

Section 608 Storm Sewers

608.1 Description

- (1) This section describes providing storm sewer.

608.2 Materials

608.2.1 Pipe

- (1) Furnish pipe consistent with the diameter the bid item indicates. Furnish materials for the various classes of pipe as follows:

TABLE 608-1 ALLOWABLE MATERIALS FOR STORM SEWER CLASSES

CLASS	ALLOWABLE MATERIALS
II	Class II reinforced concrete
III	Class III reinforced concrete
III-A	Class II and Class III reinforced concrete, corrugated polyethylene, corrugated polypropylene
III-B	Class III reinforced concrete, corrugated polypropylene
IV	Class IV reinforced concrete
V	Class V reinforced concrete

- (2) Use materials conforming to the requirements for the class of material named and specified below.
- | | |
|---|----------------------------|
| Reinforced concrete pipe..... | AASHTO M170 |
| Corrugated polyethylene pipe..... | AASHTO M294 S |
| Corrugated polypropylene pipe..... | AASHTO M330 S |
| Composite pipe, couplings, fittings and joint materials | ASTM D2680 |
| Joints using rubber gaskets | ASTM C443 |
| Joints using preformed flexible joint sealants | ASTM C990 |
| External rubber gaskets, mastic, and protective film..... | ASTM C877 |
| Mortar | .519.2.3 |
- (3) Furnish reinforced concrete pipe intended for storm sewers conforming to AASHTO M170, for the class of pipe specified, except for the following requirements. Use a concrete mixture that contains not less than 565 pounds of cementitious materials per cubic yard. Use the one of the following combinations of cementitious materials in the concrete:
- Portland cement only.
 - Portland blast furnace slag cement only.
 - Portland pozzolan cement only.
 - A combination of portland cement and fly ash where the fly ash is between 5 and 25 percent by weight of total cementitious material.
 - A combination of portland cement and ground granulated blast furnace slag where the slag is between 5 and 25 percent by weight of total cementitious material.
- (4) Regardless of the basis of acceptance of the pipe, place reinforcement according to AASHTO M170.
- (5) Furnish an engineer-approved cold-applied bituminous mastic joint sealer with a consistency that enables application to joints with a trowel if air temperatures range from 20 to 100 F.

Add 608.2.1 to specify foundation backfill used for bedding pipe and trench backfill used to backfill above the pipe.

608.2.2 Backfill

608.2.2.1 General

- (1) Furnish virgin materials consisting of either sand-sized particles or sand-sized particles mixed with gravel, crushed gravel, or crushed stone. Do not use materials classified under [301.2.4.3](#) as crushed concrete, reclaimed asphalt, reprocessed material, and blended material. The contractor may use material from the work site.
- (2) Ensure that the material provided has a liquid limit less than or equal to 25 and a plasticity index less than or equal to 6.
- (3) The department will sample and test foundation and trench backfill according to the following:
- | | |
|------------------------------------|------------|
| Sampling ^[1] | AASHTO T2 |
| Percent passing the 200 sieve..... | AASHTO T11 |

Gradation ^[1]	AASHTO T27
Liquid limit.....	AASHTO T89
Plasticity index and plastic limit	AASHTO T90

[1] As modified in [CMM 8-60](#).

- (4) Submit contractor test results for gradation, liquid limit, and plasticity index testing to the engineer for approval before placing backfill. The engineer may waive contractor testing for known sources.
- (5) Submit daily quantities for foundation and trench backfill material requiring department testing to the engineer. Determine quantities at the point of placement by collecting truck tickets as the material is placed or by another engineer-approved method.
- (6) Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction.

608.2.2.2 Foundation Backfill

- (1) Furnish foundation backfill conforming to [520.2.5.2](#).
- (2) The contractor may also furnish crushed stone chips conforming to the following:
 - A minimum of 85 percent by count of the number of particles have at least one machine-fractured face.
 - Gradation conforming AASHTO M43 as follows:

SIEVE	PERCENT PASSING BY WEIGHT	
	AASHTO No. 8 (for pipes ≤ 18-inch diameter)	AASHTO No. 67 (for pipes > 18-inch diameter)
1-inch	—	100
3/4-inch	—	90 - 100
1/2-inch	100	—
3/8-inch	85 - 100	20 - 55
No. 4	10 - 30	0 - 10
No. 8	0 - 10	0 - 5
No. 16	0 - 5	—

608.2.2.3 Trench Backfill

- (1) Furnish trench backfill material conforming to [209.2](#) or [520.2.5.2](#).

