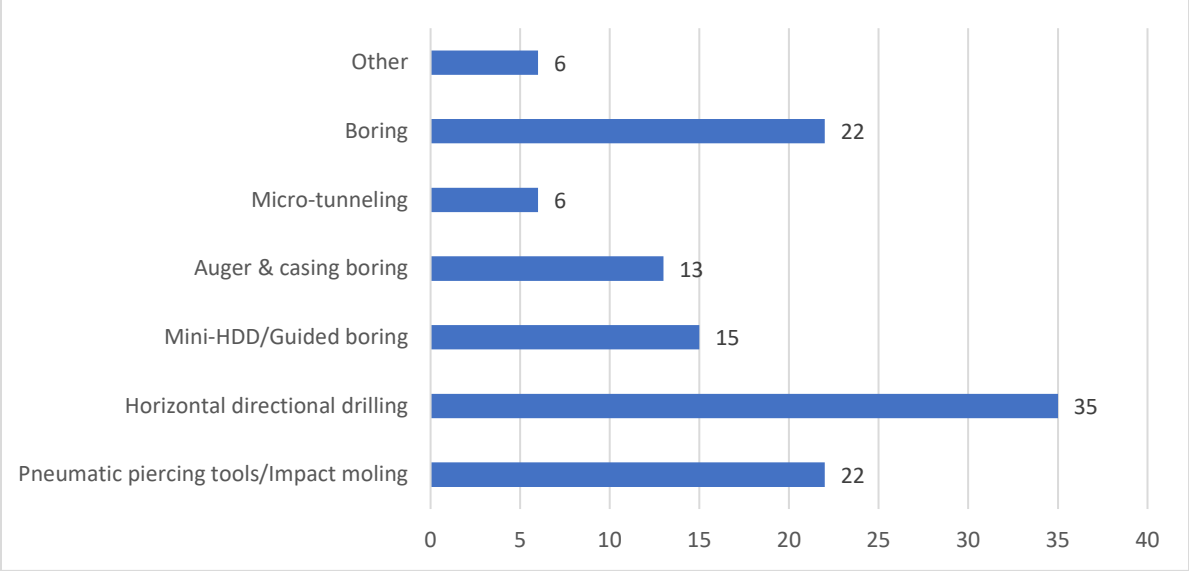
ATTACHMENT A

California Underground Facilities Safe Excavation Board ("Dig Safe Board")

Trenchless Excavation Survey Responses

August 24th to October 30th, 2020

1. What methods of trenchless excavation do you have experience with? (Select all that apply)
(Respondents: 39 out of 39)



Other:

1. Split and pull pipe replacement
2. Vibratory cable plow
3. Pipe bursting
4. TBM Pipejacking
5. CIPP
6. Pipe Ramming

2. What are the pre-work steps that you engage in to plan for a trenchless excavation project?
(Respondents: 39 out of 39)

1. potholing, surface preview and tribal knowledge
2. Establish proposed route using mapping software (if needed); Survey, refine route with plowing contractor (if needed); Clear brush, prep route (if needed); mark route, open USA ticket; Consult with Utility owners present and modify route (if needed).
3. Utility Research (SUE) levels D-A as required, Soil research (including full Geotechnical report for deep or risky projects, Notification of work and shutdown/monitoring of high-risk utilities, if necessary. Providing proper head tracking equipment and verifying effectiveness for the application. Establish contingency measures
4. Obtain municipal permits with drawings, call for utility meeting, request as-builts, meeting with conflicting utilities, review plan with municipal and customers. Call 811 for potholing. Review results and contact conflicting utilities. Review with customer and re-engineer if necessary. Call 811 for final marking.
5. Potholing
6. We hire third Party for any boring
7. Onsite meeting with contractor to discuss the route and affected pipelines.
8. Evaluate available maps/as-builts of existing facilities, physical job walk to evaluate current state of excavation site and potentially un-mapped facilities with visible features (manholes, pavement patches, risers, box lids, etc.), permitting and pre-construction meetings with local agencies, 811, field meets as needed, secondary locating method (Private locating contractors), potholing marked facilities
9. Design project taking into consideration all existing utilities, review obstacles that will be encountered. Call 811, Locate all existing facilities and pothole prior to any drilling.
10. Review the drawings that should show all the existing utilities. Review the proposed plan and profile of the drill. Note the distances of all existing utilities from the plan and profile.
11. Review density of existing utility/facilities both visually and through locate process. Evaluate surrounding ground conditions and obvious signs for obstructions and/or special conditions
12. pre-con meeting, delineate work area in white, call 811 to get a USA ticket wait the appropriate time, print out the positive response tickets,, survey the work area verify all utilities have mark, pot hole all utilities to verify depth. If crossing dig a receiving to make sure you cross it safely you can also pot hole shorter interval and make sure to go over all the USA marks with all crew members.
13. Utility search, plan and profile (as-builts) request from all utilities, cities, and county. pre work job walk.
14. Pothole all marked utilities interesting bore path. Pay for private locate for all sewers then pothole. Look for above ground indicators such as recently paved areas that indicate the existence of unmarked subsurface installations .
15. We work with local utilities and city entities to procure any utility facility sub structure mapping and/or schematic drawings indicating location and routes of utilities. We call for underground locates and then we pothole and expose any utilities that are within our work zone boundaries.
16. communicate with owners of utilities (public and private), identify utility crossings, examine red-line maps, obtain traffic control plan
17. Request substructure maps from municipality and locaally known utilities before engineering project, cal for underground locates, pothole and expose all utilities in work zone
18. Locates.
19. Delineate work zone and call in for utility mark outs, Pothole and expose utilities.
20. Obtained an approved City Excavation permit and an approved Traffic Control plan for the project work if working in the City Right Of Way. Private property work get all approvals from the property owners. Call USA Dig Alert to have all underground utilities and substructures located. Pothole all underground utilities for depths so you'll know what depth, path, and separations will be required for the project bore.
21. Mark out area call in for underground locates, pothole and expose all utilities in work zone
22. Call for locates for all utilities ,wet and dry, in the work zone.
23. Apply for all necessary City Or State Permits. White out Proposed Trench Area. Call USA Dig Alert For Utility Locates.
24. Dig alert completed, pre-construction meeting

25. Request substructure maps from municipality and locally known utilities before engineering project, call for underground locates, pothole and expose all utilities in work zone.
26. first of all do a walkthrough of my intended route, plan accordingly with the work team, spot all utilities to correctly espose it and get measurements of depth and that way plan the depth of my intented bore.
27. Get maps from city and other utilities, get UG locates done, then do pothole to see all utilities in the general work zone.
28. call 811, complete a bore profile, verify utilities and depths, calibrate equipment
29. Pre Survey work area. Call for USA marks.
30. Notify utility service alert, apply for any necessary permits. determine if there are any conflicting utilities. If proper separation of utilities cannot be confirmed using locating equipment or other means, pothole conflicting utilities to avoid damage
31. Assess that it would be beneficial to make it a trenchless project
32. Plan review, submittals, purchasing of materials, and scheduling.
33. PRE WORK: 1. Read and understand the plans 2. Call in Accurate USA
34. Scripted bore plan after 811 marks, utilize a 2nd Form Of Electronic Verification to pinpoint underground infrastructure, both depth and running line, and map prior to commencement of any Trenchless activity
35. Potholing all utilities in the planned bore path so bore rod can be observed passing each utility . Develop pre-bore profile with planned depths and bore layout. Use bore profile to "walk the bore" with all personal involved. Sweep for power with utility locating tools.
36. Prior to design: Geotechnical investigation, identify existing utility locations, identify available work areas, permitting agency jurisdiction. (not contractors)
37. Equipment serviced/inspected by shop between jobs. Contact underground service alert to mark existing utilities. Review plans to ensure all known utilities are marked. Pothole to locate all utilities in area.
38. USA and private locating
39. Locates, prepare Engineering calculations, review plans, visit site, tracking system set up etc.

