



Safety Procedure: Excavation, Trenching and Shoring

I. PURPOSE

- A. This procedure provides guidelines methods for the protection of City of Corona employees while working in and around excavations and trenches.

II. SCOPE

- A. This program applies to all employees working on projects that require excavations and/or trench shoring.

III. REGULATORY REFERENCES

- A. California Code of Regulations, Title 8, Section 1539 – 1541.1, Subchapter 4, Article 6, Excavations, Construction Safety Orders.

IV. RESPONSIBILITIES

A. Safety Division

- 1. Safety Division has overall responsibility to provide training evaluation and certification on Excavation (Trenching Shoring) in accordance with the California Code of Regulations. The Safety Division will also maintain training records and update this policy as necessary.

B. Supervisors

- 1. It is the responsibility of the supervisor to ensure compliance with all elements of this policy.

C. Employee

- 1. Each employee involved with excavation and trenching work is responsible to comply with all applicable safety procedures and requirements of this policy.

V. DEFINITIONS

A. Accepted engineering practices

- 1. Requirements that are compatible with standards of practice required by a register professional engineer.

B. Aluminum hydraulic shoring

- 1. Pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails

(walers). System is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

C. Bell-bottom pier hole

1. A type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.

D. Benching (Benching system)

1. A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near – vertical surfaces between levels.

E. Cave-in

1. The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

F. Competent person

1. 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 authorization to take prompt corrective measures to eliminate them. The competent person shall be on the job site at all times.

G. Cross Braces

1. The horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

H. Duration of exposure

1. The longer an excavation is open, the longer the other factors have to work on causing it to collapse.

I. Egress

1. A place or means of going out: "EXIT"

J. Excavation

1. Any manmade cut, cavity, trench, or depression in an earth surface, formed by earth removal.

K. Faces or sides

1. The vertical or inclined earth surfaces formed as a result of excavation work.

L. Failure

1. The breakage, displacement, or permanent deformation of a structural member or connections so as to reduce its structural integrity and its supportive capabilities.

M. Hazardous atmosphere

1. An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

N. Protective system

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

O. Ramp

1. An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

P. Registered professional engineer

1. A person who is registered as a professional engineer in the state where the work is performed. However, professional engineer, registered in any state is deemed to be "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Q. Sheeting

1. The members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

R. Shield (Shield system)

1. Structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built.

Shields used in trenches are usually referred to as “trench boxes” or “trench shields”.

S. Shoring (Shoring system)

1. A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and designed to prevent cave-ins.

T. Sloping (Sloping system)

1. A method of protecting employees from cave-ins by excavating to form sides of an excavation that is inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditional of exposure, and application of surcharge loads.

U. Spoil (Temporary spoil)

1. Shall be placed no closer than 2 feet from the surface edge of the excavation: also refer to the tabulated data.

V. Stable rock

1. A natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

W. Structural ramp

1. A ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock is not considered structural ramps.

X. Support system

1. A structure such as underpinning, bracing, or shoring which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Y. Surface loads

1. Generated by the weight of anything in proximity to the excavation, push starts for a cave-in (anything up top pushing down). Common surface loads:
 - a. Weight of spoil pile;
 - b. Weight of nearby buildings, poles, pavements, or other structure objects;
 - c. Weight of material and equipment.

Z. Tabulated data

1. Tables and charts approved by a registered professional engineer and used to design and construct a protective system. At least one copy of the tabulated data which identifies the registered professional engineer who approved the data shall be maintained at the jobsite during construction of the protective system.

AA. Trench (Trench excavation)

1. A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation), the excavation is also considered to be a trench.

BB. Undermining

1. Undermining can be caused by such things as leaking, leaching, caving or over digging. Undermined walls can be very dangerous.

CC. Vibration

1. A force that is present on construction sites and must be considered. The vibrations caused by backhoes, dump trucks, compactors and traffic on job sites can be substantial.

VI. EXCAVATION REQUIREMENTS

- A. Prior to any type of excavating or trenching work being performed or any employee entering an excavation, the following items must be checked, known and verified.

1. Underground Service Alert (USA)

- a. Notify Underground Service Alert (USA) and property owners in order to locate any utility installations such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work. This shall be determined prior to opening an excavation.
- b. The Underground Service Alert must be called at least two days prior to digging.

