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Impact of COVID-19 on ready-mix concrete (RMC) industry in Ahmedabad – A case study

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ABSTRACT

India witnessed its first case of coronavirus infection (COVID-19) on January 27, 2020, in Kerala, India. Since then, the infection has spread rapidly across the country and the pandemic outbreak has affected all industries severely including the construction sector. This study aims to understand the effect of the COVID-19 pandemic on the construction sector, particularly the ready-mix concrete (RMC) industry. An attempt was made to investigate the liabilities and the losses incurred by the RMC industry in terms of income and change in the production of concrete during the coronavirus outbreak. A preliminary survey was carried out to create a database of the RMC plants located nearby the study area i.e., Ahmedabad City in the state of Gujarat, and to prepare a questionnaire using google forms. The RMC plants were visited and from the inputs of RMC officials, statistical insights were drawn. The study reveals that during the COVID-19 lockdown period there was almost a 40% loss in concrete production & 60% loss in the income generated by the ready-mix concrete industry. In addition to this, it was also found that the industry had to pay off liabilities like land rent, electricity bills, staff salaries, etc. during the time of the pandemic. This study provides the opportunity for RMC plants to identify the vital elements involved in the operation of the plant which can be affected due to such pandemic and provides guidelines to reduce the effect of any such pandemic on the plant’s production & sales by ensuring the stability of all assets involved in its supply chain.

1. Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) commonly known as COVID-19 caused a major global economic downfall by crippling the movement of men, materials, and machinery. Due to the potential of the virus to spread rapidly and infect thousands of people, as a control measure to break the infectious chain of the virus, a lockdown/restriction to the movement was implemented in many parts of the world. In India, nationwide lockdown and curfews were implemented to contain the spread of the virus. The construction industry was also crippled during the pandemic as a large number of workers/laborers are involved in various construction activities, and the risk of transmission of COVID-19 was high. Also, the transportation sector was seriously crippled due to which there was a huge disruption in the movement of materials. Hence the construction sites were closed and/or operated with a minimum workforce [1-3].

Ordinary Portland Cement (OPC) commonly called cement is one of the basic ingredients for the ready-mix concrete (RMC) industry. During the COVID-19 wave in the years 2020 and 2021; all the OPC manufacturing units were shut which caused a break in the supply chain for the ready-mix concrete industry due to the non-availability of Ordinary Portland Cement. For over a decade, it was observed that the global demand for OPC was shrinking year by year as shown in Fig. 1 which depicts that in 2019 the countries were producing OPC less than their capacity as the overall global demand for cement had reduced. Due to the outbreak of coronavirus at the end of the year 2019, the demand for OPC was projected to further decline in the year 2020, as shown in Fig. 2 [4]. The dark grey zone indicated the regions like Southwest Asia with the strongest projected decline in cement demand with a nearly 10% reduction [4].

Cement production was affected due to the pandemic as it was expected to be. However, the sudden decline in cement production
varied with the country. India is the second-largest producer of cement with China being at the top of the list [4]. Fig. 3 portrays that India witnessed a dip in cement production during April 2020 when the country was battling the first wave of coronavirus. Also, China witnessed a dip in cement production approximately one month before India [5], this is because China had suffered the effects of the COVID-19 outbreak well before India.

India witnessed its first coronavirus case on January 27, 2020, in Kerala, India. This marked the entry of the coronavirus into the country and on 19 March 2020, two cases of covid-19 were reported in the state of Gujarat for the first time. A nationwide lockdown was implemented and all the industrial, commercial, educational, and government organizations were shut down from 22 March 2020 up to 31 May 2020 as a response action to contain the spread of the virus. During the period of complete lockdown, the cement production in India declined drastically and the production reduced to nearly 4 million metric tons in April 2020 as compared to over 30 million tons in January 2020 as shown in Fig. 4 [6]. This is in line with the Office of Economic Adviser, 2021 which indicates that the average cement production from 2020 to 2021 shrank by 10.8%. This decline in cement production has adversely affected the RMC industry.

Fig. 1. Global Cement Capacity & Production 2019 [4].

