

**Federal Building and Fire Safety Investigation
of the World Trade Center Disaster**

**Visual Evidence, Damage Estimates, and Timeline
Analysis**

September 14, 2005

William M. Pitts, Kathy Butler, Valentine Junker
Building and Fire Research Laboratory
National Institute of Standards and Technology
U.S. Department of Commerce
wpitts@nist.gov

TEAM MEMBERS

Leader: Bill Pitts

Professionals: Kathy Butler (Co-PI)
Lori Brassell

NIST Expert: Val Junker

Students:	Mohsen Altafi	Jonathan Demarest
	Joshua Novesel	Victor Ontiversos
	Rochelle Plummer	José Sánchez
	Steven Sekellick	Laura Sugden
	Brendan Williams	Lisa Petersen
	Schuyler Ruitberg	

Other Important Contributors:	Doug Walton	Ron Rehm
	Darren Lowe	Glenn Forney
	Bud Nelson	Kevin McGratten

Identification of Imagery Sources

- Web searches, personal contacts, television broadcasts, public appeals, collections, news agencies, 9/11 collections, networks and local television stations, newspapers, NYPD, and FDNY

Photographs and Videos Collected

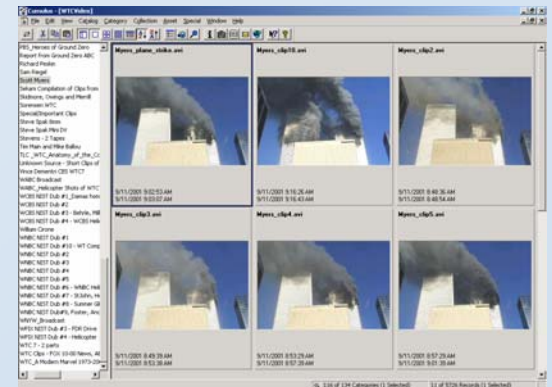
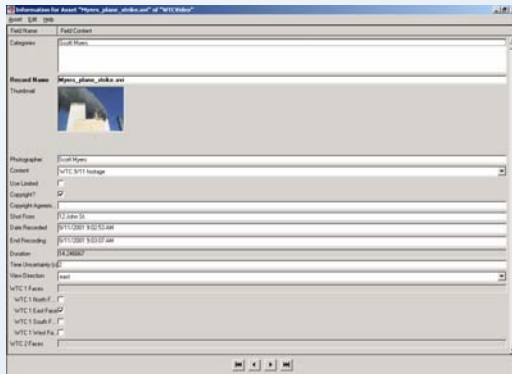
- Approximately 10,000 photographs and 300 hours of video were collected and reviewed
- Data base includes 7118 photographs and 6932 video clips totaling over 76 hours
- In addition to material from organizations, videos from approximately 40 individuals and photographs from approximately 140 individuals are included

Imagery Storage

- All material saved in digital format (provided quick access and allowed digital analysis using commercial software)
- Ethernet-based distributed network provides total storage of 1.6 terabytes

Visual Material Data Basing: Culmulus

- Associates attributes with assets
- Developed data entry forms for attributes
- Allows sophisticated searches based on attributes



TIMING

- Digital photographs and video (EXIF and meta data)
- Comparison of details (e.g., shadows, smoke and fire patterns)
- Goal was one second accuracy relative to second plane strike time defined to be 9:02:54 am
- Timed to ± 3 seconds: photos (3357 of 7118); videos (2789 of 6982)

TIMES FOR MAJOR EVENTS

Tower 1 Plane Strike: **8:46:30 am**

Tower 2 Plane Strike: **9:02:59 am**

Tower 2 Collapse: **9:58:59 am**

Tower 1 Collapse: **10:28:22 am**

Tower 7 Collapse: **5:20:52 pm**



a) 0.0 s

© Goldfish Pictures 2001





100

98

96

94

92

© 2001 Jim Huibregtse

8:47:22 a.m.

