Guide for Concrete Inspection

Reported by ACI Committee 311

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This guide discusses the need for inspection of concrete construction and other related activities, the types of inspection activities involved, and the responsibilities of various individuals and organizations involved in these activities. Field and laboratory testing activities are also considered part of inspection. This guide presents recommendations for inspection plan content and a detailed checklist of inspection attributes that can be adopted for use depending on the scope and needs of individual projects.

Keywords: concrete; construction; inspection; quality assurance; quality control; testing.

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CHAPTER 1—INTRODUCTION

1.1—Scope

This document is primarily intended for guidance in the development of inspection and testing plans that are part of the overall system designed to ensure quality in the finished concrete product. ACI Committee 311 recommends that the owner develop a quality plan, as outlined in ACI 121R, and

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that 311.4R be used to develop inspection and testing plans by those organizations assigned by the owner's quality plan to conduct inspections.

1.2—Philosophy

Inspection and testing requirements typically vary, based on the specific scope and needs of construction, and should therefore be tailored to each project individually. The content of an inspection plan is dependent on the type and complexity of the project, special features involved, quality level desired, building code requirements, and the responsibilities of the inspection organization performing the work. Any of these may necessitate the addition of more detailed inspection than conventional or may warrant a reduction from conventional requirements.

1.3—General

Inspection is simply a subsystem of the quality plan. It may be employed by the owner to evaluate future acceptance of the work or by contractors and material producers for quality-control purposes. In addition, inspection may be part of a program of activities performed by government agencies charged with enforcing building codes and other government regulations. The inspection process does not add quality to inspected items. Inspection simply establishes the status of inspected items relative to specified requirements. The information derived from inspections and tests, however, when properly evaluated, and with conclusions and decisions implemented, can result in the improvement of the quality of the product or process. The specified quality is achieved only by implementation of an adequate quality plan. Such a plan affects the entire project, from planning through design and construction to acceptance by the owner. Quality of work during the construction phase is achieved almost entirely by the contractor or producer's quality-control program. This quality-control program involves everyone from management to field supervisors to workers. Quality assurance and quality control should have strong, active support from top management and the active concern and participation of everyone involved in the construction process. Inspection and testing are only a part, though a very important part, of both quality-assurance and quality-control programs.

1.4—Definitions

1.4.1 *Quality assurance (QA)*—A management tool for all planned and systematic actions necessary to ensure that the final product meets the requirements of the contract documents and standards of good practice for the work.

1.4.2 *Quality control (QC)*—Actions taken by a contractor or material producer to provide and document control over what is being done and what is being provided so that the applicable standards of good practice and the contract documents for the work are followed.

1.4.3 *Owner*—The individual or organization having financial and legal responsibility for construction of a project, as well as bearing the ultimate responsibility for the public health, welfare, and safety related to the project. The term "owner" includes those organizations or individuals acting as agents for the owner.

1.4.4 *Architect/engineer (A/E)*—The architect, engineer, architectural firm, engineering firm, or architectural and engineering firm issuing project drawings and specifications, administering the work under contract specifications and drawings, or both.

1.4.5 *Contractor*—The organization responsible for constructing a project according to the project specifications and design drawings. The contractor may also possess the responsibilities of the A/E in designing and building the project and contract execution.

1.4.6 *Construction manager or owner's representative*—The person or management organization responsible to the owner for coordination and review of all contracted work. The person's or organization's role is to coordinate and communicate the entire scope of work to achieve a more efficient construction process.

1.4.7 *Inspection organization*—The organization, agency, or testing laboratory that is responsible for providing inspection and testing for the owner or for providing quality-control inspection and testing for the contractor or producer.

1.4.8 *Inspection*—Visual observations, measurements, and field and laboratory testing of activities, components, and materials to specified requirements along with the recording and evaluation of such data.

1.4.9 *Inspection/test report*—A document that records the results of observations, measurements, and tests as verified by the initials or signature of the individual responsible for the inspection/test activity.

1.4.10 *Material manufacturer or supplier*—The organization responsible for producing or manufacturing a product or material used in the process of construction, or for supplying products or materials to a project, with or without performing additional operations on the product or material.

1.5—Categories of inspection

Inspection activities generally fall into one of the categories described in 1.5.1 through 1.5.4.

1.5.1 *Owner's inspection*—Inspections and tests conducted by or for the owner either by the owner's in-house inspection group or by an independent inspection agency. Owner inspection is a part of the external quality assurance program conducted by the owner. Results of these inspections form the basis of the owner's decision to ultimately accept the work performed by the contractor. Owner-inspection programs should be structured so as to provide the owner with an acceptable degree of assurance that the work of the contractor is in conformance with the contract documents.