3. What actions do you take to determine that a trenchless excavation will avoid all existing facilities?
(Respondents: 38 out of 39)

1. open all the windows to ensure safe crossing, with ample clearance
2. Survey area for signs of buried facilities; Open USA ticket to notify Utilities in area; Consult with property owner and others with local knowledge.
3. Exhaustive research - research available drawings/create suitable utility background map. Identify accuracy of utility locations and take additional steps (research -including gpr, line locating, tracing, and potholing). In some cases slot trenching critical zones is necessary.
4. Obtain As-builts, meet with conflicting utilities, pot-holing and re-engineering. Hiring standby cable locators.
5. Potholing
6. We require sub-contractors to pull their own USA
7. Excavator to pothole pipelines within 10 feet of a parallel bore, expose pipeline and leave pipeline exposed when crossing with bore with a 2 foot buffer on oncoming side of bore. Peep holes to verify physical alignment of bore when drilling horizontally.
8. 811, private locates, potholing all known, marked and suspected facilities in the bore-path, communicating with utility owners as needed
9. Call 811 for utilities to locate existing facilities. Once located we pothole each utility to determine depth of existing utility and what the existing utility is.
10. Notify One-Call. Pothole existing utilities when they are close to the proposed drill.
11. Impossible to state any ground disturbing activity will avoid all existing facilities. Best practices will always be used to pre locate, utilize visual references, existing records, potholing, meeting on site with the utility/facility as required
12. leave all pot hole open and daylight shorter intervals
13. Pothole and verify utility location, depth, and type.
14. Pothole everything in pore path until found regardless even if marks are off more than the tolerance zone. All marked lines intersecting bore path pose a hazard and must be found.
15. We pothole and expose all utilities within our work zone boundaries.
16. utilize mapping information, line locate markings, and potholing.
17. pot hole and expose all utilities in work zone
18. Locates.
19. Pothole utilities.
20. Potholing all existing underground utilities to know where their at. Once all the underground utilities have been potholed and found you can determine your trenchless excavation path and separations.
21. locates then pothole and expose all utilities in work zone
22. Pothole existing utilities to determine depth
23. We Pothole and expose all utilities and document top & bottom depths.
24. Dig alert/ utility location, pot-holing first if questionable
25. pot hole and expose all utilities in work zone
26. correctly expose and get accurate measurements of existing utilities in your path.
27. Do the pot holing and see what other utilities as present.
28. pothole and verify the marked utilities
29. Pothole for all marked facilities.
30. See answer to question 2
31. Locate existing facilities
32. The project owner shall have a design that will avoid utility conflicts. 2. The contractor shall call 811, then pothole the utilities to confirm the Owner's design is correct.
33. ON THE JOB: 1. Read and understand the plans 2. Use USA locate information (contacts, line marking) to fully understand where all existing lines are at. 3. Make sure all lines are potholed, and are directly over/under the intended bore line. No offset potholes. 4. Have a foreman from our company personally survey all conflicting lines. (Don't trust anyone else's survey) Sometimes this means having a company

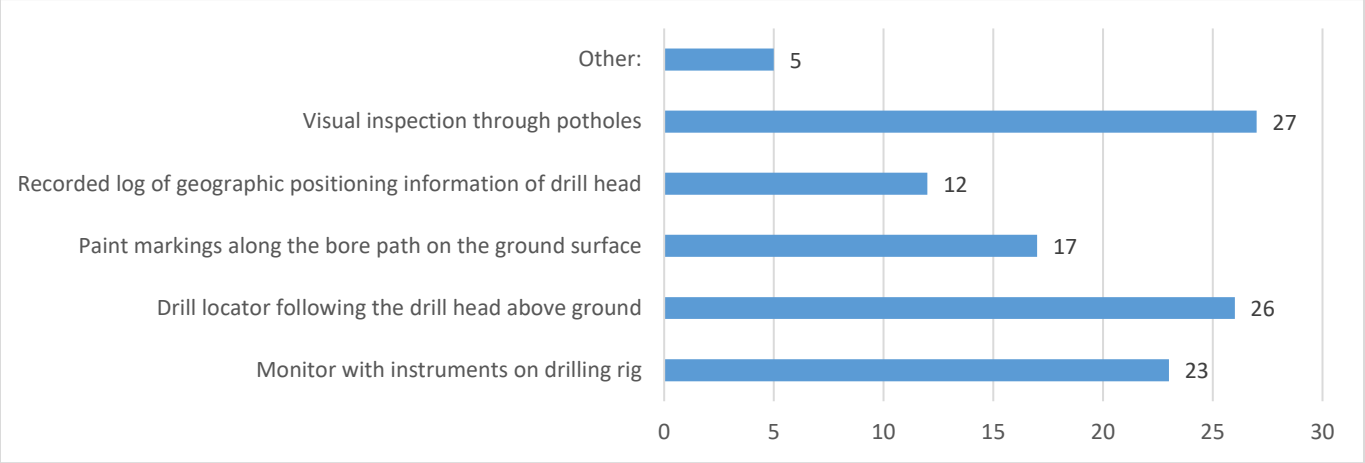
rep onsite before mobilizing to site with equipment.

34. Written and graphed Bore Plan and then potholing all obstacles in advance of any Trenchless activity
35. As stated above visual verify and measure ALL utilities prior to beginning bore operations
36. Pothole to identify location and depths. visually watch as bore rod passes by known utilities. Continually monitor location and depth of drill head
37. Potholes
38. Use appropriate tracking system, examine design for engineering error

