



# INDIANA DEPARTMENT OF TRANSPORTATION

## *Driving Indiana's Economic Growth*

### **Design Memorandum No. 16-06** **Technical Advisory**

March 8, 2016

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

**FROM:** /s/David Boruff  
David Boruff  
Manager, Traffic Administration  
Traffic Engineering Division

**SUBJECT:** Portable Signals

**REVISES:** *Indiana Design Manual Section 83-5.0*

**EFFECTIVE:** Lettings on or after September 1, 2016

The referenced section of the *Indiana Design Manual* and section 801 of the *Standard Specifications* have been revised to allow the use of portable signals to control one lane, two-way traffic as part of a maintenance of traffic plan.

#### Concurrence

The determination to use portable rather than fixed signals will be made by the designer with concurrence from the district Traffic Office. Prior to including a portable signal in a contract, the designer must complete the Temporary Traffic Signal Type Determination form and submit it to the district Traffic Engineer for concurrence. The form is available from the Department's Editable Documents webpage, under Traffic Maintenance. The form should be submitted to the district Traffic Engineer as early as possible in the plan development process but at least prior to the Stage 1 plan review.

#### Design

The designer is responsible for developing the signal timing plan and showing placement locations on the plans. When portable signals will be used, the signal phasing and timing plan should be in accordance with the FHWA *Signal Timing Manual*. The Temporary Signal Timing Plan, RSP 801-T-212, must be completed and included in the contract documents.

For a consultant–designed project, the consultant must be prequalified in Category 10.1, Traffic Signal Design.

For an in-house project, the designer should discuss the phasing and timing plan with district Traffic Engineer or the Traffic Management Division Signal Systems Engineer.

The revised *Indiana Design Manual* section includes the design parameters for portable signals and is an attachment to this memo.

#### Approved Material List

Portable Signals must be selected from the Department’s list of approved Portable Signals. Several products are currently under review, and the list will be updated accordingly.

#### Pay Items

New pay items have been created to differentiate fixed temporary traffic signals from portable signals. A supplemental description noting the location, by intersection or route number and reference post for one lane, two-way operations must be included with the use of the fixed temporary signal or portable signal pay item. The cost of vehicle detection is included in the cost of the signal, regardless of type.

Lettings Prior to September 1, 2016	Lettings On or After September 1, 2016
[None]	Portable Signal, 801-12081, LS
Temporary Traffic Signal, 801-53072, LS	Fixed Temporary Signal, 801-12082, LS
Temporary Traffic Signal with Detectors, 801-01851, LS	

Questions regarding the use of portable temporary traffic signals should be directed to the Office of Traffic Administration, Dave Boruff at dboruff@indot.in.gov.

## **83-5.0 TEMPORARY TRAFFIC SIGNAL [Rev. Mar. 2016]**

### **83-5.01 Location**

The use of a temporary traffic signal in a construction zone will be determined on a project-by-project basis. The warrant criteria for permanent installations in Section 502-3.02 should be used to help determine if a temporary traffic signal is warranted. However, the traffic volume expected during construction should be used for the warrant analysis. An Official Action, as described in Section 83-1.03, must be coordinated through the district traffic engineer. Locations where a temporary signal installation may be used include the following:

1. intersection where an existing signal must be maintained;
2. existing non-signalized intersection or drive where construction patterns and traffic volume now warrant a signal;
3. temporary haul road or other temporary access point;
4. long-term one lane, two-way traffic operation (e.g., bridge lane closure); or
5. crossroad or ramp intersection where there is an increase in traffic or there is a decrease in capacity due to the construction.

### **83-5.02 Application [Rev. Mar. 2016]**

The designer should consider the following.

1. **Existing Signals**. The designer should determine the impacts that a construction activity has on existing signal operations and should attempt to maximize the level-of-service. For example, the designer should consider the following:
  - a. recommend re-timing or re-phasing the signal to compensate for changes in traffic volume, mix, or patterns, and for changes in lane designation or intersection-approach geometrics; and
  - b. physically relocating poles or adjusting signal heads to maintain compliance with the *IMUTCD*.

- c. if temporary signals will be used, the designer should develop the signal timing plan and show placement locations on the plans.

Section 502-3.0 and the *IMUTCD* provide design information for a traffic signal.

