ACI 201.1R-08

Guide for Conducting a Visual Inspection of Concrete in Service

Reported by ACI Committee 201

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Guide for Conducting a Visual Inspection of Concrete in Service

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Guide for Conducting a Visual Inspection of Concrete in Service

Reported by ACI Committee 201

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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.

CONTENTS

ACI 201.1R-08 supersedes ACI 201.1R-92 (Reapproved 1997) and was adopted and published July 2008.

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:

1. American Society for Civil Engineers, "Guideline for Structural Condition Assessment of Existing Buildings," SEI/ASCE 11-99, ASCE, Reston, VA, 2000, 160 pp.

2. American Society for Civil Engineers, "Guideline for Condition Assessment of the Building Envelope," SEI/ASCE 30-00, ASCE, Reston, VA, 2000, 64 pp.

3. Mufti, A., "Guideline for Structural Health Monitoring," *Design Manual* No. 2, ISIS Canada, Winnipeg, MB, 2001.

4. AASHTO, "Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges," AASHTO, Washington, DC, 1989.

5. "Diagnosis of Deterioration in Concrete Structures," *Technical Report* No. 54, The Concrete Society, Blackwater, Camberley, UK, 2000.

6. "Corrosion of Steel in Concrete: Investigation and Assessment" *BRE Digest* 444, Part 2, in *Concrete Repair Manual*, American Concrete Institute, Farmington Hills, MI, 2003, 2093 pp.

7. AASHTO, *Manual for Condition Evaluation of Bridges*, second edition, AASHTO, Washington, DC, 2003.

8. "Distress Identification Manual for the Long-Term Pavement Performance Project," *Strategic Highway Research Program* SHRP-P-338, Federal Highway Administration, Washington, DC, 1993.

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.

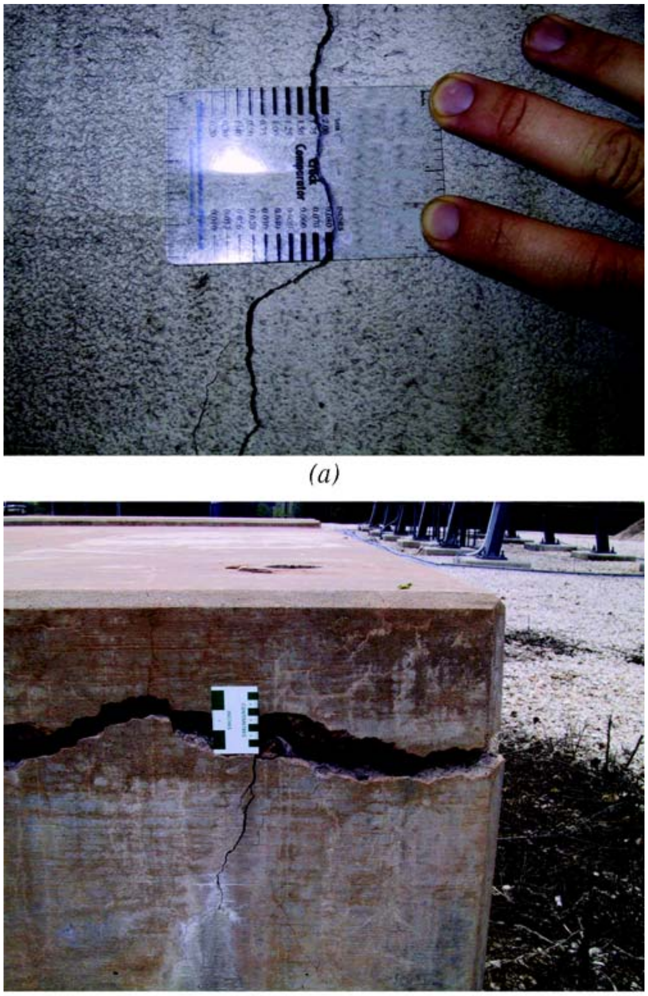


Fig. 2.1.1—Cracks of varying widths.

