

# Trenching, Shoring, Excavating Program



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## **Purpose**

Excavating is one of the most hazardous construction operations. The fatality rate for excavations is twice that of construction as a whole, and cave-ins are the number one hazard. The purpose of this training program is to protect employees from safety hazards that may be encountered during work in trenches and excavations.

## **Scope**

RW LaPine Inc. is required to participate as a contract employer at client locations with trenching and excavation work; however, RW LaPine Inc. may not initiate trenching operations. When work is performed on a non-owned or operated site, the operator's program shall take precedence; however, this document covers RW LaPine Inc. employees for basic awareness purposes that addresses all items and shall be used when an operator's program doesn't exist.

## **Definitions**

**Accepted engineering practices** means the standards of practice required by a registered professional engineer.

**Aluminum Hydraulic Shoring** means a manufactured shoring system consisting of aluminum hydraulic cylinders (crossbraces) used with vertical rails (uprights) or horizontal rails (wales).

**Bell-bottom pier hole** means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

**Benching** (Benching system) is a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or more horizontal steps, usually with vertical or near-vertical surfaces between levels.

**Cave-in** means the movement of soil or rock into an excavation, or the loss of soil from under a trench shield or support system, in amounts large enough to trap, bury, or injure and immobilize a person.

**Competent Person** means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has the authorization to take prompt corrective measures to eliminate them.

**Cross braces** mean the horizontal members of a shoring system installed from side to side of the excavation. The cross braces bear against either uprights or Wales.

**Excavation** means any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

**Faces or sides** mean the vertical or inclined earth surfaces formed as a result of excavation work.

**Failure** means the movement or damage of a structural member or connection that makes it unable to support loads.

**Hazardous atmosphere** means an atmosphere that is explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, which may cause death, illness, or injury.

**Safety Coordinator** means the individual at RW LaPine Inc. responsible for developing and implementing this program, conducting unannounced work site inspections, and ensuring that the departments comply with the program requirements.

**Kickout** means the accidental movement or failure of a cross brace.

**Protective system** means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

**Ramp** means an inclined walking or working surface that is used to gain access to one point from another. A ramp may be constructed from earth or from structural materials such as steel or wood.

**Sheeting** means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

**Shield**(Shield system) means a structure used in an excavation to withstand cave-ins and which will protect employees working within the shield system. Shields can be permanent structures or portable units moved along as work progresses. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

**Shoring** (Shoring system) means a structure that is built or put in place to support the sides of an excavation to prevent cave-ins.

Sides - See "Faces."

**Sloping** (Sloping system) means sloping the sides of the excavation away from the excavation to protect employees from cave-ins. The required slope will vary with soil type, weather, and surface or near surface loads that may affect the soil in the area of the trench (such as adjacent buildings, vehicles near the edge of the trench and so forth).

**Stable rock** means natural solid mineral material that can be excavated with vertical sides that will remain intact while exposed.

**Structural ramp** means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

**Support system** means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

**Tabulated data** means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

**Trench** (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground.

**Uprights** mean the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

**Wales** mean horizontal members of a shoring system placed in the direction of the excavation face whose sides bear against the vertical members of the shoring system or earth (the uprights or sheeting).

## **Key Responsibilities**

Management shall determine if this program is required for regulatory compliance within his/her region. If this program is deemed necessary, then management shall determine which employees within his/her region is required to receive this training. Management shall select a training facility or use an in-house qualified trainer to supply the training. Only trained personnel can be involved in working in trenches or excavations.

## **Procedures**

**Competent Person Duties** – The Safety Manager or their designee shall have the following duties:

### **Protective Systems or Equipment**

- Monitoring water removal equipment and operations.
- Removal of workers if conditions dictate.
- Atmospheric testing.
- Inspecting excavations subject to runoff from heavy rains to determine need for diversion ditches, dikes, or other suitable protection.
- Determining cave-in potential to assess need for shoring or other protective system.
- Examining damaged material or equipment used for protective systems to determine its suitability for continued use.
- Classifying soil and rock deposits, by both visual analysis and by testing, to determine appropriate protection; re-classifying, if necessary, based on changing conditions.
- Determining the appropriate slope of an excavation to prevent collapse due to surcharge loads from stored material or equipment, operating equipment, adjacent structures, or traffic, and assuring that such slope is achieved.

