Research on Design Optimization of Building Water Supply and Drainage Supported by BIM Technology

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Abstract: This paper studies the application of BIM technology in the design of building water supply and drainage system, and puts forward the strategy of data acquisition and analysis, system simulation and evaluation and design optimization based on BIM. Through BIM technology, the building water supply and drainage system can realize data integration, visual management and control, and improve the design accuracy and construction efficiency. At the same time, BIM technology also supports the simulation and performance evaluation of water supply and drainage systems, helping to identify potential problems and optimize design solutions. In addition, this paper also discusses the development trend of BIM technology in building water supply and drainage design, and puts forward future research directions and key suggestions, emphasizing the important role of BIM technology in improving design quality and efficiency, reducing operating costs and promoting building sustainability.
***Keywords*:** BIM technology, building water supply and drainage design, design optimization strategy

1. Introduction

With the acceleration of the urbanization process and the continuous development of the construction industry, the design and optimization of the building water supply and drainage system has become a subject of great concern. Especially in the current social background of pursuing high efficiency, energy saving and environmental protection, how to ensure the stable operation and efficient performance of the water supply and drainage system is particularly important. As an innovative tool in the construction industry, BIM technology provides a new solution for the simulation and evaluation of building water supply and drainage system. This paper aims to explore the simulation and evaluation method of building water supply and drainage system based on BIM technology, and propose effective design optimization scheme through optimization strategy research, so as to improve the operation efficiency and sustainability of the system.

2. The application of BIM technology in building water supply and drainage design

2.1 Development history of BIM technology in the construction industry

The development of BIM technology in the construction industry can be traced back to the late 1970s. At that time, architects and engineers began to use computer-aided design (CAD) software to create architectural models. With the development of computer technology, building information modeling (BIM) has gradually replaced the traditional CAD software and become the new standard in the construction industry. BIM enables the creation of three-dimensional building models, but also contains geometric and spatial information about the building, properties of materials and components, and even information about construction and maintenance. With the continuous development of BIM technology, the construction industry is gradually realizing the value of BIM in the design, construction and operation stages. The application of BIM makes the design and construction at all stages more coordinated, reducing errors and loopholes, thus improving the quality and efficiency of the project. In the operational phase, BIM can help building managers better manage building facilities and perform maintenance. In the future, with the continuous emergence of new technologies such as artificial intelligence, Internet of Things and cloud computing, BIM technology will be more intelligent and comprehensive, bringing more innovation and change to the construction industry. BIM technology has become one of the core competitiveness of the construction industry and will continue to play a pivotal role in the industry.

2.2 Importance of BIM technology in building water supply and drainage design

In the design of building water supply and drainage, the importance of BIM technology is self-evident. First, BIM technology can help designers and engineers create accurate three-dimensional building models to better locate and plan the location and layout of water and drainage facilities. Secondly, BIM can provide detailed attribute information of building

components, including pipe diameter, material, connection mode, etc., which helps to realize accurate design and simulation of water supply and drainage system. In addition, BIM technology can also play an important role in the construction and operation phase. During the construction phase, the construction team can use BIM models for coordination and conflict detection, thereby avoiding conflicts between the water supply and drainage system and other building components and improving construction efficiency. In the operational phase, BIM models can become a comprehensive information base for building facilities, facilitating maintenance and management. All in all, the importance of BIM technology for building water supply and drainage design lies in improving design accuracy, optimizing construction process, reducing maintenance costs, and providing technical support for the sustainable development of buildings throughout their life cycle. With the continuous development of BIM technology, it will continue to play an important role in the field of building water supply and drainage design

3. Chapter Two: Analysis of key problems in building water supply and drainage design

3.1 Challenges and difficulties in building water supply and drainage design

There are many challenges and difficulties in the design of building water supply and drainage. First of all, the structure and layout of the building should be taken into account to ensure that the design of the water supply and drainage system conforms to the overall layout of the building and does not affect the beauty and function of the building. Secondly, factors such as urban planning and environmental protection should be taken into account, and the design should meet the local planning requirements, and the treatment and discharge of rainwater and sewage should be taken into account to avoid pollution to the surrounding environment. In addition, the climate and terrain of different regions will also pose challenges to the design of water supply and drainage systems, and it is necessary to design the system reasonably according to the actual situation to ensure normal operation under various complex conditions. In addition, it is also necessary to take into account the use of the functions and needs of the building, different types of buildings need different water supply and drainage system design, so it is necessary to carry out fine design according to the actual situation. In short, building water supply and drainage design needs to consider building structure, environmental factors, regional conditions and use needs and other factors, in order to solve the various challenges and difficulties it faces.

