



Oregon
OSHA

Department of Consumer
and Business Services

Excavations

*Safe practices for business owners
and contractors*

Excavations

*Safe practices for
business owners and contractors*

About this guide

Excavations – Safe practices for business owners and contractors is an Oregon OSHA Standards and Technical Resources publication.

Questions or comments?

Technical questions about this publication?

Contact Sky Wescott: 503-947-7440, sky.i.wescott@dcbs.oregon.gov

Comments or suggestions for improving this guide?

Contact tech.web@dcbs.oregon.gov

Piracy notice

Reprinting, excerpting, or plagiarizing this publication is fine with us as long as it's not for profit! Please inform Oregon OSHA of your intention as a courtesy.



Department of Consumer
and Business Services

Introduction.....	1
How much does soil weigh?	1
Excavations and trenches.....	1
What is an excavation?	1
What is a trench?.....	2
Plan before you dig.....	2
The role of the competent person	2
How cave-ins occur	2
How do cave-ins occur?	3
How soil is tested	3
Visual tests	3
Manual tests.....	3
Examples of manual tests:	3
Protective systems	4
Sloping and benching	4
What do benched slopes look like in type A, type B, and type C soil?	4
Shoring and shielding.....	4
What do shores and shields look like?	5
Getting in and out of an excavation	5
Materials and mobile equipment.....	5
When are spoils hazardous?	6
Hazardous atmospheres	6
Water accumulation	6

Working with hydraulic excavators and backhoe loaders	6
Entering the excavator’s swing area	7
Where do I post the warning signs?.....	7
Don’t allow anyone to stand under the boom, arm, or bucket!.....	7
Using quick-coupling devices improperly.....	7
Using unsafe rigging methods to drag a trench shield	7
Working near overhead power lines.....	8
What happens if you don’t notify the utility?	8
Stability and adjacent structures.....	8
Can you spot what is wrong with these images?	9
Safe practices checklist	11
Important terms.....	14
Getting help.....	16
Oregon OSHA services	16
Need more information?	17
Notes	18

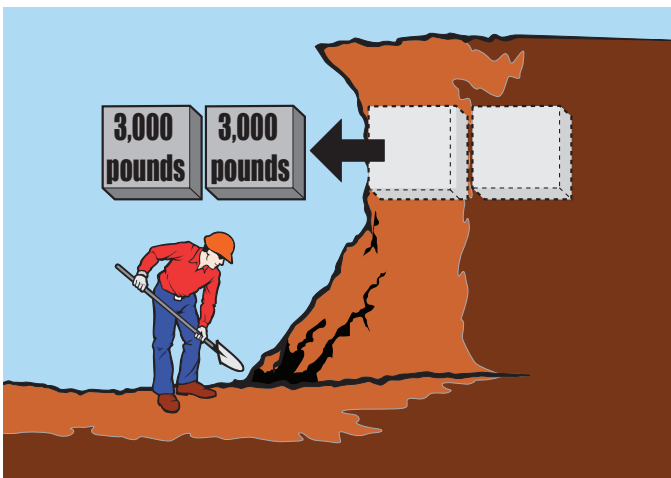
Introduction

A cave-in can trap you within seconds and kill you within minutes. Two cubic yards of soil weigh about 6,000 pounds. If you are buried, you will suffocate in less than three minutes. Even if you survive, the weight of the soil is likely to cause serious internal injuries.

But cave-ins are not the only dangers in excavation work. Lack of oxygen, toxic fumes, explosive gases, and buried power lines are also hazards. Unfortunately, many contractors who do excavation work still think it is too expensive or takes too much time to provide appropriate safeguards.

How much does soil weigh?

Two cubic yards of soil weigh about 6,000 pounds!



Excavations and trenches

Dig a hole in the ground and you have made an excavation. Excavations can be any size: wide, narrow, deep, or shallow.

A trench is a narrow excavation, not more than 15 feet wide at the bottom. If you install forms or other structures in an excavation that reduce its width to less than 15 feet, measured at the bottom, the excavation is also considered a trench.

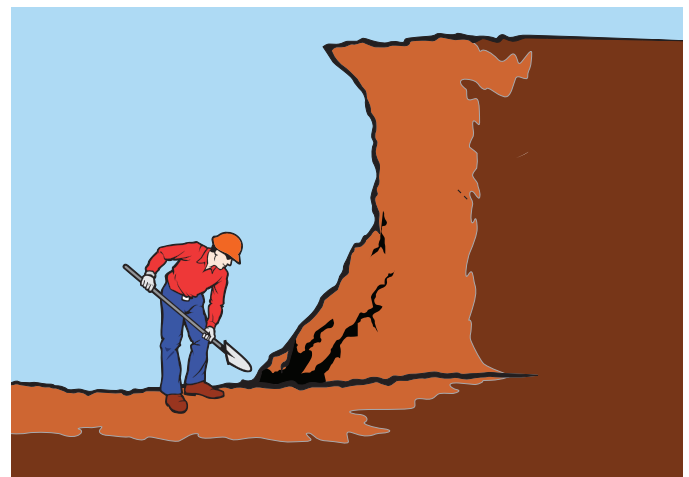
- If you work in an excavation that is five feet deep (or deeper), you must be protected from a cave-in.
- If a competent person determines that there is a potential for an excavation to cave-in, you must be protected, regardless of its depth.