4. In your experience, what may cause a drill head to deviate from its planned path?
(Respondents: 38 out of 39)

1. rocks, soft soils cause deflection
2. Rocks are the primary cause of route deviation.
3. Operator error, primarily on small operations. 2) poor tracking systems, 3) site conditions (i.e. train or ship traffic affecting magnetic tracking), physical obstructions (rock or other soil conditions).
4. Abandoned and unmarked facilities, rock and slurry, high density of underground facilities.
5. Changes in soil density. encountering buried objects or stones.
6. In-experienced drilling locator, rushing the job, and underground obstructions not marked.
7. Uncalibrated machinery, poor maintenance, unskilled labor, certain unanticipated subsurface encumbrances (rocks, pipes, etc.), existing trench lines with soft backfill, voids
8. Hitting large rocks, or other solid structures.
9. Drilling through gravel or rock layers, especially when the geology is various formations with different hardnesses.
10. Obstructions, change in soil and/or ground conditions, etc.
11. next to existing trench, drill head will wonder in to the path of trench. you also can't control the path went cobble rock makes difficult.
12. Obstacles such as rocks and change in soil types.
13. Rocks, previous bore paths, previous trenches, soil changes, faulty equipment
14. Any rocks, concrete structures and possibly large voids.
15. Rocks, unknown utilities, soil condition (sand vs hardpack), batteries in beacon giving false depths
16. sub surface rocks and/or concrete structure or large voids
17. Rocks
18. Rocks, Boulders, Large Tree Roots.
19. Concrete box substructure storm drains and inlets, rocky soil, drilling tools not properly maintained can deviate.
20. Rocks, Voids, disturbed subsoil voids, fill debris from prior work, Trash materials in prior fill Concreate/asphalt is most common
21. Rocks, and large structures
22. Large rocks, chunks of concrete or asphalt beneath the soil.
23. Rock, reinforced concrete, heavy steel pipe
24. sub surface rocks and/or concrete structure or large voids
25. river rock with sand, also if close to a dug up trech line drill head will alway try to take the softest part in the ground!
26. Open spaces; good sized rocks, other concrete items.
27. soil conditions, bad or faulty equipment
28. Operator Error
29. Does not apply to my business
30. You will know if you are off course
31. Mixed ground conditions, where you have soft ground above/below and hard ground opposite. Obstructions can deflect a bore.
32. Locator / Operator error 2. Soft or hard soil - trenchless excavation will always wander towards softer soil 3. Gravity
33. Lack of proper drilling fluids, large rocks, lack of expertise with drill crew, but most deviation occurs on the pullback, by too rapid of pullback with limited drilling material supporting the bore hole
34. Ground conditions is the primary concern such as hard pan, cobble or rock.
35. Significant change in ground condition, weak soils that cannot generate steering response, obstruction in path, error in survey, error in steering, magnetic interference
36. rocks and or inexperienced operator
37. Other utilities, big rocks and over exaggeration wet dirt
38. Faulty tracking system, Steering hands that falsify walk over data, changes in geology, improper tooling

5. What practices have you used to track the drill head over its path? (Select all that apply)
(Respondents: 36 out of 39)



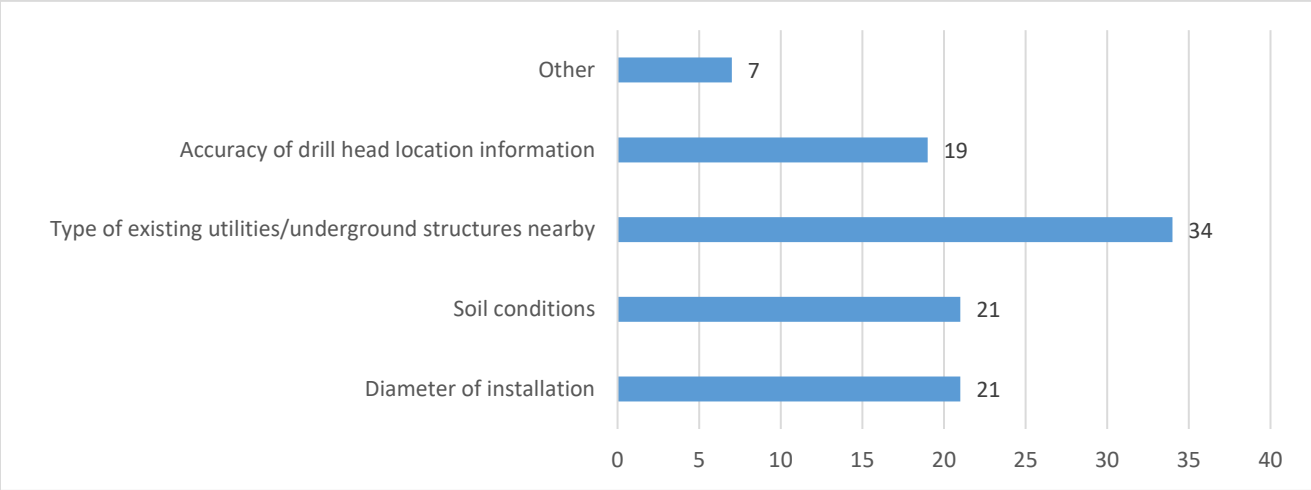
Other:

1. Potholing monitoring is primary
2. Laser guided equipment
3. Use magnetic system or gyroscope for tracking and dead reckon
4. Not a contractor
5. Does not apply

6. In general, how much space do you aim to leave between the drill head and known utilities?
(Respondents: 38 out of 39)

1. minimum 2x the diameter of the planned pipe to be bored in.
2. Depends on "known utility". When working around charged gas or electrical lines we visually confirm that the head passes by the line without making contact leaving at least 1 foot clearance. When working around our own telephone lines or optical fiber, we try to maintain 2 foot clearance (not visually confirmed).
3. Depends on the size of the operation. For large HDDs, I've set 10' clearance. As a minimum, I call for 3' clearance, unless special tracking observation methods are used
4. 2 feet or agreed on clearance with utilities, municipalities and customer.
5. Several feet.
6. Our requirement is 24 inches.
7. 12"+ depending on the facility type. Could be much greater dependent on the facility type.
8. typically try to maintain a minimum of two feet separation.
9. 5-ft
10. Attempt 24"-36" when possible, following state, local dig laws for separation as well as special requisites for high profile utilities
11. ideal distance would be 3 feet sometimes very difficult to accomplish do to space.
12. Generally one foot unless the utility owner request more. Other specifications may be required in private easements and row.
13. As much as possible.
14. A minimum of 18 inches.
15. Depending on size of head vs reamer and sleeving being pulled through. In general, we aim for 12" of clearance from the gas facility to the edge of the sleeving.
16. 18"-24"
17. 1'
18. 18 inches
19. The space between the known utilities is determined by your local utility municipalities. This space can vary from City to City, its important to research and know your separations from the existing utilities before doing any trenchless technology project.
20. 18 inches minimum
21. Min. 18 inches
22. Minimum of 18".
23. 2-3 feet
24. 18 inches minimum
25. 2 feet minimum
26. 18 inches
27. 24 inches
28. Whatever specs call for
29. Does not apply
30. 12"
31. 2' clear.
32. 2 feet or whatever the owner of the pipeline is requesting
33. 12"
34. Most utilities have published minimum standard that we must adhere to but when possible 24" is optimal separation.
35. Depends on ground conditions, condition of existing utilities, severity of damage, available work area, ability to expose and support existing utility, installation method, and new pipe/bore diameter. (General rule of thumb is one pipe diameter for pipejacking methods and 3 pipe diameters for HDD)
36. Whatever spec calls for.
37. Minimum of 12 inches
38. Depends. Like to have 10 feet