2. Exposure to Vehicular Traffic

- a. Set up traffic control as per "Work Area Traffic Control Handbook Watch Manual"

- b. Employees exposed to public vehicular traffic shall be provided with, and shall wear safety vests or other suitable garments marked with or made of reflectorized or high-visibility material (Class III Safety Garment).
3. Soils
- a. Know the soil conditions and classifications of soils.
4. Protective Systems
- a. Adequate protective systems shall be utilized to protect employees. This can be accomplished through sloping, shoring, or shielding.
 - b. Protective systems for use in excavations more than twenty (20) feet in depth must be designed by a registered engineer.
 - c. The competent person shall analyze the worksite in order to choose the appropriate method for protective support systems to be used. An excavation safety plan must be developed to protect employee.
5. Hazards / Heavy Equipment
- a. All overhead hazards (surface encumbrances) that create a hazard to employees must be removed or supported to eliminate the hazard.
 - b. While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees.
6. Exposure to falling loads
- a. No employee shall be permitted underneath loads 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 a spillage or falling materials. Operators may remain the cabs of vehicles being loaded or unloaded when the vehicles are equipped with adequate protection for the operator during loading and unloading operations.
7. Warning system for mobile equipment
- a. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of an excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation;
 - b. All spoil piles will be stored a minimum of at least (2) feet from the sides of the excavation. The spoil must not block the safe means of egress. Also refer to the tabulated data.

8. Inspections

- a. A competent person will inspect all excavations and trenches.
- b. An inspection of the adjacent areas and protective systems shall be made for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmosphere, or other hazardous conditions. Inspections should be made:
 - i. Daily
 - ii. Prior to employee exposure or entry
 - iii. After any rainfall
 - iv. Soil change
 - v. Any other time needed during the shift
 - vi. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

9. Existing Structures

- a. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure that stability of such structures for the protection of employees.
- b. 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 except when:
 - i. A support system is provided to ensure the safety of employees and the stability of the structure; or
 - ii. The excavation is in stable rock; or
 - iii. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

10. Protection from Loose Rock or Soil

- a. 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 protections shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

- b. Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least four (4) feet from the edge of the excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

11. Water Accumulation

- a. Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.
- b. 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 to ensure proper operation.
- c. 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 and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person (Attached Entry Authorization, Excavation Checklist, and Daily Log Forms)

12. Personal Protective Equipment (PPE)

- a. Workers shall be supplied with and wear any personal protective equipment (PPE) deemed necessary to protect employees.

13. Fall Protection

- a. Where employees or equipment are required to cross over excavations over six (6) feet in depth and wider than thirty (30) inches, walkways or bridges with standard guardrails shall be provided.
- b. Adequate barrier protection shall be provided at all excavations. All wells, pits, shafts, etc. shall be barricaded or covered. Upon completion, the excavated area shall be backfilled.

14. Means of Egress from Trench Excavation

- a. A stairway, ladder, ramp or other safety means of egress shall be located in trench excavations that are four (4) feet or more in depth so as to require no more than twenty five (25) feet of lateral travel for employees.

15. Hazardous Atmospheres

- a. Where oxygen deficiency (atmosphere containing less than 19.5 percent Oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, the atmospheres in the excavation shall be tested before employees enter excavations greater than four (4) feet in depth.
- b. Adequate precautions shall be taken to prevent employee exposure to atmosphere containing less than 19.5 percent oxygen and other hazardous atmospheres.
 - i. Precautions shall be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.
 - ii. When controls are used intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that atmosphere remains safe.

16. Emergency Rescue Equipment

- a. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be attended when in use.
- b. 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 life is in the excavation.

17. Emergency Repairs

- a. In the case of an emergency involving an existing trench with a contractor that has their own shoring/shielding in place, prior to allowing City employees to enter the trench, the City's Competent Person must be contacted to make the evaluation of the current safety of the trench and shoring/shielding.

- b. Once the City's competent person deems the shoring/shielding to meet City safety standards, City employees may enter the trench to make any necessary repairs.
- c. If the competent person does not deem the contractor's shoring/Shielding to meet City safety standards the appropriate correction shall be made to the shoring/shielding before City employees entering trench.
- d. When the emergency repairs have been completed any additional shoring/shielding installed by the City may be removed.
- e. If by removing the additional safety equipment the site is considered inadequately protected for the use by the contractor, action should be taken to notify the work site supervisor and project manager to report the deficiency per the MEWS policy.

VII. SOIL DEFINITIONS

A. Cemented soil

- 1. A soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

B. Cohesive soil

- 1. Clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical side slopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clay silt, sandy clay, silty clay, clay and organic clay.

