Guide for Conducting a Visual Inspection of Concrete in Service

Reported by ACI Committee 201
Guide for Conducting a Visual Inspection of Concrete in Service

Copyright by the American Concrete Institute, Farmington Hills, MI. All rights reserved. This material may not be reproduced or copied, in whole or part, in any printed, mechanical, electronic, film, or other distribution and storage media, without the written consent of ACI.

The technical committees responsible for ACI committee reports and standards strive to avoid ambiguities, omissions, and errors in these documents. In spite of these efforts, the users of ACI documents occasionally find information or requirements that may be subject to more than one interpretation or may be incomplete or incorrect. Users who have suggestions for the improvement of ACI documents are requested to contact ACI. Proper use of this document includes periodically checking for errata at www.concrete.org/committees/errata.asp for the most up-to-date revisions.

ACI committee documents are intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. Individuals who use this publication in any way assume all risk and accept total responsibility for the application and use of this information.

All information in this publication is provided “as is” without warranty of any kind, either express or implied, including but not limited to, the implied warranties of merchantability, fitness for a particular purpose or non-infringement.

ACI and its members disclaim liability for damages of any kind, including any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits, which may result from the use of this publication.

It is the responsibility of the user of this document to establish health and safety practices appropriate to the specific circumstances involved with its use. ACI does not make any representations with regard to health and safety issues and the use of this document. The user must determine the applicability of all regulatory limitations before applying the document and must comply with all applicable laws and regulations, including but not limited to, United States Occupational Safety and Health Administration (OSHA) health and safety standards.

Order information: ACI documents are available in print, by download, on CD-ROM, through electronic subscription, or reprint and may be obtained by contacting ACI.

Most ACI standards and committee reports are gathered together in the annually revised ACI Manual of Concrete Practice (MCP).

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331
U.S.A.
Phone: 248-848-3700
Fax: 248-848-3701

www.concrete.org

Guide for Conducting a Visual Inspection of Concrete in Service
Reported by ACI Committee 201

This guide provides terminology to perform and report on the visual condition of concrete in service. It includes a checklist of the many details that may be considered in making a report and descriptions for various concrete conditions associated with the durability of concrete.

Keywords: chemical attack; concrete durability; corrosion; cracking; deterioration; discoloration; environments; joints; oxidation; popouts; scaling; serviceability; spalling; staining; surface defects; surface imperfections.

ACI Committee Reports, Guides, Manuals, Standard Practices, and Commentaries are intended for guidance in planning, designing, executing, and inspecting construction. This document is intended for the use of individuals who are competent to evaluate the significance and limitations of its content and recommendations and who will accept responsibility for the application of the material it contains. The American Concrete Institute disclaims any and all responsibility for the stated principles. The Institute shall not be liable for any loss or damage arising therefrom.

Reference to this document shall not be made in contract documents. If items found in this document are desired by the Architect/Engineer to be a part of the contract documents, they shall be restated in mandatory language for incorporation by the Architect/Engineer.
CHAPTER 1—INTRODUCTION

1.1—Scope

This is a guide for a visual inspection of concrete in service. A visual inspection is an examination of concrete to identify and define many of the various conditions concrete may exhibit during its service life. The visual inspection is typically limited to the surfaces of the concrete structure that are visually accessible.

1.2—Introduction

By completing a visual inspection of the concrete immediately after construction, and through repetition at intervals during the concrete’s service life, the visual inspection provides important historical information on performance and durability. The inspection results also aid in early detection of distress and deterioration, enabling repair or rehabilitation before replacement is necessary.

It is important that the inspector properly document any observations related to environmental and loading conditions. Inspections are often supplemented with nondestructive tests, destructive tests, and other investigations, especially when distress and deterioration is observed and information regarding the internal condition of the concrete is needed.

While a visual inspection is most often used in connection with the condition survey of concrete that is showing defects or some degree of distress, its application is recommended for all concrete structures. It is important that the inspector properly document any observations related to environmental exposure (effects from physical loads, deformations, defects, imperfections, and distress), durability, and performance. Concrete material records and construction practices should be collected and reviewed.

