

A study of literatures on emerging trends of materials for precast composite panels

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Abstract

This literature provides you the basic ideas about the materials which is economic and suitable for the construction of composite panels. As we consider about the panel construction, one thing has to be assured, that weight of the precast sandwich panel should be designed considerably low compared to the normal concrete panels. This gives you an easiness to handle and transport the panel whenever and wherever it is required. Discussing the conclusion of various researchers helps you to decide the required journal study and the direction of your researches.

Keywords: composite sandwich panels, foamed concrete, reinforced concrete

Introduction

Since construction with precast composite panels is increasing in the construction works, engineers especially, civil engineers are obliged to know the emerging trends seen in the construction of the panels. Panel construction helps in easy repair and fast construction of the buildings for rapidly growing generations. We all know that minimum or expected life of a building is 50-60 years. After that new trends in construction and other changes in the structure have to make to incorporate new facilities, technologies and innovation of the world. Examples, usage of the solar panels have increased in many countries, which help them to generate energy required for the building. Here we introduce some journal and their contents in brief which is enough for you to provide a brief idea about the materials tested and used by our researchers for the construction of the panels. Shortage of the materials also gave way to the addition of these waste products into the panel construction, which help to reduce the cost of production and the environmental degradation.

1. Vinoth Kumar K, *et al.* (2016) ^[1] Experimental Study on Composite Sandwich Panels with Concrete and Corrugated Steel Faces

This paper dealt with experimental investigation on behavior of composite sandwich panel and reinforced concrete (RC) panel, under four point loading setup. For reinforced concrete panel, a grid of reinforcement of 10 mm diameter bars at 200 mm c/c in both directions (1 way distributions). For composite sandwich RC panel, trapezoidal shape corrugated core is preferred, with concrete is sandwiched between two steel layers. Steel sheets are 1mm thick plain cold rolled sheet. In four point load setup, I section with 25mm diameter mild steel roller used to transfer the static load. A Dial gauge is used to find out deflection of the specimen at the period of experiment. A LVDT (Linear Variable Differential Transducer) placed on both edges of the panel for determining horizontal movement between two material steel and concrete. Strain Gauge is used for calculating strain value of Specimen. After application of load the deflection, slip movement and crack propagation are taken at an interval of load 4 kN.

Failure modes of reinforced and sandwich concrete panel, first crack load, deflection at first crack load, breaking load and deflection at breaking load was found out. Deflection – load, load-slip, load strain bar chart for comparing the ultimate load carrying capacity of RC panel and sandwich panel is drawn. Three conclusions were obtained. First, load carrying capacity of sandwich RC panels is 1.5 times greater than that of RC panel and sandwich RC panel is more elastic than RC panel. Second, no crack was found in compression zone of panel. Third, number of embossment is proportional to strength and confinement of panel.

2. Y.H. Mugahed Amran *et al.* (2016) ^[2] Structural behavior of axially loaded precast foamed concrete sandwich Panels This paper helps to study the behavior of the panels under axial loads. The structural behavior of PFCSP (precast concrete sandwich panels) depends on the strength and stiffness of the mechanical continuous steel truss-shaped shear connector. The axial load-bearing capacity, load–deflection profiles, load–strain relationships, slenderness ratio, load–displacement, load–deformation, failure and collapse modes, cracking patterns, and propagations under constant increments of axial loads were recorded and preparation of foam concrete is discussed. LUSAS software is used to model and analyze PFCSP under axial load

3. E.A. Flores-Johnson *et al.* (2012) ^[3] Structural behavior of composite sandwich panels with plain and fiber-reinforced foamed concrete cores and corrugated steel faces

This paper studies the four-point bending response and failure mechanisms of sandwich panels with corrugated steel faces and either plain or fiber-reinforced foamed concrete core. Mechanical properties of both plain and polyvinyl alcohol fiber-reinforced foamed concrete were obtained, which are needed for the design of sandwich panel and numerical modeling. It is found that the fiber-reinforcement largely enhances the mechanical behavior of foamed concrete and composite sandwich panels. Finite element code Abaqus/Standard was employed to investigate the influence of face/core bonding and fastening on the four-point bending response of the

sandwich panels. It was found that face/core bonding plays a crucial role in the structural performance while the influence of fastening is negligible.

