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JOINT MEETING OF THE
CIVIL ENGINEER, GEOLOGIST & GEOPHYSICIST, and LAND SURVEYOR
TECHNICAL ADVISORY COMMITTEES
OF THE BOARD FOR PROFESSIONAL ENGINEERS, LAND SURVEYORS, AND GEOLOGISTS

MEETING LOCATION **AUGUST 27, 2013**

California Department of General Services
3737 Main Street, Second Floor Conference Room
Riverside, CA 92501

TAC MEMBERS

CIVIL ENGINEER TECHNICAL ADVISORY COMMITTEE

Members: Neal Colwell, PE; James Foley, PE; Adam White, PE
Board Liaisons: Robert Stockton, PE
Staff Liaisons: Susan Christ, PE

GEOLOGIST & GEOPHYSICIST TECHNICAL ADVISORY COMMITTEE

Members: William Owen, PGp, PG, CHG; Hugh S. Robertson, PG, CEG; William Cole, PG, CEG, CHG; Mark Riches, PGp; Gary Simpson, PG, CEG
Board Liaisons: Erik N. Zinn, PG, CEG
Staff Liaisons: Patty Smith

LAND SURVEYOR TECHNICAL ADVISORY COMMITTEE

Members: Michael S. Butcher, PLS; Michael B. Emmons, PLS; Paul J. Enneking, PLS; William Hofferber Jr., PLS
Board Liaisons: Patrick J. Tami, PLS
Staff Liaisons: Raymond L. Mathe, PLS

1. Roll Call
2. Public Comment
3. Evaluation of Subsurface Utility Locating pertaining to the practice of §6731 and §6731.1 (Professional Engineer Act); §7802.1 (Geologist and Geophysicist Act); §8726 (Professional Land Surveyors' Act) – (Possible Action)
4. Other Business Not Requiring Committee Action
5. Adjourn

Report from January 30, 2013 Board Meeting - Subsurface Utility Locating
Bill Owen, PG, CEG, CHG - Geology TAC chair

Mr. Owen, Chair of the Geology TAC, introduced himself. He indicated that he is the Chief of Geophysics and Geology Branch for the California Department of Transportation. He reported that one of the things that the department is becoming involved in is the field of Subsurface Utility Engineering. Subsurface Utility Engineering is a branch of engineering practice that combines civil engineering, land surveying, and geophysics in order to mitigate risks to construction projects due to underground utilities. He explained that it is a process that has been pushed by the Federal Highway Administration. Currently, 24 states have adopted a form of Subsurface Utility Engineering practice. The contract administration process evaluation report (CAPE) in 2010 indicated that 44% have an impact due to unknown utilities that were identified as a risk. Two-thirds suffered project delays due to unknown utilities.

The American Society of Civil Engineers issued their standard guidelines in 2003 which attempted to outline the process. One thing established were the quality levels for subsurface utility information. Purdue University did a study that found the return on investment on the use of the Geophysical techniques was nearly 4-1 and the range of unknown utilities range from 10-50%.

Mr. Owen noted from his estimates 90-130 companies exist in California that offer subsurface utility services. Many of these companies are advertising themselves as subsurface utility engineering firms in which some are not qualified.

His proposal to the Board is to establish a work group within the TAC to evaluate this issue further and provide recommendations.

MOTION: Mr. Tami and Mr. Zinn moved to direct staff to pursue a comprehensive evaluation of this topic with the assistance of the Geology, Civil, and Land Surveying TAC members and present a report to the Board at a future date outlining their findings and recommended course of action.

VOTE: 9-0, Motion Carried

Excerpts from the Federal Highway Administration Utility Program (http://www.fhwa.dot.gov/programadmin/sueindex.cfm)

Subsurface Utility Engineering

Subsurface Utility Engineering (SUE) combines civil engineering, surveying, and geophysics. It utilizes several technologies, including vacuum excavation and surface geophysics. Its use has become a routine requirement on highway projects in many states.

