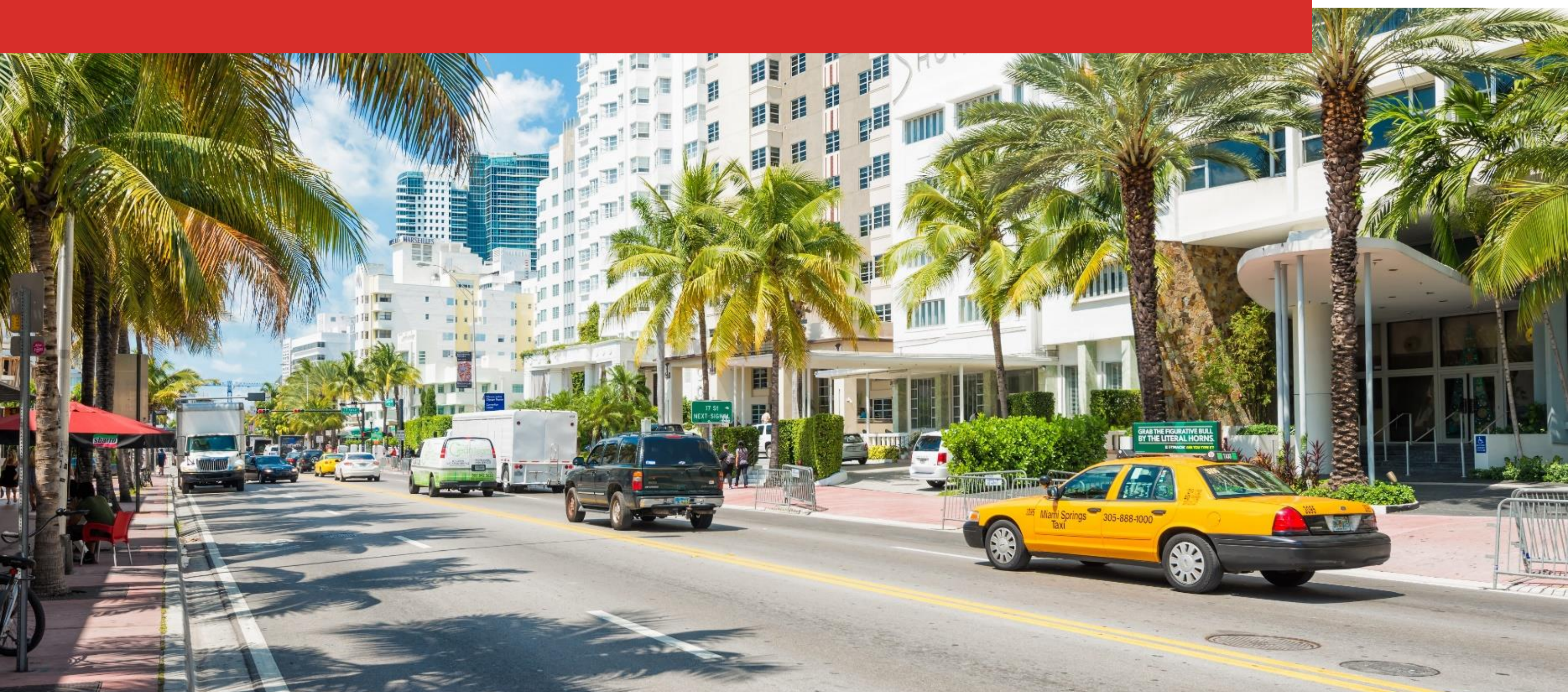
2023 TRAFFIC MONITORING HANDBOOK



FDOT

Transportation Data & Analytics Office

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ACKNOWLEDGMENT

The Florida Department of Transportation's Traffic Monitoring Handbook (TMH) is a guide for those interested in Florida's traffic monitoring program. Our office wishes to acknowledge the collaborative efforts of the supporting offices and subject matter experts that contributed to its content.

The intent of this handbook is to provide guidance to those that collect, code, and use traffic data in an accurate and consistent manner statewide. In coordination with the district offices, the Transportation Data and Analytics (TDA) Office administers the capture and analysis of traffic count data. This document is a continuation of FDOT's effort to develop a comprehensive traffic monitoring procedure.

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Note:
Recent major changes to the document include the addition of a non-motorized traffic monitoring chapter, as well as, changes to the terminology of traffic monitoring sites (TMS). Previously, **TTMS** was a telemetered traffic monitoring site and **PTMS** was a portable traffic monitoring site. These are now referred to as **continuous** traffic monitoring sites and **short-term** traffic monitoring sites, respectively.

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TRAFFIC MONITORING HANDBOOK

INTRODUCTION

This handbook describes the end-to-end process of traffic monitoring at the Florida Department of Transportation (FDOT). Starting with devices traffic collecting (vehicular, pedestrian, and/or bicycle) in the field and culminating in yearly data and User reports. This process consists of three basic stages. **Stage 1** (Device Installation) includes the installation and setup of the field units. After installation, a device can be added to the array of field units and will be either a short-term count site or a permanent continuous count site. **Stage 2** (Processes) involves the accumulation and analyses of data from devices according to a schedule that is dependent on the count site type. **Stage 3** (Finalization) covers the end of year processing to generate traffic count data to be used in Department administration of highway programs along with published datasets and reports. Traffic data is fundamental to determining vehicle miles of travel, project design parameters, road classifications, and the level of service provided by a road facility.

The State Road Department started collecting data at ten traffic count sites in 1936. As the state grew, the need to expand traffic data collection was recognized. The value of good data became apparent during the evolution of the national Department of Transportation (DOT) and eventually the Federal Highway Administration (FHWA). This data translated into revenue allocations for state and federal highway programs and is therefore a critical necessity in each State.

The data collected at a traffic monitoring site may include: volume, speed, direction, vehicle classification and/or weight. A specific site may collect only volume or speed while others collect combinations of data categories. The type of equipment installed and the programs running the equipment determine how the site functions. The purpose is to provide the Department with a basis to meet the reporting requirements of the FHWA to sustain the funding of federal transportation programs and to provide critical data required for engineering analysis of existing facilities and to identify the need for expansion in the road network.

Florida has been collecting truck weight data using weigh-in-motion equipment in 1974. Beginning in 1988, permanent weight sensors and electronics were installed in selected locations and the systems monitored traffic continuously. The weigh-in-motion equipment collects the volume, speed, vehicle classification, vehicle lengths, gross vehicle weight, axle weights, and axle spacing of every vehicle that passes over the sensors. The vehicle class, speed, and length data are binned similarly to the continuous speed and classification sites. The vehicle weight and axle spacing data are only saved for vehicle classes 4 and higher, to conserve memory in the counters. These are the classes of vehicles that exert the most force on the pavement and structures and are used for pavement design and analysis.

1. DEVICE ARRAY ESTABLISHMENT

The FDOT traffic data collection program is a collaborative effort involving the District offices throughout the State and the Transportation Data and Analytics (TDA) office in the Department's Central Office. In FDOT, traffic data covers vehicular traffic (e.g. trucks, automobiles, and motorcycles) on Florida's road system AND bicycles and pedestrians on sidewalks, bikeways, and trails.

In broad terms, the TDA office is responsible for operating the continuous traffic monitoring and weigh-in-motion programs, developing policy, maintaining the traffic databases and developing the AADT estimates. The FDOT District offices are responsible for collecting the short-term coverage counts, defining the traffic segment breaks, keeping the station inventory file updated, and defining the factor categories. These sites provide road segment-specific traffic characteristics information on a cyclical basis.

1.1. Site Types (Continuous & Short-Term)

To collect traffic data, FDOT operates two traffic count site types:

1. **Continuous Traffic Monitoring Site (Continuous)** - A statewide system currently consisting of 230 permanent continuous vehicle count stations that collect volume, speed, vehicle classification data and 35 stations that collect weigh-in-motion data 24 hours per day, 365 days per year. The data collected is transmitted using a wireless cellular device to TDA at the FDOT Central Office. Information from these sites is used to determine traffic growth and tendencies as well as develop pavement design input, seasonal adjustment factors used in determining estimates of annual average daily traffic (AADT), axle correction factors for road tube counts, and directional design hour volumes (DDHV).
2. **Short-term Traffic Monitoring Site (Short-term)** – A short-term counting program that utilizes traffic count sites that may be permanently or temporarily established. As a part of the statewide count program administered by the FDOT District Offices, each road section is generally counted about every 3 years. This program consists of approximately 16,000 sites on the State Highway System and another 2,087 sites for purposes such as sampling of off system Federal Aid eligible and non-Federal Aid eligible local facilities, county roads, off-system bridge counts, at-grade railroad crossing counts, and other samples. Results are used to develop growth factors for estimating current year counts from known prior year counts and determine Vehicle Miles Traveled (VMT).

Florida's traffic count program is based on the routine collection of data generated by traffic on Florida's road network, sidewalks and pathway systems. By far the largest dataset comes from the continuous sites which generates the equivalent of over 120,000 days of traffic counts per year.

Continuous Traffic Monitoring Site Locations

The FDOT's TDA office or a District office will determine when and where new continuous sites are required. Often when major road construction projects are undertaken, a count site will be included in the design plans at the request of the TDA or District office. Generally, 3-4 new sites are installed each year and several others receive equipment upgrades. The type of equipment installed is determined by the type of data desired. The customary procedure is to provide the site location and equipment information in the design plans as specified in the Roadway Design Plans Standard Index 17781 and17900. Each set-up has a list of pay items and details of how the site must be constructed to function properly.

Short-Term Traffic Monitoring Site Locations

It is the responsibility of each District to determine the location of short-term non-continuous traffic monitoring sites. The exact location and count type should be determined by the physical geometry of the road. Each time a count is made, the technician will re-evaluate the site to determine if field conditions are still suitable for obtaining an accurate count. Some of the factors that should be considered when selecting site locations are the presence of curves, crests, valleys, driveways, intersections, schools, number of lanes, medians, shoulders, or turn lanes.

A traffic count station is usually located within each traffic break segment. It is important to note that adjacent roadway sections can utilize count data from a station located on either side of the traffic break if the same roadway and traffic characteristics exist. This helps to reduce the number of traffic counts that must be collected, processed and stored.

1.2. Site Selection

While selecting a traffic count site, there are several techniques that should be adhered to regarding placement of the traffic counter and sensors:

- ❖ Traffic counters should be placed at locations specified by the District, as listed from the Survey Processing Software (SPS) Inventory Database.
- ❖ Ascending and descending directions should be counted at the same milepoint. In congested areas with many intersections and driveways, this may not be possible (Please refer to **Figure 1**).
- ❖ All count interval times must be consecutive throughout the duration of the count
- ❖ Both ascending and descending directions must be counted for identical dates and times
- ❖ All count locations should have field equipment (traffic counter and sensors) verification checks done prior to leaving site to assure accuracy
- ❖ GPS coordinates for the site should be noted (dependent on District)
- ❖ Each counter must have the descriptive 10-digit identification code entered by the technician as the counter is set so that the Survey Processing Software (SPS) will know how to handle the resulting data file. See the SPS Manual [1] for examples of the 10-digit identification code
- ❖ Avoid placing counters on roadways that are under construction

- Do not place counters and hoses too close to an intersection or driveways
- Ideal locations are where traffic can move freely over the hoses

Figure 1: Top Images - Close to intersection; Bottom Images – Free flow locations

Tracking of Installation

Each District will develop a tracking method to assure sensors are installed according to plans and working properly after installation:

- Once it is determined that a site will be installed, it is important to get project status reports as soon as possible from the construction department.
- If possible, attend the pre-construction meeting to advise all parties of your interest in the site.
- It is also helpful to get a contact phone number as soon as possible. This will make the communication between the responsible parties more efficient.
- Begin close follow up once the installation has begun.
- All sites must be inspected to determine that they have been built according to the plans and are in proper working condition before payment is approved.

Traffic (Road Section) Segment Breaks

Each roadway section and sub-section is defined by a beginning milepoint and an ending milepoint in the Roadway Characteristics Inventory (RCI) database. Sections and sub-sections are divided into smaller contiguous segments that have similar traffic volumes and truck traffic. These smaller segments are called traffic breaks. For every traffic break on the State Highway System, AADT and K, D and T factors are calculated. Traffic breaks are defined in the Traffic Characteristics Inventory (TCI) database and are defined by beginning and ending milepoints. Traffic breaks include the beginning and ending of each

Roadway section and subsection, the beginning and ending of exceptions, and where State and Federal roads intersect the road section. Additional traffic break points are located where there are significant changes in traffic characteristics. These changes usually occur at intersections and interchanges but the characteristics of the road can also govern break points.

Each year, through the application of engineering judgment, District traffic personnel re-evaluate all traffic breaks. Traffic breaks are added, deleted or moved to reflect changes in inventory and field conditions. Listed below are some considerations for determining the location of a traffic break point:

- Where changes in traffic volume exceed 20% (under 5,000 AADT) to 10% (over 25,000 AADT),
- Where changes in total truck volume exceed 250 vehicles per day,
- Traffic changes often occur where major County roads intersect State roads. Traffic breaks are usually placed at these intersections even if there is no significant change in traffic volume or vehicle mix, just to prove there is no significant change,
- The location of city limits and speed limits,
- Road geometry (e.g. a change in the number of lanes),
- Major commercial or residential development (such as shopping centers or subdivisions),
- Truck stops and industrial areas may indicate a change in truck traffic.

1.3. Types of Counts, Collection Periods and Duration

Volume Counts

There are two different types of volume counts that can be collected:

1. Axle volume counts – are obtained when a single road tube is set across a road. The counter connected to this road tube divides the number of hits on the tube by 2. This type of count data requires an axle adjustment factor (T-factor) to calculate a vehicle count.
2. Vehicle volume counts – are obtained from counters using sensors that detect an entire vehicle, not simply its axles. The most commonly used type of these sensors are inductive loops.

Figure 2: Inductive Loop

All of Florida's continuous traffic monitoring sites can collect vehicle volume data. The data is collected for each lane, and usually in one-hour intervals, although the intervals can be varied as needed (any period that divides evenly into 60 minutes). The most common type of sensors used to collect volume data at a continuous traffic monitoring site are inductive loops. In the case of a failed sensor, a continuous traffic monitoring site may be set to collect volume only using a single loop. **Figure 2** illustrates an inductive loop used in the volume data collection process.

Classification Counts

Classification counts can be collected and grouped in two different ways:

1. Axle classification – Axle classification consists of collecting traffic data with counters that detect axles and measure the distances between axles on each vehicle. The vehicle is then classified per the criteria contained in FHWA Classification Scheme "F" (**Figure 3**). Classification data are usually collected using a combination of presence (loops) and piezoelectric axle sensors.
2. Length classification – Presently length-based classifications are not used by FDOT to report to FHWA. Due to limitations in collected data, this type of classification is still under research.

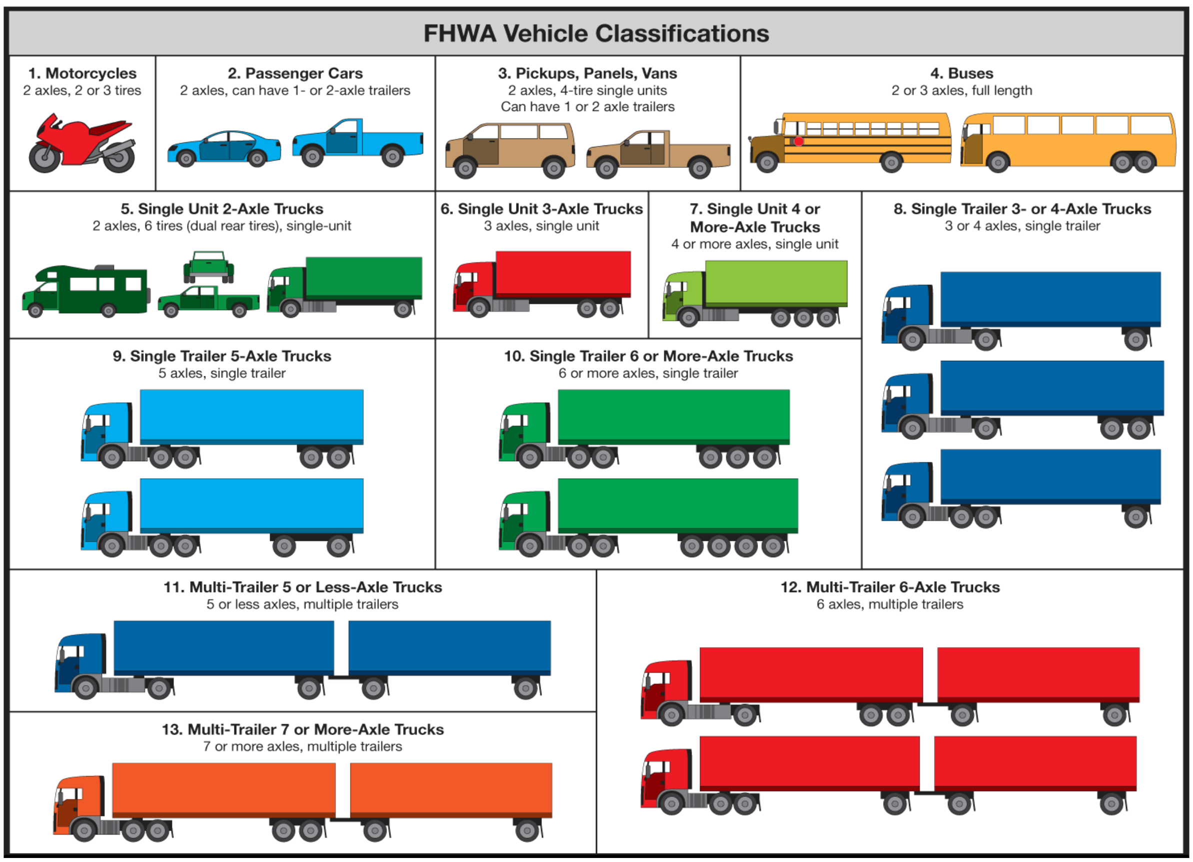


Figure 3: FHWA Scheme "F"

Vehicle classification counts obtained at approximately 64 % of the count locations are used to develop axle adjustment factors. Most of the vehicle classification counts assign vehicles to one of the thirteen vehicle type categories established by the Federal Highway

Administration (FHWA). In some cases, length-based classification data may be collected, however the data is not used in the development of axle adjustment factors. Axle adjustment factors are computed for each highway functional classification category in each FDOT region. Limited speed data is also collected during vehicle classification counts.

Figure 4: Classification Site

Florida's continuous traffic monitoring sites are built to collect vehicle classification, volume and speed data. Florida collects axle classification data according to the FHWA Scheme F standard. A typical sensor configuration used to collect vehicle class data consists of a loop-piezo-loop array. **Figure 4** illustrates a typical layout for a classification site.

Figure 5: Loop-Piezo-Loop

Traffic Speed Data Counts

All continuous traffic monitoring sites can collect vehicle speed data. Equipment required to collect speed data are two inductive loop sensors. Since 1995, all such sites have been routinely programmed to collect this data in binned files. Florida currently bins the speed data into 15 categories:

- <=20 mph
- 21-25 mph
- 26-30 mph
- 31-35 mph
- 36-40 mph
- 41-45 mph
- 46-50 mph
- 51-55 mph
- 56-60 mph
- 61-65 mph
- 66-70 mph
- 71-75 mph
- 76-80 mph
- 81-85 mph
- >=86 mph

The speed data is collected by lane for each recording interval. Only in rare cases are the speed data collected by class of vehicles, because these types of data files grow extremely large.

Acceptable Time Periods & Duration

Obtaining data that is most useful for historical trend reporting and forecasting requires that the collection period be taken during a time in which traffic would be representative of the traffic patterns on the typical weekday. There are several guidelines that should be followed to help maximize collecting typical data:

- ❖ Counts should occur between Mondays 6:00 a.m. and Friday 2:00 p.m.
- ❖ Collecting data prior to, during, or right after, holidays or special events, should be avoided.

The duration of the volume or classification count is dependent on the requirements of the District as well as the project. For the Annual Count Programs throughout the Districts, count locations are identified by the functional classification of the road on which they are located as either Rural or Urban. Because there is more day-to-day variation in the traffic flow in rural areas, a longer count duration is required to minimize this variation. The minimum requirements for Rural and Urban counts are as follows:

Rural – minimum of 48-hours of continuous data in 15-minute intervals

Urban – minimum of 24-hours of continuous data in 15-minute intervals

Re-count Conditions - Traffic counts deemed inaccurate by the district may have to be re-taken.

Traffic Re-count Conditions

When re-count conditions are noted in the field, the site will be re-counted before being submitted. Once a traffic counter has been set, the following guidelines should be followed to ensure that the collected data is accurate and will help determine if there is a reason to re-count. In general, a re-count condition will occur when:

- ❖ One or more machines at a count station mechanically fails to properly complete the count period
- ❖ One or more tubes were damaged or came loose
- ❖ An incomplete or inaccurate classification or volume count occurs during the count period
- ❖ The count was made in the wrong location
- ❖ The count was affected by an abnormal occurrence, such as a construction detour, long delay, special event, emergency incident, or adverse weather conditions.

A re-count condition may also be identified when the SPS check detects errors and subsequent tabulation and review of count results verify the need for a re-count. This condition can only be determined after District personnel have analyzed the submitted count information.

1.4. Piezoelectric Sensors

Piezoelectric axle sensors generate a uniform signal along their length when stuck by a vehicle. The configuration used in Florida is leading loop, piezo, trailing loop. **Figure 5** illustrates a typical layout for a piezoelectric sensor.

Florida installs quartz piezoelectric axle sensors at the majority of its weigh-in-motion locations. These sensors provide weight data comparable to bending plate sensors. However, since the quartz sensors are about the same size as the regular piezoelectric sensors, they can be installed in flexible pavements with little danger to the motoring public. The typical quartz sensor configuration is a leading sensor in the right wheel path, a loop, and a trailing sensor in the left wheel path. **Figure 6** is a typical depiction of quartz piezoelectric sensor.

Figure 6: Piezoelectric Sensor

1.5. Inductive Loop/ Piezoelectric Axle Sensor Sites

There are several locations throughout the state where permanent loops and piezo sensors have been installed in the pavement. These sensors may be connected to portable counters and used to collect short-term vehicle counts, speed or class surveys, depending upon the sensor configuration.

General Specifications

- A single loop is required to collect traffic volume data.
- Two loops are required to collect speed data.
- Two loops and a piezoelectric sensor in each lane are required to collect classification data.

Site Selection for Inductive Loop/Piezoelectric

When determining locations for inductive loop/piezoelectric axle sensor sites, it is important to select a location that will give the most accurate data possible. Some of the factors that should be considered or reviewed when selecting a site location are as follows:

- Avoid driveways and curves.
- Avoid acceleration/deceleration areas.
- Avoid intersections and close to intersections.
- Avoid high pedestrian traffic areas.
- Prefer locations with free flow traffic, as slow-moving traffic may limit accurate data collection.
- Prefer locations that are easy to access from the road, with off-road parking available.
- Locate the cabinet in an area where the recorder display and the traffic can be viewed simultaneously.
- Locate the cabinet in an area safe from traffic, where both directions of traffic can be seen.
- Locate Traffic Monitoring Site (TMS) cabinet within the Right of Way.
- Install TMS cabinet in compliance with the Americans with Disabilities Act (ADA).

Considerations When Installing Inductive Loop/Piezoelectric Sites

There are certain criteria that should be looked at when determining and recommending the installation of a new inductive loop/piezoelectric site. The following guidelines should be used:

- ❖ Is the site really needed?
- ❖ Recommend site replacement be added to roadway project plans by the 30% design phase.
- ❖ Does the road geometry preclude use of road tubes?
- ❖ Are safety concerns addressed in the area to be counted?
- ❖ High speed locations are unsafe for road tube use.
- ❖ Is there an accident history at the location which could indicate an unsafe location?
- ❖ Areas of high traffic with queuing traffic are not recommended collection locations.

Sources for Review

Sources to be reviewed when selecting site locations are:

- ❖ Review design plans at 30% design stage, or earlier (Construction, Reconstruction, Resurfacing), so that, if desired, loops and piezo sensors can be installed in the pavement for future use as a short-term count location
- ❖ Review video logs for possible traffic monitoring sites
- ❖ Perform field inspection

Installation/Inspection Documents

The following list of documents will be used when working with the installation and inspection of inductive loop/piezoelectric axle sensor sites:

- ❖ Specification 695 of the Standard Specifications for Road and Bridge Construction
- ❖ Standard Index 17900 - Design Standard for Construction and Maintenance Operations on the State Highway System (Please refer to Appendix)
- ❖ Plan Notes

1.6. Road Tubes

Traffic counters frequently use rubber road tubes to sense and record the number of axles at a count location. When a vehicle's axle crosses the road tube, pressure exerted from the tires causes the pulse of air that is created to be recorded and processed by the traffic counter. Road tubes are extended across desired lanes or directions that need to be counted, and depending on the type of count needed, one of several different road tube configurations may be placed in the road. The following figures illustrate typical road tube layouts:

Figure 4: Road Tube – Volume Data

Figure 5: Road Tube – Classification Data

Traffic data technicians are responsible for all road tube tests and inspections. At least once per month, replace each road tube - or blow clear and test for leaks by the application of air pressure. Visually inspect each road tube for adequate condition prior to each use.

General Specifications

- ❖ Hoses must be perpendicular to the road, with equal amounts of tension on each hose.
- ❖ Pavement should be clean and flat.

Site Selection for Road Tubes

When determining locations for road tube sites, it is important to select a location that will give the most accurate and useful data possible. When setting road tubes, you should consider the following factors:

- ❖ Avoid curves, if possible.
- ❖ Don't locate at driveways, by schools, or when the pavement is wet
- ❖ Avoid setting close to intersections, if possible—counters require vehicles of constant speed above 30 mph to work properly.
- ❖ Ensure the counter is secured in a dry location—possibly hang it above the ground.

Road Tube Installation

- ❖ For accurate vehicle classification data, both road tubes must be of the same type, condition, and within 1 inch in length.
- ❖ Road tube spacing is dependent upon average vehicle speed and equipment requirements.
  - o 16 feet is recommended for interstates;
  - o 10 feet is recommended for 55 mph roads; and
  - o 6 feet is recommended for low-speed urban roads, ramps, and curves
- ❖ Adjust the de-bounce setting.

- ❖ Hold the road tube a safe distance from your ear to feel an air pulse—if no pulse, get another hose.
- ❖ Tape down hoses to minimize hose bounce, use a minimum of 5 pieces of tape per lane.
- ❖ If nothing suitable is available for securing the counting device, drive a metal delineator post (with visible marking) into the ground, and secure the counter to the post.
- ❖ For locations that are revisited, consider permanently installing nails (driven close to the road surface) and marking the location for future use.
- ❖ Safety should always be a factor when driving nails and placing hoses.

1.7. Traffic Counters and Equipment

Acceptable Traffic Counters

Districtwide Count Programs utilize traffic counters that can count by lane, classify, measure speed, store data in files, allow user selected intervals, accept a 10-digit ID code and provide a data output file that is compatible with the FDOT Survey Processing Software (SPS). Traffic counting locations may have periods of congested traffic flow during which the axles of two or more vehicles are within 40 feet of each other. The counter shall have the ability to correctly classify vehicles during these "tailgating" conditions. Each traffic counter placed in the field should have a legible tag showing the name and telephone number of the owner. If the count is being collected by a contractor for FDOT, the name and telephone number of the FDOT contract administrator should also be written on the tag.

