# STRUCTURAL COLLAPSE OPERATIONS

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1. INTRODUCTION

1.1 Structural Collapse is defined as any incident where a building or portion of a building, including walls, floors, ceilings, partitions, or structures such as bridges, scaffolds, signs, construction sites, banners or other items have collapsed or are in danger of collapsing. A structural collapse is one of the most difficult and dangerous operations firefighters will encounter. First arriving units may find clouds of dust and smoke engulfing the area. Debris may cover large areas including streets and automobiles. Injured or disoriented people may require assistance, while others are trapped in the rubble.

1.2 According to the Citywide Incident Management System (CIMS), structural collapse is a single command event and the FDNY has been designated as the Incident Commander for collapse operations. Search and rescue is a core competency of the FDNY, which gives the Fire Department the authority to direct search and rescue operations. All city agencies, including Police and Buildings Departments, operate under the direction of the FDNY during a structural collapse rescue operation. The Incident Commander (IC), using the Incident Command System, will ensure a controlled and coordinated interagency operation.

1.3 With this responsibility comes accountability. All FDNY Chiefs, Company Officers, Firefighters and EMS personnel should be knowledgeable of the collapse rescue plan.

1.4 Causes/Indicators of a Collapse:

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>INDICATORS / SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fire/destruction of wood, heating of cast iron or unprotected steel</td>
<td>• Prolonged burning for the class of construction</td>
</tr>
<tr>
<td>• Water main breaks</td>
<td>• Heavy floor loading</td>
</tr>
<tr>
<td>• Natural causes: earthquakes, hurricanes, tornadoes, floods, heavy snow</td>
<td>• Unsupported walls</td>
</tr>
<tr>
<td>• Explosions: explosives, fuels, backdrafts</td>
<td>• Cracks, sagging or bulging walls</td>
</tr>
<tr>
<td>• Collision impact</td>
<td>• Cracking or groaning noises indicating a strain on structural members</td>
</tr>
<tr>
<td>• Vibrations, impact loads</td>
<td>• Rumbling noises or heavy puffs of smoke</td>
</tr>
<tr>
<td>• Overload on floors and/or roofs, expansion of water absorbent stock</td>
<td>• Walls leaking smoke or water</td>
</tr>
<tr>
<td>• Structural fatigue, old age</td>
<td>• Soft or spongy feeling as you walk on a floor or roof</td>
</tr>
<tr>
<td>• Faulty construction, improper alterations, nearby excavations</td>
<td>• Walls or columns out of plumb</td>
</tr>
<tr>
<td>• Cutting or removal of load bearing elements</td>
<td>• Plaster sliding off a wall, windows cracking or doors swinging open or closed, indicates movement of wall</td>
</tr>
<tr>
<td></td>
<td>• Clean wood at beam ends, indicating roof or floor pulling away from walls</td>
</tr>
</tbody>
</table>
2. INCIDENT MANAGEMENT

2.1 Both the Fire and Police Departments will dispatch resources to the scene. The first arriving resources capable of performing rescue activities will initiate life safety operations. Life safety operations in progress will not be disrupted or suspended because of the arrival or transition of Command.

2.2 The first arriving FDNY Fire Officer has prime responsibility for rescue activities at the incident site and assumes the role of Incident Commander for all structural collapses that produce casualties or threaten public safety. This member will retain that role until relieved by a superior Fire Officer. All agencies responding to an incident will assist as requested by the IC. Personnel from other agencies will be under the control of their superior officer/supervisor, who shall report to the Incident Command Post (ICP) for instructions.

2.3 When the rescue and removal of all persons involved in the incident, and stabilization of all threats to public safety have been accomplished, the scene becomes the jurisdiction of the Department of Buildings, and/or the New York State Department of Labor (for buildings under construction/demolition.) The IC will determine when an area is safe to permit personnel of other agencies, who will be coordinated through the Office of Emergency Management (OEM), into an area to begin the process of restoration and recovery. It is the mission of the Department of Buildings and the Department of Labors OSHA Compliance Office to determine the cause of the incident and whether any OSHA regulations have been violated. Therefore, it is essential that the scene not be indiscriminately damaged or disturbed after rescue operations are completed, other than to make the area safe. The IC should request the Police to provide site security if necessary.

3. OBJECTIVES OF THE FIRE DEPARTMENT

During collapse operations, control the situation by:

- Extinguishing any fire
- Conduct searches
- Locate and mitigate all Hazards
- Install appropriate protective measures (e.g. shoring)
- Remove trapped victims
- Triage, treat and transport victims
4. FIRST ARRIVING UNITS GENERAL CONSIDERATIONS / RESPONSIBILITIES

4.1 Size-Up
A cautious and deliberate size-up combined with immediate site security actions reduces vulnerability to the public, responders and the environment.

<table>
<thead>
<tr>
<th>Building Information</th>
<th>Collapse Area</th>
<th>Life Hazard</th>
<th>Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Address/CIDS</td>
<td>• Size</td>
<td>• Occupancy/Time of Day</td>
<td>• Gas Leaks</td>
</tr>
<tr>
<td>• Occupancy</td>
<td>• Floors Involved</td>
<td>• Trapped/Missing</td>
<td>• Electrical shorts</td>
</tr>
<tr>
<td>• Construction</td>
<td>• Interior/Exterior</td>
<td>• Resources On Scene/Responding</td>
<td>• Water main breaks</td>
</tr>
<tr>
<td>• Occupancy Hazards</td>
<td>• Exposures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Stability</td>
<td>• Fire Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Extent</td>
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</tbody>
</table>

4.2 Dispatch Information and Scene Size-Up will determine the following:
- Apparatus placement/street management.
- First arriving units should position themselves as per the directions in Section 5.1
- Designate an initial staging area for other responders.
- Identify a location for the ICP.

4.3 Notify the Fire Department Dispatcher of:
- The address.
- The nature of the incident.
- The need for additional FDNY units or other agency resources.
- Transmit signal 10-60 (Major Emergency Response) with appropriate code when necessary, and if conditions warrant, an additional alarm.
- Location of the ICP for the response of Fire, EMS and PD supervisors.

Note: At least one tower ladder shall be special called to every major collapse if none was assigned on the initial alarm.
4.4 **Safety Considerations**

- Safety at the scene of a collapse is the single most important consideration during the operation.
  - Identify and immediately report any sign of structural defect that could lead to a secondary collapse. Isolate these areas with barrier tape and/or other suitable means.
  - Do not enter any danger zones except to save life.
  - Place apparatus outside of the potential collapse danger zone.
  - Access control points should be established to regulate entry and exit from the control zone.
  - Doors, stairways, ladders, ramps, ditches and excavations should be made as secure as possible in the event a rapid escape from the site is required.
  
  **Note:** At all explosions and major collapses, SOC Units shall ensure the immediate area is monitored for the presence of radiological/chemical agents.

- Steps must be taken immediately to prevent further casualties. First arriving units shall examine the collapse site for dangers and take the necessary actions to prevent further injuries including:
  - Stretch hoselines to protect entire collapse area. Ensure a 3½” hoseline is stretched for tower ladder use.
  - Control utilities by shutting down the main building service entrance controls, and ensure the dispatcher has requested the response of the utility company’s emergency crews.
  - Remove lightly buried victims and deliver them to the Medical Group. CFR-D Engine Companies can assist EMS.
  - Examine premises for hazardous occupancies or processes.

