



Best Practices Guide For Trenching & Excavation Program Development

Trenching & excavations are a common part of municipal and quasi-municipal operations in most communities. Public works, water, sanitary treatment & sewer maintenance, are the different entities whose operations may be covered under this particular set of guidelines. In most of these workplaces trenching and excavation is not a daily occurrence, so it is even more critical that guidelines are developed. This written program must specify the components that are necessary to prevent employee injuries and fatalities, as well as to comply with OSHA regulations.



Trenching and Excavation Program Development

Introduction

Municipal departments and Quasi-municipal organizations that have jobsites where road and utility work is performed--especially those involved in trenching and excavating operations-- have a significant risk of injuries to employees that should be carefully considered. Anytime an employee is working adjacent to traffic, the potential hazards are serious and although trench cave-ins do not occur on a highly frequent basis, when they do occur, the result is often one or more fatalities. Frequently those that die from a trench collapse are not involved in the initial cave-in; they are the would-be rescuers. It is critically important for all employees involved in this type of operation to receive training which stresses the fact that the unstable conditions that caused the initial cave-in often can and do cause a second or even third cave-in. By understanding the hazards, providing adequate work zone traffic control, utilizing protective equipment such as trench boxes, having a competent person on site at all times to monitor the trenching operations, and having a good written program that emphasizes planning, prevention and training, excavation-related injuries and fatalities can be prevented.

Scope

This information was prepared as an outline to assist you in developing your Trenching & Excavation Program. As is the case with all safety plans, to be effective, they must relate to YOUR operations, exposures, and hazards. The information and forms provided are samples. They are intended as guides for YOUR Trenching & Excavation program development. There are specific laws, standards, rules, and regulations that pertain to this topic. We suggest that you consult them, as well as local and state public safety officials, for additional assistance.

OSHA Requirements

The OSHA standard Subpart P-Excavations (29 CFR 1926.650-652 with appendices), is the construction standard which covers the hazards and related requirements of this type of operation. The standard states that as an employer, you are responsible for having a specific set of written documentation as well as one or more designated and trained “competent” persons to ensure that employees involved in these operations are adequately protected against serious injury or death. It requires that each excavation and trenching project be evaluated, prior to any work being started, to determine the specific hazards that may occur at that jobsite. This standard states that your first goal should be to set up a process in advance where each hazard is evaluated and actions taken to minimize them prior to any workers being exposed. Obviously, because of the emergency nature of some jobsites (e.g., a pipe breaking in the middle of the night), the need for a specific procedure in place that can be easily adapted in emergency situations is critical. One example might be having a truck or trailer set up with the necessary equipment such as a trench box, barricades, ladders, and pumps that can be easily hauled to the jobsite on short notice.

Your written documentation must state clearly what the “usual” hazards are for your operations (i.e. is most of your trenching four feet or less with an occasional large project or do you have a greater variety of situations that your employees may be exposed to on a given day.) The written procedures should then be as specific as possible relating to “typical” and jobsite specific road and shoulder widths, pipe locations, soil conditions, traffic flow, and equipment available. A written excavation permit is a good way to record the necessary information (see sample).

With specific regards to Flagging & Traffic Control operations at a trenching jobsite, there is also a State of Maine law--Title 23 MRSA, Chapter 13, Section 707--that covers construction flaggers minimum training standards. This law encourages municipalities to provide training for flaggers on construction worksites that is consistent with the standards set forth in the Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways. Such training can be done internally, or by having employees attend workshops such as those presented by the Maine Department of Transportation's Maine Local Roads Center.

Steps to Develop Your Program

1. **Identify your Trenching & Excavation Hazards** ... The first step is to understand and identify the trenching and excavation operations that your department or organization usually undertakes in a "typical" work year. Do you perform this type of operation daily? Weekly? Or only occasionally? Do you do most of your trenching and excavating during the summer months? Or are you prone to emergency repair work at other times of the year? Are the trenches that you dig consistent in depth? Or do they vary from just below the surface to ten or more feet deep? Are the soil conditions fairly consistent throughout the area where you are responsible for performing this type of work (i.e. sandy gravel or hard clay)? Or are there a variety of soil conditions with which you must contend? How high is the water table in your general area?

2. **Identify your Designated Trenching & Excavation "Competent" Person(s)** ... Under OSHA regulations, for a worker to be considered a Competent Person, they must meet four basic qualifications:
 - Job experience in trenching and excavation operations;
 - An understanding of the various methods available to protect workers--sloping, benching, shoring, trench boxes, etc.;
 - Clear knowledge and understanding regarding the OSHA standards specific to trenching and excavation;
 - The authority to direct employees as to the specific procedures to ensure their safety as well as to require them to exit the trench immediately if changing conditions appear to indicate that a collapse may occur.