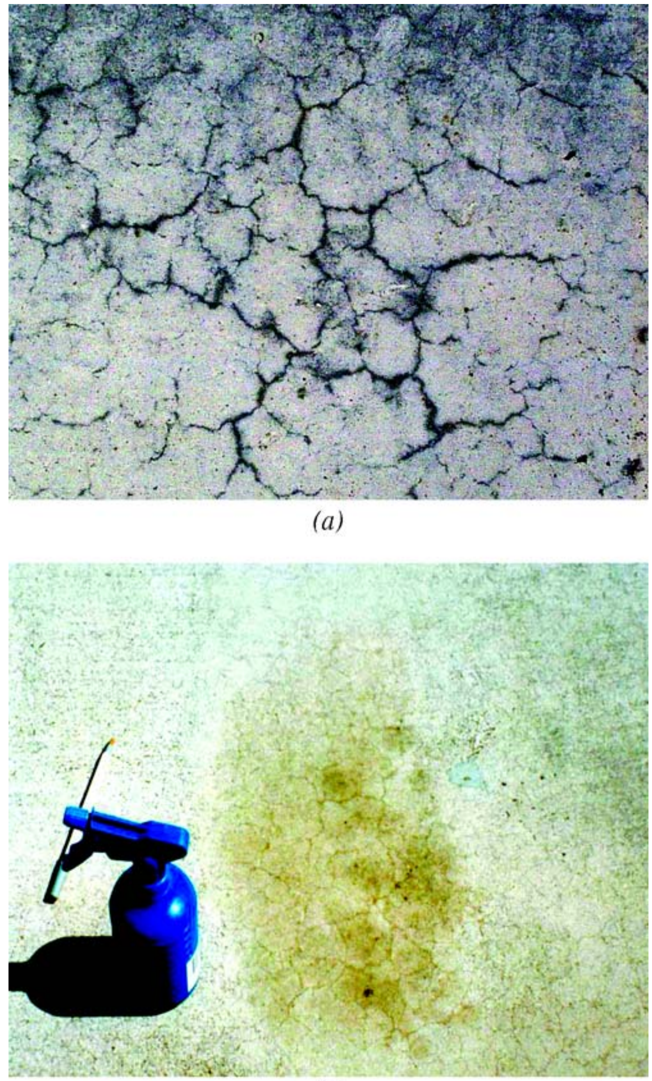


Fig. 2.1.2.2(a) Craze cracking; and (b) craze cracking highlighted with the aid of denatured alcohol.

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*.)

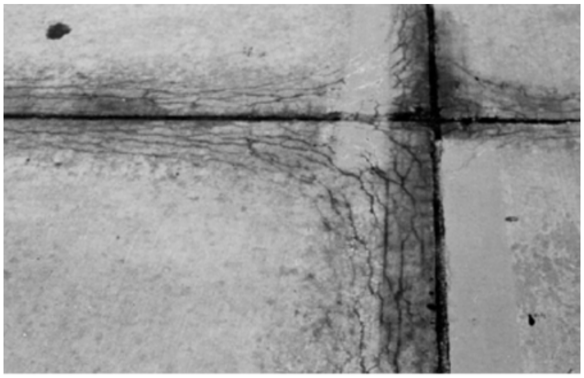
2.1.2.3 *D-cracks*—a series of cracks in concrete near and roughly parallel to joints and edges (Fig. 2.1.2.3(a) and (b)).

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.

