



## Florida Department of Transportation

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SECRETARY

January 3, 2011

Monica Gourdine  
Program Operations Engineer  
Federal Highway Administration  
545 John Knox Road, Suite 200  
Tallahassee, Florida 32303

Re: Office of Design, Specifications  
Section 741  
Proposed Specification: **7410000 Traffic Monitoring Site Vehicle Sensor (Non-Weight Applications) REVISED**

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Kip Jones of the Traffic Operations and Engineering Office for clarification, to reflect changes in technology, and define improved installation methods.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4280.

Sincerely,

Signature on File

Rudy Powell, Jr., P.E.  
State Specifications Engineer

RP/ft  
Attachment

cc: Calvin Johnson, Chief Civil Litigation  
Florida Transportation Builders' Assoc.  
State Construction Engineer

**TRAFFIC MONITORING SITE VEHICLE SENSOR - ~~CLASS H~~NON-WEIGHT APPLICATIONS.**

(REV ~~6-16-99~~~~11-3-11~~~~3-12~~) (~~FA 7-20-99~~) (~~7-02~~)

PAGE 766. The following new Section is added after Section 715:

**SECTION 741  
TRAFFIC MONITORING SITE VEHICLE SENSOR (~~CLASS H~~NON-WEIGHT APPLICATIONS)**

**741-1 Description.**

Install Traffic Monitoring Site (TMS) ~~Class H~~ Vehicle Sensors of the type and at the location(s) shown on the ~~plans~~Plans. ~~Type I and Type II TMS Vehicle Sensors are used primarily for the collection of traffic volume and vehicle classification data. They are not used to collect weight data. Volume and vehicle classification data are used to develop pavement/roadway designs, lane closure restrictions, traffic forecasting and other planning applications. Use vehicle sensors currently listed on the Department's Approved Products List (APL) and Type I and II sensors must be compatible with the electronics unit to which they will be connected.~~

**741-2-2 Materials: Type I, Axle Sensor (In-Roadway).**

~~741-2.1 General: Ensure Type I axle sensors are axle sensors installed in the roadway and secured using state approved an adhesive bonding material listed on the Approved Products List. They are used in conjunction with inductive loops to detect the number and spacing of all of the axles for each vehicle. This application provides data on the type of vehicle being monitored, i.e. passenger car, bus, tractor trailer, etc. Usually, a six foot long sensor is required to detect vehicle axles in one wheelpath. However, in situations where the lane is wider than normal, an eight foot long sensor may be specified.~~

~~741-2.1 Physical Characteristics, Type I Axle Sensors:~~

<i>Physical Characteristics, Type I Sensors</i>	
<i>Sensor Element Dimensions</i>	<i>6 feet to 8 feet in length (as specified in pPlans), 3/16 inch to 3/8 inch in diameter (varies by manufacturer)</i>
<i>Sensor Element Material</i>	<i>Pressure sensing piezoelectric</i>
<i>Pavement Operating Temperature</i>	<i>0°F to +150°F</i>
<i>Output Signal</i>	<i>Minimum +200mV for passenger/pickup truck axle @ 70°F with less than 10% negative signal</i>

~~Sensor Element Dimensions: 6 feet to 8 feet in length (as specified in plans), 3/16 inch to 3/8 inch in diameter (varies by manufacturer); Sensor Element Material: Pressure sensing piezoelectric;~~

~~Pavement Operating Temperature: 0°F to +150°F;~~

~~Output Signal: minimum +200mV for passenger/pickup truck axle @ 70°F with less than 10% negative signal.~~

**741-2.2 Installation Requirements for Type I Axle Sensors Saw Cuts:** Install sensors in accordance with the requirements of this Section and Design Standard Index No. 17900. Use a chalkline or string and paint to layout the position of the sensor and lead-in cable slots. Ensure ~~the saw cuts should~~ do not deviate more than 0.5 inch from the chalkline. The saw must have a single blade or ganged blades 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. Ensure the ~~s~~Slots for sensor lead-in cables ~~must~~ **must** ~~bear~~ 3.5 inches deep and wide enough to allow unforced placement of the cable.

