Exploration of Construction Technology and On-site Construction Management Paths in Building Engineering

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Abstract: With the deepening urbanization and the continuous increasing scale of civil engineering construction, building structures are becoming more complex so that it has lenient requirements to project quality and safety of construction. The research and application of construction technology directly affect the quality and benefit of engineering projects, while on-site construction management is often an important factor affecting construction costs and construction efficiency. This paper applies thorough analysis to the significance of on-site construction management in building engineering, and puts forward common construction technologies and paths including determing precise palette with refined construction management system; optimizing allocation and dynamic support scheduling resources; supporting development way by a whole process quality control systemin the industry; long-term approach, for example safety risk prevention and control system improvement, green construction technology promotion—to standardize approachesand be involved in modernization in order to its sustainable development.

1. Introduction

The construction industry occupies an important place in national economic development. Building engineering projects drive social urbanization and development. The continuous enlargement of the scale of building engineering projects is imposing more and more challenge on construction technology, site management and other aspects as well. The construction quality and cost is affected by the advanced construction technology. Construction technology requires on-site construction management (multiple areas, such as: construction progress, quality, safety) And therefore, construction enterprises should further develop on-site construction management strategies to best facilitate the sustainable development of construction industry.

2. Importance of Strengthening On-site Construction Management in Building Engineering

2.1 Ensuring Construction Safety

The on-site environment of building engineering is complicated, with risks such as falling objects and electric shocks. Construction enterprises should rely on effective safety system and regular safety training to let construction personnel understand the importance of safety, various ways of dealing with construction risk, emergency equipment use methods and skills through strengthen on-site construction management, reduce the probability of occurrence of construction engineering safety accidents [1]. At the same time, it also plays a preventive role in eliminating potential safety hazards through strengthened management on site so that construction can be safely and orderly carried out, project objectives can be achieved smoothly as planned, and delivery results are of high quality. The safety of construction also relates to the reputation and economy benefit of the construction enterprises. Due to the arrival of safety accidents, it directly destroys all the good reputation that an enterprise had laid down over time and also reduces the competitive advantage in market. Enhanced site-management is thus an imperative to securing construction safety.

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2.2 Improving Project Construction Quality

One approach to guarantee the construction materials and equipment quality in the course of building engineering is to strengthen on-site construction management, avoiding substandard products entering the site. And that the unified construction management measures, can also for the construction process and operational procedures to control effectively in the work of all things, to obtain a stronger engineering structure density. Also, effective on-site management also allows the construction managers to detect and solve quality problems quickly, enabling countermeasures within a short time period, helping to eradicate potential quality as well as safety hazards from the source.

2.3 Controlling Engineering Project Costs

Cost control is closely related to the economic benefits in building engineering projects. Improve the construction management ability of project cost control. Offsite construction with precast components needs materials, people, procedures, etc. and each generates some form of cost. Proper on site management policy can assign workforce for different trades in planned manner ensuring optimal utilization by all the individuals thus minimizing any wastage of man-hour. In terms of material control, it is possible to accurately calculate the amount of materials required for production, effectively reducing excess inventory backlog and capital occupation caused by over-procurement, and achieving accurate control of material costs. In addition, good on-site management can unify construction process mechanisms to prevent rework due to quality problems and various other incremental costs.

2.4 Enhancing Construction Efficiency

On-site construction management in the building engineering field coordinates many resources and processes carefully and is a key factor to improve construction efficiency. Onsite management could work reasonably well for a large resource allocation. Construction enterprises can deploy personnel in real-time according to the construction progress and needs of various trades, making sure that all workers work efficiently at the right place and time. Good management can also establish specific and reasonable construction plans, defining the content of each step, period, and responsible person to ensure that the construction is implemented as planned. At the same time, strict professional quality standards, standardized operation processes and continuously strengthened safety supervision and education on construction site to ensure that most problems are avoided from the source is bound to promote smooth and orderly engineering progress and fundamentally improve construction efficiency.

3. Analysis of Construction Technology in Building Engineering

3.1 Concrete Construction Technology

As an essential technical means in the building engineering field, concrete construction technology quality is directly related to the durability and safety of building structure. The main link in its specific operation is concrete mixing. Forced mixing equipment is selected, and the feeding order and mixing time are controlled. Generally, sand, aggregate, cement, and admixtures are first added for uniform dry mixing. The mixing time should be no less than the specified value to avoid problems such as segregation or bleeding. The curing link of concrete construction technology is crucial. Within 12 hours after pouring, moisture-retaining curing measures should be taken, such as covering. The curing time for ordinary concrete should be more than 7 days. Curing agents can be sprayed or plastic film can be used to cover the surface to keep the concrete structure moist.

