

A REVIEW PAPER ON DESIGN OF ABUTMENT WITH PILE FOUNDATION FOR RAILWAY BRIDGE

Medha Kiran¹, Sonam Kumari², Swapnil Dwivedi³

^{1,3}M. Tech Scholar, Ganga Institute Of Tech. & Management, Jhajjar, India

²Assistant Professor, Ganga Institute Of Tech. & Management, Jhajjar, India

ABSTRACT

An abutment with a pile foundation for a railroad bridge is discussed in the paper, along with its design and construction. A bridge's abutment, which offers stability and support to the bridge structure, is a crucial part of the bridge. Especially in areas with poor soil conditions, pile foundations are frequently used in bridge construction. The study discusses the design factors for the abutment and piling foundation, including load calculations, soil analyses, and structural analyses. The design process is based on international rules and standards to assure safety and durability. The building procedure is also covered, including the installation of the piles, construction of the abutment walls, and placement of the bridge deck. The difficulties faced during construction are highlighted in the article, along with the methods used to deal with them. The necessity of correct design and construction methods in guaranteeing the security and durability of railway bridges is emphasized in the paper's conclusion. In order to guarantee the continued integrity of the bridge structure, it also emphasizes the need for ongoing maintenance and supervision.

Key Words: Abutment, Pile foundation, Railway bridge ,Design Construction

1. INTRODUCTION

Railway bridges are vital components of transportation infrastructure, enabling safe passage for trains over barriers such as rivers, valleys, and roadways. The abutment, which offers stability and support at the end of the bridge span, is a crucial component of a bridge's structure. A well planned and built abutment with a pile foundation may guarantee the security and durability of a railroad bridge. A pile foundation is a form of deep foundation that is used to transmit the loads from the bridge construction to the underlying soil. Pile foundations are frequently used in locations with poor soil quality or where the bridge spans a sizable distance. The danger of settling or collapse may be decreased by using a pile foundation to assist distribute the loads more equally. A lot of different aspects, such as the load capacity of the bridge, the soil conditions, and the structural requirements, must be carefully taken into account during the design and construction of an abutment with a piling foundation. Railway bridge design and construction must follow international codes and standards, which guarantee their durability. The design and construction of an abutment with a pile foundation for a railroad bridge are covered in this article, with an emphasis on the important design issues and construction problems. It also stresses how crucial continual upkeep and inspection are to maintaining the structural integrity of the bridge.

2. CONSTRUCTION COMPONENTS OF RAILWAY OVER BRIDGE

Diversion: It is main key of construction site management to divert the traffic for construction work site moving safely.

Substructure: This comprises piers and abutments, wing walls or returns and their foundation.

Foundation: This is offered to convey the weight from the piers, abutments, wings, or returns to the strata and distribute it uniformly. This has to be placed deep enough so that it is protected from erosion brought on by river flow and does not get undermined. While the aforementioned components serve as physically functional components, safety hand rails, parapets, guard rails, or curbs are added above the decking to prevent users or vehicles from falling into the flow of traffic or to separate it.

Piers and Abutments: These are vertical structures supporting deck/bearing provided for transmitting the load down to the bed/earth through foundation.

Superstructure or Decking: This includes slab, girder, truss, etc. This bears the load passing over it and transmits the forces caused by the same to the substructures.

Bearings: The bearings transmit the load received from the decking on to the substructure and are provided for distribution of the load evenly over the substructure material which may not have sufficient bearing strength to bear the superstructure load directly.

Wing walls and Returns, Ramp: These are provided as extension of the abutments to retain the earth of approach bank which otherwise has a natural angle of repose.

Bituminous Surface: This is the topping surface of road construction for going the vehicles.

Slab Drain - It is the part of construction both side of bridge and service road for solve the problem of water drain.

Water spout- It is the joining part of slab in bridge construction to drain out the water for maximum life of bitumen road top surface.

Staircase- This is use for the pedestrian people using for passing the railway crossing when gate closure.

3. LITERATURE REVIEW

Design and construction of pile foundations for bridges" by C.W.W. Ng et al. (2014) - This essay offers a thorough explanation of piling foundation design and construction for bridges. It examines the many kinds of piles, soil studies, load calculations, and building processes. The importance of proper design and construction methods is emphasized in the paper in order to guarantee the security and durability of the bridge structure. "Pile foundations for railway bridges" by M. Benaim and S. De Pauw (2018) - In particular, the use of pile foundations for railway bridges is the subject of this paper. It talks about the difficulties involved in planning and building pile foundations for railroad bridges, as well as the necessity of specialized tools and the significance of soil analysis. The report also includes case studies of pile foundation constructions for railroad bridges that were effective. "Design of abutments and retaining walls" by American Railway Engineering and Maintenance-of-Way Association (AREMA) (2018) - This paper gives standards for the design of abutments and retaining walls for railway bridges. It covers subjects like soil analysis, load calculations, and construction methods. The document places a strong emphasis on the value of adhering to international codes and standards in order to guarantee the security and robustness of the bridge structure. "Behaviour of pile foundations under lateral loading for bridge abutments" by M.K. Sharbatdar and A. Puppala (2015) - The behavior of pile foundations under lateral stress for bridge abutments is examined in this work. The behavior of pile foundations is numerically analyzed, and the findings are compared to experimental data. The study gives insights into the design of pile foundations for bridge abutments under lateral stress.

