Application research of BIM technology in water supply and drainage engineering

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Abstract. With the development of the times, people's demands on the pipeline system are higher and higher. There are more and more pipeline types, and the design of pipeline engineering becomes more and more complex. Therefore, the use of CAD and other software for pipeline engineering design is gradually unable to meet the growing demand. Especially in today's more and more complex pipeline design, pipeline design is always met with problems such as collision or intersection, and the design of two-dimensional software makes these problems a little helpless. However, with the introduction of BIM technology, BIM technology is a technology that can build three-dimensional models and share and transmit architectural information, and is applicable to the entire life cycle of buildings. This paper mainly discusses the application of building water supply and drainage pipeline design based on BIM technology, in order to provide systematic theoretical guidance for follow-up researchers.

1. Introduction
With the vigorous development of our country economy, the national economic strength rapidly boost, this is also our country residents living standards improve, people also more and more high to the requirement of living environment, in the construction of water supply and drainage pipeline and prompting the role in the increase of is often the case, we also look at its planning to the requirement of water supply and drainage pipeline arrangement is reasonable, and have an impact on whether the construction of the whole beautiful sex. In addition to some of the above requirements, the basic requirements of water supply and drainage pipeline design are to meet the requirements of water safety for all residents, as well as the economic and energy saving requirements of water supply and drainage pipeline.

However, there are also a lot of problems in the design of water supply and drainage pipeline at the present stage. The software used by the general designer is two-dimensional CAD design software, which increases the difficulty for the design of water supply and drainage pipeline.

However, BIM technology can better solve these problems. Building information model (BIM) technology is a rapidly developing information technology, which is now mainly used in engineering management. It’s called a rule changer for the building industry model. It also functions at all stages of an engineering project (design, construction, operation, and maintenance).

2. overview of BIM
In recent years, BIM technology become a new concept in the construction industry. In fact, it is a guide to the construction industry to a higher informatization development of new technology. The
application of BIM technology and promoting China's construction industry to bring huge impact, also for our country's construction industry to provide a new thought of management, and greatly improve the construction of information integration. At the same time, it also brought great benefits to the development of construction industry, such as promoting the improvement of project quality, reduce the waste of money and materials, etc.

BIM is an engineering data model that integrates all the information of the engineering project based on 3D digital technology. It also associates all of the project information. BIM technology is software which directly applies digital technology to solve engineering project description problem. It also enables designers and engineers to respond correctly to various information about building projects, and provides a solid basis for cooperation among all parties.

BIM technology is also a digital method applied in design, construction and management. This technology integrates the construction management environment in the whole project, making the construction project more efficient and reducing the risk of the project.

3. application theory of BIM in high-rise building water supply and drainage engineering

3.1. BIM data information standard

BIM technology is to use digital information to present architectural information as an intuitive three-dimensional model, and apply the model to all stages of the project. At the same time, it is also necessary to share and transmit all data information of the project in all stages, participants and the software required for project implementation. Therefore, from a macro perspective, the structure of data information model of the whole BIM is the collection, transmission and recognition of effective information of buildings, which is also the core theory of BIM technology. Data information of BIM technology mainly includes the following three standards: storage standard, transmission standard and expression standard. All kinds of standards are the theoretical basis for the complete transmission and sharing of information by BIM technology. Specific standards include: IFC (storage standard), IMD (delivery standard) and IFD (expression standard).

3.1.1. IFC-data information storage standard

IFC (Industry Foundation Classes) standard is an architectural information processing standard that can be used to process the presentation and interchange of building data by computer. Through this standard, the data of construction projects can be identified on the computer.

3.1.2. IDM-data information transfer standard

The main role of the IDM standard is to standardize the information of all stages of building data, and form a connection with the IFC standard to achieve the perfect expression of building data information. IDM is attached to the IFC, in other words, IDM

It is part of the IFC software information exchange framework. The IDM data exchange architecture mainly consists of the following aspects, as shown in figure 1
3.1.3. *IFD- information dictionary standard*

Previously we introduced the data storage standard IFC and data transfer standard IDM for BIM technology. The IFC mainly presents the information data of each stage of the engineering project in a general standard form, which is like a grocery store of engineering data information. In it, we can find the effective information of each stage of the engineering project and make use of it. IDM is the working mode and process of data information about a specific project, just like we need to get things from the grocery store, what kind of working process we should have by what means, and IDM is the standard that provides us with means.

IFD is independent of time and use of the concept, such as our window, for example, from the various sources of information to research the concept of the window, we found that each source of information only when it comes to information on the part of the window, in the image below we used different colors for the different nature of the window, some properties in the different sources of information can be Shared and others are different:

![Fig.2 Definition of Windows in IFD standard](image)

3.2. *The role of the three standards in BIM technology*
IFC/IDM/IFD constitutes the three basic supports for the information exchange of construction projects, so it naturally becomes the three pillars for the maximization of BIM value, as shown in the figure:

Fig.3. the relationship between BIM Technology and three standards

3.3. Engineering information management of BIM technology

Traditional engineering information management involves multiple participants and is a multi-point to multi-point information exchange process. Engineering information management based on BIM changes the traditional information transmission mode, and the engineering information is effectively managed centrally. The BIM information management process is closely related to the organizational model. However, the owner plays an important role in BIM no matter what kind of organization. The owner is the owner of BIM information and also the promoter of BIM application. The owner realizes the management of BIM information directly or through the entrusted agent.

