



# 2024 SPRING CONVENTION



APRIL 21-24, 2024  
[ICRI.ORG](http://ICRI.ORG)



# ICRI & IMI: Collaborating and Investing in the Future of Skilled Craftworkers



Through the Concrete Repair Certificate Training



Casey Weisdock, MSc | IMI Director of Industry and Technical Services

APRIL 21-24, 2024

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## ➤ Outline

- Who is IMI/IMTEF
- Why CRC training was developed
- Introduction IMI-IMTEF's Concrete Repair Certificate Training
- How the CRC training was developed
- Pilot program and inaugural year







# Who is **IMI/IMTEF**

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# INTERNATIONAL MASONRY INSTITUTE

INTERNATIONAL MASONRY  
TRAINING EDUCATION FOUNDATION (IMTEF)

Apprenticeship and Journey  
Worker Training

Industry Development &  
Technical Services

# ➤ BAC: Trades

- Brick and Block
- Stone
- Restoration
- Tile
- Marble
- Terrazzo
- Rainscreen
- Refractory
- Concrete
- Plaster





# ➤ Training: Pre-Apprenticeship

- Pre-job training
- Jobcorp – Masonry contract
- National and local workforce Development Program affiliations



# ➤ Training: Apprenticeship

- Over 60 training centers nationwide
- Standardized curriculum and certified instructors
- Apprentices receive 6500 hours on-the-job and classroom training





# ➤ Training: Journeyworker Upgrades

- Grout and Reinforced Masonry Certificate
- Adhered Masonry Veneer Certificate (AMV)
- Advanced Certifications in Tile (ACT)
- Rainscreen Certificate (RSC)
- Flashing Training
  
- **Concrete Repair Certificate (CRC)**
- Historic Masonry Preservation Certificate (HMPC)
- Terra Cotta Repair Training



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## Pre-Project Training Qualifications

“Bidders will be required to provide a statement of the firm’s commitment to enroll the key journey-level masons assigned to this project in a masonry preservation training program prior to the start of the project, such as provided by the International Masonry Institute (or equal), (BAC/IMI/IMTEF National Training Center Program Contact 1-800-464-0988)”

## Project-Specific Training Program

“Bidders will be required to provide a statement of the firm’s commitment to implement a pre-job masonry preservation training program prior to the start of the project for all masons assigned to this project, such as provided by the International Masonry Institute (or equal), (BAC/IMI/IMTEF National Training Center Program Contact 1-800-464-0988)”. The training program should be structured so that it is relevant to the scope of work.



# ➤ How IMI Can Help

- Drawing and spec review
- Detailing assistance
- Job site troubleshooting
- Continuing education
- Hands-on material workshops



# ➤ Research & Industry Development

- Codes and standards
- Energy and sustainability
- Resiliency
  - Seismic design
  - Impact resistance
  - Storm shelter safety
  - Fire safety
- New and emerging products