~~Sensor Placement: Axle sensors are typically installed~~ Install axle sensors in the right-hand wheel-path midway between the leading and trailing loops as detailed in Design Standard Index 17900. ~~Installation in the left-hand wheel-path is allowed in the following situations:~~

~~At locations where no paved shoulder exist and sensor lead exit windows must be~~ installed at the right-hand edge of the roadway surface; or

~~Axle sensors are being installed~~ in a lane which is to the left of and adjacent to an open lane of traffic.

~~The sensor should be installed~~ Install the axel sensor such that the cable end is closest to the pull box to which the sensor lead cable will be routed. Install the ~~The~~ end of the sensor ~~should be installed~~ mid-way into the edge line stripe or lane line stripe, as appropriate. Ensure that the axle sensor being installed has lead-in cables of sufficient length to reach the cabinet without splicing. ~~Splicing axle sensor lead-in cable is not allowed.~~

Installation: Cut the ~~The~~ saw slot ~~should be cut~~ the length of the sensor plus an additional 3- ~~inches~~ to 4- inches. ~~Ensure the~~ ~~The~~ depth and width of the slot ~~will be~~ installed as recommended by the sensor manufacturer, typically 0.75- inches wide by 1 inch deep. ~~Use the clips or jigs provided by the manufacturer to ensure the~~ ~~The~~ sensor will be suspended at a uniform depth in the slot ~~using clips or jigs provided by the manufacturer.~~ ~~Mix and apply the bonding agent ensuring the slot is completely full with no voids beneath the sensor. Route the sensor lead to the pull box and from there to the traffic monitoring site cabinet.- Mark the sensor lead at the pull box and at termination in the cabinet using a permanent marker pen or labeler. -Provide l~~ Lane numbering information ~~will be as specified in the~~ Design Standards Index 17900.

**741-2.3, Test Requirements for Type I Axle Sensors:** ~~Perform the manufacturer's recommended on-site pre-installation test to determine the sensor's condition using an LCR~~ Inductive/Capacitance/Resistance meter. ~~Testing includes resistance across the sensor, capacitance and dissipation at minimum required values as determined by the sensor manufacturer.~~ Install only those sensors that pass the pre-installation test. ~~After installation, repeat the tests at the termination point in the cabinet. In addition, use~~ Use an oscilloscope to view and record typical waveforms and signal intensity measurements for the axles of passenger cars and large trucks. Remove and replace any sensor that fails the test at no additional charge to the Department.

### 741-3 Type II, Wireless Vehicle Sensors (Off-Roadway).

**741-3.1 General:** ~~Type II sensors are wireless devices that utilize microwave radar or other non-intrusive technology to detect and count vehicles across multiple lanes of a roadway. There are no sensors installed in the roadway. The~~ Install Type II wireless ~~detection device~~ vehicle sensors ~~is installed~~ on a pole or structure adjacent to

~~the roadway as shown in the pPlans. Proper mounting height and offset from the roadway are critical components necessary to ensure accurate data collection. These criteria must be evaluated on a site by site basis to determine if Type II sensors are appropriate for the application. Type II vehicle sensors are currently used to obtain vehicle volumes only, but may be expanded to determine vehicle speed/classification as the technology evolves.~~

<i>Physical Characteristics of Type II Sensors</i>	
<i>Detection Zone</i>	<i>A minimum of 8 distinguishable lanes within a minimum 200 feet of detection zone</i>
<i>Enclosure</i>	<i>Weatherproof aluminum, stainless steel or polycarbonate housing</i>
<i>Dimensions</i>	<i>Typically up to 15" X 12" X 6"</i>
<i>Weight</i>	<i>Typically less than 10 lbs</i>
<i>Operating Temperature (Ambient)</i>	<i>0°F to 140°F</i>
<i>Operating Frequency</i>	<i>Wireless transmission in FCC approved band or unlicensed RF range</i>
<i>Communications</i>	<i>RS-232/RS-485 ports, supports minimum 19,200 baud rate</i>
<i>Data Interface</i>	<i>Compatible with the Department's field storage devices (counters) and downloads data via contact closure board using a hardwired connection</i>

