Underground Safety Board

Board Meeting of the California Underground Facilities Safe Excavation Board

July 10, 2023

1:00 p.m.

Item 18:
Potholing Standards Development Update

Item 18 Overview

1. **Background**
   - Goals
   - Structure
2. **Potholing is about Information Development**
3. **Applicability to Case Studies**
   - San Francisco
   - Paso Robles
   - Walnut Creek
4. **Features of Draft Standards**
   - Depth
   - Continuous Potential Encounters
   - Focus on Surface Indicators
   - Interaction with Design
5. **What Is Not in Draft Standards**
6. **Next Steps**

GOVERNMENT CODE SECTION 4216.18

The board shall develop a standard or set of standards relevant to safety practices in excavating around subsurface installations and procedures and guidance in encouraging those practices…The standard or set of standards shall address all of the following:

(a) Evidence necessary for excavators and operators to demonstrate compliance with Sections 4216.2, 4216.3, 4216.4, and 4216.10.

(b) What constitutes reasonable care…in using hand tools around subsurface installations within the tolerance zone…

(c) What constitutes reasonable care…in grading activities on road shoulders and dirt roads which may include standards for potholing.

Goal of Safety Standards

1. Excellence is the goal
2. Make standards general enough to allow the standard of excellence to be met in different industries and activities
3. “Standards” that are prescriptive, widely applicable, and necessary should be considered instead for regulations

Safety is *emergent*. It emerges from everyone achieving excellence in their respective roles.

	Means	Ends
Micro	*Micro-means*	*Micro-ends*
	"Prescriptive"	"Performance-based"
Macro	*Macro-means*	*Macro-ends*
	"Management-based"	"General duty/liability"

National Academies Transportation Research Board Special Report 324; “Designing Safety Regulations for High-Hazard Industries”; 2017; DOI 10.17226/24907; http://nap.edu/24907

Structure of Standards

Title: Short description

Standard Language: Present tense language describing actions of persons

Discussion: Context to assist people in adapting standard to their processes

References: Documentation that supports need for standard

Related Requirements: References to statutory or regulatory requirements

3.4 Operator Troubleshooting Contact Available to Locators

Operators provide locators with a contact to assist them in resolving problems identified during locating activities. Persons are available to assist the locator during the hours that locators are working.

Discussion: Locates may be challenging for many reasons, including a congested right of way, broken tracer wire, or access to electrical connections to operator equipment. The operator supports locators in the field by responding to locator problems and providing instruction when a facility cannot be effectively located without further intervention.

References:

Investigation 22LA01484: Noble Creek Park (Beaumont) Late Mark Complaint

Related Requirements:

Government Code § 4216.3 (a)(1)(A)

Standards are About Information

What information is provided to the locator?

- 3.1 Relevant Information Provided to Locators
- 3.4 Operator Troubleshooting Contact Available to Locators

What information is provided to the excavator?

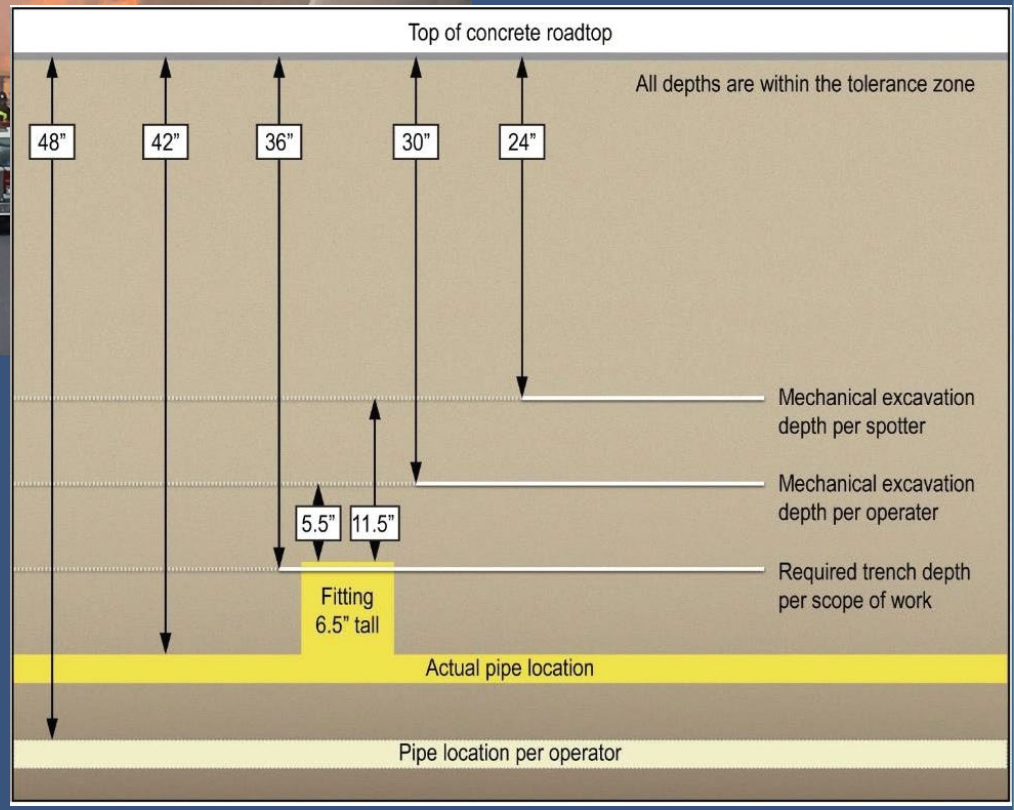
- 3.2 Information Sharing With Excavators Outside of Uniform Color Code and Marking Guidelines
- 5.1 Information Kept Onsite

