



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 1, January 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Analysis and Design of Trusses for Pune Railway Bridge across Bhima River

Mr. Chakor Pawar¹, Prof. Shelar . V .V²

P.G. Student, Dept. of Civil Engineering, Trinity College of Engineering and Research, Pune, India¹

Assistant Professor, Dept. of Civil Engineering, Trinity College of Engineering and Research, Pune, India²

ABSTRACT: A bridge must be designed to safely resist all loads and forces that may reasonably occur during its life. Presently in India, a general type of steel bridge is designed, although at a moderate pattern of Steel Bridge is required to raise by the time due to the higher demands for railways traffic and short distance routes. A bridge is a means by which a road, railway or other service is carried over an obstacle such as a river, valley, and other road or railway line, either with no intermediate support or with only a limited number of supports at convenient locations. Steel is widely used around the world for the construction of bridges of different size. It is a versatile and effective material that provides efficient and sustainable solutions. In the present dissertation work, it is proposed carry out analysis and design of different types of trusses for steel bridge in Pune. Present study involves analysis and design of truss by using STAAD PRO software. The bridge of 366m long and 7.6 m width is considered. Number of spans 30 of 12.2 m each, number of tracks 2, broad gauge is used for track and width of track is 1.676m. For seismic analysis seismic zone III considered and IS 1893 (Part III) 2016 is used. For wind analysis IS 875 (Part III) is used. The Warren truss, Pratt truss, Howe truss is considered for comparison for static and dynamic analysis. And design most economic structure for the Bhima River.

KEYWORDS: Steel bridge, STAAD PRO, IS 875, IS 1893, static and dynamic analysis

I. INTRODUCTION

Steel has been used in the construction of railway bridges since Victorian times, both in major long-span structures and in more modest spans, such as over local highways. Many of these older steel bridges are still in service, thanks to an on-going programme of maintenance, refurbishment and upgrading to suit changing requirements. Today, most railway bridges are built as replacements for earlier structures, although some entirely new structures are being built on new alignments or routes, most notably for the Channel Tunnel Rail Link. For replacement bridges, steel construction can achieve shallow construction depths, which is essential where the track level is fixed yet sufficient underline clearance is needed for highways or other services below the bridge. Steel construction is suited to prefabrication and preassembly and, because of its relatively modest self-weight, can be transported or lifted into position in the very short periods during which the railway can be closed to traffic.

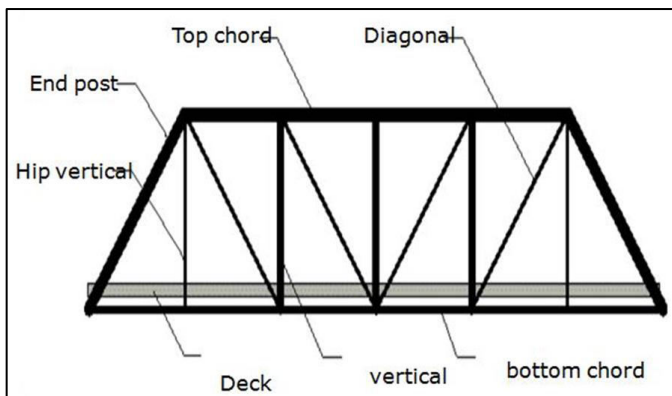
A bridge is a super structure that crosses over a gorge, road, river, railway, or other obstructions, permitting smooth and safe passage of vehicles, trains and pedestrians. A pedestrian bridge is a bridge designed for pedestrians and in some cases cyclists, animal traffic and horse riders, rather than vehicular traffic. A Railways bridge is design for railway traffic only using railway loading (IRS).The bridges complement the landscape and can be used decoratively to visually link two distinct areas or to signal a transaction. For communities in the developing world, a footbridge may be a community's only access to medical clinics, schools and markets, which would otherwise be unreachable when rivers are too high to cross. Simple truss bridge designs have been developed to be sustainable and easily constructible in such rural areas using only local materials and labour. Truss structures are composed of members that are connected to form a rigid frame of steel. This broad application can be used in many areas, such as Pedestrian Crossing Bridge, rail Bridge, Road Bridge and other transportation bridges. The individual members of a truss bridge are the load carrying components of the structure, they are arranged in a triangular manner resulting in the loads carried to become either in tension or compression. Today truss bridge are used for many purposes, since they are simple to assemble and economical. Bridge is an important structure required for the transportation network. With the fast innovation in technology the conventional bridges have been replaced by the cost effective structured system. For analysis and design of these bridges the efficient methods are available. In this paper comparative study on different type of truss bridge has been presented. Presently in India, a general type of truss steel bridge is designed, although at a moderate pattern of Steel Bridge is required to rise by the time due to the higher demands for railways traffic and short distance routes. The

