Research on Housing Construction Project Management and Quality Control Based on Total Quality Managemen

Keyong Cheng

Anhui Benji Construction Engineering Co., Ltd., Xuancheng, Anhui, 242000, China

Keywords: total quality Management; housing construction project; project management; quality Control

Abstract: Total Quality Management (TQM) is a management model centered on quality that requires the participation of all staff. Its concepts of covering the entire process, controlling all elements, and coordinating among all personnel are highly compatible with the actual needs of housing construction project management. Integrating this model into housing construction project management and quality control not only aligns with the transformation trend of the construction industry from scale expansion to in-depth quality enhancement but also compensates for the shortcomings of traditional management models through full-process control, providing strong support for the high-quality development of the industry. This study starts with the necessity of applying TQM in housing construction projects, analyzes the practical problems currently existing in the management and quality control of housing construction projects, and further explores specific application strategies of this model in key stages such as preliminary project preparation, construction process, and completion acceptance. The aim is to provide a feasible path for improving the overall quality of housing construction projects.

1. Introduction

Housing construction projects are of critical importance to national well-being and the people's livelihood, as their quality not only directly reflects the development level of the construction industry but is also closely tied to residential safety and social stability. While China's construction sector has made notable advancements in technological innovation and management optimization in recent years, quality issues such as wall leakage and structural vulnerabilities still occur periodically, resulting in economic losses and public concerns. Traditional quality control methods primarily focus on post-construction inspections during the implementation phase, lacking a systematic, lifecycle-based management approach, which makes it difficult to address root causes. In contrast, Total Quality Management (TQM), centered on holistic quality control throughout the entire process, emphasizes full participation, continuous improvement, and customer satisfaction. Integrating TQM into housing construction project management can overcome traditional limitations by establishing a comprehensive quality system, clarifying responsibilities, and optimizing processes to achieve all-round quality control [1]. Therefore, studying its application holds significant practical importance.

2. The Necessity of Applying Total Quality Management in Housing Construction Projects

2.1. An Inevitable Choice to Meet the Demands of High-Quality Development in the Construction Industry

Currently, China's construction industry is transitioning from a focus on scale expansion to quality enhancement, with high-quality development becoming the core direction of the sector. As a mainstay of the industry, the quality of housing construction projects directly influences the overall development trajectory of the construction field. Traditional quality control models, which primarily concentrate on the construction phase, fail to keep pace with the industry's need for lifecycle-wide quality management across a project's entire duration—from initiation and design to construction,

  DOI: 10.25236/icacel.2025.144

acceptance, and operation and maintenance. Total Quality Management (TQM) addresses this gap by encompassing the entire project lifecycle through systematic control, thereby elevating overall engineering quality and establishing a robust framework for high-quality development in the construction industry [2].

2.2 An Effective Approach to Addressing Current Quality Issues in Housing Construction Projects

Currently, housing construction projects often face challenges such as weak quality awareness, gaps in lifecycle-wide management, and inadequate all-factor control, leading to recurring issues like wall leakage and structural vulnerabilities. Total Quality Management (TQM), with its emphasis on "full participation and all-factor management," directly targets these problems. For instance, in material management, many projects previously conducted superficial inspections, allowing substandard materials to easily enter construction sites. By applying TQM, a comprehensive chain control mechanism—covering procurement, inspection, and storage—can be established, supplemented by QR code traceability systems. This ensures that inferior materials are barred from construction sites, significantly reducing quality risks at the source.

3. Problems in Current Housing Construction Project Management and Quality Control

3.1 Weak Quality Awareness

Many participants in housing construction projects place insufficient emphasis on quality, often falling into the trap of prioritizing progress over quality and cost over safety. For example, some development entities deliberately reduce the time and resources allocated to quality control processes to expedite project timelines or cut costs. Similarly, managers and frontline workers on the construction side frequently engage in non-compliant operations or use substandard materials due to a lack of quality awareness [3]. More critically, the absence of effective communication and collaboration among stakeholders makes it difficult to form a coordinated effort for quality control, creating a disconnect from the Total Quality Management (TQM) principle of full participation.

3.2 Gaps in Whole-Process Quality Control

Traditional quality control in housing construction focuses primarily on the construction phase while giving inadequate attention to early-stage design and post-construction operation and maintenance, resulting in fragmented lifecycle management. During the design phase, some design firms fail to adequately consider construction feasibility or practical usability, leading to issues such as poorly organized piping layouts that are difficult to rectify during construction and ultimately become latent quality defects. During construction, lax acceptance inspections athandover between work stages contribute to common problems like wall leakage and hollow floor tiles. In the completion acceptance phase, many projects apply lenient inspection standards, allowing quality issues to go undetected [4]. During operation and maintenance, the absence of a robust quality follow-up mechanism means that problems reported by property owners are not addressed promptly, undermining the building’s overall performance and user satisfaction.