150

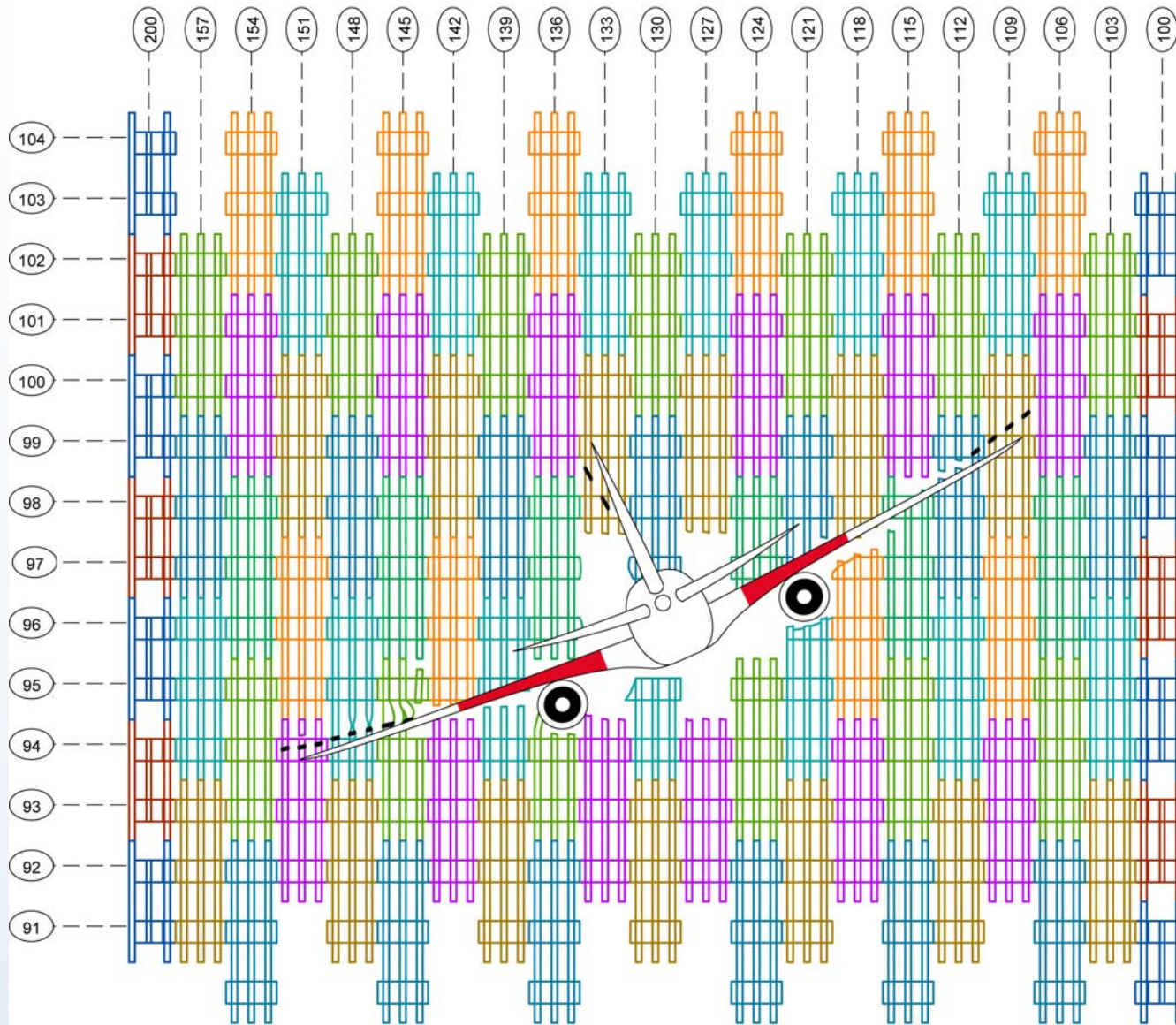
140

130

120

110

Estimate of Impact Damage - North Tower, North Face

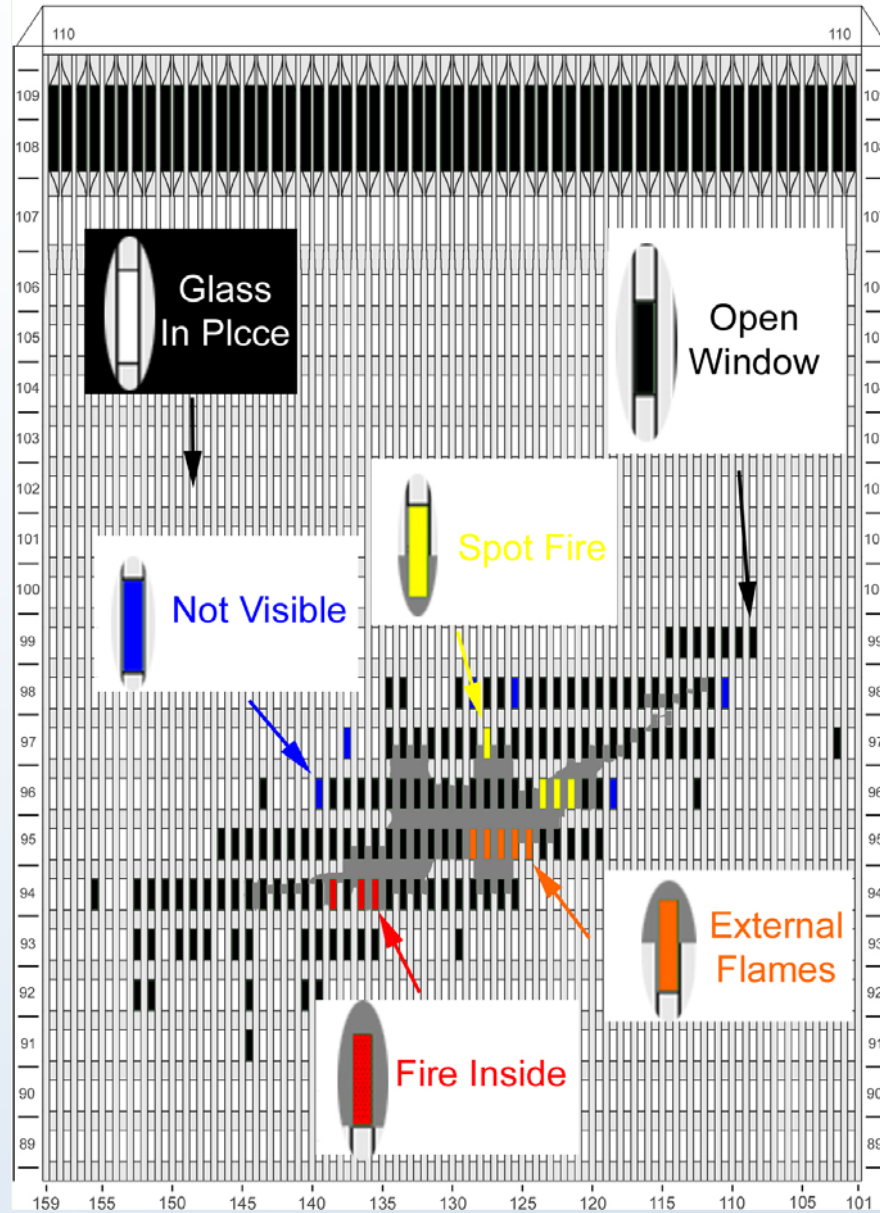


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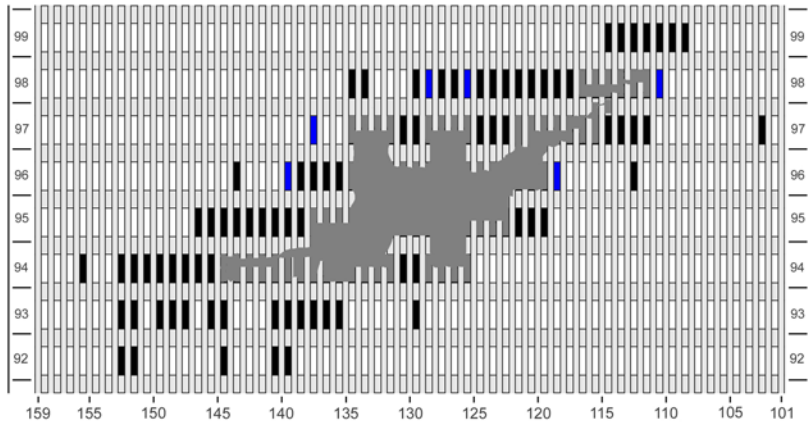