~~741-3.1, Physical Characteristics of Type II Sensors~~

~~: A minimum of 8 distinguishable lanes within a minimum 200 feet of detection zone;~~

~~Enclosure: Weatherproof aluminum, stainless steel or polycarbonate housing;~~

~~Dimensions: Typically up to 15" X 12" X 6";~~

~~Weight: Typically less than 10 lbs;~~

~~Operating Temperature (Ambient): 0°F to 140°F;~~

~~Operating Frequency: Wireless transmission in FCC approved band or unlicensed RF range;~~

~~Communications: RS-232/RS-485 ports, supports minimum 19,200 baud rate;~~

~~Data Interface: Compatible with the Department's field storage devices (counters) and downloads data via contact closure board using a hardwired connection.~~

**741-3.2 Installation Requirements:** ~~Ensure that the manufacturer's recommended mounting height and offset from roadway is available for the installation. Install The sensor must be installed, typically on a pole and "aimed" oriented at the roadway such that it is perpendicular to the target lanes of traffic with room to perform horizontal and vertical aiming adjustments. - The Order the Type II sensor must be ordered with sufficient cable length to reach the cabinet without splicing. - Fasten the cable will be fastened to the pole so wind does not move it, or routed the cable within the pole cavity to the cabinet termination point. - Provide slack in the cable at the connections to the sensor and in the cabinet to ensure the cable is stress-free. - The Contractor will~~ **Include the appropriate mounting hardware, contact closure signal that**

corresponds to vehicle presence and the manufacturer's ~~proprietary or recommended~~ surge suppression as a part of the installation.

Using the manufacturer's instructions and software, set up the lane detection zones and verify that the sensor's ~~aim~~ orientation is perpendicular to the roadway. ~~The~~ Configure the Type II sensor ~~will be configured~~ for vehicle volume ~~(counts)~~ unless otherwise specified in the ~~p~~Plans.

**741-3.3 Test Requirements for Type II Vehicle Sensors:** ~~The Contractor will~~ Conduct a visual test to determine that all detection zones ~~(lanes)~~ are being counted accurately. ~~This will be accomplished by~~ Connecting a laptop computer to the electronics unit and observing ~~ing~~ traffic in every lane, ~~and~~ verifying that each vehicle is displayed on-screen. ~~A~~ minimum of twenty vehicles should be observed for each lane of traffic with ~~no "misses"~~ all vehicles counted. ~~-~~ If any vehicles are not counted, reconfigure the Type II sensor ~~must be reconfigured~~ and repeat the visual observation test ~~repeated~~ until all lanes count correctly. If the sensor fails to provide accurate counts after three test attempts, it must be replaced with a new unit at no expense to the Department.

Use a Vehicle Sensor currently listed on the Department's Approved Products List (APL) and compatible with the electronic unit to which they will be connected meeting the following requirements:

	TYPE I		TYPE II
	Unencapsulated	Encapsulated	
Sensor Size	6 to 8 feet [1.8 to 2.4 m] long Flat Element: 3/16 to 1/4 inch [4.76 to 6.35 mm] wide Round Element: 3/16 to 1/4 inch [4.76 to 6.35 mm] dia.	6 to 8 feet long by 1 1/2 by 1 1/2 inch [1.8 to 2.4 m long by 38 by 38 mm]	8 by 10 by 12 inches [203 by 254 by 305 mm]
Encapsulant	Not Encapsulated	Epoxy Binder within an aluminum channel	N/A
Sensing Element	Pressure sensing polymer in flat coax construction	Pressure sensing polymer cable	N/A
Operating Temp.	-40°F to 158°F [-40°C to +70°C]	-40°F to 176°F [-40°C to +80°C]	-35°F to 165°F [-37°C to +74°C]
Output Signal	250 mV for 400 pound wheel load at 70°F [250 mV for 181 kg wheel load at 21°C] Minimum	1 volt signal for average passenger car tire or axel Signal to noise ratio 100:1 or better	N/A
Polarization	Increase in pressure produces positive voltage	Increase in pressure produces positive voltage	N/A
Output	± 20%	± 20%	N/A

