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Experimental Investigation in Concrete by Partial Replacement of Sand with Marble Dust: A Review

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Abstract - *Concrete is the hugest constituent to be utilized in the development business, wherein normally accessible sand is utilized as fine total. The framework advancement prompts bigger utilization of sand materials prompts outrageous quarrying. Inferable from extraordinary quarrying, normally accessible sands are getting depleted lastly finished in intermittent flood possibilities. So now we are in an opportunity to utilize exchange material for fine total in concrete. In the present business, one of the huge materials utilized in development is marble. While making the marble squares, 20-25% of powder material is acquired by sawing and cleaning process. These days removal of waste marble powder is one of the first ecological issues around the world. This present examination is planned to utilize the waste marble powder as fine total in the solid assembling, subbing the normally accessible material of sand. The substitution of waste marble was done completely and in part as 0%, 25%, half, 75% and 100% and its result on properties of cement were explored. Accordingly, we discovered that, ideal rate for supplanting of regular sand with marble powder in concrete is practically half substitution.*

Key Words: Marble dust. Fine aggregate. Concrete, sand, Cement, Replacement of sand.

1. INTRODUCTION

By and large in the solid blend configuration, concrete, fine totals of sand, coarse totals and water are the constituents for a more drawn out period, which plays a vital duty in structuring of an evaluation of cement. In any case, nowadays there is a shortage of totals. So elective new materials which are effectively accessible for minimal effort must be barged in for supplanting the fine total and just as concrete to get the comparable quality as that these ordinary constituents materials and give. So we need to chase for interchange materials to diminish the amount of essential normal materials in the solid blend without changing any blend structure method and contemplations. Utilization of less expensive material without loss of execution is pivotal to the development of development. We can't supplant the entire essential materials in the solid, yet we can supplant by interchange material somewhat. In the present world, gigantic measure of strong squanders are acquiring from assembling units and destruction of developments from human day by day living spaces. Some researchers are looking into using strong waste as partially substituting materials based on locally accessible waste materials like crushed plastic, stone residue, over-consumed blocks, m-sand, glass powder, coconut shells, waste tyres, slag, fly debris delivered from projects, broken glass pieces, rice husk debris, coconut shell debris, and so forth. A coordination effort has been made to coordinate society's need for safe and affordable trash collection. Utilizing waste materials helps maintain a pristine domain by saving common resources and dumping areas. The current method of solid growth is deemed unfeasible since it not only uses a significant amount of stone. Marble is a transformative stone of non foliated sort made out of generally calcite alongside recrystallized carbonate materials. Marble will be alluded as transformed limestone by geologists and unmetamorphosed limestone by stone artisans. Marble is usually utilized for mold and as a structure material. Squander Marble Dust (WMD) has different modern employments. It is utilized as filler in cement and clearing materials and gives a significant use to what is in any case a waste material. The measure of waste material as marble dust is expanding these days. The material is additionally used to make carbonic corrosive gas (Carbon dioxide) which is utilized in the packaging of drinks. The point of this task is to examine the impact and properties of cement with various proportions of substitution (0%, 25%, half, 75% and 100%) of regular sand with fine marble dust as fine totals. The solid evaluation of M25 was readied, crisp property of cement specifically compaction factor test and droop cone test, solidified property of cement in particular compressive quality, flexural quality and split elasticity tests were completed and contrasted and all the level of fine marble dust in concrete.

2. LITERATURE REVIEW

R.Anuradha: According to the results of the current experimental testing, using marble powder in lieu of cement and granite powder derived from crushing units in place of river sand might increase the concrete's strength qualities. In comparison to normal mix, it was shown that partial substitution of OPC with 5 and 10 percent of marble powder and fine aggregate with granite powder results in a progressive rise in compressive strength and tensile strength. More crucially, to use granite and marble powder, which are readily or inexpensively accessible, to reduce building expenses. Concrete mix with a 5% replacement

costs Rs. 5700 per m3, which is 5% cheaper than the cost of conventional mix, whereas conventional mix costs Rs. 6000 per m3. Our major goal as civil engineers is to prevent environmental degradation caused by the manufacture of cement.

Shrma et.al: The following findings have been drawn following the execution of all tests and analysis of their results: The findings of the current investigation demonstrate that MDP has tremendous potential for use in concrete as a cement alternative. The highest compressive strength was obtained with a 14 percent MDP substitution with cement. Maximum flexural strength was observed at around 17.5 percent MDP substitution with cement. When cement is substituted with MDP at a rate of 3.5 percent, the extreme value of Durability against acid attack is attained.

