Technical Analysis of Construction Techniques in Architectural Decoration Projects under the EPC General Contracting Model

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Abstract: In the field of architectural decoration engineering, the Engineering-Procurement-Construction (EPC) general contracting model has gradually replaced the traditional separated model and become a significant direction for industry development, thanks to its management advantages of integrating design, procurement, and construction. The EPC model combines the design, procurement, and construction phases, enabling construction techniques to extend beyond on-site operations and deeply integrate with design optimization, supply chain management, and schedule control throughout the entire project lifecycle. This paper analyzes the impact of the EPC model on construction techniques in architectural decoration projects, explores the collaborative logic between techniques and design, procurement, and schedule under this model, and proposes optimization strategies for construction techniques in architectural decoration projects under the EPC general contracting model, aiming to provide references for technological innovation and management upgrades in the field of architectural decoration engineering.

1. Introduction

As China's construction industry accelerates its transformation and upgrading, architectural decoration projects face increasingly stringent requirements for project management efficiency, construction quality, and cost control. Under the traditional separated "design-procurement-construction" model, information gaps and insufficient collaboration among different phases often lead to issues such as a disconnect between design plans and construction techniques, mismatches between materials and processes, and conflicts in multi-disciplinary crossover operations. These problems frequently result in high rework rates, project delays, and cost overruns. Against this backdrop, the EPC general contracting model, with its characteristics of a "single responsible entity and full-process collaboration," provides an effective solution to these issues.

2. Overview of the EPC General Contracting Model

The EPC general contracting model (Engineering-Procurement-Construction, an integrated design-procurement-construction model) is a crucial approach in the current construction industry for integrating the entire project management process. Its core is to entrust a general contractor with comprehensive capabilities to centrally manage all aspects of a construction project, including design planning, material and equipment procurement, on-site construction and installation, and post-construction acceptance, forming a "one-stop" project management system. This differs from the decentralized management model under the traditional approach, where design, procurement, and construction are handled by different entities.

From the perspective of core characteristics, the EPC model first emphasizes a "single responsible entity." The general contractor is fully responsible for project quality, schedule, cost, and safety throughout the project, avoiding the issue of responsibility evasion among different entities in the traditional model due to unclear responsibility divisions. Second, the model focuses on "full-process collaboration." Early in the project initiation phase, it enables early alignment

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among design, procurement, and construction phases. For example, in architectural decoration projects, the construction team can intervene during the design phase and optimize decoration plans based on on-site construction conditions, preventing rework caused by a disconnect between design and construction in later stages. Moreover, the EPC model offers the advantage of "efficient resource integration." The general contractor can leverage its own supply chain resources to achieve centralized procurement and precise allocation of decoration materials, ensuring both the stability of material quality and cost reduction through bulk procurement. Simultaneously, it can arrange material arrival times according to the construction schedule, reducing on-site storage pressure.

In the field of architectural decoration engineering, the EPC model is particularly well-suited. Since decoration projects involve a wide variety of materials, require fine craftsmanship, and often involve crossover operations with disciplines such as civil engineering and electromechanical systems, the EPC model can effectively address issues such as a lack of coordination between decoration design and electromechanical pipeline pre-embedding and mismatches between the procurement cycle of customized materials and the construction schedule in the traditional model. It provides strong support for achieving "quality compliance, controllable schedules, and cost optimization" in decoration projects and has been widely applied in large-scale decoration projects such as commercial complexes, hotels, and office buildings [1].

3. Core Impacts of the EPC General Contracting Model on Construction Techniques in Architectural Decoration Projects

3.1 "Upfront Integration" of Techniques and Design

In the traditional workflow of architectural decoration projects, design and construction are conducted in different phases and led by different entities. Design plans often focus more on aesthetic presentation and functional planning, with insufficient consideration for the adaptability of on-site construction techniques. This can easily lead to a situation where, after the plan is finalized, the construction phase requires repeated adjustments due to a lack of technical feasibility, resulting in an inefficient cycle of "design-rework-redesign." In contrast, the EPC model reconstructs the project participation mechanism by allowing the construction team to intervene deeply during the initial design phase, breaking down the barriers between design and construction and achieving "upfront integration" of techniques and design.