WTC 1, North Face

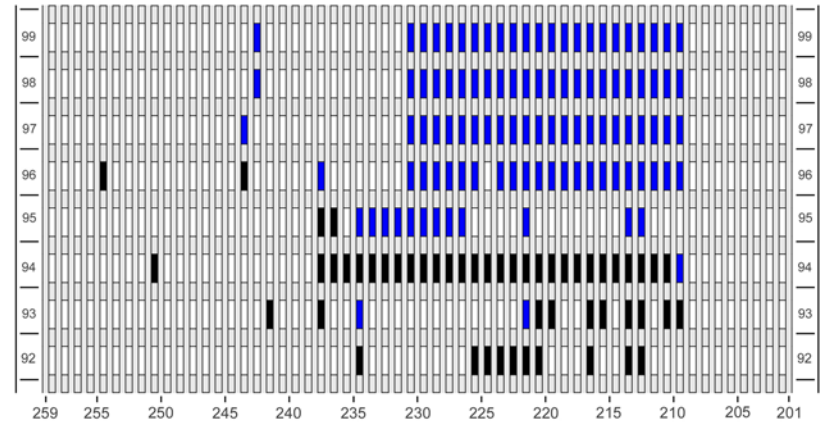
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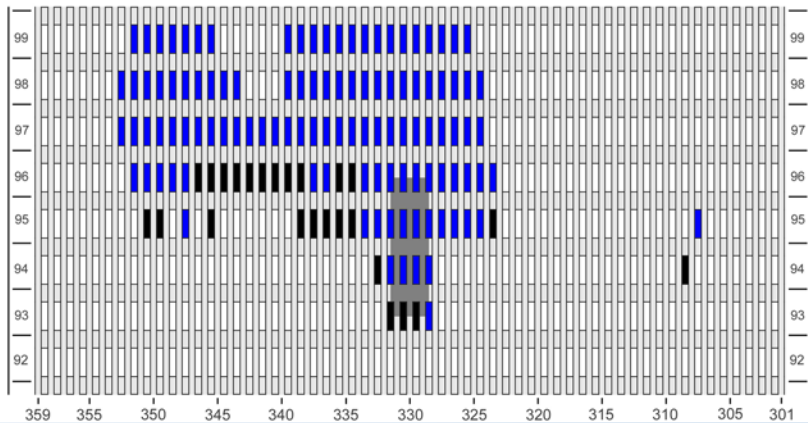
WTC 1, North Face 8:47 a.m.



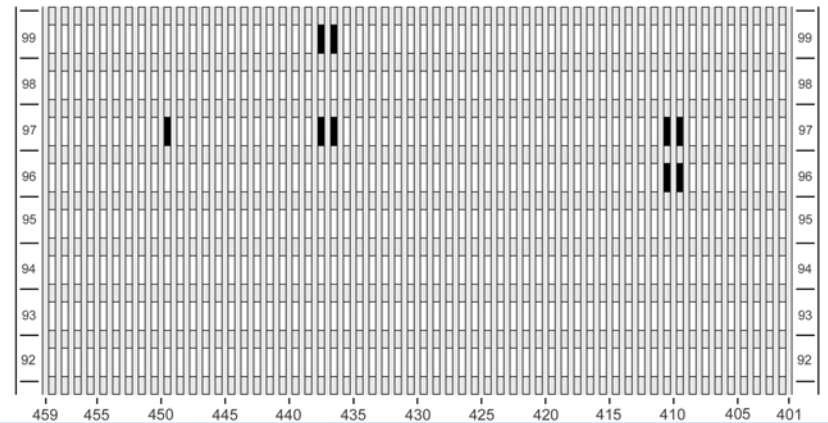
WTC 1, East Face 8:48 a.m.



WTC 1, South Face 8:47 a.m.



WTC 1, West Face 8:47 a.m.



