Appendix F –

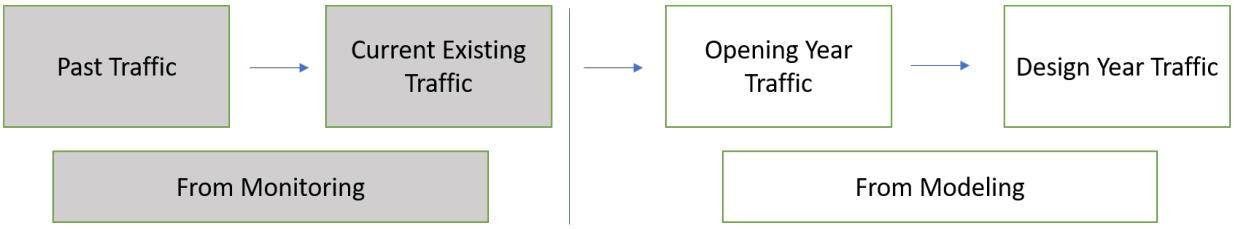
Traffic Data
for Pavement Design

Appendix F. TRAFFIC DATA FOR PAVEMENT DESIGN

F.1 BACKGROUND

The goal of pavement design is to obtain a set of specific pavement construction parameters, such as types of construction material and construction methods; thickness of various courses, including base, structural layer; and a surface course to achieve pre-determined performance criteria. Traffic, climate, soil, and other geological data are typically used as inputs for pavement design. Traffic data should cover the entire life expectancy, which is between the opening year and the last year of life expectancy (Figure F-1). The last year of life expectancy of pavement is often referred to as the design year. For detailed guidance, see AASHTO *Guide for Design of Pavement Structures* Appendix D.

FIGURE F-1 TEMPORAL DATA SEQUENCE



Source: Federal Highway Administration.

Traditionally, the traffic impact on pavement design is through the concept of equivalent single-axle loads (ESAL). One ESAL unit is equates to a 18,000 lbf (pound force) single-axle load of damage applied over the pavement design life. Traffic modeling and design traffic professionals project cumulative ESAL data from all vehicles for the entire pavement life expectancy.

The AASHTO *Mechanistic-Empirical Pavement Design Guide (MEPDG) Manual of Practice* (*MOP*) provides a design method where pavement performance can be modeled with very specific traffic-related parameters. The MEPDG method requires significant traffic data from demand forecasting professionals, which in turn necessitates significant field monitoring data for both vehicle classification and weigh-in-motion (WIM) data.

F.2 VEHICLE RELATED TERMINOLOGIES AND SOURCES OF DATA

The FHWA's 13 vehicle category classification system relies on mainly vehicle axle spacing to differentiate various vehicles. Vehicle data classified under this system are referred to as vehicle class data.

Vehicle axle configuration refers to the different axle groups that a vehicle may have. Pavement design typically uses the following axle groups: single, tandem, tridem, and quad (other than the AASHTO MEPDG, some use penta and penta plus axle groups).

Under each vehicle axle configuration, the weight on the axle/axles is called axle loading that are grouped by axle spacings closer than eight feet into either single, tandem, tridem quad or penta axle groupings. The weight is typically collected by WIM systems and reported in the units of mass (pounds). Axle load reflects both the weight of a vehicle itself and the cargo it carries and is reported by vehicle class and axle group. This is called load spectra.

The primary sources of traffic data for pavement design are vehicle classifiers and WIM systems. Vehicle classifiers provide truck volume by vehicle class counts. WIMs, in addition to truck volume by vehicle class counts, provide axle grouping, axle spacing, and axle weight information.

F.3 TRAFFIC DATA ASSOCIATED WITH ESAL

To design pavement for a travel lane, AASHTO's *Guide for Design of Pavement of Structures* offers the formula for traffic data as listed below.

TABLE F-1 TRAFFIC DATA SUMMARY

Item	Description
1	D_L (lane splitting factor): traffic distribution among different lanes with the same travel direction by vehicle types
2	D_D (directional factor): directional traffic split of a two-way roads
3	AADT by vehicle types
4	AADT by axle weight by vehicle types

Source: Federal Highway Administration.

