Experimental Investigation on Interlocking Concrete Blocks

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Abstract- *since, now a day a large amount of non-renewable resources is continuously used by the construction field, we made a study to find a better replacement for such resources without any compromise in the workability and durability of the outcome. The purpose of this project is the partial replacement of cement with waste tiles powder and complete replacement of coarse aggregates with tile pieces in interlocking wall blocks separately and check out for the changes in the strength of the blocks. The tile wastes are collected from various sources and are grinded to get powder and pieces. They are then used as the replacement in the interlocking blocks and the blocks were prepared using machineries. The blocks are then allowed for curing in water and they are then checked for their stability and durability by comparison with conventional blocks. Since, the composition of cement and tiles are slightly similar, we gone through the tile powder as a replacement. Since, tile waste are non decomposable and also not easier for disposal, they can be used in this manner.*

I. INTRODUCTION

The elimination of mortar layers between the courses of interlocking brick wall is the main characteristic of mortar less technology (MT) compared to conventional masonry. The mortar joint is replaced by physical locking features to enable the wall to withstand lateral and flexural loads Gazzola & Drysdale (1989), Marsha (1998), Drysdale & Gazzola (1991), Marzahn (1999), Shrive et al. (2003) and Jaafar et al. (2006).

A mortar layer that traditionally sparates brick courses performs a number of functions. Well-pointed mortar may add to a wall‘s aesthetic appeal – though the crudely smeared mortaring commonly found in villages of Least-Developed (African) Countries certainly does not. In _gluing‘ the bricks together, mortar increases resistance to localized forces, such as those that might punch an individual brick through a wall; however interlocking can also perform this particular function (Shrive et al. 2003). Mortar may help the wall to act as abeam spanning across soft spots in its foundation or across openings. It seals the wall against wind and noise penetration, whereas a mortar less wall has to be (internally) rendered to achieve this and other purposes.

WATER ABSORPTION TEST

Water Absorption Test is used to find out the water absorption ratio. Because the brick, which are absorbing more water cannot be used in water logging area or exterior walls which is open to sky. The bricks from all the proportion were tested. As per standard, the bricks should not absorb water more than 20% of its weight, but from the table results, bricks exceeded water absorption ratio more than 20%. In this, the mix that contains only paper and cement absorbs water more than its weight.

APPARATUS:

- Water bowl
- Sample brick
- Water

PROCEDURE:

Dry the specimen in a ventilated oven at a temperature of 105 °C to 115°C till it attains substantially constant mass. Cool the specimen to room temperature and obtain its weight (M1) specimen. Immerse completely dried specimen in clean water at a temperature of 27+2°C for 24 hours. Remove the specimen and wipe out any traces of water with damp cloth and weigh the specimen after it has been removed from water (M2).

Water ratio =M2−M1 M1x 100%

II. MATERIALS AND TESTS CEMENT

For the preparation of blocks, cement of 53 grade is used, which are tested as per IS procedure.

FINENESS TEST:

The fineness of cement has an important bearing on the rate of hydration and hence on the rate of gain of strength and also on the rate of evolution of heat. Finer cement offers a greater surface area for hydration and hence faster the development of strength. The fineness of grinding has over the

years. But now it has got nearly stabilized. Different cements are ground to different fineness. The particle size fraction below 3 microns has been found increased to have the predominant effect on the strength at one day while 3-25 micron fraction has a major influence on the 28 days strength.

APPARATUS:

- Test Sieve 90 microns
- Balance
- Gauging Trowel
- Brush

PROCEDURE:

1. Break down any air lumps in the cement suing fingers.
2. Weight accurately 100g of cement and place it on a standard 90micron I.S.seive.
3. Continuously sieve the sample for 15minutes.
4. Weigh the residue left after 15 minutes of sieving.
5. The percentage of sample residue is determined by % of residue =(weight of sample retained on sieve / Total weight Of sample) x 100%

Calculation:

Total weight of sample taken = 100g

Weight of sample retained in the sieve = 2.4 g

% of residue =(weight of sample retained on sieve / Total weight Of sample) x 100%

$$\% \text{ of residue} = \frac{2.4}{100} \times 100\%$$

$$\% \text{ of residue} = 2.4\%$$

LIMITS:

The percentage of residue should not exceed 10%.

