MAINTENANCE OF TRAFFIC – SMART WORK ZONE SYSTEM
(REV 1-31-23)

ARTICLE 102-1 is deleted and the following substituted:

102-1 Description.

Maintain traffic within the limits of the project for the duration of the construction period, including any temporary suspensions of the work. Construct and maintain detours. Provide facilities for access to residences, businesses, etc., along the project. Furnish, install, and maintain traffic control and safety devices during construction. Furnish and install work zone pavement markings for maintenance of traffic (MOT) in construction areas. Provide any other special requirements for safe and expeditious movement of traffic specified in the Temporary Traffic Control Plans. MOT includes all facilities, devices and operations as required for safety and convenience of the public within the work zone.

Incorporate smart work zone (SWZ) field devices as shown in the plans that can provide work zone data per the USDOT Work Zone Data Exchange (WZDx) specifications available at https://www.transportation.gov/av/data/wzdx. The WZDx data feed will be made available to the Department as per 102-9.1.

Do not maintain traffic over those portions of the project where no work is to be accomplished or where construction operations will not affect existing roads. Do not obstruct or create a hazard to any traffic during the performance of the work and repair any damage to existing pavement open to traffic.

ARTICLE 102-2 is deleted and the following substituted:

102-2 Materials.

Meet the following requirements:

Raised Pavement Marker Adhesive*	Section 706
Paint*	Section 710
Pavement Marking Materials*	Section 971
Temporary Raised Pavement Markers*	Section 990
Temporary Traffic Control Device Materials*	Section 990
Retroreflective and Nonreflective Sheeting for Temporary Traffic Control Devices*	Section 994

* Use products listed on the Department's APL.

102-2.1 Temporary Traffic Control Devices: Use only the materials meeting the requirements of Section 990, Section 994, Standard Plans, and the Manual on Uniform Traffic Control Devices (MUTCD).

102-2.2 Detour: Provide all materials for the construction and maintenance of all detours.

102-2.3 Commercial Materials for Driveway Maintenance: Provide materials of the type typically used for base, including reclaimed asphalt pavement (RAP) material, and having stability and drainage properties that will provide a firm surface under wet conditions.

ARTICLE 102-3 is deleted and the following substituted:

102-3 Specific Requirements.

102-3.1 Beginning Date of Contractor's Responsibility: Maintain traffic starting the day work begins on the project or on the first day Contract Time is charged, whichever is earlier.

102-3.2 Worksite Traffic Supervisor: Provide a Worksite Traffic Supervisor who is responsible for initiating, installing, and maintaining all temporary traffic control devices as described in this Section and the Contract Documents. Provide all equipment and materials needed to set up, take down, and maintain temporary traffic control, and handle traffic-related situations. Provide the Worksite Traffic Supervisor or designee with a tablet or smartphone with internet access for recording information into the Department's lane closure notification system. Use approved alternate Worksite Traffic Supervisors when necessary.

The Worksite Traffic Supervisor must meet the personnel qualifications specified in Section 105.

The Worksite Traffic Supervisor must be trained by the manufacturer on the operation and maintenance of the portable SWZ devices and SWZ location devices.

The Worksite Traffic Supervisor is to meet the following requirements and perform the following duties:

1. On site direction of all temporary traffic control on the project.
2. Is on site during all set up and take down, and performs a drive through inspection immediately after set up. During operations with lane closures, the Worksite Traffic Supervisor or on-site designee shall record lane closure information into the Department's lane closure notification system in accordance with 102-3.3.
3. Is on site during all nighttime operations ensuring proper temporary traffic control.
4. Immediately corrects all safety deficiencies and corrects minor deficiencies that are not immediate safety hazards within 24 hours.
5. Is available on a 24 hour per day basis and present at the site within 45 minutes after notification of an emergency situation and is prepared to respond to maintain temporary traffic control or to provide alternate traffic arrangements.
6. Conducts daily daytime and weekly nighttime inspections of projects with predominately daytime work activities, and daily nighttime and weekly daytime inspections of projects with predominantly nighttime work activities of all traffic control devices, traffic flow, pedestrian, bicyclist, and business accommodations.
7. Performs routine SWZ device physical inspection for functionality once per week and verify operational status and location.
8. Coordinates with the District Traffic Management Center for the operation of the SWZ devices.
9. Actively reviews the performance of the work zone to adjust the location of the SWZ devices.

Advise the project personnel of the schedule of these inspections and give them the opportunity to join in the inspection as deemed necessary.

The Department may disqualify and remove from the project a Worksite Traffic Supervisor who fails to comply with the provisions of this Section. The Department may temporarily suspend all activities, except traffic, erosion control and such other activities that are necessary for project maintenance and safety, for failure to comply with these provisions.

102-3.3 Lane Closures: Approval for all lane closures, mobile operations, and traffic pacing operations is required. Submit routine requests to the Engineer 14 calendar days in advance of planned lane closures, mobile operations, and traffic pacing operations. For unforeseen events that require cancelling or rescheduling lane closures, mobile operations, and traffic pacing operations, revise the lane closure request as soon as possible.

Record information for planned lane closures, including but not limited to begin and end lane closure times and locations, into the Department's lane closure notification system. Closure information is to be recorded within five minutes of placing the first channelizing device and removing the last channelizing device associated with the closure.

At the preconstruction conference, submit a request for access to the Department's lane closure notification system to the Engineer. Include the WTS's or designees' name, email address, and a copy of the individual's certification of training for the Department's lane closure notification system. For change of access requests, submit a request to the Engineer at least ten calendar days in advance of when the change is needed.

Information recorded in Department's lane closure system is for public information purposes and will not be used for contract administration.

102-3.3.1 Traffic Pacing: In addition to dates and locations, include a pacing plan outlining the expected equipment and number of traffic control officers required, the proposed traffic pacing lengths and durations, the available existing egresses in the event of an emergency, and a contingency plan in the event of an equipment failure.

102-3.4 Pedestrian and Bicycle Accommodations: Provide accommodations for pedestrians as shown in the Temporary Traffic Control (TTC) plans or as directed by the Engineer. Accommodate pedestrians with a safe, accessible travel path around work sites separated from mainline traffic in compliance with the Americans with Disabilities Act (ADA) Standards for Transportation Facilities (i.e., stable, firm, slip-resistant, and free of any obstruction or hazards such as holes, debris, mud, construction equipment, and stored material). When a work operation requires a sidewalk or pedestrian way closure for 60 minutes or greater, provide a pedestrian detour or temporary pedestrian way. Provide and maintain pedestrian detours and temporary pedestrian ways that are ADA-compliant as described above.

Provide appropriate signs for advanced notification of sidewalk closures and marked detours. Only approved pedestrian longitudinal channelizing devices may be used to close or delineate a pedestrian walkway.

Provide accommodations for the closure of bicycle facilities (i.e., marked bicycle lanes or paved outside shoulders 4 feet or greater in width on non-limited access roadways) as shown in the TTC plans or as directed by the Engineer.

Existing businesses in work areas are to be provided with adequate entrances for vehicular and pedestrian traffic during business hours.

ARTICLE 102-9 is deleted the following substituted:

102-9 Temporary Traffic Control Devices.

102-9.1 General: With the exception of SWZ devices, use only devices that are listed on the APL and use in conformance with the APL drawings. Immediately remove or cover, using any method of covering approved by the Engineer, any existing or temporary devices (e.g., signs) that do not apply to current conditions.

The use of NCHRP Report 350 Recommended Procedures for the Safety

Performance Evaluation of Highway Features devices purchased prior to January 1, 2020 is permitted on projects let prior to January 1, 2030. All devices manufactured or purchased on or after January 1, 2020, must be MASH compliant in accordance with Section 990.

The APL number is to be permanently marked on the device at a readily visible location. Sheeting used on devices and pavement markings are exempt from this requirement.

Notify the Engineer in writing of any scheduled operation that will affect traffic patterns or safety sufficiently in advance of commencing such operation to permit review of the plan for the proposed installation of temporary traffic control devices.

Assign an employee the responsibility of maintaining the position and condition of all temporary traffic control devices throughout the duration of the Contract. Keep the Engineer advised at all times of the identification and means of contacting this employee on a 24-hour basis.

Maintain temporary traffic control devices in the correct position, properly oriented, clearly visible and clean, at all times. All applicable temporary traffic control devices must meet the classification category of Acceptable as defined in the American Traffic Safety Services Association (ATSSA) Quality Guidelines for Temporary Traffic Control Devices and Features. Temporary concrete barriers must meet the classification category of Acceptable defined in the Department's Temporary Concrete Barrier Evaluation Guide, which may be viewed at the following URL: https://www.fdot.gov/specifications/specifications-references. Pedestrian Longitudinal Channelizing Devices (LCDs) must meet the classification category of Acceptable as defined in the Pedestrian LCD Evaluation Guide, which may be viewed at the following URL: https://www.fdot.gov/specifications/specifications-references.. Immediately repair, replace or clean damaged, defaced or dirty devices. Traffic control devices must not be cleaned while installed/used. Use of warning lights on any temporary traffic control device is prohibited, with the exception of the trailer mounted portable regulatory signs.

Employ an approved independent Channelizing Device Supplier (CDS) to provide and maintain the condition of the following non-fixed channelizing devices: drums, cones, vertical panels, barricades, temporary tubular markers, and pedestrian longitudinal channelizing devices. Cones may be provided and maintained by the Contractor.