main objectives of the present study are to analyze and design truss bridge with railway loadings and to make comparative study of these bridges.

II. PROBLEM STATEMENT

After the static and dynamic analysis of the different types of bridge, it is concluded that the warren type of truss is more economical than the pratt and Howe types of truss. The analysis should recommend the warren type of truss for the railway bridge on the Bhima River. Then it is necessary to design Warren Bridge.

2.1 BRIDGE DETAILS



Members Used For Analysis

- 1) Top Chord - ISMB 600
- 2) End Post - ISMB 600
- 3) Hip Vertical – ISMC 250
- 4) Vertical - ISMC 250
- 5) Bottom Chord - ISMB 600
- 6) Diagonal - ISMC 250

Table 1. Bridge Details for design

Bridge Details		
No	Description	
1	Span of Bridge	12.5m
2	Width of Bridge	15m
3	Lanes	2 Lanes
4	Total Height	7.5 m
5	Slab thickness (average)	0.26m
6	Type of Loading	IRC class A Train
7	Loads	EQ+WL+DL+THERMAL
	Seismic zone	III (IS 1893:2016 (Part1)Table 3, Clause 6.4.2)
	Location	Pune (Annex E)
	Zone factor (Z)	0.16 (IS 1893:2016 (Part1) Clause 6.4.2.1)
	Type of soil	Medium Soil
	Damping	5 % 16 (IS 1893:2016 (Part1) Clause 7.2.4)
	Response reduction factor (R)	5
	Importance factor (I)	1.5