The core of this integration lies in the fact that the construction team can leverage its familiarity with decoration construction processes, on-site operating conditions, and technical implementation challenges to provide reverse optimization of the design plan from the perspective of technical feasibility. During the conceptual design phase, the construction team can proactively identify the technical requirements for each decoration phase, clarify technical boundaries in areas such as material processing, component installation, and process, and integrate technical feasibility standards into the design phase. Meanwhile, for potential technical conflicts in the design, such as the adaptability of decoration shapes to construction space and the matching of complex processes with on-site operating conditions, the construction team can communicate in real-time with the design team. By adjusting design details, optimizing shape structures, or selecting more suitable technical paths, they ensure that the design plan not only meets aesthetic and functional requirements but also has a clear technical implementation path, thereby reducing the need for plan adjustments in later construction stages due to technical issues and improving the collaboration efficiency between design and construction [2].

3.2 "Linked Adaptation" of Techniques and Procurement

Architectural decoration projects involve a wide variety of materials, and different materials have significantly different requirements for construction techniques. Parameters such as a material's physical properties, chemical stability, and installation adaptability directly affect the selection of construction processes and the effectiveness of technical implementation. Under the traditional model, the procurement and construction phases are independent of each other.

Procurement decisions are often based on factors such as cost and appearance, with insufficient consideration for the adaptability between materials and construction techniques. This can easily lead to situations where the procured materials cannot meet the requirements of the construction process or where the construction techniques need to be adjusted to adapt to the material characteristics, increasing construction difficulty and potentially affecting project quality and schedule.

Under the EPC model, "linked adaptation" between techniques and procurement is achieved through integrated management processes. Before material procurement begins, the construction team first clarifies the technical standards for construction techniques in each decoration phase and compiles a clear list of technical requirements for materials, including parameters such as physical properties, chemical stability, and installation adaptability. The procurement team then uses this list as a core reference during material selection, supplier screening, and contract signing, making technical adaptability a key consideration to ensure a high degree of match between the procured materials and the established construction techniques. During the material procurement process, the construction team maintains real-time communication with the procurement team to coordinate in advance factors such as material supply cycles and processing difficulties that may affect technical implementation, preventing forced adjustments to the construction technical plan due to material issues. Additionally, after the materials arrive on-site, the construction team conducts preliminary inspections in conjunction with technical requirements to ensure that the material quality is consistent with technical standards, laying a foundation for the smooth implementation of subsequent construction techniques.

3.3 "Dynamic Collaboration" between Techniques and Schedule

Architectural decoration projects are not independent operations but require crossover progress with multiple disciplines such as civil engineering, electromechanical systems, and fire protection. The process among these disciplines is tight, and the overall project has clear schedule milestones. Under the traditional model, construction technical plans are mostly fixed at the initial project stage and lack dynamic association with the schedule plan. If there are delays in a certain discipline's process or changes in on-site operating conditions, the fixed technical plan is difficult to adjust quickly, easily leading to process conflicts, resource waste, and ultimately affecting the overall project schedule.

Under the EPC model, "dynamic collaboration" between techniques and schedule is achieved by establishing a flexible technical adjustment mechanism. At the project initiation stage, the construction team formulates an initial construction technical plan in conjunction with the overall schedule plan, clarifying the technical paths and implementation time nodes for each decoration phase. During project progress, the construction team tracks the schedule execution in real-time and dynamically evaluates the adaptability of the existing construction technical plan based on the progress rhythm of each discipline's processes. If there is a delay in a certain phase, the construction team analyzes the reasons for the delay and improves construction efficiency by adjusting the technical plan, such as selecting more efficient construction processes or optimizing process cohesion methods, to make up for the schedule gap. If on-site operating conditions change, such as limited crossover operation space or adjustments to material supply cycles, the construction team promptly adjusts the technical implementation path to ensure that the construction technical plan matches the actual conditions and schedule requirements. Meanwhile, the construction team maintains close communication with other discipline teams and plans the implementation timing of decoration construction techniques in advance based on the progress of each discipline's processes, preventing technical implementation obstacles caused by improper process and ensuring the orderly progress of construction techniques in each phase, ultimately safeguarding the achievement of the overall project schedule goal [3].

4. Optimization Strategies for Construction Techniques in Architectural Decoration Projects under the EPC General Contracting Model

4.1 Establish a Full-Process Technical Collaboration Management Mechanism

Under the EPC model, optimizing construction techniques in architectural decoration projects first requires breaking the dispersion of technical management across different phases and establishing a full-process collaboration management mechanism. The core is to clarify technical management responsibilities and standardize technical cohesion processes. First, a special technical management team should be established at the project initiation stage, with members covering technical personnel from design, procurement, construction, operation, and maintenance phases. The responsibilities of each position in technical decision-making, plan optimization, and quality control should be clarified to avoid technical issue evasion due to unclear responsibilities. Second, a standardized technical collaboration process should be formulated. For example, the design phase should output plan documents containing detailed technical parameters, which should be jointly reviewed and confirmed by the construction and procurement teams before proceeding. The procurement phase should promptly feedback the technical characteristics and supply situation of materials to provide a basis for adjustments to construction techniques. The construction phase should regularly submit technical implementation reports to the technical management team and expose on-site technical challenges in a timely manner to ensure real-time information exchange of technical information across all phases. Additionally, a technical change collaboration mechanism should be established. When a technical plan needs to be adjusted during construction, it should be jointly evaluated by technical personnel from all phases to analyze the impact of the change on design effects, procurement plans, and construction schedules. A unified change plan should be formed before implementation to avoid a chain reaction of issues across the entire process caused by technical adjustments in a single phase and ensure the continuity and stability of technical applications.

4.2 Strengthen the Collaboration Capabilities of Cross-Disciplinary Technical Personnel

The effectiveness of construction technique implementation in architectural decoration projects relies on the collaboration and cooperation of cross-disciplinary technical personnel. Therefore, optimization is needed from two aspects: personnel capacity building and collaboration mechanisms. On the one hand, cross-disciplinary professional knowledge training for technical personnel should be strengthened. For example, decoration construction technical personnel should be organized to learn the basic technical specifications of electromechanical and civil engineering disciplines to enable them to understand the technical cohesion points in crossover operations. Meanwhile, design personnel should receive training in construction processes to ensure that they can fully consider the feasibility of on-site construction techniques when designing plans, reducing technical conflicts caused by a lack of professional knowledge. On the other hand, a regular cross-disciplinary technical communication mechanism should be established. For example, regular technical collaboration meetings should be held to allow technical personnel from design, construction, procurement, and other disciplines to jointly sort out project technical challenges and propose solutions based on their respective professional advantages. At key technical nodes (such as the crossover stage of decoration surface layer construction and electromechanical pipeline debugging), relevant technical personnel should be organized to be stationed on-site for coordination to resolve technical cohesion issues in real-time. Additionally, a cross-disciplinary technical responsibility community can be established, linking the performance of technical personnel from different disciplines with the overall technical implementation effect to stimulate their collaboration enthusiasm and ensure the efficient implementation of technical plans in cross-disciplinary operations.

4.3 Promote the Integrated Development of Technological Innovation and Standardization

Under the EPC model, the optimization of construction techniques needs to balance innovation breakthroughs and standardized applications to improve the efficiency and quality of technical applications through their integration. First, a technological innovation research and development mechanism should be established. Focused on the actual needs of decoration

projects, special research and development should be carried out on industry technical pain points (such as the construction precision of complex curved surface decorations and the application stability of green materials). Meanwhile, cooperation with scientific research institutions and material manufacturers should be strengthened to introduce advanced technological achievements (such as new environmentally friendly decoration materials and intelligent construction equipment). Small-scale pilot projects should be conducted to verify their feasibility before promoting them throughout the project process. Second, technological standardization construction should be advanced simultaneously. Innovative technologies that have been proven through practice should be transformed into standardized technical plans, clarifying the processes, parameters, and quality standards for technical implementation. For example, standardized manuals should be formulated for the assembly process of prefabricated decoration components and the collision detection process of Building Information Modeling (BIM) technology to ensure that different projects and teams can apply technical standards uniformly and reduce quality fluctuations caused by differences in technical operations. Additionally, a dynamic update mechanism for technological innovation and standardization should be established. Project technical application feedback should be regularly collected, and standardized technical plans should be optimized and upgraded based on industry technological development trends. Meanwhile, new innovative achievements should be incorporated into the standardization system to form a virtuous cycle of "innovation-verification-standardization-reinnovation" and continuously enhance the core competitiveness of construction techniques in architectural decoration projects under the EPC model [4].

5. Conclusion

In conclusion, the EPC general contracting model provides a systematic scenario for optimizing construction techniques in architectural decoration projects. In the context of the current construction industry's transformation towards digitalization and green development, multi-dimensional optimization strategies can not only meet the current demands for technical efficiency and quality in decoration projects but also lay a foundation for subsequent technical iterations. As the EPC model becomes more widely adopted in the decoration engineering field, it will be necessary to continuously improve strategy details in conjunction with new industry development needs, thereby providing stronger technical support for the high-quality development of the industry.

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