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Analysis and Assessment of the Risk Associated with Ready Mix Concrete Production in Pune Region

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Abstract - Concrete is one of the most adaptable building materials available. And it is frequently regarded as the most cost-effective, strong, and long-lasting material. India's ready-mix concrete (RMC) industry is expanding at a rapid pace.This industry is exposed to risk in various concrete production processes, and it is critical to address these risks in order for the industry to gain credibility and customer confidence, as well as to have expected profit margins. Statistical quality control proves to be the most important tool in ensuring concrete of desired quality in order to gain effective productivity. An attempt is made in this work to identify the most critical failure mode in the production of concrete using a risk assessment model and the Failure Mode and Effective Analysis (FMEA) technique. The twenty-eight days' characteristics cube compressive strengths on Different grades of concrete, as well as extensive information regarding the production process and risks related with RMC production, were collected from operational RMC plants in and surrounding Pune region. The risks are quantified using the questionnaire survey with use of FMEA technique. With the Risk priority number, the mode of failure in a manufacturing process is identified, such as irregular grading, testing equipment problems, design variations, all of which were important factors to monitor. Corrective actions are investigated in this study in order to correct critical failures in the concrete production process.

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INTRODUCTION

Concrete is the most well-known material used in building. It does not exist as a standalone construction material because it is made up of a variety of other components such as cement, crushed stones, fine aggregate, and water. According to the Indian Standard Code of Practice (IS 4926), Ready Mixed Concrete is defined as concrete supplied at the job site or into the purchaser's vehicle in a plastic state that requires no further treatment before being deposited in the location where it will set and harden. Because it is more environmentally friendly, ready-mix concrete is chosen over site mix concrete. It is a solution to the clumsy and time-consuming production of concrete on building sites. It gives solutions to unique consumer problems, ensures customer satisfaction, and ensures consistent quality. It also removes the need to store materials needed in the production of concrete on job sites. RMC is already a mature industry in both Europe and the United States. The use of RMC is becoming increasingly popular in India. RMC is in high demand in both housing and infrastructure projects. This has had a significant impact on the RMC sector in India. RMC was first used in India in 1950 when dams like Bhakra Nangal and Koyna were being built. RMC began operations in Pune in 1991, but due to a variety of setbacks and issues, the plant did not last long and was shut down. In 1993, two RMC facilities were created in Mumbai to commercially sell RMC to projects that used it.

Any industrial management system must have risk management as a component.Production-line risk managementand delivery sites is expected of operation managers on RMC plants in European countries. Risk management at RMC plants in India is rarely given the attention it deserves. Risk management is an essential component of any industrial management system. In European countries, there is a greater knowledge and understanding of the importance of hazards and risk management strategies. Operations managers on RMC plants in European countries are likely to be involved in risk management at production and delivery sites. Risk management at the RMC plant is undervalued in India. According to information acquired from various RMC facilities in India, including Mumbai, Pune, and Bangalore, a regular and proper risk management technique is not applied in the Indian RMC business. The RMC industry in India will not achieve reliability or consumer confidence unless the risks are appropriately managed, and profit margins will suffer as a result. As a result, in the RMC business, there

is a requirement for a proper and efficient risk assessment technique.

The risk connected with the manufacture of concrete must be assessed on a regular basis, and the failure mechanism in the manufacturing process must be identified. In this paper, a study is conducted with the aid of statistical quality control programmes, which are an important tool for improving quality and productivity in a variety of projects. It is necessary to determine the most effective risk factors for quality control in the concrete manufacturing process and to provide a quality control model for ready-mix concrete (RMC).

LITERATURE REVIEW

In order to identify research needs in the field of concrete technology, researchers conducted a survey.a literature review was conducted by referring to various national and international journals. Each paper's synopsis is provided below.

Jyoti Trivedi, Chakradhar Iyunni(April 2015), “FMEA Risk Management Technique for Quality Control of RMC production”. As per this paper, Concrete is the most widely used construction material and is frequently regarded as the most cost-effective and long-lasting. Statistical quality control (SQC) application appears to be a useful tool for ensuring that the concrete produced is of the desired quality for effective quality control.and productivity improvement of infrastructure projects. In the production of Ready Mixed Concrete, FMEA is utilized to determine the principal failure mode (RMC)of various grades (M20, M25, M30). In the concrete manufacturing process, the Failure Mode Effect Analysis (FMEA) technique is utilised to identify risk factors for potential failure modesand to take corrective actions for improvement. The risk priority number indicates that the process failed due to irregular grading and material testing before to use in the mixing process,both of which were important factors to monitor for quality control. The study's goal is to use the failure mode effect analysis (FMEA) tool to identify effective risk factors for the concrete production process for quality control, and to propose a quality control model for ready-mix concrete (RMC). Engineers will be able to use this model to identify failures in on-process concrete production. The current study was limited to RMC plants in and around Ahmadabad, but more research could be done for other RMC plants in Gujarat. To ensure the quality of ready mix concrete and to improve RMC production, it can be continued by considering durability, density as a quality parameter, as well as compressive strength. The most effective tool for quality control of RMC production was found to be the quality control chart. The quality pattern predicted by the control chart from plants 3 and 2 was within the set limits. Plant-1's quality pattern, on the other hand, was exceeding the control limits. Plant-3 was thus subjected to the FMEA technique. For different grades of concrete from three different RMC plants, the Minitab software was used to generate Stewart control charts, and the 12th sample out of 39 samples crossed the upper control limit (UCL) –39.71 for M25 grade concrete for RMC-plant-1.

