

**APPENDIX B:  
EXPRESSWAY  
INPUTS**

## Appendix B1: HCM 2000 Multi-lane Highway Equations

The same equation used to estimate the one-way hourly capacity of freeways can also be used to estimate the one-way hourly capacity of multilane highways. Note that while the equations for freeways and multilane highways are the same, different values are used for passenger-car equivalent capacity ("Q" in the equation below). For the most accurate estimates of multilane highway capacity, refer to HCM 2000 Chapter 21.

NOTE: Two-way daily capacity = One-way hourly capacity/K /D.

$$c = Q * N * f_{HV} * f_p * PHF \quad (HCM \text{ Eqn. } 30-1)$$

Where:

- c = Capacity (vehicles/hour)
- Q = PCE (passenger-car equivalents) capacity, in pc/hr/ln, based on FFS\* (Refer to *HCM 2000 Exhibit 21-2* for PCE capacity values.)
- N = Number of through lanes
- f<sub>p</sub> = Driver population adjustment factor
- PHF = Peak-hour factor
- f<sub>HV</sub> = Heavy-vehicle adjustment factor (See *HCM 2000 Exhibits 21-8 – 21-11* for all truck and RV equivalent values; only the most common values are provided below.)

$$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)} \quad (HCM \text{ Eqn. } 21-4)$$

E<sub>T</sub> = Passenger-car equivalents for trucks/buses

E<sub>T</sub> = 1.5 (level terrain); 2.5 (rolling); 4.5 (mountainous)

E<sub>R</sub> = Passenger-car equivalents for RVs

E<sub>R</sub> = 1.2 (level terrain); 2.0 (rolling); 4.0 (mountainous)

P<sub>T</sub> = Proportion of trucks/buses in traffic stream, expressed as a decimal fraction

P<sub>R</sub> = Proportion of RVs in traffic stream, expressed as a decimal fraction

\* FFS can be either measured in the field or calculated using the following equation.

$$FFS = BFFS - f_{LW} - f_{LC} - f_M - f_A$$

Where:

BFFS = Base Free Flow Speed (BFFS = 65 mph Rural, 60 mph Urban/Suburban)

f<sub>LW</sub> = Adjustment for land width (*HCM 2000 Exhibit 21-4*)

f<sub>LC</sub> = Adjustment for right shoulder lateral clearance (*HCM 2000 Exhibit 21-5*)

f<sub>M</sub> = Adjustment for median type (*HCM 2000 Exhibit 21-6*)

f<sub>A</sub> = Adjustment for access points (*HCM 2000 Exhibit 21-7*)

***For NCDOT – TPB Level of Service D for Systems Level Planning, the NCLOS 2.1 program was used in developing the expressway capacity tables.***

## Appendix B2: Coastal Expressway Inputs

Coastal Expressway Standard	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	10	10	10	10	10	10	10	10	10
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>47500</b>	<b>58500</b>	<b>58800</b>	<b>71200</b>	<b>87700</b>	<b>88300</b>	<b>95000</b>	<b>117000</b>	<b>117700</b>
6-10% Trucks (10%)	<b>46400</b>	<b>57100</b>	<b>57400</b>	<b>69500</b>	<b>85600</b>	<b>86200</b>	<b>92700</b>	<b>114200</b>	<b>114900</b>
11-15% Trucks (15%)	<b>45300</b>	<b>55800</b>	<b>56100</b>	<b>67900</b>	<b>83700</b>	<b>84200</b>	<b>90600</b>	<b>111500</b>	<b>112200</b>
16-20% Trucks (20%)	<b>44200</b>	<b>54500</b>	<b>54800</b>	<b>66400</b>	<b>81800</b>	<b>82200</b>	<b>88500</b>	<b>109000</b>	<b>109700</b>
21-25% Trucks (25%)	<b>43300</b>	<b>53300</b>	<b>53600</b>	<b>64900</b>	<b>79900</b>	<b>80400</b>	<b>86500</b>	<b>106600</b>	<b>107200</b>
26-30% Trucks (30%)	<b>42300</b>	<b>52100</b>	<b>52400</b>	<b>63500</b>	<b>78200</b>	<b>78700</b>	<b>84700</b>	<b>104300</b>	<b>104900</b>
31-35% Trucks (35%)	<b>41400</b>	<b>51000</b>	<b>51300</b>	<b>62100</b>	<b>76500</b>	<b>77000</b>	<b>82900</b>	<b>102100</b>	<b>102700</b>

