Champlain Towers South Investigation and California Wildfires Update

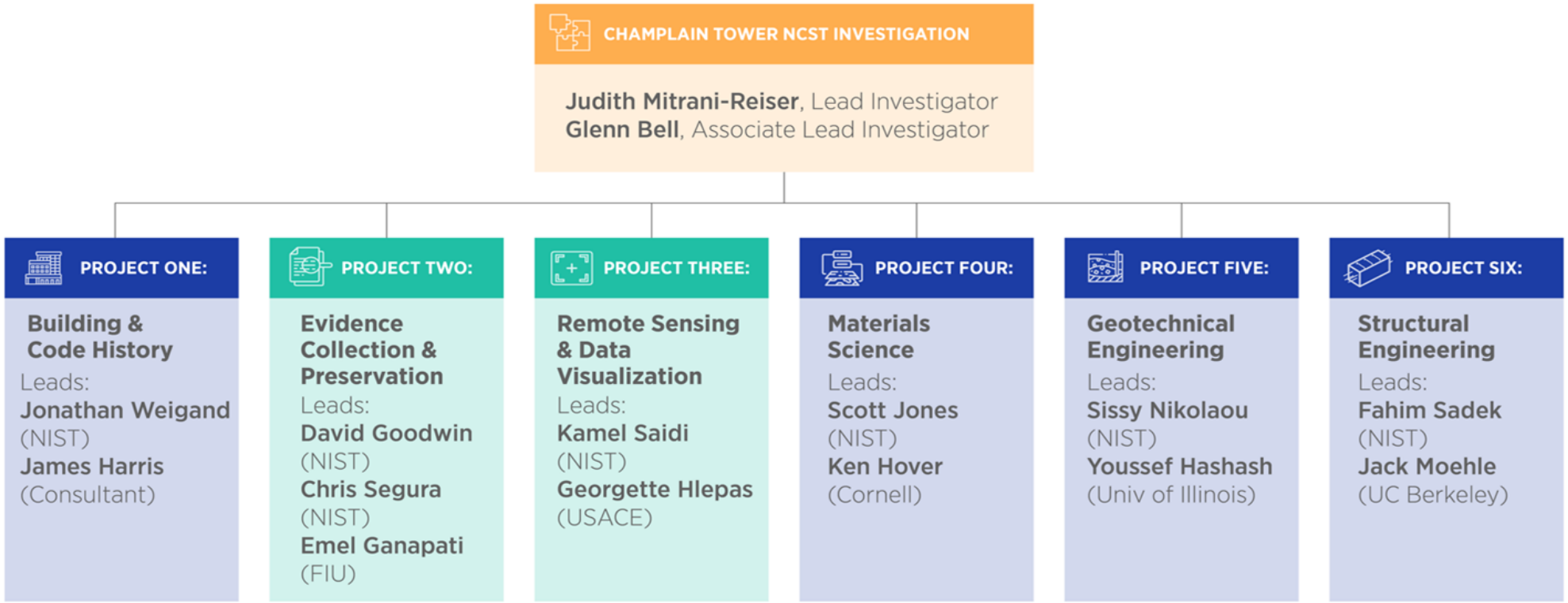
Jason Averill
Deputy Director
Engineering Laboratory

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

June 11, 2025

CTS Investigation: National Construction Safety Team (NCST)

Champlain Towers South NCST Investigation Leaders



CTS Investigation: Disclaimers for Presentation

⚠ IMPORTANT: ALL DATA ARE PRELIMINARY

- This presentation describes preliminary data gathered to date as well as preliminary analyses of these data. Data and analyses are subject to change.
- Once all data are finalized and analyzed, they will inform a broader understanding of the likely technical cause or causes of the collapse – and NIST's findings and recommendations.
- This presentation does not constitute NIST findings or recommendations.
- All survey and interview data collection included a consent process that specifies the allowable uses of data and protections of respondents.
- Copyrighted content (such as photographs) appearing in these presentations is used with permission; reproduction, redistribution or reuse may require copyright holder permission, including for content with anonymous attribution/credit.
- Every reasonable effort has been made to identify copyright holders for content (such as photographs) appearing in these presentations.

