NIST Response to the World Trade Center Disaster

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

Consideration of Public Comments
Final Report on the Collapse of the WTC Towers

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Nature of Changes

- Multiple additions and wording changes to emphasize and/or clarify aspects
- Numerous editorial changes
- Added one primary finding
- Modified six recommendations (3 amendments, 3 clarifications)
- Clarified the back-up text for several of the recommendations, including definition of tall buildings used in the report
- Greatly enhanced index of topics covered in the report

Unchanged Recommendations

- Group 1: Increased Structural Integrity

1. Prevention of progressive collapse and failure analysis of complex systems

2. Estimation of wind loads and their effects on tall buildings

3. Allowable tall building sway

Unchanged and Amended Recommendations

- Group 2: Enhanced Fire Endurance of Structures

4. Fire resistance rating requirements and construction classification

5. Fire resistance testing of building components and extrapolation of test data to quantify untested building components; *establishment of a national facility for studying and testing the components, assemblies, and systems under realistic fire conditions*

6. In-service performance requirements and inspection procedures for sprayed fire resistive materials

7. “Structural frame” approach

Unchanged or Amended Recommendations

- Group 3: New Methods for Fire Resistance Design of Structures

8. Burnout without *partial* or global *(total)* structural collapse in uncontrolled building fires

9. Performance-based design and retrofit of structures to resist fires

10. New fire-resistive coating materials, systems, and technologies

11. Evaluation of high performance structural materials under conditions expected in building fires

Unchanged and Amended Recommendations

- Group 4: Improved Active Fire Protection

12. Performance and redundancy of active fire protection systems to accommodate the greater risks associated with tall buildings

13. Advanced fire alarm and communications systems that provide continuous, reliable, and accurate information on life safety conditions to manage the evacuation process; *all communication and control paths for the pre-installed dedicated firefighter telephone system in buildings need to be designed and installed to have the same resistance to failure and increase survivability above that specified in present standards.*

14. Advanced emergency fire/control panels with more reliable information from the active fire protection systems to provide tactical decision aids

15. Improved transmission to emergency responders, and off-site black box storage, of information from building monitoring systems

Unchanged and Amended Recommendations

- Group 5: Improved Building Evacuation

16. Public education *and training* campaigns to improve building occupants' preparedness for evacuation

17. Tall building design for timely full building emergency evacuation of occupants; stairwell capacity *and stair discharge door width* should be adequate to accommodate counterflow due to emergency access by responders.

18. Design of occupant-friendly evacuation paths that maintain functionality in foreseeable emergencies

19. Planning for communications of accurate emergency information to building occupants

20. Evaluation of alternative evacuation technologies to allow all occupants equal opportunity for evacuation and to facilitate emergency response access

Unchanged Recommendations

- Group 6: Improved Emergency Response

21. Fire-protected and structurally hardened elevators

22. Effective emergency communications systems for large-scale emergencies

23. Enhanced gathering, processing, and delivering of critical information to emergency responders

24. Effective and uninterrupted operation of the command and control system for large-scale building emergencies

Unchanged Recommendations

- Group 7: Improved Procedures and Practices

25. Provision of code-equivalent level of safety and certification of as-designed and as-built safety by nongovernmental and quasi-governmental entities

26. Egress and sprinkler requirements for existing buildings

27. Retention and off-site storage of design, construction, maintenance, and modification documents over the entire life of the building; availability of relevant building information to responders in emergencies

28. Design professional responsibility for innovative or unusual structural and fire safety systems

Unchanged and Amended Recommendations

- Group 8: Continuing Education and Training

29. Professional cross training of fire protection engineers, architects, and structural engineers; *upgrade skills of building regulatory and fire service personnel*

30. Training in computational fire dynamics and thermostructural analysis

Definition of Tall Buildings

- From:
  - Buildings over 20 stories in height: NIST has found that the physiological impacts on emergency responders of climbing 20 or more stories makes it difficult to conduct effective and timely firefighting and rescue operations in building emergencies without functioning elevators. Better knowledge of the physiological impacts through research could refine the definition of tall buildings used here.
- To:
  - NIST has found that the physiological impacts on emergency responders of climbing numerous (e.g., 20 or more) stories makes it difficult to conduct effective and timely firefighting and rescue operations in building emergencies without functioning elevators. Consideration and better knowledge of factors such as ladder height, physiological factors involving emergency responders and building occupants, use of working elevators, and installation and use of protected elevators could refine the currently used definition of tall buildings to include multiple threshold levels.

Clarification to Findings

Inserted a clarification into the Executive Summary and Part III (Outcome of the Investigation):

> NIST found no corroborating evidence for alternative hypotheses suggesting that the WTC towers were brought down by controlled demolition using explosives planted prior to September 11, 2001. NIST also did not find any evidence that missiles were fired at or hit the towers. Instead, photos and videos from several angles clearly showed that the collapse initiated at the fire and impact floors and that the collapse progressed from the initiating floors downward, until the dust clouds obscured the view.

Publication of Reports on the WTC Towers

- 43 reports to be downloadable from the NIST WTC web site by late September or early October 2005
- 43 reports to be available on two CDs in October 2005
- Limited number of hard copies of NIST NCSTAR 1 available in October, 2005

Planned Schedule for WTC 7 Reports

- January 2006 — Completion of technical work
- March 2006 — Draft reports for review
- April 2006 — Draft reports to NCST AC
- May 2006 — Reports for public comment
- June 2006 — Publication