4.5 **Potential Hazards**

- **Secondary Collapse:** Structural instability of adjoining buildings.
- **Electrical Hazards:** Downed electrical wires can energize conduits, plumbing and metal structural members of the building.
- **Gas Leaks:** Broken gas pipes may cause fires or explosions.
- **Water Main Breaks:** Broken water pipes may increase the likelihood of electrical shock, threaten trapped victims with drowning, and the increased water weight may cause a secondary collapse.
- **Hazardous Materials:** Including dust, asbestos, bloodborne pathogens (BBP), and the contents of the structure. Dust is present at every collapse. Concrete dust is a strong corrosive and irritant to lung and mucous membrane tissue. The presence of hazardous materials may include flammables, corrosives or oxidizers.
- **Terrorism:** Hazardous materials and/or secondary devices.
- **Rescuer Fatigue**
- **Adverse Weather:** High winds can blow debris from upper floors, heavy rain or snow can cause secondary collapses.
4.6 **Ensure a Hazard Assessment is Performed - General Considerations**

- Each member should be alert to the signs, evidence and indications of the presence of hazardous substances during fires and emergencies.
- Personnel shall only operate to the level that they are trained.
- If it is a known hazardous materials incident, the IC will:
  - Confirm site control.
  - Immediately assign a company to perform a hazard assessment to determine the health and safety effects on members operating in the area.
  - Assign hazard identification and control to the first Hazardous Materials Technician Unit on scene. (A Haz-Mat Technician Engine Company responds automatically on transmission of signal 10-60)
  - Special call Hazardous Materials Company 1, who will assist or relieve any Haz-Mat Technician Units with Haz-Mat issues. (Haz-Mat Company 1 responds automatically on transmission of signal 10-60)
  - Determine whether operations can continue or must be changed to a defensive operation.

  **Note:** Hazardous materials may consist of multiple hazards.

- Explosions shall be viewed as possible “dirty-bomb” sites until monitoring shows the area to be clear of contamination.

The IC should gather and evaluate pertinent information prior to members entering into or undertaking activities that would place units in a contaminated environment. Voids and below grade areas shall be monitored for accumulations of flammable gases, carbon monoxide and oxygen content, prior to any entry.

4.7 **Risk vs. Benefit Analysis**

The safety of personnel needs to be *carefully* evaluated before attempting complicated rescues. Initial rescue actions should concentrate on removing able-bodied (ambulatory) and surface or lightly buried persons from immediate danger. Re-evaluate the Risk/Benefit Analysis throughout the collapse incident.

5. **STREET COORDINATION AT COLLAPSES**

5.1 Considering collapse incidents usually require specialized units, first arriving units must take positions that allow the necessary units and equipment to arrive and operate effectively.

5.2 It is critical for first responding units to address street management and fire control. Apparatus shall be parked in such a manner that special equipment, ambulances, etc., can make their way to and from the scene when ordered by the IC.

- Apparatus placement, coordination and cooperation of all responding agencies are vital to success.
- Units should take positions similar to those described below, according to the function and specific conditions at the scene.
- Positions should be taken outside of the collapse zone, in the event a secondary collapse occurs.
• Nonessential units should not block the street. Only apparatus authorized by the IC should be positioned on the street. Later arriving apparatus may only be used for their personnel; the apparatus should be parked away from the scene in a secondary staging area.

5.3 First-alarm engine companies must position themselves to protect the occupants and rescuers against the threat of fire.

• If possible, both first and second arriving engines should take separate hydrants outside the block, each on separate mains, and prepare to supply handlines and a large caliber tower ladder stream. The third and fourth engines should take similar positions at the rear of the structure.

• Two of the second alarm engine companies should be used to seal off the ends of the street. The chauffeurs of these units must remain in the cab, able to move the apparatus if directed by the IC. Remaining engine companies should be positioned well away from the scene, for they will probably be responding for personnel needs only.

Figure 1
An overhead view of a street plan at a collapse, showing key positions and facilities.

5.4 Ladder Companies have many roles at collapse incidents.

• Tower ladders should be placed in front of the collapsed structure, outside of the collapse danger zone. Initially, the first arriving tower ladder should be the only unit in front of the collapse building, unless there is a specific need for additional units. Subsequent arriving tower ladders should be positioned to reach and protect a different exposure. Additional units should be directed to a designated staging area, unless required elsewhere.
• Tower ladders are limited in size to 95 feet. At incidents involving tall/long buildings, consider placing several units around the collapse, or using aerial ladders (100’ reach) if needed.

• Aerial ladders should be kept away from the front of the building in a secondary staging area unless needed for specific rescue purposes.

• SOC Support Ladder Companies shall position the same as other ladder apparatus, with their second pieces located near the main apparatus.
  • Personnel can carry equipment, tools, etc., to scene.

5.5 Rescue companies and collapse units should be placed outside of the collapse danger zone but as close as possible to the front of the building.
  • Provides immediate access to specialized tools/equipment.

5.6 Ambulances need to be visible from the scene, but out of the way of rescue and firefighting operations.
  • First arriving ambulances need to be close to the scene to provide supplies for triage and initial treatment.
  • Additional units should stage away from the operations site, in an area where egress can be made once patients have been loaded for transport.
  • Drivers with keys must remain with the ambulances at a secure staging area for the transport of patients.

5.7 Heavy equipment, such as cranes, front-end loaders and dump trucks must also be assured access to the site.
  • Access paths that permit firefighting apparatus to pass may not be wide enough for heavy equipment.

5.8 The IC should request the Police Department to provide tow trucks to remove any vehicles impeding operations at the scene.
  • Stage tow trucks several blocks away so they can promptly remove abandoned vehicles near the incident site.
  • The tow trucks may be needed to move unattended emergency vehicles impeding operations.

6. INCIDENT COMMANDER RESPONSIBILITIES

The Incident Commander is the senior ranking Fire Officer on-scene.

The first arriving Battalion Chief must evaluate the overall incident and determine incident priorities, and if necessary adjust the operations of any and all personnel operating at the scene to reflect these priorities. Succeeding Commanders will further evaluate the needs of the incident and refine, reinforce, and/or expand the scope and depth of response activities.
First Arriving Chief Officer

6.1 Take command at the scene
Announce arrival and evaluate the ICP established by the initial IC. Ensure the ICP is located at or in the immediate vicinity of the incident site, in an area outside of the operations site and collapse zone. Keep in mind there are likely to be multiple responding agencies whose ranking representatives need to be accommodated at the ICP. The ICP must be clearly visible from the collapsed structure and accessible to incoming units. On arrival of the Division, consider use of the Division tent. Establishment of a Command Channel (Channel 2) is essential for effective communications at large incidents.

6.2 Staging Area
The initial IC establishes a staging area. Reevaluate the location and assign a company officer to be the Staging Area Manager until replaced by a Battalion Chief. Transmit a preliminary report regarding the location of the ICP and the staging area. The Dispatcher can assist in identifying a staging area.

6.3 Perform Initial Size-up

6.4 Ensure the Fire Department Dispatcher has transmitted the necessary requests for assistance and they are aware of the location of the ICP and Staging Area(s).

6.5 Collapse Incident Management
- Management
  - Survey site for potential hazards
  - Eliminate vibrations, shut down;
    o Trains
    o Nearby traffic (buses, trucks, etc.)
    o Construction site equipment
  - Identify and establish the Collapse Danger Zone.
  - Interview witnesses/victims using the Collapse Survivor Interview Form. The battalion firefighter can aid in its completion.
  - Start void searches when surface search is complete. Carefully evaluate risks when performing complicated searches.
  - Transmit progress reports.
- Resources
  - Evaluate the need for signal 10-60 with or without code, and/or the need for additional alarms.
  - Request DEP Water Department, utilities, etc.

6.6 Oversee the Street Coordination Plan
Street coordination is the art of positioning essential units in the right place and keeping unnecessary units out of the way to allow continuing access and egress for later arriving equipment.

6.7 Ensure Scene Safety and a Hazard Assessment was performed.
6.8 **Establish contact with the Law Enforcement Group or Branch.**
Request assistance for:
- Crowd control
- Ensuring smooth flow of emergency traffic
- Establishing a frozen zone barring any non-emergency vehicles
- Force protection
- Searching area for secondary devices if a bombing is suspected

6.9 **Designate a debris examination area**
It should be a paved area near the site and examined to ensure it does not contain any people, remains, or potential evidence before any debris is moved there.

6.10 **Request additional assistance as needed**
All requests for additional assistance shall go through the borough dispatcher. Requests for outside agency assistance may simultaneously be made through the OEM as well as the dispatcher.

7. **DUTIES OF FIRST ALARM UNITS AT A BUILDING COLLAPSE**

7.1 **Engine Company Responsibilities**
In order of highest to least priority, first alarm engine companies are to:
- Extinguish active fire in the affected building and surrounding debris.
- Protect exposures.
- Extinguish burning vehicles within the vicinity of the collapse.
- At scenes where there is no active fire, stretch and charge precautionary 2½” lines in sufficient number and length to cover the entire operation. In addition, a 3½” line shall be stretched and charged to supply the first arriving tower ladder.
- At a suspected terrorist event, 2½” hoselines should be located between two apparatus, or other substantial shielding, to protect personnel from secondary blasts set to injure emergency responders.

