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Basics of Concrete Repair, Repair Application Procedures

- #7 Spall Repair of Horizontal Concrete Surfaces
- #5 Vertical and Overhead Repairs using Form and Pump
- #4 Vertical and Overhead Repairs using Form and Pour

What We Will Cover

- Purpose of Repair
- When do I use these techniques
- How do I prepare the surfaces
- What are the safety considerations
- Preconstruction and Trial Repair
- Repair Procedure
- How do I check the quality of the repair
Surface Repair
The Process

- Condition
- Removal
- Material selection
- Surface prep
- Placement technique

Improper Surface Preparation
Before 1989

Concrete Removal
Chipping Hammer for Reinforcing Steel Detail Work
15# Hammer, No bigger than 30#

Removal of Concrete Under Corroding Bar
In Accordance with ICRI Guideline 310.1R

Why Here, Not Here?
Delaminated, cracked areas
Incorrect layout
Recommended layout
Surface Repair
Repair Geometry

beam section

slab or wall section

dge section

Repair Geometry

column section

Not Recommended w/o
Express Permission by
Structural Engineer

Lost Cross Section My Significantly Reduce Structural Capacity

Sawcutting

Ergonomics
Reinforcing Repair
Surface Preparation of Bars
- Cleaning required to remove bond inhibiting materials
- Heavy mill scale removed
- Heavy rust layers removed
- All oxide does not need to be removed
- Sandblasting preferred method
- Degree of blasting??

Reinforcing Repair
Preparation of Bars
- Cleaning with wire wheel

Repair of Corroded Bars
- Lost Cross Section

Placement
- Moisture Conditioning
- Bonding Repair to Substrate
- Placement Techniques
- Quality Assurance
Surface Repair

**Bonding Mechanism: Open Pores**

- After chipping
- After repair

Moisture Conditioning

- Dry Substrate?
- Wet Substrate?
- SSD?

Placement Process

- Moisture Conditioning
- Bonding Agents
- Material Placement
- Material Curing

Achieving Bond

**Bonding Agents**

- Are they necessary?
- Types

Sand Cement Slurry Broomed into Prepared Substrate

Achieving Bond

**Quality Assurance**

- Field Mockups
- Evaluate Methods
- Evaluate Materials
- Evaluate Results
Achieving Bond Quality Assurance

- Visual Evaluation

References Direct Tensile Pulloff Testing

- ASTM Standard 1583
  - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)

- ICRI Guideline 210.3 2004
  - ICRI Guideline to Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials
Placement Process

- Bonding Agents
- Moisture Conditioning
- Material Placement
- Material Curing

Placement Method Considerations

- Encapsulate Reinforcing Steel
- Uniform Material Delivery
  - No Segregation
- Complete Filling of Cavity

Surface Repair

Form & Pour RAP #4

Intimate Contact New Material to Substrate

Surface Repair

Form & pour before...

Surface Repair

Form & pour formed...
Surface Repair

Form & pour after...

One Sided Form Construction

- Formwork Construction
- Liquid Pressure of Concrete
- Design per ACI formwork Guidelines
- Chutes / Access to Place Material

Placement Of Chute Above Repair

Form and CIP

Keys to Success
- Formwork Construction
- Surface Conditioning
- Material Selection
  - Flowable
  - Non-Segregating
  - Low Shrinkage
- Placement Selection
  - Pump
  - Gravity Feed
- Curing
  - Forms in Place

Repair Materials

- Ready Mix
- Packaged Repair Materials

Column Repair
Manufactured Form Panels

Achieving Bond
- Vibration
  - Internal
  - External

Summary
- Preparation Critical Step in Achieving Long Lasting Repairs
- Bond Achieved with Open Pore Structure of Substrate
- Placement Method Creates Intimate Contact Between New and Old Materials
- Measure Quality To Ensure Proper Execution

Thank You!

Any Questions?

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