

HCM Extracts

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Tables

HCM EXHIBIT 12-12 Optimal Lengths (L_{pl}) of Passing Lanes

<i>Directional Flow Rate (pc/h)</i>	<i>Optimal Passing Lane Length (mi)</i>
100	≤0.50
200	>0.50-0.75
400	>0.75-1.00
≥ 700	>1.00-2.00

HCM EXHIBIT 20-2 Level-of-Service Criteria for Two-Lane Highways in Class I

<i>LOS</i>	<i>Percent Time-Spent-Following</i>	<i>Average Travel Speed (mph)</i>
A	≤ 35	>55
B	>35-50	>50-55
C	>50-65	>45-50
D	>65-80	>40-45
E	>80	≤ 40

NOTE: LOS F applies whenever the flow rate exceeds the segment capacity.

HCM EXHIBIT 20-4 Level-of-Service Criteria for Two-Lane Highways in Class II

<i>LOS</i>	<i>Percent Time-Spent-Following</i>
A	≤ 40
B	>40-55
C	>55-70
D	>70-85
E	>85

NOTE: LOS F applies whenever the flow rate exceeds the segment capacity.

HCM EXHIBIT 20-5 Adjustment (f_{LS}) for Lane Width and Shoulder Width

<i>Lane Width (ft)</i>	<i>Reduction in FFS (mph)</i>			
	<i>Shoulder Width (ft)</i>			
	≥ 0 < 2	≥ 2 < 4	≥ 4 < 6	≥ 6
9 < 10	6.4	4.8	3.5	2.2
≥ 10 < 11	5.3	3.7	2.4	1.1
≥ 11 < 12	4.7	3.0	1.7	0.4
≥ 12	4.2	2.6	1.3	0.0

HCM EXHIBIT 20-6 Adjustment (f_A) for Access-Point Density

<i>Access Points per mi</i>	<i>Reduction in FFS (mph)</i>
0	0.0
10	2.5
20	5.0
30	7.5
40	10.0

HCM EXHIBIT 20-7 Grade Adjustment Factor (f_G) to Determine Speeds on Two-Way and Directional Segments

<i>Range of Two-Way Flow Rates (pc/h)</i>	<i>Range of Directional Flow Rates (pc/h)</i>	<i>Type of Terrain</i>	
		<i>Level</i>	<i>Rolling</i>
0-600	0-300	1.00	0.71
>600-1200	>300-600	1.00	0.93
>1200	>600	1.00	0.99

HCM EXHIBIT 20-8 Grade Adjustment Factor (f_G) to Determine Percent Time-Spent-Following on Two-Way and Directional Segments

<i>Range of Two-Way Flow Rates (pc/h)</i>	<i>Range of Directional Flow Rates (pc/h)</i>	<i>Type of Terrain</i>	
		<i>Level</i>	<i>Rolling</i>
0-600	0-300	1.00	0.77
>600-1200	>300-600	1.00	0.94
>1200	>600	1.00	1.00

HCM EXHIBIT 20-9 Passenger-Car Equivalents for Trucks (E_T) and RVs (E_R) to Determine Speeds on Two-Way and Directional Segments

<i>Vehicle Type</i>	<i>Range of Two-Way Flow Rates (pc/h)</i>	<i>Range of Directional Flow Rates (pc/h)</i>	<i>Type of Terrain</i>	
			<i>Level</i>	<i>Rolling</i>
Trucks, E_T	0-600	0-300	1.7	2.5
	>600-1,200	>300-600	1.2	1.9
	>1,200	>600	1.1	1.5
RVs, E_R	0-600	0-300	1.0	1.1
	>600-1,200	>300-600	1.0	1.1
	>1,200	>600	1.0	1.1

HCM EXHIBIT 20-10 Passenger-Car Equivalents for Trucks (E_T) and RVs (E_R) to Determine Percent Time-Spent-Following on Two-Way and Directional Segments

Vehicle Type	Range of Two-Way Flow Rates (pc/h)	Range of Directional Flow Rates (pc/h)	Type of Terrain	
			Level	Rolling
Trucks, E_T	0-600	0-300	1.1	1.8
	>600-1,200	>300-600	1.1	1.5
	>1,200	>600	1.0	1.0
RVs, E_R	0-600	0-300	1.0	1.0
	>600-1,200	>300-600	1.0	1.0
	>1,200	>600	1.0	1.0

HCM EXHIBIT 20-11 Adjustment (f_{np}) for Effect of No-Passing Zones on Average Travel Speed on Two-Way Segments

