

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

MATERIAL SPECIFICATIONS FOR WEIGH-IN-MOTION SYSTEM

The purpose of these specifications is to describe the minimum acceptable material specifications for the Weigh-In-Motion System.

SECTION I - General

Weigh-In-Motion System (WIMS) consist of mounted roadway sensors and traffic recording electronics with software for monitoring, recording, processing, and storing dynamic vehicle weights, classification, volume and speed by lane and direction at highway speeds.

Components of the WIMS at each site are:

- WIMS Roadway Devices
- WIMS Controller Electronics
- TMS Roadside Devices

The vendor must provide full-time on-site direction during WIMS installation and system start-up. The WIMS vendor must be a WIMS supplier 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.

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- WIMS Roadway Devices

WIMS Roadway Devices include the following:

- Two Class 1 piezo axle weight sensors in each lane
- One in-road temperature sensor per site
- Three loop detectors and loop detector cables in each lane
- 3/8-inch thin wall PVC or polyethylene flexible tubing for the piezo lead-in cable

The sensors and loops must meet the following specifications and the ITS Standard Detail for WIMS Roadway Devices.

2-1 Axle Weight Sensor and Sensor Lead

The axle weight sensors must be furnished by the WIMS vendor and be of the WIMS vendor's design. Axle weight sensors must meet the requirements for Class I piezoelectric sensors. The axle weight sensors must be long enough to cross the entire lane and be active along their entire length. Each sensor must be provided with a sufficient length of shielded lead cable for termination at the controller cabinet without splicing.

2-2 In-Road Temperature Sensor and Sensor Lead

The in-road temperature sensor must be compatible with the WIMS controller. It must be rated for direct installation into the roadway surface with grout. The sensor must be fully encapsulated in urethane with a sufficient length of direct burial lead cable for termination at the WIMS controller without splicing. Temperature range of the sensor is between -40 °C to +110 °C.

2-3 Loop Detector and Loop Detector cable

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 the installation of the surface course of the pavement. Loop detector cable must be furnished by the WIMS vendor and installed as specified in 702.03.09.

The loop detectors and loop detector cables must be installed according to the WIMS vendor's recommendation and the NJDOT Standard ITS Detail for WIMS Roadway Devices.

SECTION III – Controller Electronics, WIMS

The Controller WIMS at each site must be installed in the controller cabinet. The Controller WIMS unit must include all of the equipment and software to calculate, store and transmit to a host computer all data specified in these specifications. The system must 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 Controller WIMS at each site must include but is not limited to the following components:

- WIMS Control Unit
- Communication Equipment
- Power and Communication Surge Protection
- Backup Power Supply
- Operating Software
- All necessary interconnecting cables and miscellaneous materials to make an operational System.

3-1 WIMS Control Unit

The WIMS Control Unit must at least meet the following specifications:

1. Accommodate vehicles and vehicle combinations with up to nine axles and determine each vehicle lane of travel. Allow the user to create or modify classification schemes based on the number of axles and spacing, can store up to 10 different classification schemes which the user can select. The NJDOT classification scheme must be provided as default.
2. The NJDOT classification scheme uses 14 vehicle classification categories (FHWA 13-category classification system plus a Class 14 for unclassified vehicles) based on axle configuration.
3. Provide for at least 60 days of continuous data storage when 6 lanes of in-road sensors are installed.
4. Provide communication link with an office computer. The Department must be able to operate the controller remotely including data transfer, site administration, and monitoring the operation of equipment. The operator must be able to set-up parameters for each individual lane including sensor configuration and spacing, loop tuning, and calibration factors.
5. The system must contain a password protection to protect against unauthorized access.
6. The WIMS must continue to weigh and classify vehicles with any combination of axle sensors and loops in the event of failure of one of the five sensors in a lane.
7. Compatible temperature sensor for the auto calibration feature.
8. The Sensor and Control Module interface must accommodate all sensors and loops as shown in the NJDOT Standard ITS Detail for WIMS Roadway Devices (3 loops and 2 axle weight sensors in each lane and 1 temperature probe in each site) and configured for at least 6 lanes. Each data interface module must include built in signal conditioning. All sensor modules must be field replaceable. Every module must have the feature of self testing and built in fault diagnostics. Provide all required cables and connectors to connect the unit to the sensor module interface.

3-2 Communications Equipment

The WIMS Control Unit must be accessible remotely via a communication link consisting of dial up telephone communication modem or via NJDOT Ethernet network or 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:

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

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

3-3 Power and Communications Surge Protection

Surge suppressors must be installed for all communication copper lines. The surge suppressor must comply with the following specifications:

- 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 Backup Power Supply

Provide a backup power supply. The back up power supply must include a battery and a battery charger and must be rated to ensure a minimum of 48 hours of continuous system operation during power failures.

3-5 Operating Software

The WIMS must be supplied with software which includes on-site software, communication, auto polling and office software for generating reports. The supplied communication and on-site software must operate on any IBM or compatible personal Pentium 5 computer under Windows-XP or Windows 7. The communication software must allow user-friendly communication with the WIMS and feature autodialing and user menus. The auto polling system is to operate such that multiple stations can be polled in turn, and if communication with a particular station fails, the auto polling process continues with the next station automatically.

The office software must be provided and must allow reports to be generated on collected raw vehicle record files, binned summaries, and/or precise times of sensor activations. The software must generate "C-Card" *formats* for classification data, "W-Card" *formats* for weight data, "V-Card" *formats* for volume data, and "S-Card" for site identification information as defined in the May 1, 2001 version of the Traffic Monitoring Guide. The overall system operational software must interpret the signals from in-road sensors and generate the vehicle record. The algorithm used to interpret the signals must be capable of user definition based on axle spacing of each vehicle.

While connected to any WIMS site via a communication link, the user must be able to perform the following tasks as a minimum:

- Real time vehicle viewing selectable by lane (with graphical or text output)
- Resetting of the system clock (including date)
- Monitor system Memory in terms of storage remaining
- Fail-safe purge of old files from the system

SECTION IV – TMS Roadside Devices

The TMS Roadside Devices at each site must include but is not limited to the following components:

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

4-1 WIMS Controller Cabinet and Electrical Equipment

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

- The cabinet control wiring and control equipment must be protected with a circuit breaker of proper rating located within the controller cabinet. Breaker type should be comparable to an E frame circuit breaker.
- AC Surge Protection: A 120 volt AC single phase surge protector must be installed as a precautionary measure against possible damage resulting from voltage surges on all incoming power lines. The 120 volt AC single phase surge protector must incorporate 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 surge protector must comply with the following specifications:
 - 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 must consist 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 must be completely wired and interconnected, furnished and mounted in the top of the cabinet. Two duplex receptacles (total four outlets) must be installed within the cabinet. One receptacle must be non-GFCI type receptacle for use as convenience receptacle.
- Wiring: All wiring between AC equipment must be minimum #12 AWG unless otherwise specified. Barrier type terminal blocks must be provided for all field wiring. Grounding and bonding must be made by means of #8 AWG ground wire.

4-2 Communication Service

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.

4-3 Meter Cabinet ITS for Electrical Service

The Meter Cabinet for Electrical service must conform to NJDOT standard ITS details 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 Foundations

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.