Analysis of Blended Concrete using Aerating Agent with Geopolymer

Siddhant Thakur[1], Prof. Satyendra Dubey [2,] Prof. Anubhav Rai [3]

[1]*M Tech Scholar, Department of Civil Engineering, GGITS, Jabalpur*

[2] Prof., Department of Civil Engineering, GGITS, Jabalpur

[3] Prof. and HOD, Department of Civil Engineering, GGITS, Jabalpur

ABSTRACT

Geo polymer is considered as the third-generation cement after lime and ordinary Portland cement. Light weight geo polymer concrete is produced when for foaming agent is added to slurry, the function of foam is to create an air voids in fly ash–based geo polymer slurry.

In this investigation of Light weight geo polymer concrete mixtures are produced foaming agent like aluminum powder with 0.5%,1.0%, 1.5% and 2.0% with Geo Polymer concrete and 15 Cube specimens are prepared and tested for mixtures of M30 mix as used in conventional concrete for Geo Polymer concrete ,then their physical (Density and workability) as well as specific structural (Compressive Strength) properties were investigated, Specific Strength and Percentage Strength gain for aerated concrete is compared with normal weight concrete and the results are reported.

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 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.

LITERATURE REVIEW

In this, the works relevant to this study which are conducted in past has been mentioned. In early days, Concrete was characterized as a brittle material with low tensile strength and low strain capacity.

Nihan Gulmez (2020) they studied that to find a reliable and eco-friendly method for eliminating large quantities of calcite powders originating from the marble processing industry and also aluminum shavings, a non-disposable product of metal working and shaping industry. Physical, mechanical and micro structural properties of the mortars produced with industrial wastes at different replacement percentages were evaluated. Adding up to 20% calcite to the mortar mixtures instead of cement did not cause a significant change in water absorption values compared to control mortar. **R. Balasubramanian (2019)** they concluded that the composition of reinforced samples is Lightweight Concrete (LC) mixes were prepared with 0%, 0.25%, 0.5%, 0.75%, 1%, 1.25%, 1.5%, 1.75%, 2%, of foaming agent by weight of cement in this paper we are tested in deflection behavior, tensile test and compressive test. **Priya Chetry (2018)** they concluded that the influence of replacing natural sand in concrete by 0%, 5%, 10% and 15% of marble powder, along with the addition of Aluminum waste powder by 0.25% and 0.50% by weight of sand individually and in combination in concrete. Cubes were casted and compressive strength was studied. Results showed that the compressive strength was gradually increasing and then decreases**. S. Dinesh Kumar (2017)** they discussed that to develop the most economical light weight concrete for building with satisfactory amount of compressive strength. Fly ash replacement is fixed to as 5%, 10%and 15 % of the cement in the mixture. The percentage addition of aluminum powder is limited to three categories that are 0, 0.5 and 1 to the light weight concrete mixture. At 15 % replacement of fly ash, the tested concrete block have maximum compressive strength and split tensile strength. **Ahsan Habib et al (2015)** they discussed that to the slurry of Ordinary Portland cement with different percentages such as 0.05%, 0.1%, 0.15%, 0.2%, and 0.25%. To determine the effect of aluminum powder on the final product properties, some test has been conducted such as density, water absorption and compressive strength test. **Sajan K Jose et al (2020)** they studied that Foamed concrete is an innovative and versatile lightweight building material, which is a cement-based mortar consisting of at least 20% of its volume filled with air. Use of lightweight foamed concrete blocks with densities less than 1800 kg/m3 as infills will lead to the design of slender sections. Further, the thermal insulation properties of foamed concrete blocks made it more popular in construction industry. This paper discusses the development of foamed concrete building

blocks for load bearing and non-load bearing structures. **MD Jalal et al (2017)** they research on Foam concrete is a vast majority of concrete containing no large aggregates, only fine sand and with extremely lightweight materials containing cement, water and foam. It can be considered relatively homogeneous when compared to normal concrete, as it does not contain coarse aggregate phase. However, the properties of foamed concrete depend on the microstructure and composition, which are influenced by the type of binder used, methods of pre-foamation and curing. The main advantage of foam concrete is its lightweight, which ensures economy of walls of the lower floors and foundations. **Qin xin (2016)** has analyzed Foamed concrete as a new type of lightweight, high-strength and energy-saving building materials, the foam concrete properties and preparation process analyses the research progress of Blending material, admixtures and fibers' effect on the performance of foamed concrete, puts forward the problem about development and application of the foam concrete in current research, and points out that the sustainable development is the basic idea of the foam concrete further research and application in future. **Ashish S. Moon et al (2015)** they concluded green building is an environmentally conscious building, designed, constructed and operated to minimise the total environmental impacts. Carbon dioxide (CO2) is the primary greenhouse gas emitted through human activities. It is claimed that 5% of the world's carbon dioxide emission is attributed to cement industry, which is the vital constituent of concrete. Due to CO2 there is significant contribution to the environmental pollution, there is a need for finding an optimal solution along with satisfying the civil construction needs. Foam concrete is a new innovative technology for sustainable building and civil construction which fulfills the criteria of being a Green Material.

OBJECTIVE OF THE STUDY

The idea behind this study is the utilization of fly ash in improvement in the strength of concrete and use of waste for savior of earth. This study aims to have a comparative study between foaming agent like aluminum powder with 0.5%,1.0%, 1.5% and 2.0% with Geo Polymer concrete and 15 Cube specimens are prepared and tested for mixtures of M30 mix as used in conventional concrete for Geo Polymer concrete. To find out the effect of foaming agent and fly ash on workability, strength and density when mixed with Geo Polymer concrete sample.

