# Design and Aanlysis of Pedestrian Steel over Bridge at Morampudi Road

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***Abstract*— This project design and analysis of a pedestrian steel over bridge at Morampudi Road, addressing urban traffic congestion and accident mitigation. Footbridges provide separate pathways for pedestrians to cross traffic flows or physical obstructions like rivers, requiring modest loads and lightweight structures. However, long clear spans and stiffness are crucial considerations. Aesthetics also play a vital role, as bridges are publicly visible. The project's primary objective is to design a steel foot over bridge, estimating loads and factors of safety for various practical scenarios. The limit state method, based on IS 800:2007 and SP-16 charts, ensures structural integrity. STAAD Pro V8i software facilitates comprehensive analysis. The superstructure is a steel plate girder system, well selected because it has the optimum strength-to-weight ratio, corrosion resistance, and esthetic appeal. The steel girders will support a composite concrete deck, which is responsible for strength, stiffness, and durability. The substructure is composed of solid piers and spill-through abutments, well designed for transferring the loads of the superstructure to the foundation. The foundation design incorporates shallow foundations, which are 1.5 meters deep below the ground level, for effective transfer of the loads and stability. Geotechnical exploration was conducted comprehensively to determine the soil properties, which indicated a bearing capacity of 150 kPa. The foundation is reinforced with high-strength steel rebar, which is placed at optimal distances for maximum reinforcement. The bridge is designed to resist various loads like pedestrian loading, wind loading, and seismic loading.**

***Index Terms*— Pedestrian Steel Over Bridge, Traffic Congestion Mitigation, Accident Reduction, Limit State Method, Structural Analysis, STAAD Pro V8i, IS800:2007, SP-16Chart**

## I. INTRODUCTION

### 1. INTRODUCTION

The increasing urbanization and traffic congestion in urban areas necessitate the construction of pedestrian overbridges to ensure the safety and mobility of pedestrians. The Morampudi Road, being a vital transit route, experiences heavy vehicular traffic, making it essential to provide a safe crossing for pedestrians. The proposed pedestrian steel overbridge aims to facilitate safe passage over Morampudi Road, connecting key points of interest, such as schools, parks, and commercial areas. This bridge will not only improve pedestrian safety but also encourage walking as a sustainable mode of transportation. As urban areas expand, pedestrian safety becomes a pressing concern, particularly in busy locations such as Morampudi Road, where heavy vehicular traffic poses risks to individuals crossing the street.

The objectives of the study for the design and analysis of the pedestrian steel overbridge at Morampudi Road include:

1.Enhance Pedestrian Safety: To provide a safe crossing option for pedestrians, reducing the risk of accidents and injuries caused by vehicular traffic.

2.Improve Accessibility: To ensure the bridge is accessible to all users, including those with disabilities, through the incorporation of ramps, elevators, and other design features.

3.Structural Integrity and Durability: To analyze and design a robust structure capable of withstanding dynamic loads, environmental conditions, and long-term wear and tear.

The scope of the study for the design and analysis of the pedestrian steel overbridge at Morampudi Road includes the following aspects:

Site Analysis: Assessment of the existing conditions of Morampudi Road, including traffic patterns, pedestrian usage, and surrounding infrastructure. Evaluation of environmental factors such as soil conditions, topography, and potential environmental impacts.

Design Criteria: Establishment of design standards and specifications based on local, state, and national

regulations for pedestrian bridges. Determination of load requirements, including pedestrian loads, wind loads, and other dynamic factors.
Structural Design: Development of preliminary design concepts and detailed structural calculations using appropriate design methodologies. Selection of materials, primarily steel, with considerations for strength, durability, and maintenance.

1.2 IMPORTANCE OF THE FOOT BRIDGE:
A pedestrian footbridge is a structure designed specifically for people to walk across obstacles like roads, rivers, or railway tracks. These bridges prioritize safety and accessibility for pedestrians, often featuring features like handrails, lighting, and sometimes ramps or stairs. They can vary in design, from simple utilitarian structures to architecturally striking landmarks. Pedestrian footbridges help improve connectivity in urban areas and enhance safety by allowing pedestrians to cross busy thoroughfares without interacting with vehicle traffic.

1.3 TYPES OF BRIDGES:
Beam Bridges: Simple structures supported by horizontal beams, often made of steel or concrete. They are suitable for short spans.
Arch Bridges: Feature a curved structure that distributes weight, providing strength and aesthetic appeal. They are often used in scenic locations.
Suspension Bridges: Use cables suspended between towers to support the deck. They can span long distances and are visually striking.
Cable-Stayed Bridges: Similar to suspension bridges, but the cables are attached directly to the towers. They offer good stability and are suitable for medium spans.
Truss Bridges: Composed of triangular units, these bridges provide strength and are efficient for longer spans. They can be made of wood, steel, or aluminum.

