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ICRI 2022 Spring Convention

Case Study – Precast Concrete Louver Repairs

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ICRI CONCRETE REPAIR
Restore | Repurpose | Renew

Learning Objectives

- Understand importance of identifying sources of deterioration before implementing repairs
- Understand value of developing multiple repair options for building owners so they can make educated decisions on the maintenance of their building.
- Derive logistical challenges during construction and the value of a collaborative team effort.
- Realize value of planning for large projects proactively vs. reactively.

Overview

- 61-story condo building
- Built in 1990
- 15-story parking structure abuts tower
- Facade:
  - Precast panels with exposed aggregate finish
  - Precast concrete louvers at 1st through 15th floors

Overview

- Concrete louver configuration:
  - 6 trapezoid-shaped horizontal rungs
  - Lower floors – Solid panels with replicated rungs
  - Total of 492 louvers

History

- Concrete deterioration identified in 2008


DNA3

History

- Concrete deterioration identified in 2008
- Partial or full-depth repairs performed in 2009


FRIENDLY

History

- Concrete deterioration identified in 2008
- Partial or full-depth repairs performed in 2009
- Adjacent areas exhibited deterioration within a few years
- Deterioration progressed faster than anticipated

Ring Anode Effect (Halo Effect)

- Accelerated corrosion of reinforcing around patches
- Occurs when patch properties are different than surrounding concrete
  - Conductivity
  - pH
  - Permeability (moisture)

Figure A

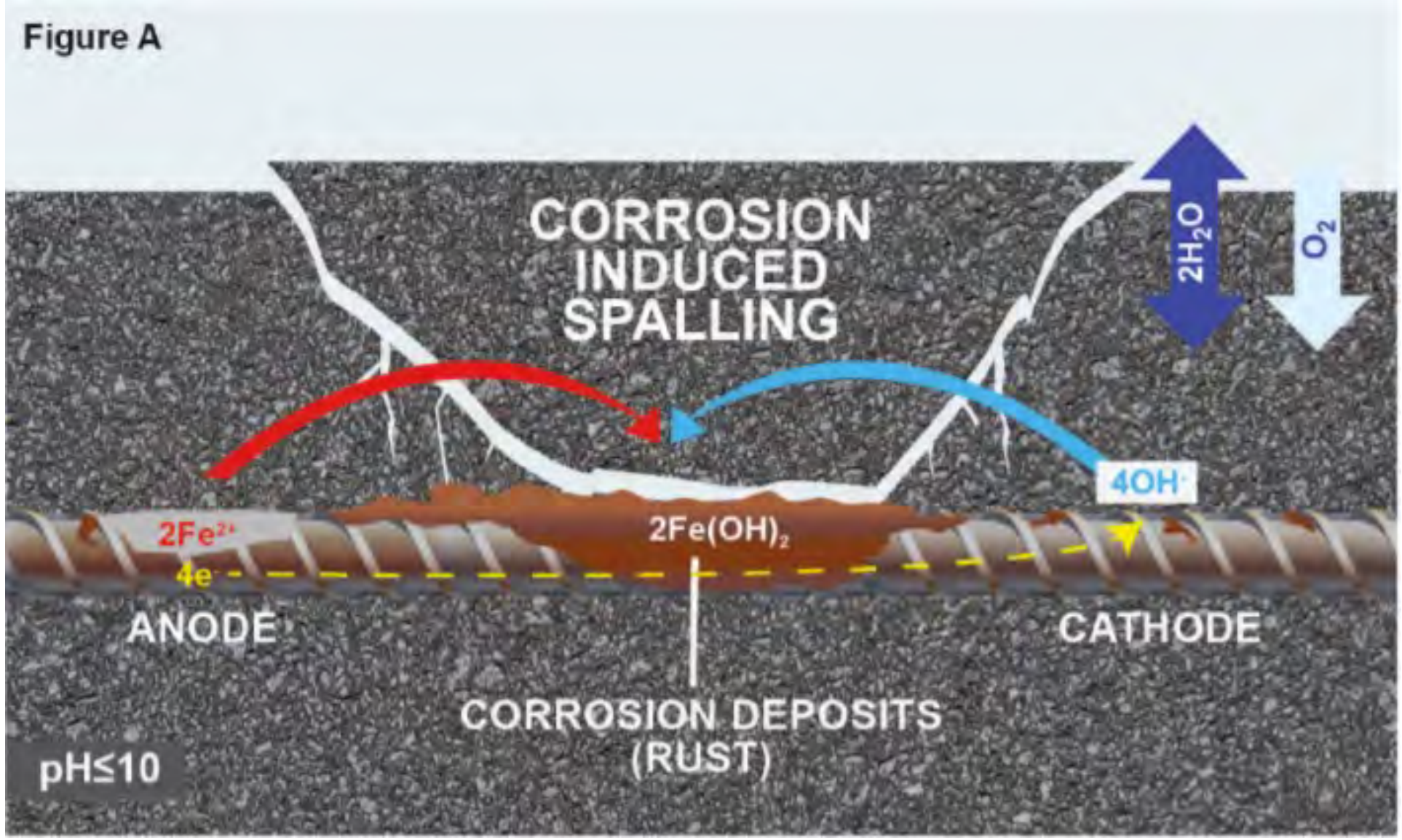
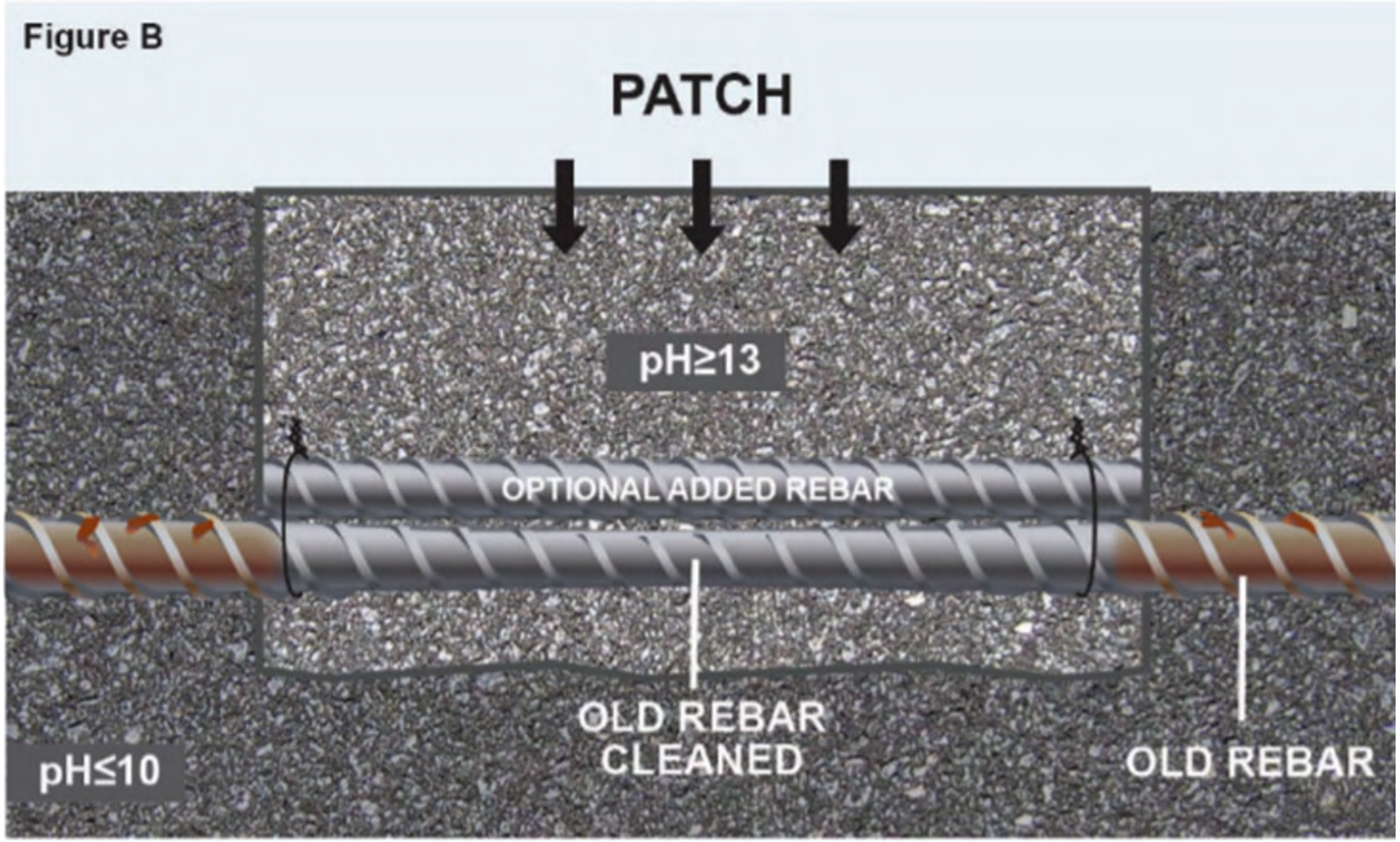


