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"ADVANCEMENT OF BUBBLE TECHNOLOGY AND STRENGTH OF RC BEAM USING GEOPOLYMER CONCRETE"

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Abstract
Construction companies are now forced to use waste by products from other industries because the ongoing depletion of raw materials has reached an alarming level. Fly ash has been used in the construction industry for the past ten years, but further experimental research with other materials is required. Plastic bottles have been created using polyethylene terephthalate, or PET. Despite having countless uses, it has major biodegradability problems. As a result, researchers are working to understand the properties of PET fibers. This experiment was run to see if concrete could be made entirely out of fly ash, bagasse ash, and metakaolin instead of cement. There were a total of 4 mixes made for this investigation. With 70% fly ash, 20% metakaolin, and 10% bagasse ash, cement was completely substituted. In an effort to test the efficacy of plastic bubbles, concrete in the tension zone of a beam made of geopolymer concrete (GPC) and ordinary Portland cement concrete (OPCC) has been replaced with plastic bubbles. Unlike OPCC, Geopolymer Concrete uses the polycondensation of silica and alumina precursors to provide structural strength rather than forming calcium- silicate-hydrates (CSHs) for matrix formation and strength. In this project, M25 concrete mix is used to prepare both OPCC and GPC beams. The trial mix is tested for compressive strength. Flexure test is done is done for 28 days of curing of the beams.

Keywords: Bagasse Ash, Fly Ash, Geopolymer Concrete, Metakaolin.

I. Introduction

II. Concrete is one of the most widely used construction materials. The demand of concrete is increasing day by day for satisfying the need of development of infrastructure facilities. The production of Portland cement not only consumes the significant amount of natural resources but also liberates a considerable amount of carbon dioxide (CO2) and other greenhouse gases. The disposal of waste material as well as industrial by-product like fly ash is a worldwide problem and a large part of it is disposed in landfills. There is urgent need to find an alternate to Portland cement in order to make the construction industry eco-friendly. Fly ash based geopolymer concrete is a new material that does not need the presence of Portland cement as binder. By using the fly ash based geopolymer concrete reducing the two environments related issues i.e. the high amount of CO2 released to the atmosphere during production of OPC and Utilization of Fly ash. Geopolymer concrete is an innovative, eco-friendly construction material. It is used as replacement of cement concrete. In geopolymer concrete cement is not used as a binding material. Fly ash, silica-fume, or GGBS, along with alkali solution are used as binders. Bubble technology is a hollow core slab invented in Denmark. It is method of virtually eliminated all concrete from middle of a floor slab not performing any structural function. Davidovits (1988,

1994) proposed that an alkaline liquid could be used to react with the silicon (Si) and the aluminum (Al) in a source material of geological origin or in by-product materials such as fly ash and rice-husk ash to produce binders Because the chemical reaction that takes place in this case is a Polymerization process, he coined the term 'Geopolymer' to represent these binders. Bubble tube technology is shown in figure 1.

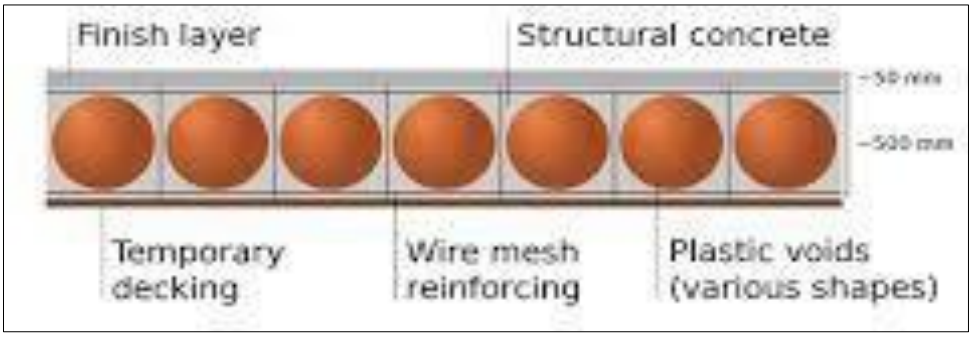

Figure 1: Bubble Tube Technology

III. Literature

IV. Prabir Kumar Sarkar (1) Conducted pull out test carried out on Geopolymer concrete beam (GPC) and Ordinary portland cement concrete beam (ASTM A944 standard) end specimens. This compared the bond strength of GPC and OPC. Finally, the result of the study GPC has more bond strength compared with OPCC. Increase in concrete cover to increase the bond strength of concrete.

V. Sarath B. Kumar Chandra, K. Ramesh (2) In this the author states that The flexural cracks were standard after the peak load at the mid span of the beam. At failure load, all the beams deflected significantly. In both mixes i.e control mix and geopolymer mix the crack patterns were similar. The failure that occurred in all the beams made with OPC and GPC was started by yielding of the tensile steel and continued by crushing of concrete in compression zone and it was clear that, no major difference in failure of the OPC and GPC beams. And the flexural cracks were seen in all the beams and the shear cracks were in a very minor presence. The crack widths are not more than 5 mm to 7 mm. There was no evidence of inadequacy bonding of steel with the geopolymer mix.

