

**Unique 00225 - Smart Work Zone System (2015 Specifications: 06-22-16)**

*(Use this unique specification when a Smart Work Zone System is needed for one or more of the following functions:*

- ***Construction Access System:*** Warns approaching traffic of construction vehicles entering live traffic from the work area (e.g., material hauling, blasting, large earthwork operations, etc.).
- ***Queue Detection System:*** Detects traffic queues in work zones, and warns drivers of changed traffic flow conditions in advance of the work area.
- ***Traffic Information System:*** Provides real-time advance notification of traffic flow conditions, estimated delay, travel times, and alternate route options.

*Insert the applicable subsections below into the appropriate locations in SP00225.*

***NOTE:*** *The Smart Work Zone System Vendor will design the final system. ODOT needs to provide adequate quantities for components in the system. Read all instructional notes carefully.)*

**00225.01(b) Definitions** - Add the following definition:

**Smart Work Zone System** - An automated system composed of a combination of traffic sensors, PCMS, video cameras, communication equipment, and other hardware and software components. The smart work zone system is used to provide real time work zone information, warnings, and guidance to public traffic, and may be referred to by one or more of the following terms based on the expected use for the system:

- Construction Access System - Used for warning public traffic of construction vehicles entering into the traffic stream from the construction site.
- Queue Detection System - Used to warn traffic approaching the work zone of slowed or stopped traffic well in advance of the Project Site.
- Traffic Information System - Used to inform approaching road users about traffic flow conditions, estimated delays, alternate routes, and other information.

Add the following subsection:

**00225.16(c) Smart Work Zone System** - Furnish a smart work zone system from a Smart Work Zone System Vendor listed on the QPL.

*(Use one or more of the following subsections (1), (2), and (3) as instructed below. If a subsection is not used, renumber the subsections to be sequential, beginning with (1).)*

*(Use the following subsection (1) when a Construction Access System is needed. If construction access locations are known, it is recommended that the placement of the system be shown in the plans.)*

**(1) Construction Access System** - Provide a construction access system for each construction access where material or equipment delivery vehicles must merge into the live traffic stream. Include the following system components:

- 1 Portable traffic sensor
- 1 PCMS, including:
  - 6 Plastic drums
  - 1 Type 3 barricade
- A dedicated website or other wireless remote system for monitoring smart work zone system functions and remotely managing PCMS messages.

Use the construction access system components to provide the following:

- Real-time messages on a dedicated PCMS that warns approaching traffic of construction vehicles entering the roadway.
- Detection of construction vehicles passing by the traffic sensor to activate the system and trigger the PCMS display.

Locate the traffic sensor to provide a maximum 5 second delay, or other time as directed, between the construction vehicle reaching the access point and the PCMS message being displayed.

Traffic sensors shall count each construction vehicle passing the sensor, record the date and time each vehicle passes the sensor, and save the construction vehicle count data.

*(Use the following subsection (2) when a Queue Detection System is needed. Show in the plans the "Approximate Limits" for the system. The system should cover from the work site to a (worst-case) point upstream where queuing may develop.*

**NOTES:**

- *For estimating purposes, the nearest PCMS to the work area may be 3 - 4 miles, or more, from the point where queuing first develops (e.g., due to a lane closure). Work Zone Traffic Analysis should be used to determine the extent of potential queuing.*
- *Locate traffic sensors approximately 1/2 mile to 1 mile apart.*
- *Include a minimum of 4 sensors and 1 PCMS in the blanks for each affected direction.*
- *Include additional sensors and PCMS for queues anticipated to exceed 4 miles. Tighter sensor spacing increases system accuracy for queue detection.*

*Assume the first traffic sensor is placed at the beginning of the work area, lane closure, or other point where delays or impacts to speed are likely to begin.)*

*Fill in the blanks with the required number of portable traffic sensors and PCMS.)*

**(2) Queue Detection System** - Provide a queue detection system at each location shown. Include the following system components:

- \_\_\_ Portable traffic sensors
- \_\_\_ PCMS
- 6 Plastic drums for each traffic sensor and each PCMS
- 1 Type 3 barricade for each traffic sensor and each PCMS
- A dedicated website or other wireless remote system for monitoring smart work zone system functions, and to remotely manage PCMS messages

*(Use the following bullet if a PTZ camera is needed.)*

- 1 Pan-Tilt-Zoom (PTZ) camera

Use the queue detection system components to provide the following:

- Real-time messages on the PCMS, warning approaching traffic of slowed or stopped traffic ahead, including dynamic advisory speeds based on measured speeds of traffic before and within the work area.
- Traffic sensors to continually monitor and measure traffic speeds before and within the work area.

