

STUDY ON READY-MIX CONCRETE, INCLUDING A SURVEY AND EXPERIMENT IN THE CONTEXT OF BANGLADESH.

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ABSTRACT

Cement concrete product is an integral part of any civil construction project and Ready mix concrete is a modern technology to prepare cement concrete in a dedicated yard and delivery to a certain distance keeping its quality same as fresh concrete. It 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. At present time ready mix concrete (RMC) is a very important subject of interest. In foreign countries most of the construction work is carried out by ready mix concrete. In the present study, it was tried to find out the condition of ready mix concrete company of Bangladesh and their products. The cost differential between Ready-mixed concrete and Site mixed concrete (SMC, hand mix concrete) is proving major constraint in its growth. It provides economy in the construction and better finish to the structure. From the survey results, it is seen that in our country also the use of RMC is quite high & is being increased. Also most of the company's RMC reached the target strength as found from the test result. However, some RMC samples failed to reach target strength.

Keywords: RMC, site mixed concrete, economy, modern technology, fresh concrete.

1. INTRODUCTION

In a batch factory, ready mix concrete is made according to a predefined mix design. Ready-mix concrete is often delivered in one of two ways. The first is the transit mixer, sometimes known as a barrel truck. Plastic concrete is transported to the construction site in this sort of truck. Ready mixed concrete (RMC), one of the most important construction materials, is prepared in modern facilities by blending components under computer control (Arioz et al, 2019). Ready mixed concrete (RMC) has a variety of advantages over site-mixed concrete. Due to its versatility, time savings, low cost, and flexibility to be adapted for a variety of purposes, ready mix concrete (RMC) is one of the most flexible and popular building materials (Rahman et al,2011).

A few of the advantages is mentioned in the table 1 below.

Table 1: Advantages of ready mix concrete (RMC) over Site Mixed concrete.

Site Mixed Concrete	Ready Mixed Concrete
Because concrete is mixed by hand, the quality varies.	Consistently high-quality concrete is produced in high-tech batching facilities in a computerized

	environment, allowing for construction to be completed in half the time.
Manual mixing takes more time, thus the project will take longer to complete.	Concrete in large amounts can be ordered. This helps the organization to grow and handle projects of any size.
Give it a little longer. Because the mixer will be too tiny to satisfy the requirement, repeated mixing is required for high quantities.	There was no waste of raw resources on site. Everything is pre-mixed and tailored to the needs of the consumer.
Due to manual mixing, a significant amount of raw material is wasted.	Raw materials are chosen following a thorough inspection.
Raw material quality is tested manually or not at all.	Consistently high-quality concrete is produced in high-tech batching facilities in a computerized environment, allowing for construction to be completed in half the time.



2. HISTORY

2.1. Global

RMC was first invented in Germany in 1903, but because to transportation constraints, commercial delivery proved impossible. In 1913, the first commercial delivery was made in Baltimore, Maryland, United States. In 1926, the first revolving drum transit mixer was invented. A RMC factory was established in 1931 for the development of Heathrow Airport in London. In the mid-1990s, the UK had over 1100 RMC factories, which consumed about 45 percent of the cement produced there. In 1997, 5850 firms in Europe produced a total of 305 million cusecs of RMC. RMC factories consumed roughly 72 percent (more than 2/3rd) of cement produced in the United States by 1990. The first RMC factory in Japan was established in 1949. By 1992, Japan had become the world's largest producer of RMC, with 18196 million tons produced. The RMC business is well developed in many other nations throughout the world, including some developing countries like Taiwan and Malaysia.

2.2 Asia

RMC plants originally appeared in India in the 1950s, and their use was limited to major building projects such as the Bhakra Dam, which was one of the first to use RMC. RMC was later employed for other huge projects such as long-span bridge building, industrial complexes, and so forth. Puna was the site of the first RMC plant, which opened in 1993.

