ORIGINATOR Director, Bureau of Highway Construction	PROCEDURE 14-1-5
CHAPTER 14	Pavements
SECTION 1	General
SUBJECT 5	Traffic

Traffic Information

Traffic information for pavement design is available from the Division of Transportation Investment Management, Transportation Forecasts and Analysis Section. See Procedure 3-10-10 for guidance on how to obtain traffic data. Information normally provided will include:

1. Current year average daily traffic
2. Construction year average daily traffic
3. Design year average daily traffic
4. Truck classification percentage, by axle configuration, of the construction year Average Daily Traffic (ADT.) In some cases the construction year classification may be projected to the design year and both classification counts will be shown. The designer should then use a straight-line average classification between the two counts.

Truck traffic for pavement design purposes is classified according to the following categories:

Heavy Single Unit Trucks	Designation
2 Axles, 6 Tires	2D
3 Axles	3SU
Tractor-Semitrailer	**Designation**
3 or 4 Axles	2S-1, 2S-2
5 Axles and Above	3S-2
Tractor-Semitrailer-Trailer	**Designation**
5 Axles and Above (Double Bottom)	2-S1-2

Unless otherwise specified, a traffic analysis period of 20 years is used.

After receiving the traffic projection data, the district can determine the Design Lane Traffic (DLT). The DLT is equal to the average of the Construction Year ADT and the Design Year ADT, multiplied by a Direction Factor (DF) and a Lane Distribution Factor (LDF), as expressed by the following formula:

$$DLT = \frac{(\text{Construction Year ADT} + \text{Design Year ADT})}{2} \times DF \times LDF$$

where:

DLT	=	The traffic volume in the lane that carries the highest number of trucks.
Construction Year ADT	=	The expected ADT for the year during which the project is built.
Design Year ADT	=	The expected ADT at the end of the design period (usually 20 years after the construction year).
DF	=	A factor representing the greater percentage of the ADT that is traveling in either direction on a 2-lane or multi-lane highway. Normally, DF = 0.50; however, where traffic generators such as industrial parks cause a greater volume of truck traffic in one direction, DF may be greater than 0.50. DF should not be confused with the term "Directional Distribution" (D). D is the directional split of traffic during the chosen design hour, expressed as a percentage of the Design Hour Volume (DHV).
LDF	=	A factor representing the percentage of truck traffic that is traveling in the outside lane of a multi-lane highway. Values for LDF are given in the table below.

LANE DISTRIBUTION FACTORS (LDFs)
FOR MULTI-LANE HIGHWAYS

Design Year ADT	Outside Lane LDF	
	Low End ADT	High End ADT
Two Lanes	1.0	1.0
Four Lanes		
Less than 10,000	.95	.95
10,000 to 25,000	.95(A)	.90(A)
25,000 to 40,000	.90(A)	.85(A)
Six Lanes		
25,000 to 40,000	.65(A)	.55(A)
Over 40,000	.50	.40

(A) Where a range of LDF values are given for a range of design year ADTs, the larger LDF shall be used with the lower ADTs in the range.

Traffic Loading

From the DLT the number of trucks in each truck classification shall be determined by multiplying the DLT by the percent of trucks in each classification. These values will be used to determine the Equivalent Single Axle Load (ESAL) for pavement design. An ESAL is the measure of an axle load expressed relative to an 18,000 lb axle load.

Normal highway traffic consists of a random mixture of vehicles with different axle loads and number of axles. Factors have been developed for each truck type so that a truck can be expressed as a certain number of ESALs.

ESAL factors for use in pavement design are given in the table below.

Truck Type	Flexible Pavement ESAL Factors	Rigid Pavement ESAL Factors
2D	0.3	0.3
3SU	0.8	1.2
2-S1, 2-S2	0.5	0.6
3-S2 & Above	0.9	1.6
Double Bottoms	2.0	2.1
Note: Load factors are not given for automobiles and light trucks, as they are insignificant for pavement design purposes.		

With these factors and a forecast of future truck traffic, the number of ESALs a pavement will experience over its design life can be estimated.

Design Daily ESALs for asphaltic pavements is defined as follows:

$$\text{Design Daily ESALs} = \frac{ADT_c + ADT_p}{2} \times DF \times LDF \times \begin{cases} 0.3(2D) \\ 0.8(3SU) \\ 0.5(2\text{-}S1 + 2\text{-}S2) \\ 0.9(3\text{-}S2+) \\ 2.0(\text{Dbl Bottoms}) \end{cases}$$

where: ADT_C is the current Average Daily Traffic

ADT_P is the Average Daily Traffic projected for the design year

DF is the Directional Factor (usually .5)

LDF is the Lane Distribution Factor

2D, 3SU, 2-S1, 2-S2, 3-S2+ and Double Bottoms are the percentage of trucks (expressed as decimal fractions) in these categories

The 20-year Design Life ESALs is just the Design Daily ESALs multiplied by 365 days per year and 20 years.

On minor highways where truck classification data are not available, multiply the total number of trucks in the design lane by a load factor of 0.9 to determine the ESALs. Use five ESALs per day as a minimum.★