The checklist includes items that might have a bearing on the durability and performance of the concrete. Individuals making the survey should not limit their investigation to the items listed, but should review any other contributing factors. Following the guide does not eliminate the need for intelligent observations and the use of sound judgment.

Individuals performing the inspection should be experienced and competent in concrete condition surveys. In addition to written descriptions, sketches of relevant features are valuable and encouraged. Photographs, including a scale to indicate dimensions, are of great value in showing the condition of concrete. Video coverage should be considered for documentation as it provides an enhanced visual dimension that may exceed that of still photography.

The descriptions and photographs provided in Chapter 2 illustrate typical observations encountered during inspections and aid in the preparation of a condition survey report by identifying the characteristics of potential problems and describing their condition. The checklist in Chapter 3 is provided to assist the user to identify the characteristics of potential condition survey findings and their description.

1.3—References

This guide should be used in conjunction with ACI Concrete Terminology and the following American Concrete Institute documents.

201.2R Guide to Durable Concrete
207.3R Practices for Evaluation of Concrete in Existing Massive Structures for Service Conditions
224.1R Causes, Evaluation, and Repair of Cracks in Concrete Structures
228.1R In-Place Methods to Estimate Concrete Strength
228.2R Nondestructive Test Methods for Evaluation of Concrete in Structures
311.1R ACI Manual of Concrete Inspection (SP-2)
349.3R Evaluation of Existing Nuclear Safety-Related Concrete Structures
350.1 Tightness Testing of Environmental Engineering Concrete Structures
364.1R Guide for Evaluation of Concrete Structures Before Rehabilitation
437R Strength Evaluation of Existing Concrete Buildings

This guide should also be used in conjunction with the following documents for condition assessment of structures:


CHAPTER 2—DESCRIPTIONS OF DISTRESS

Imperfections and distresses have been categorized and illustrated by photographs, and their severity and extent of occurrence have been quantified where possible. The purpose of the photographs is to standardize the reporting of the condition of the concrete in a structure. Those performing the survey should be thoroughly familiar with the terminology of various types of imperfections and distresses. Figures are provided to illustrate the various types of defects and distresses, along with the cause of deterioration when known.
2.1—Cracking

Crack—a complete or incomplete separation, of either concrete or masonry, into two or more parts produced by breaking or fracturing.

Cracking of concrete should be reported based on crack widths and the type of crack.

2.1.1 Crack widths—Examples of cracks of varying widths are shown in Fig. 2.1.1(a) and (b).

2.1.2 Crack patterns

2.1.2.1 Checking—development of shallow cracks at closely spaced but irregular intervals on the surface of plaster, cement paste, mortar, or concrete. (See also cracks and crazing.)

2.1.2.2 Craze cracks—fine random cracks or fissures in a surface of plaster, cement paste, mortar, or concrete (Fig. 2.1.2.2(a) and (b)).

2.1.2.2.1 Crazing—the development of craze cracks; the pattern of craze cracks existing in a surface. (See also checking and cracks.)

2.1.2.3 D-cracks—a series of cracks in concrete near and roughly parallel to joints and edges (Fig. 2.1.2.3(a) and (b)).

2.1.2.4 Diagonal crack—in a flexural member, an inclined crack, caused by shear stress, usually at approximately 45 degrees to the axis; or a crack in a slab, not parallel to either the lateral or longitudinal directions (Fig. 2.1.2.4(a) and (b)).

2.1.2.5 Hairline cracks—cracks in an exposed-to-view concrete surface having widths so small as to be barely perceptible.

2.1.2.6 Longitudinal cracks—a crack that develops parallel to the length of the member.

2.1.2.7 Map cracking—1) intersecting cracks that extend below the surface of hardened concrete; caused by shrinkage of the drying surface concrete that is restrained by concrete at greater depths where either little or no shrinkage occurs; vary in width from fine and barely visible to open and well-defined; or 2) the chief symptom of a chemical reaction between alkalis in cement and mineral constituents in aggregate within hardened concrete; due to differential
rate of volume change in different members of the concrete; cracking is usually random and on a fairly large scale and, in severe instances, the cracks may reach a width of 12.7 mm (0.50 in.) (Fig. 2.1.2.7(a) and (b)). (See also checking and crazing; also known as pattern cracking.)