C. Dry soil

- 1. Soil that does not exhibit visible signs of moisture content.

D. Fissured

- 1. A soil material that has tendency to break along definite planes or fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

E. Granular soil

- 1. Gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has not cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

F. Layered system

1. Two or more distinctly soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

G. Moist soil

1. A condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Most granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

H. Plastic

1. A property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

I. Saturated soil

1. A soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket electrometer or sheer vane.

J. Soil classification system

1. A method of categorizing soil and rock deposits in a hierarchy of Stable rock, Type A, Type B, and Type C, in decreasing order of stability.

K. Stable rock

1. A Natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

L. Submerged soil

1. Soil which is underwater or is free seeping.

VIII. SOIL CLASSIFICATIONS

A. Type A

1. Cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (TSF) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. No soil is type A if:

- a. The soil is fissured; or

- b. The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- c. The soil has been previously disturbed; or
- d. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater; or
- e. The material is subject to other factors that would require it to be classified as a less stable material.

B. Type B

- 1. Cohesive soil with an unconfined compressive strength great than 0.5 tsf but less than 1.5 tsf; or
- 2. Granular cohesion less soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
- 3. Previously disturbed soils except those which would otherwise be classes as Type C soil.
- 4. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- 5. Dry rock that is not stable; or
- 6. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical, but only if the material would otherwise be classified as Type B.

C. Type C

- 1. Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
- 2. Granular soils including gravel, sand, and loamy sand: or
- 3. Submerged soil or soil from which water is freely seeping; or
- 4. Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or steeper.

IX. ACCEPTABLE VISUAL SOIL TEST

- A. Visual analysis conducted to determine qualitative information regarding the excavation site in general, soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from the excavated material, the following observation must be taken:

1. Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material. Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
2. Observe the side of the open excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil break off a vertical side, the soil could be fissured. Small break-ups are evidence of moving ground and are indications of potentially hazardous situations.
3. Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
4. Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.
5. Observe the area adjacent to the excavation and sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.
6. Observe the area adjacent to the excavation and the area within the excavation for sources of vibration and may affect the stability of the excavation face.

X. ACCEPTABLE MANUAL TESTS

- A. The competent person will classify the soil type in accordance with the definitions on the basis of a least one visual and one manual analysis. Manual tests are considered manual analysis of soil samples conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly, the following samples are classified as:
 1. Plasticity
 - a. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin a 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.
 2. Dry strength

- a. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered un-fissured.
3. Thumb penetration
 - a. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as large clump of soil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences (rain, flooding), the classification of the soil must be changed accordingly.
 4. Other strength tests
 - a. Estimates of confined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.
 5. Drying test
 - a. The basic purpose of the drying test is to differentiate between cohesive materials with fissures, un-fissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick and six inches in diameter until it is thoroughly dry.

XI. EXCAVATION PROTECTION SYSTEMS

- A. The three basic protective systems for excavations and trenches are sloping and benching systems, shoring, and shields. The protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied to or transmitted to the system. Every employee in an excavation shall be protected from cave-ins by an adequate protective system. Exceptions to using protective system:
 1. Excavation are made entirely in stable rock; or
 2. Excavations are less than 5 feet deep and declared safe by a competent person.

XII. SLOPING AND BENCHING SYSTEMS

A. There are four options for sloping:

1. Slope to the angle required by the Standard for Type C, which is the most unstable soil type.
2. The table provided in Appendix B of the standard Title 8 CCR 1541.1 Appendix B may be used to determine the maximum allowable angle (after determining the soil type).
3. Tabulated data prepared by a registered professional engineer can be utilized.
4. Sloping and benching systems for excavations five (5) to twenty (20) feet in depth must be constructed under the instruction of a designated competent person. Sloping and benching systems for excavations greater than twenty (20) feet must be designed and stamped by a registered professional engineer. Sloping and benching specifications can be found in Appendix B Title 8 CCR 1541.1

XIII. SHORING SYSTEMS

- ### A. Shoring is another protective system or support system. Shoring utilizes a framework of vertical members (uprights), horizontal members (wales), and cross braces to support the sides of the excavation to prevent a cave-in. Metal hydraulic, mechanical or timber shoring is common examples.