**Note:** If flooding occurs, shutting off the water mains and obtaining dewatering pumps will aid victims trapped in the lower areas.

7.2 **First Arriving Engine Company: Water Supply**
- Officer
  - Supervise water supply activities / apparatus placement

  **Note:** At times it may be necessary for the first arriving Engine to take a position within the block for use of the apparatus master stream for fire control or exposure protection. The Officer must ensure a continuous source of water supply for such purposes.
- Coordinate operations with first arriving ladder company officer.
- Stretch a 2½” handline of sufficient length to cover the entire site.
- Consider stretching 3½” line to supply a tower ladder.
• First Arriving Engine Company Members
  • Position and operate handlines as ordered.
  • Members will remain together as a unit unless otherwise ordered by the IC.

7.3 Second Arriving Engine
• Officer
  • Obtain briefing from the IC and/or the first arriving engine company officer.
  • Supervise apparatus placement.
  • Ensure a 3½” supply line is stretched to the first tower ladder.

• Second Arriving Engine Company Members
  • Assist the first engine company with stretching initial handlines and tower ladder supply.
  • Members of the second engine company will remain together as a unit unless otherwise ordered by the IC.
  • If necessary, members of the second arriving engine company may perform CFR-D duties.

7.4 Third and Subsequent Arriving Engines
Under the direction of the IC, the third and any subsequent arriving engines will be utilized to perform the following:
• Fire Control.
• Stretching additional lines.
• Augmenting the water supply to first alarm units.
• Perform CFR-D duties.
• Assisting in the removal of lightly buried victims.

7.5 First Arriving Ladder Company
• Officer
  • Obtain a briefing from the IC.
  • Supervise apparatus placement.

Note: Officers have the option of splitting the Company into separate teams to cover more area.

• First Arriving Ladder Company Members: Reconnaissance
  • Perform Scene Survey
  • Perform Hazard Assessment and Control
    o Protect members from secondary collapse; mark with hazard tape, tie back or crib.
    o Keep nonessential members from entering the collapse zone.
  • Remove Surface Victims
    o Remove lightly buried victims and deliver to a Casualty Collection Point (CCP).
    o If possible, question survivors regarding the number, identity and location of other occupants prior to and after the collapse.
• Perform Preliminary Void Search
  As soon as conditions permit, begin searching areas where voids exist for possible survivors.
  o Visually search accessible voids - **DO NOT** cut, lift or remove load bearing members. Call and listen.
  o As survivors are located and removed, members should note their description and location for use in victim tracking.
• Victims should be directed/brought to a CCP.

7.6 **Second Arriving Ladder Company**
The second ladder company to arrive shall immediately begin the process of controlling the gas, electric and water services.

• Officer
  • Obtain a briefing from the IC.
  • Supervise apparatus placement.
  • Ensure the dispatcher notified the utility company emergency crews (gas, electric, water, steam).

• Second Arriving Ladder Company Members: Utilities
  o Assist with life safety if necessary. Augment search and rescue efforts.
  o The major priority is controlling the gas, electric and water services.
  o Shut down accessible services.
    1. **Gas:** Main building shut-off or curb valve.
    2. **Electric:** Main disconnect.
    3. **Water:** Main building shut-off or curb valve.

7.7 **Third and Subsequent Arriving Ladder Companies**
• Search additional line-of-sight void spaces or exposures.
• Assist with control of the utilities if needed.
• Perform debris removal as directed.
• Cut timbers for shoring as directed.
• Assist with victim removal.

7.8 **First Arriving Tower Ladder**
• Apparatus Placement
- Operations: Tower ladders can be used to:
  - Provide large caliber streams to protect victims and rescuers from fire.
  - Aid in rescuing victims.
  - Transport heavy tools.
  - Allow rescuers to traverse unstable debris, survey the collapse, access remote areas, and act as a work platform for shoring, breaching, etc.
  - Provide close-up observation and monitoring of the remaining structure for signs of secondary collapse. (Figure 2)

![Figure 2](image)

Example of how tower ladders can be utilized at collapses.

7.9 **First Arriving BLS and ALS Ambulance**

- Establish Staging Area with adequate access and egress to the site.

- Notify the dispatcher of the following: incident type, location of ICP and EMS staging area, the number of known/potential patients, type and extent of injuries, hazards, best access into the incident, and additional resources required.

- Establish a CCP within the Support Zone.

- Operations: The technician of the first arriving ambulance is responsible for triage until relieved. The driver of the unit is responsible for all radio communications.

- Don available PPE as indicated:
  - Helmet
  - PPE ensemble (Bunker style coat and pants)
  - Gloves
  - N95 respirator
  - Goggles/eye protection
  - APR mask as directed
7.10 First Arriving EMS Officer

- **Incident Responsibilities**
  - Establish and assume command of the Medical Group.
  - Obtain a preliminary report from the IC.
  - Establish and/or relocate Groups, etc.
  - Ascertain if a Rescue Group and/or Extrication Group are established.
  - Gather and report scene information to dispatch.

- **Patient Treatment Responsibilities**
  - Identify/evaluate triage and treatment strategy.
  - Emphasize early Advanced Life Support (ALS) access to patients.
  - Oversee medical care of patients.
  - Ensure decontamination as necessary.

- **Personnel Safety**
  - Evaluate scene safety/security of members on scene.
  - Ensure all EMS members are utilizing proper PPE.

- **Resources**
  - Identify/evaluate the best access and staging area for incoming EMS Units.
  - Special call additional resources as needed.
    1. Rescue Paramedics
    2. Haz-Tac Resources (HTA/HT Conditions/HT Bat)
    3. ALS and Basic Life Support (BLS) Units
    4. Officers
    5. Logistical Support Units (LSU)
    6. Mobile Emergency Response Vehicles (MERV)
    7. OMA response physician (5M)
  - Ensure hospitals are notified via Emergency Medical Dispatch (EMD).
  - Consider alternate modes of transportation for multiple patients (e.g. city bus) and hospital selections based on a route strategy.

7.11 Rescue Paramedic Ambulances

- Individuals injured in structural collapses are likely to suffer a number of serious, potentially life threatening injuries, from broken bones to crush syndrome. Rescue Paramedic ambulances are assigned to the incident. As soon as the patient is accessible and the surrounding area is safe, the paramedic must start patient care, i.e. airway management, circulatory support, monitoring vital signs, intravenous therapy, etc.
- **Haz-Tac Officer:**
  - Upon arrival, check in with the Medical Group Supervisor, report to the Rescue Group Supervisor to coordinate the operations of Rescue Paramedic Ambulances.
  - Notify the Medical Group Supervisor for additional Rescue Paramedic Ambulances as required.

7.12 **Additional Ambulances**

- Apparatus Placement: Report to the designated Ambulance Staging area.
- Operations: Treat and transport patients as directed. Utilize CCPs in the Support Zone until adequate resources are available to expand the Medical Group.

8. **THE MAJOR EMERGENCY RESPONSE SIGNAL (10-60, WITH OR WITHOUT CODE 1)**

8.1 If collapse conditions are present requiring an extensive rescue or search; the signal 10-60, with code if necessary, must be transmitted and the Collapse Rescue Plan implemented.

- Requests from the IC for additional resources above a 10-60 will require the establishment of a Staging Area. The Staging Area Manager (if staffed) responds with the Field Communications Unit. Otherwise, an additional Battalion Chief will be assigned and designated as the Staging Area Manager.
- On the transmission of a 10-60 Code 1, the appropriate Battalion Chief shall be designated Air Recon Chief and shall respond in accordance with Department policy and procedures.
8.2 In order to maintain a manageable span of control when a 10-60 is transmitted, it will be necessary to delegate functional management to Section Chiefs. The IC may utilize the ICS organization chart, Figure 3, as a guide when developing a plan to manage the assigned resources. As the incident expands, or the complexity increases, the IC can activate Branches to ensure the span of control remains manageable. The example below represents one type of organizational chart.

