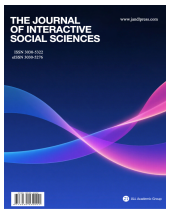
THE JOURNAL OF
INTERACTIVE SOCIAL SCIENCES
2026 Vol. 2, No. 2, ISSN 3030-5322



Construction Management Factors Influencing Concrete Crack Formation and Quality Control in Building Projects

Ran Xu[1*]

[1] Kuala Lumpur University of Science and Technology, 43000, Malaysia
Corresponding Author*: Ran Xu Email: 847421984@qq.com

ARTICLE INFO

Keywords
Concrete Cracking;
Construction Management;
Quality Control;
Building Projects
Curing;
Construction Defects
Rework
Quality Assurance

Published
15 June 2026

ABSTRACT

Concrete cracking is a common quality problem in building construction. Although cracks are often explained through material properties, shrinkage, thermal stress, reinforcement detailing, and curing conditions, many cracking problems are also shaped by construction management practices. This paper examines the construction management factors that influence concrete crack formation and proposes a process-based quality control framework for building projects. Drawing on concrete cracking guidelines, curing standards, construction quality management literature, rework studies, and quality management standards, the paper argues that concrete cracking should be understood as a socio-technical quality outcome rather than a purely technical defect. The analysis identifies seven major management-related factors: inadequate pre-construction planning, weak material procurement and acceptance control, poor supervision of concrete placing and compaction, ineffective curing management, schedule pressure, insufficient coordination among project participants, and poor documentation and feedback mechanisms. The paper further proposes an integrated quality control framework based on risk-based quality planning, supplier control, method statements, worker training, inspection and test plans, curing control, communication mechanisms, and continuous improvement. The paper contributes to construction management research by linking concrete crack prevention with quality assurance, organizational coordination, and project governance. It also provides practical implications for contractors, project managers, supervisors, and quality engineers seeking to reduce crack-related defects in building projects.

1. Introduction

Concrete is one of the most widely used materials in building construction because of its strength, durability, moldability, and economic efficiency. However, cracking remains one of the most frequent quality problems in concrete structures. Concrete cracks may arise from drying shrinkage, plastic shrinkage, thermal stress, settlement, reinforcement corrosion, construction

Citation: Xu, R. (2026). Construction management factors influencing concrete crack formation and quality control in building projects. The Journal of Interactive Social Sciences, 2(2), 57-67.

3030-5322/© The Authors. Published by J&L Academic Group PLT. This is an open access article under the CC BY 4.0 license.
https://doi.org/10.64744/tjiss.2026.234.

loading, restrained deformation, and inadequate curing (ACI Committee 224, 2001; ACI Committee 224, 2007; Safiuddin et al., 2018). Although some cracks do not immediately threaten structural safety, they may reduce durability, accelerate the ingress of water and aggressive agents, weaken user confidence, increase maintenance costs, and lead to disputes among owners, contractors, consultants, and supervisors (ACI Committee 224, 2007; Qu et al., 2024; Safiuddin et al., 2018).

Existing studies and technical guidelines have mainly explained concrete cracking through structural, material, and environmental mechanisms. ACI Committee 224 (2001) emphasized that good design and construction practices can reduce and control cracking, even though cracking caused by drying shrinkage cannot be completely eliminated in most concrete structures. Similarly, early-age cracking studies show that cracks are associated with cement hydration, shrinkage, temperature gradients, restraint, bleeding, evaporation, and curing conditions (Ghourchian et al., 2017; Safiuddin et al., 2018). These technical explanations are essential, but they do not fully explain why similar cracking problems repeatedly occur in building projects despite the availability of standards, inspection procedures, and technical knowledge.

From a construction management perspective, many concrete cracks are not only technical failures but also management failures. For example, inadequate curing may result from insufficient site supervision, unclear responsibility allocation, unrealistic schedules, lack of curing materials, or poor worker training rather than from technical uncertainty alone (ACI Committee 308, 2016; Wawak et al., 2020). Similarly, excessive water addition, improper vibration, delayed placing, and premature formwork removal are strongly connected with site control, subcontractor management, communication, and inspection routines (Gurmu & Mahmood, 2024; Love et al., 2020). Therefore, concrete cracking should be viewed as a socio-technical quality issue in which physical cracking mechanisms interact with organizational practices.