$w_{18} = D_D \times D_L \times W_{18}$

Where:

w_{18} is the ESAL for the design lane. W_{18} represents the ultimate traffic data needed for pavement design.

D_D is the traffic directional factor for a two-way roadway.

D_L is a lane traffic splitting factor for a roadway having more than one lane in each direction.

W_{18} is cumulative two-way ESAL projected for a roadway segment.

F.3.1 W_{18} – CUMULATIVE TWO-WAY ESAL

The W_{18} is the cumulative dual directional ESAL covering the entire life expectancy. To compute W_{18}, data on number of axles for various axle configurations under various axle loads are needed. While the number of axles for various axle grouping configurations under various axle loads can be obtained from traffic projection professionals, axle load equivalence factors are to be obtained from AASHTO's *Guide for Design of Pavement of Structures* Appendix D.

F.3.2 ONE OF MANY POTENTIAL W_{18} COMPUTATION PROCEDURES

1. Obtain Column A, B, and C information from AASHTO's *Guide for Design of Pavement Structures* Appendix D Tables D.1 to D.18. Values in column C are dependent on axle group, pavement type, slab thickness (for rigid pavements) or pavement structural number (for flexible pavements), and pavement terminal serviceability index.

14. Fill out Column D with forecasted cumulative traffic expected over pavement service life, measured in number of axles by axle load from traffic forecasting professionals.

15. Column E = Column C × Column D.

16. Summarize Column E to obtain the W_{18}.

TABLE F-2 ESAL COMPUTATION ILLUSTRATION

Axle Type	AASHTO Guide Table Axle Loads (KIPS)	AASHTO Guide Table Axle Load Equivalence Factor	Traffic Forecasting Cumulative Number of Axle	ESALs (Columns C X D)
Single Axle	2.00	0.00	768,021	153.6
	4.00	0.00	120,123,356	240,246.7
	6.00	0.01	3,227,896,123	35,506,857.4
	8.00	0.04	623,456,799	22,444,444.8
	10.00	0.09	321,456,799	28,931,111.9
	12.00	0.19	2,100,003	396,900.6
	14.00	0.35	186,000,159	65,844,056.3
	16.00	0.61	0	0.0
	18.00	1.00	0	0.0
	20.00	1.56	0	0.0
	22.00	2.35	0	0.0
	24.00	3.43	0	0.0
	26.00	4.88	0	0.0
	…		0	0.0
	50.00	97.00	0	0.0
Tandem Axle	2.00	0.00	0	0.0
	4.00	0.00	0	0.0
	6.00	0.00	0	0.0
	8.00	0.00	12,345,789	37,037.4
	10.00	0.01	8,964,566	71,716.5
	12.00	0.02	368,945	5,903.1
	14.00	0.03	14,789	428.9
	16.00	0.05	78,965,145	3,948,257.3
	18.00	0.08	32,514,589	2,633,681.7
	…		0	0.0
	32.00	0.84	45,678,912	38,507,322.8
	34.00	1.08	256,000	276,480.0
	36.00	1.38	12,589,631	17,373,690.8
	38.00	1.73	0	0.0
	40.00	2.15	4,781,265	10,279,719.8
	42.00	2.64	3,612,987	9,538,285.7
	…		0	0.0
	68.00	22.40	0	0.0
	70.00	25.60	0	0.0
	…		0	0.0
	86.00	66.00	14,569,124	961,562,184.0
	88.00	73.40	1,256,789	92,248,312.6
	90.00	81.50	345,789	28,181,803.5
Cumulative ESAL				1,289,846,791.7

Source: Federal Highway Administration.

F.4 TRAFFIC DATA ASSOCIATED WITH MECHANISTIC AND EMPIRICAL PAVEMENT DESIGN

AASHTO MEPDG MOP requires the extensive input of traffic data. The following are traffic data items required for the process:

1. Opening Year Two-Way Annual Average Daily Truck Traffic

   Two-way annual average daily truck traffic (AADTT) (trucks are referred to as FHWA's class 4 to 13 vehicles) is needed for opening year condition. These data are used as the base for future traffic growth projection over pavement design life. This is a projected traffic value done by a traffic forecasting professional.

2. Percent of Truck Traffic in Design Direction

   This value is the percentage of truck traffic in the design direction. Unless a roadway has an unbalanced travel for trucks, it should always be 50%.

