<u>**Federal Building and Fire Safety Investigation of the World Trade Center Disaster**</u>

Project #7: Occupant Behavior, Egress, and Emergency Communications

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Purpose and Outcomes

Purpose: To document the evacuation by collecting and analyzing information on:

- occupant behavior

- human factors

- egress

- emergency communications

- evacuation system

Desired Outcomes

- Enhanced evacuation systems

- Enhanced safety of occupants

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Technical Issues to be Investigated

- **Occupant behavior and evacuation technologies and practices for tall buildings (Project 7)**
  - Decision-making and situation awareness
  - Time-constrained evacuation strategies (e.g., defend-in-place)
  - Role of floor wardens and fire safety directors
  - Issues concerning people with disabilities
  - Human factors issues and design of egress system

- **Firefighting technologies and practices for tall buildings (Project 8)**
  - Means for emergency access, time to reach affected floors
  - Firefighting versus evacuation
  - Physical condition of firefighter under high-rise work conditions
  - Situation awareness

- **Command, control, and communication systems for emergency response (Project 8)**
  - Content and timing and quality of communications, among occupants and authorities, within and outside buildings, intra and inter group communications

- **Observations of fire and smoke conditions, structural damage, water flow, liquid fuel from aircraft (Project 7)**

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Tasks

- Data Collection

- Methodology

- Review and Analysis

- Findings, Conclusions, and Recommendations

Data Collection

- Evacuation History of World Trade Center – Technical Literature, PANYNJ, FDNY

- Design of the Egress System – Original Design and Changes – Technical Literature, PANYNJ

- Evacuation Planning – Technical Literature, PANYNJ

- Emergency Communication Systems – System Specifications, PANYNJ

- Existing Published Accounts – Over 500 Interviews Collected and Quantitatively Analyzed - NFPA

- First Person Accounts

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First Person Accounts

- ✓ Expert Team Assembled (Groner, Mileti, Proulx)
- ✓ Methodology Developed
- ✓ Contractor Selected (NuStats, Inc.)
- ✓ Survey Instruments/Protocols Drafted
- IRB Approval (In Review)
- Paperwork Reduction Act Approval (Federal Register Notice Published)
- Certificate of Confidentiality
- Field Work Begins
- Field Work Complete
- Review and Analysis
- Findings, Conclusions, and Recommendations

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Collection of First Person Accounts

- Face-to-face Interviews

  - Up to 350 Occupants of WTC 1, 2, and 7

- Telephone Interviews

  - 800 Occupants of WTC 1 and 2

- Focus Group Interviews

  - 5 Focus Groups of ~10 People Each

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Face-to-face Interviews

Objective: Document the evacuation of World Trade Center 1, 2, and 7 and collect observations and experiences relevant to the Investigation.

Universe: Individuals inside WTC 1, 2, or 7 on the morning of September 11, 2001 at the time of the first airplane impact

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Face-to-face Interviews

Selected Groups

- People Near the Impact

- Persons with Building Responsibility

- Evacuees from the Lower and Middle Thirds of WTC 1 and 2

- Building 7 Evacuees

- Mobility Challenged

- People in Elevators or Lobbies

- Families of the Victims who Communicated After First Impact

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Face-to-face Interview Methodology

Computer-assisted Personal Interviews (CAPI)

- Uninterrupted Narrative

- Structured, Chronological Record

  - Cue-Action-Reason

- Technical Probes

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Face-to-face Interviews

Sample Cue-Action-Reason

Cue	Action	Reason
Other people started to head for the stairwell	So I grabbed my laptop computer	Because in 1993 I wished I had taken my laptop

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Face-to-face Interviews

Sample Technical Probes

- Did you observe anyone moving against the flow in the stairwells during your evacuation?

- You mentioned that you saw fire in the core area. Which of the graphics in front of you best approximates the size of the fire?
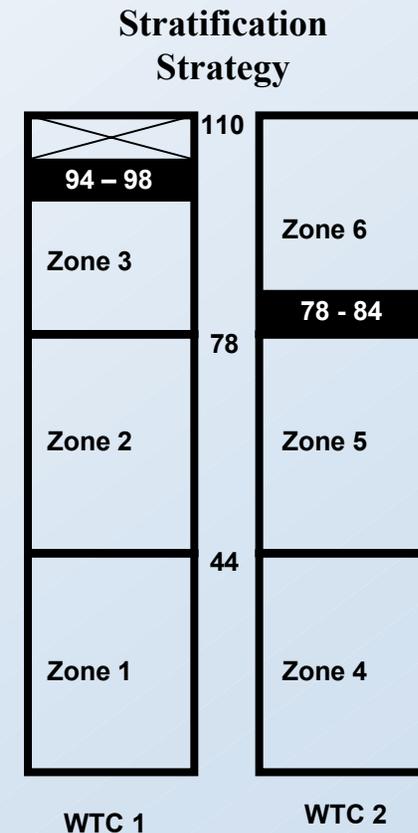
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Telephone Interviews

Objective: Generalize human behaviors and evacuation experiences of the occupants of World Trade Center 1 and 2