What information is recorded?

- 3.6 Utility Operator Locate and Mark Documentation
- 4.3 Documentation of Delineation
- 5.4 Documenting Utility Operator Marks and the Results of Potholing

San Francisco, 2019

Incident:
A mini excavator bucket struck the intersection of 2-inch and 4- inch natural gas mains, rupturing the lines and causing a fireball that engulfed nearby structures. The work was being performed by a subcontractor installing a fiber line in an urban area.

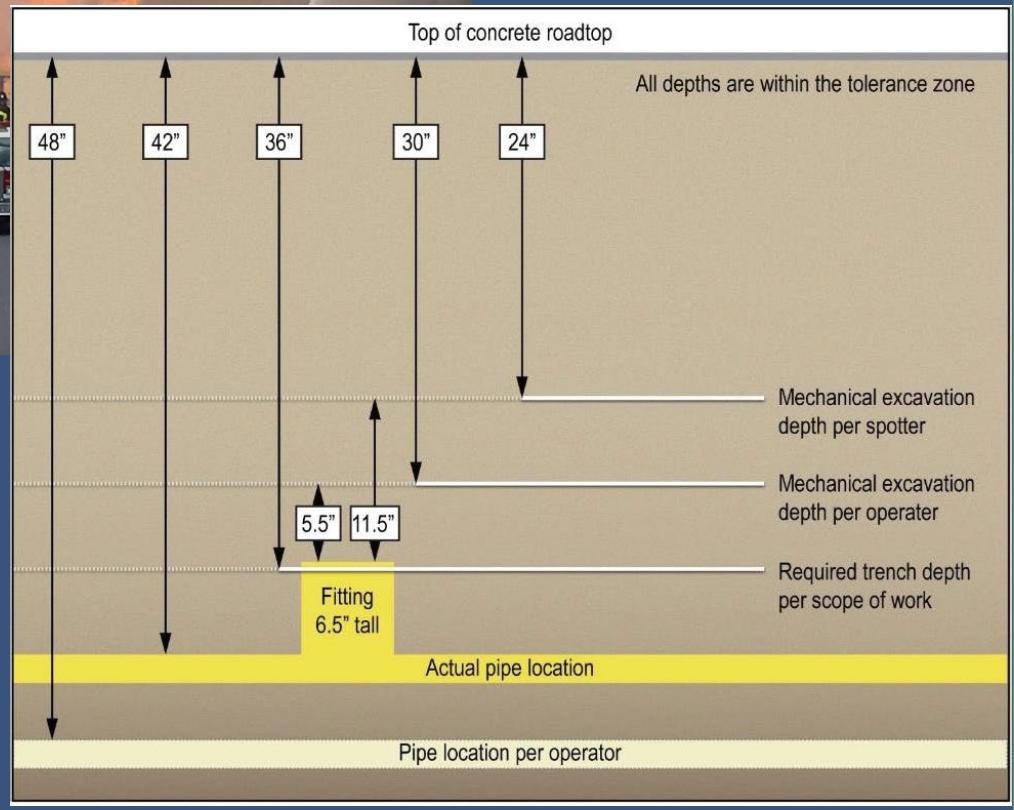


San Francisco, 2019

Design indicated no existing buried utilities. New fiber line design to be in the same location and depth as a gas pipeline main.