3. Percent of Truck Traffic in Design Lane %

   This is the percentage of truck traffic for the design lane. The design lane is typically the outside lane with a multilane highway (more than one lane in each travel direction). Trucks tend to operate away from the far inside lane, which is adjacent to the median or the center lane divide on a multilane roadway.

4. Monthly Adjustment Factor (MAF) for Each FHWA Vehicle Class 4 to 13

   The MAF reflects truck travel patterns throughout the year. There are 10 truck types (FHWA vehicle class 4-13) that require 10 temporal pattern inputs for each of 12 calendar months. Mathematically, the monthly adjustment factor for a given vehicle class and a given month is obtained by dividing the monthly average daily truck traffic (MADTT) for the month by the summation of all the 12 monthly MADTT values and then multiplying by 12. There are a total of 120 MAFs [10 vehicle classes × 12 months = 120 individual MAFs].

   The MAF formula for vehicle class i and month k is shown in the following equation.

$$\mathrm{MAF_{ik}} = \frac{\mathrm{MADTT_{ik}} \times 12}{\sum_{k=1}^{k=12} \mathrm{MADTT_{ik}}}$$

   Tables F-3 and F-4 show an example of MAF computation. $\mathrm{MADTT_{ik}}$ values should be computed using TMG procedures for MADT computation.

TABLE F-3 MADTT FOR MAF COMPUTATION

Month	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13
January	588	2,800	1,216	502	250	527	485	51	142	124
February	598	2,851	896	498	263	654	493	38	152	108
March	602	2,864	1,211	561	296	625	520	25	164	165
April	630	3,001	1,321	598	299	692	586	62	159	154
May	674	3,213	1,452	625	421	568	564	45	156	142
June	717	3,415	1,621	740	465	587	652	65	187	165
July	756	3,602	1,690	789	489	623	657	82	221	120
August	810	3,859	1,699	785	620	621	678	32	235	95
September	832	3,962	1,780	741	661	451	725	67	268	67
October	755	3,455	1,795	645	561	482	712	12	189	64
November	685	2,699	1,400	560	421	389	608	18	167	96
December	598	2,760	1,324	495	412	462	527	19	152	116
Total	8,245	38,481	17,405	7,539	5,158	6,681	7,207	516	2,192	1,416

Source: Federal Highway Administration. (MADTT is monthly average truck traffic and MAF is monthly adjustment factor)

TABLE F-4 MAF COMPUTED FROM MADTT

Month	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13
January	0.86	0.87	0.84	0.80	0.58	0.95	0.81	1.19	0.78	1.05
February	0.87	0.89	0.62	0.79	0.61	1.17	0.82	0.88	0.83	0.92
March	0.88	0.89	0.83	0.89	0.69	1.12	0.87	0.58	0.90	1.40
April	0.92	0.94	0.91	0.95	0.70	1.24	0.98	1.44	0.87	1.31
May	0.98	1.00	1.00	0.99	0.98	1.02	0.94	1.05	0.85	1.20
June	1.04	1.06	1.12	1.18	1.08	1.05	1.09	1.51	1.02	1.40
July	1.10	1.12	1.17	1.26	1.14	1.12	1.09	1.91	1.21	1.02
August	1.18	1.20	1.17	1.25	1.44	1.12	1.13	0.74	1.29	0.81
September	1.21	1.24	1.23	1.18	1.54	0.81	1.21	1.56	1.47	0.57
October	1.10	1.08	1.24	1.03	1.31	0.87	1.19	0.28	1.03	0.54
November	1.00	0.84	0.97	0.89	0.98	0.70	1.01	0.42	0.91	0.81
December	0.87	0.86	0.91	0.79	0.96	0.83	0.88	0.44	0.83	0.98
Total	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00

Source: Federal Highway Administration. (MADTT is monthly average truck traffic and MAF is monthly adjustment factor)

5. Vehicle Class Distribution

Vehicle class distribution (VCD) refers to AADTT distribution among the 10 vehicle types (FHWA vehicle class 4 to 13), expressed in percentages. The percentage data are computed from vehicle classification data using the following formula.

$$\mathrm{VCD_i} = 100\frac{\mathrm{AADTT_i}}{\sum_{i=4}^{i=13}\mathrm{AADTT_i}}$$

Where VCD_i is the truck distribution factor for vehicle class i truck and $AADTT_i$ is the AADTT for vehicle class i truck. $AADTT_i$ values should be computed using TMG procedure for AADTT computation.

