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AN EXPERIMENTAL STUDY ON EFFECTS OF GRAINITE POWDER IN PAVER BLOCKS

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Abstract - *The main objective of Waste Management System is to maximize economic benefits and at the same time to protect the environment. Granite process industry generates a large amount of wastes mainly in the form of powder during sawing and polishing processes, which pollute and damage the environment. This work aims to characterize and evaluate the possibilities of using the granite sawing wastes, generated by the process industries as alternative raw materials in the production of concrete. This granite powder waste can be utilized for the preparation of concrete as partial replacement of cement. In order to explore the possibility of utilizing the granite powder as partial replacement to cement, an experimental investigation has been carried out. The percentages of granite powder added to replace cement by weight were 25,50,75.*

Key Words: Granite powder, paver block, compression strength, cost analysis.

I. INTRODUCTION

Concrete is the single most widely used construction material in the world today. It is used in buildings, bridges, sidewalks, highway pavements, house construction, dams, and many other applications. The key to a strong and durable concrete are the mix proportions between the various components. Less cement paste can lead to more voids, thus less strength and durability while more cement paste can lead to more shrinkage and less durability. The gradation and the ratio of fine aggregates to coarse aggregates can affect strength and porosity. The mix design should also achieve the desired workability of concrete so as to prevent segregation and allow for ease of placement. Typically, a concrete mix is about 10% to 15% cement, 25% to 30% sand, 40% to 45% percent aggregate and 15% to 20% water. Entrained air (5% to 7%) is also added to concrete to improve durability. Concrete should have enough compressive strength and flexural strength to support applied loads. At the same time it should have good durability to increase its design life and reduce maintenance costs. In general, durable concrete will have good resistance to freeze and thaw, abrasion, sulfate reactions, ultraviolet radiation, seawater, alkali-silica reaction, and chlorides. The gradation and maximum size of aggregates are important parameters in any concrete mix.

II. SCOPE

- To promote the granite waste from quaries as a useful product
- To manage the disposal of waste product into construction raw material
- To encourage the waste product as ecofriendly material

III. OBJECTIVES

- To utilize the waste materials available in the granite quaries.
- To study the compressive strength of the paver blocks by adding different percentage of granite powder.
- To reduce the cement content and recycling the usage of water granite powder.

IV. LITERATURE REVIEW

K. ShyamPrakash and Ch. Hanumantha Rao , et. al, results of experimental investigations conducted, it is concluded that the quarry dust can be used as a replacement for fine aggregate. It is found that 40% replacement of fine aggregate by quarry dust gives maximum result in strength than normal concrete and then decreases from 50%. The compressive strength is quantified for varying percentage and grades of concrete by replacement of sand with quarry dust.

Ravindra Nagar, Vinay Agrawal, Aditya Rana, Anshuman Tiwari, et. al, study investigates the feasibility of using granite cutting waste (GCW) as a partial substitute of rivers sand in high strength concrete based on strength, durability &micro structural attributes at 0.30, 0.35 and 0.40 water cement ratios (w/c) by substituting 0%, 10%, 25%, 40%, 55%and 70% river sand by GCW suggested that25–40% river sand can be substituted by the GCW with a favorable influence on the investigated parameters. The optimum amount of GCW to be used in concrete depends significantly upon water-cement ratio of concrete.

V. MATERIALS TO BE USED

1. Cement
2. Fine Aggregate
3. Coarse aggregate
4. Water
5. Granite Powder

1. CEMENT

The Cement is board sense can be described as a material with adhesive and cohesive properties, which is capable of binding mineral fragment into compact mass. There are several types of available of which Portland cement is most well-known and we use it. The OPC-43 grade cement shall confirm to IS:8112-1989 and the designed strength of 28 days shall be minimum 43 MPa or 430 kg/sqcm. Even though 43 Grade cements early strength is less as compared to that of 53 Grade, with time it will attain the same ultimate strength as that of 53 Gradecement. The specific gravity of cement would be 3.15 which is being used.

2. FINE AGGREGATE

Aggregate which is passed through 4.75 mm IS sieve and retained on 75 micron I.S. sieve is termed as fine aggregate. M-sand is well graded and falls within the limits of grading zone-II sand, grading limits specified in IS 383 code. Code allows 20% fines less than 150 microns for crushed stone sands. M-sand is devoid of clay size fraction and the fraction below 150 microns is about 18%. M-sand conforming IS 383-1970 was used in this project.

