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A REVIEW PAPER ON PARITALLY REPLACEMENT OF CEMENT BY MARBLE DUST IN RIGID PAVEMENT

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Abstract *This paper aims to specialise in the possibilities of using waste materials from different engineering activities in the preparation of innovative concrete. The use of waste marble powder (dust) was suggested in partial replacement of cement, for the production of Concrete Mix. Tests were conducted on concrete mix for different times to determine their workability, compressive strength and flexural strength. Partial replacement of cement by fluctuating percentage of marble powder reveals that increased waste marble powder ratio consequence in increased workability and compressive strengths of the concrete at respectively curing age. The marble dust from marble processing is a waste which can be utilized for concrete pavement. The use of this waste was proposed in numerous percentages as an addition to and as a substitute of cement, to produce concrete mixtures. Within the study, the use of marble dust collected during the shaping process of marble blocks has been examined in the concrete mixtures as cementitious material. The study's hewed that marble wastes, which are within the dust form, could be used as cementitious material in concrete mixtures where they are available, and the cost of construction is lower than ordinary concrete materials. The concrete is prepared containing 0, 5, 10, 15 and 20% waste of marble dust with cement compared to the entire quantity of normal concrete. The prepared mixtures were then analyzed in conditions of their properties both in fresh and in hardened state. Tests were conducted at different times to look out compressive strength with partial replacement of marble dust in cement concrete determined for 7, 14 and 28 days.*

Keywords: Cement, Aggregates, Marble dust, Concrete, Compressive Strength, Flexural Strength

1. INTRODUCTION

Marble is a rock resulting from the transformation of a pure limestone. The purity of marble is responsible for its colour and appearance if it is white then the limestone is consisting solely of calcite (100% CACO3). Marble dust is an industrial by-product attained during sawing, shaping, and polishing of marble. The result is that the mass of marble waste 20% of total marble quarried as reached as extreme as masses of tons and causes a significant problem to the environment. In India, MDP is settled by sedimentation and then dumped away which ends up an environmental pollution, Moreover, to forming dust in summer and threatening both agriculture and public health. It is predictable that the Rajasthan marble processing enterprise produces 1800m3 (4500 tons) marble waste annually, which indicates that using marble waste can indirectly reduce CO2 emission to the atmosphere. Marble dust is not only the inexpensive material but also improves the properties of the concrete so by varying marble dust contents the mechanical and physical characteristics of fresh and hardened concrete can be improved. Now-a-days the cost of cement is increasing so if we use the waste material in the production of the concrete, so we decrease the price of rigid pavement.

A Highway pavement can be multi-layered structural part of the road which is subjected to stresses imposed by vehicular loading applied, as well as to deterioration from the effects of weather and the abrasive action of moving traffic. Pavement is the actual travel surface especially made long-lasting and functional to withstand the traffic load travelling upon it. Pavement allows friction for the vehicles thus providing comfort to the driver and transfers the traffic load from the upper surface to the natural soil. A satisfactory pavement design is one that can withstand these effects for a required period. A pavement consists of a multi-layer system, which is formed of several layers of compacted unbound aggregates or bound materials.

1.1 Types of pavement

Road pavement are generally classified into two categories, namely:

1.Rigid pavement

2.Flexible pavemen

1.1.1 Rigid pavement

The pavement which possess sufficient flexural strength to transmitted the wheel load stresses to a wider area below and provide great resistance to deformation under

the wheel loads are identified as rigid pavements. Rigid characterstics of the pavement are associated with rigidity or flexural strength or slab action so load is distributed over a wide area of sub-grade soil. The rigid pavements are normally made of Portland cement concrete and therefore called cement concrete (CC) pavements. Plain cement concrete pavement slabs manufactured from specified strength characteristics are laid, with or without steel reinforcement at the joints.

Since there is only one layer of material between the concrete and sub-grade, this layer can be called as base or sub-base course. In rigid pavement the stresses are not transferred from particles to particles to the lower layers as within the case of flexible pavement layers. The rigid pavement has capable of transmitting the wheel load stresses through a way wider area below the pavement slab. The rigid pavement does not get deformed to form of the supporting layer below, because the pavement slab can bridge the gap or slight differences of the surface of the supporting layer below.

The main difference in the structural behaviour of rigid pavement is compared to the flexible pavement is that the critical condition of stresses in the rigid pavement is the maximum flexural stress occurring at certain critical locations of the CC slab due to combined action of wheel load and the temperature changes.

