

TECHNICAL SPECIAL PROVISION 725M ITS SYSTEM MAINTENANCE AGREEMENT

725.01 Description

1. The purpose of this Contract is to provide preventive maintenance, repair maintenance, and special repair maintenance for the equipment associated with the TDOT Nashville SmartWay ITS system, including the regional Transportation Management Centers (TMC). The Contractor will provide these preventive, repair and special repair maintenance activities for all existing equipment.

Throughout the duration of this Contract, new ITS infrastructure may be installed in areas not specifically included in the Contract. The Contractor shall coordinate with TDOT for any additional cost and requirements to maintain future ITS equipment not included in this Contract.

The term “TDOT” refers to Tennessee Department of Transportation or their representative.

The TDOT SmartWay ITS System consists of four regions as well as associated Rural ITS systems:
Region 1 – Knoxville
Region 2 – Chattanooga
Region 3 – Nashville
Region 4 – Memphis

The Contract for each Region will be bid separately.

725.01.01 Maintenance Definitions

1. “Maintenance for the System” is preventive maintenance (PM) and consists of regularly scheduled activities such as, but not limited to, electrical testing, replacement of necessary parts, device inventory, lubrication, cleaning, and maintaining a 5’ radius around hubs, cabinets, and devices that is clear of bushes, limbs, and vegetation. The vegetation removal shall also include the removal of vegetation within CCTV lines of sight/viewing areas (200’ line of site for CCTV) and for solar power panels’ line of sight to the sun (50’ radius around solar panel). All labor, work equipment, and materials needed to complete the preventive maintenance work shall be included in the Maintenance for the System pay item. All replacement parts and equipment replacement items will be paid for separately as described in *Section 725.17 – Appendix B – Equipment to be Maintained*. The Contractor shall perform all preventive maintenance activities recommended by this

Technical Special Provision (TSP) as well as those recommended by the manufacturer within the periodic intervals required. This shall include the periodic inspection, cleaning and inventory of the equipment and the resulting documentation of this inspection.

2. "Repair Maintenance" consists of responding to and repairing the failures reported concerning the various field components of the system. Repair maintenance shall include the reactive, day-to-day repair, replacements, and diagnostic work necessary to keep the System fully operational. Work under repair maintenance may also be generated by failures caused by Acts of God, equipment knock downs, unforeseen fiber optic damage, other construction activities, or other special requests from TDOT. Acts of God include, but are not limited to, damages that occur resulting from winds above the equipment design speed, floods, facility fire, and lightning/electrical storms. A repair maintenance response is defined as the Contractor receiving notice from TDOT of a failure and the Contractor responding to make repairs and provide TDOT with a summary of repairs. If repairs cannot be accomplished within 8 hours of notification the contractor shall prepare an action plan, including estimated time to repair, and if necessary, an estimated cost to repairs and submit these items to TDOT. The response report may be sent via email and shall be submitted within the specified time periods as defined in this Contract.
3. "Special Repair Maintenance" consists of responding to the failures reported concerning the various field components of the system. Work under special repair maintenance may be generated by failures caused by Third Party Damage or required system modifications or improvements that exceed the intent and scope of this Contract. Third Party Damage is defined as damage caused by vehicle collision, explosions or terrorism, caused by any person or company that is not related to the Contractor, vendor or any subcontractors involved in this Contract. Required system modifications or improvements are defined as any upgrade or modification requested by TDOT and may be requested to modernize technology or otherwise modify or upgrade the system in order to meet operational standards. Additionally, work under this item may include relocation of facilities. A special repair maintenance response is defined as the Contractor receiving notice from TDOT of a failure and the Contractor responding with a field assessment of the problem, preparation of a plan and schedule for repair, itemized cost for repair and submission of that report to TDOT. The response report may be sent via email and shall be submitted within the specified time periods as defined in this Contract.

725.01.02 General Requirements

1. The Contractor shall maintain all ITS assets within the TDOT SmartWay system and will perform work that produces end results in accordance with TDOT's Specifications including all Supplemental Specifications and Special Provisions.

These include, but are not limited to:

- a. TDOT Standard Specifications for Road and Bridge Construction (Latest Edition).
 - b. Manual on Uniform Traffic Control Devices (Latest Edition).
 - c. TDOT Roadway and Structure Drawings (Latest Revised).
2. Proper health and safety measures will be taken to ensure safety for the traveling public, TDOT employees, Contractor employees, and subcontractor employees.
 3. Maintenance of traffic is solely the responsibility of the Contractor. Under no circumstances will maintenance of traffic be an additional pay item, without prior written approval from TDOT for extenuating circumstances. The Contractor will also be responsible for acquiring any lane closure permits from TDOT before any work begins in the area.
 4. TDOT will pay all highway electric bills. Responsibility for maintaining power to devices will be as follows:
 - a. From the utility to the demarcation point – Local Utility Companies.
 - b. From the demarcation point to the control cabinet or breaker and from the control cabinet or breaker to and within the devices - Contractor.
 5. The Contractor shall maintain the TDOT Maintenance Database for all maintenance work, which shall detail all complaints or requests and the dispositions of the items contained in the log. The TDOT Maintenance Database shall be provided to the Contractor along with training on the proper use of the Database.
 6. All overhead work over impacted traffic lanes shall include proper lane closures in accordance with MUTCD, except when the Contractor is working inside a DMS enclosure.
 7. The Contractor is required to provide all operational crews with working cell phones at all times. In addition, the Contractor shall provide phone contacts and email capable devices for the crew supervisor and technicians. The Contractor shall provide to TDOT and keep current all emails and cell phone contact numbers. It is essential that the operating crews can contact the TMC to ensure correct operation of equipment and verify equipment status in the control center.
 8. TDOT will appoint a representative who will act as contract administrator with the responsibility of ensuring work is done to a specified standard defined in this TSP. This representative will be responsible for verifying the Contractor satisfactorily completes the work. The TDOT representative will be responsible for the overall

monitoring of the Contractor's work.

725.01.03 Form of Contract

Under the terms of this Contract, there are several requirements:

1. The first requirement will be for performing the (preventive) Maintenance for the System. This will be a fixed annual price as described in the Payment Section. Preventive maintenance consists of regularly scheduled activities such as, but not limited to, communications and electrical testing, labor for replacement of necessary parts or equipment, device inventory, lubricating, cleaning, and maintaining a 5' radius around hubs, cabinets, and devices that is clear of bushes, limbs, and vegetation. The vegetation removal shall also include the removal of vegetation within CCTV 200' lines of sight/viewing areas and for solar power panels' line of sight to the sun (50' radius around solar panel). Loss of the line of sight/viewing shall be considered a Condition 2 Equipment failure as defined in 725.01.03-2.b. Failure to respond to vegetation removal and tree trimming within 10 days as determined needed by TDOT shall be considered failure to perform preventive maintenance. The Contractor shall perform all preventive maintenance activities recommended by this TSP as well as the equipment' manufacturer within the periodic intervals recommended. This shall include the periodic inspection and cleaning of the equipment and the resulting documentation of this inspection. No additional compensation will be made for preventive maintenance activities at night and any additional resources necessary for night work are included in the lump sum cost. All work covered under Maintenance will be paid at the lump sum cost as described in the Payment Section and no additional compensation is provided. Note that this pay item does not include the cost of the replacement equipment or spare parts. Those items are paid as described later in this Section.
2. The second requirement is for performing Repair Maintenance or any additional work at the request of TDOT. Repair Maintenance consists of responding to the various failures reported concerning the various field components of the system. Repair maintenance will include the reactive, day-to-day maintenance, replacements, and diagnostic work necessary to keep the System operational. Work under this pay item may also be generated by failures caused by Acts of God, equipment knock downs, unforeseen fiber optic damage, other construction activities, or other special requests from TDOT. The Contractor must provide the required minimum number of personnel for each region at all times (see *Section 725.19 – Appendix D – Minimum Personnel Requirements*), and all necessary tools, equipment, and engineering for the repair maintenance work. A response report containing the items identified in Section 725.05 must be submitted to TDOT within the time frames noted below. Notice of a failure shall be communicated to the Contractor via phone call and a follow up e-mail. Payment will be made at the hourly unit price as

described in the payment Section.