The CDS shall not be affiliated with the Contractor and must be approved by the Department. Department approved CDSs are listed on the State Construction Office website. CDSs seeking inclusion on the list must meet the requirements of 102-9.1.1. The CDS shall submit a monthly certification on letterhead that the channelizing devices mentioned above installed/used within the work zone meet classification category of Acceptable as defined in the Pedestrian LCD Evaluation Guide and the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features. The CDS shall submit the monthly certification on letterhead for channelizing devices installed/used within the work zone. The CDS certification shall include the following statement, "I certify that I have provided and maintained the following devices <list devices covered under the certification> in accordance with Pedestrian LCD Evaluation Guide and the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features." If the Contractor chooses to provide and maintain cones, the Contractor must submit a monthly Contractor certification on letterhead that all cones installed/used within the work zone meet acceptable standards as outlined in the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features. The Contractor certification shall include the following statement,

"I certify that I have provided and maintained cones in accordance with the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features."

An employee or authorized representative of the SWZ device manufacturer shall be onsite during the initial installation of SWZ devices and be available on call for the first 15 days of operation. An employee or authorized representative of the SWZ device manufacturer must provide technical support to the Work Zone Traffic Supervisor for the duration of project.

Ensure that WZDx data feeds from SWZ devices are transmitted via a secure connection to the Department's endpoint. The endpoint shall be a single location that is determined by the Department.

Test all portable SWZ devices per manufacturers recommended procedures. Conduct testing of the device when installed and continue testing at the frequency recommended by the manufacturer. Submit all test results to the Engineer for approval.

102-9.1.1 Approved Independent Channelizing Device Supplier (CDS) Requirements: Submit the following documents to the State Construction Office for review and approval

1. A letter on company letterhead signed and dated by the owner of the company or company officer with the following information and statements:

a. The company's owners, stockholders, and officers.

b. A statement declaring that the company will not perform as a CDS on any project where there is common ownership, directly or indirectly, between the company and the Contractor.

c. A statement declaring that the company will furnish and maintain the condition of all channelizing devices with the exception of cones as required in 102-9.1 with its own forces.

d. A statement declaring at least five years of experience in providing channelizing device supplier services, with its own inventory of channelizing devices.

e. On a separate sheet, list a sample project history of the company's experience as a channelizing device supplier for the five years declared in item 1(d) above including the following information:

1. Project name and number and a brief description of CDS work performed,
2. Beginning and ending date of CDS project activities,
3. Location of project (city, state),
4. Monetary amount of CDS work on project,
5. Owner of project, contact person and phone number with area code,
6. Name of Contractor (client) that the work was performed for and phone number with area code.

2. A maintenance plan for approval by the Department that outlines the frequency and methods for maintaining the condition of all channelizing devices, except cones owned and maintained by the Contractor, installed/used in the work zone.

102-9.2 Work Zone Signs: Use work zone signs in accordance with the TTCP and Standard Plans.

102-9.2.1 Post Mounted Signs: Meet the requirements of 990-8.

102-9.2.2 Portable Signs: Portable signs may be used when the work zone condition will be in place for 24 hours or less, or as approved by the Engineer.

102-9.2.3 Barrier Mounted Signs: If post mounting criteria cannot be achieved and a barrier or traffic railing exists, attach work zone signs to barrier or traffic railing in accordance with the Standard Plans. Use Standard Plans, Index 700-012 only when mounting the sign to the top of the barrier or traffic railing places the sign panel closer than two feet from the traveled way.

102-9.3 Business Signs: Use business signs in accordance with the TTCP and Standard Plans. Furnish signs having retroreflective sheeting meeting the requirements of Section 990.

102-9.4 Channelizing Devices: Use channelizing devices in accordance with the TTCP, Standard Plans, and MUTCD.

102-9.4.1 Cones: Use cones in active work zones where workers are present.

Use cone collars at night designed to properly fit the taper of the cone when installed. Collars may be removeable or attached permanently. Place the upper 6 inch collar a uniform 3-1/2 inches distance from the top of the cone and the lower 4 inch collar a uniform 2 inches distance below the bottom of the upper 6 inch collar.

102-9.4.2 Pedestrian Longitudinal Channelizing Devices (LCDs): Use LCDs listed on the APL for pedestrian use and meeting the requirements of Section 990 and the Standard Plans. Pedestrian LCDs must be interlocked except for the stand-alone unit placed perpendicular to a sidewalk. Ballast pedestrian LCDs as shown on the APL.

Ensure that joints on the pedestrian LCDs are free of sharp edges and have a maximum offset of 1/2 inch in any plane.

102-9.4.3 SWZ Location Device: Provide SWZ location devices on all projects that utilize SWZ management strategies and are providing a WZDx feed as per the Plans.

102-9.5 Temporary Barrier: Use temporary barrier in accordance with the TTCP and Standard Plans. Obtain and use precast temporary concrete barrier from a manufacturing plant that is on the Department's Production Facility Listing. Temporary concrete barrier must meet the material and construction requirements of Section 521 unless noted otherwise in the Standard Plans. Proprietary temporary concrete, steel, or water filled barrier used must be listed on the APL.

The maximum allowable height increase between consecutive temporary barrier units in the direction of traffic is one inch.

Temporary barrier must comply with Standard Plans, Index 102-100 or 102-120. Install temporary barriers as either anchored or freestanding as shown in the TTCP or the Standard Plans. An anchored unit is defined as having at least one stake or bolt into the underlying pavement or bridge deck. All other units, including those with keeper pins, are considered freestanding.

Remove temporary asphalt pads and repair all attachment scars to permanent structures and pavements after barrier removal. Make necessary repairs due to defective material, work, or Contractor operations at no cost to the Department. Restore barrier damaged by the traveling public within 24 hours after notification as authorized by the Engineer.

Trailer mounted barriers listed on the APL may be used in lieu of temporary barriers or positive protection at the option of the Contractor. Trailer mounted barriers listed on the APL must have an FHWA eligibility letter and be successfully crash tested in accordance with MASH TL-3 criteria. All trailer mounted barriers must be equipped with an APL listed truck mounted attenuator, an APL listed vehicle mounted arrow board and vehicle warning lights in accordance with this Section.

102-9.5.1 Temporary Barrier Meeting the Requirements of Standard Plans, Index 102-120 and 102-110: Ensure the marking requirements of the respective Index are met.

102-9.5.1.1: Proprietary Precast Temporary Concrete Barrier Fabricated prior to 2005: Submit a certification stating that all unmarked barrier units meet the requirements of the Specifications and the Standard Plans. Certifications will be project specific and non-transferable.

102-9.5.1.2 Proprietary Precast Temporary Concrete Barrier Fabricated in 2005 or later: Ensure each barrier unit has permanent clear markings, showing the manufacture date, serial number, manufacturer's name or symbol, and the APL number. Label the markings on a plate, plaque, or cast in the unit. Proprietary barrier fabricated prior to 2016 and marked with the "INDX 521" in lieu of the APL number will be permitted.

102-9.5.1.3 Temporary Concrete Barrier Repair: Before beginning the repair, remove all laitance, loose material, and any other deleterious matter to sound concrete or a minimum depth of one inch. Additionally, when reinforcing bars, inserts or weldments are exposed, remove the concrete to provide a minimum one-inch clearance all around. Fill the repair area with an approved high performance concrete repair material in accordance with 930-5 and the manufacturer's recommendations. Restore surfaces and edges to the original dimensions and shape of the barrier.

Repairs are not allowed on barrier units that have one or more of the following deficiencies: structural cracking or cracks that exist through the entire cross-section; unit-to-unit connection assemblies or anchor slots are broken or no longer in a fixed position.

Do not paint repaired barriers.

102-9.6 Barrier Delineators: Use barrier delineators on top of temporary barriers in accordance with the Standard Plans and the requirements of Section 705.

102-9.7 Temporary Glare Screen: Use temporary glare screens listed on the APL that meet the requirements of Section 990.Use screen systems in conjunction with temporary barrier at locations identified in the Plans.

When glare screen is utilized on temporary barrier, barrier delineators will not be required.

102-9.8 Temporary Crash Cushion (Redirective or Gating): Use temporary crash cushions in accordance with the details and notes shown in the TTCP, Standard Plans, and requirements of the pre-approved alternatives listed on the APL.

Temporary crash cushions can be either new or used functionally sound refurbished devices. Performance of intended function is the only condition for acceptance. All metallic components must be galvanized in accordance with Section 967.

Anchor abutting temporary barrier in accordance the Standard Plans or APL drawings, as required. Bidirectional installations must have a transition panel installed between the crash cushion and the abutting barrier. Delineate the crash cushion in accordance with Section 544. Maintain the crash cushions until their authorized removal. Do not place any materials or equipment within the length of the crash cushion.

Remove temporary asphalt or concrete pads and repair all attachment scars to permanent structures and pavements after crash cushion removal. Make necessary repairs due to defective material, work, or Contractor operations at no cost to the Department. Restore crash cushions damaged by the traveling public within 24 hours after notification as authorized by the Engineer.

102-9.9 Temporary Guardrail: Use temporary guardrail in accordance with the TTCP and Standard Plans. Install the temporary guardrail in accordance with the Section 536.