	TYPE I		TYPE II
	Unencapsulated	Encapsulated	
Uniformity			
Capacitance	7.2 nF for 6 foot long sensor with 100-foot cable [7.2 nF for 1.8 m long sensor with 30-m cable]	N/A	N/A
Temperature Sensitivity	2% per degree Fahrenheit [2% per degree Celsius]	N/A	Auto-Compensating
Transmission Frequency	N/A	N/A	10.525 Ghz ± 25 MHz
Transmission Power	N/A	N/A	10-mW maximum
Coverage Area	N/A	N/A	Oval shaped detection area: 10 feet [3-m] minimum 200 feet [61-m] maximum Elevation Beam Width 50 degrees Azimuth Beam Width 15 degrees
Detection Zone	N/A	N/A	6 Zones minimum
Enclosure	N/A	N/A	NEMA 3R Aluminum or Stainless Steel
Power	N/A	N/A	9 to 36 vDC or 95 to 135 vAC

— Ensure that the Vehicle Sensor is marked in accordance with Section 748 and the markings are visible after installation.

— Use bonding agents listed on the APL and which are approved for use with the sensor being installed.

— The approval process for equipment and/or material(s) used at a Traffic Monitoring Site is covered in Section 748.

#### 741-3 Installation Requirements:

— **741-3.1 General:** Install the Vehicle Sensor in accordance with the manufacturer's recommended installation procedure, and the Contract Documents.

— **741-3.2 Saw Cuts:** Use a chalk line or equivalent method to outline the perimeter of the sensor on the pavement and routes for lead-in cables. Do not allow the saw cut in the pavement to deviate more than 1 inch [25 mm] from the chalk line. Ensure that all saw cuts are free of any dust, dirt or other debris and completely dry prior to the installation of the loop wire, loop wire twisted pair lead or lead-in cable.

— Make saw cuts sufficient in depth to ensure that the top conductor of the loop wire or lead-in cable is a minimum of 1 inch [25 mm] below the final surface of the roadway.

741-3.3 Piezoelectric Axle Sensor (Type I):

~~741-3.3.1 General:~~ Install the sensor in the right wheelpath of the travel lane, with the lead-in cable orientated toward the pull box to which the lead-in cable will be pulled. Ensure that the end of the sensor element or channel is 6 inches [150 mm] from the right edge of the travel lane, unless otherwise specified in the Contract Documents. Ensure that all lead-in cable(s) are sufficient in length to extend to the traffic monitoring site cabinet without splicing.

~~741-3.3.2 Encapsulated Sensor:~~ Install either a rigid or flexible channel encapsulated sensor flush with the traffic bearing surface of the roadway by sawing a slot into the pavement perpendicular to the flow of traffic, equal to the length of the sensor plus 4 inches [102 mm] by 2 1/4 inches wide by 2 inches deep [57 mm wide by 50 mm deep]. Suspend the sensor within the slot with jigs. Prepare and apply bonding agent in accordance with the sensor manufacturer instructions, ensuring that there are no voids around the sensor and the bonding agent cures to bear traffic within four hours of application. Remove the jigs, after the bonding agent has cured. Route the sensor lead-in cable to the pull box and through the conduit to the traffic monitoring site cabinet. Mark the sensor lead-in cable(s) at the pull boxes and at the point of termination within the traffic monitoring site cabinet with an indelible marker numbering the lanes as specified in the Design Standards.

~~741-3.3.3 Unencapsulated Sensor:~~ Install the unencapsulated sensor by sawing a slot into the pavement perpendicular to the flow of traffic, equal to the length of the sensor plus 4 by 3/4 inch wide by 3/4 inch deep [102 by 19 mm wide by 19 mm deep]. Suspend the sensor within the slot with jigs. Prepare and apply bonding agent in accordance with the sensor manufacturer instructions, ensuring that there are no voids around the sensor and the bonding agent cures to bear traffic within four hours of application. Remove the jigs after the bonding agent has cured. Route the sensor lead-in cable(s) to the pull box and through the conduit to the traffic monitoring site cabinet. Mark the sensor lead-in cable(s) at the pull boxes and at the point of termination within the traffic monitoring site cabinet with an indelible marker, numbering the lanes as specified in the Design Standards.