- a. Condition 1 Failure – A failure is defined as a Condition 1 Failure if it involves a DMS Sign, network failures, multiple cameras where sections of the interstate cannot be adequately monitored as determined by TDOT, changeable speed limit signs and/or swing gates, over-height vehicle detection systems, any failure that causes approximately ten (10) percent of the Regional SmartWay System to become dysfunctional, and/or a failure that poses a safety threat to the motoring public as determined by TDOT. The Contractor shall respond at the failure site within two (2) hours of notice of a failure by TDOT and make necessary repairs within 6 hours of notification. If repairs cannot be accomplished within 8 hours of notification the Contractor shall prepare an action plan, including estimated time to repair, and if necessary, an estimated cost to repair and submit these items to TDOT. This response requirement applies 24 hours a day, 7 days a week. This communication shall initially be provided verbally to TDOT but shall be re-iterated in writing by e-mail or hard copy by no later than 10:00 AM the following day.
 - i. The Contractor shall start work the next day after receiving all parts necessary for the repair and perform the work with due diligence according to the schedule agreed upon. Failure to start work the next day will result in Liquidated Damages of \$500 per day per device until work is started.
 - ii. The Contractor shall achieve and maintain a 95 percent operational rate for all devices classified as Condition 1 devices. The Contractor shall track the operational rate of all devices on a daily basis and report the operational status to TDOT on a weekly basis. Failure to achieve a 95 percent daily operational rate will result in Liquidated Damages of \$500 per day per device until the operational rate meets the 95 percent minimum requirement. If the failure is beyond the control of the Contractor as determined by TDOT (i.e., Third Party Damage or Acts of God), then the devices may not be subject to Liquidated Damages.
- b. Condition 2 Failure – A failure is defined as a Condition 2 Failure if it does not fall under the definition of a Condition 1 Failure, but does involve critical components of the ITS system, including but not limited to, CCTV cameras, Radar Detection Systems (RDS), Highway Advisory Radio (HAR) transmitter, signs or components, and Video Detection Systems (VDS), Fiber network.. The Contractor shall respond at the failure site within four (4) hours of notice of a failure by TDOT and make necessary repairs within 8

hours of notification. If repairs cannot be accomplished within 8 hours of notification the Contractor shall prepare an action plan, including estimated time to repair, and if necessary, an estimated cost to repair and submit these items to TDOT. This response requirement is limited to normal business hours (8:00 a.m. to 5:00 p.m.) Monday thru Friday. This communication shall initially be provided verbally to TDOT but shall be re-iterated in writing by e-mail or hard copy by no later than 10:00 AM the following business day.

- i. The Contractor shall start work next business day after receiving all parts necessary for the repair and perform the work with due diligence according to the schedule agreed upon. Failure to start work within this timeframe will result in Liquidated Damages of \$500 per day per device until work is started.
 - ii. The Contractor shall achieve and maintain an 85 percent operational rate for all devices classified as Condition 2 devices (with the exception of CCTV cameras – the daily operational rate for all CCTV cameras shall be 95 percent). The Contractor shall track the operational rate of all devices on a daily basis and report the operational status to TDOT on a weekly basis. Failure to achieve an 85 percent daily operational rate will result in Liquidated Damages of \$500 per day per device until the operational rate meets the 85 percent minimum requirement. If the failure is beyond the control of the Contractor as determined by TDOT (i.e., Third Party Damage or Acts of God), then the devices may not be subject to Liquidated Damages.
 - iii. Condition 2 failure will be assumed by default if updates to the Database are more than one (1) week behind schedule. Liquidated damages will be assessed the following calendar day following the (1) week delay.
3. The third requirement is for the storing and replenishing of spare parts. The initial list of existing spare parts that will be provided to the Contractor is defined in *Section 725.18 – Appendix C – Required Spare Parts Inventory*. The cost of storing and insuring the inventory of spare parts shall not be paid separately and shall be included in the Maintenance lump sum pay item. The cost of replenishing used spare parts and other replacement equipment shall be paid for under the Spare Parts and Equipment Replacement pay item. A 15% markup on the invoice price shall be allowed on direct material costs of the replacement equipment. If TDOT requests that the Contractor provides any other ITS related equipment under this contract, the equipment shall be provided at cost plus a 15% markup as described above.
 4. The fourth requirement is for performing Special Repair Maintenance. In addition

to the items of work described above, there may be special circumstances and/or situations that result from Third Party Damage, required system modifications requested by TDOT that exceed the intent and scope of this Contract, relocation of facilities. For these situations, the Contractor will be asked to submit a separate cost proposal and schedule to TDOT within three (3) business days. Once approved, the Contractor shall start the work within five (5) days of approval and perform the work with due diligence according to the schedule agreed upon. These items will be paid for under the line item 725-10.80 Special Repair Maintenance. It will be TDOT's sole decision to determine whether or not a specific item of work can be completed within existing pay items. Failure to meet the time frames outlined in this section will result in Liquidated Damages of \$500 per day per device until corrected.

5. The fifth requirement is for the Contractor to be provided access to the TDOT Maintenance Database and to be trained on any procedures for using the Database for the purpose of documenting and tracking all Repair or Special Repair Maintenance activities (see Section 725.05 of this Contract for more details). Once a repair or special repair task is complete, the Contractor shall submit final paperwork within five (5) business days that indicates the total number of hours worked (this is not considered Man Hours worked). If not submitted within five (5) business days or time allotted by TDOT due to unforeseen incidents and the time extension approved by TDOT, the Contractor will be subject to delayed payment on the completed task and Liquidated Damages of \$25.00 per day per repair
6. It is understood and agreed that the Contractor assumes all responsibilities that relate to protection of the "waters of the United States" and/or "waters of the State of Tennessee." It is also understood and agreed that the Contractor shall be responsible for obtaining any permits required by the Contractor's method of construction, including without limitation haul roads, temporary channels or temporary ditches, or off-site waste and/or borrow areas.
7. If at any time the Contractor becomes aware that sedimentation is occurring or has occurred in streams impacted by an on-going project, the Contractor shall immediately notify the TDOT project supervisor to evaluate the Erosion Prevention and Sediment Control (EPSC) measures employed, repair or replace defective EPSC measures, and install, as applicable, additional or other EPSC measures with the goal of eliminating future sedimentation. If the sedimentation is a result of the Contractor's actions, then the cost of remedial actions are to be included in other Items.

725.02 Schedule of Work

1. TDOT will permit access to facilities as required by the Contractor for the purposes of maintenance.

2. Maintenance support shall be provided during all operational hours of the TMC.
3. TDOT reserves the right to either cancel this Maintenance Agreement in part, or in its entirety without liability to the TDOT on thirty (30) days written notification to the Contractor. TDOT shall direct that the work under this Maintenance Agreement be performed by the Contractor for a three (3) year period. TDOT shall have no obligation in excess of the amount contracted for, or for services rendered by the Contractor, which are not performed within the specified period.

725.03 Monthly Status Meetings

1. Every month the Contractor shall hold a status meeting with TDOT. At these meetings, the Contractor shall discuss the previous month's repairs, anticipated work for the next month, spare part purchases for the month, an accurate spare parts inventory and other operational problems that may arise. The Contractor is responsible for taking and distributing the minutes of these meetings. These minutes shall be transmitted to TDOT for review and approval within seven (7) days following the meeting. Progress payments for Maintenance may be withheld until the meeting is held and meeting minutes are submitted to TDOT. Note that on some occasions more frequent meetings may be needed during some months, as determined by TDOT. No additional costs will be allowed for these additional meetings.

725.04 Maintenance Procedures

1. For each major equipment type there are defined minimum preventive maintenance procedures. These minimum procedures are defined in Section 725.16: *Appendix A – Preventive Maintenance Procedures*. Each equipment preventive maintenance procedure has a fixed period between procedures. These are defined in Appendix A.
2. The start time for these periods shall begin upon Notice to Proceed. However, it is required that initially all equipment be subjected to preventive maintenance within 50% of the time between maintenance procedures. For example, those items that need to be maintained every six (6) months must have their initial maintenance activity performed within the first three (3) months of notice to proceed. Should individual items be found to be faulty such that preventive maintenance cannot be performed, these items must be reported to TDOT, and replaced or repaired as directed.
3. Maintenance procedures performed under Repair or Special Repair Maintenance shall use materials and installation procedures as specified in this TSP for new construction. At the sole discretion of TDOT, certain repairs which are not possible to complete to the same standard as the new construction may be made utilizing

materials and procedures as directed by TDOT.

