



**SPECIAL PROVISIONS
FOR
TUNNELING WITH INITIAL SUPPORT**

**Woodbury County
IM-NHS-029-6(257)147--03-97**

**Effective Date
March 18, 2014**

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

120153.01 DESCRIPTION.

A. Summary.

1. Tunneling with initial support.
2. Installing carrier pipe inside initial support.
3. Backfill grouting between carrier pipe and initial support.

B. References.

1. American Society for Testing and Materials (ASTM):
 - a. A325: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - b. A563: Standard Specification for Carbon and Alloy Steel Nuts.
 - c. A572: Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - d. C76: Standard Specification for Reinforced Concrete, Culvert, Storm Drain, and Sewer Pipe.
 - e. C204: Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus.
 - f. C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
2. American Welding Society (AWS): D1.1: Structural Welding Code - Steel.

120153.02 MATERIALS.

A. Carrier Pipe (within initial support).

1. As specified in Standard Specifications and as shown in the contract documents.
2. Carrier pipe support and bracing: Use manufactured spacers to position and support the carrier pipe within the casing as designed/selected by the Contractor's Professional Engineer. Material shall be sound and compatible to prevent galvanic corrosion. Wood skids will not be allowed.

B. Mixes.

1. Cellular (foam) Concrete Grout
 - a. For use in any length of carrier pipe.
 - b. Design and mix proportions by the Contractor's Professional Engineer.
 - c. Low density, non-bleeding cellular concrete.
 - d. Portland cement and water slurry blended with a high stability pre-generated foaming agent.
 - e. Fluid (10 inch slump), pumpable.
 - f. Wet Density: greater than 30 pounds per cubic foot.
 - g. 28 day Compressive Strength: 100 psi minimum.
 - h. Adjust proportions to meet project requirements.
2. If groundwater is entering the tunnel, the backfill grout shall have a minimum density of 70 pcf so that the water will be displaced by the grout.

C. Equipment.

1. Concrete Pumps: Pumping and pneumatic conveying equipment shall be of suitable, approved types with adequate placing capacity. Carefully control pneumatic placement to prevent segregation of the discharged concrete. Equipment shall be cleaned at the end of each operation.
2. Concrete Conveying Equipment: Concrete conveying equipment shall be designed so as to minimize segregation during hauling and dumping.

D. Source Quality Control.

1. Manufacturer's Certifications: Provide certifications of all testing performed by the pipe manufacturer at the manufacturing site documenting compliance with the standard specifications under which the pipe is manufactured. Certifications shall include, but not be limited to, pipe thickness, pipe strength, stiffness, static pressure tests, material composition, and gasket test requirements.
2. Pipe Material Compliance: Engineer may select an Independent Testing Laboratory (ITL) to perform testing and inspection of pipe materials for compliance with the standards under which the pipe is manufactured. Contractor shall coordinate obtaining access for the Engineer and ITL to pipe manufacturing site for tests and inspections. Contractor shall pay cost of any failed tests or re-inspections necessitated by failure of initial tests or inspection, without any reimbursement under the allowance.

120153.03 CONSTRUCTION.

A. Submittals.

1. Shop Drawings and Product Data: For initial support, carrier pipe, fittings, skids, bracing, and related appurtenances.
 - a. Test results for RCP concrete strength.
 - b. Reinforcing size, shape, yield strength and complete stress-strain curve for each lot of steel used.
 - c. Drawings showing tunnel initial support including plans for contact grouting to fill overcut voids.
 - d. Drawings for carriers, skids, and pipe blocking.
2. Layout drawings showing locations and elevations of various pipe designs.
3. For the items listed below, submit the licensed professional engineer's certification stating that the designs have been prepared by the professional engineer and that the professional engineer will be responsible for their execution.
 - a. Design and calculations for tunnel initial support.
 - b. Design and calculations for carriers, skids, and bracing for the carrier pipe when subjected to placing and grouting activities.
 - c. Inspection reports certifying that the structures built conform to the professional engineer's design.
 - d. Revisions to shop drawings, as necessary, to accommodate field conditions encountered at the site during execution.
4. Material descriptions and mix designs for backfill grout. Bulkhead design, vent and slick lines, and methods for placing backfill grout.
5. Field quality control test results.
6. Certificates of foundry, plant, or factory pipe test and inspection results as required by the standard specifications to which the material is manufactured.
7. Welder certifications consistent with AWS D1.1 Appendix E.
8. Names and project lists for key equipment operators and supervisors.

