

# Application of BIM Technology in Municipal Pipeline Project

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**Abstract:** Building Information Modeling (BIM) applications are the focus of the construction industry in recent years, as an advanced technology, has been successfully applied in the construction industry abroad, and produced a huge economic benefits. In this paper, a review of the past five years and foreign literature, systematic exposition of domestic and foreign research and application of BIM and connotation, analyzes the benefits of BIM technology and broad prospects for development. Then it analyzes the BIM technology in the comprehensive municipal pipeline design advantages and practical needs.

**Keywords:** Building information modeling (BIM); Comprehensive municipal pipeline; Collision detection; Construction design

## 1. Introduction

As an important part of urban infrastructure, the municipal comprehensive pipeline has its own concealment. Sort is various, pipelines and staggered complex, a lot of collision problem in the initial design phase due to the limitations of traditional pipeline comprehensive design existence itself, is not fully guarantee the rationality of the layout of pipelines. It is relatively common to cause the second excavation. Changes frequently, delay the construction period, this phenomenon has seriously affect the normal operation of our city and the normal life of people, using at present advanced BIM comprehensive technology, can greatly improve the efficiency of comprehensive pipeline. BIM comprehensive technology, the construction of the pipeline 3 d modeling, architectural and mechanical and electrical equipment using BIM technology in visualization model and the collision detection function, collision check to the existing information model, can be directly to find the problems in the pipeline comprehensive, timely adjustments, thereby reducing the unnecessary rework during construction, improves the one-time success rate of fire engineering installation, so as to achieve the engineering elevation and high requirements of the construction quality[1]. So it is important to introduce BIM technology in the design of municipal pipelines. In our country, how to apply information technology to the construction of urban infrastructure is an important subject.

## 2. An Overview of BIM Technology

BIM (Building Information Modeling, Building Information model) is based on 3d digital technology, simulating the real Information of buildings, and the detailed expression of relevant Information of the

project. BIM technology is a direct application in the construction project of digital information technology, to solve the problem of construction project in the software design, make a design staff and engineers can make accurate to all kinds of building information to deal with, and provides a relatively solid foundation for cooperative work.

As soon as BIM technology was published, it soon caused a wave of information revolution in the global construction industry, which became the focus of the construction industry. According to statistics, about four-fifths of the top 300 U.S. construction companies in 2010 have successfully applied BIM technology. Because of the domestic study of BIM started relatively late, at present, BIM technology in domestic has not been widely practical application, in the field of construction engineering, design units and some domestic enterprises began to actively in the process of design tentatively used BIM technology for pipeline design. The Beijing Olympic Games and the Shanghai shen-capital building project are also integrated with BIM technology[2]. Domestic Shanghai tower in the project preliminary design, construction drawing design, construction management and late operation and maintenance of integrated technology involved in the entire life cycle of BIM, whether from the design quality and design efficiency or construction progress control and management of comparison, economic and social benefits are huge, and this is the first domestic application of BIM technology in the whole life cycle of the engineering project[3].

## 3. Development Status of BIM Technology

Through the review of a large number of Chinese and foreign documents, BIM technology has been developed

for more than 20 years, and it is a brand new field in the international field. The United States is the first country in the world to apply BIM (Building Information Modeling). With the rapid development of technology globalization, BIM technology has developed into developed countries such as Europe, South Korea and Singapore. At present, these countries attach great importance to BIM, which provides a favorable development and application environment for BIM technology. Among them, BIM is the most common and mature application in the United States.

### 3.1. Foreign research status

The American academy of architectural sciences released NBIMS in 2007. The BIM applied research was carried out by its Building SMART Alliance (BSA). By the end of 2008, BSA had issued a series of BIM related application standards. Many countries in Europe have been aware of the important value of BIM technology, and have also initiated BIM technology research. Related data statistics show that some European countries of BIM technology penetration rate has exceeded 60%, in Europe and the United States and other developed countries, all engineering projects, the application of BIM technology project ratio above 50%. In Western Europe, the proportion of construction projects into BIM concept design is very high, in the UK, since 2010, the trend of BIM promotion is relatively obvious, the mandatory use of BIM technology at the same time, the government also issued a series of documents, give enterprises the preferential policy, BIM standards issued is promotes the development of BIM standardization, BIM utilization rate of the highest when France, nearly 40% of the project adopted the technology, the figure is slightly higher with the UK and Germany.

Technology in South Korea get rapid development strength in BIM standards issued in time, more than South Korea government attaches great importance to for the BIM technology application, and have developed their own detailed schedule for the development of BIM to guide and standardize the application of BIM technology. In addition, South Korea large construction firms are also actively research and application of BIM technology, made great contribution to the development of BIM, such as Daelim construction company will be the BIM technology used in construction management, schedule management and cost control; In addition, BMIS adopts BIM technology to design and organize the project design and construction phase, and promote the popularization and development of BIM in the construction field through the efforts of all parties.

