Green Building Technology with the Principles of Yangsheng: Environmental Ecology Creating and Computer Simulation in Green Building

Wenqin Huang¹*, Yuhui Yang², Defei Liu³
¹Department of Philosophy, Southwest University, Chongqing, China, 400715
²Department of Philosophy, Southwest University, Chongqing, China, 400715
³Center for Studies of Education and Psychology of Ethnic Minorities, Southwest University, Chongqing, China, 400715

*Corresponding author e-mail: huangwenqin48@163.com

Abstract. A green building is based on the concept where the building process is harmless, energy consumption is low and balance between human and nature is achieved, creating an external living environment that can promote physical and mental health. This article discusses Green Building Technology (GBT) with the principles of Yangsheng from four aspects: the combination of GBT and theme of Yangsheng, design principles of Yangsheng in GBT, Creating Environmental Ecology of Yangsheng in GBT and computer simulation in GBT related to Yangsheng. It provides a possible way for the development of the green building industry in the future.

Keywords: Green building Technology, Yangsheng, Environmental Ecology, Computer Simulation

1. Introduction

GBT is a construction method with the minimum building resources consumed and in harmony with the environment. It includes green equipment technology, green envelope structural design, green space design, etc. As the traditional wisdom of China, "Unity of human and nature "天人合一": harmonious relationship between architecture and nature is the main approach of Yangsheng "天人合一". Putting Yangsheng in GBT is to promote the physical and mental health of the human beings through the
appropriate natural, external and home environment. It not only creates a healthy living environment and condition for residents but also provides an opportunity for harmonizing modern and tradition in China.

2. Combination of GBT and theme of Yangsheng

2.1. The concept of natural harmony in GBT

The concept of green building was proposed by American architect Paul Soller in the 1960s. After the contribution by other architects, the United Nations published "Our Common Future" in 1987 to establish sustainable development. In 1990, the first green building standard report was published in the UK. In 2004, the Ministry of Construction, China, embraced a new era by launching the "National Green Building Innovation Award".

The main idea of green architecture is living in harmony with nature which human beings have been exploring since ancient time. Green architecture achieves the sustainable development with long term benefits, including environmental friendliness, low resource consumption, and minimization of construction waste, leading the construction industry towards friendliness and sustainability.

3. "Unity of human and nature" achieves Yangsheng's goal of physical and mental health

Zhuangzi (369-286 BCE) was the first person to use "Yangsheng" to describe cultivating life, promoting health and pursuing longevity, which includes maintaining physical and mental health, being in harmony with the environment and society, under the most important principles of Yangsheng: "Unity of human and nature "

The theme of Yangsheng is to create an external and domestic living environment in harmony with nature which promotes health and longevity. Putting Yangsheng in GBT is to create a healthy living environment and condition for residents.

4. Design principles of Yangsheng in GBT

4.1. Physical health: green and eco-friendly

The materials for green and healthy buildings should be non-polluting, durable, recyclable, and high in performance. Environmentally friendly interior materials such as plates, composite wood, paints and coatings, adhesives and sealants should be selected. The use of which can prevent the generation of harmful substances such as VOCs in indoor air at source.

Noiseless design necessitates the use of sound insulation floor slab, enclosure structure, household walls, exterior windows, doors with effective sound insulation to reduce noise. Because excessive noise impacts people's health adversely, thick glass for windows, silent pipes, and the sound insulation of the inner and outer structures should be used to reduce noise.

4.2. Mental health: art and aesthetics

Aesthetics and art can satisfy people's emotional and aesthetic needs. Art can soothe people's souls and
rehabilitate spirit. Therefore, aesthetics design must be incorporated in the whole design of the green building.

Effective use of the local natural environment in design can promote local residents’ mental health, Therefore, architectural design for green building must reflect the local cultural characteristics and customs to cater to the local cultural psychology.

4.3. In harmony with Nature: energy saving and environmental protection

The concept of low energy consumption and improved resource utilization should be incorporated always. Resource utilization mainly includes saving materials and land, making full use of resources, avoiding waste of resources and using sustainable and renewable resources, such as water energy, electric energy, land, materials, etc.