2. Bridge. If a lane is expected to be closed overnight, a temporary signal should be considered.
3. Type of Temporary Signal – One Lane, Two-Way Traffic Control. A temporary traffic signal may either be fixed or portable, the type selected should be detailed on the plans and the appropriate pay item included in the cost estimate.
  - a. If a temporary traffic signal is chosen as an element of a temporary traffic control plan the designer should consider whether it may be more cost effective to use a portable signal. Portable signals are mounted on trailers rather than wood poles and are generally rented by the contractor. When the need for a temporary traffic signal is expected to be less than six weeks, or the cost to bring electric service to the location is more than \$10,000, portable traffic signals will typically be less expensive. Portable signals require a relatively flat area, approximately 8 ft by 8 ft in size, to accommodate the trailer. If necessary, a temporary landing area for the trailer may be constructed, using suitable material, on the side slope. If a temporary landing area is needed it should be shown on the plans.
  - b. In order to include the portable signal pay item into a contract the designer must obtain concurrence from the district Traffic Office that the portable type is the best option. The Temporary Traffic Signal Type Determination form is available from the Department's [Editable Documents webpage](#), under Traffic Maintenance. The form should be submitted to the district Traffic Engineer as early as possible in the plan development process but at least prior to Stage 1 plan submittal.
4. Type of Temporary Signal - Intersection Traffic Control. In accordance with the *IMUTCD*, Section 4D.32 temporary signals for intersection traffic control must be fixed. However, roads and drives within a one lane, two-way work zone may be controlled by portable signals.
5. Vehicle Detection. Whether fixed temporary or portable, the signal should include vehicle detection. The detection area should be shown on the plans. See Figure 83-5A, Vehicle Detection Typical Placement Areas. The *Standard Specifications* allow the contractor to use either inductive loop or wireless detection for fixed temporary signals,

but only wireless for portable. Where it is determined that another type of detection is needed, a unique special provision should be included in the contract.

6. Phasing/Timing Plans for Portable Signals. If portable signals will be used, the designer should develop the signal phasing and timing plan in accordance with the FHWA *Signal Timing Manual* and complete the Temporary Signal Timing Plan (RSP 801-T-212) and include this in the contract documents.

a. For consultant designs the consultant shall be prequalified in Category 10.1, Traffic Signal Design.

b. For in-house projects the designer should discuss the phasing and timing plan with district Traffic Engineer or the Systems Engineer in the Traffic Management Division.

c. Total cycle length should be limited to 255 seconds and the all red clearance interval to 99 seconds. The following parameters may be used:

i. Actuation should be provided and shown on the plans. See Figure 83-5A, Vehicle Detection Typical Placement Areas.

ii. The minimum green time for both phases is based on driver expectation and may be set at 15 seconds for major arterials regardless of speed and 10 seconds for minor arterials or collectors. The *Signal Timing Manual* allows for lower values based on engineering judgment (see Table 5-3).

iii. The maximum green time for each phase should be exceed the time it takes to clear a peak hour queue but should be limited to no more than 90 seconds for arterials and 40 seconds for collectors. This queue clearance time can be estimated by this equation:

$$G_q = 3 + 2n$$

where,  $G_q$  = green time to clear queue

$n$  = the number of vehicles in the queue

To determine the number of vehicles in queue, the peak hour volume is divided by the number of cycles per hour so establishing  $G_q$  is an iterative process.

iv. Yellow change interval should be based on the approach speed. Yellow change intervals on rural state highways may be set at 4 seconds for 40 mph and 5 seconds for 45 mph or greater.

v. All red clearance phase must be established by calculating the travel time from signal to signal, which is the distance from signal to signal divided by the operating speed.

$$T = d \div \text{avg. operating speed}$$

where, T = travel time for red clearance (seconds);

d = distance between signals (ft)

$$\text{avg. operating speed (ft/sec)} = 1.467 \times \text{avg. operating speed (mph)}$$

The average operating speed through the work zone will depend on many conditions, e.g. truck volume, length of the work zone, lane width, shoulder width, offset to barriers, and pavement condition, but can be estimated at 25 mph.

d. The designer should confirm that the anticipated queue will not encroach upon adjacent intersections. If encroachment is expected additional planning will be needed, e.g. the portable signal may need coordinated with the adjacent signal.

7. Plan Sheets. Show each temporary-signal installation, whether fixed or portable, in the traffic-maintenance plan. The placement locations for temporary signals should conform to the *IMUTCD* requirements for lateral and longitudinal signal positioning. For portable signals the designer should indicate if both signal heads must be mounted overhead.

8. Pay Items. A supplemental description noting the location, by intersection or route number and reference post for one lane, two-way operations, must be included with the use of the fixed temporary signal or portable signal pay item. Vehicle detection is included in the cost of the pay item.