

**STATE OF NEW JERSEY
BUREAUS OF ITS ENGINEERING AND SATETY & DATA DEVELOPMENT
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625**

MATERIAL SPECIFICATIONS FOR TRAFFIC VOLUME SYSTEM

The purpose of these specifications is to describe the minimum acceptable material specifications for the Traffic Volume System (TVS).

SECTION I - General

The TVS includes roadway loops, traffic recording equipment and software for monitoring, recording, processing, and storing vehicle volume, speed, length, gap and headway by lane and by direction at highway speeds.

The TVS vendor must be a supplier of Automatic Traffic Recorder (ATR) for at least a minimum of 3 years and the equipment supplied must be in operation for a minimum of 2 years by a public agency. Reference list of people who currently use the proposed equipment must be provided.

The TVS consists of the following components at each site:

- TVS Roadway Loops
- Automatic Traffic Recorder
- TMS Roadside Devices

All equipment and material must be corrosion resistant and hardened to operate under following environment conditions:

- Operating Temperature: -40°F to +160°F
- Storage Temperature: -40°F to + 160°F
- Operating Humidity: 20% to 95 % R.H (Non-condensing)

SECTION II- TVS Roadway Loops

The loop detectors and loop detector cables must meet the following specifications and the ITS Standard Details for TVS Roadway Loops. The TVS Roadway Loops consists of the following items in each lane:

- Two loop detectors
- Loop detector cable

To protect the integrity of the pavement and loop detector installation, cracks and joints in the roadway pavement should not be located closer than 18 inch upstream or downstream of the loop detector being installed.

2-1 Loop Detector

Provide material as specified in 918.02.02. There will be no splices in the roadway. Loop detectors are to be installed in the base course of the pavement and sealed before installation of the surface course of the pavement. Loop detectors are 6'x6' and consist of 4 turns of loop detector wire. Install loop detectors as specified in 702.03.09.

2-2 Loop Detector Cable

Install loop detector cables as specified in 702.03.10. Run loop detector cables into the 1 1/2 inch rigid metallic conduits installed 18 inch from the edge of the paved shoulder to the nearest junction box.

SECTION III – Automatic Traffic Recorder (ATR)

The Automatic Traffic Recorder will be installed in the controller cabinet. The ATR includes all of the equipment and software to calculate, store and transmit to a host computer all data specified in these specifications. The system will operate on AC power with a DC battery backup system to provide uninterrupted power during AC power outages for a minimum of 48 hours.

The ATR at each site must include but is not limited to the following components:

- Automatic Traffic Recorder Unit
- Compatible Modem
- Operating Software
- Polling, Editing, Communication and Reporting Software
- Backup Power Supply
- Data Surge Protection
- User and Service Manuals
- All necessary interconnecting cables and miscellaneous materials to make an operational System

3-1 Automatic Traffic Recorder (ATR) Unit

Each ATR Unit must be capable of receiving inputs from two loops in each lane of twelve (12) lanes (24 loops) minimum configuration. Since every loop may not be operable at all times, each unit must have channel mapping features so that vehicle speeds, lengths, gaps, and headways are recorded in lanes with two functioning loops and volumes are **correctly** recorded in lanes with only one functioning loop. Firmware must not erroneously halve or double recordings in any lane. The unit must be capable of:

1. Internally storing 60 days of hourly volume data for each loop; and 15 days of 15-minute volumes for each channel. The unit must be capable of storing the recorded data, in the mode selected by the operator, as individual vehicle records; as precise times of sensor activations; or as aggregated "binned" records for each recording interval and channel as selected by the user.
2. The unit must be capable of accurately recording vehicles using loops with inductance ranging between 75 and 500 micro-Henries.
3. Provide automatic retuning of loop detectors that can be disabled manually by the operator.
4. Must have optional inputs for up to 8 piezo for vehicle classification.

Selectable recording intervals must be 15-minutes or 60-minutes. The option to record in 1 or 5-minute intervals must be included. Each 60-minute recording interval must start and end on the hour; 15-minute recording intervals must start and end on the hour or 15, 30, or 45 minutes after the hour; and 5-minute recording intervals must start and end on the hour or multiples of 5-minutes after the hour (e.g. 0805, 0810, 0815, etc.). The operator must have the option of setting the recorder to start recording on the hour, regardless of recording interval.

The recorder must have an on-board real-time clock and calendar. When the recorder is polled from the central system, the on-board clock and calendar must be automatically synchronized as a default, or this feature must be able to be deselected by the operator.

Include with the ATR all required cables, wiring harnesses and connectors.

Remotely via modem or on-site monitoring of system, the operator must be able to:

1. Remap channels
2. Individually set up loop size, sensitivity and loop spacing by lane.
3. Set date and time
4. Remote or on-site monitoring of system operation must not interfere with recording of data. Recording of data must proceed without interruption when viewing site parameters, previous recordings, or sensor activations.

User Interface: Each ATR must be equipped with an integral keypad and display (LCD), as well as firmware, so that it can be set up in the field, recordings can be viewed, and basic diagnostic tests can be made on site. The user must be able to perform the following functions directly:

1. Set up 8-digit station ID
2. Set recording interval
3. Set/reset date and time
4. Set up sensor array (configuration, size, and spacing)
5. Set loop inputs and recording channels
6. View battery voltage
7. View available memory and memory in use
8. Set up data recording parameters including speed, length, gap, and headway in addition to volume
9. Set up bin thresholds so that 12 speed bins and 5 length bins can be recorded.
10. View recordings by bin
11. View volumes by channel and recording interval
12. View individual sensor activations
13. View individual recordings for each vehicle in real time (accumulating volume by channel, vehicle speed and/or length, and bin assignment of each vehicle; and gap or headway between two vehicles).
14. Pause the display to examine the recordings as described in "m" above
15. Adjust detector sensitivity by loop
16. Map channels into groups, such as by direction and local and express lanes, for each sensor input.