METHODOLOGY

Following test were conducted on prepared samples and materials also as per relevant IS code of Practice:

1. Slump Cone Test
2. Compressive Strength Test

SLUMP CONE TEST

This is a test used extensively in site work all over the work. The slump test does not measure the workability of concrete although ACI 116R – 90 describes it as a measure of consistency, but the test is very useful in detecting variations in the uniformity of a mix of given nominal proportions. The slump test is prescribed by IS: 456 (2000), ASTM C 143 90A and BS 1881 Part 102:1983.

COMPRESSIVE STRENGTH TEST

Compressive strength of concrete depends on many factors such as water-cement ratio, cement strength, quality of concrete material, quality control during production of concrete etc. Test for compressive strength is carried out either on cube or cylinder. Various standard codes recommend concrete cylinder or concrete cube as the standard specimen for the test. Out of test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not.

OBSERVATION AND RESULTS

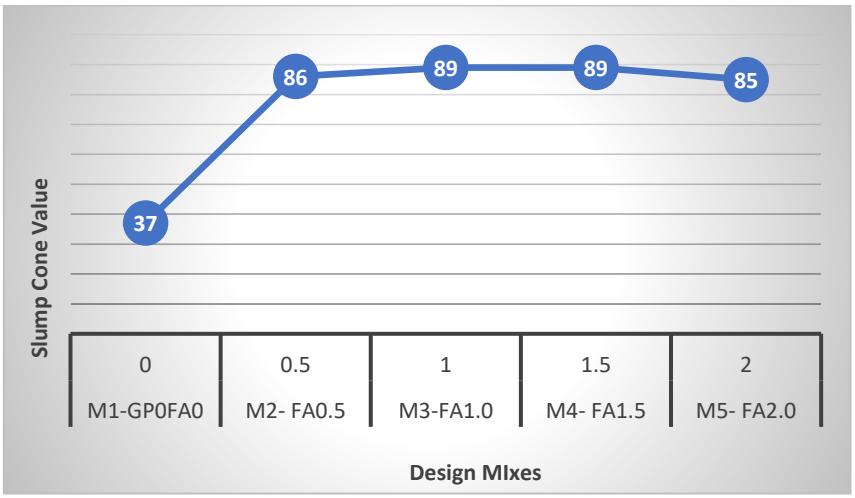
SLUMP CONE TEST

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 20% GEOPOLYMER AND DIFFERENT % OF FOAMING AGENT FOR 28 DAYS

S NO	MIX	FOAMING AGENT (%)	SLUMP VALUE
1	M1-GP0FA0	0	37
2	M2- FA0.5	0.5	86

3	**M3-FA1.0**	**1.0**	**89**
4	**M4- FA1.5**	**1.5**	**89**
5	**M5- FA2.0**	**2.0**	**85**



SLUMP CONE VALUE OF M30 GRADE OF CONVENTIONAL CONCRETE WITH 20% GEOPOLYMER AND DIFFERENT % OF FOAMING AGENT FOR 28 DAYS

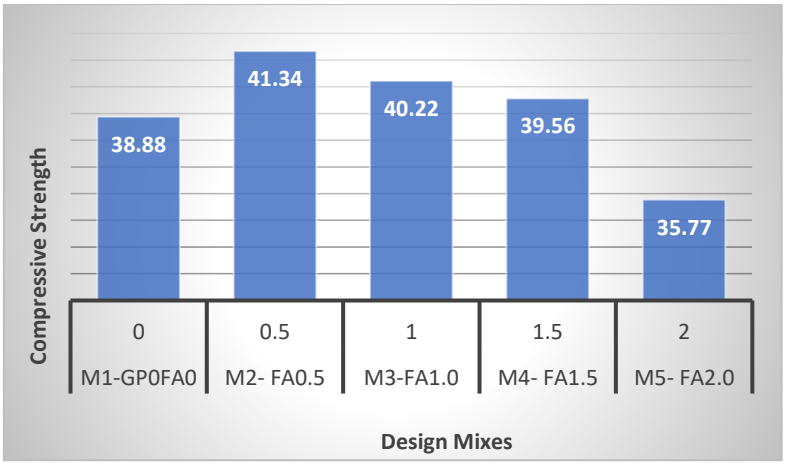
COMPRESSIVE STRENGTH TEST

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. This test give us a thought regarding every one of the attributes of cement. With the assistance of this test we can watch that if Concreting has been done appropriately.

COMPRESSIVE STRENGTH VALUE OF M30 GRADE OF CONVENTIONAL CONCRETE WITH 20% GEOPOLYMER AND DIFFERENT % OF FOAMING AGENT FOR 28 DAYS

S NO	MIX	FOAMING AGENT (%)	COMPRESSIVE STRENGTH VALUE
1	**M1-GP0FA0**	**0**	**38.88**

2	**M2- FA0.5**	**0.5**	**41.34**
3	**M3-FA1.0**	**1.0**	**40.22**
4	**M4- FA1.5**	**1.5**	**39.56**
5	**M5- FA2.0**	**2.0**	**35.77**



COMPRESSIVE STRENGTH VALUE OF M30 GRADE OF CONVENTIONAL CONCRETE WITH 20% 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 41.34 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 0.5% & 1.0% foaming agent with 20% of geopolymer respectively, the strength % is slightly increased i. e about 6.3% & 4% 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.

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