4. Should the Contractor perform a Repair or Special Repair Maintenance action and within five (5) days the same fault is reported on the same piece of equipment, it is the Contractor's responsibility to make the second and any subsequent same-fault repairs at no cost to TDOT. Should a particular device persist in the same failures, upon TDOT's instruction, such device shall be replaced and paid for by TDOT under the Repair Maintenance procedures.
5. Upon completion of any maintenance activity, the work shall be subject to a random inspection by TDOT. Work that is determined to be unacceptable shall be re-performed by the Contractor at the Contractor's expense. No additional compensation will be made for routine maintenance activities at night or holidays and any additional resources necessary for night work are included in the lump sum pay item unit cost.
6. For damage caused by Acts of God, Third Party Damage, or TDOT personnel (including TDOT contractors), the Contractor is responsible for photographing all damaged structures and equipment; obtaining police reports; obtaining crash reports and/or driver information; and for submitting this information to TDOT. This information must be provided before payment of repairs.

725.05 Record Keeping Procedures

1. The Contractor shall use the TDOT Maintenance Database that will be provided by TDOT to the Contractor to show all preventive, repair maintenance, special repair maintenance and inventory activities. This database shall also keep the inventory of current spare parts. The database files shall be updated weekly at a minimum. A summary of the next week's planned maintenance activities is required in a format to be decided by TDOT. The format of the database may be changed at some point during this Contract. When this change is completed, the Contractor will then be required to use the new format. No additional cost will be allowed for this change.
2. The records for both preventative maintenance, repair maintenance, and special repair maintenance shall include all applicable information. Examples of the type of information include, but are not limited to, the following:
 - a. Date and time of failure report or date of repair or special repair maintenance
 - b. Person or source of the report
 - c. Location of device
 - d. Description of failure or symptom
 - e. Name of person responding
 - f. Arrival time at location of reported failure
 - g. Weather and condition of the site

- h. Actions taken
 - i. Schedule of initiating corrective work and estimated completion of work
 - j. Date and time of completion of work
 - k. Spare part details – inventory and bar code information
 - l. Any consequential events – such as, but not limited to, failure to operate or secondary failure
3. The Contractor shall maintain accurate and complete records of all work activities, status reports, meeting notes, cost proposals, invoices, inventory records, etc. The project As-Built Documentation, including the System Equipment Inventory, shall be updated if any information contained therein is changed due to preventive, repair, special repair maintenance activity or the completion of new ITS projects. As-Built Documentation shall consist of, but not be limited to, modifying GPS coordinates, adding fiber and devices from new ITS projects, modifying cabinet drawings, wiring diagrams, or installations. As-Built Documentation shall be in the latest TDOT approved Microstation CAD format and PDF. The Contractor shall perform all administrative tasks. All project records will be the property of TDOT and shall be returned to TDOT prior to final payment of the Contract.

725.06 Equipment Control

1. The Contractor shall maintain the inventory of spares to ensure the repair response time specified in the appendices. All spare part replenishments new and repaired shall be bench tested and marked with test date and technician prior to adding back into inventory initially, the Contractor will be supplied with the existing spare parts by equipment type as defined in *Section 725.18 – Appendix C – Required Spare Parts Inventory*. As equipment is used from the spare parts inventory, the Contractor may invoice TDOT for replacement spares added back to the inventory no more than once per month. However, the cost of the replacement spares shall be submitted to TDOT for approval prior to ordering. A 15% markup will be allowed on direct material costs of the spares. Shipping, insurance, and purchase costs shall be first paid directly by the Contractor and then billed to TDOT. The paid invoice must be included in the documentation provided to TDOT. TDOT must give prior written approval for each order made by the Contractor. The Contractor shall inventory the spare parts at a minimum of every six (6) months and provide the inventory list to TDOT. Spare part records are to include at a minimum:
 - a. Manufacturer
 - b. Model number
 - c. Descriptive title
 - d. Serial number
 - e. Location
 - f. Purchase date

- g. Date installed – when applicable
 - h. Location of installation– when applicable
 - i. Bar code and inventory information
2. The Contractor is fully responsible for these spares. The Contractor shall insure the inventory of spares against all hazards or loss and name TDOT as the beneficiary in the case of loss. A copy of the insurance documents must be provided to TDOT. TDOT has the right to audit the inventory at any time by providing the Contractor with three (3) day notice. For failed equipment, the Contractor shall submit a Return Merchandise Authorization (RMA) and ship for repairs within five (5) working days of the failure. It is the contractor’s responsibility to track all repairs shipped and provide TDOT with the progress as requested. Failure by the Contractor to meet either of these time frames will result in Liquidated Damages of \$500 per day per equipment piece.
3. The Contractor shall perform a complete bench test on all equipment and materials received for spare parts. The component bench test shall demonstrate that all equipment and materials are in full compliance with all performance requirements and works “out of the box” by visual inspection, setup, and operation “on the bench, functional testing of the component including manufacturers recommended startup diagnostics and testing prior to any field installation of that equipment or material. Test results documentation shall be provided for each equipment item and materials. This document shall include the manufacturer’s serial number where applicable.
4. In addition to maintaining the spare parts inventory, the Contractor shall also ensure the availability and access to all vehicular equipment (trucks, bucket trucks, backhoes, front end loaders and diagnostic equipment, etc.) and engineering/technical equipment needed to respond to and repair equipment failures and malfunctions. All equipment that is typically needed to assess the repair, shall be available and at the failure site within the response requirement timeframes outlined in Section 725.01.03. If typical maintenance equipment is not available within this timeframe, the Contractor shall be considered to have missed the required response requirement and may be subject to Liquidated Damages at the discretion of TDOT. If specialty equipment is needed that is not typical, the Contractor shall notify TDOT of this need and TDOT will determine if an exception can be made in that situation.

725.07 Bar Code System

1. The Bar code system will be updated and maintained during Preventive Maintenance. As part of the preventive maintenance checklist the contractor shall verify and maintain the current barcode system for each device and update the bar codes as needed to keep the equipment inventory up to date within the TDOT Maintenance Database.

2. The Contractor shall ensure that all existing, new and replacement equipment has bar code labels attached. If existing devices are identified that do not have a bar code label, a bar code number and label shall be assigned to the device and the information input into the TDOT Maintenance Database. Each new barcode label applied to a device is required to be entered into the TDOT Maintenance Database. The Contractor will be provided with the existing equipment but shall be responsible for replenishing labels, ink, toner, etc. and maintaining the barcode equipment. The cost for using and maintaining the Bar Code System (both parts and labor) shall be included in the lump sum bid price for Maintenance of the System and shall become the property of TDOT.
3. At a minimum, the System Equipment Inventory shall include the following information about each equipment item:
 - a. Device/equipment item name
 - b. Location (station and device ID)
 - c. Sheet number in plans
 - d. Latitude and longitude using State Coordinates
 - e. Make, model and manufacturer part number
 - f. Serial number
 - g. Barcode equipment ID
 - h. Barcode location ID
 - i. Revision ID
 - j. Firmware ID
 - k. Purchase date
 - l. Installation date
 - m. Repair date (if applicable)
 - n. Manufacturer contact information

725.08 Staffing/Management Plan

1. The Contractor must provide the minimum required personnel for the duration of this Contract to ensure satisfactory completion of all Preventive Maintenance, Repair Maintenance, and Special Repair Maintenance activities. The Level 3 Technician shall remain actively involved in daily maintenance activities and the monthly meetings. Refer to *Section 725.19 – Appendix D – Minimum Personnel Requirements*.
2. Within thirty (30) days of notice to proceed, the Contractor shall submit a Staffing/Management Plan defining the personnel for this contract for approval by TDOT. Resumes for the staff must be submitted for approval by TDOT. During the project life, changes to staff shall require approval of TDOT or its designee prior to use of the staff on the project. TDOT shall have the right to reject any proposed replacement personnel. If at any time TDOT deems the Contractor's personnel

unacceptable, TDOT reserves the right to cancel the Contract.