102-9.10 Trailer Mounted Devices:

102-9.10.1 Arrow Board: Use arrow boards in accordance with the TTCP, Standard Plans, and that meet the requirements of Section 990. Ensure that the arrow board display panel is raised to a fully upright position and is fully visible to motorists. Use Type B arrow boards on roadways with an existing posted speed of 45 MPH or less for maintenance and mobile operations on any speed facility. Use Type C arrow boards for all other operations on roadways with an existing posted speed of 50 MPH or greater, and may be substituted for Type B arrow boards on any speed facility.

102-9.10.1.1 SWZ Arrow Board: Use SWZ arrow boards as required by the TTCP to advise approaching traffic of lane closures or shoulder work.

102-9.10.2 Portable Changeable Message Sign (PCMS): Use PCMSs or truck mounted changeable message signs in accordance with the TTCP, Standard Plans and Section 990 to supplement other temporary traffic control devices used in work zones. Ensure that the PCMS display panel is raised to a fully upright position and is fully visible to motorists. Reduce the intensity of the flashers when using PCMS at night. Use PCMS with a minimum letter height of 18 inches. For facilities with posted speed limits of 45 mph or less, PCMS with a minimum letter height of 12 inches may be used.

For roadways with speed limits greater than 45 mph, the message displayed on the PCMS must be unobstructed from 800 feet. For roadways with speed limits of 45 mph or less, the message displayed must be unobstructed from 650 feet.

Messages must have no more than two phases. The display time for each phase must be at least two seconds but no more than three seconds. The sum of the display time must be a maximum of six seconds.

102-9.10.2.1 SWZ PCMS: Use SWZ PCMS as required by the TTCP to supplement other temporary traffic control devices used in work zones.

102-9.10.3 Portable Regulatory Signs (PRS): Use PRSs in accordance with the TTCP, Standard Plans, and Section 990. Ensure that the PRS sign panel is raised to a fully upright position and is fully visible to motorists.

Activate portable regulatory signs only during active work activities and deactivate when no work is being performed.

102-9.10.3.1 SWZ Variable Speed Limit (VSL) Sign: Use SWZ VSL signs as required by the TTCP.

102-9.10.4 Radar Speed Display Unit (RSDU): Use RSDUs in accordance with the TTCP, Standard Plans and Section 990 to inform motorists of the posted speed and their actual speed. Ensure that the RSDU display panel is mounted in accordance with the manufacturer's recommendations.

Activate the radar speed display unit only during active work activities and deactivate when no work is being performed.

102-9.10.4.1 SWZ Variable Speed Limit (VSL) Sign with Electronic Speed Feedback Sign (ESFS): Use SWZ VSL signs with ESFS as required by the TTCP. SWZ VSL signs with ESFS can be used in place of VSL signs.

102-9.11 Temporary Signalization and Maintenance: Provide and maintain temporary signals and signalization at existing, temporary, and new intersections including, but not limited to, the following:

1. Installation of temporary poles and span wire assemblies as shown in the TTCP,

2. Temporary portable traffic signals as shown in the TTCP,

3. Adding or shifting signal heads,

4. Trouble calls,

5. Maintaining intersection and coordination timing and preemption devices. Coordination timing will require maintaining functionality of system communications.

Phase and time signals in accordance with the Plans. Obtain approval from the District Traffic Operations Engineer for any timing changes that are either reoccurring or last longer than 24 hours.

Restore any loss of operation within 12 hours after notification. Provide alternate temporary traffic control until the signalization is restored.

Provide temporary pedestrian signalization in accordance with the TTCP, and maintain pedestrian signalization at existing, temporary, and new intersections.

Provide traffic signal equipment that meets the requirements of the Standard Plans and 603-2. The Engineer may approve used signal equipment if it is in acceptable condition. Replacement components for traffic signal cabinet assemblies will be provided by the maintaining agency.

102-9.11.1 Temporary Signals for Lane Closures on Two-Lane, Two-Way Roadways: Temporary signals may be used, at the Contractor's option, as an alternate to flaggers for lane closure operations on two-lane, two-way roadways in accordance with Standard Plans, Index 102-606. The Contractor's Engineer of Record must provide the signal timing for the temporary signals. The District Traffic Operations Engineer must approve the installation and timing of temporary signals prior to beginning work. Adjust timing based on changing field conditions as approved by the Worksite Traffic Supervisor. Submit to the Engineer any timing changes that are reoccurring or last longer than 24 hours for District Traffic Operations Engineer's approval Temporary signals can either be portable signals or span wire signals and must be listed on the APL. Provide two signal faces for each approach.

102-9.12 Temporary Traffic Detection and Maintenance: Provide and maintain temporary traffic detection at existing, temporary, and new signalized intersections. Ensure that vehicle detectors and systems can detect vehicles in each movement on each approach and call the correct vehicle phase when vehicle demand is present. Ensure adjacent lanes and opposing movements do not place false calls. Provide temporary pedestrian detection in accordance with the TTCP, and maintain pedestrian detection at existing, temporary, and new intersections. Ensure pedestrian detectors call the correct pedestrian phase when pedestrian demand is present.

Provide temporary traffic detection equipment listed on the APL.

Restore any loss of detection within 12 hours. If permanent traffic detection cannot be restored within 12 hours, provide temporary detection. Ensure 90% accuracy per signal phase, measured at the initial installation and after any lane shifts, by comparing sample data collected from the detection system with ground truth data collected by human observation. Collect the sample and ground truth data for a minimum of five minutes during a peak and five minutes during an off-peak period with a minimum three detections for each signal phase. Perform the test in the presence of the Engineer.

102-9.13 Existing ITS Maintenance: Provide maintenance at existing ITS locations. Diagnose any loss of functionality within 8 hours. Restore any loss of functionality within 24 hours. The Engineer may extend the allowable downtime beyond 24 hours. Configure and

install Department furnished equipment as necessary. Ensure that all stand-alone functions of replaced ITS devices are tested as detailed in the Contract Documents and as approved by the Engineer. Perform the test in the presence of the Engineer.

102-9.14 Truck Mounted Attenuators and Trailer Mounted Attenuators: Use truck mounted and trailer mounted attenuators in accordance with the manufacturer's recommendations and Standard Plans.

For existing posted speeds of 50 mph or greater, use either truck mounted attenuators or trailer mounted attenuators that meet TL-3 criteria. For existing posted speeds of 45 mph or less, use either truck mounted attenuators or trailer mounted attenuators that meet TL-2 or TL-3 criteria.

102-9.15 Temporary Raised Rumble Strip Set: Use temporary raised rumble strips per the manufacturer's recommendations and in accordance with Standard Plans, Index 102-603.

The temporary raised rumble strip may be either a removable striping type or a portable type. Use a consistent type and color throughout the work zone.

102-9.16 Automated Flagger Assistance Devices (AFAD): Furnish, install, maintain, remove, and relocate AFADs in accordance with the Plans, Standard Plans, Index 102-603, and APL vendor drawings.

Position AFADs where they are clearly visible to oncoming traffic. AFADs may be placed on the centerline if they have been successfully crash tested in accordance with MASH TL-3 criteria. A gate arm is required in accordance with Section 990 if a single AFAD is used on the shoulder to control one direction of traffic.

The devices may be operated either by a single flagger at one end of the traffic control zone, from a central location, or by a separate flagger near each device location. Use only flaggers trained in accordance with Section 105 and in the operation of the AFAD. When in use, each AFAD must be in view of, and attended at all times by, the flagger operating the device.

Provide two flaggers on-site and use one of the following methods in the deployment of AFADs:

1. Place an AFAD at each end of the temporary traffic control zone, or
2. Place an AFAD at one end of the temporary traffic control zone and a flagger at the opposite end.

A single flagger may simultaneously operate two AFADs as described in (1) or a single AFAD as described in (2) if all of the following conditions are met:

1. The flagger has an unobstructed view of the AFAD(s),
2. The flagger has an unobstructed view of approaching traffic in both directions,
3. In the event of an AFAD malfunction, restore normal flagging operations with flaggers or immediately cease the flagging operation and reopen the roadway.

AFADs may be either a remotely controlled Stop/Slow AFAD mounted on either a trailer or a movable cart system, or a remotely controlled Red/Yellow Lens AFAD.

Illuminate the flagging station when the AFAD is used at night. When the AFAD is not in use, remove or cover signs and move the AFAD device outside the clear zone or shield it with a barrier.

AFADs will not be paid for separately. AFADs may be used as a supplement or an alternate to flaggers in accordance with the Plans, Standard Plans, Index 102-603, and the APL vendor drawings. Include the cost for AFADs in Maintenance of Traffic, Lump Sum.

102-9.17 Temporary Lane Separator: Use temporary lane separators (asphalt or portable) in accordance with the TTCP and Standard Plans.

When using portable temporary lane separators, anchor the portable temporary lane separator with a removable anchor bolt. Use epoxy on bridge decks where anchoring is not allowed. Remove the epoxy from the bridge deck by hydroblasting or other method approved by the Engineer.

Repair any damage to the existing pavement caused by the removal of temporary lane separator.

