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SMM-001 | Concrete Quality Management Manual

Purpose

Concrete quality management is not limited to testing concrete cubes or checking whether the final strength meets the specified requirement. It is a complete system of controlling materials, production, handling, placement, testing, documentation and corrective action.

SMM-001 provides a practical framework for concrete quality management, helping project and quality teams establish consistent controls from the selection of materials through final verification.

The objective is simple: make the quality process systematic, traceable and practical enough to work at site level.

1. What Is Concrete Quality Management?

Concrete quality management is the coordinated control of all activities that can influence the performance and consistency of concrete.

It begins before concrete production and continues through batching, transportation, placement, curing, testing and review of results.

A good quality management system does not depend on detecting problems after they occur. It focuses on preventing variation and identifying deviations early.

2. The Quality Management Chain

Concrete quality is the result of a chain of interconnected activities:

Materials → Mix Design → Batching → Mixing → Transportation → Placement → Compaction → Curing → Testing → Documentation → Review

A weakness at any stage can affect the final performance of concrete.

Therefore, quality should not be treated as the responsibility of only the laboratory or QA/QC department. It is a shared responsibility across the complete concrete operation.

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3. Material Control

The quality of concrete begins with the quality and consistency of its constituent materials.

Cement, supplementary cementitious materials, aggregates, water and chemical admixtures should be controlled through appropriate source approval, testing, storage and routine monitoring.

Particular attention should be given to aggregate moisture, grading, absorption and changes in material source or stockpile condition because these can directly influence concrete consistency and effective water content.

4. Mix Design Control

A concrete mix design should not be considered a fixed recipe that can be changed casually at the plant or site.

The approved mix should have clearly defined materials, proportions, target workability, performance requirements and applicable acceptance criteria.

Any significant change in cement, SCM, aggregate source, admixture or water requirement should be evaluated before implementation.

Mix optimisation should improve performance and economy without compromising the required quality and durability.

5. Batching and Production Control

Consistent concrete requires consistent batching.

Batching systems should be checked for correct material identification, weighing accuracy, moisture correction, water adjustment and admixture dosing.

Actual aggregate moisture should be monitored regularly, particularly after rainfall or significant changes in stockpile condition.

The objective is to ensure that the materials entering every batch remain as close as practical to the approved mix design.

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6. Fresh Concrete Control

Fresh concrete should be checked for the properties that are important to its intended application.

Depending on the project requirements, this may include workability, temperature, appearance, segregation, bleeding and other relevant characteristics.

A variation in fresh concrete properties should not automatically be corrected by adding water at site. The reason for the variation should first be understood and controlled at its source.

7. Sampling and Testing

Testing is meaningful only when the sample and testing process are reliable.

Representative sampling, correct specimen preparation, proper identification, curing and testing are essential for obtaining dependable concrete test results.

An isolated abnormal result should therefore be investigated through the complete testing chain before conclusions are drawn about the concrete itself.

8. Site Placement and Curing

Concrete quality can be compromised even when the concrete leaving the plant is satisfactory.

Transportation time, placement method, reinforcement congestion, compaction, finishing, temperature and curing conditions can all influence the final performance.

The quality management system should therefore extend beyond the RMC plant and include practical controls at the point of placement.

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9. Documentation and Traceability

Good documentation allows the team to understand what happened when a result is normal as well as when something goes wrong.

Records should provide traceability between materials, batch details, delivery information, sampling, testing, placement location and final results.

Documentation should support engineering decisions rather than become a paperwork exercise.

10. Handling Non-Conformities

A non-conformity should be treated as an opportunity to identify and control the cause.

The first step is to establish the facts. The team should then determine whether the deviation is related to materials, batching, testing, handling, placement, curing, equipment or another process.

Corrective action should address the root cause rather than simply treating the visible symptom.

11. Root Cause Analysis

Effective concrete quality management requires a shift from asking “What went wrong?” to asking “Why did it happen?”

A structured investigation should consider the complete process and available evidence before identifying the root cause.

Repeated problems should always trigger a review of the system rather than repeated temporary corrections.

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12. Continuous Improvement

A quality management system should evolve with experience.

Trends in strength, workability, material properties, temperature, rejection, complaints and non-conformities can provide valuable information about process performance.

Regular review of this information allows the team to identify variation early, improve controls and reduce recurring problems.

13. Practical Quality Management Checklist

Before considering a concrete quality system effective, check:

- Materials are approved and consistently controlled
- Aggregate moisture and absorption are regularly monitored
- Approved mix designs are clearly identified
- Batching and dosing systems are checked
- Fresh concrete properties are monitored
- Sampling and cube preparation are controlled
- Curing and testing procedures are followed
- Site placement and curing are monitored
- Records provide complete traceability
- Non-conformities are investigated
- Corrective actions address root causes
- Quality trends are reviewed for continuous improvement

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14. SM Practical Insight

Concrete quality cannot be tested into concrete after the work is complete.

Testing tells us what happened. Quality management helps us control why it happened.

The strongest quality systems therefore do not depend only on more testing. They control the process that produces the concrete and use test results as feedback for continuous improvement.

Good concrete quality management is ultimately about controlling variation before it becomes a problem.

15. Closing Note

SMM-001 is intended as a practical reference for engineers, QA/QC teams, RMC professionals, contractors and project teams involved in concrete production and construction.

The Manual provides a framework for thinking about concrete quality as a complete process rather than a collection of individual tests.

The practical objective is simple: consistent materials, consistent processes, reliable testing and traceable decisions leading to consistent concrete performance.

Disclaimer

This Manual is provided by SM Knowledge Hub (SMKH) as a practical technical reference based on engineering principles and field experience. It is intended to support professional judgement and does not replace applicable codes, statutory requirements, project specifications, contractual requirements, approved quality plans or project-specific procedures.

Users should verify the requirements applicable to their specific project, materials, equipment and construction conditions before implementation. SMKH and DMSA shall not be held responsible for decisions taken solely on the basis of this Manual without appropriate professional evaluation and project-specific verification.

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