
S.O.P #: TACTICAL OPERATIONS MANUAL #13

SUBJECT: TRENCH/EXCAVATION

DIVISION: EMERGENCY OPERATIONS

Objective: To serve as a guide for all fire department personnel operating at or near trench/excavation incidents during emergency and non-emergency operations.

Section 1: Purpose

To provide a guideline to all Fire and EMS personnel responding to incidents involving trench/excavation emergencies. Cave-ins pose the greatest risk and are much more likely than other excavation-related accidents. Other potential hazards include falls, falling loads, hazardous atmospheres and incidents involving mobile equipment. This guide by no means circumvents the use of training, practice, experience and judgment by individuals while operating at a trench/excavation related incident.

Section 2: Definitions

- A. **Assistant Safety Officer (ASO)** - This position is in addition to the Safety Officer (SO). This position will be responsible for the safety of personnel in the Hot and Warm Zone.
- B. **Excavation** - Defined as any man made cut, cavity, trench, or depression in the earth surface, formed by earth removal that is wider than deep. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less (measured at the bottom of the excavation), that area within the excavation is considered to be a trench.
- C. **Ground Pads** – Materials used around the lip of a trench to distribute the force and weight of rescuers decreasing the chances of secondary collapse.
- D. **Incident Commander (IC)** – The individual responsible for all incident activities, including the development of strategies and tactics. This includes ordering and releasing resources. The IC has overall authority and responsibility for conducting incident operations at the incident site.
- E. **Lip** – defined as a two foot area from edge of trench. This is a **very dangerous** area.
- F. **Medical Specialist**- This position shall be assigned to a Rescue Technician with EMS training. The Medical Specialist shall be tasked with providing treatment and care to the victim(s) in the Hot Zone. The Medical Specialist falls under the Rescue Branch, but should coordinate medical issues or concerns with the Medical Branch Director, when appropriate.
- G. **Rescue Branch Director** – This position shall be filled by those personnel meeting the NFPA 1006 Technician Level for trench rescue when possible and will be responsible for the development and implementation of the rescue plan in the Hot and Warm Zone.
- H. **Rescue Technician**- This position shall be filled by those members meeting the NFPA 1006 requirements to operate in the Hot Zone.
- I. **Safety Officer (SO)** – This person is responsible for overseeing all incident operations with a focus on the health and safety of all personnel. The Safety Officer is assigned by the IC.
- J. **Spoil Pile** – This is defined as the excavated dirt removed from the trench.

- K. **Trench** – A trench is a narrow excavation (in relation to its length) made in the earth surface. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

Section 3: **Response**

A trench rescue assignment shall consist of the following response:

1. 1st Alarm – A Standard Rescue Box consisting of (1) Battalion or Division Chief, (1) Engine, (1) Truck, (1) Medic Unit, (1) EMS Supervisor, (1) Heavy Rescue Squad, USAR 17, and Confined Space Team from 32, HM 114 (with air monitoring capabilities)
2. Additional resource requests will need to be requested through the IC to dispatch.

*** **NOTE***** For confirmed working incidents, IC should confirm that a full trench rescue assignment has been dispatched. Also consider requesting: BGE, PIO, State Highways, MOSH, Rehab Unit, Aviation, Mutual Aid Special Operations Teams, Department of PAI for structural engineer, or any other agency that may be of assistance in mitigating the incident safely and efficiently. Resources shall be requested by the IC through Fire Dispatch.

Section 4: **General Safety Guidelines**

- A. Trench/Excavation rescue incidents are high risk/low frequency events. The IC needs to assess the risk to departmental personnel and develop the safest and most efficient incident action plan for the incident.
- B. The safety and well-being of all personnel shall be of the highest priority. Personnel will not take unnecessary risks for any activity that is not essential to the immediate protection of a savable life.
- C. Rescue operations are labor intensive and crews should be rotated to rehab when possible. This will ensure rehydration and physical rest for members.
- D. All operations at the scene of a trench/excavation incident shall be performed in a safe manner. No member should operate above their level of training or without proper PPE.
- E. A timely risk assessment should be performed to determine if it is a rescue or recovery operation.
- F. Responding units should keep roadways open and park a minimum of 250' away from the incident. Units with rescue equipment shall proceed to a safe location as determined by the IC in conjunction with the Rescue Branch Director, but generally no closer than 100 feet.
- G. All personnel should wear appropriate PPE, (helmet, gloves, eye protection, and steel toe boots at a minimum). Full turn out gear may not be the most appropriate PPE.
- H. No Personnel (or civilians) should enter an unprotected trench or a trench that has not been deemed atmospherically safe through use of air monitoring equipment.**

