STUDY OF LIGHT WEIGHTCONCRETE WITH ALUMINIUM POWDER WITH GEOPOLYMER

Sandeep Kumar Yadav[1] , Prof. Satyendra Dubey[2], Prof. Vedant Shrivastava[3]

[1]*M Tech Scholar, Department of Civil Engineering, GGITS, Jabalpur*
[2,] Assistant Prof, Department of Civil Engineering, GGITS, Jabalpur
[3,] HOD, Department of Civil Engineering, GGITS, Jabalpur

ABSTRACT
After lime and regular Portland cement, geo polymer is regarded as the third generation of cement. When a foaming agent is added to the slurry, which serves the purpose of creating air spaces in the fly ash-based geo polymer slurry, light weight geo polymer concrete is created. Cubes specimens are prepared and tested for mixtures of M30 mix as used in conventional concrete for Geo Polymer concrete in this investigation of light weight geo polymer concrete mixtures, foaming agents like aluminum powder with 0, 0.25%, 0.75% and 1.0% with Geo Polymer concrete, and then their physical (Density and workability) as well as specific structural (Compressive Strength) properties were investigated. specific percentages and strengths When compared to regular weight concrete, aerated concrete gains strength.

Key Words- Light weight concrete, Geo polymer concrete mass, Geo Polymer, strength properties, foaming agent, density, target strength, fly ash.

INTRODUCTION

The infrastructure needs of our country is increasing day by day and with concrete is a main constituent of construction material in a significant portion of this infra-structural system, it is necessary to enhance its characteristics by means of strength and durability. Several efforts are in progress to supplements the use of Portland cement in concrete in order to address the global warming issues. These includes the utilization of supplementary cementing materials such as fly ash, granulated blast furnace slag, rice husk ash and meta kaolin and the development of alternative binders to Portland cement. Geo polymer foam concrete is a more sustainable version of the lightweight concrete that uses waste, reduces the carbon dioxide emissions and has better resistance to fire and aggressive chemicals.

Geo polymers are amorphous or semi-crystalline three-dimensional alumina-silicates that are synthesized by the reaction of solid alumina silicate materials with alkaline solutions. Silica and Alumina species which are provided by source materials are two main ingredients of geo polymers nanostructure. It is well known that the dissolution rate of Al and Si from source materials and the time-release of these species into the solution make some differences in the kinetics of geo polymerization reaction and similarly on the chemistry of the developing geo polymer gel. Regardless of possible impacts of aluminum corrosion reaction on geo polymer formation mechanism, Al metal has been used as a chemical foaming agent in lightweight geo polymer concrete. The corrosion of Aluminum metal in aqueous alkaline solutions has been known as a useful method for generating hydrogen gas for various applications such as producing clean fuel. Recently, an interest in the reaction of Al/water system for producing hydrogen has increased due to its applications in lightweight aerated concretes.

LITERATURE REVIEW

In this, previous studies that are relevant to this study have been mentioned. In early days, Concrete was portrayed as a weak material with low rigidity and low strain limit. Nihan Gulmez (2020) looked into this to find a dependable and eco-friendly way to get rid of a lot of marble processing calcite powder and aluminum shavings—a non-recyclable product from the metalworking and shaping industry. At various replacement percentages, the mortars made with industrial waste were evaluated for their physical, mechanical, and microstructural properties. When compared to the mortar used as a control, the water absorption values did not significantly change when up to 20% calcite was added to the mortar mixtures instead of cement. Lightweight Concrete (LC) mixes were prepared with 0%, 0.25%, 0.5%, 0.75%, 1%, 1.25%, 1.5%, 1.75%, and 2% of foaming agent by weight of cement. In this study, we are tested in deflection behavior, tensile test, and compressive test. They concluded that the composition of reinforced samples is LC. Priya Chetry (2018) came to the conclusion that the addition of aluminum waste powder and marble powder had an impact of 0.25 percent and 0.50 percent, respectively, by weight of natural sand in concrete, respectively. Compressive strength of the cast cubes was investigated. According to the findings, the compressive strength gradually increased before decreasing. S. Dinesh Kumar (2017) reported that they discussed developing the most cost-effective, lightweight, and compressive-strengthening building concrete. 5 percent, 10 percent, and 15 percent of the cement in the mixture must be replaced with fly ash. Aluminum powder can only be added in three different amounts to the light weight concrete mixture: 0, 0.5, and 1. The tested concrete block had maximum split tensile strength and compressive strength at a fly ash replacement rate of 15%. According to Ahsan Habib et al. (2015), the slurry of Ordinary Portland cement contains varying percentages of 0.05%, 0.15%, 0.2%, and 0.25%. A number of tests, including the density, water absorption, and compressive strength tests, have been carried out in order to ascertain how aluminum powder affects the properties of the finished product. According to the research conducted by Sajan K. Jose et al. (2020), foamed concrete is a cement-based mortar in which at least 20% of its volume is filled with air. It is an innovative and adaptable lightweight building material. Slender sections will be created by using lightweight foamed concrete blocks with densities less than 1800 kg/m3.