What is an excavation?

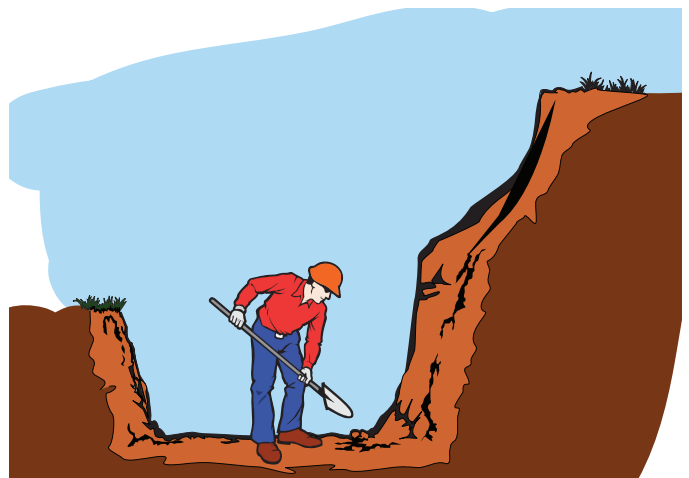
An excavation is a cut, cavity, or depression a person makes in the earth's surface.



Experienced emergency responders must be available if an entrant needs help.



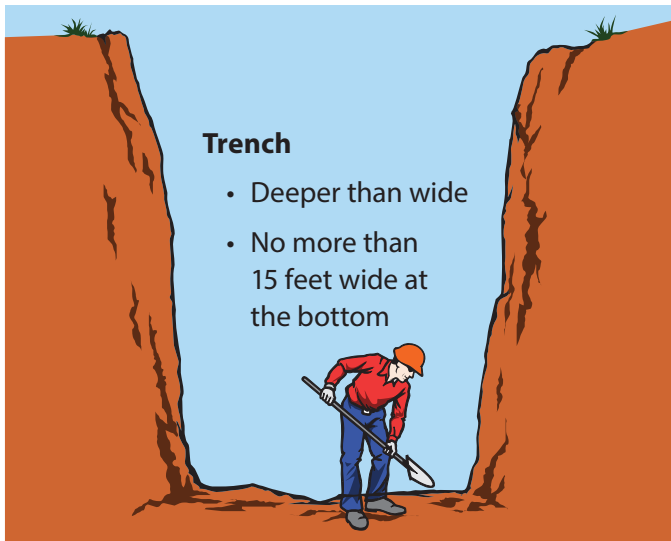
Sloughing dirt can injure or kill a worker.



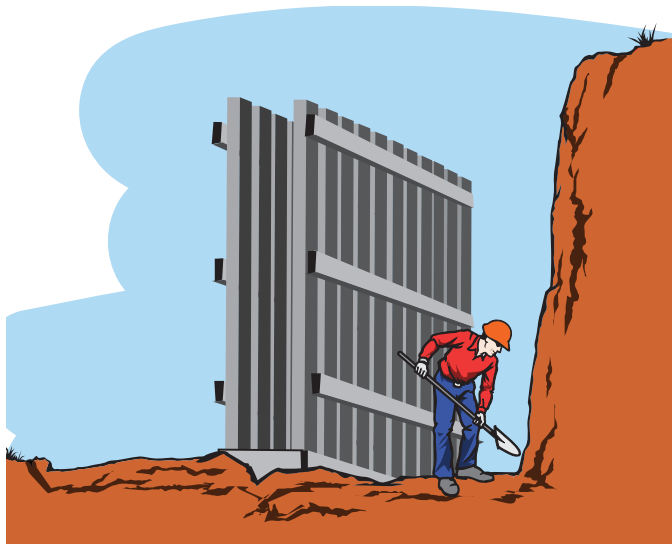
Be aware of the hazards you are exposed to.

What is a trench?

A trench is deeper than it is wide – and not more than 15 feet wide at the bottom.