![10-60 ICS Organizational Chart](image)

**Figure 3**
10-60 ICS Organizational Chart

8.3 The first arriving Deputy Chief becomes the Incident Commander and the first arriving Battalion Chief can be reassigned as the Planning Section Chief. Upon arrival at the scene, the Command Chief will assume the role as IC. The first arriving DC may then be designated as the Operations Section Chief or the Search and Rescue Branch Director, depending on conditions and other previous assignments.
8.4 The Safety Officer and Public Information Officer are a part of the IC’s Command Staff.

- The Safety Officer monitors incident operations and advises the IC on all matters relating to operational safety, including the health and safety of members. The Safety Officer will be designated as such by the Borough Dispatcher. The Safety Officer will assist the Safety Operating Battalion.

- The Public Information Officer (PIO) is responsible for developing and releasing information about the incident to the news media, incident personnel and other agencies and organizations, and will be assigned by the IC.

8.5 General Staff

The Operations, Planning and Logistics Sections are General Staff positions, which are responsible for the functional aspects of the incident. They will be staffed as necessary depending on the size and complexity of the incident.

8.6 Operations Section

- This section includes the Fire Branch, Fire Sector, or Fire Control Group; Search & Rescue Group, Sector, or Branch; Medical Group and the Law Enforcement/Intel Group, as well as Staging. Generally, a Branch will be activated if Groups(s) or Sector(s) become too large to retain a manageable span of control.

- The second arriving DC, assigned on a 10-60 Code 1, becomes the Operations Section Chief or a Branch Director, depending on previous assignments. This DC may be designated the FAST Branch Director if signal 10-66 was transmitted in conjunction with signal 10-60 Code 1.

- Staging

When staffed, the Staging Area Manager responds with the Field Communication Unit. Otherwise, the Dispatcher will assign a BC as the Staging Area Manager for any request for resources above the initial 10-60 signal.

- Search and Rescue Branch, Group or Sector
  - The Rescue Operations Battalion is designated as a Search and Rescue Branch Director or Sector/Group Supervisor depending on the scope of the collapse and rescue effort. **Resources will be assigned to this Branch, Group or Sector, as necessary.**
  - Victim Removal Leader

  This position will normally be filled by a Rescue Company Officer until relieved by the Rescue Operations Battalion once he or she is relieved as the Search and Rescue Director or Supervisor.

- Fire Branch, Fire Sector or Fire Control Group

The second arriving BC may be designated as the Fire Branch Director or Fire Sector/Group Supervisor.

16
• **Law Enforcement/Intel Group**
  An NYPD Officer will assume command of the Law Enforcement Group with responsibility for traffic control, perimeter security, investigation of suspicious packages and devices, force protection and disorder control.

• **Medical Group**
  - An EMS DC will be assigned as the Medical Group Supervisor.
  - The Medical Group will be responsible to track all victims.

8.7 **Planning Section**

• The first arriving BC may be reassigned as the Planning Section Chief. This Chief is responsible for the collection, evaluation, and dissemination of operational information related to the incident, maintaining information on the current and forecasted situation, and on the status of resources assigned to the incident.

• The BC designated as the Resource Unit Leader by the respective Borough Dispatcher, shall report to the Planning Chief and begin tracking resources, both assigned and operating, from all agencies involved. He/she shall remain at this position until relieved by the Officer of the Field Communications Unit, who shall assume that role upon his/her arrival. At this time, the BC shall report to the Planning Section Chief for reassignment to either a Situation Unit Leader, or a position necessary to support the Operation.

8.8 **Logistics Section**

• The Logistics Section Chief is responsible for providing services, facilities and material support for the collapse incident. The Logistics Section will coordinate requests for heavy equipment, specialized resources and supplies, such as shoring materials, steel or concrete cutting equipment. They are responsible for the Tactical Support Unit, Recuperation and Care Unit and the Debris Removal Leader.

• **Street Coordination Manager**
  The early assignment of a Street Coordination Manager will prevent needless congestion and repositioning of apparatus as an incident escalates. A company officer will be assigned as the Street Coordination Manager, with the following responsibilities:
  - Establish contact with PD and EMS Officers for traffic flow.
  - Ensure access/egress of essential vehicles.
  - Position apparatus for most efficient use.
  - Coordinate apparatus staging areas.
  - Coordinate CCP with an EMS Officer.
Rescue Task Forces

A RTF is assigned on the transmission of a 10-60, and a second RTF is assigned on the transmission of a 10-60 Code 1.

A Rescue Task Force (RTF) is comprised of the following resources:

- 1 Rescue Company
- 1 Collapse Rescue Unit.
- 1 SOC Support Ladder Company
- 1 Rescue Paramedic Unit
- 1 Haz-Tac Officer.

Note: When Collapse Rescue is transported by an SSL, no additional SSL is required. Also, the 2nd RTF will not include a Rescue Co. The additional Rescue assigned on the 10-60 fulfills this requirement.

9. SAFETY PRECAUTIONS DURING COLLAPSE OPERATIONS

9.1 Safety

The IC will assign a Safety Officer who shall consider any of the following tactics in response to reports of structural defects that may lead to a collapse.

- Illuminate any danger areas, especially at night.
- An experienced Safety Officer should investigate any reports of signs of a collapse.
  - The Safety Officer shall report to the IC whether or not it is safe to continue to operate in the vicinity of the hazard.
  - Surveyor’s transits can be used to monitor walls, floors, etc. for signs of continuing movement. They can be found on Tactical Support Units and Collapse Rescue Units.
- Increase supervision in dangerous areas
  - At least one additional Safety Officer shall be assigned to monitor the reported hazard area up close.
  - The Safety Officer shall ensure strict adherence to safety procedures and continuously monitor and analyze structural collapse hazards.
    - The Safety Officer’s priority is the safety of members and civilians.
- Establish safety zones around danger areas.
  - Mark off danger areas with hazard tape.
  - Take into consideration the vertical and horizontal distances walls, chimneys, or other structures may fall. The falling portion may cause a collapse of structures surrounding it, such as trees, light poles, etc.
  - The danger zone shall not be entered by anyone, including firefighters except to save a life.
• Evacuation
  o An emergency evacuation is necessary when an imminent collapse is obvious, or has already happened.
  o When evacuating, leave behind hoselines, tools, and equipment; they can be recovered later if conditions permit.

• At construction or demolition sites, seek out the Site Safety Manager or Construction Manager for information about previous conditions.

9.2 The acronym LCES stands for: Lookouts, Communications, Escape Routes, and Safe Havens. It describes additional safety procedures required at collapse incidents.

• Lookouts
  o Posted around the perimeter of the collapse site.
  o Monitor hazardous areas for movement; utilize surveyor transits.
  o Have immediate radio contact with all rescue teams in their area of responsibility.
  o Lookouts shall be equipped with handheld air horns, as well as HTs for warning of impending dangers. All Battalions, Divisions, SOC Units and Collapse Rescue Units are equipped with these for use by lookouts at these incidents.

• Communications
  o All members must be aware of the evacuation signaling method that will be in use.
  o The following is the standard emergency signaling system used by all FEMA USAR Task Forces, and adopted by this Department. It may be sounded on a handheld aerosol can air horn, or on apparatus air horns. Each Safety Officer and member monitoring a transit, as well as members positioned as lookouts for hazard monitoring, will be issued an air horn.

    1 Long Blast (3 seconds)          Cease Operations/All Quiet
    3 short blasts (1 second each)    Evacuate the area
    1 long and 1 short blast          Resume Operations

  o Those operating power tools may not hear the announcement over the HT. Apparatus air horns may be beneficial after the initial HT announcement, followed by another HT announcement after the air horns have ceased.
• **Escape Routes**
  - All members operating in the danger zone must have a preplanned escape route, as well as an alternate route.
  - Identify the hazards in your operating area and identify paths away from them.
  - Know how long it will realistically take you to reach safety

• **Safe Havens**
  - In some cases, it may not be possible to reach a remote area quickly. In these cases, rescuers need to create a safe haven in the immediate proximity to the rescue site.
  - In a collapse, this may be done by shoring the area where the rescuers are operating so that a secondary collapse will not affect them, or it may mean removing a hazard, such as by tying back or pulling over a leaning wall before entering the area below it.