2.3 Bangladesh

Ready-Mix Concrete is a form of concrete that is made to a specific recipe at a factory or batching plant and then delivered to a job site using truck-mounted transit mixers. This produces a precise mixture, allowing for the development and use of specialised concrete mixtures on construction sites. The first ready-mix facility was created in the 1930s, but it was not until the 1960s that the industry began to grow dramatically, and it has continued to grow since then. RMC was first launched in Bangladesh in 1991.

(Monem). In recent years, many ready-mix concrete companies have sprouted up in Bangladesh. Concord, NDE, SANY, Shah Cement, Crown Cement, and Abdul Monem are just a few examples of concrete that has been pre-mixed.

There have some figure showing how the ready-mix concrete process began from start.

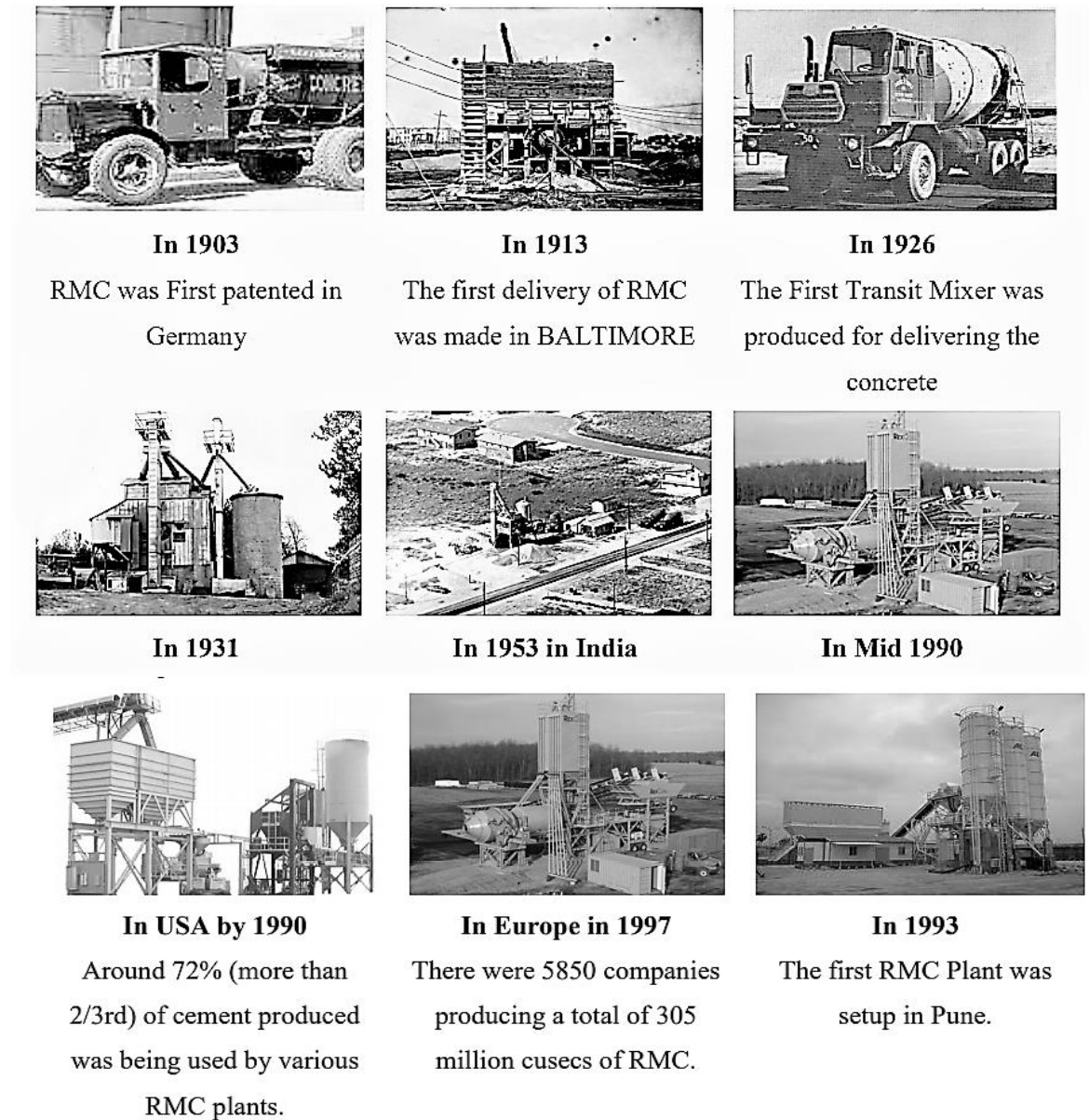


Figure 1: Ready-mix concrete process began

3. TYPES OF RMC

1. Transit mixed concrete
2. Shrink mixed concrete

3. Central mixed concrete.

3.1 Transit mixed concrete