RESULT:

The fineness value of cement is 2.4 % (i.e. 2g of cement retained).

PRODUCTION OF BRICKS/BLOCKS

The process starts with collection of materials and testing, followed by preparation, mixing and molding (by hand, machine pressing or ramming between shutters). Finally, curing is needed for all elements containing cement. In this competitive world, the production process is the most important part of the building materials industry. It assures standardized quality and adequate quantity of materials to fulfill the needs of the market. In this thesis, we shall look at the production of Interlocking Bricks (IB).

SELECTION OF SUITABLE MATERIALS

Low-quality materials usage will lead to the improper results causing damages in walls like cracks, holes, disjoints etc., Hence materials used for construction should be of best quality and should be tested for their capability and durability.

Cement used for the manufacturing of bricks is of grade 53 OPC cement and of fineness 90 microns. The quality of cement should be better and of appropriate proportion since it is the major deciding factor of the strength of the block. In case of coarse aggregate, to limit the size of gravel and remove other large particles, chipsets passing through 10mm and retained in 4.75mm sieve are taken. M-sand is the fine aggregate that we are using for the block preparation. Since, demand for the sand now a days is high and also they are not much cost effective, m-sand is used.

Flash is the material which is used because of its binding property. Flash powder used is very fine and of powder form. It is added in a proportion equal to that of cement.

TEST ON BLOCKS COMPRESSIVE STRENGTH TEST

Aim To determine the compressive strength of block specimen prepared and to verify the strength requirements as desired and stipulated.

APPARATUS

Compression testing machine

MIXING

1. the cement, fly ash and fine aggregate was mixed on a water tight non- absorbent platform until the mixture is thoroughly blended and is of uniform color.
2. They are mixed on a clean surface free of dust and moisture.
3. The coarse aggregate is added to the mix with cement and fine aggregate is uniform distributed throughout the batch.
4. The water is added to the mix until the mixture appears to be homogenous.

CURING

The test specimen are stored in moist air for 24 hours and after this period the specimen are marked and kept submerged in clear fresh water until taken out prior to test.

The curing is done under controlled conditions free from moisture and is kept separately preventing them from sliding on each other.

PRECAUTION

The water for curing should be tested every 7 & 14 days and the temperature of water must be at 27°+2°C

PROCEDURE

1. The specimen from the water is removed after specified curing time and wipe out excess water from the surface.
2. The bearing surface of the specimen is cleaned.
3. The specimen is placed in the machine in such a manner that the load shall be applied to the opposite sides of cube casted.
4. The specimen is aligned centrally on the base plate of the machine.
5. This is applied on the specimen gradually without t shock and continuously at the rate of140kg/cm²/minute till the specimen fails.
6. The maximum load carried by the specimen is noted.

OBSERVATIONS:

0% tile powder & 100% cement
W/c ratio = 0.25
Date of casting = 26/02/2017
Date of testing = 05/03/2017
Days of curing = 7
Weight of cube = 7.45 Kg
Ultimate load = 150kN
Ultimate strength= Ultimate load/Surface area of application of load

= (150 x 1000) / (225 x 105)
= (150000) / (23625)
= 6.34 N/mm²

Result

Ultimate strength of block = 6.34 N/mm².

III. CONCLUSION

Thus, the above tests shows that the strength of the interlocking blocks has been increasing when the cement is replaced with tile powder and chipsets are replaced with tile pieces separately in the blocks. The increase in strength of the block shows the capability of using those blocks replaced with tile components in the field. For the case of curing period of 7 days, the strength extends to a maximum level and is more probably suits for construction. Thus, interlocking blocks which is cured for only 7 days is preferred for the usage. However, blocks undergone curing for a period of 14 days shows a negative deviation in strength comparing with 7 days cured blocks. This may be due to the fact that only a small portion is comprised of cement. Also, the blocks with replacement of chipsets by tile pieces shows more performance than tile powder with cement. So, we conclude that interlocking blocks replaced with waste tile component shows an increased performance on 7 days curing.

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