The ACI 562 Code
How does it affect your concrete repair project?
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
THE ACI 562 REPAIR CODE

BACKGROUND AND GENERAL REQUIREMENTS

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

Questions?

Save for forum discussion