MISSISSIPPI DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION NO. 907-664-1

DATE: 01/17/2017

SUBJECT: Communications Node

Section 907-664, Communications Node, 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 907-664 - COMMUNICATIONS NODE

907-664.01—Description. This work consists of furnishing and install a communication node, hut and equipment in accordance with the plans and contract documents. 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 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 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 Communication Huts. The Communication node equipment shall be modular 19-inch rack mountable.

A list of Communication node installation locations and specific interface card configurations shall be shown in the plans or contract documents.

907-664.02.2—Communication 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, 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 inches 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:

• 30" x 70" 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
• Two 4-foot fluorescent ceiling mount fixture with two 40-watt cool white lamps in 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’ x 8’ plywood board mounted on one wall
• Overhead cable trays as outlined in the project related Communications Node Notice to Bidders
• Equipment Racks as outlined in the project related Communications Node Notice to Bidders
• WEB based rack mounted remote environmental monitoring system with components as outlined in the project related Communications Node Notice to Bidders
• 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 below construction requirements section

The building’s outer dimensions and any required layout for locations of doors, conduits, racks, cable trays, etc. shall be covered in the plans or contract documents.

907-664.02.3--Communication 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 concrete in accordance with the applicable sections of the Standard Specifications. The vault walls, floors and roof shall be minimum six inches (6”) thicknesses. The vault shall be sized and installed as detailed in these specifications and contract documents. The vault will be accessed through a minimum 30-inch diameter manhole assembly and cover. The iron manhole cover shall be imprinted with “MDOT COMMUNICATIONS.” The concrete roof of the vault shall be installed below ground level with the vault cover ring installed so that the manhole is approximately two to three inches above ground level. 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 shall connect the vault and provide a path for the fiber from the vault to the hut. This connecting conduit shall conform to the Department standard Type IV (PVC) conduit. Four lines of 4-inch conduit shall 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 Requirements.

907-664.03.1—Communication Node. Communication (OTN) nodes will be installed in Traffic Management Centers (TMC) or in climate controlled Communication Huts. Communication nodes in the MSTraffic network shall be interconnected by dual point-to-point optical fiber links as indicated in the Communication Node Notice to Bidders or directed by the Engineer. These fibers will form two (2) counter-rotating, redundant rings. The second ring will serve as a backup and should be able to, either partly or completely, take over all data transport. Installation will include, but is not limited to, expanding the central video management system and interconnecting the appropriate number of video interfaces between networked Traffic Management Centers (TMC) located across the State. Nodes should be installed in 19-inch equipment cabinets and all interface cables must be labeled. Video that is placed on the MDOT Node fiber ring or any city/agency traffic cameras must be available/delivered to a monitoring wall in the TMC. Type C network switches that interface with field devices will connect to the communication nodes via Gigabit Ethernet over multimode fiber optic cables.

907-664.03.2—Communication 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 Type III Geotextile and then a 5-inch thick layer of Size 57 Aggregate, 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 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.** The uninterruptible power supply (UPS) shall be mounted at the bottom of the equipment rack containing the communication node and network switch. The communication node and network switch input and any ancillary equipment power supplies shall be connected to the UPS. The UPS network interface shall be connected to the network switch.

**907-664.03.2.2--Grounding System.** All grounding and bonding materials shall be connected in accordance with 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. Grounding or bonding wire or strap shall not be spliced. 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 the Engineer’s 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 AWG or smaller shall be eight inches (8”). Minimum bending radius of any interior grounding wire #2 AWG 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 master ground buss bar (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 AWG BSC that is exothermically welded to the bottom of the bar. The MGB shall be installed with standoffs in the lower center of the hub wall. The MGB down conductor shall be installed through the PVC ground wire sleeve directly to the chemically-enhanced ground rod in the grounding ring immediately outside of the building. The area around the ground wire shall be sealed in the sleeve entry hole with waterproof outdoor-rated silicone caulk. Expanding foam or caulk products shall not be used. The electrical panel load center and the generator supply transfer switch shall be bonded to the MGB with #2 AWG BSC. Each individual equipment rack shall be bonded directly to the cable runway with a #2 AWG BSC. Inside the hub building, the hub door shall be bonded 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. The door frame shall be bonded directly to the MGB with a #6 AWG BSC. Unless otherwise specified, all any other metallic materials in the hub interior shall be bonded 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-pound magnesium material. The hub ring ground rods and ground strap shall be installed at a depth of 18 inches. The ground strap shall be installed in one continuous length; do not splice. Ground ring inspection handholes shall be installed at the four ground rods outside the corners of the building. The top of the ground rod shall be exposed for inspection. Chemically-enhanced ground rods shall be installed at the Hub Single Point Ground (HSPG) immediately outside of the hub building below the MGB position. A ground ring shall be installed with a minimum of seven ground rods and one chemically-enhanced ground rod at the HSPG. Ground enhancement material shall be provided as required to comply with the maximum ground impedance requirements. As a minimum, ground enhancement material shall be provided for the complete length of the hub grounding ring strap. Corrosion protection sacrificial anodes shall be installed in accordance with the manufacturer’s recommendations. A minimum of one shall be installed 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 the Department.

Network switches are not included in this work. Network switches shall be provided by the Contractor per the plans under the appropriate pay item number. Installation, configuration, and cabling of the Communication Node is inclusive of all devices, and network switches that are located in the Communications 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 Department 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 hut. All equipment shall be installed according to the manufacturer’s recommendations or as directed by the Department.

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, Communication Hut, Communications Node Equipment Installation and Configuration, and Communication Node Modification will be measured per each.

Communications Node Training will be measured per lump sum.

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

The OTN Node Training, measured as prescribed above, will be paid for at the contract lump sum price, which price shall be full compensation for all materials and software for all equipment, travel expenses, software and incidentals necessary to complete the work.

Payment will be made under:

907-664-A: Communications Node - per each
907-664-B: Communications Node Hut - per each
907-664-C: Communications Node Equipment Installation and Configuration - per each
907-664-D: Communications Node Modifications - per each
907-664-E: Communications Node Training - lump sum