California Underground Facilities Safe Excavation Board

July 11-12, 2022

Agenda Item No. 16 Information Item – Staff Report

Potholing Standards Development

PRESENTERS

Tony Marino, Executive Officer

SUMMARY

Statute directs the Board to consider standards for potholing around roadways. However, potholing occurs in many circumstances and excavations, and statute does not specify the frequency or locations excavators should pothole. The ambiguity centers on two undefined terms in Government Code 4216.4(a)(1): conflict and exact location. This report describes the harms that can be caused by these. Board staff have scheduled a workshop on Thursday, August 4 from 3-5 p.m. to seek input from the public about circumstances in which potholing practices and increased information sharing can increase public and worker safety. Staff recommends that the Board form a Potholing Committee to lead the development of potholing standards and that the Board encourage participation in the August 4 workshop.

STRATEGIC PLAN

2021 Strategic Plan Objective: Improve Excavation Safety and Location Practice Safety

Strategic Activity: Develop Safety Standards

BACKGROUND

Potholing has been a continuous but indirect topic of conversation in the Board's standards development, and the Board has held numerous workshops and surveys that involve potholing practices.[1]

[1] November 8, 2018, Agenda Item No. 7, *AB 1914: Initial Discussion on Scope of Implementation*; *April 24, 2019, Reasonable Care Standards Workshop; AB 1914 Workshop Survey – Results Summary;* May 13-14, 2019, Agenda Item. No. 6, *AB 1914 Implementation*; August 27, 2020, Agenda Item No. 1, *Trenchless Excavation Reasonable Care Workshop*; September 14, 2020, Agenda Item No. 18, *Discussion on Reasonable Care Standards Development for Trenchless Excavation Techniques;* October 29, 2020, Agenda Item No. 3, *Reasonable Care in Trenchless Excavation*; November 16, 2020, Agenda Item No. 9, *Update on Reasonable Care Standards Development for Trenchless Excavation Techniques*; *Trenchless Excavation Survey Responses*; July 13, 2021, Agenda Item No. 7, *Update on Safety Standards: Public Works Excavation Survey and Interviews Preliminary Results*; *Preliminary*

Government Code § 4216 Requirements and Title 19 Regulations

Government Code § 4216 and the California Code of Regulations (CCR) Title 19 contain provisions related to potholing and the determination of the location of a facility. For instance, excavators must determine the exact location of facilities with hand tools prior to using power tools,[2] on-site meetings occur in the vicinity of high priority facilities to determine how to determine the location of the facility,[3] and an excavator requests additional information on the location of a facility if they cannot determine its location with hand tools.[4]

The Board implemented AB 1914 (Flora, 2018) in regulation codified as 19 CCR § 4501, which specifies the conditions for and use of equipment other than hand tools that may be used to determine the exact location of a facility.[5] This regulation allows for a process for excavators and operators to come to agreement on the use of different tools if there is a question of the safety of workers or effectiveness of the tool.[6]

The Board also created a process for the resolution of conflicting information on the location of a facility in an area of continual excavation.[7] If the operator and excavator disagree as to the exact location of the facility, the operator must demonstrate the facility is in conflict through the provision of documentation on the exact location or by exposing the facility.[8]

Board standards for potholing could continue to outline standard circumstances and processes for potholing such as these by providing meaning for many terms in statute, such as "exact location,"[9] "in conflict,"[10] "verify the location,"[11] and "additional information"[12] on the location of a facility. Potholing standards can then specify where it is in the interest of public and worker safety to pothole a facility and what additional information an operator should provide when potholing does not find a facility or discovers new information about the facility.

DISCUSSION

Definition of Potholing

The Common Ground Alliance (CGA) defines a "test-hole" in the Glossary of its Best Practices as the "exposure of a facility by safe excavation practices used to ascertain the precise

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Public Works Excavation Survey Data; July 21, 2021, Agenda Item No. 1, *Workshop: Earthwork and Road Construction Excavation*; November 9, 2021, Agenda Item. No. 5, *Update on Safety Standards – Next Steps*.

