8.8 Roadway Overtopping

8.8.1 General

Roadway overtopping will begin when the headwater rises to the elevation of the roadway. The overtopping will usually occur at the low point of a sag vertical curve on the roadway. The flow will be similar to flow over a broad crested weir. Flow coefficients for flow overtopping roadway embankments are found in HDS No. 1, Hydraulics of Bridge Waterways, as well as in the documentation of HY-7, the Bridge Waterways Analysis Model. Curves from the latter are included in Figure 8-9. The roadway overtopping flow rate can be determined using the following equations.

$$\mathbf{Q_r = C_d\, L\, HW_r^{1.5}} \qquad \textbf{(8.9)}$$

Where: Q_r = overtopping flow rate, m^3/s (ft^3/s)
C_d = overtopping discharge coefficient (weir coefficient) = $k_t\, C_r$
k_t = submergence coefficient
C_r = discharge coefficient
L = length of the roadway crest, m (ft)
HW_r = the upstream depth, measured above the roadway crest, m (ft)

8.8.2 Length

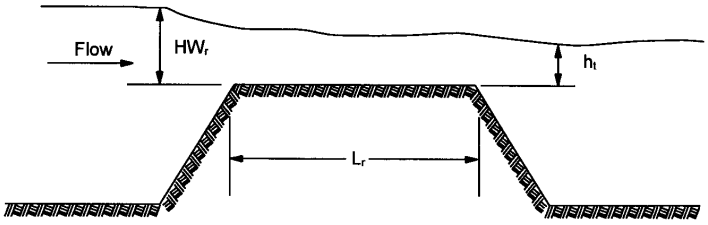
The determination of length versus HW is difficult to define when the length of the crest is defined by a roadway sag vertical curve.

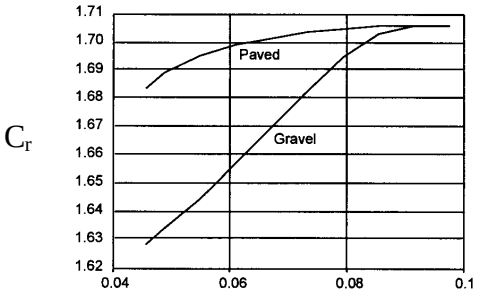
- It is recommended to subdivide the length into a series of segments. The flow over each segment is calculated for a given headwater. The flows for each segment are added together to determine the total flow.
- As an approximation, the length can be represented by a single horizontal line (one segment). The length of the weir is the horizontal length of this segment. The depth is the average depth (area/length) of the upstream pool above the roadway.

8.8.3 Total Flow

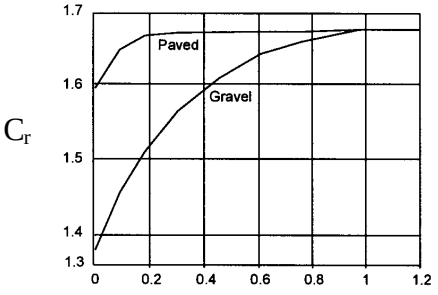
Total weir flow is calculated for a given upstream water surface elevation using equation 8.9.

- Roadway overflow plus culvert flow must equal total design flow.
- A trial and error process is necessary to determine the flow passing through the culvert and the amount flowing across the roadway.
- Performance curves for the culvert and the road overflow may be summed to yield the overall performance characteristics at the crossing.