608.3 Construction

608.3.1 Excavation

608.3.1.1 General

- (1) Unless the contract specifies otherwise or the engineer allows, perform sewer construction in open trenches and in a way that protects pipelines or sewers from unusual stresses.

Revise 608.3.1.1(2)-(4) to add requirements for trench dimensions that are the same as specified for culvert pipe.

- (2) Place and compact the embankment to at least one foot above the elevation of the top of the storm sewer pipe before excavating the trench. Perform trenching, shoring, and excavating according to 29 CFR part 1926, OSHA subpart P. If utilities and other restraints make sloping or benching of the excavation impracticable, employ a shoring system.

http://www.dol.gov/dol/cfr/title_29/
- (3) Make trenches wide enough to provide free working space on each side of the pipe. This space shall not exceed 1/2 the nominal diameter of the pipe, and never be less than 6 inches. The required working space shall depend upon the size of the pipe and the character of the material in the excavation; however, always provide sufficient space between the pipe and the sides of the trench to allow for preparing the foundation, laying the pipe, and placing and compacting the backfill. If the height of the proposed embankment or earth cover above the top of the pipe exceeds 6 feet, excavate the trench below the top of the pipe as vertical as possible.
- (4) For steel or concrete pipe, make the trench wide enough to allow for preparing the foundation, laying the pipe, and placing and compacting backfill, except that the trench width shall not exceed the pipe's outside diameter by more than 36 inches. For polyethylene and polypropylene pipe, conform to [ASTM D2321](#) and ensure that the trench is as wide or wider than the pipe outside diameter plus 16 inches or the pipe outside diameter times 1.25 plus 12 inches whichever is wider.
- (5) Excavate the trenches in reasonably close conformity with the plans and as the engineer laid out in the field. Begin trench excavation at the proposed sewer outlet and proceed toward the upper end.
- (6) Keep the trenches dewatered until the joint material sufficiently hardens.

- (7) If the contract specifies or the engineer allows, the contractor may construct sewers by tunneling or jacking instead of open trenching. Adhere to the construction details the plans show, the contract specifies or the engineer establishes.
- (8) Understand that the inlet and discharge elevations for storm sewers the plans show, are subject to revisions in order to fit field conditions, and the engineer may adjust the profile grades from those the plans show.
- (9) If using sheeting or shoring in excavation, remove sheeting and braces in a way that does not disturb the completed work. **Backfill displaced areas with material conforming to [608.2.2](#) and place foundation backfill conforming to [608.3.2](#) and place trench backfill conforming to [608.3.5](#).**

608.3.1.2 Rock Excavation for Storm Sewer

- (1) Classify rock excavation for storm sewer as specified for rock excavation in [205.2.3](#), except include rock boulders with a volume of 1/2 cubic yard or more.

608.3.2 Constructing Foundation

Revise 608.3.2 to restrict the lift thickness for placing foundation backfill to 6 inches.

- (1) Construct the foundation in the trench to prevent subsequent settlement and rupture of the sewer pipe.
- (2) **Excavate the trench to at least 6 inches below the elevation established for the bottom of the pipe. Backfill to this depth with foundation backfill. Mechanically compact foundation backfill before laying the pipe. After laying the pipe, place and mechanically compact foundation backfill to an elevation of 12 inches above the pipe to provide full and continuous support. Do not place lifts more than 6 inches thick as measured after compaction. Compact the entire layer before placing the next layer. Do not compact by flooding if using foundation backfill with a dense-graded base gradation.**
- (3) If the engineer determines that existing foundation material for at least 6 inches below the bottom of the pipe conforms to [608.2.2.2](#); the contractor need not excavate, backfill, or shape the bed under the pipe.
- (4) If rock, hardpan, or fragmented material exists, excavate the trench below the pipe to a depth equal to 1/2 inch per foot of proposed embankment above the top of the pipe, but not less than 6 inches. Construct the foundation and backfill to 12 inches above the pipe with foundation backfill as specified above.
- (5) Excavate recesses to receive bells if necessary.
- (6) If the contractor cannot obtain the proper bearing for the sewer, excavate unsuitable material and backfill with foundation backfill.

