Micah Lee Paulk **SB 865 and ASCE 75-22**

"Commencing January 1, 2023, all new subsurface installations, except for specified oil and gas flowlines 3 inches or less in diameter that are located within the administrative boundaries of an oil field, be mapped using a geographic information system and maintained as part of the permanent records of the operator"- Excerpt from Senate Bill 865 (2020).

Former State Senator Jerry Hill (D) introduced Senate Bill 865 (SB 865) in January 2020 to "*Build upon my previous work to strengthen safe excavation practices in our state,".* Mr. Hill served the San Bruno district, which was the site of a gas pipeline explosion, resulting in the loss of eight lives and injuring 58 other people, as well as, $1.6 billion in damages and the loss of thirty-eight homes. This explosion resulted from "grossly inadequate," infrastructure safety.

According to Sarah Magruger Lyle, President and CEO of Common Ground Alliance (a non-profit organization dedicated to preventing damage to underground utility infrastructure) (CGA) *"Underground utility damages have an estimated societal cost of $30 billion each year. With increased excavation activity and significant investment in infrastructure on the horizon with the passage of the 2021 Infrastructure Investment and Jobs Act, it is critical that the industry commit to taking concrete actions to address the inefficiencies within our industry and reverse this trend in damages."* According to the CGA, there were over 215,000 damage events in 2021 in the United States. A damage event is defined as *"any impact or exposure that results in the need to repair an underground facility due to weakening or the partial or complete destruction of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection, or housing for the line, device, or facility. There does not need to be a release of product,".* (CGA, 2022, p. 9) For years, many excavators have relied on poorly drawn, spatially

inaccurate data, facility maps, or the work of utility designators that use pipe and cable locators to identify buried utilities, leading to costly damages, injuries, and fatalities.

SB 865 seeks to remedy these less reliable methods of buried utility investigation by putting these utilities into geographic information systems. The policy change outlined in SB 865 may be intended to prevent utility damages that can cause loss of life, injury, and increased costs associated with excavations for construction. Beginning on January 1, 2023, "*all new subsurface installations, except for specified oil and gas flowlines 3 inches or less in diameter that are located within the administrative boundaries of an oil field, be mapped using a geographic information system and maintained as part of the permanent records of the operator*" (SB 865, 2020). The goal of this regulation would be to create a digital record of all newly constructed utilities. When a new construction project begins that requires excavation, the buried utilities can be located accurately based on the geographic information system (GIS) that the operator is now legally required to maintain.

In 2021, California experienced over 9,000 damage events (CGA, 2022). If appropriately implemented by the utility operators, there should be a decrease in these types of damage. According to the “Dirt Report” (2022), half of the damages in California in 2021 resulted from excavation or locating practices. With a geospatially accurate GIS database to determine the real-world location (i.e. latitude/longitude, horiztonal/vertical datums) of buried infrastructure, there should be fewer utility strikes. With fewer utility strikes, there is less potential for injury and loss of life. It would also potentially save millions in repairs.

The law is mute when it comes to defining a geographic information system. As well-intentioned as this proposal may seem, there are inherent deficiencies when viewing the statute through the lens of a geospatial professional (in California, this would be a licensed land surveyor implemented and supported by Geographic Information Systems Professionals (GISP)

in most cases). Referring to the bill's original text as introduced, it becomes clear that the author does not understand the language of geotechnical practices. "Commencing January 1, 2021, all new subsurface installations shall be tagged with GIS coordinates and maintained as permanent records of the operator. " There is no such thing as "GIS coordinates." Even with the updated language, there still lies a myriad of issues with this law's vagueness.

There is no definition of "geographic information system" or requirement for what data is to be collected, and there is a wide gap between best practices and being simply in compliance with the law as written. Google Earth is a geographic information system. Should a utility operator seek to minimize costs and remain in compliance with the law, they would only have to create lines, polylines, points, and polygons depicting their newly installed subsurface infrastructure. The law says nothing of accuracy or type of GIS, which could result in more damages, injuries, and loss of life. It is also lacking any protocols for dissemination of data for future use cases where excavations could disturb or damage the buried utilities. Tectonically speaking, California's geography only serves to complicate the matter.