[1] January 14, 2019, Agenda Item No. 6, *Legal Counsel Opinion on GOV 4216.4(a) and GOV 4216.4(b)*.

[2] Cal. Gov. Code § 4216.4(a)(1)

[3] Cal. Gov. Code § 4216.2(c)

[4] Cal. Gov. Code § 4216.4(b)

[5] 19 CCR § 4501(b)

[6] 19 CCR § 4501(c)

[7] Cal. Gov. Code § 4216.10

[8] 19 CCR § 4351(c)(1)(A) and (B) Agricultural Operations; 19 CCR § 4361(c)(1)(A) and (B) Flood Control Facilities

[9] Cal. Gov. Code § 4216.4(a)(1)

[10] Cal. Gov. Code § 4216.4(a)(1)

[11] Cal. Gov. Code § 4216.2(c)

[12] Cal. Gov. Code § 4216.4(b)

horizontal and vertical position of underground lines or facilities."[13] However, Government Code 4216 lacks a definition of potholing despite use of the term in 4216.18.[14] For purposes of this report and to maintain consistent understanding, Board staff has defined potholing and a pothole as an excavation to determine the location of a facility.

Statute Does Not Specify Where to Pothole When Excavating Parallel to Facilities

Government Code 4216.4(a)(1) states except for requirements with vacuum excavation, that "if an excavation is within the tolerance zone of a subsurface installation, the excavator shall determine the exact location of the subsurface installations in conflict with the excavation using hand tools before using any power-driven excavation or boring equipment within the tolerance zone of subsurface installations."[15]

Section 4216.4(a)(1) describes the action of potholing. Section 4216.18(c) directs the Board to consider standards for potholing in grading activities on road shoulders and dirt roads with respect to section 4216.4(a)(1) and the action of determining the exact location of a facility with hand tools prior to the use of power tools.[16] However, potholing applies to all types of excavation involving the use of power tools around facilities.

If an excavator is only using hand tools, Board approved equipment pursuant to 19 CCR 4501, or vacuum excavation when agreed to by an operator, they would not need to determine the exact location of a facility prior to using those tools.[17] If an excavator plans to use power tools, statute directs them to determine the exact location of subsurface installations in conflict prior to the use of those power-driven tools.

It is unclear in Government Code 4216 what a conflict is or what the exact location of a facility is. These terms are undefined, and it is not clear how they relate to one another.

For instance, the exact location of a facility could be sufficient to determine a conflict or lack of conflict in several ways:

1. If an excavator finds the exact location of a facility, such as by exposing the facility in a pothole, they can take steps to avoid that facility as they excavate.
2. If excavation proceeds according to plan and a damage does occur, then a conflict could be seen to have occurred at that location.

If an excavator knows the exact location of a facility, they could be able to know whether or how that facility conflicts with a planned excavation. Potholing and exposing a facility provides that exact information. In a pothole, the excavator can see the facility depth, direction of run, material, size, and other features.

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[13] CGA Best Practices Appendix A Glossary of Terms and Definitions
[14] Cal. Gov. Code § 4216.18(c)
[15] Cal. Gov. Code § 4216.4(a)(1)
[16] Cal. Gov. Code § 4216.18(c)
[17] 19 CCR § 4501 Use of Equipment Other Than Hand Tools to Determine the Exact Location of a Subsurface Installation.; Cal. Gov. Code § 4216.4(2)

Pursuant to Government Code 4216.3(a)(1)(A), operators can provide three responses to an excavator: the approximate locations of their facilities in field markings within a tolerance zone, provide maps or other information on the location of their facilities, or notify an excavator of a lack of conflict.[18] An excavator can then use any approximate information to determine whether or how an excavation is in conflict with their excavation. If a conflict can be known given the information an operator provides, the excavator can pothole the facility with the appropriate tools and determine its exact location. If an excavator does not find the facility, they can seek additional information from the operator to find the facility.[19] If the excavator finds the facility and it is not in conflict, they can continue to avoid the facility.

