



The ACI 562 Code

How does it affect your concrete repair project?



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ACI 562

- How does it affect your concrete repair project?

Background and General Requirements – Keith Kesner

Evaluation – Chuck Larosche

Repair Design – Rick Edelson

Durability – Randal Beard

Forum Discussion – Kevin Conroy



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THE ACI 562 REPAIR CODE

BACKGROUND AND GENERAL REQUIREMENTS

KEITH KESNER – CHAIR ACI 562
WDP & Associates, Inc.



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ACI 562 – Background

- Code for repair of existing concrete structures
- Developed to improve concrete repair practice
- Performance-based code
- Help design professionals and building officials
- Work in progress

Committee interested in feedback

Working on adoption into IEBC-18



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ACI 562 – Philosophy

- Emphasize **performance** based rather than prescriptive requirements
- Encourage **creativity** and **flexibility**
- Promote **innovation** and **new materials**
- Establish **responsibilities**
- Enhance life safety (equivalent safety)
- Extend service life
- Provide **sustainable** and economic alternatives
- Use ACI and other “code” documents by reference



Building Codes

- Developed by consensus process (ANSI process)
 - Written by code writing organization
 - Code committee
 - Membership balance
 - Producers / Users / General Interest
- Written for design professionals
 - Architects and engineers
- Adopted in law
 - General building code
 - Feeder building codes – ACI 318, ACI 562



Responsibilities

- Licensed Design Professional
 - Evaluation
 - Repair & durability design
- Constructor – through plans and specifications
 - Follow evaluation and design specifications
 - Report uncovered defects
 - Construction sequencing, means & methods
- Owner – through general building code
 - Known conditions and maintenance



ACI 562 - Applicability

- Existing concrete buildings
- Superstructure, foundations (slabs), precast elements – structural load path
- Structural vs. nonstructural – “Unsafe”
- Composite members – concrete
- Nonbuilding structures when required



ACI 562 - Process

- **Preliminary Evaluation**

Determination of design basis code

Substantial structural damage

- Evaluation

- Repair design

- Durability considerations

- Construction and Quality Assurance

- Maintenance Recommendations



ACI 562 - Process

- Preliminary Evaluation
- **Evaluation**
 - Extent of problems
 - Extent of required repairs
- Repair design
- Durability considerations
- Construction and Quality Assurance
- Maintenance Recommendations



ACI 562 - Process

- Preliminary Evaluation
- Evaluation
- **Repair design**
 - How repairs are to be made
 - Material selection
- Durability considerations
- Construction and Quality Assurance
- Maintenance Recommendations



ACI 562 - Process

- Preliminary Evaluation
- Evaluation
- Repair design
- **Durability considerations**

How to make repairs / repaired structure last
Service life

- Construction and Quality Assurance
- Maintenance Recommendations



How to Use ACI 562?

- General Requirements

Why is an LDP involved?

Is it an existing structure?

Where does the structure fit in code maze?



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Existing Structures

- Defined in ACI 562 and IEBC
 - Structure with a certificate of occupancy
 - Structure currently in use
- ACI 318
 - Deals with new construction
 - Repairs that satisfy new code requirements



Design Basis Code

- General building code under which the repair project is completed
- Possible design basis codes:

IBC

IEBC

Local building code, i.e., NYC Building Code

ACI 318

Combination of ACI 318 and 562



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When do structures need to satisfy current codes?

- IBC – Chapter 34*

If alterations or additions increase force in a structural element by more than 5%

Repairs to elements that are found to unsound or structurally deficient

- IEBC

When substantial structural damage has occurred

- When required by a local code or building official



Preliminary Evaluation

- Preliminary evaluation

 - Determine extent of structural damage present

 - Evaluation based upon in-place conditions

 - Can use assumed material properties

 - Establish design basis code

- Substantial structural damage

 - Determines if compliance with current code is required



Quasi - Case Studies

- Office Building
 - Constructed in 2007
 - Post-tensioned flat plate structure
- Parking Structure
 - Constructed in 1988
 - Reinforced concrete beams and slabs
- Mixed-Use Building
 - Constructed in 1960
 - Reinforced concrete beams and slabs



