THREE-BLOCK MASONRY PROPERTIES RESEARCH

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Abstract

Bricks are used to build walls, pavements, and other masonry building features. Since it was first used to build the Great Pyramid of Giza around 2500 BC, brick is one of the earliest building materials. The size, substance, and manufacturing technique were all varied throughout the years, resulting in thousands of different kinds of bricks. As part of our research, we've created an interlocking pattern that turns rectangular bricks into triangles. Any light weight concrete material [AAC, CLC] may be utilized in the triangle framework. Instead of using fine aggregate and coarse aggregate, we've created a new lightweight concrete mix that incorporates photocatalyst and a particular quantity of cement. As an innovative eco-friendly low weight block, the triangular blocks give an attractive look and also eliminate dead load with outstanding self-cleaning function.

Keywords—Interlocking triangular M-sand that is self-cleaning and light in weight.

INTRODUCTION

In our nation, red brick is the most common building material, but the manufacture of it generates a significant amount of carbon dioxide. Although the need for bricks cannot be ignored, this led to the development of new bricks. The block's form and appearance haven't changed despite the proliferation of different kinds of bricks. The TRIBLOCK is a Triangular-shaped product that is designed to meet the needs and specifications stated above, and it is referred to as such because of its form. When it comes to the origins of the term "interlocking," it refers to a method used to firmly join two or more items or substances. Mortarless technology and interlocking bricks will continue to be used in the same way. The ancient Romans were the first to employ interlocking bricks for pavement in road building in the prehistoric era, replacing stones with bricks later on. The massive Brihadeeswarar temple in Tamilnadu, India, is a clear example of interlocking work, despite the fact that bricks were not employed in its construction. Interlocking bricks were manufactured in industry for the benefit of youngsters in the 19th century in order to help them develop their fine motor abilities. Students' enthusiasm for engineering and building was piqued as a result of the bricks' primary function: improving their inventiveness. Interlocking blocks of stabilized soil, burned clay, or some other substance were then produced and dispersed throughout a broader area of the earth as a result of this. The use of interlocking bricks in mortarless brick building is on the rise. In a stretcher bond, concrete interlocking blocks are set dry or with little mortar slurry to create a wall using a mortarless interlocking masonry technique. Blocks are employed in a mortarless masonry technique to connect and to ensure that the structure is level and aligned. They might be utilized to create sturdy, long-lasting, and cost-effective structures. Even in these interlocking kinds of blocks, thin mortar of the prescribed type may be used in accordance with IS 4326:1993 3 (Indian Standard for Earthquake Resistant Design and Construction of Building - Code of Practice). Many organic contaminants disintegrate at a slow pace due to sunlight's UV radiation, which is a natural process. NOX, SOX, and COX are only few of the organic pollutants that are often found in buildings and other concrete structures. Most of the smoke and sulfur dioxide (SO_2), a significant component of air pollution, that makes up smog is emitted by motor vehicles. It is these pollutants, such as NO_x, SO_x, and COX, that make a building filthy and impair the air quality. In order to minimize pollution, the only way to reduce smog is to limit the number of cars on the road, yet the use of automobiles cannot be disrupted. The discovery of photocatalytic materials to counteract these effects led to the development of such compounds as TiO_2, ZnO and others. Concrete is coated with photocatalystic chemicals, which subsequently react with pollution-causing elements and minimize their impact, releasing oxygen and carbon dioxide as a byproduct.

MATERIALS AND METHODS

Ordinary Portland cement of 53 grade, with a specific gravity of 3.15, has an initial setting time of 52 minutes and a total setting time of 600 minutes for the idea. Material passing through an IS 4.75mm sieve with a specific gravity of 2.5 and (M Sand) is manufactured. Because it is an unwanted byproduct of the iron and steel industry, iron slag was sieved using an IS 20mm sieve and then weighed at 1350 kg/m3 to get its specific gravity of 2.0. Classic super flow superplasticizer is employed in our project to provide both workability and strength. As a result, titanium dioxide, a photocatalytic material, is employed to provide self-cleaning effects. There are two methods of doing research: Initial designs for brick patterns and molds for the bricks are prepared, then construction begins. Concrete grades M30 and M10 are utilized when trial and error procedures have produced excellent mold conditions. After 7 and 28 days, the samples is tested.

CONCEPT DEVELOPMENT AND SPECIMEN CAST

The picture below illustrates the design's interconnecting principle. A Triangular brick with sides enabling lateral interlocking has been exhibited. Intrusion and extrusion ends form an interlocking end. It is built in a way that reduces building time. The wall's stability and strength are enhanced by this Interlocking end. Its three sides are all 1' (feet) in length. End Blocks are created because the wall finishes at the end. Quadrilateral is the form of this Block. Interlocking End Blocks come in two flavors: intrusion- and extrusion-end varieties. An extrusion and an intrusion were both 2.5" long (inches).

