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TITLE: ALKALI-ACTIVATED FLY ASH AS A BINDER IN PAVEMENT

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Abstract

- *In the presents study highway engineers have focused on the possibility of use of alkali activated binders for use in concrete pavements. There are two types of alkali activated binders in which alkali activated slag concrete and alkali activated slag fly ash concrete are prepared and then It is compared with ordinary Portland cement concrete. Mixing of cementitious binders in concrete during the construction of work its increases the Strength and Durability of pavement. Fly ash is a fine powder that is a by- product of burning pulverized coal in electric generation power plants. Utilisation of this by-product as a Geopolymer raw material can solve the environmental risk. Raw fly ash has a positive effect on geopolymer. In present paper deals with overview of fly ash and there are two prosperous fly ash utilization possibilities:1) hydraulic binder 2) Geopolymer through experimental results. Use of fly ash as added material as in the case of geopolymer concrete, reduces the use of cement. Reduction of cement usage will reduce the production of cement which in turn cut the CO2 emissions. In this project Interlocking pavers are produced geopolymer product that is individually placed as per the requirement. The Fibre geopolymer concrete is eco-friendly concrete since there is no CO2 emission. Binders could be produced by polymeric reaction of alkali liquids with the silicon and the aluminium in the source materials such as fly ash and rice husk ash and these binders are termed as Geopolymer. In Geopolymer Concrete, fly ash and aggregates are mixed with alkaline liquids such as a combination of Sodium Silicate and Sodium Hydroxide.*

Keywords: *Alkali activated binders, Strength, Durability, Fly-ash, Key Geopolymer etc.*

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1. INTRODUCTION

The large demand of concrete in civil engineering due to increase in population the need of sustainable and eco-friendly building materials. To improve feasibility of concrete researcher have tried used fly ash, ground granulated blast furnace slag, rice husk ash, welding flux slag and other waste product mixed in building materials. Geopolymer binder utilise industrial waste to form a suitable binder.

The economic growth of the nation is linked to power availability and high proportion of coal based thermal power station, generation of fly ash is increase in future. Its estimated that copal ash generation will likely to grow over 200Mt.

In India thermal power plant generate ash in the form of fly ash (80-90%) and bottom ash (10-20%) in which 38% ash content coal, it is further estimated that only 51% ash is useful for utilization.

Large volume of fly ash is being produced by thermal power stations and part of the fly ash produced is used in concrete industry, low laying area fill, roads and embankment, brick manufacturing etc. The balance amount of fly ash is being stored in fly ash. Use of fly ash as added material as in the case of geopolymer concrete, reduces the use of cement. Reduction of cement usage will reduce the production of cement which in turn cut the CO2 emissions. In this project Interlocking pavers are produced geopolymer product that is individually placed as per the requirement

The main objective of this paper is to expand fly ash based geopolymer concrete which can be used as partial replacement of OPC concrete in pavement blocks. Use of fly ash in pavement block which is most eco-friendly and feasible. It improves the strength and durability of concrete pavement block.

1.1 MATERIALS

In this we can study the experimental investigation carried out to develop the geopolymer concrete based of alkali activated fly ash by sodium Hydroxide with sodium silicate.

1.Cement: The cement used for it is ordinary Portland cement (OPC-53 grade). Properties of Ordinary Portland Cement are as follow.

Table 1.1. Propertie of OPC-53 Grade

Property	Value
Standard consistency	31%
Specific gravity	3.17
Initial setting time	60 minutes
Final setting time	450 minutes

2.Sodium Hydroxide: Commercially available sodium hydroxide flakes with a purity of 98% were used. Sodium hydroxide in the form of pellets with specific density of 2.13g/cm^3.

3.Sodium Silicate: Commercially available sodium silicate solution to the industries. The density of sodium silicate is 1.53g/cm^3.

4.Fly ash: Low calcium class F fly ash of Specific gravity 2.35 (passing 45 micron) is use.

5.Coarse Aggregate: Crushed stone from granite was used as a coarse aggregate. Material passing from 10mm sieve and retained on 4.75mm sieve. Specific gravity is 2.67.
F
6.Fine Aggregate: Quarry sand is use as fine aggregate. Material passing from 4.75mm sieve and retained on 75micron sieve. Specific gravity is 2.67.

7.Water: Normal water is use for mixing and curing.

2. INTERLOCKING PAVING BLOCKS

Using the optimized mix of geopolymer concrete, an interlocking block with a surface area of 26, 551 mm2 was cast using the vibrating paving block making machine. The top surface of the paving block was made smooth by applying Plaster of Paris and was placed between two plywood plates.

Geopolymer concrete could be manufactured by using the conventional techniques used in the production of Portland cement concrete. In experiments -

- fly ash and the aggregates mix in a pan carefully for three minutes.
- The liquid slury is formed, add water if required.
- The liquid component mixture is them added to the dry materials and mix it for another four minutes.
- Then fresh concrete is cast and compacted by usual method.
- Geopolymer concrete is cohesive in nature.
- The workability of the fresh concrete was tested by slump cone test.
- Curing: Heat curing is initial for fly ash based geopolymer concrete. Both curing temperature and curing time control the compressive strength of geopolymer concrete.

After casting the specimens:

1) Specimens were kept in rest period in room temperature for 2 days
2) The geopolymer concrete was demoulded and then placed in an autoclave for steam curing for 19 hours at a temperature of 60^{o}C.
3) The cubes were then allowed to cool to be in solid form in room temperature for 21 hours.

Fig.1.Interlocking paving block

2.1 ADVANTAGES OF FIBRE GEOPOLYMER CONCRETE:

- The Fly ash is an easily available material and side product of burning coal and Compared to cement it is of low capital cost.
- The chemical used are easily available in the market.

2.2 TEST TO BE CONDUCTED ON PAVING BLOCK

- Compressive Strength Test
- Flexural Strength
- Abrasion Resistance
- Water Absorption
- Density

3. CONCLUSION

Test result corresponding to the compressive strengths of geopolymer concrete with time, NaOH concentration. According to the experimental result of geopolymer concrete, the following observation can be made

1.The Low calcium fly ash based Geopolymer concrete has excellent compressive strength within short period (3 days)

2.Flexural strength is increased very highly.

3.Fly ash based geopolymer concrete can be efficiently used to manufacture relatively high strength interlocking paving blocks.

4. The time taken for the strength gain in ambient cured samples was much higher than that of the heat cure samples. Approximately half of the strength achieved by heat curing after 28 days can be also achieved by keeping it at room temperature for the same time period.

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