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Eco-Friendly use of Granite Fines Waste in Building Blocks

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Abstract

India is endowed with one of the best granite deposits in the world and accounts for over 20% of world's resource in granite. Granite fines are waste produced in granite factories while cutting granite rocks to the desired shapes and also in polishing granite slabs. Disposal of this granite fines has become a major problem. Random disposal of the granite fines would lead to health hazard and disposal in landfill will decrease the life of landfill. Worldwide consumption of sand as fine aggregate in concrete production is very high and several developing countries have encountered some strain in the supply of natural sand in order to meet the increasing needs of infrastructural development in recent years. Over extraction of sand from river changes the river characteristics and effects on environment and biodiversity. A Situation that is responsible for increase in the price of sand and the cost of concrete. Expensive and scarcity of river sand which is one of the constituent material used in the production of conventional concrete was reported in India.

The present study suggests that incorporation of granite fines in building blocks as a replacement to fine aggregates and compare favorably with that of conventional used building materials. Study also suggest using granite fines at optimum percentage of replacement of fine aggregates will not only save large quantity of natural sand but will also reduce the pollution created due to the disposal of this granite fines.

Due to scarcity and ever increasing cost of landfill space and awareness about environment, by-product utilization like granite fines becomes an effective alternative for waste disposal. This gives a new solution for sustainable development, avoiding environmental degradation. In this context, the study aims at effective utilization of granite fines in producing different building blocks such as Mardini pressed soil blocks, Adobe blocks and Concrete blocks etc.

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1.0 Introduction

Granite industry is one of the leading industries in Bangalore. Jigani Industrial area has about more than 300 granite industries and producing more than 150 tonnes of granite waste every day. Disposal of these granite fines is one of the environmental hazards (Allam M. E.,et al, 2014)and is a major problem in Bangalore. Granite fines are produced during various process of cutting and polishing of granite slabs, the powder produced is carried out with water and this water is stored in tanks. Sludge thus produced is waste product for the granite industry (Arshad A, et al, 2014). After evaporation of water the granite sludge remained is transported and disposed of haphazardly in unscientific way. Landfill identified by the government had fill up in six months before its life of about five years due to unscientific management. At present disposal of granite slurry is restricted to dump in abandoned quarries. As factories are situated close to the residential areas, in case of random disposal of the granite fines would lead to serious health hazards for people dwelling in the areas.

Adobe block is one of the oldest and most widely used building materials in the world (Bharath B, et al, 2014). Adobe has been a traditional construction material especially in developing countries and/or rural regions because of its simplicity and low cost, energy efficient and approachable building material(Deepak Bansal, et al, 2014). Earth is an ecologically sound, environmentally friendly, thermally performable, and abundantly available building material. Despite all these merits, adobe has some serious disadvantages such as low mechanical properties and poor moisture resistance (Razia Begum et.al., 2014). Traditionally mud has been extensively used for building construction in India and elsewhere. Traditional earth construction technology has undergone a considerable change that enhances earth's durability and quality as a construction material for low-cost buildings(Ayan et.al.,2014). Such methods include rammed earth and machine compressed stabilized earth blocks. Construction practices of today heavily depend on materials like burnt bricks, cement, and other metals like steel, aluminum etc. (Ribeiroet.al., 2014). These are energy intensive materials which consume a lot of energy and thus the production of these building blocks has a negative impact on environment. Since these materials can be produced only in particular areas, there is a need to transport these materials to the site where they are to be used and again results in consumption of energy.So it is quite evident that these materials contain lot of embodied energy in them. Hence it is important to produce alternative building materials which consume less energy and can be used for construction and such materials are adobe block and soil block (Kumutha R et.al., 2013) . Granite waste collected from jigani industrial area were analysed for their properties like specific gravity, grain size distribution, water absorption etc. Results shows that these fines can utilized in building blocks. Present study aims at utilizing granite fines in Adobe, Mardini pressed soil blocks and Concrete blocks.Successful utilization of granite fines as fine aggregate would turn this waste material, which causes an environmental load due to disposal problem into valuable resources, reduction in the strain on the supply of natural sand and economy in concrete production.

2.0 Experimental Investigation

The experimental program included, firstly the preliminary investigation on the materials used for the study, i.e., Cement, Sand, and Granite fines, and Coarse aggregates.

Soil

Soil used in compressed soil blocks should not be surface soil and it must be free from organic components. All types of soil are not suitable for the manufacture of soil blocks. Many soils can be selected based on the experience and knowledge by identifying the properties like specific gravity and particle size distribution. In present study soil available in RVCE campus was taken and properties like specific gravity and particle size distribution were analyzed.

Cement

Cement used for this project is 53 grade, as per IS: 12269. The cement had the initial setting time of 43 minutes and Final setting time of 3 hour 38mins.