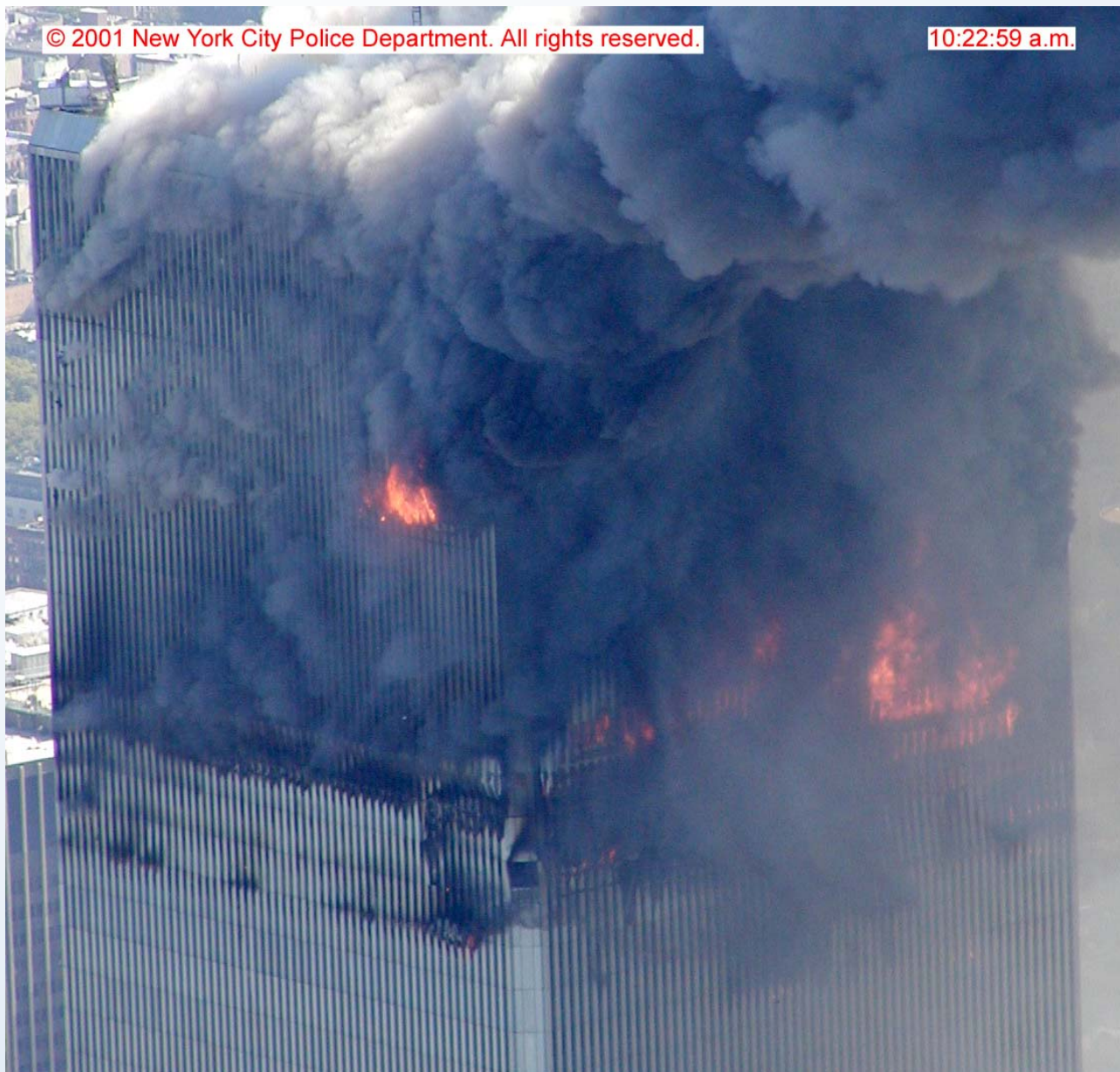
© 2001 Jeroen Morriën

9:33:13 a.m.



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10:22:59 a.m.



