حل تمرین‌های کتاب مهندسی ترافیک

Traffic Engineering (McShane) , 2004

توسط : دکتر پرهام حیاتی

تابستان ۱۳۹۱

CHAPTER 2

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Subject: Road User and Vehicle Characteristics
Year. Month. Date.

2.1 $d_r = 1.47 S t_{PRT} = 1.47 \times 55 \times 3.2 = 258.72$ ft

2.2 $d = 1.47 S_i t_{PRT} + \frac{S_i^2 - S_f^2}{30\left(\frac{\text{deceleration rate}}{32.2} \pm 0.01 G\right)}$

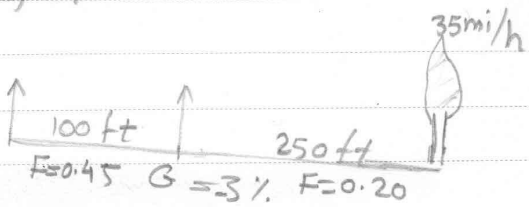
$400 = 1.47 \times 60 \times t_{PRT} + \frac{60^2 - S_f^2}{30\left(\frac{10}{32.2}\right)} \Rightarrow 372672 = 821.74 t_{PRT} + 3600 - S_f^2$

$S_f^2 = 821.74 t_{PRT} - 126.72 \Rightarrow S_f = \sqrt{821.74 t - 126.72}$

reaction Time	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
S_f	16.86	26.36	33.25	38.94	43.90	48.36	52.43	56.22	59.76	63.10

if t_{PRT} ↑ $\Rightarrow$ S_f ↑

2.3



$d_b = \frac{S_i^2 - S_f^2}{30(F \pm 0.01 G)}$

$250 = \frac{S_i^2 - 35^2}{30(0.2 + 0.01 \times 3)} \Rightarrow S_i = 35.6$ mi/h

$100 = \frac{S_i^2 - 35.6^2}{30(0.45 - 0.03)} \Rightarrow S_i = 50.27$ mi/h

2.4 $d = 1.47 S_i t + \frac{S_i^2 - S_f^2}{30(0.348)}$ $S_i = 70$ mi/h, $S_f = 60$ mi/h, $t = (10.2 - 11.2)$ rural roads

$\Rightarrow d = 1.47 \times 70 \times 10.7 + \frac{70^2 - 60^2}{30(.348)} = 1225$ ft

1205 − 100 = 1105 ft

2.5 safe stopping distance

$d = 1.47 \times 35 \times 1 + \frac{35^2 - 0}{30(0.348 - 0.01 \times 2)} = 175.94$ ft

$t = \frac{175.94 \text{ ft}}{1.47 \times 35} = 3.42$ sec

rural freeways 3 sec

2.6 $d = 1.47 \times 80 \times 3 + \frac{80^2 - 0}{30(0.348 + 0.01 \times 4)} = 902.63$ ft

2.7 $R = \frac{S^2}{15(0.01 e + f)} \Rightarrow R = \frac{70^2}{15(0.01 \times 6 + 0.1)} = 2041.67$ ft

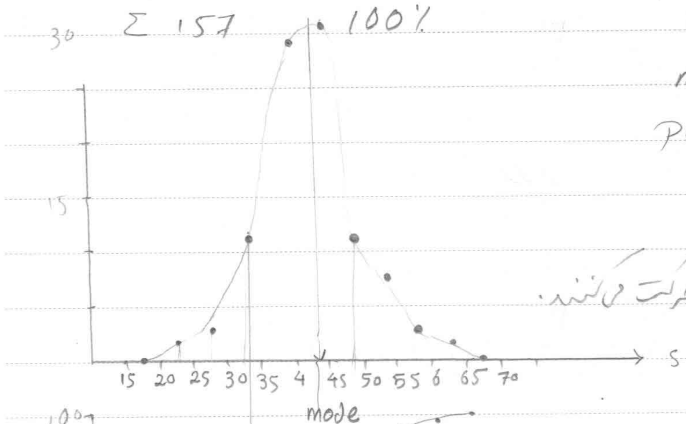
CHAPTER 9

Subject: Speed, Travel Time, and Delay studies — پرهام حیاتی

Year. Month. Date.