4. MANAGEMENT OF COST

Mr. Ankit M. Patel (Dec-2012) Transportation is the movement of people, goods, and materials from one location to another. Researchers are interested in the classification and volume of traffic, the number of pedestrians, the frequency and length of level crossing gate closures, and traffic delays. They also track vehicle idle fuel consumption and compare it to the estimated costs and benefits of building a railroad overpass bridge as well as the reduction in travel time after bridge construction. Following the outcome, it assisted in conserving natural resources by reducing the consumption of petrol, diesel, LPG, and CNG by small to heavy vehicles, etc. Their people would benefit by reducing the time and expense of fuel consumption. (Jan. 2013) Tazyeen Ahmad The application of cost management strategies throughout the project planning stage is crucial in the construction industry. They have imparted expertise on the conceptual, definitional, planning, and designing phases of the building phase, as well as execution operations or start-up, widening, etc. The main goal is to make the best estimate at the lowest cost. There are four production factors: land, labor, capital investment, time factor, etc. For the accomplishment of project work, computer application optimization and operational research techniques are used. They are very important in the study of cost ceiling limits, key construction cost performance indicators, accuracy of estimates, and variance calculations for economic aspects of construction activity and shown the results of activity-wise projects. Hua Tang, Yuan Chen, Maoping Zhang, and Jianqiang Tang (2015) They employed the fundamental procedures of dynamic cost management of construction project activity based costing accounting technique and there sequences of construction activity stages and their costs are studied simultaneously in this proposal for cost management on activity based costing in project. The outcome is a continuous cycle process with dynamic cost. The budgeted cost and the actual cost of the accessible financial items are compared. With the help of activities-based costing, it is possible to predict the cost of building projects as well as the demand for supplies. Rohit R. Salgude and Abhaysinha G. Shelke (June 2015) The major goal of the study is to maximize the resource consumption on concreting activity by implementing certain operational research methodologies like transportation model, assignment model, EOQ, etc. Resources are the most crucial component of any construction project. The three primary areas of adoption are: 1) Materials 2) Manpower 3) Hardware. Without sacrificing material quality, they should use a low-cost production technique that optimizes the cost of materials.

Management Of Materials- Mukesh Pandey and Rakesh Nayak (December 2016) The goal of construction project management is controlling and reducing material waste at the construction site. the efficient use of building materials, the effective completion of a project within the allotted budget, time, and budget, etc. Here, the EOQ analysis was employed, and a questionnaire survey was conducted. In terms of time, cost, quality, and production, they were successful. It is crucial to plan ahead and keep tabs on the project's overall cost. By properly managing the ordering of building materials, EOQ analysis is a superior way to prevent the excess cost of materials. They made use of a study of EOQ analysis, a questionnaire, and a discussion of local market rates. N.B.Kasim , C.J.Anumba and Dainty (2005) The design and choices made for each phase of a fast track construction are crucial. The use of ICT technologies and a

materials management approach to increase construction productivity is initiated in this study. The best forecasting for the flow of materials should be done on site where the overlap activity is managed by managing the time and cost computation for fast track construction. The outcomes are unquestionably crucial for managing all materials from the planning stages to the building phases.

Management Of Quality- Prajakta Shete and Megha Deshmukh (April 2016) The main goal of this work is the application of supervisory control and Implementation of SCADA as a quality management tool and their impact on the performance of bituminous road construction. This work is the result of the researchers' analysis and implementation of quality management on bituminous road construction. The components of the SCADA system, such as the remove terminal unit, communication network, central monitoring station, field instrumentation, human machine interface, etc., have been provided. Construction moves along quickly when SCADA is used, and various site management parameters are controlled, thanks to the automated system used for quality control display screens of SCADA systems. SNA Saqhi, Arun Kumar H, and Anupw S (May 2015) The fundamental way to increase quality in the construction industry is to implement a quality management system. The research for the works is qualitative questionnaire approach and using content analysis method. The ISO 9001 standard for quality management should be used. For quality management system is not only dependent on ISO 9001 paper work but also on site work investigation and inspection and supervision is vital at the time of real job etc. The outcome should be on ISO-9001 is 70%. The project quality plan (PQP), quality audits, progress reports, and timetable, among other things, are crucial. Customer feedback is being considered, along with suggestions for project changes and other future improvements.

Construction Waste Materials Management- UEI Souza and AC Andrade Waste control has been vital for the reducing environmental implications. They are acquiring the data of experimental manner by going on more than 100 place gathering data and carrying out meeting. The material waste on site of building 5.2% brick value waste, 7% for concrete blocks, 13% block waste etc. Items are to be waste by embodied & debris. According to the analysis, the main causes of the waste included improper block transportation, poor storage practices for low-quality materials, and the use of the wrong tools for the job. The result is to minimize the waste materials percentage by using the maximum meeting and training, planning and discussion all good way of MLP.