3. COARSE AGGREGATE

Aggregate which is retained on IS test sieve no. 4.75 mm is called coarse aggregate. Broken stone is generally used as a coarse aggregate. For thin slabs and walls, maximum size of coarse aggregate should be limited to one-third the thickness of concrete section.

As per I.S. 383-1963, shape of particle of the aggregate may be rounded, regular, angular and flaky. Rounded particles do not have good interlocking, where as irregular and angular particle show very good interlocking effect. Aggregate should have rough surface to get better bond between particles and cement paste. Porosity and water absorption should be less .Use of the largest permissible maximum size of coarse aggregate permits a reduction in cement and water requirements.

4. WATER

Portable waters are generally considered satisfactory for mixing and curing of concrete. The value of pH should not be less than 6. It should not contain high concentration of sodium and potassium. Less than 8% of silt is permissible.

5. GRANITE POWDER

Granite powder, a waste material from the granite polishing industry, is a promising material for use in concrete similar to those of pozzolanic materials such as silica fume, fly ash, slag, and others. These products can be used as a filler material (substituting sand) to reduce the void content in concrete. Graniteit is the plutonic igneous rock because it is formed due to solidification of magma at great depths. The word "granite" comes from the Latin granum. It is a holocrystalline and leucocratic rock because it is completely crystalline and light coloured rock. It is acidic rockbecause it is very rich in silica content (nearly 72%). Granite is compact, dense, massive and hard rock.

VI. PAVER BLOCK MAKING PROCESS

Fig.1 GRANITE POWDER

Fig .2 MOULD FOR PAVER BLOCK

Fig.3 FRESHLY PREPARED MIX

Fig.4 PAVER BLOCKS

Fig.5 TESTING OF PAVER BLOCKS

VII. TEST TO BE PERFORMED

A. COMPRESSIVE STRENGTH TEST

The brick specimens are immersed in water for 24 hours. The specimen is placed in compression testing machine with 6 mm plywood on top and bottom of it to get uniform load on the specimen. The load is applied axially at a rate of 14 N/mm^2.The crushing load is noted. Then the crushing strength is the ratio of crushing load to the area of block loaded. Average of three specimens is taken as the crushing strength. The crushing load is noted for blocks named 1,2,3,4,5,6&7 (different proportions).

B. WATER ABSORPTION TEST

A brick is taken and it is weighed dry.It is then immersed in water for 24 hours. It is weighed again and the difference in weight indicates the amount of water absorbed by the block. It is should not exceed 20 percent of weight of dry block.

C. SHAPE AND SIZE TEST

In this test, a block is closely inspected. It should be of standard size and its shape should be truly rectangular with sharp edges. For this purpose, 3 blocks are selected at random and they are stacked length wise, along the width and along the height.

D. IMPACT TEST

In this test, few blocks are dropped from 1m height. If blocks are broken it indicates low impact value and not acceptable for construction work. Good quality blocks do not break at all.

E. SOUNDNESS TEST

In this test, two randomly blocks are hardly punched with each other. If they produce a clear metallic sound and remain unbroken then they are good quality blocks.

F. HARDNESS TEST

In this test, scratches are made on the surface of block by a one-rupee coin. If it does not leave any impression the block surface then it will be considered as good quality blocks.

E. EFFLORESCENE TEST

This test is carried out to obtain the presence of alkaline substances in blocks. After this test procedure, a white or grey layer is formed on block surface, it means alkali is present in the blocks.

VIII. CONCLUSIONS

Based on the above experimental procedure and test, we conclude as ;

1. The Quality of material used for Granite Powder concrete tested and verified on the basis of IS Code.

2. The specific gravity value of cement, Granite Powder, M-Sand and coarse aggregate required for design mix are tested.

3. All the mixes used for the study shows adequate workability. Workability of concrete satisfied on the basis of site condition for compaction.

4. The Compressive strength of concrete while replacing the Fine aggregate with Granite Powder is tested at 28th day and verified.

5. Due to addition of Granite powder and partial same chemical composition of cement, Compressive strength value obtained is greater than the Conventional Concrete.

6. The Granite powder Concrete of grade M30 is tested as per IS code.

7. Hence huge dumping of waste in the environment is reduced and this may increase the usage of Granite Powder more.

8. Economical construction is also achieves.

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