

Necessity of Effective Quality Control System for Bridge Construction (A Review)

Mr. Anil Barge^{1*}, Prof. Avdhooth Kadu²

¹ PG Student. Dept of Civil Engg. PVPIT, Pune, Maharashtra, India

Email: anilbarga@gmail.com

² Professor, Dept of Civil Engg, PVPIT, Pune, Maharashtra, India

Abstract - As urbanization quickens and transportation systems proceed to advance, bridges, as indispensably components of urban foundation, confront progressively impressive challenges in their plan and development administration. This inquire about investigates the integration of naturally inviting, financially productive, and socially satisfactory plan standards and development administration strategies in bridge designing from the viewpoint of economical advancement. Through case investigations and information measurements, this paper presents optimized bridge plan arrangements beneath different natural conditions and examines techniques to play down asset squander and improve development effectiveness, in this way accomplishing the feasible improvement objectives of bridge building. The quality parameters should easy to understand specially checklists should be easy to understand and easy for implementation. In this study is carried out to analyze the scenario of Quality Control System application, to identify factors affecting the construction organization and to issue recommendations on how to improve the implementation of Quality Control System in Construction Industry. The growth in infrastructure increases in our country which leads the construction of new bridges is one most the key elements in this. Initially the checklists are observed from different site the defects will identify in check lists and suggest new checklists for each items of construction. This paper finds Necessity of Effective Quality Control System for Bridge Construction by analysing the different Literature review

Keywords: Construction Industry, Quality Control System, Checklist , Bridge

-----X-----

INTRODUCTION

A procedure used by a company to guarantee that manufacturing defects are decreased or eliminated and that product quality is maintained or enhanced. The company must foster a culture of perfection among management and staff in order to implement quality control. To do this, employees are trained, product quality benchmarks are established, and items are tested for statistically significant deviation.

The implementation of precise controls is a key component of quality control. These measures aid in standardising both output and responses to problems with quality. Reducing the margin of error by clearly defining which production activations need to be carried out by which staff members lessens the possibility that workers will be doing jobs for which they lack the necessary training.

Market rivalry has played a significant part in the law of survival of the fittest throughout the development of the market economy. The market and competitors will continue to put pressure on construction companies, and customers' demands for quality assurance will

only grow. As a result, construction companies must enhance internal quality, bolster management, and pay special attention to quality control.

Since quality is a sign of human civilization, quality control will become increasingly important in business as civilization advances. One could argue that there is no economic gain if there is no quality control. A vast array of intricate processes go into construction projects. The quality of construction is influenced by a wide range of factors, including geography, geology, hydrology, design, materials, machinery, management systems, and so forth.

Due to the fixed project location, high volume, and several project locations, inadequate control over these elements may result in quality issues. Building organisations can achieve optimal economic outcomes by managing the entire building process, adhering strictly to quality standards and user-promising needs, and meeting quality, schedule, cost, and other requirements. In order to produce more composite products that are high-quality, safe, appropriate, and cost-effective, construction businesses must uphold the quality first principle and

insist on quality standards that are based on artificial control and prevention.

Reasons Why Qc Implementation In Construction Industry

Followings are the defects which would be caused at the time of construction:

- The cement sand mix in the mortar and brick masonry is made quite early, prior to its use and in larger quantities than required.
- The construction materials like sand, bricks, Aggregate etc are not washed and are full of deleterious material and dust.
- Compaction of bottom strata in foundation work is not carried out.
- During concreting of footing, the concrete is poured at a height greater than 1m.
- Generally, trapezoidal footings are resorted to where concrete is never vibrated.
- Reinforced concrete column, being an important part of the structure are neither mechanically vibrated nor machine mixed.
- They are cast in short lifts with increased number of joints.
- Cover to reinforcement in column, beams and slabs is insufficient.
- No cover to reinforcement in contact of the ground
- Misalignment of column at foundation level and rectification at higher level, leading to eccentric loading.
- Reinforced coping at plinth level being an important barrier to dampness is never densely cast.
- The plinth filling is never carried out in layers nor compacted.
- At the joints of Reinforced concrete and brick masonry, either :-