*(Use the following bullet if the PTZ camera bullet was used above.)*

- Remote accessibility to live PTZ camera feeds and images being captured by the PTZ camera and, if applicable, remote operation capabilities for the PTZ camera.

Traffic sensors shall trigger the system PCMS to display appropriate messages.

Traffic sensors shall have the ability to count vehicles, record speeds for all vehicles passing the sensor, and record the date and time each vehicle passes the sensor.

*(Use the following subsection (3) when a Traffic Information System is needed. Show in the plans the "Approximate Limits" for the system.*

**NOTES:**

- *System traffic sensors are normally set up before (up to 1 mile) and within the work area. PCMS are placed in advance of major junctions, and on intersecting major routes.*
- *Include a minimum of 4 traffic sensors and 1 PCMS in the blanks for each affected direction. Assume 1/2 - 1 mile spacing for traffic sensors. Tighter sensor spacing increases system accuracy.*
- *For projects with long work areas (> 1.5 miles), add 1 additional traffic sensor for every additional 1/2 mile in work area length. Consider 1 additional PCMS for every mile of additional work area length.*

- *System may extend several miles in advance of the work area, including onto intersecting roads, depending on accesses and interchanges within project limits, available alternate routes, etc.*
- *Consider including additional traffic sensors (one per 1/2 mile) and additional PCMS in advance of the work zone and on intersecting highways for the following conditions:*
  - *Long projects (> 5 miles) with multiple inputs to mainline – particularly major routes or State highways*
  - *Complex projects with a duration of more than one year*
  - *Projects with the potential for frequent extended queues or excess delays*

*Fill in the blanks with the required number of portable traffic sensors and PCMS.)*

**(3) Traffic Information System** - Provide a traffic information system at each location shown. Include the following system components:

- \_\_\_ Portable traffic sensors
- \_\_\_ PCMS
- 6 Plastic drums for each portable traffic sensor and each PCMS
- 1 Type 3 barricade for each portable traffic sensor and each PCMS
- A dedicated website or other wireless remote system for monitoring smart work zone system functions, and to remotely manage PCMS messages.

*(Use the following bullet if a PTZ camera is needed.)*

- 1 Pan-Tilt-Zoom (PTZ) camera

Use the traffic information system components to provide the following:

- Real-time advance warning messages on PCMS, displaying dynamic work zone travel time information, alternate route options, detour route information, or other project-specific information, as shown or as directed.
- Traffic sensors to continually monitor and measure traffic speeds before and within the work area.

*(Include the following bullet if the PTZ camera bullet was used above.)*

- Remote accessibility to live PTZ camera feeds and images being captured by the PTZ camera; and, if applicable, remote operation capabilities for the PTZ camera.

Traffic sensors shall trigger the system PCMS to display appropriate messages.

Traffic sensors shall have the ability to count vehicles, record speeds for all vehicles passing the sensor, and record the date and time each vehicle passes the sensor.

Add the following subsection:

**00225.34 Smart Work Zone System Technician** - Provide a smart work zone system technician skilled in the operation of all system equipment and software. The system technician shall be locally available while the system is in use, and able to respond to system issues in person within 4 hours of notification. The system technician may be an employee of the Smart Work Zone System Vendor. Duties of the system technician include the following:

- Perform all testing and debugging of the system before system turn-on.
- Service and maintain all system components during operation of the system.
- Move portable components, as needed or directed.
- Respond to emergency situations, as needed.
- Maintain all system equipment maintenance logs.

Add the following subsection:

**00225.46(d) Smart Work Zone System** - At least 48 hours before system turn-on:

- Coordinate the deployment and operation of the smart work zone system with the Engineer.
- Provide a copy of the TCP showing the location of each smart work zone system.
- Provide a schedule of the anticipated operation times, dates and durations.

*(Use this paragraph if a PTZ camera is needed.)*

Install PCMS, portable traffic sensors, and trailer-mounted PTZ cameras according to the “PCMS Installation” detail shown on the standard drawings.

*(Use this paragraph if a PTZ camera is NOT needed.)*

Install PCMS and portable traffic sensors according to the “PCMS Installation” detail shown on the standard drawings.

Operate the smart work zone system according to the following:

*(Use one or more of the following three optional subsections as instructed. If using more than one, renumber the second and third, as applicable. Fill in all blanks and replace text that is underlined and in italics.)*

*[ Option 1 - Use this option when a Construction Access System is needed. ]*

**(1) Scheduled Use for a Construction Access System** - Use a construction access system to monitor the construction access on the (*northbound, eastbound, etc.*) side of the \_\_\_\_\_ Highway, at approximate engineering station XXX+XX, during (*Insert a brief description of construction work. Refer to specific Phases or Stages if applicable.*) activities.

