

Trench Safety Awareness

Trenches represent a number of hazards, including collection of liquid or vapor, entry of objects such as pipes or boulders 'stored' at the perimeter, limits to pathways for mobile equipment and cave-in during work. Recognition of the hazards and elements of work practices needed for safe routine work or to prepare for an emergency will contribute to reduced risk of injury.

In this program, you will review the risks of excavation and trench collapses. By discussing measures that protect workers, using accepted practices and government regulations, you will identify elements in a Standard Operating Procedure (SOP) that will guide you in using safe work practices and responding to emergencies.

Objectives

When you have completed this exercise, you will be better able to:

- Describe risks of excavation
- Describe types of collapses
- Identify protection/preventive methods
- Distinguish between regulations and safe work practices
- Identify elements needed in an SOP if an emergency occurs

Introduction

A trench is one type of excavation.

Any man-made cut into the earth or a depression in the ground formed by removal of earth is an excavation. OSHA defines a trench as a narrow excavation that is deeper than it is wide, with a maximum width of 15 feet (4.5 meters).

Local/regional/industry example.

Your facilitator will provide a report of a trench incident from the region or your industry. Review the facts of the report and work in small groups to complete the following Worksheet:

Describe:

Anticipated hazards

Contributing factors

Protective/preventive
measures

OSHA summarizes five important aspects of working around trenches here:

<https://www.youtube.com/watch?v=ImqLTgKNVQo&feature=youtu.be>.

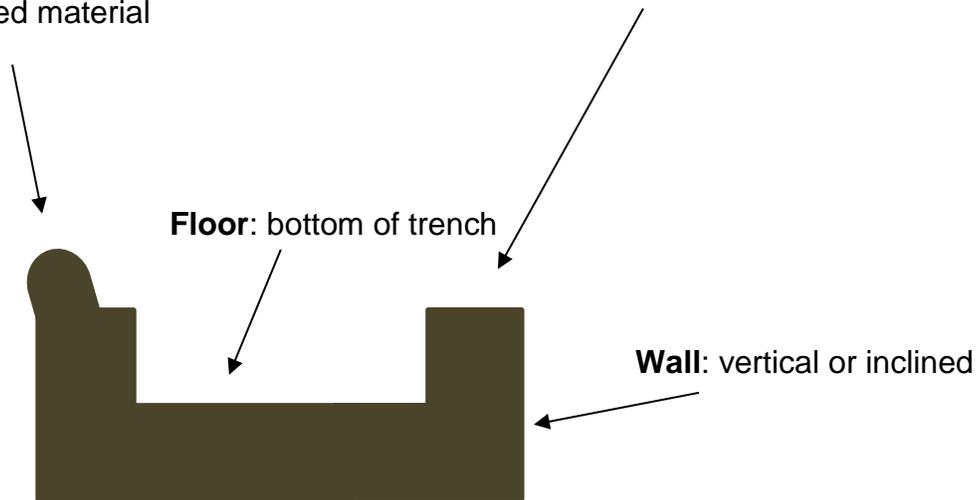
1. Ensure a safe way to enter and exit the trench
2. Provide cave-in protection
3. Always keep materials away from the sides of the trench
4. Identify any standing water or atmospheric hazards
5. Never enter an uninspected trench

Which of these aspects contributed to the example you reviewed?

Trench terms

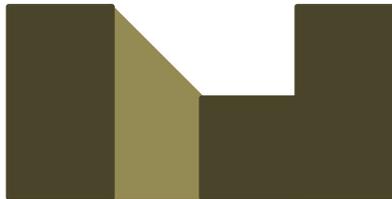
Spoil Pile:
excavated material

Lip or Edge: at ground level, all the way around the trench



Trenches may be dug to meet or intersect another trench. These are often referred to by the shape that is formed. Examples are L-shape, T-shape, X-shape. A trench that does not intersect another trench may be referred to as Straight Run.

The trench shown above has straight walls. The walls may be sloped or benched, as illustrated below:



Left wall is sloped



Left wall is benched

Describing the shape and other characteristics accurately may be very important to save time during an emergency.

