

***A Publication for AGA Members***

Prepared by the AGA Operations Section

Field Operations Committee

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## **Implementing Damage Prevention in Field Operations**

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## I. Purpose

The purpose of this white paper is to provide guidance on how operators can proactively help improve their existing damage prevention programs and provide potential components of a damage prevention program that build off what may be minimally required by existing law. While readers should consider 811 messaging as a fundamental part of their plan, this paper aims to identify additional actions that operators can take to drive down excavation-related damages to their system. This paper presents opportunities that are available to operators through training, partnership, and accountability to reinforce the fundamental approach that damage prevention is a shared responsibility. This paper does not imply that the absence of any of these practices would mean that an operator's damage prevention program is incomplete but rather offers points for consideration that have proven successful for many operators. This paper recognizes that there are regional and cultural challenges that exist.

The actions in this paper should be evaluated in light of each operator's system, geographic variables, the operator's independent integrity assessment, risk analysis and mitigation strategy and what has been deemed reasonable and prudent by their state regulators. Therefore, not all the practices described in this document will apply to all operators. Each operator must incorporate the strategies that they believe will be most effective for their systems.

## II. Background & Reference to Previous White Papers

This paper aims to build on the platform of past AGA papers, best practices and a community of effort designed to protect the communities we serve and the public at large. Some of these earlier AGA papers, like the 2004 Technical Note, *Directional Drilling Damage Prevention Guidelines for the Natural Gas Industry* that was appended to the 2010 AGA White Paper, *Natural Gas Pipelines and Unmarked Sewer Lines – A Damage Prevention Partnership*, addressed specific issues related to cross bores. These papers emphasized the importance for established industry practices, including: one call locating, community education, employee safety training, advance planning, and on-site investigations. In addition, the pot-holing procedure discussed in the 2016 AGA White Paper, *Reducing Pipeline Damages from the Use of Horizontal Directional Drilling*, outlined a series of common-sense construction procedures that, if followed, can help reduce damage to underground facilities when excavating or engaging in directional drilling. This paper will not revisit points made in earlier papers. It will, however, build upon them.

## III. Locate Management

### a. Overview

Success for both contractor and in-house locating resources balances on the accuracy and timeliness of each locate. Thus, locating accuracy and timeliness becomes the most controllable inputs an operator can have when preventing excavation damage once a locate request has been submitted. The size, tenure, and experience of your work force comprise a critical role in damage prevention. The investment in training and professional development for underground locators is critical when you consider the safety of the public, the cost of repair, and the impact to customers. Key work groups comprised of expert and experienced locators can be leveraged to manage your most critical infrastructure, high risk projects, and knowledge transfer. Involving locators in damage prevention

programs can result in positive outcomes. Managing the on-time performance of locates is also a fundamental part of reducing underground damages.

### **b. Staffing Resources**

One of the largest challenges facing operators is predicting and appropriately staffing for the incoming volume of locate tickets. The increase in, and success of, public awareness programs is leading to larger volumes of tickets every year. Additionally, incoming work is not equally divided amongst the twelve months of the year, or even the days of the week. Additional challenges around locator staffing and retention can be even more prominent in northern states, where the fluctuation of incoming locate volumes is more pronounced due to weather and seasonal construction activities. Most states do not have any mechanism to control or limit the incoming volume of work for locators, so prudent preparation and staffing models must be leveraged and taken into consideration.

Several strategies are available to create a more flexible approach to addressing the incoming volume of tickets. Organizations may want to consider utilizing a combination of both in-house and contract resources to assist in peak-shaving or assign burdensome activities like project tickets and investigations for electronically unlocatable facilities to a special team of locators so that these activities do not interfere with the timely completion of ordinary locates.

