



# INDIANA DEPARTMENT OF TRANSPORTATION

*Driving Indiana's Economic Growth*

## Design Memorandum No. 10-27 Technical Advisory

November 22, 2010

**TO:** All Design, Operations, and District Personnel, and Consultants

**FROM:** /s/ David Boruff  
David Boruff  
Traffic Administration Section Supervisor  
Traffic Support Division

**SUBJECT:** Wireless Vehicle-Detection System and Decision-Making Criteria

**REVISES:** *Indiana Design Manual Section 77-4.02(03)*

**ADDS:** *Indiana Design Manual Section 77-4.02(04)*

**EFFECTIVE:** May 11, 2011, Letting

### I. Wireless Vehicle-Detection System

A wireless vehicle detector is similar to a magnetometer detector except that it uses a low-power radio to transmit the signal to a wireless repeater or receiver processor. The signal is recorded by an amplifier and is relayed to the controller as a passage or presence vehicle. The detector is placed in a drilled vertical hole of 0.2 ft (60 mm) depth in the pavement surface. The wireless repeaters and receiver processors should be mounted to the signal structures. The ethernet cable for the receiver processors may be run across span wire on a span-and-strain-pole installation. See Recurring Plan Detail 805-T-173d, included herewith. Wireless vehicle detectors are sufficiently sensitive to detect bicyclists or for use as a counting device. A disadvantage of a wireless vehicle detector is that it should be replaced at least every 10 years, and the wireless repeater's batteries should be replaced every 2 years. See Figure 10-27A for wireless-system typical installation details, or Figure 10-27B for hybrid wireless-system typical installation details.

## **II. Decision-Making Criteria for Use of Detection System Other than Inductive Loops**

Such a system will require plans details. In specifying such a system, the designer should submit documentation that two of the following conditions have been satisfied.

1. An inductive loop design will not function due to a physical limitation such as right-of-way limitations, geometrics, pavement conditions, obstructed conduit paths, etc.
2. A full inductive loop design has been considered and there is a post-design lifecycle cost advantage to using a detection system other than loops. Design-time cost or labor savings will not be considered in lifecycle-cost calculations.
3. A hybrid design using loops at the stop line and wireless magnetometers for advance vehicle detection has been considered and evaluated where wireless magnetometers have been evaluated for advance vehicle detection only, and the hybrid design is the most cost effective, based on post-design lifecycle cost.

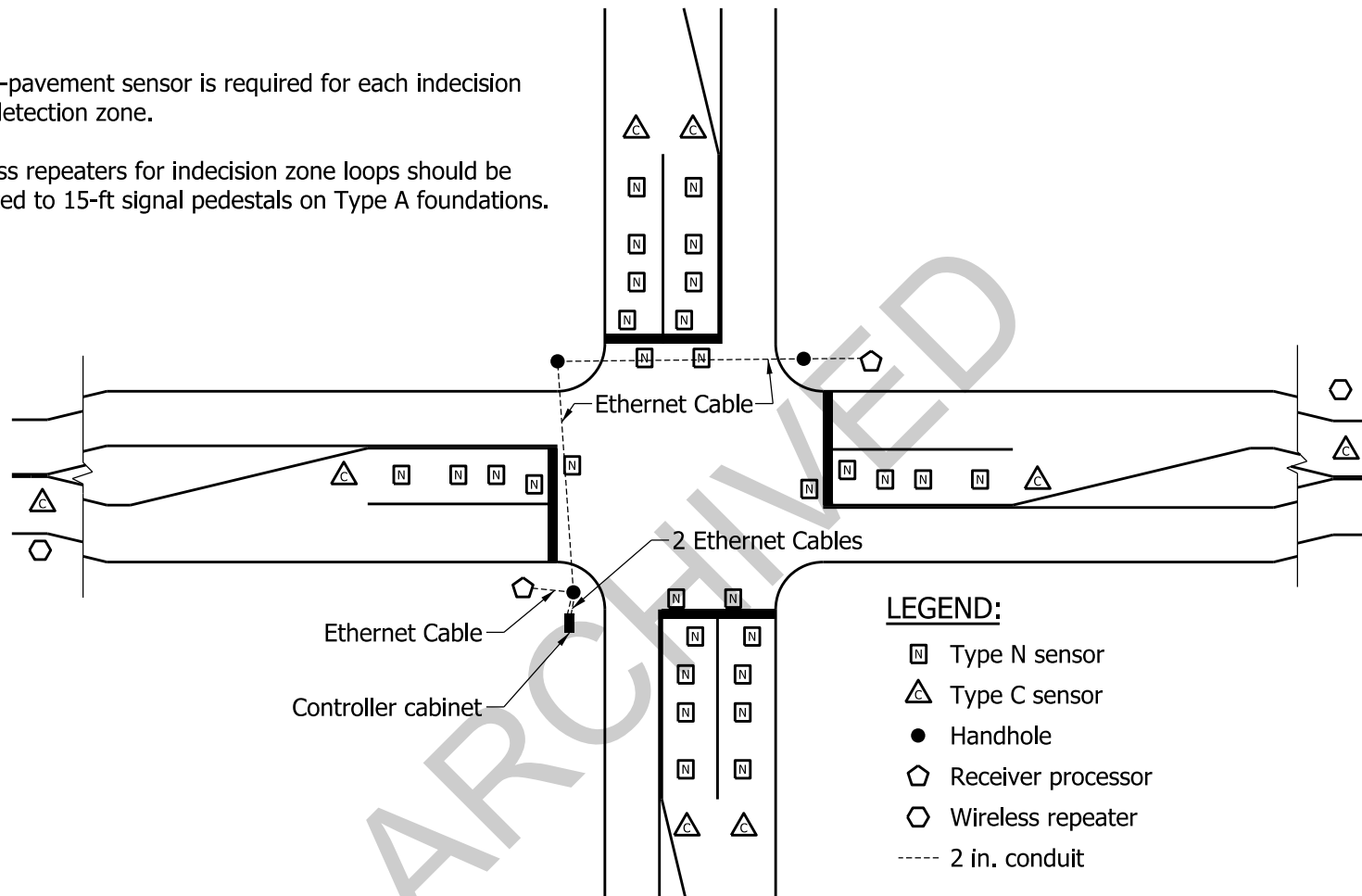
Written concurrence will also be required from the Office of Traffic Control Systems and the district traffic engineer, before wireless vehicle detection may be used at a specific location. For a local-agency project, such concurrence will be required from the local agency.

