Use of Computers in Reconstruction of Ancient Buildings

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Abstract

Many cities in China today are in the midst of a profound architectural transformation. Among these rapidly developing cities, most of them are many centuries old, possessing rich historical architecture of distinct local traditions. However, the ancient buildings and the neighborhood are disappearing quickly, because of the wholesale demolition for urban development or many years of neglect. In this paper, the use of computers in reconstruction of ancient buildings is briefly discussed with some case studies. The advanced computer technology provides a powerful tool for the ancient architecture preservation and reproduction. It makes the reconstruction engineering more efficient, true to the original, and low cost.

1 Introduction

Ancient architecture is of social, cultural, scientific and nostalgic importance. Its unique design and decorative techniques are valuable and can be used in modern architecture. How to preserve these vernacular buildings of many centuries old is nowadays a major task faced by many historic Chinese cities that are undergoing rapid changes. The use of computers in preservation and reconstruction of ancient architecture has been shown to be a very powerful and effective way.

2 Preservation and Reconstruction

Many ancient buildings, which survived the vicissitudes of history, need a number of repairs because of the damage caused by the elements. This preservation process may involve the replacement of some ruined components. However, sometimes, we even have to disassemble a building into parts first and put it back at a new location. When this happens, the reconstruction process is probably the only way to save such a building from being permanently destroyed.

Computers find a lot of important applications in the preservation and reconstruction process of ancient architecture. The applications can be divided in the following aspects:

2.1   Digital Representation of an Ancient Building

Before an ancient building is disassembled and moved to a new location, it is important to digitize the whole structure of the ancient building, including survey and drawing, the present appearance and status quo ante.

2.2   Selection of New Location

Where the ancient building will be relocated is one of the key issues of the process. It should fit in well with the surrounding buildings and neighborhood at the new location. Its building style and space structure should be in harmony with others. In particularly, these factors have to be considered: building heights, colors, materials, roof structures, orientation, and the distance to other buildings. With the help of a computer, we can visualize the fitting effect of the ancient building into a possible location. The location selection has never been easier by using the computer technology.

2.3   Disassembly and Inventory

Based on the computer drawings and the digital representation of the building, the best way to disassemble the building can be determined with a minimum damage. An inventory of all parts with detailed dimensions and drawings is generated with a computer. The computer drawing can be

Figure 1. White Horse Taoist Temple (after reconstruction).

used for the duplication of the part, if the replacement is necessary. Hence the repairs and assembly can be combined during the reconstruction stage.

2.4 Reconstruction

The digitized information about the building from the computer is used for the accurate and precise restoration of the building during the reconstruction stage. The attention has been paid to that the reconstructed building should remain the same style and appearance as the old one. In order to achieve this, the steps listed below have been followed.

- The reconstruction is done precisely according to the working drawing from the computer.
- The original parts have been put back into the right positions as they were.
- The duplicated part used to replace the damaged one should be made of the same material, shape and size as the original.

3 Case Studies

Here are a few examples of the ancient buildings which have been recently repaired or to be reconstructed in Wenzhou, China.

Figure 2. Detailed wood structure of the White Horse Taoist Temple.

3.1 Bai Ma Dao Guan (White Horse Taoist Temple, Wenzhou, Zhejiang, China)

This Taoist Temple was originally built in 618 AD, during the transition of the Sui Dynasty to the Tang Dynasty. The building has the unique and prominent feature of the classical Chinese architecture – the timber framework composed of columns, beams, purlins and a multitude of corbel brackets. The wood structure of the building was reconstructed in 1997 at the original location. Figure 1 shows the interior structure of the building after reconstruction. As a Taoist Temple, although it is different from other kinds of structures, the building follows the basic principle for a Chinese structure - balance and symmetry. Figure 2 shows one of the details of the wood building structure.

3.2 Miao Guo Si (Magic Fruit Buddhist Temple, Wenzhou, Zhejiang, China)

Shown in Figure 3 is the building layout of Miao Guo Si. This Buddhist Temple was initially built in the Tang Dynasty (714 AD). Its flying eaves, pointed roofs and layers of rookeries reflect the flourishing Tang Dynasty which was a period of great prosperity. It differs from the Taoist Temple as shown in Figure 1 in the layout of buildings, ways of groupings, system of colored paintings and themes of engravings. Portraits of Buddhas, murals, engraved tables, calligraphy, Buddhist utensils, furnishings, and Buddhist scriptures are carefully kept in the construction. As a cultural relic, all the wood structure was reconstructed at the original location in 1984. Figure 4 shows the interior structure after reconstruction.

3.3 Zheng's Stele Pavilion (Wenzhou, Zhejiang, China)

The Pavilion to be reconstructed was originally built in the Ming Dynasty (1608 AD). Figure 5 shows one possible location for this Pavilion. As shown in Figure 5, the pavilion consists of a main gate at the center, two wings extended from either side of the main gate to form other two rooms, and surrounding winding corridor. The main purpose of this pavilion is to keep three big stone steles which are precious with engraved calligraphy.

4 Conclusions

The protection of ancient constructions as cultural relics has been an urgent issue in China. A lot of efforts have been spent for the preservation and reconstruction of these buildings. In this specific area, the computer technology has found its unique role in the survey and drawing, urban planning,

and reconstruction. With its help, not only is the restoration more accurate and efficient, but the construction time and cost are dramatically reduced too.

Figure 3. Building

layout.

Figure 4. Interior structure after reconstruction.

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