*Image from concreteprotection.com



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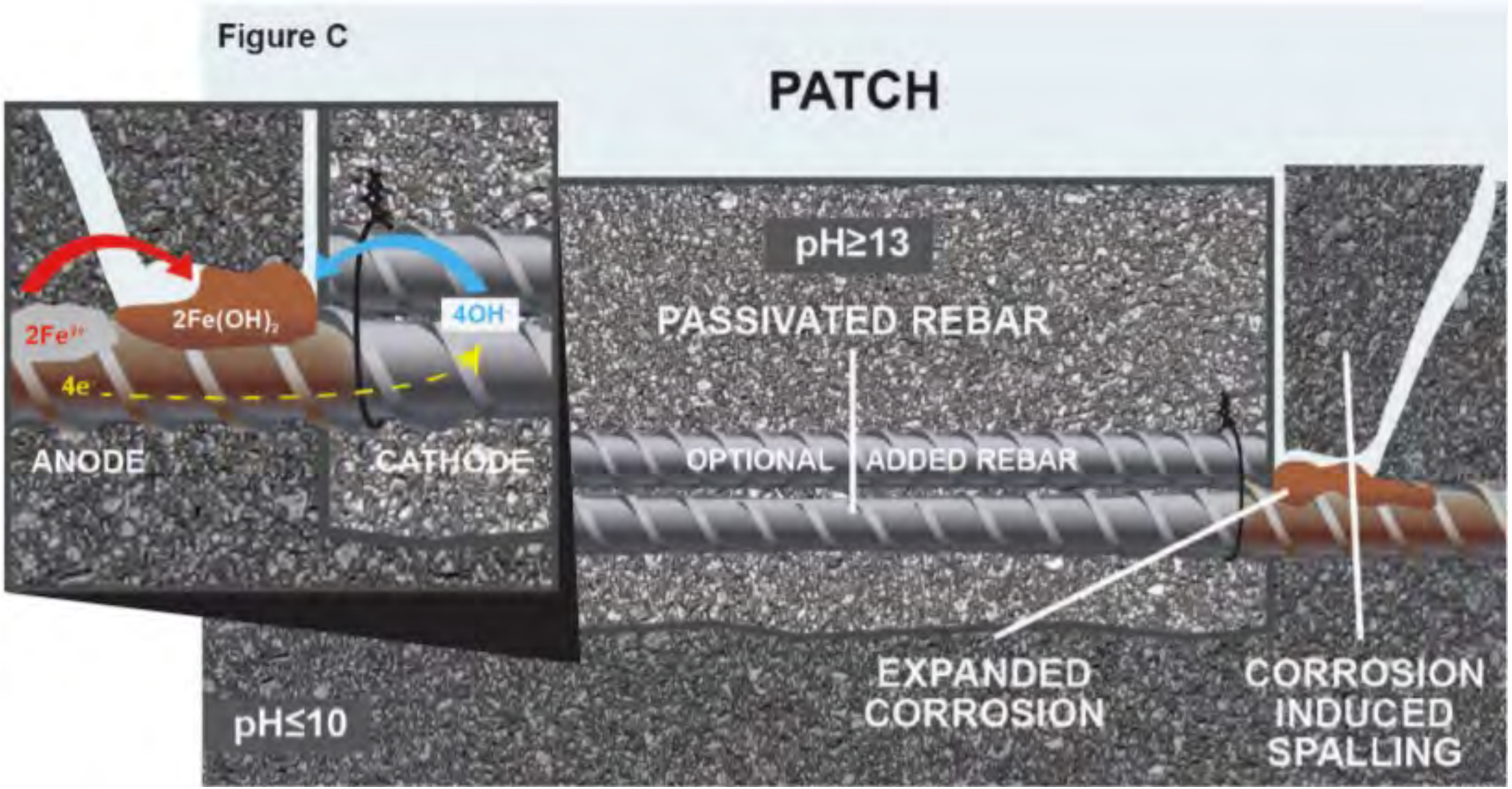
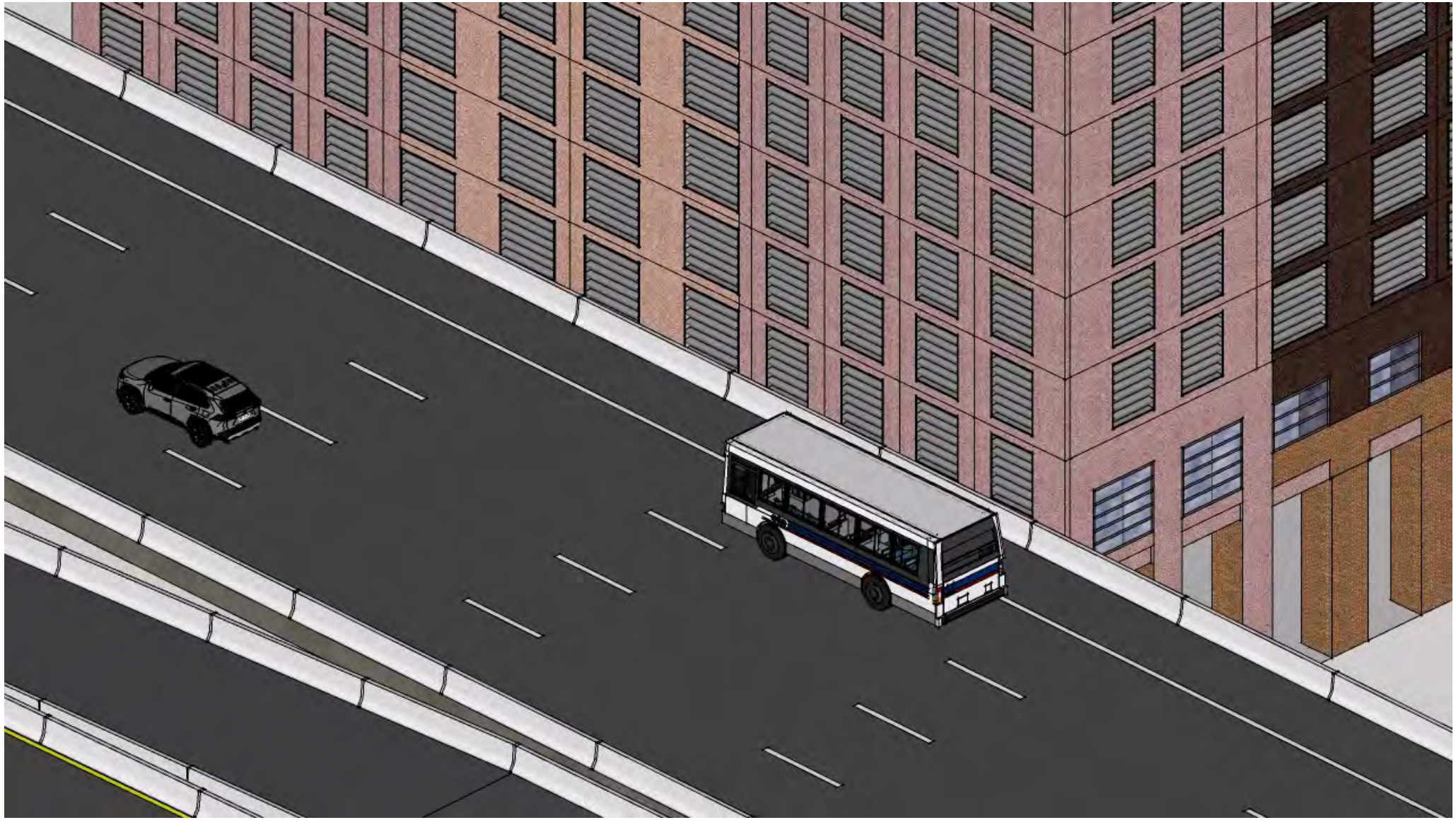


