

MDOT Use Only

Checked _____

Loaded _____

Keyed _____

07 -



SM No. CSP9999010071

PROPOSAL AND CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

07

Construction of a Tower & ITS Field Device Deployment, known as State Project
Nos. SP-9999-01(007) / 107364301, 302 & 303 in Lee, Pontotoc & Union Counties.

Project Completion: 09/27/2018

(STATE DELEGATED)

NOTICE

**BIDDERS MUST PURCHASE A BID PROPOSAL FROM
MDOT CONTRACT ADMINISTRATION DIVISION TO BID
THIS PROJECT.**

Electronic addendum updates will be posted on www.gomdot.com

SECTION 900

OF THE CURRENT

2017 STANDARD SPECIFICATIONS

FOR ROAD AND BRIDGE CONSTRUCTION

JACKSON, MISSISSIPPI

**MISSISSIPPI DEPARTMENT OF TRANSPORTATION
TABLE OF CONTENTS**

**PROJECT: SP-9999-01(007)/107364301 - Lee
SP-9999-01(007) / 107364302 - Pontotoc
SP-9999-01(007) / 107364303 - Union**

Section 901 - Advertisement

Section 904 - Notice to Bidders

#1	Governing Specification
#2	Status of ROW, w/ Attachments
#3	Final Cleanup
#9	Federal Bridge Formula
#12	MASH Compliant Devices
#234	Contract Time
#235	Traffic Management Center (TMC) Modifications
#236	Location & Configuration of Communications Nodes
#237	Tupelo Antenna Tower
#238	ITS Equipment Cabinet Modifications
#239	Pre-Bid Meeting
#240	Camera Pole with Foundation, 80' Pole - Camera Lowering Device
#248	Radio Interconnect

Section 907 - Special Provisions

907-103-1	Award and Execution of Contract
907-636-1	Ground Mounted Enclosures
907-650-1	On-Street Video Equipment
907-659-2	Traffic Management Center (TMC) Modifications
907-661-2	Fiber Optic Cable (OSP)
907-663-2	Networking Equipment
907-664-2	Communications Node
907-666-2	Bluetooth Detection System (BDS)
907-675-1	Antenna Tower

Section 905 - Proposal, Proposal Bid Items, Combination Bid Proposal

State Board of Contractors Requirement

State Certification Regarding Non-Collusion, Debarment and Suspensions

Section 902 - Contract Form

Section 903 - Contract Bond Forms

(REVISIONS TO THE ABOVE WILL BE INDICATED ON THE SECOND SHEET
OF SECTION 905 AS ADDENDA)

06/28/2017 11:26 AM

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 901 - ADVERTISEMENT

Electronic bids will be received by the Mississippi Transportation Commission at 10:00 o'clock A.M., Tuesday, July 25, 2017, from the Bid Express Service and shortly thereafter publicly read on the Sixth Floor for:

Construction of a Tower & ITS Field Device Deployment, known as State Project Nos. SP-9999-01(007) / 107364301, 302 & 303 in Lee, Pontotoc & Union Counties.

The attention of bidders is directed to the predetermined minimum wage rate set by the U. S. Department of Labor under the Fair Labor Standards Act.

The Mississippi Department of Transportation hereby notifies all bidders that it will affirmatively insure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, sex, age, disability, religion or national origin in consideration for an award.

Plans and specifications are on file in the offices of the Mississippi Department of Transportation.

Bid proposals must be purchased online at <https://shopmdot.ms.gov>. Specimen proposals may be viewed and downloaded online at no cost at <http://mdot.ms.gov> or purchased online. Proposals are available at a cost of Ten Dollars (\$10.00) per proposal plus a small convenience fee. Cash or checks will not be accepted as payment.

Plans must be purchased online at <https://shopmdot.ms.gov>. Costs of plans will be on a per sheet basis plus a small convenience fee. If you have any questions, you can contact the MDOT Plans Print Shop at (601) 359-7460, or e-mail at plans@mdot.state.ms.us. Plans will be shipped upon receipt of payment. Cash or checks will not be accepted as payment.

Bid bond, signed or countersigned by a Mississippi Agent or Qualified Nonresident Agent, with Power of Attorney attached, a Cashier's check or Certified Check for five (5%) percent of bid, payable to STATE OF MISSISSIPPI, must accompany each proposal.

The attention of bidders is directed to the provisions of Subsection 102.07 pertaining to irregular proposals and rejection of bids.

MELINDA L. MCGRATH
EXECUTIVE DIRECTOR

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 1

CODE: (IS)

DATE: 03/01/2017

SUBJECT: Governing Specifications

The current (2017) Edition of the Standard Specifications for Road and Bridge Construction adopted by the Mississippi Transportation Commission is made a part hereof fully and completely as if it were attached hereto, except where superseded by special provisions, or amended by revisions of the Specifications contained within this proposal. Copies of the specification book may be purchased from the MDOT Construction Division, or online at shopmdot/default.aspx?StoreIndex=1.

A reference in any contract document to controlling requirements in another portion of the contract documents shall be understood to apply equally to any revision or amendment thereof included in the contract.

In the event the plans or proposal contain references to the 2004 Edition of the Standard Specifications for Road and Bridge Construction, it is to be understood that such references shall mean the comparable provisions of the 2017 Edition of the Standard Specifications.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 2

CODE: (IS)

DATE: 03/01/2017

SUBJECT: Status of Right-of-Way

Although it is desirable to have acquired all rights-of-way and completed all railroad agreements, utility adjustments and work to be performed by others prior to receiving bids, sometimes it is not considered to be in the public interest to wait until each and every such clearance has been obtained. The bidder is hereby advised of possible unacquired rights-of-way, relocations, railroad agreements and utilities adjustments which have not been completed.

The status of right-of-way acquisition, utility adjustments, encroachments, potentially contaminated sites, railroad facilities, improvements, and asbestos contamination are set forth in the following attachments.

In the event right of entry is not available to ALL parcels of right-of-way and/or all work that is to be accomplished by others on the date set forth in the contract for the Notice to Proceed is not complete, the Department will issue a restricted Notice to Proceed.

ASBESTOS CONTAMINATION STATUS OF BUILDINGS
TO BE REMOVED BY THE CONTRACTOR
SP-9999-01(007)
107364 - 301000, 302000 & 303000
Lee, Pontotoc & Union Counties
June 12, 2017

Reference is made to notices to bidders entitled "Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP)" and "Removal of Obstructions".

The following pertinent information is furnished concerning asbestos containing materials (ACMs), if any, found in buildings to be removed by the Contractor.

There is no Right of Way required for this project. There are no buildings to be removed by the contractor.

STATUS OF POTENTIALLY CONTAMINATED SITES

SP-9999-01(007)

107364 -301000, 302000 & 303000

Lee, Pontotoc & Union Counties

June 12, 2017

THERE IS NO RIGHT OF WAY REQUIRED FOR THIS PROJECT. NO INITIAL SITE ASSESSMENT WILL BE PERFORMED. IF CONTAMINATION ON EXISTING RIGHT OF WAY IS DISCOVERED, IT WILL BE HANDLED BY THE DEPARTMENT.

Improvements to be included in Notice to Bidders to be removed by the Construction Contractor
FMS Construction Project No: 107364-301000, 302000 & 303000
External ROW No: SP-9999-01(007)

Parcel No:
Station No:
Property Owner:
Description/Pictures:

NA

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: ROW Division
Trudi Loflin

DATE: January 17, 2017

FROM: District 1
Jamie McDonald *JM*

SUBJECT OR PROJECT NO: SP-9999-01(007)
107364/301000, 302000, 303000

INFORMATION COPY TO:

COUNTY: Lee, Pontotoc & Union

Asst. Chief Engineer – Pre Construction
District Engineer (Holley)
Project Engineer
Project File

District 1 Status Report

1. STATUS OF RIGHT OF WAY: All ROW to be done within MDOT ROW
2. RIGHT OF WAY CLEARANCE: There are no encroachments on the Right of Way.
3. STATUS OF AFFECTED RAILROAD OPERATING FACILITIES: None affected.
4. STATUS OF REQUIRED UTILITY RELOCATIONS: None Required
5. STATUS OF CONSTRUCTION AGREEMENT: None Required.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 3

CODE: (SP)

DATE: 01/17/2017

SUBJECT: Final Clean-Up

Immediately prior to final inspection for release of maintenance, the Contractor shall pick up, load, transport and properly dispose of all litter from the entire highway right-of-way that is within the termini of the project.

Litter shall include, but not be limited to, solid wastes such as glass, paper products, tires, wood products, metal, synthetic materials and other miscellaneous debris.

Litter removal is considered incidental to other items of work and will not be measured for separate payment.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 9

CODE: (IS)

DATE: 03/01/2017

SUBJECT: Federal Bridge Formula

Bidders are hereby advised that the latest revision of Federal Highway Administration Publication No. FHWA-HOP-06-105, **BRIDGE FORMULA WEIGHTS**, dated August 2006, is made a part of this contract when applicable.

Prior to the preconstruction conference, the Contractor shall advise the Engineer, in writing, what materials, if any, will be delivered to the jobsite via Interstate route(s).

Copies of the **BRIDGE FORMULA WEIGHTS** publication may be obtained by contacting:

Federal Highway Administration
400 7th Street, SW
Washington, DC 20590
(202) 366-2212

or

http://www.ops.fhwa.dot.gov/Freight/publications/brdg_frm_wgths/bridge_formula_all_rev.pdf

An on line **BRIDGE FORMULA WEIGHTS CALCULATOR** is available at

http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 12

CODE: (IS)

DATE: 03/01/2017

SUBJECT: MASH Compliant Devices

Bidders are hereby advised that the Standard Specifications may require certain traffic control and permanent safety hardware devices to meet the requirements of the Manual for Assessing Safety Hardware (MASH). However, devices meeting the requirements of NCHRP Report 350 will be allowed until the mandatory effective date for MASH compliance. The following table shows the effective dates for MASH compliant devices.

Device	Effective Date for MASH Compliance
W-beam barriers, cast-in-place concrete barriers	December 31, 2017
W-beam terminals	June 30, 2018
Cable barriers, cable barrier terminals, crash cushions	December 31, 2018
Bridge rails, transitions, all other longitudinal barriers including portable barriers installed permanently, all other terminals, sign supports, all other breakaway hardware	December 31, 2019

Temporary work zone devices, including portable barriers manufactured after December 31, 2019, must have been successfully tested to the 2016 Edition of MASH. Such devices manufactured on or before this date and successfully tested to NCHRP Report 350 or the 2009 Edition of MASH may continue to be used throughout their normal service lives.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 234

CODE: (SP)

DATE: 6/27/2017

SUBJECT: Contract Time

PROJECT: SP-9999-01(007) / 107364301, 302, & 303 – Lee, Pontotoc, & Union Counties

The calendar date for completion of work to be performed by the Contractor for this project shall be **September 27, 2018** which date or extended date as provided in Subsection 108.06 shall be the end of contract time. It is anticipated that the Notice of Award will be issued no later than **August 8, 2017** and the effective date of the Notice to Proceed / Beginning of Contract Time will be **September 7, 2017**.

Should the Contractor request a Notice to Proceed earlier than **September 7, 2017** and it is agreeable with the Department for an early Notice to Proceed, the requested date will become the new Notice to Proceed date.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 235

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Traffic Management Center (TMC) Modifications

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Bidders are hereby advised that the following Traffic Management Center (TMC) Modifications will be required for this project.

MDOT TMC Modifications

Site 1: Tupelo Regional TMC – 1909 N. Gloster Street, Tupelo, Mississippi (MDOT District 1 Headquarters)

Site 2: The MDOT Statewide TMC is located at 2567 North West Street, Jackson, MS, 39216. The center is in the MDOT Shop Complex, Building A, on the 3rd Floor.

SITE #1:

Software: The Contractor shall initially use vendor supplied software to test the Traffic Signal Controllers, Radar Detection Systems (RDS), Bluetooth Detection Systems (BDS), and Closed Circuit Television Camera (CCTV) systems installed, interfaced or configured on this project and demonstrate full compliance with the contract requirements. The Contractor shall test each using the leased line. A minimum of Two (2) licensed copies of each system of the vendor supplied software must be provided to MDOT upon completion of the testing for each component.

Equipment: Layout of the equipment, video systems, and workstations for the Tupelo Regional TMC shall be as directed and approved by the MDOT Project Engineer. Contractor must coordinate with the MDOT District 1 IT representative prior to installation of equipment.

- **Video Systems:**

The Contractor shall provide, install, and integrate any equipment needed to support displaying and monitoring existing and new video from MDOT Statewide TMC VDMS systems and this project in the Tupelo Regional TMC. The contractor to include at a minimum two 60 inch video monitors and a PC at Site 1 (lower level, west wing conference room) that can support both monitors at 4K resolution. The video system shall be configured and support the ability to show the MDOT VDMS First responders page running a minimum of 12 simultaneous videos on one screen and the MDOT ATMS software status screen on the other monitor or both screens running MDOT VDMS videos, each with 12 simultaneous videos displayed.

The video monitors at a minimum shall have the following:

- Minimum of 60 inches each.
- Supports 4k resolution.
- Minimum of 3 HDMI inputs
- RGB input.

The Video PC at a minimum shall:

- Support display to both monitors
- Support running MDOT VDMS and ATMS running at the same time such that:
 - Displaying the VDMS with 12 Simultaneous videos on each display or VDMS with 12 simultaneous videos on one display and ATMS status screen on the other display.

● **Tupelo Regional EOC Operator Workstation:**

The Contractor shall provide, install, and integrate in the Tupelo Regional TMC, a PC and two connected monitors that shall communicate on the MDOT Statewide TMC network and function as a EOC Operators Workstation. The Operator Workstation shall be capable of logging into the Statewide TMC and running any software or application that any Statewide TMC operator's workstation is capable of. This includes but not limited to the TMC ATMS, the MDOT VDMS, HAR clients, RWIS Clients. The workstation shall support the ability to display up to four simultaneous displays and initially be configured with two displays that are a minimum of 32 inch monitors. The operator workstation shall support at a minimum displaying the VDMS with 12 Simultaneous videos on one display and ATMS screen on the other display.

● **Tupelo Regional TMC Operator Workstation:**

The Contractor shall provide and install necessary power and network cabling to support the installation of a future TMC operator workstation and video display systems at location as directed by the Project Engineer.

● **Leased Line Service:**

The Contractor shall be responsible for all coordination, installation, materials, and any equipment necessary to install an AT&T METRO - E leased line service, that is part of the MPLS service, to connect the Tupelo Regional TMC, new project devices, and new project tower to the Statewide TMC network. The Contractor shall provide the address of the Tupelo Regional TMC and any information required for AT&T to provide service to the Tupelo Regional TMC. The Contractor shall be responsible that the leased line service is provisioned to support the bandwidth necessary to support:

- The projects new devices and the Tupelo's region's existing devices communicating to the Statewide TMC systems, including cameras dual stream video.
- The Projects new tower and network interfaces
- The new Tupelo Regional TMC and operators remote logging into the Statewide systems to support streams to the video displays and operator stations and its displays. The Contractor shall be responsible to coordinate with MDOT and AT&T for testing the configurations of the new leased circuit between the statewide and Tupelo Regional TMC. The Contractor shall coordinate with MDOT to install and configure an MDOT provided router to connect and interface to the MPLS network on the AT&T leased line.

● **Network Switch Connections:**

The ports, as listed in the table below, from each of the appropriate 72 fiber termination panels will connect in pairs to the SFP (Optical ports) of the Network Switch via appropriate single mode fiber optic patch cords, unless otherwise directed and/or approved by the ITS Engineer or his designee.

	Buffer Tube		
Trunk	BL	OR	SL
To Tower			49,50,59,60

SITE #2:

Software: The Contractor shall initially use vendor supplied software to test the Traffic Signal Controllers, Radar Detection Systems (RDS), Bluetooth Detection Systems (BDS), and Closed Circuit Television Camera (CCTV) systems installed, interfaced or configured on this project and demonstrate full compliance with the contract requirements. The Contractor shall test each using the leased line. A minimum of Two (2) licensed copies of each system of the vendor supplied software must be provided to MDOT upon completion of the testing for each component.

MDOT ATMS Software: The Contractor shall update the licenses and license keys for the existing MDOT ATMS software to include all ITS devices, existing and provided by the Contractor under this project, that the existing ATMS has modules and device drivers for. The Contractor is required to fully configure the existing ATMS software for operation, status monitoring, configuring, and control of any of the RDS sensors, BDS sensors, and CCTV systems installed, interfaced or configured on this project. At a minimum, this shall include:

- Update and configure the existing map to show the locations of all ITS devices existing and provided by the Contractor that the existing ATMS has modules and device drivers for, including but not limited to: the RDS, BDS, and CCTV with dynamic icons.
- Install and configure all ITS devices existing and provided by the Contractor that the existing ATMS has modules and device drivers for, including but not limited to: RDS, BDS, and CCTV systems into the software’s database.
- Configure Speed Map for new RDS and Blue Tooth Devices and travel time segments as directed by the MDOT Statewide TMC Manager.
- Provide configurations, licenses, and software required for BDS data (raw, reports, and XML feeds) integration to ATMS and reporting software.
- Install and Configure New Video Display systems in Tupelo Regional TMC to use First Responders Page of the MDOT VDMS system with existing and new video system devices.
- Install and configure an Emergency Operations Center (EOC) workstation in the Tupelo Regional TMC to use TMC and ATMS software by logging into the MDOT Statewide TMC
- Install and configure network systems to pass network data and video between field site devices, new communication tower installed on this project and the fiber connected between tower and the Tupelo Regional TMC, the leased line Service, and the MDOT Statewide TMC.

The Contractor is required to arrange for the ATMS vendor to be on-site to complete this configuration and provide the required testing to show that the software is fully functioning for each RDS, BDS, and CCTV.

SITE #1 and #2:

Testing: The Contractor shall submit a proposed test plan for review and approval by MDOT. The Test Plan shall demonstrate full compliance with all requirements in the plans and specifications.

Training: 6 hours of training and assistance for a maximum of 12 people shall be provided for operations, testing, and maintenance of the TMC & EOC Systems provided on this contract.

All work, materials, equipment and related items described in this NTB shall be included in the lump sum pay item for 907-659, Traffic Management Center Modifications.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 236

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Location & Configuration of Communications Nodes

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Communications Node

Bidders are hereby advised that:

- MDOT is to provide the network switch that is to be installed in the Communications Node Hut.
- Communications Node Huts, Communications Node Vaults, and all Communications Node Training shall be paid under Pay Item 907-664-B
- Modifications to existing equipment at the District 1 Headquarters office and the MDOT Statewide TMC shall be paid under TMC Modifications Pay Item 907-659-A.

All ancillary components to comprise a fully functional and operable final system shall be provided by the Contractor. The Contractor shall coordinate with MDOT to determine the necessary components. This may include, but is not limited to, network management / maintenance software licensing, optical transceivers, node chassis and power supplies. Any part substitutions due to revision or version changes must be approved by the MDOT Project Manager. All required components shall be included in the price bid for pay item no. 907-664-B.

Communications Node HUT

Communications Node Huts, Vaults, and grounding systems, placed near the Antenna Tower at the MDOT District 1 Headquarters office located at 1909 N. Gloster Street, Tupelo, MS, 38804, will be provided as part of this project and shall be paid under Pay Item 907-664-B.

Communications Node Installation, Configuration

- All Parts, components, installation, configuration, and cabling of the Communications Node and ITS equipment located in the Communications Node Hut, except the MDOT provided Network Switch itself and switch configuration as covered in the Networking Equipment NTB, shall be paid under Pay Item 907-664-B.
- The Contractor shall provide electrical service during project and burn-in period.
- The Contractor shall arrange for transfer of electrical service to MDOT after project acceptance as directed by the MDOT ITS Program Manager.
- The Contractor shall interface and configure the Communications Node near the Antenna Tower to the MDOT District 1 Headquarters office Communications Node to provide communications between the two.
- The Network Switch will be connected by the Contractor in the Hut as follows:
 - The Contractor is responsible to mount the Network Switch in the Contractor provided 19 inch racks at the Communications Node Huts.

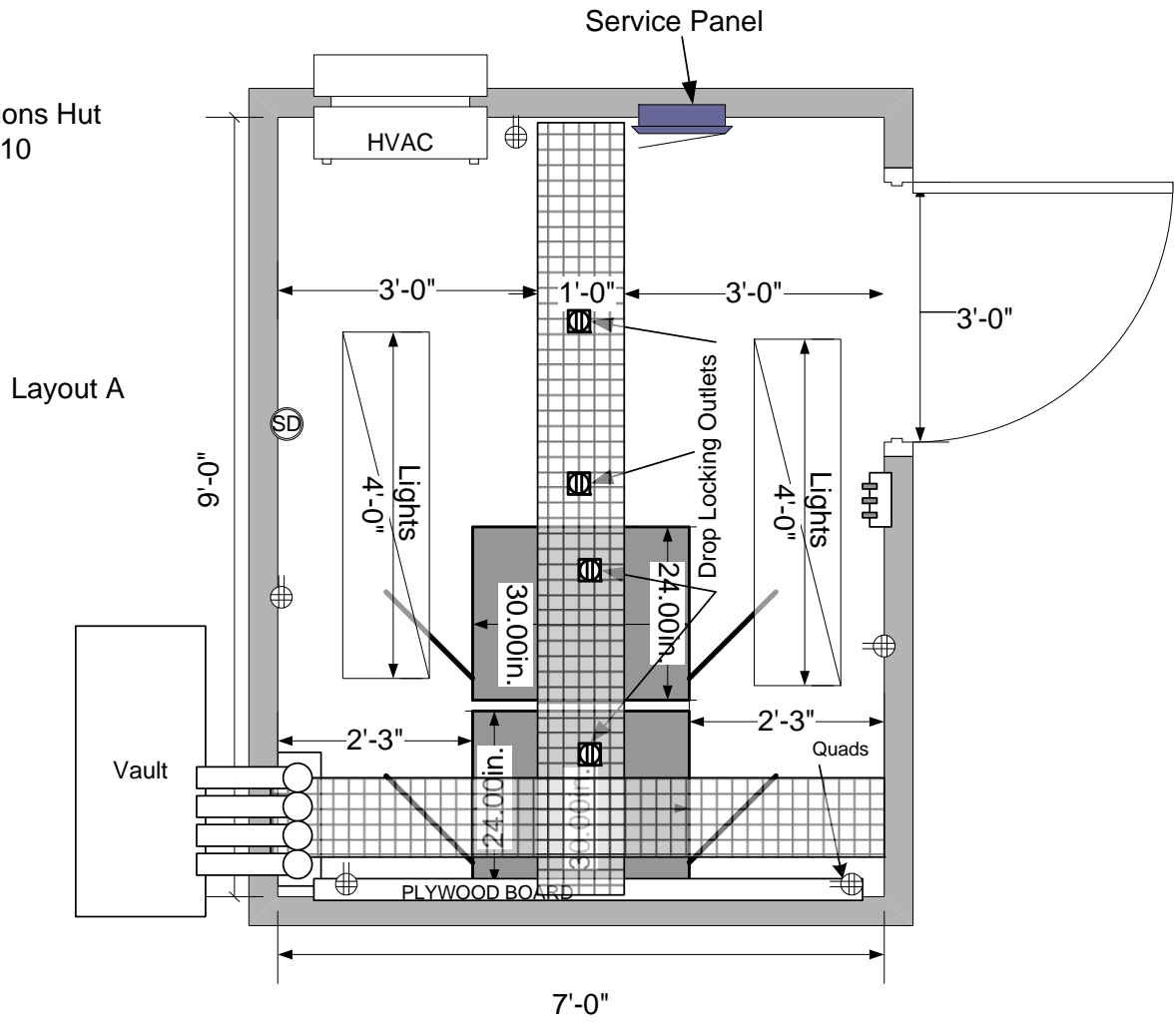
- The Contractor shall provide fiber optic patch cords at least six feet (6') in length. In addition, the Contractor shall provide 10 spare fiber optic patch cords per Communication Node Hut.
- The Contractor shall submit to the ITS Engineer for approval, a cable connection diagram done in Visio and an excel spreadsheet with port connections one week prior to connecting the Network Switch in the HUT buildings.
- **Communications Node Hut near the Antenna Tower**
 - At the proposed Communications Hut near the Antenna Tower, the Contractor shall terminate all 72 proposed FO trunk fibers.
 - The ports, as listed in the table below, from each of the appropriate 72 fiber termination panels will connect in pairs to the SFP (Optical ports) of the Network Switch via appropriate single mode fiber optic patch cords, unless otherwise directed and/or approved by the ITS Engineer or his designee.

Trunk	Buffer Tube		
	BL	OR	SL
To D1 HQ			49,50,59,60

- WEB based rack mounted remote environmental monitoring system with the following elements:
 - H.264 IP based PTZ camera provided per special provision no. 907-650 shall be connected to the Network Switch in the HUT via network cables.
 - Environmental sensors for heat and humidity
 - Power monitoring sensor
 - Alarm management system with email forwarding function

Layout of Communications HUT

8x10
Communications Hut
9/22/2010



8' x 10' outside Dimensions

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 237

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Tupelo Antenna Tower

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Bidders are hereby advised that the following Antenna Tower specifications shall be required on this project. Work and materials not paid for under other pay items shall be included in the price bid for pay item number 907-675-A.

Tupelo Antenna Tower

Scope of Work: The Mississippi Department of Transportation desires to construct a 150-foot monopole Antenna Tower able to support four levels of antenna arrays including, but not limited to the tower, foundation, anchor bolts and templates, waveguide ladder, safety devices, power, lighting, painting, lightning rod, grounding system, ice bridge, Contractor-designed tower-mounted wireless system, attachment hardware and brackets. All structures must meet 2012 IBC and TIA 222-G Standards. The foundation and grounding system must meet Motorola R-56 Standards. The lighting system and paint must be in accordance with FAA and FCC rules and regulations, if applicable. The tower will be constructed at the MDOT District 1 Headquarters office located at 1909 N. Gloster Street, Tupelo, MS, 38804 near an existing monopole tower.

A new Communications Hut shall be installed near the new Antenna Tower while the existing 150-foot monopole Antenna Tower and existing Tower building shall be demolished and removed as part of this project. These shall be paid for under the associated pay items of Removal of Obstructions (202-A), Removal of Antenna Tower Communication Hut (202-B), and Communications Node Hut (SP 907-664-B).

A wireless communication system shall be designed and installed on the proposed Antenna Tower as part of the Antenna Tower pay item (SP 907-675-A). A preliminary Microwave Network Feasibility Assessment, including line of sight measurements, has been included in Appendix A for informational purposes. Not all project sites are included in the report and the report includes some sites that are not a part of the project. It is the Contractors responsibility to design and install a complete and fully functional wireless system based on actual conditions found in the field.

Project Location/Site: The proposed tower will be installed near the existing monopole tower at the MDOT District 1 Headquarters office. The proposed tower coordinates will be 34°17'28"N, 88°43'2"W.

Typical EIA soil conditions for this area of Mississippi should be used by the Bidder to determine the bid estimate for the tower foundation. MDOT will provide boring logs & soil

samples to the Contractor as an addendum to the project Bid Package. Based on the Final Geotechnical Soil Report provided by MDOT, the Contractor must submit a foundation design, certified by a professional engineer registered in the state of Mississippi, to the Project Engineer.

Design, Installation and Configuration: The foundation must be of a drilled pier design. The contractor is responsible for designing all components of the tower and for specifying the required concrete mix design.

Temporary Silt Fence and Solid Sodding shall be used at the Tower site to control erosion. Silt Fence shall be placed as directed by the Project Engineer to prevent runoff from the top of the hill upon which the Antenna Tower sits. This shall be paid for under the associated pay items of Solid Sodding (216-A), Watering (219-A), and Temporary Silt Fence (234-A).

