at any time, then Grantee shall perform no construction activities on Access Drive 2 during such time.

The Contractor shall construct the southern portion of MC 85 first in order to provide additional width for existing lane closures and minimize the closures of through lanes. Alternate construction sequencing for MC 85 will not be allowed without the review and approval of the Engineer. The Contractor shall provide his construction phasing plan at or prior to the preconstruction meeting for review and approval.

The Contractor shall coordinate and verify all event schedules with adjacent cities, adjacent property owners, and MCDOT. The Contractor shall also coordinate construction activities to avoid impacting traffic operations during major events and seasonal peak times for the warehouses, other businesses, and residents.

Maintaining Existing Traffic Signals and Lighting Systems:

The Contractor shall phase the new traffic signal equipment construction to minimize downtime. This may include splice pits to integrate the new traffic signal equipment with the existing traffic signal system. Temporary traffic signals are required as part of the construction, the Contractor shall submit a traffic control plan showing the temporary traffic signal layout for review and approval by the Engineer. The cost of temporary traffic signals shall be paid under bid items 470.80001 (MC-85 and 91st Avenue) and 470.80002 (MC-85 and 83rd Avenue).

401.11 PAYMENT, the first sentence in the 2015 City of Phoenix Supplement to the 2015 MAG Uniform Standard Specifications is revised to read:

Payment for complete temporary traffic control will be made at the unit bid price in the proposal item TRAFFIC CONTROL.

401.11 PAYMENT, add the following:

No separate measurement or payment will be made for the installation of painted temporary striping. The cost will be considered included in the 401.01000 Traffic Control item.

No separate measurement or payment will be made for pre-marking the roadway. The cost will be considered as included in the applicable final striping bid items.

SECTION 402 SMARTER WORK ZONE SYSTEM

402.1 DESCRIPTION:

This project requires the contractor to plan for, deploy, and operate Smarter Work Zone (SWZ) technology at the project site for 120 calendar days, at a minimum, with the option for MCDOT extend the number of calendar days needed.

The Contractor shall assist MCDOT in evaluating the following anticipated benefits of using the SWZ system:

- Improve speed limit compliance through the work zone;
- Increase travel time reliability through the work zone;
- Reduce number of crashes in the work zone;
- Reduce queues resulting from the work zone; and
- Assess use of alternative roads.

If the use of this technology proves to be beneficial, MCDOT may continue to require these types of SWZ technologies on future projects.

MCDOT will not take possession of SWZ equipment when the project is finished, except for the MCDOT furnished DSRC equipment that needs to be removed and returned to MCDOT.

No specific manufacturer/vendor's equipment is pre-approved. The smart work zone special provision is an open specification of various types of equipment/systems that can be provided by multiple manufacturers/vendors in the smart work zone industry. Below is a list (in alphabetical order) of known smart work zone equipment providers that may be able to provide some or all of the different systems required, but the contractor is NOT limited to selecting from these providers:

- All Traffic Solutions
- Blyncsy, Inc.
- iCone Products, LLC.
- Renaissance Technologies, Inc.
- Street Smart Rental, Inc.
- TrafficLogix
- VER-MAC
- WANCO, Inc.
- Work Area Protection

On days when SWZ devices are required by the Resident Engineer, the SWZ items shall be treated as necessary traffic control items required on the site. The Contractor shall plan for, deploy, and operate Smarter Work Zone (SWZ) technology at the project site for 120 calendar days, at a minimum, with the option for MCDOT extend the number of calendar days needed per MCDOT's discretion. The Contractor shall assist MCDOT in evaluating the following anticipated benefits of using the SWZ system:

- Improve speed limit compliance through the work zone;
- Increase travel time reliability through the work zone;
- Reduce number of crashes in the work zone;
- Reduce queues resulting from the work zone; and
- Assess use of alternative roads.

The SWZ system is comprised of Inform, Advise, Warn, Check and Standalone Detection SWZ Locations within the project area and SWZ system software that is used by the Contractor to monitor and control the various SWZ system devices that are deployed at the SWZ locations.

The project also includes MCDOT furnished and Contractor installed Dedicated Short Range Communications (DSRC) for vehicle-to-infrastructure (V2I) two-way wireless communications equipment that is to be installed on and connected to the SWZ system portable device trailer's power supply. This DSRC communications equipment is for a separate system referred to as the Connected Vehicle Work Zone Notification System, that the SWZ system is not dependent on, being provided through the Commercial Vehicle Information Systems & Network (CVISN) project for providing better info for freight operators about work zones.

The following items shall be submitted at the preconstruction conference when reasonably feasible. When not submitted at the preconstruction conference, the submittal(s) shall be specifically shown in the work schedule. The submittals shall be scheduled at least 45 days prior to intended use and/or material transport to the project site.

(A) Cellular Communications Site Assessment Summary
(B) SWZ VMS System Algorithms and Messages
(C) SWZ Report Formats
(D) SWZ Variable Message Sign System application programming interface (API) file format and sample data sets for one way communications from the Variable Message Sign System to the Connected Vehicle Work Zone Notification System
(E) SWZ ARID (Anonymous Re-Identification Device) Detector System API file format and sample data sets for one way communications from the ARID Detector System to the Connected Vehicle Work Zone Notification System
(F) SWZ Speed Feedback System API file format and sample data sets for one way communications from the ARID Detector System to the Connected Vehicle Work Zone Notification System
(G) SWZ System User Manuals for Devices and Software
(H) SWZ System Training Curriculum
(I) SWZ User Access Privileges
(J) SWZ Alert Messages
(K) SWZ System Acceptance Testing Procedures
(L) SWZ Mode of Operation Deployment Schedule ("Normal" vs. "Baseline Data")

The Contractor shall be responsible for the safety of all SWZ materials and shall take all necessary precautions to avoid loss by vandalism, fire or theft, or damage by water, and shall bear the cost of replacing any such material that is lost, destroyed or damaged.

402.2 MATERIALS:

402.2.1 SWZ Equipment Requirements:

All SWZ equipment components that are intended to be located outdoors shall meet the following environmental requirements:

(1) System device components shall be NEMA-3R (Rainproof and sleet resistant) or IP22 (Protection against solid objects over 12mm and against direct spray up to 15 degrees from vertical) rated for outdoor use.

(2) System device components shall meet NEMA TS1/TS2 Environmental requirements for temperature.

(3) System device components that don't meet the above NEMA TS1/TS2 and NEMA-3R or IP22 shall be mounted within a NEMA-3R or IP22 rated enclosure that provides a ventilation system (i.e., temperature sensor, ventilation fan, dust filters, etc.) of sufficient capacity to prevent equipment inside from overheating or be explicitly designed to withstand and operate in seasonal high temperatures for the project area. The design of the provided capacity of this ventilation system shall account for the heat radiating from the enclosure mounted equipment and the historically high temperatures encountered within the summer season at Maricopa County, AZ.