2.1.2.8 Pattern cracking—cracking on concrete surfaces in the form of a repeated sequence; resulting from a decrease in volume of the material near the surface, or an increase in volume of the material below the surface, or both. (See map cracking.)

2.1.2.9 Plastic shrinkage cracking—cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic (Fig. 2.1.2.9(a) and (b)).

2.1.2.10 Random cracks—uncontrolled cracks that develop at various directions away from the control joints.

2.1.2.11 Shrinkage cracking—cracking of a structure or member due to failure in tension caused by external or internal restraints as reduction in moisture content develops, carbonation occurs, or both (Fig. 2.1.2.11).

2.1.2.12 Temperature cracking—cracking due to tensile failure, caused by temperature drop in members subjected to external restraints or by a temperature differential in members subjected to internal restraints (Fig. 2.1.2.12).
2.1.2.13 Transverse cracks—cracks that occur across the longer dimension of the member.

2.2—Distress
Concrete distress should be reported based on visual observations of the deterioration.

Deterioration—1) physical manifestation of failure of a material (for example, cracking, delamination, flaking, pitting, scaling, spalling, and staining) caused by environmental or internal autogenous influences on rock and hardened concrete as well as other materials; or 2) decomposition of material during either testing or exposure to service. (See also disintegration.)

2.2.1 Chalking—formation of a loose powder resulting from the disintegration of the surface of concrete or an applied coating, such as cementitious coating.

2.2.2 Curling—the distortion of concrete member from its original shape such as the warping of a slab due to differences in temperature or moisture content in the zones adjacent to its opposite faces (Fig. 2.2.2). (See also warping.)

2.2.3 Deflection—movement of a point on a structure or structural element, usually measured as a linear displacement or as succession displacements traverse to a reference line or axis.

2.2.4 Deformation—a change in dimension or shape (Fig. 2.2.4).
2.2.5 Delamination—a separation along a plane parallel to a surface, as in the case of a concrete slab, a horizontal splitting, cracking, or separation within a slab in a plane roughly parallel to, and generally near, the upper surface; found most frequently in bridge decks and caused by the corrosion of reinforcing steel or freezing and thawing; similar to spalling, scaling, or peeling except that delamination affects large areas and can often only be detected by nondestructive tests, such as tapping or chain dragging (Fig. 2.2.5).

2.2.6 Disintegration—reduction into small fragments and subsequently into particles (Fig. 2.2.6(a) through (f)). (See also deterioration.)
2.2.7 Distortion—see deformation.
2.2.8 Drummy area—area where there is a hollow sound beneath a layer of concrete due to a delamination, poor consolidation, or void. (See also delamination.)
2.2.9 Dusting—the development of a powdered material at the surface of hardened concrete (Fig. 2.2.9). (See also chalking.)
2.2.10 Efflorescence—a deposit of salts, usually white, formed on a surface, the substance having emerged in solution from within either concrete or masonry and subsequently been precipitated by a reaction, such as carbonation or evaporation (Fig. 2.2.10(a) and (b)).

2.2.11 Exfoliation—disintegration occurring by peeling off in successive layers; swelling up, and opening into leaves or plates like a partly opened book.
2.2.12 Exudation—a liquid or viscous gel-like material discharged through a pore, crack, or opening in the surface of concrete.
2.2.13 Joint deficiencies—expansion, contraction, and construction joints not functioning in intended service conditions.
2.2.13.1 Joint spall—a spall adjacent to a joint (Fig. 2.2.13.1).
2.2.13.2 Joint sealant failure—joints opened due to a cracked and/or debonded sealant (Fig. 2.2.13.2).
2.2.13.3 Joint leakage—liquid migrating through the joint.
2.2.13.4 Joint fault—differential displacement of a portion of a structure along a joint.
2.2.14 Leakage—contained material is migrating through the concrete member.
2.2.14.1 Leakage, liquid—liquid is migrating through the concrete (Fig. 2.2.14.1).
2.2.14.2 Leakage, gas—gas is migrating through the concrete.
2.2.15 Mortar flaking—a form of scaling over coarse aggregate (Fig. 2.2.15).