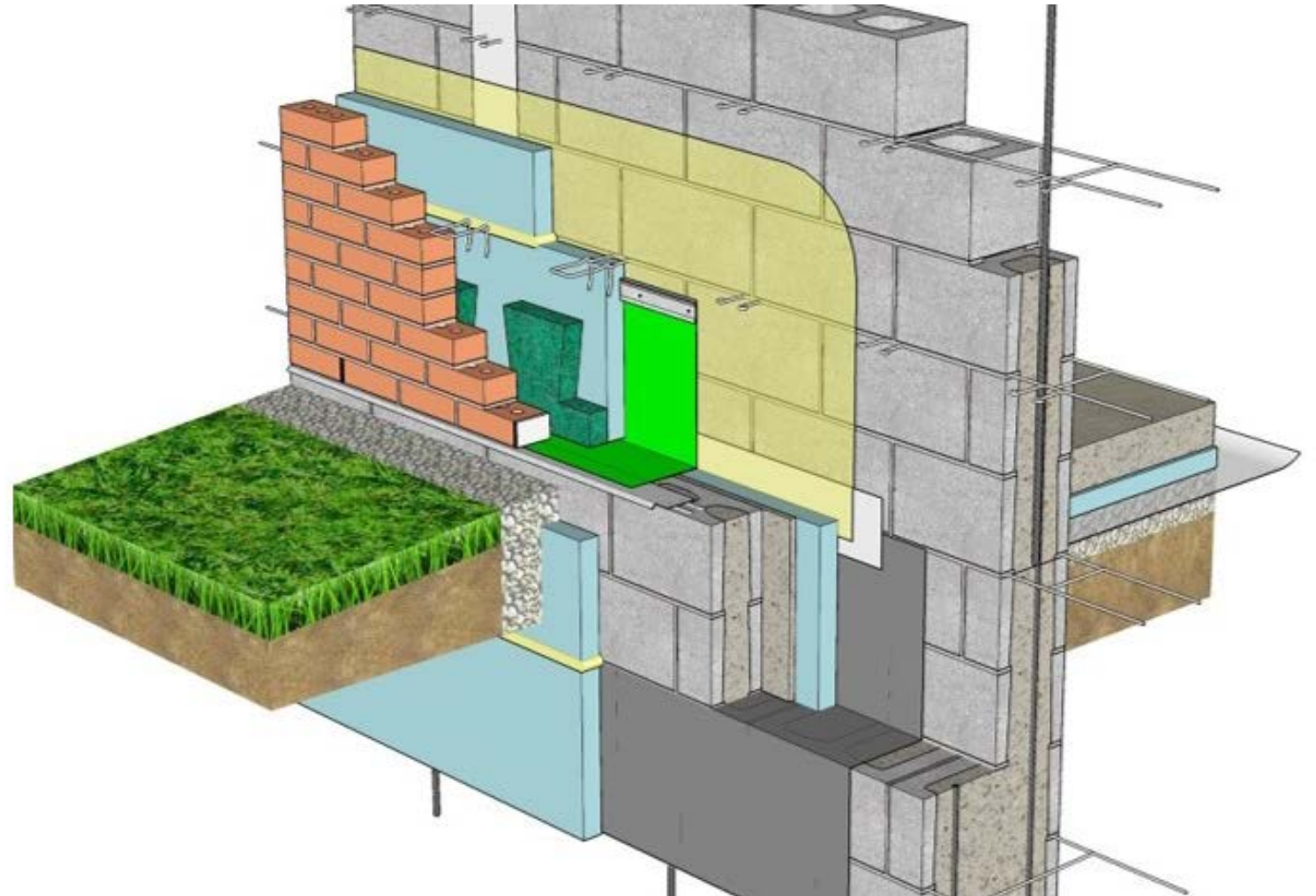




# ➤ Masonry Detailing Series

➤ Access hundreds of details across materials and crafts.

➤ [www.imiweb.org](http://www.imiweb.org)



## HIVE

**\$135** (Volume discounts apply - pricing varies based on amount of licenses purchased)

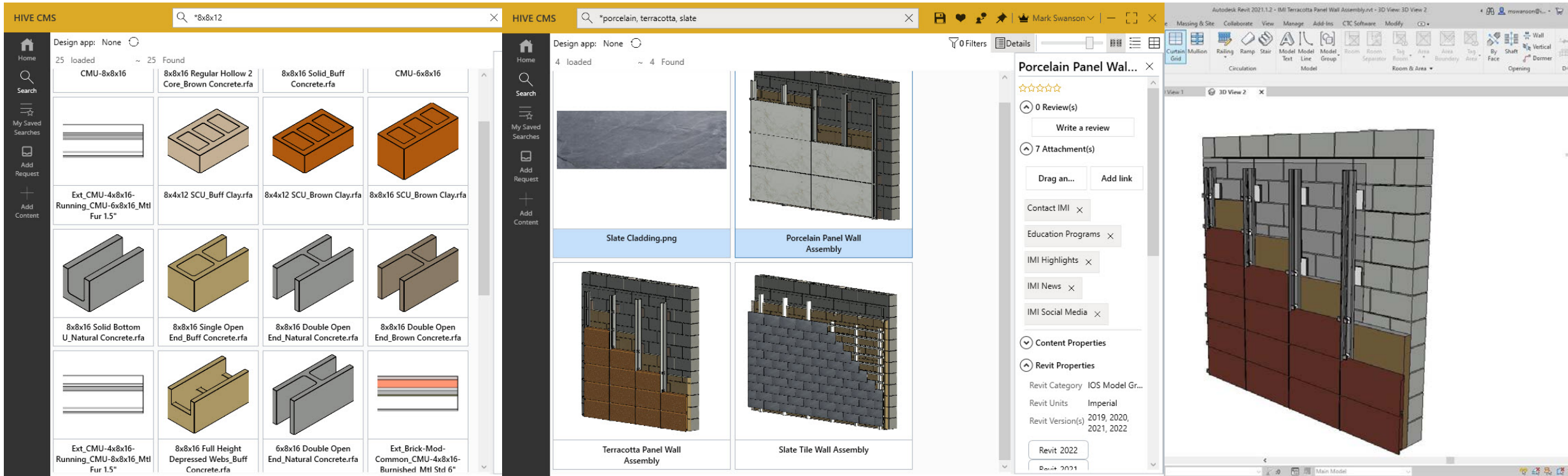
Per user for a 1 year subscription

- 1 + [ADD TO CART](#)

- [SIGN IN / SIGN UP](#)
- [TRY HIVE FREE FOR 14 DAYS](#)
- [WHITE PAPERS](#)
- [RELEASE NOTES](#)
- [WATCH DEMO VIDEO](#)
- [PRICING](#)
- [BROCHURE](#)

After the free trial period ends, the IMI free masonry content and HIVE public libraries will still be functional.

