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
NFPA 1670
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
NFPA 1670
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.
(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 18th, 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

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.
- Bottom quadrant — number of live and dead victims still inside structure (X = no victims).
- 2 live 3 dead.
Building Construction Types and Characteristics
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

- 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