Typical trench



Trench created by formwork

Plan before you dig

Planning reduces the chance that something will go wrong when you start a job. Consider the following before you start excavating:

- Debris near the excavation site that could create a hazard
- How employees will get in and out of the excavation

- How to protect people from falling into the excavation
- How to respond to emergencies
- Location of overhead power lines and underground utility lines (Call 811 from anywhere in Oregon for help in locating underground utility lines)
- Possibility of atmospheric hazards in the excavation
- Possibility of water in the excavation
- Stability of soil at the excavation site
- Stability of structures adjacent to the excavation site
- Vehicles and other mobile equipment that will operate near the excavation
- Weather conditions

The role of the competent person

A designated competent person who has training in soil analysis, protective systems, and Oregon OSHA's Division 3, Subdivision P, Excavation requirements must be on site to classify the soil, select a protective system, oversee installation, and inspect the system after installation.

If there are no existing hazards, the competent person can leave the excavation site for a short time, but must be present when a protective system is moved. Soil conditions could change or new hazards may arise that require the competent person's judgment.

The competent person must be knowledgeable about the type of soil excavated and the protective system used and must inspect them daily for signs of instability, damage, or other hazards; the competent person must approve any changes. Inspections are also necessary after heavy rain or activities such as blasting that may increase the risk of cave-in.

The competent person must have authority to immediately correct the hazards and to order employees to leave the excavation until the hazards have been corrected. An employee who is trained and can identify excavation hazards but doesn't have the authority to correct them is not a competent person.

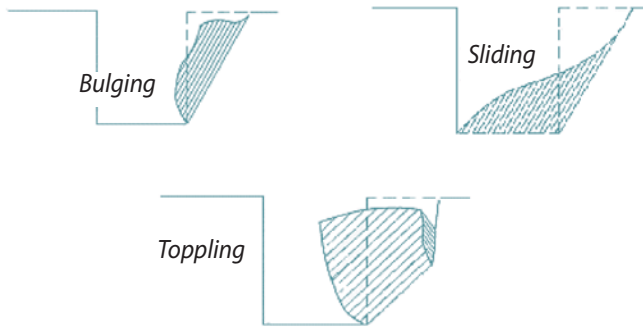
How cave-ins occur

Undisturbed soil stays in place because opposing horizontal and vertical forces are evenly balanced. When you create an excavation, you remove the soil that provides horizontal support. Soil will eventually

move downward into the excavation. The longer the face (a side of the excavation) remains unsupported, the more likely it is to cave in.

How do cave-ins occur?

When you create an excavation, you remove the soil that provides horizontal support.



Soil and stability

Some soils are more stable than others. The type of soil is one of the factors that determine the chance that an excavation will cave in. There are three basic soil types that you may encounter in Oregon:

- Type A – very stable. Clay is an example.
- Type B – less stable than type A soil. Crushed rock, silt, and soils that contain an equal mixture of sand and silt are examples.
- Type C – less stable than type B soil. Gravel and sand are examples.

Soil has other qualities that affect its stability. These include granularity, saturation, cohesiveness, and unconfined compressive strength.

- Granularity refers to the size of the soil grains; the larger the grains, the less stable the soil.
- Saturation means how much water soil will absorb.
- Cohesiveness means how well soil holds together; clay is a cohesive soil.
- Unconfined compressive strength is determined by a test that shows how much pressure it takes to collapse a soil sample. For example, type A soil must have an unconfined compressive strength of at least 1.5 tons per square foot.

How soil is tested

A competent person must conduct visual and manual soil tests before anyone enters an excavation. Visual and manual tests are a critical part of determining the type of protective system that will be used.

Visual tests

Visual testing involves looking at the soil and the area around the excavation site for signs of instability. The competent person might do visual tests such as the following:

- Observe the soil as it is excavated. Soil that remains in large clumps when excavated may be cohesive. Soil that breaks up easily is granular.
- Examine the particle sizes of excavated soil to determine how they hold together.
- Look for cracks or fissures in the faces of the excavation.
- Look for layers of different soil types and the angle of the layers in the face of the excavation that may indicate instability.
- Look for water seeping from the sides of the excavation.
- Look for signs of previously disturbed soil from other construction or excavation work.
- Consider vibration from construction activity or highway traffic that may affect the stability of the excavation.

Manual tests

Manual testing involves evaluating a sample of soil from the excavation to determine qualities such as cohesiveness, granularity, and unconfined compressive strength. Soil can be tested either on site or off site, but should be tested as soon as possible to preserve its natural moisture.

Examples of manual tests:



Plasticity test. Shape a sample of moist soil into a ball and try to roll it into threads about 1/8-inch in diameter. Cohesive soil will roll into 1/8-inch threads without crumbling.



Dry strength test. Hold a dry soil sample in your hand. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it's granular. If the soil breaks into clumps that are hard to break into smaller clumps, it may be clay combined with gravel, sand, or silt.



