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# A Review on the Study of the Mix Cement Properties of Cement Mortar Used in the Plaster from Different Waste Materials

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## ABSTRACT

The implementation of regulations like demonetization, the Real Estate Regulatory Authority (RERA), Real Estate Investment Trusts (REITs), the Goods and Services Tax (GST), etc., has accelerated the construction of buildings. In order to meet the rising demand, builders and developers must also accelerate the completion of construction projects by utilizing more affordable and quicker-to-assemble building components that are readily available in the community. Ready-mix plaster, a versatile construction material, has garnered significant attention in the building industry due to its ease of use, rapid application, and consistent quality. This paper provides a comprehensive review of ready-mix plaster, focusing on its properties, applications, and future prospects. The building's aesthetic, planning, design, and material selection must complement the local building customs and the people's way of life. The selection of appropriate and locally accessible building construction materials is contingent upon the use of acceptable technology and approach. In addition to choosing technology based on the local conditions, one needs ensure that the structures constructed are robust, functional, and long-lasting. It is important to choose the technology based on the existing local conditions while also ensuring that the structures are long-lasting, dependable, and serve the intended purpose. When constructing a building, different the structure's aesthetic appeal is improved through the application of finishing materials. The market has expanded over the last few decades to offer a wide range of alternative building materials that are more affordable, faster, safer, and have greater functional performance. The new building materials have been swiftly embraced by developers and builders, particularly the finishing materials, which are inexpensive and easy to apply or install. Wall surfaces are typically covered with a layer of "neeru" and cement mortar applied from the inside when a building is being constructed. This study reviews the different ready mix plaster proportions with the different replacing material and by the different proportions of the mix. This study gives the better idea in the formulations of the best suitable material for the ready mix concrete and give the better strength and suitable characteristics which become the environmental sustainable and environmental friendly construction material. This study helps to the civil engineers for the better development of the construction material and improves the sustainability by research and development in the construction activities.

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***KEYWORDS:*** *Ready Mix Plaster, W/C Ratio, Fly-ash*

## INTRODUCTION

Plastering is a process of applying one or more coats of mortar to a concrete surface, brickwork, stone masonry or lathing. It should be resilient enough to withstand moisture intrusion and weather consistency. Its appearance should be pleasant. These characteristics are dependent on the workmanship, materials utilized, mix composition, and strength of the mechanical bond between the plaster and backing surface.

Originally made of hydraulic or air lime, the plaster and mortars were later altered for certain uses (Fort et al. 2020).

This research was conducted as a component of a larger project that aimed to show the technical environmental and financial benefits of recycling an industrial by products like fly ash from ukai thermal power station. New research and innovative aspects of waste management must be pursued in order to implement the strategy (Monosi et al 2012). The primary goals of their strategy are to prevent waste and promote effective recycling, as well as to amend legislative to improve its implementation, it describes measures intended to lesser the pressure on the environment caused by waste production and management. The qualities of the combined material (sand and binder combined), the layer thickness, and the application technique all have a major impact on how well interior and exterior plaster operate. A suitable plaster can be designed based on the type of application by obtaining certain qualities from admixture and materials used (Monosi et al 2012).

Plaster selection is after determined by the external surface appearance; therefore, improving surface finishing should be the goal of innovative plaster design. Fly ashes frequently have cheaper, lighter and finer characteristics that standard ingredients; these characteristics should help with surface finishing (Monosi et al 2012).

The country's current significant infrastructure growth has driven up the demand for sand. The natural river sand basins are becoming less abundant due to excessive sand mining. Natural sand extraction is expensive due to lack natural sand and environmental restrictions, considering the fact that artificial sand and natural river sand have differing qualities, it is nevertheless frequently utilized as a fine aggregate in concrete nowadays (Vipushan R. et al 2019).

The workability of mortar is influenced by various factors, primarily the characteristics of the fine aggregates. They include surface roughness, shape and aggregate, among others. This study aims to examine the workability and further associate characteristics of using artificial in plastering mortar and comparing it with river sand workability mortar for plastering. Additionally, the study aims to create produced dry plaster admixture sand with the capacity to be worked and retain workability comparable to plastering using different types of sand (Vipushan R. et al 2019).

The proper ratio of cement, sand and particular additives is pre-mixed and knows as mortar or ready mixed cement from the factory (Wiwat &Sookramoon 2018).

In the traditional construction process, cement mortar is mostly used for wall plastering. Gypsum can be used for internal plaster. This project examines the study of partial replacement of sand with fly ash as it is the wastage which can be used as a material, as fly ash material can be reused for examine as we can reuse the pollution as well. (Ar. Namrata Patil 2022).

Sand has a significant impact on cement mortar's performance as a necessary component. In the civil engineering sector, will inevitably become necessary due to factors like repeatability and ease of usage. A common tool for bonding, plastering, building, and repairing structure is cement mortar (Dong Yan et al.2022).

One of the most widely used binders in dry-mix mortar, including masonry, adhesive and plastering mortar is cement. For this source, cement serves as a binder to guarantee that the right strength class and end product durability are achieved. (Spychal &Czapik 2021).