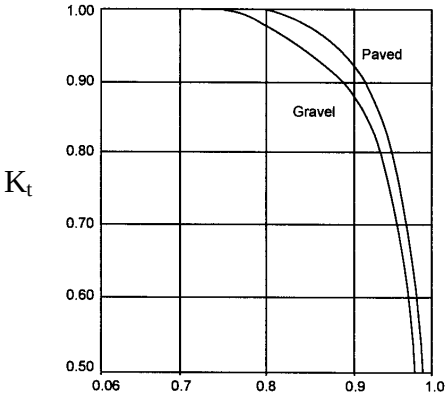


HW_r (m)
Discharge Coefficient for
$HW_r/L_r > 0.15$



HW_r (m)
Discharge Coefficient for
$HW_r/L_r \leq 0.15$

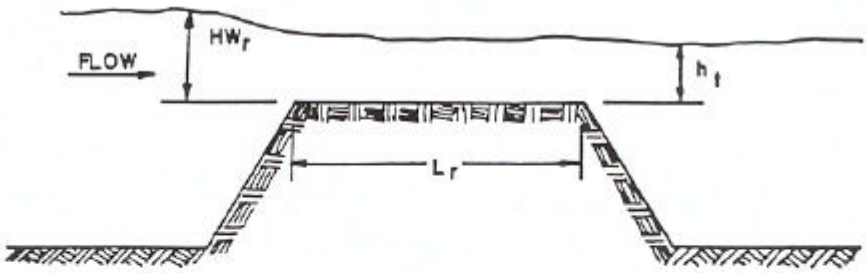
$C_d = k_t C_r$
C_r = Coefficient of Free Discharge
k_t = Adjustment Factor for Submerged Weir Flow
(TW is Higher Than Roadway Elevation)
$Q_r = C_d L HW_r^{1.5}$



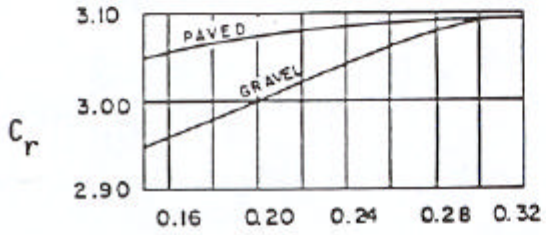
h_t/HW (m)
Submergence Factor

Discharge Coefficients for Roadway Overtopping

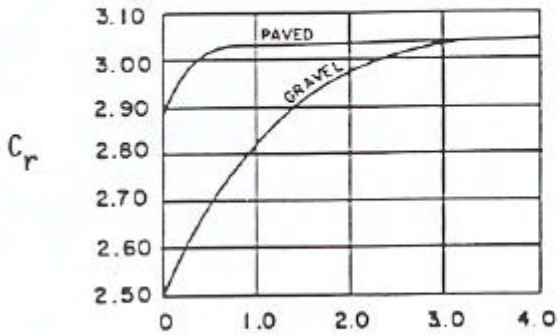
Figure 8-9 Curves for Roadway Overtopping (Metric units)



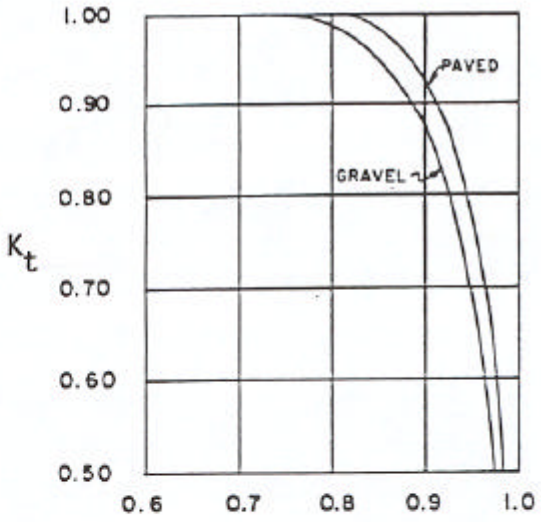
$C_d = k_t C_r$
C_r = Coefficient of free discharge
K_t = Adjustment factor for submerged flow
$Q_r = C_d L H W_r^{1.5}$



HW_r (ft)
Discharge Coefficient for
$HW_r/L_r > 0.15$



HW_r (ft)
Discharge Coefficient for
$HW_r/L_r \leq 0.15$



h_t/HW (ft)
Submergence Factor

Figure 8-9.1 Curves for Roadway Overtopping (English units)