Experimental study on light weight Paver Block by Partially replacing binding material

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Abstract

This study aims to evaluate recycle aggregate foam concrete compressive strength test, split tensile test and density showed a minor reduction after the incorporation of Granite wastes. The Sustainability of granite waste in powder form to partially replace cement in light weight foaming Paver was investigate with aim to discover a green construction material Foamed Paver Block is either a mortar or cement pastes in which air-voids are artificially entrapped in mortar The Main Objective of is to test various hardened foam concrete strength and compare them to Conventional concrete.

Keywords:-
Foam, Cement, Coarse aggregate, Granite Powder, mixing, Cube

Introduction: Recycled foam concrete is an innovative and sustainable construction material that integrates foam and recycled aggregates, offering a more environmentally friendly alternative to traditional concrete The low-density property of this foamed concrete increased its popularity in the construction field as it helps in reducing the self-weight and size structures ,reduce cement usage and thus reduce overall construction cost Well-prepared granite waste can be used as coarse aggregate. The morphological parameters of the aggregates were determined. The impact of aggregate morphology on concrete properties was analyzed Granite waste has good fire resistance and at the same time has a high fracture strength of up to 39MPa. This material is good and convenient to use as a building material because of its strain-free property. Granite powder waste is also a good protective material for building structures as it is low in water absorption and can resist both acid and alkali toxic agents combined with Granite waste powder as partial replacement for cement with replacement levels of 0%, 10%, and 20% cement was slightly substituted by Granite waste powder at varying levels of 0%,10%,20%,30%, and 40%of the cement Partial replacement of Portland cement in lightweight foamed concrete as an approach in the current trend Through this project, we investigated the suitability of Granite wastes To partially replace cement in the lightweight foamed concrete, which is extremely important.

Experimental Program

Materials Used

Granite Powder

Granite is the most common intrusive rock in Earth's continental crust, It is familiar as a mottled pink, white, gray, and black ornamental stone. It is coarse- to medium-grained

PROPERTY	VALUE
Specific gravity	2.10
Water absorption	10.5%
Impact value	49.86%

Table 1 Physical properties of granite powder

Cement

Cement is obtained by grinding the raw materials (calcareous materials like limestone, chalk, marine shell and argillaceous materials containing silica,alumina and iron oxide).The mixture is then burnt in a large at a temperature of 1300°C to 1500°C.OPC53gradeconfirming IS 8112: 1989wasuse

TEST PARTICULARS	RESULT OBTAINED
Specific gravity	3.15
Normal consistency	32
Initial setting time (minutes)	130
Final setting time (minutes)	240

Table 2 physical properties of cement

Coarse aggregate

Locally available coarse aggregate shaving the size of 6 mm were used in the present work. The gradation, specific gravity, water absorption, density were found. Testing on coarse aggregates was done as per IS: 2386 (Part I) – 1963, IS : 2386 (Part III) - 1963 IS : 2386 (Part III) - 1963 and the results obtained were referred with IS 383 : 2016.The test results conducted on coarse aggregate are reported in Tables 3.

PROPERTY	VALUE
Specific gravity	2.76
Water absorption	0.67%
Bulk density	1642.47kg/m^2

Table3 Physical Properties of coarse aggregate

Fine aggregate

Manufacturing sand was used throughout the investigation as the fine aggregate conforming to grading zone III. The properties of sand by conducting tests according with IS2386(part -1) -1963. The Specific gravity, fineness modulus and moisture content were determined.

TEST PARTICULARS	RESULT OBTAINED
Specific gravity	2.53

Table 4 Physical properties of fine aggregate

Water

Water is an important ingredient of concrete as it actively participates in chemical reaction with cement. This is the least expensive but most important ingredient of concrete. Clean potable water conforming to IS: 456-2000 was used; the water used in the preparation of mortar should not need to be distilled water, but must be free of all acids and other dissolved salts. A lower water-to-cement ratio yields a stronger, more durable concrete

Foam

Foam stability, compressive strength, drying shrinkage of the foamed concrete specimen were experimentally studied and analyzed. Also, the characterization of the micro-structure i.e. pores size and their distribution has been investigated in this study to gain in sight in to the impact.

