

www.cqim.rs

**1<sup>st</sup> QoL**  
**QUALITY**  
**RESEARCH**

ISBN 978 - 86 - 6335 - 033 - 5

**1<sup>st</sup> International**  
**Quality Conference**  
**on Quality of Life**

**09.06.-10.06.2016. Center for Quality, Faculty of Engineering, University of Kragujevac**



- Theoretical Approaches**
- Empirical Approaches**
- Local, Regional and Global Quality of Life**
- Sustainable Development and Quality of Life**
- Freedom and Quality of Life**
- Quality and Quality of Life**
- Impact of development science and technology on quality of life**
- Methodology of Quality of Life and Happiness**
- Management of sustainable development**
- Current Issues**
- Perspectives of Quality of Life**



**09.06.-10.06.2016., Kragujevac, Serbia**

**1<sup>st</sup> QoL**  
**QUALITY**  
**RESEARCH**

Tea Spasojevic-Santic<sup>1)</sup>  
Daniela Stanojlovic<sup>2)</sup>

1)IMS Institute, Serbia,  
tea.spasojevic@institutims.rs  
2)University of Novi Sad  
Faculty of Technical Sciences,  
Serbia, [stanojlovicb@sbb.rs](mailto:stanojlovicb@sbb.rs)

## EARTHSHIP – A NEW HABITAT ON EARTH FOR QUALITY LIFE

**Abstract:** *The general view is that people have good quality of life when they meet their basic needs for shelter, food and water. An earthship is a type of passive solar house made of natural and recycled materials. Behind the earthship concept is 40 years of research and thousands of built self-sufficient buildings that are green in its materials and energy efficiency. The quality of life of its residents is reflected in a state of wellbeing as they live- off- grid, without bills, growing their own food and living in a harmony with themselves and with nature. Therefore, this paper shows that the Earthship concept is an excellent example of a sustainable quality of life.*

**Keywords:** *Earthship, New Habitat, Quality of Life*

### 1. INTRODUCTION

We have a lot of opportunities to use or reuse construction, demolition and other types of waste, but we are using just a small part of it. At the same time, we are putting huge pressure on natural resources demanding new construction materials and the Worldwatch Institute predicts that by 2030 we will run out of many natural resources [1].

The main barriers for wider use of waste materials in construction are: waste disposal costs are often smaller than the costs of recycling of the same materials, limited research in the field and inflexible building codes [2].

Moreover, the future of construction, which aims to be green, is putting strong accent to use local materials, readily available, reused and renewable resources. More recent example is Earthship Biotechnology which uses old used tires, cans and glass as a building material.

### 2. RESEARCH METHODOLOGY

Through eConzortia KoBSON (Library Consortium of Republic of Serbia) and EBSCO Discovery Service (EDS) we have performed a search based on the key word „earthship“.

The result came back with 882 entries found in the library collection. The majority of the results are in the magazines (380), then news (82), and academic journals came third with 66 entries.

We have decided to focus solely on academic journals in this research and after applying two more filters (selection of publication and time frame of past 10 years) - new result was 19 articles. The next step was to read carefully titles and abstracts and to discard all those articles that do not fit to our scope, theme and subject.

Furthermore, we have performed a detail search of other relevant sources and have found additional material in the form of books, thesis, rule book, etc. The same criteria has been applied for these additional sources (time framework and selection of publications), whereas the only exception were the books written by Michael Reynolds, the author of earthship (published in 1990).

### 3. EARTHSHIP CONCEPT

The Earthship concept was created by Michael Reynolds, an architect, in the early 1970s. As he said in his book earthship is “a self-contained vessel capable of sustaining an environment for human habitat on its own, through its own interfacing with natural phenomena” [3]. It is a type of passive solar house that is made of both natural and recycled materials (such as earth-packed tires).

The biggest community with growing number of earthships built is in Taos, New Mexico. Back in 2007 planning approval for the first earthships in England has been granted.

These earth-sheltered constructions have been analyzed in 2009 for their benefits of reducing thermal effects of global warming. The researches show the effectiveness of the thermal charging and discharging in heavy weight constructions, like earthships. The result is moderation of extreme external temperatures. The thermal store in earthship regulates the room temperature by absorbing the summer heat and releasing it in the winter [4].