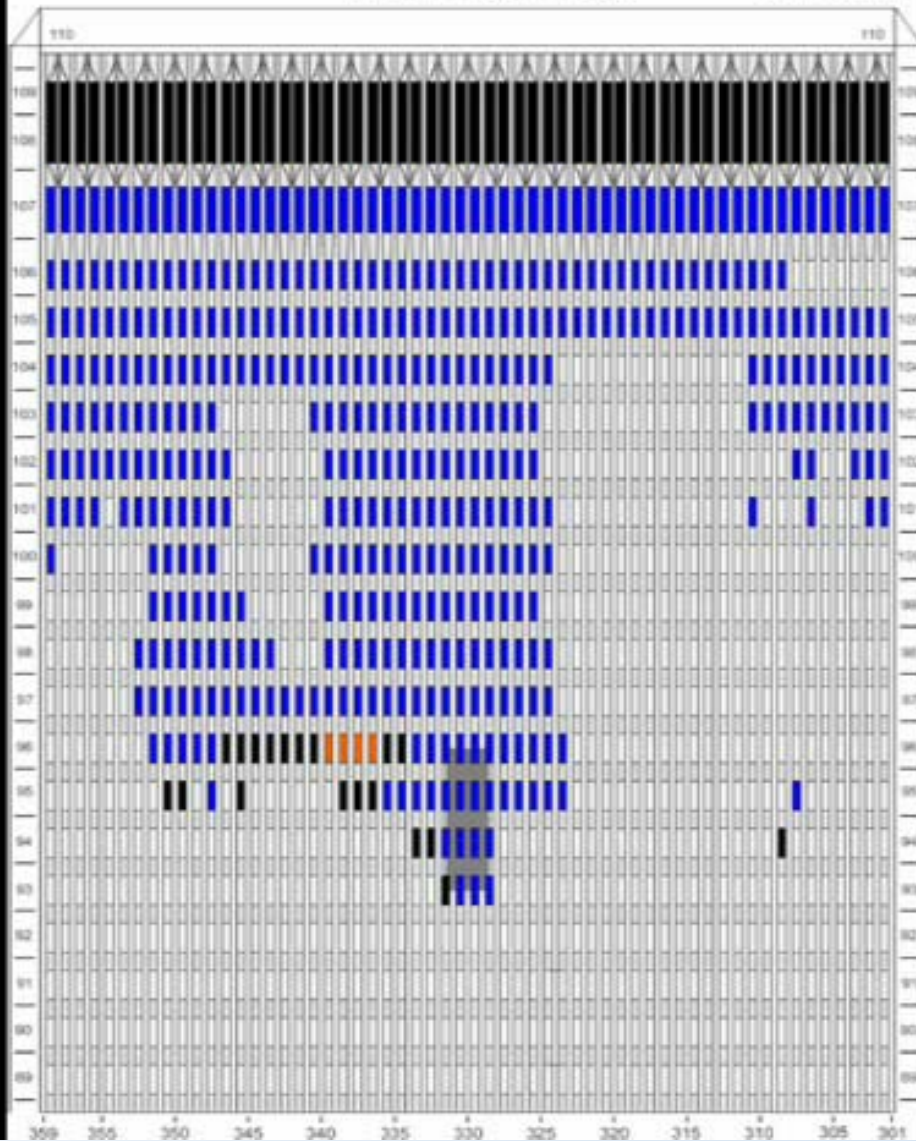
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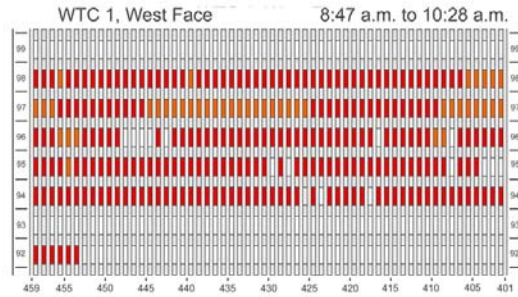
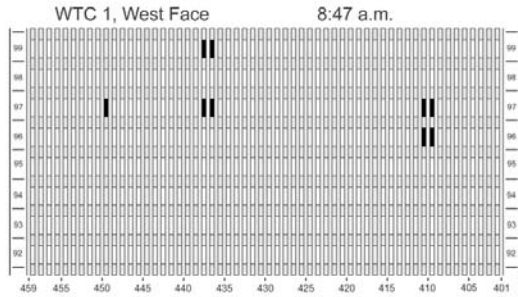
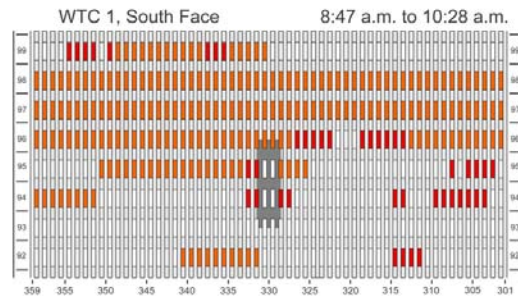
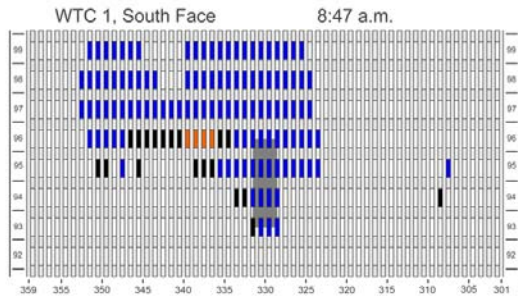
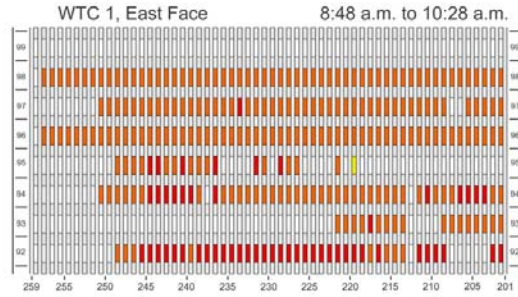
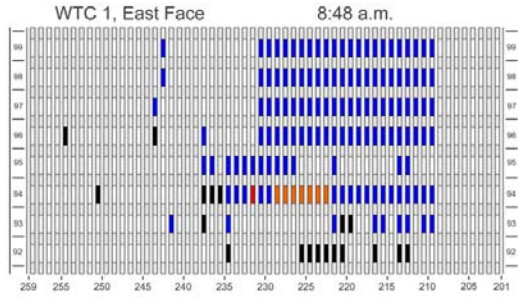
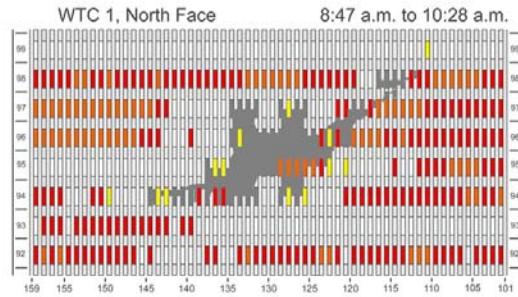
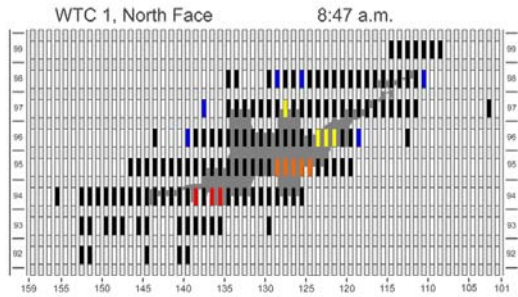
10:22:59 a.m.



WTC 1, South Face

8:47 a.m.





