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Exploration of Building Modeling Technology Based on Revit

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Abstract: The increasing attention paid by modern people to the quality of the development of the construction industry has led to stricter requirements for the construction process even before construction projects. On this basis, the construction software market has emerged, promoting the development of BIM systems. This system includes complete functions such as the design of building drawings, multi-dimensional viewing angles, building function roaming, and social environment beautification, It can meet the needs of Party A and also supervise the construction progress process, scientifically and reasonably divide the work progress, improve construction efficiency, save costs, strengthen safety effects, avoid the destructive impact of unreasonable construction, and ensure the safety of workers' lives and property. This article mainly introduces Revit software to everyone. Since its emergence, Revit has provided accurate data information for building construction, presenting all construction plans and details from foundations to columns, slabs, walls, etc., which is beneficial for avoiding risks; Secondly, this software runs through all processes before and after construction, transforming abstract designs into visual and concrete ones, facilitating early planning and rational resource utilization, accelerating construction progress, and promoting the rapid development of the modern construction industry.

1. Introduction

Traditional design institutions in the construction industry use two-dimensional computer-aided drawing to express designers' ideas, which improves the efficiency of the drawing process. However, due to the often too brief description of the drawings, it leads to incorrect information or speculation and misjudgment. BIM is a "digital model" established for the entire lifecycle, design, construction,

and operation of a construction project based on all relevant construction project data. BIM (Building Information Modeling) technology has been applied in the construction industry in Europe, the United States, Japan, Hong Kong, and other countries and regions. Building Information Modeling (BIM) will completely transform the field of civil engineering, from 2D drawings to 3D design and construction. In multiple national key projects such as the Shanghai Financial Center, Shenzhen Ping An Financial Center, Hong Kong Zhuhai Macao Bridge, and Shanghai Disney project, BIM digital construction technology has achieved successful research and results, effectively improving project management level, and becoming an important driving force for business transformation and upgrading [1-2].

2. The Application of Revit in Practice

As a commonly used software in the construction industry, Revit is an important tool for application and learning. This software is produced by Autodesk and has completely different operating modes, file systems, and program encoding. It is a 3D design and information management software centered on BIM. Supporting the design, drawing, and quantity calculation functions required for construction projects, suitable for various types of engineering projects.

2.1. Engineering Construction Level

It can be said that the most important function of Revit is its application in the construction industry. It integrates views of construction drawings, elevations, cross-sectional views, and detailed drawings, suitable for the work content of engineering building information entity models, as shown in Figure 1 below, and is presented in a three-dimensional modeling manner as a whole. As long as the design starts from the plane, the remaining views will be integrated due to the BIM information, while other projects will also be built together [3-4].

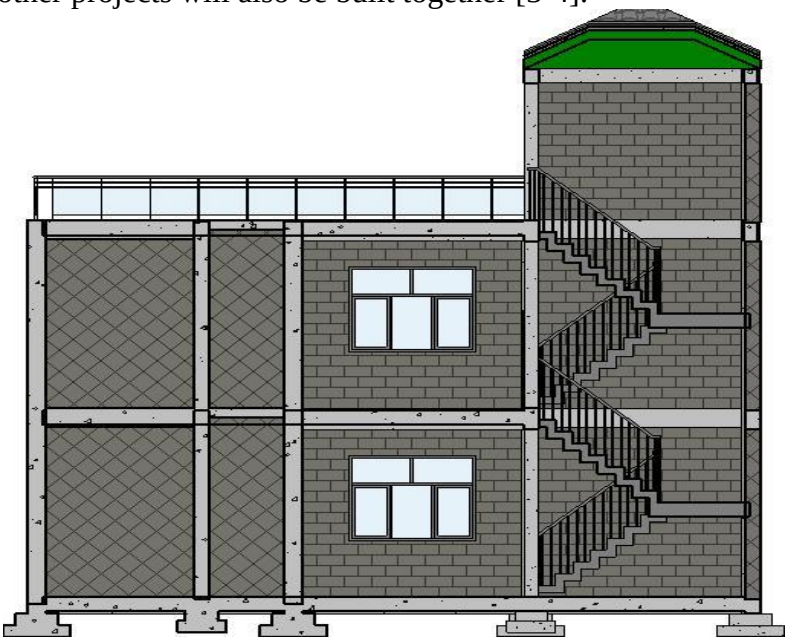

Fig. 1. Profile of the model

2.2. MEP Aspect

Revit MEP is the second feature of Revit. It mainly provides methods for HVAC, electrical and

