The Scientific Layouts of Glass Bridges in Tourist Areas from the Perspective of Sustainable Development

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Abstract. In order to accurately explore the scientific layouts of glass bridges in tourist areas from the perspective of sustainable development, the literacy investigation method is applied and the obtained references are analyzed theoretically. The analysis results have shown that in terms of the scientific layouts of glass bridges, factors including topography and terrain, environmental capacity, tourist landscape perception, functional zoning and streamline design, integration of surrounding environment, tourist flow, styling and characteristic culture, detail design, safety issues, and tourist warnings are the key directions of the scientific layouts of the glass bridges. In summary, the scientific layouts of glass bridges in tourist areas from the perspective of sustainable development need to be considered at a very wide range; each direction is very important for the layouts of glass bridges; the layout design is a complete and complex systematic project. Therefore, the deep comprehension of the scientific layouts of the glass bridges would be referential to subsequent studies of the latecomers.

Keywords: glass bridge; ecology; layout; tourism; analysis.

1. Introduction

In recent years, the construction of glass-structured architectures has continued to develop, such as the completion of the Tianmenshan Mountain Skywalk, the opening of theYuntiandu Glass Bridge over the Great Canyon in Zhangjiajie, the development of the scenic views of the mountain-type scenic viewing platforms [1], and the World BASE Jump Competition held in the Longgang Tourist Attraction in Yunyang. Glass-structured architectures have attracted the attention of the public and continuously brought benefits to tourist areas [2]. The great views of rivers and mountains in various tourist areas give tourists beautiful visual experiences, and the glass-structured architectures deepen such perceptions of tourists and open up the adventures and expeditions, which makes the outdoor activity more interesting and more experiential. As an important human landscape in the mountain-type tourist areas, the glass-structured architecture uses their viewing platforms or the function of the walking trails and the special performances of the glass, integrates various design expressions [3], and is important to space division, landscape construction, cultural construction, and entertainments in the tourist areas, which is in line with the current policy supports for the development of leisure tourism products in China and is an important promoter of the innovation and transformation of the tourist area; also, it is an effective way to enhance the attraction and competitiveness of the tourist areas. Therefore, the landscape design strategy of glass-structured architectures in mountain-type tourist areas is discussed [4]; in addition, the common problems are analyzed, the construction theories are improved, the design difficulties are discussed, and the scientific and effective design strategies, which are all important to the construction of mountain-type tourist areas and the design of glass-structured architectures [5].

Glass-structured architectures are not ordinary architectures. In addition, the special environment of the tourist areas also makes the aesthetic requirements for glass-structured architectures even higher [6]. The glass-structured architectures have also become parts of the tourist areas, which requires them not only to maintain the coordination of the surrounding environment but also to ensure the harmony between the artificial landscape and the main landscape around the structure [7], making tourists feel that they are parts of the beautiful natural landscapes. The construction and design of glass-structured architectures are based on their own functions, the identity of the viewing platforms, and the landscapes of the tourist areas; it is necessary to control the structural beauty and highlight its distinctive advantages. Besides, FL Wright once said that “Architecture is based on structure, which is used to express the scientific art of thought” [8].

In summary, the literacy investigation method is applied to explore the scientific layouts of glass bridges in tourist areas from the perspective of sustainable development, and the obtained references are analyzed theoretically; results have shown that the layouts of glass bridges need overall consideration and multi-level designs and planning; each direction is very important for the layouts of glass bridges; the layout design is a complete and complex systematic project. Therefore, the deep comprehension of the scientific layouts of the glass bridges would be referential to subsequent studies of the latecomers.

2. Methodology

2.1 Research Methods

the literacy investigation method is applied and the obtained references are analyzed theoretically.

2.2 Design Principles of Glass Bridges

(1) The measurements should suit to local conditions; (2) The people-oriented principles must be carried out; (3) The development must be sustainable; (4) The safety and comfort must be ensured; and (5) The aesthetics of patterns should be considered.

2.3 Topography and Terrain

As the tourist resource-based architecture, the glass-structured architectures are generally built in areas with large height differences; in addition, the properties and characteristics of the glass materials are different from other material; the topography and terrain would affect the feasibility of the constructional structure, as well as the construction cost and the safety of operation and maintenance during the construction of the project. In the initial stage of construction, it is necessary to fully analyze the topography and terrain, and conduct feasibility studies to ensure smooth follow-up work.

2.4 Environmental Capacity

Glass-structured architectures would bring a large number of tourists, which is a great challenge for the surrounding environment. Mountain-type tourist areas have limited spaces for the exploration with a fragile ecological environment. In the initial stage of site selection, it is necessary to evaluate the environmental capacity; under the scope of environmental accommodation, the ecological corridors should be protected from being destroyed, and the tourist areas should not be excessively congested.