Whether you are leveraging in-house or contract locators, increasing the depth of available skills in the workforce can support long term readiness and help respond to an increased workload when peak locating times are present. During periods of lower locate ticket volume, those same resources can complete other less time-restrictive work, such as marker post inspections and replacements, investigation and remediation of unlocatable facilities. This creates a more flexible pool of resources and leverages workforce knowledge and skills across various tasks. Organizations may also consider data/trend analysis to proactively manage workload increases. Trends may show specific times in the year workload increases, who is requesting the work, where is the work being requested etc.

Controlling the number of locate tickets called in by one's own organization (e.g. when they are called in and how many times a particular ticket is called in before being worked) and partnering with large volume excavators can yield positive results in eliminating wasteful locates due to poor planning or imprecise marking instructions.

### **c. Training**

A mature training program that includes both the theory and practical application of locating can provide confidence for an operator that technicians are prepared for the challenges they will face. Understanding the training programs used by contract locating vendors can provide confidence in the operator that locators are qualified. Additionally, having mentors available for a new locator, and having a support structure in place to provide feedback, helps enable long term success.

### **d. Quality Assurance/Quality Control**

A process that outlines how locates will be inspected can help ensure that employees and vendors are properly executing applicable processes and procedures. Additional insight into the performance of an employee or vendor can prevent damages due to inaccurate locates. In addition to periodically verifying

the Operator Qualifications for individuals, the operator has several options available to validate the quality and accuracy of the field work being performed. Periodic reviews of a contractor's quality assurance programs can provide insight into their commitment to continuous improvement. While most contract locating companies perform self-audits, a third party or in-house resource should also be considered as they can provide an independent and unbiased review of the work performed in the field.

Predictive analytic software can assist in assessing the efficiency of ticket selection. Audits can be performed to verify the accuracy of the locate, proper scope of locate ticket is marked, the proper completion of required documentation, and compliance with any necessary additional processes or marking standards (e.g., labels, flags, etc.). Additionally, requesting retraining documentation when an audit is failed, or an at-fault damage occurs helps raise awareness to damage prevention. When these initiatives uncover defective work, corrective actions can be taken and lessons-learned can be identified to help prevent reoccurrence. Finally, data points can be collected for analysis to identify any trends that may require additional action or attention.

#### **e. Scorecard Metrics**

Weekly/monthly scorecard metric review meetings assist with ensuring alignment between all stakeholders. Accuracy and on-time performance are basic key performance indicators that should be included in scorecard metrics. Additional monthly metrics can be added such as expected staffing resources, audited performance, customer complaints and issues, near misses, volume of open or incomplete work, volume comparisons to previous time frames and/or mapping corrections submitted. Scorecards for the locating process should track performance related to improving quality and timeliness, as well as interactions with stakeholders throughout the process.

#### **f. Contracts**

Familiarity with a vendor's policies, procedures and practices and their commitment to those practices, can help mitigate risk to public safety. Contractual provisions that balance incentives and potential remedies within a contract can drive meaningful results. Payment arrangements can be tailored to work best for both the operator and the vendor which may include unit, hourly or combination-based rates. Additionally, pricing can be tailored based on work type and risk (e.g., fiber, significant interstate or state highway work, large scale industrial construction). Establishing a centralized and comprehensive approach to contractor oversight may also be a way to monitor conformance with contract and regulatory requirements. This oversight may assist in monitoring the quality of the work performed, public safety, and risks associated with these construction activities.

A prudent review should be performed to fully understand the value that is being delivered, and at what cost. Contracts should clearly outline the expectations of every aspect of locating, including the accuracy, timeliness, required documentation, and other key issues. Effective relationship management is critical to maintaining a successful relationship where all parties understand expectations and challenges are faced collaboratively. Opportunities for engagement are available through a variety of ways. For example, introducing operator values, highlighting key points around public safety, and clearly explaining expectations and available support during new locator classes can demonstrate your commitment to safety and to your contractor's success. Performing joint audits and attending contractor front-line meetings provides a platform for open dialogue and partnership. The data and documentation sharing from both parties allows for continuous improvement of the overall process.

