International Journal for Development of Science and Technology (IJDST)

Vol. 1, Issue 1, June 2017, PP. 1-4

www.ijdst.com

ISSN: 2456-8503

A STUDY ON ATTRIBUTES OF HARDEND CONCRETE BRICKS USING EXPANDED POLYSTYRENE BEADS

Mr. K.C. Sunny, Research Scholar in Civil Engineering, Bharath Unviersity, Chennai, India.

Dr. Chokkalingam, Professor (Emeritus), Dept. of Civil Engineering Bharath University, Chennai, India.

Abstract

Polystyrene blend cement is a light-weight and low quality materials which can be utilized for development. This venture shows the aftereffects of a test examination of the properties of solidified solid blocks containing expanded Polystyrene dots. The dots are being utilized as a piece of sand substitution inside the blends. An entire of two hundred examples of blocks with the quality size of 215mm x 102.5mm x 65mm was set up amid this review. Among the properties contemplated was compressive quality, water ingestion, drying shrinkage and wet development of the Polystyrene solid blocks. It had been observed that Polystyrene cement is to a great degree helpless against isolation and has low compressive quality. The properties of the blocks are essentially impacted by the substance of Polystyrene dots inside the breaking point. The outcomes show that Polystyrene solid consolidate with beyond any doubt segment of the globules could offer as a fitting diverse material inside the business.

Keywords: *Hardened concrete brick expanded polystyrene (eps) beads lightweight concrete eps concrete compressive strength water absorption density reduction thermal insulation waste recycling sustainable building materials mechanical properties mix design replacement of coarse aggregate eco-friendly construction.*

Introduction

Concrete technology is growing and plenty of advances and innovations are made to deal with challenges of the many construction aspects. Several productions of light-weight concrete had been designed and prominent among them are the use of light-weight aggregates and artificial aggregates such as fly ash and scum/slag. This project aims at study on producing lightweight concrete bricks by using the expandable polystyrene. Polystyrene is chosen due to its lightweight properties, with good energy absorbing characteristic and good thermal insulator leading mainly to non-structural applications.

Polystyrene is created by radical vinyl polymerization, from the compound phenyl ethylene. Expandable Polystyrene (EPS) in the meantime is Polystyrene in raw beads being steam-heated, inflicting it to expand. Polystyrene has been used mainly in cold countries to form concrete blocks for residential functions.

Polystyrene blend cement is one among a few light-weight, low quality materials with sensible vitality riveting attributes. It's prestigious for its sensible warm and acoustic protection properties driving in the primary to non-basic applications and also shaped rooftop and divider boards and light-weight infill pieces.

It's conjointly been pondered to be utilized as a center material as a part of sandwich boards, shafts, and pieces [7], as a sub-base material for street asphalts and conjointly in skimming marine structures. In Japan, it's been utilized in the advancement of sea overnight boardinghouses wall. A review led by [8] on joining subtle elements and material conduct of Polystyrene blend concrete confirmed that quality and thickness territory unit controlled by factor consolidate extents [9]. Agreeing their review on the properties of solidified cement containing Polystyrene dabs. Their outcomes demonstrated that the quality, solidness and synthetic resistance of Polystyrene blend cement of a determined thickness territory unit stricken by the water to bond quantitative connection.

Another study by Bischoff [1] found that Polystyrene combination concrete is beneficial to soak up energy and to scale back contact loading hundreds throughout onerous impact at low velocities. Work was conjointly disbursed by the Cement and Concrete Association of latest island in 1991 that examined the strengths and a few drying shrinkages of recycled EPS concrete. The study highlighted difficulties in compaction and finishing of concrete with densities below 1000kg/m3.

Hamdan [3] amid a review reports that the work of Polystyrene globules as light-weight mixes indicates light-weight property that highlights the work of Polystyrene total cement in non-auxiliary applications.

3. Experimental works using EPS

3.1 Materials

The materials employed in this study were standard Portland cement, fine sand, cinnamene beads (2.36mm) and H2O.

3.2 Casting and combination

Five completely different specimens of concrete bricks were ready, labeled as P0, and P1 to P4. These specimens disagree from each other by the Polystyrene beads content in their mixes. As results of the beads are flare in weight and density, the mixes were ready by volume. The management combine, specimen P0 has proportion of 1:3:0 that stands for 1 half cement three components sand and zero half Polystyrene. Polystyrene was additional in proportions as a part of sand replacement. The specimen with most Polystyrene content is specimen P4 that consists of one half cement, one half sand and a couple of components Polystyrene. The water-cement quantitative relation is 0.4 for all specimens.

3.2.1 Methodology of casting

The beads have the tendency to float to the highest surface throughout combination and compaction, thus the dry sand and cement were initial additional along during a typical pan mixer before water was additional in. once decent combination, the Polystyrene beads were additional and totally mixed into the mortar. To attenuate segregation, vibration compaction was avoided and every one the mixes were compacted by hand tamping. The specimens were dry because the solidification methodology.

3.3 Laboratory tests

The tests enclosed during this project were the dimension, weight and density check, compressive strength at seven and twenty eight days age, inaudible pulse velocity, water absorption drying shrinkage and wet enlargement. All check procedures were done as a region of testing for brick standards, and for inaudible pulse velocity.