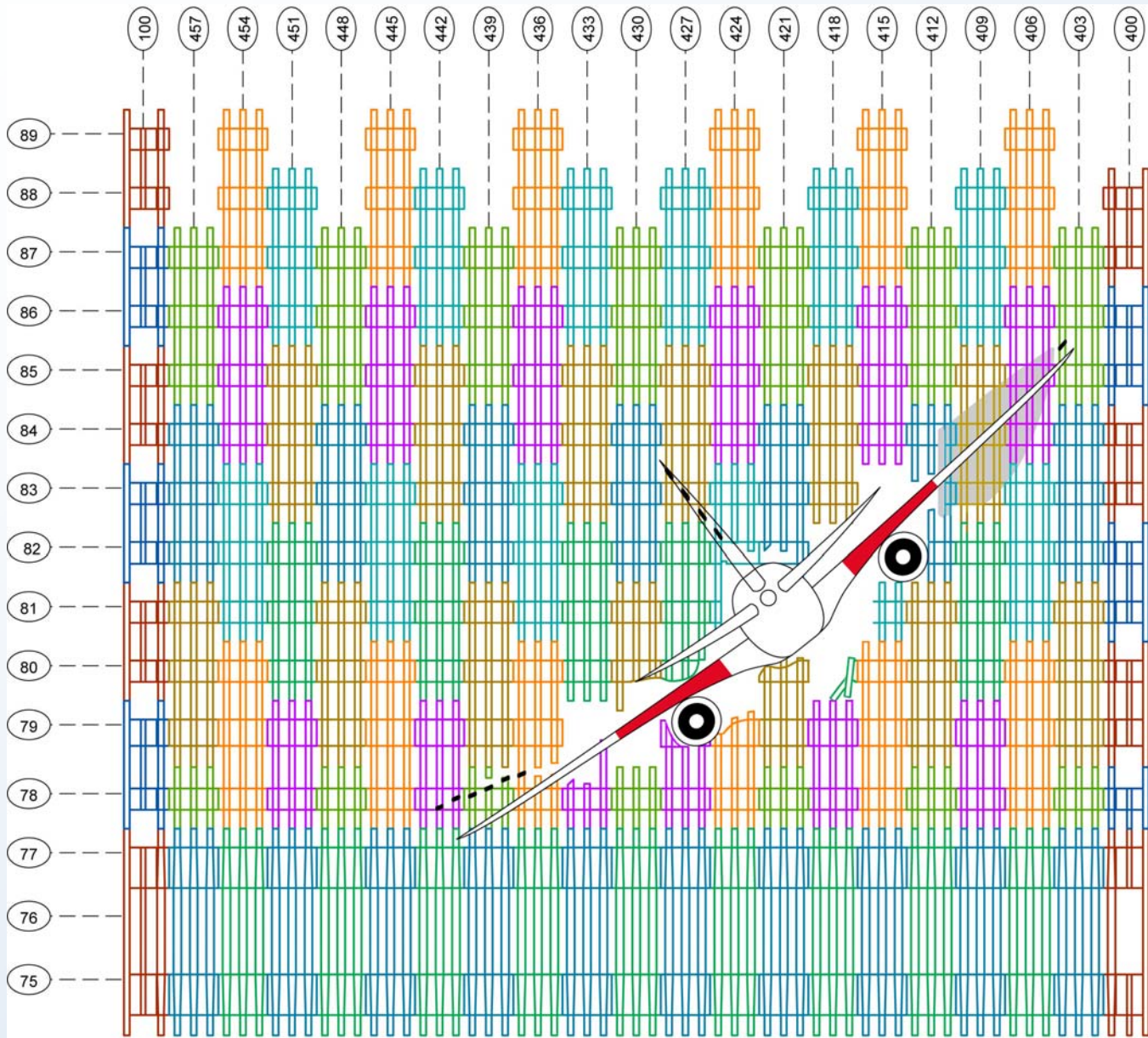
SOME IMPORTANT OBSERVATIONS FOR WTC 1

- Extensive fire spread on multiple floors
- Short periods of rapid fire spread and growth
- Southeast quadrant of tower appeared to be relatively undamaged and fire did not appear in area until after an hour
- Fires appeared to jump upwards over floors
- Inward bowing of columns on south face

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9:02:59 a.m.

