering Science and Research Technology, 2018.
- [26]. V. Swathy Padmaja, T. Ramya, K. Gayathri, P. Lakshmi Devi. “Analysis and Design of Flyover by using Staad pro”. International Research Journal of Engineering and Technology, Vol. 6, Issue 6, 2019.
- [27]. Allan Pereira, Faizan Inamdar, Nawnath Rathod, Feroj Shaikh. “Analysis and Design of Bridge Deck on Staad Pro V8i”. International Journal of Innovative Research in Science Engineering and Technology, 2022.
- [28]. Akshay Sagale, Sandip Dongre. “Analysis and Design of Cable Stayed Bridge Using Staad Pro”. International Journal for Research in Applied Science and Engineering Technology, 2020.
- [29]. M.G. Kalyansheti, G.S. Mirajkar. “Comparison between Conventional Steel Structure and Tubular Steel Structure”. International Journal of Engineering and Research and Application, Vol. 2, Issue 6, 2012.
- [30]. Gaurav Shinde, Nikhil Pitale. “Study of Various Types of roof Trusses for Same Span”. International Research Journal of Engineering and Technology, Vol. 6, Issue 4, 2019.
- [31]. Prince Bhanarkar, Prof. Deepak Irkullawar. “Review Paper on Analysis and Design of Steel Truss by Using Angle and Tube Section”. International Research Journal of Engineering and Technology, Vol.9, Issue 1, 2022.
- [32]. Manjusha Nathe, Dr. Sachin Mulay. “Comparative Study of Cold-Formed Steel Foot Over Bridge under Different Configuration”. International Research Journal of Engineering and Technology, Vol.8, Issue 8, 2021.
- [33]. Umesh Rajeshirke. “Design and Construction of Pedestrian Bridge at Kharghar, Navi Mumbai. 36th IASBE Symposium, Kolkata, 2013.
- [34]. Mallikarjun I Pattanshetti, Deepak Patil. “Dynamic Analysis of Pedestrian Steel Bridge”. International Research Journal of Modernization in Engineering Technology and Science, 2022.
- [35]. G. Venkata Siva Reddy, P. Chandan Kumar. “Response of Box Girder Bridge Span”. International Journal of Bridge Engineering, 2014.
- [36]. B. Vaignan, Dr. B. S. R Prasad. “Analysis of Voided Deck Slab and Cellular Deck Slab Using Midas Civil”. International Journal of Engineering Research and Technology, Vol. 3, Issue 9, 2014.

- [37]. Kotiya Tejal, Farhan Vahora. "Dynamic Analysis of Suspension Bridge under Moving Load". International Research Journal of Engineering and Technology, Vol.4, Issue 4, 2017.
- [38]. Salunke Rohit Ram, Dr. B.H. Shinde. "Mountain Foot Bridge: Temporary Bridge Designed and Analyzed by Software STAAD Pro". International Journal for Research in Applied Science and Engineering Technology, 2020.
- [39]. Mohankar. R.H., Ronghe. G.N. "Analysis and Design of Underpass RCC Bridge". International Journal of Civil and Structural Engineering, 2010.
- [40]. Shreedhar. R, Shreyansh Patil. "Comparative Study of PSC Box Girder Bridge Using IRC 112-2011 and IRC 18-2000". I-manager Journal on Structural Engineering, 2016.
- [41]. Mahesh Tandon. "Economical Design of Earthquake-Resistant Bridge". ISET Journal of Earthquake Technology, 2005.
- [42]. M Kalpana, B.V. Mohan Rao. "Analysis and Design of Foot Bridge". International Journal of Pure and Applied Mathematics, Vol.119, No.17, 2018.
- [43]. Kapil Mohaliya, Sourabh Dashore. "Design and Deflection Analysis of Deck Slab". International Journal of Scientific Research and Engineering Trends, Vol.7, Issue 2, 2021.
- [44]. Sagar Dhengare, Rajesh Bhagat, Dr. Ajay Gajbhiye. "Minimum Requirements of steel in Designing of the Approach Bridge-Deck slab". Journal of Engineering Research and Application, Vol.10, Issue 4, 2020.
- [45]. Naveen Ram Kumar R, Navneet Harshit, Aparna S Bhaskar. "Pedestrian Steel Truss over Bridge Analysis and Design at Saharsa Railway station, Bihar". International Journal of Civil Engineering and Mechanics, Vol.8, No.1, 2021.
- [46]. Kausar T. Shaikh, Dr. S. S. Kadam. "Design Optimization of Bay Spacing of Steel Foot Over Bridge". International Research Journal of Modernization in Engineering Technology and Science, Vol.5, Issue.6, 2023.
- [47]. Surana Samyak, TP Manoj, Santhi A. S. "A Parametric Study of Integral Bridges Subjected to Thermal Loading". International Journal of Civil Engineering and Technology, Vol.8, Issue.4. 2017
- [48]. Pravin Jaiswal, Priyanka Dubey. "Study and Analysis of RC Deck Slab Bridge with Varying Thickness". International Research Journal of Modernization in Engineering Technology and Science, Vol.4, Issue.4, 2022.
- [49]. Dr. Vinayak Vaidya. "Analysis and Design of Foot Over Bridge". International Journal for Research in Applied Science and Engineering Technology, Vol.11, Issue.4, 2023.
- [50]. Rajesh. S. "Design of a Steel Foot Over Bridge in a Railway Station". International Journal of Civil Engineering and Technology, Vol.8, Issue.8, 2017.
- [51]. Vikas, Bhupinder Singh. "Effect of Variation in Geometrical Parameters on the Roof Trusses". International Journal on Recent and Innovation Trends in Computing and Communication, Vol.5, Issue.7, 2017.
- [52]. Tomasz Siwowski, Damian Kaleta. "Structural behavior of all-Composite Road Bridge". Composite structures, Vol.192, 2018.
- [53]. Heena Dewangan, Kaushik Majumdar. "A Review on Comparison of Different Types of Trusses in Vibration Analysis Using Staad Pro". International Journal of Engineering Science and Research Technology, 2018.