*Image from concreteprotection.com

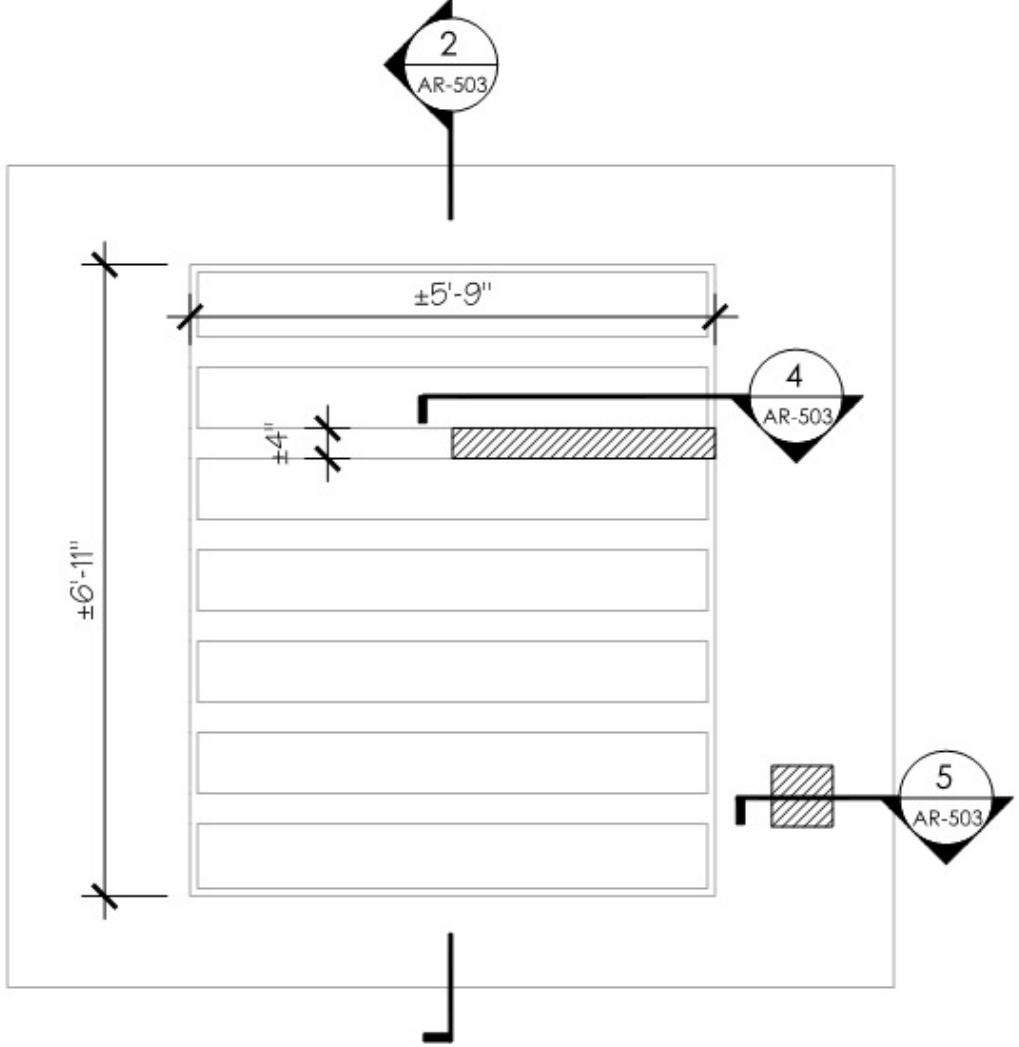
History

- Deterioration attributed to:
  - Insufficient cover over reinforcing steel
  - Near horizontal surfaces on louver rungs
  - Salt spray from Lake Shore Drive