3. **Identify the Hazard Control Methods that you will use under typical conditions...**
Once you have identified the typical types of trenching and excavation work that you ordinarily perform and have designated and trained one or more competent persons, you need to list and obtain the equipment needed to ensure safe jobsite operations.

This equipment may include, but is not limited to:

- Signs, barricades, and cones
- Stop/Slow paddles, flags, or signs for flagging operations
- Pumps, hoses, and peastone gravel
- Trench boxes and/or shoring
- Ladders of multiple lengths
- Personal Protective Equipment such as hard-hats, safety eyewear, reflective vests, gloves, and waterproof footwear.

Each of these pieces of equipment should be listed with the quantity available and should be included as an equipment inventory with your written program.

4. **Create Written Procedures for Trenching & Excavation Operations** ... Trenching and excavation operations are the safest when every employee on the jobsite knows exactly what to do under both typical and emergency conditions. The best way to ensure this is to have a written set of procedures describing your typical and emergency trench work. Written procedures are a set of step-by-step instructions that allow all employees to perform an operation repeatedly with a consistent, positive end result-- the road and/or utility is placed or repaired and no employee injuries or fatalities have occurred. In addition to being important for job efficiency and employee safety, the availability of a description of the design of protective systems to be used for each jobsite (including necessary tabulated data) is a requirement of the OSHA excavation and trenching standard.

5. **Provide Training and Keep Records of Training Sessions** ... The best way to make sure employees avoid trenching hazards in your workplace is by conducting training. The OSHA standard requires that everyone who will be exposed to this type of operation be properly trained. This training must cover:
 - How trench collapses can and do occur.
 - Soil and jobsite conditions, which are high hazards.
 - Traffic conditions and the role of the flaggers in controlling traffic.
 - Protective methods and equipment--sloping, trench boxes, etc.
 - The likelihood that once a cave-in occurs fatalities will result.

All employee training relative to trenching & excavation operations and other roadwork should be documented in a central training file. If the project is a long one (more than a few days), then copies of training records should also be maintained at the jobsite. This documentation should include the topic and a brief program description, the name(s) of the instructor(s), the date, time and location of each session, and the name of each employee who attended the program.

Key Elements

To be effective, YOUR program needs to clearly identify the following:

- Key personnel (including “competent persons”) who have responsibility for each segment of the program.
- Methods that your operations will utilize to prevent cave-ins.
- Traffic control methods and flagger responsibilities.
- How and when training will be conducted.
- How records will be kept.
- Procedures to evaluate and update the program.
- Methods used to locate possible underground utilities before you dig.
- Location of possible underground utilities before you dig.

Sample Program

The attachments provided are intended to help you develop YOUR program. Each of the program elements is covered by one or more of the appendices. Each organization will need to carefully analyze their potential exposures to properly determine how in-depth their own program needs to be.

Attachments:

- Trench Inspection and Entry Authorization Form
- Sample Excavation Checklist
- Sample Daily Trenching Log

Sources of Additional Help

OSHA Standards:

29 CFR 1926.650-652 with Appendices

Dig Safe @ www.digsafe.com, (888) 344-7233

American Traffic Safety Services Association Flagging Handbook, (703) 898-5400

Maine Department of Labor, Bureau of Labor Standards, Safety Division, (207) 624-6460

Maine Department of Transportation, Maine Local Roads Center, (207) 287-2152

Manual on Uniform Traffic Control Devices (MUTCD)

MMA Training - Please call your Risk Management Services @ (800) 590-5583

NOTE

This information is intended to assist you in your loss control efforts. We do not assume responsibility for the discovery or elimination of all hazards that could possibly cause accidents or losses. "Best Practices" are developed from the best information available and may not address every possible cause of loss. Compliance with these recommendations does not guarantee the fulfillment of your obligation under local, state or federal laws.

