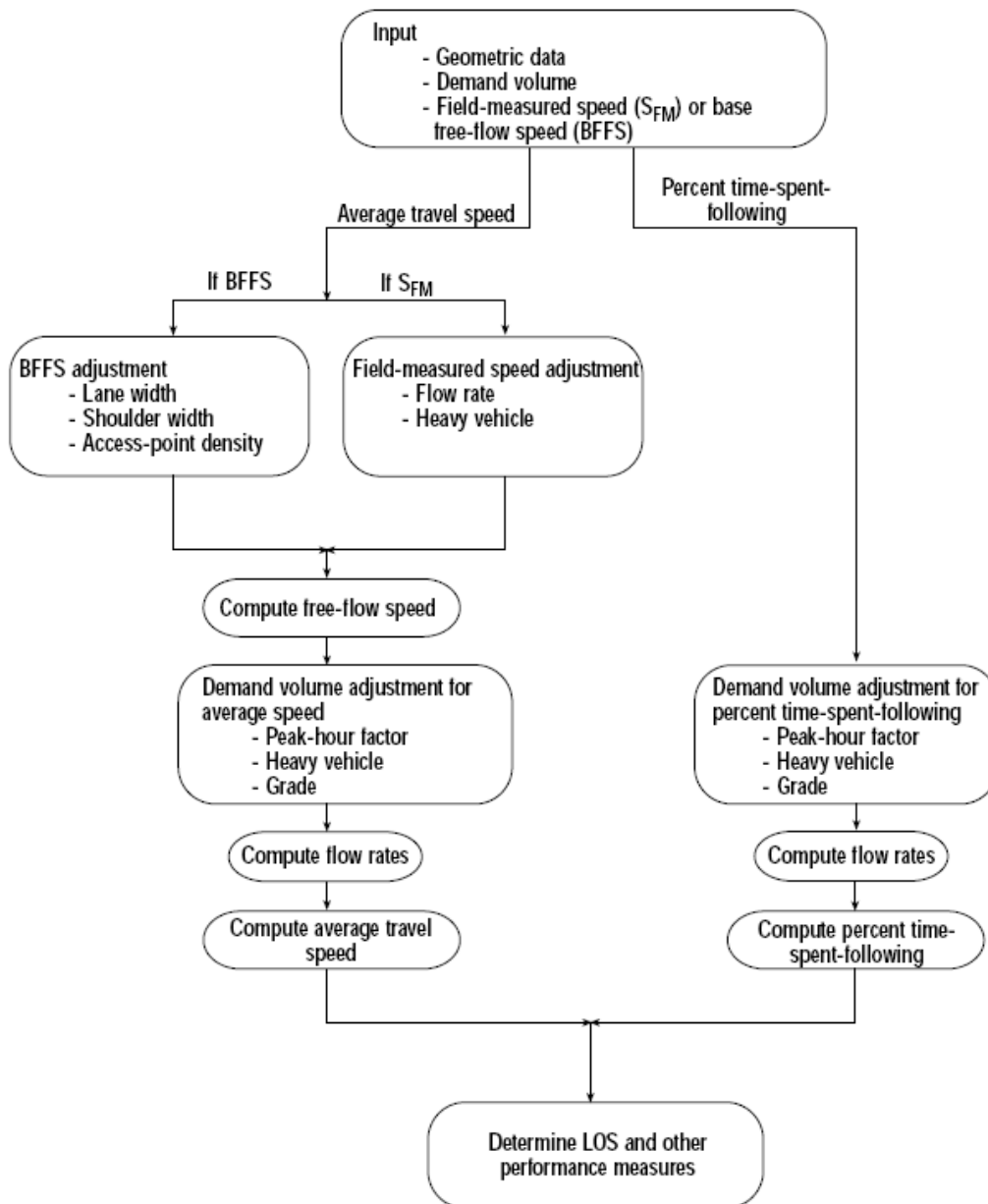


KAPACITET I NIVO USLUGE DVOTRAČNIH PUTEVA HCM-2000

EXHIBIT 20-1. TWO-LANE HIGHWAY METHODOLOGY



Kapacitet trake

1700 voz/h

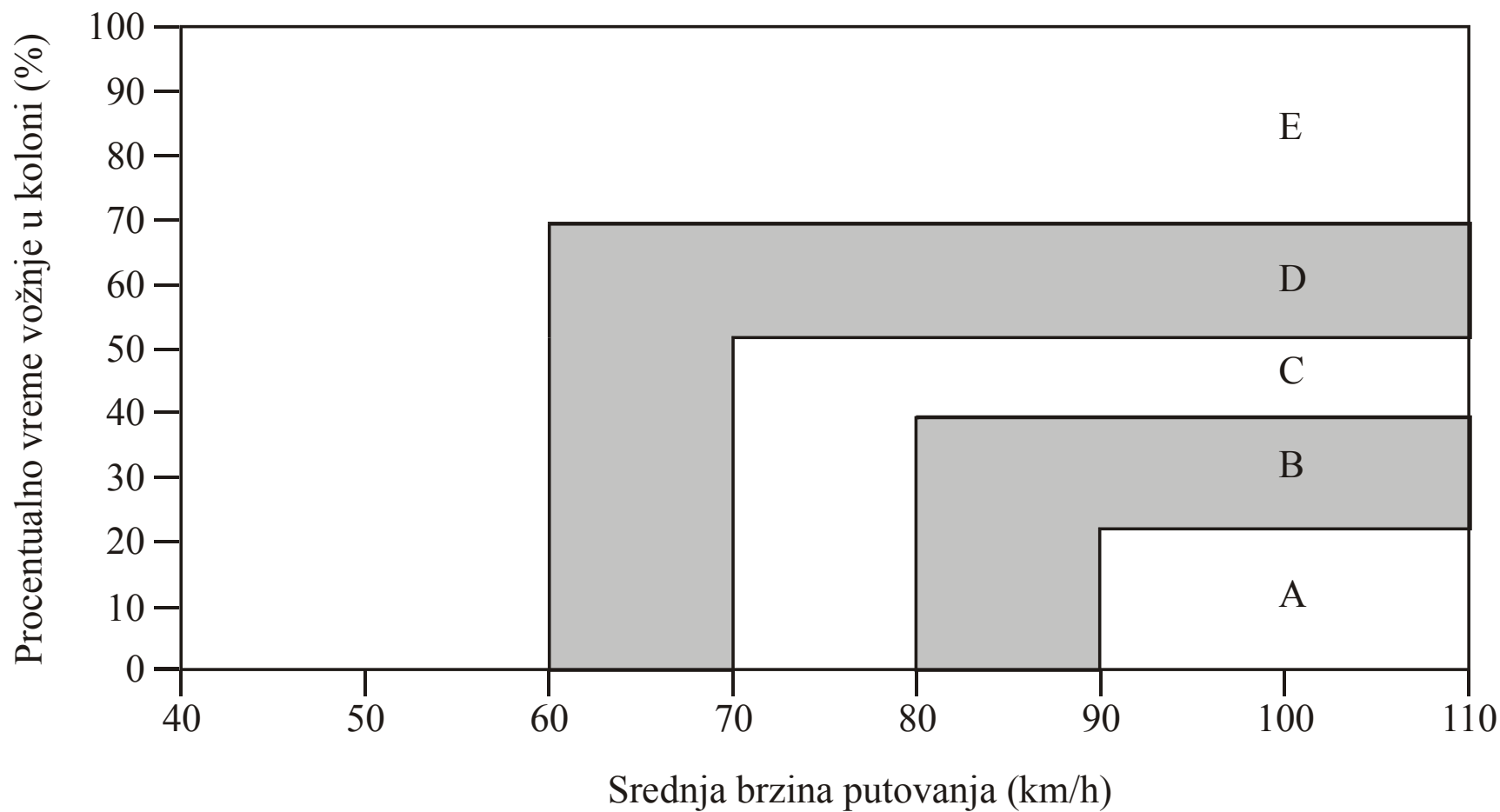
Kapacitet puta

3200-3400 voz/h

Kapacitet dvotračnih puteva za dvosmerni saobraćaj prema metodologiji HCM-2000

-putevi prvog ranga

Nivo usluge	Procenat vremena vožnje u koloni	Srednja brzina vožnje u koloni
A	≤ 35	> 90
B	$> 35-50$	$> 80-90$
C	$> 50-65$	$> 70-80$
D	$> 65-80$	$> 60-70$
E	> 80	≤ 60