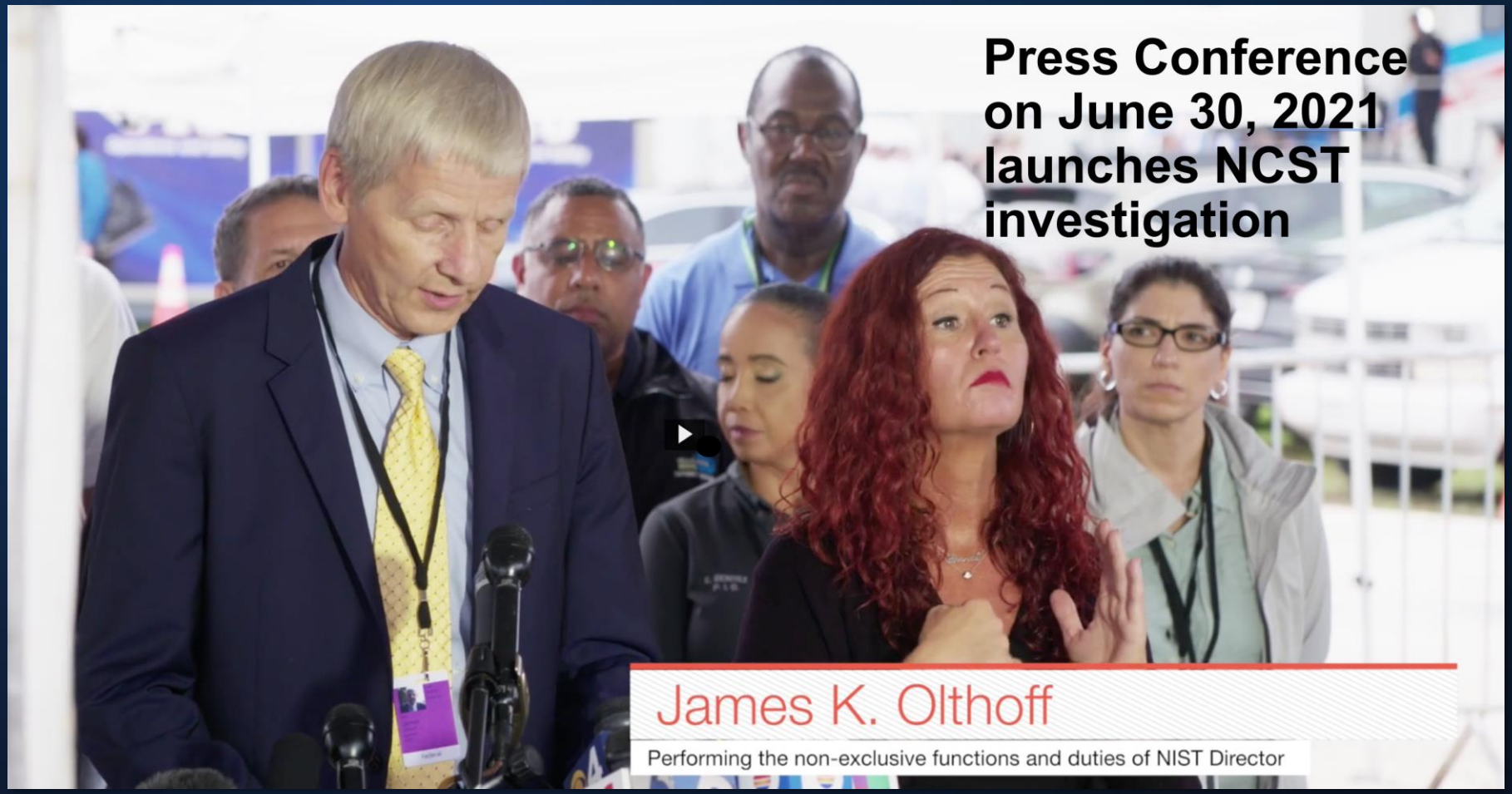
CTS Investigation

01 Background

CTS Investigation

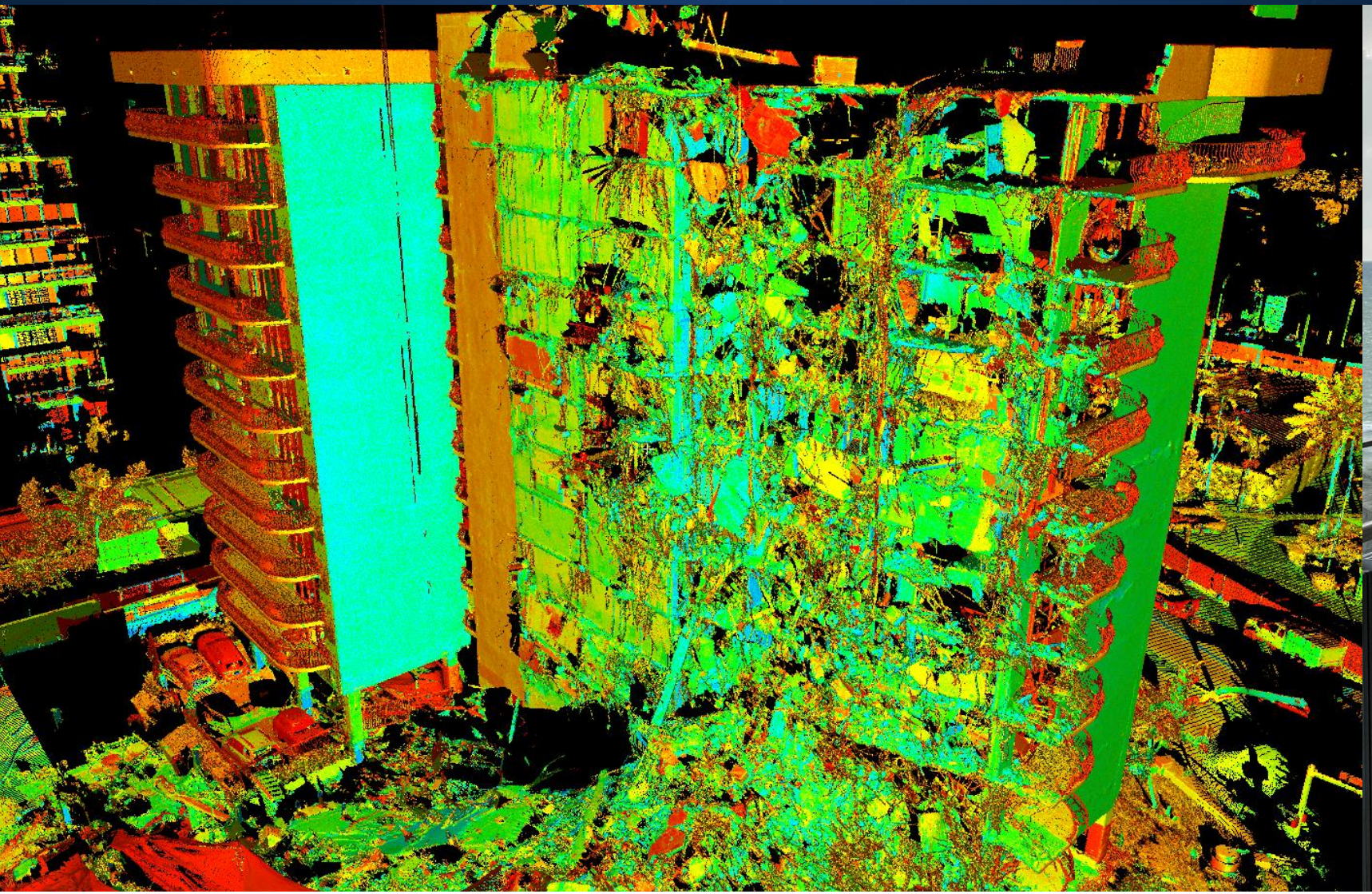
Source: NIST

CTS Investigation: NIST Launches NCST Investigation



Source: NIST

CTS Investigation: Initial Evidence Collection

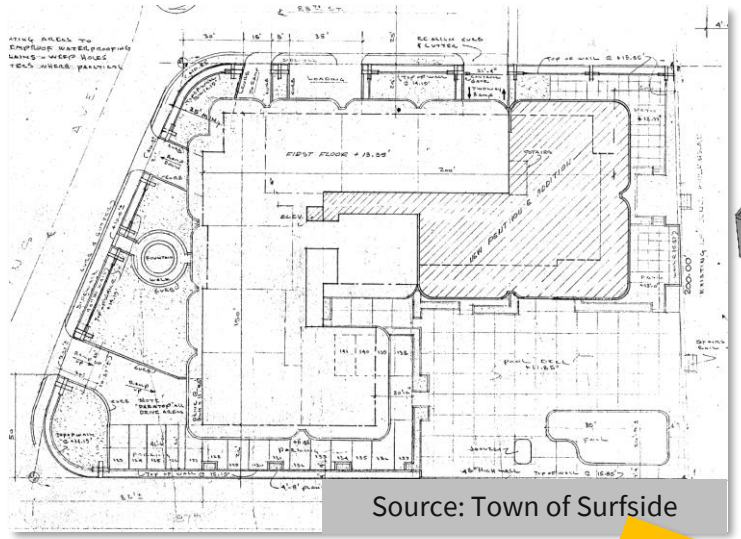


Source: NSF, NIST

Experts from FEMA, NSF, USGS, and USACE support remote sensing activities

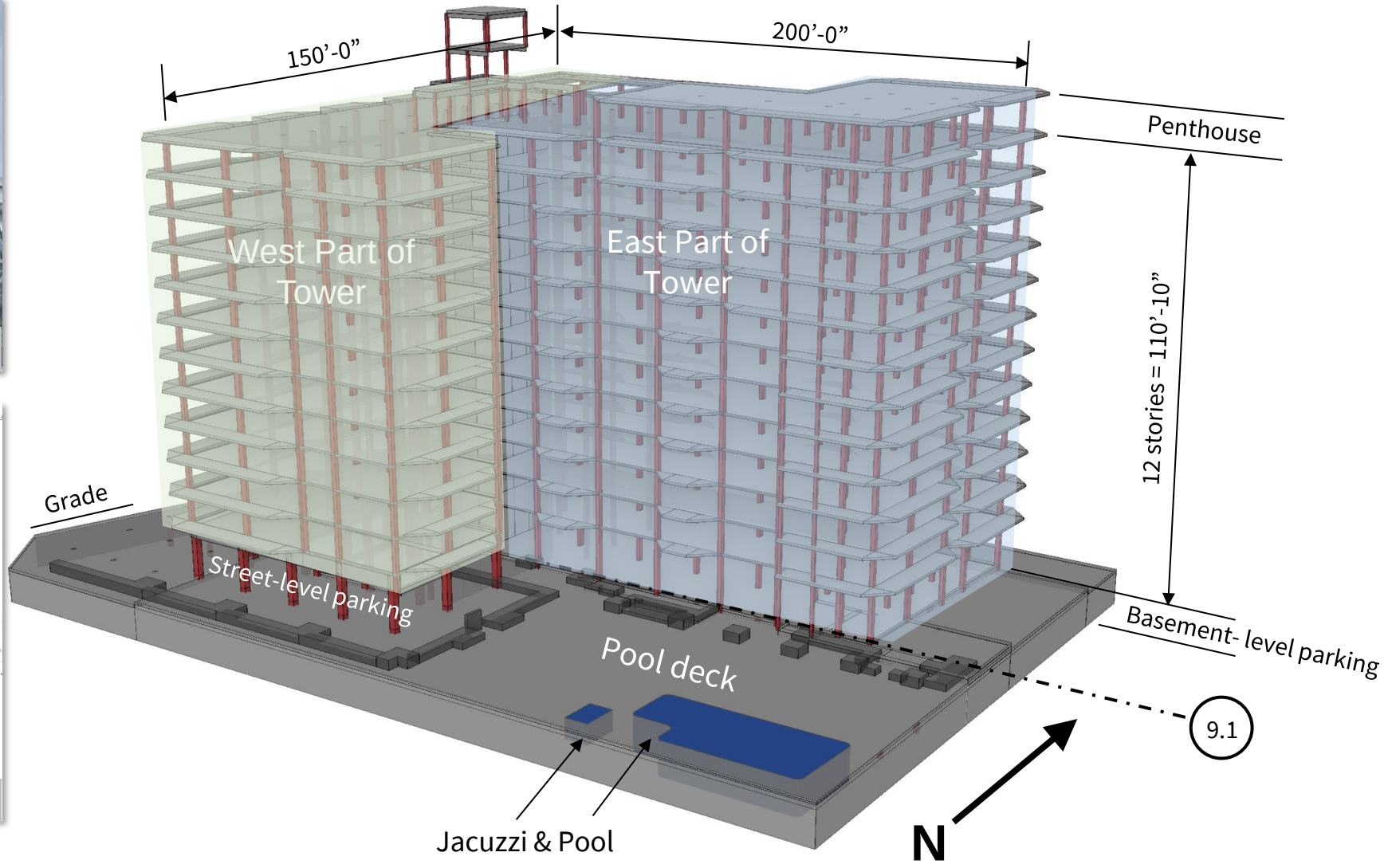
CTS Investigation: Description of the Building

