

AT LAST!
SPECIFICATIONS FOR CONCRETE REPAIR

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A TYPICAL PROFESSIONAL DESKTOP

TYPICAL NEW CONCRETE SPECIFICATION

QUALITY ASSURANCE PROVISIONS IN MASTERSPEC:

- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. Preinstallation Conference: Conduct conference at Project site.

This is a Reference Specification that the Architect/Engineer can apply to any construction project involving structural concrete by citing it in the Project Specifications. Checklists are provided to assist the Architect/Engineer in supplementing the provisions of this Reference Specification as needed by designating or specifying individual project requirements.

The first five sections of this document cover general construction requirements for cast-in-place structural concrete and slabs-on-ground. These sections cover materials and proportioning of concrete; reinforcement and prestressing steel; production, placing, finishing, and curing of concrete; formwork performance criteria and construction; treatment of joints; embedded items; repair of surface defects; and finishing of formed and unformed surfaces. Provisions governing testing, evaluation, and acceptance of concrete as well as acceptance of the structures are included. The remaining sections are devoted to architectural concrete, lightweight concrete, mass concrete, post-tensioned concrete, shrinkage-compensating concrete, industrial floor slabs, tilt-up construction, precast structural concrete, and precast architectural concrete.

Keywords: architectural; cold weather; compressive strength; durability; concrete slab; consolidation; curing; finish; formwork; grouting; hot weather; industrial floors; inspection; joints; lightweight concrete; mass concrete; mixture proportions; placing; precast; post-tensioned; prestressing steel; repair; reshoring; shoring; shrinkage-compensating; slabs-on-ground; steel reinforcement; testing; tilt-up; tolerance; welded wire.

CONTENTS

(mandatory portion follows)

Section 1—General requirements, p. 5

- 1.1—Scope
 - 1.1.1—Work specified
 - 1.1.2—Work not specified
 - 1.1.3—Units
- 1.2—Definitions
- 1.3—Referenced standards and cited publications
 - 1.3.1—Referenced standards
 - 1.3.2—Cited publications
 - 1.3.3—Field references
- 1.4—Standards-producing organizations
- 1.5—Submittals
 - 1.5.1—General
 - 1.5.2—Contractor's quality control
- 1.6—Quality assurance and quality control
 - 1.6.1—General
 - 1.6.2—Responsibilities of Contractor
 - 1.6.3—Responsibilities of Owner's testing agency
 - 1.6.4—Tests on hardened concrete in place
 - 1.6.5—Evaluation of concrete strength tests
 - 1.6.6—Acceptance of concrete strength
 - 1.6.7—Field acceptance of concrete
- 1.7—Acceptance of structure
 - 1.7.1—General
 - 1.7.2—Dimensional tolerances
 - 1.7.3—Appearance
 - 1.7.4—Strength of structure
 - 1.7.5—Durability
- 1.8—Protection of in-place concrete
 - 1.8.1—Loading and support of concrete
 - 1.8.2—Protection from mechanical injury

Section 2—Formwork and formwork accessories, p. 13

- 2.1—General

- 2.1.1—Description
- 2.1.2—Submittals
- 2.2—Products
 - 2.2.1—Materials
 - 2.2.2—Performance and design requirements
 - 2.2.3—Fabrication and manufacture
- 2.3—Execution
 - 2.3.1—Construction and erection of formwork
 - 2.3.2—Removal of formwork
 - 2.3.3—Reshoring and backshoring
 - 2.3.4—Strength of concrete required for removal of formwork
 - 2.3.5—Field quality control

Section 3—Reinforcement and reinforcement supports, p. 16

- 3.1—General
 - 3.1.1—Submittals
 - 3.1.2—Material storage and handling
- 3.2—Products
 - 3.2.1—Materials
 - 3.2.2—Fabrication
- 3.3—Execution
 - 3.3.1—Preparation
 - 3.3.2—Placing

Section 4—Concrete mixtures, p. 20

- 4.1—General
 - 4.1.1—Description
 - 4.1.2—Submittals
 - 4.1.3—Quality control
 - 4.1.4—Material storage and handling
- 4.2—Products
 - 4.2.1—Materials
 - 4.2.2—Performance and design requirements
 - 4.2.3—Proportioning
- 4.3—Execution
 - 4.3.1—Measuring, batching, and mixing
 - 4.3.2—Delivery

