Ready Mixed Concrete – Present Status and Future Growth Prospects

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Introduction

The Indian construction industry has been traditionally labour oriented. The pace of mechanization in the past has been very slow due to the availability of cheap labour 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 synchronise with the over all 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.

Concrete is the largest ‘man made’ material in the world and stands second to water in per capita consumption. It is estimated that world over about 3800 million tons of cement and 8000 million tons of concrete were used during the year 2013. Average per capita annual consumption of cement worldwide is about 500 kg against 210 kg in India. Similarly world over per capita concrete consumption is about 1 ton while it is 500 kg in India. Though cement and concrete consumption is expected to grow at the average rate of 3% to 4% world over, but in India 6% to 8% growth is likely to take place during the next decade. It is therefore very important from life cycle cost, durability and environmental considerations that majority of concrete is produced in centralized RMC plants.

One of the major causalties of heavy reliance on labour intensive techniques of construction is the quality of work. Site-mixed concrete has serious limitations as far as quality of concrete and speed of construction are concerned. Generally cost remains the driving factor in deciding the award of construction contracts and very little or no premium is placed on quality. As a result many structures have shown premature deterioration and the cost of repairs and rehabilitation is proving prohibitive. Now growing realization is surfacing that quality and consistency cannot be achieved by relying on age-old techniques of construction. The growth prospects of RMC in India in this context looks very bright but the RMC has not maintained the desired pace of growth in spite of this realization due to numerous constraints.

The growth of RMC industry world over has followed ‘S’ curve. The progress during the formative years say upto 10 years is slow, then it follows high growth path for the next 30 to 40 years and again it starts slowing down until it reaches a plateau. In most of the countries, RMC took about 10 to 12 years to consume 10% cement production, while in India commercial RMC is able to consume only about 8.5% of cement production even after 15 years. The growth is very slow from international standards, and main reasons could be identified: (a) VAT/sales tax and excise duty on RMC while no such tax on SMC (b) infrastructure cost in setting up RMC plants is
high due to difficulty in getting land at reasonable cost. (c) lack of codal and specifications support (d) more consideration for cost over quality (e) mind-set of people.

Inspite of the existing constraints, RMC has very bright prospects in middle to long-term time frame. The availability of quality RMC equipment indigenously produced or assembled has brought down the capital cost considerably. The trained and skilled manpower to operate RMC plants is though in short supply but gradually increasing due to better awareness and career prospects in this industry. The importance of quality concrete is being realized by more and more construction professionals and it will help in boosting the use of RMC at most locations. The large size of construction projects early completion and increasing use of higher grades of concrete are other favourable factors for the growth of RMC.

HISTORICAL PERSPECTIVE

Ready-mixed concrete was first patented in Germany in 1903, but the means of transporting it had not been developed sufficiently by then to enable the concept to be commercially exploited. The first commercial delivery of RMC was made in Baltimore, USA in 1913 and the first revolving drum type transit mixer, of a much smaller capacity than those available today, was born in 1926. By the late 1920s and 1930s, RMC was introduced in some of the European countries.

The early plants were of a very small capacity. In 1931, a ready-mixed concrete plant was set up at what is now the site of Heathrow airport, London, had a 1.52 m$^3$ (2-yd$^3$) capacity central mixer, supplying through six 1.33 m$^3$ (1 ¾ -yd$^3$) capacity agitators with an output of 30.58 m$^3$/hr (40 yd$^3$/hr). Aggregates were stored in a four-compartment bin of about 76.45 m$^3$ (100 yd$^3$) capacity. The cement was handled manually in bags. Till the beginning of World War II, there were only six firms producing RMC in the UK. 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 percent of the cement produced in that country.

In Europe, the European Ready Mixed Concrete Organization (ERMCO) was formed in 1967 and is a federation of the national associations of the 22 countries. As of in 2013 there are 5,850 companies represented by it having a turnover of 13.11 billion Euros and producing a total of 349.4 million m$^3$ of RMC. Cement consumption averaged 60.8 percent of total cement sales, and RMC consumption of 1.2 m$^3$/capita/annum (3.0 ton)$^4$.

In USA, till 1933, only 5 percent of the cement produced was utilized through the RMC route. ASTM published the first specification of ready-mixed concrete, C34, in 1934. The industry in USA has progressed steadily. During 1950 to 1975, the RMC industry’s consumption of total OPC used in the USA increased from 1/3$^{rd}$ to 2/3$^{rd}$ and by 1990, this consumption increased to 72.4 percent of the total OPC consumed in that country. There were as many as 5,000 RMC companies in the country in 1978. This number however, dropped to 3,700 in 1994 with only 6 to 7 percent of the companies controlling nearly 50 percent of the RMC market share. According to Gaynor, this trend of consolidation of the market has fostered greater technical sophistication in the industry. During 2013, RMC production in USA was 115million m$^3$ and turnover of 15.6 billion USD.

