

Research on BIM Technology in Highway Construction Safety Management

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Abstract:

With the development of society, all kinds of construction projects are often affected by different factors, and therefore need to be supported by relevant information technology. BIM technology is a new tool for architecture, engineering, and civil engineering, which has been widely accepted and used in the industry as soon as it was proposed. BIM technology and related software can be used to integrate project information from the architectural design phase to the end of the building life cycle, and from construction to maintenance in a targeted manner, which can significantly increase the level of information aggregation in construction projects. Because BIM databases also respond to the dynamic range of changes associated with changes in various metrics, their accuracy and speed of update also meet design requirements.

Keywords:

Highway; in safety management; BIM technology research

With the emergence of BIM technology in various construction industries, road construction is also gradually adopting this technology, the advantages of which are unmatched by many existing information modeling technologies. For example, visualization, customization, modeling, optimization, graphical, etc. Commonly used BIM modeling software is progressively implemented through expert testing. The technical basis is mainly related to 3D graphics, physical modeling, computer-aided design and building-related developments. These concepts have great advantages when used for road safety monitoring to minimize the adverse effects of accidents and construction defects. For the safety of road construction workers and the proper execution of construction, this paper provides recommendations and suggestions related to BIM technology to contribute to the development of the construction industry.

1. The significance of highway construction safety management application of BIM technology

1.1 Improving the efficiency of construction management

Construction site conditions during highway construction are difficult, with construction management standards and quality control points varying from region to region. Manual controls are labor-intensive, and data statistics and control errors are prone to error, making it possible to predict problems over time. In severe cases, this can compromise project design. The introduction of BIM technology improves the efficiency of construction management in all sections of the road, enabling the timely detection of potential problems in the construction sector, enhancing reliable anti-theft measures, and reducing safety risks. At the same time, workers using BIM technology can organize design data from all stages of highway construction into relevant documents, track actual highway construction, and present them in the form of 3D models. Over time, project management control and transparency will also improve, leading to greater overall management efficiency than ever before.

1.2 Data and information sharing

BIM technology is based on computer technology. Asset managers collect information related to road construction during the preparatory phase of road construction and enable trained personnel to use BIM technology to regularly provide new data as it emerges from the construction process at headquarters. Do. By combining all types of data and developing a suitable design model, we can provide real-time feedback on road construction and identify any issues that may exist. This allows the highway construction management to have dedicated staff to analyze problems, adjust the strategic construction plan,

improve construction efficiency, and reduce the likelihood of safety issues during construction. BIM technology also enables administrators to remove resource records and associated data from each building block in a timely manner, improving the quality of their value-for-money program like never before [1].

1.3 Promotion of Engineering Construction Visualization

BIM technology utilizes three-dimensional geometries to display relevant construction plans so that decision-makers can easily analyze the actual state of each construction site and better anticipate construction. Managers as well as other stakeholders can directly observe the interconnections of the various parts of the construction project, with all aspects favorably analyzing the impact on the highway project. If required, we can also provide advice on highway construction, which helps to scientifically define the highway at all stages of highway construction. On the other hand, stakeholders can utilize BIM rendering technology to develop a detailed project plan that connects the key elements of the project to major subdivisions and integrates the project capabilities provided by BIM technology. In addition, the relationship between projects is reduced, reducing the possibility of problems in the construction process itself.

2. specific use of BIM technology in the construction of highway engineering safety management

2.1 Risk management

In the process of highway construction, BIM technicians must optimize the demand model and establish an effective real-time early warning mechanism for the highway construction process, so that the project manager and departmental personnel can understand the current status of the construction project, and classify and track all kinds of safety problems encountered in the process of highway construction. The occurrence of sloping ditch landslides or localized landslides that seriously affect construction safety should be reported to the supervisory personnel in a timely manner. The statistics of all kinds of accidents in the process of road construction are analyzed, and all hidden dangers affecting road safety are eliminated in a timely manner. Road construction safety management is based on BIM building information modeling to analyze the safety performance of road structures. Based on the measurement data, we put special emphasis on preventing risk and behavioral factors on the highway. A classification of hazardous locations has been developed taking into account different drilling depths and warning mechanisms. Technicians must carefully monitor each highway construction process to ensure that it meets the requirements of industrial safety standards and focus on verifying spatial collisions. Road construction safety management functions are prioritized for use based on the type of conflict in the safety classification. During the phase management of a highway construction project, technicians must collect and categorize information sources so as not to affect the performance of the various large-scale machinery and materials involved in underground engineering drilling, providing a data vehicle for ensuring road safety.