Section 5: **Initial Operations Guidelines**

- A. The first arriving officer shall establish command and complete a size-up to include the following:

1. Evaluate current and potential hazards immediately effecting the rescue operation within the trench and the rescue area. (Hazards such as utilities, toxic atmospheres, liquid flowing in trench, weather, risk of secondary collapse, etc...)
 2. Determine the existence, location, and condition of victim(s).
 3. Determine the mechanism of entrapment, nature of illness or injury. Observe from a safe location if possible the type of entrapment, i.e., totally buried, partially buried, trapped by utilities or construction equipment.
 4. Determine the potential for a rapid **non entry** rescue or a victim self-rescue.
 5. Attempt to identify, locate and secure a witness or Site Supervisor as quickly as possible. This person will assist in providing information as to what work was being performed and the possible last known location of a victim(s).
 6. Determine if there have been any communications with the victim(s).
 7. Determine if safety precautions are in place. (trench boxes, dewatering devices, ladders, or utility lock-out usage)
 8. Determine time incident occurred.
 9. Onsite witnesses should be segregated until each can be interviewed. The responsible party/competent person for the job site shall be kept at the command post for the duration of the incident.
 10. All information gathered shall be written down for ease of exchange and accuracy. This will reduce the possibility of incomplete or inaccurate information.
- B. IC must make a determination to proceed in a **Rescue Mode** or **Recovery Mode**. This decision must then be clearly communicated to all personnel. The IC should communicate information from the ongoing size-up to USAR 17 officer if not already on scene.
1. **Rescue Mode** - Rescue operations must be initiated as soon as possible with proper equipment and qualified personnel.
 2. **Recovery Mode** - Recovery operations are to proceed in a manner that presents minimal risk to department members.
- C. **Actions of personnel with first arriving companies.**
1. Establish scene security and control zones. (Hot, Warm, Cold) See section 5.D.
 2. Establish point of entry control using level II accountability. (See Tac 7)
 3. Perform hazard control for scene safety to include:
 - (a) The presence of and control of disrupted and non-disrupted utilities. May secure if safe to do so.
 - (b) The presence of and mitigation techniques to handle flowing water or other liquid accumulating in the trench.
 - (c) The presence of and mitigation of hazardous materials or hazardous atmospheres.
 - (d) The presence of cracks or changing ground conditions around the trench that could lead to secondary collapse.
 - (e) Visualize and ensure the spoil pile is a minimum of two feet from trench lip.

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- (f) Minimize the presence of heavy loads near the open trench and fire hazards.
 - (g) Running equipment in the warm or hot zone should be shut down (this should be done by a trained operator). The Rescue Branch Director may deviate from this if it directly relates to the rescue effort and is determined not to pose any additional hazard to operating personnel.
4. Approach the site with extreme caution. If safe to do so place a ladder in the end of the trench for emergency egress only.
 5. Perform **non entry** rescue, or assist with a victim self-rescue. This can be accomplished by placing a ladder in the trench for the victim to climb out. Extreme caution should be used when working around the lip of a trench. (Limit the number of personnel working around the lip of the trench).
 6. Obtain information regarding trench depth, length, and width.
 7. Communicate with victim(s). It is important to explain what is going on and keep them up to date. Begin providing treatment as soon as is possible. This may include lowering O2 or other medical equipment to the victim.
 8. Establish temporary victim sheltering. This can be accomplished by placing a ladder over the victim and placing a board or other solid object on ladder to protect victim from falling debris. You can also consider providing a hard hat to the victim(s).
 9. Establish de-watering operations if there is the risk of accumulating water in the trench.
 10. Move the spoil pile at least two feet back from trench lip.
 11. Place ground pads around the trench to distribute the weight of crews working around trench.
 12. Perform atmospheric monitoring (Meter minimum of: O2, CO, H2S, and LEL readings).
 13. Perform ventilation in trench when necessary.