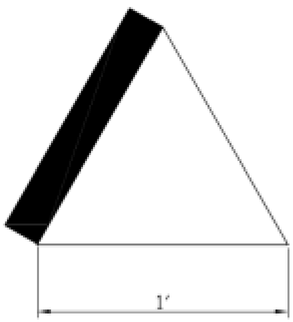


Fig. 1 Interlocking bricks (Main block)

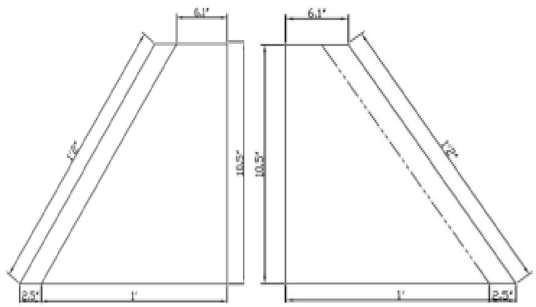


Fig. 2 Interlocking bricks (End blocks with intrusion and extrusion end

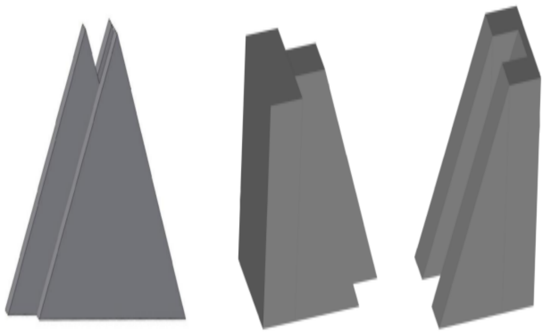


Fig .3 Interlocking Brick (3D design)

A wooden mould is composed of lumber with screw and bolt configurations based on the interlocking pattern shown in this article. On the basis of trial and error, the mold is next put to the test using various materials. A. First Trial Testing Clay Soil for Brick Moulds: This is done via a trial-and-error technique using common local clay to make the block. It takes two hours to dry the clay soil. The mixture is then diluted with the required amount of water to get the desired consistency. Formwork is placed in a screw pattern. Placement of the soaked clay sample into the formwork is completed. Afterwards, it's allowed to air dry for 4 days. About four days are spent drying the clay block in the sunshine. Demoulding is accomplished carefully by removing the screw arrangements four days after the mold has been set. When demoulding begins, tiny fractures appear on the surface, which progresses to a large crack at the extrusion point. The only form left after the last demoulding step is an equilateral triangle. These two ends of the clay brick are where the fracture is visible. In spite of the formwork's excellent size, quality, and shape there seems like a failure in this try because of the substance (clay).

Fig. 4 Image displaying damaged trial made of clay

B. Trial 2:

No errors were identified in the block's form or size, however there was a slight inaccuracy in the extrusion process, which is highlighted by the red spot.

Fig.5 Image displaying small error at extrusion part with red spot.

C. Trial 3

Finally, we've achieved a form that is almost identical to what we had projected; as a result, concrete is a superior material for furthering the concept and incorporating it throughout the demoulding process.

V. CASTING OF SPECIMEN

An interlocking block and sample specimen cubes are made from M10 and M30 concrete grades. The block's Compressive Strength is evaluated after curing for 7 and 28 days. The specimen 53 grade of Ordinary Portland Cement is mixed with the specified quantity of M-Sand, iron slag, and titanium dioxide (TiO2) (OPC). Superplazticier, a new additive, makes it easier to complete tasks.

Batching and Mixing

At first the raw materials such as slag, m-sand, cement, TiO2 water with super plasticizer is batched and taken of specified below given quantity, at next stage the TiO2 which is to be replaced with cement is added to cement and mixed thoroughly. At third stage the coarse aggregate is mixed well with trowel and next the cementetious material is added again mixed thoroughly and then water mixed with suitable admixture is added to it.