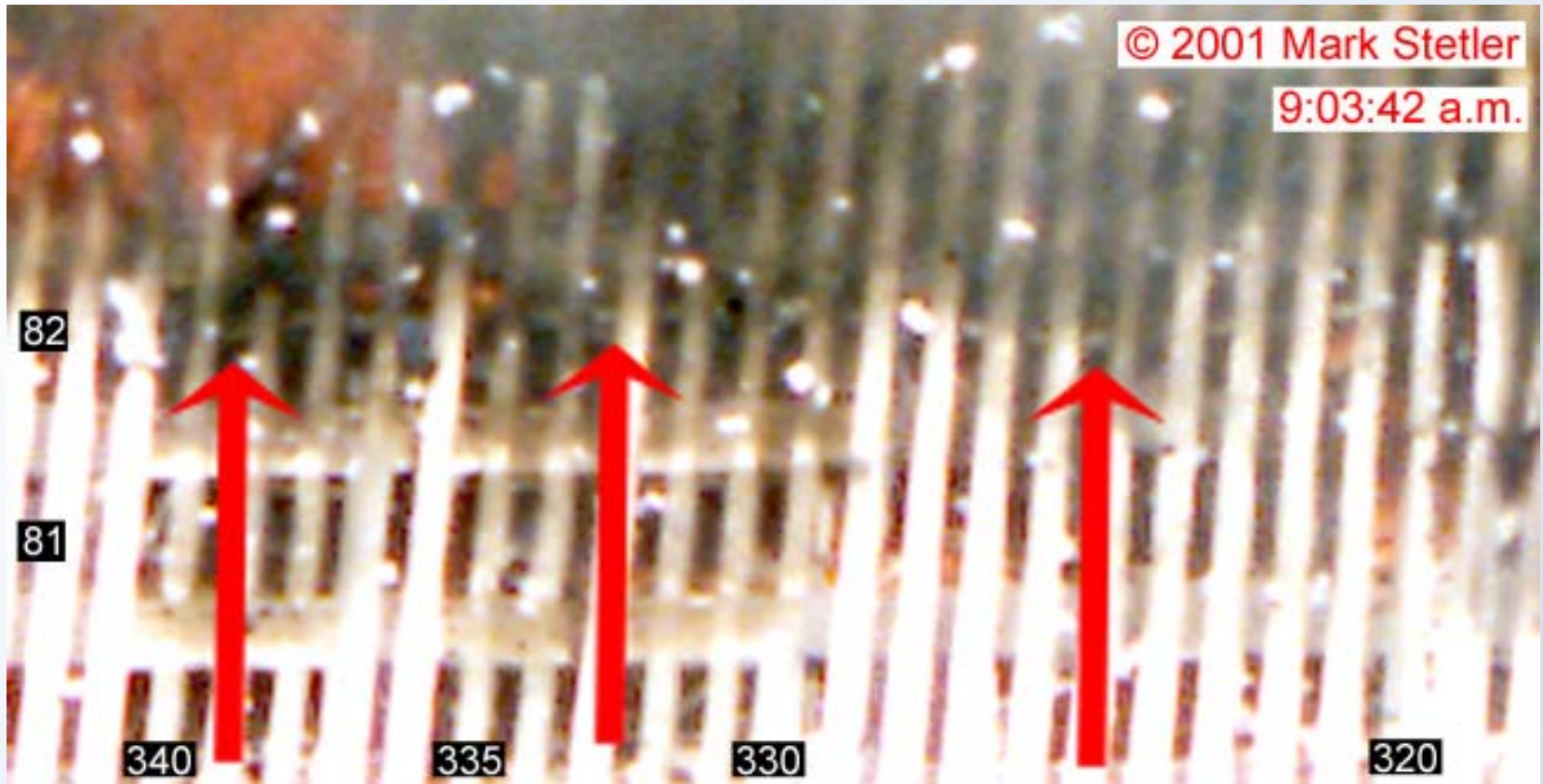


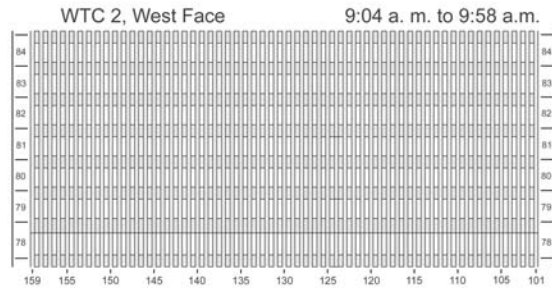
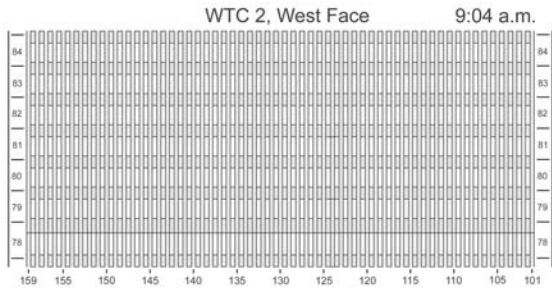
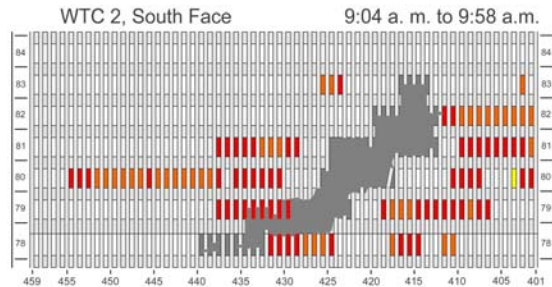
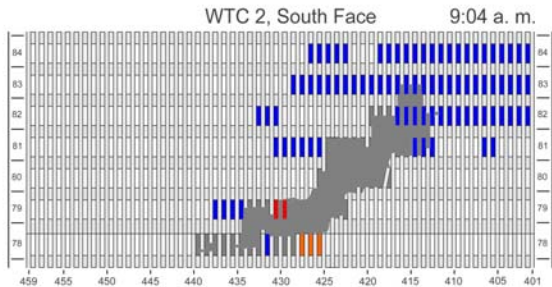
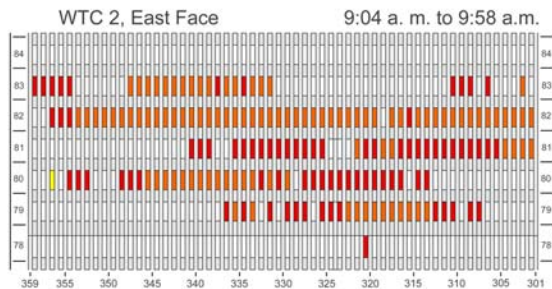
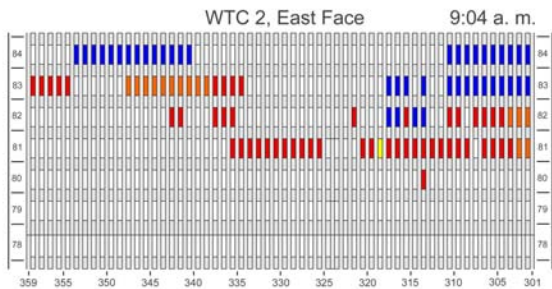
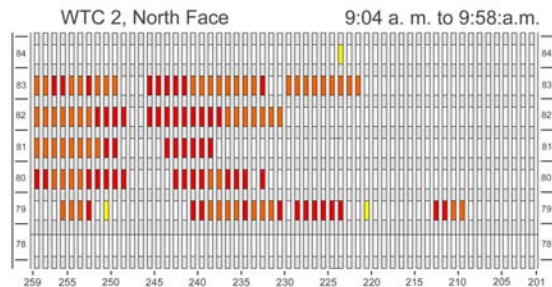
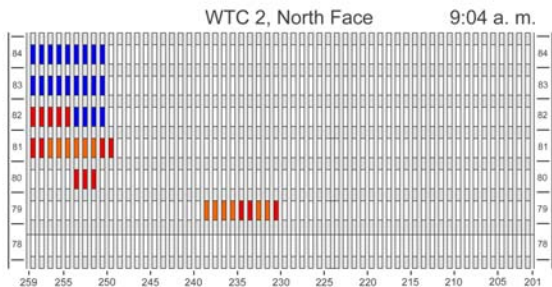


Damage in shaded area cannot be accurately determined.

