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Design and Analysis of Foot Over Bridge Using Plated Fabricated Steel Member

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***Abstract**:*
Footbridges are needed where there is a separate pathway must be supplied for human beings to move site visitors flows or some physical impediment, along with a river. The masses they convey are, with regards to toll road or railway bridges, pretty modest, and in most circumstances a reasonably light structure is needed. They are, but, often required to give a protracted clear span, and stiffness then becomes an crucial consideration. The bridges are frequently required very virtually on view to the general public and consequently the advent deserves careful attention. Steel of ers financial and appealing kinds of creation which suit all of the requirements demanded of a footbridge. 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. In order fulfil the requirement of this improved visitors in the limited land the length of bridge will become medium to large. During an earthquake, failure of shape starts at factors of weak spot. Generally, weak spot is due to geometry, mass discontinuity and stiffness of shape. In this undertaking we can layout for a most appropriate foot over bridge together with connection details and additionally estimation of structural components at the side of foundation detailing for the foot over bridge structure.

***Keywords**:*
Foot over bridge, stiffness, earthquake, foundation etc.

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I. INTRODUCTION

The steel areas required ought to be accessible in principle asset focuses - The segments are probably going to be more uniform fit as a fiddle and size than timber segments, permitting clear development of standard truss plans - Joints are less demanding to make than in timber trusses . It ought to be conceivable to develop a standard outline in a medium measured workshop in advantageous estimated parts for transport to site. Get together on location includes darting the parts together and fitting a timber deck, errands that can be done under supervision of a capable expert by neighbourhood craftsmen and others talented in utilizing their hands. Synthesis of quantitative and qualitative evidence for accident analysis in risk based highway planning, states the quantitative and qualitative evidence for the accident analysis road space is a scarce resource so accumulation of future volume traffic is taken into account. The forecasting for the future volume traffic is calculated and appropriate junctions are provided. Physical method of traffic control, states the designing and control of signals at the various junctions on the basis of traffic flow and time period for the particular junction. Signal control at intersections, states the different methods of signal design and provides information about trial cycle method in which traffic volume count for every 15 minutes is taken into consideration for each junction. Road safety management using Weight-age analysis, states the method of weight-age analysis in which accident severity index is calculated and design criteria is decided based on the accident cost ratio.

SCOPE

- Foot-over bridge for most critical junction.
- Estimation of structural component of foot-over Bridge.
- This project includes accident analysis and design of each junction.
- Traffic forecasting for future ten years with sign.

II. METHODOLOGY

The target of this venture is to outline a Foot over scaffold , alongside association &foundation points of interest, and to dissect it, beneath said fundamental parameters are considered:
Broad writing review by alluding books, specialized papers did to comprehend essential idea of subject.
i. Selection of a suitable model of foot over scaffold.
ii. Computation of burdens and choice of preparatory cross-segments of different auxiliary individuals.

iii. Geometrical demonstrating and basic investigation of foot over scaffold for different stacking conditions according to IS Codal arrangements.

iv. Interpretation of results. Following exploration must be completed for meeting the above destinations:

v. Now foot over bridge are demonstrated and investigated as a three dimensional structure utilizing STADD.Pro V8

vi. STAAD pro highlights cutting edge UI, perception devices, capable investigation and plan motors with cutting edge limited component (FEM) and dynamic examination abilities. From show era, investigation and configuration to representation and result confirmation STAAD genius is the expert first decision. STAAD expert was created by rehearsing engineers far and wide. It has advanced more than 20 years and meets the necessities of ISO 9001 confirmation. STAAD or (STAAD.Pro) is an auxiliary investigation and outline PC program initially created by Research Engineers International at Yorba Linda, CA in year 1997. In late 2005, Research Engineers International was purchased a more established adaptation called STAAD-III for windows is utilized by Iowa State University for instructive purposes for common and basic specialists. At first it was utilized for DOS-Window framework. The business form STAAD Pro is a standout amongst the most generally utilized basic investigation and outline programming. It underpins a few steel, cement and timber configuration codes.

III. LITERATURE REVIEW

Synthesis of quantitative and qualitative evidence for accident analysis in risk based highway planning, states the quantitative and qualitative evidence for the accident analysis road space is a scarce resource so accumulation of future volume traffic is taken into account. The forecasting for the future volume traffic is calculated and appropriate junctions are provided.

Physical method of traffic control, states the designing and control of signals at the various junctions on the basis of traffic flow and time period for the particular junction.