TABLE F-5 VEHICLE CLASS DISTRIBUTION COMPUTATION ILLUSTRATION

Parameter	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Total
$AADTT_i$	235	654	961	1,620	1,240	654	598	103	1,245	4,621	11,931
VCD_i,%	2.0	5.5	8.1	13.6	10.4	5.5	5.0	0.9	10.4	38.7	100.0

Source: Federal Highway Administration.

6. Hourly Adjustment Factor (HAF) for FHWA Vehicle Classes 4-13

Truck hourly distribution factor refers to the percentage of hourly AADTT among a 24-hour period starting at midnight. There are 24 HAFs. One set of 24 HDF factors is computed using AADTT (for FHWA vehicle classes 4-13 combined) using the following formula.

$$\mathrm{HAF_h} = 100\frac{\mathrm{AADTT_h}}{\mathrm{AADTT}}$$

Where HAF_h is the truck hourly distribution factor for the h^{th} hour of the day, $AADTT_h$ is the AADTT for hour h for vehicles in FHWA classes 4–13 combined, and the AADTT is vehicles in FHWA classes 4–13 combined. $AADTT_h$ and AADTT values should be computed using TMG procedures for AADTT computation.

TABLE F-6 TRUCK HOURLY DISTRIBUTION FACTOR COMPUTATION ILLUSTRATION

Start Time	End Time	$AADTT_h$	HAF, %
00:00	01:00	8	0.6
01:00	02:00	9	0.7
02:00	03:00	12	0.9
03:00	04:00	16	1.3
04:00	05:00	25	2.0
05:00	06:00	36	2.8
06:00	07:00	45	3.5
07:00	08:00	68	5.3
08:00	09:00	78	6.1
09:00	10:00	76	5.9
10:00	11:00	78	6.1
11:00	12:00	82	6.4

Start Time	End Time	$AADTT_h$	HAF, %
12:00	13:00	98	7.7
13:00	14:00	98	7.7
14:00	15:00	86	6.7
15:00	16:00	88	6.9
16:00	17:00	74	5.8
17:00	18:00	78	6.1
18:00	19:00	64	5.0
19:00	20:00	52	4.1
20:00	21:00	54	4.2
21:00	22:00	26	2.0
22:00	23:00	18	1.4
23:00	24:00	10	0.8
Total (AADTT)		1,279	100.0

Source: Federal Highway Administration. (AADTT is annual average daily truck traffic and HAF is hourly adjustment factor)

7. Axle Load Distribution Factors

FHWA vehicles in classes 4 to 13 can have a variety of axle configurations, including single axle, tandem axle, tridem axle, and quad axle. For a given vehicle class and axle configuration, axle weight varies depending on vehicle load. Axle Load Distribution Factors (ALDFs) provide information about the percentage of axle counts expected within each defined load bin. The distributions are provided for a typical day of each calendar month (January through December) for each FHWA vehicle class (classes 4 through 13) and each axle group (single, tandem, tridem, and quad). In the current guide, the quad axle group includes axle groups with four or more axles. This is one of the most demanding datasets. Mathematically, the ALDF is the percentage of axles within a given axle load range (or load bin) among all axles counted or estimated for a given vehicle class, axle configuration, and calendar month. The computation of the ALDF is based on monthly axle load data for a particular vehicle class, axle configuration, and axle load group, if at least 7 DOW of axle loading data are present in the calendar month. For the months with less than 7 DOW of axle loading data, ALDFs are computed using ALDF values for adjacent months (by averaging) or using annual axle count summaries.

7a. Single Axle Load Distribution Factors

There are 39 axle load groups or bins for single axles. The axle loading reporting starts with a load bin containing the percentage of axles weighing between 0 and 3,000 lbs. and ends with a load bin for axles weighing 41,000 lbs. or more. All load bins have increments of 1,000 lbs., except the first one. Table F-7 provides an example of single axle load distribution factors for selected months and vehicle classes.