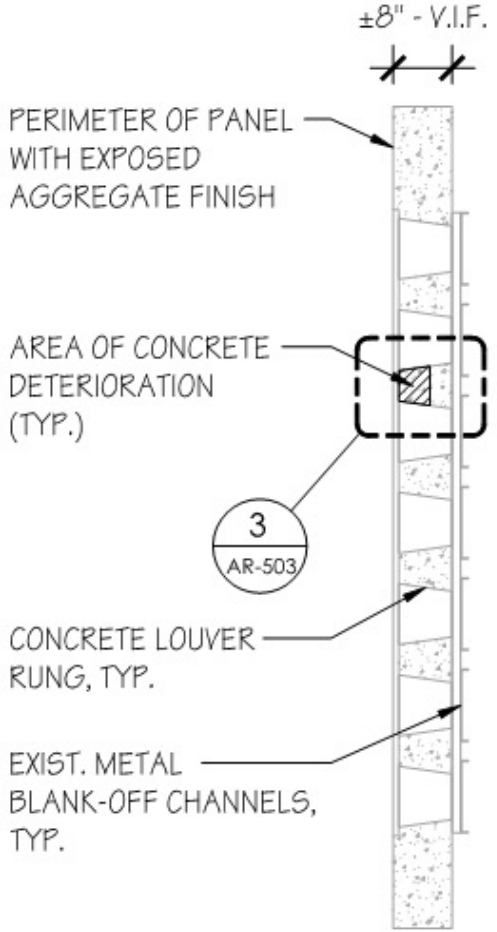


Development of Repair Options

- Conceptual repair options developed in 2015
  - Level 1:
    - Conventional concrete repairs
    - Acrylic waterproofing coating
  - Level 2:
    - Conventional concrete repairs
    - Elastomeric waterproofing membrane