9.3 **Personal Safety Measures**
- Don all available PPE for the hazardous materials or BBP present. Use respirators if compatible with conditions, i.e. the area has been monitored to be free of atmospheric hazards other than dust or particles the respirator can protect against.
- Take rest and rehabilitation breaks. Maintain hydration. The IC shall consider special calling additional RAC Units as needed.

9.4 **Other Safety Considerations at Collapses**
- Permit entry only by properly trained and equipped personnel.
- Maintain accountability of all members. Remove all nonessential personnel.
- Shut down all utilities.
- Monitor the atmosphere for flammable or toxic gases, as well as sufficient oxygen.
- Prohibit smoking, eating or drinking on the debris pile. Send members to designated rehab areas after decontaminating.
- Do not cut or remove major supports. Work around them, if possible.
- If you must absolutely cut supports, brace and shore around them and prepare for secondary collapse by removing everyone but the personnel performing the cut.
- Rotate personnel frequently, every half-hour or less if possible.
- Maintain communications between rescue teams and between rescuers and victims.
- Seek expert assistance in the form of structural engineers, riggers or other specialties through OEM.
- If terrorism is suspected, use the apparatus and NYPD to block access to the area. Also request that NYPD check for secondary devices.
- A SOC Support Ladder could be utilized as an additional FAST truck, working within the Search and Rescue Sector or Branch.
10. OPERATIONAL PROCEDURES AND STRATEGIES

10.1 Available Specialized Resources

A number of special units, specializing in collapse rescues may be automatically assigned or special called to any incident.

Rescue Companies

Rescue Company members are trained in Collapse Rescue Operations.

- Due to the weight of their equipment, access to the collapse site for at least the first arriving Rescue as well as at least one Collapse Rescue Unit must be ensured.
- Rescue Companies will perform any victim removal activity that involves tunneling, trenching, shoring or cutting of structural members.
- Two Rescue Companies are assigned to all major collapses.
- At least one Rescue Company should be deployed at each buried victim location.
- If dangerous void entries or tunneling operations are to be made, a third Rescue Company should be relocated to quarters near the incident or assigned to the staging area for rapid intervention of members if a secondary collapse occurs.

10.1.2 Squad Companies

Squad Company members are trained in Collapse Rescue Operations.

- Their apparatus does not carry all the necessary equipment to perform tunneling, trenching, or shoring, but they are trained to use equipment found on Rescue apparatus, Collapse Rescue Units, and in Collapse PODs.
- At large scale incidents with multiple buried victims, the IC may assign a Squad Company to sites where there is no Rescue Company available.

10.1.3 Collapse Rescue Units

These units are stocked with additional supplies, tools and shoring.

- They augment the tools and supplies carried by the Rescue Companies.
- They carry heavy timbers, which no other unit carries.
- They shall be given priority access to the operational area.
  One Collapse Rescue Unit is located in each borough and responds as part of a Rescue Task Force.

10.1.4 Tactical Support Units

SOC operates two of these units.

- Provides electric power for tool operation and scene lighting.
- Carries the Stanley Hydraulic System, which operates a variety of chain and circular saws, including a chain saw for cutting through concrete, as well as jackhammers and a dewatering pump.
- Carries a surveyor’s transit.
10.1.5 **Technical Response Vehicle (TRV)**
Operated by Squad Company 1, it provides many of the capabilities of a Tactical Support Unit, as well as carrying equipment for dealing with hazardous materials.

10.1.6 **Special Operations Support Ladder Companies**
Members are trained in collapse operations, void access and shoring techniques.
- Assist Rescue Companies in tunneling and victim removal.
- Can act as a second FAST Unit, working underneath the Search and Rescue Branch.

10.1.7 **Hazardous Materials Company**
Haz-Mat personnel may be special called to assist the second arriving ladder company in shutting down utilities.
- Monitor the scene for the presence of flammable gases, toxic materials and asbestos.
- Determine the need for any decontamination.
- Use for mitigation of leaks and spills.

10.1.8 **SOC Dewatering Unit**
- The dewatering unit carries a number of portable pumps; 95 GPM to 800 GPM.
- The pumps can prevent water from ruptured water pipes or hoselines from interfering with rescue efforts and can handle debris.
- The unit responds with one firefighter.
- Requires at least one Engine or Squad Company to assist in placing and supervising the pumps and providing discharge hoses for the pumps.
- The unit carries several power units for the Stanley Hydraulic System.

10.1.9 **SOC Compressor Truck**
This vehicle carries a large industrial air compressor and an assortment of air powered tools such as pavement breakers, rock drills, and accessories to assist in breaching concrete and other masonry structures.

10.1.10 **SOC Logistics Support Vehicle**
SOC maintains a step-van vehicle that will respond to major collapses with a supply of disposable items such as steel and concrete cutting blades for saws, batteries and chargers for battery operated tools, and 5 gallon buckets for moving debris.
10.1.11 **Con Edison Vacuum Truck**

Consolidated Edison maintains a number of these highly specialized vehicles needed for life threatening emergencies. The Department has had great success with these vehicles at several trench cave-ins, and have used them to remove large quantities that they use daily. They have agreed to make them available to the Fire Department as of loose materials ranging from sand to gravel to canned foods. They are extremely valuable pieces of equipment under the right circumstances, but due to the extreme suction pressures they create, can also be dangerous to persons operating near their inlets. They may only be used by trained members of Special Operations Command, in conjunction with the Con Ed operators and at the direction of the Incident Commander.

10.1.12 **Collapse PODS (Portable On Demand Storage)**

The Department has staged for deployment 5 Collapse PODS Containers for storing shoring equipment to be deployed at large scale emergencies.

- The containers are filled with shoring lumber, metal and concrete cutting saw blades, and a cutting table with templates for fabricating shoring.
- They contain no tools.
- The containers are dispersed throughout the five boroughs, with two containers in each borough.
- Only a Command Chief can request the response of the PODS.

10.1.13 **Fire Marshals**

Fire Marshals provide a unique service at collapse, they specialize in intelligence gathering. They can interview occupants/witnesses to help determine the occupancy of the building and location of potential victims. They can assist in obtaining information on the building itself prior to collapse. They can gather information to help in the cause determination of the collapse. They can act as a liaison with law enforcement and other agencies as needed.

10.1.14 **Rescue Paramedic Ambulance Units**

- Some ALS Haz-Tac Ambulance Units have been trained to operate within collapses and confined spaces. They are located in each borough.
- A Rescue Paramedic Unit will be assigned on the initial report of a major collapse or a 10-60 signal as part of a Rescue Task Force.
- Rescue Paramedic Units may be assigned to the Medical Group, the Rescue Group, or the Extrication Group for confined space operations for entrapped patients.
- The unit shall report to staging, then to the Medical Group Supervisor at the ICP upon arrival.
- Conduct medical management of entrapped civilians or responders prior to extrication, with the emphasis on management of potential crush syndrome.
10.2 **Interagency Coordination**

Early establishment and clear identification of the ICP is vital to organizing the proper coordination of outside resources. The first arriving BC must notify the Dispatcher of the location of the ICP, and request all responding agencies to be notified to send their ranking representative to that location. OEM should be used to coordinate any requests for assistance from other agencies. Police presence is required in the areas surrounding the collapse site. The IC should request a Police Department Supervisor to report to the ICP. Coordination of all actions through the ICP, with the cooperation of all personnel, will improve the odds of survival for anyone still alive in the debris pile. Each responder must understand the importance of their actions as part of a team effort, working in unison to ensure the safety of all.

10.3 **FEMA Urban Search and Rescue Task Forces (USAR)**

There are 28 Task Forces nationwide, including one in NYC, sponsored by local agencies in conjunction with the Federal Emergency Management Agency (FEMA). FEMA USAR Task Forces operate with a Federal Incident Management Team as their supervision/support under the Incident Management System (IMS). A FEMA USAR Task Force Consists of 72 personnel, who are mostly Technical Rescue trained Fire Department members, with additional specific skilled personnel such as physicians and structural engineers. They are grouped into two shifts to provide around the clock operating capability. Each shift provides the following capabilities: Search, Rescue, Medical and Technical Information.

