HIGHPLAN Computational Methodology

Version 2.0.0 (updated 7/21/2006)

Dr. Scott Washburn
University of Florida
Transportation Research Center

Application of the HIGHPLAN Computational Steps to a Multilane Highway Segment

Inputs and Initial Computations

1. Input Roadway and Traffic Data

Roadway Variables

AreaType := 1 1 = Urbanized, 2 = Transitioning/Urban, 3 = Rural developed, 4 = Rural undeveloped

NumberofLanes := 4 PostedSpeed := 45 mi/hr

AnalysisType := 0 0 = Segment, 1 = Facility Median := 0 0 = No, 1 = Yes

Terrain := 2 Level = 1, Rolling = 2 LeftTurnLane := 0 0 = No, 1 = Yes

Traffic Variables

AADT := 40000 PercentHeavyVehicles := 0.02 P_T := PercentHeavyVehicles

K := 0.095 BaseCapacity := 2000

D := 0.55 LocalAdjustmentFactor := 1.0 LAF := LocalAdjustmentFactor

PHF := 0.925

2. Calculate DDHV (Design Directional Hour Volume)

DDHV := AADT·K·D

DDHV = 2090

3. Determine E_T (Truck passenger car equivalency factor)

PCE(Terrain) := | out ← 1.5 if Terrain = 1
| out ← 2.5 if Terrain = 2
| out

From Exhibit 21-8
HCM 2000

PCE(Terrain) = 2.5 $E_T := PCE(Terrain)$ $E_T = 2.5$

4. Calculate heavy vehicle factor (f_{HV})

$$f_{HV} := \frac{1}{1 + P_T \cdot (E_T - 1)}$$

Equation 21-4
HCM 2000

$f_{HV} = 0.971$

5. Calculate Base Analysis Volume (v_p)

$$v_p := \frac{DDHV}{PHF \cdot \frac{NumberofLanes}{2} \cdot f_{HV} \cdot LAF}$$

Equation 21-3
HCM 2000

$v_p = 1163.6$ veh/h

6. Determine adjustment for the presence of a median and/or left turn lanes

Left Turn Lane Adjustment (LTadj) = -0.2 for left turn lanes NOT present, LTadj = 0 otherwise.
Median Adjustment (MedAdj) = -0.05 for no median present, MedAdj = 0 otherwise. Note: The presence of a median, but no left turn lanes is not a valid option per FDOT guidance.

Left Turn Lane:

$$LTadj(LeftTurnLane) := \begin{| } out \leftarrow -0.2 \text{ if } LeftTurnLane = 0 \\ out \leftarrow 0 \text{ if } LeftTurnLane = 1 \\ out \end{|}$$

$LTadj(LeftTurnLane) = -0.2$ $LTadj := LTadj(LeftTurnLane)$ $LTadj = -0.2$

Median:

$$MedAdj(Median) := \begin{| } out \leftarrow -0.05 \text{ if } Median = 0 \\ out \leftarrow 0 \text{ if } Median = 1 \\ out \end{|}$$

$MedAdj(Median) = -0.05$ $MedAdj := MedAdj(Median)$ $MedAdj = -0.05$

Final Adjustment Value for Left Turn Lane and Median:

$AdjMedLTL := (1 + LTadj + MedAdj)$ $AdjMedLTL = 0.75$

7. Determine Facility Adjustment Factor (FacAdj)

FacAdj = 1.0 for Analysis Type = Segment

FacAdj = 0.9 for Analysis Type = Facility

$$\text{FacAdj}(\text{AnalysisType}) := \begin{cases} \text{out} \leftarrow 1.0 \text{ if } \text{AnalysisType} = 0 \\ \text{out} \leftarrow 0.9 \text{ if } \text{AnalysisType} = 1 \\ \text{out} \end{cases}$$

$\text{FacAdj}(\text{AnalysisType}) = 1$ $\quad$ $\text{FacAdj} := \text{FacAdj}(\text{AnalysisType})$ $\quad$ $\text{FacAdj} = 1$