1 TYPICAL ELEVATION AT TYPE I LOUVER REPAIR
1/2" = 1'-0"



2 TYPICAL SECTION
1/2" = 1'-0"

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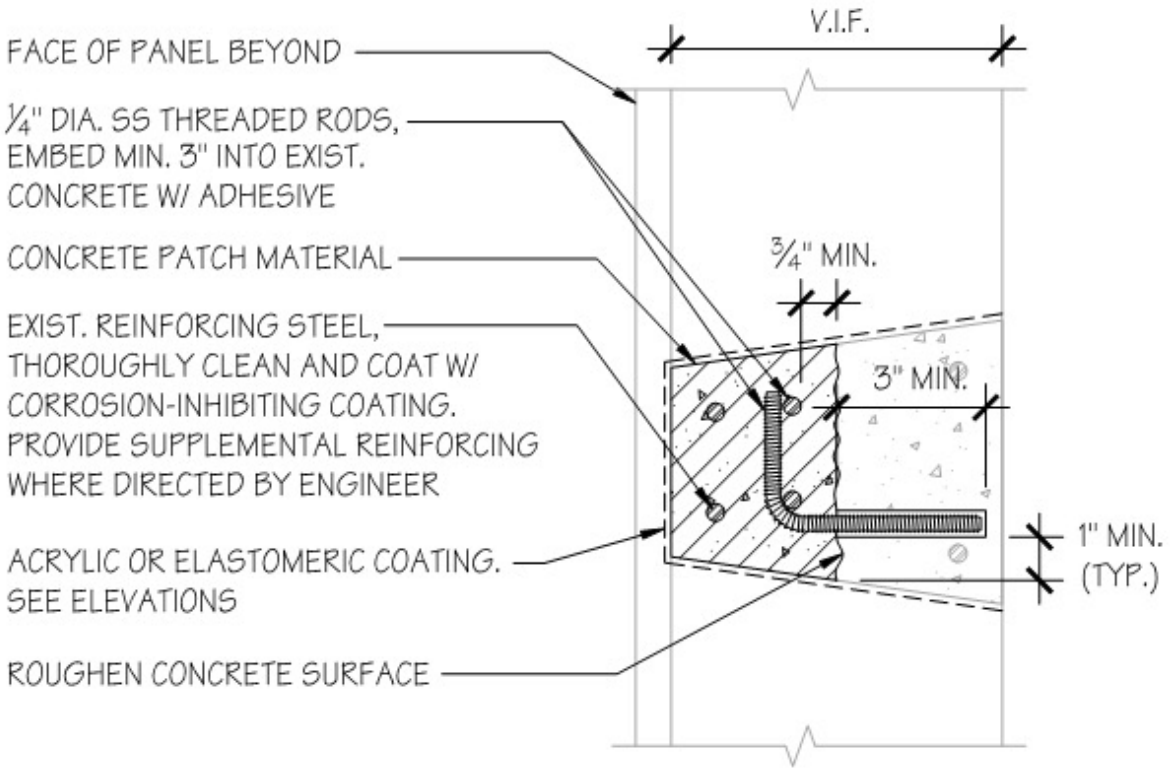
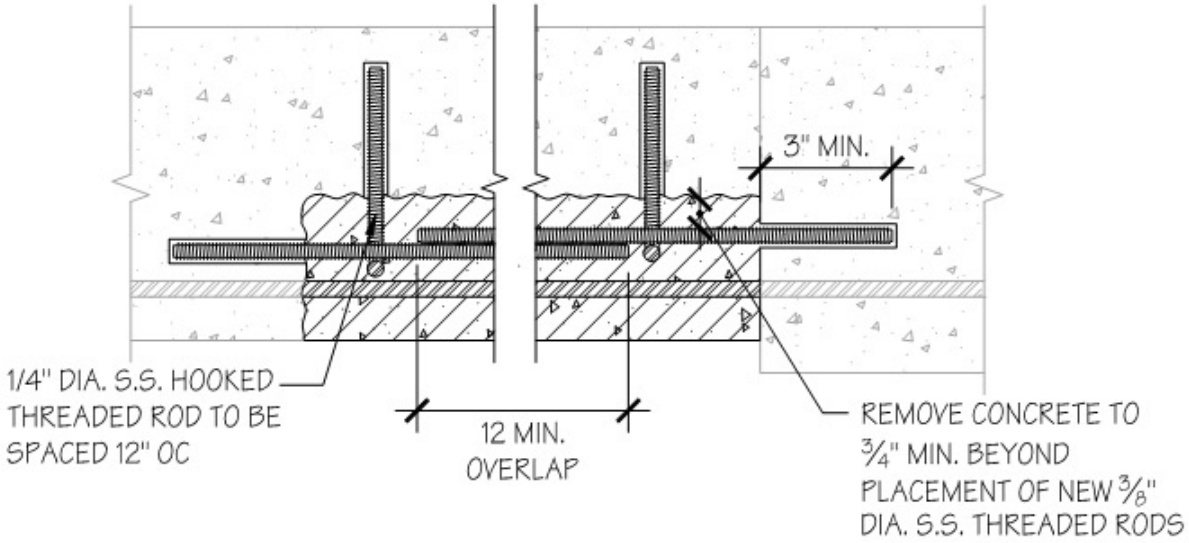
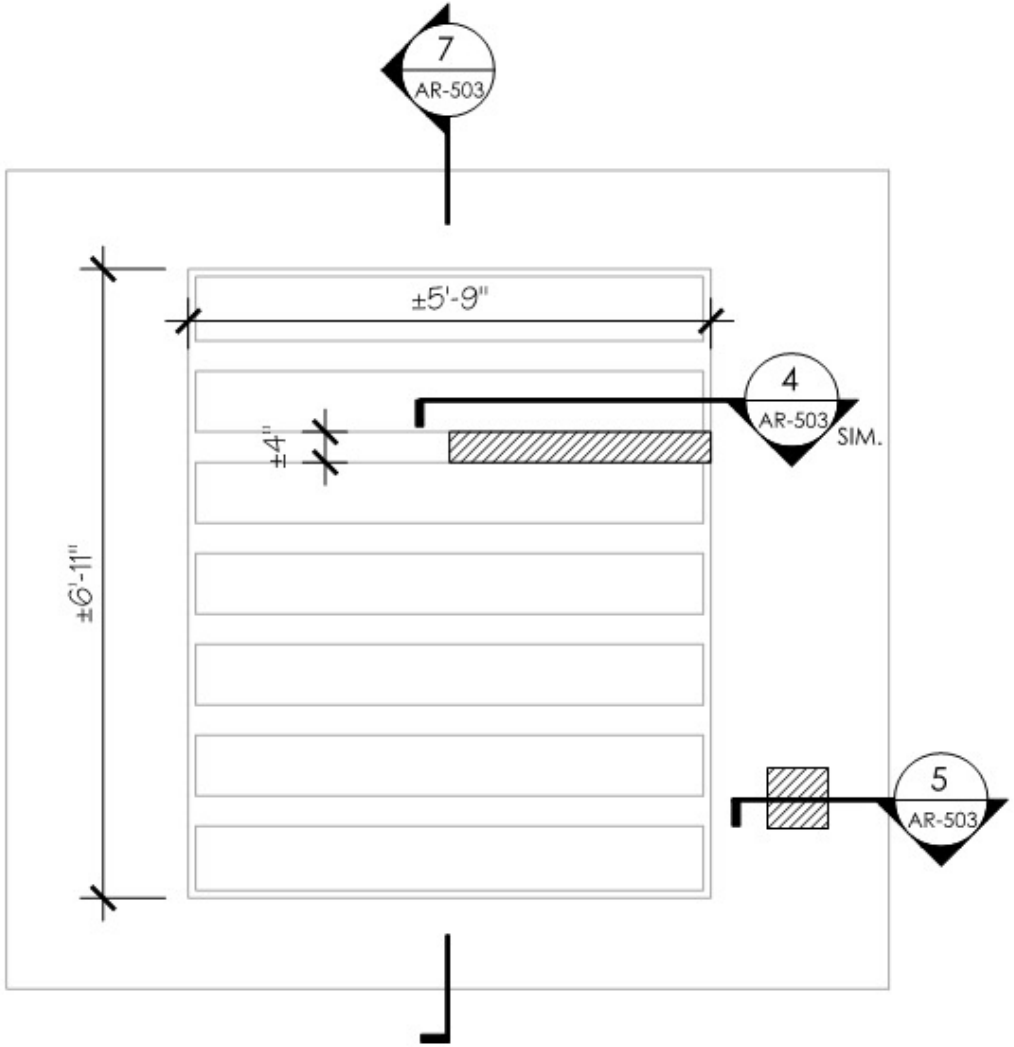


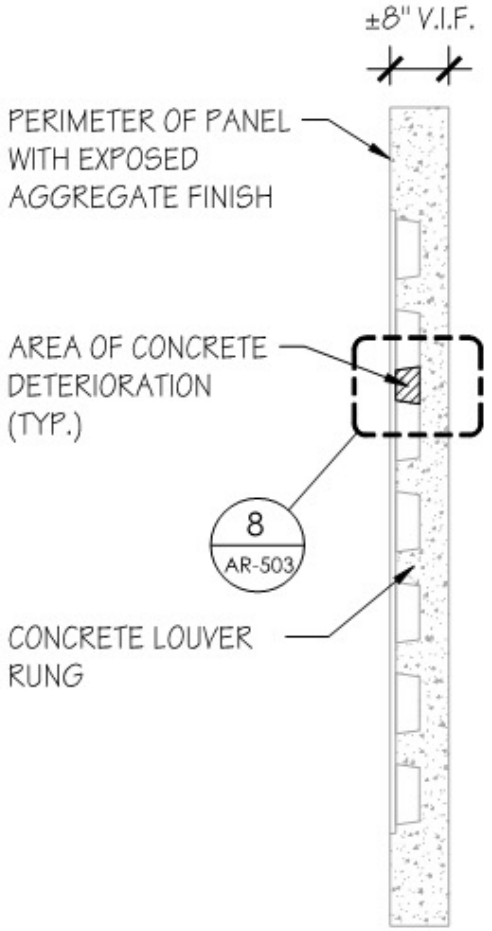
3 REPAIR SECTION
3" = 1'-0"



