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Green BIM in sustainable infrastructure

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Abstract

The objective of this paper is to explore BIM (Building Information Modeling) applications in sustainable infrastructures. In response to the global warming, the shortage of energy resources, and the challenges of environmental degradation, humans are trying to build low-carbon Eco-cities and to popularize low-carbon green buildings. Building “green”- refers to the entire life cycle of the building, which includes maximizing the conservation of resources (energy, water, land and materials), protecting the environment, reducing pollution, providing people with healthy, comfortable and efficient use of space, and establishing a harmony of nature and architecture. In the field of green and sustainable buildings, BIM can be integrated in analog-energy buildings, the air flow analysis and buildings’ sunshine ecosystems. By using BIM it is possible to reduce waste and improve construction quality. BIM builds a “visualization” of the digital building models through a multi-dimensional digital design solutions, which provide the “simulation and analysis” of scientific collaboration platforms for designers, architects, utilities engineers, developers and even end users. Moreover, the BIM helps them to take advantage of three-dimensional digital models in design and construction of projects and operational management.

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Keywords: Green building; Information modeling

1. Research problem

In implementation process of green designs, sustainable design methods can be used to analyze the impacts of green buildings, including all aspects of lighting, energy efficiency, sustainability of materials and other building performances. It is essential to combine the designs and the constructions of green technology, thus making a design more reasonable and optimized, and finally achieving the accordance with green buildings parameters. At the same time, green buildings measures will also promptly complete expression in the construction design, thereby ensuring that the project results meet the standards of green buildings [2]. In the experimental study, a series of building



Fig. 1. Tent Hotel in Hengshan NaShan Village. Bird eye view.

information models will be created in the process of proposing site design, building design, construction, execution, maintenance, renovation, demolition. For instance, window to wall ratio control, building shape, air distribution, building natural ventilation, natural lighting, design optimization and adjustment based on the results of the analysis, efficient building envelope, vertical greening systems, ground source heat pump coupling solar heat pump systems, water-saving irrigation systems, energy dissipation architecture, renewable and recyclable ways of exploiting materials and other technical measures, analog implementation, solar air conditioning and rainwater harvesting, etc. BIM technology in the design stage of sustainable infrastructure will be made full use of.

2. Research methodology

In the case study, a series of building information models will be created in the project, we will simulate the green buildings and analyze them. The sustainable design methods in BIM will be used to analyze the impacts of green buildings, including all aspects of lighting, energy efficiency, sustainability of materials and other building performance [1]. It is essential to combine the designs and the constructions of green technology, thus making a design more reasonable and optimized, and finally achieving the accordance with green buildings.

2.1. Green BIM with the planning site location and analysis

The site location and analysis are the main factors affecting the position of the buildings. Those factors could determine the spatial orientation and facade of the buildings and contact with the construction process of the surrounding landscape. During the planning process, the site topography, vegetation, and weather conditions are important factors. The traditional site analysis has drawbacks, such as lack of quantitative analysis, excessive subjective factors, incapacity in dealing with prodigious amount of data and information. By taking advantages of BIM and GIS, we could build simulation spatial data modeling sites and scenarios of buildings. At the planning stage, by using BIM to assess site conditions and characteristics, it is feasible to make an ideal key decisions, traffic flow line organizational relationships and building layout.

2.1.1. Project overview

The case study is based on an international design competition of the Tent Hotel. The sites and proposition of the tent-themed hotels, which can adapt to various climates, is convenient to build up, and then form a local cultural flavors and inspire a new style of holidaymaking. The project site is Hengshan NaShan Village in Hengshan scenic area of Hengyang city, which is approximately 130 kilometers away from Changsha city, the capital of Hunan province and is about 150 km from the Huanghua Airport in Hunan province. The village is 4.5 kilometers away from Hengshan city center, and is available within 15 minutes' drive, or 1 hour's walk. In a distance of 12 kilometers to the top of peak ZhuRongFeng, the village is available within 40 minutes' drive or 4 hours' walking. Since 2005, the hotel industry in China have been developing in a high speed, as a consequence of more and more

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