### **Inspecting Trench and Protective Systems**

- Inspections prior to entry and authorizing immediate removal of employees from the hazardous area where evidence of possible cave-in, failure of protective systems, hazardous atmospheres, or other hazardous conditions exists.

### **Unsafe Access/Egress**

- Determining structural ramps that are used solely by employees as a means of access or egress. Structural ramps used for access or egress of equipment must be designed by a competent person qualified in structural design.

### **Utilities and Pre-work Site Inspection**

The location of underground installations shall be determined before excavation.

When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours, or cannot establish exact locations of these installations, RW LaPine Inc. may proceed, provided it does so with caution and provided detection equipment or other acceptable means to locate utility installations are used.

Excavation shall be done in a manner that does not endanger the underground installations or the employees engaged in the work. Utilities left in place shall be protected by barricades, shoring, suspension or other means as necessary to protect employees.

### **Protection of the Public**

Barricades, walkways, lighting and posting shall be provided as necessary for the protection of the public prior to the start of excavation operations.

Guardrails, fences, or barricades shall be provided on excavations adjacent to walkways, driveways and other pedestrian or vehicle thoroughfares. Warning lights or other illumination shall be maintained if necessary for the safety of the public and employees from sunset to sunrise.

Wells, holes, pits, shafts and all similar hazardous excavations shall be effectively barricaded or covered and posted as necessary to prevent unauthorized access. All temporary excavations of this type shall be backfilled as soon as possible.

### **Protection Against Falls**

Walkways or crossings shall be protected by standard guardrails or railings shall be provided where employees and the general public are permitted to cross over excavations. Where workers in the excavation may pass under these walkways or bridges, a standard guardrail and toe board shall be used.

### **Protection of Workers in Excavations**

#### **Access and Means of Egress**

Stairs, ladders or ramps shall be provided where employees are required to enter trench excavations over 4 feet deep. The maximum distance of lateral travel (e.g., along the length of the trench) required to reach the means of egress shall not exceed 25 feet.

#### **Structural Ramps**

Structural ramps used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a person qualified in structural design, and shall be constructed in accordance with the design.

Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent movement or displacement.

Structural members used for ramps and runways shall be of uniform thickness.

Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping.

Structural ramps used in place of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

### **Ladders**

When portable ladders are used, the ladder side rails shall extend a minimum of 3 feet above the upper surface of the excavation.

Ladders shall have nonconductive side rails if work will be performed near exposed energized equipment or systems.

Two or more ladders, or a double-cleated ladder, will be provided where 25 or more employees will be conducting work in an excavation where ladders serve as the primary means of egress, or where ladders serve two-way traffic.

Ladders will be inspected prior to use for signs of damage or defects. Damaged ladders will be removed from service and marked with "Do Not Use" until repaired.

Ladders shall be used only on stable and level surfaces unless secured. Ladders placed in any location where they can be displaced by workplace activities or traffic shall be secured, or barricades shall be used to keep these activities away from the ladder.

Non-self-supporting ladders shall be positioned so that the foot of the ladder is one-quarter of the working length away from the support.

Employees shall not be allowed to carry any object or load while on the ladder that could cause them to lose their balance and fall.

### **Exposure to Vehicular Traffic**

Employees exposed to vehicular traffic shall be provided with, and shall wear vests or other suitable garments marked with or made of reflectorized or high-visibility material. Warning vests worn by flagmen shall be red or orange, and shall be of reflectorized material if worn during night work.

### **Employee Exposure to Falling Loads**

No employee shall be permitted underneath loads (or where loads may fall) handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles provide adequate protection for the operator during loading and unloading operations.

### **Warning System for Mobile Equipment**

A warning system shall be used when mobile equipment is operated adjacent to the edge of an excavation if the operator does not have a clear and direct view of the edge of the excavation. The warning system shall consist of barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

### **Hazardous Atmospheres**

The atmosphere shall be tested for air contaminants (oxygen, flammable gases, etc.) in excavations over 4 feet deep if a hazardous atmosphere exists or could reasonably be expected to exist. A hazardous atmosphere could be expected, for example, in excavations in landfill areas, in excavations in areas where hazardous substances are stored nearby, or in excavations near or containing gas pipelines.