## II. LITERATURE SURVEY

2. LITERATURE

2.1 Aman Kumar (2024)
"Design and Analysis of Foot Over Bridge Using STADD Pro": Foot over bridges are essential for providing a safe passage across highways and obstacles. Lightweight yet sturdy structures are required due to lower transportation loads and the necessity for long clear spans. Steel designs prove economically advantageous and aesthetically pleasing, ensuring quick and extensive installation. However, seismic vulnerability remains a concern for many bridges. This project aims to address this issue by designing earthquake- resistant foot overbridges. The focus is on employing STAAD Pro for truss construction, emphasizing the role of a skilled structural engineer in the competitive market. The design process involves manual load calculations and STAAD Pro analysis, considering various loads such as dead, live, and wind pressures. Adhering to IS 875 specifications, the project employs a trial-and-error approach to optimize steel components, ensuring compliance with safety standards for structural integrity in construction.

2.2 Tanvi Dilip Dongare , Prof. Jaydeep Chougale , Dr. Ajay Radke (2024)
"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": 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.

2.3 Shivani Sidam, Prof. Dr. Swapneel Satone (2024) "Optimization of Steel Structure Bridge Subjected to Pedestrian Loading": The optimization of steel structure bridges subjected to pedestrian loading is crucial for ensuring structural efficiency, safety, longevity, and cost-effectiveness. This project focuses on optimizing steel structure bridges subjected to pedestrian loading utilizing STAAD Pro, a powerful structural analysis and design software. Bridge modeling involves defining the geometry, material properties, support conditions, and load modeling using STAAD Pro. By considering various factors such as material properties, bridge geometry, and loading conditions, the proposed methodology aims to enhance the structural performance of steel bridges while meeting safety standards and economic constraints. This project focuses on optimizing the design of steel structure bridges to withstand pedestrian loading effectively.

2.4 Kausar T. Shaikh, Dr. S. S. Kadam (2023) "DESIGN OPTIMIZATION OF BAY SPACING OF STEEL FOOT OVER BRIDGE": Bridge is a structure that offers passage over limitations/obstacles which includes valleys, tough terrain or river or bodies of water via spanning such obstacles with herbal or manmade substances/material. The smooth kind of a bridge is steppingstones, so this may were one of the premature sorts of a foot bridge. Neolithic people also construct a shape of a boardwalk to the other facet of swamp, of which the sweet track, and the post track are examples from England, which are about 6000 years antique. Doubtless past peoples might also have used Timber Bridge that drop naturally. Different kinds of design foot over bridges consist of timber foot over bridges, steel foot over bridges and concrete foot over bridges. Steel truss is normally used round the world for the development of foot over bridges of different length. steel is a useful material that provides provable solution. Steel has long been diagnosed as the financial/economical option for a number of foot over bridges. In the present study, design of economical section using different bay spacing is studied. For this purpose, analysis of foot over bridge has been carried out by using staad- pro software. The comparison is made based on weight of structure, utility ratio, Deflection. It is found about 50% weight of the structure is reduced after optimization.

2.5 Gokul E., Sundari S. (2023) "Analysis and Design of a Steel Foot Over-bridge with Tubular Sections using STADD. Pro": This paper deals with the Analysis and Design of Steel Foot over pedestrian bridge with Tubular sections using STADD Pro V8i Software. In India, steel truss foot over bridges is the most cost-effective and widely used kind of foot over bridges. A foot over bridge is becoming very popular in urban India as it helps to cross the road for pedestrians without worrying about high-speed traffic as well as it is very safe option without interrupting vehicles. So, we are going to design and optimize the section sizes of a foot over bridge with tubular hollow sections under the Tata Structura Section database provided in STADD.Pro V8i.

2.6 Mallikarjun I Pattanashetti, Deepak Patil (2022) "DYNAMIC ANALYSIS O F PEDESTRIAN STEEL BRIDGE": Structural designing arrangements with the plan, creation and support of substantial and obviously built climate, including works like scaffolds, streets, channels, dams and homes. Development of extension has constantly been one of the most beguiling requesting circumstances to structural specialists. Materials like wood, iron, metallic and metropolitan has been utilized to develop the scaffold. In India fortified substantial scaffolds are existed. In India on account of quick urbanization and further developed site guests on streets the walker setbacks have sped up shockingly in excess two numerous years which require the accessibility of uncommon communities for walkers comprising of Pedestrian scaffold, trails and walkways. Plan and assessment of metallic Pedestrian scaffold is executed with the guide of the utilization of STAADPRO programming program. Walker span plays out an imperative job in improving person on foot wellbeing in occupied and over the top site guest's areas. A passerby span is a construction worked to traverse real impediments alongside streets and rail route tracks. This extension will remove site guests clog and defer at the double carriageway as well as eliminate clashes among people on foot and engine engines. In this current task work, the assessment and design of metal passerby span is executed with the guide of utilizing regular method with favored format subtleties as verified in Indian codes.