The Contractor must provide, installed and working at the new tower, the following equipment:

- 1 - Contractor-designed, tower-mounted wireless system
- 1 - Waveguide ladder, at a minimum
- 1 - Climbing System with Fall Restraint System
- 1 - Lighting System, if necessary
- 1 - Ice Bridge to be placed between Tower and Point of Entrance to Communication Hut per the written Specifications

Demolition of Existing Tower: The Contractor will dismantle, remove and dispose of the existing 150 feet tall monopole tower once the MDOT and C Spire equipment has been installed on the proposed tower and all equipment has been removed from the existing tower. The existing tower foundation will be wrecked to a depth of two feet (2') below finished grade.

Coordination with Existing Carrier: The Contractor shall coordinate with C Spire to provide a proper schedule for C Spire to place equipment on the new Antenna Tower and remove equipment from the existing Antenna Tower.

Documentation: The Contractor must provide a Conceptual Tower Design. Preliminary drawings and/or design documentation shall be provided to the Engineer as soon as possible after the award of the contract. The suitability of the proposed tower design will be verified by including complete tower and foundation construction drawings and detailed structural analysis and calculations in bidders pricing proposal. Drawings must include installation details for all assemblies provided. The tower foundation drawings must include requirements to verify concrete and rebar quality.

These documents shall contain sufficient detail such that MDOT could engage an independent engineering firm to conduct third party structural reviews of submitted tower proposals.

All drawings and calculations will be stamped by a professional engineer registered in the State of Mississippi. Any drawing errors encountered during construction of the tower shall be corrected and re-issued as "As-Built" drawing revisions prior to receipt of final payment.

All documents and drawings must be professionally drafted, clear, and legible. Contractor must provide an electronic copy of all documents and drawings.

The submitted documentation must clearly name the manufacture and model of safety climb system.

The Engineer will review the submittals and be prepared to discuss the submitted documentation before or at the preconstruction conference.

MDOT reserves the right to accept or reject the proposed Conceptual Design at its sole discretion.

References: The Contractor must be a reputable, established, and financially stable provider of Antenna Towers and provide a minimum of three (3) references for similar projects to the Project Engineer.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 238

CODE: (SP)

DATE: 06/20/2017

SUBJECT: ITS Equipment Cabinet Modifications

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Bidders are hereby advised that the following additional requirements for Cabinet Modifications shall be required on this project. Work and materials not paid for under other pay items shall be included in the price bid for pay item number 660-B.

Cabinet Modifications:

Furnish, install, configure, test and integrate all proposed ITS communication, network, video and associated equipment as shown in the plans into the proposed and existing traffic signal controller and ITS cabinets. This shall be paid for under the associated pay items of: Radar Detection Systems (641-C & D), On Street Video Equipment (SP 907-650-A), Fiber Optic Cable (SP 907-661-A), Radio Interconnect System (662-B & D), Networking Equipment, terminal servers, and CAT-6 (SP 907-663-A, B, & D), and Bluetooth Detection System (SP 907-666-A). Install all incidentals, cabling and materials necessary to provide communications, power, and surge protection to the equipment cabinet, ITS devices, networking equipment, traffic signal controllers, cameras, and detector units.

This shall include the following existing Traffic Signal Cabinets at the intersections of:

- Coley Rd. with
 - o McCullough Rd. (Sta. 6007+45)
 - o US Highway 78 Eastbound Ramps (Sta. 6039+25),
 - o US Highway 78 Westbound Ramps (Sta. 6044+00),
- State Route 145 with
 - o US Highway 278/State Route 6 (Sta. 4073+50),
 - o Shell St. (Sta. 4092+65),
 - o S. Green St. (Sta. 4127+00),
 - o W. Eason Blvd. (Sta. 4147+50),
 - o Garfield St. (Sta. 4186+00),
 - o Crossover Rd. (Sta. 4197+90),
 - o Daybrite Dr. (Sta. 4208+30),
 - o President Ave. (Sta. 4212+50),
 - o Varsity Dr. (Sta. 4219+40),
 - o Robert E. Lee Dr. (Sta. 4227+65),
 - o Walmart signal (Sta. 4233+85),
 - o Main St. (Sta. 4246+20),
 - o Jefferson St. (Sta. 4251+90), and
 - o E. Jackson St. (Sta. 4271+20).

Work will include installing and connecting Radio Interconnect antennas and ITS devices as shown on the plans. All labor, equipment and materials necessary to provide the physical entrance for communication and power cables into the cabinet, whether via existing spare conduit or with a new and separate conduit entrance, shall be included in the bid price for pay item number 660-B, unless specifically identified for separate payment in the Plans. Materials and construction methods for all cabinet entrances shall conform to details shown in the Plans and all other requirements set forth in the Plans and specifications. At locations where communications currently exist, the contractor shall make every effort to limit communication down-time to existing ITS and Traffic Signal devices. The Contractor shall submit a change-over plan which details the proposed cut-over and anticipated down time to MDOT for approval prior to disrupting current equipment communications.

In addition, the existing cabinets shall be modified so that the existing and proposed ITS devices will be connected to the existing and proposed equipment, as set forth in the Plans and specifications, and configured to communicate to the Communications Node in the MDOT District 1 Headquarters office (via the Antenna Tower and Communications Node Hut being installed on this project) and on to the Statewide Traffic Management Center.

Installation and Configuration: The Contractor shall install the radio interconnect, network switches, and terminal servers as shown on the plans, shall provide and connect communication cables as necessary to the devices and traffic signal controller, and configure the traffic signal controller to communicate with the existing traffic signal controller management software in the Statewide TMC.

All work, equipment, cords, configuration, and incidental cabling to modify the traffic signal controller to communicate and be integrated with the existing traffic signal controller management software in the TMC equipment room will be considered incidental and shall be included in the cost of pay item number 907-659-A.

All work, equipment, cords, configuration, and incidental cabling required at the existing cabinets to connect equipment at existing locations, but not covered under other pay items, shall be considered incidental and shall be included in the cost of pay item number 660-B. All existing equipment that is removed shall be delivered to the MDOT District Office.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 239

CODE: (SP)

DATE: 6/27/2017

SUBJECT: Pre-Bid Meeting

PROJECT: SP-9999-01(007) / 107364301, 302, & 303 – Lee, Pontotoc, & Union Counties

A non-mandatory pre-bid meeting will be held at 10:30 A.M. on Tuesday, **July 11, 2017** in the first floor Auditorium of the MDOT District Headquarters Building located at 1909 North Gloster Street, Tupelo, MS. Prospective bidders are strongly encouraged to attend to discuss requirements of the Drawings and Specifications for this Project, to request clarifications or additional information to the Documents, and to visit the Project Site. A safety vest in compliance with the 2017 Standard Specifications will be required to tour the Project Site.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 240

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Camera Pole with Foundation, 80' Pole - Camera Lowering Device

PROJECT: SP-9999-01(007) / 107364301, 302 & 303 – Lee, Pontotoc and Union County

Bidders are hereby advised that the following Camera Pole with Foundation, 80' pole required on this project shall be inclusive of a camera lowering device as detailed in the plans and meeting the following requirements.

Pole Shaft

In addition to the requirements set forth in Section 634 for Galvanized Steel Poles for Cameras, the pole shaft shall meet the following requirements:

1. A removable cap shall be provided to cover the shaft top when no device is mounted on pole.
2. A hand hole shall be provided at 48 inches above the base. A cover for the hand hole shall be provided.
3. Conduit and wire entries into the pole shall be made through a boss. A wireway for the lifting, power, and video cabling shall be provided through the bosses.
4. The pole shall have a plate mounted tenon that allows the arm/camera orientation to change by 360 degrees so that the camera can be installed in such a way that it does not come in contact with the pole mounted cabinet during lowering/raising operation.

Camera Lowering Device

1. The lowering device system shall be designed to support, raise, and lower a standard CCTV camera, lens, housing, PTZ mechanism, cabling, connectors, and other supporting field components.
2. The camera connector box shall be cast ZA-12 (12% Al and 88% Zn) and have a minimum weight that ensures stability of the camera during raising and lowering operation. The camera connector box shall have fully gasketed doors to prevent water intrusion. The bottom of the camera connector box shall be equipped with a condensation/moisture exit system.
3. The camera connector block shall be molded in thermoset, weather-resistant, synthetic rubber designed to handle harsh environments. Electrical contacts must also be designed to handle harsh environments.
4. There shall be a locking mechanism between the fixed and movable components. For the movable components, a latching mechanism shall be provided to hold the device in place (when latched all weight shall be removed from the lowering cable) and to raise or lower the assembly using the lowering tool and lowering cable. The suspension contact unit housing shall be weatherproof with a gasket to isolate the interior from dust and moisture.

5. All pulleys shall have sealed, self-lubricated bearings, oil tight bronze bearings, or sintered bronze bushings. The lowering cable shall be a minimum 1/8 inch diameter stainless steel aircraft cable.
6. Internal wireways shall prevent the stainless steel lifting cable from contacting power or video cabling. The only cable permitted to move is the lifting cable, all other cables must remain stable and secure during lowering and raising operations.
7. The lowering tool shall consist of a lightweight metal frame and winch assembly, a quick release cable connector, an adjustable safety clutch, and a variable speed industrial duty electric drill motor. This tool shall be able to access the lifting cable through a pole handhole, shall support itself and the load during lowering, and shall provide a means to prevent freewheeling when loaded. This tool shall have a reduction gear to reduce the manual effort required during lifting operations. In addition, this tool shall be provided with an adapter for operating the lowering device with a portable drill using a clutch mechanism. The portable lowering tool shall be included as part of the system.
8. The lowering device shall include customized adapter brackets to install cylindrical type PTZ CCTV camera that have mounting base below the camera assembly and is required to be installed in upright position.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SECTION 904 - NOTICE TO BIDDERS NO. 248

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Radio Interconnect

PROJECT: SP-9999-01(007) / 107364301, 302 & 303 – Lee, Pontotoc and Union County

Bidders are hereby advised that the following Radio Interconnect specifications will be required on this project. Work and materials not paid for under other pay items shall be included in the price bid for pay item number 662-B and D.

Radio Interconnect

Scope of Work: The Mississippi Department of Transportation desires to implement a wireless RF Data network as indicated in the plans. It shall be incumbent upon the Contractor to design and install a 100% functional wireless system capable of providing video and data to the projects sites as shown on the plans. The Contractor may utilize Line-Of-Sight and Non-Line-Of-Sight, license restricted and license free spectrums to provide communications. MDOT is not specifying a specific technology or mix of technologies. A variety of frequency bands can be used. However, the communication system must meet the requirements of Section 662 of the Standard Specifications. The radio channel infrastructure must be designed to support the full requirements of these specifications. It is expected that the system will transmit data over standard conventional radio channels. The system shall utilize necessary equipment to be able to provide Ethernet or Serial capability as needed.

The RF infrastructure provided in this project must cover all intersections and connections as shown in the plans and provide communications back to the MDOT District 1 Headquarters office located at 1909 N. Gloster Street, Tupelo, MS, 38804. The system must be expandable to cover future intersections which MDOT may choose to add at a future date.

Project Locations/Sites: Predictable and consistently reliable RF communications coverage shall be required for all MDOT connection locations shown in the plans. The MDOT has supplied limited information on many of the suggested sites in Appendix A of the Tupelo Antenna Tower NTB. However, it will be the Contractor's responsibility to forecast coverage from these sites using their own methods. These forecasts must meet MDOT's requirements for the desired system coverage and future growth. The Antenna Tower shall be placed within reasonable proximity to the location shown on the plans, unless otherwise approved by the project engineer; however, the Contractor is not limited to the locations shown for other antennas. It is the responsibility of the Contractor to select the antenna locations that will guarantee MDOT the desired system coverage outlined in these specifications and maintaining the ability for future growth. However, MDOT must approve all new antenna locations. MDOT will negotiate any necessary agreements and access permits with the local municipalities or owners and therefore must be made aware of these needs as early as practicable.

It is also the Contractor's responsibility to determine the number of radio channels needed to meet the minimum system requirements. The MDOT will not be liable for any costs incurred by the Contractor in preparing a response to these specifications. The Contractor will submit a response at his own risk and expense.

The Contractor is responsible for the RF link performance. If the RF coverage performance of the installed system does not meet the requirements of these specifications, the Contractor will modify or otherwise cause the system to meet the minimum requirements at no cost, directly or indirectly to the MDOT and must state a time commitment for correcting such a condition.

The minimum bandwidth provided per each individual link shall be the cumulative minimum bandwidth of each device type and number of each per device utilizing that link according to the following table of minimum bandwidth requirements.

Device Type	Min Bandwidth per Device
CCTV PTZ	1.256 Mbps
CCTV Fixed	256 kbps
Detection	256 kbps
Traffic Signal Controller	128 kbps

Training: After the installation is complete, the Contractor shall provide formal classroom training and "hands-on" operations training for proper operation and maintenance of the Radio Interconnect Systems. The training shall be provided for up to six personnel designated by the ITS Engineer and shall be a minimum of four hours in duration. The training shall cover as a minimum preventive maintenance, troubleshooting techniques, fault isolation and connection analysis. All training materials shall be provided by the Contractor.

- 1) Prior to training, submit resume and references of instructor(s). Also, submit an outline of the training course in a Training Plan. Submit the Training Plan within 90 days of Contract Notice-to-Proceed. Obtain approval of the Plan from the Engineer and the Traffic Engineering ITS Department. Explain in detail the contents of the course and the time schedule of when the training will be given.
- 2) Furnish all handouts, manuals and product information.
- 3) For the training, use the same models of equipment furnished for the project. Furnish all media and test equipment needed to present the training.
- 4) Training shall be conducted in the Tupelo area.
- 5) Training instructor(s) shall be manufacturer-certified, experienced in the skill of training others.

The training shall be conducted by a trainer with a minimum of four years of experience in training personnel on the operation and maintenance of Radio Interconnect Systems.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-103-1

CODE: (SP)

DATE: 05/02/2017

SUBJECT: Award and Execution of Contract

Section 103, Award and Execution of Contract, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-103.01--Consideration of Proposal.

Delete the fourth and fifth sentences of the third paragraph of Subsection 103.01 on page 19, and substitute the following.

Should the attachment not accompany the bid when submitted, the Contractor shall have 10 days following the opening of the bids to furnish the required information to the Contract Administration Director for attachment to the bid. Failure to provide the attachment within 10 days will result in the nonresident Contractor's bid being rejected and not considered for award. As used herein, the term "resident Contractor" includes a nonresident person, firm or corporation that has been qualified to do business in this State and has maintained a permanent full-time office in the State of Mississippi for two years prior to the submission of the bid, and the subsidiaries and affiliates of such a person, firm or corporation.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-636-1

CODE: (SP)

DATE: 05/02/2017

SUBJECT: Ground Mounted Enclosures

Section 636, Electrical Cable, of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction is hereby amended as follows.

907-636.01--Description. Delete the last sentence of the last paragraph in Subsection 636.01 on page 555 and substitute the following.

It shall include excavating, laying, placing tracer cable or tape, backfilling, replacing sod, aerial supports and/or pull-through conduits, as applicable; and transformer enclosures and/or terminal boxes when not placed under other items of the contract.

907-636.02--Materials. After the paragraph of Subsection 636.02 on page 555, add the following.

907-636.02.1--Ground Mounted Meter Enclosure.

907-636.02.1.1--Meter Base. Meter bases shall be NEMA Type 3R with a minimum rating of 100 amps and shall meet the requirements of the local utility. The meter base shall be provided with ampere rating of meter sockets based on sockets being wired with insulated wire rated at least 167°F. The meter base shall be designed for underground service.

Meter bases shall be 4-terminal, 600 volt, single phase, 3-wire furnished with the following:

- (a) Line, load and neutral terminals accepting #8 to 2/0 AWG copper/aluminum wire,
- (b) Ringed or ringless type, with or without bypass,
- (c) Made of galvanized steel,
- (d) Listed as meeting UL Standard UL-414, and
- (e) Underground service entrance as specified.

The meter bases shall have electrostatically applied dry powder paint finish, light gray in color, with a minimum thickness of 2.4 mils.

A 1-inch watertight hub for threaded rigid conduit shall be furnished with meter base.

907-636.02.1.2--Disconnect. External electrical service disconnects shall be furnished with a single pole 50-amp inverse time circuit breaker with at least 10,000 RMS symmetrical amperes short circuit current rating in a lockable in open or closed position in accordance with National Electric Code (NEC) and be a NEMA 3R Type enclosure. The disconnect shall be listed as meeting UL Standard UL-489 and marked as being suitable for use as service equipment.

The disconnect enclosure shall be fabricated from galvanized steel and electrostatically apply dry powder paint finish, light gray in color, to yield a minimum thickness of 2.4 mils. Ground bus and neutral bus shall be provided with at least four terminals with minimum wire capacity range of number 14 through number 4.

For 480V service, a local utility approved, lockable, non-fused disconnect switch on the supply side of the meter base shall be furnished, installed, and labeled as "Utility Disconnect". A separate load side disconnect with overcurrent protection shall be provided within two feet (2') of the meter.

907-636.02.1.3--Ground Mounted – Pedestal – Service Panel. The pedestal shall be of NEMA Type 3R rainproof construction and shall be UL Listed as "Enclosed Industrial Control Equipment" (UL 508A). External construction shall comply with UL50 requirements and shall be of G90 galvanized steel with light green #14672 Federal Specification 595 polyurethane industrial grade powder paint.

Hinges shall be stainless steel and of the continuous piano hinge type.

The pedestal mounting bolts shall not be externally accessible. The pedestal shall be able to be embedded in concrete or use anchor bolts for mounting on concrete base. Either pedestal mounting base or anchor bolt kit shall be used for installation.

The service pedestal should have three separate isolated sections for metering equipment, utility termination and customer equipment.

The metering section shall be pad-lockable and sealable and have a hinged swing hood with an integral hinged polycarbonate sealable window for access to demand meters. Meter socket type shall meet the requirements of the serving utility.

The utility termination section shall be pad-lockable and sealable and shall have a stainless steel handle provided on a lift-off cover. Sufficient clearance shall be provided for a 4-inch diameter conduit for utility cables entrance. Utility landing lugs shall be UL listed and shall accommodate conductor sizes between AWG #6 – 350 kcmil.

The customer compartment door shall be hinged on the left hand side. A stainless pad-lockable hasp shall be provided to secure customer compartment. A door keeper shall be provided to keep the door in an open position. A print pocket shall be provided on the inside of the door in a weatherproof sleeve. Required UL labeling shall be located on the inside of the customer door. Distribution and control equipment shall be behind an internal dead-front door with a quarter-turn securing latch and be hinged to open more than 90 degrees. The dead-front door shall be hinged on the same side as the customer section door. All distribution and control equipment shall be factory wired using 600-volt wire sized to NEC and UL requirements.

The service pedestal shall be rated for operation at 10K minimum amps interrupting capacity (AIC). The provided documentation shall list circuit breaker combinations and those to be used

for de-rated operation for series ratings. Circuit breakers shall be permanently labeled with engraved name plates.

The serving utility shall be contacted for necessary requirements before ordering or installing equipment.

907-636.02.2--Ground Mounted Transformer Enclosure.

907-636.02.2.1--Disconnect. The disconnect shall meet the requirements of Subsection 907-636.01.2.

907-636.02.2.2--Ground Mounted - Pedestal – Service Panel. The ground mounted - pedestal – service panel shall meet the requirements of Subsection 907-636.01.3. In addition, the transformer shall be rated to match the requirement of the primary service and the types of load served as specified in the plans. The transformer unit shall be installed inside the enclosure and meet all applicable codes. Each transformer shall be furnished as one complete unit and wiring of multiple transformers to meet the required ratings at each enclosure location is not allowed. Step-up and Step-down transformers shall be designed specifically for each application. Reverse feeding of step-up and step-down transformers is not allowed. All transformers shall be designed for outdoor installation and rated 600 VAC and below.

907-636.04--Method of Measurement. After the first paragraph of Subsection 636.04 on page 557, add the following.

Ground Mounted Enclosures, complete in place and accepted, will be measured as a unit quantity per each for a complete and operable unit in accordance with the contract provisions.

907-636.05--Basis of Payment. After the first paragraph of Subsection 636.05 on page 557, add the following.

Ground mounted enclosures, measured as prescribed above, will be required wherever ground mounted meter enclosures or step-up or step-down transformers are noted as required in the plans. The enclosures shall be paid for at the contract unit price bid per each; which price shall be full compensation for any transformers (as described in the plans), foundation construction, cabinets, pedestals, meter bases, disconnects, relays, terminals, circuit breakers, sockets, hubs, buses, connectors, mounting material, all other materials for constructing, installing, connecting, testing and final cleanup; and for all equipment, labor, tools and incidentals necessary to complete the work in accordance with the contract documents.

After the last pay item listed on page 558, add the following.

907-636-I: Ground Mounted * Enclosure - per each

* Indicates Meter or Transformer Enclosure Type

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-650-1

CODE: (SP)

DATE: 01/17/2017

SUBJECT: On-Street Video Equipment

Section 907-650, On-Street Video Equipment, is hereby added to and made part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-650 - ON-STREET VIDEO EQUIPMENT

907-650.01--Description. This work shall consist of providing all labor, materials, equipment, and incidentals necessary to furnish, install, test, train, and operate CCTV Camera Systems. CCTV Camera System shall be provided to provide TMC personnel with live streaming video of the roadway network via CCTV Camera Systems. CCTV Camera Systems include both fixed and PTZ cameras.

907-650.02--Materials. All materials furnished, assembled, fabricated or installed shall be new, corrosion resistant.

Support equipment for the CCTV Camera Systems shall be provided in a Type B ITS Equipment Cabinet as described in Section 660.

The CCTV Camera System shall comply with the following minimum materials specifications:

907-650.02.1--General Capabilities and Performance Requirements. Overall CCTV Camera System capabilities and performance requirements include the following:

- 1) CCTV PTZ Cameras shall be placed and installed at fixed locations to provide full coverage of the mainline travel lanes and shoulders.
- 2) CCTV Fixed Cameras shall be placed and installed at fixed locations to provide coverage of the mainline travel lanes. The cameras shall be provided with a varifocal lens which shall be adjusted by the Contractor for the desired view of the mainline. At major intersections fixed cameras shall also be adjusted to the desired view of the surface streets. The Contractor shall record the adjusted views and submit to the MDOT ITS Engineer or his designee for approval and the MDOT Project Engineer. This recording shall be in a format playable with Windows Media Player or pre approved by MDOT ITS Engineer.
- 3) The CCTV Camera System components shall be compatible with each other and be of rugged design and suitable for reliable operation when mounted in their fixed locations.
- 4) The PTZ and the Fixed cameras shall be provided as either Ethernet IP-based or Analog as indicated in either project plan sheets or Notice to Bidders or should be assumed Ethernet IP if description isn't provided.
- 5) The CCTV Camera System shall be capable of attended and unattended, continuous 24 hours per day operation at fixed sites.

- 6) The Contractor shall ensure that the installed equipment provides unobstructed video of the roadway, traffic, and other current conditions around a roadside CCTV field site; that it responds to camera control signals from an operator of the system; and that the video images can be transmitted to remote locations interfaced to the system for observation.
- 7) PTZ and IP based cameras shall be capable of being remotely controlled and programmed.
- 8) All PTZ enclosures shall be provided with the ability to be pressurized for environmental protection.
- 9) PTZ Dome type cameras shall be mounted together with the zoom lens and integrated into the pan and tilt device within the dome enclosure forming a totally integrated, easily removable assembly.
- 10) All cameras shall include a high quality integrated camera/lens combination.
- 11) The camera shall also be equipped with an auto-iris lens capability compatible with the zoom lens supplied.
- 12) Iris capability shall include a provision for manual override via software.
- 13) The PTZ camera shall be capable of auto-focus during zoom-in or zoom-out, with provisions for override via software.
- 14) Overexposure protection shall be provided - the camera shall not be degraded or damaged under normal reasonable operating conditions.
- 15) The capability for local control of pan, tilt and zoom functions shall be provided at the roadside cabinet using vendor-supplied software installed on a laptop computer.
- 16) All IP Based CCTV cameras shall support the NTCIP 1205 v1.08 or later version if backward compatible communication protocol.

907-650.02.2--Analog Camera Unit. The minimum Camera Unit requirements include:

- 1) The camera unit shall incorporate solid-state design and provide digital signal processing (DSP) capable of providing clear and low-bloom color video pictures during daylight hours and monochrome video at night when the roadway is illuminated with minimal roadway lighting.
- 2) The Analog Camera shall be fully compliant with all aspects of the National Television Standards Committee (NTSC) specification, and produce NTSC compatible video.
- 3) The Analog camera shall operate over wide dynamic light conditions ranging from low light/dusk to full sunlight having day (color)/night (monochrome) switchover and iris control, with user-selectable manual and automatic control capabilities.
- 4) The camera unit shall be equipped with a low light level sensor to automatically switch the camera to Black and White mode.
- 5) The camera unit shall be equipped with an override capability to allow the camera to be manually switched via software to turn off the automatic low light level sensor switch feature for Color or Monochrome operation.
- 6) Image sensor: 1/3 inch charge-coupled device (CCD) employing digital video signal processing (DSP) technology with a minimum Effective Picture Elements of 768 horizontal x 494 vertical pixels.
- 7) The camera unit shall include integrated image stabilization.
- 8) Sensitivity: The camera shall maintain usable video under both day and nighttime lighting conditions.

- 9) Video output synchronization shall be 2 to 1 interlace and will observe the NTSC (color) and EIA RS-170 (black and white) standards.
- 10) Resolution: 470 lines horizontal and 350 TV lines vertical, NTSC equivalent.
- 11) Signal-to-noise ratio: 48 dB, minimum with AGC off, un-weighted, and 4.5MHz filter.
- 12) Video Signal Format: National Television Standards Committee (NTSC) composite video output of 1 Volt_{p-p} at 75 ohms, unbalanced.

907-650.02.3--Internet Protocol IP Camera Unit. IP cameras shall provide the same functionality as the analog camera units specified in subsection 907-650.02.2, in addition to the following minimum requirements:

- 1) Power over Ethernet or 24 VAC Power Input.
- 2) Open Architecture.
- 3) Shall utilize H.264 (Video Coding Experts Group (VCEG)/Moving Picture Experts Group) Video Compression Technology types as directed by the Intelligent Transportation Systems Program Manager
- 4) Standard Definition (SD) Units Shall be capable of 2 simultaneous H.264 video streams.
 - a. The primary stream shall provide 480p at 30 fps and the ability to be reduced to D1 resolution at 30 fps.
 - b. The secondary stream shall provide a minimum CIF resolution 30fps.
- 5) High Definition Units (HD) Shall be capable of 2 simultaneous H.264 video streams.
 - a. The primary stream shall provide 720p at 30 fps at a minimum and the ability to be reduced to D1 resolution at 30 fps.
 - b. The secondary stream shall provide a minimum CIF resolution 30fps.
- 6) Image sensor: 1/3 inch charge-coupled device (CCD)
- 7) Shall be capable to take video snapshots in JPEG format and transfer image via FTP.
- 8) IP encoded streams and Video Compression Technology shall be compatible with the existing video streaming servers and decoders for the www.mdottraffic.com WEB site or as approved by the Intelligent Transportation Systems Program Manager.
- 9) Internet Protocols: TCP, UDP (Unicast, Multicast IGMP V2), UPnP, DNS, DHCP, RTP, NTP
- 10) Support Real Time Streaming Protocol (RTSP)
- 11) Multilevel Password Protection.
- 12) EDR (Extended Dynamic Range).
- 13) C/CS Lens Mount.
- 14) Backlight Compensation.
- 15) Low Profile Top/Bottom Mount.
- 16) BNC Service Connector. Tap shall be installed inside cabinet.