Boobalan et.al: The following conclusion were obtained from this experimental investigation, The concrete hardened property of compressive strength was improved with addition of upto 50% by weight of waste marble powder replacement for natural sand and compressive strength decreases additional any increment. Replacement of natural sand from 0-100% with waste marble powder, decreasing trend was there in split tensile strength of cylinders were decreased. Though the 25% replacement of natural sand with waste marble powder had given tensile strength nearly identical to the tensile strength of the control mix with 0% waste marble powder. The incremental trend was observed in flexural strength value of prisms specimens with addition upto 50% waste marble powder replacement with natural sand replacement and then regularly decreasing. Thus we came to the conclusion that, optimum replacement percentage of natural sand with waste marble powder in concrete is almost 50%.

Katuwal et.al: From the study, it can be concluded that marble dust can be satisfactorily utilized as a constituent of concrete of grade M35 by using it as a replacement of cement at 10% of the total weight of cement and 15% of the total weight of fine aggregate. By comparing the results obtained from the study, it can be seen that 15% replacement of fine aggregate by marble dust gives slightly higher strength of concrete than 10% replacement of cement by marble dust. The use of 15% of marble dust as fine aggregates for M35 concrete will ensure that waste marble dust are put to large scale use, thus enabling reuse of waste materials instead of being dumped in landfills. The use of marble dust shall also help in reduction of the dependence on natural aggregates to a certain extent, thus providing time for their replenishment.

Shirulea et.al: As much as 10% of the weight of cement can be replaced with waste marble powder to boost the compressive strength of cubes, but any additional waste marble powder reduces compressive strength. When waste marble powder is added to cylinders, the split tensile strength of the cylinders increases by up to 10% when weight of cement is replaced, and it declines with every further addition of waste marble powder. Thus, we discovered the ideal replacement rate for marble powder with cement, which is close to 10% cement for both cubes and cylinders. We have proposed a straightforward method to reduce building expenses by utilising marble powder, which is readily or inexpensively accessible; more significantly. Our primary goal as civil engineers has led us into the area of environmental degradation caused by the manufacture of cement.

Gautam, Verma: Marble dust has shown to be highly helpful in ensuring excellent mortar and concrete cohesion. According to the results of the study mentioned above, marble dust may be utilised as a cement substitute. A marble dust replacement of 10% produces concrete that is superior to control concrete in terms of strength and quality. The findings demonstrated that adding marble stone dust to cement to replace 10% of it increased its compressive strength, splitting tensile strength, and durability-related parameters. According to test results, this industrial waste can enhance the behaviour of new concrete, hardened concrete performance, and plain concrete by up to 15%.

Anil Kumar: The earth's natural resources are being rapidly depleted in today's society. Numerous environmental issues arise during the production of cement, such as the release of CO2 into the atmosphere, which is bad for both human health and the environment. Because of this, substituting byproducts like marble powder and fly ash for cement in the appropriate amounts appears to be a suitable option. According to earlier studies, adding just the right amount of marble powder and fly ash to concrete can improve its qualities.

Dr. B. Krishna Rao: Following conclusions may be drawn from this study's findings: Where there is a competitive cost advantage, the use of marble dust in place of cement in the manufacturing of concrete for the building sector should be encouraged. At 10% substitution of marble powder in the regular mix, it was observed that, after 7, 28, and 56 days, the flexural strength improved by 11.22, 20.8, and 14.8%, respectively. When marble powder was substituted at 15 and 20 percent, there was a noticeable loss in strength. 10 percent replacement with marble powder is determined to be the greatest replacement option for replacement for compressive strength, split tensile strength, and flexural strength because the rise in percentage of strength is substantial compared to other variants in the mix.

Kishan N. Davara et. al: The arranged the survey on fractional substitution of concrete and sand by marble powder content. By checking on inferred that compressive quality was expanded by expansion of half by weight of waste marble powder with sand and after that quality was diminished, alongside concrete functionality diminished.

Pooja J. Chavhan et.al: watched the conduct of marble powder as fractional supplanting with sand by 0-half with an augmentation of 5%. The greatest compressive and split rigidity was accomplished at 45% supplanting with sand. More prominent functionality, compressive quality of cement and mortars was accomplished by expanding the waste marble granule or waste marble powder and saw that compressive quality of different cement blends in with the consideration of marble granules was gotten 5 to 10% more noteworthy than the control examples. Nataraja et. al had done the examination on paver obstructs with squashed stones and eccentric materials, for example, broken pavers, kadapa for various rate substitution of coarse total and inferred that kadapa had invigorated better with ordinary paver squares [10]. Ranjan Kumar (2015) watched the conduct of substitution of concrete by 0-20% with marble dust powder in the solid. Their test examination presumed that 10% expansion in quality for compressive quality and split and flexural quality expanded by 15% contrasted with ordinary solid examples.

