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Study on Foamed Concrete

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Abstract: *Recently, foamed concrete widely used in civil construction and building, because of its high fluidity and settlement. Foamed concrete as a new type of lightweight according to its features and uses. It is similar to aerated concrete, lightweight concrete and porous concrete. The term foam concrete is containing no coarse aggregates only fine aggregate (sand), cement, water & stable foam to perform the concrete. This paper provides a review of foamed concrete constituents, fabrication techniques, and properties of foamed concrete, advantages, disadvantages and application. Conclusions: Use of the foaming agent in concrete mix that will reduce the self weight and generate growing density and absorption rate of concrete that is getting low.*
Keywords: *materials, manufacturing method, advantage, disadvantage and application.*

I. Introduction

The foamed concrete has a long history and it was first made into use in the year 1923. It was initially used as an insulating material. Improvements throughout the past 20 years in the areas of production equipment and better quality foam making agents make the use of foam concrete in large scale. Foamed concrete is defined as a light cellular concrete which can be classified as a lightweight concrete (density of 400–1850 kg/m3) with random air-voids created from the mixture of foam agents in mortar. Foamed concrete is recognized for its high flow ability, low cement content, low aggregate usage, and excellent thermal insulation .This type of concrete lighter than normal concrete due to the foam that been used. The main specialties of this concrete are its low density and thermal conductivity. In practice, foamed concrete has been commonly used in construction applications in different countries such as Germany, UK, Philippines, Turkey, and Thailand.

II. Materials of foamed concrete

Following are ingredients of foam concrete as explain below

2.1 Cement: Based on BS 12:1996, ordinary Portland cement is usually used as the main binder for foamed concrete. Portland cement is a hydraulic cement that when mixed in the proper proportions with water, will harden under water (as well as in air). The basic ingredient for Portland cement consists. Lime-rich materials, such as limestone, seashells, marl, and chalk that provided the calcareous components. Clay, shale, fly ash, or sand to provided the silica and alumina. Iron ore, iron containing shale, mill scale or similar material to provided.

2.2 Water: Water is one of the important material for the foamed concrete. The quality of the water must base on the BS3148. The criteria on of portability of water are not absolute. Water with pH 6 to 8 is suitable for use. Natural water that is slightly acidic is harmless, but water containing humid or other organic acids may adversely affect the hardening of concrete

2.3 Fine aggregate: Generally the fine aggregate shall consist of natural sand, manufactured sand or combination of them. For sand Such &Seifert (1999) recommend that only fine sands suitable for concrete (to BS 882:1992) or mortar (to BS 1200: 1976) having particle sizes up to about 4 mm and with an even distribution of sizes should be used for foamed concrete.

2.4 Forming Agent: KEMILITE-LW is a synthetic foaming agent used for producing controlled low density foam concrete. It can be added directly to the concrete or can be added through foam generating equipment. Product Specification Physical Appearance – Light yellow translucent liquid Specific Gravity – 1.0 - 1.05 pH - > 7.5 Chloride Content - < 0.10%. Dosage may vary depending upon mix design, process, and aggregate type and desired effect, however typically 200ml– 600 ml per 50 kg cement. In case of hard water, a higher dosage maybe required.

III. Manufacturing process

Foamed concrete typically consists of slurry of cement or fly ash and sand and water, although some suppliers re-commend pure cement and water with the foaming agent for very lightweight mixes. This slurry is further mixed with synthetic aerated foam in a concrete mixing plant. A foaming agent, mixed with water and air from a generator Created a foam . The foaming agent used must be able to produce air bubbles with a high level of stability, resistant to the physical and chemical processes of mixing, placing and hardening.

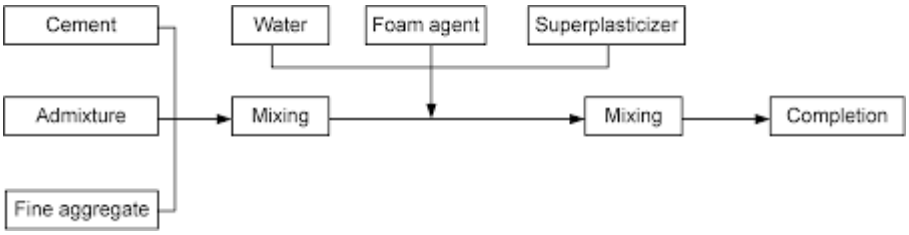

Fig.1.Foamed Concrete Manufacturing Process.