907-650.02.4--PTZ Camera Lens. The minimum camera lens requirements include:

- 1) The camera lens shall have a minimum F-Stop of 1.4 to 1.6.
- 2) Optical and Digital Zoom:
 - a. Shall provide an optical zoom of 35X for analog dome cameras.
 - b. Shall provide a minimum optical zoom of 18X and a minimum digital zoom of 6X for IP PTZ cameras.

- 3) Zoom Control: The zoom magnification shall be fully controllable via the remote PTZ mechanism. The time to pass through the full range of movement of Iris, Zoom and Focus shall in no case exceed 10 seconds.
- 4) Iris and Focus: Support automatic iris and focus control with manual override capability. The iris shall be in a closed position when there is no power.
- 5) White or Color Balance: Support automatic or set to yield optical results under various outdoor lighting conditions.
- 6) Shutter Speed: Support automatic or set to yield optimal results under low lighting conditions without blooming or smearing, auto-iris on. Provide electronic shutter that is selectable in steps.
- 7) The lens shall be equipped for continuous remote control of zoom, focus and iris.
- 8) Mechanical or electrical means shall be provided to protect motors from overrunning in extreme positions.
- 9) The zoom lens shall be an integrated camera/lens combination.
- 10) Vibration or ambient temperature changes shall not affect the automatic iris function, focus mechanism and zoom mechanism.
- 11) The lens shall be optically clear, impact resistant and acrylic. The acrylic lens shall not yellow and shall not introduce appreciable light loss or geometric distortion over a 10-year service life when exposed to the environment.
- 12) The zoom mechanism shall be designed for maintenance-free operations. All gearing and bearings shall be self-lubricating with lubrication and gearing tolerances compatible with the environmental specifications contained herein.

907-650.02.5--Character Generator. The minimum character generator requirements include:

- 1) The capability of generating and superimposing lines of English language text on the video image/stream shall be provided.
- 2) A minimum of 20 characters per line that are between 10 and 30 horizontal TV lines in height shall be provided.
- 3) Control (enable, disable and edit) of this feature shall be available remotely and at the field site using a laptop computer.
- 4) The text messages shall be stored in non-volatile memory.
- 5) Characters shall be white with a black border to ensure legibility in varied scenes.
- 6) The following minimum text insertion requirements shall be provided with the ability to individually turn each one on or off:
 - a. Camera ID
 - b. Sector Message
 - c. Alarm Messages
 - d. Pan/Tilt Azimuth/Elevation
 - e. Compass Direction in 8 discreet zones

907-650.02.6--PTZ Enclosure. The minimum PTZ enclosure requirements include:

- 1) Sealed, pressurized dome enclosure that provides complete protection for the camera and lens assembly from moisture and airborne contaminants.

- 2) Environmental resistant and tamper proof meeting NEMA 4X or IP-67 rating requirements.
- 3) The dome enclosure shall be constructed in such a way that unrestricted camera views can be obtained at all camera and lens positions.
- 4) Dome environmental control shall be provided by nitrogen pressurization with a Schrader Valve for pressurization and purging. The enclosure shall be designed to be pressurized to the manufactures recommended level .with dry nitrogen. The notation “CAUTION – PRESSURIZED” shall be printed on the rear plate of the enclosure and shall be clearly visible and readable.
- 5) An alarm shall be displayed under low-pressure conditions and displayed on the camera video. The low-pressure alarm shall be on/off selectable by the operator at the TMC.
- 6) The PTZ dome enclosure shall consist of a two-piece (upper and lower half) dome.
- 7) A harness and cables shall be provided with each enclosure to extend the video, power and data from the CCTV Camera System to the field cabinet. No harness shall be exposed. All entry points shall have gaskets to prevent moisture entry. A sealed connector shall be at the top of the dome.
- 8) The dome enclosure shall assist in preventing lens fogging and effectively reduce internal temperatures.
- 9) The enclosure shall minimize glare and provide overexposure protection for the camera when pointed directly at the sun.
- 10) The enclosure shall be equipped with a heater, a defroster and a thermostat.
- 11) The camera equipment inside the dome enclosure shall meet all its specified requirements when operating under the following conditions:
 - a. Ambient Temperatures: From -40°C to +65°C (-40°F to +149°F). A heater/blower shall be used to maintain internal dome temperatures within the manufacturer required operating temperatures for their equipment.
 - b. Relative Humidity: 5% and 95%, non-condensing.
- 12) Total weight of CCTV cameras (including the housing, sunshield, and all internal components shall be less than 18 pounds.
- 13) At a minimum, dome enclosures shall be secured with a mounting plate/attachment designed to withstand a 90mph sustained wind speed with a 30% gust factor. For projects that are in areas with higher wind standards, the higher standard is required.

907-650.02.7--Pan and Tilt Unit (PTU). The minimum pan and tilt unit requirements include:

- 1) The motorized, remotely controlled Pan/Tilt unit shall be mounted within the dome enclosure. The unit shall be integrated with the CCTV control system.
- 2) For dome enclosed units, the unit shall provide a minimum continuous tilt (vertical) movement of 90 degrees from horizontal and continuous pan (horizontal) movement of 360 degrees. Tilt speed shall be variable from zero up to 40 degrees per second, minimum, and the pan speed shall be variable from zero up to 80 degrees per second, minimum.
- 3) For separately housed tilt motor units (non-Dome Cameras), the unit shall provide a minimum continuous tilt (vertical) movement of +90° to -90° degrees from horizontal and continuous pan (horizontal) movement of 360 degrees. Tilt speed shall be variable from zero up to 34 degrees per second, minimum, and the pan speed shall be variable from zero up to 80 degrees per second, minimum.

- 4) The unit shall be capable of simultaneous pan, tilt movements and zoom on one camera
- 5) Drive motors shall be capable of instantaneous reversing, be corrosion resistant, not require lubrication, and have overload protection.
- 6) Braking shall be provided in both pan and tilt movements to enable fast stop and reversal and to prevent drifting.
- 7) The viewing limits shall be set by a minimum of eight (8) discreet privacy zones that are software selectable.

907-650.02.8--Camera Control Receiver – Driver. The minimum camera control receiver-driver requirements include:

- 1) The camera control receiver shall provide a single point interface for control, power and video communications.
- 2) The camera control receiver-driver shall be included within the dome enclosure and control the camera, pan/tilt and lens functions at each CCTV site.
- 3) The unit shall provide alphanumeric generation for on-screen titles.
- 4) The unit shall provide the ability to display diagnostic information on the screen in response to user commands.
- 5) The diagnostic information shall include current pan, tilt, zoom and focus positions, and error codes for power, communication, position and memory problems.
- 6) The capability for programmed tours shall be provided.
- 7) The camera control receiver shall use non-volatile memory to store the required information for presets, camera ID and sector text.
- 8) Presets shall meet the following requirements:
 - a. A minimum of 64 presets shall be supported. Each preset shall consist of pan, tilt, zoom and focus positions.
 - b. The Contractor shall develop and install ten (10) presets for each camera. The Contractor shall submit the preset locations to the MDOT ITS Engineer for review and approval.
- 9) Protocols: CCTV cameras shall support at a minimum the Pelco D and the NTCIP 1205 v1.08 communication protocol. No camera control receiver-driver shall use non-published protocols. The Contractor shall provide protocol documentation.
- 10) Communications Interface: The communications interface shall support communications compliant with RS- 232, and/or 485 (user selectable), or shall provide a network interface port.
- 11) Serial communications interface shall be compatible with the Video Encoder serial port as defined in Section 907-662 .
- 12) Standard interface connectors shall be provided.
- 13) The local video input and output connections shall be the BNC type for analog cameras. IP Based Cameras should stream video over the Ethernet connection but include a BNC type connection for local testing, configuration, and calibration.
- 14) Connector(s) shall also be used for connecting the control outputs from the control receiver-driver unit to the camera, lens and pan/tilt mechanisms.

907-650.02.9--Fixed Camera Lens. The fixed camera lens shall meet the following minimum requirements.

- 1) Type Varifocal
- 2) Format Size 1/3 Inch
- 3) Mount Type CS
- 4) Focal Length 5-50
- 5) Zoom Ratio 1.4 -360
- 6) Relative Aperture (F) 1.6-360
- 7) Iris Auto (Direct Drive)
- 8) Focus Manual
- 9) Zoom Manual
- 10) Minimum Object Distance 0.5 m
- 11) Back Focal Length 10.05 mm
- 12) The camera lens shall have a minimum F-Stop of 1.4 to 1.6.
- 13) Shall provide a varifocal zoom of 5-50 mm.
- 14) Iris: Support automatic iris control with manual override capability. The iris shall be in a closed position when there is no power.
- 15) White or Color Balance: Support automatic or set to yield optical results under various outdoor lighting conditions.
- 16) Shutter Speed: Support automatic or set to yield optimal results under low lighting conditions without blooming or smearing, auto-iris on. Provide electronic shutter that is selectable in steps.
- 17) Vibration or ambient temperature change shall not affect the automatic iris function, focus mechanism or zoom mechanism.
- 18) The lens shall be optically clear, impact resistant and acrylic. The acrylic lens shall not yellow and shall not introduce appreciable light loss or geometric distortion over a 10-year service life when exposed to the environment.

907-650.02.10--Fixed Camera Enclosure. The fixed camera lens shall meet the following minimum requirements.

- 1) Designed for Outdoor Applications
- 2) Maintenance access for servicing
- 3) Environmental resistant and tamper proof meeting NEMA 4X or IP-66 rating requirements.
- 4) A harness and cables shall be provided with each enclosure to extend the video, power and data from the CCTV Camera System to the field cabinet. No harness shall be exposed. All entry points shall have gaskets to prevent moisture
- 5) The enclosure shall minimize glare and provide overexposure protection for the camera when pointed directly at the sun.
- 6) The enclosure shall be equipped with a heater, a defroster and a thermostat.
- 7) The camera equipment inside the enclosure shall meet all its specified requirements when operating under the following conditions:

- a. Ambient Temperatures: -10°C to +50°C (14°F to +122°F). A heater/blower shall be used to maintain internal temperatures within the manufacturer required operating temperatures for their equipment.
- b. Relative Humidity: 5% and 95%, non-condensing.
- 8) Total weight of CCTV cameras (including the housing, sunshield, and all internal components shall be less than 18 pounds.
- 9) The enclosure shall be secured with a mounting plate/attachment designed to withstand a 90mph sustained wind speed with a 30% gust factor. For projects that are in areas with higher wind standards, the higher standard is required.

907-650.02.11--Electrical. The minimum electrical requirements include:

- 1) The CCTV Camera System shall be furnished with any and all equipment required for a fully functional system, including all appropriate power and communications cables as defined by the manufacturer.
- 2) The power cables shall be sized to meet the applicable National Electrical Code (NEC) requirements.
- 3) Total power consumption shall not exceed 125 watts.
- 4) All devices supplied as system components shall accept, as a primary power source, 120 volts of alternating current (VAC) at an input of 60 hertz. Any device that requires source input other than 120 VAC at 60 hertz, such as cameras, PTUs, receiver/drives and dome heaters/blowers that operate at 24 volts or other, shall be furnished with the appropriate means of conversion.
- 5) IP fixed cameras shall receive Power over Ethernet (POE) with appropriate cabling.

907-650.02.12--Coaxial Cabling. The minimum coaxial interconnect cable requirements include:

- 1) The coaxial cable from the CCTV Camera System to the equipment cabinet shall be Belden 8281 or approved equivalent.
- 2) RG 59/U, 20AWG, bare copper conductor, polyethylene insulation.
- 3) 98% tinned copper, double braid shield, black polyethylene jacket.
- 4) Characteristic Impedance: 75 ohms (Ω), nominal.
- 5) Capacitance (conductor to shield): 21pF/ft; Inductance: 0.131uH/ft, nominal.

907-650.02.13--Surge Protection. All CCTV Camera System electrical interconnects shall be protected from voltage surges caused by lightning and external electromagnetic fields. The minimum surge protection requirements include:

- 1) Surge protectors shall be furnished for all non-dielectric cable and conductors (video, data/signal and device/assembly power) between the CCTV Camera System and the equipment cabinet.
- 2) The surge protectors shall have leads that are kept to a minimum length as recommended by the surge device manufacturer.
- 3) All surge protection devices shall be designed to meet the temperature and humidity requirements expected in this type of outdoor application.

- 4) All Surge protectors shall be U.L. listed (UL 1449, UL 497, 497A, 497B, etc., as appropriate) and bonded to the same single-point ground point.
- 5) Coaxial Cable Surge protectors for coaxial cable shall meet/provide the following functionality:
 - a. Attenuation: 0.1dB @10 MHz, typical
 - b. Input/Output Impedance: 75 ohms nominal
 - c. Operating Voltage of the surge protector shall match characteristics of the ITS device/assembly
 - d. Peak Surge Current: 5,000-amperes for an 8x20 microsecond waveform
 - e. Response Time: 1 nanosecond or less
- 6) Low Voltage/Signal Cable Surge protectors for data/signal/control cable shall meet/provide the following functionality:
 - a. Peak Surge Current: 10,000-amperes for an 8x20 microsecond waveform
 - b. Response Time: 1 nanosecond or less
 - c. Life Expectancy: Capable of surviving at a minimum of 25 occurrences at 2000-amperes
- 7) CCTV power surge protectors for power from equipment cabinet power distribution to the CCTV Camera System shall meet/provide the following functionality:
 - a. Frequency: DC to 10MHz
 - b. Clamping Voltage: < 30VAC (rms) or 42VDC
 - c. Insertion Loss: < 0.2dB
 - d. Input/Output Impedance: 75 ohms, typical
 - e. Peak Surge Current: 3000-amperes
 - f. Response Time: 1 nanosecond or less
- 8) Surge protection for the IP Fixed cameras shall include provisioning for the Power over ETHERNET (POE) cabling and voltages.

907-650.03--Installation Requirements. All equipment shall be installed according to the manufacturer's recommendations, the Plans and as follows:

- 1) The Contractor shall provide the MDOT with a written inventory of items received and the condition in which they were received. Inventory shall be inclusive of make, model, and serial numbers, MAC address, and installation GPS coordinates. All equipment shall be installed according to the manufacturer's recommendations or as directed by the MDOT.
- 2) Materials and associated accessories/adapters shall not be applied contrary to the manufacturer's recommendations and standard practices.
- 3) Shall include all materials needed to permanently mount the CCTV camera to the support structure as indicated in the plans.
- 4) Furnish and install power, video, and data cables, and any and all ancillary equipment required to provide a complete and fully operational CCTV system site.
- 5) Verify all wiring meets NEC requirements where applicable.
- 6) All above requirements apply to both new CCTV sites as well as sites where an existing CCTV is being replaced.
- 7) Any new, additional or updated drivers required for the existing ATMS software to communicate and control new CCTV installed by the Contractor shall be the responsibility of the Contractor.

907-650-03.1--CCTV Test Requirements. The Contractor shall conduct a Project Testing Program. All costs associated with the Project Testing Program shall be included in overall contract prices; no separate payment will be made for any testing.

- 1) The Contractor is responsible for planning, coordinating, conducting and documenting all aspects of the Project Testing Program. The Project Engineer, ITS Engineer, and/or their designee(s) are only responsible for attending and observing each test, and reviewing and approving the Contractor's test results documentation. The ITS Engineer, Project Engineer and/or their designee(s) reserve the right to attend and observe all tests. The Contractor is required to perform the final project acceptance test with the MDOT ITS Engineer or his designee present.
- 2) Each test shall fully demonstrate that the equipment being tested is clearly and definitely in full compliance with all project requirements. Test procedures shall be submitted and approved for each test as part of the project submittals. Test procedures shall include every action necessary to fully demonstrate that the equipment being tested is clearly and definitely in full compliance with all project requirements. Test procedures shall cross-reference to these Technical Specifications or the Project Plans. Test procedures shall contain documentation regarding the equipment configurations and programming.
- 3) No testing shall be scheduled until approval of all project submittals and approval of the test procedures for the given test.
- 4) The Contractor shall provide all ancillary equipment and materials as required in the approved test procedures.
- 5) The Contractor shall request in writing the Project Engineer's approval for each test occurrence a minimum of 14 days prior to the requested test date. Test requests shall include the test to be performed and the equipment to be tested. The Project Engineer reserves the right to reschedule test request if needed.
- 6) All tests shall be documented in writing by the Contractor in accordance with the test procedure and submitted to the Project Engineer within seven (7) days of the test. Any given test session is considered incomplete until the Project Engineer has approved the documentation for that test session.
- 7) All tests deemed by the Project Engineer to be unsatisfactorily completed shall be repeated by the Contractor. In the written request for each test occurrence that is a repeat of a previous test, the Contractor shall summarize the diagnosis and correction of each aspect of the previous test that was deemed unsatisfactory. The test procedures for a repeated test occurrence shall meet all the requirements of the original test procedures, including review and approval by the Project Engineer and ITS Program Manager or his designee.
- 8) The satisfactory completion of any test shall not relieve the Contractor of responsibility to provide a completely acceptable and operating system that meets all requirements of this project.
- 9) Standalone Acceptance Test (SAT). The Contractor shall perform a complete SAT on all equipment and materials associated with the field device site, including but not limited to electrical service, conduit, pull boxes, communication links (fiber, leased copper, wireless), control cables, poles, etc. An SAT shall be conducted at every field device site. Where applicable, a SAT shall be conducted for a fully installed and completed connection to the designated Traffic Management Center (TMC) or central data/video collection site.

- 10) The SAT shall demonstrate that all equipment and materials are in full compliance with all project requirements and fully functional as installed and in final configuration. The SAT shall also demonstrate full compliance with all operational and performance requirements of the project. All SATs will include a visual inspection of the cabinet and all construction elements at the site to ensure they are compliant with the specifications.

907-662.03.2--Warranty. Minimum warranty requirements are as follows:

- 1) All warranties and guarantees shall be assigned to the Mississippi Department of Transportation.
- 2) The warranty shall be a **minimum of one (1) year warranty** per CCTV and all other installed and/or attached appurtenances.
- 3) The one year warranty period begins upon final acceptance of the video subsystem.
- 4) During the warranty period, the Contractor shall repair or replace with new or refurbished material, at no additional cost to the State, any product containing a warranty defect, provided the product is returned postage-paid by the Department to the manufacturer's factory or authorized warranty site.
- 5) Products repaired or replaced under warranty by the manufacturer shall be returned prepaid by the manufacturer.
- 6) During the warranty period, technical support shall be available from the Contractor via telephone within **four (4) hours** of the time a call is made by the Department, and this support shall be available from factory certified personnel.
- 7) During the warranty period, **updates and corrections to hardware**, software and firmware shall be made available to the Department by the Contractor at no additional cost.

907-662.03.3--MDOT Employee Training. Minimum Training requirements are as follows:

- 1) The Contractor shall provide a camera system training plan that includes a schedule, documentation to be provided, identified trainer, and location at a minimum to MDOT Project Manager. The camera system training plan must be accepted by the MDOT Project Manager and ITS Engineer and training must be completed before burn in period may start.
- 2) The training shall be approved two (2) weeks ahead of the scheduled date.
- 3) For provided devices that MDOT already has the same make and model existing in the system:
 1. One (1) day of on site device operation, maintenance, and configuration training for up to 10 individuals.
 2. One (1) day of on site system training at TMC for up to 10 people, that is separate from above training and specifically for software control of integrated devices.
- 4) For provided devices that MDOT does not have the same make and model existing in the system:
 1. Three (3) days of on site device operation, maintenance, and configuration training for up to 10 individuals.
 2. Three (3) days of on site system training at TMC for up to 10 people, that is separate from above training and specifically for software control of integrated devices.

907-650.04--Method of Measurement. On-Street Video Equipment will be measured per each camera installation.

907-650.05--Basis of Payment. On-Street Video Equipment, measured as prescribed above, will be paid for at the contract unit price bid per each, which price shall be full compensation for furnishing all materials inclusive of camera unit, housing, pan/tilt drive, receiver/driver, software driver, mounting hardware, any necessary enclosures, items necessary to mount the camera unit from a mast arm pole, steel strain pole, pole extension pipe, etc., for all installing, connecting, cutting, pulling and testing and for all equipment, tools, labor, and incidentals necessary to complete the work.

Required cabinet facilities, including transformer and/or disconnects, will not be measured for separate payment.

Progress payments for the On-Street Video System will be paid as follows:

- 1) 50% of the contract unit price upon delivery of equipment and approval of any bench and/or pre-installation test results, as prescribed in Project Testing Program;
- 2) An additional 40% of the contract unit price upon approval of Stand Alone Acceptance Test results; and
- 3) Final 10% of the contract unit price upon Final Project Acceptance.

Payment will be made under:

907-650-A: On-Street Video Equipment Type _____ - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-659-2

CODE: (SP)

DATE: 06/06/2017

SUBJECT: Traffic Management Center (TMC) Modifications

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-659, Traffic Management Center (TMC) Modifications, is hereby added to and becomes part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows:

SECTION 907-659 -- TRAFFIC MANAGEMENT CENTER (TMC) MODIFICATIONS

907-659.01--Description. The MDOT Statewide Traffic Management Center (TMC) is located in the Traffic Engineering Division in the MDOT Shop Complex at 2567 North West Street, Jackson, Mississippi. Regional and City Traffic Management Centers may be located statewide. The following is a list of existing/planned centers and their addresses:

City of Jackson TMC – 300 North State Street, Jackson, Mississippi (basement)

Northwest Regional Combined TMC – 8791 Northwest Drive, Southaven, Mississippi (Police Department)

City of Ridgeland TOC – 304 Hwy 51, Ridgeland, Mississippi (City Hall)

Oxford Combined TMC – 715 Mollybarr Road, Oxford, Mississippi (Oxford Police Department)

Hattiesburg Regional TMC/EOC – 6356 Hwy 49N, Hattiesburg, Mississippi (MDOT District 6 Headquarters)

Batesville Regional TMC/EOC – 150 Hwy 51N, Batesville, Mississippi (MDOT District 2 Headquarters)

Natchez Combined TMC – 233 Devereaux Drive, Natchez, Mississippi (Police Department)

Gulf Regional TMC – 16499 Hwy 49, Saucier, Mississippi (MDOT Lyman Project Office)

Tupelo Regional TMC – 1909 N. Gloster Street, Tupelo, Mississippi (MDOT District 1 Headquarters)

Additional Traffic Management Centers may be added as needed.

907-659.02--Blank.

907-659.03--Construction and Operation Requirements.

907-659.03.1--TMC Modifications. The MDOT TMC modifications required to integrate and operate the traffic systems and devices shall be provided. These include, but are not limited to, expanding the central video management system, interconnecting the appropriate number of video interfaces to the TMC video management systems, expanding the MSTraffic backbone network through radio communications, wireless communications, T1 lines or fiber communications,

expanding or configuring signals in the existing Central Traffic Signal software system, or upgrading existing signal systems, expanding the Automated Traffic Management System (ATMS), and integrating all the existing computing facilities. All TMC modifications must meet U.S. Department of Transportation Intelligent Transportation System (ITS) Standards, Policies, and Architectures as well as MDOTs applicable Statewide or Regional Architecture.

907-659.03.2--TMC Modifications - Monitor Systems. Roadway traffic monitor locations shall provide local control functions related to traffic slowdowns and other congestion monitors as defined by MDOT Traffic Engineering. Additionally, the traffic monitor systems shall provide on-line data for use by the existing MDOT ATMS for engineering, operations, planning, incident, and mdottraffic.com purposes. This data shall include, but is not limited to, per vehicle raw data which shall be transmitted to and stored and managed by the ATMS. The traffic monitor systems shall be capable of utilizing both or either loop, microloop, radar, Bluetooth, DSRC, and/or video detection information. The system shall provide a consistent communication and management system regardless of detection methods used. All Traffic Monitoring Systems must meet U.S. Department of Transportation Intelligent Transportation System (ITS) Standards, Policies, and Architectures as well as MDOT's applicable Statewide or Regional Architecture.

907-659.03.3--TMC Modifications – Installation Requirements. All equipment shall be installed according to the manufacturer's recommendations, the Plans and as follows:

- 1) Any new, additional or updated drivers required for the existing ATMS software to communicate and control new devices installed by Contractor shall be the responsibility of the Contractor.
- 2) Installation of all equipment and software shall be included. The Contractor must provide the MDOT ITS Manager with an Installation Schedule. The Installation Schedule must be approved by the State Traffic Engineer.
- 3) All equipment and software must be fully functional and pass a Final Inspection by the ITS Manager and Project Engineer before being accepted by MDOT.

907-659.03.4—MDOT Employee Training. Training shall be provided covering the system architecture, operations, and maintenance of the TMC systems. If training requirements include travel on the part of training participants then the cost of the travel shall be included.

907-659.04--Method of Measurement. Traffic Management Center Modifications, Traffic Management Center Modifications – Monitor Systems, and Traffic Management Center Modifications – Training, complete in place, tested and accepted, will be measured on a lump sum basis.

907-659.05--Basis of Payment. Traffic Management Center Modifications, Traffic Management Center Modifications – Monitor Systems, and Traffic Management Center Modifications - Training, measured as prescribed above, will be paid for at the contract lump sum price, which price shall be full compensation for furnishing all materials for all installing, connecting, cutting, pulling and testing and for all equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under:

907-659-A: Traffic Management Center Modifications - per each or lump sum

907-659-B: Traffic Management Center Modifications – Monitor Systems - per each or lump sum

907-659-C: Traffic Management Center Modifications – Training - lump sum

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-661-2

CODE: (SP)

DATE: 06/05/2017

SUBJECT: Fiber Optic Cable (OSP)

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-661, Fiber Optic Cable, is hereby added to and becomes part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-661 -- FIBER OPTIC CABLE (OSP)

907-661.01--Description. The work shall consist of the construction of the infrastructure required to install, replace, or upgrade fiber optic cable. The infrastructure shall include all necessary conduits, pull boxes, pole line hardware, building entries, risers and fiber cable to make a complete system.

907-661.02--Materials.

907-661.02.1--Single Mode Fiber Optic Cable (FO Cable). The Contractor shall provide 72-count fiber optic cable that meets the following requirements:

- All-dielectric, outside plant, loose tube cable with central strength/anti-buckling member
- Dry water blocking materials and construction
- Reverse oscillating “SZ” stranded buffer tube construction
- High tensile strength yarn
- Medium density polyethylene outer jacket
- 72-fiber cable with six (6) active buffer tubes and 12 individual stranded fibers per buffer tube
- Cable construction design that allows no more than six (6) buffer tube positions
- Maximum diameter 0.48 inches
- Maximum weight 0.07 pounds per foot.

The Contractor shall provide a Corning ALTOS All-Dielectric, Pirelli FlexLink, OFS MiDia, or approved equivalent cable. This cable shall be designated as a trunk cable.

The Contractor shall ensure that the cable can withstand a maximum pulling tension of 600 pounds (lbf) during installation and 180 pounds (lbf) installed long term (at rest).

The cable shall have a shipping, storage and operating temperature range of -30°C to +70°C and installation temperature range of -30°C to +60°C.

The Contractor shall provide cable with outer jacket marking using the following template.