3. The staffing/management plan shall include:
 - a. Proposed plan for communication and coordination among the Team and staff members.
 - b. Qualifications of all personnel. All staff must be qualified for the various types of devices and equipment they will be working on. If qualified personnel are not available on Contractor's staff, work must be performed by a factory trained manufacturer representative, who also meets the Staffing Qualifications outlined in section 725.09, at no additional cost to TDOT.

725.09 Staffing Qualifications

1. All personnel associated with this Contract must be qualified for the work that is to be performed. Lead communications and field hardware technicians shall hold all current required licenses for the work to be performed, and at a minimum have experience in the installation and maintenance of the equipment listed in *Section 725.17 – Appendix B – Equipment to be Maintained*. The technicians must be familiar with and clearly demonstrate familiarity with trouble shooting the types of devices that are installed. Technicians that are responsible for the electronic components must have a minimum of a two (2) year associate degree in electronics, communications or a related field of study plus two (2) years relevant work experience. An equivalent to this qualification would be a minimum of five (5) years of relevant field experience. Any proposed equivalent must be approved by TDOT. The Contractor shall have knowledge of and be able to operate existing equipment and software and must stay up to date on all hardware and software upgrades and be able to operate the software upgrades for the equipment, as needed.
2. Specifically, technicians must possess the following minimum skills:
 - a. Level 1 Technician – Possesses basic knowledge of electrical/electronic equipment, works under the supervision of a Level 2 or Level 3 Technician, assists in troubleshooting and repairing communications and computer networks and ITS field devices, assists in equipment inventory and the bar code system, and performs other related duties as assigned.
 - b. Level 2 Technician – Possesses intermediate level knowledge of electrical/electronic equipment, has experience in the installation and maintenance of communications and computer networks, troubleshooting and repairing computer networks and ITS field devices, clearly demonstrates understanding of fiber optic cables and equipment, may assist in training

lower level technicians, performs equipment inventory and bar coding system, and performs other related duties as assigned.

- c. Level 3 Technician – Possesses the knowledge to perform complex communications network and ITS field device technical support, advanced troubleshooting skills, experience with repair and maintenance of equipment within the TMC including the video wall, ability to remotely monitor the ITS system, advanced knowledge of fiber optic cables and test equipment, ability to read and follow schematics and diagrams, ability to organize work tasks, may assist in training lower level technicians, and performs other related duties as assigned.

725.09.01 Initial On-Site Training and Orientation

1. To allow for a smooth transition between Contracts, during the early stages of the Contract, each on-site staff member assigned by the Contractor to this Contract shall be required to attend a minimum of eighty (80) hours of on-the-job training and orientation. The Contractor shall schedule the training which shall be completed during a one (1) month overlap period at the end of the previous Contract and after this Contract is in effect. The training shall be specific to the TDOT SmartWay System and include, at a minimum, spare parts and inventory issues, updating the new Contractor on the status of the existing devices, existing maintenance issues as well as how to update and maintain the TDOT Maintenance Database. As a result of any staff turnover, new personnel shall also meet the above training requirements.
2. This training and orientation shall consist of vendor training as well as meetings/work sessions with the current maintenance contractor and TDOT staff to become familiar with the current system and status of maintenance issues. This training will include site visits to selected equipment locations in the field.
3. Technician personnel are required to attend vendor-based training with attention to basic equipment operating theory, equipment failure diagnosis, troubleshooting practices, and use of diagnostic software for each critical model of equipment comprising the TDOT SmartWay ITS System. The Contractor will coordinate this training with the appropriate vendors. This training will be held at the Region's TMC.
4. The Contractor's cost for the initial on-site training and orientation shall not be paid separately and shall be included in the cost of the Maintenance for the System.

725.10 Safety Plan

1. The Contractor is required to follow all applicable safety laws, regulations, and TDOT standard safety procedures. This includes compliance to the requirements of

the Manual on Uniform Traffic Control Devices (MUTCD), OSHA, and others as appropriate. Appropriate safety attire for personnel in the field, clear markings, and functional safety lights on vehicles must be part of the safety plan.

2. If lane and shoulder closures are needed, the Contractor shall obtain approval and the proper permits for these closures before work begins.

725.11 Contractor's Responsibility for Utility, Property and Services

1. The Contractor shall ensure the protection of all utilities, conforming to all regulations applied to work within the State.
2. At points where the Contractor's operations are adjacent to the properties of any utility, including railroads, and damage to which might result in considerable expense, loss, or inconvenience, work shall not commence until arrangements necessary for the protection thereof have been completed.
3. The Contractor shall cooperate with owners of utility lines so that removal and adjustment operations may progress in a reasonable manner, duplication of adjustment work may be reduced to a minimum, and services rendered by those parties will not be unnecessarily interrupted.
4. If any utility service is interrupted as a result of accidental breakage or of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the authority in the restoration of service. The Contractor shall be responsible for any damage to utilities that are attributable to his neglect or methods of performing work.

725.12 Performance of the Contractor

1. Throughout this Contract, TDOT may conduct a review of the various works performed by the Contractor. These reviews shall be to determine the compliance of the Contractor's operations with the maintenance requirements, the terms of the Contract, and the policies and procedures of TDOT. The Contractor shall fully cooperate with these reviews. If deficiencies are found, TDOT shall inform the Contractor of this in writing. The Contractor shall take immediate remedial action to cure any deficiencies. No additional compensation will be due to the Contractor associated with such remedial actions.
2. The Contractor is required to maintain the devices uniformly and consistently throughout the Maintenance Contract period, meeting both TDOT and, as appropriate, the manufacturer's performance specifications, as well as respond to

failures identified by TDOT. Continued poor performance of work or failure to perform shall cause the Contractor to be declared in default of the Contract. Failure to meet the maintenance requirements specified in this Contract shall result in a written notice from TDOT. This information shall inform the Contractor of non-compliance, as well as the withholding of progress payments that will occur. Progress payments will be withheld under the following conditions.

- a. Regarding Preventive Maintenance: Failure of the Preventive Maintenance schedule is reached when all installed devices of a system (e.g. RDS, CCTV, or DMS systems) are found to be 10% behind schedule for the regularly scheduled preventive maintenance procedures. Failure of the Preventive Maintenance Schedule will cause a deduction of the monies due the contractor, not as a penalty, but as Liquidated Damages at \$500 per day for each device count above the 10% limit. Items where the failure to respond is beyond the control of the Contractor, or if the delay is previously approved by TDOT, will not be subject to these Liquidated Damages. Upon verification by TDOT that Preventative Maintenance is back on less than 10% behind schedule, deduction shall stop for each of the systems identified as behind schedule in the same day that verification took place.
 - b. Regarding Repair and Special Repair Maintenance: All repair maintenance and special repair maintenance requests shall be responded to in the manner and time frames described in Section 725.01.03. Failure to respond within the required response requirement will cause a deduction of monies due the Contractor, not as a penalty, but as Liquidated Damages at \$100.00 per hour for each hour thereafter that the response remains in disregard by the Maintenance Contractor. Items where the failure to respond is beyond the control of the Contractor, or if the delay is previously approved by TDOT, will not be subject to these Liquidated Damages.
3. It is not the intent of TDOT to unfairly penalize the Contractor for events beyond his control such as acts of God, vehicle hits, severe weather conditions, major power failure, etc. Failure to perform either repair maintenance, special repair maintenance or the preventive maintenance during such periods will not be used to penalize the Contractor, provided the Contractor returns to standard operations after such periods have ended. It is the Contractor's responsibility to notify TDOT in writing if maintenance activities cannot be performed due to the events mentioned above. TDOT, in turn, will provide a written response to the request.
 4. The Contractor must ensure that all warranties remain valid. To achieve this, the Contractor shall perform all the preventive work specified by the manufacturer within the periods specified by the manufacturer for all equipment.

5. The Contractor shall provide vehicular equipment such as, but not limited to bucket trucks, inspection trucks, field engineering equipment, tools, materials, cellular phones and other equipment necessary to perform the work. The Contractor shall provide conveniently located secure premises to store all test equipment. The Contractor shall provide workbench facilities to enable diagnostic testing and remedial work.

