Study of Collaborative Management for Transportation Construction Project Based on BIM Technology

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Abstract. Abstract. Building Information Modeling (BIM) is a building modeling technology based on the relevant information data of the construction project. It is an advanced technology and management concept, which is widely used in the whole life cycle process of planning, design, construction and operation. Based on BIM technology, transportation construction project collaborative management can have better communication through authenticity simulation and architectural visualization and can obtain the basic and real-time information such as project schedule, engineering quality, cost and environmental impact etc. The main services of highway construction management are integrated on the unified BIM platform for collaborative management to realize information intercommunication and exchange, to change the isolated situation of information in the past, and improve the level of information management. The final BIM model is integrated not only for the information management of project and the integration of preliminary documents and design drawings, but also for the automatic generation of completion data and final accounts, which covers the whole life cycle of traffic construction projects and lays a good foundation for smart highway construction.

1. Introduction

The integrated informatization management platform based on BIM technology are combined with BIM technology, computer technology, internet of things technology, mobile network technology, virtual reality, simulation technology and latest philosophy of management of highway construction project management which collects and integrate project information and data[1][2]. Through unified model in BIM collaborative management platform, various information and data such as figures, graphics, BIM models, 3D simulations, and dynamic simulations are provided for project manager and participant which manage projects effectively and achieve project schedule, quality and investment management objectives[3].

In the process of the implementation of traditional traffic construction projects management, problems such as repeated construction, rework and waste of resources often occur due to incomplete...
design or poor communication[4]. Due to the lack of effective means of information technology, information in each stage included traffic construction projects decision-making, design, construction and operation is managed in isolation[5]. The main services of highway construction management are integrated on the unified BIM platform for collaborative management to realize information intercommunication and exchange, change the isolated situation of information in the past, and improve the level of information management. The final BIM model is integrated not only for the information management of project and integration of documents and design drawings in the prephase, but also for completion data and final accounts autogeneration, which covers the whole life cycle of traffic construction projects and lays a good foundation for smart highway construction. In the construction industry modernization, industrialization, informatization integration strategy, the application of BIM technology is imperative.

2. Application of BIM in Engineering Management

BIM technology which has five characteristics included visualization, coordination, simulation, optimization and graphical representation, provides a new driving force for the Engineering construction industry, especially the enterprise's production efficiency with three-dimensional digital design technology and three-dimensional collaborative management concept. The role of BIM in project management for project owners is mainly reflected in the following aspects: conflict recognition, such as the construction process analysis meets the requirements of site deployment, simulating visual environment, providing more reliably determine the site conditions for the preparation of schedule, construction sequence, site layout, and personnel arrangement etc. BIM technology can make up for the defect which the traditional project management software is not intuitive with charts and text. BIM technology provides not only a three-dimensional model with information and data about project quality, schedule and cost etc for project management, but also the integrated results with more specific and intuitive.

The role of BIM in project management for construction companies is mainly reflected in the following aspects: synchronizing the information for construction needed, forecasting schedule and cost with cost control, and analyzing construction process with machining and installation of components. Not only interface, order and engineering specialty coordination of construction, but also combination of construction simulation and construction organization plan, equipment and material transportation, allocation of labor and machinery can be intuitively and effectively arranged on the unified BIM platform.

The impact of BIM on traffic construction projects is the whole process and all-round, but the BIM model can have some different from the model required for project management. Building information model based on BIM technology will be in the core and dominant position in the whole process of project management including progress control, cost control, quality control and resource management etc based on BIM model with management tool and platform.

(1) Visual management

Multimedia dimensional view of the road, bridge, tunnel or scene, panoramic roaming, aerial aerial bird's eye view of roaming can be carried by BIM model visualization. At the same time, in the three-dimensional scene, the engineering model integrates the data of project design, construction, investment, schedule, quality, and so on. The basic information, construction information and engineering attributes of any parts and components for transportation construction project can be queried and searched(Figure1).
Investment control management based on BIM

According to the support of structured data of BIM model, the cost management analysis based on BIM technology can provide the data needed for cost management dynamically according to the project construction plan. Engineering quantity statistics and cost analysis can be carried out by BIM model for transportation construction project, and the progress of automatic statistics and measurement payments can be carried out by integrating model and the bill of quantities (Figure 2).