Fig. 2. Projected Cement Demand, 2019 vs 2020 [4].
The closure of all manufacturing units resulted in an increase in the unemployment rates all across the country and the laborers started to head back to their native places [7]. As a result, the supply chain involved in the ready-mix concrete industry was hindered due to the absence of labor and required raw materials like cement. Fig. 5 depicts the increase in the unemployment rate to nearly 23% when cement production declined to its minimum in April 2020 [5]. This phenomenon that occurred in India is in line with the contractual problems that arose in Oman’s construction industry due to a lack of supplies and labor [8]. Moreover, the skilled and unskilled labors, engineers, and officials employed in the ready-mix concrete plants were also physically and mentally impacted due to the sudden spread of coronavirus which is in line with the survey carried out on 150 Jordanian engineers which indicated that the covid-19 impacted more than 95% of the engineers [9]. In addition to this, the ready-mix industry had to establish new protocols and procedures like social distancing to deal with the pandemic which further decreased the output capacity [10]. In this study, an attempt is made to understand how the COVID 19 has affected RMC plants operating in the City of Ahmedabad.

Losses in concrete production and income or revenue, tenure of plant closure, and change in the price of raw materials were analyzed.

2. Methodology

2.1. General

The City of Ahmedabad is considered the study area. It has a population of more than 5.5 million, making it the most populous city in the state of Gujarat. There are 12 main Industrial Estates, 12 Special Economic Zones, and 10 Industrial Parks/Developers in Ahmedabad [11]. The city is witnessing large-scale construction activity such as industrial, commercial, and residential projects. There are approximately 30 RMC plants in and around the City of Ahmedabad supplying ready mix concrete to the construction sites. The project methodology included gathering insight regarding the impact of the pandemic on the construction industry by review of recent works of literature. Then a draft survey questionnaire was prepared to understand the effect of lockdown on Ready Mix Concrete plants. Further, the survey questionnaire was modified after consultation with a few experts (managers at the RMC plant) in the RMC industry. The google form-based questionnaire was designed in such a way that all the aspects of the impact of the pandemic get reviewed and analyzed thoroughly. The final survey questionnaire interview using google forms was conducted by visiting a total of 11 RMC plants and interacting with 25 Managers and Engineers (QA/QC team, Engineering, and Design team, and Logistics team) at the Plants. During the site visits, the basic functioning of ready-mix concrete plants was also learned. The needful analysis and visual conclusions were later drawn & penned down from the data collected. A flow chart summarizing the project methodology is given in Fig. 6 below.

2.2. Site visit details

Site visits to 11 RMC plants were carried out and data was collected. The data collection began in the last week of August 2021 and lasted until the second week of November. Visits to the RMC plants gave an exposure to be in direct contact with the plant managers whose valuable insights contributed majorly to the project. The RMC plants selected for the research work were in the surrounding area of Ahmedabad, Gujarat. The visits were carried out under strict COVID-19 protocols and safety measures were undertaken like proper use of helmets, safety shoes, reflecting jackets, hand gloves, face masks, safety goggles, and safety belts. Table 1 provides the details of the site visits and Fig. 7 (a), (b), (c) & (d) shows the site photographs of the RMC plants visited.

2.3. Information collection form

The information collection form was developed using the google forms tool and the form was designed in 8 sections, each section focusing on a different approach to understanding the impact of COVID-19 on the RMC industry. This google form was the center for collecting the survey data. A brief description of the questionnaire is given below:

Section-I: General.

The first section of the google form contained basic questions regarding the company’s name, RMC plant address, name of the contact person, their designation, and email address.

Section-II: Overview of COVID-19 impact on the RMC industry.

This section of the google form was devised to understand the overall impact of the pandemic on the RMC industry. Questions such as: whether or not there was any impact of the pandemic...
on that particular RMC plant. If yes, then the tenure for closure of the RMC plant was noted. If no, then the strategies adopted by the RMC plant to keep the plant operational were noted. If the plant had any impact on COVID-19, then that would have surely affected the concrete production of the plant.

Section-III: Concrete Production during the Pandemic.

To reach a firm conclusion for the information collected in Section II, Section-III questions were designed. In this section, the monthly concrete production of the RMC plant before & after the lockdown was noted. The time taken by the plant to reach its normal concrete production capacity after re-opening the market was also obtained.

Section-IV: Raw Material Availability.

This section was designed to understand the raw material scenario during the pandemic. Information was obtained regarding the old raw material stock such as Cement, Fly-Ash, Aggregates, Sand, Water, and Admixtures already present with the RMC plant. Information regarding the availability of new raw material stock and the potential sources of these raw materials was noted as illustrated below.

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**Table 1**

| Sr. No | RMC Plants | Date of visit       |
|--------|------------|---------------------|
| 1      | RMC 1      | 25th August 2021    |
| 2      | RMC 2      | 10th September 2021 |
| 3      | RMC 3      | 1st October 2021    |
| 4      | RMC 4      | 1st October 2021    |
| 5      | RMC 5      | 15th October 2021   |
| 6      | RMC 6      | 26th October 2021   |
| 7      | RMC 7      | 26th October 2021   |
| 8      | RMC 8      | 26th October 2021   |
| 9      | RMC 9      | 9th November 2021   |
| 10     | RMC 10     | 9th November 2021   |
| 11     | RMC 11     | 9th November 2021   |

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**Question-I.**

The scenario of old stock of raw material available with the plant during the lockdown: (Choose one).

