

A Design and Research on Protection of Architectural Heritage Based on Digital Technology

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Abstract: In the era of digital information, how to reasonably use new-tech and idea for the architectural heritage protection remains urgent. In terms of digital protection, 3D laser scanning technology can perfectly remedy the manual measurement limitation thus correctly obtaining the relevant data. Via analysis, we find that the architectural heritage bears in itself the parameterized characteristic. As Building Information Modeling (BIM) can help realize the parametric design, we proposed a feasible Architectural Heritage Information Model with the BIM “family” connecting architectural heritage and BIM. Finally, the parameter-induced graphic driving is achieved based on the relation between the two.

Keyword: Parameterization; Architectural Heritage; Information Modeling

1 APPLICATION OF DIGITAL PROTECTION TECHNOLOGY

1.1 *Three-dimensional laser scanning technology*

At present, for the protection of architectural heritage generally limited to repair and maintain the existing situation, and less for their own intrinsic architectural heritage law research in the understanding of how to design a building in the ancient heritage of not doing enough. Parametric design application ancient model, can create dynamic static measurement data to create a three-dimensional model based on French. Parametric design applied to the study of architectural heritage inherent law, the law can create complex and cumbersome architectural heritage members clearly expressed, so that the architectural heritage of the design concept and construction logic clearly demonstrated.

Three-dimensional laser scanning technology is a technology in the wake of the development of laser measurement technology formed, which is reflected by the object by measuring the time the laser pulses can be obtained from the information.

Due to the non-divergent laser, laser measurement precision is very high in kind, according to the reality learned that laser is used to measure the distance of Earth to the moon, can be accurate to centimeters or more. On the basis of the measurement by laser scanning on the physical distance, but also measure the height of the horizontal and vertical azimuth angle, so you can calculate the trigonometric method by the laser hit the horizontal distance between the vertical height of a point on the physical.

Can be calculated for each spot in the scanning system as defined in the three-dimensional spatial coordinates Cartesian coordinates based on the measured angle and distance. If a certain kind of continuous spatial sampling density scan measurement, overall measurement can be performed on the physical space relative positioning, which is the technical principles of three-dimensional laser

scanning technology. Terrestrial laser scanning system consists of three-dimensional scanners, computer control and data storage, tripods and other accessories.

Development of digital technology to promote more accurate graphics technology equipment have been produced, a more accurate real digital preservation and archiving technology also will be born. And digital photography combined with laser scanning eye can capture subtle details, such as building surface cracks. By recording the laser light is emitted from the object to the reflected or refracted back in time, to calculate and processing software can understand the point of view of the object, as well as the location of the material, and finally a three-dimensional image.

Digital preservation is the use of advanced 2D and 3D scanning, digital photography, 3D modeling and image processing technology to achieve high-precision acquisition and preservation of heritage graphical structure and texture information. Aim is to establish relevant digital model in the computer, an information heritage preservation, restoration, research, development and utilization of visits and provide accurate digital material.

1.2 *Building information modeling technology*

The relevant information and data building information model is based on building projects as a basis for the model, building model were established, true information through digital information simulation building has. It has visualization, coordination, simulation, optimize and can plot of five characteristics.

BIM design process from the resource, behavior, delivered in three basic dimensions, given the implementation of corporate design standards specific methods and practices contents. BIM (Building Information Model) is not a simple digital information integration, but a digital information applications and can be used for digital approach design, construction and management. This approach supports the integrated management of the environment of construction projects, construction works can significantly improve the efficiency of its entire process, a significant reduction in risk.

For one building element, it itself carries a lot of information, how that information is combined with the model functions ancient building information models where the information into the system. BIM's information into the system is completely dependent on the model itself, the modeling process is the information input process. In ancient building information model, all information is recorded in the form of parameters or primitive type properties among members. The system comes with a conventional family model contains parameters related to the more comprehensive mechanism for designers demand entry, and

for the family model to establish their own, it may be all the information needed to classify add member properties dialogue box. Making parameters added, the software offers a variety of parameter types and groupings to facilitate designers to model complex information classification entry, and each has its own parameter types and system functions, such as material type provides several default type, designers can be copied in a new material library or depending on the circumstances.