2.5 Tourist Landscape Perception

The comprehensive analysis of the location of the glass-structured architectures can provide tourists with the necessary landscape perception elements such as visual perception, viewing angle, viewing distance, orientation, visual quality, and psychology. The glass-structured architectures should be selected in the wide and open field with beautiful sceneries. Therefore, the distant view could be used to achieve a quiet and far-reaching landscape effect, and the specific environment could be utilized through various scenery setting methods. The permeability of the glass allows the tourists to look down vertically, and the height difference that increases the vertical depth could give the tourists a sense of smoothness, generating visual impacts and psychological shock. From the perspective visual effects, the rationality of site selection is examined, and the landscape perception and tour experience of tourists are predicted.

2.6 Tourist Flow

Although the mountain and forest tourist areas are large, the available space for architecture construction is limited. Therefore, in addition to considering the ecological problems, the development of glass bridges in such tourist areas should also focus on the issue of tourist flow. The tourist flow refers to the number of tourists passing through per unit time. In some glass bridge

attractions of tourist areas, tourists must be organized to visit the glass bridge. Therefore, the tourist flow of the glass bridge affects the tourist dispersion of the tourist areas and the direction of tourist flow, which is the important reference for the determination of the width of the glass bridge and the capacity of the tourists.

2.7 Functional Zoning and Streamline Design

According to the flow of tourists, the dimension of the tourist area is determined, the functional partition is rationally arranged, the road-stream is organized, and the site selection of the structure is adjusted. It should be noted that glass-structured architecture is connected to the roads of the tourist area. In terms of the glass viewing platforms, it is very important to arrange road tours scientifically to prevent the tourists from walking repeatedly thereby causing congestion. In terms of glass bridges and glass paths, special attention should be paid to the location of the sites, which should be combined with other attractions in the tourist areas to avoid the isolation of certain attractions due to the unreasonable routes. It is necessary to make tourist enjoy infinitely good sceneries all the way, also, the visual fatigue should be avoided, and the landscape nodes should be accessible to tourists. If tourists must climb over the mountains to get to the beautiful scenic spots and attractions, they would never come to visit. From the overall perspective, the behaviors of tourists should be guided through road flow lines; in addition, combined with the construction of supporting service facilities, the tourist flow could be divided or converged, thereby ensuring the order of the tourist areas.

2.8 Integration of Surrounding Environment

The location of the glass-structured architectures in the tourist areas must be integrated with the surrounding natural environment and the artificial environment. The good project site selection rarely changes the original landscape of the base site and the architectures are designed to merge in the surrounding environment. The glass-structured architectures are landscape nodes for artificial constructions. As the famous poem says, “I stand on the bridge to see the scenery, and the people watching the scenery look at me upstairs”, the viewing platforms are also the scenery of the tourist areas; therefore, the integration with the overall natural environment must be valued to satisfy the overall needs of the environment. Due to the particularity of the glass material, the integration of the expressiveness of the structure with the original humanistic environment of the tourist area is an important issue. At the beginning of site selection, the scientific construction of the humane environment in the tourist area should be fully considered; in addition, special attention must be paid to the layouts of the original architectures and to prevent the newly constructed architectured from being isolated.

2.9 Styling and Characteristic Culture

In the landscape design, it is necessary to deeply understand the local regional cultural background, explore the local cultural characteristics of the natural landscape and human landscape, and fully respect the historical, spatial and diversity of culture. Through the direct expression of language and words, abstract symbols are also used to refine the meaning or create an atmosphere, etc., to show the local culture, local practices, historical contexts, or folk customs. In the design of the glass structure project, the light and shadow effects and the transparency of the glass structure, the symbolization of the unique shape of the structure, the meaning of the sketch and the sculpture, and the rendering of the color can be used to express the humanistic thought of the landscape and make the structures vivid. In terms of the design content of glass-structured architectures, it is necessary to carry the regional history, culture, and social spirit to meet the spiritual needs of the tourists and to create the differences and characteristics of tourism products through cultural expressions.

2.10 Detail Design

The details of such projects can be designed from the following aspects.

First, the application of special effects of glass. Glass has not only the excellent permeability but also the reflection, illusion, deformation, anti-skid, and anti-freezing effects; in addition, colored glass

can block unsightly parts, the holographic decomposition film laminated glass can present different patterns, the frosted glass can create special artistic concepts, etc., which can be applied to the design details to create the various and colorful effects.

Second, the creation of fun landscape spaces. Interesting creations are as small as trash cans, night lightings, plants, color configurations, etc., and as large as the glass-structured architectures that are linked to music-sensing electronic components, bungee jumping attraction, strops, stages, BASE jump attractions, etc. All of these can be designed into various interesting nodes through details to enhance the fun of the landscape and provide the necessary entertainments for tourists.