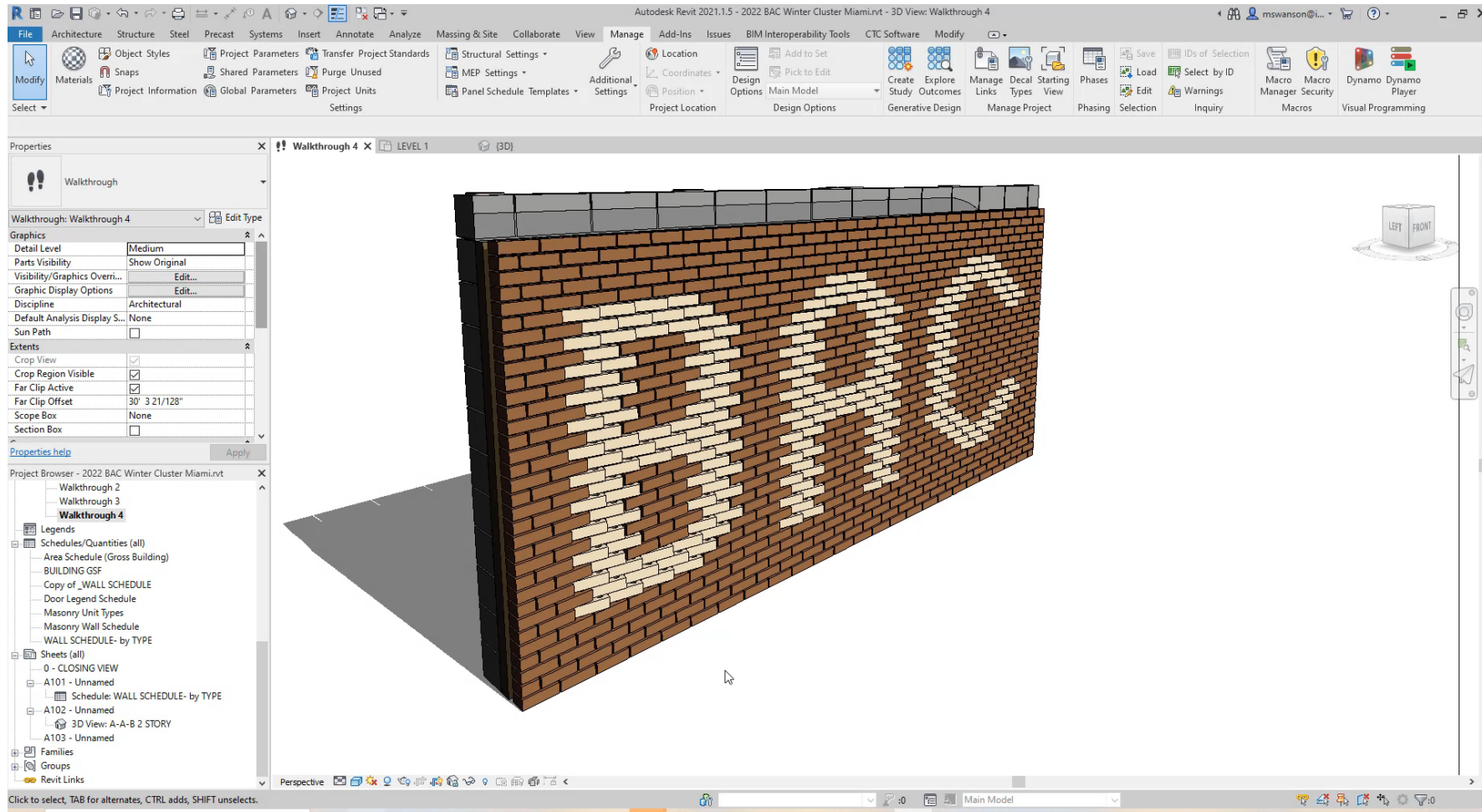




Individual masonry units

Rainscreen wall assemblies

Drop into Revit & modify







# **Why** The CRCT Was Developed

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Many prominent concrete structures in the U.S. are eligible for nomination and are beginning to require significant repair and restoration. Climate change is accelerating deterioration.





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- Almost 40% percent of our bridges are 50 years or older with 56,007 rated as structurally deficient in 2016.
- The average age of the 90,580 dams in the country is 56 years with deficient high hazard potential dams estimated at 2,170.
- 90% of concrete failures is attributed to a combination of inadequate installation, poor design or site management.





Coupled with the \$550 billion becoming available through **the Infrastructure Investment and Jobs Act (IIJA)**, a critical need has arisen for skilled, knowledgeable craftworkers to carry out this specialized work for decades to come.



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# ➤ Industry Training

➤ For installers

➤ Taken on greater importance in the industry to increase project success

Source: March/April 2024 ICRI CRB

## ICRI and the North Texas Chapter Team Up on Field Applicator Training Program

by Mark LeMay

Over the past six months, ICRI has been hard at work developing a pilot version of an exciting new program to better meet the needs of contractors in the field doing the hands-on work of concrete repair and restoration. After extensive preparation, ICRI, in conjunction with the North Texas Chapter, launched the pilot version of this new Field Applicator Training Program on December 13, 2023, at RTC Glass & Restoration facility in Carrollton, Texas. The all-day event was attended by 20 participants from NTX Contractor member companies (Fig 1). All participants are relatively new to the field of concrete repair and the majority were not familiar with ICRI guidelines.



Fig. 1: Group participants-Class photo

The training program is being developed by a Task Group of ICRI's Professional Development Committee to provide basic knowledge about reinforced concrete, substrate and surface preparation, repair materials and methods, and hands-on experience placing concrete repair materials in horizontal, vertical, and overhead applications. It is hoped that the program can eventually be conducted by ICRI Chapters and member companies under the guidance of ICRI's Subject Matter Experts.

### BASIS OF TRAINING PROGRAM

The Field Applicator Training program is based upon industry best practices as outlined in ICRI's published Technical Guidelines and utilizes much of the basic information contained in ICRI's Concrete Surface Repair Technician (CSRT) program. By developing the

Another benefit to this training program is that it complements the CSRT certification by targeting the repair applicator in addition to expanding ICRI'S offering to the repair industry. As a one-day, in-person training program, the classroom sessions alternated with hands-on workstations, educating, and demonstrating the various aspects related to the proper repair of concrete surfaces.

### PILOT PROGRAM

The first pilot program started with a classroom session presented by Stephen Grelle, PE, to review the components that make up reinforced concrete, the modes of concrete deterioration, and how to identify and properly remove areas of unsound concrete (Fig. 2). Special topics included identifying the locations and depths of embedded metal elements in a concrete element, using properly sized tools for the job, and outlining concrete removals around reinforcing bars, and proper repair geometry.