Thumb penetration test. This test roughly estimates the unconfined compressive strength of a sample. Press your thumb into the soil sample. If the sample resists hard pressure, it may be type A soil. If it is easy to penetrate, the sample may be type C.

Pocket penetrometers offer more accurate estimates of unconfined compressive strength. These instruments estimate the unconfined compressive strength of saturated cohesive soils. When pushed into the sample, an indicator sleeve displays an estimate in tons per square foot or kilograms per square centimeter.

Protective systems

The basic methods for protection from cave-ins are sloping, benching, shoring, and shielding. The method you should use depends on factors such as soil type and water content, excavation depth and width, the nature of the work, and nearby activities that could increase the risk of a cave-in. The competent person has the responsibility for considering these factors and for determining the appropriate protective system.

Sloping and benching

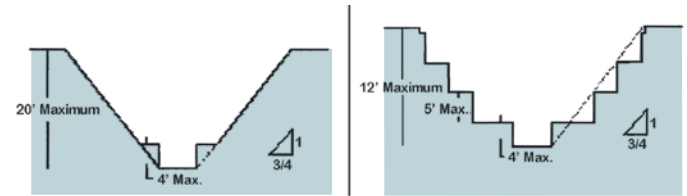
Sloping and benching provide protection by removing material from the face of an excavation at an angle to its floor; in general, the flatter the angle, the greater the protection. Benches are cuts in the slope that give it a stair-step appearance. There are two types of benches: simple and multiple.

Rain, vibration, and pressure from heavy equipment can make soil unstable and increase the risk of a cave-in. Sloped or benched excavations that show signs of cracks, bulges, or clumps of soil that fall away from the faces are dangerous and must be inspected

by a competent person. You must immediately get out of the excavation and stay away until the competent person determines it is safe to enter. NOTE: Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer according to 1926.652(b) and (c).

What do benched slopes look like in type A, type B, and type C soil?

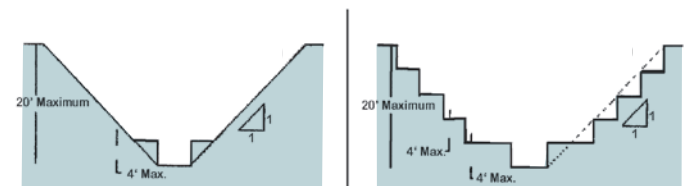
Type A soil: simple and multiple benches



Simple Bench Excavation

Multiple Bench Excavation

Type B soil: simple and multiple benches



Simple Bench Excavation

Multiple Bench Excavation

Type C soil: simple and multiple benches

- Benching in type C soil requires a registered professional engineer.

Shoring and shielding

Shoring and shielding systems can prevent cave-ins in excavations with or without sloped or benched faces. The safest way to install and remove them is from outside the excavation.

Shores are vertical or horizontal supports that prevent the faces of an excavation from collapsing. Vertical shores are called uprights. They are easy to install, relatively inexpensive, and often used in stable soil or in shallow excavations that have parallel faces. Vertical shores must be sized for the excavation's dimensions and soil type.

Horizontal shores are called walers. Walers are often used when unstable soil makes sloping or benching impractical and when sheeting is necessary to prevent soil from sliding into the excavation.

Shields provide employees a safe work area by protecting them from collapsing soil. Shields don't prevent cave-ins, but "shield" workers if a face does collapse. They are usually placed in the excavation by heavy equipment.

Shoring and shielding systems are available from manufacturers in a variety of dimensions, usually aluminum or steel, or they can be custom-built from tabulated data approved by a registered professional engineer. Manufacturers will also provide tabulated data with their systems that includes engineering specifications, depth ratings, special instructions, and system limitations. Only by carefully studying and understanding the manufacturer's tabulated data can the competent person choose the correct protective system.

What do shores and shields look like?



Horizontal shore

Photo credit: Speed Shore Corp.



Trench shield

Photo credit: Speed Shore Corp.



Two employees in excavation making pipe connections.

Getting in and out of an excavation

An excavation that has a depth of four feet or more must have a means for entering and exiting — such as a stairway, ladder, or ramp — within 25 feet of employees; their safety may depend on how quickly they can climb out.

Structural ramps that are used to enter and exit the excavation must have nonslip surfaces and be designed by a competent person. A competent person must also evaluate ramps made from soil that are used to enter and exit an excavation.



Vertical shore

Photo credit: Speed Shore Corp.

Materials and mobile equipment

Excavated soil, called spoils, piled too close to the edge of an excavation can cause a cave-in. So can heavy equipment. Keep spoils and heavy equipment at least two feet from the edge; when possible, use vertical shores or shields that extend above the top of the excavation to restrain spoils. Spoils and heavy equipment that exert an excessive load on ground adjacent to the excavation could cause a cave-in.

See “Can you spot what is wrong” on Page 9 for more examples of unsafe trenches.

