

# Special Specification 6488

## Traffic Data Collection System - Weigh-In-Motion (TDCS-WIM)



### 1. DESCRIPTION

Install or replace and calibrate Traffic Data Collection System – Weigh-In-Motion (hereafter “TDCS-WIM”) in pavement at the location shown on the plans.

### 2. MATERIALS

- 2.1. Provide all materials, not supplied by the Department, necessary for the TDCS-WIM. Provide a task in the project schedule for delivery of Department furnished materials and provide a minimum of 30 days’ notice to the Department for delivery of Department furnished materials.

Conform to the pertinent requirements of the following Items:

- Item 360, “Concrete Pavement”
- Item 400, “Excavation and Backfill for Structures”
- Item 618, “Conduit”
- Item 620, “Electrical Conductors”
- Item 624, “Ground Boxes”
- Item 628, “Electrical Services”
- Item 656, “Foundations for Traffic Control Devices”
- Item 680, “Highway Traffic Signals”
- Item 684, “Traffic Signal Cables”
- Item 688, “Pedestrian Detectors and Vehicle Loop Detectors.”

- 2.2. **Loop Wire.** Use stranded copper No. 14 AWG XHHW cross-linked-thermosetting-polyethylene-insulated conductor rated for 600 v AC for vehicle detector loop wire unless otherwise shown on the plans. Show the name or trademark of the manufacturer, insulation voltage rating, wire gauge, and insulation type at approximate 2 ft. intervals on the insulation surface of each length of wire.

Use sealant for the vehicle detector loops in accordance with DMS-6340, “Vehicle Loop Wire Sealant.”

- 2.3. **Loop Lead-In Wire.** Use Type C cables meeting the requirements of IMSA 50-2 for loop detector lead-in installations consisting of stranded two conductor twisted and shielded No. 14 cable. Ensure conductors have a minimum of two twists per foot within the cable.

- 2.4. **Splice Protection.** Use through-splice connector, Uraseal Type ES200SV or other equivalent, for small hard-to-splice areas that provides a 100% watertight seal and protection up to 600 v AC as per Item 684, “Traffic Signal Cables.”

- 2.5. **Ground Conductors.** Use stranded copper No. 8 AWG.

- 2.6. **Department Furnished Materials.** The Department will furnish the following TDCS-WIM equipment and materials to the Contractor:

- Kistler quartz class I sensors with lead-in wires,
- specialized epoxy for Kistler quartz class I sensors,
- traffic data collection cabinet – typically Type 5 cabinet unless otherwise shown on the plans,
- cabinet base,
- cabinet and base hardware,
- WIM controller, and
- Internet protocol (IP) cellular modem.

Contact Department representative to coordinate delivery of Department furnished materials. Certify that they are in good condition and sign off on delivery of the materials.

### 3. EQUIPMENT

Provide all equipment, including but not limited to, boring equipment; concrete wet saws; one Class 9 vehicle and one Class 5 vehicle in new or like new condition and loaded to the limits specified, with air suspension; and other equipment necessary to install a fully functional TDCS-WIM. Provide boring equipment equipped with guidance and location devices.

### 4. CONSTRUCTION

Layout, stake, and install sensors, loops, conduit, ground boxes, and foundation as shown on the plans. The TDCS locations on the plans are diagrammatical, and the Department representative may shift within design guidelines where necessary to secure a more desirable location. Use established industry and utility safety practices when working near overhead or underground utilities. Consult with the appropriate utility company before beginning work.

- 4.1. **Conduit.** Install conduit in the specified types and sizes shown on the plans. Install conductors and seal the ends of conduits terminating in ground boxes and in the controller assembly enclosure with an approved sealing compound.

Install conduit by the horizontal directional drilling method when boring. A soil investigation is not required.

- 4.2. **Loop – Class I.** Install or replace conductors for loop lead-in cable consisting of two No. 14 stranded tinned copper. Ensure loop lead-in cable conforms to the calculated cross-sectional area of ASTM Designation B 286, Table 1. Use lead-in cable that is insulated with high-density polyethylene. Ensure that the conductors are twisted together with at least two turns per foot and the twisted pair is protected with a copper or aluminum polyester shield.

Cut slots for inductive detector loops only after the concrete pavement has been ground, straight-edged, and brought into tolerance as required by quartz sensor manufacturer. Cut slots for loops no deeper than 3 in., but deep enough to provide a minimum of 1 in. depth of sealant over the wire and wide enough such that the loop wire wraps will fit loosely in the slot. Wash clean, blow out, and thoroughly dry slots cut in the pavement before installing conductors. Install five turns of wire for each loop. Twist each wire pair from the loop to the shoulder termination ground box a minimum of five turns per foot. After conductors are installed in the slots cut in the pavement, fill the slots with loop sealant to within 1/8-in. of the pavement surface in a manner such that the loop wire is encapsulated with the sealant to the bottom of the slot, with a minimum sealant thickness of 1 in. above the top conductor in the saw cut. Remove all surplus sealant from the adjacent road surfaces without the use of solvents before the sealant sets.

