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

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Abstract - Our has historically been labor-oriented. Due to the abundance of cheap labour, lack of capital investment, and the highly fragmented character of the construction sector, mechanisation has historically progressed very slowly. Even while most industrialised nations have mechanisation levels far above 70%, it is still only between 25% and 30% in the United States. Large-scale investments were made possible by India's economy's liberalisation beginning in 1991 in the areas of infrastructure, industry, housing, and agriculture. For the new-age buildings to have a viable life cycle cost, they needed to be completed quickly and to a high standard. In order to align with the overall development goal, the new scenario made it easier to create RMC facilities on a commercial scale and sped up the pace of mechanisation. RMC began operating on a large scale in India in 1993 at a single factory near Pune. It now accounts for around 15% of all concrete produced in the nation. RMC has a stake of up to 50% to 60% in several major cities including Bangalore, Hyderabad, Mumbai, and Chennai. If the necessary assistance is given by the regulatory bodies, customers, and decision-makers during its early years, RMC in India has immense development opportunities. 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 initially proposed the concept of ready-mix concrete (RMC), and in 1903, he received a patent for the invention in Germany. He found in 1907 that shaking freshly-poured concrete while transporting it might extend the time for transportation in addition to cooling it. Thus, an off-site concrete was created as a result of this.

In Baltimore, Maryland, in 1913, soon before the First World War, the first batch of concrete that was mixed off-site and brought to a building site was successfully completed. The expansion of the RMC business was aided by the new and rapidly expanding automotive industry's rising supply of special transport vehicles. In the United States, the first transit mixer idea appeared in 1926. The first RMC facility was built in the UK in 1939, and the country also saw the publication of the first RMC specifications in 1933.

RMC production in the United States increased significantly between 1950 and 1980, reaching a peak supply of 31 million cubic metres in 1974. However, between 1974 and 1980, RMC supplies were 25 million cubic metres annually on average. In the United States, there were 3700 RMC firms by 1990, and they were using 75% of the cement used by the building sector. In 1990, the RMC factory in Japan used around 70% of the cement produced overall. Nearly 16% of the total cement consumed in Malaysia in 1990 was used in RMC plants. RMC factories utilise 43% of the total cement consumed in the UK.

RMC IN INDIA:

RMC was originally employed in India in 1950 when dams like Bhakra Nangal and Koyna were being built. Concrete is moved throughout the building site either manually or mechanically using ropeways, buckets, or conveyor systems.

the RMC in Pune in 1991. However, this factory did not last very long owing to several setbacks and issues, and it was shut down. Two RMC plants were established in Mumbai within a few months of one other in 1993 to commercially sell RMC to the projects where they were installed. One factory was built by Unitech Construction in the Hiranandani Complex, while another was built by Associated Cement Companies at the Bharat Diamond Bourse Commercial Complex.

Later, RMC sales to other projects were permitted for these plants as well. RMC was therefore effectively developed in India sometime around 1994.RMC makers from outside of India quickly developed an interest in the Indian market, leading two extremely reputable companies—Fletcher Challenge Ltd. from New Zealand and RMC Ready Mix from the UK—to lay foot on Indian soil.

SCOPE OF RMC IN INDIA: The country's ready mixed concrete sector is growing and increasing quickly, albeit somewhat more slowly than it should have. Over time, a number of leading cement and building firms as well as technology organisations have given this growth the proper drive. The "India Cement Industry Restructuring Project" of the World Bank, for which a technical study report on the growth of the bulk cement market in India was produced in 1996, has proven to be a successful step towards modernising the country's cement distribution system, including the construction of ready-mix concrete plants. India and for a slow transition. From the conventional method of bagged shipping to bulk transportation via the establishment of ready-mixed concrete facilities across the nation. The action plan's advice offered helpful direction for growing the bulk cement industry, opening the door for the establishment of ready-mixed concrete facilities in India. Cement Manufacturers Association reports that RMC is increasingly being advised for all significant public construction projects including motorways and flyovers. Even modest home builders in locations like Bangalore and Chennai have begun to show a clear preference for RMC over cement. Experts claim that India has significant potential for RMC development and expansion. By installing RMC units in various consumption locations, it may expand to use 40–45 percent of cement by 2015. RMC industry in India must adjust its practises to match those in other sophisticated nations where RMC business has been running effectively in order for the sector to expand healthily. The general goals for designing, managing, and operating ready-mixed concrete (RMC) remain the same as those for planning and carrying out concrete building projects, according to the European Ready Mixed Concrete Organisation (ERMCO). RMC should no longer be marketed just in terms of strength grades but rather in conjunction with strength durability classification in accordance with the Concrete Codes, which increases the sellability of RMC in terms of the project needs. The administration and operation of RMC must take into account the proper environmental, safety, and health requirements for the workforce.

