

Manual Section 7	Issue Date 11/05/10	Revision Date 01/01/24	Policy Number LLCP-073
Ground Disturbance, Excavation & Trenching			

Purpose

This section describes the requirements for excavation and trenching.

Scope

All LLC Companies including, Blanchard Industrial, LLC, GIS Engineering, LLC, Grand Isle Shipyard, Inc., and GWIS, Mack Steel, NuWave, Sun Industries, Valvemax, Discovery Industries, Inc.; hereafter identified as “Company”.

General Requirements

All excavations shall be made in accordance with the rules, regulations, requirements, and guidelines set forth in 29 CFR 1926.650, .651, and .652; the Occupational Safety and Health Administration's standard on Excavations, except where otherwise noted below.

Note: During all ground disturbance tasks, Company employees must maintain a minimum of two (2') feet distance from all piping and process components.

Procedures

A competent person shall be placed in charge of all excavations. Underground utilities must be located and marked before excavation begins. Utilize any drawings and/or maps of buried conduits, cables and piping is available prior to beginning the excavation. The location of underground installations shall be determined before excavation. When utility companies or clients cannot respond to a request to locate underground utility installations within 24 hours, or cannot establish exact location of these installations, the employer may proceed, provided the employer does so with caution and provided detection equipment or other acceptable means to locate utility installations are used. Employees are not allowed in the excavation while heavy equipment is digging.

Inspections and Responsibilities

The competent person is responsible for and shall conduct inspections:

- Daily and before the start of each shift.
- As dictated by the work being done in the trench.
- After every rain storm.
- After other events that could increase hazards, such as snowstorm, windstorm, thaw, earthquake, dramatic change in weather, 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.

(For excavations 4 feet or greater in depth, a trench inspection form shall be filled out for each inspection.)

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Soil Types

Type A - Most stable: clay, silty clay, and hardpan (resists penetration). No soil is Type A if it is fissured, is subject to vibration of any type, has previously been disturbed, or has seeping water.

Type B - Medium stability: silt, sandy loam, medium clay and unstable dry rock; previously disturbed soils unless otherwise classified as Type C; soils that meet the requirements of Type A soil but are fissured or subject to vibration.

Type C - Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock, and soil from which water is freely seeping.

Layered geological strata (where soils are configured in layers) - The soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e. where a Type C soil rests on top of stable rock.

Because most excavations on Company/Client property will be conducted in order to repair / replace existing pipelines or equipment (i.e. the soil has been previously disturbed), **excavations shall be made to meet the requirements for Type B or Type C soils only**, as appropriate.

Testing Methods

The competent person in charge of the excavation shall be responsible for determining whether the soil is Type B or C. If the competent person wants to classify the soil as Type C, they do not need to do any tests. Tests must be conducted to determine if the soil can be classified as Type B. To do this, the competent person shall use a visual test coupled with one or more manual tests.

Visual Test

In addition to checking the items on the trench inspection form, the competent person should perform a **visual test** to evaluate the conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. The competent person also checks for any signs of vibration.

During the visual test, the competent person should check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has been previously disturbed, and, if so, what sort of backfill was used, and observe the open side of the excavation for indications of layered geologic structuring.

This person should also look for signs of bulging, boiling, or sloughing, as well as for signs of surface water seeping from the sides of the excavation or from the water table.

In addition, the area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

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Manual tests

Thumb penetration test

Attempt to press the thumb firmly into the soil in question. If the thumb penetrates no further than the length of the nail, it is probably Type B soil. If the thumb penetrates the full length of the thumb, it is Type C. It should be noted that the thumb penetration test is the least accurate testing method.

Dry strength test

Take a sample of dry soil. If it crumbles freely or with moderate pressure into individual grains it is considered granular (Type C). Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can only be broken with difficulty) it is probably clay in combination with gravel, sand, or silt (Type B).