- The old stock was NOT AVAILABLE at the Plant during lockdown
- The old stock was AVAILABLE at the Plant but was NOT SUFFICIENT for the entire lockdown
- The old stock was AVAILABLE at the Plant and was SUFFICIENT for the entire lockdown
- Any other information regarding old stock of Raw Material.

**Question-II.**

The scenario of new stock of raw material availability with the plant during the lockdown: (Choose one).

- New stock of Raw materials was NOT AVAILABLE during lockdown / unable to procure raw ingredients for concrete production.
- New stock of Raw materials was PARTIALLY AVAILABLE during lockdown
- New Raw Material was ALWAYS available during lockdown
- Any other information regarding the availability of raw material.

**Question-III to V.**

- If New Raw material was available even during the lockdown, then what were the sources by which the material was available.
- How many months did it take for the raw material availability scenario to get back to normal?
- Was there any change in the price of raw materials after the re-opening of the market?
Section-V: Liabilities, Labor and Equipment Management.

The industry would have got affected due to labor unavailability and other liabilities that the RMC plants would have to bear. To get a conclusion on this, the Section V of the google form was designed. Information regarding labor scenarios before and after the relaxation of lockdown was noted along with different types of liabilities that the plant had to meet as illustrated below:

**Question-I.**
Mention all the liabilities that were to be managed during the lockdown. (Tick all applicable options).

- Electricity and water bills
- Staff Salaries
- Maintenance of Machinery and Equipment
- Medical liabilities of staff
- Rent
- Machinery and Equipment rent
- Transportation costs
- Any other costs involved

**Question-II.**
The scenario of laborer’s availability during the lockdown: (Choose one).

- No labor available during lockdown
- Only a few laborers are available during lockdown
- All labors available during lockdown
- Any other information

**Question-III.**
The scenario of Labor availability after the lockdown was relaxed (Choose one).

- Labors were STILL NOT available even after relaxation of lockdown
- All the LABORS were IMMEDIATELY available as soon as the lockdown was relaxed
- Labors were available AFTER SOME TIME soon after the lockdown was relaxed
- Any other information

**Question-IV.**
How many months did it take for the Labor availability scenario to get back to normal after re-opening the market?

**Question-V.**
After the re-opening of the plant, what was the scenario for machinery? (Choose one).

- The existing machinery was in perfect condition and was ready to use. No maintenance or buying of new machinery was required
- New machinery had to be purchased
- No new machinery was needed. Just existing machinery needed maintenance
- Any other information

Section-VI: Losses Incurred.

To understand the losses that the RMC industry had to bear section 6 was designed. Information regarding the losses that occurred in the production of concrete and income in percentage were noted. Moreover, information on the time taken to achieve liquidity in the industry was also gathered in the same section. The questions are given below:

- Due to the pandemic, what percentage of loss occurred in the production of concrete, if any? (Ex: 30% loss in production)
- Due to the pandemic, what percentage of loss occurred in the income of the plant, if any? (Ex: Approx. 20% loss in income)
Section-VII: Action Strategies:
Another factor that was studied involved understanding how the companies coped with the changing environment due to COVID-19. Answers to the following questions were noted:

- Were there any action strategies developed by the officials to deal with the Covid situation? If yes, what were they?
- When the plant was completely closed, did the officials find ways to carry out work from home? If yes, Specify in detail.
- Were there any entertainment activities like webinars, and workshops conducted in online mode to keep the employees feel lively in such hard times?

Section-VIII: Conclusion.
In the last section, summarized input from the authority in charge regarding the whole scenario of the coronavirus was noted. Following questions were asked to the plant head/senior managers.

- Even after all the hardships, was there any positive impact that Covid brought on RMC Industry? (Write NA, if no positive impact was observed)
- Currently, after almost a year of re-opening, is the plant still facing any long-term Impacts of Covid? If yes, Specify in detail.
- Any recommendations from your side regarding the research?

