



Review Paper on Foot Over Bridge Using Cold Formed Light Gauge Section

Omkar S. Komawar¹, Prof. Sonali C. Patil²

¹M. Tech Student, Structural and Construction Engineering Department, Ballarpur Institute of Technology, Maharashtra, India

²Assistant Professor, Structural and Construction Engineering Department, Ballarpur Institute of Technology, Maharashtra, India

Abstract - A foot over bridge is a bridge designed for pedestrians. They are located across roads to let pedestrians cross safely without disturbing the traffic. Nowadays traffic is increasing day by day and the speed of vehicle. So, the pedestrian faces the problem to cross the road due to heavy traffic, hence there is need of safety crossings therefore the foot over bridge shall be constructed. In present practice hot rolled steel is used but cold formed steels are harder and stronger than hot rolled steel. Cold formed steel is a light gauge steel used to make construction processes smoother and products stronger. Cold formed steel is not heavy, having more strength and durability.

Key Words: Cold Formed Steel, Hot rolled steel, Light gauge steel.

1. INTRODUCTION

A pedestrian bridge, often referred to as a footbridge or walking bridge, is a structure designed specifically for the safe passage of pedestrians over obstacles such as roads, rivers, railway tracks, or other potentially hazardous areas. Unlike vehicular bridges, pedestrian bridges prioritize the safety and convenience of those on foot, providing a dedicated pathway for pedestrians to traverse without the interference of motorized traffic.

These bridges serve not only as functional connectors but also as architectural and aesthetic elements in urban and rural landscapes. They come in various designs, materials, and styles, ranging from simple and utilitarian structures to intricate and visually striking landmarks. The purpose of a pedestrian bridge extends beyond its basic functionality; it contributes to the overall accessibility, connectivity, and aesthetics of a community.

Pedestrian bridges are essential components of urban planning and infrastructure, fostering pedestrian-friendly environments

and encouraging sustainable modes of transportation. They play a crucial role in enhancing mobility, promoting physical activity, and creating inviting public spaces. Additionally, these bridges contribute to the overall safety of pedestrians by providing designated pathways away from vehicular traffic.

In this introduction, we will explore the diverse facets of pedestrian bridges, from their engineering and architectural significance to their impact on community well-being and connectivity. As integral elements of the built environment, pedestrian bridges exemplify the harmonious intersection of functionality, safety, and design, enriching the urban fabric and creating pathways for people to connect and explore their surroundings.



Fig. No. 1. Lattice Type Truss Pedestrian Bridge.

1.1 Hot rolled steel sections

Hot-rolled steel sections refer to structural steel components that are shaped through the hot rolling process. This

manufacturing method involves heating steel billets or slabs to high temperatures and passing them through rollers to achieve the desired shape. The hot rolling process allows for the production of a wide range of steel sections with various profiles and dimensions, making it a versatile and widely used method in the construction and manufacturing industries.

Here steel gets solidified but it is never allowed to cool down completely. The hot steel then passes through number of rollers that squeezes the material into desired cross-sectional shape & size. Rolling the steel while it is still hot allowing it to be deformed with no resulting loss in ductility, as would be in the case of cold formed steel sections during the rolling process; the member goes on increasing in length, which are cut to standard lengths which are subsequently cut to the length required for particular structure.

Advantages and disadvantages of hot rolled steel sections

The Advantages of hot rolled steel sections are as follows:

1. Hot rolled sections have high strength per unit weight.
2. Property maintained steel structures have long life.
3. The erection process is faster.
4. The material properties do not change with time. Which makes it most suitable material for structures
5. Additions & alterations become easy.

The Disadvantages of hot rolled steel sections are as follows:

1. Steel structures in hot rolled sections undergo corruptions where exposed to conditions, therefore, they require frequent painting.
2. Steel members require fireproof treatment. This aspect increases cost of construction.

1.2 Cold formed steel sections

Cold-formed steel (CFS) is the common term for steel products shaped by cold-working processes carried out near room temperature, such stock bars, and sheets of cold rolled steel (CRS) are commonly used in all areas of manufacturing. Cold-formed steel, especially in the form of thin gauge sheets, is commonly used in the construction industry for structural or non-structural items such as columns, beams, joists, studs, floor decking, built-up sections and other components. Cold formed steel is a light gauge steel used to make construction

processes smoother and products stronger. Cold formed steel is not heavy, having more strength and durability.