Construction quality research supports this view. Wawak et al. (2020) found that construction quality is affected by project process quality, organizational process quality, and final product quality. Gurmu and Mahmood (2024) further identified lack of communication, lack of teamwork, lack of skilled workers, poor supervision, design errors, design complexity, and low-bid contracting as critical factors affecting quality in building construction projects. These findings indicate that construction defects are rarely caused by isolated technical errors; rather, they often emerge from the interaction between human behavior, management systems, project organization, and technical execution.

This paper therefore examines the construction management factors influencing concrete crack formation and proposes a quality control framework for crack prevention in building projects. The paper addresses the following research questions:

RQ1: What construction management factors contribute to concrete crack formation in building projects?

RQ2: How do these management factors interact with technical cracking mechanisms?

RQ3: What quality control measures can be adopted to reduce crack-related defects during construction?

2. Literature Review

2.1 Concrete Cracking as a Technical and Quality Problem

Concrete cracking is influenced by both early-age and long-term mechanisms. Early-age cracking may occur before concrete has developed sufficient tensile strength, particularly when plastic shrinkage, settlement, autogenous shrinkage, temperature gradients, and restraint exceed the material's capacity to resist tensile stress (Ghourchian et al., 2017; Safiuddin et al., 2018). Plastic shrinkage cracking is especially sensitive to environmental conditions such as wind speed, air temperature, relative humidity, and concrete temperature because these factors influence the rate of surface moisture evaporation (Ghourchian et al., 2017). Thermal cracking is also significant in large or restrained concrete elements because hydration heat may produce internal temperature gradients and tensile stress (ACI Committee 224, 2001).

However, technical causes are often shaped by construction processes. For instance, evaporation-related cracking is influenced not only by weather but also by whether site managers monitor environmental conditions, prepare curing materials, schedule pours appropriately, and start curing on time (ACI Committee 308, 2016; Ghourchian et al., 2017). Drying shrinkage cracking may be associated with concrete composition and restraint, but the risk can be aggravated by poor mix control, excessive water addition, insufficient joint planning, and inadequate curing (ACI Committee 224, 2001; Safiuddin et al., 2018). Thus, technical cracking mechanisms are closely connected with construction decisions.

Concrete cracking is also a quality management issue because it affects conformity, durability, serviceability, appearance, maintenance cost, and stakeholder satisfaction. ACI Committee 224 (2007) notes that crack evaluation requires consideration of crack location, width, pattern, movement, cause, and structural significance. From the perspective of project delivery, cracks may also trigger rework, repair, delay, claims, and reputational loss (Love et al., 2020, 2022). Therefore, crack control should not be limited to post-defect repair; it should be embedded into the construction quality management process.

2.2 Construction Quality Management and Process Control

Quality management in construction aims to ensure that project outputs conform to design specifications, contractual requirements, regulatory standards, and user expectations. ISO 9001:2015 defines the requirements for establishing, implementing, maintaining, and continually improving a quality management system (International Organization for Standardization [ISO], 2015). ISO 10005:2018 provides guidance for quality plans, which is particularly relevant to construction because each project has specific methods, risks, participants, and site conditions (ISO, 2018).

Construction quality is process-dependent. Unlike manufacturing, construction projects are temporary, site-based, fragmented, and highly dependent on coordination among multiple organizations (Wawak et al., 2020). This means that defects often arise not only from technical incompetence but also from process discontinuity, unclear responsibilities, poor information transfer, and insufficient inspection (Gurmu & Mahmood, 2024; Wawak et al., 2020). In concrete works, quality depends on a chain of activities, including design review, procurement, mix approval, batching, transport, placing, compaction, finishing, curing, inspection, testing, and documentation (ACI Committee 308, 2016; Safiuddin et al., 2018).

Quality control and quality assurance are both necessary. Quality control focuses on operational checks such as slump tests, temperature measurement, reinforcement inspection, formwork inspection, vibration control, curing inspection, and strength testing. Quality assurance focuses on the management system that ensures these checks are planned, implemented, recorded, reviewed, and improved (ISO, 2015; ISO, 2018). Therefore, effective crack prevention requires both technical inspection and managerial governance.