Singapore government department of information technology in the construction of the role is also very seriously, as early as in 2004 established the first

automated system of examination and approval, improve the electronic information level of the project.

Since 2009, a lot of design companies and construction units the BIM technology application to practice step by step, the Japanese government also gradually realize that BIM technology bring profound changes, asked the government to the tentative combined with BIM technology projects, and explores and summarizes the BIM in visual design, the whole cycle potential advantage and implementation process of information management, push the BIM nationwide are widely used in Japan.

### 3.2. Domestic research status

Started in 2003 to explore the BIM technology in China, so far for BIM technology in the research and application in the field of architecture for 10 years, and in the pipeline project to urban road design research is still in its infancy.

In 2001, the ministry of housing and urban-rural development formulated the tenth five-year plan for the informationization of construction industry, and the plan was revised in 2003 according to the development of digital informationization in the construction industry. Further clear about the construction of informationization in the future, the development trend of industry informatization is proposed to the overall goal of positioning in "perfect standard system of informatization construction, the important task is to apply single construction industry mature technology of management information system (MIS), computer aided design (CAD) and relational database technology (RDBS), automatic control technology (AC) for applications such as the main body of organic integration, integration of a number of information technology in improve the integration of enterprise management in[4].

From now on, BIM concept has been gradually known to China's construction industry, but mainly used in design units. Architectural design and research institute of tsinghua university, China institute of architectural design and research institute, Chinese building and other domestic some power design institute and property companies have begun to BIM technology research to establish a department. 3 some cities consulting companies are also beginning to try each cycle through the BIM technology to the construction projects, including prophase planning, design, construction, operation and maintenance, etc. From the BIM technology application range and depth of understanding, BIM comprehensive application technology research in China's construction industry is still in its infancy, but BIM technology consultancy and training institutions, the application of BIM in practice value and practical significance also started by relevant government

departments, industry associations, BIM in construction industry in various fields of extension and depth will be the trend of The Times.

### 3.3. Application of BIM in pipeline engineering

As a new science and technology, BIM has been recognized and applied in the engineering construction industry of developed countries, and has led to an unprecedented transformation in the construction industry.

As an important part of modern construction industry, the pipeline engineering of many construction projects has adopted BIM technology. At present, Europe and the United States and other developed countries has been using BIM 3 d visualization technology can effectively solve the problem of complex project of comprehensive pipeline engineering, Japan is also in actively learn the successful experience of western countries used BIM, and set out to study the relevant technical standards of the BIM, is to speed up the construction of pipeline engineering for promotion and application of BIM technology. The national BIM standards issued by the us government in 2007 clearly stipulate that the integrated pipeline project for construction projects must use BIM technology. Many European countries construction projects have also been integrated into the BIM technology, such as BMW (BMW told Welt) in the world, and in Munich and Stuttgart porsche museum many little-known construction, their comprehensive pipeline engineering are using BIM technology, and obtained the domestic and international construction industry professionals[5].

Because of the domestic study of BIM started relatively late, at present, BIM technology in domestic construction industry has not been widely practical application, in the field of construction engineering, design units and some domestic enterprises began to actively tentatively used in the design process BIM technology in pipeline design, can let the engineers to make more scientific decision, greatly improve the quality of the comprehensive pipeline engineering, avoid change again and again.

The application of BIM in integrated pipeline engineering is mainly focused on the construction area, while the research and application of the municipal pipeline project are still in the exploration stage.

## 4. The Significance of BIM Technology in Municipal Pipeline Engineering

Many problems existing in the comprehensive pipeline project, especially the design method and design tools have some limitations, some design mistakes until construction stage is found out, to a great extent, the municipal comprehensive pipeline engineering quality to drop, affect the normal quality of life of residents and

urban service level. In the face of many influence factors, and the shortcomings of the current technologies and methods, considering the pipeline project is integrated the realistic need, according to the characteristics of the BIM technology and function, using BIM technology in integrated pipeline engineering has important practical significance.

The three-dimensional pipeline synthesis is based on the three-dimensional model to optimize the design scheme of various integrated pipelines of urban roads, is mainly to line configuration mode and to optimize design, in view of the collisions between the pipeline to adjust, perfect design. Introduced a concept of BIM in the design of the pipeline stage, and blend in BIM technology in the design, designers can on BIM platform structures, consistent with the actual project of information model, the various professional engineers can respectively on the same model to carry on the design, and timely access to relevant information and other professional designers design intention, thus effectively solved the traditional two-dimensional because communication is not timely, in the design of information transmission errors caused by design errors, such as in the design phase to avoid the many problems can only be found to the construction stage, reduce the design change and mentioned the design quality and construction efficiency greatly.