This conflict resolution can be clear when excavating across a tolerance zone.

If an excavation will cross the approximate location of a facility, then there is a possible conflict. When a planned excavation crosses a facility or tolerance zone of a facility, an excavator can pothole at that location, find the depth and horizontal location of the facility, and then take steps to avoid the facility with the tools they use to continue excavation.

When excavation runs parallel to a facility, such as to install facilities along a road or right-of-way, it is not clear when a conflict exists in the same way as an excavation crossing a facility.

When an excavator potholes to expose a facility at multiple locations along a facility, the exact location of a facility could be known at those specific locations where the facility is exposed, while between potholes an excavator has an approximate idea of the facility location.

The National Transportation Safety Board (NTSB) summarized the safety issue like this in 1997:

> "The only certain method of determining facility depth is to expose the pipe, conduit, or cable through hand digging or through vacuum excavation. Southwestern Bell's use of vacuum excavation to expose and document exact facility locations is credited with decreasing cable damages by 50 percent in Texas during 1996. This method positively identifies both the horizontal and vertical location of the pipe at a specific site. But certainty about the line's position is inversely related to its distance from the test hole. Depth depends on how the line was installed and on the changes in surface grade caused by erosion or construction since installation."[20]

That is to say that the greater the distance between potholes, the less certain an excavator can be about the exact location of a facility and the greater the risk of a damage. Between potholes, an excavator has an approximation of the facility location and possibly an approximation of a conflict with their excavation.

There are three other circumstances when an excavator knows something about a conflict or lack of conflict:

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[18] Cal. Gov. Code § 4216.3(a)(1)(A)

[19] Cal. Gov. Code § 4216.4(b)

[20] National Transportation Safety Board, Safety Study: Protecting Public Safety Through Excavation Damage Prevention, PB97-917003, NTSB/SS-97/01 pg. 35

3. An excavator exposes the entirety of a facility.
4. An operator notifies an excavator of no conflict with planned excavation.
5. An operator provides the exact location of a facility.

Those are all cases in which potholing may not be needed at all.

The findings of Board Investigations Report 20SA01279, discussed further below, concludes that "Government Code does not require an excavator to expose the full extent of all subsurface installations with hand tools, nor does it specify at which points an excavator should expose the installations, such as at branches or crossings."[21]

The Board can clarify statute, the responsibilities of an excavator, and the circumstances for potholing in its standards.

Potholing Depends on Facility Information Provided by Operators

Potholing also depends on the information that an operator provides to the excavator. An excavator determines where to pothole based on facility information from operators, such as to establish a tolerance zone within a delineated area.

For instance, in Board investigation 20SA1040, an operator was unable to hook up to a facility directly and instead located the facility by connecting to the vault of the facility, leading to a signal and field marking that was 20 feet away from the active facility. When an excavator went to work in the area, they believed they were excavating 20 feet away from a facility when the facility was in the path of excavation and damaged.[22] When an operator's facility location information is inaccurate, an excavator has no reason to pothole to expose the facility or find its exact location. In this case, the tolerance zone of the facility was 20 feet away from the planned excavation.

In that case the excavator did not know of the exact location of the facility or any possible conflict. If an excavator does pothole and is unable to find its exact location using the appropriate tools, then statute directs the excavator to request additional information on the location of a facility.[23] With this additional information, the excavator can pothole the facility and proceed to use other tools with a lower risk of damage.

Accurate information is the minimum for safety. However, two excavation damages highlight how a lack of standards for information sharing between parties impacts where an excavator potholes the facility.

Are the Depth and Facility Structure Parts of an Exact Location?