725.13 Contractor's Responsibility for Water Quality and Storm Water Permits

1. The conditions of this Contract apply to all construction on this project pursuant to the following:
 - a. Section 404 of the Federal Clean Water Act (33 U.S.C. §1344), and all implementing regulations, including without limitation regulations of the U.S. Army Corps of Engineers governing permits for discharges of dredged or fill material into waters of the United States in 33 CFR Part 323;
 - b. The Tennessee Water Quality Control Act (T.C.A. §69-3-101, et seq.) and all implementing regulations, including without limitation the Rules of the Tennessee Department of Environment and Conservation governing NPDES permits in Chapter 1200-4-10, and Aquatic Resource Alteration permits in Chapter 1200-4-7;
 - c. Section 26a of the TVA Act of 1933 as amended (49 Stat. 1079, 16 U. S. C. §831y1.) and all implementing regulations, including without limitation the regulations of the Tennessee Valley Authority governing construction in the Tennessee River System in 18 C.F.R., Part 1304; and
 - d. Coast Guard Bridge Permit (USCG) (§9 of the Rivers and Harbors Appropriation Act of 1899) and all implementing regulations, including but not without limitation for projects which impact streams deemed navigable by the U.S. Coast Guard.
2. All streams, springs, and wetlands shall be crossed by either attaching conduit to bridges or by crossing over or under existing culverts. No maintenance operations within streams, spring flows, or wetlands, jacking/boring under streams, or open cutting of streams, shall occur without first obtaining approval from TDOT and instructions regarding permit requirements. Additionally, no clearing of stream banks shall occur without first obtaining approval from TDOT. The TDOT representative will be responsible for obtaining guidance from the TDOT

Environmental Division.

725.14 One Call Service

1. The cost for activating and or maintaining the One Call system for a given region is the responsibility of the Contractor. The Contractor must register or update the One Call system in TDOT's name and shall be listed as the first contact individual for all One Call inquiries. If applicable, the Contractor shall also coordinate with the equivalent utility location systems in Arkansas (Region 4), Mississippi (Region 4), Kentucky (Region 1 & 3), and Georgia (Region 2).
2. The Contractor shall receive all one call tickets and perform the locates in accordance within call requirements, in the time specified on the One Call tickets and to the tolerance requirements of One Call. If the Contractor fails to perform the locate in the specified time after receiving the One Call ticket from TDOT, or does not locate the facility per One Call requirements and the facility is damaged, it will be the responsibility of the Contractor to repair the damage at his own expense including all incidental and related items.

The Contractor shall be responsible for updating the One Call system when system changes or expands. When new ITS projects are complete their As-built information will be delivered to the contractor. It is the contractor's responsibility to add this new As-built information to the One Call system. The Contractor must add new ITS information within 60 days from the time the new information is received.

3. The Contractor shall maintain an accurate and complete record of all One Call locates using the TDOT Maintenance Database. The records should include the following:
 - a. Date and time One Call ticket was received
 - b. Person or source of One Call ticket
 - c. Location
 - d. Name of person performing locate
 - e. Date and time locate begins and is completed
 - f. Estimate of the length located
 - g. Any relevant information regarding problems that would result in a locate taking longer to complete than normal.

725.15 Measurement

725.15.01 Maintenance for the System

1. The Contractor shall be compensated for Maintenance for the System on the contract

lump sum price paid at a monthly rate equal to one thirty-sixth (1/36) of the price bid. This rate shall include all labor, tools, vehicles, equipment, and engineering necessary to perform preventive maintenance on the System in accordance with the provisions of the Contract. The price bid shall be full compensation for all labor, tools, materials, equipment and incidentals necessary to complete the work. The payment request for Annual Maintenance must include documentation of maintenance activities for that month.

2. The Contract price exercised by TDOT shall constitute the entire compensation due the Contractor for the preventive maintenance activities and all of the Contractors obligations hereunder regardless of the difficulty, materials, labor or equipment required. The cost of storing and insuring the inventory of spare parts and equipment shall also be included in the price bid. The Contract Price includes but is not limited to, all applicable taxes, fees, overhead profits and all other direct and indirect costs incurred or to be incurred by the Contractor.

725.15.02 Repair Maintenance

1. Repair Maintenance includes the reactive, day-to-day repair, replacements, and diagnostic work necessary to keep the system fully operational. For all the work required to repair, modify or replace system components the Contractor shall be compensated his hourly labor costs for such operations at the hourly rate bid for Repair Maintenance Labor. This hourly rate includes but is not limited to all labor, overhead, bucket trucks, inspection trucks, field engineering equipment, tools, materials, cellular phones, and any other equipment necessary to perform the work. Hours shall be based on actual time on task plus a maximum of two (2) hours travel time, or actual travel time if less than two (2) hours. No further labor costs will be allowed. The price bid shall be full compensation for all labor, tools, equipment and incidentals necessary to complete the work. The price bid per hour includes all labor charges regardless of the number of people at the site and all equipment cost regardless of how much equipment is required.
2. All repair maintenance activities which extend beyond eight (8) hours of repair maintenance labor shall require the submission of an itemized cost estimate and be approved by TDOT prior to continuing with the repair. For all repair maintenance, the Contractor cannot bill or collect payment from TDOT until the repair is completed and verified by TDOT.

725.15.03 Special Repair Maintenance

1. Special Repair Maintenance consists of responding to the failures reported concerning the various field components of the system. Work under special repair maintenance may be generated by failures caused by Third Party Damage or

required system modifications or improvements that exceed the intent and scope of this Contract. Additionally, work under this item may include relocation of facilities. For all the work required to repair, modify or replace system components the Contractor shall be compensated his approved bid price for work performed under the Special Repair Maintenance item. This bid price includes but is not limited to all labor, overhead, bucket trucks, inspection trucks, field engineering equipment, tools, materials, cellular phones, and any other equipment necessary to perform the work. The price bid shall be full compensation for all labor, tools, equipment and incidentals necessary to complete the work. The price bid includes all labor charges regardless of the number of people at the site and all equipment cost regardless of how much equipment is required.

2. The direct cost of the One Call Service tickets shall be paid under Special Maintenance Repair item.
3. The Contractor will be asked to submit a separate cost proposal and schedule to TDOT for consideration and approval. Once approved, the Contractor shall start the work within five (5) days of approval and perform the work with due diligence according to the schedule agreed upon. These items will be paid for under the line item 725-10.80 Special Repair Maintenance. For all special repair maintenance, the Contractor cannot bill or collect payment from TDOT until the repair is completed and verified by TDOT. When a separate cost proposal is not agreed upon mutually, TDOT may issue a written order that the work be completed on a force account basis and paid for as provided in Subsection 109.04. The cost proposal should be completed and submitted using the attached special repair form.

725.15.04 Spare Parts and Equipment Replacement

1. Spare Parts and Equipment Replacement is a pay item that will be used to reimburse the contractor invoice cost plus 15% for replacement parts needed throughout this contract. The bid price shall be as shown in *Section 725.20 – Appendix E – Payment*, which will establish a base amount that will be used as needed as replacement parts are ordered and invoiced by the Contractor. The required bid amount is meant only to establish a base amount and does not guarantee that the entire amount will be needed or used. Any unused funds in this pay item at the end of the contract will remain the property of TDOT.

725.15.05 One Call Service

1. One Call Service is a pay item that will be used to compensate the Contractor for registering with One Call and locating TDOT ITS facilities. The Contractor will be responsible for receiving the One Call tickets, logging the information into the Database, and for locating the ITS facility within the specified time frame and

location tolerance. This item is for field locates only and will be based on an hourly rate that includes but is not limited to all labor, overhead, vehicles, equipment, materials, cellular phones and any other equipment needed to perform the locate. The base hourly amount for bidding will be 6000 hours. Hours shall be based on actual field time to complete the task only. This pay item price shall be inclusive of all review time necessary to prepare for field locates. The direct cost of the One Call Service tickets shall be paid under Special Maintenance Repair item.

725.15.06 Software and Network Maintenance and Support

1. Software and Network Maintenance and Support is a pay item that will be used to reimburse the contractor invoice cost plus 15% for acquisition/renewal of manufacturer's software and network maintenance and support charges. The Contractor shall purchase support packages, including software upgrades that will cover the entire Contract period for all field switches, video encoders, wireless radios, HAR transmitters, and for all vendor-specific software, which includes, but is not limited to, CCTV, DMS, HAR, and all detection components. All software and network maintenance and support agreements shall be in the name of TDOT and shall remain the property of the Department at the conclusion of the Contract. The bid price shall be as shown under *Section 725.20 – Appendix E – Payment*, which will establish a base amount that will be used as needed as acquisitions/renewals are required and invoiced by the manufacturer. The required bid amount is meant only to establish a base amount and does not guarantee that the entire amount will be needed or used. Any unused funds in this pay item at the end of the contract will remain the property of TDOT.