2.3 Rework, Defects, and Organizational Learning

Concrete cracking is closely linked to construction defects and rework. Rework refers to unnecessary work caused by errors, omissions, changes, or failures to meet requirements (Love et al., 2020, 2022). In construction projects, rework may reduce productivity, increase cost, delay completion, and reduce stakeholder trust (Love et al., 2022). Crack repair is a typical example of rework when cracks result from poor execution or inadequate quality control.

Rework research is useful for understanding concrete cracks because it shifts attention from the visible defect to the underlying management system. Love et al. (2020) argued that errors and violations are important sources of rework in construction. Love et al. (2022) further emphasized that rework mitigation requires leadership, learning, psychological safety, and error management rather than a purely punitive approach. This is relevant to crack prevention because workers and supervisors may hide minor nonconformities if the site culture discourages reporting. As a result, early warning signs such as delayed curing, excessive water addition, poor compaction, or surface plastic cracking may not be addressed in time.

A learning-oriented quality culture is therefore essential. When cracks occur, the project team should identify whether the cause relates to material quality, construction method, supervision, schedule pressure, communication failure, design ambiguity, or environmental exposure (ACI Committee 224, 2007; Love et al., 2022). Without root-cause analysis, crack repair may address the symptom while allowing the same management failure to recur.

3. Methodology

This paper adopts a conceptual review approach. A conceptual review is appropriate when the purpose is to synthesize existing literature, clarify relationships among concepts, and develop an analytical framework rather than test hypotheses through primary data. In this paper, the conceptual review integrates concrete cracking literature, construction quality management studies, rework research, and international quality management standards.

The reviewed sources were selected from four categories. First, technical guidelines and studies on concrete cracking and curing were reviewed, including ACI 224R, ACI 224.1R, ACI 308R, and studies on early-age cracking and plastic shrinkage (ACI Committee 224, 2001, 2007; ACI Committee 308, 2016; Ghourchian et al., 2017; Safiuddin et al., 2018). Second, construction quality management literature was examined to identify management-related quality factors in building projects (Gurmu & Mahmood, 2024; Wawak et al., 2020). Third, rework and defect management studies were reviewed to understand how errors, violations, communication failures, and organizational learning influence construction quality (Love et al., 2020, 2022). Fourth, ISO 9001 and ISO 10005 were used to frame the proposed quality control system from a process-based quality management perspective (ISO, 2015, 2018).

The analysis followed three steps. First, common technical causes of concrete cracking were summarized from concrete literature. Second, construction management factors related to quality defects were extracted from construction management and rework studies. Third, the technical and managerial factors were integrated into a socio-technical framework explaining how management practices influence crack formation during building construction.

4. Construction Management Factors Influencing Concrete Crack Formation

4.1 Inadequate Pre-Construction Quality Planning

Pre-construction quality planning is a fundamental step in crack prevention. Before concrete works begin, project teams should clarify concrete grades, mix design requirements, reinforcement details, joint arrangements, placing methods, curing methods, inspection points, testing requirements, and acceptance criteria (ACI Committee 224, 2001; ISO, 2018). If these requirements are not translated into project-specific quality plans, site teams may rely on informal experience rather than controlled procedures.

Inadequate quality planning increases cracking risk in several ways. First, high-risk concrete elements may not be identified before construction. Basement walls, long-span slabs, roof slabs, transfer beams, podium slabs, water-retaining structures, and mass concrete elements usually require more careful control because they are more vulnerable to shrinkage, thermal stress, restraint, and environmental exposure (ACI Committee 224, 2001; Safiuddin et al., 2018). Second, unclear planning weakens responsibility allocation. If the quality plan does not specify who is responsible for curing, temperature monitoring, joint protection, inspection records, and corrective actions, these tasks may be neglected after concrete placement (ISO, 2018; Wawak et al., 2020). Third, lack of planning may lead to insufficient preparation of labor, equipment, curing materials, and inspection resources, especially during large concrete pours (ACI Committee 308, 2016).

