



National
Operational
Guidance

Hazard

**Unstable or collapsed natural or built
environments**



NFCC
National Fire
Chiefs Council

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Hazard - Unstable or collapsed natural or built environments

Hazard Knowledge

Fire and rescue services may be called to many natural or built environments, some of which can be defined as confined spaces; this includes trenches, excavations and pits.

Personnel should be aware that some of these environments require additional resources and skills beyond the scope of non-specialist responders.

The natural environment, such as a trench, excavation, pit, cliff or steep ground, or free-flowing solids, may be subject to instability, for example due to:

- Excessive rainfall
- Vibration from nearby heavy vehicles or machinery
- Severe impact
- Loads, such as vehicles, machinery or building materials, being positioned close to an edge
- Failure of supports

A serious risk of injury exists at incidents involving an unstable natural environment because soil can weigh up to 1.7 tonnes per cubic metre. Even small collapses may be fatal. The hazards to people include:

- Becoming trapped or buried
- Being crushed by the movement of soil and any subsequent loading
- Falling into a trench, pit or opening
- Drowning

Trenches and excavations are present in building works and utilities maintenance, and pits can be found in a variety of locations, such as used or abandoned mines or quarries, and agricultural or industrial sites. An incident involving a trench or excavation may require shoring or the removal of soil, along with having to relocate heavy machinery or other objects.

Any unsupported trench or excavation may be subject to collapse and there are many factors that will influence stability, such as:

- Height of face
- Angle of face
- Type of soil



- Adjacent loading
- Vibration from nearby machinery or vehicles
- Water content
- Surface water
- Buried services or other obstructions – refer to [Utilities and fuel](#)
- Changes in soil type or make-up
- Previously worked-on ground
- Weather conditions
- Length of time the trench or excavation has been exposed

Loading at ground level adjacent to the trench increases the likelihood of unstable faces collapsing, as does vibration from machinery or vehicles; this area should be kept clear.

The incident may involve:

- Collapse of the sides or roof
- People or objects falling into the opening
- Materials falling onto people working in the opening
- The undermining of nearby structures
- Damage to utilities
- Water ingress



Control measure - Cordon controls: Unstable or collapsed natural or built environments

Control measure knowledge

To prevent collapse or further collapse of an unstable surface, trench, excavation or other natural or built environment, access to the surrounding area should be carefully controlled.

Equipment entering the area should be limited to essential items only.

An area should be identified a suitable distance away from the hazard area for personnel, equipment, machinery and any items being removed including debris. Material removed from a trench should not be placed above the area where excavation is taking place, but instead moved a safe distance away to prevent slippage or collapse.

Where possible, vehicles, machinery or equipment creating vibration should be isolated. Incident



commanders need to assess the risk of moving vehicles, machinery or equipment to a safe distance as the movement and redistribution of weight could lead to further collapse.

Strategic actions

Fire and rescue services should:

- Ensure personnel have access to appropriate specialist advice and equipment to assess unstable or collapsed natural or built environments
- Consider providing local equipment or access to specialist resources to enable personnel to work safely in the area around unstable or collapsed natural or built environments

Tactical actions

Incident commanders should:

- Establish cordon controls for an unstable or collapsed natural or built environment at an appropriate distance from the hazard area
- Identify an appropriate area to locate equipment, personnel and debris to prevent further collapse of an unstable natural or built environment
- Consider isolating, controlling or moving vehicles, machinery or equipment for incidents involving an unstable or collapsed natural or built environment



Control measure - Safe system of work: Unstable or collapsed natural or built environments

Control measure knowledge

An incident involving an unstable or collapsed opening may require:



- [Shoring](#)
- Removal of fallen or collapsed materials
- Isolation of machinery or vehicles
- Relocation of loads, such as vehicles, machinery or building materials
- Reducing movement in the hazard area
- Appropriate location of fire and rescue service vehicles, equipment and personnel

The opening should be assessed at the earliest opportunity. Although the initial assessment can be carried out by first responders, it may be necessary to seek specialist advice.

Specialist advice may be available from a competent person, structural engineer or tactical adviser and should be sought prior to committing personnel to the hazard area.

If personnel need to enter where any of the support system has been compromised, it will be essential to consult with the responsible person or competent person to determine a safe system of work. This could be the contractor or a civil engineer.

The hazard area should be monitored for signs of collapse; this may include distortion or deflection of supports, tension cracks or soil movement.

The minimum number of personnel should be committed to the hazard area, especially if the assessment or monitoring indicates the potential for further collapse. There should also be emergency procedures in place, which can be initiated if required.

Additional loading such as fire and rescue service vehicles, equipment and personnel is to be avoided, as this can further contribute to secondary collapse.

Where it is necessary to work around the opening, appropriate working at height procedures should be adopted. Any additional load placed in the area should be risk assessed and consideration given to spreading the load, for example by using trench sheets or plywood. It should be considered that using methods that cover large areas can prevent early signs of collapse being identified. For more information refer to:

- Safe system of work: [Unguarded edges](#)
- Water rescue and flooding: [Spread the load](#)

Other safe systems of work or procedures may be involved in rescue operations, such as those for:

- Confined spaces; for example a trench may collect flammable or toxic vapours or have an oxygen-deficient atmosphere
- Working at height, for example, personal protective equipment (PPE) may be required for unguarded edges
- Access and egress, as this may be restricted

Strategic actions

Fire and rescue services should:

- Establish arrangements with appropriate agencies to provide specialist advice, assessment and monitoring of excavations
- Ensure personnel are aware of local or national arrangements and the specialist advice available for excavations

Tactical actions

Incident commanders should:

- Avoid applying additional loads to the excavation, such as fire and rescue service vehicles, equipment and personnel
- Consult with the responsible person or competent person to establish a safe system of work for an unstable or collapsed natural or built environment
- Consider requesting specialist advice regarding unstable or collapsed natural or built environments
- Identify the type of material being excavated and the height and angle of the excavated face
- Have emergency procedures in place for an unstable or collapsed natural or built environments
- Ensure that the minimum numbers of personnel work in the hazard area for an unstable or collapsed natural or built environment
- Assess and continuously monitor the hazard area for signs of further collapse of an unstable or collapsed natural or built environment
- Consider spreading the load of equipment or personnel to reduce the pressure on the

opening



Control measure - Shoring

Control measure knowledge

Shoring can be described as temporary support to elements of a structure using metal or timber shoring systems and can be provided by urban search and rescue (USAR) teams.

Shoring provides:

- Temporary stability of structures, objects or debris
- Protection from falling debris, secondary collapse to enable search or rescue operations to proceed
- Support to vertical, horizontal or sloping surfaces

Any shoring operation should be carried out by competent personnel with the appropriate level of knowledge and training, using suitable equipment. The shoring should be continually assessed and monitored throughout the incident.

It may be necessary to use temporary shoring to save life or prevent an incident escalating. However, the equipment immediately available to fire and rescue services, or to urban search and rescue (USAR) teams, may not be of sufficient strength to substitute for excavation support systems.

On-site machinery, vehicles or equipment, such as excavation support systems or materials suitable for use as trench or pit supports, may be available. However, the available equipment may have already failed, requiring a detailed risk assessment prior to further use.

If an excavation support system has been compromised, personnel should seek the advice or assistance of the responsible person or competent person, such as the contractor or a civil engineer.

Strategic actions

Fire and rescue services should:



- Consider providing shoring equipment and materials

Tactical actions

Incident commanders should:

- Consider requesting specialist advice and resources for shoring
- Ensure the competent person for shoring continually assesses and monitors its effectiveness
- Seek advice or assistance for shoring from the responsible person or competent person