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Experimental Study on Strength of Concrete Using Waste Foundry Sand and Marble Dust Powder

Ankush Narwal¹, Amit Kumar²

M. Tech Scholar, Dept. of Civil Engineering, R.P.E.T Bastara, Karnal Haryana, India¹

Assistant Professor, Dept. of Civil Engineering, R.P.E.T Bastara, Karnal Haryana, India²

ABSTRACT: Modern concrete technology has the potential to use less energy and natural resources. Waste materials can be used in place of cement and sand since they are readily available and reasonably priced. The primary usage of marble in building construction is for flooring. The operation of processes like sawing, grinding, and polishing generates a lot of waste. Therefore, marble is a preferable substitute for cement. The article discusses the potential for partially substituting marble dust powder for cement in the production of concrete. Foundry sand is the sand that has been removed from the foundry after it can no longer be used. Because of high silica content and containing mostly natural sand material in it, it cannot be disposed off easily. Its properties are just like the properties of natural or factory-made sand. Thus it will usually be used as a replacement of sand. The demand of concrete structures is more now a day and to emphasizing the usage of eco-friendly materials in concrete, in this paper the cement is partially replaced by marble dust powder and sand is partially replaced by waste foundry sand. The purpose of the practical assessment was to ascertain the mechanical properties of concrete. This study compares the qualities measured—compressive strength, flexural strength, and split tensile strength—with the traditional M30 concrete mix. Marble dust powder and waste foundry sand (MDP 0%:WFS 10%), (MDP 0%:WFS 10%),(MDP 10%:WFS 10%),(MDP 10%:WFS 15%),(MDP 15%:WFS 10%),(MDP 15%:WFS 15%) have been used. Better outcomes are at (MDP 10%: WFS 15%), according to the results, for all cubes, cylinders, and beams.

KEYWORDS : Ordinary Portland Cement(OPC),Waste Foundry sand, Marble Dust Powder

I.INTRODUCTION

1.1 General

Currently, the primary component of a population's structural improvement is construction. Concrete is an erecting material made of water, coarse and fine aggregate, and cementation ingredient. We need to find a technique to lower the cost of building supplies because these components are becoming more expensive these days. In order to partially accomplish the aforementioned goal, waste foundry sand (WFS) and marble dust powder (MDP) are used in place of some of the cement. The marble were generally worn the same as a construction substance given that earliest times. Dumping of the waste materials of the marble operate, consisting of extremely fine powders, is one of the environmental harms worldwide today. Rising demand for marble innovation raises the production of waste marble objects. At the quarries, 40–60% of the total volume of modernization is lost as marble is discharged during the production of building blocks. When processes like sawing, grinding, and polishing are run, a significant amount of waste is produced. Marble is therefore a better substitute for cement. Sand is efficiently processed and used again and again by foundries. As the sand will now not be reprocess inside the crush, it is detached preliminary the foundry and is termed “foundry sand”. Six to ten million tonnes of foundry sand are produced each year. Foundry sand, like a number other waste products, has useful uses in other sectors. In line with the rapid increase in manufacturing activity, readily available supplies of regular sand have become more scarce. Waste One of the elements to be utilised in concrete as a partial substitute for sand is foundry sand. It is difficult to dispose of because it contains a high silica content and largely natural sand material. The square measure of its characteristics is the same as that of manufactured or natural sand. As a result, regular sand is used to partially replace the foundry sand.

1.2 Waste Foundry Sand

Environmental problems arise from the dissipation generated by business endeavours. The recycling of these waste items might then be highlighted. Because of the development of both ferrous and nonferrous metal throwing commercial businesses, the foundry sand is of the highest quality. Due to its strong thermal conductivity, foundry sand

has been used as a trim throwing material for hundreds of years. Sands are shaped and reused multiple times during the throwing process. Its characteristics are similar to those of natural or artificial sand; trash manufactured sand has a fineness modulus of 1.90. Thus it will unremarkably be used as a replacement of sand. The significant disposal expenditure has formed the present examine of waste foundry sand removal in landfills less complimentary. In accumulation the economic burden to the foundries, land-filling waste foundry sand also make them likely for future environmental expenditure, remediation harms, and regulatory limitations. Foundry sand can be used in a selection of applications associated to infrastructure engineering and treatment works. Waste Foundry Sand given away in Fig.1.1



Fig.1.1 Waste foundry sand

1.2.1 Types of Foundry Sand

1.2.2.1 Green Sand

The green sand is mainly used molding medium by foundries. Silica sand is the mass standard with the intention of resists elevated temperature, as the casing of clay binds the sand together. Green sand has a mud substance that outcome in a fraction of substance that passes at $75\mu\text{m}$. suitable to carbon substance; it looks black in color, or from time to time gray. It also contains chemicals such as MgO , K_2O , and TiO_2 .