The proper and successful use of SUE benefits both highway agencies and the impacted utilities in the following ways:

- Unnecessary utility relocations are avoided. Accurate utility information is available to the highway designers early enough in the development of a project to design around many potential conflicts. This significantly:
- Reduces costly relocations normally necessitated by highway construction projects.
- Delays caused by redesign when construction cannot follow the original design due to utility conflicts are reduced.
- Construction delays caused by cutting, damaging, or discovering unidentified utility lines are reduced.
- Contractor claims for delays resulting from unexpected encounters with utilities are reduced.
- Safety is enhanced. When excavation or grading work can be shifted away from existing utilities, there is less possibility of damage to a utility that might result in personal injury, property damage, and releases of product into the environment.

SUE Standards and Definitions

The American Society of Civil Engineers' (ASCE) *Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data* was published and distributed in 2003. The ASCE standard makes it very clear that SUE is a process, not a technology. It defines SUE as a branch of engineering practice that involves managing certain risks associated with:

- utility mapping at appropriate quality levels,
- utility coordination,
- utility relocation design and coordination,
- utility condition assessment,
- communication of utility data to concerned parties,
- utility relocation cost estimates,
- implementation of utility accommodation policies, and
- utility design.

These activities, combined with traditional records research and site surveys, and utilizing new technologies such as surface geophysical methods and non-destructive vacuum excavation, provide "quality levels" of information.

SUE Quality Levels

Quality levels may be thought of as degrees of risk, or how much information is really needed to adequately design and construct a highway project. Highway plans typically contain disclaimers as to the accuracy of the utility information. The use of quality levels allows project

owners to decide what quality level of information they want to apply to their risk management challenge and to certify on project plans that a certain level of accuracy and comprehensiveness has been provided.

There are four recognized quality levels of underground utility information ranging from Quality Level (QL) D (the lowest level) to Quality Level A (the highest level).

Each of the four quality levels is described as follows:

- Quality Level D. QL-D is the most basic level of information for utility locations. It comes solely from existing utility records or verbal recollections, both typically unreliable sources. It may provide an overall "feel" for the congestion of utilities, but is often highly limited in terms of comprehensiveness and accuracy. QL-D is useful primarily for project planning and route selection activities.
- Quality Level C. QL-C is probably the most commonly used level of information. It involves surveying visible utility facilities (e.g., manholes, valve boxes, etc.) and correlating this information with existing utility records (QL-D information). When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, is primarily on rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.
- Quality Level B. QL-B involves the application of appropriate surface geophysical methods to determine the existence and horizontal position of virtually all utilities within the project limits. This activity is called "designating". The information obtained in this manner is surveyed to project control. It addresses problems caused by inaccurate utility records, abandoned or unrecorded facilities, and lost references. The proper selection and application of surface geophysical techniques for achieving QL-B data is critical. Information provided by QL-B can enable the accomplishment of preliminary engineering goals. Decisions regarding location of storm drainage systems, footers, foundations and other design features can be made to successfully avoid conflicts with existing utilities. Slight adjustments in design can produce substantial cost savings by eliminating utility relocations.
- Quality Level A. QL-A, also known as "locating", is the highest level of accuracy presently available and involves the full use of the subsurface utility engineering services. It provides information for the precise plan and profile mapping of underground utilities through the nondestructive exposure of underground utilities, and also provides the type, size, condition, material and other characteristics of underground features.

How SUE Works in Project Development

The engineer, when involved, will advise the highway agency of utility risks and recommend an appropriate quality level of utility data as described above for a given project area at the appropriate time within the project planning and design process. The highway agency will then specify to the engineer the desired quality level of utility data.

The engineer will furnish the desired utility quality level to the highway agency in accordance with the standard of care and will be responsible for negligent errors and/or omissions in the utility data for the certified utility quality level .

