

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

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Abstract: The EPC general contracting model for architectural decoration engineering has gradually replaced the traditional separated model that separates design, procurement and construction to become an important direction and carrier for industry development benefiting from its management advantages of integrating design, procurement and construction. The EPC approach integrates the design, procurement, and construction phases into a single contract and allows for construction techniques to go beyond the confines of the site enabling it to become deeply integrated into both design optimization as well as supply chain management and schedule control across the entire project lifecycle. The paper studies the influence of EPC model on construction technology in architectural decoration project, expounds collaborative logic among technique and design, procurement and schedule under this mode, puts forward strategies for constructing technology optimization both architectural decoration projects under EPC generator contracting model, and hopes to provide reference for technological innovation and management upgrading of architectural decoration engineering field.

1. Introduction

With the acceleration of transformation and upgrading of China's construction industry, architectural decorative projects also face higher and higher requirements in terms of the efficiency of project management, quality and cost control. However, under the traditional separated "design-procurement-construction" mode, the different phases lack a systematic overall view and insufficient cooperation which often leads to problems such as the disconnection between design planning and construction techniques, mismatch of materials with processes, multi-disciplinary crossover operations in conflict. These issues often lead to elevated rates of re-work, schedule slippage and cost overruns. In this context, the EPC general contracting model, as a new construction organization mode characterized by "one responsible entity and full-process cooperation," effectively solves the above problems.

2. Overview of the EPC General Contracting Model

The EPC general contracting model (Engineering-Procurement-Construction, a design procurement construction integration model) is an important means of integrating the whole project management process in today's construction industry. The essence of it is that a general contractor with full capabilities has been entrusted to centrally manage all aspects of construction work, including design planning, materials and equipment procurement, on-site construction and installation, and post-construction acceptance, establishing a "one-stop" project management system. This is in contrast to the decentralized management model of conventional delivery, where design, procurement and construction are split among different entities.

At the most critical detail level: The EPC model first focuses on a "single responsible entity" from functional attributes standpoint. This model shall be responsible for project quality, schedule, cost and safety until the end of the project itself; avoiding responsibility evasion among relevant parties in traditional "contract-split" projects due to ambiguous responsibilities. Second, the mode is centered around "whole-process collaboration. It helps in getting the design, procurement and

construction phases in sync early in the project initiation cycle. For example, in the architectural decoration project, when designing the construction team can be involved to create and optimize decoration plans according to on-site construction conditions, effectively avoiding rework caused by design and construction is not corresponding in the later stage. Besides, the EPC model has the advantage of "effective resource integration." At the same time, it can schedule material arrival time according to the construction schedule and reduce on-site storage pressure.

The EPC model is well adapted in architectural decoration engineering. Decoration projects require more material types and fine craft, as well as systematic cross-working with civil engineering, electromechanical pipeline pre-embedding and other disciplines. The EPC mode can solve the above drawbacks in a traditional model such as decoration design and no coordination of pipe tunnel construction, uncoupling between procurement period of some customized materials and construction period. It has been widely used in large decoration projects such as commercial complexes, hotels, and office buildings, which can effectively help to achieve "quality compliance, controllable schedules, and cost optimization" for decoration projects ^[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 traditional architectural decoration projects, the whole project design and construction is divided into two phases, separately designed by the designer and constructed by the constructor. The emphasis in design plans is too often on how pretty things look, and whether they will function effectively not enough attention is paid to how construction techniques on-site will evolve. This can quickly turn into a scenario, whereby the design can get frozen post plan finalization whilst the construction phase continuously has to readapt because of lack of technical feasibility leading to an inefficient "design-rework-redesign" process. The EPC could forces the construction to break down the barriers to achieve "upfront integration" of techniques and design, through early intervention of the construction team in the initial design stage, reconstructing project participation mechanism.

The key to integration is that the construction team can use its understanding of decoration construction processes, on-site operating conditions and technical implementation difficulties, to provide reverse optimization of design plans from the perspective of technical feasibility. Also, during the period of conceptual design, the construction team can take the initiative to elicit technical requirements for each decoration phase and clarify technical boundaries in materials processing, components installation and process in addition to incorporate with the technical feasibility standards into design. Within the range of potential technical conflicts in the design, such as whether the decoration shape can adapt to the construction space and whether complex processes can match on-site operation conditions, real-time communication between the construction team and design team is conducted. Through manipulation of individual design details, optimization of form structures or through selection of more informed technical routes to guide the overall project design outcomes will 1) ensure that design plan meets both aesthetic and functional requirements, 2) facilitate a definite technical path for implementation for guiding construction stage results in later stages and avoid those adjustments that are delayed due to lack of consideration from a technical perspective reducing efficiency in working between design and construction teams ^[2].