© 2021, Used with permission



Source: Town of Surfside

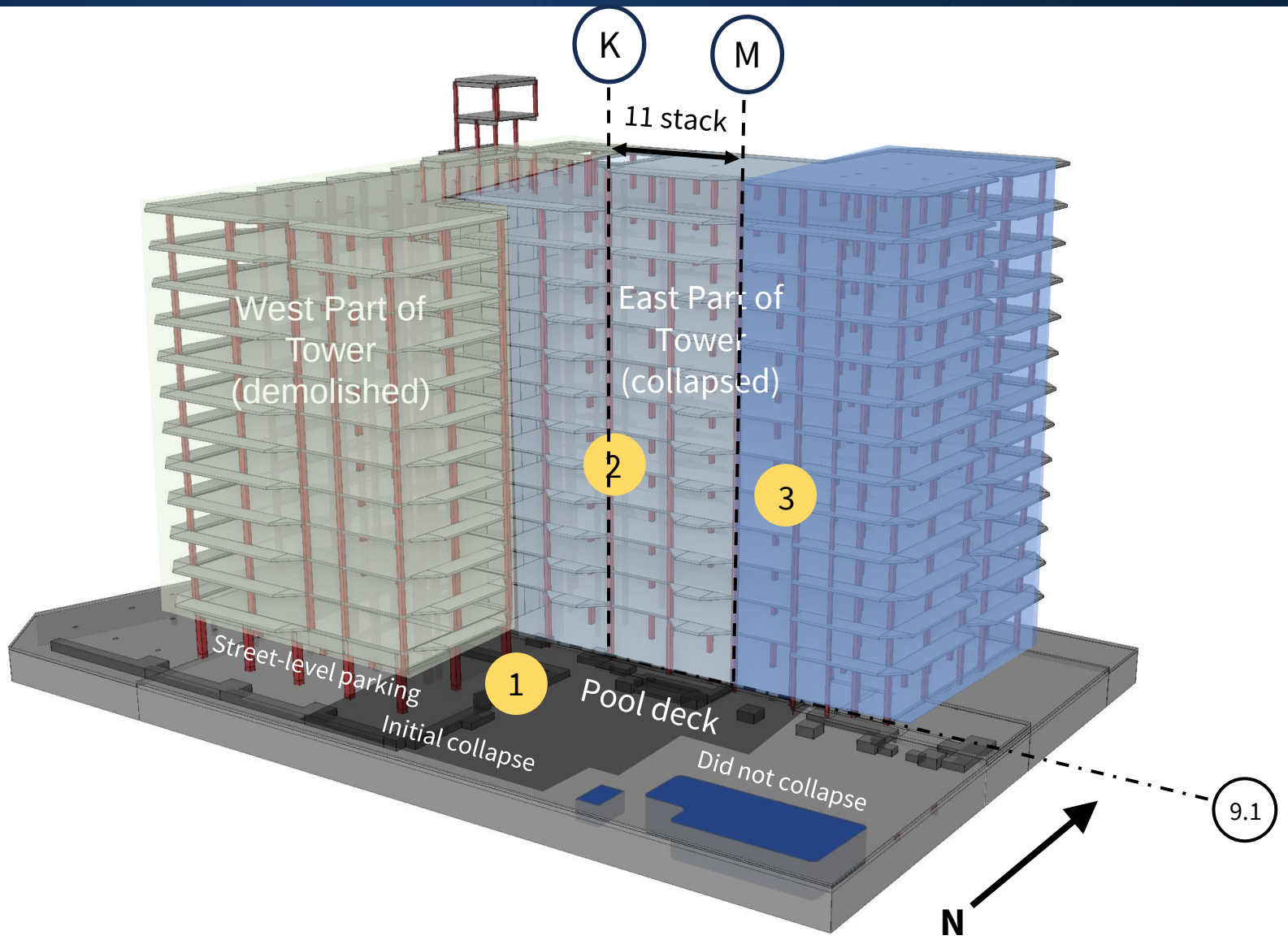
direction of view



Source: NIST

CTS Investigation: Collapse Sequence

Collapse:
June 24, 2021
1:22:17 am



Source: NIST

CTS Investigation

02 Photographic and Video Evidence: Collapse Timeline

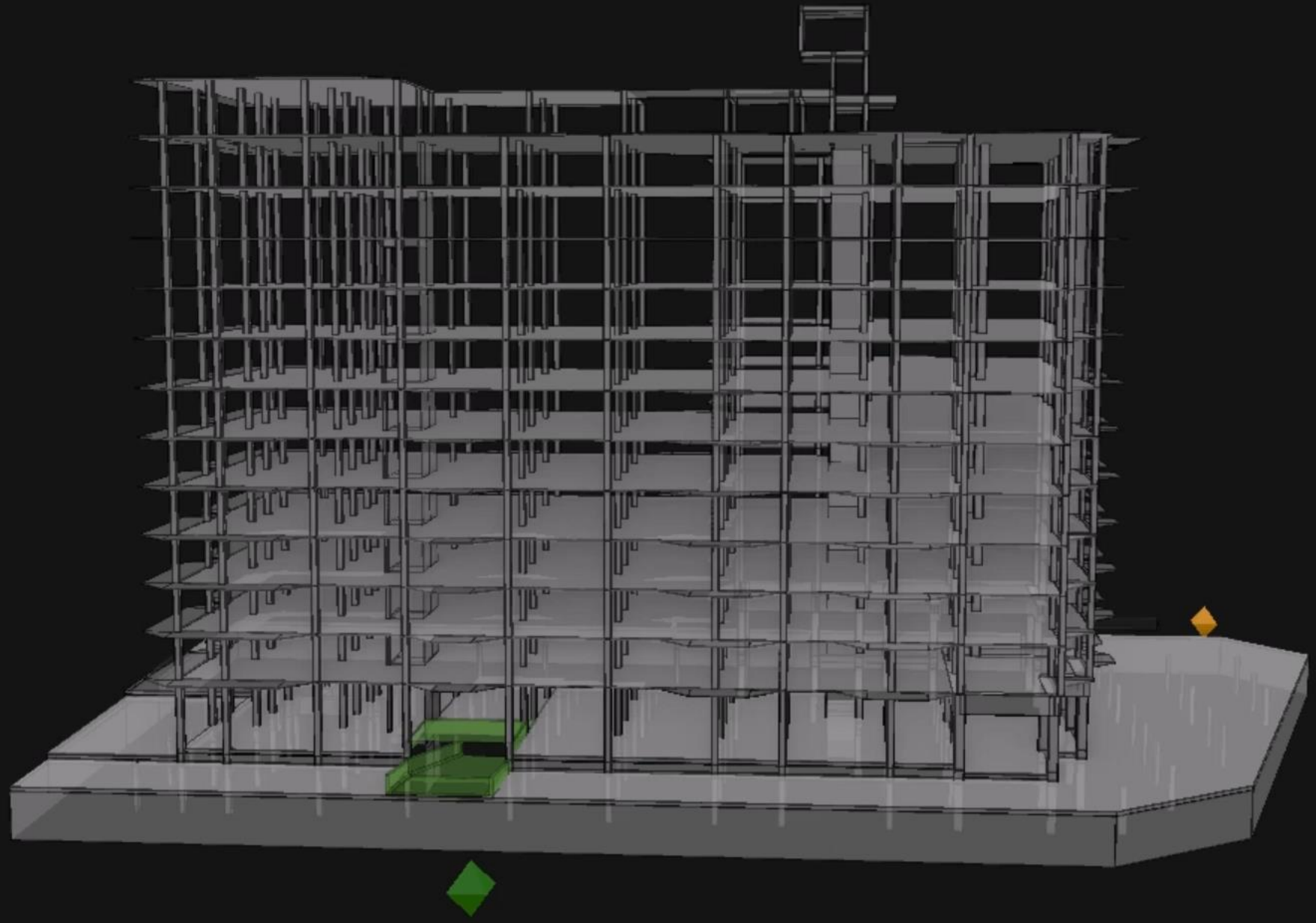
Warning: Some images may be disturbing

01:18:18

Source: NIST

Enhanced Image

Digitally adapted by NIST (Original Source: 2021, A. Sarmiento)

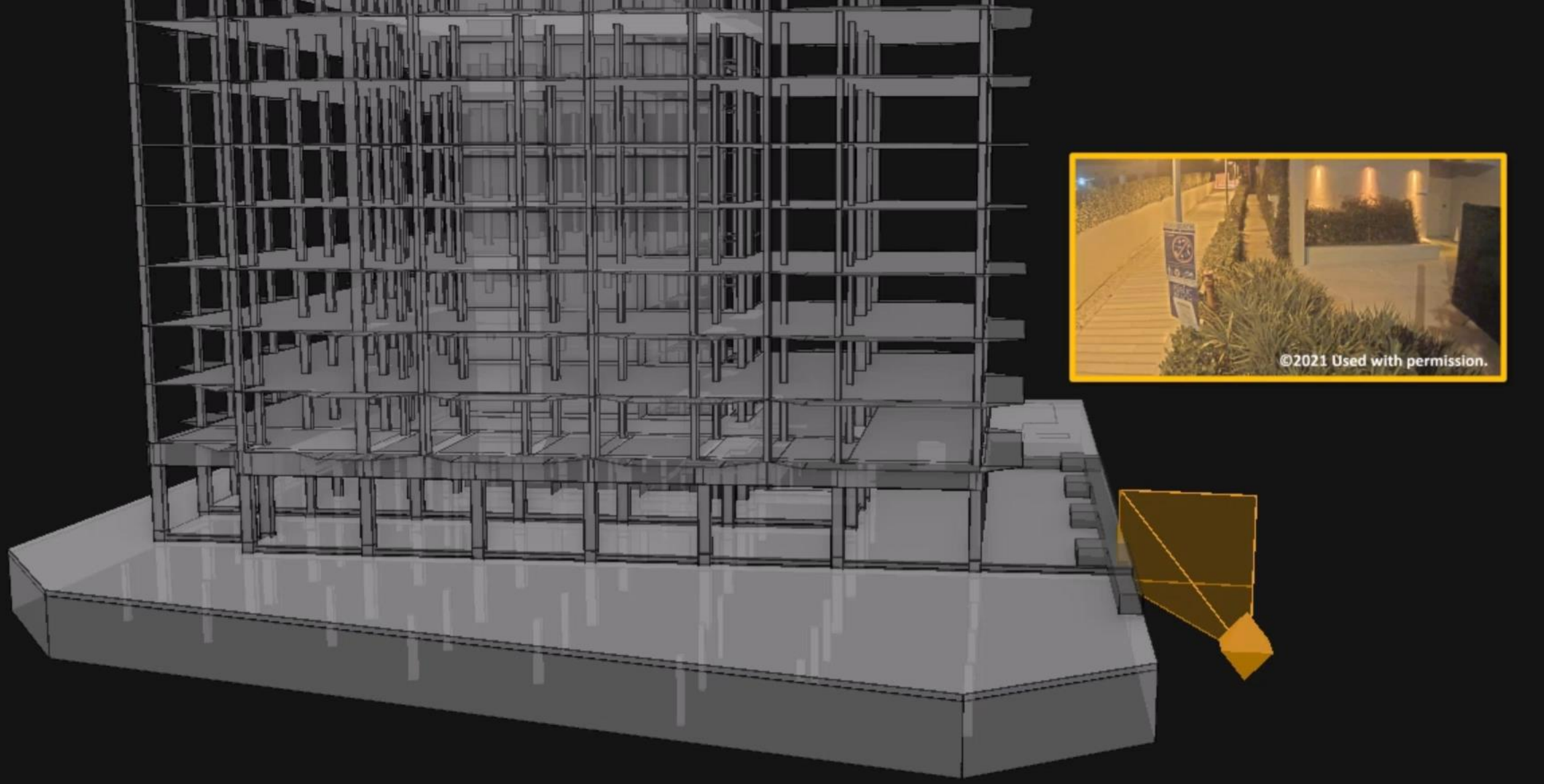


01:21:39

Parking Garage Ramp

Source: NIST

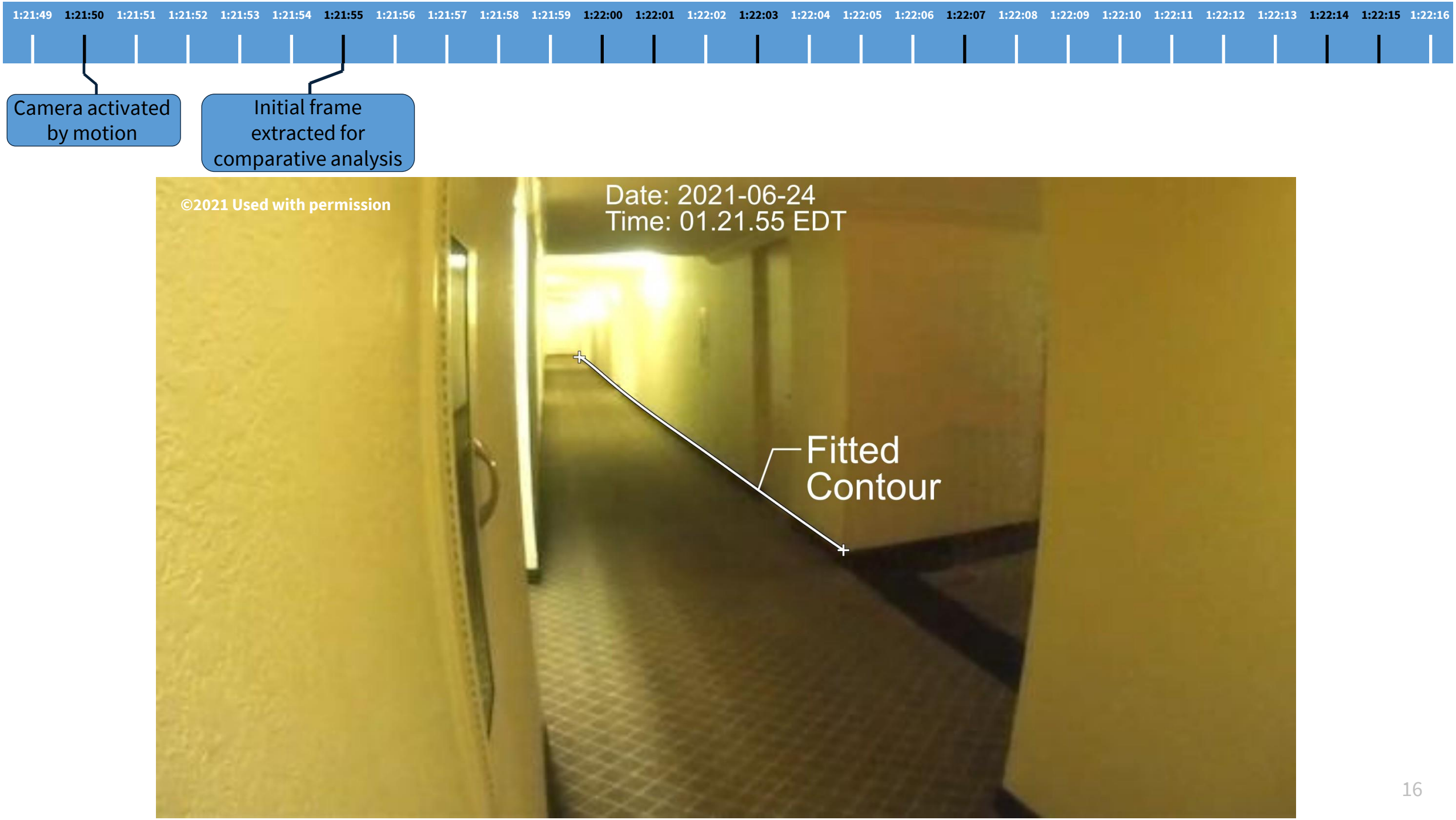

MIAMIBEACH
PUBLIC BEACH
ATTENTION
©2021 Used with permission.
1:22:17.876 AM
Beach Access Walkway camera activated by motion
South Face camera activated by motion
1:21:39
1:22:17
1:21:00
1:21:50
1:22:00
1:22:50
1:23:00
1:23:50
1:24:00
1:24:50
1:25:00
1:25:50
1:26:00
1:26:50
1:27:00
N.W. East View 1:21:39.128 AM 6/24/2021
©2021 Used with permission