Plasticity or Wet Thread Test

Take a moist sample of the soil. Mold it into a ball and then attempt to roll it into a thin thread approximately 1/8 inch in diameter by two inches in length. If the soil sample does not break when held by one end, it may be considered Type B.

A pocket penetrometer, shearvane, or torvane may also be used to determine the unconfined compression strength of soils.

Spoil

Temporary spoil shall be placed no closer than 2 feet from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance should not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.

Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.

Permanent spoil should be placed some distance from the excavation.

Surface Crossing of Trenches

Surface crossing of trenches should not be made unless absolutely necessary. However, if necessary, they are only permitted under the following conditions:

- **Vehicle crossings** must be designed by and installed under the supervision of a registered professional engineer.
- **Walkways or bridges** must:
 - have a minimum clear width of 20 inches,
 - be fitted with standard rails, and
 - extend a minimum of 24 inches past the surface edge of the trench.

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Access and Egress

- Trenches 4 feet or more in depth shall be provided with a fixed means of egress. (Stairway, ladder, etc.)
- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 feet laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 inches above the landing.
- Metal ladders should not be used when electric utilities are present.

Exposure to Vehicles

Employees exposed to vehicular traffic shall be provided with and required to wear reflective vests or other suitable garments marked with or made of reflectorized or high-visibility materials. Trained flag persons, signs, signals, and barricades shall be used when necessary.

Exposure to Falling Loads

- All employees on an excavation site must wear hard hats.
- Employees are not allowed to work under raised loads.
- Employees are not allowed to work under loads being lifted or moved by heavy equipment used for digging or lifting.
- Employees are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.
- Equipment operators or truck drivers may remain in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.

Warning Systems for Mobile Equipment

The following steps should be taken to prevent vehicles from accidentally falling into the trench:

- Barricades must be installed where necessary,
- Hand or mechanical signals must be used as required,
- Trenches left open overnight shall be fenced and barricaded.

Testing for Atmospheric Contaminants

If there is any possibility that the trench or excavation could contain a hazardous atmosphere, atmospheric testing must be conducted prior to entry. Conditions that might warrant atmospheric testing would be if the excavation was made in a landfill area or if the excavation was crossed by, was adjacent to, or contained pipelines containing a hazardous material (for example, natural gas lines).

Testing should be conducted before employees enter the trench and should be done regularly to ensure that the trench remains safe. The frequency of testing should be increased if equipment is operating in the trench.

Testing frequency should also be increased if welding, cutting, or burning is done in the trench.

Employees required to wear respiratory protection must be trained, fit-tested, and enrolled in a respiratory protection program.

Some trenches qualify as confined spaces. When this occurs, compliance with the Corporate Confined Space Program is also required. This would include a rescue plan in place, continuous monitoring, barricades and signage at a minimum. Review Confined Space Policy for additional requirements.

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Standing Water and Water Accumulation

Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees must work in the excavation:

- Use of special support or shield systems approved by a registered professional engineer.
- Water removal equipment, such as pumps, used and monitored by a competent person.
- Employees removed from the trench during rainstorms
- Trenches carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench.

Benching, Sloping, Shoring, and Shielding Requirements

All excavations or trenches 4 feet or greater in depth shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in OSHA's Excavation standard, 29 CFR 1926.650, .651, and .652.

Excavations or trenches 20 feet deep or greater must have a protective system designed by a registered professional engineer.

Excavations under the base of footing of a foundation or wall require a support system designed by a registered professional engineer.

Sidewalks and pavement shall not be undermined unless a support system or another method of protection is provided to protect employees from their possible collapse.

Benching

There are two basic types of benching, single and multiple, which can be used in conjunction with sloping.

In Type B soil, the vertical height of the benches must not exceed 4 feet. Benches must be below the maximum allowable slope for that soil type. In other words, a 10-foot deep trench in Type B soil must be benched back 10 feet in each direction, with the maximum of a 45-degree angle.

