

Worked Example

Using the traffic count of two-way traffic count in Table 1, where a classified traffic count was for a week in March and the non-commercial vehicles have been analyzed to be an average of 950 vehicles per day. The commercial vehicles' traffic count is shown in Table 1. Estimate the ADT and AADT

Table 1: Two-Way Traffic Count

Time			Number of Commercial vehicles for each hour of the day						
			Mon	Tue	Wed	Thu	Fri	Sat	Sun
0.00	-	1.00	-	-	1	-	-	0	-
1.00	-	2.00	-	-	2	-	-	1	-
2.00	-	3.00	-	-	3	-	-	2	-
3.00	-	4.00	-	-	3	-	-	2	-
4.00	-	5.00	-	-	5	-	-	1	-
5.00	-	6.00	-	-	6	-	-	1	-
6.00	-	7.00	3	-	7	-	10	2	-
7.00	-	8.00	4	-	10	24	11	5	4
8.00	-	9.00	8	-	11	32	13	6	5
9.00	-	10.00	15	-	12	41	23	7	8
10.00	-	11.00	22	-	24	55	40	19	16
11.00	-	12.00	33	-	35	38	32	30	22
12.00	-	13.00	38	-	43	40	-	38	33
13.00	-	14.00	45	-	55	-	-	50	-
14.00	-	15.00	39	-	60	-	-	55	-
15.00	-	16.00	42	-	72	-	-	67	-
16.00	-	17.00	62	-	48	-	-	43	-
17.00	-	18.00	48	-	56	-	-	51	-
18.00	-	19.00	-	-	43	-	-	38	-
19.00	-	20.00	-	-	32	-	-	27	-
20.00	-	21.00	-	-	18	-	-	13	-
21.00	-	22.00	-	-	11	-	-	6	-
22.00	-	23.00	-	-	8	-	-	3	-
23.00	-	24.00	-	-	4	-	-	1	-
Survey hour (hr)			12	-	24	6	6	24	6
24hrs Traffic Count			A		569	B	C	468	D

Solution

The table shows that 24hrs traffic count was taken for Wednesday and Saturday. Hence there is a need to determine the 24-hour full-day count for other days which are shown as A, B, C D and E respectively on the table where only a partial daily count was taken.

Using Equation 1

$$A = \frac{359 \times 569}{433} = 472 \text{veh}, \quad B = \frac{230 \times 569}{135} = 969 \text{ veh}, \quad C = \frac{129 \times 569}{99} = 741 \text{ veh},$$

$$\text{The average weekday traffic count} = \frac{472+569+969+741}{4} = 688 \text{veh}$$

The full count day for Sunday is estimated as

$$D = \frac{88 \times 468}{105} = 392 \text{ veh}$$

The average commercial daily traffic for the week = $((5 \times 688) + 392 + 468)/7 = 614 \text{veh}$.

The ADT = The average of the non-commercial vehicles and commercial vehicles.

$$= 950 + 614 = 1564 \text{ Veh}$$

Percentage of Commercial vehicles = 39.26%

Using the example above where the traffic data was collected in March and other months have been analyzed. It is always better to determine the seasonal variation factor which could be used in determining the factor that could be used in adjusting the analyzed data to eliminate the effect of seasonal variation.

Since the traffic count was conducted in March, it could be seen that the value for March is 614 veh which is lower than the annual average of 862. Hence, there is a need to estimate the Seasonal Variation factor (SF) as presented in Table 3.

Table 2 represents the analyzed data for the year. Use the data to determine the seasonal correction factor.

Table 2: ADT for Each Month of the Year

Month	ADT (CV)(Yr)
Jan	850
Feb	778
Mar	614
Apr	840
May	920
Jun	870
Jul	990
Aug	780
Sep	870
Oct	845
Nov	820
Dec	840
Annual Mean	862

Table 3: Seasonal Variation (SF)

Month	ADT (CV)(Yr)	SF
Jan	850	0.99
Feb	778	0.90
Mar	614	0.71
Apr	840	0.97
May	920	1.07
Jun	870	1.01
Jul	990	1.15
Aug	780	0.90
Sep	870	1.01
Oct	845	0.98
Nov	820	0.95
Dec	840	0.97
Annual Mean	862	1.00

The SF is determined by dividing the value for each month by the annual mean.