III. RESULTS AND DISCUSSION

1) Top Chord

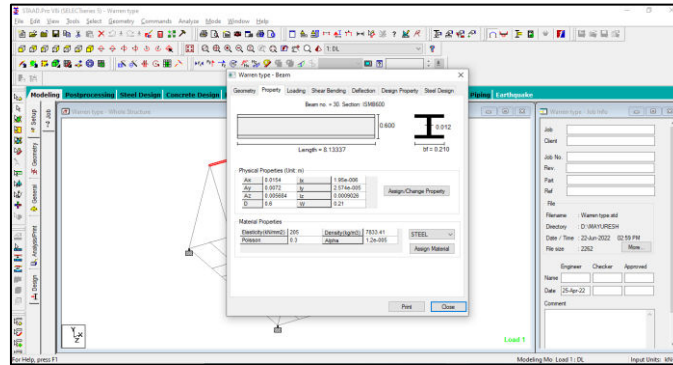


Fig 1 Top Chord before Design - ISMB 600

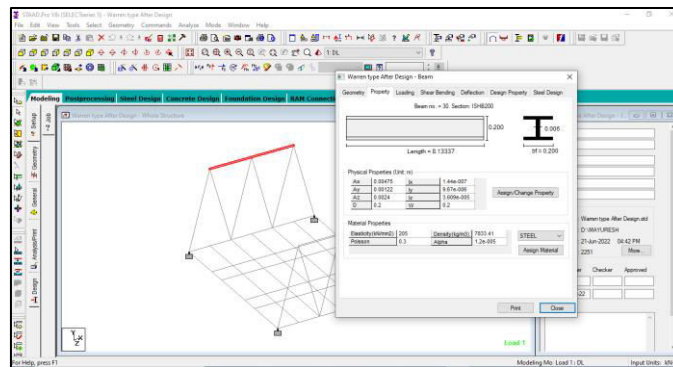


Fig 2 Top Chord After design – ISHB 200

2) End Post

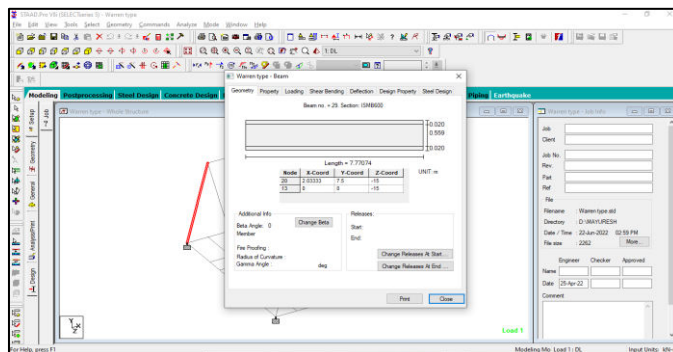


Fig 3 End Post before Design - ISMB 600

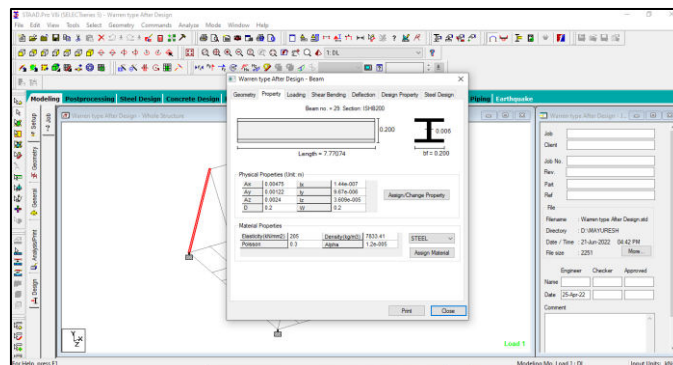


Fig 4 End Post after design– ISHB 200

3) Bottom Chord

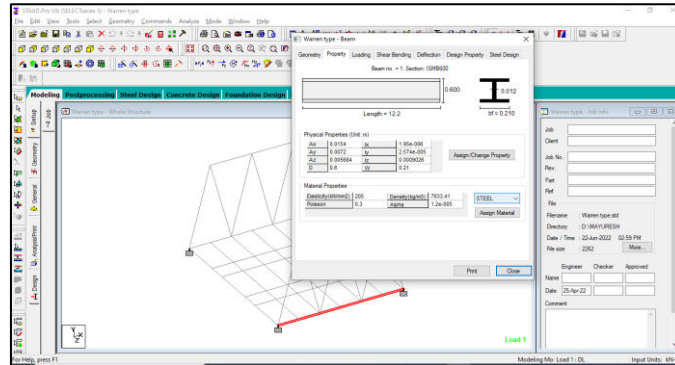


Fig 4 Bottom Chord before Design - ISMB 600

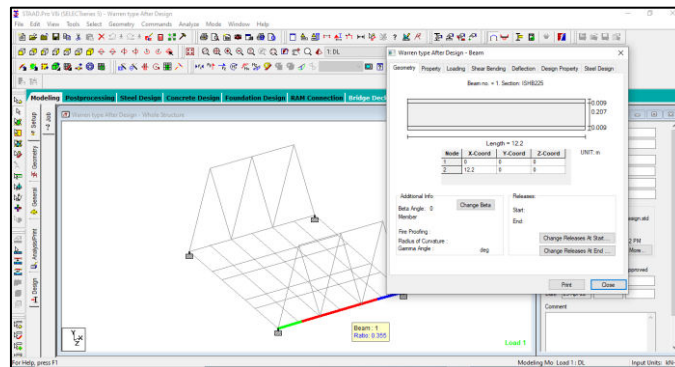


Fig 5 Bottom Chord After design ISHB 225

4) Diagonal

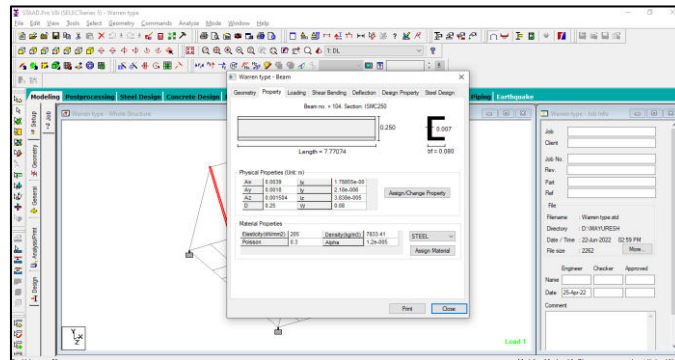


Fig 6 Diagonal before Design - ISMC 250

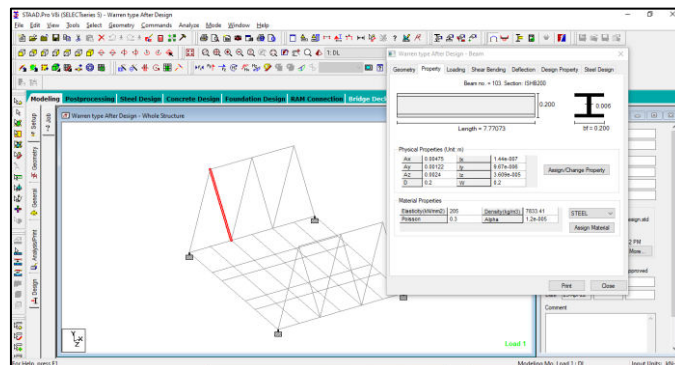


Fig 7 Diagonal After design - ISHB200