Manufacturer's Name - "Optical Cable" - Month/Year of Manufacture - Telephone Handset Symbol - "MDOT" - "72F SM"

The Contractor shall include in the outer jacket marking the cable sequential length in accordance with the following:

- In English units every two (2) feet
- Within -0/+1% of the actual length of the cable
- In contrasting color to the cable jacket
- Marking font height no less than 0.10 inch
- On any single length of cable on a reel, the sequential length markings do not run through "00000"

907-661.02.2--Single Mode Fiber Optic Cable Indoor/Outdoor Riser Rated. The Contractor shall provide fiber optic plenum rated cable that meets the following requirements when called for on the Plans:

- All-dielectric, inside plant, loose tube central core cable
- High tensile strength yarn surrounding the central tube core
- Dry water blocking materials and construction
- 72-fiber cable with six (6) active buffer tubes and 12 individual stranded fibers per buffer tube
- Corning Freedom LST All-Dielectric, Pirelli CentraLink, or approved equivalent cables shall be provided. This cable shall be designated as the building entry cable.

The Contractor shall ensure that the cable can withstand a maximum pulling tension of 300 pounds (lbf) during installation.

The cable shall have a shipping, storage and operating temperature range of -30°C to +70°C and an installation temperature range of -10°C to +60°C shall be provided.

The Contractor shall provide cable with outer jacket marking using the following template.

Manufacturer's Name - "Optical Cable" - Month/Year of Manufacture - Telephone Handset Symbol - "MDOT" - "72F SM"

The Contractor shall include in the outer jacket marking the cable sequential length in accordance with the following:

- English units every two (2) feet.
- Within -0/+1% of the actual length of the cable
- Contrasting color to the cable jacket
- Marking font height no less than 0.10 inch
- The sequential length markings do not run through "00000" on any single length of cable on a reel

907-661.02.3--Single Mode Fiber Optic Drop Cable (FO Drop Cable). The Contractor shall

provide 12-count Single Mode Fiber, Pre-Terminated Drop Cable Assemblies. These assemblies shall be employed when connecting a camera, traffic controller, DMS or other device to the main cable.

Assemblies shall be factory assembled and terminated on one end with ceramic ferrule, LC compatible, heat cured epoxy connectors with an operational temperature of -40°C to $+70^{\circ}\text{C}$. Each connector shall have a minimum of a 1-inch strain relief boot.

Insertion loss for each connector shall not exceed 0.30 dB.

Return loss for single mode connectors shall be greater than 45 dB.

Each assembly shall be fully tested and those test results placed on a test tag for each assembly.

Each assembly shall be individually packaged within a box or reel, with the submitted manufacturer's part number marked on the outside of the package.

Individual 250- μm coated fibers shall be up-jacketed to 1/8-inch using fan-out tubing. This tubing shall contain a 900- μm Teflon inner tube, aramid yarn strength members and an outer jacket.

The fan-out tubing shall be secured to the cable in a hard epoxy plug transition. Length of the individual legs shall be a minimum of three feet with the length difference between the shortest and longest legs of the assembly being no more than two inches.

The 12-Fiber, Pre-terminated Drop Cable Assemblies provided shall meet the following minimum requirements:

- All-dielectric, outside plant, loose tube central core cable shall be used
- High tensile strength yarn surrounding the central tube core
- Dry water blocking materials and construction
- Twelve (12) individual stranded fibers contained within the central tube core
- Corning Freedom LST All-Dielectric, Pirelli Centralink, or approved equivalent cables shall be used. This cable shall be designated as the drop cable

The Contractor shall ensure that the cable can withstand a maximum pulling tension of 300 pounds (lbf) during installation.

The cable shall have a shipping, storage and operating temperature range of -30°C to $+70^{\circ}\text{C}$ and an installation temperature range of -10°C to $+60^{\circ}\text{C}$.

The Contractor shall provide cable with outer jacket marking using the following template.

Manufacturer's Name - "Optical Cable" - Month/Year of Manufacture - Telephone Handset
Symbol - "MDOT" - "12F SM"

The Contractor shall include in the outer jacket marking the cable sequential length in

accordance with the following:

- English units every two (2) feet
- Within -0/+1% of the actual length of the cable
- Contrasting color to the cable jacket
- Marking font height no less than 0.10 inch
- The sequential length markings do not run through "00000" on any single length of cable on a reel

907-661.02.4--Multimode Fiber Optic Drop Cable (MM FO Drop Cable). The Contractor shall provide 12-count Multimode Fiber, Pre-Terminated Drop Cable Assemblies. These assemblies shall be employed when connecting a camera, traffic controller, DMS or other device to the main cable.

Cable Assembly shall be rated for outdoor environment and have operational temperature of -40°C to +70°C. Each connector shall have a minimum of a 1-inch strain relief boot. The Cable Assembly shall also be pre-terminated on one end.

Insertion loss for each connector shall not exceed 0.30 dB.

Fiber loss shall not exceed 3dB/km for 850 nm and 1 dB/km for 1300 nm.

Each assembly shall be fully tested and those test results placed on a test tag for each assembly.

Each assembly shall be individually packaged within a box or reel, with the submitted manufacturer's part number marked on the outside of the package.

The fan-out tubing shall be secured to the cable in a hard epoxy plug transition. Length of the individual legs shall be a minimum of three feet with the length difference between the shortest and longest legs of the assembly being no more than two inches.

The 12-Fiber, Pre-terminated Drop Cable Assemblies provided shall meet the following minimum requirements:

- All-dielectric, outside plant, loose tube central core cable shall be used
- High tensile strength yarn surrounding the central tube core
- Dry water blocking materials and construction
- Twelve (12) individual stranded fibers contained within the central tube core
- Corning Freedom LST All-Dielectric, Pirelli Centralink, or approved equivalent cables shall be used. This cable shall be designated as the drop cable

The Contractor shall ensure that the cable can withstand a maximum pulling tension of 300 pounds (lbf) during installation.

The cable shall have a shipping, storage and operating temperature range of -30°C to +70°C and an installation temperature range of -10°C to +60°C.

The Contractor shall provide cable with outer jacket marking using the following template.

Manufacturer's Name - "Optical Cable" - Month/Year of Manufacture - Telephone Handset Symbol - "MDOT" - "12F MM"

The Contractor shall include in the outer jacket marking the cable sequential length in accordance with the following:

- English units every two (2) feet
- Within -0/+1% of the actual length of the cable
- Contrasting color to the cable jacket
- Marking font height no less than 0.10 inch
- The sequential length markings do not run through "00000" on any single length of cable on a reel

907-661.02.5--Plenum Rated Nonmetallic Corrugated Raceway. The Contractor shall provide plenum rated nonmetallic corrugated raceway inside buildings when cable is not in rigid conduit when called for on the plans.

The installation shall conform to NEC articles 770 and 800.

Raceway shall meet UL Standards 910 and 2024.

The Contractor shall provide 2-inch diameter raceway unless larger is called for in the plans.

The Contractor shall provide Fiber Optic Fusion Splice (FO Splice Fusion) for splicing of all fibers with a fully automatic portable fusion splicer that provides consistent low loss (max 0.10 dB) splices.

SPLICER shall provide three-axis fiber core alignment using light injection and loss measurement techniques.

The fusing process shall be automatically controlled.

The splicer shall provide splice loss measurements on an integral display, as well as a magnified image of the fiber alignment.

The Contractor shall retain ownership of the fusion splicer.

907-661.02.6--Fiber Optic Connectors. The Contractor shall provide fiber optic connectors for all fiber optic infrastructures including but not limited to fiber optic termination cabinets, fiber optic drop panels, and fiber optic patch cords.

The Contractor shall provide only factory-installed keyed LC compatible connectors for all fiber optic infrastructures.

Field-installed connectors shall not be used.

Adapter couplers shall not be used to change connector types.

Ceramic ferule connectors, factory-installed, with a thermal-set heat-cured epoxy and machine polished mating face shall be used.

Connectors shall be installed as per manufacturer application and recommendations, including proper termination to the outer-tubing (900-micron tubing, 3-mm fan out tubing, etc.) required for the application.

Connectors rated for an operating temperature of -40°C to +75 °C shall be used.

Simplex connectors for all male LC connectors shall be used and a latching cover for two male connectors being used in a duplex configuration shall be provided. Female couplers may be duplex but must allow simplex mating connectors.

Dust caps shall be provided for all exposed male connectors and female couplers at all times until permanent connector installation.

907-661.02.7--Fiber Optic Termination Cabinet (FO Termination Cabinet). Fiber optic termination cabinets shall be provided in communications hubs, field junctions, and the MDOT Traffic Management Center (TMC) as shown in the Plans for termination of 48 or 72-fiber outside plant (OSP) cable.

The Contractor shall provide wall/shelf mount 12-fiber distribution cabinet equipped with fiber optic connector modules in a 12-fiber configuration. These will be used in field equipment and communication cabinet locations.

Termination cabinets with cable management features included shall be provided.

The Contractor shall use termination cabinets that are fully compatible with all components of the fiber optic infrastructure as specified, including, but not limited to, fiber optic cable, fiber optic fusion splices and fiber optic connectors.

The Contractor shall provide rack-mount termination cabinets designed to fit standard 19-inch EIA equipment racks.

The Contractor shall provide all mounting hardware and supports to mount the termination cabinets in the locations shown in the Plans.

The Contractor shall provide fiber optic termination cabinets providing 72-fiber connectors and capable of storing 72 fusion splices in splice trays.

The Contractor shall provide termination cabinets that integrate the splice trays and connector modules into one compartment within one cabinet, or houses the splice trays and connector modules in separate compartments integrated into one cabinet.

The maximum dimensions of a complete termination cabinet shall be 7-rack units, 12.25 inches

high by 16 inches deep.

Fiber optic termination cabinets shall be fully enclosed metallic construction with a protective hinged front cover for the connector ports.

The cabinet shall have cable access on all sides of the enclosed area behind the connector port panel.

The Contractor shall provide sufficient splice trays for storing 72 fusion splices in 12 or 24-splice increments.

The Contractor shall provide termination cabinets with fiber optic connector modules in a 12 fiber configuration of six (6) rows of one (1) duplex connector couplers. Connector modules shall mount vertically in the termination cabinet front panel.

Connector modules shall include clearly legible and permanent labeling of each of the 12 fiber connector couplers, and shall be labeled and identified as shown in the Plans.

The Contractor shall provide factory-assembled 12-fiber termination interconnect cables (pigtail cables) to be fusion spliced to the outside plant or indoor cable and connected to the rear of the connector modules.

Termination interconnect cables shall be all-dielectric, single jacketed cable with high tensile strength yarn surrounding 12 individual 900-micron fibers following EIA/TIA-598B color identification with factory-installed connectors.

The Contractor shall provide all incidental and ancillary materials including but not limited to grommets, cable strain relief and routing hardware, blank connector panels and labeling materials.

The cable shall be new (unused) and of current design and manufacture.

907-661.02.8--OSP Closures for Aerial, Pole Mount, Pedestal and Hand Hold Environments. OSP closures for aerial, pole mount, pedestal and hand hole shall be capable of accepting up to eight cables. The closures shall be capable of storing up to eight 90-inch lengths of expressed buffer tubes and up to 96 splices.

Assembly shall be accomplished without power supplies, torches, drill kits or any special tools. Re-entry shall require no additional materials.

Sealing shall be accomplished by enclosing the splices in a polypropylene case that is clamped together with a stainless steel latch and sealed with an O-ring.

Closure shall be capable of strand mounting with the addition of a strand mounting bracket.

Splice case shall be non-filled, non-encapsulate to prevent water intrusion, and shall allow re-entry without any special tools.

The closure shall be capable of preventing a 10-foot water head from intruding into the splice compartment for a period of seven (7) days.

It is the responsibility of the Contractor to ensure that the water immersion test has been performed by the manufacturer or an independent testing laboratory, and the appropriate documentation has been submitted to the Engineer.

907-661.02.9--OSP Closures for Drop Cable Splice Points. OSP closures for aerial, pole mount, pedestal and hand hold shall be capable of accepting the trunk cable and two drop cables. The closures shall be capable of storing up to eight 90-inch lengths of expressed buffer tubes and up to 48 splices.

Assembly shall be accomplished without power supplies, torches, drill kits or any special tools. Re-entry shall require no additional materials.

Sealing shall be accomplished by enclosing the splices in a polypropylene case that is clamped together with a stainless steel latch and sealed with an O-ring.

Closure shall be capable of strand mounting with the addition of a strand mounting bracket.

Splice case shall be non-filled, non-encapsulate to prevent water intrusion, and shall allow re-entry without any special tools.

The closure shall be capable of preventing a 10-foot water head from intruding into the splice compartment for a period of seven days.

It is the responsibility of the Contractor to ensure that the water immersion test has been performed by the manufacturer or an independent testing laboratory, and the appropriate documentation has been submitted to the Engineer.

907-661.02.10--Patch Cords and Jumper Cables. Any patch cords or jumper cables required to connect the new fiber and equipment at existing locations shall be considered incidental and shall be included in the cost of pay items 907-661-A and 907-661-B.

Any patch cords used for system configuration shall be compatible with fiber types and connectors specified herein.

Single-mode patch cords shall be yellow in color.

Jacketing material shall conform to the appropriate NEC requirement for the environment in which installed.

All cordage shall incorporate a 900- μ m buffered fiber, aramid yarn strength members and an outer jacket.

Patch cords may be simplex or duplex, depending on the application.

Attenuation shall be less than 1.0 dB/km @ 1310 nm, 0.75 dB/km @ 1550 and have a total

attenuation of less than .5 dB.

The Contractor shall be responsible to determine and provide attenuators with the proper attenuation to not exceed the optical budgets of the equipment connected by patch cables.

907-661.02.11 Cable Labels. The Contractor shall provide cable labels that meet the following requirements:

- Self-coiling wrap-around type
- PVC or equivalent plastic material with UV and fungus inhibitors
- Base materials and graphics/printing inks/materials designed for underground outside plant use including solvent resistance, abrasion resistance and water absorption
- Minimum size of 2.5 inches wide by 2.5 inches long
- Minimum thickness of 0.010 inches
- Orange label body with pre-printed text in bold black block-style font with minimum text height of 0.375 inches
- The Contractor shall pre-print the following text legibly on labels used for all fiber optic trunk cables:

Caution Fiber Optic Cable Mississippi Department of Transportation (601) 359-1454

- The Contractor shall pre-print the following text legibly on labels used on all fiber optic drop cables (FO Drop Cable):

Caution Fiber Optic Drop Cable Mississippi Department of Transportation (601) 359-1454

- On all cable labels, the Contractor shall print the text specified above twice on the label with the text of the second image inverted. The end result shall be text which “reads correctly” when the label is coiled onto a cable.

907-661.02.12--Cable Markers. The Contractor shall provide low profile soil cable markers which meet the following requirements:

- 3.5 inches in diameter
- UV stabilized for Maximum fade resistance
- Durable and abrasion resistant
- Lawn mower resistant
- Orange in color
- Printed Legend:

Fiber Optic Cable
Mississippi Department of Transportation
Traffic Engineering Division (601)359-1454

The Contractor shall install cable markers with a 13-inch nylon stake every 500 feet along the

fiber run.

907-661.02.13--Conduit Detection Wire. Conduit detection wire shall be #10 AWG stranded copper, orange-insulated, THHN -THWN conductor.

The Contractor shall furnish and install a detection wire surge protection system. The Contractor shall ensure that detection wires are attached to a surge protection system designed to dissipate high transient voltages or other electrical surges.

The Contractor shall ensure that the detection wire surge protection system is grounded to a driven rod within 10 feet of the system using AWG #6 single conductor wire. Grounding must be done through a stand alone system not connected to power or ITS device grounding.

The Contractor shall ensure that the surge protection system normally allows signals generated by locate system to pass through the protection system without going to ground.

907-661.02.14--Project Submittal Program Requirements. The Contractor shall provide project submittals for all fiber optic infrastructures. The project submittals for fiber optic infrastructure shall include all items in this provision and any additional requirements included in any Notice to Bidders.

The Contractor shall provide project submittals including manufacturer recommended operations, maintenance and calibration procedures for the following equipment:

- Fiber optic installation and testing tools
- Fusion splicers
- Cable pulling strain dynamometers and breakaway links
- Cable air jetting/blowing systems
- OTDRs
- Optical attenuation testers (light sources and power meters)

The Contractor shall submit documentation and proof of manufacturer recommended operator training and certification for the following equipment:

- Fusion splicers
- Cable air jetting/blowing systems
- OTDRs
- Optical attenuation testers (light sources and power meters)

907-661.03--Construction Requirements. All equipment shall be installed according to the manufacturer's recommendations, the Plans and as follows.

907-661.03.1--General Requirements.

- a) The Contractor shall install all fiber optic infrastructures according to the manufacturer's recommended procedures and specifications.
- b) The Contractor shall provide all necessary interconnections, services and adjustments

required for a complete and operable data transmission system.

- c) The Contractor shall install all fiber truck, drop, and patch cables such that attenuation shall be less than 1.0 dB/km @ 1310 nm, 0.75 dB/km @ 1550.
- d) All pole attachments, service loops and conduit risers shall be placed to minimize the possibility of damage as well as to facilitate future expansion or modernization.
- e) The cable shall be installed in continuous runs as indicated on the plans. Splices shall be allowed only at drop points or reel end points specified in the plans.
- f) At drop locations only, those fibers necessary to complete the communication path shall be spliced. Other fibers in the cable(s) shall be left undisturbed, with a minimum of five feet of buffer tube coiled inside the closure.
- g) Sufficient slack shall be left at each drop point to enable access of the cable components and splicing to occur on the ground. This is typically two times the pole height plus 15 feet.
- h) For aerial (not including aerial fiber in conduit attached to bridges) installations, the following minimum slack requirements shall apply:
 - For aerial slack storage at splice points, a radius controlling device, commonly referred to as a SNO-SHOE, shall be used for securing resulting cable slack at aerial splice points and shall be mounted directly to the strand.
 - For aerial cable runs exceeding 6-pole spans between splice points as indicated on the plans, two opposing SNO-SHOES shall be placed on the span 50 feet apart to provide for a 100-foot service loop for future drops and for slack for repair and pole relocations.
- i) Drop cable shall be routed to the controller cabinets via conduit risers as illustrated in the plans. The cable entrance shall be sealed with a duct plug designed for fiber optic cable to prevent water ingress.
- j) The minimum requirement for fiber protection outside a fiber optic enclosure in ALL cases shall be 1/8-inch fan-out tubing, containing a hollow 900- μ m tube, aramid strength members and an outer jacket, and shall be secured to the cable sheath.
- k) The minimum requirement for fiber protection inside wall mount or rack mount fiber enclosure shall be 900- μ m buffering, intrinsic to the cable in the case of tight buffered fibers, or in the case of 250- μ m coated fibers, a fan-out body and 900- μ m tubing secured to the buffer tube(s).
- l) During installation, even if the tension specifications for the cable are not exceeded, the first ten feet shall be discarded.
- m) Warning tape shall be placed 12 inches above the cable not to deviate \pm 18 inches from the centerline of the optical cable. Warning tape shall be at least two inches wide and colored orange.

907-661.03.2--Cable Shipping and Delivery. The cable shall be packaged on reels for shipment. Each package shall contain only one continuous length of cable. The packaging shall be constructed as to prevent damage to the cable during shipping and handling.

Both ends of the cable shall be sealed to prevent the ingress of moisture.

A weatherproof reel tag shall be attached to each reel identifying the reel and cable so that it can be used by the manufacturer to trace the manufacturing history of the cable and the fiber. A cable data sheet shall be included with each reel containing the following information:

- Manufacturer name

- Cable part number
- Factory order number
- Cable length.
- Factory measured attenuation of each fiber

The Contractor shall cover the cable with a protective and thermal wrap.

The outer end of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose in transit. The inner end of the cable shall be projected a minimum of 6.5 feet into a slot in the side of the reel, or into housing on the inner slot of the drum, in such a manner as to make it available for testing.

Each reel shall be plainly marked to indicate the direction in which it is to be rolled to prevent loosening of the cable on the reel.

907-661.03.3--Cable Handling and Installation. The Contractor shall not exceed the maximum recommended pulling tension during installation as specified by the cable manufacturer.

The Contractor shall continuously monitor pulling tensions with calibrated measuring devices, such as a strain dynamometer.

The Contractor shall ensure that the minimum depth of the cable is a minimum of 36 inches unless shown otherwise in plans.

All pulled installations shall be protected with calibrated breakaway links.

The Contractor shall ensure that the minimum recommended bend radius is not exceeded during installation as specified by the cable manufacturer. Unless the manufacturer's recommendations are more stringent, the following guidelines shall be used for minimum bend radius:

- 20 X Cable Diameter Short Term - During Installation
- 10 X Cable Diameter Long Term - Installed

Before cable installation, the cable reels and reel stands shall be carefully inspected for imperfections or faults such as nails that might cause damage to the cable as it is unreeled.

All necessary precautions shall be taken to protect reeled cable from vandals or other sources of possible damage while unattended. Any damage to reeled cable or the reel itself shall necessitate replacement of the entire cable section at no additional cost to the State.

Whenever unreeled cable is placed on the pavement or surface above a pull box, the Contractor shall provide means of preventing vehicular or pedestrian traffic through the area in accordance with the safe maintenance of traffic provisions.

The cable shall be kept continuous throughout the pull. Cable breaks and reel end splices are permitted only in Type 5 pull boxes and occur at a minimum of 10,000 feet.

Where a cable ends in an underground fiber optic closure, all unused fibers and buffer tubes shall be secured and stored in splice trays in preparation for future reel end splicing and continuation.

907-661.03.4--Cable Storage. The Contractor shall properly store all cable to minimize susceptibility to damage. The proper bend radius shall be maintained, both short and long term, during cable storage.

Storage coils shall be neat in even length coils, with no cross over or tangling.

Storage coils of different cables shall be kept completely separate except when the cables terminate in the same splice closure.

Storage coils shall be secured to cable racking hardware with tie wraps, Velcro straps, or non-metallic cable straps with locking/buckling mechanism. No adhesive or self-adhering tapes, metal wires and straps, or rope/cord shall be used to secure coils.

Unless otherwise noted on the plans, the following are the requirements for cable storage for underground applications:

- Trunk cable in Type 4 pull box 25 feet
- Trunk cable in Type 5 pull box 200 feet
- Trunk cable in Surface Mounted pull box 5feet
- Drop cable in Type 4 pull box 10 feet
- Drop cable in Type 5 pull box, not terminated in a splice closure 10 feet
- Drop cable in Surface Mounted pull box, not terminated in a splice closure5 feet
- Drop cable in Type 5 pull box, terminated in a splice closure with the trunk cable 100 feet
- Drop cable in Surface Mounted pull box, terminated in a splice closure with the trunk cable 5 feet
- Trunk cable end in Type 5 pull box 200 feet
- Drop cable terminated in same splice closure as trunk cable end 200 feet
- Trunk cable end in Surface Mounted pull box 10 feet

The Contractor shall label each pull box with a numbered disk obtained from the Traffic Engineering Division. The disk shall be installed in accordance with the manufactures specification on the lid of each pull box. Numbers shall be noted on the As-Built plans for each pull box.

No slack cable shall be stored inside the communications hub building or Control Center.

907-661.03.5--Cable Labels. Cable labels shall be installed on all trunk and drop fiber optic cables. The installed cable shall be cleaned of all dirt and grease before applying any label.

The Contractor shall label all cables in or at every location where the cable is exposed outside of a conduit, innerduct or pole using the cable IDs for trunk cables or the device number for drop cables.

As a minimum, cable labels shall be installed in the following locations:

- Within 12 inches of every cable entry to a pull box, equipment cabinet, communications hub, or the TMC
- Within 12 inches of the exterior entry point of every fiber optic splice closure, termination cabinet and drop panel
- Every 30 feet for the entire length of cable in any storage coil in pull boxes
- Within one (1) foot of every pole attachment
- On every riser
- On every splice enclosure

907-661.03.6--Conduit Detection Wire. The Contractor shall install one conduit detection wire in all conduit banks. Conduit detection wire is required in all conduit banks installed by any installation method, including trenching, directional boring or plowing.

Only one conduit detection wire is required per installed conduit bank regardless of the number of conduits installed in that segment. Conduit detection wire shall be installed inside the conduit.

Conduit detection wire is not required for structure mounted conduit, except where underground segments of structure mounted conduit are greater than 20 feet in length.

The conduit detection wire shall be continuous and unspliced between pull boxes and shall enter the pull boxes at the same location as the conduit with which it is installed, entering under the lower edge of the pull box.

Four (4) feet of conduit detection wire shall be coiled and secured in each pull box or vault.

When two or more detection wires are in any pull box, the Contractor shall mechanically splice all detection wire together.

Conduit detection wire is required in drop cable conduits.

A detection wire surge protection system shall be furnished and installed. Detection wires shall be attached to surge protection systems designed to dissipate high transient voltages or other electrical surges. The detection wire surge protection system shall be grounded to a driven rod within 10 feet of the system using AWG #6 single conductor wire. Grounding shall be done through a stand alone system not connected to power or ITS device grounding. The surge protection system shall normally allow signals generated by locate system to pass through the protection system without going to ground.

907-661.03.7--Splicing into Existing Fiber Optic Cable. At some locations, the Contractor may be required to splice new drop cable into existing fiber optic cable at existing pull boxes. The Contractor is responsible to protect all existing fiber during this work. No separate payment shall be made for splicing into the existing fiber. The cost for all fiber optic work and equipment shall be included in the bid price for pay items 907-661-A and 907-661-B.

The Contractor must notify the Project Engineer in writing no less than ten (10) days in advance of doing any work to existing fiber optic cable. Before any work can begin the Contractor must have obtain approval from the Project Engineer.

907-661.03.8--Replace Fiber Optic Cable. In locations specified in the Plans, the Contractor shall be required to remove and replace existing fiber optic cable with new fiber optic cable. The new fiber optic cable shall be an equivalent cable having the same cable type, assembly, connectors, size, construction, buffer tube construction, temperature characteristics, tensile strength, and optical characteristics. The cable type and mode shall be the same unless specified as otherwise in the Plans or Notice to Bidders. The new cable shall be a compatible replacement having equivalent or improved link characteristics. The Contractor is required to install the cable as per manufacturer application and recommendations and adhere to the Installation Requirements and Testing specifications as stated herein. No separate payment will be made for this work. The cost for pulling new fiber optic cable for cable replacment, and splicing/terminating all fibers shall be included in the cost of pay item 907-661-E.

907-661.03.9--Replace Fiber Optic Drop Cable. In locations specified in the Plans, the Contractor shall be required to remove and replace existing fiber optic drop cable with new fiber optic drop cable. The new fiber optic drop cable shall be an equivalent cable having the same cable type, assembly, connectors, size, construction, buffer tube construction, temperature characteristics, tensile strength, and optical characteristics. The cable type and mode shall be the same unless specified as otherwise in the Plans or Notice to Bidders. The new cable shall be a compatible replacement having equivalent or improved link characteristics. The Contractor is required to install the cable as per manufacturer application and recommendations and adhere to the Installation Requirements and Testing specifications as stated herein. No separate payment will be made for this work. The cost for pulling new fiber optic drop cable for cable replacment, and splicing/terminating all fibers shall be included in the cost of pay item 907-661-F.

907-661.03.10--Upgrade Fiber Optic Cable. In locations specified in the Plans, the Contractor shall be required to upgrade existing fiber optic cable to new cable that adheres to the respective cable specification and requirements. The cable type and mode shall be the same unless specified as otherwise in the Plans or Notice to Bidders. The cable upgrade shall be treated as a new cable installation and adhere to all corresponding specifications and requirements stated herein. No separate payment will be made for this work. The cost for pulling new fiber optic to upgrade existing cable, and splicing/terminating all fibers shall be included in the cost of pay item 907-661-G.

907-661.03.11--Fiber Optic Connections at Existing Communication Nodes. In some locations, the Contractor shall be required to pull new fiber optic cable into an existing communications huts. No separate payment will be made for this work. The cost for pulling the fiber into the hut, providing and installing the termination equipment, and terminating all the fibers shall be included in the cost of pay items 907-661-A and 907-661-B.