water supply and drainage engineers to establish more accurate calculation values, water and electricity models and cost information based on the architectural model designed by Revit, as shown in Figure 2. Revit MEP supports building systems throughout the building lifecycle using informative models. The most complex electromechanical, electrical, and mechanical engineering systems are analyzed through the review of building information model models and the use of built-in interference checking systems to analyze design issues and quickly correct errors.

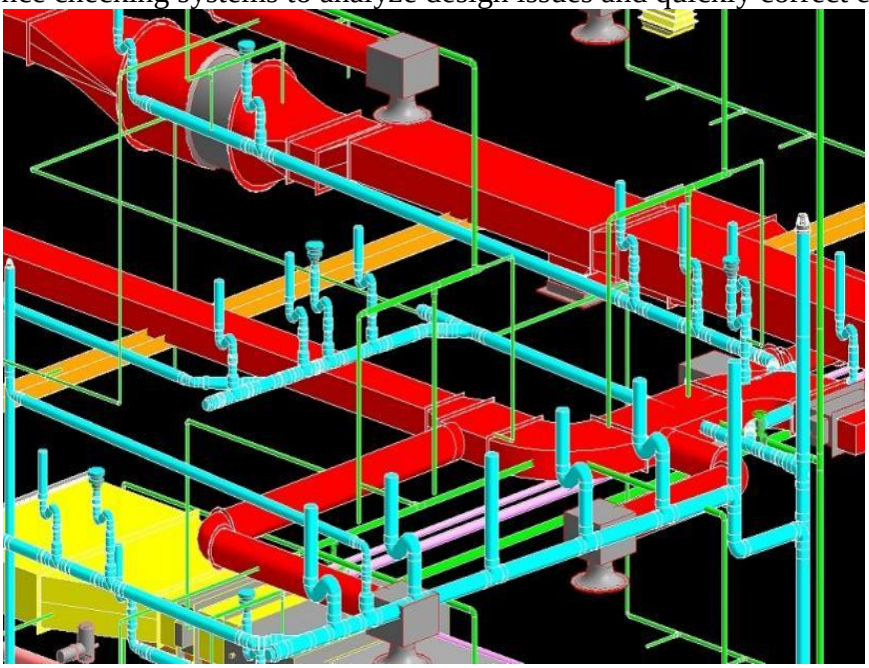

Fig. 2. The electromechanical diagram drawn by Revit

2.3. Structural Level

Auto Revit Structure is the third largest software of Revit, used in the field of architecture and engineering. Let structural engineer and interior designers more accurately formulate and build efficient engineering building structures, thereby saving time and raw material costs. Because Revit structure has the advantages of BIM, it can coordinate structural design documents in multiple fields, reduce errors, and strengthen the collaboration between structural engineer, architects, MEP engineers and large project team members such as the owner.

2.4. Energy Analysis

The green energy simulation software launched by Autodesk Labs is used for conceptual design and green building design. This software has the same engine as Revit's BIM, but focuses more on analytical tools than Revit. The main functions include the following [5]:

①Create forms freely through Revit's volumetric modeling method and obtain analytical data.

②Simulate solar radiation and sunlight trajectory, conduct CFD analysis and energy consumption analysis. As shown in Figure 3.

③The visual simulation system can be immediately used and quickly compared.