01:21:50

Beach Access Walkway

Source: NIST


1:21:49
1:21:50
1:21:51
1:21:52
1:21:53
1:21:54
1:21:55
1:21:56
1:21:57
1:21:58
1:21:59
1:22:00
1:22:01
1:22:02
1:22:03
1:22:04
1:22:05
1:22:06
1:22:07
1:22:08
1:22:09
1:22:10
1:22:11
1:22:12
1:22:13
1:22:14
1:22:15
1:22:16
Camera activated by motion
Initial frame extracted for comparative analysis
©2021 Used with permission
Date: 2021-06-24
Time: 01.21.55 EDT
Fitted Contour

1:21:49 1:21:50 1:21:51 1:21:52 1:21:53 1:21:54 1:21:55 1:21:56 1:21:57 1:21:58 1:21:59 1:22:00 1:22:01 1:22:02 1:22:03 1:22:04 1:22:05 1:22:06 1:22:07 1:22:08 1:22:09 1:22:10 1:22:11 1:22:12 1:22:13 1:22:14 1:22:15 1:22:16

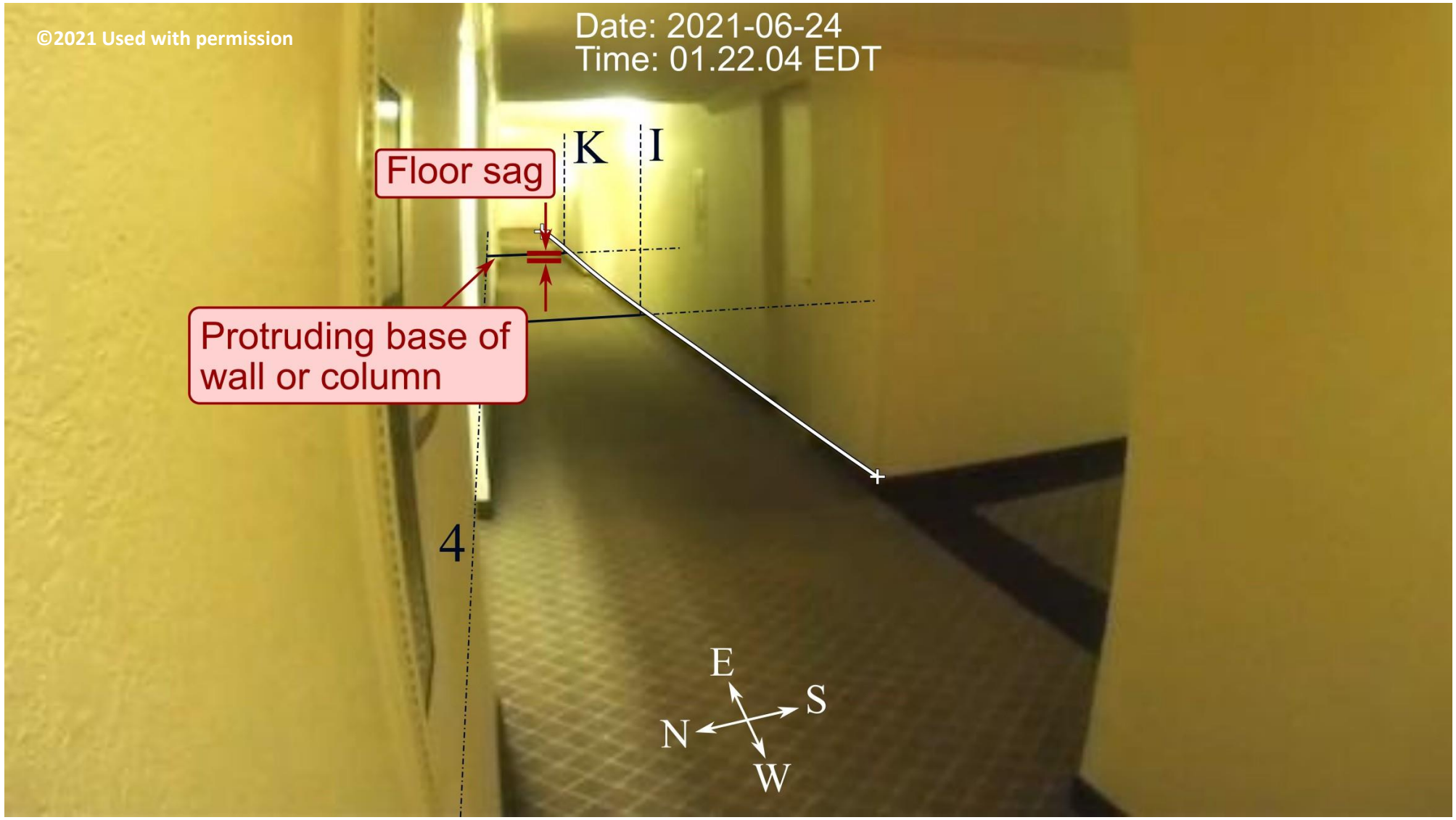
Camera activated by motion

Initial frame extracted for comparative analysis

Begin roaring, rumbling sounds

Floor begins to sag near Grid Line K

Begin displ. at north wall at or near Column K-4



1:21:49 1:21:50 1:21:51 1:21:52 1:21:53 1:21:54 1:21:55 1:21:56 1:21:57 1:21:58 1:21:59 1:22:00 1:22:01 1:22:02 1:22:03 1:22:04 1:22:05 1:22:06 1:22:07 1:22:08 1:22:09 1:22:10 1:22:11 1:22:12 1:22:13 1:22:14 1:22:15 1:22:16

Floor movement briefly slows

Camera activated by motion

Initial frame extracted for comparative analysis

Begin roaring, rumbling sounds

Floor begins to sag near Grid Line K

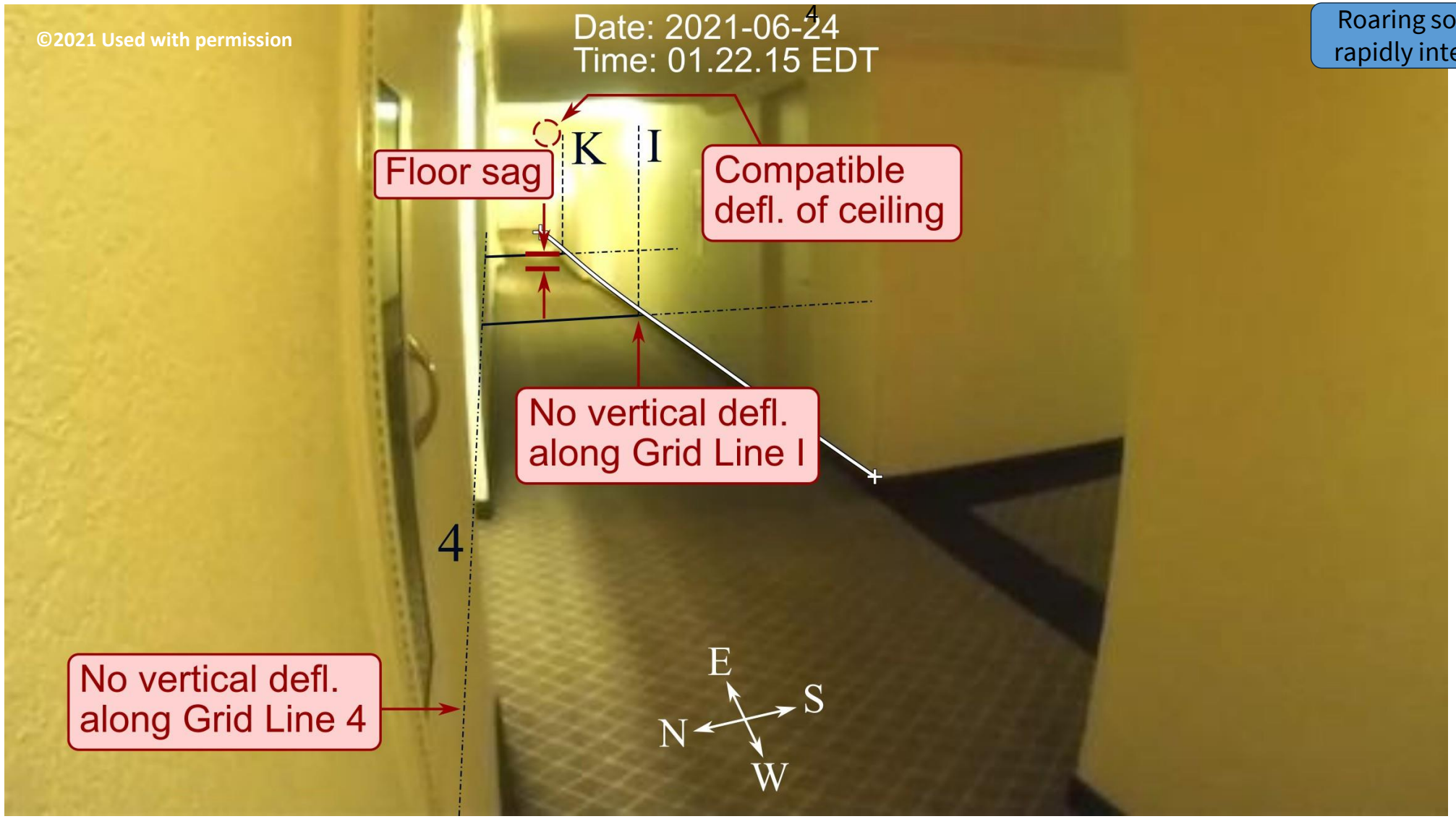
Begin displ. at north wall at or near Column K-4

