EXPERIMENTAL EVALUATION OF ECOFRIENDLY NO-FINES GEOPOLYMER CONCRETE FOR SUSTAINABLE PAVEMENT APPLICATION

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Abstract - *Water penetration and storage abilities make No-fine cement concrete unique as a pervious concrete, while using it in pavements to decrease flood risks by storm water management. But still cement is the main part as a binder material, which contributes in global warming by having carbon dioxide emissions during cement production in plants. New researches have shown Geopolymer technology a good alternative material for concrete to omit cement and combat against the global warming which the world is concerned nowadays. No-fine Geopolymer concrete is the solution for both global warming and flood risks. This paper aims to find M20 grade eco-friendly no-fine geopolymer concrete having ingredients of fly ash waste material, coarse aggregates, sodium hydroxide, sodium silicate and GGBS in different percentages to enhance its compressive strength.*

Key Words*: *Geopolymer Technology, Storm Water Management, Compressive Strength, M20 Grade Eco-Friendly

1. INTRODUCTION

Urbanization and development of the world is increasing day by day along with increase in population and human needs hence concrete is still worldwide used material in construction industry since long time. Concrete having properties of high compressive strength, ease of shape, durability, availability and low cost make it correlative of urbanization. Many advancements have been brought in concrete to use it in different environments and serviceability purposes. But still researches are needed to make it more beneficial technically, environmentally and economically. From these three aspects enough changes have been brought in concrete in technical and economic aspects such as innovations of high strength concrete, acid resistant concrete, mass concrete, lightweight concrete, self-cured concrete and many more with low costs that can be available and used globally. Looking at environmental aspect concrete needs to be green and eco-friendly.

2. NO-FINES CONCRETE

No-fines Concrete is termed as pervious concrete because of voids present in its structure. Presence of voids is due to omitting the fine aggregates thus it become light weight also. On other hand using no-fines concrete for pavements will reduce run off water during storms by absorbing and transferring water to the ground, this will help to recharge ground No-fines concrete is also called thirsty concrete. So using no-fines concrete will make pavements pervious and sustainable

2.1 GEOPOLYMER CONCRETE

Ajay Kumar Singh studied strength and durability of Fly ash and GGBS based Geopolymer concrete. The specimens were taken to be tested after 28 days of curing in sun. Then the specimens were immersed in 3% HCL, 3% H2SO4 and 3% HNO3. Results showed greater resistance to acid environment and high compressive strength compared to conventional Portland cement concrete.

3. SODIUM HYDROXIDE

Sodium hydroxide and Potassium hydroxide alkaline both can be used to achieve geopolymer. In this study Sodium hydroxide alkaline has been used. Sodium hydroxide can be found in flakes form in local market. Usage of Sodium hydroxide depends upon the molarity of the solution. The molecular weight of sodium hydroxide is 40 gr to find any desired molarity of solution simply multiply the molarity into the molecular weight of the sodium hydroxide to make one litter of sodium hydroxide solution of 12 moles. This research has used 12 mole sodium hydroxide alkaline solution to find the mass of sodium hydroxide flakes 10x40=480 grams, so 480 grams of sodium hydroxide flakes are required to make 1 litter of sodium hydroxide solution of 12 moles.

3.1 SODIUM SILICATE

Sodium Silicate is the second essential alkaline of geopolymer chemistry used in this research and was purchased from local suppliers. Sodium Silicate is available in solution form having concentration 40-54 %. A solution with 52% concentration were used for this experimental work. The 1:2.5 ratio of sodium hydroxide to sodium silicate were adopted for all mixes. Concentration of sodium silicate shows the amount of water present in solution, for example sodium silicate of 52% concentration means 52 % water is present to the all weight of the solution in the liquid. Sodium silicate is more dense that sodium hydroxide so both solutions are mixed properly first a day before the day of mixing and preparing of the geopolymer concrete. Sodium silicate has water color with littledimness

4. CONCLUSIONS

From environmental and storm water management aspects enhancing the technology of No- fines geopolymer technology will result in sustainable development for global warming reduction and minimizing flood risks because of no cement present in geopolymer concrete and the ability of absorbing large amount of water. Enough strength and infiltration rate is achieved which can be used for low traffic roads and pavements. Future studies are expected from researchers in this field with lower size aggregates, temperatures and high molarity of sodium hydroxide to make environment green and sustainable.

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