Comparative Study of M20 GRADE of Concrete Casted using OPC & PPC with Partial Replacement of Cement by Marble Dust

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ABSTRACT: The main objective of this project is to study the characteristic properties of concrete casted by using OPC & PPC with partial replacement of cement with marble dust. Because of the higher cost of the natural material, we have forced to focus on replacement of low cost concrete materials as alternative and cost effective source for construction of concrete. The marble dust used in this project is obtained from shaping, cutting, polishing etc. Then the marble dust replaced concrete properties will be compared with conventional concrete.

Among the types of cement used in concrete construction, i.e., Ordinary Portland Cement (OPC) and Portland Pozzolana Cement (PPC). With these types of cement many researches have been done. Now in this project, the certain amount of cement can be replaced with marble dust. For determining and to compare the strength properties, the marble dust replaced concrete has been casted then will be compared with the conventional concrete. For this project, the several properties of marble dust have been studied. Also to determine the optimum percentage of marble dust, the marble dust replaced concrete with different percentages have been casted, cured & tested. Then with this determined optimum percentage of marble dust specimens will be casted and compared with conventional concrete. The optimum percentage of marble dust used in this project was found to be 5% for the two types cement such as OPC & PPC. The different strength properties such as compression strength and split tensile strength has been determined by laboratory test.

Art of Making Concrete

Concrete is a composite material, made by mixing Coarse aggregate, Fine aggregate, Cement and Water.

Coarse Aggregate

As per IS 383:1970, coarse aggregate used for this project satisfies the specifications provided in the Indian Standard.

Fine Aggregate

Fine aggregates used in this project also satisfies the specifications provided in the Indian Standard.

Cement

Two types of cement, Ordinary Portland Cement (OPC) and Portland Pozzolana Cement (PPC) of grade 53 has been used for this project.

Marble Dust

One of the major waste produced in the stone industry during cutting, shaping, and polishing of marbles is the marble dust. Due to the availability of large quantity of waste produced in the marble factory, this project has been planned and proceeded. The marble dust used in this project is in powdered form, Odourless, Grey in colour with the moisture content of 1.59%.

The chemical properties of marble dusts are tabulated as,

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\begin{align*}
\text{SiO}_2 & \quad 28.35 \\
\text{AL}_2\text{O}_3 & \quad 0.47 \\
\text{Fe}_2\text{O}_3 & \quad 9.70 \\
\text{CaO} & \quad 40.45 \\
\text{MgO} & \quad 16.25 \\
\text{Density} & \quad 2.80 \text{ g/cm}^3
\end{align*}
\]

Mix Design

Mix Ratio

The mix design for M20 grade of concrete have been done with the determined properties of concreting materials and the mix ratio for the M20 grade of concrete as per IS 10262:1982 was found to be 1:1.75:3.53.

Experimental Verifications

Compression Strength Test

In order to determine the strength properties of hardened concrete, the cubes of size 150mm*150mm*150mm will be casted and cured for 7days and 28days. Then the compression strength of the cured specimens will be determined at 7days and 28days.

Split Tensile Strength Test

In order to determine the strength properties of hard-
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Conclusion

From this project, we conclude that the two types of cement OPC & PPC which are partially replaced with cement shows good binding property as cement, so it can be partially used as a replacement of cement and it does not show any variation in compression strength of over conventional concrete.

From the experimental result, it is found that the physical characteristic and compressive strength is very much equal to that of conventional concrete. And it also showed little higher compressive strength value over conventional concrete. From this we may conclude that these partial replacement of marble dust as cement material can be used in structural concrete work.

Acknowledgement

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References

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German researchers develop flying robots to inspect buildings from the air

Researchers at the Fraunhofer Institute for Non-Destructive Testing IZFP in Saarbrucken, Germany are pioneering the development of flying robots that are equipped to inspect buildings for damage.

Test engineers have thus far relied on observation with the naked eye to inspect concrete for cracks. In addition to being a highly fallible procedure, it also necessitates the usage of expensive equipment such as cranes, industrial climbers or even helicopters to observe hard to reach areas.

The development of aerial robots by the Fraunhofer Institute promises to remedy these shortcomings through the use of a device capable of reaching and closely observing those areas which are difficult for human beings to access directly. Their ‘octocopter’ is a small remote-controlled flying robot equipped with eight rotors and a high-resolution digital camera. The miniature aircraft is capable of drifting and hovering at the whim of its controller, enabling it to scrutinise those parts of buildings which would be impossible for a person to access unaided.

Sensors on the octocopter maintain its stability in fraught wind conditions, ensuring that it remains at the same altitude and doesn’t collide with either buildings or the protruding features of other large structures. In addition to superior access, the flying robot also confers the advantage of enhanced observation and recording capabilities, using its digital camera to capture a near inexhaustible series of high-resolution images for subsequent examination. These images can then be combined to produce sophisticated 2D and 3D data models which will provide engineers with a comprehensive picture of a building structure, including any cracks or defects in urgent need of remedy. This imagining capability could be even further enhanced by the incorporation of a thermal imaging camera, which would be capable of assessing the quality of a structure’s insulation set up.