

considered if justified on the basis of extensive documentation.

3) Combined Sewer Interceptors

Intercepting sewers, in the case of combined sewer systems, should fulfill the above requirements for sewers and have sufficient additional capacity to transport the increment of combined sewage required by the IPCB Regulations.

c) Alternate Methods

When deviations from subsections (a) and (b) are proposed, a description of the procedure used for sewer design shall be included in the submission of plan documents.

d) Basis of Design and Calculations

The basis of design for all sewer projects shall accompany the plan documents. Calculations shall be submitted to show that sewers will have sufficient hydraulic capacity to transport the design peak flows.

(Source: Amended at 21 Ill. Reg. 12444, effective August 28, 1997)

<BSection 370.320 Details of Design and Construction>>

a) Minimum Size

No public gravity sewer conveying raw sewage shall be less than 8 inches in diameter.

b) Depth

Sewers shall be sufficiently deep to prevent freezing. Sewers should be sufficiently deep to serve basements except where overhead sewers are required by local ordinances or will be provided.

1) Minimum Cover

The minimum cover of sewers shall be no less than 3 feet unless special structural protection is provided.

2) Buoyancy

Where high ground water conditions are anticipated, buoyancy of sewers shall be considered and, if necessary, adequate provisions should be made for protection.

c) Slope

1) All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The following minimum slopes shall be provided; however, slopes greater than these are desirable:

Minimum Slope in Feet

Sewer Size	Per 100 Feet	Flow (mgd)
8 inch	0.40	0.49
10 inch	0.28	0.75
12 inch	0.22	1.07
14 inch	0.17	1.43
15 inch	0.15	1.61
16 inch	0.14	1.85
18 inch	0.12	2.35
21 inch	0.10	3.23
24 inch	0.08	4.13
27 inch	0.067	5.17
30 inch	0.058	6.37
33 inch	0.050	7.66
36 inch	0.046	9.23
42 inch	0.036	12.41

2) Under special conditions, if detailed justifiable reasons are given, slopes slightly less than those required for the 2.0 feet per second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the design engineer must furnish with his report his computations of the depths of flow in such pipes at minimum, design average, and design peak rates of flow. It must be recognized that decreased slopes may cause additional sewer maintenance expense and special linings or materials should be considered for corrosion protection.

3) Uniform Slope

Sewers shall be laid with uniform slope between manholes.

4) Steep Slope Protection

Sewers on 20 percent slope or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

- A) Not over 36 feet center to center on grades 20 percent and up to 35 percent.
- B) Not over 24 feet center to center on grades 35 percent and up to 50 percent.
- C) Not over 16 feet center to center on grades 50 percent and over.

d) Alignments

1) Straight Alignments

Except as noted in subsection (d)(2), all sewers shall be laid with straight alignments between manholes.

2) Curvilinear Alignments

Curvilinear sewers are permitted in special cases provided the following minimum requirements are met:

A) Curvilinear Sewers 24 Inches in Diameter and Smaller

- i) Location: Curvilinear alignments should follow the general alignment of streets.
- ii) Type Curve: Only simple curve design is acceptable.
- iii) Radius of Curvature: The minimum allowable radius of curvature is 300 feet.
- iv) Manholes: Manholes are required at the beginning and end of all curves.
- v) Joints: Compression joints are required. The ASTM or AWWA maximum allowable deflection of the pipe joints shall not be exceeded.
- vi) Velocity: In order to maintain a minimum velocity of 2 feet per second in curvilinear sewers, hydraulics of the curvilinear alignment shall be taken into account and the minimum slopes indicated in subsection (c)(1) must be increased accordingly.

B) Curvilinear Sewers 24 Inches Through 48 Inches in Diameter

Curvilinear sewers larger than 24 inches in diameter up to 48 inches in diameter constructed with pressure pipe meeting AWWA standards may be used. Other curvilinear sewers larger than 24 inches in diameter up to 48 inches in diameter shall meet the requirements of subsection (d)(2)(A) except that the joints must be manufactured so that they fit together squarely without deflection at the design curvature and the radius of curvature may be less than 300 feet.

C) Curvilinear Sewers Larger Than 48 Inches in Diameter

Curvilinear sewers larger than 48 inches in diameter shall be provided with square fitting compression joints and shall meet the requirements of subsection (d)(2)(A)(vi). The remaining design requirements under subsection (d)(2)(A) for these sewers will be reviewed by the Agency on a case by case basis.

e) Increasing Size

When a smaller sewer joins a larger one, the invert of the larger

sewer should be sufficiently lower to maintain the energy gradient. An approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

f) High Velocity Protection

Where velocities greater than 15 feet per second are attained, the special provisions described in subsection (c)(4) shall be made to protect against displacement by erosion and shock.

g) Materials and Installation

1) Materials

A) Any generally accepted material for sewers will be given consideration, but the material selected should be suitable for local conditions, such as character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion, structural considerations and similar problems.

B) All sewers shall be designed and installed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. When the bearing strength of the pipe is not adequate to withstand the superimposed loading, other pipe material, special handling, concrete cradle or special construction shall be used.

C) For new pipe materials for which ASTM standards have not been established (see subsection (g)(2)), the designing engineer shall provide complete installation specifications developed on the basis of criteria adequately documented and certified in writing by the pipe manufacturer to be satisfactory for the design conditions for the specific project. Such documentation and manufacturers' certification shall be submitted as a part of the project plan documents.

2) Installation

A) Standards

i) Installation specifications shall contain appropriate requirements based on the criteria, standards and requirements established by ASTM. Requirements shall be set forth in the specifications for the pipe and methods of bedding and backfilling thereof so as not to damage the pipe or its joints, impede cleaning operations and future tapping, nor create excessive side fill pressures or ovalation of the pipe, nor seriously