All SWZ equipment components shall be provided fully functional and as an integrated part of the overall SWZ system and shall remain fully functional and integrated when deployed in the project area.

402.2.1 (A) "Inform" SWZ Location:

The "Inform" SWZ location is the first SWZ location that a driver traveling on MC-85 will encounter prior to the beginning of the work zone. There are two "Inform" locations, one for each direction of travel. "Inform" devices are deployed where there is an option for drivers to take an alternate route and thus avoid the work zone entirely. The message displayed on the "Inform" variable message sign is intended to provide information to drivers regarding the conditions of the work zone, such as congestion or crashes, queue warning, travel time, delay time, and available alternate routes to allow drivers to make informed decisions about their routing.

The Contractor shall provide "Inform" devices as a fully functional system component that includes the following elements and meeting the associated performance requirements identified in Section 402.2.2.

(1) One or two portable device trailers for each "Inform" SWZ location capable of transporting and mounting all the necessary system elements.

(2) A variable message sign (VMS) mounted to a trailer with mounting bracket to adjust the field of view from the variable message display sign. The variable message display area shall be a full matrix display and messages displayed shall be compliant with the FHWA Manual on Uniform Traffic Control Devices (MUTCD), 6F-2 - Portable Changeable Message Signs and display three lines of eight characters per line with each character a minimum size of five pixels wide- by seven pixels high. The size of the characters shall be adjusted to correspond with industry recommended sizes for the actual speed limits posted, in the signs field of view, per the approved traffic control plans and shall accommodate speed limits up to 50mph. The signs should be visible from 1/2 mile under ideal day and night conditions. Under low light level conditions, the sign shall automatically adjust its light source so as to meet the legibility requirements and not impair the drivers, vision. The pixels shall be constructed with Light Emitting Diodes (LEDs). The LEDs within the sign shall be visible to drivers that are in front of the sign and within a 30-degree cone of view from the sign.

(3) Non-intrusive, side-fire radar-based traffic detection sensor system with a telescoping pole that provides a minimum height of 20-feet and higher, if needed per detection sensor manufacturer's recommendations to avoid detection sensor coverage area concerns with vehicle occlusion on a roadway that has a significant amount of heavy truck traffic, and mounted to the same trailer as the "Inform" variable message display sign or on a separate trailer, that is configured with sufficient detection zones to cover all travel lanes (in both directions of travel at each trailer location) and can detect the travel lane closest to the trailer when the trailer and associated trailer barricades are deployed at the edge of this first travel lane. Each detection zone shall be configured to provide per-lane vehicle presence, volume, occupancy (queue detection), and speed data. The selection of which traffic detection sensor system manufacturer(s) and model number(s) to provided and the associated quantity needed on each trailer shall account for minimal recommended offset distance from nearest travel lane while still achieving detection data in all travel lanes. Requiring this trailer to be deployed at an offset that is beyond what is practical for the project work zone constraints shall be deemed unacceptable. The addition of an additional detector type, that provides similar performance (i.e., video detection, which can also detect speed, volume, and occupancy) for the nearest travel lane, is acceptable.

(4) ARID (Anonymous Re-Identification Device) sensor(s) that detects the Bluetooth and WiFi signals in both travel directions from vehicles, hands-free sets, mobile phones, and navigation systems.

402.2.1 (B) "Advise" SWZ Location:

The "Advise" SWZ location is the second SWZ location that a driver traveling on MC-85 will encounter prior to the beginning of the work zone. There are two "Advise" locations, one for each direction of travel. It is deployed just prior to the "Road Work Ahead" sign, before the beginning of any lane restrictions or active work spaces. The message

displayed on the “Advise” variable message sign is intended to provide information to drivers regarding work zone conditions, such as congestion or crashes, queue warning, travel time, delay time, and available alternate routes. The “Advise” SWZ location also provides a closed-circuit television (CCTV) camera system with pan, tilt, and zoom (P/T/Z) capabilities for the MCDOT traffic management center (TMC) operators and construction staff to monitor the traffic conditions alone the project corridor.

The Contractor shall provide “Advise” devices as a fully functional system component that includes the following elements and meeting the associated performance requirements identified in Section 402.2.2.

(1) One or two portable device trailers for each “Advise” SWZ location capable of transporting and mounting all the necessary system elements.

(2) A VMS mounted to a trailer with mounting bracket to adjust the field of view from the variable message display sign. The variable message display area shall be a full matrix display and messages displayed shall be compliant with the FHWA Manual on Uniform Traffic Control Devices (MUTCD), 6F-2 - Portable Changeable Message Signs and display three lines of eight characters per line with each character a minimum size of five pixels wide by seven pixels high. The size of the characters shall be adjusted to correspond with industry recommended sizes for the actual speed limits posted, in the signs field of view, per the approved traffic control plans and shall accommodate speed limits up to 50mph. The signs should be visible from 1/2 mile under ideal day and night conditions. Under low light level conditions, the sign shall automatically adjust its light source so as to meet the legibility requirements and not impair the drivers, vision. The pixels shall be constructed with LEDs. The LEDs within the sign shall be visible to drivers that are in front of the sign and within a 30-degree cone of view from the sign.

(3) Non-intrusive, side-fire radar-based traffic detection sensor system with a telescoping pole that provides a minimum height of 20-feet and higher, if needed per detection sensor manufacturer’s recommendations to avoid detection sensor coverage area concerns with vehicle occlusion on a roadway that has a significant amount of heavy truck traffic, and mounted to the same trailer as the “Advise” variable message display sign or on a separate trailer, that is configured with sufficient detection zones to cover all travel lanes (in both directions of travel at each trailer location) and can detect the travel lane closest to the trailer when the trailer and associated trailer barricades are deployed at the edge of this first travel lane. Each detection zone shall be configured to provide per-lane vehicle presence, volume, occupancy (queue detection), and speed data. The selection of which traffic detection sensor system manufacturer(s) and model number(s) to provided and the associated quantity needed on each trailer shall account for minimal recommended offset distance from nearest travel lane while still achieving detection data in all travel lanes. Requiring this trailer to be deployed at an offset that is beyond what is practical for the project work zone constraints shall be deemed unacceptable. The addition of an additional detector type, that provides

similar performance (i.e., video detection, which can also detect speed, volume, and occupancy) for the nearest travel lane, is acceptable.

(4) ARID sensor(s) that detect the Bluetooth and WiFi signals in both travel directions from vehicles, hands-free sets, mobile phones, and navigation systems.

(5) A CCTV camera with P/T/Z capabilities mounted to the same telescoping pole as the side-fire radar-based traffic detection sensor system, or mounted to a separate telescoping pole that provides a minimum height of 20-feet.