Vijay Baheti, D. Bhosale (2015), A Risk Assessment of Ready-Mix Concrete Production with the Goal of Proposing an Effective Model for Including Precautionary Measures.In the construction industry, concrete is the most widely used and widely accepted material. SQC is a useful instrument for ensuring that concrete meets the specified quality standards. In the construction industry, concrete is the most widely used and widely accepted material. SQC is a useful instrument for ensuring that concrete meets the specified quality standards. In India, the ready-mix concrete business is expanding at a rapid pace. Quality control charts are useful for monitoring the quality of RMC during the manufacturing process. The use of statistical quality control charts aids in the monitoring of concrete quality at the RMC plant during the manufacturing process. The rigorous identification and evaluation of primary failure modes, as well as the effective handling of the results, is critical to the success of ready-mix concrete manufacturing for various grades of concrete (M20, M25, M30, M40). The Failure Mode and Effective Analysis technique is used in this paper to determine the various failure modes in the RMC production process. The different aspects in the manufacturing process, such as mix design of various grades, material grading, process and testing equipment, will aid in showing risk priority number to monitor concrete quality control.

Hanumant P. Naiknavare, Swati D. Deshpande, Rajesh D. Padhye, (May 2016), “Model Chart of Quality Control Process for Ready Mixed Concrete Plants”. In order to ensure that the concrete is of the correct quality, quality control must be done throughout the entire process, from raw material reception to delivery at the site. As a result, when considering the use of Ready Mixed Concrete (RMC), it is critical to check that the RMC supplier has implemented a quality assurance procedure. Quality control is the process by which entities assess the quality of all variables involved in the production process. At the RMC factory, a quality control system should be implemented. The RMC Quality Assurance Program is broken into three parts: forward control, immediate control, and retrospective control. RMC manufacturers should have laboratory facilities to conduct the necessary tests to assure quality control at all stages of concrete production. This document offers a typical RMC plant model that must be implemented for quality control. The Company strictly regulates the quality of all ingredients through rigorous testing, employs stringent controls on process parameters, monitors critical qualities of fresh and hardened concrete, and employs the well-known Cusec technique to detect any changes in the properties of concrete. All of these efforts result in uniform and ensured concrete quality for clients. In contrast, in a typical site-mixed concrete, there is limited control

over the quality of input materials, batching of ingredients, and mixing of concrete, resulting in poor, non-uniform, and inconsistent concrete quality. Customers who use RMC are not required to acquire and store cement, aggregates, sand, water, and admixtures on-site. This not only reduces the amount of space required on building sites, but it also reduces the work required on the part of customers to buy various supplies, assure their correct storage, and periodically verify their quality standards.

Vipin V. Munot, Ashish P. Waghmare, (Dec 2014), "Compressive strength of Ready Mixed Concrete Using Soft Computing Techniques"Concrete compressive strength is a significant, and maybe the most important, mechanical property that is typically tested after a conventional curing period of 28 days. Ready Mix Concrete's 28-day compressive strengthwas evaluated utilising a feed forward back propagation neural network, Fuzzy Logic, and Adaptive Neuro Fuzzy Inference System (ANFIS) modelling in this study. Data for ready-mixed concretes (RMC) were gathered from the RMC batching plant. For various input scenarios, many models have been constructed. The compressive strength was modelled as a function of five variables, and the effects of each parameter on networks for Artificial Neural Network (ANN), Fuzzy Logic, and ANFIS models were investigated. Soft computing is a new discipline that combines fuzzy logic, neural computing, evolutionary computation, machine learning, and probabilistic reasoning. Soft computing approaches offer a wide range of applications due to their high learning capacity, cognitive ability, and tolerance for ambiguity and imprecision. Soft computing techniques, in general, mirror human reasoning more closely than traditional techniques, which are mostly based on conventional logical systems, such as sentential logic and predicate logic, or rely significantly on a computer's mathematical capabilities.

Goutam Dutta, Debasis Sarkar (May 2015), "Design and Applications of Risk adjusted Cumulative Sum (RACUSUM) for online strength monitoring of ready mixed concrete".

In this study, an effort was made to create and implement a new CUSUM technique for the RMC sector that addresses the risks involved and connected with RMC production. This method is known as Risk Adjusted CUSUM (RACUSUM). The cumulative sum (CUSUM) approach is a powerful statistical process control tool for monitoring the quality of ready-mixed concrete (RMC) during the manufacturing process. The term "online quality monitoring" refers to the RMC plant's continuous monitoring of concrete quality during the manufacturing process. The compressive strengths of various concrete classes during a 28-day period,as well as thorough information about the production process and the risks associated with RMC manufacture, were collected from active facilities in and around Ahmadabad and Delhi. A likelihood-based scoring approach is used to quantify the hazards. Finally, a risk adjusted CUSUM model is created by superimposing the predicted risks' weighted scores on the standard CUSUM plot. This model is a more useful and realistic tool for determining RMC strength.

METHODOLOGY OF WORK

Extensive literature survey is carried out at the starting of the research work for identifying various factors affecting the concrete production process at the RMC plant. The next step is to collect the data needed to identify production failures at RMC plant. After this, a questionnaire survey and in-person interviews will be used to collect data from RMC plants. Afterwards, the Failure Mode and Effects Analysis technique is to be used and remedial actions are to identified.

DATA ANALYSYS AND DISCUSSION

In this project, FMEA is used. The RMC plants with moderate to major effects on the operation of the plant's production process are chosen for the risk assessment technique based on the results of the questionnaire survey. Five plants around the pune region are considered for the study and severity is measured in quantitative manner.

CONCLUSION

The quality control chart proved to be the most effective tool for RMC production quality control. In this study, FMEA was used. The results show that the risk priority number has a high value of the process factor and is critical, which needs to be corrected right away for process improvement. To improve the quality of RMC production, material should be graded properly, including sieve analysis, and material should be tested before being used in mix design.

REFERENCES

1. Ali Rosit, SubandiyahAzis, Bambang Wedyatadji, "Analysis of Investment Feasibility of Batching PlantDevelopment", International Journal of Scientific & Technology Research, 5(12), DECEMBER 2017.

2. L.R. Manjunatha, Dr.Sandhya and R. Anvekar, "History of ready mix concrete industry in India", ABBS Management Business and Entrepreneurship Review, 6 (1), October 2014 - March 2015.

3. Al-Araidaha, A. Momania, "Costing of the Production and Delivery of Ready-Mix-Concrete "Jordan Journal of Mechanical and Industrial Engineering, 6(2), April 2012.

4. IS 4926-2003, Standard on Ready Mixed Concrete – Code of Practice, BIS, New Delhi.

5. A.K., Jain, *Ready Mixed Concrete Present and Future Growth Prospects*, Ultra Tech Cement Ltd., India.

6. Goutam Dutta and Debasis Sarkar, "Design and Applications of Risk Adjusted Cumulative Sum (RACUSUM) for online strength monitoring of Ready Mixed Concrete", Indian institute of technology research and publications, W.P. No. 2008-08-01 August 2008.
7. Mohamed A 2, "Use of basic quality tools for improvement of the construction industry", International journal of civil and environmental engineering, 28-35.
8. Gupta D. Y, "A revolution in production of concrete", NBMC, May 2008.
9. Agnieszka Dziadosz, Mariusz Rejment, "Risk analysis in construction projects- chosen methods", Procedia engineering 122,258-265, July 2015.
10. MehrzadEbrahemzadih, G.H.Halvani, Behzad Shahmoradi, Omid Giahil, "Assessment and Risk Management of potential hazards by failure mode and effect Analysis (FMEA) method in Yazd Steel Complex" open Journal of safety science and Technology, 2014,4,127-135,September 2014.
11. Jyoti Trivedi and Dr. Chakradhar Iyunni, "FMEA risk management Technique for quality control of RMC production", International journal of advance engineering and research Development (IJAERD), e-ISSN: 2348-4470, print-ISSN:2348-6406, May 2015.
12. Gunjunjoshi, Himanshu Joshi, "FMEA and Alternatives v/s Enhanced Risk Assessment Mechanism", International Journal of computer Applications, 0975-8887, volume 93, No 14, May 2014.
13. Hanumant P. Naiknavare, Swati D. Deshpande, Rajesh D. Padhye, (May 2016), "Model Chart of Quality Control Process for Ready Mixed Concrete Plants", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 50-54.
14. Vipin V. Munot, Ashish P. Waghmare, (Dec 2014), "Compressive strength of Ready Mixed Concrete Using Soft Computing Techniques", International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622, Vol. 4, Issue 12(Part 3), December 2014, pp.12-14.
15. M. B. Chougule, N. P. Sonaje, (July 2014), "Anova Method and T test method as statistical tools for monitoring performance of pilot plant water used in textile wet processing", International Journal of Application or Innovation in Engineering & Management (IJAIEM), ISSN: 2319-4847, Volume 3, Issue 7, July 2014
16. E.Poovaragavan, K.ChandraSekar (April 2016), "Continuous Process Improvement in Ready mix Concrete Plants", International Journal of Scientific & Engineering Research, ISSN : 2229-5518, Volume 7, Issue 4, April-2016.

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