102-9.18 Type III Barricades: Use type III barricades in accordance with the TTCP and Standard Plans. Ensure stripes are sloping downward in the direction road users are to pass. Mount sign panels in accordance with the manufacturer's instructions. Do not place ballast on any rails, or higher than 13 inches above the driving surface. Do not splice the retroreflective sheeting.

102-9.19 SWZ Vehicle Detectors: Use SWZ vehicle detectors as required by the TTCP. Test SWZ vehicle detectors per the manufacturer's recommendations.

102-9.20 SWZ Cameras: Use SWZ cameras as required by the TTCP.

102-9.21 SWZ Central Processor: Provide the SWZ central processor as required by the TTCP.

ARTICLE 102-11 is deleted and the following substituted:

102-11 Method of Measurement.

102-11.1 General: Devices installed/used on the project on any calendar day or portion thereof, within the Contract Time, including time extensions which may be granted, will be paid for at the Contract unit price for the applicable pay item. Include the cost of any work that is necessary to meet the requirements of the Contract Documents for MOT under Maintenance of Traffic, lump sum when separate payment is not provided.

102-11.2 Traffic Control Officers: The quantity to be paid for traffic control officers will be at the Contract unit price per hour (4 hour minimum) for the actual number of officers certified to be on the project site, including any law enforcement vehicles and all other direct and indirect costs. Payment will be made only for those traffic control officers specified in the Plans and authorized by the Engineer.

102-11.3 Special Detours: When a special detour is shown in the Plans, the work of constructing, maintaining, and subsequently removing such detour facilities will be paid for under Special Detour, lump sum. However, traffic control devices, warning devices, barriers, signing, pavement markings, and restoration to final configuration will be paid for under their respective pay items.

102-11.4 Commercial Material for Driveway Maintenance: The quantity to be paid for will be the certified volume, in cubic yards, of all materials authorized by the Engineer, acceptably placed and maintained for driveway maintenance. The volume, which is authorized to be reused, and which is acceptably salvaged, placed, and maintained in other designated driveways will be included again for payment. Commercial Material used for Temporary Openings will not be included for separate payment.

102-11.5 Work Zone Signs: The number of temporary post-mounted signs (temporary regulatory, warning and guide) certified as installed/used on the project will be paid for at the Contract unit price for work zone signs. When multiple signs are located on single or multiple

posts, each sign panel will be paid individually. Signs greater than 20 square feet and detailed in the Plans will be paid for under Maintenance of Traffic, lump sum.

Temporary portable signs (excluding mesh signs) and vehicular mounted signs will be included for payment under work zone signs, only if used in accordance with the Standard Plans.

The number of temporary barrier mounted signs (temporary regulatory, warning and guide) certified as installed/used on the project will be paid for at the Contract unit price for barrier mounted work zone signs.

Work zone signs may be installed fourteen days prior to the start of Contract Time with the approval of the Engineer and at no additional cost to the Department.

102-11.6. Business Signs: The number of business signs certified as installed/used on the project will be paid for at the Contract unit price for business signs.

102-11.7 Channelizing Devices: The number of SWZ location devices, drums, vertical panels, and Type I, Type II, or direction indicator barricades, certified as installed/used on the project meeting the requirements of Standard Plans, Index 102-600 and have been properly maintained will be paid for at the Contract unit prices for channelizing device.

Payment for drums, vertical panels, and Type I, Type II, and direction indicator barricades will be paid per each per day.

Payment for vehicular LCDs will be paid as the length in feet installed divided by the device spacing for barricades, vertical panels, and drums and certified as installed/used on the project meeting the requirements of Standard Plans, Index 102-600 and have been properly maintained will be paid for at the Contract unit price for channelizing device.

Payment for pedestrian LCDs, certified as installed/used on the project and properly maintained, will be paid per linear foot per day. Placement of pedestrian LCDs at locations not shown in the TTCP, or not authorized by the Engineer, will be at the Contractor's expense. Payment for pedestrian LCD mounted signs will be made under Work Zone Signs.

Payment will not be made for channelizing devices unsatisfactorily maintained, as determined by the Engineer. Payment will be made for each channelizing device that is used to delineate trailer mounted devices. Payment will be made for channelizing devices delineating portable changeable message signs during the period beginning 14 working days before Contract Time begins as authorized by the Engineer.

102-11.8 Temporary Barrier: The quantity to be paid for will be the length, in feet, of freestanding units or anchored units certified as installed/used on the project. The quantity to be paid for relocating barrier will be based on the relocated installation type. No separate payment will be made for the asphalt pad. For freestanding units transitioned to a crash cushion, the cost of anchoring the transition units will be included in the cost of the temporary crash cushion in accordance with 102-11.11.

102-11.9 Barrier Delineators: No separate payment will be made for barrier delineators installed on top of temporary barrier. Include the cost for barrier delineators in the cost of the barrier.

102-11.10 Temporary Glare Screen: The certified quantity to be paid for will be determined by the number of sections times the nominal length of each section.

102-11.11 Temporary Crash Cushions: No separate payment will be made for the concrete or asphalt pad.

102-11.11.1 Redirective: The quantity to be paid for will be the number of temporary crash cushions (redirective) certified as installed/used and maintained on the project,

including anchoring of temporary barrier necessary for transition to the crash cushion and delineation.

102-11.11.2 Gating: The quantity to be paid for will be the number of temporary crash cushions (gating) certified as installed/used and maintained on the project, including anchoring of temporary barrier necessary for transition to the crash cushion and delineation.

102-11.12 Temporary Guardrail: The quantity to be paid for will be the length, in feet, of temporary guardrail constructed and certified as installed/used on the project. The length of a run of guardrail will be determined as a multiple of the nominal panel lengths.

102-11.13 Arrow Board: The quantity to be paid at the contract unit price will be for the number of arrow boards certified as installed/used on the project on any calendar day or portion thereof within the Contract Time. Payment will be made for up to two inactive days where the arrow board is used on the two days preceding and following the inactive days as authorized by the Engineer. Payment for additional days may be authorized by the Engineer due to inclement weather.

102-11.14 Portable Changeable Message Sign: The quantity to be paid at the Contract unit price will be for the number of PCMSs or truck mounted changeable message signs certified as installed/used on the project on any calendar day or portion thereof within the Contract Time. Payment will be made for each portable changeable message sign that is used during the period beginning 14 working days before Contract Time begins as authorized by the Engineer. Payment will be made for up to two inactive days where the portable changeable message sign is used on the two days preceding and following the inactive days as authorized by the Engineer. Payment for additional days may be authorized by the Engineer due to inclement weather.

102-11.15 Portable Regulatory Signs: The quantity to be paid for will be the number of portable regulatory signs certified as installed/used on the project on any calendar day or portion thereof within the Contract Time, will be paid for the Contract unit price for portable regulatory sign. Payment will be made for up to two inactive days where the portable regulatory sign is used on the two days preceding and following the inactive days as authorized by the Engineer. Payment for additional days may be authorized by the Engineer due to inclement weather.

102-11.16 Radar Speed Display Unit: The quantity to be paid for will be the number of radar speed display units certified as installed/used on the project on any calendar day or portion thereof within the Contract Time, will be paid for the Contract unit price for radar speed display unit. Payment will be made for up to two inactive days where the radar speed display unit is used on the two days preceding and following the inactive days as authorized by the Engineer. Payment for additional days may be authorized by the Engineer due to inclement weather.

102-11.17 Temporary Signalization and Maintenance: For existing intersections, the certified quantity to be paid for will be the number of signalized intersections per day for the full duration of the Contract. For temporary intersections, the certified quantity to be paid for will be the number of signalized intersections per day for the duration of the temporary intersection. No separate payment will be made for temporary signalization and maintenance at new intersections.

102-11.18 Temporary Traffic Detection and Maintenance: For existing intersections, the certified quantity to be paid for will be the number of signalized intersections per day beginning the day Contract Time begins and ending on the day the permanent detection is operational and the final lane configuration is in place. For temporary and new intersections, the certified quantity to be paid for will be the number of signalized intersections per day beginning the day the temporary detection is functional and ending the day: the permanent detection is

operational and the final lane configuration is in place for a new intersection; or, when the detection is removed for a temporary intersection.

102-11.19 Existing ITS Maintenance: For existing ITS locations, the certified quantity to be paid for will be the number of calendar days from Contract Time start to Final Acceptance.

102-11.20 Work Zone Pavement Markings: Painted pavement markings will be paid as specified in 710-10. The quantity of removable tape to be paid for solid, 10'-30' skip, 3'-9' dotted, 6'-10' dotted, and 2'-4' dotted lines will be the length, in gross miles, authorized and acceptably applied under this Section and certified as installed/used on the project. The quantity of removable tape to be paid for transverse lines will be the length, in linear feet, authorized and acceptably applied under this Section and certified as installed/used on the project. The quantity of removable tape to be paid for pavement messages, symbols, and arrows will be per each, authorized and acceptably applied under this Section and certified as installed/used on the project. The quantity of temporary RPMs to be paid will be the number of RPMs authorized and acceptably applied. No separate payment will be made for the cost of removing conflicting pavement markings. Payment for removing conflicting pavement markings (paint, tape, thermoplastic, raised pavement markers, etc.) will be included in Maintenance of Traffic, lump sum.

102-11.21 Temporary Raised Rumble Strips: The quantity to be paid for will be the number of calendar days, or portions thereof, that temporary raised rumble strips are certified as installed/used on the project within the Contract Time. No adjustment will be made to the per day measurement for the number of strips or sets used, or for the number of times the sets are relocated.