Exercise – What are the risks of excavation?

Using your experience and the example discussed earlier, list the types of risks that should be anticipated prior to and during excavation of a trench.

Your facilitator will list these where everyone can see them, as you make contributions.

Turn the page to view one list of risks; you may add to this from your discussion.

Risks during excavation of a trench include:

- Utilities, overhead and below surface
- Pipes
- Buried drums or refuse, including hazardous materials
- Water seepage
- Cave-in
- Moving equipment
- Changes in soil composition—example: clay top removal uncovers sandy soil
- Poor lighting for equipment operator

Exercise - What are the risks in or around a trench?

Using your experience and the examples discussed earlier by each small group, provide examples of the causes and types of risks that should be anticipated regarding:

- Cave in, collapse
- Other activities in and around a trench

Your facilitator will list these where everyone can see them, as you make contributions.

Turn the page to view one list of risks; you may add to this from your discussion.

Risks during trench work include:

Cave-in or trench collapse:

- Spoil pile collapses wall and slides into trench
- Lip shears off into trench
- Material staged at lip causes wall collapse
- Vibration around the trench causes wall collapse or slide in
- Crack parallel to one wall
- Too much or too little water affects soil
- One soil layer compresses or gives way

Other-than cave-in:

- Injury or other medical emergency
- Toxic gas/vapor seepage causes exposure
- Toxic gas/vapor collects in trench from external source
- Falling load such as pipe or supplies
- Shoring restraint failure
- Dislodged boulder or spoil material falls into trench
- Heavy equipment rolls or falls into trench
- Worker falls in
- Biological exposures from injured worker (blood/vomit/urine/feces)
- Lack of communication
- Contact with electrical lines
- Disruption of sewer/water/natural gas/steam/gas/compressed gas
- Limited or inadequate egress

Why are trench injuries so serious?

Average soil weighs

100 pounds per cubic foot

2,700 pounds per cubic yard, more than 1 ton

Collapse happens in seconds, with no or little warning

Engulfment results in suffocation, asphyxia, crushing/impact injury

What are the costs?

Answer: far reaching, as shown by the Equipment World report.

OSHA fines are just the beginning. A trench death stops work, increases workers' compensation costs, hikes your insurance premiums and makes you ineligible to work for certain owners. And all of that is before the legal fees. Most frustrating of all: every death could have been prevented by using methods that have been known for decades.

We wanted to examine the human side of the trench fatality statistics. We talked to survivors, co-workers, victims' families and first responders. We heard from victims' advocates and lawyers. We asked trench protection experts and contractors for best practices.

These deaths delivered immeasurable loss. They all began with the decision that a trench didn't require worker protection.

Taken from the introduction here: <https://www.equipmentworld.com/special-report-death-by-trench/> accessed Feb 4, 2019.

What is OSHA doing?

OSHA recognizes a threat of collapse at virtually any excavation and in October 2018 issued a National Emphasis Program on Trenching and Excavation effective nationwide and in State Plan offices. Compliance Safety and Health Officers are authorized to initiate an inspection of any open trench or excavation, regardless of whether an apparent violation is observed; any incident, referral or complaint will result in an evaluation. See https://www.osha.gov/sites/default/files/enforcement/directives/CPL-02-00-161_0.pdf.

How frequent are these injuries?