2.4. Data obtained

When the visits to ready-mix concrete plants were carried out, the google forms were filled simultaneously depending upon the responses obtained from the plant manager, QA/QC Engineers, logistics head, or the authority-in-charge who was present at the ready-mix concrete plant. After all the visits to RMC plants and interactions with the plant officials were carried out, the information gathered in the google form was retrieved. The data obtained from each ready-mix concrete plant was unique in itself and after careful analysis, a comparison table (Table 2) between all the 11 RMC plants was made based on the below-mentioned categories:

- % Loss in the income of the ready-mix concrete plant due to the closure of plants because of the implementation of a nationwide lockdown
- % Loss in the concrete production due to closure of plants because of implementation of nationwide lockdown
- The period for closure of the ready-mix concrete plant (expressed in months)
- The change in the raw material (cement, fine aggregate, coarse aggregate) prices after the re-opening of the market when compared to the raw material prices before the outbreak of the coronavirus pandemic. (In terms of percentage)

- The concrete production was carried out by the ready-mix concrete plant before the coronavirus pandemic and lockdown.
- The concrete production was carried out by the ready-mix concrete plant after the coronavirus pandemic and lockdown.

Apart from these numeric and quantitative data, qualitative data was also obtained from the information collection form about the approximate time taken by the industry to get its production back on track, availability scenario about raw materials like cement, condition of machinery involved before and after lockdown, maintenance required, etc. From section 3, it was evident that it nearly took 4 months for the RMC industry to get back to its original concrete production capacity. Also, the majority of the plant managers mentioned that the equipment’s of the ready-mix concrete plant required maintenance. However, none of the ready-mix concrete plants had to completely buy new machinery even after the plant remained closed for 2–3 months. However, the maintenance of the machinery took time and this caused a delay in the re-opening of the ready-mix concrete after the relaxation of the lockdown guidelines [11]. Also, from section 5 of the information collection form, it was observed that even when the ready-mix concrete plants had to face losses in their income due to the closure of the RMC plants, they still had to pay off some liabilities like land rent, electricity bill, etc. Moreover, section 7 indicated that some of the ready-mix concrete plant’s officials took initiative to conduct informative webinars on COVID-19 guidelines, its precautions, dos, and don'ts while they were working from home. Apart from these informative webinars, technical webinars were also conducted on topics like new-age concrete, 3D concrete printing, etc. to keep the employees engaged during their time at home.

3. Results & discussions

Using the data from Table 2, Figs. 8 to 12 were obtained. From the column chart shown in Fig. 8, it is evident that most of the RMC plants remained closed for at least 2 months due to the covid pandemic, exactly between the time frame of the end of March 2020 to the end of May 2020 during which the lockdown was implemented. During this time of closure, the ready-mix concrete industry faced losses which are depicted in Figs. 11 & 12. However, the ready-mix concrete plant no. 2 remained closed for a longer duration of time i.e., 9 months, which was a striking feature. The reason behind this was that the company was facing a large number of losses. And the company already had one more functional plant located at a different place that was capable of handling the existing demand alone as the existing demand was lower than the usual demand [4]. Hence, the ready-mix company had decided to temporarily close their RMC plant i.e., RMC plant no. 2.

From Table 2, the fluctuation in the concrete production before & after the corona pandemic was observed. This change occurred due to the sudden closure of the RMC plants for a longer time. The graph in Fig. 9 gives a stand for comparison between the concrete production before and after lockdown. The blue color line in the line chart shows the production of concrete before the corona pandemic.
pandemic times, during which the plant ran at its full capacity. And the red line indicates the concrete production after the pandemic when the plant ran under a few restrictions of the government. In almost all the Ready-mix concrete plants, the concrete production has been negatively affected by COVID, as a downfall in the line graph is noticed. Moreover, from Table 2, the average decrease in concrete production, in most cases, was observed to be near about 1000 m$^3$. However, the RMC plant no. 1 depicted a striking feature. The concrete production for this ready-mix concrete plant increased from 3000 m$^3$ to 3500 m$^3$. The reason behind this increase was found that the plant had a lot many pending orders to meet. Once the situation went back to normal, they increased their production at a higher pace which led to this increase in concrete production. On the contrary, the concrete production for ready-mix concrete plant no. 2 is depicted as zero, as the plant was then temporarily shut down.

But from Fig. 9, it is noticed that the concrete production was negatively affected due by the pandemic whose effect lasted for at least 2 months.

Whenever any change occurs in any market, then that directly affects the prices for all the interlinked items & activities. Similarly, when the ready-mix concrete industry got affected due to the pandemic its effect was also applicable to the raw material industry. The prices of the raw material started to fluctuate. For the ready-mix concrete industry, the main raw materials are cement, sand, coarse aggregates & fine aggregates. The lockdown brought an immediate effect on the supply chain linked with the industry and as a result of this, there was a small increase in the prices of the raw materials. Using the data of the 4th category of Table 2, the pie chart represented in Fig. 10 was prepared. It has been found that more than 50% of the officials at the ready-mix concrete plants mentioned that not any significant increase in the price of raw materials has occurred due to the two-month lockdown. However, a small percentage of the increment (0–2%) was noted in some of the RMC plants. A completely negligible increment of more than 2% was observed in the rest. However, no RMC depicted that the price change was greater than 5%. So, there was a very minute effect on the prices of raw materials due to the coronavirus pandemic.