4 REPAIR SECTION
3" = 1'-0"

ICRI CONCRETE REPAIR



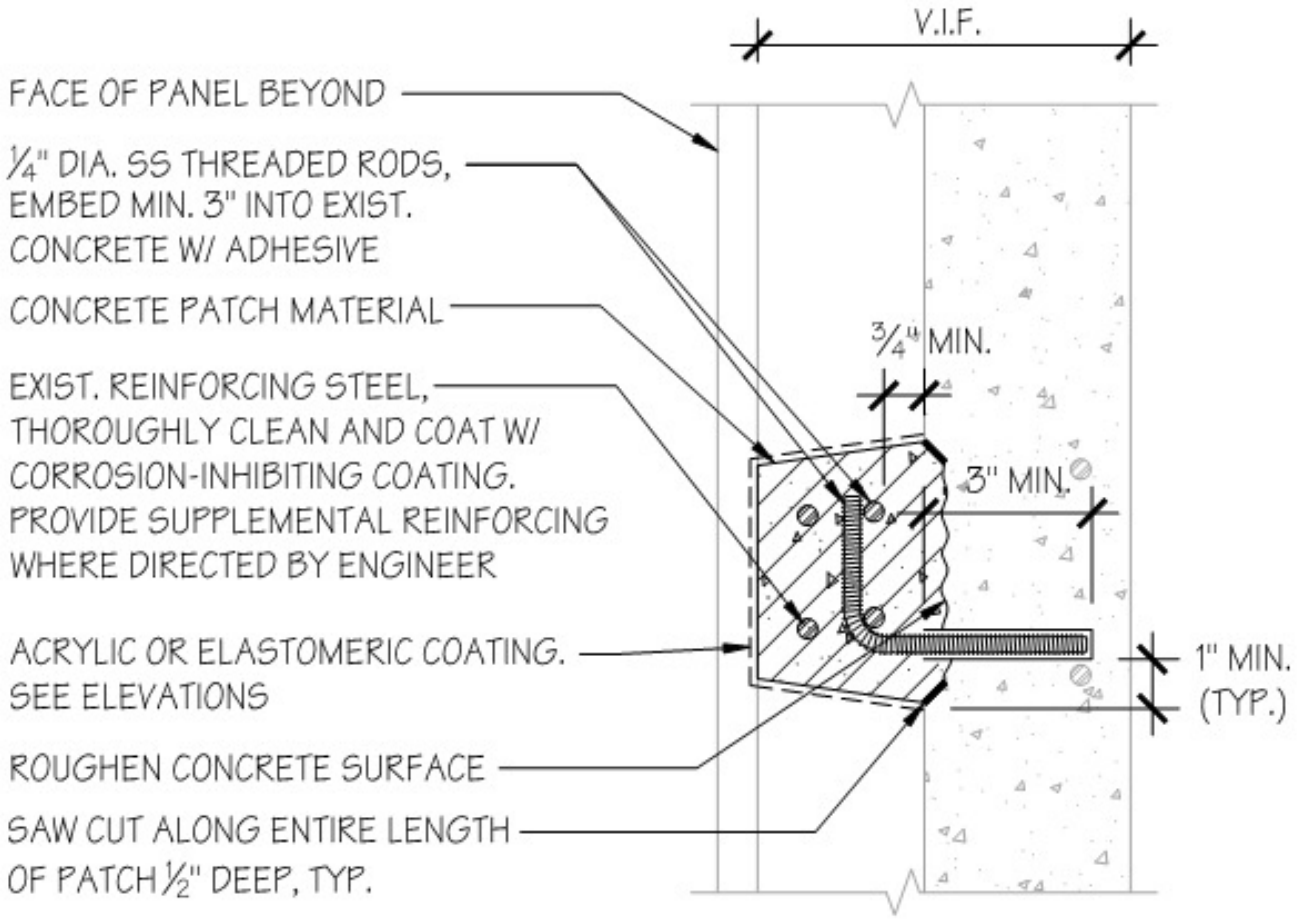


6 TYPICAL ELEVATION AT TYPE II LOUVER REPAIR

1/2" = 1'-0"

7 TYPICAL SECTION

1/2" = 1'-0"

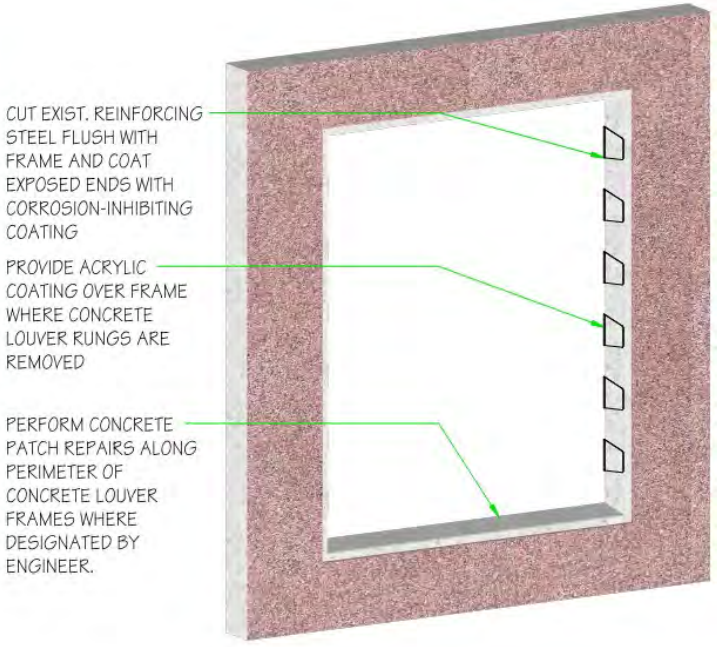


8 REPAIR SECTION
3" = 1'-0"

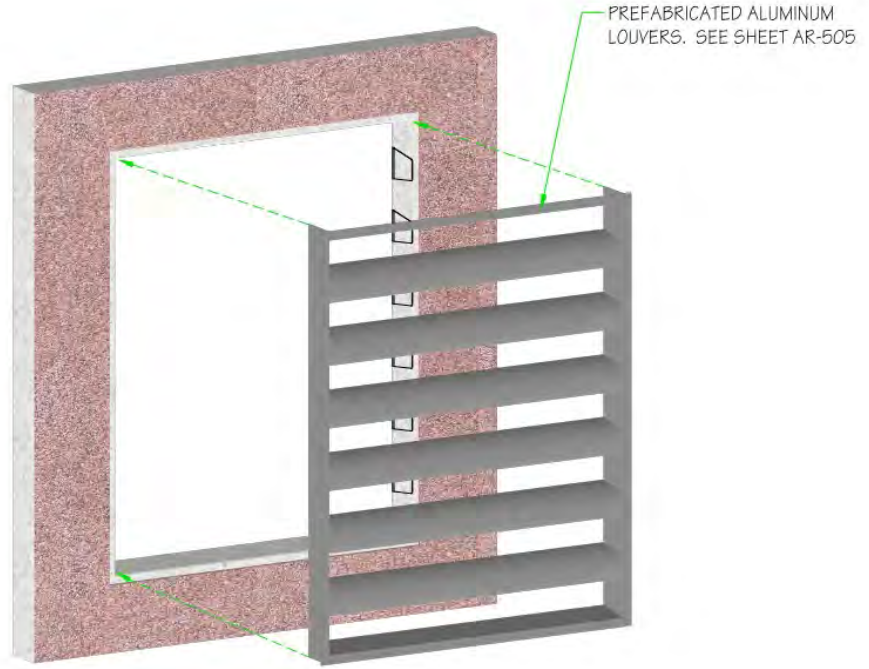
Development of Repair Options

- Conceptual repair options developed in 2015
  - Level 1:
    - Conventional concrete repairs
    - Acrylic waterproofing coating
  - Level 2:
    - Conventional concrete repairs
    - Elastomeric waterproofing membrane
  - Level 3:
    - Over-cladding with prefabricated GFRC “caps”
  - Level 4:
    - Remove rungs
    - Install prefabricated aluminum louvers