Recurring Plan Detail 805-T-173d and Recurring Special Provision 805-T-173, also included herewith, should be called for once the required written concurrences are obtained to include this work in the contract.

db:alu  
Attachments

**NOTES:**

1. One in-pavement sensor is required for each indecision zone detection zone.
2. Wireless repeaters for indecision zone loops should be mounted to 15-ft signal pedestals on Type A foundations.

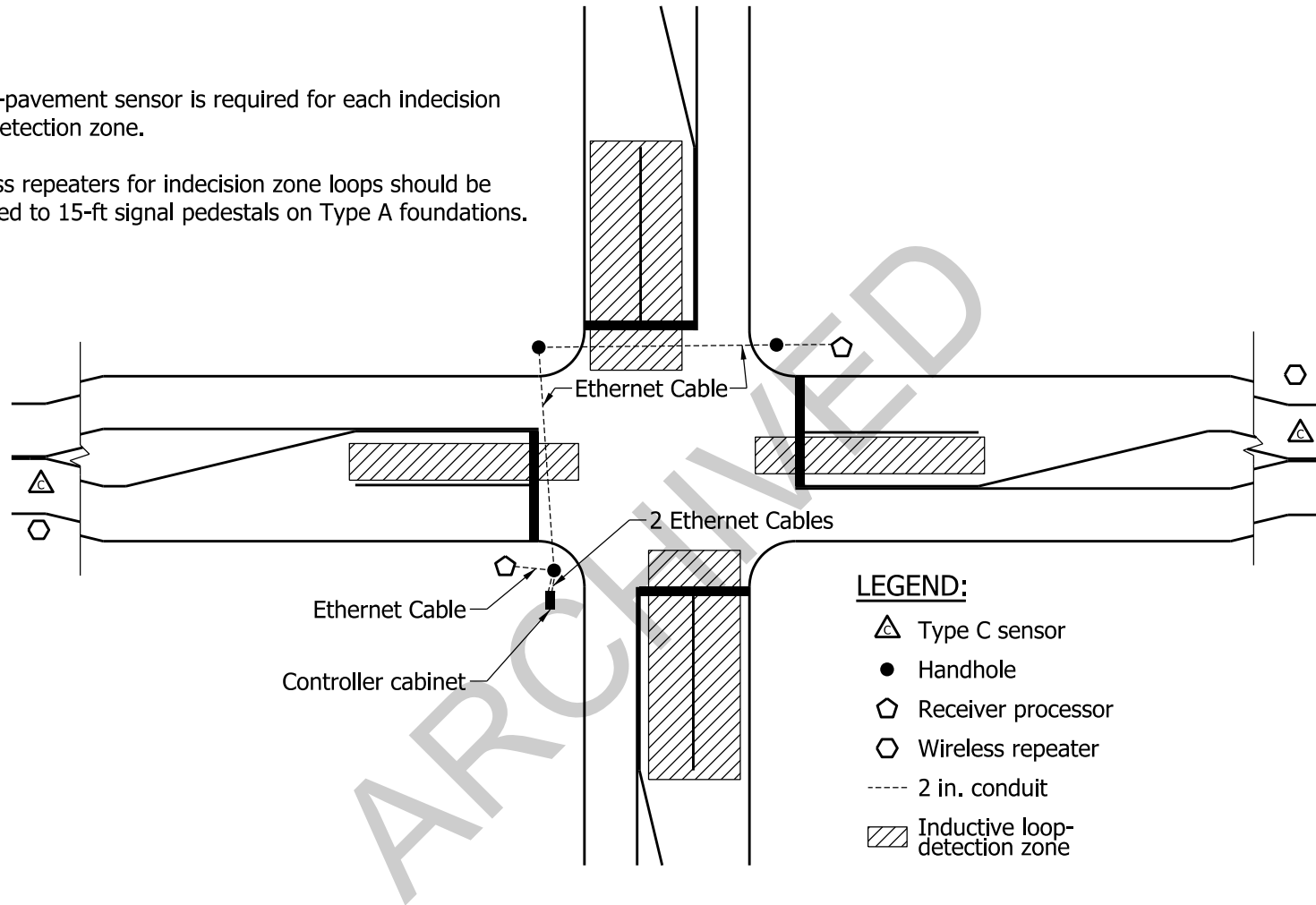


**TYPICAL WIRELESS-VECHICLE-DETECTION SYSTEM**

**Figure 10-27A**

**NOTES:**

1. One in-pavement sensor is required for each indecision zone detection zone.
2. Wireless repeaters for indecision zone loops should be mounted to 15-ft signal pedestals on Type A foundations.



**LEGEND:**

- △ Type C sensor
- Handhole
- ⬠ Receiver processor
- ⬡ Wireless repeater
- 2 in. conduit
- ▨ Inductive loop-detection zone

**TYPICAL HYBRID WIRELESS-VECHICLE-DETECTION SYSTEM**

**Figure 10-27B**

## 805-T-173 WIRELESS VEHICLE DETECTION SYSTEM

(Adopted 09-16-10)

**Description**

This work shall consist of furnishing and installing wireless vehicle detection systems for vehicle detection at traffic signals.

**Materials**

The wireless vehicle detection system, WVDS, is comprised of wireless in-pavement magnetometers, contact closure cards, receiver processors, and wireless repeaters installed for a signalized intersection. The system shall be capable of monitoring vehicles on a roadway via detection of changes in inductance caused by the presence or passage of a vehicle and shall provide detector outputs to a traffic signal controller.