General Specifications

Acceptable traffic counters must have the following capabilities:

- ❖ Record traffic data (axle count, vehicle count, speed and/or classification) in specified time intervals
- ❖ Generate the 10-digit ID code required by the Survey Processing Software
- ❖ Provide a data output file that can be read into the SPS

Some acceptable devices include the following examples:

Figure 6: Metro Count

Figure 7: PEEK Sabre

Figure 8: ADR 3019

Figure 9: Phoenix2 II

Figure 10 : ADR 2000

Figure 11: EMU 3

Figure 15: iSinc

Certification of Traffic Monitoring Equipment

All traffic counters used by the Department or their consultants for general data collection activities must be certified for accuracy at least once per year. See Traffic Monitoring Equipment Certification Form (**Appendix A**). These certifications must be turned in to TDA no later than January 31st of each year.

Each counter shall be tested for accuracy with a specialized traffic counter tester. All sensor inputs (air switches, contact closure boards, loop boards and/or piezo boards) will be tested. A minimum test will consist of a 15-minute survey. The counter shall have a minimum of 95% accuracy of each criteria of data collected.

Traffic Site Vehicle Equipment

All District and consultant vehicles shall be equipped with the following equipment:

- Currently approved safety vests (worn by everyone during all field operations)
- Four-way flashing lights and a minimum of two yellow strobes mounted on a light bar
- Appropriate tools and supplies (e.g., traffic counter, spray paint, asphalt tape, nails, hammer, etc.)
- Appropriate manuals for counters
- Two-way radio or cellular phone
- Fire extinguisher
- First aid kit
- Orange cones
- Security chains and locks

Equipment for Inspection of a Permanent Site

The following equipment are recommended when inspecting a permanent site: Multi-meter, laptop computer, earth ground tester, loop wire insulation tester, tool kit with all applicable tools (pliers, screwdrivers, etc.), oscilloscope, gloves, shovel, broom, lubricant, insect repellant, wasp spray, insecticide, axe and pruners or shears.

Figure 16: (Left to Right) Oscilloscope; Multi-Meter; Laptop Computer; LCR Meter

1.8. Safety Procedures for Traffic Count Personnel

All traffic count personnel must be provided a minimum of two-weeks training by accompanying an experienced field technician who is collecting traffic data. All personnel must be trained in first aid techniques and must be familiar with the following safety procedures before they are allowed in the field. All vehicles used for traffic data collection will be equipped with the minimum equipment specified above.

All traffic count personnel shall adhere to the following procedures:

- Seat belts shall be worn during operation of vehicles.
- Safety vests and Underwriters Laboratories (UL) approved safety glasses or safety prescription glasses shall be worn during field operations.
- Vehicle lights shall be used in the following manner:
  - Turn signals and yellow roof mounted strobe lights shall be activated when approaching the work site, generally five hundred to one thousand feet (500' – 1000') before the site.
  - Four-way flashers shall be activated at the work site and the flashers and strobe lights shall remain activated until the proper turn signal is activated to leave the work site.
  - Strobe lights shall be turned off after the vehicle safely re¬enters traffic flow.
- Traffic count personnel shall conform to **OSHA RULES & REGULATIONS** as well as the **MOT**
- Vehicles shall be parked where there is adequate space to park the vehicle safely without blocking sidewalks and driveways and parked a minimum of four (4) feet from the edge of pavement.
- Traffic count personnel shall exercise extreme caution when entering the road to set or retrieve traffic sensors.
- Under no circumstances shall sensors be placed in the road when it is raining or foggy.

- ❖ Traffic count personnel have the right to request their supervisor assign additional help to assist them if they deem there is a need for a two-person crew to set equipment safely.
- ❖ Only authorized vehicles are permitted to cross the Interstate/Turnpike/Limited Access Controlled Facility medians. All other vehicles are subject to moving violations.
- ❖ Reflective vests must always be worn when working at night.
- ❖ Night work should be done only when traffic flow dictates it to be necessary, and then only with two or more technicians. One person should spot while the other is working near the pavement. At least one set of eyes should always be on traffic when someone is working in the traveled way.

2. PROCESS

2.1. Data Acquisition

FDOT's traffic monitoring program is a year-round activity for the TDA Central and District Offices that does not stop for holidays, hurricanes, or any other situation. The TDA Central Office operations involve daily acquisition of traffic count data from the continuous traffic monitoring sites (Continuous) and from the weigh-in-motion (WIM) sites. This data is examined and analyzed for accuracy and completeness so that problem sites can be quickly identified and corrected. This is accomplished through teams in the office and field that communicate daily. At the end of the physical year, year-end calculations are performed that result in data, factors and used throughout the traffic monitoring system.

In the District offices, the operation involves the accumulation of data (called short-term count data) from short-term traffic monitoring sites (Short-term), analyzing the data for accuracy and completeness, and passing that data to the TDA Central Office. Should the District discover problems with the data then the problem site is re-counted.

To maximize the efficiency and accuracy of traffic data, the Districts and Central Office must conduct a comprehensive analysis process that involves more than just obtaining and processing raw counts. After gathering the data, it is further processed to insure its integrity and validity and stored in a database. They must analyze the counts for acceptability, evaluate and monitor conditions that affect traffic data, and maintain a Traffic Monitoring Program that will obtain an accurate picture of evolving traffic characteristics.

2.2. Survey Processing Software (Sps)

All short-term traffic surveys performed for the annual program should be processed and uploaded to the FDOT mainframe using the Survey Processing Software. SPS was developed to provide a software package that could transfer raw data from a variety of traffic counters to a personal computer (PC), perform the required quality control minimum and maximum volume check on the raw data, and then upload summarized classification and volume data statistics from the accepted data from the District PC to the FDOT mainframe. SPS is a custom application written within Microsoft Access. See the Survey Processing Software User Manual [1] for operating instructions.

The four main functions of SPS are:

- **Convert Raw Data** - This function was designed to download the files contained in the traffic counters to the District or Consultant's computer. It was written so that FDOT does not need to purchase multiple copies of each counter manufacturer's proprietary software and spend the time learning how to use each. With SPS, the same steps are performed by the technician to download the counter data, regardless of brand--the software handles all the special vendor commands.

- **Load SPS Database** - Once the traffic data files are extracted from the counters, they are loaded into the SPS Microsoft Access database before they can be further analyzed. This routine can read the files created by the previous step and can also read the proprietary file formats created by several of the vendor software packages. All files transferred to the Districts by the Consultants must be in *.txt or *.prn file format. These files can be transferred by physical media, Email attachments, or through the FTP site. SPS loads the data into its database by organizing it into 24-hour blocks starting with the first data interval. It also organizes the data by station and by date. If less than 24-hours of data is available, further processing cannot be undertaken.

- **Edit SPS Database** - The edits performed by SPS alert the Districts to possible problems with the quality and accuracy of the counts by comparing each traffic survey to information stored in two tables---the Station Inventory and the Variance Factors tables. If there are discrepancies, SPS creates interactive error messages for analysis by District personnel. The operator can verify the accuracy of the count, make corrections to input data files, or update the Station Inventory, and then choose to accept or reject the data.

  Toward the end of this step, SPS asks the user if it should create Record Summary and Synopsis reports. The Record Summary Report is primarily useful in examining classification data by hour of the day and by lane. The Synopsis Report displays a single day of volume information on one page, shows the calculated morning and afternoon peak hour data, and, for classification surveys, shows the Truck Percentage (T%). Even though the actual count may start at any time of day, SPS reorganizes the data into a uniform format running from midnight to midnight. This format makes it easy for the user to see how traffic flows through the day. A final set of mental quality control edits should be performed on the data before it is transferred to the mainframe. These edits are not performed by SPS, but by the user, such as, are the types of vehicles and the volumes reasonable for the location where the count was collected?

- **Upload Data to Mainframe** - The final step in processing the traffic data through the Survey Processing Software is creating the summary records that are transferred to the mainframe. SPS creates for each station and date a single annual summary record, and a daily summary record for each direction of traffic data. Additionally, SPS adds the seasonal factor category from the Station Inventory to the volume summary record. If the volume data is from an axle counter (road tube), SPS also adds the axle factor category.

The summary records created by SPS to upload to the database are:

1. **ANS** -- The annual summary record, which contains the county, site, year, date, peak hour time, peak hour volume, peak hour truck volume, peak/daily ratio, and peak hour factor.

2. **CNT** -- The daily volume record, which contains the county, site, year, direction, date, survey type, survey program, total volume, seasonal factor category, and axle factor category.
3. **CLS** -- The daily vehicle classification record, which contains the site, year, direction, date, survey type, survey program, class 01 through class 15 volumes, total volume, and truck volume.

The summary records described above are written by SPS into a file named NCTRAFF.FDF that is transferred to the mainframe. A message will appear in the Status bar to tell a user when the transfer is complete. Upon successful transfer, SPS automatically launches a batch job that loads the summary data into the mainframe TCI database. The load program will then notify the user via email about the status of the upload. The email lists those records successfully loaded and creates an error file for unsuccessfully loaded records. If an error file was created during the TCI upload, the user can log into TCI, click on the District Tab, make corrections to the ANS, CNT or CLS records, and re-submit the load job. Or the user may elect to make corrections to the appropriate data files on the PC and rerun that station's data through the entire SPS process or request a re-count.

SPS Manual Data Entry

Traffic counts can be manually entered into SPS by selecting the Count tab under the SPS Current Database. A new window will open. It will display detail "Records" in the top portion of the screen and "Summary" records below. First clear any summary records, then add new data by selecting the "Add a Count Summary Report" icon (third icon to the right of "Summary"—the icon looks like a sheet of paper). Type-in the 2-digit county number and the 4-digit site number, making sure to include leading zeroes. Type-in the date in a MM/DD/YYYY format. Enter the alpha direction code--N, S, E, W or B. If the manually added count record is an estimate (most manually entered counts are), enter a Survey Type code of "0", and a Survey Program code of "1". Enter the AADT value, taking care to round estimates to the nearest 50 (if AADT < 1000), nearest 100 (if AADT >=1000 and nearest AADT <10,000), or nearest 1000 (AADT >=10,000) vehicles, depending upon the volume range. Enter an Edit Flag code of "0". When complete, upload the manual counts to the mainframe via the process described above.

SPS Edits Performed

SPS performs the following verifications, edits, and/or checks on the traffic data being processed:

- County-Station number is valid,
- Data type (axle, vehicle, classification) against the Survey Type code in the SPS short-term Inventory,
- Type of data being analyzed is compatible with the Sensor Type code in the SPS short-term Inventory,
- short-term inventory codes agree that the data being processed is from a portable counter,

i.e. the Survey Program code of the data must be 1 - 4

- Compares direction codes in the data to ascending/descending directions in the SPS inventory,
- Data from all lanes is present in the input files,
- Station Inventory to ensure the data is either directional or non-directional,
- Minimum of 24-hours of data for each count,
- Any directional volumes equal to “0” between 5:00am and midnight,
- No 4 consecutive hours have the same total,
- Volume in one direction is not greater than 80% of the total volume,
- Compares daily volumes of the count being edited to the minimum and maximum “variance factor” values for the station, month, and year, considering whether the data is an axle or vehicle count,
- Hourly volumes do not exceed 2000 vehicles for 2-lane roads, or 2500 vehicles per lane on all others,
- Classification Types 1, 4, and 15 are not above specified percentage as identified by the user.

Problems

If codes in the raw data file don't match codes in the Inventory, SPS can't load the count and can't process it. The codes for the following items must match:

- County/Site Number
- Number of Lanes - Ascending/Descending
- Ascending/Descending Directions
- Count by Direction
- Count by Lane
- Sensor Type
- Survey Program
- Survey Type

Survey Type must agree with Sensor Type. Our Inventory currently utilizes the following codes for Sensor Type and corresponding Survey Type for short-term counts:

- Type 1 (Axle Counts) must be coded with Sensor Type 7 (Road Tubes)
- Type 2 (Vehicle Counts) must be coded with Sensor Types 1 - 6 (Loops and/or Piezos)
- Type 3 (Classification Counts) must be coded with Sensor Type 7 (2-Road Tubes) or Sensor Types 4 - 6 (Loops and Piezos)

Errors occur when the field technician doesn’t program the counters with the proper codes for Survey Program, Sensor Type, and Survey Type.

- Counts obtained by a consultant must be coded for Survey Program 2
- Sensor Type will be either 7 (road tubes) or Type 4 - 6 (Loops and Piezos)
- Survey Type will be either code 2 (Vehicle), code 3 (Classification) or code 1 (Axle)

Problem Resolution

Often, the problem can be fixed by correcting the codes in the Inventory or raw data file.

- ❖ To identify the problem, open the .PRN or .TXT file and compare it to the Inventory.
- ❖ If you can't fix it, check your records before making a re-count---the problem might be an incomplete or corrupted data file (for instance, maybe all the lanes were counted but are not being processed).

If the site was classified last year, the Inventory will be coded Survey Type 3 and Count-by-Lane yes; the count won't load if data is missing for any lanes. This happens when:

- ❖ This year's data is volume, not counted by lane
- ❖ The number of lanes being processed doesn't match the number of lanes listed in the Inventory.
- ❖ Data is missing for any lane.

If the direction codes don't match, the count won't load - This most often happens when the ascending/descending direction isn't obvious to the technician in the field---for instance, a road might be Ascending N (1) and Descending S (5) according to the Inventory, but the segment of road where the count is taken might run NE and SW and the technician codes the count with E (3) and W (7).

> ***HINT:*** *You can often save yourself research time by the way you describe the site location in the Inventory: in this case, if you have described the site as NE or SW of the intersection---you know that E is N and W is S, and you can correctly edit the data file. Remember to update the TCI codes to match the data you send to the mainframe or the SPS upload to mainframe will fail---with the one exception: the software will allow you to utilize more than one Survey Program for each site.*

2.3. Analyzing The Data

Acceptability of Short-Term Data

Even though acceptance of one or more days of data is accepted during preliminary edits, continue analyses to determine if all facets of the data appear reasonable. To analyze the count for acceptability, apply Seasonal Factors (SF) and Axle Correction Factors (ACF) from the previous year and compare it to historical data. Guidelines used to determine if counts are of acceptable quality will vary from site-to-site. There are no “hard, fast” rules because there are many variables that cause traffic characteristics to fluctuate.

Each District will determine what constitutes a significant difference for each facet of each short-term count. For example:

- ❖ Define a specific range that you consider reasonable; for instance, from 20% under 5,000 AADT to 5% over 50,000 AADT,
- ❖ Select a single percentage such as 10% for volume and 5% for classification categories,

- ❖ Use a combination of methods. Start with a single percentage (such as 10%) for all preliminary screening. For counts that fall through the preliminary screen, continue analysis by using other guidelines that include regional growth trends and conditions,
- ❖ For a quick volume screen without applying Seasonal Factors: if the County's seasonal fluctuation varies at least 20% between peak and off-peak, and screening percentage is 10%, there is no need to apply SF unless the ADT varies from historical AADT by more than 20%,
- ❖ If the data fails any acceptability tests; investigate why it failed and conduct further analyses until arriving at a logical decision to: accept, re-count, or estimate,
- ❖ During the annual data processing activities described in Chapter 4 of the Annual Data Processing Report, re-evaluation of accepted counts using current year Seasonal and Axle Factors is possible.

Analyzing Raw Counts

It is important to remember when analyzing the counts, that the purpose of the annual traffic count program is to monitor traffic growth. Try to avoid significant traffic fluctuations that are due to temporary events such as road construction or severe weather. The data must be examined by direction, hour, and count interval (usually 15-minutes); from one day to the next and year-to-year.

Conduct a preliminary analysis by utilizing reports produced by SPS, the short-term Inventory Database, previous year AADT Report, Traffic Count Location Maps, Straight Line Diagrams, local street maps, and other counts obtained on adjacent road segments.

Using the reports produced by SPS, look at the count itself. Usually the directional split will be close to equal, and the count will be similar for both days. Also look for incorrect directional relationships¬--morning rush hour is usually toward town; evening rush is opposite.

Consider changes that have taken place in the field, such as lanes added, changes in one-way pairs, road transfers, new intersections, etc. Compare the count to last year's AADT. Total volume and truck volume should be within reasonable increase or decrease of previous year's counts, considering the season the count is taken and historic growth trends, providing there have been no significant changes in the field.

If AADT appears to be significantly higher or lower than expected, find out if there have been temporary changes in the field that might have influenced the traffic. If changes are temporary (such as construction), don't use the count. If you can find no obvious reason for the change, apply the previous year's Seasonal and Axle Factors and conduct a more detailed evaluation:

- ❖ Be aware that changes in one County can affect traffic patterns in another County,
- ❖ Consider the possibility that our winter visitors moved to Florida early this year because it snowed earlier than usual or they extended their stay in Florida to avoid a late snow up North,

- ❖ Gas prices and the economy will influence travel.

Don't automatically reject a count just because the total volume or truck volume shows significant change. If there have been numerous changes in your District, counts might not follow historical trends.

Locate the site on a map and visualize how traffic would flow. Imagine yourself in various driving situations---what route would you take? It might be obvious why the directional split is extreme, or why truck % or volume significantly differs from one segment to the next.

Analyze each category of your classification counts according to your District's needs. In general, Federal Roads and Interstates require scrutiny to produce accurate classification and volume, State Roads require accurate truck percentage (T%) and volume. Federal Aid (off-system) roads need accurate volume.

- ❖ Except for classes 6 and 7 (due to dump trucks with lift axles), categories can be expected to be very similar by direction.
- ❖ On the Interstate, most trucks are usually Class 9 vehicles--as much as 80 to 90% of traffic loadings.
- ❖ There will be no numbers in category 14, this is reserved for special classifications hat can be used.
- ❖ Class 11, 12 or 13 vehicles shouldn't be on roads where their use is not permitted or expected.

  e.g.: expect a lot of class 13 trucks on the Interstate, but not on a 2-lane country road

- ❖ SPS creates error messages for counts with more than 3% in category 1, 5% in category 5, or 10% in category 15, by default. Districts can adjust these defaults as necessary.
- ❖ Vehicles that could not be clearly classified are put into Category 15 (Unknown). A high number in category 15 is a good indication that the traffic was not properly classified---it is also a good indication that the PIEZO might be going bad.
- ❖ Historical analysis will help you verify questionable volumes in the classification categories.

Review the *.SYN Report to verify the following information.

- ❖ AM/PM time: Occasionally a counter reverses AM and PM, resulting in a count that shows all the vehicles traveling during the night.
- ❖ Peak hours usually occur due to people traveling to work in the morning and home in the afternoon.
- ❖ The SPS, Peak Hour Report is set by Planning requirements and assumes Peak Hour is from 5:00 - 6:00 PM at all sites. This is not useful for analyzing accuracy of counts.
- ❖ 15-minute intervals: There should be no 0's during peak hours.

- There should be no exceptionally high or low counts during any intervals.
- *.SYN files are the only reports that show T24 truck percentages, which can be verified with nearby classification counts, other counts obtained at this site during the current year, and previous T%.
- Compare it to counts that were made in adjacent road segments, and on intersecting roads.

If a count's validity is questioned; conduct additional in-depth analyses using Historical Traffic Data, Video log, and field review to consider long-term changes that are taking place in the field. Consult with people in other FDOT departments or local governments (MPO, County or City) who are knowledgeable about local conditions. Straight Line Diagram (SLD), field review, I-View and Video log, can be helpful in identifying conditions that have influenced a long-term change in traffic characteristics, such as:

- Lanes added (this can be done by restriping as well as widening).
- Changes in one-way pairs.
- Road transfers.
- New intersections/interchanges (especially on limited access roads).
- New roads.
- New housing developments.
- Changes in land use.
- Unusual configuration of one-way pairs may influence directional splits on other segments.
- Truck routes divert truck traffic.
- Traffic generators such as truck stops influence truck traffic.
- When City Limits are moved, speed limits will change.
- Orange groves can die causing sudden changes in traffic flow.
- Over a period of years, mining operations open new entrances or move to new areas when the old mines are played out.
- Truck patterns and type are heavily affected by local economic activity.
- A high percentage of through trucks tends to result in higher weekend and nighttime truck traffic than a road with a low volume of through trucks. This can cause significant differences in T% at continuous (which count all week) and T% at nearby short-term sites (which count only weekdays).
- Traffic flow exhibits more seasonal variation in recreational areas.
- Traffic flow exhibits higher daily fluctuations in rural areas.
- Re-counts or additional counts later in the year may help with difficult decisions.
- After you are reasonably confident that a count is of acceptable quality, upload it to the mainframe. (Please refer Chapter 4 for more details)

Some or all counts and re-counts along a road might show significant change for no apparent reason. After completing your analyses, what are your options for counts that remain questionable?

- ❖ If you believe a change is temporary, and the count would significantly skew the history for the site; you can elect to reject the count and have Central Office provide an estimated AADT for the site.
- ❖ If you believe the change is part of a new trend, or if you are still not confident in a count, you can elect to upload the data to the mainframe and re-evaluate it during the AADT Development and Finalization Process.
- ❖ Follow-up during next year's count cycle to confirm decisions and resolve any unanswered questions.

Examples and Tips From The Districts

Sites 2000 and 2002 are coded as Classification counts, and databases were submitted in the classification format. Volumes look reasonable, but these look like bad counts since there are 0's in all categories except Category 2. What caused this to happen? Was the counter programmed wrong, was data lost? If classification is required, request a re-count. Probably the counter was merely incorrectly coded for classification, but a volume count was collected¬--in which case, you can re-code the data file and accept it as a volume count.

SPS won't load data for Site 1007. The error message reads "missing lane number 2 direction (E)." The classification data file submitted for this tube count has only 1 lane "E" and 1 lane "W" for this 4-lane location. Did the technician find a nearby 2-lane segment where the count was obtained? If so, you need to know where the count was made and why the site was moved. The site can be moved to the new milepoint for a more accurate classification, you can use the same site number, if there is nothing between the old location and the new one that will cause a significant change in traffic characteristics (such as a truck stop or major intersection); otherwise, assign a new site number. If an axle count was submitted instead of a classification count, change SPS' short-term Inventory "SURVEYTYP" code to "1", and change "CntByLane" code to "F". If the site can no longer be classified with tubes, maybe this site is a candidate for permanent sensor installation.

Site 5130, with an ADT of 5,900 each direction is a little low, but not low enough to reject the count. In the classification categories, however, there are several discrepancies: in category 3, SB is more than twice as high as NB; Category 6 NB is 10 times higher than SB; Categories 5, 8, 9, and 10 have similar differences. This site is located on a 2-lane road several miles from the Interstate, so we don't expect to see 410 vehicles in category 13. Nearby sites don't have this many Class 13 trucks---where did they all come from, and where did they go? Looking only at Category 13, the 410 vehicles (378 of them are NB) with 7 or more axles is potentially 1,435 class 2 vehicles---no wonder the ADT is low! You don't have to look any further to reject this data and request a re-count. Maybe this site can no longer be classified. Is your PIEZO going bad?

Sites 0108 and 0111 cause the error message "missing lane number 2- direction (E)." These volume counts are coded as classification. Change the SPS short-term Inventory

"CntByDir" code to "F" and the “SURVEYTYP” code to “1” and these records should pass the edits.

Site 0079 NB on 3/5, the ADT was significantly (approximately 45%) lower than NB---historically, D is similar; so you should reject that day. On 3/6, NB and SB are similar and look reasonable according to last year's count. In the classification data, however; there are 1002 class 6 trucks NB and 40 class 6 trucks SB. The Synopsis Report shows 1020 vehicles in one 15-minute interval. Since there was only a total of 2,641 vehicles for the day, request a re-count.

2.4. Maintaining Efficiency and Accuracy

Over time, traffic data must effectively document evolving traffic patterns, and identify local variations in traffic characteristics. The Districts will develop recommendations and modify their Traffic Data Collection Program to maintain maximum efficiency and accuracy. It might be desirable to:

- ❖ Count more frequently, for longer periods, at locations where traffic characteristics are rapidly changing,
- ❖ Begin counting at additional sites as growth indicates,
- ❖ As adjacent segments become more homogenous, reduce counting sites,
- ❖ Consider locations for permanent sensor installation,
- ❖ Unusual seasonal fluctuations might require increasing counting frequency or modifying the schedule,
- ❖ Unique vehicle mix, or seasonal variations in truck percentage, might require more than one classification count per year.

During analysis, you might realize the need to conduct counts at “test” sites to obtain supplemental data for current or future analyses.

- ❖ Test counts will provide data for analysis of evolving field conditions,
- ❖ Test counts can be used to follow-up on questions that weren’t resolved to your satisfaction while analyzing current-year counts,
- ❖ If you wish, tests can be conducted every 2 or 3 years over a period of several years---the data can be stored in the mainframe database and a history can be built without assigning the test site to a section break.

3. FINALIZATION

3.1. Annual Data Processing

Between January 1 and March 15 each year, the Districts and the TDA office work together to evaluate and finalize traffic data that was captured during the previous calendar year. This year-end process includes factor development and assignments, and application of appropriate factors to traffic counts. AADT, K, D, and T are estimated for every traffic break of the State Highway System, all off-system roads that are functionally classified minor collector and above, and local roads that are NHS or SIS.

During this period, TDA produces several reports to help the Districts analyze short-term data and update databases. TDA coordinates this process within strict deadlines. Please refer to the Quality Control (QC) Plans in Appendices C and D, flow charts and QC plan deadlines.

Monthly ADT

Monthly ADTs are computed in the following manner:

- Each direction of travel at each site is processed separately,
- Only daily records with flags of N (normal), A (atypical), H (holiday) and S (special event) are used. Any records flagged B (bad) are not used in any calculation,
- For each month, all the Mondays, Tuesdays, etc. are averaged,
- The monthly ADT is computed by averaging the seven day-of-week averages. Note, if a Saturday or Sunday average is unavailable for a month, then that monthly ADT is not calculated. However, if both the Saturday and Sunday, and at least one weekday averages are available for a month, the monthly ADT will be computed based on the averages of available days.

AADT Computations

Annual average daily traffic counts are computed in the following manner:

- Monthly averages for each day-of-week are averaged to generate annual day-of-week averages,
- Seven-annual average day-of-week values are averaged for an annual average daily traffic,
- Directional annual average daily traffic volumes are summed to generate the annual average daily traffic for a station.

Seasonal Adjustment Factors

Seasonal (volume) adjustment factors are calculated in the following manner:

- Each direction of travel at each site is processed separately,
- Monthly ADTs are estimated for those months where data is lacking. Monthly ADTs will not be estimated for those stations missing more than 2 consecutive months of data,
- Monthly factors are computed by dividing the AADT by the MADT,

- For each station, directional monthly factors are averaged together. For those stations that have only one good direction of data, the monthly factors are used for the station.

Factor Categories

Each year, changes in the number and type of counts result in the need to update the Assignment of Stations to Categories, and the Assignment of Categories to Counts. During the AADT DEVELOPMENT PROCESS, the Districts work closely with the Central Office to make certain the correct assignments are made, and the Inventory Database is updated. Seasonal and Axle Factors are applied to short-term counts to estimate AADT.

Assigning Stations to Categories

District staff assign up to eight stations to each factor category, so that reasonable factors can be calculated even if any stations are not counted that year, or if it is counted but has atypical or insufficient data. Assignments to categories can be made anytime throughout the count year cycle by using the Seasonal or Axle Factor Category Assignment screens available under the Factor Category (FCAT) tab on the TCI application.

Seasonal Factor Categories

It is recommended that more than one count station be assigned to each factor category so that a fair representation of the traffic's seasonal flow and volume can be estimated. Seasonal categories have been designed to be county specific with at least one "Countywide" Seasonal Factor Category for each County and one Seasonal Factor Category for each Interstate Road within each County. Additional Seasonal Factor Categories can be developed to handle geographic differences within a single county (for example, beach traffic has different characteristics than urban traffic).

Axle Factor Categories

Axle Factor Categories are handled similarly to Seasonal Factor Categories, except both continuous and short-term classification stations can be assigned to Axle Factor Categories. Axle Factor Categories are more roadway-specific than Seasonal Factor Categories---an Axle Factor Category must be developed for each Roadway Section. This results in considerably more Axle Factor Categories than Seasonal Factor Categories.

