

Structural Collapse Rescue
NFPA 1670 Awareness Level



Kansas Search & Rescue
Response System
General Training Requirement

NFPA 1670

Structural Collapse Rescue

- (1) Recognizing the need for structural collapse search and rescue
- (2) Identifying the resources necessary to conduct structural collapse search and rescue operations
- (3) Initiating the emergency response system for structural collapse incidents
- (4) Initiating site control and scene management

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Structural Collapse Rescue

- (5) Recognizing the general hazards associated with structural collapse incidents, including the recognition of applicable construction types and categories and the expected behaviors of components and materials in a structural collapse
- (6) Identifying the types of collapse patterns and potential victim locations
- (7) Recognizing the potential for secondary collapse

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Structural Collapse Rescue

- (8) Conducting visual and verbal searches at structural collapse incidents, while using approved methods for the specific type of collapse
- (9) Recognizing and implementing a search and rescue/search assessment marking system, building marking system, victim location marking system, and structure marking system, such as the ones used by the FEMA US&R System

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Structural Collapse Rescue

- (10) Removing readily accessible victims from structural collapse incidents
- (11) Identifying and establishing a collapse safety zone
- (12) Conducting reconnaissance (recon) of the structure (s) and surrounding area

Disasters can be man made or natural

- May 18,th 1980, eruption of Mt. St. Helens
- Oklahoma City Bombing, April 19, 1995
- 9/11 – World Trade, Pentagon

They can be relatively small scale or cover large areas

- Sioux City Airliners Crash



- Mississippi Valley Flood



Resources

- Local Resources
- State Resources
- Federal Resources



Local Resources

- Fire Department
- Law Enforcement
- Public Works
- Volunteer search and rescue
- Community Disaster Response
- Light rescue teams from business and industry



State Resources

- State Police
- National Guard
- Governor can request a declaration of disaster from the President



Federal Resources

- FEMA (Federal Emergency Management Agency)
- US&R task forces comprised of four components
 - Search
 - Rescue
 - Medical
 - Technical

Four Phases of Structural Collapse Rescue



Phase I

Size up and Recon

- Depending on event can last few minutes to several hours
- Find out how big the problem is
- Organized survey of the damaged area
- What resources are available?
- What can we do about the problem?

Prioritize the problems

- *First priority is yourself*
 - *Second is your co-worker*
 - Third is other people
 - Fourth is property
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- Prioritization allows you to determine which problems to solve first

Establish Command and Control

- Designate a command spot
- Remain available by staying in the command post

Rescue and remove surface victims

- 50% of all survivors are surface victims- injured but not trapped, Deal with them first
- Remove them from the hazards
- Keep people from entering structures, allow structures time to settle
- Organize spontaneous rescue teams and direct them where they will do the most good

Phase II

- Begins when rescue teams arrive and ICS has been established
- Use info. gathered to search the likely survival places
- Use location methods, searching outside by voice, listening devices, dogs, heat sensing and fiber optics

Phase II (cont.)

- Search the voids as a last resort
- Enter those voids that have highest likelihood of survivors
- Shore as you go
- Monitor for hazards
- 30% of all survivors in Structural collapse are involved in non structural entrapment



Phase III

- Starts after all surface victims are removed and cared for and those in voids can be removed without major debris removal
- Selective debris removal using heavy equipment , trained rescue teams working with private contractors
- Removal of entombed victims

Phase IV

- Usually 5-6 days after event
- Probability of further survivors is minimal, and private contractors will usually finish clean up

Search



Type of Search

- Physical Search
- Canine Search
- Technical Search
- Use all three for the most complete search

Search Markings



Single slash drawn upon entry to a structure or area indicates search operations are currently in progress