5) Before and After Design

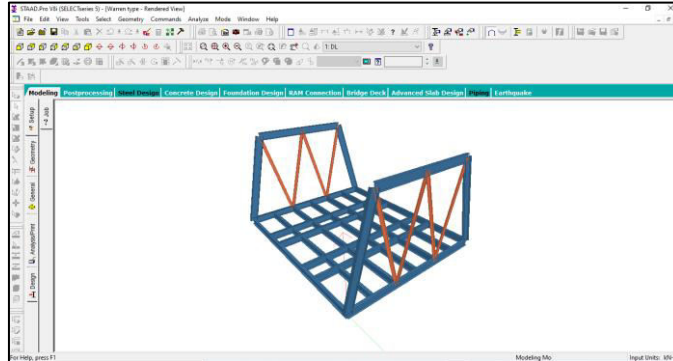


Fig 8 Warren type of bridge Before Design

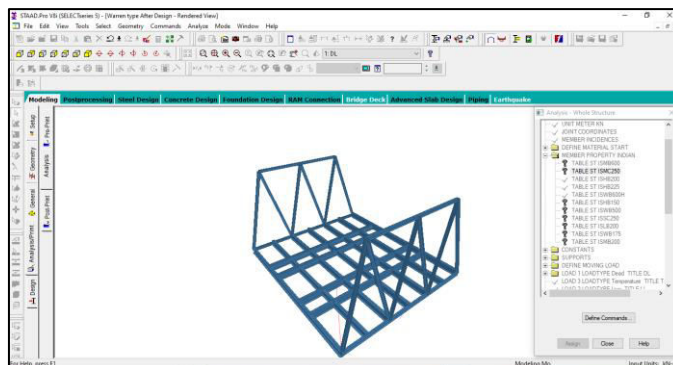


Fig 9 Warren type of bridge after design in Staad pro

VI. CONCLUSION

- There are three types of sections utilized in this research (i.e. Warren truss, Pratt truss and Howe truss) and analyze it for both static and dynamic methods.
- From the static analysis, it is concluded that the Warren type of truss is more economical than the Pratt and Howe types of truss by 30–40%.
- For dynamic analysis, models are performed for seismic and wind forces. For seismic analysis, it concludes that Warren types of truss are more economical than Pratt and Howe types of truss by 20–30%.