Axle factors are derived from classification counts by dividing the total volume of vehicles by half the number of axles present on those same vehicles. This results in a factor that is always less than 1.00 (although it may round to 1.00 if there are few trucks in the traffic stream).

Computing Seasonal And Axle Factors

Data from all stations assigned to a factor category are averaged to generate Monthly Average Factors.

- The Monthly Average Factors are assigned to the week of the year that contains the midpoint of the month.

- ❖ Weeks without factors are estimated by extrapolating from the mid-week of one month to the mid-week of the next month.

Assigning Categories to Counts

Seasonal and Axle Factors are assigned to each count by SPS when counts are processed--according to information contained in the Station Inventory Database. These assignments must be reviewed and updated during the AADT Development Process---with special care given to stations with more than one type of count.

Update Factor Categories

- ❖ Seasonal and Axle Factor Categories and assignments can be updated at any time throughout the year,
- ❖ At least one continuous count station (Continuous) must be assigned to each Seasonal Factor Category,
- ❖ At least one seasonal or continuous class station must be assigned to each Axle Factor Category,
- ❖ A Seasonal Factor Category must be assigned to each short-term monitoring site,
- ❖ An Axle Factor Category must be assigned to each short-term monitoring site,
- ❖ Assign classification stations to any Axle Factor Category for which no axle factors can be calculated because of lack of data.

Estimating AADT

Any active stations not counted during the year will have their AADT estimated by applying a Growth Factor (as obtained from the continuous count data) to the previous year's AADT. Estimated AADT values will be computed for a maximum of two years in a row. Each station is to be counted a minimum of once every three years. When a site can't be counted for a third year, the site will be deactivated in the Station Inventory and a station from a break with similar traffic characteristics will be assigned to the break. If they wish, the Districts can estimate an AADT for the third year manually.

Final Review

After updated factors are applied and reports are generated a final review is done. The following should be considered:

- ❖ Review the factored counts to make sure the correct Seasonal and Axle Factor Categories are applied to each count depending upon the type of count, the sensor type, and the survey program.
- ❖ If multiple counts are taken throughout the year at the same count station, it is possible that different Seasonal and Axle Factor Categories have been assigned to each count, depending on whether changes have been made to the Seasonal or Axle Factor Category assigned to a count station in TCI. If this occurs, manually change the incorrect factor category assigned to the count by using the TCI Count Data update screen. All counts at the same station should use the same Seasonal Factor Category for the count year. If there are multiple axle counts loaded for a

single station during the year, the same Axle Factor Category should be assigned to each.

- ❖ Make sure all factors are applied as desired adjust sites which the resulting AADT’s are not reasonable.
- ❖ Make sure all desired count sites are activated in TCI and deactivate sites that won’t be used.
- ❖ Make sure all counts are correctly included in the current year database. Districts can manually add, delete, or change count summaries from the Count Data screen in TCI.
- ❖ Compare the directional split to historic counts and to adjacent counts to make sure they are reasonable.
- ❖ Verify that any AADT that is 20% lower or higher than the previous year AADT is in fact a legitimate value, and not an error.
- ❖ All counts must either be directional or bi-directional at each site.
- ❖ Review truck volumes and T% to make sure they are reasonable. If truck volumes weren’t collected at a site, or aren’t reasonable, the Districts can assign T% from another site (called a “cross-reference”).
- ❖ K, D, and T Factor assignments not made at the District level will default to a Statewide Functional Classification Category.

3.2. Annual Statistics

An AADT, Standard K, D and T factors must be assigned to each count station. T factors can be calculated for all vehicle classification stations. K and D factors can only be calculated for continuous count stations with sufficient quantities of good data. For all other stations, the K, D and T values are estimated, based on the following methodology:

Choice by	**Continuous Monitoring Sites**		**Short-Term Monitoring Sites**	
Priority	K and D	T	K and D	T
1st	Seasonal Factor Category	Cross Reference	Seasonal Factor Category	Axle Factor Category
2nd	Functional Classification Category	Axle Factor Category	Districtwide Functional Classification Category	Districtwide Functional Classification Category
3rd	Statewide Functional Classification Category	Districtwide Functional Classification	Statewide Functional Classification Category	Districtwide Functional Classification
4th	_	Statewide Functional Classification	_	-

Traffic Breaks

To assign an AADT, Standard K, D and T Factors to all roads in the RCI database, the Traffic Breaks file is used. This file is used to assign data collected at a point of the road to a length of road. Traffic Break statistics development is accomplished after the AADT, K, D, and T values are finalized for each station. This involves review of the Traffic Breaks File on the Mainframe and the Traffic Breaks with no AADT Report for proper break points and station assignments. These Traffic Breaks can be entered or modified in the Traffic Breaks Characteristic (RCI database, Feature 330) at any time during the count year. One, and only one, count station must be assigned to each Traffic Break.

The TDA Office will compare the updated Traffic Breaks to the RCI database and provide a list to the Districts of any traffic break segments that must be modified to exactly match the current RCI database. Once the files agree, TDA will submit the job to delete all the traffic data in RCI Feature 331 and replace it with the new traffic data.

Rollover

The final step in the AADT development process is carried out by TDA. This consists of adding the finalized traffic data to the mainframe TCI databases, closing the old count year, opening the new count year, and copying the Axle and Seasonal Factor Categories (and station assignments) and the Traffic Breaks files into the new count year tables. After the Traffic Breaks traffic data is finalized, usually by April 1, TDA “closes” the databases so no more changes can be made. The Districts can then begin uploading SPS count summaries for the new count year.

3.3. Data Distribution

After TDA completes Rollover, no further changes can be made to the data for the year just closed, and this “official” data is made available for distribution and use until the next annual update. The Florida Department of Transportation Annual Average Daily Traffic Reports (a separate AADT Report for each County in the State of Florida) and other reports containing Annual Vehicle Classification, Peak Season Factor Category, Volume Factor Category Summary and Weekly Axle Factor Category reports are accessible on-line through the internet from TDA on the FDOT Florida Traffic Online web page at: https://tdaappsprod.dot.state.fl.us/fto/

These reports contain AADT, K, D, T and other information for every Section Break on the State Highway System. Traffic Count Station Location Maps for each county are also on the web page.

Data can also be accessed directly from RCI and TCI by users that have access to the FDOT host computer and possess a valid USERID and password.

4. COUNT SITE FIELD INSPECTION AND INVENTORY

4.1. Introduction

This chapter details the procedures and equipment used in the field when inspecting new and existing traffic monitoring sites. Throughout this handbook we have referenced the various types of traffic monitoring sites that make up the over 15,000 locations statewide where traffic data is collected on a 3-year cycle. Two categories of traffic monitoring sites have permanent equipment physically located in the road: Continuous Traffic Monitoring Sites (Continuous) and some Short-term Traffic Monitoring Sites (Short-term). They are the backbone of the traffic count program administered by the Florida Department of Transportation Central (TDA) and District offices.

Specifically, over 300 continuous sites are polled via wireless modem daily by the TDA computers. They record and transmit every day of the year and provide the data used for adjusting short-term traffic counts to Annual Average Daily Traffic (AADT). The second, short-term sites, are usually installed in high volume urban arterials where rubber hose counts or other equipment are difficult to install and maintain. The permanent parts of the installation are the in-pavement sensors (loops and/or piezos) and the traffic cabinet. Greater reliability and accuracy are the reason loops are preferred to hose counts. A traffic counter is normally placed in the cabinet and attached to the wire harness for a short period (2-7 days) either annually or quarterly then moved from one site to another, hence the term portable traffic monitoring. Some locations are in rural or urban fringe areas that are located for coverage counts on roads that have the potential for significant increases in traffic as development and new traffic patterns evolve. Others are located for safety reasons as the difficulty in setting road tubes is dangerous due either to high travel speeds and/or road volumes and visibility issues.

4.2. Installation and Maintenance Responsibility

Creation of a continuous site is determined by the District and/or the TDA at Central Office. The acceptance of the installation by the Department is determined after field inspection and inventory by a qualified technician completing the procedures outlined in this chapter. The next sections of this chapter detail the field inspection and inventory requirements of continuous and short-term sites.

Counts can be taken by other methods while a site is under repair, using non-intrusive technologies such as: Microwave radar.

4.3 Field Inspections of Traffic Monitoring Sites

This process begins with a request or work order from the Central or District Office for a field inspection and inventory of equipment at a new or existing site. Once the work order is initiated, a trained service technician makes a visit to the site to ensure the correct equipment is installed and working as specified by the design request of the District or

Central Office. The following steps outline the recommended process that should be used by all technicians when inspecting and inventorying a continuous or short-term site. The significant difference between continuous and short-term sites is the wireless modem connection required for transmitting the data daily and the solar panel that supplies power to the battery. Short-term sites may have the same cabinet, counter harness, loop diagrams and internal panels as a continuous site, but do not have the need for continuous power or communications.

Current data forms are required by FDOT to be completed by the field technician at each installation, to update the count site database. This handbook will step through the process of completing each of these reports, providing photo examples of the steps, and equipment used and installed at the sites.

At The Site

Upon arriving at the field site, the technician should follow the standard steps described earlier in this handbook for exiting the road safely by activating turn signals and flashers in advance of the site and pulling completely off the road and, whenever possible, providing the maximum amount of separation from the travel lanes and clear zones of the road, or a minimum of 4 feet. The technician should have a current safety vest on prior to or immediately after exiting the vehicle. It is important to always proceed slowly and cautiously when working at any location adjacent to the road. This is especially true when working alone, as is often the case with most field inspections at continuous or short-term sites. The technician should always face oncoming traffic whenever making field measurements and checking in-road devices or those adjacent to the travel lanes. BE ALERT!!!

The steps provided here require operating knowledge of oscilloscopes, multi-meters, and basic wiring. Voltages are low and therefore electrical shock is not a concern. However, damage to components from improper use or incorrect connection of testing equipment should be considered at all times. Examples of some of the equipment used in testing the equipment are provided in Section 4 of this handbook, as they are common to the technician and his tasks. Photos or videos of most of the equipment types and procedures used are provided to assist in identifying components and safe practices. All models or manufacturers may not be represented in the samples provided due to newer and more efficient replacements becoming available.

Sensor Configuration

Check Condition - Visually inspect loops and piezos for rutting, cracking, and breaks. If cracks allow water to surround the leads, it may interfere with the operation of the sensors. When checking the depth of cracks or missing sealant, don't use a sharp object like a screwdriver or pocketknife to probe as it may result in sensor damage.

Check Layout - Loops should be centered in the lane and perpendicular to lane stripes. The piezo sensor should be located between the loops and positioned to cover only a single wheel path. In WIM sites, the layout will be Piezo-Loop- Piezo with the loop between 2 piezos.

The following Figures illustrate various loop layouts:

Figure 17: Piezo Loop Piezo (P-L-P) Layout

Figure 18: Piezo (P) Layout

Figure 19: Loop Piezo Loop (L-P-L)

Figure 20: Loop (L) Layout

Figure 21: WIM Bending Plate Layout

Figure 22: WIM Piezo Layout

Measure Spacing - With a wheel or tape measure, check loops to ensure that spacing is 16 feet from leading edge to leading edge. Each loop should measure 6 x 6 feet. The piezo should be centered between the two loops.

Check Sealant & Grout - Check that the loop slot is filled with sealant. The piezo grout should be smooth. The piezo grout should be even with or slightly higher than the pavement surface. If the piezo grout is concave, the sensors will not perform correctly. Refer to the Approved Products List (APL) for sealant and grout compliance.

Check Pull-Box - Check the pull-box for correct installation. Pull-boxes should be located a minimum of 8 feet from the edge of pavement. Lids should be level with surrounding surface. Inspect the concrete box for cracks to ensure it is intact. Pull-boxes should be sitting on a 12 to 15- inch gravel base to allow proper drainage. The loop wires should be spliced only if total length of wire exceeds 150 feet. Stranded 14-gauge wires should be spliced by soldering or crimping to 14-gauge home run cable that is grounded in the cabinet. Piezo wires should not be spliced but simply passed through directly to cabinet.

4.4. Cabinet Inspection

Take Photos - Site photos are a visual record of the cabinet conditions, configuration, and cabinet inventory. The photos should include the sensors, counter, pull-boxes, and inside and outside of the cabinet.

The following figures illustrate varied cabinet inspection layouts.

Figure 23: Type 3 cabinet

Figure 24: Type 4 Cabinet

Figure 25: Breakaway Pole Mount

Figure 26: Type 5 Cabinet

Figure 27: High Base

Figure 28: Low Base

Check Fasteners - Check that the cabinet is securely fastened and that it is good and tight. There should not be any rust on bolts, nuts or brackets.

Check Height - The bottom center of a pole mounted or break-away pedestal cabinet should be 4-feet above the ground. A low base mounted cabinet sits on a 3.5-inch concrete platform.

Check Seals - Ensure that all entry holes are sealed against water and insect intrusion.

Check Wiring Harness - Check that the wiring harness is installed.

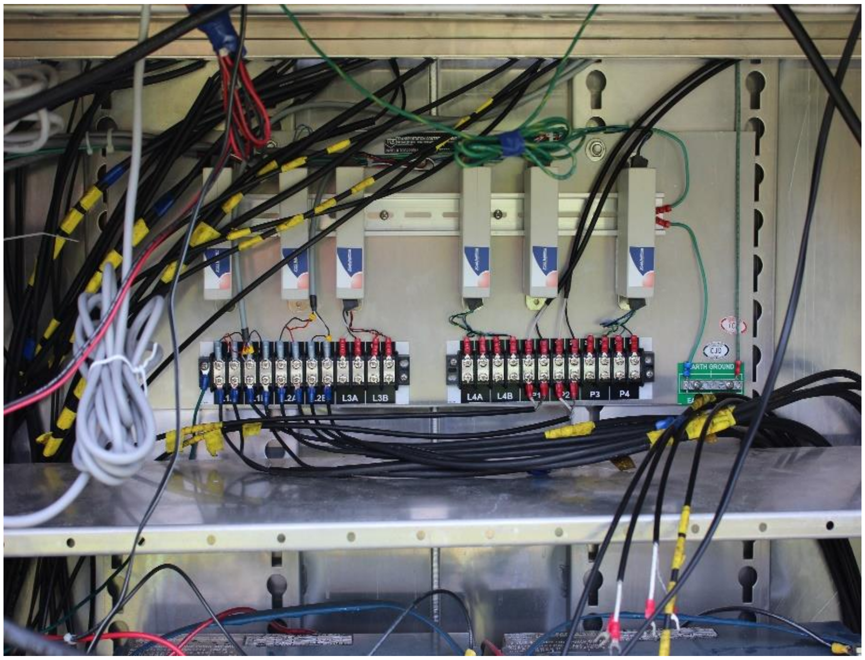


Figure 29: Wiring Harness

Locate Diagram - Locate and verify that the sensor wiring diagram was left by the contractor in the cabinet. Be sure the diagram is written directly on the cabinet door.

Record GPS - GPS coordinates should be recorded for this site, if not already present, measure and record them. The GPS coordinates will help technicians locate the cabinet and ensure that the GIS maps are accurate. Output should be expressed in degrees with five decimal places to be consistent with the database.

4.5. Loop Inspections

Label Leads - Ensure that all loops and piezo leads are clearly labeled as described in Design Standard 17900, Sheet 5.

Measure Loop Resistance - To test the series resistance of a loop, the loop must first be isolated from the terminal strip. Set the multimeter to the ohms setting and connect the multimeter leads to each end of the loop. Refer to State Specification 695-7 for all requirements pertaining to loop resistance.

Measure Loop Inductance - To measure inductance, an LCR meter is used. A four-turn loop should measure a minimum 100 microhenries.

Measure Loop Insulation - To measure loop insulation the loop must first be isolated from the terminal strip. Set the insulation tester (megger) to the 500volt setting, connect the negative lead to ground outside of the cabinet, and connect the positive lead to one end of the loop wire. While injecting voltage into the wire, the meter should read greater than 200 Megaohms for new loops and greater than 20 Megaohms for existing loops. Remember to reattach and securely tighten the leads to the terminal strip after testing.

4.6. Check Piezos

Measure Voltage Output - Remove the piezo coax cable from the terminal strip. The ground side of the coax cable is wrapped around the center conductor. Connect the oscilloscope probe to the center conductor of the piezo, and the piezo ground to the oscilloscope probe ground.

As vehicles pass over the piezo, measure voltage output with the oscilloscope. The pulse should be a minimum of 200 millivolts for a car.

Measure Capacitance, Resistance and Dissipation - To test resistance of a piezo, the piezo must first be isolated from the terminal strip. Set the multimeter to the ohms setting and connect the multimeter leads to the center conductor and the ground of the piezo. The piezo's resistance should read more than 20 mega ohms. If the resistance is less than 20 mega ohms, the piezo should be replaced. Measure capacitance and dissipation of the piezo using an LCR meter. The capacitance of a newly installed piezo should be within plus or minus 20% of the factory certified measurement. If needed, the capacitance can be estimated based on the length of the piezo and cable. The dissipation of a newly installed piezo should be no more than .04 nano-farads, existing piezo readings can vary.

4.7. Check Communications (Continuous Only)

CHECK MODEM - The modem is connected to the counter by a cable. Record the equipment type and serial number. Check power and ground. Connect the modem to a laptop using a modem cable. Remember to plug the modem back in when finished.

4.8. Check Power

Solar Panel (Continuous Only)

- ❖ Refer to Design Specification 17900 for orientation of solar panels.
- ❖ Visually inspect overhead lines, cables and trees. They should not shade the surface area of the solar panel.
- ❖ Disconnect the solar panel from the regulator and verify that it produces 18-22 volts DC and a minimum of 4.5 amps.
- ❖ Connect the regulator and verify that the output voltage reads 13.5 - 14.1 volts DC on a sunny day.

Figure 30 Solar Panel 85 Watts

Check Battery

Check the battery to be sure that it is providing power.

- A good battery under load shows a reading of greater than 12 volts DC.
- Measure and record the amperage rating, 100 amp/hr. is required.
- Verify that the voltage doesn't drop below 12 volts DC when placed under a 3.5-amp load.

4.9. Backplane

A backplane provides a mounting facility for terminal strips where all sensor leads connect in the cabinet. A wiring harness connects the loops and piezos to the terminal strips. The harness ends in a 26-pin connector which is connected to the counter.

Figure 31: Wiring Harness 26 Pin PAT & PEEK

Figure 32: 26 Pin Connector

Figure 33: Surge Suppression – Atlantic Scientific

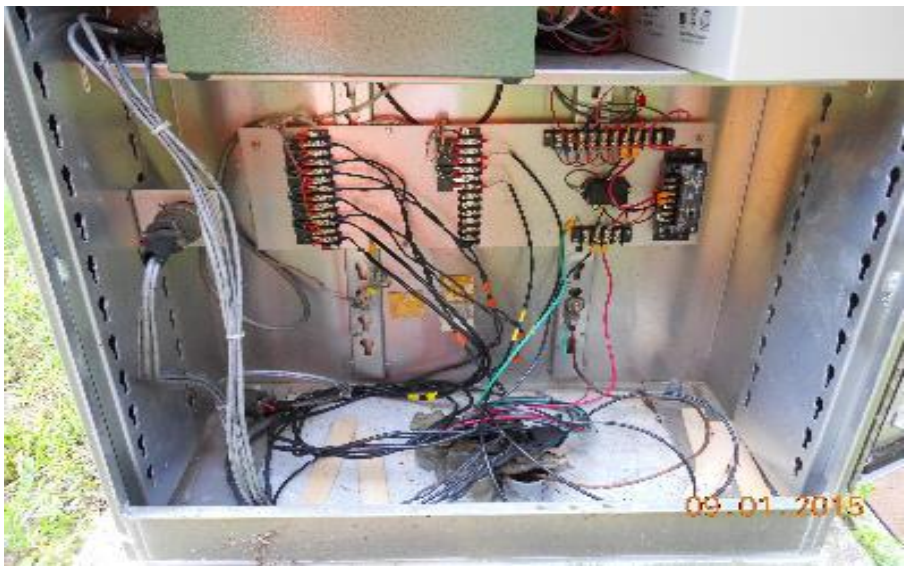


Figure 34: Walton Backplane with EDCO Suppression

4.10. Check Counter

Record the equipment type, NH number, and serial number of the counter. Connect the laptop to the counter by disconnecting the cable connected to the modem and connecting it to the laptop. Run the compatible software program for the equipment type. After it begins to communicate with the counter you may be prompted to enter the password. Check that the information coming from the counter is correct. Set the time for the correct time zone and count interval. Check each lane's vehicle data for accurate class, speed, weight, and volume data. Test sensors to see that the loops and piezos are sending proper signals. Monitor traffic data for 30 to 45 minutes to visually verify that the data being collected seems reasonable. The vendor software program displays the lane number, the exact time the vehicle is counted, the speed, number of axles, length axle bin, speed bin, weights and the distance between axles. The distance between the back axles of a semi-trailer is typically 3.9 to 4.1 feet. For continuous counter operation verification, call the TDA field unit at 850-921-7300 or 1-800-399-5523. The technician will replicate a communication session and verify that the counter is transmitting appropriate data.

Figure 35: Peek 241 A

Figure 36: Diamond Phoenix 2

Figure 37: Peek ADR3000

Figure 38: MetroCount

Figure 39: Jamar

Figure 40: TDC EMU3

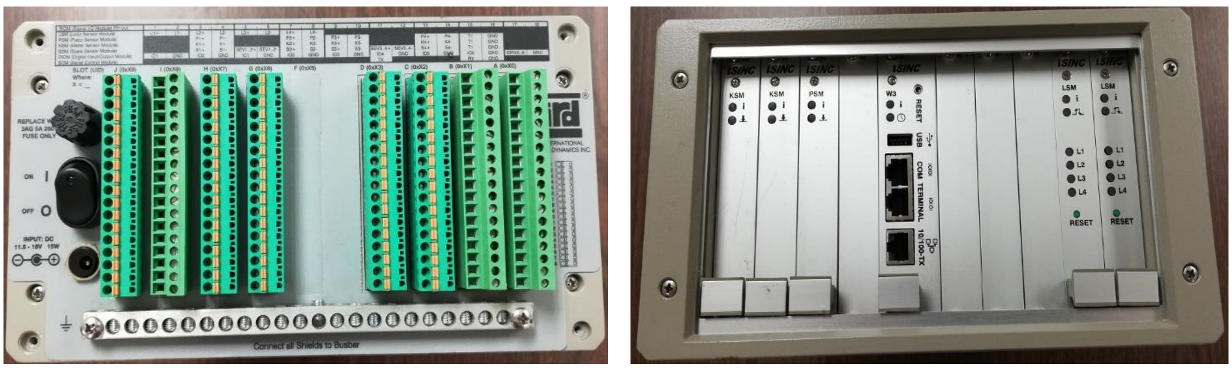


Figure 41: IRD iSinc

4.11. Final Re-Check

Prior to closing the cabinet:

- Check that all tools and test equipment have been removed.
- Check all cables and connections are secure. It may save the inconvenience of coming back to simply plug a modem back in.
- Ensure that all paper work for the site is in the plastic bag or pocket attached to panel door.
- Be sure that all fields are completed and proper equipment type is circled on all forms.
- Take photos of the installation, location, cabinet mounting and signage. Submit the photos with completed paper work to the appropriate FDOT facility for database updating.
- Return all tools and test equipment to your vehicle and secure them for safety.
- Tag any equipment that is faulty for return to the appropriate FDOT facility.
- Be sure that flashers and turn signals are used to safely re-enter the traffic stream when traffic permits.

5. NON-MOTORIZED TRAFFIC MONITORING

5.1. Introduction

The purpose of introducing non-motorized modes to the Handbook is to support FDOT's statewide effort to collect and maintain a statistically valid bicycle and pedestrian traffic monitoring data program so that statistics can be calculated and published annually. The data is collected to service FDOT data customers, partner agencies, and the public. Like motorized traffic volume data, non-motorized data can be used for similar types of analyses such as planning, designing, and programming facilities, pavement improvements, trail maintenance, and more.

5.2. National Methodology

According to the *FHWA Traffic Monitoring Guide (TMG)*, the methodology used to develop a non-motorized traffic volume program involves following some of the established motorized data program procedures. For example, developing a non-motorized program includes establishing site selection and equipment installation/data collection criteria based on a geographic footprint with continuous and short-term volume counting that can statistically represent other non-motorized facilities. Once the selection criteria are established, a survey of stakeholders is conducted to gather input from across the geographic area being evaluated. Survey respondents first provide recommended sites in which to collect non-motorized count data. Next, the selection criteria are applied to the recommendations automatically creating a way of prioritizing where counting equipment and installation investments might be best implemented. Statewide traffic monitoring programs generally include the following:

- ❖ A modest number of permanent, continuously operating, data collection stations
- ❖ A larger number of short-term data collection sites

The short-term counts provide the geographic coverage to understand traffic characteristics on individual roads, streets, shared use paths, and pedestrian facilities. They provide site-specific data regarding volume, time of day and day of week. Statistics such as annual average daily pedestrians (AADP) and/or average annual daily bicycles (AADB) cannot be accurately measured during a short-term count. Instead, data collected through short-term counts are factored to create annual average estimates. The development of those estimates requires the operation of continuous count stations. Continuous count stations provide data on seasonal and day of week trends. Continuous count stations also provide highly accurate data regarding changes in travel volumes among other characteristics. As data is collected, quality assurance and quality control processes are applied to the data collection and data analysis processes. Once the data is verified, statistics are calculated and published on an annual basis. Finally, data customers are provided with access to this data for many different analyses.

5.3. National Non-Motorized Data Collection Challenges

There are numerous challenges to consider when developing a count location or numerous locations. Above all, accuracy of the count should be top priority when developing a count location. During the FHWA Bicycle-Pedestrian Count Technology Pilot, some Metropolitan Planning Organizations (MPOs) participating in the pilot observed over-counting and under-counting of bicyclists and pedestrians. Over and under counting could be due to counter positioning or other factors related to counter specifications. To ensure the accuracy of a count, it is paramount that anomalies are investigated and corrected once the source of the discrepancy is identified. The following section will highlight some of the more popular data collection techniques and devices used throughout the industry today. As explained in the TMG, there are two over-arching challenges to consider when developing a non-motorized traffic monitoring program:

- Pedestrians and bicyclists are less confined to fixed lanes or paths of travel, making it easier to undercount if they move out of the range of the counter
- Pedestrians and bicyclists sometimes travel in closely spaced groups, making it easier to undercount if a traveler is blocked by another traveler in front, also known as occlusion

5.4. National Continuous Count Practices Overview

As described, the process for developing a continuous non-motorized traffic program should follow these steps:

1. Review any/all existing count programs
2. Develop an inventory of available continuous count locations and equipment
3. Determine traffic patterns to be monitored
4. Establish pattern/factor groups
5. Determine the appropriate number of continuous monitoring locations
6. Select specific continuous and short-term count locations
7. Compute monthly, day of week, and hour-of-day factors to annualize short-term counts

The following sections will break down in the detail these 7 steps.

1. **Review Existing/All Count Programs**

   When reviewing and assessing what existing count programs are already in place within or near your jurisdiction, it is important to coordinate with other government agencies/entities. Many MPOs, local governments, and advocacy groups have been monitoring non-motorized activity prior to state agencies. In addition to transportation related groups, other agencies, organizations, and community groups such as health agencies, parks departments, retail and/or business organizations, and bicycle/pedestrian advocacy groups should all be contacted and coordinated with as potential partners. Several of these potential partners may have previously collected non-motorized data.