Transit mixed Ready Mix Concrete is defined as components that are batched at a central plant and thoroughly mixed in the truck while in transit. The water is kept separate from the cement and aggregates throughout transit, allowing the concrete to be mixed shortly before being placed on the job site (Rahman et al, 2011).

3.2 Shrink mixed concrete

During transit, the concrete is partially mixed in the plant mixer and then balanced in the truck-mounted drum mixer. The amount of mixing done in the transit mixer is determined by how much mixing is done in the central mixing plant. To determine the amount of mixing required by the drum mixer, tests should be undertaken (Sen et al, 2016).

3.3 Central mixed concrete

Central-mixed Ready Mix Concrete is defined as RMC that is mixed at the factory and then transported in a truck-mixer or agitator truck. Centrally mixed ready mix concrete is frequently used in our country (Rahman et al, 2011).

4. PROCESS OF READY MIX CONCRETE

Show the process of ready-mix concrete in figure:

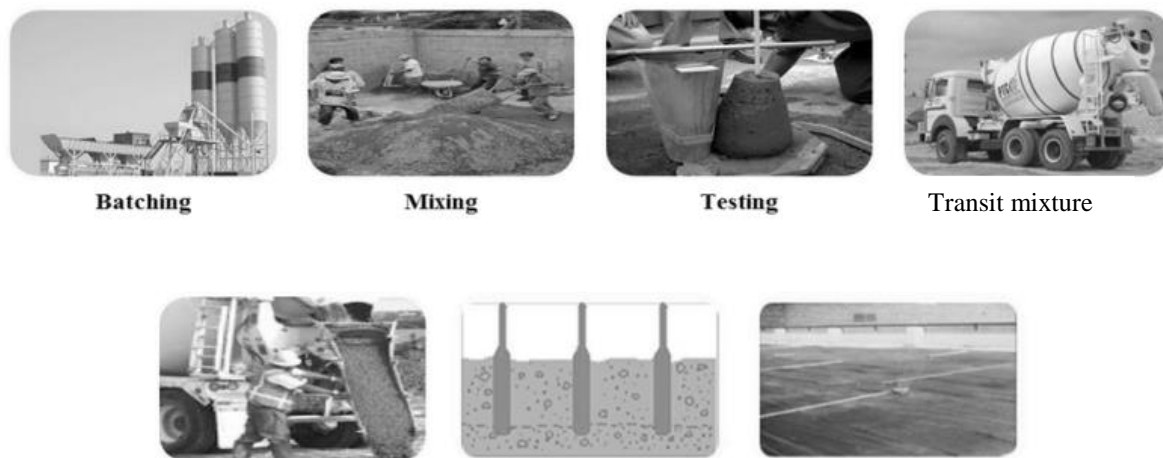


Figure 2: Process of Ready Mix Concrete (Pitroda et al, 2014).

5. APPLICATIONS OF READY MIX CONCRETE (RMC) IN THE CONSTRUCTION INDUSTRY

Show the application (where it uses mainly) of ready-mix concrete in figure:



Figure 3: Applications of Ready Mix Concrete (Pitroda et al, 2014).

