Issue 9 vol 3 ISSN: 2321-8134

IJFEAT

INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

ALTERNATE ENERGY EFFICIENT BUILDING MATERIAL AND TECHNIQUE

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Abstract

To build up a house is a great problem in today's world. The paper presents work on low-cost and sustainable alternative building materials having advantages on area India, where concrete or steel buildings is expensive.In this study paper the Alternate construction materials and techniques for building design in the field of civil engineering. The technology and material utilized locally available row materials, waste and by product from industry and other manufacturing process.

Housing consume energy at different level in throughout life. Building materials occupy a great consumption. The amount of energy used by materials used in building during their life cycle is an important parameter in determining the energy efficiency of the building. In this study, the importance of energy- efficient material selection in designing "energy-efficient building" is considered and discussed. The technology included here indicate more option which has been developed in India and are being extensively utilized in the construction of low cost housing both in rural and urban area. The purpose of this paper is to detect alternative low-cost building materials for possible use in low-cost housing having advantages on areas such as India where concrete or steel housing is expensive.

Index Terms: *Alternative Energy Efficient Building Material, Low-Cost Housing; Sustainability, materialefficiency;resourceefficiency.*

INTRODUCTION

1. General

Green building concept has taken off in previous year with many builders and new building owners looking for new and different methods of construction that can more sustainablepotential to energy cost. Construction of low cost housing by using the low cost building materials increases the access to buildings for low income group peoples. This concept of Low cost housing can be achieved by use of efficient planning and project management, low cost materials, economical construction technologies and use of alternate construction methods available. The profit gained from use of such methods and technology can decrease the cost of construction and make the low cost housing accessible to all. The use of low cost alternate building materials also prevents the rise of construction cost or highly building material cost due to use of scarce building materials which eventually increase the cost of the project. Some alternative building material can be made out of natural materials, while others can help to lower energy costs of the occupant once built.

1.1 Need

The big demand of building material rising with the need of housing in both rural and urban area. Resources used to manufacture construction materials affected the environment by depleting natural resources, using energy, and releasing pollutants to the land, water.Thats why it becomes necessary to think over this problem seriously and to provide some solution for beneficial and to make the alternative materials available to solve the housing problem.Energy consumption or requirement of energy is rapidly increasing due to the increase in population and urbanization. Residential energy requirements vary from region to region or place to place, depending on climate, dwelling type and level of development. The 8% construction activities consume of the globally used energy every year. This amount is a growing concern about energy consumption in buildings and its possible adverse impacts on the environment.Total energy use during the life cycle of a building is a growing research field. Recycling provides the opportunity to reduce the embodied energy by using recycled and replacing the energy efficient building material.

1.1Alternative Building Material

(a) Guna Vault Roof: "Guna vault roofing system which is most suitable and included in low cost housing.it consist of burnt clay pipe. This word guna is derive from telagu language. It look like semi-cylindrical

pan tiles are obtained by such pipe as atumbler splitting in to two part.These "Guna" tapering pipes can be socketed into or fix up into one another forming an arch over a suitably curved shuttering. A number series of such arches make a barrel vault capable of withstanding considerable loads can bear the weight – up to 1 ton/m2. The top of the roof is covered with a plaster finish. After joints are filled with the (mixing of cement and sand) and topped with plaster, the roof becomes rigid and waterproof, doing totally without steel or timber. The cost of this roof works Rs.20/sq.ft.

It has the following advantages:

1. Inside air the hollow-tiled roof protects from heat and cold. A 10o temperature difference ranges is vary in slab roof and guna vault roof.
2. It has no under structure, It can bear weight of 1000 kg/m2.
3. It is fabricated and it ready for used within 3 days.
4. Requires no maintenance cost and has life span of more than 50 years.
5. It is not affected by rain, hail or wind.
6. The vault roof is safe even in earthquakes.

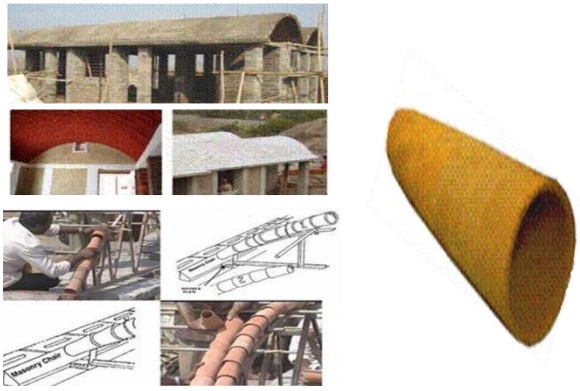

Fig.1 :Guna Vault Roof

1.2 AAC Block

Autoclaved Aerated Concrete. is not a "new" invented It had been invented over 80 year in 1923, It has been used extensively in Europe and Asia. It comprises over 40% of all construction in the United Kingdom and 60% in Germany and 16% in India. Since ancient times, lightweight aggregates and foaming agents have been employed to reduce the weight of concrete. However, unlike these foamed or light aggregate mixes, true aerated concrete relies on the alkaline binder (lime & cement) reacting with an acid to release gases, which remain entrained in the material.