Construction schedule control based on BIM

Actual progress and construction process can be visually expressed for each participant including construction team, the supervisor and the owner of the project which can master the actual progress and scene condition of the project by integrating model and construction schedule with gantt chart, network diagram and 3D animation etc. The feasibility of various construction and process plans can be compared and final scheme optimization can be decided by dynamic simulation in different construction stage and construction technology in important link. Various construction resources can be dynamically and reasonably allocated, and the influence of deviation on the duration of a project and its causes can be analyzed by BIM technology for accurate planning, tracking and control. At the same time, the deconstruction for transportation construction project and the standardization of construction process inspection, the actual progress of the project can be queried checked and controlled based on BIM technology (Figure 3).
(4) Construction organization and simulation based on BIM

The key or difficult parts of the construction can be simulated and the construction plan can be analyzed and optimized by BIM technology. The construction work and key procedure in the process of construction can be intuitively understood and the difficulties and key points in the construction process can be mastered. The construction plan will be further optimized and improved to improve construction efficiency and safety.

(5) Quality management in site based on BIM

Though the BIM model compared with the construction results in site, mistakes can be avoided effectively and timely and there is great significance and value in reducing rework and reducing costs respect(Figure4). BIM technology enriches the quality inspection and management of the project, and integrates the quality information in BIM model. Through the model browsing, the quality problems can be efficiently transferred at all levels and users, and quality inspection and control tools can be further optimized by integrating BIM with modern management techniques.

(6) Construction change management based on BIM

Construction change will directly affect the construction cost of transportation construction project, and coordination and coordination of construction change, cost and schedule will be actualized in construction stage by BIM technology. As the contents of the construction change will be updated immediately on the building information model and the barriers to information transmission have been greatly removed, information transmission and interactive time are substantially reduced among the
design company, owner, supervisor and contractor, and construction change, cost and schedule will be dynamic controlled and order managed.

(7) Drawings and document management based on BIM

Through the BIM integrate design drawings, design optimization of the different specialty in transportation construction project, at the same time construction change, contract, documents and other information and model will be integrated, construction status, model components and their corresponding drawings, construction change information, and documentation in each construction phase will be queried and retrieved in arbitrary time. Combining cloud technology and mobile Internet technology, engineering documents and data can be cooperated and shared quickly, safely, conveniently, and controlled in the transportation construction project with corresponding authority control. It provide great convenience in field office and cross specialty collaboration in document inquiry, approval and communication by actual time BIM model in PC Browsers and mobile devices.

(8) Safety civilization management based on BIM

Management and construction staff can investigate and determine the hazard of construction process and the disaster process is simulated based on BIM in advance which the cause of the disaster was analyzed, corresponding measures was draw up, and the control of the entrance and exit, the layout of the work face are dynamically checked and adjusted.

(9) Other management and applications based on BIM

For some key control engineering, sensors and other equipment can be integrated and associated in BIM model and platform combined with the internet of things technology, monitoring data in real-time for the sensors and equipment such as compaction, temperature, force etc can be obtained. In the construction process, consumption of materials and settlement of machinery are timely count, and resources, materials, costs are effectively and dynamically analyzed and controlled with resource planning and material management based on BIM. With the accumulation of BIM sample project and model, the BIM database of each specialty will be formed gradually, and finally the enterprise BIM component library will be formed.

3. Conclusion

the whole process data in the whole process from the earlier stage of project construction, implementation period and completion acceptance to the operation and maintenance in construction projects is associated and integrated, and it will run through the full life cycle of transportation construction project based on BIM technology in transportation construction project with collaborative management system and data integration. During the period of construction, the final BIM model is gradually accumulated to actualize data integration of the construction specialty, such as subgrade and pavement engineering, bridge engineering, tunnel engineering, traffic safety engineering, electromechanical engineering, greening, environmental protection engineering, house-building engineering, etc, which satisfy the requirements of the current highway information construction, and lays a good foundation for highway construction and Smart transportation.

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