608.3.3 Laying Pipe

- (1) Begin laying pipes in finished trenches at the lowest point and proceed towards the upper end, also lay the pipe so the spigot or tongue ends point in the direction of flow.
- (2) Clean sockets carefully before lowering pipes into trenches. Lower and place the pipes to avoid unnecessary handling in the trench or damage to the pipe. Provide a firm bearing beneath the entire length of each section and make it substantially true to the line and grade required.
- (3) Lay pipes with ends abutting. Take care when shoving the pipes together so the joints are properly adjusted and not overly large. Fit and match the pipes so that if set firmly in line and grade they form a sewer with a smooth and uniform invert.
- (4) Provide joint ties on storm sewer system in fall and outfall pipes. Tie the last 3 sections or, if using apron endwalls, the endwall and the last 2 sections. Ties are not required on installations with masonry endwalls unless the plans show otherwise.
- (5) After installing the pipe, seal lift holes with suitable concrete or other engineer-approved plugs.
- (6) If it is difficult to obtain the size pipe the plans or the contract specifies, the contractor may, with the engineer's approval, provide a larger size.

608.3.4 Joints

- (1) Make joints for concrete pipe with portland cement mortar, annular rubber or plastic gaskets, external rubber gaskets, or engineer-approved mastic joint sealer, as specified below, or by a combination of these types, unless the plans or contract special provisions specify the type to use.
- (2) If using mortar or trowelable mastic joint sealer, fill the joint with mortar or mastic sealer and wipe the inside of the joint and finish smooth.
- (3) If using annular rubber or plastic gaskets, fit the gasket snugly into the annular space between the surfaces of the connecting parts of the pipe sections to form a flexible, watertight joint.
- (4) If using preformed mastic joint sealer, remove sharp edges and protrusions from pipe joint surfaces and clean dust, dirt, and other foreign matter from them. The contractor may use of a primer. If using a primer, use the type recommended by the preformed seal manufacturer. After the primer dries, remove the

wrapper from one side of the seal only and press the seal to the primed surface. When ready to assemble, remove the remaining wrapper and fit the pipe sections in place. Shove the pipe sections together at the required alignment. Make seals of sufficient size so that after the pipe sections are in their final position a squeeze-out of the seal is evident around the joints exterior circumference. Remove and make flush with the interior pipe wall, any extrusion of the seal inside the pipe.

- (5) Place external rubber as the manufacturer specifies and the engineer approves.
- (6) Seal joints for composite pipe with standard couplings and solvent cement or with rubber or plastic gaskets. Follow the manufacturer's directions.

608.3.5 Backfilling Trenches

- (1) Deposit backfill material in all trenches and excavations immediately after placing sewer pipe in a way that causes no damage to the pipe. Fill the trench simultaneously on both sides of the sewer without causing injurious side pressures.
- (2) Place trench backfill from 1 foot above the top of the pipe to the top of the subgrade in layers no more than 8 inches thick after compaction. Mechanically compact the entire length of each layer to the same degree as the material next to the trench before placing the next layer.
- (3) If puddling or flooding is required or approved for consolidating backfill or crushed stone chips; do not perform the first flooding until after backfilling the trench or excavation to at least 2 feet above the top of the pipe, and after compacting the backfill by tamping. Perform the second flooding after the previous trench filling and after compacting in uniform layers. Avoid excess water to minimize pressure on the pipe. Do not puddle or flood if using 3/4-inch or 1 1/4-inch dense-graded base.
- (4) Do not walk or work on the completed pipe, except as necessary to tamp or backfill, until backfilling the trench to at least 2 feet above the top of the pipe.