Crossing slash drawn upon search personnel exit from the structure or area

E-20



Left quadrant — rescue team identifier

7/15/91
1400 hr



Top quadrant — time and date task force personnel left structure



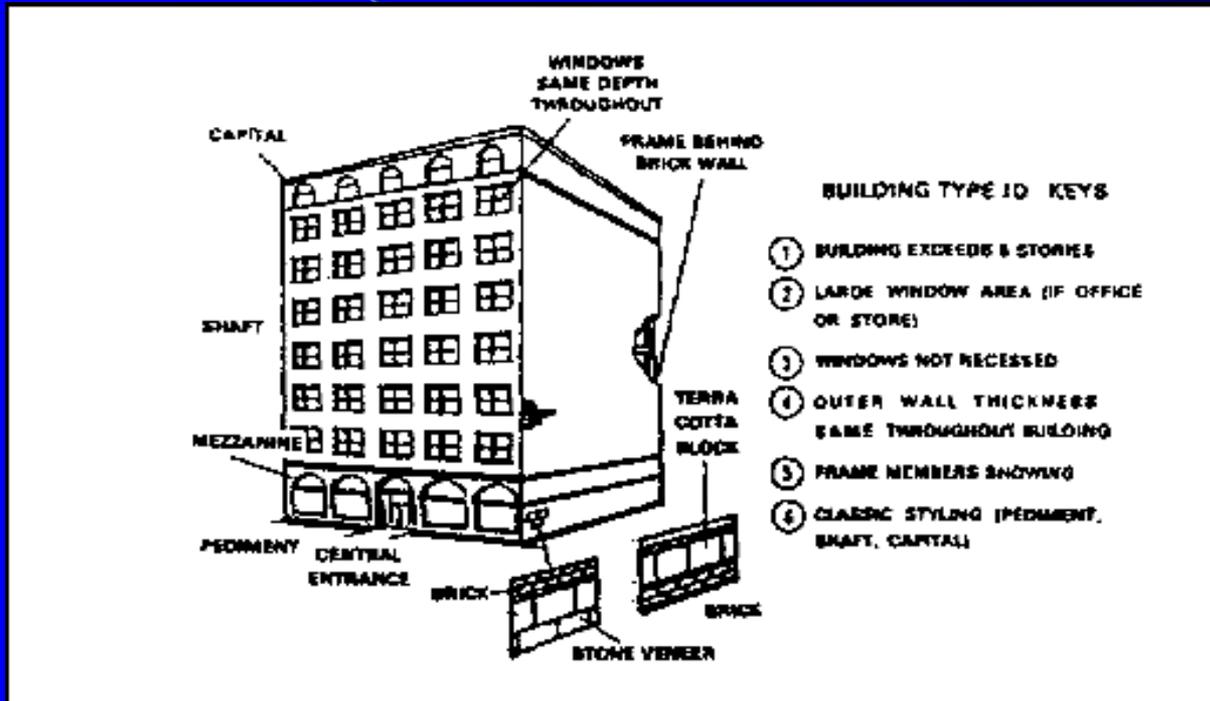
Rats Right quadrant — personal hazards



2 live
3 dead

Bottom quadrant — number of live and dead victims still inside structure (X = no victims)

Building Construction Types and Characteristics



Light Frame Building Collapse



Light Frame Building Collapse

- Residential homes and apartments
- Highly susceptible to fires
- Complete collapses occur frequently

- Rescuers look for badly cracked walls, leaning walls, offset of structure from foundation, or leaning first story

Heavy Wall Unreinforced Masonry (URM)



Heavy Wall Unreinforced Masonry (URM)

- One to six stories high, residential, commercial, industrial, or institutional
- Principle weakness in lateral strength
- Partial collapse is most common

- Rescuers check for loose/broken parapet walls, connections between walls and floor, unsupported and partially collapsed floors

Heavy Wall Tilt-Up/Reinforced Masonry



Heavy Wall Tilt-Up/Reinforced Masonry

- One to five stories
- Usually industrial/commercial
- Weakness is between walls and floors or roofs. Walls fall away from floor/roof
- Rescuers check connection of walls and roofs/floors, and connection between beams and columns

