

S-28 **(2104) REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES**

Abandoned structures and other obstructions shall be removed from the Right of Way and disposed of in accordance with the provisions of MnDOT 2104, except as modified below:

S-28.1 All removal and disposal operations shall be incidental. The removal of any unforeseen obstruction requiring in the opinion of the Engineer equipment or handling substantially different from that employed in excavation operations, will be paid for as Extra Work as provided in MnDOT 1402.5.

S-29 **(2563) PORTABLE CHANGEABLE MESSAGE SIGN**

The Contractor shall furnish, install, maintain and remove Portable Changeable Message Signs in accordance with Contract provisions, as directed by the Engineer and the following:

S-29.1 The Portable Changeable Message Signs shall be trailer mounted three line, DOT signs with eight characters per line with a character height of 18 inches [450 mm] as approved by the Engineer.

S-29.2 (PCMS) Type C Trailer Mounted Message Signs will be permitted and shall be on the Approved Products List for “Changeable Message Signs: Type C - Three Lines, Trailer Mounted” as found at: <http://www.dot.state.mn.us/products/temporarytrafficcontrol/tcceelectronicsequipment.html>. It is imperative that the Contractor continually operate each PCMS at maximum legibility. Many factors, such as mechanical problems, insufficient charging, incorrect intensity settings, or other factors can degrade performance. If at any time the Contractor fails to operate a Portable Changeable Message Sign at maximum legibility, as determined by the Engineer, no payment will be made for each day that the Message Sign is deemed inadequate.

S-29.3 The changeable message signs shall be in operation within 24 hours of notification by the Engineer. Remove the changeable message signs within 24 hours after notification by the Engineer. Multiple mobilizations of the changeable message signs will be required and shall be incidental. The changeable message signs shall be subject to approval of the Engineer. All maintenance and repair as required will be incidental.

S-29.4 Except as approved by the Engineer, the message sign shall be stored off the shoulder when not in use. Delineate the changeable message sign according to Layout 4 (Partial Shoulder Closure) in the Field Manual if the Engineer permits the sign to remain on the shoulder.

S-29.5 When not being actively used as a traffic control device, the Portable Changeable Message Sign shall be stored beyond the clear zone distance. **Non-compliant charges, for each incident, will be assessed at a rate of \$500.00 per incident that the Engineer determines that the Contractor has not complied.**

S-29.6 Measurement will be made by the number of Portable Changeable Message Signs furnished and installed per day of service (Unit Day) as specified.

S-29.7 Payment for Portable Changeable Message Signs furnished and installed, as directed by the Engineer, will be made under Item 2563.613 (Portable Changeable Message Sign) at the Contract bid price per Unit Day. This payment shall be compensation in full for all costs incidental thereto, including but not limited to furnishing and installing the signs with appropriate message, maintaining the signs, revising the messages as directed by the Engineer, and removing the signs at the direction of the Engineer. The Portable Changeable Message Signs shall remain the property of the Contractor.

S-30 **(2563) DYNAMIC MERGE SYSTEM**

This Project will utilize a Dynamic Merge (DM) System. The system shall be fully automated and a stand-alone system, capable of providing real-time information in early and late merge conditions. The system must be able to collect data on the current traffic conditions prior to a lane closure. Under predefined traffic

conditions, Portable Changeable Message Signs (PCMS) must display merging instructions to motorists in the section of roadway preceding the lane closure.

S-30.1 SYSTEM REQUIREMENTS:

This item shall consist of furnishing, installing, relocating, operating, and maintaining an automated, portable, real-time work zone system meeting the requirements noted herein, during the duration of the Project. Included in the operational responsibilities is the assuming of all communication costs such as cellular telephone, satellite, and internet subscription charges. In addition to these requirements, the Contractor shall assume all responsibility for any damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the systems deployment.

- (A) All DM Systems shall be on **MnDOT's Qualified Products List for Traffic Control Devices** which can be found on Mn/DOT's Office of Traffic, Security and Operations' website.
- (B) Qualified DM Systems shall consist of at least the following components:
 - 1) At least three Portable Changeable Message Signs (PCMS) per lane closure (expandable based on the specific project).
 - 2) Sufficient Equipment Control Units (ECU) to maintain continuous, dynamic communication to deliver appropriate messaging to the PCMS's, and to provide remote access to the system for operation, malfunction detection and data collection.
 - 3) Sufficient traffic detection device(s) to achieve the desired dynamic traffic control.

S-30.2 SYSTEM OPERATION:

The DM System shall detect a minimum of 2 distinct traffic conditions:

- (A) Free Flow:
Definitions of free-flow may vary by project, but typical traffic condition warrants may include:
 - 1) A trend of vehicle speeds at two points above an adjustable parameter. This parameter should be set for optimal results based on on-site monitoring and review as directed by the Engineer. Typically 50 mph may be utilized as a guideline.
 - 2) A trend of vehicle speeds at two points above an adjustable parameter. This parameter should be set for optimal results based on on-site monitoring and review as directed by the Engineer. Typically 50 mph may be utilized as a guideline.
 - 3) A trend of vehicle volume between two points below an adjustable parameter. This parameter should be set for optimal results based on on-site monitoring and review as directed by the Engineer. Typically 1000 vehicles/hour may be utilized as a guideline.
 - 4) A trend including reduced vehicle speeds together with increased volume. These parameters should be set for optimal results based on on-site monitoring and review as directed by the Engineer.