Benching is not allowed in Type C soil.

Sloping

Maximum allowable slopes for excavations less than 20' based on soil type and angle to the horizontal are as follows:

Soil Type	Height / Depth Ration	Slope Angle
Type B	1:1	45 degrees
Type C	1 1/2:1	34 degrees

A 10-foot-deep trench in Type B soil would have to be sloped to a 45-degree angle, or sloped 10 feet back in both directions. Total distance across a 10-foot-deep trench would be 20 feet, plus the width of the bottom of the trench itself. In Type C soil, the trench would be sloped at a 34-degree angle, or 15 feet back in both directions for at least 30 feet across, plus the width of the bottom of the trench itself. Illustration of simple slope trenching in B and C type soils.

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Shoring

Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. There are two basic types of shoring, timber and aluminum hydraulic.

Because the Physical Plant has aluminum hydraulic shores, they will be the focus of this section. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install them. They are also light enough to be installed by one worker; they are gauge-regulated to ensure even distribution of pressure along the trench line; and they can be adapted easily to various trench depths and widths. However, if timber shoring is used, it must meet the requirements of 29 CFR 1926.650, .651, and .652. All shoring shall be installed from the top down and removed from the bottom up. Hydraulic shoring shall be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

The top cylinder of hydraulic shoring shall be no more than 18 inches below the top of the excavation. The bottom of the cylinder shall be no higher than four feet from the bottom of the excavation. (Two feet of trench wall may be exposed beneath the bottom of the rail or plywood sheeting, if used.)

Three vertical shores, evenly spaced, must be used to form a system. Wales are installed no more than two feet from the top, no more than four feet from the bottom, and no more than four feet apart, vertically.

Hydraulic shores must be installed in accordance with Table D - 1.2 and Table D - 1.3 in soil Type B.

Hydraulic shores must be installed with sheeting in accordance with Table D - 1.4 in soil Type C.

Here are some typical installations of aluminum hydraulic shoring:

- Vertical aluminum hydraulic shoring (spot bracing)
- Vertical aluminum hydraulic shoring (with plywood)
- Vertical aluminum hydraulic shoring (stacked)
- Aluminum hydraulic shoring wailer system (typical)

Shielding

Trench boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents.

The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.

Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching.

The box must extend at least 18 inches above the surrounding area if there is sloping toward the excavation. This can be accomplished by providing a benched area adjacent to the box.

Any modifications to the shields must be approved by the manufacturer.

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Shields may ride two feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no caving under or behind the shield.

Workers must enter and leave the shield in a protected manner, such as by a ladder or ramp.

Workers may not remain in the shield while it is being moved.

Training

The HSE Dept. shall ensure that all employees and/or contractors who participate in Ground Disturbance activity receive Ground Disturbance Training prior to their involvement in the activity and a minimum of every three years thereafter.

- Each Competent Person shall receive training in the recognition of applicable hazards associated with Ground Disturbance activities (to include OSHA excavation requirements) and corrective measures required to eliminate such hazards.
- Each Qualified Equipment Operator shall be instructed in the safe competent operation of equipment used in Ground Disturbance activities. Competency training shall also include OSHA excavation and Ground Disturbance requirements.
- Each Qualified Line Finder shall be instructed in the safe and competent operation of equipment used to locate buried facilities prior to Ground Disturbance activities.
- Awareness training shall be available for individuals that are impacted and/or involved in ground disturbance activity.

The training shall include a mechanism of ensuring employee and/or contractor's comprehension of the Ground Disturbance process and/or associated equipment.

Retraining shall be provided whenever there is a change in the Ground Disturbance process, whenever job changes or changes in equipment or processes present a new hazard, in response to an incident, or when there is reason to believe that there are inadequacies in the employee and/or contractor's knowledge.

All training must be documented, including knowledge verification by means of examination with the date and names of employees and/or contractors attending the training.