Excerpts from the Federal Highway Administration Utility Program (http://www.fhwa.dot.gov/programadmin/equip.cfm)

Proper Use of Surface Geophysical Equipment

The proper selection and application of surface geophysical techniques for achieving Quality Level B data cannot be overstated. Obviously, a wide range of available equipment is mandatory. Just as important is the provider's use and interpretation of this equipment. This is difficult to judge, although the lack of a subject expert and documented technician training should raise questions. Providers should have the in-house expertise and equipment to accomplish utility search and trace functions. They should be able to demonstrate this expertise through personnel qualified by education and experience in surface geophysical methods. They should also be cognizant and capable of other methods that may have limited, but important, usefulness.

The current version of the ASCE's Standard Guidelines for the Collection and Depiction of Existing Subsurface Utilities contains an appendix on surface geophysical techniques that may be useful in evaluation of providers' equipment lists. In general, the following statements summarize this document.

1. Electromagnetic methods include the following: pipe and cable locators (inductive, conductive, active, and passive modes), terrain conductivity, ground penetrating radar, ground resistivity techniques, optical methods, and computer-driven algorithms coupled with data collection techniques.

    a. A wide variety of pipe and cable locators are almost always necessary for a successful utility mapping project

    b. A wide range of available frequencies is necessary to search for utilities. In general, frequencies from 50Hz, to 480kHz can be successful. It is usually prudent to have this complete range available during a utility search.

    c. Devices are necessary for metallic utilities or utilities that can accept a metallic conductor or transmitter (sonde) inserted into them (e,g. empty conduits, storm/sanitary sewers with access, empty and accessible pipes, etc.).

    d. Terrain conductivity is sometimes a useful method for typical utilities and usually necessary for UST, well, and septic field detection and mapping.

    e. Metal detectors are necessary for finding shallow manhole lids, valve box covers, etc.

    f. GPR is a utility detection technique whose usefulness is limited to specific projects. Its costs are high and probabilities of success, versus other methods, are low. Under the right conditions, GPR can be a useful tool to assist in detecting close-to-the-surface and medium-to-large diameter utilities. Many firms lease the most up-to-date models on a case-by-case basis due to rapidly changing technology.

    g. Optical methods, such as cameras to image and provide records of cables in vaults or look into empty conduits and pipes, can be useful.

2. Magnetic methods typically use gradiometrics. Isolated shallow ferrous utilities, underground storage tanks, wells, and vault covers may be detectable via this method. Joints on otherwise undetected pipes may be detectable due to the bi-polar

magnetic field of pipes. Gradiometers, such as the Schonstedt GA-52B, are a standard tool for utility mapping purposes.

3. Elastic wave methods are necessary. Typically, there are three separate types of acoustic emission that should be available: resonant sonics , active sonics, and passive sonics. All three require different pieces of equipment.

Excerpts from CI/ASCE 38-02: Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data

5.3 Quality Level B

Typical tasks by the engineer leading to utility quality level B are:

5.3.1 Perform tasks as described for quality level C. Quality level C and B tasks do not necessarily need to be performed in any prescriptive order. It may be more cost effective to perform some quality level B tasks before and/or in conjunction with quality level C or D tasks.

5.3.2 Select an appropriate suite of surface geophysical methods (see the Appendix for discussions of methods, relative merits, and relative costs) to search for utilities within the project limits or to perform a utility trace for a particular utility system.

5.3.3 Apply appropriate surface geophysics to search for utilities within the project limits, or trace a particular utility system if the scope of investigation is limited.

5.3.4 Interpret the surface geophysics. Depending on the methods, this may be performed in the field or in the office.

5.3.5 Mark the indications of utilities on the ground surface for subsequent survey. Local utility owners, agencies, and/or one-call statutes may dictate, or suggest, the markings' colors, sizes, and/or other labeling. Care should be taken to differentiate markings placed on the ground for design purposes from those placed on the ground for damage prevention purposes. (Note: If a particular surface geophysical method allows for field data collection or storage for future computer downloading and evaluation, if a utility search technique that allows for comprehensive area coverage is used, and if a survey grid or line is laid out that allows for future correlations of surface geophysical data to points depicted on a map, then ground markings may be unnecessary.)