Office Building

- Owner and Tenant complaints
 - Floor deflections
 - Cracking of partition walls
- Construction completed in 2007
- Drawings / construction records?
 - Full set of drawings and shop drawings
 - Full set of construction records



Office Building

- Preliminary Evaluation



Office Building

- Structural System

Flat plate post-tensioned slabs – 8” thick

40 foot x 40 foot main bay

12 inch square columns

No drop panels or column capitals

Shear walls for lateral loads

- Building Code

IBC and ACI 318-02



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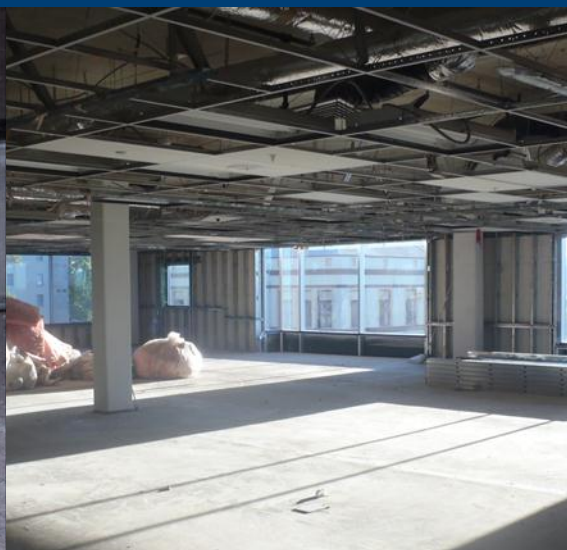
Office Building

- Preliminary evaluation

Review design and construction records

Investigate distress

Examine code requirements



Office Building

- Preliminary evaluation findings
 - Excessive span to slab depth ratios
 - “Small” columns
 - Misplaced reinforcing steel – SPR survey
- Recommendation to Owner
 - Unsafe** – close facility for repairs



Office Building

- Design basis code options
 - ACI 318-02 and ACI 562 (if safe)
 - Current IBC and local codes (upgrade)
- Required option
 - Upgrade to current code requirements
 - ACI 318-11 and State Building Code
 - Building official's mandate



Parking Structure

- Construction completed in 1986
- Owner concerns
 - Overhead concrete spalling
 - Leakage through concrete deck
- Drawings / Construction records?
 - Full set of structural drawings
 - No construction records



Parking Structure

- Structural system

Reinforced concrete beams and slabs
20 foot slab span / 50 foot beam span
Expansion joints at 150 foot spacing

- Building codes

IBC / IEBC and ACI 1983



Parking Structure

- Preliminary Evaluation



Parking Structure

- Preliminary evaluation

Damage due to long-term chloride exposure

Lack of maintenance

No evidence of design / construction defects



Parking Structure

- Design basis code options
 - ACI 318-83 and ACI 562 (if safe)
 - Current IBC and local codes (upgrade)
- Selected option
 - Safe structure – use ACI 318-83 and ACI 562
 - Repair options – to be determined



Mixed-Use Building

- Construction completed around 1960
- Owner concerns:
 - New owner wants to convert into condos
 - Wants to add concrete balconies to structure
 - Capacity of existing structure?
- Drawings / Construction records?
 - Destroyed by fire or flood



Mixed-Use Building

- Preliminary evaluation
 - Is the structure safe for continued use
 - Structural system and geometry?
 - Extent and type of damage?
- Material properties – preliminary analysis
 - Testing / measurement
 - Assumed material properties



Mixed-Use Building

- Preliminary evaluation



Mixed-Use Building

- Preliminary evaluation findings
 - Structure is in good condition
 - Rational gravity and lateral load system
 - No evidence of distress
 - New balconies feasible
- Design basis code options
 - Original design code and ACI 562 or
 - Upgrade to current code requirements



Mixed-Use Building

- Design basis code – new balconies
ACI 318-11
- Design Basis Code - Building
Selected ACI 318-11 and ACI 562
Voluntary upgrade



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Thank You – on to Evaluation

ACI 562-13

Code Requirements for Evaluation,
Repair, and Rehabilitation of
Concrete Buildings (ACI 562-13)
and Commentary

An ACI Standard

Reported by ACI Committee 562



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Questions?

Save for forum discussion



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