INTRODUCTION TO TRENCHING

OBJECTIVES

Upon completion of this section, the participant should be able to:

1. Describe the difference between an excavation and a trench.
2. List trench dimensions parameters and describes the conditions for trench regulation and exemption for residential construction.
3. Acquire a working knowledge of trenching terminology.
4. Identify the responsibilities of the competent person, Registered Professional Engineer, Employer, and Worker.

Introduction

In 1907, George Goethals was appointed by President Theodore Roosevelt to be Chairman and Chief Engineer or the Panama Canal Project. During this project, a treacherous excavation known as the Culebra Cut was made through the jungle. Being over 270 feet deep in some places, the walls of this excavation were notorious for collapsing. After the project was finished, Mr. Goethals was retained by a city in the Eastern United States to help them solve a situation where landslides continuously covered up railroad tracks in a ravine. In looking at the problem, Mr. Goethals was reminded of the Culebra Cut. After a short time, he issued his report back to the city fathers. It read simply, "let it slide down and shovel it out".

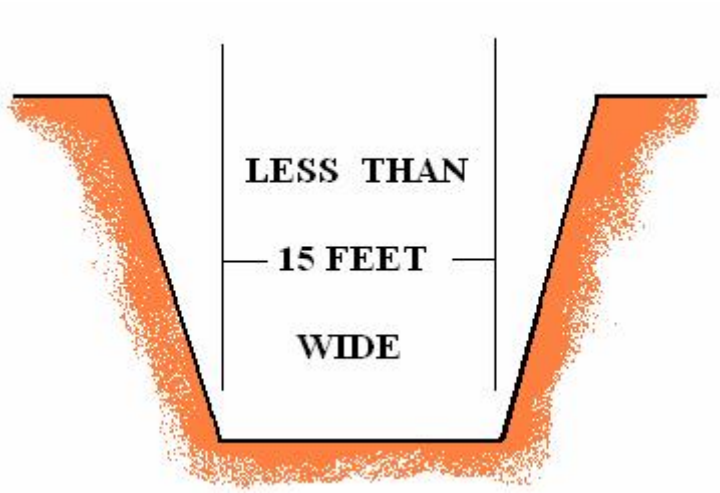
While this approach may have had some appeal in the early 1900's, the modern contractor cannot conduct trenching activities this way. Trenching and soil excavation is very common and important construction activities. In most cases, these openings in the earth are either for new construction or repair purposes. Done correctly, it can be a very safe activity. Done carelessly however, it can be deadly. Each year, over 100 workers are killed and many more are seriously injured in trenching accidents. ***Also, trenching and excavation accidents account for some of the largest fines imposed by OSHA.***

Standards, which addressed these activities, were first initiated in 1969. On October 31, 1989, OSHA's standards for Trenching and Excavations (CFR 1926.650 - 1926.652 and Appendices) became law. This standard will be the basis for this text.

Before studying the specific parts of this Standard, we need to be aware of a few definitions:

EXCAVATION: An excavation is any opening or depression in the earth's surface. It can be as narrow as a backhoe bucket or as wide as an open pit mine. All excavations are man-made and have unsupported walls of earth or rock as its borders.

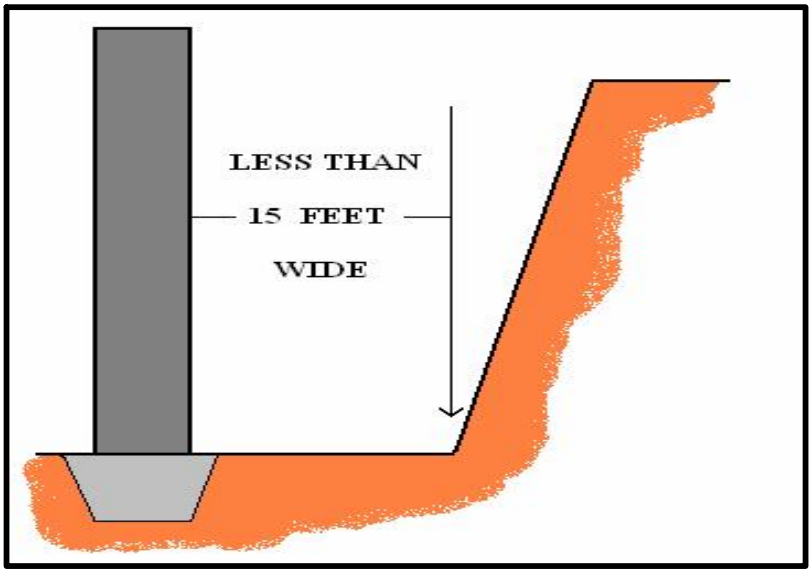
TRENCH: An excavation in which material removal forms a narrow opening in the ground. Unlike large excavations, a trench is generally deeper than it is wide. OSHA considers an excavation to be a trench if it is 15 feet wide or less at the bottom of the excavation.