During Free Flow conditions, the DM System shall display no lane use messages, and therefore allow traffic to resume typical early merge operation.

- (B) Congestion:
Definitions of congestion may vary by project, but typical traffic condition warrants may include:
- 1) A trend of vehicle speeds at two points below an adjustable parameter. This parameter should be set for optimal results based on on-site monitoring and review as directed by the Engineer. Typically 20 mph may be utilized as a guideline.
 - 2) A trend of vehicle volume between two points above an adjustable parameter. This parameter should be set for optimal results based on on-site monitoring and review as directed by the Engineer. Typically 1500-1700 vehicles/hour may be utilized as a guideline.
 - 3) A trend including reduced vehicle speeds together with increased volume. These parameters should be set for optimal results based on on-site monitoring and review as directed by the Engineer.

S-30.3 When traffic conditions warrant a change to the dynamic merge strategy, the DM System shall display lane use messages on the PCMS(s). The messages shall consist of two alternating displays as described below. The PCMS(s) shall be located in advance of the lane closure as determined by the Engineer based upon estimated queue lengths and Project geometry. Approximate locations for various stages will be shown on the Plans.

- (A) PCMS located at point of merge shall display:
MERGE HERE – TAKE TURNS
- (B) Intermediate PCMS located beyond estimated queue length at the time when DM System activation will occur shall display:
MERGE AHEAD – USE BOTH LANES
- (C) PCMS located beyond estimated maximum queue length shall display:
STOPPED TRAFFIC AHEAD – USE BOTH LANES

S-30.4 SYSTEM PERFORMANCE:

(A) Continuous Operation: The DM System shall be active 24/7 for the duration of the Project as per the Project definition.

(B) Traffic Detectors: All sensors shall be of a type whose accuracy is not degraded by inclement weather or degraded visibility conditions including precipitation, fog, darkness, excessive dust, and road debris.

(C) Data Logging: The DM System shall capture a continuous event log including all traffic conditions, all System State changes, and all changes in the message displayed.

- (D) Remote Access:
- 1) System Data Log: Password-protected users shall have the capability to view all system log data and create graphs based on available data with time and date stamps. At the request of the Engineer, the vendor shall provide the Department with this logged information on disk at any time during the project.
 - 2) System Assessment: The DM System shall be configured to assess any type of malfunction that has occurred. This assessment includes communication disruption between any device in the system and any device malfunctions including PCMS malfunctioning. The system shall be capable of notifying the Engineer's office and the Contractor about any system malfunction.

- 3) Remote Control: The DM System shall include the capability to allow a password-protected user to reset the system state via the internet using cell phone, desktop, or other "connected" PDA.
- 4) Remote Monitoring: The DM System shall have the capability of real-time remote monitoring and PCMS control.

(E) Manual Control: The DM System shall be manually controllable on-site. The capability to switch between states of free-flow and congestion allows for maximum flexibility.

S-30.5 SYSTEM TRAINING:

Interested parties shall attend an education and training session at or near the time and place of the construction kick-off meeting. The training shall include at least one representative from each of the following entities:

Local Highway Patrol
Prime Contractor
Department of Transportation representative
Others

The training shall consist of at least a review of the following:

- Data Sheets indicating what messages will be conveyed.
- In the event of an emergency, instructions on how to override system messages.
- In the event of a power failure, instructions detailing how to power cycle the system.
- Basic listing of what to monitor, and what causes messages to change.
- List of telephone numbers to call to request technical support.
- Data Logging, printing reports, and graphing results.

S-30.6 SYSTEM WARRANTY, MAINTENANCE, AND SUPPORT:

The DM System shall be maintained, supported, and warranted against material defects by its supplier through the duration of the deployment.

The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning any request for correcting any deficiency in the system. If the Contractor is negligent in correcting the deficiency within two hours of notification the Contractor shall be subject to the hourly charge of \$250.00 as set forth in Section S-26 (FAILURE TO COMPLETE THE WORK ON TIME) of these Special Provisions.

S-30.7 MEASUREMENT and PAYMENT:

Measurement and payment will be made at the Contract Unit Price Per Day (or Weekly) (or Monthly) which shall be compensation in full for furnishing, installing, maintaining and removing the system, including the PCMS's. Any relocation or repositioning along the Project or removal of equipment from the Project will be incidental to the Contract unit price for rental.

Payment will be made under Item 2563.613 (Dynamic Merge System) at the Unit Day Contract bid price.

NOTE: UNIT MONTH is defined as the System maintenance, and all associated costs to provide and maintain detection, automation and display of the system as a whole for any period more than fourteen (14) days and less than thirty (30) days.

S-31 **FINAL ESTIMATE AND FINAL PAYMENT**

The following provisions shall apply to preparation of the Final Estimate and execution of Final Payment under this Contract:

S-31.1 **FINAL ESTIMATE**

State Law provides that the final estimate will be made within 90 days after completion of all work required under this Contract. If, however, the total value of the Contract exceeds \$2,000,000.00, the 90 day requirement will not apply and the time allowed for making such final estimate shall be 180 days after the work under this Contract has been, in all things, completed to the satisfaction of the Commissioner.

S-31.2 **FINAL PAYMENT**

If this Contract contains a "Disadvantage Business Enterprise or Targeted Group Business" goal, the following requirement shall apply:

"Before final payment is made, the Contractor shall also complete an affidavit showing the total dollar amounts of work performed by disadvantaged business enterprise (DBE) and targeted group business (TGB) and/or veteran-owned small business."