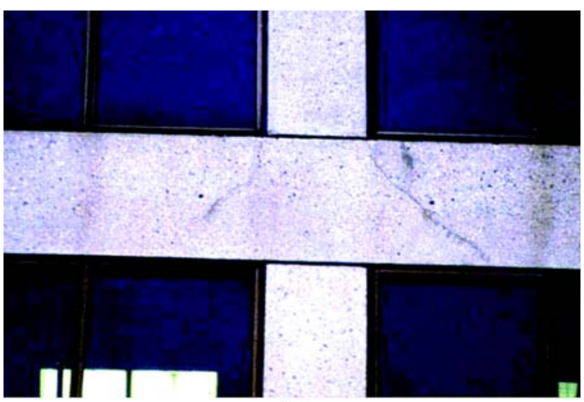
2.1.2.7 *Map cracking*—1) intersecting cracks that extend below the surface of hardened concrete; caused by shrinkage of the drying surface concrete that is restrained by concrete at greater depths where either little or no shrinkage occurs; vary in width from fine and barely visible to open and well-defined; or 2) the chief symptom of a chemical reaction between alkalis in cement and mineral constituents in aggregate within hardened concrete; due to differential



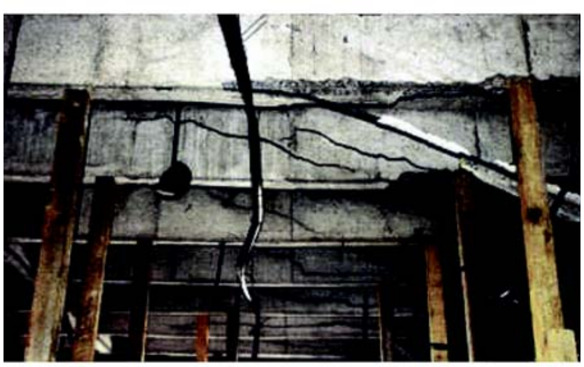
(a)

(b)

Fig. 2.1.2.3—D-cracks: (a) fine; and (b) severe, with spalling present.



(a)



(b)

Fig. 2.1.2.4—Diagonal cracking.

(a)

(b)

Fig. 2.1.2.7—Map (pattern) cracking.

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).

(a)

(b)

Fig. 2.1.2.9—(a) Plastic shrinkage cracking; and (b) plastic shrinkage cracking, close-up.

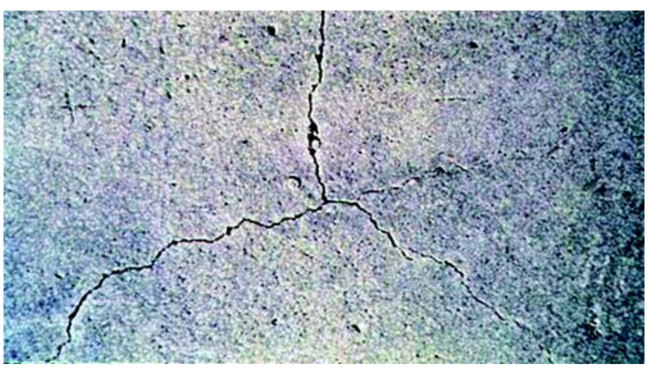


Fig. 2.1.2.11—Shrinkage cracking.

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

Fig. 2.1.2.12—Temperature cracking.

Fig. 2.2.2—Diagonal cracking due to curling of floor slab.

Fig. 2.2.4—Deformation and spalling due to corrosion of reinforcement.

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).

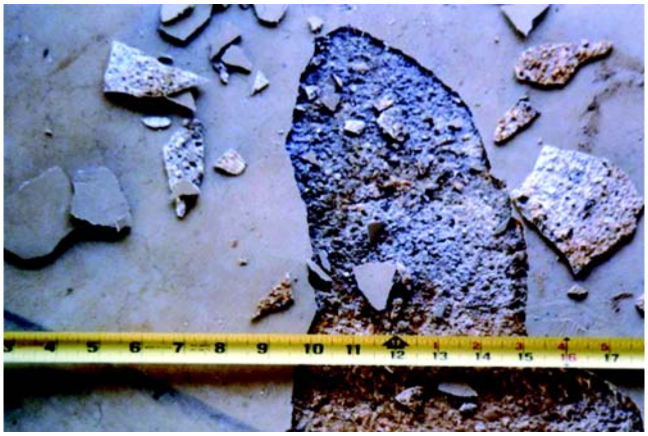


Fig. 2.2.5—Delamination.

