Excavation and Trenching Program

Rev. April 2023

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I. Policy

This program has been developed to protect City of Redlands ("City") employees from the serious hazards associated with excavation and trenching activities. All participation in excavation and trenching activities will be in accordance with Cal/OSHA rules and regulations, as well as the procedures outlined in this program. Only employees trained and authorized may enter job sites containing excavations or trenches. This program will establish the responsibilities, training standards, and procedures for work performed in excavations and trenches.

II. Authority

California code of regulation Title 8 Section 1540-1541.1

III. Scope

This program applies to all City employees whose job tasks require exposure to excavations and or trenches.

IV. Definitions

A. **Accepted Engineering Practices** - Those requirements which are compatible with standards of practice required by a registered professional engineer.

B. **Aluminum Hydraulic Shoring** - A pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

C. **Benching (Benching System)**- 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.

D. **Cave-In** - 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.

E. **Competent Person**- 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.

F. **Cross Braces-** 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.

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

H. **Faces** or **Sides-** The vertical or inclined earth surfaces formed because of excavation work.

I. **Failure-** The breakage, displacement, or permanent deformation of a structural member or connection to reduce its structural integrity and its supportive capabilities.

J. **Hazardous Atmosphere-** 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.

K. **Kick Out-** The accidental release or failure of a cross brace.

L. **Protective System-** 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.

M. **Ramp-** 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.

N. **Registered Professional Engineer-** A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "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.

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

P. **Immediately Dangerous to Life or Health (IDLH)** - Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a trench or excavation.

Q. **Shield (Shield System) -** A 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 in accordance with 1926.652(c) (3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

R. **Shoring (Shoring System)-** A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

S. **Sides** – See "Faces"

T. **Sloping (Sloping System)-** A method of protecting employees from cave-ins by excavating to form sides of an excavation that are 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 conditions of exposure, and application of surcharge loads.

U. **Stable Rock -** Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is stable when the rock material on the side or 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.

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

W. **Support System -** A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

X. **Tabulated Data -** Tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Y. **Trench (Trench Excavation) -** 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 (4.6 m). If forms or other structures are installed or constructed in an

excavation to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Z. **Trench Box** – See "Shield".

AA. **Trench Shield** – See "Shield"

BB. **Uprights -** 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."

CC. **Wales -** Horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

V. Responsibilities

RISK MANAGEMENT

A. Review and revise the Program:
    1. On an annual basis;
    2. When changes occur to CCR T8, that prompt revision of this document
    3. When operational changes occur that require a revision of this document
    4. When there is an accident or near miss that relates to this program
B. Review and grant approval of a contractor's excavation pre-qualifications prior to start of project.
C. Coordinate necessary training and consult on the necessary Personal Protection Equipment (PPE) required for hazards in excavation procedures.
D. Respond to inquiries from City employees regarding the excavation program.

DIRECTORS, MANAGERS, AND SUPERVISORS

A. Ensure excavation teams undergo proper training prior to excavation involvement.
B. Provide proper equipment for excavation activities.
C. Maintain gas monitor/instrument bump test and calibration records.
D. Should an incident occur, complete a Report of Employee Injury or Incident form and any additional documentation needed to investigate work related injuries and illnesses.
E. Ensure provisions of excavation program are fulfilled.
F. Ensure that employees are informed, trained, and provided with the appropriate shoring systems and equipment to be protected from potential excavation hazards.

COMPETENT PERSON

A. Receive training to achieve and maintain "competent person" status.
B. Act as the "competent person" for job sites under their control that contain excavation or trenches.
C. Evaluate excavations in work areas under their control.
D. Stop work when conditions arise that put employees in danger.
E. Eliminate hazardous conditions.

AFFECTED EMPLOYEES

A. Comply with the Excavation Program and any further recommendations provided by the supervisor or competent person.
B. Complete excavation training requirements and request further instruction if needed.

C. Conduct assigned tasks in a safe manner and properly wear all assigned personal protective equipment.
D. Report any issues to immediate supervisor or competent person for assistance.

CONTRACTORS

A. Contractors who perform work on City property must adhere to the City's Excavation Program. It is the responsibility of the Project Manager to ensure these measures are carried out.
B. Contractors must also submit a copy of their Excavation Program to Risk Management for review.
C. Contractors with an insufficient program will not be allowed to begin work until their program meets or exceeds the requirements of the City's program.
D. Contractors are expected to always enforce these guidelines while performing work for the City.
E. If there is a conflict in procedures between Contractor and City programs, notification will be sent to Risk Management for support.

