Study on Fine Management of Swivel Bridge Engineering Based on BIM Information Platform

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Abstract. Swivel bridge has the characteristics of complex construction environment, difficult construction, high requirement, tight construction period, many coordination relations and huge amount of information. Based on the BIM technology, the project information management platform carries out fine management of the project, focusing on the functional planning and overall framework of the platform. On this basis, the letter is elaborated in detail. Information management, progress management, construction simulation, progress difference analysis, task collaboration, quality improvement collaboration, safety issues collaboration and other important functional modules. Practice has proved that, compared with the traditional model, the project information management platform based on BIM technology has obvious advantages in saving costs, improving the degree of management refinement, and training BIM reserve personnel, and has a good prospect for promotion.

1. Background
Swivel bridge is a special kind of construction method in bridge engineering. It is usually used to cross obstacles such as rivers, valleys and railways, etc. It has the advantages of safety, high reliability, good integrity, and can reduce the cost of hoisting effectively. There are still the following problems to be solved urgently: ① The traditional design and construction way of bridges are severely disjointed, and it is impossible to start with the whole process management. ② The project management is hard to implement in detail, lacks of a way to combine delicacy management with advanced technology. ③ Owners can hardly feel a sense of participation during the whole management process and they lack the right to speak.

2. Method
Preliminary study on fine management of swivel bridge engineering based on BIM information platform is based on the overall research idea of "finding problems, analyzing problems and solving problems". See Figure 1 for details.
This paper makes a preliminary analysis: firstly, BIM technology is introduced, which includes visual communication platform, management collaboration platform, highly computer simulation and construction optimization, etc. It can preliminarily improve the construction management of bridge engineering projects; secondly, solving bridge construction management problems requires a series of BIM technology to provide stable state. At present, there is no BIM management platform designed for bridge engineering specially in China, and the swivel bridge belongs to a special construction method in bridge engineering, so the existing BIM management platform cannot solve the problem of characteristics in swivel bridge engineering.

Based on the above contents, a detailed management method of swivel bridge is customized and developed based on BIM information platform to solve a series of characteristics problems existing in this kind of project.

3. Introduction of Customized BIM Information Platform

3.1. Platform Function Planning

The main purpose of project information management platform based on BIM technology is to make the delicacy management be better realized in construction process, so proper functional planning will determine the success or failure of the system and the effect of the management. According to the theory and practice of project management, the main functions of the information management platform of this project include: informatization management, quality control, investment management, progress management and safety controlling. See Figure 2 for details.

![Figure 2. The functional planning of project informatization management platform based on BIM technology](image-url)
3.2. Overall Platform Architecture
The overall framework of the platform contains the project preparation stage, construction stage and operation and maintenance stage. Cloud server and cloud computing function are used to realize the management application from BIM model creation to PC management platform and mobile APP. See Figure 3 for details.

![Figure 3. Overall framework architecture of project informatization management platform based on BIM technology](image)

3.3. The Function Module of Information Management Platform
According to the requirements of management and archives filing, an online archives database is established to realize online archiving and classified access of data; besides quickly picking up the quality, safety, investment, progress, information and related construction schemes, construction drawings, meeting summaries and supervision notices of various parts (components) through the model of sand table, project funds can also be supervised and urged to the synchronize the compilation of project materials, checking the integrity of archives at any time, ensuring the rapid completion of the project completion acceptance phase of archives’ acceptance and archives’ transfer, improving the level of project archives’ management.

3.4. The Function Module of Platform Progress Management
In addition, during the practical work, the project platform can also be used to compare the planned progress with the actual progress. Through the project management platform electronic sand table module, combined with UAV site inspection, the project image progress will be more intuitive and diversity. After comparing the progress differences of the right part 18 # pier pile foundation, the BIM model can be displayed intuitively. The construction party immediately increases the equipments to ensure the formation of the 18 # pier side slope retaining structure, so as to facilitate the construction of the subsequent caps.

