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# Standard Practice for Installing and Using Pneumatic Tubes with Roadway Traffic Counters and Classifiers[1]

This standard is issued under the fixed designation E1957; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers the use of pneumatic road tubes to detect the passing of load-bearing vehicle axles as part of roadway traffic monitoring.

1.2 The practice applies only to pneumatic road tubes used for the detection of load-bearing vehicle axles on a roadway.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *axle*—the axis oriented transversely to the nominal direction of vehicle motion, and extending the full width of the vehicle, about which the wheels at both ends rotate.

2.1.2 *axle counter*—a device that receives signals from an axle sensor and indicates the cumulative number of axles that were detected by the sensor during a specified time interval.

2.1.3 *axle sensor*—a device that generates a signal indicating the passing of a load-bearing vehicle axle.

2.1.4 *machine count*—the cumulative number of axles, vehicles, or vehicles within specified classes, or all of these, indicated or recorded by a traffic recording device for a specified time interval.

2.1.5 *manual count*—recorded vehicle counts or vehicle classification counts, or both, based upon human observation.

2.1.6 *pneumatic road tube*—an elastic tube that is stretched across a roadway for the purpose of detecting the passage of a load-bearing vehicle axle.

2.1.7 *traffic counter*—a device that indicates, and usually records, the number of vehicles or vehicle axles, or both, that pass over a point on a lane or roadway during a specified time interval.

2.1.8 *traffic recording device*—an instrument that receives signals from a sensor(s) and registers axle count, vehicle count, vehicle classification count, speed, gap, or headway (any or all of these) for defined time intervals.

2.1.9 *validation count*—an independent count made to establish an accepted reference value against which a recorded count will be compared to determine its accuracy and reliability.

2.1.10 *vehicle*—one, or multiple, mobile unit(s) designed to travel upon a roadway; a vehicle comprises one powered unit and may include one or more non-powered trailer or semi-trailer unit(s).

2.1.11 *vehicle classifier*—a device that senses and records the number of vehicles of defined types (classes) that pass a point on a lane or roadway during a specified time interval.

2.1.12 *vehicle classification count*—the cumulative number of vehicles of each defined type (class) recorded for a specified time interval.

2.1.13 *verification count*—a count made on the same segment of roadway concurrently with a validation count to test the performance of a traffic counter or vehicle classifier.

## 3. Significance and Use

3.1 This practice addresses the recording of traffic characteristics, using pneumatic tubing with recording devices. This practice provides information for use with professional judgment by governmental agencies and private firms in the management of roads and roadway traffic.

3.2 Traffic monitoring is important to the safe and efficient movement of people and goods. The purpose of this practice is to ensure that traffic monitoring procedures produce traffic data and summary statistics that are adequate to satisfy diverse and critical traffic information needs.

## 4. Procedure

4.1 *Installation Procedures and Techniques:*

[1] This practice is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.52 on Traffic Monitoring.

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4.1.1 Select a relatively straight and smooth section of roadway with free flowing traffic throughout the duration of the data-collection session. For example, in selecting the roadway section, attention should be given to avoiding proximity to driveways and intersections. The availability of a place to anchor the traffic recording device is also important.

4.1.1.1 In those areas that have designated parking spaces, where a parking vehicle might impinge upon the road tube, covering the affected part of the tube with a segment of angle iron with tabs welded thereto and fastened to the roadway is strongly encouraged.

4.1.2 Install the tubing on the surface of the roadway, perpendicular to the flow of vehicular traffic. The end away from the recording device must be effectively sealed to prevent leakage of air and to prevent the intrusion of foreign matter and water. This end must be secured to the ground or pavement using a suitable anchoring device, such as a nail, clamp, or bracket.