Adequate precautions shall be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or forced ventilation of the workspace.

Forced ventilation will be provided where necessary to ensure the atmosphere is safe.

When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, continuous air monitoring will be performed. The device used for atmospheric monitoring shall be equipped with an audible and visual alarm.

Atmospheric testing will be performed using a properly calibrated direct reading gas monitor. Direct reading gas detector tubes or other acceptable means may also be used to test potentially toxic atmospheres.

### **Personal Protective Equipment**

All employees working in trenches or excavations shall wear approved hard-hats and safety toed boots.

Employees exposed to flying fragments, dust, or other materials produced by drilling, sawing, sanding, grinding and similar operations shall wear approved safety glasses and/or a faceshield.

Employees exposed to hazards produced by, or performing, welding, cutting, or brazing operations shall wear approved spectacles or a welding faceshield or helmet.

Employees entering bell-bottom pier holes or other similar deep and confined footing excavations shall wear a harness with a lifeline securely attached to it. The lifeline shall be separate from any line used to handle materials and shall be individually attended at all times while the employee wearing the lifeline is in the excavation.

Employees shall wear approved gloves or other suitable hand protection.

Employees using, or working in the immediate vicinity of, hammer drills, masonry saws, jackhammers or similar high noise producing equipment shall wear suitable hearing protection.

Each employee at the edge of an excavation 6 feet or more deep shall be protected from falling. Fall protection shall be provided by guardrail systems, fences or barricades.

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, etc. shall be readily available where hazardous atmospheric conditions exist or may develop during work in an excavation. This equipment shall be attended when in use. Only personnel that have received approved training and have appropriate equipment shall attempt retrieval that would require entry into a hazardous atmosphere.

### **Protection from Hazards Associated with Water Accumulation**

Employees shall not work in excavations that contain or are accumulating water unless precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions taken must include inspection by a competent person before work begins, special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water or use of safety harnesses and lifelines.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operation shall be monitored by a competent person trained in the use of the equipment.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation. Precautions shall also be taken to provide adequate drainage of the area adjacent to the excavation.

The competent person shall inform workers of the precautions or procedures that are to be followed if water accumulates or is accumulating in an excavation.

### **Stability of Adjacent Structures**

The competent person will determine if the excavation work could affect the stability of adjoining buildings, walls, sidewalks or other structures.

Support systems (such as shoring, bracing, or underpinning) shall be used to assure the stability of structures and the protection of employees where excavation operations could affect the stability of adjoining buildings, walls, or other structures.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted.

### **Protection of Employees from Falling Objects and Loose Rocks or Soil**

Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of:

- Scaling to remove loose material;
- Installation of protective barricades, such as wire mesh or timber, at appropriate intervals on the face of the slope to stop and contain falling material; or
- Benching sufficient to contain falling material.

Excavation personnel shall not be permitted to work above one another where the danger of falling rock or earth exists.

Employees shall be protected from excavated materials, equipment or other materials that could pose a hazard by falling or rolling into excavations.

Protection shall be provided by keeping such materials or equipment at least 2 feet from the edge of excavations, by the use of restraining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both.

Materials and equipment may, as determined by the competent person, need to be stored further than 2 feet from the edge of the excavation if a hazardous loading condition is created on the face of the excavation.

Materials piled, grouped or stacked near the edge of an excavation must be stable and self-supporting.

Using the following categories, soil is classified into different types, which determine the kind of cave-in protection required. Only a competent and trained person can determine the soil type by using these classifications.

- Grain sizes are usually classified into four types: gravel, sand, silt, clay. Gravel is the least stable, and clay is the most stable.
- Saturation is the amount of water that the soil is currently holding. Complete saturation is much less stable than soil that is only slightly damp. However, soil with no water content is unstable.
- Cohesiveness is a test that determines how well the soil sticks together. The more it sticks together, the more stable the trench walls will be. The field test usually consists of rolling the soil in your hand into the shape of a worm and observing how and when it separates.
- Unconfined compressive strength determines how much weight per square foot the soil can withstand. This will determine how easily the soil will shear and cave in

### **Soil Types**

Soil classifications must be determined by testing and protective systems designed according to soil classifications.

