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A REVIEW PAPER ON MAINSTREAMING OF GREEN CONCRETE

Kumar Aryan[*1], Piyush Kulshreshta[*2], Omendra Singh[*3], Md. Asif Raini[*4], Asst. Prof. Yasir Karim[*5]

[*1,2,3,4]U.G. Student, Department Of Civil Engineering, KIET Group Of Institutions, Ghaziabad, Uttar Pradesh, India.

[*5]Assistant Professor, Department Of Civil Engineering, KIET Group Of Institutions, Ghaziabad, Uttar Pradesh, India.

ABSTRACT

The use of conventional concrete is the cause for a huge volume of CO2 emission. Therefore, for reducing the emission of Co2 different types of concrete are under development using waste products from industries, agricultural use like blast-furnace slag, silica fume, fly-ash which would require less amount of energy and besides that it would also cause considerably less harm to the environment. "Green concrete" is a relatively new technology that is being developed these days to counter the effect on environment due to the production of cement. During the manufacturing process of the cement, high amount of greenhouse gases mainly carbon-dioxide is emitted which harms the environment significantly, so by the process of replacing a certain percent of cement by different waste materials which harm the environment, we not only minimize the complication of discarding of these materials but also, we minimize the production of carbon-dioxide during the cement manufacturing process, product of which we minimize the adverse effect on environment. Roughly, around (8-10) % of carbon-dioxide (CO2) is produced from the operations related to manufacturing and transport in concrete industry. Co2 is a major gas following steam, which is responsible for generating greenhouse effect.

Keywords: Concrete, Fly Ash, Green Concrete, Energy Consumption, CO2 Emission.

I. INTRODUCTION

With an ever-increasing population, the construction industry's demand continues to rise, and with it, the consumption of concrete rises at a rapid rate. Highways, airports, factories, and bridges are examples of major development projects in developing nations. These initiatives are vital for these countries to keep up with fast globalisation. Concrete is the most important component of infrastructure development because it offers the necessary durability, strength, and hardness. Normal building procedures are often designed to provide short-term financial rewards, but sustainable construction practises are designed to provide long-term durability and effectiveness. As a consequence of the negative environmental effect of typical construction materials such as concrete, architects and engineers are becoming more interested in the problem of sustainable development. Various new sustainable development materials are being used to minimise the impact on the environment. Cement manufacturing accounts for around 6% of worldwide CO2 emissions, making it a significant contributor to the problem of global warming (Greenhouse gas). India, as a rapidly developing country, is the world's third largest cement producer and, in addition, a major user of cement per capita. According to statistics, India utilises roughly 1.2 Tonn per capita per year, although the global average is about 0.6 Tonn per capita per year. The amount of CO2 emitted by one tonne of concrete might range from 0.05 to 0.13 tonns. 95 percent of all CO2 emissions from 1 m3 of concrete are produced during the cement manufacturing process.

As a result, GREEN CONCRETE plays a critical role in reducing the negative effects of concrete use. In the year 1998, DR. W.G. used the name GREEN CONCRETE for the first time in Denmark. Using waste elements such as incinerator residue, red mud, burnt clay, sawdust, combustor ash, and foundry sand, he created the world's first green concrete. The three major aims of adopting the green idea in concrete, according to W.G., are to minimise greenhouse gas emissions (CO2), reduce the use of natural resources such as limestone, and increase the durability of the concrete. and clay used in the production of concrete and cement, and use waste materials such as fly ash, silica fume, and glass shards that pollute the environment. These green concrete goals will ensure long-term growth while presenting no threat to our natural resources.. Green concrete may be made by substituting various waste products slag iron and quarry dust for some coarse aggregate, and slag iron and quarry dust for some fine aggregate According to their experiments, fly ash concrete is made by replacing fine

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aggregate with fly ash. Four concrete mixes were created, one of which was a control mix without the use of fly ash. The compressive strength of the fly ash replacement specimen is higher than that of the control mix, according to several tests performed on the mixes. The compressive strength of 15 percent replacement of fly ash was the greatest among the various percentages of replacement of fly ash.