Safety Standards

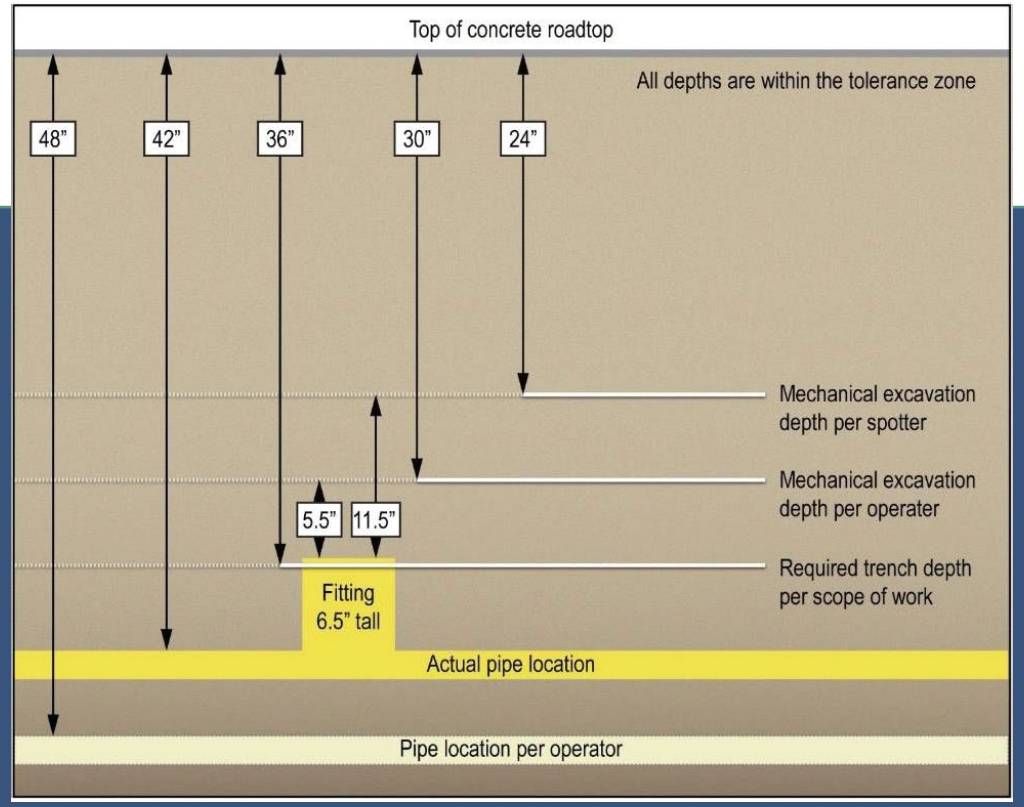
Pending design standards



San Francisco, 2019

Facilities were not potholed prior to installation of the fiber line, leading the subcontractor to need to make design decisions—like that of facility alignment and clearances with other utilities—on the fly that should have been made by a licensed engineer.