7b. Tandem Axle Load Distribution Factors

There are 39 axle load group for tandem axles. For tandem axles, the axle loading reporting starts with the load bin containing the percentage of axles weighing between 0 and 6,000 lbs. and ends with the load bin for axles weighing 82,000 lbs. or more. All load bins have increments of 2,000 lbs., except the first one.

7c. Tridem Axle and Quad Axle Load Distribution Factors

There are 31 axle weight groups for tridem and quad axles. For both tridem and quad axle vehicles, the axle weight group starts with a load bin containing the percentage of axles weighing between 0 and 12,000 lb. and ends with a load bin for axles weighing 102,000 lbs. or more. All other load bins have

increments of 3,000 lbs.

7d. Default Axle Load Distribution Factors

FHWA Long-Term Pavement Performance Program has developed a library of axle loading defaults for each FHWA vehicle class 4–13 and axle group (single, tandem, tridem, quad). For more information, see FHWA Report FHWA-HRT-13-089.

TABLE F-7 ILLUSTRATION OF SINGLE AXLE LOAD DISTRIBUTION FACTORS FOR JANUARY, FEBRUARY AND DECEMBER FOR SELECTED VEHICLE CLASSES

Month:		January	January	January	January	January	January	January	January	January	January	February	February	December
Vehicle Class:		4	5	6	7	8	9	10	11	12	13	4	5	13
Axle Weight (lbs.) (Ending Load Bin Values):	3,000	1.8	10.05	2.47	2.14	11.65	1.74	3.64	3.55	6.68	8.88	1.8	10.03	8.88
	4,000	0.96	13.21	1.78	0.55	5.37	1.37	1.24	2.91	2.29	2.67	0.96	13.21	2.67
	5,000	2.91	16.42	3.45	2.42	7.84	2.84	2.36	5.19	4.87	3.81	2.91	16.41	3.81
	6,000	3.99	10.61	3.95	2.7	6.99	3.53	3.38	5.27	5.86	5.23	3.99	10.61	5.23
	7,000	6.8	9.22	6.7	3.21	7.99	4.93	5.18	6.32	5.97	6.03	6.8	9.24	6.03
	8,000	11.47	8.27	8.45	5.81	9.63	8.43	8.35	6.98	8.86	8.1	11.47	8.27	8.1
	9,000	11.3	7.12	11.85	5.26	9.93	13.67	13.85	8.08	9.58	8.35	11.31	7.12	8.35
	10,000	10.97	5.85	13.57	7.39	8.51	17.68	17.35	9.68	9.94	10.69	10.97	5.85	10.69
	11,000	9.88	4.53	12.13	6.85	6.47	16.71	16.21	8.55	8.59	10.69	9.88	4.54	10.69
	12,000	8.54	3.46	9.48	7.42	5.19	11.57	10.27	7.29	7.11	11.11	8.54	3.46	11.11
	13,000	7.33	2.56	6.83	8.99	3.99	6.09	6.52	7.16	5.87	7.32	7.32	2.56	7.32
	14,000	5.55	1.92	5.05	8.15	3.38	3.52	3.94	5.65	6.61	3.78	5.55	1.92	3.78
	15,000	4.23	1.54	3.74	7.77	2.73	1.91	2.33	4.77	4.55	3.1	4.23	1.54	3.1
	16,000	3.11	1.19	2.66	6.84	2.19	1.55	1.57	4.35	3.63	2.58	3.11	1.19	2.58
	17,000	2.54	0.9	1.92	5.67	1.83	1.1	1.07	3.56	2.56	1.52	2.54	0.9	1.52
	18,000	1.98	0.68	1.43	4.63	1.53	0.88	0.71	3.02	2	1.32	1.98	0.68	1.32
	19,000	1.53	0.52	1.07	3.5	1.16	0.73	0.53	2.06	1.54	1	1.53	0.52	1
	20,000	1.19	0.4	0.82	2.64	0.97	0.53	0.32	1.63	0.98	0.83	1.19	0.4	0.83
	21,000	1.16	0.31	0.64	1.9	0.61	0.38	0.29	1.27	0.71	0.64	1.16	0.31	0.64
	22,000	0.66	0.31	0.49	1.31	0.55	0.25	0.19	0.76	0.51	0.38	0.66	0.31	0.38
	23,000	0.56	0.18	0.38	0.97	0.36	0.17	0.15	0.59	0.29	0.52	0.56	0.18	0.52
	24,000	0.37	0.14	0.26	0.67	0.26	0.13	0.17	0.41	0.27	0.22	0.37	0.14	0.22
	25,000	0.31	0.15	0.24	0.43	0.19	0.08	0.09	0.25	0.19	0.13	0.31	0.15	0.13
	26,000	0.18	0.12	0.13	1.18	0.16	0.06	0.05	0.14	0.15	0.26	0.18	0.12	0.26
	27,000	0.18	0.08	0.13	0.26	0.11	0.04	0.03	0.21	0.12	0.28	0.18	0.08	0.28
	28,000	0.14	0.05	0.08	0.17	0.08	0.03	0.02	0.07	0.08	0.12	0.14	0.05	0.12
	29,000	0.08	0.05	0.08	0.17	0.05	0.02	0.03	0.09	0.09	0.13	0.08	0.05	0.13

