

HDD Guidelines Handbook

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1. Introduction

Horizontal Directional Drilling (HDD) is a trenchless installation technique developed to install pipe under natural or manmade obstacles, especially waterways and highways. Today directional drilling is utilized not only for crossings, but also for parallel installations along the right-of-way as an alternative to digging trenches. HDD is utilized for the installation of gas, water and sewer mains; chemical pipelines; and electric and communications conduits.

1.1 Purpose

The purpose of this handbook is to provide basic guidelines for projects utilizing HDD techniques that will help ensure public safety and protect existing underground facilities. This handbook is not intended to be a step-by-step procedure manual but rather a collection of fundamental elements of the HDD process.

1.2 Acknowledgement

This handbook is closely modeled after The City of Overland Park, Kansas, Right-of-Way Permits, Horizontal Directional Drilling Guidelines Handbook¹. A special thank you goes to the City of Overland Park, Kansas for allowing the reproduction of text and drawings from their handbook.

2. Basic HDD Process

Every HDD project is unique and will have unique elements, conditions and requirements. There are several manufacturers and a wide range of HDD equipment. The manufacturer's operation manual should be the primary information source for HDD equipment and should be followed during all operations.

The following sections outline the basic process for HDD projects. For in-depth information regarding HDD, refer to the Horizontal Directional Drilling Good Practices Guidelines,² by the HDD Consortium. The HDD Consortium also offers a companion Training Curriculum.

3. Planning and Design

Prior to submitting an application for a right-of-way permit for an HDD installation, the Permittee (or its designer) shall undertake a thorough design process. It is recommended that Subsurface Utility Engineering be utilized as part of this design process.

3.1 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 American Society of Engineers (ASCE) has recently published standard guidelines covering utility data collection and depiction. Refer to the ASCE standard, CI/ASCE 38-02, for more information on the tasks involved in each SUE quality level and suggestions for depicting SUE information. References 4 and 5, identified in Appendix A, also provide valuable information and insight into SUE, including history and benefits.

The main components of SUE are defined as follows:

- 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.

Quality levels are assigned to SUE data that allows everyone involved in the project to understand the data provided and to manage risks accordingly. A brief description of the four quality levels of SUE data is as follows:

- 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.

3.2 Minimum Design Requirements

At a minimum, the Permittee (or its designer) shall complete the following design tasks prior to submitting a right-of-way permit application:

- Obtain right-of-way and property line information through survey records, or other sources

- Collect existing underground utility information utilizing SUE including the
 - horizontal position of all known underground facilities and structures
 - vertical position of all known underground facilities and structures (whenever possible)
- Prepare or obtain scaled base mapping for the planned installation including all existing surface features and improvements
- Obtain general and/or specific geotechnical information (as required or deemed necessary by the Permittee or Engineer) including
 - USDA Soil Conservation Service data for the project area
 - site-specific geotechnical sampling and analysis
- Prepare Construction Plans using the information noted above including
 - the location of all planned improvements
 - existing surface and subsurface utility information
 - SUE quality levels
 - right-of-way limits and property ownership information

3.3 Additional Design Considerations

In addition to the design requirements listed previously, the Permittee (or its designer) should consider and design for the following:

- Minimum horizontal and vertical clearance requirements (see HDD Minimum Clearances drawing later in this document) including
 - road setbacks and existing surface features
 - existing underground utilities and structures
- Product pipe and reamer diameter requirement

<u>Product Diameter</u>	<u>Reamer Diameter²</u>
<8"	Product + 4"
8" to 24"	Product x 1.5
>24"	Product + 12"

- The bore geometry for the given ground profile including
 - bore length(s) and depth requirements
 - bending radii for the final product pipe (typically 100' radius per 1 inch product diameter, with 600' to 1,000' radius minimums depending on subsurface materials and equipment requirements)
 - entry and exit pit locations with plan size and depth as required
- Drilling equipment requirements for the given geotechnical conditions, geometry, and final product diameter including
 - thrust and pullback ratings
 - mud motors vs jetting heads

- wireline vs walkover tracking systems
- Equipment and material handling requirements including
 - drilling fluid and drilling fluid containment
 - drill operation and final product staging
- Product material strengths, capacities, and coupling methods

4. Permitting

The following information shall be provided as part of the permit application process:

- Proposed Project Information including
 - Project type (communication, gas, etc.)
 - System capacities (types, pressures, etc.)
- Construction Plans based on scalable mapping, utilizing SUE and in accordance with the permit agency's plans submission requirements including
 - the proposed alignment (dimensioned)
 - existing utility information (within 25' of the proposed facility)
 - right-of-way information
- Proposed facility information and details including
 - final product material type and dimensions
 - proposed depths of cover and clearances
 - all proposed above and below grade structures
- Specific installation requirements or typical installation parameters indicating the design bending radii and diameter(s)
- Assumed subsurface geotechnical conditions based on experience, USDA Soil Survey data, or site-specific soil report
- A Traffic Control Plan in accordance with the permit agency's requirements
- A Storm Water Pollution Prevention and Erosion Control Plan as required by federal, state and local requirements. For minimum requirements refer to Section 6.5 Storm Water Pollution Prevention
- A Construction Schedule indicating the proposed start date(s), completion date(s), and restoration schedule

5. Construction Safety

Prior to performing work involving HDD under a Right-of-Way Permit, the Permittee (or its Contractor) shall implement the following safety guidelines:

- Perform all operations in compliance with OSHA guidelines and insure that all personnel are properly trained and equipped to work in the public right-of-way
- Ensure that the approved traffic control plan (required with the permit application) is implemented and followed at all times
- Ensure that all storm water pollution prevention measures (required with the permit application) are implemented and followed at all times
- Ensure all setbacks, offsets, and clearances are maintained
- Ensure that utility One-Calls and other utility coordination requirements have been met
- Positively locate/expose (by potholing) all crossed utilities
- Positively locate/expose (by potholing) all parallel utilities at the beginning and ending of all bores and
 - every 200' if it is within 5' of the proposed alignment
 - every 50' if it is within 3' of the proposed alignment
 - and additionally as requested by the permit agency
- The HDD Contractor shall have a planned response in the event of a utility strike including utility owner notification and how to avoid
 - electrocution in the event of an electric strike
 - combustion in the event of a gas line strike
 - contamination in the case of a sewer strike

6. Construction Guidelines

All construction work shall be performed in accordance with permit agency requirements and as outlined below. For all work involving horizontal directional drilling under a Right-of-Way Permit, the Permittee (or its Contractor) shall perform the tasks outlined in the following sections.

6.1 *Prior to Construction*

The following shall be performed prior to construction:

- The HDD Contractor shall familiarize itself with the work area and the technical requirements of the plans
- The Permittee (or its Contractor) shall establish construction marking/staking, prior to construction, to indicate
 - HDD entry and exit locations, and
 - proposed HDD alignment at 50 foot (max) intervals
- Provide the permit agency with a contact list of all crew foremen

6.2 During Construction

The following shall be performed during construction:

- The HDD Contractor shall calibrate its tracking and locating equipment at the beginning of each work day. A log shall be maintained and submitted to the permitting agency.
- The HDD Contractor shall monitor and record the alignment and depth readings provided by the tracking system
 - every 25 to 30 feet (8 to 9 meters) for normal conditions,
 - every 5 to 10 feet (2 to 3 meters) where precise alignment control is necessary
- The HDD Contractor shall complete the HDD installation as designed and permitted both horizontally and vertically unless otherwise authorized by the permit agency
- The HDD Contractor shall attempt to maintain drilling fluid circulation throughout the HDD process during
 - the initial pilot hole installation
 - the reaming and back pull process(es) (The pull back should not exceed the fluid circulation rate capabilities).
- The HDD contractor should backream as required to accommodate the product size. It is preferable that the use of compaction reamers be avoided. However, the Contractor shall not expand the bore hole by more than six inches (6") using only a compaction reamer.
- The HDD Contractor shall plan its reaming and back pulling operations carefully to ensure that, once started, all reaming and back pulling operations can be completed without stopping and within the permitted work hours
- The HDD Contractor shall at all times and for the entire length of the HDD alignment be able to demonstrate and provide the
 - the horizontal and vertical position of the alignment
 - the fluid volume used, return rates, and pressures
- A municipal inspector should monitor and verify the alignment measurements provided by the HDD Contractor
- The HDD Contractor shall inspect the work and surrounding area to ensure that no construction-related damage has occurred including
 - heaving or humping of paved surfaces, and
 - drilling fluid fractures or releases

- At the request of the permit agency, the Contractor shall provide access for inspection of the HDD operations

6.3 Following Construction

Items noted below shall be performed following construction:

- Prior to the start of backfilling excavations under paved surfaces, the Permittee shall notify the permit agency to schedule an inspection
- The Permittee (or its Contractor) shall ensure that all cleanup and restoration is in compliance with the permit agency's requirements for right-of-way restoration. Upon completion of all right-of-way restoration activities, the Permittee will schedule a closeout inspection
- The Permittee shall notify the permit agency upon completion of all project work including final punch list items
- The Permittee's 2-year maintenance period will not begin until any corrective actions required have been completed and subsequently approved by the permit agency