A FEMA Task Force may be requested to respond through OEM. Task Forces can mobilize within 6 hours of notification. They provide their own transportation and logistical support to be self sufficient for 72 hours of operations. Their operational capabilities are equivalent to our Special Operations Command. The FDNY IC should designate a “FEMA USAR Group” to coordinate operations of one or more USAR Task Forces. FDNY units may be assigned to operate with a USAR Task Force to provide local knowledge of the situation or to provide additional resources.

11. **RESCUE OPERATIONAL PLAN**

11.1 Rescue operations are designed to provide the greatest chance of survival to the greatest number of victims, while using the most efficient deployment of manpower. It consists of five separate stages of operations, which should be carried out in order. To be thorough and to be certain no victims are overlooked, all five stages should be carried out under Fire Department direction and control, even though private contractors will likely carry out much of the work in the final stage.
The five stages of a collapse rescue operation are:

1. **Reconnaissance**

2. **Accounting for and removal of the surface victims**

3. **Search of the voids**

4. **Selected debris removal and tunneling**

5. **General debris removal**

11.2 **Reconnaissance**

The reconnaissance phase constitutes a portion of the IC’s size-up. Determining where to start looking is the key for locating victims. This reconnaissance/intelligence gathering process occurs during the size-up phase of the incident. Before searching can commence, the IC must identify: What happened? Where? Who’s missing? Where were they last seen? Can they possibly be alive? What help will be required? What is the situation with the fire, secondary collapse, explosions, or other dangers? Is this incident the result of a terrorist act? If so, what is the potential for a secondary attack on rescuers? Answers to these questions will help prevent additional casualties. This is a risk/benefit decision. Our actions are guided by; comparing the risks to the rescuers to the benefit of rescuing potential survivors. No lives should be risked to recover a body. While searching, utilize the Search Assessment Marking System.

During the reconnaissance phase, it is important to identify and mitigate the following:

- The construction of the building and the likelihood of a secondary collapse.
- Occupancies that pose additional dangers, such as pesticides, flammables or other dangerous goods stored in the area.
- Problems with utilities. The IC should immediately request utility repair crews to shut off the services in the street.
- For buildings under construction or demolition, request the Site Safety Officer or Construction Manager to report to the ICP.

11.3 **Accounting for and Removal of the Surface Victims**

Victims may be found in various degrees of entanglement. After completing the reconnaissance phase, or simultaneously, if conditions and personnel permit, start the removal of victims who are lightly pinned. In some cases, they won’t require much assistance. They will most likely be in shock and should be examined and questioned before leaving the scene. Immediately designate an officer to keep track of all persons who are removed from the debris. This officer should obtain the person’s name and where he or she was located when the collapse occurred. If time permits, ask the victim to point out his escape route. If other persons who were located near it are missing, such information may give you the most direct route to them. The member designated to obtain victim information is the Victim Accounting Manager. He or she should make note of any injuries and, if transportation was involved, to what hospital and by whom.
Having an accurate list of who was in the building and accounting for each can tell you who is missing. Do not jeopardize members by having them look for a nonexistent victim. Account for all known occupants, and call off any dangerous operations once everyone has been accounted for. Use Fire Marshals for interviewing victims and canvassing hospitals. Examine surrounding buildings for the presence of surveillance or security cameras that may have captured the collapse on tape. Send Fire Marshals or a Battalion to each of these camera recording locations to view the incident tape to help determine if a passerby was caught in the collapse on the sidewalk or in the street in front of the collapse site.

11.4 Searching Voids

In building collapses, void spaces are often created that could shelter victims. Debris is supported by parts of the foundation or strong items found within the building, resulting in an area large enough for victims to survive. There are four common types of voids: lean-to, V-shaped, pancake, and the individual void.

- **Lean-to voids** result from the failure of the support at one end of a floor or roof. If one bearing wall gives way while the other remains intact, the floor will drop at the end that failed. Everything on the floor will be thrown into a heap at the low end. There is an excellent chance of survival for persons who were on the floor below if they were near the remaining wall. People on the falling floor may also survive if heavy objects don’t crush them. The smallest chance of survival is for anyone on the lower floor in the vicinity of the failed wall.

![Figure 4](image)

*Figure 4*

A lean-to is produced when one bearing wall fails, leaving floors suspended from the remaining walls. Lean-to collapses produce large voids that may contain survivors. An unsupported lean-to is extremely dangerous and must be secured early.

- **V-shaped voids** result when a floor fails in the middle, usually a result of overloading or a part of the floor is burned away and under a load. The walls and floors above usually remain intact, although any floors below may collapse because of the weight of the falling debris. The shape of the collapse produces two voids on the sides of the debris, both of which should be searched. Victims on the collapsing floor not in the vicinity of the collapse will be thrown toward the center along with the loose debris.
Victims directly below the collapse will have the least chance of survival, while those along the perimeters will have the greatest.

**Figure 5:**
V-shaped collapses produce large voids along the remaining walls. These voids are likely locations to find survivors.

- **In pancake collapses**, the floors of the structure fall in layers, resembling a stack of pancakes. Although this may appear to present an unstable situation, this is not the case. Numerous rescues have been made from pancake collapses. Survival depends on the presence of strong objects nearby to keep the weight of the entire load from landing on the victim. Items such as a series of refrigerators, washing machines, and display cases can hold up the floor above, which often remains intact. Locating the victims of pancake collapses is often simpler than in other types of collapses, since the floors usually maintain their physical aspect and the victims aren’t as likely to be thrown as they would if the floor were to incline. It may be possible to crawl in or out of the space between floors. Shoring should be installed as members enter a void and progress inward.

**Figure 6:** This two-story frame home under construction pancaked straight down, trapping one worker in the basement. The worker was face down in wet concrete. The floors above were prevented from reaching the lowest floor by the foundation walls that created a void one-to-two feet high in the basement.

- **Individual voids** may be found in any type of collapse. They result from spaces formed by strong objects that prevent a collapse into that particular section. They are difficult to locate, for they occur at random depending on the layout of partitions and furniture. Searching void spaces should be done immediately after the surface victims have been removed, or simultaneously if sufficient personnel are available.
Figure 7: Rescue and Squad Companies and Collapse Rescue Units carry search cameras that can extend through holes bored in floors and roofs to quickly identify and survey voids. The cameras have sound as well as video feeds to try to contact potential survivors. Once identified, the fastest and safest means of reaching victims can then be determined.

- In fire related collapses, fire will be trying to fill these same void spaces. The survival of the victims depends on reaching them first, preferably with a hoseline. Trapped victims should be provided a spare SCBA or the FAST-PAK. Attach a search rope to the person to lead other rescuers directly to him.

Figure 8: Fire related collapses can trap firefighters. Our ability to rescue them depends upon all members knowing the critical tasks that must be performed, and carrying out their assignments in an organized and professional manner.

- Locating Victims in a collapse. Victims may be located within a void or debris pile by using a number of methods:
  - Hailing (Verbal contact): Calling out within voids and listening for a reply. This requires a degree of silence that may not be present in the early phases of an operation. If a voice is heard, it may be difficult to locate the source, since debris within voids can distort sound. The “around-the-clock” method may be useful: members position themselves at various locations around the area where a voice is heard, and take turns calling out and listening for the victim, in an attempt to triangulate their position. If the missing person is a firefighter, they may be able to direct rescuers via HT.
  - PASS Alarm or Feedback Assisted Rescue (FAR): Relies on the electronic sound emitted by the member’s PASS alarm or the feedback created on the trapped member’s HT. The “around-the-clock” method can help locate the source of the sound.
• **Emergency Alert Tone Assisted Rescue**: If a member becomes trapped in a collapse, the member should activate the EMERGENCY ALERT TONE. If the member is unable to activate the tone on their own, the IC can activate the Emergency Alert Tone Assisted Rescue Procedure.