Month:		January	January	January	January	January	January	January	January	January	January	February	February	December
Vehicle Class:		4	5	6	7	8	9	10	11	12	13	4	5	13
	30,000	0.05	0.02	0.05	0.08	0.04	0.01	0.02	0.06	0.02	0.05	0.05	0.02	0.05
	31,000	0.04	0.02	0.03	0.72	0.04	0.01	0.03	0.03	0.03	0.05	0.04	0.02	0.05
	32,000	0.04	0.02	0.03	0.06	0.12	0.01	0.01	0.04	0.01	0.08	0.04	0.02	0.08
	33,000	0.04	0.02	0.03	0.03	0.01	0.01	0.02	0.01	0.01	0.06	0.04	0.02	0.06
	34,000	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0	0.01	0.02	0.03	0.02	0.02
	35,000	0.02	0.02	0.01	0.02	0.02	0	0.01	0	0	0.01	0.02	0.02	0.01
	36,000	0.02	0.02	0.01	0.02	0.01	0.01	0	0	0	0.01	0.02	0.02	0.01
	37,000	0.01	0.01	0.01	0.01	0.01	0	0.01	0	0.01	0.01	0.01	0.01	0.01
	38,000	0.01	0.01	0.01	0.01	0	0	0	0.02	0.01	0.01	0.01	0.01	0.01
	39,000	0.01	0	0.01	0.01	0.01	0	0.01	0.01	0	0.01	0.01	0	0.01
	40,000	0.01	0	0.01	0.01	0	0	0.04	0.02	0	0	0.01	0	0
	41,000+	0	0	0	0	0	0	0	0	0	0	0	0	0
% of Total		100	100	100	100	100	100	100	100	100	100	100	100	100

Source: *Federal Highway Administration.*

8. Number of Axles per Truck Class for Each Axle Group

   The number of axles per vehicle class for a given axle configuration is an annual average number of axles per vehicle category (per vehicle class and vehicle axle configuration). An example of axles per truck is shown in Table F-8.

TABLE F-8 AVERAGE NUMBER OF AXLES PER AXLE GROUP PER VEHICLE CLASS

FHWA Vehicle Class	Single	Tandem	Tridem	Quad
Class 4	1.43	0.57	0.00	0.00
Class 5	2.00	0.00	0.00	0.00
Class 6	1.00	1.00	0.00	0.00
Class 7	1.26	0.20	0.63	0.15
Class 8	2.62	0.49	0.00	0.00
Class 9	1.27	1.86	0.00	0.00
Class 10	1.09	1.15	0.79	0.05
Class 11	5.00	0.00	0.00	0.00
Class 12	4.00	1.00	0.00	0.00
Class 13	1.59	1.26	0.69	0.31

Source: Federal Highway Administration.

9. Axle Spacing

   Axle spacing data are only applicable to tandem, tridem, and quad vehicles in the sense for pavement design concepts discussed here. It is the distance between two consecutive tandem, tridem, and quad axles.

10. Average Axle Width

    The distance between the two outside edges of an axle is defined as axle width.

11. Wheelbase

    The distance between the steering and the first device axle of a tractor or a heavy single unit. This definition is only applicable to the pavement design concept discussed here.

