Research on Rural Landscape Planning and Design based on BIM

Yuchen Bai1,*

1Urban Construction Institute, Xi’an Siyuan University, Shaanxi, China

*Corresponding author e-mail: baiyuchen@xasyu.cn

Abstract. Garden landscape is the soft decoration of living environment. By creating a comfortable and pleasant environment, landscape design can not only improve the microclimate, but also improve people's spiritual life. With the rapid development of rural areas, rural landscape planning and design has become an important direction of rural sustainable development in the future, which has also become a new starting point of building a beautiful China. However, how to plan and construct the relevant landscape design has become an important research topic. With the increasing status of BIM in the construction industry, BIM has been applied to landscape planning. This paper first analyzes the difference between BIM and traditional landscape design software. Then, this paper puts forward a detailed rural landscape planning and design scheme, which can better improve the living standards of rural people.

Keywords: Computer Software, BIM, Rural Landscape, Landscape Planning and Design

1. Introduction

By 2017, China's urbanization rate has reached 57.96%. Therefore, rural development has become the focus of social attention, which has become an important direction driven by the rapid urbanization wave. With the slogan of building beautiful countryside, rural construction has become an important strategic direction [1]. Rural landscape is an ornamental complex system formed by interaction with human beings under various factors such as geographical environment, human history, social factors and so on. The complex system has many functions, such as production, life, viewing, entertainment and so on, which is an important part of the scientific planning of rural landscape [2]. With the improvement of living standards, rural people pay more and more attention to spiritual civilization and spiritual belonging. Therefore, rural landscape planning and design has gradually been important applications in rural areas, including green plants, flowers, water, architecture, etc., which can highlight the architectural aesthetics and rural cultural characteristics. Therefore, rural landscape planning should not only give full play to the cultural and ornamental benefits of the landscape, but also increase the economic benefits. We can attract tourists by creating tourist towns and so on. Through ecological planning and design, rural landscape planning can create a pleasant space, which will allocate resources for human settlements. Through scientific planning and design, we can
effectively promote the harmonious coexistence of man and nature, which will create a scientific and artistic sustainable development landscape [3].

2. Comparison between BIM Technology and Sketch Up

2.1. Different design platforms

SketchUp is a software for landscape planning and 3D visual simulation, which has been widely used in landscape design. Because SketchUp is only used for landscape planning software, it requires less computer configuration. However, BIM is a comprehensive large information platform, which can be applied to the whole life cycle of buildings. At the same time, BIM has a variety of software interface, which can be used in the whole life cycle applications [4]. Therefore, BIM Technology has better requirements for computer technology, which requires higher configuration equipment. In the landscape animation demonstration, the computer has very high requirements for graphics card, memory and CPU, which is also a weakness of BIM. SketchUp can realize the three-dimensional expression of terrain features and landscape plants, which will present some characteristics of three-dimensional design. However, in the design process, designers constantly call the information in the two-dimensional drawings to build the three-dimensional model, which is achieved through the two-dimensional design platform. BIM reduces the work intensity of landscape designers, which simplifies the process of landscape 3D design. BIM can integrate the plane, profile, cross-section, structure and other information into one model. Through the model, landscape designers can directly carry out landscape design, which can directly carry out the follow-up design work. BIM is a 3D design platform, which can fundamentally solve the technical bottleneck of 3D design of 2D platform. Therefore, the future landscape design based on BIM will become more practical and beautiful [5].

2.2. Comprehensive information management capability

Rural planning and construction project is a complex and huge project, which will involve many different professionals. However, some designers will not be able to fully consider the application of other disciplines due to the level limit, which is impossible to complete the whole design at one time. Traditional design software SketchUp needs to modify the design results repeatedly, which greatly consumes the energy of designers. At the same time, independent design will delay the design progress. However, BIM is a comprehensive information platform, which can add all design and project information in the whole life cycle. Through BIM, we can achieve multi professional cooperation, which can effectively solve the problem of information communication. Through BIM model, multi-disciplinary designers can simultaneously design each specialty, which can be updated in real time. Through BIM platform, we can provide a more reasonable design platform for designers [6].

Based on the BIM design platform, the design team can fully communicate and cooperate with each other according to their own professional requirements, which helps to reduce the problems caused by untimely communication. Through BIM, we can fully reflect the wishes of designers, which will help the project team to find the optimal design scheme. SketchUp only contains some information about the landscape. However, BIM model covers all the professional design information of the project, which will avoid the repeated work of designers constantly referring to other drawings. The whole replacement of traditional landscape design software is very cumbersome, which will often lead to missing or wrong replacement. The linkage design of BIM model will be updated in real time, which can effectively solve the above problems. BIM Technology can express engineering information intuitively through three-dimensional model, which is not only helpful for designers to improve design efficiency and quality, but also conducive to construction personnel to quickly export all the information needed for construction [7].
3. Rural landscape planning and design based on BIM

3.1. Patch green space
Patch green space is the basic unit of ecological landscape pattern, which is a common structural feature in landscape. Patch green space and mountainous rural settlement space fit the largest degree, which is closely related to the ecological nature of rural landscape. Therefore, in the rural landscape planning, we need to fully consider the size, number and shape of patches, which will provide a more stable micro environment for rural ecology. At the same time, most patches of green space can be embedded in the productive landscape, which requires full integration and coordination of productive landscape planning. In this paper, based on BIM, patch green space design is carried out, as shown in Figure 1.