Significance: : India is seeing widespread infrastructure construction as a result of the substantial concrete demand. But the lack of labour and the lack of concrete-laying space prevents this demand from being fully met. The quality of concrete is frequently compromised by labour neglect, and there is a scarcity of space for cast-in-place building in major cities.Due of this, RMC concrete is widely used throughout the nation.However, these plants have several issues, and as a result, their usefulness is compromised. Effective construction management is needed to overcome this.

LITERATURE REVIEW

Dr. S. K. Dave, The Ready Mix Concrete (RMC) Initiative, its premise, the difficulties encountered, and the opportunities in our nation, India, are all represented in this paper. Nowadays, practically all of the construction industry uses RMC concrete, which is employed when a job needs to be done quickly and efficiently.

The majority of RMC facilities are found in seven major Indian cities, where they account for 30% to 60% of all the concrete utilised in those cities. RMC accounts for around 5% of all the concrete utilised in India. RMC is becoming more and more popular in cities for the obvious reasons of limited development area and the necessity to reduce environmental pollutants. This is true even though the cost is between 12% and 20% greater than site-mixed concrete.

M. Takeyama, The Narihirabashi Plant of Tokyo Concrete Kogyo Co. produced the country's first batch of ready-mixed concrete (RMC) in November 1949. Any RMC facility located across the nation is now only a phone call away from providing RMC.

However, in recent years, the expansion of already existing plants as well as the growth of new RMC facilities has resulted in an excessive rise in supply capacity relative to demand, which has significantly decreased the operation rate.

Arjita Biswas. The environmental impact of sludge water disposal is developing as a result of the rising demand for ready-mixed concrete. A single concrete truck needs between 700 and 1300 gallons of wash water per working day.

Untreated sludge water is not permitted for dumping into urban sewers due to the high levels of suspended particles and alkalinity. In general, two series-connected sedimentation basins are used in the sludge water disposal process. The first basin is used to collect leftover concrete and truck and concrete plant wash water. Each transit combination is cleaned with 120 to 200 litres of water to get rid of the sludge that has built up on the blades, wall, and floor of the transit mixer.

Prof.Jyoti Trivedi, In European nations, people are aware of the significance of hazards and the methods for managing them. Operation managers in RMC factories in European nations are probably involved in risk management at manufacturing facilities and delivery locations.

At the RMC facility in India, risk management does not receive adequate attention. Information acquired from many RMC facilities in India, including those in Mumbai, Navi Mumbai, Pune, Bangalore, and Noida, demonstrates that the Indian RMC industry does not follow a regular and appropriate risk management method. Without appropriate risk

management, the RMC business in India won't be able to acquire the trust of its clients and would also see a decline in profit margins.

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

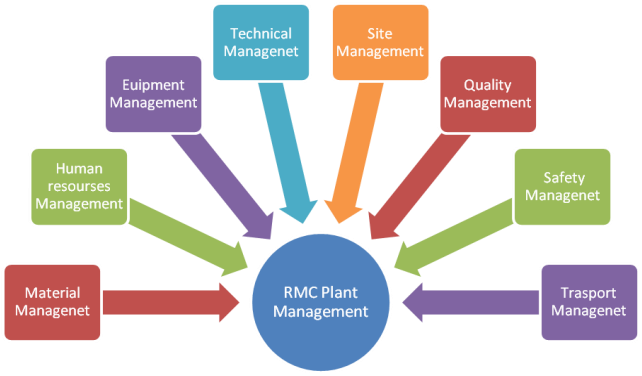

Figure 1: RMC Plant Management

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:

- Group the RMC plant's activities into several divisions. To better understand the challenges involved in managing RMC plants, prepare extensive questionnaires for each segment and distribute them to various RMC facilities.
- Prepare a thorough corrective action plan for each component to address the issues. Additionally, create a checklist for each area of the RMC plant to ensure seamless operation.
- By using an appropriate case study, to investigate the cost-benefit analysis following the implementation of the corrective plan.

