Introduction to Transportation Planning

An Online Continuing Education Course for Engineers

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I. Background

Corridor traffic forecasting and project design traffic forecasting projects require the forecasts of Annual Average Daily Traffic (AADT) and Design Hourly Volume (DHV). AADT and DHV are related to each other by the ratio known as the K-factor.

The Association of State Highway and Transportation Officials (AASHTO) suggests, and the Federal Highway Administration (FHWA) requires that K_{30} be used for all design hour traffic projections. The overall truck volume and AADT are related to each other by the T-factor. The total impact of traffic on pavement design is expressed in units of ESALs, which represent truck axle weights converted into 18,000-pound loads carried by a single, four-tire axle.

II. Forecasting

A. Project Design Traffic Forecasting

The project design traffic forecasting process estimates traffic conditions used for determining the geometric design of a roadway and/or intersection, and the number of 18 KIP ESALs that pavement will be subjected to over the design life. Project design traffic forecasting is required for reconstruction, resurfacing, adding lanes, bridge replacement, new roadway projects, and major intersection improvements. The process is site-specific and covers a limited geographic area.

B. Corridor Traffic Forecasting

Corridor traffic forecasting is used to determine the required number of lanes within a corridor or system to meet anticipated traffic demands. It is required prior to the establishment of a new alignment or the widening of existing facilities. Corridor traffic models are usually calibrated for forecast traffic for a specific corridor and are usually more specific than the urban area or statewide models and more general than a project-specific model.

C. Equivalent Single Axle Loading (ESAL) Forecasting

The equivalent single axle loading (ESAL) forecasting process is necessary for pavement design for new construction, reconstruction, or resurfacing projects. The pavement design for new alignment and reconstruction projects requires a structural loading forecast using the 18 KIP ESAL forecasting process. Structural design is primarily dependent upon the heavy axle loads generated by commercial traffic. The pavement design of new roadway construction, reconstruction or resurfacing is based on accumulated 18 KIP ESALs. Truck traffic and damage factors are needed to calculate axle loads expressed as ESALs.

III. Traffic Data Sources

A. Traffic Adjustment Data Sources

1. Permanent Continuous Counts

Traffic data is collected through permanently-installed traffic counters. These Telemetry Traffic Monitoring Sites (TTMSs) continuously record the distribution and variation of traffic flow by hours of the day, days of the week, and months of the year, from year to year, and transmit the data remotely. The TTMSs collect data 365 days a year. For these TTMS sites, actual AADT, K, D, and T are measured. This information provides a statistical basis for estimating AADT, K, D, and T for all other traffic counts where short-term traffic counts are obtained.

Permanent traffic counters use inductive loops to detect vehicles and record the traffic volumes for each hour. A single loop is required to collect traffic volume data. Two loops are required to collect speed data. Two loops and an axle sensor are required to collect vehicle classification data, and two loops with a weight sensor (piezo or bending plate) are required to collect vehicle weight data.

2. Permanent Continuous Classification Counts

These classification counts are collected daily and are used to produce AADT, K, D and T. These counts are also used to calculate axle correction factors, K_{30}, D_{30} and T for design applications

3. Portable Seasonal Classification Counts

Portable Traffic Monitoring Sites (PTMSs) are automatic traffic recorders that are temporarily placed at specific locations throughout the state to record the distribution and variation of traffic flow. Seasonal classification counts are used to develop the axle correction factors and truck percentages during the year. These counts are performed one or more times a year (24 – 48 hours each) as deemed necessary to capture the seasonal truck variation. The classification counts will be used to estimate the axle correction factor and percentage of trucks.

B. Short-Term Traffic Counts

These counts are primarily performed by local agencies and consultants, who are responsible for them and use various portable traffic counting devices. The counts are collected using axle counters, vehicle counters, and/or video detection.

Portable traffic counters frequently use rubber hoses that record by sensing the number of axles. These counters are small enough to be transported, contain a power source, and may be easily secured to a telephone pole, fence post, signpost, tree, etc. They may include time period

recording or cumulative counts. Most traffic volume counters utilize electronic storage and require software and/or hardware to download the collected data. The downloaded data can be transferred directly to a computer or may be printed in a report format. Video detection can also be used to collect the same data.

1. Portable Axle Counters

If the counting device measures the "number of axles," an axle factor is assigned to the specific count location based on the trucking characteristics of that location. The axle correction factor is applied to the count, and then the count is seasonally adjusted.

2. Portable Vehicle Counters

If the counting device counts the "number of vehicles," the count site will require no axle corrections.

3. Seasonal Adjustments

All short-term counts must be adjusted to reflect the seasonal changes in traffic volumes. The seasonal factors, K and D, are used to estimate the average K_{30} and D_{30} for system-level analysis.

IV. Traffic Adjustment Factors

A. Seasonal Factor (SF)

The Monthly Seasonal Factor (MSF) for a particular month in a particular location is derived from the Annual Average Daily Traffic (AADT) divided by the Monthly Average Daily Traffic (MADT) for a specific month at that count site:

$$MSF = AADT/MADT$$

Weekly Seasonal Factors (SF) are developed by interpolating between the monthly factors for two consecutive months. The Seasonal Factors are calculated for each week of the year for each permanent count station. The SF and Axle Correction Factors are used to convert ADT to AADT.

B. Axle Correction Factor

The Axle Correction Factors are determined by using the data from continuous classification counts and portable seasonal classification counts following the guidelines described in the FHWA Traffic Monitoring Guidelines.

For design traffic purposes, the data collected on a road system is used to measure the values identified as AADT, K, D, and T. AADT, K, and D are the three critical numbers that determine the geometric design of a road. T is the critical value for pavement design. AADT is the most important value used in design traffic forecasts because K, D, and T are key factors that are related to AADT.

C. Annual Average Daily Traffic (AADT)

The Annual Average Daily Traffic (AADT) is the estimate of typical daily traffic on a road segment for all days of the week, Sunday through Saturday, over the period of one year. AADT is determined by dividing the total volume of traffic on a highway segment for one year by the number of days in the year. The AADT is the best measure of the total use of a road because it includes all traffic for an entire year.

Average Daily Traffic (ADT) is obtained by a short-term traffic count. Short-term counts are commonly referred to as "raw counts" or simply "traffic counts." ADT is typically a 72-hour traffic count collected on Tuesday, Wednesday, and Thursday divided by three. However, ADT can be based on the simple average of any short-term traffic count at least 24 hours long. 24-hour and 48-hour traffic counts are often taken to measure ADT and converted to AADT for design traffic projects. For design traffic forecasts, the Weekly Correction Factor (SF) and Axle Correction Factor should be used to convert ADT to AADT.

AADT = ADT

When the ADT tion factor assigned to that site, it will p ear at that site known as AADT.

D. K Factor

K is the proportion ritical in design traffic forecasts bec y traffic going to work and coming h used, it is appropriate to desig

It may not be financ therefore, the 30th highest hour of the y roportion of AADT occurring du affic projections are expressed as AADT (DHV). AADT and DHV are related to each other in the follow equation: