

#### Who is a Repair Technician?

- The Repair Technician is NOT the Licensed Design Professional (LDP)
- the engineer or architect, licensed as described, who is responsible for the structural design of a particular project (also historically engineer of record)
- The 562 Code is specifically written for the LDP

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#### Who is a Repair Technician?

#### The very first statement of the Code:

- ACI 562-16, "Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures" was developed to provide design professionals involved in the assessment of existing concrete structures a code for the assessment of the damage and deterioration, and the design of appropriate repair and rehabilitation strategies.
- 1.5 Responsibilities of the licensed design professional

## 1.5 Responsibilities of the licensed design professional

 1.5.1 The licensed design professional for the project is responsible for 1) assessing; 2) designing, detailing, and specifying the work proposed and material requirements; 3) establishing requirements to maintain load paths for the work proposed; and 4) preparing construction documents of the work proposed and specifying a quality assurance program.

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#### Who is a Repair Technician?

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#### Who is a Repair Technician?

- 10.2.1C The quality of concrete repairs is largely dependent upon the workmanship during construction. Inspection is necessary to verify repairs and rehabilitation work are completed in accordance with construction documents.
- 10.2.2C Repair construction should be inspected to verify the quality of materials, quality of workmanship, and for compliance with the intent of the construction documents.

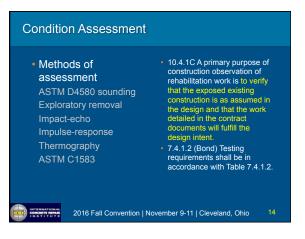
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#### Who is a Repair Technician?

The Repair Technician is the person qualified to inspect the quality of the work.

- From the Ownership side: This is the Quality Assurance Inspector.
- From the Contractor side: This is the person responsible to control the quality of work, i.e. Quality Control.
- From the ACI 562 side: An individual who has been certified as qualified to perform testing and inspection on concrete repairs, i.e. either of the above two individuals.
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#### Carbonation and Chloride contamination

- Corrosion of reinforcing steel can be initiated by either carbonation or chloride contamination or both.
- 7.6.2 Concrete—The in-place properties of the concrete, in accordance with Chapter 6, shall be used in the repair design.
   7.6.2C The extent and cause
- e of deterioration and the concrete strength and quality should be assessed, including compressive strength, chlorides, carbonation, sulfate attack, alkali-silica reaction, physical damage, corrosion-induced spalling, and cracking. Chloride penetration can cause corrosion that can lead to cracking and spalling.

### Concrete removal Repair area geometry Undercutting reinforcing steel 7.6.6 Repair geometry— Configuration of repairs shall consider the potential for stress concentrations and cracking in both the existing structure and the repair area.

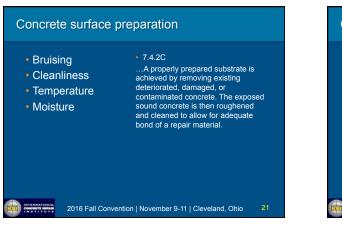
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#### Concrete removal

CONCRETE REPAIR

- 7.6.6C Repair shapes with sharp reentrant corners can cause stress concentrations that may result in cracking. Long, slender (high aspect ratio) repair areas also may result in cracking. The shape of the repair should be considered to reduce stress concentrations and possible cracking.
- Methods discussed in ICRI No. 310.1R provide guidance to reduce cracking in concrete repairs including providing a uniform depth of edges and substrate, repair geometry, surface preparation, concrete removal below reinforcement (undercutting) and elimination of feather edge repairs.

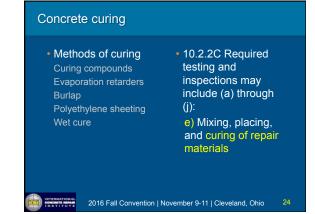
Methods of removal • Jack Hammer Chipping • Hydrodemolition • Saw cutting perimeter • Surface roughness (ICRI CSP chips) • Bruising (microfractures)	<ul> <li>10.2.2C Required testing and inspections may include (a) through (i):         <ul> <li>a) Delivery, placement, and testing reports documenting the identity, quantity, location of placement, repair materials tests, and other tests as required</li> <li>b) Construction and removal of forms and reshoring</li> <li>c) Concrete removal and surface preparation of the concrete and reinforcement</li> </ul> </li> </ul>	<ul> <li>Bruising</li> <li>Cleanliness</li> <li>Temperature</li> <li>Moisture</li> </ul>	<ul> <li>d) Placing of reinforcement ar anchors</li> <li>e) Mixing, placing, and curing repair materials</li> <li>f) Sequence of erection and connection of new members</li> <li>g) Tensioning of tendons</li> <li>h) Review and reporting of construction loads on floors, beams, columns, and walls</li> <li>i) General progress of work</li> <li>j) Installation and testing of p</li> </ul>
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### Cementitious replacement material

<ul> <li>Material selection</li> <li>Compatibility</li> </ul>	<ul> <li>7.5.1 Design of the repair system shall consider the properties and installation of the repair materials and systems. These include, but are not limited to:</li> </ul>		
	<ul> <li>physical properties of the repair materials, type of application, adhesion, volume stability, thermal movement, durability, corrosion resistance, installation methods, curing requirements, and environmental conditions.</li> </ul>		
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#### Cementitious replacement material • 10.2.2C Required testing Methods of and inspections may include (a) through (j): placement Dry-packing a) Delivery, placement, and testing reports Trowel applied documenting the identity, Poured flatwork quantity, location of placement, repair materials Form and pour Form and pump tests, and other tests as Preplaced aggregate required... Shotcrete e) Mixing, placing, and curing of repair materials 2016 Fall Convention | November 9-11 | Cleveland, Ohio CONCRETE REPAIR



Bond					
Mechanisms affecting bond     Surface roughness (ICRI CSP chips)     Table 7.4.1.2—Testin requirements where upartially or totally resi by the concrete					
	V 2	Reference	Testing requirements		
<ul> <li>Bruising</li> </ul>	Less than 30 psi	7.4.2	Bond-integrity testing		
(microfractures)	Between 30 and 60 psi	7.4.3	Quantitative bond strength testing		
• ASTM D4580	Greater than 60 psi	7.4.4	Quantitative bond strength testing		
<ul> <li>sounding (integrity)</li> <li>Bond pull-off testing (quantitative)</li> <li>7.4.2C</li> <li>Bond integrity testing can consist of various qualitative test methods such as sounding in accordance with ASTM D4580</li> </ul>					
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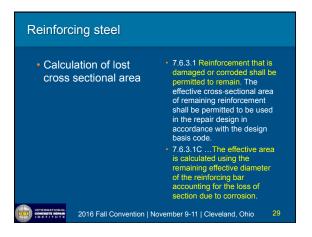
Bond	
<ul> <li>Bond pull-off testing</li> </ul>	<ul> <li>7.4.3CBond capacity has primarily been evaluated using direct tension pull-off tests, as defined in ASTM C1583 and as described in ICRI No. 210.3.</li> </ul>
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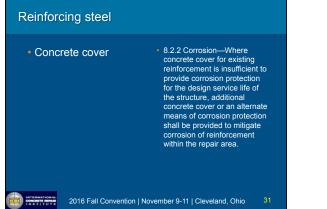
#### Reinforcing steel corrosion

- Acceptable corrosion
- Unacceptable corrosion
- Damaged reinforcing

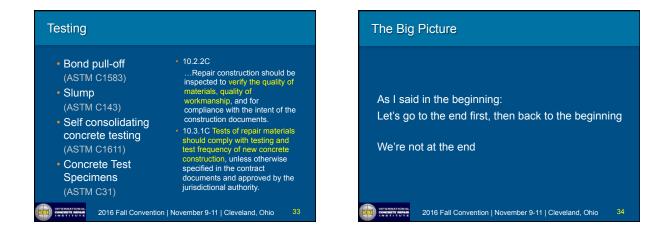
 8.4.1C Untreated reinforcement corrosion limits the life expectancy of repair areas, repair materials, and repaired structures. ICRI No. 310.1R provides guidelines on removal of damaged concrete and cleaning of reinforcing steel. Repairs that do not address reinforcement corrosion may negatively impact the design service life and require more intensive monitoring.











### Chapter 10 – Quality Assurance

- 10.2.2 The construction documents shall include testing and inspection requirements applicable to the project.
- 10.2.2C ...Repair inspector qualifications for inspection of concrete repairs should be demonstrated by certification...An individual who has been certified an ICRI Concrete Surface Repair Testing Technician (ICRI Concrete Surface Repair Technician)



