Deteriorating Buildings: Ticking Time Bombs

TH205

Thursday, June 21, 2018 | 7:30 AM – 9:00 AM

1.5 Learning Units

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

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Speakers List

- **Howard L. Zimmerman, FAIA [Moderator]**
  Principal, Howard L. Zimmerman Architects, PC
- **Joan Berkowitz, FAPT**
  Senior Project Manager/Senior Preservationist
  Howard L. Zimmerman Architects, PC
- **Charles Bransby-Zachary, BSc MRICS**
  Principal, CBZ Consulting
- **David B. Peraza, PE**
  Principal Engineer, Exponent Engineering, PC

Course / Learning Objectives

- Learn how to identify aging conditions and their potential resulting problems, as well as the necessity for regulating statutes.
- Begin to comprehend applicable methods of investigation and assessment through a variety of investigation methodologies (e.g., visual, low-tech, high-tech, nondestructive and destructive).
- Learn to identify possible causes of deterioration, such as ferrous metals, water infiltration, poor initial design, poorly executed repairs, structural issues, and material properties, and to determine whether a problem is isolated or systemic.
- Explore the repair methodologies best-suited to the problem, material, municipal requirements, and project schedule and budget.

Agenda

SAFETY IN THE URBAN ENVIRONMENT
LOAD BEARING MASONRY
MATERIALS THROUGHOUT HISTORY
CONCEALED METAL
TERRA COTTA
STEEL FRAME
CAVITY WALL
CONTEMPORARY CONSTRUCTION
MATERIAL DEFECTS
SUPERTALLS
HUMAN ERROR
SUMMARY

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LOAD BEARING MASONRY

Medieval Castle Kent, South East England (1127)

Observed Conditions Falling Masonry

Investigation Methods GPR; Infrared Thermal Imaging

Root Causes No Rain Water Discharge; Exterior Wall Tops Exposed

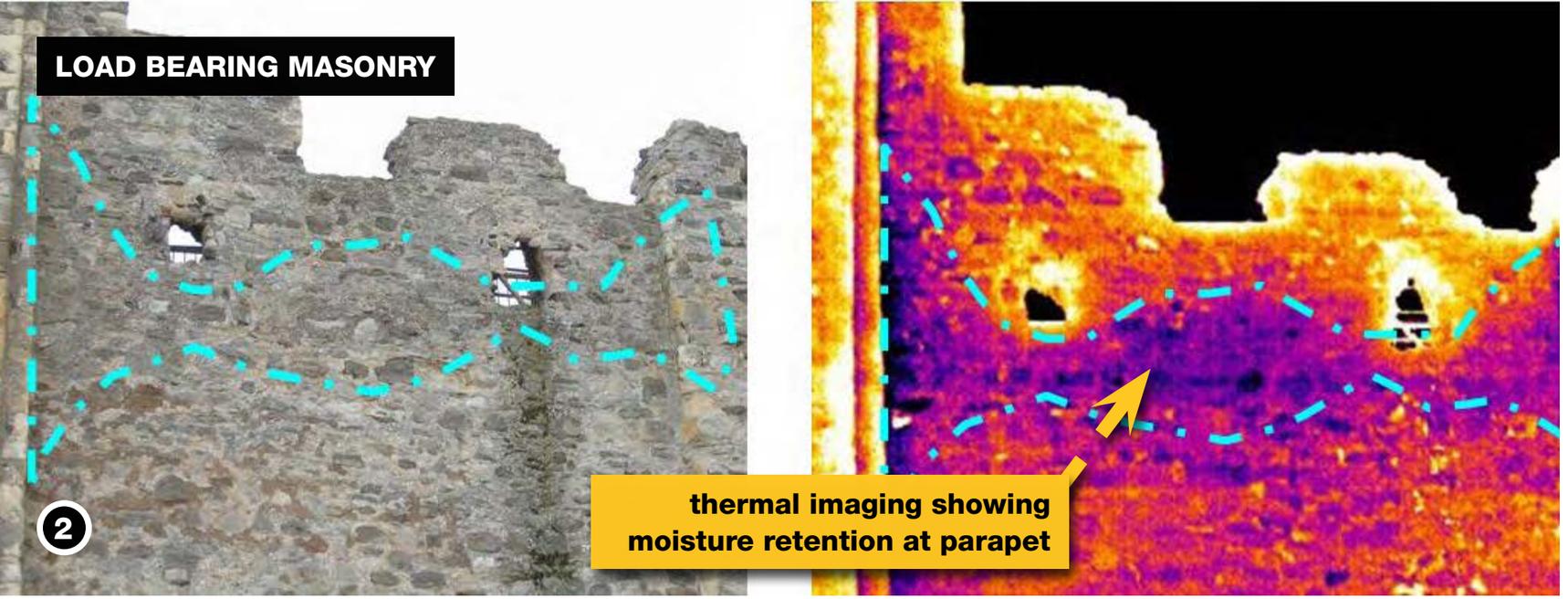
Potential Repair Grout & Repointing; New Roof; Water Discharge System

885 years to failure

LOAD BEARING MASONRY

1

2



thermal imaging showing moisture retention at parapet

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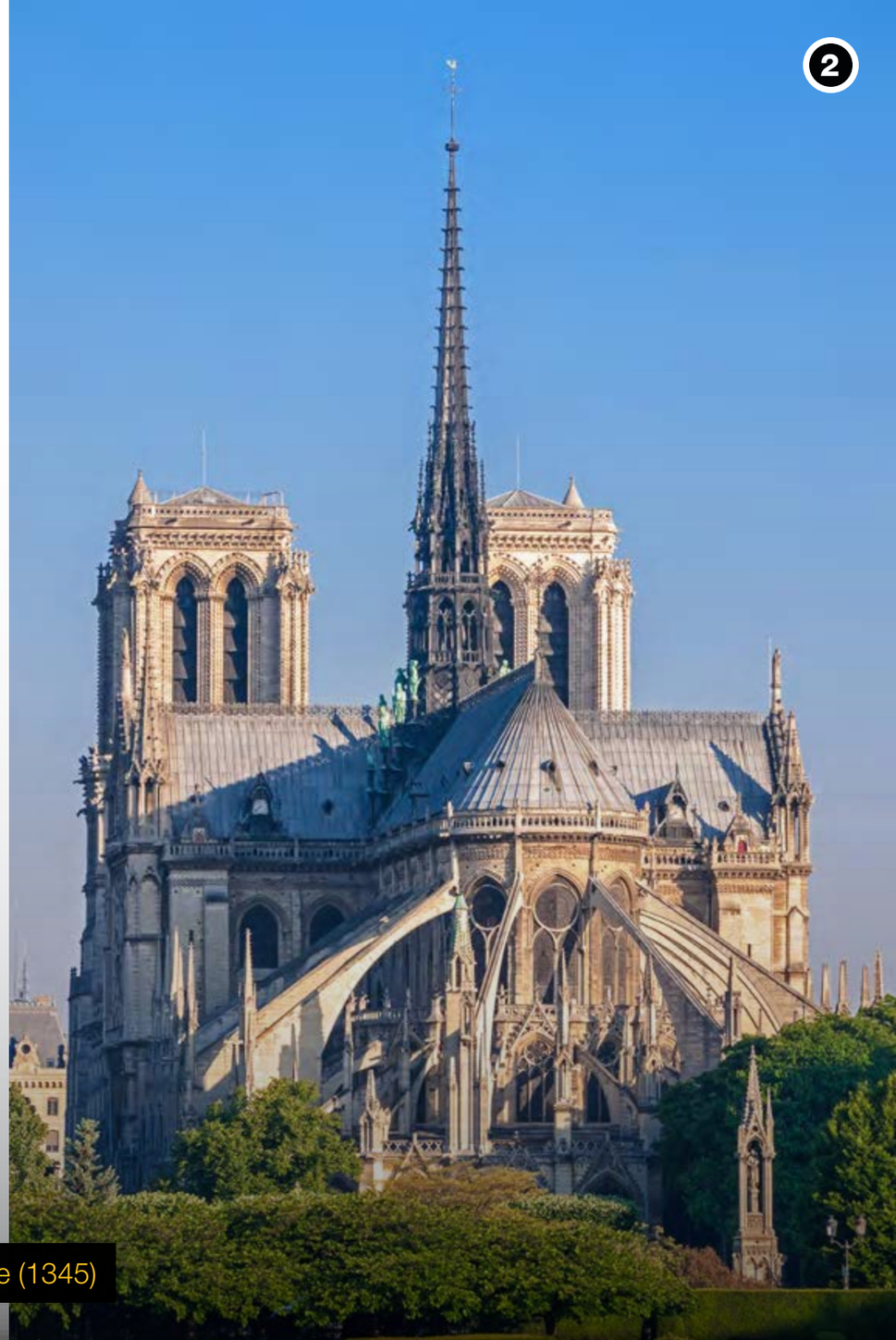
MATERIALS THROUGHOUT HISTORY

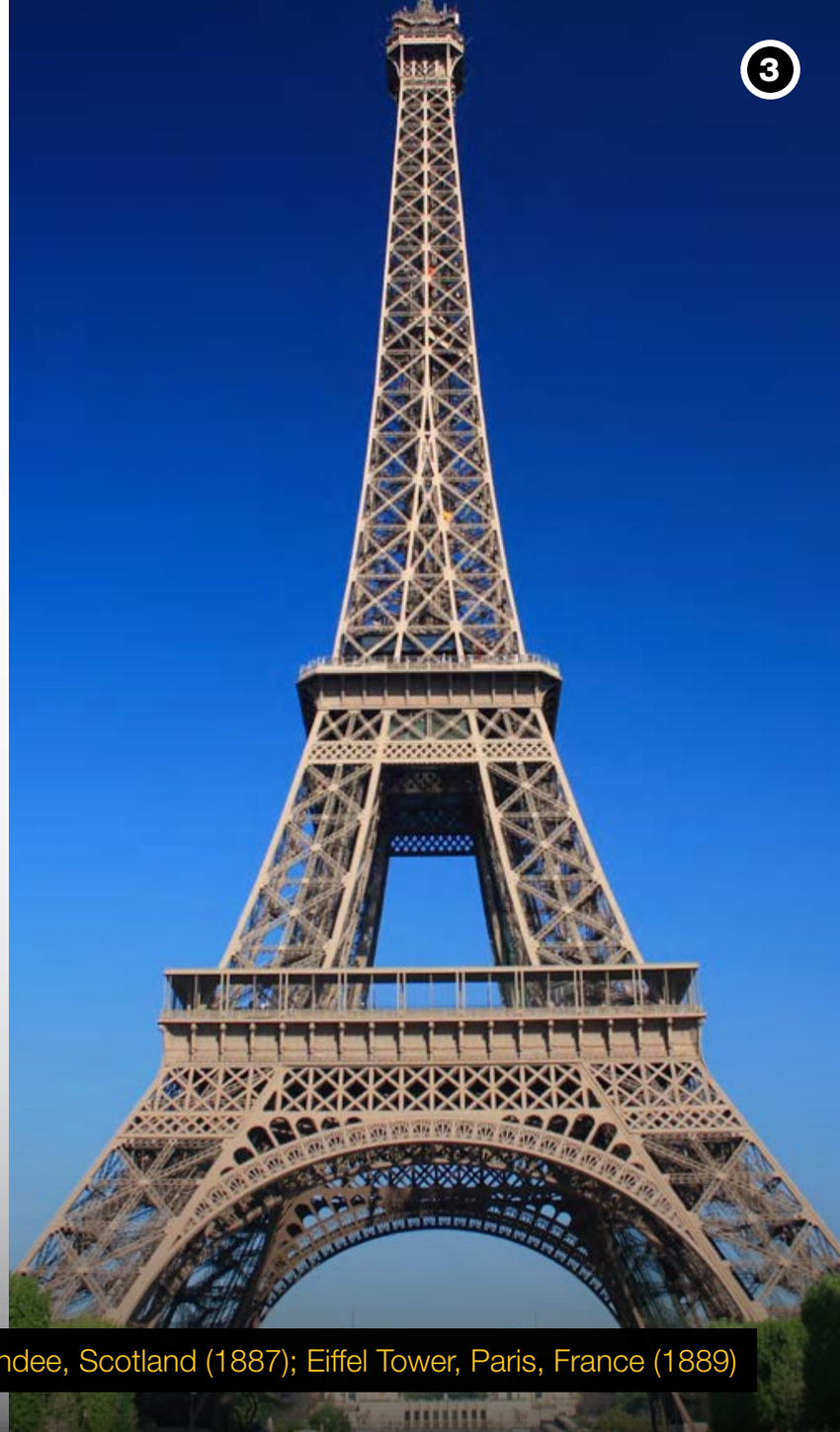
Load Bearing Masonry



Examples of Flying Buttresses Basilica of San Vitale, Ravenna, Italy (547); Notre Dame Cathedral, Paris, France (1345)

MATERIALS THROUGHOUT HISTORY

Cast & Wrought Iron



Examples of Cast & Wrought Iron Construction The Iron Bridge, Shropshire, England (1781); Tay Bridge Disaster, Dundee, Scotland (1887); Eiffel Tower, Paris, France (1889)

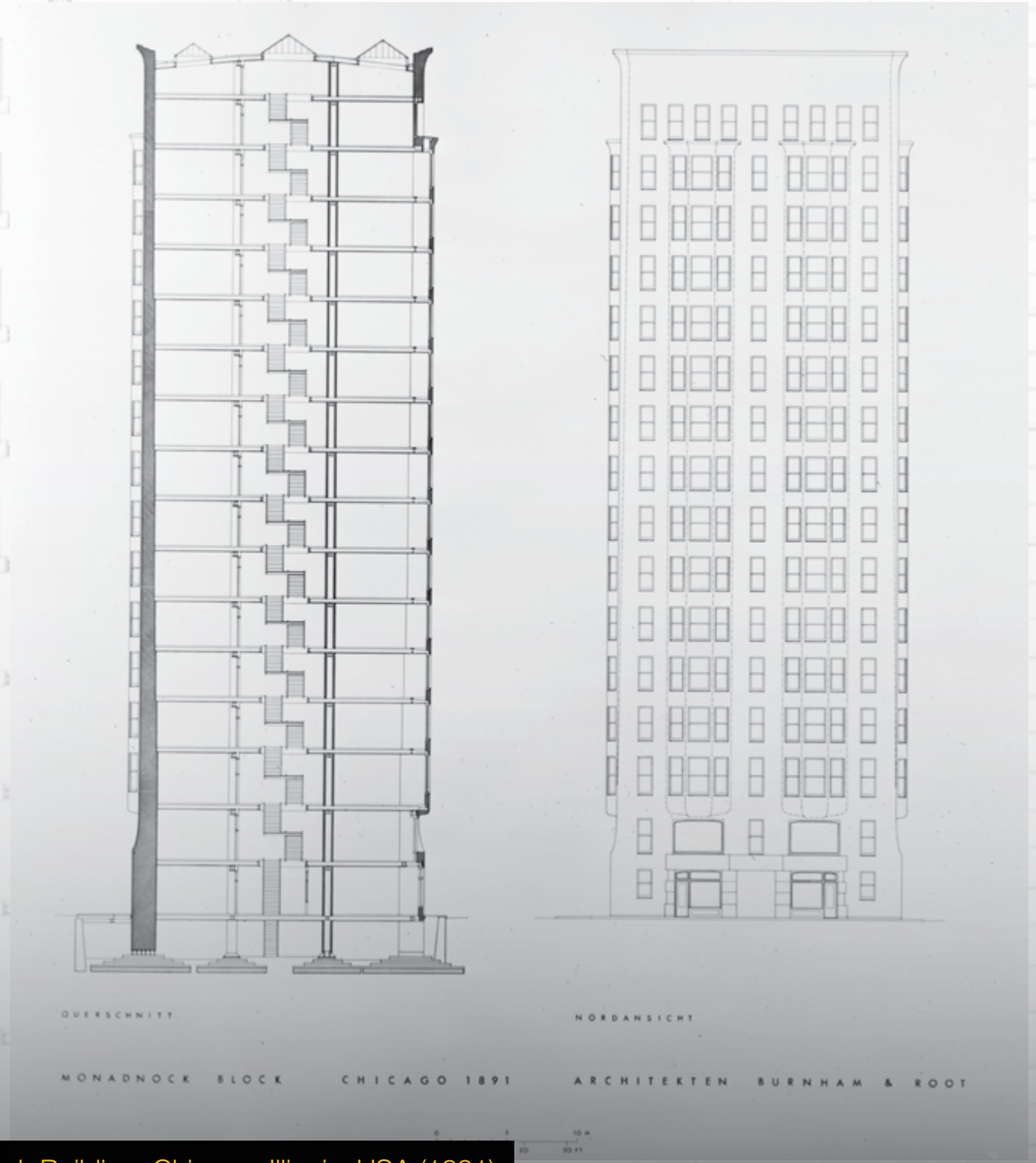
MATERIALS THROUGHOUT HISTORY

Load Bearing Masonry

Modern Load Bearing Construction Monadnock Building, Chicago, Illinois, USA (1891)

MATERIALS THROUGHOUT HISTORY

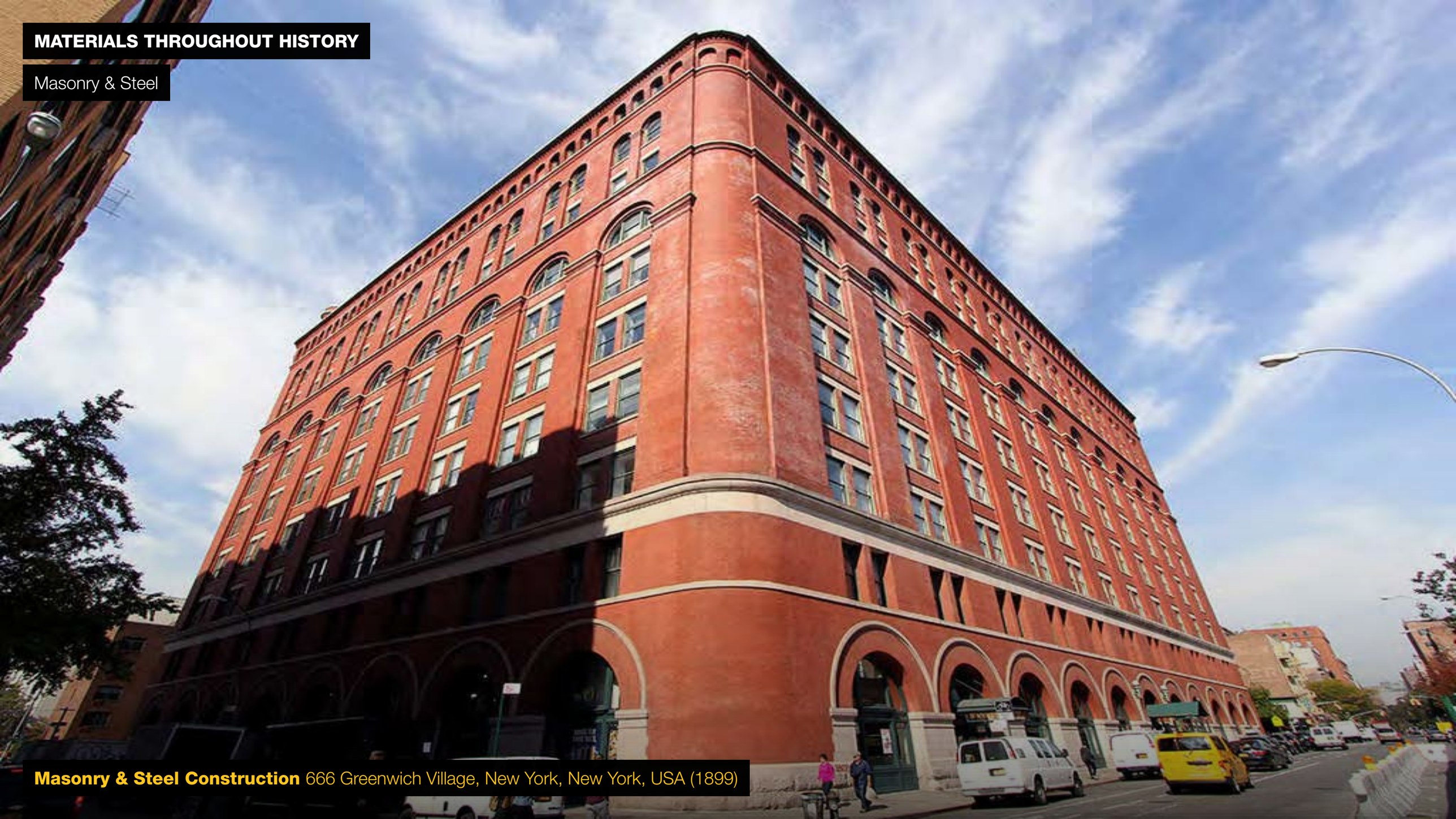
Load Bearing Masonry



Modern Load Bearing Construction Monadnock Building, Chicago, Illinois, USA (1891)