In general, information management of BIM mainly consists of the following steps.

1) Determine the organizational model. The determination of the organizational model is mainly to give full play to the core concept of BIM technology in the project, so as to improve the work efficiency of all stages of the project and meet customer needs to the maximum.

2) Formulate corresponding process management rules and regulations. Rules and regulations are established to standardize the sharing and transmission of data information.

3) Determine the corresponding professional software platform. Professional software based on BIM can give full play to the advantages of information integration. Therefore, it is necessary to select different types of software in different stages of architectural life and different specialties. Problems such as support for data standards, compatibility for data formats, and interaction between professional software should be considered.

4) Select the BIM information integration software and hardware platformism information integration platform is the key to achieve data integration among heterogeneous systems. It needs to meet the BIM information integration platform which is adapted to the project construction scale and requirements. BIM's information management is in its infancy, and there is still a lot of research work to be done. This paper only proposes the overall management process.

4. Discussion on application and results of BIM in engineering

4.1. Application of BIM in water supply and drainage management of high-rise buildings

In the professional design of water supply and drainage, the laying of pipes is the most important part of the professional design of water supply and drainage, and also the part that needs to be accurately expressed in the professional drawings of water supply and drainage. However, the pipe types of water supply and drainage specialty are many and miscellaneous, and the pipe in many places needs to be laid centrally. Therefore, it is an important problem to distinguish the pipe types in the construction drawings of water supply and drainage specialty.
In BIM software, it can directly draw pipes. Of course, the piping drawing function of BIM software is not so simple. If it is only a simple drawing function, then the drawings it draws cannot be used in actual engineering construction. In traditional CAD drawing, the drawing of pipes is usually expressed by different layers. (a) shows the result of not using the filter, and (b) shows the water supply and drainage pipe after using the filter.

Figure 4(a) shows the result of not using the filter, and figure 4(b) shows the water supply and drainage pipe after using the filter.

4.2. Intelligent drawing management

In BIM technology, the catalog and frame of construction drawings can be set into a special group. As various parameters in the group are related to each other, the information of drawings and the catalog can be updated in time, which greatly improves the efficiency of drawing management in the project and reduces the errors during construction.

4.3. Well-expressed water supply and drainage plan

The engineering project is designed with BIM technology and the parametric design concept of BIM is used. This is essentially different from the traditional two-dimensional design. In BIM technology, the standard representation of water supply and drainage plans of high-rise buildings is mainly achieved through working sets, filters and modification of some groups in software. In figure 5, it can be found that the plane diagram designed with BIM software is consistent with the plane diagram expression of traditional two-dimensional design.

Fig 5 Project equipment room of water supply and drainage plan

4.4. Visualize the general pattern of water supply and drainage
During the site construction of the installer, the general drawing of water supply and drainage plays a vital role in guiding the construction.

To be effective, therefore, the site construction plans for water supply and drainage must be accurate, detailed, image and specific. However, in the traditional water supply and drainage system in details, more commonly expressed as a single wire to pipeline, with illustrations to express the equipment, the single wire can't reflect the reality of the pipe diameter, often exist in drawing pipe can have space to place, the actual construction pipeline root will not fit in the original space, for water supply and drainage equipment installation is often so, too. However, if the Revit MEP software is used to draw the large-sample diagram of water supply and drainage, the location of equipment installation can be vividly seen and the size of equipment to be installed is consistent with the real size, which greatly reduces the construction difficulty of installation workers and ensures the consistency of construction and design drawings.

In addition, the water supply and drainage master plan can be generated in the process of water supply and drainage plan drawing. See figure 6, figure 7.

![Fig. 6 The first floor of The toilet water supply and drainage project details](image)

![Fig 7 Part of the detail project fire pipeline](image)

5. Conclusion

Software applications based on BIM technology, this paper studies the connotation of building information model (BIM) and its application in the high-rise building water supply and drainage engineering management theory (BIM data dictionary information storage, transmission, information standards, building information model standard framework, engineering information management, etc.), as well as the design and construction management technology, analyzes the BIM technology in the high-rise building water supply and drainage engineering management advantage.

As a new kind of 3d design technology, BIM system get rapid hair exhibition in recent years, great development space, can greatly improve the building water supply and drainage engineering design results. BIM technology in our country is still in its infancy, many design institute has not used the technology, design, application and promotion of all the problems, it is necessary to reform the
whole system. BIM technology is the product of science and technology and the progress of The Times. The design personnel of water supply and drainage should actively think about innovation, promote the research and development of BIM technology, and then promote the development of water supply and drainage design of the whole building.

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