D. Control Zones (Consider these as minimum distances)

1. **Hot Zone** – Defined as 50' from all edges of the trench.
2. **Warm Zone** – Defined as 100' from the outside edge of Hot Zone.
3. **Cold Zone** – Defined as the area beyond the outside limit of Warm Zone. (minimum 150' from edge of trench)
4. **No Vibration Zone** – Consider limiting any operation that could impact the stability of the trench 300' or more. (I.E. Highways, Trains, Construction sites). Position responding units 250' away. (Apparatus on scene should shut down equipment when safe to do so, this will reduce ground vibration.) Exception will be units with rescue equipment, but only after a thorough risk assessment, and coordination between the Rescue Branch Director and the IC.

Section 9: **Medical Considerations**

- A. Oxygen therapy should be a consideration. If patient's arms are free and they can assist themselves, you may have equipment lowered to them and instruct them on how to use it.
- B. Warming techniques should be a consideration. The ground temperature below the surface on average is only 50-60 degrees F. Even if the ambient air temperature is hot, remember to prevent hypothermia in your patient.

- C. Patients involved in these types of incidents often have a high risk of crush syndrome/compartment syndrome. Be prepared to follow current medical protocols.
- D. Control any major bleeding through use of a tourniquet, if indicated.
- E. Consider requesting BCoFD Associate Medical Directors.
- F. Consider requesting aeromedical resources, including the “Go Team”, through dispatch.

Section 7: **Special Considerations**

- A. Trench/Excavation operations can be very technical and long in overall duration. With this in mind, it is imperative that all operations be focused on the safety and well-being of fire department personnel. Below is a potential list of considerations that may need to be implemented or acquired to assure a successful and safe incident.
 - 1. Be prepared to implement an alternative action plan if the current plan needs to be changed.
 - 2. Make sure the rehab area has been established far enough away from the incident that personnel truly get away from the work area.
 - 3. Co-workers and family members of those trapped need to be cared for as well. Consider calling for a member of the Critical Incident Stress Management Team (CISM) to assist. (See Personnel 22)
 - 4. The use of full structure gear can fatigue personnel quickly. Remember the basics of good PPE, head, hand, foot, and eye protection.
 - 5. The need for heavy timber to supplement the shoring plan must be considered. Any trench deeper than fifteen (15) feet will require a structural engineer to be on site to develop a shoring plan. This resource will be acquired from the Department of Permits, Approvals, and Inspections and can be requested via Fire Dispatch.
 - 6. These incidents are considered as a potential crime scene and most will be investigated by MOSH.
 - 7. Consider the notification of additional technical rescue team(s) to support on scene resources.
 - 8. Consider a minimum of two initial Rescue Groups. This allows members to rotate and rehab during long operations.

Section 8: **Post Rescue/Demobilization**

- A. Ensure victim(s) have been treated and transported to the appropriate medical facilities.
- B. All rescue personnel should report to rehab for medical assessment, hydration, and nutrition.
- C. The Rescue Branch Director and ASO will discuss and confer with the IC as to the equipment retrieval plan. It may be safer to mechanically dig the trench to make it an excavation. This should be coordinated jointly with the MOSH inspector.
- D. Assure that all information gathered from the incident has been properly documented and all appropriate forms are turned in to the Rescue Branch Director.
- E. A completed inventory of all equipment that has been damaged, irretrievable or expended, should be given to the Rescue Branch Director.
- F. Assure all equipment has been accounted for and returned to service.
- G. Begin releasing units as they become ready for service.
- H. The Rescue Branch Director shall be responsible for notifying the Division Chief of Special Operations of any equipment or materials that have been expended.

TRENCH/EXCAVATION RESCUE TACTICAL CARD

Trench - A trench is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

Excavation - Defined as any man made cut, cavity, trench, or depression in the earth surface, formed by earth removal that is wider than deep. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less (measured at the bottom of the excavation), the excavation is also considered to be a trench

Hot Zone	This area includes the trench and 50' in all directions from the lip of the trench.
Warm Zone	This area begins at the edge of the hot zone (50') and extends an additional 100'
Cold Zone	This area is located 150' away from the lip of the trench.
Vibration Zone	Consider limiting any operations within 300' such as Highways, Trains and Construction.