6.4 Drilling Fluid Containment and Disposal Requirements

The HDD Contractor shall contain, handle, and dispose of drilling fluids in accordance with the following requirements:

- All drilling fluid and fluid additives shall be disclosed, and Material Safety Data Sheets (MSDS) shall be provided to the permit agency upon request
- Excess drilling fluid shall be confined in a containment pit at the entry and exit locations until recycled or removed from the site
- Precautions shall be taken to insure that drilling fluid does not enter roadways, streams, municipal storm or sanitary sewer lines, and/or any other drainage system or body of water
- Unintended surfacing of drilling fluid shall be contained at the point of discharge and recycled or removed from the site
- Drilling fluids that are not recycled and reused shall be removed from the site and disposed at an approved disposal site
- Drilling fluids shall be completely removed from the construction site prior to back filling or restoring the site

- Collection, transportation, and disposal of drilling fluids shall be environmentally safe and comply with local ordinances and government regulations

6.5 Storm Water Pollution Prevention

All construction activities shall be performed in accordance with the National Pollution Discharge Elimination System (NPDES) as regulated by the Environmental Protection Agency (EPA), as well as state and local requirements.

The Permittee (or its Contractor) shall implement best management practices to ensure that storm water runoff is not contaminated by sediment caused by land disturbances associated with construction activities. For a full list and discussion of recommended best management practices please see the following publications Construction Site Storm Water Runoff Control⁶ and Protecting Storm Water⁷.

The following seven goals (or “Golden Rules”) shall be applied for all Storm Water Pollution Prevention planning:

- Ensure that sediment controls are in place prior to disturbance.
- Maintain sediment controls throughout the construction and restoration processes.
- Minimize the overall disturbance whenever possible.
- Protect disturbed areas throughout the construction process.
- Prevent storm water runoff from entering disturbed areas.
- Never intentionally discharge construction contaminants directly into creeks, rivers, ditches, or storm systems.
- Complete permanent restoration as soon as possible.

In addition to the overall goals stated above, the contractor shall, at a minimum, implement the following specific practices:

- Provide temporary erosion protection whenever possible:
 - Mulch, seed, or gravel may be applied even if a disturbed area may and/or will be disturbed again or other permanent measures of stabilization are to follow
 - Cover spoil piles with a tarp or contain with a sediment barrier
- Contain disturbed sediment on site:
 - Use sediment barriers such as silt fence, sand bags, straw bails, rock checks and/or sediment traps to contain sediment on the construction site
 - Existing vegetation may be used as a sediment filter where minimal grades and sheet flow runoff will occur
 - Insure that all sediment barriers are installed and functioning properly
- Avoid causing flooding in roadways and adjacent right-of-way:
 - Do not block existing culverts and storm inlets except as a last resort
 - Ensure that sediment is removed from sediment traps and filters after all storm events.

7. Construction Records

The HDD Contractor shall keep detailed and accurate records of all activities associated with the HDD process. Upon completion of HDD installations, the Permittee shall provide the permit agency with As Built plans and any supporting documents within 60 days of project completion. As Built plans should be in electronic format, but hard copy format may be approved on a case-by-case basis by the permitting agency. HDD construction records and As Built plans shall include the following:

- HDD tracking data and operator logs shall be maintained daily and shall be made available upon request to the permit agency. These field records and operator notes shall specify:
 - the type of tracking equipment used
 - the length and depth of the HDD installation
 - additional information that may include steering adjustments and other equipment performance parameters

- As Built plans shall be derived from the tracking data and operator logs. At a minimum, the drawings shall indicate:
 - horizontal and vertical HDD alignment (dimensioned)
 - existing utility horizontal locations and depths at all exposed or potholed locations
 - existing utility horizontal locations where indicated with field locates

- As Built plans shall conform to the same plans submission requirements as for Right-of-Way Permits and as described in this handbook.

Appendix A – References

1. Overland Park, Kansas, The City of Overland Park, Kansas, Right-of-Way Permits, Horizontal Directional Drilling Guidelines Handbook, May 2002.
2. HDD Consortium, Horizontal Directional Drilling, Good Practices Guidelines, May 2001.
3. 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.
4. 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>.
5. Jeffery J. Lew, Subsurface Utility Engineering: An Initial Step in Project Development, available from <http://asceditor.unl.edu/archives/1996/lew96.htm>, on the Internet.
6. U.S. Environmental Protection Agency, Construction Site Storm Water Runoff Control, available from <http://www.epa.gov/npdes/menuofbmps/menu.htm>, on the Internet.
7. Missouri Department of Natural Resources, Protecting Storm Water, available on the Internet at <http://www.dnr.state.mo.us/wpscd/wpcp/wpcp-guide.htm>.