B. Definitions.

1. Initial Support: The support system installed at the heading immediately following excavation or passage of shield / Tunnel Boring Machine to minimize ground movement and loosening, and to maintain the stability of the excavation. It may include tunnel shield, jacked pipe, steel casing, ribs and lagging, and other means.
2. Skin Tight: Lagging installed such that there are no gaps greater than 1/4 inch between lagging boards.

C. Quality Assurance.

1. Perform all work in conformance with authorities having jurisdiction.
2. Have the following designs prepared by a Professional Engineer, licensed in Iowa, with professional experience in the design and construction of tunneling systems and excavation support systems.
 - a. Tunnel initial support and face control design and construction.
 - b. Support elements shall be designed to provide sufficient capacity to support the ground safely and maintain the shape of the tunnel without encroaching on the final structure as shown on the drawings.

3. Professional Engineer shall inspect the installations he designed to ensure that they are constructed in conformance with the design.
4. Welders shall be certified in accordance with standards of the AWS D1.1 Section 5 Parts B, C, D and E.

D. Site Conditions.

The ground load may be asymmetric in local areas due to sloped soil bedding, irregular overexcavation, asymmetric ground failure, or other causes. Design the initial support to carry these inclined and surcharge loads. Extra bracing may be necessary at these locations.

E. Tunneling with Initial Support.

Steel casing installed by Microtunneling. Conform to Special Provisions for Microtunneling.

F. Carrier Pipe Installation Inside Initial Support.

1. Install the carrier pipe within the initial support as specified herein. Secure pipe to spacers or blocking with straps. Thoroughly inspect each joint prior to insertion into the tunnel. Support carrier pipe within the initial support so that pipe bells do not rest directly on the initial support and minimum clearance is maintained. Distribute the load of the carrier pipe along the initial support with an adequate method of support.
2. Install permanent vertical and lateral blocking to prevent carrier pipe from floating either vertically or laterally during testing and placement of annular space backfill.

G. Backfill Grouting.

1. Thoroughly clean and remove all dirt, debris, and water from the interior of the initial support before placing backfill grout.
2. If water is entering the crown of the tunnel, stop it or divert it around the sides so that it does not affect the integrity of the backfill grout.
3. Construct a solid concrete block and mortar bulkhead in the annular space between the carrier pipe and initial support after the carrier pipe has been installed. Wrap the portion of the carrier pipe passing through the brick bulkhead with three layers of 15 pound asphalt impregnated felt before constructing the bulkhead.
4. After the carrier pipe has been inspected and tested, fill the annular space between initial support and carrier pipe completely with backfill grout in one continuous uninterrupted operation in a manner to prevent the occurrence of any voids between the initial support and the carrier pipe. Place grout from the downstream end and vent as necessary. Pump at a pressure below that which may endanger rupture of the initial support or carrier pipe. After complete filling, maintain a pressure of at least 4 psi for 30 minutes to ensure annular space remains filled. If water is present, provide a means to displace the water with grout.

H. Field Quality Control.

The Engineer may request up to 20 inspection holes at no extra cost to the Contracting Authority to determine the completeness of contact grouting. Drill holes in grout through grout holes or drill new holes at locations selected by the Engineer. The holes shall have a minimum diameter of 1.5 inches. Drill holes in liner as recommended by the manufacturer. If a void is found, the inspection hole will be used as a grout hole. Place grout to fill the void. Holes that encounter voids will not be counted against the inspection hole allowance.

I. Testing and Inspection.

The Contracting Authority's independent testing laboratory shall sample and test backfill grout for slump, shrinkage, and compressive strength as specified in the Standard Specifications at no cost to the Contractor. Take samples of each separate concrete pour.

120153.04 METHOD OF MEASUREMENT.

Tunneling with Initial Support will not be measured for payment.

120153.05 BASIS OF PAYMENT.

Tunneling with Initial Support is incidental to bid item Sanitary Sewer Gravity Main with Casing Pipe, Trenchless, Reinforced Concrete Pipe (RCP), 370D (Class V), 54 in. and will not be paid for separately.