STEP 1
EXTERIOR VIEW



STEP 2
EXTERIOR VIEW



STEP 3
EXTERIOR VIEW

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Repair Recommendations

- Highest level of repairs for highest chloride exposure
- Lower-level repairs for other areas
- Recommended a combination of Level 1, 2, & 4 repairs

1 PARTIAL EAST ELEVATION
1/8" = 1'-0"

PRECAST CONCRETE LOUVER FINISH SCHEDULE

- PREFABRICATED COATED ALUMINUM LOUVERS (BASE BID)
- SILICONE ELASTOMERIC COATING (BASE BID)
- ACRYLIC PROTECTIVE COATING (BASE BID)

LEGEND

- TYPE 1 SEALANT JOINT
- TYPE 3 SEALANT JOINT
- TYPE 4 SEALANT JOINT
- I TYPE I CONCRETE LOUVER
- II TYPE II CONCRETE LOUVER

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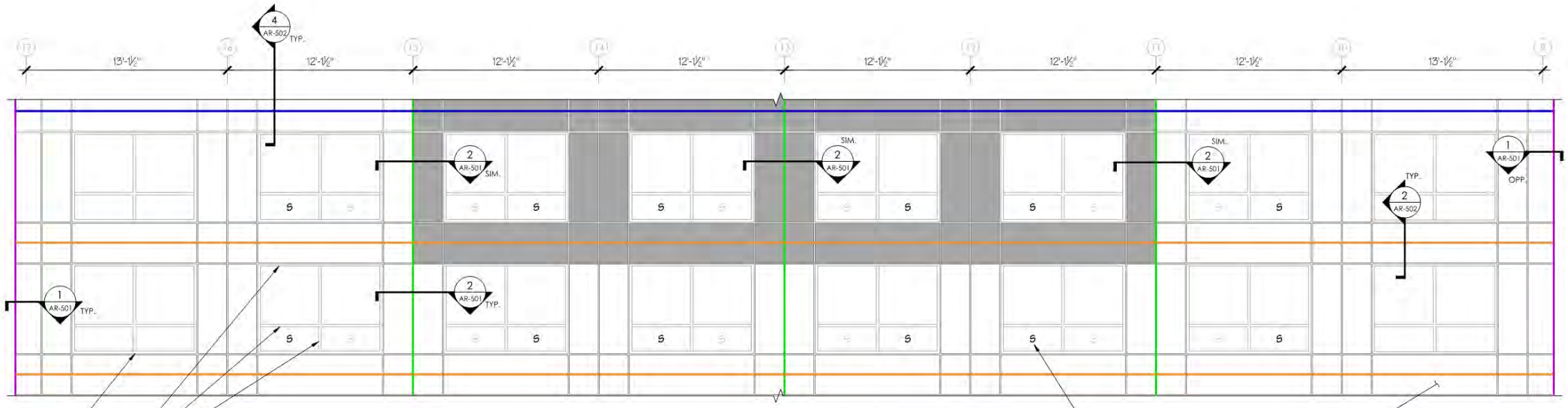
Repair Implementation

- Shared financial responsibility for facade maintenance
- Extensive deliberation between HOA and commercial owner
- Periodic make-safe repairs until full repairs could be implemented

Meanwhile.....

- Sealant at precast joints and window perimeters neared end of useful life
- HOA budgeted for proactive comprehensive sealant replacement project in 2018 and/or 2019



REMOVE AND REPLACE WINDOW PERIMETER SEALANT AT WINDOWS ON 16TH FLOOR AND ABOVE, TYP.

REMOVE EXPOSED PORTIONS OF EXIST. GLAZING GASKETS WHERE DESIGNATED BY ENGINEER AT WINDOWS ON 16TH FLOOR AND ABOVE. PROVIDE NEW LIQUID-APPLIED GLAZING SEALANT WHERE EXPOSED PORTIONS OF EXIST. GLAZING GASKETS ARE REMOVED

EXIST. PRECAST CONCRETE FACADE PANELS WITH EXPOSED AGGREGATE FINISH. PERFORM CONCRETE PATCH REPAIRS WHERE DESIGNATED BY ENGINEER. ROUT AND SEAL CRACKS WHERE DESIGNATED BY ENGINEER. SEE DETAILS 5/AR-503 AND 9/AR-503.

PROVIDE WINDOW SCREENS ADJACENT TO EXISTING WINDOW SCREENS, TYP. (ALTERNATE 2).

1 ENLARGED PARTIAL ELEVATION

1/4" = 1'-0"

LEGEND

- TYPE 1 SEALANT JOINT
- TYPE 2 SEALANT JOINT
- TYPE 3 SEALANT JOINT
- TYPE 4 SEALANT JOINT
- EXIST. WINDOW SCREEN
- S NEW WINDOW SCREEN

