

Exploration of the Whole Process Cost Management Path for Road and Bridge Engineering Based on BIM

Lei Shen

Shandong Transport Vocational College, Weifang 261100, China

Abstract: With the continuous development of society, the business environment has undergone tremendous changes. In order to survive in fierce market competition and to pursue sustainable development, various industries must strengthen cost management. Road and bridge engineering has complex and variable characteristics. In order to better manage the cost of road and bridge engineering, this article mainly explores the importance and criticality of BIM technology based cost management throughout the entire process of road and bridge engineering. The problems and challenges in cost management throughout the entire process of road and bridge engineering are proposed, and effective strategies for addressing these problems are analyzed in detail to promote the further development of road and bridge engineering, improve construction efficiency, reduce risks, and enhance economic benefits.

Keywords: BIM; Road and Bridge Engineering; Cost Management

1. The significance and criticality of cost management throughout the entire process of road and bridge engineering

In the construction of road and bridge engineering projects, the cost management of construction projects should be continuously strengthened, and it should be regarded as the central point of work. Only by scientifically and reasonably controlling cost, effectively reducing construction costs, and keeping them within the scientific budget range, can road and bridge projects be constructed smoothly. Cost management of road and bridge construction projects refers to the process of statistical and detailed analysis of the comprehensive costs required for the design, construction, and completion stages of the project. By utilizing the comprehensive cost of engineering construction and the unit cost of various construction projects, the rationality of engineering cost can be effectively monitored, ultimately achieving the grand goal of minimizing investment and maximizing benefits. The standardization of cost management throughout the entire process of road and bridge engineering construction will determine the cost control ability and predictability of road and bridge construction enterprises, as well as the implementation of related data work such as cost budget assessment. It has important effects on the decision-making process and business management of enterprises, especially on the quality of engineering. Therefore, enterprises should pay more attention to the quality of cost management. In other words, to improve the cost effectiveness of road and bridge construction projects, it is necessary to further enhance the level of specific design schemes and cost control capabilities.

2. The problems and challenges faced by cost management in road and bridge engineering

2.1. Supervision cannot fully cover project costs

At present, the inadequate supervision of the road and bridge engineering market has led to unreasonable competition mechanisms among many enterprises. They do not attach importance to quality requirements and blindly pursue low prices and price advantages to obtain bidding. Some enterprises even engage in prepaid construction and unpaid project payments in order to obtain benefits from engineering construction. The long-term existence of these problems will inevitably lead to the inability to fully implement cost management in road and bridge engineering construction, resulting in serious problems such as substandard construction quality, long construction cycles, and unreasonable resource allocation. These issues will to some extent lead to conflicting interests between Party A and Party B in the project, sparking various unnecessary disputes and hindering the supervision of project costs. They cannot be fully implemented in the construction process and face great challenges, affecting the healthy development of the entire road and bridge engineering industry.

2.2. Inconsistent computing system

In the cost of road and bridge construction projects, it is necessary to calculate the quantity of work more accurately. Considering the large length of the construction project, designers generally do not consider the calculation formula for converting natural dense soil to compacted cubic meters when borrowing calculations, nor do they make corresponding adjustments to the calculation formula based on the highway grade, resulting in inaccurate calculation formulas and hindering the engineering inspection qualification. The lack of precise calculation and evaluation by engineering designers on the amount of earthwork increase during the construction process has led to an increase in the completion cost of the project, prolonged the construction period, and further increased material consumption on the original basis, which has a further impact on the control effect of earthwork in the later construction site. According to relevant research, some cost managers have not fundamentally controlled the construction process of roads and bridges, resulting in continuous errors during specific construction. For example, in full width or half width road bridges, the number of welded steel bars and concrete strength of drilled piles do not meet the requirements. The main reason for this phenomenon is that the estimated amount of steel reinforcement for the main beam is too large, the calculation of the amount of steel reinforcement for the bridge deck and pavement is incorrect, and the calculation of the quantity of concrete for cylindrical piers does not consider the π value. In addition, there are incomplete parts in the summary table of bridge engineering quantities, which ultimately hinder the construction quality of the project and fail to meet the design requirements.

2.3. The lack of scientific and comprehensive engineering design results in unreasonable project costs

When planning long-distance road projects, it is necessary to fully consider their systematicity and comprehensiveness. Before design, detailed geological and topographic surveys should be conducted to ensure that the design data on the drawings match the actual situation. However, many construction units lack careful on-site verification and have not discovered the irrationality of the design drawings. After the completion of the project, many places need to be reworked, seriously affecting cost management. In view of this, it is required that designers personally visit site in person, conduct on-site inspections for design, and adjust and improve the design routes or water channel faults that have problems in the initial stage of design, in order to avoid increasing project costs in the later stage, affecting the overall planning of the project, leading to greater difficulty in later construction, increased construction volume, and further improvement of the technical difficulty of the building project.