3.5. The Function Module of Platform Collaborative Management
It realizes multi-party collaboration such as construction plan submission, site construction submission, intermediate measurement application, quality and safety collaborative management, the examination and approval of special report, etc. It realizes online task filling and the online approval of construction management personnel, improves the efficiency of communication and speeds up the speed of task processing. When through up the on-line query of task flow, we can grasp the progress of task approval in time, realize online initiation and item-by-item processing of various collaborative tasks, and improve the overall management level. The main application points of this project platform collaborative management include: task collaboration, the approval of scheme collaboration, the improvement of quality collaboration, security issues collaboration.

The project platform realizes information linkage management by using PC and mobile APP, and realizes the improvement of quality collaboration.
4. Case study

4.1. Project Profile
The integral construction section of National Expressway Network is from Kunming-Chuxiong Expressway to Minshan-Guangtong Expressway, connected Anchu Expressway. It is 114.916 km long and Two-way six-lane. The design speed of traffic is 100 km/h and the width of subgrade is 33.5 meters. Total investment of transmission line is 15.07 billion yuan. This expressway will through Lufeng County to Kunming, the main line of Kunche Expressway (Qinfeng-Heping Experimental Section) starts at K60+622 which is located in Dade Village, Lufeng County. The route is from east to west, and the main line ends at K61+395 to Heping Town, with a total length of 773m. The Kunche Expressway (Qinfeng-Heping Test Section) which is over passed Chengdu-Kunming Railway Flyover Project (The paper will abbreviate it as Upper Crossing Chengdu-Kunming Railway Overpass Project) is the key control project of the whole construction section. The Upper Crossing Chengdu-Kunming Railway Flyover Project is divided into two parts: the left part is 254 m in length while the right part is 294 m in length. The costing of this project is about 70 million yuan. The project adopts the way of swivel construction: turning the T-frame with anti-clockwise 66 degrees to the bridge position, setting up the speed with 0.016-0.02 rad/min, the weight with around 15,000 tons, and putting it to right position with only one turning, the swivel operation time needs about 60 minutes.

4.2. Application Points
This project is based on BIM technology project information management platform for bridge engineering management, the main application points are as follows.

4.2.1. Information management. Building online archives, realizing online archiving and classified access of data; Picking up quickly in quality, safety, investment, progress information and related construction schemes, meeting minutes, supervision notifications of various appropriate parts (components) through sand table model. Supervising the synchronization of project data compilation and integrity inspection to ensure that acceptance of archives and transfer of archives should be completed quickly when the project is completed, so as to improve the management level of project archives.

4.2.2. Schedule management. Through the importing of progress planning, simulating construction process, assisting in the formulation of project land use plan, demolition plan, material procurement plan, testing plan, capital use plan, etc.; filling in actual construction progress, and generating project image progress and deviation display automatically; It also can realize automatic early warning of key line delay, so as to grasp real-time of project progress and make timely adjustments to deviations to ensure that the overall progress meets the requirements.

4.2.3. Investment management. Real-time correlation and on-line consultation of receipt records, project changes and intermediate measurement data to form the completed project quantity.

4.2.4. Cooperative task management. This project has cooperated with other parties such as the submission and examination of construction schemes, on-site construction inspection, application for intermediate measurement, collaborative treatment of quality and safety, examination and approval of special reports, etc. It realizes online task filling and approval, improves communication efficiency and speeds up processing speed. Through on-line inquiry of task flow, real-time control of approval progress, it also has realized online initiation and item-by-item processing of collaborative tasks, and improved overall management level.

5. Conclusion
This project integrates BIM modeling, collision detection, construction animation simulation, UAV
three-dimensional scene modeling, three-dimensional laser scanning and other frontier technologies into the swivel bridge project. By integrating various data and information, the project management information platform based on BIM technology is developed, which lays a solid foundation for fine construction management of swivel bridges. Practice has proved that BIM technology has incomparable advantages over traditional management mode in finding drawings errors, technical submission, engineering statistics, collision detection and information integration and so on. The implementation of this technology has brought tremendous technical and economic benefits to project management, and has a good prospect of promotion. With the continuous progress of science and technology, BIM technology will surely get greater development. New technologies such as BIM+3D printing, BIM+IOT, BIM+GIS, BIM+new method disclosure, BIM+VR, BIM+AR, intelligent site will gradually enter the field of project delicacy management.

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