402.2.1 (C) "Warn" SWZ Location:

The "Warn" SWZ location is the third SWZ location that a driver traveling on MC-85 will encounter. There are two "Warn" locations, one for each direction of travel. It is positioned within the beginning of the work zone at a point just downstream of the first arterial roadway crossing to warn drivers, that just turned into the work zone, and drivers continuing to traveling along MC-85, of the current posted legal speed limit and the speed at which they are currently driving. This device trailer contains a speed feedback sign in conjunction with a static posted speed limit sign and a forward-firing radar detector.

The Contractor shall provide "Warn" devices as a fully functional system component that includes the following elements and meeting the associated performance requirements identified in Section 402.2.2.

(1) One portable device trailer for each "Warn" SWZ location capable of transporting and mounting all the necessary system elements.

(2) A static MUTCD compliant enforceable speed limit sign, at the top, posting the legal speed limit that has been identified for the work zone.

(3) A static sign stating "YOUR SPEED" with a multi-colored LED variable speed message display that displays the actual real-time speed of the vehicle currently driving within the detection zone of the trailer mounted traffic speed detector. The color of the speed message shall be yellow when the driver is traveling at or below a pre-set speed threshold and red or blue when the traveling speed is above the speed threshold.

(4) Non-intrusive, forward-firing radar-based traffic speed detection sensor system.

402.2.1 (D) "Check" SWZ Location:

The "Check" SWZ location is the fourth SWZ location that a driver traveling on MC-85 will encounter. There are two "Check" locations, one for each direction of travel. It is positioned in areas that have a high concentration of construction workers present and downstream of the "Warn" device trailer. The "Check" device trailer provides driver feedback, such as speed feedback as compared to the work zone speed limit. The "Check" device trailer location shall be moved a few times per work day/night, as

necessary within the 2nd half of the work zone and where a high concentration of workers are anticipated to be working. This device trailer contains a speed feedback sign in conjunction with a static posted speed limit sign and a forward-firing radar detector.

The Contractor shall provide "Check" devices as a fully functional system component that includes the following elements and meeting the associated performance requirements identified in Section 402.2.2.

(1) One portable device trailer for each "Check" SWZ location capable of transporting and mounting all the necessary system elements.

(2) A static MUTCD compliant enforceable speed limit sign, at the top, posting the legal speed limit that has been identified for the work zone.

(3) A static sign stating "YOUR SPEED" with amulti-colored LED variable speed message display that displays the actual real-time speed of the vehicle currently driving within the detection zone of the trailer mounted traffic speed detector. The color of the speed message shall be yellow when the driver is traveling at or below a pre-set speed threshold and red or blue when the traveling speed is above the speed threshold.

(4) Non-intrusive, forward-firing radar-based traffic speed detection sensor system.

402.2.1 (E) "Stand-Alone Detection" SWZ Location:

The "Stand-Alone Detection" device location is the first SWZ location that a driver traveling on a road perpendicular to MC-85 will encounter before crossing or turning onto MC-85. There are four "Stand-Alone Detection" locations, two for each of the two alternate routes perpendicular to MC-85. It is approximately 0.25 miles north and south of MC-85 and positioned on the north and south bound side of the arterial road (i.e., the location north of MC-85 will be on the northbound side and the location south of MC-85 will be on the southbound side). The primary purpose of this detector location is to count the number of cars traveling away from the MC-85 intersection downstream from the "Inform" or "Advise" locations. Note that both downstream locations for this detector will be tested at various points throughout the deployment phase per the direction of the Engineer, so all possible locations must be accounted for in the TCP. Secondary purposes include counting the number of cars heading towards MC-85 and queue detection of vehicles approaching MC-85. There will be one pair (north and south sides) of "Stand-Alone Detection" device locations for the selected major arterial road alternate route that is available to MC-85 eastbound drivers. There will be a second pair of "Stand-Alone Detection" device locations for the selected major arterial road alternate route that is available to MC-85 westbound drivers. The major arterial roads that are selected (for eastbound direction alternate routes and for the westbound alternate route) shall each be directly prior to the work zone travel lane changes (i.e., lane restriction taper) for the respective MC-85 direction of travel.

The Contractor shall provide “Stand-Alone Detection” SWZ devices as a fully functional system component that includes the following elements and meeting the associated performance requirements identified in Section 402.2.2.

(1) One portable device trailer for each “Stand-Alone Detection” SWZ location capable of transporting and mounting all the necessary system elements.

(2) Non-intrusive, side-fire radar-based traffic detection sensor system with a telescoping pole that provides a minimum height of 20-feet and higher, if needed per detection sensor manufacturer’s recommendations to avoid detection sensor coverage area concerns with vehicle occlusion on a roadway that has a significant amount of heavy truck traffic, and mounted on the trailer, that is configured with sufficient detection zones to cover all travel lanes (in both directions of travel at each trailer location) and can detect the travel lane closest to the trailer when the trailer and associated trailer barricades are deployed at the edge of this first travel lane. Each detection zone shall be configured to provide per-lane vehicle presence, volume, occupancy (queue detection), and speed data. The selection of which traffic detection sensor system manufacturer(s) and model number(s) to provided and the associated quantity needed on each trailer shall account for minimal recommended offset distance from nearest travel lane while still achieving detection data in all travel lanes. Requiring this trailer to be deployed at an offset that is beyond what is practical for the project work zone constraints shall be deemed unacceptable. The addition of an additional detector type, that provides similar performance (i.e., video detection, which can also detect speed, volume, and occupancy) for the nearest travel lane, is acceptable.

(3) ARID sensor(s) that detect the Bluetooth and WiFi signals in both travel directions from vehicles, hands-free sets, mobile phones, and navigation systems.

402.2.1 (F) Portable Device Trailers

The Contractor shall provide portable trailers capable of transporting all the necessary system elements and capable of mounting fully functional SWZ devices, as identified for each of the respective SWZ locations (“Inform,” “Advise,” “Warn,” “Check,” and “Stand-Alone Detection”) along the roadside. Each device trailer shall provide the following common elements:

(1) A trailer number that is unique (i.e., trailers deployed in the project area shall not have the same number as other deployed trailers) and is visible from the first vehicle travel lane adjacent to the deployed trailer.

(2) A solar-powered distribution assembly (PDA) with sufficient battery capacity to support all trailer mounted components for a period of seven days without sunlight. This power distribution assembly shall include intelligence for monitoring the power of the batteries and shall send a "critically low on power" type alarm message, via the trailer mounted cellular communications gateway, to the remote system server.

All necessary cables and devices needed for interconnecting the trailer mounted devices to this powered distribution assembly shall also be provided.

(3) A SWZ cellular communications gateway with sufficient communications data ports and an associated cell phone provider data plan that can support all the communication needs of the trailer mounted SWZ devices within the project area. All necessary cables and devices needed for interconnecting the trailer mounted devices to this gateway shall also be provided. It shall be the Contractor's responsibility to perform a site assessment of the project area and pick a cellular network provider that had sufficient data network capacity and coverage needed for this project. The Contractor shall submit to the engineer for approval a Cellular Communications Site Assessment Summary document identifying the project areas evaluated, the cellular network provider selected, and a statement indicating that there is sufficient data network capacity and coverage needed for this project.