Apply the SF to the value for March

The SF for March is 0.71

Hence the value becomes $614/0.71 = 829$ veh.

Since the value after applying the adjustment factor is lower than the Annual Mean, hence AADT of 862 veh. should be adopted.

AXLE LOAD DATA ANALYSIS

Worked Example

Estimate the Equivalency Factor (EF) from the set of axle load survey data presented in Table 3.

Table 3: Axle load survey data

Direction of Travel	Time	Vehicle Class	Axle configuration	E = Empty, F = Full or partially full	Load Type	Axle load (tonne)		
						Axle 1	Axle 2	Axle 3
Ado -Ikere	7.00	3	1.22	E	None	3.11	3.23	2.99
Ado -Ikere	11.24	3	1.22	E	None	3.22	3.31	3.01
Ado -Ikere	13.45	3	1.22	F	Sand	4.25	6.55	7.33
Ado -Ikere	15.12	3	1.22	F	Cement	3.99	8.66	8.22

Solution

The EF will be estimated using Equation 2.

Estimating EF for the vehicle at 7.00 am

$$\text{EF for axle 1} = \left(\frac{3.11}{8.16}\right)^{4.5} = 0.013$$

$$\text{EF for axle 2} = \left(\frac{3.23}{8.16}\right)^{4.5} = 0.015$$

$$\text{EF for axle 3} = \left(\frac{2.99}{8.16}\right)^{4.5} = 0.011$$

Total EF for axles 1, 2 and 3 = 0.039.

Estimate the EF for all the axles and sum the EF axle for each vehicle for each vehicle.

Estimate the average EF for empty vehicles and Full vehicles separately and find the average EF for all vehicles. The estimation of EF for the vehicles is shown in Table 4.

Table 4: Estimation of EF

Direction of Travel	Time	Vehicle Class	Axle configuration	E = Empty, F = Full or partially full	Load Type	Axle load (tonne)			Total EF per Veh	Average EF for E and F	Average EF for all Vehicles (VEF) (ESA/Veh)
						Axle 1	Axle 2	Axle 3			
Ado - Ikere	7.00	3	1.22	E	None	3.11	3.23	2.99	0.039	0.042	0.876
Ado - Ikere	11.24	3	1.22	E	None	3.22	3.31	3.01	0.044		
Ado - Ikere	13.45	3	1.22	F	Sand	4.25	6.55	7.33	1.042	1.711	
Ado - Ikere	15.12	3	1.22	F	Cement	3.99	8.66	8.22	2.380		

Total Traffic Loading During the Pavement Design Life

The Cumulative Equivalent Standard Axle Load (ESAL) is the total traffic loading on the pavement during the design life and it can be estimated using the following parameters:

- Average Daily Traffic of each vehicle class in each direction
- Average Equivalence Factor per vehicle for each class of vehicle
- Average ESA per day for each class of vehicle: this can be estimated by multiplying the average EF per vehicle by the average traffic flow for that vehicle category.
- Daily Traffic loading (one way): This is the total sum of ESA/day for all vehicle categories in each direction (in ESA/day)
- Annual Traffic loading (One way): this is the total ESA/day multiplied by 365 and it is usually expressed as a million Equivalent Standard axles per year (MESA/year) in each direction.

Traffic loading over design life is the total cumulative ESA which can be estimated using:

$$\text{Total cumulative ESA} = \left(\frac{ax365x100}{b} \right) \times \left[\left(1 + \frac{b}{100} \right)^{c+d} - \left(1 + \frac{b}{100} \right)^d \right]$$

Where:

a = Current average annual traffic loading in ESA per day (one way)

b = Annual growth rate (%)

c= Design life (Years)

d= Number of years to start of design life