LOW COST BUILDING MATERIAL

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ABSTRACT

Affordable housing is a term used to describe dwelling units whose total housing cost are deemed "Affordable" to a group of people within a specified income range. (www.wikipedia.com) In India, the technology to be adopted for housing components should be such that the production and erection technology be adjusted to suite the level of skills and handling facilities available under metropolitan, urban and rural conditions.(P.K.Adlakha and H.C .Puri, 2003).

The World Bank identified 152 developing countries as of the year 2007, of which it is reported one in two people are without adequate shelter. 1 UN-Habitat is working to lower the statistic through the provision of low-cost, sustainable building materials and technologies while recognizing the 'Adequate Shelter forAll' agenda, committing to, "Access to safe and healthy shelter and basic services recognized as essential to aperson's physical, psychological, social and economic well-being and should be a fundamental part of ourgent actions for the millions of people in the world
Without decent living conditions."

Keyword : *Rubber, tire veener, straw & resin panels*

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1. Introduction

Affordable housing is a term used to describe dwelling units whose total housing cost are deemed "Affordable" to a group of people within a specified income range. (www.wikipedia.com) In India, the technology to be adopted for housing components should be such that the production and erection technology be adjusted to suite the level of skills and handling facilities available under metropolitan, urban and rural conditions.(P.K.Adlakha and H.C.Puri, 2003.

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2. Sustainable low-cost housing

The link between sustainability and urban housing has been an ongoing global debate for more than two decades, failing to gain the depth of attention necessary until the late 1990s. Sustainable housing remains a relatively new concept to developing countries. While there have been different approaches and conceptions of sustainable models for development internationally, specific to climatic circumstances, addressing the major shift in the distribution between rural and urban migration and exploring stages of implementation, there're mains definitive barriers. In most developing countries, the mindset regarding sustainable development is limited to an understanding of economic growth, while to the north the focus emphasizes eco logical issues. The Habitat Agenda underlines the importance of developing new approaches in managing and planning rapid urban growth and human settlements. Problems associated with urbanization differs relative to location, making it impossible to develop anover all approach to sustainable housing. The overall concept should be acompilation of energy and environmental energy issues in the built environment.

It is also necessary to define the judging criteria associated with 'sustainable housing'.The definition of low-cost, in a housing sense, dependsgreatly on the economic capacity of the target group. One concept of affordability may prove to expensive in other instances of country implementation. Economic models should be interwovento include financial schemes, reducing the affordability. Creating jobs through labor models,workshops and capacity building is critical tothe long-term objectives and direct communitybenefit, particularly focusing on women.Sustainable materials are key to limiting the impacton the ecological system.

Local techniques and technology, resources and materials are a good starting point when researching or implementing projects. Housing models should determine the sustainability of the building materials through lifecycle analysis, and occupational use of building including renewable energy, water, land and use ofresources. Appropriate technology goes hand in hand with the design and building materials. It should correspondto local conditions, reflect and respect climatic conditionsand demand a minimum of maintenance Local sensitivity with regards to status can greatly impact the success of projects. When introducing new low-cost housing developments and design it is important not to be labeled as homes only for the low-income families and individuals.

3. Materials

- **3.1 Rubber**

3.1.1 Tire Veneer

Summary:

Tires are essential globally, at all levels of development. Millions are discarded annually as they wear out relatively fast – this product makes use of recycling the material into a usable material for various types of applications.

How it is used:

The most common application is as an environmentally responsive flooring material resilient both indoors and out. Areas of use extend to areas such as sports and recreation ,animal housing and high traffic areas outdoors – and a variety of consumer products, vibration dampeners and furniture surfaces internally.

How it is made:

In the retreading process, the old tread is removed by grinding and the resulting dust is termed buffings. These buffings are non-laminated polymerically bound black SBR rubber. To give more aesthetic appeal to the material ,colorful virgin EPDM rubber granules are added along with a urethane binder. The homogenized mixture is approximately80% black rubber and 20% colored rubber although his percentage can be varied. The percentage of black rubber indicates the post-consumer content.

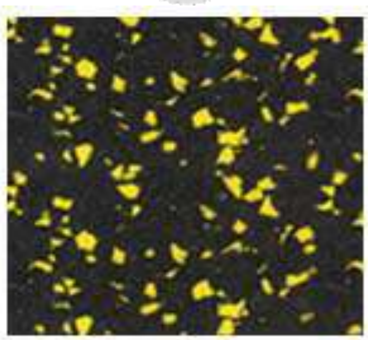

Fig 3.1.1 Tire Veneer

- **3.2 Insulation**

3.2.1 Straw and Resin Panels

Summary:

Informal settlements in northern Pakistan have becomethe pilot site of a new technology created at MIT to providemuch needed insulation and sound absorption for existinghousing. Using agricultural waste, such as straw, a binderis applied that is made up of local resins to form insulating panels that can be easily installed under and between existing corrugated metal sheeting – and lightweight corrugated iron currently being used as roofing by over one million people in Pakistan alone.

The technology and construction method also mitigates added deaths when the region experiences earthquakes, as heavy earthen roofs often collapse and bury those inside. With the manufacturing is able to be carried out locally with already available materials to meet the growing needs, there is an opportunity for business creation and income generation.

Fig 3.2.1 Straw and Resin Panels

3.2.2 Flax Insulation

Summary:

Flax is a plant native to the region extending from the eastern Mediterranean to India and China, and was once extensively cultivated in Egypt today flax fibers are amongst the oldest fiber crops in the world. The fiber has is soft, flexible, stronger than cotton but not as elastic. Natural insulation can be made from 100% flax fibers by matting them together into a non-woven process and then utilizing their properties for insulation in lofts or wall cavities.

The material has very low embodied energy and the thermal conductivity of flax insulation is 0.037 W/mK, making it ideal for breathable constructions.

Fig 3.2.2 Flax Insulation

3.2.3 Wood Fiber Insulation

Summary:

Wood fiber insulation panels are made from 100% pulped wood fiber with no added harmful chemicals or materials, using the dry manufacturing process there is no water treatment necessary and energy costs are low. There are various types of wood fiber insulation for different uses and purposes – floor and roof insulation and internal external wall insulation. The thermal conductivity values range from 0.04 – 0.05 W/mK. They protect against cold in the winter and heat in the summer.

Fig 3.2.3 Wood Fiber Insulation

3.2.4 Corkoco

Summary:

The material is a panel made of combination cork and bioecologic coconut fiber, mainly used for acoustic insulation.

How it is used:

The performance is specialized in providing acoustic insulation and insulation – for installation in attics, gaps, between rooms or apartments.

How it is made:

There are two levels of performance panels available. One is simply a coconut fiber panel; the other is a sandwich of a corkpan panel between two sheets of coconut fiber.

Fig 3.2.4 Corkoco

3.2.5 Grancrete

Summary:

Greensulate is a low-cost, biodegradable rigid insulating composite. At the end of its life-cycle, the material biodegrades, rapidly breaking down and enriching the surrounding soil – even accelerating the rate of breakdown for surrounding and nearby waste.

How it is used:

It can be used as an insulating composite for packaging or industrial use in housing, to retain heat easily and costeffectively as it is cheaper than foam products (between 0.50-3.00 USD per cubic foot). Greensulate acts as a biodegradable replacement for polystyrene and Styrofoam.

How it is made:

There are no energy inputs, including heat and light since the material is grown from renewable agricultural waste resources using both agricultural and industrial waste.

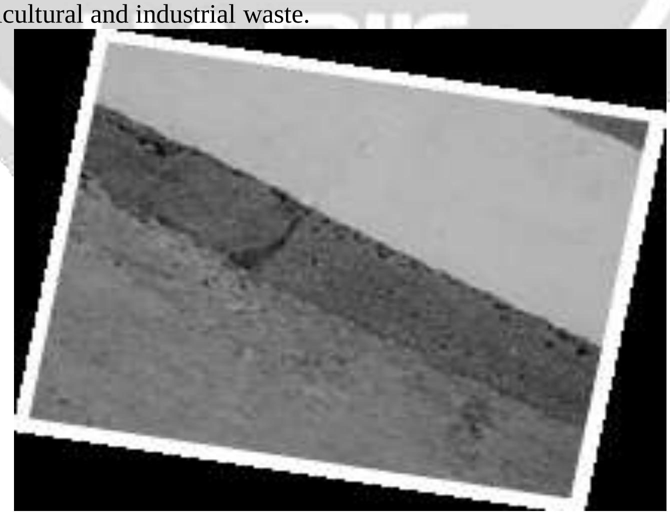

Fig 3.2.5 Grancrete

3.3 Concrete/ cement

Cement based building materials consume vast quantities of natural resources and contribute to a large proportion of construction, demolition and similar waste. **If the manufacturing of cement could be altered to reduce the carbon emissions by just 10%, it would accomplish one-fith of the Kyoto Protocol goal of a 5.2 percent reduction in total carbon dioxide emissions.** There are currently available multiple alternatives or additives that can help reduce waste and CO2 emissions when applied correctly and suitably to location specifications

3.3.1 Rice husk ash/ Pozzolanas

Summary:

Pozzolanas are materials containing reactive silica and/or alumina, which in their own right have little binding ability. Yet, when mixed with lime and water it will set and harden like cement. They are important ingredients in alternative cement compounds, making a significant contribution towards low-cost materials.

