#1 $V_p = \frac{Q}{(PHF)(N)(f_{HV})(f_p)}$

$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$

$P_T = 10\% + 2\% = 12\%$

$P_R = 3\%$ $E_T = 2$ $E_R = 2.25$

$f_{HV} = \frac{1}{1+0.12(2-1)+0.03(2.25-1)} = 0.8639$

with $N=2$

$V_p = \frac{8100}{(0.95)(2)(0.8639)(1)} = 1888.62$ pc/h/ln

For LOS B, we need 1000pc/h/ln or less for FFS around 100km/h with $N=4$

$V_p = 944.31$ pc/h/ln

$FFS = BFFS - f_{LW} - f_{LC} - f_N - f_{ID}$

$f_{LW} = 0$ $f_{LC} = 0.3$ $f_N = 2.4$

1 interchange / 1.6km = 0.625 $f_{ID} = 4$

$FFS = 105 - 0 - 0.3 - 2.4 - 4 = 98.3$

Need 2 additional lanes

At capacity $\Rightarrow$ LOS E

Assuming BFFS of 110 km/h for urban

$FFS = BFFS - f_{LW} - f_{LC} - f_N - f_{ID}$

$f_{LW} = 2.1 \quad f_{LC} = 1.9 \quad f_N = 7.3$

1 interchange / 3.2 km = 0.3125 inter / km, $f_{ID} = 0$

$FFS = 110 - 2.1 - 1.9 - 7.3 = 98.7$ km/h

$$V_p = \frac{DDHV}{PHF(N)(f_p)(f_{HV})}$$

$$f_p = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)}$$

$P_T = 8\%$ $\quad E_T = 2.5$ rolling terrain $\quad P_r = 0$

$$f_p = \frac{1}{1 + 0.08(2.5-1)} = 0.893$$

$$V_p = 2300 = \frac{DDHV}{(0.98)(2)(1)(0.893)}$$

$DDHV = 4025.64$ veh/h

$DDHV = (K)(D)(AADT) \quad K = 11.5\% \quad D = 0.58$

$AADT = 60\ 384.4$ vpd