5.3.6 Survey all markings that indicate the presence of a subsurface utility. This survey should be to the accuracies and precision dictated by the project's survey control.

5.3.7 Depict all designated utilities. These utility depictions may follow the general guideline as presented in Section 6.0. Depiction is usually accomplished via computer-aided design and drafting or manual plotting methods onto plan sheets, into geographic information systems databases, or onto other appropriate documents. Quality level B data should be reproducible by surface geophysics at any point of their depiction.

5.3.8 Correlate the designated utilities' depictions with utility records and/or surveyed appurtenances to identify utilities that may exist but were not able to be designated.

5.3.9 Resolve differences between designated utilities and utility records and surveyed appurtenances. This may take the form of additional surface geophysical searches or depiction of designated or nondesignated utilities at a lower quality level. It may take the form of an upgrade at appropriate points to quality level A information. Situations require judgment that a designated utility and a utility of record are actually identical, even if not interpreted as geographically coincident.

5.3.10 Recommend to the project owner additional measures to resolve differences if they still exist. Such recommendations may include additional or different surface geophysical methods, exploratory excavation, or an upgrade to quality level A data.

Excerpts from the Consultant Prequalification Manual, Georgia Department of Transportation, January 15, 2009, Pages 36–38

a. Class 5.08—Overhead/Subsurface Utility Engineering (SUE)

This class of work is defined as the engineering processes that involve managing certain risks associated with accurately and comprehensively identifying, characterizing, and mapping overhead and underground utility facilities. The major activities include utility records research, mapping, designating, utility impact analysis, locating, and data management. Other activities associated with this class of work are utility relocation design, coordination, and training. These activities, when coordinated with utility owners, Department personnel, and surveyors, provide high quality utility information for use during project development, design, and construction. These activities should conform to standards and guidelines as described in FHWA and ASCE Subsurface Utility Engineering publications in conjunction with the Department"s current standards, guidelines, and processes and SUE scope of services.

(1) Professional Status

Registration as a Professional Engineer with the Georgia State Board of Professional Engineers and Land Surveyors and proven proficiency in the field of Civil Engineering with emphasis on transportation and utility design.

Registration as a Land Surveyor with the Georgia State Board of Professional Engineers and Land Surveyors and proven proficiency in the field of route surveying with emphasis on designating utilities.

(2) Adequacy of Personnel

At least two professionals, one of each as stated in item one (1) above are required. One of the professionals is required to perform independent checks of data, calculations, plans and reports of the other.

At least two designators are required.

At least one key personnel must demonstrate a strong working knowledge of the Department's current Plans Development Process (PDP).

Must have sufficient personnel to prepare engineering plans, reports and specifications to the Department's current Electronic Data Guidelines and SUE Standards.

Must demonstrate to have sufficient personnel to accommodate multiple projects simultaneously.

The number of professional and technical support personnel must be recorded and updated.

(3) Equipment

Must have adequate equipment to demonstrate the ability to designate both metallic and non-metallic types of underground utility facilities in accordance with the current ASCE standard CI/ASCE 38-02 "Standard Guidelines for the Depiction of Existing Subsurface Utility Data".

Must have adequate equipment to demonstrate the ability to locate underground utility facilities in a minimally intrusive manner.

Must have adequate equipment to demonstrate the ability to accurately and efficiently survey and reduce field information.

Must have adequate equipment to prepare engineering plans, reports and specifications to the Department's current Electronic Data Guidelines and SUE Standards.

Must have adequate equipment to accommodate multiple projects simultaneously.

(4) Past Record, Experience, and Capability

Satisfactory experience must be demonstrated in the activities required by this class either by the individual (s) who are bona fide employees for the firm thereof.