Table I Mix Proportioning for M10

SL.NO	MATERIALS	QUANTITY
1	Cement	276.4kg/m 3
2	Water	152kg/m 3
3	Fine aggregate	739.05 kg/m 3
4	Coarse aggregate	924.76 kg/m 3
5	Chemical admixture	2.76 kg/m 3
6	Water-cement ratio	0.55

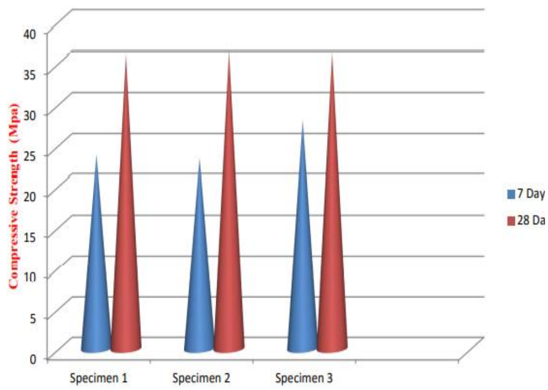
Table II Mix Proportioning for M30

SL.NO	MATERIALS	QUANTITY
1	Cement	369.67 kg/m 3
2	Water	152 kg/m 3
3	Fine aggregate	659.7 kg/m 3
4	Coarse aggregate	938.24 kg/m 3
5	Chemical admixture	2.76 kg/m 3
6	Water-cement ratio	0.40

Table IV Compressive Strength for M10 Mix: At 28 Days in (Mpa)

SPECIMENS	Density(kg/m$^{3)}$	Compressive strength of cube at 28 days in(M
Specimen 1	2115.5	36.11
Specimen 2	2145.7	36.52
Specimen 3	2120.1	36.31
Average	2127.1 kg/m ^{3}	36.31 Mpa

Compressive Strength of cube for M10 Mix



First, the raw materials such as slag, m-sand, cement, and TiO2 water with super plasticizer are batched and taken in the stated amount below. Next, the TiO2 that will be replaced by cement is added to cement and completely mixed together. In the third step, the coarse aggregate is fully mixed using trowel, then the cementitious material is added and properly mixed, and finally water combined with the appropriate admixture is applied.

Fig. 13 Testing of END BLOCK [intrusion] in UTM

Rhodamine B Dye Decolourization Test

Fig. 14 Freshly Rhodamine B Dye applied specimen

Fig. 15 Rhodamine B dye applied surface at 6 hrs.

Fig. 16 Decolorized surface at 12 hrs

Water Absorption Test

The proportion of water absorbed by a specimen is known as water absorption. In order to conduct a water absorption test, we cast six 100mm cubes and dried them in an oven at 1100C for almost two hours.

Fig.17 Specimen kept in Oven for water absorption

Finally, the surface of the cube is gently cleaned and the weight is recorded as w2 and the water absorption value is shown below for both the M10 and M30 models.

	Sample 1	Sample 2	Sample 3
Dry weight W1	2092	1941	2053
Wet weight W2	2155	1991	2112
Water absorption	3.01%	2.57%	2.87%

Average value = 2.81%

Table X Water Adsorption Test for M30 Mix

	Sample 1	Sample 2	Sampasele 3
Dry weight W1	1973	1969	2011
Wet weight W2	2045	2037	2062
Water absorption	3.64%	3.45%	2.53%

Average value = 3.2%

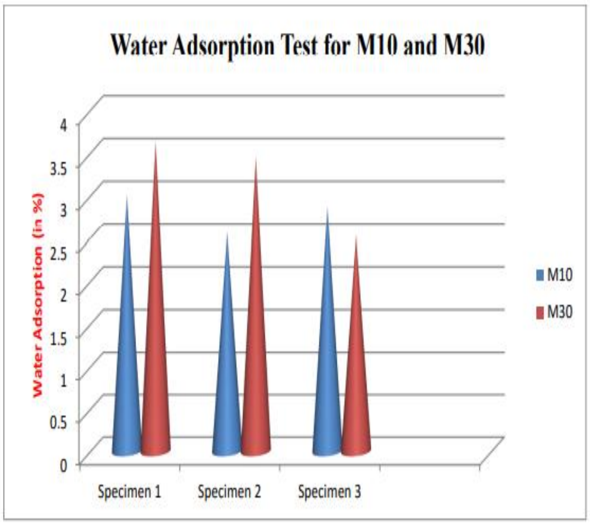


Fig. 17 Water Adsorption Test for M10 and M30 mix

VII. CONCLUSIONS

From our experiments, we may take the following conclusion:Iron slag reduces water content, which is countered by the use of a super plasticizer in the formulation.The decolorization impact of 1 percent TiO2 rapidly rises with time when it is added to the solution. As a result, it may be concluded that adding 1% TiO2 to a wall will cause it to self-clean. This feature contributes to the improvement of the environment.The average compressive strength of cubes of M30 grade at 7 days and 28 days is found to be 30.7 Mpa and 44.77 Mpa, respectively, while M10 grade it is found to be 25 Mpa and 36.31 Mpa, respectively. It is also discovered to be 23.73 and 73.93 for the Block, which is built of M10 grade material. As a result, because of the block's form, it has a higher compressive strength than the cube, allowing the newly constructed structure to sustain greater loads.

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