The main material for the earthship (after soil) is used tires. The use of old tires is regulated in Republic of Serbia with the Law on Waste Management and a set of rule books. According to the Law on Waste Management used tires belong to so called special waste streams and all the information on produced tires, recycled or other way treated tires needs to be recorded and reported [5]. If we just look at Tire code, and article on treatment of used tires there are just two ways that discarded tires can be used and that is: to recycle them or to use them as energy source - Rule Book on the Method and Procedure of Waste Tire Management [6].

Earthships have been built or are under construction in following European countries: Portugal, Spain, United Kingdom, Denmark, Estonia, Sweden, Belgium, France, Czech Republic, and Netherlands [7]. All of the European earthships have been built as projects of non-profit organizations due to construction laws and building codes.

### 3.1. Structure of an earthship

In the combination of known techniques such as thermal mass and passive houses lies the origin of the first Earthships. Techniques, systems and designs have changed vastly throughout the years, each new model improving the one before [8].

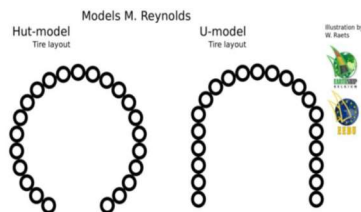


Figure 1. First modules of an Earthship

The first model created was the Hut-model which is essentially a tire circumference. This

evolved to the base of all future models, the U-model (Figure 1).

The Hut-model opened up creating a straight façade where the greenhouse was added. There Huts and U's were combined to create a house as big as the client desired.

The floors and roof are covered by existing Constructions Lows and Regualtions, and the only unconventional material is tire.

Tire walls are load bearing walls in the structure of an earthship. They are so wide, actually much wider than required foundations and the first layer is placed into undisturbed soil that they become monolith and are both wall and foundations. All of these walls must have bonding beams made of wood or concrete [2,3].

Earthship as a structure needs to take two groups of load: horizontal and vertical load. Earthships are buried in soil which surrounds the structure from three sides and is considered as horizontal load on the structure [3,8]. The only open side is the façade facing south and this side takes the horizontal load from wind. Vertical loads come from self-weight, use and gravitation loads (Figure 2).

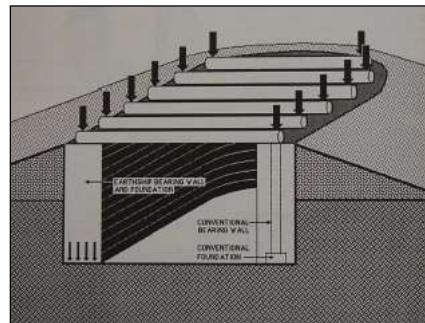


Figure 2. Load transmission

### 3.2. Materials

The main properties that make a material suitable for an Earthship are [3,8]:

- The materials must be found locally. Indigenous.
- Recycled.
- Natural.
- Low energy used during fabrication or transformation.
- Dense if being used for thermal mass.
- Durable and resilient (if built in an earthquake territory).

- Easy construction. Unskilled labor must be able to build the house. The materials must be light enough to be manipulated by man, and the construction solutions must be simple to execute.

The use of tires, glass, and plastic bottles is not actually a form of recycling. It is more a method of down-cycling where the materials can never be reused in the future [2].

In Republic of Serbia 26.000 t of used tires is collected each year, and it is estimated that 50.000 t are disposed to landfills [9].

Partition walls inside the Earthship are non-load bearing and they are made of cans and bottles which are placed in layers and glued with a mixture made of clay, sand straw and water. They are being executed in two forms: as framed structure (framed with wooden beams and filled with can/bottles and mud) or free form (without the frame).

### 3.3 Water System

Earthship houses are not connected to a centralized source of water [8].

The Earthship catches rain water and uses it four times over before disposing of it. The way that this is done is the roof of the Earthship catches rainwater or melted snow and channels it through a filter into cisterns [10]. Figure 3 show a diagram of the water system.

### 3.4. Sewage System

The black water that comes from the toilets needs to be treated before we return it in the ground. The creators of earthship suggest to use compost toilets or septic tanks [3,8].