MATERIALS THROUGHOUT HISTORY

Masonry & Steel



Masonry & Steel Construction 666 Greenwich Village, New York, New York, USA (1899)

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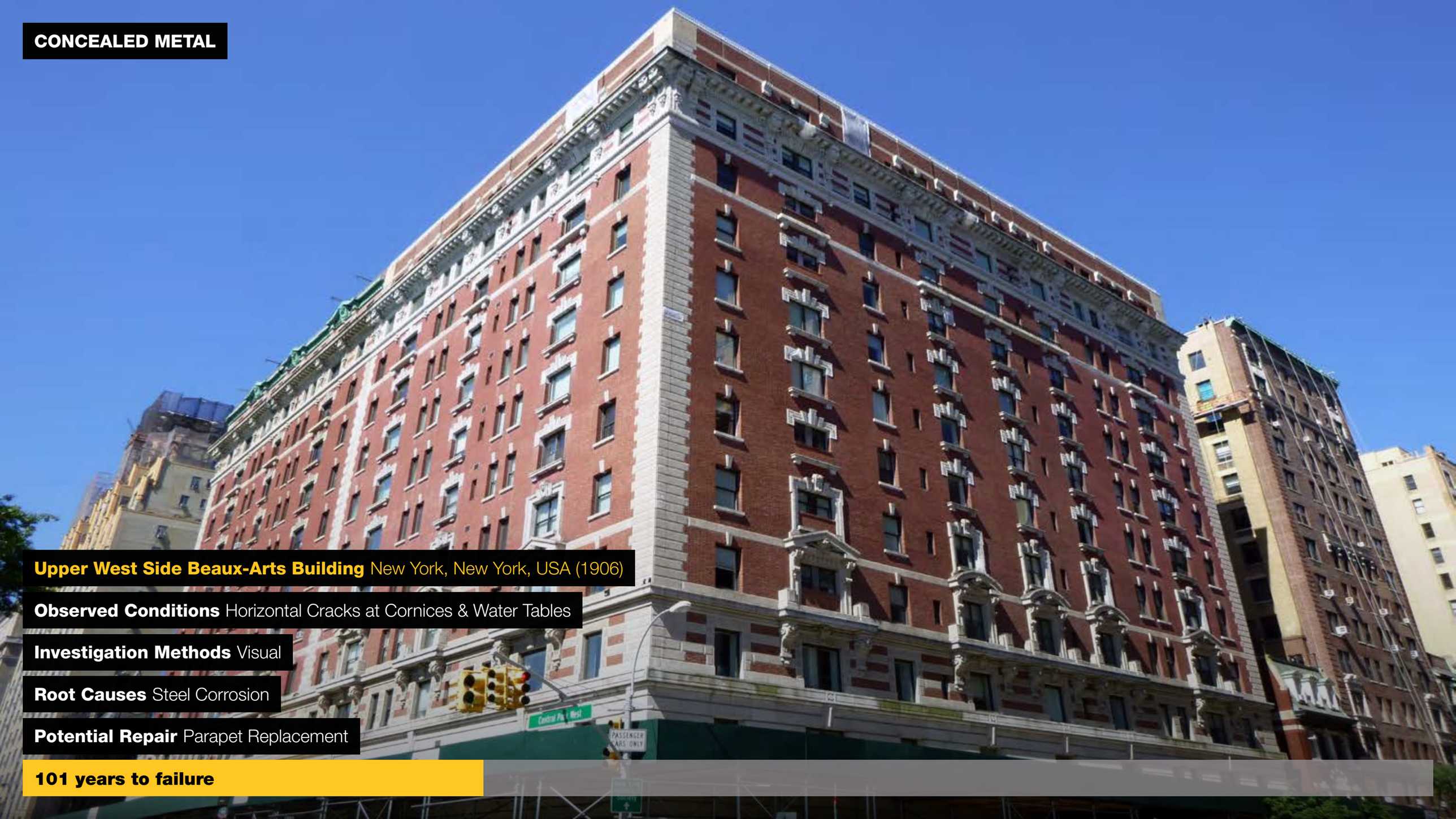
CONCEALED METAL



Upper West Side Beaux-Arts Building New York, New York, USA (1906)

Observed Conditions Horizontal Cracks at Cornices & Water Tables

Investigation Methods Visual

Root Causes Steel Corrosion

Potential Repair Parapet Replacement

101 years to failure


CONCEALED METAL
2


damage invisible to the naked eye
1


3

CONCEALED METAL

1

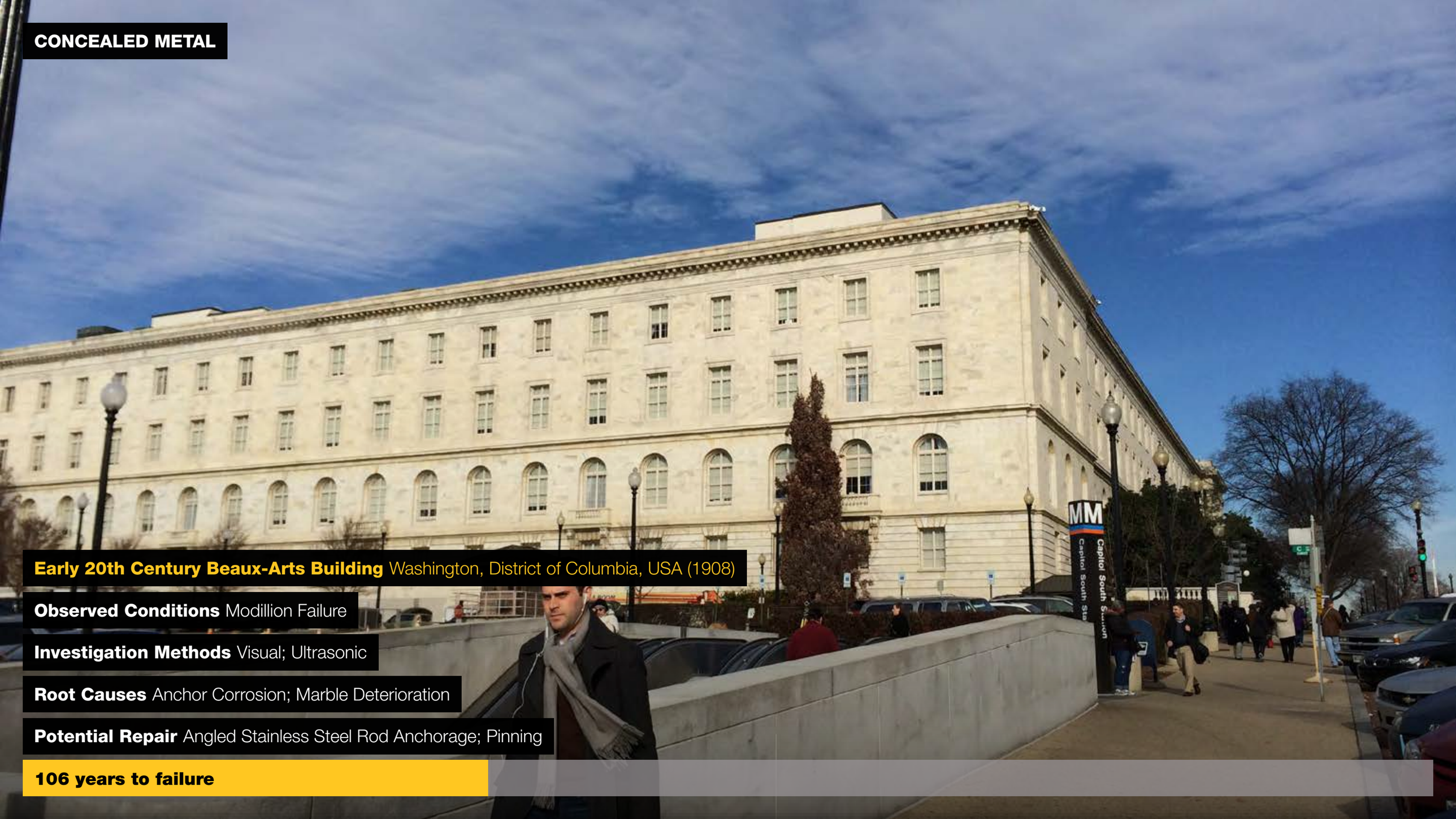
2


CONCEALED METAL
1


2


severely corroded
steel anchors
3

CONCEALED METAL



Early 20th Century Beaux-Arts Building Washington, District of Columbia, USA (1908)

Observed Conditions Modillion Failure

Investigation Methods Visual; Ultrasonic

Root Causes Anchor Corrosion; Marble Deterioration

Potential Repair Angled Stainless Steel Rod Anchorage; Pinning

106 years to failure

CONCEALED METAL


CONCEALED METAL

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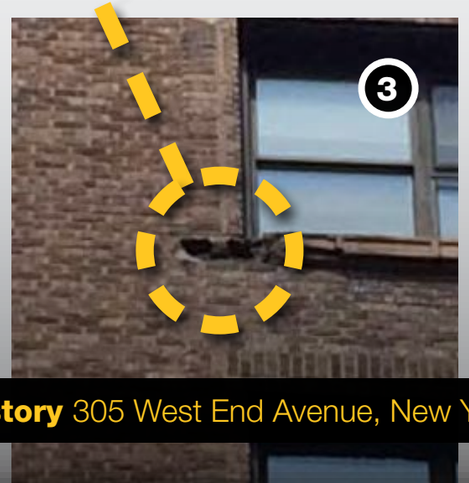
TERRA COTTA

2

1



3

Landmark Case in Façade Ordinance History 305 West End Avenue, New York, New York, USA (1923)

THE REAL DEAL
NEW YORK REAL ESTATE NEWS

New York Miami Los Angeles

Esplanade Venture charged in facade collapse that killed child

Two-year-old died in 2015 accident at 305 West End Avenue

Engineer Accused of Failing to Assess Manhattan Building Where Falling Debris Killed Girl

By Rick Rojas Nov. 17, 2015

Maqsood Faruqi, 55, has been cha
offering a false instrument for fili
New York City Department of Investigati

Six months after a terra cotta windowsill crumbled and fell some
fatally striking 2-year-old girl on the Upper West Side of Manhatta
investigators announced on Tuesday that they had found a trail of
the engineer who was hired to

Girl, 2, Dies After Being Hit by Falling Facade in Manhattan

By Al Baker May 17, 2015

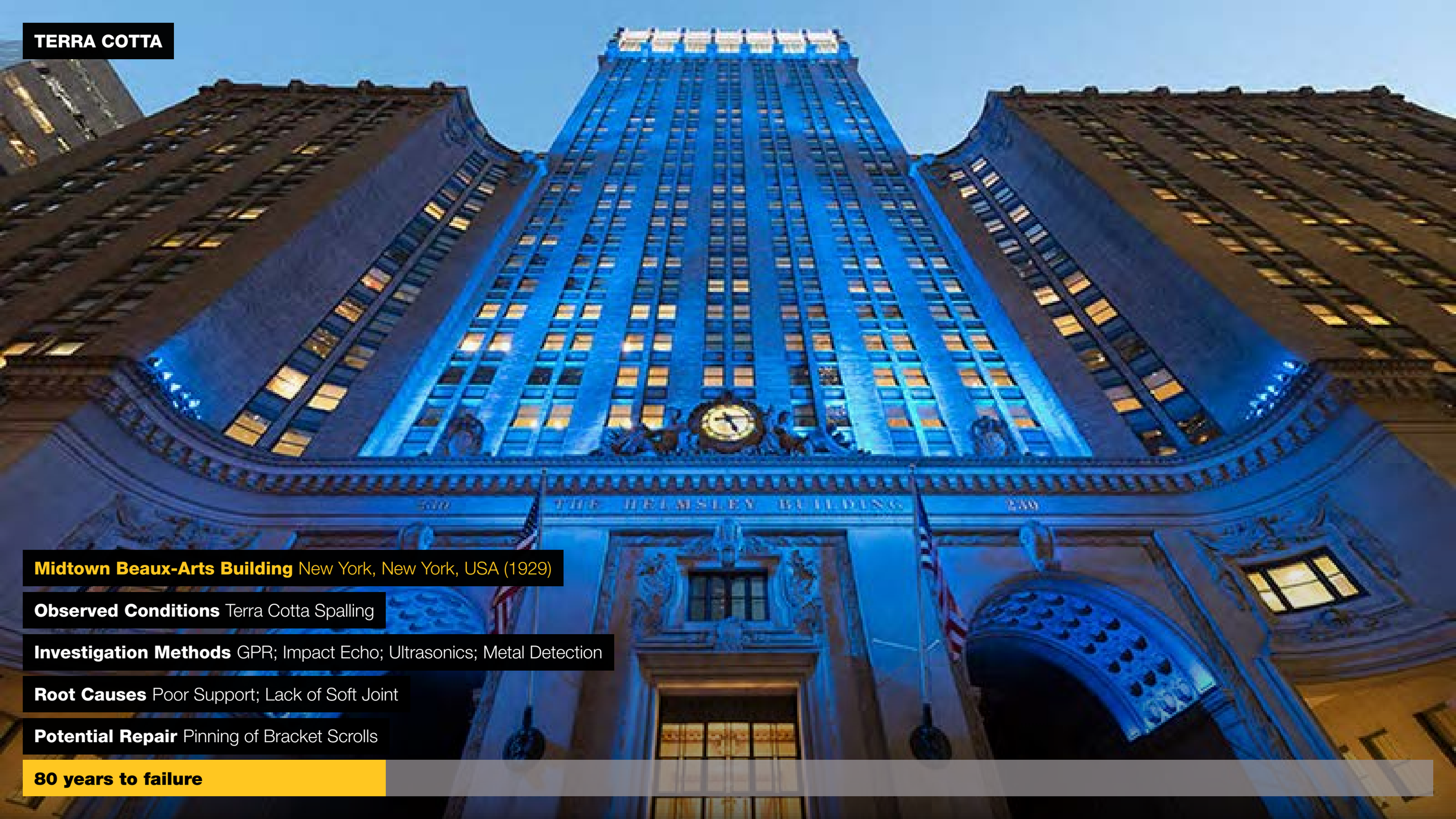
A 2-year-old girl died Monday from injuries she sustained
brick facade broke free from a building on Manhattan's Up
rained down on her and her grandmother as they sat on a
below, the authorities said.

The girl, Greta Greene of Brooklyn, was struck in the head
bricks from a portion of an eighth-floor window ledge gave

Her grandmother, Susan Frierson, 60, was struck in the wr
had minor injuries, the police said.

The episode occurred around 11:05 a.m. outside the Esplan
home for older adults on West End Avenue between West
Streets, officials said.
Responding emergency workers took Greta to NewYork-P
Hospital/Weill Cornell Medical Center, where the police sa
surgery.