3.2 "Linked Adaptation" of Techniques and Procurement

Construction techniques across the board differ quite a lot due to different material demands, and architectural decoration projects are no exception. These parameters, along with those of a construction process and technical realization effectiveness itself, directly impact the selection of processes used in construction and the very efficiency of their implementation. In the conventional model, the procurement and construction phases are separate. Often procurement decisions are made by taking into account of cost and looks, but poorly consider the complementarity between materials and construction methods. It can easily lead to the procured materials failing to meet the

requirements of the construction method or that the construction technique must be adjusted so that it can adapt to the characteristics of materials, increasing construction difficulty, and even affecting project quality and schedule.

EPC aligns adaptation of techniques and procurement through integrated management processes. The first step of the construction team is to clarify the technical standards for construction techniques in each decoration phase and create a list of technical requirements for materials, including parameters such as physical properties, chemical stability, and installation adaptability before they start material procurement. Material list coming out of this process is then used by procurement team as a core reference when selecting materials, screening suppliers and entering in supply contracts where technical adaptability is among key consideration so that high degree of match between procured material and defined construction techniques can be ensured. The construction team is in real-time communication with the procurement team during material procurement, and makes coordination in advance regarding other factors involving material supply cycles and processing difficulties that may affect technical implementation, avoiding forced adjustments of construction technical plan due to problem in terms of materials. Moreover, after the materials are sent to the construction site, combined with technical requirements, preliminary inspection is carried out by the construction team on site — it will serve to verify whether material quality is consistent with technical standards and thus prepare for smoothness of implementing subsequent construction techniques.

3.3 "Dynamic Collaboration" between Techniques and Schedule

Architectural decoration is not an independent system, and its construction needs to be crossed with other disciplines including civil engineering, electromechanical systems, fire protection and so on. The process is tight among these various disciplines, and the overall project has well-defined schedule milestones. In conventional model, the construction technical plan is basically a fixed value in the front-end project stage of construction and does not establish dynamic association with schedule plan. In some discipline, if there is a delay in the process or changes in on-site operating conditions, it will be difficult for the fixed technical plan to be adjusted promptly and conveniently, easily causing conflicts in processes, wasting resources deeply and ultimately affecting the completion time of the entire project.

In the EPC mode, one realization of "dynamic collaboration" between means and schedule is to set up a flexible technical adjustment mechanism. The construction team will compile an initial construction technical plan in conjunction with the overall schedule plan, so as to formulate technical paths and implementation time nodes for each decoration stage at project initiation phase. In project progress, the construction team will dynamically adjust the execution of the process according to the rhythm of each discipline process, record in real time whether it is effective, and constantly test whether this approach works, that is, whether at least one of several technical plans formulated previously can adapt according to field changes or delays. When there is a lag in a certain construction phase, the construction team analyzes the reasons for the lag and adjusts technical plans such as choosing relatively efficient construction processes or optimizing process cohesion methods to improve construction efficiency and make up for schedule gaps. For example, if there are changes in on-site operation conditions — such as the limited space for crossover operation or adjustments to material supply cycles — the construction team will quickly adjust the technical implementation path based on these conditions to ensure that the technical plan of construction best matches actual conditions and schedule requirements. On the other hand, the construction team keeps in touch with other disciplines and forwards the timing of decorating construction process techniques ahead of their implementation based on various discipline processes' advancement to stop potential issues from occurring at later stages due to poor procedural planning between different disciplines ^[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