Fig. 2: Stephen Grelle, PE, presenting first classroom session

This session was followed by the first "workstation," where attendees had to acoustically sound a concrete slab using chain dragging, hammers, metal-sprocketed wheels, and steel rods to find and mark the delaminated and unsound sections of concrete (Fig. 3).

Surface preparation was the topic at the second workstation. The ICRI concrete surface profile (CSP) chips were on display, along with various tools and equipment used for surface preparation, including shotblasting

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# Introduction to IMI-IMTEF's

# Concrete Repair Certificate Training

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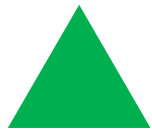
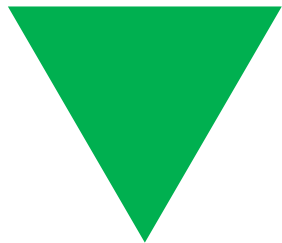
# ➤ Concrete Repair Certificate Training

- Developed by the **International Masonry Institute** in partnership with the **International Concrete Repair Institute**.
- A 3-day course offered partly online and in-person at the John J. Flynn BAC/IMI International Training Center in Bowie, MD.
- 28-hour minimum program that meets ASTM E2659-09 Standard Practice for Certificate Programs.



# ➤ Concrete Repair Certificate Training

- Bricklayer and Allied Craftworker Members must attend and pass ICRI'S Concrete Surface Repair Training online course prerequisite to participating in the IMI/IMTEF Concrete Repair Certification hands-on portion at the International Training Center.



**CSRT**  
A Self-Guided  
Training Program  
Focused On  
Concrete  
Surface  
Repair

## Concrete Surface Repair Technician (CSRT) Online Program

The Education Course provides a fundamental knowledge and a number of best practices in concrete surface repair:

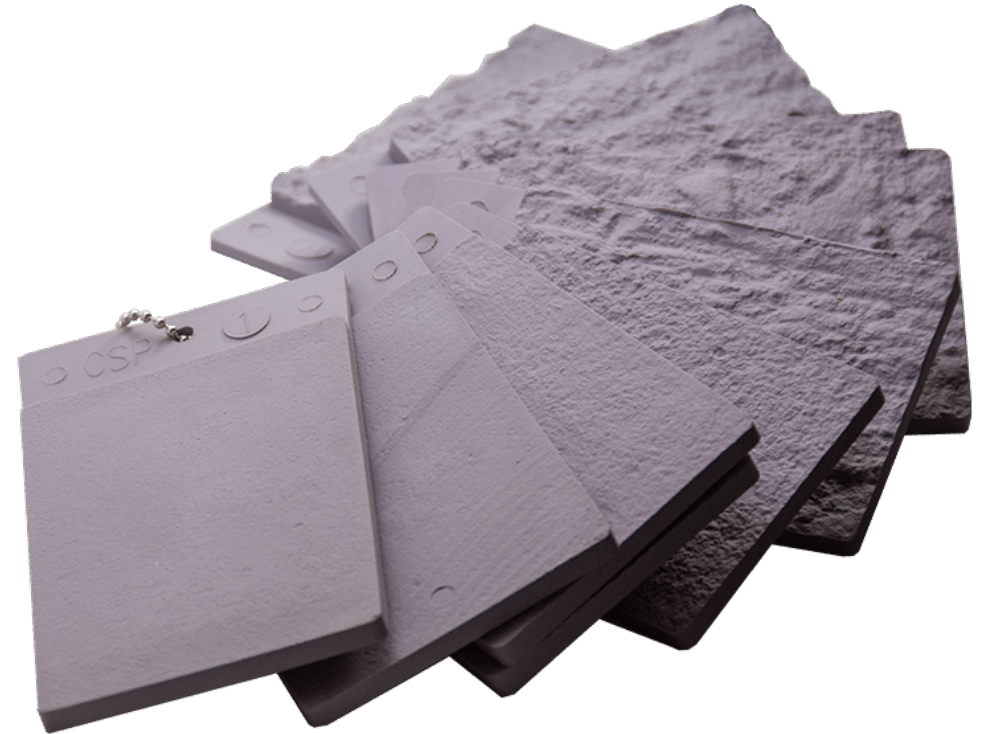
- Build your concrete repair knowledge
- Provide valuable training to your employees
- Learn at your own pace from industry experts you can trust
- Gain essential knowledge and training from your office or home

CSRT Online Program

# ➤ Concrete Repair Certificate Training

## Day 1 ICRI CSRT **Online** Course Modules

- CSRT Module 1: What is Reinforced Concrete?  
Deterioration of Concrete?
- CSRT Module 2: Quality Requirements for Concrete  
Surface Repair
- CSRT Module 3: Concrete Repair Methods and Materials
- CSRT Module 4: Quality Controls for Concrete Surface  
Repairs – Preplacement
- CSRT Module 5: Quality Controls for Concrete Surface  
Repairs – Post Placement Inspection



# ➤ IMI Classroom Curriculum

- Module 1: Intro to Concrete, and its Deterioration Mechanisms
- Module 2: Intro to Concrete Condition Assessment
- Module 3: Concrete Repair I (Patch Repair)
- Module 4: Concrete Repair II
- Module 5: Historic Concrete Matching Methodology

## NATURAL CEMENT VS PORTLAND CEMENT

- Natural cement is made from a type of limestone with a high clay content that occurs naturally as an impurity **VS Portland cement, which is made from artificial mixtures of limestone and clay or shale, gypsum and other additives .**
- Natural cement is **more permeable, and less brittle but is softer than modern day Portland.**
- Portland cement reaches much **higher compressive strength** than natural cements.