2. Develop an Inventory of Available Continuous Count Locations and Equipment

Once an active coordination with state, regional and local partners is established, the next step is to develop an inventory of all past and on-going count programs within your jurisdiction. In addition to mapping data collection locations, the FHWA Traffic Monitoring Guide recommends the following information to be recorded, if possible:

Table 1: Existing Continuous Count Sites and Technology at "Bicycle City, USA"	
Existing monitoring locations and why they were chosen	6 stations, 2 have a focus on safety, 2 are evaluating facility performance, and 2 are for general traffic monitoring purposes.
Existing equipment and any noted performance/accuracy limitations	5 locations use side-fire infrared. 1 of the 5 locations are undercounting due to a high number of clustering. The 6th location is using an innovative smart camera technology still under review.
Who is using existing data, and for what decisions?	These counters are managed by the State DOT for state planning and safety purposes, however the local city and county are actively utilizing the data as well to support local planning, operations, and safety.
Is the existing data sufficient? If not, what are the additional user needs and their priorities?	The existing data is revealing data gaps where additional bike/ped. routes have been created due to new development. Additional counters would be helpful, if funding is made available.
If there is no existing data, who would utilize the data, and for what decisions?	The local MPO and County would value the additional data to support local and regional planning efforts.

If data does exist for a specific location, the following analysis should be conducted, if possible:

Table 2: Existing Continuous Count Station Data at "Bicycle City, USA"	
How do counts vary throughout the day?	Location 1 of 6 shows typical commuter traffic data on weekdays with a peak in the morning hours, and a peak in the late afternoon. Weekend counts drop significantly with recreational traffic trends showing one peak around noon.
How do counts vary by day of the week?	Weekday commuter traffic is generally consistent week by week with no significant changes.
How do counts vary by month or season?	The Fall/Winter/Spring months show a 30% difference in daily traffic on weekdays in comparison to Summer months. This could be due to high heat, consistent rain, and no school in session.
How do counts vary for inclement weather and other special events?	This count station shows that traffic drops significantly during inclement weather. Local partners have informed the DOT that this particular route has a yearly street parade, 1 marathon, and 1 bike race, per year. Those special event dates are noted in our DOT database.
How does traffic vary by street functional class and the presence of bike or pedestrian facilities?	Location 1 of 6 is a C6 Urban Core Major Arterial with fully separated shared paths on both sides of the roadway. The location has ample bike parking, bike sharing stations, lighting, mid-block crosswalks, transit stops, and way-finding signage.
How do traffic patterns and profiles compare at different locations in areas with different land use and demographic characteristics?	Location 1 of 6 serves the most commuter traffic. This location serves the urban core with various commercial, government, educational, and healthcare facilities along the route. The location is on a route with ample lighting which facilitates travel in the late and early morning hours. Location 2 of 6 is also commuter traffic, but on a lower volume street with no lighting, less dense commercial activity, and only one transit stop. The other 4 locations are

	recreational traffic patterns on regional trail facilities connecting to residential land uses and state/local parks, and no transit stops.

After reviewing the existing non-motorized data, one should have an understanding of the format of the data, and how it may be accessed and/or manipulated for further analysis. The following elements should be considered:

- What formats such as data structure, time intervals, and metadata are available and/or being reported from the field equipment?
- What quality assurance and quality control processes are in place for the field data?
- Are erroneous or suspicious data flagged and/or removed?
- What summarization or adjustment factors (if any), are applied to the field data?
- How does the existing count program account for missing data?
- Are estimated values flagged or documented within the metadata?
- Are the non-motorized data integrated with motorized data? Or, is there a separate process in place?
- Are data summarization processes automated to the fullest extent possible? At what point is a manual review and/or intervention required?

The final step is to consider summary statistics. Continuous count stations should be providing 24 hours of hourly count data, 365 days a year. This continuous data stream is often summarized into a few basic summary statistics such as Annual Average Daily Pedestrians and Annual Average Daily Bicyclists. Since we are still in the process of getting a better understanding of non-motorized traffic, other summary statistics are also important to consider.

- Seasonal Average Daily Traffic
- Average daily traffic by month and day of week
- Peak hour volumes for peak seasons

3. Determine Traffic Patterns to be Monitored

After reviewing and documenting the existing non-motorized traffic inventory, the next step is to determine which traffic patterns are to be assessed. Part of the process will be determining which functional road classes and bicycle/pedestrian facilities are to be monitored. Examples include: local roads, county roads, state roads, shared use paths, trails, pedestrian malls, etc. Once the non-motorized network has been defined, one should determine traffic patterns on the network, using their best judgement. Most commonly, facilities will have a relative mix of commuter, recreational, and utilitarian trips. Depending on the proportions of these trip types, traffic patterns will begin to emerge. These patterns should be used in the next step to establish seasonal factor groups. The most popular method to determine traffic pattern groups is through visual analysis and charting existing data. Continuous count data is ideal for this step, but short-term count data may be used as an alternative with caution.

4. Establish Seasonal Factor Groups

After traffic patterns have been defined, the next step is to develop unique traffic pattern factor groups. Establishing factor groups serves as the foundation for the statewide non-motorized traffic monitoring program. At this early stage of the practice, non-motorized groups can be classified into one of three categories. As more data becomes available, factor groups can be further refined.

- **Commuter and work/school-based trips –** typically a high peak in the morning with a second peak in the (late) afternoon
- **Recreation/utilitarian trips –** may peak only once daily, or be relatively balanced throughout the day
- **Mixed trip purposes –** has varying levels of the two different trip purposes above, or may include other miscellaneous trip purposes

Overall, it should be anticipated that climate conditions will have a significant impact on seasonal non-motorized patterns. Day to day weather conditions will have an impact on day-of-week or weekly patterns but should have minimal effects on seasonal impact. In addition, facility type and adjacent land use will also influence the purpose and timing of the trip.

5. Determine the Appropriate Number of Continuous Count Locations

This is still a relatively new realm of data collection for the state, therefore early stages of determining continuous count locations will be based on the amount of existing data available in the previous steps and using best judgement. As time progresses, more data will facilitate more informed decisions. At this point however, it is estimated that each district should target three to five continuous count stations to be installed for each factor group.

6. Select Specific Continuous Count Locations

After the number of count locations within each factor group has been established, the next step is to identify specific count station locations. The TMG advises several considerations to be addressed at this step:

Differentiating bicycle vs pedestrian traffic

Shared use paths and trails, used by pedestrians and bicyclists, should be equipped with data collection devices which can differentiate between modes. Exclusive bicycle lanes and separated bicycle lanes can be equipped with technology such as inductive loops or pneumatic road tubes, which only count bicyclists (Refer to **Figure 44**). Finally, pedestrian malls, sidewalks, and walking paths can be equipped with single-purpose counts such as infrared to count pedestrians exclusively.

Selecting representative continuous count locations

While it may be tempting to only install data collection devices at locations with the highest levels of non-motorized traffic, it would fail to produce a representative sample of activity to be further adjusted for annualized counts for lower volume facilities. It must be emphasized that the primary purpose of continuous count locations is to factor short-term count locations for all context classes. Continuous count locations in high volume areas may look impressive at first glance, but may not yield accurate results when factoring some short-term counts.

Selecting optimal installation locations

- ❖ Preferably on straight, level sections of road or trail, not on curves or near a steep grade
- ❖ On smooth pavement or another compact surface
- ❖ At a chokepoint or bottleneck where the traveled way is clearly defined, and deviation is not common
- ❖ For infrared sensors, not pointed toward waterbodies or direct sunlight
- ❖ For (passive) infrared sensors, not directly facing the roadway unless a vertical barrier exists.
- ❖ For inductance loop detectors, not near high-power utility lines that could disrupt or distort the detection capability

7. Compute Adjustment Factors

The calculation of adjustment factors should be similar to motorized traffic volume procedures. These adjustment factors are tailored for each factor group as defined in Step 4. Due to the relative newness of non-motorized traffic monitoring programs, very few agencies have created day-of-week adjustment factors. The current practice is to gather short-term counts during dates and times that are believed to be average, therefore reducing the perceived need for adjustment. This practice will evolve and refine as more data and count stations are installed around the states.

5.5. National Short-Term Count Practices Overview

The majority of count stations across the states are short-term count sites. Coupled with continuous count stations, these locations can help produce sub-area or regional travel trends. Short-term counts are performed on specific facilities based on certain needs, but it is not known whether that specific facility is representative of a sub-area or region. More data and research are required to establish those standards.

Selection of Count Locations

The following National Bicycle and Pedestrian Documentation (NBPD) Project Criteria are recommended for short-term counts:

- ❖ Pedestrian bicycle and corridor areas (downtowns, near schools, parks, etc.)
- ❖ Representative locations in urban and rural locations
- ❖ Key corridors that can be used to gauge the impacts of future improvements

- Locations where counts have been conducted historically
- Locations where on-going counts are being conducted by other agencies through a variety of means, including video
- Potential improvement areas such as gaps, pinch points, and locations that are operationally difficult for bicyclists and pedestrians to deviate from
- Locations where the number of crashes involving either bicyclists and/or pedestrians are high
- Select locations that meet as many of the above criteria as possible

Once general monitoring locations have been identified, the most suitable counter positioning should be determined. The NBPD project recommends the following guidance for counter positioning:

- For multi-use paths and parks, locations near the major access point are best
- For on-street bikeways, locations where few if any alternative parallel routes are best
- For traditional downtown areas, a location near a transit stop is best. Count at one access point
- For shopping malls, a location near the main entrance and transit stop is best. Count at one access point
- For employment areas, either on the main access roadway or near off-street multi-use paths is best. Count at one access point
- For residential areas, locations near higher density developments or near parks and schools are best. Count at one access point

Mid-block versus Intersection Counts

- Mid-block counts are taken at a roadway segment location along a non-motorized facility
    - They are typically used to identify general use patterns along a facility, and are the equivalent of short-term motorized counts.
- Intersection crossing counts that should be taken where a non-motorized facility crosses another facility of interest
    - Typically used for safety and/or operational purposes and are most like motorized intersection turning movement counts.

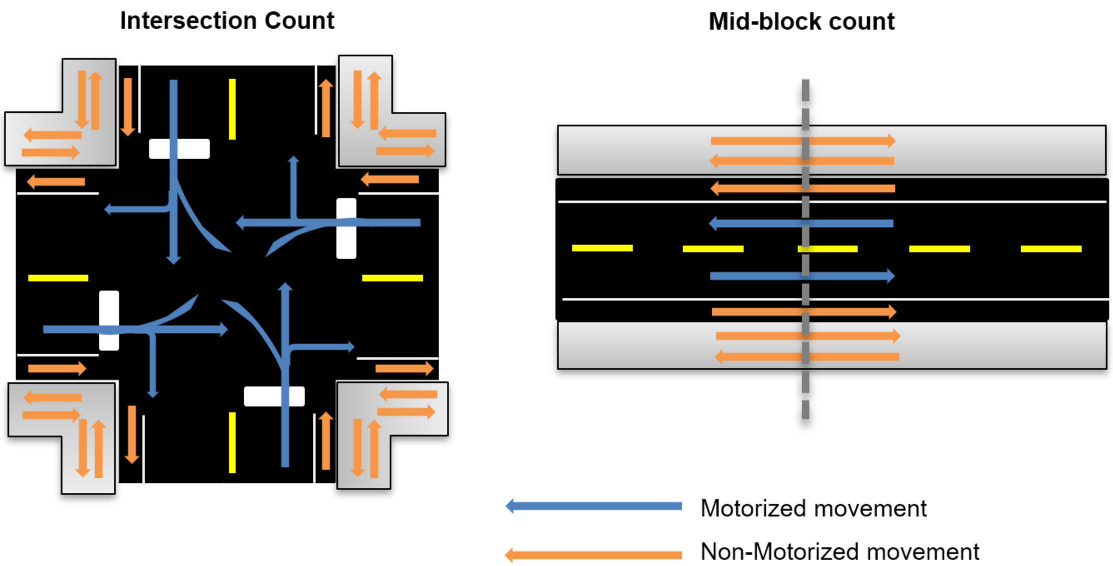


Figure 42: Intersection counts and Mid-block count sample

Note: The FDOT Transportation Data and Analytics Office only performs counts at the mid-block

Duration of Counts

According to the TMG, when using traditional automated equipment such as bicycle tubes and/or infrared counters, the ideal duration for a short-term count is between 7 to 14 days. In the past, non-motorized counts were focused on two consecutive hours on a single day, but this method is becoming increasingly rare as more technology evolves and more agencies understand the variability of non-motorized traffic. Seven days is the recommended minimum duration for an automated short-term count and 14 days is preferred so that every day of the week is captured. If one day of the week shows an anomaly, or has a weather event or equipment malfunction, then the other week can serve as a back-up to ensure every day of the week is captured.

With the rise of camera-based counting systems and Artificial Intelligence (AI) processing software, the degree of counting accuracy and validity has improved considerably in comparison to traditional automated equipment. With the understanding that camera-based equipment requires increased costs and additional challenges in regard to battery life, a minimum of one full weekday (Tuesday, Wednesday or Thursday) and one weekend day is recommended when using camera technology for counting.

Count Magnitude and Variability

If non-motorized levels are consistently high, shorter periods and/or fewer days may be considered. A longer duration count will be required to determine how variable the non-motorized traffic is by time of day and day of week.

Weather

Weather can be credited with significant shifts in non-motorized activity. Seasonal weather patterns are expected between winter and summer seasons. Heavy rains, unexpected heat waves, or cold fronts could also produce atypical variations to non-motorized activity.

Due to weather providing a significant impact on non-motorized travel, it is important to record weather conditions whenever possible.

- ❖ **High temperature –** Record approximate high temperature for either day or duration of the count
- ❖ **Low temperature –** Record approximate low temperature for either day or duration of the count

Months/Seasons of Year Data Collection

The specific months/season of the year for short-term counts should be outlined to represent average or typical use levels, which can be readily determined for continuous counters. Short-term counts may be used to collect other months/seasons of the year that are not considered average or typical; but a factoring process is needed to adjust the counts to best represent an annualized estimate.

Factoring Short-term Counts

Depending on the count duration, type of data collection equipment, and presence of inclement weather, there may be up to five factors that could be applied to short-term counts:

Table 3: Short-term count Factors

Time of day	When less than a full day is collected, this factor adjusts a sub-daily count to a total daily count.
Day of week	When data is collected on a single weekday or weekend day, this factor adjusts a single daily count to an average daily weekday count, weekend count, or day of week.
Month/season	When less than a full year of data is collected, this factor adjusts an average daily count to an annual average daily count.
Occlusion	When certain types of automatic counter equipment are used, this factor adjusts for occlusion.
Weather	When short-term counts are collected during periods of inclement weather, this factor adjusts an inclement weather count to an average, typical count.

5.6. National Non-Motorized Data Collection Technology Overview

As non-motorized data collection has gained importance, the market has responded with an array of data collection devices to aid in developing valid and reliable data collection programs. Today, there are various data collection devices used for recording non-motorized activity. Depending on the characteristics of the facility, surrounding environment, duration of the count, budget and staffing resources, these factors will play a role in determining the most appropriate data collection device to use at a count location.

National Non-Motorized Counting Equipment

5.6.1. Manual Counts

The oldest and most popular technique for counting non-motorized activity. With this technique, a person situates themselves in a location with a clear view of the observations area. Supplied with either a clip board, paper/writing device, or an electronic counting board, or a laptop computer with an open spreadsheet/electronic document, the person individually records each non-motorized traveler, documenting direction, gender, age, demographics, helmet usage, and/or other features. While in person observation comes with its advantages, there are specific challenges to be aware of. Manual counts are a relatively expensive method of data collection. At high volume locations, it might be difficult for a single person to capture all the data accurately. For instance, a live count staged at an urban city street may experience hundreds or even thousands of non-motorized travelers within a two-hour period, all moving in different directions and at different speeds. The addition of automobile traffic obscuring a person's view makes it very difficult to collect an accurate count. Observation periods longer than 2 hours may also cause a decrease in accuracy due to fatigue of the observer. For these reasons, manual counting will remain an effective method for short-term counts rather than a method for longer duration counts.

Figure 43: Manual Counter

5.6.2. Pneumatic (bicycle) tubes

Pneumatic tubes are a popular technique used for capturing non-motorized activity. Whenever a bicycle rides over the rubber tubes, pulses of air are sent through the tube. The pulses of air are converted into electrical signals and recorded by a receiver in the counter. Data collection vendors have created pneumatic tubes specific for bicycle data collection. Pneumatic tubes used for automobiles should not be used when collecting bicycle traffic data. Bicycle tubes are calibrated to detect the appropriate air pulse strength, and are softer to make it easier for bicycles, skateboards, and skates to cross over the tubes without tripping or falling.

To reduce chances of tripping, all pneumatic tubes should be securely fastened to the road with nails on each end, and further reinforced with special road tape along the center of the tubes. Depending on the duration of the count, once tubes are laid down, they should be periodically checked by technicians to makes sure they are secure to the pavement and collecting data properly. Pneumatic tubes are considered a reliable device option for recording bicycle traffic only, not for collecting pedestrian traffic. Passive infrared counters can be used in conjunction with tubes for enhanced bicycle detection. Please review **Figure 58** Non-motorized Data Collection Equipment Matrix for more information about combining technologies.

Figure 44: Pneumatic Tubes

5.6.3. Passive Infrared

Passive infrared uses infrared technology to record activity whenever a heat-producing object passes through a detection zone. This device can record both bicyclists and pedestrians since it does not require physical touch to record activity. Infrared counters are not able to differentiate between the two modes. Combined with pneumatic tubes, inductive loops, or piezoelectric strips, differentiation can be accomplished. Passive infrared does have challenges with occlusion. Occlusion represents lost data, not recorded due to interference from an object in front of the device's field of detection. Groups of walkers, runners, and/or bicyclists passing in front of a passive infrared sensor simultaneously are at risk of inaccurate counts. Overhead installation of the device is a common solution to avoid occlusion. Having the device pointed downward means that a group of non-motorized travelers can all pass through the field simultaneously and the device will detect all travelers. It is recommended that technicians calibrate and conduct their own ground-truth count tests for the automated technologies before they deploy at a given site or set of sites.

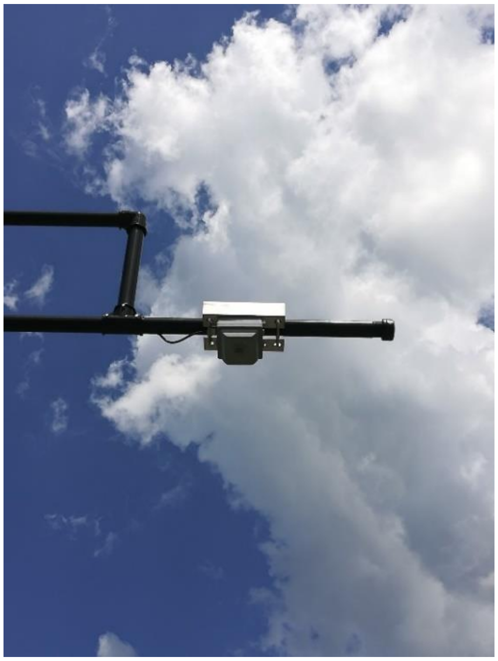


Figure 45: Overhead Passive Infrared

Figure 46: Overhead Passive Infrared setup

Figure 47: Passive Infrared (Q-Free/TDC)

Figure 48: Passive Infrared (Eco Counter)

5.6.4. Active Infrared

While passive infrared sensors use one device that has a designated detection zone, active infrared sensors consist of two: a signal transmitter on one side, and a receiver on the other. Together, these units create an invisible infrared beam. When an object interrupts the beam, a count is recorded. An active infrared beam has a narrower spread than a passive infrared beam. It can be used for recording both bicyclists and pedestrians but will not differentiate between the two. Like passive infrared, if multiple objects are moving close together, it is possible for occlusion to occur. Infrared devices can be combined with pneumatic tubes, inductive loops, or piezoelectric strips to differentiate between bicyclists and pedestrians.

Figure 49: Active Infrared

5.6.5. Automated Video Cameras

Automated video cameras are a newer form of data collection technology. Automated cameras have numerous benefits associated with them but are considered the most expensive data collection device. Automated video cameras provide the ability to capture the activity and direction of travel of all surface transportation modes through a designated detection zone. Software might be imbedded in the camera to allow for automatic distinction between bicyclists and pedestrians. Weather and lighting affect the accuracy of the captured data. Manual validation of suspicious data should be done, which increases data accuracy. Using cameras for recording non-motorized activity provides an added benefit of capturing behavior. For example, through video analysis, a safety expert and/or design engineer may be able to identify interventions that would improve the safety of a location by observing the behavior of the non-motorized and motorized travelers through the camera’s recording.

Figure 50: Video Cameras

5.6.6. Inductive Loops

Inductive loops create a magnetic field which is disrupted when a metallic object crosses over the field. If the disruption meets a predetermined threshold, a detection occurs, and the object is counted by a data logger or computer controller. The metal frames of a bicycle for example can serve as the metallic object that causes the disruption. The preferred counting location for inductive loops is at a location where bicycles are free flowing or not likely to stop. Ideally, loop detectors for bicycle counting will be placed on exclusive bicycle lanes. If loop detectors are placed in lanes shared by motorized traffic, special algorithms will be needed to distinguish the different modes. Inductive loops may be combined with an infrared device to differentiate between bicyclist and pedestrians.

According to the TMG, the most important variables in accurate bicycle detection via loop detector are:

- **Loop configuration –** Several different wire patterns have been used for counting bicycles such as: quadrupole, diagonal quadrupole, chevron, and elongated diamond patterns.
- **Detector circuit sensitivity –** The sensitivity should be high enough to detect bicycle frames but not high enough to detect motorized vehicles in parallel lanes.

- **Bicycle position over the loop –** pavement stencils may be used to indicate optimal bicycle position over the loop detector, which is typically directly over the saw cut for the wire coil.
- **Bicycle size and composition –** A large steel bicycle frame will more likely disrupt the loop's detector field than a smaller non-steel frame. Some inductance loop detectors can detect bicycles with non-steel frames due to the presence of ferrous metal in the wheels or other bicycle components.

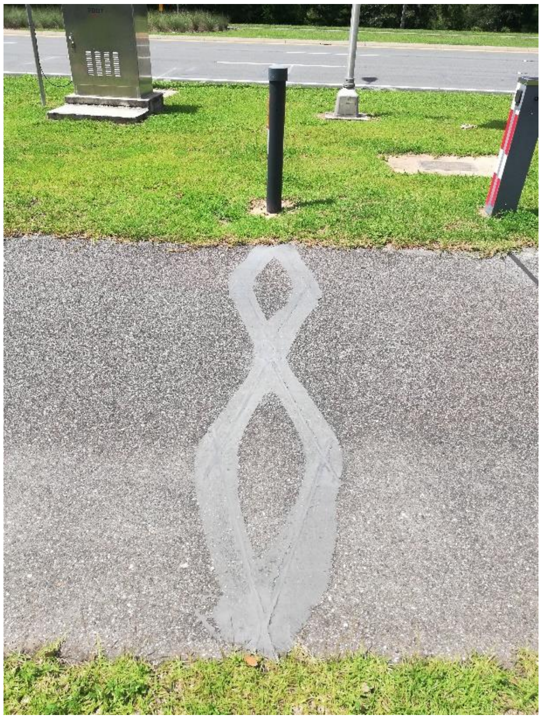


Figure 51: Inductive Loop in Bike Path

Figure 52: Inductive Loops in Shared Lane

5.6.7. Piezoelectric Strips

Piezoelectric strips (piezos) emit an electrical signal when they are physically deformed. Counters using this technology embed two or more strips into the pavement across the travel way. When a bicycle passes over piezoelectric strip, the pressure exerted on the strip momentarily deforms it which causes it to emit an electric pulse. The counters require pavement cuts to install the material and, depending on the location, considerable lead time may be necessary to obtain needed permits before the installation. The data logger is usually stored in a utility box/cabinet next to the facility, which may require additional excavation and costs.

Overall, piezos function like pneumatic tubes, replacing air pressure with an electric signal and can be used to detect direction and speed using multiple strips. However, unlike pneumatic tubes, piezoelectric strips are a permanent fixture that costs more to install. They cannot be used in mixed traffic, or to detect pedestrians unless combined with an infrared sensor.

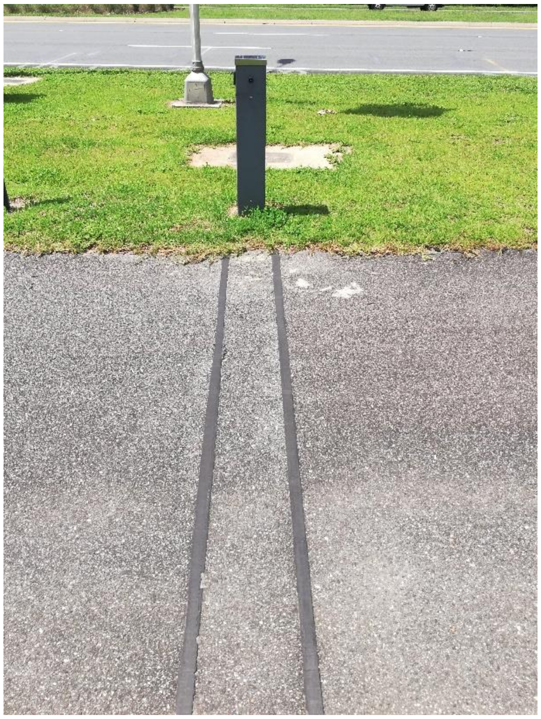


Figure 53: Piezoelectric Strips in a Bike Lane

5.6.8. Radar Sensors

Radar sensors can be either AC or DC powered, and typically use a single unit that combine a radio wave transmitter and receiver. After transmitting a radio wave pulse, the sensor will detect any return echo. If the radio wave encounters a bicycle or pedestrian in its path, part of the wave will bounce back and return to the unit. Using the amount of time it takes for the signal to return, distance from the sensor is calculated. Direction of travel is determined as the radar sensor continuously emits and receives radio wave pulses. In a mixed zone (motorized and non-motorized traffic) or where different modes are travelling very close to each other, the installation of radar scanners is not recommended.

Figure 54: Radar Scanner (Courtesy of FHWA)

5.6.9. Thermal Sensors

Thermal sensors operate like passive infrared but are typically mounted above the detection area. This method allows for more data gathering, such as directionality and speed. Thermal sensors are deemed expensive to install and, therefore, would be used mostly in continuous monitoring locations. In addition, they do not have the ability to differentiate between bicyclists and pedestrians.

Figure 55: Overhead Thermal Counter (Courtesy of FHWA)

5.6.10. Laser Scanners

Laser scanners send pulses of light in various directions and then record and analyze the reflections. They cannot differentiate between bicyclists and pedestrians. Experience of laser scanners within the United States is still very limited. Two versions of the laser scanners exist: horizontal and vertical. Laser scanners deployed at continuous count locations will require an available electrical power connection. Horizontal scanners will require locations with no obstructions. Vertical scanners are mounted above the detection area, which may induce additional installation costs. To this point, laser scanners have primarily been used indoors, but could potentially be used in an outdoor setting for a temporary study.

5.6.11. Pressure and Acoustic Sensors

These sensors are buried beneath the surface of a facility. The devices sense the pressure waves emitted by pedestrians or bicyclists as they step on or pass over the surface. They are used primarily on unpaved paths. Since they can only sense movements directly above them, they are only reliable if pedestrians or bicyclists pass a single file or if multiple sensors are used side by side. They do have the capability to differentiate between bicyclists and pedestrians.

Figure 56: Pressure Sensitive Counter (Courtesy of BeCounted.co.nz)

5.6.12. Magnetometers

Magnetometers detect metallic objects passing over a magnetic field. While popular in use for detecting motorized traffic, they are still new regarding detecting bicycle activity. Magnetometers are best suited for rural locations due to their highly sensitive detection rates of ferrous metal objects. In addition, due to their limited detection range, they are preferably installed at locations in which bicyclists will be traveling in a single file. They are not used for detecting pedestrians. They are considered expensive to install due to their need to be embedded in pavement.