Mary.et.al: There is an improvement in all mechanical qualities when discarded marble is used in place of fine aggregate. The highest compressive and tensile strengths may be achieved by replacing fine aggregate with discarded marble powder. For both cubes and cylinders, the ideal replacement rate for marble powder with fine aggregate is close to 10% cement.

Ahmad et.al: In this study, marble waste was utilised as a fine aggregate in proportions of 0%, 20%, 40%, 60%, 80%, and 100% by weight of fine aggregate. Based on the results of the experimental work, it has been determined that the proportion of marble waste increases the workability of concrete. The highest slump was attained when marble waste was substituted 100% of the time. The reason for this is that marble absorbs more water than unprocessed sand. As a result, there is more water available to act as a lubricant between the coarse aggregate particles. When marble waste was substituted for up to 60% of the weight, the strength (compressive, flexure, and split tensile) rose, and after that point, the strength rapidly fell. Because marble has a lower fineness modulus than natural sand, it fills in the spaces left by the coarse aggregate and sand to produce more dense concrete, which improves mechanical performance. Conclusion: Marble debris may be utilised as fine aggregate to enhance the mechanical qualities of traditional concrete. These waste materials can be effectively employed as fine aggregates in the making of concrete from an economic and environmental standpoint.

Dhanaseker, Lavanya: according to the findings and observations from this experimental research investigation. The following inferences are made: It has been shown that experimental results for the 10% replacement of marble powder & quarry dust to PPC have increased in strength compared to 0% and 10% replacement. The strength reduced once marble powder was replaced by more than 20%. The addition of waste marble powder and quarry dust progressively increases the flexural strength of beams by up to 10%, and also, any addition of the contemporaneous products causes the strength to diminish. Based on the results of the tests done on concrete made with marble powder and quarry dust, it can be said that, when used up to a 10 percent replacement of cement with a w/c ratio of 0.46, marble powder and quarry dust can boost the overall strength of the concrete. The valuable pozzolanic minerals, marble powder and quarry dust, have the ability to partially replace cement and fine aggregate, respectively. This could lessen the environmental issues.

Rangesh: Concrete that has been partially replaced with marble dust and fly ash has improved mechanical and durability characteristics. enhancement of compressive strength with the use of 30% marble dust and 15% fly ash in cement concrete. The presence of marble dust and fly ash in concrete actually creates denser matrices, strengthening the matrices' resistance to water intrusion, one of the most significant factors accelerating concrete degradation.

Saran, Venkat: designed to examine the viability of replacing fine aggregate with used marble dust. It offers special benefits including abundance, accessibility, and affordability. The results of the experiment indicate that using marble dust powder can enhance the performance of hardened concrete. Results for the compressive strength of concrete containing marble dust powder demonstrated consistency with control concrete. When marble dust powder is added to concrete, the compressive strength is raised by up to 50% by weight sand; however, if it is used more than 50%, the strength may automatically drop. The split tensile strength of cylinders is reduced by 100% addition, thus we want to replace 50% of the cylinders with sand, and the strength will only obey up to that proportion. By the durability of the compressive strength and split tensile strength of concrete with replacement of fine aggregate at 10%, 20%, 30%, 40%, and 50% Strength rises for 7 days and 28 days when using marble dust powder in NACL solution, as demonstrated. Sand is becoming more scarce everywhere these days. Therefore, I draw the conclusion from this project that we can substitute fine aggregate for sand up to 50% of the time when sand is required for building. The material is very reasonably priced per tonne.

AshmiJenika. et.al: the need for environmentally friendly building in the modern world and the potential use of marble powder to partially replace cement in the creation of concrete. The project focuses on using marble powder in building to save costs and be more environmentally friendly. It might pave the way for more affordable, pollution-free concrete building while still achieving the needed strength. In this experimental enquiry, a study on conventional concrete with concrete by substitution of marble powder

0%, 2.5%, 5%, 7.5%, 10%, 12.50%, and 150% by cement has been explored. The results have been provided. Concrete may profit from marble powder, a byproduct, by using it to increase durability, reduce costs, and protect the environment. Marble powder is added to concrete to boost its compressive strength and split tensile strength. More than 12.5 percent marble powder in concrete reduces its compressive and split tensile strengths while improving workability. Up to 10% more flexural strength is progressively added to beams. This led to the conclusion that, as compared to normal concrete, partial cement substitution using waste marble powder is both feasible and cost-effective.