Fig. 2.2.6(a)—Disintegration.

Fig. 2.2.6(b)—Disintegration from chemical attack.

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).

Fig. 2.2.6(c)—Disintegration from chemical attack.

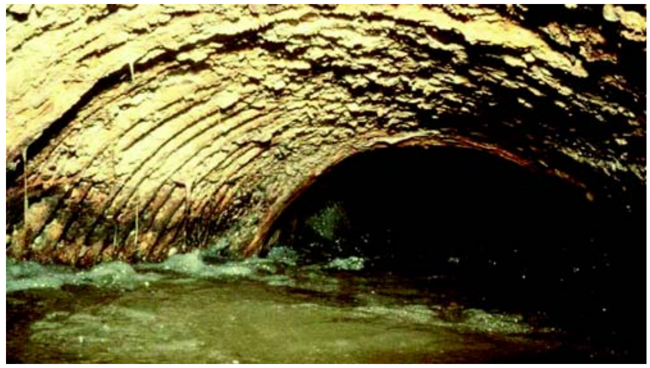


Fig. 2.2.6(d)—Disintegration of sewer pipe from biological chemical attack.

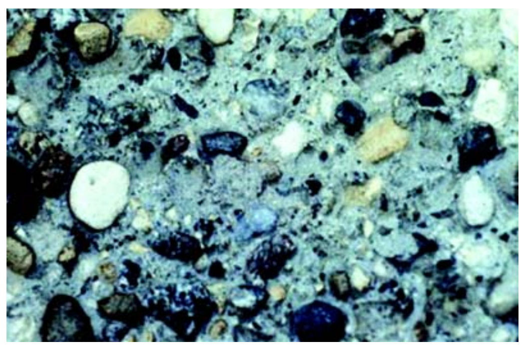


Fig. 2.2.6(e)—Disintegration due to erosion and abrasion.

Fig. 2.2.6(f)—Disintegration due to erosion and cavitation damage.

2.2.6 *Disintegration*—reduction into small fragments and subsequently into particles (Fig. 2.2.6(a) through (f)). (See also *deterioration*.)

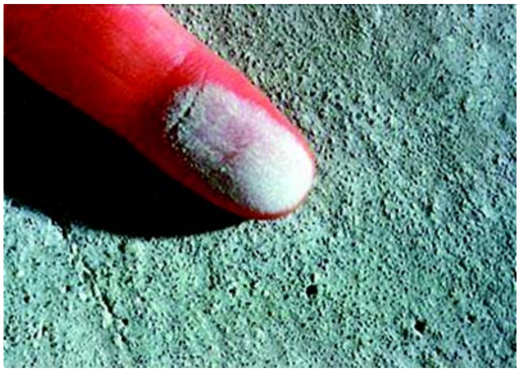
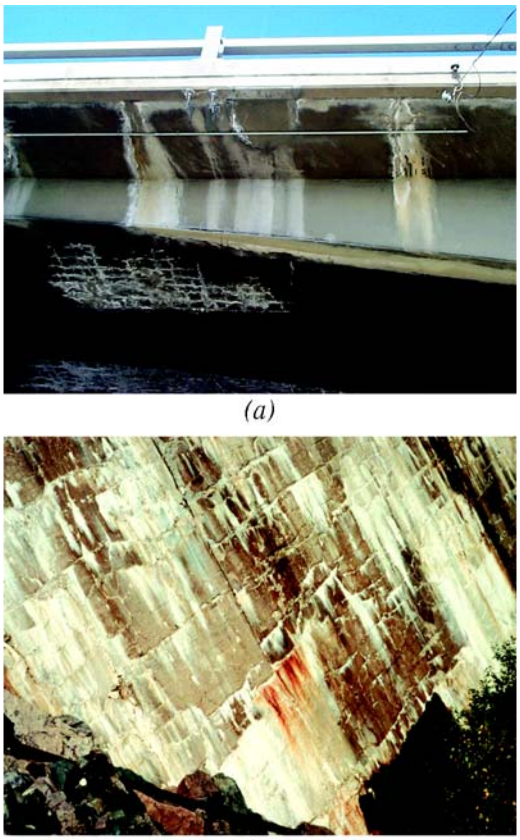