1.5.2 *Quality-control inspection: contractor*—A series of formalized activities and procedures that are part of the contractor's operation, providing in-process evaluation of the quality of construction. These activities help to assure the contractor that the finished construction will meet all requirements of the project plans, drawings, and specifications, and will be accepted by the owner.

1.5.3 *Quality-control inspection: producer*—A series of formalized activities and procedures that are part of the

fabricating or manufacturing operation of a producer or fabricator of concrete materials, reinforcement, or products who furnishes products to the construction industry or to a specific project. Examples are operations of cement and aggregate producers, concrete producers, precasters, prestressing concrete fabricators, and reinforcing steel mills and fabricators. Production-inspection personnel operate essentially the same way as those described for the contractor. They aid in ensuring that finished products will meet general specifications or those specifications relative to a specific project.

1.5.4 *Compliance inspection*—A series of formalized activities and procedures performed by government agencies charged with the responsibility for enforcing building codes and other regulations. In these cases, compliance inspectors have the responsibility for ensuring that the finished structure conforms to specified codes or regulations. The organization and activities of these inspectors are governed almost entirely by the requirements of building codes or government regulations. An overlap of compliance inspection and owner inspection often occurs when the owner engages the services of a special inspector, as required by some building codes, to oversee and confirm the performance of inspections required by the code. In most cases, the technical requirements of the building code are similar, if not identical, to the requirements given in project specifications and drawings.

1.6—Inspection team

Regardless of classification, an inspection team or group may consist of a number of individuals or, for very small projects, a single individual. Inspection may be performed by a variety of groups, such as:

- Owner's inspection personnel;
- A/E's inspection personnel;
- Laboratory's inspection force;
- Contractor's inspection force; and
- Material manufacturer's and supplier's inspection force.

All inspection force personnel should be qualified and, as applicable, certified to conduct inspections and tests for which they are assigned.

CHAPTER 2—RESPONSIBILITIES

2.1—Scope

This chapter defines the general responsibilities for inspection placed on the owner, A/E, inspection organization contractor, and manufacturer or fabricator in conforming to the recommendations of this guide.

2.2—Owner's responsibilities

2.2.1 The owner should provide for a program of inspection separate and distinct from quality-control inspection conducted by the contractor or by material producers. The A/E should provide the owner with recommendations for the scope and content of inspections and tests to be included in the owner's inspection plan. The owner should review the inspection plan with the A/E and, where appropriate, select the level of inspection required that is consistent with project size, quality, complexity, and the requirements of the local building code.

2.2.2 In conjunction with the A/E, the owner should be responsible for arranging a preconstruction conference that includes all parties involved in the construction project. The conference should include review of the inspection and testing plan(s), and confirm lines of communication, responsibilities, and minimum quality levels for the project. To be effective, the inspection personnel should have the active support of the owner.

2.2.3 The fee for owner inspection should be a separate and distinct item and should be paid by the owner, or by the A/E acting on behalf of the owner, directly to the inspection organization. The owner or A/E should avoid the undesirable practice of arranging payment through the contractor for inspection services intended for use by the owner as a basis of acceptance. Such a practice is not in the owner's interest and may result in a conflict of interests. Impartial service is difficult under such circumstances, and the fees for inspection are eventually paid by the owner in any case.

2.2.4 As a professional service, the selection of the inspection organization/laboratory should be based primarily on qualifications, not on price. It should be done as carefully as the selection of the A/E. The owner should check the physical facilities of the organization/laboratory, review the supervisory program and the qualifications of the supervisory staff, and review accreditations, the latest evaluation, or both, made by the evaluation authority and ensure that any necessary corrective measures have been taken. It should review the organization's ongoing training program of its personnel. The personnel should be certified and meet the qualifications of Section 3.5. The owner should also review the qualifications of all testing and inspection personnel to be assigned to the owner's project. The owner's approval should be required for all personnel before such assignment.

2.2.5 When the project specifications require extensive quality-control inspection by the contractor, the owner should not reduce or eliminate owner inspection. If the contractor's quality-control inspection program becomes the owner's inspection program, the system is nullified. The objections are exactly as stated previously against the practice of having the contractor hire and pay an inspector to perform inspection for the owner. When the owner requires the contractor to have a quality-control inspection program, the owner should still accept responsibility for inspection to provide assurance that the contractor's quality-control program achieves its objectives.

2.3—Architect/engineer's inspection responsibilities

2.3.1 For the protection of the public and the owner, the responsibility for planning and detailing owner inspection should be vested in the A/E as a continuing function of the design responsibility. The A/E should ensure that the program for owner inspection meets all requirements of design specifications and the local building code. The inspection responsibility may be discharged directly, may be