Two-Way Demand flow Rate, v_p (pc/h)	Reduction in Average Travel Speed (mph)					
	No-Passing Zones (%)					
	0	20	40	60	80	100
0	0.0	0.0	0.0	0.0	0.0	0.0
200	0.0	0.6	1.4	2.4	2.6	3.5
400	0.0	1.7	2.7	3.5	3.9	4.5
600	0.0	1.6	2.4	3.0	3.4	3.9
800	0.0	1.4	1.9	2.4	2.7	3.0
1000	0.0	1.1	1.6	2.0	2.2	2.6
1200	0.0	0.8	1.2	1.6	1.9	2.1
1400	0.0	0.6	0.9	1.2	1.4	1.7
1600	0.0	0.6	0.8	1.1	1.3	1.5
1800	0.0	0.5	0.7	1.0	1.1	1.3
2000	0.0	0.5	0.6	0.9	1.0	1.1
2200	0.0	0.5	0.6	0.9	0.9	1.1
2400	0.0	0.5	0.6	0.8	0.9	1.1
2600	0.0	0.5	0.6	0.8	0.9	1.0
2800	0.0	0.5	0.6	0.7	0.8	0.9
3000	0.0	0.5	0.6	0.7	0.7	0.8
3200	0.0	0.5	0.6	0.6	0.6	0.7

HCM EXHIBIT 20-12 Adjustment ($f_{d/np}$) for Combined Effect of Directional Distribution of Traffic and Percentage of No-Passing Zones on Percent Time-Spent-Following on Two-Way Segments

		<i>Increase in Percent Time-Spent-Following (%)</i>					
		<i>No-Passing Zones (%)</i>					
<i>Two-Way Flow Rate, v_p (pc/h)</i>	<i>0</i>	<i>20</i>	<i>40</i>	<i>60</i>	<i>80</i>	<i>100</i>	
<i>Directional Split = 50/50</i>							
≤200	0.0	10.1	17.2	20.2	21.0	21.8	
400	0.0	12.4	19.0	22.7	23.8	24.8	
600	0.0	11.2	16.0	18.7	19.7	20.5	
800	0.0	9.0	12.3	14.1	14.5	15.4	
1400	0.0	3.6	5.5	6.7	7.3	7.9	
2000	0.0	1.8	2.9	3.7	4.1	4.4	
2600	0.0	1.1	1.6	2.0	2.3	2.4	
3200	0.0	0.7	0.9	1.1	1.2	1.4	
<i>Directional Split = 60/40</i>							
≤200	1.6	11.8	17.2	22.5	23.1	23.7	
400	0.5	11.7	16.2	20.7	21.5	22.2	
600	0.0	11.5	15.2	18.9	19.8	20.7	
800	0.0	7.6	10.3	13.0	13.7	14.4	
1400	0.0	3.7	5.4	7.1	7.6	8.1	
2000	0.0	2.3	3.4	3.6	4.0	4.3	
≥2600	0.0	0.9	1.4	1.9	2.1	2.2	
<i>Directional Split = 70/30</i>							
≤200	2.8	13.4	19.1	24.8	25.2	25.5	
400	1.1	12.5	17.3	22.0	22.6	23.2	
600	0.0	11.6	15.4	19.1	20.0	20.9	
800	0.0	7.7	10.5	13.3	14.0	14.6	
1400	0.0	3.8	5.6	7.4	7.9	8.3	
≥2000	0.0	1.4	4.9	3.5	3.9	4.2	
<i>Directional Split = 80/20</i>							
≤200	5.1	17.5	24.3	31.0	31.3	31.6	
400	2.5	15.8	21.5	27.1	27.6	28.0	
600	0.0	14.0	18.6	23.2	23.9	24.5	
800	0.0	9.3	12.7	16.0	16.5	17.0	
1400	0.0	4.6	6.7	8.7	9.1	9.5	
≥2000	0.0	2.4	3.4	4.5	4.7	4.9	
<i>Directional Split = 90/10</i>							
≤200	5.6	21.6	29.4	37.2	37.4	37.6	
400	2.4	19.0	25.6	32.2	32.5	32.8	
600	0.0	16.3	21.8	27.2	27.6	28.0	
800	0.0	10.9	14.8	18.6	19.0	19.4	
≥1400	0.0	5.5	7.8	10.0	10.4	10.7	

HCM EXHIBIT 20-13 Grade Adjustment Factor (f_G) for Estimating Average Travel Speed on Specific Upgrades

		<i>Grade Adjustment Factor, f_G</i>		
		<i>Range of Directional Flow Rates, v_d (pc/h)</i>		
<i>Grade (%)</i>	<i>Length of Grade (mi)</i>	<i>0-300</i>	<i>>300-600</i>	<i>>600</i>
$\geq 3.0 < 3.5$	0.25	0.81	1.00	1.00
	0.50	0.79	1.00	1.00
	0.75	0.77	1.00	1.00
	1.00	0.76	1.00	1.00
	1.50	0.75	0.99	1.00
	2.00	0.75	0.97	1.00
	3.00	0.75	0.95	0.97
	≥ 4.00	0.75	0.94	0.95
$\geq 3.5 < 4.5$	0.25	0.79	1.00	1.00
	0.50	0.76	1.00	1.00
	0.75	0.72	1.00	1.00
	1.00	0.69	0.93	1.00
	1.50	0.68	0.92	1.00
	2.00	0.66	0.91	1.00
	3.00	0.65	0.91	0.96
	≥ 4.00	0.65	0.90	0.96
$\geq 4.5 < 5.5$	0.25	0.75	1.00	1.00
	0.50	0.65	0.93	1.00
	0.75	0.60	0.89	1.00
	1.00	0.59	0.89	1.00
	1.50	0.57	0.86	0.99
	2.00	0.56	0.85	0.98
	3.00	0.56	0.84	0.97
	≥ 4.00	0.55	0.82	0.93
$\geq 5.5 < 6.5$	0.25	0.63	0.91	1.00
	0.50	0.57	0.85	0.99
	0.75	0.52	0.83	0.97
	1.00	0.51	0.79	0.97
	1.50	0.49	0.78	0.95
	2.00	0.48	0.78	0.94
	3.00	0.46	0.76	0.93
	≥ 4.00	0.45	0.76	0.93
≥ 6.5	0.25	0.59	0.86	0.98
	0.50	0.48	0.76	0.94
	0.75	0.44	0.74	0.91
	1.00	0.41	0.70	0.91
	1.50	0.40	0.67	0.91
	2.00	0.39	0.67	0.89
	3.00	0.39	0.66	0.88
	≥ 4.00	0.38	0.66	0.87

