

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	87 N-0720-01	2023	349	517

19.2 MATERIALS

19.2.1 GENERAL

Supply all tools, equipment, materials, supplies, and manufactured articles and perform all operations necessary to install KDOT furnished equipment and construct the communications facilities as shown on the Plans and as specified herein, or as directed by the Engineer.

19.2.2 CONNECTORS, CABLES AND ADAPTERS

Incidental items include all connectors, adaptors, and cables, including but not limited to serial cables, alarm cables, all power cables for Cisco equipment, DC power cables, AC power cables, fiber optic jumpers, DS-1 cables, Ethernet cables, interface cables, located within and between all ITS cabinets and KDOT designated facilities. There will be no separate payment for incidental items. Use outdoor-rated for cables exposed to weather conditions or installed in field cabinets.

19.3 CONSTRUCTION REQUIREMENTS

19.3.1 GENERAL

Furnish all tools, equipment, materials, supplies, and manufactured articles and perform all operations necessary to install KDOT-furnished equipment and Contractor-furnished equipment and construct the communications facilities as shown on the Plans and as specified herein.

19.3.2 KDOT FURNISHED EQUIPMENT

Receive and review the installation wiring diagrams from the KDOT-furnished communication equipment suppliers. Use these drawings to make necessary terminations to all KDOT-furnished and Contractor-furnished communication equipment.

19.3.3 COMMUNICATION SCHEMATIC DRAWINGS

Submit as-built communication schematic drawings to the Engineer based on the actual connections made in the field and in the KDOT designated facility. Include in the as-built communication schematic drawings all equipment, both KDOT furnished and Contractor furnished. Leave a copy of these approved drawings in each respective ITS cabinet or KDOT designated facility. Use documentation format as specified in these specifications.

19.3.4 NETWORK CONFIGURATIONS

KDOT will provide IP addressing and configuration files for each KDOT furnished communication equipment type. Make all necessary network configurations. Coordinate with KDOT and receive approval for any downtime necessary to connect the new network components.

19.3.5 COORDINATION

Provide a skilled staff member to attend a coordination meeting prior to installation of communication equipment.

19.4 INTEGRATION WITH CENTRAL SOFTWARE

Ensure proper integration and functionality with systems as identified by KDOT or KC Scout. Ensure continuity of functions currently in place, and prevent disruption of service for any sites not included in the plans. Coordinate with KDOT or KC Scout to identify affected systems and devise methods to prevent service interruptions.

Perform software integration testing in coordination with KDOT or KC Scout on ATMS and video distribution systems. Configure both KDOT furnished and Contractor furnished equipment as needed in order to achieve functionality prescribed by KDOT. Travel to site locations as many times as required to test and configure equipment to provide a working communication system with KDOT or KC Scout central software. Complete integration prior to final acceptance.

20.0 ITS COMPONENT TESTING

20.1 DESCRIPTION

Test all ITS devices and communication links installed in this project. Demonstrate functionality of each device using a test plan provided by KDOT. Test plans will include a list of items to be tested, a test method (observation, calculation, or demonstration), an expected result, and an obtained result. Seek KDOT approval for input or specific procedures or for modifications to the test plan.

First, test each unit with its vendor software, then coordinate with KDOT to test with KDOT ATMS software, finally check transmission at site and at the KDOT designated facility. Demonstrate through testing that the equipment associated with each cabinet works as required. The tests described below are in addition to any other tests required herein.

20.2 MATERIALS

Provide all testing equipment, labor, materials and incidentals required to carry out the KDOT-provided test plan and all tests described in this section.

20.3 CABINET LEVEL FUNCTIONAL TESTS

Perform testing on each of the field components installed. Ensure that this testing verifies the proper functioning of the field components after installation. Perform the tests identified under this type of testing on each installed component and ensure the results are signed off by the Engineer or designated KDOT representative.

Provide copies of the test results for each component to KDOT and if requested, the test hardware and software.

20.3.1 CCTV PAN-TILT-ZOOM (PTZ) CAMERA CONTROL TEST

Ensure that the PTZ camera control test verifies the functionality of the installed camera controller as well as the serial communication to the camera controller. This test will use vendor test software to the CCTV camera to be commanded to turn on; turn off; send a message to the controller to pan right and left; send a message to the controller to tilt up and down; and send a message to the camera controller to zoom-in and zoom-out.