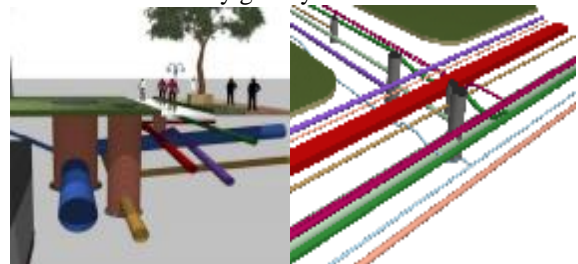


Figure 1. Three-dimensional model of underground pipeline using BIM

## 5. Apply BIM Technology to the Counter-measures in Municipal Pipeline Engineering

### 5.1. BIM software platform selection

Autodesk Revit series software is one of BIM core series software, which was first developed by American Revit Technology in the late 1990s for parameterized design software. There are three major software programs, including Revit Architecture, Revit Structure, and Revit MEP. These three software provide BIM solutions for architecture, structure and equipment. And the 2013 Revit software is a combination of three series of software, which is based on BIM's design oriented solution.

As the core modeling software of BIM technology, one of the characteristics of Revit is the parametric design

method, which is mainly reflected in the parameterized construction drawing and parameterized modification engine. In software, information is stored in the database in digital form, which facilitates timely updating and sharing. There is a real time correlation between data, and when a set of data changes, other associations can be reflected. Users can simply enter a message at design time to capture this information and apply it throughout the project. A 3D model built in this way is a database of associations between elements and elements. Only models that are built in this way can change flexibly along with the design. Revit also includes a powerful function to visualize, which can be rendered in video mode by rendering.

## 5.2. Application of BIM technology in municipal pipeline engineering

According to the function of building information model technology, combined with the pipeline engineering in the design phase of the problems facing, and draw lessons from BIM application in building design and construction of pipelines and successful experience, summed up the BIM application in pipeline comprehensive thinking.

First of all, I need to be familiar with the drawings provided by the design unit, analyze the key points and parts of the drawing, and be familiar with the arrangement of the various professional pipelines and the relationship of space position.

Second, create 3D building model first, then will be imported into the 2D drawings in Revit software, on the platform to build the 3D model of professional equipment, water supply and drainage pipeline, strong and weak current bridge, communication pipeline model, respectively, by the professional engineers work on the same platform for 3D model creation, the application of the 3D visualization technology of BIM to complicated equipment in the process of pipeline design, then each system integration together.

Then, based on BIM comprehensive collision detection of pipeline, and improve the BIM pipeline model, implementation of BIM technology in pipeline comprehensive series of application, effectively solve the

pipeline in the comprehensive "wrong, leakage, touch, lack of" wait for a phenomenon as shown[6].

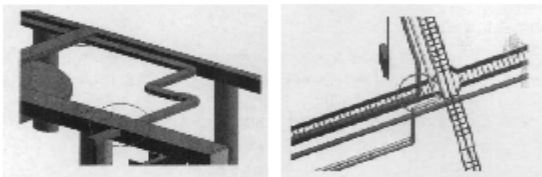


Figure 2. Shows the location of the conflict

Also can need according to their own separate between the various systems and system testing, and then export the collision check report, and accordingly on the 2 d drawings automatically tag design errors, in view of the pipeline based on the analysis of collision problems and propose solutions in time, at the same time apply for design change, modify and perfect the two-dimensional construction drawing, and then adjust the BIM model, combined with perfect designs, after convenient late to deepen the design of piping drawings, used to guide the construction.

BIM model integrates each professional model building, structure, and utilities, in Revit platform can be conveniently generated profile and plane figure, help engineer to clearly understand the pipeline layout, accurate guide the construction. In addition, the BIM technology can automate the rapid statistical tasks of materials and engineering for each professional pipeline, and generate relevant documentation for project cost control and later maintenance management.

## 6. Summary and Prospect

Building informatization is the inevitable trend of the construction industry. Compared with many developed countries and regions of the world, China's construction industry informatization level has serious lag behind, informatization level of the construction industry in China is still a long way to go, building information model is applied in the construction industry information technology revolution, with the level of the rapid development of computer technology and improvement of related software BIM technology, how to make use of BIM technology to improve the efficiency of the engineering design, improve the quality of the project, reduce waste, reduce the delay of construction period, so as to enhance enterprise core competitiveness, is the main task of the current construction industry.

Urban power supply, water supply, gas supply, communication, drainage and other integrated pipelines are an important part of maintaining the normal operation of modern cities. The purpose of pipeline synthesis is to rationally utilize the urban space and to determine the position of urban engineering pipeline in urban underground space. Pipeline design has become an important part of urban road design, BIM comprehensive technology used in municipal engineering, pipeline has become a big trend of municipal engineering in the future, so comprehensive actively promote BIM technology in the moment is crucial, but BIM technology promotion is a long-term and arduous project.

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