6. SIGNIFICANCE

We may save time and money on labour costs by employing ready mix concrete (RMC). Ready-mix concrete can be utilized in the following locations:

1. Major infrastructure projects such as dams, roads, bridges, tunnels, and canals.
2. For concrete pouring in congested places where material storage is impossible.
3. Sites with a high volume of visitors that causes issues.
4. When there are fewer supervisors and labourers.
5. To reduce the amount of time spent on building, etc.
6. Massive industrial and residential construction projects.

7. ECONOMIC GROWTH

RMC is a revolutionary concrete concept in Bangladesh's construction business that was established a decade ago. It was initially not adopted by contractors because it is expensive due to its large equipment and machineries, as well as the high tax on RMC and the easy availability of manpower at a lower rate, but as time passed, they realized that it is cheaper in large or medium scale projects because it requires less time, manpower, and has a higher strength than site mix concrete. As a result, it saves time and money in the long run. In comparison to site mix concrete, RMC is also environmentally favourable because it eliminates noise and air pollution by mixing in a closed chamber (Pitroda et al, 2014)

8. READY MIX CONCRETE (RMC) SPECIFICATIONS

1. Concrete of higher grade is produced.
2. On-site storage of basic materials is eliminated.
3. Hiring plant and machinery are no longer in use.
4. There is no waste of fundamental ingredients.
5. Concrete production-related labour is no longer required.
6. The amount of time necessary is drastically reduced.
7. Noise and dust pollution at the construction site are decreased.
8. There is no waste on the job site.
9. It is eco-friendly.

9. LIMITATIONS OF READY MIX CONCRETE (RMC)

1. A large initial investment is required.
2. Expensive for modest projects (small quantity of concrete).
3. Requires an efficient transit infrastructure from the R.M.C. to the site.
4. If the right dose of admixture is not delivered, a traffic jam or vehicle failure will occur.
5. Workers should arrive on site ready to pour the concrete and vibrate and compact it.

10. SURVEY ON RMC IN BANGLADESH

Numerous forms of data, such as production per month, cost, manufacturing strength range, target strength gain, travel time, and so on, were obtained from various reputable ready mix companies during the course of these studies. These figures are quite valuable for comparing the activity of different businesses. The following is a graph and bar-chart representation of the questionnaire form and survey data:

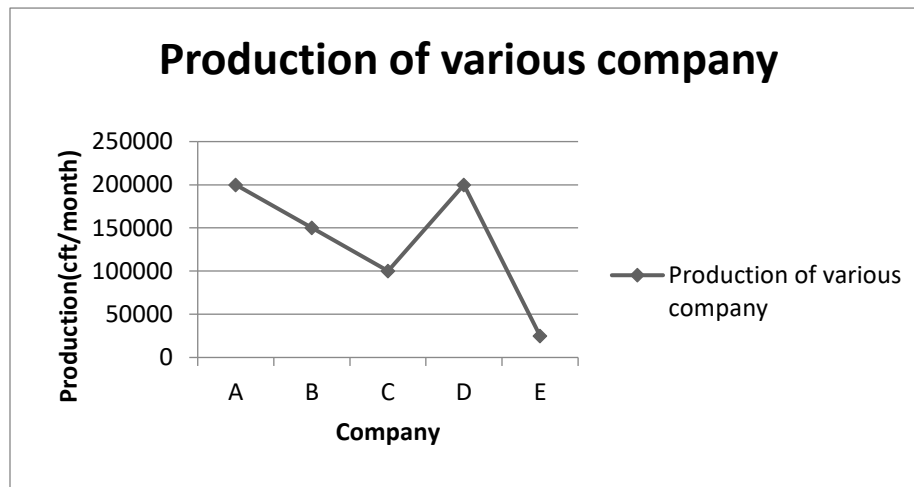


Figure 4: Production of various companies (2010)

