

A3.3 Hydroplaning

Hydroplaning occurs when a tire is separated from the road surface by a layer of fluid. Major variables influencing hydroplaning conditions include:

- Pavement texture depth (TXD), in millimetres
- Cross slope of pavement (Sx), in m/m
- Pavement width (W), in m
- Rainfall intensity (i), in mm/hour
- Tire tread depth (TD), in mm
- Tire pressure (P), in psi
- Vehicle speeds, in kph
- Water depth (WD), in millimetres

Only the first three variables are design parameters that can be controlled by the engineer, with typical values as follows:

- Pavement texture depth, 0.25 to 1.5 millimetres
- Cross slope of pavement, 0.01 to 0.03 m/m (can be higher for super-elevated sections)
- Pavement width, 3 to 15 metres

An evaluation of the potential for hydroplaning requires selection of design variables that minimize the pavement water depth. An empirical equation for computing water film depth, based on experimental studies conducted at Texas A&M University for the USDOT, FHWA, and presented in the two volume report FHWA-RD-79-30 and 31 (1979), can be used for this evaluation. Knowing the water film depth and various operational parameters, the vehicle speed at which hydroplaning occurs can be estimated using a second empirical equation. Both equations are presented below:

The equation for estimating the vehicle speed at which hydroplaning occurs is expressed as:

$$v = 1.609[SD^{0.04}P^{0.3}(.039T_D + 1)^{0.06}A] \quad (\text{Eq. A3-1})$$

where:

- v = vehicle speed at which hydroplaning occurs, in kph
- SD = $100 [(W_d - W_w) / W_d]$ = spindown percent (10 percent spindown is used as an indicator of hydroplaning)
- W_d = rotational velocity of a rolling wheel on a dry surface
- W_w = rotational velocity of a wheel after spinning down due to contact with a flooded pavement
- P = tire pressure, in pounds per square inch (use 24 psi for design)
- T_D = tire tread depth, in millimetres (use 1.59 mm for design)
- A = the greater of $(10.409 / .039WD) + 3.507$ or $[(28.952 / (.039WD^{0.06})) - 7.817](.039TXD^{0.14})$
- WD = water depth, in mm (see Equation A3-2)
- TXD = pavement texture depth in millimetres (use 0.51 mm for design)