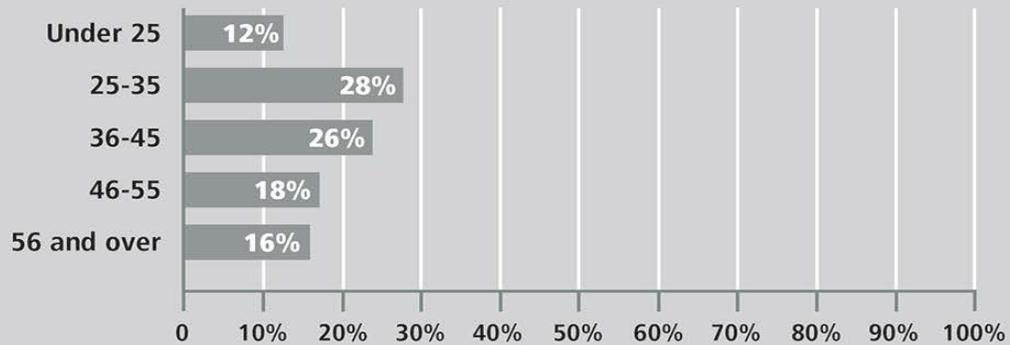
Dirt doesn't discriminate

Examining trench fatalities that occurred over a two-year period, *Equipment World* found that those who've spent years working in construction are just as vulnerable as new workers. During 2016-2017, the youngest trench collapse victim was 18 years old; the oldest was 66.

Company hierarchy also doesn't matter: four construction company owners died in trenches during this period.

In three incidents, there were two victims on one jobsite.

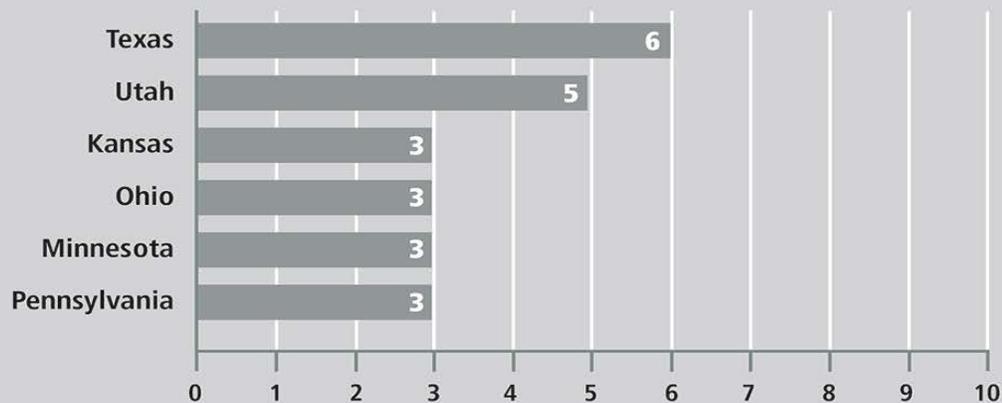
Average age of victim: 39 years old



Equipment World examination of 51 trench fatalities in 2016-17; age information unavailable on one fatality.

Top 6 states for trench deaths (2016-2017)

Trench fatalities occurred in 28 states, but these states had the highest number of deaths in the two-year period.