Action Guide	Initial Tactical Considerations
General Safety and Possible Immediate Life Saving Actions	<ul style="list-style-type: none"> <input type="checkbox"/> Stage equipment at least 250' away and keep access open for USAR 17 and other Rescue Companies. <input type="checkbox"/> Shut down roadways and re-route all non-essential traffic at least 300' <input type="checkbox"/> PPE: Helmet, Gloves, Eye Protection, Steel Toe Boots. Turnout gear can be used if no other options are available. <input type="checkbox"/> Initial recon should be done by approaching the trench with extreme caution. <input type="checkbox"/> If safe to do so a non-entry rescue can be performed of a victim that can self-rescue by placing a ladder near them. <input type="checkbox"/> Order anybody in an unprotected trench to come out. <input type="checkbox"/> Have ladders placed at least every 25' in trench where any crews maybe working for emergency egress. <input type="checkbox"/> If victim is visible place temporary shielding to protect victim. (Place ladder in trench with victim under ladder. Place board, plywood or other object over ladder to create safe area. <input type="checkbox"/> Remove all non-essential rescue personnel back at least 50' from the trench. <input type="checkbox"/> Shut down all heavy equipment operating within 300'
First arriving Officer/IC Command and Size-Up.	<ul style="list-style-type: none"> <input type="checkbox"/> Establish Command. <input type="checkbox"/> Assign Incident Safety Officer and Rescue Branch Director <input type="checkbox"/> Secure responsible person (witness or site supervisor) <input type="checkbox"/> Determine what has happened. (Trench collapse, mechanical entrapment, unconscious or injured person in a trench) <input type="checkbox"/> Assign crews to determine the length, width, and depth of trench. <input type="checkbox"/> Determine what work was being performed? <input type="checkbox"/> Determine the presence of any hazards or contents in the trench. <input type="checkbox"/> Determine type of injuries and number of victims. <input type="checkbox"/> Is the victim(s) visible or completely buried? <input type="checkbox"/> Determine how long victim has been buried and last known location <input type="checkbox"/> If no witness present look for clues(tools sitting on edge of trench) <input type="checkbox"/> Is there any type of safety precautions in place (trench boxes, tag-out lockouts...?) <input type="checkbox"/> Make a decision regarding operating in a Rescue Mode or Recovery Mode and communicate to all personnel.

Action Guide	Initial Tactical Considerations
Resource needs	<ul style="list-style-type: none"> <input type="checkbox"/> Assess on scene capabilities <input type="checkbox"/> Assess need for additional resources and request them. This includes: BGE, Water Company, Public Works, State Highways, PIO, PAI for Structural Engineer, Law Enforcement and Mutual Aid Special Ops Teams.
Additional Considerations	<ul style="list-style-type: none"> <input type="checkbox"/> Level area around trench for ground pad placement. <input type="checkbox"/> Control or have all utilities in immediate area controlled by trained personnel or responsible companies. (Water, gas, electric...) <input type="checkbox"/> De-water trench if necessary. <input type="checkbox"/> Assess and move spoil pile away from trench a minimum of two feet. <input type="checkbox"/> Perform air monitoring of the trench to include the top, middle, and bottom levels. This information should be documented to include time performed. <input type="checkbox"/> Perform ventilation of trench, if necessary.
Medical Considerations	<ul style="list-style-type: none"> <input type="checkbox"/> Oxygen therapy consideration. <input type="checkbox"/> Consideration to warming techniques. Even when the outside air temperature is hot, the ground temperature only averages 50-60 degrees F. If wet, hypothermia could happen much faster. <input type="checkbox"/> Consideration and preparation should be given for crush/compartment syndrome as victims become unburied. <input type="checkbox"/> Consider requesting BCoFD Associate Medical Directors, or “The Go Team” through dispatch for extensive entrapments. <input type="checkbox"/> Consider the use of tourniquets for major bleeding control.

