

# TRAFFIC ENGINEERING

Civil Engineering Department

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Expansion Factors, used to adjust periodic counts, are determined either from continuous count or from control count stations.

1. Hourly expansion factor (HEF) = 
$$\frac{\text{total volume for 24 hr period}}{\text{volume for particular hour}}$$

These factors are used to expand counts of durations shorter than 24 hr to 24 hr volumes, by multiplying the hourly volume for each hour during the count period by HEF, for that hour.

2. Daily expansion factors (DEF) = 
$$\frac{\text{average total volume for week}}{\text{average volume for particular day}}$$

These factors are used to determine weekly volumes from counts of 24 hr duration by multiplying the 24-hr volume by DEF.

3. Monthly expansion factors (MEF) = 
$$\frac{\text{AADT}}{\text{ADT for particular month}}$$

The AADT for a given year may be obtained from ADT for a given month by multiplying this volume by MEF.

Example: A traffic engineer urgently needs to determine the AADT on rural primary road that has the volume distribution characteristics shown in Table 1, 2 and 3 and she collected the data shown in Table (4) on a Tuesday during the month of May. Determine the AADT of the rural road using expansion factors.

Hour	Volume	HEF	Hour	Volume	HEF
6:00-7:00 a.m.	294	4.2	6:00-7:00 p.m.	743	16.62
7:00-8:00 a.m.	426	2.9	7:00-8:00 p.m.	706	17.49
8:00-9:00 a.m.	560	22.05	8:00-9:00 p.m.	606	20.38
9:00-10:00 a.m.	657	18.8	9:00-10:00 p.m.	489	25.26
10:00-11:00 a.m.	722	17.1	10:00-11:00 p.m.	396	31.19
11:00-12:00 a.m.	667	18.52	11:00-12:00 p.m.	360	34.31
12:00-1:00 p.m.	660	18.71	12:00-1:00 a.m.	241	51.24
1:00-2:00 p.m.	739	16.71	1:00-2:00 a.m.	150	82.33
2:00-3:00 p.m.	832	14.84	2:00-3:00 a.m.	100	123.5
3:00-4:00 p.m.	836	14.77	3:00-4:00 a.m.	90	137.22
4:00-5:00 p.m.	961	12.85	4:00-5:00 a.m.	86	143.6
5:00-6:00 p.m.	892	13.85	5:00-6:00 a.m.	137	90

Total daily volume = 12350

Table (2): Daily expansion factors for rural primary road 20

Day of week	Volume	DEF
Sunday	7895	9.515
Monday	10714	7.012
Tuesday	9722	7.727
Wednesday	11413	6.582
Thursday	10714	7.012
Friday	13125	5.724
Saturday	11539	6.510
Total weekly Volume = 75122		

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Table (3): Monthly expansion factors for a rural primary road

Month	ADT	MEF	Month	ADT	MEF
Jan.	1350	1.756	Oct.	2500	0.948
Feb.	1200	1.975	Nov.	2000	1.185
Mar.	1450	1.635	Dec.	1750	1.354
Apr.	1600	1.481			
May	1700	1.334			
June	2500	0.948			
July	4100	0.578			
Aug.	4550	0.521			
Sept.	3750	0.632			

Total yearly volume = 28450  
Mean Average daily volume = 2370

Table (4)

Hour	Volume
7:00 - 8:00 a.m.	400
8:00 - 9:00 a.m.	535
9:00 - 10:00 a.m.	650
10:00 - 11:00 a.m.	710
11:00 - 12:00 a.m.	650

Solution:

estimate the 24 hr volume for Tuesday using factors in Table (1):

$$= \frac{400 \times 2.9 + 535 \times 2.205 + 650 \times 1.88 + 710 \times 1.71 + 650 \times 1.852}{5}$$

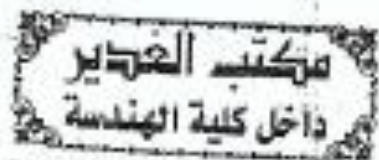
$$= 11959 \text{ vpd}$$

adjust the 24 hr volume for Tuesday to an average for the week using the factor given in Table (2)

$$\text{Total 7-day volume} = \frac{11959 \times 7.727}{7} = 13201 \text{ vpd}$$

Since the data were collected in May, use the Factor shown for May in Table (3) to obtain AADT:

$$\text{AADT} = 1320 \times 1.394 = 18402 \text{ vpd}$$



### Traffic Volume Forecast

The design should include the expected future traffic for period range (15-20) years

$$F = (1 + \text{growth rate})^{\text{no. of years}}$$

$$F = (1 + i)^n$$

$$\text{Future} = \text{present} \times F$$

$$\text{Future} = \text{present} \times (1 + i)^n$$

$n$ : analysis period (design and construction life)

present: current volume.

$i$ : growth factor rate (3-12)%  
in decimal.

Example : Design data is required for the improvement of two-way highway with central reverse. The current traffic 3000 veh/day in both directions. The improved road with a design life of 20 years, annual growth rate of traffic is (8%) and the construction periods is 5 years,  $K = 12\%$ ,  $D = 55\%$ .

Solution:

$$\text{Future} = \text{present} (1 + \text{growth rate})^{\text{no. of years}}$$

$$= 3000 (1 + 0.08)^{25} = 20400 \text{ veh/day}$$

$$\text{DHV} = 20400 * 0.12 * 0.55 = 1346 \text{ veh/day}$$