Section 5—Handling, placing, and constructing, p. 25

- 5.1—General
 - 5.1.1—Description
 - 5.1.2—Submittals
 - 5.1.3—Delivery, storage, and handling
- 5.2—Products
 - 5.2.1—Materials
 - 5.2.2—Performance and design requirements
- 5.3—Execution
 - 5.3.1—Preparation
 - 5.3.2—Placement of concrete
 - 5.3.3—Finishing formed surfaces
 - 5.3.4—Finishing unformed surfaces
 - 5.3.5—Sawed joints
 - 5.3.6—Curing and protection
 - 5.3.7—Repair of surface defects

Section 6—Architectural concrete, p. 30

- 6.1—General

ACI 301 BASIC SECTIONS

- Section 1 - General Requirements
- Section 2 – Formwork and formwork accessories
- Section 3 – Reinforcement and reinforcement supports
- Section 4 – Concrete mixtures
- Section 5 – Handling, placing, and constructing

MODIFICATIONS REQUIRED TO TAILOR
CONSTRUCTION DOCUMENTS FOR THE PROJECT

ACI 301 TAILORING REQUIREMENTS

MANDATORY REQUIREMENTS CHECKLIST

Section/Part/Article	Notes to Specifier
<i>Reinforcement and reinforcement supports</i>	
3.2.1.1	Specify required grades, types, and sizes of reinforcing bars.
3.2.1.10	Specify types of reinforcement supports and location used within structure. Refer to Chapter 3 in <i>CRSI Manual of Standard Practice</i> .
3.3.2.3	Specify the cover for headed shear stud reinforcement and headed reinforcing bars. Refer to ACI 318-08 Chapter 7.
3.3.2.7	Show splices on Project Drawings.

OPTIONAL REQUIREMENTS CHECKLIST

Section/Part/Article	Notes to Specifier
<i>Concrete</i>	
<i>General requirements</i>	
4.2.2.7.a	
4.2.2.7.b	
1.5.2	Specify when Contractor is required to submit a Quality Control Plan.
1.6.1.2	Indicate acceptable certification programs in Contract Document. As a minimum, certification programs should include written and performance evaluations as described in ACI CP-1.
1.6.2.2, 1.6.2.3, 1.6.3.1	Specify if other testing arrangements are required.

SUBMITTALS CHECKLIST

1.6.3.2.d These items listed will be submitted by the Contractor and reviewed by the Architect/Engineer. All submittals and responses should be retained in files for future reference during the Work. Some submittal requirements shown will apply only when optional requirements are selected and written into the Project Specifications. Once optional requirements have been selected, review the Section/Part/Article indicated for the submittal item to see if it applies.

Section/Part/Article	Submittal items and Notes to Specifier
<i>General requirements</i>	
1.5.2	When required, Quality Control Plan.
1.6.2.1	Qualifications of proposed testing agency.
1.6.2.2.e	Test data on materials and concrete mixtures.
1.6.2.2.f	Quality control program of the concrete supplier. Refer to the NRMCA publication <i>Guideline Manual for Quality</i>

Licensed Design Professional must input requirements into construction documents.

WHAT IS 563?

WHY DOES IT EXIST?

- Specifications for the repair of structural concrete in buildings.
 - Industry consensus on best practices for repair.
 - Benefits all by minimizing confusion and providing solid framework for good quality projects.
- **ANTICIPATED RESULT: Improved durability of repairs, and lower societal costs.**

301 vs 563 OVERVIEW

301 – Specifications for Structural Concrete

- General →
- Formwork →
- Reinforcement →
- Concrete mixtures →
- Handling, placing, and constructing →
- ... *Special types of concrete*
 - *Architectural concrete*
 - *Precast concrete*
 -

563 – Specifications for Repair of Structural Concrete in Buildings

- General
 - *Shoring & Bracing*
 - *Concrete removal and Preparation for Concrete Repair*
- Formwork
- Conventional Reinforcement
- Conventional Concrete Mixtures
- Handling and Placing Conventional Concrete
- *Proprietary Repair Materials*
- *Crack Repair (partnered with ACI 503)*
- *Shotcrete (partnered with ACI 506)*
- *Polymer Overlays (partnered with ACI 548)*
- *Special repair topics (PENDING):*
 - *Corrosion, Repair of Arch Concrete, Repair of Precast Structural Concrete, Repair of Post-tensioned concrete, etc.*

LICENSED DESIGN PROFESSIONAL MUST AGAIN INPUT REQUIREMENTS INTO CONSTRUCTION DOCUMENTS.