A spokesman for the city's Buildings Department said an
violation had been issued to the building's owner, Esplanac



TERRA COTTA

Midtown Beaux-Arts Building New York, New York, USA (1929)

Observed Conditions Terra Cotta Spalling

Investigation Methods GPR; Impact Echo; Ultrasonics; Metal Detection

Root Causes Poor Support; Lack of Soft Joint

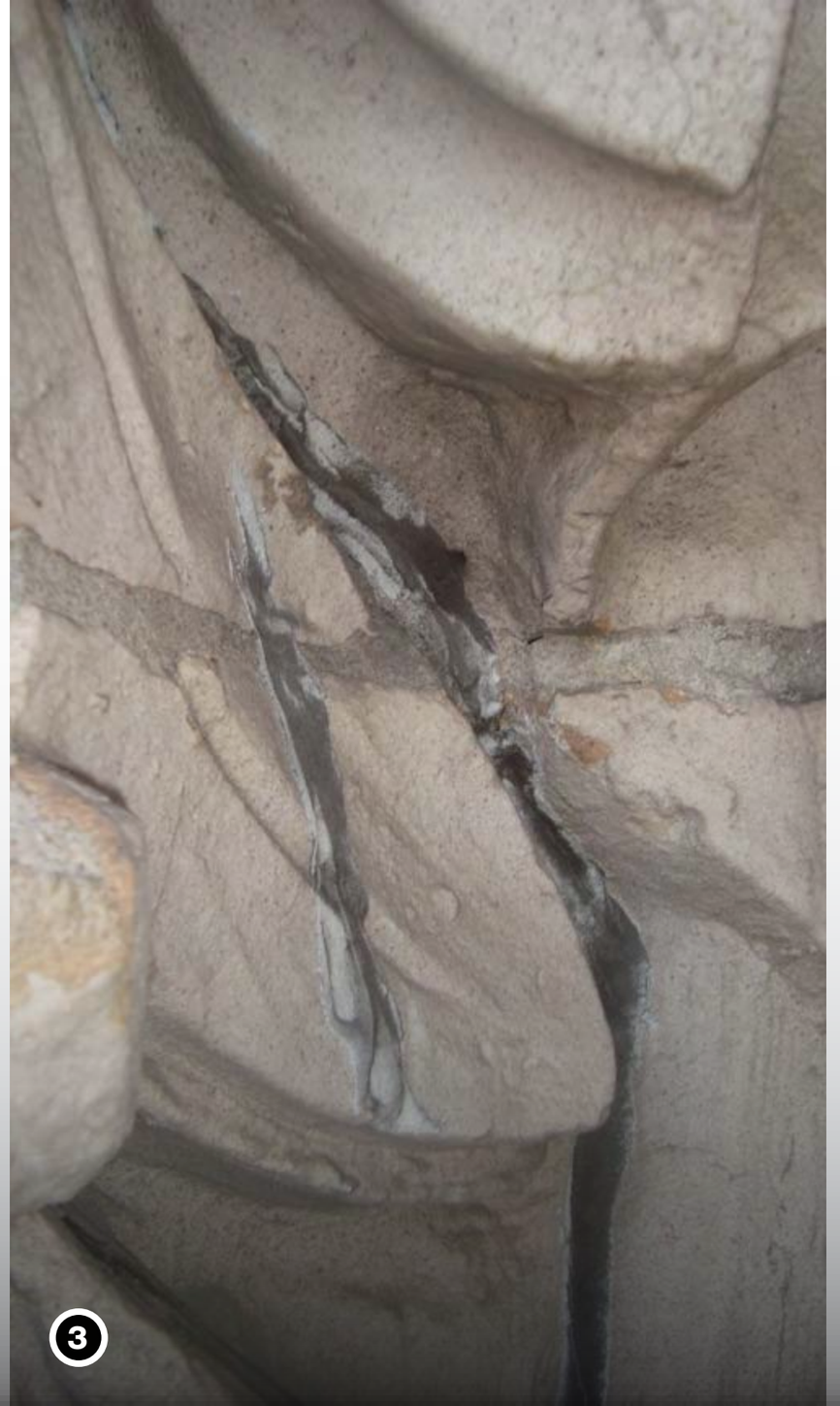
Potential Repair Pinning of Bracket Scrolls

80 years to failure

TERRA COTTA

2

1



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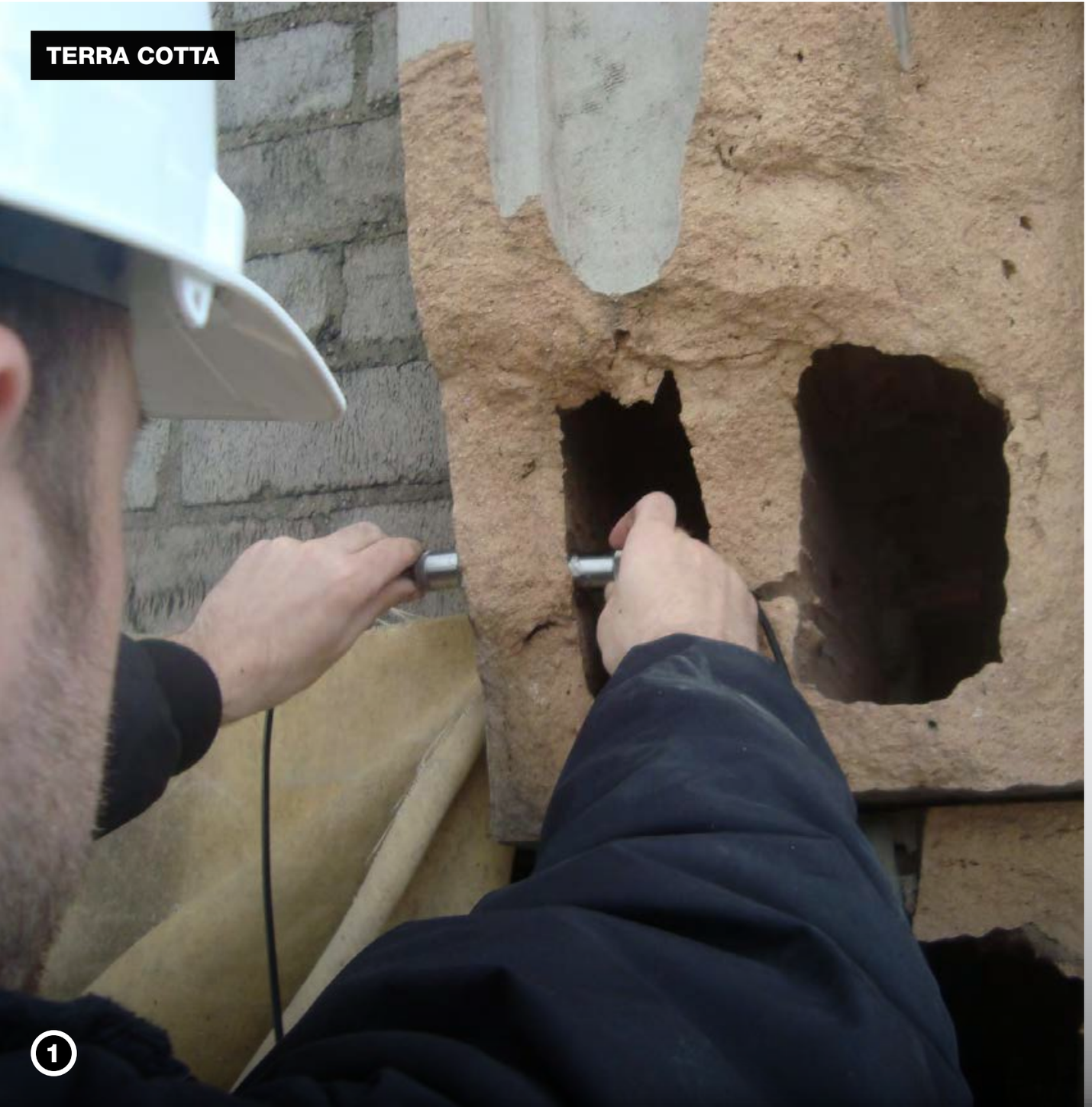
TERRA COTTA



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STEEL FRAME

Stone Panels

1

2

Financial District Art Deco Building New York, New York, USA (1929)

Observed Conditions Vertical Cracking of Limestone

Investigation Methods Visual; Probes; GPR; Metal Detection

Root Causes Steel Sizing Design; Steel Corrosion

Potential Repair Replace Stone; Modify Steel; New Expansion Joints

87 years to failure

STEEL FRAME

Stone Panels

vertical cracks in stone visible across surface

1

2

3

STEEL FRAME

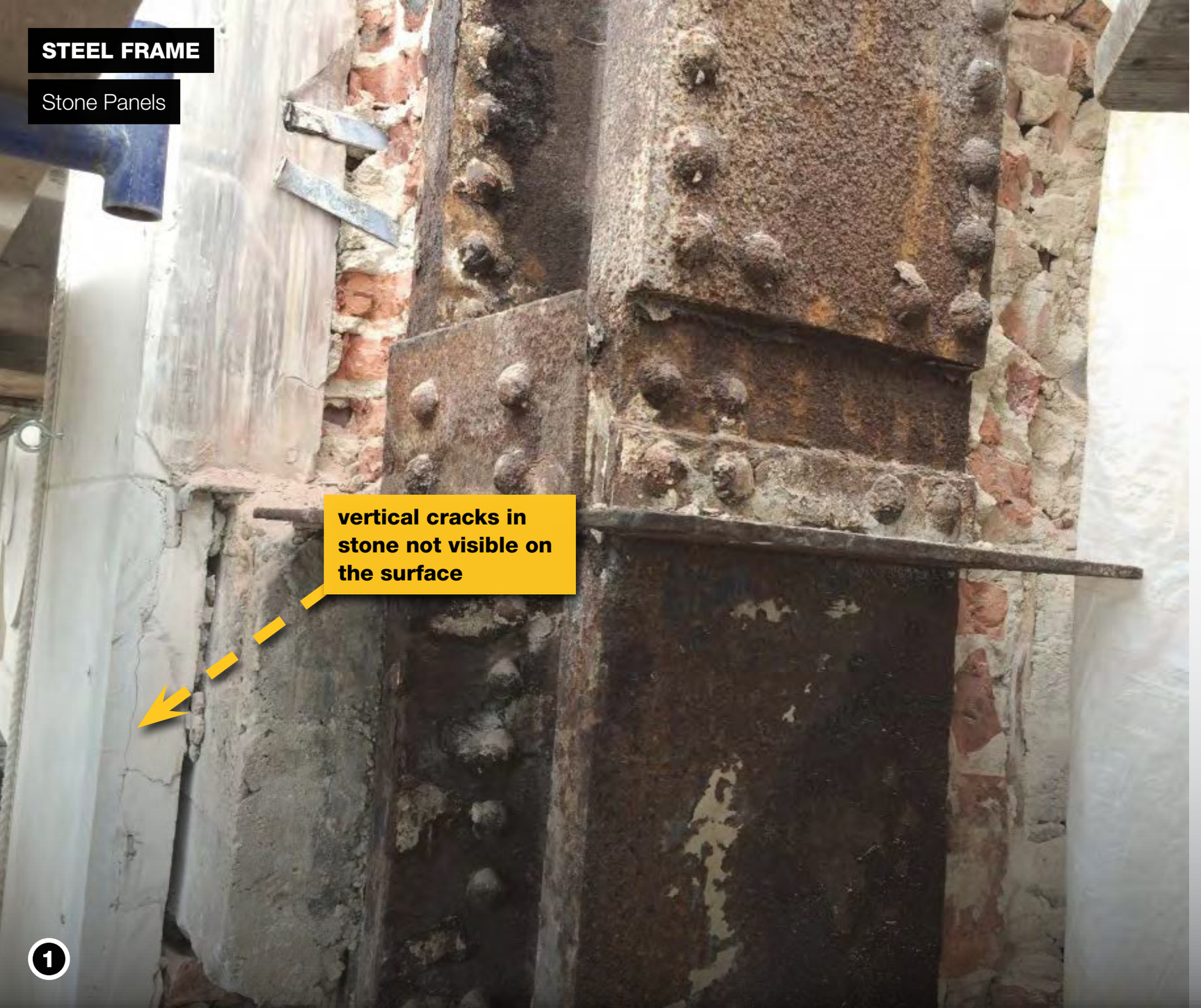
Stone Panels

1

2

STEEL FRAME

Stone Panels

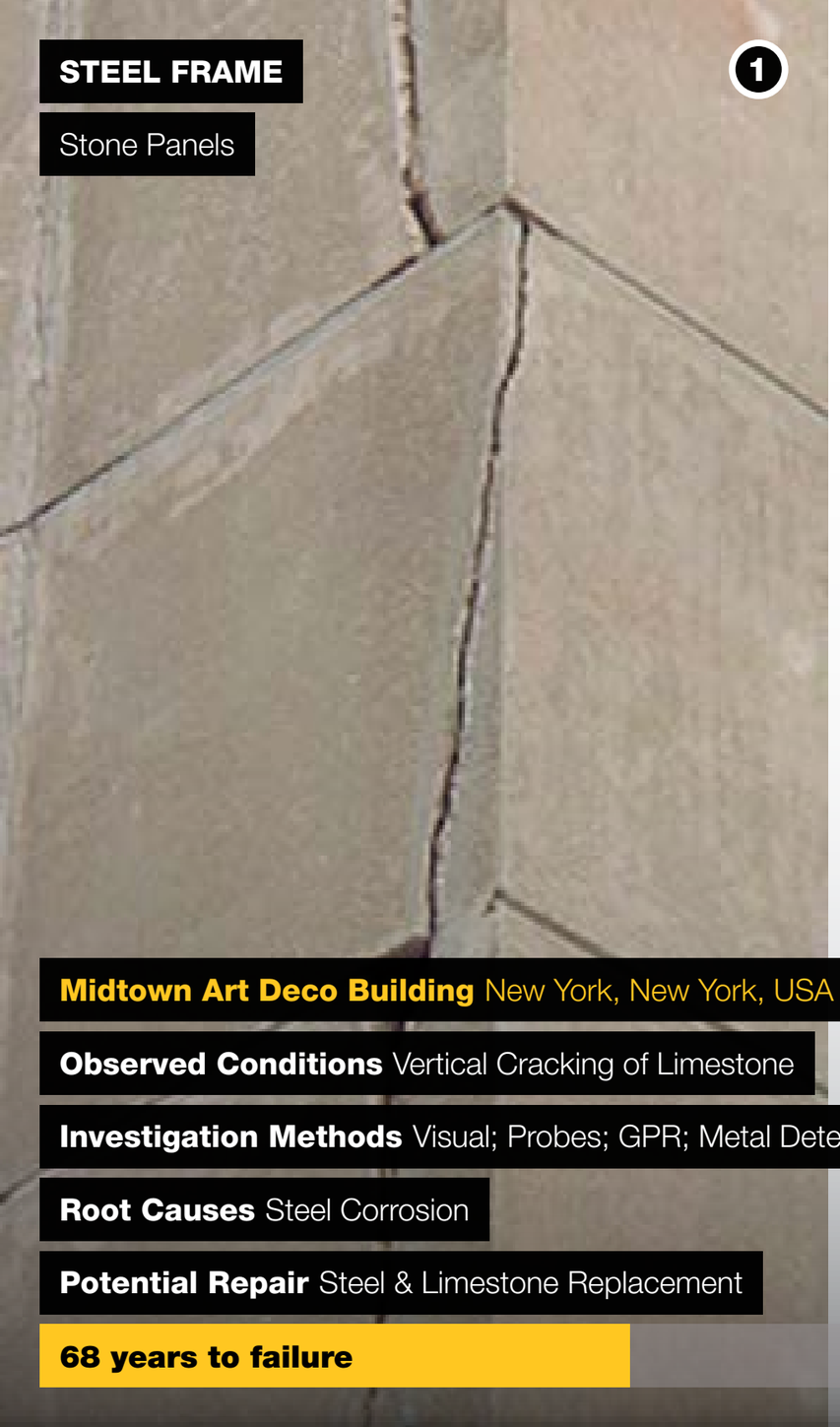


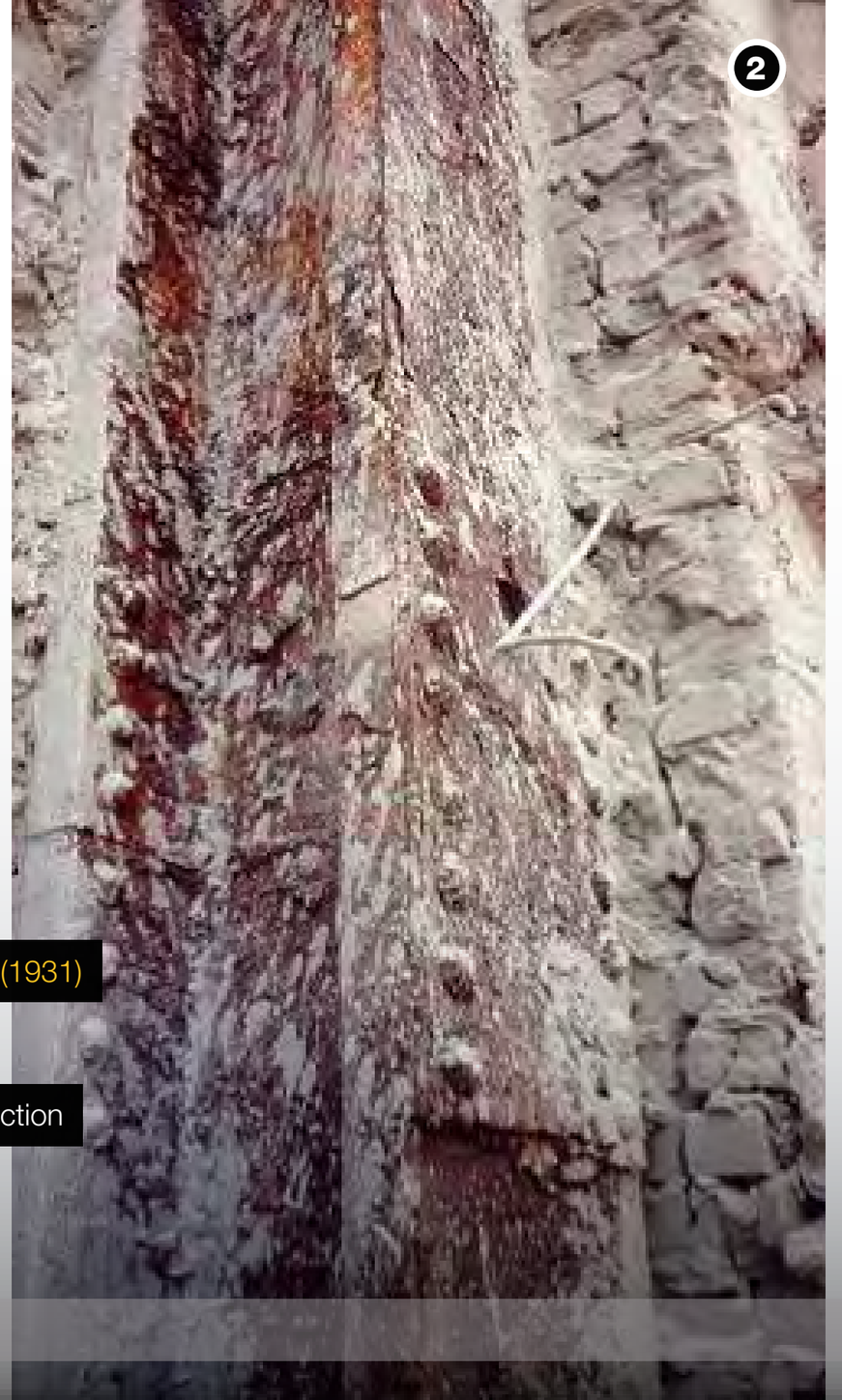
1

2

STEEL FRAME

Stone Panels





Midtown Art Deco Building New York, New York, USA (1931)

Observed Conditions Vertical Cracking of Limestone

Investigation Methods Visual; Probes; GPR; Metal Detection

Root Causes Steel Corrosion

Potential Repair Steel & Limestone Replacement

68 years to failure

STEEL FRAME

Stone Panels

Midtown Art Deco Building New York, New York, USA (1929)

