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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

Agenda RAP 4, 5 & 7

- Surface Preparation
- Placement Techniques
  - Full Depth
  - Form and Pour
  - Form and Pump
- Quality Assurance/Control

Repair Techniques

Surface Preparation
Surface Repair
The Process

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

Improper Surface Preparation

Before 1989

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

In Accordance with ICRI Guideline 310.1R

Removal of Concrete Under Corroding Bar

Why Here, Not Here?

Delaminated, cracked areas Incorrect layout Recommended layout

Surface Repair
Repair Geometry
Surface Repair
Repair Geometry
beam section
slab or wall section
edge 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 Steel Repair & Protection

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??

Preparation of Bars
- Cleaning with wire wheel

Reinforcing Repair

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

Repair of Corroded Bars
Repair Damaged Reinforcement Under the Direction Of A Licensed Engineer

Lost Cross Section
Bonding Mechanism: Open Pores

Placement Process

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

Achieving Bond Quality Assurance

- Field Mockups
- Evaluate Methods
- Evaluate Materials
- Evaluate Results

Surface Repair

Moisture Conditioning

Achieving Bond Bonding Agents

- Are they necessary?
- Types

Sand Cement Slurry Broomed into Prepared Substrate

Dry Substrate?

Wet Substrate?

SSD?
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

Intimate Contact New Material to Substrate

Form and Pump Procedure

- Surface Preparation
- Surface Conditioning
- Formwork Erection
- Port Locations
  - 3 - 4 Ft. on Center
- Proper Venting

Form & Pump RAP #5

Cavity Filling
- Vertical Repairs
  - Fill From Lowest Points
- Pump from Port to Port
- Monitor Pressure
Form and Pump Procedure

- Achieving Bond
- Expel Entrapped Air
- Form Pressurization
  - Gauge Pressure
  - Formwork Design Pressure
  - Communication
- Formwork Failures

Tensile Anchor Attachment

Flowable SCC Form and Pump

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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