Fig. 2.2.9—Dusting.



(a)

(b)

Fig. 2.2.10—(a) Efflorescence staining; and (b) cracking and efflorescence.

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)).

Fig. 2.2.13.1—Joint spall.

Fig. 2.2.13.2—Joint sealant failure.

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.

Fig. 2.2.14.1—Leakage, liquid.

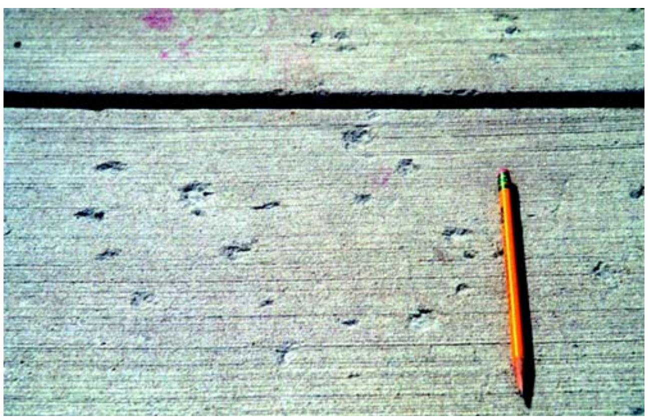


Fig. 2.2.15—Mortar flaking.

Fig. 2.2.16—Peeling.

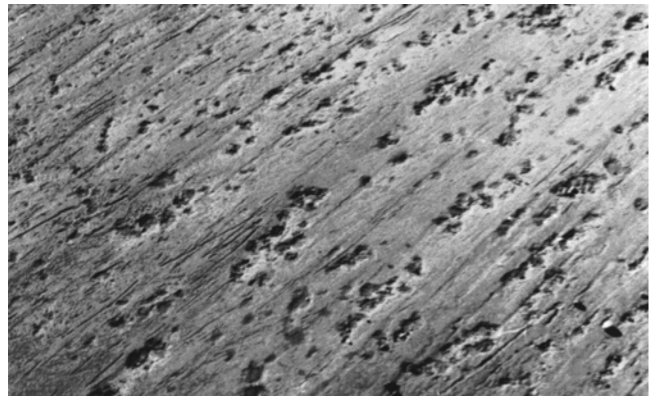


Fig. 2.2.17—Pitting.

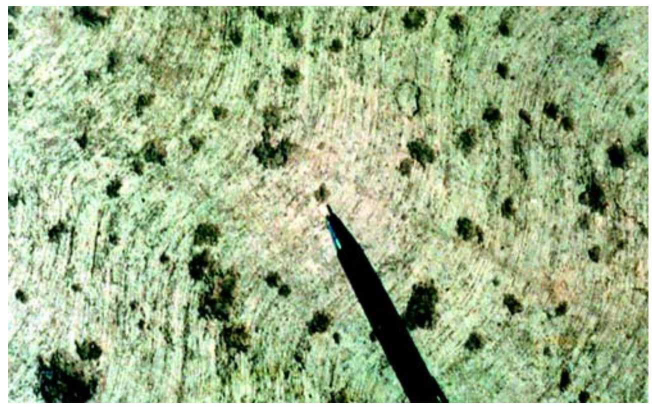


Fig. 2.2.18.1—Small popout.