LITERATURE REVIEW

Ahmad Huzaimi Abd Jamila,b,, Mohamad Syazli Fathia (2021) The authors discover that it is possible to adopt Lean Construction (LC) and Sustainable Construction (SC) ideas and practices simultaneously in a strategic manner to achieve waste reduction improvements that have a positive impact on the environment and the economy. According to the paper, although both ideas and practices have the potential to have a major positive impact on the environment and the economy, companies are still having trouble effectively integrating them. The paper

concludes that inadequate execution and integration of both principles have been experienced by the building industry in numerous nations.

Therefore, this paper aims to lay the groundwork for future empirical study by investigating on various dimensions of SC and LC, where the theoretical and practical findings provided a foundation for integrating the two initiatives to yield the efficient use of valuable resources.

Ahmed S. Agha (2016). Total quality management, or TQM, is a management philosophy that has been extensively applied in the manufacturing and other service industries, according to the author, who also notes how much it may increase quality in these domains. It is further noted that a small number of research and articles have tried to introduce the advantages of this philosophy to the building sector. The purpose of this paper's results is to highlight recent research on how TQM implementation in the construction sector can improve business quality and how it can be applied appropriately at various stages of project construction.

M.S. Abd-Elwahed & M.A. El-Baz (2018) In order to monitor the various policies to implement the quality strategies and the degree of their integration into the industrial management systems generally, this paper measures the level of knowledge, understanding, and application of quality management tools in a sample of Saudi Arabia's industrial sector. The author completed the questionnaire in order to address important topics, such as knowledge and comprehension of the various methods to quality management (QM) and the instruments that go along with them. Along with the impact of the executive technique of management and its suitability for the appropriate use of quality tools, the effects of each QM strategy on the level of actual growth of the industrial organizations are validated.

Maha Alkasisbeh (2018) The primary findings of the author's six sigma tool analysis revealed that, accounting for 52.2% of all building project issues in Amman, the main causes of excavation collapse, faulty roof water proofing, poor rainfall drainage systems, and inadequate ventilation are all related to building projects. The paper concludes that even though cause and effect diagrams and Pareto analysis have been around for a while, it has successfully demonstrated how to use these basic Six Sigma tools to identify the root causes of problems and allocate resources to solve them. This paper may lead to a significant discussion about the application of Six Sigma and its research in developing nations' building industries, which may be very beneficial.

Sarathkumar K, Loganathan R (2016) The paper concludes that six sigma is a novel concept in the construction industry, and its goal is to lower building defects. This research seeks to assess Six Sigma as a process improvement methodology in the construction industry. Understanding the elements

influencing the construction process and analyzing the factors for improvement are crucial to improving the construction process. The authors propose utilizing the DMAIC process to enhance a building's painting, tile, and brick work. The suggested corrective action plans for the issue were completed from the perspective of implementing the Six Sigma concept on the job site. The author's completion of the questionnaire satisfies the requirements for control plans of the last phase of building operations.

Savita Sangle M.C. Aher, R.V. Devalkar (2017) The author applied the DMAIC approach to a case study of a residential structure, utilizing seven quality control techniques. The paper said To raise the quality, six sigma techniques have been implemented. The results point to the need for appropriate management support, training, and small adjustments to present work practices in order to enhance quality and, ultimately, customer happiness.

Sneha P. Sawant, Smita V. Pataskar (2014) Six Sigma is a quality improvement technique that has been applied in various industries, including manufacturing, according to the author. In the construction business, six sigma is new. The paper outlined the fundamental theories, methods, and instruments utilized in Six Sigma. A residential building case study is examined whereby the Six Sigma principles are implemented for internal finishing work. The Six Sigma technique is utilized to enhance quality and is assessed in relation to the sigma level. The paper makes the case that improving quality and, ultimately, customer satisfaction—which is of utmost importance—can be achieved with the right training, managerial support, and small adjustments to present work procedures.