4.1 Existing Facility Verification Conducted Prior to and Separate from Construction for Designed Projects



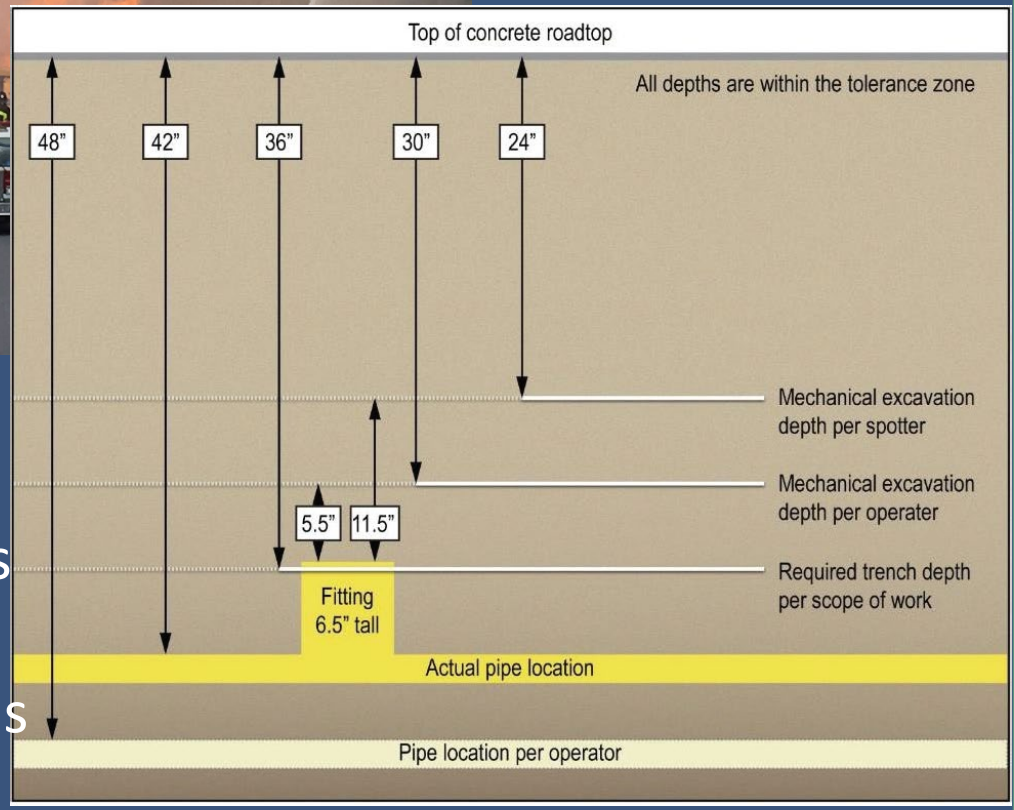
Facility verification via potholing prior to construction and recording the location information (including depth) in pothole logs would have provided workers a better understanding of where the utilities were located and their depth within the excavation area.

San Francisco, 2019

Subcontractor potholed both the 2” and the 4” gas lines, but not at their intersection, where a fusion-welded joint protruded upward six and a half inches.

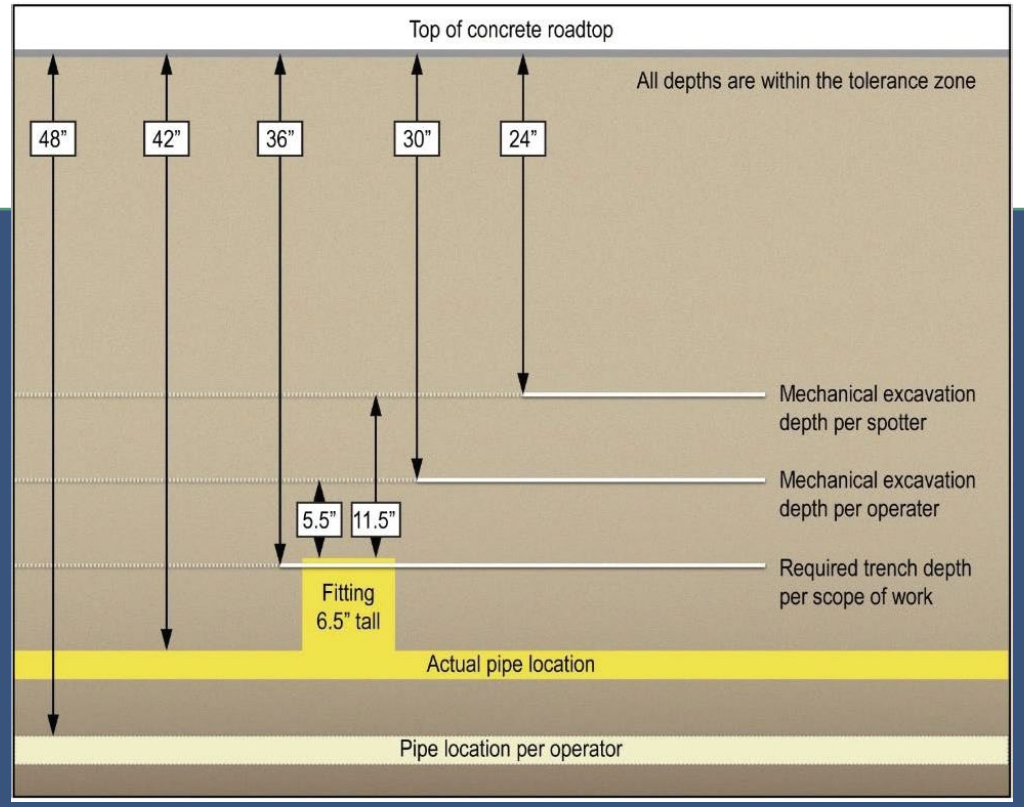
5.3 Identification of Potholing Locations

Had the excavator considered buried facility intersections when determining where to pothole, they likely would have found the fusion weld appurtenance with hand tools and not struck it with an excavator bucket.