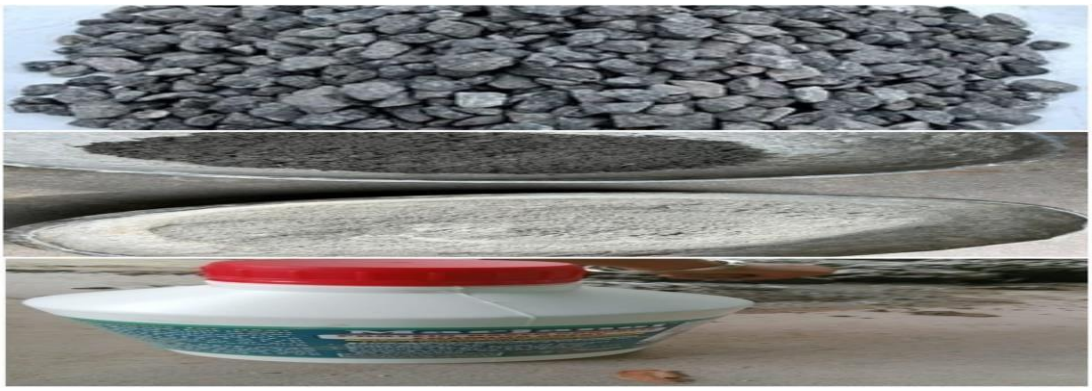

Fig 1: Material Requirement

Mix proportion

The mix design has been made for M25 grade conventional Paver and light weight concrete use of code IS 10262-1982,IS456-2000 recommended. The water cement ratio(W/C) was kept constant at approximately 0.45 for all mixes, The percentage like 10%,25%, and50%,in corporation was used as partial and full replacement of natural coarse aggregate and the fly ash percentage like 15%, 20%, 25% used as partial replacement for cement concrete. Mix proportion obtained for M25Grade of conventional concrete and light weight Paver Block mix ratio was 1:1:2

Casting of Specimen

Fresh prepared mixes were casted for each group in three standard cube moulds, cylinder moulds Three groups of mixtures were produced. For each mixture, specimens were prepared in the cubical 250×250×250mm, . The mixing process was as follows: firstly, coarse, fine and lightweight aggregate (granite powder and foam) and 1/3 of the water were loaded into the mixer for 1 minute. Then the cement, remaining water, were added. Finally, the constituents were mixed for 3 minutes. The mixture was rested for 3 minutes then mixed again for a further 2 minutes. After that moulds were filled by concrete in the suitable mix. The top surface of the concrete was leveled with the help of trowel and was left for 24 hours allowed the concrete to set. The specimen were remolded after 24 hours.

S.No	Type of Paver	Cement(kg)	Coarse aggregate(kg)	Fine Aggregate(kg)	Granite Powder and Foam	Water cement ratio
1	Conventional concrete	4.90	14.70	7.45	-	0.45
2	Concrete with 10% Granite powder and foam	4.90	13.23	7.45	1.47	0.45
3	Concrete with 15% Granite Powder and foam	4.90	11.025	7.45	3.675	0.45
4	Concrete with 20% Granite Powder and foam	4.90	7.35	7.45	7.35	0.45

Table 5 Mix Proportion

Result and Discussion

The Discussion will be focused on the performance of lightweight expanded Light weight paver block All the Tests Method adopted were describe in the previous one. The results Presented on regarding the Compressive strength, CBR test, split tensile strength and Flexural strength. The performance of concrete is influenced by proper and good practice of mixing which can lead to better performance and quality of the concrete. In the present study, M25 grade of concrete cubes of size 250×250×250mm, cubes were cast for determining the compressive strength, The cast specimens were re moulded at the end of 24 hours ,7 days cured for28days .Paver is an artificial stone like material having an excellent resistance to compression

Compressive Strength

Compressive strength is the primary physical property of Paver (others are generally defined from it),and is the one most used in design .It is one of the fundamental properties used for quality control for light weight Paver. compressive strength may be defined as the measured maximum resistance of a concrete specimen to axial loading. Cubes speciens were tested for compressive strength in the Compression testing machine of capacity 2000KN.The Cube specimen also were tested to determine split tensile strength. The prism specimens were tested in Universal testing machine of capacity 2000KN.An average of three specimens was tested for each strength tests.

S.No	**Type of Concrete**	**Compressive strength in n/mm2**	**Weight of Cube in kg**
1	Conventional concrete	11.47	6.3
2	Concrete with 10% Granite powder and Foam	8.02	5.8
3	Concrete with 15% Granite Powder and Foam	6.45	5.3
4	Concrete with 20% Granite powder and Foam	5.15	4.47