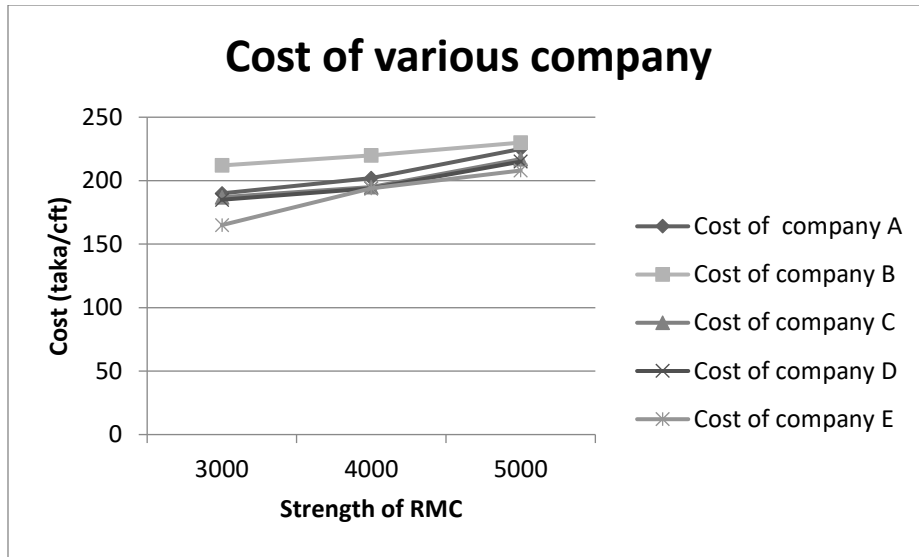


Figure 5: Cost comparison of various companies (2010)

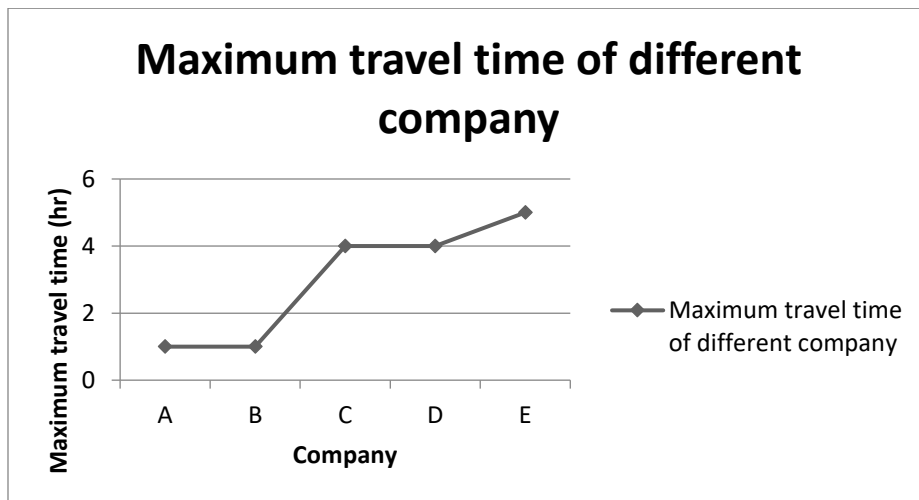


Figure 6: Maximum travel time of various companies (2010)

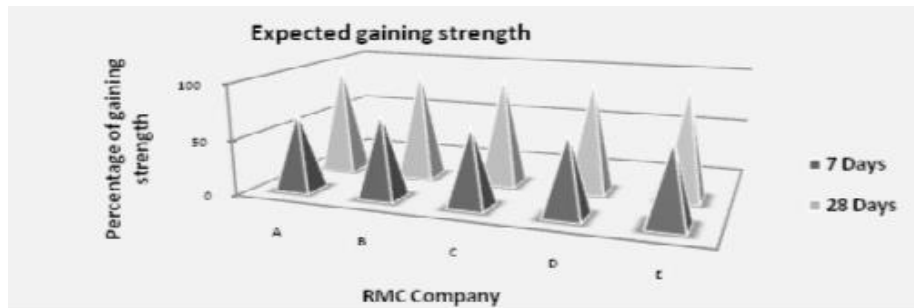


Figure 7: Bar chart of gaining strength of various companies

Now show in graph (a) and (b) indicates that with an increase in casting delay time the strength of concrete increases (after an initial setting time until it cast). But after an optimum time, the strength of concrete begins to decrease.

