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NEW TYPES OF SUSTAINABLE WALL ELEMENTS FOR PREFABRICATED HOUSES

PhD Minka Ćehić, Assistant professor
University of Bihać, Faculty of Technical Engineering Bihać
Ul. Dr. Irfana Ljubijankića bb, Bihać
Bosnia & Herzegovina

PhD Salah–Eldien Omer, Professor
SAG CONSULTING d.o.o.,
Vramčeva 17, Zagreb
Croatia

ABSTRACT
In sustainable construction of new buildings are used sustainable construction methods and materials, thereby reducing noise, pollution and waste in urban areas, reducing energy consumption and thus the impact on the environment (local and global). Sustainable buildings are economically efficient, environmentally friendly and protect natural resources. Such objects are for users comfortable and healthy.
In the paper will be presented new types of sustainable wall elements for prefabricated houses.
Keywords: sustainability, sustainable construction, prefabricated buildings, wall elements

1. INTRODUCTION
At the present time very much and often talk about sustainability and sustainable development. Under the concept of sustainability implies the ability to satisfy their own needs without compromising future generations in meeting theirs. Sustainability can be (and at the same time) and ideas, and a way of life, and the method of production and method of construction.
The importance of those performance house that affect sustainability in the broader sense is clearly recognized. Approximately 40% of total energy consumption in Europe is related to the construction sector, and he causes about 1/3 of CO2 emissions. More than 50% of all materials which are produced underground exploitation of mineral resources and 25% of the total amount use wood mass used for the production of construction materials and other construction needs. Also, the total amount of water used in the world, 16% is used in the construction industry. Moreover, according to the EU Directorate General for Environment (DG Environment), construction is one of the sector that produces the most waste in the European Union (450 million tons per year, representing about a quarter of the total amount of waste created in Europe). However, the importance of construction is not only looking at its impact on the environment. The practices applied in the construction affect the key aspects of social life such as the availability of services, comfort, health, protection and safety, in a word - the overall quality of life of citizens. At the international and European level and at the level of individual countries there are a number of methodologies for assessing the sustainability of buildings, of which the most important are: "LEED" (Leadership in Energy and Environmental Design), "BREEAM" (Building Research Establishment Environmental Assessment Method), "SBTOOL "," DGNB "(German certificate for sustainable buildings), or "LEnSE" (Label for Environmental, Social, and Economic buildings). The philosophy of sustainable construction is based in the pursuit of achieving as close to zero negative impact on human health and the environment. He wants to achieve the following goals: zero energy, zero water, zero waste, zero emissions, zero carbon and zero ignorance.
Sustainable construction means that the actual building used sustainable materials, safe building practices in line with new construction technologies. This means that the construction of new buildings using sustainable construction methods and materials, which reduces noise, disturbance and waste in urban areas, reducing energy consumption and thus the impact on the environment (local and

global). Sustainable buildings are economically efficient, environmentally friendly and acceptable, and protect natural resources. These are the building for users comfortable and healthy. From the point of view of thermal insulation of buildings, sustainable construction means enabling a comfortable environment with minimal costs for heating and cooling buildings. Reducing the cost of heating and cooling is directly linked with the need for energy. With sustainable construction we achieve that buildings consume less energy, and thus the least burdens the environment with discharges of harmful substances in the process of production, circulation and consumption.

2. SUSTAINABLE SYSTEMS FOR CONSTRUCTION OF PREFABRICATED BUILDINGS

The definition of sustainable construction system entails the use of materials and energy from environmental systems, and the construction, which will provide the comfort of human life and prosperity. A careful analysis and selection of materials and the way they are combined can provide significant improvement in convenience and cost-effectiveness of home and greatly reduce environmental impact during the life cycle. Important factors that could affect the choice of construction systems their endurance, life-cycle of environmental impacts, life cycle cost-effectiveness, role in improving the thermal properties, reuse or recyclability and the availability of local materials and skills required to build the system. The first step in any strategy for the use of sustainable materials is a reduction in demand for new materials. In this respect, it is recommended the use of natural materials or materials obtained through recycling.