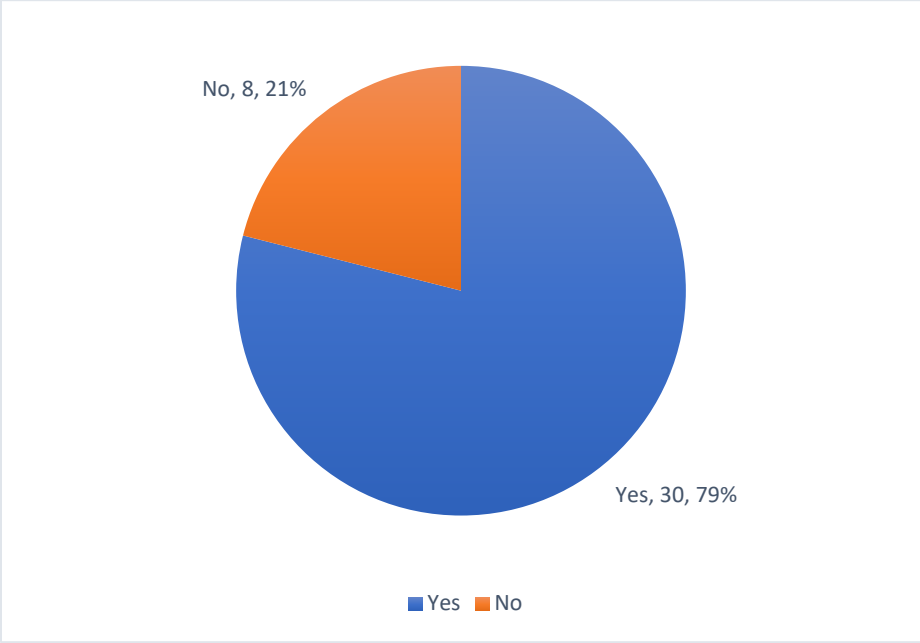
7. Do any of the following features cause you to add extra space between the drill head and known utilities? (Select all that apply)
(Respondents: 37 out of 39)



Other:

1. Pull back or reaming conditions
2. Special separation requisites of utility/facilities
3. Depth beyond 35’
4. Pre-ream
5. Interferences with tracking
6. See answer to 6
7. Does not apply

8. If conditions allow, do you pothole or excavate borehole windows to visually inspect or follow the drill head along the bore path? (Respondents: 38 out of 39)



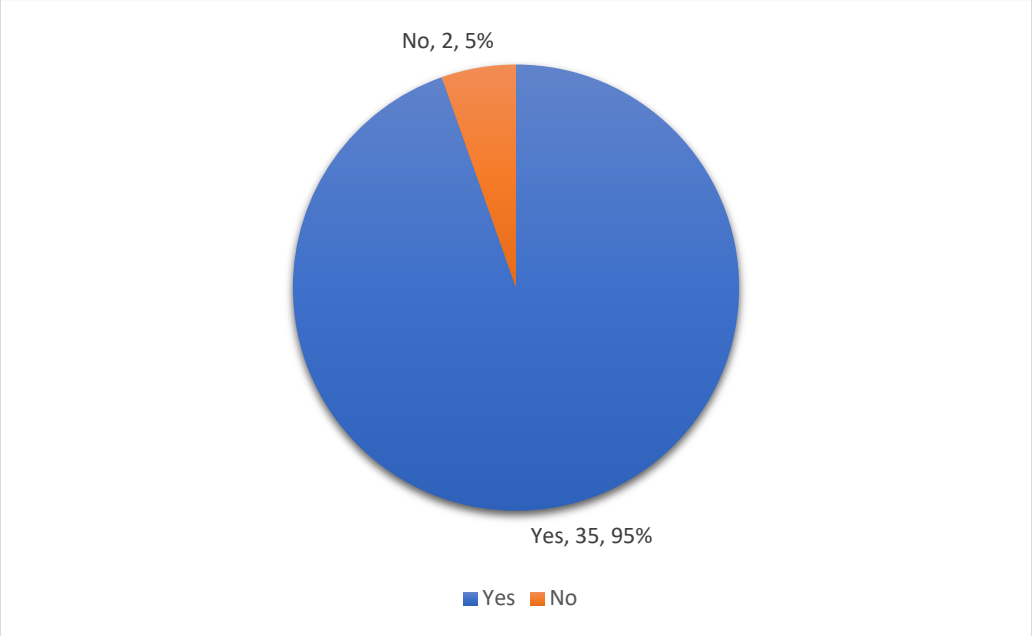
9. If conditions do allow you to visually follow the drill head, how do you determine the intervals between potholes or the points at which to pothole? (Respondents: 33 out of 39)

1. rule of thumb is every 50 feet, depending on density of crossings
2. When deemed required, yes
3. if bore head within 3 feet of markings, near high priority facilities and near large facilities.
4. Site conditions.
5. Discussed with contractor onsite, our requirement is every 10 feet within 10 feet of our pipeline.
6. Windows are typically only done at known facility crossings unless extenuating circumstances exist.
7. Potholes only at existing utilities or structures or when a problem is encountered where physical inspection is required.
8. Only pothole existing utilities. We get good information from the magnetic coil and do not pothole excessively.
9. Often enough to avoid damages. Density of existing utility/facilities, hazards, noted irregular depths of existing discovered through potholing help identify intervals along the planned route
10. According to the signal on the locating device. At all utilities. When drill head deviates from required path.
11. Potholes are at every subsurface installing crossing and as needed for installation purposes.
12. Every 200 feet and/or the utility locations and the planned structure placement.
13. consider the following: Soil conditions, bore gel retrieval holes, known utility crossings
14. utility locations, planned structure placement, or every 200 feet
15. Any utility in path, Every 150' to 200'
16. The intervals will be determined by the size of the project bore and existing conditions.
17. utility locations, planned structure placement, or minimum every 200 feet
18. Locations of utilities, plan placement of structures, or every 200 feet
19. Normally the only time we have an exposed pothole while drilling. Is when it is required by the utility company. HP Gas Line, Forced Sewer Mains and sometimes large water lines.
20. Geographic features, known utilities
21. utility locations, planned structure placement, or every 200'
22. any conflicting cross points in my intended running line.
23. Yes, every 25 feet if possible and 3 feet before any utility crossing
24. Does not apply to my business
25. We pot hole only if made too. We locate all facilities prior to drilling. We pot hole water and gas.
26. the utility owner generally determines this.
27. NO
28. Generally potholes for utilities allow adequate number of points to daylight and visually affirm position
29. As stated before all utilities are potholed and if ground conditions and diameter of the bore require the addition of "relief" holes they will be added.
30. Potholes are generally only used when absolutely necessary due to close proximity of crossing known utilities with minimal clearance. In HDD, potholing often leads to short circuiting the drilling fluid path back to the rig which can result in hydrofractures/surface spills, and inefficient cleaning of the bore. Potholing may be used with pipejacking operations, but usually only when obstructions are encountered that prevent the forward movement of the machine/tunnel.
31. Currently only potholing at known utilities.
32. At crossing utilities or less disruptive for surface
33. Do not. Use magnetic or gyroscopic steering to avoid erroneous walk over systems

10. Are there any conditions in which you would not visually inspect or follow the drill head?
(Respondents: 35 out of 39)