102-11.22 Temporary Lane Separator: The quantity to be paid for will be the field measure, in feet, of temporary lane separator certified as installed/used on the project, including drainage gaps, completed and accepted. The cost of any pavement repairs due to removal is included in the cost of Maintenance of Traffic, lump sum.

102-11.23 Temporary Signals for Lane Closures on Two-Lane, Two-Way Roadways: The quantity to be paid for will be the number of temporary signals per day installed/used at the locations shown in the TTCP. Temporary signals installed/used at the Contractor's option as an alternative to flaggers will be included in Maintenance of Traffic, lump sum.

102-11.24 Temporary Highway Lighting: When temporary highway lighting is required by the Plans, the work of constructing, maintaining, and removing the temporary highway lighting, including all materials and any necessary design work, will be paid for under temporary highway lighting, lump sum.

102-11.25 Pedestrian or Bicycle Special Detours: When a pedestrian or bicycle special detour is shown in the Plans, the work of constructing, maintaining, and subsequently removing such detour facilities will be paid for under pedestrian or bicycle special detour, lump sum. However, traffic control devices, warning devices, barriers, signing, pavement markings, and restoration to final configuration will be paid for under their respective pay items.

102-11.26 Type III Barricades: The number of type III barricades certified as installed/used on the project will be paid for at the Contract unit price for type III barricades.

102-11.27 Limited Access Temporary Openings: Include all construction, maintenance, removal, and restoration costs of temporary openings in Maintenance of Traffic, lump sum. No separate payment will be made for commercial material, gates, or fence.

102-11.28 SWZ Location Devices: The quantity to be paid for will be for the number of SWZ location devices, certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.29 SWZ Arrow Boards: The quantity to be paid at the Contract unit price will be for the number of SWZ arrow boards certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.30 SWZ PCMSs: The quantity to be paid at the Contract unit price will be for the number of SWZ PCMSs certified as installed/used on the project on any calendar day or portion thereof within the Contract Time. Payment will be made for each SWZ portable changeable message sign that is used during the period beginning fourteen working days before Contract Time begins as authorized by the Engineer.

102-11.31 SWZ VSLs: The quantity to be paid for will be the number of SWZ VSL signs certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.32 SWZ VSL signs with ESFS: The quantity to be paid for will be the number of SWZ VSLsigns with ESFS certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.33 SWZ Vehicle Detectors: The quantity to be paid for will be the number of SWZ vehicle detectors certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.34 SWZ Cameras: The quantity to be paid for will be the number of SWZ cameras certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

102-11.35 SWZ Central Processor: The quantity to be paid for will be the number of SWZ central processors certified as installed/used on the project on any calendar day or portion thereof within the Contract Time.

ARTICLE 102-13 is deleted and replaced by the following:

102-13 Basis of Payment.

102-13.1 Maintenance of Traffic (General Work): When an item of work is included in the proposal, price and payment will be full compensation for all work and costs specified under this Section except as may be specifically covered for payment under other items.

102-13.2 Traffic Control Officers: Price and payment will be full compensation for the services of the traffic control officers.

102-13.3 Special Detours: Price and payment will be full compensation for providing all detour facilities shown in the Plans and all costs incurred in carrying out all requirements of this Section for general MOT within the limits of the detour, as shown in the Plans.

102-13.4 Commercial Materials for Driveway Maintenance: Price and payment will be full compensation for all work and materials specified for this item, including specifically all required shaping and maintaining of driveways.

102-13.5 Work Zone Signs: Price and payment will be full compensation for all work and materials for furnishing signs, supports and necessary hardware, installation, relocating, maintaining, covering, and removing signs.

102-13.6. Business Signs: Price and payment will be full compensation for all materials and labor required for furnishing, installing, relocating, maintaining, and removing the signs as well as the cost of installing any logos provided by business owners.

102-13.7 Channelizing Devices: Prices and payment will be full compensation for furnishing, installing, relocating, maintaining, and removing the channelizing devices.

102-13.8 Temporary Barrier: Price and payment will be full compensation for furnishing, installing, maintaining, and removing the barrier and asphalt pad. When called for, temporary barrier (relocate) will be full compensation for relocating the barrier.

102-13.9 Temporary Glare Screen: Price and payment will be full compensation for furnishing, installing, maintaining, and removing the glare screen certified as installed/used on the project. When called for, glare screen (relocate) will be full compensation for relocating the glare screen.

102-13.10 Temporary Crash Cushion (Redirective or Gating): Price and payment will be full compensation for furnishing, installing, maintaining, and removing crash cushions, object markers, and concrete or asphalt pads.

102-13.11 Temporary Guardrail: Price and payment will be full compensation for furnishing all materials required for a complete installation, including end anchorage assemblies and any end connections to other structures and for installing, maintaining, and removing guardrail.

102-13.12 Arrow Board: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining, and removing arrow boards.

102-13.13 Portable Changeable Message Sign: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining, and removing portable changeable message signs.

102-13.14 Portable Regulatory Signs: Price and payment will be full compensation for furnishing, installing, relocating, operating, maintaining, and removing a completely functioning system as described in these Specifications.

Payment will include all labor, materials, incidentals, repairs, and any actions necessary to operate and maintain the unit at all times that work is being performed or traffic is being affected by construction and/or MOT operations.

102-13.15 Radar Speed Display Unit: Price and payment will be made only for a completely functioning system as described in these Specifications. Payment will include all labor, hardware, accessories, signs, and incidental items necessary for a complete system. Payment will include any measurements needed to ensure that the unit conforms to all Specification requirements.

Payment will include all labor, materials, incidentals, repairs, and any actions necessary to operate and maintain the unit at all times that work is being performed or traffic is being affected by construction and MOT operations. Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining, and removing radar speed display unit.

102-13.16 Temporary Signalization and Maintenance: Price and payment will constitute full compensation for furnishing, installing, operating, maintaining, and removing temporary traffic control signals including all equipment and components necessary to provide an operable traffic signal. Payment will be withheld for each day at each intersection where the temporary signalization is not operational within 12 hours after notification.

102-13.17 Temporary Traffic Detection and Maintenance: Price and payment will constitute full compensation for furnishing, installing, operating, maintaining, and removing temporary traffic detection including all equipment and components necessary to provide an acceptable signalized intersection. Take ownership of all equipment and components. Payment will be withheld for each day at each intersection where the temporary detection is not operational within 12 hours after notification.

102-13.18 Existing ITS Maintenance: Price and payment will constitute full compensation for diagnosing, troubleshooting, configuring, installing, operating, maintaining, and removing existing ITS devices including all auxiliary equipment and device components. Payment will be withheld for each day where the ITS device is not operational within the allowable downtime, beginning at the time of notification. Payment will not be withheld for days of delay when the Department or Maintaining Agency is unable to furnish the replacement ITS device to the Contractor.

102-13.19 Work Zone Pavement Markings: Price and payment will be full compensation for all work specified including, all cleaning and preparing of surfaces, furnishing of all materials, application, curing and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work. Final payment will be withheld until all deficiencies are corrected.

Removable tape or durable paint may be substituted for standard paint at no additional cost to the Department.

Payment for temporary RPMs used to supplement line markings will be paid for under temporary raised pavement markers. Install these RPMs as detailed in the Standard Plans.

102-13.20 Temporary Raised Rumble Strips: Price and payment will be full compensation for all work and materials described in this Section, including all cleaning and preparing of surfaces, disposal of all debris, furnishing of all materials, application, curing, removal, reinstalling and protection of all items, protection of traffic, furnishing of all tools, machines and equipment, and all incidentals necessary to complete the work.

102-13.21 Temporary Lane Separator: Price and payment will be full compensation for all work specified in this Section.

102-13.22 Temporary Signals for Lane Closures on Two-Lane, Two-Way Roadways: Price and payment will be full compensation for furnishing, installing, operating, maintaining, and removing temporary traffic signal including all equipment and components necessary to provide an operable portable traffic signal.

102-13.23 Temporary Highway Lighting: Price and payment will be full compensation for providing all temporary highway lighting shown in the Plans.

102-13.24 Pedestrian or Bicycle Special Detours: Price and payment will be full compensation for providing all pedestrian or bicycle special detours shown in the Plans.

102-13.25 Type III Barricades: Prices and payment will be full compensation for furnishing, installing, relocating, maintaining, and removing the type III barricades.

102-13.26 SWZ Devices: Price and payment will be full compensation for furnishing, installing, operating, relocating, maintaining, and removing SWZ devices such as SWZ location devices, SWZ arrow boards, SWZ vehicle detectors, SWZ PCMS, SWZ VSL signs, SWZ VSL signs with ESFS, SWZ cameras, SWZ detectors, and SWZ central processors.

102-13.27 Payment Items: Payment will be made under:

Item No. 102- 1- Maintenance of Traffic - lump sum.
Item No. 102- 2- Special Detour - lump sum.

