EQUATIONS TEST 2

$$d_p = v_o t = (1.47) V_o t$$

U.S. Customary

$$d_B = 1.075 \frac{V_o^2 - V_F^2}{a} \quad (3\text{-}1)$$

$$d_B = \frac{v_o^2 - v_F^2}{2a}$$

$$d_B = \frac{v_o^2 - v_F^2}{2g f_f}$$

where:

- d_B = braking distance, ft
- V = design speed, mph
- a = deceleration rate, ft/s^2

U.S. Customary

$$SSD = 1.47Vt + 1.075 \frac{V_o^2 - V_F^2}{a} \quad (3\text{-}2)$$

$$SSD = v_o t + \frac{v_o^2 - v_F^2}{2a}$$

$$SSD = d_p + d_B$$

$$SSD = v_o t + \frac{v_o^2 - v_F^2}{2g f_F}$$

where:

- SSD = stopping sight distance, ft
- V = design speed, mph
- t = brake reaction time, 2.5 s
- a = deceleration rate, ft/s^2

U.S. Customary

$$d_B = \frac{V^2 - V_f^2}{30\left[\left(\frac{a}{32.2}\right) \pm G\right]} \quad (3\text{-}3)$$

$$d_B = \frac{v_o^2 - v_f^2}{2(a \pm g G)}$$

$$d_B = \frac{v_o^2 - v_f^2}{2g(f_f \pm G)}$$

where:

- d_B = braking distance on grade, ft
- V = design speed, mph
- a = deceleration, ft/s^2
- G = grade, rise/run, ft/ft

U.S. Customary

$$\frac{0.01e + f_s}{1 - 0.01ef_s} = \frac{v^2}{gR} = \frac{0.067V^2}{R} = \frac{V^2}{15R} \quad (3\text{-}6)$$

where:

e = rate of roadway superelevation, percent
f_s = side friction (demand) factor
v = vehicle speed, ft/s
g = gravitational constant, 32.2 ft/s^2
V = vehicle speed, mph
R = radius of curve measured to a vehicle's center of gravity, ft

U.S. Customary

$$f_s = \frac{V^2}{15R} - 0.01e \quad (3\text{-}7)$$

U.S. Customary

$$R_{min} = \frac{V^2}{15(0.01e_{max} + f_{s\,max})} \quad (3\text{-}8)$$

$$\frac{100}{2\pi R} = \frac{D}{360} \quad (2.4.2)$$

or

$$D = \left(\frac{5729.58}{R}\right)^\circ$$

Horizontal curves

E = $R\left(\sec\frac{\Delta}{2}-1\right)$

M = $R\left(1-\cos\frac{\Delta}{2}\right)$

T = $R\tan\frac{\Delta}{2}$

L = $100\frac{\Delta}{D}$

LC = $2R\sin\frac{\Delta}{2}$

Vertical curves

$$A = G_2 - G_1 \text{ percent} \qquad (2.4.9)$$

$$K = \frac{L}{|A|} \qquad (2.4.10)$$

$$E = \frac{AL}{800}\text{ ft} \qquad (2.4.11)$$

$$y = 4E\left(\frac{x}{L}\right)^2 \qquad (2.4.12)$$

$$X = \frac{LG_1}{G_1 - G_2} \qquad X \geq 0 \qquad (2.4.13)$$

$$\text{Elevation of } P = \left[\text{elevation of VPC} + \left(\frac{G_1}{100}\right)x\right] + y \qquad (2.4.14)$$

Crest vertical curves

U.S. Customary

When S is less than L,

$$L = \frac{AS^2}{100\left(\sqrt{2h_1} + \sqrt{2h_2}\right)^2} \quad (3\text{-}41)$$

When S is greater than L,

$$L = 2S - \frac{200\left(\sqrt{h_1} + \sqrt{h_2}\right)^2}{A} \quad (3\text{-}42)$$

Sag vertical curves

U.S. Customary

When S is less than L,

$$L = \frac{AS^2}{200\left[2.0 + S\left(\tan 1^\circ\right)\right]} \quad (3\text{-}47)$$

or,

$$L = \frac{AS^2}{400 + 3.5S} \quad (3\text{-}48)$$

When S is greater than L,

$$L = 2S - \frac{200\left[2.0 + S\left(\tan 1^\circ\right)\right]}{A} \quad (3\text{-}49)$$

or,

$$L = 2S - \frac{400 + 3.5S}{A} \quad (3\text{-}50)$$

Earth quantities

$$V = \left(\frac{A_1 + A_2}{2}\right)L$$