3.3 Inadequate All-Factor Management

Most frontline workers in housing construction projects are migrant laborers with limited educational backgrounds and professional skills, coupled with a lack of systematic quality training. Their unfamiliarity with construction specifications and quality standards often leads to operational errors and quality defects. Additionally, some management personnel lack professional quality management expertise, making it difficult to effectively implement quality control measures. In material management, loopholes in procurement oversight allow certain suppliers to cut corners by providing substandard materials, creating latent risks for project quality [5]. Regarding machinery and equipment, outdated performance at some construction sites not only slows progress but may also compromise quality due to equipment failures. Furthermore, outdated construction techniques and insufficient adoption of advanced technologies hinder compliance with modern quality control

requirements in housing construction projects.

4.Application Strategies for Total Quality Management in Housing Construction Project Management and Quality Control

4.1 Strengthening Quality Awareness and Establishing a Participatory Quality System

Construction enterprises should develop tailored quality training programs for all stakeholders and personnel across different roles in housing construction projects. For management staff of development entities, training should focus on Total Quality Management (TQM) principles and project-specific quality control processes. Design personnel should receive targeted training on design codes and quality risk prevention, with some enterprises utilizing case studies to analyze wall cracking caused by design flaws, thereby enhancing risk awareness among designers. Frontline workers in construction firms should undergo training emphasizing construction techniques and operational standards—for instance, one project organized hands-on training for steel bar tying to ensure workers mastered correct spacing and methods. For supervision personnel, training should reinforce supervisory responsibilities and inspection methodologies, such as studying key points for on-site supervision of concealed works to improve oversight capabilities. Through stratified training, this approach comprehensively elevates quality awareness and professional competence across all project participants [6].

All participants in housing construction projects must establish a lifelong quality accountability system, assigning specific quality responsibilities to individual roles and personnel. The project leader of the development entity assumes overall responsibility for the project's quality, including approving quality plans and making major quality-related decisions. The lead designer from the design firm is accountable for the quality of design proposals, ensuring compliance with codes and the absence of safety hazards—for example, in one project, the lead designer was held responsible for rectifying design omissions that caused pipeline conflicts. The project manager of the construction firm serves as the primary on-site quality controller, with full responsibility for quality management throughout construction, while frontline workers are individually accountable for the quality of their respective operational tasks. For the supervision entity, specialized supervisory engineers bear responsibility for quality oversight within their assigned disciplines, with penalties for failure to detect quality issues. Additionally, incentive and penalty mechanisms must be implemented. In one housing project, teams achieving quality compliance received RMB 20,000 in rewards, whereas teams found cutting corners were fined RMB 10,000 and subjected to work suspensions for rectification. Such measures effectively mobilize full participation in quality management efforts.

All participants in housing construction projects must jointly establish a multi-dimensional communication and coordination mechanism. Regular quality review meetings should be held weekly, bringing together representatives from development, design, construction, and supervision entities to collectively discuss quality issues identified during the week. Additionally, an information-sharing platform should be developed, leveraging Building Information Modeling (BIM) technology to create a collaborative management system. Design firms can upload 3D models, while construction teams provide real-time feedback on discrepancies between on-site conditions and design specifications. Supervision entities verify rectification progress through online monitoring—for instance, one project utilized this system to promptly identify and resolve pipeline conflicts, preventing costly rework. Through such coordinated mechanisms, stakeholders break down information silos and form a unified front for quality control.

4.2 Implementing Whole-Process Quality Control Across the Project Lifecycle

Design firms must integrate Total Quality Management (TQM) principles throughout the design phase of housing construction projects. This begins with conducting comprehensive project research, including organizing field surveys to assess geological conditions and conducting interviews with development entities to clarify user requirements. For example, in a residential project, the design team identified high demand for natural lighting during research and adjusted window sizes and building spacing accordingly. Design firms should also establish a multi-party review mechanism

involving development, construction, supervision, and geotechnical investigation units to jointly evaluate design proposals, with a focus on structural safety and construction feasibility. Furthermore, promoting the application of Building Information Modeling (BIM) technology enables visual analysis of design schemes through 3D modeling. In one project, BIM modeling revealed pipeline intersection conflicts, allowing proactive adjustments to routing and eliminating latent quality risks at the source [7].

During the construction phase of housing projects, construction firms must rigorously implement whole-process quality control measures. For process-based quality management, detailed quality standards and acceptance procedures should be established, with the "self-inspection, mutual inspection, and special inspection" system enforced. For example, in masonry wall construction, workers first conduct self-inspections of mortar joint thickness, followed by mutual inspections of verticality between teams, and finally special inspections of flatness by quality inspectors before proceeding to the next construction stage. For concealed works, supervision entities must assign personnel for full-time on-site supervision. In one project's foundation construction, supervisors conducted 24-hour on-site monitoring, documenting steel bar tying and concrete pouring processes while retaining video records for quality traceability during acceptance inspections. Regarding material and equipment control, construction firms should establish a full-lifecycle management system. This includes selecting qualified suppliers during procurement, conducting standardized sampling inspections (e.g., testing waterproof membranes for heat resistance and tensile strength), and implementing categorized storage—such as housing cement in weatherproof warehouses to prevent material degradation that could compromise quality.