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?					
Sr. no.	Questions	1	2	3	4	5
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)

To assess the many causes of construction waste, the Relative Importance Index (RII) ranking approach was used. The most important causes of construction waste variables in the construction industry may be determined from the ranking given to each cause of construction waste. The RII has been applied in several fields to assess the relative significance of one thing to others. The relative relevance index for each cause was calculated using the algorithm below.

The relative importance indices (RII) for each element were calculated using the five-point scale, which ranges from I (extremely low) to 5 (very high) 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

4. Less affects

2. Highly affects

5.Very less affects

3.Moderately affects

Group 1:

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

Remedial Measure: In the building and development industries, the location of the RMC plant is crucial. There are several factors to take into account while choosing a location for the RMC plant. The effects of the RMC plant on the environment must also be taken into account.Even if the site selection requirements for the RMC plant are perfect, we also take into account the plant's economic viability.A large region may be served by a central concrete batching facility.Despite the fact that the factories are situated in regions designated for industrial use, delivery vehicles can nonetheless reach inner cities or residential areas.The local material supply should

be close to the intended RMC plant location. The site chosen should be remote from residential zones to lessen the effects of noise and dust pollution on the neighbouring residential areas.The intended site location's transportation infrastructure for the RMC plant should be taken into account.The RMC plant should be situated in such a way as to balance out residential neighbourhoods and construction zones, and it should be able to operate around-the-clock when necessary.The ideal site placement should be close to regions with the highest potential for output.It should be simple to get skilled employees close to the preferred site location of the RMC facility.RMC plant waste should be conveniently disposed of without having an impact on the regions close to the chosen 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 the RMC plant to operate effectively in the intended site location. Additionally, it is important that these resources are inexpensive and conveniently accessible near the RMC plant in order to run the RMC plant efficiently. Process management is concerned with the coordinated planning, organising, and control of the movement of materials into, through, and out of an organisation. The lifeblood and heart of the manufacturing system in the RMC plant is to be regarded every resource that is employed directly or indirectly in the production of a good. Various resources used in RMC plant should have consistent deliveries to the RMC plant so that there will not be delay in further processes in RMC plantmanufacturing the product

Group no 3

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

Remedial Measure In the RMC plant's production unit, supervision is a must. In the RMC plant, supervision is required for all activities. When producing concrete at the RMC plant, supervision is essential. Another crucial component of labour labour is supervision. In the RMC plant, supervision is responsible for planning and organising the production of concrete. The act or duty of watching over something or someone is known as supervision. A supervisor is someone who exercises supervision.To supervise is to monitor staff members' work. The individual providing supervision may not have a formal title or may have the title of manager or supervisor, with the latter having greater authority.In general, supervision involves imparting information, assisting with task organisation, boosting motivation, and keeping an eye on activities and outcomes; the proportion of each aspect varies.

Group no 4

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

Remedial Measure The key component to operating an RMC plant in an economically efficient manner is watertight cement silos. In the RMC plant, cement is a component used to make concrete. In addition, cement is the component that costs the most to make in the RMC facility. The most crucial element is how well cement is used in the RMC plant to produce concrete. For the RMC plant to use cement effectively and economically, moisture-free cement silos are necessary. The most crucial element in the operation of pumping cement at the RMC plant is waterproof cement silos.

