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A study on factors involved in equipment quality and management in ready mix concrete

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***Abstract*— In development ventures, quality, time and cost are the principle factor for its prosperity. Accomplishing great quality in scheduled time and planned cost is one of the harder errand. The utilization of ready mix concrete for the development activities will diminish the time with a little variation in cost. The part of ready mix concrete in huge ventures, high innovation structures, dams, and modern structures and so on keeps on developing quickly. Conforming to the laws ought to be on accomplishing ideal equipment quality and transportation in ready mix concrete. Thus, equipment quality management integrates and continuously interacts with human, technical, financial, and production system in order to achieve efficiency and quality in transportation. This task includes an investigation on factors associated with equipment quality administration and quality transportation which are impacting in ready mix concrete. It clarifies quickly about the question, nature, extent of study, devices utilized for consider, need of study and gathering information from settled ready mix concrete plants in India. This proposal depicts equipment arranging, determination, appropriateness, support administration, wellbeing administration, save part administration, user training, nature of materials, mix design, hardware condition, geography and climate conditions. The major prudent steps for support of equipment have considered for dealing with the upkeep capacity of equipment in the ready mix concrete plants.**

Keywords— ***Quality Management, Equipment Management, Transportation, Production System.***

I. INTRODUCTION

The developing construction industry is familiarized conventionally in working with labours. The abundant labours, absence of money speculation Furthermore Exceedingly divided way of the development division. The liberalization for Indian economy began starting with 1989 What's more cleared those manner for extensive scale speculations to infrastructure, modern Also agribusiness parts. Those mega ventures obliged pace What's more calibre from claiming development perfect for worldwide principles. It prompted fractional equipmentation of development industry Also approach from claiming prepared ready-mix concrete on India may be those Conclusion from claiming this improvement. Those ready mixed concrete for India once business support began for 1994 What's more need attained regarding 2% transformation starting with the site-mixed cement Eventually started at 2001. It may be gladdening that those acceptability from claiming primed ready mixed concrete is expanding however in a moderate pace.

Supplies personal satisfaction management What's more personal satisfaction transportation need aid paramount criteria's which chooses the upgrade Also best possible use for primed ready mixed concrete over constructional business. In spite of the fact that a calibre oversaw economy Furthermore transportation may be required for specialized foul What's more expedient development What's more toward the same time for prudent What's more auspicious fruition from claiming one task.

II. EQUIPMENT QUALITY MANAGEMENT IN READY MIX CONCRETE PLANT

In request to guarantee that cement processed may be about fancied quality, it may be fundamental that calibre control is exercised in the least the phases right starting with receipt about crude material will conveyance from claiming cement at site. Thus, same time arranging to utilize primed blended Concrete, it ought to make guaranteed that producer for RMC need received calibre certification programme. Personal satisfaction control is a transform by which substances survey those nature for every one variables included over processing. Nature control framework ought a chance to be formed at RMC plant. Calibre certification Programme to RMC camwood make comprehensively

isolated under three segments i.e. Ahead control, prompt control and review control.

III. TRANSIT MIXED READY-MIX VS VOLUMETRIC MIXED READY MIX

A unified cement batching plant might serve a totally territory. Site-mix trucks camwood serve a significantly bigger range including remote areas that standard trucks can't.

• Those clump plants would have found in zones zoned to mechanical use, same time those conveyance trucks might administration private regions alternately internal urban areas. Site-mix trucks have the same competencies.

• Volumetric trucks frequently all the have an easier water request Throughout those batching methodology. This will handle a cement that could make essentially stronger in compressive quality contrasted with those incorporated clump plant to those same blend outline utilizing those ASTM C109 test technique.

IV. OBJECTIVES

Construction is a dynamic, competitive, ever changing and challenging industry. This research was aimed at identifying the major influencing factors involved in equipment quality management and transportation in ready-mix concrete plant. To achieve the aims, objectives has been identified as following:

- To study on factors involved in equipment quality in management and transportation in ready-mix concrete.

V. SCOPE OF WORK

The scope of the research is mainly focused on literature review and a questionnaire survey. The questionnaire survey would be designed based on the influencing factors involved in equipment quality management and transportation in ready-mix concrete.

VI. TOOLS FOR STUDY

A questionnaire shall be prepared for collecting data from Site Engineers, Drivers, Owners and Workers of ready-mix concrete plant.

VII. NEED FOR STUDY

- To identify the influencing factors involved in equipment quality management and transportation in ready-mix concrete plant.
- To improve the factors and bring suggestion to improve the equipment quality and quality transportation.

VIII. LITERATURE REVIEW

Mohammed Amir khan et al (2017) had founded that in today's business world the production and transportation is one of the most challenging aspects to ensure timely delivery of materials to customers, so a systematic method named failure mode effects and criticality analysis is used to improve the planning and delivery of RMC. In this method different mitigation strategies were suggested based on our findings.

Sudeshna Wawhal et al (2017) had found out that placing is a major on-going operation on construction projects in many countries. Evaluating the productivity of a ready mix concrete batch plant is one of the most challenging tasks of a plant manager and engineer, since it involves lot of uncertainties, thus risks. Delivering ready-mixed concrete (RMC) efficiently to construction sites is a practical concern and one of the most challenging tasks for RMC batch managers.

Faaique Mohammed et al (2016) had studied a negative impact on use of RMC in major constructional projects, it is important to address these risks, so that industry shall gain confidence, and shall have expect profit margins. The risk causes can be classified as internal as well as external risks. These two risks cannot be avoided completely, so suitable strategies can be adopted to manage these risks. This shall help in achieving the objectives of RMC business in terms of production and supply cost.

Melba Alias et al (2015) have studied the factors affecting the performance of constructional projects and have studied them such as material cost, incorrect planning, poor financial control. The major factors affecting the performance of projects were identified as increase in material cost, inadequate supply of labor, incorrect planning, wrong method of estimation, and poor control on site. In this analysis questionnaire is prepared, and analysis is done.

Shobha Rani Nadupuru et al (2015) states that the concrete is one of the most widely used construction materials in the world. However, the production of Portland cement, an essential constituent of concrete, leads to the release of significant amount of CO2, a greenhouse gas; one ton of Portland cement clinker production is said to creates approximately one ton of CO2 and other greenhouse gases. Environmental issues are playing an important role in the sustainable development of the cement and concrete industry.

Nuntana et al (2015) proposed a systematic model by using bee algorithm to optimize ready mixed concrete truck scheduling problem from a single plant to multiple sized receivers in a large search space using uncertain factors of bee algorithm compared to genetic algorithm. The objective is to minimize the total waiting durations of RMC trucks.

Slawomir Biruk (2015) had studied that the ready mixed concrete is the primary material required for buildings and public infrastructure work. RMC is produced to meet customer's demands and its deliveries must conform to construction site and technological operating constraints the material cannot be prepared in advance and stored. Concrete production scheduling and truck dispatching is mainly handled manually by experienced RMC batching plants staff. The paper presents simulation model which can be used to access alternative strategies for truck allocation and production planning in stochastic environment. The model's operation is illustrated by a notional case the model prompted solutions of improved transshipment efficiency and

reduced plant operating cost under assumed operating constraints.

Rahul Mahajan, Reuben Buthello (2015) had found out that concrete had a direct effect on the strength and durability of a structure, as till now concrete has not a perfect storage area, it affects quality of materials, to make it strong and durable, testing should be done. An RMC is a ready to use material with predetermined mixture of cement, sand, aggregates and water. RMC is a type of concrete manufactured in a factory according to the specifications of customer, at a centrally located batching plant.

Jyoti and et al (2015) had assessed for effective quality and productivity improvement of infrastructure projects, statistical quality control application proves to be an important tool which can be used in order to ensure that concrete produced is of desired quality. In order to identify the major failure mode in production of Ready Mixed Concrete of different grades (M20, M25, M30) FMEA is used. The Failure Mode Effect Analysis technique is to identify risk factors for the potential failure mode in the production process of concrete and to take the appropriate corrective actions for improvement. The risk priority number results indicate process failure in terms of irregular grading process, material testing prior use in mixing process which were the important factor to be monitored for quality control.

Ashish Makwana (2013) examined one of the most useful method for selecting project that is becoming more important is analytic hierarchy process. It is a tool to help with technical managerial problems. Ready mix concrete industry is continuously growing all over the world and India is not an exception to it. The pace of mechanization in the past was very slow due to the availability of cheap and abundant labor, lack of capital investment and the highly fragmented nature of the construction sector. At the present, the cost differential between ready mixed concrete and site mixed concrete is proving a major constraint in its growth. This problem will be resolved with the increasing awareness about the advantages of ready mix concrete by end consumers.

Walke et al (2012) had found that RMC industry is exposed to multidimensional risks from all directions. These risks must be addressed properly so that RMC industry shall gain credibility, confidence of the customers and shall have expected profit margins. The risk sources pertaining to RMC industry are internal as well as external. This paper proposes a simple yet effective procedure for qualitative analysis of risks having internal and external sources related to ready mix concrete plants. Once the risks are qualitatively analyzed, the appropriate response strategies can be adopted to treat these risks.