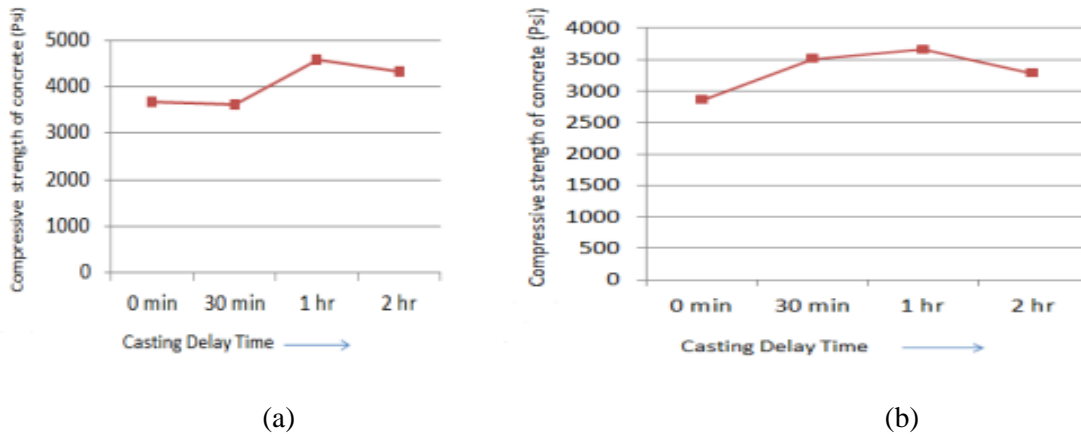


Figure 8: (a) compressive strength vs. Casting delay time (for w/c ratio 0.5); (b) compressive strength vs. Casting delay time (for w/c ratio 0.6).

11. EXPERIMENTAL PROGRAM READY MIXED CONCRETE (RMC) AND SITE MIXED CONCRETE (SMC)

The slump test is used to determine whether or not a concrete mix is workable. The measured slump must fall within a certain tolerance, or range, of the intended slump. Concrete workability is primarily determined by consistency; wetter mixtures are more workable than drier mixes, but workability of concrete of the same consistency can vary. It's also known as the relative fluidity of freshly mixed concrete, which indicates how workable it is. Now showing graph from experimental data which indicate comparison between RMC and SMC.

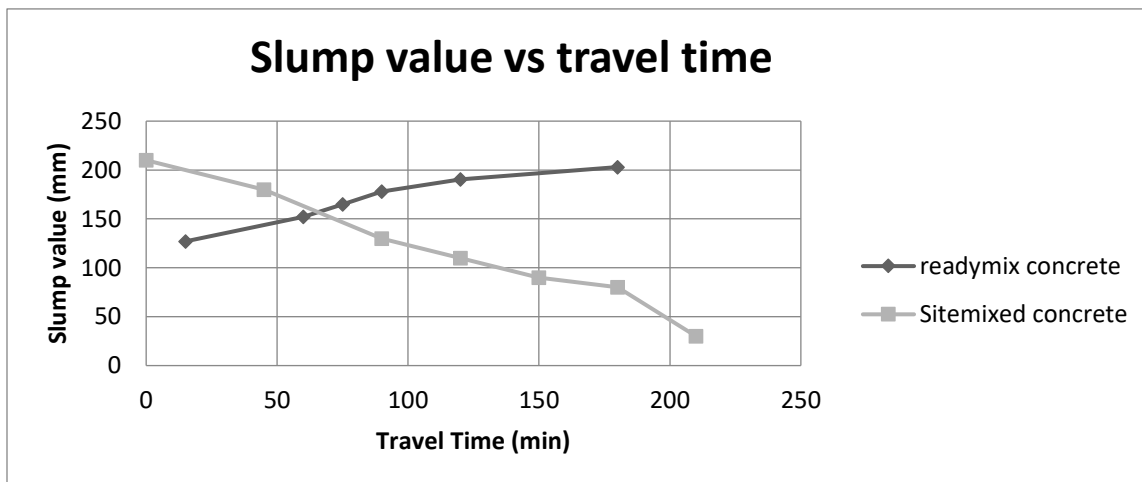


Figure 9: Slump value of Travel time for RMC and SMC.