SAMPLE – Trench Inspection and Entry Authorization Form

TRENCH INSPECTION AND ENTRY AUTHORIZATION FORM						
LOCATION:					DATE:	
TIME OF INSPECTION(S)						
WEATHER CONDITIONS:				APPROX. TEMP.:		
CREW LEADER			SUPERVISOR:			
DIMENSIONS:	DEPTH =			Yes	No	HAZARDOUS CONDITIONS
	TOP =	W	L	<input type="checkbox"/>	<input type="checkbox"/>	... Surface drainage
	BOTTOM =	W	L	<input type="checkbox"/>	<input type="checkbox"/>	... Below water table
SOIL TYPE:		TESTED:		<input type="checkbox"/>	<input type="checkbox"/>	... Bulging wall(s)
<input type="checkbox"/> Solid rock, shale		<input type="checkbox"/> Yes		<input type="checkbox"/>	<input type="checkbox"/>	... Floor heaving
<input type="checkbox"/> Average soil		<input type="checkbox"/> No		<input type="checkbox"/>	<input type="checkbox"/>	... Frozen soil
<input type="checkbox"/> Fill material				<input type="checkbox"/>	<input type="checkbox"/>	... Super-imposed loads
<input type="checkbox"/> Loose sand				<input type="checkbox"/>	<input type="checkbox"/>	... Vibration
				<input type="checkbox"/>	<input type="checkbox"/>	... Wet soil
PROTECTION METHODS:			PLACEMENT OF SPOILS & EQUIPMENT			
<i>(Walls MUST be vertical-NO voids)</i>			<input type="checkbox"/> ... Spoils at least 2 feet from edge of trench			
SHORING:			<input type="checkbox"/> ... Spoils not increasing super-imposed load			
<input type="checkbox"/> Timber			<input type="checkbox"/> ... Backhoe at end of trench			
<input type="checkbox"/> Pneumatic			<input type="checkbox"/> ... Compressor, etc. at remote location			
<input type="checkbox"/> Hydraulic						
Screw Jacks			LADDER LOCATION			
<input type="checkbox"/> Trench Shield			<input type="checkbox"/> ... Located in protected area			
UNEVEN, IRREGULAR WALLS			<input type="checkbox"/> ... Within 25 feet of safe travel			
<input type="checkbox"/> Trench box			<input type="checkbox"/> ... Secured			
Sloping: <input type="checkbox"/> 1:1 (45°) <input type="checkbox"/> 1 1/2:1 (34°)			<input type="checkbox"/> ... Extends 36 inches above the landing			
Yes No ENVIRONMENTAL CONDITIONS:			OTHER:			
<input type="checkbox"/> <input type="checkbox"/> Gas detector used?			<input type="checkbox"/> <input type="checkbox"/> Shoring equip. & mats inspected prior to use?			
<input type="checkbox"/> <input type="checkbox"/> Confined space permit issued?			<input type="checkbox"/> <input type="checkbox"/> Is trench SAFE to enter?			
COMMENTS:						
				Work Order #		
NOTE	All unsafe conditions must be corrected prior to trench entry. If any hazardous conditions are observed, the trench must be immediately evacuated and no one allowed to re-enter until corrective action has been taken.					
	<div style="background-color: #cccccc; padding: 5px;"> TO BE FILLED OUT BY EHS PERSONNEL Excavation Entry Authorized By: _____ <div style="text-align: right; font-weight: bold;">EHS Inspector</div> </div>					

SAMPLE – Excavation Checklist (Sheet 1 of 3)

(To be completed by a Competent Person)

SITE LOCATION:		
DATE:	TIME:	COMPETENT PERSON:
SOIL TYPE: (See attached form):		
SOIL CLASSIFICATION:	EXCAVATION DEPTH:	EXCAVATION WIDTH:
TYPE OF PROTECTIVE SYSTEM USED:		

Indicate for each item: YES - NO - or N/A for not applicable

1. General Inspection of Jobsite:	
A. Excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work.	
B. Competent person has the authority to remove employees from the excavation immediately.	
C. Surface encumbrances removed or supported.	
D. Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.	
E. Hard hats worn by all employees.	
F. Spoils, materials, and equipment set back at least two feet from the edge of the excavation.	
G. Barriers provided at all remotely located excavations, wells, pits, shafts, etc.	
H. Walkways and bridges over excavations four feet or more in depth are equipped with standard guardrails and toeboards.	
I. Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic.	
J. Employees required to stand away from vehicles being loaded or unloaded.	
K. Warning system established and utilized when mobile equipment is operating near the edge of the excavation.	
L. Employees prohibited from going under suspended loads.	
M. Employees prohibited from working on the faces of slopes or benched excavations above other employees.	
2. Utilities:	
A. Utility companies contacted and/or utilities located.	
B. Exact location of utilities marked.	
C. Underground installations protected, supported, or removed when excavation is open.	
3. Means of Access and Egress:	
A. Lateral travel to means of egress no greater than 25 feet in excavations four feet or more in depth.	
B. Ladders used in excavations secured and extended three feet above the edge of the trench.	
C. Structural ramps used by employees designed by a competent person.	

