

# Design Drawings Practice

## 1. Objective

This practice will define the collection and depiction of underground utility data on design drawings for construction projects in public rights-of-way.

## 2. Requirements

The American Society of Civil Engineers (ASCE) has recently published standard guidelines covering utility data collection and depiction. The ASCE standard, which is based on subsurface utility engineering (SUE), presents a system of classifying the quality of subsurface utility data, allowing project stakeholders to better manage risks involved with excavating near underground facilities.

The intent of this practice is to conform to and recommend the use of the ASCE standard for all projects in public rights-of-way. The project owner, design engineer, and permitting authority must understand and agree to the quality level of the utility information that is required for each project.

This practice does not negate or replace any existing or more stringent law, code, standard or requirement currently utilized by permitting agencies and/or governing authorities. In the case of conflicting information, the stricter requirement should prevail.

## 3. Practice Statement

The designer or engineer shall incorporate underground utility information on design drawings based on subsurface utility engineering practices and CI/ASCE 38-02, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.

## 4. Practice Description

During the design phase, the designer gathers available information on underground facilities in the proposed construction area. The information is overlaid onto scaled base maps of the construction route or area. The consolidated drawings help in determining final route selection and design.

## 5. Practice Procedure

### 5.1. *Collection of Data*

The designer should obtain or prepare scaled base maps of existing surface and subsurface facilities within the construction limits of the project. At a minimum, the base maps should show right-of-way limits, edges of pavement or face of curb, sidewalks, above ground and underground utilities as well as all surface features within the proposed construction area.

Data for preparing base maps can be collected from various sources and methods. The basic background can come from aerial photography, USGS maps, right-of-way

drawings, street maps, surveys or a combination of sources. Underground and subsurface utility information should be collected using the SUE process.

**5.1.1. Right-of-Way Research.** An essential step in the planning and design phase of a project is determining the limits of the public right-of-way and property lines. This information can be collected from existing plats, right-of-way maps, tax maps, surveys, right-of-way markers or other sources such as as-built drawings of street widening projects. Gathering and depicting this information is critical in ensuring that the limits of the project boundary are defined, thus helping to ensure that construction activities do not encroach upon private property.

**5.1.2. Subsurface Utility Engineering (SUE).** SUE is an engineering process used to identify and map underground utilities and structures as well as assign a quality level to data. The main components of SUE are:

- Designation – the use of geophysical investigating methods such as electromagnetic pipe detectors to determine the horizontal position of subsurface facilities.
- Locating – also known as potholing. Locating or potholing utilizes non-destructive digging equipment to expose the underground facility at critical points along its path to determine the horizontal and vertical position of the facility.
- Data Management – the collection, documentation, reduction, and depiction of information and data in a suitable format.

A brief description of the four quality levels of SUE data is provided below. Refer to CI/ASCE 38-02 for more information on the tasks involved in each quality level.

- Quality Level A provides the highest level of accuracy. It involves locating or potholing utilities as well as activities in quality levels B, C, and D. The located facility information is surveyed and mapped and the data provides precise plan and profile information.
- Quality Level B involves designating the horizontal position of subsurface utilities through surface detection methods and collecting the information through a survey method. Includes quality level C and D tasks.
- Quality Level C involves surveying visible subsurface utility structures such as manholes, hand-holes, utility valves and meters, fire hydrants, pedestals and utility markers, and then correlating the information with existing utility records to create composite drawings. Includes quality level D activities.
- Quality Level D provides the most basic level of information. It involves collecting data from existing utility records. Records may include as-built

drawings, distribution and services maps, existing geographic information system databases, construction plans, etc.

## **5.2. Design**

Data collected during the SUE process must be combined with base map or background information to create a composite drawing. The composite drawing is then used to determine the best design based on avoiding and minimizing conflicts with existing facilities. New proposed facilities should be routed and designed to maintain a minimum 2 feet horizontal and vertical clearance from all existing utilities, structures, and property lines. Refer to local codes and permit requirements that may have stricter minimum clearances or additional requirements.

**5.2.1. Selecting SUE Quality Level.** It is recommended that the project owner, the engineer or designer, and the governing authority work together to determine the quality level appropriate for an individual project. Many factors can play a role in determining the quality level required for a project. These include project location, existing utility congestion, right-of-way width, and the size or extent of the project. Also, it could be appropriate that certain areas or sections of a project may require a higher quality level than another.