Item No. 102- 3-	Commercial Material for Driveway Maintenance - per cubic yard.
Item No. 102- 4-	Pedestrian or Bicycle Special Detour - lump sum.
Item No. 102- 14-	Traffic Control Officer - per hour.
Item No. 102- 30-	Temporary Highway Lighting - lump sum.
Item No. 102- 60-	Work Zone Sign - per each per day.
Item No. 102- 61-	Business Sign - each.
Item No. 102- 62-	Barrier Mounted Work Zone Sign – per each per day
Item No. 102- 71-	Temporary Barrier - per foot.
Item No. 102- 75-	Temporary Lane Separator - per foot
Item No. 102- 73-	Temporary Guardrail - per foot.
Item No. 102- 74-	Channelizing Devices.
Item No. 102- 76-	Arrow Board - per each per day.
Item No. 102- 78-	Temporary Raised Pavement Markers - each.
Item No. 102- 81-	Temporary Crash Cushion, Gating - per location.
Item No. 102- 89-	Temporary Crash Cushion, Redirective - per location.
Item No. 102- 94-	Glare Screen - per foot.
Item No. 102- 99-	Portable Changeable Message Sign - per each per day.
Item No. 102-104-	Temporary Signalization and Maintenance - per intersection per day.
Item No. 102-107-	Temporary Traffic Detection and Maintenance - per intersection per day.
Item No. 102-112-	Existing ITS Maintenance – per day.
Item No. 102-115-	Type III Barricade - per each per day.
Item No. 102-120-	Temporary Signal for Lane Closures on Two-Lane, Two-Way Roadways – per each per day.
Item No. 102-150-	Portable Regulatory Sign - per each per day.
Item No. 102-150-	Radar Speed Display Unit - per each per day.
Item No. 102-909-	Temporary Raised Rumble Strips - per day.
Item No. 102-913-	Removable Tape.
Item No. 710-	Painted Pavement Markings.
Item No. 711-	Thermoplastic Pavement Markings.
Item No. 922-102-	Smart Work Zone Devices- per each per day.

TEMPORARY TRAFFIC CONTROL DEVICE MATERIALS – SMART WORK ZONE SYSTEM
(REV 1-31-23)

ARTICLE 990-3 is deleted and the following substituted:

990-3 Portable Devices (Arrow Boards, SWZ Arrow Boards, Changeable Message Signs, SWZ Changeable Message Signs, Regulatory Signs, Radar Speed Display Units and Truck Mounted Changeable Message Signs, Automated Flagger Assistance Devices SWZ Variable Speed Limit (VSL) Signs, SWZ VSL with an Electronic Speed Feedback Sign (ESFS), SWZ Vehicle Detectors, SWZ Cameras).

990-3.1 General: With the exception of the SWZ Camera and SWZ Vehicle Detector, all portable devices shall meet the physical display and operational requirements of the Manual on Uniform Traffic Control Devices (MUTCD). With the exception of SWZ devices, all portable devices shall be listed on the Department's Approved Product List (APL). Except for SWZ location devices, all SWZ devices are mounted on trailers. Manufacturers seeking evaluation of their product must submit the following:

1. Certification showing that the product meets the requirements of this Section.

2. Drawings of the device along with technical information necessary for proper application, field assembly, and installation.

Portable devices shall meet the following requirements:

3. Ensure that all assembly hardware less than 5/8 inch in diameter, including nuts, bolts, external screws and locking washers are Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws and studs shall meet ASTM F593. Nuts shall meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter shall be galvanized. Bolts, studs, and threaded rod shall meet ASTM A307. Structural bolts shall meet ASTM F3125, Grade A325.

4. The controllers and associated on-board circuitry shall meet the requirements of the Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices. All electronic assemblies shall meet the requirements of NEMA TS-4-2016 Section 2.

5. The controller and associated on-board circuitry shall not be affected by mobile radio, or any other radio transmissions.

6. An operator's manual shall be furnished with each unit.

7. All portable devices shall be permanently marked with, manufacturer's name or trademark, model/part number, and date of manufacture or serial number.

8. Portable devices and trailers shall be delineated on a permanent basis by affixing retroreflective sheeting in a continuous line on the face of the trailer as seen by oncoming road users.

9. SWZ portable devices shall be equipped with wireless Global Positioning System (GPS) location and remote communication devices capable of generating a data feed which conforms to the Work Zone Data Exchange (WZDx) standard and is made available to FDOT.

990-3.1.1 Electrical Systems:

990-3.1.1.1 Solar Powered Unit: The solar powered unit shall meet the following:

1. The unit shall provide automatic recharging of power supply batteries to normal operating levels with meters showing charge.

2. Solar array recovery time for arrow boards and regulatory signs shall be accomplished in a maximum of three hours.

3. Arrow boards and changeable message signs shall be designed to provide 180 days of continuous operation with minimum onsite maintenance.

990-3.1.1.2 Battery Life Test: Meet the following:

1. The photovoltaic unit shall be designed to provide 21 days of continuous operation without sunlight with a minimum of onsite maintenance for arrow boards, SWZ arrow boards, changeable message signs, SWZ changeable message signs, SWZ VSL signs, SWZ VSL signs with an ESFS, SWZ vehicle detectors, and SWZ Cameras, or 10 days of continuous operation without sunlight with a minimum of onsite maintenance for regulatory signs and radar speed display units, or 2 days of continuous operation without sunlight with a minimum of onsite maintenance for Automated Flagger Assistance Devices signs.

2. The battery shall be equipped with a battery controller to prevent overcharging and over-discharging. An external battery level indicator shall be provided.

3. The battery, controller, and power panel shall be designed to be protected from the elements and vandalism.

4. Automatic recharging of power supply batteries shall be provided with charge indicator meter.

5. An AC/DC battery charger unit shall be provided.

990-3.1.2 Display Panel and Housing:

1. The display housing assembly shall be weather-tight.

2. Except for Automated Flagger Assistance Devices, the display assembly shall be equipped with an automatic dimming operational mode capable of a minimum of 50% dimming and a separate manual dimmer switch

3. The display panel background and frame for the display assembly shall be painted flat black and shall meet Federal Specification TT-E-489.

4. The display panel for arrow boards and changeable message signs, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the panel to the ground, in accordance with the MUTCD. The display panel for radar speed display units, when raised in the upright position, will have a minimum height of 5 feet from the bottom of the panel to the ground.

5. The regulatory speed sign panel for regulatory signs, SWZ VSL signs, SWZ VSL signs with an ESFS, and radar speed display units, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the regulatory sign panel to the ground.

6. The unit shall have an accessible mechanism to easily raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.

7. The display panel for changeable message signs shall have a safety system to protect against the panel falling from the trailer to the roadway should the panel separate from the lift system.

990-3.1.3 Controller: The Controller shall meet the following:

1. Controller and control panel shall be housed in a weather, dust, and vandal resistant lockable cabinet.

2. Controller and associated on-board circuitry shall meet the requirements of the FCC Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise by Class A digital devices.

3. For changeable message signs and arrow boards ensure that the sign control software provides an on-site graphical representation that visibly depicts the message displayed on the sign face.

4. For changeable message signs, if remote communication is included, ensure that the sign controller is addressable through the Ethernet communications network using software that complies with the National Transportation Communications for ITS Protocol (NTCIP) 1101 base standard, including all amendments as published at the time of contract letting, the NTCIP Simple Transportation Management Framework, and conforms to Compliance Level 1. Ensure that the software implements all mandatory objects in the supplemental requirement SR-700-4.1.1-01, FDOT Dynamic Message Sign NTCIP Requirements, as published on the FDOT State Traffic Engineering and Operations Office web site at the time of contract letting. Ensure that the sign complies with the NTCIP 1102v01.15, 2101 v01.19, 2103v02.07, 2201v01.15, 2202 v01.05, and 2301v02.19 standards. Ensure that the sign complies with NTCIP 1103v02.17, section 3. Ensure that additional objects implemented by the software do not interfere with the standard operation of mandatory objects.

5. The SWZ VSL sign and the SWZ VSL sign with an ESFS shall support the NTCIP protocol. The VSL display shall have the capability of being remotely changed. The sign location, speed value, and battery voltage shall be remotely accessible. The activity log report shall be available for download.

990-3.1.4 Support Chassis: The support chassis shall meet the following:

1. The support chassis shall be self-contained and self-supporting without the use of additional equipment or tools.

2. Both trailer and truck-mounted units are allowed for arrow boards and changeable message signs. Trailer mounted units are required for regulatory signs, and radar speed display units, SWZ Arrow Boards, SWZ Cameras, SWZ Changeable Message Signs, SWZ VSL Signs, SWZ VSL Signs with an ESFS, and SWZ Vehicle Detectors. SWZ Vehicle Detectors and SWZ Cameras may be installed on SWZ PCMS trailers. Automated Flagger Assistance Devices may be trailer or non-trailer units.

a. Trailer mounted unit:

1. The sign, power supply unit and all support systems shall be mounted on a wheeled trailer.

2. The trailer shall be equipped with Class A lights, using a plug adaptor.

3. The trailer shall be equipped with adjustable outrigger leveling pads, one on each of the four frame corners.

4. The trailer shall be designed to be set up at the site with its own chassis and outriggers, without being hitched to a vehicle.

5. The trailer shall be equipped with fenders over the tires and shall be made from heavy-duty material sufficient to allow a person to stand and operate or perform maintenance on the unit.

6. The trailer shall meet all equipment specifications set forth in Chapter 316 of the Florida Statutes, and by such rule, regulation or code that may be adopted by the Department of Highway Safety and Motor Vehicles.