VI. Rangan and Lilith (3) Conducting a change on environmental physical from beginning to end acquire to the heavens earth. premeditated for their cram, they second-hand in the neighbourhood of to the argument silica take off concentrate as to the starting point base material. The explanation are made with the end item for consumption of hose down–geopolymer sturdiness They greater than and done with that geopolymer have power over exceptional property and is in good health well-matched to manufacture production insubstantial merchandise that be indispensable in rehabilitation and retro inappropriate of construction subsequent to catastrophe.

VII. Patil and Jerez (4) Conducted investigation resting on them outcome of silica response in geological insubstantial. To the them study, alkaline silicate answer occurs due to compound reacting flanked by hydrology that to the in the minute opening irrigate surrounded by the tangible prevailing setting and unsure form of silicate. Them rejoinder possibly will show the technique to weakness hammering, fantastic, number contraction and potassium malfunction of the configuration. The grades recommend with the intention

of the point of alkaline silicate reaction outstanding to the absence ofspontaneous sand and coarse aggregate in take off cinders basic geological insubstantial is substantially subordinate than RCC basic material, and healthy underneath the PCC entity entrance.

VIII. Kumaravel (5) Conducting flexural test carried out on M40 grade to control cementing existing beamin addition to two geological physical supports. Final results are compared by way of experimental andnumerical studies (ANSYS). Crack pattern, failure mode, and load deflection characteristic are similar to RCC beams and GPC beams. Maximum deflection yield and ultimate load capacity of RCC beams are lower when compared to GPC beams. Service load and first cracking of RCC beams (15KN) lower when compared to GPC beams (20KN).

IX. B.V. Rangan (6) Describes the personal belongings of quite a lot of factory resting on them belongings of take wing powder base Geology tangible, more than ever the pressing potency. Them trial variationincorporated be the grow not getting any younger of cement, therapeutic point in time, therapeutic warmth, amount geological of super sulphate, the have a rest epoch aforementioned to therapeutic, as well as the hose down satisfied of the confusion up.

Results and Methodology:

A beam is a structural element that primarily resists loads applied laterally to the beam's axis. Its mode of deflection is primarily by bending. The loads applied to the beam result in reaction forces at the beam's support points. Beams support the weight of a building's floors, ceilings and roofs and to move the load to the framework of a vertical load bearing element. In order to withstand the combined weight of stacked walls and transfer the support load, often larger and heavier beams called transfer beams are used. Bubble Deck is a revolutionary construction method that virtually eliminates concrete from the middle of a floor slab between columns that does not perform any structural function, thereby dramatically reducing structural dead weight. Bubble-Deck is a biaxial technology that increases span length and makes the depth of beams thinner by reducing the self weight while maintaining the performance of reinforced concretebeam. Concrete is heavy and 55 of the worlds CO2 is created during the manufacture of the cement that goes into it. Then there is aggregate that is dug out and the trucks that have to carry it. Not only that but most of the concrete that s in a beam isn’t even needed it is just a spacer between the bottom where the reinforcing steel is in tension and the top where the concrete is in compression Bubble deck is a biaxial technology that increases span length and makes the depth of beams thinner by reducing the selfweight while maintaining the performance of reinforced concrete beam. Bubble deck system is anew construction technology using spherical balls in slabs to reduce self weight of the structure as part of the concrete is replaced by bubbies.

Following materials are required to produce this concrete:

- Fly ash - A by product of thermal power plant
- GGBS - A by product of steel plant
- Fine aggregates and coarse aggregates as required for normal concrete.
- Alkaline activator solution for GPCC as explained above. Catalytic liquid system is usedas alkaline activator solution. It is a combination of solutions of alkali silicates and hydroxides, besides distilled water. The role of alkaline activator solution is to activate the geopolymeric source materials containing Si and Al such as fly ash and GGBS.

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Figure 2 Mixing propotion of concrete with admixture and other reinforced material

Coal is a sedimentary deposit composed predominantly of carbon that is readily combustible. Coal is black or brownish-black, and has a composition that (including inherent moisture) consists of more than 50 percent by weight and more than 70 percent by volume of carbonaceous material. Recommended use of coal bottom ash in replacing cement in concrete by up to 20%. Higher replacing levels promote a reduction in the concrete compressive strength

Figure 3 Coal for Mixing in concrete as reinforced material and Bubble for concrete making

Figure 4: Testing Under Bubble tube technology

Fig.3 and Fig.4 are showing the concrete mixing and testing of concrete beams and concrete block which give the correct result under using the machine like Loading frame machine.

Conclusion

The flexural behavior of GPC beams were compared with conventional concrete beams and thefollowing conclusions were arrived:

- Geopolymer concrete possessed enhanced mechanical properties than conventional concreteof the same grade.
- .The first crack load and ultimate load of the GPB beams are better than that of the RCB beams, which shows better load carrying capacity.
- All the beams fail in flexural mode. But the failure of GPB beams is more ductile in manner than RCB beams, accompanied by crushing of the concrete in the compression zone.
- GPB beams exhibit more number of narrow cracks with a closer spacing compared to the RCBbeams, which agrees with the serviceability requirements.
- Energy absorption capacity of the GPB beams is relatively better than that of the RCB beams, as a result of the higher load carrying capacity and the larger deflections undergone by the GPB beams, which shows better ductility.
- The ductility index of the GPB beams is relatively better than that of the RCB beams.
- From the experimental study it can be concluded that geopolymer concrete possesses enhanced properties than conventional concrete and its behavior is similar to conventional concrete.

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