California is moving. With this movement comes considerable problems relating to accurate positional data related to buried infrastructure. Coordinate systems also present significant problems for utility operators that will be required to comply with SB 865. Many geographic information systems utilize World Geodetic System 84 (WGS 84) coordinate systems to map data. Engineering and surveying use the North American Datum of 1983 (NAD 83). Both systems were created in the early 80s, and at the time, there was not much difference in the geospatial position between the two. Neither adequately accounts for the rate with which California on the Pacific Plate moves along the San Andreas fault. The shift between the two systems is 3-5 feet for land on the North American Plate alone. There are 3-5 centimeters of movement along the San Andreas Fault to the northwest each year. Extrapolate that movement

over decades. Without the proper documentation of the coordinate system used to collect/store the data, there is an extraordinary potential for more utility strikes.

To account for the movement, the mapping requirement is date stamped with "epochs" with the datum in use. To state which datum used is not enough for California utility operators to create an accurate GIS depiction of their buried assets. An epoch is used to determine position based on a date (Maher, 2020). This ensures that surveyors or engineers can account for the movement of California when building infrastructure or attempting to determine the position of a fixed object on the earth's surface. Differences in epochs can also vary by several feet. Feet matter when using this data to relocate buried utilities. There is greater danger in an excavator thinking they know where a utility is because coordinates indicate the location than for the excavator not to know.

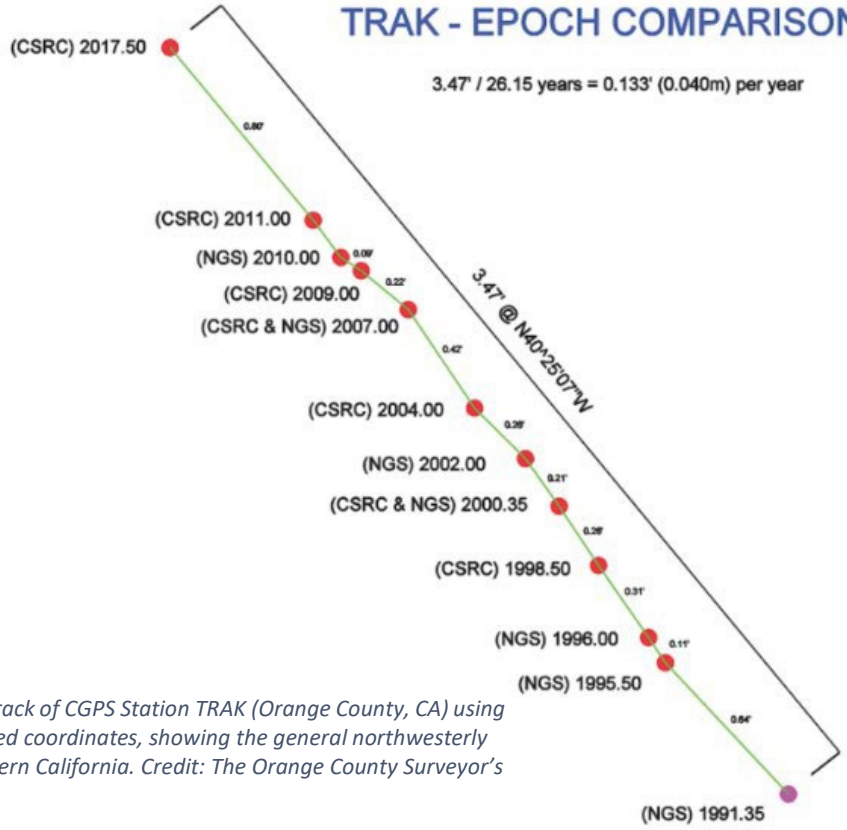

Figure 1 To-scale track of CGPS Station TRAK (Orange County, CA) using published determined coordinates, showing the general northwesterly movement of Southern California. Credit: The Orange County Surveyor's Office, California.

The law makes no provision for capturing important data like datums and epochs or its storage in GIS. On large projects with several utilities, there runs a risk of segmentation of GIS data; several epochs and datums, and various data formats have the potential to create further confusion and conflict. If the as-built of the exposed utility is collected in NAD 83 (1991.35) but a person attempts to relocate after the utility is buried but is in NAD 83 (2017.50), they have an error over 3 feet *(see Figure 1*). There is the potential to create silos of data with disparate standards, accuracies, oversight, and dissemination.