Observed Conditions Steel Deterioration; Cracking; Spalling

Investigation Methods Sounding; Ultrasonic Thickness Gauge; Probes

Root Causes Corroding Steel Behind Terra Cotta

Potential Repair Steel Cleaning and Waterproofing; Terra Cotta Replace

88 years to failure

STEEL FRAME

Stone Panels

1

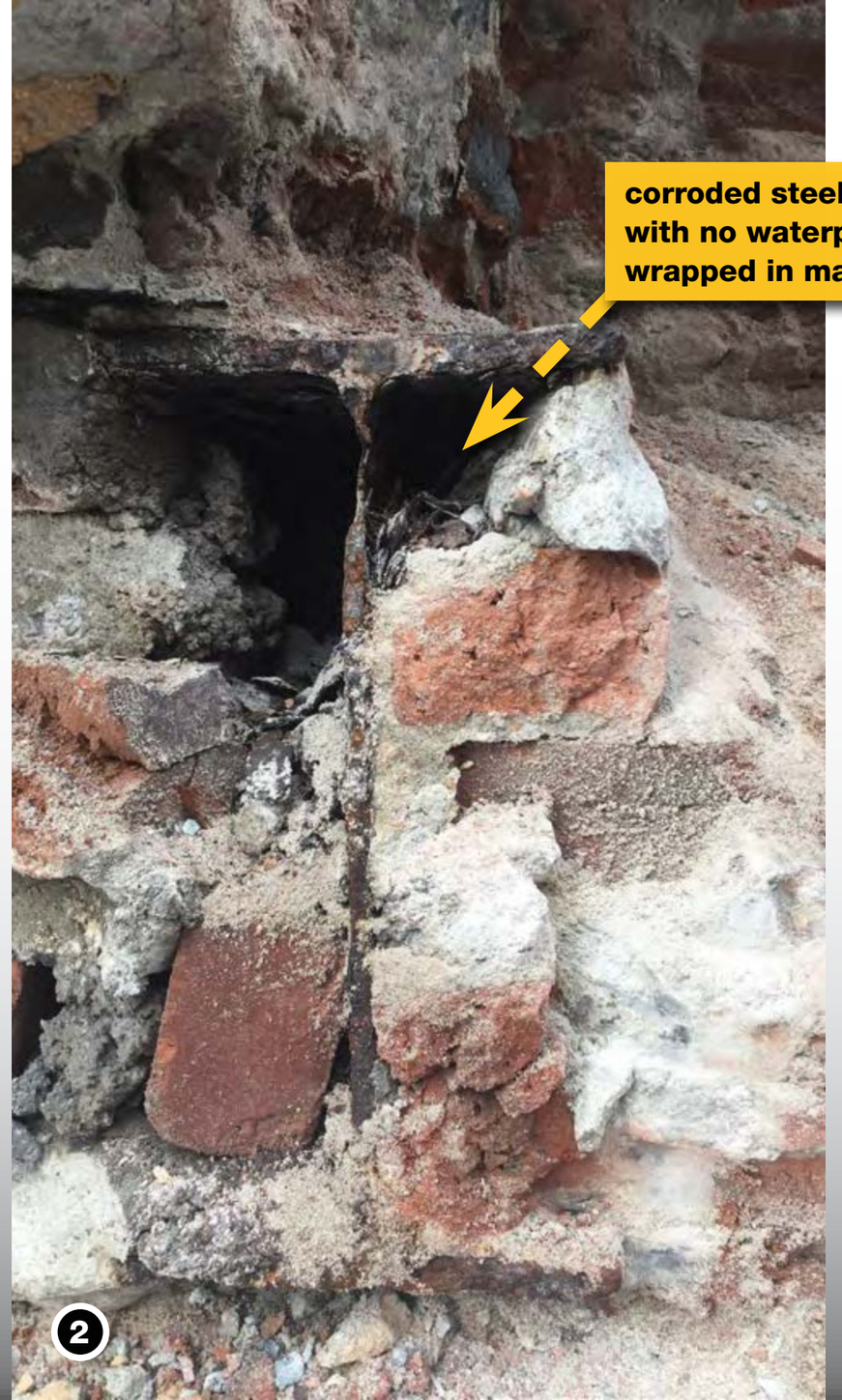
2

3

STEEL FRAME

Stone Panels

1



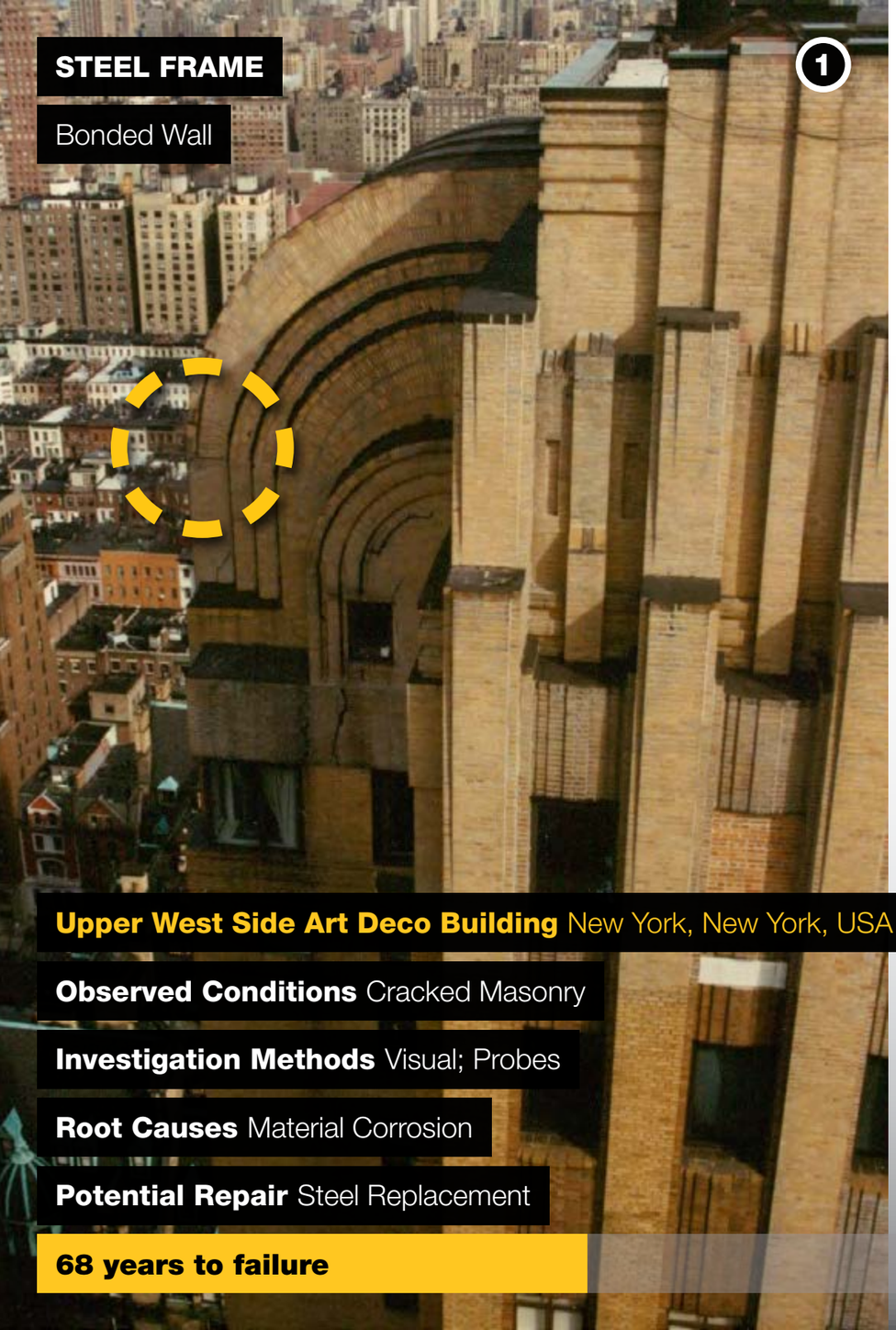
2

3

STEEL FRAME

Bonded Wall

1



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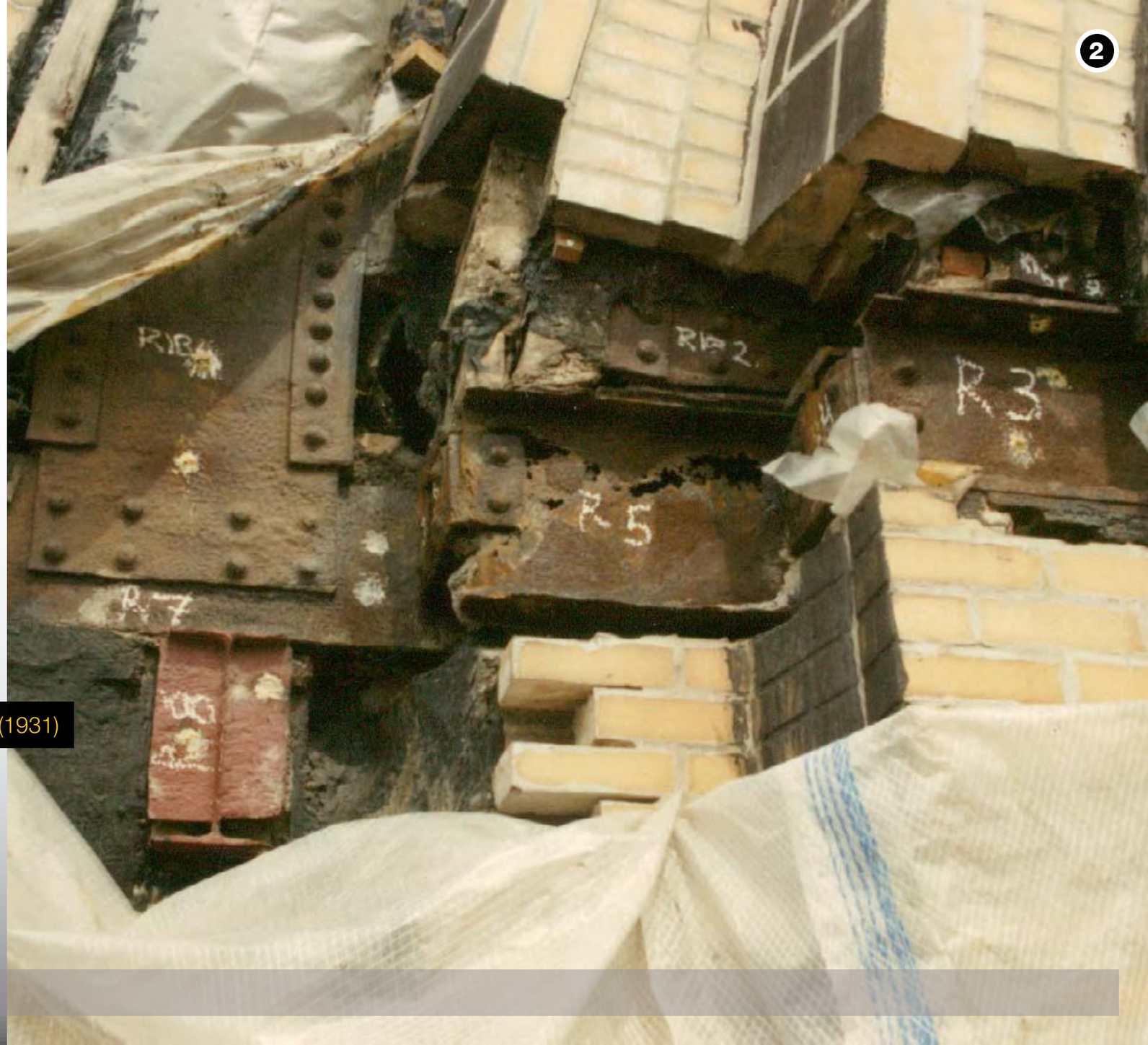


Upper West Side Art Deco Building New York, New York, USA (1931)

Observed Conditions Cracked Masonry

Investigation Methods Visual; Probes

Root Causes Material Corrosion

Potential Repair Steel Replacement

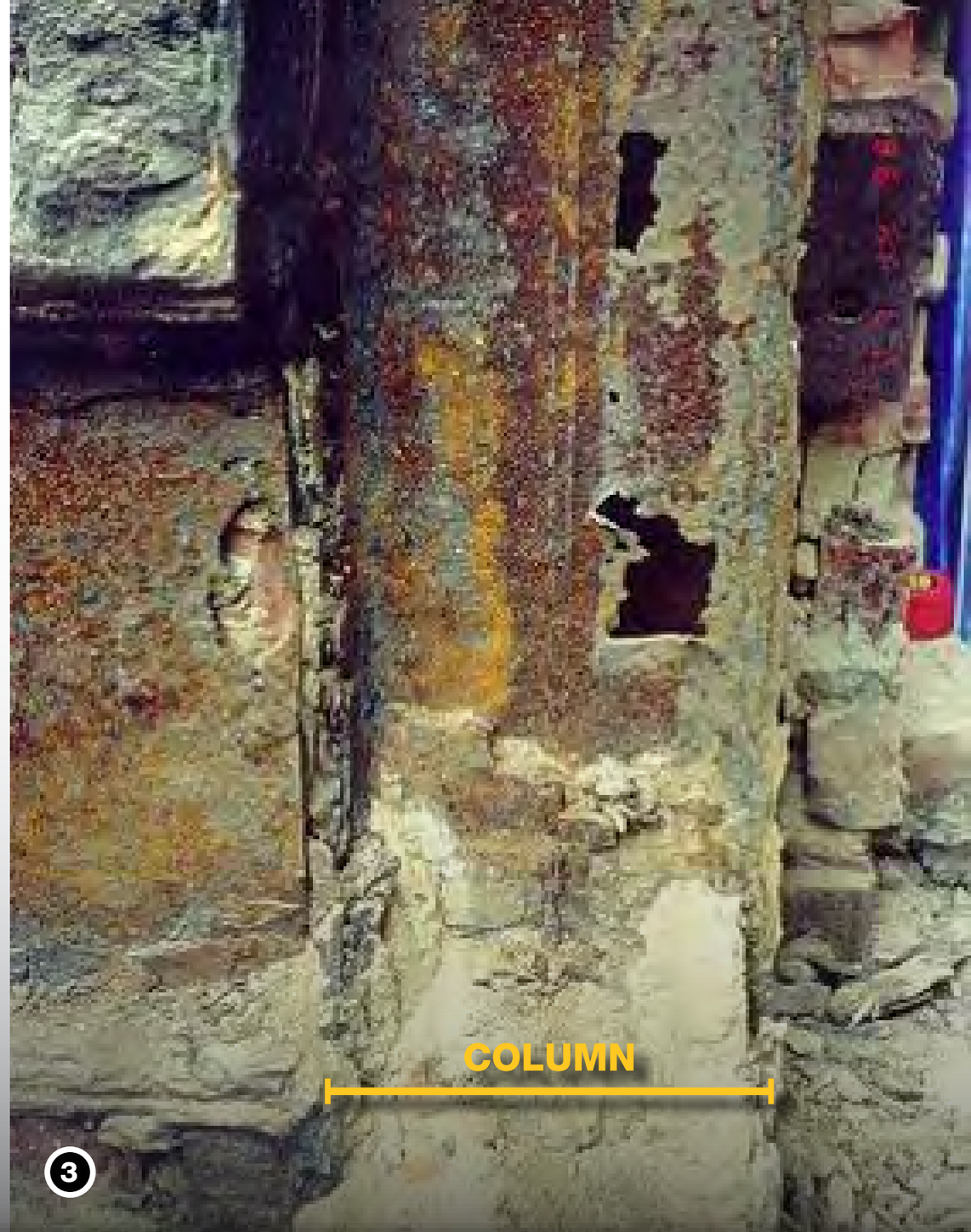
68 years to failure

STEEL FRAME

Bonded Wall

2

1



3

STEEL FRAME

Bonded Wall

Examples of Common Bonded Wall Hidden Conditions Various Locations

STEEL FRAME

Stone Panels

1

2

Lenox Hill Art Deco Building New York, New York, USA (1929)

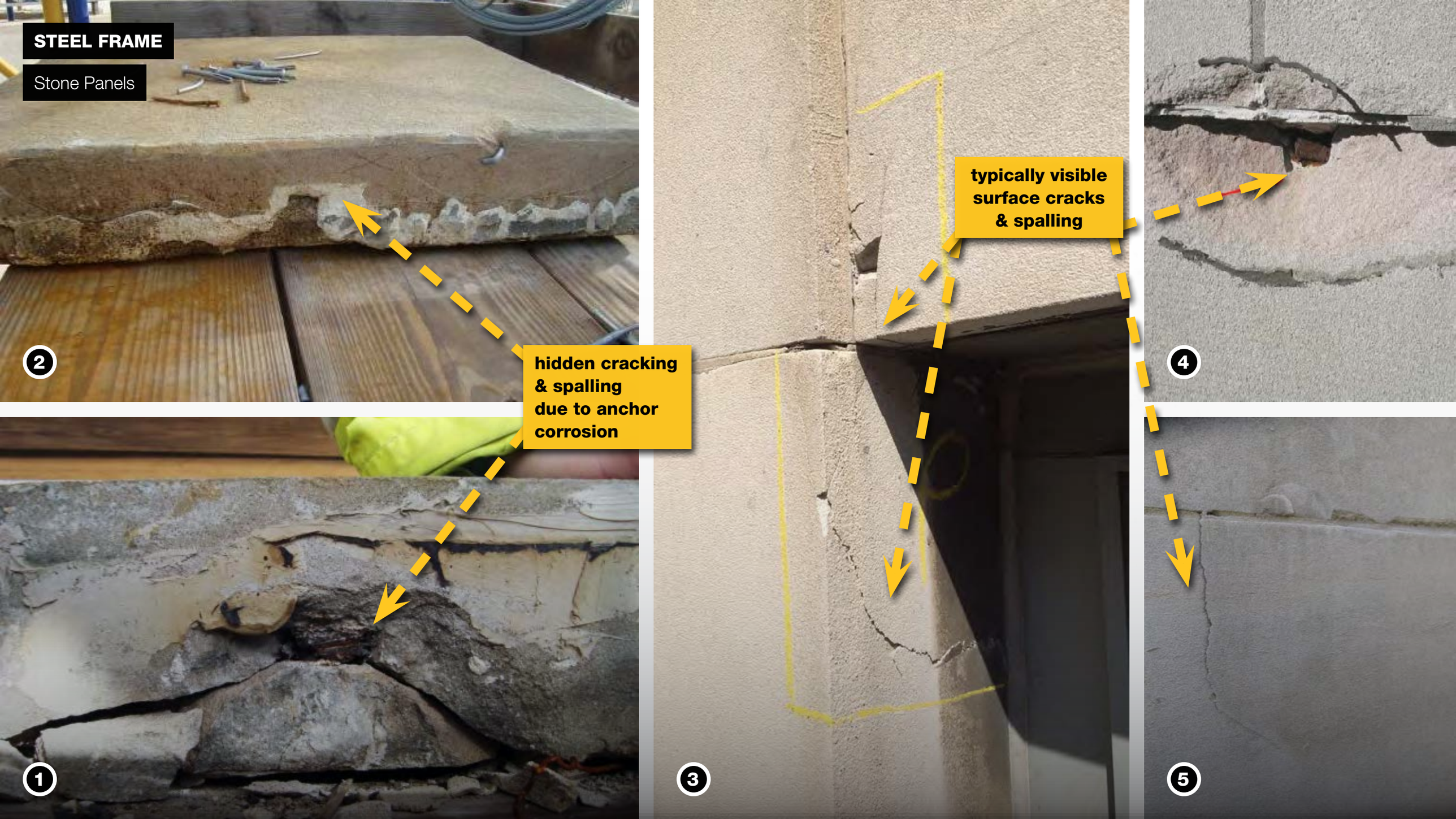
Observed Conditions None Visible (Spalling of Rear Stone Face)

Investigation Methods GPR; Metal Detection; Infrared Thermal Imaging

Root Causes Material Corrosion

Potential Repair Stone and Anchor Replacement

79 years to failure


STEEL FRAME
Stone Panels
hidden cracking & spalling due to anchor corrosion
typically visible surface cracks & spalling
1
2
3
4
5