Universe: Individuals inside WTC 1 or 2 on the morning of September 11, 2001 at the time of the first airplane impact
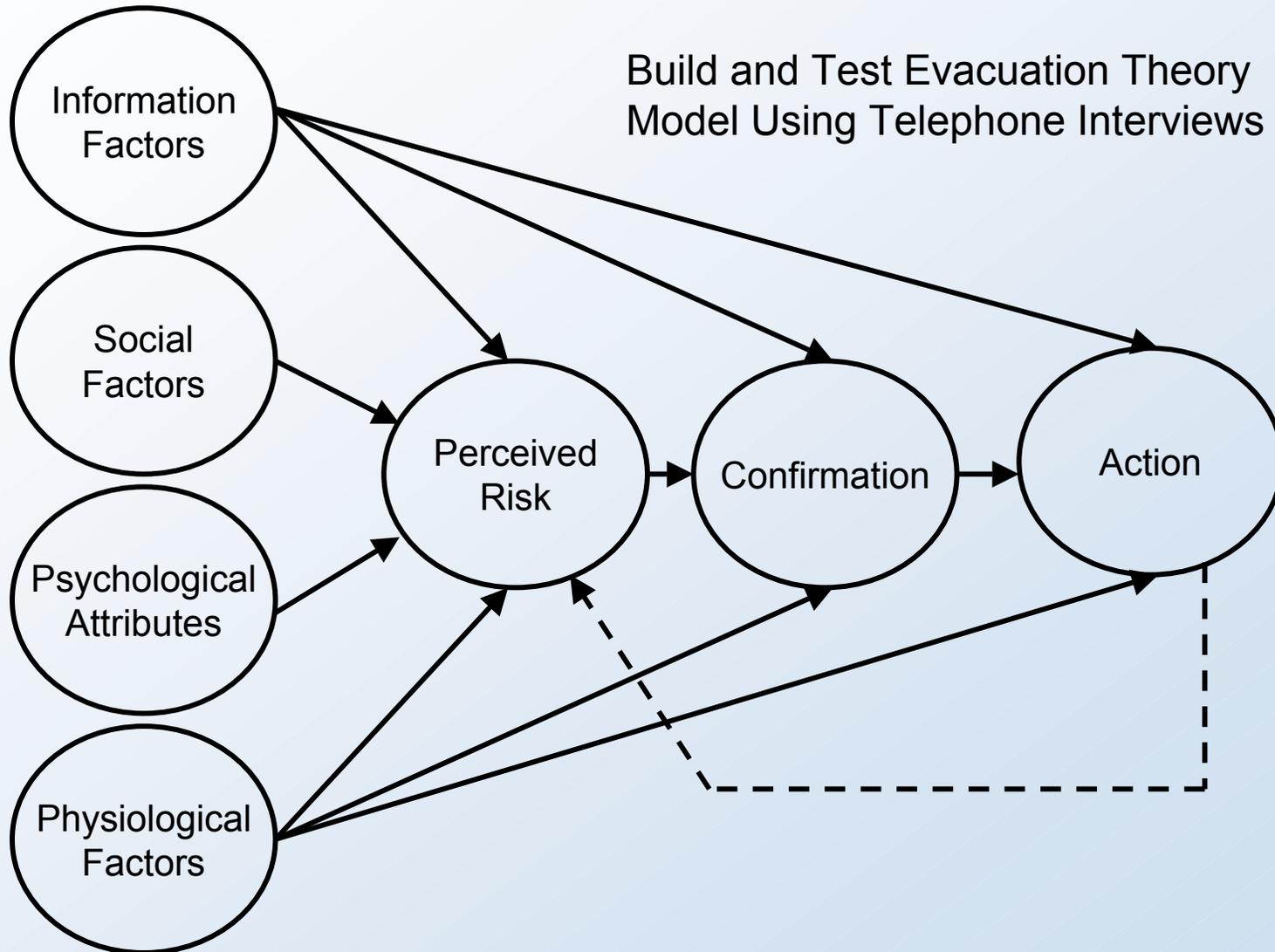
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Telephone Interviews

Stratification Variables:

- Tower 1 or Tower 2

- Floor Height Using 3 Zones

- Tenant Size

Stratification Strategy

WTC 1	WTC 2
110	
94 – 98	Zone 6
Zone 3	78 - 84
78	Zone 5
Zone 2	
44	
Zone 1	Zone 4

Telephone Interviews

Build and Test Evacuation Theory Model Using Telephone Interviews

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Telephone Interview Structure

- **Initial awareness**
  - **information (source, channel, additional)**
  - **social, physical, risk perception**

- **Interim awareness**
  - **information (source, channel, additional)**
  - **social, physical, risk perception, action**

- **Egress**
  - **incentives**
  - **constraints**
  - **characteristics**

- **Outcomes**
  - **injuries**
  - **observations**

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Telephone Interviews

Sample Questions:

- I would like you to think about the time period between when you first became aware that something had happened to the World Trade Center and when you began your evacuation. During this time period, did you receive any additional information on what was going on?

- At any time during your evacuation did you leave this stairwell?

- Is there anything else you would like to say or let people know regarding your experience on September 11th?

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Focus Group Interviews

Objective: Enhance recall of specific group experiences.

Selected Groups:

- Occupants Near the Floors of Impact

- Occupants Trapped in Elevators

- Occupants Above Floors of Impact

- Witnesses to Fireball in Lobby

- Other

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Analysis of First Person Accounts

Quantitative Analysis (Regression, Correlation, Tests of Statistical Significance, etc)

- Telephone Interviews

- Existing Published Accounts

Qualitative Analysis (Established Data Analysis Software Tools)

- Face-to-face Interviews

- Focus Group Interviews

Findings, Conclusions, and Recommendations

Compare and Analyze:

- Evacuation History

- Published Accounts

- Photographic and Electronic Data

- Data from First Person Accounts

- Egress and Emergency Communication System Design Records

Develop:

- Findings

- Conclusions

- Recommendations

Advisory Committee Feedback:

- Overall goals and objectives

- Data collection, review, and analysis approach

- Other ideas and suggestions?

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