4. Qin xin (2016) ^[4] Research status of foamed concrete
Foamed concrete as a new type of lightweight, high-strength and energy-saving building materials, is widely used in the construction industry. As its high quality performance and broad space for development, Foamed concrete has been respected by the construction industry. This paper which based on the foam concrete properties and preparation process analyses the research progress of Blending material, admixtures and fibers' effect on the performance of foamed concrete, puts forward the problem about development and application of the foam concrete in current research, and points out that the sustainable development is the basic idea of the foam concrete further research and application in future.
5. Mohiyuddin. C.S. (2015) ^[5], A Study On Behavior of Sandwich Panels under Impact Loads.
A Sandwich structured composite is a special class of composite materials that is fabricated by attaching two thin but stiff skins to a lightweight but thick core. The separation of the skins by the core increases the moment of inertia of the panel with little increase in weight, producing an efficient structure for resisting bending and buckling loads. The strength of sandwich panels depends on the size of the panel, facing material used and the number or density of the honeycomb cells within it. Honeycomb composites are used widely in many industries, from aerospace industries, automotive and furniture to packaging and logistic. The behavior of honeycomb sandwich panels under impact loads are investigated in this project by experimental and analytical studies on honeycomb sandwich panels. The modeling was done in HYPER-MESH and analysis was done with the help of LS-DYNA.
6. Ameer A. Hilal *et al.* (2015) ^[6] the Use of Additives to Enhance Properties of Pre-Formed Foamed Concrete.
The Aim of the study is the partial replacement of OPC and sand by Silica Fume (SF) and Fly Ash (FA). SF is the byproduct formed at production of silica from electric furnaces. SF is used to improve cement paste/ aggregate bond. FA is the byproduct of coal in thermal power station. FA gives good thermal insulation. Super plasticizer used here is MIGHTY21 EG made by Kao chemical company and it is a water reducing agent. Specimen's cubes (100×100×100 mm) of conventional mixes (FC) and mixes with additives are tested here. Compressive strength test is done. Results are obtained are as follows. When silica fume is added- 10% increase in 28 day compressive strength is seen while Fly ash is added - 60% increase in 28 day compressive strength is seen and when Super plasticizer is added - 115% increase in 28 day compressive strength is seen.
7. Hanizam Awang *et al.* (2014) ^[7], Durability properties of foamed concrete with fiber inclusion.
Lightweight Foamed Concrete (LFC) has wide applications in Floor construction, bridge strengthening, roofing insulation etc. Inclusion of fiber- enhances durability of construction. Comparison of five different fibers is done. The fibers used for the comparison are AR Glass, polypropylene, steel, kenaf and oil palm. British

Standards (BS EN 196) codes are used. Scanning electron microscopy test (SEM) and shrinkage test is conducted. Result shows that AR glass fiber shows the lowest value of drying shrinkage compared to other fibers and steel fiber is poor in thermal insulation.

8. Maheshkumar H. Thakrale *et al.* (2014) ^[8], Experimental study on foam concrete.

The study conducted here was based on two type of mixes (Mix 1- cement and fly ash combination, Mix 2- cement, sand and fly ash). Experimental procedure for conducting the cube test is mentioned her. Experimental result for the compressive strength and density is compared with normal concrete. Gain of strength with age graph is plotted. They have studied about target plastic density of foam concrete and strength density ratio of foam concrete.

Some of their conclusions are as follows. Density of foam concrete increases when fine aggregate is added in foamed concrete and it will lead to increase of compressive strength and reduction of the construction cost. Foam concrete mixed proportions is good for making partition walls in construction field. The addition of fly ash equal to the amount of cement in the foamed concrete mixture, helps the concrete to gain target strength with age. Use of fly ash in foamed concrete can increase its good properties. De-moulding of higher density foamed concrete panel is possible only after 24 hours, and very great amount of care has to be taken when it is de-moulded. Minimum three days has to be given for de-moulding of lower density foamed concrete.

Conclusions

FOAM concrete is classified as a lightweight aerated concrete which could be based on either mortar or a cement paste in which stable bubbles are entrapped within the mortar's matrix by using a protein or a synthetic based foaming agent. With a wide densities ranging from as low as 300 kg/m³ to as high as 1800 kg/m³, lightweight foamed concrete (LFC) is applicable to be used in multiple applications such as trench reinstatement, roofing insulation, construction of partition wall panels.

The inclusion of fiber into LFC is one approach to enhance its durability properties. Prior to 1960, sandwich technology was confined entirely too aerospace applications. An increase in the number of alternative uses of this technology was discovered when structural insulated panels (SIP) were used to construct buildings, refrigerated storages, and automobiles and in various processes operations in the shipbuilding industries.

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