

Two Lane Highways – Procedures from 2000 Highway Capacity Manual

Maximum flow rates on two-way streets: 1700 cars/hour in one direction and 3200 in both directions

Level of Service is based on:

Average Highway Speed: Average speed of all vehicles to travel over a highway segment

Percent Time Spent Following: Average percent of time that vehicles spend in platoons behind slow vehicles due to inability to pass. (Percentage of vehicles traveling at **headways of 3 seconds or less**, as shown in Figures 20-3 and 20-4.)

Class I Two Lane Roads: Relatively high speed roads, arterials, primary highways. Level of Service is based on both percent time spent following and average highway speed.

Class II Two Lane Roads: Motorists do not expect to travel at higher speeds; access routes to Class I roadways, serve short trips. Level of Service is based only on percent time spent following.

Highway Capacity Manual 2000

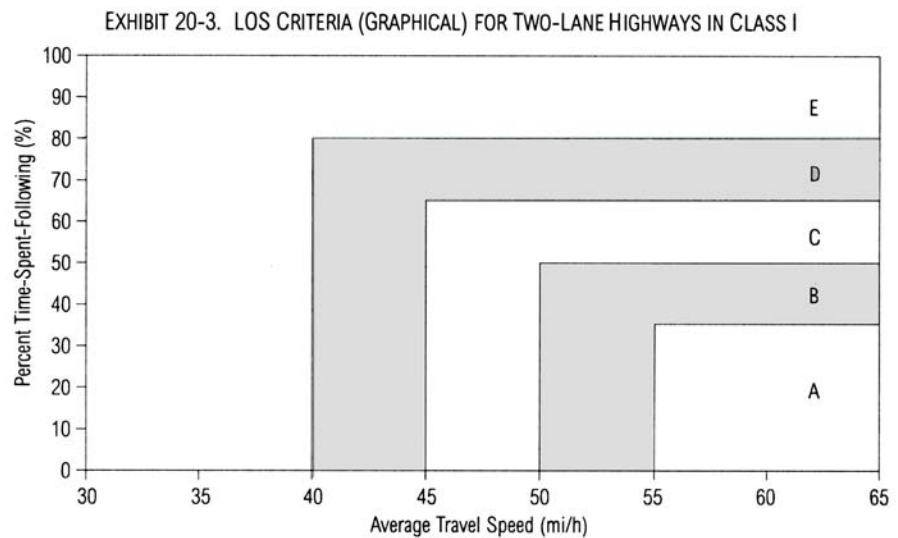
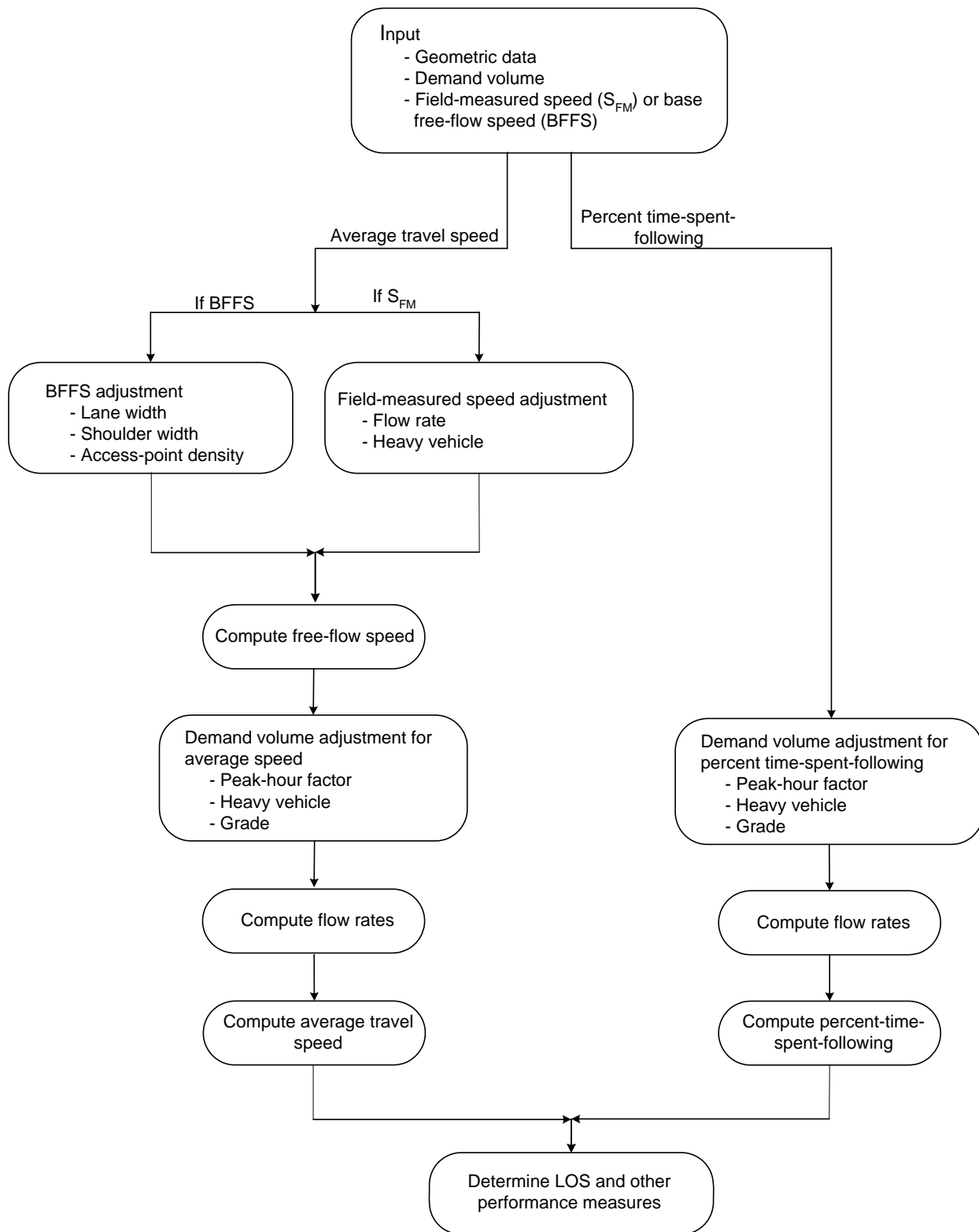


