Effective Approaches to Construction Engineering Cost Control in Construction Project Management

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Abstract: Within the current socio-economic landscape of China, the development of the construction engineering industry significantly impacts the overall economic volume and regional economic development, highlighting its paramount importance. For the construction industry to achieve sustainable development momentum, ensuring the benefit of engineering construction must be the foundational premise. This necessitates that enterprises carry out targeted engineering cost control work, considering various cost consumptions during construction such as human resource costs, material costs, and equipment and energy costs, to flexibly formulate engineering cost control plans. Based on this, this paper explores strategies for construction engineering cost control from various perspectives including project budgeting, controllable expenditure ranges, and human resource management.

1. Introduction

Engineering cost control is crucial for guaranteeing the comprehensive benefits of construction projects. Construction engineering enterprises must adhere to the concept of whole-process cost control when conducting budget and cost control work. This involves analyzing and judging each stage of the construction project, effectively predicting construction costs for each stage. Determining the cost expenditure situation subsequently provides a realistic basis for setting the project construction management plan. For the reasons above, construction enterprises need to establish targeted engineering cost control paths based on the specific circumstances of the project to ensure the maximization of project benefits.

2. The Significance of Carrying Out Engineering Cost Control in Construction Project Management

2.1 Beneficial for Enhancing Project Economic Benefits

To ensure the comprehensive benefits of construction projects and allow the construction engineering industry to gain broader development space, enhancing project economic benefits should be the fundamental starting point. Implementing targeted construction engineering cost control work and applying the whole-process cost control concept enables the rational allocation of materials, resources, and energy used in construction, leading to higher usage efficiency. This effectively controls the cost of each construction stage, safeguarding project economic benefits.

2.2 Beneficial for Enhancing Enterprise Competitiveness

For construction enterprises to gain a firm footing in the current competitive industry environment, enhancing their own industry competitiveness should be the key focus. Specifically, the accelerating pace of China's socio-economic development and increasing urbanization levels have led to the expanding scale of the construction industry. However, during its development, the industry faces numerous challenges, including high homogenization among enterprises and declining real estate prices, intensifying internal competition. For construction enterprises seeking

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new development opportunities under these circumstances, it is essential to implement whole-process project cost management and control. By improving quality, reducing costs, and optimizing construction processes, they can achieve the most considerable economic benefits, thereby enhancing their comprehensive competitive strength within the industry.

3. Principles to Follow in Construction Engineering Cost Control

3.1 Active Control Principle

Construction projects are often large-scale, have long cycles, and involve multiple construction stages and technical points. To ensure the effectiveness of cost control and thus guarantee comprehensive project benefits, the active control principle must be upheld. Construction enterprises need to reasonably divide various construction stages based on the project's specific situation, determine the specific use of human resources, materials, and equipment, and use this as a basis to formulate systematic cost control plans. This involves proactively reducing costs, proactively optimizing construction stages, and ensuring comprehensive cost control effectiveness[1].

3.2 Whole-Process Cost Control Principle

To achieve the desired results in construction engineering cost control, the whole-process cost control principle should be actively implemented. The concept of cost management and control must permeate every stage of the construction project, enabling effective coordination among different construction stages, departments, and responsible parties. Cost control should be treated as an important task from the initial project design stage through to the final completion acceptance stage. Furthermore, the project budget should serve as the basic premise for setting the cost control plan. More practical cost management paths can be formed based on the project's specific scale and functional attributes, thereby optimizing the allocation of human resources, equipment, and materials during construction[2]. Additionally, when implementing the whole-process cost control principle, it is crucial to fully recognize that cost management is not solely the responsibility of designers, site managers, or project managers. Front-line construction workers should also develop a strong sense of cost control, avoiding material and energy waste during specific construction tasks, thus improving project cost control effectiveness.

4. Exploring Approaches to Construction Engineering Cost Control in Project Management

4.1 Conduct Cost Control in the Investment Decision-Making Stage Based on Project Specifics

In past construction projects, awareness of cost control during the investment decision-making stage was often weak, significantly increasing the likelihood of exceeding budgets or estimates during subsequent construction. Therefore, cost control work in the investment decision-making stage must be prioritized. Specifically, this stage involves tasks such as the allocation of various resources and determining the project funding scale, which significantly impact the project cost. Decision-makers must objectively assess the project scale and the specific funding requirements for construction, establishing comprehensive and feasible fund management plans. Particular consideration should be given to the geographical conditions, economic development situation, and price fluctuations of materials and equipment in the project's location. Making targeted investment decisions based on this analysis can effectively prevent blind investment and unscientific bidding, while also reducing enterprise investment risks, aligning with the modern and sustainable development needs of construction enterprises [3].

