Other considerations include inconvenience, hazards, and nuisances to pedestrian traffic and buildings adjacent to roadways which are located within the splash zone. These considerations should not be minimised and, in some locations such as commercial areas, may assume major importance.

For urban multi-lane kerbed roadways designed for less than 80 kph with no parking and no shoulders, it is not practical to avoid travel lane flooding when longitudinal grades are flat or less than 1.0 percent. However, flooding shall never exceed the lane adjacent to the kerb or shoulder for design conditions. Bridges with kerbs and no shoulders should also use this criterion. For single-lane roadways, such as ramps at interchanges, at least 2.5 metres of roadway shall remain unflooded for design conditions. For design speeds of 80 kph and greater on roads with shoulders, the design storm runoff shall not impinge on the travel way.

### A3.4.2 Gutter Fundamentals

A pavement gutter is the section of a roadway normally located at its outer edge to convey stormwater runoff. It may include a portion of a travel lane or be a separate section at the edge of the travel way or at the edge of the shoulder, but it usually has a triangular shape defined by the cross slope and kerb. In lieu of kerbs, it is possible to use a v-shaped monolithic pavement section, but only when traffic control is unnecessary, such as on low volume residential streets.

Major components of a typical gutter section include:

- Pavement cross slope (Sx)
- Longitudinal slope (S)
- Width of flow or spread (T)
- Width of depressed gutter flow (W)
- Depth of gutter flow (d)
- Cross slope of depressed gutter (Sw)

Sketches showing the relationship of these components for three typical gutter sections are presented in Figure A3-1. The first sketch shows a kerb and gutter section with a straight cross slope; the second a V-shaped section without a kerb; and the third a depressed kerb and gutter section of width (W) and cross slope ($S_w$). These sketches are provided to define fundamental parameters and are not intended to be used as standard details of the Department.

Gutter flow is a form of open channel flow that can be analysed using a modified form of Manning's Equation. The modification is necessary because gutter flow typically has a water surface width of more than 40 times the depth of flow. Under such conditions, the hydraulic radius does not properly describe the cross section of flow. The modified form of Manning's Equation is presented in HEC-12 (USDOT, FHWA, 1984) as follows:

$$\mathbf{Q = (0.0159 / n)\, S_x^{5/3}\, S^{1/2}\, (3.28T)^{8/3}} \qquad \textbf{(Eq. A3-3)}$$

where:

Q = gutter flow rate, in $m^3$/sec
N = Manning's roughness coefficient
Sx = pavement cross slope, in m/m
S = longitudinal slope, in m/m
T = width of flow or spread, in metres