Rice husks are a large by-product – one ton is produces per five ton of rice paddies, and it is estimated that 120 million tons of husk could be available annually on a global basis. Rice is a major crop in many third world countries – including China and the Indian sub-continent, South-east Asia and in some regions of Africa and South America. While once considered as a waste by-product, it has now been successfully implemented as a Pozzolanas in the commercial production of cement in several countries including Colombia, Thailand and India including several pilot projects underway in most of the major rice-growing countries worldwide leaving considerable opportunity for expansion into small and large scale production. Environmental aspects are deeply incorporated into the manufacturing process, as low-heat is necessary for the burning of the husk and carbon quantities of the ash over 10% will adversely affect the strength. Simple incinerators can be made of fired clay bricks capable of controlling lower carbon quantities, used in banks of 3-4 they may produce one tone of ash per day. Weight for weight, rice husk contains an energy value about half that of coal, and is therefore an important energy source, though it must be consumed close to natural production as transportation is a very unviable option. Only 20% of its weight may be utilized as a pozzolana.

The success of using rice husks depends on the self construction of individual ovens. With the ovens, this method would be sufficient and successful, making rice husk ash an affordable and sustainable alternative to cement.

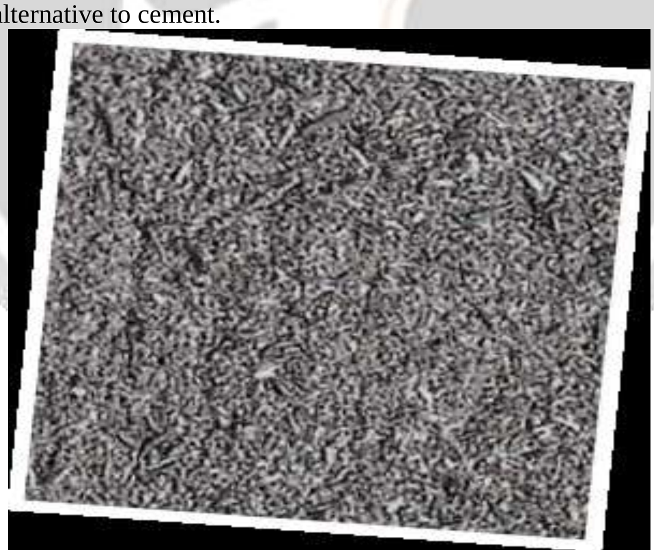

Fig 3.3.1 Rice husk ash/ Pozzolanas

3.3.2 Recycled materials in concrete

Summary:

Despite obvious environmental and cost advantages, there is limited development and research regarding the inclusion of waste or industrial by-products in the makeup of concrete building materials. One risk of incorporating recycled materials into the compound is a lack of homogeneity and the chance of contamination that in general lower the quality of the product.

There is evident opportunity for further engineering and research testing of new cement products containing waste, focusing on durability and the binding capability crucial for their viability.

Fig 3.3.2 Recycled materials in concrete

3.3.3 Concrete canvas

Summary:

Concrete canvas is exactly what its name says – canvas impregnated with concrete power. With a wide range of applications, it is an extremely valuable solution to both short term emergency response and long term installations. The material is a 3-dimensional fiber matrix containing a specially formulated dry concrete mix. A PVC backing on one side of the surface ensures the material is completely waterproof, while hydrophilic fibers on the opposite surface help aid the hydration by drawing water into the cement . material can be pulled, slightly stretched, draped and so forth fixing in place is done by nails, staples or coated with an adhesive for easy attachment to other surfaces.

Once fixed, the material may be hydrated either by spraying or being fully immersed in water. The water activated the concrete powder and the canvas concrete hardens to become strong, durable, waterproof and fireproof. Fresh water and sea water may be used to hydrate. Once wet, the material remains flexible and workable for 4 hours. Once set, the fibers help to reinforce the concrete and prevent cracking.