When are spoils hazardous?

Spoils and heavy equipment that exert an excessive load on ground adjacent to an excavation could cause a cave-in.

Hazardous atmospheres

Hazardous atmospheres can occur in excavations near landfills, sites contaminated by leaking gas lines or storage tanks, in sewers, and in other confined spaces. If these conditions are possible, a competent person must test for oxygen deficiency (oxygen levels less than 19.5 percent) and hazardous atmospheres before you can enter.



Water accumulation

Water makes soil unstable. You cannot enter an excavation when water has built up unless you are protected from the unstable soil. Protection includes specialized support systems and water-removal equipment. A competent person must inspect the excavation and monitor methods used to control water accumulation.



Working with hydraulic excavators and backhoe loaders

You can dig an excavation with a hand shovel or an excavator. Use a hand shovel improperly and you risk blisters. Use an excavator improperly and you risk a life. Too many workers are hurt because they do not follow safe practices when they use hydraulic excavators and backhoe loaders. Most accidents happen for three reasons:

- Entering the excavator's swing area
- Using quick-coupling devices improperly
- Using unsafe rigging methods to drag a trench shield

Entering the excavator's swing area

Be aware of the excavator's swing area and blind spots. Always maintain at least three feet of unimpaired clearance between the excavator's rotating superstructure and adjacent objects. Keep others outside the area by marking it with rope, tape, or a similar barrier, if necessary.

- Post warning signs that say DANGER – STAY CLEAR on all sides of the excavator.
- Don't allow anyone to stand under a suspended load or the boom, arm, or bucket.
- Keep the bucket as close to the ground as possible when workers are attaching loads.
- Lower the boom to a safe position with the bucket on the ground and turn off the excavator before getting off.

Where do I post the warning signs?

Post warning signs that say DANGER – STAY CLEAR on all sides of the excavator [from Division 3, Subdivision O, 437-003-0090(1)]



In this picture, when the equipment rotates, a pinchpoint would be created by the rotating superstructure and the dumptruck. Being in this area could be fatal.

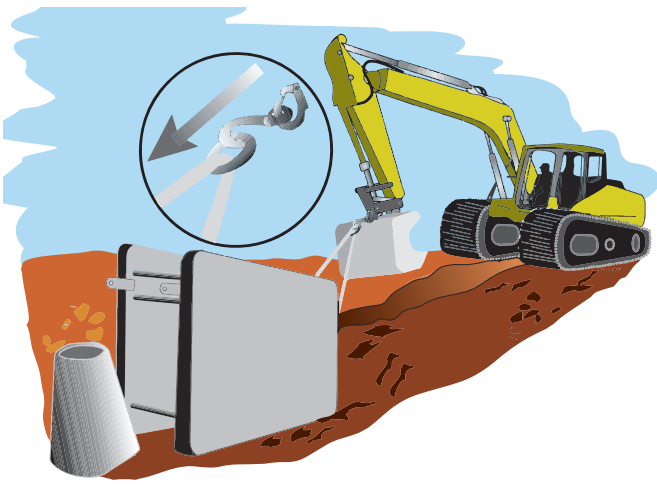
Don't allow anyone to stand under the boom, arm, or bucket!



Using quick-coupling devices improperly

Aftermarket "quick-coupling" devices make it easy to change buckets or replace other attachments. However, a number of workers have been killed when the coupling devices have not been locked properly and the buckets have detached. Manufacturers of quick couplers recognized the hazard and newer devices have locks that prevent buckets from detaching unintentionally, but not all users may be aware of the problem. Retrofit locking pins are available for older equipment.

- Follow the manufacturer's instructions for using positive locks on quick-disconnect equipment.
- Securely latch attachments such as quick-disconnect buckets before beginning work.
- Make frequent visual inspections of quick-disconnect systems — especially after changing attachments.



Using unsafe rigging methods to drag a trench shield

Using an excavator to drag a shield through a trench can put tremendous forces on rigging components. For example, the force required to drag a 10,000-pound trench shield through a narrow trench will increase dramatically with resistance from the trench walls or from plowing of the front of the shield. Know the sling's rated capacities and never exceed them. The whiplash effect of a broken or improperly rigged sling can kill anyone in its path.

- Follow the instructions in the operator's manual when using an excavator to lift or move an object.
- "Lift and drag" to move a trench shield horizontally in a trench; avoid "plowing" with the front of the shield. Plowing significantly increases the tension on the slings.
- Some manufacturers of trench shields warn workers to stay out of the "box" while it is being moved. Always check the manufacturers' requirements.
- Never use damaged chains or frayed cables, slings, straps, or ropes.
- Use an appropriate lifting shackle for attaching cables or slings.
- Never stand in line with, or next to, a sling that is under tension.