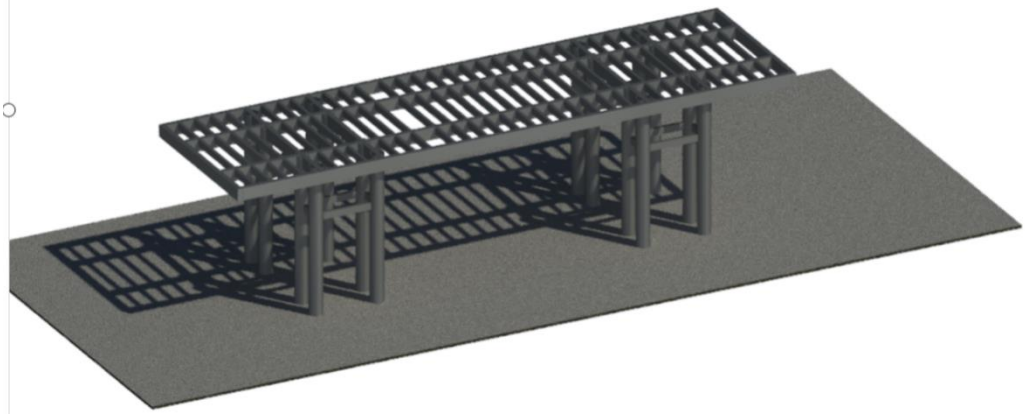

Fig. 3. The gate of Chongqing Yitong College simulates the track of solar radiation and sunshine

3. Problems Encountered During Revit Based Modeling Process

3.1. Beam not Visible In Plan View

In Revit, a plan view generally refers to a plan view in four directions: east, west, north, south, and north. The views seen at different levels are different (as shown in the following figure)

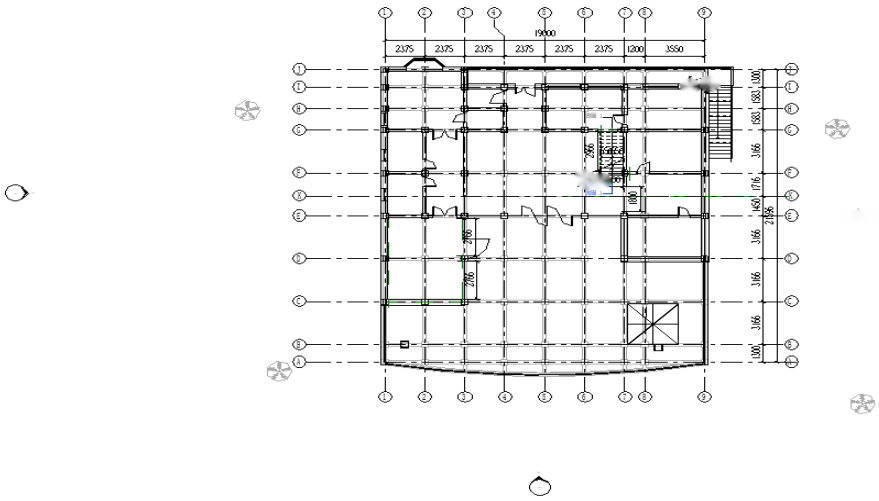

Fig. 4. Plane beam view

ut sometimes, components at the same elevation and height cannot be displayed in the drawing area (as shown in the following figure)

Reason: At the height of level 3, the view height and depth in the software system properties are not sufficient. In the figure below, the height of level 3 is 8 meters. At this time, if the top view range in the view range is less than 8 meters, then the beam component located at 8 meters cannot be seen in the plan view of level 3.