Possible change in floor angle west of Grid Line K

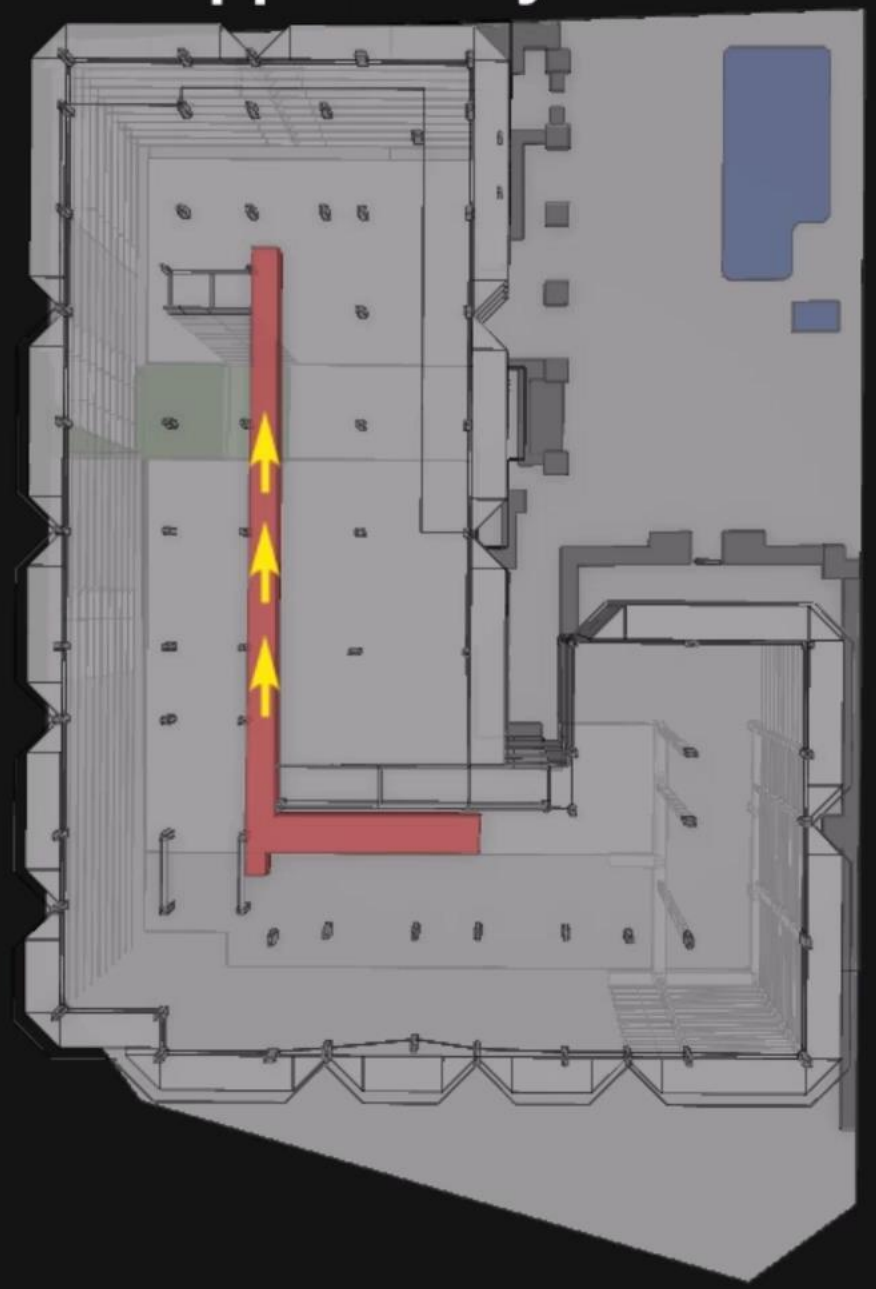
Possible change in floor angle east of Grid Line K