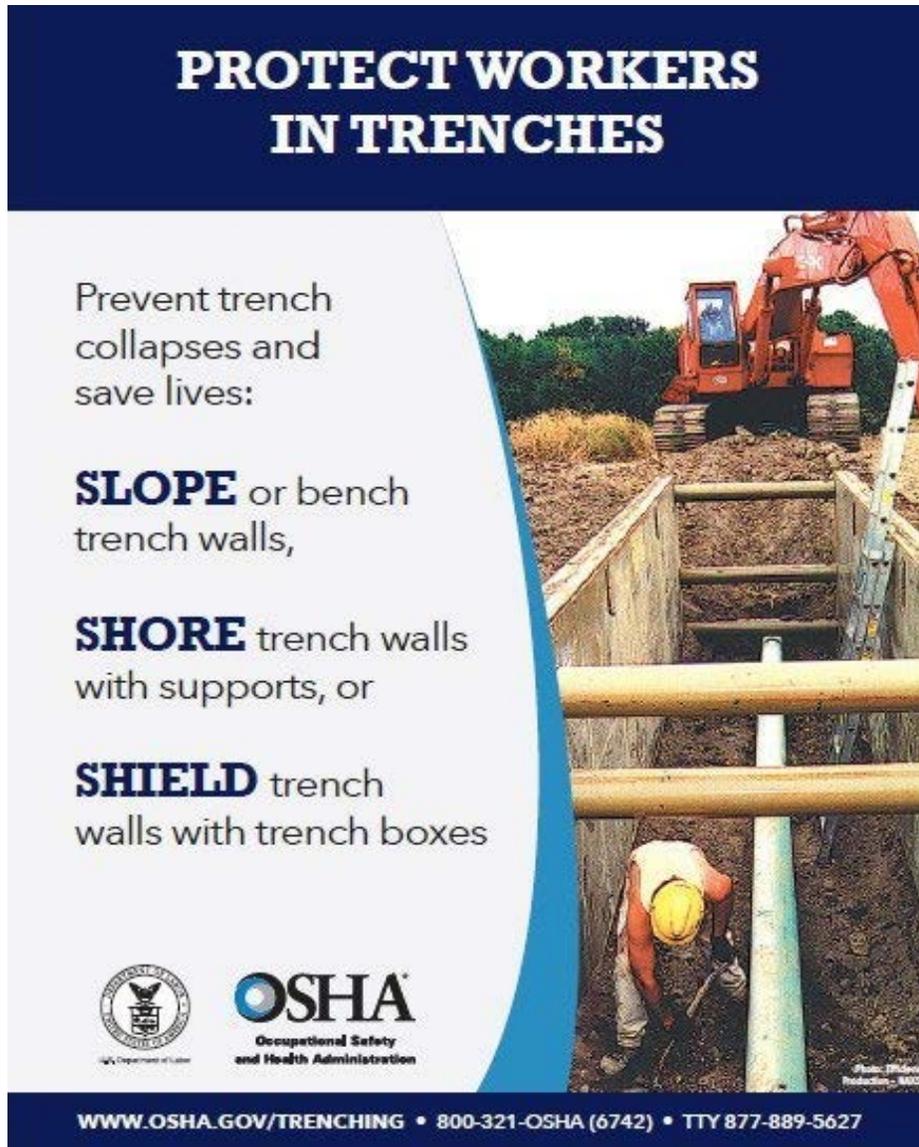
Equipment World examination of 51 trench fatalities in 2016-17

<https://www.equipmentworld.com/not-so-great-escapes-trench-collapse-survivors-live-with-fear-disabilities-and-recriminations/> Accessed Feb 4, 2019.

Exercise - Worker protection and exposure prevention methods

Hazards can be prevented.

Go back to the list of trench hazards that you developed. Work in small groups to complete a worksheet provided by the facilitator.



**PROTECT WORKERS
IN TRENCHES**

Prevent trench collapses and save lives:

SLOPE or bench trench walls,

SHORE trench walls with supports, or

SHIELD trench walls with trench boxes

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<https://www.osha.gov/SLTC/trenchingexcavation/> accessed Feb 4, 2019

During the report back to the group, make additional entries to those shown below.

Strategies and Protective Systems

Situation	Event	Strategy/Protective System
Cave-in or trench collapse		Overall: slope, shore, shield
	Spoil pile collapses wall and slides into trench	Spoil pile away from lip
	Lip shears off into trench	Soil analysis by competent person
	Material staged at lip causes wall collapse	Staging further from lip
	Vibration around the trench causes wall collapse or slide in	Prevent vibration
	Crack parallel to one wall	Soil analysis and daily inspection
	Too much or too little water affects soil	Soil analysis and daily inspection
	One soil layer compresses or gives way	Soil analysis and daily inspection

Situation	Event	Strategy/Protective System
Other-than cave-in		Overall: awareness, training for role or responsibility, team response to observation
	Injury or other medical emergency	Emergency Response Plan (ERP)
	Toxic gas/vapor seepage causes exposure	Evaluate before entry, during
	Toxic gas/vapor from external source collects	Evaluate before entry, during
	Falling load (pipe, supplies)	Protective gear, barrier at lip, operator training
	Shoring restraint failure	Daily inspection, alerting as needed
	Dislodged boulder or spoil material falls into trench	Lip barrier
	Heavy equipment rolls or falls into trench	Soil determination, operator training
	Worker falls in	Lip barrier
	Biological exposures from injured worker (blood/vomit/urine/feces)	ERP, training
	Lack of communication	Hand and other signals
	Contact with electrical lines	Planning, call 811
	Disruption of sewer/water/natural gas/steam/gas/compressed gas	Call 811
	Limited or inadequate egress	Ladder or other method