725.15.07 Payment

- A. See *Section 725.20 – Appendix E – Payment* for payment schedule.

725.16 Appendix A – Preventive Maintenance Procedures

All supplies and parts used in the maintenance of equipment shall meet the manufacturer's recommendations for the unit being serviced. The procedures listed in this Appendix are minimum standards for this Contract.

725.16.01 (Permanent) Closed Circuit Television Camera Preventive Maintenance

A. Camera PM at Pole Level.

Perform the following tests once each six (6) months:

1. Check camera housing pressure (this should be 5 PSI \pm 1 PSI), or as specified by the manufacturer. Re-pressurize with dry nitrogen if not within limits and document readings on sheet provided.
2. Visually inspect camera housing.
3. Clean glass with suitable glass cleaning agent.
4. Inspect pan and tilt mechanism and adjust limit switches where applicable.
5. Inspect housing mounting for corrosion.
6. Remove any bird nest around the camera housing.
7. Check and inspect the integrity of all cable harnesses and connectors. (Replace defective item where applicable)
8. Check integrity of surge protector (replace where applicable).
9. Replace filter in camera housing
10. Check operation of thermostat inside camera housing
11. Check for corrosion of terminal inside housing.

B. Camera PM at Cabinet Level.

Perform the following tests once each three (3) months:

1. Check integrity of all cables and connectors.
2. Check all local functions (Pan, Tilt, Zoom in, Zoom out, Focus far, and Focus near).
3. Check integrity of surge protectors.
4. Check operation of auto-iris and adjust for correct operation per operational and maintenance manual.
6. Check circuit box at the base of the camera pole to ensure that the terminal strips are corrosion free.

7. Check proper function of thermostat.
8. Check fan and replace where applicable.
9. Clean and vacuum inside of cabinet.
10. Inspect and change filter where applicable.
11. Check light bulb and replace where applicable.
12. Check incoming power for proper voltage and correct if not within tolerances.
13. Check cabinet door(s) for proper closure.
14. Visually inspect pole for damage.
15. Visually inspect pole grounding system.
16. Inspect pole anchor bolt nuts to ensure they are tight.

725.16.2 (Portable) Closed Circuit Television Video Preventive Maintenance

- 1) Preventive Maintenance (Minimum Requirements)
 - a) Visually inspect equipment and trailer for damage
Check trailer lights and tire pressure. 6 months
 - b) Grease trailer axles 12 months
 - c) Check batteries and charging condition 6 months
 - d) Verify that the solar panel is mounted securely and is facing south. Inspect solar panel for damage and clean panel. Check voltage coming from the back of the solar panel. 6 months
 - e) Check that all hardware is tight throughout the entire trailer as well as within the electronics enclosure. Check tightness of wire screw terminals and cable connectors as well. 6 months
 - f) Check all local functions (Pan, Tilt, Zoom In, Zoom Out, Focus For, Focus Near) 6 months
 - g) Visually inspect camera housing and clean glass with Suitable glass cleaning agent. 6 months

725.16.03 (Permanent) Dynamic Message Signs Preventive Maintenance

A. Preventive Maintenance (Minimum requirements)

UNIT ITEM	ACTION REQUIRED	PM FREQUENCY
Power Supply	Check for proper voltage	6 months
Photo Cell	Clean photo cell aperture	6 months
Ventilation	Clean or replace filters	As needed
Lexan cleaning	Clean front surface with approved	Yearly

	detergent	
Cabinet Filter	Clean or replace filters	6 months
Fans	Check fan condition and thermostat settings	6 months
Vacuum (cabinet)	Vacuum and Clean to ensure cabinet is clean of debris and obstruction to free flow and ventilation to filter units	6 months
Test	Row and Column Check	Monthly
Test	All "ON" and ALL "OFF"	Monthly
Test	Check alpha numeric characters	Monthly

725.16.04 (Portable) Dynamic Message Signs Preventive Maintenance

A. The portable DMS requires scheduled maintenance as detailed below.

Fluid Levels of batteries – check for proper electrolyte level (distilled water)	Weekly or every 50 hours of operation
Wiring – make sure all terminals, connectors and plugs are clean and tight.	1,000 hours or 3 months
Trailer – inspect trailer structure for damages	1,000 hours or 3 months
Sign Mast – check hydraulic power unit for proper fluid level	Every 1,000 hours
PV Panel – check for dirt, dust and/or snow	Weekly* (having the ability to lift the panels usually cleans itself during the rain)

725.16.05 Demarcation Point Preventive Maintenance

A. The demarcation points play a very important role by acting as collection points for the power service that is fed to the devices. In addition, the demarcation points act as collection points for field data and video prior to being sent to the TMC. It is therefore imperative that the unit be maintained at the highest level of performance. Contractor shall ensure that periodic maintenance on the essential sub units are done as stipulated.

B. Perform the following tests once each three months

- 1) Check integrity of all cables and connectors
- 2) Check incoming power for proper voltage and correct if not within tolerances
- 3) Check integrity of circuit breakers and TVSS
- 4) Clean and vacuum inside of cabinet
- 5) Inspect and change filter where applicable
- 6) Check cabinet door for proper closure
- 7) Check light bulb and replace where applicable
- 8) Check fan and replace where applicable

725.16.06 Wireless Radio Preventative Maintenance

When visiting a radio sites for Maintenance

- A. 5.8 GHz/20-60 Mbps Radio Link Maintenance
- B. 23 GHz/45 Mbps Radio Link Maintenance
- C. 11 GHz/155 Mbps Radio Link Maintenance

, the following items will be checked and the results recorded:

- 1) RSL voltage
- 2) PWR voltage
- 3) Far End RSL voltage
- 4) Alarm Conditions
- 5) Adequate ventilation
- 6) Verify security ID is set the same at each radio through NMS

Any alarm conditions or out of tolerance conditions should be recorded, Report to TDOT, and troubleshooting should begin immediately according to the manufacturer's equipment manual.

725.16.07 Fiber Optic Cable Preventive Maintenance

- A. Use an OTDR to test all fibers after any repair work.
- B. Compare and document reading with that from original installation tests and the previous tests. Tests should document the total, cumulative dB loss since the previous test. Results must be recorded in the TDOT maintenance database.

725.16.08 RDS Preventive Maintenance

- A. The following shall be done every 6 months:
- 1) The unit shall be cleaned and the security of the pole mounting shall be checked.
 - 2) The unit shall be tested in the field for accuracy of speed and volume data.

725.16.09 Video Detector Preventive Maintenance

Intentionally Omitted

725.16.09.01 Video Detector PM at Pole Level

Intentionally Omitted

725.16.09.02 Video Detector Preventive Maintenance at Cabinet Level

- A. Perform the following tests once each three months
- 1) Check integrity of all cables and connectors.
 - 2) Check raw video from the camera and check detection zones for proper configuration
 - 3) Check integrity of surge protectors.
 - 4) Check proper function of thermostat.
 - 5) Check fan and replace where applicable.
 - 6) Clean and vacuum inside of cabinet.
 - 7) Inspect and change filter where applicable.
 - 8) Check light bulb and replace where applicable.
 - 9) Check incoming power for proper voltage and tolerances.
 - 10) Check cabinet door(s) for proper closure
 - 11) Visually inspect pole for damage.
 - 12) Visually inspect pole grounding system.
 - 13) Inspect anchor bolt nuts and arm extension connections to ensure they are tight.

725.16.10 (Permanent) Highway Advisory Radio Preventive Maintenance

- A. Perform the following tests once every 6 months. The preventive maintenance checks should be made by fully trained communications/electronics personnel who

are intimately familiar with Amplitude Modulation (AM) and HAR station technology and equipment:

1. Monitor the station's broadcast in a vehicle. That is, determine if the range of your radio station continues to be what it was when installed. Take care to monitor the station with the same radio in the same vehicle at the same physical locations to make this judgment, since radio sensitivity, signal coverage and vehicle interference levels vary widely. Note locations on the road where the signal begins to get softer, then is no longer intelligible.