• **Interview witnesses**: When trapped individuals are unable to speak or make other sounds, observations of survivors can aid in determining who was in what area when the collapse occurred. The Collapse Survivor Interview Form is intended to prompt information that will guide us to where the victims were last seen. This interview utilizes the LUNAR method for locating missing members by establishing their: Last seen location or reference point, Unit member is working in, Name, Assignment and Resources needed to reach safety. Information about the surrounding furnishings and wall or floor coverings alerts searching members when they are in the vicinity of missing persons. Additional information may be gained by viewing the surrounding building’s surveillance or security cameras for visitors or passersby. All information gained about victim location from witness interviews, from EMS or Fire Marshal’s canvassing hospitals, from initial units rescuing survivors, as well as security video, etc, or in the case of a fire related collapse, the results of unit roll calls, must be relayed to the Victim Accounting Manager to ensure all potential victims are accounted for.

• **Explore voids**: physically looking at debris in a void is a very difficult task. The entire debris pile and everyone in it is likely to be covered in the same exact color of dust. If the trapped person is unable to move or communicate, it is possible to be near them and not know it. Utilize a Thermal Imaging Camera to help detect body heat of unconscious individuals and look for movement as they breathe. Rescue and Squad Companies carry search cameras to help search voids and detect barely audible sounds.

• **Electronic listening devices**: Life Detection Systems are located on all Collapse Rescue Units. When the probes are placed on top of the debris pile, it detects sounds or vibrations from within the pile. These devices are quite sensitive and can pick up sounds or vibrations for a considerable distance. They are not practical to be used during the initial stages of a collapse, for there is too much activity. It is appropriate to use these devices once the void exploration phase is complete and all known victims have been removed during the selected debris removal. It is necessary to remove all personnel from the debris pile and shut down all moving equipment before they are put into use. The sensors are placed on the debris pile and moved in a grid pattern, allowing readings from multiple devices to be compared.

• **Search Dogs**: FEMA USAR Task Forces and a number of other agencies can provide dogs specifically trained to detect persons trapped within a collapsed structure. FEMA tests and rates dogs assigned to USAR Task Forces for this purpose. Other non-trained/certified dogs are not reliable for this purpose and should not be used.
11.5 **Shoring**

- Shoring is the installation of temporary structures to support a load. In collapse rescue operations, shoring is most often undertaken to form a protected area where rescuers and victims can be safely sheltered from secondary collapse.

- First arriving units may be forced to perform some emergency shoring using available materials on hand in order to safely reach trapped victims. Units other than Rescue or Squad Companies should not perform any cutting of load bearing elements, since first alarm units are not trained or equipped to properly shore around such loads. Once a Rescue Company is on-scene, the installation of additional shoring should generally be left to these units, supported by Squad Companies and SOC Support Ladder Companies. Rescue Companies carry a variety of shoring equipment and devices, each with its own limitations. Knowledge of these limitations is essential for the safety of all persons in the area.

- **Shoring Guidelines:** At times, the FDNY is asked by the Department of Buildings, or Housing Preservation and Development to install shoring in structures that have suffered structural damage. As a guideline, the FDNY will only install shoring in the following instances:
  - Whenever human life is in danger, to provide a safe area around victims/rescuers.
  - When shoring will permit a building to remain safe to occupy.
  - Buildings in which there is no civilian life hazard will only be shored if the shoring can be safely installed at minimal risk to members, and where there is a substantial property risk that can be safeguarded by the shoring.
  - A vacant or unoccupied building will not be shored when there is a substantial risk to members installing the shoring, or the use of shoring is unlikely to substantially improve the overall outcome.
  - If the building is going to be demolished, even after shoring, it will not be shored, except to facilitate rescue operations or the safe evacuation of occupants.
  - Once installed, shoring will only be removed when the load is otherwise stabilized, or the situation permits the shores to be removed from a safe area.

11.6 **Selected Debris Removal and Tunneling**

- The selected debris removal phase begins when all voids have been searched and people are still unaccounted for. Selected debris removal is used to reach specific locations where victims are located or suspected to be. It is not a useful tactic if we have no idea where the victims are located. It may involve breaching a hole through a wall, cutting through a roof or a floor or tunneling through mixed debris.

- **Victim Removal Leader**
  - Directs the victim removal activities that can be accomplished by shoveling, hand digging, or the cutting of non-bearing structural members.
  - Ensures that only the members directly involved in a trenching or tunneling operation are near the area of operations.
• The Rescue Operations Battalion should be assigned as the Victim Removal Leader to supervise selected debris removal. Objectives must be clear to ensure the correct operation is chosen.

• Use extreme caution. This is an even more dangerous task than a void search, since it might require you to move items supporting loads, possibly causing a secondary collapse. Only collapse trained members of SOC units are to perform tunneling or trenching involving the cutting of potentially load bearing structural members. Expose only the absolute minimum number of personnel necessary to perform each task and rotate these members out for a rest at frequent intervals-30 minutes is the recommended maximum work time.

• Victim removal requiring tunneling, trenching or cutting through supporting members should only be performed by collapse trained members of SOC Units, assisted by a designated Support Group. The Victim Removal Leader shall determine the need for additional Support Groups to assist the SOC Units in tunneling or trenching. The Support Groups shall be formed by the Staging Officer and may consist of Squad companies, SOC Support ladder companies or other ladder or engine companies.

• Tunneling and removing debris involves arduous labor and requires fresh personnel with clear minds. It is the Officer’s responsibility to ensure a member does not work beyond their capacity while trying to reach a trapped victim, for fatigued firefighters make fatal mistakes. The Officer needs to assume a supervisory role, monitoring the progress and the condition of the members, as well as arranging for support operations. If the Officer becomes involved in manual labor, these other tasks will be overlooked, and the rescuers and the victims will suffer.

• Utilize multiple methods to remove victims; for many of them are time consuming and may not always be successful. Two or more approaches could increase the chances of success. This should only be pursued if it is practical. Manpower, equipment, and the stability of debris are important factors in a rescue; actions should not be pursued if it will have a negative effect on either the rescue team or the victim. Ensure communication between the two teams is maintained, especially regarding problems they are encountering.

• If the victim has been pinned for more than one hour or appears to have suffered serious injuries, a Rescue Paramedic must be given access to the patient as soon as there is access, in order to treat for crush syndrome or other life threatening injuries.

• Establish a Demolition Debris Removal Log which shall be maintained by the officer responsible for debris examination and removal.
• Once all of the live victims have been removed, the selected debris removal operation should cease. This includes situations where you reach a victim who is obviously lifeless or who has been pronounced dead. To risk the lives of members to retrieve a body is not justified.

11.7 Collapse survival rates

• Do not assume that no one can possibly be alive within a debris pile simply because you cannot hear or see them. The table below illustrates the potential survival ratios for victims buried in a collapse. Survival for as long as 14 days has been documented in earthquakes around the world. Do not proceed to the General Debris Removal Phase until all means of searching for survivors have been exhausted or all occupants and visitors have been accounted for.

<table>
<thead>
<tr>
<th>Time of Extrication</th>
<th>Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 minutes</td>
<td>99.3%</td>
</tr>
<tr>
<td>1 day</td>
<td>81</td>
</tr>
<tr>
<td>2 days</td>
<td>36.7</td>
</tr>
<tr>
<td>3 days</td>
<td>33.7</td>
</tr>
<tr>
<td>4 days</td>
<td>19</td>
</tr>
<tr>
<td>5 days</td>
<td>7.4</td>
</tr>
</tbody>
</table>

11.8 Crush Syndrome

Crush syndrome is a potentially life threatening condition that develops in buried collapse victims whose circulation to the limbs becomes restricted. Any type of weight that limits blood flow to a limb, similar to a tourniquet, can create this condition. The limb, denied a source of fresh, oxygenated blood, continues to function becoming acidic as the blood remains trapped in the limb, and is not returned to the lungs and kidneys to be cleaned and re-oxygenated. As long as the pressure is on the limb, the patient is stable. Problems develop when rescue personnel are freeing the patient and the pressure on the limb is lessened. When the weight is released, circulation begins again and the acidic blood in the limb is flushed back into circulation. If the patient is not properly treated prior to this happening, the acidic blood can kill the person by triggering cardiac arrhythmias, kidney failure and other deadly disorders. The patient dies what is known as “the smiling death.” They are so happy to be freed from the collapse that they smile from ear to ear, only to die of a heart attack on the way to the hospital.