- The most stable type of soil is Type A. It is dense and heavy and consists primarily of clay.
- Type B has a medium level of stability and is made of soils such as silt, sandy loam, and medium clay.
- The least stable soil is Type C, which consists of gravel, loamy sand, and soft clay.

Timber shoring or aluminum hydraulic shoring must be determined according to the appendixes A & C of 29 CFR 1926 (Excavations).

The devices should be used while in good repair and maintenance. If damaged they must be inspected.

Employees should be protected from hazards of falling, rolling or sliding materials or equipment. Shields should not be subjected to excessive forces and will be installed to protect employees from lateral loads. Employees are restricted from being in the shield when installing or removing. The shield must be designed to resist calculated trench forces.

### **Daily Inspection**

The competent person shall conduct daily inspections of excavations, adjacent areas, and protective systems for evidence of a situation that could result in possible cave-ins, 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 the trench will be or is occupied by employees.

Where the competent person finds evidence of a situation that could result in a possible cave-in, failure of protective systems, hazardous atmosphere, or other hazardous conditions, exposed employees shall be immediately removed from the hazardous area until precautions have been taken to assure their safety. There shall be a written log of all inspections conducted. This log shall include the date, work site location, results of the inspection, and a summary of any action taken to correct existing hazards.

## **Training**

All personnel involved in trenching or excavation work shall be trained in the requirements of this program and regulatory requirements.

Training shall be performed before the employee is assigned duties in excavations.

Retraining will be performed whenever work site inspections conducted by the competent person or Health Safety Officer indicate that an employee does not have the necessary knowledge or skills to safely work in or around excavations.

Training records shall include the date(s) of the training program, the instructor(s) of the training program, a copy of the written material presented, and the names of the employee(s) to whom the training was given.

# RW LaPine      **EXCAVATION CHECKLIST**

(To be completed by a Competent Person)

SITE LOCATION:		
DATE:	TIME:	COMPETENT PERSON:
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 six 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.	
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 taken 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 to 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.	
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.	

RW LaPine Inc.  
DAILY TRENCHING LOG

DATE:	SIGNATURE:
WEATHER:	PROJECT:
Was One Call System (811) contacted:      Yes _____      No _____	
Protective system:    Trench shield (box) _____      Wood shoring _____ Sloping _____      Other _____	
Purpose of trenching: Drainage _____      Water _____ Sewer _____      Gas _____ Other _____	
Were visual soil tests made:      Yes _____      No _____ If yes, what type?	
Type of Soil:      Stable Rock _____ Type A _____ Type B _____ Type C _____	
Surface encumbrances:      Yes _____      No _____ If yes, what type?	
Water conditions:      Wet _____      Dry _____      Submerged _____	
Hazardous atmosphere exists:      Yes _____      No _____ <i>(If yes, follow confined space entry procedures policy; complete confined Space Entry Permit; monitor for toxic gas(es))</i>	
Is trenching or excavation exposed to public vehicular traffic (exhaust emission): Yes _____ No _____ <i>(If yes, refer to confined space entry procedures; complete Confined Space Entry Permit; monitor for toxic gas(es))</i>	
Measurements of trench: Depth _____ Length _____ Width _____	
Is ladder within 25 feet of all workers:      Yes _____      No _____	
Is excavated material stored two feet or more from edge of excavation: Yes _____ No _____	
Are employees exposed to public vehicular traffic: Yes _____ No _____ <i>(If yes, warning vests required)</i>	
Are other utilities protected:      Yes _____      No _____ <i>(Water, sewer, gas or other structures)</i>	
Are sewer or natural gas lines exposed: Yes _____ No _____	
Periodic Inspection (changing conditions):      Yes _____      No _____	
Did employees receive training in excavating:      Yes _____      No _____	
Any Corrective Actions and Remarks:	