IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 3, November 2025
Impact Factor: 7.67

Pedestrian Suspension Bridge

Abin Jaison and Jeena B Edayadiyil

Abstract: *A suspension pedestrian bridge, where the deck is hung below suspension cables on vertical suspenders, is proposed as an economical and sustainable solution to rural isolation. This project aims to design a 42-meter-long suspension bridge across the Karamana River at Aryanadu, Trivandrum, to provide a convenient pathway for villagers. The design was executed using AutoCAD for layout and STAAD.Pro for 3D structural analysis and design.*

Keywords: *suspension pedestrian bridge*

I. INTRODUCTION

Suspension bridges, with a history dating back over 2000 years, are characterized by a deck hung below suspension cables. The modern form, developed in the 18th century, is now the preferred solution for very long spans. This project focuses on designing a pedestrian suspension bridge with a bi-layer composite deck (laminated GFRP and glass) to meet safety and serviceability requirements under pedestrian loads.

II. LITERATURE REVIEW AND IDENTIFIED GAPS

A review of recent literature was conducted:

- Y.-C. Ni et al. (2021) performed operational modal analysis on a long-span suspension bridge using a Bayesian method, establishing a benchmark for structural health monitoring.
- A. Juozapaitis et al. (2006) investigated a new steel structural system for pedestrian bridges using stiff suspension members and flexible decks, reducing tensile forces and eliminating the need for pre-stressing.
- K. Miyachi & S. Nakamura (2021) designed an aesthetically pleasing S-curved cable-stayed pedestrian bridge, confirming its serviceability against deflection and vibration criteria.
- F. Rizzo (2020) studied the aeroelastic response, finding that bridges with wood and hemp cables had a higher critical flutter speed than those with steel.

Gaps Identified: The literature review revealed several research gaps, including non-optimal calculation methods for new materials, unconsidered cable flexural stiffness, omission of heavy wind flow analysis, and limited sensor use in monitoring. Furthermore, vertical and dynamic analyses were often not carried out, and some experiments required excessive repetition to investigate errors.

Objectives and Scope

The primary objectives of this project are:

1. To assess pedestrian conflict in the study area.
2. To assess the feasibility of constructing a suspension bridge.
3. To design the suspension bridge.

The scope is confined to designing a pedestrian suspension bridge at Chokkantheeni Kadavu, Aryanad, as a viable solution to rural isolation.

III. METHODOLOGY

The project was executed in two phases:

1. Analytical Phase: The structural behavior (deflection, bending moments, shear forces) was analyzed using STAAD.Pro V8i software.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 3, November 2025
Impact Factor: 7.67

2. Design Phase: The bridge components were designed manually according to Indian Standard Codes, based on field data and software analysis results.

The design followed a sequential flow: Configuration of Span Length → Design of Bridge Deck → Design of Cross Beams → Design of Vertical Suspenders → Design of Main Cable → Design of Anchorage.

Design Procedure and Results

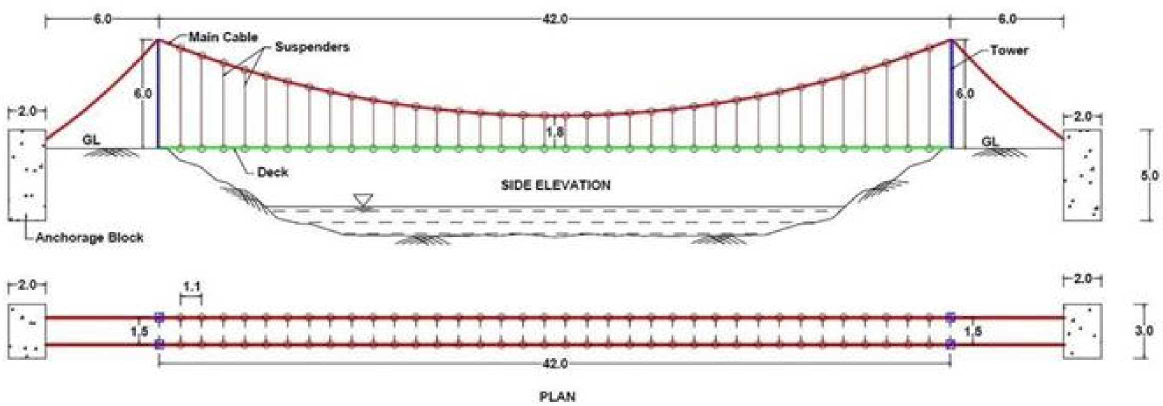
Key design calculations and final member specifications are summarized below:

