

Values of the Roughness Coefficient N

TYPE OF CHANNEL AND DESCRIPTION	MIN.	NOR.	MAX.
CLOSED CONDUITS FLOWING PARTLY FULL			
METAL			
Brass, Smooth	0.009	0.010	0.013
Steel			
1. Lockbar and Welded	0.010	0.012	0.014
2. Riveted and Spiral	0.013	0.016	0.017
Cast Iron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
Wrought Iron			
1. Black	0.012	0.014	0.015
2. Galvanized	0.013	0.016	0.017
Corrugated Metal			
1. Subdrain	0.017	0.019	0.021
2. Storm Drain	0.021	0.024	0.030
NONMETAL			
Lucite	0.008	0.009	0.010
Glass	0.009	0.010	0.013
Polyethylene	0.009	0.009	—
PVC (polyvinyl chloride)	0.009	0.009	—
Cement			
1. Neat, Surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
Concrete			
1. Culvert, Straight and Free of Debris	0.010	0.011	0.013
2. Culvert w/Bends, Connections, Some Debris	0.011	0.013	0.014
3. Finished	0.011	0.012	0.014
4. Sewer w/Manholes, Inlet, etc., Straight	0.013	0.015	0.017
5. Unfinished, Steel Forms	0.012	0.013	0.014
6. Unfinished, Smooth Wood Form	0.012	0.014	0.016
7. Unfinished, Rough Wood Form	0.015	0.017	0.020
Wood			
1. Stave	0.010	0.012	0.014
2. Laminated, Treated	0.015	0.017	0.020
Clay			
1. Common Drainage Tile	0.011	0.013	0.017
2. Vitrified Sewer	0.011	0.014	0.017
3. Vitrified Sewer w/Manholes, Inlet, etc.	0.013	0.015	0.017
4. Vitrified Subdrain w/Open Joint	0.014	0.016	0.018
Brickwork			
1. Glazed	0.011	0.013	0.015
2. Lined w/Cement Mortar	0.012	0.015	0.017
3. Sanitary Sewers Coated w/Sewage Slimes, w/Bends and Connections	0.012	0.013	0.016
4. Paved Invert, Sewer, Smooth Bottom	0.016	0.019	0.020
5. Rubble Masonry, Cemented	0.018	0.025	0.030

- Min = Minimum
- Nor = Normal
- Max = Maximum

Manning's Equation

Used for open channel flow (natural or man-made).

$$V = \frac{K}{N} R^{2/3} S_e^{1/2} \text{ or } Q = \frac{K}{N} A R^{2/3} S_e^{1/2}$$

Where:

V= Average velocity of pipe in channel [ft./sec.].

K= 1.49 for U.S. units; 1 for metric units.

A= Area of channel [ft.²].

R= Hydraulic radius (area ÷ perimeter) [ft.].

S_e= Slope of energy grade line [ft./ft.].

N= Manning's roughness coefficient from table (non-dimensional).

Q= Flow in cu. ft./sec.