9.1

Speed Gr.	MS	Freq (n)	% freq	Cum freq %	n S	n S²
15–20	17.5	0	0	0	0	0
20–25	22.5	3	1.91	1.91	67.5	1518.75
25–30	27.5	6	3.82	5.73	165	4537.5
30–35		18	11.46	17.19	585	19012.5
35–40		45	28.66	45.85	1687.5	63281.25
40–45		48	30.57	76.42	2040	86700
45–50		18	11.47	87.89	855	40612.5
50–55		12	7.65	95.54	630	33075
55–60		4	2.55	98.09	230	13225
60–65		3	1.91	100	187.5	11718.75
65–70		0	0	100	0	0
		Σ 157	100%		6447.5	273621.25



mode = 42.5 mi/h

pace = 35 – 45

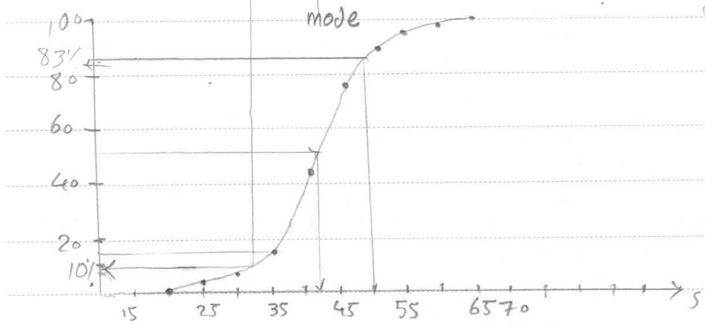
17 → 76%

76 − 17 = 59%

۷۳٪ از رانندگان در محدوده سرعت pace حرکت می‌کنند.

تخلف رانندگان: 2% + 5% = 7%

2 + 9 = 11% + 59 = 70% → 30%



P_{50} = Median = 42 mi/h

P_{85} = max = 50 mi/h

P_{15} = min = 35 mi/h

$$\bar{x} = \frac{\sum N_i S_i}{N} = \frac{6447.5}{157} = 41.06 \text{ mi/h}$$

$$S = \sqrt{\frac{\sum n_i S_i^2 - N\bar{x}^2}{N-1}} = \sqrt{\frac{273621.25 - (157 \times 41.06^2)}{157-1}} = 7.57 \text{ mi/h}$$

$$E = \frac{S}{\sqrt{N}} = \frac{7.57}{\sqrt{157}} = 0.6 \Rightarrow \mu = \bar{x} \pm 1.96E \Rightarrow \mu = 41.06 \pm 1.96(0.6)$$

$$39.88 \le \mu \le 42.24$$

$$\mu = \bar{x} \pm 3E \Rightarrow \mu = 41.06 \pm 3(0.6) \Rightarrow 39.26 \le \mu \le 42.86$$

$$N \ge \frac{1.96^2 \times 7.57^2}{1.5^2} = 97.84 \approx 98$$ عدد

PAPCO

CHAPTER 14

Subject:
Year. Month. Date. ( )

بهرام حیاتی

14.3. class I rural 2lane HW 4% @ 2miles

BFFS = 55 mi/h, 11 ft + 2 ft (sh), 5 Acc/mil, 80% NP

$V = 250$ veh/h, $P_T = 20\%$, $P_R = 10\%$, $70_{up}/30_{down}$, PHF = 0.88

LOS = ?