Roaring sounds rapidly intensify

End of video



Upper Story Corridor



~01:22

Source: NIST

CTS Investigation: 11 Stack Unit Footage

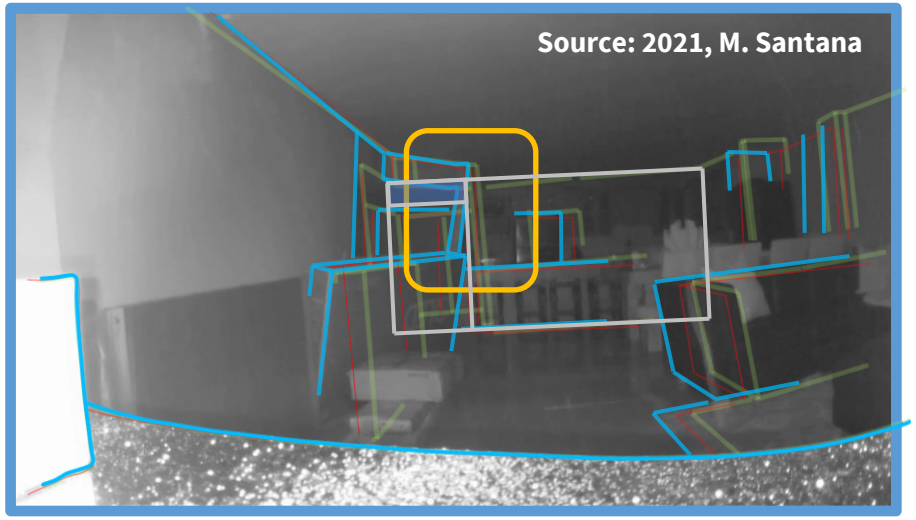
L

M

CTS Investigation: 11 Stack Unit Footage

L

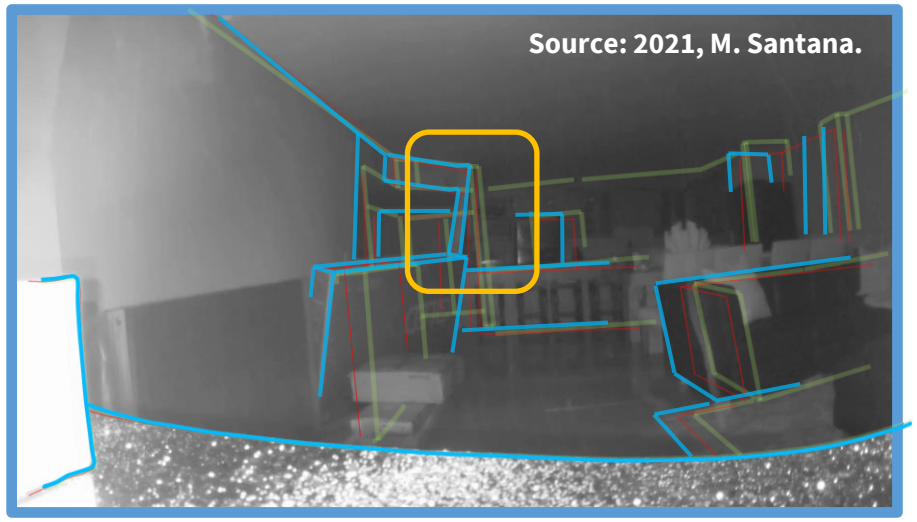
M

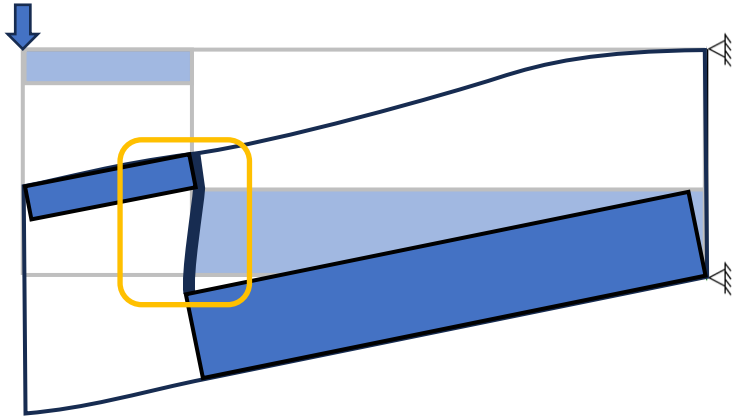


CTS Investigation: 11 Stack Unit Footage

L

M





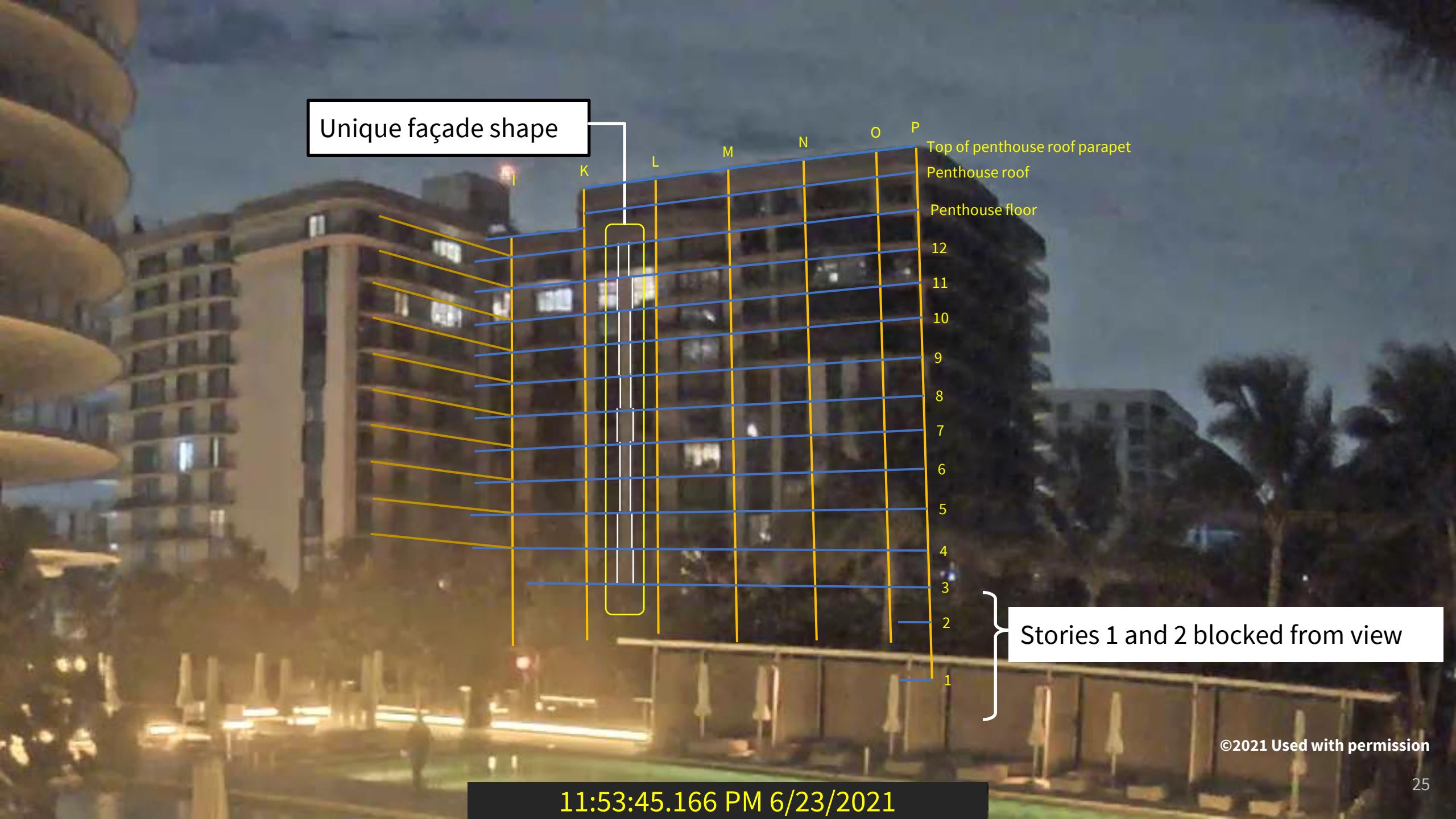
11 Stack Unit

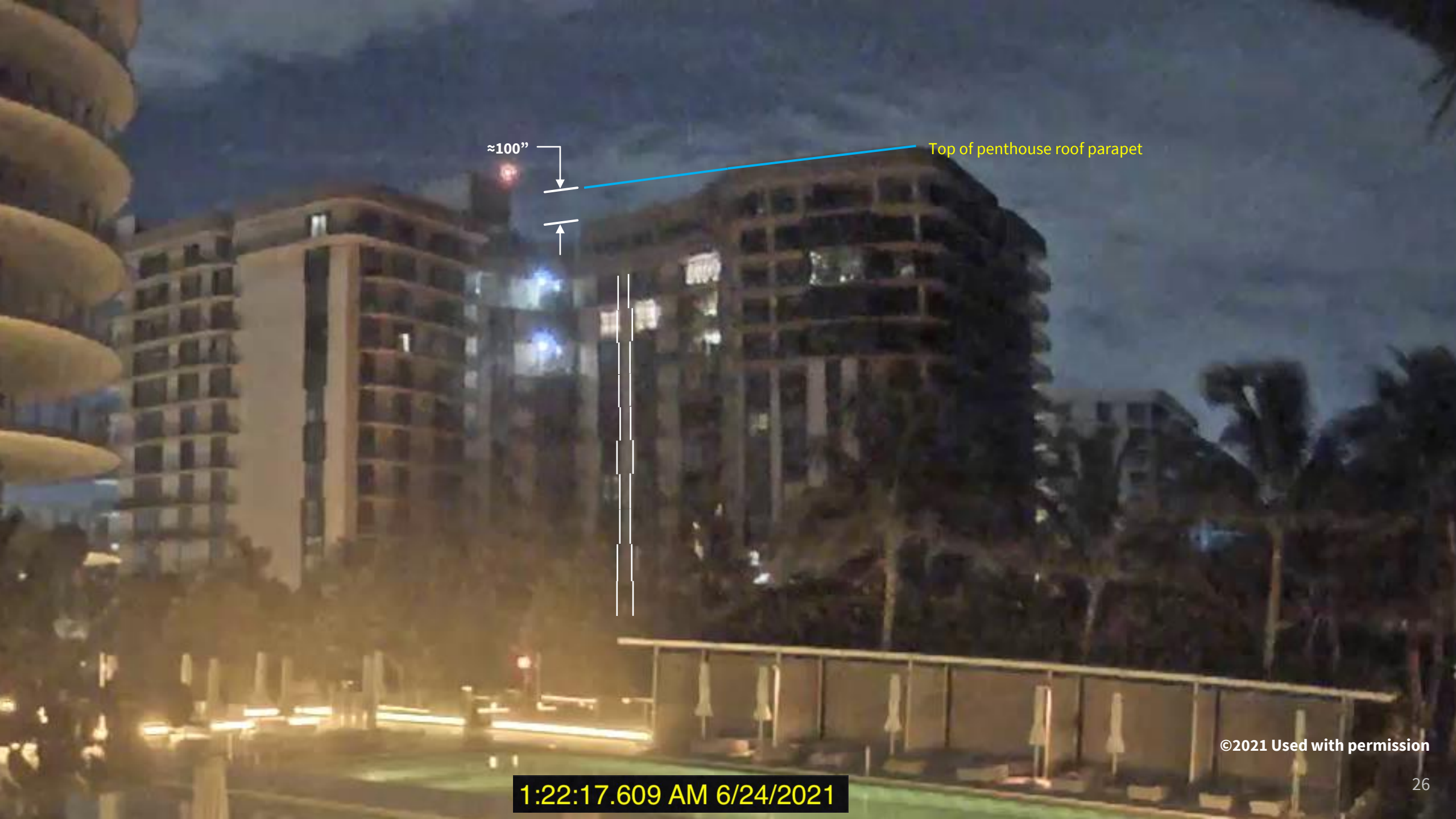
01:22:17

Source: NIST

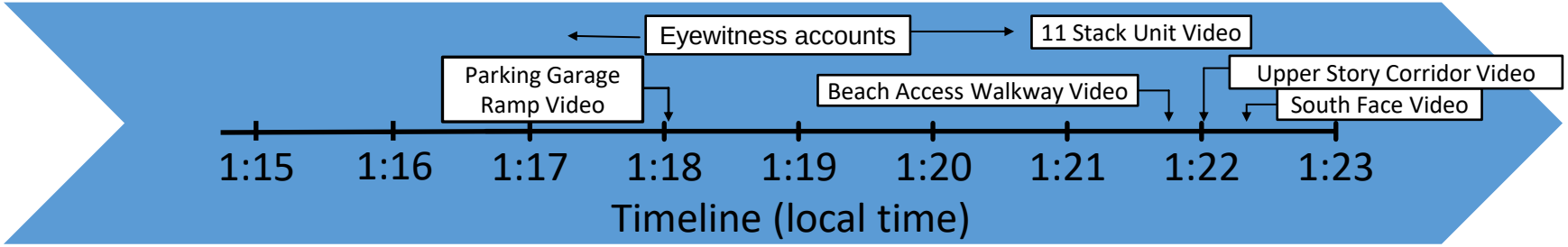
CTS Investigation: South Face Footage

Understanding Unique Features


Unique façade shape
I
K
L
M
N
O
P
Top of penthouse roof parapet
Penthouse roof
Penthouse floor
12
11
10
9
8
7
6
5
4
3
2
1
Stories 1 and 2 blocked from view
©2021 Used with permission
11:53:45.166 PM 6/23/2021



CTS Investigation: Collapse Sequence



1. The pool deck collapsed between its southern extremity and its connection to the tower more than four minutes before the general collapse of the tower.

2. In the tower collapse, Grid Line 9.1 started to drop a second, or a bit more, before 1:22:17 am, the time of the first frame of the South Face Video, starting at Column K-9.1 and/or L-9.1.

3. Videos show severe structural movements in the tower between Grid Lines K and M and Grid Lines 4 and 9.1 prior to the precipitous drop of the tower along Grid Line 9.1.

4. As the columns on Grid Line 9.1 dropped, the collapse advanced northward.

5. While there is strong evidence that the collapse initiated in the pool deck, we have not yet ruled out a failure initiation in some part of the tower that led to a collapse in the pool deck.

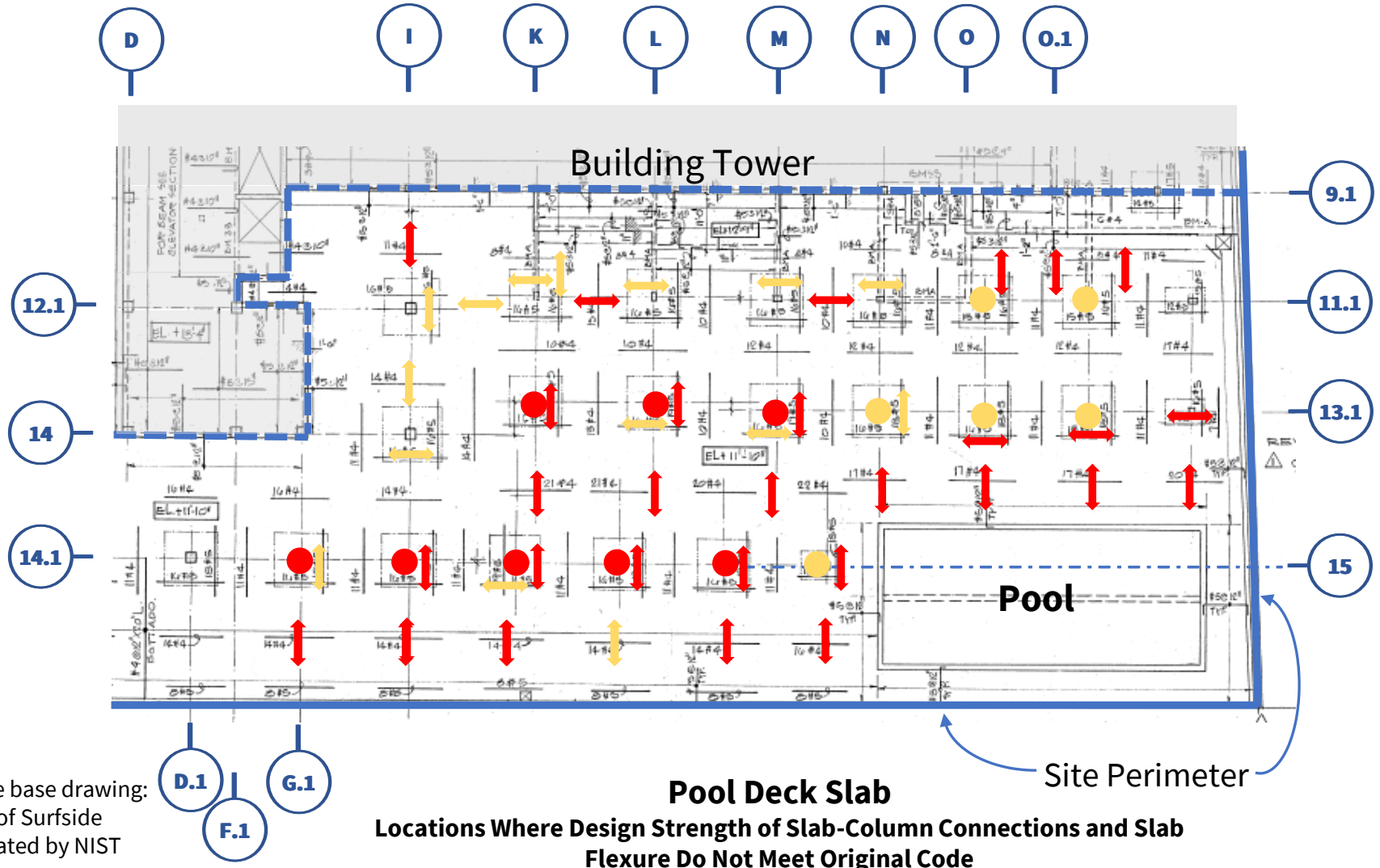
PRELIMINARY ANALYSIS RESULTS

CTS Investigation

03

As-built Conditions and Testing

CTS Investigation: Structural Code Checks



Source base drawing:
Town of Surfside
Annotated by NIST

Pool Deck Slab

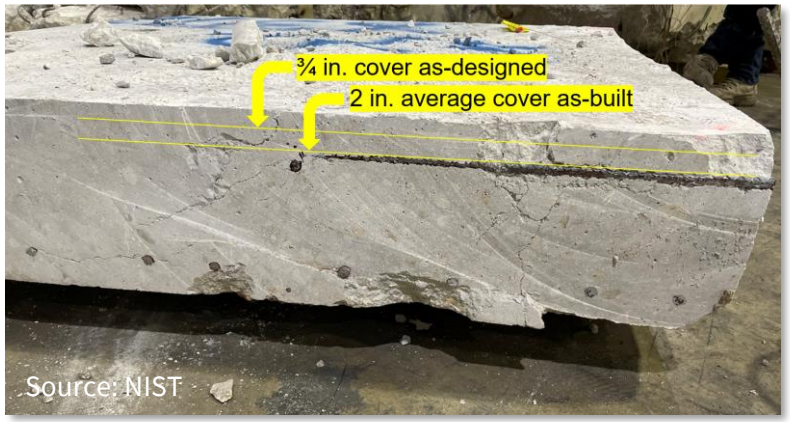
Locations Where Design Strength of Slab-Column Connections and Slab Flexure Do Not Meet Original Code (DCR > 1.0)

Figure Legend

Degree of Understrength	Location of Understrength: slab-column connections	Location of Understrength: slab flexure
severe	●	⟷
moderate	●	⟷

