

A Review on “Performance and Quality Management of Ready Mix Concrete Plant”

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Abstract— Ready Mix Concrete is a ready-to-use material which is a mixture of Cement, Sand, Aggregate and Water. RMC is a type of Concrete which is mixed in a batching plant according to the specification of the customer and delivered to the site by the use of transit mixer as it is away from the construction site. It is necessary to ensure that concrete produced in a RMC plant should be of desired quality. Quality control is exercised in all stages right from material purchase to delivery of concrete at site. While using ready mix concrete it should be ensure that the producer of RMC has adopted quality assurance. Best practices are used to maintain quality as an alternative to mandatory standards. In order to ensure that concrete produced is of desired quality, it is necessary that quality control is exercised at all the stages right from receipt of raw material to delivery of concrete at site. This paper is an attempt to study the quality management of RMC Plant. This paper presents the results of an experimental study carried out to determine the concrete compressive strength at different RMC plants. The various control charts are drawn to know the corrective measures to be taken due to RMC production. The tests are carried out in accordance with IS standards. When applying best practice to organizations it will improve the unique qualities of an organization with the practices that it has in common with others.

Keywords: Quality procedures, Standards, Organization RMC, Concrete Strength, Plant Deviation, Control Charts

I. INTRODUCTION

Construction is very big industry in India and concrete is the biggest product in construction industry all over the world. Large projects require speed as well as quality of construction which meets international standards. In past few years concrete technology is improved greatly. Use of Ready Mixed Concrete (RMC) for construction has grown tremendously in developing countries. The incredible growth of RMC industry in India is very important aspect. In today's date because of fast growing economy and rapid urbanization demand for multistoried buildings, real estate project, commercial complex like shopping complex, multistoried malls, retail shops has been increased tremendously. For these purpose need and demand of good quality concrete have been increased greatly to make structure safe and durable. Good quality of concrete required in large quantities can be fulfilled by RMC plants.

In today's era computerized weigh batcher are used in most of the RMC plants in India which completely replaces volume batcher, aggregates and cement are stored in bins and silos, belt conveyer are used to transport the aggregate from bins to hoppers like these new techniques are used by RMC industry which helps consumer to ignore old site mix techniques. But after this also the quality of

RMC plant and plants material is very important issue. With rapid growth of the industry, the challenges of maintaining desired quality and standard of RMC plants have also increased.

II. LITERATURE REVIEW

First RMC plant introduced in Germany in 1903, but for the purpose transporting it had not been developed sufficiently to use as commercial plant. The first commercial delivery of RMC was made in Baltimore, USA in 1913 and the first revolving drum type transit mixer, of very smaller capacity than those available today, was made in 1926. By the late 1920s and 1930s, RMC was introduced in some of the European countries[1].

The early plants were of a very small capacity. In 1931, a RMC plant was set up at Heathrow, London, had a 1.52 m³ capacity central mixer, supplying through six 1.33 m³ capacity truck mixers. Aggregates were stored in a four-compartment bin[1]. The cement was handled manually in bags. Till the beginning of World War II, there were only six firms producing RMC in the United Kingdom. After the war, there was a boost to the RMC industry in whole of Europe, including the UK. In the mid-nineties, there were as many as 1,100 RMC plants in UK, consuming about 45 per cent of the cement produced in that country[2].

European Ready Mixed Concrete Organization (ERMCO) was formed in the Europe in 1967 and is a federation of the national associations of the 22 countries. As of in 2015 there are 7,250 companies represented by it having a turnover of 13.11 billion Euros and producing a total of 349.4 million m³ of RMC[2]. In United States of America, till 1933, only 5 per cent of the cement produced was utilized through the RMC route[10]. American Society for Testing and Materials (ASTM) published the first specification of ready-mixed concrete, C94, in 1934. the companies controlling nearly 50% of the RMC market share. During 2013, RMC production in USA was 115 million m³ and turnover of 15.6 billion USD[3][4].

In Japan, the first RMC plant was set up in 1949. Initially, dump trucks were used to haul concrete of low consistency for road construction. In the early 1950s, mixing type truck mixers were introduced and since then there has been a phenomenal growth of the industry in that country. During 2013, Japan produced 86 million m³ concrete and turnover of 10.50 billion USD[3][6].