VI. Program

PRIMARY PROCEDURES

A. Underground Utility Locating
    1. All utilities in the vicinity of the excavation must be marked or located prior to the disturbance of soil or ground cover.
    2. The location of the utilities should be performed jointly by City of Redlands Personnel and Underground service alert (USA).
        a. When excavation operations approach the estimated location of underground installations, clearance must be maintained between the underground utility, as marked, and the cutting edge or point of mechanized equipment.
        b. The clearance must not be less than two (2) feet on either side of the outer limits of the utility. However, if the clearance is less than two (2) feet, exposure of the utility may be accomplished only using hand excavation, air cutting, or vacuum excavation.
        c. Any utilities exposed during excavation activities shall be properly supported to prevent movement of the utility line.
B. Staging and Surface Encumbrance
    1. When leaving an excavation open and unattended measures shall be taken to prevent unauthorized access. When an excavation is unattended and more than one (1) foot in depth a six (6) foot chain link fence is required surrounding the excavation. When an excavation is less than a foot in depth, 42-inch temporary fencing is acceptable. Fencing is required for depressions left by the removal of trees unless the depression is backfilled at once
    2. Any surface encumbrances, or impediments, that are in a position that could create a hazard to employees in or around the excavation shall be removed or supported to safeguard employees. All soil and rock removed during the excavation shall be placed at least two (2) feet from the edge of the excavation.
C. Public Protection
    1. Barricades, walkways, lighting, and signs must be provided for the protection of the public before the start of excavation operations. Guardrails, fences, or barricades will be provided adjacent to walkways, driveways and other pedestrian or vehicle thoroughfares.
    2. Only City employees authorized to work in or near excavations shall be allowed in excavation work areas. Unauthorized personnel shall be removed from the work area immediately.
D. Inspections
    1. A competent person shall perform daily inspections before work begins and as needed throughout the shift to ensure no hazardous condition exists.

2. No employee shall enter an excavation prior to inspection by the competent person.
3. No employee shall enter an excavation until all hazards are properly mitigated.
4. Appendix A and Appendix B shall be used for inspections by supervisor and competent person.

EXCAVATION REQUIREMENTS

A. Vehicular Traffic
    1. Employees exposed to public vehicular traffic shall wear ANSI approved safety vests.
        a. Day time and/or below 50 mph= Class II
        b. Night Time and/or above 50 mph=Class III
B. Competent Person
    1. Every excavation worksite must have a competent person on site.
C. Falling Loads
    1. 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 any spillage or falling materials.
D. Access and Egress
    1. A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are four (4) feet in depth or greater. Safe means of egress should be provided so that no more than 25 feet of lateral travel is necessary for employees to reach egress.
        a. If a ladder is used for access or egress, it must be secure and extend at least 36 inches above the landing.
        b. Structural ramps that are used solely by employees shall be designed by a competent person, while ramps that are used for access or egress of equipment shall be designed by a competent person qualified in structural design.
E. Hazardous Atmospheres
    1. When potential or hazardous atmospheres exist, atmospheric monitoring shall be performed prior to entry into the excavation and continuously to prevent build up.
        a. At a minimum, monitoring shall be performed for percent oxygen content, lower explosive limit (LEL), carbon monoxide, and hydrogen sulfide.
        b. Safe entry conditions are defined as an oxygen content between 19.5-23.5%, a lower explosive limit < 10%, carbon monoxide < 25 parts per million (ppm), and hydrogen sulfide < 10 ppm.
        c. If an additional specific atmospheric contaminant exists or has the potential to exist, monitoring for that contaminant shall be performed.
        d. Measures that can be taken to control hazardous atmospheres include providing forced ventilation and, if necessary, the use of appropriate respiratory protection equipment.
        e. Prior to a member of the excavation crew donning respiratory protection equipment, the competent person for the excavation shall contact the City Safety Specialist for consultation.
        f. Where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation the City Safety Specialist and City Fire Department shall be notified.
F. Water Accumulation
    1. City of Redlands employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions are taken to protect employees from hazards posed by water accumulation. Special precautions shall be given when excavations have soil conditions that could cause a quicksand effect and trap an employee. The precautions necessary to protect employees adequately vary with each project, but could include:
        a. Water removal to control the level of accumulating water;

b. Special support or shield systems to protect from cave-ins;
c. Use of board or other equivalent means placed on base of excavation; or
d. Use of a safety harness and lifeline.

2. If water removal equipment is utilized to control accumulating water, it should be monitored by a competent person.
3. If excavation work interrupts the natural drainage of surface water, 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.