## METHODOLOGY&MATERIALS

Two tests were run to determine the cement's workability.

- **Standard consistency test of cement according to IS 4031 - 1988 (Part 4)**

1. Take 400 gm of cement.
2. 2.Prepare a paste of weighed quantity of cement with a weighed quantity of water. The time of gauging should be between 3 to 5 minutes at the time of adding water to dry cement until commencing to fill the mould.
3. Shake the mould slightly to remove the air.
4. Fill the Vicat mould with paste and level it with a trowel.
5. Place the mould in Vicat apparatus with the non-porous plate, under the rod bearing plunger.
6. Lower the plunger gently till it touches the cement surface. Release the plunger allowing it to sink into the paste.

7. Note the reading.
8. Repeat the above procedure taking fresh samples of cement and different quantities of water until the plunger is penetrate 5 to 7 mm from the bottom.
9. After getting the penetration between 5 to 7 mm repeat the practical twice with same amount of water obtained to get the penetration between 5 to 7 mm.

**Initial & Final setting time test According to IS - 4031-1988 (Part -5)**

**INITIAL PREPARATION**

1. Note down the initial reading when the needle C touches the non-porous plate every time while performing lest.
2. Consistency test to be done before starting the test procedure to find out the water required to give the paste normal consistency (P).
3. Take 400 gm of cement and prepare a cement paste with 0.85 times P of water by weight of cement.
4. Gauge time is kept between 3 to 5 minutes. Start the stop watch at the instant when the water is added to the cement.
5. Fill the Vicat mould, with the cement paste. Smooth off the surface of the paste making it level with the top of the mould. The cement block thus prepared is called test block.

**INITIAL SETTING TIME**

6. Place the test block confined in the mould and resting on the non-porous plate, under the rod bearing the needle C.
7. Lower the needle gently until it comes in contact with the surface of test block and quick release, allowing it to penetrate into the test block.
8. In the beginning the needle completely pierces the test block. Repeat this procedure i.e. quickly releasing the needle after every 15 minutes till the needle fails to pierce the block for about 5.0 ± 0.5 mm measured from the bottom of the mould. Note this time.
9. If at any interval the when observing the reading is near about 5 mm from bottom then take the time interval for next observation would be at every 5 minutes.

**FINAL SETTING TIME**

10. Replace the above needle by the one with an annular attachment Needle F.
11. The cement should be considered as finally set when, upon applying the needle gently to the surface of the test block, the needle makes an impression therein, while the attachment fails to do so.
12. The period elapsing between the time, water is added to the cement and the time, the needle makes an impression on the surface of the test block, while the attachment fails to do so, is the final setting time, Record this time.

1. **Tests were done to assess the sand's workability.**

Sieve Analysis Test of Fine Aggregate

(**IS 2386-1986 (PART 1)**) Reaffirmed 2021

**PROCEDURE**

1. Bring the sample to an oven dry condition before weighing and sieving.
2. Take minimum 200 gm of sample.
3. Assemble sieve in ascending order of sizes with pan Carefully pour the fine aggregate sample into top sieve and place lid on top.
4. Shake the sieve with hand.
5. Remove the sieve from stake and carefully weigh the sample retained on each sieve in a porcelain dish on the weight balance and repeat the same procedure for remaining sieves also, and weight the soil in the pan as well.
6. Calculate the percentage passing per sieve.

2. **Specific Gravity and Water Absorption test of Fine Aggregate**

**(IS 2386-1963 PART 3) Reaffirmed 2021**

**PROCEDURE**

1. Take 1 kg of sample for 10 mm to 4.75 mm or 500 gm of sample for finer than 4. 75 mm and keep it in a tray and covered with distilled water at a temperature of 22°C to 32°C for 24 ± 1/2 hours.
2. Remove the entrapped air or bubbles with the help of glass rod.
3. Now drain the water carefully from the sample, by decantation through a filter paper and material retained should be returned to the sample.
4. Pass the warm air to the sample to make it look like a saturated surface dry sample and should be weighted (Weight A).
5. Now the sample should be placed in the pycnometer and pour distilled water into it until it is full.
6. Eliminate the entrapped air by rotating the pycnometer on its side, the hole in the apex of the

cone being covered with a finger. Wipe out the outer surface of pycnometer and weigh it (Weight B).

7. Transfer the contents of the pycnometer into a tray, care being taken to ensure that all the aggregate is transferred.
8. Refill the pycnometer with distilled water to the same level. Wipe out the outer surface of pycnometer and weigh it (Weight C).
9. The difference in the temperature of the water in the Pycnometer during the first and second weighing shall not exceed 2°C.
10. The water shall then be carefully drained from the sample by decantation through a filter paper and any material retained returned to the sample.
11. The sample shall be placed in the oven in the tray at a temperature of 100 to 110°C for 24 + 1/2 hours, during which period it shall be stirred occasionally to facilitate drying. It shall be cooled in the air-tight container and weighed (Weight D).

