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Experimental Study on Effect on Compressive Strength of Interlocking Tiles upon Replacing Cement and Aggregate by Bagasse ash, Lime and Demolished Concrete

Satyendra Kumar, Vipin Kannaujiya[2]

[1]PG Student, Civil Engineering, ITM Lucknow, Uttar Pradesh, India
[2]Assistant professor, Department of Civil Engineering, SRMCEM Lucknow, Uttar Pradesh, India

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Abstract - *Construction is the major part of everyday life. It requires all the construction material which mainly include cement and sand. Cement provides the basic strength to the building. The manufacturing of cement is a major issue as it involves pollution on a large level as well as cost of construction also increases. If some of raw material having similar composition can be replaced by weight of cement in concrete then cost could be reduced without affecting its quality. For this reason sugarcane bagasse ash (SCBA) is one of the main byproduct can be used as mineral admixture due to its high content in silica (SiO2).A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement.*

The project focuses on the reuse of industrial wastes as a part of building material to provide economical and strong interlocking tiles. Recent researches have shown that bagasse ash, the waste produced from sugarcane industry is rich in cementous property. Use of it as a partial replacement of cement saves the cost of cement. Demolished concrete will be used in place of aggregates to provide economical replacement of aggregates.

Through various study results it was obtained that replacement of cement only by Bagasse ash led to a decrement in strength, therefore we are adding lime in it. The proportions were checked through hit and trial and content of Bagasse ash varied from 20% to 50% and best strength was obtained at 30% cement and 70% material being Bagasse ash.

***Key Words*: Sugarcane Bagasse ash (SCBA), concrete, Ecofriendly environment**

1. INTRODUCTION

Ordinary Portland cement is the most extensively used construction material in the world. Since the early 1980's, there has been an enormous demand for the mineral admixture and in future this demand is expected to increase even more. Also in this modern age every structure has its own intended purpose and hence to meet this purpose modification in traditional cement concrete has become essential. This situation has led to the extensive research on concrete resulting in mineral admixture to be partly used as cement replacement to increase workability in most structural application.

As the population of the nation is increasing, the industrialization and pollution level is also increasing. Therefore it is our foremost duty to reduce the pollution and make the planet healthy for living.

Air pollution is not only caused due to release of toxic gases from the factories but also due to minute particulate materials (fly ash) which are produced because of burning of coal and other materials. The production of sugar and jaggries released huge amount of bagasse ash. In India there are about 443 operating sugar mills where after extracting juice from sugar cane the remained part (bagasse) is further used as fuel to heat the boilers. The incineration of bagasse produces the ash. Bagasse has a various use in market as such in production of woods, animal foods and thermal expansion etc. then also a lot of bagasse remains unused and they get dumped as landfill. With the advancement in the technology new methods have been adopted to reduce the consumption of cement. One such method is addition of bagasse ash to concrete. Sugarcane ash is an industrial waste product which contains aluminium ion and silica, which is pozzolanic in nature. In Bagasse there is 50% cellulose, 25%of hemicellulose and 25% of lignin. It has been observed that approximately 26% of bagasse and 0.62% of residual ash are produced from 1 ton of sugarcane. Use of ash in concrete reduces the cement requirement and also reduces the cost of construction. Researchers also suggest that the bagasse fly ash can be successfully used in producing bricks, tiles, stabilizing the soil etc.

2. IMPORTANCE OF PROJECT

In this project the experimental investigation is done on the effect on compressive strength by the use of bagasse ash, lime and demolished concrete. The project aim is to partially replace OPC by SCBA and marble dust and coarse aggregate by demolished concrete in the manufacture of interlocking tiles and compare its results with the normal interlocking tiles. The use of SCBA, Marble dust and demolished concrete reduces the cost of interlocking to a considerable extent as the cost of bagasse ash, lime and demolished concrete is almost negligible. In the production of cement the limestone and clay is heated to a high temperature of 1500 ˚C in a kiln

then these material fused and form clinker which further crushed to form cement. Thus this process is very costly and emit large amount of carbon dioxide to the environment. Thus, use of SCBA in place of cement reduces the consumption of cement, which consequently reduces the problem of generation of Carbon Dioxide. The project also aims to reduce the problem of disposal of bagasse ash, lime and demolished concrete. As bagasse ash is very light in weight hence is easily dispersed in air and its inhalation causes health issues. Hence the project is advantageous economically as well as environmentally eco-friendly

3. MATERIALS

3.1: Cement

In this research work cement used is Ordinary Portland cement (OPC Grade 53).