HCM EXHIBIT 20-14 Grade Adjustment Factor (f_G) for Estimating Percent Time-Spent-Following on Specific Upgrades

		<i>Grade Adjustment Factor, f_G</i>		
		<i>Range of Directional Flow Rates, v_d (pc/h)</i>		
<i>Grade (%)</i>	<i>Length of Grade (mi)</i>	<i>0-300</i>	<i>>300-600</i>	<i>>600</i>
$\geq 3.0 < 3.5$	0.25	1.00	0.92	0.92
	0.50	1.00	0.93	0.93
	0.75	1.00	0.93	0.93
	1.00	1.00	0.93	0.93
	1.50	1.00	0.94	0.94
	2.00	1.00	0.95	0.95
	3.00	1.00	0.97	0.96
	≥ 4.00	1.00	1.00	0.97
$\geq 3.5 < 4.5$	0.25	1.00	0.94	0.92
	0.50	1.00	0.97	0.96
	0.75	1.00	0.97	0.96
	1.00	1.00	0.97	0.97
	1.50	1.00	0.97	0.97
	2.00	1.00	0.98	0.98
	3.00	1.00	1.00	1.00
	≥ 4.00	1.00	1.00	1.00
$\geq 4.5 < 5.5$	0.25	1.00	1.00	0.97
	0.50	1.00	1.00	1.00
	0.75	1.00	1.00	1.00
	1.00	1.00	1.00	1.00
	1.50	1.00	1.00	1.00
	2.00	1.00	1.00	1.00
	3.00	1.00	1.00	1.00
	≥ 4.00	1.00	1.00	1.00
$\geq 5.5 < 6.5$	0.25	1.00	1.00	1.00
	0.50	1.00	1.00	1.00
	0.75	1.00	1.00	1.00
	1.00	1.00	1.00	1.00
	1.50	1.00	1.00	1.00
	2.00	1.00	1.00	1.00
	3.00	1.00	1.00	1.00
	≥ 4.00	1.00	1.00	1.00
≥ 6.5	0.25	1.00	1.00	1.00
	0.50	1.00	1.00	1.00
	0.75	1.00	1.00	1.00
	1.00	1.00	1.00	1.00
	1.50	1.00	1.00	1.00
	2.00	1.00	1.00	1.00
	3.00	1.00	1.00	1.00
	≥ 4.00	1.00	1.00	1.00

HCM EXHIBIT 20-15 Passenger-Car Equivalents for Trucks (E_T) for Estimating Average Speed on Specific Upgrades

Grade (%)	Length of Grade (mi)	Passenger-Car Equivalent for Trucks, E_T		
		Range of Directional Flow Rates, v_d (pc/h)		
		0-300	>300-600	>600
$\geq 3.0 < 3.5$	0.25	2.5	1.9	1.5
	0.50	3.5	2.8	2.3
	0.75	4.5	3.9	2.9
	1.00	5.1	4.6	3.5
	1.50	6.1	5.5	4.1
	2.00	7.1	5.9	4.7
	3.00	8.2	6.7	5.3
	≥ 4.00	9.1	7.5	5.7
$\geq 3.5 < 4.5$	0.25	3.6	2.4	1.9
	0.50	5.4	4.6	3.4
	0.75	6.4	6.6	4.6
	1.00	7.7	6.9	5.9
	1.50	9.4	8.3	7.1
	2.00	10.2	9.6	8.1
	3.00	11.3	11.0	8.9
	≥ 4.00	12.3	11.9	9.7
$\geq 4.5 < 5.5$	0.25	4.2	3.7	2.6
	0.50	6.0	6.0	5.1
	0.75	7.5	7.5	7.5
	1.00	9.2	9.0	8.9
	1.50	10.6	10.5	10.3
	2.00	11.8	11.7	11.3
	3.00	13.7	13.5	12.4
	≥ 4.00	15.3	15.0	12.5
$\geq 5.5 < 6.5$	0.25	4.7	4.1	3.5
	0.50	7.2	7.2	7.2
	0.75	9.1	9.1	9.1
	1.00	10.3	10.3	10.2
	1.50	11.9	11.8	11.7
	2.00	12.8	12.7	12.6
	3.00	14.4	14.3	14.2
	≥ 4.00	15.4	15.2	15.0
≥ 6.5	0.25	5.1	4.8	4.6
	0.50	7.8	7.8	7.8
	0.75	9.8	9.8	9.8
	1.00	10.4	10.4	10.3
	1.50	12.0	11.9	11.8
	2.00	12.9	12.8	12.7
	3.00	14.5	14.4	14.3
	≥ 4.00	15.4	15.3	15.2