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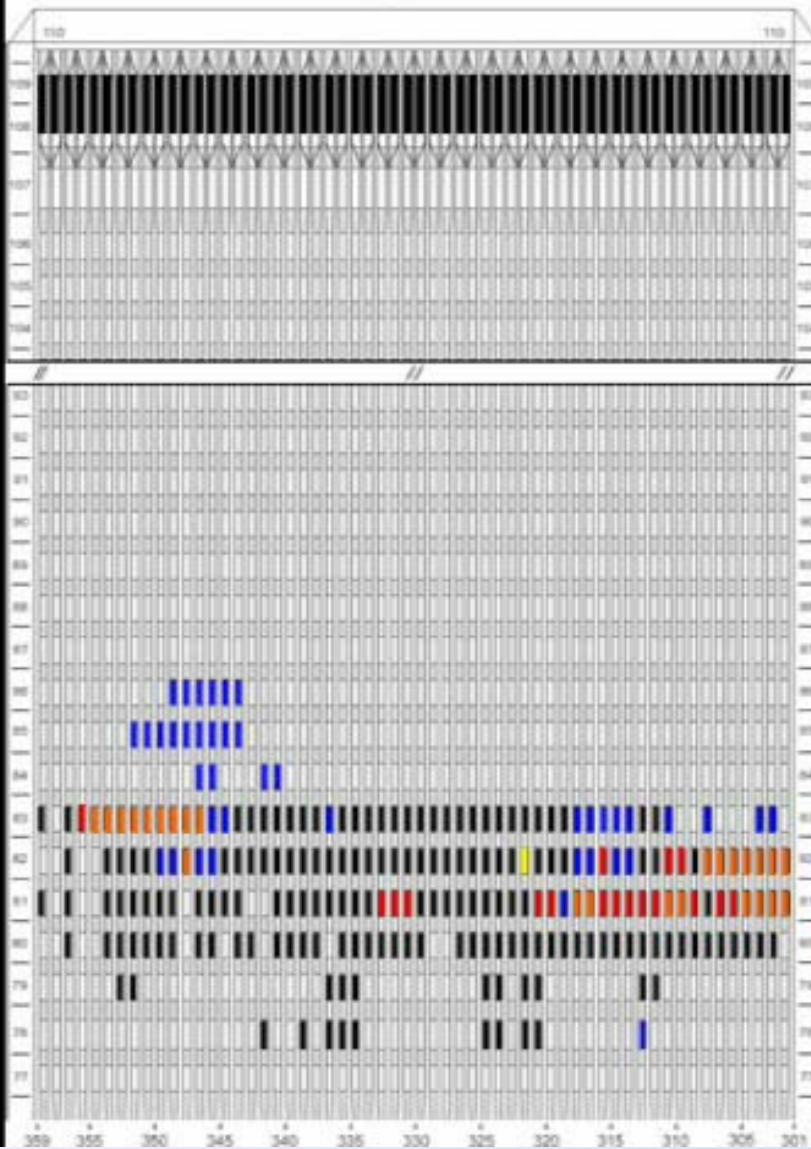
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WTC 2, East Face

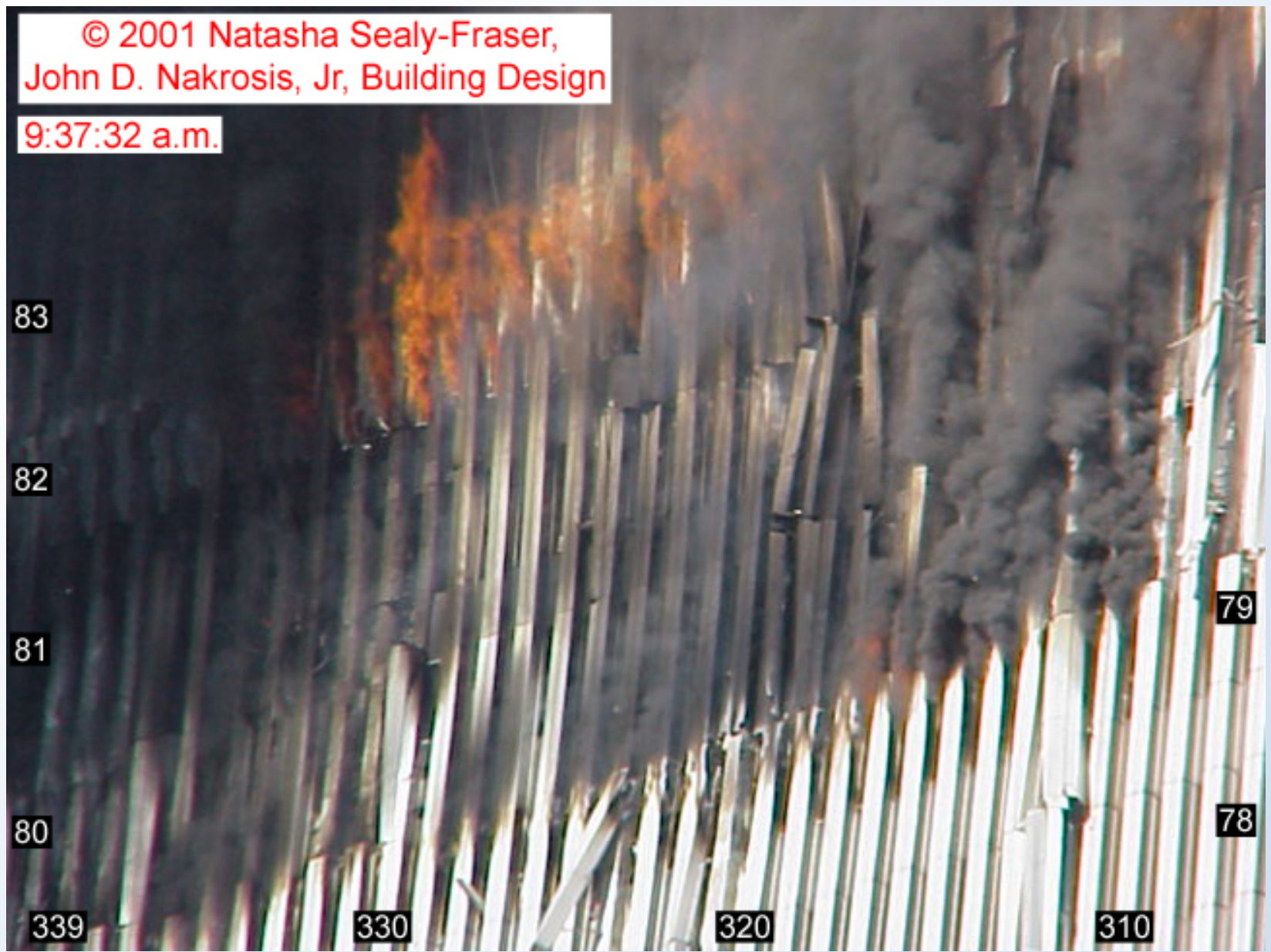
9:03 a.m.





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John D. Nakrosis, Jr, Building Design

9:37:32 a.m.



IMPORTANT OBSERVATIONS FOR WTC 2

- Large, long-lived fires on debris piles in northeast corner (81st floor) and on north face (79th floor) following aircraft impact
- Limited fire spread compared to WTC 1
- Short, intense burning periods likely due to presence of unburned aviation fuel
- Large section of 83rd floor on east side likely dislodged during aircraft impact, continued to shift downwards during event
- Bowing observed on the east face prior to collapse