907-661.03.12--Drop and Insert Applications. The signal from the TMC to local controllers, cameras, and/or dynamic message signs will be conveyed via the backbone and branch cables.

The appropriate closure (Subsection 907-661.02.8) shall be used.

A 12-port fiber distribution cabinet and appropriate jumper shall be installed within the cabinet at locations approved by the Engineer.

At each device, the applicable fibers will be routed in and out of the equipment cabinet using a pre-terminated drop cable.

Only fibers required for the drop and insert shall be cut, no other fibers in the cable shall be cut without the approval of the Engineer.

The fibers shall be connected to the transmission equipment via LC/LC fiber optic patch cables.

The drop cable shall be routed in a position that will allow access to all installed components without movement of the cable.

In traffic signal control boxes the drop cable shall be routed up the left rear corner to a shelf mounted fiber optic termination cabinet.

In ITS equipment or communication cabinets the cable shall be routed neatly allowing for service of all installed components.

907-661.03.13--Testing.

907-661.03.13.1--General Requirements. The project testing program for fiber optic infrastructure shall include but is not limited to the specific requirements in this subsection.

All test results shall confirm physical and performance compliance with this TSP including but not limited to optical fibers and fusion splices. No event in any given fiber may exceed 0.10 dB. Any event measured above 0.10 dB shall be replaced or repaired at the event point.

The Contractor shall provide the tentative date, time and location of fiber optic infrastructure testing no less than seven (7) days in advance of the test. The Contractor shall provide confirmed date, time and location of fiber optic infrastructure testing no less than 48 hours before conducting the test.

The Contractor shall provide test results documentation in electronic format (3 copies) and printed format (3 copies). Electronic formats shall be readable in Microsoft Excel or other approved application. Printed copies shall be bound and organized by cable segment.

- Two sets are for the Traffic Engineering ITS Department
- One set are for the Engineer

All test results shall be provided in English units of measure of length.

All test results documentation shall be submitted to the Engineer within 14 days of completion of the tests.

The ITS Engineer, Project Engineer and/or their designee(s) are only responsible for attending and observing each test, and reviewing and approving the Contractor's test results documentation. The ITS Engineer, Project Engineer and/or their designee(s) reserve the right to attend and observe all tests. The Contractor is required to perform the Pre-Installation test and the Standalone Acceptance test with the MDOT ITS Engineer or his designee present.

907-661.03.13.2--Pre-Installation Test (PIT). The Contractor shall perform a PIT on all FO Cable prior to any cable removal from the shipping reels.

The Contractor shall perform a PIT on each cable reel delivered to the job site.

The PIT for FO Cable shall include but is not limited to:

- A visual inspection of each cable and reel
- An OTDR Test and documentation as required in the Standalone Acceptance Test (SAT) for three randomly selected fibers from each buffer tube

An Optical Attenuation Test is not required. However, if the Contractor decides to perform one of these tests for his or her own protection, it should be documented and provided to the Engineer.

907-661.03.13.3--Standalone Acceptance Test (SAT). The Contractor shall perform an SAT on all fiber optic infrastructures on this project after field installation is complete, including but not limited to all splicing and terminations. All fiber in pull boxes shall be in its final position mounted to the racks prior to the start of testing.

An SAT for each fiber in each cable shall include OTDR Tests and Optical Attenuation Tests.

For the Attenuation Tests, all fibers in all FO Cables and FO Drop Cables shall be tested from termination point to termination point, including:

- Fibers from FO Termination Cabinet to FO Termination Cabinet
- Fibers from FO Termination Cabinet to FO Drop Panel
- Fibers from FO Drop Panel to FO Drop Panel
- Fibers from FO Termination Cabinet to the end of the cable run in the last FO closure

All test results shall confirm compliance with this TSP including but not limited to optical fibers and fusion splices. No event in any given fiber may exceed 0.10 dB. Any event measured above 0.10 dB shall be replaced or repaired at the event point.

Test documentation shall include but is not limited to:

- Cable & fiber identification
- Cable & fiber ID and location - Physical location (device ID and station number of FO Termination Cabinet, FO Drop Panel, or cable end FO closure), fiber number, and truck or drop cable ID for both the beginning and end point
- Operator name

- Engineer's representative
- Date & time
- Setup and test conditions parameters
- Wavelength
- Pulse width Optical Time Domain Reflectometer (OTDR)
- Refractory index (OTDR)
- Range (OTDR)
- Scale (OTDR)
- Ambient temperature
- Test results for OTDR test (each direction and averaged)
- Total fiber trace (miles)
- Splice loss/gain (dB)
- Events > 0.05 dB
- Measured length (cable marking)
- Total length (OTDR measurement)
- Test results for attenuation test (each direction and averaged)
- Measured cable length (cable marking)
- Total length (OTDR measurement from OTDR test)
- Number of splices (determined from as-builts)
- Total link attenuation

The OTDR Test shall be conducted using the standard operating procedure and recommended materials as defined by the manufacturer of the test equipment.

The Contractor shall use a factory patch cord ("launch cable") of a length equal to the "dead zone" of the OTDR to connect the OTDR and the fiber under test.

Bi-directional OTDR tests shall be conducted and bi-directional averages calculated for each fiber.

All tests shall be conducted at 1310 and 1550 nm for single mode cable.

The Contractor shall conduct the Optical Attenuation Test using the standard operating procedure and recommended materials as defined by the manufacturer of the test equipment.

Bi-directional Optical Attenuation tests shall be conducted and bi-directional averages calculated for each fiber.

A continuity or tone test shall be performed after installation to confirm that a continuous run of conduit detection wire was installed between pull boxes or vaults.

The Contractor shall prepare a test plan, supply equipment, conduct the test and document the results.

The test plan shall be submitted at least 15 working days prior to the desired testing date.

Testing shall not begin until the Engineer has approved the test plan, and all tests shall be conducted in the presence of the Engineer. The Traffic Engineering ITS Department representative shall be notified of the testing dates and invited to observe all testing.

The Traffic Engineering ITS Department may perform additional testing of any and all infrastructure using their own equipment. The Contractor may observe this testing.

The burn in period can not start until the Traffic Engineering ITS Department is satisfied with the installation.

907-661.03.14--Documentation - As-Built Plans. The Contractor shall provide GPS locations of all pull boxes, splices, termination equipment cabinets, ITS field locations and all pole locations.

The Contractor shall record the sequential footage markers from the fiber optic trunk and drop cables for each GPS location.

The Contractor shall provide scanned PDF files of all plan sheets with pen and ink markups.

The Contractor shall also provide MDOT with an electronic file containing all of the data and test reports required above in a format that is compatible with Microsoft Excel.

A copy of all documentation shall be provided to the MDOT Traffic Engineering ITS Department and Project Office

The Contractor shall provide a site location inventory of ITS devices to include manufacturer model, serial numbers, and quantity. It shall also include the following:

- Communication Network Equipment
- Video Encoders and Decoders
- Cameras
- Dome Camera housings
- DMS Signs
- Any other serial numbered devices installed

907-661.03.15--MDOT Employee Training. Minimum training requirements are as follows:

- 1) After the installation is complete, the Contractor shall provide formal classroom training and "hands-on" operations training for proper operation and maintenance of the fiber optic plant. The training shall be provided for up to six personnel designated by the Engineer and shall be a minimum of one day in duration. The training shall cover as a minimum preventive maintenance, troubleshooting techniques, fault isolation and OTDR trace analysis. All training materials shall be provided by the Contractor.
- 2) A Training Plan shall be submitted within 90 days of the Notice-to-Proceed. Approval of the Plan shall be obtained from the Engineer and the Traffic Engineering ITS Department. A detailed explanation of the contents of the course and the time schedule of when the training shall be given shall be included in the Training Plan.

- 3) Prior to training, the Contractor shall submit resume and references of the training instructor(s) along with an outline of the training course in a Training Plan. Training instructor(s) shall be manufacturer-certified, experienced in the skill of training others. The training shall be conducted by a trainer with a minimum of four years of experience in training personnel on the operation and maintenance of fiber optic systems.
- 4) The Contractor shall furnish all handouts, manuals and product information for the training. The same models of equipment furnished for the project shall be used in the training. The Contractor shall furnish all media and test equipment needed to present the training. Training shall be conducted in the Jackson area.

907-661.04--Method of Measurement. Fiber optic cable of the type specified will be measured by the linear foot, and shall be obtained by accurate measurement of the runs including horizontally, vertically, aerially along the messenger cable, from the trunk line to the controller cabinet, and with liberal allowances made for slack in boxes, as indicated in the plans.

The cost for all fiber optic work, equipment and testing shall be included in the bid price for fiber optic cable.

All required cabinet facilities shall not be measured for separate payment. All standard or special fiber optic modems, fan out boxes, connectors, terminations cabinets, patch cords, raceways, splicing devices, splicing, detection wire, warning tape, above ground markers, backplane facilities, twisted pair communications cable interface devices, etc., and any other cabinet modifications required for the fiber optic system shall be included in the price bid for other items of work.

907-661.05--Basis of Payment. Fiber optic cable, measured as prescribed above, will be paid for at the contract unit price bid per linear foot, which price shall be full compensation for furnishing all materials, for all installing, connecting, cutting, pulling and testing and for all equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under:

907-661-A: Fiber Optic Cable, *	- per linear foot
907-661-B: Fiber Optic Drop Cable, *	- per linear foot
907-661-E: Replace Fiber Optic Cable	- per linear foot
907-661-F: Replace Fiber Optic Drop Cable	- per linear foot
907-661-G: Upgrade Fiber Optic Cable	- per linear foot

* Indicate the type of cable. Cable may be aerially supported as indicated in the plans.

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-663-2

CODE: (SP)

DATE: 06/21/2017

SUBJECT: Networking Equipment

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-663, Network Switch, is hereby added to and becomes part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-663 -- NETWORKING EQUIPMENT

907-663.01--Description. This section specifies the minimum requirements for providing networking communication equipment, including network switches, terminal servers, fiber optic modems, cell modems, and associated cabling, furnished and installed.

Type A, Type B, Type D, Type E, and Type F switches shall be environmentally hardened and rated for an operating temperature of 70 degrees celcius. These switches support Intelligent Transportation Elements deployed on arterial streets and the highway system. Elements include but are not limited to traffic signals, dynamic message signs, surveillance cameras, and vehicle detection systems. Type C switches will support the Intelligent Transportation System and be installed in the Traffic Management Center and Communications Huts which are environmentally controlled. Type C switches are not required to be hardened.

This Section also specifies the minimum requirements for stand alone and network switch module Terminal Servers, stand alone and network switch module cellular modems, and Category 6 cable. The Terminal Servers shall be hardened. The Terminal Server device, also commonly referred to as a Port Server device, will be used to communicate bi-directionally between IP-based Ethernet network systems and existing field devices that communicate or are controlled via a full-duplex serial interface. Cellular modems shall be used to communicate via cell to remote sites such as portable traffic signal sites, portable CMS, smart work zones or ITS site locations, or sites or devices, that need serial or Ethernet communication that can be provided over cellular service.

The Category 6 cable will be installed in conduit and cabinets between elements that are within 300 feet of each other to eliminate the need for two hardened switches. The work shall consist of providing all labor, materials, equipment, and incidentals necessary to furnish, install, and test the networking equipment.

907-663.02--Materials. Network Switches Type A, Type B, Type C, Type D, Type E, Terminal Servers, Cell Modems, and associated cabling will be placed in the field device cabinets and shall meet the following requirements:

907-663.02.1--Network Switch Requirements. The Type A, Type B, Type C, Type D, and Type E Network switches shall adhere to the following minimum requirements.

- 1) Field switch optical ports shall meet the following:
 - a. The minimum optical budget between transmit and received ports shall be 18dB.
 - b. Shall include LC connector types.
 - c. Optical receiver maximum input power level shall not be exceeded.
 - d. Optical attenuators shall be added as needed; fiber optic attenuator patch cords shall be in accordance with Section 657 of the Standard Specifications. It is the Contractor's responsibility to determine where attenuators are needed and shall be included in the cost of the switch.
 - e. The Contractor shall be required to measure the optical power on each optical port to ensure that power entering the receiver is within the acceptable power budget of the optical port.
 - f. Optical interface equipment shall operate at 1310 nm.
- 2) Operate from 100 VAC to 200 VAC.
- 3) The field switches [this excludes Type C] shall operate between -34° to +74° Celsius, including power supply.
- 4) The field switches [this excludes Type C] shall operate from 10% to 90% non-condensing humidity.
- 5) Meet the IEEE 802.3 (10Mbps Ethernet) standard.
- 6) Meet the IEEE 802.3u (Fast Ethernet 100 Mbps) standard.
- 7) Meet the IEEE 802.3x (Full Duplex with Flow Control) standard.
- 8) Meet the IEEE 802.1p (Priority Queuing) standard.
- 9) Meet the IEEE 802.1Q (VLAN) standard per port for up to four VLAN's.
- 10) Meet the IEEE 802.1w (Rapid Spanning Tree Protocol) standard.
- 11) Meet the IEEE 802.3ad (Port Trunking) standard for a minimum of two groups of four ports.
- 12) The field switches shall meet IEEE 802.3D (Spanning Tree Protocol) standard.
- 13) Capable of mirroring any port to any other port within the switch.
- 14) Password manageable through:
 - a. SNMP
 - b. Telnet/CLI
 - c. HTTP (Embedded Web Server) with Secure Sockets Layer (SSL)
- 15) Full implementation of SNMPv1 and SNMPv2c.
- 16) Full implementation of GVRP (Generic VLAN Registration Protocol).
- 17) Full implementation of IGMP and IGMP snooping.
- 18) Minimum MTBF of 100,000 hrs using Bellcore TS-332 standard.
- 19) Full implementation of RFC 783 (TFTP) to allow remote firmware upgrades.
- 20) UL approved.
- 21) The field switch shall provide status indicators as follows: 1) power on an off, 2) network status per port (transmit, receive, link, speed), and 3) status indicators shall be LED.
- 22) Unused ports (copper and optical) shall be covered with rubber or plastic dust caps/cover.

907-663.02.1.1--Type A Network Switch. Type A network switches shall adhere to the following minimum requirements.

- 1) Minimum of six 10/100/1000 Base-TX ports. Each port shall connect via RJ-45 connector.
- 2) Minimum of two 1000 Base Long Reach optical ports.
- 3) Full implementation of RMON I and RMON II.
- 4) Rack, shelf or DIN Rail mountable. If shelf mounted, the Contractor must furnish and install a shelf if shelf space is not available in the facility. Any shelf used shall be ventilated as per the Network Switch manufacturer recommendation.
- 5) All power transformers provided shall be "fastening mechanism" type. No plug-in types shall be permitted. All corded transformers shall be mountable with the ability to neatly secure power cords.

907-663.02.1.2--Type B Network Switch. Type B network switches shall adhere to the following minimum requirements.

- 1) Minimum of twelve 10/100/1000 Base-TX ports. Each port shall connect via RJ-45 connector.
- 2) Minimum of one 10/100/1000 Base-TX ports. Each port shall connect via RJ-45 connector.
- 3) Full implementation of RMON I and RMON II.
- 4) Minimum of two 1000 Base Long Reach optical ports.
- 5) Rack, shelf or DIN Rail mountable. If shelf mounted, the Contractor must furnish and install a shelf if shelf space is not available in the facility. Any shelf used shall be ventilated as per the Network Switch manufacturer recommendation.
- 6) All power transformers provided shall be "fastening mechanism" type. No plug-in types shall be permitted. All corded transformers shall be mountable with the ability to neatly secure power cords.

907-663.02.1.3--Type C Network Switch. Type C network switches shall be installed in the communication hubs and shall meet the following requirements:

- 1) Each switch shall be populated with modules including the following features and capabilities:
 - i. Layer 2/3 switching and routing services
 - ii. Minimum of 64Gbps/48Mpps module Bandwidth
 - iii. Min of 8-GE uplink ports available per network switch assembly. The Contractor shall provide an uplink SFP optical module compatible with the interface for the uplink as indicated in the Location & Configuration of Communication Nodes notice to bidders for each uplink
 - b. In one (or more)Fiber SFP-based module(s): a minimum of 48 1000Base-X (SFP-based) compatible access ports and a minimum of 8 1000Base-X (SFP-based) uplink ports. The Contractor shall provide whichever is greater between a min number of SFP optic modules to interface to the fiber as indicated in the plans and NTBs, or a min of 14 and shall meet the following minimum requirements:
 - i. Optical budget of 18dB
 - ii. Hot-swappable network modules
 - iii. Same optical wavelength as Type A & B switches
 - iv. Same optical transmitter power as Type A & B switches
 - c. In one (or more) modules: 24 Ethernet 10/100/1000 RJ-45 ports
- 2) Optical receiver maximum input power level shall not be exceeded.

- 3) Optical attenuators shall be added as needed; fiber optic attenuator patch cords shall be in accordance with Section 657 of the Mississippi Standard Specifications for Road and Bridge Construction. It is the Contractor's responsibility to determine where attenuators are needed and shall be included in the cost of the switch.
- 4) 19" rack mountable.
- 5) Operate from 5° to 40° Celsius.
- 6) NEBS Level 3 compliant.
- 7) Operate from 10 to 80 non-condensing humidity
- 8) Designed as a chassis with easy to remove modules.
- 9) Chassis backplane shall be passive.
- 10) All modules shall be hot-swappable.
- 11) Meet the IEEE 802.1d (Virtual Bridge) standard.
- 12) Meet the IEEE 802.1x (authentication) standard.
- 13) Meet the requirements of :
 - a. IEEE 802.3z
 - b. IEEE 802.3ab
 - c. GR-20-CORE: Generic requirements for Optical Fiber and Optical Fiber Cable
 - d. GR-326-CORE: Generic Requirements for Singlemode
- 14) Full implementation of RIP protocol as outlined by RFCs: 1058, 1723, 1812
- 15) Full implementation of OSPF protocol as outlined by RFCs: 2178, 1583, 1587, 1745, 1765, 1850, 2154, 2328, 1850, 1997, 2385, 2439, 2842, 2918, 2370.
- 16) Capable of mirroring any port to any other port within the switch.
- 17) Password manageable through SSH (Secure Shell).
- 18) Full implementation of MLD (Multicast Listener Discovery).
- 19) Full implementation of IGMPv2.
- 20) Full implementation of PIM-SM and PIM-DM.
- 21) Comply with FCC 47 CRF Part 15 Class A emissions.
- 22) Bandwidth flow rate limiting policing support per port.
- 23) Full security implementation of
 - a. Support SSH, 802.1x (rel 2)
 - b. Access Control Lists (ACL's)
 - c. RADIUS authentication
 - d. TACACS+ authentication
- 24) Have redundant power supplies installed.
- 25) The power supply units shall be hot swappable.
- 26) Switch assembly shall have a minimum of 4 module slots.
- 27) Blank covers for all remaining slots.

907-663.02.1.4--Type D Network Switch. Type D network switches shall be of chassis design. The switch shall be able to accept a minimum of four (4) different type modular cards and have Layer 2 switch and Layer 3 routing capabilities. The Type D network switch shall meet the minimum requirements specified below:

- 1) The switch shall be chassis designed with a minimum of four (4) module slots.
- 2) Each switch shall be able to accept the following type modules:
 - a. Ethernet module:
 - i. A minimum number of six (6) 10/100Base-TX compatible RJ45 ports.

- ii. The Contractor shall provide the minimum number of modules necessary to meet or exceed the required number of ports as indicated in the plans and NTBs.
- iii. Total required bandwidth shall per chassis shall not exceed 10 Gbps
- b. Fiber based modules:
 - i. The module shall accept SFP type fiber modules
 - ii. The Contractor shall supply any necessary fiber modules that meet the requirements of speed, type of fiber, and link budget connection.
 - iii. The Contractor shall provide the minimum number of modules necessary to meet or exceed the required number of ports as indicated in the plans and NTB
- c. WAN module:
 - i. T1, DS3 or Metro Ethernet Interface (as per NTB or project plans)
 - 1) The Interface shall be T1, DS3 or Metro Ethernet
 - 2) The ports shall connect via RJ45 connector.
 - ii. Cellular Interface
 - 1) Contractor shall provide information to the Project Engineer to enable activation of the modem.
 - 2) Contractor shall get prior approval from the Projcet Engineer on selection of cellular radio type (HSPA/EVDO)
- d. Terminal Server module:
 - i. Module that meets Terminal Server requirements Subsection 663.02.6.
- e. Power Supply module:
 - i. The power module provided shall be “screw terminal block” type. No pluggable terminal block.
 - ii. Input power: Same as Type A and Type B switches.
 - iii. Power module shall be hot-swappable.
 - iv. The Contractor shall supply the necessary amount of power supplies to meet power requirements for all cards installed and the chassis itself
- 3) Software license shall provided to match functionality of installed modules.
- 4) Shall be DIN or Panel mountable.
- 5) The swich shall provide layer 2 and 3 switching and routing services
- 6) Meet the IEEE 802.1d (Virtual Bridge) standard.
- 7) Meet the IEEE 802.1x (authentication) standard.
- 8) Password manageable through SSHv2 (Secure Shell).
- 9) Full implementation of VRRP.
- 10) Comply with FCC 47 CRF Part 15 Class A emissions.
- 11) Bandwidth flow rate limiting policing support per port.
- 12) Full security implementation of
 - a. Support SSH2, 802.1x (rel 2)
 - b. Access Control Lists (ACL's)
 - c. RADIUS
- 13) Blank covers for all remaining slots.
- 14) Electronic surfaces shall be covered with conformal coating for additional environmental protection.

907-663.02.1.5--Type E Network Switch. Type E network switches will be installed in locations where multiple backbone fibers converge or high concentration of ports are needed for a field location but need a hardened switch and shall meet the following requirements:

- 1) Each switch shall be populated with redundant switch fabric modules that meet the following minimum requirements:
 - a. Layer 2/3 switching and routing services
 - b. 64Gbps/48Mpps module Bandwidth
 - c. Min of 2-GE uplinks available per card with a minimum capability to expand to 8. The Contractor shall provide an uplink SFP optical module compatible with the interface for the uplink as indicated in the Location & Configuration of Communication Nodes notice to bidders for each uplink.
- 2) Optical interfaces shall include 1000 Base-X (SFP-based module(s)) with a minimum of 8 ports. The Contractor shall provide whichever is greater between a min number of SFP optic modules to interface to the fiber as indicated in the plans and NTBs, or a min of six (6) and shall have a minimum Optical budget of 18dB and be the same optical wavelength as Type A & B switches.
 - a. Optical receiver maximum input power level shall not be exceeded.
 - b. Optical attenuators shall be added as needed; fiber optic attenuator patch cords shall be in accordance with Section 657 of the Standard Specifications. It is the Contractor's responsibility to determine where attenuators are needed and shall be included in the cost of the switch.
- 3) Include a minimum 8 Ethernet 10/100/1000 ports
- 4) 19" rack mountable.
- 5) Operate from -30° to +70° Celsius.
- 6) Operate from 10 to 90 non-condensing humidity
- 7) Chassis backplane shall be passive.
- 8) All modules shall be hot-swappable.
- 9) Meet the IEEE 802.1d (Virtual Bridge) standard.
- 10) Meet the IEEE 802.1x (authentication) standard.
- 11) Meet the requirements of :
 - a. IEEE 802.3z
 - b. IEEE 802.3ah
 - c. GR-20-CORE: Generic requirements for Optical Fiber and Optical Fiber Cable
 - d. GR-326-CORE: Generic Requirements for Singlemode
- 12) Full implementation of RIP protocol as outlined by RFCs: 1058, 1723, 1812
- 13) Full implementation of OSPF protocol as outlined by RFCs: 2178, 1583, 1587, 1745, 1765, 1850, 2154, 2328, 1850, 1997, 2385, 2439, 2842, 2918, 2370.
- 14) Capable of mirroring any port to any other port within the switch.
- 15) Password manageable through SSHv2 (Secure Shell).
- 16) Full implementation of GMRP (Generic Multicast Registration Protocol).
- 17) Full implementation of IGMPv2.
- 18) Full implementation of PIM-SM and PIM-DM.
- 19) Full implementation of DVMRPv3.
- 20) Full implementation of VRRP.
- 21) Comply with FCC 47 CRF Part 15 Class A emissions.
- 22) Bandwidth flow rate limiting policing support per port.
- 23) Full security implementation of
 - a. Support SSH2, 802.1x (rel 2)
 - b. Access Control Lists (ACL's)

- c. RADIUS
- d. TACACS
- 24) Have redundant power supplies installed.
- 25) Blank covers for all remaining slots.
- 26) Have options or modules to add a terminal server as specified in Subsection 663.02.2
- 27) Have options or modules to add a cellular interface as specified in Subsection 663.02.3

907-663.02.1.6--Type F Network Switch. Type F network switches will be layer 3 switches installed in field locations with wireless communications or access points and shall meet the following requirements:

- 1) Each switch shall be populated with switch modules that meet the following minimum requirements:
 - a. Layer 2/3 switching and routing services
 - b. 20Gbps Aggregate Bandwidth
 - c. Min of 4-GE uplinks available per switch with a minimum of 2 being fiber ports. The Contractor shall provide an uplink SFP optical module compatible with the interface for the uplink as indicated in the Location & Configuration of Communication Nodes notice to bidders for each uplink.
 - d. SD flash port for swappable Management Card configuration
 - e. Supports High Density Power over Ethernet (PoE) for up to 8 devices
 - f. Supports Cisco Common Industrial Protocol (CIP)
 - g. Support of SCADA (Supervisory Control And Data Acquisition) connectivity.
 - h. Can be supported with IP services.
 - i. 5 year PID warranty
- 2) In addition to the uplink ports, interfaces ports shall include:
 - a. 8 PoE 10/100/1000
 - b. 4 SFP ports
 - i. Optical receiver maximum input power level shall not be exceeded.
 - ii. Optical attenuators shall be added as needed; fiber optic attenuator patch cords shall be in accordance with Section 657 of the Mississippi Standard Specifications for Road and Bridge Construction. It is the Contractor's responsibility to determine where attenuators are needed and shall be included in the cost of the switch.
- 3) Din Rail Mountable.
- 4) Operate from -40° to +70° Celsius.
- 5) Operate from 5 to 95 non-condensing humidity
- 6) Supports IEEE 802.1AE MACsec, Security Group Access Control Lists (SGACL)
- 7) Meet the IEEE 802.1d (Virtual Bridge) standard.
- 8) Meet the IEEE 802.1x (authentication) standard.
- 9) RIPng, OSPFv6, and EIGRPv6 support
- 10) Full implementation of GMRP (Generic Multicast Registration Protocol).
- 11) Full implementation of IGMPv2.
- 12) Full implementation of PIM-SM and PIM-DM.
- 13) Full implementation of DVMRPv3.
- 14) Full implementation of VRRP.
- 15) Supports Redundant DC input voltage
- 16) Power supplies with PoE support and 6-foot minimum power cord(s).

907-663.02.2--Terminal Server. Terminal server shall adhere to the following minimum requirements.