~~741-3.4 Microwave Radar Vehicle Sensor (Type II):~~ Install the microwave radar sensor as specified in the Contract Documents. Use a NEMA 3R stainless steel or aluminum enclosure to house the sensor. Use stainless steel bands to mount the enclosure to a pole or stainless steel expansion bolts to mount the enclosure to a concrete structure. Mount the sensor 16 to 23 feet [4.9 to 7.0 m] above the surface of the roadway, unless otherwise specified in the Contract Documents.

741-4 Piezoelectric Axle Sensor Test Requirements.

~~Perform the manufacturer's recommended on-site pre-installation test to determine the sensor's condition. Install only those sensors that pass the pre-installation test. Repeat the test, following installation, at the lead-in point of connection in the traffic monitoring site cabinet. Remove and replace any sensor which fails the test at no additional cost to the Department.~~

~~Record representative waveforms for a passenger car, single-unit truck, and a tractor/semi-trailer combination vehicle, for each piezoelectric axle sensor. This requirement may be waived by the Engineer if one or more of these vehicles are not in the traffic stream. Place a copy of the final test results, including the date of installation,~~

~~manufacturer's name, model number for each sensor, type of bonding agent used and recorded waveforms, in a waterproof package in the cabinet and furnish one copy to the Engineer.~~

**741-45 Guaranty Provisions ~~for Type I and Type II Vehicle Sensors.~~**

**741-54.1 Contractor's Responsibility:** Secure all guaranties that are customarily issued by the equipment manufacturers for the specific equipment included in the Contract. Ensure that the form in which such guaranties are delivered includes the provision that they are subject to transfer to the Department, and is accompanied by proper validation of such fact. Transfer guaranties at final acceptance of the work (or equipment) by the Department.

**741-54.2 Terms:** Ensure that the manufacturers of the equipment stipulate the terms of guaranties when submitting a request to the Department for certification and for equipment submittal for construction projects. Include terms for a specified service performance with provisions for repair parts and labor, or for replacement. *Ensure the p*~~Provisions shall~~ define the equipment "installation date" as the date for such guaranty to be in effect. For construction projects, the "installation date" is the first day of equipment "burn-in". For warehouse purchases, the "installation date" is the date of visual inspection approval, not to exceed ten days after delivery date.

**741-54.3 Conditions:** When guaranty is available, ensure that a written and signed guaranty accompanies the manufacturer's billing invoice. The Engineer will sign and retain the original and provide a copy to the manufacturer. If the Contractor does not comply with the terms of the guaranty, the Department may suspend the certification. Comply with additional terms and conditions as stated in purchasing agreements.

**741-6-5 Method of Measurement ~~for Type I and Type II Vehicle Sensors.~~**

**741-65.1 General:** Measurement for payment will be in accordance with the following tasks.

**741-65.2 Furnish and Install:** The Contract unit price each for Vehicle Sensor ~~(Class II)~~, furnished and installed, includes the Vehicle Sensor ~~(Class II)~~, lead-in cable(s), bonding agent, all equipment, materials, and labor necessary for a complete and accepted installation.

**741-65.3 Furnish:** The Contract unit price each for Vehicle Sensor ~~(Class II)~~, furnished, includes the Vehicle Sensor ~~(Class II)~~ and materials as specified in the Contract Documents, plus all shipping and handling costs involved in the delivery as specified in the Contract Documents.

**741-65.4 Install:** The Contract unit price each for Vehicle Sensor ~~(Class II)~~, installed, includes all lead-in cable(s), bonding agent, miscellaneous materials, labor, and equipment necessary for a complete and accepted installation. The Engineer will supply the Vehicle Sensor ~~(Class II)~~.