HCM EXHIBIT 20-16 Passenger-Car Equivalents for Trucks (E_T) and RVs (E_R) for Estimating Percent Time-Spent-Following on Specific Upgrades

Grade (%)	Length of Grade (mi)	Passenger-Car Equivalent for Trucks, E_T			RVs, E_R
		Range of Directional Flow Rates, v_d (pc/h)			
		0-300	>300-600	>600	
$\geq 3.0 < 3.5$	0.25	1.0	1.0	1.0	1.0
	0.50	1.0	1.0	1.0	1.0
	0.75	1.0	1.0	1.0	1.0
	1.00	1.0	1.0	1.0	1.0
	1.50	1.0	1.0	1.0	1.0
	2.00	1.0	1.0	1.0	1.0
	3.00	1.4	1.0	1.0	1.0
	≥ 4.00	1.5	1.0	1.0	1.0
$\geq 3.5 < 4.5$	0.25	1.0	1.0	1.0	1.0
	0.50	1.0	1.0	1.0	1.0
	0.75	1.0	1.0	1.0	1.0
	1.00	1.0	1.0	1.0	1.0
	1.50	1.1	1.0	1.0	1.0
	2.00	1.4	1.0	1.0	1.0
	3.00	1.7	1.1	1.2	1.0
	≥ 4.00	2.0	1.5	1.4	1.0
$\geq 4.5 > 5.5$	0.25	1.0	1.0	1.0	1.0
	0.50	1.0	1.0	1.0	1.0
	0.75	1.0	1.0	1.0	1.0
	1.00	1.0	1.0	1.0	1.0
	1.50	1.1	1.2	1.2	1.0
	2.00	1.6	1.3	1.5	1.0
	3.00	2.3	1.9	1.7	1.0
	≥ 4.00	3.3	2.1	1.8	1.0
$\geq 5.5 < 6.5$	0.25	1.0	1.0	1.0	1.0
	0.50	1.0	1.0	1.0	1.0
	0.75	1.0	1.0	1.0	1.0
	1.00	1.0	1.2	1.2	1.0
	1.50	1.5	1.6	1.6	1.0
	2.00	1.9	1.9	1.8	1.0
	3.00	3.3	2.5	2.0	1.0
	≥ 4.00	4.3	3.1	2.0	1.0
≥ 6.5	0.25	1.0	1.0	1.0	1.0
	0.50	1.0	1.0	1.0	1.0
	0.75	1.0	1.0	1.3	1.0
	1.00	1.3	1.4	1.6	1.0
	1.50	2.1	2.0	2.0	1.0
	2.00	2.8	2.5	2.1	1.0
	3.00	4.0	3.1	2.2	1.0
	≥ 4.00	4.8	3.5	2.3	1.0

HCM EXHIBIT 20-17 Passenger-Car Equivalents for RVs (E_R) for Estimating Average Travel Speed on Specific Upgrades

		<i>Passenger-Car Equivalent for RVs, E_R</i>		
		<i>Range of Directional Flow Rates, v_d (pc/h)</i>		
<i>Grade (%)</i>	<i>Length of Grade (mi)</i>	<i>0-300</i>	<i>>300-600</i>	<i>>600</i>
$\geq 3.0 < 3.5$	0.25	1.1	1.0	1.0
	0.50	1.2	1.0	1.0
	0.75	1.2	1.0	1.0
	1.00	1.3	1.0	1.0
	1.50	1.4	1.0	1.0
	2.00	1.4	1.0	1.0
	3.00	1.5	1.0	1.0
	≥ 4.00	1.5	1.0	1.0
$\geq 3.5 < 4.5$	0.25	1.3	1.0	1.0
	0.50	1.3	1.0	1.0
	0.75	1.3	1.0	1.0
	1.00	1.4	1.0	1.0
	1.50	1.4	1.0	1.0
	2.00	1.4	1.0	1.0
	3.00	1.4	1.0	1.0
	≥ 4.00	1.5	1.0	1.0
$\geq 4.5 < 5.5$	0.25	1.5	1.0	1.0
	0.50	1.5	1.0	1.0
	0.75	1.5	1.0	1.0
	1.00	1.5	1.0	1.0
	1.50	1.5	1.0	1.0
	2.00	1.5	1.0	1.0
	3.00	1.6	1.0	1.0
	≥ 4.00	1.6	1.0	1.0
$\geq 5.5 < 6.5$	0.25	1.5	1.0	1.0
	0.50	1.5	1.0	1.0
	0.75	1.5	1.0	1.0
	1.00	1.6	1.0	1.0
	1.50	1.6	1.0	1.0
	2.00	1.6	1.0	1.0
	3.00	1.6	1.2	1.0
	≥ 4.00	1.6	1.5	1.2
≥ 6.5	0.25	1.6	1.0	1.0
	0.50	1.6	1.0	1.0
	0.75	1.6	1.0	1.0
	1.00	1.6	1.0	1.0
	1.50	1.6	1.0	1.0
	2.00	1.6	1.0	1.0
	3.00	1.6	1.3	1.3
	≥ 4.00	1.6	1.5	1.4