Figure 57: Magnetometer (Courtesy of FHWA.DOT.gov)

1. What are you Counting?						
2. What is the count duration?	Technology	Bicyclists Only	Pedestrians Only	Pedestrians & Bicyclists Combined	Pedestrians & Bicyclists Separately	Cost
Continuous Count	Piezo/Inductance Loops	✅			🟨	$ $
How long determines complexity of installation	Magnetometer	✓				$ - $ $
	Pressure Sensor	✓	✓	✓	✓	$ $
	Radar Sensor	✓	✓	✓		$ - $ $
	Seismic Sensor	✓	✓	✓		$ $
	Automated Camera	✓	✓	✓	✓	$ $
	Infrared Sensor	✓	✅	✅	🟨	$ - $ $
	Pneumatic Tubes	✅			🟨	$ - $ $
Short-term Count	Manual Counts	✅	✅	✅	✅	$ $ - $ $ $

✓ Indicates that counting with this technology is possible

✅ Indicates a common or preferred practice

🟨 Indicates a common practice, but technology must be combined with other technology to differentiate between the two modes

Figure 58: Non-Motorized Data Collection Equipment Matrix

5.7 FDOT Continuous Count Operations

The FDOT Continuous Count program completed its first round of statewide continuous count installations in December 2020. FDOT TDA will continue to coordinate with FDOT Districts and local agencies for subsequent installations. Continuous Count data collection follows national guidelines so the data collected can be submitted to FHWA.

5.8 FDOT Short-term Count Operations and Loaner Program Guidelines

With the FDOT Non-Motorized Traffic Monitoring Program (NMTMP) still in its early stages of development, FDOT TDA is deploying short-term counts with the primary purpose to determine future statewide continuous counter installations. FDOT TDA is loaning short-term count equipment to FDOT Districts and local agencies who are willing to assist with deployment operations and logistics. Local agencies can use non-motorized data collected to support their local safety, planning, and engineering efforts. FDOT TDA will incorporate collected data into its statewide public-facing data repository, report data to FHWA, and use the data for continuous counter site selection assistance.

Any local agency that wants to participate in the loaner program must first sign a Memorandum of Agreement (MOA) between FDOT and the partnering agency. See MOA template in **Appendix F**.

Short-term Count Loaner Program Lessons Learned

- Coordinate with local partners to understand potential disruptions to data collection such as trail/roadway/bridge construction, special events, etc.
    - Providing preliminary deployment training is a public engagement strategy that provides local partners with the tools to become comfortable with the equipment and fully understand safety and security expectations.
- Providing on-site training to local partners provides the opportunity for them to adopt count sites to manage on their own, and to develop consistent data collection methodologies with the state.
- As local partners are trained in device deployment, it is best to factor in a safety and security inspection on the day prior to data collection beginning.
- Some local partners utilized its in-house traffic engineering team, already trained in traffic data collection equipment (such as tubes), to manage the deployments in their jurisdiction.

The following sections highlight FDOT TDA's recent experience utilizing its in-house non-motorized data collection equipment in the field. These devices have been placed on numerous trail and roadway facilities throughout the state of Florida.

FDOT TDA Short-Term Count Technology Best Practices

FDOT TDA Infrared Counter Best Practices

Infrared counters are portable devices used to count non-motorized activity on trails, sidewalks, and paths. An example of an installed infrared counting unit is displayed in **Figure 59 and 60**. The device is integrated by an infrared scope and a counting system. The components are enclosed in a 3rd party metal casing for protection from weather and vandalism, and for ease of installation. The infrared device can be mounted on trees, poles, and fences. The next section of this report documents the benefits, constraints, and deployment process of the infrared counter used in short-term counts for the FDOT Non-Motorized Traffic Monitoring Program. The benefits, constraints, and deployment process detailed below are based on current deployment technologies.

Figure 59: Non-Motorized Enclosure Case

Figure 60: Non-Motorized Infrared Sensor

Benefits

- Affordable, non-intrusive, and easily deployed compared to other counters.
- Counts pedestrians and bicyclists on diverse types of paths and sidewalks.
- Compact, unobtrusive, and resistant to rain, dust, and extreme temperatures
- Long battery life, approximately 1-2 years.
- The maximum range is approximately 20 feet.
- Large data storage capacity.

Constraints

- Does not detect speed, direction, or classify modes.
- Staff time is required for manual data extraction.
- Powerlines, windows, and water bodies can interfere with the unit's detection field.
- Dependent on appropriately placed infrastructure (poles, signs, trees)
- Both the benefits and constraints of the infrared counter should be considered throughout the deployment process.

Infrared Deployment Process Best Practices

The deployment process consists of four interrelated phases, outlined below:

- Pre-Deployment Mobilization
- Installation
- Maintenance
- Deinstallation

Each phase of the deployment process requires dedicated and thorough staff to ensure a successful deployment. The necessary steps for each phase are detailed below.

Pre-Deployment

Prior to deployment, team members should have a firm understanding of each site location through review of on-site and virtual site evaluation forms. These forms are available on the program website. Proper preparation to minimize surprises in the field are critical for a successful short-term count deployment. To ensure adequate supply of counters and supplies, utilize the deployment checklist in **Appendix E**. The supplies needed for every deployment regardless of counting technology are as follows:

Figure 61: Non-Motorized Deployment Supplies

- Safety vests for every team member
- Safety cones to denote work zone
- Ample water supply
- Sufficient sun screen
- Multiple pairs of gloves for each team member
- Digital camera or smart phone and charger(s)
- Sufficient bug spray
- Broom
- Scraper
- Storage bins for units and tools
- ... (based on field conditions)

Prior preparation to the fieldwork is critical to ensuring a smooth installation.

Installation

Figure 62 displays the different materials of the Infrared Unit. Each component is explained in more detail below:

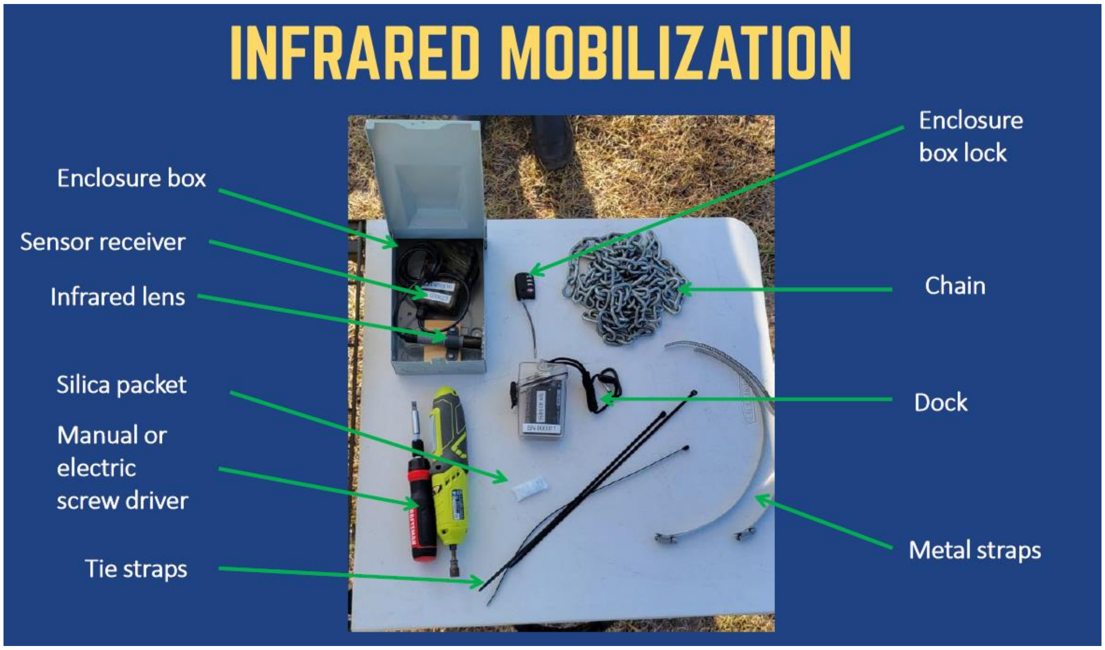


Figure 62: Non-Motorized Infrared Deployment Materials

- The infrared sensor comes inside a metal enclosure box which protects the sensor from theft and environmental elements.
  - Inside the enclosure box is the sensor receiver housed in a camouflage case and the sensor lens.
  - The sensor lens is the most delicate component of the unit. It must be both protected from obstruction, and properly pointing trough the enclosure box hole during data collection.
  - A silica packet will protect the sensor from moisture during deployment.
  - A lock and chain add a level of security against theft.
- The sensor dock is the necessary device used to activate the sensor and extract data from the sensor.
- Metal straps secure the sensor box to the post, pole, tree or sign. The straps come with a quick release screw that can be tightened with a screwdriver.
- A chain attached to the enclosure box and locked to the pole, sign, or tree adds an additional level of security.

With a thorough understanding of the components of the infrared unit, and the following step-by-step process, any team member can successfully deploy the equipment.

- Designate your work zone with safety cones and always keep the right-of-way clear during installation.

Figure 63: Non-Motorized Deployment Work zone

- ❖ Place enclosure box at approximately waist high on the post.
- ❖ Use an electric or manual screwdriver to tighten the metal strap until snug on the post.
- ❖ Once secure, add a silica packet to the inside of the camouflage case to protect the unit from moisture during the deployment.
- ❖ Ensure the sensor lens is pointed towards the open hole and that the wires are not tangled.

Figure 64: Non-Motorized Infrared Sensor Orientation

- ❖ Ensure the sensor is pointed towards the facility and perpendicular to the path or sidewalk.
- ❖ Start the sensor receiver by attaching the dock to the sensor receiver. A green light on the dock will indicate that the unit is functioning properly.
- ❖ Detach the dock from the sensor receiver.

- ❖ Put sensor receiver back into the receiver case and close the receiver case.
- ❖ Perform a quick test to ensure the counter is functioning by having a person walk through the detection field. You should see a small green light flash on the sensor.
- ❖ Close the enclosure box and secure the unit to the post with a lock and chain.

Figure 65: Non-Motorized Infrared Deployment Lock and Chain

- ❖ Tilt the sensor box slightly towards the facility to assist with drainage.

Figure 66: Non-Motorized Infrared Tilt Technique

- ❖ Clean any debris from the installation process and ensure the site is clean before leaving.

Figure 67: Non-Motorized Infrared Deployment Sample

Maintenance

Throughout the data collection period, each unit at each site location should be inspected. Additionally, a manual data extraction should be performed at the mid-point of the data collection period to verify that the infrared unit is counting properly. A step-by-step process detailing how to extract data during a maintenance check is shown below:

- Inspect the outside of the unit for signs of vandalism, tampering, or malfunction.
- Unlock the unit and inspect the inside of the enclosure box for signs of moisture and/or small animals (ants, spiders, lizards, etc.).
- Detach the sensor receiver case from the enclosure box and open the sensor receiver case.
- Attach the data dock to sensor receiver.
- Wait until dock indicates data is downloaded via a flashing greenlight.
- Put sensor receiver back in the sensor receiver case and reattach to the enclosure box.
- Add an additional silica packet if signs of moisture are present.
- Close and lock enclosure box.
- Ensure unit is at the correct height and tilt on the post.

Deinstallation

At the end of a short-term data collection period, the infrared unit should be deinstalled from each data collection site. A step-by-step process detailing how to deinstall the infrared counter is below:

- Designate your work zone with safety cones and keep the right-of-way clear at all times during installation
- Inspect the outside of the unit for signs of vandalism, tampering, or malfunction.
- Unlock the unit and inspect the inside of the enclosure box for signs of moisture and small animals (ants, spiders, etc.).
- Detach the sensor receiver case from the enclosure box.
- Attach the data dock to the sensor receiver.

- ❖ Wait until dock indicates data is downloaded via a flashing greenlight.
- ❖ Put sensor receiver back in the camouflage sensor receiver case and close the receiver case.
- ❖ Loosen the metal straps with an electric or manual screwdriver.
- ❖ Inspect and clean the site from any debris left over from the short-term count.
- ❖ Store the units in their properly labeled bins in a safe and secure fashion that minimizes movement while traveling.

All phases of the deployment process are critical to ensuring a successful short-term deployment. Dedicated, skilled, and thorough staff are vital for successful data collection efforts.

FDOT TDA Pneumatic Bicycle Tube Deployment Best Practices

The bicycle tube counters FDOT TDA utilizes consist of a portable device integrated by two pneumatic tubes and an electronic counter specially calibrated for bicycles. It is configured to detect bicycle direction, speed, axle spacing, headway, and volume. FDOT TDA has an office safety policy to only deploy bicycle tubes on designated bicycle facilities. Standard 5' sidewalks are not considered a designated bicycle facility, and are therefore not included in any bicycle tube deployment. The next section of this report documents the benefits, constraints, and deployment process of pneumatic bicycle tubes. The benefits, constraints, and deployment process detailed below are based on current deployment technologies.

Figure 68: Non-Motorized Bicycle Tube Sensor

Figure 69: Non-Motorized Bicycle Tube sample

Benefits

Some of the key benefits of this device are:

- ❖ Affordable and long lasting compared to other counting technologies.
- ❖ Detects volume, speed, and direction.
- ❖ Easy to moderate difficulty to install.
- ❖ Resistant metallic casing for protection from weather and vandalism.
- ❖ Large data storage capacity
- ❖ Can be installed for extended periods of time with a battery life of up to 3-4 years.

Constraints

Despite the benefits discussed above, the technology has constraints.

- Materials used in the installation process (nails/screws, tape, tube) can be intrusive.
- Deployment requires trained and dedicated staff to install, maintain, monitor, deinstall, and manually extract data. Materials used in installation require safety precautions.
- Data from on-road facilities such as unprotected bike lanes may be more prone to error if motor vehicles drive over tubes.
- Dependent on appropriately placed infrastructure (poles, signs, trees).

Partners must use their best judgement when deciding whether or not it is appropriate to deploy bicycle tubes on facilities with steady pedestrian traffic. Both the benefits and constraints of the pneumatic bicycle tubes should be considered throughout the deployment process.

Deployment Process

The deployment process consists of four different phases, outlined below:

- Pre-Deployment Mobilization
- Installation
- Maintenance
- Deinstallation

Each phase of the deployment process requires dedicated and thorough staff to ensure a successful deployment. The necessary steps for each phase are detailed below:

Pre-Deployment Preparation

Prior to deployment, team members should have a firm understanding of each site location through review of on-site and virtual Site Evaluation forms (**Appendix F**). To ensure adequate supply of counters and supplies, utilize the deployment checklist in **Appendix E**. The supplies needed for every deployment regardless of counting technology are as follows:

- Safety vests for every team member
- Safety cones to denote work zone
- Ample water supply
- Sufficient Sun Screen
- Multiple pairs of gloves for each team member
- Digital camera or smart phone and charger(s)
- Sufficient bug spray
- Broom
- Scraper
- Storage bins to transport units.
- ... (based on field conditions)

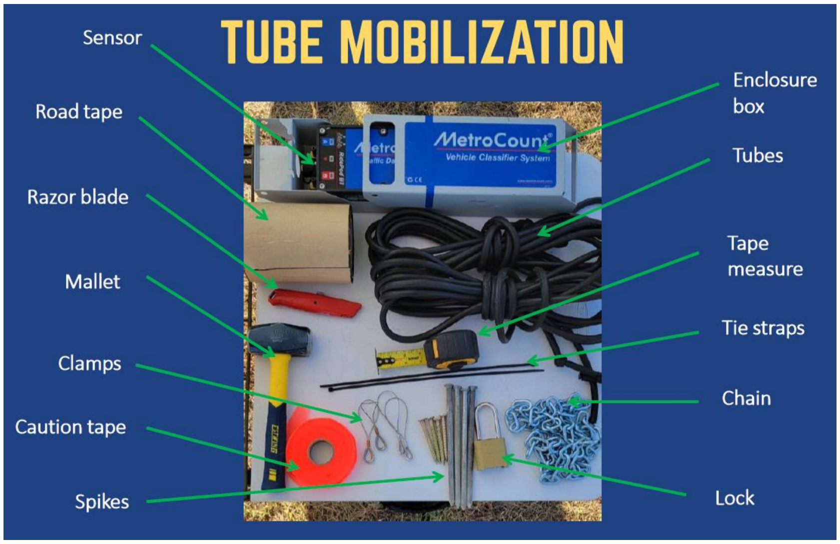


Figure 70: Non-Motorized Bicycle Tube Materials

The more prepared team members are before fieldwork commences, the more successful field work will be. Prior preparation is critical to ensuring a smooth installation.

Installation

Figure 70 displays the different materials of the pneumatic tube unit. Each component is explained in more detail below:

- Safety vests.
- Safety cones to denote a work zone.
- The sensor enclosure box protects the sensor receiver box from theft and the elements.
- The sensor receiver contains bronze tube prongs and A/B markings that must be pointed outwards to be accessible during deployment.
- Bicycle tubes consist of two tubes with a knotted and open end for each. The open ends will be attached to the bronze sensor receiver ends mentioned above.
- Clamps or cleats are used to attach the ends of the tubes to the ground.
- Long metal spikes or nails are used to secure the tubes to the ground.
    - The long metal spikes are for securing the tubes into gravel, grass, or dirt on off-road trails and shared use paths.
    - Nails are used for asphalt locations like bike lanes.
- A mallet is used to secure the spikes or nails into the ground.
- A tape measure is used to make sure the tubes are 18″ apart on each side.
- Orange caution tape is used to alert facility users and landscapers of the tubes′ presence.
- Bituminous road tape is used to secure the tubes to the facility.
- A utility knife or razor blade is used to cut the road tape to deinstall the bicycle tubes.

With a thorough understanding of the components of the infrared unit, and the following step-by-step process, any team member can successfully deploy the equipment.

- Put on safety vests and place safety cones to denote a work zone.
  - Designate a spotter who will stay alert to traffic while the installation is in progress.
- Secure the tubes to the far end of the path.
- Ensure the ends of the tubes are properly knotted and the correct cleats or clamps are attached using the figure-eight method.

Figure 71: Non-Motorized Bicycle Tube Figure 8 Technique

- Feed the tube through the hole in the loop. Repeat for the second clamp or cleat.
- Ensure both tubes have cleats at their respective ends.
- Use spikes to nail through the open end of the cleat on both sides of each tube.

Figure 72: Non-Motorized Bicycle Tube Spike Technique

- Both parallel tubes need to be 18″ apart for the counter algorithm to work properly. Use a tape measure to assist.

Figure 73: Non-Motorized Bicycle Tube Spacing Measurement Technique

- Identify the ends of the tube that will be inserted to the unit′ s sensor prongs.
- Ensure the correct tube is inserted to the appropriate prongs, labeled A and B.
  - The tube inserted in A should be closer to eastbound traffic.
  - The tube inserted in B should be closer to westbound traffic.

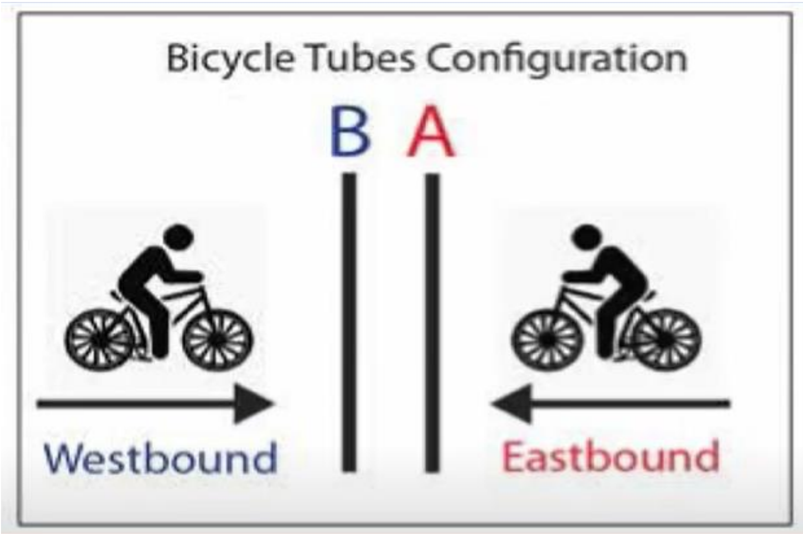


Figure 74: Non-Motorized Bicycle Tube Configuration Graphic

- Close the enclosure box.
- Ensure there are no kinks or pinches in the tubes.
- Use pieces of bituminous road tape to secure the tubes to the facility pavement.
- To ensure proper installation, the road tape should stick to the tube before being placed on the facility surface. This will help ensure that the tubes stay secure throughout the data collection process.

- ❖ Tie high visible caution tape to each end of both tubes so they are visible to landscapers.
- ❖ Use a bicycle to confirm the tubes are registering counts, indicated by flashing green and red lights in the register displays labeled A and B.

Figure 75: Non-Motorized Bicycle Tube Prongs A and B Close-up

- ❖ Secure the enclosure box to the post with chains and a lock.

Figure 76: Non-Motorized Bicycle Tube Bicycle Test Technique

Maintenance

Throughout the data collection period, each unit at each site location should be inspected. Additionally, a manual data extraction should be performed to verify the unit is counting properly. A step-by-step process detailing how to extract data during a maintenance check is shown below:

- ❖ Put on safety vests and place safety cones to denote a work zone.
- ❖ Inspect the tubes for punctures or kinks.
- ❖ Inspect the enclosure box for signs of vandalism or damage.

- ❖ Unlock the unit and inspect the inside of the enclosure box for signs of moisture and small animals (ants, spiders, lizards, etc.).
- ❖ Use a bicycle to ensure the counter is counting properly.
- ❖ Connect the computer where the data will be downloaded and stored.
- ❖ Close and lock the enclosure box.

Deinstallation

After a data collection period is over, team members will travel to each collection site to deinstall the units. Deinstallation combines elements from the maintenance and installation components of the deployment process. A step-by-step process detailing the deinstallation process is listed below:

- ❖ Put on safety vests and place safety cones to denote a work zone.
- ❖ Inspect the tubes for punctures or kinks.
- ❖ Inspect the enclosure box for signs of vandalism or damage.
- ❖ Unlock the unit and inspect the inside of the enclosure box for signs of moisture and small animals.
- ❖ Connect the computer that will be used to download and store the data.
- ❖ Download the data and save it.
- ❖ Detach the tubes from the unit.
- ❖ Pull long metal spikes or nails from the far side of the collection site.
- ❖ Using a utility knife, carefully cut the road tape on each side of the tube taking extra caution to not cut the tube itself.
- ❖ Once the tubes are detached from the unit, spikes, and road tape, one team member should peel as much road tape as possible off of each tube.
- ❖ Remove the excess road tape from the facility. It may be necessary to utilize a scraper to remove the excess road tape.
- ❖ Detach the caution tape from the tubes.
- ❖ Wrap the tubes holding one end of the tube in one hand and wrap each tube around the arm just above the elbow and through the crook of the thumb and finger. Do this for each tube separately.
- ❖ Wrap each tube around each other so they are grouped together. Properly wrapped tubes will resemble the tubes in the figure above.
- ❖ Before leaving the site ensure that all road tape, marking tape, spikes, cleats/clamps, tools, cones, and units are cleared from the site.

Following these procedures assist in ensuring a successful short-term deployment. Knowing how to deploy non-motorized counting technology, while critical, is one of several components necessary for a short-term data collection deployment. Site selection in particular provides ample opportunity to prepare for the unexpected and ensure a smooth deployment.

5.9 FDOT TDA Site Selection Methodology

Virtual Site Visit Best Practices

- Visit locations virtually using Arc GIS, Google Earth, Google Maps, etc.
- Log the following:
    - Site Name
    - Site GPS coordinates
    - Anticipated Factor Group
    - Anticipated Volumes
    - Anticipated Equipment
    - Managing Agency(ies)
    - Roadway/Land use characteristics
- Other observations to consider:
    - Bike/Ped crash proximity
    - Context Classification
    - Transit stop proximity
    - US Bike Route and/or regional trails
    - Demographic Information

On-Site Evaluation Best Practices

- Evaluate site-specific conditions and note existing infrastructure.
- Look for choke points.
- Determine baseline activity levels and note traveler attire & behavior (commute/recreation)
- Look for origins and destinations.
- Always good to have local expert present
- Note any special observations

Site Selection Lessons Learned:

- Site Selection is a dynamic process
- Site priorities may change with shifting political and agency priorities
- Can change with new technological equipment
- Can change with funding availability
- Virtual Site Visits, On-site Visits, and short-term counts are a great way to select continuous count stations with confidence
- Learn more about local partner count efforts
- Test different types of equipment for best accuracy
- Dense traffic may indicate which technology is needed
- Time of day usage may indicate how long data collection should take place. For example, some facilities are not open 24 hours a day such as transit stops and trails that are on park property
- Avoid having to move a continuous counter post-installation

TRAFFIC CHARACTERISTICS INVENTORY (TCI) DATABASE

The official traffic database resides on the Department's computer network, where it can be viewed by anyone in the Department. However, only authorized traffic count personnel may insert, delete, or change any data, or view the open-year traffic data. It is a relational database containing station information, historical and current year traffic volumes, and vehicle classification data. Some traffic count stations have historical data as far back as 1970. The stations' database records are used in data quality checking of short-term counts.

Home Tab

Figure 77: Traffic Characteristics Inventory (TCI) Webpage

Station Tab

Station Identification

The official Station Inventory is maintained in the FDOT database. It contains information such as: Station ID, County, Location, Latitude, Longitude, Seasonal FCAT, Sensory Type, Survey Type, Count By, Count By Lane, Ascending Direction, Descending Direction, Active, Managing District, Axle FCAT, Purpose Code, Survey Program, Count Median Lane?, Ascending number of Lanes, Descending number of Lanes, Roadway ID and Beginning Milepoint.

Each evening, the data in the Station Inventory is copied to a dataset residing on the host. It is this copy that is downloaded by SPS and placed into an ACCESS table on the District PC. SPS can download this dataset whenever the operator desires.

If the District operator does not want to wait until the following day to download the updated Station Inventory to the District PC, it is possible to change the piece of data in the SPS station inventory and continue to process the traffic data. However, the next time SPS downloads the Station Inventory, any changes made to the SPS station inventory will be over-written or lost. To avoid problems with the Weekly Load, be sure to update the Station Inventory database so it matches the information in the summary records. (See SPS EDITS PERFORMED and PROBLEM RESOLUTION).

Stations Per Roadway

All traffic count stations located along a specific section of road (Roadway ID) for every year (active or / and in-active) can be viewed using this transaction. The stations are listed in ascending order of station milepoint. The user can elect to display all, active, or inactive stations. The count year is optional, if entered, the transaction will display the AADT of the selected count year, Station status, beginning / ending milepoint, type and status. This transaction can make a nice ad-hoc report of the traffic volumes on a specific road.

Count Tab

Station Counts

The detailed traffic count data are stored in this traffic database. It contains the date and direction of the count, and its raw and adjusted values. Anyone can look at this historical data, but only traffic count personnel can view the data for the current open year. A quick look at this database can confirm that a load job has run successfully.

Volume Statistics

The processed traffic data is stored in the annual count database. It consists of such items as the AADT, K, D, and T Factors for all sites, and the peak hour information for short-term counts only. This data is updated annually.

AADT History

Historical Annual Average Daily Traffic volumes are saved in the TCI database. The database contains traffic from as far back as 1970 for some stations. This data can be viewed by specifying the six-digit count station number, and the earliest year for which data is desired. The transaction will return traffic volumes from the entered year (or next closest stored year) forward to the latest year.

Monthly ADT

This table stores the monthly ADT values for the continuous counters only. The monthly ADTs are stored for each direction of travel at the station.

Class Data Tab

Classification Detail

The 24-hour summaries of each type of vehicle, and the daily total volume are stored for each direction, lane, and date for each short-term classification station.

