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Case Study on Pre-Stressed I-Girder Type Bridge at 1st Gate Belagavi

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ABSTRACT: A case study at Belagavi's first railway gate has been conducted in this report. Growth of population has increased the demand of usage of new roads and given rise for roads over railway lines. Government officials have suggested constructing a railway over a bridge to address the problems with traffic flow at the first railway gate, but this proposal has several drawbacks. A revised approach has been suggested after the drawbacks have been identified. Bridges are major elements of any road system, and pre-stress girder bridges are becoming more prevalent. As a result, the design of a railway overbridge of pre-stressed I-girder type has been done at the first railway gate Belagavi. To get a better understanding of the revised plan, a 3-D model has been developed using Google Sketch-up software. By executing the aforementioned stages the effective and flexible results in traffic regulation by revised plan, reduction in time of travel, reduction of accidents, less effect on economy are achieved. The pre-stressed I-girder type bridge analysis and subsequent design has shown that the structure is capable of handling the external load and forces safely.

KEYWORDS: Bridge, Traffic, Railway over bridge, Proposed plan, Girder.

I. INTRODUCTION

Bridge engineering is a very important and predominant part of civil engineering works. At Present each construction is observed under the respective governments of the countries. Now a day the traffic has reached to move above the railway lines and thus construction of railway over bridge is taken into account. Railway over bridges are mainly constructed to connect the moment of people safely via using railway over bridges that are separated by railway lines. The railway over bridge is typically developed at a place which provides user compatibility. Belagavi city is Proposed as the Second Capital of the State and an important educational hub in the state of Karnataka. It has been chosen as a Smart city. The decongestion of the vehicle traffic on major roads is therefore needed to design space for road traffic at heavy traffic areas of Belagavi. The railways connecting to Hubballi-Dharwad are passing in between the cities are interconnected to the roads of city and are causing a great traffic. In this the 1st railway gate is selected for the development and planning. The required data is obtained from south western railway hubballi division government officials also proposed plan of a rail over bridge at the 1st railway gate.

II. RELATED WORK

The necessary data collection- The congress road up to Gogte circle is rigid, traffic volume count are 7000 PCU, speeds of the vehicles passing at first gate are 34 vehicles per hour in the speed range of 30 to 60 kmph approximately, traffic movement during peak ours is 94% in terms of cumulative frequency, secondary data of accidental analysis are approximately 30 to 55 per year due to fault of driver of motor vehicle.

To compare various types of vehicles and drivers under specific circumstances, to plan traffic control and to regulate the traffic rules, the remodel of existing 1st railway gate is necessary by bridge construction. Hence pre-stressing method of class 1 type girders for the bridge deck is designed at 1st railway Tilakwadi, Belagavi.



III. METHODOLOGY

Preliminary studies- The coordinates of Belgaum are 15°52'N 74°30'E, / 15.87°N 74.5°E, / 15.87; 74.5. Its typical elevation is 751 metres (2,464 feet), Selected area has co-ordinates 15°50'20"N 74°30'05"E. Unit ground water recharge is 0.025m to .01m as per the ministry of water resources central ground board of Belagavi district Karnataka. And falls under seismic zone 4, Geotechnically red soils and black soils are the two primary type of classifications. Two-wheeled and four-wheeled vehicles make up the majority of travelling vehicles (cars). Pedestrians also effectively use that road. There are two near-by bridges close to the research area. The bridges are bowstring girder bridges with a long approach.