-putevi drugog ranga

Nivo usluge	Procenat vremena vožnje u koloni
A	≤ 40
B	$> 40-55$
C	$> 55-70$
D	$> 70-85$
E	> 85

Određivanje brzine u slobodnom toku FFS

$$FFS = S_{FM} + 0.0125 \frac{V_f}{f_{HV}}$$

- FFS = estimated free-flow speed (km/h),
 S_{FM} = mean speed of traffic measured in the field (km/h),
 V_f = observed flow rate for the period when field data were obtained (veh/h),
and
 f_{HV} = heavy-vehicle adjustment factor, determined as shown in Equation

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

- FFS = estimated FFS (km/h);
 $BFFS$ = base FFS (km/h);
 f_{LS} = adjustment for lane width and shoulder width, from Exhibit 20-5; and
 f_A = adjustment for access points, from Exhibit 20-6.

Faktor prilagođenja za širinu trake i bočne smetnje **f_{LS}**

Širina trake izražena u metrima	Promena brzine slobodnog toka u km / h			
	Bočna smetnja, udaljenost u metrima			
	$\geq 0,0 < 0,6$	$\geq 0,6 < 1,2$	$\geq 1,2 < 1,8$	$\geq 1,8$
$2,7 < 3,0$	10,3	7,7	5,6	3,5
$\geq 3,0 < 3,3$	8,5	5,9	3,8	1,7
$\geq 3,3 < 3,6$	7,5	4,9	2,8	0,7
$\geq 3,6$	6,8	4,2	2,1	0,0

Faktor prilagođavanja za postojeći broj konfliktnih tačaka f_A

Broj tačaka sukobljavanja po kilometru	Promena brzine slobodnog toka u km / h
0	0,0
6	4,0
12	8,0
18	12,0
≥ 24	18,0

Određivanje protoka izraženog za vršni petnaestominutni period

$$V_p = \frac{V}{PHF * f_G * f_{HV}}$$

- V_p = passenger-car equivalent flow rate for peak 15-min period (pc/h),
- V = demand volume for the full peak hour (veh/h),
- PHF = peak-hour factor,
- f_G = grade adjustment factor, and
- f_{HV} = heavy-vehicle adjustment factor.

Faktor prilagođenja za podužni nagib f_G prilikom određivanje brzine

Vrednost protoka u oba smera	Vrednost protoka u jednom smeru	Vrsta terena	
		Ravničarski	Brežuljkast
0 – 600	0 – 300	1,00	0,71
> 600 – 1200	> 300 – 600	1,00	0,93
> 1200	> 600	1,00	0,99

Faktor prilagođenja za podužni nagib f_G , za određivanje procentualnog vremena vožnje u koloni

Vrednost protoka u oba smera	Vrednost protoka u jednom smeru	Vrsta terena	
		Ravničarski	Brežuljkast
0 – 600	0 – 300	1,00	0,77
> 600 – 1200	> 300 – 600	1,00	0,94
> 1200	> 600	1,00	1,00

Ekvivalenti svođenja teških teretnih i rekreacionih vozila f_{HV} u putničke automobile, pri određivanju brzine

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

P_T = proportion of trucks in the traffic stream, expressed as a decimal;

P_R = proportion of RVs in the traffic stream, expressed as a decimal;

E_T = passenger-car equivalent for trucks,

E_R = passenger-car equivalent for RVs,

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

Ekvivalenti svođenja teških teretnih i rekreacionih vozila **f_{HV}**
u putničke automobile, pri određivanju procentualnog
vremena vožnje u koloni

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

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

Određivanje srednje brzine putovanja

$$ATS = FFS - 0.0125v_p - f_{np}$$

- ATS = average travel speed for both directions of travel combined (km/h),
 f_{np} = adjustment for percentage of no-passing zones (see Exhibit 20-11),
 v_p = passenger-car equivalent flow rate for peak 15-min period (pc/h).