San Francisco, 2019

The operator of the mini excavator and his spotter did not have the same understanding of how deep they were excavating and were digging deeper than each believed.



5.3 Documenting Utility Operator Marks and the Results of Potholing

Had the excavator measured and recorded the depth of the of 2-inch and 4-inch natural gas mains when they exposed them, the excavator likely would have recognized that the path of their fiber conduit was co-incident with the existing gas line.

Paso Robles, 2008

Incident:
An excavator bucket struck an 8-inch city water line while installing a large diameter county water pipeline. The water flooded the empty pipeline while two workers were inside removing support struts, drowning them. The project inspector had thought that a water line was in the area, and work stopped briefly, but work continued after a brief discussion until the water line was struck.

Paso Robles, 2008

The water company provided maps in lieu of marks due to traffic from the busy intersection, but map did not include a legend or orienting features.

Safety Standards
4.2 Traffic Control Information for Locators on Ticket

The excavator providing traffic control restrictions and other information on the ticket could have assisted with obtaining operator locate and marks for existing subsurface installations.

Paso Robles, 2008

The water line was not potholed. The water company representative and construction foreman performed a walkthrough two weeks prior to excavation. During walkthrough, each had a different understanding about whether line would be marked.

Safety Standards
4.1 Existing Facility Verification Conducted Prior to and Separate from Construction for Designed Projects

Ensuring potholing was performed on all facilities in the path of excavation prior to construction and recording location information in pothole logs may have provided workers a better understanding of where the facilities were located.

Paso Robles, 2008

During the discussion of the possible presence of a water line, no one contacted the city to determine whether a water line was nearby.

Safety Standards
5.1 Information Kept Onsite

The excavator stopping work and contacting the utility operator to clarify the location of the water line prior to proceeding could have allowed the excavator to learn of the line before striking it.

WALNUT CREEK, 2004

Incident:
While digging a trench to install a large diameter waterline, an excavator bucket struck a 10-inch gasoline pipeline killing five and seriously injuring another four. The line had been marked as straight along a street, but it in fact had been installed with a jog to go around an oak tree. The oak tree had since been removed.

Chronicle / Michael Maloney, 2004

Walnut Creek, 2004

The petroleum pipeline company's line rider did not consult the maps when locating, which indicated the jog in the line.

Safety Standards
3.1 Relevant Information Provided to Locators

Had the operator's locators and standby personnel been provided with the drawings provided to the engineering company designing the water project, the line locator and standby personnel may have identified the bend in the pipe prior to excavation.

Walnut Creek, 2004

The line was not marked again after the project had been turned over to the new company; rather the pipeline company and the contractor relied on stakes placed the previous year to identify the potholing locations.
The construction supervisor relied on the line rider and the stakes of previous potholes and did not consult design documents

Safety Standards
5.1 Information Kept Onsite

Chronicle / Michael Maloney, 2004

Had relevant design documents been kept onsite and available for all workers to see, the contractor may have noticed the discrepancy between the straight line of stakes and the bend indicated in the design documents.

Walnut Creek, 2004

The line was not marked again after the project had been turned over to the new company; rather the pipeline company and the contractor relied on stakes placed the previous year to identify the potholing locations

Chronicle / Michael Maloney, 2004

Safety Standards
5.3 Identification of Potholing Locations

Had the excavator used design plans when determining locations to pothole, the potholing crew may have identified the jog in the petroleum pipe during potholing.

Statute Calls for Standards Regarding Depth

4216.18. (b) What constitutes reasonable care, as required by paragraph (1) of subdivision (a) of Section 4216.4, in using hand tools around subsurface installations within the tolerance zone, considering the need to balance worker safety in trenches with the protection of subsurface installations. As part of determining reasonable care, the board shall consider the appropriate additional excavating depth an excavator should make if either of the following occur:
(1) The subsurface installation is delineated within the tolerance zone but it is not in conflict with the excavation.
(2) The location of a subsurface installation is determined, but additional subsurface installations may exist immediately below the located subsurface installation.

