



American Concrete Institute®
Advancing concrete knowledge

**Field Guide to Concrete Repair
Application Procedures**

ACI Fall 2011 Convention
October 16 – 20, Cincinnati, OH

ACI
WEB SESSIONS



Peter Emmons, FCI, is President of Structural Preservation Systems, Inc., Hanover, MD. He is Chairman of ACI Committees 364, Rehabilitation and 546, Repair of Concrete.

ACI
WEB SESSIONS

**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

Peter Emmons
pemmons@structural.net



Note: Content specific to RAP 4 and RAP 7 can be found at:
http://www.concrete.org/education/Webcasts/RAP_Part_a.html

Agenda RAP 4,5 & 7

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

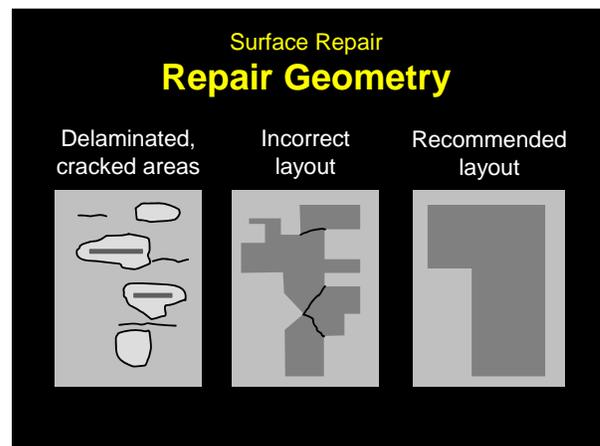
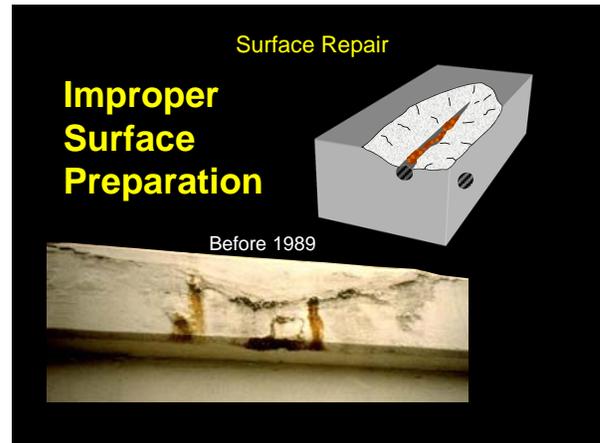
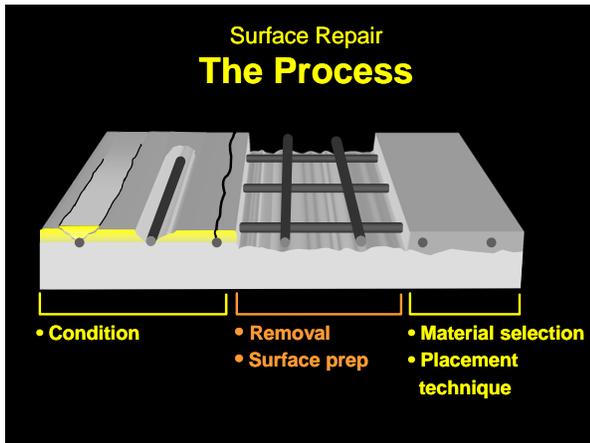
Note: Content specific to RAP 4 and RAP 7 can be found at:
http://www.concrete.org/education/Webcasts/RAP_Part_a.html