- 1) 10/100 Base-T Ethernet port connection
- 2) RJ-45/DB9 Serial port connection
- 3) RS-232/422/485 selectable serial connections
- 4) Baud rates up to 230 Kbps
- 5) Full Modem and hardware flow control
- 6) TCP/UDP Socket Services
- 7) UDP Multicast
- 8) Telnet and Reverse Telnet
- 9) Modem emulation
- 10) SNMP (Read/Write)
- 11) PPP
- 12) Port buffering
- 13) HTTP
- 14) Remote management
- 15) DHCP/RARP/ARP-Ping for IP address assignment
- 16) LED status for link and power
- 17) The Terminal Server shall support a minimum of Four (4) bi-directional serial communications over Ethernet 10/100 Base-TX.
- 18) Each Terminal Server shall have a minimum of four (4) EIA-232/422/485 serial interface ports. These ports shall be individually and independently configurable, directly or over the network, to EIA-232/422/485 mode of operation as defined by the EIA for data format, data rate and data structure (e.g., the number of bits, parity, stop bits, etc.). Each serial port shall support up to 230 Kbps.
- 19) Each serial port shall support IP addressing and socket number selection.
- 20) The equipment shall provide the capability to establish an IP connection directly from a workstation to any encoder IP address and socket number transport serial data.
- 21) Each Terminal Server shall have an Ethernet Interface (10/100Base-TX protocol, Full/Half-Duplex, Auto Sense (802.3), RJ-45).

907-663.02.3--Cell Modem. Cellular Modem, and associated equipment shall be new and constructed using the highest quality, commercially available components and techniques to assure high reliability and minimum maintenance and meet the following requirements.

907-663.02.3.1--Functional Requirements. Cellular Modem, antenna, wiring assemble, configuration software, and installation necessary shall be provided and furnished for a working cellular wireless communication connection in accordance with plans and specifications and compatible with the requirements of the MDOT system, and the wireless service carrier used by MDOT. Unless otherwise indicated on the plans, all items that are required to complete the installation and ensure an operational system shall be supplied by the Contractor whether listed above or not. Items required but not listed above shall be at no direct pay. All components supplied by the Contractor are the responsibility of the Contractor. It shall be the responsibility of the Contractor to properly configure and deliver a working cellular communications system. It shall be the responsibility of the Contractor to determine the final configuration of all electrical

connections. Cellular account setup shall be coordinated with MDOT Traffic Engineering Division. Warranty and cellular carrier account shall be transferred into MDOT's name upon acceptance of the project.

907-663.02.3.2--Cellular Modem System. The cellular modem shall adhere to the following minimum requirements.

- 1) Model and Type provided shall be pre-approved on a MDOT cellular service carrier.
- 2) Highest available on a MDOT cellular service carrier of 4G, EVO, or higher service.
- 3) Minimum of one 10/100 Base-T RJ45 Ethernet port
- 4) Minimum of one RS-232 serial port
- 5) Minimum of one external antenna connector
- 6) GPS Data available
 - a. Acquisition Time under 2 seconds
 - b. Accuracy: under 5m 90% of time
 - c. Tracking Sensitivity: -161 dBm
- 7) Device Configuration and Management Software via web interface.
- 8) Communications and Protocols supported:
 - a. Network: TCP/IP, UDP/IP, DNS
 - b. NAT and DHCP routing with VLAN, VRRP, and Static Routes configurable
 - c. Includes TELNET, SMTP, SNMP, SMS sessions and services
 - d. Serial: TCP/UDP PAD Mode, Modbus (ASCII,
 - e. GPS: NMEA V3.0, TAIP, RAP
 - f. Provides VPN security with up to five (5) tunnels
- 9) Provides event reporting for GPS/AVL, Network Parameters, Data Usage, Time, Power, and Device Temperature over SMS, SNMP, or Email, SNMP.
- 10) Input Voltage: 10 to 36 VDC
- 11) Operating Temperature of -30° to +70° Celsius

907-663.02.4--Category 6 Cable. Category 6 cable shall adhere to the following minimum requirements.

- 1) 4 Pair #24 AWG UTP Category 6 Cable
- 2) This item is paid for Category 6 cables installed between cabinets and does not apply to other patch cords installed inside cabinets or huts.
- 3) Supplied Category 6 cable shall be suitable for use outdoors in duct and as a minimum meet the following requirements:
- 4) Fully water blocked
- 5) Conforms to the National Electrical Code Article 800
- 6) UL 1581 certified
- 7) Voltage Rating 300 Volts or greater
- 8) Operating and installation temperature (-4°F to 140°F)
- 9) Bend Radius 10 x Cable OD or smaller
- 10) Recommended for 1000Base-T applications for a distance of 100 meters.

907-663.02.4.1--Category 6 Patch Cords. The Cat 6 Patch Cords shall be furnished and installed as needed to connect the Network Switches with other equipment. Cat 6 Patch Cords

shall be considered an incidental component for this project and furnished and installed as needed to provide a functional system. Cat 6 Patch Cords shall meet the following minimum requirements:

- 1) All patch cords shall be from the same manufacturer.
- 2) Shall incorporate four (4) pair 24 AWG stranded PVC Category 6.
- 3) Shall be factory made; Contractor or vendor assembled patch cords are not permitted.
- 4) Shall be TIA/EIA 568-B.2-1 compliant. Patch Cords shall be compliant to T568B pin configuration (which ever is used).
- 5) Certified by the manufacturer for Category 6 performance criteria.
- 6) Length as needed. Excessive slack is not permitted.

907-663.02.5--Project Submittal Program Requirements. The Contractor shall provide project submittals for network switches including scheduling requirements. The project submittals for network switches, terminal servers, cellular modems, and fiber optic modems shall include but are not limited to the specific requirements in this subsection.

- 1) The Contractor shall submit detailed cut sheets which document compliance with all parameters required in this section. If a parameter is not covered in the cut sheet a signed statement from the manufacturer on letterhead shall be submitted as an attachment. Failure to address all requirements will result in rejection of the submittal.
- 2) The Contractor shall submit documentation and proof of manufacturer-recommended training and certification for the installation and configuration of network switches.
- 3) The Contractor shall submit technical specifications for the minimum transmitter port to receiver port optical attenuation required for the switches to function in accordance with this specification for the optical links shown on the plans.

907-663.03--Construction Requirements. All networking equipment shall be installed according to the manufacturer's recommendations, the Plans and as follows:

- 1) Network switches shall only be configured and installed by the switch manufacturer trained personnel.
- 2) Network switches shall be installed in accordance with manufacturer's guidelines and requirements.
- 3) The Contractor shall request from the Department, switch configuration information (such as IP address, VLAN Tag values, etc.) not more than 30 days after the switch submittals have been approved.
- 4) The Contractor shall provide as needed the necessary Cat 6 patch cords and fiber optic patch cords for a complete and functional installation.
- 5) Category 6 cable installed in conduit shall be installed and terminated per the manufacturers recommended procedures. Slack CAT-6 cable shall be provided in pullboxes as indicated in the plans.
- 6) The Contractor shall provide training for proper management of the equipment installed. This training should cover daily operation as well as maintenance and configuration of the switching equipment installed as part of this project and meet the requirements of Subsection 663.03.4 of this document.

- 7) The Contractor shall provide the MDOT with a written inventory of items received and the condition in which they were received. Inventory shall be inclusive of make, model, and serial numbers, MAC address, and installation GPS coordinates. All equipment shall be installed according to the manufacturer's recommendations or as directed by the MDOT.
- 8) Any new, additional or updated drivers required for the existing ATMS software to communicate and control new Networking Equipment installed by the Contractor shall be the responsibility of the Contractor.

907-663.03.1--Switch Configuration Requirements. The Contractor shall configure network switches as follows:

- 1) All 100 Base-TX ports shall be configured as follows:
 - a. RSTP/STP – Off.
 - b. Unused TX ports shall be disabled.
 - c. Operating TX ports shall be programmed to filter only for the MAC address of the connected device.
- 2) All 1000 Base-FX ports shall be configured as follows:
 - a. RSTP/STP – On.
 - b. IGMP Snooping – On.
- 3) The Type D switch configuration shall be as outline in the Project plans and details.
- 4) All network switches shall be installed and configured with the same firmware configuration. The optimum settings shall be used consistently system-wide. Any locations that require different settings for optimum performance shall be approved by the Engineer.
- 5) The Switches shall be configured to enable multicasting and turn on multicast protocols.
- 6) The Contractor may submit an alternate switch configuration to the ITS Engineer for review and approval; The ITS Engineer will review alternate switch configuration documentation. The goal of the switch configuration is to reduce the network delay, as well as provide network redundancy.
- 7) The Contractor shall submit an electronic copy of all final and approved configurations of all switches to the Project engineer and to the ITS Engineer.

907-663.03.2--Testing. The Contractor shall conduct a Project Testing Program as required below. All costs associated with the Project Testing Program shall be included in the overall contract price; no separate payment will be made for any testing.

- 1) All test results shall confirm physical and performance compliance with these Special Provisions.
- 2) Each test shall fully demonstrate that the equipment being tested is clearly and definitely in full compliance with all project requirements.
- 3) Contractor shall submit all test results documentation to the Engineer for review within 14 calendar days of completion of the tests.
- 4) All tests deemed by the Project Engineer to be unsatisfactorily completed shall be repeated by the Contractor. In the written request for each test occurrence that is a repeat of a previous test, the Contractor shall summarize the diagnosis and correction of each aspect of the previous test. The Contractor shall summarize the diagnosis and correction of each aspect of the previous test that was deemed unsatisfactory. The test procedures for a

repeated test occurrence shall meet all the requirements of the original test procedures, including review and approval by the Project Engineer and ITS Manager or designee.

- 5) The satisfactory completion of any test shall not relieve the Contractor of responsibility to provide a completely acceptable and operating system that meets all requirements of this project.

907-663.03.3--Documentation. As-built Plans showing switch configuration and connections shall be provided to the Project Engineer and ITS Engineer in electronic format.

The Contractor shall submit documentation and proof of measured optical power budgets to all optical links of all type switches. All equipment and software must be fully functional and pass a Final Inspection by the ITS Manager and Project Engineer before being accepted by the MDOT

907-663.03.4--Warranty. Minimum warranty requirements shall be as follows.

- 1) All warranties and guarantees shall be assigned to the Mississippi Department of Transportation.
- 2) The warranty shall be a minimum of one (1) year warranty unless otherwise stated.

907-663.03.5--MDOT Employee Training. After the installation is complete, the Contractor shall provide formal classroom training and "hands-on" operations training for proper operation and maintenance of the network switch. The training shall be provided for up to six personnel designated by the ITS Engineer and shall be a minimum of four hours in duration. The training shall cover as a minimum preventive maintenance, troubleshooting techniques, fault isolation and circuit analysis. All training materials shall be provided by the Contractor.

- 1) Prior to training, submit resume and references of instructor(s). Also submit an outline of the training course in a Training Plan. Submit the Training Plan within 90 days of Contract Notice to Proceed. Obtain approval of the Plan from the Engineer and the Traffic Engineering ITS Department. Explain in detail the contents of the course and the time schedule of when the training will be given.
- 2) Furnish all handouts, manuals and product information.
- 3) For the training, use the same models of equipment furnished for the project. Furnish all media and test equipment needed to present the training.
- 4) Training shall be conducted in the Jackson area.
- 5) Training instructor(s) shall be manufacturer-certified, experienced in the skill of training others.
- 6) The training shall be conducted by a trainer with a minimum of four years of experience in training personnel on the operation and maintenance of fiber optic systems.

907-663.04--Method of Measurement. Network Switches of the type specified, Terminal Server, and Cellular modem will be measured per each installation as specified in the Plans.

Category 6 Cable, Installed in Conduit, will be measured by the linear foot, obtained by accurate measurement of the runs including horizontally, vertically, aerially along the messenger cable, from the device to the device cabinet, and with liberal allowances made for slack in boxes, as indicated in the plans.

907-663.05--Basis of Payment. Network Switches, measured as prescribed above, will be paid for at the contract price per each installation, which price shall be inclusive of furnishing, installing, system integration and testing of a Network Switch including all chassis, modules, power cables, power supplies, software, license, fiber optic patch cords, fiber optic attenuator patch cords, Cat 6 patch cords, and all incidental components, attachment hardware, mounting shelf and hardware, testing and training requirements, and all work, equipment and appurtenances as required to provide a fully functional switch ready for use. Type C, Type D, and Type E Network Switch module cards shall be specified per Project plans or NTBs for each site location. It shall also include all system documentation including: shop drawings, operations and maintenance manuals, wiring diagrams, block diagrams, and other material necessary to document the operation of the switch and network.

Terminal Server, measured as prescribed above, will be paid for at the contract price per each, which price shall be inclusive of furnishing, installing, system integration and testing of a Terminal Server including all incidental components, attachment hardware, mounting shelf and hardware, testing and training requirements, and all work, equipment and appurtenances as required to provide a fully functional Terminal Server ready for use.

Cellular modem, measured as prescribed above, will be paid for at the contract unit price per each, which price shall include the modem, antenna, reset timers, cabling, factory and manufacturing inspection, testing, storage, packaging, shipping, warranty, and all work, equipment, and appurtenances as required to effect the full operation and control of the cellular modem complete in place and ready for use.

Category 6 Cable, Installed in Conduit, measured as prescribed above shall be paid for at the contract price per the linear foot, which price shall include all incidentals necessary to complete the work.

Payment will be made under:

- 907-663-A: Network Switch, Type ___ - per each
- 907-663-B: Terminal Server - per each
- 907-663-C Cellular Modem - per each
- 907-663-D: Category 6 Cable, Installed in Conduit - per linear foot

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-664-2

CODE: (SP)

DATE: 06/20/2017

SUBJECT: Communications Node

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-664, Communications Node, is hereby added to and becomes part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-664--COMMUNICATIONS NODE

907-664.01--Description. A Communication Node is a collection of communication and network equipment including LAN and WAN interfaces to the MDOT ITS. It includes an environmental controlled prefabricated Communications Node Hut building used to house the equipment, and the interfaces to ITS devices in the field and to Traffic Management Center systems and computers over fiber, wireless, and leased line communication systems. Work also includes making modifications to existing Communication Nodes in accordance with the plans, special provisions, Notice to Bidders, and contract documents.

907-664.02--Materials.

907-664.02.1--Communications Node. The Communications Node supports communication transmission systems and monitoring equipment based on the latest network technology. It is characterized by network switching equipment and interfaces for localized networks, devices, and interfaces to backbone networks and interfaces. These include but are not limited to the following: fiber, copper ports, wireless, and leased communication interfaces. The Communications node supports almost all standard and/or customized transmission requirements for voice, data, LAN and video.

Communication nodes can be configured with a range of interface cards which allows them to be used for diverse applications. Communication nodes will be installed in Traffic Management Centers (TMC) and climate controlled Communications Node Huts. The Communication Node equipment shall be modular 19-inch rack mountable.

A list of Communication node installation locations and configurations shall be shown in the Notice To Bidders.

907-664.02.2--Communications Node Hut. The equipment building shall be of a modular, prefabricated type construction. The walls, roof, and floor shall be concrete with reinforcing steel, polypropylene fiber reinforced, and 4,000 PSI minimum at 28 days compressive strength.

The minimum design loads shall be:

- Seismic load performance category “C”, Exposure Group III
- Standard Live Roof Load – 60 PSF
- Standard Floor Load – 250 PSF
- Standard Wind Loading – 130 MPH

The roof panel shall slope one inch (1") from center to sides. The roof shall extend a minimum of 1½" beyond the wall panel on each side.

Roof, floor, and wall panels must each be produced as single component monolithic panels. No roof, floor, or vertical wall joints will be allowed except at corners. Wall panels shall set on top of floor panel.

The following shall be included in the building:

- 3'0" x 7'0" x 1¾" galvanized steel door and frame with dead bolt lock, door knob and three (3) keys
- Distribution panel board, 120/240 VAC interior, single phase, three wire, 200 amp main including breakers, (with 40-circuit minimum load panel)
- 2- 4-foot fluorescent ceiling mount fixture with two 40-watt cool white lamps each
- Exterior light with photocell, 120 VAC
- 1½ ton, 17,000 BTU, 5-kw unit, 30 AMP, 120 VAC AC unit
- Minimum of five 120 VAC grounded duplex receptacles and all conduit and wiring with a minimum of one on each wall
- Minimum of four 120 VAC grounded overhead locking receptacles and all conduit and wiring
- ¾ inch thick 4 ft by 8ft plywood board mounted on one wall
- Overhead cable trays as outlined in the project related Communications Node NTB
- Equipment Racks as outlined in the project related Communications Node NTB
- Any equipment or materials necessary to route the cabling in a neat and organized manner (e.g., cable ties).
- WEB based rack mounted remote environmental monitoring system with components as outlined in the project related Communications Node NTB
- H.264 IP based PTZ camera with built in WEB server for browser viewing and control
- Finished walls and ceiling with insulation and vinyl floor tiles
- Halo ground system
- Exposed aggregate finish or comparable finish as directed by Engineer
- 10" x 20" opening in the floor for four 4-inch conduits to provide access to the Communication Node Vault. Contractor shall seal the opening around the conduits after conduits are installed.
- A wall mounted CO2 fire extinguisher rated for electrical fires, to be located inside the hub building adjacent to the hub door opening.
- An uninterruptible power supply, and grounding system detailed in the construction requirements section of this special provision

The building's outer dimensions and any required layout for locations of doors, conduits, racks, cable trays, etc shall be covered in the Notice to Bidders.

907-664.02.3—Communications Node Hut Vault. A communications conduit vault shall be installed at Hut locations where the communications conduit, fiber and required fiber slack coils will be stored. The vault will be formed from two Type 5 pull boxes placed next to each other with one concrete collar around both. The Type 5 pull boxes shall meet the requirements as specified in Section 637 of the Standard Specifications. The communications vault will be located approximately five (5) feet from the rear side of the Hut building and in no case more than 10 feet from the building so that the conduit connecting the vault and the Hut can be minimized.

Conduit carrying fiber to and from field locations may enter the vault on any of the three sides of the vault not adjacent to the Hut. Conduit will connect the vault and provide a path for the fiber from the vault to the Hut. This connecting conduit will conform to MDOT standard Type IV (PVC). Four lines of 4-inch conduit will be provided to connect the vault and the Hut. The conduit leaving the vault shall be aligned horizontally, spaced apart from adjacent conduit sufficiently to allow proper grouting and sealing. The conduits shall be aligned and enter the vault level, straight and perpendicular to the vault wall. Minimum cover over the conduit between the vault and the Hut shall be 36 inches. The conduit shall be placed horizontally until it connects with a 90 degree long sweep as it enters the Hut vertically in the floor near the inside of the rear wall of the Hut. The conduit will be trenched and buried in accordance with the trenching detail provided in the plans.

907-664.03--Construction and Operation Requirements.

907-664.03.1--Blank.

907-664.03.2—Communications Node Hut. The installation of the modular, prefabricated building shall consist of installing the leveling crushed gravel pad, providing 120/240 power to the building and connecting the distribution panel to the power supply, and testing the equipment for proper working/running condition. The building shall be placed no closer than 2' 0" to an existing structure.

The building shall be set on a 4-inch minimum depth, level, crushed gravel base, with that base being at least one foot longer than the length and width of the building. Conduit for the fiber interconnect system is to be in place before the building is set on the gravel base.

As part of site preparation, the area surrounding the communications building shall be leveled and prepared with a layer of Geotextile (Type III Erosion Control) and then a 5-inch thick layer of Mineral Aggregate (size 57), in addition to a 5' x 3' x 5" concrete pad shall be installed in front of the door. The cost of the items shall be included in the lump sum price bid for the Communications Node Hut.

The Contractor shall anchor the site as appropriate and approved by the Project Engineer to withstand wind loading requirements of the site locations.

907-664.03.2.1--Uninterruptible Power Supply.

- Mount the UPS at the bottom of the equipment rack containing the communication node and network switch.
- Connect the communication node and network switch input and any ancillary equipment power supplies to the UPS.
- Connect the UPS network interface to the network switch.

907-664.03.2.2--Grounding System.

- Install all grounding and bonding materials according to the manufacturer's recommended procedures and specifications.
- All metallic materials interior or exterior to the hub building shall be bonded to the grounding system directly.
- All electrical and electronic equipment shall be bonded to the grounding system through the electrical service feed to the equipment, or shall be bonded directly if the electrical service feed is not grounded unless otherwise recommended by the equipment manufacturer.
- Grounding and bonding wire shall be bare solid copper (BSC) unless otherwise specified.
- Grounding strap shall be BSC unless otherwise specified.
- Do not splice any grounding or bonding wire or strap.
- All below ground or exterior connections between wire, ground rod, and metallic structures and posts shall be made only by exothermic welding. All exothermic welding shall be performed in the presence of the Engineer or designee.
- All connections to ground strap shall be made by silver soldering/brazing, except when impractical due to size and/or quantity of straps, where approved mechanical strap connectors shall be used with the Engineer's approval.
- Interior connections for bonding jumpers shall be by mechanical fasteners with silver soldered lugs. Copper conductive paste shall be used with mechanical fasteners.
- Minimum bending radius of any exterior grounding wire or strap shall be 24 inches.
- Minimum bending radius of any interior grounding wire #6 or smaller shall be 8 inches.
- Minimum bending radius of any interior grounding wire #2 or larger or any grounding strap shall be 12 inches.
- All metallic communications facilities entering the hub building shall be isolated from remote facility ground through isolation or neutralizing transformer technology per IEEE Std. 487-2000.

907-664.03.2.2.1--Interior Grounding System.

- The MGB shall be minimum 0.25" x 4" x 12" buss bar fabricated from solid copper alloy and shall include insulated mounting standoffs.
- The MGB down conductor shall be #2 BSC that is exothermically welded to the bottom of the bar.

- Install the MGB with standoffs in the lower center of the hub wall. Connect the MGB down conductor through the PVC ground wire sleeve directly to the chemically-enhanced ground rod in the grounding ring immediately outside of the building.
- Seal around the ground wire in the sleeve entry hole with waterproof outdoor-rated silicone caulk. Do not use expanding foam or caulk products.
- Bond the electrical panel load center and the generator supply transfer switch to the MGB with #2 AWG BSC.
- Bond each individual equipment rack directly to the cable runway with a #2 AWG BSC.
- Inside the hub building, bond the hub door to the door frame six inches (6") from the top of the door frame with a #2 AWG flexible copper wire or braid jumper of sufficient length to not hinder door movement. Bond the door frame directly to the MGB with a #6 AWG BSC.
- Unless otherwise specified, bond all any other metallic materials in the hub interior to the MGB with minimum #10 AWG stranded copper wire. Do not daisy-chain or splice bonding wires.

907-664.03.2.2.2--Exterior Grounding System.

- Ground rods shall be copper-clad 5/8-inch diameter 8-foot long steel electrical ground rods.
- Ground ring shall be formed with 3-inch wide #20 AWG BSC strap.
- Ground rod inspection handholes shall be plastic or polymer round enclosures minimum 12 inches in diameter and 18 inches deep.
- Chemically-enhanced ground rods shall be 10-foot long hollow copper tubes chemically-charged grounding electrode with an access handhole, and shall include ground enhancement backfill material.
- Sacrificial anodes for corrosion protection of the exterior grounding system shall be a minimum of 32 lb. magnesium material.
- Install the hub ring ground rods and ground strap at a depth of 18 inches. Install the ground strap in one continuous length; do not splice.
- Install ground ring inspection handholes at the four ground rods outside the corners of the building. Ensure the top of the ground rod is exposed for inspection.
- Install chemically-enhanced ground rods at the Hub Single Point Ground (HSPG) immediately outside of the hub building below the MGB position.
- Install a ground ring with a minimum of seven ground rods and one chemically-enhanced ground rod at the HSPG.
- Provide ground enhancement material as required to comply with the maximum ground impedance requirements. As a minimum, provide ground enhancement material for the complete length of the hub grounding ring strap.
- Install corrosion protection sacrificial anodes in accordance with the manufacturer's recommendations. Install a minimum of one for each ground ring.

907-664.03.3--Communication Node Installation, Configuration, & Training. Installation of all equipment, racks, cabling, monitoring systems, and software shall be included. The Contractor must provide the MDOT ITS Engineer with an Installation Schedule. The Installation Schedule must be approved by the State Traffic Engineer. All equipment and software must be fully

functional and pass a Final Inspection by the Project Engineer and ITS Engineer before being accepted by MDOT.

Network switches are not paid under this special provision. Network switches shall be provided as covered in the Communications Node NTB and per the plans, under the appropriate pay item number in Special Provision 907-663. Installation, configuration, and cabling of the Communication Node is inclusive of all devices, and network switches that are located in the Communications Node Hut. This work shall include modifications to existing equipment, and network switches to provide system communications to the TMC and Integration to the TMC systems.

The Contractor shall provide the MDOT with a written inventory of items received and the condition in which they were received. Inventory shall be inclusive of make, model, and serial numbers, MAC address, and installation GPS coordinates of the Communications Node Hut. All equipment shall be installed according to the manufacturer's recommendations or as directed by the MDOT.

Any new, additional or updated drivers required for the existing ATMS software to communicate and control new equipment installed by Contractor shall be the responsibility of the Contractor.

Training shall be provided covering the system architecture, operations, and maintenance of the Communication Nodes and MSTraffic network. If training requirements include travel on the part of training participants then the cost of travel shall be included.

907-664.04--Method of Measurement. Communications Node Hut, complete in place, will be measured per each installation. Such measurement shall be inclusive of the Communications Node, the Communications Node Hut, vault, equipment installation and configuration, inclusive of the configuration of the communication and interface equipment, complete in place, tested, and accepted for a complete and operable unit in accordance with the contract provisions, required training and all wiring, hardware, and incidentals necessary to complete the work.

907-664.05--Basis of Payment. Communications Node Hut, measured as prescribed above, will be paid for at the contract unit price bid per each, which price shall be full compensation for furnishing all materials, construction installation, connecting, testing, training, for all equipment, tools, labor, and incidentals required to complete the work.

Payment will be made under:

907-664-B: Communications Node Hut - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-666-2

CODE: (SP)

DATE: 06/06/2017

SUBJECT: Bluetooth Detection System (BDS)

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-666, Bluetooth Detection System, is hereby added to and made a part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-666 -- BLUETOOTH DETECTION SYSTEM

907-666.01--Description. This section specifies the minimum requirements for Bluetooth Detection Systems (BDS) furnished and installed in accordance with the Plans and contract documents. The work consists of providing all labor, materials, equipment, and incidentals necessary to furnish, install, and test a fully operational BDS. The Contractor shall install a fully operational BDS that supplies a compatible data format for the detection data that can be integrated into the existing ITS or traffic management system.

The BDS will provide point-to-point detection of vehicles carrying devices that utilize Bluetooth technology. The vehicles are anonymously detected by discovering Bluetooth enabled devices and collecting their Media Access Control (MAC) addresses. The MAC addresses are stored such that the data retrieved is in a format that cannot be tracked, and any data distinctive to a device is not retrieved (i.e., device name or description). The MAC address is affixed with a time stamp and origin or destination information which is used to determine travel time, direction, and speed data. The BDS will be able to detect both discoverable (unpaired) and non-discoverable (paired) MAC addresses. In addition, DSRC (dedicated short range communications) functionality will be included by an integrated radio that operates in the 5.9 GHz and within the allocated 75 MHz of spectrum. BDS will support Traffic Management Center (TMC) operations by providing personnel with concurrent travel time and speed data corresponding to the traffic sampled.

The BDS shall be located in an equipment cabinet, pole-mounted, or mounted to overhead structures. The system shall include power source, processor, antenna(s), data processing/monitoring software, mounting equipment, up to 100 feet of cable per detector to the nearest ITS or traffic signal cabinet, and all items necessary for a complete fully functional installation. The software package shall include all necessary software licenses for functionality including, but not limited to, web interface, configuration tools, GIS map, data processing, data archiving, XML and GPS data transmission to be used with the MDOT ATMS information systems.

907-666.02--Materials. Bluetooth Detection Systems Type A, Type B, and associated equipment shall meet the following requirements.

