



**D E N V E R**

**THE MILE HIGH CITY**

CITY AND COUNTY OF DENVER

DEPARTMENT OF PUBLIC WORKS | ENGINEERING DIVISION

## **Storm Drainage and Sanitary Sewer Construction Detail and Technical Specifications**

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### **4.0 Utility Trenching and Excavation**

#### **4.0.1 General**

All excavations, trenching, shoring and stockpiling of excavated materials shall be in strict compliance with the applicable Occupational Safety and Health Act (OSHA) rules and regulations.

Except where shown otherwise on the Drawings, and except when the Project Construction Engineer gives written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipe line as shown on the Drawings and specified herein. Permission for tunnel work may be granted for crossing under sidewalks, driveways, or existing utility lines, but such tunnels shall not exceed 10 feet in length. No separate payment will be made for any of the work involved for these items and all costs incurred will be included in the applicable unit price bid for the associated pipe segments, structures and appurtenances.

The length of trench permitted to be open at any one time may be limited when, in the opinion of the Project Construction Engineer, such limitation is necessary for the safety and convenience of the public; however, in no case shall the length of open trench exceed 150 feet. All trenches and excavations left overnight shall be protected as specified by the Project Construction Engineer. This may include, but is not limited to: fencing, concrete, barriers, additional signage or any other measures required to provide public safety.

#### **4.0.2 Subsurface Information**

Whenever subsurface exploration, consisting of test holes and borings, has been made along the route of the work, the information obtained from these test holes will be included in both the Bid Submittal Package and the Contract Documents.

Subsurface information is provided for general information, and conditions may vary due to the location on jobsite and time of year. The City does not accept any responsibility for assumptions or generalizations made by the Contractor. Each bidder and Contractor must form his/her own opinion of the character of the work and of the materials to be excavated, and he/she must make his/her own interpretations and investigations regarding all conditions affecting the work to be done.

#### **4.0.3 Trench Width**

Except as may be otherwise specified on the Drawings, the maximum clear trench width measured at a point one (1) foot above the top of the pipe barrel shall not be greater than that set forth in the most recent edition of the Standard Detail Drawings.

The trench width shall be sufficient to permit the pipe to be placed and jointed properly and to allow for the construction of appropriate structures and appurtenances. The width shall be as such to allow backfill to be placed and compacted as specified. No pipe shall be installed in a bedding trench having a width (as measured at one (1) foot above the top of the pipe) greater than the outside diameter of the pipe plus sixteen (16) inches for pipe having internal diameters of thirty-three (33) inches or less. No bedding trench shall be greater than the outside diameter of the pipe plus twenty-four (24) inches for all pipes with internal diameters of thirty-six (36) inches or more.

If the stated maximum trench widths are exceeded either through accident or otherwise and if the Project Construction Engineer determines that the design loading of the pipe will be exceeded, the Contractor will be required to either support the pipe with an improved trench bottom or to use a stronger class. The cost of such remedial measures shall be entirely at the Contractor's own expense. If deemed necessary, the Contractor shall brace or shore this portion of the trench excavation to maintain the required trench width at the top of the pipe.

#### **4.0.4 Trench Walls**

All trench sidewalls shall be properly sloped, benched, braced, shored or sheeted to assure safe working conditions and to prevent cave-ins. All trench operations including sloping or benching of the trench sidewalls and stockpiling of excavated materials shall be confined to the width of the permanent rights-of-way plus any temporary construction easements.

##### **4.0.4.1 Sloping or Benching**

Sloping or benching of the trench walls will normally be allowed, provided that such sloping or benching complies with all applicable State and Federal Occupational Safety and Health Administration (OSHA) requirements; and provided further, that such sloping or benching does not endanger adjacent utilities or structures or the public. In the event the Contractor elects to slope or bench the trench sidewalls, the sloping or benching shall terminate at a

depth not less than one (1) foot above the top of the pipe barrel and, from that point to the bottom of the excavation, the trench wall shall be vertical (with adequate shoring as necessary).

#### **4.0.4.2 Bracing Shoring, Sheeting**

The sides of the excavation shall be securely held in place with suitable bracing and shoring wherever necessary to prevent caving. In addition, bracing, shoring, sheeting, etc. shall be in accordance with all applicable State and Federal Occupational Safety and Health Administration (OSHA) requirements. Shoring shall be removed as the work and backfilling operations progress, unless ordered by the Project Construction Engineer to be left in place. The Contractor will be responsible for minimizing the disturbance of compacted bedding during advancement and removal of shoring within the bedding trench zone. All voids and separations shall be backfilled and recompacted with the appropriate bedding materials and in conformance with Section 5.0 of these Details and Technical Specifications. The Contractor will be paid for shoring so ordered left in place on the basis of invoiced material only. All other shoring shall be considered as incidental to construction and all costs incurred, except for materials ordered to be left in place, will be considered to be included in the unit price bid for the construction of each section of sewer, associated structures, laterals and appurtenances.