2. Visit the transmitter location:
 - a. Check the antenna field strength and station's wattmeter to make certain that forward and reflected power readings remain constant at the original levels. Record both settings in the Maintenance Database

 - b. Check actual transmitter power output. Make certain that the audio entering the transmitter is at an appropriate level. If not, adjust the transmitter's "mod adjust" control to yield a full, high quality broadcast sound.

 - c. Check average modulation percentage. Record settings in the Maintenance Database.

 - d. Check audio frequency response (or intelligibility), Record results in Maintenance Database

 - e. Check compliance with FCC rule 90.242, should be done in the field using correct and industry-accepted testing equipment and procedures

 - f. Make a visual inspection and clean all parts.

 - g. Check batteries and charge/recondition as needed. Perform capacity test procedure.
 - 1) Make sure the battery is boost-charged
 - 2) With the battery temperature above 70 ° F (21.1°C), discharge the battery at 25A to 10.50 volt (1.75 volts per cell), for a 12-volt battery.
 - 3) If the battery fails to deliver 80% of its 100-amp capacity, it should be replaced.

 - h. Check that all hardware is tight throughout equipment cabinet and on the antenna support pole
 - 1) Check integrity of all cables and connectors.
 - 2) Check integrity of surge protectors.

- 3) Check proper function of thermostat.
- 4) Check fan and replace where applicable.
- 5) Clean and vacuum inside of cabinet.
- 6) Inspect and change filter where applicable.
- 7) Check light bulb and replace where applicable.
- 8) Check incoming power for proper voltage and correct if not within tolerances.
- 9) Check cabinet door(s) for proper closure

725.16.11 (Portable) Highway Advisory Radio Preventive Maintenance

1. Preventive Maintenance (Minimum Requirements)
 - a. Visually inspect equipment and trailer for damage 6 months
 - b. Check trailer lights and tire pressure 6 months
 - c. Grease trailer axles 12 months
 - d. Check the station's wattmeter to make certain that forward and reflected power readings remain constant at the original levels. 6 months
 - e. Make certain that the audio entering the transmitter is at an appropriate level. If not, adjust the transmitter "mod adjust" control to yield a full, high quality broadcast sound. 6 months
 - f. Check batteries and charging condition As needed
 - g. Verify that the solar panel is mounted securely and facing south. Inspect solar panel for damage and clean panel. Check voltage coming from the back of the solar panel. 6 months
 - h. Check that all hardware is tight throughout the entire trailer as well as within the electronics enclosure. Check tightness of wire screw terminals and cable connectors as well. 6 months

725.16.12 Video Wall Preventive Maintenance

- A. The contractor will provide a preventive maintenance (PM) visit (1 visit per year) and one (1) as needed emergency visit, per year. During the PM visit the contractor will perform the following services as they relate to the Video Wall System equipment outlined in table below.
 1. Color Balance of Video Wall
 2. Brightness Adjustment of Video Wall
 3. All video wall projector filters will be changed
 4. Complete operational checkout of the system functions
 5. Detailed inspection and testing of selected system components

6. Readjustment of levels, equalization of equipment settings as required to maintain or optimize
7. Overall system performance
8. Reloading of system software, if required to restore functions or update code changes
9. Professional cleaning screens, projector lenses and other critical surfaces, as needed
10. Lubrication of moving parts as recommended by manufacturers
11. Identification and repair of faulty wire or connections in the system and correct other operating
12. Conditions that are not within industry standards
13. Detailed Service Reports
14. Software updates
15. Recommendations for any additional services and upgrades required

In addition to the PM inspection, weekly inspections of the video wall lamps and the replacement of lamps as necessary shall be performed.

B. The following is a list of the major components of the Video Wall covered under the terms and conditions of the Preventative Maintenance and Service Agreement.

Qty	Mfg	Model	Description
4	BARCO	BARCBL320621	CABLE, 5M DVI-DVI INTERFACE (COPPER)
8	BARCO	BARCBL320641	CABLE, 20 METER INTERFACE
18	BARCO	BARCGPIUI20OVD2	LAMP, OV D2 ILLUMINATION UNIT 120W
1	BARCO	BARCGPLICOV2	OV-D2 LICENSED OPTIONS
1	BARCO	BARCRS3045C	CONTROL ROOM MANAGEMENT SUITE ON CD
18	BARCO	BARCRS3045F	APOLLO, COMPL. FUNCTIONALITY (PER CUBE)
3	BARCO	BARPSI321401	WALL FIXATION FOR OVERVIEW- MP50 A-SHAPED
18	BARCO	BARR9842800	DUST FILTER
0	BARCO	BARR9842807	LAMP, 120/132WATT OV-D2
19	BARCO	BARR9842980	OV-508 PROJECTION MODULE 50" XGA DLP
2	BARCO	BARR9861445	CABLE, 5M DVI-D DUAL LINK COPPER
4	BARCO	BARR9861447	CABLE, 20M DVI-D DUAL LINK COPPER
18	BARCO	BARSCR310601	SCREEN, 50" MP HVA
1	BIAMP	BIACPA130	TRANSFORMER, 130 W DUAL
1	BIAMP	BIANEXIACS	PROCESSOR, DIGITAL SIGNAL W/10 INPUTS

Outputs are listed in the following table.

Qty	Mfg	Model	Description
1	CRESTRON	CREC2ENET2	DUAL PORT 10/100 Base T ETHERNET CARD W/ e-Co

1	CRESTRON	CREMC2E	CONTROL SYSTEM, W/ETHERNET PROFESSIONAL 2-S
1	CRESTRON	CREPRO2	PROFESIONAL DUAL BUS CONTROL SYSTEM
6	CRESTRON	CRETPSGTPI	Isys G-SERIES TOUCHPANEL INTERFACE W/QuickMed
24	EXTRON	EXT2665601	ADAPTER, DISPLAY PORT MALE TO DVI FEMALE
1	EXTRON	EXT4206903	TWO-WAY IN-WALL SPEAKERS WITH 8" WOOFER, P
2	EXTRON	EXT6043920	AMPLIFIER, MINI DISTRIBUTION MDA 3AV
1	EXTRON	EXT6046801	MATRIX SWITCHER, CROSSPOINT 450 PLUS 2424
1	EXTRON	EXT6047601	SCAN CONVERTER, VSC500
1	EXTRON	EXT6072601	SCALER, TWO INPUT IN1502
2	EXTRON	EXT7063501	RECEIVER, MTP- MINI TWISTED PAIR FOR RGBHV
25	EXTRON	EXT6080801	INTERFACE, DVI TO ANALOG RGB VIDEO – DVI-RG
1	PIONEER	PIODVR560H	PIONEER DVR-560H CODE FREE DVD RECORDER
2	TOSHIBA	TOSDR570	DVD RECORDER W/ 1080P UP CONVERT W/TUNER,
1	V-BRICK	VBR80000077	ETHERNET NETWORK VIDEO RECORDER
2	V-BRICK	VBR91104200000	ENCODER, MPG2 SINGLE CH 10/100BT ETHERNE
8	APC	APCS20BLK	POWER CONTITIONER W/BATTERY BACKUP 1.2
1	AVOCENT	AV0LCD17SRP001	17" LCD DISPLAY, RACK MOUNTABLE

725.16.13 Network Hubs (Buildings and Communication cabinets)

- 1) Preventive Maintenance (Minimum Requirements)
 - a) Verify system redundancy by turning off the switch ports one at a time and monitor network activity for 15 minutes. Record any issues and submit a plan to TDOT within 10 days with test results outstanding issues, and recommendations 12 months
 - b) The AC units shall be cleaned and checked for Freon leaks if applicable 6 months
 - c) AC Filters shall be changed 3 months
 - d) Batteries will be tested by turning off Power to the UPS. UPS will run until they reach 80% of a full charge. Approximate time to full discharge will be recorded on the Maintenance ticket 6 months

725.16.14 Solar Power Preventive Maintenance

- 1) Perform the following Tests once each 6 months
 - 1) Inspect and clean solar panels
 - 2) Inspect and clean cabinet
 - 3) Clean battery terminals
 - 4) Check batteries and charge/recondition as needed. Perform capacity test procedure.