Fig 3.3.3 Concrete canvas

3.3.4 Magnesium oxide cement

Summary:

Magnesium oxide cement is often referred to as 'eco-cement' as it has been engineered to incorporate a large proportion of waste materials while retaining highly durable qualities for construction. Magnesium deposits are found worldwide and cover roughly 8% of the earth's surface and phosphates are available from rock, animal wastes and fermented plants.

Depending on where they are mined, magnesium oxide and magnesium choloride cements require only 20-40% of the energy required to produce Portland cement. MgO uses 'reactive' magnesia that is able to be manufactured at a lower temperature than Portland cement, and utilizing a large portion of Pozzolanas by-product and producing environmentally friendly, non-toxic cement. This makes it more recyclable than Portland cement and is expected to improve the durability while being capable of high propensity for binding waste materials. Studies are ongoing, currently producing positive results. Magnesium-based cements are proven exceptional in promoting the health for occupants of homes in which they are used as the prime building material. The natural compound binds exceptionally well to other cellulose materials, such as plant fibers, wood chips, Styrofoam, and stone, unlike Portland cement that repels cellulose. The compressive strengths are many times stronger than conventional concrete.

Fig 3.3.4 Magnesium oxide cement

- **3.4 Bricks**

3.4.1 Fly Ash Technology - Flash Bricks

Summary:

Fly ash is a fine, toxic powder produced as a byproduct from coal-burning power plants. In India alone, approximately 100 million tones are generated per year, while 200 million tones are produced in China. The Indian Government took action in 2005, requiring 25 percent of the fly ash to be used in the manufacturing of clay bricks for construction within a 50 km radius of the original coal plant source.

Coal fired power plants are not as common world wide such as in the Middle East where acute shortages of durable and natural building materials mean importation at considerable financial and environmental cost. Bricks can be manufactured entirely from waste fly ash, formally referred to as Flash Bricks. The materials properties include being 28 percent lighter and 24 percent stronger than comparable clay bricks. A separate aggregate called Flashag, a concrete can be made that is 22 percent lighter and 20 percent stronger than standard products. The construction technique and process is improved as the material allows for lighter structures, shallower foundations.

Fig 3.4.1 Fly Ash Technology - Flash Bricks

3.4.2 Cannabrick

Summary:

Cannabrick is derived from the cannabis plant using the woody inner core as a material element for construction. This part of the plant is free of THC and used primarily for construction in the housing sector. Performance is excellent against fire and water, as silica leached from the soil through the plant, combined with unabsorbed lime makes a chemical bond similar to cement – and cannabis cement requires lime. The material is 100% natural, 100% fireproof and conforms 100% to the Kyoto carbon credit compliance.

Fig 3.4.2 Cannabrick

3.4.3 Syndecrete

Summary:

Syndecrete is a version of concrete that uses natural minerals and recycled materials as aggregate. Fly ash is also part of the compound, an environmental material that conserves natural resources and prevents the production of typical concrete contents by resourcing waste from coal production.

How is it used:

There are a variety of domestic applications – tiles, sinks, countertops and slabs.

How is it made:

The manufacturing process utilizes fly ash, which is a byproduct of coal when it is consumed in a power plant, and then combines lime to form the cementitious compound. This method requires less water and gives better durability and workability when compared to typical concrete.

Fig 3.4.3 Syndecrete

3.5 Textiles

3.5.1 ZeroFly

Summary:

Zerofly, manufactured through Vestergaard Frandsen, is a plastic sheeting deployed in complex disasters to provide immediate shelter with an added insecticide proven to protect against disease vectors such as malaria mosquitoes. The strategy driving the development of such materials incorporates the Millennium Development Goals of combating diseases, improving maternal health, reducing infant mortality rate and establishing global partnerships for development. Environmental importance is also critical Zerofly works to assure the protection and minimization possible adverse effects on the environment through reducing waste and emissions into the air, ground and water,recycling and reusing materials and products where ever possible and implementing environmentally friendly technologies.

Fig 3.5.1 Zero Fly

5. CONCLUSION

In a building the foundation, walls, doors and windows, floors and roofs are the most important components, which can be analyzed individually based on the needs thus, improving the speed of construction and reducing the construction cost.

The major current methods of construction systems considered here are namely, structural block walls, mortar less block walls, prefabricated roofing components like precast RC planks, precast hollow concrete panels, precast concrete/Ferro cement panels are consi

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