- Deck: 6mm thick Aluminum sheets.
- Main Beams: ISA 150x150x18 mm.
- Cross Beams: ISA 45x45x4 mm.
- Vertical Suspenders: 40 # 8mm diameter steel rods.
- Main Cable: 80mm diameter steel wire rope.
- Anchorage Block: 3x2x5 m R.C.C. block.
- Tower: ISWB 550x250x10 section.
- Foundation: Combined footing of 3.1x1x0.6 m

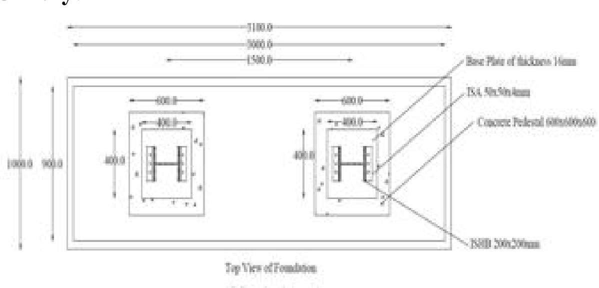
The software analysis confirmed that all designed members, including beams, towers, and cables, passed the stress checks as per the IS-800 code, with all safety ratios .

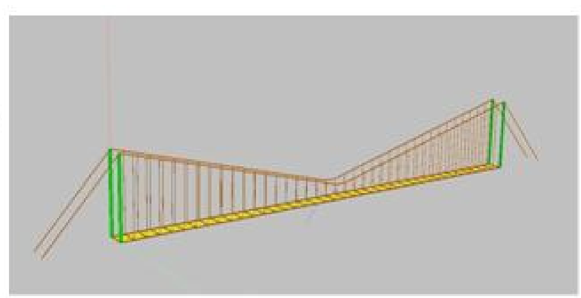
IV. CONCLUSION

The project concludes that a suspension bridge is essential at the proposed site in Aryanad. The design of all components—deck, suspenders, main cables, and towers—has been completed and verified for stability. The construction of this bridge will provide a critical and economical solution for pedestrian crossing, significantly improving access to education, healthcare, and commerce for the local community.



Gallery:-

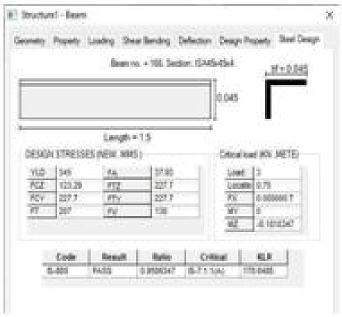
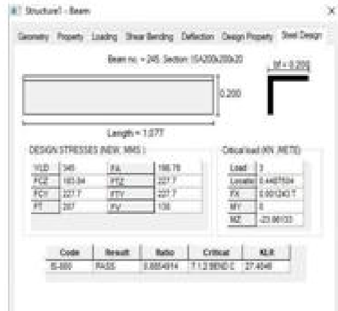
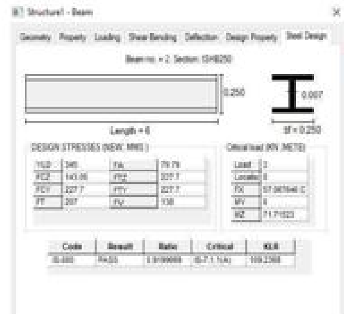