3.2 The role of BIM technology in solving the problems of building water supply and drainage design

BIM technology plays an important role in solving the problems of building water supply and drainage design. First of all, BIM can realize the integrated design and coordination of architectural design, structure and water supply and drainage system, making the coordination between various subsystems more close and reducing conflicts and errors in the design process. Secondly, BIM can use 3D modeling technology for visual display to help engineers and designers more intuitively understand the various components and pipeline layout involved in the water supply and drainage system, so as to optimize the design scheme and improve the design efficiency. In addition, BIM can also realize real-time monitoring and simulation analysis of building structures and water supply and drainage systems, helping to predict the operation of the system under different conditions, so as to identify problems and optimize design in advance. In addition, BIM technology can also achieve data sharing and collaboration, promote cooperation and communication between design teams, and improve the efficiency and quality of design and construction. In short, BIM technology can provide comprehensive support for the design of building water supply and drainage system through collaborative design, visual display, real-time monitoring and data collaboration, and help solve problems and challenges in the design process.

4. The optimization method of building water supply and drainage design based on BIM technology

4.1 Data collection and analysis of BIM technology in building water supply and drainage design

BIM technology plays an important role in the data collection and analysis of building water supply and drainage design. First of all, BIM technology can obtain the three-dimensional digital model of the building, including building structure, pipeline layout, equipment installation and other information, which provides a reliable data basis for the design of water supply and drainage system. Secondly, BIM technology can realize the integration and sharing of multidisciplinary data, including data in multiple design fields such as structure, HVAC, water supply and drainage, which is conducive to

comprehensive analysis and collaborative design. At the same time, the BIM model can be used to conduct hydraulic simulation and fluid dynamics analysis, evaluate pipeline flow rate, pipe network pressure and other parameters, and provide a scientific basis for the design and optimization of water supply and drainage system. In addition, BIM technology can also carry out data collection and monitoring in the construction stage, achieve visual management and control of the construction process, and improve construction quality and efficiency. In summary, the data collection and analysis of BIM technology in building water supply and drainage design can realize the integration and analysis of building data, provide a scientific basis for system design and construction, and help optimize system design and improve construction efficiency.

4.2 Simulation and evaluation of building water supply and drainage system based on BIM

BIM based simulation and evaluation of building water supply and drainage system refers to the use of BIM technology to simulate and evaluate the performance of building water supply and drainage system. Through the BIM model, the spatial layout, pipeline network and equipment installation of the building can be accurately obtained, providing a reliable data basis for the construction of the model. The hydraulic simulation tool integrated in BIM software can be used to simulate the flow, pressure, speed and other parameters of the water supply and drainage system, so as to evaluate the operation effect of the system. Through the simulation analysis, we can find the potential problems in the system, such as insufficient water pressure, hydraulic mismatch, etc., and optimize the design. In addition, the simulation operation can also evaluate the energy consumption and energy efficiency of the system, and provide a scheme reference for the energy saving transformation of the system. BIM simulation and evaluation of building water supply and drainage system can not only effectively improve the accuracy of system design and the prediction ability of system performance, but also optimize the operation scheme of the system and improve the sustainability of the system in the building life cycle. In summary, BIM based simulation and evaluation of building water supply and drainage system is an efficient method, which helps to optimize system design and improve system operation efficiency.

5. Conclusion and prospect

Through this research, we draw some important conclusions about the optimization strategy of building water supply and drainage design combining BIM technology. First of all, the use of BIM technology can achieve a comprehensive integration and comprehensive analysis of building water and drainage systems, so that designers can more accurately evaluate the performance and efficiency of the system. Secondly, BIM technology can effectively assist design teams to collaborate and share information, significantly improving design efficiency and collaborative work ability. In addition, through the simulation tools provided by the BIM platform, different design schemes can be simulated and analyzed and compared to provide a scientific basis for design decisions. Finally, we found that building water supply and drainage design combined with BIM technology can effectively reduce system operating costs and improve system efficiency and sustainability. These conclusions bring us some implications. First of all, BIM technology has brought new ideas and methods for the design of building water supply and drainage system, which can consider the performance and efficiency of the system in the design stage, providing more possibilities for building energy conservation and environmental protection. Secondly, the practical application of BIM technology has proved its importance and value in architectural design, and it is suggested that design and construction parties make full use of BIM technology in future projects to improve design quality and efficiency.

References

[1] Yinlan Hu, The application of BIM technology in the design of building water supply and drainage study [J]. Journal of housing and real estate, 2016 (21) : 1. The DOI: CNKI: SUN: ZZFD. 0.2016-21-129.

[2] Wu Manjun, Yuan Ansheng. Research on Design and Optimization of Building Water Supply and Drainage based on BIM Technology [J]. Chinese Science and Technology Journal Database (Abstract Edition) Engineering Technology, 2023.

[3] Ma Wengang. Discussion on the application of BIM Technology in building water supply and drainage design [J]. Engineering Technology Innovation and Development, 2023.DOI:10.37155/2972-4333-0101-16.

[4] Wang Tiantian. Application research of BIM technology in building water supply and drainage engineering design [J]. Building Materials Development Orientation, 2022, 20(10):3.