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### CONCRETE ALKALI SILICA REACTION (ASR)

For alkali-silica reaction to occur, three conditions must be present:

- Reactive forms of silica in the aggregate
- High-alkali (pH) solution
- Sufficient moisture [RH80%]

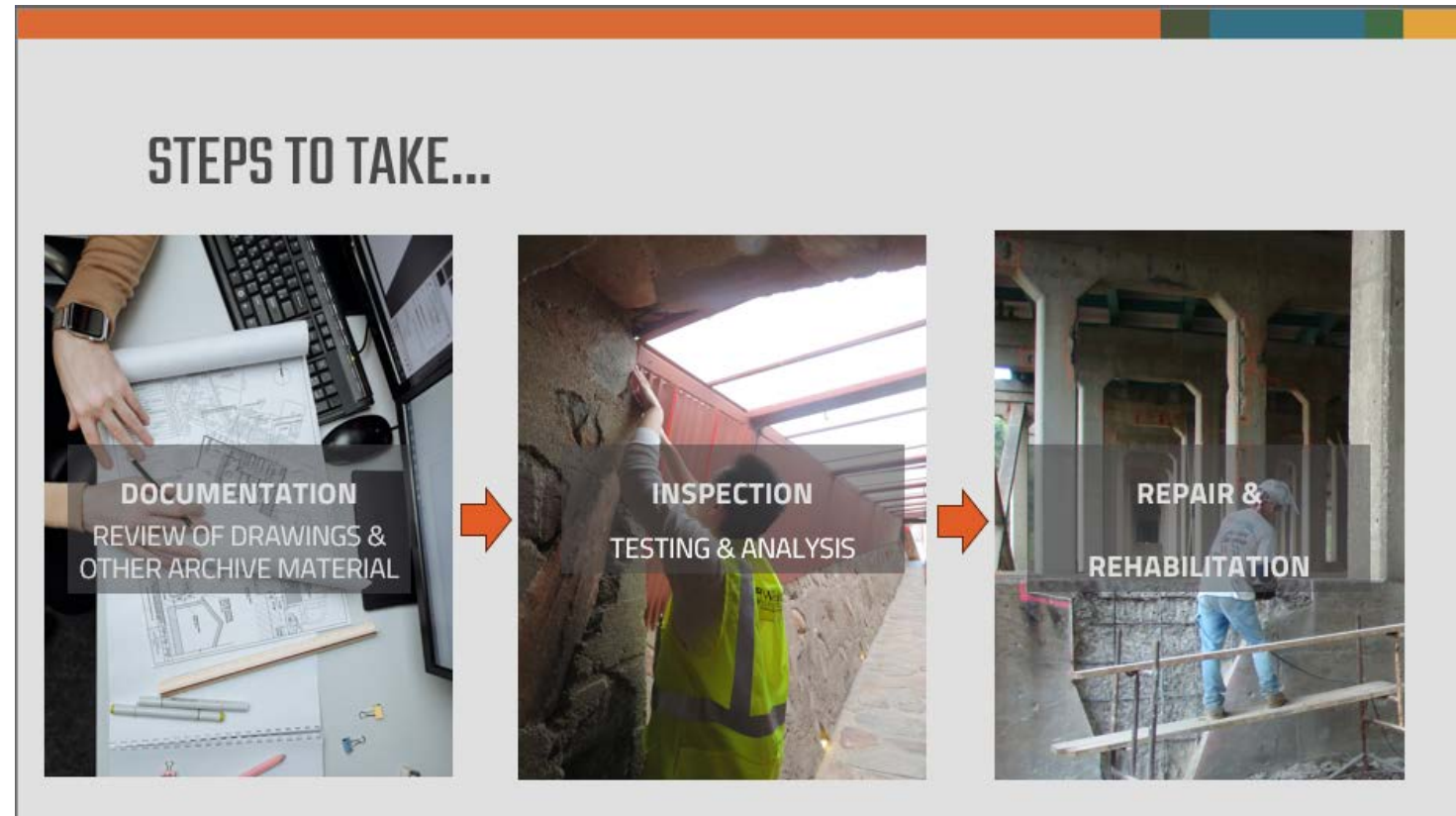
**COMMON REACTIVE AGGREGATES:**

- **Opal**—more than 0.5% by mass
- **Chert or Chalcedony**—more than 3.0%
- **Natural volcanic glasses**—more than 3.0%

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## CONCRETE REPAIR **FIRST STEP**



- Perform a **sounding survey** to determine the extent of the delaminated and deteriorated area. Mark the area and receive **proper approval before proceeding with any work.** (Refer to: *ASTM D4580-03 Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding*)
- Perform a **cover survey** to identify the configuration (spacing) and depth of the steel reinforcement to avoid damaging the reinforcement during the demolition work.

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Sounding survey

Cover Survey



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## 2.2 Remove & Demo deteriorated concrete

### CONCRETE REPAIR **SECOND STEP**



**Why is important to remove concrete behind the corroded or damaged embedded steel?**

- Provides the necessary mechanical key so that the repair can meet structural requirements and does not detach.
- Allows access to clean and re-embed the original steel with a new concrete alkaline passive film
- Ensures removal of all damaged or chemically contaminated concrete

This is also important when the original concrete is heavily contaminated with chlorides and others external contaminants – example parking garages, bridge decks etc.