XIV. SHIELDING SYSTEMS

- ### A. Shielding is the third method of providing a safety workplace. Unlike sloping and shoring, shielding does not prevent a cave-in. Shields are designed to withstand the soil forces caused by cave-in and protect the employees inside the structure. Most shields consist of two flat, parallel metal walls that are held apart by metal cross braces, shielding must be certified in design by a registered professional engineer and must have either a registration plate on the shield or registration papers from the manufacture on file at the jobsite office.

1. Shield Systems Repairs or Modifications

- a. The following precautions and procedures must be taken when working with shield systems:
 - i. Shield must not have any lateral movement when installed.
 - ii. Employees will be protected from cave-ins when entering and exiting the shield (examples – ladder with the shield or a properly sloped ramp at the end);

- iii. Employees are not allowed in the shield during installation, removal, or during any vertical movement;
- iv. Shields can be 2 ft. above the bottom of an excavation if they are designed to resist loads at the full depth and if there are no indications of caving under or behind the shield;
- v. The shield must extend at least 18 inches above the point where proper sloping begins (the height of the shield must be greater than the depth of the excavation); and
- vi. The open end of the shield must be protected from the exposed excavation wall. The wall must be sloped, shored, or shielded. Engineer designed end plates can be mounted on the ends of the shield to prevent cave-ins.

XV. TRAINING

- A. The competent person(s) must be trained in accordance with the OSHA Excavation Standard, and all other programs that may apply and must demonstrate a thorough understanding and knowledge of the programs and the hazards associated. All other employees working in and around the excavation must be trained in the recognition of hazards associated with trenching and excavating. Refresher training required annually.

XVI. ATTACHMENTS

- A. Appendix A – Trench Inspection and Entry Authorization Form
- B. Appendix B – Excavation Checklist
- C. Appendix C – Daily Trenching Log
- D. Maximum Allowable Slopes

Appendix A Trench Inspection and Entry Authorization Form



LOCATION:				DATE:			
TIME OF INSPECTION:							
WEATHER CONDITIONS:				APPROX. TEMP.:			
CREW LEADER:				SUPERVISOR:			
DEMENSIONS:		DEPTH =		Yes	No	HAZARDOUS CONDITIONS	
		TOP =	W	L	<input type="checkbox"/>	<input type="checkbox"/>	...Surface drainage
		BOTTOM =	W	L	<input type="checkbox"/>	<input type="checkbox"/>	...Below water table
SOIL TYPE		TESTED		<input type="checkbox"/>	<input type="checkbox"/>	...Bulging wall(s)	
<input type="checkbox"/>	Solid rock, shale	<input type="checkbox"/>	Yes	<input type="checkbox"/>	<input type="checkbox"/>	...Floor heaving	
<input type="checkbox"/>	Average soil	<input type="checkbox"/>	No	<input type="checkbox"/>	<input type="checkbox"/>	...Frozen soil	
<input type="checkbox"/>	Fill material			<input type="checkbox"/>	<input type="checkbox"/>	...Super imposed loads	
<input type="checkbox"/>	Loose sand			<input type="checkbox"/>	<input type="checkbox"/>	...Vibration	
				<input type="checkbox"/>	<input type="checkbox"/>	...Wet soil	
PROTECTION METHODS				PLACEMENT OF SPOILS & EQUIPMENT			
Walls MUST be vertical - No Voids				<input type="checkbox"/>	<input type="checkbox"/>	...Spoils at least 2 ft. from edge of trench	
SHORING:				<input type="checkbox"/>	<input type="checkbox"/>	...Spoils not increasing super-imposed load	
<input type="checkbox"/>	Timber			<input type="checkbox"/>	<input type="checkbox"/>	...Backhoe at end of trench	
<input type="checkbox"/>	Pneumatic			<input type="checkbox"/>	<input type="checkbox"/>	...Compressor, etc. at remote location	
<input type="checkbox"/>	Hydraulic			LADDER LOCATION			
<input type="checkbox"/>	Screw Jacks			<input type="checkbox"/>	<input type="checkbox"/>	...Located in protected area	
<input type="checkbox"/>	Trench Shield			<input type="checkbox"/>	<input type="checkbox"/>	...Within 25 feet of safe travel	
UNEVEN, IRREGULAR WALLS				<input type="checkbox"/>	<input type="checkbox"/>	...Secured	
<input type="checkbox"/>	Trench box			<input type="checkbox"/>	<input type="checkbox"/>	...Extends 36 inches above the landing	
Sloping:		<input type="checkbox"/>	1:1 (45°)	<input type="checkbox"/>	1-1/2:1 (34°)	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	...Leads to safe landing	
Yes	No	ENVIRONMENTAL CONDITIONS				OTHER	
<input type="checkbox"/>	<input type="checkbox"/>	Gas detector used?				<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	Confined space permit issued?				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	Shoring equip. & matls. Inspected prior to use	
				<input type="checkbox"/>	<input type="checkbox"/>	Is trench SAFE to enter?	
COMMENTS:							
All unsafe conditions must be corrected prior to trench entry. If any hazardous conditions are observed, the trench must be immediately evacuated and no one allowed to re-enter until corrective action has been taken.				Excavation Entry Authorized By: _____			

