

Manning's Equation

Civil Engineering

Open channel flow from slope and roughness.

Uniform open channel flow is set by slope, roughness and the shape of the wetted cross-section.

$$v = R^{(2/3)} S^{(1/2)} / n \cdot R = A/P$$

Concrete pipe

$n \approx 0.013$

Smooth surface.

Weedy earth channel

$n \approx 0.035$

Rough and slow.

Pipe running half full

$R = D/4$

As for full bore.

THE COMMON MISTAKE

✗ **Dividing area by the full perimeter**

✓ **Divide by the wetted perimeter**

Hydraulic radius is flow area over wetted perimeter. The free water surface is not a boundary, so it never counts toward P.

Educational reference. Manning assumes steady uniform turbulent flow, and roughness values carry wide uncertainty.