**3. Bulk density and voids of fine aggregate**
**(IS 2386-1963 (PART 1)) Reaffirmed 2021**

PROCEDURE:

Rodded or Compacted Weight

1. Take oven dry or saturated surface dry or with given percentage of moisture according to test requirement.
2. Measure the volume of the cylindrical metal measure by pouring water into the metal measure or measure the dimension of cylinder with help of the tape a record
3. the volume of measure. (V)
4. The measure shall be filled about the one third full with thoroughly mixed aggregate and tamped with 25 strokes of the rounded end of the temping rod.
5. A further similar quantity of the aggregate shall be added and a further tamping of 25 strokes given.
6. The measure shall be finally be filled to overflowing tamped 25 times and the surplus aggregate stuck off using straight edge.
7. The net weight of aggregate in the measure shall be determine. (W)

**Loose Weight**

1. Take oven dry or saturated surface dry or with given percentage of moisture according to test requirement.
2. Measure the volume of the cylindrical metal measure by pouring water into the metal measure or measure the dimension of cylinder with help of the tape an record the volume of measure. (V)
3. The measure shall be filled to be overflowing by means of a shovel or scoop, the aggregate shall not be discharged from the 5 cm above the top of the measure.
4. The surface of the aggregate shall then be levelled with the help of straight edge and the net weight of the aggregate in the measure shall be determined (W).

**Standard Operating procedure for Silt & Clay content of Fine Aggregate**
**(IS 2386 PART -1963) REAFFIRMED 2021**

PROCEDURE

1. The sample is dried to constant weight in the oven at a temperature of 110 plus/minus 5 °C.
2. Take 500 gm oven dry sample (weight A).
3. After drying the test sample is placed in a container with sufficient water to cover the test sample, and agitated vigorously sample to separate all the fine particles from the coarse particles.
4. Then the entire test sample with water is poured over the nested sieves arranged with 1.18 mm sieve on the top and 75-micron sieve at the bottom, and is washed under running water until wash water is clear.
5. All the material retained on the nested sieve is returned to the washed sample and is dried to constant weight at a temperature of not exceeding 110°C (weight B).

**Tests of Mortar**

The consistency results for all samples (measurements using the drop cone method in CM and the flow table method in MM) are shown in table 1.

| Symbol of Mortar | Flow [1] (mm) | Cone Penetration [2] (cm) |
|---|---|---|
| C0 | 205 | 12.9 |
| C1 | 165 | 8.5 |
| C2 | 169 | 8.0 |
| C3 | 165 | 7.7 |
| C4 | 155 | 6.6 |
| C5 | 164 | 7.9 |

**Table 1 Consistency Results for Mortar**

C1 mortar flowed at a rate of 165 mm. This amount served as the starting point. The plastic consistency of all mortars from C1 to C5 is (flow diameter in the 140 mm to 200 mm) (Warszawa, Poland 2007). C4 mortar showed the least amount of flow among the mortars that had been mixed with admixture (155 mm), although C2 mortar produced the maximum measurement (169 mm). The consistency was affected by the type of additive in both situations. The use of limestone raises the water requirement of mortars, which decreases flow, whereas ground-granulated blast-furnace slag promotes flow. It is possible to see a similar pattern in the cone penetration test example (Spychal and Czapik 2021).

It is possible to conclude that all tested materials attain the consistency value typical of plasters used in practice by taking into account the consistency of C 1-C5 mortars as per. Plastering mortars should have a consistency of 6–9 cm for plasters applied manually, and 8–11 cm for plasters applied mechanically (by machine) (Cracow et al 2013). Any mortar that has been altered by adding cellulose ether can be applied by hand. A machine can only apply C1 and C2 mortars. (Spychal and Czapik 2021).

**Conclusion**

This study of ready-mix plaster underscores its significance as a versatile and indispensable construction material. With its ease of use, consistent quality, and rapid application, ready-mix plaster has revolutionized traditional plastering and finishing processes, offering efficiency and reliability to construction projects of all scales. This study explored the key properties and components of ready-mix plaster, emphasizing the critical role of binders, aggregates, additives, and water in achieving desirable performance characteristics. Additionally, this study delved into its diverse applications across interior and exterior surfaces, highlighting its adaptability to different substrates and environmental conditions. Moreover, this study has addressed the importance of quality control measures in manufacturing and application processes to ensure batch-to-batch consistency and long-term performance. Proper storage, handling, and substrate preparation have been identified as crucial factors in optimizing the efficacy of ready-mix plaster. Looking ahead, the future of ready-mix plaster appears promising, with ongoing advancements in technology and formulation. Innovations such as self-leveling plasters, eco-friendly additives, and enhanced durability coatings hold the potential to further enhance the material's performance and sustainability. This study conclude that ready-mix plaster continues to play a pivotal role in modern construction practices, offering solutions that balance efficiency, quality, and environmental responsibility. As the construction industry evolves, ready-mix plaster is poised to remain at the forefront, driving innovation and meeting the evolving needs of builders, contractors, and architects worldwide.

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