The WVDS shall include in-pavement magnetometers, a minimum of 2 receiver processors, the required mounting equipment, cables, rack mounted cards, set-up and operating software, all connectors, and miscellaneous equipment necessary for the installation and operation of the system. If required, the WVDS shall also include wireless repeaters.

Only models from the Department's approved materials list for traffic signal control equipment shall be used.

Ethernet cable for wireless vehicle detectors shall be outdoor rated and UV shielded.

**Construction Requirements**

Prior to the installation, the Contractor shall test all in-pavement sensors and demonstrate proper operation and communication between the in-pavement sensors and the receiver processor and wireless repeater, if required.

Prior to the installation, the Contractor shall demonstrate that each in-pavement sensor shall be installed within range of its corresponding receiver processor, using wireless repeaters as necessary. All in-pavement sensors assigned to either a receiver processor or wireless repeater shall be located within a 120° arc measured from the receiver processor or wireless repeater.

The Contractor shall install each in-pavement sensor in the roadway according to the manufacturer's recommendations and as shown on the plans. Holes cored in the pavement shall be cleaned and dried before installing in-pavement sensors. The cored pavement shall be backfilled according to the manufacturer's recommendations.

Receiver processors and wireless repeaters shall be mounted on traffic signal steel strain, or cantilever poles, or signal pedestals on type A foundations. The mounting height of receiver processors above the pavement surface shall be between 20 ft (6.0 m) and 35 ft (10.7 m). The mounting height of wireless repeaters above the pavement surface shall be between 13 ft (3.9 m) and 35 ft (10.7 m).