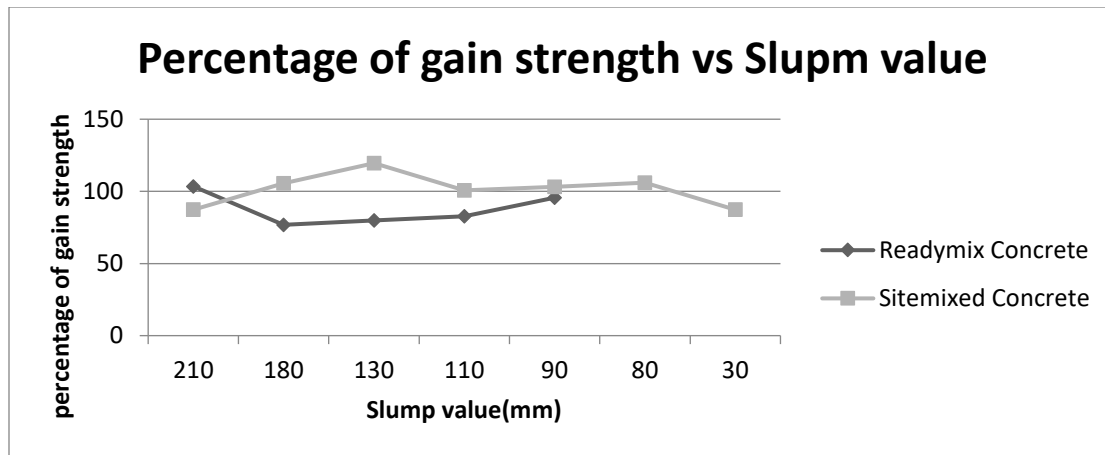


Figure 9: Percentage of strength value of slump value for RMC and SMC.

12. CONCRETE IN A STANDARD READY-MIX VERSION VS. CONCRETE IN A SITE-MIX VERSION

For major projects requiring a huge volume of concrete, ready-mix concrete is usually recommended. Site mixing is a preferable alternative for minor projects and restorations with a lesser concrete volume. A large region can be served by a centralized concrete batching facility. Site-mix trucks can reach areas that regular trucks cannot, such as rural places. Despite the fact that the plants are in industrial zones, the delivery trucks can service residential districts or inner cities. The same features apply to site-mix vehicles. The quality of site mixed concrete is not comparable to ready mixed concrete that is weighed because it is volumetrically metered.

13. CONCLUSIONS

Ready Mixed Concrete (RMC) is a new method of producing concrete in large quantities distant from the actual placement site. RMC is a ready-to-use product. It is widely used all around the world. In Bangladesh, there are enough ready mix concrete producers to accommodate consumer demand. The general public has little knowledge about and trust in ready-mix concrete. Despite its increased cost, ready-mix concrete is often preferable for many projects. When materials are required in a plant environment, the quality of ready-mix concrete is higher, and batch variance is small. It increases the structure's strength while also increasing its durability. It cuts down on both noise and air pollution. The supervision and labour costs associated with RMC production are lower, and the concrete quality is higher. It's ideal for large-scale industrial and residential projects where time is critical. However ready-mix concrete supplied by corporations frequently fails to reach the necessary strength which show in the figure 9 from survey. Considering its advantages its use should be expanded. As a result, RMC businesses should expand their output while rigidly maintaining the quality of their concrete.

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