20.3.2 CCTV STAND-ALONE TEST

Following the installation, conduct an approved stand-alone test for each CCTV to verify that the units operate as specified. Ensure that this test demonstrates that video data from the CCTV camera can be manually selected on the IP network switch and be displayed on a workstation monitor at a KDOT-designated facility. Use vendor's software to test the CCTV camera for the follow commands: to turn on, turn off, pan right and left, tilt up and down, and zoom-in and zoom-out. If a unit fails to pass the stand-alone test, correct or replace the unit, and repeat the test until proven successful.

For each unit of equipment, conduct approved stand-alone tests that exercise all stand-alone functional operations of the equipment including the following: control of focus, iris, and power on/off; range of pan, tilt, zoom and digital zoom; presence and quality of video signal; camera ID and preset text generation; and pan and tilt limit stops are set to the Engineer's specification.

Stand-alone test the CCTV camera assembly for no-less-than 24 hours as a complete unit to include the CCTV camera, all cabling, all surge suppression, video encoder and/or IP network switch (if applicable) as required per project plans and specifications. This testing will require that each CCTV location be connected to a laptop to exercise the CCTV camera functionality.

Verify the video transmission quality; response to all central software commands identified under functional requirements; horizontal and vertical resolution; and verify the video transmission quality to the designated KDOT or KC Scout facility. Conduct the test in the following order: test with vendor software at site, test with the ATMS software, verify video transmission at site, and verify video transmission at the designated KDOT or KC Scout facility. Test video for smooth frame transmission, good color, and overall image quality. Ensure no video locking.

Prior to testing, the contractor shall program CCTV cameras according to the documented requirements. Coordinate with the Engineer to obtain written programming procedures. After programming is complete, the Engineer will verify that cameras are correctly programmed, and network communication is functional. Once programming and communication is verified, the CCTV subsystem test may begin.

20.4 DYNAMIC MESSAGE SIGN TEST

Perform the DMS test to evaluate the functionality of the installed DMS signs as well as the communication links between the controller and the KDOT central software. Use vendor software and KDOT's current NTCIP-compliant central software for this test. This testing will require that each DMS location be connected to a laptop to exercise DMS functionality. Contact and coordinate with the DMS manufacturer to power up the unit and perform sign commissioning. Provide all equipment required to complete testing.

20.4.1 DMS STAND-ALONE TEST

Following the installation, including power connectivity, conduct an approved stand-alone test for each DMS assembly to verify that the unit operates as specified. Complete the stand-alone test for each DMS within two weeks following the installation of the DMS case, cabinet, power, and communication links. If a unit fails to pass the stand-alone test, correct or replace, and repeat the test until proven successful.

If DMS parts are defective, coordinate with the DMS vendor to obtain warranty replacement of defective parts for DMS or other KDOT-provided equipment and reinstall at no charge to KDOT.

Perform the stand-alone test for the DMS system using both the controller front display panel and a laptop. Provide the laptop. The DMS manufacturer shall provide the vendor software for the test.

20.4.2 DMS COMMISSIONING

Manufacturer shall perform on-site DMS commissioning including communication testing with KDOT central software. DMS commissioning includes the following items: DMS system is installed correctly, DMS system is functioning correctly, DMS is ready for normal operations without the need for an additional site visit, record of all tests and setup tests performed. Manufacturer shall provide procedures. DMS commissioning shall include the following tests in this order: test with vendor software at site, test with KDOT central software, verify transmission at site, verify transmission at KDOT facility.

20.5 VEHICLE DETECTOR TEST

Test each radar vehicle detector to confirm the accuracy of the data reported to the KDOT designated facility staff.

20.5.1 VOLUME

Use human observers to count the vehicles in each lane during a 15 minute interval. The total for each lane shall be compared with the lane total for the same period reported by the central computer. The totals from the computer and from the observers must not differ by more than 10 percent for every lane.