G. Employee Protection
1. All materials and equipment, including spoils, shall be kept at least two (2) feet from the edge of an excavation to prevent materials or equipment from falling or rolling into excavations.
a. Protection shall also be afforded to prevent loose rock or soil from falling and rolling from an excavation face onto an employee.
b. Measures that can be taken to prevent such events are scaling to remove loose material, installation of protective barricades on the face to stop and contain material, or other means that provide equivalent protection.
c. Employees are not permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at lower levels are protected from the hazard or falling, rolling, or sliding material and equipment.

H. Fall protection
1. Walkways or bridges with standard guardrails shall be provided when employees or equipment are required or permitted to cross over an excavation over 6-feet in depth and wider than 30 inches.

PROTECTIVE SYSTEMS

A. Soil Classification
1. All soils in the City of Redlands shall be designated as Type C unless a determination is made by the competent person that a Type A or B soil is present.
2. When soils are configured in layers, they will be classified by the weakest layer.
3. Soil shall be classified by the competent person before selecting a protective system.

B. Maximum Allowable Slope

Soil or Rock Type	Max Allowable Slope (H:V)[1] For Excavations less than 20ft deep
Stable Rock	Vertical (90 degrees)
Type A[2]	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	½ :1 (34 degrees)

a. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
b. A short term (< 24 hours) maximum allowable slope of ½ H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet or less in depth. Short term maximum allowable slopes for excavations greater than 12 feet in depth shall be ¾ H:1V (53 degrees).
c. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

C. Use of support systems, shield systems, and other protective systems
1. Any excavation deeper than 5 ft. must have a protective system.
2. Any excavation deeper than 20 ft. must have a protective system designed by a professional engineer.

3. Trench boxes and hydraulic shoring shall be used according to the manufacturer's tabulated data, and shall be in accordance with all specifications, recommendations and limitations issued or made by the manufacturer.
    a. When a shield (trench box) is used, work shall not be permitted outside the shield.
    b. Employees shall not be allowed in shields when they are being installed, removed, or moved vertically.
    c. Timber shoring shall be used according to tabulated data.
    d. Timber shoring in a trench greater than 20 feet in depth shall be designed by a registered professional engineer.
    e. Materials and equipment used for protective systems shall be free from damage or defects that may impair their proper function.
    f. A competent person shall examine materials or equipment that is used for protective systems. If the materials or equipment are found to be damaged or defective they shall be removed from service and not put back into service until it is evaluated and approved by a registered professional engineer.
    g. Materials and equipment used for protective systems shall be used and maintained in a manner that is consistent with the recommendations of the manufacturer.
    h. All protective systems are stored at the City Yard located on1270 W Park Ave. in the Water Distribution Weld Shop.

D. Installation and Removal of Support
1. Excavation of material shall be limited to a level no greater than 2 feet below the bottom of the members of the support system, given that the system is designed to resist the forces calculated for the full depth of the trench and when given that there are no indications of the loss of soil from behind or below the support system.
2. Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.
3. Members of the support system shall be securely connected together to prevent sliding, falling, kick-outs, or other failures.
4. Members of support systems shall not be subject to loads exceeding their capacity.
5. Prior to the removal of support members, precautions should be taken to ensure the safety of employees.

E. Stability of Adjacent Structures
1. 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 the stability of such structures for the protection of employees.
2. Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall not be permitted except when:
    a. A support system, such as underpinning is provided to ensure the safety of employees and the stability of the structure; or
    b. The excavation is in stable rock; or
    c. A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation to be unaffected by the excavation activity, or
    d. A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees
3. Sidewalks, pavements, and adjoining structures shall not be undermined unless a support system or other method of protection is provided to protect employees from the possible collapse of such structures.

F. Bump test and Calibration
1. All direct-reading portable gas monitors or instruments must have a Bump Test with the appropriate gases as required by the manufactures instructions, prior to each days use.

2. Always make sure to check the expiration date of the gas before usage.
3. If an instrument fails a bump test, the operator should perform a full calibration on the instrument before use.
4. If the instrument fails full calibration, the instrument must be taken out of service.
5. For calibration frequency, use the manufactures guidelines.
6. Bump test and calibration records must be kept on file for the life of the instrument.
7. Operators using this equipment must be trained in proper usage, storage, and calibration/bump test procedures.

EMERGENCY RESCUE EQUIPMENT

All emergencies shall immediately be called in to Emergency Services (911), Department Managers, and Risk Management upon occurrence of an incident.

A. Non-entry rescue attempts shall be the only acceptable rescue for excavation emergencies.
    1. To facilitate non-entry rescue, retrieval systems or methods shall be used. Retrieval systems shall meet the following requirements:
        a. Each excavation entrant shall use a full body harness, with a retrieval line attached at a suitable point (for example at the center of the entrant's back near shoulder level) so that when extracted, the entrant presents the smallest possible profile.
        b. The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary.
B. Emergency rescue equipment shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation.