The decision to brace, shore or sheet the excavation shall be entirely the Contractor's responsibility. However, if the Project Construction Engineer is of the opinion that any part of the excavation is not properly supported, he/she may order the placement of additional supports by and at the expense of the Contractor. Compliance with such order shall not relieve or release the Contractor from his/her responsibilities to provide a safe work zone.

#### **4.0.5 Preparation of Foundation for Pipe Laying**

When the excavation is in firm soil, care shall be taken to avoid excavation below the established grade (i.e. the specified overdepth to accommodate the particular class of bedding). The different methods and classes of bedding are described within section 5.0 of these Detail and Technical Specifications.

##### **4.0.5.1 Dewatering**

During construction, the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench or other part of the work. In water bearing strata, well points, sub drains or any other method approved by the Project Construction Engineer may be required to provide a dry trench.

The discharge from any trench dewatering operations shall be conducted to natural drainage channels or other structures as approved by the Project Construction Engineer and in accordance with applicable permits. Ground water shall not be discharged into sanitary sewers.

Pipe trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing. Dewatering, sufficient to provide a completely dry trench, shall be maintained

during all pipe laying and jointing operations. The Contractor shall be responsible for damage of any nature resulting from the dewatering operations.

Unless provided for in the Contract Documents, dewatering shall be considered as incidental to construction and all costs incurred will be considered to be included in the unit price bid for the construction of each section of sewer line, associated structures, laterals and appurtenances.

#### **4.0.5.2 Overexcavation and Replacement with Select Backfill Material**

If soft or otherwise unsuitable foundation material is encountered in the bottom of the trench, it shall be removed and replaced with select backfill material and/or angular rock bedding material so as to provide a suitable foundation for the pipe structure and/or appurtenance, as determined by the Project Construction Engineer.

In the event that overexcavation and replacement with select backfill material is below the water table, the sub-bedding material shall consist of 3/4 to 1-1/2-inch rock (or larger if approved). All work shall conform to the most recent edition of the Standard Details.

If provided for in the Contract Documents, the cost of overexcavation and replacement with select backfill material will be paid for per the associated measurement and payment description. If no pay item for such work is included in the Contract Documents, the Contractor shall consider all costs incurred are to be included in the unit prices bid for the construction of each section of sewer, associated structures, laterals and appurtenances.

#### **4.0.5.3 Rock Excavation**

Rock shall be defined as material consisting of igneous, metamorphic and sedimentary materials which cannot be excavated without blasting or the use of rippers, or boulders or other detached stones each having a volume of 1/2 cubic yard or more, or having a specific gravity of at least 2.25 and weighing not less than 140.4 pounds per cubic foot. The unit price bid for rock excavation will include granular bedding, select material, or any other material specifically approved by the Project Construction Engineer required to fill the excavated area.

#### **4.0.5.4 Muck Excavation**

Muck shall be defined as an organic soil consisting of highly decomposed materials. Soils with more than 30% organic material are considered “organic” soils and are generally referred to as peat or muck. These soils have bulk densities as low as 25 to 37 lb/ft<sup>3</sup>. The unit price bid for muck excavation will include granular bedding, select material, or any other backfill material specifically approved by the Project Construction Engineer required to fill the excavated area.

#### **4.0.6 Pavement and Sidewalk Cuts**

Where excavation is required under concrete or asphalt paved areas, including gutters and walks, the surfacing material shall be cut or rotomilled in such a manner as to produce a smooth, straight cut edge and confine the excavation to a minimum practical width. The pavement or concrete shall be cut or removed at least one (1) foot beyond the top width of

the trench on each side. All broken pavement, asphalt, concrete or other debris resulting from this initial work shall be immediately removed from the job site or stockpiled in an approved manner so that it is kept separated from the remaining trench excavation. This debris will not be allowed, to be mixed in the trench backfill material.

#### **4.0.7 Cut-off Walls**

Cut-off walls are only required as noted in the contract documents and as specifically requested by the Project Construction Engineer to prevent migration of water through the pipe bedding zone. The Project Construction Engineer may specify alternate locations from those shown in the plans. Concrete cut-offs are the preferred installation method. Refer to Standard Detail S-301.1 for typical locations and additional information.