Research on Construction of Highway Bridge Quality Engineering Based on BIM Technology

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Abstract: At present, the construction of large domestic bridges is responding to the guidance of the Ministry of Transport on building quality projects, and exploring the construction model of quality projects. This research is based on fully investigating the experience of domestic large-scale bridge quality engineering construction, combining the engineering characteristics of highways, and proposing the application of BIM technology to achieve information sharing and collaborative operations between all aspects of project management.

1. Research background
According to the quality engineering guidance of the Ministry of Transport, the new construction projects are built with high quality and durability, safety and comfort, economic and environmental protection, and social recognition as the construction goals. Builders need to improve the following aspects of the ability: engineering design, engineering management, engineering quality, engineering safety assurance, engineering technology innovation ability, engineering quality soft power, etc., to solve the actual design, construction, management, and implementation of a variety of problems.

2. The specific application of BIM technology in highway engineering to create quality engineering

2.1 On-site quality management
On-site quality and safety hazard investigation through the mobile APP has the advantages of standardization, convenience and high efficiency. On-site management staff directly sent the quality problem to the rectifier through the description, classification and photo of the quality problem and rectified within a limited time. The rectifier entered the acceptance link after the rectification according to the requirements. The BIM client can view the status of quality problem discovery, rectification, acceptance and archiving in real time. This technology has played a huge role in the on-site quality management of the Second Humen Bridge, and has truly achieved quality management in the end and implemented it to people.

2.2 Prefabricated beam factory management
Develop the production management system of the prefabricated beam factory to realize the dynamic
management of the beam factory. The prefabricated section beam production system uses beams as the unit to realize information management in the whole process of prefabricating, storing beams, beaming and erection; achieving traceability of supporting materials, quality acceptance and other information; dynamically reflecting the production information of the base of the prefabricated beam factory. Establish a unique full life cycle "ID card number" for each segment beam, and paste the QR code to develop the WeChat management terminal to realize each beam section from steel bar binding, prefabrication, beam storage, beam construction to operation and maintenance Full life cycle management.

2.3 Remote manufacturing and prefabricated assembly

Use Tekla modeling software to import the material list of the parts in the BIM 3D model of the steel box beam into the SigmaNEST nesting system to automatically realize the optimal configuration of the steel plate blanking. The exported material list can guide the raw material procurement of the manufacturer, and the export cutting command can be entered CNC machine tools realize automatic cutting. See the following figure for details:

Complete the development and application of three aspects based on BIM technology: (1) Establish a full-line refined BIM model. (2) Build a BIM platform. (3) Develop the combined application of BIM and construction technology. (4) Develop the combined application of BIM and construction management.

BIM is used most frequently during the construction phase and is also the most profitable phase. During the construction process, there are many BIM participants. It is advisable to set up a BIM general consultant on the project to assist the owner to do BIM management and application guidance. For the owner, the application points of BIM during the construction period are mainly projected collaborative management, including project OA, portal website, quality supervision and management, safety production management, schedule planning, contract management, project amount payment, on-site quality safety management and prefabrication plant remote progress quality management, etc.

2.4 Progress management

By developing the mobile app on-site signing function, real-time statistics of the actual progress of the project are realized, and the signing image data is uploaded to the platform in real time, realizing three-dimensional progress management; developing a component-based progress plan management module to achieve planned progress management; and measurement Data association, synchronous management of project measurement progress.

2.5 Security Management

Safety management includes three aspects of equipment, personnel and risk early warning management. Equipment management achieves one machine and one certificate, strengthens the management of equipment access, use, repair and maintenance; personnel management achieves one person and one certificate, through the management personnel's whereabouts, strengthens education and training, improves personnel safety prevention awareness and safety knowledge level; based on The BIM model establishes a risk source identification system, uses geographic fences to automatically alert people entering the risk area, and realizes intelligent and controllable safety management.

2.6 Drawing and file management

Associate two-dimensional drawings with BIM models according to components to achieve two-way retrieval and review of drawings and models; develop mobile APPs and compile catalog indexes for easy reference; develop a drawing change system to implement change processes and version management of new and old drawings. The purpose of file management is to keep files naturally and to facilitate retrieval, so that files can be kept anytime and anywhere, and file information can be queried in real time.
2.7 Measurement Payment Management
Through the BIM three-dimensional model, make a more intuitive query on the implementation of the list; split the engineering quantity list by component and associate it with the BIM model, click the model to query the cost, measurement and payment of the component in real time; Connected to the BIM platform, combined with the real-time progress of the project, quality records, hidden safety and other data, comparative query and measurement payment situation.

3 Application value of BIM technology
(1) Optimize the basic work of project management. Optimize the WBS decomposition of the project with the help of refined BIM model;
(2) Optimize schedule management. With the help of the schedule planning tool based on the WBS decomposition of the project, the plan can be made simply and quickly, avoiding the use of an Excel table to formulate a static schedule plan. The changes are cumbersome and cannot be effectively associated with the overall WBS decomposition of the project. The plan is seriously disconnected from the actual problem;
(3) Quality and safety closed-loop management. With the on-site quality and safety management mobile phone APP, front-line staff can find problems, submit problems, solve problems at any time, save on-site paper records, housekeeping work to the computer, and eliminate the use of Office to make reports. It also can be generated automatically by the BIM system platform.
(4) Quality and safety education is in place. Adopt mobile APP for quality and safety education and assessment, and realize the online and real-time education and assessment.
(5) Visualizing technology. Use visual methods for technical briefing. The technical briefing meeting materials can be traced at any time, consulted at any time, and reported in real time;
(6) Statistical analysis of project management data. Owners can view the safety, quality, progress, measurement / cost status of the project in real time, and can identify the most problematic bid sections through data analysis, quality and safety issues that have not been rectified after the deadline, project quality, safety, and cost development trends; Data for horizontal comparison of projects;
(7) Investment and cost control. Control investment and cost based on the number of precise projects;
(8) Comprehensive collaborative management. Effectively integrate with measurement and other information systems to achieve all-round collaborative management.

4 Conclusion
Taking quality engineering as the starting point, introducing advanced information technology based on BIM to comprehensively improve the management quality and efficiency of personnel, mechanical equipment, materials, and project investment; improve the standardization and assembly of highway engineering construction And the technical level of construction specialization
It is embodied in the following two aspects:
(1) BIM is combined with construction technology to review and collide design drawings to greatly reduce errors and omissions. With the help of three-dimensional models, the degree of detailed design of the detailed structure of design drawings can be effectively improved.
(2) BIM and management technology are combined to achieve effective management of all construction personnel through the BIM collaborative management platform during the construction management process, record the work trajectories of project participants, and achieve full responsibility traceability of important project nodes.

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