8. Calculate Adjusted Analysis Volume (AdjVol)

$$\text{AdjVol} := \frac{v_p}{\text{AdjMedLTL} \cdot \text{FacAdj}}$$

$\text{AdjVol} = 1551.5$ veh/h $\quad$ $V := \text{AdjVol}$ $\quad$ $V = 1551.5$ veh/h

9. Determine Average Passenger Car Speed

$\text{FFS} := \text{PostedSpeed} + 5$

$\text{FFS} = 50$

Exhibit 21-3
HCM 2000

$$\text{Speed}(\text{FFS}, \text{AdjVol}) := \begin{cases} \text{out} \leftarrow \text{FFS} \text{ if } \text{AdjVol} \le 1400 \\ \text{if } \text{AdjVol} > 1400 \\ \quad \begin{cases} \text{out} \leftarrow \text{FFS} - \left(\frac{3}{10} \cdot \text{FFS} - 13\right) \cdot \left(\frac{\text{AdjVol} - 1400}{28 \cdot \text{FFS} - 880}\right)^{1.31} \text{ if } \text{FFS} > 55 \\ \text{out} \leftarrow \text{FFS} - \left(\frac{34}{205} \cdot \text{FFS} - \frac{219}{41}\right) \cdot \left(\frac{\text{AdjVol} - 1400}{\frac{171}{5} \cdot \text{FFS} - 1181}\right)^{1.31} \text{ if } 50 < \text{FFS} \le 55 \\ \text{out} \leftarrow \text{FFS} - \left(\frac{10}{43} \cdot \text{FFS} - \frac{350}{43}\right) \cdot \left(\frac{\text{AdjVol} - 1400}{33 \cdot \text{FFS} - 1050}\right)^{1.31} \text{ if } 45 < \text{FFS} \le 50 \\ \text{out} \leftarrow \text{FFS} - \left(\frac{1}{5} \cdot \text{FFS} - \frac{56}{9}\right) \cdot \left(\frac{\text{AdjVol} - 1400}{36 \cdot \text{FFS} - 1120}\right)^{1.31} \text{ if } \text{FFS} = 45 \end{cases} \end{cases}$$

$\text{Speed}(\text{FFS}, \text{AdjVol}) = 49.4$ $\quad$ $S := \text{Speed}(\text{FFS}, \text{AdjVol})$ $\quad$ $S = 49.4$ mi/h

10. Calculate density

$$D := \frac{AdjVol}{S}$$

D = 31.4 pc/mi/ln

Equation 21-5
HCM 2000

Determine Level of Service

```
LOS(FFS,D) := if FFS ≥ 60
                  out ← "A"  if D ≤ 11
                  out ← "B"  if 11 < D ≤ 18
                  out ← "C"  if 18 < D ≤ 26
                  out ← "D"  if 26 < D ≤ 35
                  out ← "E"  if 35 < D ≤ 40
                  out ← "F"  if D > 40
              if 55 ≤ FFS < 60
                  out ← "A"  if D ≤ 11
                  out ← "B"  if 11 < D ≤ 18
                  out ← "C"  if 18 < D ≤ 26
                  out ← "D"  if 26 < D ≤ 35
                  out ← "E"  if 35 < D ≤ 41
                  out ← "F"  if D > 41
              if 50 ≤ FFS < 55
                  out ← "A"  if D ≤ 11
                  out ← "B"  if 11 < D ≤ 18
                  out ← "C"  if 18 < D ≤ 26
                  out ← "D"  if 26 < D ≤ 35
                  out ← "E"  if 35 < D ≤ 43
                  out ← "F"  if D > 43
              if 45 ≤ FFS < 50
                  out ← "A"  if D ≤ 11
                  out ← "B"  if 11 < D ≤ 18
                  out ← "C"  if 18 < D ≤ 26
                  out ← "D"  if 26 < D ≤ 35
                  out ← "E"  if 35 < D ≤ 45
                  out ← "F"  if D > 45
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From Exhibit 21-2
HCM 2000

LOS(FFS,D) = "D"