How is Depth Information Developed?

CARCGA 2019 Proposal:

"Soft" dig within tolerance zone to the depth of excavation plus an additional buffer depth. If you don't find the facility, you have information to suggest that it is deeper.

Strengths: Straightforward

Weaknesses: Doesn't account for mismarks

Constraint: Operators don't provide depth information

How is Depth Information Developed?

3.1 Relevant Information Provided to Locators

"Utility operators also provide the following information to employee and contract locators to the extent the information exists:… The presence of deeply-buried facilities,…

3.6 Utility Operator Locate and Mark Documentation

"…The field mark documentation includes location reference information where feasible, especially of surface indicators, and indicates the presence of deeply buried facilities."

5.5 Deeply Buried Facilities – Exceptions to Positive Confirmation Based on Data Quality C Information

"When the utility operator has identified a facility significantly deeper than the excavation, designers and/or excavators can use a combination of Quality Level C and Quality Level D information in lieu of exposure."

How is Depth Information Developed?

Safety Standards proposal:

Don't need to expose facility if other information indicates facility is "deeply buried." Operator provides information to excavator about the presence of "deeply buried" facilities.

Strengths: Better accounting for mismarks

Weaknesses: Information may not exist

Not all operators will follow the standard

Addressing Continuous Potential Encounters

0.2 Continuous Potential Encounter

"A continuous potential encounter means a situation where an excavation could interact with an existing buried facility at multiple locations, such as in the installation of a new buried facility parallel to the existing buried facility or road milling or grading over existing buried facilities…"

5.3 Identification of Potholing Locations

"… If the excavation has the potential for continuous potential encounters with existing buried utilities, such as in trenching or boring to install a new buried utility parallel to an existing one or road milling or grading over existing lines, the excavator determines where to pothole and how many potholes to make to preserve clearance and depth buffers."

Surface Indicators to Confirm Documentation and Marks

3.6 Utility Locate and Mark Documentation

"…The field mark documentation includes location reference information where feasible, especially of surface indicators, and indicates the presence of deeply buried facilities."

4.3 Documentation of Delineation

"…The photographs of delineation include reference information where feasible, especially of surface indicators."

5.2 Confirmation of Marks Using Utility Operator Responses and Surface Indicators

"…The excavator uses the response information provided by utility operators and reviews the site for surface indicators to confirm that all utility operators have identified their buried facilities…"

Surface Indicators to Confirm Documentation and Marks

5.3 Identification of Potholing Locations
"Using design plans (as available), utility operator marks and maps, and surface indicator surveys, the excavator determines where potholes are necessary to determine the exact location of existing buried facilities..."

5.4 Documenting Utility Operator Marks and the Results of Potholing
"The excavator records utility operator field marks, including through photographs. The photographs of field marks include reference information where feasible, especially of surface indicators..."

5.6 Identification and Protection of Sewer Laterals
"...If sewer laterals are determined likely, the excavator will look for surface indicators indicating the location of sewer laterals, including cleanouts...."

Design and Potholing Standards are Linked through Information Development and Dissemination

4.1 Existing Facility Verification Conducted Prior to and Separate from Construction for Designed Projects

"For projects requiring design, facility verification through potholing is conducted prior to construction. Information regarding the location (including depth) of buried facilities is recorded in pothole logs."

5.1 Information Kept Onsite

"Project owners ensure that excavators are provided all relevant documents... Excavators keep this information…onsite and available for all workers to review. Relevant documents include …

- design plans showing information about subsurface installation locations,
- information regarding the buried facilities in the excavation area that have been provided by utility operators that had not been reviewed in the development of design plans, and
- pothole logs.