Vehicle Statistics

Annual vehicle summary classification data is stored in this database table. It contains the annual percentages of traffic by each vehicle classification, the annual T Factor (daily truck percentage), and the design hour heavy, medium and total truck percentages. This data is updated annually.

Vehicle History

The annual classification summary data are displayed on this Inquiry Only screen. The 15 Modified Scheme "F" vehicle classes are collapsed into just 4 groups (passenger vehicles, single-unit trucks, semi-trailer combination trucks, multi-trailer combination trucks) to fit on the screen. The percentages are multiplied with the AADT to calculate the number of vehicles in each group. The data is stored by county-station and year.

The database contains classification traffic data from as far back as 1970 for some stations. This data can be viewed by specifying the six-digit count station number, and the earliest year for which data is desired. The transaction will return information from the entered year (or next closest stored year) forward to the latest year.

Speed Data Tab

Under Development

In the future, Speed Detail, Speed Statistics, and Speed History data will be available – continuous stations only.

Factor Category (FCAT) Tab

Seasonal Factor Category

Seasonal Factor Categories are those groupings of continuous count stations whose data will be used to develop the factors that will adjust short-duration counts for the time of year. The category is a 4-digit number—the first 2 digits are the county codes, and the second 2 digits are a user supplied sequence number. It contains a verbal description that informs the user of its intended use, and a maximum of eight continuous count station numbers.

The End-of-Year Processing programs calculate the appropriate factors from the data collected at the stations assigned to the factor categories. It is best if multiple stations (upper limit of 8), are assigned to a factor category, so that reasonable factors can be calculated even if a single station is not counted that year, or if it is counted but has atypical traffic.

Axle Factor Category

Axle Factor Categories are those groupings of vehicle classification stations whose data will be used to develop the factors that will adjust axle counts into vehicle counts. The category is a 4- digit number—the first 2 digits are the county codes, and the second 2 digits are a user supplied sequence number. It contains a verbal description that informs the user of its intended use, and a maximum of eight vehicle class stations. Both short-duration and continuous classification stations can be assigned to Axle Factor Categories. The End-of-Year processing programs calculate the appropriate factors from the data collected at the stations assigned to the factor categories. It is best if multiple stations (upper limit of 8), are assigned to a factor category, so that reasonable factors can be calculated even if a single station is not counted that year, or if it is counted but has atypical traffic.

Weekly Seasonal Adjustment Factors

The Weekly Seasonal Adjustment Factors are stored in the database and displayed with this application. There can be from 52 to 54 weekly factors, depending upon which day-of-week January 1 falls. The seasonal adjustment factors are multiplied with the raw count (and axle correction factor for road tube volume counts) to derive an AADT estimate. If the Seasonal Factor is greater than 1, that means the count was collected during a time of the year when the traffic volumes are low, and must be raised to reach the annual average. If the seasonal factor is less than 1, the raw count was collected during a time of year when the traffic volumes are high, and the raw count must be lowered to the annual average.

Weekly Axle Adjustment Factors

The Weekly Axle Adjustment Factors are stored in the database and displayed with this application. There can be from 52 to 54 weekly factors, depending upon which day-of-week January 1 falls. All axle adjustment factors are less than or equal to 1. The axle adjustment factors are multiplied with the raw count to lower axle counts into vehicle count estimates.

Traffic Breaks Tab

Per Roadway

The Section Breaks Database contains the beginning and ending milepoint limits of the traffic break segments as defined by District personnel and the station at which the traffic for that break is counted, and a flag indicating whether that station is located within, adjacent to, or from a different roadway than the traffic break segment. Traffic section breaks are defined for each traffic count cycle. They are used to distribute the traffic volumes taken at a specific point (i.e., station) to a length of road (i.e., section).

Reports Tab

Station Inventory (**Figure 78**) This Tab produces a report of the traffic monitoring stations for the District and station status selected by the user:

Traffic Station Inventory Report

District: 01

Active and Inactive

Station ID	Active	Location	Sen Typ	Srvy Typ	Srvy Pgm	Purp Cd	SFCAT	AFCAT	Dir	Ln?	Md?	Asc Dir	Dsc Dir	Asc Ln	Dsc Ln	Rdwy ID	MilePnt
01 0001	Y	SR 776, EAST OF CR 775 & AINGER CREEK CH142	7	3	2	A	0102	0109	D	Y	N	E	W	2	2	01050000	2.736
01 0002	Y	CR 775/PLACIDA, S OF SR 776 AT AINGER CREEK CC 126	7	3	2	H	0100	0109	D	Y	N	N	S	2	2	01060000	9.100
01 0003	N	SR 45/US 41 300' NORTHWEST OF SR 776 (CH21)	7	1	2	A	0100	0102	D	N	N	N	S	2	2	01010000	21.956
01 0004	Y	SR 776, SOUTHWEST OF SR 45/US 41 CH306	7	3	2	A	0102	0105	D	Y	N	E	W	2	2	01050000	17.519
01 0005	N	EAST OF SR 35		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0006	N	BURNT STORE ROAD, SOUTH OF SR 45		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0007	Y	SR45/US41, 300' NW OF MURDOCK CIR/SE OF SR776 CH20	7	3	2	A	0103	0102	D	Y	N	N	S	3	3	01010000	21.605
01 0008	Y	SR 35/US 17, N OF CR 764/S WASHINGTON LP RD (CH112)	7	3	2	A	0101	0107	D	Y	N	N	S	2	2	01040201	0.030
01 0009	N	SOUTH OF SR 776		1	1	A	0100		B	N	N	N	S	0	0		0.000
01 0010	Y	SR 35/US 17, 2500' NE OF CR 74/BERMONT RD CH284	7	3	2	A	0101	0107	D	Y	N	E	W	2	2	01040000	3.909
01 0011	Y	N BEACH RD, 100 FT S OF LEMON BAY DR, ENGLEWOOD	7	1	2	O	0100	0109	B	N	N	N	S	1	1	01512000	0.853
01 0012	N	CR 775/PLACIDA ROAD, NW OF BOCA GRAND CSWY CC 164	7	1	1	A	0100	0109	B	N	N	N	S	1	1	01060000	0.400
01 0014	N	SR-45/US-41,1.4 MI. N OF OIL WELL RD,CHARLOTTE CO.	3	4	5	A	0103	0108	D	Y	N	N	S	2	2	01010000	4.575
01 0015	Y	SR 35/US 17 SB/MARION AV, NE OF DUPONT ST CH 286	7	3	3	A	0103	0106	O	Y	N	S		3	0	01040101	1.285
01 0016	Y	SR 45/US41, 1 MI NORTH OF CR 765 @ BRIDGE CH288	7	3	2	A	0103	0110	D	Y	N	N	S	2	2	01010000	11.162
01 0017	N	TAYLOR ROAD SOUTHEAST OF AIRPORT ROAD		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0018	N	TAYLOR ROAD NORTH OF SR 45		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0019	Y	SR 45/US 41, SOUTHEAST OF ZEMEL ROAD CH189	7	3	2	A	0103	0108	D	Y	N	N	S	2	2	01010000	2.309
01 0020	N	SR 45/US 41 SOUTHEAST OF CR 765A, TAYLOR ROAD	7	3	2	A	0103		D	Y	N	N	S	2	2	01010000	8.545
01 0021	Y	SR 45/US 41, SE OF CR 765/ALLIGATOR CREEK CH185	7	3	2	A	0103	0108	D	Y	N	N	S	2	2	01010000	9.838
01 0022	Y	CR 775/ PLACIDA, S OF ROTUNDA BLVD CC 140	7	3	2	H	0100	0109	D	Y	N	N	S	2	2	01060000	4.760
01 0023	Y	SR 35/US 17, SOUTH OF DESOTO COUNTY LINE CH115	7	3	2	A	0101	0107	D	Y	N	N	S	2	2	01040201	4.392
01 0024	N	SOUTH JONES LOOP ROAD, EAST OF TAYLOR ROAD		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0025	N	NORTH JONES LOOP ROAD, EAST OF TAYLOR ROAD		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0026	N	SOUTH SHELL CREEK ROAD, EAST OF SR 35		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0027	N	NORTH SHELL CREEK ROAD, EAST OF SR 35		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0028	N	BEACH ROAD NORTHWEST OF EMON BAY BRIDGE		1	1	A	0100		B	N	N	E	W	0	0		0.000
01 0029	Y	SR 776, 200' WEST OF CR 771 CH160	7	3	2	A	0102	0104	D	Y	N	E	W	2	2	01050000	9.365
01 0030	Y	SR45/US41, 300' NW OF TARPON BLVD/SE OF MIDWAY BLVD	7	3	2	A	0103	0102	D	Y	N	N	S	3	3	01010000	19.447
01 0031	N	HARBOR VIEW ROAD EAST OF DANFORTH ROAD		1	1	A	0100		B	N	N	N	S	0	0		0.000
01 0032	Y	SR45/US41NB, NW OF PEACE RIVER/MELBOURNE ST CH290	7	3	2	A	0103	0101	O	Y	N	N		3	0	01010000	15.169
01 0033	Y	SR45/US41/CROSS ST SB, NW OF PEACE RIVR BDG CH292	7	3	2	A	0103	0101	O	Y	N	S		2	0	01010101	0.110
01 0034	Y	SR 93/I 75, SOUTHEAST OF NORTH JONES LOOP RD/CR 768	7	1	2	A	0175	0113	D	N	N	N	S	2	3	01075000	11.216
01 0035	N	SR 93/I 75 SOUTH OF SR 35/US 17	7	3	2	A	0175		D	N	N	N	S	2	2	01075000	14.698
01 0036	Y	SR 93/I 75, 0.4 MI SE OF HARBOR VIEW ROAD/CR 776	7	3	2	A	0175	0114	D	Y	N	N	S	3	3	01075000	17.516
01 0037	Y	SR 93/I 75, SOUTHEAST OF KINGS HIGHWAY/CR 769	7	3	2	A	0175	0114	D	Y	N	N	S	2	2	01075000	20.064
01 0038	Y	SR 93/I 75, NORTHWEST OF KINGS HIGHWAY/CR 769	7	3	2	A	0175	0114	D	Y	N	N	S	2	2	01075000	21.472
01 0039	Y	SR-31, S OF CR 74	7	3	2	A	0104	0111	D	Y	N	N	S	1	1	01030000	11.993
01 0040	Y	SR 776, WEST OF CR 775/PINE STREET (CC120)	7	3	2	A	0102	0109	D	Y	N	W	E	2	2	01060000	9.260

Page 1

Figure 78: Station Inventory Report

AADT History (**Figure 79**) This Tab produces a report of the AADTs for the selected years and stations after logging in using the Login Tab:

Traffic Station AADT History Report
County: 01 - CHARLOTTE
Count Years: 1998 - C to 2007 - C
Active and Inactive

Station ID: 010001 | Roadway: 01050000 | Milepoint: 2.736
Location: SR 776, EAST OF CR 775 & AINGER CREEK | CH142

Count Year	Year Type	Asc Dir	Asc AADT	Dsc Dir	Dsc AADT	Bidir AADT
1998	C	E	14,500	W	14,500	29,000
1999	C	E	15,000	W	15,000	30,000
2000	C	E	15,500	W	15,500	31,000
2001	C	E	17,000	W	16,500	33,500
2002	C	E	16,500	W	16,500	33,000
2003	C	E	16,500	W	17,500	34,000
2004	C	E	18,000	W	17,000	35,000
2005	C	E	16,500	W	16,000	32,500
2006	C	E	17,000	W	17,000	34,000
2007	C	E	0	W	0	0

Station ID: 010003 | Roadway: 01010000 | Milepoint: 21.944
Location: SR 45/US 41 300' NORTHWEST OF SR 776 | (CH21)

Figure 79: Traffic Station AADT History Report

Raw Counts (**Figure 80**) This tab produces a report of all the raw counts that have been saved in the database for the selected year and stations after logging in using the Login Tab:

Raw Counts Report
Historical Counts for 2006 - C
County: 75 - ORANGE

Station ID: 753006 | Roadway ID: 75280000 | Milepost: 9.600
Location: ON I-4, 0.038 MI E OF UNIVERSAL BLVD C/L(ITS)

Station ID: 753007 | Roadway ID: 75280000 | Milepost: 10.898
Location: ON SR-400(I-4) UNDER SR-91 UNDERPASS (UCLP)

EAST											ASC AADT	DSC AADT	TOTAL AADT
2006 - C	1/24/2006	75,365	1/25/2006	74,304	1/26/2006	50,122	4/25/2006	73,432	4/26/2006	74,646	76,000	81,500	157,500
2006 - C	4/27/2006	75,770	5/13/2006	62,154	6/14/2006	76,712	6/15/2006	78,939	10/17/2006	76,818	76,000	81,500	157,500
2006 - C	10/18/2006	73,441	10/19/2006	82,889							76,000	81,500	157,500
WEST											ASC AADT	DSC AADT	TOTAL AADT
2006 - C	1/24/2006	80,729	1/25/2006	81,637	1/26/2006	36,574	4/25/2006	73,865	4/26/2006	78,477	76,000	81,500	157,500
2006 - C	4/27/2006	82,200	5/13/2006	70,064	6/14/2006	81,029	6/15/2006	85,730	10/17/2006	80,365	76,000	81,500	157,500
2006 - C	10/18/2006	83,533	10/19/2006	93,065							76,000	81,500	157,500

Station ID: 753012 | Roadway ID: 75280000 | Milepost: 14.324
Location: ON I-4, 0.63 MI. SW OF US-441 (ITSV)

Station ID: 753018 | Roadway ID: 75280000 | Milepost: 15.414
Location: ON I-4,0.46 MI.NE OF US-441 (ITS)

EAST			ASC AADT	DSC AADT	TOTAL AADT
2006 - C	11/1/2006	90,688	90,500	106,000	196,500
WEST			ASC AADT	DSC AADT	TOTAL AADT
2006 - C	11/1/2006	105,821	90,500	106,000	196,500

Station ID: 753021 | Roadway ID: 75280000 | Milepost: 15.714
Location: ON SR-400(I-4)0.76 MI NE OF SR-500(NOT ACTIVE)

Station ID: 753027 | Roadway ID: 75280000 | Milepost: 16.341
Location: ON I-4, 0.3 MI. SW OF SR-408 CONNECTOR (ITS)

Station ID: 753034 | Roadway ID: 75280000 | Milepost: 17.354
Location: ON I-4, 0.205 MI. NE OF SR-400 MAINLINE (ITS)

Station ID: 753030 | Roadway ID: | Milepost: 0.000

Figure 80: Raw Counts Report

Monthly Continuous ADT (**Figure 81**) This tab produces a report of the monthly ADTs for the selected years and stations:

Monthly Continuous ADT Report
District: 01
All Count Years

Station ID	Count Year	Direction	Month	Monthly ADTs
010014	1979 - S	NORTH	January	5,935
			February	7,170
			March	7,020
			April	5,880
			May	4,650
			June	4,420
			July	0
			August	0
			September	8,560
			October	4,740
			November	5,130
			December	5,265
		SOUTH	January	6,255
			February	7,475
			March	7,005
			April	5,850
			May	4,625
			June	4,500
			July	0
			August	0
			September	0
			October	4,880
			November	5,360
			December	5,705

Station ID	Count Year	Direction	Month	Monthly ADTs
010014	1980 - S	NORTH	January	5,920
			February	6,860
			March	6,685
			April	5,895
			May	4,810
			June	4,740
			July	4,862

Figure 81: Monthly Continuous ADT Report

Login Tab

This Tab allows authorized users of TCI to log in to enable the user to select either the Resubmit Load or Station Data Load tabs.

Traffic Flow Breaks

The traffic flow breaks are stored and maintained in the Roadway Characteristics Inventory (RCI) database, under Feature 330. The user must enter the roadway ID (county, section, subsection) of the desired road. RCI will return a list of all traffic break segments that have been identified along this road. Each traffic break consists of the beginning and ending milepoints of the break, and two characteristics: FLWBRKID (count station assigned to the break) and TRFBRKCD (traffic break code). See RCI Features and Characteristics Handbook.

If the beginning and ending milepoints of traffic break segments are tied to an intersecting road (RCI Feature 251), when the road is shortened or lengthened (due to a re-inventory), then the milepoints of the traffic break are automatically adjusted correspondingly. This keeps the traffic breaks synchronized with RCI so that the AADT, K, D and T can be easily placed into RCI Feature 331 after the annual traffic data processing cycle.

APPENDIX A.

Traffic Monitoring Equipment Certification

As you know the new objective evaluation process will include points based on when (or if) certification is provided that traffic monitoring equipment is proper and functioning correctly. We now have a certification process and form that can be used for this purpose. The attached sheet has the Traffic Monitoring Certification Guidelines on one side and the Traffic Monitoring Equipment Certification Form on the other side.

Please review the Guideline and the Form, and let me know if you have suggestion for improving either of them. If you have questions about the details of them please contact Joey Gordon.

Copies of the Guideline and Form may be available at the Transportation Data Collectors Meeting meeting; if you have a chance, you may want to discuss these materials with your Director before then.

Test Date:				Test Begin Time: AM / PM		Test End Time: AM / PM	
Test Site Location:				Traffic Monitoring Equipment Being Tested			
				Make:			
Test Site Direction:				Model No.:		Serial No.	
COMPARATIVE ANALYSIS							
Results of Equipment Tested				Continuous or Visual Test Results			
Total Vehicles Counted:				Total Vehicles Counted:			
Vehicle Counts (By Class) If Applicable:				Vehicle Counts (By Class) If Applicable:			
Class 1:				Class 1:			
Class 2:		Class 1-3		Class 2:		Class 1-3	
Class 3:				Class 3:			
Class 4:				Class 4:			
Class 5:				Class 5:			
Class 6:		Class 4-8		Class 6:		Class 4-8	
Class 7:				Class 7:			
Class 8:				Class 8:			
Class 9:				Class 9:			
Class 10:				Class 10:			
Class 11:		Class 9-13		Class 11:		Class 9-13	
Class 12:				Class 12:			
Class 13:				Class 13:			
Class 15:		Class 15		Class 15:		Class 15	
Total:				Total:			
This is to certify that the portable traffic monitoring equipment listed above was tested in accordance with the guideline on the reverse of this form (to be incorporated in a procedure currently being developed), and meets the accuracy requirements needed for traffic data programs. Otherwise, the equipment is "REJECTED" as reflected in the comments section below.							
Test Performed By: Name				Title			
Organization				Signature			
Test Monitored / Analyzed By: Name				Title			
Organization				Signature			
Comments				REJECTED WHEN THIS BOX IS CHECKED			

Figure 82: Traffic Monitoring Equipment Certification Form

Traffic Monitoring Equipment Certification Guideline

Once a year, all portable traffic volume counters and portable automatic vehicle classification counters used by the Department or used by consultants for general data collection activities or other Department projects must be certified for accuracy in data collection.

The testing of portable traffic volume counters will consist of setting the portable counters sequentially at a selected location and then comparing their counts with reference counts taken at the same time from an adjacent telemetered traffic monitoring site or a manual count. 10-15 machines can be set at one time for a minimum of one-hour data collection. If the count for a portable machine is within ten percent of the reference volume count, then the equipment is functioning properly.

For portable automatic vehicle classification counter operation, two tests are used for certification:

1. The total volume is compared to the total reference volume. If the portable automatic vehicle classification counter total counts are within ten percent of the reference volume, then the accuracy test is met.
2. The counts for each of the 14 classes will be grouped for comparison to make sure that an anomaly in one class with a very low volume for instance, doesn’t disqualify a machine. The groupings will be: a) Classes 1 through 3, b) Classes 4 through 8, c) Classes 9 through 13, d) Class 15 (unknown vehicle types)

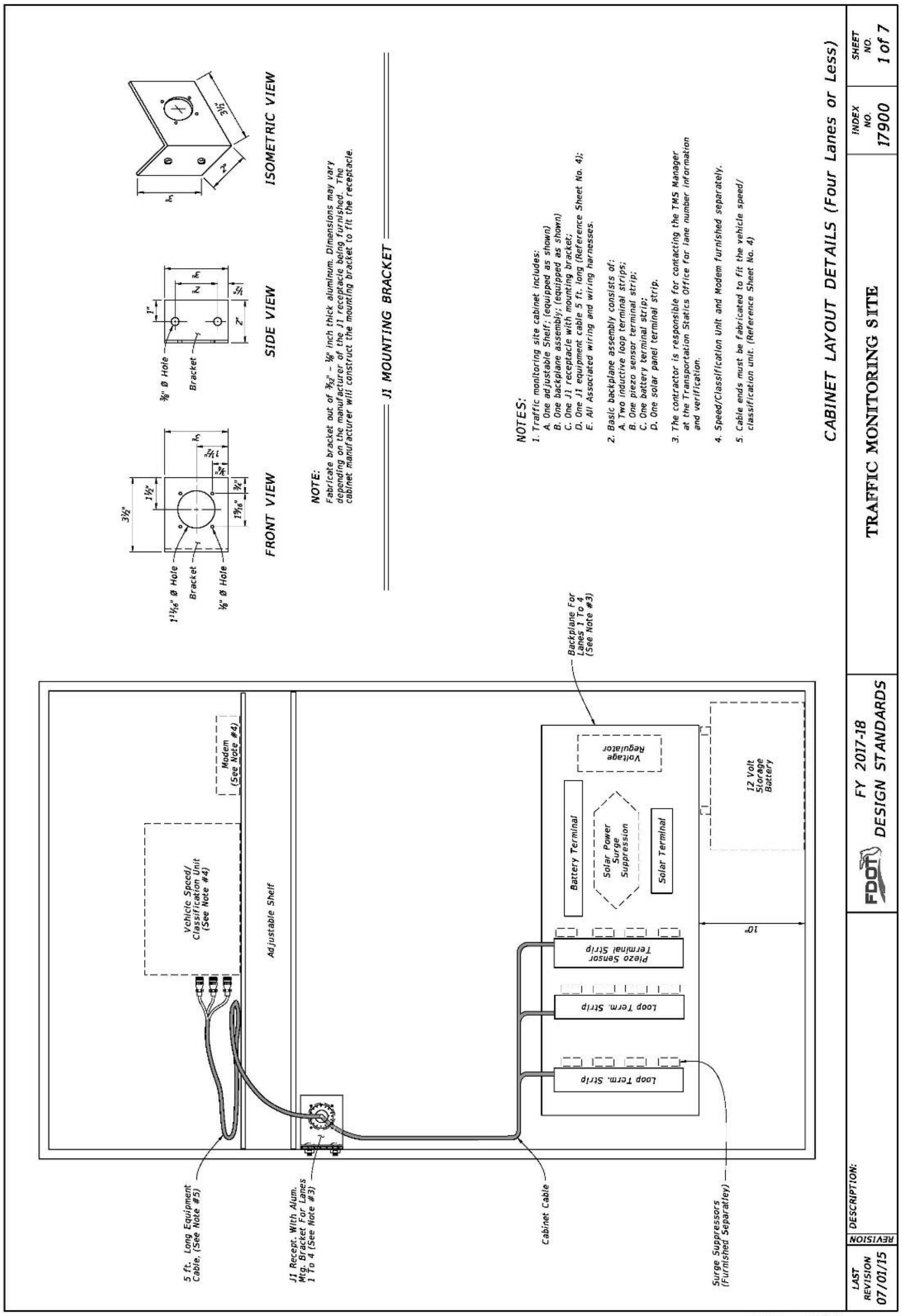
If the difference in any of the first 3 group totals for the classification counts compared to the reference data do not exceed ten percent and then the class 15 counts are less than 10% of the total counts, then the test is met. Any portable machine that passes the accuracy test for traffic volume and / vehicle classification can be certified for only the type of count on which it was tested (i.e. volume, classification or volume and classification).

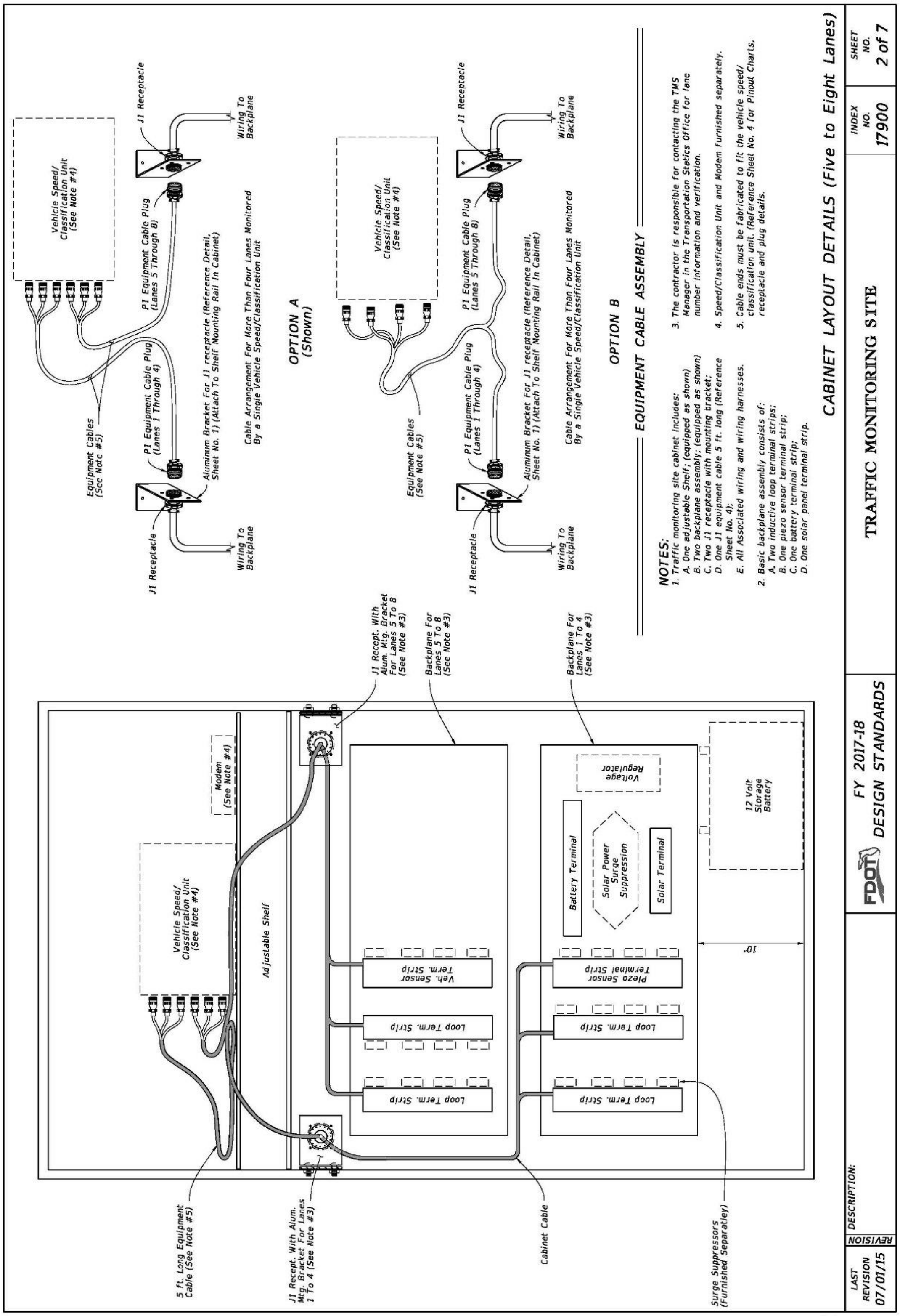
The test results will be documented for each counter to be used on a Department project. The documentation will be submitted to the district and the Central Office for their working files and must include:

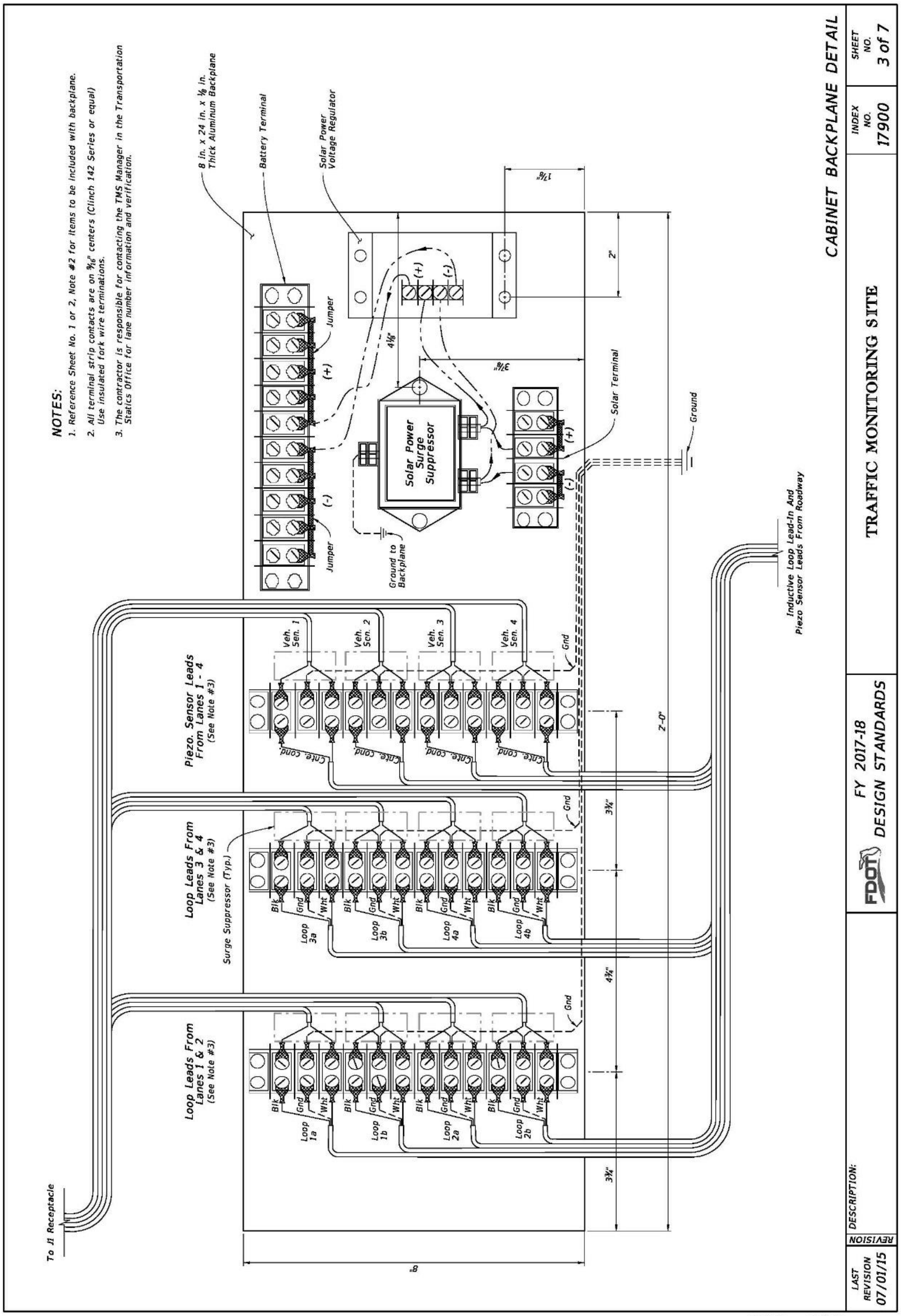
1. Count location and direction of travel
2. Automatic count manufacturer make, model number, and serial number
3. Volume count data and / or classification count data from the automatic counter in tabular form and in fifteen-minute intervals
4. Date and times of testing
5. A certification stating that the counter has successfully completed testing for data collection accuracy.

