### Clause 7.5.2 SETTING VELOCITY OF DISCRETE PARTICLES

The following equations may be used in arriving at settling velocity of discrete spherical particles:

<table>
<thead>
<tr>
<th>Law</th>
<th>Equation</th>
<th>Applicable for range of Reynolds Number, $N_R$</th>
<th>Particle size in mm for specific gravity of 2.65 and temp. of 20°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock’s (Laminar)</td>
<td>$V_S = \frac{g}{18} \left( \frac{\rho_s - \rho}{\mu} \right) d^2$</td>
<td>1</td>
<td>upto 0.1</td>
</tr>
<tr>
<td>Hazen’s (Transition)</td>
<td>$V_S = \left[ \frac{4}{3} \frac{g}{C_D(\rho_s - \rho)} / \rho \right]^{0.5}$</td>
<td>1-1000</td>
<td>0.1 - 1.0</td>
</tr>
<tr>
<td>Newton’s (Turbulent)</td>
<td>$V_S = \left[ 3.3 \frac{g}{\rho} \left( \frac{\rho_s - \rho}{\rho} \right) d \right]^{0.5}$</td>
<td>$10^3 - 10^4$</td>
<td>Greater than 1</td>
</tr>
</tbody>
</table>

Where,

- $V_S$ = Settling velocity of particle, (L/T)
- $\rho_s$ = Mass density of the particle, (M/L³)
- $\rho$ = Mass density of the water, (M/L³)
- $g$ = Acceleration due to gravity, (L/T²)
- $d$ = Diameter of the particle, (L)
- $C_D$ = Dimensionless drag coefficient defined by

\[
C_D = \frac{24}{N_R} + \frac{3}{\sqrt{N_R}} + 0.34
\]

- $N_R$ = Reynolds number = $V_S d \rho / \mu$
  - dimensionless
- $\mu$ = Absolute or dynamic viscosity of water (M/LT)