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Implementation of Construction Management Approach for Improving the Productivity of RMC Plants

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Abstract - Our has been traditionally labor oriented. The pace of mechanization in the past has been very slow due to the availability of cheap labor in abundance, lack of capital investment and the highly fragmented nature of the construction industry. The degree of mechanization is still around 25%-30% while it is well above 70% in most of the developed countries The liberalization of Indian economy from 1991 onwards paved the way for large scale investments in infrastructure, industrial, housing and agriculture sectors. The new age constructions required speed and superior quality to obtain profitable life cycle cost of the projects. The emerging scenario helped to increase the pace of mechanization and facilitated the establishment of RMC plants on commercial scale to synchronies with the overall development strategy. RMC in India on commercial scale started in 1993 at Pune with only one plant. It has achieved nearly 15% share of the total concrete produced in the country. In some major cities, like Bangalore, Hyderabad, Mumbai and Chennai the share of RMC has reached as high as 50% to 60%. The growth prospects of RMC in India are enormous, provided requisite support is provided by the regulatory authorities, consumers and decision makers during its formative years. In this project the critical factor causing improving productivity will indentify.

Keywords: RMC Plant, Critical factor, Productivity

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INTRODUCTION

Architect Jurgen Heinrich Magens is credited with introducing the concept of ready-mix concrete (RMC) and receiving the RMC patent in Germany in 1903. It was not until 1907 that he realized vibrating newly mixed concrete while it was being transported could extend its usable life. Consequently, this led to the creation of off-site concrete.

Baltimore, Maryland, accomplished the first concrete mixing and delivery off-site to a building site in 1913, shortly before the start of World War I. The burgeoning automobile industry contributed to the growth of the RMC sector by making customized transport vehicles more readily available. In the United States, the first transit mixer concept originated in 1926 as well. The United Kingdom erected its first RMC plant in 1939, and the country released its first RMC standards in 1933.

The United States had a significant increase in RMC production between 1950 and 1980, reaching a peak supply of 31 million cubic meters in 1974. However, between 1974 and 1980, RMC supplies were 25 million cubic meters annually on average. By 1990, there were 3700 RMC makers in the United States, and these companies used 75% of the cement used in the building sector. RMC plants in Japan were using up about 70% of the world's cement production in 1990. RMC factories in Malaysia used about sixteen percent of all the cement that was consumed in 1990. RMC factories utilise 43 per cent of the cement consumed in the United Kingdom.

Rmc in india

RMC was originally utilized in India in 1950 at the construction sites of dams like as Bhakra Nangal and Koyna. Concrete is moved during construction either mechanically or manually using ropeways,

buckets, and conveyor systems. RMC located in Pune in 1991. However, this facility did not last long and was closed as a result of numerous pit falls and issues. In 1993, two RMC plants were established in Mumbai in a matter of months in order to supply RMC to projects in which it was placed on a commercial basis. One factory was established by Unitech Construction at the Hiranandani Complex, while another plant was established by Associated Cement Companies at the Bharat Diamond Bourse Commercial Complex.

Later on, these plants were permitted to sell RMC to further projects. Consequently, RMC was effectively founded in India sometime after 1994.Outside of India, RMC makers quickly developed an interest in the Indian market, leading two well-known producers—Fletcher Challenge Ltd. of New Zealand and RMC Ready Mix of the UK—to establish themselves in the Indian soil.