1.2.2.2 Chemically Bonded Sand

The chemical bonded sand consists of 93-99% silica and 1-3% compound binder. Silica sand is entirely assorted with the chemicals; a method initiates the effect that cures and hardens the accumulation. Present are various chemical binder systems utilized in the granulate production. The mainly frequent chemical binder systems used are, epoxy resins, furfurals alcohol, phenol-urethanes and sodium silicates.

Generally, they are used in core construction wherever soaring strengths are essential to resist the temperature of dissolve metal. Silica sand is totally mixed with the chemicals; a medium initiates the effect to facilitate cures and hardens the mass. The chemically bonded sand is naturally of off-white color.

1.3 Applications of Waste Foundry Sand

The foundry sand is mostly fine aggregate. It's used in many of the same behavior as natural or simulated sands. This includes a huge quantity of civil manufacturing applications such as flow able fill, embankment, Portland cement concrete and hot mix asphalt . The foundry sands have also been used generally agriculturally as mud.

The leading quantity of foundry sand is used in the geotechnical application, such as site development fills, embankments and road bases.

The foundry sand has a lot of valuable applications in other production. It commonly consists of coated with a thin

layer of burnt carbon, remaining binders, silica sand, etc. It preserve be used in concrete to obtain better strength and another stability factor.

1. Waste foundry sand is used as an embankment material. It has very good properties that make it better for embankment material.
2. It can be use as a substituent of fine aggregate in highways and roadways pavement work construction.

1.4 Marble Dust Powder

Marble is a building material commonly used in decoration in palaces and monuments given that earliest time. The marble is a metamorphic rock produced by the revolution of limestone which is sedimentary rock by weight and high temperature in the earth shell by environmental method. Chemically it contains calcite, dolomite or serpentine material which makes the marble as a crystalline rock. Marble is hard, compact and extremely fine-grained metamorphosed rocks accomplished of attractive a spotless polish. Marble is powerful, includes a dignified look and huge demand in manufacture and embellishment. Marble dust concentrate is formed preliminary the limestone dispensation plant life throughout the decisive, determining, and polishing. Throughout this method, concerning 22-28% of the processed marble revolve into the crush form. Each time, million a lot of marble waste, from dispensation undergrowth is unrestricted. The clearance of this dissipate marble on top of soils causes a decrease in permeability and contaminate the greater than groundwater when deposited beside the catchment area. As a result, utilizing this marble dissipate surrounded by the accommodation production itself would make possible to look after the surroundings from dumpsites of marble and conjointly limit the unnecessary subtraction of expected assets of sand. Marble powder was collected from the Soami marble, Kharar, sieved by IS-90 sieve prior to the making of concrete. Marble dust powder shown in Fig.1.2



Fig.1.2 Marble dust powder

2.1 Objectives

1. To reduce the waste and reducing the environmental degradation caused by foundry waste and marble dust.
2. To improve the properties of marble dust powder and waste foundry sand in collaboration with aggregates and water.
3. To study the outcome of replacing different percentages of marble dust powder and waste foundry sand resting on the flexural strength and splitting tensile strength (Indirect tensile strength) along with compressive strength to appraise it with a conventional concrete mix of M30.

III.LITERATURE REVIEW

3.1 General

There is a lot of literature available regarding concrete using lime and other admixtures like geopolymers, fly ash, coconut, plastic waste, rice husk ash, marble dust, saw dust ash and many more. A lot of experimental work has been done on concrete using rice husk ash, waste ceramic tiles, fly ash, glass powder and other admixtures. However,

literature interrelated to strength explanation of concrete using marble dust powder and waste foundry sand by performing several tests has been presented in this general.