(4) A GPS device that collects and reports trailer location data to identify the actual trailer location and can be integrated within the cellular communications gateway or connected to this gateway as a stand-alone device. The GPS device shall provide location data within 10 meters or less of the actual trailer location. All necessary cables and devices needed for connecting to cellular communications gateway shall also be provided.

(5) Cable mounting provisions shall be provided within the trailer for securing cables during system operation and during transport to a different location.

(6) Mounting provisions to haul the trailer and associated trailer mounted devices from one location to the next without needing a separate vehicle to transport any of the components that are intended to be mounted on the trailer.

(7) The device trailer shall be street legal, have functioning break lights connected to it when being towed, support driving speeds of 75 mph when being towed, and provided with a standard size trailer hitch.

(8) The device trailer shall have adjustable leveling legs that can completely support the weight of a fully loaded trailer. The adjustable height of the legs should be able to raise the trailer wheels a minimum of 4" between the bottom of the wheels and a flat/level surface that the trailer is standing on. The device trailer shall have a minimum of two level gages (length and width positions) to Indicate when the trailer is level.

(9) When in operation with all stabilizing devices in place, the device trailers shall be capable of withstanding wind gusts up to 80 mph without overturning or changing orientation.

(10) MCDOT furnish and Contractor installed Dedicated Short Range Communications (DSRC) radio and associated DSRC cellular communications gateway that are connected to the trailer's PDA.

402.2.2 SWZ System Software and Performance Requirements:

The Contractor provided SWZ system shall be comprised of the following systems integrated together as one complete system, as four separate systems, or any combination thereof:

(1) Variable Message Sign System: This system is comprised of a Contractor hosted remote server and database that is integrated to the variable message signs, side-fire radar-based traffic detection sensors, and GPS devices at the "Inform," "Advise," and "Stand-Alone Detection" SWZ locations.

(2) Speed Feedback System: This system is comprised of a Contractor hosted remote server and database that is integrated to the speed feedback sign, forward-firing radar detector, and GPS devices at the "Warn" and "Check" SWZ locations.

(3) CCTV System: This system is comprised of a Contractor hosted remote server that is integrated to the CCTV camera and P/T/Z devices at the "Advise" SWZ locations.

(4) ARID Detector System: This system is comprised of a Contractor hosted remote server and database that is integrated to ARID detector devices at the "Inform," "Advise," and "Stand-Alone Detection" SWZ locations.

The MCDOT furnish and Contractor installed DSRC radio and cellular communications gateway that is connected to the portable device trailer's power distribution assembly (PDA) will be a completely separate system with software that the Contractor does not have to provide or configure.

402.2.2 (A) Variable Message Sign System Requirements:

The Contractor provided hosted remote server and databases shall include the following minimum functionality:

(1) A secured Web interface application software that allows TMC operators and other project stakeholders to log into the Contractor provided server, from a PC connected to the internet, using unique identifying credentials assigned to each person, for access to the system graphical user interface (GUI). Through this GUI, project stakeholders shall have the ability to monitor the status of the system devices and access the data being archived by the system. Users that have been granted higher access privileges, based on pre-defined user log-in credentials, shall also have the ability to change the messages that are being displayed on each VMS.

(2) The VMS control software shall support displaying a single message over two display cycles (i.e., part of the message on the first cycle and the remaining part of the message on the second display cycle).

(3) Mobile device application software that allows field personnel out on the project site and other project stakeholders to log into the Contractor provided server, from a mobile application on their cell phone (i.e., an android and apple mobile device) connected to the internet, using unique identifying credentials assigned to each person, for access to the system GUI. Through this application, project stakeholders shall have the ability to monitor the status of the system devices. Users that have been granted higher access privileges, based on pre-defined user log-in credentials, shall also have the ability to change the messages that are being displayed on each VMS.

(4) Configurable with a trailer number to identify all field devices (with the exception of the CCTV camera assembly, ARID detector, and DSRC System) that are mounted to the trailers at the “Inform,” “Advise,” and “Stand-Alone Detection” SWZ locations and have the respective trailer number tagged to all archived data sets from these trailer mounted field devices.

(5) A GUI map that auto-populates the trailer location on the map, based on the GPS coordinates received from the trailer mounted GPS device. The GUI shall be configured to include the device location name (i.e., “WB MC-85 Advise” location), the trailer number, and a list of devices on the trailer.

(6) GPS coordinates received from the GPS device on the portable device trailer shall be archived with the associated trailer number tag at a minimum frequency of once daily at the beginning of each work day and each time devices are moved.

(7) Receive and archive "critically low on power" type alarm message, with trailer number and time stamp, and forward this alarm to the operator(s) using the Mobile Devices Application Software and via emails and text messages to a list of pre-defined stakeholders that want to receive the message.

(8) Monitor and archive "loss of communications" type alarms, with trailer number and time stamp, and forward this alarm to the operator(s) via emails and text messages to a list of pre-defined stakeholders that want to receive the message.

(9) Receive and archive detector speed data using one minute averages, at a minimum, for each travel lane (i.e., each detection zone).

(10) Receive and archive detector volume data using one minute intervals, at a minimum, for each travel lane (i.e., store the sum of the number of vehicles counted within each one minute interval per detection zone).

(11) Receive and archive detector occupancy (queue detection) data for each travel lane (i.e., compute the length of time a vehicle queue was detected for each detection zone and archive this data). The interval in which this data is archived shall include the length of time (the duration) for each vehicle queue with start and end time stamps.

(12) Provide a GUI that shows the current message being displayed on each VMS that is deployed.

(13) Provide a GUI that is configured to include a library of pre-approved VMS messages for each location type (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, and EB MC-85 Advise) and supports both user selectable messages (from the message library) and system generated messages based on pre-approved system algorithm parameters.

(14) Log the operator's credentials into the system's historical database each time an operator changes a message being displayed on a VMS and archive all new message being displayed with the associated time stamp. The operator's credentials that are logged for system generated message changes shall be something like "system algorithm."

(15) Provide a system algorithm that calculates and archives vehicle travel time data using one minute averages, at a minimum, for each of the following:

(a) WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
(b) EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
(c) WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
(d) EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations
(e) Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
(f) Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
(g) Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
(h) Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
(i) Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
(j) Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
(k) Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
(l) Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.

(16) Provide a system algorithm that automatically changes the VMS messages being displayed on each VMS based on a pre-approved algorithm that calculates real-time traffic conditions and displays the appropriate message (i.e., stopped traffic

ahead, alternate route, travel time, etc.) for each VMS location, based on the traffic conditions calculated. The Contractor proposed system algorithm shall include, at a minimum, four different traffic condition thresholds with an associated hierarchy of message types for each threshold that the system will display.