EXHIBIT 20-4. LOS CRITERIA FOR TWO-LANE HIGHWAYS IN CLASS II

LOS	Percent Time-Spent-Following
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.

EXHIBIT 20-1. TWO-LANE HIGHWAY METHODOLOGY



Calculations for Average Highway Speed (Class I highways)

Free Flow Speed: Speed of traffic under low flow conditions, measured or calculated.

$$FFS = BFFS - f_{LS} - f_A$$

BFFS = Base free flow speed = Free flow speed or design speed

f_{LS} = land and shoulder adjustment from table 20-5

f_A = Access point (intersections and driveways) adjustment from table 20-6

Demand Flow Rate (V_{ps}): Adjusted hourly demand based on peak hour factor, trucks and grades

$$V_{ps} = \frac{V}{PHF * f_{gs} * f_{HVS}}$$

V_{ps} = flow rate in passenger car equivalents in peak 15 minutes for speed

V = hourly traffic volume

PHF = peak hour factor

f_{gs} = grade adjustment factor for speed

f_{HVS} – heavy vehicle adjustment for speed

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

P_T = portion of trucks and buses

P_R = portion of recreational vehicles

E_T = passenger car equivalency for trucks

E_R = passenger car equivalency for recreational vehicles

V_p (ie V_{ps} or V_{pf}) is calculated using different numbers depending on if it is a specific section or a general section and if you want to find average speed or percent time spent following (PTSF). Use the table below to determine which figures to use.