Flexural stresses are developed at different locations of the CC pavement slab reckoning on the relative location of the wheel load with respect to its position on the CC slab and the also the effect of temperature changes at the situation at the purpose of your time of the day and night. Rigid lasts much, much longer (30+ years) compared to flexible pavement (5-10 years). Generally a well designed and constructed pavement doesnot required major maintenance work except maintennance of drainage and joints of the CC

1.2 Types of rigid pavement

1. Jointed plain cement concrete pavements

2. Jointed reinforced cement concrete pavements.

3. Continuously reinforced concrete pavements.

4. Prestress concrete pavements.

1.3. Components of pavement

1. Subgrade course

2. Sub-base course

3. Base course

4. Cement concrete slab.

1.4 Scope of present work The aim of the projected work is to study the effect of use of marble dust as partial replacement of cement to produce concrete pavement cost effective. The effect of marble dust powder has been delibreate on the sength characterstics of concrete pavement.

2. LITREATURE REVIEW

Valeria (2005) [1] He obtained that marble dust powder had very extreme Blaine fineness price of concerning 1.5m2/g, with ninetieth of particles passing through 50-micron sieve and five hundredth through 7micron sieve. It had been obtained that marble powder had a high surface area.

Demirel et al (2010) [2] by experimentation studied the effects of using waste marble dust (WMD) as a fine material on the mechanical properties of the concrete. For this purpose four dissimilar sequences of concrete-mixtures were ready by replacing the fine sand (passing 0.25 mm sieve) with WMD at amounts of 0%, 25%, 50% and 100% by weight so as to workout the effect of the WMD on the compressive strength with relevance the curing age of 3, 7, 28 and 90 days. Water-cement ratio was adopted 50. It was understood from the data that the compressive strength had increased with the increase WMD content. There was an increase of about 10% for the M100%, this could not be only because of the filling of the voids in the concrete mix but also due to the little cement properties of marble dust by providing an extra quantity of cement in the mix.

Hebhoub et al (2010) [3] verified the possibility of using marble wastes as a substitute rather than natural aggregates in concrete production, trial investigation was carried out on three series of concrete mixtures: sand substitution mixture, gravel substitution mixture and a mixture of both aggregates (sand and gravel). The concrete formulations were produced with a constant water/cement ratio of 0.5. The compressive strength for the all the combination in sand substitution improved except 100% replacement for sand. The 50% replacement of marble dust as sand had a highest upsurge of 20% to that of control mix and in case of coarse aggregate 75% marble dust powder replacement illustrations an increase of 25 %.

Baboo Rai (2011) [4] have done their investigation on influence of marble dust powder in concrete mix. Limited replacement of cement and usual fine aggregates by

fluctuating percentage of marble powder discloses that increased waste marble powder result in increased workability and compressive strengths of the concrete.

Vaidevi C (2013) [5] found that the use of this waste was proposed in different percentages both as an addition to and instead of cement, to produce concrete mixtures. The study presented the cost of these cementitious material decreases cost of construction when replaced by different percentages of marble dust powder. Compressive test and tensile tests were conducted. 10% replacement gives the best result and for every 10 bags of cement, the addition of 10% of marble dust saves 1bag of cement and 1 bag of cost.

3. MATERIALS

3.1 Cement

Cement as a material which possesses very high adhesive and cohesive properties which makes it possible to bond with other materials to form a compact mass. Cement is a material which possesses high cementatious properties.

3.2 Aggregate

Aggregate is broad category of basic materials used in construction, including sand, gravel, crushed stone, brick and so on. It constitutes 85% of the volune of concrete.

Types of aggregates

i. Fine aggregates
ii. Coarse aggregates

Fine aggregates are those aggregates which can pass through 4.75mm IS sieve, the residue sieve are not considered. It consists silt, sand. It contributes to reducing the number of voids and increasing the workability.

Coarse aggregates are those aggregates which are the residue of 4.75mm IS sieve and pass through 75mm IS sieve. It consists gravel, uncrushed gravel.

3.3 Marble dust powder

Marble stone industry generates both solid waste and stone slurry. Whereas solid waste results from the rejects at the mine sites or at the processing units, stone slurry is a semi liquid substance consisting of particles originating from the sawing and the refining processes and water used to cool and oil the sawing and polishing machineries. Stone slurry produced during handling corresponds to around 20% of the final product from stone industry. Therefore, the scientific and industrial community must commit towards more sustainable practices. Marble dust powder 0%, 5%, 10%, 15%, 20% used in concrete pavement.

3.4 Water

Portable water was used in the laboratory for trial mixes. A respectable thumb rule to follow is that if water is pure adequate for drinking it is suitable for mixing concrete. Nearby available portable water was used for mixing and curing.

Table 3.1: Stipulation for proportioning of Concrete

Grade designation	M30
Maximum nominal size of aggregate	20mm
Workability	75mm-100mm (slump)
Exposure condition	Moderate
Types of aggregates	Crushed angular
Minimum cement content	300 kg/m^3
Maximum cement content	450 kg/m^3
Maximum water cement ratio	0.50
Chemical admixture	Super plasticizer

Test performed on fresh concrete

i. Slump test

Tests performed on hardened concrete

i. Compressive strength test
ii. Flexural strength test

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