Therefore, pre-construction planning should not be treated as a formal document prepared only for approval. It should function as a practical risk-control tool that links design requirements, site methods, inspection procedures, and responsible persons.

4.2 Weak Material Procurement and Acceptance Control

Material quality is a direct technical factor affecting concrete cracking, but it is also a construction management issue. Cement, aggregates, admixtures, water, reinforcement, and ready-mixed concrete must be selected, procured, inspected, stored, and accepted according to project requirements (ACI Committee 224, 2001; Safiuddin et al., 2018). If procurement decisions focus mainly on low price rather than technical suitability and supplier reliability, concrete performance may become unstable.

Ready-mixed concrete creates a critical interface between the contractor and the concrete supplier. Workability, delivery time, batching accuracy, admixture dosage, concrete temperature, and water–cement ratio must be controlled because they influence shrinkage, strength development, and cracking risk (ACI Committee 224, 2001; Safiuddin et al., 2018). Unauthorized water addition on site is particularly problematic. Although it may temporarily improve workability, it can increase drying shrinkage, reduce strength, and worsen durability performance (ACI Committee 224, 2001; Safiuddin et al., 2018).

Supplier control should therefore include supplier qualification, mix design approval, trial mix

verification when necessary, delivery ticket checking, slump testing, temperature measurement, sampling, strength testing, and rejection procedures for nonconforming concrete (ISO, 2015, 2018). From a management perspective, these controls help prevent cracks by reducing variability in concrete quality and by ensuring that technical requirements are consistently implemented on site.

4.3 Poor Supervision of Placing, Compaction, and Finishing

Concrete placing, compaction, and finishing are highly sensitive to site workmanship. Even if the mix design is appropriate, poor execution may cause segregation, honeycombing, settlement cracking, weak interfaces, cold joints, excessive bleeding, surface defects, and local stress concentrations (ACI Committee 224, 2001; Safiuddin et al., 2018). These defects can later develop into visible cracks or durability problems.

Poor supervision is a critical management factor. Gurmu and Mahmood (2024) identified poor supervision and lack of skilled workers among the key causes of poor quality in building construction projects. In concrete works, supervisors must check whether the concrete is placed within the allowable time, whether the placing sequence follows the method statement, whether vibration is adequate, whether reinforcement and embedded items remain in position, and whether finishing is conducted at the proper time (ACI Committee 224, 2001; ACI Committee 308, 2016).

Both insufficient and excessive vibration may create quality problems. Insufficient vibration may leave voids and honeycombing, whereas excessive vibration may cause segregation and bleeding. Poor finishing timing can also contribute to surface cracking, especially if finishing is performed while bleed water is still present or if the surface dries too rapidly (Ghourchian et al., 2017; Safiuddin et al., 2018). These problems show that crack prevention requires continuous process supervision rather than only final inspection.

4.4 Ineffective Curing Management

Curing is one of the most important construction-stage controls for reducing cracking risk. The purpose of curing is to maintain adequate moisture and temperature conditions so that cement hydration can continue and early-age shrinkage can be reduced (ACI Committee 308, 2016). Inadequate curing may increase plastic shrinkage, drying shrinkage, surface cracking, thermal gradients, and strength development problems (ACI Committee 308, 2016; Safiuddin et al., 2018).

However, curing is frequently weak in construction management because it occurs after concrete placement, when site attention often shifts to the next activity. ACI Committee 308 (2016) emphasizes curing practices, materials, procedures, and monitoring methods, which indicates that curing should be treated as a controlled process rather than an informal aftercare activity. In practice, curing failures may include delayed curing, insufficient curing duration, lack of curing materials, inadequate water supply, failure to protect concrete from wind and sun, premature formwork removal, and absence of curing records (ACI Committee 308, 2016; Ghourchian et al., 2017).

Curing management is especially important in hot, dry, windy, or cold weather. Plastic shrinkage risk increases when evaporation exceeds bleeding and when the concrete surface loses moisture rapidly (Ghourchian et al., 2017). Therefore, site managers should monitor weather conditions, prepare curing resources before placement, assign curing responsibility, and document curing implementation. Without these management controls, even technically suitable concrete may crack because the required hydration environment is not maintained.