Tapan Vora, 2014, Six Sigma is used as business improvement method, aimed for achieving defect free quality in products and services. It is considered as the latest tool in respect of quality, widely used worldwide for obtaining the finest quality in products and services. It is modeled and designed in such a way, to acquire huge money oriented results through gain in Productivity and improvement in Quality. According to Tapan Vora, Six Sigma is a quality based tool and a technique, which may be used in any organization to improve the process. It was initially used in manufacturing, but now in all the areas of the organization.

Hamad M.A, 2014, The term "Sigma" originates from statistics and is widely applicable to statistical methods of quality control and in process control, and also it examines the capability of the process. According to Hamada, process capability is the capacity of the processes to produce substantially good amount of output in manufacturing and other industries within the specified requirements. Six Sigma is applicable in every organization where operations and processes are involved. An operation is where input gets converted into a product or service through a process. Processes which are operating with Six Sigma quality in a short period are assumed to

produce defects less than 3.4 Defects in one Million times. To generate meaningful process performance an orderly and systematic process is needed.

Elliot Boldt, 2013, It is observed that the product and service quality of depends on customer satisfaction and is the foundation for any organization. The existence of an organization is based on the number of customers and their loyalty. Organizations should identify the needs of the customer and satisfy the demands. According to Elliot Boldt, all organizations identifies various types of needs for its customers. It is required to identify what the customer wants and provide it immediately at the lowest cost. Also, we have to ensure that products and services are of high quality and are reliable for the purpose. .

SUMMARY OF LITERATURE REVIEW

Overview of Sustainable Development Principles in Civil Engineering

The pursuit of balance between social well-being, economic prosperity, and environmental protection forms the basis of sustainable development. It is now essential to include this holistic approach into civil engineering procedures as it becomes more and more popular. This means moving away from traditional engineering paradigms and toward ones that put sustainability first when it comes building bridges. Redefining bridge design and construction management processes has made the integration of resilience planning, carbon footprint reduction, and life cycle assessment crucial.

Environmentally Friendly Bridge Design:

Balancing Form and Function The drive towards environmentally friendly bridge design has sparked a wave of innovation in materials, technologies, and methodologies. Sustainable design principles dictate the adoption of low-impact materials, such as recycled steel and high-performance concrete, which minimize resource consumption and reduce carbon emissions. Moreover, the integration of green infrastructure elements, like vegetation and renewable energy systems, into bridge structures offers a symbiotic relationship between transportation functionality and ecological preservation. The literature underscores the importance of hybrid designs that fuse aesthetics, functionality, and environmental responsibility, ushering in a new era of iconic, sustainable bridges.

Cost-Effective Construction Practices for Sustainable Bridges

In the construction phase, as much as during design, sustainability is to be achieved in bridge construction. Adopting lean building principles-based cost-effective construction techniques increases productivity while reducing waste. Methods such as prefabrication, modular construction, and efficient scheduling shorten project durations while also

conserving resources. Moreover, integrating Building Information Modeling (BIM) makes it easier to plan collaboratively, reduce risk, and allocate resources effectively. Numerous examples of successful implementations of these methods that have reduced environmental impact and increased economic viability can be found in the literature.

Community Acceptance: Connecting Society and Infrastructure Community inclusion and acceptance are important but frequently overlooked components of sustainable bridge designs. Participation of the public in the decision-making process guarantees that bridges are in harmony with the surrounding urban fabric, empowers stakeholders, and promotes openness. Studies underscore the importance of early involvement, open communication, and public discussions in cultivating favorable attitudes towards bridge projects.

CONCLUSION

The importance of bridges in creating today's urban landscapes cannot be emphasized in a time of rapid urbanization and ongoing transportation network expansion. These essential infrastructure elements function as landmarks that define the character of cities and as conduits for connectivity, making it easier for people and things to move about. However, the difficulties in guaranteeing the sustainability of bridge design and construction have grown more complicated and urgent as cities change and people increase. A checklist can be a very useful tool for ensuring high standards in bridge construction.