Also, contractors having their own quality assurance and quality control programs should be considered as a contract requirement. Utility operators should have a clearly defined locate policy/standard that can be accompanied with a contract that clearly defines specific policies/procedures for locating for that specific utility. Where state-imposed fines/penalties are imposed for inadequate locate practices the contract needs to specifically spell out reimbursement plans from locate contractor to utility operator for any fines or penalties.

There are attributes specific to any given operator that can impact the volume of work that may be open or require an extension past the start time of a locate request. It is important to take time to understand these attributes for your respective situation and take these attributes into account when making resourcing decisions. Some examples of the attributes you should consider include: the type(s) of product your organization delivers (gas, gas/electric, gas/water, gas/steam, etc.); your incentive and remedy structure with your vendor or the lack thereof; whether you have a vendor or if the work could be completed in house or by a combination of contracted and internal resources; and how different types of tickets are segregated and defined (i.e. project ticket, normal notice ticket, emergency ticket, second notice, remark). An operator's product delivery mix can impact on time performance (OTP) in multiple ways. If you have a predominantly natural gas infrastructure and are dealing with challenges presented by aging assets (e.g., difficulty detecting facilities via locating equipment, or lack of sufficient records indicating accurate location of the facilities) it may be necessary to resource with an understanding that more time will be required to appropriately mark the facilities. It may also be appropriate to use safe excavation techniques, such as hand digging and vacuum excavation, to find a facility for which inadequate records exist or for which standard locating equipment is insufficient (i.e. cast-iron facilities, plastic facilities with broken or no tracer wire, etc.). If you have a product mix that is more heavily weighted toward facilities that are locatable using equipment or for which adequate records exist, it may be possible that fewer resources would be required to meet the OTP targets that are established by your respective organization's targets or state regulator's requirements.

Regardless of the resources completing the locating for your company, an effective means to better managing on time performance may come from incentive and remedy structure. If using a third - party locators, structures implementing these measures should be included in the contract. Whether you have established a target, or you adopt the target or requirement from your state regulator, you can consider that point to be neutral and pay incrementally more than normal for better performance or pay incrementally less for worse performance. Effectively managing every ticket every day requires an operator to have the ability to identify the status of any given ticket in real time. Optimally, when a contract locating vendor is used, real-time positive response flows through the operator's ticket management system so there is an independent calculation of on time performance, as well as transparency with the status of every ticket.

#### **g. Considerations for electronically unlocatable assets**

While electronic locating methods and technologies continue to improve in terms of sensitivity and accuracy, these locating methods are an electronic proxy that infers the location of the underground facility unlike actual exposure of the subsurface utility by vacuum excavation (potholing) where the utility's precise horizontal and vertical position can be visually determined. Furthermore, because of distortion in the electromagnetic field caused by changing density of the earth and its composition, the proximity to other underground facilities, moisture content and other factors, such as the depth and size of the utility, the precise horizontal location of the underground facility may not be exactly where the

strongest electromagnetic field is located from above ground. This can result in an inaccurate mark that is not exactly above the underground facility.

Assets that are electronically unlocatable can be at higher risk for damage without a robust process to identify them. Ensuring your employees and/or vendors understand the processes and procedures around electronically unlocatable facilities is an important damage prevention measure. Good communication between facility owners and excavators is also key when an electronically unlocatable facility is identified. Other technology and tools, including insertable sondes or cameras, are available and may be helpful to determine the location of unlocatable assets. In addition to construction practices, future needs of locating the asset should be taken into consideration. GPS coordinates can be taken or other products such as electronic marker balls can be left on the asset to ensure it can be located in the future.