Appendix B

Excavation Checklist (Sheet 1 of 2)

To be completed by a Competent Person



SITE LOCATION:		
DATE:	TIME:	COMPETENT PERSON:
SOIL TYPE: (See attached form):		
SOIL CLASSIFICATION:	EXCAVATION DEPTH:	EXCAVATION WIDTH:
TYPE OF PROTECTIVE SYSTEM USED:		

Indicate for each item: **YES - NO - N/A**

1. General Inspection of Jobsite

A. Excavation, 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 four feet or more in depth are equipped with standard guardrails and toeboards.	
I. High visibility vests 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.	

Excavation Checklist (Sheet 2 of 2)



Indicate for each item: **YES - NO - N/A**

5. Hazardous Atmosphere

A. Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustibile 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 lover explosive limit of the gas.	
D. Testing conducted often to ensure that the atmosphere remains safe.	
E. Emergency equipment, suchas 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 not in good condition have been removed from service.	
D. Damaged materials and equipment used for protective systems inspected by a registered professional engineer after repairs and before being placed back into service.	
E. Protective systems provided to ensure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.	
F. Members of supports system securely fastened to prevent failure.	
G. Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure.	
H. Backfilling progresses with removal of support system.	
I. 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 suport the loads calculated for the full depth.	
J. Shield system placed to prevent lateral movement.	
K. Employees are prohibited from remaining in shield system during vertical movement.	

CORRECTIVE ACTIONS AND REMARKS:



Appendix C

Daily Trenching Log

DATE:		SIGNATURE:	
WEATHER:		PROJECT:	
Dig Alert contacted:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Utilities are located and marked:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Protective system:	<input type="checkbox"/> Trench shield (box)	<input type="checkbox"/> Wood shoring	
	<input type="checkbox"/> Sloping	<input type="checkbox"/> Other _____	
Purpose of trenching:	<input type="checkbox"/> Drainage	<input type="checkbox"/> Water	
	<input type="checkbox"/> Sewer	<input type="checkbox"/> Gas	
	Other _____		
Visual soil tests made:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, what type?			
Manual soil tests made:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, what type?			
Type of soil:	<input type="checkbox"/> Stable Rock	<input type="checkbox"/> Type A	<input type="checkbox"/> Type B <input type="checkbox"/> Type C
Surface encumbrances:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
If yes, what type?			
Water conditions:		<input type="checkbox"/> Wet	<input type="checkbox"/> Dry <input type="checkbox"/> Submerged
Possible hazardous atmosphere exists:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>If yes, follow confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es)</i>			
Measurement of trench:		Depth _____	Length _____ Width _____
Ladder within 25 feet of all workers:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Excavated material (pile) 2' or more from edge of excavation:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Employees exposed to public vehicular traffic:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Other utilities protected (water, sewer, gas):		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Sewer or natural gas lines exposed:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
<i>If yes, refer to confined space entry procedures policy; complete Confined Space Entry Permit; monitor for toxic gas(es).</i>			
Periodic inspection:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Employees trained in excavation:		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Employees briefed on hazards of this job:		Yes <input type="checkbox"/>	No <input type="checkbox"/>

Appendix D

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWANCE SLOPES (H:V) (1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP (3)
STABLE ROCK	VERTICAL (90 DEG.)
TYPE A (2)	$\frac{3}{4}$: 1 (53 DEG.)
TYPE B	1:1 (45 DEG.)
TYPE C	1 $\frac{1}{2}$:1 (34 DEG.)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal, been rounded off.
2. A short-term maximum allowable slope of 1/2H: IV (63 deg. is allowable in excavations in Type A soils that are 12 feet (3 in depth. Short-term maximum allowable slopes for excavations 12 feet (3.67 m) in depth shall be 3/4H: IV (53 deg.).
3. Sloping or benching for excavations greater than **20 feet deep** shall be designed by a registered professional engineer.