Working near overhead power lines

Before you do any work within 10 feet of a high-voltage power line, notify the utility that controls the line at least two business days before you begin. If you don't

know who controls the line, any utility can help you.

You need to tell the utility the location, what work you need to do, and when you need to do it.

To ensure that you do the work safely, the utility may help you with tasks such as the following:

- Coordinate work schedules
- Identify and provide temporary visual barriers that help prevent encroachment with the lines
- De-energize and ground the lines
- Temporarily raise or move the lines

What happens if you don't notify the utility?

Oregon's Overhead Line Safety Act and Oregon OSHA rules require that you stay at least 10 feet away from these utilities. You could be responsible for all damages and costs that result from an electrical contact. There is also a potential penalty of up to \$70,000 for violations of these rules, in addition to the cost of injuries and repairs to the system.

Stability and adjacent structures

Make sure that structures, roadways, and sidewalks adjacent to the excavation are adequately supported.

- Use an appropriate support system – such as shoring or bracing – if the excavation could affect the stability of nearby buildings, sidewalks, and roads.
- Don't excavate below the base or footing of any foundation that might endanger employees, unless you do one of the following:
 - Use a support system that protects employees and keeps the structure stable.
 - Ensure that the excavation is in stable rock
 - Have a registered professional engineer determine that the structure will not be affected by the excavation work.
 - Have a registered professional engineer determine that the excavation work will not endanger employees.

Can you spot what is wrong with these images?





Two workers are exposed to a cave-in hazard while building a retaining wall next to a face cut. This illustrates that not just utility workers can be exposed to excavation/cave-in hazards, and that employers need to evaluate work areas and recognize cave-in hazards.



Protective shoring system did not extend to the top of the excavation. Also, no cave-in protection at the open end of the trench box.



Excavation is not sloped at an angle no steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal).



Unsafe egress. Employee egressing from trench had no choice but to have help to get out safely. Foreman is the person with the red hard hat helping out employee egressing.



Protective shoring system did not extend to the top of the excavation.

Note: A professional engineer must design excavations deeper than 20 feet. Also, more hazards, including improper use of equipment based on the manufacturer's requirement for the protective system or failure of competent person duties, may be present.

Safe practices checklist

All your answers should be “Yes!”

Yes No

- | | | |
|--|--------------------------|--------------------------|
| 1. A designated competent person at the excavation site understands visual and manual test methods, use of protective systems, the hazards of excavation work, and the requirements of Oregon OSHA's excavation standards. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. A designated competent person inspects the excavation, adjacent areas, and protective systems daily before work begins, as necessary throughout the shift, and after rain or other conditions that could increase the risk of a hazard. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. A designated competent person has authority to immediately correct hazards and to order employees to leave the excavation until the hazards have been corrected. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Sewer, telephone, fuel, electric, or water lines near the site have been located and clearly marked. Contact the Oregon Utility Notification Center for help in locating underground utility lines – call 811 in Oregon. | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Hard hats are required whenever there are overhead hazards. | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Debris and other unnecessary material have been cleared from the site. | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Employees who are exposed to vehicle traffic are provided with and wear high-visibility garments. | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Excavations at remote sites have appropriate warning barriers. | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Employees are protected from loose rock or soil that could fall into the excavation. | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Employees are prohibited from working or standing under suspended loads. | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Employees are required to stand away from vehicles that are being loaded or unloaded. | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Employees are prohibited from working on the faces of sloped or benched excavations when other employees are below them. | <input type="checkbox"/> | <input type="checkbox"/> |

	Yes	No
13. Mobile equipment operators have an effective way of knowing when they are too close to the edge of an excavation. Examples include barricades, hand or mechanical signals, stop logs, or grading away from the excavation.	<input type="checkbox"/>	<input type="checkbox"/>
14. Spoils, equipment, and tools are at least two feet from the edge of the excavation.	<input type="checkbox"/>	<input type="checkbox"/>
15. Walkways that cross over excavations more than six feet deep have standard guard rails and toe boards.	<input type="checkbox"/>	<input type="checkbox"/>
16. Underground installations are protected, supported, or removed when the excavation is open.	<input type="checkbox"/>	<input type="checkbox"/>
17. Excavations that have a depth of four feet or more have ladders or other means of safe access within 25 feet of employees.	<input type="checkbox"/>	<input type="checkbox"/>
18. Ladders are secured and extend three feet above edge of the excavation.	<input type="checkbox"/>	<input type="checkbox"/>
19. A designated competent person designs the structural ramps that employees use to enter and exit the excavation.	<input type="checkbox"/>	<input type="checkbox"/>
20. Structural ramps have nonslip surfaces.	<input type="checkbox"/>	<input type="checkbox"/>
21. Employees are prohibited from entering an excavation that shows signs of water accumulation, unless they are protected from the risk of a cave-in.	<input type="checkbox"/>	<input type="checkbox"/>
22. A competent person monitors the methods used to control water from accumulating in an excavation.	<input type="checkbox"/>	<input type="checkbox"/>
23. Surface water or runoff is diverted away from the excavation.	<input type="checkbox"/>	<input type="checkbox"/>
24. The atmosphere in an excavation is tested when the possibility of a hazardous atmosphere exists.	<input type="checkbox"/>	<input type="checkbox"/>
25. Employees are protected from hazardous atmospheres or atmospheres containing less than 19.5 percent oxygen.	<input type="checkbox"/>	<input type="checkbox"/>
26. Emergency rescue equipment is available when hazardous atmospheres could exist in an excavation.	<input type="checkbox"/>	<input type="checkbox"/>