II. MATERIALS USED IN GREEN CONCRETE

FLY ASH:

Fly powder is finely split residue that results from the combustion of powdered coal in an explosion, which is transported by flue gases and collected. The amount of fly powder left behind after burning is estimated to be over 75 million tonnes per year, and its disposal has become a serious challenge. Instead, it may be put to good use in a big way. The most common and extensively used building material is Portland cement concrete. Some built-in drawbacks of Portland cement are still difficult to overcome due to limitations in the production process and raw ingredients.

FLY ASH

SILICA FUME:

Producing silicon metal or ferrosilicon alloys produces silica fume as a by-product. Concrete is one of silica fume's most advantageous applications. It's a highly reactive pozzolan due to its chemical and physical characteristics. Silica fume concrete may be extremely strong and long-lasting. Silica fume is available from concrete additive manufacturers and is easily added throughout the concrete manufacturing process if specified. The concrete contractor must pay extra care to the placement, finishing, and curing of silica-fume concrete.

SILICA FUME

RECYCLED AGGREGATE:

Recycled aggregates are made by repurposing materials that were once utilised in building. Sand, gravel, crushed stone, and asphalt are examples. The phrase basically includes the materials that have previously been employed in building. The aggregates must subsequently undergo reprocessing, which includes crushing and mixing, to verify that they fulfil regulatory criteria.

RECYCLED CONCRETE AGGREGATE

GROUND GRANULATED BLAST FURNANCE SLAG:

GBS (Ground Granulated Blast-furnace Slag) is a pozzolanic by-product of iron blast furnaces that is usually used in concrete. Blast furnaces operate at temperatures of above 1,500°C and are fed with a carefully balanced mix of iron ore, coke, and limestone. The iron ore is transformed to iron, whereas the remaining components float on top, generating slag. If this slag is to be used in the manufacturing of GGBS, it must be taken over as a molten liquid and swiftly cooled in massive volumes of water. Rapid cooling enhances cementitious qualities and results in coarse granules that imitate sand. After being granulated, the slag is dried and crushed into a powder.

GROUND GRANULATED BLAST FURNANCE SLAG

III. LITERATURE REVIEW

Fly ash concrete is made by replacing fine aggregate with fly ash. Four concrete mixes were created, one of which was a control mix without the use of fly ash. The compressive strength of the fly ash replacement specimen is higher than that of the control mix, according to several tests performed on the mixes. The compressive strength of 15 percent replacement of fly ash was the greatest among the various percentages of replacement of fly ash [1].Silica fume concrete, they employed silica fume instead of cement, with a cement replacement percentage ranging from 0% to 10%. Silica fume replacement has been shown to improve concrete strength while also improving chloride resistance. The replacement percentages for each of the three concrete mixes utilised in the test were 0%, 5%, and 10%, respectively. After 28 days, the specimens were subjected to a variety of tests, with the results revealing that 10% replacement silica fume outperforms all other replacements in terms of compressive strength [2].Slag concrete is a type of concrete that has been treated with slag. The study was centred on the use of a combination of high-volume fly ash and slag to replace cement. Four mix designs with varying proportions of slag and high-volume fly ash, as well as a control mix, were constructed and evaluated. The compressive strength of high-volume fly ash was lower than that of PC concrete, according to the test results. Furthermore, adding slag to high-volume fly ash cement improves the fire resistance of concrete, however it is not recommended to mix slag with fly ash because it diminishes the concrete's compressive strength [3]. The study was undertaken to check the feasibility of using recycled aggregates in place of nominal aggregates. The test subject was created with different percentages of replacement of nominal aggregate by recycled aggregate like 0% 10% 20% 30% replacement and tested for compressive strength test, Split tensile test, and flexural strength test. The results of the tests revealed that increasing the percentage of recycled aggregate substitution causes a drop in concrete strength qualities [4].In the lab, the macro and micro properties of concrete incorporating liquid crystal glass (LCD) glass were studied. Scrap LCD was used to replace ten percent, twenty percent, thirty percent, forty percent, and fifty percent of the cement. Furthermore, natural sand was replaced with glass sand at 10%, 20%, and 30% substitution rates, respectively. A series of experiments were used to assess the performance of LCD glass. The addition of glass sand to the mixture boosted compressive strength, according to the results of the trials. Furthermore, over time, glass sand improved the concrete's resilience and quality. By decreasing the use of cement and sand in concrete, glass might assist to preserve natural resources and cut carbon emissions [5].In the replacement of cement by brick dust gives maximum compressive strength up to 10% replacement and any further replacement of cement by brick dust gives a low compressive strength concrete [6].When replacing fine aggregate with marble powder and quarry dust to make green concrete, a 50 percent replacement yields sufficient compressive strength, but any additional replacement improves workability at the expense of compressive strength and split tensile strength [7].Although it is theoretically feasible to replace 100 percent of cement with fly ash, more than 80 percent requires the use of different chemical activators, thus normally only 30 percent of cement is replaced with fly ash. [8].It is not possible to replace fine aggregate with broken brick debris because the compressive and flexural strengths of concrete are reduced. Although the binding strength between brick debris and cement paste is strong, and concrete's fire resistant quality improves significantly [9].It is preferable to use destroyed brick waste aggregate to replace aggregate rather than granite to replace aggregates. The ability of brick wastes to withstand significantly greater temperatures than granite aggregates explains their superior performance [10]. When agricultural wastes such as banana peel are used to replace roughly 10% to 20% of the traditional concrete, many qualities of the concrete such as workability, strength, and other attributes are improved. [11].Rice husk can also be replaced in the cement which act as both an admixture and as a pozzolanic material , it improves the workability of the concrete and due to presence of some quantity of silica it also increases the setting time of the concrete [12].For the production of green concrete by the replacement of stone waste generally 20% replacement is done for OPC and 10% maximum for PPC. Increase in replacement affects the split tensile strength of the concrete the more the replacement the less the achieved strength [13].