Heavy Floor Building



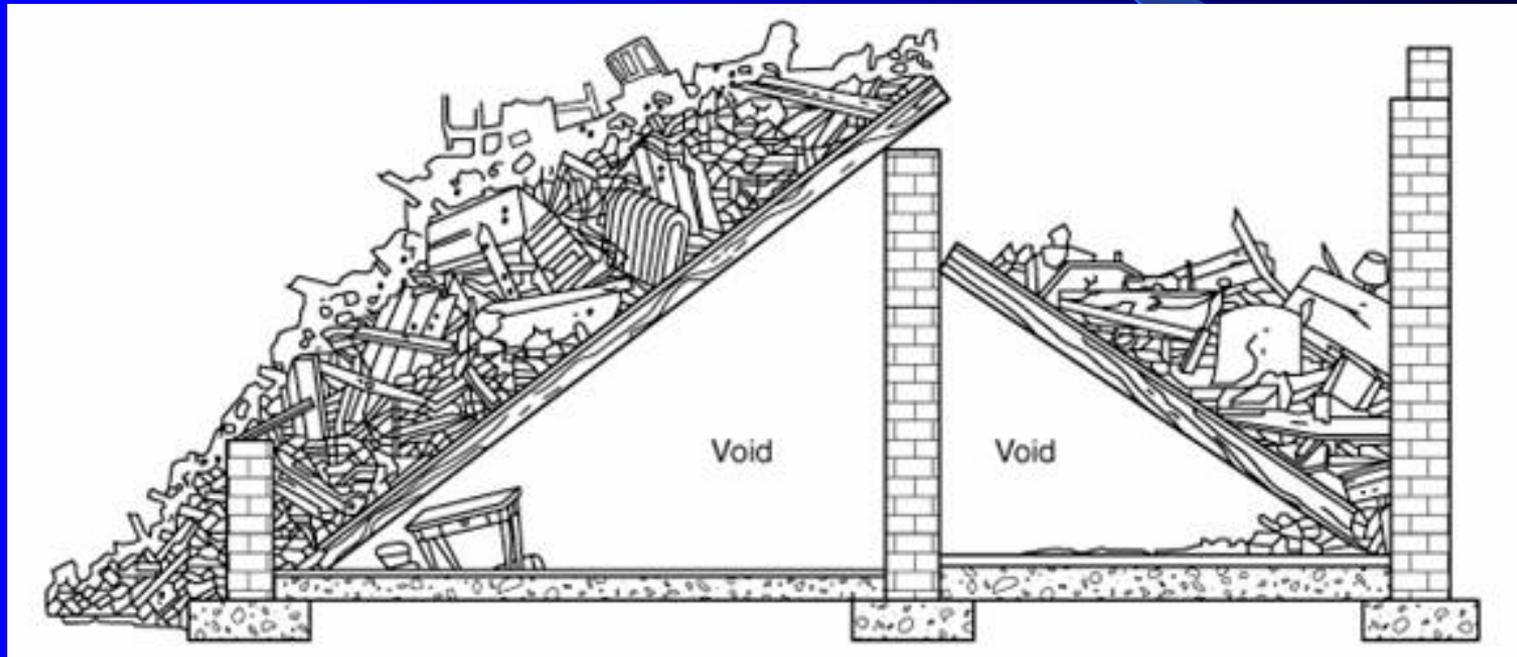
Heavy Floor Building

- Residential, commercial, industrial
- Concrete frames up to 12 stories
- Includes concrete highway bridges
- Weakness is poor column reinforcement, and connection between floor and column
- May fail partially or completely, and potential laterally