Since cold formed steel sections are produced in cold conditions, this cold forming gives rise to an increase in the yield strength. This increase is predominant in zones where metal is bent. As the name suggests cold formed steel sections are formed by rolling the material in cold conditions or by bending the steel plates in press breakers. Cold formed steel sections are comparatively new concept as compared to conventional hot rolled sections. Cold formed steel sections are available in variety of shapes. The usual & most common preferred sections are channels, Zees, angles, hot sections, tees, I- sections & tabular sections.

Advantages and disadvantages of cold formed sections

The Advantages of cold formed sections are as follows:

1. Cross sections are formed to close tolerances & specifications & these can be constantly repeated as long as required.
2. Cold rolling can be employed to reduce. Almost any desired shape to any desired length.
3. Pre galvanized & percolated materials can be formed, so that high resistance to corrosion, sides an attractive surface finish can be achieved.
4. All conventional joint methods can be employed.
5. High strength to weight ratio is achieved in cold formed sections.
6. They are usually light making it easy to transport & erect

The Disadvantages of cold formed sections are as follows:

1. Higher forces are required for deformation of plates into desired shapes.
2. For this process the equipment required are to be more powerful & heavy.
3. Less ductility is available in case of CFS.
4. Metal surfaces must be clean & scale free.
5. Strain hardening occurs.



Fig. No. 2. Pedestrian Bridge

2. OBJECTIVE OF THE STUDY

1. To access and compare the properties of Cold formed steel and Hot rolled steel sections.
2. To Model Pedestrian bridge using Staad Pro software by using Cold Formed and Hot rolled steel sections.
3. To Investigate the Structural performance of Cold Formed Steel by replacing Hot rolled steel.
4. To Identify the advantages and Disadvantages of Cold formed steel as compare to Hot rolled steel.
5. To give an Idea of Use of Cold formed Steel section to Engineers after calculating the strength and other properties of the same sections.

3. LITERATURE REVIEW:

1. S. Rajesh, Pradeep Saravanan. S (2017) Minimum specifications as per Indian Railways Work Manual: Width of gangway: 2m Clearance from centre line of rail = 2.36m, in this paper various components of the Foot Over Bridge Namely Main Truss, Columns along with the Footings have been analyzed using STAAD.Pro.
2. M Kalpana and B. V. Mohan Rao (2018) studied on foot over bridge, Construction of bridge has always been one of the most fascinating challenges to civil engineers A pedestrian bridge is a structure built to span physical, obstacles such as roads and railway tracks. These bridges will eliminate traffic congestion and delay at the highway as well as eliminate conflicts between pedestrian and motor vehicles. In this present project work, the analysis and design of RCC pedestrian bridge is done by using STAAD pro with standard design details as mentioned in Indian codes. The planned pedestrian bridge is modeled in STAAD Pro Various loads & combinations are included in the frame analysis also included lateral loads. Structural design is to be done using Limit state method.
3. T. Prashanthand V. Gokulnath (2018) studied about earthquake load for foot over bridge. Due to fast creation of a massive quantity of foot over bridges, many existing bridges placed in seismic zones are poor to face up to earthquakes. During an earthquake, failure of shape starts at factors of weak spot. Generally, weak spot is due to geometry, mass discontinuity & stiffness of shape. In this undertaking we can lay out for a most appropriate foot over bridge together with connection details & additionally estimation of structural components at the side of foundation detailing for the foot over bridge structure. They concluded that the wind load acting on foot over bridge will be comparatively less in magnitude as it is open structure with more openings, but failure of the towers is mainly due to High Intensity Winds and Earthquakes. It is so high factor of safety should be given to wind loads and seismic loads.
4. Akhil sharma, Ashwani kumar, Sunil Sharma, Arjun singh chib, Rakesh Abrol (2020) as per this paper designing in Staad.pro is lot quicker and more accurate, all the diagrams like shear force diagram, bending moment diagram etc can be easily obtained and real time visualization of the behavior of structure can also be animated. Moreover, this computer simulation technique provides us a stability check criterion for members and sections. We can have a clear vision of the estimation of materials to be used.
5. J. Rondal as per this paper the last decade has shown large and important progresses in the knowledge of the behavior of cold-formed steel members and structures. All the main ingredients are now brought together—scientific knowledge, high strength steels, modern methods of fabrication, modern design specifications, etc.—and the industry of the light gauge construction seems to be ready to enter, with confidence, in the new millennium.
6. Arunabha Banerjee, Akhilesh Kumar Maurya as per this paper According to this paper they studied all the loading criteria's in a specific area Live load with Carrying goods and other loads.
7. Navyashree P M, Sowjanya G V, Dr. T. V. Mallesh (2020) as per this paper Behavior of CFS sections like angle section (Z section), build up sections, double channel beam section, section with stiffeners have been investigated. The American standard (AISI) and AZ/NZ codal provisions has been used. The Numerical modeling of the various Cold Formed Steel section is being carried out by using the FEA software's, ANSYS and ABAQUS.
8. Dr. Vinayak Vaidya, Prasad Ugemuge, Gautam Wakpajjan, Shrutika Tiple, Nikhil Bhadke (2023) as per this paper study highlights the importance of considering various factors such as location, design, accessibility, and maintenance when planning and constructing foot over bridges. The implications of the research findings suggest that further research and practical application are

