

SECTION 330523-1  
GUIDELINES FOR UTILITY HORIZONTAL DIRECTIONAL BORINGS

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PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The following general and specific guidelines are intended for all horizontal directional borings that use the slurry-type method or auger-type method regarding the installation of conduits and other underground utilities.
- B. The following general and specific guidelines are intended for the installation of pipe by pipe ramming, pipe jacking, microtunneling, impact moling, and plowing.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01050 – Field Engineering  
Section 02100 – Clearing and Grubbing  
Section 02200 – Earthwork  
Section 02225 – Earthwork for Structures and Pipelines

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

"SUBDIVISION SPECIFICATIONS FOR STREETS AND ROADS", Latest Revision, Metropolitan Government of Nashville and Davidson County

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"Underground Utility Damage Prevention Act of the State of Tennessee", Latest Revision

"Stormwater Management Manual" (SMM), Latest Revision, Metropolitan Government of Nashville and Davidson County

"Occupational Safety and Health Act" (OSHA), Latest Revision, State and Federal Governments

"American Society of Testing and Materials" (ASTM), Latest Revision

PART 2 - MATERIALS AND CLASSIFICATION – (Not Used)

PART 3 – EQUIPMENT – (Not Used)

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PART 4 - EXECUTION

4.1 GENERAL GUIDELINES

- A. A thorough investigation shall be performed to compile all the information on the known utility systems paralleling or crossing the proposed path on the new utility extension.
- B. This information is to be placed on a set of engineered construction plans which indicate both the plan view and profile view of all existing utilities.
- C. The plans should indicate the proposed route of the new or extended underground utility and its relationship with all other known utilities in the shared corridor.
- D. If necessary, and at the discretion of Public Works, advanced subsurface investigations may be required to accurately depict the exact location of each utility. (see Subsurface Utility Engineering)
- E. The plans shall have detail sheets that indicate the various types of trench line cross sections required. The trench line cross section(s) must be: 1) Meet the minimum standards of restoration as established by Metro, 2) Indicate the total number of conduits and diameter of each that are to be placed in the duct bank system, 3) Identify the proposed users of each conduit in the duct bank system, 4) Color coated for user distinction, and 5) Identify the duct(s) to be dedicated to Metro.
- F. All of the various utility record atlas research, subsurface investigations, and plan development must be completed prior to beginning the permit approval process.
- G. All utility main separation guidelines must be honored. All utility main easements must be honored. Generally speaking, no reductions below the absolute minimum requirement between the existing utility main(s) and the conduit bundle (directional boring method) will be approved.
- H. The original drawings should continuously reflect the proposed elevations of the new utility in relationship with the interpolated or known elevations of the existing systems. At the time of construction shop drawings shall be continuously submitted to further support the plans.
- I. All of the Subsurface Utility Engineering investigation and pre-engineering must be verified in the field as part of the Final Engineering Check. All utilities must be marked and all known utilities accounted for prior to beginning any construction. "Potholing" will be required when no other accurate information is available to verify the actual location of an existing utility. Public Works will require the contractor to provide modern vacuum type test pit equipment and employ modern day methods to minimize the destructive nature of potholing and test pitting for utilities. (see Subsurface Utility Engineering)

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4.2 SPECIFIC GUIDELINES FOR HORIZONTAL DIRECTIONAL BORING

- A. All of the above mentioned Subsurface Utility Engineering investigations and pre-engineering must be verified in the field as part of the Field Engineering Check in the proposed work.
- B. Prior to beginning work and as part of the Final Engineering Check, the contractor is required to contact each appropriate utility company and hold a field meeting to discuss any concerns or discrepancies.
- C. The contractor shall contact the appropriate utility company and determine if there are any requirements for observation pits, which shall be typically 6"x6" wide but no more than 2'x2' wide. In some locations, requirements for observation pits may be waived if the Subsurface Utility Engineering and subsurface investigations indicate the existing utilities at a separation of significant safety and no risk. In all cases the appropriate utility inspector shall be contacted in advance and given the opportunity to monitor the sonar and depth scanning device while the contractor's operations cross or parallel a given utility line.
- D. All utility main separation guidelines and utility main easements must be honored. The horizontal separation path between a new utility and existing utility should be both designed and targeted at a minimum distance of 8 feet or more when determined practical and doable. Reductions in this guideline may be considered on a case by case basis. If approved, at no time will the minimum separation shown on the plans or targeted in the field, be inside the absolute minimum of 5 feet horizontal separation between any existing utility main and the new utility. This separation is to be measured from the outside diameter of the known utility to the outside edge of the conduit bundle.
- E. Three (3) feet is to be interpreted as the minimum vertical separation requirement. The designed target depth of separation should always be greater than this depth by at least one foot or more. This depth is measured to the outside edge of the conduit bundle being pulled through by the back reaming device.
- F. All new conduit systems that parallel an existing trunk line or outfall line whose service laterals crossover the proposed new utility run must maintain a subsurface elevation that is equal to or less than the profile grade of the lowest known utility sharing the corridor. This typically will be the sanitary, storm, or combined sewer main.
- G. Public Works recognizes the maximum bore depth beneath Metro's right-of-way to be a threshold of twelve (12) feet below the surface elevation of the utility/conduit run. Special approval is needed to go beyond this depth. Public Works will not allow any future point repairs to a conduit or cable system installed below this established "threshold depth".
- H. As instructions to the directional borer, the design engineer must pre-determine