Faktor prilagođenja **f_{np}** usled zabrane preticanja
za srednju brzinu putovanja

Two-Way Demand Flow Rate, v_p (pc/h)	Reduction in Average Travel Speed (km/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	1.0	2.3	3.8	4.2	5.6
400	0.0	2.7	4.3	5.7	6.3	7.3
600	0.0	2.5	3.8	4.9	5.5	6.2
800	0.0	2.2	3.1	3.9	4.3	4.9
1000	0.0	1.8	2.5	3.2	3.6	4.2
1200	0.0	1.3	2.0	2.6	3.0	3.4
1400	0.0	0.9	1.4	1.9	2.3	2.7
1600	0.0	0.9	1.3	1.7	2.1	2.4
1800	0.0	0.8	1.1	1.6	1.8	2.1
2000	0.0	0.8	1.0	1.4	1.6	1.8
2200	0.0	0.8	1.0	1.4	1.5	1.7
2400	0.0	0.8	1.0	1.3	1.5	1.7
2600	0.0	0.8	1.0	1.3	1.4	1.6
2800	0.0	0.8	1.0	1.2	1.3	1.4
3000	0.0	0.8	0.9	1.1	1.1	1.3
3200	0.0	0.8	0.9	1.0	1.0	1.1

Određivanje procenta vožnje u koloni

$$PTSF = BPTSF + f_{d/np}$$

$PTSF$ = percent-time-spent following,

$BPTSF$ = base percent time-spent-following for both directions of travel combined (use Equation 20-7), and

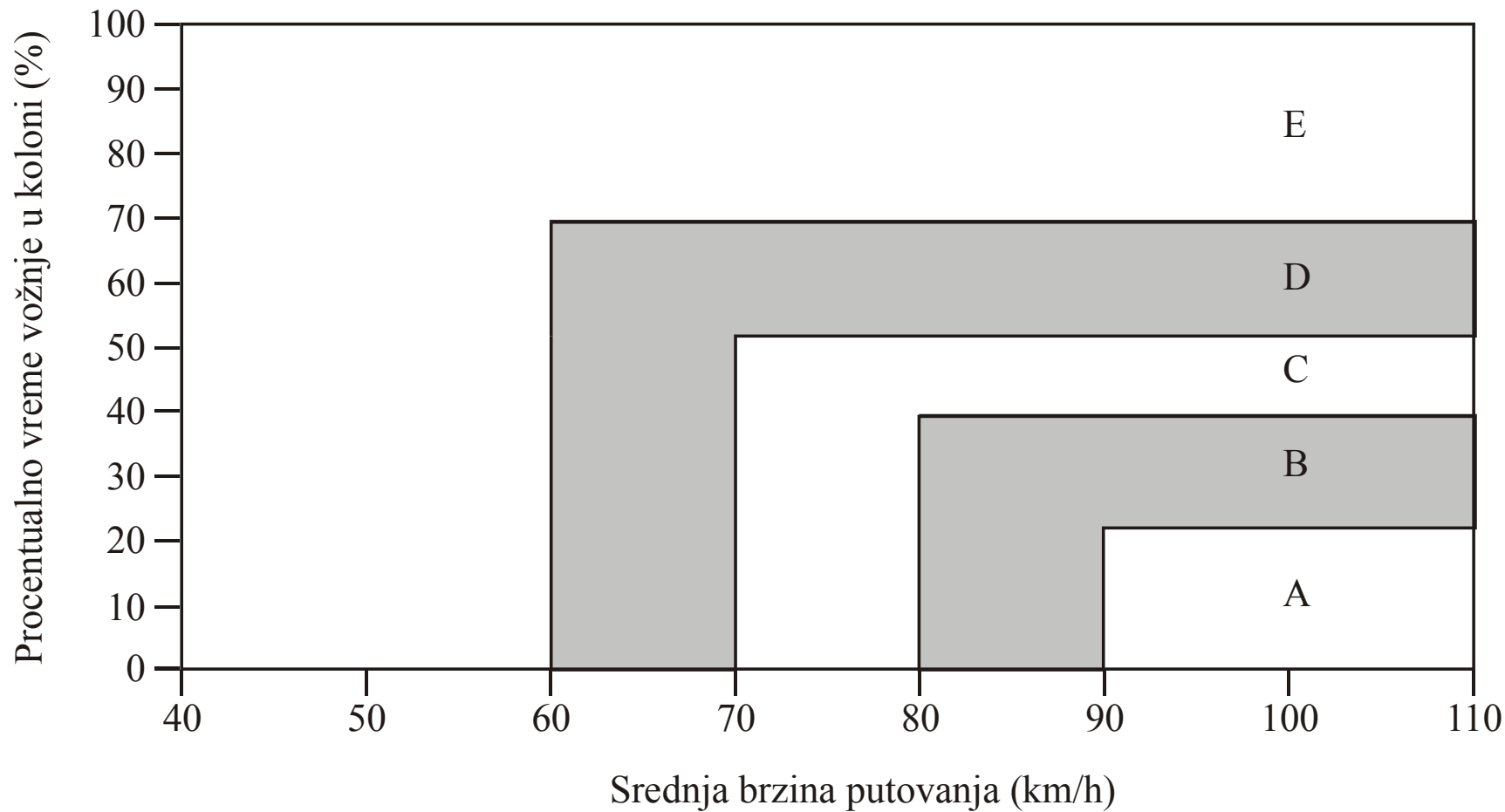
$f_{d/np}$ = adjustment for the combined effect of the directional distribution of traffic and of the percentage of no-passing zones on percent time-spent-following.