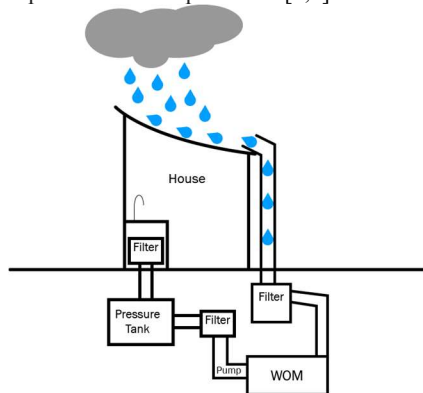


Figure 3. A diagram of the water system

### 3.5. Energy efficiency

Earthship, like any other home can have lighting, electronic devices (TV, computer, stove, fridge, etc.). The electricity needed for these appliances comes from solar panels and/or wind power. The energy collected in this way is stored in batteries for later use.

Earthship is a zero energy house, as it creates enough solar and wind energy to cover its needs and a passive house, because it captures energy thanks to the materials used and construction techniques applied [8,10].

## 4. LIFE IN AN EARTSHIP

Quality of life (QOL) is the general well-being of individuals and societies. It is very important to highlight that QOL has a wide range of contexts including: economic state, healthcare, education, politics, employment, environment etc.

Michael Reynolds mission statement when he was founding Earthship Biotechnology [3] consisted of:

- evolving the way humans live on this planet by evolving existing methods of living, home by home.
- making small, believable steps toward slowing down and ultimately reversing the negative impact of human development as it relates to the Earth's ability to continue to support life.
- to present these steps in a way that affords easy understanding and inspires people to act.
- to empower people to make positive changes in their own lives to reduce their personal effect on global warming.
- to build homes that are self reliable.

The inhabitants of an Earthship are enjoying simpler life as they are free from the utilities bills, mortgages, homeowner fees, etc. Earthships claim to be independent to food, materials or monetary system [8].

## 5. CONCLUSION

We can conclude that if we manage to divert our focus from anthropocentrism to

biocentrism we can reduce the stress on both-ourselves and the planet.

Bearing in mind that Earthship concept fulfills elementary human needs to the already

existing activities of the planet we can all agree that an Earthship is a new habitat on Earth for sustainable quality of life.

## REFERENCES:

- [1] Gorgolewski, M. (2010). Urban Salvation. *Alternatives Journal (AJ) - Canada's Environmental Voice*, 36(4), 30-33. Retrieved from: <http://search.ebscohost.com.proxy.kobson.nb.rs:2048/login.aspx?direct=true&db=aph&AN=52104458&site=eds-live>
- [2] Kennedy, S. A. (n.d.). *Waste materials: A study of their potential*
- [3] Reynolds, M. (1990). *Earthship: How to Build Your Own* (Vol. 1).
- [4] Ip, K., & Miller, A. (2009). Thermal behavior of an earth-sheltered autonomous building – The Brighton Earthship. *Renewable Energy*, 34(9), 2037-2043. doi:10.1016/j.renene.2009.02.006
- [5] Law on Waste Management (2016). *Official Gazette of Republic of Serbia*, no.36/2009, 88/2010 and 14/2016.
- [6] Rule Book on the Method and Procedure of Waste Tire Management (2009). *Official Gazette of Republic of Serbia*, no. 104/2009 and 81/2010.
- [7] The Map of the Earthships Built or Being Built in Europe. (2016). Retrieved from: [http://eebu.earthshipseurope.org/index.php?option=com\\_gmapfp&view=gmapfp&layout=categorie&catid=46&id\\_perso=2&Itemid=107](http://eebu.earthshipseurope.org/index.php?option=com_gmapfp&view=gmapfp&layout=categorie&catid=46&id_perso=2&Itemid=107)
- [8] Quintana, F.C. (2012). EARTHSHIPS-Do they have a future in Denmark? Dissertation. *Bachelor of Constructing Architecture*.
- [9] Stanojevic, D., & Toskovic, D. (2011). Used Tires Management, Achievements in the World and Situation in Serbia. *Hem. Ind.* 65.doi:10.2298/HEMIND110729061S
- [10] Resarch 5 Earthship Systems – Water Cycle. (2011). Retrieved from: <https://justinsmediaclassblog.wordpress.com/2011/09/14/resarch-5-earthship-systems-water-cycle/>