![Figure 1. The design of patch green space based on BIM.](image)

3.2. Design of Pond
In rural landscape planning, we will inevitably encounter ecological ponds of different sizes, quantities and depths, which will play an important role in the rural ecological environment. Pond is not only an important animal habitat, but also an important factor affecting local microclimate. Therefore, we must carry on the landscape planning to the pond, which will have ecological, aesthetic, leisure and other multiple functions. For natural ponds, we can carry out scientific restoration and protection, which can leave room for natural development. For artificial ponds, we should combine the ecological expansion of the surrounding plant communities, which can improve the landscape. In this paper, BIM is used to plan the evolution process of pond landscape, as shown in Figure 2.

![Figure 2. Evolution process of pond landscape based on BIM.](image)
3.3. Design of pool revetment
There are usually quiet lakes in rural resorts. Trees, shrubs or combinations can be planted on shore. Stones were placed under the bank and aquatic plants were planted. Among them, the natural revetment can plant a large number of aquatic plants, such as Acorus calamus, pingpengcao, qianqu Cai, which will form a natural plant community. On the plane, we can maintain the natural trend of the river on the earth, which is the only choice for this ecological planning. By dredging the bottleneck area of the river, we can make the flow unobstructed and keep the constant water volume. Therefore, tourists can get close to the water, which will form a hydrophilic landscape. In this paper, the design of pool revetment is planned by BIM, as shown in Figure 3.

![Figure 3. Design of pool revetment based on BIM.](image)

3.4. Landscape design
For the villages with lakes, we can carry out landscape design by adding pavilions and other traditional ornamental landscapes, as shown in Figure 4. Corridor green space has the function of separation and connection to landscape, which will directly affect the ecology of rural landscape. Corridor green space is not a completely closed linear landscape, which is not a simple path to connect patches of green space. Therefore, we need to consider the ecological, landscape, cultural ideal corridor. Therefore, the planning and design of corridor green space should be combined with the special situation of mountainous countryside, which can deal with the relationship between corridor and edge effect.

![Figure 4. Design of landscape topography based on BIM.](image)

3.5. Farmland color
Color is one of the effective ways to shape the aesthetic image of mountain rural farmland landscape. Different kinds of crops show different colors in different seasons, different climates and different environments. At the same time, the difference of crop species will produce different surface features, which are expressed in scattered or concentrated way. Therefore, we can create subtle or shocking aesthetic phenomena. Therefore, the rural farmland landscape should be combined with the unique geographical environment, farming culture, local customs and other elements. Through the selection
of plant varieties and seasonal collocation, we can carry out farmland color planning, which will highlight the local color and characteristics. Through the farmland color matching, we can create the farmland landscape with the characteristics of mountainous rural color, as shown in Figure 5.

![Figure 5. Farmland color.](image)

4. Conclusion
Rural landscape planning needs to take ecological environment protection as the core for sustainable development of ecological planning and design, which has become the development trend of landscape design. Through BIM, we can carry out more scientific rural landscape planning and design, which has a better contact platform for designers, constructors and managers.

Acknowledgement
Shaanxi Provincial Education Department special scientific research project "Shaanxi Guanzhong area new rural construction in the protection and development of local landscape ", project number :20 JK0299, research results.

References
[1] Fan Jianhong, Wei Cheng, Li Songzhi. Concept connotation and development of Rural Landscape [J]. Tropical geography, 2009, 9 (3): 285-289.
[2] Fang Zhaoling. Overview of French landscape: landscape concept and main problems in its development [J]. Urban environmental design, 201 (2): 12-14.
[3] Jiang Deping, Zhou Xintao. Research on the elements of rural landscape planning under the development trend of new urbanization [J]. Architecture and culture, 2016 (9): 200-202.
[4] Wang Yuncai, Liu binyi. On Chinese rural landscape and rural landscape planning [J]. Chinese garden, 2013, 19 (1): 55-58.
[5] Xie Yanling. Study on the planning and design of rural tourism area under the background of integration of agriculture and Tourism [J]. Chinese horticultural abstracts, 2016, 32 (12): 155-156.
[6] Ye Ting, Tian Mengxiong. Discussion on the application of green building in landscape planning and design [J]. Southern agriculture, 2018, 12 (03): 64-65.
[7] Zhang Peng, Du Hongru, Ni Tianqi. Review of typical models of new rural community construction in China and Its Enlightenment [J]. Productivity research, 2017, 36 (1): 42-45.