HCM EXHIBIT 20-18 Passenger-Car Equivalents (E_{TC}) for Estimating the Effect on Average Travel Speed of Trucks That Operate at Crawl Speed on Long Steep Downgrades

<i>Passenger-Car Equivalent for Trucks at Crawl Speeds, E_{TC}</i>			
<i>Range of Directional Flow Rates, v_d (pc/h)</i>			
<i>Difference Between FFS and Truck Crawl Speed (mph)</i>	<i>0-300</i>	<i>>300-600</i>	<i>>600</i>
≤ 15	4.4	2.8	1.4
25	14.3	9.6	5.7
≥ 40	34.1	23.1	13.0

HCM EXHIBIT 20-19 Adjustment (f_{np}) to Average Travel Speed for Percentage of No-Passing Zones in Directional Segments

Opposing Demand Flow Rate, v_o (pc/h)	No-Passing Zones (%)				
	≤ 20	40	60	80	100
<i>FFS = 65 mph</i>					
≤ 100	1.1	2.2	2.8	3.0	3.1
200	2.2	3.3	3.9	4.0	4.2
400	1.6	2.3	2.7	2.8	2.9
600	1.4	1.5	1.7	1.9	2.0
800	0.7	1.0	1.2	1.4	1.5
1000	0.6	0.8	1.1	1.1	1.2
1200	0.6	0.8	0.9	1.0	1.1
1400	0.6	0.7	0.9	0.9	0.9
≥ 1600	0.6	0.7	0.7	0.7	0.8
<i>FFS = 60 mph</i>					
≤ 100	0.7	1.7	2.5	2.8	2.9
200	1.9	2.9	3.7	4.0	4.2
400	1.4	2.0	2.5	2.7	2.9
600	1.1	1.3	1.6	1.9	2.0
800	0.6	0.9	1.1	1.3	1.4
1000	0.6	0.7	0.9	1.1	1.2
1200	0.5	0.7	0.9	0.9	1.1
1400	0.5	0.6	0.8	0.8	0.9
≥ 1600	0.5	0.6	0.7	0.7	0.7
<i>FFS = 55 mph</i>					
≤ 100	0.5	1.2	2.2	2.6	2.7
200	1.5	2.4	3.5	3.9	4.1
400	1.3	1.9	2.4	2.7	2.8
600	0.9	1.1	1.6	1.8	1.9
800	0.5	0.7	1.1	1.2	1.4
1000	0.5	0.6	0.8	0.9	1.1
1200	0.5	0.6	0.7	0.9	1.0
1400	0.5	0.6	0.7	0.7	0.9
≥ 1600	0.5	0.5	0.6	0.6	0.7
<i>FFS = 50 mph</i>					
≤ 100	0.2	0.7	1.9	2.4	2.5
200	1.2	2.0	3.3	3.9	4.0
400	1.1	1.6	2.2	2.6	2.7
600	0.6	0.9	1.4	1.7	1.9
800	0.4	0.6	0.9	1.2	1.3
1000	0.4	0.4	0.7	0.9	1.1
1200	0.4	0.4	0.7	0.8	1.0
1400	0.4	0.4	0.6	0.7	0.8
≥ 1600	0.4	0.4	0.5	0.5	0.6
<i>FFS = 45 mph</i>					
≤ 100	0.1	0.4	1.7	2.2	2.4
200	0.9	1.6	3.1	3.8	4.0
400	0.9	0.5	2.0	2.5	2.7
600	0.4	0.3	1.3	1.7	1.8
800	0.3	0.3	0.8	1.1	1.2
1000	0.3	0.3	0.6	0.8	1.1
1200	0.3	0.3	0.6	0.7	1.0
1400	0.3	0.3	0.6	0.6	0.7
≥ 1600	0.3	0.3	0.4	0.4	0.6

HCM EXHIBIT 20-20 Adjustment (f_{np}) to Percent Time-Spent-Following for Percentage of No-Passing Zones in Directional Segments