4.2 Carry Out Cost Control in the Design Stage Considering Different Disciplines

Cost control during the design stage is critical, related to the involvement of multiple disciplines in construction projects. The multitude of involved disciplines makes the design of construction drawings and plans challenging, requiring comprehensive consideration of various factors, especially the practical challenges of cost control across different specialties. For instance, during the design stage, accurate calculation of project quantities is essential. This calculation must consider the project's specific scale, construction quality requirements, and on-site management, among other factors, to ensure accuracy [4]. Furthermore, the design process necessitates frequent communication between cost managers and designers. Therefore, cost managers require strong communication skills to ensure the final design is highly executable, avoiding frequent design changes during construction.

To ensure the comprehensive effectiveness of cost control in the design stage, the following aspects should be addressed: First, determine the project construction budget. When designing the construction scheme, it must strictly adhere to relevant laws, regulations, and current industry standards regarding construction stages, personnel allocation, and selection of materials and equipment. This avoids non-compliance or exceeding standards, facilitating smoother cost control during construction and improving on-site management efficiency. When setting the project budget, the specific functional requirements of each project component must be fully considered to enhance the feasibility of the budget standards [5]. Second, apply the Limit Design method. To ensure effective cost control during design, traditional design methods should be innovated. Currently, the Limit Design method is widely used in large construction projects. It involves analyzing the project's specific scale and construction stages, and using BIM technology to simulate the entire construction process. This helps identify key construction points and potential issues in the design during the early stages, allowing for effective optimization of the design scheme. It significantly reduces the possibility of design changes and cost overruns during construction [6]. Through the flexible application of BIM technology, the budget quota for the construction project can be determined, enabling limit design of the construction scheme.

4.3 Manage Material Prices and Machinery Costs Effectively, and Control Human Resource Costs

During formal construction, the involved cost control content exhibits diversified characteristics. Material cost control, mechanical equipment cost control, and human resource cost control are the three most critical aspects. Ensuring effectiveness in these three areas leads to tangible results in on-site construction cost control, safeguarding the project's comprehensive benefits.

4.3.1 Material Cost Control

Modern construction projects utilize large quantities of materials. It is essential to ensure that the quality, performance, and specifications of materials match the specific requirements of the on-site construction to facilitate smooth operations and quality control. However, while ensuring quality and rational material selection, material cost control must also be prioritized. When selecting main building materials like cement and steel, market price fluctuations should be investigated first. After determining their price variation range, tendering and bidding can be used for procurement, ensuring comprehensive quality and performance while achieving the best cost-effectiveness. For smaller bulk materials like fine aggregates and fittings, they can be purchased directly from local distributors or manufacturers according to the project's specific design requirements. Establishing long-term relationships with local material suppliers can also be beneficial for effective cost control [7]. Once materials arrive on site, they are often not used immediately and require storage. Storage

areas must be damp-proof and fire-proof to prevent material degradation or damage, effectively reducing the potential for subsequent cost increases.

4.3.2 Mechanical Equipment Cost Control

Modern construction projects involve numerous large mechanical equipment, typically including cranes, bulldozers, loaders, concrete mixers, excavators, tower cranes, etc. The cost of these large equipment items is high. To achieve effective project cost control, renting should be prioritized where possible. Moreover, clear precautions must be established for the use and daily storage of this equipment. For example, specialized technicians should be assigned for regular inspections to identify damaged parts, functional degradation, or other faults. Any issues found should prompt immediate replacement or repair, ensuring equipment is always in good working condition and ready for use. Upon project completion, timely equipment demobilization is crucial. This not only shortens rental periods and reduces costs but also facilitates smoother final acceptance and site clearance.

4.3.3 Human Resource Cost Control

Besides materials and machinery, human resources represent another significant cost in construction projects, especially for large-scale modern projects involving diverse personnel types (designers, site managers, technical staff, inspectors, maintenance personnel, supervisors, etc.). Effective human resource cost control requires setting targeted work plans based on the specific functions of different roles. Rational functional division ensures staff across positions and departments fully utilize their capabilities during their duties, avoiding human resource cost waste.

Construction enterprises can expand their workforce through broader recruitment channels, forming professional, high-quality construction teams. This effectively reduces the error tolerance rate in on-site operations, leading to more efficient human resource utilization. Furthermore, for most modern projects, the number of designers, construction managers, and supervisors is relatively fixed, making cost optimization in these areas challenging.

In comparison, the group of construction technicians is larger. Optimizing personnel costs can be achieved by building high-quality construction technician teams. The allocation of technical personnel should be based on the specific site conditions, project scale, and technical difficulty to ensure their suitability, thereby reducing human resource costs.

5. Conclusion

In summary, when carrying out construction engineering cost control, improving fund utilization efficiency and ensuring scientific project management should be the foundational premises. Through implementing the whole-process cost control concept and deeply analyzing each project stage, technical points, and material/equipment usage of construction enterprises, engineering cost control can be conducted methodically, thereby promoting the enhancement of project economic benefits. In the future, BIM technology should be flexibly utilized to understand project specifics, ensuring the effective implementation of the whole-process cost control concept in modern construction projects.

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