SHORING & BRACING



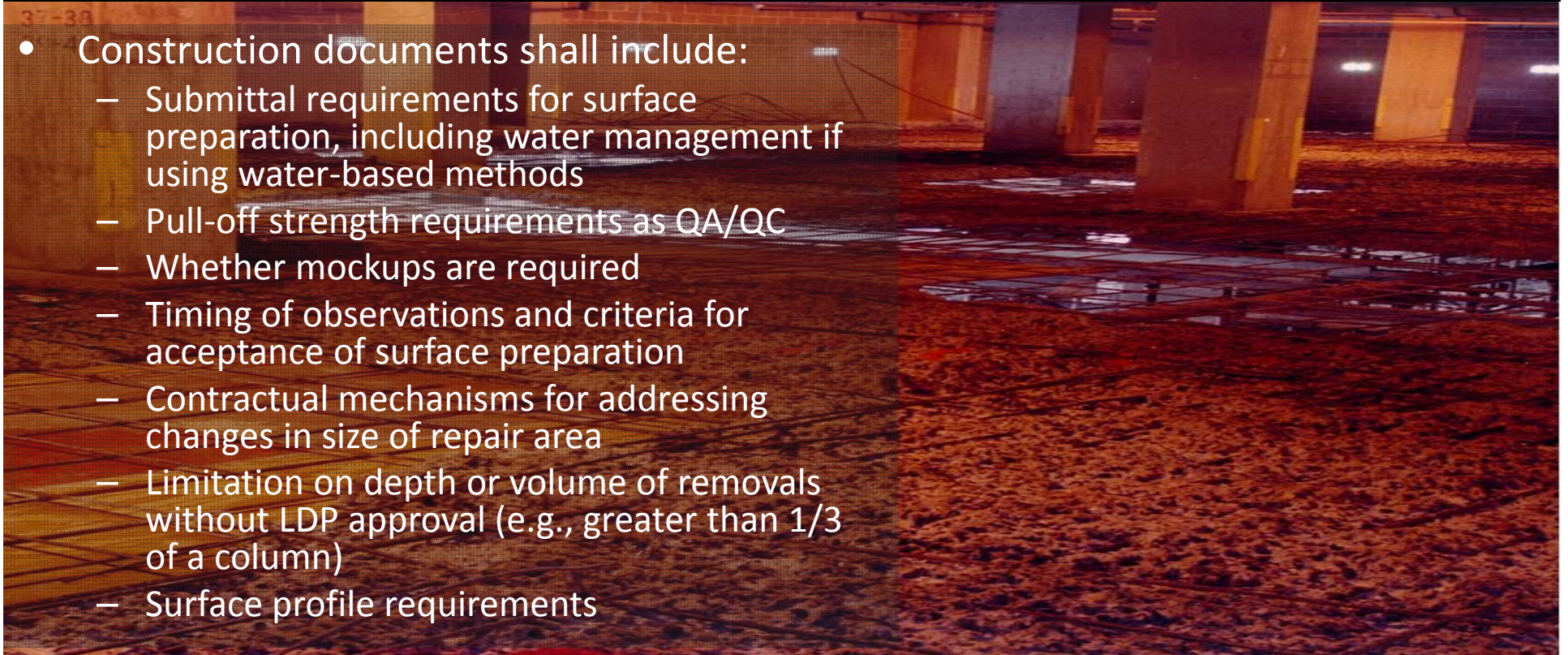
SHORING & BRACING



- Construction documents shall include:
 - Temporary shoring, bracing, and their sequencing, and account for unloading
 - Provisions for prestressed components
 - Performance requirements for shoring/bracing systems
 - Submittal requirements from contractor for all stages of work
 - Execution instructions and field quality control

CONCRETE REMOVAL & PREPARATION FOR CONCRETE REPAIR

- Construction documents shall include:
 - Submittal requirements for surface preparation, including water management if using water-based methods
 - Pull-off strength requirements as QA/QC
 - Whether mockups are required
 - Timing of observations and criteria for acceptance of surface preparation
 - Contractual mechanisms for addressing changes in size of repair area
 - Limitation on depth or volume of removals without LDP approval (e.g., greater than 1/3 of a column)
 - Surface profile requirements