IV. ADVANTAGES OF GREEN CONCRETE

- Reduction In CO2 Emissions .
- Manufacturing Costs Are Cheap Owing To The Usage Of By-Products.
- Energy And Water Are Conserved And Also Aids In The Recycling Of Industrial Waste .
- Aids And Supports Sustainable Development By Having Stronger Strength And Durability Than Regular Concrete.
- Improves Workability.
- It Requires Less Maintenance.
- It Reduces The Effect Of Creep And Shrinkage.
- It Gives Good Fire Resistance.
- Dead Load Of The Building Is Minimized.
- Green Concrete Is Eco Friendly In Nature.
- Much Change In Material Is Not Required Than That Of Normal Concrete.

V. SCOPE OF GREEN CONCRETE IN INDIA

In the history of the concrete industry, green concrete is a game-changing notion. Green concrete takes longer to arrive in India owing to challenges with industrial waste disposal, but it has a reduced environmental impact due to decreased CO2 emissions. The usage of green concrete can help to minimise a lot of product wastage. Various non-biodegradable material can also be utilized, nullifying the need to discard of them. As a result, we still have work to do in terms of integrating sustainable design ideals to benefit society.

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VI. CONCLUSION

Green concrete helps minimize the negative environmental impact that traditional concrete has during its development and use. As a result, this substance might be classified as a long-term material. The manufacture of green concrete uses less energy and gasoline. Water consumption on-site is also lower than it is with concrete mixture. Green concrete requires less energy and petroleum to produce. Water use on-site is also lower than with traditional concrete. Fly ash is a waste product from coal-fired power stations that is usually dumped in ponds or landfills.

Fly ash has the ability to replace cement, a component with huge environmental repercussions due to air pollution from cement manufacturers, according to research. Crushed concrete may be reused as aggregates to save money on raw materials and minimise the amount of garbage created by destroyed concrete constructions.

Finally, the notion of green concrete cannot exist on its own. It must be accompanied with a sustainable design concept that considers the whole life cycle of the building as well as factors of energy efficiency and maintenance. Concrete is one of the few construction materials that can provide decades of virtually maintenance-free service, but it requires adequate design to satisfy the needs of users throughout the course of their lives.

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