Table 1 Level-of-Service Criteria for Two-Lane Highways in Class I

LOS	*Percent Time-Spent-Following*	*Average Travel Speed (mi/h)*
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.

Table 2 Level-of-Service Criteria for Two-Lane Highways in Class II

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

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

Table 3 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

	Increase in Percent Time-Spent-Following (%)					
	No-Passing Zones (%)					
Two-Way Flow Rate, v_p (pc/h)	*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

Table 4 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

Table 5 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

Table 6 Adjustment (f_{np}) for Effect of No-Passing Zones on Average Travel Speed on Two-Way Segments

	Reduction in Average Travel Speed (mi/h)					
	No-Passing Zones (%)					
Two-Way Demand Flow Rate, v_p (pc/h)	*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

Table 7 Grade Adjustment Factor (f_G) to Determine Average Travel Speeds on Two-Way and Directional Segments

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

Table 8 Passenger-Car Equivalents for Trucks (E_T) and RVs (E_R) to Determine Speeds on Two-Way and Directional Segments

			Type of Terrain	
Vehicle Type	*Range of Two-Way Flow Rates (pc/h)*	*Range of Directional Flow Rates (pc/h)*	*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

Table 9 Adjustment (f_{LS}) for Lane Width and Shoulder Width

	Reduction in FFS (mi/h)			
	Shoulder Width (ft)			
Lane Width (ft)	*≥ 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

Table 10 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

Table 11 Level-of-Service Criteria for Multilane Highways

Free-Flow Speed	*Criteria*	*LOS* A	B	C	D	E
60 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	40
	Average speed (mi/h)	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 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	41
	Average speed (mi/h	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 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	43
	Average speed (mi/h)	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 mi/h	Maximum density (pc/mi/ln)	11	18	26	35	45
	Average speed (mi/h)	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)	480	810	1170	1550	1900

Table 12 Passenger-Car Equivalents for Trucks and Buses (E_T) and RVs (E_R) on General Highway Segments: Multilane Highways and Basic Freeway Sections

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

Table 13 Adjustment (f_{LW}) for Lane Width

Lane Width (ft)	*Reduction in FFS, f_{LW} (mi/h)*
12	0.0
11	1.9
10	6.6

Table 14 Adjustment (f_{LC}) for Lateral Clearance

Four-Lane Highways		*Six-Lane Highways*	
Total Lateral Clearance (ft)	*Reduction in FFS (mi/h)*	*Total Lateral Clearance (ft)*	*Reduction in FFS (mi/h)*
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

Table 15 Adjustment (f_M) for Median Type

Median Type	*Reduction in FFS (mi/h)*
Undivided highways	1.6
Divided highways (including TWLTLs)	0.0