2.4. Assess insufficient ground attachments

In the actual construction of road and bridge projects, the engineering department needs to solve the problems faced by local residents, promptly handle ground attachments, and standardize the management of rural personnel and property relocation. Currently, in order to more effectively evaluate and handle the ground attachments generated during the construction process, it is often necessary to rely on evaluation reports provided by third-party organizations. However, these reports may not be detailed enough and lack accuracy, which poses difficulties for the government to provide subsidies. Farmers often seek more benefits during the land acquisition stage, and may neglect the requirements for data organization, resulting in errors and affecting the cost management of road and bridge engineering, leading to actual expenditures that do not match the expected goals.

3. Strategy for Whole Process Cost Management of Road and Bridge Engineering Based on BIM

3.1. Create a cost control system

When implementing road and bridge cost management, the engineering unit can take a commercial perspective as the starting point to analyze and formulate a series of road and bridge cost standards and operating procedures. Based on the needs of the owner, scientifically plan and design each sub project, clarify its characteristics and needs, meticulously plan and scientifically allocate resources, and ensure that

the engineering design meets the specific needs of different construction stages. Engineering enterprises at all levels should have a comprehensive understanding of the project situation, and all work must follow the design regulations and standards. Firstly, reduce the backlog of building materials for road and bridge engineering, minimize inventory levels, and reduce unnecessary cost expenditures. Secondly, guided by the market, actively formulate and improve management strategies to avoid the problem of delayed supply of materials and funds from suppliers, improve engineering efficiency, and shorten the construction period. By implementing the above two measures to achieve minimum inventory and rapid response, we can reduce warehousing costs, reduce significant capital investment, and achieve the effectiveness of cost management in road and bridge engineering.

3.2. Improve the cost management system

Engineering units should pay attention to establishing a scientific cost system. Firstly, fully utilize the work value of cost personnel, establish a sound accountability mechanism, strictly manage according to relevant standards, actively analyze the suggestions put forward by the staff, investigate and study them, and timely adopt effective suggestions to improve cost management work. Secondly, clarify the division of responsibilities. Cost management responsibility should not only be the responsibility of individual cost management departments, but also the mutual coordination and cooperation between various construction and technical departments to achieve the overall cost awareness of each department of the construction unit. Thirdly, establish a professional cost management organization to facilitate consultation, supervision, accountability, and moderate delegation of power, in order to reduce the pressure on cost personnel and improve the efficiency of cost management work.

3.3. Strengthen talent cultivation

With the continuous development of the market economy, the road and bridge industry has ushered in vigorous development. The road and bridge cost market is thriving, and the various skills of enterprise employees are facing great challenges. In order to strengthen the cost supervision of the entire process of road and bridge engineering, achieve efficient investment and return, and strengthen the leading role of talents, it is necessary to continuously increase employee training on the basis of recognizing the characteristics of cost management in road and bridge engineering projects. Engineering units can hire professional personnel to provide systematic training for internal employees, improve their professional knowledge and skills, cultivate their innovative abilities, and adapt to the continuous adjustment and improvement of the entire cost management process.

3.4. Creating a refined cost management model

To effectively carry out design and construction activities and implement construction cost management for engineering projects. The construction unit should first enhance the formulation of specific construction plans to make production more scientific and standardized. Increase construction procedures and review efforts to avoid delays in the project schedule. Continuously adjusting and optimizing the operation and cost budget management mode is conducive to ensuring the construction quality of the project, standardizing the operation process of construction personnel, reducing safety accidents, and further enhancing continuous cost control. Secondly, construction units should use cost information management to reduce expenses, optimize construction processes, and strictly control the procurement of building materials, reasonable allocation, capital investment, specific work creation, personnel responsibility arrangement, and other aspects to ensure the quality of the entire construction process.

Conclusion

Overall, BIM technology is the result of the rapid development of contemporary information technology and has unique value in the entire process cost management of road and bridge engineering. Compared to traditional cost management methods, BIM technology is based on information technology, effectively avoiding human errors, significantly improving the efficiency of cost work and the accuracy of data calculation, thereby promoting significant improvement in the quality of engineering cost management. The construction of road and bridge

engineering is relatively complicated and time-consuming, which will to some extent constrain the cost management of the project. The application of BIM technology in cost management of road and bridge engineering can effectively reduce project costs, reduce construction time, and promote the development of road and bridge engineering.

References

[1]Wang Batu. Research on the whole process cost management of road and bridge projects based on BIM [J]. the Pearl River Water Transport, 2018 (10)

[2]Yang Baosan. Research on Whole Process Collaborative Management of Construction Project Cost Based on BIM Technology [J]. China Architecture Decoration and Decoration, 2023 (23)

[3]Wang Haifeng. Application Analysis of BIM Technology in Engineering Cost Management in the Era of Big Data [J]. Intelligent Building and Construction Machinery, 2023, 5 (5)