Coastal Expressway Minimum	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>11</b>
D Factor	60	<b>65</b>	60	60	<b>65</b>	60	60	<b>65</b>	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>43200</b>	<b>49100</b>	<b>53500</b>	<b>64800</b>	<b>73600</b>	<b>80200</b>	<b>86300</b>	<b>98200</b>	<b>107000</b>
6-10% Trucks (10%)	<b>42100</b>	<b>47900</b>	<b>52200</b>	<b>63200</b>	<b>71900</b>	<b>78300</b>	<b>84300</b>	<b>95800</b>	<b>104400</b>
11-15% Trucks (15%)	<b>41200</b>	<b>46800</b>	<b>51000</b>	<b>61700</b>	<b>70200</b>	<b>76500</b>	<b>82300</b>	<b>93600</b>	<b>102000</b>
16-20% Trucks (20%)	<b>40200</b>	<b>45700</b>	<b>49800</b>	<b>60300</b>	<b>68600</b>	<b>74800</b>	<b>80500</b>	<b>91500</b>	<b>99700</b>
21-25% Trucks (25%)	<b>39300</b>	<b>44700</b>	<b>48700</b>	<b>59000</b>	<b>67100</b>	<b>73100</b>	<b>78700</b>	<b>89400</b>	<b>97500</b>
26-30% Trucks (30%)	<b>38500</b>	<b>43700</b>	<b>47700</b>	<b>57700</b>	<b>65600</b>	<b>71500</b>	<b>77000</b>	<b>87500</b>	<b>95400</b>
31-35% Trucks (35%)	<b>37700</b>	<b>42800</b>	<b>46700</b>	<b>56500</b>	<b>64200</b>	<b>70000</b>	<b>75300</b>	<b>85600</b>	<b>93300</b>

**NOTE: Truck percentage occurs within the peak hour, not a daily truck percentage**

## Appendix B3: Piedmont Expressways Inputs

Piedmont Expressway Standard	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	10	10	10	10	10	10	10	10	10
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>47500</b>	<b>58500</b>	<b>58800</b>	<b>71200</b>	<b>87700</b>	<b>88300</b>	<b>95000</b>	<b>117000</b>	<b>117700</b>
6-10% Trucks (10%)	<b>46400</b>	<b>57100</b>	<b>57400</b>	<b>69500</b>	<b>85600</b>	<b>86200</b>	<b>92700</b>	<b>114200</b>	<b>114900</b>
11-15% Trucks (15%)	<b>45300</b>	<b>55800</b>	<b>56100</b>	<b>67900</b>	<b>83700</b>	<b>84200</b>	<b>90600</b>	<b>111500</b>	<b>112200</b>
16-20% Trucks (20%)	<b>44200</b>	<b>54500</b>	<b>54800</b>	<b>66400</b>	<b>81800</b>	<b>82200</b>	<b>88500</b>	<b>109000</b>	<b>109700</b>
21-25% Trucks (25%)	<b>43300</b>	<b>53300</b>	<b>53600</b>	<b>64900</b>	<b>79900</b>	<b>80400</b>	<b>86500</b>	<b>106600</b>	<b>107200</b>
26-30% Trucks (30%)	<b>42300</b>	<b>52100</b>	<b>52400</b>	<b>63500</b>	<b>78200</b>	<b>78700</b>	<b>84700</b>	<b>104300</b>	<b>104900</b>
31-35% Trucks (35%)	<b>41400</b>	<b>51000</b>	<b>51300</b>	<b>62100</b>	<b>76500</b>	<b>77000</b>	<b>82900</b>	<b>102100</b>	<b>102700</b>

