HIGHPLAN Computational Methodology

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Methodology When Passing Lane is Included (based on Sample Problem 1)

ORIGIN ≡ 1

1. Input Roadway and Traffic Data.

Roadway Variables

PassingLaneSpacing := 2 mi

$L_u := 0$ $L_{pl} := 1$ FDOT default values

Traffic Variables

DirFlowRate := 610.8 veh/h calculated previously, v_d, Directional Flow Rate Step 9, Example 3

2. Determine the Downstream Length of Roadway Affected by Passing Lanes on Directional Segments (for Level or Rolling Terrain)

L_{de} = Downstream Length of Affected Roadway, in miles

Interpolation:

$v_d := DirFlowRate$

$L_{de1} := 8.1 + (v_d - 400) \cdot \frac{5.7 - 8.1}{700 - 400}$ $L_{de1} = 6.414$ PTSF From Exhibit 20-23 HCM 2000

$L_{de2} := 1.7$ ATS

3. Determine the Factors for Estimation of Average Travel Speed and Percent Time Spent Following within a Passing Lane.

Calculations:

$$f_{pl}(DirFlowRate) := \begin{| if\ 0 \le DirFlowRate < 300 \\ \quad | out_1 \leftarrow 0.58 \\ \quad | out_2 \leftarrow 1.08 \\ if\ 300 \le DirFlowRate < 600 \\ \quad | out_1 \leftarrow 0.61 \\ \quad | out_2 \leftarrow 1.10 \\ if\ DirFlowRate \ge 600 \\ \quad | out_1 \leftarrow 0.62 \\ \quad | out_2 \leftarrow 1.11 \\ out \leftarrow \begin{pmatrix} out_1 \\ out_2 \end{pmatrix} \\ out}$$

From Exhibit 20-24
HCM 2000

$$f_{pl}(DirFlowRate) = \begin{pmatrix} 0.62 \\ 1.11 \end{pmatrix} \qquad f_{pl} := f_{pl}(DirFlowRate)$$

$$f_{pl} = \begin{pmatrix} 0.62 \\ 1.11 \end{pmatrix}$$

f_{pl} in miles for PTSF
f_{pl} in miles for ATS

4. Adjust Percent Time Spent Following for Passing Lanes

a. Calculate L_d, the length of the two-lane highway downstream of the passing lane and beyond its effective length (mi).

Calculations:

$$L_{d1} := PassingLaneSpacing - \left(L_u + L_{pl} + L_{de1}\right)$$

$$L_{d1} = -5.414\ mi$$

b. Calculate PTSF using either Equation 20-19 or Equation 20-20 from HCM 2000

Input:

$PTSF_d := 76.2$ calculated previously, PTSF without passing lanes
Step 14, Example 3

Calculations:

$$PTSF_{pl}(L_{de1}, f_{pl}, L_{d1}) := \left| \begin{array}{l} \text{if } L_{d1} \geq 0 \\ \quad \left| \begin{array}{l} \text{out} \leftarrow \dfrac{PTSF_d \cdot \left[L_u + L_{d1} + f_{pl_1} \cdot L_{pl} + \left(\dfrac{1 + f_{pl}}{2} \right) \cdot L_{de1} \right]}{\text{PassingLaneSpacing}} \\ \text{out} \end{array} \right. \\ \text{if } L_{d1} < 0 \\ \quad \left| \begin{array}{l} \text{out} \leftarrow \dfrac{PTSF_d \cdot \left[L_u + f_{pl} \cdot L_{pl} + f_{pl} \cdot (L_{de1} + L_{d1}) + \left(\dfrac{1 - f_{pl}}{2} \right) \cdot \left[\dfrac{(L_{de1} + L_{d1})^2}{L_{de1}} \right] \right]}{\text{PassingLaneSpacing}} \\ \text{out} \end{array} \right. \\ \text{out} \end{array} \right.$$

$$PTSF_{pl}(L_{de1}, f_{pl_1}, L_{d1}) = 48.4$$

4. Adjust Average Travel Speed for Passing Lanes

a. Calculate Ld, the length of the two-lane highway downstream of the passing lane and beyond its effective length (mi).

Calculations:

$$L_{d2} := \text{PassingLaneSpacing} - (L_u + L_{pl} + L_{de2})$$

$$L_{d2} = -0.7$$

b. Calculate PTSF using either Equation 20-21 or Equation 20-22 from HCM 2000

Input:

$ATS_d := 44.2$ mi/h — calculated previously, ATS without passing lanes Step 12, Example 3

Calculations:

$$ATS_{pl}\left(L_{de2}, f_{pl}, L_{d2}\right) := \left| \begin{array}{l} \text{if } L_{d2} \geq 0 \\ \quad \left| \begin{array}{l} \text{out} \leftarrow \dfrac{ATS_d \cdot \text{PassingLaneSpacing}}{L_u + \dfrac{L_{pl}}{f_{pl}} + \dfrac{2 \cdot \left(L_{de2} + L_{d2}\right)}{1 + f_{pl} + \left(f_{pl} - 1\right) \cdot \left[\dfrac{L_{de2} \cdot \left(L_{de2} + L_{d2}\right)}{L_{de2}}\right]}} \\ \text{out} \end{array} \right. \\ \text{if } L_{d2} < 0 \\ \quad \left| \begin{array}{l} \text{out} \leftarrow \dfrac{ATS_d \cdot \text{PassingLaneSpacing}}{L_u + \dfrac{L_{pl}}{f_{pl}} + \dfrac{2 \cdot \left(L_{de2} + L_{d2}\right)}{1 + f_{pl} + \left(f_{pl} - 1\right) \cdot \dfrac{L_{de2} - \left(L_{de2} + L_{d2}\right)}{L_{de2}}}} \\ \text{out} \end{array} \right. \\ \text{out} \end{array} \right.$$

$$ATS_{pl}\left(L_{de2}, f_{pl_2}, L_{d2}\right) = 48.3$$