~~**741-6.5 Modify:** The Contract unit price each for Vehicle Sensor (Class II), modified, as specified in the Contract Documents, includes all labor, equipment and miscellaneous materials necessary for a complete and accepted installation.~~

**741-7-6 Basis of Payment.**

Price and payment will be full compensation for all work specified in this Section. Payment will be made under:

7410000  
741-1 Items

Item No. 741- ~~70~~ *1- Traffic Monitoring Site* Vehicle ~~sensor~~ *Sensor*  
*(Class II) - Non-Weight Applications--* each.  
~~Item No. 2741- 70 — TMS Vehicle sensor (Class II) — each.~~

**TRAFFIC MONITORING SITE VEHICLE SENSOR - NON-WEIGHT APPLICATIONS.**

**(REV 11-3-11)**

PAGE 766. The following new Section is added after Section 715:

**SECTION 741  
TRAFFIC MONITORING SITE VEHICLE SENSOR (NON-WEIGHT APPLICATIONS)**

**741-1 Description.**

Install Traffic Monitoring Site (TMS) Vehicle Sensors of the type and at the location shown on the Plans. Use vehicle sensors currently listed on the Department's Approved Products List (APL) and compatible with the electronics unit to which they will be connected.

**741-2 Type I Axle Sensor (In-Roadway).**

**741-2.1 General:** Ensure Type I axle sensors are installed in the roadway and secured using an adhesive bonding material listed on the Approved Products List

Physical Characteristics, Type I Sensors	
Sensor Element Dimensions	6 feet to 8 feet in length (as specified in Plans), 3/16 inch to 3/8 inch in diameter (varies by manufacturer)
Sensor Element Material	Pressure sensing piezoelectric
Pavement Operating Temperature	0°F to +150°F
Output Signal	Minimum +200mV for passenger/pickup truck axle @ 70°F with less than 10% negative signal

**741-2.2, Installation Requirements:** Install sensors in accordance with the requirements of this Section and Design Standard Index No. 17900. Use a chalkline or string and paint to layout the position of the sensor and lead-in cable slots. Ensure the saw cuts do not deviate more than 0.5 inch from the chalkline. The saw must have a single blade or ganged blades 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. Ensure the slots for sensor lead-in cables are 3.5 inches deep and wide enough to allow unforced placement of the cable.

Install axle sensors in the right-hand wheel-path midway between the leading and trailing loops as detailed in Design Standard Index 17900. Installation in the left-hand wheel-path is allowed at locations where no paved shoulder exist and sensor lead exit windows are installed at the right-hand edge of the roadway surface or in a lane which is to the left of and adjacent to an open lane of traffic.

Install the axle sensor such that the cable end is closest to the pull box to which the sensor lead cable will be routed. Install the end of the sensor mid-way into the edge line stripe or lane line stripe, as appropriate. Ensure that the axle sensor being

installed has lead-in cables of sufficient length to reach the cabinet without splicing. Splicing axle sensor lead-in cable is not allowed.

Installation: Cut the saw slot the length of the sensor plus an additional 3 - to 4 inches. Ensure the depth and width of the slot are installed as recommended by the sensor manufacturer, typically 0.75 inch wide by 1 inch deep. Use the clips or jigs provided by the manufacturer to ensure the sensor will be suspended at a uniform depth in the slot. Mix and apply the bonding agent ensuring the slot is completely full with no voids beneath the sensor. Route the sensor lead to the pull box and from there to the traffic monitoring site cabinet. Mark the sensor lead at the pull box and at termination in the cabinet using a permanent marker pen or labeler. Provide lane numbering information as specified in Design Standards Index 17900.

**741-2.3, Test Requirements:** Perform the manufacturer’s recommended on-site pre-installation test to determine the sensor’s condition using an Inductive/Capacitance/Resistance meter. Install only those sensors that pass the pre-installation test. After installation, repeat the tests at the termination point in the cabinet. Use an oscilloscope to view and record typical waveforms and signal intensity measurements for the axles of passenger cars and large trucks. Remove and replace any sensor that fails the test at no additional charge to the Department.

