

NCDOT LOCATION & SURVEYS SUBSURFACE UTILITY ENGINEERING GUIDELINES

Subsurface Utility Engineering

Subsurface Utility Engineering (S.U.E.) is the engineering processes that accurately and comprehensively identify, characterize, and map underground utility facilities. It includes the three major activities of designating, locating, and data management. These activities, when combined with traditional record research, coordination with utility owners, and site surveys, provide high quality utility information for use during project development and design.

Reasons for Subsurface Utility Engineering

Accurate utility data can prevent construction delays, claims, and accidents. Early accurate utility data can also be used as a design tool to avoid major utility conflicts. Subsurface Utility Engineering also affords the designer an opportunity to accelerate the preconstruction process by providing early accurate utility information to the designer. This program is supported at the national level by FHWA in an effort to reduce unexpected utility conflicts on construction, reduce unnecessary utility relocations and enhance safety.

North Carolina Department of Transportation's History with S.U.E.

The North Carolina Department of Transportation has been aware of and interested in S.U.E. for many years. The Department's SUE program began in 1991 with one contract. The program has grown steadily through the years. SUE has become an integral part of the Highway Design Process for the NCDOT.

Quality Levels

Highway plans typically contain disclaimers as to the quality of utility information. The use of quality levels in the SUE process allows designers to certify on the plans that a certain level of accuracy and comprehensiveness has been provided. The end product (the CADD file or project plans) may contain any or all of the quality levels. There are four quality levels:

Quality Level D Defined

Information comes solely from existing utility records. It may provide an overall "feel" for the congestion of utilities, but it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should

be confined to project planning and route selection activities. In addition to subsurface utilities, quality level D for NCDOT should include all major overhead transmission lines.

Description of the Engineers Work for Quality Level D

The Engineer will conduct appropriate records research, investigate site conditions and depict the record location of all subsurface utilities including, but not limited to telephone, telephone fiber optic cable, power, water, gas, sanitary sewer (force mains and gravity sewer greater than six inches in diameter) on the best available base mapping. The Engineer also will depict the record location of all overhead power transmission lines 14.4 KV or larger. If available the Engineer will depict the record size and material composition of the record utilities. The Engineer will depict by records all major structures, both above and below ground associated with these utilities including but not limited to manholes, pump stations, vaults, towers and poles on the best available base mapping. Depending upon the stage of project development, electronic base mapping may be unavailable. If electronic base mapping is unavailable record information may be hand drafted on hard copies of the best available base mapping, including but not limited to Local GIS mapping or Public Hearing Maps. Base mapping to be used will be determined at the project-scoping meeting.

Information to be provided to the Engineer by the State with Respect to Quality Level D

With respect to the Level D services provided by the Engineer, the State shall:

When requested, provide reasonable assistance to the Engineer in obtaining plans, plats and other data that are available from utility owners. When available, provide plans showing the project limits, alignment, centerline, profile, benchmark and other data for selected projects. Provide the best available base mapping for the use of the Engineer in depicting the record location of subsurface utilities. Take all steps reasonably necessary to advise those individuals or entities that may rely on the Level D mapping services provided to use all appropriate precautions when conducting activities that may damage any underground utility. Such precautions shall include, but not to be limited to, giving notification to utility owners or "one-call" centers, if any, and hand exposing all utilities when conducting excavation work near the same. Such hand exposing shall ensure the safety of such work and the integrity of such utilities.

Quality Level C Defined

Quality Level C Involves surveying visible aboveground utility facilities, such as manholes, valve boxes, posts, etc. and correlating this information with existing utility records. When using this information, it is not unusual to find that many underground utilities have been either omitted or erroneously plotted. Its usefulness, therefore, should be confined to rural projects where utilities are not prevalent, or are not too expensive to repair or relocate.

Description of the Engineers work for Quality Level C

The Engineer will conduct appropriate records research, investigate site conditions and will survey all visible aboveground utility facilities. The Engineer will then correlate the surveyed information with existing utility records and depict the record location of subsurface utilities and the surveyed above-ground utility facilities on the best available base mapping. If electronic base mapping is unavailable Level C information may be hand drafted on hard copies of the best available base mapping, including but not limited to Local GIS mapping or Public Hearing Maps. Base mapping to be used will be determined at the project-scoping meeting.

Information to be provided to the Engineer by the State with Respect to Quality Level C

With respect to the Level C services provided by the Engineer, the State shall:

When requested, provide reasonable assistance to the Engineer in obtaining plans, plats and other data that are available from utility owners. When available, provide plans showing the project limits, alignment, centerline, profile, horizontal survey control and other data for selected projects. Provide the best available base mapping for the use of the Engineer in depicting the record location of subsurface utilities correlated with surveyed above ground utility facilities. Take all steps reasonably necessary to advise those individuals or entities that may rely on the Level C mapping services provided to use all appropriate precautions when conducting activities that may damage any underground utility. Such precautions shall include, but not to be limited to, giving notification to utility owners or "one-call" centers, if any, and hand exposing all utilities when conducting excavation work near the utilities. Such hand exposing shall ensure work safety and utility integrity.