PRELIMINARY ANALYSIS RESULTS

CTS Investigation: As-Built Conditions



1 Top Reinforcement in Pool Deck Lower than Design Requirements


Source: Town of Surfside

2 Placement of Top Bars in Column Strips

3 Position of Reinforcement Cage within Columns

4 Alignment of Concrete

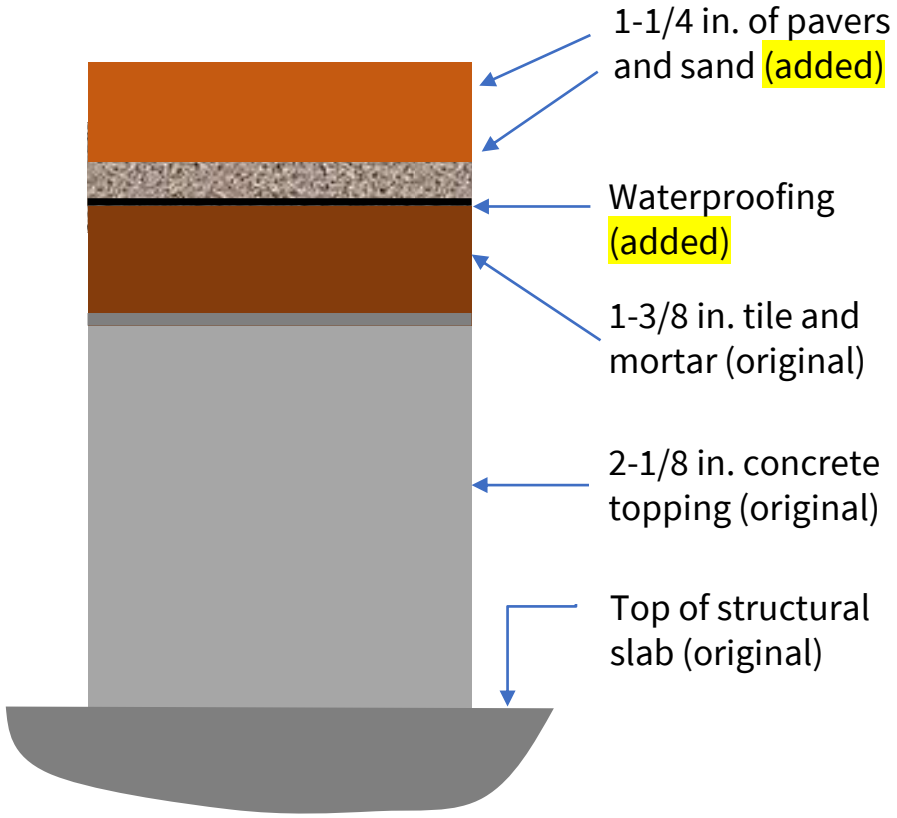
5 Short, high lap splices in columns

PRELIMINARY ANALYSIS RESULTS

CTS Investigation: Added Fill and Paving on Pool Deck

9 in. added sand setting bed

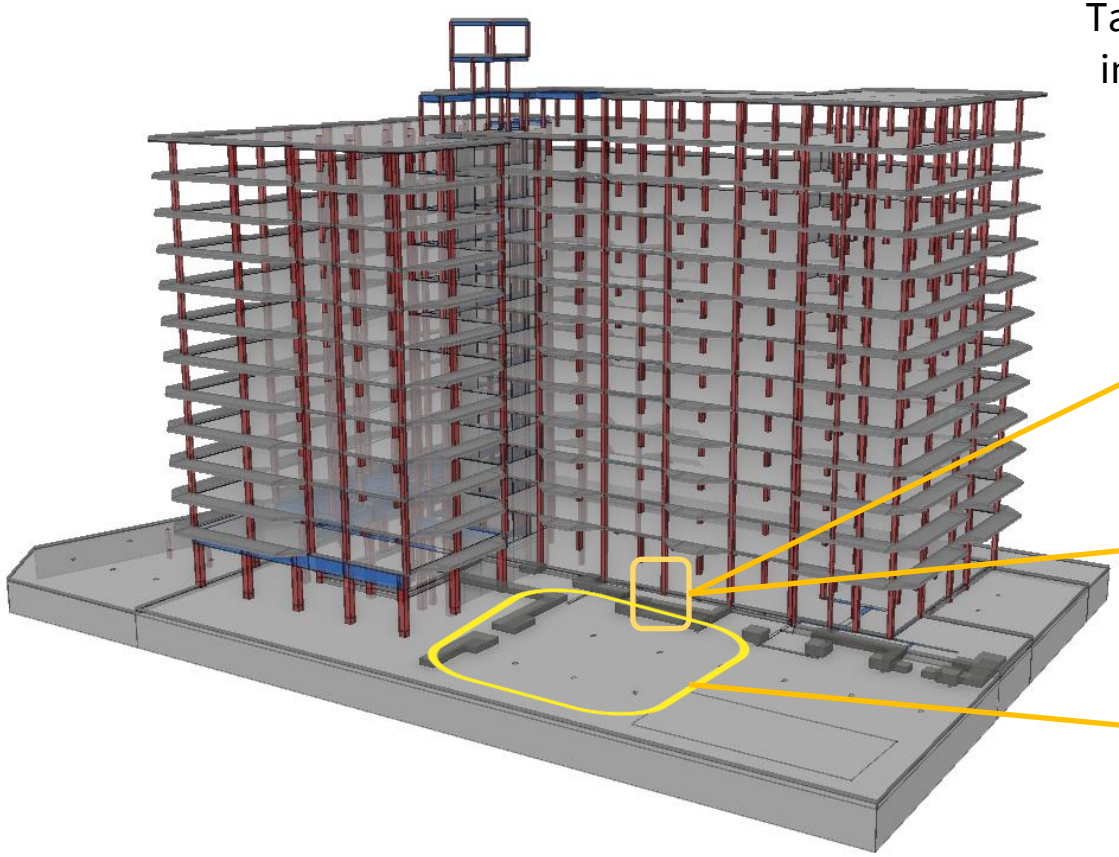
Source: Structures Specialist from US&R Ohio Task Force 1



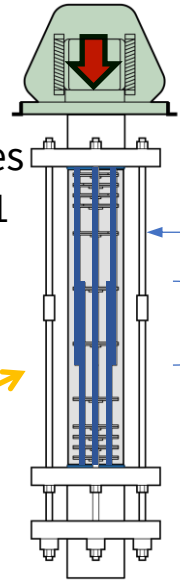
Observations by Morabito Consultants

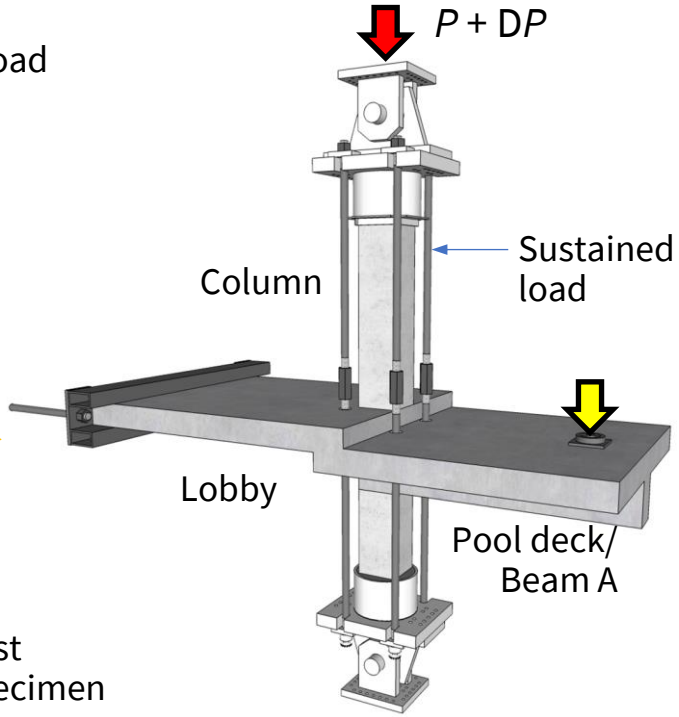
PRELIMINARY ANALYSIS RESULTS

CTS Investigation: Structural Laboratory Tests

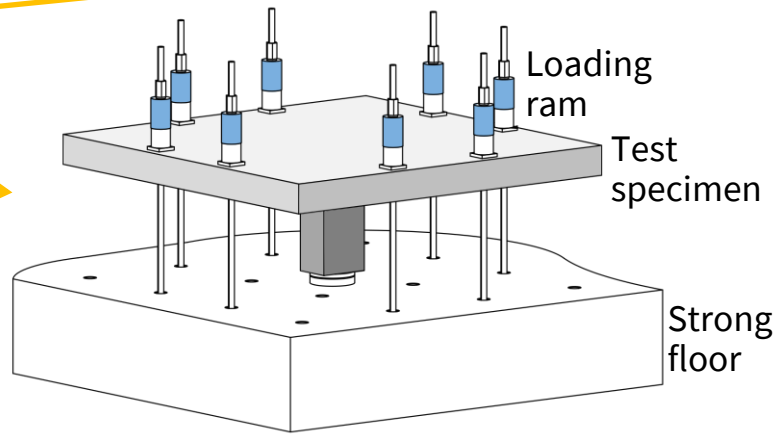


Task 3 – Lap splices in column at L-9.1





Task 2 – Connection at L-9.1



Task 1 – Slab-column connection in pool deck

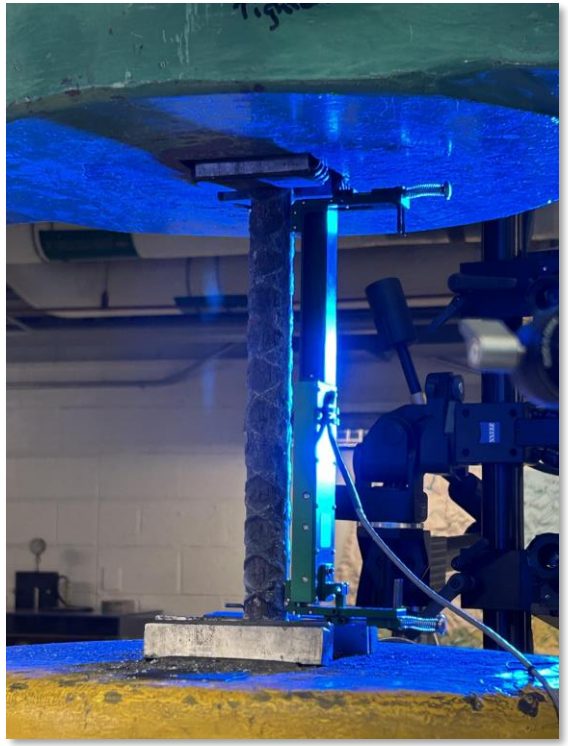
Test replicas represent conditions in CTS structure as faithfully as possible.