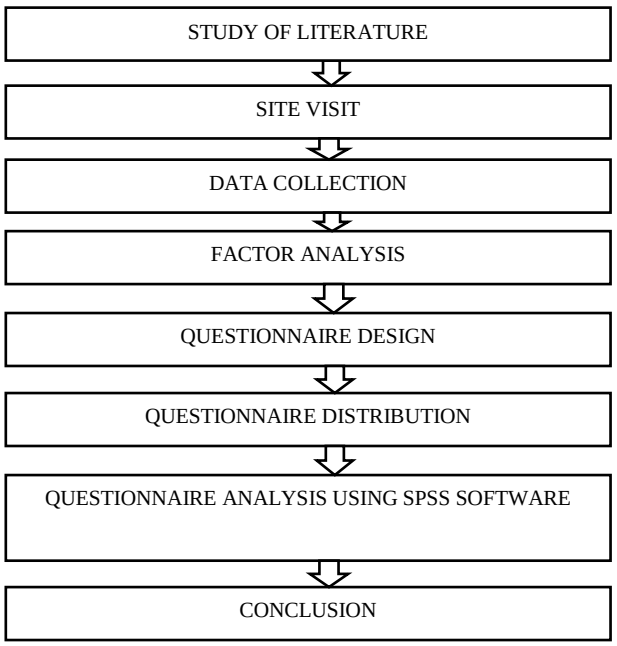
Al-Araidah et al (2012) presented a model for costing production and transportation of ready-mix-concrete based on type of the mix and customer site information. The on-floor cost of the mix is based on the type of concrete and is estimated using activity-based costing. The cost of transporting RMC to customer's site is obtained as a function of traveling distance, traffic factor, and demand. Volume-based discounts, penalty for late delivery, and cost of mix spoilage are considered. Moreover, the paper provides a cost ground for improving the RMC production system using activity-based management to improve the financial performance of the company. The proposed model is applied at a local RMC company where obtained results show differences between the costing system of the company and that using the proposed model.

Debasis Sarkar et al (2010) had made an attempt to design and apply a new cumulative sum procedure for RMC industry which takes care of risks involved in and associated with the production of concrete. The cumulative sum procedure is an effective statistical process control tool that can be used to monitor the quality of ready mixed concrete during its production process. A risk adjusted cumulative sum model was developed by imposing the weighted score of the estimated risks on the conventional cumulative sum plot. This model is a more effective and realistic tool for monitoring the strength of ready mixed concrete.

Ming Lu et al (2009) had investigated the feasibility of directly sourcing autonomous operations data from constructional vehicle positioning system, so as to enable productivity analysis in RMC production and delivery. It describes the technical design and system components of an automated data collection solution to accumulating concrete delivery operation data, which is extended from a construction vehicle positioning system tailored for high dense urban areas.

Abdul Rahman et al (1999) defines that a managing quality scheme to be adopted for improved quality, as RMC is not regulated or monitored and there are no local standard specifications. This has contributed to a general disregard for the basics of good quality as well as cheating by some ready mix concrete producers. To rectify the situation and to improve the performance of RMC producers, systematic external monitoring and inspection is required.

IX. METHODOLOGY



These factors are collected from the literatures which contains relevant investigations to the project carried out in this review. The factors are

- Equipment selection
- Equipment suitability
- Maintenance management
- Safety management
- Spare part management
- User training
- Quality of materials
- Mix design
- Dispatch time
- Equipment condition
- Nature of transit truck driver
- Topography and weather condition

X. DESCRIPTIVE STATISTICS

In this survey totally 96 questionnaires were distributed to the targeted respondent in order to identify the factors involved in equipment quality and management in ready mix concrete. In those 74 responses has been received. The responses rate of this survey was 77%. The response rate will be explained in the below table and chart by using SPSS software to determine the most influencing factor.

Table.1 Response rate

DESCRIPTION	SURVEY COLLECTED
Questionnaire Distributed	96
Response Collected	74
Male Respondents	68
Female Respondents	6
Respondent Rate	77%

Totally 96 questionnaires were distributed to various construction site engineers through Google forms and manual survey also conducted. In this 74 site engineers responses has been received. Among this 74 response 68 site engineers are comes under Male site engineers and 6 site engineers are comes under female site engineers because in construction sectors there is very low percentage of women's worked as a site engineer in India.

XI. RELIABILITY TEST

In this study, the method utilized for evaluating is Cronbach's reliability. To establish the internal consistency, Cronbach's Alpha value was used to access the reliability of the scale considering the minimum value of 0.7 (cronbach 1970, Nunnally 1978) the calculator value was 0.687 which exceed the threshold limit.

Table.3 Reliability test

Cronbach's Alpha	No. of Items
0.687	33

XII. KMO AND BARTLETT'S TEST

Prior to the extraction of factors, KMO and Bartlett's test has to be performed

Table.4 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.709
Bartlett's Test of Sphericity	Approx. Chi-Square	910.400
	df	435
	Sig.	.000

Factor analysis was administered to identify the important factor in equipment quality and management in ready mix concrete and to establish here suitability for further analysis. The KMO measure of sampling adequacy was 0.709 confined that they was significant correlation among the variable to apply the factor analysis.

XIII. CONCLUSION

Based on the various literature reviews the factors were identified for the equipment quality and management in ready mix concrete in the construction industries. This thesis explores the factor influenced in ready mix concrete in India, also the equipment quality management for best operation and quality transportation in ready mix concrete. The equipment quality management and quality transportation are well studied and finally the influencing factors involved in equipment quality management and quality transportation in ready mix concrete is find out. The methodological approach used in this study is a quantitative descriptive design using question in person of questionnaire survey. Finding from the survey of the result, indicates that the managing the standards of Equipment quality and quality transportation in RMC in the construction industry.

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