Third, the combination of landscape, function, and humanity. Landscape, function, and humanity are the pursuit of modern landscape design. The specialty of the humanization of glass-structured architectures is to meet the needs of different groups of people, such as the roads that specially designed for the elderly, the tour routes for tourists that do not prefer irritating experiences, etc.; in addition, tourists could use the shoe covers on the bridge to prevent the glass on the bridge from being scratched, the graphical inscriptions could be written in multiple languages, etc.

2.11 Safety Issues

Safety issues should always be a very important issue during the construction process, the tour, or the safe maintenance and reinforcement process. In the process of glass bridge construction, various factors that affect the safe construction of the glass bridge are found. For example, the construction of glass bridges is generally the flexible construction with no specific detailed construction design drawings; as in the tourist season, the tourist flow is too heavy, making the glass bridge overload; in addition, some glass bridges in some tourist areas are overused and in disrepair; besides, workers who construct the glass bridges are often without safety protection measures, which also causes certain safety problems. These factors are safety issues that exist during the construction of glass bridges. Therefore, these factors should be fully considered when creating a glass bridge to build a safer, more scientific, and more attractive glass bridge.

2.12 Tourist Warnings

The glass-structured attraction is not suitable for special people such as patients with high blood pressure, heart disease, and fear of heights. The staircases of the suspended glass bridges are not suitable for the elderly and children. Some tourist areas do not pay attention to the particularity of these groups and do not construct special facilities for special groups. These should all be optimized by detail design processing.

3. Results and Discussion

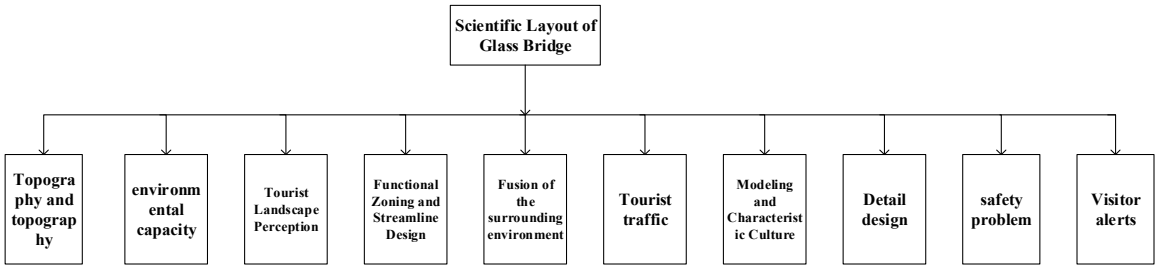

Figure. 1 Factors of scientific layouts of glass bridges

It can be seen from Figure 1 that the scientific layout of the glass bridge is various in the direction of development with countless aspects. It is a complex ecological project, which requires coordination and cooperation in all aspects to form a good and sustainable ecological environment. Safe and sustainable development of the tourist area is very urgent since the layout determines all subsequent adjustments of the glass bridge.

Figure. 2 Photos of glass bridges

It can be seen from Figure 2 that the glass bridges are very complicated projects, which are mostly constructed on cliffs and are very dangerous. Therefore, there are many factors to be considered in the design of the sustainable construction of the glass bridges, so that the glass bridges would continue to operate for a long time. Since the space for subsequent changes is very small, it is very important for the pre-planning of the glass bridges.

Table 1. Top 10 glass bridges in China

No.	1	2	3	4	5
Name	Tianmenshan Mountain Skywalk	“The Greatest Skywalk” in Chongqing	Yuntiandu Glass Bridge over the Great Canyon in Zhangjiajie	Aizhai Glass Bridge	The Yellow River 3D Glass Bridge
No.	6	7	8	9	10
Name	Mount Marenqifeng 3D Cliff Ladder Glass Path	Tianyunshan Mountain Glass Path	Hubugan Suspended Glass Bridge	Shaoxing Xinchang Feilong Glass Path	Qingyuan Niuyuzui Suspended Glass Bridge

As shown in Table 1, the construction of glass bridges in China is already numerous. Many tourist areas have already developed and built their own glass bridges to attract tourists. However, for the sustainable layout of glass bridges, there is still a lot of work that has not been done, which would greatly restrict the planning and development of the glass bridges in later stages; therefore, it is extremely important to plan the scientific layouts in advance.

4. Conclusion

The literacy investigation method is applied and the obtained references are analyzed theoretically. The analysis results have shown that in terms of the scientific layouts of glass bridges, factors including topography and terrain, environmental capacity, tourist landscape perception, functional zoning and streamline design, integration of surrounding environment, tourist flow, styling and characteristic culture, detail design, safety issues, and tourist warnings are the key directions of the scientific layouts of the glass bridges. In summary, the scientific layouts of glass bridges in tourist areas from the perspective of sustainable development need to be considered at a very wide range; each direction is very important for the layouts of glass bridges; the layout design is a complete and complex systematic project. Therefore, the deep comprehension of the scientific layouts of the glass bridges would be referential to subsequent studies of the latecomers.

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