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3. SUSTAINABLE WALL ELEMENTS FOR PREFABRICATED HOUSES

In developing sustainable wall systems need to be observed the following principles:

- Use low - influential materials (non-toxic, for example, recycled concrete and brick as aggregates for concrete production; recycled glass bottles and alternatives to mineral wool and other insulating materials which together can replace less environmentally friendly option.
- Energy efficiency - use modern manufacturing processes and efficient technologies to create energy efficient and sustainable products which require less energy to produce
- Quality and durability - (durable, high - performance product that requires less frequent replacement, which reduce the overall manufacturing impact
- Design for reuse and recycling - use recycled resources in manufacturing of recycled products. Use of materials that originate from rapidly renewable sources which will not become depleted in the future, unlike products made from oil.
- Low embodied energy - take into account whole life cycle energy usage, for every resource and final product.

Under construction of prefabricated buildings today are commonly used modular construction system. At the same applies in site and framework construction systems. All structural systems can be customized to meet a good level of energy efficiency, but some of them provide the fulfillment of these requirements to the highest standards.

In the case of framework systems wall panels are installed in wooden or steel structure. Wooden frames characterized by several important characteristics: they are made of wood which is a renewable, environmentally friendly material (organic and non-toxic material) in comparison with e.g. Brick requires significantly less energy to produce, process and transport, upon the expiry of usability framework of the building, material is used (wood) can be reused or recycled.

The construction of wooden prefabricated houses, the following systems: open panel systems, closed wooden frames, and structural insulated panels. Open panel systems are typically used to create interior walls. The frame of the panel is made of soft wood, covered with construction material such as plywood or OSB, waterproof membrane on the outside and open the inside. In the selection of plywood or OSB board takes into account the low emission (e.g., formaldehyde). Windows and doors are installed at the site after the presentation of all electrical and other installations, setting up home insulation (waterproof insulation, vapor barriers, etc.). The built-in windows and doors must have a low coefficient of thermal conductivity. The insulation to be installed in the panels of wood, pulp, wool, straw, hemp and similar environmentally friendly materials.

Figure 1. Wood fibre wall insulation in section

Figure 2. Softbatts Sheep's Wool Insulation

Figure 3. Straw Paneling System

Most Scandinavian companies use closed frame and advanced panel systems. The panels are supplied fully furnished and insulated, fitted with windows and doors in them. The advantage of these panels is a hermetic structure that requires minimal on-site, as well as good thermal protection.

Structural insulated panels (SIPS) are high performance building panels used in floors, walls and roofs. The panels are usually made of a sandwich of insulating core of rigid foam of polyurethane (PU) or expanded polystyrene (EPS) between the layer of OSB / 3, but can be used and other flat materials. These panels are manufactured in a factory-controlled environment and adapt to the design of each house. The system is a closed timber-frame panel, usually comprising 140mm studs sheathed both sides with Oriented Strand Board (OSB) and filled with Polyurethane foam insulation or foam of expanded polystyrene (EPS). he interior side of the panel is faced with a heat reflective membrane and an air gap is left between it and the internal wall cladding. The exterior side is faced with a breathable waterproof membrane and 50mm of cavity insulation. U-value this of wall is 0.113W/m2K and negates the need for 'central' heating, while the SIP panels with a core of EPS foam 0.10 W / m2K.

There are no studs or framing members for structural purposes. SIPs share the same structural concept as an I-beam. The rigid EPS core of the SIP acts as the web, while the OSB sheathing exhibits the same function as the flanges. Other facings can be used if required (plywood, pressure-treated plywood, cement board, magnesium oxide board, etc.) but through extensive research, it was shown that OSB is the most efficient and versatile.