U.S. Department of Transportation
Federal Highway Administration

Search | Feedback

Design

Subsurface Utility Engineering

FHWA > Design > Utility Program > SUE > Related Web Sites

Context Sensitive Solutions

Design Awards

Design Standards

Interstate System

Subsurface Utility Engineering

Utility Program

Value Engineering

Related Web Sites

U.S. Department of Transportation

Federal Highway Administration

- Office of Program Administration, Utilities Program
- Office of Real Estate Services

Research and Special Programs Administration

- Office of Pipeline Safety

State Transportation Departments

- Georgia Department of Transportation

Providers

The FHWA will no longer provide links to web sites of SUE providers. It is not possible, nor the role of the FHWA, to determine which firms are truly providing SUE services as the FHWA believes they should be provided and which firms are not. The following paragraphs describe the FHWA's concept of SUE. All providers claiming to provide SUE services are encouraged, as a minimum, to adhere to these basic principles.

Subsurface Utility Engineering evolved from the concepts of providing better utility mapping on documents. However, in the past decade it has grown significantly. It is now defined as a branch of civil engineering practice dedicated to managing the risks of underground utilities. The original "designating" and "locating" functions are but two of many tools that are necessary to accomplish this management. Firms who do only "designating and locating" will be hard pressed to make a case that they practice subsurface utility engineering; they are only providing a map. Indeed, firms offering only this limited scope may inadvertently be negating the great strides SUE has made.

SUE may best be described by the series of responsibilities of the engineer and project owner as outlined in the ASCE/ANSI Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data. The following synopsis illustrates this responsibility.

More Information

- Related Web Sites
- SUE Brochure

Contact

Ken Leuderalbert
Office of Program Administration
317-226-5351
E-mail Ken

In general, the engineer should have enough knowledge about utilities (e.g. costs to move, installation practices, design considerations, safety issues) to consider risk factors for a particular project. The engineer should have knowledge of federal, state, and local accommodation policies so that cost responsibilities can be estimated since cost is certainly a risk. The engineer should be able to put together a preliminary cost estimate, based upon utility prior rights and likely adjustment schemes. The engineer should be able to assist the project owner in negotiating a scope of work that fits the project's needs, rather than just regurgitating the standard mapping scope ("designating" and "locating") in existence since the 1980s. Such a scope might include what quality levels to use, when to use them, when and how to communicate data to others in the design process and so forth. The engineer should be able to produce that mapping. The engineer should be able to identify potential conflicts with the design footprint and offer sensible and practical avoidance alternatives to the designers. When avoidance is not practical, the engineer should be able to offer up detailed relocation plans and their costs. The engineer should be able to communicate information to the constructors through unambiguous mapping deliverables, written reports, and/or verbal briefings.

The FHWA believes that SUE providers must distance themselves from the images of paint marks on the ground and vacuum trucks as the primary representations of a subsurface utility engineering firm. They should focus instead upon the judgment that engineers provide throughout the life of a project, and the deliverables produced that reflect that judgment.

Updated: 04/07/2011

6731. Civil engineering defined

Civil engineering embraces the following studies or activities in connection with fixed works for irrigation, drainage, waterpower, water supply, flood control, inland waterways, harbors, municipal improvements, railroads, highways, tunnels, airports and airways, purification of water, sewerage, refuse disposal, foundations, grading, framed and homogeneous structures, buildings, or bridges:

(a) The economics of, the use and design of, materials of construction and the determination of their physical qualities.

(b) The supervision of the construction of engineering structures.

(c) The investigation of the laws, phenomena and forces of nature.

(d) Appraisals or valuations.

(e) The preparation or submission of designs, plans and specifications and engineering reports.

(f) Coordination of the work of professional, technical, or special consultants.

(g) Creation, preparation, or modification of electronic or computerized data in the performance of the activities described in subdivisions (a) through (f).

Civil engineering also includes city and regional planning insofar as any of the above features are concerned therein.

Civil engineers registered prior to January 1, 1982, shall be authorized to practice all land surveying as defined in Chapter 15 (commencing with Section 8700) of Division 3.

[NOTE: The last registration number issued to a civil engineer registered before January 1, 1982 was 33,965.]