	Average Speed	PTSF
General Section		
Grade Adjustment	20-7	20-8
Truck Passenger Car Equivalents	20-9	20-10
Recreational Vehicle Car Equivalents	20-9	20-10
Specific Upgrade		
Grade Adjustment	20-13	20-14
Truck Passenger Car Equivalents	20-15	20-16
Recreational Vehicle Car Equivalents	20-17	20-18

Average Highway Speed

$$\text{AHS} = \text{FFS} - .00776 * V_{ps} - f_{np}$$

where:

FFS is free flow speed

V_{ps} = volume of passenger cars for speed

f_{np} = no passing zone correction found in figure 20.11

Calculation for Percent Time Following (PTSF):

Demand flow rate, V_{pf} , is found the same way as for Average Highway Speed except tables for **different grade adjustment factors and vehicle equivalencies** are used. PTSF is then found as follows:

$$\text{PTSF} = \text{BPTSF} - f_{d/np}, \text{ with}$$

PTSF = percent time spent following

BPTSF = Base percent time spent following for both directions, found from the following equation:

$$\text{BPTSF} = 100(1 - e^{-0.000879V_p})$$

$f_{d/np}$ = directional distribution and no passing zone adjustments found from table 20-12, given V_{pf} the percent no passing zones, and the directional split

Level of Service

If V_{ps} is greater than 3200, then the roadway is saturated and at level of service F

If V_{ps} in a single direction is greater than 1700 (i.e at a 50-50 split = $V_p/2$), the roadway is also at LOS F

For a class I roadway, use figure 20-3 to determine LOS

For a class II roadway, use figure 20-4 to determine LOS

Example:

Given:

Class I two-lane highway with 50% no passing zones
 1600 vph both ways
 15% trucks and buses, 4% RVs
 0.95 PHF
 4' shoulders, 11' lanes
 60 mph BFFS
 6 miles rolling terrain
 20 access points/mile

a) What is LOS?

Average highway speed calculation

$$f_g = .99 \quad \text{Fig. 20-7}$$

$$\left. \begin{array}{l} E_T = 1.5 \\ E_R = 1.1 \end{array} \right\} \quad \text{Fig. 20-9}$$

$$F_{HV} = \frac{1}{1 + .15(1.5 - 1) + .04(1.1 - 1)} = .931$$

Pass car flow rate for speed

$$V_{ps} = \frac{1600}{.95 * .99 * .931} = 1827 \text{ passenger cars/hour}$$

(capacity = 3200 in both directions)

$$V_{ps} = .50 * 1827 = 914 \text{ passenger cars/hour}$$

(capacity = 1700 passenger cars/hour in each direction)

Free flow speed

$$\text{FFS} = \text{BFFS} - f_{LS} - f_A$$

Lane and shoulders adjustment

$$f_{LS} = -1.7 \text{ mph} \quad (20-5)$$

Access points adjustment

$$f_a = -5.0 \quad (20-6)$$

$$\text{FFS} = 60 - 1.7 - 5.0 = 53.3 \text{ mph}$$

Average travel speed

$$ATS = FFS - .0076 V_{ps} - f_{np}$$

No passing zone adjustment

$$f_{np} = 0.8 \text{ (Fig. 20-11)}$$

$$ATS = 53.3 - .00776 * 1827 - .8$$

$$ATS = 38.3 \text{ mph}$$

(this is enough information to determine it is at LOS E)

Percent Time Following

$$fg = 1.0 \quad (\text{from Fig.20-8})$$

$$ET = 1$$

$$ER = 1$$

$$f_{HV} = \frac{1}{1 + .15*(1-1) + .04(1-1)} = 1$$

$$V_{pf} = \frac{1600}{.95 * 1 * 1} = 1684$$

$$\text{each direction} = .50 * 1684 = 842$$

$$\begin{aligned} \text{BPTSF} &= 100 (1 - e^{-.000879 * 1684}) \\ &= 77.2\% \end{aligned}$$

