4.2 Pipe Materials

The City of Portland Standard Construction Specifications describe a variety of pipeline materials acceptable for use on public projects within the City. BES does not approve, for use in the construction of public sewers, of all the pipe material types presented in the Standard Construction Specifications. Designers shall ensure all designs allow for the use of accepted materials that conform to this Manual and all applicable sections of the Standard Specifications and Standard Details.

At times, the selection and use of an alternate pipeline material may be necessary to address a specific design or construction issue. BES shall receive and review submittal information for these alternate materials before incorporation into a project. Should BES make special consideration to use an alternate product, it will be for the specific project and circumstances in question and will not be interpreted as a general approval for use elsewhere. A designer proposing an alternate material shall follow the variance process (Refer to Chapter 2, The Variance Process – Requesting a Change from these

Standards.) Designers shall provide documentation on the plans citing any alternate material approved for use. If the material specification is lengthy or complex, provide supplemental data to the Special Specifications.

4.2.1 Pipeline Materials

Historically, most public sanitary, combination and storm sewers (including culverts) were of rigid pipe materials. The primary material used has been concrete pipe conforming to either ASTM C-14 (non-reinforced) or C-76 (reinforced). The development and improvement of thermoplastic pipe materials has increased the use of flexible pipe throughout the City. BES has identified a limited number of rigid and flexible pipeline materials as being acceptable for public sewer projects. BES must review alternate materials before their use on any project.

Materials for pipe 15-inches in diameter and smaller - including sanitary sewer laterals - include non-reinforced and reinforced concrete, polyvinylchloride (PVC) or solid-wall high-density polyethylene (HDPE). For pipes larger than 15- but less than 36-inches in diameter, non-reinforced concrete, reinforced concrete and HDPE are suitable materials. Pipe 36-inches in diameter and larger shall use reinforced concrete or HDPE. The design live and dead load conditions as well as depth of burial and constructability factors limit the choice of material available to a designer.

Table 4.1 presents the pipe and joint materials that BES accepts for gravity and pressure sanitary, storm, and combined sewer systems. Designer must note the pipe material, specification and strength class on the construction plans along with the bedding class or method. Do not change pipeline materials between manholes.

Use of Alternate Pipe Materials

A designer may select pipe manufactured to industry standards for special projects or conditions. For example, when a sewer is to be designed to flow under highly surcharged conditions, or where groundwater levels are excessive, reinforced concrete low-head pressure pipe might be considered. In areas where hydrogen sulfide may create corrosion problems, such as downstream from pumping station or pressure sewer discharge, a designer may want to specify PVC, Solid Wall HDPE or Fiberglass pipe be used if available in the required diameter. Other situations involving pipe rehabilitation might require investigation of HDPE stud liner, PVC T-Lock or RCP with extra “sacrificial” concrete or other special protective lining to address project conditions. BES will review any proposal to use pipe material not listed in Table 4.1.

4.2.2 Joints

Each joint or opening provides a potential path for extraneous water and tree roots intrusion. To improve the operational efficiency of a sewer, designers should always attempt to design a system that minimizes the number of joints.

Design all public gravity sewers with standard mechanical joint couplings and fittings. The advent of new pipe materials, increased pipe segment length, and improved mechanical joint/gasket and coupling design help to reduce the number of pathways for infiltration and root intrusion.

Table 4.1 Gravity Sewers - Standard Pipeline and Joint Materials

SEWERS 4-INCHES THROUGH 15-INCHES IN DIAMETER INCLUDING SEWER LATERALS: 6-INCH DIAMETER LATERALS TO NEW SEWERS, 4-INCH DIAMETER LATERALS WHEN TAPPING OR CONNECTING TO EXISTING SEWERS		
Pipe Type and Material	**ASTM Standard Reference**	
	Pipe	**Joint**
Polyvinylchloride (PVC)	ASTM D3034, SDR 35 and 26 AWWA C 900, Class 150	ASTM D3212 ASTM D3139
Non-reinforced Concrete	ASTM C-14, Class 3, ASTM C985	ASTM C443
High Density Polyethylene (HDPE) PE 3408	ASTM D3350, ASTM F714 DR 26, 21, 17 and 11	Standard Mechanical HDPE couplings or fusion welding ASTM D3261
Reinforced Concrete	ASTM C-76, Classes III, IV & V	ASTM C443
SEWERS 16-INCHES THROUGH 36-INCHES IN DIAMETER		
Pipe Type and Material	**ASTM Standard Reference**	
	Pipe	**Joint**
High Density Polyethylene (HDPE) PE 3408	ASTM D3350, ASTM F714 DR 26, 21, 17 and 11	ASTM D3261
Non-reinforced Concrete	ASTM C-14, Class 3, ASTM C985	ASTM C443
Reinforced Concrete	ASTM C-76, Classes III, IV & V	ASTM C443
SEWERS GREATER THAN 36-INCHES IN DIAMETER		
Pipe Type and Material	**ASTM Standard Reference**	
	Pipe	**Joint**
High Density Polyethylene (HDPE) PE 3408	ASTM D3350, ASTM F714 DR 26, 21, 17 and 11	ASTM D3261
Reinforced Concrete	ASTM C-76, Classes III, IV, & V ASTM C-655 for Class III larger than 108", Class IV larger than 84" and Class V larger than 72".	ASTM C443

4.2.3 Fusion Welding

HDPE pipe is the only pipe material that employs fusion welding to join segments. BES accepts as a standard practice the fusion welding of HDPE pipe. BES also allows joining HDPE pipe with standard push-on couplings and mechanical coupling devices as long as the fittings are made from HDPE or steel that are pressure rated compatible with the pipe. Situations when fusion welded HDPE pipe could be used are: slip lining, pipe bursting, force main, where contaminated soil or groundwater exists or on steep slopes.

When encountering contaminated soil, a designer will need to determine the contaminant type. Research has shown solvents with low molecular weight or organic solvents and their vapors can permeate some plastic pipe materials and some elastomeric gasket materials. Material selection must insure no leaching of the contaminant through the pipe wall or joint to the pipe interior. HDPE and PVC gasketed

fittings are also subject to this potential leaching.

Only pressure applications and other critical installations require that a data logger record and document the joint quality and integrity of the fusion welded system.

4.2.4 Selection of Pipe Class and Wall Thickness

Polyvinyl Chloride Pipe (PVC) ASTM D3034 and High Density Polyethylene Pipe (HDPE) ASTM F 714.

When bedded and backfilled in accordance with the Standard Detail for Flexible Pipe Bedding (Standard Plan 4-02) both PVC and HDPE pipe are suitable for installation up to 18 feet of cover measured from the pipe invert.

For depth greater than 18 feet, either the contract documents must be modified to provide better bedding/backfill, or specify stronger pipe material, such as Ductile Iron pipe or a thick-walled plastic pipe.

Concrete Pipe ASTM C 14 and ASTM C 76.

Pipe class selection for a new installation for various depths of cover is determined using the information in this chapter as well as the referenced ASTM standards. A designer should note that construction conditions including the bedding, backfill, trench width and all other criteria are assumed to be in accordance with BES specifications and Standard Plans. For conditions that differ from these criteria, special analysis is required to support a design.

Regardless of the pipe type, the design calculations should generally follow the procedures presented in this Manual as well as any additional information available from manufacturer's literature.