907-666.02.1--Functional Requirements. The Bluetooth Detection System (BDS) shall process

and analyze data collected from vehicles traveling along a route. The BDS shall discover devices within a distance of 300 feet from its antenna at the height suggested by the manufacturer. The system shall detect visible Bluetooth devices at the point of origin/destination and temporarily store their associated MAC addresses to memory to be transmitted to a centralized server/database. The MAC addresses shall be anonymous or encrypted. Each anonymous MAC address shall be affixed with the time of detection and the location of origin or destination. Travel time and speed shall be processed for each unique MAC address by utilizing the times of detection and locations detected. The BDS shall not be used to monitor vehicle presence or traffic volume as the system accuracy is dependent on Bluetooth device sample rates.

The DSRC component shall support two way communication between itself and DSRC devices mounted in or integrated in newer vehicles. The DSRC will be used to capture and transmit the basic safety message , probe vehicle data, signal phase and timing message, and traveler information message.

The BDS shall transmit detection information and information captured from the DSRC over an Ethernet connection or cellular data connection to a centralized remote database or server. A software package shall be available to provide a web interface used to monitor BDS data, monitor BDS status information, and view statistical reports. The web interface shall provide real-time BDS data on a GIS map with reporting tools. The reporting tools shall include, but not limited to, real-time and statistical travel time data, real-time and statistical traffic speed data, anonymous MAC addresses, location(s) of detection, time of detection, and date of detection.

The system will be able to use DSRC data to enhance the information provided through the system generated reports. As the DSRC population grows, reports driven by that data will be developed without effect to the sensors.

907-666.02.2--Bluetooth Detection System. The BDS Type A and Type B shall adhere to the following minimum requirements.

The Bluetooth radio and antenna shall operate in the unlicensed ISM band at 2.4 GHz. The radio shall comply with all FCC regulations and standards. A single Cat-5e Outdoor Rated Ethernet cable shall provide power and network connection to each BDS unit. No coaxial cable shall be allowed. The antenna shall be omnidirectional or directional as indicated in the Plans and per the manufacturer's recommendations. The BDS shall not interfere with any other ITS devices operating on the same frequency. If separation is needed for such devices to operate, it shall be surveyed and determined by the Contractor prior to installation, and then relocated with approval of the Engineer. Costs for positioning and/or moving the BDS shall be included in the cost of the BDS unit.

The microcontroller shall include SD host and card for data logging and processing by standalone BDS detector units detached from the MDOT network. The Bluetooth microcontroller shall include sufficient non-volatile RAM(NVRAM), Flash memory, SD host, SD card, and Ethernet controller/module.

The BDS system shall be capable of utilizing either directional or Omni directional antennas. Omni

directional antennas shall be standard unless indicated otherwise in plans or as approve by the Engineer.

907-666.02.3--Type A Bluetooth Detector. The Type A Bluetooth Detector shall be a pole mounted self-enclosed unit capable of detecting Bluetooth enabled devices traveling along a roadway. The following are the minimum Type A Bluetooth Detector requirements.

- 1) The Type A BDS shall be located outside the equipment cabinet and enclosed inside a NEMA 4X enclosure that is resistant to damage by weather or vandalism. The cabinet shall be mounted on a pole, or overhead structure as appropriate for the site and as specified in the Plans.
- 2) The Contractor shall provide a power supply or PoE injector to convert the available single phase 110 – 220 VAC to the manufactures specified operational voltage. The power supply or PoE injector shall be located in the equipment cabinet. The PoE injector shall conform to the IEEE 802.3af and IEEE 802.3at PoE standards.

907-666.02.4--Solar Power. A Type A BDS with solar power shall be optional to include a solar panel, battery, mounting equipment, cables, and all items necessary for a complete fully functional installation. All solar panels shall be in accordance with UL1703, or equivalent. The solar cell shall have a minimum power capacity of 30 watts. The battery shall provide sufficient power for all BDS component operation for a minimum of 168 hours (7 days). The supplier shall provide documentation specifying approximate daily power generation, power consumption, storage capacity, and charge rates representing an optimal power source to the satisfaction and approval of the Project Engineer. The Contractor shall test the battery for faulty irregularities and provide documentation to the Project Engineer stating the battery's voltage, and resistance. The battery voltage and resistance shall be meet the manufacturers specifications. Should solar power be specified with the Type A BDS, the NEMA 4 enclosure shall be sized appropriately for the solar power components.

907-666.02.5--Type B Bluetooth Detector. The Type B Bluetooth Detector shall be a cabinet mounted unit capable of detecting Bluetooth enabled devices traveling along a roadway. The following are the minimum Type B Bluetooth Detector requirements.

- 1) The Type B BDS shall be located inside the equipment cabinet and be shelf, rack, module, or DIN rail mountable. Other mounting options may be submitted for review by the Project Engineer.
- 2) The Contractor shall provide a power supply to convert the available single phase 110 – 220 VAC to the manufactures specified operational voltage. The power supply shall be located in the equipment cabinet.
- 3) POE injectors shall conform to the distances shown on the plans.

907-666.02.6--Wireless Communications. The Type A and Type B BDS shall be upgradable to include a cellular modem and antenna capable of transmitting data using a MDOT cellular service provider. The Contractor shall coordinate with the MDOT for cellular service. The Contractor shall be responsible for establishing cellular service. The cellular modem shall be Quad-band GSM 850/900/1800/1900 MHz GSM/GPRS. The GSM modem shall have the option to use a high

gain omnidirectional antenna or directional antenna via an external SMA connector on the enclosure. The cellular modem shall support the TCP/IP networking protocols: TCP, UDP, DNS, DHCP, HTTP, HTTPS, FTP and NTP.

907-666.02.7--Bluetooth Detection System Server. The Bluetooth Detection System Server shall be a centralized server capable of analyzing and processing BDS Detector data from the roadways where the detectors are deployed and distributed to the MDOT ATMS system. The following are the minimum requirements for the BDS software package and database.

- 1) No more than one (1) software package shall be required for each regional TMC network.
- 2) The software package shall include a secure web-based monitoring system (web GUI). The web GUI shall allow the Contractor or TMC personnel to view, analyze and configure data.
- 3) The web GUI shall include a GIS map overlay and display dynamic real-time BDS detector data.
- 4) The server shall be located locally at the regional TMC or hosted offsite by a third party.
- 5) The server shall be capable of adding an undefined number of detectors forming a BDS network.
- 6) The web GUI shall be used to monitor data (i.e., speed and travel times) from any BDS detector pair on the network.
- 7) The server shall be capable of logging any change in a devices status in its network.
- 8) The logging of devices shall include unique device identifier, BDS detector status, and BDS detector battery status (solar power option).
- 9) The server shall be capable of logging, processing, and setting flags for DSRC message sets compatible with Society of Automotive Engineers (SAE) including but not limited to: Basic Safety Message (BSM); Probe Vehicle Data (PVD); Signal Phase and Timing Message (SPaT); and Traveler Information Message (TIM). The system shall generate alert system messages based on flags.
- 10) The server shall be capable of logging and processing all DSRC data collected from each device in its network. The logging of devices shall include MAC address pairs, detection origin, detection destination, origin detection time, destination detection time, number of paired MAC addresses, percentage of paired MAC addresses, real-time speed, and travel times.
- 11) The server shall be capable of logging all data collected from each device in its network. The logging of devices shall include MAC address pairs, detection origin, detection destination, origin detection time, destination detection time, number of paired MAC addresses, percentage of paired MAC addresses, real-time speed, and travel times.
- 12) The web server shall archive all BDS data for a minimum of 365 days at a frequency equivalent to the detection sampling rate.
- 13) The server shall be capable of generating performance measurement reports including traffic speed, travel times, raw data and smoothed data, origin and destination. All reports generated shall be in the format that includes day, month, year, hours, minutes, and seconds.
- 14) All data served from the server shall be transmitted via XML.
- 15) The Contractor shall provide an uninterruptable power supply (UPS) for the server. The UPS cost shall be absorbed into the BDS Server cost. The UPS shall meet the following

minimum operational requirements.

- a. The UPS shall protect the server and associated equipment from power surges, spikes, and other power disturbances. The UPS shall be capable of restoring power automatically upon return of utility power.
- b. In the event of a power disturbance the UPS battery backup shall maintain a 1000W load for a minimum runtime of 3600 seconds (1 hour).
- c. The UPS shall indicate the availability of battery backup power.
- d. The UPS shall be configurable over the network via remote management.
- e. The UPS battery shall be hot-swappable for uninterrupted power to the server and associated equipment.

907-666.02.8--Network Requirements. The Type A and Type B BDS shall meet the following minimum network requirements.

- 1) The network connection shall be Ethernet Compliant IEEE 802.3, 802.3u, and 802.3x; 10/100 Mbps or higher, auto sensing full/half-duplex operations.
- 2) The BDS shall connect to a network device (i.e., media converter, Ethernet switch /router, etc.) via a RJ45 port/connector through outdoor rated Category 5e or higher cable.
- 3) All RJ45 ports shall be standard EIA/TIA-568-A pin-outs and shall be rated at 10/100 Base-T or better.
- 4) The BDS shall support protocols TCP, UDP, DNS, DHCP, HTTP, HTTPS, FTP and NTP.

907-666.02.9--Environmental Conditions. Unless stated otherwise, the equipment shall meet all operational requirements during and after exposure to any variation of the following environmental conditions.

- 1) Ambient temperature range of -30°C to +65°C
- 2) Relative humidity from 5% to 90% humidity
- 3) Rain and other precipitation up to 3.5 inches/hour

907-666.02.10--Mounting Requirements. The BDS and antenna(s) shall be mounted in accordance with the manufacturers specifications at the location stated in the Plans so that it collects data from each travel lane in both directions of travel. Mounting of the antenna shall meet any FCC rules and regulations and include any special permits and licenses given the geographical location. The Contractor shall be responsible for attaining all FCC licenses and permissions.

907-666.02.11--Surge Suppression. Surge Suppression shall be provided to protect the equipment from surges across the BDS power or communications cables. The minimum surge protection requirements include the following.

- 1) Surge protectors shall be furnished for all non-dielectric cable and conductors between the BDS or BDS antenna and the equipment cabinet.
- 2) The surge protectors shall have leads that are kept to a minimum length as recommended by the surge device manufacturer.
- 3) All surge protection devices shall be designed to meet the temperature and humidity requirements expected in this type of outdoor application.

- 4) All surge protectors shall be U.L. listed and bonded to the same single-point ground point.

907-666.03--Construction Requirements. All equipment shall be installed according to the manufacturer's recommendations, the Plans, and as follows.

- 1) The Contractor shall install the BDS or BDS antenna on a pole at the manufacture's recommended height above the road surface so the best sampling rate is achieved. DSRC shall be implemented as integrated functionality that does not require any additional setup during installation.
- 2) The Contractor shall provide the MDOT with a written inventory of items received and the condition in which they were received. Inventory shall be inclusive of make, model, and serial numbers, MAC address, and installation GPS coordinates. All equipment shall be installed according to the manufacturer's recommendations or as directed by the MDOT.
- 3) All equipment and software must be fully functional and pass a Final Inspection by the ITS Manager and Project Engineer before being accepted by the MDOT
- 4) The Contractor is responsible for the installation and configuration of the server and server software. The Contractor shall provide a fully-functional server integrated into the MDOT existing ITS management system network that maintains all operational requirements. The server shall meet the Bluetooth Detection System manufacturers recommendation for hardware requirements, software requirements and network requirements.

907-666.03.1--Testing. The Contractor shall conduct a Project Testing Program as required below. All costs associated with the Project Testing Program shall be included in the overall contract price; no separate payment will be made for any testing.

907-666.03.1.1--General Requirements. The Contractor shall conduct a project testing program for all BDS provided. The project testing program for BDS shall include but is not limited to the specific requirements in this subsection.

- 1) All test results shall confirm physical and performance compliance with this Special Provision.
- 2) Each test shall fully demonstrate that the equipment being tested is clearly and definitely in full compliance with all project requirements.
- 3) Contractor shall submit all test results documentation to the Engineer for review within 14 calendar days of completion of the tests.
- 4) All tests deemed by the Project Engineer to be unsatisfactorily completed shall be repeated by the Contractor. In the written request for each test occurrence that is a repeat of a previous test, the Contractor shall summarize the diagnosis and correction of each aspect of the previous test. The Contractor shall summarize the diagnosis and correction of each aspect of the previous test that was deemed unsatisfactory. The test procedures for a repeated test occurrence shall meet all the requirements of the original test procedures, including review and approval by the Project Engineer and ITS Manager or designee.
- 5) The satisfactory completion of any test shall not relieve the Contractor of responsibility to provide a completely acceptable and operating system that meets all requirements of this project.

907-666.03.1.2--Standalone Acceptance Test (SAT). The Contractor shall perform a complete SAT on all BDS equipment and materials associated with the field device site, including but not limited to electrical service, cabling, etc. A SAT shall be conducted at every field device site with BDS equipment.

The SAT shall demonstrate that all BDS equipment and materials are in full compliance with all MDOT project requirements and fully functional as installed and in final configuration. The SAT shall demonstrate full compliance with all operational and performance requirements of the project requirements. All SATs also include a visual inspection of the cabinet and all construction elements at the site to ensure they are compliant with the contract documents. The SATs for each site type shall include but are not limited to the following.

- 1) Verify that physical construction has been completed as detailed in the plans.
- 2) Inspect the quality and tightness of ground and surge protector connections.
- 3) Inspect the integrity of all cable connections and terminations and verify that the cables are connected and terminated as specified in the Plans.
- 4) Verify proper voltages for all power supplies and related power circuits.
- 5) Verify that the power applied to the BDS meets the power rating stated in the manufacture specifications.
- 6) Verify network connection to the BDS through ping and telnet session from a remote PC.
- 7) Confirm that the system is fully functional, detecting Bluetooth devices at a sample rate approved by the ITS Engineer.

907-666.03.2--Warranty. Minimum warranty requirements shall be as follows.

- 1) All warranties and guarantees shall be assigned to the Mississippi Department of Transportation.
- 2) The warranty shall be a minimum of one (1) year warranty per BDS, BDS Server, BDS Server software and all other installed and/or attached appurtenances.
- 3) The warranty period begins upon final acceptance of the BDS system.
- 4) During the warranty period, the Contractor shall repair or replace with new or refurbished material, at no additional cost to the State, any product containing a warranty defect, provided the product is returned postage-paid by the Department to the manufacturer's factory or authorized warranty site.
- 5) Products repaired or replaced under warranty by the manufacturer shall be returned prepaid by the manufacturer.
- 6) During the warranty period, technical support shall be available from the Contractor via telephone within four (4) hours of the time a call is made by the Department, and this support shall be available from factory certified personnel.
- 7) During the warranty period, updates and corrections to hardware, software and firmware shall be made available to the Department by the Contractor at no additional cost.
- 8) During the warranty period, software updates including bug/ error patches, performance improvements, and firmware shall be made available to the Department by the Contractor at no additional cost to the MDOT.

907-666.03.3--Maintenance and Technical Support. The supplier shall maintain a sufficient inventory of parts to provide support and maintenance/repair of the Bluetooth Detection System. These parts shall be available for delivery within 30 days of receipt of a purchase order by the supplier at the supplier's then current pricing and terms of sale.

The supplier shall maintain an ongoing program for customer support for the system. This support shall be via telephone, email or personnel sent to the installation upon receipt of a purchase order at the suppliers then current pricing and terms of sale for technical support services.

907-666.04--Method of Measurement. Bluetooth Detection System of the Type specified, Bluetooth Detection System Server, and Bluetooth Detection System Server Licensing will be measured per each installation, and as specified in the Plans.

907-666.05--Basis of Payment. Bluetooth Detection System, Bluetooth Detection System Server, and Bluetooth Detection System Server Licensing, measured as prescribed above, will be paid for at the contract price per each, which price shall be full compensation for installation, system integration, documentation, training and testing of a complete BDS system site including radio, processor, antenna, system enclosure, solar power, surge protection devices, and all cables between BDS and the cabinet (up to 100'), attachment hardware and brackets, completion of all testing requirements and all work, labor, tools, materials, equipment, incidentals equipment, and appurtenances as required to provide and install a complete BDS system. It shall also include all system documentation including shop drawings, operations and maintenance manuals, wiring diagrams, block diagrams and other materials necessary to document the operation of the BDS.

Payment will be made under:

- 907-666-A: Bluetooth Detection System, Type ___ - per each
- 907-666-B: Bluetooth Detection System Server - per each
- 907-666-C Bluetooth Detection System Server Licensing - per each

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-675-1

CODE: (SP)

DATE: 06/21/2017

SUBJECT: Antenna Tower

PROJECT: SP-9999-01(007) / 107364301 – Lee, Pontotoc and Union County

Section 907-675, Antenna Tower, is hereby added to and made a part of the 2017 Edition of the Mississippi Standard Specifications for Road and Bridge Construction as follows.

SECTION 907-675 – ANTENNA TOWER

907-675.01–Description. This special provision describes the specifications and minimum requirements for a total turn-key Antenna Tower solution. The physical location, site descriptions, and dimensions will be provided in a detailed Notice to Bidders.

The Contractor shall be responsible for the complete design, documentation, manufacture, assembly, system integration, testing, hardware and installation of the steel tower structure including, but not limited to, the foundation, power, anchor bolts and templates, Contractor-designed tower-mounted wireless system, integral welded waveguide ladder, ice bridge, cable safety climb devices, beacon mount (if applicable), lightning rod, EIA grounding, attachments and other components necessary to form a complete tower to support the radio antennas and related equipment. The complete and working system shall be in accordance with any applicable Federal Communications Commission (FCC) and Federal Aviation Administration (FAA) rules and regulations.

The tower shall have demonstrated long-term durability to withstand extreme temperatures, weather conditions and will be designed in accordance with the 2012 IBC and TIA 222-G Standard for a 115 MPH Ultimate 3-second gust wind speed.

Tower must be a Structure Class II, Exposure Category C, and a Topographic Category 1.

The tower shall be warranted fully as a complete assembly by the manufacturer for a period of 10 years.

The Contractor is to design and install a wireless communications system for MDOT that will provide stable communication to the sites and ITS devices shown in the plans. The Contractor is to determine and install the number and type of radios necessary at the Tower location, including all pertinent equipment, as part of the Antenna Tower pay item.

907-675.02–Materials. The Contractor is responsible for the complete tower and foundation design and shall meet the following minimum design criteria:

- 1) Tower drawings & foundation design must be certified by a professional engineer

- registered in the state of Mississippi.
- 2) The tower shall meet all requirements listed in the 2012 IBC and the latest revision of the Electronics Industry Association Structural Standards for Steel Antenna Tower and Supporting Structures (EIA/TIA-222G).
 - 3) All tower materials and hardware will be hot dipped galvanized.
 - 4) Tower will be manufactured using high quality steel.
 - 5) All structural bolts must be SAE J429 Grade 5, ASTM A325, or ASTM A449.
 - 6) Nuts must be either ASTM A563 Grade DH or ASTM A194 Grade 2H.
 - 7) The tower structure shall be designed to support the following:
 - a) The structure shall be designed for wind velocity for a 115 MPH Ultimate 3-second gust wind speed, applicable ice, wind, and gust factors to be in accordance with the EIA/TIA-222G.
 - b) In addition, the structure must be designed not to exceed 95% of design capacity of any tower or foundation component.
 - c) At a minimum, the structure shall be capable of supporting the proposed and future equipment loads. All antennas, ports, mounts, feed lines, and other equipment shall be considered in the structural analysis:

Carrier	Mount Level (ft)	No. of Ant.s	Antenna Manufacturer	Antenna Model	Antenna Azimuth (degrees)	Mount	Feed Lines	Note
MDOT	150	TBD	TBD	TBD	TBD	TBD	TBD	1,2
C Spire	135	3	CommScope	HBX-6517DS-VTM	60/180/300	(3) Valmont Heavy Duty V-Frames (VFA12-HD)	(6) Eupen EC7-50A	3
		3	CommScope	HBXX-6517DS-VTM			(2) ofs LGIO-018	
		3	CommScope	LNx-6515DS-A1M			(2) Belden YC58127	
		3	CommScope	TTTT65AP-1XR			(3) Amphenal 942-98721-1FXXXX	
		3	Alcatel-Lucent	B25 RRH4x30			(3) Amphenal 941-99033-1YXXX	
		3	Nokia	FZHJ B41 RRH				
		3	Raycap	RALDC-1201-PF-48				
		Future	120	12			CommScope	
12	Ericsson			RRUS-32	(6) Rosenberger Leoni WR-VG86ST-BRDA			
12	Andrew			ETD819G-12UB				
3	Raycap			DC6-48-60-18-8F				
Future	105	12	CommScope	SBNHH-1D65C	0/120/240	(3) Valmont Heavy Duty V-Frames (VFA12-HD)	(12) Andrew LDF7-50A	3
		12	Ericsson	RRUS-32			(6) Rosenberger Leoni WR-VG86ST-BRDA	
		12	Andrew	ETD819G-12UB				
		3	Raycap	DC6-48-60-18-8F				

Notes:

- 1) Contractor is to design a system for MDOT that will provide stable communication to the sites and ITS devices as shown in the plans.
- 2) Feed lines are to be routed up the interior of the pole.
- 3) Feed lines are to be routed up the exterior of the pole.

- d) The analysis model should be prepared using actual proposed tower and equipment orientations.
- e) Twist and sway should be computed and verified to be within acceptable limits at each level of microwave antenna loading.
- f) MDOT feed lines will be considered to be located on the interior of the tower. All other feed lines should be considered to be located on the exterior of the tower.
- g) The Antenna Tower should be designed to accept three separate waveguide ladders, one for each of the 105, 120, and 135 foot mounting levels.

907-675.02.1-General Requirements. The antenna tower system shall meet the following general requirements:

- 1) A microwave antenna transmits its signal within a limited beam width. This width is a characteristic of the antenna size and the signal frequency. Excessive movement in the tower may result in signal loss. Therefore, the structure shall be designed to provide the

stability required by the wireless antenna manufacturers for clear reception and transmission of the wireless video and data that is being transmitted. Design calculations shall evaluate both twist and sway to ensure they meet the microwave system's manufacturers recommendations.

- 2) The Antenna Tower will be fabricated in section lengths suitable for shipping over the road. The tower may feature either lap splices or bolted flange splices using high strength bolts. No field welding or cutting shall be permitted in order to construct the tower.
- 3) Tower will include one climbing system with cable type safety climb device equipped with a climbing sleeve which meets the requirements outlined in ANSI A14.3 "Safety Requirements for Fixed Ladders" and OSHA Standard 1926.502.
- 4) One waveguide ladder shall be provided on the outside face of the structural members for the 135 foot mounting level. Cable supports shall be sized to sufficiently handle the cable required for the C Spire equipment as shown above, at a minimum.
- 5) Contractor will provide an ice bridge to cover the MDOT feed lines from the tower to the building. The ice bridge will be constructed of galvanized grip span bridge channel supported by angle members. The ice bridge will be supported by three-inch galvanized steel pipes set in concrete at both the tower and building which isolate the bridge from the building and the tower. No attachments or penetrations to the building or tower are allowed. Additional support pipes may be installed as required. The depth of the foundation for the pipe supports will be three feet or below the frost level, whichever is greater.
- 6) The structure shall be grounded in accordance with Motorola R56 Standards and Guidelines for Communication Sites.
- 7) The structure shall include all hardware, mounting devices, brackets, bolts and assemblies necessary to mount the antennas.
- 8) The structure shall be galvanized in accordance with ASTM A153 to protect the entire structure from rust and corrosion.

The Contractor shall provide the Engineer four sets of calculations and shop drawings for all items associated with the manufacturing, construction and installation of the tower structure and foundation. All structural plans, calculations and materials shall be approved by the Engineer and MDOT Bridge Division. Each design and shop drawing must be stamped by a professional engineer registered in the State of Mississippi.

Shop drawings must be approved prior to fabrication, and it is expressly understood and agreed upon that said approval does not relieve the Contractor of its responsibility for the proper design, fabrication and erection of the structure. Any drawing errors encountered during construction of the tower shall be corrected and re-issued as "As-Built" drawing revisions prior to receipt of final payment.

907-675.02.2-Ports. At every antenna level, the tower will have three (3) ports, 9 inches wide by 12 inches tall located below the planned equipment mount elevation such that the feed lines can be installed on the interior of the tower. Three (3) ports will also be provided approximately nine feet (9') above the base of the tower for exiting of the interior feed lines. All ports in the tower will be equipped with a bolt-on cover.

907-675.02.3-Contractor-Designed, Tower-Mounted Wireless System. The tower-mounted

radio interconnect system shall meet the following requirements:

- 1) The number and type of radios installed at the Tower site will be determined by the Contractor and will provide stable communication to the sites and ITS devices shown in the plans with sufficient bandwidth for all devices to communicate properly across the network.
- 2) All wireless communication components shall be as specified in Section 662 of the Standard Specifications.
- 3) The Contractor-Designed, Tower-Mounted Wireless System shall include, but not be limited to, all radios, software, base stations, power supplies, antennas, communication and power cables and connectors, lightning suppressors, mounting hardware, enclosures, receivers, transceivers, and system documentation necessary at the Tower site to connect to MDOT devices as shown in the plans.
- 4) Antenna mount assemblies for all MDOT equipment will be provided. Drawings must include installation details for all assemblies provided. Two (2) stiff arm tiebacks are to be supplied on all microwave antennas (if applicable).

907-675.02.4–Foundation Requirements. The antenna tower shall meet the following foundation requirements:

- 1) Foundation design must be certified by a professional engineer registered in the state of Mississippi and must be in accordance with the TIA 222-G Standard per parameters provided in the supplied site specific Geotechnical Report.
- 2) Custom foundation drawings must be provided to the Project Engineer based upon the MDOT provided Geotechnical Soil Report and must include requirements to verify concrete and rebar quality.
- 3) The foundation must be of a drilled pier design and should account for all tower reactions. Foundations shall conform to Section 803 of the Standard Specifications.

907-675.02.5–Antenna Tower Grounding Requirements. Contractor is to install a ground ring around the proposed tower foundation in accordance with Motorola R-56 Standards and Guidelines for Communication Sites.

Tower will be equipped with a lightning rod which is connected to a jacketed 2/0 downlead cable. The cable will extend to ground elevation where it is to be connected to the tower ground ring system.

Upon completion, the ground system will be megger tested to insure the system meets a five-ohm resistance. The Contractor is required to modify grounding systems as required to achieve this grounding resistance.

907-675.02.6–Antenna Tower Lighting Requirements. An FAA approved dual red-white lighting system will be provided if required. The antenna tower lighting shall meet the following requirements:

- 1) The installed lighting system shall be a Dual Lighting system consisting of Strobe Medium Intensity Flashing white system for daytime and twilight, and red obstruction light system

for nighttime. The lighting system shall meet FAA Advisory Circular AC- 70/7460-IK "Obstruction Marking & Lighting" Guidelines.

- 2) The beacon(s) shall have a flash rate which meets FAA requirements and shall not be affected by changes in line voltage or frequency.
- 3) The control unit/power supply shall be solid state design and is to be mounted in the communications shelter. The lighting system shall operate on 120 volt AC 60 Hz single phase power.
- 4) There shall be a minimum of three (3) alarm outputs provided as listed below. These alarm outputs shall be dry contact closures.
 - a) Top beacon strobe problem which includes failure and/or out of tolerance flash rate.
 - b) Top beacon red light problem which includes a failure and/or out of tolerance flash rate.
 - c) Red light side light problem.
- 5) There shall be a minimum of two (2) status outputs provided as listed below. These status outputs shall be dry contact closures.
 - a) Day time strobe functioning.
 - b) Night time red lights functioning.
- 6) These dry contacts shall monitor the state of the controller. Designs which monitor the photocell to determine day/night status shall not be allowed.
- 7) The unit shall be equipped with lighting arrestor and transient surge suppression on all electronics.
- 8) One (1) hardcopy written manual and one (1) electronic copy of the manual shall be provided for the lighting system. The technical manual shall accurately describe service procedures, with module description circuit diagrams, replacement parts list, installation procedures, mechanical details, and termination points for equipment exactly as purchased.
- 9) There shall be no interference generated by the lighting system that could possibly interfere with the radio systems on the tower. If there is, Contractor will correct at his own expense to the satisfaction of the Project Engineer.
- 10) Obstruction light mounts properly sized for the legs shall be provided. Obstruction light fixtures shall be constructed of a corrosion resistant metal. Non-metallic fixtures will not be accepted.