	Yes	No
27. Employees who work in excavations are trained to use appropriate personal protective equipment.	<input type="checkbox"/>	<input type="checkbox"/>
28. A designated competent person has classified soil at the excavation site with at least one manual test and one visual test.	<input type="checkbox"/>	<input type="checkbox"/>
29. Materials and equipment used for protective systems at the excavation site are chosen based upon soil analysis, excavation depth, and expected loads.	<input type="checkbox"/>	<input type="checkbox"/>
30. Materials and equipment used for protective systems are inspected regularly and are in good condition.	<input type="checkbox"/>	<input type="checkbox"/>
31. Damaged equipment is removed immediately from service.	<input type="checkbox"/>	<input type="checkbox"/>
32. Protective systems are installed without exposing employees to the risk of cave-ins.	<input type="checkbox"/>	<input type="checkbox"/>
33. Structures, roadways, and sidewalks adjacent to the excavation are adequately supported.	<input type="checkbox"/>	<input type="checkbox"/>
34. Excavations are backfilled when protective systems are removed.	<input type="checkbox"/>	<input type="checkbox"/>
35. Appropriate sloping, shoring, or shielding protects employees who work in excavations five or more feet deep.	<input type="checkbox"/>	<input type="checkbox"/>
36. A designated competent person determines the type of shield used at a site by considering factors such as the nature of the work, excavation dimensions, soil characteristics, and equipment used to lower or position the shield.	<input type="checkbox"/>	<input type="checkbox"/>
37. Employees in excavations more than 20 feet deep are protected by a system designed by a registered professional engineer.	<input type="checkbox"/>	<input type="checkbox"/>
38. Shields are installed so that they do not move laterally.	<input type="checkbox"/>	<input type="checkbox"/>
39. Employees are not allowed in shields that are moved vertically.	<input type="checkbox"/>	<input type="checkbox"/>

Important terms

Adjacent	The area within a horizontal distance from the edge of a vertical-sided excavation equal to the depth of the excavation.
Aluminum hydraulic shoring	A pre-engineered system of aluminum hydraulic cylinders (cross braces) and vertical rails (uprights) or horizontal rails (walers). Designed to support the faces of an excavation.
Benching	A method of sloping the sides of an excavation by forming a series of steps.
Cave-in	The separation of a mass of soil or rock from the face of an excavation into an excavation.
Competent person	A person capable of identifying existing and predictable hazards in the surroundings or working conditions and who has authorization to take prompt corrective measures to eliminate the hazards.
Cross brace	Horizontal member of a shoring system installed perpendicular to the sides of an excavation, the end of which bears against uprights or wales.
Excavation	A cut, cavity, or depression a person makes in the earth's surface.
Face	The side of an excavation.
Hazardous atmosphere	An atmosphere that could cause an injury or illness. Examples: explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, or toxic.
Previously disturbed soil	Soil that has been disturbed from excavation work or other digging. Soil cannot be classified type A if it has been previously disturbed. Use visual tests to identify previously disturbed soil.
Protective system	A system designed to protect workers in excavations. Sloping and benching, shores, and shields are examples of protective systems.
Ramp	An inclined walking or working surface constructed from earth or from structural materials such as steel or wood.

Registered professional engineer	A professional engineer registered in the state where the work is performed. A professional engineer registered in any state can approve designs for manufactured protective systems or tabulated data used in interstate commerce.
Sheeting	Component of a shoring system that prevents soil from sliding into an excavation.
Shield	A structure able to withstand forces caused by a cave-in. Shields can be manufactured or custom-built in accordance with 1926.652(c)(2)-(c)(4). Shields are also called trench boxes and trench shields.
Shore	A structure that supports the sides of an excavation and prevents cave-ins.
Sloping	A method of inclining the face of an excavation to minimize the risk of a cave-in. The maximum allowable slope varies with soil type, environment, and work done at the excavation site.
Soil	Weathered rock, gravel, sand, or combinations of clay, silt, and loam.
Stable rock	Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.
Structural ramp	A ramp made of steel or wood, usually for vehicle access. Ramps made from soil or rocks are not considered structural ramps.
Support system	A system that supports an adjacent structure, underground installation, or the face of an excavation.
Surcharge	A load exerted on ground adjacent to an excavation.
Tabulated data	Tables and charts, approved by a registered professional engineer, used to design and construct a protective system. At least one copy of the data and the name of the engineer who approved it must be kept at the site while the system is constructed.
Trench	An excavation that is longer than wide. In general, the depth is greater than the width, but the width measured at the bottom of the trench is not greater than 15 feet.
Upright	The vertical member of a shoring system.