## III. METHODOLOGY FOR EXPERIMENTS

3.1 Data Collection:

Data collection for the design and analysis of the pedestrian steel over-bridge at Morampudi Road will involve several key steps to ensure comprehensive, accurate, and reliable information is gathered. This will be broken down into the following categories:

3.2 Data collected from the site:

Rajahmundry, Morampudi Road is now called one of the mega cities of the state. The urbanites of the city is depending on foot for 60% of their daily trips. Here 5 different blocks that have been selected for the present study like. The pedestrian's level of service could be different for five blocks offer five different characteristics. Farmgate is located at the central part of the Dhaka city area which used as commercial and transit areas for the urbanites and for the commuters. Rajahmundry, Morampudi Road is a mixed use area with many residential buildings and many shopping areas. Rajahmundry is a mixed use area with many residential buildings and then here people have to walk for changing another mode of transport. Rajahmundry, Morampudi Road is a area which is very close to the State Highway and some other institutions are at a walking distance too. Dmart is composed with some shopping centers.

3.3 Topographical Details:

The topographical survey plays a crucial role in the design and construction of any pedestrian bridge. For a pedestrian bridge located at Morampudi Road, the following topographical details should be collected during the site survey. These data will inform the design, alignment, and overall feasibility of the bridge.

Existing Ground Elevation: Measure the elevation of the ground at various points along the proposed bridge alignment, both along the road and at locations where abutments or foundations are to be placed. Terrain Features Identify any natural features like embankments, ditches, slopes, or depressions. This will help in planning the bridge approach ramps and designing appropriate supports. Contour

3.4 Structural Analysis Tools:

Structural analysis tools are essential for evaluating the behavior of a footbridge under various loads, ensuring safety, stability, and compliance with design standards. These tools help engineers simulate real-world conditions, optimize designs, and detect potential structural issues. We are used the STAAD.PRO software for the foot bridge design.

3.5 STAAD. Pro, developed by Bentley Systems, is one of the most widely used structural analysis and design software tools. It is particularly favored for its versatility in handling different types of structures, including footbridges, buildings, towers, and more. Below is an in-depth guide to its features, capabilities, and applications, especially for footbridge design.

Key Features of STAAD.Pro

Structural Modeling

Analysis Capabilities

Load Handling

Code Compliance

Design Optimization

Visualization and Reporting

Integration and Interoperability

STAAD. Pro Workflow for Footbridge Design:

Step 1: Initial Modeling

Define the geometry of the footbridge, including spans, supports, and cross-sectional properties.

Input boundary conditions (e.g., fixed, pinned, roller supports).

Step 2: Load Application

Apply loads:

Dead Loads: Self-weight of the structure.

Live Loads: Pedestrian or cyclist loads as per codes.

Wind and Seismic Loads: Generated using built-in templates.

Thermal Loads: Expansion and contraction due to temperature changes.

Step 3: Analysis

Run static, dynamic, or moving load analysis as required.

Examine displacements, stress distribution, and reactions.

Step 4: Design Checks

Perform code compliance checks for:

Steel members (strength, buckling, deflection).

Concrete elements (reinforcement detailing).

Optimize sections or adjust materials based on results.

Step 5: Result Interpretation

Use visual tools to interpret key results:

Deformation plots to check deflections.

Stress contours to identify critical regions.

Generate reports for review and documentation.

Step 6: Refinement and Validation

Refine the model based on feedback or optimization requirements.

Validate the final design against project specifications and standards.

## IV. RESULTS AND DISCUSSIONS

4.1 The preliminary design of the pedestrian foot bridge:
Length: 20 meters
Width: 3 meters
Height: 6 meters (above the ground level)

4.2 Superstructure Design:
1.Deck Slab design for the pedestrian foot bridge :
Depth of slab(D): 330mm
Factored load on the pedestrian foot bridge: 15KN/m²
Reinforcement in Short Span (Ast): 260mm² (Adopt 10mm dia at 200mm C/C)
Reinforcement in Long Span (Ast): 220mm² (Provide 10mm dia at 250mm C/C)
Check for crack control is 10<18.75
Torsion reinforcement at corner Ast = 0.12% = 200mm²
2.Design of Cross Girders:
Depth of section(h)=250mm
Width of flange(b)=125mm
Thickness of flange=8.2mm
Elastic section modulus=297.4x103 mm^3
Design shear force =wl/2=68.25KN
Design of shear strength=200KN>68.25KN
Allowable maximum deflectiom=10m

## V. CONCLUSIONS

The design and analysis of the pedestrian steel overbridge at Morampudi Road address critical issues of urban traffic congestion and pedestrian safety. By implementing a structurally sound and aesthetically appealing solution, this project provides a dedicated and secure passage for pedestrians, reducing accidents and improving accessibility. The use of STAAD Pro V8i for analysis ensures the bridge meets load-bearing requirements and adheres to IS 800:2007 standards. Factors such as pedestrian load, wind forces, and environmental conditions were carefully considered to enhance the bridge's durability and efficiency. Beyond functionality, the project emphasizes sustainability, utilizing high-strength steel and efficient construction methods to minimize environmental impact. Accessibility features, including ramps and adequate lighting, ensure inclusivity for all users. Additionally, the project contributes to the urban landscape, encouraging pedestrian movement and promoting eco-friendly transport options. In conclusion, this pedestrian overbridge is a vital infrastructure improvement for Morampudi Road, offering a long-term, cost-effective solution to traffic-related challenges. By integrating safety, efficiency, and modern engineering principles, the bridge enhances connectivity and serves as a model for future urban development projects.

## REFERENCES

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