Signal control at intersections, states the different methods of signal design and provides information about trial cycle method in which traffic volume count for every 15 minutes is taken into consideration for each junction.

Road safety management using Weight-age analysis, states the method of weight-age analysis in which accident severity index is calculated and design criteria is decided based on the accident cost ratio.

Necessity

People are unaware about traffic at junctions.

<u>While crossing the road this may lead to loss of life or injury, in order to reduce this effect there is a necessity for foot over bridge at most critical junctions:</u>

Regulation of the traffic flow and time delay.

Reducing the number of accidents.

Long sight clearance distance.

Configuration of Foot over Bridge

A foot over bridge of 20m high is analysis and designed.

The configuration of the tower is as follows:

Span of bridge = 20 m

The proposed structure is a Skywalk for Pune Metro.

DESIGN CODES AND STANDARDS

Structural analysis and design of Steel structure will be carried out as codes and standards

- IS: 875(Part 1)-1987 - Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Unit Weights of Buildings Materials and Stored Material
- IS: 875(Part 2)-1987 - Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Imposed Loads
- IS: 875(Part 3)-2015 - Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Wind Loads
- IS: 1893-2016 - Criteria for Earthquake Resistance Design of structures (Part-1)
- IS: 1893-2015 - Criteria for Earthquake Resistance Design of structures (Part-4)
- IS: 800-2007 - Code of Practice for General Construction in steel.

PRIMARY LOAD CASE

L/C	Name
1	EQ X
2	EQ Z
3	DEAD LOAD
4	LIVE LOAD
5	WIND LOAD (+Z) CFI + 0.8
6	WIND LOAD (+Z) CFI -0.8
7	WIND LOAD (+X) CFI +0.8
8	WIND LOAD (+X) CFI -0.8

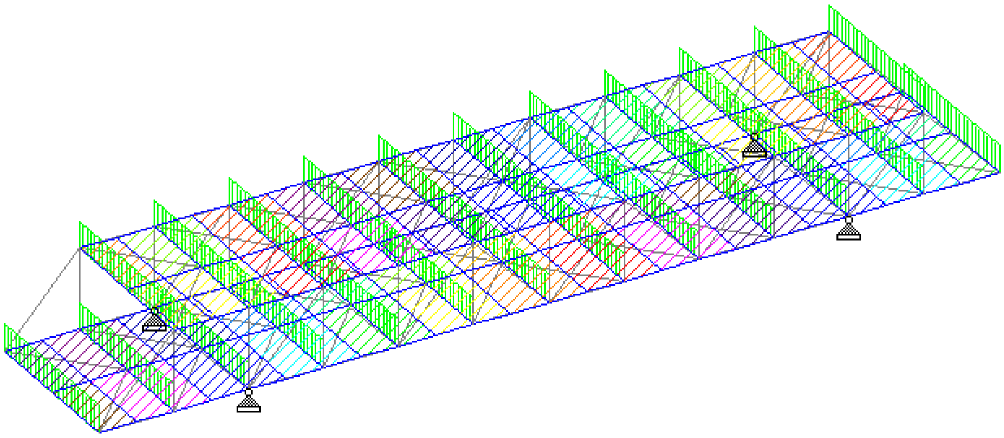
MATERIAL OF CONSTRUCTION
Structural steel IS 2062 Fy = 250 N/mm^2
DESIGN LOADS: -

DEAD LOADS

A permanent Load is defined as the self-weight of the structure or equipment and isindicated as a ‘Dead Load’ (DL). The unit weight of materials in general, should be in accordance with IS:875 Part-1.Typical values used to calculate dead Load values for the following materials are:

- Structural Steel =78.50 kN/m^3
- 200 MM Thickness RCC Deck Slab =5.00 kN/m^2

The following dead Loads will be included in the design of structures.
Dead loads shall consist of self-weight of the structure and other permanent loads which are supported by the structure. Self-Weight of the Structure: Self-weight of the structure has been calculated using the density provided in the STAAD Pro.