IV. Manufacturing method

Foamed concrete is a lightweight, free flowing material which is manufactured by adding foam, prepared by aerating a foaming agent solution, to cement paste or 11 cement mortar. Figure shows the process of the manufacturing of the foamed concrete. The 3 basic methods of producing foamed concrete are:

1. Pre-foamed Method.
2. Inline System Wet Method.
3. Inline System Dry Method.

4.1Pre-foamed method: This method involves half a load (normally 3m3) or less, of base materials being delivered to site in a ready mix wagon, with the pre-foamed foam (either a wet or dry system) after that foam injected directly into the back of ready mix wagon. The various foaming agents used are detergents, resin soap, glue resins, spooning, and Hydrolyses proteins. Normally, the hydrolyzed protein based foaming agent been employed in the producers of the pre-foamed concrete. Within the generator, the agent is diluted with water to make a pre-foaming solution which is then forced at high pressure through the foaming lance. By this way uniform and stable foam produces which has a volume of about 20 to 25 times that of the pre-foaming solution. Batching of cement paste for adding the spree-foamed in to it to produced the foamed concrete. The three major disadvantages of this method are:

1. The size of truck affect the manufactured volume.
2. The quality of foamed concrete is reliant on the mixing action of the truck to blend the foam.
3. when the material is out of specification then the whole is rejected.

4.2Inline system (wet method): Inline system (wet method) has been driven in the main part by the need for both higher product quality control and a commercial requirement for lower density material. This method incorporate the same type of foam generator and foaming chemicals as used in the pre-foam method, but differs in that it excepts wet base materials into an onboard hopper. The base materials used in this method are generally wetter than the ones used in the pre-foam method but comprise of the same materials. These systems work by feeding the base material and the foam (dry type only) through a series of static inline mixers where the two components are mixed together. Mixers have the effect of blending the foam and the based materials together into a completely homogenized mix ensuring a completely repeatable mixing process along with a constant checking procedure via the continual on-board density monitor. As compare to ore-foam method in this method of production the output volume is not governed by the size of the ready-mix wagon, hence one 8 cubic meter delivery of base materials from a ready-mix supplier will produce 35 cubic meters of a 500kg/m3 density foamed concrete. This is an extremely effective method of working.

4.3Inline system (dry method): These inline systems in dry method are a relatively new development and are in the main operated in Europe although versions are gradually being accepted in the UK. They operate on a similar principal to the dry inline method but instead of accepting wet materials from ready-mix supplier they have dry materials loaded in on-board silo' s and aggregate bins. After that these materials can then be batched, weight and mixed on-site as required via on-board mixers. Once blended the base mix in then pumped to a mixing chamber where the foam is then added in a similar way to the dry method. One of major disadvantage is that they require large amounts of water at site (to mix the cement and aggregate together) they are unsuitable for congested city centre or projects.

V. Advantages

Following are advantages of foam concrete.

a) The dead weight is reduced as it is light weight concrete
b) Cost effective, less maintenance
c) Non-hazardous and faster work completion
d) The foam concrete structure has excellent load spreading and distributing capability

VI. Disadvantages

Following are disadvantages of foam concrete.

a) Time of mixing longer
b) With the increase in density, the compressive strength and flexural strength decreases
c) Difficulty in finishing
d) Presence of water in the mixed material make the foam concrete very sensitive.

VII. Application of foam work

Foamed concrete has found applications in many civil and structural engineering areas because it distinctive properties of foamed concrete including density reduction, low thermal conductivity, high flow ability and self-compacting concrete, and given the ease of producers and its relatively cost-effectiveness.. For example, the low density foamed concrete has been used for cavity filling and insulation while the high densities were used in structural applications. Other applications of foamed concrete include (1) production of lightweight blocks and pre-cast panels,(2sss) fire insulation, (3) thermal and acoustic insulation, (4) road sub-base, (5) trench reinstatement, (6) soil stabilization and (7)shock absorbing barriers for airports and regular traffic . Also, due to flow ability features, it is a superlative material for voids such as old sewers, storage tanks, basements, ducts and voids under roadways occurred by cliff of heavy rains . Application of foamed concrete has become popular worldwide, especially at the regions suffering from housing shortages or subjected to adverse weather, hurricanes and earthquakes

VIII. Conclusion

Based on this paper we are conclude that the using foaming agent in concrete in the alternation of course aggregate we will be reduce the self weight of concrete and also reduce the cost of construction and transportation. Due to best property and less self weight, we can achieve the more advantages like economy, user-friendly and give good expose aspects.

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