3.2 Marble Dust Powder

Jinshan et al. (2018) this paper produced high strength simulated earthenware from marble dust by using outside adjustment approach and frostiness sintering. Sintering is used to modify the marble powder and 5900C for ninety minutes. This approach improves the densification and growth. Flexural strength of earthenware is found to be better than the original marble slabs.

Gupta, et al. (2017) reviewed on the marble powder obtained from the marble production and experiment with it by making the concrete by replacing cement. It provides the effective results in concrete and gives economic results. This process also reduces the effects of marble dust on environment.

Manpreet, et al. (2017) this paper reviewed different methods of sand and cement replacement from the concrete by using marble dust. This work also considers the impact on the environment after using marble dust in concrete. The analysis of cost is also done to support the utilization of marble dust in concrete. The outcomes of the study show that it is beneficial and reduces its impact on the environment.

Vigneshpandianet, et al. (2017) this paper proposed a method for the consumption of marble dust in manufacture concrete. Marble dust modified the properties like chemical, mechanical and physical of cement. It showed the protective material result in concrete and no perceptible result in the hydration progression. The results of the proposed method are better when sand is replaced by marble dust.

Aruntas, et al. (2010) in this paper, the author experimented on the marble dust utilization in concrete. Marble dust modified the properties like chemical, mechanical and physical of cement. It showed the filler effect in concrete. The results of the proposed method are better when sand is replaced by marble dust.

Ilker Bekiret al. (2009) in this paper, the author reviewed the different methods and approaches on the alternate of cement with waste marble powder and this marble is aggregated in concrete production. It minimizes the construction cost of concrete and improves the mechanical properties of concrete. This dust also better its comprehensive strength.

3.3 Waste Foundry Sand

Pendhari A. and Nagarnaik P. (2016) in this paper, the impact of foundry sand while fine total replacement on the compressive strength of concrete with an M20 mix design. The rate of foundry sand utilized for substitution were 100 percent, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% as a result of weight of fine total. The test indicated great outcome, demonstrating the ability of foundry sand for being a segment in cement for granting strength. Production concrete from reused equipment spares vitality and preserves assets that result in a secure repairable setting.

Vema Reddy Chevuri and S. Sridhar (2015) in this paper the performance of concrete is confident by partly replacing the natural sand with foundry sand which is a waste product from machine industries. Simulated sand was replaced with five percentages (0%, 5%, 10%, 15%&20%) of waste Foundry Sand by weight. The compression test, flexural strength and splitting tensile strength test were carried out to evaluate the strength properties of concrete at the age of 7 & 28 days. Test consequences showed a supposed rising strength and hardness properties of concrete by the accumulation of waste foundry sand as a fractional replacement of natural sand.

Monosi .S et al. (2010) during this paper investigated the properties of mortars and Concretes containing completely different dosages of used mill sand (UFS) as partial replacement of sand in each contemporary and hardened condition. The control mortar sample with w/c equal to 0.50 requires the addition of 0.5% by cement weight, while mortars containing UFS need an add up to 1.8. Compressive Strength of Concrete decreased slightly due to the replacement of regular coarse aggregate with a foundry. The Compressive Strength of Concrete additionally decreases with increasing amounts of WFS. Not much work has been reported on the use of WFS in Concrete and Concrete related products. Some researchers have reportable on the work regarding the varied applications and ways used for testing of the Concrete created by mill sand

IV. CONCLUSIONS

From the respective study following conclusions can be seen:

1. As per the investigation, better results are at (MDP 10%: WFS 15%) for all cubes, cylinders and beam.
2. The compressive strength of Concrete cubes increases up and about toward (MDP 10%: WFS 15%) and starts decreasing for the further % values.
3. The split tensile strength of concrete cylinders increases up and about toward (MDP10%: WFS15%) and starts decreasing for the further % values.
4. The flexural strength increases up to (MDP 10%: WFS 15%) and starts decreasing for the further % values.



5. To save the surroundings, MDP and WFS may be used as an enhanced limited deputy of cement and sand in concrete.
6. Waste foundry sand and marble dust waste both wastes can be effectively used within the concrete mix up the same as an eco-friendly construction substance.
7. The use of marble waste powder represents good performance due to proficient micro filling ability.

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