	No-Passing Zones (%)				
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<i>Opposing Demand Flow Rate, v_o (pc/h)</i>					
	≤ 20	40	60	80	100
<i>FFS = 65 mph</i>					
≤ 100	10.1	17.2	20.2	21.0	21.8
200	12.4	19.0	22.7	23.8	24.8
400	9.0	12.3	14.1	14.4	15.4
600	5.3	7.7	9.2	9.7	10.4
800	3.0	4.6	5.7	6.2	6.7
1000	1.8	2.9	3.7	4.1	4.4
1200	1.3	2.0	2.6	2.9	3.1
1400	0.9	1.4	1.7	1.9	2.1
≥ 1600	0.7	0.9	1.1	1.2	1.4
<i>FFS = 60 mph</i>					
≤ 100	8.4	14.9	20.9	22.8	26.6
200	11.5	18.2	24.1	26.2	29.7
400	8.6	12.1	14.8	15.9	18.1
600	5.1	7.5	9.6	10.6	12.1
800	2.8	4.5	5.9	6.7	7.7
1000	1.6	2.8	3.7	4.3	4.9
1200	1.2	1.9	2.6	3.0	3.4
1400	0.8	1.3	1.7	2.0	2.3
≥ 1600	0.6	0.9	1.1	1.2	1.5
<i>FFS = 55 mph</i>					
≤ 100	6.7	12.7	21.7	24.5	31.3
200	10.5	17.5	25.4	28.6	34.7
400	8.3	11.8	15.5	17.5	20.7
600	4.9	7.3	10.0	11.5	13.9
800	2.7	4.3	6.1	7.2	8.8
1000	1.5	2.7	3.8	4.5	5.4
1200	1.0	1.8	2.6	3.1	3.8
1400	0.7	1.2	1.7	2.0	2.4
≥ 1600	0.6	0.9	1.2	1.3	1.5
<i>FFS = 50 mph</i>					
≤ 100	5.0	10.4	22.4	26.3	36.1
200	9.6	16.7	26.8	31.0	39.6
400	7.9	11.6	16.2	19.0	23.4
600	4.7	7.1	10.4	12.4	15.6
800	2.5	4.2	6.3	7.7	9.8
1000	1.3	2.6	3.8	4.7	5.9
1200	0.9	1.7	2.6	3.2	4.1
1400	0.6	1.1	1.7	2.1	2.6
≥ 1600	0.5	0.9	1.2	1.3	1.6
<i>FFS = 45 mph</i>					
≤ 100	3.7	8.5	23.2	28.2	41.6
200	8.7	16.0	28.2	33.6	45.2
400	7.5	11.4	16.9	20.7	26.4
600	4.5	6.9	10.8	13.4	17.6
800	2.3	4.1	6.5	8.2	11.0
1000	1.2	2.5	3.8	4.9	6.4
1200	0.8	1.6	2.6	3.3	4.5
1400	0.5	1.0	1.7	2.2	2.8
≥ 1600	0.4	0.9	1.2	1.3	1.7

HCM EXHIBIT 20-21 Values of Coefficients (a , b) Used in Estimating Percent Time-Spent-Following for Directional Segments

<i>Opposing Demand Flow Rate, v_o (pc/h)</i>	<i>a</i>	<i>b</i>
≤ 200	-0.013	0.668
400	-0.057	0.479
600	-0.100	0.413
800	-0.173	0.349
1000	-0.320	0.276
1200	-0.430	0.242
1400	-0.522	0.225
≥ 1600	-0.665	0.199

HCM EXHIBIT 20-23 Downstream Length (L_{de}) of Roadway Affected by Passing Lanes on Directional Segments in Level and Rolling Terrain

<i>Directional Flow Rate (pc/h)</i>	<i>Downstream Length of Roadway Affected L_{de} (mi)</i>	
	<i>Percent Time-Spent-Following</i>	<i>Average Travel Speed</i>
≤ 200	13.0	1.7
400	8.1	1.7
700	5.7	1.7
≥ 1000	3.6	1.7

HCM EXHIBIT 20-24 Factors (f_{pl}) for Estimating the Average Travel Speed and Percent Time-Spent-Following Within a Passing Lane

<i>Directional Flow Rate (pc/h)</i>	<i>Average Travel Speed</i>	<i>Percent Time-Spent-Following</i>
0-300	1.08	0.58
>300-600	1.10	0.61
>600	1.11	0.62

HCM EXHIBIT 20-27 Factors (f_{pl}) for Estimation of Average Travel Speed and Percent Time-Spent-Following Within a Climbing Lane

<i>Directional Flow Rate (pc/h)</i>	<i>Average Travel Speed</i>	<i>Percent Time-Spent-Following</i>
0-300	1.02	0.20
>300-600	1.07	0.21
>600	1.14	0.23

HCM EXHIBIT 21-2 Level-of-Service Criteria for Multilane Highways

<i>Free-Flow Speed</i>	<i>Criteria</i>	<i>LOS</i>				
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
60 mph	Maximum density (pc/mi/ln)	11	18	26	35	40
	Average speed (mph)	60.0	60.0	59.4	56.7	55.0
	Maximum volume-to-capacity ratio (v/c)	0.30	0.49	0.70	0.90	1.00
	Maximum service flow rate (pc/h/ln)	660	1080	1550	1980	2200
55 mph	Maximum density (pc/mi/ln)	11	18	26	35	41
	Average speed (mph)	55.0	55.0	54.9	52.9	51.2
	Maximum v/c	0.29	0.47	0.68	0.88	1.00
	Maximum service flow rate (pc/h/ln)	600	990	1430	1850	2100
50 mph	Maximum density (pc/mi/ln)	11	18	26	35	43
	Average speed (mph)	50.0	50.0	50.0	48.9	47.5
	Maximum v/c	0.28	0.45	0.65	0.86	1.00
	Maximum service flow rate (pc/h/ln)	550	900	1300	1710	2000
45 mph	Maximum density (pc/mi/ln)	11	18	26	35	45
	Average speed (mph)	45.0	45.0	45.0	44.4	42.2
	Maximum v/c	0.26	0.43	0.62	0.82	1.00
	Maximum service flow rate (pc/h/ln)	490	810	1170	1550	1900