Table 6 7 Days compressive strength of concrete

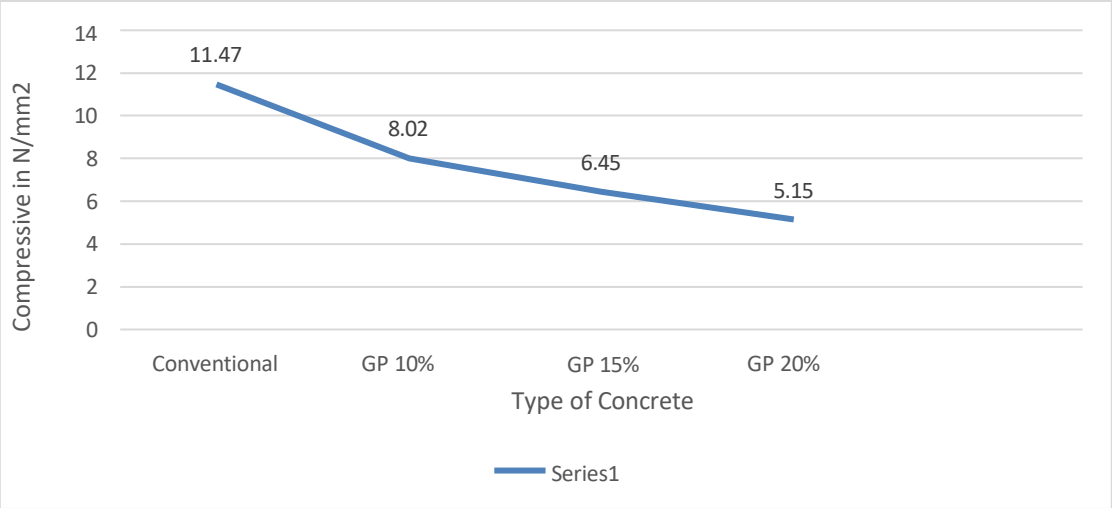

Figure 3 Graph Details of 7 days Compressive Strength

S.No	**Type of Concrete**	**Compressive strength in n/mm2**	**Weight of Cube in kg**
1	Conventional concrete	21.57	6.9
2	Concrete with10% Foam and Granite Powder	19.55	6.3
3	Concrete with 15% Foam and Granite Powder	17.32	5.7
4	Concrete with 20% Foam and Granite Powder	16.88	5.3

Table7: 28 Days compressive strength of concrete

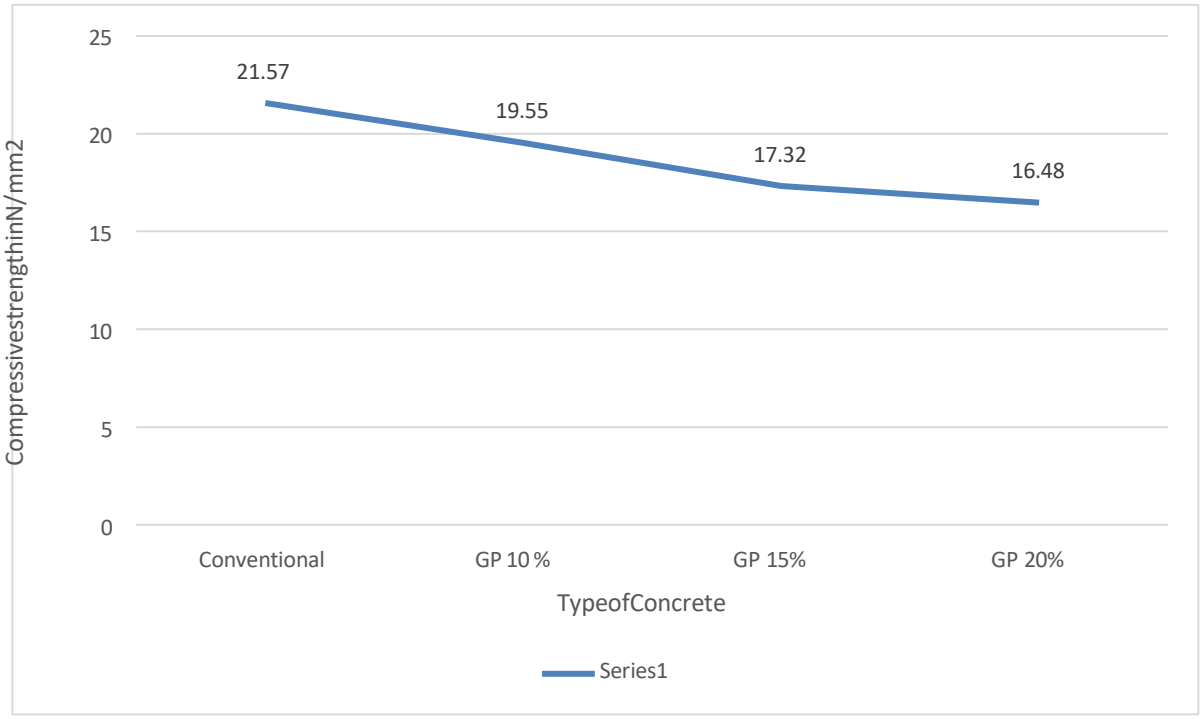

Figure 4 Graph Details of 28 days compressive strength of concrete

Figure 5 Compressive Testing

Conclusion

Based on the experimental investigations concerning the compressive strength and split tensile strength of concrete, the observations and the following conclusions are drawn from the present study.

- Compression strength value is compared to normal concrete and replacement of Coarse aggregate by Granite Powder and foam from different percentages
- Maximum value of strength is obtained in 20% replacement of Granite Powder and Foam with coarse aggregate
- Concrete with 20% replacement of Granite Powder and Foam the compressive strength is comparable with normal concrete.
- This type of Paver can be utilized in non load bearing type for use in precast buildings.

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