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. By 1973, there were 3,413 RMC plants in Japan and this number rose to 4,462 by the end of the 1980s. By 1992 Japan was the then largest producer of RMC, producing 181.96 million tones of concrete per annum. During 2013, Japan produced 86 million m$^3$ concrete and turnover of 10.50 billion USD.
In many other countries of the world, including some of the developing countries like Taiwan, Malaysia, Indonesia, as well as certain countries in the Gulf region, the RMC industry is well-developed today. 

The growth pattern of RMC world over can be divided into three phases. The phase I or the introduction phase is considered up to 10% cement consumption by the RMC industry. The phase II or the growth phase is assumed up to 50% cement consumption and phase III or consolidation phase is considered thereafter. During the consolidation phase, the growth touches the plateau and shows a nominal growth in the range of 1%-2%. Based on the available data, the growth pattern of RMC in different countries is given in table – 1

Table – 1- Growth pattern of RMC in different countries

<table>
<thead>
<tr>
<th>Growth Pattern</th>
<th>Countries</th>
<th>Phase (I) Cement consumption (10%) number of years taken</th>
<th>Phase (II) Cement consumption (50%) number of years taken</th>
<th>Phase (III) Consolidation phase achieved after number of years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid Growth</td>
<td>Greece, Finland, West Germany, Japan, Switzerland,</td>
<td>5 to 6</td>
<td>18 to 20</td>
<td>20 to 35</td>
</tr>
<tr>
<td>Normal Growth</td>
<td>Spain, Ireland, Italy, Austria, Belgium, Great Britain, Norway, Sweden, Australia, USA</td>
<td>10 to 11</td>
<td>30 to 35</td>
<td>35 to 40</td>
</tr>
<tr>
<td>Slow Growth</td>
<td>Portugal, France, Netherlands, Denmark</td>
<td>18 to 20</td>
<td>40 to 45</td>
<td>45 to 50</td>
</tr>
</tbody>
</table>

**DEVELOPMENT OF RMC IN INDIA**

Ready-mixed concrete 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. These were, however, captive plants which formed an integral part of the construction project. RMC in a true commercial sense had yet to arrive in the country.

In 1974, a techno-economic feasibility study for setting up of RMC plants in India was conducted by the Central Building Research Institute (CBRI), Roorkee. 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 effect savings.

In the late 1970s, the then Cement Research Institute of India (CRI) – now the National Council for Cement and Building Materials (NCB) – carried out a techno-economic viability study of RMC, to be transported without agitation. In this study, it was observed that the conventional RMC would be uneconomical under the then-prevailing conditions, wherein only small volumes of concrete (1
m³ or less) could be handled at a time, thereby making the transportation cost higher. To reduce the total cost, the study suggested that only a part of the mixing water (about 60 percent) be added at the central plant and such a “semi-dry” mix be transported in non-agitating trucks to the construction site, where the mix could be discharged from the truck to the mixer and remixed with the addition of the balance water. This study further recommended that once the demand for RMC went up, conventional agitator trucks could be introduced, without any change in the central infrastructure. Based on this study, a feasibility report for setting up of RMC plant at Delhi was jointly prepared by the NCB and the Central Public Works Department (CPWD) in 1988.

It was during the 1970s when the Indian construction industry went overseas particularly to the Gulf region, that an awareness of ready-mixed concrete was created among Indian engineers, contractors, builders, etc. Indian contractors in their works abroad began to use RMC plants of 15 m³/hr to 60 m³/hr capacity, and some of these plants were brought to India during the mid – 1980s but used for major construction works. During this period Indian equipment manufacturers had also started manufacturing small RMC plants of maximum capacity of 15 m³/hr. These plants were also used at construction sites.

It was only after cement was fully decontrolled, and particularly since the early 1990s, that RMC has been talked about on a commercial basis. The first plant belonging to Ready-Mix concrete Industries, 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. After this beginning, number of players came forward and set up RMC plants in different parts of the country, mainly in the metropolitan areas. Currently, based on the information obtained from various RMC manufacturers, there are about 2000 commercial plants in existence in the country with a total capacity of 75,000 m³/hr. 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).