608.3.6 Clean Out

- (1) Clean new or re-laid sewers of accumulations of silt, debris, and other foreign matter, and before acceptance, test all installations with water or other engineer-approved methods. These tests must indicate unimpeded flow.
- (2) Clean existing sewers of silt, debris, and other foreign matter that accumulated due to the contractor's operations.

608.3.7 Deflection Testing

- (1) The department accepts polyethylene and polypropylene pipe based on testing with a department-approved mandrel. Test pipe as the engineer directs after installation but before paving or finish grading.
- (2) Provide a mandrel with a diameter equal to 92.5 percent of the pipe's nominal diameter and having cable attachment points on each end of the core. Ensure that the mandrel has nine fins or legs permanently marked to designate the pipe size and the allowable percent deflection.
- (3) The engineer will designate at least 10 percent of the installed length of pipe for testing. The mandrel must pass through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, engineer may require additional testing.
- (4) Relay or replace pipe with deflection greater than 5 percent. Retest all relayed or replaced pipe.

608.3.8 Restoring the Work Site

- (1) Restore the worksite to its original condition. Provide topsoil and seeding, patch overlying pavements or sidewalk, and perform other related work as the engineer directs.

608.4 Measurement

608.4.1 Pipe Sewers

- (1) The department will measure the Storm Sewer Pipe bid items by the linear foot acceptably completed. This measurement equals the distance along the centerline of the pipe, from the pipe end at a free outlet to the center of the end catch basin, manhole, inlet, junction or other drainage structure; or from center to center of catch basins, end manholes, inlets, other drainage structures or junctions. The department will make no deduction from these measured lengths for intermediate catch basins, manholes, inlets, other drainage structures, junctions, or fittings.

608.4.2 Rock Excavation for Storm Sewer

- (1) The department will measure Storm Sewer Rock Excavation by the cubic yard acceptably completed. The department will measure this work in its original position and compute the volume, excluding boulders, by the method of average end areas.
- (2) The department will measure boulders of 1/2 cubic yard or more as specified for boulders and surface stone greater than one cubic yard in [205.4.1](#).

- (3) The department will measure this work vertically from the top of the rock to the bottom of the rock, or to an elevation 6 inches below the bottom of the pipe, whichever is higher. The department will measure this work horizontally as the outside diameter of the pipe plus 3 feet, 1 1/2 feet on either side, regardless of actual width required under [608.3.1.1](#).

608.5 Payment

608.5.1 General

Revise 608.5 to clarify payment for water used for compaction and dust control.

- (1) The department will pay for measured quantities at the contract unit price under the following bid items:

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
608.0005	Storm Sewer Rock Excavation	CY
608.0200 – 0299	Storm Sewer Pipe Reinforced Concrete Class II	LF
608.0300 – 0399	Storm Sewer Pipe Reinforced Concrete Class III	LF
608.0400 – 0499	Storm Sewer Pipe Reinforced Concrete Class IV	LF
608.0500 – 0599	Storm Sewer Pipe Reinforced Concrete Class V	LF
608.3000 - 3099	Storm Sewer Pipe Class III-A	LF
608.3600 - 3699	Storm Sewer Pipe Class III-B	LF
608.6000 - 6099	Storm Sewer Pipe Composite (inch)	LF

- (2) Payment for the 608 bid items also includes water for compaction and dust control, except if the contract contains the Water bid item, the department will pay separately for water under [624.5](#).

608.5.2 Pipe for Storm Sewer

- (1) Payment for the Storm Sewer Pipe bid items is full compensation for providing storm sewer; for excavating, except for rock excavation; for providing and removing sheeting and shoring; for constructing the foundation and backfilling; for cleaning out; and for restoring the work site.

608.5.3 Rock Excavation for Storm Sewer

- (1) Payment for Storm Sewer Rock Excavation is full compensation for all rock excavation and disposal. If the contract does not contain the Storm Sewer Rock Excavation bid item, the department will pay for the required excavation as specified for extra work in [109.4](#).