2.2.16 Peeling—a process in which thin flakes of mortar are broken away from a concrete surface, such as by deterioration or by adherence of surface mortar to forms as forms are removed (Fig. 2.2.16).

2.2.17 Pitting—development of relatively small cavities in a surface; in concrete, localized disintegration, such as a popout; localized corrosion evident as minute cavities on the surface (Fig. 2.2.17).

2.2.18 Popout—the breaking away of small portions of a concrete surface due to localized internal pressure that leaves a shallow, typical conical, depression with a broken coarse aggregate at the bottom.

2.2.18.1 Popouts, small—popouts leaving depressions up to 10 mm (0.4 in.) in diameter, or the equivalent (Fig. 2.2.18.1).

2.2.18.2 Popouts, medium—popouts leaving depressions between 10 and 50 mm (0.4 and 2 in.) in diameter (Fig. 2.2.18.2).

2.2.18.3 Popouts, large—popouts leaving depressions greater than 50 mm (2 in.) in diameter (Fig. 2.2.18.3).

2.2.19 Scaling—local flaking or peeling away of the near-surface portion of hardened concrete or mortar. (See also peeling and spalls.)
2.2.19.1 *Scaling, light*—loss of surface mortar without exposure of coarse aggregate.

2.2.19.2 *Scaling, medium*—loss of surface mortar 5 to 10 mm (0.2 to 0.4 in.) in depth and exposure of coarse aggregate (Fig. 2.2.19.2).

2.2.19.3 *Scaling, severe*—loss of surface mortar 5 to 10 mm (0.2 to 0.4 in.) in depth with some loss of mortar surrounding aggregate particles 10 to 20 mm (0.4 to 0.8 in.) in depth (Fig. 2.2.19.3).

2.2.19.4 *Scaling, very severe*—loss of coarse aggregate particles as well as surface mortar, generally to a depth greater than 20 mm (0.8 in.) (Fig. 2.2.19.4).

2.2.20 *Spall*—a fragment, usually in the shape of a flake, detached from a concrete member by a blow, by the action of weather, by pressure, by fire, or by expansion within the larger mass.
2.2.20.1 Small spall—a roughly circular depression not greater than 20 mm (0.8 in.) in depth and 150 mm (6 in.) in any dimension (Fig. 2.2.20.1).

2.2.20.2 Large spall—may be roughly circular or oval or, in some cases, elongated, and is more than 20 mm (0.8 in.) in depth and 150 mm (6 in.) in greatest dimension (Fig. 2.2.20.2(a) and (b)).

2.2.21 Warping—out-of-plane deformation of the corners, edges, and surface of a pavement, slab, or wall panel from its original shape. (See also curling.)

2.3—Textural features and phenomena relative to their development
Textural features and phenomena should be reported based on visual observations.

2.3.1 Air void—a space in cement paste, mortar, or concrete filled with air; an entrapped air void is characteristically 1 mm (0.04 in.) or greater in size and irregular in shape; entrained air void is typically between 10 µm and 1 mm (0.04 mil and 0.04 in.) in diameter and spherical or nearly so.

2.3.2 Blistering—the irregular raising of a thin layer at the surface of placed mortar or concrete during or soon after completion of the finishing operation; also, bulging of the finish plaster coat as it separates and draws away from the base coat (Fig. 2.3.2).

2.3.3 Bugholes—small regular or irregular cavities, usually not exceeding 15 mm (0.6 in.) in diameter, resulting from entrapment of air bubbles at the surface of formed concrete during placement and consolidation (Fig. 2.3.3). (Also known as surface air voids.)
2.3.4 Cold joint—a joint or discontinuity resulting from a delay in placement of sufficient duration to preclude intermingling and bonding of the material in two successive lifts of concrete, mortar, or the like.