#### **h. Positive Response**

Providing expectations related to communications with excavators and associated documentation will be critical to a vendor partnership. Positive response<sup>1</sup> through the One Call Center to the excavator would be the preferred method of documentation. However, not all One Call Centers have agreement from all members to implement positive response. If that option is not available, the locator and the operator must agree upon the appropriate mode of communication (i.e. call and leaving a voicemail, or talking with person who called in the ticket, or the talking with the person at the job site) and how that communication is documented (recorded line, log book, etc.). Additionally, ticket management software that communicates directly with the excavator to provide additional information about the job site (e.g., photos of the locate performed and any additional information regarding abandoned lines that may be present or issues that have been identified) can be leveraged to assist in preventing damages.

## **IV. Construction Practices**

In addition to the directional drilling guidelines provided in the 2016 White Paper, *“Reducing Pipeline Damages from the Use of Horizontal Directional Drilling”*, the Common Ground Alliance has a list of excavation best practices that can be found in Chapter 5 of its Best Practices Guide that has been recommended by all stakeholders. In addition to promoting these guidelines both internally and externally, operators should consider how the placement of new facilities could potentially impact the locating and identification of these facilities in the future. For example, installing a new plastic main within 24 inches of an abandoned one could lead to future confusion for an excavator excavating around your plant if they are attempting to expose it and discover the abandon line first assuming it is the live one. In other words, where you install your lines can be just as important as ensuring your lines are readily locatable for future locating purposes. When replacing a pipe, operators can also consider using the same location as the original pipe by utilizing pipe splitting technology. The depth of the facility can also impact accurate locating. Although many state statutes do not require new facilities to be made

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<sup>1</sup> “Positive response” is a term used to describe the two types of action taken by a facility owner/operator after it receives notification of intent to excavate. The facility owner/operator must 1) mark its underground facilities with stakes, paint, or flags; or 2) notify the excavator that the facility owner/operator has no underground facilities in the area of excavation. This process allows the excavator to begin work in a timely manner.

locatable, additional steps should be taken to ensure there is sufficient data (e.g. GPS) to provide options to adequately address future locating needs.

## **V. Mapping/As-Builts**

Today's underground world is a maze of pipes and cables that is becoming increasingly congested. Moreover, there is an unknown number of facilities that have never been accurately mapped or recorded. Some of this infrastructure was installed more than 150 years ago when as-built drawings referred to relative measurements from surface features that have long since disappeared (e.g. "2 Chains & 2 Links NNE of the Old Oak Tree"). Mechanical measurement tools of variable precision were also used. Since then, survey mapping has improved significantly but historically, recording the presence and location of buried utilities was not formally required or was not carried out in an accurate or methodical way.

Instead, without reliable drawings or maps, every worksite became a sort of blank canvas in which responsible contractors aided by the growing use of vacuum excavation adopted a cautious, careful digging approach. Often times excavating methods were reverted to open trenching and hand digging, while less responsible excavators were less careful and chose to "dig blind". That changed somewhat when directional drilling and boring began to replace open trenching as a less intrusive, less expensive, and faster method of installing or replacing underground infrastructure. With so many communications lines, fiber-optic cables, petroleum, natural gas, electricity, water and sewer lines, public safety issues reached a point where both industry and government intervened to mandate a better, more reliable way to quickly and accurately locate and identify buried infrastructure to avoid excavation mishaps that could result in significant damage, interruption of service, serious injury to workers or the public, or negative impact on the environment.

### **a. Internal Data Gathering**

Motorized robotic "pigs" and CCTV cameras have gotten so small that they can be inserted, under no-blow conditions, and can even travel into and inspect service laterals to provide precise location data that should help avoid cross bores in the future. Small cameras, some equipped with a compact sonde that can be detected from the surface, can be connected to a calibrated mechanical pushrod and inserted through small holes cored through pavement to visually identify the location of leaking bell joints in cast iron pipe that can be marked on the road surface. Many jurisdictions are using this technology to facilitate minimally intrusive anaerobic "keyhole" leak repairs.