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## CORROSION INHIBITORS CONCRETE COATING

Corrosion Inhibitors are used to mitigate corrosion activity and can affect steel reinforcement in concrete in two ways:

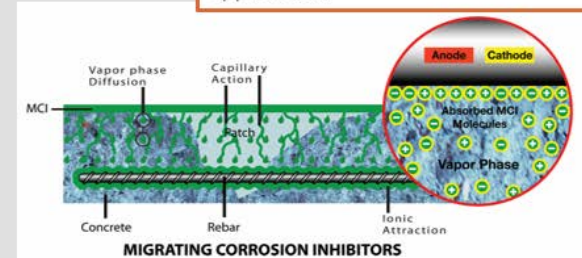
- By **delaying the time of depassivation** by strengthening the passive film
- By **reducing the corrosion rate** after depassivation.

An inhibitor fits into one of three broad electrochemical classes: (a) anodic, (b) cathodic and (c) mixed, depending on whether it affects the anodic reaction, the cathodic reaction, or both.

### REPORTED ISSUE FROM THE FIELD:

- PENETRATION PROBLEMS
- ELECTROCHEMISTRY IMBALANCE

Follow manufacturer's instructions for application.



### TWO TYPES CORROSION INHIBITORS

- SURFACE APPLIED
- MIXED-IN

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## MORE ELECTROCHEMICAL REPAIRS

Reference:  
NACE Report 01101 Electrochemical Chloride Extraction – A State of the Art Report 7.4.4  
NACE Standard SP0107-2017

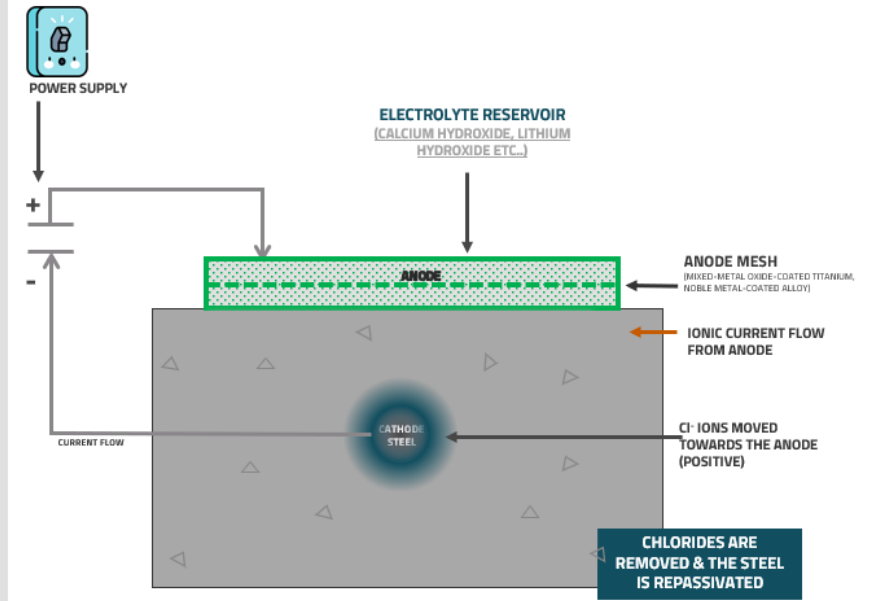
### CHLORIDE EXTRACTION

Electrochemical chloride extraction (ECE) is a form of **desalination**, which **extracts chloride ions** from contaminated concrete and **reinstates the passivity of steel** reinforcement.

Temporary Installation / Non-destructive  
Time: Approx. 6-8 weeks

#### When to adopt this method?

Chloride extraction is used for structures that are suffering of chloride attack. (Contain high levels of chlorides).





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## HISTORIC CONCRETE TESTING & MOCK-UPS

### ASSESSMENT

**What is the original concrete made of?**

**N.B.** Modern repair materials are generally stronger, more freeze-thaw resistance etc.. than historic concrete.

Polymer-modified materials are often NOT appropriate for repair of historic concrete. Polymer-modified materials contain polymers although improving its bond strengths, but they reduce the permeability of the material...

**INCOMPATIBILITY OF THE MATERIAL AND INCORRECT SELECTION CAN LEAD TO ACCELERATED DETERIORATION.**





# ➤ IMI Hands-On Curriculum

- Wall Vertical Patch Repair:  
Repair Area Preparation
- Anchorage and Reinforcing Steel
- Concrete Mixes
- Concrete Matching Mixes
- Repair Mix Installation
- Remove Formwork and Review  
Concrete Repair Modules 4 & 5



