Continuous Grades

The water flowing in the section of a gutter inlet occupied by the grate is called *frontal flow*. When the gutter flow velocity is low enough, the grate inlet intercepts all of the frontal flow and a small portion of the *side flow*, which occurs along the length of the grate. As the gutter flow velocity increases, water may begin to skip, or *splash over*, the grate and the efficiency of the inlet may be reduced. If splash-over does not occur, the capacity and efficiency of a gutter inlet will increase with an increase of the longitudinal slope (the reverse of the effect on kerb-opening and slotted inlets).

The ratio of frontal flow to total gutter flow for a straight cross slope (see Figure A3-1) is expressed as:

$$\mathbf{E_o = Q_w / Q = 1 - (1 - W/T)^{2.67}} \qquad \textbf{(Eq. A3-16)}$$

where:

E_o = ratio of frontal flow to total gutter flow
Q_w = frontal flow in width (W), in m^3/sec
Q = total gutter flow, in m^3/sec
W = width of gutter inlet or grate (see Figure A3-5), in m
T = total spread of water in the gutter (see Figure A3-1) in m

The ratio of side flow to total gutter flow is expressed as:

$$\mathbf{Q_s/Q = 1 - Q_w/Q = 1 - Eo} \qquad \textbf{(Eq. A3-17)}$$

where:
Q_s = side flow intercepted by gutter inlet, in m^3/sec
Q = total gutter flow, in m^3/sec
Q_w = frontal flow in width (W), in m^3/sec
E_o = ratio of frontal flow to total gutter flow (see Equation A3-16)

The ratio of intercepted frontal flow to total frontal flow is expressed as:

$$\mathbf{R_f = 1 - 0.09\ (v - v_o)} \qquad \textbf{(Eq. A3-18)}$$

where:
R_f = ratio of intercepted frontal flow to total frontal flow
v = average velocity of gutter flow, in m/sec
v_o = average gutter velocity where splash-over first occurs, in m/sec

The ratio of intercepted side flow to total side flow is expressed as:

$$\mathbf{R_s = 1 / \{1 + [(0.15\ (3.28v)^{1.8}) / (S_x\ (3.28L)^{2.3})]\}} \qquad \textbf{(Eq. A3-19)}$$

where:
R_s = ratio of intercepted side flow to total side flow
v = average velocity of gutter flow, in m/sec
S_x = cross slope of gutter, in m/m
L = length of grate, in m