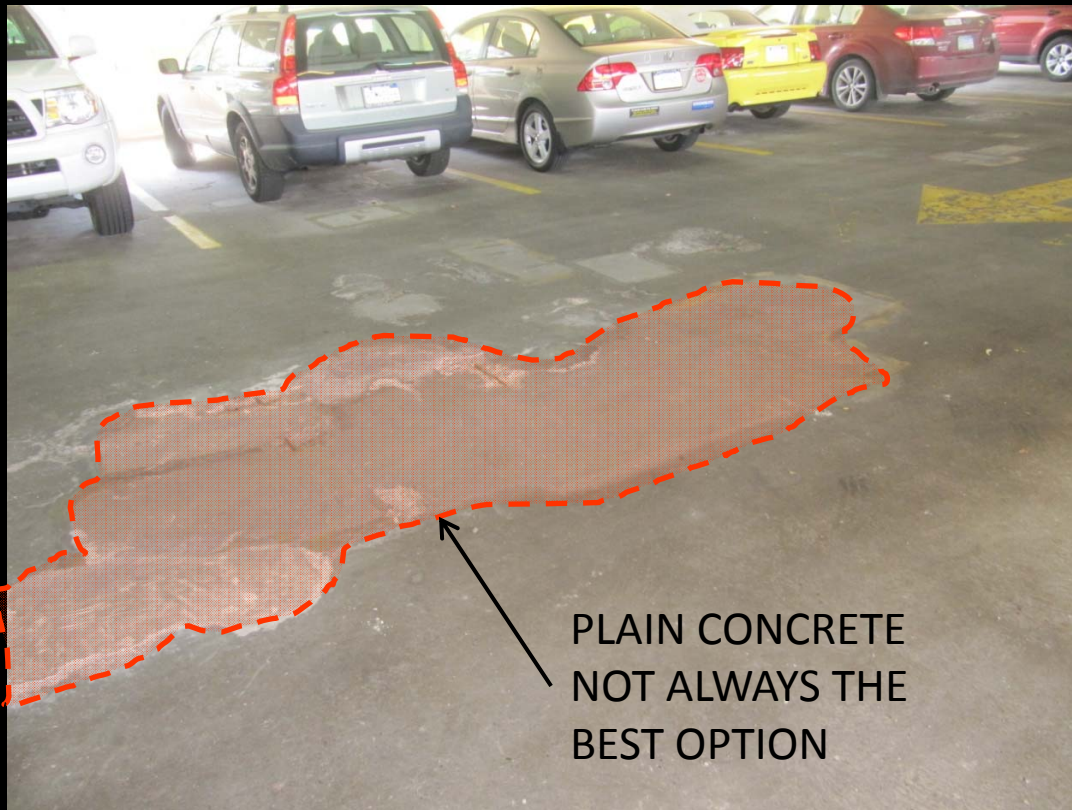


“CONVENTIONAL” REINFORCEMENT & CONCRETE, AND THEIR PLACEMENT



- Very similar sections to 301
- Construction documents shall include:
 - Submittal requirements for reinforcement placement, Contractors QC program, etc.
 - Mockups and their criteria for acceptance
 - Concrete type and materials requirements
 - Concrete curing requirements
 - ... and more!

PROPRIETARY REPAIR MATERIALS



PLAIN CONCRETE
NOT ALWAYS THE
BEST OPTION

- Localized repairs and architectural requirements for façades do not always prompt conventional concrete.
- Construction documents shall include:
 - Submittal and mockup requirements
 - Acceptance criteria
 - Record-keeping requirements
 - Field inspection requirements

CRACK REPAIR

Active? Wet? Elongating or widening? Width changes?



CRACK REPAIR



- *Ref. ACI 503.7 “Specification for Crack Repair by Epoxy Injection”*
- Construction documents shall include:
 - Crack locations to be repaired, and those outside the scope.
 - QC criteria (NDE or destructive) and the repair requirements for core holes
 - Submittal requirements
 - The removal of metal ports where there is risk of corrosion
 - Record-keeping requirements

