GGBS based geo-polymer light weight concrete by using foaming agent.

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Abstract: In this project, geopolymer concrete is made using the geopolymer technology. GGBS will be mixed with an alkaline activator solution (a mixture of sodium silicate and NaOH) and foam to generate lightweight concrete. NaOH pellets will be diluted with distilled water to create the NaOH solution. A homogenous slurry made from the Reactives will be combined to make it, after which it will be poured into a specific mould and allowed to cure for 24 hours at room temperature. After the curing procedure, the samples' compressive strength will be assessed on days 3, 7, and 14.

KEYWORDS: GGBS, M Sand, Light Weight, Molarity, Foaming Agent

1. INTRODUCTION:-

Concrete, a widely used building material, makes the best foundations, architectural structures, bridges, roadways, block walls, fences, and poles. One tonne of Portland cement requires the production of one tonne of CO2, which is then discharged into the environment. About 65 percent of the greenhouse gases responsible for global warming are made up of CO2. The manufacturing of ordinary Portland cement (OPC) is estimated to generate 1.35 billion tonnes annually, or around 7% of all greenhouse gas emissions to the earth's atmosphere. However, a lot of energy is used in the cement business. The next most energy-intensive operation is the production of Portland cement, which requires 4GJ of energy per tonne. After the iron and steel and thermal power industries, the Indian When it comes to coal use, the cement industry came in third. The industry's capacity was around 198 million tonnes at the beginning of the fiscal year 2008–2009. India's demand for cement is expected to rise by 10% a year over the next few years, thanks to investments in housing, infrastructure, and corporate capital. The demand-supply situation in the cement sector is likely to improve starting in 2008-09, with production and consumption expected to increase by 9 to 10%. (2007) Ragan and Hardjito (2006).

Granulated blast furnace slag is a byproduct of the blast furnaces used to make iron (GGBS). GGBS is a granular, non-metallic material that is mostly composed of silicates and calcium aluminates. GGBS's particle size is quite comparable to cement's. In order to increase the workability, density, durability, and alkali-silica reaction resistance of the concrete, GGBS is routinely combined with Portland cement as a low-cost filler. There is a high possibility for contamination since Geopolymer Concrete (GPC) uses all classes and grades of GGBS through the application of the appropriate process technology. because of this, the mix design for this geopolymer mix is determined by trial and error. GGBS and water were added to make a slurry, which was then used to create foam concrete in two phases. Pre-foam was made using a liquid foaming component. Initially, sand, coarse aggregate, and GGBS were well blended. Water is then added to the mixture and well mixed in until the appropriate consistency is achieved. Water and a foaming agent were combined to make pre-foam separately. The GGBS slurry is then mixed with pre-foam.

Materials

2.1 GGBS USED:

Molten iron blast furnace slag can be cooled in water or steam to produce glassy ground granulated blast furnace slag.

FIG 2.1GGBS PASTE

2.2: Agent Foaming:

Dew Foam LW is a concrete air-entraining additive developed from carefully selected polymers with the aim of evenly dispersing tiny air bubbles throughout the concrete mixture. The cohesiveness and freeze-thaw resistance of the concrete can be improved by using this effect.

FIG 2.2 Foaming Agent

2.3 M SAND:

Manufactured sand can be used in place of natural sand (M-sand). Manufacturing sand is made by crushing hard granite stone. M-sand has a size of less than 4.75mm.

FIG 2.3 M-SAND

2.4 Mix Design:

Geopolymer concrete does not yet have a defined mix design. The strength of cement concrete is known to be influenced by the water to cement ratio, but this is not always the case. because of this, the mix design for this geopolymer mix is determined by trial and error. GGBS and water were added to make a slurry, which was then used to create foam concrete in two phases. Pre-foam was made using a liquid foaming component. Initially, sand, coarse slurry is aggregate, and GGBS were well blended. Water is then added to the mixture and well mixed in until the appropriate consistency is achieved. Water and a foaming agent were combined to make pre-foam separately. The GGBS then mixed with pre-foam.

Calculating the mix for GGBS concrete:

For nine 100mm x 100mm x 100mm cubes, the following quantities should be used: GGBS = 2.5 kg; fine aggregates = 3.75 kg; coarse aggregates = 6.25 kg; foaming agent = 20ml.

A mix design for typical concrete was created in this study utilising the aspercodebook456:2000 technique.

Concrete mix design is the process of choosing the right materials for concrete and determining their proportions with the aim of generating the cheapest concrete while retaining the required minimum characteristics like strength, durability, and consistency.

Calculating the mix for standard concrete

To make nine cubes (100mm x 100mm x 100mm)

Fine aggregates are equal to 3.75 kg, coarse aggregate is equal to 6.25 kg, and cement weighs 2.5 kg.

The following components make up the methodology for the current work: • GGBS will be used as the starting material to create geopolymer concrete; • Alkaline activators, like sodium hydroxide and sodium silicate, will be used to create the process for creating geopolymer concrete; and • The properties of GGBS based on geopolymer concrete will be observed, particularly its compressive strength.

DETAILED PROCEDURE

Compression testing, material selection, mix proportioning,specimen preparation/casting, and specimen preparation. Results

PROPORTIONING THE MIX FOR THE NINE CUBE (100mm x 100mm x 100mm)

GGBS weighs 2.5 kilogrammes, fine aggregates 3.75 kilogrammes, coarse aggregate 6.25 kilogrammes, and foaming agent 20 millilitres.