    Table F-9 summarizes traffic data requirements for MEPDG. Each parameter listed in Table F-9 requires a representative value or a set of values computed using hourly, monthly, or annual traffic summary statistics.

TABLE F-9 TRAFFIC DATA SUMMARY

Item #	Item Name	# of Data Points	Summarization Level	Foundation Data	Data Dimension
1	Annual Average Daily Truck Traffic	1	One annualized value	AADTT	By sum of all trucks
2	% of Truck Traffic in Design Direction	1	One annualized value	AADTT	By sum of all trucks and travel direction
3	% of Truck Traffic in Design Lane	1	One annualized value	AADTT	By sum of all trucks, travel direction, and travel lane
4	Monthly Adjustment Factors	120	One set of monthly values	MADTT	MADTT by truck class for each month in a year
5	Vehicle Class Distribution	12	One set of annualized values	AADTT	AADTT by truck class
6	Hourly Adjustment Factors	24	One set of annualized values	AADTT by hour	AADTT by sum of all trucks by hour of the day
7	Axle Load Distribution Factors – Single Axle	4680	One set of representative values for each calendar month	Monthly axle counts by weight	Monthly axle count data by truck class, axle configuration, and axle weight group
	Axle Load Factor – Tandem	4680	One set of representative values for each calendar month	Monthly axle counts by weight	Monthly axle count data by truck class, axle configuration, and axle weight group
	Axle Load Factor – Tridem	3720	One set of representative values for each calendar month	Monthly axle counts by weight	Monthly axle count data by truck class, axle configuration, and axle weight group
	Axle Load factor – Quad	3720	One set of representative values for each calendar month	Monthly axle count by weight	Monthly axle count data by truck class, axle configuration, and axle weight group
8	Number of Axles Per Truck	40	One set of annualized values	Annualized axle counts	Monthly axle count data by truck class and axle configuration
9	Axle Spacing – tandem, tridem, and quad	3	One set of annualized values	Annualized axle spacing summary	Annual axle count by axle configuration
10	Wheelbase – short, medium, and long categories)	3	One set of annualized values	Annualized axle spacing summary	Annual axle count by wheelbase

Source: Federal Highway Administration.

F.5 SUMMARY

Traffic data is one of the most critical elements in pavement design. Even though all traffic data used in pavement design reflects future traffic conditions, traffic monitoring programs and traffic monitoring data provide the needed ground truth in the projection processes including, but not limited to, establishing historical trend and model calibration and validation.

F.6 SCREENSHOTS OF AASHTOWARE PAVEMENT ME DESIGN SOFTWARE GUIS FOR TRAFFIC INPUTS

The following tables, figures and text describe the traffic inputs from AASHTOWARE Pavement ME Design software, version 2.6.0.

TABLE F-10 VEHICLE CLASS DISTRIBUTION AND GROWTH RATE INPUTS

Vehicle Class	Distribution (%)	Growth Rate (%)	Growth Function
Class 4	0.90	3.5	Compound
Class 5	9.64	3.5	Compound
Class 6	3.53	3.5	Compound
Class 7	1.59	3.5	Compound
Class 8	3.63	3.5	Compound
Class 9	74.42	3.5	Compound
Class 10	0.58	3.5	Compound
Class 11	4.25	3.5	Compound
Class 12	1.31	3.5	Compound
Class 13	0.15	3.5	Compound
Total	100.00	3.5	Compound

Source: AASHTOWare Pavement ME Design™ Software, Version 2.6.0, June 2020, American Association of State Highway and Transportation Officials 555 12th Street NW, Suite 1000, Washington, DC, 20004.

TABLE F-11 MONTHLY ADJUSTMENT INPUTS

Month	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13
January	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
February	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
March	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
April	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
May	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
June	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
July	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
August	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
September	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
October	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
November	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
December	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92

Source: AASHTOWare Pavement ME Design™ Software, Version 2.6.0, June 2020, American Association of State Highway and Transportation Officials 555 12th Street NW, Suite 1000, Washington, DC, 20004.