Table 16 Adjustment (f_A) for Access-Point Density

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

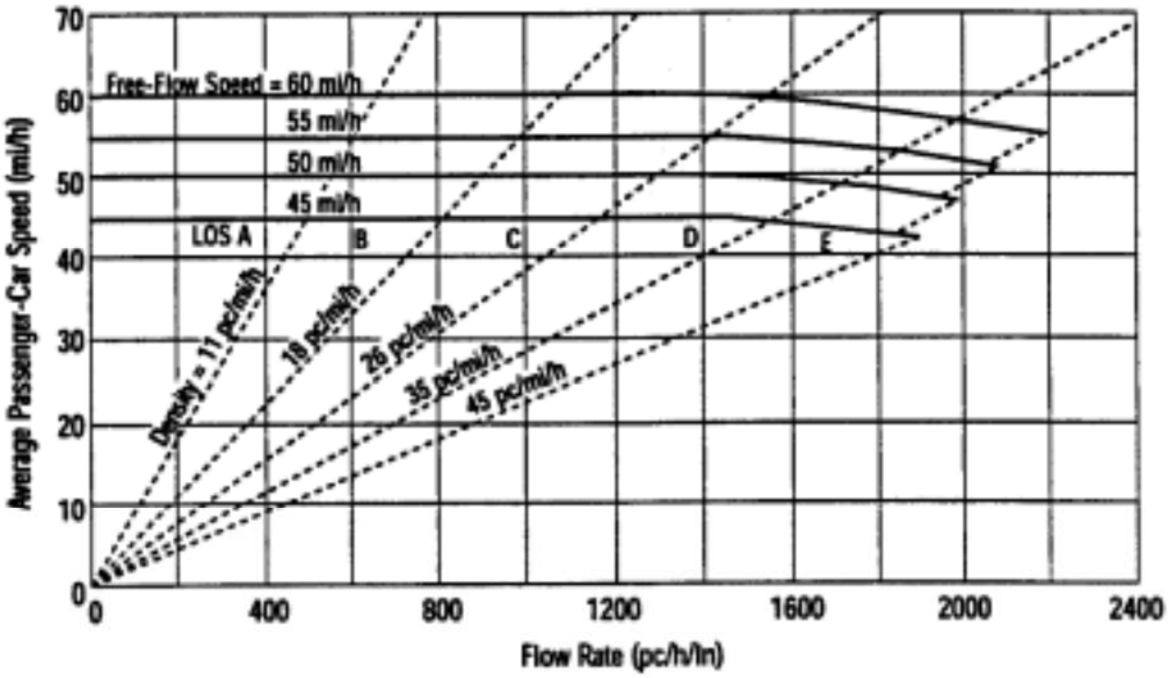

Figure 1: Speed- Flow Curves with Level -of-Service Criteria for Multilane Highways

$$f_w = 1 + \frac{(W - 12)}{30}$$

W = lane width (ft)

$$f_{HV} = \frac{100}{100 + \%HV(E_T - 1)}$$

$\%HV$ = percent heavy vehicles for lane group volume

$$f_g = 1 - \frac{\%G}{200}$$

$\%G$ = percent grade on a lane group approach

$$f_p = \frac{N - 0.1 - \frac{18N_m}{3600}}{N}$$

N = number of lanes in lane group
N_m = number of parking maneuvers/h

$$f_{bb} = \frac{N - \frac{14.4N_B}{3600}}{N}$$

N = number of lanes in lane group
N_B = number of buses stopping/h

$f_a = 0.900$ in CBD
$f_a = 1.0$ in all other areas

f_{LU}: Through or shared lane group:

f_{LU}=0.95

Exclusive left turn or right turn

f_{LU}=1

f_{LT}: Shared lane group:

f_{LT}=1/ (1+0.05 P_{LT})

P_{LT} = proportion of LTs in lane group

Exclusive left turn :

f_{LT}=0.95

f_{RT}: Exclusive right turn :

f_{LT}=0.85

P_{RT} = proportion of RTs in lane group

Shared lane :

f_{RT}=1- 0.15P_{RT}

Level-of-Service Criteria for Signalized Intersections

LOS	Signalized Intersection
A	≤10 sec
B	10–20 sec
C	20–35 sec
D	35–55 sec
E	55–80 sec
F	≥80 sec

$$d_{li} = 0.5C\frac{\left(1-\frac{gi}{C}\right)^{2}}{1-(\frac{gi}{C})[\min(X_{i,}1.0)]}$$

Where:
d_{1i} = delay per vehicle for lane group *i* (sec/veh),
C = cycle length (seconds),
g_i = effective green time for lane group *i* (seconds),
X_i = volume/capacity (v/c) ratio for lane group *i*

$$d_A = \frac{\sum_i d_i v_i}{\sum_i v_i}$$

Where:
d_A = average delay per vehicle for approach A in seconds,
d_i = average delay per vehicle for lane group i (on approach A) in seconds, and
v_i = analysis flow rate for lane group i in veh/h.

$$d_I = \frac{\sum_A d_A v_A}{\sum_A v_A}$$

Where:
d_I = average delay per vehicle for intersection in seconds, and
d_A = average delay per vehicle for approach A in seconds, and
v_A = analysis flow rate for approach A in veh/h.