3.2 Soft Soil Foundation Treatment Technology

The treatment of soft soil foundation is an important link for ensuring the safety and stability of buildings. Predominantly soft soil contains high levels of water content and compressibility. Direct construction may result in issues such as tilting or settlement of built structures. The replacement

method is one of the important methods in the technology of soft soil foundation treatment. It involves mainly the excavation of the weak soil layer at the foundation base and replacement with high-equality materials with low compressibility, hence improving the bearing capacity of the foundation. In the case of deep soft soil foundations, the dynamic compaction method is selected with the help of an impact force due to the freefall of heavy hammer which presses and forms a denser ground, where soil particles turn into various positions.

3.3 Steel Structure Construction Technology

Steel structure construction technology is a core supporting technology of modern building engineering, which has the advantages of short construction cycle and light weight. Which is commonly applied to constructions such as towers and bridges. Steel Structure Construction technology is mostly based on processing of material components. Processing of components generally makes use of methods like CNC cutting and auto-welding [2]. On-site installation is equally crucial at the same time. In the case of large steel structures, we usually use a block lifting method, our facility is also called Tower crane (if it has top kit) or Crawler cranes or Spider Cranes to make sure that assembled parts will be placed into numberous orientations with high preciseness. In addition, steel structure construction technology of anti-corrosion treatment measures in the choice of sandblasting for rust removal with coating to form a composite protective layer, and long-term application of the building steel structure protection in some harsh environment.

4. Effective Paths for On-site Construction Management in Building Engineering

4.1 Establishing a Refined Construction Management System

In the case of building engineering, on-site construction management should also form a relatively perfect construction management system. It is necessary to build a standard process framework, dividing the whole construction cycle of building engineering project into several nodes, and clarifying the technical standard when quality acceptance must be conducted and the responsible entities for it at each node in construction. Traceability of construction operations can be realized with visual disclosure templates. The construction enterprise must also strengthen a dynamic data-driven decision-making mechanism. Construction and operation data should be integrated with the aid of BIM technology. Since IoT sensors are used to monitor the environmental parameters and equipment operating status on-site in real-time, construction enterprises should collect all such data as soon as possible. With the support of big data analysis platform, a dynamic risk early warning model should be established to realize accurate prediction and dynamic adjustment of process interfaces. Accordingly, it is suggested that the construction site implement a grid-based management model in which the entire construction site can be divided into individual management units, with corresponding personnel assigned within each unit to supervise and track safety inspections and work progress. A linked mechanism with joint problem discovering and rectification analysis should be grounded. It should use mobile terminals to report construction safety hazard and feedback results, so that management commands can be responded in a timely manner. In addition, construction enterprises shall establish a whole element collaborative supply chain management system and strengthen the cooperation between construction enterprises and material suppliers as well as equipment leasing enterprises to guarantee project construction quality starting from its source. Construction enterprises should focus on the development of talent echelon, take smart construction sites and lean construction as environmental themes for training activities in stages, guide on-site personnel to adapt to new ideas and technologies and form traditional management methods into intelligent direction transformation method, provide systematic high-quality engineering construction solutions.

4.2 Optimizing Resource Allocation and Dynamic Scheduling

The science of building engineering should provide recommendations to optimize resource allocation and dynamic scheduling on the construction site. It should built a digital resource

management platform based on BIM technology, which integrates manpower, materials and machinery. Resource requirement and distribution Information of different construction areas should be reflected in the 3d Model as visual form to provide accurate data support for resource configuration in real-time building construction. On-site management in the resource allocation link should be based on the integration of dynamic reserve and gradient deployment. Resource demand curves need to be collated by the construction schedule. For materials falling on the critical path, a JIT (Just in time) supply mode should be followed. On non-focus paths, construction enterprises should regionalized the resource pools and improve equipment utilization by means of leasing in shared projects. Additionally, in the dynamic scheduling link construction enterprises should build a three-tier response mechanism. At first level, the project manager has to modify daily work surface depending on climate and process interfaces. Second-level scheduling calls for the engineering department to use terminal devices to track on-site actual progress of different construction teams, reflecting real flexible human resources complementarity [3]. The third -level scheduling is detailed analysis of big equipment such as concrete mixer, and tower crane using IoT sensors. Additionally, a dashboard that relates material and equipment utilization with construction team performance assessments will be developed as a motivate to engage all staff in resource optimization. It is crucial for the pursuit of resource allocation flexibility from day one on-site management builds up capacity to adapt resource flows according to construction dynamics.