SCOPE OF RMC IN INDIA: The ready-mix concrete sector is growing rapidly and taking off on a national scale in the nation, despite a slight delay. Over time, a number of cutting-edge cement and building enterprises as well as technological organizations have contributed to this progress. The "India Cement Industry Restructuring Project" of the World Bank, which produced a technical study report in 1996 on the growth of the bulk cement market in India, turned out to be a beneficial step in the modernization of the country's cement distribution system, including the establishment of ready-mix concrete plants and a gradual shift. Transitioning from the conventional bag-based mode of transportation to bulk transportation by establishing ready-mixed concrete factories throughout several regions. The action plan's advice served as helpful direction for growing the bulk cement industry, opening the door for the construction of ready-mix concrete facilities in India. The Cement Manufacturers Association reports that RMC is becoming more and more advised for all significant public construction projects, including flyovers and highways. Even modest house builders in locations like Bangalore and Chennai have begun to express a clear preference for RMC over cement. Experts state that RMC in India has a great deal of room to expand and improve. By 2015, it can develop to use 40–45% of cement by installing RMC plants in different consumption centers.

The RMC business in India must adjust its own procedures to match those in other developed nations where it has been running profitably in order for the industry to thrive healthily. The European Ready Mixed Concrete Organization (ERMCO) has established the general goals that must be met in order to design, manage, and operate RMCs; these goals are indistinguishable from those of planning and carrying out concrete building projects. RMC's marketing strategy should no longer solely focus on strength grades, but rather incorporate a combination of strength and durability classifications in accordance with Concrete Codes. This will enhance RMC's marketability with respect to project needs. Management must consider the appropriate environmental, safety, and health laws for the workforce.

Significance: The extensive spread of infrastructure development throughout India is a result of the substantial quantity of concrete needed. However, labor availability and concrete storage space availability are the main obstacles to meeting this need. There's a lack of room for casting in site construction in metro areas, and labor neglect frequently results in subpar concrete quality.This explains why RMC concrete is used extensively throughout the nation.However, these plants encounter numerous issues, which negatively impact their functionality. Effective construction management is needed to overcome this.

LITERATURE REVIEW

Dr. S. K. Dave, This essay outlines the Ready Mix Concrete (RMC) Initiative, its premise, the difficulties encountered, and the opportunities that exist in India. These days, RMC concrete is employed almost exclusively in the construction sector when tasks need to be finished quickly and efficiently.
The majority of RMC plants are found in seven major Indian cities, and they account for between 30% and 60% of the city's total concrete consumption. Approximately 5% of all concrete used in India comes from RMC. The increased ubiquity of RMC in urban areas can be attributed to the space constraints that limit construction as well as the need to reduce environmental contamination. This is despite the fact that it costs between 12% and 20% more than site-mixed concrete.

M. Takeyama, November 1949 saw the Tokyo Concrete Kogyo Co.'s Narihirabashi Plant produce the nation's first batch of ready-mixed concrete (RMC). These days, all it takes to obtain RMC is a phone call to any of the RMC plants located around the nation. However, in recent years, the number of new RMC facilities has increased, and older plants have expanded as well, resulting in an excessive increase in supply capacity relative to demand and a notable decline in operation rate.

Arjita Biswas. The environmental impact of disposing of sludge water is rising as the demand for ready-mixed concrete rises. For a single concrete truck, 700–1300 liters of wash water are needed each working day.

Urban sewers are not authorized to receive the discharge of untreated sludge water due to the excessive alkalinity and significant amount of suspended materials. Generally, two series-connected sedimentation basins are used in the sludge water disposal process. Remaining concrete and truck and concrete plant wash water are collected in the first basin. To clean each transit combination and get rid of the sludge from the blades, wall, and floor of the transit mixer, between 120–200 liters of water are needed.

"Prof.Jyoti Trivedi, In European nations, there is a cognizance and comprehension of the significance of hazards and the strategies for managing them. Risk management at the production plant and distribution sites is probably a responsibility of operation managers on RMC plants in the European Union.
At the RMC facility in India, risk management is not given significant weight. Data collected from various RMC plants in India, including those in Mumbai, Navi Mumbai, Pune, Bangalore, and Noida, indicates that the Indian RMC industry does not follow a consistent and appropriate risk management methodology. In addition to losing consumers' trust and dependability, the RMC sector in India will see a decline in profit margins if risks are not well managed.