4.5 Schedule Pressure and Improper Construction Sequencing

Schedule pressure is a major management factor influencing concrete cracking. Building projects often operate under strict deadlines, and contractors may accelerate work to meet progress targets. Acceleration may lead to premature formwork removal, early loading, shortened curing periods, rushed finishing, inadequate inspection, and poor coordination between trades (Love et al., 2020; Wawak et al., 2020). These actions may increase cracking risk because concrete needs sufficient time to gain strength and develop durability.

Improper sequencing can also create cracking problems. For example, if reinforcement, embedded pipes, sleeves, openings, and formwork are not fully checked before concrete placement, later corrections may disturb fresh or early-age concrete. If heavy materials are stacked on slabs before sufficient strength development, early loading may produce cracks. If adjacent pours and construction joints are poorly planned, restraint and differential shrinkage may increase (ACI Committee 224, 2001; Safiuddin et al., 2018).

Therefore, project schedules should integrate quality requirements rather than focus only on speed. Concrete work programmes should include realistic time for pre-pour inspection, concrete delivery, placement, finishing, initial curing, continued curing, formwork removal, strength verification, and post-pour monitoring (ACI Committee 308, 2016; ISO, 2018). A schedule that ignores these process requirements may produce short-term progress but long-term quality defects.

4.6 Insufficient Coordination Among Project Participants

Building construction involves owners, designers, contractors, subcontractors, suppliers, supervisors, and consultants. Concrete cracking may occur when these participants fail to coordinate design information, construction methods, inspection requirements, and site changes. Construction quality literature consistently identifies communication and teamwork as critical factors affecting project quality (Gurmu & Mahmood, 2024; Wawak et al., 2020).

Coordination failure can influence cracking in several ways. Late design changes may alter reinforcement details, joint locations, slab thickness, or embedded items. Mechanical and electrical subcontractors may create congestion or move reinforcement to install pipes and sleeves. Concrete suppliers may not receive complete information about special performance requirements. Supervisors may inspect after critical work has already been covered. Each of these coordination failures may increase the probability of cracking or related defects (Gurmu & Mahmood, 2024; Love et al., 2022).

Effective coordination requires drawing control, technical meetings, method statement review, request-for-information procedures, joint inspections, and clear communication channels. Before large or high-risk concrete pours, project teams should confirm drawings, mix requirements, placing sequence, inspection points, curing responsibilities, weather response measures, and emergency procedures (ISO, 2018; Wawak et al., 2020). In this sense, crack control is also a coordination problem.

4.7 Poor Documentation, Feedback, and Corrective Action

Documentation is essential for crack prevention because it allows project teams to trace quality problems and identify root causes. Important records include mix design approvals, delivery tickets, slump tests, concrete temperature records, weather records, reinforcement inspections, pre-pour checklists, curing logs, cube or cylinder test results, nonconformance reports, photographs, crack

monitoring records, and repair records (ACI Committee 224, 2007; ISO, 2015, 2018).

Poor documentation weakens learning. If cracks occur but the project team cannot trace concrete batches, curing duration, weather conditions, placement sequence, or inspection results, root-cause analysis becomes difficult. As a result, repairs may be carried out without correcting the underlying process failure (Love et al., 2022). This can lead to repeated defects across floors, blocks, or future projects.

A quality management system should include nonconformance reporting, corrective action, preventive action, and lessons learned (ISO, 2015). For concrete cracks, this means that the project team should not only repair the crack but also ask why it occurred, whether similar areas are at risk, and what management process should be improved. This feedback mechanism transforms cracking from an isolated defect into an opportunity for organizational learning.

5. Proposed Quality Control Framework for Crack Prevention

Based on the above analysis, this paper proposes a seven-component quality control framework for reducing concrete crack formation in building projects.

5.1 Risk-Based Quality Planning

The first component is risk-based quality planning. The project team should identify crack-sensitive elements before construction and classify them according to risk level. High-risk elements may include basement walls, roof slabs, long-span slabs, transfer beams, podium slabs, water-retaining structures, and mass concrete components (ACI Committee 224, 2001; Safiuddin et al., 2018). For each element, the quality plan should define technical requirements, inspection points, responsible personnel, curing methods, environmental controls, and documentation requirements (ISO, 2018).