1. Never
2. I'd never want to drill without either tracking the head or having a well documented plan to gauge progress
3. open soil with no known/marked facilities (all USA members responded, "clear")
4. When unable due to site conditions.
5. No
6. No
7. We would not visually inspect the drill bit if there were no existing utilities in close proximity.
8. Existing crossings, Rock (hard surface) conditions, excessive depth of bore, restrictions from local regulations from city, county, state not allowing cutting of windows in newer road surfaces, sidewalks, special ornamental considerations ,
9. absolutely not, you only asking for trouble
10. No
11. Can't think of any
12. No
13. In rural areas with no known utilities in or near the proposed bore path. In this scenario, inspections holes would still be utilized, but possibly to a lesser extent.
14. No
15. lazy
16. No
17. You would not visually inspect the drill head if your boring at very deep depths.
18. no
19. No
20. We always follow the drill head with the locator, but we usually don't have open holes for visual inspection. The only time I would probably do that is if we were having a problem with our tracking system. If you have a problem with your tracking system you probably shouldn't be drilling.
21. Under a road/sidewalk/driveway in which no utilities have been located or indicated.
22. no
23. no
24. No
25. if the bore head is to deep or submerged under water
26. does not apply
27. Yes
28. it is not a critical facility or there is sufficient clearance.
29. I mainly do pilot tube and auger boring, we never want potholes. Unwanted potholes just cause the boring to get off of line and grade.
30. No
31. Only in what we call "green field" conditions would we not pothole. Green field is when there are absolutely no substructures within the work zone, we will still electronically locate the progress of the bore.
32. See answer to 9.
33. Wide open fields
34. Open field no utilities
35. Use magnetics or gyroscope - we will always track and follow drill head but not visually, by use of steering system

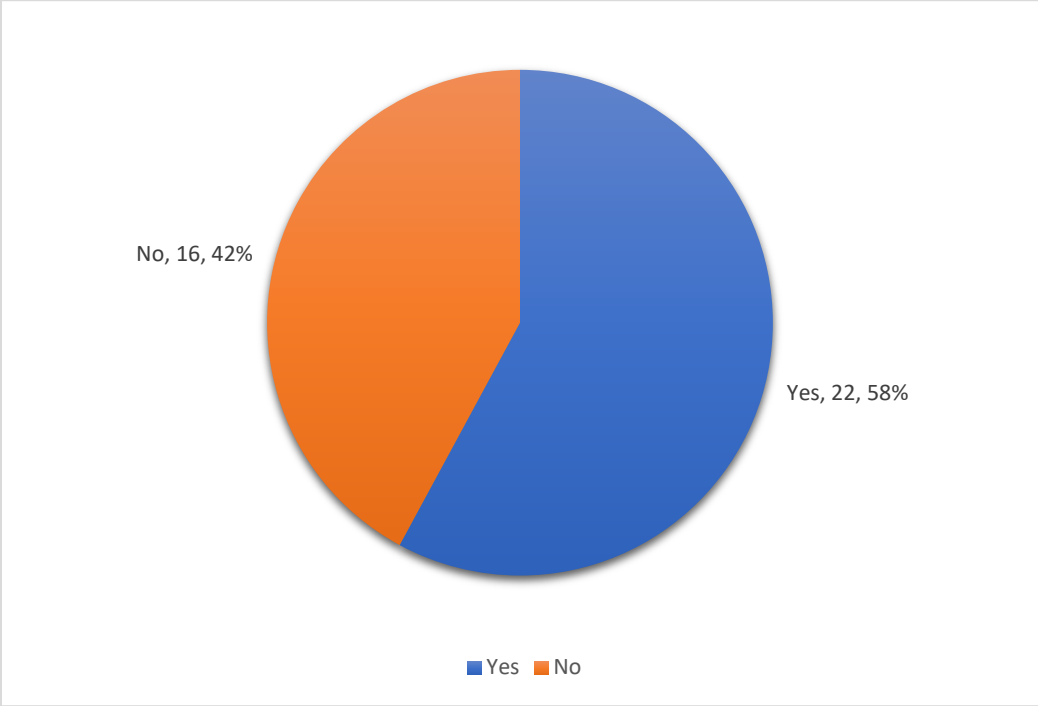
11. In general, would you recommend potholing at known facility crossings?
(Respondents: 37 out of 39)



12. Are there any conditions in which you would not pothole at a known facility crossing?
(Respondents: 34 out of 39)

1. Never. it is a must!
2. See number 6 above.
3. Perhaps with well documented SUE level A records
4. If already know depth; boring depth no within 4 feet of known facility depth; written explicit permission for facility owner or municipal/property owner.
5. No
6. No. Any exception to potholing would have to be approved by the facility owner ad a variance granted by the interested parties and would be on an exception basis only.
7. No
8. If they were sufficiently deeper or shallower than the pilot hole.
9. See #10 above
10. not a good practice! went working near facility you need to insure you take necessary measures and precautions went crossing them.
11. Only if ROW owner will not allow it and takes full responsibility.
12. Can't think of any
13. No. If we cannot locate the marked utility, we will excavate 24 to 30 inches below the horizontal drilling path.
14. No.
15. no, if unable to locate excavate to 24 inches below horizontal directional drilling depth
16. No.
17. No, all facilities need to be potholed and located.
18. no - if unable to locate excavate to 24 to 36 inches below horizontal directional drilling depth
19. No
20. No.
21. No
22. No, if unable to locate excavate to 24 inches below horizontal directional drilling depth
23. no
24. if the known depth of the facility was separated by 5 feet or more
25. none
26. See answer to question 2
27. We scan for utilities. 100% accurate
28. ALWAYS attempt potholing. Only stop looking for it if the utility owner signs saying the utility is to deep to find. 20+ feet or so.
29. Deeper than planned bore path by 5'
30. No
31. If there is uncertainty of the utility elevation, potholing is recommended prior to construction to identify and mitigate risk. Often potholes are backfilled and compacted before commencing trenchless excavations. If clearance is minimal and risk of damage is high, existing utilities can be physically restrained to prevent movement/damage. This is relatively rare for well designed projects.
32. None
33. When private locating has been performed with proper depths
34. Provide sufficient depth or separation by design.

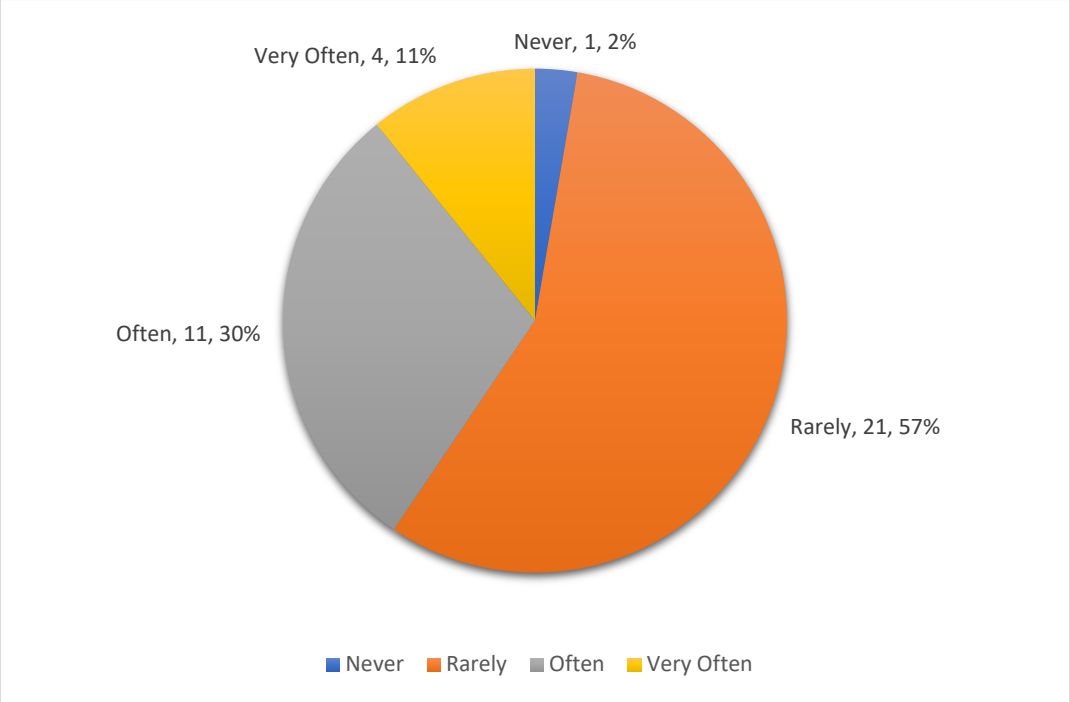
13. Have you experienced any conditions on a trenchless project for which potholing was burdensome or impossible? (Respondents: 38 out of 39)