In January 2022, the Board discussed the National Transportation Safety Board and Board staff investigation into the February 6, 2019, damage to a gas distribution pipeline that led to an

[21] January 10-11, 2022, Agenda Item No. 11, Review of National Transportation Safety Board Report NTSB/PAR-21/02 and Staff's Findings Related to an Excavation Damage in San Francisco on February 6, 2019. Pg. 14
[22] Underground Safety Board, Report of Investigation 20SA1040 - Kings
[23] Cal. Gov. Code § 4216.4(b)

explosion and fireball in San Francisco.[24] This incident complicates the NTSB's 1997 assessment above by demonstrating that, in addition to local conditions such as erosion and installation standards at the time of installation, the depth of a facility can also involve the facility shape or structure.

Board Investigation Report 20SA01279 found that the excavator potholed by hand to determine the location of the facility prior to using power equipment but was uninformed of a raised branch connection above the pipeline at another location and did not pothole that location.[25] The change of depth of the raised branch connection was not identified in the standard and accurate field markings provided by the operator or in the engineering plans provided to the excavator by the project designer.[26] The excavator used the information from the exposed facility to approximate the depth of the facility at another location. In this case, the excavator believed that after potholing with hand tools to find the depth of the facility at one location, that the facility was not located at the depth of excavation at another location. However, the facility structure extended upwards at the branch connection in the path of planned trenching and the excavator struck the connection.

This lack of information about the facility combined with the excavator's lack of requesting additional information from the operator (during either the excavation or design phase) or discovery of additional facility locations through multiple potholes created a safety issue. If an operator notifies an excavator of non-standard specifications of the facility and its installation, an excavator can take steps to avoid the facility and pothole to confirm its exact location and/or conflict. On the other hand, an excavator is placed at additional risk if an operator does not provide that information and an excavator does not seek additional information on a facility when excavating parallel to that facility. A single pothole was inadequate information to proceed with excavation in this case.

Government Code § 4216 places some standards on the information an operator is required to provide an excavator by reference to the CGA Best Practices Appendix B Uniform Color Code and Marking Guide.[27] These CGA Guidelines provide examples of standard utility markings that include an operator's name and information on the size of and material of the facility.

However, Government Code § 4216 does not require an operator to provide specific additional information such as the depth of a facility, sudden changes in the facility depth, or the vertical structure of connections of facilities. A potholing standard could address this safety issue by requiring specific additional information be provided by operators at some point in the project lifecycle prior to excavation. Then when an excavator knows of a change in the facility, they can pothole at that location to find the exact location of the facility.

A potholing standard could address this safety issue by identifying the circumstances to

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[24] January 10-11, 2022, Agenda Item No. 11, Review of National Transportation Safety Board Report NTSB/PAR-21/02 and Staff's Findings Related to an Excavation Damage in San Francisco on February 6, 2019.

[25] 20SA01279 Report of Investigation - San Francisco, Key Findings pg. 14

[26] 20SA01279 Report of Investigation - San Francisco pp. Finding of lack of information in engineering plans p. 14; National Transportation Safety Board Report NTSB/PAR-21/02 Finding of accurate field markings p. 32

[27] Cal. Gov. Code § 4216.18

pothole a facility and discover or confirm additional information about the facility.[28]

Potholing Frequency and a Lack of a Standard for Information Gathered from Potholing

The Board's education course includes a case study of an excavation damage that caused multiple fatalities in Walnut Creek, CA in 2004.[29] In that incident, a facility was potholed every 50 feet, however between two potholes there was a jog in the petroleum fuel facility that was included on the design plans initially provided to the excavator but not included in field markings provided by the operator or potholed by the initial excavator. A second excavator later joined the project and relied on recent field markings that did not show the jog in the line and the potholing performed by the first group which occurred at 50-foot intervals and did not expose the jog. Based on that information the excavator believed there was a straight alignment of the facility and did not confirm conflicting information of the horizontal jog of the facility as shown on the plans.

Excavators rely on information about changes in the facility location provided from an operator to pothole and find the exact location of the facility through potholing, and that information has value after potholing such as recording the location of a facility at those potholes and what places were or were not potholed. Government Code 4216 does not provide a standard for information sharing or documentation of potholes between parties and the Board could learn more about this topic.