5.2 Supplier and Material Control

The second component is supplier and material control. Concrete suppliers should be selected based on technical capability, batching control, delivery reliability, quality records, and previous performance. Material control should include mix design review, trial mix verification when necessary, delivery ticket checking, slump testing, temperature measurement, sampling, strength testing, and rejection procedures for nonconforming concrete (ACI Committee 224, 2001; ISO, 2015). These measures reduce the risk of cracking by improving consistency in concrete quality.

5.3 Method Statements and Worker Training

The third component is method statement control and worker training. Method statements should explain the required placing sequence, vibration method, construction joint treatment, finishing procedure, curing method, weather response, and emergency measures (ACI Committee 308, 2016; ISO, 2018). Workers and subcontractors should receive pre-task training, especially before high-risk concrete works. Training should explain not only what procedures are required but also why poor practices such as excessive water addition, delayed curing, and improper vibration increase cracking risk (Ghourchian et al., 2017; Safiuddin et al., 2018).

5.4 Inspection and Test Plan

The fourth component is an inspection and test plan. Inspection should occur before, during, and after concrete placement. Pre-pour inspection should verify formwork, reinforcement, cover,

embedded items, cleanliness, openings, and construction joint preparation. During-pour inspection should monitor concrete delivery, workability, temperature, placing sequence, compaction, and finishing. Post-pour inspection should monitor curing, protection, formwork removal, early loading, and crack development (ACI Committee 224, 2007; ACI Committee 308, 2016). This process-based inspection approach is consistent with the quality planning logic of ISO 10005 (ISO, 2018).

5.5 Curing Management System

The fifth component is a formal curing management system. Curing should be planned before concrete placement, not improvised after finishing. The curing plan should specify start time, duration, method, materials, responsible personnel, inspection frequency, and weather-related adjustments (ACI Committee 308, 2016). In hot, dry, or windy conditions, additional measures such as wet coverings, curing compounds, fogging, evaporation reducers, sun protection, or windbreaks may be necessary to reduce surface moisture loss (ACI Committee 308, 2016; Ghourchian et al., 2017).

5.6 Communication and Coordination Mechanism

The sixth component is communication and coordination. Project teams should hold technical coordination meetings before high-risk concrete works. These meetings should involve the contractor, subcontractors, supplier, designer, supervisor, and quality personnel. The purpose is to confirm drawings, mix requirements, placing methods, inspection points, curing responsibilities, and contingency measures (Gurmu & Mahmood, 2024; Wawak et al., 2020). Clear coordination reduces the likelihood that design changes, embedded services, or subcontractor activities will create crack-related defects.

5.7 Feedback and Continuous Improvement

The seventh component is feedback and continuous improvement. When cracks appear, the project team should record crack width, length, location, pattern, timing, environmental conditions, and possible causes (ACI Committee 224, 2007). Root-cause analysis should then be conducted to determine whether the cracking is related to material, design, construction method, curing, weather, supervision, schedule pressure, or coordination failure (Love et al., 2022). Corrective actions should be documented and communicated to prevent recurrence. This approach aligns with the continuous improvement principle of ISO 9001 (ISO, 2015).

6. Discussion

The analysis demonstrates that concrete cracking in building projects should be understood as a socio-technical quality outcome. Technically, cracking is associated with shrinkage, settlement, thermal gradients, restraint, strength development, reinforcement detailing, and curing conditions (ACI Committee 224, 2001; Safiuddin et al., 2018). Managerially, these technical mechanisms are influenced by planning, procurement, supervision, scheduling, coordination, documentation, and organizational learning (Gurmu & Mahmood, 2024; Wawak et al., 2020).

This socio-technical interpretation has three important implications. First, crack prevention should move upstream. Instead of waiting for cracks to appear and then repairing them, project teams should manage cracking risks during planning, supplier selection, method preparation, and pre-pour coordination (ACI Committee 224, 2001; ISO, 2018). Second, crack prevention requires clear responsibility. Curing, inspection, testing, documentation, and corrective action should be assigned to specific persons or teams, because unclear responsibility often leads to neglected quality

tasks (ISO, 2015; Wawak et al., 2020). Third, project organizations need a learning-oriented quality culture. If workers and supervisors hide mistakes due to fear of blame, early warning signs may not be reported. Rework research suggests that error management, communication, leadership, and organizational learning are essential for reducing repeated defects (Love et al., 2020, 2022).