6731.1. Civil engineering; additional authority

Civil engineering also includes the practice or offer to practice, either in a public or private capacity, all of the following:

(a) Locates, relocates, establishes, reestablishes, or retraces the alignment or elevation for any of the fixed works embraced within the practice of civil engineering, as described in Section 6731.

(b) Determines the configuration or contour of the earth's surface or the position of fixed objects above, on, or below the surface of earth by applying the principles of trigonometry or photogrammetry.

(c) Creates, prepares, or modifies electronic or computerized data in the performance of the activities described in subdivisions (a) and (b).

(d) Renders a statement regarding the accuracy of maps or measured survey data pursuant to subdivisions (a), (b), and (c).

7802.1. "Geophysics" defined

"Geophysics," as used in this chapter, refers to that science which involves study of the physical earth by means of measuring its natural and induced fields of force, including, but not limited to, electric, gravity, and magnetic, and its responses to natural and induced energy and the interpreting of these measurements and the relating of them to the physics of the earth.

8726. Land surveying defined

A person, including any person employed by the state or by a city, county, or city and county within the state, practices land surveying within the meaning of this chapter

who, either in a public or private capacity, does or offers to do any one or more of the following:

(a) Locates, relocates, establishes, reestablishes, or retraces the alignment or elevation for any of the fixed works embraced within the practice of civil engineering, as described in Section 6731.

(b) Determines the configuration or contour of the earth's surface, or the position of fixed objects above, on, or below the surface of the earth by applying the principles of mathematics or photogrammetry.

(c) Locates, relocates, establishes, reestablishes, or retraces any property line or boundary of any parcel of land, right-of-way, easement, or alignment of those lines or boundaries.

(d) Makes any survey for the subdivision or resubdivision of any tract of land. For the purposes of this subdivision, the term "subdivision" or "resubdivision" shall be defined to include, but not limited to, the definition in the Subdivision Map Act (Division 2 (commencing with Section 66410) of Title 7 of the Government Code) or the Subdivided Lands Law (Chapter 1 (commencing with Section 11000) of Part 2 of Division 4 of this Code).

(e) By the use of the principles of land surveying determines the position for any monument or reference point which marks a property line, boundary, or corner, or sets, resets, or replaces any such monument or reference point.

(f) Geodetic or cadastral surveying. As used in this chapter, geodetic surveying means performing surveys, in which account is taken of the figure and size of the earth to determine or predetermine the horizontal or vertical positions of fixed objects thereon or related thereto, geodetic control points, monuments, or stations for use in the practice of land surveying or for stating the position of fixed objects, geodetic control points, monuments, or stations by California Coordinate System coordinates.

(g) Determines the information shown or to be shown on any map or document prepared or furnished in connection with any one or more of the functions described in subdivisions (a), (b), (c), (d), (e), and (f).

(h) Indicates, in any capacity or in any manner, by the use of the title "land surveyor" or by any other title or by any other representation that he or she practices or offers to practice land surveying in any of its branches.

(i) Procures or offers to procure land surveying work for himself, herself, or others.

(j) Manages, or conducts as manager, proprietor, or agent, any place of business from which land surveying work is solicited, performed or practiced.

(k) Coordinates the work of professional, technical, or special consultants in connection with the activities authorized by this chapter.

(l) Determines the information shown or to be shown within the description of any deed, trust deed, or other title document prepared for the purpose of describing the limit of real property in connection with any one or more of the functions described in subdivisions (a) to (f), inclusive.

(m) Creates, prepares, or modifies electronic or computerized data in the performance of the activities described in subdivisions (a), (b), (c), (d), (e), (f), (k) and (l).

(n) Renders a statement regarding the accuracy of maps or measured survey data.

Any department or agency of the state or any city, county, or city and county that has an unregistered person in responsible charge of land surveying work on January 1,

1986, shall be exempt from the requirement that the person be licensed as a land surveyor until such time as the person currently in responsible charge is replaced.

The review, approval, or examination by a governmental entity of documents prepared or performed pursuant to this section shall be done by, or under the direct supervision of, a person authorized to practice land surveying.