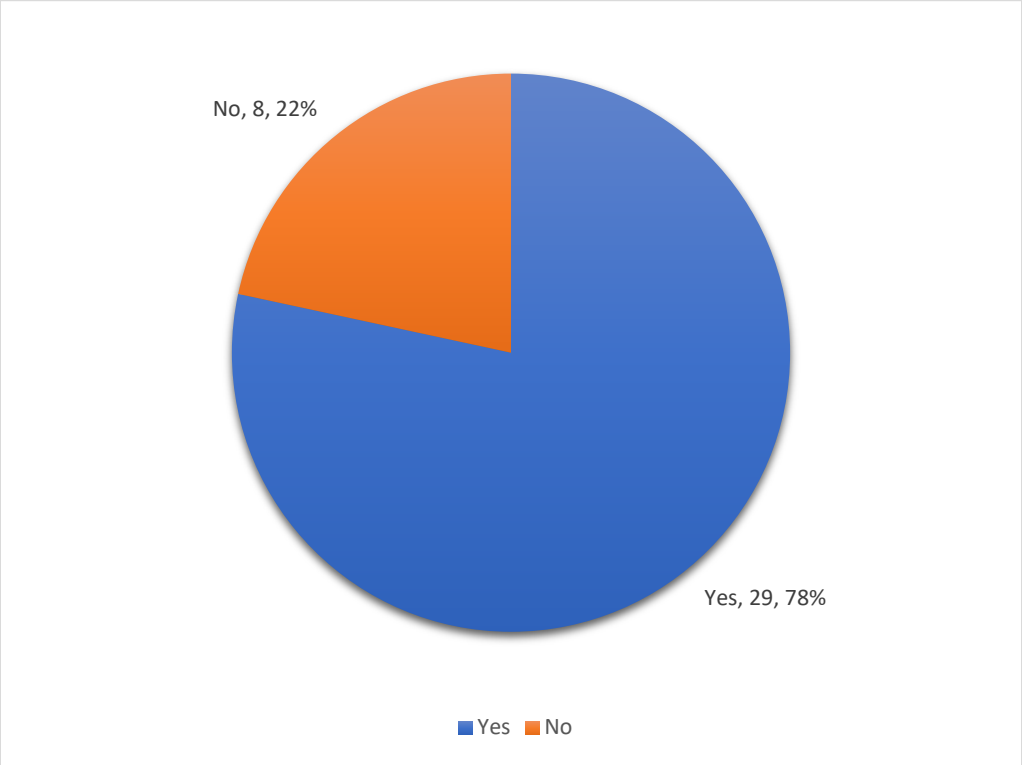
14. Could you explain those conditions? (Respondents: 25 out of 39)

1. Traffic, hi density of existing subsurface installations, limits placed on excavator by utility owner when involving encroachment of HP lines, cal trans work window time limits.
2. When drilling more than a 3 or 4 feet deep, when drilling under a paved highway, when drilling under a river and when drilling under water lines, sewer lines or other customer-owned facilities it's not practical to pothole.
3. Depth, water table, contaminated soils, and site conditions (Freeway traffic, etc.)
4. Under, near or within restricted easement such as railway, pipeline, storm drain, etc.
5. N/A
6. Rocky conditions, highly traveled road ways, water ways.
7. See #10 above
8. as a contractor it is your responsibility to make sure you have properly locate all utility underground.
9. Large ROW crossings, such as Freeway corridors.
10. None to my knowledge.
11. N/A
12. bridges or water crossings
13. Note - This mandated a new path. Utilities were encased in a large concreate filled area. Under a asphalt paved road.
14. Burdensome yes, but impossible no. Rocky soil.
15. Burdensome - Unable to find "marked" facilities
16. Not impossible but due to local paving requirements could be cost prohibitive
17. Depth. Traffic. Meny reasons
18. Where contractors previously installed existing utilities using the HDD method, installing the utility at great depths or beneath creeks, railroads, freeways, structures, etc.
19. when the utility is to deep.
20. Concrete being several feet thick and road moratoriums where cities will not allow newer streets to be cut
21. Potholing is always burdensome, but it is required. Hard ground conditions and deep utility crossing can be very difficult.
22. Under rivers, creeks, or other environmentally sensitive areas. Within Caltrans, UPRR or other heavily traffic ROW. Under private property.
23. burdensome - crazy amount of utilities in the ground in the middle of a street requiring traffic controls.
24. Thick concrete
25. Too deep, in sensitive environmnents

15. How often do you encounter unmarked abandoned lines while using trenchless techniques?
(Respondents: 37 out of 39)



16. In your experience, can soil conditions cause a deviation from the pilot bore in reaming or the pull back of the installation? (Respondents: 37 out of 39)



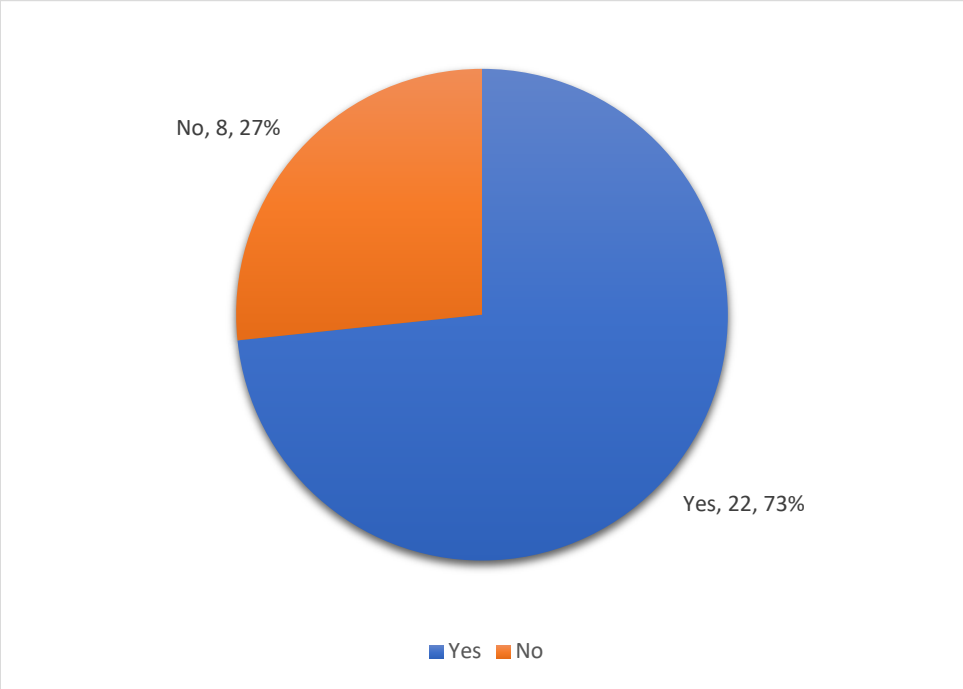
17. In your experience, if you have seen this happen under what soil conditions did this occur?
(Respondents: 30 out of 39)