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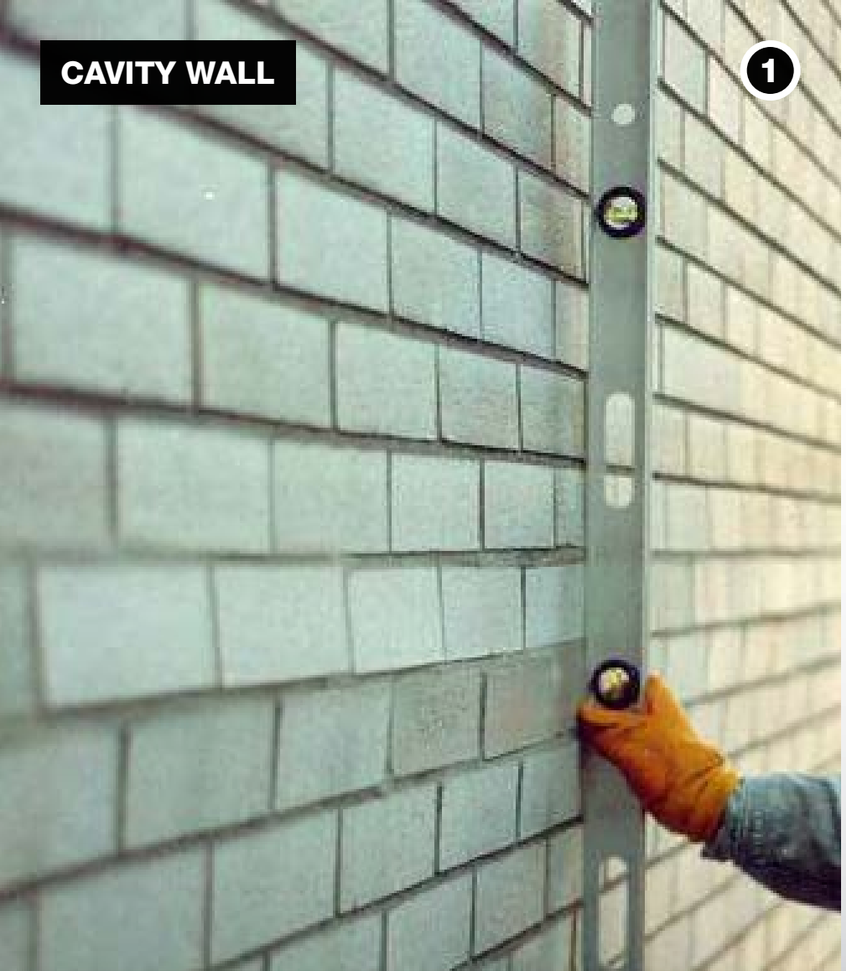
CAVITY WALL

1



2

3

Midtown International Style Building New York, New York, USA (1957)

Observed Conditions Brick Panel Failure/Partial Collapse

Investigation Methods Visual; Thermography; GPR; Metal Detection

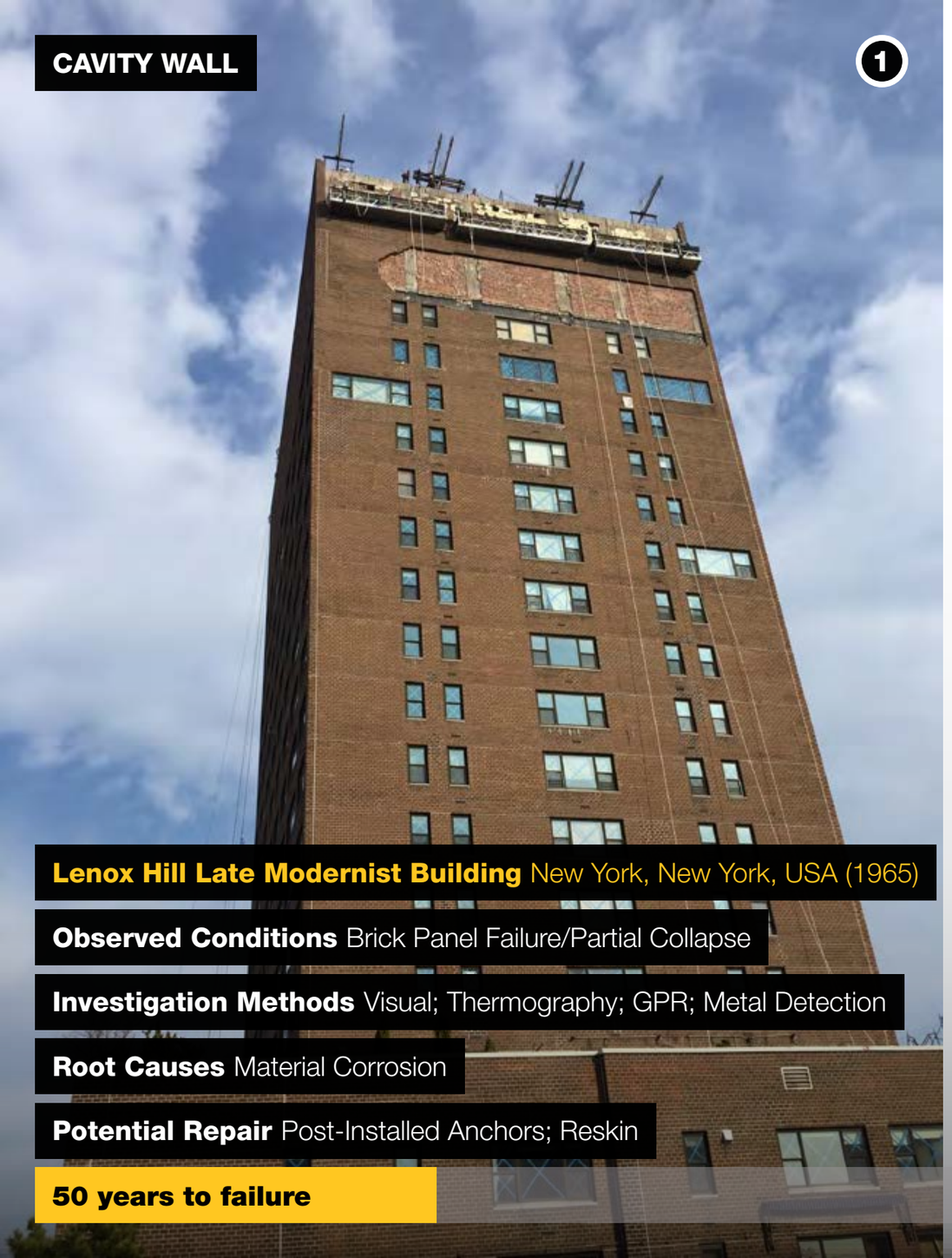
Root Causes Field Modifications; No Soft Joints/Relieving Angles

Potential Repair Spandrel Panel Replacement; Reskin

40 years to failure

CAVITY WALL

1



Lenox Hill Late Modernist Building New York, New York, USA (1965)

Observed Conditions Brick Panel Failure/Partial Collapse

Investigation Methods Visual; Thermography; GPR; Metal Detection

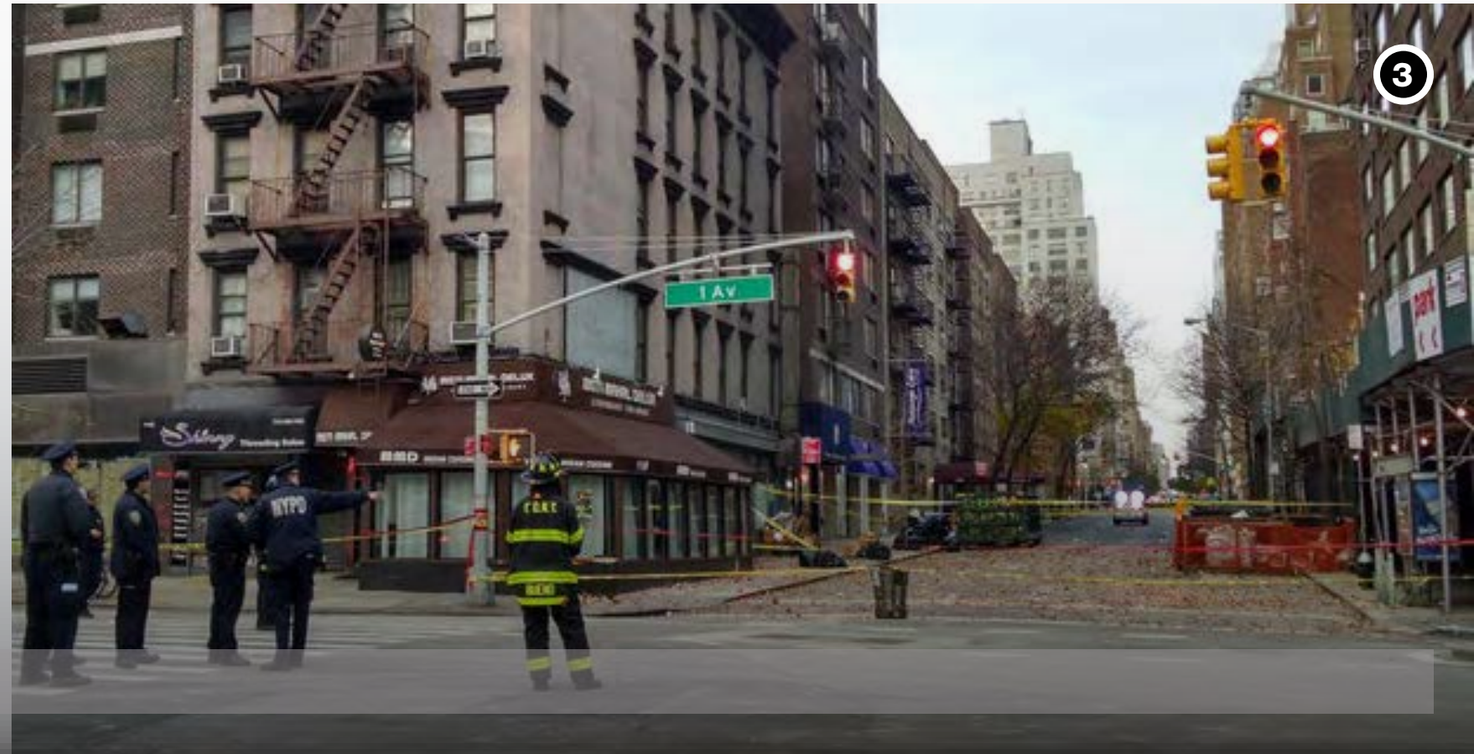
Root Causes Material Corrosion

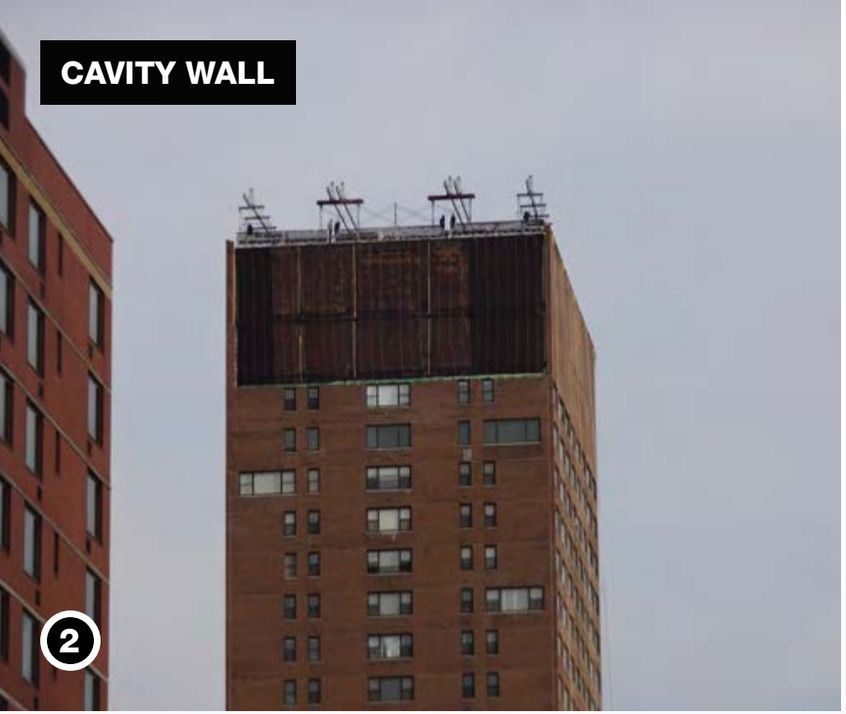
Potential Repair Post-Installed Anchors; Reskin

50 years to failure

2

3

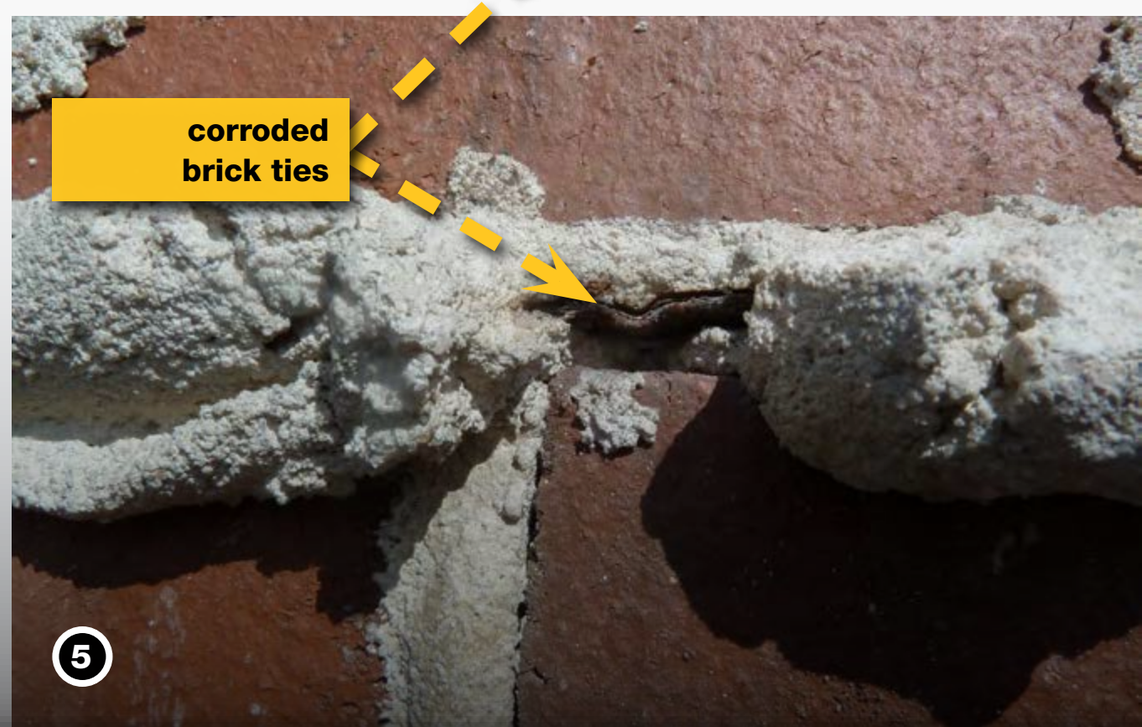



CAVITY WALL
2


collapsed bricks held by waterproofing membrane
3


4


1


corroded brick ties
5

CAVITY WALL

1

Owner to Dismantle Flawed Madison Ave. Facade

By CHARLES V. BAGLI

The developer Harry Macklowe said yesterday that he would dismantle the entire south facade of his 39-story tower at 540 Madison Avenue, brick by brick, rather than risk having another section of the wall break away from the building and tumble

bracing.

Officials said the avenue would remain closed to automobiles, at least until Monday night.

City officials say the building is now structurally stable, but the developer has decided not to try to salvage the remaining

serious problems with the brickwork around the end of October, the Macklowe Organization said. Fearing that bricks might come loose, workers began putting up safety nets several weeks later, and the contractor obtained a permit on Nov. 25 for a sidewalk shed along Madison Avenue.

High-Rise Wall Breaks Loose, Raining Debris On Shoppers

By DAVID M. HALBFINGER

A section of a Madison Avenue office tower's side wall suddenly peeled off yesterday, raining debris on holiday shoppers and tourists, snapping a hanging work platform in two and dangling a ton of bricks from a torn safety net.

A man and a 3-year-old girl were only slightly injured, but neighboring buildings were evacuated and several blocks were closed to traffic into the night. Hundreds of passers-by

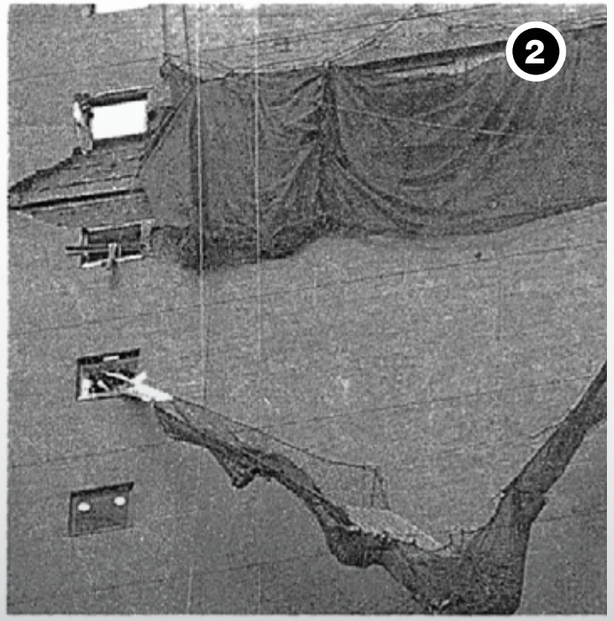
overloaded net.

the start of business this morning. The

Madison Avenue, at least certain areas of Madison Avenue, are not safe right now," Mr. Giuliani said. Holding one of the bricks, which he said weighed about two pounds, the Mayor said that the safety net "wasn't adequate enough, but at least it did enough of its job to protect people's lives."

The authorities said the accident began when a section of the building's 33d-floor side wall, facing a building to the south, suddenly broke loose around 12:44 P.M. The falling

2



A safety net was bent by the weight of bricks that tore loose from t Madison Avenue yesterday. Some of the debris fell on the streets.

fell while looking up at the falling bricks. He refused medical attention.

About half an hour after the initial shower of bricks, the platform snapped in two, and another wave of debris rained down on the street.

According to city officials and owners of the buildings next to the tower, about five months ago construction workers started punching holes in the brick wall and installing windows on every floor.

lowe Organization, did not respor phone messages left at its office

Ted Birkhahn, a spokesman for Department of Buildings, said th November, an architect or engi working for the owner inspected tower's facade and found that exterior brickwork was "pulling bulging" away from a middle la of brick in the cavity between exterior and interior masonry.

