TMT Traffic Data Workflow
Traffic Survey – Road Tube Sensor Count Basics

Road Tube Based Count Elements

Volume counts are collected to provide a measure of total traffic for a variety of processes. This document provides details related to volume counts collected using a counter and pneumatic sensor (road tube) configuration. Details about other count types or technologies will be provided in other documents.

Counters are configured with an air switch, timer or clock, and a count board that translates the sensor inputs into measured values. The air switch has a piezo diaphragm that converts the air pulse caused by a wheel crossing the road tube into an electronic pulse that is processed by the count board. Counters have a minimum threshold for an electronic pulse to be recorded as an axle event. Additionally, they have a setting where they will not accept any inputs for a brief time period after a recorded electronic pulse (measured in milliseconds). These settings are required to eliminate rebound air pulses caused by a variety of factors that can result in false axle events. Many counters have multiple air switches to allow use of more than one tube for both volume counts (optional) and vehicle class counts (required).

Two types of counters can be used to record sensor inputs, binned and event recorders. The binned type counter has count intervals input at installation. The counter will record two axle events as 1 axle pair as this is the most common axle combination. Vehicles with 3 or more axles are counted as more than 1 axle pair. At the end of a count interval, the counter will record the total number of axle pairs sensed during that time period and then start counting from zero for the next interval. The binned counter must be programmed at installation with the count interval and data can't be evaluated below this level. The event recorder time stamps each axle event and records them as individual records in its memory. The event recorder data is processed after the data is captured and allows the analyst to generate many types of summaries. Data from a tube based volume installation, regardless of the counter type used, can't be used to distinguish between vehicle types and the number of axles per vehicle can't be determined. All volume data summaries generated from both binned and event recorders are in axle pairs. This is the raw count. The data is usable in raw form for a variety of processes. The axle pair counts are representative of total volume and typically are only a moderate over count of vehicles. Some processes apply an axle factor to convert an axle pair count to a vehicle count estimate.

Placement of the tube sensor is important for collection of good quality data. The road tube must be placed perpendicular to the flow of travel to ensure only one air pulse per axle is generated. Vehicles crossing the tubes at an angle can produce an air pulse for each wheel on an axle. Tubes must be placed away from intersections to avoid this condition. Additionally, queuing traffic can result in air pulses from moving vehicles being blocked by vehicles stopped on the tube. Placing tubes in curves or where vehicles are under heavy acceleration or deceleration is avoided. The forces acting on the tubes cause them to fail prematurely.

It is important that the tube not be placed across too many lanes. On heavily traveled roads with numerous lanes of travel, high volumes of traffic occur for extended periods of time. When a tube is placed across too many lanes, wheels from different vehicles will cross the tube simultaneously and will cause air pulses to be blocked. Near simultaneous hits can result in multiple air pulses being detected as a single axle event. Using multiple counters at one station to reduce the number of lanes per tube being detected improves the quality of the count. Staggering counter installations by direction to situate them further from intersections where queues occur will improve data quality also.

All traffic count technologies have limitations and many are better suited for particular conditions. Errors occur in all counts regardless of the technology used. All have difficulties, and higher levels of error, when collecting data under congested traffic conditions. The road tube sensor may seem archaic as compared to other advanced technologies but it is still the most cost effective way to collect basic short-term traffic counts and is still the industry standard. Knowing when to use a particular technology and using techniques to minimize the impact of conditions that degrade the quality of the data are important to meeting the needs of your customers and the processes the traffic data supports.

Lastly, there are conditions where traffic data can't be collected reliably with any electronic device. Equipment may be deployed and it will generate numbers, but the quality of the data is so poor that the analysis it is being used in will be compromised. In many of these cases Traffic Survey will collect data manually as this is the only collection technique that will produce a reliable count. It is important to recognize these situations early to avoid unnecessary work and schedule the right type of count so that good quality data is delivered in a timely manner.

The most basic volume count will have a single tube placed across all lanes of travel on a segment. Counters that support multiple road tubes can be used to collect counts in more detail including volume by direction and vehicle classification counts. In some cases more than one counter must be used on multilane facilities due to medians or to improve the quality of the count. Most of the basic concepts provided in this document are applicable to both volume and vehicle classification counts collected using road tube sensors. However, vehicle classification counters require good traffic flows to be able to collect valid class data. Volume counts can be collected on most segments, but the requirements for vehicle class counts are more limiting and will be covered under a separate document.