The minimum distance between a receiver processor and wireless repeater mounted on the same structure shall be 2 ft (0.6 m). This distance may be increased to enable better communication between the devices.

After installation, the Contractor shall demonstrate successful communication between each in-pavement sensor, receiver processor, and wireless repeater to the Engineer.

**Method of Measurement**

Wireless magnetometer detectors, contact closure cards, receiver processors and wireless repeaters will be measured by the number of units installed.

**Basis of Payment**

Wireless magnetometer detectors, contact closure cards, receiver processors and wireless repeaters will be paid for at the contract unit price per each.

<b>Pay Item</b>	<b>Pay Unit Symbol</b>
Contact Closure Card.....	EACH
Receiver Processor.....	EACH
Wireless Magnetometer Detector Type_____	EACH
Wireless Repeater.....	EACH

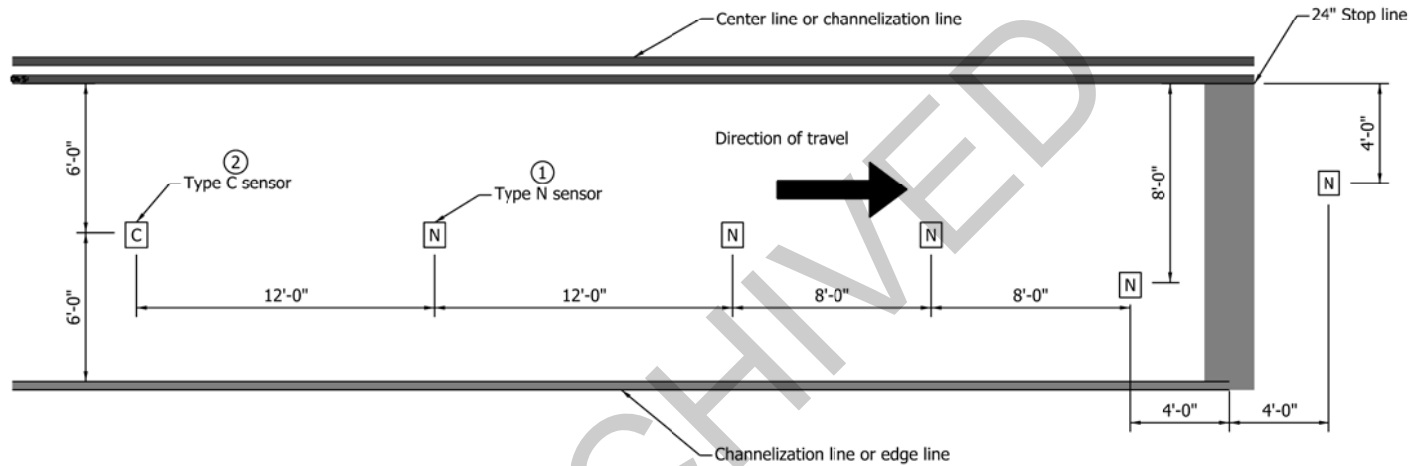
The cost of coring the pavement, sealant, and all work necessary for proper installation and operation of the in-pavement sensors shall be included in the cost of the wireless magnetometer detector.

The cost of cables, connectors, set-up and operating software, access boxes, rack mounted expansion cards, and all hardware necessary to complete the installation shall be included in the cost of the contact closure cards.

The cost of required mounting equipment, cables, connectors, and miscellaneous equipment necessary for proper installation and operation of the receiver processors shall be included in the cost of the receiver processors.

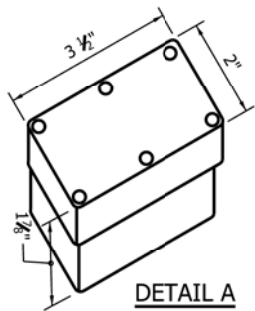
The cost of required mounting equipment, connectors, and miscellaneous equipment necessary for proper installation and operation of the wireless repeaters shall be included in the cost of the wireless repeaters.





**NOTES:**

- ① Type N sensors detect only vehicle presence.
- ② Type C sensors detect vehicle presence and provide vehicle counts.
- 3. There should be at least 1/4" and no more than 1/2" of clearance between the top of the sensor and the top of the pavement



**DETAIL A**

Wireless in-pavement sensor  
(both types)

INDIANA DEPARTMENT OF TRANSPORTATION

WIRELESS VEHICLE DETECTORS  
STOP BAR DETECTION ZONE