Example Problem 4A-8_2, Evaluate SW-549 Installed in a Sag

Determine if an SW-549 barrier grate intake will function sufficiently for a 50 year storm.

Given:

Maximum allowable spread, T = 8 ft.

Flow from left side of intake Q_L = 1.05 ft^3/s.

Flow from right side of intake Q_R = 0.88 ft^3/s.

Manning's coefficient for new pavement: n = 0.016.

Cross slope: S_x = 0.03 ft/ft.

Solution:

1. Total flow $Q_i = Q_L + Q_R = 1.05 + 0.88 = 1.93\ ft^3/s$.
2. Start by assuming weir flow. Use Equation 4A-8_9 with P = 7.52 ft (the perimeter of a Type S grate) to solve for average depth (d):

$$d = \left(\frac{Q_i}{C_w P}\right)^{2/3} = \left(\frac{1.93}{3.0 \times 7.52}\right)^{2/3} = 0.19 \text{ ft.}$$

   This is less than 0.4 feet, so the assumption of weir flow is correct.

3. Approximate the spread (T) at the grate using Equation 4A-8_12:

$$T = \frac{d}{S_x} = \frac{0.19}{0.03} = 6.33 \text{ ft.}$$

   This is less than the maximum allowable spread of 8 feet, so an SW-549 is adequate.

Discussion:

The designer will need to check spread to the left and right of the intake to verify they are less than allowable spread.

The designer will also need to verify this intake will function sufficiently for a 100-year storm. For the 100-year storm, encroachment must not exceed that allowed by Table 1 of Section 4A-6. In addition, the designer needs to check for potential roadway crown or curb overtopping.

This example ignores the effect of clogging. Clogging is typically not an issue with barrier intakes located on rural facilities, which tend not to accumulate debris (e.g. leaves and branches). However, in an urban area, debris from landscaping, as well as trash (e.g. food wrappers and pop cans/bottles) can lead to clogging, and in these areas designers may want to consider a including a clogging factor as part of their intake calculations.