(17) Generate the following weekly system reports in Microsoft Excel format or some other type of Engineer approved format that allows MCDOT to easily populate the data into a Microsoft Excel spreadsheet, using the copy and paste functionality of a personal computer. Each of the following reports shall clearly identify the calendar week that the data within the report represents, a descriptive report name that distinguishes the report from other reports generated, identifies the type of data provided in the report, and provides the day of week and time of day (or time interval) for each data set contained within the report:

(a) VMS Message History: This report shall identify the time of day each message on a VMS changed, the actual wording of the new message being displayed, and the credentials of the operator that changed the message. This report shall also identify when there was no message being displayed (i.e., operator blanking the sign and when the sign was powered off). This report shall be organized per VMS location using the trailer number with associated GPS coordinates and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform and EB MC-85 Advise).

(b) System Alarm History: This report shall identify the time of day each trailer had an alarm type message (i.e., critically low on power, loss of communications, etc.). This report shall be organized per trailer number with the associated GPS coordinates of the trailer at the time the alarm was received. The type of alarm message, including low power, loss of communications, and other types, shall also be identified with the time of day, trailer number, and trailer location.

(c) Detector Speed Data: This report shall identify the vehicle speed data collected using one minute averages, at a minimum, for each travel lane (i.e., each detection zone). This report shall be organized using the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only, NE Detector Only, and SE Detector Only). The associated GPS coordinates of the trailer at the time the data was received shall be included with the trailer number or location name. The data for each trailer location shall be organized per detection zone (i.e., per travel lane) and it shall be clear in the report which direction of travel is covered by each detection zone.

(d) Detector Volume Data: This report shall identify the detector volume data collected using one minute intervals, at a minimum, for each travel lane (i.e., provide the sum of the number of vehicles counted within each one minute interval per detection zone). This report shall be organized using the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only,

NE Detector Only, and SE Detector Only). The associated GPS coordinates of the trailer at the time the data was received shall be included with the trailer number or location name. The data for each trailer location shall be organized per detection zone (i.e., per travel lane) and it shall be clear in the report which direction of travel is covered by each detection zone.

(e) Detector Occupancy (Queue Detection) Data: This report shall identify the detector queue detection data for each travel lane (i.e., provide the length of time / duration for each vehicle queue with start and end time stamps) This report shall be organized using the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only, NE Detector Only, and SE Detector Only). The associated GPS coordinates of the trailer at the time the data was received shall be included with the trailer number or location name. The data for each trailer location shall be organized per detection zone (i.e., per travel lane) and it shall be clear in the report which direction of travel is covered by each detection zone.

(f) Travel Time Data: This report shall identify vehicle travel time data using one minute averages, at a minimum, for each for each of the following:

- WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
- EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
- WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
- EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations
- Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Other possible travel time combinations, as directed by MCDOT.

(18) Provide an application programming interface (API) for one way communications from the Variable Message Sign System to the Connected Vehicle Work Zone Notification System that is being furnished by the CVISN project. The API shall transmit/push the following data, in one minute intervals, to the Connected Vehicle Work Zone Notification System using Extensible Markup Language (XML), JavaScript Object Notation (JSON), or another approved open-standard file format:

(a) VMS Message Data: The actual wording of the message currently being displayed on each variable message sign deployed on the project, with the corresponding time-stamp, GPS coordinates of the sign, trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform and EB MC-85 Advise).

(b) Detector Speed Data: The current vehicle speed data using one minute averages, at a minimum, for each travel lane (i.e., each detection zone), with the corresponding time-stamp, GPS coordinates of the associated detector device, the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only, NE Detector Only, and SE Detector Only). It shall be clear in the data provided which direction of travel is covered by each detection zone.

(c) Detector Volume Data: The current detector volume data using one minute intervals, at a minimum, for each travel lane (i.e., provide the sum of the number of vehicles counted within each one minute interval per detection zone), with the corresponding time-stamp, GPS coordinates of the associated detector device, the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only, NE Detector Only, and SE Detector Only). It shall be clear in the data provided which direction of travel is covered by each detection zone.

(d) Detector Occupancy (Queue Detection) Data: The current detector queue detection data for each travel lane, with the corresponding time-stamp, GPS coordinates of the associated detector device, the trailer number and/or the location name (i.e., WB MC-85 Inform, WB MC-85 Advise, EB MC-85 Inform, EB MC-85 Advise, NW Detector Only, SW Detector Only, NE Detector Only, and SE Detector Only). It shall be clear in the data provided which direction of travel is covered by each detection zone.

(e) Travel Time Data: The current vehicle travel time data using one minute averages, at a minimum, with the corresponding time-stamp, GPS coordinates of the associated detector devices for each of the following:

- WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
- EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
- WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
- EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations

- Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Other possible travel time combinations, as directed by MCDOT.

402.2.2 (B) Speed Feedback System Requirements:

The Contractor provided hosted remote server and databases shall include the following minimum functionality:

(1) A secured Web interface application software that allows TMC operators and other project stakeholders to log into the Contractor provided server, from a PC connected to the internet, using unique identifying credentials assigned to each person, for access to the system GUI. Through this GUI, project stakeholders shall have the ability to monitor the status of the “Warn” and “Check” system devices and set the speed threshold level that changes the color of the speed message to yellow when the driver is traveling at or below the threshold and changes the color to red or blue when the traveling speed is above the speed threshold.

(2) Configurable with a trailer number to identify all field devices (with the exception of the DSRC System) that are mounted to the trailers at the “Warn” and “Check” SWZ locations and have the respective trailer number tagged to all archived data sets from these trailer mounted field devices.

(3) A GUI map that auto-populates the trailer location on the map, based on the GPS coordinates received from the trailer mounted GPS device. The GUI shall be configured to include the device location name (i.e., “WB MC-85 Warn” location), the trailer number.

(4) GPS coordinates received from the GPS device on the portable device trailer shall be archived with the associated trailer number tag at a minimum frequency of once daily at the beginning of each work day and each time devices are moved.

(5) Receive and archive "critically low on power" type alarm message, with trailer number and time stamp, and forward this alarm to the operator(s) via emails and text messages to a list of pre-defined stakeholders that want to receive the message.

(6) Monitor and archive "loss of communications" type alarms, with trailer number and time stamp, and forward this alarm to the operator(s) via emails and text messages to a list of pre-defined stakeholders that want to receive the message.

(7) Receive and archive detector speed data using one minute averages, at a minimum, for each “Warn” and “Check” SWZ location.

(8) Provide a system algorithm that automatically displays the current speed of the vehicle that is currently within the detection zone.