• Crush Syndrome, also known as traumatic rhabdomyolysis, is a condition that results from muscle reperfusion with subsequent secondary systemic effects. These are all direct and indirect consequences of prolonged, continuous pressure on the limbs. The condition is characterized by hypovolemic shock and hyperkalemia. Crush Syndrome is fundamentally based on three criteria:
  • Compromised local circulation.
  • Involvement of muscle mass.
  • Prolonged compression (usually 4-6 hours but possibly less than an hour).
11.8.2 Prevention of the “smiling death” is accomplished by establishing intravenous lines (IVs) into the patient prior to releasing the pressure. With the IVs in place, paramedics can combat the returning acidic blood with injections of a Bicarbonate solution.

11.8.3 During collapse rescues, Rescue Paramedics shall be given access to the patient as soon as the patient is sufficiently exposed to permit the establishment of an IV, as long as the area around the patient is stable. The entire victim does not have to be exposed; an arm, a leg, or even the neck is all that is required. The Rescue Paramedic must coordinate closely with the rescuers, to ensure IV placement will not unduly hamper the ongoing effort to extricate the victim. If possible, the IV bag should be positioned out of the path of debris removal. Extrication may have to be paused periodically in order to replenish the IV supply, check the status of the infusion site, etc. Rescue personnel shall provide all the assistance the Rescue Paramedic requires to effect this effort.

11.9 Rescue Paramedic Collapse/Confined Space Operations

11.9.1 The evaluation and treatment of patients within a confined space is critical for the patient's survival. Collapse/Confined space medicine requires paramedics to have sharp, well honed patient assessment and management skills. Only paramedics actively practicing ALS care as their day-to-day primary assignment, and trained in collapse/confined space medicine, are permitted to perform advanced procedures on entrapped patients.

11.9.2 All interventions should be well thought out and based on currently accepted medical practices and protocols.

11.9.3 Units on scene should provide a preliminary progress report with emphasis on:
- Duration of entrapment.
- Anticipated duration of entrapment.
- Mechanism of entrapment.

11.9.4 Identify the need for additional Rescue Paramedic Ambulances, specialized units, additional supervision and resources.

11.9.5 In order to increase patient survival and decrease mortality rates, medical intervention and assessment by Rescue Paramedics should begin as soon as the patient is reached and the space is stabilized.

11.9.6 Contact with online medical control should be made early in the incident with the medical control physician kept well informed.

11.9.7 Rescue operations may not permit the paramedic to remain at the patient’s side during the entire extrication process. Therefore, the Medical Group Supervisor shall be cognizant of the patient’s needs as well as the needs of the rescue group. The Medical Group Supervisor, in conjunction with the IC, shall establish specific parameters as to the frequency of the patient’s reevaluation and ongoing treatment.
11.9.8 Size up:
- Inquire if the patient has any preexisting medical conditions.
- Consider atmospheric and temperature conditions.
- Determine which extrication devices would be most suitable.

11.10 Treatment of Victims by Rescue Paramedics

11.10.1 Evaluate the patient(s) following the New York State Department of Health Bureau of Emergency Medical Services advanced level patient assessment algorithm.

11.10.2 Determine overall patient status.

11.10.3 Report physical findings to the Medical Group Supervisor who, in conjunction with the IC and online medical control physician, shall develop a medical care plan addressing the following with full utilization of discretionary decisions as defined in the REMSCO general operating procedures:
- Stabilize vital signs.
- Perform advanced monitoring and medical management, (e.g., intravenous medication administration, EKG, O₂, pulse oximetry, End-tidal CO₂ detection).
- Perform early intervention in the prevention of and treatment of:
  - Crush Syndrome
  - Hyperkalemia to reduce lethal cardiac dysrhythmias.
  - Dehydration.
  - Hyper- and hypothermia.
- Control pain and improve patient cooperation through the use of analgesics.
- Monitor patients receiving pre-hospital sedation.
- Prevent exacerbation of existing injuries/illnesses by being directly involved in ongoing care, packaging, movement and reassessment of patient status.
- Act as an extension of the response physician by maintaining contact with the physician when performing advanced medical procedures within the Rescue Paramedic scope of practice.
- Monitor rescue team activities for impact on the patient, (e.g., CO production, dust, heat, noise) and for potential injuries they might receive during rescue operations.

11.11 Triage, Treatment, Transport

11.11.1 All patients triaged, treated or transported must be tracked by EMS. Information regarding patient count and types of injuries should be relayed to the IC through the Medical Group Supervisor.
11.12 **General Debris Removal**

11.12.1 After all other methods have been employed and persons are still missing, and their location is unknown, remove all rubble and systematically strip the area, without regard or preference for any particular location. This phase is begun when it is certain there are no other survivors, all voids have been searched and the selected debris removal and tunneling demonstrates there is no chance for survival for missing victims. Specially trained search dogs can be useful in making this assessment, if fire and smoke permit. This operation should be completed under the direction of the FDNY, even though heavy equipment may be required.

11.12.2 While in this phase, cordon-off a designated area to examine debris and keep the crowds away. Maintain at least one SOC Unit on site throughout this operation to provide technical assistance.

11.12.3 Each load of debris must be spread out on the ground and thoroughly examined before removal from the site. All debris from the structure should be deposited in the debris examination area rather than simply being deposited in the nearest convenient corner. This will ensure a victim has not been inadvertently buried under more debris.

11.12.4 The Demolition Debris Removal Log must be maintained when there are still victims unaccounted for. It should also be performed at any event that results in a collapse, since there may be persons present who have not been missed yet. It is necessary to examine every inch of the structure, right down to the foundation, to avoid overlooking a victim who has not previously been reported missing.

11.13 **Victim Removal Tools**

11.13.1 The right tool for each task will require the judgment of trained personnel based on the criteria described below.

11.13.2 Depending on the type of building that has collapsed, rescuers will encounter layers of various types of debris. Certain tools lend themselves to different types of debris. Jackhammers, concrete cutting saws and torches are required for Class 1 buildings; chainsaws are appropriate at most buildings with wooden floors and roofs. Heavy demolition equipment (cranes, bulldozers, etc.) is **forbidden** during the Selected Debris Removal stage. Although a manual operation is very time consuming, it is necessary if survivors are expected. Extreme caution must be exercised when operating tools to avoid injuring trapped victims.
11.13.3 Once the operations come within reach of the victim, all work should proceed with only hand powered tools, unless the object and the victim are visibly clear and no injury is likely.

11.13.4 Tools that produce no exhaust fumes, such as battery or electrically powered tools, are preferable to gasoline driven units. Besides emitting no fumes, electric tools are easier to put down and pick up again without the hassle of having to shut them off and restart them; moreover, they lack the noise of a gas engine.

11.13.5 Tools that perform a task without producing showers of sparks are usually preferable to those that do, e.g., use a sawzall instead of a torch to cut steel.

11.13.6 Speed, working room and length of operation will also impact tool choice.

12. DEMOBILIZATION

12.1 The Fire Department will remain at the collapse site until debris removal phase is complete or until the IC is reasonably certain all victims have been removed.

- Fire Department presence in the form of a watchline shall be maintained as long as there are personnel operating in the debris pile for search or investigative purposes.

- The IC must ensure that a written log of all visitors and investigators entering the collapse site is maintained. When operations are completed this log shall be forwarded to the Chief of Operations.

- Before the Department leaves the scene, the area must be secured to prevent additional dangers to the public.

- All tools are to be considered expendable. No lives shall be endangered to remove shoring or retrieve other tools or equipment that may have been left in hazardous locations once the life hazard has been resolved. Tools and equipment that can be retrieved without entering hazardous areas shall be returned to service. Other equipment will be retrieved as the building is either demolished or made safe by contractors.

13. CONCLUSION

13.1 All members have an obligation to themselves, their families, and their peers to avoid placing themselves in areas where collapse is likely. Additionally, all members must act as the eyes and ears of the IC, reporting any conditions indicating an impending collapse. Knowledge of the causes and warning signs of a collapse can help prevent our members from being caught in collapses, during fire operations, or secondary collapses at other events.