$g = 4\%$, $L = 2$ mile ⇒ specific grade, $FFS = BFFS - f_{LS} - f_A = 55 - 3 - 1.25 = 50.75$ mi/h

$V_u = 70\% \times 250 = 175$ veh/h → 0–300, class I ⇒ ATS, PTSF

$V_d = 30\% \times 250 = 75$ veh/h

ATS_u: $f_G = 0.66$, $E_T = 10.2$, $E_R = 1.4$; $f_{HV} = \frac{1}{1+0.2(9.2)+0.1(0.4)} = 0.347$; $V_u = \frac{175}{0.88 \times 0.66 \times 0.347} = 868$ pc/h

ATS_d: $f_G = 1$, $E_T = 1.7$, $E_R = 1.0$; $f_{HV} = \frac{1}{1+0.2(0.7)} = 0.877$; $V_d = \frac{75}{0.88 \times 1 \times 0.877} = 97$ pc/h

$PTSF_u$: $f_G = 1$, $E_T = 1.6$, $E_R = 1.0$; $f_{HV} = \frac{1}{1+0.2(0.6)} = 0.893$; $V_u = \frac{175}{0.88 \times 1 \times 0.893} = 223$ pc/h

$PTSF_d$: $f_G = 1.0$, $E_T = 1.1$, $E_R = 1.0$; $f_{HV} = \frac{1}{1+0.2(0.1)} = 0.980$; $V_d = \frac{75}{0.88 \times 1 \times 0.98} = 87$ pc/h

300–600 مقادیر متناظر با حجم در بازه‌ی در محدوده قرار دارند لیکن مقادیر مرتبط با حجم در بازه‌ی نباشد تغییر کرد

ATS_u: $f_G = 0.91$, $E_T = 9.6$, $E_R = 1.0$; $f_{HV} = \frac{1}{1+0.2(8.6)} = 0.368$ ⇒ $V_u = \frac{175}{0.88 \times 0.91 \times 0.368} = 594$ pc/h

$PTSF_u$: $f_G = 0.98$, $E_T = 1.0$, $E_R = 1.0$; $f_{HV} = \frac{1}{1+0} = 1$ ⇒ $V_u = \frac{175}{0.88 \times 0.98 \times 1} = 203$ pc/h

با توجه به اینکه مقادیر حجم در محدوده حجم فرض 600 قرار دارند لیکن مورد تأیید می‌باشد.

$V_u(ATS) = 594$ pc/h

$V_d(ATS) = 97$ pc/h

$ATS_d = FFS_d - 0.00776(V_d + V_o) - f_{np}$

$ATS_u = 50.75 - 0.00776(594 + 97) -$

u: $f_{np\ 50/u} = 2.4$ → 50.75 ⇒ 5 mile 0.2; $f_{np\ 55/u} = 2.6$; 0.75 → $f_{np} = 2.48$

d: 400 → 2.6, 600 → 1.7; 200 → 0.9, 197 → 0.886 → 1.7

$ATS_u = 50.75 - 0.00776(594 + 97) - 2.4 = 43$

$ATS_d = 50.75 - 0.00776(97 + 594) - 1.7 = 43.7$

$V_u(PTSF) = 203$ pc/h

$V_d(PTSF) = 87$ pc/h

$PTSF_d = BPTSF_d + f_{np}$

$BPTSF_d = 100(1 - e^{a V_d^b})$ → up = 36.38, down = 23.88

$f_{np\,u} = 26.3$; 15 → 0.75; 15.8 → 0.27; → 26.57 ⇒ 26.6

$a_u = 0.013$, $b_u = 0.668$

$f_{np\,d} = 31$ → 0.18; 200 → 12; 30.82 → 3; → 0.18; 50
11.1 → 0.17; 200 → 3 → 28.43; 55; 2.39 → 5; 0.36 → 0.27
30.46 ⇒ 30.5

203: 0.044; 200 → 3 → $a_d = 0.014$

0.189; 200 → 3 → $b_d = 0.665$

$PTSF_{up} = 36.38 + 26.6 = 63\%$

$PTSF_{down} = 23.88 + 30.5 = 54.4\%$

	ATS	PTSF		LOS
up	43 D	63 C	→	D
Down	43.7 D	54.4 C		D