$$BPTSF = 100 \left(1 - e^{-0.000879 v_p} \right)$$

Faktor uticaja zona bez preticanja f_{np} na srednju brzinu putovanja

Two-Way Demand Flow Rate, v_p (pc/h)	Reduction in Average Travel Speed (km/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	1.0	2.3	3.8	4.2	5.6
400	0.0	2.7	4.3	5.7	6.3	7.3
600	0.0	2.5	3.8	4.9	5.5	6.2
800	0.0	2.2	3.1	3.9	4.3	4.9
1000	0.0	1.8	2.5	3.2	3.6	4.2
1200	0.0	1.3	2.0	2.6	3.0	3.4
1400	0.0	0.9	1.4	1.9	2.3	2.7
1600	0.0	0.9	1.3	1.7	2.1	2.4
1800	0.0	0.8	1.1	1.6	1.8	2.1
2000	0.0	0.8	1.0	1.4	1.6	1.8
2200	0.0	0.8	1.0	1.4	1.5	1.7
2400	0.0	0.8	1.0	1.3	1.5	1.7
2600	0.0	0.8	1.0	1.3	1.4	1.6
2800	0.0	0.8	1.0	1.2	1.3	1.4
3000	0.0	0.8	0.9	1.1	1.1	1.3
3200	0.0	0.8	0.9	1.0	1.0	1.1

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



Drugi parametri toka

$$v/c = \frac{v_p}{c}$$

v/c = volume to capacity ratio;

c = two-way segment capacity—normally 3,200 pc/h for two-way segment and 1,700 for a directional segment; and

v_p = passenger-car equivalent flow rate for peak 15-min period (pc/h).

$$VkmT_{15} = 0.25 \left(\frac{V}{PHF} \right) L_t$$

$VkmT_{15}$ = total travel on the analysis segment during the peak 15-min period (veh-km), and

L_t = total length of the analysis segment (km).

$$VkmT_{60} = V * L_t$$

$VkmT_{60}$ = total travel on the analysis segment during the peak hour (veh-km).

$$TT_{15} = \frac{VkmT_{15}}{ATS}$$

TT_{15} = total travel time for all vehicles on the analyzed segment during the peak 15-min period (veh-h).