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A Review on the Comparison of Compressive Strength of Green Concrete

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ABSTRACT:

Green concrete is nothing but concrete made with eco friendly wastes. In concrete industries green concrete is a revolutionary topic. Green Concrete is a environmental friendly material. Among all materials used in the construction industry concrete is main material for construction purposes. Billions of tons of naturally occurring materials are mined for the production of concrete which will leave a substantial mark on the environment. To reduce such emissions, various types of concrete were developed by various researchers by using some waste products from industries and agriculture. It depicts the convenience of the usage of various by products such as dust, marble, fly ash, plastic waste, marble granules, silica fumes, blast furnace, slag, etc. which requires less amount of energy and it is also less harmful to environment.

KEYWORDS: *Concrete, aggregates, sustainability, durability, fly ash, supplementary cementious materials, industrial wastes, agricultural waste, construction industries, carbon dioxide emissions.*

I. INTRODUCTION:

The size of construction industry all over the world is growing at faster rate. The huge construction growth boosts demand for construction materials. Green concrete is nothing but using greener materials concrete to make a infrastructure more sustainable. Green Concrete is cheap to produce because it is prepared by waste materials which lowers the energy consumption, increases its strength and durability. Green Concrete was first developed by Dr.WG in 1998.He made green concrete by including various aspects such as mechanical properties, fire resistance, durability, strength, thermodynamic properties, environmental properties, etc. to prepare green concrete. At recent century India has taken a major initiative in developing the infrastructure such as express highway, bridges, power projects, airports, industries, etc. to cope up with the requirements of globalization. some researchers take an initiative to reduce the emissions of Carbon dioxide from concrete by replacing the some amount of cement by various supplementary cementious materials. The use of such materials improves the property of concrete.

Concrete is the most widely used construction material in the world (Aitcin, 2000; Mobasher, 2008). It contains four basic ingredients: water, cement, fine aggregate (sand) and coarse aggregate. The manufacturing of traditional concrete using Portland cement (PC) releases a large amount of greenhouse gases such as CO2 (Meyer, 2005; Bentz, 2010; Bondar et al., 2011). Also, the production of Portland cement is energy-intensive.

The use of supplementary cementitious materials (SCMs), recycled aggregates and other industrial wastes could reduce the environmental impacts of concrete production (Lepech et al., 2008). In this study, aggregates from recycled waste streams or other non-conventional aggregate materials (e.g., lightweight aggregate) are defined as alternative aggregate (AA). The SCMs and AAs are called "green" raw materials in this paper. According to Mannan and Ganapathy (2004), using agricultural and industrial wastes as replacement materials in the concrete industry has dual advantages of cost reduction and a better way of waste disposal. They also pointed out that the material recovery from the conversion of these wastes into useful materials benefits both the environment and the conservation of natural resources.

1 Green concrete is very often considered to be cheap to produced due to use of recycled material.

2 It reduce the CO_2 emission from concrete and reduces the impact on earth.

3 Green concrete is one of the major tool in the feature when the natural resource are on the verge of extinction .

4 Having so much of advantageous has led to popularity in construction world and one of the emerging Technology in sustainable construction.

II. PROPERTIES OF GREEN CONCRETE

The replacement of conventional Portland cement with SCMs and the use of AAs in concrete have been studied in the U.S. and worldwide, in particularly on how these materials impacted concrete properties. The common SCMs studied include, but may not be limited to, fly ash, furnace slag, and silica fume (Basri et al., 1999; Kevern et al., 2011; Limbachiya et al., 2012). Other researchers have also investigated some AAs, such as tire rubber (Nehdi and Khan, 2001), building rubbles (Khalaf and Devenny, 2004), oyster shell (Yang et al., 2005), waste glass (Berry et al., 2011), RCA (Limbachiya et al., 2012), and waste-expended polystyrene reground material (Trussoni et al., 2012). Results showed that depending on the type of raw material and percentage of replacement, concrete properties could be enhanced or negatively impacted compared with that of conventional concrete. For example, Basri et al. (1999) found that a higher percentage of fly ash used in the mix reduced the concrete compressive strength. Limbachiya et al. (2012) concluded that 30% of RCA replacement decreased concrete strengths.

1. It improves the workability.
2. It improves strength development.
3. It improves the curing properties.
4. It improves durability.
5. It improves corrosion protection.
6. It improves frost.
7. It improves new deterioration mechanism.
8. It improves environmental impact.

III. RESEARCH GOALS AND METHODOLOGY:

The research presented in this paper aims to investigate the needs of the concrete industry towards environmental sustainability and the current status of "green" concrete production and implementation. The feedback from the industry is very valuable in refining the research problems of "green" concrete in academia and providing researchers with insights on addressing the industry concerns of using "green" concrete.

Local survey participants (from Central Ohio) were mainly recruited by looking through two publicly available sources: 1) the membership list of ORMCA representing concrete producers and 2) the Membership Directory Book of the Builders Exchange of Central Ohio. The researchers first contacted the selected local companies and explained the purpose of this study and the confidentiality of interview participants. After obtaining their commitment, researchers interviewed one person (recommended by the company to have the best knowledge or expertise in concrete production) per company. The concrete companies for online survey were found through websites of the National Ready Mixed Concrete Association and other trade associations in concrete production/manufacturing and contacted by using their listed email addresses. An on-line survey recruitment script was included in each email. The interviews and online surveys were conducted between July and October, 2012. No identifiable information related to the survey/interview participants was identified in the survey process.