Cut slots for replacement loops at same locations as previous installation. The previously installed loops are not salvageable.

Install loop conductors without splices, terminating in the nearest ground box. Seal the open end of cable jackets or tubing in a manner similar to the splicing requirements to prevent the entrance of water.

Provide all materials including, but not limited to, loop wire, loop lead-in wire, splices, backer rod, and loop wire sealant.

- 4.3. **Sensor and Loop Lead-In Wire Identification.** Use a minimum of four wraps of colored electrical tape or heat shrink sleeves based on the following color code unless otherwise shown on the plans. Use brown for first lane, red for second, orange for third, yellow for fourth, green for fifth, and blue for sixth. Identify Lane 1 as the outside lane of the dominant direction of either northbound or eastbound based on roadway designation. Identify the entrance lane sensor lead-in wire and loop lead-in wire with a single-color band and the exit lane sensor lead-in wire and loop lead-in wire with a double-color band. Entrance and exit are based on traffic direction.

- 4.4. **Grounding and Bonding.** Install the grounding conductors in accordance with Item 680, "Highway Traffic Signals." Connect sensor ground conductors to cabinet ground bus bar.

- 4.5. **WIM Quartz Class I Sensor Slot.** Cut the slot with a pavement milling machine. For cutting the cable slot, the blade must be 8 mm (only one cut required). Wash clean, blow out, and thoroughly dry slots cut in the pavement before installation. Provide equipment and materials at the site to perform additional chipping, grinding, and cleaning of the slot.

Cut slots for replacement sensors at same locations as previous installation. The previously installed sensors are not salvageable.

- 4.6. **WIM Quartz Class I Sensor Installation.** Install quartz sensor conforming to manufacturer's requirements. Provide equipment, tools, and materials at the site to perform installation of quartz sensors.

- 4.7. **WIM Conductors and Splicing Identification.** Make splices between loop lead-in wire and loop detector wires only in the ground box near the loop the cable is servicing. Use non-corrosive solder for splices. Splice loop wires to the loop lead-in cables. Identify each loop wire pair, loop lead in wire, and WIM lead-in or extension cable based on loop number or quartz sensor number in each ground box and in the cabinet enclosure as per Section 4.3, "Sensor and Loop Lead-In Wire Identification." Do not splice the quartz sensor wire.

- 4.8. **Controller Assembly.** Construct controller foundation in accordance with Item 656, "Foundations for Traffic Control Devices." Install Department furnished cabinet in accordance with Item 680, "Highway Traffic Signals."

- 4.9. **WIM System Calibration.** Calibrate the system in accordance with ASTM E 1318-02, Section 7.5, except where noted below.

- 7.5.1 – Calibration adjustments to be performed by Department representative.
- 7.5.3 – Provide one Class 9 and one Class 5 (2-D) air suspension vehicles for the test units. Furnish the test vehicles loaded to the specified limits and their drivers at the site for the day of the performance test, fully fueled, a measure of the vehicle axle spacing to the nearest 0.1 ft. and with a current day certified public scale weight ticket that has a record of each axle or axle group and gross vehicle weight. Provide the Class 9 vehicle with a tractor driver and trailer air suspension tandems, loaded to a gross weight of between 75,000 and 80,000 lb. Load the Class 5 vehicle to 90% of its registered weight. Provide vehicles that comply with all provisions of Section 7.5.3, except as noted.
- 7.5.4 – Not applicable.
- 7.5.5.2 – The use of a radar speed meter is not required. The comparison between measured axle spacings of the test trucks and their WIM generated axle spacings may be used to determine speed calibration.