During the completion acceptance phase, the development entity shall take the lead in establishing an acceptance team comprising representatives from development, design, construction, supervision, and geotechnical investigation units to conduct comprehensive inspections of both the project entity and documentation. For instance, during the acceptance of a residential community, the inspection team tested concrete strength, wall flatness, and other indicators while reviewing construction records and material inspection reports. Upon identifying poorly sealed doors and windows, they mandated corrective actions by the construction firm before permitting re-inspection.

In the operation and maintenance phase, the development entity or property management service provider must establish a quality follow-up mechanism by regularly visiting owners to collect feedback on quality issues. One project implemented quarterly post-occupancy evaluations, addressing problems such as wall leakage and pipe blockages through prompt repairs. Meanwhile, relevant units should conduct statistical analysis of quality defects—for example, a project identified inadequate waterproofing as the primary cause of bathroom leakage, leading to process optimization in subsequent projects and achieving continuous quality improvement.

4.3 Optimizing All-Factor Management to Enhance Quality Control Standards

In terms of workforce management, construction firms should strengthen oversight of frontline workers by implementing skills training and safety education programs while enforcing a certification-based employment system. For example, one project required scaffolders to complete specialized training and pass examinations before receiving operational certification, thereby reducing safety and quality incidents caused by improper handling. Additionally, construction enterprises need to recruit professional quality management personnel to establish specialized teams that promote advanced management methodologies, improving overall quality control efficiency [8].

Construction firms must establish a material quality traceability system that leverages Internet of Things (IoT) technology for end-to-end tracking of material procurement, inspection, and utilization processes. In one housing construction project, QR codes containing information such as manufacturer details, specifications, and inspection reports were affixed to steel bars, concrete, and other materials. Project managers could instantly access material data by scanning these codes with mobile devices, enabling rapid traceability—for instance, when a batch of steel bars failed inspection, the system quickly identified their specific application locations for prompt replacement. Simultaneously, construction enterprises should strengthen supplier management by implementing a

supplier evaluation system that scores vendors based on quality, delivery timeliness, and service performance. Unqualified suppliers are systematically eliminated to ensure consistent material quality standards.

In terms of machinery and equipment management, construction firms must establish an equipment inventory system with regular maintenance protocols. For instance, one project maintained detailed records of usage hours and maintenance history for tower cranes, concrete pumps, and other equipment, conducting monthly inspections—such as checking wire rope wear on tower cranes—and promptly replacing degraded components to ensure operational safety. Regarding construction method management, construction enterprises should promote advanced technological processes. One project adopted prefabricated building technology, leveraging factory-produced components and on-site assembly to minimize operational errors and enhance construction quality. Additionally, the application of Building Information Modeling (BIM) for construction simulation proved effective—another project utilized BIM models to simulate concrete pouring sequences, optimizing the construction plan to prevent cold joints and ensure structural integrity.

5.Conclusion

The principles of Total Quality Management (TQM)—emphasizing "full participation, whole-process control, all-factor management, and continuous improvement"—are highly compatible with the demands of housing construction project management. Its application effectively addresses current challenges such as weak quality awareness and fragmented lifecycle control. By establishing a participatory quality system, implementing full lifecycle management, and optimizing all-factor governance, TQM enhances engineering quality, ensures building safety, and supports high-quality industry development.

As the construction sector advances toward digitalization and green transformation, TQM must evolve through technological integration and conceptual innovation to tackle emerging challenges. This foundational approach will safeguard public safety, drive industrial progress, and elevate China’s housing construction quality to new heights.

References

[1] Qu, T. (2024). Application of Total Quality Management in Quality Control of Architectural Decoration Construction [J]. China Building Decoration, 2024(23): 119-121.

[2] Zhu, Y. H., Lu, X., & Zhou, X. K. (2024). Analysis of Anti-Leakage Construction Techniques for Roofing Projects Based on Total Quality Management Strategies [J]. Engineering Technology Research, 2024, 9(20): 93-95.

[3] Li, S. J., Su, J. J., & Wang, Y. J. (2024). Research on Problems and Countermeasures in Technical Management at Housing Construction Sites [J]. Sichuan Building Materials, 2024, 50(10): 200-202.

[4] Liang, X. G. (2024). Exploration of Total Quality Management and Quality Control in Construction Projects [J]. Brick-Tile, 2024(10): 99-102.

[5] Luo, S. X. (2024). A Brief Analysis of Total Quality Management Applications in Construction Project Management [J]. China Building Decoration, 2024(17): 139-141.

[6] Yan, J. (2024). Research on Total Quality Management During the Construction Phase of Building Projects [J]. Construction & Budgeting, 2024(6): 31-33.

[7] Hu, N., & Tao, J. J. (2024). Analysis of Problems and Countermeasures in Housing Construction Project Management [J]. Real Estate World, 2024(4): 86-88.

[8] Zhang, Y. S. (2023). Countermeasure Analysis of Construction Quality Management for

Housing Projects Based on Total Quality Management Concepts [J]. Building Technology Development, 2023(S2): 47-50.