After hanging safety nets ar

3

Midtown Late Modernist Building New York, New York, USA (1971)

Observed Conditions Bulging Masonry; Panel Failure/Partial Collapse

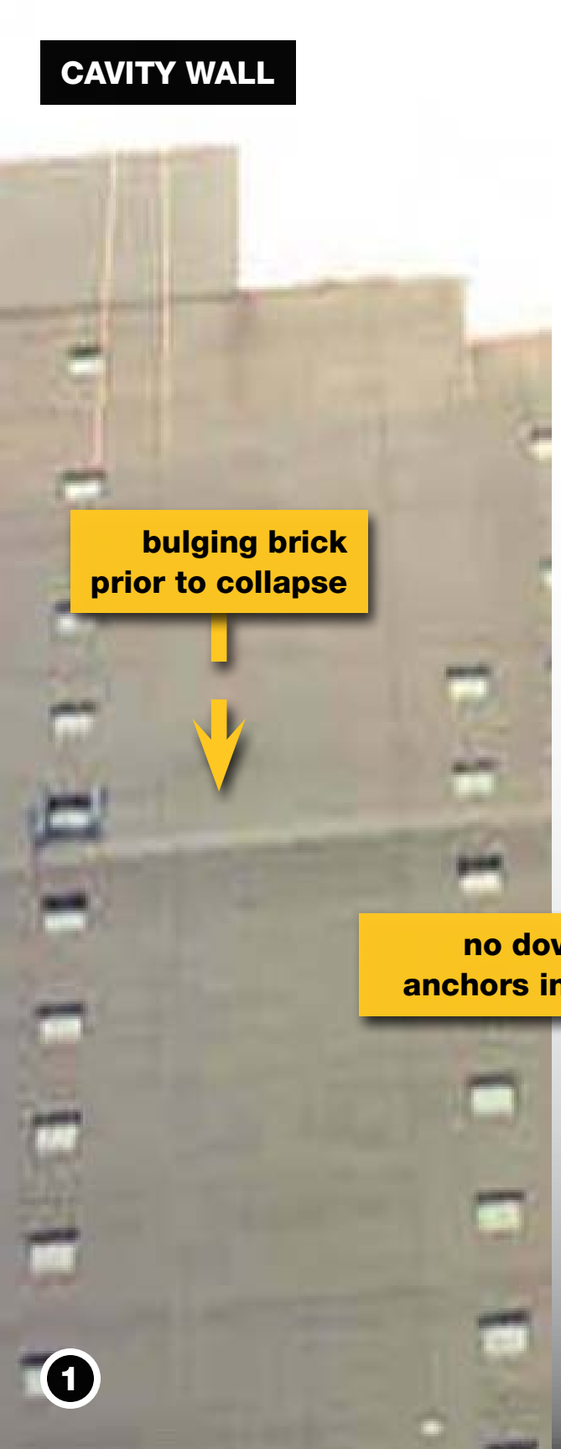
Investigation Methods Visual Thermography; Radar; Metal Detection

Root Causes Installation Error

Potential Repair Post Installed Anchors; Reskin

26 years to failure

CAVITY WALL



1

2

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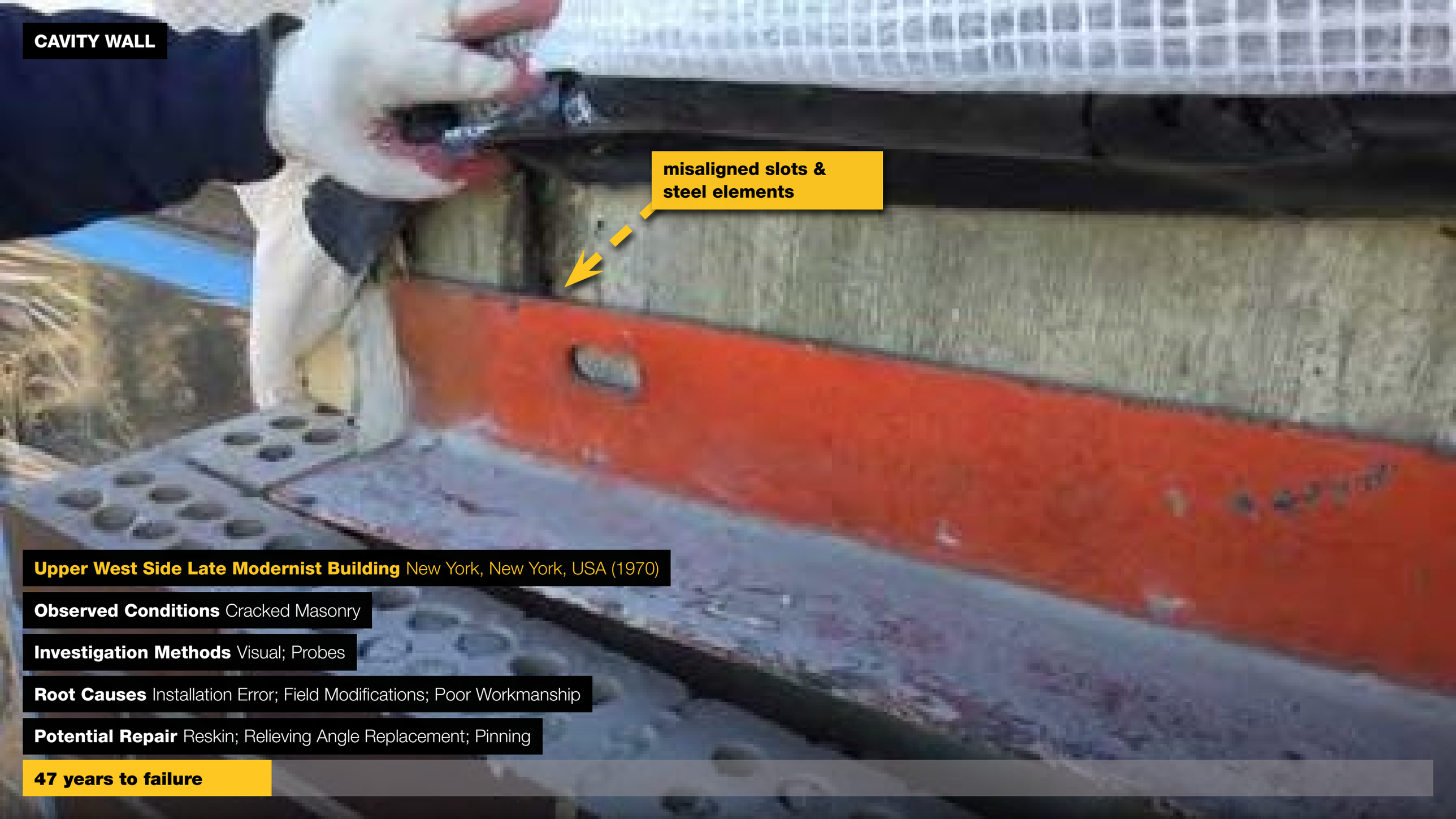
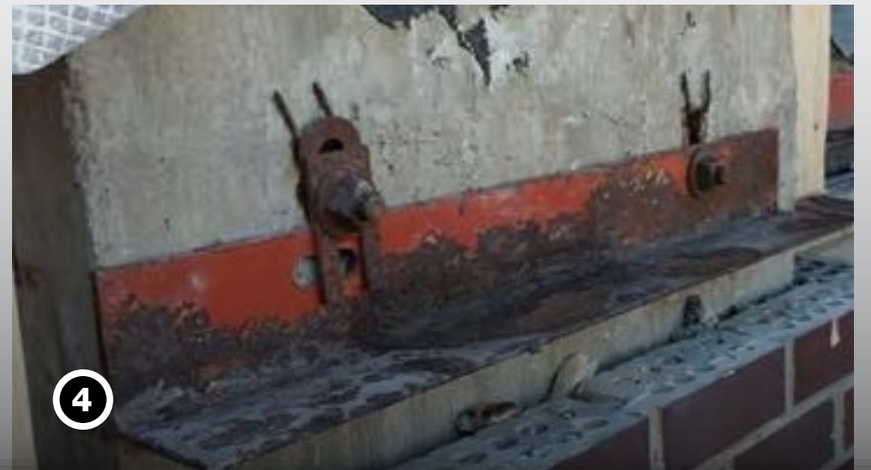

CAVITY WALL
misaligned slots &
steel elements
Upper West Side Late Modernist Building New York, New York, USA (1970)
Observed Conditions Cracked Masonry
Investigation Methods Visual; Probes
Root Causes Installation Error; Field Modifications; Poor Workmanship
Potential Repair Reskin; Relieving Angle Replacement; Pinning
47 years to failure


CAVITY WALL
1


2


4


improper field modifications leading to concrete cracking
3

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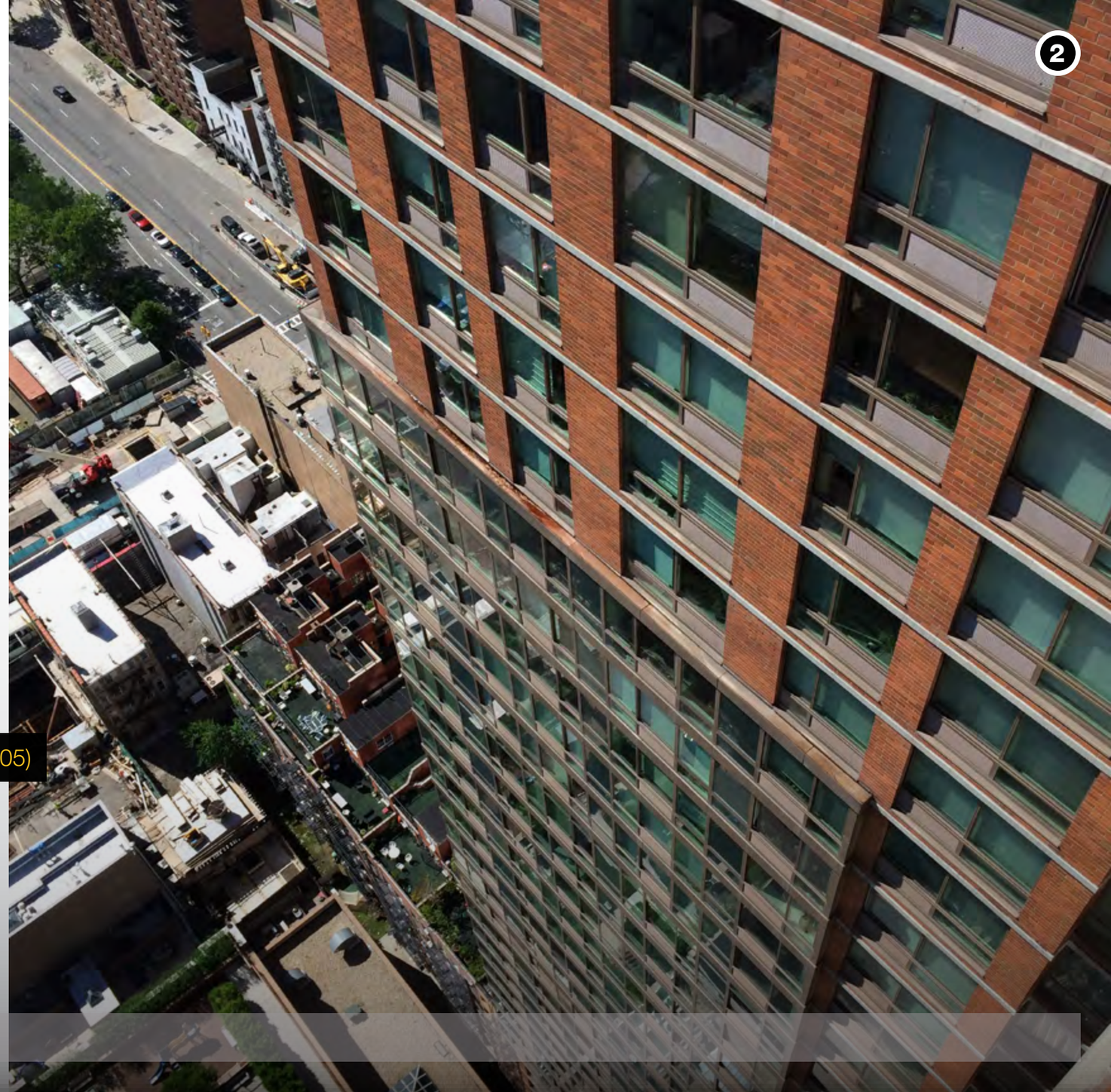
CONTEMPORARY CONSTRUCTION

Poured Reinforced Concrete

1

2



Upper East Side Contemporary Building New York, New York, USA (2005)