HCM EXHIBIT 21-4 Adjustment (f_{LW}) for Lane Width

<i>Lane Width (ft)</i>	<i>Reduction in FFS, f_{LW} (mph)</i>
12	0.0
11	1.9
10	6.6

HCM EXHIBIT 21-5 Adjustment (f_{LC}) for Lateral Clearance

<i>Four-Lane Highways</i>		<i>Six-Lane Highways</i>	
<i>Total Lateral Clearance^a (ft)</i>	<i>Reduction in FFS (mph)</i>	<i>Total Lateral Clearance^a (ft)</i>	<i>Reduction in FFS (mph)</i>
12	0.0	12	0.0
10	0.4	10	0.4
8	0.9	8	0.9
6	1.3	6	1.3
4	1.8	4	1.7
2	3.6	2	2.8
0	5.4	0	3.9

HCM EXHIBIT 21-6 Adjustment for Median Type

<i>Median Type</i>	<i>Reduction in FFS (mph)</i>
Undivided highways	1.6
Divided highways (including TWLTLs)	0.0

HCM Exhibit 21-7 Access-Point Density Adjustment

<i>Access Points/Mile</i>	<i>Reduction in FFS (mph)</i>
0	0.0
10	2.5
20	5.0
30	7.5
≥40	10.0

HCM EXHIBIT 21-8 Passenger-Car Equivalents on Extended General Highway Segments

Factor	Type of Terrain		
	Level	Rolling	Mountainous
E _T (trucks and buses)	1.5	2.5	4.5
E _R (RVs)	1.2	2.0	4.0

HCM EXHIBIT 23-2 Level-of-Service Criteria for Basic Freeway Segments

<i>Criteria</i>	<i>LOS</i>				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>FFS = 75 mph</i>					
Maximum density (pc/mi/ln)	11	18	26	35	45
Maximum speed (mph)	75.0	74.8	70.6	62.2	53.3
Maximum v/c	0.34	0.56	0.76	0.90	1.00
Maximum service flow rate (pc/h/ln)	820	1350	1830	2170	2400
<i>FFS = 70 mph</i>					
Maximum density (pc/mi/ln)	11	18	26	35	45
Maximum speed (mph)	70.0	70.0	68.2	61.5	53.3
Maximum v/c	0.32	0.53	0.74	0.90	1.00
Maximum service flow rate (pc/h/ln)	770	1260	1770	2150	2400
<i>FFS = 65 mph</i>					
Maximum density (pc/mi/ln)	11	18	26	35	45
Maximum speed (mph)	65.0	65.0	64.6	59.7	52.2
Maximum v/c	0.30	0.50	0.71	0.89	1.00
Maximum service flow rate (pc/h/ln)	710	1170	1680	2090	2350
<i>FFS = 60 mph</i>					
Maximum density (pc/mi/ln)	11	18	26	35	45
Maximum speed (mph)	60.0	60.0	60.0	57.6	51.1
Maximum v/c	0.29	0.47	0.68	0.88	1.00
Maximum service flow rate (pc/h/ln)	660	1080	1560	2020	2300

<i>FFS = 55 mph</i>					
Maximum density (pc/mi/ln)	11	18	26	35	45
Maximum speed (mph)	55.0	55.0	55.0	54.7	50.0
Maximum v/c	0.27	0.44	0.64	0.85	1.00
Maximum service flow rate (pc/h/ln)	600	990	1430	1910	2250

HCM EXHIBIT 23-4 Adjustments for Lane Width

<i>Lane Width (ft)</i>	<i>Reduction in Free-Flow Speed, f_{LW} (mph)</i>
12	0.0
11	1.9
10	6.6

HCM EXHIBIT 23-5 Adjustments (f_{LC}) for Right-Shoulder Lateral Clearance

<i>Right-Shoulder Lateral Clearance (ft)</i>	<i>Reduction in Free-Flow Speed, f_{LC} (mph)</i>			
	<i>Lanes in One Direction</i>			
	2	3	4	5
≥ 6	0.0	0.0	0.0	0.0
5	0.6	0.4	0.2	0.1
4	1.2	0.8	0.4	0.2
3	1.8	1.2	0.6	0.3
2	2.4	1.6	0.8	0.4
1	3.0	2.0	1.0	0.5
0	3.6	2.4	1.2	0.6

HCM EXHIBIT 23-6 Adjustments (f_n) for Number of Lanes

<i>Number of Lanes (One Direction)</i>	<i>Reduction in Free-Flow Speed, f_n (mph)</i>
≥ 5	0.0
4	1.5
3	3.0
2	4.5

HCM EXHIBIT 23-7 Adjustments (f_{ID}) for Interchange Density

<i>Interchanges per Mile</i>	<i>Reduction in Free-Flow Speed f_{ID} (mph)</i>
0.50	0.0
0.75	1.3
1.00	2.5
1.25	3.7
1.50	5.0
1.75	6.3
2.00	7.5