2.2 Establishing a virtual three-dimensional model of the construction project to reduce engineering errors

The main advantage of BIM technology is the ease and accuracy of information processing. The most likely causes of accidents and problems during road construction depend on modeling. Although in the past 2D modeling was greatly delayed due to the rapid development of mathematical modeling techniques, BIM technology visualization may lead to the emergence of other modeling techniques for decades. Imagery is a form of visualization that is very important in the construction industry. When engineers are presented with blueprints, it is important to be able to accurately identify and design every detail. However, the use of BIM technology is compared to the current skill level of many engineering teams. Many areas often require a test of experience and imagination. Using BIM technology to create virtual 3D civil engineering models can significantly reduce technical errors. For example, a highway construction team can plan the structure of an entire building based on a BIM application management platform to build a complete 3D dynamic image integration platform, which is central to the construction of a multi-lane highway. The combination of features provides the construction team with an overview of the project and construction direction in the most intuitive way. Engineers must create 3D models, GIS models, information management systems, and risk management platforms in mobile apps using field data from a taxonomy-based BIM management platform that integrates knowledge from a variety of disciplines, including math and physical engineering. A complete BIM highway construction system model has been created to accurately and efficiently model the construction site from three perspectives: the construction team, the engineering design and management team, and the safety monitoring team[2].

2.3 Functional security controls

In the process of construction management, BIM technology can also be utilized in virtual construction technology to show environmental features and all aspects of highway construction directly in the model. Managers can study the virtual model before construction, analyze potential quality issues and potential safety risks during construction, and apply limited prevention strategies to complete construction management tasks in a virtual environment. Planning during construction also focuses on modern highways, including construction planning, environmental factors, technology applications, and other aspects that may affect construction planning. If the actual construction plan differs significantly from the projected duration, the quality of the project cannot be guaranteed and conflicts can arise between the constructor and the construction organization. Arbitrary adherence to the construction plan also poses a safety risk. IM technology is integrated into the highway construction process through the direct implementation of 4D modeling, which visualizes interfaces and design sequences and empowers contractors and subcontractors to build more professional and manageable structures. Combining 4D design modeling with design organization planning and safety management planning describes design management, including equipment planning, assignment of tasks and materials, and safety management processes. In addition, in recent years, many builders have utilized BIM technology to track project progress directly using 4D construction modeling to avoid mismanagement of development, which increases construction safety risks.

2.4 Isolation of hazardous areas

Risks must be considered in road construction, and BIM technology allows for the quick identification of hazardous areas during construction and the definition of separate guidelines that enable construction managers to respond quickly to emergencies. For a complete project that can utilize technology to identify safe escape routes and effectively facilitate road construction, the psychological changes of construction crews and local managers are largely taken into account. Expedition personnel can manage the construction site based on a master plan developed using local disaster protection and BIM technology. This allows for a safer and more standardized approach to construction on site, thus improving overall construction efficiency.

2.5 Virtual emergency drills and technical safety briefings

BIM technology has a very close relationship with the development of computer technology, and BIM technology can simulate the production of a project in real-time using 3D virtual images. In the process of applying computerized BIM technology, it can also be combined with VR technology to provide a virtual space for managers to use virtual characters to carry out relevant construction work. Relevant managers can also use BIM technology to conduct virtual emergency response training. This allows you to effectively improve emergency response skills and quickly respond to on-site safety issues. On the other hand, in road construction, BIM technology can be used to determine the risk level of different areas, and the construction management procedures carried out at each stage are determined by the risk level, with the builder coordinating the use of locations and equipment between construction crews. Based on this, safety training can effectively improve the safety management awareness of construction personnel and avoid safety risks in road construction [3].

3. Conclusion

The use of BIM technology in road construction can break the time and space barriers of construction management. Construction managers can track the construction process, and dig into the problems and difficulties in the loading of relevant data, as well as the actual construction situation, linking the program to create a BIM technology model. Adaptation programs can promote road construction in a more standardized way and effectively improve the quality of road construction safety management.

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