907-675.02.7–Antenna Tower Painting Requirements. The tower will be painted to meet FAA requirements if necessary.

907-675.03–Construction Requirements.

907-675.03.1–Installation Requirements. Installation of the antenna tower system shall be as follows:

- 1) Contractor is responsible for obtaining all building permits and Contractor's license as required to perform the work.
- 2) Contractor must receive confirmation from the FAA (form 7460-1) for final tower height, with the approved lighting and painting system, and comply.
- 3) The foundation shall be made with one continuous pour. The Contractor shall retain services

of a qualified independent testing laboratory to perform quality assurance testing of concrete samples.

- 4) An independent 3rd party inspection will be completed prior to pouring concrete to verify the dimensions of the excavation and placement of reinforcing bars.
- 5) Erection of the proposed tower will be completed in accordance with all local building codes, OSHA, TIA, and ANSI/ASSE A10.48-2016 requirements. The tower must be plumbed to meet the TIA 222 Revision G Standard requirements.
- 6) Contractor is responsible for installing all of MDOT's proposed Contractor-Designed, Tower-Mounted Wireless System equipment on the tower.
- 7) Safety Requirements:
 - a) Field Employees of Contractor and all sub-Contractors must be CPR and First Aid certified (CFR 1926.23).
 - b) All climbing employees must be trained and equipped for fall protection and rescue (CFR 1926 Subpart M) and meet all OSHA requirements.
 - c) Contractor must have in place and enforce a Safety Program and provide a written copy to the Engineer through MDOT's normal submittal process.
 - d) The Contractor and all sub-Contractors must have a Work Comp Mod Index of 1.0 or less for the previous three years.
 - e) The Contractor must have all the necessary insurance policies that name MDOT as an additional insured. All sub-Contractors must be properly insured as well.
 - f) Contractor will supply crew members with all safety devices required by OSHA, state, local, and federal regulations as needed to complete the project.
 - g) All work crews on the project will obey all rules as stated in OSHA, state, local, and federal regulations.
 - h) All personnel on site must wear hard hats, safety glasses and work boots with a defined heel. While climbing or performing elevated work personnel must wear a full body harness and be fastened to the tower 100 percent of the time.
 - i) The Contractor must submit all certificates of insurance and climbing certifications of his and his sub-Contractors to MDOT prior to starting work on the project job site.
- 8) All exterior electrical wiring shall be installed in liquid proof conduit with appropriate fittings
- 9) All interior electrical wiring shall be installed in thin-wall metal conduit with appropriate fittings.
- 10) Contractor will remove all debris, scrap, unused material, components, and unnecessary equipment from site immediately upon completion of construction. Burial or burning of any item is forbidden. Contractor will not allow trash of any sort to move to neighboring property. No material may be stored on neighboring property without first obtaining approval.
- 11) The vendor/Contractor shall be held liable for damage caused by negligent Contractor's actions to any and all existing buildings, towers, cables, wiring lighting, HVAC systems, radio equipment, and all other State property at the site during the installation work and subsequent system testing if any damage occurs.
- 12) The vendor/Contractor shall be responsible for security of all supplied equipment and materials left at the work site during installation.
- 13) Contractor will arrange and pay for the installation and use of temporary power to the site during construction if necessary.

907-675.03.2-Contractor's Warranty. The Contractor shall guarantee all Contractor supplied materials and workmanship against defects or incorrect manufacturing for a period of one year after installation. Repair or replacement of any defective materials, correction of faulty workmanship, or correction of any items not in accordance with these specifications shall be made at the Contractor's expense.

907-675.03.3-Testing Requirements. The following are the requirements for testing the antenna tower system.

- 1) An inspection of the tower by an independent 3rd party, paid by MDOT, will be performed to determine if work has been completed in accord with construction documentation
 - a) A report of the observations, stamped by a Professional Engineer registered in the State of Mississippi, will be prepared and sent to MDOT and the Contractor.
 - b) The Contractor must be prepared to return to the site to correct any discrepant issues.
- 2) Tightness on 10% of the overall tower bolts should be checked, including 10% of the bolts in each section of tower.
- 3) The tower must be plum with no twist in the tower.
- 4) The Engineer shall have the option to witness all tests.
- 5) Grounding System must meet all Motorola R-56 testing guidelines. The ground system will be megger tested to insure the system meets a five-ohm resistance.

907-675.04-Method of Measurement. Antenna Tower, complete in place, will be measured per lump sum, inclusive of all wiring, hardware, and incidentals necessary to complete the work.

Antenna Tower will each be paid on a lump sum basis as follows:

- 20% upon complete installation of foundations
- 50% upon installation of the complete structure and Contractor-Designed tower mounted wireless system components
- 30% upon complete installation and verification of a working system.

907-675.05-Basis of Payment. Antenna Tower, measured as prescribed above, will be paid for at the contract unit price lump sum, which price shall be full compensation for design, manufacture, construction, installation, documentation, drawings, and testing of a complete system including, but not limited to the tower, foundation, anchor bolts and templates, waveguide ladder, safety devices, power, lighting, painting, lightning rod, grounding system, ice bridge, Contractor-designed tower-mounted wireless system, attachment hardware and brackets and all work, labor, tools, materials, equipment, coordination with C Spire, system integration, coordination and compliance with FAA and FCC, incidentals, and appurtenances as required to provide and install a complete working, and integrated tower and wireless system.

907-675-A: Antenna Tower

- lump sum

SECTION 905 - PROPOSAL

Date _____

Mississippi Transportation Commission
Jackson, Mississippi

Sirs: The following proposal is made on behalf of _____
_____ of _____

for constructing the following designated project(s) within the time(s) hereinafter specified.

The plans are composed of drawings and blue prints on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

The Specifications are the current Standard Specifications of the Mississippi Department of Transportation approved by the Federal Highway Administration, except where superseded or amended by the plans, Special Provisions and Notice(s) to Bidders attached hereto and made a part thereof.

I (We) certify that I (we) possess a copy of said Standard and any Supplemental Specifications.

Evidence of my (our) authority to submit the Proposal is hereby furnished. The proposal is made without collusion on the part of any person, firm or corporation. I (We) certify that I (we) have carefully examined the Plans, the Specifications, including the Special Provisions and Notice(s) to Bidders, herein, and have personally examined the site of the work. On the basis of the Specifications, Special Provisions, Notice(s) to Bidders, and Plans, I (we) propose to furnish all necessary machinery, tools, apparatus and other means of construction and do all the work and furnish all the materials in the manner specified. I (We) understand that the quantities mentioned herein are approximate only and are subject to either increase or decrease, and hereby propose to perform any increased or decreased quantities of work at the unit prices bid, in accordance with the above.

I (We) acknowledge that this proposal will be found irregular and/or non-responsive unless a certified check, cashier's check, or Proposal Guaranty Bond in the amount as required in the Advertisement (or, by law) is submitted electronically with the proposal or is delivered to the Contract Administration Engineer prior to the bid opening time specified in the advertisement.

INSTRUCTION TO BIDDERS: Alternate and Optional Items on Bid Schedule.

1. Two or more items entered opposite a single unit quantity WITHOUT DEFINITE DESIGNATION AS "ALTERNATE ITEMS" are considered as "OPTIONAL ITEMS". Bidders may or may not indicate on bids the Optional Item proposed to be furnished or performed WITHOUT PREJUDICE IN REGARD TO IRREGULARITY OF BIDS.
2. Items classified on the bid schedule as "ALTERNATE ITEMS" and/or "ALTERNATE TYPES OF CONSTRUCTION" must be preselected and indicated on bids. However, "Alternate Types of Construction" may include Optional Items to be treated as set out in Paragraph 1, above.
3. Optional items not preselected and indicated on the bid schedule MUST be designated in accordance with Subsection 102.06 prior to or at the time of execution of the contract.
4. Optional and Alternate items designated must be used throughout the project.

I (We) further propose to perform all "force account or extra work" that may be required of me (us) on the basis provided in the Specifications and to give such work my (our) personal attention in order to see that it is economically performed.

I (We) further propose to execute the attached contract agreement (Section 902) as soon as the work is awarded to me (us), and to begin and complete the work within the time limit(s) provided for in the Specifications and Advertisement. I (We) also propose to execute the attached contract bond (Section 903) in an amount not less than one hundred (100) percent of the total of my (our) part, but also to guarantee the excellence of both workmanship and materials until the work is finally accepted.

I (We) shall submit electronically with our proposal or deliver prior to the bid opening time a certified check, cashier's check or bid bond for **five percent (5%) of total bid** and hereby agree that in case of my (our) failure to execute the contract and furnish bond within Ten (10) days after notice of award, the amount of this check (bid bond) will be forfeited to the State of Mississippi as liquidated damages arising out of my (our) failure to execute the contract as proposed. It is understood that in case I am (we are) not awarded the work, the check will be returned as provided in the Specifications.

SECTION 905 -- PROPOSAL (CONTINUED)

I (We) hereby certify by digital signature and electronic submission via Bid Express of the Section 905 proposal below, that all certifications, disclosures and affidavits incorporated herein are deemed to be duly executed in the aggregate, fully enforceable and binding upon delivery of the bid proposal. I (We) further acknowledge that this certification shall not extend to the bid bond or alternate security which must be separately executed for the benefit of the Commission. This signature does not cure deficiencies in any required certifications, disclosures and/or affidavits. I (We) also acknowledge the right of the Commission to require full and final execution on any certification, disclosure or affidavit contained in the proposal at the Commission's election upon award. Failure to so execute at the Commission's request within the time allowed in the Standard Specifications for execution of all contract documents will result in forfeiture of the bid bond or alternate security.

Respectfully Submitted,

DATE _____

Contractor

BY _____
Signature

TITLE _____

ADDRESS _____

CITY, STATE, ZIP _____

PHONE _____

FAX _____

E-MAIL _____

(To be filled in if a corporation)

Our corporation is chartered under the Laws of the State of _____ and the names, titles and business addresses of the executives are as follows:

President Address

Secretary Address

Treasurer Address

The following is my (our) itemized proposal.

Proposal(Sheet 2-1)

Pontotoc, Union & Lee

Construction of a Tower & ITS Field Device Deployment, known as State Project Nos. SP-9999-01(007) / 107364301, 302 & 303 in Lee, Pontotoc & Union Counties.

Line no.	Item Code	Adj Code	Quantity	Units	Description[Fixed Unit Price]
Roadway Items					
0010	201-A001		1	Lump Sum	Clearing and Grubbing
0020	202-A001		1	Lump Sum	Removal of Obstructions
0030	202-B261		1	Each	Removal of Antenna Tower Communication Hut
0040	216-A001		350	Square Yard	Solid Sodding
0050	219-A001		7	Thousand Gallon	Watering (\$20.00)
0060	234-A001		250	Linear Feet	Temporary Silt Fence
0070	618-A001		1	Lump Sum	Maintenance of Traffic
0080	619-D1001		80	Square Feet	Standard Roadside Construction Signs, Less than 10 Square Feet
0090	619-D2001		160	Square Feet	Standard Roadside Construction Signs, 10 Square Feet or More
0100	619-E1001		1	Each	Flashing Arrow Panel, Type C
0110	619-E3001		1	Each	Changeable Message Sign
0120	619-G4005		240	Linear Feet	Barricades, Type III, Single Faced
0130	619-G7001		10	Each	Warning Lights, Type "B"
0140	620-A001		1	Lump Sum	Mobilization
0150	634-B001		6	Each	Traffic Signal Equipment Pole Shaft Extension, 10-foot, Video Camera Mount
0160	634-E001		8	Each	Camera Pole with Foundation, 50' Pole
0170	634-E004		3	Each	Camera Pole with Foundation, 80' Pole
0180	634-F002		2	Each	Detector Pole with Foundation, 35' Pole
0190	634-I001		7	Each	Wood Pole, Class II Height 40'
0200	636-B034		3,475	Linear Feet	Electric Cable, Underground in Conduit, THHN, AWG #1, 3 Conductor
0210	636-B041		1,765	Linear Feet	Electric Cable, Underground in Conduit, THHN, AWG #2, 3 Conductor
0220	636-B048		2,125	Linear Feet	Electric Cable, Underground in Conduit, THHN, AWG #4, 3 Conductor
0230	636-E001		4,770	Linear Feet	Electric Cable, Underground in Conduit, Tracer Cable
0240	637-A009		31	Each	Pull Box Enclosure, Type 2, Tier 22
0250	637-A013		12	Each	Pull Box Enclosure, Type 4, Tier 22
0260	637-A015		12	Each	Pull Box Enclosure, Type 5, Tier 22
0270	637-I001		1,285	Linear Feet	Traffic Signal Conduit Bank, Underground, Drilled or Jacked, Rolled Pipe, 2 @ 2"
0280	637-I002		7,485	Linear Feet	Traffic Signal Conduit Bank, Underground, Drilled or Jacked, Rolled Pipe, 2"
0290	637-I004		380	Linear Feet	Traffic Signal Conduit Bank, Underground, Drilled or Jacked, Rolled Pipe, 4 @ 2"
0300	641-C001		3	Each	ITS Radar Detection, 1 Sensor
0310	641-D001		100	Linear Feet	Radar Detection Communication Cable

Proposal(Sheet 2-2)

Pontotoc, Union & Lee

Line no.	Item Code	Adj Code	Quantity	Units	Description	Fixed Unit Price
0320	660-A003		11	Each	Equipment Cabinet, Type B	
0330	660-B001		12	Each	Cabinet Modifications	
0340	662-B001		7	Each	Radio Interconnect, Installed in Existing Controller Cabinet	
0350	662-D001		1	Each	Radio Interconnect, Broadband, Long Range	
0360	662-D002		20	Each	Radio Interconnect, Broadband, Short Range	
0370	699-A001		1	Lump Sum	Roadway Construction Stakes	
0380	907-636-I001		2	Each	Ground Mounted Meter Enclosure	
0390	907-636-I002		2	Each	Ground Mounted Transformer Enclosure	
0400	907-650-A002		39	Each	On Street Video Equipment, Fixed Type	
0410	907-650-A003		17	Each	On Street Video Equipment, PTZ Type	
0420	907-659-A001		1	Lump Sum	Traffic Management Center Modifications	
0430	907-659-C001		1	Lump Sum	Traffic Management Center Modifications - Training	
0440	907-661-A004		2,920	Linear Feet	Fiber Optic Cable, 72 SM	
0450	907-663-A001		8	Each	Network Switch, Type A	
0460	907-663-A002		2	Each	Network Switch, Type B	
0470	907-663-A003		1	Each	Network Switch, Type C	
0480	907-663-A006		12	Each	Network Switch, Type F	
0490	907-663-B001		8	Each	Terminal Server	
0500	907-663-D001		8,355	Linear Feet	Category 6 Cable, Installed in Conduit	
0510	907-664-B001		1	Each	Communications Node Hut	
0520	907-666-A001		6	Each	Bluetooth Detection System, Type A	
0530	907-666-C001		6	Each	Bluetooth Detection System Server Licensing	
0540	907-675-A001		1	Lump Sum	Antenna Tower	

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

CONDITIONS FOR COMBINATION BID

If a bidder elects to submit a combined bid for two or more of the contracts listed for this month's letting, the bidder must complete and execute these sheets of the proposal in each of the individual proposals to constitute a combination bid. In addition to this requirement, each individual contract shall be completed, executed and submitted in the usual specified manner.

Failure to execute this Combination Bid Proposal in each of the contracts combined will be just cause for each proposal to be received and evaluated as a separate bid.

It is understood that the Mississippi Transportation Commission not only reserves the right to reject any and all proposals, but also the right to award contracts upon the basis of lowest separate bids or combination bids most advantageous to the State.

It is further understood and agreed that the Combination Bid Proposal is for comparison of bids only and that each contract shall operate in every respect as a separate contract in accordance with its proposal and contract documents.

I (We) agree to complete each contract on or before its specified completion date.

COMBINATION BID PROPOSAL

This proposal is tendered as one part of a Combination Bid Proposal utilizing option ___* of Subsection 102.11 on the following contracts:

* Option to be shown as either (a), (b), or (c).

	<u>Project No.</u>	<u>County</u>	<u>Project No.</u>	<u>County</u>
1.	_____	_____	6.	_____
2.	_____	_____	7.	_____
3.	_____	_____	8.	_____
4.	_____	_____	9.	_____
5.	_____	_____	10.	_____

(a) If Combination A has been selected, your Combination Bid is complete.

(b) If Combination B has been selected, then complete the following page.

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

For Informational Purposes Only

SECTION 905 - COMBINATION BID PROPOSAL (Continued)

Project Number	Pay Item Number	Unit	Unit Price Reduction	Total Item Reduction	Total Contract Reduction
9.					
10.					

(c) If Combination C has been selected, then initial and complete ONE of the following.

_____ I (We) desire to be awarded work not to exceed a total monetary value of \$ _____.

_____ I (We) desire to be awarded work not to exceed _____ number of contracts.



TO: EXECUTIVE DIRECTOR, MISSISSIPPI DEPARTMENT OF TRANSPORTATION
JACKSON, MISSISSIPPI

CERTIFICATE

If awarded this contract, I (we) contemplate that portions of the contract will be sublet. I (we) certify that those subcontracts which are equal to or in excess of fifty thousand dollars (\$50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on September 8, 2011.

I (we) agree that this notification of intent DOES NOT constitute APPROVAL of the subcontracts.

_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)
_____	_____
(Individual or Firm)	(Address)

NOTE: Failure to complete the above DOES NOT preclude subsequent subcontracts. Subsequent subcontracts, if any, equal to or in excess of fifty thousand dollars (\$50,000.00) will be in accordance with regulations promulgated and adopted by the Mississippi State Board of Contractors on September 8, 2011.

Contractor _____

MISSISSIPPI DEPARTMENT OF TRANSPORTATION
CERTIFICATION

I, _____,
(Name of person signing bid)

individually, and in my capacity as _____ of
(Title of person signing bid)

(Name of Firm, partnership, or Corporation)

do hereby certify under penalty of perjury under the laws of the United States and the State of Mississippi

that _____, Bidder
(Name of Firm, Partnership, or Corporation)

on Project No. **SP-9999-01(007)/ 107364301000, SP-9999-01(007) / 107364302000 & SP-9999-01(007) / 107364303000**

in **Pontotoc, Union & Lee** County(ies), Mississippi, has not either directly or indirectly entered into any agreement, participated in any collusion; or otherwise taken any action in restraint of free competitive bidding in connection with this contract; nor have any of its corporate officers or principal owners.

Except as noted hereafter, it is further certified that said legal entity and its corporate officers, principal owners, managers, auditors and others in a position of administering federal funds are not currently under suspension, debarment, voluntary exclusion or determination of ineligibility; nor have a debarment pending; nor been suspended, debarred, voluntarily excluded or determined ineligible within the past three years by the Mississippi Transportation Commission, the State of Mississippi, any other State or a federal agency; nor been indicted, convicted or had a civil judgment rendered by a court of competent jurisdiction in any matter involving fraud or official misconduct within the past three years.

Do exceptions exist and are made a part thereof? Yes / No

Any exceptions shall address to whom it applies, initiating agency and dates of such action.

Note: Exceptions will not necessarily result in denial of award but will be considered in determining bidder responsibility. Providing false information may result in criminal prosecution or administrative sanctions.

All of the foregoing is true and correct.

(1/2016 S)

SECTION 902

CONTRACT FOR SP-9999-01(007)/ 107364301000, SP-9999-01(007) / 107364302000 & SP-9999-01(007) / 107364303000

LOCATED IN THE COUNTY(IES) OF Pontotoc, Union & Lee

STATE OF MISSISSIPPI,
COUNTY OF HINDS

This contract entered into by and between the Mississippi Transportation Commission on one hand, and the undersigned contractor, on the other witnesseth;

That, in consideration of the payment by the Mississippi Transportation Commission of the prices set out in the proposal hereto attached, to the undersigned contractor, such payment to be made in the manner and at the time of times specified in the specifications and the special provisions, if any, the undersigned contractor hereby agrees to accept the prices stated in the proposal in full compensation for the furnishing of all materials and equipment and the executing of all the work contemplated in this contract.

It is understood and agreed that the advertising according to law, the Advertisement, the instructions to bidders, the proposal for the contract, the specifications, the revisions of the specifications, the special provisions, and also the plans for the work herein contemplated, said plans showing more particularly the details of the work to be done, shall be held to be, and are hereby made a part of this contract by specific reference thereto and with like effect as if each and all of said instruments had been set out fully herein in words and figures.

It is further agreed that for the same consideration the undersigned contractor shall be responsible for all loss or damage arising out of the nature of the work aforesaid; or from the action of the elements and unforeseen obstructions or difficulties which may be encountered in the prosecution of the same and for all risks of every description connected with the work, exceptions being those specifically set out in the contract; and for faithfully completing the whole work in good and workmanlike manner according to the approved Plans, Specifications, Special Provisions, Notice(s) to Bidders and requirements of the Mississippi Department of Transportation.

It is further agreed that the work shall be done under the direct supervision and to the complete satisfaction of the Executive Director of the Mississippi Department of Transportation, or his authorized representatives, and when Federal Funds are involved subject to inspection at all times and approval by the Federal Highway Administration, or its agents as the case may be, or the agents of any other Agency whose funds are involved in accordance with those Acts of the Legislature of the State of Mississippi approved by the Governor and such rules and regulations issued pursuant thereto by the Mississippi Transportation Commission and the authorized Federal Agencies.

The Contractor agrees that all labor as outlined in the Special Provisions may be secured from list furnished by

It is agreed and understood that each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and this contract shall be read and enforced as though it were included herein, and, if through mere mistake or otherwise any such provision is not inserted, then upon the application of either party hereto, the contract shall forthwith be physically amended to make such insertion.

The Contractor agrees that he has read each and every clause of this Contract, and fully understands the meaning of same and that he will comply with all the terms, covenants and agreements therein set forth.

Witness our signatures this the ___ day of _____, _____.

Contractor(s)

By _____

MISSISSIPPI TRANSPORTATION COMMISSION

Title _____

By _____

Signed and sealed in the presence of:
(names and addresses of witnesses)

Executive Director

Secretary to the Commission

Award authorized by the Mississippi Transportation Commission in session on the ___ day of _____, _____, Minute Book No. _____, Page No. _____.

SECTION 903
PERFORMANCE AND PAYMENT BOND

CONTRACT BOND FOR: SP-9999-01(007)/ 107364301000, SP-9999-01(007) / 107364302000 & SP-9999-01(007) / 107364303000

LOCATED IN THE COUNTY(IES) OF: Pontotoc, Union & Lee

STATE OF MISSISSIPPI,
COUNTY OF HINDS

Know all men by these presents: that we, _____

(Contractor)

_____ Principal, a _____

residing at _____ in the State of _____

and _____

_____ (Surety)
residing at _____ in the State of _____,

authorized to do business in the State of Mississippi, under the laws thereof, as surety, effective as of the contract date

shown below, are held and firmly bound unto the State of Mississippi in the sum of _____

_____ Dollars, lawful money of the United States of America, to be paid to it for which payment well and truly to be made, we bind ourselves, our heirs, administrators, successors, or assigns jointly and severally by these presents.

The conditions of this bond are such, that whereas the said _____

_____ principal, has (have) entered into a contract with the Mississippi Transportation Commission, bearing the date of _____ day of _____ A.D. _____ hereto annexed, for the construction of certain projects(s) in the State of Mississippi as mentioned in said contract in accordance with the Contract Documents therefor, on file in the offices of the Mississippi Department of Transportation, Jackson, Mississippi.

Now therefore, if the above bounden _____ in all things shall stand to and abide by and well and truly observe, do keep and perform all and singular the terms, covenants, conditions, guarantees and agreements in said contract, contained on his (their) part to be observed, done, kept and performed and each of them, at the time and in the manner and form and furnish all of the material and equipment specified in said contract in strict accordance with the terms of said contract which said plans, specifications and special provisions are included in and form a part of said contract and shall maintain the said work contemplated until its final completion and acceptance as specified in Subsection 109.11 of the approved specifications, and save harmless said Mississippi Transportation Commission from any loss or damage arising out of or occasioned by the negligence, wrongful or criminal act, overcharge, fraud, or any other loss or damage whatsoever, on the part of said principal (s), his (their) agents, servants, or employees in the performance of said work or in any manner connected therewith, and shall be liable and responsible in a civil action instituted by the State at the instance of the Mississippi Transportation Commission or any officer of the State authorized in such cases, for double any amount in money or property, the State may lose or be overcharged or otherwise defrauded of, by reason of wrongful or criminal act, if any, of the Contractor(s), his (their) agents or employees, and shall promptly pay the said agents, servants and employees and all persons furnishing labor, material, equipment or supplies therefor, including premiums incurred, for Surety Bonds, Liability Insurance, and Workmen's Compensation Insurance; with the additional obligation that such Contractor shall promptly make payment of all taxes, licenses, assessments, contributions, damages,

any liquidated damages which may arise prior to any termination of said principal's contract, any liquidated damages which may arise after termination of the said principal's contract due to default on the part of said principal, penalties and interest thereon, when and as the same may be due this state, or any county, municipality, board, department, commission or political subdivision: in the course of the performance of said work and in accordance with Sections 31-5-51 et seq. Mississippi Code of 1972, and other State statutes applicable thereto, and shall carry out to the letter and to the satisfaction of the Executive Director of the Mississippi Department of Transportation, all, each and every one of the stipulations, obligations, conditions, covenants and agreements and terms of said contract in accordance with the terms thereof and all of the expense and cost and attorney's fee that may be incurred in the enforcement of the performance of said contract, or in the enforcement of the conditions and obligations of this bond, then this obligation shall be null and void, otherwise to be and remain in full force and virtue.

_____	_____
(Contractors) Principal	Surety
By _____	By _____
	(Signature) Attorney in Fact
	Address _____

Title _____	_____
(Contractor's Seal)	(Printed) MS Agent

	(Signature) MS Agent
	Address _____

	(Surety Seal)

	Mississippi Insurance ID Number



BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____
Contractor

Address

City, State ZIP

As principal, hereinafter called the Principal, and _____
Surety

a corporation duly organized under the laws of the state of _____

as Surety, hereinafter called the Surety, are held and firmly bound unto State of Mississippi, Jackson, Mississippi

As Obligee, hereinafter called Obligee, in the sum of **Five Per Cent (5%) of Amount Bid**

Dollars(\$ _____)

for the payment of which sum will and truly to be made, the said Principal and said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for **Construction of a Tower & ITS Field Device Deployment, known as State Project Nos. SP-9999-01(007) / 107364301, 302 & 303 in Lee, Pontotoc & Union Counties.**

NOW THEREFORE, the condition of this obligation is such that if the aforesaid Principal shall be awarded the contract, the said Principal will, within the time required, enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this obligation to be void; otherwise the Principal and Surety will pay unto the Obligee the difference in money between the amount of the bid of the said Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former, but in no event shall liability hereunder exceed the penal sum hereof.

Signed and sealed this _____ day of _____, 20__

(Witness)

(Principal) (Seal)

By: _____
(Name) (Title)

(Witness)

(Surety) (Seal)

By: _____
(Attorney-in-Fact)

(MS Agent)

Mississippi Insurance ID Number