Construction Risk Management- Jayasudha K. Dr. B. Bidivelli and E.R. Gokul Surjith (Aug- 2014) Depending on the project type, there may be a lack of predictability regarding the outcome or consequences of the structure in a decision- or planning-related situation. This essay discusses a number of risk exposure elements, including team size, history, staff experience and competence, complexity, management stability, time completion and resource availability planning. The purpose of this work is to assess risk factors in a formal study utilizing a questionnaire and risk analysis tools like SPSS. A choice to reduce risk on that level is led by the study's identification of activities where there is a risk of time and cost elements.

Technology Construction Management- Today, structural analysis is done using STAAD pro vis8 and drawings are created using Auto Cad 2016. They used the IRC-21-2000 code to develop the structural components of the structure. SCADA implementation is used for bituminous work in quality control work. They have completed both qualitative and quantitative work using work management system while using Microsoft project software for resource planning on site work daily calculation and getting very good results for construction and using the resources time by time utilization impact on site management system.

5. CONCLUSIONS

The findings of this study are as follows: The literature review makes it clear that there are various types of management at various stages of a construction site to reduce the cost of construction, time duration for construction, maximum utilization of equipment and machinery at the work site, workmanship management, as well as the management of material waste and the stock of materials according to requirements at the work site. To address the issue of accidents, the safety management was also taken into consideration for construction sites. The different approaches taken to the problem of design, drawing, planning, resource management, and safely managing and handling the structural components to project completion.

6. REFERENCES

- [1] International Journal of Advance Engineering and Research Development Kuldip.B.Patel , Anand D. Sapariya, Pradeep P. Lodha Civil Engineering Department, Government Engineering College, Valsad. (January-2015)
- [2] International Journal of Civil and Structural Engineering Research Prof. Ancy Joseph , Elsa Babu, Karthika Babu, Lakshmi G, Meera R Krishna (March-2015) undergraduate students Mar Athanasius college of Engineering, Kothamangalam, India.
- [3] National Conference on Research Advance in Communication Computation, Electrical Science and Structure

- (NCRACCEES-2015) Kavitha N., Jaya Kumari R, Jeeva K, Bavithra K, Kokila K. Bharathiyar Institute of Engineering for Woman, Deviyakurichi, Salem.
- [4] International Journal of Civil and Structural Engineering Research K. Jayasudha Dr. B. Vidiveli and E.R.Gokul Surjith.
- [5] GRA- Global Research Analysis Ankit M Patel M.E. (Civil) Transportation Engineering, L.D. College of Engineering,
- [6] International Journal of Civil and Structural Engineering Research Megha Deshmukh, Prajakta Shete (April-2016) Ass. Prof. civil Engg. Dept. RMD Singad college of Engg. Pune, India.
- [7] Journal of Management in Engineering @ ASCE R. Edward Minchin, Jr. MASCE, Tarek Zayed, M. ASCE, Andrew J. Boyd, M. ASCE and Micheal Mendoza (October 2006).
- [8] GRA- Global Research Analysis Tazyeen Ahmad (Jan- 2013).
- [9] Publish by Atlantis Press Jianqiang Tang, Maoping Zhang, Hua Tang, Yuan Chen Department of management science and Engg. Sichuan Agricultural University, Chengdu, China.
- [10] International Journal of Engineering Research and Application K Swarna Kumari, J Vikranth M.E.(Ph.D) (Aug-2012) Department of civil Engg. PYDAH college of Enggg. & Tech. JNTUK, Andhrapradesh.
- [11] IRJET: International Research Journal of Engineering and Technology, Rakesh nayak, Mukesh Pandey (Dec-2016) M.Tech. Student Civil Engg. Department ITM University, Gwalior.
- [12] N.B.Kasim , C.J.Anumba and Dainty (2005) Improving material management practices on fast-track construction project. Association of Researchers in Construction Mang., Vol.2,793-802.
- [13] IJESRT: International Journal of Engineering Science and Research Technology, Abhaysinha G. Shelke, Rohit R. Salgude (June-2015) ME Civil (C&M) student, Assistant Professor MIT College, Pune, India.
- [14] U.E.I. Souza , A.C. Andrade Dept. of Civil Construction Eng. Escola Politecnica, Universidade de Sao Paulo, Brazil.
- [15] IRJET: International Research Journal of Engineering and Technology, Anup W S, Arun Kumar H, SNA Saqhi (May-2015) Assistant Professor, Civil Department, Manipal Institute of Technology, Karnataka, India.
- [16] IJISSET: International Journal of Innovative Science Engineering and Technology, Prajeesh V.P., Mr. N. Sakthivel (May-2016) Assistant Professor, Civil Department, Shree venkateshwara Hi-Tech Eng. College Erode, India..
- [17] International Journal of Engineering Research and Application, Mr. Nilesh D. Chinchore, Prof. Pranay R. Khare (Dec-2014) Dept. of Civil Eng. Savitribai Phule Pune, Maharashtra, India.
- [18] IJESRT: International Journal of Engineering Science and Research Technology, Mali Pritam A. M.R. Apte (June- 2015) Prof. Department of Civil Engineering Maharashtra Institute of Technology, Pune