Alireza Mokhtarzadeh and Catherine French studied the use of supplementary cementitious materials, such as fly ash and silica fume, does not necessarily translate into higher strengths. It was shown that benefits from inclusion of fly ash and / or silica fume in the production of HSC depended on the factors such as mixture proportions, type of aggregate in the mixture and the method of curing. When the strength of the HSC was limited by the failure of the aggregate, further reduction in the w-c ratio will not increase strength, and may cause problems by reducing workability of the mixture.

Charles Berryman et al. investigated the maximum compressive strength was found at a fly ash replacement percentage of 35% for concrete containing Class C fly ash. The mean value of compressive strength for 35% type C fly ash was slightly above 41.5 MPa. The maximum compressive strength for concrete where cement was replaced with Class F fly ash was at 25% replacement. Maximum compressive strength for concrete containing type F fly ash was approximately 36.0 MPa.

N. Bouzoubaa, et al. studied the type of the fly ash used, the concrete made with the HVFA blended cements developed higher compressive strength at all ages than that of the HVFA concrete in which unground fly ashes and laboratory - produced portland cements had been added separately at the concrete mixer. The increase in the compressive strength was more significant for the HVFA blended cement produced with the cement without a SP and made with coarse fly ash.

H. B. Mahmud, et al. had studied the experimental study on suitability of Quarry Dust as Partial Replacement Material for Sand in Concrete. Results obtained indicate that the incorporation of quarry dust into the concrete mix as partial replacement material to river sand resulted in lower 28th day compressive strength. The results of

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the study also indicates that quarry dust can be utilised as partial replacement material to sand, in the presence of silica fume or fly ash, to produce concretes with fair ranges of compressive strength.

According to **Tarun R. et al**. to develop structural grade concrete containing high-volume of high calcium fly ash (ASTM Class C) concrete mixes were proportioned for four levels of cement replacements (40%, 50%, 60%, and 70%) by fly ash. Fly ash-to-cement ratio was maintained at 1-1.25 for all test conditions. Properties of concrete, namely, compressive strength, splitting tensile strength, and modulus of elasticity were determined as a function of fly ash amounts and age. Modulus of elasticity for fly ash concrete at 28 days was not determined. It was computed from the formula in the ACI code. The test results showed that the compressive strength of fly ash concrete was higher than the strength of the reference concrete at 28-day age within the experimental range.

IV. POTENTIAL BARRIERS IN IMPLEMENTING GREEN CONCRETE:

Despite the potential benefits from using “green” raw materials in concrete production, there are barriers to the wide application of potential SCMs and AAs. Generally speaking, the barriers exist in concrete properties, cost effectiveness, and industry perception as explained below:

- Concrete properties: Using waste streams as concrete ingredients could improve certain types of concrete properties while undermining some others. For example, Yang et al. (2005) found that using crushed oyster shell maintained or improved the compressive strength but decreased the workability. The chemical reaction between silica-rich glass and the alkali was a major concern when using glass in concrete (Batayneh et al., 2007). Concrete containing plastic aggregate decreased compressive and tensile strengths (Siddique et al., 2008). In addition, there generally lacks quantitative data on properties of concrete using waste materials (Duxson et al., 2007).
- Cost effectiveness: Cost effectiveness would be the driving force for the industry to implement “green” concrete. Recycling and reuse of wastes requires extra labor and energy input. Batayneh et al. (2007) suggested that the cost between crushing wastes (e.g., glass, plastic and RCA) and supplying prime aggregate (gravel) should be compared in project management. Similarly, Meyer (2009) recommended comparing the transportation cost between RCA from construction & demolition debris and virgin aggregate.
- Industry perception/practice: The construction and building product industry is conservative in nature due to the fear of product failure, which becomes a barrier to the utilization of waste materials as pointed out by Duxson et al. (2007). They also indicated the existing negative perceptions of the industry on nonconventional practice in concrete production, which may not be always true. For example, fly ash-contained cement was perceived to have the poor freeze-thaw resistance. Also, the industry tends to follow existing building codes and standards and is resistant to new technologies (Duxson et al., 2007). Therefore, it is necessary to advance the understanding of concrete properties when using “green” raw materials, reduce potential cost in the recycling and reuse process, improve industry standards, and educate the industry about new technologies.

V. ADVANTAGES OF GREEN CONCRETE:

- Much change is not required for the preparation of green concrete compared to conventional concrete.
- Reduces environmental pollution.
- Have good thermal and acid resistance.
- Compressive and split tensile strength is better with some materials compared to conventional concrete.
- Reduces the consumption of cement overall.
- Green concrete is economical compared to conventional concrete.
- It has good acid resistance.
- It increases compressive strength.
- It increases split tensile strength.
- Reduce consumption of the cement.
- It is cheaper.

VI. DISADVANTAGES OF GREEN CONCRETE:

- Structures constructed with green concrete have comparatively less
- Life than structures with conventional concrete.
- Compressive strength and other characteristics are less compared to conventional concrete.
- Water absorption is high.
- Shrinkage and creep are high compared to conventional concrete.
- Flexural strength is less in green concrete.
- It has less structure construction.
- It has less flexural strength.
- Shrinkage is high.
- Creep is high.

VII. CONCLUSION:

In this article, we have studied about the green concrete like properties, preparation, advantages, disadvantages, etc.

With the help of Green Concrete we can save the natural materials for future generations. Green Concrete Technology is one major steps in construction industry to achieve sustainable construction. It is cost effective. This paper deals with the use of Portland cement. With the waste materials we can help to reduce the environmental problems. In this article, we conclude that one ton of conventional cement approximately produce a one ton of carbon dioxide. To over come from this factor Green Concrete is best material. In future, green concrete will not reduce environmental problems but it also reduces the cost of concrete. Water absorption

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is slightly greater that the conventional concrete.Permeability of green concrete is less than conventional concrete.

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