You can see that all trenches are excavations, but not all excavations are trenches.

The definition of trench also implies that if any structure within an excavation reduces the width between that structure and the excavation wall to 15 feet or less, that part of the excavation is also considered to be a trench and subject to 29 CFR 1926.652. Commonly, this situation occurs when concrete foundation forms are placed. There was a lot of speculation of whether the space between the forms and the excavation wall constituted a trench. This question was answered in 1995 when OSHA issued a statement exempting house foundation basement excavations from 29 CFR 1926.652 under the following conditions

- The house foundation basement excavation is less than 7.5 feet deep or is benched at least 2 feet horizontally for every 5 feet or less vertically;
- The maximum horizontal width (excavation face to form a wall) at the bottom of the excavation is as wide as practical but not less than 2 feet;
- All soil, equipment, and material surcharge loads are no closer in distance to the top edge of the excavation than the excavation is deep. However, when front end loaders are used to dig the excavations, the soil surcharge load shall be placed as far back from the edge as possible but never closer than 2 feet:



- There is no water, surface tension cracks, or other environmental conditions present that reduce the stability of the excavation;
- There is no heavy equipment operating in the vicinity that cause vibration to the excavation while employees are in the excavation;
- Work crews in the excavation are the minimum number needed to perform the work;
- The work has been planned and is carried out in a manner to minimize the time employees are in the excavation.

It should be emphasized that this exemption was made for residential house foundations only. Similar situations involving commercial foundations, industrial foundations, or other types of excavations will still be considered trenches and be subject to the Trenching Standard.

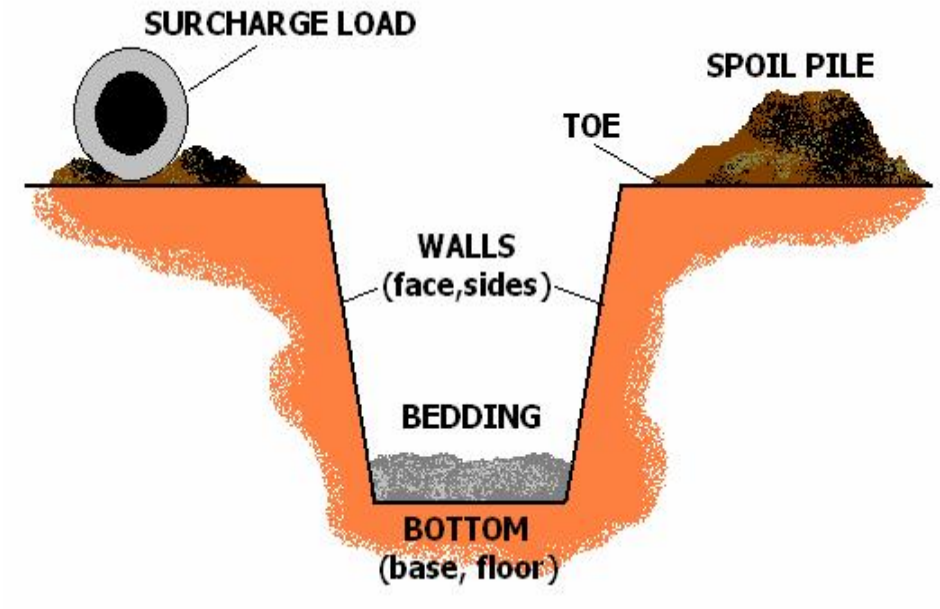
PARTS OF A TRENCH

So that we can be consistent in our terminology, let's look at the parts of a trench:

WALL: (FACE, SIDES) the sides of the trench.