2 THE ESTABLISHMENT OF BIM BUILDING INFORMATION MODELING HERITAGE

2.1 *BIM advantage*

BIM drawing thinking has changed a lot, it means graphic information from a single line to carry a variety of engineering information into building components, it realized from the application point, line drawing building projection, architectural expression to use accurate data recording building information to explain the transition of the building. BIM is essentially equivalent to a database that records the various data complete information about all of the construction process, the physical geometry information including building components, cost and production management information, and so on.

Logical Construction built the logical and actual construction BIM model high degree of unity, compared to 3dmax and other three-dimensional modeling software, BIM models modified linkage great savings renderings companies repeatedly revised wasted human and material resources; the roof curve compared to the use of CAD drawing repeated Videos roof projection curve each facade also precise a lot of convenience; information and detailed data model parameter sharing applications enable orderly management of the entire document; reused family make the design work has become effective convenient etc.

In addition, the building information model in the protection of architectural heritage in archival work can also have a good application. Our legacy of rich and varied architectural heritage, imagine if all create a complete building information model for each legacy buildings and collect them together to create a heritage building information model repository that will enable the architectural heritage of great information Perfection and systematic. Architectural heritage information model repository will be built based on the database, which means that it is a good statistical work is completed within the data repository, so that we have a comprehensive and systematic understanding of Chinese architectural heritage. For example, when creating each building information model, we can record this building's construction, architectural form and style in which important

parts of the project information, as an example of architectural heritage style under a specific category.

2.2 "Family" establishment

Architectural heritage information model for the protection of architectural heritage importance of archival work in that "family" establishment. "Family" for building components for, and when we were in-depth study of a construction element and classified in accordance with a certain condition, the summary of its shape structure rules, find out the universal significance of drive parameters established this family file type with common sense, it can be said that the model belonging to a particular style common characteristics of all of the components described or a member belonging to the construction of the building instance of this template form. Establishment of a "family" will enable us to recognize documents of a particular type of building elements from a macro point of view the whole picture, and more intuitive to show some form of classification of various components

The entire building information model contains two parts data and graphical information, BIM has a complete database mainly through the family to build. BIM can be said to be a combination of all races. All the family can be attributed to the broad categories into software systems. BIM software in the main categories of walls, columns, roofs, framework, doors and windows, each category has its own category with the characteristics, such as windows and doors can be inserted directly on the wall and open holes. Each category below, could create numerous family, family can be defined by a specific property information - the main control parameters to generate a complete building components.

For example, in a cylindrical system family, BIM software defines the column diameter, column height, material and other parameters to control the generation of a column family, and these parameters are part of the database, and can be viewed any time. Family can be modified on the basis of a model of the family. Group set up process is as follows: For the graphic topology relationships between specific member, controls the graphic to find several main constraint to use as the main drive parameters, ensure the same graphical topology relations on the basis of data obtained a new geometry as a follower point, or direct relationship between time constraints and the main constraint values and logical drive parameters to define the times, and driven by the main constraint point or the main constraints and constraints to jointly define a sub-family, in order to achieve graphical parameter control.

This column building elements form a more independent and relatively simple, easy to make an independent family directly into the project file. We know that the pillars of

ancient buildings in general practice have collection points and the side of the foot, relatively fixed shape, if we find a good collection points and side foot control constraints, and define it as the main drive parameters to achieve the parameters of the control body then when we establish a good column family, this family model can be applied to many common projects, simply by changing the parameter value. Because in the same building, the type of beam member more, length, width, size of each member of the Higher slightly different but have similar shapes, and therefore these members can be classified into several production model family, then each family member made into the following types, which will greatly improve efficiency. Ancient building information model component elements of ancient building system mainly refers to large wood removed, the remaining part of the wall and roof, including pedestal and base class masonry, doors, windows, ceilings and other wooden parts. Similarly, models of ancient buildings can be part of the family member for accurate detailed performance.