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*.)

Fig. 2.2.18.2—Medium popout.

Fig. 2.2.18.3—Large popout.

Fig. 2.2.19.2—Medium scaling.

Fig. 2.2.19.3—Severe scaling.

Fig. 2.2.19.4—Very severe scaling.

2.2.19.1 *Scaling, light*—loss of surface mortar without exposure of coarse aggregate.

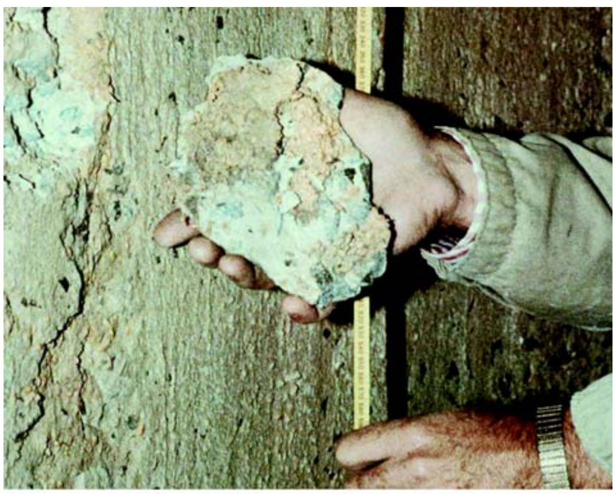
2.2.19.2 *Scaling, medium*—loss of surface mortar 5 to 10 mm (0.2 to 0.4 in.) in depth and exposure of coarse aggregate (Fig. 2.2.19.2).

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.

Fig. 2.2.20.1—Small spall due to tie rod rusting.



(a)

(b)

Fig. 2.2.20.2—(a) Large spall; and (b) spalling of concrete and rusting of reinforcement.

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).

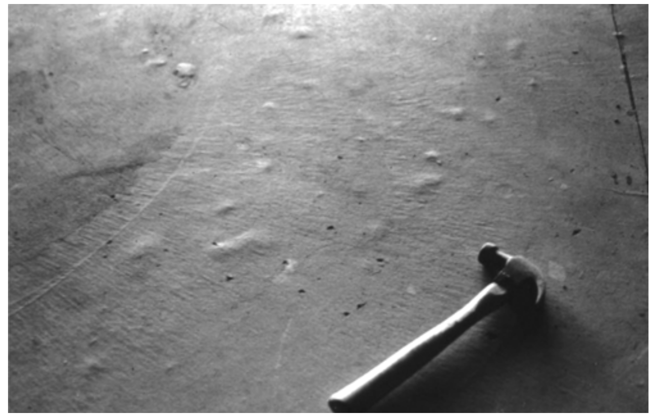


Fig. 2.3.2—Blistering.

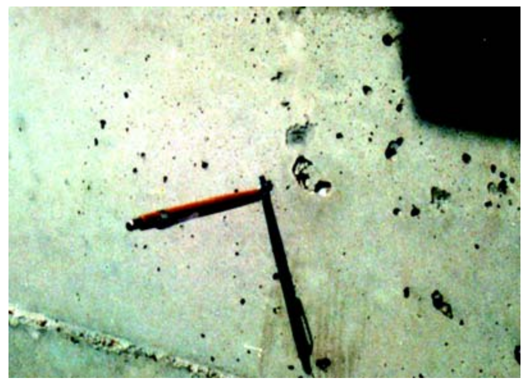


Fig. 2.3.3—Bugholes.

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.