SHOTCRETE

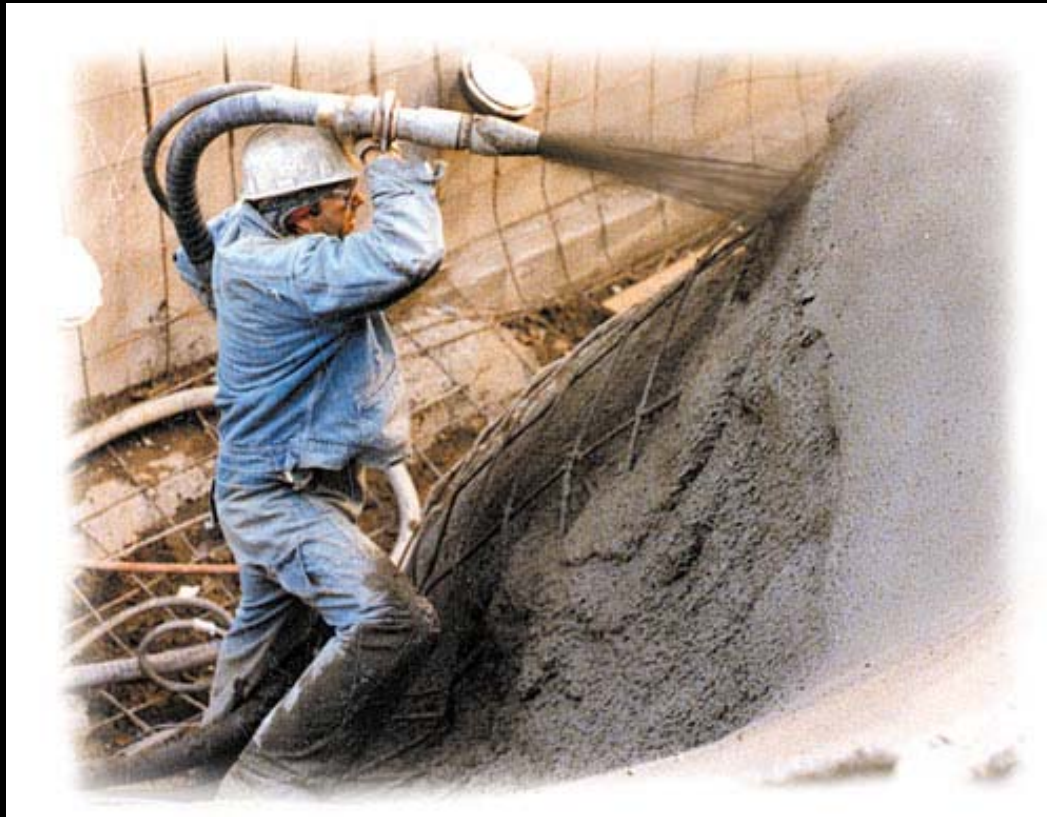
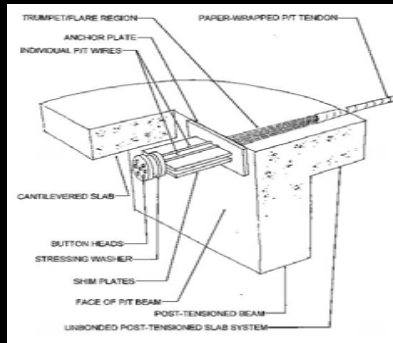
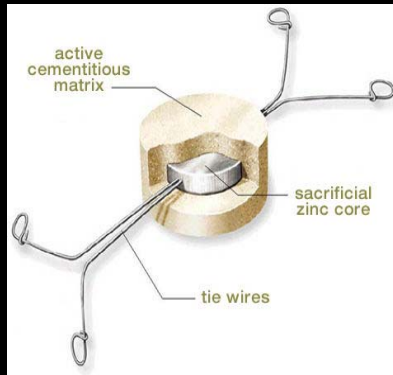


Image courtesy Walsh Construction

- *Ref. ACI 506.2 “Specification for Shotcrete”*
- Construction documents shall include:
 - Submittal requirements
 - Preconstruction testing requirements
 - Mockups and test panel requirements
 - Whether site mixed or prepackaged, and inclusion of fibers
 - Bond requirements
 - Execution requirements.

ADDITIONAL SECTIONS & THEIR CHALLENGES



- Further time needed than available:
 - Architectural & Precast Concrete Repairs
- Highly project specific & difficult to generalize:
 - Corrosion mitigation
 - Sacrificial systems
 - Impressed current systems
 - inhibitors
 - PT repairs
- Progress continues... but not likely for this cycle.

SUMMARY, PROGRESS & SCHEDULE

- *563 in progress*
 - *Original sections are being drafted*
 - *Partnerships with other ACI committees are being struck*
- *Will be straightforward & easy to implement*
- *Aligned with 562 adoption in IEBC*
 - *Anticipated 2015*

GREAT ADDITIONAL READING

The New ACI 301, “Specifications for Structural Concrete”

The 2010 edition includes major additions

APRIL 2011 / **Concrete International**

BY W. CALVIN MCCALL

LOOK FORWARD TO SIMILAR
563 DOCUMENT

How to Develop Better Project Specifications

Guidance for incorporating ACI 301 and
other reference specifications in project specifications

Concrete International / JUNE 2011

BY W. CALVIN MCCALL



QUESTIONS?