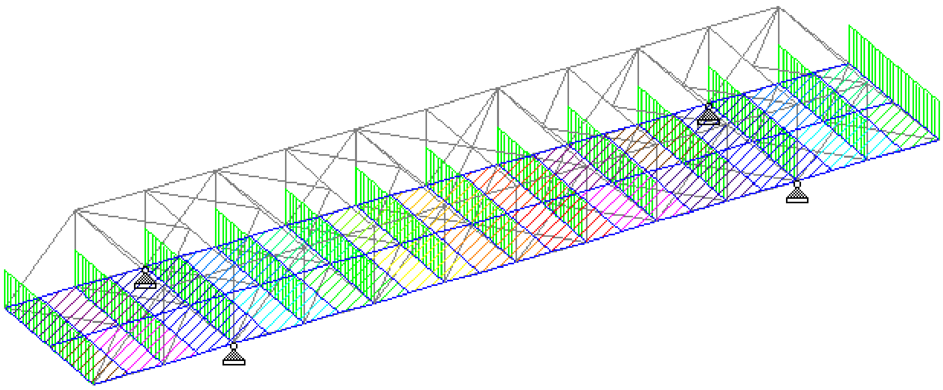


IMPOSED LOADS

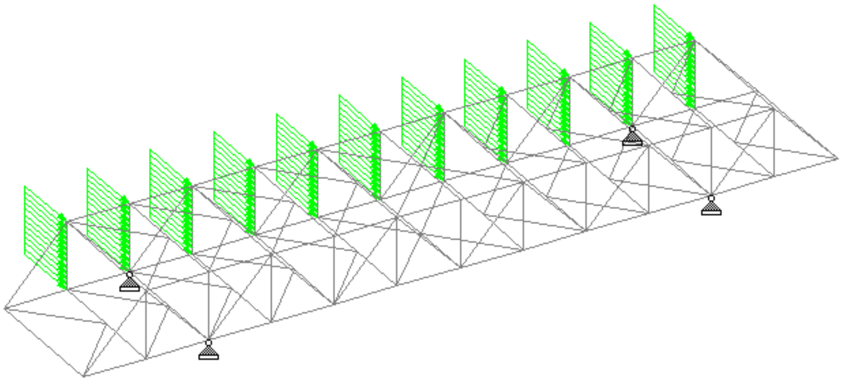
Imposed loads shall, in general, be as per IS:875 Part-2. However, the following minimum live loads shall be considered in the design of structures to account for maintenance and erection as well:

- Live Load = 5.0 kN/m^2

Staircase load considered 500 kg /m =5.00 kN/m^2

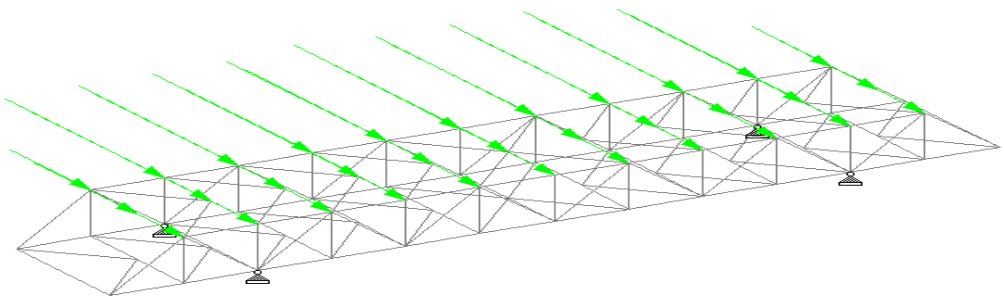


WIND LOAD
Wind load / pressure on the structure will be carried out as per IS 875 Part-3 -2015
Wind load for individual Member, coefficient is considered for flat side Member is 1.8.



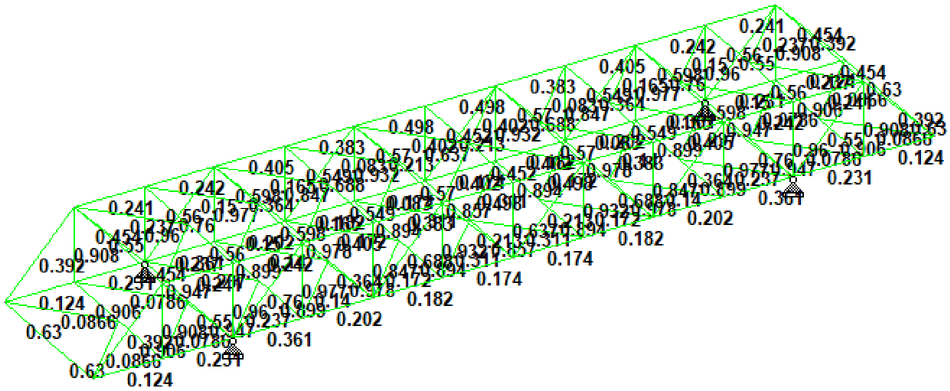
SEISMIC LOAD

Seismic forces shall be based on IS: 1893 (Part- 1) (considering Zone III) and as per Project specific recommendations as shown below,
Seismic base forces are as per staad using following parameters for static method
Zone =V =0.16
Importance factor = 1.00
Response reduction factor = 5
Damping factor = 2%