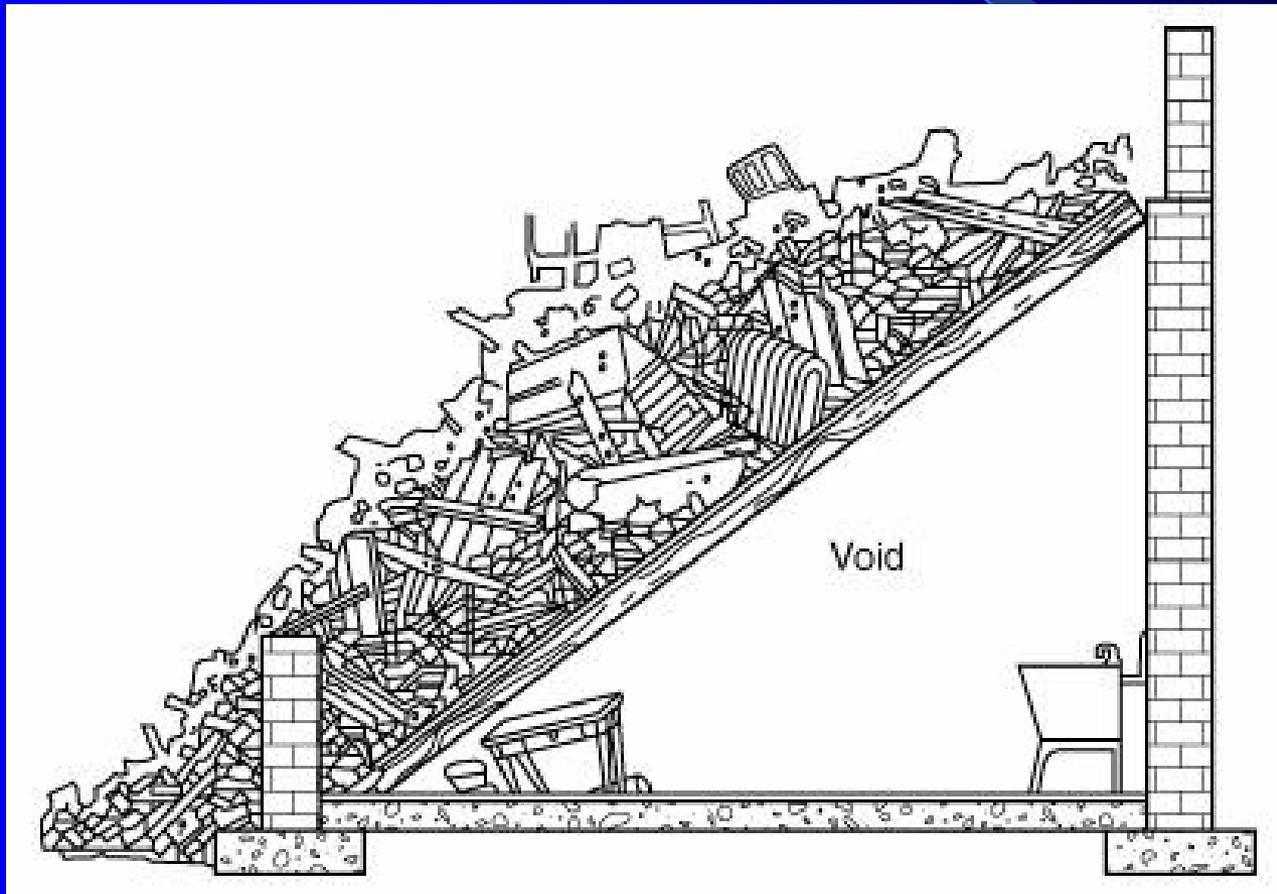
Types of Collapse Voids

- Lean-To
- V-Type
- Pancake
- Cantilever

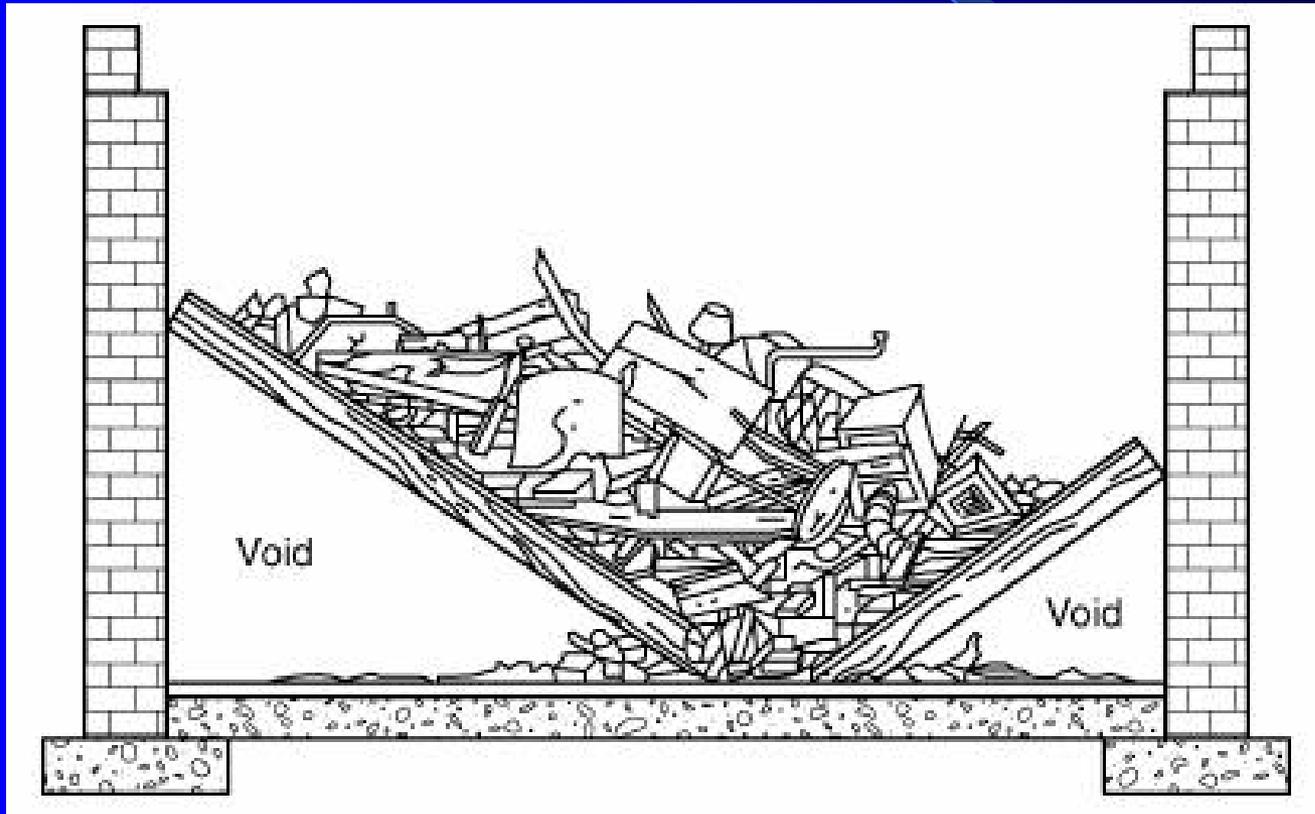
Lean-To Void



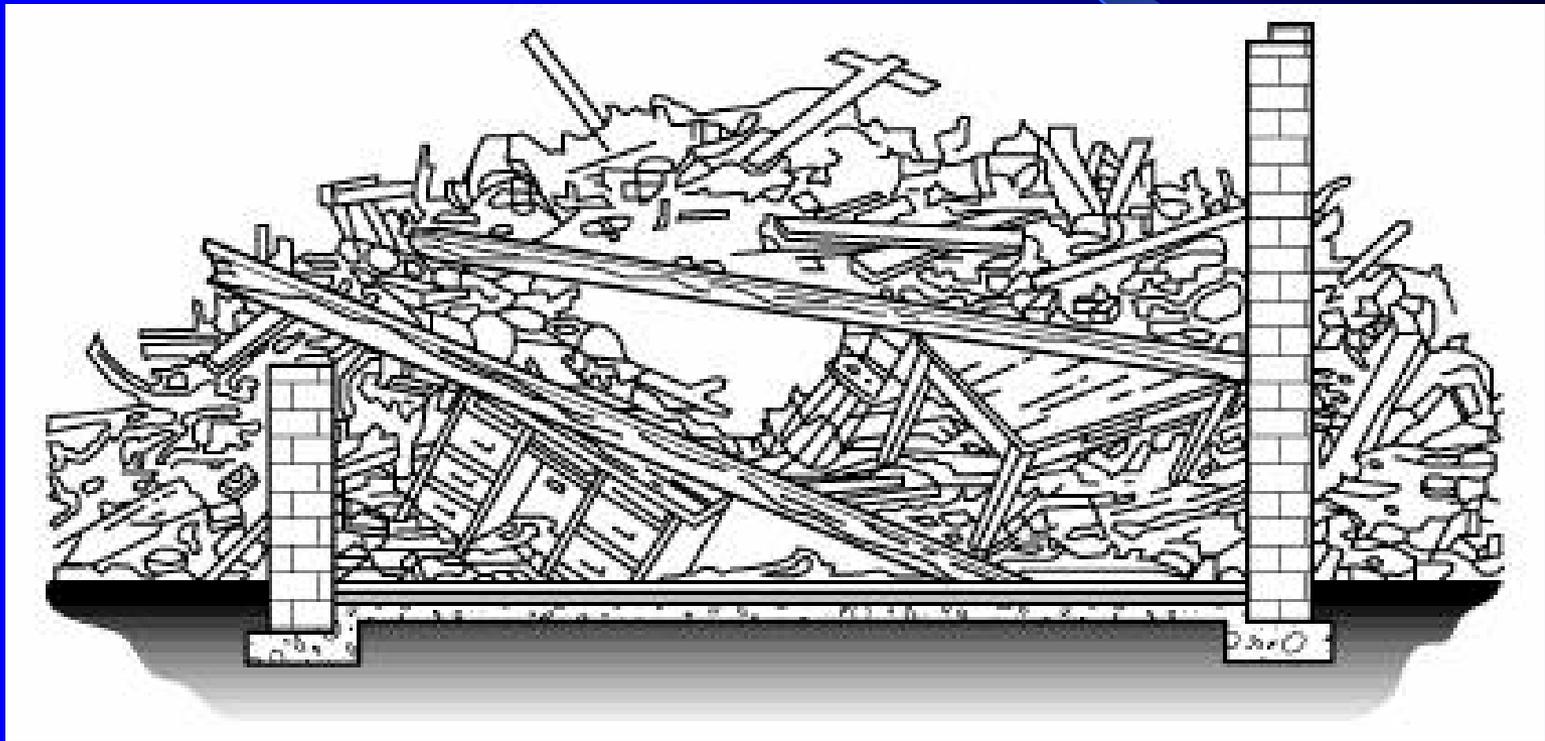
Lean-To Void



V-Type Collapse Void



Pancake Void



Cantilever Void



Shoring