Group no 5

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

Remedial Measure Concrete preparation depends significantly on the water's quality. Water impurities can negatively impact the strength and durability of concrete as well as the cement's ability to set. Water's chemical components may actively engage

in chemical processes, which might have an impact on how concrete sets, hardens, and develops strength.In addition, health concerns about the proper management of such water must be taken into account. It is possible to determine whether water is suitable by looking at prior service records or by having it tested against performance standards including setting times, compressive strength, and durability tests. For combining water with its components, such as total alkalis, chloride sulphate, etc., limits are set. Saline water and recycled water handling safety is additionally ensured through biological treatment and pathogen reductions.

CONCLUSION

Ready to Eat A recent method of producing concrete in huge quantities away from the actual placement location is called concrete. It is extremely helpful in cities with high concrete demand and congested building sites where on-site mixing is impractical. RMC manufacturing has lower manpower and supervision expenses, and the concrete is of higher quality. It is appropriate for huge industrial and residential projects when timing is crucial.RMC activities are heavily automated and completely under electronic control, which lowers the likelihood of mistakes in a variety of procedures. Additionally, it is ecologically beneficial and reduces pollutants brought on by building site dust, which may also. The current study created a structure that helps the director of the RMC plant resolve his or her issue.We thoroughly investigated the RMC plant, created questionnaires outlining the issues that are often encountered by different RMC plants, and then posed these questions to various RMC plant staff members. By posing this query, we were able to analyse several characteristics and identify those that were crucial, such as site selection, resource management, supervision, and equipment.The site location, material handling, material management, and order processes all play crucial roles in the increase in productivity of the RMC plant and the achievement of large profit.In order to maintain this profit margin and increase customer happiness, this parameter must be effectively controlled. We can also draw the conclusion that in order to operate the RMC plant effectively, a checklist is needed at every stage. As a result, we must use construction management strategies in order to increase the plant's productivity.

REFERENCES

1. *Ready Mix Concrete: Challenges & Opportunities in India"*, Dr. S. K. Dave, Shri N. K. Pandya, Shri B. V. Modi, International Journal of Advanced Research In Engineering ,Science And Management, ISSN : 2394-1766, Vol-11 Issue 12,Page No:01-08

2. *Present technology of ready-mixed concrete and future prospects"* M. Takeyama, *Muguzine qf Concrete Research,* September 1996 Page No: 199-209

3. *Analysis of Sludge Formed in R.M.C Plant"* By Arjita Biswas and P.R Adavi, AKGEC International Journal of Technology, Vol. 2,Issue No:12,Page No:60-65.

4. *Failure Mode Effect Analysis (FMEA) Risk Management Technique For Quality Control of RMC Production",* Prof.Jyoti Trivedi, Dr.Chakradhar Iyunni, *International Journal of Advance Engineering and Research Development (IJAERD) e-ISSN: 2348 - 4470 , print-ISSN:2348-6406.*

5. *A Brief Study of Ready-Mix Concrete: Features & Uses in Construction on the Context of Bangladesh",* Md. Nazmul Haq, Md. Saidur Rahman Chowdhury , Hunain Mahmud , IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 8, Issue 3 (Sep. - Oct. 2013), Page No: 55-57.

6. *Quantization of risks involved in supply of ready mix concrete in Construction industry in indian scenario*",By Mohd Amir Khan, Shumank Deep, Mohd Asim, Zishan Raza Khan, International Journal of Civil Engineering and Technology, Volume 8, Issue 3, March 2017, Page No:175–184.

7. *A study on customer preferences and perceptions on quality and services of ready mixed concrete as a sustainable building material in Bangalore city, Karnataka***",** By L R Manjunatha, Sandya R Anvekar, S Savitha Sagari, Archana Kumarswamy , International Journal of Research in Engineering and Technology, Volume: 03 Special Issue: 06 , May-2014 Page No:07-14

8. *Time Management in RMC Plant"* By Prof. S.S. Deshmukh and Yogiraj Lohokare, *International Journal for Scientific Research & Development ,Vol. 5, Issue 07, 2017,Page No:267-270.*

9. *Qualitative Analysis of Internal And External Risks For Ready Mix Concrete Plants – A Case Study Approach"***,** By R. C. Walke, Prof. V.M. Topkar, IOSR Journal of Engineering May. 2012, Vol. 2 Issue No: 5 Page No: 1013-1019.

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