- 7.5.5.3 – Conduct tests at the maximum specified speed determined for the site. Conduct the number of runs and speeds of initial series of runs by all test vehicles as indicated by the Department representative to best determine the initial settings of the WIM controller software's wheel load and speed correction factors. Following initial setting of correction factors, conduct a minimum of two valid runs by each test truck for every 5 mph increment between and including the minimum and maximum speed range established. Instruct the test truck drivers to make every run centered in the designated lane. In addition to recording all data, plot each run on a graph displaying speed as the x-axis and percent gross weight error as the y-axis. Use different plotting symbols for each of the two test trucks.
- 7.5.5.5 – The Department representative will decide on whether adjustments to the controller software's wheel load and speed correction factors will be based upon mean values for the test truck data sets and graphical plots or by some other method if it is deemed that either of the test truck's data contains anomalies that should not be used. For any wheel load correction factor adjustment exceeding 5%, provide at least two additional runs by all test trucks at the speed or speeds necessary to confirm that the correction factor adjustment effected a linear adjustment in the test vehicles' recordings of wheel loads. This process must be repeated until it can be demonstrated that the TDCS-WIM installation meets or exceeds the ASTM E 1318 Type II performance requirements for TDCS-WIM installation to be accepted.

Provide Department representative with copies of all test vehicle data, graphs, and controller software's correction factor settings and adjustments compiled by Department representative during the calibration process.

#### 4.10. **Performance Tests.**

- 4.10.1. Provide a minimum of 30 days' notice before installation and saw cutting. Have Department representative on site during installation and saw cutting.

Complete the "Sensor Reading Data Sheet" before calibration. The "Sensor Reading Data Sheet" will be provided by the Department. Ensure all measurements meet the parameters conforming to the manufacturer's manual and in accordance with "FHWA's 13 Vehicle Category Classification" in the *FHWA Traffic Monitoring Guide (TMG)*  
[https://www.fhwa.dot.gov/policyinformation/tmguide/tmg\\_fhwa\\_pl\\_13\\_015.pdf](https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_fhwa_pl_13_015.pdf).

Replace failed or damaged existing TCDS-WIM components when caused by the Contractor. The Department will relieve the Contractor of maintenance responsibilities upon passing a 30 day performance test of the TDCS-WIM and acceptance of the Contract. If any failure occurs during the 30 day test period, repair or replace the component failure. This repair or replacement will start a new 30 day test period including site calibration.

- 4.10.2. Have Department representative on site during calibration.

Complete site calibration within the first 14 days of the 30 day performance test period.

- 4.11. **Removal.** Remove existing electrical services, controllers, cables, conduit, ground boxes, and other accessories. Remove materials so damage does not occur or abandon in place. Remove and store items designated for reuse or salvage at locations shown on the plans or as directed.

Remove abandoned concrete foundations, including rebar, to a point 2 ft. below final grade. Backfill holes with material equal in composition and density to the surrounding area. Replace surface material with similar material to an equivalent condition.

Accept ownership and dispose of unsalvageable materials in accordance with federal, state, and local regulations.

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**5. MEASUREMENT**

This Item will be measured by the foot of saw cut containing loop wire and by each Sensor Installation or Replacement; Calibration; and Removal.

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**6. PAYMENT**

The work performed and materials furnished, in accordance with this Item and measured as provided under "Measurement," will be paid for at the Unit price bid for "Saw Cut Loop Installation," "Sensor Installation or Replacement," "Calibration", and "Removal. This price is full compensation for furnishing all equipment, materials, labor, tools, and incidentals.

Conduit will be paid for under Item 618, "Conduit." Conductors will be paid for under Item 620, "Electrical Conductors." Ground boxes will be paid for under Item 624, "Ground Boxes." Electrical services will be paid for under Item 628, "Electrical Services." Foundations will be paid for under Item 656, "Foundations for Traffic Control Devices." Ground conductors will be paid for under Item 620, "Electrical Conductors," and cabinet installation will be paid for under Item 680, "Highway Traffic Signals."

- 6.1. **Saw Cut Loop Installation.** This price is full compensation for removing and disconnecting loop wires; saw cutting pavement, installing new loops, loop lead-in wires, and connections; accessing existing conduit and bores, as applicable; replacing damaged components; disposing of unsalvageable materials; and materials, equipment, labor, tools, and incidentals.
- 6.2. **Sensor Installation or Replacement.** This price is full compensation for installing sensor ground wires and making connections; saw cutting pavement, installing new Department furnished materials, including, but not limited to Quartz Class I Sensors; installing connections and conductors; accessing existing conduit and bores, as applicable; replacing damaged components; disposing of unsalvageable materials; and materials, equipment, labor, tools, and incidentals. If replacement, the price includes removing and disconnecting sensor conductors.
- 6.3. **Calibration.** This price is full compensation for calibrating a complete in place TDCS-WIM installation and materials, equipment, labor, tools, and incidentals.
- 6.4. **Removal.** This price is full compensation for removing, salvaging and disassembling, and stockpiling cabinet, controller, and modem; abandoning in place existing conduit; removing existing foundations; backfilling and surface placement; disposing of unsalvageable materials; and materials, equipment, labor, tools, and incidentals.