Regulations and guidelines for safe work practices

OSHA sets regulations that employers must meet as part of the overall responsibility to provide a workplace safe of recognized hazards. The Hazardous Waste Operations and Emergency Response Standard (HAZWOPER, 29CFR1910.120) specifies that excavations must be made shored and sloped consistent with 29CFR Part 1926. A useful explanation of the standard is found in the Field Operations Manual here: https://www.osha.gov/dts/osta/otm/otm_v/otm_v_2.html#6. Various protective systems designed to protect employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures are also described.

Important functions at any trench operation are performed by the Competent Person who should be able to demonstrate the following:

- Training, experience, and knowledge of:
 - soil analysis
 - use of protective systems
 - requirements of [29 CFR Part 1926 Subpart P](#)
- Ability to detect:
 - conditions that could result in cave-ins
 - failures in protective systems
 - hazardous atmospheres
 - other hazards including those associated with confined spaces
- Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required

The Competent Person is also responsible for inspections. The frequency and conditions requiring inspections follow:

- Daily and before the start of each shift
- As dictated by the work being done in the trench
- After every rainstorm
- After other events that could increase hazards, e.g. snowstorm, windstorm, thaw, earthquake, etc.
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur
- When there is a change in the size, location, or placement of the spoil pile
- When there is any indication of change or movement in adjacent structures

The qualifications of the Competent Person and results of inspections are phrased as 'should'. These are guidelines, not required by OSHA but a representation of good practice. Contrast this with the scope of the inspection shown in [1926.651\(k\)\(1\)](#):

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

Good work practice would include formal documentation of the qualifications of the Competent Person and a Standard Operating Procedure (SOP) for documentation of the findings of each inspection using a form to help assure that no item is overlooked.



Working Safely in Trenches

When done safely, trenching operations can reduce worker exposure to cave-ins, falling loads, hazardous atmospheres, and hazards from mobile equipment.

OSHA standards require that trenches and protective systems be inspected daily and as conditions change by a competent person before work begins.

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Never enter a trench unless:

- It has been properly inspected by a competent person.
- Cave-in protection measures are in place.
- There is a safe way to enter and exit.
- Equipment and materials are away from the edge.
- It is free of standing water and atmospheric hazards.

Prevent trench collapses:

- Trenches 5 feet deep or greater require a protective system.
- Trenches 20 feet deep or greater require a protective system designed by a registered professional engineer.

Protective systems for trenches:

- SLOPE or bench trench walls by cutting back the trench wall at an angle inclined away from the excavation.
- SHORE trench walls by installing aluminum hydraulic or other types of supports to prevent soil movement.
- SHIELD trench walls by using trench boxes or other types of supports to prevent soil cave-ins.