BOTTOM: (BASE, FLOOR) the bottom of the trench.

SPOIL: the pile of excavated earth that was removed to form the trench. The leading edge of this pile is called the TOE.



SURCHARGE LOAD: any weight on top of the surface of the soil, which would add extra stress to the walls of the trench. Spoil piles, backhoes, rocks, vehicles, buildings, or other loads placed near the trench opening would be surcharge loads.

BEDDING: A material that is usually placed around a pipe prior to backfilling. In most cases, bedding is gravel, sand, or fine crushed rock, and it extends from 5 inches below the pipe to 6 inches above the pipe.

SHAPE OF THE TRENCH

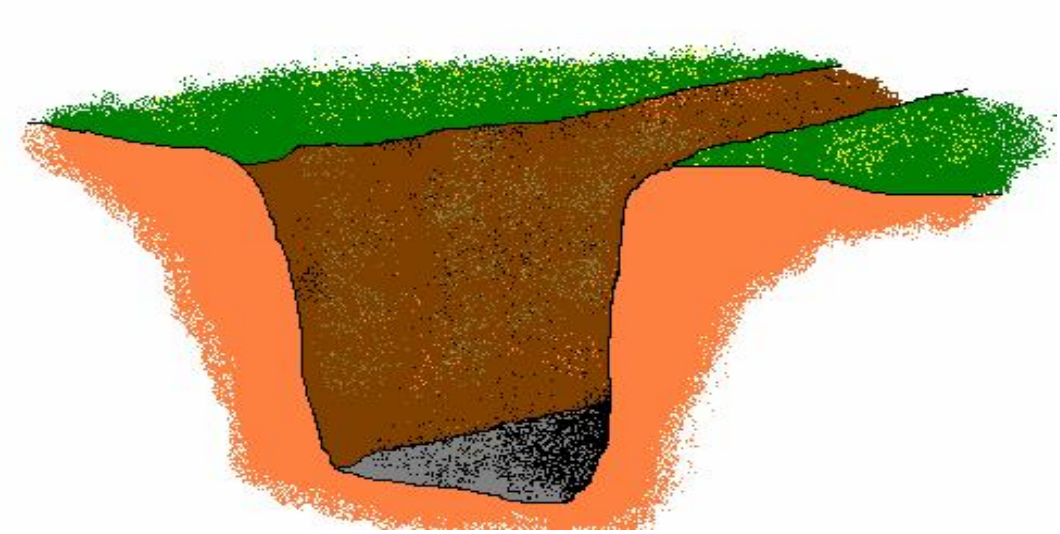
The shape of a trench is determined by:

Purpose of the trench:

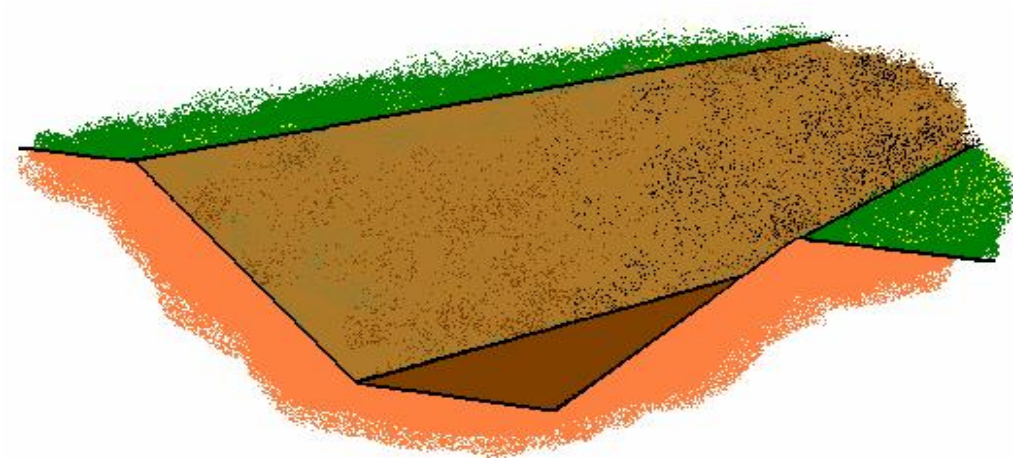
- The type of soil the trench is being dug in:
- The size of pipe or conduit that is going into the trench:
- Availability of shielding or shoring;
- Location of buildings, utilities, etc.
- Location of the trench (roadway, open field, etc.); Conduit loading requirements.