OBJECTIVES

- To study of difficulties facing while operating the RMC plants in section wise by circulating the questionnaires on different RMC plants.
- To prepare the detailed remedial plan for each section to overcome the difficulties. Also prepare the checklist for each section for smooth functionality of RMC plant.
- To indentify the check list parameter for smooth functioning of RMC plant

METHODOLOGY

Step no 1: Divide the functions of RMC plant in different sections then Prepare the detailed questionnaires for each section and circulated on different RMC plants to understand difficulties facing while operating the RMC plants

Step no 2: Prepare the detailed remedial plan for each section to overcome the difficulties. Also prepare the checklist for each section for smooth functionality of RMC plant.

Step no 3: To study of cost benefit analysis after implementing the remedial plan by taking suitable case study.

DATA COLLECTION

1 Construction Management Aspect in RMC Plant

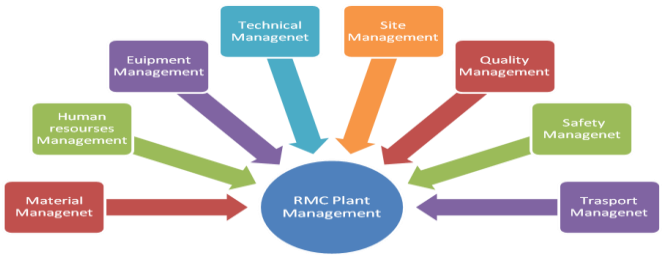

Figure 1: RMC Plant Management

Need Of Effective Rmc Plant Management

- Concrete demand by customer in developing area.
- Cost control on aggregate for size, shape and grading. Not exercised on a site
- Blocking of roads/approaches.
- Dust pollution.
- Manual operation.
- Wastage materials.
- Quality assurance.
- Restricted space.
- Speed on construction site.
- Economy management.

Method of Data Collection

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Detailed Questionaries'

General Information :

1) Name of Plant Manufacturer
2) Type of Plant
3) Plant's Rated capacity, m3/hour
4) Type of Mixer* Rotating-drum type
5) Mixer batch size, m3
6) Storage Capacity
   - Cement, tonnes-
   - Fly ash, tonnes-
   - Slag, tonnes-
   - Other cementitous material, tonnes-
7) Coarse aggregates, tonnes or m3
   - 10-mm-

- 20-mm-
- 40-mm-

8) Fine aggregates, tonnes or m3
   - River sand
   - Manufactured sand
   - Crusher fines, tonnes or m3

9) Water, litres-
   - Chemical admixtures, litres
   - Plasticiser
   - Superplasticiser
   - Retarder