3 PARAMETRIC DESIGN ARCHITECTURAL HERITAGE INFORMATION MODEL

3.1 *The concept of parametric design*

Parametric design model changes by means of a portion size or a few parts, auto-complete the relevant parts of the model changes to realize the size of the model-driven, in which geometric and topological information required is a computer-driven automatic extraction of. Parametric Design constraints drive is based on the relationship between the various elements of the development provided to achieve these constraints can be constructed in the building mode, it can be modulus relationship, it has certain features and rules. Architectural heritage as a carrier of ancient civilizations, today various studies feudal social, political, cultural, military, science and technology, and the people to provide valuable information. In the process of urbanization, the architectural heritage protection work there room for improvement. First, the mapping results of the architectural heritage is not intuitive, too can learn from drawings, architectural heritage in the process of mapping, the data is generally in the form of plans, elevations, sections that out, spatial relations and some architectural heritage construct more complex and requires a considerable number of cross-sectional and detail to fully articulate the building. Secondly, the internal laws of the architectural heritage of understanding is not deep enough. Since entering the information society, people use high-tech measurement technology to produce three-dimensional model, though give people more intuitive impression, but these models are mostly used for rendering or animation, the lack of project

information model, the model is not the relationship between the various components of architectural heritage information.

3.2 *The method of parametric design*

Parametric design approach is the architectural heritage of the modulus, specifications and other information input model, no matter how the model changes, the inherent logic of the architectural heritage Construction will not change. Thus, the model can not only meet the needs of an intuitive visual, but also in the post-modification model, spatial location and size of the architectural heritage of each component member will change accordingly. This change is a computer automatically. Three-dimensional parametric model can automatically generate any portion of the flat, vertical, sectional view.

To create a three-dimensional architectural heritage parametric model, the first of its structural analysis, research which parameters can be compared with the full expression of architectural heritage features. The more parameters, the more the expression of the characteristics of the architectural heritage intact, but too many parameters also make less versatile, the resulting model is too large, the impact speed. In Tongwa for example, can record the complete four corners of the damaged portion accounted watt high proportion, as if it is a member of the filters need to be replaced, the unit price can also be used to replace the definition of statistical follow-up member of that repair costs to prepare. After recording the relevant data, you can build a residual bad member screening schedule according to specific conditions, for example Tongwa, it can be a complete screening of the damaged portion of the four corners of the tile high as more than a third of the member to be replaced member, statistics of these members as well as their cost-efficiency replacement required, which will need to be greatly improved before the cost of construction work on the budget. After recording the status quo after the model should be replicated archive repair design carried out in the presence information to copy this model, after the establishment of a model of the proposed repairs to the pre-construction and construction.

Since the status of the building information model is entirely based on the current situation of the building, including the practice of thatch backing layer and so on, so when making repairs required for the design model can be fully established on the basis of the model to modify the current situation, the need for replacement of residual bad member, simply select and change the type to. All changes in the status quo on the basis of the model should be based on a new stage, in order to facilitate viewing at any time to modify the operation of each phase. After the renovation is completed after the building information model, the software

also can make use of BIM data exchange capabilities, import it into the structural analysis software or energy analysis software for simulation analysis through comparison of programs select the best solution.

4 SUMMARY

Architectural Heritage repair work is an important part of the architectural heritage protection, the architectural heritage information model used in this process, it will protect the architectural heritage of digital systems is significant. Architectural heritage information model based on the actual process of mapping a detailed record a variety of information architectural heritage itself, it can completely replace the traditional mapping drawings as design and construction data archive for future inspection carried out at the time of repair of architectural heritage. Component size and process data practices rely on information model architectural heritage recording, you can be a member of the residual bad repair or replacement; dimensions and materials in accordance with member data model records of the missing members can be made up with the original. In addition, it has been severely damaged and repaired urgently, on the verge of collapse ruined building information model can be applied to architectural heritage in the course of them were rehabilitated.

Through the above description is not difficult to find, the building information model can be applied to studies of ancient architecture. With the study of ancient ancient architecture building information model will greatly facilitate the research work. Building an accurate record of the information it can give historians provide rich and accurate research data; dimensional presentation contains details of its construction elements of buildings can be more intuitive to show the face of the building; it's powerful database functionality capable of building information very system statistics and classification; its component model can help family more clarity on the building in different ways to classify; to achieve its member based on the size of the bucket mouth parametric control helps clearer profound understanding of ancient buildings wooden structure to create a way and so on. In short, it parametric qualities enable it to study the ancient architecture provides a wide range of convenience and a variety of ideas.