**741-3 Type II, Wireless Vehicle Sensors (Off-Roadway).**

**741-3.1 General:** Install Type II wireless vehicle sensors on a pole or structure adjacent to the roadway as shown in the Plans

Physical Characteristics of Type II Sensors	
Detection Zone	A minimum of 8 distinguishable lanes within a minimum 200 feet of detection zone
Enclosure	Weatherproof aluminum, stainless steel or polycarbonate housing
Dimensions	Typically up to 15” X 12” X 6”
Weight	Typically less than 10 lbs
Operating Temperature (Ambient)	0°F to 140°F
Operating Frequency	Wireless transmission in FCC approved band or unlicensed RF range
Communications	RS-232/RS-485 ports, supports minimum 19,200 baud rate
Data Interface	Compatible with the Department’s field storage devices (counters) and downloads data via contact closure board using a hardwired connection

**741-3.2 Installation Requirements:** Install the sensor on a pole oriented at the roadway such that it is perpendicular to the target lanes of traffic with room to perform horizontal and vertical aiming adjustments. Order the Type II sensor with sufficient cable length to reach the cabinet without splicing. Fasten the cable to the pole so wind does not move it, or route the cable within the pole cavity to the cabinet termination point. Provide

slack in the cable at the connections to the sensor and in the cabinet to ensure the cable is stress-free. Include the appropriate mounting hardware, contact closure signal that corresponds to vehicle presence and the manufacturer's recommended surge suppression as a part of the installation.

Using the manufacturer's instructions and software, set up the lane detection zones and verify that the sensor's orientation is perpendicular to the roadway. Configure the Type II sensor for vehicle volume unless otherwise specified in the Plans.

**741-3.3 Test Requirements:** Conduct a visual test to determine that all detection zones are being counted accurately. Connect a laptop computer to the electronics unit and observe traffic in every lane, verifying that each vehicle is displayed on-screen. A minimum of twenty vehicles should be observed for each lane of traffic with all vehicles counted. If any vehicles are not counted, reconfigure the Type II sensor and repeat the visual observation test until all lanes count correctly. If the sensor fails to provide accurate counts after three test attempts, it must be replaced with a new unit at no expense to the Department.

#### **741-4 Guaranty Provisions.**

**741-4.1 Contractor's Responsibility:** Secure all guaranties that are customarily issued by the equipment manufacturers for the specific equipment included in the Contract. Ensure that the form in which such guaranties are delivered includes the provision that they are subject to transfer to the Department, and is accompanied by proper validation of such fact. Transfer guaranties at final acceptance of the work (or equipment) by the Department.

**741-4.2 Terms:** Ensure that the manufacturers of the equipment stipulate the terms of guaranties when submitting a request to the Department for certification and for equipment submittal for construction projects. Include terms for a specified service performance with provisions for repair parts and labor, or for replacement. Ensure the provisions define the equipment "installation date" as the date for such guaranty to be in effect. For construction projects, the "installation date" is the first day of equipment "burn-in". For warehouse purchases, the "installation date" is the date of visual inspection approval, not to exceed ten days after delivery date.

**741-4.3 Conditions:** When guaranty is available, ensure that a written and signed guaranty accompanies the manufacturer's billing invoice. The Engineer will sign and retain the original and provide a copy to the manufacturer. If the Contractor does not comply with the terms of the guaranty, the Department may suspend the certification. Comply with additional terms and conditions as stated in purchasing agreements.

#### **741-5 Method of Measurement**

**741-5.1 General:** Measurement for payment will be in accordance with the following tasks.

**741-5.2 Furnish and Install:** The Contract unit price each for Vehicle Sensor, furnished and installed, includes the Vehicle Sensor, lead-in cable(s), bonding agent, all equipment, materials, and labor necessary for a complete and accepted installation.

**741-5.3 Furnish:** The Contract unit price each for Vehicle Sensor, furnished, includes the Vehicle Sensor and materials as specified in the Contract Documents, plus all shipping and handling costs involved in the delivery as specified in the Contract Documents.

**741-5.4 Install:** The Contract unit price each for Vehicle Sensor, installed, includes all lead-in cable(s), bonding agent, miscellaneous materials, labor, and equipment necessary for a complete and accepted installation. The Engineer will supply the Vehicle Sensor.

**741-6 Basis of Payment.**

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 741- 1- Traffic Monitoring Site Vehicle Sensor - Non-  
Weight Applications- each.