Quality Level B Defined

Quality Level B involves the use of surface geophysical techniques to determine the existence and horizontal position of underground utilities. This activity is called "designating". Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals. Decisions can be made on where to place storm drainage systems, footers, foundations and other design features in order to avoid conflicts with existing utilities. Slight adjustments in the design can produce substantial cost savings by eliminating utility relocations.

Description of the Engineers work for Quality Level B

For the purposes of these Guidelines, "designate" means to indicate, by marking, the presence and approximate horizontal location of subsurface utilities using geophysical prospecting techniques, including, without limitation, electromagnetic and sonic techniques. The Engineer will provide these services as requested by the State to aid in the design of site, right of way or construction plans for projects selected by the State. In performing designating services the Engineer will provide all equipment, personnel and supplies required to perform designating services. The Engineer will determine which equipment; personnel and supplies are required to perform the designating services. The Engineer will conduct appropriate records research, investigate site conditions and identify on the ground applicable project limits provided by the State. The Engineer will obtain all necessary permits from city, county or other municipal jurisdictions to allow the Engineer to work in the existing streets, roads and rights-of-way. The Engineer will designate the approximate horizontal location of existing utilities by paint markings in accordance with the uniform color code scheme. The paint marks will be at frequent intervals to adequately identify the subsurface utility and at all bends in the line in order to establish the trend of the line. The utilities will be designated as well as their corresponding lateral lines up to the point of distribution, existing Right of Way limits, or whichever is specifically requested and scoped for each individual project. Unless expressly requested, the Engineer will not be required to designate or record storm or sanitary sewers (except sewer force mains), empty or abandoned utilities and vault or manhole limits or dimensions. The Engineer will prepare appropriate field sketches of marked utilities and survey designating marks, which will be referenced to project control provided by the State. The Engineer will draft survey information in a Microstation design file using Microstation Version 8 (or the

current version of Microstation used by NCDOT) and utilizing the state's NC Map Menu (provided by the State). All survey work, including the retracing of survey centerlines or baselines, will be determined and performed by the Engineer unless otherwise specified at the project scoping meeting. The Engineer will compare survey information drafted in the Microstation design file with information provided from field sketches and evaluate all drafted information in the field for accuracy and reliability. The Engineer will final draft all information into the Microstation design file to account for any corrections noted from the previous step and review the design file against all records, field sketches, and field notes. The Engineer will ensure that the Microstation SUE design file is compatible with the State's other design files so that the SUE design file can be referenced to the other files. The Engineer will ensure that a professional engineer or registered land surveyor licensed in North Carolina reviews all receivable information. The Engineer will deliver with the receivable information a certification letter addressed to the Location and Surveys Unit Head attesting that the information is in accordance with the Limited Services Contract and accepted surveying and engineering practices. If any unusual circumstances are encountered in the field or in the course of gathering record information which might adversely affect the quality of the Level B information the Engineer will submit a project report describing the unusual circumstances and the work effort expended to overcome the unusual circumstances. For Level of service B subsurface utility data produced pursuant to these Guidelines the Engineer will deliver, one (1) Microstation design file, a certification letter, a transmittal dated as of the date the information was placed on the NCDOT Server and if circumstances warrant, a project report.

Information to be provided to the Engineer by the State with Respect to Quality Level B

With respect to the designating services provided by the Engineer, the State shall:

When requested, provide reasonable assistance to the Engineer in obtaining plans, plats and other data that are available from utility owners. Provide plans showing the project limits, alignment, centerline, profile, horizontal control and other data for selected projects. Provide notifications to adjacent property owners concerning designating and surveying activities on selected projects. Take all steps reasonably necessary to advise those individuals or entities that may rely on the designating services provided to use all appropriate precautions when conducting activities that may damage any underground utility. Such precautions shall include, but not to be limited to, giving notification to utility owners or "one-call"

centers, if any, and hand exposing all utilities when conducting excavation work near the same. Such hand exposing shall ensure the safety of such work and the integrity of such utilities.

Quality Level A Defined

Involves the use of nondestructive digging equipment at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics. This activity is called "locating." It is the highest level presently available. When surveyed and mapped, precise plan and profile information is available for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the designer can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information such as utility material, condition, size, soil contamination, and paving thickness also assists the designer and utility owner in their decisions.