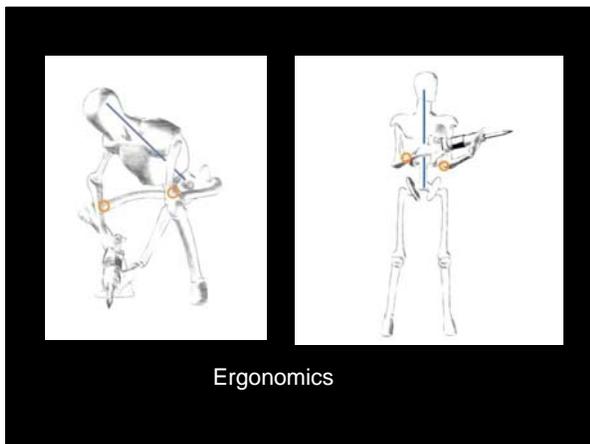
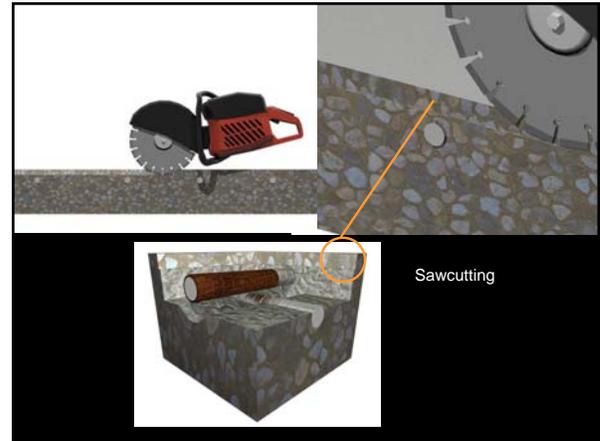
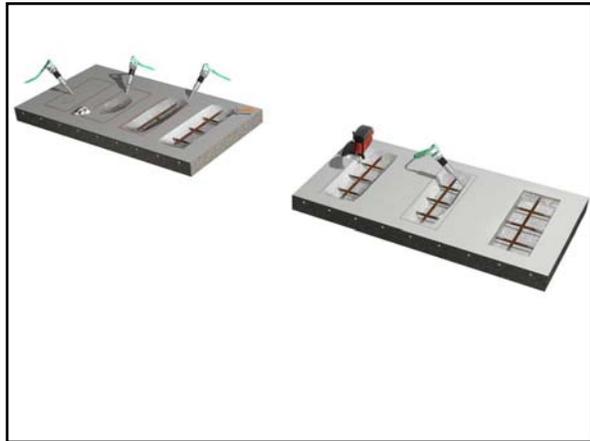
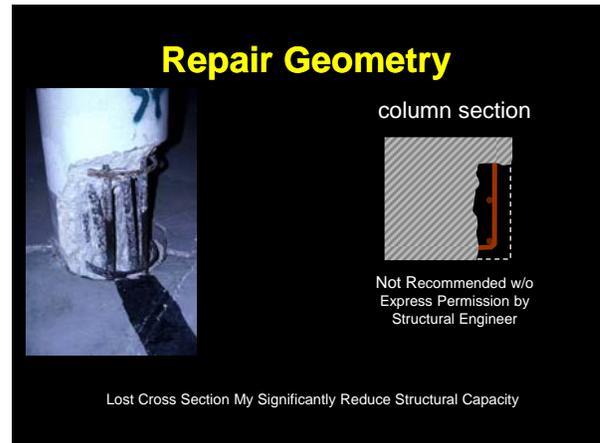
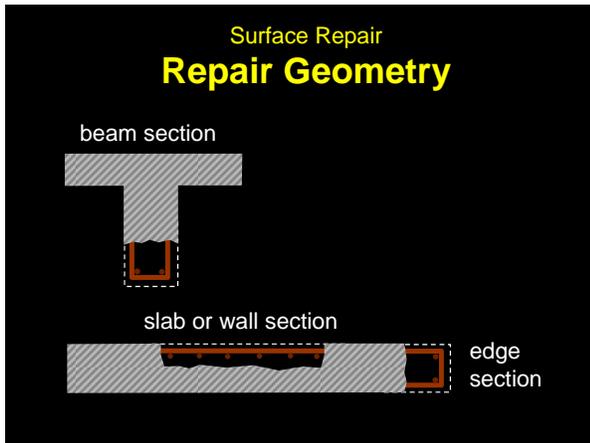
What We Will Cover

- 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

Repair Techniques

Surface Preparation







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??

A photograph showing several vertical reinforcing steel bars embedded in a concrete wall, with some surface rust visible.

Reinforcing Repair

Preparation of Bars

A diagram illustrating the abrasive blast cleaning process. It shows a cross-section of a concrete substrate with a reinforcing steel bar. Labels include: Concrete Substrate, Reinforcing Steel, Abrasive, Abrasive Pulse, and Nozzle. An inset shows a hand using a nozzle to clean a bar, labeled 'Abrasive Blast Cleaning'. To the right is a photograph of a red industrial sandblasting machine.

Reinforcing Repair

Cleaning with wire wheel

A photograph of a worker wearing a hard hat and safety glasses, using a wire wheel tool to clean a hole in a concrete wall.

Repair of Corroded Bars

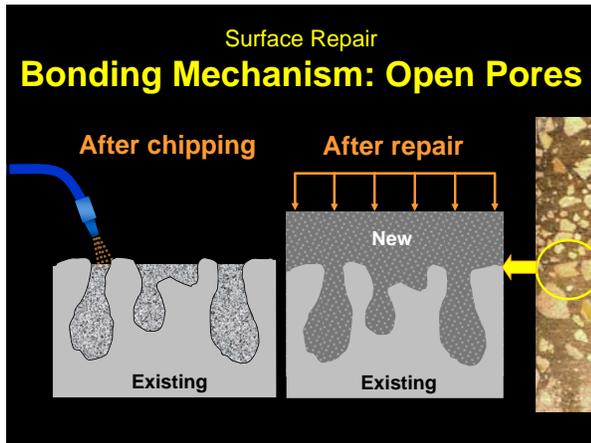
Repair Damaged Reinforcement Under the Direction Of A Licensed Engineer

A photograph showing a cross-section of a concrete wall with severely corroded and rusted reinforcing steel bars. A white circle highlights a specific area of damage, with an arrow pointing to it.