990-3.1.5 Cellular Modem: For SWZ devices, cellular modems shall be capable of providing 4G LTE and backward compatible with 3G communications. Cellular modems shall provide cellular communications via a removable subscriber identity module (SIM) card.

Cellular modems shall be capable of providing positional information (i.e., latitude and longitude of device) with accuracy of 3 meters.

990-3.1.5.1 Network Interface: The cellular modem shall include a minimum of two 10/100 BASE-T Ethernet ports. All copper-based network interface ports utilized shall be registered jack (RJ)-45 connectors. The cellular modem unit shall comply with the following minimum requirements:

1. FirstNet broadband communications network
2. Multi-carrier support (AT&T, Verizon, and Sprint) by software configuration
3. 4G LTE cellular network support
4. License-free enterprise software supporting advance routing protocols, VPN, logging, authentication, and stateful firewall

990-3.1.5.2 Protocols: The unit shall have the ability to utilize, at a minimum, the following protocols:

1. Network: TCP/IP, UDP/IP
2. Routing: Network Address Translation (NAT), Port Address Translation (PAT), Dynamic Host Configuration Protocol, and Static Routing.
3. Application: SSH, SNMP, Radius Server Capable

990-3.1.5.3 Event Reporting: The unit shall have the capability to record and report, at a minimum, the following events in plain text:

1. Event log
2. Email notification of link status changes
3. Bandwidth status
4. Remote syslog host capable

990-3.1.5.4 Security: The device shall have the following security provisions:

1. Ability to establish VPN tunnels
2. IPsec and SSL
3. Port forwarding

990-3.1.5.5 Mechanical Specifications: The cellular modem shall be permanently marked with manufacturer name or trademark, product or part number, date of manufacture, and serial number. All parts shall be made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum brass, or gold-plated metal.

990-3.1.5.6 Environmental Specifications: The cellular modem shall perform all required functions under the following environmental conditions: -20 to 70 oC, 10 – 95%, non-condensing.

990-3.1.5.7 Electrical Specifications: The cellular modem must operate on a nominal voltage of 12 V direct current (V_{DC}). Supply an appropriate voltage converter for units that require operating voltages other than 12 V_{DC}.

990-3.1.5.8 Antenna: The antenna shall be fully compatible with the proposed cellular modem.

990-3.2 Portable Arrow Board and SWZ Portable Arrow Board:

990-3.2.1 Arrow Board Matrix:

1. The minimum legibility distance for various traffic conditions are based on the decision-sight distance concept. The minimum legibility distance is the distance at which a driver can comprehend the arrow board message on a sunny day or a clear night. The arrow board size that is needed to meet the legibility distance is listed as follows:

Table 990-1			
Type	Minimum Size	Minimum Number of Elements	Minimum Legibility Distance
B	30 by 60 inches	13	3/4 mile
C	48 by 96 inches	15	1 mile

Type B arrow boards may be used on low to intermediate speed (0 mph to 50 mph) facilities or for maintenance or moving operations on any speed facility. Type C arrow boards shall be used for all other operations on high-speed (50 mph and greater) facilities and may be substituted for Type B arrow boards on any speed facility.

2. Devices shall meet all arrow board displays identified in the MUTCD.

3. The element lens should be 5-3/4 inches in diameter. Smaller element lens diameters are permissible only if they provide an equivalent or greater brightness indication and meet the legibility criteria in 990-3.2.1(a).

4. The color of the light emitted shall be in accordance with the MUTCD.

5. There shall be a 360 degree hood for close-up glare reduction.

6. For solar powered arrow boards the bulbs shall provide a 350 candle power intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

7. The flashing rate of the element shall not be less than 25 flashes or more than 40 flashes per minute as required in the MUTCD.

8. The minimum element "on time" shall be 50% for the flashing arrow and 25% for the sequential chevron.

990-3.3 Portable Changeable Message Sign (PCMS) and SWZ PCMS:

990-3.3.1 Message Matrix:

1. Message matrix panel shall be a maximum height of 7 feet by a maximum width of 146 inches.

2. The matrix must be capable of displaying three lines of 8 characters using an 18 inch or 12 inch font. PCMS with a minimum font size of 18 inches shall be used on any speed facility. PCMS with a minimum font size of 12 inches may be used on facilities with speed limits of 45 mph or less.

3. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS (Standard Highway Signs) companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

4. Similar components shall be interchangeable.

990-3.3.2 Operation and Performance:

1. The message shall be displayed in upper case except when lower case is project specific and is allowed by the MUTCD.

2. The message matrix panel shall be visible from one-half mile.

3. The 18 inch letter height message shall be legible from 650 feet for nighttime conditions and 800 feet for normal daylight conditions.

4. The 12 inch letter height message shall be legible from 650 feet for nighttime conditions and 650 feet for normal daylight conditions.

5. Under variable light level conditions the sign shall automatically adjust its light source to maintain legibility.

6. The message panel shall have adjustable display rates, so that the entire message can be read at least twice at the posted speed.

7. The control panel shall have the capability to store a minimum 50 pre-programmed messages.

8. The controller in the control panel shall be able to remember messages during non-powered conditions.

9. The controller shall allow the operator to generate additional messages on site via the keyboard.

10. All messages shall be flashed or sequenced. In the sequence mode, the controller shall have the capability to sequence three line messages during one cycle.

11. The SWZ PCMS shall use a wireless Global Positioning System (GPS) location and a remote communication device.

990-3.4 Portable Regulatory Signs:

990-3.4.1 Sign Panel Assembly: The sign panel assembly shall consist of a 24 inches by 30 inches "SPEED LIMIT XX" sign panel and a "WHEN FLASHING" sign panel, intended to notify oncoming traffic the speed limit where workers are present. The sign panel assembly shall meet the following minimum physical requirements:

1. The sign panel shall fold down and be pinned in place for towing. Maximum travel height shall be 80 inches.

2. Construct the sign panel and light housing to allow the unit to be operated in the displayed position at speeds of 30 mph. Design the sign panel assembly to withstand transport speeds of 65 mph.

3. Construct the sign panel such that, when in the raised position, the sign panel will have a height of 7 feet from the bottom of the lowest panel to the ground, in accordance with the MUTCD.

4. Provide the unit with a mechanism to raise and lower the sign panel. Provide the unit with a device to lock the sign panel in the raised and lowered position.

990-3.4.2 Flashing Lights: Provide a pair of hooded PAR 46 LED advance warning flashing lamps on each side of the top of the sign panel. These lamps shall be visible day or night at a distance of one mile with a flash rate of approximately 55 flashes per minute.

The lamp lens should be at least 5-3/4 inches in diameter. Smaller diameter lens are permissible if they provide an equivalent or greater brightness indication and meet the legibility criteria above.

The color of the light emitted shall be in accordance with the MUTCD. For solar powered units, the bulbs shall provide a 350 candlepower intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

990-3.5 Portable Radar Speed Display Unit:

990-3.5.1 Display Unit Panel and Housing: Meet the requirements of 990-3.1.2 and the following physical requirements as a minimum:

1. Provide capability to mount a 24 inches by 30 inches regulatory sign with interchangeable numbers showing the posted speed limit above the message display.

2. Provide legend "YOUR SPEED" either above or below the message display.

990-3.5.2 Message Display: The message display shall meet the following physical requirements as a minimum:

1. Provide a bright LED, two-digit speed display on a flat black background with bright yellow LEDs.

2. Each digit shall contain either a seven-segment layout or matrix-style design. Each digit shall measure a minimum 18 inches in height.

3. Speed display shall be visible from a distance of at least one-half mile and legible from a distance of at least 650 feet under both day and night conditions.

4. Display shall adjust for day and night operation automatically with a photocell.

990-3.5.3 Radar: The radar unit shall not be affected by normal radio transmissions and meet the following physical requirements as a minimum:

1. Approach-Only sensor.

2. Equipped with a low power K-Band transmitter.

3. Part 90 FCC acceptance, 3 amps, 10.8 V_{DC} to 16.6 V_{DC}. Fuse and reverse polarity protected.

4. Range of 1,000 feet for mid-size vehicle, capable of accurately sensing speeds of 10 mph to 99 mph with over speed function that operates when a vehicle approaches over the posted speed limit.

990-3.6 Truck Mounted Changeable Message Sign:

990-3.6.1 General: Truck mounted changeable message signs shall meet the physical display and operational requirements of the MUTCD and be listed on the APL.

1. Sign shall be secured on the vehicle for normal operation.

2. A fault light shall be located on rear of the sign and operate whenever the sign is displaying a message. The light shall flash at the same rate as the message being displayed.

3. An operator's manual shall be furnished with each sign.

4. The manufacturer name, model or part number, and date of manufacture or serial number shall be permanently affixed to the sign housing.

990-3.6.2 Display Panel and Housing:

1. The housing maximum size shall not exceed a width of 96 inches.

2. The housing shall be designed to withstand exposure to the elements and include a locking device to secure the housing from unauthorized entry.

3. Provisions (by convection or fan) shall be made for heat dissipation within the unit.

4. The message matrix panel background and frame for the dynamic message assembly shall be painted flat black, Federal Specification TT-E-489.