Source all images: NIST

CTS Investigation: Materials Testing and Evaluation

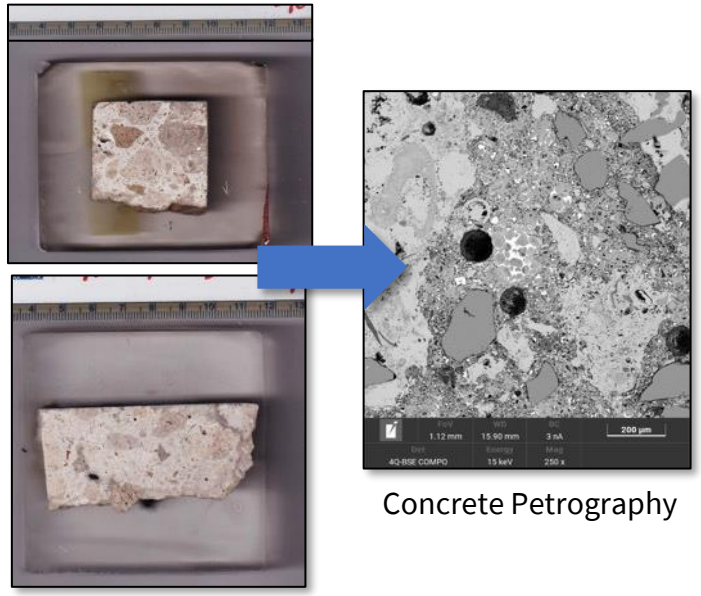
594 Tests Completed for Mechanical Properties of Concrete

183 Tests Completed for Mechanical Properties of Reinforcing Steel



Approx. 300 Petrographic, Chemical, and Durability Related Property Tests of Structural Concrete

Test for resistance to chloride ion penetration.



Concrete Petrography

Source all images: NIST

CTS Investigation

04

Potential Recommendation Topics

CTS Investigation

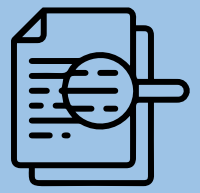
The recommendations portion of NIST's report will be key to ensuring lessons learned result in improvements in practice to see that a disaster like the Champlain Towers South collapse never happens again.

Source: NIST

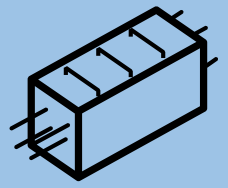
CTS Investigation: Potential Recommendations Topics

Created by Black Ant from Noun Project

Codes and Standards for New Construction



Records Retention



Quality Assurance in Design and Construction

Training and Resources for Building Ownership

Created by Design Circle from Noun Project

Assessment of Existing Buildings

Created by satouru sai from Noun Project

Evacuation and Emergency Response Procedures

2025 Los Angeles County Fires Preliminary Reconnaissance February 4-6, 2025

NIST field team: Tanya Brown-Giammanco (Team Lead)
Tom Cleary, Chris Clavin, Joel Cline, Nico de Toledo
Virtual support: Billy Hughes

NIST
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

Event Summary

- At least 8 fires
- Various potential ignition mechanisms (under investigation by others)
- Rapid fire spread caused by winds in excess of 80 mph in some regions
- Two largest fires, Eaton and Palisades, responsible for more than 10,000 structures destroyed
- More than 25 fatalities
- At least 150,000 people evacuated, with millions receiving inadvertent evacuation notices
- Electrical power affected by intentional disruptions (to protect firefighters and avoid ignitions) and downed lines
- Water system affected

Deployment Overview

Main objective:

Gather necessary information to inform a decision for invoking a more extensive disaster investigation or study under the NCST Act, National Windstorm Impact Reduction Program Act (NWIRP), and/or NIST Organic Acts

Goals:

1. Connect with local officials to determine code conditions and associated building performance in hardened and non-hardened communities
2. Determine next steps anticipated by other local, state, and Federal agencies
3. Determine whether a further study or investigation is warranted given NIST's unique capabilities and authorities, and the ability to recommend changes to codes, standards, and practices

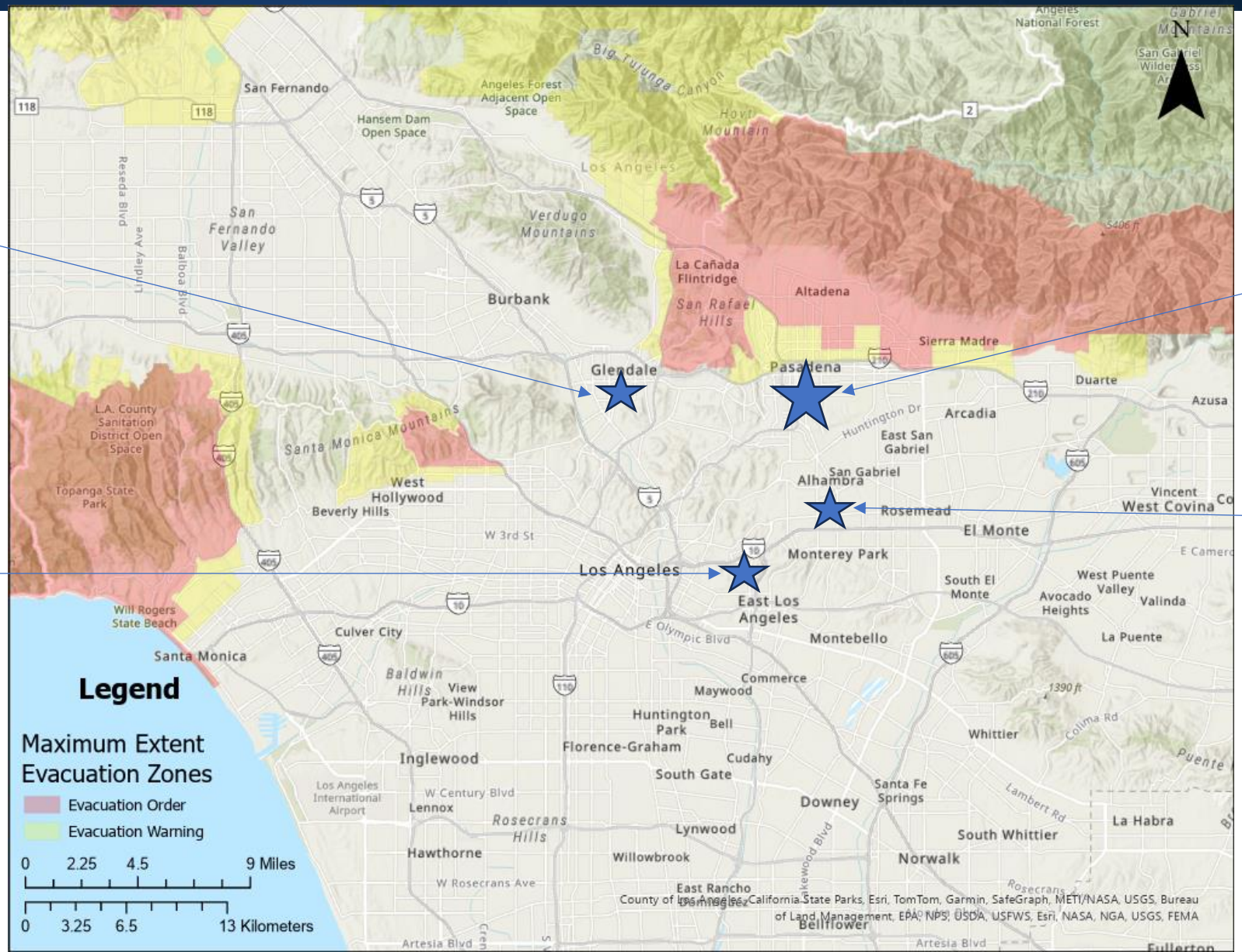
Deployment Overview

Hotel

JFO

DPW

EOC



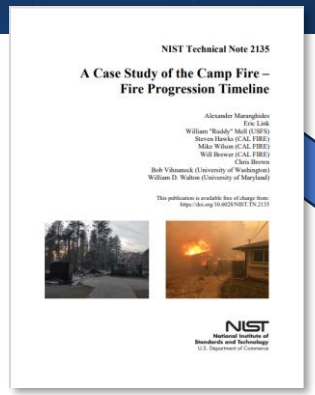
Evacuation zone source: https://services.arcgis.com/RmCCgQtiZLDCtblq/arcgis/rest/services/Maximum_Extent_Evacuation_Zones/FeatureServer

★ = Generalized location

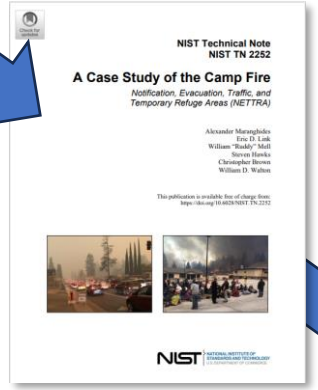
ESCAPE

WUI Fire **E**vacuation and **S**heltering **C**onsiderations – **A**ssessment, **P**lanning, and **E**xecution

- Methodology designed to leverage the lessons learned from the Camp Fire to *enhance life safety* of residents during WUI Fire evacuations
- Specifically designed for small and intermediate size intermix communities
- NIST Technical Note revised and rereleased (2025) along with online educational tool
  - Tool for first responders (fire, law enforcement and town officials) - four-hour course
  - Over 9,000 hits in first month



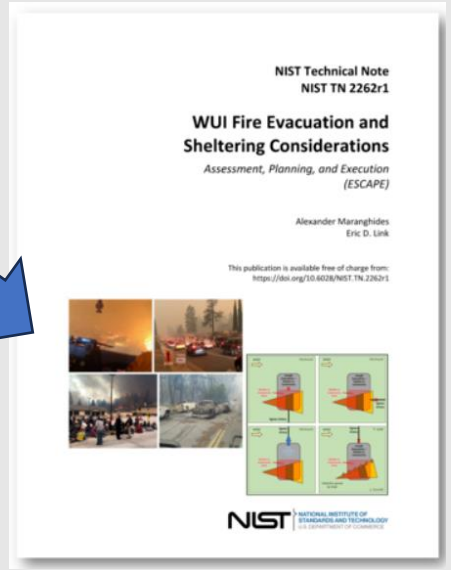
Camp Fire - Fire Progression – technical foundation



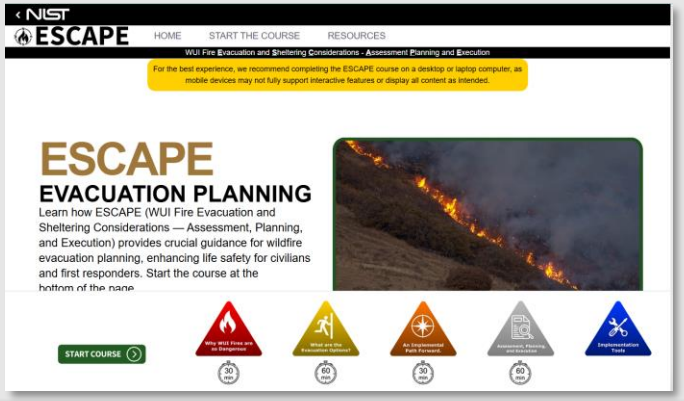
Camp Fire - Life Safety

ESCAPE

Implementable methodology



Online educational tool



San Mateo County, CA:
"You have created the wheel; it is up to us to use it"

⇨ https://escape.nist.gov/

Questions & Discussion

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE