

CONCRETE REHABILITATION SCENARIOS FROM INITIAL REPAIR TO COATING PROTECTION

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INTRODUCTION

- International Concrete Repair Institute (ICRI)
 - Formed in 1988
 - Lack of Standards & Guidelines Prior to Formation
 - Purpose:
 - Improve Quality of Concrete Restoration
 - Improve Repair & Protection
 - Be a Resource to Owners, Engineers, & Contractors
 - Members
 - Specialty Concrete Restoration Contractors
 - Engineers
 - Manufacturers

EXAMPLES OF CONCRETE RESTORATION SCENARIOS

Vertical – Concrete Vault

Before



After



EXAMPLES OF CONCRETE RESTORATION SCENARIOS

Specialty – Pedestrian Bridge

Before



After



EXAMPLES OF CONCRETE RESTORATION SCENARIOS

Overhead - Steam Tunnel

Before

After



EXAMPLES OF CONCRETE RESTORATION SCENARIOS

High Rise

Before



After



EXAMPLES OF CONCRETE RESTORATION SCENARIOS

Deck Repair

Before



After

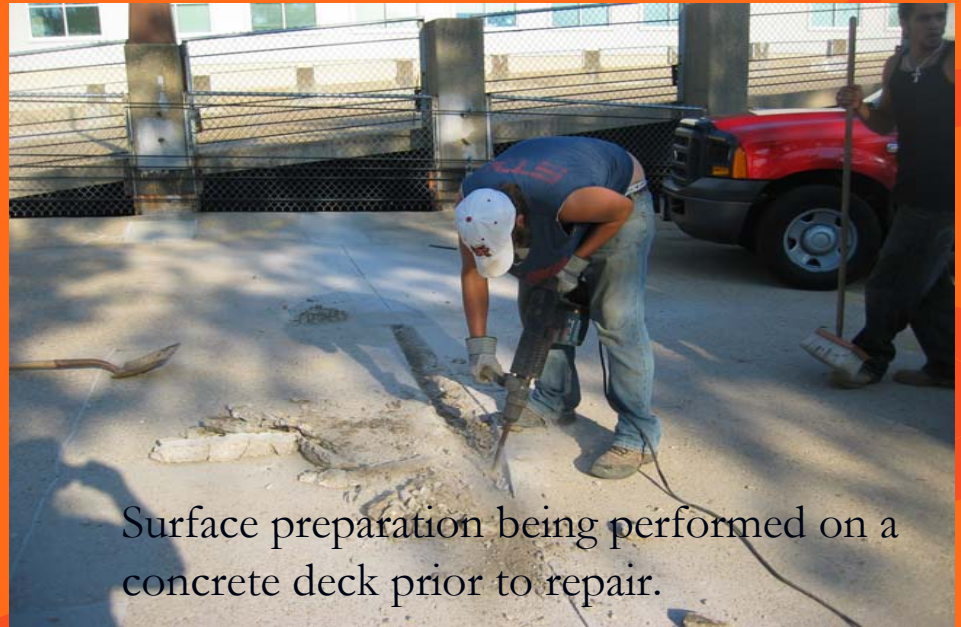


KEY ISSUES

- Cause of Concrete Deterioration or Damage
- Repair Method to be Utilized
- Equipment to be Utilized
- Materials to be Utilized
- ICRI, ASTM, or ACI Standards
- Structural Engineer/Architect to be Involved in Project

CONCRETE REPAIR PREPARATION

- Crucial to a Successful Outcome
- Removal of Damaged/Deteriorated Concrete Accomplished in Conjunction with Surface Preparation



Surface preparation being performed on a concrete deck prior to repair.

SURFACE PREPARATION SCENARIOS

- Hand-chipping
- Electric, air or hydraulic powered chippers
- Hydrodemolition
- Coring
- Concrete Planer
- Concrete Sawing



Routing out cracks in concrete

EQUIPMENT SELECTION CRITERIA

- Size of Repair Area
- Exposure of Reinforcing Steel
- Location of Structure
 - Horizontal/Vertical/Overhead
 - Indoor/Outdoor
 - Height
 - Temperature
 - Weather Conditions
- Specified End Result

VARIOUS REPAIR SCENARIOS

- Fiber Reinforced Polymer Modified Cement-Based Patching Materials
- Epoxy-Based Grouts for Patching & Crack Injection Applications
- Methyl Methacrylate Patching Materials
- Flexible Urethane-Based Grouts
- Specialty Cement-Based Patching & Grouting Materials

BASIC REPAIR METHODS

- Creation of Repair Perimeter
 - Concrete Saws
 - Carbide or Diamond Tipped Grinder Blades
- Remove Damaged/Deteriorated Concrete
 - Small Electric or Air Chipping Hammers
 - Large Pneumatically Driven Concrete Breakers Mounted on Back Hoes

CRACK REPAIR

- Determine Cause of Cracking
 - Settlement of Structure
 - Thermal Expansion or Contraction
 - Absence of Adequate Expansion Joints
- Select Repair Scenario
 - Low Likelihood of Further Cracking
 - High Likelihood of Further Cracking



SPALL REPAIR

- Determine the Cause of Spalling
 - Reinforcing Steel Set too Close to Surface
- Recognition & Exposure of Reinforcing Steel
 - Treatment
 - Wire Brushing
 - Sandblasting
 - Coating with Zinc Rich Primer
 - Replacement of Reinforcing Steel



Picture: Overhead repair area prepared prior to material application



Picture: Form work in place while applying overhead repair mortar.

SPALL REPAIR CON'T

Select Repair Scenario

- Thickness of Repair
- Projected Allowance for Cure Time
- Climatic Conditions
- Exposure to Chemicals/Water/Heat/Cold/etc.
- Specified End Result
- Method of Placement
 - Hand Toweled
 - Pumping/Pouring the Materials to a Temporary Form
 - Pneumatically Applied (Shotcrete)

WATER INTRUSION

- Determine Cause of Water Intrusion
 - Through Cracks in Concrete Structure
 - Between Concrete & Piping
 - Through Honeycombs
 - Through Control or Expansion Joints
 - Through Other Voids

Picture: Pumping ports installed prior to pumping material into void to stop sewage seepage into storm collection systems



WATER INTRUSION CON'T

- Below Grade Repair Situations
 - Water Intrusion Must Be Stopped
 - Damp Areas
 - Rapid Setting Hydraulic-Based Cement Compounds
 - Polymer Modified Cement-Based Materials
 - Rapid Setting Epoxy, Urethane, or Acrylic Coatings
 - Flowing Water
 - Expandable Polyurethane Grout
- Above Grade Repair Situations
 - Low Viscosity Polyurethane-Based Materials

CONCLUSION

- Correct Repair Methods & Materials Lead to
 - Successful Patching Outcomes
 - Successful Coatings Applications
- For Further Information:
 - www.icri.org

THANK YOU

- *Any questions?*

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