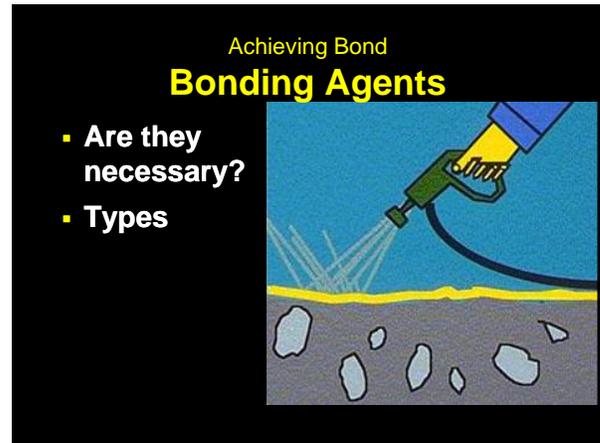
Lost Cross Section

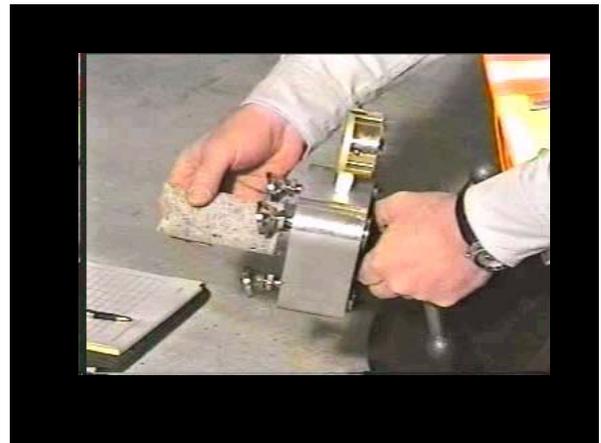
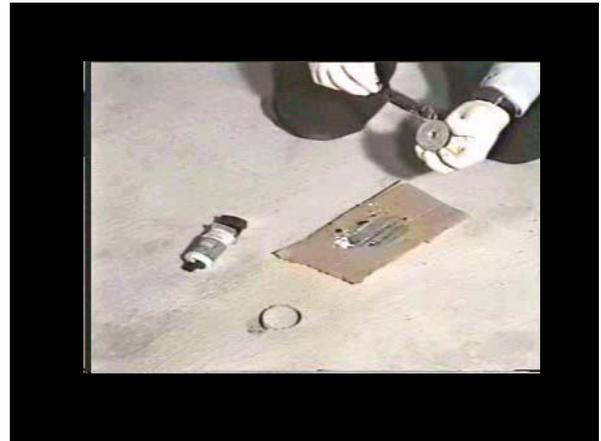
Placement

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



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





Achieving Bond
Quality Assurance

- **Visual Evaluation**

Full Depth Core

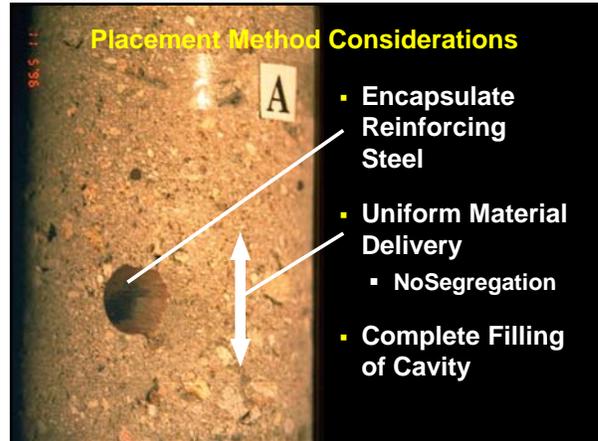
References Direct Tensile Pull-off Testing

- **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



Intimate Contact
New Material
to Substrate

Placement Techniques

- Full and Partial Depth Slab Repairs
- RAP 7

Surface Repair Full-Depth Repair



Complete Full Depth Formwork



Repair Materials

- Ready Mix Concrete



Placement and Vibration



Screeding



Floating Surface



Curing-Burlap



Placement Techniques

- Partial Depth Slab Repair



Repair Materials

- Ready Mix Concrete
- Packaged Repair Materials

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?

Peter Emmons
Pemmons@Structural.net