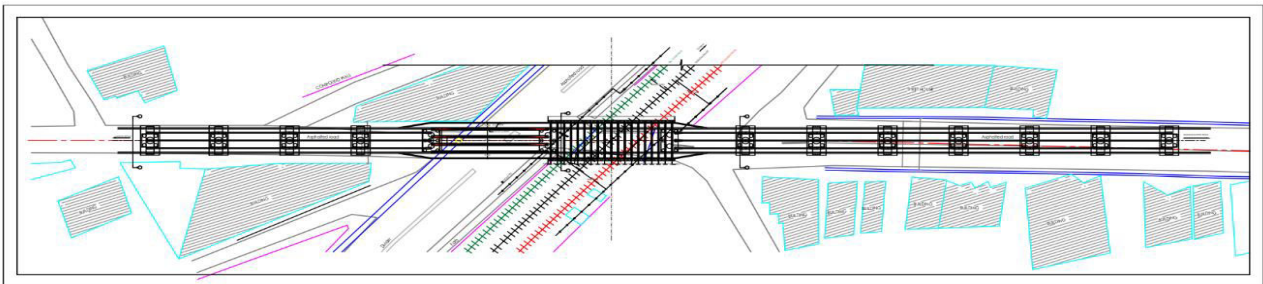


Fig. 1. An image of proposed plan of government at Tikalwadi

Government officials has planned for span of 33.46 rail over bridge using Mandoli road and the Shukrawarpeth road. The total length used is 558.865m. Width of congress road is 16.3 m with rigid pavement, width of Mandoli road and shukrawarpeth road is 8.9 m and 14.5 m, width available for the passage of railway tracks 22.9 m. Clearance height is 6.84 m, 3 numbers of railway tracks existed. Mandoli road, having width 8.9 m and residential neighbourhood and likely to travel the Khanapur road and railway station road, The planning has given a direct access of movement to Shukrawarpeth road. width of bridge is 8.3 m affects the local business economies. No provision for movement of pedestrians Shukrawarpeth road.

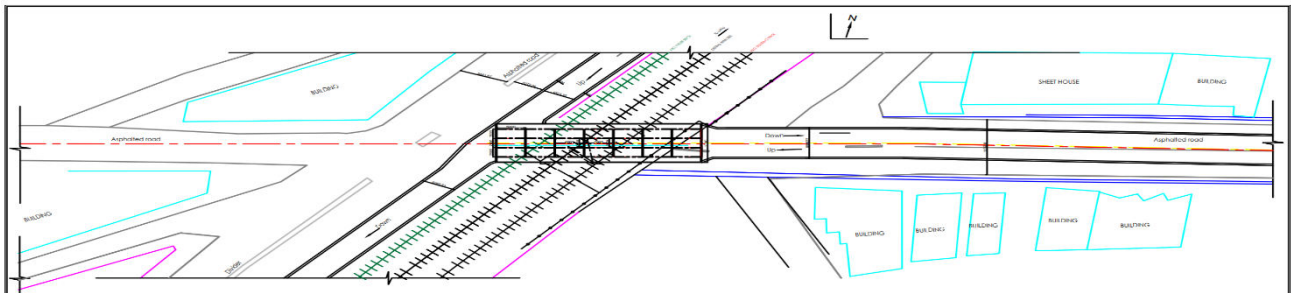


Fig. 2. Proposed revised plan of 1st Railway gate Tilakwadi Belgaum

Width of road taken for moving up from two lane congress road and for downward movement of vehicles is 6.1 m and 6 m. Width of bridge 10.5 m, Post tension pre-stress girders provided with 4 number of main girders with 7 number of cross beams with total span of railway over bridge 35 m.

In the plan there is no obstruction for the movement of vehicle users from Mandoli road to Congress road as they can utilize the whole road width of 8.9 m. Upward and downward movements will ease in reaching from congress road to Shukrawarpeth road which is having width of 14.5 m it will not affect near-by located shops. Users heading from Goavees can easily reach the congress road by using the elevated approach of Shukrawarpeth road. Utilization of single lane road for the elevated portion will not affect the vehicles heading to Khanapur road. Access for the pedestrian movement achieved.

Data for the design of post tensioned pre-stressed concrete T-Beam bridge deck, effective span 35m, width of road 7.5m, kerbs 0.6m, footpath 1.5m, thickness of wearing coat 0.08m, live load of IRC Class AA tracked vehicle, for deck slab grade of concrete M20, for pre-stressed concrete girders grade of concrete M50 with cube strength at transfer as M40, Loss ratio 20%, spacing of cross girders 5m, grade of steel for HYSD bars Fe415, Strands conforming to IS: 6006-1983 are available for use 15.2mm Design girders as class 1 type conforming to the specification of the



codes IRC:6-2014,IRC:112-2011 and IRC 112-2011. Cross section of deck: Thickness of deck slab 250 mm, width of kerb 600 mm, depth of kerb 300 mm, take spacing of main girder as 2.5 m, width of main girder 200 mm, over all depth of bridge deck with girders 2100 mm, number of cross girder provided 7 No's, width of cross beam 200 mm, depth of cross beam 1575mm.

Total design bending moment at shorter span MBU 58.269548 KNm, Total design bending moment at longer span MLU 20.061202KNm. Total design ultimate shear force VU 100.61809KN.

Design of deck slab and reinforcements: Reft along short span (ReffB) 12mm dia bars at 150mm C/C spacing Reft along longer span (ReftL) 10mm dia bars at 300mm C/C spacing, ultimate flexural strength and shear strength is $M_u 89.153061 \text{KNm} > 58.2695 \text{KNm}$ _hence safe, $V \text{ R.D.C} = 107.76998 \text{KN} > 100.618 \text{KN}$ _hence safe.