Further refinement during the rulemaking process would refine and dictate the standards for the uniformity of the data collection. The California Underground Safety Board (CUSB), empowered by the Dig Safe Act of 2016, can create rules and regulations related to Government Code 4216 (the code that SB 865 augments to require GIS for newly constructed utilities). The CUSB should engage the community of licensed land surveying and GIS professionals to produce rules that detail the appropriate data collection process. Standards should be established to record the location of subsurface utility installations during construction. There also must be a clearly stated way to exchange data among various stakeholders to ensure the data's legitimacy, timeliness, and accuracy. A licensed land surveyor must oversee and verify the pedigree of the data collected, and the CUSB should require their license number to be included in the data recorded in the GIS as maintained by the utility operator. Including geospatial professionals in the rulemaking process will ensure that the best practices are transparent and well-defined.

The American Society of Civil Engineers (ASCE) recently released a standard to create reliable data for geographic information systems, ASCE 75-22 (ASCE, 2022). ASCE 75-22 Standard Guidelines for Recording and Exchanging Utility Infrastructure Data is a standard that the Underground Safety Board should adopt for creating a uniform approach to collecting,

verifying, and housing utility information (subsurface or above ground). If this standard were to be used by every utility operator, then it would create a baseline for the attributes and features that would be collected every time an as-built of a newly constructed utility is completed. ASCE 75-22 requires collecting data related to utility type, feature type, component, horizontal spatial reference, vertical reference, horizontal accuracy level, vertical accuracy level, etc. Included in 75-22 is an attribute named "Certification Summary, " where the credentials of the licensed professional would attach their information. The Underground Safety Board should require all utility operators to use this standard when recording into GIS and exchanging utility infrastructure data. Coupling the standards set forth by ASCE 75-22 with existing land surveying and GIS data recording practices would improve buried locating activities. These datasets may become quasi-public records (sensitive infrastructure may need to be handled separately) and be made available through county GIS websites with similar attributes and feature data as indicated in ASCE 75-22.

Secondary markers are affixed in curbs when setting monuments in areas that are likely to be disturbed, like the centerline of a road. These are direct ties to the monuments that define the legal infrastructure of ownership. When a street improvement project begins, a land surveyor will determine the position of the centerline monument and the measured relation to existing ties. This data is recorded in a preconstruction corner record. Street improvements often remove centerline monuments. Land surveyors reinstall the centerline monument with the aid of the remaining ties

and preconstruction corner record. These ties are paramount in preserving the right-of-way, easements, property lines, etc.

The Board should create a regulation that requires setting “utility monuments” that act similarly to centerline monument ties. When the installation of a new utility occurs, there must be documentation as outlined in ASCE 75-22 and an above-ground marker that is recorded as part of the permanent record of the utility operator. This monument will act as a tie to the buried utility with coordinates, datums, and epoch dates, all certified by a licensed land surveyor.

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Future improvements that require excavation and the re-location of buried utilities will benefit from the surface utility monument. The cost barrier to acquiring high-accuracy global navigation satellite systems (GNSS) receivers has subsided significantly over the last five years. A field locator equipped with a GNSS receiver and coordinates from the various utility operators' GIS databases could “check” into the utility monument set during the installation process. If the position shows a discrepancy between the monument and what the GNSS receiver is indicating, the locator would know that there is an error somewhere in the calculated position of the monument (maybe in the wrong datum). Of course, with standardization of data collection on the as-built side, there should be less chance of this occurring. Once the locating technician has successfully checked into the surface utility monument, they can confidently move to the buried utility position. The buried utility could be verified by utilizing geophysical equipment such as pipe and cable locators, ground penetrating radar, or potholing. This process would create a form of two-factor authorization to prevent future utility damage.

Senate Bill 865 can potentially create positive outcomes regarding the future of utility damage prevention. Standards must be enacted that are overseen and qualified by licensed geospatial professionals. Horizontal and vertical datum shifts present a largely unaddressed problem with the changes to Government Code 4216 by SB 865. Fortunately, ASCE has created standards that can simplify and unify the execution of creating a reliable geographic information system. The Underground Safety Board should embrace these standards and make them part of the Government Code to prevent future disasters related to improper locating or excavating practices.

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