Table-1

S.No	Name of experiment	Normal Range	Obtained Value(Avg.)
1	Consistency of cement	26 to 33 %	38%
2	Fineness of cement	Should not exceed 10%	5%
3	Initial setting time	30 min	27 min
4	Final setting time	600 min	635 min

3.2. Sugarcane Bagasse ash

It is a waste material. It can be easily available in sugarcane industry (Sugar mills). The combination of silica, alumina and iron oxide is more than 70% in Sugarcane bagasse ash(SCBA).The mix design of concrete with bagasse ash is prepared according to strength required as per IS: 10262-1981 and IS : 456-2009.

Table-2

Test	Sample1	Sample 2	Sample 3	Avg. Value
Fineness	7.83	7.99	6.43	7.42
Consistency	40	50	45	45

3.3. Lime

Lime is a calcium containing inorganic mineral composed primarily of oxides and hydroxides. These materials are still used in large quantities as building and engineering materials as chemical feedstock's and for sugar refining among other uses. Lime has Cementing capability. It has higher acid resistance due to its alkaline nature. It has property of sealing of micro cracks.

3.4. Demolished concrete

When a structure demolishes due to any disaster like earthquake, flood etc. or a structure completes its life span and we demolish it ourselves, then the demolished concrete is re-cycled for its re-use. The re-cycling and re-use of demolished concrete seems feasible solution in rehabilitation and new constructions after the natural disaster or demolition of old structures.

Table- 3

S.No.	Name of Experiment	Normal Range	Obtained Value
1	Crushing Value Test	30-45%	32.93%
2	Impact Value Test	30-45%	23.52%
3	Abrasion Test	30-50%	32.2%
4	Water Absorption Test	0.1-2%	3.25%
5	Specific Gravity Test	-	2.88

4. EXPERIMENTAL PROCEDURE

4.1. Mixing

We have prepared interlocking tiles of various compositions by varying the proportions of bagasse ash and lime while keeping the proportions of cement, demolished concrete and Murom constant. For making concrete, hit and trail method is done changing the percentage of bagasse ash and lime . After weighing all the materials, they are mixed in the laboratory. All the materials are first mixed in dry state then water is mixed in the material to make a paste of concrete. It is thoroughly mixed so that all the materials are mixed perfectly. The following compositions are casted using rubber mould of capacity 3kg and vibrating table. For the surface finish a paste of white cement and colour is prepared and is poured on the mould before placing the mix on it. This helps the casted sample to be easily taken off from the mould and also gives aesthetic appearance.

4.2. Casting

After forming mixture, it should be poured into the mould. At the time of pouring of concrete sufficient vibration should be provided for the proper settlement of the concrete using tampering rod. By providing the vibration we can reduce the voids which are generated in the concrete pouring.

4.3. Curing

After the casting of all specimen then we demould the specimen after 24 hours of casting and then after specimens are cured under water for 7, 14 and 28 days.

4.4. Testing

Sample from fresh concrete shall be taken as per Indian standard code IS 2911 and sample shall be made, cured and tested at specified number of 7,14 and 28 days in accordance with IS 516. The strength parameters are based to 28 days' strength. Test at other age shall be performed, if specified.

For compressive strength test interlocking tiles of size 270mm×100mm×50mm were made. Test was done on the hydraulic testing machine. Compressive strength is defined as resistance of concrete to axial loading. Cubes are placed in the machine and after tightening its wheel start button is pressed as pressure is begin to apply. Reading of meter is note down when cracks are there on cubes.

5. CONCLUSIONS

1. The strength of the interlocking attained was 72.28 percent of the standard specimen with using only 30 percent of the cement used in standard specimen.

2. The cost of best interlocking was Rs. 4.6095 as compared to standard specimen which costs approximately Rs.8.39.

3. Hence the cost of interlocking is almost halved and the strength attained is72.28 percent of standard specimen.

4. Reduction in cement consumption ultimately results in reduced pollution.

5. Problem of disposal of bagasse ash solved to a great extent.

6. Sugarcane bagasse ash and demolished concrete both are waste material so it also reduce the cost of interlocking tiles by using these in the mix.

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