(9) Generate the following weekly system reports in Microsoft Excel format or some other type of Engineer approved format that allows MCDOT to easily populate the data into a Microsoft Excel spreadsheet, using the copy and paste functionality of a personal computer. Each of the following reports shall clearly identify the calendar week that the data within the report represents, a descriptive report name that distinguishes the report from other reports generated, identifies the type of data provided in the report, and provides the day of week and time of day (or time interval) for each data set contained within the report:

(a) System Alarm History: This report shall identify the time of day each trailer had an alarm type message (i.e., critically low on power, loss of communications, etc.). This report shall be organized per trailer number with the associated GPS coordinates of the trailer at the time the alarm was received. The type of alarm message, including low power, loss of communications, and other types, shall also be identified with the time of day, trailer number, and trailer location.

(b) Detector Speed Data: This report shall identify the vehicle speed data collected using one minute averages, at a minimum, for each “Warn” and “Check” SWZ location. This report shall be organized using the trailer number and/or the location name (i.e., WB MC-85 Warn, WB MC-85 Check, EB MC-85 Warn, and EB MC-85 Check). The associated GPS coordinates of the trailer at the time the data was received shall be included with the trailer number or location name.

(10) Provide an application programming interface (API) for one way communications from the Speed Feedback System to the Connected Vehicle Work Zone Notification System that is being furnished by the CVISN project. The API shall transmit/push the detector speed data, in one minute intervals, with time stamp,

trailer name, and associated GPS coordinates to the Connected Vehicle Work Zone Notification System using Extensible Markup Language (XML), JavaScript Object Notation (JSON), or another approved open-standard file format.

402.2.2 (C) CCTV System Requirements:

The Contractor provided hosted remote server shall include the following minimum functionality:

(1) A secured Web interface application software that allows TMC operators and other project stakeholders to log into the Contractor provided server, from a PC connected to the internet, using unique identifying credentials assigned to each person, for access to the P/T/Z controls and video stream of each camera location.

(2) The ability to configure a minimum of five camera pre-set positions (i.e., five different fields of view).

(3) The ability to view the real-time video stream being generated by each camera.

(4) Generate the following weekly system reports in Microsoft Excel format or some other type of Engineer approved format that allows MCDOT to easily populate the data into a Microsoft Excel spreadsheet, using the copy and paste functionality of a personal computer. The following report shall clearly identify the calendar week that the data within the report represents, a descriptive report name that distinguishes the report from other reports generated, identifies the type of data provided in the report, and provides the day of week and time of day (or time interval) for each data set contained within the report:

(a) System Alarm History: This report shall identify the time of day each trailer had an alarm type message (i.e., critically low on power, loss of communications, etc.). This report shall be organized per trailer number. The type of alarm message, including low power, loss of communications, and other types, shall also be identified with the time of day and trailer number.

402.2.2 (D) ARID Detector System Requirements:

The Contractor provided hosted remote server and databases shall include the following minimum functionality:

(1) A secured Web interface application software that allows TMC operators and other project stakeholders to log into the Contractor provided server, from a PC connected to the internet, using unique identifying credentials assigned to each person, for access to the system GUI. Through this GUI project stakeholders shall have the ability to monitor the status of the system devices, and access the data being archived by the system.

(2) Configurable with a trailer number to identify all ARID detector device locations and have the respective trailer number tagged to all archived data sets from these devices.

(3) A GUI map that auto-populates the trailer location on the map, based on the GPS coordinates received from the ARID detector device or trailer mounted GPS device. The GUI shall be configured to include the device location name (i.e., “WB MC-85 Advise” location) and the trailer number.

(4) GPS coordinates received from the ARID detector device or GPS device on the portable device trailer shall be archived with the associated trailer number tag at a minimum frequency of once daily at the beginning of each work day and each time devices are moved.

(5) Monitor and archive "loss of communications" type alarms, with trailer number and time stamp.

(6) Calculate and archive ARID detector travel time data using one minute averages, at a minimum, for each of the following:

(a) WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
(b) EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
(c) WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
(d) EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations
(e) Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
(f) Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
(g) Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
(h) Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
(i) Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
(j) Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
(k) Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
(l) Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
(m) Other possible travel time combinations, as directed by MCDOT.

(7) Generate the following weekly system reports in Microsoft Excel format or some other type of Engineer approved format that allows MCDOT to easily populate the data into a Microsoft Excel spreadsheet, using the copy and paste functionality of a personal computer. Each of the following reports shall clearly identify the calendar week that the data within the report represents, a descriptive report name that distinguishes the report from other reports generated, identifies the type of data provided in the report, and provides the day of week and time of day (or time interval) for each data set contained within the report:

(a) ARID Travel Time Data: This report shall identify vehicle travel time data using one minute averages, at a minimum, for each for each of the following:

- WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
- EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
- WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
- EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations
- Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Other possible travel time combinations, as directed by MCDOT.

(b) System Alarm History: This report shall identify the time of day each trailer had an alarm type message (i.e., critically low on power, loss of communications, etc.). This report shall be organized per trailer number. The type of alarm message, including low power, loss of communications, and other types, shall also be identified with the time of day and trailer number.

(8) Provide an application programming interface (API) for one way communications from the ARID Detector System to the Connected Vehicle Work Zone Notification System that is being furnished by the CVISN project. The API shall transmit/push the following data, in one minute intervals, to the Connected Vehicle Work Zone Notification System using Extensible Markup Language (XML), JavaScript Object Notation (JSON), or another approved open-standard file format:

(a) ARID Travel Time Data: The current vehicle travel time data using one minute averages, at a minimum, with the corresponding time-stamp, GPS coordinates of the associated detector devices for each of the following:

- WB Travel time between WB MC-85 Inform and EB MC-85 Inform locations
- EB Travel time between EB MC-85 Inform and WB MC-85 Inform locations
- WB Travel time between WB MC-85 Advise and EB MC-85 Advise locations
- EB Travel time between EB MC-85 Advise and WB MC-85 Advise locations
- Travel time between WB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper.
- Travel time between WB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between WB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the WB lane restriction taper, if the Stand-Alone Detection is located downstream from the WB Advise location.
- Travel time between EB MC-85 Inform and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Inform and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper.
- Travel time between EB MC-85 Advise and the NB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Travel time between EB MC-85 Advise and the SB Stand-Alone Detection on the alternate route before the EB lane restriction taper, if the Stand-Alone Detection is located downstream from the EB Advise location.
- Other possible travel time combinations, as directed by MCDOT.

402.3 CONSTRUCTION:

The Contractor submitted Traffic Control Plan (TCP) shall include SWZ devices and the associated barricades for these SWZ devices. See Section 401 Traffic Control for additional requirements.

The Contractor shall identify two members of the construction crew as the primary and secondary SWZ System Managers who shall be responsible for maintaining the system operation and dealing with any issues or questions that may arise. The contact info

(mobile phone number and email address) of these SWZ System Managers shall be provided to the RE and TMC representatives. The SWZ System Managers shall be trained on deploying and operating all of the SWZ system equipment and Web interface applications.