2.3.5 Cold-joint lines—visible lines on the surfaces of formed concrete indicating the presence of a cold joint where one layer of concrete had hardened before subsequent concrete was placed (Fig. 2.3.5).

2.3.6 Discoloration—departure of color from that which is normal or desired (Fig. 2.3.6). (See also staining.)

2.3.7 Honeycomb—voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles (Fig. 2.3.7(a) and (b)).

2.3.8 Incrustation—a crust or coating, generally hard, formed on the surface of concrete or masonry construction or on aggregate particles.

2.3.9 Laitance—a layer of weak material known as residue derived from cementitious material and aggregate fines either: 1) carried by bleeding to the surface or to the internal cavities of freshly placed concrete; or 2) separated from the concrete and deposited on the concrete surface or internal cavities during placement of concrete underwater.

2.3.10 Sand pocket—a zone in concrete or mortar containing fine aggregate with little or no cement material.

2.3.11 Sand streak—a streak of exposed fine aggregate in the surface of formed concrete, caused by bleeding.
2.3.12 Segregation—the differential concentration of the components of mixed concrete, aggregate, or the like, resulting in nonuniform proportions in the mass.

2.3.13 Staining—discoloration by foreign matter (Fig. 2.3.13(a) through (c)).

2.3.14 Stalactite—a downward-pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping liquid from the surface of concrete, commonly shaped like an icicle (Fig. 2.3.14). (See also stalagmite.)

2.3.15 Stalagmite—an upward-pointing deposit formed as an accretion of mineral matter produced by evaporation of dripping liquid, projecting from the surface of rock or of concrete, commonly roughly conical in shape. (See also stalactite.)

2.3.16 Stratification—the separation of overwet or overvibrated concrete into horizontal layers with increasingly lighter material toward the top; water, laitance, mortar, and coarse aggregate tend to occupy successively lower positions in that order; a layered structure in concrete resulting from placing of successive batches that differ in appearance; occurrence in aggregate stockpiles of layers of differing grading or composition; a layered structure in a rock foundation.

CHAPTER 3—VISUAL INSPECTION REPORT AND CHECKLIST

Individuals conducting the visual inspection should select those items important to the specific concerns relating to the reasons for the inspection. Other items and factors not indicated in the checklist may be involved and should not be overlooked during the inspection. The Visual Inspection Form in the Appendix may be used to document results of the inspection.

A final report should be prepared to document the results of the completed inspection. The report should include the following as a minimum:

(a) Names of individuals conducting inspection;
(b) Purpose of the inspection;
(c) Listing of available existing documentation for the structure;
(d) Type, age, location, and general description of the structure;
(e) Inspection techniques employed (for example, direct visual inspection and chain drag);
GUIDE FOR CONDUCTING A VISUAL INSPECTION OF CONCRETE IN SERVICE

(f) Field observations and extent of structure inspected;
(g) Field tests employed and data collected, if applicable;
(h) Conclusions and recommendations; and
(i) Annotated photographs and sketches.

The first page of the report should include the name(s) of the personnel participating in the inspection, including person in responsible charge, names of any subcontractors used (if applicable), date of the work, and weather conditions during the survey. The conclusions should include recommendations for further testing and evaluation, if needed, to quantify any inspection observations, such as to assess the degree of internal degradation.

The visual inspection is often used as an introductory step in the evaluation of a structure for structural capacity, such as to justify continued or altered use, to analyze in-place strength or deformation, or to define the need for maintenance and rehabilitation. The related ACI reports listed in Chapter 1 should be reviewed to obtain additional guidance before mobilization, particularly if the survey is part of a more encompassing evaluation.