Specific trench shapes include:

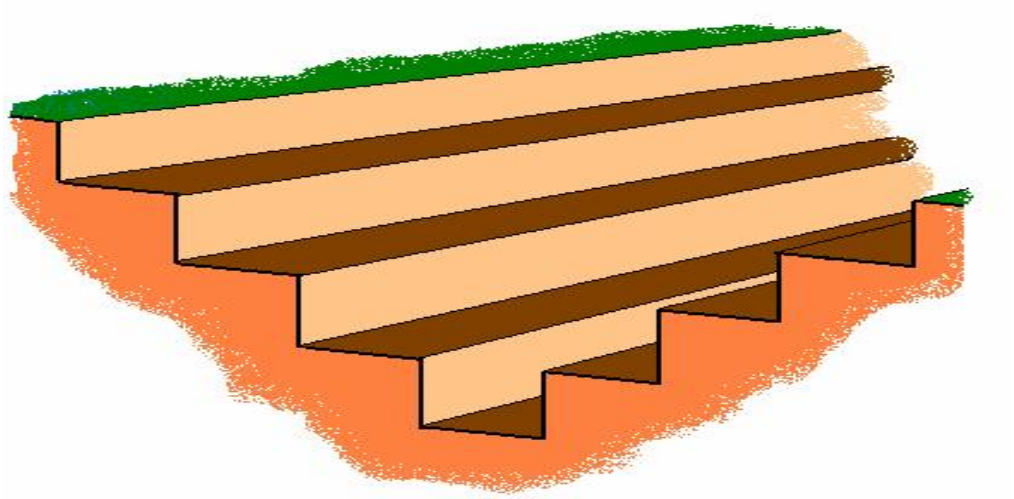
STRAIGHT TRENCH: A trench where the sides are parallel and at right angles to the base. Straight trenches are usually used in areas where there is limited surface area to disturb, such as a roadway or near buildings. Protection systems such as shoring or trench boxes would be required.



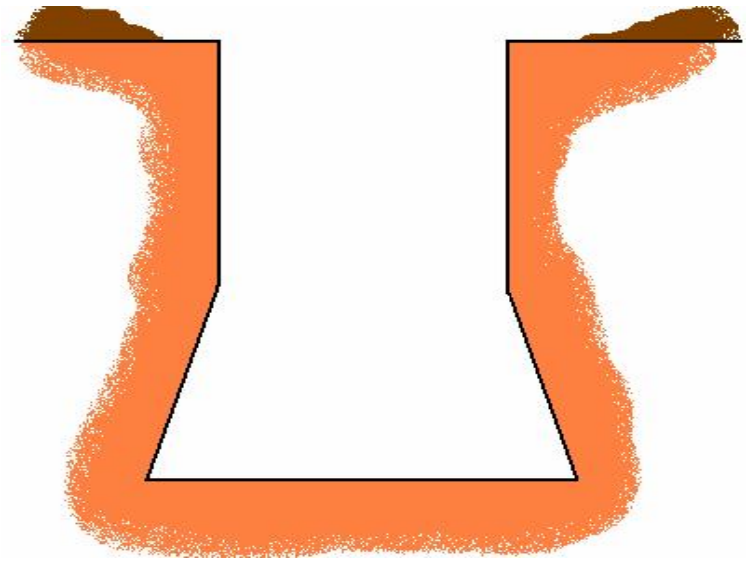
SLOPED TRENCH: A trench where the sides have been angled to prevent cave-in. The angle of the slope is determined by the soil type, trench depth, and in some cases, the time that the trench will remain open. This type of trench is common on new construction sites where disturbing a wider path of soil is not a problem or where other protection systems are not available. It may also be used when placing large pipes or culverts. VERTICAL SIDE LOWER PORTION-type trenches employ sloping and shielding.