Environment polluting construction and domestic waste will be generated during construction. It is necessary to strictly manage waste by establishing a waste recovery and treatment system, and improve the waste classification treatment system to avoid damage to the environment.

4.4. People-friendliness: natural and comfortable

"People-friendliness" during the building design, function and area allocation stage setting is important for health, safety, harmony and privacy, suitability and comfort of personal life. Using intelligent control system, integrated with GBT principle, such as the hydropower system, air conditioning system, monitoring system, and lighting system will provide convenient and comfort for residents is an effective way to meet "People-friendliness".

In building’s layout design, it’s important to provide comfort by using local natural resources and elements rather than artificial elements. For example, natural design will help people enjoy life and relax more. Natural design also help people access the state of self-cultivation 修身养性, and achieve the goal of Yangsheng.

5. Creating Environmental Ecology of Yangsheng in GBT

5.1. External ecology: integration with the natural environment

Ecology of site selection: natural scenery and suitable climate. Ancient Yangsheng people always chose a natural environment with a fresh environment, fresh air, sufficient sunshine, pleasant climate and beautiful scenery to live, because living with a scenery of green hills and the waters is a suitable external living environment which can promote health and longevity. Suitable climate refers to fresh air, sufficient sunlight, and a pleasant climate. In the design of the building, we need to choose building site by analyzing the local environmental-climate data, using suitable building materials according to local weather conditions, and arrange the building structure according to the climate, light, natural conditions.

Ecology of community: combined with Nature and Humanistic Environment. In the design of the green ecological structure in building, reasonable green space with trees, flowers, ponds, fountains, rockery, etc. should be allocated. This will promote the physical and mental health of the residents. Architectural design also should be unified with surrounding environment, without affecting the local
cultural landscape by integrating with local culture, characteristics and customs.

5.2. *Internal ecological environment: make full use of natural resources*

Ecology of Space design: using natural resources. New natural energy resources, such as solar and wind energy should be used in green building. For example, High-performance envelope structure, shading design, natural ventilation, sufficient sunlight, natural lighting, solar hot water, solar photovoltaic, efficient energy-saving lighting, high-efficiency water-saving appliances are effectively ways to use natural resources. In the interior design, we need to make full use of natural light and arrange the lamps in a reasonable position. The light environment simulation technology can be used to design the direction of the building and the position of the windows and doors to get sufficient sunshine, which can enhance physical and mental health of the residents.

Ecology of Living condition: healthy and safe, Comfortable and convenient. The living condition refers to fresh air at comfortable temperatures, water from recycled system, and garbage with proper disposal. Water-saving appliances such as inductive(touch)-type faucets, water-saving nozzles, water-saving toilets, water-saving washing equipment, water-saving showers in kitchen, toilet, bathing, and laundry must also be convenient and comfortable for user.

6. *Computer simulation in GBT related to Yangsheng*

6.1. *Digital assessment and integrated technology used in green building*

Digital assessment is important in the practical application of GBT, the quantitative analysis method by computer science can be used to assess the feasibility of the design scheme. For example, the consumption of building energy can be evaluated digitally to manage energy consumption by establishing a mathematical model.

Integrated used also can be used in green building. An intelligent control system, organically combining the hydropower system, air conditioning system, monitoring system, and lighting system, designed by Internet Technology, provides a comfortable and convenient living condition to residents.

6.2. *Computer simulation of the real scene: 3D design*

In external design. BIM technology, combination of the modeling software(Revit) and the energy consumption analysis software(Ecotect), used to choose building site by simulating the surrounding environment. BIM technology can help make appropriate arrangements for the building structure by simulating the local climate, light, natural landscape in three-dimensional(Figure 1).

Regarding Internal design, BIM technology can be used to simulate water supply and drainage pipelines, install auxiliary facilities to avoid installation conflicts, analyze the lighting situation of the building, arrange the windows and lamps in a reasonable position, and simulate of indoor ventilation by establishing a three-dimensional model of surrounding ventilation conditions indoor.
7. Conclusion

In order to cope with the challenges of climate warming, resource shortage, and deterioration of the ecological environment, we need to promote GBT to achieve sustainable development. We also need to incorporate Yangsheng principles into GBT to create a physical and mental health living environment for residents.

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