For construction management research, this paper expands the discussion of concrete cracking beyond material and structural explanations. It suggests that cracks can be studied through the lenses of project governance, quality assurance, site behavior, communication, and organizational learning. Future empirical studies may use surveys, case studies, or mixed methods to test how management variables influence crack occurrence in different project contexts.

7. Conclusion

Concrete cracking is commonly associated with material properties, shrinkage, thermal stress, restraint, design, and curing. However, many crack-related defects in building projects are also influenced by construction management factors. This paper identified seven major management factors: inadequate pre-construction planning, weak material procurement and acceptance control, poor supervision of placing and compaction, ineffective curing management, schedule pressure, insufficient coordination, and poor documentation and feedback mechanisms.

This study contributes to construction management research by reframing concrete cracking as a socio-technical quality problem. It also proposes a quality control framework based on risk-based planning, supplier control, method statements, worker training, inspection and test plans, curing management, communication, and continuous improvement. For practitioners, the key implication is that crack prevention should be embedded into the entire construction process rather than treated as a post-defect repair activity. A systematic quality management approach can reduce crack-related defects, minimize rework, improve durability, and enhance stakeholder satisfaction in building projects.

Acknowledgments
We are grateful to all respondents who participated in this study.

Funding
There is no fundings for this work.

References

[1]. ACI Committee 224. (2001). Control of cracking in concrete structures (ACI 224R-01). American Concrete Institute.

[2]. ACI Committee 224. (2007). Causes, evaluation, and repair of cracks in concrete structures (ACI 224.1R-07). American Concrete Institute.

[3]. ACI Committee 308. (2016). Guide to external curing of concrete (ACI 308R-16). American Concrete Institute.

[4]. British Standards Institution. (2009). BS EN 13670:2009 Execution of concrete structures. BSI Standards Limited.

[5]. Ghourchian, S., Wyrzykowski, M., & Lura, P. (2017). A practical approach for reducing the risk of plastic shrinkage cracking of concrete. RILEM Technical Letters, 2, 40–44. https://doi.org/10.21809/rilemtechlett.2017.45

[6]. Gurmu, A. T., & Mahmood, M. N. (2024). Critical factors affecting quality in building construction projects: Systematic review and meta-analysis. Journal of Construction Engineering and Management, 150(3), Article 04024004. https://doi.org/10.1061/JCEMD4.COENG-13794

[7]. International Organization for Standardization. (2015). ISO 9001:2015 Quality management systems—Requirements. ISO.

[8]. International Organization for Standardization. (2018). ISO 10005:2018 Quality management—Guidelines for quality plans. ISO.

[9]. Love, P. E. D., Matthews, J., Fang, W., & Porter, S. R. (2020). Rework in construction: A focus on errors and violations. Journal of Construction Engineering and Management, 146(9), Article 06020001. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001901

[10]. Love, P. E. D., Matthews, J., Sing, M. C. P., Porter, S. R., & Fang, W. (2022). State of science: Why does rework occur in construction? What are its consequences? And what can be done to mitigate its occurrence? Engineering, 18, 246–258. https://doi.org/10.1016/j.eng.2022.05.010

[11]. Qu, Z., Zhang, X., & Li, Y. (2024). A review on early-age cracking of concrete: Causes and control. Case Studies in Construction Materials, 21, Article e03848. https://doi.org/10.1016/j.cscm.2024.e03848

[12]. Safiuddin, M., Kaish, A. B. M. A., Woon, C.-O., & Raman, S. N. (2018). Early-age cracking in concrete: Causes, consequences, remedial measures, and recommendations. Applied Sciences, 8(10), Article 1730. https://doi.org/10.3390/app8101730

[13]. Wawak, S., Ljevo, Ž., & Vukomanović, M. (2020). Understanding the key quality factors in construction projects—A systematic literature review. Sustainability, 12(24), Article 10376. https://doi.org/10.3390/su122410376