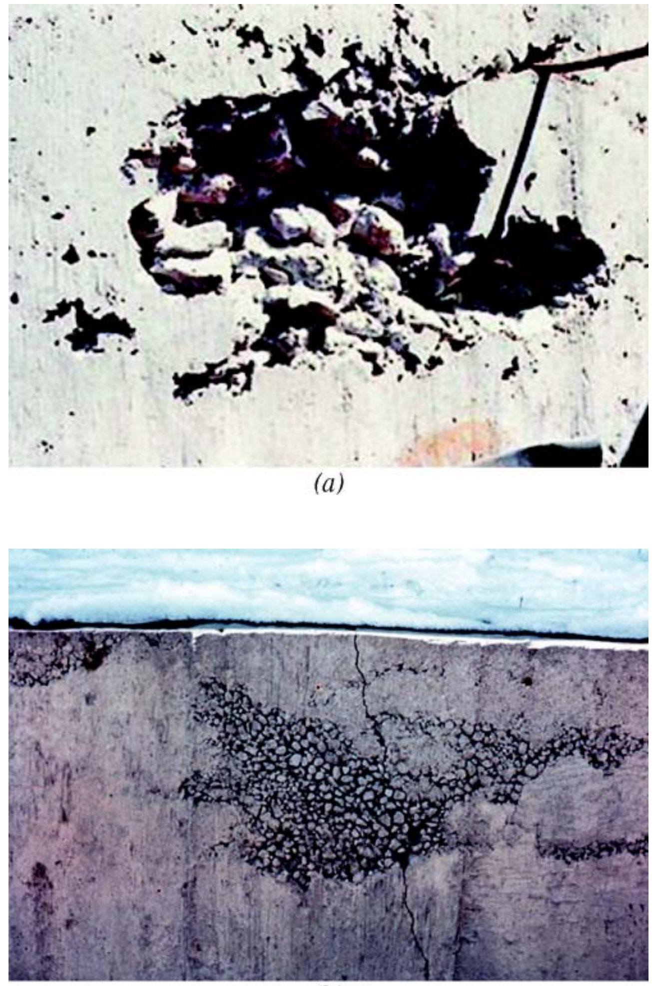
2.3.1 *Air void*—a space in cement paste, mortar, or concrete filled with air; an entrapped air void is characteristically 1 mm (0.04 in.) or greater in size and irregular in shape; entrained air void is typically between 10 μm and 1 mm (0.04 mil and 0.04 in.) in diameter and spherical or nearly so.

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.)

Fig. 2.3.5—Cold-joint line.

Fig. 2.3.6—Discoloration.



(a)

(b)

Fig. 2.3.7—Honeycombing.

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.

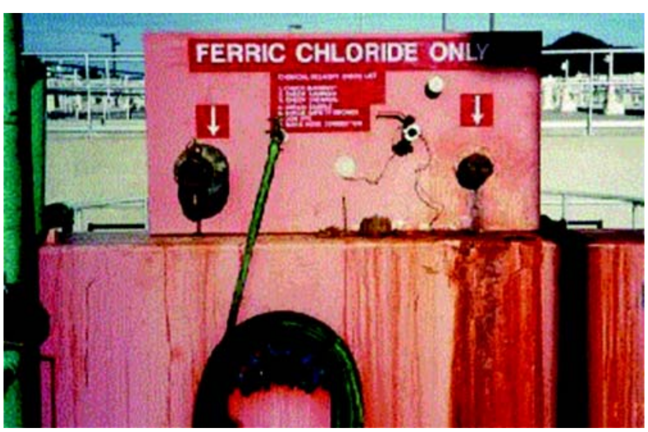
2.3.9 *Laitance*—a layer of weak material known as residue derived from cementitious material and aggregate fines either: 1) carried by bleeding to the surface or to the internal cavities of freshly placed concrete; or 2) separated from the concrete and deposited on the concrete surface or internal cavities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

(a)

(b)



(c)

Fig. 2.3.13—(a) Staining from rust; (b) staining from potassium permanganate; and (c) staining from ferric chloride.