Observed Conditions Concrete Spalling

Investigation Methods Visual; Sounding; GPR; Metal Detection

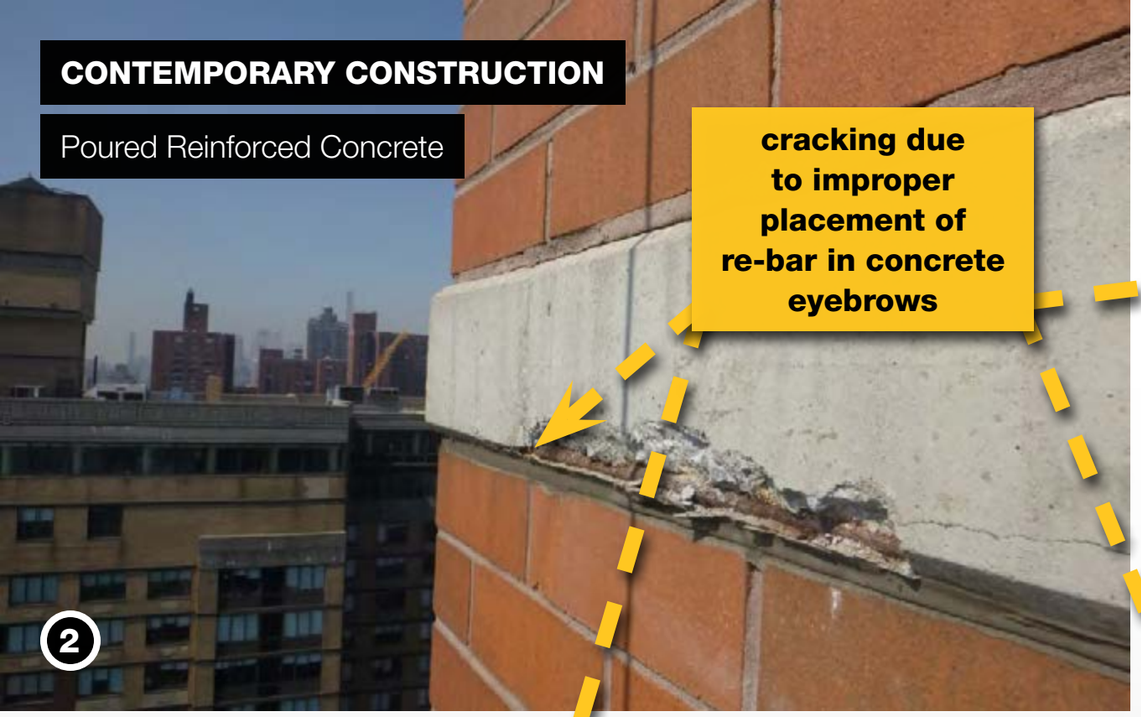
Root Causes Concrete Coverage

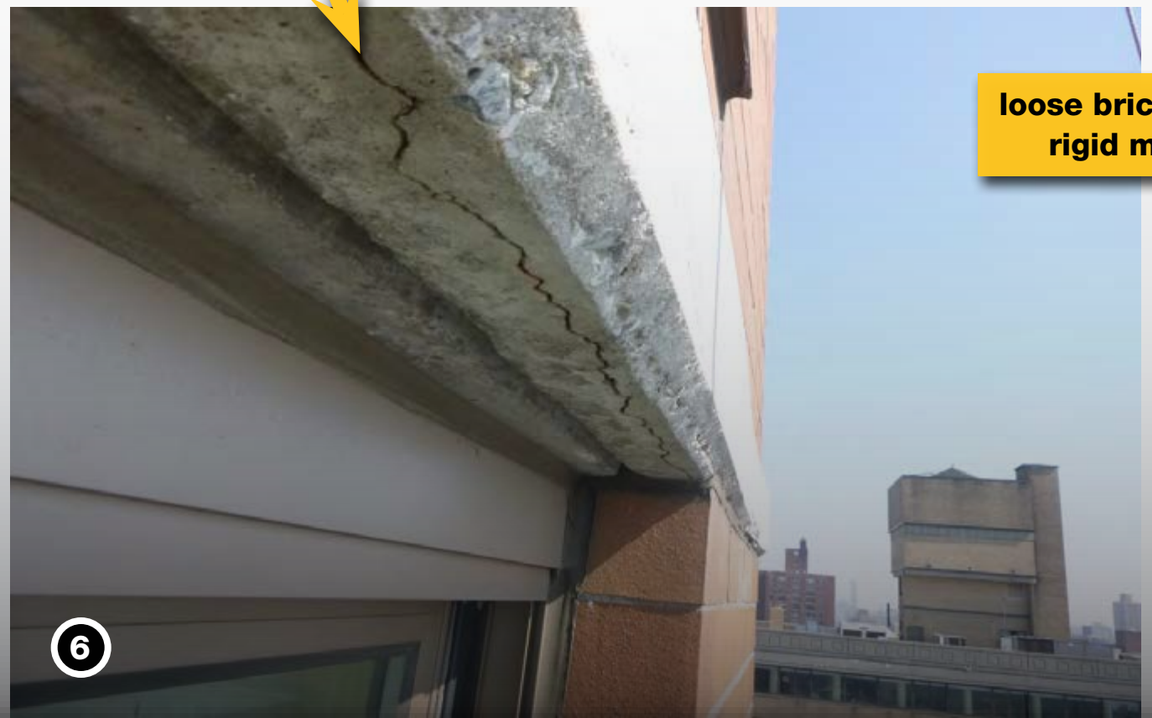
Potential Repair Concrete Patching

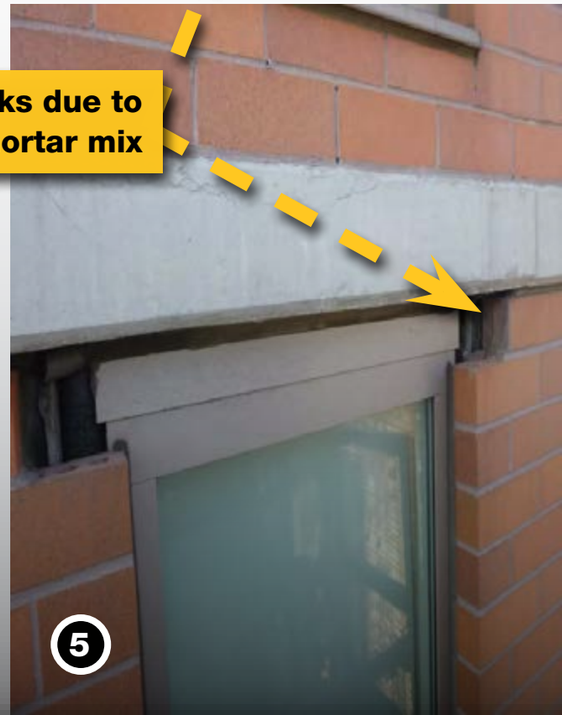
10 years to failure

CONTEMPORARY CONSTRUCTION

Poured Reinforced Concrete







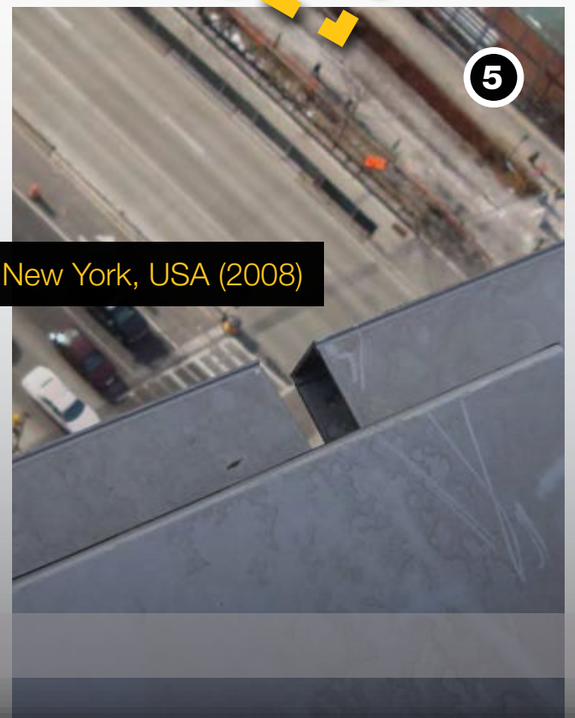
CONTEMPORARY CONSTRUCTION

Glass & Metal Envelopes

1

2

3



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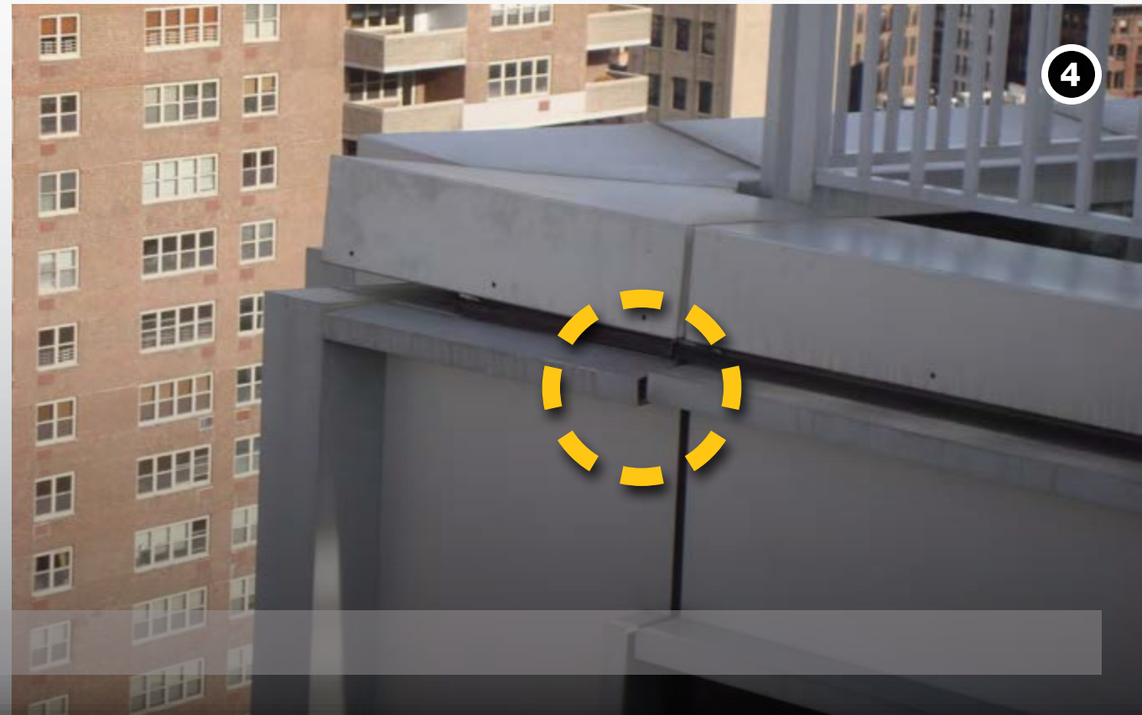

4

Financial District Contemporary Building New York, New York, USA (2008)

Observed Conditions Falling Curtain Wall Cladding

Investigation Methods Visual; Probes

Root Causes Workmanship

Potential Repair Façade Repairs

3 years to failure

Agenda

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CONTEMPORARY CONSTRUCTION
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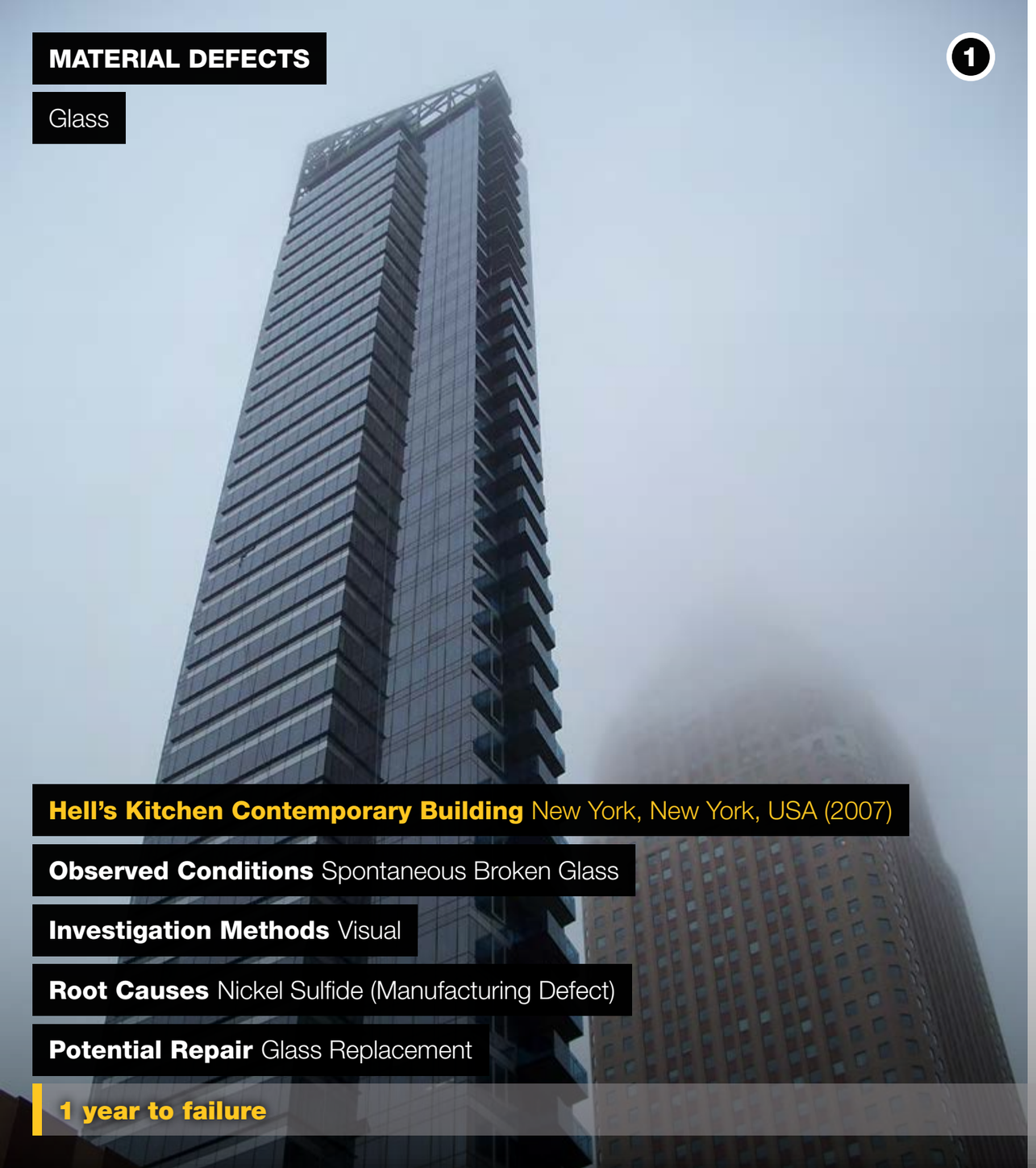
SUMMARY

MATERIAL DEFECTS

Glass

1



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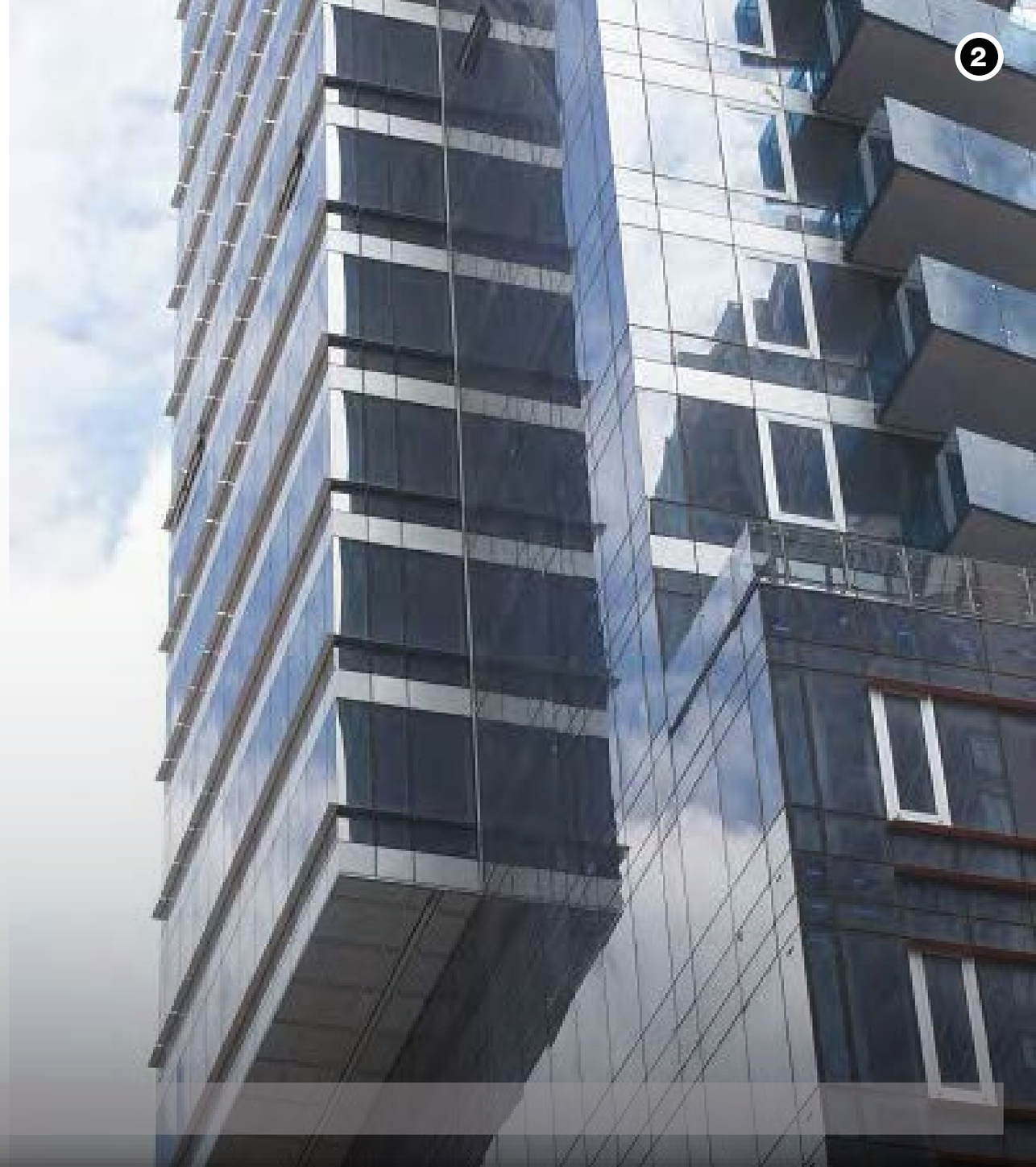


Hell's Kitchen Contemporary Building New York, New York, USA (2007)

Observed Conditions Spontaneous Broken Glass

Investigation Methods Visual

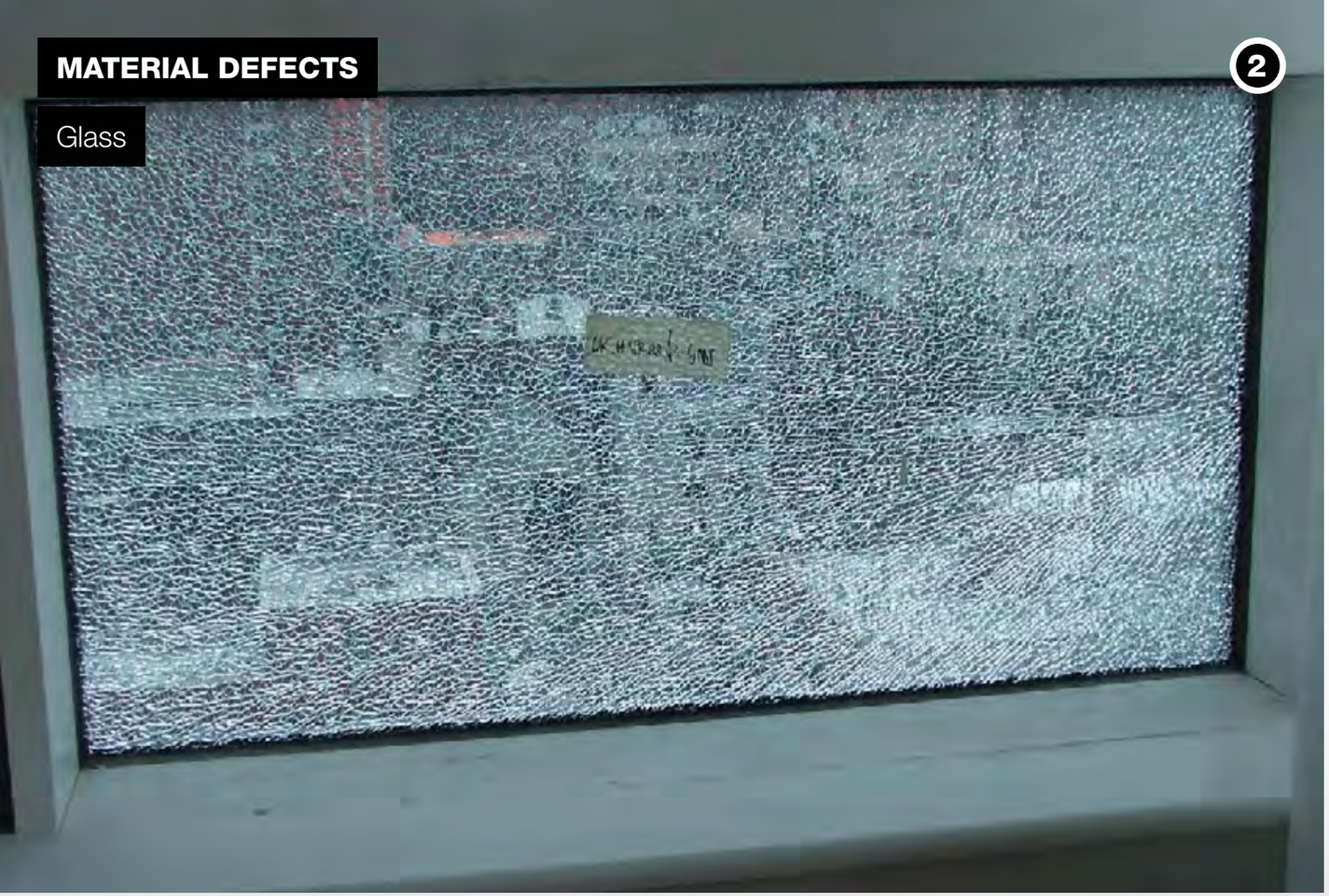
Root Causes Nickel Sulfide (Manufacturing Defect)

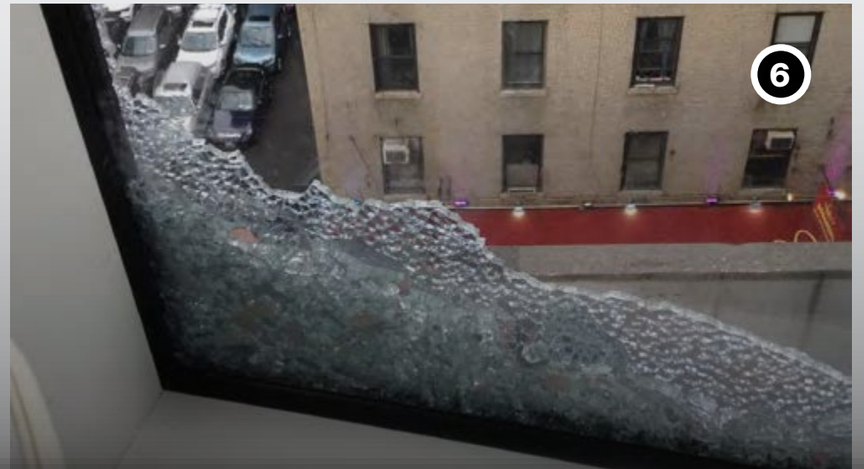
Potential Repair Glass Replacement

1 year to failure

MATERIAL DEFECTS

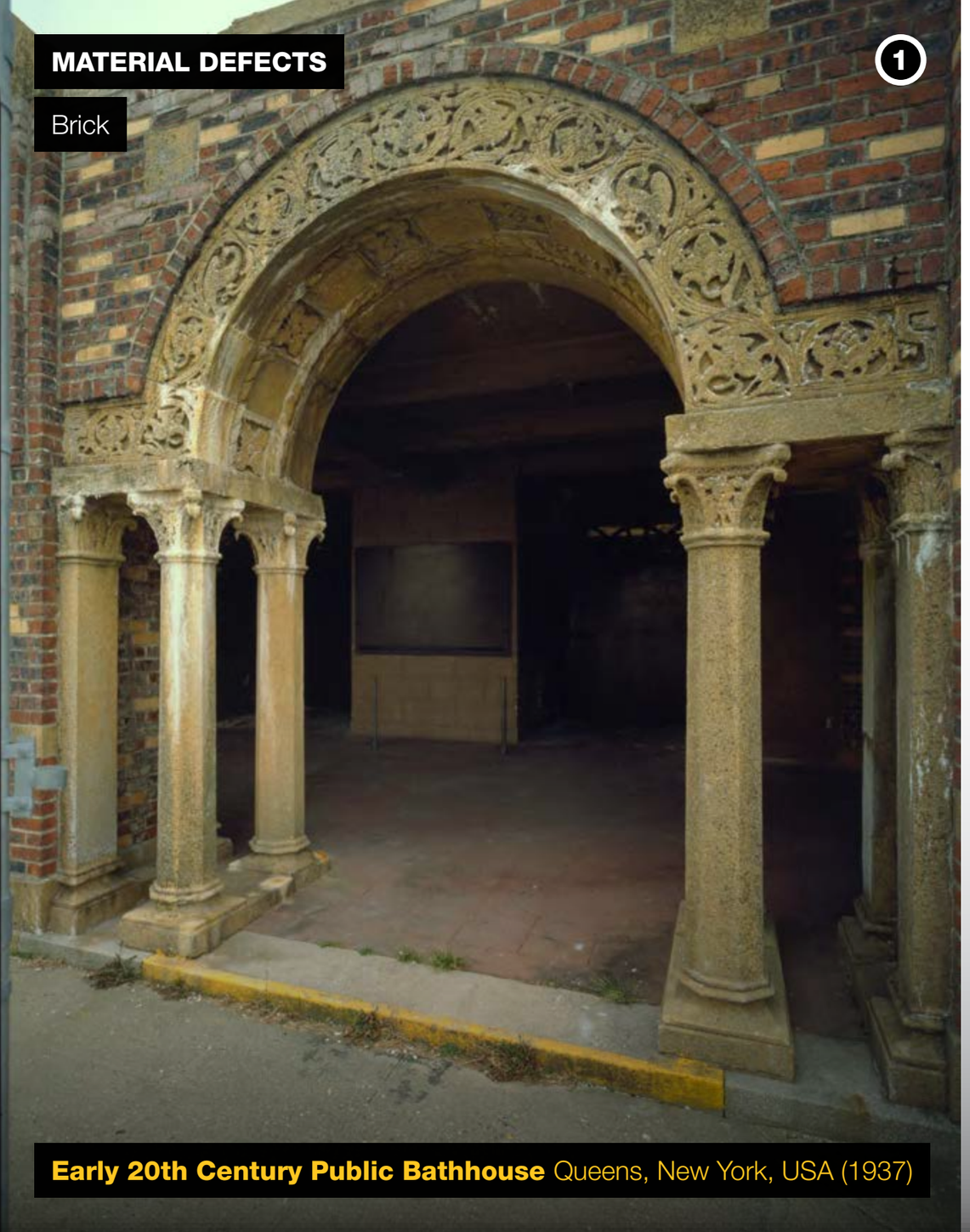
Glass





MATERIAL DEFECTS

Brick



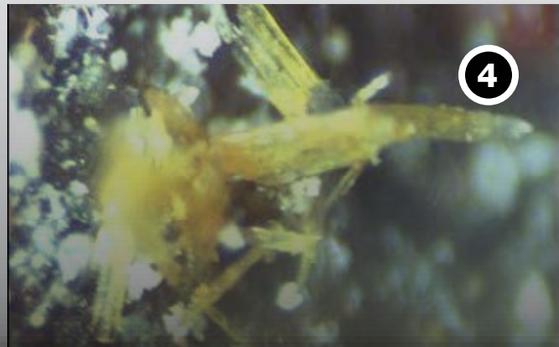
1

Early 20th Century Public Bathhouse Queens, New York, USA (1937)