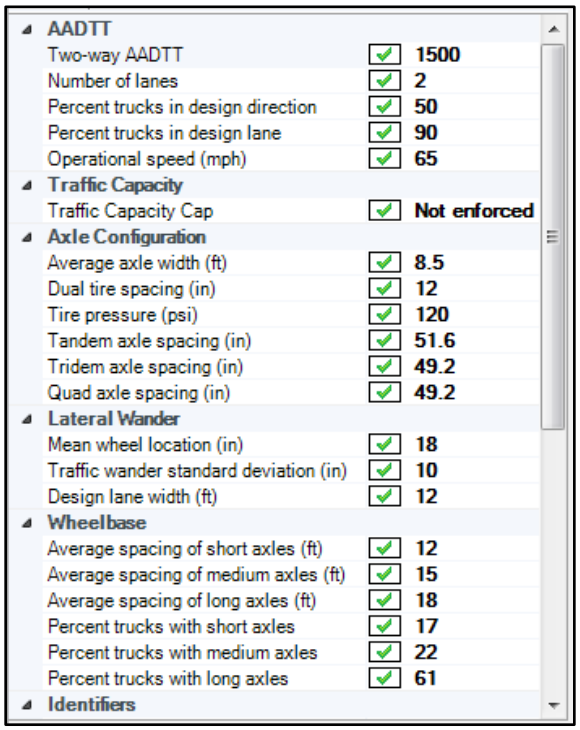
TABLE F-12 AXLES PER TRUCK INPUTS

Vehicle Class	Single	Tandem	Tridem	Quad

Class 4	1.61	0.39	0.00	0.00
Class 5	2.03	0.06	0.00	0.00
Class 6	1.03	0.98	0.00	0.00
Class 7	1.05	0.02	0.97	0.00
Class 8	2.24	0.79	0.00	0.00
Class 9	1.28	1.84	0.00	0.00
Class 10	1.13	1.02	0.92	0.00
Class 11	4.94	0.00	0.00	0.00
Class 12	3.37	1.28	0.00	0.00
Class 13	1.39	0.77	0.81	0.27

Source: AASHTOWare Pavement ME Design™ Software, Version 2.6.0, June 2020, American Association of State Highway and Transportation Officials 555 12th Street NW, Suite 1000, Washington, DC, 20004.

FIGURE F-1. AADTT, TRAFFIC CAPACITY, AXLE CONFIGURATION, LATERAL WANDER, AND WHEELBASE INPUTS.



Source: Screen capture from the AASHTOWare Pavement ME Design™ Software. Reference: AASHTOWare Pavement ME Design™ Software, Version 2.6.0, June 2020, American Association of State Highway and Transportation Officials 555 12th Street NW, Suite 1000, Washington, DC, 20004.

Note 1: Average axle width, mean wheel location, design lane width, and all wheelbase inputs shown in Figure F-1 are only used for rigid pavement analyses.

Note 2: The green checkmarks shown in Figure F-1 mean that the values entered are within the minimum and maximum input values for which the software was designed.

AXLE LOAD DISTRIBUTION FACTORS INPUTS

Axle load distribution tables will show for each month of the year the classes 4 through 13 values of axle loading for each of the axle loading groups (single, tandem, tridem and quad) in various 1,000 lbs. increment ranges with single axle in 1,000 lbs. increment ranges, tandem in 2,000 lbs. increment ranges and tridem and quad in 3,000 lbs. increment ranges. These often are referred to load spectrum by vehicle class.

TABLE F-13 HOURLY ADJUSTMENT INPUTS FOR EVERY HOUR OF THE DAY

Time of Day	Percentage
12:00 am	2.50
1:00 am	2.28
2:00 am	2.26
3:00 am	2.44
4:00 am	2.77
5:00 am	3.37
6:00 am	4.20
7:00 am	4.66
8:00 am	4.90
9:00 am	5.14
10:00 am	5.31
11:00 am	5.39
12:00 pm	5.37
1:00 pm	5.43
2:00 pm	5.56
3:00 pm	5.58
4:00 pm	5.38
5:00 pm	5.05
6:00 pm	4.63
7:00 pm	4.20
8:00 pm	3.84
9:00 pm	3.59
10:00 pm	3.28
11:00 pm	2.87
Total	100.00

Source: AASHTOWare Pavement ME Design™ Software, Version 2.6.0, June 2020, American Association of State Highway and Transportation Officials 555 12th Street NW, Suite 1000, Washington, DC, 20004.

Note 4: Hourly adjustments are only used in rigid pavement analyses.