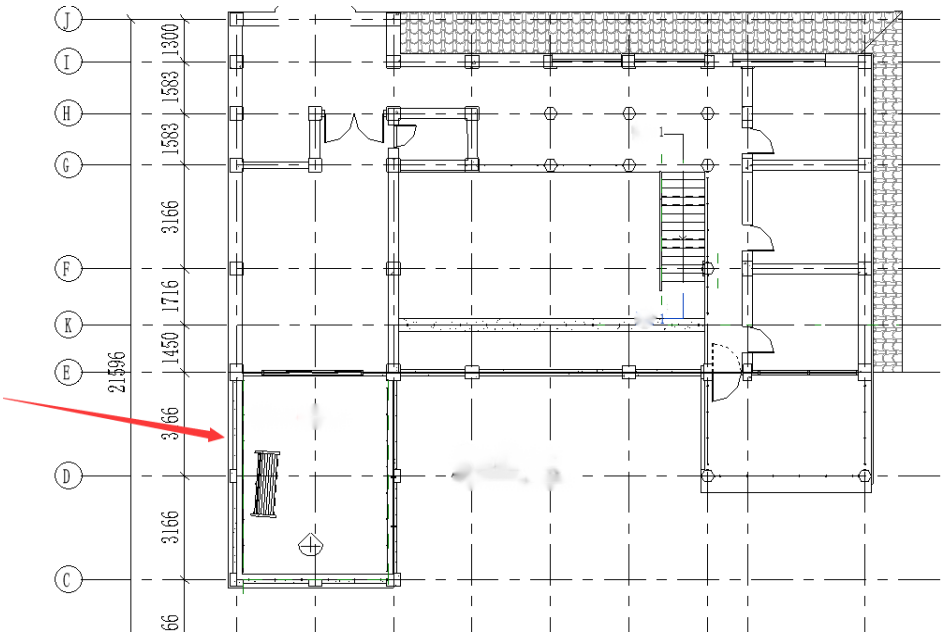

Fig. 5. The plane beam is visible

3.2. Permanently Hiding Components

Select the object that needs to be hidden or isolated, and click the "Temporary Hide/Isolate" button in the view control bar.

Isolation Category - displays only elements of the same type as the selected object, which can be multiple categories.

Hide Category - Hides only elements of the same type as the selected object, which can be multiple categories.

Isolate Elements - Only display unit elements selected by the mouse.

Hide Elements - Hides only the unit elements selected by the mouse.

3.3. Reasons Why Components Are Not Visible In Elevation Views

Reason: Similar to the human eye perspective, Revit also relies on elevation symbols to observe components on the facade, which conforms to the general shape of "" visible on the "site" plane in the plan view. If the elevation symbol is misplaced, the elevation it is on will not be visible, taking the east elevation as an example, as shown in the following figure:

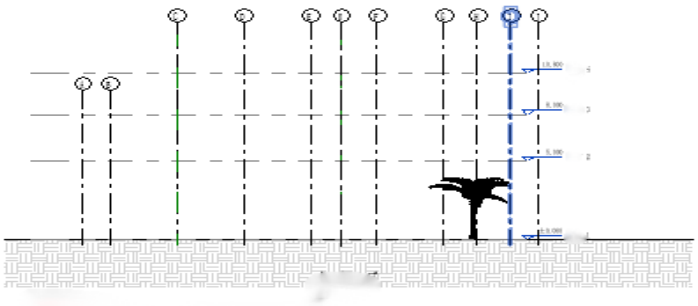

Fig. 6. Elevation View

3.4. Reason for 3D Invisibility

Reason 1: The deviation between the top and bottom of the view range is too large or too small;

Reason 2: Model element visibility. If the corresponding category of the model is not checked, the element is not visible

Reason 3: Filter. If a filter is set for the pipeline system or entity category, the corresponding category is not checked, and the entity is also invisible.

4. How to Improve the Quality of Revit Modeling Skills

4.1. Feature Optimization

In general, the following characteristics of Revit models can affect performance: complex geometry, multiple parameterized relationships, multiple constraints, graphical representation of complex views, and linked files.

The following sections will discuss multiple aspects of modeling and provide some suggestions to address special situations. Taking these factors into account when examining the model and its constituent families will help optimize model performance.

(1) Array

Copy objects using arrays and associate them together. After deploying an array, performance can be improved by ungrouping array objects and removing their parameterized associations. Alternatively, clearing the 'Group and Associate' checkbox when creating an array can also result in the same result.