At present nearly 6 million m³ RMC per month (72 million m³ per year) is produced by commercial plants in India. The consumption of concrete in India during the year 2013-2014 is estimated 460 million m³. Though no authentic figures are available, but it can be assumed that nearly 15% to 20% concrete is being used by major mega projects where weigh-batched concrete through dedicated plants is used. The balance about 380 million m³ is used on medium, small and individual house building projects. If we consider the penetration of commercial RMC in this segment, then RMC has a share of about 18% at present. The slow growth pattern model requires 18 to 20 years to achieve 10% cement consumption through RMC route. The actual start of commercial RMC in India can be assumed from 1994 and it has already taken nearly 20 years to achieve 8.5% cement consumption. The growth of RMC industry in last 3 to 4 years has been comparatively slow due to overall depression in GDP and Economic growth in the country, otherwise by now RMC could have achieved 10% consumption of total cement produced in the country.

Table: 2- Commercial- RMC plants in India in the year 2013

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Zone</th>
<th>Provinces /Area</th>
<th>Approximate Commercial RMC</th>
</tr>
</thead>
</table>
The growth of RMC in any country has a direct co-relation with the growth of its cement industry and consumption of cement by the construction industry. The growth of Indian cement industry can be broadly divided into three phases (a) phase-I from 1950 to 1982, the era of controls, (b) phase II from 1982 to 1990, the era of partial and full decontrol (c) phase-III from 1991 to now the era of economic liberalization. The growth of cement industry during these phases has followed the pattern as shown in table – 3.

Table-3 Growth of cement Industry in India

<table>
<thead>
<tr>
<th>Phase</th>
<th>% Growth of GDP (average)</th>
<th>% Growth of cement industry (average)</th>
<th>% Growth of Cement Industry over GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>1950 – 1982</td>
<td>4.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Phase II</td>
<td>1982 – 1991</td>
<td>5.35</td>
<td>8.86</td>
</tr>
<tr>
<td>Phase IIIA</td>
<td>1991 – 2009</td>
<td>7.3</td>
<td>8.94</td>
</tr>
<tr>
<td>Phase IIIB</td>
<td>2009 - 2013</td>
<td>5.8</td>
<td>6.70</td>
</tr>
</tbody>
</table>

The data of GDP growth and cement growth are not coherent and have fluctuated widely during the various plans and annual plans. However, the following inferences can be drawn;

a. The cement industry growth has always been higher than the GDP growth
b. The cement industry has grown faster during 1982 – 1991 the era of partial and full decontrol of cement industry.
c. The GDP growth has been higher after 1991, the post era of liberalization as well as cement industry growth.
d. The proportion of cement industry growth to GDP growth has come down during this period from the average of 1.5 – 1.6 to 1.2- 1.15

In coming years, the ratio of cement consumption to GDP growth may vary between 1.1 to 1.2 times. If we assume GDP growth of 7% upto the year 2017 and 6.5% from 2017 to 2022, the pattern of cement and concrete consumption in the country may emerge as given in table – 4

Table – 4 Probable pattern of cement and concrete consumption in next three five years plans.
<table>
<thead>
<tr>
<th>Years</th>
<th>Corresponding 5 year plan</th>
<th>GDP Growth (%)</th>
<th>Cement consumption growth (%)</th>
<th>Expected cement consumption (Mio T) at the end of plan year</th>
<th>Consumption of concrete (average) (Million m³)</th>
<th>Concrete consumption at sites without dedicated plants where RMC has potential to penetrate @ 30% of (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 – 2012</td>
<td>11&lt;sup&gt;th&lt;/sup&gt;</td>
<td>8.5</td>
<td>10.14</td>
<td>226.90</td>
<td>408.0</td>
<td>122.40</td>
</tr>
<tr>
<td>2012 – 2017</td>
<td>12&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7</td>
<td>7.7</td>
<td>327.48</td>
<td>588.0</td>
<td>176.40</td>
</tr>
<tr>
<td>2017 - 2022</td>
<td>13&lt;sup&gt;th&lt;/sup&gt;</td>
<td>6.5</td>
<td>7.0</td>
<td>448.67</td>
<td>806.0</td>
<td>241.80</td>
</tr>
</tbody>
</table>

**Assumptions:** - (a) 60% of cement produced is used in concrete. (b) 30% of total concrete used in the country is assumed may fall under the category of commercial RMC as the balance will be used on mega project where captive plants are set up and at sites in rural and semi-urban areas where site mixed concrete is used.

