Traffic Volume Studies

- Engineers often use counts of number of vehicles or pedestrians passing a point, entering an intersection, or using a particular facility such as travel lane, crosswalk or sidewalk.

- Counts are usually samples of actual volumes, although continuous counting is also sometimes performed.

- Sampling periods may range from a few minutes to a month or more.

Traffic Volume Studies

- The two basic methods of counting traffic are:
  - Manual observation
  - Automatic recording

Traffic Volume Studies

- Many types of counts require classification that are obtained more easily and accurately with trained observers.

- Examples include vehicle occupancy, pedestrians, turning movements, and vehicle classifications.

- Other reasons for conducting manual counts are time and resources.

Traffic Volume Studies

- Typical equipment needed for manual counts are:
  - Tally Sheets, or
  - Mechanical Count Boards, or
  - Electronic Count Boards
Traffic Volume Studies

Manual Observation

- Manual traffic counting requires trained observers.
- They must be relieved periodically to avoid fatigue and degraded performance.
- Breaks of 10 to 15 minutes should be scheduled at least every 2 hours.
- If data collection period is more than 8 hours, breaks of 30 to 45 minutes should be allowed every 4 hours.

Traffic Volume Studies

Automatic Recording

- The automatic counting method involves the laying of surface detectors (such as pneumatic road tubes) or subsurface detectors (such as magnetic or electronic contact devices) on the road. These detect the passing vehicle and transmit the information to a recorder, which is connected to the detector at the side of the road.

Traffic Volume Study

Daily Volumes and Their Use

- A common time interval for volumes is a day.
- Daily volumes are frequently used as the basis for highway planning and general observations of trends.
- Traffic volume projections are often based on measured daily volumes.

Traffic Volume Study

Daily Volumes and Their Use (Contd.)

- There are four commonly used daily volume parameters:
  1. Average Annual Daily Traffic (AADT): is the average 24-hr traffic volume at a given location over a full 365-day year.
  2. Average Annual Weekday Traffic (AAWT): is the average 24-hr traffic volume occurring on weekdays over a full 365-day year.
  3. Average Daily Traffic (ADT): is an average 24-hr volume at a given location for some period of time less than a year, but more than one day.
  4. Average Weekday Traffic (AWT): is an average 24-hr traffic volume occurring on weekdays for some period less than one year.

Traffic Stream Parameters

Table 3-7: Illustration of Daily Volume Distributions

<table>
<thead>
<tr>
<th>Month</th>
<th>No. of Vehicles</th>
<th>Total Annual Volume</th>
<th>Total Weekly Volume</th>
<th>AADT</th>
<th>AWT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>35</td>
<td>414,000</td>
<td>396,000</td>
<td>5,463</td>
<td>5,343</td>
</tr>
<tr>
<td>Feb</td>
<td>27</td>
<td>378,000</td>
<td>353,000</td>
<td>4,901</td>
<td>4,781</td>
</tr>
<tr>
<td>Mar</td>
<td>28</td>
<td>429,000</td>
<td>412,000</td>
<td>5,463</td>
<td>5,343</td>
</tr>
<tr>
<td>Apr</td>
<td>30</td>
<td>490,000</td>
<td>464,000</td>
<td>6,001</td>
<td>5,881</td>
</tr>
<tr>
<td>May</td>
<td>27</td>
<td>400,000</td>
<td>377,000</td>
<td>4,863</td>
<td>4,733</td>
</tr>
<tr>
<td>Jun</td>
<td>27</td>
<td>383,000</td>
<td>364,000</td>
<td>4,691</td>
<td>4,561</td>
</tr>
<tr>
<td>Jul</td>
<td>28</td>
<td>450,000</td>
<td>424,000</td>
<td>5,563</td>
<td>5,443</td>
</tr>
<tr>
<td>Aug</td>
<td>27</td>
<td>365,000</td>
<td>343,000</td>
<td>4,491</td>
<td>4,361</td>
</tr>
<tr>
<td>Sep</td>
<td>30</td>
<td>452,000</td>
<td>428,000</td>
<td>5,653</td>
<td>5,533</td>
</tr>
<tr>
<td>Oct</td>
<td>30</td>
<td>410,000</td>
<td>392,000</td>
<td>5,263</td>
<td>5,143</td>
</tr>
<tr>
<td>Nov</td>
<td>30</td>
<td>400,000</td>
<td>383,000</td>
<td>5,143</td>
<td>5,023</td>
</tr>
<tr>
<td>Dec</td>
<td>30</td>
<td>330,000</td>
<td>310,000</td>
<td>4,063</td>
<td>3,943</td>
</tr>
<tr>
<td>Year</td>
<td>360</td>
<td>4,940,000</td>
<td>4,600,000</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

AADT = 2,490,000 / 360 = 6,911.11
AADT = 2,490,000 / 360 = 6,911.11

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Traffic Stream Parameters

**Hourly Volumes and Their Use**

- While daily volumes are useful in highway planning, they cannot be used alone for design or operational analysis purposes.
- Traffic volume varies considerably during the course of a 24-hr day, usually with periods of maximum volume occurring during the morning and evening commuter "rush" hours.
- The single hour of the day that has the highest hourly volume is referred to as the "peak hour".
- Traffic volume within this hour is of greatest interest to traffic engineers in design or operational analysis.