1.2.1 Manufacturing

Unlike most other concrete applications, AAC is produced using no aggregate larger than sand. Quartz sand, calcites gypsum, lime (mineral) and/or cement and water are used as a binding agent. Aluminium powder is used at a rate of 0.05%–0.08% by volume (depending on the pre-specified density). In some countries, like India and China, fly ash generated from thermal power plants and having 50-65% silica content is used as an aggregate. When AAC is mixed and cast in forms, several chemical reactions take place that give AAC its light weight (20% of the weight of concrete) and thermal properties. Aluminium powder reacts with calcium hydroxide and water to form hydrogen. The hydrogen gas foams and doubles the volume of the raw mix are creating a bubbles 3mm (⅛ inch) in diameter. At the end of the foaming process, the hydrogen escapes into the atmosphere and is replaced by air.When the forms are removed from the material, it is solid but still soft. It is then cut into either blocks or panels, and placed in an autoclave chamber for 12 hours. During this steam pressure hardening process, when the temperature reaches 190° Celsius (374° Fahrenheit) and the pressure reaches 8 to 12 bar, quartz sand reacts with calcium hydroxide to form calcium silicate hydrate, which gives AAC its high strength and other unique properties. After the autoclaving process, the material is ready for immediate use on the construction site. Depending on its density, up to 80% of the volume of an AAC block is air. AAC's low density also accounts for its low structural compression strength. It can carry loads of up to 8 MPa (1,160 PSI), approximately 50% of the compressive strength of regular concrete.

1.2.2Advantages of AAC

Lightweight saves transportation charges of labour and save the cost. (550 kg/m3 - half of weight of light weight aggregate blocks) Larger size (6 times larger than brick) leads to faster construction and less mortar requirement for joining.

1.2.3 Fire Resistant

It has one of the highest fire resistance material used as a building materialin homebuilding. AAC are protected from fire protection around steel columns and steel beams and in the construction of shaft walls, stairwells, corridors and firewalls.

1.2.4 Environmentally Friendly

The process of manufacturing AAC uses only natural materials and no pollutants are produce which is harmful for environment.AAC is totally free of toxic or harmful substances. AAC a very eco- friendly building material. .

1.2.5 Breathable

It resist mold growth.

1.2.6 Good Sound Insulation Property

Its capacity of noise reduction co-efficient is more than twice that of a standard concrete block wall and over 7 times that of ordinary concrete.

1.2.7 Easily Workable

It can easily cut to any required shape, can be sawed, nailed and drilled easily even than wood.

1.2.8 Durable
With good resistance to sulphate attack.
1.2.9 Economic
No curing is required, labour cost is saved hence.

Fig no. (2) AAC block

1.3Insulated Concrete Form Wall
Insulated Concrete Forms (ICFs)are modular forms that are typically made from expanded polystyrene and assembled on site. Once the concrete is poured, the foam remains in place, providing full height basement insulation and basement walls ready for finishing.
The concept related the value of something is like an art as it is a science. This observation is particularly true of decisions related to a new home purchase. One person may determine "best" value by lowest cost or highest quality while another makes a decision purely on intangibles (i.e., comfort, aesthetics, "peace of mind").The to determine value, a homebuyer, builder, or designer should make informed about house construction options. This guide provides for that need by evaluating and determining the costs and benefits of using Insulating Concrete Forms (ICF) in the construction of a home or other similar buildings. By the several study it has been determined that using ICF wall construction generally adds about 3 to 5 percent to the total purchase price of a typical wood-frame home and land (about 5 to 10 percent of the house construction cost).
Following are the sum benefits of insulated concrete form wall
1.3.1 Structural safety: This factor involves the ability of ICF construction to resist damage and protect occupants from fire, wind, earthquakes, and flooding. The inherent strength of ICF construction against severe wind loads, including hurricanes and tornadoes, are most notable.
1.3.2 Comfort: Though somewhat intangible, comfort deals with important issues such as even distribution of air temperature in the home and the quietness or acoustical properties of the home. ICF construction provides improved reduction of "outdoor" noise relative to standard home construction practices.
1.3.3 Energy efficiency: Energy efficiency is the ability to maintain acceptable indoor living conditions (i.e., air conditioning or heating) at a low monthly energy cost. ICF construction, in general, provides improved energy efficiency relative to standard home construction practices.
1.3.4 Durability: This factor deals with a building or material's ability to resist rot, decay, corrosion, pest attack, and other forms of degradation that may occur over time. generallyconcrete is known to be highly resistant to degradation, there is insufficient data to provide meaningful comparisons to standard home construction.
1.3.5 Following are the benefits of insulated concrete form