(2) Restrictions

The minimum restrictions help prevent the following situations from occurring:

When moving objects, an "unable to keep connected" error occurs, and when users unknowingly acquire object ownership, working set sharing problems occur.

Design Options:

Restrict the use of rooms in design options, as detecting room option conflicts takes a lot of time, and using a separate model can make various changes throughout the entire building wing.

As long as design options are useful for the project, they should be retained. Even if the options may not be active and visible, all design options will be updated when modifications are made in the main model.

Consider whether options should be retained for the long term in separate models, which can be linked as needed.

Minimize the number of linked or imported DWG files.

Avoid importing unnecessary data, such as hatches or AutoCAD specific line processing (such as construction lines). Delete unnecessary parts and layers from the DWG file in AutoCAD, and only import the cleaned smaller DWG.

Avoid exploding geometry imported from DWG files. The decomposition operation in Revit can modify the DWG from a single managed element to hundreds or thousands of other elements based on the number of entities in the imported DWG. Increasing the number of elements can affect regeneration, manipulation, and view update times.

Only basic DWG files should be linked to necessary views. Unlink files that are no longer needed.

Turn off the visibility of 2D AutoCAD and DWG in vertical views. The 2D AutoCAD file linked to a plan view will display as collinear segments in the elevation, resulting in reduced performance.

It is beneficial for large projects to divide a model into different project files, link these files to a single central file, and assign each model to a working set (see the working set section). When

dividing a single project into multiple models, some typical segmentation points are as follows: individual buildings, building cores, building shells, interiors, expansion joints.

(3) Modeling in a simplified way

Minimize geometric details that are not visible at the selected output scale. Usually, the necessary level of detail in a given model can be conveyed to the team at well-known drawing scales or some other commonly used scales. The project team's understanding of typical 2D drawing conventions should be utilized as much as possible, using the correct level of complexity in the model.

Before determining the construction of walls, roofs, windows, and doors, regular versions of these elements (incorporating fewer geometric shapes) should be used. Unless material usage or other types of analysis are applied to the model, ordinary walls should be considered sufficient to meet the needs of certain projects or project areas.

The consistent practice of users is to decompose the large model into multiple files (each with a size of approximately 200MB), and then link the generated project files together. If the user processes a file and uninstalls other links during most of the time, this process is most effective. Engineers of the architectural model may have to maintain one or more frequently loaded links, which may affect model size estimates and thresholds for these disciplines [6].

When creating a detail view, the model is filled with filled areas (instead of lines), and the connected geometry is limited to necessary conditions. Unneeded area schemes are removed, unnecessary groups are maintained, unused groups are removed from the Project Browser, and unused objects are regularly cleared. As cleared objects cannot be restored, you may need to create a backup of the project before clearing.

(4) Railing

Avoid using railings for large-scale fences or separation systems, or at least limit the visibility of these elements. Revit does not issue a warning for this, but performance is affected due to the large number of lines required to generate each railing element.

If you need rich railing elements, please consider modeling the simplified railing representation based on the railing details to fully illustrate the design.

Similar to railings, stairs are also complex elements, but may not be easy to simplify. Restrict the visibility of stairs to the necessary basic views.

(5) Parts and components

Restrict the creation of parts and components with unnecessary elements to avoid overloading the model with unnecessary detailed information. Consider creating parts in a separate model and linking the original model. It is possible to use rebar sets instead of individual rebar elements to avoid filling the project template with a large number of families, as these families are not useful for every project. Compared to the comprehensive template, it is recommended to use the simplest template.

4.2. View Optimization

To improve the performance of opening a project, set a drafting view with fewer elements as the starting view (Manage tab Manage Project panel Start View). It is possible to first minimize the depth of the view in elevation, plan, and section views, so that geometry hidden by other elements in the view does not affect the drawing performance of the view.

To reduce the amount of geometry maintained in the view, consider post clipping the view. The additional workload cost of object clipping caused by post clipping is often compensated for by the reduced amount of geometry maintenance in the later stage. When working in the view, use a section box to limit the visible geometry. Minimize the number of views to help reduce model size.