BENCHED TRENCH: A trench where the sides have been cut away to form steps. Vertical distances (height of step) are determined by soil type. Multiple bench or single bench systems can be used.



BELL-BOTTOM PIER HOLE: A trench which is usually used in footing placement. Its top is usually narrower than its bottom, thus giving it a bell shape in cross-section. With the sides sloping inward over the floor of the hole, the possibility of collapse is much greater than in other styles of trenches. Additional protection systems are required for those who work in this type of excavation.



KEY PERSONNEL

We now shift our focus from the trench to the people who will make the trenching operation safe. Each individual associated with a trenching operation has certain areas of responsibility. Let's look at the roles of the competent person, the Registered Professional Engineer, and the worker.

THE COMPETENT PERSON

OSHA has recognized that each excavation site must have an on-site person who is responsible for the safety aspects of that operation. This is the competent person. This individual may be the foreman, backhoe operator, or a worker. Regardless of their other duties, the competent person has the following responsibilities:

- Identify existing and potential hazards;
- Inspections of the trench and trench area;
- Atmospheric analysis and ventilation control;
- Evaluation of water hazards and water removal;
- Soil classification;
- Inspection of safety equipment and approval of minor protective equipment repairs;
- Design ramps for personnel use only:
- Be knowledgeable in the use of protective systems;
- Assures that the Standards are followed.

The competent person job on a trenching site is analogous to the safety officer on an emergency scene. Each is charged with the responsibility of site safety and each has the authority to stop an activity without their supervisor approval if an actual or potential threat to worker safety is discovered. Further, they have the duty to halt work until the safety threat is corrected, without this authority; a person is legally not a competent person.

The Competent person is not required to be on the site at all times. He or she is RESPONSIBLE as the Competent person at all times however. If on-site, they may also perform other duties in addition to their competent person duties as long as the responsibilities of the competent person position are met. It is also

important that the competent person possess documentation that they are indeed "competent" in soil analysis, the use of protective systems, and hazard recognition,

THE REGISTERED PROFESSIONAL ENGINEER

In most cases, a worker or supervisor with minimal training can adequately fulfill the responsibilities of the competent person. However, in some situations, the hazard potential is so great or the protection system design so complicated, the design of the trenching and protective systems operation can only be done by a professional. This is the job of the Registered Professional Engineer (RPE) their duties include:

- Approval of protective system designs where the trench is over 20 feet deep;
- Approval of protective systems which involve working close to or under footings, foundations, retaining walls, or other structures;
- Custom design of protective systems;
- Approval of tabulated data for protective systems; Approval of major repairs to Protective systems.
- In short, they are considered to be the "experts" in designing and approving Protective systems.

The law states that the RPE needs to be registered in the state where the work is performed. It goes on to state, however, that an out-of-state RPE can approve tabulated data or manufactured protective systems that are used in interstate commerce. Therefore, a construction company from Michigan can come into Iowa and use their tabulated data or their protective systems that were designed by a RPE back in Michigan.

As was the case with the competent person, the RPE must posse documentation that they are indeed working within the discipline applicable to excavation work. In other words, a RPE who designs airplane wings for an airplane manufacturer is not working within their discipline if they approve tabulated data for an excavation protective system.

THE EMPLOYER

As is the case with most OSHA law, the employer is ultimately responsible for the safety of his employees. The employer's responsibilities include:

- Making contacts for utility location:
- Assure that their employees follow the Standard;
- Select and/or construct the protective systems to be used.

These responsibilities may be delegated to the competent person, Registered Professional Engineer, or some other individual. The ultimate responsibility cannot be delegated however.

THE WORKER

The worker also bears responsibility for his or her own safety. In some cases, the worker is the person most able to prevent an injury to them self or another CO-worker. Some of their responsibilities include:

- Assure that they follow the Standard;
- Work within the protective system;
- Evacuate the trench when the trench box is being moved vertically, when an unprotected cave-in has occurred, or when any unforeseen hazard presents itself;
- Wear a harness and lifeline if working in a bell-bottom pier hole or in an area of increased hazard.

WHEN ALL OF THESE INDIVIDUALS WORK TOGETHER, THE SAFETY OF TRENCH WORK IS ENHANCED.