- a) Make sure the battery is boost-charged with the battery temperature above 70 ° F (21.1°C), discharge the battery at 25A to 10.50 volt (1.75 volts per cell), for a 12-volt battery.
- b) If the battery fails to deliver 80% of its 100-amp capacity, it should be replaced.

725.17 Appendix B – Equipment to Be Maintained

All existing SmartWay and all ITS equipment installed as part of the Rural ITS project and equipment at the TMC shall be subject to the preventive and unscheduled maintenance procedures. As devices are added to the SmartWay System, these devices will be added to the maintenance list for this contract. This includes but is not limited to the following subsystems and approximate quantities:

Existing Equipment:

1. Eighty One (81) Dynamic Message Signs (DMS) and related equipment/communications,
2. Two Hundred six (206) Closed Circuit Television (CCTV) and related equipment/communications,
3. One Hundred fifty three (153) Video Encoders,
4. Five Hundred fifty eight (558) Radar Detection System (RDS) and related equipment/communications,
5. Electrical (Demarcation Points) and related transformers, conduit/wire, and related equipment/communications,
6. Fiber Optic Infrastructure, conduit, fiber GBIC, routers, switches, UPS and related equipment connecting devices and systems to the Demarcation Points,
7. Sixteen (14) Permanent Highway Advisory Radio (HAR) and related equipment/communications,
8. TMC Equipment:
 - a. Eighteen (18) 52” Barco Cube Video Wall
 - b. Four (4) LCD Flat Panel TV’s
 - c. Intermec Barcode Equipment
 - d. UPS
 - e. Consoles
 - f. Four (4) Impath Decoders

TMC Console Maintenance:

- A. The Contractor is responsible for the maintenance of the TMC operator consoles and their workability including the removal and replacement of a console due to incompatibility with future equipment, and furniture damage beyond reasonable

repair and maintenance. The Contractor is not responsible for maintenance of the computer workstations.

- B. Operator Consoles in the TMC include all equipment within the console including the console itself but does not include the computer work stations.

725.18 Appendix C – Required Spare Parts Inventory

- A. The Contractor shall be provided the following approximate quantity of spare parts and modules to provide the required maintenance. Spares will be replenished as used, so that the following minimum quantities, in working order, are available at all times and will be delivered to TDOT at the conclusion of the maintenance contract. Note that only the major items are listed below. All supporting, incidental, ancillary, and peripheral items necessary for a fully populated and complete installation shall also be maintained in the inventory. (For example, conduit would also require couplers, pull tape, tone wire, blank duct plugs, cable duct plugs, etc.)

1. Thirteen (13) FO closures
2. Thirty-One Thousand One Hundred Seventy-Four (31,174) of FO Cable.
3. Ninety-Eight (98) Fiber Modems
4. Thirteen (13) Pull Boxes
5. Two Thousands Seven Hundred Thirty Seven (2,737) linear Feet of cable
6. Thirty-Two (32) Poles (35'+ Pole Height)
7. Forty-Two (42) Antennas
8. Twenty-One (21) Antenna Suppressors
9. Two (2) Application Servers
10. One Hundred Twenty-Two (122) Camera assemblies
11. Seven (7) DMS controllers
12. Thirty-Five (35) LED face sign modules for DMS signs
13. Twenty-Eight (28) LED Drivers
14. Eighteen (18) LED Panels
15. Thirty-Seven (37) MM Fiber
16. One (1) DMS cable assembly
17. Twenty-One (21) Radios
18. Twenty-Nine (29) video encoders
19. Four (4) Video Decoders
20. Twenty-One (21) Network Switches
21. Twelve (12) Transformers
22. Fifty-Five (55) Radar detection Systems
23. Twenty-Eight (28) Radar Suppression Units

24. Two (2) Solar Power systems (HAR Sign)
25. Forty (40) Video Detection System
26. Seventeen (17) Highway Advisory Radio Systems
27. Nine (9) Portable VMS Sign Modules
28. Seventeen (17) Highway Advisory Signs
29. Seven (7) Breakaway Bases
30. Forty-Eight (48) DSU units
31. Five Thousands (5,000) linear feet of 1-1/4" HDPE Conduit.
32. Seven Thousands Eight Hundred (7,800) linear feet Of 2" HDPE Conduit.
33. Three Hundred Thirty (330) Cable Markers
34. Sixty-Two (62) Cabinets
35. Twenty-One (21) CCTV Controllers
36. Fifty-Five (55) Surge Suppressors
37. Seven (7) Seven Surge Protectors
38. Ten (10) Video Wall lamps
39. Twelve (12) Terminal Servers
40. Thirty-Three (33) DMS Fans
41. Fifty-Nine (59) Solar Power Systems for RDS

B. Expansion spare parts inventory

1. Ten (10) Terminal Servers
2. Two (2) Vicon cameras (SDVFT-023)
3. One (1) DMS Controller (Dak VFC-3000)
4. Four (4) DMS Fans (Mechatronics)
5. Two LED Boards (Dak OA-1253-1512)
6. One (1) Lowering Device (626-101-36)
7. One (1) Type E pull Box (Quazite)
8. Three (3) Firetide Radios with antennas (7020)
9. One (1) switch (Rugged Com RS900G)
10. Three (3) video encoders (Impath i5110)
11. One (1) video encoder (Imapth i4110)
12. One (1) Winch Assembly (Thern)

B. All items in the spare parts inventory measured by linear foot shall be single continuous un-spliced lengths. If a portion of a length in inventory is used for repair, the remainder of the original length shall remain TDOT property in the inventory and the Contractor shall procure a replacement continuous length of the minimum above.

- C. Only replacement parts provided by or functionally equivalent to those provided by the original manufacturer shall be allowed. Functional equivalency shall be approved at the sole discretion of TDOT. The Contractor shall provide conveniently located secure premises to store all spare parts inventory.
- D. Spare Parts Inventory minimum quantities can be increased or decreased at the engineer’s discretion

725.19 Appendix D – Minimum Personnel Requirements

- A. The Contractor must provide a minimum of a four (4) person team that consists of three (3) Level 2 Technicians and one (1) Level 3 Technician and meets the qualifications set forth in this Contract for the duration of this Contract to ensure satisfactory completion of all Preventive Maintenance, Repair, and Special Maintenance activities. The project manager and lead technician shall remain actively involved in the monthly meetings.
- B. The Level 3 Technician must report to the TMC during working hours.
- C. Personnel responding to repair work items shall have necessary equipment and parts required to perform the work.
- D. The Contractor must plan and execute the work in a manner to meet the required contract performance levels. Provide adequate manpower, equipment, and materials in accordance with the plan of operations and scheduling requirements so that maintenance and construction of the various items or groups of items can be carried out and completed within the contract time limitations based on the contract performance levels.

725.20 Appendix E – Payment

The contract price shall be full compensation for all work specified in this Section.

Payment will be made under the following items:

Foot Notes	Item No.	Description	Unit	Quantity for State Project Number
1	725-10.75	TDOT SmartWay ITS System Maintenance (3 years)	LS	1
2	725-10.76	Repair Maintenance Labor	Hour	5000
3,6	725-10.77	Spare Parts and Equipment Replacement	Dollar	1,000,000
7	725-10.78	One Call Service	Hour	6000
4	725-10.79	Software and Network Maintenance and Support	Dollar	125,000
5	725-10.80	Special Maintenance Repair	Dollar	2,500,000

Footnotes:

1. Maintenance for the System will be paid monthly at one thirty-sixth (1/36) of the price bid.
2. Repair will be paid at the hourly rate upon completion and acceptance of a repair or modification.
3. Required bid amount for Spare Parts and Equipment Replacement is \$1,000,000. Spare parts and equipment replacement will be paid at invoice cost plus 15% as replacement parts are ordered and invoiced by the contractor.
4. Required amount for Software and Network Maintenance and Support is \$125,000. Software and Network Maintenance and Support will be paid at invoice cost plus 15% as maintenance and support costs are invoiced by the manufacturer.
5. Required bid price for Special Repair maintenance is \$2,500,000.00
6. Quantities can be increased or decreased at the engineer's discretion.
7. The direct cost of the One Call Service tickets shall be paid under Special Maintenance Repair item.