Research on Management Models in Supervision Quality Control of Housing Construction Projects

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Abstract： In recent years, the number of housing construction projects in China has continued to grow. Project scales have expanded from ordinary residences to large-scale commercial complexes and high-rise buildings, significantly increasing project complexity. Concurrently, societal demands for the quality of housing construction projects have continuously risen, focusing not only on functional usability but also emphasizing structural safety and durability. During the construction process, supervision quality control is the key link in ensuring project quality. The management model of supervision directly determines the efficiency and effectiveness of quality control. Against this background, in-depth research into the management models of supervision quality control for housing construction projects, exploring scientific methods for model selection and optimization pathways, has become an urgent need for improving project quality and promoting the healthy development of the construction industry. This article conducts an in-depth study on the management models of supervision quality control for housing construction projects. First, it outlines the main work content of supervision quality control. Next, it discusses the necessity of strengthening supervision quality control for housing construction projects. Finally, it proposes strategies for optimizing the management model of supervision quality control. The aim is to enhance the efficiency of supervision quality control for housing construction projects, reduce quality risks, ensure project quality meets standards, and provide theoretical and practical support for the industry to optimize supervision quality control work.

1. Introduction

The quality of housing construction projects is the core of engineering construction, directly related to people's lives and property safety and the market reputation of the construction industry. Supervision units, as a crucial link in engineering quality management, serve as the key defense line for ensuring project quality. They supervise, inspect, and coordinate the entire construction process through the application of scientific management models. Therefore, researching the management models of supervision quality control for housing construction projects, clarifying the applicable conditions of different models, and exploring pathways for model optimization hold significant theoretical and practical importance for improving the quality of supervision work, ensuring project safety, and promoting the high-quality development of the construction industry.

2. Main Work Content of Supervision Quality Control

2.1 Preparation Stage

During the pre-construction preparation stage, the supervision unit organizes the construction unit, contractor, and design unit to review the construction drawings. This involves checking for design flaws, dimensional inconsistencies, unclear technical requirements, etc., while confirming compliance with current national building codes and the project's actual needs. If issues are identified, the supervision unit promptly proposes revisions to prevent subsequent construction quality hazards arising from drawing problems. Secondly, the supervision unit focuses on reviewing the contractor's construction plan, specifically examining the reasonableness of quality control

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measures, the scientific nature of the construction sequence, and the compliance of technical parameters. For instance, the load-bearing calculations in formwork erection schemes and post-concrete curing plans are scrutinized. Construction can only commence after the plan passes the supervision unit's review [1]. Additionally, the supervision unit verifies the qualifications certificates of construction management and technical personnel, ensuring specialized operators possess valid licenses. It also inspects the models and performance of construction equipment to confirm they meet project requirements and have passed necessary inspections, ensuring personnel and equipment provide reliable support for project quality.

2.2 Construction Stage

During construction, the supervision unit's quality control work becomes more detailed. Specifically:

Material & Equipment Quality Control:

Upon arrival of materials (e.g., steel bars, cement, aggregates) at the site, the supervision unit requires the contractor to provide quality documentation (certificates, test reports).

Witness Sampling & Testing: Key materials are sampled under supervision according to specifications and sent to accredited laboratories for retesting. Only materials passing these tests can be used, preventing substandard materials from compromising construction quality.

Construction Process Monitoring:

Routine Inspection & On-site Stand-by Supervision: Supervision personnel conduct routine patrols and provide stand-by supervision for critical work procedures, including foundation excavation, rebar binding, formwork installation, concrete pouring, masonry work, and roof waterproofing.

Procedure Quality Verification: Construction operations and the quality of completed work are checked against design drawings and specifications (e.g., verifying rebar specifications/spacing, concreting sequence, and compaction adequacy).

Non-conformance Handling: If procedure quality is found deficient, the supervision unit immediately issues a rectification notice requiring the contractor to halt work and correct the issue. Only after rectification and re-inspection can the next procedure proceed [2].

Quality Record Management: The supervision unit meticulously documents all inspections, test data, rectification status, etc., during construction, forming a comprehensive supervision quality archive to support project handover and future quality traceability.

2.3 Completion Acceptance Stage

Preliminary Acceptance:

The supervision unit conducts a preliminary quality inspection against design drawings, standards, and the contract. This includes checking appearance quality, structural safety, and functional performance (e.g., wall/floor flatness, smooth operation of doors/windows, proper functioning of plumbing and electrical systems).

The supervision unit verifies the completeness, accuracy, and standardization of completion handover documents submitted by the contractor (e.g., construction records, test reports, quality assessments).

Any quality issues identified during preliminary acceptance trigger a rectification request to the contractor. Completion is re-verified after rectification [3].

Formal Completion Acceptance Participation: Once the project meets acceptance criteria, the supervision unit participates in the formal completion acceptance organized by the construction unit. It reports on the supervision quality control process and outcomes, submits the supervision quality assessment report, and assists the acceptance team in the overall inspection.

Completion Acceptance Filing Assistance: After successful acceptance, the supervision unit assists the construction unit in completing the project completion acceptance filing procedures. This concludes the supervision unit's quality control responsibilities.