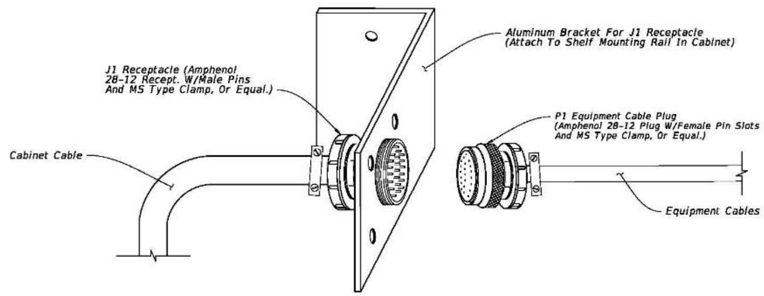
APPENDIX B.

Standard Index 17900 Cabinet Installation Details



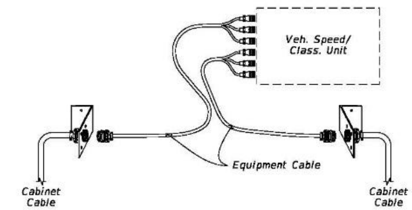

Vehicle Speed/ Classification Unit (See Note #4)
J1 Receptacle
Wiring To Backplane
P1 Equipment Cable Plug (Lanes 5 Through 8)
P1 Equipment Cable Plug (Lanes 1 Through 4)
Equipment Cables (See Note #5)
Aluminum Bracket For J1 receptacle (Reference Detail, Sheet No. 1) (Attach To Shelf Mounting Rail In Cabinet)
Cable Arrangement For More Than Four Lanes Monitored By a Single Vehicle Speed/Classification Unit
OPTION A (Shown)
OPTION B
EQUIPMENT CABLE ASSEMBLY
NOTES:
1. Traffic monitoring site cabinet includes:
A. One adjustable Shelf; (equipped as shown)
B. Two backplane assembly; (equipped as shown)
C. Two J1 receptacle with mounting bracket;
D. One J1 equipment cable 5 ft. long (Reference Sheet No. 4);
E. All Associated wiring and wiring harnesses.
2. Basic backplane assembly consists of:
A. Two inductive loop terminal strips;
B. One piezo sensor terminal strip;
C. One battery terminal strip;
D. One solar panel terminal strip.
3. The contractor is responsible for contacting the TMS Manager in the Transportation Statics Office for lane number information and verification.
4. Speed/Classification Unit and Modem furnished separately.
5. Cable ends must be fabricated to fit the vehicle speed/ classification unit. (Reference Sheet No. 4 for Pinout Charts, receptacle and plug details.
J1 Recept. With Alum. Mtg. Bracket For Lanes 5 To 8 (See Note #3)
Backplane For Lanes 5 To 8 (See Note #3)
Backplane For Lanes 1 To 4 (See Note #3)
Modem (See Note #4)
Adjustable Shelf
Veh. Sensor Term. Strip
Loop Term. Strip
Piezo Sensor Terminal Strip
Battery Terminal
Solar Power Surge Suppression
Solar Terminal
Voltage Regulator
12 Volt Storage Battery
10"
5 ft. Long Equipment Cable (See Note #5)
J1 Recept. With Alum. Mtg. Bracket For Lanes 1 To 4 (See Note #3)
Cabinet Cable
Surge Suppressors (Furnished Separatley)
CABINET LAYOUT DETAILS (Five to Eight Lanes)
LAST REVISION 07/01/15
REVISION
DESCRIPTION:
FY 2017-18 DESIGN STANDARDS
TRAFFIC MONITORING SITE
INDEX NO. 17900
SHEET NO. 2 of 7


NOTES:
1. Reference Sheet No. 1 or 2, Note #2 for items to be included with backplane.
2. All terminal strip contacts are on 9/16" centers (Cinch 142 Series or equal)
Use insulated fork wire terminations.
3. The contractor is responsible for contacting the TMS Manager in the Transportation Statics Office for lane number information and verification.
8 in. x 24 in. x 1/8 in. Thick Aluminum Backplane
Battery Terminal
Solar Power Voltage Regulator
Jumper
(+)
(-)
Solar Power Surge Suppressor
Ground to Backplane
Solar Terminal
Ground
Inductive Loop Lead-In And Piezo Sensor Leads From Roadway
Piezo. Sensor Leads From Lanes 1 - 4 (See Note #3)
Loop Leads From Lanes 3 & 4 (See Note #3)
Loop Leads From Lanes 1 & 2 (See Note #3)
Surge Suppressor (Typ.)
Veh. Sen. 1
Veh. Sen. 2
Veh. Sen. 3
Veh. Sen. 4
Cntr. Cond.
Gnd
Blk
Wht
Loop 1a
Loop 1b
Loop 2a
Loop 2b
Loop 3a
Loop 3b
Loop 4a
Loop 4b
To J1 Receptacle
2'-0"
8"
CABINET BACKPLANE DETAIL
TRAFFIC MONITORING SITE
FY 2017-18 DESIGN STANDARDS
INDEX NO. 17900
SHEET NO. 3 of 7
LAST REVISION 07/01/15
REVISION
DESCRIPTION:

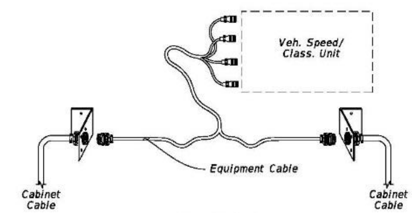


J1 RECEPTACLE PINOUT	
26 Recessed Male Pins	
A	Loop 1a (5a) yellow
B	Loop 1a (5a) purple
C	Loop 1b (5b) gray
D	Loop 1b (5b) pink
E	Loop 2a (6a) brown
F	Loop 2a (6a) blue
G	Loop 2b (6b) orange
H	Loop 2b (6b) tan
J	Loop 3a (7a) white
K	Loop 3a (7a) green
L	Loop 3b (7b) red
M	Loop 3b (7b) black
N	Gnd
P	Loop 4a (8a) w/yellow
R	Loop 4a (8a) w/purple
S	Loop 4b (8b) w/gray
T	Loop 4b (8b) w/brown
U	Piezo 1 (5) (+) w/blue
V	Piezo 1 (5) sh w/orange
W	Piezo 2 (6) (+) w/green
X	Piezo 2 (6) sh w/red
Y	Piezo 3 (7) (+) w/black
Z	Piezo 3 (7) sh w/red/blk
a	Piezo 4 (8) (+) red/ green
b	Piezo 4 (8) sh red/yellow
d	Gnd red/black

J1 EQUIPMENT CABLE PLUG		
26 Female Pin Slots		
A	Loop 1a (5a)	Connect To Electronics Unit
B	Loop 1a (5a)	
C	Loop 1b (5b)	
D	Loop 1b (5b)	
E	Loop 2a (6a)	
F	Loop 2a (6a)	
G	Loop 2b (6b)	
H	Loop 2b (6b)	
N	Gnd	
J	Loop 3a (7a)	Connect To Electronics Unit
K	Loop 3b (7b)	
L	Loop 3b (7b)	
M	Loop 3b (7b)	
P	Loop 4a (8a)	
R	Loop 4a (8a)	
S	Loop 4b (8b)	
T	Loop 4b (8b)	
d	Gnd	
U	Piezo 1 (5) (+)	Connect To Electronics Unit
V	Piezo 1 sh	
W	Piezo 2 (6) (+)	
X	Piezo 2 sh	
Y	Piezo 3 (7) (+)	
Z	Piezo 3 sh	
a	Piezo 4 (8) (+)	
b	Piezo 4 sh	



OPTION A



OPTION B

NOTES:

1. The contractor is responsible for contacting the TMS Manager in the Transportation Statics Office for lane number information and verification.
2. The equipment cable can accommodate up to four lanes of inductive loop and piezo sensor inputs. (Reference Sheet No. 1 for cabinet layout)
3. For more than four lanes and up to eight lanes of inputs, the following options are available:
   - A. Second Vehicle Speed/Class. Unit and separate equipment cable connecting to a second J1 receptacle; or
   - B. Single Vehicle Speed/Class. Unit capable of up to eight lanes of inputs and a single equipment cable with split ends to fit two J1 receptacles. (Reference Sheet 2 detail)
4. Numbers in parenthesis in the pinout chart identify lane numbers when a second backplane for lanes 5 through 8 is required.
5. Cable Ends must be fabricated to fit the vehicle Speed/Classification Unit.

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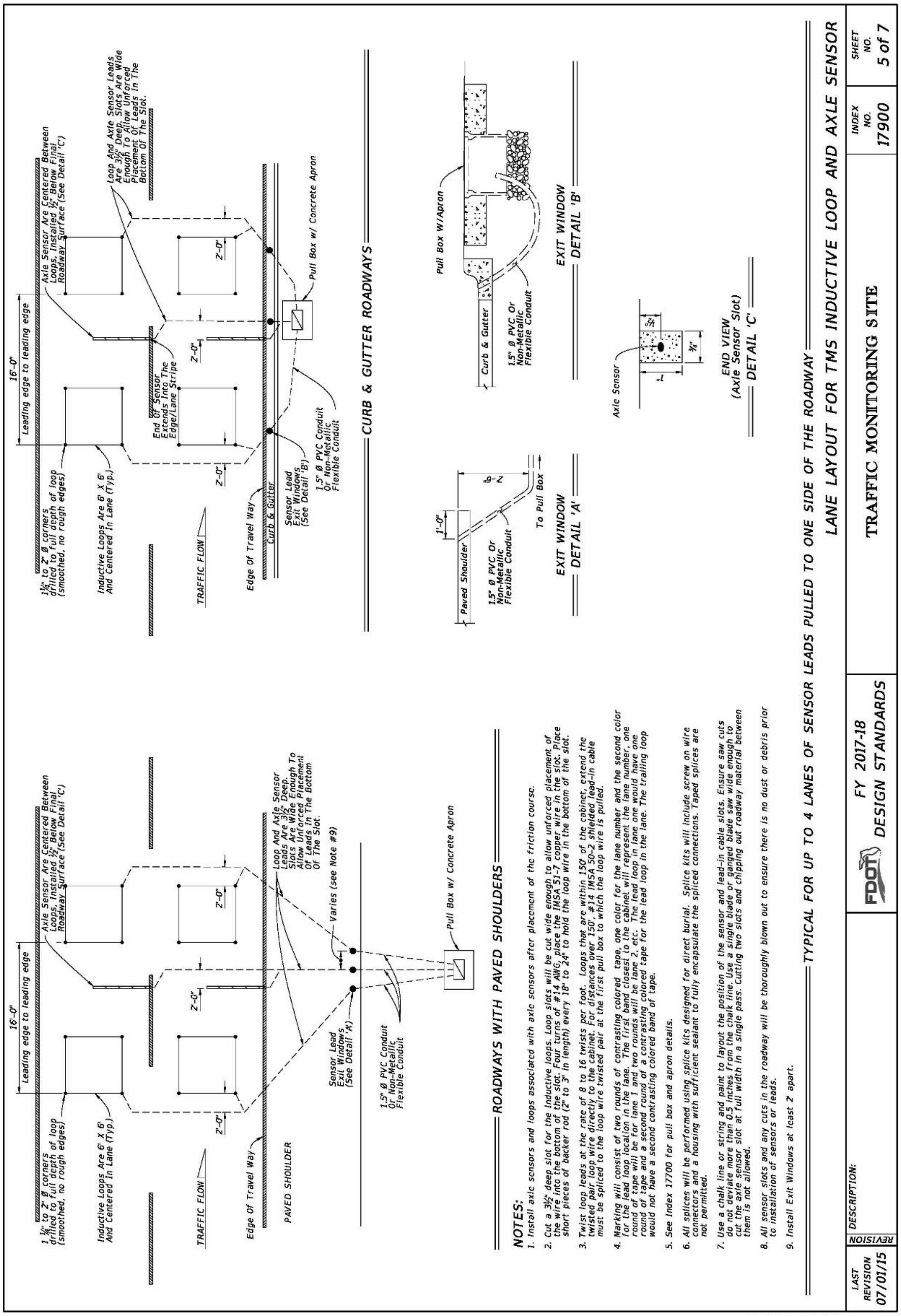
LAST REVISION 07/01/15	REVISION	DESCRIPTION:	FDOT FY 2017-18 DESIGN STANDARDS	TRAFFIC MONITORING SITE	INDEX NO. 17900	SHEET NO. 4 of 7


16'-0"
Leading edge to leading edge
1 ½" to 2" Ø corners drilled to full depth of loop (smoothed, no rough edges)
Axle Sensor Are Centered Between Loops, Installed ½" Below Final Roadway Surface (See Detail 'C')
Inductive Loops Are 6' X 6' And Centered In Lane (Typ.)
TRAFFIC FLOW
2'-0"
Edge Of Travel Way
PAVED SHOULDER
Loop And Axle Sensor Leads Are 3½" Deep. Slots Are Wide Enough To Allow Unforced Placement Of Leads In The Bottom Of The Slot.
Sensor Lead Exit Windows (See Detail 'A')
Varies (see Note #9)
1.5" Ø PVC Conduit Or Non-Metallic Flexible Conduit
Pull Box w/ Concrete Apron
ROADWAYS WITH PAVED SHOULDERS
End Of Sensor Extends Into The Edge/Lane Stripe
Curb & Gutter
Sensor Lead Exit Windows (See Detail 'B')
CURB & GUTTER ROADWAYS
1'-0"
Paved Shoulder
1.5" Ø PVC Or Non-Metallic Flexible Conduit
2'-6"
To Pull Box
EXIT WINDOW
DETAIL 'A'
Pull Box W/Apron
EXIT WINDOW
DETAIL 'B'
Axle Sensor
1"
½"
¾"
END VIEW
(Axle Sensor Slot)
DETAIL 'C'
NOTES:
1. Install axle sensors and loops associated with axle sensors after placement of the friction course.
2. Cut a 3½" deep slot for the Inductive loops. Loop slots will be cut wide enough to allow unforced placement of the wire into the bottom of the slot. Four turns of #14 AWG, place the IMSA 51-7 copper wire in the slot. Place short pieces of backer rod (2" to 3" in length) every 18" to 24" to hold the loop wire in the bottom of the slot.
3. Twist loop leads at the rate of 8 to 16 twists per foot. Loops that are within 150' of the cabinet, extend the twisted pair loop wire directly to the cabinet. For distances over 150', #14 IMSA 50-2 shielded lead-in cable must be spliced to the loop wire twisted pair at the first pull box to which the loop wire is pulled.
4. Marking will consist of two rounds of contrasting colored tape, one color for the lane number and the second color for the lead loop location in the lane. The first band closest to the cabinet will represent the lane number, one round of tape will be for lane 1 and two rounds will be lane 2, etc. The lead loop in lane one would have one round of tape and a second round of a contrasting colored tape for the lead loop in the lane. The trailing loop would not have a second contrasting colored band of tape.
5. See Index 17700 for pull box and apron details.
6. All splices will be performed using splice kits designed for direct burial. Splice kits will include screw on wire connectors and a housing with sufficient sealant to fully encapsulate the spliced connections. Taped splices are not permitted.
7. Use a chalk line or string and paint to layout the position of the sensor and lead-in cable slots. Ensure saw cuts do not deviate more than 0.5 inches from the chalk line. Use a single blade or ganged blade saw wide enough to cut the axle sensor slot at full width in a single pass. Cutting two slots and chipping out roadway material between them is not allowed.
8. All sensor slots and any cuts in the roadway will be thoroughly blown out to ensure there is no dust or debris prior to installation of sensors or leads.
9. Install Exit Windows at least 2' apart.
TYPICAL FOR UP TO 4 LANES OF SENSOR LEADS PULLED TO ONE SIDE OF THE ROADWAY
LANE LAYOUT FOR TMS INDUCTIVE LOOP AND AXLE SENSOR
LAST REVISION 07/01/15
REVISION
DESCRIPTION:
FDOT
FY 2017-18 DESIGN STANDARDS
TRAFFIC MONITORING SITE
INDEX NO. 17900
SHEET NO. 5 of 7
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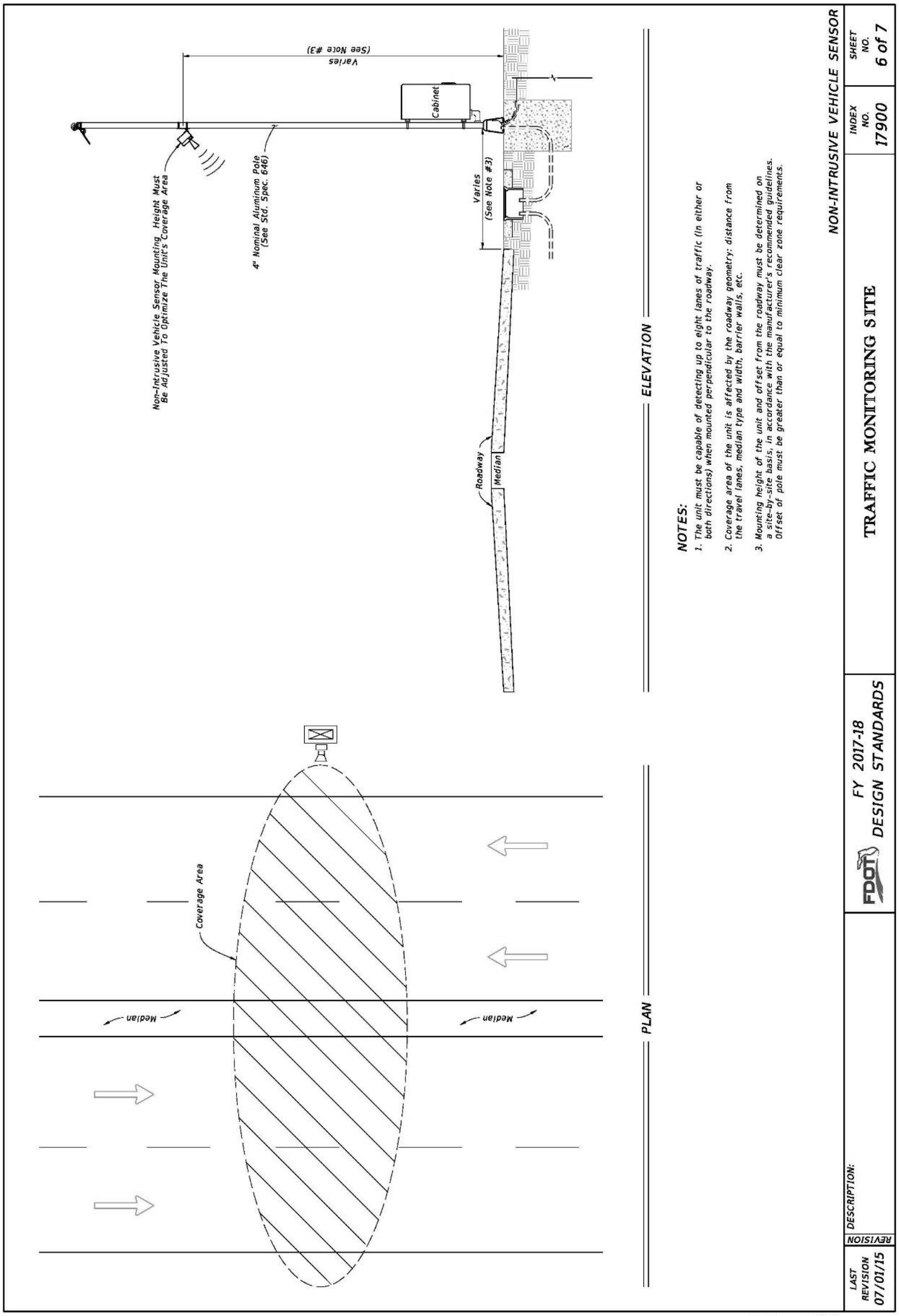
Non-Intrusive Vehicle Sensor Mounting Height Must Be Adjusted To Optimize The Unit's Coverage Area
4" Nominal Aluminum Pole (See Std. Spec. 646)
Varies (See Note #3)
Cabinet
Varies (See Note #3)
Roadway
Median
ELEVATION
Coverage Area
Median
Median
PLAN
NOTES:
1. The unit must be capable of detecting up to eight lanes of traffic (in either or both directions) when mounted perpendicular to the roadway.
2. Coverage area of the unit is affected by the roadway geometry: distance from the travel lanes, median type and width, barrier walls, etc.
3. Mounting height of the unit and offset from the roadway must be determined on a site-by-site basis, in accordance with the manufacturer's recommended guidelines. Offset of pole must be greater than or equal to minimum clear zone requirements.
NON-INTRUSIVE VEHICLE SENSOR
LAST REVISION 07/01/15
REVISION
DESCRIPTION:
FY 2017-18 DESIGN STANDARDS
TRAFFIC MONITORING SITE
INDEX NO. 17900
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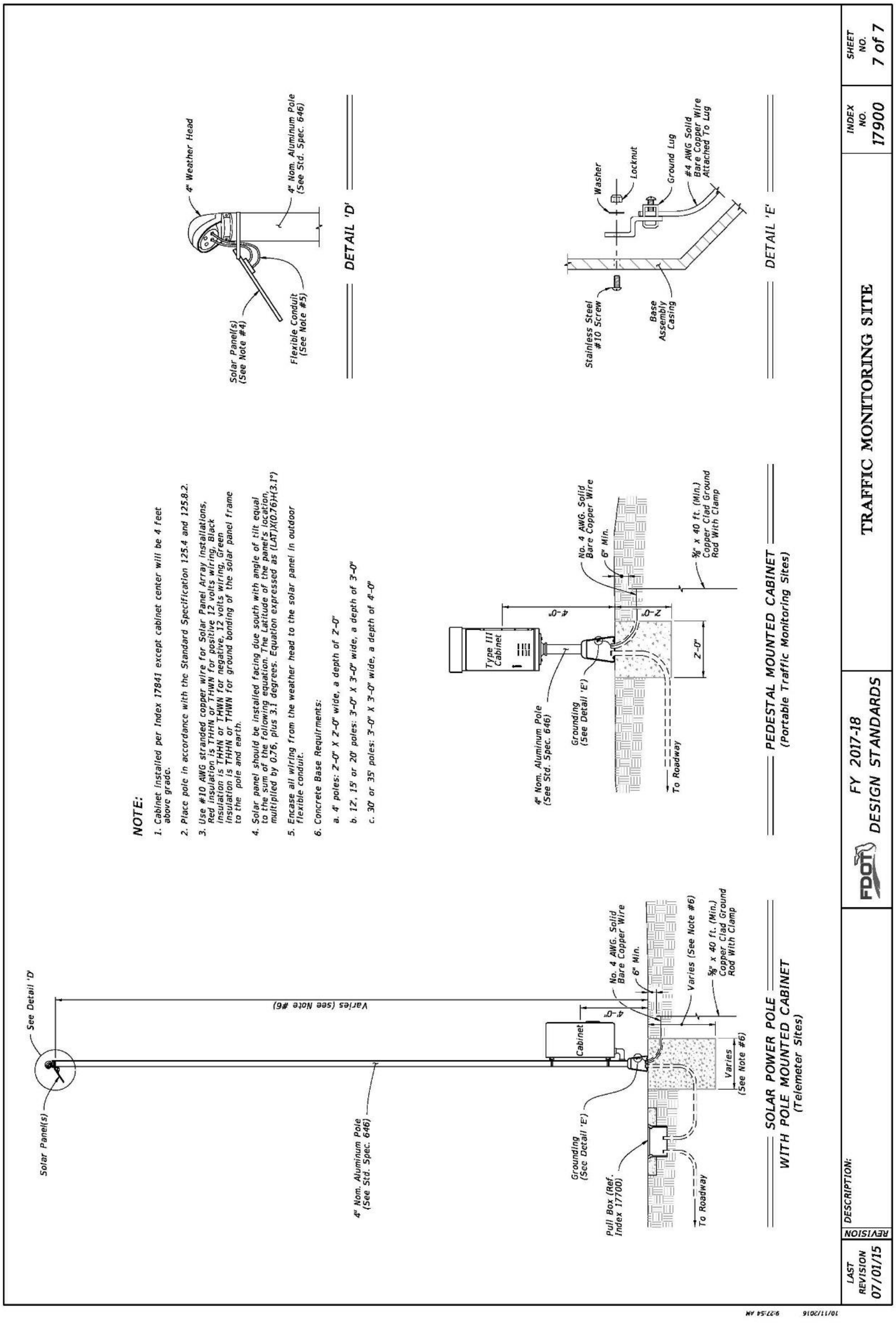
Solar Panel(s)
See Detail 'D'
4" Nom. Aluminum Pole (See Std. Spec. 646)
Varies (see Note #6)
Grounding (See Detail 'E')
Pull Box (Ref. Index 17700)
Cabinet
4'-0"
No. 4 AWG. Solid Bare Copper Wire
6" Min.
To Roadway
Varies (See Note #6)
5/8" x 40 ft. (Min.) Copper Clad Ground Rod With Clamp
Varies (See Note #6)
SOLAR POWER POLE WITH POLE MOUNTED CABINET
(Telemeter Sites)
NOTE:
1. Cabinet installed per Index 17841 except cabinet center will be 4 feet above grade.
2. Place pole in accordance with the Standard Specification 125.4 and 125.8.2.
3. Use #10 AWG stranded copper wire for Solar Panel Array installations, Red insulation is THHN or THWN for positive 12 volts wiring, Black insulation is THHN or THWN for negative, 12 volts wiring, Green insulation is THHN or THWN for ground bonding of the solar panel frame to the pole and earth.
4. Solar panel should be installed facing due south with angle of tilt equal to the sum of the following equation. The Latitude of the panel's location, multiplied by 0.76, plus 3.1 degrees. Equation expressed as (LAT)X(0.76)+(3.1°)
5. Encase all wiring from the weather head to the solar panel in outdoor flexible conduit.
6. Concrete Base Requirments:
a. 4' poles: 2'-0" X 2'-0" wide, a depth of 2'-0"
b. 12', 15' or 20' poles: 3'-0" X 3'-0" wide, a depth of 3'-0"
c. 30' or 35' poles: 3'-0" X 3'-0" wide, a depth of 4'-0"
4" Weather Head
Solar Panel(s) (See Note #4)
Flexible Conduit (See Note #5)
4" Nom. Aluminum Pole (See Std. Spec. 646)
DETAIL 'D'
Type III Cabinet
4" Nom. Aluminum Pole (See Std. Spec. 646)
Grounding (See Detail 'E')
No. 4 AWG. Solid Bare Copper Wire
6" Min.
4'-0"
2'-0"
2'-0"
To Roadway
5/8" x 40 ft. (Min.) Copper Clad Ground Rod With Clamp
PEDESTAL MOUNTED CABINET
(Portable Traffic Monitoring Sites)
Stainless Steel #10 Screw
Washer
Locknut
Base Assembly Casing
Ground Lug
#4 AWG Solid Bare Copper Wire Attached To Lug
DETAIL 'E'
LAST REVISION 07/01/15
REVISION
DESCRIPTION:
FDOT
FY 2017-18 DESIGN STANDARDS
TRAFFIC MONITORING SITE
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APPENDIX C.