TRAINING

A. All personnel involved in trenching or excavation activities shall be trained under the following guidelines:
    1. Training shall be performed before employees are assigned duties in excavations;
    2. Retraining will be performed when work site inspections indicate that an employee does not have the necessary knowledge or skills to safely work in or around excavations, or when changes to this program are made; or
    3. At minimal on a two-year basis.
    4. Training will be offered via:
        a. Classroom for competent person; and
        b. NeoGov for awareness level.
B. Training records will be maintained by the Safety Specialist, and shall include:
    1. Date of the training program;
    2. Name(s) of the instructor(s) who conducted the training;
    3. A copy of the written material presented; and
    4. Name(s) of the employee(s) who received the training.
    5. Certificates of completion by employees who received the training.

VII. Recordkeeping

All training records and documents prepared in association with the Excavation Program will be maintained by the Office of Human Resources/Risk Management.
Bump Test and calibration records will be maintained by department designees.

VIII. Additional References

http://www.dir.ca.gov/Title8/1540.html
http://www.dir.ca.gov/Title8/1541.html
http://www.dir.ca.gov/Title8/1541_1.html

Excavation Competent Person Evaluation Form

Employee Name: _____ Date: _____
Job Title(s): _____
Department: _____
Phone Number: _____

Instructions: Evaluate the designated individual by completing the items in the evaluation list by indicating the appropriate response and noting descriptive conditions in the comments column.

Description of Evaluation Item:			
Does the designated individual have training and knowledge of:	**Yes**	**No**	**Comments**
The requirements of 1926 Subpart P?	☐	☐	
The use of protective systems?	☐	☐	
Soils analysis and classification?	☐	☐	
The use of the soil classification worksheet?	☐	☐	
Hazardous environments?	☐	☐	
Does the designated individual have the authority to:	**Yes**	**No**	**Comments**
Take prompt corrective measures to eliminate existing and predictable hazards?	☐	☐	
To stop work?	☐	☐	
Does the designated individual have the knowledge and authority to conduct inspections:	**Yes**	**No**	**Comments**
Of the jobsite on a daily basis?	☐	☐	
Of adjacent areas?	☐	☐	
Of the protective systems?	☐	☐	
Prior to the start of work?	☐	☐	
As needed throughout the work shift?	☐	☐	
After a rainstorm or hazard-increasing occurrence?	☐	☐	
Of excavation safety equipment used in protective systems?	☐	☐	
Using the Excavation Site Checklist and Daily Field Report?	☐	☐	
Additional Comments:			

Supervisor: _____ **Date:** _____

Excavation Site Checklist and Daily Field Report

Competent Person: _____ Date: _____
Project Name: _____ Time: _____
Project Location: _____ Rainfall (Inches): _____
Weather Conditions: _____

Instructions: Complete the items in the checklist by circling the appropriate response and noting descriptive conditions in the comments column. Sign the form to attest that the indicated items were reviewed during the inspection.

Description of Inspection Item:	Yes	No	Comments
1. Have all utilities marked their locations?	☐	☐	
2. Have all affected parties been notified?	☐	☐	
3. Is proper traffic control in place?	☐	☐	
4. Has the soil been classified?	☒	☐	All soils are classified as type C soils unless otherwise determined by the competent person
5. Has a protective system been selected by the competent person?	☐	☐	
6. Has the competent person inspected the excavation/trench prior to start of each work period?	☐	☐	
7. Has the work plan been discussed with all employees?	☐	☐	
8. Are all employees protected from cave-ins when entering and exiting the excavation?	☐	☐	
9. Have hazardous objects around the excavation been removed or supported?	☐	☐	
10. Is all spoil maintained at least 2 feet back from the edge of the excavation?	☐	☐	
11. Are ladders used for access and egress? If so, are they installed correctly?	☐	☐	
12. Are employees protected from loose materials or tools which could fall into the trench?	☐	☐	
13. Are employees wearing the proper safety equipment?	☐	☐	
14. Is the excavation/trench free of standing or seeping water?	☐	☐	
15. Are there evidences of shrinkage cracks in the face of the trench wall?	☐	☐	
16. Were there evidences of sloughing of soil from the trench face since the last inspection?	☐	☐	
17. If a support system has been installed, was it installed in accordance with recommendations?	☐	☐	
18. Is heavy equipment kept away from the edge of the excavation?	☐	☐	
19. Are any changed conditions properly noted?	☐	☐	
20. Additional comments on safety.	☐	☐	

Competent Person Signature: _____ **Date:** _____