### **b. External Data Gathering**

In 2008, the United Kingdom engaged in an ambitious bifurcated program of Assessing the Underworld (ATU) and Mapping the Underworld (MTU)<sup>2</sup> that included a 10-year project to develop a multi-sensor location device that can "see through the ground" and map in 3-D to record the position of all buried utility assets without excavation. Thus far, the concept has been proven in principle, but a practical solution that accurately identifies the position and condition of buried infrastructure that rivals the accuracy of visual inspection has yet to emerge.

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<sup>2</sup> <http://assessingtheunderworld.org/>

### **c. Conventional Data Gathering**

In 2011, the CSA published the *S250-11 “CSA Standard for Mapping of Underground Utility Infrastructure”*. This voluntary Standard improves record keeping and helps ensure that accurate information about underground utility infrastructure at or below grade is captured and available for future projects and can be applied to proposed, existing, abandoned-in-place, retired or reserved-for-future-use situations.

This standard is based on the premise that it is a privilege, not a right, to bury anything underground in a public right of way, and that in consideration for that privilege, the owner is obliged to provide an accurate and retrievable as-built location of that utility infrastructure. It acknowledges the importance of the “Call Before You Dig” program but recognizes that program as a “reactive” measure to a long history of missing or poor records and inaccurate mapping. Instead, it proceeds to develop a proactive catalogue of procedures that can be employed to improve the accuracy and usefulness of the underground mapping records going forward.

This standard recognizes that the most reliable way to accurately identify and record the location of underground utility infrastructure is to do so while the utility infrastructure is exposed and available for direct inspection and measurement. This generally occurs at the time of construction, when the underground utility infrastructure is exposed and visible during the installation process, and later, when the utility infrastructure is exposed during the course of subsequent excavation for maintenance or modification purposes, potholing, or as part of a subsurface utility infrastructure mapping investigation. The standard, which favors absolute, rather than relative, spatial positioning employs both commonly used horizontal and vertical datum to record horizontal position and depth. It also takes advantage of advanced GPS that can relatively cheaply provide on-site sub-meter accuracy. The standard is forward-looking and is not intended to be applied retroactively to existing installations by requiring the owner to initiate independent locating activities to update prior records.

## **VI. Excavation Outreach**

### **a. First and Second Party Excavators**

Support at the executive leadership level of the operator is critical to drive results and accountability relative to preventive measures taken to avoid excavation damages. It is the responsibility of the operator to ensure their crews and contractor crews are trained and knowledgeable about the one call laws in the state they excavate in. Contractors that excavate near underground facilities must possess the qualifications necessary to conduct such activities in a manner that is skillful, safe, and reliable. Participating in programs such as the Gold Shovel Standard allows you to view excavation damages company and contractor crews are involved with other operators. They also ensure there is an executive level commitment to annual training and accountability. The requisite qualification of the contractor serves to protect the public and the integrity of underground facilities in the vicinity of the excavation. Using qualified contractors ensures that all contractors who bid and work on a project employ safe work habits and are capable of performing the requested work. Allowing a competitive bidding process from qualified and competent locators ensures the best quality and pricing available while reducing damages to underground facilities. Penalties and incentives around public safety and excavation damage can be written to ensure more than timely installation or repairs.

Establishing a centralized and comprehensive approach to contractor oversight may also be a way to monitor conformance with contract and regulatory requirements. This oversight assures the quality of

the work performed, maximizes public safety, and mitigates risks associated with these construction activities. Resources may include a Quality Assurance or Quality Control department as well as anyone who visits the job site including inspectors.

Potential goals of contractor oversight include:

1. Define review plans for the contractor base
2. Establish procedures for operator reviews
3. Create a system for tracking and monitoring review observations and recommendations
4. Issue corrective actions to deficient contractors, as necessary
5. Verify timely implementation of corrective actions by contractors
6. Verify the effectiveness of those corrective actions
7. Benchmark contractor groups on key metrics

While the One-Call law provides minimum requirements, operators should consider requiring industry best practices to reduce and minimize excavation related damages as outlined by the Common Ground Alliance (CGA). Innovation and new processes evolve more quickly when relationships with contractors and crews are strong. Communication is the key to ensuring safety and protecting vital facilities; and that free-flow communication allows all stakeholders to focus on the common goals for safety and damage prevention. Each near miss or damage should be reviewed jointly for opportunities to prevent reoccurrence. Encouraging contractors to develop their own quality assurance and quality control programs fosters the vendor partnership model. The data and documentation sharing from both parties allows for continuous improvement of the overall process.