1. All soils. Wet bay mud is the worst.
2. Many situations due to overbends/underbends (i.e. getting the conduit to turn up to follow the bore path)
3. Transitioning soil types (sand, clay, rock, slurry).
4. Various.
5. Near existing trench lines with soft backfill, intermittent hard soils and sugar sand, heavy cobble
6. Sand and cobble conditions
7. Often during multiple ream passes, the reamed hole becomes deeper than the pilot hole.
8. Occurs rarely. Unusual conditions can arise as with any mechanized placement of facilities
9. wet or muddy soil conditions. existing trench line.
10. Sandy
11. Rocky soil and/or sandy soil.
12. generally, gravity tends to pull the bore rod/ reamer down, so loose, sandy, or muddy soil conditions can cause the reamer to sink somewhat on pullback.
13. sandy soil / rocky soil
14. Rocky
15. It's been known to happen, I've not seen this happen yet.
16. Rocky soil, Sandy soil, fractured DG/soil, pre disturbed fill areas,
17. Sandy and rocky soil
18. N/A
19. Rocky soil / Sandy soil
20. sand
21. in very rocky or compacted soil it has caused deviations
22. Does not apply
23. Buried material
24. hard/soft split conditions
25. Too many potholes that were not filled in properly before we cross them. Also hard ground combined with soft ground or just rock in the area.
26. Never the soil, generally always the lack of proper drilling fluids that are "shoring for the bore hole" that allows the reamer to easily follow the intended bore path
27. Cobble/rocky soil as well as sandy and silty
28. When HDD alignments are designed along interfaces between significantly different soil consistencies (rock/soil, or soft soil/hard soil). The reamer can be pushed into the softer ground if it can't get a good "bite", especially if the interface is encountered at a very flat/oblique angle.
29. Wet
30. transition zones of geologic layers especially at soil to rock interface or right above

18. Are there any ways in which you have modified your practices based on the soil composition?
(Respondents: 26 out of 39)

1. Slow and study
2. When drilling in unusually sandy or loose soil, we often modify our drilling fluid mix to compensate.
3. Yes
4. Slow down, pilot hole at transition.
5. I don't have this information. The contact/source I would use for this information is unavailable at the time of this survey completion
6. Yes, different soil conditions each require a unique mud (bentonite) mix.
7. Sometimes we run casing in gravelly soils to keep it off the drill pipe.
8. Yes, best practices dictate how to successfully approach different ground and soil compositions
9. yes, we will get back with the engineer to see if there a different path we can take.
10. yes
11. Boring mud is critical to ensure the bore path remains
12. If the soil is quite rocky we would open trench the path as opposed to directional bore.
13. Not to my knowledge
14. No
15. Yes
16. Any changes are always based on a safest course of actions, and are case by case addressed
17. Using proper steer bit and drill mud for soil conditions.
18. yes, the thickness of my mix.
19. does not apply
20. yes.
21. Yes. Fill in pothole after survey, if the utility is more than 5' away from intended casing installation. Also if rocky, try to get more than 2 feet of space between. Also if the line is of fragile construction.
22. Adjusting drilling fluids to the geology of the soil is a must on every job
23. Yes, everything for adjusting the length of the bores changing the type of drill bits and reamers used to the additives used in our drill fluids.
24. Different tooling, different drilling fluid composition, different rig strength, use of conductor casing, grouting, modified alignment
25. Yes
26. Always, proper tooling, fluid management, penetration rates, etc should be based on material drilling. Start w 1 but may end with different bit or reamer.

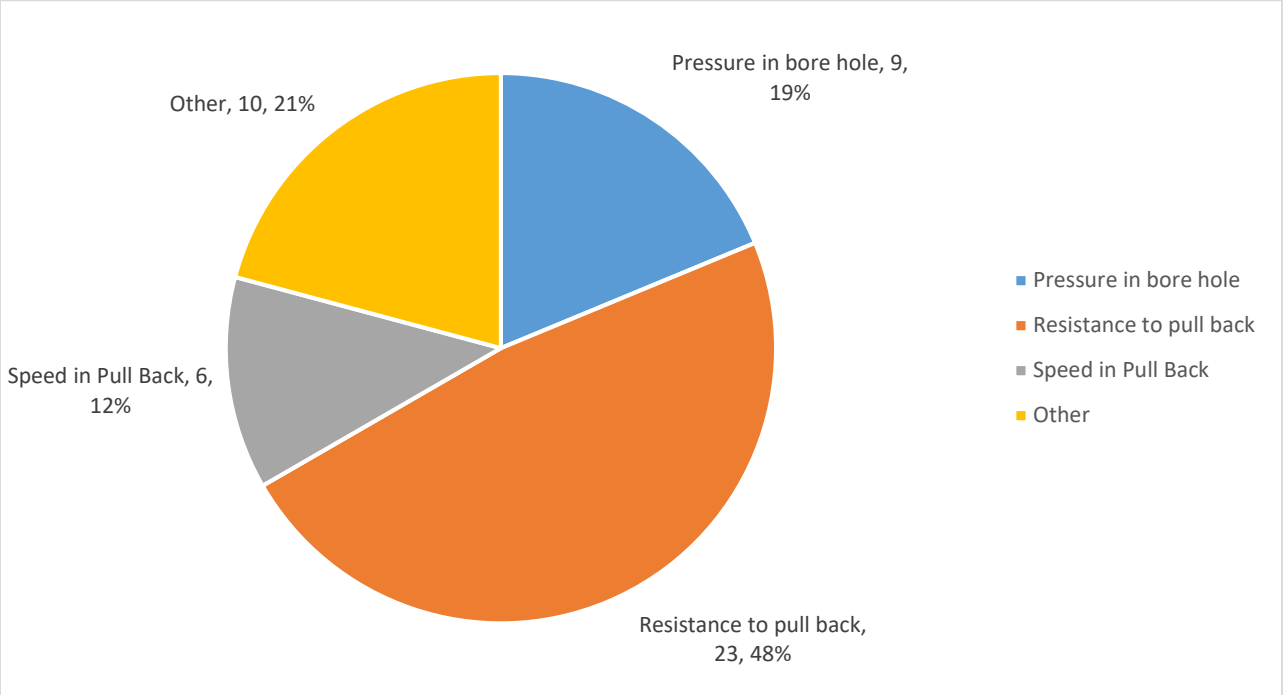
19. Have you been able to identify problematic soil conditions in soil samples or during the pilot bore? (Respondents: 30 out of 39)