3. Necessity of Strengthening Supervision Quality Control in Housing Construction Projects

Safeguarding the Client's Investment & Objectives: The construction unit invests substantial funds seeking a quality-compliant building. Without effective supervision quality control, issues like material substitution or non-standard construction can occur, leading to substandard quality. This not only increases repair costs and delays project delivery, impacting the client's return on investment, but may also force costly rework or reconstruction [4].

Enforcing Contractor Responsibility & Enhancing Quality: The contractor's execution directly determines the final building quality. Through continuous inspection, the supervision unit identifies problems in the contractor's processes, techniques, and quality management, mandating timely rectification. This compels contractors to establish robust quality management systems, enhance technical training, adhere strictly to drawings and specifications, avoid quality hazards from errors, and ultimately boost their market competitiveness.

Ensuring User Safety & Protecting Property: Occupants (residents, employees) live and work in these buildings. Quality directly impacts their safety and property. Inadequate supervision control can lead to structural hazards (cracks, leaks, insufficient load-bearing). During use, these hazards may cause collapses or leaks, threatening lives and damaging property (e.g., furniture, finishes).

4. Effective Pathways to Optimize the Management Model of Supervision Quality Control

4.1 Perfecting the Supervision Quality Control System

Develop Comprehensive Rules & Responsibilities:

Based on national regulations (e.g., Code for Construction Project Supervision, Unified Standard for Construction Quality Acceptance of Buildings) and its operational characteristics, the supervision unit should establish integrated rules covering material inspection, procedure acceptance, non-conformance handling, and records management. Specific standards must be defined (e.g., verifying steel mill certificates, mechanical property test reports, mandated sampling rates). Procedures must also be stipulated (e.g., contractor self-inspection followed by a formal request for procedure inspection/approval by supervision personnel before proceeding) [5].

Clearly define quality responsibilities for each role (e.g., Chief Supervision Engineer oversees overall quality; Professional Supervision Engineers handle specialty inspections), ensuring accountability at every stage and preventing buck-passing.

Standardize Quality Control Procedures:

Develop procedural manuals mapping quality control points from preparation through completion acceptance.

The preparation phase procedure must include plan review, personnel/equipment verification, and drawing review, specifying timelines and deliverables (e.g., plan review completed within 5 working days of receipt, with written feedback).

The construction phase procedure must define frequency and requirements for patrols, stand-by supervision, and parallel testing (e.g., mandatory full-time stand-by supervision with records for critical activities like concrete pouring).

The completion acceptance procedure must cover pre-acceptance, document verification, and formal acceptance participation, ensuring systematic closure.

Strengthen Internal Oversight & External Communication:

Establish an internal quality audit team to periodically inspect project supervision work, verifying record authenticity and rectification implementation. Audit findings should prompt timely notification and corrective action [6].

Build communication channels with the client and contractor. Hold regular quality meetings to report status, solicit feedback, and adjust control measures. For recurring issues, analyze root causes collaboratively and implement/track improvement actions.

4.2 Enhancing the Comprehensive Competence of Supervision Personnel

Elevate Professional Skills:

Provide specialized training on industry advancements (e.g., prefabricated construction, green building standards) delivered by experts or seasoned engineers.

Encourage personnel to obtain professional qualifications through exams, driving systematic learning.

Relevant authorities should establish learning platforms disseminating policies, standards, and facilitating peer exchange to broaden professional perspectives [7].

Foster Professional Ethics & Accountability:

Conduct regular ethics workshops and case studies (e.g., accidents caused by supervision negligence) to reinforce the critical importance of their role for quality and safety, clarifying duties and mission to prevent negligence or falsification.

Implement a robust performance appraisal system linking responsibility fulfillment to rewards/penalties, incentivizing diligence and strict quality control while penalizing negligence.

Develop Communication & Coordination Skills:

Provide training (e.g., simulations, workshops) on effective communication techniques (clarity, active listening, conflict resolution) essential for interactions with clients, contractors, and designers – such as issuing non-conformance reports or reporting quality status [8].

Encourage personnel to proactively gain practical experience, learn from interactions, and continuously refine their communication skills to build consensus and foster collaboration on quality objectives.

5. Conclusion

In summary, the management model applied in supervision quality control for housing construction projects is a critical factor influencing project quality. The effectiveness of supervision work directly depends on the scientific selection and efficient operation of the model. By analyzing prevalent supervision management models, clarifying the advantages and applicable scenarios of each, and proposing optimization measures such as perfecting the quality control system and enhancing supervision personnel competence, this article demonstrates that only by selecting a model suited to the project's specific conditions and continuously optimizing its operation can the supervision unit fully exert its role in quality control. This is essential for effectively preventing quality risks and ensuring housing construction projects meet the expected standards. As the construction industry advances towards intelligence and sustainability, the management models for supervision in housing construction projects also require continuous innovation. Actively integrating information technology and utilizing big data analysis to optimize the focus of quality control will further enhance the precision and efficiency of supervision quality control.

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