

Six Stages of Rescue

Scope

This guidance document provides advice and information for the incident commander and personnel attending structural collapse incidents in regards to a sequence of actions that will promote the safe rescue of persons.

The Six Stages of Rescue

To assist the creation of an operational plan, the 'Six Stages of Rescue' provides a framework for the organisation of any collapsed structure incident. Whilst it is likely that there will not be a clear delineation between each stage and there will be times when stages overlap – the incident command structure must ensure that each stage is undertaken and completed. This logical and progressive approach will mean that rescue personnel will maximise effectiveness, particularly in the early stages of an incident.

Progression through the stages will take a considerable time even at a small single dwelling collapse. The tactical plan should take account of this and of the resources required to achieve a safe and successful conclusion to the incident. Rescue operations are conducted under the six following stages:

The Six Stages of Rescue		
Stage 1	R	Reconnaissance and survey
Stage 2	E	Elimination of utilities
Stage 3	P	Primary surface search and rescue
Stage 4	E	Exploration of voids and spaces
Stage 5	A	Access by selected debris removal
Stage 6	T	Terminate by general debris removal

Stage One – Reconnaissance and Survey

The area is searched for possible casualties (surface and/or buried) and the evaluation of the structure's stability and potential danger to rescue personnel is performed. Further guidance is provided in "SOP_SSA001_Scene and Structural Assessment". Immediately after a collapse, the debris of the building is very unstable and prone to additional movement. Rescuers must assess the nature of the scene and the pattern of the collapse before entering onto a pile of rubble to ensure their own safety and that of those potentially buried in it. Examples of collapse patterns are included in "SOP_SSA004_Collapse Patterns". Thermal imaging cameras will assist in this task, particularly if operations are taking place during the hours of darkness. Temporary shoring may be necessary to support structures and prevent further movement, before accessing the debris or attempting rescues. Remove all surface casualties as quickly and safely as possible.

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During Stage 1, as much information must be gathered as is possible at the onset of the incident. "Intelligence" regarding the last known locations and activities of those believed to be in the structure will greatly assist in developing a plan for recovery efforts. Preliminary search efforts should be concentrated on areas where people were last seen or known to be.

A list of the people normally in the building should be obtained or created by the emergency services. It is suggested that an individual be designated to interview those that may have escaped the collapse, were eyewitnesses, or were in the building and rescued early in the effort.

All the information gathered during Stage 1 must be collated, assessed and presented in a way that will inform the decision making process adopted by the incident command structure. Further guidance is available in "SOP_SSA002_Mapping Operations" and "SOP_SSA003_Reporting and Recording Information".

Stage Two - Elimination of Utilities

During Stage 2 of the incident, all utilities must be evaluated and controlled for safety. If necessary, utility services should be isolated before any rescue work proceeds. If this is not possible, the condition of the utilities present in the structure should be continually monitored. Dynamic risk assessments based on the information received from the monitoring process can dictate additional control measures and will provide personnel with information as to the working environment.

Personnel should be aware that some supplies may not have been located and made safe and therefore should not cut the following:

- Water pipes - flooding or a sudden ingress of water has been known to drown rescuers and casualties in flooded basements. The sound of flowing water can also interfere with the use of acoustic search equipment.
- Gas pipes – gases leaking into a collapsed building can pool at lower levels, e.g. basements, dependent upon the density of the gas.
- Electrical cables or wires - experience has also shown that other wiring, telephone cables for example, can become live after coming into contact with mains wiring.

Stage Three - Primary Surface Search and Rescue

Based on the initial search results, the incident commander must prioritise the rescue sites and determine what resources to commit to each site based on the potential for successful rescue of those trapped.

The incident commander must tailor the strategy, and sector commanders the tactics to fit the general situation and specific problems encountered. After ensuring rescuer safety and minimal movement of the debris, the following options should be considered:

- Search canines – dogs can cover large areas of the debris quickly and may cause less secondary debris movement.