Design of longitudinal girders: bending moment for outer girder 12564.3 KNm, Inner girder 11720.7 KNm, shear force for outer girder 1533.86 KN, Inner girder 1731.07 KN, minimum section modulus $2.4 \times 10^9 < 3.5 \times 10^9$ _hence the section is adequate. Pre-stressing force: All the stresses of top and bottom fibres at transfer and service loads are within the permissible limits. ultimate flexural strength: $18521.10532 \text{KNm} > 12564.3 \text{KNm}$ _ hence safe. ultimate shear strength: $V(\text{rdc})$ is $2666.639747 \text{KN} > 1731.07 \text{KN}$ _hence safe.

Design of Cross girders: Ultimate BM 317.293KNm, Ultimate SF 419.622 KNm, $M_u(\text{lim}) 1263.62129 \text{KNm} > 317.293$ _hence ok, provide 16 mm dia bars 200 mm c/c spacing, $V(\text{rdc}) 428.167431 > 419.6221 \text{KN}$ _hence safe.

3-D Model of new proposed plan

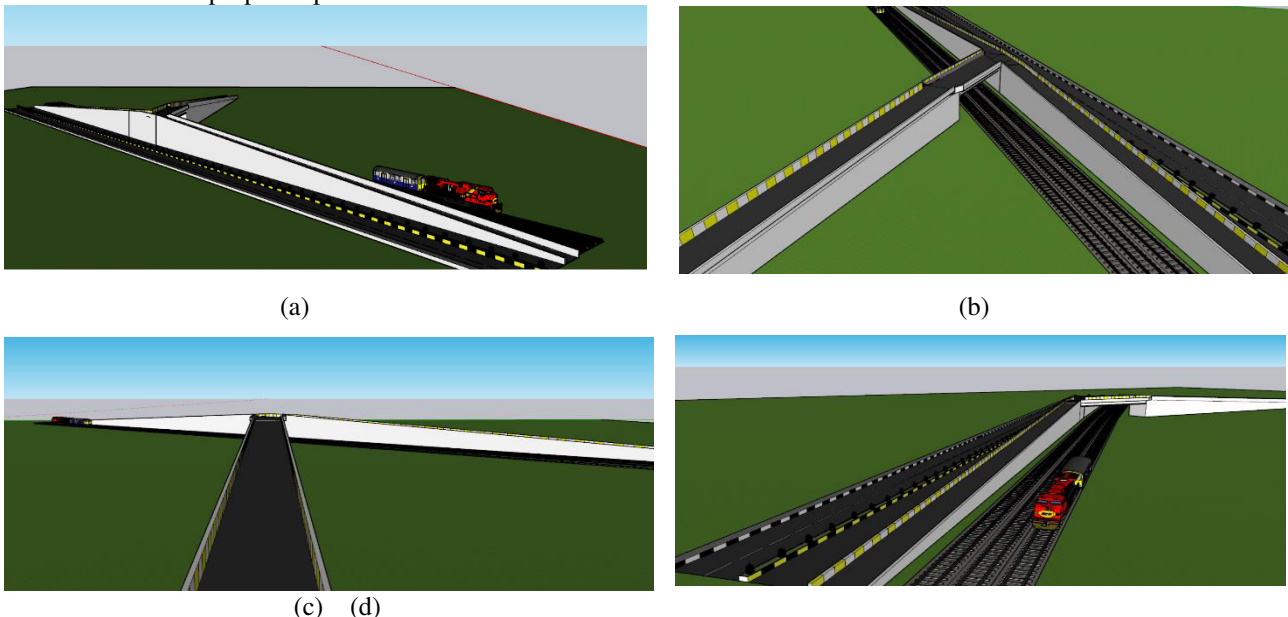


Fig. 3. (a) An overall view of Tilakwadi 1st railway gate model (b) Image of approach connecting the Shukrawarpeth road (c) Rising approach from Mandoli road to connect congress road (d) Image of road heading downwards from Shukrawarpeth road to Congress road

IV. EXPERIMENTAL RESULTS

Revised plan results: The revised plan has a better way of *regulating the traffic* with very smooth and effective flow. Plan has direct approach existing *2 lane congress*. The revised plan has *given access* for the movement of vehicles from Congress road to Shukrawarpeth road. The traffic movement will be *reduced* in the Goavees circle. Not connected to the Mandoli road and *reduced length* of railway over bridge. The access for *the movement of pedestrian* traffic is been achieved.

Travel time results: travel time is reduced as there is *direct movement* the vehicle to reach the *destination*. *Very effective for the Mandoli road* users as they *need not to travel* to Shukrawarpeth road in order to reach 3rd railway gate or the Gogte circle. Accidents reduction results: In the revised plan there will be *less amount of accidents* occurring as the movement of traffic *flow will be through congress* road also.