HCM EXHIBIT 23-8 Passenger-Car Equivalents on Extended Freeway Segments

Factor	Type of Terrain		
	Level	Rolling	Mountainous
E_T (trucks and buses)	1.5	2.5	4.5
E_R (RVs)	1.2	2.0	4.0

HCM EXHIBIT 23-9 Passenger Car Equivalents for Trucks and Buses (E_T) on Upgrades

<i>Upgrade (%)</i>	<i>Length (mi)</i>	E_T								
		<i>Percentage of Trucks and Buses</i>								
		2	4	5	6	8	10	15	20	25
<2	All	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	0.00-0.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
≥2-3	>0.25-0.50	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	>0.50-0.75	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	>0.75-1.00	2.0	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5
	>1.00-1.50	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0
	>1.50	3.0	3.0	2.5	2.5	2.0	2.0	2.0	2.0	2.0
>3-4	0.00-0.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	>0.25-0.50	2.0	2.0	2.0	2.0	2.0	2.0	1.5	1.5	1.5
	>0.50-0.75	2.5	2.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	>0.75-1.00	3.0	3.0	2.5	2.5	2.5	2.5	2.0	2.0	2.0
	>1.00-1.50	3.5	3.5	3.0	3.0	3.0	3.0	2.5	2.5	2.5
>4-5	>1.50	4.0	3.5	3.0	3.0	3.0	3.0	2.5	2.5	2.5
	0.00-0.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	>0.25-0.50	3.0	2.5	2.5	2.5	2.0	2.0	2.0	2.0	2.0
	>0.50-0.75	3.5	3.0	3.0	3.0	2.5	2.5	2.5	2.5	2.5
	>0.75-1.00	4.0	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0
>4-5	>1.00	5.0	4.0	4.0	4.0	3.5	3.5	3.0	3.0	3.0
	0.00-0.25	2.0	2.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5
>4-5	>0.25-0.50	4.0	3.0	2.5	2.5	2.0	2.0	2.0	2.0	2.0

>5-6	>0.30-0.50	4.5	4.0	3.5	3.0	2.5	2.5	2.5	2.5	2.5
	>0.50-0.75	5.0	4.5	4.0	3.5	3.0	3.0	3.0	3.0	3.0
	>0.75-1.00	5.5	5.0	4.5	4.0	3.0	3.0	3.0	3.0	3.0
	>1.00	6.0	5.0	5.0	4.5	3.5	3.5	3.5	3.5	3.5
>6	0.00-0.25	4.0	3.0	2.5	2.5	2.5	2.5	2.0	2.0	2.0
	>0.25-0.50	4.5	4.0	3.5	3.5	3.5	3.0	2.5	2.5	2.5
	>0.30-0.50	5.0	4.5	4.0	4.0	3.5	3.0	2.5	2.5	2.5
	>0.50-0.75	5.5	5.0	4.5	4.5	4.0	3.5	3.0	3.0	3.0
	>0.75-1.00	6.0	5.5	5.0	5.0	4.5	4.0	3.5	3.5	3.5
	>1.00	7.0	6.0	5.5	5.5	5.0	4.5	4.0	4.0	4.0

HCM EXHIBIT 23-10 Passenger-Car Equivalents for RVs (E_R) on Upgrades

Grade (%)	Length (mi)	E_R								
		Percentage of RVs								
		2	4	5	6	8	10	15	20	25
≤ 2	All	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
>2-3	0.00-0.50	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	>0.50	3.0	1.5	1.5	1.5	1.5	1.5	1.2	1.2	1.2
>3-4	0.00-0.25	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	>0.25-0.50	2.5	2.5	2.0	2.0	2.0	2.0	1.5	1.5	1.5
	>0.50	3.0	2.5	2.5	2.5	2.0	2.0	2.0	1.5	1.5
>4-5	0.00-0.25	2.5	2.0	2.0	2.0	1.5	1.5	1.5	1.5	1.5
	>0.25-0.50	4.0	3.0	3.0	3.0	2.5	2.5	2.0	2.0	2.0
	>0.50	4.5	3.5	3.0	3.0	3.0	2.5	2.5	2.0	2.0
>4-5	0.00-0.25	4.0	3.0	2.5	2.5	2.5	2.0	2.0	2.0	1.5
	>0.25-0.50	6.0	4.0	4.0	3.5	3.0	3.0	2.5	2.5	2.0
	>0.50	6.0	4.5	4.0	4.0	3.5	3.0	3.0	2.5	2.0

HCM EXHIBIT 23-11 Passenger Car Equivalents for Trucks (E_T) and Buses on Downgrades

Downgrade (%)	Length (mi)	E_T			
		Percentage of Trucks			
		5	10	15	20
<4	All	1.5	1.5	1.5	1.5
4-5	≤ 4	1.5	1.5	1.5	1.5
4-5	>4	2.0	2.0	2.0	1.5
>5-6	≤ 4	1.5	1.5	1.5	1.5
>5-6	>4	5.5	4.0	4.0	3.0
>6	≤ 4	1.5	1.5	1.5	1.5
>6	>4	7.5	6.0	5.5	4.5