20.5.2 SPEED

Conduct this test one lane at a time. Use a trained, experienced operator with a LIDAR gun to measure the speeds of individual vehicles, excluding large trucks, in the lane. Measure as many vehicles as possible in a 10 minute period and the results averaged. Calculate a weighted average speed for the same period based on data from the central computer. Weight the speed for each reporting period by the number of vehicles in that reporting period. The speeds from the computer must be within fifteen percent of the observed speed for every lane. If vehicles in the closest lane interfere with speed measurements in other lanes, provide a means of elevating the observer enough to provide a clear line of sight to the vehicles being observed.

20.6 60 DAY ACCEPTANCE TESTING

The test period for each device (including all CCTV, DMS, and VDS) will be 60 days, to commence when all work has been completed, materials have been furnished and completely installed, and copies of the test results have been received and accepted by the Engineer. Final system acceptance for each device will be defined as when the device has operated continuously and successfully for 60 calendar days with no more than 2 calendar days downtime due to mechanical, electrical, and/or other malfunctions.

20.7 WIRELESS DATA COMMUNICATIONS LINK TEST

Prior to testing an installed link, calculate expected signal strengths for each link and expected throughput. Include the following in the test plans installation documentation for each site: Transmit power setting, antenna type and gain, antenna azimuth, transmit frequencies (or channel/band for broadband equipment), antenna height, and minimum receive power for the applicable modulation scheme/throughput as provided by the manufacturer. Include in the test reports: signal quality, modulation scheme selected (or selected by device if automatic), link throughput for TCP and UDP protocols using a tool such as Iperf over a period of no less than 60 seconds and packet loss over a period of no less than 60 seconds. Include in the test report comparisons of observed and expected throughput for each link. Provide test results to the Engineer.

20.8 FIBER OPTIC TESTS

Provide sample test results and test procedures to the Engineer for approval before testing begins.

After all splices and terminations have been completed, test each fiber, including spares and unterminated fibers, with a power meter/stable laser source and OTDR between termination points (or ends of fiber for unterminated fiber). Test fiber optic cables bi-directionally. Provide launch cable when testing. Provide launch cable of appropriate length based on pulse width. Both ends of the tested fiber need a launch cable to accurately measure connectors.

Conduct power meter tests for each fiber to demonstrate connectivity and attenuation from origin to destination. Model this test after FOTP-171 insertion loss. Demonstrate that the attenuation for each fiber path including connectors, and splices as a whole, comply with the loss budgets required by these documents. Submit a test result summary sheet showing calculated attenuation, splice and connector losses, and tested loss for each fiber to the Engineer for review and approval. The Contractor may request a sample test result summary sheet. Test between termination and ITS Cabinets as designated by the Engineer.

Conduct bi-directional OTDR and power meter tests end to end. End to end is defined as KDOT designated facility to field device. This includes tests for each fiber from the designated KDOT facility to the field device. If using two OTDR or power meter testers, verify that they are providing similar results using the same pulse width on a single fiber prior to testing. Provide these results to the Engineer upon request. Provide a launch cable that is at least ten times the pulse width used for the test and a receive cable.

Conduct the tests at test wavelengths of 1310 nm and 1550 nm. Prior to testing, provide the Engineer with an example test sheet for approval that includes OTDR and power meter test data as well as physical characteristics of the fiber optic cable and the cable run. Provide OTDR trace results in a graphical form acceptable to the Engineer. Identify direction using an A/B identifier for each fiber tested. Identify the pulse width used on all trace results.

The actual link loss must be less than the calculated maximum for each fiber and no unexplained events shall exist. If any fiber fails to satisfy the specified performance requirements in the 1310 nm or 1550 nm wavelength tests, determine the cause and correct the failure to the satisfaction of the Engineer. Provide electronic copies of all test results to the Engineer. Provide test results with a summary table indicating fiber data, calculated losses, 1310 nm results, 1550 nm results, and fiber identification.

Plotted : 25-SEP-2023 18:45

Drawn By : lovohs
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KANSAS DEPARTMENT OF TRANSPORTATION				
ITS EQUIPMENT SPECIFICATIONS				
ITS-S12		VERSION DATE: 02-12-21		
APPD	DESIGNED	DETAILED	QUANTITIES	TRACED
	DESIGN CK.	DETAIL CK.	QUAN. CK.	TRACE CK.