Economic factor results: In revised plan I have not used the Mandoli road hence the *economies of individual* shops located besides the road will not be affected. Design consideration results: For increased span from 33.4 m to 35 m the results are as follows. For bridge deck the design bending moment is 89.153KNm and the design shear force is 107.77



KN which are *safe in both flexure and shear*. For the longitudinal girders I have taken the depth of 2.1m and the design bending moment is 12564.3 KNm and the design shear force is 1731.07 KN which are *safe in flexure and shear*. Pre-stressing forces applied to top and bottom fibres during transfer and service loads are *entirely within safe, allowable limits*. And are safe in flexure and shear. The railway over bridge designed is safe and having sufficient depth of girders to resist the loads acting on it.

V. CONCLUSION

Gathering all the necessary information is accomplished by conducting a reconnaissance survey at the first railway gate which is located at Tilakwadi, Belagavi. The flexible and effective movement of traffic at the first railway gate has been achieved by presenting a revised plan. By proposing a revised plan, a pathway for pedestrian movement is attained. The safe design results are obtained by completing the manual design of a railway overbridge with a 35 m span. A 3-D rendering of revised plan is provided to get a good understanding of what all concepts proposed in the new plan. After completing all of the aforementioned stages, the results of the revised plan are compared to the results of the government's suggested plan. And significant advantages have been achieved by carrying out this case study.

REFERENCES

- [1] Dande Gangasekhar¹, Sri B Ramakrishna, "Design of Rail Over Bridge". The International Journal of Emerging Science and Engineering – Volume 8, Issue No 8, April/2018.
- [2] Prof. Ancy Joseph, Elsa Babu, Karthika Babu, Lakshmi G, Meera R Krishna, "Analysis And Design Of Railway Over Bridge At Kumaranellur". International Journal of Civil and Structural Engineering Research ISSN 2348-7607 (Online) Vol. 2, Issue 2, pp: (124-127), Month: October 2014 - March 2015.
- [3] P. Pulkkinena, S. Hopfb and A. Jutilac *, "Conceptual design of the Chenab Bridge in India". © 2012 Published by Elsevier Ltd. Selection and review under responsibility of University of Žilina, FCE, Slovakia.
- [4] Thanushree H, Siddesha H, Dattatreya J K, Dr.S.V.Dinesh, "Analysis of Rcc and Psc Bridge Deck Slab for Various Spans". International Journal of Scientific & Engineering Research, Volume 7, Issue 3, March-2016 859, ISSN 2229-5518.
- [5] Shubham Landge, Umesh Bhagat, Shubham Bhaishare, Ved Prakash, Dr. I. P. Khedikar, "Analysis and Design of Pre Stressed Concrete I-Girder Bridge". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 05 | May-2018 p-ISSN: 2395-0072.
- [6] Gokul Mohandas V, Dr. P. Eswaramoorthi, "ANALYSIS OF PRESTRESSED CONCRETE GIRDER FOR BRIDGES". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 02 | Feb 2020 p-ISSN: 2395-0072.
- [7] RAHUL GANGWAR, ANKUR PRATAP SINGH, T.N. PANDEY, "Comparative Study of RCC and PSC Girder". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072.
- [8] Muhammad Ashraf. S, Aneetta Varghese, Anna Mariam Saji, Aswin Hanuraj. R, Maneesh T Manoj, "DESIGN AND ANALYSIS OF CHAMAKKAVU BRIDGE". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072.
- [9] Viqar Nazir, Mr. Sameer Malhotra, "DESIGN OF A PRESTRESSED CONCRETE BRIDGE AND ANALYSIS BY CSiBRIDGE". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 09 | Sep 2019 www.irjet.net p-ISSN: 2395-0072.
- [10] T.Muhilan, A.Yacop Raja, "DESIGN AND ANALYSIS OF PRESTRESSED BRIDGE". International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072.
- [11] N. Krishna Raju, "Design of Bridges". Fourth and Fifth edition.
- [12] Pigeaud's Curves, For moment coefficients.
- [13] IRC: 18-2000, The Indian Road Congress 2000, Design Criteria for Pre Stressed Concrete Road Bridges (Post Tensioned Concrete) (Third Revision).
- [14] IS: 6006-1983, Indian Standard Specification for Uncoated Stress Relieved Strand for Pre Stress Concrete (First Revision).
- [15] IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges, Section:2 Loads and Stresses (Revised Edition).



- [16] IRC: 21-2000, Standard Specifications and Code of Practice for Road Bridges, Section:3 Cement Concrete (Plain and Reinforced) (Third Revision).
- [17] IRC: 112-2011, Code of Practice for Concrete Road Bridges.
- [18] IS: 1343-2012, Indian Standard, Pre Stress Concrete – Code of Practice (Second Revision)



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