Piedmont Expressway Minimum	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	<b>11</b>	<b>13</b>	<b>13</b>	<b>11</b>	<b>13</b>	<b>13</b>	<b>11</b>	<b>13</b>	<b>13</b>
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>43200</b>	<b>45000</b>	<b>45300</b>	<b>64800</b>	<b>67500</b>	<b>67900</b>	<b>86300</b>	<b>90000</b>	<b>90500</b>
6-10% Trucks (10%)	<b>42100</b>	<b>43900</b>	<b>44200</b>	<b>63200</b>	<b>65900</b>	<b>66300</b>	<b>84300</b>	<b>87800</b>	<b>88400</b>
11-15% Trucks (15%)	<b>41200</b>	<b>42900</b>	<b>43200</b>	<b>61700</b>	<b>64400</b>	<b>64700</b>	<b>82300</b>	<b>85800</b>	<b>86300</b>
16-20% Trucks (20%)	<b>40200</b>	<b>41900</b>	<b>42200</b>	<b>60300</b>	<b>62900</b>	<b>63300</b>	<b>80500</b>	<b>83900</b>	<b>84400</b>
21-25% Trucks (25%)	<b>39300</b>	<b>41000</b>	<b>41200</b>	<b>59000</b>	<b>61500</b>	<b>61900</b>	<b>78700</b>	<b>82000</b>	<b>82500</b>
26-30% Trucks (30%)	<b>38500</b>	<b>40100</b>	<b>40300</b>	<b>57700</b>	<b>60200</b>	<b>60500</b>	<b>77000</b>	<b>80200</b>	<b>80700</b>
31-35% Trucks (35%)	<b>37700</b>	<b>39200</b>	<b>39500</b>	<b>56500</b>	<b>58900</b>	<b>59200</b>	<b>75300</b>	<b>78500</b>	<b>79000</b>

**NOTE: Truck percentage occurs within the peak hour, not a daily truck percentage**

## Appendix B4: Mountain (Level) Expressway Inputs

Mtns Expressway Standard (Level)	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	11	11	10	11	11	10	11	10	10
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>47500</b>	<b>53200</b>	<b>58800</b>	<b>71200</b>	<b>79800</b>	<b>88300</b>	<b>95000</b>	<b>106400</b>	<b>117700</b>
6-10% Trucks (10%)	<b>46400</b>	<b>51900</b>	<b>57400</b>	<b>69500</b>	<b>77900</b>	<b>86200</b>	<b>92700</b>	<b>103800</b>	<b>114900</b>
11-15% Trucks (15%)	<b>45300</b>	<b>50700</b>	<b>56100</b>	<b>67900</b>	<b>76100</b>	<b>84200</b>	<b>90600</b>	<b>101400</b>	<b>112200</b>
16-20% Trucks (20%)	<b>44200</b>	<b>49500</b>	<b>54800</b>	<b>66400</b>	<b>74300</b>	<b>82200</b>	<b>88500</b>	<b>99100</b>	<b>109700</b>
21-25% Trucks (25%)	<b>43300</b>	<b>48400</b>	<b>53600</b>	<b>64900</b>	<b>72700</b>	<b>80400</b>	<b>86500</b>	<b>96900</b>	<b>107200</b>
26-30% Trucks (30%)	<b>42300</b>	<b>47400</b>	<b>52400</b>	<b>63500</b>	<b>71100</b>	<b>78700</b>	<b>84700</b>	<b>94800</b>	<b>104900</b>
31-35% Trucks (35%)	<b>41400</b>	<b>46400</b>	<b>51300</b>	<b>62100</b>	<b>69600</b>	<b>77000</b>	<b>82900</b>	<b>92800</b>	<b>102700</b>

Mtns Expressway Minimum (Level)	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	Level	Level	Level	Level	Level	Level	Level	Level	Level
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>39600</b>	<b>48700</b>	<b>49000</b>	<b>59400</b>	<b>73100</b>	<b>73600</b>	<b>79100</b>	<b>97500</b>	<b>98100</b>
6-10% Trucks (10%)	<b>38600</b>	<b>47600</b>	<b>47900</b>	<b>57900</b>	<b>71400</b>	<b>71800</b>	<b>77300</b>	<b>95200</b>	<b>95700</b>
11-15% Trucks (15%)	<b>37700</b>	<b>46500</b>	<b>46800</b>	<b>56600</b>	<b>69700</b>	<b>70100</b>	<b>75500</b>	<b>93000</b>	<b>93500</b>
16-20% Trucks (20%)	<b>36900</b>	<b>45400</b>	<b>45700</b>	<b>55300</b>	<b>68100</b>	<b>68500</b>	<b>73800</b>	<b>90800</b>	<b>91400</b>
21-25% Trucks (25%)	<b>36100</b>	<b>44400</b>	<b>44700</b>	<b>54100</b>	<b>66600</b>	<b>67000</b>	<b>72100</b>	<b>88800</b>	<b>89400</b>
26-30% Trucks (30%)	<b>35300</b>	<b>43400</b>	<b>43700</b>	<b>52900</b>	<b>65200</b>	<b>65600</b>	<b>70500</b>	<b>86900</b>	<b>87400</b>
31-35% Trucks (35%)	<b>34500</b>	<b>42500</b>	<b>42800</b>	<b>51800</b>	<b>63800</b>	<b>64200</b>	<b>69000</b>	<b>85000</b>	<b>85600</b>