4.3 Strengthening Whole-Process Quality Control

Whole-process quality control is a focus of building engineering on-site construction management. In the stage of construction preparation, construction enterprises should strictly review construction drawings and technical plans to organize multi-professional joint briefing meetings, to achieve smooth interface between the two processes of construction process and design intention. Construction Enterprises should also build a material and machinery access mechanism, implementing a three-party joint inspection system for materials entering the site as well as adopting the advantages of QR Code tracing systems to create Transparency in quality information management. A multi-level (in three levels) quality control network should be established in construction. Construction teams should emphasize on inspecting standardized construction processization operations and provide standardized operational guidance for concrete pouring, rebar tying, and other links on the site. Project department should utilize BIM technology to accurately control the verticality and flatness of building structure. Construction supervision units need to focus on check before they can be invisible works. Many building construction sites are often exposed to some quality problems, and in order to solve these construction quality problems, construction enterprises need to establish an intelligent site platform for collecting data on the construction environment in real time, issues early warnings when monitored type of data deviate from standards level, and then use this adjustment measure jointly with qualitative parameters of the ongoing processes. Moreover, during the quality acceptance link, on-site management should strengthen a joint acceptance system, improve quality traceability and optimization mechanisms in construction process, with constant optimization of construction processes using the PDCA cycle till to form full-process quality control.

4.4 Establishing a Safety Risk Prevention and Control System

Building engineering construction management for on-site should aim at preventing and controlling the safety, building a system of safety risk prevention and control. You must always follow the principles of prevention first and hierarchical prevention and control. From the full life cycle angle of project construction, risks should be considered by systematically identifying them during the preparation phase, such as using BIM technology and expert demonstration. For any high-risk project, like deep foundations and high formwork a risk list should be defined along with the process or management responsible person for each risk level. At the same time, construction enterprises should build a dual prevention mechanism that deepens risk graded management and control and hidden danger investigation. Risk sources should be monitored in real time; closed-loop management strategies shall be adopted through the application of regular methods, such as safety

briefings and weekly special inspections. According to this, construction enterprise should build a multi-party collaborative construction safety supervision network and develop the professional linkage mechanism with engineering supervision and third-party safety consulting agencies. The individual responsible for the construction project should be identified as soon as unsafe dangers are discovered, thus offering a strong security assurance for whether building engineering projects function safely.

4.5 Actively Promoting Green Construction

Management of green construction on-site in building engineering is an important content of construction enterprise management. Construction managers should use the systematic whole-process environmentally-friendly management methods. In terms of construction preparation stage, it is required to formulate detailed special green construction plans for implementation at the engineering site, clarify objectives and control measures for energy saving, material saving and environmental protection, incorporate them into project management outline so that green concepts can be implemented in particular engineering practices from the source [4]. Construction Enterprises should promote prospectively Resource-efficient Technologies, applying energy-saving machinery and equipment, rainwater recycling systems, carbon emission reduction in transportation and saving wastes by accurately calculating the amount of material needed to cut down on-site waste through BIM technology and precast processing. The entire construction process must attach great importance to environmental protection, focusing on ecological conservation and humanistic care. Construction layout should be reasonably planned to reduce land disturbance. The on-site environment can be improved by setting up green enclosures and creating temporary green belts. Furthermore, on-site construction management should implement construction waste classification management, setting up dedicated recycling pools for metals, wood, concrete, etc., and establishing a closed-loop system for construction waste treatment in conjunction with professional recycling enterprises—for example, using crushed waste concrete for road base paving and increasing the reuse rate of wooden formwork. In the green construction link, a digital management platform can be built to monitor energy consumption, environmental parameters, and other data in real-time, ensuring green construction transforms from a concept into a promotable standardized practice.

5. Conclusion

In summary, construction technology and on-site construction management in the building engineering field jointly promote the stable development of the construction industry. Effective on-site management can translate advanced construction technology into practical results. Therefore, construction enterprises should establish a refined construction management system, optimize resource allocation and dynamic scheduling, strengthen whole-process quality control, establish a scientific and reasonable safety risk prevention and control system, and actively promote green construction to provide strong support for the high-quality development of the construction industry.

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