An Alternative Use of Scrap Material in Construction by Replacing Conventional Material

Moumita Samanta¹, Piyush Das²
M. Tech. Student¹, Assistant Professor²
Department of Civil Engineering
Kalinga University, New Raipur (C.G.), India

Abstract:
Use of Scrap Materials in Construction by replacing conventional materials it’s still kind of a new concept in India. But for our environment’s safety it is very important to reduce the quantity of scrap/waste materials by using different works. Because if we only dump those materials any particular place then due to their effect that place/area can convert into barren land which directly effect our environment. The rate of producing of Scrap/Waste materials is increase day by day. Nowadays, natural resources are depleting worldwide, while at the same time the generated wastes from the industries are increasing substantially. Using of scrap materials in construction it can be a new concept for India but if we look Worldwide then it’s definitely not a new concept. The aim of this paper is to describe the industrial and natural waste utilization in construction materials.

Key Words: Scrap/Waste Material, Plastic Bottles, Eco Bricks.

1. INTRODUCTION

Everyday millions of plastic bottles are used for packed drinking water purpose, which only increase the quantity of plastic bottle waste after consuming the water. And as we all knows plastic never decomposed which directly effect our environment. So instead of increasing the quantity we can use plastic bottles in construction work. Eco friendly construction method is not new but still out of reach of many people due to lack of knowledge and awareness. In our country, there is a great demand for construction materials in civil engineering field. The researchers have developed the waste management strategies to apply for replacement of materials for their specific need. This paper deals with the review of different kinds of scrap/wastes, like Bottles, E-waste, Medi-wastes, Fly Ash, Scrap Materials etc.

2. MATERIAL

2.1. Bottles – Eco Bricks or Bottles Bricks is a new concept. But in now days this new concept can easily replace the old concept of Terracotta Bricks. Now days this is a new style of building construction in which we usually use bottles ( although plastic and glass bottles both ca used ) as masonry units. And bind them with clay / cement mortar or any other joint compounds with the help of some admixtures.

2.2. Filling Material -

2.2.1. E-Waste – Electronic Waste is one of the serious problem for human health and environment in India. According to the research India is the “Fifth largest electronic waste producer in the world”; approximately 2 million tons of electronic waste produced annually and a huge amount of e-waste is imported from all over world. According to ASSOCHAM (Associated Chambers of Commerce and Industry of India) the annual growth rate of electronic waste in India is 30%.

2.2.2. Medi - Waste – Medical Waste is very harmful waste for our health and as well as our environment also. And the rate of producing of medi-waste is increasing day by day. According to a survey in India medical waste is generated about 775.5 tons per day, so by 2022 the growing rate is increase 550.9 tons per day from current level of estimation. The compound annual growth rate (CAGR) is increase about 7%, reveals by ASSOCHAM – Velocity joint study.

2.2.3. Fly Ash - Fly Ash is a fine powder of burning coal. Fly ash contains many toxic substances which can be very harmful for human health as well as environment also. The main sources of fly ash generating is industries, and the rate of quatiity is increasing each passing day. Now days govrment also promote to use fly ash in construction in the form of fly ash bricks or as a component of cement.

2.2.4. Scrap Material – Scrap Material means any kind of waste which is non-reusable. It can be any particular types of waste material, or mixture of different types of waste material.

2.3. Binding Material –
2.3.1. Cement Mortar
2.3.2. Cement Concrete

2.4. Admixtures –

2.4.1. Epoxy Resin - Epoxy Resin is basically a chemical. Epoxies are thermoset plastics made by the reaction of two or more industrial chemical compounds. Epoxy resins are used in a wide array of consumer and industrial applications because of their toughness, strong adhesion, chemical resistance and other specialized properties. Epoxy Resin has a property of make/join a bond between Plastic and glass materials with cement mortar/concrete.

