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Comparative Study on Green & Coventional Concrete (An Experimental Study)

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***Abstract*— Green concrete is a new form to the existing (regular) types of concrete which resembles the conventional concrete but its manufacturing or usage of this concrete requires minimum amount of heat energy and causes the lowest harm to the surrounding environment. Since it deals into uses of the recycled aggregates and materials, it also reduces the extra load in landfills and mitigates the wastage of aggregates. Thus, the net CO2 emissions are reduced. The reuse of materials also contributes intensively to economy. Green concrete can be considered elemental to sustainable development since it is eco-friendly in nature. One of the methods for manufacturing of green concrete involves reduction of amount of cement in the mix, which add to the reduction the total cement consumption. The use of waste materials also solves the problem of disposing the excessive amount of industrial wastes. This paper discusses the importance of Green Concrete in the present day context and highlights its merits over conventional concrete which otherwise posing a serious threat to the environment through global warming.**

I. INTRODUCTION

Green concrete name easily gives a illusion of something related to the colour of the substance or the product. But this logic is nowhere in picture as the product has no resemblance to the green colour.

Normally in the production of cement there is emission of carbon-di-oxide. The cement industry is also in question to lower its co2 emission as to rising global concerns.

The connection between the cement industry and concrete industry is very evident as the latter cannot be produced with the former. So, Green concrete can also be an answer to those concerns.

As this world is developing so fast it is next to impossible to replace concrete industry , it is evident from the fact that it is one among the largest industries providing economy , capital and employment.

The only way-out is to find an alternative which can bring a balance between the development and the environmental concerns. That is why green concrete is catching eyeballs of various analyst worldwide. “Denmark” being the first among them.

Checking the the possible ways to get green concrete in work will certainly boost the development process without hampering the current growth rate.

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The by products will also get value as they will be ultimately used in the green concrete making process. As green concrete presents various ways for its production that there are many entities of zero or low value which can be used.

Dismantled concrete

Flyash

Use of wasted wooden chunks from fitting works as aggregate mixture. etc

Green concrete is also comparably cheap to manufacture, as, for example, waste products are used as a partial substitute for cement portion, costing for the disposal of waste are avoided, energy consumption of materials in manufacturing period is lower, while durability is greater. Green concrete is a new form to the existing (regular) types of concrete which resembles the conventional concrete but itsmanufacturing or usage of this concrete requires minimum amount of heat energy and causes the minimal destruction or damage to the surrounding environment

EXPERIMENTAL STUDY – M25

STRENGTH ANALYSIS

CONVENTIONAL CONCRETE M25

Cement + Aggregates (Fine + Coarse) + Water

GREEN CONCRETE MIX M25

I. Cement 50% replaced by Fly Ash

II. Aggregates

Portion of Fine Aggregates is remain in same quantity as Conventional Concrete Proportion.

Portion of Coarse Aggregates is remain in same quantity as Conventional Concrete Proportion.

III. Water

Same Quantity of water to be used as per the mix of conventional concrete. (Water/Cement Ratio Taken: 0.5)

II. MIX DESIGN FOR M25

Calculation of quantities of

A. Cement
B. Sand
C. Aggregate for 1m3 concrete

As per IS 456:2000

M25 =1:1:2

Adding to get total volume = 1+1+2=4

Considering factor of safety to counter shrinkage= 1.54 to 1.57 adopted 1.57
So, for the mix design
Total Volume of Concrete 1.57m3

Calculation Of Volume Of Cement

Vol. of Cement = Cement X 1.57
C+S+Agg

= 1 . X 1.57
1+1+2

= 0.3925

1m3of Cement = 1440 kgs

0.393m3 =1440x0.393

= 565.92 Kgs

For 1m3 Cement = 565.92 kg of Cement is required

No. of Bags = 565.92 / 50 = 11.31
=12 Bags (Rounded to Higher Value)

Calculation Of Volume Of Sand
Vol of Sand = Sand X 1.57
C+S+Agg

= 1 . X 1.57
1+1+2

= 0.393m3

1m3 of sand = 1600-1800 kgs (assuming 1600 kgs)