4. Results and analysis

4.1 Dimension

According testing methods for brick standards, the scale for every mixture of the concrete bricks were evaluated. By examination these results from every combine to the given customary, it's shown that the size of the mixes conformist to the quality. The main reason to the variations within the dimensions of every specimen is within the moulds that were employed in making ready the bricks. It looks that wood molds got to be modified as enlargement and contraction to wet and dry conditions of the blending method and therefore the close weather have an effect on moulds size. Bleeding is additionally suspected to contribute to the various sizes of the size of the specimens. Harm that occurred to the specimens might result from the presence of huge voids contributed by the beads within the specimens. This leads to the loss of water within the specimens.

4.2 Weight and density

Weight and density is that the 1st indicator whether or not the material is thought-about into the light-weight material class. Mix P2, P3 and P4 have density but the counseled density for light-weight concrete that is 1800 kg/m3. It's found that there's an instantaneous relationship between the polystyrene content and therefore the weight and density of the specimens. The light-weight property of polystyrene beads contributes to the low weight and rarity of the specimens.

4.3 Compressive strength

In this study, one week and four compressive strength tests were allotted. It had been determined that there's a relationship between the compressive strength and therefore the weight and density of the specimens.

Compressive strength check at one week and 4 weeks shows similar manner within the decrease in strength with regard to vinyl benzene contents. As Polystyrene beads contribute to low weight and denseness; it additionally contributes to the low strength of the specimens. Polystyrene beads don't contribute to the strength of the used material. The strength obtained within the mixes with Polystyrene beads is extremely low, owing to the beads' weakness in compression. This can be additionally as a result of Polystyrene beads don't react with chemicals with the combination to contribute strength. There's depletion in strength as Polystyrene content is exaggerated.

4.4 Ultrasonic pulse velocity test

Ultrasonic pulse velocity can be employed during the study as an estimation of specimens' strength and related as a graph. Concrete with light-weight mixture is probably going to grant a lower pulse rate at a given strength level. For each combine with completely different four week compressive strength, the link with regard to pulse velocity is found as $fc = 3.81e^{0.34V}$ with correlation of 0.92.

4.5 Water absorption

Experimental investigation on specimens' capability to soak up water was done with the 5-hour boiling technique. Specimen with additional polystyrene content shows larger absorption capability. The water absorbed within the bricks attributable to the water migrates outward into the capillary pores within the hardened cement paste. The absorption of water into the bricks isn't as a result of Polystyrene adsorbs water; in reality, Polystyrene encompasses a closed-cell structure that forbids absorption of water into it. However, the presence of Polystyrene that induces pores and voids to the bricks had increased the water migration within the bricks. Therefore, the absorption of water is higher for combine that has additional Polystyrene content.

4.6 Drying shrinkage and wet enlargement

Drying shrinkage and wet enlargement tests aim to make sure the capability of bricks once exposed to the new and weather of the atmosphere. Concrete loses wetness because it hardens, inflicting it to contract or shrink. Specimens with additional Polystyrene beads expertise additional proportion of shrinkage with 0.133% for specimen P4 and 0.058% for specimen P1. When quantity of cement is less, it results in less hydration and reaction between cement, sand and water. Excess water within the specimens with additional Polystyrene beads can expose to higher proportion of shrinkage. The content of Polystyrene beads additionally affects the wet enlargement proportion. It shows that specimen P4 had expertise highest wet enlargement of 0.163% and P1 with lowest proportion for 0.069%. Specimens with higher content of Polystyrene have additional voids and pores, attracting additional water to achieve into it.

5. Conclusion

The workability characteristics of the mixes are terribly completely different from the conventional concrete. Compaction by rodding or vibration wasn't effective attributable to the light-weight nature of the mixes. The mixes were cohesive that the cement suspension coating the beads was terribly effective in holding the combo along. Polystyrene concrete brick is extremely liable to segregation wherever putting and compacting will be quite tough utilizing vibrating compaction techniques. Polystyrene concrete bricks with densities less that 1800 kg/m3 have terribly low strength. Combine P2 with compressive strength of f14.0 N/mm^2 and density of 1646 kg/m^3 is that the most fitted combine to be used as a load bearing internal wall. Combine P3 and P4 could be used as a non-load bearing internal wall.

Properties of Polystyrene concrete bricks found through this study indicate its potential to be employed in the civil construction business.

References

1. P.H. Bischoff et al., 'Polystyrene Aggregate Concrete Subjected to Hard Impact', Proceedings-Institution of Civil Engineers, Part 2: Research and Theory, Vol. 89, 1990, pp. 225-239.
2. J.H. Bungey et al., Testing of Concrete in Structures, Chapman and Hall, UK, 1996
3. A Hamdan, Kajian Rekabentuk Campuran Konkrit menggunakan Styropor sebagai Agregat Ringan, Universiti Teknologi Malaysia, 2000
4. N Jackson et al., Civil Engineering Materials, Macmillan, UK, 1988
5. AM Neville, Properties of Concrete, Longman, UK, 1995
6. SG Park et al., 'Report Study-Polystyrene Aggregate Concrete', Building Research Association of New Zealand, 1999
7. GM Parton et al., 'Polystyrene Bead Concrete Properties and Mix Design', Magazine of Concrete Research, Vol. 43, No. 3, 1982, pp. 153-161
8. SH Perry et al., 'Mix Details and Material Behavior of Polystyrene Aggregate Concrete', Magazine of Concrete Research, Vol. 43, No. 154, 1991, pp. 71-76
9. Ravindrarajah et al., 'Properties of Hardened Concrete Containing Treated Expanded Polystyrene Beads', Cement and Concrete Composites, Vol. 16, No. 4, 1993, pp. 273-277
10. MA Riley, 'Mix Details and Material Behavior of Polystyrene Aggregate Concrete', Magazine of Concrete Research, Vol. 43, No. 155, 1991, pp. 87-92