ANALYSIS AND DESIGN
Analysis and design of Steel framed structures will be done in Staad.Pro-CONNECT Edition will be as perIndian Standard IS 800-2007(LSM)

STRENGTH UNITY CHECK



DEFLECTION CHECK

Limiting Vertical Deflections: (Steel structure)
Limiting permissible vertical deflections for structural member such as gantry girder for electric overhead crane, manually operated crane, purlin supporting any type of roofingmaterial under dead + live load or dead + wind conditions shall be as specified in IS 800.
Girder/beam for Platform supporting Span/240
Span = 20m
Allowable Deflection = 20000 / 240 = 83.33mm > 30.39 mm Hence Safe.

			Horizontal	Vertical	Horizontal
	Node	L/C	X mm	Y mm	Z mm
Max X	62	1040 ULC, 1	2.987	0.327	0.000
Min X	72	1042 ULC, 1	-2.987	0.327	0.000
Max Y	1	1040 ULC, 1	0.110	2.481	-0.002
Min Y	32	1035 ULC, 1	-0.713	-30.390	0.000
Max Z	42	1049 ULC, 1	1.402	-2.684	5.933
Min Z	53	1051 ULC, 1	1.402	-2.684	-5.933

TOTAL STAAD WEIGHT = 25.8 TON

IV. CONCLUSION

In the present era, technology in construction is growing at a rapid phase which require adequate knowledge in construction and designing for foot over bridge means like structural components of foot over bridge, columns, beams, loadings on foot over bridge etc. So there is need for proper estimation while designing and analysing the foot over bridge.

If we could optimize the design of foot over bridge and use more resources, it will save a lot of money and resources. In olden day's angle sections are used in making of truss in structure of foot over bridge, currently tubular sections are preferred as they are more economical.

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. So high factor of safety should be given to wind loads and seismic loads.

REFERENCES

[1]. IRC: 6-2014 Section –II (Loads and Stresses) standard specifications and code of practice for road bridges.
[2]. Engstrom, B., (2011). Design and analysis of deep beams, plates and other discontinuity regions. Department of Civil and Environmental Engineering, Chalmers University of Technology, Goteborg
[3]. Blaauwendraad, J. (2010) Plates and FEM - Surprises and Pitfalls. Springer, Dordrecht.
[4]. Al-Emrani, M., Engström, B., Johansson, M. & Johansson, P. (2008): Bärande construction Del 1 (Load bearing structures part 1. In Swedish). Department of Civil and Environmental Engineering, Chalmers University of Technology, Goteborg.
[5]. Sustainable Bridges (2007): Non-Linear Analysis and Remaining Fatigue Life of Reinforced Concrete Bridges. Sustainable Bridges - Assessment for Future Traffic Demands and Longer Lives.
[6]. Durkee, Jackson, "Steel Bridge Construction", Bridge Engineering Handbook, Crcpress, PP 45-58, 2000.
[7]. G. Mylonakis and G. Gazetas. "Seismic soil-structure interaction: beneficial or detrimental", Journal of Earthquake Engineering, 4(03):277–301, 2000.
[8]. Granath, P., "Distribution of Support Reaction Against A Steel Girder On A Launching Shoe." Journal of Constructional Steel Research, Vol. 47, No.3, Pp. 245-270, 1998.

[9]. Durkee, Jackson L., "Foot Over Bridge Erected By Launching", Journal Of The Structural Division, ASCE, Vol. 98, No. ST7, Proc. Paper 9028, Pp. 1443-1463, July,1997
[10]. M. Ciampoli and P.E. Pinto. "Effects of soil-structure interaction on inelastic seismic response of bridge piers". Journal of structural engineering, 121(5):806–814, 1995.
[11]. M.Ciampoli and P.E. Pinto. "Effects of soil-structure interaction on inelastic seismic response of bridge piers". Journal of structural engineering, 121(5):806–814, 1995.
[12]. J.C. Wilson and B.S. Tan. "Bridge abutments: assessing their influence on earthquake response of meloland road overpass." Journal of Engineering Mechanics, 116(8):1838– 1856, 1990.