Description of the Engineers work for Quality Level A

For the purposes of these Guidelines, "locate" means to obtain the accurate horizontal and vertical position of subsurface utilities by excavating a test hole. In performing locating (test hole) services, the Engineer will provide all equipment, personnel and supplies required to perform its locating services. The Engineer will determine which equipment; personnel and supplies are required to perform such services. The Engineer will conduct appropriate records research and investigate site conditions. The Engineer will obtain all necessary permits from city, county or other municipal jurisdictions to allow the Engineer to work in existing streets, roads and rights-of-way. The Engineer will electronically sweep proposed crossings and perform necessary procedures to assure that the test hole is excavated in the correct location and on the correct underground utility. The Engineer will excavate test holes to expose the utility to be measured in such a manner that insures the safety of excavation and the integrity of the utility to be measured. In performing such excavations, the Engineer will comply with all applicable utility damage prevention laws and coordinate with utility inspectors, as required, and will be responsible for any damage to the utility during excavation of same. The Engineer will investigate, evaluate, measure and record (i) horizontal and vertical location of top and/or bottom of utility referenced to project datum, (ii) elevation of existing grade over utility at test hole referenced to project datum, (iii) outside diameter of utility and configuration of non-encased,

multi-conduit systems and duct banks, (iv) utility structure material compositions, when reasonably ascertainable, (v) benchmarks and/or project control used to determine elevations, (vi) paving thickness and type, where applicable, (vii) general soil type and site conditions, and (viii) such other pertinent information as is reasonably ascertainable from the test hole site. When more than one utility is present in one test hole the Engineer will investigate, evaluate, measure and record the aforementioned information for each utility present. References to project datum shall maintain vertical tolerances to +/- .05' based on benchmarks shown on Engineer's work product and horizontal tolerances to applicable surveying standards. If turns or additional benchmarks are required, the Engineer shall perform such services according to established surveying practices. The Engineer will furnish and install permanent marks directly above centerline of utility structure at each excavated test hole and record the elevation of the above ground marker. The Engineer will provide permanent restoration of pavement within the limits of the original cut. When test holes are excavated in areas other than roadway pavement, these disturbed areas shall be restored as nearly as reasonably possible to the condition that existed prior to excavation. The Engineer will evaluate and compare obtained information with utility information described in utility records and resolve conflicts. The Engineer will draft the horizontal location and test hole number corresponding to the test hole certification form in a Microstation design file using the State's NC Map Menu. The Engineer will compile all pertinent information concerning each test hole. Such information shall be formatted and presented on Engineer's proprietary Certification Form. The Engineer will provide a Microsoft Word Document to NCDOT containing the following Test Hole information: project number, TIP number, test hole number, project description, owner of utility, type of utility, size of utility, utility structure material composition, depth of utility below existing grade, top elevation of utility referenced to project datum, northing and easting of utility referenced to project datum, or design alignment station and offset (if design alignment is available). The Engineer will complete a test hole data summary sheet summarizing the test hole information for each project. A staff professional engineer and/or land surveyor (licensed in North Carolina) in responsible charge will perform a final review and seal the proprietary Certification Form. The Engineer will prepare a certification letter addressed to the Location and Surveys Unit Head attesting that the information is in accordance with the Limited Services Contract and accepted surveying and

engineering practices. For Level of Service A, the Engineer shall deliver, one (1) Microstation design file, two (2) copies of the test hole certification forms signed and sealed by a North Carolina registered professional engineer or professional land surveyor, a Microsoft Word Document containing the Test Hole information, a Test Hole Summary Form, an ASCII file containing the northing, easting and elevation of the located utility for each test hole and a transmittal dated as of the date the information was placed on the NCDOT Server. When more than one utility is present in one test hole the Engineer will investigate, evaluate, measure and record the aforementioned information for each utility present.

Information to be provided to the Engineer by the State with Respect to Quality Level A

With respect to locating services provided by Engineer the State will: provide plans showing the alignment, centerline, profile, horizontal and vertical survey control and locations of required test holes for selected projects. The State will provide notification to adjacent property owners concerning surveying and locating activities on all projects. The State will take all steps reasonably necessary to advise those individuals or entities that may rely on locating services provided hereunder to use all appropriate precautions when conducting activities that may damage any underground utility. Such precautions shall include, but not be limited to, giving notification to utility owners or "one-call" centers, if any, and hand exposing all utilities when conducting excavation work near them. Such hand exposing shall ensure the safety of the excavation and the integrity of such utilities. The State will provide to the Engineer a blank Microsoft Word document containing a standard format for presenting test hole information.

WORK STANDARDS

Field data shall be obtained in conformity with current practices of the State as outlined in the various Unit Manuals and Unit Guidelines in regard to presentation, media, sheet sizes, scales, billing of pay items, special drawings, and summaries thereof. All original calculations, field notes, quantity calculations, boring logs, subsurface utility data, any necessary project special provisions, and other material in addition to the drawings prepared under these Guidelines shall be the property of the State and shall be turned over to the State upon completion of the work, if requested by the state.