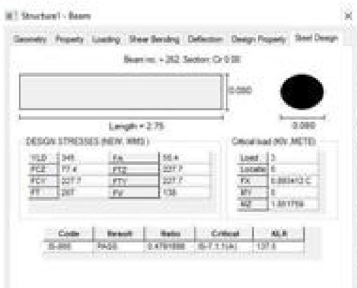
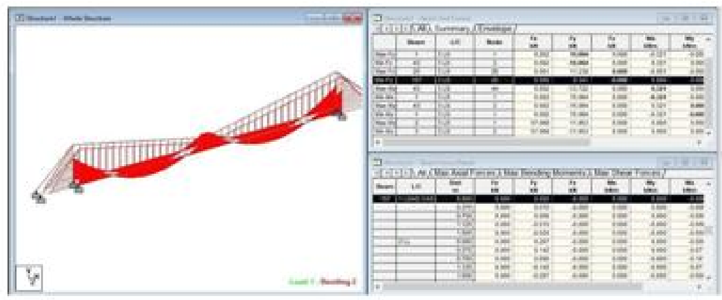
.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 3, November 2025
Impact Factor: 7.67

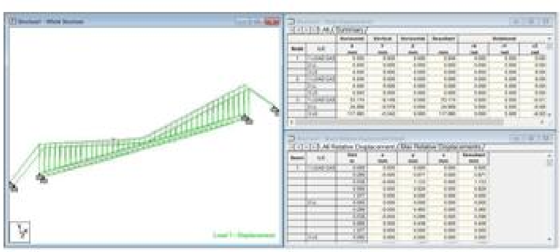
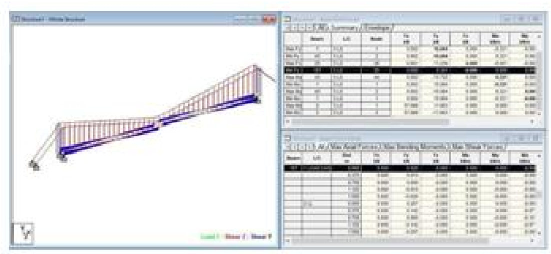
Combined Footing Plan

Beam Design Longitudinal Beam design Tower Design

Vertical Cable DesignBending Moment

Displacement Shear

Table showing the designed member

Members	DesignSections
Deck	6mmthickAluminumsheets
Mainbeams	ISA150x150x18mm
Cross beams	ISA45x45x4mm
Verticalsuspenders	40#8mmϕ steelrods
MainCable	80mmϕsteelwirerope
CombinedAnchorageBlock	3x2x5mR.C.C.
Anchoragereinforcement	16mmϕat80mmc/c
Tower	ISWB550x250x10
BasePlate	400x400 mmsize,16mmthick
Flangeplate	ISA20x20x4mm

Concrete Pedestal	0.6x0.6x0.6mofP.C.C.
CombinedFooting	3.1x1x0.6m

REFERENCES

[1] NI, Y., ZHANG, Q. and LIU, J., 2021. Ambient vibration test and operational modal analysis of a long-span two-tower suspension bridge using a Bayesian method. *Journal of Sound and Vibration*, [online] 512, p.116386. Availableat: https://www.sciencedirect.com/science/article/abs/pii/S0022460X21003907 [Accessed 7 June 2022].

[2] JUOZAPAITIS, A., VAINIŪNAS, G. and KAKLAUSKAS, G., 2006. A new steel structural system of a suspension pedestrian bridge. *Journal of Constructional Steel Research*, [online] 62(9), pp.897-905. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0143974X0600026X [Accessed 7 June 2022].

[3] MIYACHI, K. and NAKAMURA, S., 2021. Cable-Stayed Bridge with S-Curved Girder: Shake Hands Bridge. *Structural Engineering International*, [online] 31(3), pp.341-348. Available at: https://www.tandfonline.com/doi/abs/10.1080/10168664.2020.1812530 [Accessed 7 June 2022].