OBJECTIVE OF THE STUDY

The thought behind this study is the usage of fly debris in progress in the strength of cement and utilization of waste for rescuer of earth. This review plans to have a relative report between frothing specialist like aluminum powder with 0, 0.25%, 0.75% and 1.0% with Geo Polymer concrete and 3D shape examples are ready and tried for combinations of M30 blend as utilized in regular cement for Geo Polymer concrete. To figure out the impact of frothing specialist and fly debris on functionality, strength and thickness when blended in with Geo Polymer substantial example.

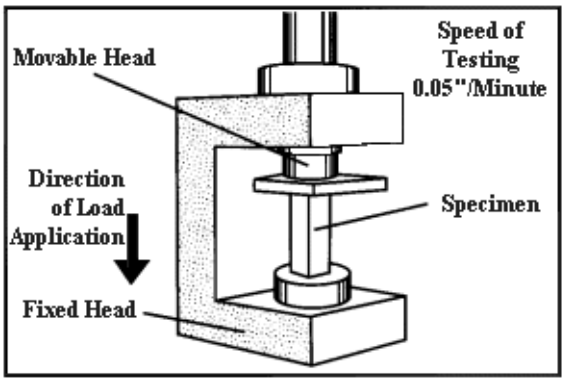
METHODOLOGY

In this, we will examine about the system utilized in this work. The material was gathered from various areas and the data about the material has been gotten. A view on these materials has been given and the properties of these are beneath.

Materials	Mass
Course aggregate	1123.05
Fine aggregate	712.82
Fly ash (class F)	413.30
Sodium Hydroxide solution	57.6 (12 molar)
Sodium Silicate solution	144
Extra water	10
Aluminum powder -	
0.25%	1.03
0.50 %	2.06
0.75%	3.09
1.00 %	4.13

Following test were led on pre-arranged examples and materials likewise according to applicable IS code of Training.

1. Slump Cone Test
2. Compressive Strength Test
3. Density Test



SLUMP CONE TEST

This is a test utilized broadly in site work all around the work. The rut test doesn't quantify the functionality of cement despite the fact that ACI 116R - 90 depicts it as a proportion of consistency, however the test is exceptionally helpful in recognizing varieties in the consistency of a blend of given ostensible extents. The rut test is recommended by IS: 456 (2000), ASTM C 143 90A and BS 1881 Section 102:1983.

COMPRESSIVE STRENGTH TEST

Compressive strength of cement relies upon many factors, for example, water-concrete proportion, concrete strength, nature of substantial material, quality control during creation of cement and so on. Test for compressive strength is completed either on 3D square or chamber. Different standard codes suggest substantial chamber or substantial solid shape as the standard example for the test. Out of many test applied to the substantial, this is the highest level of significant which gives a thought regarding every one of the attributes of cement. By this single test one adjudicator that regardless of whether Cementing has been done appropriately.

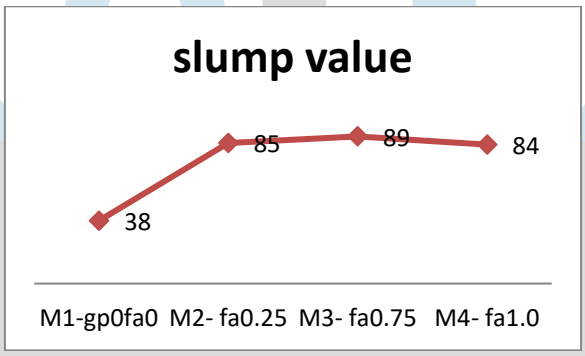
OBSERVATION AND RESULTS

SLUMP CONE TEST

This is a test used extensively in site work all over the work. The slump test is prescribed by IS: 456 (2000), ASTM C 143 90A and BS 1881 Part 102:1983.