*(Use the following paragraph when more than one system is needed in multiple locations at the same or overlapping times.)*

Use an additional construction access system to monitor the construction access on the (northbound, eastbound, etc.) side of the \_\_\_\_\_ Highway, at approximate engineering station XXX+XX, during (Insert a brief description of construction work. Refer to specific Phases or Stages if applicable.) activities.

*(Insert “500” in the blank for low-speed roads (< 45 mph). Insert a value of 1000 to 1500 in the blank for high-speed roads (≥ 45 mph). Show the PCMS in the plans as close as practicable to the distances used. Avoid placing temporary signs between the System PCMS and the construction access. Use, “LEFT” or “RIGHT” in Panel 2, as appropriate.)*

Program the following messages into the PCMS, or as directed:

<b>Panel 1</b>	<b>Panel 2</b>
TRUCKS	SLOW FOR
ENTERING	TRUCKS
_____ FT	ON RIGHT (or LEFT)

Locate traffic sensors and PCMS as shown, or as recommended by the smart work zone system technician.

*[ End Option 1 ]*

*[ Option 2 - Use this option when a Queue Detection System is needed. ]*

**(1) Scheduled Use for a Queue Detection System** - Use a queue detection system on the \_\_\_\_\_ Highway to monitor traffic queuing in the (northbound, eastbound, etc.) direction during (Insert a brief description of construction work. Refer to specific phases/stages of traffic control if applicable.) activities.

*(Use the following paragraph when more than one Queue Detection System is needed in multiple locations at the same or overlapping times.)*

Use an additional queue detection system to monitor traffic queuing on the \_\_\_\_\_ Highway in the (northbound, eastbound, etc.) direction during (Insert a brief description of construction work. Refer to specific phases/stages of traffic control if applicable.) activities.

*(Use the following paragraphs and PCMS message if sporadic queuing is anticipated. Fill in the blank with the same value used in subsection “a. Traffic Sensor Thresholds” below.)*

*[ Begin Sporadic Queuing language ]*

Locate traffic sensors and PCMS as shown, or as directed. Program PCMS messages as shown below, or as directed:

<b>Panel 1</b>	<b>Panel 2</b>
PREPARE	SLOW

TO STOP  
AHEAD

TO  
\_\_\_ MPH

Program the PCMS to stop displaying the message three minutes after an extended traffic queue is no longer detected.

**[ End Sporadic Queuing language ]**

*(Use the following paragraphs and PCMS messages if frequent or significant extended traffic queuing is anticipated, and two PCMS are included in the system to manage traffic queues (see 00225.16 above). Fill in the blank with the same value used in subsection "a. Traffic Sensor Thresholds" below.)*

**[ Begin Frequent or Significant Queuing language ]**

Program the following messages into the system PCMS closest to the work area:

**Panel 1**

STOPPED  
TRAFFIC  
AHEAD

**Panel 2**

WARNING  
PREPARE  
TO STOP

Program the following messages into the next closest system PCMS to the work area:

**Panel 1**

SLOWED  
TRAFFIC  
AHEAD

**Panel 2**

SLOW  
TO  
\_\_\_ MPH

Program the PCMS to stop displaying the message 3 minutes after an extended traffic queue is no longer detected.

**[ End Frequent or Significant Queuing language ]**

**a. Traffic Sensor Thresholds** - Locate traffic sensors and PCMS as directed. Program traffic sensor thresholds as follows:

*(Use the following paragraph if using only one PCMS in the system. Fill in the blank with a value as indicated for the pre-construction posted speed and highway type:*

- *> 55 mph, divided highways/freeways: Use 30 mph below posted speed*
- *45 –55 mph, other high-speed roads: Use 25 mph below posted speed*
- *< 45 mph, low-speed roads: Use 20 mph below posted speed)*

Program traffic sensors to trigger messages for the PCMS when the average measured traffic speed drops below \_\_\_ mph.

*(Use the following two paragraphs if using two PCMS in the system. Fill in the blank with a value as indicated for the pre-construction posted speed and highway type:*

- *> 55 mph, divided highways/freeways: Use 40 mph below posted speed*
- *45 –55 mph, other high-speed roads: Use 30 mph below posted speed*
- *< 45 mph, low-speed roads: Use 20 mph below posted speed)*

For the PCMS closest to the work area, program traffic sensors to trigger the display of the messages when the average measured traffic speed drops below \_\_\_\_ mph.

*(Fill in the blank with a value as indicated for the pre-construction posted speed and highway type:*

- *> 55 mph, divided highways/freeways: Use 35 mph below posted speed*
- *45 –55 mph, other high-speed roads: Use 25 mph below posted speed*
- *< 45 mph, low-speed roads: Use 15 mph below posted speed)*

For the next closest PCMS to the work area, program traffic sensors to trigger the display of the messages when the average measured traffic speed drops below \_\_\_\_ mph.

