

Conversion Factors and Unique Formulae Associated With the Transportation Professional Certification Board's Certification Examinations

Soft Conversion Factors

METRIC	ENGLISH	ENGLISH	METRIC
1 meter (m)	3.28 feet (ft)	1 foot (ft)	0.305 meters (m)
1 kilometer (km)	0.62 miles	1 mile (5280 ft)	1.609 kilometers (km)
1 km/hour	0.62 mph	1 mph	1.609 km/hour
1 kilogram (kg)	2.20 pounds (lb)	1 pound (lb)	0.454 kilograms (kg)

Hard Conversion Factors

Lane Width

Shoulder Width/Clearance

METRIC (m)	ENGLISH (ft)	METRIC (m)	ENGLISH (ft)
3.6 meters (m)	12 feet (ft)	3.0 meters (m)	10 feet (ft)
3.3 meters (m)	11 feet (ft)	2.4 meters (m)	8 feet (ft)
3.0 meters (m)	10 feet (ft)	1.8 meters (m)	6 feet (ft)
2.7 meters (m)	9 feet (ft)	1.2 meters (m)	4 feet (ft)

Metric	English
$E_m = \lambda^2 / \mu(\mu - \lambda)$ <p>Where: E_m = average queue length (veh) λ = arrival rate (v/min) μ = service rate (v/min)</p>	
<p>If $S < L$, then $L = AS^2/658$ If $S > L$, then $L = 2S - (658/A)$</p> <p>Where: L = length of vertical curve (m) A = algebraic difference in grades (%) S = sight distance (m)</p>	<p>If $S < L$, then $L = AS^2/2158$ If $S > L$, then $L = 2S - (2158/A)$</p> <p>Where: L = length of vertical curve (ft) A = algebraic difference in grades (%) S = sight distance (ft)</p>
$d = 0.278 Vt + 0.039 V^2/a$ <p>Where: d = stopping distance (m) V = initial speed (km/h) t = brake reaction time, 2.5 s (s) a = deceleration rate (m/s²)</p>	$d = 1.47 Vt + 1.075 V^2/a$ <p>Where: d = stopping distance (ft) V = initial speed (mph) t = brake reaction time, 2.5 s (s) a = deceleration rate (ft/s²)</p>

Metric	English
$P/F = 1/(1 + i)^n$ <p>Where: P = present worth of a future amount F = future amount i = interest rate n = service life</p>	
$P/A = [(1 + i)^n - 1] / [i(1 + i)^n]$ <p>Where: P = present worth of a series of future amounts A = annual amount i = interest rate n = service life</p>	
$CP = t + (v/(2a \pm 2Gg)) + (W+L)/v$ <p>Where: CP = change period (change + clearance intervals) (s) t = driver perception/reaction time (s) v = approach velocity (m/s) a = deceleration rate (m/s²) G = acceleration due to gravity (m/s²) g = percent of grade/100 W = width of intersection (m) L = length of vehicle (m)</p>	$CP = t + (v/(2a \pm 2Gg)) + (W+L)/v$ <p>Where: CP = change period (change + clearance intervals) (s) t = driver perception/reaction time (s) v = approach velocity (ft/s) a = deceleration rate (ft/s²) G = acceleration due to gravity (ft/s²) g = percent of grade/100 W = width of intersection (ft) L = length of vehicle (ft)</p>
$PF = f_p(1-P)/(1-(g/C))$ <p>Where: PF = progression factor f_p = supplemental adjustment factor P = proportion of vehicles arriving on green g = green time of phase(s) C = cycle length</p>	
$f = (V^2/127R) - e/100$ <p>Where: f = side friction factor V = speed (km/h) R = curve radius (m) e = rate of superelevation (%)</p>	$f = (V^2/15R) - e/100$ <p>Where: f = side friction factor V = speed (mph) R = curve radius (ft) e = rate of superelevation (%)</p>

Metric	English
$d = 0.28V(J + t_a)$ <p>Where: d = sight distance required (m) V = approaching train velocity (km/h) J = driver perception/reaction time (s) t_a = time to accelerate and clear (s)</p>	$d = 1.47V(J + t_a)$ <p>Where: d = sight distance required (ft) V = approaching train velocity (mph) J = driver perception/reaction time (s) t_a = time to accelerate and clear (s)</p>
$C_o = (1.5L + 5)/(1 - Y_1 - Y_2 - Y_3 - \dots - Y_n)$ <p>Where: C_o = optimum cycle length(s) L = lost time/cycle(s) Y_n = critical volume/saturation flow rate by phase</p>	
$K = L/A$ <p>Where: K = a factor L = length of curve (m) A = algebraic difference in grades (%)</p>	$K = L/A$ <p>Where: K = a factor L = length of curve (ft) A = algebraic difference in grades (%)</p>
$U_s = dn/\Sigma t$ $U_t = \Sigma u/n$ $U_t = U_s + \sigma_s^2 / U_s$ <p>Where: U_s = average space-mean speed U_t = average time-mean speed σ_s² = variance of space-mean speeds d = distance traversed n = number of travel times observed t_i = travel time for the <i>i</i>th vehicle u_i = speed of the <i>i</i>th vehicle</p>	