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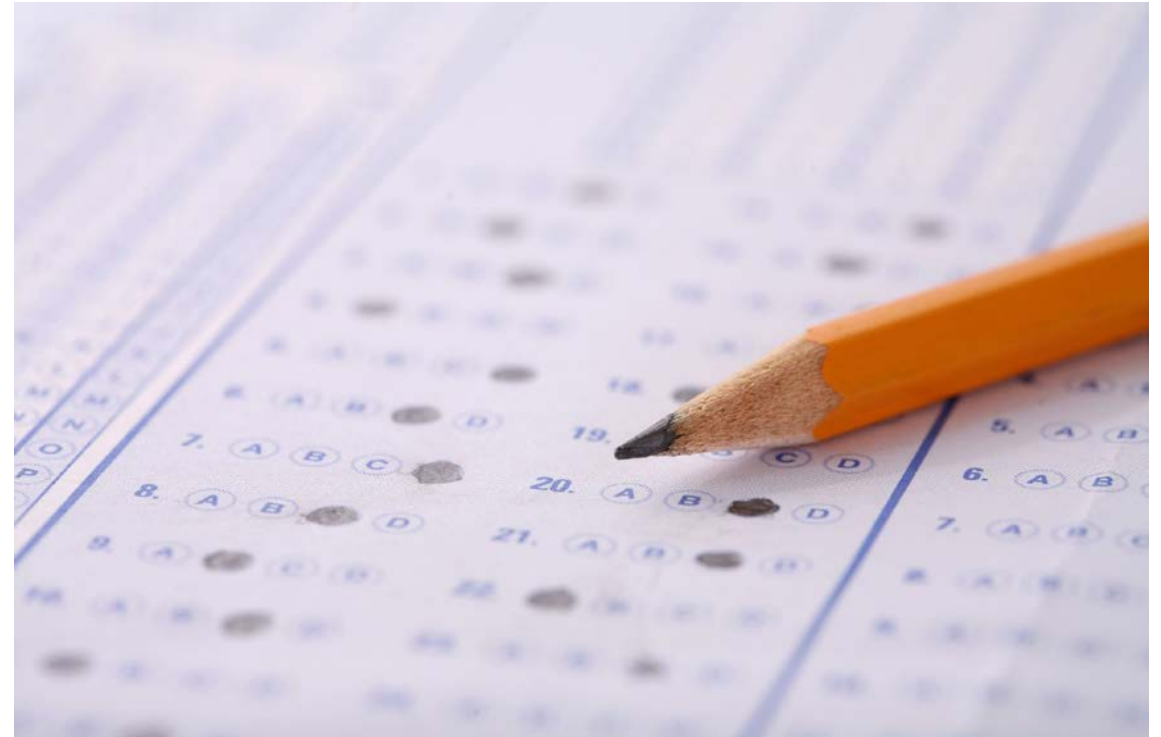
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  - Repair Mix Installation
  - **Remove Formwork and Review Concrete Repair**
- Modules 4 & 5**



# ➤ IMI Review & Exam

- Review and Final Exam:
- Instructor led review of the program material in advance of the examination
- 50-Question Exam
- Passing the Exam is required to gain the certificate





# How The CRCT Was Developed

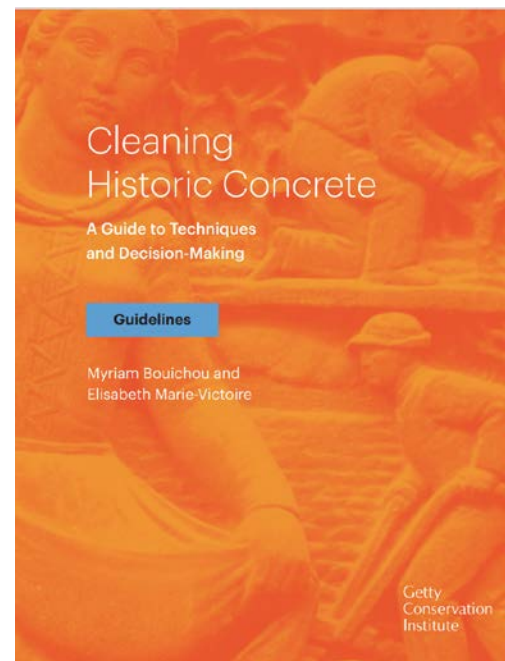
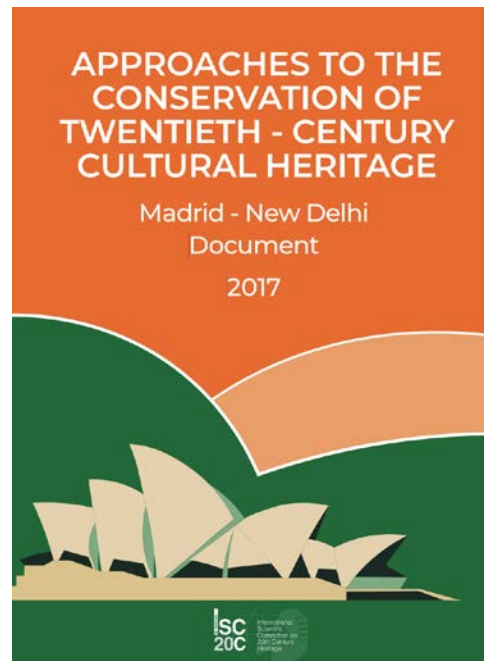
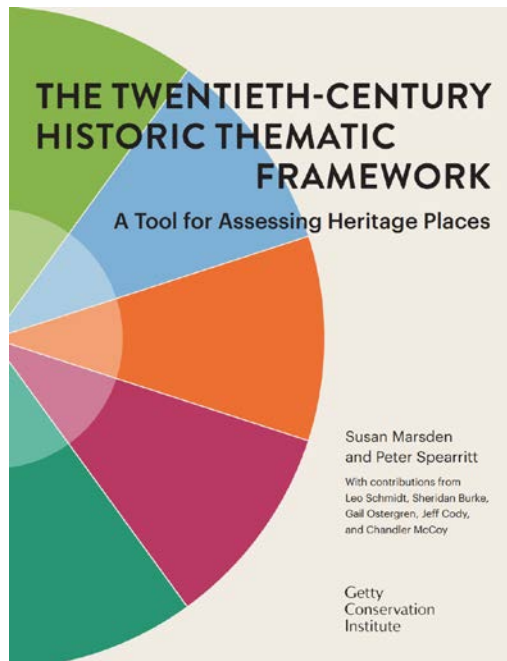
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# ➤ Review of Existing Material