1. ICF construction costs about 3 to 5% more than new construction building.
2. Relative to standard housing construction practices, ICF construction offers several performance benefits.
3. Based on any single benefit of ICF construction, it is generally more economical to consider upgrading standard wood-frame construction to achieve "equivalent" performance.
4. It is generally more economical or practical to consider ICF construction based on the collective benefits.
5. The individual performance attribute which has greatest technical significance to ICF construction is structural safety.


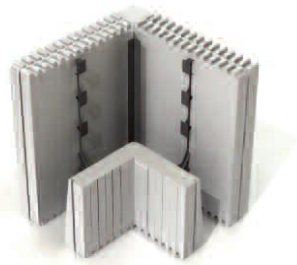

Fig 3 Insulated Concrete Form (ICF)

1.4 Plytanium Thermostat Radiant Barrier Roof Sheathing
Plytanium Thermostat Radiant Barrier Roof Sheathing is a Rated Sheathing plywood panel with an aluminum foil/Kraft paper laminate layer on one side. It is designed especially to reflect solar heat waves. In other words, it limits the transfer of heat from the outside (i.e. through roof) into the attic space. The bright aluminum foil is highly reflective; up to 97 percent of the radiant heat can be reflected away from the attic.
Plytanium Thermostat Radiant Barrier Roof Sheathing is specially designed for attic sheathing applications and reflects up to 97% of the sun's radiant heat from being absorbed into the attic of your home. Now, you can maintain indoor comfort while potentially lowering cooling energy consumption.

For new homes, additions or renovations, Plytanium Thermostat Radiant Barrier Roof Sheathing is an excellent roof sheathing choice. It's easy and payable and installs as easily as other roof sheathing. Plus, choosing Plytanium Thermostat Radiant Barrier Roof Sheathing can offer long-term savings by reducing cooling energy consumption.

1.4.1 Decrease in Energy Consumption

The cooling system can work more efficiently since there is lower radiant-heat transfer into the attic. Studies have shown that radiant barriers can reduce peak cooling energy consumption by up to 17 percent.

1.4.2Increase in Operational Efficiency of Cooling Equipment

The lower the temperature in the attic can enable the attic mounted air conditioning equipment and duct systems to operate more efficiently.it increases utilization of spaces.

1.4.3 Lower temperatures, greater comfort

Plytanium Thermostat Radiant Barrier Roof Sheathing can lower peek attic temperatures up to 30°F by reducing summer radiant heat gain into the attic.

1.4.4 Science behind the scenes

How does it work? If you've ever gone into an attic on a hot summer day, you know that radiant heat from the sun is typically absorbed into the attic as it passes through an ordinary roofing system. Plytanium Thermostat Radiant Barrier Roof Sheathing features quality plywood backed by a specially designed aluminum foil/Kraft paper laminate. The panels are installed foil side down facing the attic space. Since aluminum foil is highly reflective, up to 97% of the radiant heat is reflected from entering the attic space.

Why Plywood for Roofs?

Roof appearance. Minimizes "telegraphing" due to edge swell; a visible outline of the panel under the shingles may occur with OSB, but is very rare with plywood. Flatter roof. Plywood will deflect (sag) less between the rafters than OSB over time under high humidity, helping maintain a flatter roof longer than OSB. Less opportunity for shingle damage.

1 Pneumatically driven nails have a more consistent depth of drive into plywood than OSB resulting in less shingle damage.
2 Holds shingles firmly.
3 Higher load capacity than osb. suppose comparison between plywood and OSB ,The allowable uniform load and span rating for 15/32" plywood is higher than for 7/16" OSB, which means it can withstand heavier loads from snow and ice than OSB.

Fig 4: Radiant Barrier Sheathing

4. CONCLUSION

Many opportunities are available for materials advances to reduce the energy use and atmospheric emissions associated with the building sector. It will also improve the energy and cost energy and cost performance of walls, roofs, windows, mechanical systems, and on-site renewable electrical and thermal systems can all be improved through advances in materials. Materials that reduce energy use in both new construction and retrofitting and refurbishment projects are needed the demand of building material rising with the need of housing in both rural and urban area. Resources used to manufacture Construction materials affected the environment by depleting natural resources, using energy, and releasing pollutants to the land, water.

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