Total No of Members

- ISHB 200 - 14 No of Members
- ISHB 225- 2 No of Members
- ISWB600H - 11 No of Members

REFERENCES

- [1] Shubhank Gupta, Prof. Sudhir S. Bhadauria, Prof. Suresh S. Kushwaha (2017), “Comparative Analysis of Different Truss Type Railway Steel Bridge Considering Railway Loadings.”
- [2] T. Pramod Kumar, G. Phani Ram (2015), “Analysis and Design Of Superstructure Of Road Cum Railway Bridge Across Krishna River.”
- [3] Sumit V. Bajare, Sanjay K. Bhadke, Vikrant Vairagade(2016), “Investigating in Analysis and Design Of 24m Long Span Steel Girder Considering the Load Of Special Vehicle.”
- [4] V. R. Shinde, Prof. A. S. Patil, Prof. U. A. Mahadik (2021), “Comparative Analysis of Truss Bridges.”
- [5] Ghassan Shaker Abd, Ahmed Shany Khusheef, Ahmed Mohamad Aliwy, Saddam Hassan Raheemah(2019), “Design and Analysis Of 3D Bridge Truss Using Steel and Concrete Materials.”



- [6] Anjali Verma, Sahu D. L. Sahu, Hitesh Kodwani (2019), “Analysis of Different Railway Bridge Sections Considering Seismic a Load As Per Railway Provisions.”
- [7] Gopal Dayaram Pal, Ashraf Patel, Niraj Meshram, Sayyed Aamir Hussain (2021), “A Review Study on Different Truss Type Railway Steel Bridge.”
- [8] Santosh Kumar Suman, Rakesh Patel (2018), “Analysis of Different Truss Bridge to Configure the Best Suited Shape for Practical Implementation.”
- [9] Safwan Asghar Abbas “Designing A Truss Bridge” Ghulam Ishaq Khan Institute of Engineering Sciences and Technology July 2020
- [10] Ramzi Nasar K et. al. “A parametric study on fatigue life of plate girder railway bridge with varying velocity of rolling stock” IOP Conf. Series: Materials Science and Engineering 989 (2020)
- [11] Mr. Saddam Musa Patvegar et. al. “Comparative Parametric Study of Vierendeel Girder and Truss Girder for Single Track Railway Bridge” (IRJET) Volume: 03 Issue: 06 | June-2016
- [12] Varsha Patil, et. al. “Damage detection of warren truss bridge using frequency change Correlation” Science Direct International Conference on Materials, Machines and Information Technology-2022
- [13] V Ravi sankar et. al. “Overview - of Seismic Resistance of Railway Steel Trusses Bridges Using Splice Connection” IJIRSET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 9, September 2019
- [14] Jatin jain et. al. “Modal And Analysis Of Different Truss Bridges Under Dead Load Condition” (IRJET) Volume: 08 Issue: 05 | May 2021
- [15] Han-Wei Zhao et. al. “Representation of In-Service Performance for Cable-Stayed Railway-Highway Combined Bridges Based on Train-Induced Response’s Sensing Data and Knowledge” MDPI April 2022
- [16] E. Bhargavi et. al. “Comparative Parametric Study of Steel Bridge Trusses by Applying External Prestressing” International Journal of Engineering Technology, Management and Applied Sciences July 2015, Volume 3, Issue 7

IS CODES:

- i. IS: 875-2015 Wind Loads on Buildings and Structures
- ii. IS 1893 – 2002 Earthquake Resistant Design of Structures
- iii. IS 800 (2007) Code for general construction in steel structures.
- iv. IRC-24-2001 for the design of steel or wrought iron bridges carrying rail
- v. IRC Class A- Loads Considered for Design of Bridge Structures



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details