Appendix A: Surface indicator Library

- Reference guide for surface indicators
- Provides information about what to expect underground when these seen above ground
- Allow excavators to identify unmarked facilities
- Guide to be populated by operator photos and descriptions

Appendix A: Surface Indicators of Buried Facilities

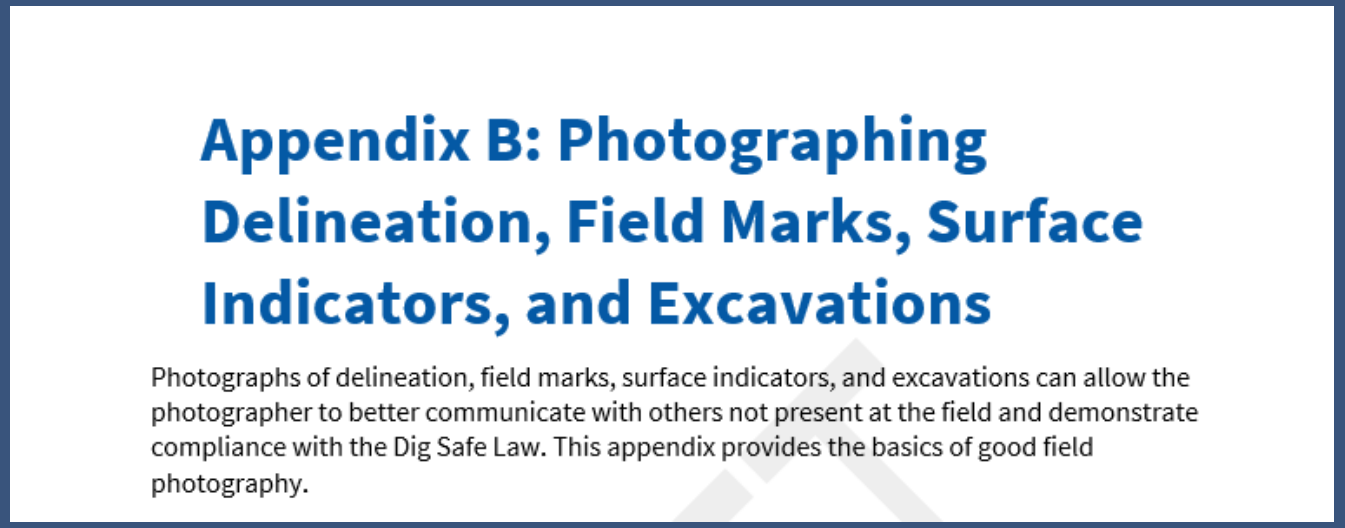
While buried facilities are not themselves directly visible, their presence is rarely completely hidden. Buried facilities can often be identified by personnel access points, surface equipment fed by underground lines, or locations where the facility transitions between above-ground and below-ground. Collectively, these are referred to as "surface indicators." The following is a collection of different types of surface indicators and description of what numbers and types of buried facilities they may indicate.

1.1 Pad-Mounted Transformer

Pad-mounted transformers are part of the electric distribution system that take distribution-level voltages and step the voltage down to lower voltages to serve homes and businesses. As such, pad-mounted transformers can be expected to have a 4-35 kilovolt input connected and one or more outputs in the hundreds of volts.

Appendix B: Guide to Photography

- Provide guidance for taking images of delineations, field marks, surface indicators, and excavations
- Allow field personnel take pictures with context (geographic features, street signs, etc.) to better capture what they see on site.



Appendix B: Photographing Delineation, Field Marks, Surface Indicators, and Excavations

Photographs of delineation, field marks, surface indicators, and excavations can allow the photographer to better communicate with others not present at the field and demonstrate compliance with the Dig Safe Law. This appendix provides the basics of good field photography.

Not Included In Current Draft

- **The extent of facility exposure necessary**

  4216.18 *(b) [T]he board shall consider the appropriate additional excavating depth an excavator should make if…*

  (2) The location of a subsurface installation is determined, but additional subsurface installations may exist immediately below the located subsurface installation.

- **Operator information sharing for shallow facilities**

Current Outline for Standards

0. Definitions
1. [Reserved]
2. **Design**
3. **Locate and Mark**
4. **Pre-Excavation**
5. **Excavation**
6. Unmarked and Abandoned Facilities

Potholing Committee: Members Bianchini and Charland
Planning and Design Committee: Members Johns and Johnson
Unmarked and Abandoned Lines Committee: Members Johns & Munoz

Next Steps

- Workshops on draft standards (August/September)
- Design Standards (November/January)
- Review missing elements (1st Quarter 2024)
  - The extent of facility exposure necessary
  - Shallow facilities

Potholing Committee: Members Bianchini and Charland
Planning and Design Committee: Members Johns and Johnson
Unmarked and Abandoned Lines Committee: Members Johns & Munoz