Checklist

1. Description of structure
   1.1 Name, location, type, and size
   1.2 Owner, project engineer, contractor, date(s) of construction
   1.3 Photographs
      1.3.1 General view
      1.3.2 Detailed close-up of condition of area
   1.4 Sketch map—orientation indicating the sunny and shady areas and the well and poorly drained regions

2. Nature of environmental and loading conditions
   2.1 Exposure
      2.1.1 Environment: arid, subtropical, marine, freshwater, industrial, etc.
   2.2 Drainage
      2.2.1 Flashing
      2.2.2 Joint sealants
      2.2.3 Weepholes
      2.2.4 Contour
      2.2.5 Elevation of drains
   2.3 Loading conditions
      2.3.1 Dead
      2.3.2 Live
      2.3.3 Impact
      2.3.4 Vibration
      2.3.5 Traffic
      2.3.6 Seismic
      2.3.7 Other
   2.4 Soils (foundation conditions)
      2.4.1 Expansive soil
      2.4.2 Compressible soil (settlement)
      2.4.3 Evidence of pumping

3. Distress indicators
   3.1 Cracking
   3.2 Staining
   3.3 Surface deposits and exudations
   3.4 Leaking

4. Present condition of structure
   4.1 Overall apparent alignment of structure
   4.2 Surface condition of concrete
      4.2.1 General conditions (good, satisfactory, poor)
      4.2.2 Formed and finished surfaces
        4.2.2.1 Smoothness
        4.2.2.2 Holes (surface air voids)
        4.2.2.3 Sand streaks
        4.2.2.4 Honeycomb
        4.2.2.5 Soft areas
        4.2.2.6 Cold joints
        4.2.2.7 Staining
      4.2.3 Cracking
        4.2.3.1 Location and frequency
        4.2.3.2 Crack map
        4.2.3.3 Width and pattern (see descriptions)
        4.2.3.4 Leaching, stalactites
        4.2.3.5 Working versus nonworking (dormant)
      4.2.4 Scaling
        4.2.4.1 Area, depth
        4.2.4.2 Type (see definitions)
      4.2.5 Spalls and popouts
        4.2.5.1 Number, size, and depth
        4.2.5.2 Type (see definitions)
      4.2.6 Stains, efflorescence
      4.2.7 Exposed reinforcement
      4.2.8 Curling and warping
      4.2.9 Erosion
      4.2.10 Previous patching or other repair
      4.2.11 Surface coatings/protective systems/linings/toppings
        4.2.11.1 Type and thickness
        4.2.11.2 Bond to concrete
        4.2.11.3 Condition
      4.2.12 Penetrating sealers
        4.2.12.1 Type
        4.2.12.2 Effectiveness
        4.2.12.3 Discoloration
### VISUAL INSPECTION FORM

<table>
<thead>
<tr>
<th>1. GENERAL</th>
<th>Report number</th>
<th>Purpose of inspection</th>
<th>Inspector’s name(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A. DESCRIPTION OF THE STRUCTURE</td>
<td>Name</td>
<td>Location</td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photographs</td>
<td>General view</td>
<td>Detailed close-up of condition of area</td>
<td></td>
</tr>
<tr>
<td>Sketch map orientation indicating sunny and shady areas and well and poorly drained regions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1B. MATERIALS USED (if known)</th>
<th>Concrete</th>
<th>Normalweight aggregate type</th>
<th>Aggregate size</th>
<th>Admixture type</th>
<th>Mixture proportion</th>
<th>Compressive strength</th>
<th>Modulus of elasticity</th>
</tr>
</thead>
</table>

| 2. NATURE OF ENVIRONMENTAL AND LOADING CONDITIONS | Exposure | Environment (arid, subtropical, marine, freshwater, industrial, etc.) | Weather (July and Jan. mean temperatures, mean annual rainfall, and months in which 60% of rainfall occurs) | Freezing and thawing | Wetting and drying | Drying under dry atmosphere | Chemical corrosion and attack (sulfates, acids, bases, chloride, gases) |Abrasion, erosion, cavitation, impact | Electric conductivity | Deicing chemicals that contain chloride ions | Heat from adjacent sources |
|--------------------------------|---------|-----------------------------|----------------|----------------|-------------------|---------------------|----------------------|
| Drainage | Flashing | Joint sealants | Weepholes | Contour | Elevation of drains |