5. The face of the display shall be easily opened from the front. Faces that open up shall be locked to stay open far enough to allow for servicing of all message panel components.

6. The face of the sign shall be covered by an impact resistant polycarbonate face that aids against glare and includes an ultraviolet inhibitor to protect from fading and yellowing.

7. The display panel support structure, when raised in the upright position, shall be designed to allow for a minimum height of 7 feet from the bottom of the panel to the ground.

8. The unit shall have a manual and automatic control mechanism to raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.

990-3.6.3 Message Matrix:

1. The matrix shall utilize light emitting diodes (LED).

2. LEDs used shall be amber (590 nm dominate wavelength) and shall meet the visibility requirements of this specification. LEDs shall have a viewing angle no less than 30 degrees. LED intensity shall not fall below 80 percent within three years.

3. All display modules shall be identical and interchangeable.

4. The matrix shall be capable of displaying a minimum of two lines of eight characters each, using a 10 inch font that meets the height to width ratio and character spacing requirements in the MUTCD, Section 2L.04 (paragraphs 05, 06, and 08) and Section 6F.60, paragraph 15.

5. The matrix shall provide variable letter, graphic and symbol sizes from 10 to 36 inches. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

990-3.6.4 Electrical System:

1. The power supply shall be a 12 V_{DC} system designed to operate the sign with a dedicated battery that is charged by the vehicle electrical system, but isolated so it does not drain the vehicle battery.

2. All internal sign components shall be treated with a protective, weather-resistant polyurethane or silicone conformal coating to protect against the adverse effects of humidity and moisture.

990-3.6.5 Sign Controller:

1. The sign controller shall be housed inside the sign and shall be equipped with a security lockout feature to prevent unauthorized use.

2. An external weather-resistant, hand-held control keypad shall be used to display the message on the sign.

3. The sign controller shall have the capability to provide a predetermined or blank default message upon loss of controller function.

990-3.6.6 Operation and Performance:

1. The message shall be displayed in upper case.

2. The message matrix panel shall be visible from one-half mile. With a 10 inch character displayed, the sign shall be legible from a distance of 400 feet in both day and night conditions. Under variable light level conditions, the sign shall automatically adjust its light source to meet the 400 foot visibility requirement.

3. The sign shall have the capability to store a minimum of 40 common messages and graphics of which a minimum of 30 shall be user-programmable messages.

4. All messages shall be capable of being flashed or sequenced. In the sequence mode, the message shall consist of no more than two phases, with each phase consisting of no more than three lines of text. Both message dwell time and message flash rate shall be individually programmable.

990-3.7 Automated Flagger Assistance Devices (AFAD):

990-3.7.1 General: AFAD's shall meet the physical display and operational requirements in the MUTCD and be listed on the APL. Manufacturers seeking evaluation of their product for the APL must include detailed vendor drawings, signed and sealed by a Professional Engineer registered in the State of Florida, showing typical application of the device in accordance with Standard Plans, Index 102-603. All electronic assemblies shall meet the requirements of NEMA TS-5-2017 Section 4.

990-3.7.2 Stop/Slow Automated Flagger Assistance Devices: Provide a remotely operated Stop/Slow AFAD including a Stop/Slow sign that alternately displays the stop face and the slow face of a Stop/Slow paddle.

When a gate arm is used, ensure that the gate arm descends to a down position across the approach lane of traffic when the stop face is displayed and then ascends to an upright position when the slow face is displayed.

Ensure the gate arm is fully retroreflectorized on both sides, with vertical alternating red and white stripes at 16 inch intervals measured horizontally in accordance with the MUTCD. When the arm is in the down position blocking the approach lane:

1. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and,

2. The end of the arm shall reach at least to the center of the lane being controlled.

990-3.7.3 Red/Yellow Lens Automated Flagger Assistance Devices: Provide a remotely operated Red/Yellow Lens AFAD that alternately displays a steadily illuminated circular red lens and a flashing circular yellow lens to control traffic.

Ensure that the Red/Yellow Lens AFAD includes a gate arm that descends to a down position across the approach lane of traffic when the steady circular red lens is illuminated and then ascends to an upright position when the flashing circular yellow lens is illuminated.

Ensure that the gate arm is fully retroreflectorized on both sides, with vertical alternating red and white stripes at 16 inch intervals measured horizontally in accordance with the MUTCD. When the arm is in the down position blocking the approach lane:

1. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and,

2. The end of the arm shall reach at least to the center of the lane being controlled.

Do not provide a change interval between the display of the steady circular red indication and the display of the flashing circular yellow indication. Provide a steady illuminated circular yellow indication, with at least a 5 second duration, between the transition from flashing circular yellow indication and the display of the steady circular red indication. The Engineer may approve a different duration, provided it falls within the range recommended by the MUTCD.

990-3.8 SWZ VSL Sign and SWZ VSL with ESFS: The size of the VSL sign shall meet the requirements of MUTCD Section 2B.03. The VSL sign letter height shall be designed

in accordance with the FHWA Standard Highway Signs 2012 Supplement. The VSL sign legend "SPEED LIMIT" shall be a black legend on a white retroreflective background. The VSL legend shall be displayed in white LEDs on an opaque black background. The VSL must be able to display speed limits from 5-70 mph in five mph increments.

The ESFS shall be mounted below the speed limit sign. The ESFS displays the speed at which they are traveling to approaching drivers. The changeable portion of the ESFS display panel shall be approximately the same height, width, and stroke of the VSL display. The vehicle speed feedback plaque shall be mounted above the ESFS display.

The ESFS speed threshold must automatically calibrate to the new SWZ portable VSL sign value.

990-3.9 SWZ Vehicle Detector: The SWZ vehicle detector must meet the requirements of Section 995. The SWZ vehicle detector must collect speed and volume data, 24 hours a day, seven days a week, in all weather conditions. The SWZ vehicle detector must be compatible with the SWZ central processor.

990-3.10 SWZ Camera: The SWZ camera must be listed on the APL and meet the requirements of Section 996.

ARTICLE 990-13 is deleted and the following substituted:

990-13 Channelizing Devices.

990-13.1 General: Provide channelizing devices in accordance with the MUTCD and the dimensions shown in the Standard Plans. SWZ location devices shall be provided in accordance with the Developmental Standard Plans. SWZ location devices shall be equipped with wireless Global Positioning System (GPS) location and remote communication devices. The SWZ location device shall be designed to provide 10 days of continuous autonomous operation without recharging.

990-13.2 Product Application: Manufacturers seeking inclusion of channelizing devices on the APL shall submit the following:

1. For Cones, Drums, and Temporary Tubular Markers:
    a. Photographs
    b. Drawings of sufficient detail to distinguish between similar devices
    c. Manufacturer self-certification of MASH compliant
2. For Barricades and Vertical Panels:
    a. Installations Instructions
    b. Photographs
    c. Drawings (may be included in Installation Instructions) of sufficient detail to distinguish between similar devices
    d. Any field assembly details and technical information necessary for proper application and installation
    e. Crash testing reports demonstrating the device meets MASH TL-3
    f. All relevant FHWA Eligibility Letters

SECTION 990 is expanded by the following new Article:

990-18 SWZ Central Processor.

The central processor shall meet the following:

1. Two-way secured wireless communication with the roadside equipment including SWZ location devices, SWZ arrow boards, SWZ cameras, SWZ PCMSs, SWZ VSL signs, SWZ VSL signs with an ESFS, and SWZ vehicle detectors.

2. Collect operational status of all work zone equipment. The software interface must display the current status (e.g., device location, on/off, SWZ arrow board display, SWZ PCMS message, SWZ VSL value, traffic volume and speed data, communication status, power level) in both a list and map view.

3. The map view must show common device icons and color-coded sensors and roadway segments based on vehicle speed data. The map must utilize a common base map (e.g., Google, Waze, etc.) and be scalable.

4. Capable of acquiring traffic speed data and selecting messages automatically without operator intervention after initialization. The lag time between changes in speed threshold ranges and the posting of the appropriate SWZ message(s) must be no greater than 60 seconds.

5.The processed data is used as an input in the system logic to remotely control messages displayed on the SWZ PCMS. The SWZ vehicle detector must provide speed data to an external system controller every minute, which must utilize the approved system logic and automatically update the associated SWZ PCMS message every minute as necessary.

6. Capable of providing warning and distance-based outputs regardless of the order the vehicle detectors are deployed. The adjustment must be automatic and must occur within ten minutes of deployment or any shifts or order change of devices.

7. Capable of storing and displaying messages created by the Department and logging this action when overriding any default automatic advisory message.

8. Capable of sending alerts via SMS, email, and SNMP.

9. Server-based, located in a secure cloud environment.

10. Incorporates an error detection and correction mechanism to ensure the integrity of traffic condition data and motorist information messages. Any required configuration of the communication system must be performed automatically during system initialization.

11. Stores system raw data for post-processing, reporting, and evaluation. The data shall include the traffic volumes and average speeds through the work zone, travel times through the work zone, time stamped work zone speed limits, time stamped PCMS messages, and work zone layout.

12. Data shall comply with the AASHTO Connected and Automated Vehicle requirement described at https://cav.transportation.org/work-zones/.

13. Capable of publishing the WZDx data feed from the system in real-time via a secure connection to the Department's API endpoint. The selected endpoint shall be a single location that is determined by the Department.