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where “relief pits” are to be provided in the directional bore runs. Relief pits are defined as mid points in the length of the bore run, which allow spoils and/or injection material to be discharged. Proper vacuum equipment must be available at relief pits to handle the spoils. Typically, it is expected that relief pits are no more than one foot square.

- I. The design engineer must calculate the descending angle and ascending angle for each new bore pit location. This information must be shown on the original plans or submitted as a shop drawing for final review and approval prior to commencing work.
- J. The design engineer must then calculate the exact location and/or setback of each bore pit, to establish a pre-determined location based on the aforementioned utility separation and in particular the minimum clearance guidelines. No boring operations are to begin until the project or design engineer has submitted these geometric calculations to Public Works and received approval.
- K. No directional boring operations shall begin until the necessary and adequate equipment is in-place that will capture, contain, and remove the generated spoils.
- L. No directional boring operations shall begin until all these aforementioned specific project engineering items, plus those mentioned in the general guidelines above, have been completed to Public Works’ satisfaction and approval.
- M. No directional boring will be allowed in certain areas of the city where it is determined to have a “higher risk factor” given the utility clutter and the known existence or undocumented substructures such as old sheeting and shoring systems, all types of old foundations, possible rubble fill, or other conflicts creating possible navigational problems. Therefore, without special approval by Public Works, in writing, directional boring will not be allowed in areas determined to have a higher risk factor. Limited runs and/or localized areas of directional boring may be approved on a case-by-case submission basis for these same designated areas. These no bore area restrictions do not necessarily apply to individual boring runs designed to cross from one side of the street to the other side. The restrictions apply mainly to continuous corridor run type bore plans.
- N. As deemed necessary, Public Works will require the contractor to “TV Investigate” any sewer or gas line or even a water line, that has been crossed or paralleled, to prove no damage has resulted from the boring operations.
- O. As a final submission requirement the contractor/sponsor/engineer must get together all notes and then submit a set of as-built drawings with field notes that reflect the actual new utility layout and exact depths. Final plans must be submitted showing all changes, highlighted notes, or delineated references concerning the as-built information specifically.
- P. Metro Nashville/Davidson County is a GIS city, therefore all as-builts must also

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be submitted in a digital fill format. This along with GPS coordinates provided on certain benchmarks and monuments, adjacent fixtures, or manhole structures will enable Metro to conveniently update records on such projects as our telecommunications fiber optics vector files or any other of the numerous new utility network files now being maintained on our GIS system.

#### 4.3 SUBSURFACE UTILITY ENGINEERING

Subsurface Utility Engineering (SUE) is a process for identifying, verifying, documenting to determine of the exact location of existing underground facilities. Subsurface Utility Engineering, or SUE is a new discipline that utilizes modern electronic line tracing techniques (Designation), non-destructive air-vacuum excavation technology to expose subsurface facilities (Locating), and state-of-the art survey mapping techniques (Data Management). Depending on the information available and the technologies employed to verify facility locations, a level of quality of information can be associated with underground facilities.

SUE is divided into four components or quality levels. Starting with Quality Level D (the lowest level), the accuracy and reliability of the survey increase up to Quality Level A (the highest level).