FDOT Quality Assurance Monitoring Plan

PRIMARY FUNCTION: **Traffic Data Reporting**
Critical Process: Annual District Traffic Monitoring Activities

Critical Requirement 1: Produce Annual Traffic Data Collection Schedule

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. Provide District Traffic Data Collection Schedule for Portable Traffic Monitoring Sites (PTMSs) to be counted for the program year to TDA by January 31.	A. Provide Traffic Data Collection Schedule to TDA by January 31.	A-1. Identify active sites as of December 31 for your district for next year's data collection.
		A-2. Prepare a summary report including the total number of active sites for each county.
		A-3. Prepare data collection schedule and submit it to TDA.

Critical Requirement 2: Ensure Traffic Data Collection Equipment Functions Properly

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. Equipment Certifications will be sent to TDA by January 31 each year.	A-1. District will submit an Equipment Certification Report to TDA by January 31.	A-1. Schedule and complete testing of in-house equipment by December 1.
	A-2. District will maintain record of equipment certification by model and serial number for three calendar years.	A-2. 1.) Obtain Equipment Certification Reports from consultants/contractors before count cycle starts. 2.) Update equipment certification files as necessary.

Critical Requirement 3: Perform Urban and Rural Area Traffic Data Collection

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. All routine data collection begins January 1 and ends November 15 for urban and rural areas with notification provided to TDA after completion.	A. District will conduct its traffic data collection each year on or after January 1 and complete it on or before November 15.	A-1. Manage and coordinate Traffic Data Collection Program to be conducted within prescribed timeframe.
		A-2. Obtain available raw counts from local governments and other FDOT offices.

Critical Requirement 4: Ensure HPMS off-system traffic counts collected

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. All new Off-System HPMS samples added to required Traffic Data Collection Schedule are counted.	A-1. District will receive an updated list of Off- System HPMS samples provided at least two months prior to beginning of the next year count cycle (no later than Nov. 30).	A-1. Include all new HPMS Off-System samples in yearly count schedule (January 31 deadline).
	A-2. District will collect traffic counts on all new samples.	A-2. 1.) Obtain traffic counts on all scheduled samples (November 15 deadline). 2.) Submit traffic counts and synopsis reports to TDA (December 31 deadline).
B. At least one-third of the Off-System HPMS samples shall be counted each year.	B. Off-System HPMS sample traffic data will be obtained by the District Offices on a 3-Year cycle.	B-1. Identify all HPMS samples due to have new Off-System counts.
		B-2. Determine method of obtaining counts.
		A-3. Include all direct counts in count schedule.
		A-4. Collect counts from local government, MPO or direct counts.
		B-5. Submit traffic counts.

Critical Requirement 5: Collect Strategic Intermodal System (SIS) Connectors vehicle classification surveys

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. All SIS connector routes of sufficient length shall have an annual vehicle classification survey or volume count conducted.	A. District shall conduct annual vehicle classification surveys on all SIS connector routes in their Districts that are of sufficient length to allow vehicles to be classified.* (*See Section VIII Annual Data Processing of the Traffic Monitoring Handbook.)	A-1. Identify all SIS connectors in their District.
		A-2. Identify if SIS connector is sufficient length for vehicle classification survey.
		A-3. Schedule SIS connectors for annual vehicle classification survey if of adequate length. If length is not sufficient for classification survey, schedule a volume count.
		A-4. Conduct survey by end of annual cycle.

		A-5. Submit survey and synopsis reports to TDA (December 31 deadline).

Critical Process: Development of the Average Annual Daily Traffic (AADT)

Critical Requirement 1: Process Traffic Data for Annual Average Daily Traffic (AADT) Development

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. By December 31 - The Appropriate Office in the District (AOD) will edit and process all traffic count data.	A. Complete final weekly load Traffic Count Data into the mainframe and notify TDA of completion of traffic data processing by December 31.	A-1. Review, edit, and load raw counts during processing using Survey Processing Software (SPS).
		A-2. Prepare notification correspondence for TDA by December 31.
		A-3. Send Synopsis reports to TDA of all counts.
B. By March 15 - AADT development will be completed.	B. Review and edit adjustment factors for AADT development according to the following schedule: 1.) TDA will send the required draft Adjustment Factor Reports by the first week of February and the Districts will respond within one week. 2.) TDA will send draft Factored Counts Reports by the third week of February and the Districts will respond within one week. 3.) TDA will send draft AADT Reports by the first week of March and the Districts will respond within one week.	B-1. In coordination with TDA review, update, and finalize the following reports: 1.) Adjustment Factor Report 2.) Factored Counts Report 3.) AADT Report
		B-2. Notify TDA as critical steps are completed.
C. An AADT may not be estimated for more than two consecutive years without appropriate justification for on system roadways, and five years for off-system roadways and ramps.	C. Prepare and provide third year estimates and justification to TDA by scheduled date (if required).	C. Identify active sites for which no valid count was obtained: 1.) Determine amount of time identified sites have not had a valid count. 2.) Determine reason why identified sites have not had a valid count (i.e., weather, equipment, construction). 3.) Determine how to handle third year/sixth year estimates: i. make station inactive ii. provide manual estimate

Critical Process: Ensure Traffic Section Break Accuracy

Critical Requirement 1: Accurate beginning and ending mile point verified and updated in the Roadway Characteristics Inventory (RCI) database

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. By March 15 and December 31 each year Districts will have accurate Traffic Section Breaks beginning and ending mile points in the Roadway Characteristics Inventory (RCI) database.	A. The official record of Traffic Break beginning and ending mile points will be verified and updated in the Roadway Characteristics Inventory (RCI) database by the District Office.	A-1. Each year Section Breaks are reevaluated.
		A-2. Determine continuous segments that have similar traffic volumes and truck traffic.
		A-3. Update Section Breaks in RCI.
		A-4. Verify accuracy using RCI edits and GIS tool.

Critical Requirement 2: Active Traffic Count Station Numbers (Feature 326) match Traffic Flow Break Stations (Feature 330)

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. By March 15 and December 31 each year Districts will have accurate Flow Break Count Station data coded in RCI.	A. Flow Break Count Stations, Traffic Station Types, and Traffic Count Station Numbers are accurately coded in the RCI database.	A-1. Verify Flow Break IDs have active Traffic Count Station Numbers.
		A-2. Verify Traffic Count Station Numbers are not coded at ending mile points.
		A-3. Verify that both Traffic Count Station Types and Traffic Count Station Numbers are coded.

Critical Requirement 3: Flow Break Count Station (Feature 331) has accurate Road Type (Feature 120) coded

TDA Compliance Indicators	District QC Plan	District QC Tasks/Activities
A. By March 15 and December 31 each year Districts will have accurate Directional Distribution Factors coded in RCI.	A. Traffic Flow Breaks are accurately coded in the RCI database.	A. Verify Road Type (Feature 120) agrees with Directional Distribution Factor (AVGDFACT).

APPENDIX D.

TTMS Inspection & Inventory Forms

TRAFFIC MONITORING INSPECTION SHEET (FDOT)

Operation	Date; Technician; Certified; Speed; Counts; Classification; Weight
Site info	Site; Unit; Lattitude; Longitude; Speed Limit N /E; S / W; Warning Sign Installed; Camera; Bluetooth; Temp Sensor Reading ___ Ohms
Counter	Equipment Type; NH Number; Serial Number; Firmware; 2nd NH
Modem	Modem Type; IP; Operational; Firmware; IMEI; SIM; RSSI; RSRP
Sensors	Number of Lanes; Loop Sealant; Sensor Configuration; Piezo Sealant; Sensor Mount; Loop Length ___ ft. ___ in.; Piezo Type; Sensor Spacing ___ ft. ___ in.
Power	Power; Number of solar panels; Total Wattage; Solar Output Voltage; Solar Output Amperage; Solar Regulator Output Voltage; Total # of Batteries; Battery Voltage (under load); Sun Cond
Cabinet	Mast Type; Cabinet Type; Cabinet Mount; Universal Harness; Backplane
Suppression	Power; Piezo Sensor; Loop Sensor; Weigh Pad
Lane relation	Lane 1; Lane 5; Lane 2; Lane 6; Lane 3; Lane 7; Lane 4; Lane 8
Comments	

Revision
8/9/2017

TRAFFIC MONITORING INSPECTION SHEET (FDOT)

Loops

		Inductance	Insulation	Resistance	Spliced
Lane 1	Loop 1				
	Loop 2				
Lane 2	Loop 3				
	Loop 4				
Lane 3	Loop 5				
	Loop 6				
Lane 4	Loop 7				
	Loop 8				
Lane 5	Loop 9				
	Loop 10				
Lane 6	Loop 11				
	Loop 12				
Lane 7	Loop 13				
	Loop 14				
Lane 8	Loop 15				
	Loop 16				

Key

Loops

1. **Inductance** (LCR Meter) when checking on a 4 turn loop we need to see at least 100uH. (New or existing)

2. **Insulation** (Megger) when checking you should see a reading of 200 MΩ or higher.(existing 20 MΩ or higher)

3. **Resistance** (Multi-Meter) when checking a reading above 3.0Ω it is considered bad.

TRAFFIC MONITORING INSPECTION SHEET (FDOT)

Piezos

		Voltage	Dissipation	Resistance	Capacitance	Spliced
Lane 1	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 2	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 3	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 4	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 5	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 6	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 7	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					
Lane 8	Piezo 1					
	Piezo 2					
	Piezo 3					
	Piezo 4					

Key

Piezos

1. **Voltage:** (o-scope) when checking the minimum peak reading on the o-scope it should be greater than 200mV for a class two vehicle.
2. **Dissipation:** (LCR Meter) when testing the reading shouldn’t be more than 0.04 on new installs. Existing piezos readings can vary.
3. **Resistance:** (Multi-Meter) Measure the resistance across the piezo leads. The meter should be set on the 20MΩ setting. The meter should read in excess of 20MΩ
4. **Capacitance**: (LCR Meter) Measure the capacitance of the sensor with the attached lead in cable. The meter should typically be set on a 20nF range. The red probe should be connected to the center electrode of the cable and the Black probe to the outer braid. A reading between 4nF and 15nF is acceptable.

TRAFFIC MONITORING INSPECTION SHEET (FDOT)

Kistlers

SITE					CPU EPROM:	
KISTLER SENSORS					MEG OHMS	DATE INSTALLED
LANE	CHANNEL	SENSOR	CAP	D		

DIP EPROM:						
LOOPS						
LANE	CHANNEL	FREQ.	THRESHOLD	MEG OHM	RESIST.	INDUCT.
1	2					
2	3					
3	4					
4	6					
5	7					
6	8					

Comments:	WIM SENSOR CONFIGURATION :	CLASS SENSOR CONFIGURATION:

BROWN : SIGNAL +	WHITE : SIGNAL -	YELLOW : EXCITATION +	GREEN : EXCITATION -

DATE:	RESISTANCE VALUES IN OHMS								SITE :
	LANE		LANE		LANE		LANE		
W.PAD CABLE	W.PAD 1	W.PAD 2	W.PAD 3	W.PAD 4	W.PAD 5	W.PAD 6	W.PAD 7	W.PAD 8	NORMAL VALUES
BROWN / WHITE (SIG +/ SIG -)									(840 - 850 OHMS)
YELLOW / GREEN (EXC. + / EXC. -)									(980 - 1.O K OHMS)
BROWN / YELLOW (SIG.+ / EXC. +)									(700 - 720 OHMS)
WHITE / YELLOW (SIG.- / EXC. +)									(700 - 720 OHMS)
BROWN / GREEN (SIG. + / EXC. -)									(700 - 720 OHMS)
WHITE / GREEN (SIG. - / EXC. -)									(700 - 720 OHMS)
BROWN / SHIELD									(100 MEG OHMS >)
WHITE / SHIELD									(100 MEG OHMS >)
YELLOW / SHIELD									(100 MEG OHMS >)
GREEN / SHIELD									(100 MEG OHMS >)

The resistance values are measured when the weighpads are completely disconnected from the DAW190 or the iSinc Lite system.

	ZERO POINTS (VALUES IN mV)								
	LANE		LANE		LANE		LANE		
W.PAD CABLE	W.PAD 1	W.PAD 2	W.PAD 3	W.PAD 4	W.PAD 5	W.PAD 6	W.PAD 7	W.PAD 8	NORMAL VALUES
BROWN / WHITE (SIG +/ SIG -)									(DAW190) (0.0 to +/- 7.0mV)
BROWN / WHITE (SIG +/ SIG -)									(iSinc Lite) (0.0 to +/- 10.0mV)

Turn off the WIM system. Disconnect the +signal (Brown wire) and the -signal(White wire). Turn the system back on and measure the zero point of the weighpad between the disconnected +signal(Brown wire) and the -signal(White wire).

Traffic Monitoring Inspection Sheet (FDOT)

Site Photos

		Required
		Door diagram.
		Close up of all backpanels in the cabinet.
		Pic with cabinet door open, showing what equipment is installed.
		Exterior of cabinet showing "buried cables" warning sign.
		Exterior of cabinet showing site # sticker.
		All roadway sensors (labeled in photo desc).
		All exit windows (leads exiting roadway).
		Back side of solar panel(s) showing wattage label (if applicable).
		Inside of pull boxes, showing wire labeling and splices.
		NH and SN on the classifier, microwave device, and camera.
		Image looking down the roadway in each direction, including the arrays in the photo. Label the photo which direction the camera is facing. Example: Looking East, etc.

APPENDIX E.

Non-Motorized Mobilization/Deployment Checklists

Please review the following pages

Data Collection Check List- **IR**

Project/Deployment: ________________________________

Date: ____

Enter amount of Equipment Needed	0	

Description	**Qty**	**Check List**
IR Boxes	1	
Metal Straps	0	
Chain	0	
Locks	0	

Tools		
Shuttle Dock	1	
Cable (optional)	1	
Laptop (optional)	1	
Drill and Hex Socket (5/16)	1	
Spare Batteries (AA)& (AAA)	1	
Measuring Tape	1	
Shuttle Dock	1	

Pre-Configuration	Check
Shuttle Time Set	
Device Pre-Configuration	
Battery Level Good	
Devices Pre-Armed	
Silica Desicant Replaced	

Period: _____ Delay: ________

Prepared By: ________________________________ Date: ________________________________

Data Collection Check List- **Tube Counter**

Project/Deployment: ________________________________

Date: ____

Enter amount of Equipment Needed	0	

Description	**Qty**	**Check List**
Devices	0	
Tubes (Check Length)	0	
Tape (Ft)	0	
Straps/Cleats	0	
Nails/Spikes	0	
Bullets	0	
Locks (2612)	0	
Plugs	0	
Chains	0	

Extra Sets 1

Boxes 1
Boxes 1

Tools		
Powder Gun/Hammer	1	
Measuring Tape/Blocks	1	
Laptop /Tester	1	
Torch	1	
Cutting /Knife		
PryBar	1	
Blower	1	
Safety Tape(Roll)	1	
Download Cable	1	

Pre-Configuration	Check
Erase Device/ Data Downloaded	
Configured Settings (Metro Counter)	
Date and Time Set or Verified	
GPS Location Set	

Prepared By: ________________________________ Date: ________________________________

APPENDIX F.

Non-Motorized Short-term Count Loaner MOA

FDOT Non-Motorized Traffic Monitoring Program
Short-Term Counting Hardware (or Short-Term Count)

Memorandum of Agreement

This Memorandum of Agreement, hereinafter referred to as the “Agreement” is made and entered into on the last date executed below, by and between the Florida Department of Transportation, an agency of the State of Florida, hereinafter referred to as the “Department”, and the [insert Agency Name] hereinafter referred to as the “[insert abbreviated Agency Name]”.

RECITALS**:**

A. WHEREAS, the Department seeks to establish a statewide Non-Motorized Traffic Monitoring Program (the “Program”) and seeks to continue the expansion of the Program;

B. WHEREAS, the [insert abbreviated Agency Name] has agreed to participate in the Program by assuming certain responsibilities in the matter and to the extent set out in this Agreement

C. WHEREAS, the [insert abbreviated Agency Name] acknowledges that it benefits from the installation of a non-motorized counting device (“Equipment”) in its vicinity;

D. WHEREAS, the Department is authorized under Section 334.044, Florida Statutes, to enter into contracts and agreements;

NOW, THEREFORE, in consideration of the mutual benefits contained in this Agreement, the parties agree as follows:

1. GENERAL PROVISIONS

1.1. The Department may select any vendor with which it has established agreements or contracts and who is qualified and approved to perform the work described in this Agreement. The [insert abbreviated Agency Name] may delegate the performance of its obligations under this Agreement, upon prior written approval from the Department, to an agent who is qualified and approved by the Department to perform the work, which may include a local government member and/or consultant of the [insert abbreviated Agency Name].

1.2. The Department will provide technical oversight to [insert abbreviated Agency Name], which may include but is not limited to, site selection and technical assistance with equipment and software. The [insert abbreviated Agency Name] must provide a primary contact for the program to the Department upon signing this Agreement.

1.3. The Department will work with the [insert abbreviated Agency Name] and/or its agent to complete the first installation of the non-motorized counter (“Equipment”) as a form of training to the [insert abbreviated Agency Name] and/or its agent. Any additional Equipment will be installed by the [insert abbreviated Agency Name] and/or its agent, with installation support from the Department as needed.

1.4. Failure on the part of the [insert abbreviated Agency Name] to comply with any of the provisions of this Agreement will be grounds for the Department to terminate its participation, regain possession of the Equipment from the [insert abbreviated Agency Name] and if applicable, seek repayment for any damages done to the Equipment beyond standard wear and tear.

1.5. Any amendments to this Agreement or its terms will be agreed upon in writing by all parties prior to being implemented. The Department may delegate the approval of these amendments to the Manager of the Department’s Transportation Data Analytics (TDA) Office.

2. SCOPE OF PROJECT

2.1. The [insert abbreviated Agency Name] and/or its agent shall be responsible for providing installation approval and access to the proposed short-term count locations. The [insert abbreviated Agency Name], at its sole expense, shall install, monitor, and inspect the Equipment. All short-term count locations must be identified and selected in accordance with the Department’s Non-Motorized Traffic Monitoring Program. The [insert abbreviated Agency Name] will submit a list of potential sites to the Department for written approval prior to the installation of any Equipment. Both parties will provide access to data collected through the Equipment. At the conclusion of the project, the [insert abbreviated Agency Name] will return the Equipment, and other related hardware, to the Department.

2.2. The Department, at its sole expense, will provide the [insert abbreviated Agency Name]with the Equipment and other hardware which shall adhere to the following specifications:

- Capture non-motorized travelers using infrared detectors.
- Capture bicycles using bicycle only road tubes.
- Measure the direction of travel of cyclists.
- Transmit data wirelessly or are required to have data downloaded and sent to the Department.
- Do not have any speed restrictions on capturing data.

- Record count data at 1-hour intervals for a minimum of 2 weeks per location.
- May be removed using readily available tools and street maintenance equipment.
- Include necessary supporting installation equipment such as any enclosure box, screws, cables, nails, road tape etc.
- Include an enclosed secure box or structure with key entry or another unlocking device included.
- Include any necessary cords to connect a field computer or other mobile device to the count device.
- Include a minimum 1-year manufacturer's and/or seller's warranty for all Equipment and software.
- Include a manual describing installation procedures, specifications, and maintenance instructions.
- The Equipment is contained by a waterproof design.
- The Equipment has a battery life of 2 years minimum.
- The Equipment has data compatibility with Microsoft Office Excel (v2010 or later).

3. ROLES AND RESPONSIBILITIES

3.1. [insert abbreviated Agency Name] **Responsibilities**

1. Locate Utilities, if necessary, for Equipment installation.
2. Set up and manage traffic control, if necessary, for Equipment installation.
3. Clean up site.
4. Approve Equipment installation locations.
5. Meet Department staff on site during Equipment installation training and install, inspect, and monitor Equipment according to technical oversight provided by the Department.
6. Provide the Department with pictures of the first Equipment installation and removal procedure and all subsequent Equipment installation and removal performed during the term of this Agreement.
7. Retrieve and submit data to Department in accordance with Department guidelines.

3.2. Department Responsibilities

1. Conduct Equipment test prior to field deployment.
2. Deliver Equipment to be installed to [insert abbreviated Agency Name].
3. Test for environmental interference with Equipment.
4. Determine final Equipment placement.
5. Provide Equipment installation and removal training to [insert abbreviated Agency Name] and/or its agent.
6. Conduct diagnostics/compile logger information after installation.

7. Equipment maintenance which may include battery upkeep and replacement of Equipment parts such as screws, nails, hoses, and roadway tape.

3.3. Responsibilities for both parties during installation of <u>first</u> Equipment

1. Bring installation Equipment, which may include: hammer, tape measure, rake, broom, road tape, cones, safety vests, etc.
2. Provide bicycle for testing during Equipment installation training.
3. Provide laptop for finalizing and testing the Equipment.

4. CONTRACT TERM; TERMINATION

4.1. The useful life of this Equipment may be up to ten (10) years. This Agreement shall be for a period of five (5) years. Either party may terminate this Agreement at any time with a thirty (30) day written notice of intent to terminate.

4.2. In the event of termination, the [insert abbreviated Agency Name] will return all Equipment, and other related hardware, to the Department within seven (7) calendar days of equipment removal. The [insert abbreviated Agency Name] shall not be liable for any damage to the Equipment if the [insert abbreviated Agency Name] has provided the Department with pictures of the Equipment installation and removal and the Department determines the Equipment was installed and removed properly.

5. RIGHT TO INSPECT

5.1. The Department shall have the right to inspect, test, approve or reject, any portion of the work being performed by the [insert abbreviated Agency Name] or its agent(s) to ensure compliance with the provisions of this Agreement. Any deficiencies inconsistent with the Department’s data collection protocols or Non-Motorized Travel Monitoring Handbook and specifications found during an inspection must be corrected within 48 hours.

6. CONTRACTOR COMPLIANCE

6.1. The “[insert abbreviated Agency Name]” will be responsible for ensuring that its agent(s) and contractor(s) comply with all terms of this Agreement and any instructions issued by the Department as a result of any review or inspection made by Department representatives.

7. INDEMNIFICATION

7.1. It is specifically agreed between the parties executing this Agreement that it is not intended by any of the provisions of any part of this Agreement to create in the public or any member thereof, a third-party beneficiary under this Agreement, or to authorize anyone not a party to this Agreement to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this Agreement. The [insert abbreviated Agency Name] agrees to include the following indemnification in all contracts with contractors/subcontractors and consultants/subconsultants who perform work in connection with this Agreement:

“The contractor/consultant shall indemnify, defend, save, and hold harmless the State of Florida, Department of Transportation, including the Department’s officers and employees, from liabilities, damages, losses and costs, including, but not limited to, reasonable attorney’s fees, to the extent caused by the negligence, recklessness or intentional wrongful misconduct of the contractor/consultant and persons employed or utilized by the contractor/consultant in the performance of this Agreement.”

IN WITNESS WHEREOF, each of the undersigned parties has caused its duly authorized representative to execute this Memorandum of Agreement.

[insert Agency Name]

SIGNED BY: ____

TITLE: ____

DATE: ____

ATTEST TO: Approved as to form:

By: ________________________ By: _______________________________

FLORIDA DEPARTMENT OF TRANSPORTATION

TRANSPORTATION DATA AND ANALYTICS OFFICE MANAGER:

SIGNED BY: ____

DATE: ____

LEGAL REVIEW: ____

ABBREVIATIONS

AADB – Average Annual Daily Bicycles

AADP – Annual Average Daily Pedestrians

FCAT – Factory Category

FDOT – Florida Department of Transportation

FHWA – Federal Highway Administration

MPO's – Metropolitan Planning Organizations

NBPD – National Bicycle and Pedestrian Documentation

TCI – Traffic Characteristics Inventory

REFERENCES

[1] Florida Department of Transportation, "Survey Processign Software Version 5.0 User Manual," Florida Department fo Transportation, Tallahassee, 2016.

[2] U.S. Department of Transportation - Federal Highway Administration, "Traffic Monitoring Guide," U.S. Department of Transportation, 2013.

[3] U.S. Department of Transportation - Federal Highway Administration, "FHWA Bicycle-Pedestrian Count Technology Pilot" U.S. Department of Transportation, 2016.

[4] National Cooperative Highway Research Program, "Guidebook on Pedestrian and Bicycle Volume Data Collection", NCHRP, 2014.

[5] National Cooperative Highway Research Program, "Methods and Technologies for Pedestrian and Bicycle Volume Data Collection", NCHRP, 2016.

[6] National Bicycle and Pedestrian Documentation, "Project Criteria", http://bikepeddocumentation.org/

[7] Florida Department of Transportation, Non-Motorized Transportation Count Data Collection Study, FDOT 2016.