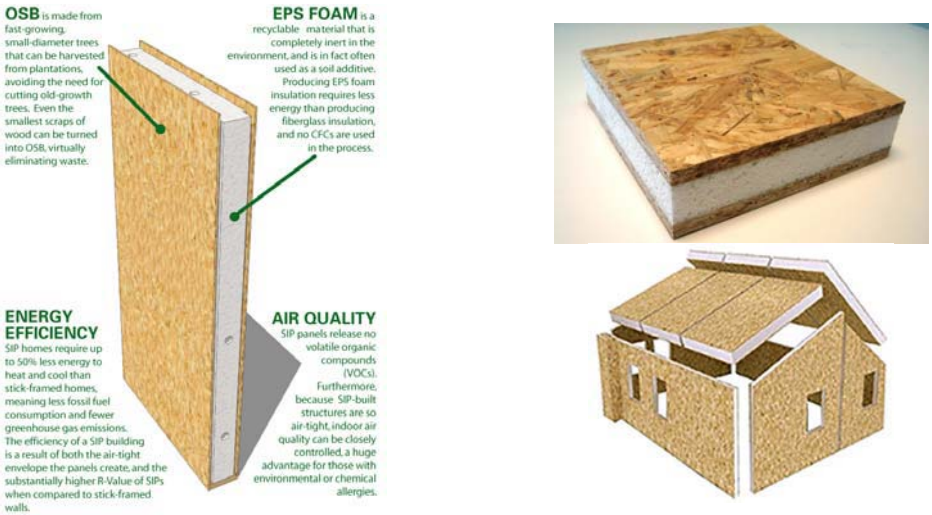

Figure 4. SIP paneli structural insulated panels

To create sustainable walls can be applied in addition to wooden frames and steel frames. Steel is an excellent reusable material. Steel can be recycled many times without any degradation of properties in terms of performance or quality. Steel construction has excellent low waste credentials during all phases of the building life cycle. It generates very little waste, with the byproducts of steel production widely reused by the construction industry. Any waste generated during manufacture is recycled. There is virtually no waste from steel products on the construction site. In addition to the main structural framework, the various parts of a building can be built using sustainable products and components. Improved environmental performance of concrete wall panel system is assessed considering the entire life cycle of components (concrete and insulation as well as wall panel system as a whole). Technology deals with three major environmental problems: the reduction of greenhouse gas emissions for the energy efficiency of buildings, increase the efficiency of resource use CDW (50% of the total number of aggregates obtained from CDW for the production of records) and reducing the use of chemicals regulated with phenol and formaldehyde in the production process of insulating materials. Besides the main structural frame, the various components of a building can be constructed using the sustainable products and components. One very good example is the use of drywalls with plasterboards or fibre-cement boards as internal walls, which is gaining popularity among the private residential projects. The constant improvement in its performance means that it now meets high level specifications in the areas of acoustic insulation, thermal insulation and resistance to fi re and damp conditions. Drywall is an ecological product, applied dry, generating no waste and pollution. Fly Ash, a by-product of coal burning power plants can be substituted for energy intensive cement. Tire Rubber, recycled post-consumer aggregate, ceramic microspheres, industrial byproducts can be added to concrete. Concrete with these admixtures requires less cement and has greater insulation value and less weight: Use high strength concrete only where it is required and avoiding long spans (greater than 10 meters) or column plan shifts saves concrete and reinforcing steel. Industrial waste materials as lightweight aggregates to replace sand in mortar. The use of interlocking CMUs (requiring no mortar) is ideal for landscape retaining walls.
You can apply many other materials such as natural mineral paints (washable, free of toxic chemicals, free of asthma-gens, hypoallergenic, and permeable, prohibit bacteria that form the mold, and absorb CO2 (the Sick Building Syndrome, however). Biobrick ("employs bacteria to produce natural cement within a mix of asphalt), Reinforced Wood Wool Cement Board (versatile building material made from wood wool and cement. The wooden pole in the board results in a constructive element. It can be used for walls and roofs. Boards are fire-resistant, waterproof, rot-resistant, termite- and vermin-resistant, insulating, sound-absorbing, free of harmful emissions, and accept a wide range of finishes (Reinforced Wood Wool Cement Board).

4. CONCLUSION

Finding solutions to reduce the negative impact that human activities have on the environment, the task of all industries. Building construction as one of the largest consumers of natural resources and environmental pollutants that should be the primary task. Sustainable construction reduces the impact of construction activities on the environment, and is based on the promotion of building materials that are not harmful to the environment, energy efficiency of buildings and waste management throughout the life cycle of the building from construction to demolition.
In designing the wall elements for prefabricated buildings, regardless of whether the supporting structure of wood or metal, it is possible in accordance with the principles of sustainable construction use new types of materials. The paper presents several examples of sustainable wall elements for prefabricated buildings.

5. LITERATURE

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