402.3.1 SWZ System Mobilization and Demobilization:

The Contractor shall provide a staging area and deliver the SWZ system field equipment to the staging area a minimum of two (2) weeks prior to needing to deploy the equipment within the work zone. The Contractor is responsible for the equipment while it is stored in the staging area and any insurance deemed necessary.

The Contractor shall be responsible for picking up the SWZ field devices from the staging area and mobilizing the SWZ field devices at the work zone locations identified within the approved TCP.

The Contractor shall set up, configure, and perform acceptance testing activities to verify proper operation. The Contractor shall provide these activities each time one or more SWZ field devices are moved within the project area. The Contractor shall relocate system field devices in accordance with changes to the TCP and for system performance evaluation reasons.

Upon completion of the SWZ system deployment period, the Contractor shall demobilize the SWZ field devices and remove them from the project site.

402.3.1 (A) System Configuration:

The Contractor shall provide support from a local and/or remote location for the setup and configuration of the SWZ system. All on-site system configuration procedures shall be clearly documented within the approved SWZ System User Manuals submittal.

The Contractor shall coordinate with the Engineer and submit Contractor proposed VMS messages for approval. No message shall be displayed on a VMS sign without prior approval from the Engineer. The Contractor's SWZ VMS System Algorithms and Messages submittal shall include the proposed system algorithm with a minimum of four different real-time traffic condition thresholds (calculated based on SWZ system detector data) with an associated hierarchy of message types for each threshold that the system will display. The submittal shall include multiple message options message (i.e., stopped traffic ahead, alternate route, travel time, etc.) for each VMS location and for each real-time traffic condition threshold. The Contractor shall coordinate with the Engineer to pre-define alternate routes that may be used and include each of the associated alternate route messages in the submittal.

The Contractor shall coordinate with the Engineer and provide a SWZ User Access Privileges submittal that clearly identifies each user by first and last name and the associated level of access that each of these users will have when logging into the system

The Contractor shall coordinate with the Engineer and provide a SWZ Alert Messages submittal that clearly identifies all stakeholders by first and last name, the associated types of system generated alerts that each of these stakeholders want to receive, and the method (email and/or text) that the stakeholder wants receive the alert.

The Contractor shall provide a SWZ Report Formats submittal that includes a sample format for each type of required system report.

Each SWZ system deployment configuration shall include two basic modes of operation. This first mode of operation shall be referred to as "Normal Operation" and the second shall be referred to as "Baseline Data Operation." Within the baseline data mode of operation, all the system devices shall be fully operational and there shall be no messages displayed on the VMS and speed feedback signs (i.e., all message displays are blanked). During this baseline data mode of operation, the system shall be collecting, archiving, calculating, and reporting all the required data the same way that is used during normal operation. The baseline data collecting periods of time shall be clearly documented within the system reports, to distinguish them from the data that was collected during normal operations. This baseline data mode of operation and the associated data is a key component for evaluating the system performance. The Contractor shall coordinate with the Engineer and submit a SWZ Mode of Operation Deployment Schedule that identifies when the system is scheduled to be in each mode of operation (i.e., "Normal Operation" vs. "Baseline Data Operation").

The Contractor shall log into the SWZ system and confirm that the system setup and configuration has been completed and all SWZ field devices are operating as intended for the project area. Once this is confirmed, the Contractor shall send an email to the Engineer letting the respective stakeholders know that the system is set up, operating properly, and ready to start acceptance testing.

402.3.1 (B) System Acceptance Testing:

The Contractor shall preform and successfully pass system acceptance testing in accordance with the approved SWZ system acceptance testing procedures. The testing procedures submitted by the Contractor and approved by MCDOT shall demonstrate proper operation of all system and device configurations in accordance with the performance requirements. The testing procedures shall include the following:

(1) Initial system and device testing intended to demonstrate that the system provided successfully achieves all the required functionality, performance requirements, and reporting requirements. This initial system testing shall be at a test bed location provided by the Contractor where the field devices are deployed.

(2) Individual SWZ location types testing to verify the system and devices at each individual "Inform," "Advise," "Warn," "Check," and "Stand-Alone Detection" SWZ location is configured, reporting, and operating properly when moved in the project area after initial system setup.

402.3.1 (C) System Training:

The Contractor shall provide system training in accordance with the approved SWZ system training curriculum. The training curriculum submitted by the Contractor shall demonstrate proper system setup, testing, operational procedures. The training shall reflect the actual needs of the field personnel and other project stakeholders accessing the system. Training shall ensure that field personnel are up-to-date on the safest and most efficient methods for moving and setting up field devices in the project area.

The Contractor shall coordinate with the Engineer to identify mutually agreed to training dates/times for each training class. The Contractor provided training shall include the following, at a minimum:

(1) One four-hour training class, at the 2901 W Durango St, Phoenix, AZ 85009 MCDOT facility, for MCDOT TMC representatives that will be accessing the system for system evaluation purposes. The training shall be hands-on type training using a PC that is connected to the SWZ system server(s) via the internet.

(2) One four-hour training class, at the test bed location provided by the Contractor where the field devices are deployed, for Contractor field personal that will be deploying and operating the system and for MCDOT representatives that will be observing the system operation and acceptance testing.

All on-site system configuration procedures shall be clearly covered in the System Training provided.

402.3.1 (D) Lessons Learned Workshop:

Following the completion of the SWZ system deployment period, MCDOT will host a four-hour (4-hour) Lessons Learned Workshop in a MCDOT facility. The Contractor, MCDOT, and the SWZ equipment vendor(s) are required to participate in this workshop to discuss SWZ system functionality, how the system could be better used by the Contractor, and debrief SWZ deployment lessons learned.

402.3.2 System Operations and Maintenance:

The Contractor shall operate the SWZ system and provide technical support to MCDOT throughout the duration of the SWZ system deployment period. The Contractor shall be responsible for identifying and performing preventive maintenance of the SWZ system and for software/firmware updates addressing glitches, substandard performance, and requested system configuration changes, reporting changes, and VMS system algorithm and message changes that may be desired as part of the system evaluation process. The Contractor shall resolve demonstrated software and equipment failures.

The SWZ equipment vendor shall provide support from a local or remote location for operation while the equipment is deployed within a work zone. The Contractor shall provide on-site system operational functions using the Portable Operator Control Device

provided with the system. All on-site system operational and safety procedures shall be clearly documented within the submitted SWZ system user manuals.

While the SWZ system is set-up and operating in the project area, the SWZ equipment vendor, the MCDOT RE, the MCDOT TMC representative, and the Contractor superintendent shall coordinate via email if there are any problems or issues that arise after the initial set-up. The stakeholder that notices the issue shall initiate the email and copy all other stakeholders and resolution will be confirmed via email.