- Traffic volume within this hour is of greatest interest to traffic engineers in design or operational analysis.

**Traffic Stream Parameters**

**Hourly Volumes and Their Use (contd...)**

- The peak hour volume is generally a directional volume and may be viewed as a directional design hour volume (DDHV).
- Directional Design Hour Volume may estimated using the following relationship:

\[
DDHV = \text{AADT} \times K \times D
\]

- \( K \) = proportion of daily traffic occurring during the peak hour, expressed as a decimal, and
- \( D \) = proportion of peak hour traffic traveling in the peak direction, expressed as a decimal.
- "K" often represents the proportion of AADT occurring during the thirtieth highest peak hour (30 HV) of the year.

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**Traffic Volume Studies**

**Types of Counts**

- Different types of traffic counts are carried out, depending on the anticipated use of the data to be collected. They are:
  - Cordon Counts
  - Screen Line Counts
  - Intersection Counts
  - Pedestrian Volume Counts, and
  - Periodic Volume Counts (Continuous, Control, and Coverage Counts)

**1. Cordon Counts**

- When information is required on vehicle accumulation within an area, a cordon count is undertaken.
- The area for which the data are required is cordoned off by an imaginary closed loop.
- The intersection of each street crossing the cordon line is taken as a count station where volume counts of vehicles and/or persons entering and leaving the cordon area are undertaken.
Traffic Volume Studies

Types of Counts

1. Information obtained are useful for planning parking facilities, updating and evaluating traffic operational techniques, and making long range plans for freeway and arterial street systems.

2. Screen Line Counts
   - The study area is divided into large sections by running imaginary lines across it.
   - Traffic counts are taken at each point where a road crosses the screen line.
   - Data collected facilitates the detection of variations in the traffic volume and traffic flow direction due to the changes in the land-use pattern of the area.

3. Intersection Counts
   - Intersection counts are taken to determine vehicle classification, through movements and turning movements at intersections.
   - Data collected are mainly used in determining phase lengths and cycle times for signalized intersections and also for channelization at the intersections.

4. Pedestrian Volume Counts
   - Volume counts of pedestrians are made at locations such as mid-blocks, crosswalks, and transit stations.
   - Counts are usually made to evaluate the existing or proposed pedestrian facilities.

5. Periodic Volume Counts
   - In order to obtain certain traffic volume data, such as AADT, it is necessary to obtain data continuously.
   - However, it is not feasible to collect continuous data on all roads because of the cost involved.

To make reasonable estimates of annual traffic volume characteristics on an area-wide basis, different types of periodic counts with count durations ranging from 15 minutes to continuous, are conducted.

Periodic volume counts are used to calculate expansion factors needed to estimate the annual traffic volume.
Traffic Volume Studies

- Expansion Factors from Continuous Count Stations

- Hourly Expansion Factor (HEF)

\[ HEF = \frac{\text{total volume for } 24\text{–}hr\text{ period}}{\text{volume for particular hour}} \]

- Daily Expansion Factor (DEF)

\[ DEF = \frac{\text{average total volume for a week}}{\text{average volume for particular day}} \]

- Monthly Expansion Factor (MEF)

\[ MEF = \frac{\text{AADT}}{\text{AADT for particular month}} \]
Traffic Volume Studies

Calculating AADT using expansion factors

- A traffic engineer urgently needs to determine the AADT on a rural primary road that has the volume distribution characteristics shown in previous Tables 4.6, 4.7, and 4.8. He collected the data shown below on a Tuesday during the month of May. Determine the AADT of the road.

<table>
<thead>
<tr>
<th>Time Period</th>
<th># Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 – 8:00 AM</td>
<td>400</td>
</tr>
<tr>
<td>8:00 – 9:00 AM</td>
<td>535</td>
</tr>
<tr>
<td>9:00 – 10:00 AM</td>
<td>650</td>
</tr>
<tr>
<td>10:00 – 11:00 AM</td>
<td>710</td>
</tr>
<tr>
<td>11:00 – 12:00 Noon</td>
<td>650</td>
</tr>
</tbody>
</table>

Traffic Volume Studies

Expanding Short Counts

- The data collected from traffic volume counts may be presented in several ways depending on the type of count conducted and the primary use of the data. They are:
  - Traffic Flow Maps
  - Intersection Summary Sheets
  - Time-Based Distribution Charts
  - Summary Tables

Presentation

- In taking intersection counts with people in the field, even when automated recording equipment is used, it is common for an observer to take short breaks during the counts and/or alternate attention between approaches, movements, or lanes.
- This is done for practical reasons, including the cost associated with crew size and equipment.
- The need to do short counts and/or alteration presents an interesting estimation problem.
Volume/Demand/Capacity

- **Volume** on a road is the number of vehicles passing the measurement point during a specified time interval.
- **Demand** is a measure of the number of vehicles (or passengers, or persons) waiting for service in the given time period.
- **Capacity** is the maximum number that can reasonable be expected to be served in the given time period.