10) Brief description of recycling facility, if any-

11) Number of trucks with rated capacities-

Section Wise Questions

Sr. No.	Questions	1	2	3	4	5
01	Are silos for cement feeding area totally waterproof?					
02	Is there dust free flow of cement in to silos?					
03	Is there dust free flow from silos to mixer?					
04	Is there separate storage system for different types of SCM (fly ash, ggbs, etc)?					
05	Is there any system to identify storage and disposal of the rejected materials?					
06	Are there separate provision for different size and type of aggregates?					
07	Are there sign boards to indicate different size of aggregate?					
08	Are there precautions taken to prevent mixing of aggregates with dust, mud, soil?					
09	Are there any precaution to prevent contamination of different sizes and types of aggregates with each other?					
10	Are there any temperature control technique to control temperature of aggregate?					
11	Are any provisions for control of temperature of aggregate to be effectively mentioned and working?					
12	Is there any timely storage of aggregates					
13	Is these adequate storage of water to satisfy the day to day needs?					
14	Has the water storage facility been protected to minimize the risk of contamination of deleterious substances?					
15	Are records available providing evidence that control on the temperature of water is exercise when producing temperature control concrete?					
16	When recycled water is being used are systems in place and in operation to accurately measured the use of water and to ensure the performance of produce concrete (mainly strength and workability) is not adversely affected by its use?					
17	Does the process of weighing and discharge in to mixer happen without loss of materials?					
18	Is the central mixer maintain in an efficient and clean condition?					
19	Are the mixer drum and mixer blades clean from appreciable accumulation of harden concrete					
20	Is the mixer capable of producing uniform concrete within the time specified in the operational manual of manufacture?					
21	Does the organization established and implement procedure for maintenance of plant, equipment and facilities?					
22	Does organization replace the mixer blades and arms immediately if it is found at there is excessive wear of the same?					
23	Are the truck mixer maintain in an efficient and clean condition?					
24	Are the blades free of excessive wear?					
25	Are chemical admixture stored properly to avoid contamination and degradation on exposure to direct sunlight?					
26	Is there provision for providing (manually or automatically) agitation to liquid admixture that are not stable solution?					
27	Storage and handeling system adequately protect from freezing of admixture during winter season?					
28	Are the adequate precautions taken to use the admixture before expiry date?					
29	Is a systematic record to scale check and calibration of waiting and system available?					
30	Are hoppers self cleaning and fitted with means to assure complete discharge?					
31	Are vibrators or other equipments installed in such a way that not to affect accuracy of weighing?					
32	Does the company keep a dated record of source of all material in the format?					
33	If there is change in the source of material is it traceable from the list in table?					
34	Does company carry out the test on aggregate in its specified frequencies?					
35	Is there any lack of human resource management?					
36	Are there any affects on production of concrete because of unskilled labour working at the RMC plant?					
37	Is there any affect on RMC due to communication gap between oraganisation and contractor?					

DATA ANALYSIS

Data Analysis Method

RELATIVE IMPORTANCE INDEX (RII)

The relative importance of the various sources of construction waste were ranked using the Relative Importance Index (RII) ranking technique. It is feasible to determine the most important causes of construction waste elements in the construction sector based on the ranking given to each cause of waste. In numerous fields, the RII has been utilized to assess an item's relative worth to others. The relative relevance index for each cause was calculated using the following equation.

The five-point scale ranging from l (very low) to 5 (Very high) was adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \frac{\Sigma W}{A \times N}$$

Where:

W = Weight age given to each factor (ranging from 1 to 5)

A is 5 (the highest weight) and

N is the Total number of Respondents

The RII value had a range from 0 to 1 (0 not inclusive), the higher the value of RII indicates that the more important

Scale of questionnaires

Following scale taken for analysis of questionnaires on scale 1to 5 ratings were given

1 .Very highly affects

2. Highly affects

3. Moderately affects

4. Less affects

5. Very less affects

Group 1:

Results: From this data analysis the critical factor is Selection of site for RMC plant

Remedial Measure: In areas undergoing development and construction, the choice of location for an RMC facility is crucial. Multiple factors need to be taken into account while choosing a location for the RMC plant. It is also necessary to take into account how the RMC plant will affect the environment.Even though the optimum site parameters for an RMC plant exist, we also take into account the conditions that are both affordable and appropriate for the plant.A large region can be served by a centralized concrete batching facility.The delivery trucks can service inner cities or residential areas even though the plants are situated in regions designated for industrial use.

The material's local availability should be close to the RMC plant's intended location.The site should be chosen far from residential areas in order to lessen the effects of dust and noise pollution on the surrounding residential areas.In the intended site location, transportation facilities for the RMC plant should be taken into account.The RMC plant should be situated in a way that balances residential and construction zones, and it is operational around-the-clock when needed.The ideal site placement should be found in these kinds of places where output is expected to be at its highest.It should be simple to get skilled labor close to the intended RMC plant location.RMC plant waste should be conveniently disposed of without harming the surroundings of the intended site location.

Group no 2

From this group 2 Lack of Resource is the critical factor

Remedial Measure

Cement, aggregates, fly ash, ggbs, chemical admixture, water, and other resources are needed for an RMC plant to function effectively at the intended site location. In order to operate the RMC plant in an efficient manner, these materials need also be reasonably priced and easily accessible in the vicinity of the facility. Process management is the planning, arranging, and regulating of the integrated movement of materials into, through, and out of an organization. The lifeblood and heart of the manufacturing system in the RMC plant should be regarded as any resource used, whether directly or indirectly, in the production of a product. Consistent delivery of various resources to the RMC plant is necessary to ensure that there are no delays in subsequent processes in the further processes in RMC plantmanufacturing the product

Group no 3

Result: From this group 3 :Lack of Supervision is the critical factor

Remedial Measure Under the RMC plant, supervision is a required procedure in the manufacturing unit. In the RMC facility, supervision is required for every action. The operation of the RMC plant during the manufacture of concrete depends heavily on supervision. Another crucial aspect of labor work is supervision. In the RMC plant, supervision is responsible for planning and organizing tasks related to concrete manufacturing. The act of supervising someone or something is called supervision. A supervisor is someone who oversees others.Supervising employees' work is known as supervision.

The individual providing supervision may not have a formal title or may go by the title manager or supervisor, with the latter having more authority.In general, supervision consists of knowledge-sharing, task organization assistance, motivation-boosting, and activity and outcome monitoring; the relative importance of each component varies depending on the situation.

Group no 4

Result: From this group : Waterproof Cement Silos is critical factor

Remedial Measure The key component of an economically viable RMC plant's operation is waterproof cement silos. In the RMC plant, cement is the substance used to make concrete. Additionally, the most expensive component used in the RMC plant to make concrete is cement. The most crucial element is the RMC plant's efficient utilization of cement in the production of concrete. Cement must be used economically and efficiently in RMC plants, which requires cement silos protected from moisture intrusions. Waterproof cement silos are essential for the cement pumping process, which is the most critical aspect of the RMC plant's operation.

Group no 5

Result: From this group : Quality of water is critical factor

Remedial Measure When it comes to the preparation of concrete, water quality is crucial. Water impurities can negatively impact the strength and longevity of concrete, as well as interfere with the cement's ability to set. Concrete's setting, hardening, and strength development may be

impacted by the chemical components found in water, which may actively engage in chemical processes.Health concerns pertaining to the proper management of such water also need to be taken into account.

Water suitability can be determined by looking up previous service records or by testing it against performance standards using tests like compressive strength and durability and setting times. There are restrictions on the amount of water that can be mixed with some components, like total alkalis and chloride sulfate. Reclaimed water and saline water handling safety is further guaranteed by biological treatment and pathogen reductions.

CONCLUSION

A contemporary method of producing concrete in big quantities away from the placement site is called ready-mix concrete. It is especially helpful in urban locations where there is a strong demand for concrete and construction sites are surrounded by crowded areas that make on-site mixing impractical. The production of RMC involves lower labor and supervision expenses and produces concrete of superior quality. Large-scale industrial and residential projects when time is of the essence can benefit from it.Because RMC activities are completely automated and electronically regulated, there is a lower chance of error in any given activity.

It is also environmentally friendly and brings down pollution due to dust at construction can also be expedited by employing the RMC. The current study produced a framework that helps the director of the RMC plant sort out the issue at hand.We conducted a thorough study of the RMC plant and created questionnaires addressing common issues encountered by different RMC plants. We then sent these questionnaires to various staff members at the RMC plant. By posing this query, we are able to examine several parameters and identify the important ones, such as equipment, resource management, supervision, and site selection.

The RMC plant's site location, material handling, material management, and order systems are crucial factors in achieving large profit through productivity improvements.In order to boost the profit margin and customer happiness, this parameter must be effectively controlled.Finally, we can say that in order to operate the RMC plant, a checklist is needed at every stage. Since all of these tasks fall under the purview of construction management, implementing construction management strategies is essential to raising the plant's productivity.

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