20. Could you explain your process for the identification of these soil conditions?
(Respondents: 22 out of 39)

1. Potholing allows to understand soils.
2. When we encounter soil which seems easy to drill initially but the bore begins to collapse making head turning difficult or impossible or head directional control is lost, we'll begin altering the fluid mix.
3. rock, cobbles, clays, coral cause significant problems with boring operations. Soils/geotech investigation are required to avoid problematic conditions
4. Soil sampling at utility conflict pothole.
5. We require a good geological study before bidding on most jobs. We also study the cuttings as they come off of the cleaning system screens to see what we are drilling through.
6. At times through the initial start of the pilot hole special can help in this identification, but, this may not be reprehensive or similar conditions for the planned distance of the bore path
7. excavate a bore slot and see what type of soil classifications we are working with stable or least stable soil
8. In some soils it is tough to follow the bore head with readings from your receiver.
9. We use past experience in areas we know have rocky soil conditions.
10. rocks or hard pack sand
11. Proofing the soil in advance to construction.
12. Soil conditions are usually determined during the potholing process.
13. basiclly when you are only able to drill by carving and not as much drilling in the run.
14. if there is an issue with head pressure and difficulty in the bore process it will indicate that there is possibly rock or very compacted soil
15. Does not apply
16. Entry pit
17. Years of experience
18. Generally from the potholes
19. If the drill head deviates from the anticipated path can be an indicator of changes in soil conditions, as well as pressure changes on drill fluids. A drop in pressure (loss of flow) can indicate a void or other changes in soil.
20. Soils coming of separation plant based on shaker screen size/hydrocyclones/centrifuges. Extensive gravel is problematic if there are insufficient fine-grained soils to provide bore stability. Soft soils can collapse on the bore. Plastic/fat clays which come out in large plugs can clog the bore and result in hydrofracture down hole.
21. Wet or sand with rocks
22. GEOLOGIC INVESTIGATION AND TESTING FOR SOIL CHARTACTERISTICS IMPACTING DRILLING. Not enough room for me to explain. You either have engineers and drillers who know what they are doing or not. The difference is obvious in both cases.

21. What do you pay attention to in pull back of a drill head or facility installation? (Select all that apply) (Respondents: 36 out of 39)



Other:

1. All of these (2x)
2. Back flow
3. Product feed rate into far end of bore
4. Slurry mix
5. Speed and resistance are both equally important
6. Change of reamer size when pulling back
7. Proper drilling fluids, the right rate, the right mixture for the soils
8. Preswab hole first to prove hole
9. Does not apply

22. Is there anything else you would like to share (ideas, best practices, hazards, other information)?
(Respondents: 17 out of 39)

1. We've found our head location system to be very accurate and trustworthy but, it must be tested before each bore. We've also found that head location can be adversely impacted by large, buried, metal objects such as automobiles and farm equipment.
2. Boring contractors should participate and be well versed in Trenchless Trade organizations and periodicals. It is a relatively new technique and new discoveries and improvements are constantly occurring.
3. Pilot holes and utility pot holes, combined with accurate mapping and constant locating of bore head are best practices.
4. As an Oil Operator, I've have seen many boring activities crossing or running parallel to our pipelines, the most common argument is having the contractor follow our rules and restrictions within 10 feet of our HP Subsurface Pipeline. Our requirement is to have a clearance of 24 inches around the pipeline, boring companies need to be aware of the importance of this separation especially around High Pressure Subsurface Pipelines.
5. Care, planning, communications and collaborating with existing utility/facilities will provide the best due diligence possible prior to construction. Always understanding and having a plan for what to do in the event of a damage is key to recovery in all underground excavation and utility/facility placement.
6. Many bore operators will utilize various shortcuts to determine the depth of subsurface facilities in lieu of potholing. for example, a bore operator may open the front cap on a fire hydrant and place a tape measure down to the plunger to determine the depth of the top-of-pipe. they may also open manholes to determine sewer depths rather than potholing
7. Nothing to add at this time.
8. Safety first, check twice, Every job is unique.
9. just make sure everything is correctly marked on the job, never make a run if missing utility markings.
10. It is a best practice for our company to maintain greater than 24 inches from any facility.
11. There are many different trenchless methods. This survey only applies to the directional boring method. Consideration should be given to other methods
12. More regulations is not the answer. Certified contractors is.
13. Training of crews, is essential on: Best Practices; Safety, proper equipment operation, jobsite and public; Operation of equipment; Profiling the jobsite; Bore Planning; Drilling Fluids; 2nd Form of Verification for existing utilities; Trenchless electronics.
14. If needed we can share or directional bore logs and our mole logs along with the procedures we have developed.
15. I would be very careful in making sweeping generalizations or regulations that apply to all trenchless construction methods since so much of risk mitigation is unique to each project. NASTT provides several Good Practices books which addresses the major concerns for each installation method, but the way to address those concerns depends greatly on the geotechnical conditions, the installation method, the pipe/bore diameter, and the risk of damage to existing facilities. Where practical, limiting restrictions on trenchless construction can lead to less costly projects, which serves the tax payers well. However, where necessary, additional mitigation measures to limit risk usually end up saving money in the long run (compared to fixing damaged facilities). The key is competent designers who understand the various facets of each construction method and the limitations and applications for each method.
16. Tailgate meeting with all crews to identify all hazards and emergency shutdown at each bore location
17. Surface tracking requires more skill then many contractors have on staff. They buy a walkover then think they know what they are doing. If they cannot calculate and track their position using dead reckoning in addition to run the walk over or other steering guidance systems, then they shouldn't be steering and probably shouldn't even be drilling. I have caught multiple steering hands falsifying data with walk over. Owners do not put enough emphasis on tracking systems and site geology. Instead they want contractor to assume all risk. Contractors loose sight of importance of tracking etc. because proper tracking takes more time, so pursuit of $ governs their decisions leading to error. Owners who allow walk over should require as-built with internal gyroscopic mapping tool. Select contractor based on qualifications, not low bid! I would love to expand this discussion

23. What is your name and organization) (Respondents: 31 out of 39)

1. Steve Bryan, Pinnacles Telephone Co.
2. William Johns, Utility Coordinating, Inc.
3. Worster Construction Management
4. Torrance Logistics Company
5. PG&E
6. The Ponderosa Telephone CO.
7. Joseph L. Parrish, HDD Manager, ARB, Inc., 26000 Commercentre Dr., Lake Forest, CA 92630
8. TDS Telecom
9. Irish construction
10. John Foster, retired Eastern MWD.
11. Charter/Spectrum Communications
12. Chris Davy, Southwest Gas Corp.
13. Peter Crampton Charter Communications
14. Brian Scott Schultz / Charter Communications (Spectrum)
15. Spectrum Cable
16. Glen Barker, Spectrum
17. Cochran Communication Construction Inc.
18. Frank Andrews, Charter/Spectrum Communications
19. Tyler Matthies / Spectrum
20. unitechz communications
21. Kinder Morgan
22. gopher-it trenchless
23. BAT
24. Pacific Boring, Inc.
25. Allstate Boring
26. Mike Anderson, Ditch Witch West
27. Veteran Pipeline Construction & Accu-Bore Directional Drilling
28. Kate Wallin, Bennett Trenchless Engineers
29. Royal Electric
30. TrenchFree Inc
31. The HDD Company