SAMPLE – Excavation Checklist (Sheet 2 of 3)

Indicate for each item: YES - NO - or N/A for not applicable

Means of Access and Egress (Cont'd):	
D. Structural ramps used for equipment designed by a registered professional engineer (RPE).	
E. Ramps constructed of materials of uniform thickness, cleated together on the bottom, equipped with no-slip surface.	
F. Employees protected from cave-ins when entering or exiting the excavation.	
4. Wet Conditions:	
A. Precautions take to protect employees from the accumulation of water.	
B. Water removal equipment monitored by a competent person.	
C. Surface water or runoff diverted or controlled to prevent accumulation in the excavation.	
D. Inspections made after every rainstorm or other hazard-increasing occurrence.	
5. Hazardous Atmosphere:	
A. Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible or other harmful contaminant exposing employees to a hazard.	
B. Adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/or to other hazardous atmospheres.	
C. Ventilation provided to prevent employee exposure to an atmosphere containing flammable gas in excess of 10% of the lower explosive limit of the gas.	
D. Testing conducted often to ensure that the atmosphere remains safe.	
E. Emergency equipment, such as breathing apparatus, safety harness and lifeline, and/or basket stretcher readily available where hazardous atmospheres could or do exist.	
F. Employees trained to use personal protective and other rescue equipment.	
G. Safety harness and lifeline used and individually attended when entering bell bottom or other deep confined excavations.	
6. Support Systems:	
A. Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.	
B. Materials and equipment used for protective systems inspected and in good condition.	
C. Materials and equipment not in good condition have been removed from service.	
D. Damaged materials and equipment used for protective systems inspected by a registered professional engineer (RPE) after repairs and before being placed back into service.	
E. Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or threat of being struck by materials or equipment.	
F. Members of support system securely fastened to prevent failure.	
G. Support systems provided in ensure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.	
H. Excavations below the level of the base or footing supported, approved by an RPE.	
I. Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure.	

SAMPLE – Excavation Checklist (Sheet 3 of 3)

Indicate for each item: **YES - NO - or N/A** for not applicable

J. Backfilling progresses with removal of support system.	
K. Excavation of material to a level no greater than two feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.	
L. Shield system placed to prevent lateral movement.	
M. Employees are prohibited from remaining in shield system during vertical movement.	

CORRECTIVE ACTIONS AND REMARKS:

SAMPLE – Daily Trenching Log

DATE:	SIGNATURE:
WEATHER:	PROJECT:
Was Dig Safe contacted:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Utilities are located and marked:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Protective system: <input type="checkbox"/> Trench shield (box) <input type="checkbox"/> Sloping	<input type="checkbox"/> Wood shoring <input type="checkbox"/> Other _____
Purpose of trenching: <input type="checkbox"/> Drainage <input type="checkbox"/> Sewer Other _____	<input type="checkbox"/> Water <input type="checkbox"/> Gas
Were visual soil tests made: If yes, what type?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Were manual soil tests made: If yes, what type?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Type of soil: <input type="checkbox"/> Stable Rock <input type="checkbox"/> Type A <input type="checkbox"/> Type B <input type="checkbox"/> Type C	
Surface encumbrances: If yes, what type?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Water conditions: <input type="checkbox"/> Wet <input type="checkbox"/> Dry <input type="checkbox"/> Submerged	
Possible hazardous atmosphere exists: <i>(If yes, follow confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es)).</i>	Yes <input type="checkbox"/> No <input type="checkbox"/>
Is trenching or excavation exposed to public vehicular traffic (exhaust emission): <i>(If yes, refer to confined space entry procedures; complete Confined Space Entry Permit; monitor for toxic gas(es)).</i>	Yes <input type="checkbox"/> No <input type="checkbox"/>
Measurements of trench: Depth _____ Length _____ Width _____	
Is ladder within 25 feet of all workers:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Is excavated material stored two feet or more from edge of excavation:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Are employees exposed to public vehicular traffic: <i>(If yes, warning vests required)</i>	Yes <input type="checkbox"/> No <input type="checkbox"/>
Are other utilities protected: <i>(Water, sewer, gas or other structures)</i>	Yes <input type="checkbox"/> No <input type="checkbox"/>
Are sewer or natural gas lines exposed: <i>(If yes, refer to confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es)).</i>	Yes <input type="checkbox"/> No <input type="checkbox"/>
Periodic inspection:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Are employees trained in excavating:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Were employees briefed on hazards of this job:	Yes <input type="checkbox"/> No <input type="checkbox"/>