The Walnut Creek incident also shows that a standard frequency of potholing is not a substitute for finding the exact location of a facility at non-standard locations such as at points of conflicting information or changes in the facility.

Additional potholing can provide more certainty to the approximation of the location of a facility, and additional information on the facility location can increase that certainty. Board standards can act to improve both sides of the equation, facility information and potholing practices, to increase public and worker safety.

Existing Ticket Data is Unhelpful for Analysis of the Accuracy of Operator Responses

Facility information such as included on a map or painted in a field marking can provide an approximation of the location of an underground facility. In developing safety standards for excavation, the Board could look to gather data on the efficacy of operator practices to determine the general accuracy of operator responses pursuant to 4216.3(a)(1)(A), either with no conflict, field markings, or providing other information.[30]

However, Board staff cannot determine general field marking accuracy from current ticket data and ticket types because there is not a consistent way for excavators to report an inaccurately

[28] January 10-11, 2022, Agenda Item No. 11, Review of National Transportation Safety Board Report NTSB/PAR-21/02 and Staff's Findings Related to an Excavation Damage in San Francisco on February 6, 2019. Pgs. 13-15

[29] September 14, 2021, Agenda Item No. 3: Presentation of the Board's Education in Lieu of Fines Course: "Dig Safe Basics: Excavation Safety Near Subsurface Installations."

[30] Cal. Gov. Code § 4216.3(a)(1)(A)

marked facility. An excavator may either submit a damage/exposure ticket for a facility exposed that they did not know about, remarks with a remark ticket, notify the call center through a no-response ticket that an operator has not responded for their facilities, or contact an operator directly outside of the ticket.[31] An excavator could use any of these options in the case of an inaccurately marked facility, and all these options can also be used to indicate other situations such as an abandoned facility, a dig-in damage, faded field markings, or any non-response of an operator. Thus, the extent to which an operator provides inaccurate markings cannot be accurately determined at this time.

Statute requires that the excavator notify the one-call center when an operator fails to identify their facilities through field markings or information on the location of their facilities.[32] However, remark, no response, damage, and exposure ticket types obscure the distinction between a facility that is marked inaccurately and a facility that has not been marked at all.

A systemic reason for that discrepancy is that these ticket-types facilitate communication in the direction from the excavator to an operator and notify the operator that there is a problem to resolve. A cause or causes of a problem are discovered in response to these ticket-types by way of ongoing communication, field meetings, additional information, or investigations. However, the ticket system lacks the capability for additional documentation, records, or closure for these kinds of communication loops. Electronic Positive Response (EPR) allows for additional communication from the operator to the excavator, however statute defines a single function for EPR.[33]

This lack of a standard way to identify, report, or record insufficient operator responses limits the Board's ability to enforce Government Code § 4216 and to identify areas where policy standards could improve operator responses and public safety.

Potholing and Related Law in Other States

Current law in other states address various aspects of potholing and information sharing in ways that California does not.

- Where California requires finding the facility through potholing in the tolerance zone, Oregon regulations address depth and require either the excavator find the facility or continue to pothole two feet beneath the planned excavation to check for the possibility of the facility existing immediately beneath the planned excavation. [34]
- Where California requires that an excavator request additional information from an operator if they cannot find a facility, in New York an operator must verify their facility location information or must provide field assistance to the excavator. [35]
- Where California does not require any provision of the quality of information to the

[31] DigAlert 2023 Ticket Type, Headers, and Explanations
[32] Cal. Gov. Code § 4216.3(e)
[33] Cal. Gov. Code § 4216(e)
[34] Oregon Administrative Rules § 952-001-0090(3)(c)
[35] New York Codes, Rules and Regulations 16 CRR-NY 753-4.10 Unverifiable Underground Facilities

excavator, Kansas requires an operator of sewer or water facilities to notify the excavator of the approximate accuracy of some field markings and provide additional guidance during excavation. [36]

- Where California does not address unlocatable facilities, Georgia[37] and Oregon require an operator to provide additional communication and markings for unlocatable facilities.[38]
- Where California does not require the provision of depth for locate and mark practices, Colorado requires the provision of depth of a facility when it is known and that an operator must provide additional documented information of the facility along with field markings. [39]
- Where California does not require visual tracking of the location of boring equipment through potholes, Arizona[40], Colorado[41], Oregon[42], and Kansas[43] require keeping open potholes for boring under certain circumstances.