To optimize linking to the activity model.

When working in a linked file environment, use the "Wireframe" or "Shaded" display mode. Avoid hiding a large number of individual elements in a view.

Turn off "visibility/graphics" and unnecessary categories in the template. When pasting into a closed view using the 'Align Paste' tool, the target view will be opened and closed. When you need to repeat this type of operation multiple times, opening all target views before starting the paste operation sequence can improve performance. Zoom in on the view to accelerate drawing and snapping. If the view is very dense and the snap lines are scattered in all directions, clear the "Snap to Distant Objects" setting in the snap dialog box (Manage tab Settings panel Snaps). Close unnecessary windows. When working in a 3D view, most files are placed in RAM. Furthermore, it is recommended to close these views when saving to the central file, as Revit will update the complex view during the save process [7].

4.3. Mechanism Optimization

Revit initially implemented working set as a mechanism to enable multiple users to work together on a single model by taking temporary ownership of user-defined element groups. Checking out a working set prevents other users from editing any part of the working set. By performing the Save to Central operation, you can stop controlling the working set.

Revit now has a transparent mode for element borrowing, which automatically assigns ownership of edited elements to users, allowing for more intuitive interaction with the model in a multi-user environment. Users can use the element borrowing feature to select elements to edit, allowing Revit to silently grant and manage ownership of the elements until the next time the user performs a "sync with central file" operation, when these edited elements are available for use by all other users of the model.

The Revit platform team recommends that you often use working set to separate conceptual areas of a project, such as separate buildings, grids and levels, building cores, building shells, furniture and equipment that span multiple categories.

In some cases, you may need to check out working set, such as to avoid accidental changes to specific model elements, such as building grids or linked files. In this case, BIM managers or team leaders sometimes choose to check out working set that contain elements that should not be edited or relocated at will. Recommendation: working set can help manage element visibility, reducing visual clutter during editing and reducing Revit memory usage. Closing working set that you don't need can free up memory intensive tasks for Revit, such as printing, exporting, and upgrading existing models to the current Revit version.

Places links and imported items into a single working set and closes the working set when not in use. When you open a workshared project file, use the ability to selectively open working set.

5. Conclusion

In the long run, the development of BIM is a common trend. BIM technology is a project management and control technology that combines construction technology and information technology. The construction industry is using BIM technology to shift from broad management to comprehensive management. From decisions made in previous meetings to empirical decisions. The construction industry is approaching the digital age. BIM technology makes it easy to reduce and develop prefabricated building, significantly improve the quality of civil engineering, and shorten the construction period. BIM technology replaces traditional engineering industry management systems to achieve digital and integrated management. In his entire career, he has basic knowledge of 3D data modeling, planning, planning, design and architectural design.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Hu Yuchao Fundamentals of Revit Architectural Modeling and Interior Design. Beijing: Mechanical Industry Press, 2017, 33-35

[2] Ke Weimin Application Analysis of BIM Technology in Residential Building Design . Architecture and Decoration, 2021, 15 (3): 153

[3] Yin Fei, Xie Zhiying The Application Advantages of BIM Technology in Architectural Engineering Design . Sichuan Building Materials, 2021, 47 (2): 25-26

[4] Shen Juncheng, Yang Aiping Research on the Application and Development Trends of BIM in Architectural Design . China Real Estate Industry, 2021, 19 (1): 67

[5] Zhang Weijin, Zhou Jin A Rapid Modeling Method for Subway Entrance and Exit Based on Revit . East China Jiao Tong University, 2022, 31 (3): 12-15

[6] Yang Yun Research on Revit based arch bridge modeling methods . China University of Mining and Technology, 2021, 23 (4): 15-6

[7] Xie Xingxing Development of a Revit based rapid modeling plugin for drainage ditches . School of Civil and Architectural Engineering, Hubei University of Technology, 2021, 24 (3): 5-16