Directional Distribution/No Passing Adjustment

$$f_{dnp} = +4.8 \text{ (Fig. 20-12)}$$

$$\text{PTSF} = 77.2 + 4.8 = 82.0\%$$

LOS = E from Chart 20-4

EXHIBIT 20-5. ADJUSTMENT (f_{LS}) FOR LANE WIDTH AND SHOULDER WIDTH

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

EXHIBIT 20-6. ADJUSTMENT (f_A) FOR ACCESS-POINT DENSITY

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

EXHIBIT 20-7. GRADE ADJUSTMENT FACTOR (f_G) TO DETERMINE SPEEDS ON TWO-WAY AND DIRECTIONAL SEGMENTS

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

EXHIBIT 20-8. GRADE ADJUSTMENT FACTOR (f_G) TO DETERMINE PERCENT TIME-SPENT-FOLLOWING ON TWO-WAY AND DIRECTIONAL SEGMENTS

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

EXHIBIT 20-9. PASSENGER-CAR EQUIVALENTS FOR TRUCKS AND RVs TO DETERMINE SPEEDS 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	1.7	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

EXHIBIT 20-10. PASSENGER-CAR EQUIVALENTS FOR TRUCKS AND RVs 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

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 (mi/h)					
	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

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

Two-Way Flow Rate, v_p (pc/h)	Increase in Percent Time-Spent-Following (%)					
	No-Passing Zones (%)					
	0	20	40	60	80	100
Directional Split = 50/50						
≤ 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
Directional Split = 60/40						
≤ 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
Directional Split = 70/30						
≤ 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
Directional Split = 80/20						
≤ 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
Directional Split = 90/10						
≤ 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

EXHIBIT 20-13. GRADE ADJUSTMENT FACTOR (f_G) FOR ESTIMATING AVERAGE TRAVEL SPEED ON SPECIFIC UPGRADES

Grade (%)	Length of Grade (mi)	Grade Adjustment Factor, f_G		
		Range of Directional Flow Rates v_d (pc/h)		
		0-300	> 300-600	> 600
≥ 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
	≥ 4.00	0.75	0.95	0.97
≥ 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
	≥ 4.00	0.65	0.91	0.96
≥ 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
	≥ 4.00	0.56	0.84	0.97
≥ 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
	≥ 4.00	0.46	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
	≥ 4.00	0.39	0.66	0.88

EXHIBIT 20-14. GRADE ADJUSTMENT FACTOR (f_G) FOR ESTIMATING PERCENT TIME-SPENT-FOLLOWING ON SPECIFIC UPGRADES

Grade (%)	Length of Grade (mi)	Grade Adjustment Factor, f_G		
		Range of Directional Flow Rates, v_d (pc/h)		
		0-300	> 300-600	> 600
≥ 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
≥ 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
≥ 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
≥ 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

EXHIBIT 20-15. PASSENGER-CAR EQUIVALENTS FOR TRUCKS 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
≥ 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	
≥ 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	
≥ 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	
≥ 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	

EXHIBIT 20-16. PASSENGER-CAR EQUIVALENTS FOR TRUCKS AND RVs 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	
≥ 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
	≥ 4.00	1.4	1.0	1.0	1.0
≥ 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
	≥ 4.00	1.7	1.1	1.2	1.0
≥ 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
	≥ 4.00	2.3	1.9	1.7	1.0
≥ 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
	≥ 4.00	3.3	2.5	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
	≥ 4.00	4.0	3.1	2.2	1.0
		4.8	3.5	2.3	1.0

EXHIBIT 20-17. PASSENGER-CAR EQUIVALENTS FOR RVs FOR ESTIMATING AVERAGE TRAVEL SPEED ON SPECIFIC UPGRADES

Grade (%)	Length of Grade (mi)	Passenger-Car Equivalent for RVs, E_R		
		Range of Directional Flow Rates, v_d (pc/h)		
		0-300	> 300-600	> 600
≥ 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
≥ 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
≥ 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
≥ 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