3-2 Communications Equipment

The ATR unit must be accessible remotely via a communication link consisting of dial up telephone communication modem or via Ethernet network, or via a high-speed internet protocol (IP) link to the device for system monitoring, setup, and data collection from NJDOT office located in Trenton. Communication interfaces can be:

- Ethernet Interface for network communications
- RS232 Interface for dial up communications

Provide a dial up remote communication modem as standard unless otherwise specified in the contract documents.

3-3 Data Surge Protection

All communication copper lines are to be equipped with data surge suppressors. The following requirements apply to a surge suppressor:

- Peak Current: 10 kilo amps (8x20 microsecond waveshape)
- Occurrences at 2 000 amps: 50 typical
- Response Time: < 5 nanoseconds
- Voltage Clamp: 8, 12, 20, 30 or special
- Series Resistance: 24 ohms total
- Operating Temperature: -40 °F to +185 °F
- Primary Protector: Three element gas tube, 10 kilo amps, 8x20 microseconds per side
- Secondary Protector: Solid state clamps, 1.5 kilowatt minimum

3-4 Power Supply and Backup Power Supply

The battery chargers and the charging circuit within the ATR must be designed and constructed so that the batteries are maintained above minimum operating voltage and amperage; and batteries cannot discharge through chargers.

The backup power supply must be rated to ensure a minimum of 48 hours of continuous system operation during power failures.

3-5 Operating, Polling, Editing and Reporting Software

The following software is required to retrieve and process data:

- On-site software

- Communication software
- Auto-polling software
- Reporting software.

The supplied communication and on-site software must be compatible with any IBM personal computer using Microsoft Windows XP or Windows 7 operating system. A user interface is required in the communication software. The auto-polling application must have the ability to poll multiple stations in sequence and maintain a log with failed connections. Software must be compatible with TRADAS-3 (Chaparral Systems Corporation) that is used by NJDOT.

SECTION IV – TMS Roadside Devices

The TMS Roadside Devices at each site include at a minimum the following components:

- Controller Cabinet Type P-TMS
- Foundation ITS Type D or D-MC
- Meter Cabinet ITS and Foundation ITS Type MC
- Data Surge Protection
- Electrical and communication services, cables and wires

4-1 TVS Controller Cabinet and Electrical Equipment

The TVS Controller cabinet must be made of NEMA 3R aluminum cabinet (Grade 50-52-H32) fabricated in accordance with the ITS standard detail for the Controller Cabinet, Type P-TMS (ITS-704-31). The cabinet cannot be painted. All surfaces of the cabinet must be clean, free of holes or blemishes, smooth without burrs and with exterior corners rounded. All cabinet doors incorporate hinges and hinge pins utilizing stainless steel. Use stainless steel pop-rivets or stainless steel nuts and bolts to fastened doors and cabinets hinges. Welding of hinges to cabinets and door is not permitted. Dimensions of the cabinet furnished must meet or exceed all minimum dimensions shown. The enclosure will be equipped with an adjustable shelf, cabinet light with switch, thermostatically controlled fan, load center panel board, ground fault duplex receptacles, grounding and bonding devices, and all mounting brackets installed at vendor's factory.

- Use a circuit breaker of proper rating located within the controller cabinet to protect inside wiring and equipment.
- Breaker type should be comparable to an E frame circuit breaker.
- AC Surge Protection: Install a 120 volt AC single phase surge protector as a precautionary measure against possible damage resulting from voltage surges on all incoming power lines. The 120 volt AC single phase surge protector incorporates a series choke at a maximum clamp voltage of 340 volts at 20 kilo amps with 5 nanosecond response. In addition, the surge protector must have the capability of removing high energy surges and block high speed transients. The following specifications apply to the surge protector:
 - Peak Current: 20000 amps (8x20 microsecond waveshape)
 - Occurrences: 20 times at peak current
 - Minimum Series Inductance: 200 microhenries
 - Continuous Series Current: 10 amps
 - Temperature Range: -40 °F to +185 °F
- Load Center: Load Center consists of a 120/240 volt AC, single-phase, three-wire, solid neutral 100 Amp bus distribution panel with a 2-pole, 240 volt, 100 amp main circuit breaker, eight (8) single-pole 20-Amp, 120 volt branch circuit breakers and (2) single-pole spaces within a NEMA-1 enclosure without door. Three thermostatically controlled fans with a minimum of 100 CFM air flow for ventilation are going to be completely wired and interconnected, furnished and mounted in the top of the cabinet. Install two duplex receptacles (total four outlets) within the cabinet, where one receptacle as a non-GFCI type for use as a convenience.
- Wiring: Use a minimum #12 AWG wiring between AC equipment. Provide barrier type terminal blocks for all field wiring. Use #8 AWG ground wire for grounding and bonding.

- Communication Cable. Install underground conduit for the communication cable from the utility pole to the controller. Provide and install the materials necessary to provide complete installation as specified in 704.03.01.B.2.

4-2 Meter Cabinet ITS for Electrical Service

The Meter Cabinet for Electric service must conform to NJDOT standard ITS detail for Meter Cabinet ITS.

Install underground conduit and electrical conductors that extend from a meter cabinet or junction box to a point on the service pole and supply sufficient length conductors to extend to the overhead utility service as required by the utility. Notify the utility and complete the required applications for inspection.

4-3 Cabinet Foundation

Cabinet foundation for the Controller Cabinet Type P-TMS must conform to NJDOT standard ITS detail for Foundation ITS Type D or D-MC. Meter Cabinet Foundation must conform to NJDOT standard ITS detail for Foundation ITS Type MC.