2.4.2. Build Silicone Sealant - Build is a high quality neutral curing, low modulus 100% silicone sealant that provides a...
permanent flexible, durable, watertight seal for general purpose sealing. It has a property to create a bond between many non-porous materials like ceramics, glass, plastic metals, rubbers etc. with concrete, mortar. This chemical is suitable for internal as well as external sealing applications, waterproofing and weatherproofing, sealing of connecting and expansion joints in construction. This chemical is acid free, non-toxic, water and uv resistant proof. The main concept of this paper is replacing of conventional materials by using scrap/waste material in construction. Where we can bottles as an eco-bricks and other waste/scrap materials as a filling material for eco-bricks and cement mortar/concrete as a binding material between bottles. Some chemicals like Epoxy Resin, Build Silicone Sealant etc. which is use as admixtures to create a bond between bottles and concrete/mortar mixture.

3. OBJECTIVE

3.1. The main objective of this concept is replacing of conventional materials in construction by using scrap material which is harmful for environment without harming human health.

3.2. To find the compressive strength of bottles with filling.

4. HISTORY

4.1. Using of bottles in construction is not a new concept. It is believed that the first bottle house was constructed in 1902 by William F. Peck in Tonopah, Nevada. He built a house by using 10,000 bottles of J. Hostetter’s Stomach Bitters. The house was demolished in the early 1980s.

4.2. Around 1905, Tom Kelly built a house in Rhyolite, Nevada. By using 51,000 beer bottles.

4.3. The Heineken WOBO (World Bottle) – The concept of Heineken Wobo’s bottles house is one of the famous concept in bottles house construction’s history. In 1963 built a house by using 100,000 glass bottles by placing them horizontally and interlocking manner.

4.4. In India this concept is very new. As we know the growing rate of plastic is increasing each passing day and around 60% plastic is end up in landfills. To solve this issue and to recycle the plastic waste a couple from Hartpla village of Naital dist., Uttarkhand has built an fourroom homestay out of 26,000 plastic bottles. In India this concept is kind of still unknown. And those projects where this concept is used they mostly use mud as a binding agent/material with some admixtures like rice husk, cow dung etc. instead of cement mortar/concrete mixture.

5. PLANNING OF WORK

5.1. Experimental Work - Compressive strength test for each bottle was determined on universal testing machine and the average value was considered for analysis. Weight of empty bottles and completely filled bottles were noted and the amount of waste used as filling material also should be noted. The value of compression strength test should be noted. By compression test we can find the compressive strength value of completely filled bottle.

5.2. Methodology - In this process, the first step is collecting the waste bottles from stores, waste collectors and other possible resources. Once the bottles are collected they have to be filled with the filling materials such as e-waste, medi-waste, any kind of scrap, fly ash etc. (all filling materials should be fill in powder form). After that we have add some liquid such as some chemicals or water to convert the filling materials from powder to solid form. To provide the structural strength. All bottles should properly tamping in installment and they are tightly capped and sealed. After that we have to perform the compressive strength test to find the compressive strength value of filled bottles. Then we can use those bottles as replacement of bricks in construction work. But after and before every mortar/concrete level we need to use some chemicals like epoxy resin, Build Silicone Sealant etc. to join/create a bond between bottles and cement mixture. We have to provide a few thin layer of P.C.C./R.C.C. beam after a proper height interval which is decide according to the total height of the wall.
6. BENEFITES –

6.1. The total waste generated is reduced.
6.2. The mostly sources of materials is local except for those chemicals ( Admixture ).
6.3. The natural resources are preserved.
6.4. The waste bottles and materials are inexpensive.
6.5. This concept helps a lot to heal our environment.
6.6. It is a green construction concept.
6.7. The main material ( bottle ) is non brittle where bricks is brittle.
6.8. Since it’s non brittle, that’s why it can take heavy compressive load as compare to bricks.

7. DISADVANTAGE & CURE –

7.1. Temperature – Plastic bottles has a limited life span due to UV ray. Hot climate or direct exposure to sun could make plastic soft and they can be brittle. And in India variation between temperature is very high according to the seasons. To protect such structures from temperature we need to protect climate by plantation.

7.2. Wind Load - Mostly loads work on any structure in vertical direction, but wind load works on horizontal direction. And due to properties plastic/glass bottles never create/join a bond with cement mortar/concrete without any admixtures. That’s why if wind load is heavy then it can directly effect on the structure, and structure can get fail. To protect the structure ( G+ ) from wind load we has two options. Either we use this technology for inner wall or we need dense place/location where wind load is not so heavy.

8. FACILITIES REQUIRED

8.1. Proper knowledge about this concept.