RMC plants arrived in India in the early 1950s, but their use was restricted to only major construction projects such as large dams. Bhakra and Koyna dams were some of the early projects where RMC was used. Later on, RMC was also used for other large projects such as construction of long-span bridges, industrial complexes, etc. For establishment of commercial RMC plants in India, the

Central Building Research Institute (CBRI) Roorkee conducted a techno-economic feasibility study in 1974. The study recommended setting up of RMC plants in major metropolitan towns of the country. It also suggested the use of fly ash as a partial replacement of cement to effective savings[9].

In Maharashtra, the first commercial plant belonging to Ready-Mix concrete Industries of Pune was set up in 1992. It has its own aggregate quarry. Later in 1994, two RMC plants were set up as dedicated but on commercial terms at Bandra-Kurla Complex in Mumbai, which was followed by another in Navi Mumbai. Currently, based on the information obtained from various RMC manufacturers, there are more than 4000 commercial plants in existence in the country with a total capacity of 98000m³/hr[11]. The Ready Mix Concrete Manufacture's Association (RMCMA) was formed in India in 2007 with head quarter in Mumbai. RMCMA is doing very valuable work in the fields of quality assurance and certification of RMC plants of its member companies through Quality Council of India (QCI)[12].

III. METHODOLOGY

- 1) Quality Control of RMC can be divided into three convenient areas like forward control, immediate control and retrospective control (Dewar and Anderson, 1988).
- 2) Forward control basically deals with procedures of quality control to be followed before the production process. This covers (i) Materials storage, (ii) Monitoring of quality of materials, (iii) Modification of mix design, (iv) Plant maintenance, (v) Calibration of equipment and (vi) Plant and Transit mixer condition.
- 3) Immediate control is concerned with instant action to control the quality of concrete during production or that of deliveries closely following production. This covers (i) Weighing – correct reading of batch data and accurate weighing, (ii) Visual observation and testing of concrete during production and delivery (assessment of uniformity, cohesion, workability, adjustment of water content) and (iii) Making corresponding adjustments at the plant automatically or manually to batched quantities to allow for observed, measured or reported changes in materials or concrete qualities.
- 4) Retrospective control primarily deals with the quality control procedures after production. This covers (i) Sampling of concrete, testing and monitoring of results, (ii) Weighbridge checks of loaded and unloaded vehicle weights, (iii) Stock control of materials and (iv) Diagnosis and correction of identified faults. A standard Quality Control lab with testing equipment is established at the plant. In order to maintain the quality of concrete a well-defined system in controlling the quality of all ingredients of concrete is followed. A proper document is maintained to keep a list of sources of all incoming materials in the plant. The list is dated and any change in source of materials is updated in the list accordingly. The list is displayed at a prominent location in the plant.
- 5) The quality control laboratory is equipped with sophisticated instruments and manned by trained and

widely experienced personnel. It is observed that, the quality is monitored at every stage, right from receipt of raw material to dispatch and placing of concrete, which ensures that consistent quality of concrete should reaches to the site. The incoming materials particularly raw materials like cement, coarse aggregate 10 mm, coarse aggregate 20 mm, fine aggregate, admixtures should be subjected to testing as per adopted acceptance sampling plan. A scheme for the basic tests to be conducted for raw materials, fresh concrete and hardened concrete along with their frequency of testing. Steps that should be followed from planning to the completion of work in RMC plant are as follows:

- 1) Mix Design,
- 2) Approval by Authority,
- 3) The Establishment of QC/QA Laboratory,
- 4) Incoming Material,
- 5) Testing and Inspection,
- 6) Material Stored,
- 7) Central Pan Mixture,
- 8) Final Mixed Concrete,
- 9) Loading Transit Mixture,
- 10) Check the slump of concrete.

IV. EXPECTED CONCLUSION

This research work results into calculating the factors affecting quality of RMC plants and study the good practices implemented to control the quality with proper management. From the above review it is also concluded that much research has been done on the quality management and quality control of RMC plants. For the purpose of quality control, basic information and data must be collected through a questionnaire and in-depth interviews with various RMC owners. This review gives an idea about identifying the reasons affecting the quality of plant, an idea of gaining knowledge regarding administrative and management practices and also the factors involved in quality management and transportation of RMC. The methodology followed in this research is commonly applicable and followed in all RMC plants. The primary objective of this review is to improve the quality of RMC plant by adopting effective quality system, to determine the practical difficulties in adopting the quality system and to follow the best management practices. This study helps in understanding important objectives related to this industry and also objectives like safety, pollution, plant management in which RMC industry have to work seriously as these points are not taken seriously from RMC owners. Management practices followed in various RMC Plants would be gathered. The Quality Improvement and best management Practices would be identified and implemented in RMC Plant.

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