The Contractor shall provide the Engineer with responses to all questions and concerns, throughout the contract period and within 5 working days of notification if the SWZ equipment is not active in the project area, and within 24 hours or less when the SWZ equipment is deployed within the project area.

The Contractor shall be responsible for trouble shooting and fixing any problems with the MCDOT furnish and Contractor installed DSRC radio and cellular communications gateway equipment as it relates directly how the equipment is mounted to the portable device trailers and how the power for these devices are connected to the trailer's PDA.

The Contractor shall be responsible for modifying file format, trouble shooting and fixing any problems with the SWZ Variable Message Sign System API and the SWZ ARID Detector System API and associated data sets for one way communications to the Connected Vehicle Work Zone Notification System.

402.3.2 (A) System Reporting:

The Contractor shall submit weekly system reports, as identified herein, to the Engineer. The Contractor shall submit each of these weekly reports by the close of business the following business day. The following weekly reports shall be included in these submittals:

(1) Variable Message Sign System
  (a) VMS Message History report
  (b) System Alarm History report
  (c) Detector Speed Data report
  (d) Detector Volume Data report
  (e) Detector Occupancy (Queue Detection) Data report
  (f) Travel Time Data report

(2) Speed Feedback System
  (a) System Alarm History report
  (b) Detector Speed Data report

(3) ARID Detector System
  (a) ARID Travel Time Data report

402.4 MEASUREMENT:

The per day units of measurements, defined in this section, includes both required modes of operation ("Normal Operation" and "Baseline Data Operation").

(A) Measurement for SWZ System Mobilization and Demobilization shall be made on a Lump Sum basis. This lump sum measurement shall include all materials, equipment and labor necessary to facilitate SWZ system mobilization and demobilization per the contract documents. SWZ system includes but is not limited to the mobilization and removal of SWZ system devices, submittals, installing and removing DSRC equipment, and software including related modifications, configurations, acceptance testing, training and lessons learned workshop.

(B) Measurement for SWZ System Operations and Maintenance shall be measured per day for each day all the associated devices and software are fully functional with no loss of communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements and providing the required daily system reports. This per day measurement shall include all materials, equipment and labor necessary to operate and maintain a fully functional SWZ system per the contract documents.

(C) Measurement for each "Inform" SWZ Location shall be measured per day for each day all the associated devices and software are fully functional with no loss of communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements, and actively deployed in the project area. This per day measurement shall include all materials, equipment and labor necessary to achieve a fully functional "Inform" SWZ Location per the contract documents.

(D) Measurement for each "Advise" SWZ Location shall be measured per day for each day all the associated devices and software are fully functional with no loss of communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements, and actively deployed in the project area. This per day measurement shall include all materials, equipment and labor necessary to achieve a fully functional "Advise" SWZ Location per the contract documents.

(E) Measurement for each "Warn" SWZ Location shall be measured per day for each day all the associated devices and software are fully functional with no loss of communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements, and actively deployed in the project area. This per day measurement shall include all materials, equipment and labor necessary to achieve a fully functional "Warn" SWZ Location per the contract documents.

(F) Measurement for each "Check" SWZ Location shall be measured per day for each day all the associated devices and software are fully functional with no loss of

communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements, and actively deployed in the project area. This per day measurement shall include all materials, equipment and labor necessary to achieve a fully functional "Check" SWZ Location per the contract documents.

(G) Measurement for each "Standalone Detection" SWZ Location shall be measured per day for each day all the associated devices and software are fully functional with no loss of communications or power failures for 98% of the construction work day, including achieving all the associated performance requirements, and actively deployed in the project area. This per day measurement shall include all materials, equipment and labor necessary to achieve a fully functional "Standalone Detection" SWZ Location per the contract documents.

(H) No direct measurement of individual traffic control elements or devices will be made. All traffic control devices, unless otherwise noted, shall be considered as included in the measurement for the Traffic Control pay item, as specified in Section 401.

(I) No direct measurement of the following elements or devices will be made. All of the following elements and devices shall be considered as included in the measurement for the respective SWZ locations (Inform, Advise, Warn, Check, and Standalone Detection):

(1) Portable device trailers, including but not limited to unique trailer number, solar PDA, cellular communications gateway with cell phone provider data plan, GPS device, and MCDOT furnished and Contractor installed DSRC radio and associated DSRC cellular communications gateway.

(2) SWZ system software and performance requirements, including but not limited to variable message sign system, speed feedback system, CCTV system, and ARID detector system.

402.5 PAYMENT:

(A) Payment for SWZ System Mobilization and Demobilization will be made at the Contract Lump Sum Price. Payment shall be full compensation for performing all activities associated with fulfilling the SWZ system requirements that are not directly included within other pay items. Contractor will be compensated for this contract item at a rate of 20% of the contract lump sum after successful completion of all required submittals and acceptance testing. The remaining 80% of the contract amount will be prorated over the entire length of the SWZ system deployment period.

(B) Payment for SWZ System Operations and Maintenance will be made at the Contract Unit Price. Payment shall be full compensation for performing all

activities associated with operating and maintaining a fully functional SWZ system per the contract documents.

(C) Payment for each "Inform" SWZ Location will be made at the Contract Unit Price. Payment shall be full compensation for performing all activities associated with achieving a fully functional "Inform" SWZ Location per the contract documents.

(D) Payment for each "Advise" SWZ Location will be made at the Contract Unit Price. Payment shall be full compensation for performing all activities associated with achieving a fully functional "Advise" SWZ Location per the contract documents.

(E) Payment for each "Warn" SWZ Location will be made at the Contract Unit Price. Payment shall be full compensation for performing all activities associated with achieving a fully functional "Warn" SWZ Location per the contract documents.

(F) Payment for each "Check" SWZ Location will be made at the Contract Unit Price. Payment shall be full compensation for performing all activities associated with achieving a fully functional "Check" SWZ Location per the contract documents.

(G) Payment for each "Standalone Detection" SWZ Location will be made at the Contract Unit Price. Payment shall be full compensation for performing all activities associated with achieving a fully functional "Standalone Detection" SWZ Location per the contract documents.

SECTION 405 SURVEY MONUMENTS

405.3 CONSTRUCTION:

405.3.1 INSTALLATION, add the following:

The County will locate and tie-out the existing survey monuments. The Contractor shall furnish and install new survey markers in the asphalt concrete pavement at locations designated by the Engineer. The Engineer will have the new survey monuments punched and documented.

SECTION 420 CHAIN LINK FENCES

420.1 DESCRIPTION, add the following**:**
This work includes constructing, maintaining, and removing temporary fencing around private properties only, not contractor work zones. Temporary fence shall provide a secure, visible boundary adjacent to protected areas.

420.2 MATERIALS, add the following:

Unless otherwise indicated, type of temporary chain link fencing shall be the Contractor's option.