4.1.2.1 A suitable small leak shall be provided between the other end of the tube and the attached air pressure sensing diaphragm near the recording device. This leak shall be sized so that the static air pressure within the sealed-end tube, affected by gradual temperature and atmospheric pressure changes, will remain near ambient atmospheric pressure at all times and will not significantly affect the magnitude of the dynamic air pressure pulse generated inside the tube when a moving vehicle tire impacts the tube.

4.1.3 Place a second anchoring device at the near edge of the pavement. This device must not restrict the flow of air. Pull the tube across the roadway, and through the anchoring device. Between the anchoring devices, stretch the tube approximately ten percent of its length, for example, for a 10.0 m (32.8 ft) length of tube, stretch the tube 1.0 m (3.3 ft). While it is stretched taut, secure the tube with the second anchoring device.

4.1.4 The tube may be secured to the pavement surface between the anchoring devices with other appropriate anchoring devices, such as asphaltic or adhesive tape. This tape can be spaced at 1 m (3.3 ft) to 1.5 m (5 ft) intervals along the length of the tube.

4.1.5 The installation of tubes should be accomplished in a manner that places no nails in the wheel path on the surface of the traveled roadway.

4.1.6 When the use of more than one tube is required, for example, for vehicle classification or speed data collection, both tubes must be exactly the same length from the counter to the near edge of the pavement. The spacing between the road tubes must be the same distance at both ends and in the middle to assure the accuracy of the speed and vehicle classification. In addition, the two sections of tube should be of the same cross-section, approximate quality, durability, and age.

4.1.7 The length of the pneumatic road tube should be between the minimum and maximum specified by the manufacturer of the traffic monitoring device. The use of shorter lengths of tubing may result in damage to the recording device. The strength of the air pulse, and therefore the accuracy of the count, can be influenced by a number of factors, including: tube length, tube cross-section, hardness of the tube, speed of traffic, tire widths, distance between recording device and point of impact on the tube, and uncontrolled movement of the tube.

4.2 Once the tube or tubes have been installed and connected to the traffic recording device, a verification count must be made to determine if the air pulses are being recorded correctly.

4.2.1 *Validation Count*—Initialize the traffic recording device (note the indicated axle count) and then have one or more persons count and record manually the number of axles that pass over the tube or tubes (validation count) until at least 50 axles have passed. Concurrently, note the indicated machine count (verification count) on the traffic recording device. Compare the machine count(s) with the manual count(s) (validation count(s)) to verify that the axle counts are being determined correctly.

4.2.1.1 If more than one manual count is made, there shall be no more than 2 % difference from the largest value for any count to be acceptable for use in determining the validation count. Repeat the manual counts (and the machine counts concurrently) as necessary until this condition is satisfied; then calculate the mean value of all manual counts and round the mean value to the nearest integer. Use this integer value as the validation count. For acceptable performance, the machine (verification) count should not vary from the validation count more than 4 %, preferably less. Do not begin a data-collection session until the pneumatic road tube(s) and the associated traffic recording device are performing acceptably.

4.2.2 On low volume roads, it may be necessary to manually check the performance of the pneumatic road tube(s) using an alternative method. As an example, the equipment installer's vehicle may be used to test the installation.

4.2.3 At the end of the data-collection session, repeat the procedure outlined in 4.2.1 to make certain that the installation is still properly registering the axles. If the installation is not functioning acceptably, the entire count should be retaken.

4.3 *Pressure Testing of Road Tube*—Verify that the road tube or tubes can hold 7 kPa (1 psi) of air pressure for 1 min; if not, discard the road tube. At this time, the tube should be cleaned by blowing compressed air through it. Care must be taken to not damage the tube(s) during removal of the end plug(s).

4.3.1 At regular intervals such as at the end of each data-collection session, inspect each road tube, paying particular attention to the area around the clamps. During the inspection, check the tube for chafing, abrasions, or punctures. The tubes should be tested at least once every month of use for air pressure retention, in accordance with 4.3.

## 5. Keywords

5.1 axle counters; axle sensors; pneumatic road tubes; vehicles; vehicle axles; vehicle classifiers

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