For architectural decoration project, EPC model involves breaking up the dispersion of construction technology management in different stages and establishing a full-process collaborative management mechanism. The essence is to clarify the division of labor and responsibilities of technical management and standardize the technical cohesion process. The first is to form a special technical management team at the project initiation stage, personnel including design, procurement, construction operation and maintenance phase technical personnel. To prevent evasion of technical issues resulting from undesignated roles, define responsibility areas for each position during voting on technical decisions, plan optimization, and quality assurance. Second, we need to create a uniform technical cooperation process. Among which, the output plan documents in the design stage → should include detailed technical parameters that need to be jointly reviewed and confirmed by construction and procurement before proceeding. The procurement phase should quickly feedback the technical characteristics and supply situation of materials, the construction technique adjustment basis. The construction period shall report the technical implementation of regularly should be reported to the technical management team, but also timely exposure to on-site technical problems to ensure real-time interphase technical information exchange. Also, we should set up a collaboration mechanism for technical changes. If the construction is executed and subsequently a technical plan needs to be modified, then all phase-related technical staff should jointly evaluate the situation, analyze whether this change will have an impact on design effects or need changes in procurement plans and construction schedules. Implementation should design a unified change plan to avoid technical changes in a certain link of the entire process, triggering a series of interconnected problems and affecting external services; on the other hand, it can also ensure that technical applications remain stable during maintenance.

4.2 Strengthen the Collaboration Capabilities of Cross-Disciplinary Technical Personnel

Architectural decoration projects construction technique implementation effect is highly dependent on different disciplines cross-tech personnel joint work. Thus, optimization must occur in two aspects: personnel capacity building and collaboration mechanisms. To some extent professional knowledge training of cross-bordered and multi-field talents for technical personnel should be strengthened. Consider organizing decoration construction technical personnel to learn the basic technical specifications of electromechanical discipline and civil engineering discipline, so that they can understand which points are relevant when a work requires crossover operations. At the same time, design personnel also need training on construction processes so that they understand what techniques can be applied and how to incorporate this knowledge into plans without causing design problems due to a lack of relevant expertise. On the flip side, regular cross-disciplinary technical communication chain needs to be formalized. Such as holding such regular technical cooperation meeting, project construction, design, procurement and other disciplines of professional technical personnel together to discuss the project there are several technical problems need to be solved in one place, each based on their own advantages put forward ideas or solutions. On-site coordination to address technical cohesion issues in real-time At critical technical nodes (e.g., stages where decoration surface layer construction and electromechanical pipeline debugging overlap), relevant technical personnel should be organized to be stationed on-site to coordinate and resolve the relevant issues. Besides, a cross-disciplinary technical responsibility community can be established to link the technical personnel performance of different disciplines with the overall effect of its technical implementation in order to drive their collaborative enthusiasm and promote efficient carrying out of technical plans in cross-disciplinary operations.

4.3 Promote the Integrated Development of Technological Innovation and Standardization

The technical application of EPC model can realize classic innovation breakthroughs and

standard applications through the effective integration of its own style, and optimize construction techniques on this basis to a certain extent. The first one should be to set up a technological innovation research and development mechanism. And focused on the real needs of decoration projects, targeting industry technical pain points (such as complex curve surface decoration construction precision, green materials applying stability) for special R D. At the same time, strengthen cooperation with scientific research institutions and material manufacturers to introduce advanced technological achievements (such as new environmental protection decoration materials and intelligent construction equipment). Promoting these all through the vogue process should be preceded by small scale pilot tasks to confirm their feasibility. Second, promoting the simultaneous advancement of technological standardization construction. Promising technologies that have been tested in practice must be converted into standard technical solutions, which define the procedures and quality standards for technical implementation. For instance, unified manuals should be designed for the assembly process of prefabricated decoration components and the instrument collision detection process in BIM technology so that different engineering technical standards can be implemented uniformly, reducing quality fluctuations caused by differences in operation techniques. In addition, we should set up a dynamic update mechanism for technological innovation and standardization. Technical plans should be standardized, and industry development characteristics should be considered to regularly summarize project technical application feedback and identify commonality points for optimization and upgrading. At the same time, these innovative achievements should be included in the standardization system, forming a "innovation-verification-standardization-reinnovation" virtuous circle to continuously improve EPC model architectural decoration project construction skills core competitiveness ^[4].

5. Conclusion

Notably, the EPC general contracting model is a systematic scenario for promoting construction methods in architectural decoration projects. Under the background of digitalization and green development in the construction industry which is undergoing transformation and improvement, multi-dimensional optimization strategies can not only meet technical efficiency and quality requirements of decoration projects at current stage, but also lay a foundation for subsequent technical iterations. With the increasing maturity of EPC model in decoration engineering area, continuous refinement of strategy details according to new development requirements of industry is needed to provide stronger technical support for high-quality development in this field.

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