



UNDERGROUND Around the World

Contributed by SeeScan, Inc.

As readers of American Locator, we're familiar with the basics of damage prevention in the United States. The adoption of 811, national and state standards, technology and training all support the goal of avoiding utility strikes. But beyond our own backyard, every country with buried infrastructure must also manage the hazard of utility strikes.

It's critical everywhere to take steps to protect buried assets, but the systems and procedures used in damage prevention vary considerably by nation. Locating utilities in particular has some considerable differences depending on where you are in the world. Whether and how to locate utilities is often a matter of history and how a nation's buried network of utilities is administered. In this article, we discuss damage prevention tools and processes in a sample of nations across the globe and a little about how those processes came into being.

North America

The United States

Damage prevention in the US is essentially synonymous with the 811 "Call Before You Dig" one-call system. Under this system, anyone who is about to begin a digging project—including excavators and property owners—must call 811, typically at least two days prior to beginning the dig. The call is routed to the caller's local one-call center, which creates a "ticket" and alerts utility owners with services in the area of the intent to dig. It's up to the utility owner to send a locator to mark out the utilities in the area. Usually, contractors bid for jobs to perform the locate.

The locator receives as-built maps of utilities in the area and performs the locate, marking out utilities according to the color-coded standard laid out by the American Public

Works Association. Once the locate is complete, the locator informs the one-call center, which gives clearance to the excavator to dig. The excavator then digs around the marks to avoid striking the utility.

Some logistics of the damage prevention process—such as how long mark-outs are valid and how far in advance the one-call center must receive a ticket request—vary by state.

Exemptions to 811 are also determined by individual states. For example, many state DOTs are exempted from one-call regulations; according to a 2014 survey, 19 of 46 responding state DOTs answered that the DOT was not a member of the state's one-call system. There are other state-by-state exemptions as well: for example, California exempts owners of non-pressurized sewers, drain lines and storm drains. Many states also exempt homeowners who are digging above a specified depth.

Canada

National Level

Similar to the United States, Canada uses a one-call system that varies in standards and practices by province. "Click Before You Dig" was created by the Canadian Common Ground Alliance and modeled after the US "Call Before You Dig" system. As the name suggests, requests can be filled out online or through regional one-call mobile apps. Utility locating in Canada is regulated at the provincial

level. However, on May 2nd, 2017, the Senate of Canada voted to adopt Bill S-229. Among other damage prevention measures, Bill S-229 would require locating utilities prior to planned excavations on federally regulated lands across Canada. Until and unless Bill S-229 passes in the House of Commons, the requirements for utility locating are left up to individual provinces to legislate. Alberta's and British Columbia's processes illustrate some of the significant differences in damage prevention approaches across Canada.

Alberta

The Alberta Damage Prevention Council (ADPC), a "non-profit society of stakeholders in the damage prevention process," developed the province's damage prevention protocol. To dig anywhere in Alberta, a request is made to the Alberta one-call center. The center notifies all utility owners that are members of the ADPC, who provide records of buried utilities to the one-call center.

Unlike in the US, the excavator may receive written clearance from the utility owner to dig without a physical locate if the records are deemed reliable. Without clearance, a locator must be hired to mark out the dig area. Because locating demand tends to be seasonal, most utility owners use contract locators instead of in-house locators.

If required, the locator performs the locate, marks out the utility positions, and provides some documentation of those positions, which can be in the form of a sketch or photograph. The excavator receives notification from the one-call center and may proceed with excavation.

British Columbia

British Columbia implemented its "Click Before You Dig" system, BC One Call, in 2015—about two years after Alberta. Their system is similar; a request to dig is made, utility members are notified by the one-call center, and a map of nearby facilities is provided to the excavator. However, physical locating is not explicitly required. Instead,

excavators are instructed to "measure and mark your site to show where the underground services are. Then, hand dig to expose the services" before excavating.

Beyond BC One Call, it is the excavator's responsibility to obtain any required permits from utility owners. Additionally, BC One Call's adoption is not yet 100%, and states that excavators should check with local utility owners to ensure that they have received maps of all utilities in the dig area.

Mexico

With the second highest GDP in Latin America, and as one of the fastest growing nations in the world, Mexico is investing heavily into its underground infrastructure. The National Infrastructure Program (PNI) of 2014–2018 aims to make far-reaching infrastructure improvements across multiple

sectors: action programs include the extension of the gas pipeline network, the laying of new fiber optic cables, improving drainage and sewerage, and expanding access to potable and farm water into rural areas. All of this construction means Mexico is contending with the hazard of utility strikes more than ever before.

As of now, federal laws governing the safe digging around buried utilities are absent.

Some jurisdictional laws require excavators to obtain maps of buried utilities before breaking ground. Mexico City levies a fine of 10% of the proposed value of a construction project for not gathering the as-builts before digging. Yet the same regulation makes no mention of utility locating.