- Quality Level D – Historical Utility Records Research. This 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 it is often highly limited in terms of comprehensiveness and accuracy. Its usefulness should be confined to project planning and route selection activities. In order to verify the existence of utilities or to pinpoint the exact location of underground structures, additional detection methods would be required.
- Quality Level C – Site Assessment. This is the most commonly used level of information and is a slight improvement of Quality Level D information or utility data from existing records. Quality Level C information involves surveying visible aboveground utility facilities, such as manholes, valve boxes, posts, etc., and correlating this information with existing utility records. A visual assessment of the site is performed and compared to the historical utility maps. This visual assessment provides an overall impression of the degree of potential conflicts in the excavation area. This site assessment seeks to achieve two objectives: 1) assessing the current state of visual markings, and 2) determining the existence of inconsistencies between the historical maps and the actual location.
- Quality Level B – Designation. – This information involves “designating”, the professional selection, application, and interpretation of appropriate surface geophysical methods and techniques, to find, map, and determine the existence and horizontal position of virtually all utilities within the project limits. 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. This two-dimensional horizontal mapping information is usually sufficient to accomplish preliminary engineering goals.

Designation is the process where by the approximate horizontal location of a utility is

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determined. Following a rough approximation of the general location of facilities provided by Quality Level D (historical records) and Quality Level C (site assessment), a number of geophysical technologies can be used, selected by applicability, for identifying the horizontal locations of particular utilities.

- A. Induction utility locators operate by locating either a background signal or by locating a signal introduced into the utility line using a transmitter. There are three sources of background signals that can be located. A utility line can act like a radio antenna, transmitting electromagnetic signals that can be picked up with a receiver. A signal can be indirectly induced onto a utility line by placing the transmitter above the line. A direct induced signal can be generated using an induction clamp. This is the preferred method of tracing, where possible. These signals can be located horizontally on the surface using a receiver.
  - B. Ferrous Metal or Magnetic locators operate by indicating the relative amounts of buried ferrous metals. They have limited application to locating and identifying utility lines but can be very useful for locating underground storage tanks, buried manhole covers, or other subsurface objects with a large ferrous metal content.
  - C. Electromagnetic survey equipment is used to locate metallic utilities. This method pulses the ground and records the signal retransmitted back to the unit from subsurface metal. Particularly useful for locating metal pipelines and conduit, the device can also help locate other subsurface objects such as underground storage tanks, buried foundations (that contain structural steel), and pilings and pile caps (that contain steel).
  - D. Ground Penetrating Radar (GPR) is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants (a term that describes an electrical parameter of a material). The GPR system consists of an antennae, which houses the transmitter and receiver; and a profiling recorder, which processes the received signal and produces a graphic display of the data. The transmitter radiates repetitive short-duration EM signals into the earth from an antennae moving across the ground surface. Depth of investigation of the GPR signal is highly site specific, and is limited by signal attenuation (absorption) of the subsurface materials. Ideally, the survey is performed along a pre-selected system of perpendicular or parallel transect lines.
  - E. Acoustic location methods generally apply to waterlines. A highly sensitive acoustic receiver listens for background sounds of water flowing; (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. This method may have good identification results, but can be inaccurate. Acoustics can also be utilized to determine the location of plastic gas lines.
- Quality Level A – Non-Destructive Air-Vacuum Excavation. This information provides the highest level of accuracy presently available and the full use of the subsurface utility engineering services. It involves “locating”; the use of non-destructive digging equipment to expose buried utilities at critical points and provides information for the precise plan and profile mapping of those underground utilities. The use of

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nondestructive digging equipment, particularly vacuum excavation, eliminates damage to underground utility facilities traditionally caused by backhoes.

Non-destructive Air-Vacuum Excavation is used to determine the exact horizontal and vertical location of facilities. The process involves removing the surface material over approximately a 1'x1' area at the electronically determined approximate horizontal location produced during the designation stage. The air-vacuum process proceed with the simultaneous action of compressed air-jets to loosen soil and vacuum extraction of the resulting debris. The process continues until the utility is uncovered. Normally, the following information (if applicable) is recorded for each vacuum excavation: the utility type, material, size, depth, condition, location (x, y, z), orientation, roadway section materials and depths, soil type, and water table.

Air-Vacuum Excavation can also be used at a proposed boring location to excavate below the "utility window", which is usually eight feet. This reduces the risk to utilities during the initial drilling process. Soil samples can be taken during the air-vacuum excavation process. Frequently, contaminants move along utility line trenches. Air-vacuum excavation can be used to obtain soil samples adjacent to utility lines without risking damage. After concluding the air-vacuum stage, the exact utility data is then translated into a computer generated three-dimensional map.

When all three procedures (designation, locating, and data management) are applied, a clear and exact visual representation of the position of underground utilities in an area of excavation is produced. Each of these tools, applied independently, offers a limited and only partial representation of the subsurface utilities. The benefits derived from the application of these procedures are maximized when each is fully utilized to complement one another.

PART 5 - MEASUREMENT AND PAYMENT – (Not Used)

**END OF SECTION - 330523**