REFERENCES

1. Ahmad Huzaimi Abd Jamila,b,, Mohamad Syazli Fathia (2016),” *The Integration of Lean Construction and Sustainable Construction: A Stakeholder Perspective in Analyzing Sustainable Lean Construction Strategies in Malaysia*” Science Direct 100 (2016) 634 – 643
2. Ahmed S. Agha (2016).” *Total Quality Management In Construction Industry*”. International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016
3. M.S. Abd-Elwahed & M.A. El-Baz (2018).” *Impact of Implementation of Total Quality Management an Assessment of Saudi Industry*” South African Journal of Industrial Engineering May 2018 Vol 29(1), pp 97-107
4. Maha Alkasisbeh (2018).” *Implementation of Six Sigma Tools in Building Construction*”, Proceedings of the International Conference on Industrial Engineering and Operations Management Paris, France, July 26-27, 2018
5. Sarathkumar K, Loganathan R (2016)” *Evaluation of Six Sigma Concepts in Construction Industry*”, International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016
6. Savita Sangle M.C. Aher, R.V. Devalkar (2017) *Total quality Management in Construction Industry*” International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Volume 5, Issue 3 (May-June 2017), PP. 111-115
7. Sneha P. Sawant, Smita V. Pataskar (2014),” *Applying Six Sigma Principles in Construction Industry for Quality Improvement*” Advances In Engineering And Technology - ICAET-2014 Copyright © Institute of Research Engineers and Doctors.
8. Tapan Vora, 2014, *Journey from six sigma to Lean Six Sigma*, International journal of Modern engineering research, Vol 4, Issue 2.
9. Hamad M.A, 2014, *How to reduce waste on industries by using Lean sigma tool*, International journal of Scientific Engineering research, Vol 5, Issue 8, pp 442-445.
10. Elliot Boldt, 2013, *Total Sustainability assessments for Manufacturing operations through Six Sigma*, Science Journal of Environmental Engineering Research, Vol . 2013 pp: 1-6
11. Mamatha K, 2014, *Application of Six sigma methodology to reduce rework at earth moving Equipment*, International journal of Engineering science and Technology, Vol.6, pp: 417-422.
12. Prabir K B, 2011,*Using Six Sigma in Adopting Business excellence Model*, International Journal of Business and Management, Vol .6 pp : 273-277.
13. Uddin S.M, 2014, *Minimization of defects in sewing section of Garment factory through DMAIC*, Research Journal of Engineering sciences, Vol .3 , pp: 22-25.
14. Ibrahim H E, 2014, *Implementation of Lean six Sigma in a Pharmaceutical Industry*, International journal of scientific and Engineering Research, Vol .5, pp 519-529.
15. Mayank Bundele. 2014, *Sustainable quality of safety in safety management with six Sigma*, International journal of scientific and Engineering Research, Vol .7, pp 539-545.
16. Satish Kumar, 2014, *Impact of Six sigma DMAIC approach on Manufacturing industries*, International journal of Research in Engineering and technology. Vol : 3 page 12652-12658.

17. Surendraj Dharmapal. 2014, *Integrating Six Sigma Tools on agile Methodology*, International journal of Advanced Research in Software Engineering . Vol 4, pp 295-300.
18. Anup A J, 2014, *Six Sigma technique for Quality improvement in Valve Industry*, International journal of Advanced Research in Engineering, Vol 2, pp 1-6.
19. Ivan Sunit R, 2014, *Implementation of six sigma Using DMAIC Methodology in small scale Industries*. International journal of Modern Engineering Research. Vol. 4, pp 44-49.
20. Pepper, M., 2010, *"The evolution of Six Sigma"*, International Journal of Quality, Vol.2, pp.138-155.

Corresponding Author

Mr. Anil Barge*

PG Student. Dept of Civil Engg. PVPIT, Pune,
Maharashtra, India

Email: anilbarge@gmail.com