Manuel Blas, a construction supervisor, explains how excavation work is typically carried out in Guadalajara, the capital of the state of Jalisco. According to Blas, maps are not necessarily given to excavators before digging, and utilities often go unlocated. Workers use shovels to hand dig, and in the process find buried pipes—typically water or sewer. Blas mentions that much of the electrical grid is transmitted through overhead lines, and that many residents rely on propane canisters for their heating and cooking needs.



South America

Brazil

In a 2011 interview with media outlet Tribuna de Minas, sanitary engineer Marco Antônio Soares Lage stated, “No Brazilian city has perfect knowledge of its underground networks. Today, with new interferences such as fiber optic cables, gas pipelines and even underground electricity, this situation tends to worsen.” In the same year, a number of explosions in Rio de Janeiro’s sewers—caused by excavation accidents—prompted the city to begin mapping its underground infrastructure. By 2014, Rio concluded its mapping project with Geovias, a GIS database of the city’s five main utilities.

Other Brazilian cities have also undertaken efforts to protect their buried assets by mapping their subterranean utility networks. In São Paulo, individual utility owners have their own mapping databases. The differences between these maps were seen as a problem, and within the last decade the city began integrating its disparate maps into a centralized database. Some utility owners have taken further steps to reduce risk; for example, Comgás, a major gas company, uses non-destructive methods like pipe jacking or directional drilling during maintenance or expansion work.

Ecuador

Ecuador is the most recent country to implement a nationwide Subsurface Utility Engineering standard. NTE INEN 2873, published in 2015 by the Ecuadorian Institute for Standardization, lays out a procedural framework for assessing and improving on the reliability of existing maps—which includes utility locating methods. It also specifies the documentation of utilities during installation.

Alejandro Rodas Zambrano is the General Manager and Director of Projects at SUE LATAM, a SUE firm based in Quito. He explains that while the standard is not law, any governmental institution can adopt it as a technical requirement. For now, Ecuador lacks any enforceable governmental programs aimed at damage prevention. It’s an ambitious project given Ecuador’s infrastructure challenges, where many of its critical services are developing. To top it off, utility locating is uncommon.



A professional SUE technician for SUE LATAM designates a line for the design phase of the Guayasamin project in Quito. As the first to use SUE in Quito, the project is a milestone for damage prevention in the nation.



SUE LATAM performs SUE for all of the underground utilities at the Huachi campus of the Technical University of Ambato. Alejandro Rodas, project engineer and General Manager, center left; Nick Zembillas, CEO and recognized international technical expert in SUE, center right.

Additionally, the British Standards Institution along with the Institution of Civil Engineers introduced PAS 128 (Publicly Available Specification) in June 2014 as a nationwide SUE standard for buried utility detection. While a PAS is not a legal document, it can serve as a pathway to a more formal standard. PAS 128 lays out uniform methods for detection and verification of buried utilities and describes four “Survey Category Types” ranging from A–D. These are

Rodas is hopeful that the nature of damage prevention in Ecuador will change. Like other SUE standards, NTE INEN 2873 seeks to mitigate risks for purposes of project planning and utility installation. Yet SUE LATAM and other stakeholders are pushing for it to serve as the foundation for a nationwide damage prevention program—whenever and wherever Ecuadorean soil is broken.

The United Kingdom

The United Kingdom has made significant headway into standardizing damage prevention practices. HSG47, issued by the Health and Safety Executive, is a guidance that aims to educate workers on the hazards of digging near buried utilities and how to reduce risks. Under HSG47, anyone planning to dig must contact utility owners for maps—this can be carried out through one-call services, such as “LinesearchbeforeUdig,” but is not required.

nearly identical to the American Society of Civil Engineers’ SUE Quality Levels and are meant to encourage uniform standards in any underground utility survey.

To perform a Type B survey, which stops short of physically exposing the utility, surveyors must perform the following steps:

- Research utilities in the area to be dug
- Obtain appropriate reference maps from utility owners
- Conduct a site-specific risk assessment
- Perform a locate to verify utility positions on the reference map
- Create a deliverable report (a map) indicating utilities and their horizontal and/or vertical positions

The South Pacific

Australia

Australia does not have nationwide damage prevention laws. However, it does use model Codes of Practice for both excavation and construction work. These codes include specific regulations related to “underground essential services.” According to Safe Work Australia, a code of practice must be approved in a jurisdiction in order to carry any legal weight within that jurisdiction.

Under the excavation Code of Practice, the “person conducting a business or undertaking who has management or control of a workplace” must first obtain information on underground essential services. Using Australia’s “Dial Before You Dig” system is cited as an option for obtaining this information, but is not required. Once gathered, the buried asset’s positional information must be distributed to any onsite worker, made available for inspection, and kept until the excavation work is completed. The code also recommends a visual inspection of the dig area and/or exposing the service by potholing via vacuum excavation.

Despite the lack of national laws, New South Wales has attempted to regulate safe excavation practices related to gas and electrical lines with the New South Wales Electricity and Gas Supply Acts. Both acts require the excavator to obtain information regarding the assets’ positions but do not specifically mandate physical locating.

