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Experimental Study on Characteristics Strength of Concrete on Partially Replacing Sand with Waste Foundry Sand and Cement with Marble Dust Powder

Amit Sandhu¹, Deepak Pannu², Meena Devi³, Ravikant Sharma⁴

M.Tech Scholar, Dept. of Civil Engineering, R.P.E.T Bastara, Karnal Haryana, India^{1,2,3}

Assistant Professor, Dept. of Civil Engineering, R.P.E.T Bastara, Karnal Haryana, India⁴

ABSTRACT: The modernism of concrete technology can decrease the utilization of natural resources and energy sources. Cement and sand can be replaced by waste materials which can not only easily available but also economical in nature. Marbles are mainly used in flooring purpose in building construction. A large amount of waste is produced during the working of processes like sawing, grinding and polishing. Hence marble is the better option of replacement with cement. This paper explains the possibility of using the marble dust powder in concrete manufacturing as the partial replacement of cement. The sand which can no longer be reused is removed from the foundry and is termed as foundry sand. 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 practical examination has been carried out in order to determine the mechanical characteristics of concrete. The properties which are determined in this paper are compressive strength, flexural strength and split tensile strength which is compared with conventional concrete mix of M30. 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. Results indicate that better results are at (MDP 10%: WFS 15%) for all cubes, cylinders and beams.

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

I. INTRODUCTION

1.1 General

In the present time construction is the main part of the structural improvement of a population. Concrete is an erection matter consisting of cementations substance, coarse and fine aggregate, and water. Nowadays the cost of these materials is increased so, we need to look at a way to reduce the cost of building materials. To achieve the above objective the cement is partially replaced with marble dust powder (MDP) and sand with waste foundry sand (WFS). 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. The amount of marble discharged as dissipate through building block manufacture at the quarries is equal to 40 - 60 % of the overall modernization volume. A great quantity of waste is formed during the operational of processes like sawing, grinding and polishing. Hence marble is the better option of replacement with cement. Foundries effectively reprocess and reuse the sand a lot of times. As the sand will now not be reprocess inside the crush, it is detached preliminary the foundry and is termed "foundry sand". The foundry sand invention is arranged of six to ten million plenty yearly. Similar to several waste products, foundry sand has valuable applications to other industries. Appropriate to quick climb in manufacture activity; the accessible sources of ordinary sand have gotten bushed. Waste Foundry sand is one of the materials to be used in concrete as a partial alternate of sand. Because of high

silica content as well as containing mostly natural sand material in it, it cannot be disposed off easily. Its properties square measure the same as the properties of natural or factory-made sand. Thus the foundry sand is individual partly replaced with the normal sand.

1.2 Waste Foundry Sand

The dissipate produced by commercial ventures cause ecological issues. Subsequently, the recycle of this waste objects can be accentuated. The foundry sand is top notch silica sand that is a effect from the invention of both ferrous as well as nonferrous metal throwing commercial enterprises. From hundreds of years, foundry sand has been utilized as a trim throwing material since it has high warm conductivity. In the throwing procedure, shaping sands are reused numerous times. Its properties are kind of like the properties of natural or factory-made sand; the fineness modulus of waste manufactory sand is three.027. 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.1.1Waste foundry sand

1.2.1 Types of Foundry Sand

1.2.2.1Green 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. Greensand has a mud substance that outcome in a fraction of substance that passes at 75µm.suitable to carbon substance; it looks black in color, or from time to time gray. It also contains chemicals such as MgO, K₂O, and TiO₂.

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.

Vigneshpandian 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.

Aruntaş, 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 betters 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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