<table>
<thead>
<tr>
<th>3. DISTRESS INDICATORS</th>
<th>Cracking</th>
<th>Staining</th>
<th>Surface deposits and exudations</th>
<th>Leaking</th>
</tr>
</thead>
</table>
## VISUAL INSPECTION FORM

<table>
<thead>
<tr>
<th>Overall apparent alignment of structure</th>
<th>Settlement</th>
<th>Deflection</th>
<th>Expansion</th>
<th>Contraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>General condition: good, satisfactory, poor</td>
<td>Smoothness</td>
<td>Bugholes (surface air voids)</td>
<td>Sand streaks</td>
<td>Honeycomb</td>
</tr>
<tr>
<td>Formed and finished surfaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface condition of concrete</td>
<td>Smoothness</td>
<td>Bugholes (surface air voids)</td>
<td>Sand streaks</td>
<td>Honeycomb</td>
</tr>
<tr>
<td>Cracking</td>
<td>Location and frequency</td>
<td>Crack map</td>
<td>Leaching, stalactites</td>
<td>Working versus nonworking (dormant)</td>
</tr>
<tr>
<td>Scaling</td>
<td>Area, depth</td>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spalls and popouts</td>
<td>No., size, and depth</td>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stains, efflorescence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed reinforcement: corrosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curling and warping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td>Abrasion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cavitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous patching or other repair</td>
<td>Type and thickness</td>
<td>Bond to concrete</td>
<td>Condition</td>
<td></td>
</tr>
<tr>
<td>Surface coatings, protective systems, linings, toppings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetrating sealers</td>
<td>Type</td>
<td>Effectiveness</td>
<td>Discoloration</td>
<td></td>
</tr>
</tbody>
</table>
As ACI begins its second century of advancing concrete knowledge, its original chartered purpose remains “to provide a comradeship in finding the best ways to do concrete work of all kinds and in spreading knowledge.” In keeping with this purpose, ACI supports the following activities:

- Technical committees that produce consensus reports, guides, specifications, and codes.
- Spring and fall conventions to facilitate the work of its committees.
- Educational seminars that disseminate reliable information on concrete.
- Certification programs for personnel employed within the concrete industry.
- Student programs such as scholarships, internships, and competitions.
- Sponsoring and co-sponsoring international conferences and symposia.
- Formal coordination with several international concrete related societies.
- Periodicals: the *ACI Structural Journal* and the *ACI Materials Journal*, and *Concrete International*.

Benefits of membership include a subscription to *Concrete International* and to an ACI Journal. ACI members receive discounts of up to 40% on all ACI products and services, including documents, seminars and convention registration fees.

As a member of ACI, you join thousands of practitioners and professionals worldwide who share a commitment to maintain the highest industry standards for concrete technology, construction, and practices. In addition, ACI chapters provide opportunities for interaction of professionals and practitioners at a local level.

**American Concrete Institute**  
38800 Country Club Drive  
Farmington Hills, MI 48331  
U.S.A.  
Phone: 248-848-3700  
Fax: 248-848-3701  
[www.concrete.org](http://www.concrete.org)
The AMERICAN CONCRETE INSTITUTE

was founded in 1904 as a nonprofit membership organization dedicated to public service and representing the user interest in the field of concrete. ACI gathers and distributes information on the improvement of design, construction and maintenance of concrete products and structures. The work of ACI is conducted by individual ACI members and through volunteer committees composed of both members and non-members.

The committees, as well as ACI as a whole, operate under a consensus format, which assures all participants the right to have their views considered. Committee activities include the development of building codes and specifications; analysis of research and development results; presentation of construction and repair techniques; and education.

Individuals interested in the activities of ACI are encouraged to become a member. There are no educational or employment requirements. ACI’s membership is composed of engineers, architects, scientists, contractors, educators, and representatives from a variety of companies and organizations.

Members are encouraged to participate in committee activities that relate to their specific areas of interest. For more information, contact ACI.

www.concrete.org