- Vertical Shores
 - T-Shore (Spot shore)
 - Window and Door shores
 - Laced Posts
 - Cribbing

Shoring

- Lateral Shores
 - Trench Shore
 - Wood Horizontal Shores
 - Hydraulic Trench Shore
 - One-Sided Trench Shore
 - Raker Shores

Safety



Categories of Hazards

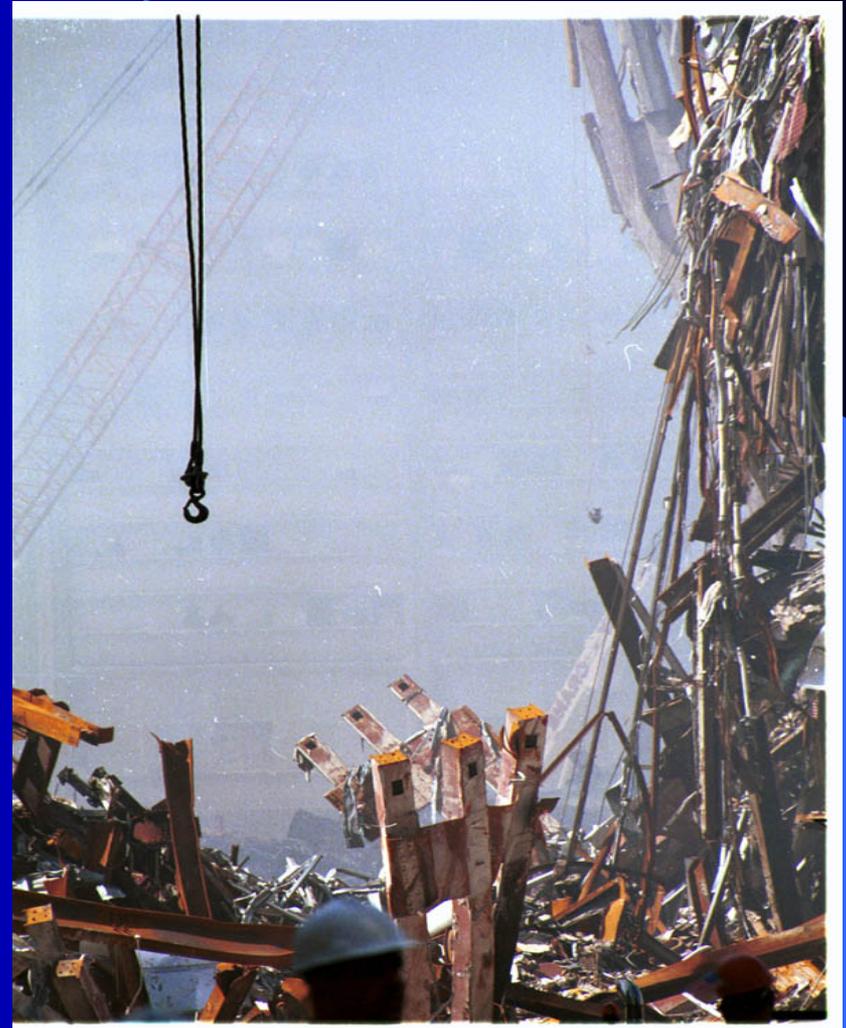


Structural Instability

- Weakened Floors, walls, roofs, beams and columns
- Free standing walls
- Spalling of Concrete structure, masonry
- Shifting of debris from aftershocks, vibrations or secondary collapse
- Attached buildings can be an exposure, or weakened by collapse