It is in the governing agency's best interest to evaluate each project and set the quality level deemed appropriate for its conditions. One way of accomplishing this task is to have the engineer or designer review the construction area, available utility records, and project requirements. A recommendation to the governing agency regarding the quality level deemed appropriate would then be made. The city can then approve the suggested quality level or require that a higher quality level be established.

Local governments may wish to establish required SUE quality levels for designs that address construction in certain areas of the city or certain corridors, based on the prevalence and density of underground facilities in the rights-of-way and the types of facilities present. Such requirements can provide engineers guidance in preparing their design drawings and the engineer can request a change in requirements if they feel this is necessary.

## **5.3. Drawing Requirements**

The basic design deliverable should include existing site and utility information and new facilities in an electronic drawing format. Based on circumstances, hard copy format may be allowed by the city. The drawings should be drawn to scale, with dimensions indicating the horizontal position of existing and new facilities. Distinct line types, symbols, and notes should be used to indicate different types of facilities, SUE quality levels, and new or existing facilities. The drawings should include a drawing legend and contain the information described in the following sections.

**5.3.1. Identify SUE Quality Level.** CI/ASCE 38-02 describes and explains ways of depicting SUE information on the drawings. The basic requisite is to indicate on the drawings the quality level of each set of utility data through various line types or notes.

For example a section of gas line information with quality level A would be depicted with one line type and a section of gas line information with quality level D would be depicted with a different line type. Refer to CI/ASCE 38-02 for more information.

**5.3.2. Identify Information Source.** Each set of facility data can also include a note explaining the source of the information in addition to the quality level. For example, gas line information shown with a quality level D could also include notes that indicate one section of information came from original gas main construction drawings in 1967 and another section from gas main relocation as-built drawings in 1999. Including the source and date of the information could provide clues regarding the accuracy of the information to persons familiar with the area and/or the facility owners. As another example, consider that potholing information is collected in 1999 during the design phase, but project construction does not begin until 2001. The governing authority may be aware of unrelated construction or changes that occurred in the project area between design and construction that could render the previously obtained potholing information inaccurate or insufficient.

**5.3.3. Plan and Profiles.** Scaled plan drawings depicting utilities and structures with horizontal positions should be required for all projects. The plan view should have dimensions indicating the clearance between new facilities and existing facilities, structures, and property lines.

Where information is available, vertical positions of underground facilities should also be indicated in some manner. At a minimum, vertical position information should be included in a note format for each utility that will be crossed by new construction.

The best method of depicting vertical position information is to include profile drawings with the plan view. The profiles should be depicted in the same horizontal scale as the plan and should be aligned directly below the plan view. The profile should depict the vertical position of both existing and new facilities with dimensions indicating clearances.

## 6. References

- American Society of Civil Engineers, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE Standard No. 38-02, Preliminary Copy, 2002. (Note that this guideline document is available for purchase through the ASCE Publications Home Page at [www.pubs.asce.org](http://www.pubs.asce.org).)
- U.S. Department of Transportation, Federal Highway Administration, Office of Program Administration, SUE web site, available on the Internet at <http://www.fhwa.dot.gov/programadmin/sueindex.htm>.
- Jeffery J. Lew, Subsurface Utility Engineering: An Initial Step in Project Development, available on the Internet at <http://asceditor.unl.edu/archives/1996/lew96.htm>.

## **7. Practice Outcomes**

As with any construction project, the success of a project is often highly dependent upon the quality of the design and the design drawings. The benefits of SUE have been touted in studies and documents produced by the Federal Highway Administration and other organizations. Studies show significant savings on the overall project due to reduced change orders, reduced work delays and less utility relocations. The cost of implementing SUE is relatively low. Many SUE tasks are already performed during the design process. One potential cost increase to the design process may be the requirement for high Quality Level data. However, high Quality Level data may only be required in specific locations or under certain conditions. This is part of the SUE process that allows stakeholders to evaluate and manage the risks.

### **7.1. *Evaluating the Practice***

One way to evaluate the outcome of this practice is to collect data on projects utilizing SUE. If facilities are damaged on projects that utilize SUE, then data could be collected to determine how the design drawings may have had an impact. For example, if the data shows that damage is consistently occurring on projects and/or in areas that utilize Quality Level D, then stakeholders may decide that a higher quality level is required on future projects. Conversely, if the data shows that facility damage occurs equally across all quality levels, then stakeholders may need to re-evaluate the overall expense and effectiveness of the supposed higher quality data. Collection of data for projects utilizing SUE will definitely add to the understanding of the success and/or failures of the utilized methods.