Getting help

The following sources offer more information about how to protect yourself, your co-workers, and your employees from [silicosis](#).

- ▶ Your insurance carrier offers on-site safety and health consultations, including air sampling and air monitoring. Contact your carrier to request a consultation.
- ▶ Oregon OSHA offers no-charge, on-site workplace consultations, full-service safety and health training, a video-lending library, and information online. To contact us, see the back page of this publication.
- ▶ Other resources
 - National Institute for Occupational Safety and Health (NIOSH), www.cdc.gov/niosh
 - Occupational Safety and Health Administration (OSHA), www.osha.gov
 - Mine Safety and Health Administration (MSHA), www.msha.gov

Oregon OSHA services

Oregon OSHA offers a wide variety of safety and health services to employers and employees:

Enforcement

- ▶ **503-378-3272; 800-922-2689; enforce.web@dcbs.oregon.gov**
- Offers pre-job conferences for mobile employers in industries such as logging and construction.
- Inspects places of employment for occupational safety and health hazards and investigates workplace complaints and accidents.
- Provides abatement assistance to employers who have received citations and provides compliance and technical assistance by phone.

Consultative Services

- ▶ **503-378-3272; 800-922-2689; consult.web@dcbs.oregon.gov**
- Offers no-cost, on-site safety and health assistance to help Oregon employers recognize and correct workplace safety and health problems.
- Provides consultations in the areas of safety, industrial hygiene, ergonomics, occupational safety and health programs, assistance to new businesses, the Safety and Health Achievement Recognition Program (SHARP), and the Voluntary Protection Program (VPP).

Standards and Technical Resources

- ▶ **503-378-3272; 800-922-2689; tech.web@dcbs.oregon.gov**
- Develops, interprets, and gives technical advice on Oregon OSHA's safety and health rules.
- Publishes safe-practices guides, pamphlets, and other materials for employers and employees.
- Manages the Oregon OSHA Resource Center, which offers safety videos, books, periodicals, and research assistance for employers and employees.

Oregon OSHA services *(continued)*

Appeals

► 503-947-7426; 800-922-2689; admin.web@dcbs.oregon.gov

- Provides the opportunity for employers to hold informal meetings with Oregon OSHA on concerns about workplace safety and health.
- Discusses Oregon OSHA's requirements and clarifies workplace safety or health violations.
- Discusses abatement dates and negotiates settlement agreements to resolve disputed citations.

Conferences

► 503-378-3272; 888-292-5247, Option 1; oregon.conferences@dcbs.oregon.gov

- Co-hosts conferences throughout Oregon that enable employees and employers to learn and share ideas with local and nationally recognized safety and health professionals.

Public Education

► 503-947-7443; 888-292-5247, Option 2; ed.web@dcbs.oregon.gov

- Provides workshops and materials covering management of basic safety and health programs, safety committees, accident investigation, technical topics, and job safety analysis.

Need more information? Call your nearest Oregon OSHA office.

Salem Central Office

350 Winter St. NE
Salem, OR 97301-3882

Phone: 503-378-3272
Toll-free: 800-922-2689

Fax: 503-947-7461
en Español: 800-843-8086
Website: osha.oregon.gov

Bend

Red Oaks Square
1230 NE Third St., Suite A-115
Bend, OR 97701-4374
541-388-6066
Consultation: 541-388-6068

Eugene

1500 Valley River Drive, Suite 150
Eugene, OR 97401-4643
541-686-7562
Consultation: 541-686-7913

Medford

1840 Barnett Road, Suite D
Medford, OR 97504-8293
541-776-6030
Consultation: 541-776-6016

Pendleton

200 SE Hailey Ave.
Pendleton, OR 97801-3072
541-276-9175
Consultation: 541-276-2353

Portland

Durham Plaza
16760 SW Upper Boones
Ferry Road, Suite 200
Tigard, OR 97224-7696
503-229-5910
Consultation: 503-229-6193

Salem

1340 Tandem Ave. NE, Suite 160
Salem, OR 97301-8080
503-378-3274
Consultation: 503-373-7819

Notes

[illegible]

Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