Overhead Hazards

- Loosened debris and unstable building structures overhead
- Low hanging power lines
- Building contents that are unstable and displaced
- Failing slings or cables while lifting material



Surface Hazards



Sharp Debris

- Broken Glass
- Jagged Metal
- Nails
- Wood Splinters
- Rough Masonry



Slippery Surfaces



- Fluids
- Water, Ice, Snow
- Sewage
- Unsure footing
- Improper footwear

Other Surface Hazards

- Sink holes/ground depression by earth movement
- Downed live power lines
- Opened manhole covers and other dangerous opening when flooding occurs
- Heavy equipment

Below-grade Hazards

- Atmospheric changes due to ruptured fuel, gas lines or presence of hazardous chemicals
- Floods
 - May have caused the collapse
 - From ruptures water/sewage lines
 - From ground water
- Elevation differences can cause difficult access and egress

Utilities Hazards

- Electric
- Fuel/gas
- Water
- Steam
- Sewage



Hazardous Materials

- Commercial establishment
- Hazardous Household Chemicals
 - Ammonia, Bleach, cleaners, solvents, etc.
- Garage

Other Hazards

- Fire, Smoke, Explosion
- Heavy Vibrations
- Inhalation Hazards
- Power tools
- Noise
- Scene Control



What Are Some of the Hazards?



Hazards?





Floor Collapse



Safety Equipment



Personal Protective Equipment

- Helmet
- Eye Protection
- Gloves
- Knee pads
- Clothes
- Work Boots
- Radio
- Lights



Personal Lights

- Hand light
- Helmet light
- Don't rely on one person for light
- Have back-up
- Chemical light

Respiratory Protection

- Level will depend on atmospheric hazards
- Cartridge filter
- SCBA
- Supplied Air



Safety Officers

- One for each unit
- Shouldn't be engaged in rescue efforts
- Concentration on team and hazards
- Utilize Safety checklist
- Rotation of crews

Rotating Crews

- Lessens the risk of fatigue injuries
 - Rotate partial crews
 - Monitor work times of all crews
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- Rescuers will work longer if they're not told to take a break

Communications

- Maintain voice contact with rescuers
- Communicate needs to team leaders
- All rescuers should have a portable radio
- Have predetermined hand signals



Communications Cont'

- Coordinate rescue effort with other teams so that one team doesn't place other team in danger.
- Advise team leaders of progress
- Especially important during night ops

Evacuation/Escape Procedures

- Signaling systems

- FEMA US&R task force evacuation signals

- Devices

- Air horns
- Hand held CO2 boat horns
- Vehicle horns

Signals

- Cease operation/all quiet: One long Blast (3 seconds)
- Evacuate area: Three short blasts (one second each)
- Resume Operations: One long and one short blast

Escape Procedures

- Alternate exit
- Communicate if you become trapped
- Radio
- Voice
- Banging on structure
- Prearranging signals
- Advise leaders of escape from building

Approach Considerations

- Secondary devices
- Safe Zones/Collapse area (Danger Zones)
- Hazardous materials
- Control of Scene

Safety Considerations

- Wear proper gear, use the buddy system
- Control utilities early
 - Gas, Electric, Water
- Monitor atmosphere
 - Radioactivity, O₂, Flammable
- Eliminate fire danger
 - Have hoses/extinguishers available
 - wet areas prior to using spark producing tools

Safety Considerations Cont'

- Establish safe areas to keep people out of dangerous areas
 - Barrier tape in X pattern to warn about hazard
 - Two rows of straight tape to control access
- Monitor Building Movement
- Before searching voids remember, “3 Ss”
 - Survey
 - Stabilize
 - Search

Safety Considerations Cont'

- Have awareness for Stress Factors
- Rehab
- Enforce Safety

- Rescuer Safety is number one Priority!

This completes the general training
requirement for NFPA 1670
Structural Collapse Rescue Awareness

Click the box below to take a quiz and
receive a Certificate of Completion.

FINAL QUIZ