According to Michael Twohig, a subsurface utility engineering consultant who has worked on multiple projects in Australia, one of the main differences between Australian and US damage prevention efforts is whose responsibility it is to locate utilities. Once notified of an intent to dig through 811, a US asset owner must have their utilities marked—either by locating themselves or hiring a contractor. In Australia, it’s the excavator who locates utilities or contracts out the job.

Malaysia

Service disruptions caused by utility strikes prompted Malaysia’s Department of Survey and Mapping to develop the JUPEM organization in 2006. The goal of JUPEM is to gather utility positional data into one centralized online system, generate high-quality maps, and distribute the maps for free to any stakeholder in the damage prevention process.

Theoretically, these maps combine geospatial data acquisition, GIS, and other devices to be as accurate as possible. The Standard Guideline for Underground Utility Mapping, created in tandem with JUPEM, describes the roles and responsibilities of excavators, utility owners and others involved in the process. The guideline also lays out a framework for utility “quality levels.” As in the UK, these quality levels are modeled after the US’ SUE categories. Under the guideline, utility owners must achieve “quality level A” positional information. Among other criteria, quality level A data requires previously existing maps of the utility, physical locating, accurate depth measurements and utility condition assessment.

Despite the existence of the guideline, the government of Malaysia does not mandate utility companies to provide updated information to JUPEM after utility locating has been completed. In response, JUPEM has set out to conduct its own utility surveys to maintain quality.

Asia

China

Rapid industrialization and an economic boom have led to a hearty investment in underground infrastructure in China. By 2020, China is expected to spend approximately 500 billion yuan (\$64.4 billion) in updating older utilities alone. Most pipelines were installed just after China’s economic reform of 1978, and many require updating.

When an area is to be dug in China, excavators must ask local government departments to notify utility owners of their intent to dig. A paper is countersigned, showing which utilities are within the area. Utility owners then hire contractors to locate the utilities, although they sometimes locate their own utilities themselves. Whoever locates the utilities receives older paper maps from the Urban Construction Archives for free. Locators can also purchase newer maps from local Surveying and Mapping Institutes—these are governmental agencies that perform updated utility surveys.

Once the process is complete, utility owners keep the updated positional information for future excavation work. All parties sign an NDA with the utility owners, keeping the information under lock and key. According to a source familiar with China’s utility locating processes, utility owners often

do not share utility information with the government.

Japan

In 1986, Japan's Ministry of Construction created the Road Administration Information Center (ROADIC) in response to multiple fatal gas explosions that occurred across the nation. Following its successful implementation in Tokyo, ROADIC soon spread to other cities and now operates across Japan.

ROADIC facilitates cooperation between utility owners and regional government agencies but leaves damage prevention standards up to individual utility owners. However, mapping is mostly standardized. ROADIC uses the Road Administration Information System (ROADIS) custom mapping software called TUMSY (Total Utility Mapping System) for asset management, data collection and exporting, and other GIS functions. Because of ROADIC's widespread adoption, much of Japan uses the TUMSY standards for utility mapping. (One notable exception is the National Telecommunications Company, which uses its own GIS program.)

Global Consequences

This overview only begins to cover damage prevention efforts—and utility locating's place in those efforts—worldwide. Mapping, too, is something of a global mixed bag. Yet what becomes clear amid the tangle of laws is the priority that some nations are placing on creating, updating and maintaining maps over locating procedures—a reverse arrangement to how we've structured damage prevention in the US. While much of the planet remains "off the grid" (or aboveground), it's only a matter of time until buried infrastructure becomes the mainstay of developing economies the world over. Mitigating the risk of utility strikes is truly a global responsibility, but to better protect American infrastructure, it may be worth peering beyond our own backyard.

Country	Locating status	Administrator/ Facilitator	Maps given to	Nationwide mapping effort	SUE Standard
Australia	Recommended in Code of Practice	Dial Before You Dig	Excavator (required in NSW)		Standard 5488-2013
Brazil	Sometimes practiced	Locally administered	Excavator		
Canada	Widespread, federal law pending	Click Before You Dig	Excavator		CSA Standard S250
China	Practiced but not required	Locally administered	Locator		
Ecuador	Practiced, not required	Locally administered	Excavator		NTE INEN 2873
Japan	Up to utility owners	ROADIC	All stakeholders	●	
Malaysia	Recommended in guideline	JUPEM	Excavator	●	Standard Guideline for Underground Utility Mapping
Mexico	Practiced but not required	Locally administered	Excavator		
United Kingdom	Required under HSG47	Multiple options	Locator and excavator	●	PAS 128
United States	Required with exceptions	Call Before You Dig	Locator		CI/ASCE 38-02

Global Damage Prevention Chart



Underground utility repair in Tokyo's Shibuya ward

Special thanks to Manuel Blas, Alejandro Rodas, SUE LATAM, Michael Twohig, and many others who contributed information for this article.

SeeScan, Inc. is a manufacturer of utility locating and plumbing diagnostic solutions in San Diego, CA.



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