0.393m3 of sand = 1600 x 0.393

= 628.8kgs. fo 1m3 Concrete

or, 629kgs

Calculation Of Volume Of Coarse Aggregates
Quantity of Agg =Agg. X 1.57
C+S+Agg

= 1 .X 1.57
1+1+2

= 0.785m3

Now,
1m3 ofAgg. = 1500- 1800 kgs (assuming 1560 kgs)
= 0.785 or = 1560 X 0.785

= 1224.6 kgs

20mm aggregate size = 1224.6 kg

Water Requirements
Cement Requirement = 12 bags = 600 kg

W/C Ratio = 0.5
water required = 600 X 0.5

= 300kgs

or, 300 Liters

Table 1(Required Quantities of Materials for 1m3of Concrete)

Material	Quantity
Cement	12 Bags or 0.416 m3
Sand	0.393m3
Aggregates	0.785m3
Water	300 Liters

III. EXPERIMENT AND RESULT COMPARISIONS

Result comparision for Compressive Strength Test (Cube Test) in between Conventional Concrete and Green Concrete. The Strenght has been observed in 7 days and 28 days respectively

Table 2(Cube Test Comparision b/w Conventional Concrete and Green Concrete-50% Replacement)

	7days Strength	28days Strength
Conventional Concrete		
Sample 1	22.454	27.923
Sample 2	22.001	29.767
Sample 3	21.105	28.963
Avg Strength	21.853	28.884
Green Concrete(50%flyash in place of cement)		
Sample 1	20.321	23.814
Sample 2	18.159	22.835
Sample 3	18.180	24.504
Avg Strength	18.887	23.730

Replacement of 25% Cement With Fly Ash

Table 3(Conventional Concrete and Green Concrete-25% Replacement)

	7 days Strength	28days Strength
Conventional Concrete		
Sample 1	21.856	26.987
Sample 2	21.921	29.172
Sample 3	22.211	29.438
Avg Strength	21.996	28.532
Green Concrete (25%flyash)		
Sample 1	19.567	24.213
Sample 2	20.005	24.462
Sample 3	19.792	24.118
Avg Strength	19.788	24.264

IV. COST ANALYSIS FOR 1M3 CONVENTIONAL CONRETE

Now performing the cost analysis for 1m3 Conventional Concrete.

Materials

1 Cement :- 12 Bags
Cost= Rs 258.70/ Bag
= 12x 258.70
= Rs 3104.40

2 Sand= 0.393m3
Cost= Rs 150.80/m3 (KoilwarQuary)
= 0.393x 150.80
= Rs 59.26

3 Aggregates (20mm Nominal Size) = 0.785m3

Cost = Rs 550.85/m3
= .785x550.85
= Rs 432.42

4 Water Quantity = 300Lit.
Rat= Rs 40 Per K.L.
= 40x 300 =Rs 12
1000

Machinery

Concrete Mixer (1cum)
Output of Machine = Cum/Hour = 7.5/hour
Required Output= 1cum.
Rate = 247/h
= (1/7.5) x 247 = Rs 32.94
= Rs 33.00

Total Cost Of Conventional Concrete /m3
CEMENT = Rs 3104.40
SAND = Rs 59.26
AGGREGATES =Rs 432.42
WATER =Rs 12
CONCRETE MIXER = Rs 33
TOTAL COST = Rs3641.08/m3

Replacing the cement portion by fly ash in propoetions of 5%, 10%, 15%, 20%, 25%, 30%, 40% & 50% to see the cost comparision.

Table 4(Cost Comparision among Green Concrete with percentange wise replacement)

Concrete type	Cost per cum
Conventional Concrete	Rs 3641.08/m3
Green Concrete (5% Replacement)	Rs3522.30/m3
Green Concrete (10% Replacement)	Rs 3403.36/m3
Green Concrete (15% Replacement)	Rs3284.86/m3
Green Concrete (20% Replacement)	Rs3164.22/m3
Green Concrete (25% Replacement)	Rs3047.14/m3
Green Concrete (30% Replacement)	Rs2930.8/m3
Green Concrete (40% Replacement)	Rs2690.92/m3
Green Concrete (50% Replacement)	Rs2449.6/m3

CONCLUSION

As per the conducted cube test results of both conventional concrete and green concrete we can conclude in terms of compressive strength mixing of fly ash content up to 25% in place of cement results in minute reduction of compressive strength.

Such minute reduction can be seen as a positive sign as these mix of green concrete can easily be used in making of temporary structures, low traffic roads etc.

Even the cost analysis suggests that the reduction of cost is quite effective and if the quality control is monitored properly

the results can easily be in good terms with engineering's main motto – efficient quality with cost efficiency

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