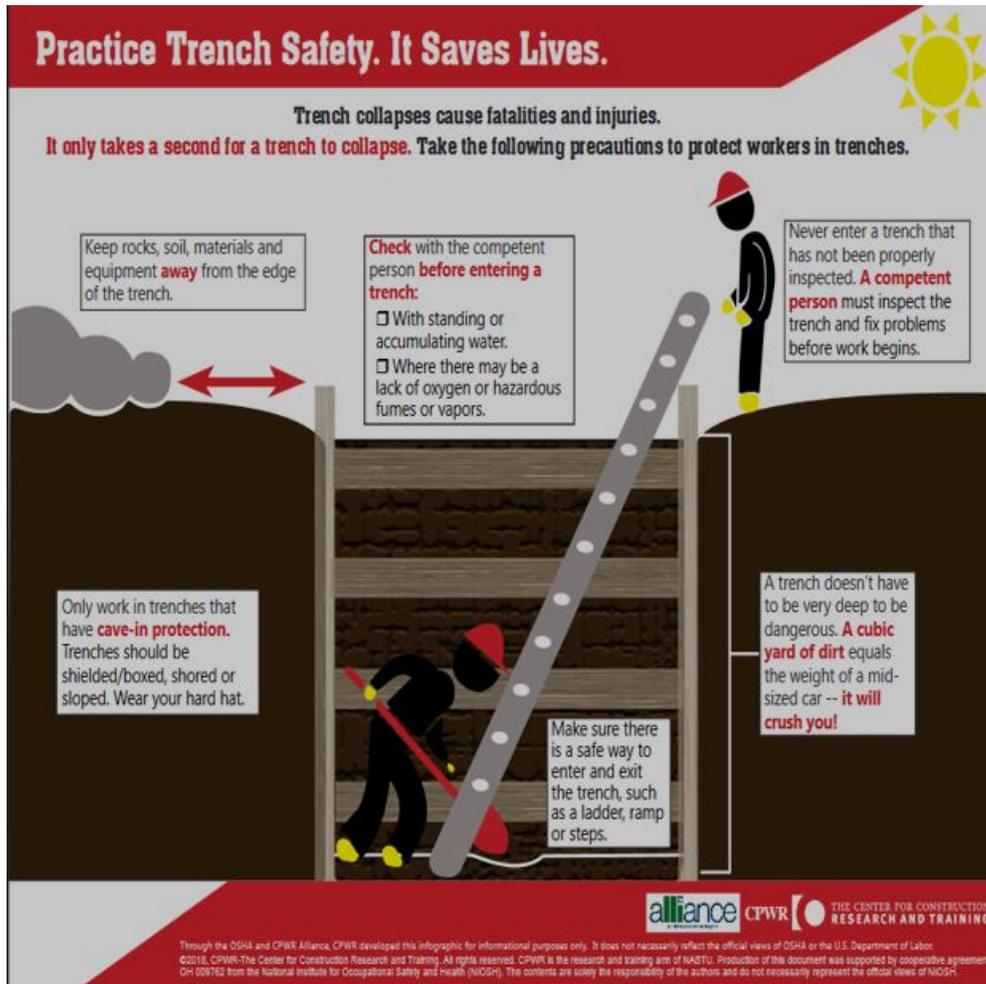


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www.osha.gov (800) 321-OSHA (6742)

OSHA 3043-0811 2018

https://www.osha.gov/Publications/trench/trench_safety_tips_card.pdf , accessed Feb 4, 2019.



https://www.cpwr.com/sites/default/files/publications_handouts-and-toolbox-talks_infographics_trench-safety-infographic.pdf, accessed Feb 4, 2019.

SOP elements for potential emergency during trench work

Emergency rescue equipment is required for trench operations where there is a reasonable expectation that there may be hazardous atmospheric conditions at an excavation. This includes respirators, safety harness and line or basket stretcher. 1926 subpart P does not include consideration of rescue for other hazards.

As part of the hazard assessment required at hazardous waste sites and industrial sites for emergency response planning, a more extensive list of potential hazards might be developed. Important considerations might include:

- Anticipated hazards
 - Cave-in
 - Physical hazard
 - Atmospheric hazard
 - Medical emergency
 - Hazardous material
 - Heat/cold stress
 - Biological exposures
- Emergency alerting systems
- Utility control
- Onsite vs offsite expertise
 - Equipment operators
 - Soil engineer
 - Medical
 - Trench rescue teams
 - Confined space rescue teams
- Equipment and supplies
 - Life support
 - Air bags
 - Sheeting/shoring
 - Protective gear
 - Generator
 - Lighting
- Information dissemination
- Traffic control
- Incident Command structure and implementation

Summary

During this part of the refresher program, did you:

- Describe risks of excavation?
- Describe types of collapses?
- Identify protection/preventive methods?
- Distinguish between regulations and safe work practices?
- Identify elements needed in an SOP if an emergency occurs?

Based on this exercise, what takeaways do you have as you go back to work?

Please ask any remaining questions.