#### **b. Third Party Excavators**

Many operators offer free educational opportunities for excavators including on-line training to in-person options. Emphasizing employee and public safety throughout your presentation and enabling and empowering work stop authority culture can be highly effective with the right support. In person training is the most effective as it provides an opportunity for the audience to interact, ask questions and actually see the operator's investment in their success. Hands on training provides the opportunity to return the favor – to provide contact information and a foundation for who the excavator can turn to when there are questions and issues with locates and/or the operators plant in the field. Leveraging tail gate safety talks in the field can create meaningful interaction and a platform for good relations between the excavator and operator. Time spent during stand-by activities can provide an opening for a safety stand down discussion regarding operating pressure, method of exposure, and preparation in the event something goes wrong. Providing these educational engagements in multiple languages, specifically the language most common to the excavators working in your area, should be considered. Opportunities for education exist within every interaction.

Watch and Protect (Stand-by) processes can also enhance your ability to ensure the integrity of your assets. Specifically, some utilities have implemented Damage Prevention Vehicle programs (DPV), using either in-house or contract safety inspectors whose sole task is to patrol and visit third-party excavations to ensure compliance with Dig Safe law and regulations. In addition to the inspection and education benefits of the field visits, the electronic data collected creates a large excavator risk database that can be used to optimize future inspections.

Considerations for your process can include, the pressure or size of your system, the excavator involved, the location of the work (e.g. wall to wall concrete), the type of work being performed (e.g. open cut vs directional drill, auger or dill holes for power poles), and the consequence area near the pipe. In addition, a safety tailgate performed jointly with the excavator prior to work being performed can help promote partnership and safety prior to beginning work.

A meaningful relationship between high volume excavating companies and a Damage Prevention department can be highly effective at providing direct access to those who can address issues and concerns in the field. In addition, excavators that work a high volume of tickets can assist in providing future projected ticket counts. Predictive analytic software can drive efficiency with your outreach resources. Pre-construction or engineering meetings can and should be leveraged to identify high risk areas, potential areas where locating might pose a challenge and develop communication expectations and guidelines. Special effort can be directed at those companies who frequently damage an operator's system to help develop accountability internally as well as those who they work for. The theory that everyone works for someone can and should be considered. There can be accountability for third party excavators outside of regulatory enforcement although it requires an additional amount of legwork. Insurance companies can also be leveraged for better behavior in the field. Additionally, programs such as the Gold Shovel Standard can apply pressure for reporting and transparency within a community if enough operators are on board.

### **c. Additional Outreach Activities**

There are many opportunities to create and leverage outreach through creative partnerships with stakeholders. Creating free videos showing "how & why" it is important to expose facilities the right way can be a useful outreach tool that educates the workforce, contractors, and other partners. Partnering with other utilities, municipalities and organizations can help spread the damage prevention message more broadly.

Additionally, company sponsored ambassador programs that engage internal employees not only educate them about the 811 process, it enlists their help to identify and potentially prevent damages when they see others performing excavation. Engaging employees across an organization can be vital to the success of damage prevention efforts. Whether seeking to address issues of performance of locating personnel, repairing electronically unlocatable facilities, fixing problems of inadequate records or engaging with external excavation crews, having field employees who can be the "eyes and ears" of an organization to report and address problems encountered can have impact far beyond what a damage prevention staff can accomplish alone.