**NOTE: Truck percentage occurs within the peak hour, not a daily truck percentage**

## Appendix B5: Mountain (Rolling) Expressway Inputs

Mtns Expressway Standard (Rolling)	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	11	11	10	11	11	10	11	11	10
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>41200</b>	<b>50700</b>	<b>56100</b>	<b>61700</b>	<b>76100</b>	<b>84200</b>	<b>82300</b>	<b>101400</b>	<b>112200</b>
6-10% Trucks (10%)	<b>38500</b>	<b>47400</b>	<b>52400</b>	<b>57700</b>	<b>71100</b>	<b>78700</b>	<b>77000</b>	<b>94800</b>	<b>110400</b>
11-15% Trucks (15%)	<b>36100</b>	<b>44500</b>	<b>49200</b>	<b>54200</b>	<b>66700</b>	<b>73900</b>	<b>72200</b>	<b>89000</b>	<b>98500</b>
16-20% Trucks (20%)	<b>34000</b>	<b>41900</b>	<b>46400</b>	<b>51100</b>	<b>62900</b>	<b>69600</b>	<b>68100</b>	<b>83900</b>	<b>92800</b>
21-25% Trucks (25%)	<b>32200</b>	<b>39600</b>	<b>43900</b>	<b>48300</b>	<b>59500</b>	<b>65800</b>	<b>64400</b>	<b>79300</b>	<b>87700</b>
26-30% Trucks (30%)	<b>30500</b>	<b>37600</b>	<b>41600</b>	<b>45800</b>	<b>56400</b>	<b>62400</b>	<b>61000</b>	<b>75200</b>	<b>83200</b>
31-35% Trucks (35%)	<b>29000</b>	<b>35700</b>	<b>39600</b>	<b>43500</b>	<b>53600</b>	<b>59300</b>	<b>58000</b>	<b>71500</b>	<b>79100</b>

Mtns Expressway Minimum (Rolling)	2 Lanes Per Direction			3 Lanes Per Direction			4 Lanes Per Direction		
	Urban	Suburban	Rural	Urban	Suburban	Rural	Urban	Suburban	Rural
Terrain	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>	<b>Rolling</b>
LOS	D	D	D	D	D	D	D	D	D
PHF	0.92	0.9	0.88	0.92	0.9	0.88	0.92	0.9	0.88
Driver Pop Factor	1	1	1	1	1	1	1	1	1
K Factor	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>12</b>
D Factor	60	60	60	60	60	60	60	60	60
RV	0	0	0	0	0	0	0	0	0
Lane Width	12	12	12	12	12	12	12	12	12
Total Lat Clearance	8	10	12	8	10	12	8	10	12
Access Points/Mile	15	10	5	15	10	5	15	10	5
Median Type	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
0-5% Trucks (5%)	<b>37700</b>	<b>46500</b>	<b>46800</b>	<b>56600</b>	<b>69700</b>	<b>70100</b>	<b>75500</b>	<b>93000</b>	<b>93500</b>
6-10% Trucks (10%)	<b>35300</b>	<b>43400</b>	<b>43700</b>	<b>52900</b>	<b>65200</b>	<b>65600</b>	<b>70500</b>	<b>86900</b>	<b>87400</b>
11-15% Trucks (15%)	<b>33100</b>	<b>40800</b>	<b>41000</b>	<b>49700</b>	<b>61200</b>	<b>61500</b>	<b>66200</b>	<b>81600</b>	<b>82100</b>
16-20% Trucks (20%)	<b>31200</b>	<b>38400</b>	<b>38700</b>	<b>46800</b>	<b>57600</b>	<b>58000</b>	<b>62400</b>	<b>76900</b>	<b>77300</b>
21-25% Trucks (25%)	<b>29500</b>	<b>36300</b>	<b>36600</b>	<b>44200</b>	<b>54500</b>	<b>54800</b>	<b>59000</b>	<b>72700</b>	<b>73100</b>
26-30% Trucks (30%)	<b>28000</b>	<b>34500</b>	<b>34700</b>	<b>42000</b>	<b>51700</b>	<b>52000</b>	<b>55900</b>	<b>68900</b>	<b>69300</b>
31-35% Trucks (35%)	<b>26600</b>	<b>32800</b>	<b>33000</b>	<b>39900</b>	<b>49100</b>	<b>49400</b>	<b>53200</b>	<b>65500</b>	<b>65900</b>

**NOTE: Truck percentage occurs within the peak hour, not a daily truck percentage**