2

5

3



4

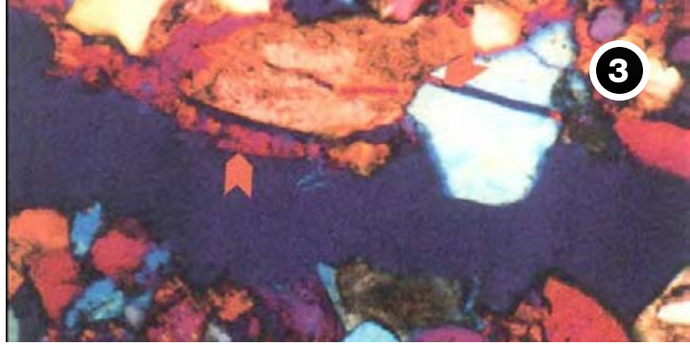
MATERIAL DEFECTS

Gypsum

1

2

3



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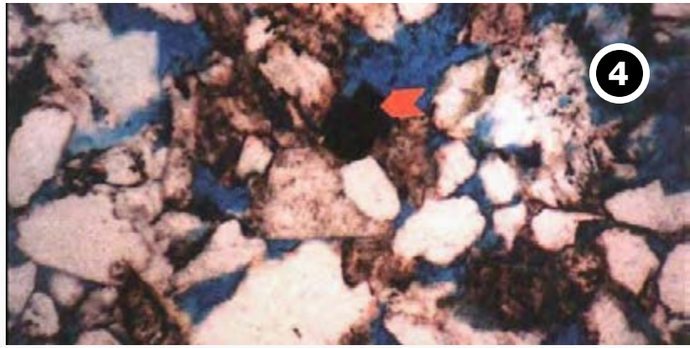

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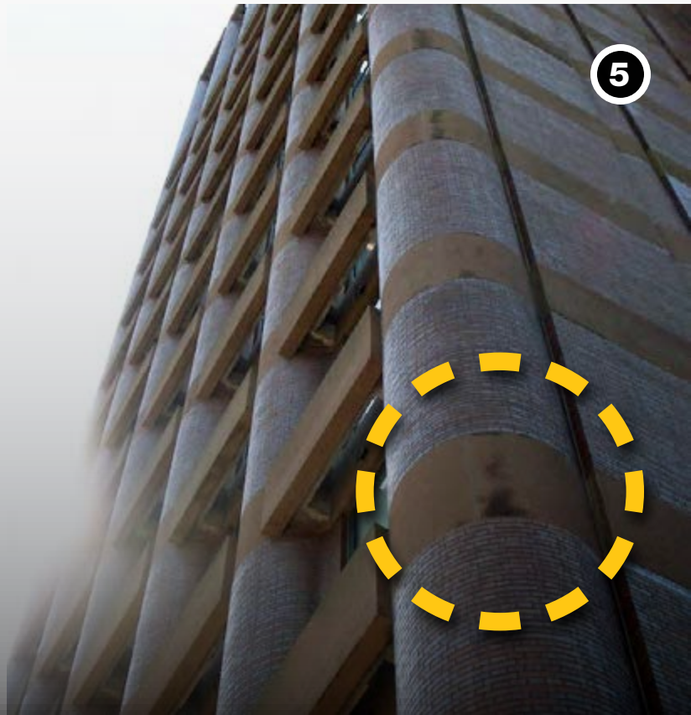
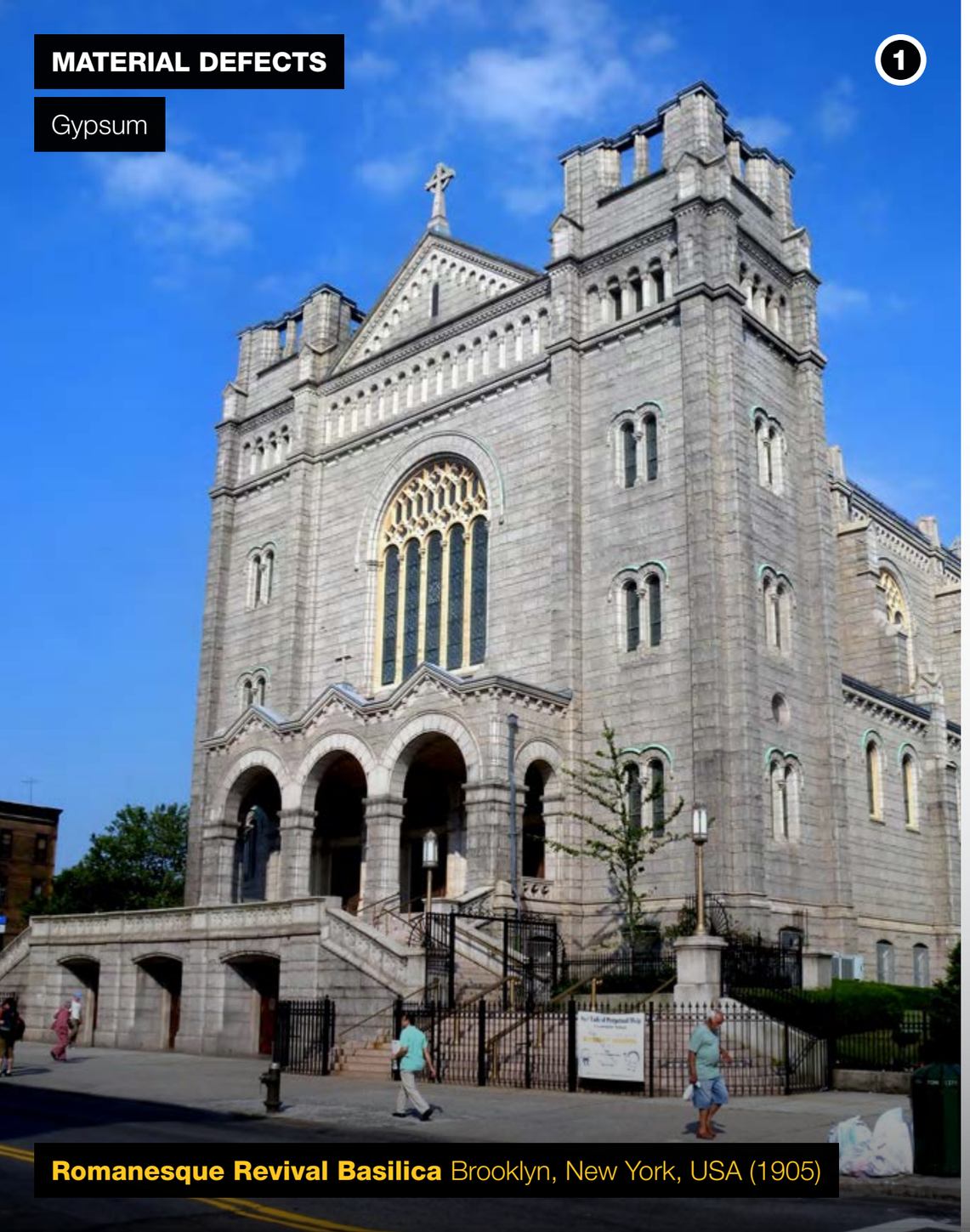


Academic Building New Haven, Connecticut, USA (1965)

MATERIAL DEFECTS

Gypsum



1

Romanesque Revival Basilica Brooklyn, New York, USA (1905)

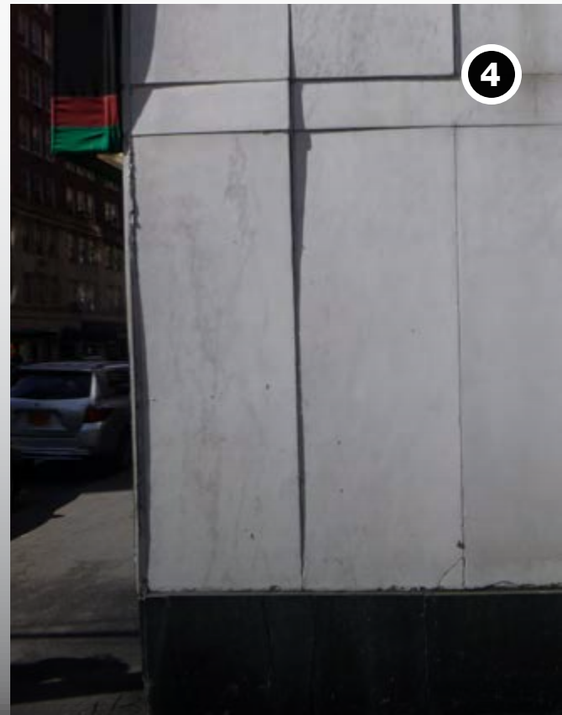
2

3

4

MATERIAL DEFECTS

White Glazed Brick



Early 20th Century Commercial Building Queens, New York, USA (1930)

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SUPERTALLS

Tall and Narrow Structures -- What to expect?

Burj Khalifa (2,717ft)

United Arab Emirates (2008)

432 Park Avenue (1,396ft)

New York, USA (2015)

111 West 57th Street (1,428ft)

New York, USA (2019)

MoMA Tower (1,050ft)

New York, USA (2018)

SUPERTALLS

Tall and Narrow Structures -- What to expect?

9 DeKalb Avenue (1,030ft)

New York, USA (2021)

125 Greenwich Street (912ft)

New York, USA (2019)

30 Park Place (869ft)

New York, USA (2016)

111 West 57th Street (661ft)

New York, USA (2019)

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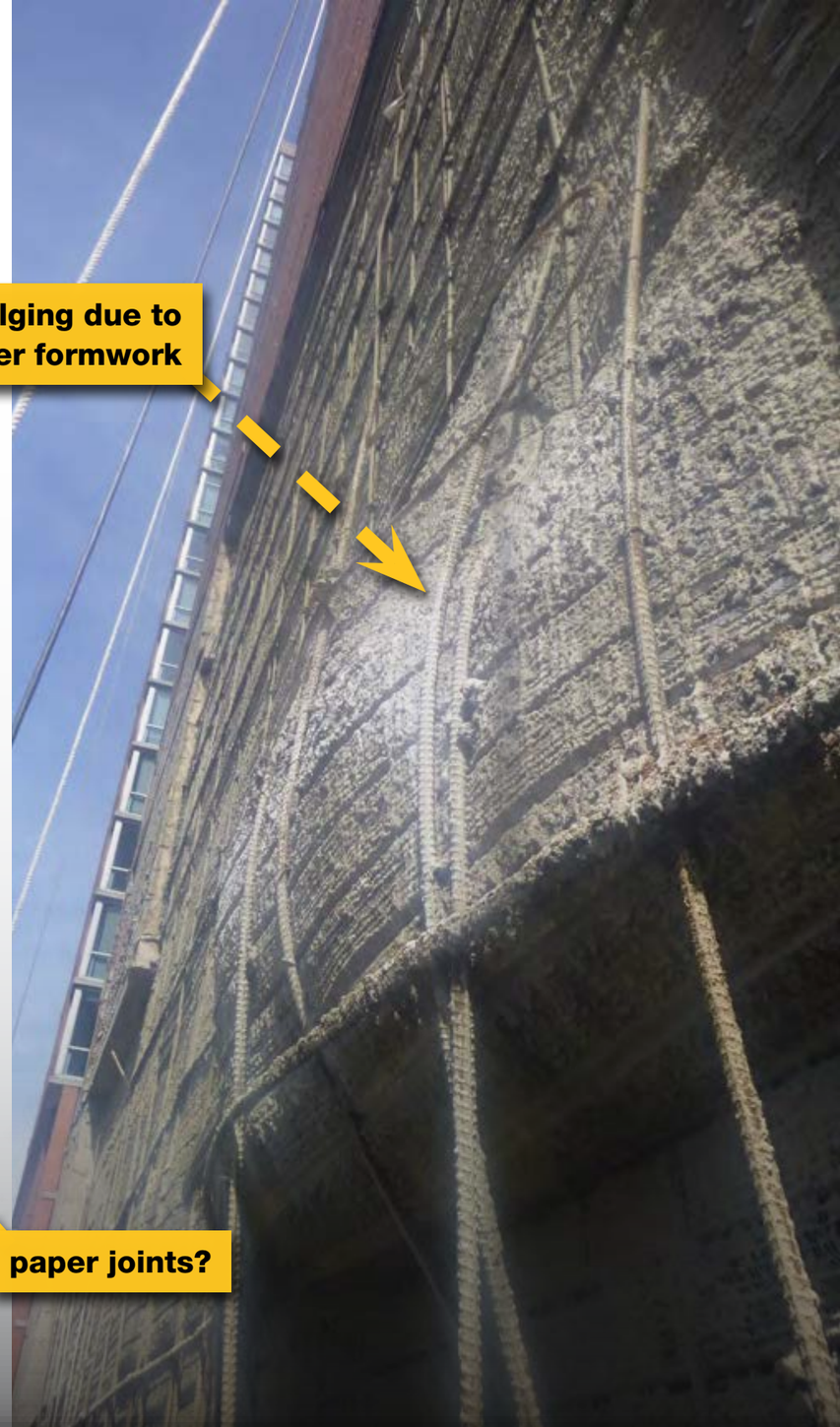
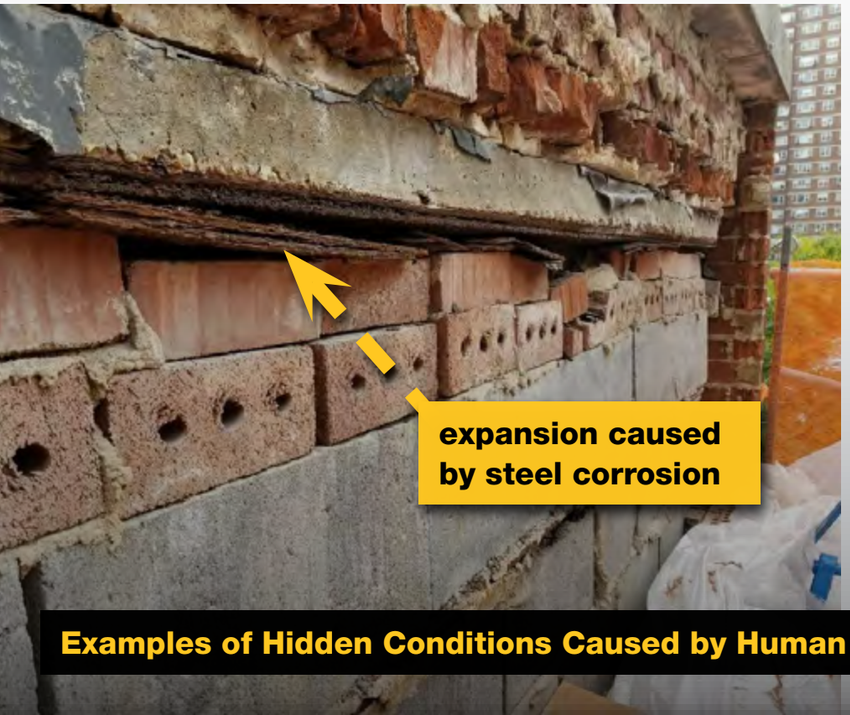
HUMAN ERROR

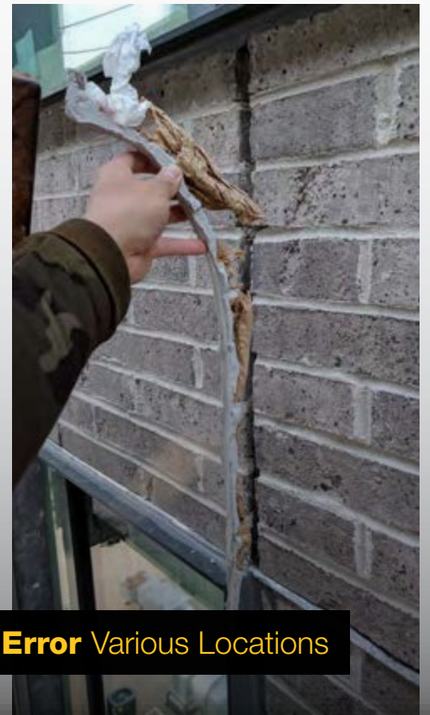
i.e. “Whoops!”

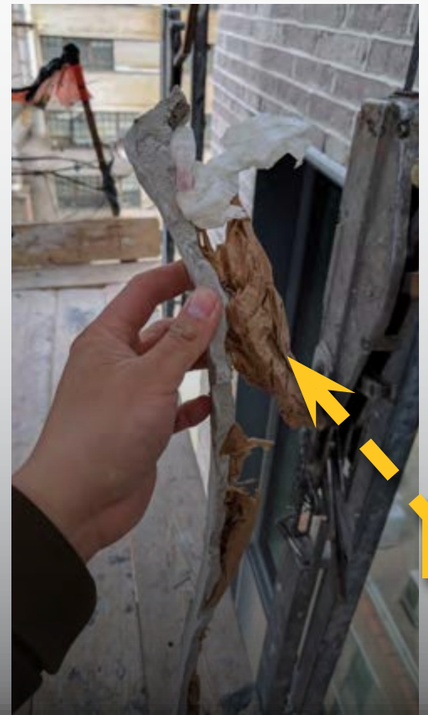


bulging due to improper formwork



expansion caused by steel corrosion





paper joints?

Examples of Hidden Conditions Caused by Human Error Various Locations

Agenda

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SUMMARY

What have we learned?
Where do we go moving forward?

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Thank you!