Communicating damage prevention metrics internally to employees and management brings awareness to the need for improvement and can lead to increased engagement from operations staff and others. Setting internal targets, communicating benchmarking data and tracking/reporting performance metrics can be invaluable in engaging employees outside traditional damage prevention departments to rally around the cause of employee and public safety. Coordinating with internal safety departments to communicate damage prevention as being equivalent to personal safety programs also has benefit in engaging employees. Additionally, adding metrics like high performance team (HPT) to the list of annual corporate goals or incorporating into an organization's incentive plan can help substantially in engaging assets from across the organization to focus on improvement.

## VII. Homeowner Outreach

Outreach for homeowners is focused on increasing awareness for safe behaviors around utility hazards. Pipeline Operators provide education to understand the importance of using the one-call ticket process, planning ahead, and how to work safely around those located lines. Many operators leverage their company website to explain the 811 process, as well as using company bills to remind homeowners to call before you dig with informative bill inserts. Traditional advertising such as billboards, radio, and television is still meaningful; however, social media has evolved into reaching a targeted audience that can create a more efficient means of allocated dollars for awareness messaging. Partnerships with other organizations such as one call centers, municipalities and other operators help leverage resources. Community liaisons that work for operators can influence local communities to promote or require use of 811 while issuing excavation permits.

Additional opportunities exist to reach homeowners through participation at local festivals, state fairs, home improvement stores, emergency responder safety days and other similar community events. Public Awareness programs also provide many operators the opportunity to educate other audiences such as the agriculture community, excavators and third-party contractors, public officials, educators and students the importance of using the one call system and tie in additional natural gas safety messaging. In addition, there are many professional organizations and collaborative efforts that may assist with reaching out to these targeted audiences.

## VIII. One Call Centers

Each state's One Call center is governed by a board of directors of various industry stakeholders. Board members use their industry knowledge and experience to help shape how participants interact with the one call centers. While the core role for one call center is to notify operators of where excavations will be taking place, many offer additional services that can be meaningful. The support and partnership you can get from one call centers on continuous improvement initiatives can be highly impactful in preventing underground damages.

Not only can they play a key role in educating excavators, but the board often has influence over the amount and type of general "Call Before You Dig (811)" messaging promulgated to the general public. The board can often ensure that a positive response mechanism is in place for operators to better communicate with excavators around the status of their ticket, even if it is not required by state. Ensuring that accurate and readily available contact information for both operators and excavators is a fundamental action that can help provide an effective means of communication should any questions or concerns arise. It can also reduce downtime and prevent excavation related damages.

Some One-Call boards have broad control over the types of tickets issued, and the requirements associated with those tickets. Influence over the duration, validity, and length of a locate request including technology based white lining can contribute to the stakeholders' measure of success. Although damage prevention laws vary from state to state, one constant is that timing requirements can impact the entire locate process. For example, some states have a 48-hour window or 72-hour window to complete locates while other states require a locate to be complete by midnight on the second working day. Design, subsurface engineering, or pre-planning tickets can contribute to overall preparation and avoid utility conflicts or accommodate for damage prevention efforts prior to excavating. Additionally, project tickets and procedures for large and long-term excavation projects can be structured to promote partnership and accountability from both the excavator and those that are

executing the locating. Finally, agreements regarding how often and what areas should be located should be accurately documented to ensure that all parties understand the terms of agreement.

## **IX. Closing Comments**

While enforcement varies from state to state, the need for operators to protect their facilities will always exist. Today, education, outreach and influence are the cornerstone for building good relationships with those that work around our assets; however, there will always be additional opportunities to learn and refine the ways to eliminate underground excavation damages. Technological advances may prove to be perhaps the most pivotal factor for damage prevention. When the subsurface utility engineering level information becomes the utility as-built standard, and advancements in GPS and emerging markets in augmented reality as well more prevalent predictive analytic modeling are made, operators will be able to leverage their time and resources in a more efficient and effective way than they have been historically able to. Damage prevention and ensuring that the safety of those that work and live around pipelines is put first will no doubt continue to be a shared responsibility.