Santhosh el.al: according to the literature Based on an examination of the literature, it has been determined that using marble in place of cement will produce concrete in a sustainable way. The highest compressive strength was 14 percent cement substitution with marble powder. Because leftover marble powder has a huge surface area, it made concrete less workable. The marble powder's durability properties improved, making it appropriate as a concrete addition. When cement is replaced with marble dust, extreme value against acid assaults is obtained. Initial and final setting durations are shown to rise but not very considerably, whereas standard consistency is found to decrease. This is advantageous for appropriate concrete setting since the first setting period needs to be lengthy enough to allow for concrete transportation and placement. By replacing cement with powdered marble dust, the concrete's compressive strength is increased by 15%.

Amudhavalli: 20 percent is determined to be the desired marble dust percentage in concrete. Compressive strength has been shown to increase by 6% in PEFRC compared to regular concrete. Concrete with 0.4 percent polythene fibre and 20 percent marble dust has the highest splitting tensile strength. Mix M3 has the highest flexural strength, and its highest strength is 5.68 N/mm2.

Ellappan et.al: Based on the studies done on concrete cube specimens, the following conclusions may be drawn. All mechanical qualities are increased by up to 20% when scrap marble is used in lieu of cement. Maximum compressive strength is achieved by substituting discarded marble powder for 20% of the cement. The ideal replacement ratio of cement to marble powder is around 20 percent cement for both cubes. More crucially, to use marble powder, which is readily or inexpensively accessible, to reduce building expenses. Our major goal as civil engineers is to prevent environmental degradation caused by the manufacture of cement.

Anwar et.al: For more effective replacement, compare the characteristics of M20 grade ceramic waste powder concrete with marble dust powder concrete at the water cement ratio of 0.50. Based on experimental research into the compressive strength of concrete, the following conclusions are drawn: When marble dust powder is added to conventional concrete, its characteristic strength is reduced as compared to conventional concrete. As a result, up to 20% by weight of cement has replaced the marble dust powder without changing the concrete's typical M20 grade strength. The compressive strength diminishes when more marble dust powder is used to replace cement. Concrete has a compressive strength of 23.20 N/mm2 when ceramic waste powder replaces 30% of the cement, whereas marble dust powder replaces 20% of the cement to yield a compressive strength of 24.30 N/mm2. As a result, ceramic waste is more affordable than marble dust powder without reducing the strength of the concrete relative to regular concrete. As a result, the replacement is both technically and financially viable. The best option and most highly valued use of such waste is the use of ceramic waste or marble dust and its application for the sustainable growth of the building sector. One of the main goals of civil engineers is to solve the environmental pollution caused by the manufacture of cement. It is a potential alternative method for the safe disposal of ceramic waste powder and marble dust powder.

Jashandeep, Bansal: All mechanical qualities are increased by up to 12% when scrap marble is used in place of cement. Maximum compressive and tensile strength is achieved by substituting discarded marble powder for 12 percent of the cement. For both cubes and cylinders, the ideal replacement rate for marble powder with cement is close to 12 percent cement. More crucially, to use marble powder, which is readily or inexpensively accessible, to reduce building expenses. Our major goal as civil engineers is to prevent environmental degradation caused by the manufacture of cement.

3. CONCLUSION

After studying literature review in this paper, we have found some conclusion which is given below:

1. Its typical strength is reduced when ceramic waste powder is added. As a result, up to 30% by weight of cement has replaced the ceramic waste powder without altering the concrete's distinctive strength of M20 grade. The compressive strength falls as cement is replaced with ceramic waste powder more often.

2. The compressive strength of concrete tends to grow as the percentage of marble powder and quarry dust increases up to a specific percentage and then starts to decrease as the percentage of marble powder and quarry dust increases. This concrete mixture outperformed regular concrete by 10% when marble powder and quarry dust were substituted. The results of the compression and split-tensile tests showed that the proportion of

marble powder and quarry dust enhances the strength of concrete and controls the workability of the concrete during mixing.

3. The workability improved as the amount of marble powder rose. The mechanical characteristics grew as the number of curing days increased. With an increase in marble powder up to 10% replacement, the compressive strength rose. At 7, 28, and 56 days, respectively, it was found that the strength had grown by 2.81, 2.92, and 4.58 percent as compared to the standard mix with a 10 percent replacement of marble powder. It was shown that, after 7, 28, and 56 days, the tensile strength of marble powder had increased by 0.43 percent, 11.6 percent, and 5.6 percent, respectively, as compared to normal mix.

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