From Fig. 11, the loss in income for the various ready-mix concrete plants can be seen. The maximum loss of 70% was observed at RMC 3,5 & 7. This occurred as the plants were shut for nearly 2 months and the industry had no other source of income. On average, 60% loss was observed in the income of the RMC industry. From Fig. 12, the loss in concrete production for the various ready-mix concrete plants can be seen. The maximum loss of 55% was observed in RMC 11 whereas the least loss was noticed at RMC 1 of 20%. However, on average, nearly 40% loss has occurred to the ready-mix concrete industry in terms of concrete production which is a significantly large number.
From the survey carried out, it was observed that some of the very common liabilities that the ready-mix concrete industry had to face during the time of the pandemic were land rent, electricity bills, water bills, staff salaries, machinery & equipment rent, transportation costs & medical liabilities of staff. However, out of all the above-mentioned liabilities, the most general liabilities were land rent, electricity bills, water bills & staff salaries. Moreover, section 5 of the information collection form indicated the labor availability scenario during the time of lockdown and it was found that for the majority of the ready-mix concrete industry the laborers had migrated to their hometowns during such times as it was difficult for them to survive when everything went on hold. In the same section, survey data conveyed that after the re-opening of the ready-mix concrete industry, the industry had to carry out maintenance for their machinery which was completely shut down for nearly two months, which caused a delay in re-starting the plant.

Moreover, due to sudden the lockdown, the cash inflow and outflow between parties involved in the supply chain of the ready-mix concrete industry became stagnant. As a result, short-term liquidity was not achieved and this gave rise to a short-term financial crisis for all the involved parties. However, after the relaxation of the lockdown norms, the ready-mix concrete industry started to run at its normal capacity within just a few months and the financial issues were soon resolved. It was also observed that during the time of lockdown, it was extremely difficult to obtain new stock of raw materials like cement, sand, etc. It was because intercity and interstate connectivity were prohibited. As a result, transportation of raw materials from their source to the ready-mix plants became a huge question. This hindrance generated due to the rules and guidelines of lockdown caused a break in the supply chain of the ready-mix concrete industry.

4. Conclusion

- The COVID-19 spread outbreak has affected every type of industry in one way or the other. In this study, an attempt was made to determine the effect of COVID’19 on the ready-mix industry. However, the impact on the industry was not that extreme as compared to other industries, but it cannot be neglected. This study can act as a reference for understanding the difficulties the ready-mix concrete industry faced during the critical times of lockdown & pandemic.

- From the above study, it can be concluded that there was a significant amount of impact on the ready-mix concrete industry due to the COVID-19 pandemic. There was almost a 40% loss in concrete production & a 60% loss in the income generated for the ready-mix concrete industry. In addition to this, it was also noted that the industry also had to pay off liabilities like land rent, electricity bills, maintenance costs, etc. even when the revenue generated by the industry was almost nil. Moreover, the period of two months was an average time for which the plants remained closed. Some RMC plants faced acute labor shortage post-COVID-19 lockdown which caused a decrease in Concrete Production. It can also be concluded that there is a high level of interdependency between the ready-mix concrete industry and the raw material industries like the cement, aggregate, and admixture industries. Availability of adequate transportation modes for raw materials, availability of laborers, and proper functioning and maintenance of machinery like conveyor belts, dosing equipment, mixers, silos, etc. are vital for a fully functional ready-mix concrete industry.

- In nutshell, the industry faced many drawbacks due to the sudden upspring of an uninvented situation in terms of income & production. Also, the transportation sector was seriously crippled due to which there was a huge disruption in the movement of materials. However, in a time span of 4–5 months, the industry recovered from all of its negative impacts and went back to working in normal conditions just like before.

CRediT authorship contribution statement

Mauli Bhatt: Writing – original draft, Visualization. Nisarg Patel: Writing – original draft, Visualization. Tejas M. Joshi: Conceptualization, Methodology, Data curation, Writing – review & editing. Hemanth Kamplimath: Conceptualization, Methodology, Data curation, Writing – review & editing. Darshan Shah: Data curation, Conceptualization.

Data availability

No data was used for the research described in the article.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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