The Board can use these requirements as inspiration for its potholing standards.

Common Ground Alliance Best Practices with Potholing

Government Code 4216.18 directs the Board to develop safety standards relevant to excavating around subsurface facilities and that these standards are not intended to replace other standards such as the CGA Best Practices.[44] Many CGA Best Practices relate to the process of potholing of a facility. However, these practices do not identify or prescribe specific circumstances or frequencies at which potholing should occur, with the exception of casing size, what information an operator should provide about a facility with respect to branches, connections, or other features of a facility.[45]

Some CGA Best Practices are implemented in Government Code § 4216. However, many CGA Best Practices are not implemented or partially implemented in California law and regulation, such as information sharing practices for locators and excavators following inaccurate locates and error correction,[46] that locate marks extend a distance beyond the delineated area,[47] enhanced information sharing of documentation and images between parties,[48] or that parties

[36] Kansas Statute Chapter 66-1806(b) Identification of Location of Facilities; Duties of operator; liability for damages
[37] Georgia Code § 25-9-7(b)(2)(A)(ii); Georgia Code § 25-9-7(k)(1)
[38] Oregon Administrative Rules § 952-001-0070(1)(b)
[39] Colorado Revised Statutes § 9-1.5-103(4)(a)(1)
[40] Arizona Revised Statutes § 40-360.22(E)(3)
[41] Colorado Revised Statutes § 9-1.5-103(4)(c)(I)(A)
[42] Oregon Administrative Rules § 952-001-0090(5)
[43] Kan. Admin. Regs. § 82-14-2(j)(7)
[44] Cal. Gov. Code § 4216.18
[45] CGA Best Practices Appendix B Uniform Color Code and Marking Guide
[46] CGA Best Practice 4.2 Corrections and Updates; CGA Best Practice 5.21 Mismarked Facilities
[47] CGA Best Practice 4.8 Facility Marking
[48] CGA Best Practice 3.31 Enhanced Positive Response

meet to determine how to safely proceed with trenchless excavation when a facility may be difficult or impossible to pothole given local conditions.[49] Board staff, with the leadership of a Potholing Committee, can continue researching these Best Practices to consider ways to inform future Board work. The Planning and Design Ticket Committee can also look to the best practice of Subsurface Utility Engineering that will involve potholing practices in the design phase of excavation.

Public Workshop on Potholing

Board staff has scheduled a virtual workshop on Thursday, August 4 from 3 to 5pm to better understand potholing practices and the information provided by operators prior to or during potholing to locate the facility. The audience will be utility potholing specialists and excavators that use hand tools or vacuum excavation as agreed to by operators to pothole facilities.

Potential topics of discussion at the workshop are planned to be:

- How do you decide where to pothole?
- Why do you pothole?
- How do you decide to widen a pothole or use multiple potholes for a facility?
- What information provided by an operator makes potholing more cost effective?
- What best practices or techniques do you use to pothole?

Board staff will continue to develop these topics and provide discussion questions prior to the workshop.

Staff would like to bring pothole and utility locating specialists and general excavators together for the workshop and requests that members of the public and Board share the agenda with associations and colleagues who can contribute their experiences to the workshop. Attendees can register for the workshop by following the link through the workshop agenda.

Board staff will also reach out directly to potholing and utility location specialists throughout California to invite them to the workshop.

RECOMMENDATION

Staff recommends that the Board form a Potholing Committee, review this report, discuss the circumstances they recommend to pothole a facility, and direct staff to proceed with information gathering and further research on potholing.

[49] CGA Best Practice 5.29 Trenchless Excavation