

## 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 Guayasamín 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.

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.

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 the four "Survey Category Types" ranging from A–D. These are

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