- Professional consultants reviewed the ICRI CSRT Training to understand how the IMI training could compliment, and build off that material
- Existing IMI Journeyworker Upgrade Trainings were reviewed to align training framework
- Industry Literature Review of Concrete Repair from 1960 to present day



# ➤ Curriculum Development

## Develop PowerPoint Presentation Material and Critical Learning Objectives

- Incorporate:
  - Case Studies & Graphics-Pictures
  - Introduction to Electrochemical Repairs
  - Statistical Data





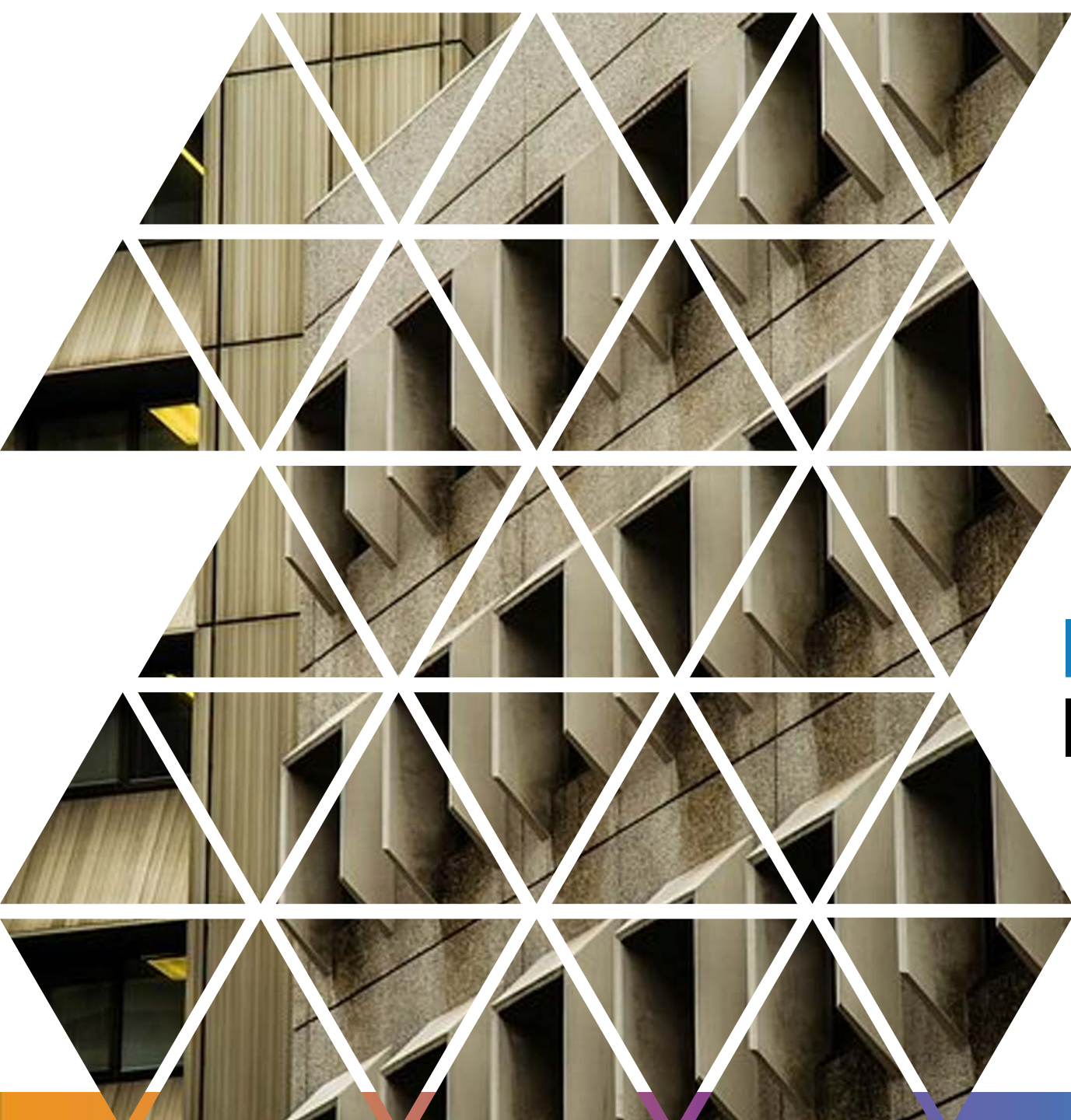
# ➤ Curriculum Development

## Developed Training Modules And Critical Learning Objectives With IMTEF Staff

- Survey Methods
  - Carbonation Test In Class
  - Hands-on Basic Concrete NDT Assessment
- Removing Deteriorated Concrete Through Various Methods
- Patch Repairs
- Matching For Historic Concrete Repair







# Pilot Program and Inaugural Year

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# ➤ Curriculum Development

- First training: Fall 2023
- First training season: Winter 2024
- First season, and course feedback used to make minor changes





➤ **Thank you!**

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