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- Specialist search teams – small teams undertaking a ‘hasty’ search will maximise search opportunities whilst minimising risk.
- General audible search – when all work at the site is shut down for a few minutes to listen for calls for help. These can be prompted by rescuers calling into the debris pile.
- General search teams – searching in a sweep pattern across the debris pile will have a high probability of locating surface victims, but put a larger number of persons at risk.

The advantages and disadvantages of these options are detailed in “SOP_SEA008_Search Strategy”. As many as one half (½) of all building collapse survivors have historically been rescued near the surface of the debris and early in the effort. Search and rescue efforts should be concentrated on those areas that are believed to be the last known locations of people, when the collapse occurred. Remove all casualties as quickly and safely as possible.

As the surface search proceeds, further information as to the nature and topography of the debris should be collected, recorded and analysed. A priority will be to identify areas of the collapse where voids and spaces not immediately accessible could be found. The use of building plans showing the location of basements, stairwells and lift shafts would assist in this process as would an analysis of the type of construction and the observed collapse patterns.

Extreme care must be used during Stage 3 to ensure that rescuers do not become victims. Personnel should not be misled by the outward appearance of a structure - what appears to be a settled pile of debris could, in reality, be lacking any genuine support and a secondary collapse could occur without warning. If available, advice from suitably experienced structural engineers can assist in developing an understanding of the nature of the debris pile.

Stage Four - Exploration of Voids and Spaces

All voids and non-accessible spaces identified in the previous stages must be searched and explored for live victims. A combination of visual and audible search can be used during Stage 4. If there is a need to enter and work in confined spaces a specific risk assessment should determine the system of work employed.

Explore visually, or with technical search cameras all possible "voids" that are open or can be reached by removing surface debris and/or core drilling through debris. Trained search canines can also be effectively deployed into voids and accessible spaces.

It is suggested that, at approximately every hour on the hour, all work at the site be shut down for a few minutes to listen for calls for help. During this period, selected personnel should both call into the debris and strike parts of the debris so that these sounds are transmitted into the debris pile. Simultaneously, sound detection devices can be used to "listen" for movement or sounds deep within the debris. Further information is contained in “SOP_SEA007_Audio-Technical Search”.

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Finally and if safe to do so, crews can access the top of the debris pile and systematically search the surface in specific grids. Use tape and markers to visually demonstrate the areas that have been searched and those that could potentially contain victims. These grid searches can be planned using drawings created by the emergency services or aerial photographs of the incident.

Stage Five - Access by Selected Debris Removal

Selected debris removal, using special tools and techniques, may be necessary after locating a victim. It may be necessary to remove only certain obstructions that are blocking access to the victim. Information concerning a victim's location prior to the collapse and the nature of the structure can be helpful during the selected debris removal phase.

During Stage 5 the use of heavy plant should be considered. Specialist machinery can grasp, cut and lift objects within the debris pile, provided access can be gained. Named 'de-layering', the principle to be adopted is one of lifting the debris rather than pulling horizontally. Lifting debris will immediately reduce the load on the remaining debris pile reducing the chance of secondary collapse. Pulling will shift the load path, possibly onto a weaker part of the remaining structure, and thereby increase the possibility of secondary collapse. Advice from suitably experienced structural engineers will be critical in determining the sequence of de-layering.

As voids and other survivable spaces are uncovered by the de-layering process these should be searched using a combination of canine, visual and audible search techniques.

Stage Six - Terminate by General Debris Removal

General debris removal is usually conducted after all known victims have been removed and operations are entering the 'recovery phase'. Typically, general debris removal entails the extensive use of heavy machinery and transport to remove the debris. The decision to use heavy equipment and enter this phase must be given serious consideration, especially if there remains a possibility that live victims might survive in the debris.

In the event of information being obtained that indicates the possibility of other victims, operations can be stepped back to Stage 5.

During Stage 6, only limited numbers of rescue personnel need to maintain a presence at the scene. Only if working directly with contractors and assisting debris removal operations do they need to be committed onto the debris pile. At this stage the risks of injury are high and the potential for rescue low as the heavy machinery removes the debris. If rescue personnel need to be committed onto the debris pile to perform specific actions, then heavy machinery should be stopped whilst these operations are being completed.

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