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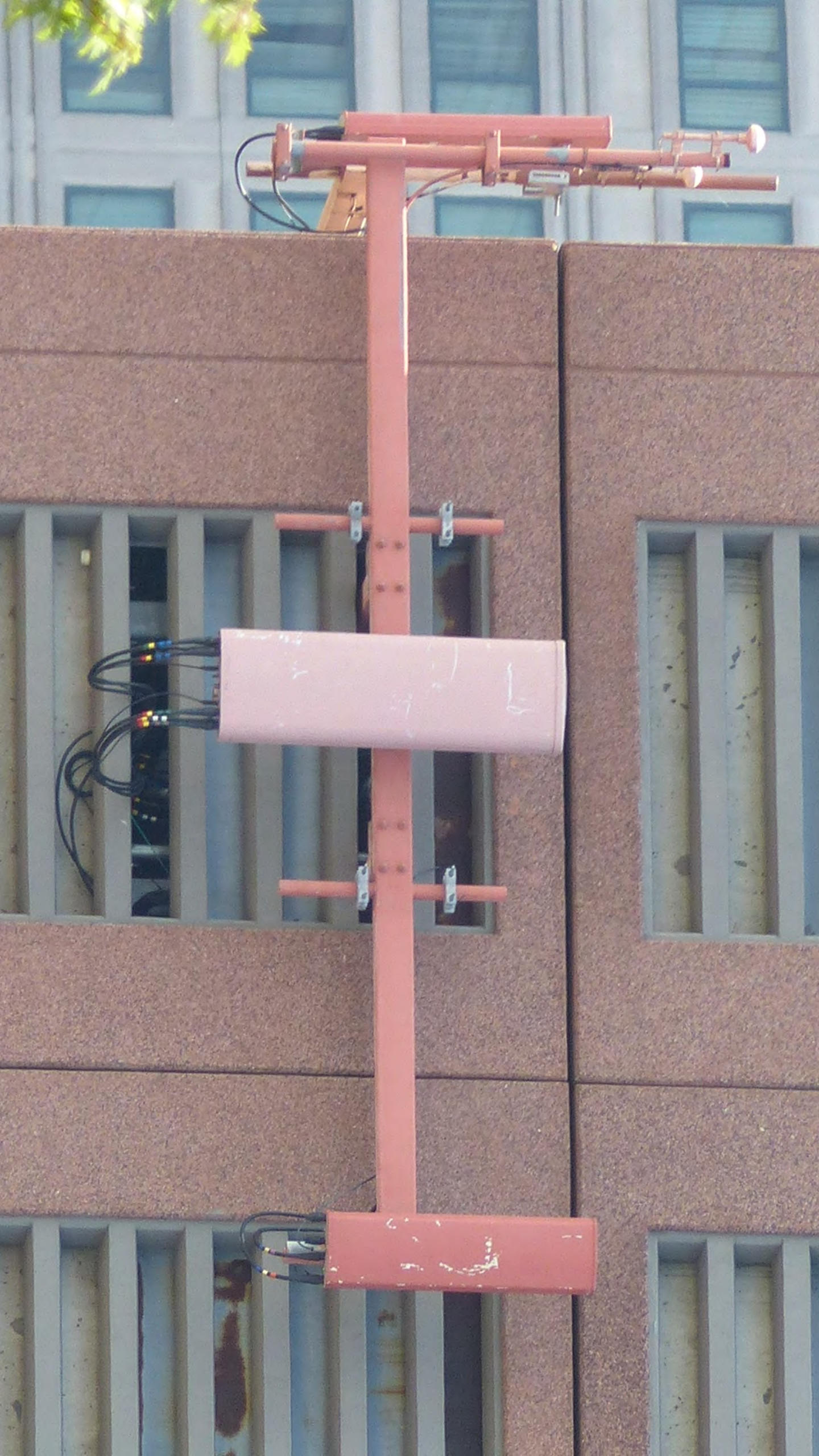
Repair Implementation

- Timelines converged
- The 2 projects became one
- Construction documents prepared in 2018
- Project awarded in January of 2019
- Work began in March of 2019

Repair Implementation

- Logistical challenges early on:
  - Longer lead-time for replacement louvers
  - Access around wall-mounted cellular equipment
- Contractor ran 8 swingstages
- Flexibility in daily work

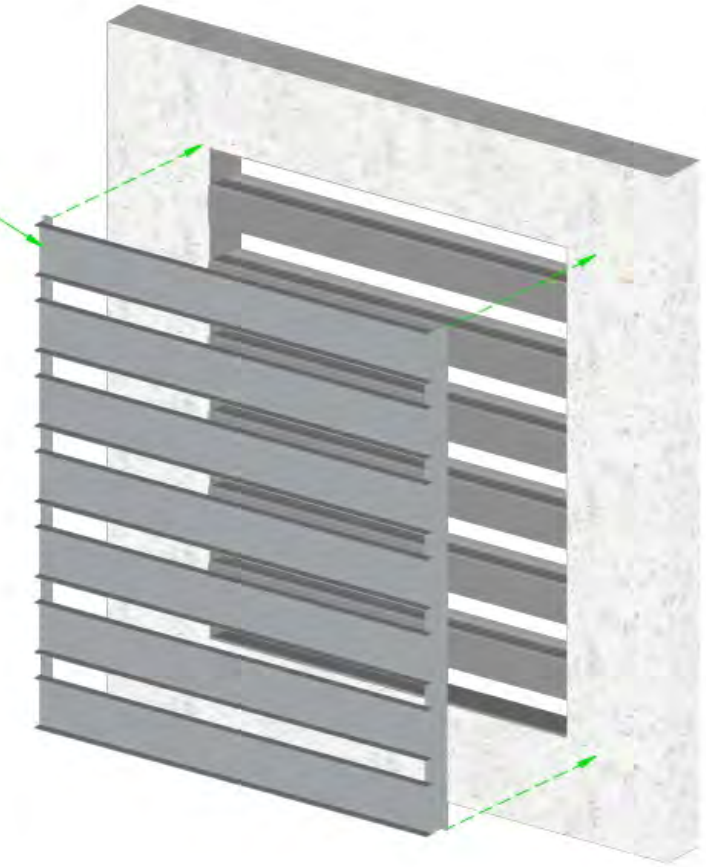


Repair Implementation

- Louver replacement
  - Metal channel replacement (win-win)

PREFABRICATED ALUMINUM LOUVERS. SEE SHEET AR-505

STEP 4
EXTERIOR VIEW



REINSTALL EXIST BLANK-OFF CHANNEL ASSEMBLIES. RELOCATE EXIST Z-GIRTS AS NECESSARY TO ACCOMMODATE NEW LOUVERS

STEP 5
INTERIOR VIEW

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Repair Implementation

- Louver replacement
  - Metal channel replacement (win-win)
  - Staged workers inside garage for efficiency


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NAVY PIER

Repair Implementation

- Other miscellaneous repairs
  - Concrete patch repairs
    (matching the exposed aggregate finish)
  - Glazing gasket replacement
  - Failed IGU replacement
  - Window screen replacement
  - Expansion joint between garage & adjacent building

Project Stats

- Original Contract: $3.3M
- Final Construction Cost: $2.8M
- Completed in ~10 months (December 2019)
- 57 precast louvers replaced with aluminum
- 46 precast louvers received elastomeric coating
- Remaining 389 louvers received acrylic coating
- ~60,000 linear feet of sealant replacement (>11 miles)

Summary

- Evaluation process identified sources for deterioration
- Advanced planning allowed for…
  - Development of repair options
  - Association to build funds
  - Proactive facade repairs (sealant)
  - Collaborative effort among project team
  - Under budget


SKY CLEANER
CAUTION
WARNING

Questions?

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