**[ End Option 2 ]**

**[ Option 3 - Use this option when a Traffic Information System is needed. ]**

**(1) Scheduled Use for Traffic Information System** - Use a traffic information system to display real-time traffic information on the \_\_\_\_\_ Highway in the (northbound, eastbound, etc.) direction during Stage \_\_\_\_, Phase \_\_\_\_, during (brief description of construction work) activities.

*(Include the following paragraph when more than one system is needed in multiple locations at the same or overlapping times.)*

Use an additional traffic information system to display real-time traffic information on the \_\_\_\_\_ Highway in the (northbound, eastbound, etc.) direction during Stage \_\_\_\_, Phase \_\_\_\_, during (brief description of construction work) activities.

Locate system PCMS and traffic sensors, and program PCMS messages, as directed.

**[ End Option 3 ]**

*(Use the following subsections (2) and (3) for all Smart Work Zone Systems. Renumber the subsections appropriately if more than one of the optional subsections above were used.)*

**(2) Traffic Data Logs** - Maintain a traffic data log with date and time stamps for each smart work zone system. At the completion of the Project, provide all traffic data logs on CD-ROM, DVD, or portable flash drive in Microsoft Excel format.



**(3) Agency Access to System and System Data** - Provide password protected access to the smart work zone system components and website. Provide passwords to the Engineer and identified Agency personnel. Access shall allow authorized personnel to:

- Retrieve and graph collected volume and time data
- Within collected data, view when the system sensor was triggered and what message was displayed on the PCMS
- Change PCMS messages
- Operate system cameras

**00225.66 Portable Electrical Signs** - Add the following to the end of this subsection:

If a smart work zone system or any of its components malfunctions, do the following:

- Notify the Engineer.
- Take the smart work zone system out of service and make repairs.
- Place the system back in service within 48 hours of the notification .

Maintain a service and repair log for the smart work zone system that includes dates, times and descriptions for at least the following information:

- When service and maintenance were performed.
- Equipment that was serviced and why service was necessary.
- Durations of operational and equipment failures.
- All operational and equipment failures.
- All repairs that were made.

Keep the log with the smart work zone system.

While the smart work zone system is in use, keep repair equipment and parts on the Project Site, or other location that will allow system repairs to be completed within 48 hours of the notification.

***(Use the following paragraph when a Construction Access System is included.)***

If a construction access system goes out of service, immediately install temporary signing as directed, or immediately install a "TRUCKS ENTERING HIGHWAY XXXX FT" (CW23-7-54) sign in advance of the construction vehicle access at sign spacing "A" from the "TCD Spacing Table" shown on the standard drawings. Locate the sign on the same side of the roadway as the access. The sign may be installed on a TSS.

***(Use the following paragraph and PCMS Message when a Queue Detection System is included. Do not fill in the blank.)***

If the queue detection system being used to monitor traffic queues goes out of service, immediately provide a PCMS to display the following messages until the system is repaired and functioning properly. Locate the PCMS and program the appropriate distance, as directed:

**Panel 1**  
TRAFFIC  
SLOWED  
AHEAD

**Panel 2**  
SLOWED  
TRAFFIC  
NEXT \_\_\_ MI

Add the following subsection:

**00225.86(c) Smart Work Zone System** - The quantities of smart work zone mobilization will be measured on the unit basis. The quantities will be limited to those in the approved TCP unless otherwise approved by the Engineer.

The quantities of use of the smart work zone system will be measured on the time basis. If the smart work zone system malfunctions for more than a total of 2 hours within a single day, no measurement will be made for the smart work zone system for that day unless otherwise approved by the Engineer.

**00225.96 Temporary Electrical Signs** - Add the following pay items to the pay item list:

- (c) Smart Work Zone System Mobilization .....Each
- (d) Smart Work Zone System ..... Day

Add the following three paragraphs after the paragraph that begins "Items (a) and (b)...":

Item (c) includes moving personnel, equipment, supplies, and incidentals to and from the Project Site.

Item (d) includes all hardware, software, system-specific PCMS, traffic sensors, PTZ cameras, and other equipment needed for the system to operate properly.

If the smart work zone system malfunctions for more than a total of 2 hours within a single day, no payment will be made for the smart work zone system for that day unless otherwise approved by the Engineer.

Add the following paragraph to the end of this subsection.

No separate or additional payment will be made for relocating and repositioning the smart work zone system, for the services of the smart work zone system technician, or for providing and installing temporary signs or PCMS while required systems are out of service.