SLUMP CONE VALUE OF M30 GRADE OF CONVENTIONAL CONCRETE WITH GEOPOLYMER AND DIFFERENT % OF FOAMING AGENT FOR 28 DAYS

S NO	MIX	FOAMING AGENT (%)	SLUMP VALUE
1	M1-GP0FA0	0	38
2	M2-FA0.25	0.25	85
4	M3-FA0.75	0.75	89
5	M4-FA1.0	1.0	84



Slump Cone Value Of M30 Grade Of Conventional Concrete With Geopolymer And Different % Of Foaming Agent For 28 Days

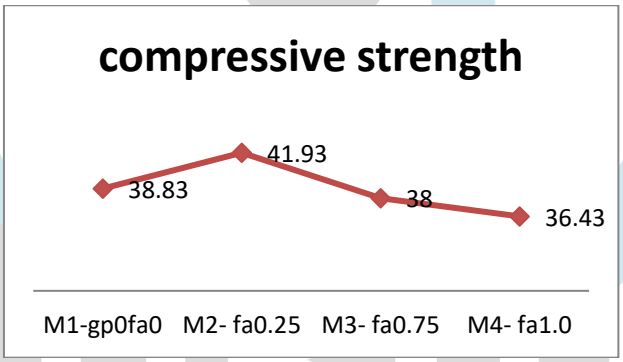
This is a test utilized broadly in site work all around the work. The rut test doesn't quantify the functionality of cement despite the fact that ACI 116R - 90 depicts it as a proportion of consistency, however the test is exceptionally helpful in recognizing varieties in the consistency of a blend of given ostensible extents. The rut test is recommended by IS: 456 (2000), ASTM C 143 90A and BS 1881 Section 102:1983.

COMPRESSIVE STRENGTH TEST

The compressive strength of concrete is one of the most important Properties of concrete in most structural application concrete is implied primarily to resist compressive stress. A material under pressure will in general decrease the size, while in strain, size extends. Out of many test applied to the substantial.

COMPRESSIVE STRENGTH VALUE OF M30 GRADE OF CONVENTIONAL CONCRETE WITH GEOPOLYMER AND DIFFERENT % OF FOAMING AGENT FOR 28 DAYS

S NO	MIX	FOAMING AGENT (%)	COMPRESSIVE STRENGTH VALUE
1	M1-GP0FA0	0	38.83
2	M2-FA0.25	0.25	41.93
4	M3-FA0.75	0.75	38.00
5	M4-FA1.0	1.0	36.43



Compressive Strength Value Of M30 Grade Of Conventional Concrete With Geopolymer And Different % Of Foaming Agent For 28 Days

CONCLUSION

The experiment shows that the effect of foaming agent can still be a promising work as there is always a need to overcome the problem of concrete. The following conclusions could be drawn from the present investigation.

The maximum compressive strength of specimen after 28 days is 41.93 N/mm² of normal Geo polymer concrete, and in other mix of Light weight geo polymer concrete, the strength is getting reduced with increase in percentage of foaming agent. It is observed that there is slight decrease in strength and significant decrease in density. On adding 0.25% & 0.5% foaming agent respectively, the strength % is slightly reduced i. e about 2% & 6% respectively. But the % density is largely reduced i. e about 5 % & 13% respectively.

Workability is increase and density is decrease in geo polymer concrete with increase in % of foaming agent.

From the above points it can be concluded that foaming agent is very effective for improving the workability of the Light weight geo polymer concrete. Therefore the performance of the concrete will be improved if proper design and construction methodology is adopted.

REFERENCES

1. IS: 456: 2000, Plain and Reinforced Code of practice
2. IS: 10262-2009 (Reaffirmed 2004): Recommended guidelines for concrete mix design, Bureau of Indian Standard, New Delhi-2004.
3. IS: 383-1970: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standard, And New Delhi- 197.
4. Gambir, M.L., "Concrete Technology", 2nd edition, Tata McGraw hill co. Ltd, New Delhi, 1995
5. Shetti M S "Concrete Technology-Theory and Practices", *S Chand publications*, New Delhi.

6. Prabir k Sarkar and b Vijya Rangan, "Geo polymer Concrete using Fly ash" ,ISBN 978 -2, Nova Science Publishers, INC. 2014.
7. PENDYALA CHANAKYA, DIPTIKAR BEHRA, "Experimental Study on Compressive Strength of Concrete by Partial Replacement of Cement with Metakaolin", International Journal of Scientific Engineering and Technology Research Volume.05, IssueNo.26, September-2016, Pages-5354-5358
8. SP 23: 1982 'Handbook on Concrete Mixes (Based on Indian Standards)', Bureau of Indian Standards, New Delhi.
9. Abdullah Anwar: Study of Compressive Strength of Concrete by Partial Replacement of Cement with Marble Dust Powder. I Indian ISSN (Print) : 2321-5747, Volume-2, Issue-3. (2014).
10. Huang, X., et al., A review: Feasibility of hydrogen generation from the reaction between aluminium and water for fuel cell applications. Journal of Power Sources, 2013. **229**: p. 133-140.
11. Narayanan. N, Ramamurthy. K, (2000): Structure And Properties Of Aerated Concrete: A Review, Elsevier, pp. 321-329.