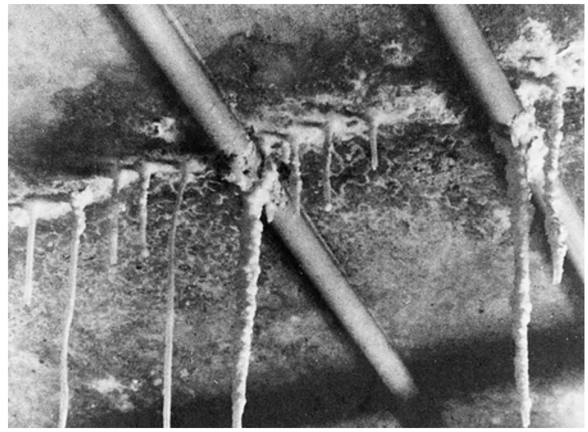


Fig. 2.3.14—Stalactite.

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);

(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.
      2.1.2 Weather (July and January mean temperatures, mean annual rainfall, and months in which 60% of rainfall occurs)
      2.1.3 Freezing and thawing
      2.1.4 Wetting and drying
      2.1.5 Drying under dry atmosphere
      2.1.6 Chemical corrosion and attack: sulfates, acids, bases, chloride, gases
      2.1.7 Abrasion, erosion, cavitation, impact
      2.1.8 Electric conductivity
      2.1.9 Deicing chemicals that contain chloride ions
      2.1.10 Heat from adjacent sources
   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
      4.1.1 Settlement
      4.1.2 Deflection
      4.1.3 Expansion
      4.1.4 Contraction
   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 Bugholes (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
         4.2.7.1 Corrosion
      4.2.8 Curling and warping
      4.2.9 Erosion
         4.2.9.1 Abrasion
         4.2.9.2 Cavitation
      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

APPENDIX

VISUAL INSPECTION FORM

1. GENERAL	Report number		
	Purpose of inspection		
	Inspector's name(s)		
1A. DESCRIPTION OF THE STRUCTURE	Name		
	Location		
	Type		
	Size		
	Owner		
	Project engineer		
	Contractor		
	Date(s) of construction		
	Photographs	General view	
		Detailed close-up of condition of area	
	Sketch map orientation indicating sunny and shady areas and well and poorly drained regions		
1B. MATERIALS USED (if known)	Concrete	Normalweight aggregate type	
		Aggregate size	
		Admixture type	
		Mixture proportion	
		Compressive strength	
		Modulus of elasticity	
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	
	Loading conditions	Dead	
		Live	
		Impact	
		Vibration	
		Traffic	
		Seismic	
		Other	
	Soils (foundation conditions)	Expansive soil	
		Compressible soil (settlement)	
		Evidence of pumping	
3. DISTRESS INDICATORS	Cracking		
	Staining		
	Surface deposits and exudations		
	Leaking		

VISUAL INSPECTION FORM

4. PRESENT CONDITION OF STRUCTURE	Overall apparent alignment of structure	Settlement		
		Deflection		
		Expansion		
		Contraction		
	Surface condition of concrete	General condition: good, satisfactory, poor		
		Formed and finished surfaces	Smoothness	
			Bugholes (surface air voids)	
			Sand streaks	
			Honeycomb	
			Soft areas	
			Cold joints	
			Staining	
		Cracking	Location and frequency	
			Crack map	
			Width and pattern	
			Leaching, stalactites	
			Working versus nonworking (dormant)	
		Scaling	Area, depth	
			Type	
		Spalls and popouts	No., size, and depth	
			Type	
		Stains, efflorescence		
		Exposed reinforcement: corrosion		
		Curling and warping		
		Erosion	Abrasion	
			Cavitation	
		Previous patching or other repair		
		Surface coatings, protective systems, linings, toppings	Type and thickness	
			Bond to concrete	
			Condition	
		Penetrating sealers	Type	
			Effectiveness	
			Discoloration	

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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.
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Guide for Conducting a Visual Inspection of Concrete in Service

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