Sustainable Infrastructure Communities and adapting to Global Climate Chaos

Its combination of energy efficiency, structural solidity, resource conservation and low construction costs heralds a radical change in the way homes and communities around the world can be designed and built. With the ability to accommodate the ultimate in creative expression due to it's design flexibility. The construction method may include such perks as tax breaks, generation of greenhouse gas credits, reduced insurance premiums and lower maintenance costs.

The ultimate in extreme weather housing, the insulation provided by the composite materials is effective enough that the house can be heated or cooled using less than half the energy it takes for a home built with conventional materials. The foam / concrete house also can is more resistant to fire, mold and pests than typical homes, and better able to withstand such hazards as earthquakes, extreme weather, climate conditions and flooding with it's resistance to water. It natural resistance to pests both insects and rodents reduce the costs associated with pest control, exposure to toxic pesticides and the diseases transmitted by them. It's available non-porous interior designed without cracks and crevices makes sterilization and cleaning a breeze. The use of a natural non-toxic residue free biocide, anolyte solution, the same used by the human body to destroy pathogens, created using salt water and sunlight reduces the risk of contagions producing disease.

Compared to other environmentally sensitive, energy-efficient construction methods this technique used for the foam house is better by every measure. The method may have its greatest potential for a significant impact in Third World nations. Foam / Concrete composites buildings could be the answer to housing growing populations more affordably, as well as more securely, particularly in regions threatened by extreme climate chaos or prone to earthquakes. Optimized for countries that do not have wood, steel, and other materials for infrastructure, or which can be very expensive in those that do have the resources. It can take months or up to three years to build just one house, with this approach a house can go up in a matter of days.

Test results also scored well in the Scottsdale Green Building program. The components rated very high 80-points, indicating sustainability. In terms of energy conservation, materials reduction, and other environmental elements, it proved exceptionally earth friendly. The buildings conserve raw materials by eliminating the need for conventional structural components such as wood or metal framing, straps, nails, wallboard, stucco, and insulation. The structures are energy-efficient, with an energy rating of R40 in the walls and R100 for roofs. Typically found in homes, fiberglass blankets of insulation have a nominal R-value rating of less than half of polystyrene foam. Higher R-values translate into less energy consumption for heating and cooling. It replaces every structural component, including walls, floors, and roof, providing a near air-tight-building envelope.

The new construction method and material is being targeted for use in 45 acre spiritual retreat, conference / workshop center, pod housing and sustainable living prototype in New Mexico. One using surface soil remineralization in place of petroleum based fertilizers and pesticides and Amaranth as a food staple.

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The new composite building system features a patented a building technique and material composed of expanded polystyrene foam coated with a structurally reinforced concrete composite. These materials form an incredibly strong bond to withstand building loads. Fibers are disbursed throughout the matrix of the composite, which makes the material three to five times stronger than steel. The foam cores are over 98% air and provide the means to hold an outer concrete skin that gives the structure its strength. When completed the structure is a single seamless structure multiple components becoming one very solid structure without cracks or crevices or structure weakening joints.

These bonded components are inexpensive to maintain, durable, and resistant to fire, mold, pests, earthquakes and extreme weather and wind conditions. The structure also provides superior insulating qualities reducing the energy requirements for heating and cooling if needed.

The structures can also be supplemented with additional technology to provide shielding from electromagnetic radiation and turn the structure itself into a large solar cell allowing for a distributed decentralized energy infrastructure with each unit able to feed the grid with surplus energy when equipped with battery storage. Each unit is intelligently connected to a wireless mesh communications network supported by each individual unit connected to all the rest as one contiguous whole, for voice, data, and video. This allows hospitals and manufacturing facilities to negotiate energy draws from each individual unit providing fail safe distributed energy architecture.

The technique binds the lightweight foam and a glass fiber-reinforced concrete. Crucial to this method becoming viable is a special computer program that takes an architectural design and slices it up into pieces allowing the data to be fed to computer controlled foam cutters, which produce the pieces for easy assembly. The light weight foam pieces allow large panels to be lifted into place by a single worker.

The architects CAD/CAM design is processed generating digital instructions that directed a robotic foam cutter to accurately carve the polystyrene shapes required for the building. The end result is a set of building blocks that may be curved, angular, or the more traditional square and rectangular shapes. These individually fashioned pieces are assembled onsite like LEGOs. The rectangular panels range up to four by eight feet. Exterior walls are eight to ten inches thick, and interior walls are four inches thick. Patented roof beams, manufactured out of polystyrene foam and concrete composite, are thirty-inch thick supports. The box frame design is much stronger than conventional construction. This increases the maximum span without requiring internal supporting walls or posts. “Clear Span” construction provides the designer free reign to use up to 40 feet of unobstructed space between walls.

After assembly with a special adhesive, the foam is spray coated with cement creating a single one piece unit.

Special tools, such as nail guns, electric saws, or compressors, are not necessary in the construction of a home. In actuality, the most unusual machine needed during construction is a hotwire tool that is used to cut out windows, doors, or other openings from the foam blocks. Any mistakes are easily fixed with a handheld foam gun. It’s a forgiving system that can be repaired easily with unskilled labor. A worker can be taught to do the job in two or three days. And it is a lot easier than wood frame construction.

The fusion of the foam and a glass fiber-reinforced concrete materials offers enough strength and durability to construct a house without using any standard framing or reinforcement — wood, steel or otherwise — and without a single nail, bolt or screw. The result is a seamless single piece structure limited in form only by the imagination the design whether it be a conventional ranch, English Tudor, adobe or any style that could be imagined including a house without right angles and only curved surfaces.

The other important achievement making this technology viable is a patented method of predicting the performance of the structural members of an entire building composed of these composites. Traditional composite materials have had limited application in the building industry because there have been no practical means for predicting the performance of buildings using composites as structural members. Desktop computing in the last few years advanced to the point where a program could simulate the effects of earth movement, wind, snow load, and other natural forces on these composite structures. The drawings of the proposed building are used in concert with a mathematical program called Finite Element Analysis. FEA is used to predict the performance of the structure against the forces of nature. A performance record of the building is available for review by architects, builders, and local building authorities.

One major milestone and proof of viability was the passing of a series of durability tests that conform to International Commercial Code (ICC) standards. ICC requires a myriad of tests performed by an independent laboratory for fire, aging, x-rays, water absorption, freeze/thaw, salt spray, water penetration, seismic, and structural strength. it is clear from the computer modeling that all aspects of structural concerns can be met with this technology – wind, earthquakes, ground settling, etc. which may become much more important in the near future with the threat of Global Climate Chaos.

If the construction method is applied on a large scale, an economy of scale is created resulting in costs well below those built with conventional materials. Build time is very short, a few days, which means a large number of units can be built and habitable within weeks making it appropriate for rebuilding large areas ravaged by extreme weather, earthquakes or other destructive forces.

The walls consist of 8-inch-thick blocks of polystyrene coated with a quarter inch thick "skin' of the fiber concrete. The layer of concrete is too thin to work just by itself and the foam is too weak to work by itself. But when bonded together, the result is something to marvel at perhaps qualifying as a miracle material.

The Composite, is poised to transform the construction industry by being stronger, more design-flexible, less expensive and more sustainable than conventional building materials and methods. It has the potential to fundamentally change the way construction companies conceive their projects, now that advanced computer age technologies have caught up with the imagination of architects and builders to create better and energy efficient structures. The composite introduces 21st century science, computer technology and mathematics to an industry that still relies heavily on products and techniques popularized in the 19th century and used ever since.

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