The expected consumption of cement and concrete during next 10 years is projected in table – 4. Taking into consideration, the growth pattern of RMC world over, the expected potential of concrete in India and the progress made over the last 15 years, the growth of RMC in India may follow a path identical to the slow growth pattern followed by it internationally. The 5.6% consumption of cement through RMC in India was achieved within 12 years and 8.5% within 17 years. Presuming better growth rate, the 10% penetration may be achieved within next 2 to 3 years or say by the years 2015. Based on above assumptions and fast mechanization of construction industry in India and numerous other favourable factors, the growth of commercial RMC in India is estimated as given in table – 5

**Table 5: Expected growth of commercial RMC in India**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Concrete consumption (million m³) (2)</th>
<th>Concrete used on sites without dedicated plants where RMC could be used of (2) (30%) (3)</th>
<th>Total RMC actually used/ or likely to be used (Million m³) (4)</th>
<th>RMC penetration (5)</th>
<th>Expected number of RMC Plants (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>252</td>
<td>75.60</td>
<td>21.6</td>
<td>8.40</td>
<td>600</td>
</tr>
<tr>
<td>2012</td>
<td>408</td>
<td>122.40</td>
<td>64.0</td>
<td>13.3</td>
<td>1700</td>
</tr>
<tr>
<td>2017</td>
<td>588</td>
<td>176.40</td>
<td>95.0</td>
<td>16.15</td>
<td>2260</td>
</tr>
<tr>
<td>2022</td>
<td>806</td>
<td>241.80</td>
<td>154.0</td>
<td>19.10</td>
<td>3200</td>
</tr>
</tbody>
</table>

In arriving the figures few assumption are made (a) the growth pattern is expected to accelerate after 2013 (b) The output of plants to increase from present average of 3000 m³/month to 4000 m³/month over the years.

**FACTORS AFFECTING FUTURE GROWTH OF RMC IN INDIA**

a. Consolidation of Indian Construction Industry. The average size of individual civil contract would increase to Rs. 50 crores and above.
b. Mechanization of construction and premium on mechanized construction in tender evaluation and awards.

c. Changes in contract specifications and introducing separate rates for RMC and site mixed concrete. Recognizing RMC as a separate product than site mixed concrete.

d. Changing IS codes and making it mandatory for medium and major construction sites to use RMC. Similar changes in specification of major construction organization in Govt. / PSUs/Private sector.

e. Availability of land in urban areas by Local authorities/SEZ on long-term lease at reasonable rates to RMC producers.

f. Production of quality RMC equipment in India conforming to international standards to bring down initial cost of the project. Initiative has already been taken by reputed foreign and Indian manufactures in this direction.

g. Mindset of the construction professionals and the end consumers to value quality and long-term durability rather than economy alone especially in tier II and tier III cities.

h. Improvement in road net work to reduce turn around time of delivery vehicles.

i. Judicious and equitable taxation policy on RMC by Central and State Govts.

These are some of the factors, which are considered critical in the future development of RMC. Inspite of existing constraints, the future of RMC is bright in India, as the country cannot afford to continue to follow unscientific practices for long. The major advantages of RMC are recognized as given in subsequent paragraphs;

ADVANTAGES OF RMC

a. Uniform and assured quality of concrete, similar to a factory made product.

b. Higher durability and superior performance of structures built with RMC.

c. Faster construction speed.

d. Storage needs of raw materials at construction sites are eliminated.

e. Addition of admixtures and additives like fly ash, silica fume is easier.

f. Proper-documentation of the mix design are generated and stored for long periods.

g. Reduction in wastage of raw materials at construction sites.

h. RMC is eco-friendly and sustainable product.

CONCLUSION

The growth of any industry especially in a developing country is dictated by technology absorption, immediate markets, capital investment, risk taking capacity, government support and future
prospects. Construction will continue to dominate Indian economy in coming decades and cement and concrete will continue to remain the backbone of the construction industry. In this scenario, cement and concrete are indispensable components of the engine for the economic growth. Cement and concrete will continue to grow at 1.1 to 1.2 times of GDP growth and with the international exposure of the economy, the premium will be laid on life cycle cost rather than initial cost of the projects. It is here that RMC will receive considerable importance over site mixed concrete and will emerge as most preferred construction material even in tier II and tier III cities.

The growth of RMC in India over the last 15 years can be viewed from both optimistic and pessimistic perspectives. It would be more prudent to view the developments positively. In a short span of time, RMC has made a place for itself throughout the country. People have become aware of it, people like it, people want to use it, people have a very favourable opinion about it and it is this changing mindset that will accelerate the future growth of RMC in India. There are numerous constraints in its growth at present but the overwhelming advantages the product offers will become sufficient reason to resolve the existing impasse. World over growth of RMC has followed ‘S’ curve and in India also, same pattern is emerging, may be with minor changes in the gradient of the curve. The RMC industry has arrived in India for ever and it will continue to forge ahead with accelerated pace in the years to come.

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5. Gaynor, R.D. Ready mixed concrete, ASTM STP-169, American Society for Testing and Materials, USA