necessary to address the challenges associated with foot over bridge implementation and maintenance. In conclusion, foot over bridges is an essential component of modern urban infrastructure & their implementation should be approached with careful consideration of various factors.

4. METHODOLOGY

1. Review of Literature
2. Preparation of problem statement for Foot over bridge.
3. Preparation of plan and elevation of the structure using AutoCAD
4. Replacement of conventional steel with cold formed light gauge steel
5. Analysing and Designing the overall foot over bridge for the loading details
6. Result and conclusion

5. PROBLEM STATEMENT

In the present study, Foot over bridge is considered. In present practice hot rolled steel is used but cold formed light gauge steels are harder and stronger than hot rolled steel therefore cold formed light gauge steel is more feasible to use. Foot over bridge is analyze and design by using STAAD PRO software.

1. Type of bridge: Warren type
2. Span: 10m. (Across the width of double lane)
3. Width of pathway: 2m. (As per construction document 353)
4. Headroom clearance on bridge: 2.3m. (As per construction document 353)
5. Headroom clearance below bridge: 5.50m. (As per Indian road congress)

6. CONCLUSIONS

As per the literature review many authors referred conventional steel in their project work. Conventional steel structures are sensitive to atmospheric conditions. Steel corrodes fast in the presence of oxygen and moisture. In present practice hot rolled steel is used but cold formed light gauge steels are harder and stronger than hot rolled steel. As per as we now concern, replacement of conventional steel by Cold formed Light gauge steel will helps us to fight the high air borne salts present in air for long time. The structure will have high strength, light in weight, durability and will reduce maintenance efforts thus benefiting greatly in the longer run.

7. REFERENCES

1. IS 800 (2007): General Construction in Steel-code of practice.
2. ARE 1893 (2002) criteria for earthquake resistant design.
3. IS 875 (part 3) wind load calculation.
4. CD 353 “Design criteria for footbridges”
5. “Plan of a steel foot over bridge in an urban railway station” (2017) [International journal of pure and applied mathematics] by S. Rajesh, Pradeep Saravanan. S.
6. “Analysis and design of foot bridge” (2018) [International journal of Pure and Applied Mathematics] by M Kalpana, B. V Mohan Rao.
7. “Analysis and design of footbridge connecting (2nd floors) of block A and block B of MIET Jammu” (2020) [International journal of engineering research and technology] by Akhil Sharma, Ashwani Kumar, Sunil Sharma, Arjun Singh chip, Rakesh Abrol
8. “Analysis and Design of a Steel Foot Over-bridge with Tubular Sections using Sandro” (2020) [International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences] by T. Prashanth, V. Gokul Nath.
9. “Cold formed steel members and structures” [Journal of Constructional Steel Research] (Elsevier) by J. Rondal
10. “A comparative study of pedestrian movement behavior over foot over bridges under similar land-use type” [World Conference on Transport Research]. (Elsevier) (2019) by Arunabha Banerjee, Akhilesh Kumar Maurya
11. “Analysis of Cold Formed Steel Sections” (2020) [International Journal of Engineering Research & Technology] by Navyashree P M, Sowjanya G V, Dr. T. V. Malleh
12. “Analysis and Design of Foot Over Bridge” [International Journal for Research in Applied Science & Engineering Technology].(2023) by Dr. Vinayak Vaidya, Prasad Ugemuge, Gautam