PREPARE/FORMULATE SPECIMENS:

First, a weighed quantity of sodium hydroxide (NaOH) in flakes and sodium silicate to fit 4 Molarity are dissolved in a specified amount of purified water (4M). After that, the mixture is swirled ferociously with a glass rod until it has cooled. The final product was kept in a beaker for 24 hours. The alkaline solution and polymerization process may mix while you wait. Sodium hydroxide and sodium silicate were added to the dry mixture of GGBS, fine aggregate, and coarse aggregate on a metallic tray. Additionally, a calculated amount of foaming agent was used. The mix proportions of GGBS, fine aggregate, and coarse aggregate in the current experiment were 1: 1.5: 2.5. Prior to now, the dry ingredients had been thoroughly mixed for five minutes. The freshly mixed concrete was poured into moulds right away. Concrete cubes measuring 100 x 100 x 100 mm that had just been poured were cast to test the compressive strength. After casting for ambient curing, all of the specimens were stored at room temperature, and after being remoulded the next day, they were all kept there until the testing day. The cast cubes underwent compression testing in a machine to ascertain their compression strength at 3, 7, and 14 days after ambient curing. The results were documented.

Calculations: 3.1 Mix Design Calculations For Nine Cubes (100 mm x 100 mm x 100 mm) • GGBS = 2.5 kg • Fine Aggregates = 3.75 kg • Coarse Aggregates = 6.25 kg • Foaming Agent = 20 ml

3.2 Test of compressive strength Estimation: -

Compression testing was finished in accordance with IS 516:1959 standards. Every single sample of concrete was put through compression testing with a 1000 KN capacity. Concrete cubes of 100 mm x 100 mm x 100 mm were subjected to a crushing strength test, and the results were positive. The maximum load placed on the samples was calculated by dividing the failure load by the area of the specimens' ultimate compressive strength. The following chapter's graphs show the results after they have been plotted.

Fig 3 Compressive Strength testing Machine

3.2 Geo-polymeric concrete cubes with a 3 molarity compression strength test

Geo polymer concrete Block	**3rd DAY Molarity=4**	**7rd DAY Molarity=4**	**14rd DAY Molarity=4**
Weight (Kg)	2.3	2.35	2.28
Load (KN)	70	133.3	175
Stress (N/mm^2)	7	13.3	18

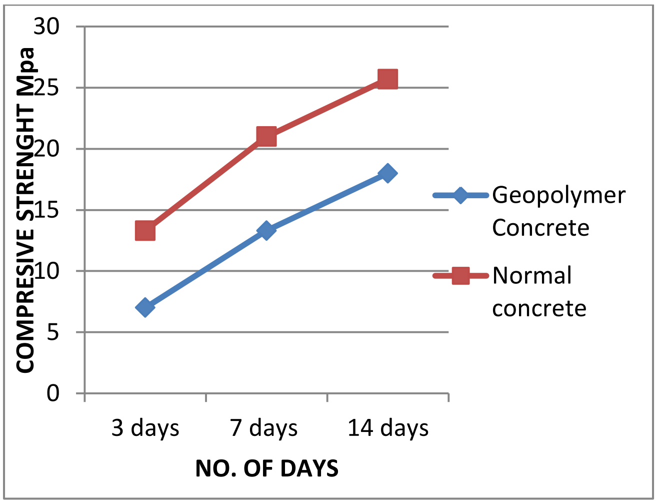
3.4 Compressive strength test of geo-polymeric concrete cubes with 6 molarity

Geo polymer concrete Block	**3rd DAY Molarity=6**	**7rd DAY Molarity=6**	**14rd DAY Molarity=6**
Weight (Kg)	2.45	2.5	2.42
Load (KN)	234	300.3	393.3
Stress (N/mm^2)	23.4	30.03	39.3

3.5 Compressive strength test of geo-polymeric concrete cubes with 8 molarity

Geo polymer concrete Block	**3rd DAY Molarity=8**	**7rd DAY Molarity=8**	**14rd DAY Molarity=8**
Weight (Kg)	2.4	2.4	2.38
Load (KN)	307.3	350	400
Stress (N/mm^2)	31	35	40

Graph off comparison of cement concrete and geo-polymer (4 MOLARITY) compressive strength.



4. SUMMARY

• The compressive strength of ambient-cured specimens at 14 days is greater than that of conventional concrete for alkaline molarity of 8 molar.

• The compressive strength of ambient cured specimens at 14 days is about 1.5 times that of regular concrete for an alkaline molarity of 8 molar.

• After being cured in an ambient laboratory environment, the compressive strength of geopolymer concrete made with GGBS gets stronger over time.

• The greatest compressive strength of 100% GGBS at 14 days after ambient curing was 40 MPa.

The compressive strength of geopolymer concrete based on GGBS increases as the alkaline solution concentration rises. Several technical articles form the basis of this analysis.

• The compressive strength of concrete grows proportionally with age and reaches a certain age.

• As a result, we suggest utilising light concrete with an 8 molarity that is GGBS-based. after 14 days of ambient curing, NaoH and Na2siO3 have reached their maximum compressive strength.

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