12.2.6 VIDEO ENCODER
Provide video encoders that are an Impath i-Volution i5110-ET ruggedized multi-protocol standalone encoder with Vicon protocol or approved equal as shown on the construction Plans. Encoders submitted as an approved equal must be capable of all i5110-ET protocols and have been tested and proven to be compatible with KDOT's ATMS software.
The following requirements apply:
1. Temperature hardened NEMA 4 for outdoor applications (-34°C to +74°C)
2. Concurrent H.264, MPEG 2, MPEG 4 video streaming
3. Up to full D-1 resolution
4. Unicast and Multicast Video
5. Auto-Start video streaming
6. 1 Video input and 2 serial data ports (RS232 and RS422/485)
7. Network Interface IEEE 802.3 Ethernet RJ-45
8. Embedded Web-based manager
9. Embedded Web-based video viewing utility that can display live video and provide control of pan-tilt-zoom, focus, and preset functioning.

12.2.7 POWER SUPPLY
Furnish and install a power supply that meets the following minimum requirements.
1. To be used with outdoor dome PTZ cameras
2. Input Voltage: 120V, 50/60 Hz
3. Output Voltage: 24V
4. Output Current: 2A to 4A
5. Output Power: 50VA 100VA
6. Compliant to NEMA TS2
7. Operating Temperature: -10˚C to 45˚C
8. Humidity: Up to 90% relative, non-condensing

12.2.8 SURGE PROTECTION
Furnish and install a surge protection system that consists of the following components:
1. Surge protection on power conductors. Ensure that the conductors carrying power to the camera assembly are protected by surge protectors in the cabinet.
2. Surge protection on communication conductors. Ensure that the conductors carrying control signals from the cabinet to the camera are protected by surge protectors in the cabinet.
3. Surge protection for coaxial cable, when applicable. Ensure that the coaxial cable carrying the video signal from the camera assembly to the cabinet is protected by a surge protector in the cabinet.

Provide surge protector products that meet the following minimum requirements:
1. UL listed and labeled to current editions of UL 497B and UL 497C
2. Operating Temperature: -40°F to 185°F
3. Operating Humidity: 95% RH non-condensing
4. Wall, DIN rail or 19" rack mountable
5. Three stage protection
6. 10 year product warranty
7. The minimum requirements listed on the following table:

Circuit	Maximum Continuous Operating Voltage	Frequency/ Bandwidth/ Data Rate	Surge Capacity	Max. Let-Through Voltage
12 VDC	15-20 V	N/A	5kA per mode (8x20 µs)	<150Vpk
24 VAC	30-55 V	N/A	5kA per mode (8x20 µs)	<175Vpk
48 VDC	60-85 V	N/A	5kA per mode (8x20 µs)	<200Vpk
Coaxial Composite Video	4-8 V	Up to 1.5 GHz	10kA per mode (8x20 µs)	<100Vpk
RS422/ RS485	8-15 V	Up to 10 Mbps	10kA per mode (8x20 µs)	<30Vpk
Ethernet Data	7-12 V	> 100 Mbps/ 125 MHz	3kA per mode (10x1000 µs)	<30Vpk
Power over Ethernet	44-52 V	> 100 Mbps/ 125 MHz	10kA per mode (8x20 µs)	<90Vpk

12.2.9 AIR TERMINAL
Furnish and install a solid or tubular aluminum, copper, or stainless steel at least 5/8 inch in diameter air terminal. Use air terminals that are UL listed.

12.2.10 POLE GROUNDING
Provide pole grounding that meets the requirements of the Power Supply Assembly, Power, and Grounding sections of these specifications.

12.2.11 TRANSPORTATION
Obtain the correct transportation guidelines from the manufacturer and implement these guidelines. Take precautions to ensure no damage to the lowering system.

12.3 CONSTRUCTION REQUIREMENTS

12.3.1 CAMERA ASSEMBLIES
Install the dome so that the pole does not block the camera's view of traffic. Refer to the Plans for guidance on where the allowable blind spot is located.

12.3.2 POLE AND FOUNDATION
Contact the Engineer a minimum of two weeks prior to final placement of the CCTV foundation to schedule the final location review. Brace concrete poles after placement of fill for a period of no less than 24 hours.

12.3.3 NETWORK SWITCH CONNECTIONS
Request port assignments from the Engineer/owner at least 4 weeks prior to making the physical connections to the network switch. Supply technicians with at least one year of experience installing and configuring Cisco network switches. Submit experience resume to the Engineer for approval prior to performing any work.

12.3.4 SURGE PROTECTION
Terminate all the cables on surge protectors.

12.3.5 AIR TERMINAL
Install the air terminal on the opposite side of the pole from the dome. Position the rod to project a minimum of 5 feet in length above the top of pole (not including the lowering device cap) with an equal length to be mounted to the pole. Provide and install an air terminal mounting bracket. Locate and size the air terminal to adhere to the 150 foot radius rolling sphere model as described in NFPA 780 and as shown on the Plans. Seek approval from Engineer for adjustment of 5 foot height requirement.

Apply a copper-based conductive sealant between the rod and the pole before tightening the bolts. Perform all work related to the installation of the air terminal in accordance with NFPA 780.

12.3.6 POLE GROUNDING
Connect the bottom of the pole to one or more ground rods using a minimum #4 stranded or solid copper grounding conductor from pole to grounding rod. Construct the ground conductor to travel through the foundation in a schedule 40, non-metallic, U.L. listed conduit as shown in the plans. If the steel pole thickness is 3/16 inch or less, use a copper down grounding conductor. Clean galvanized ground lug at bottom connection point prior toexothermic welding. Use exothermic welding for all ground wire connections, except the connection to the pole, which shall use the pole's grounding lug.

Use a device that measures resistance to ground using the three-point fall-of-potential method to ensure that the resistance from the air terminal to ground does not exceed 5 ohms in dry conditions. Add more ground rods if necessary to achieve this requirement. Bond multiple grounding rod electrode assemblies to each other with No. 2 AWG solid bare tinned copper wire that is exothermically welded at all connection points.

12.3.7 CCTV CAMERA LOWERING SYSTEM
Ensure that the lowering device manufacturer furnishes a factory representative to assist with the assembly and testing of the first installation of the lowering system onto the pole assembly. Ensure that this installation is working properly and is approved by the Engineer prior to a second installation. Ensure that the lowering device manufacturer is available to assist in a second installation or possibly a third installation until the manufacturer and KDOT are satisfied with proper installation. Provide from the manufacturer the applicable documentation certifying that the Contractor has been instructed on the installation, operation and safety features of the lowering device. Provide the Engineer with operational instructions.

13.0 VEHICLE DETECTION SYSTEM

13.1 DESCRIPTION
Furnish and install a Vehicle Detection System (VDS) including lightning surge protection, AC/DC power converter and a media converter for Ethernet communications for the purposes of detecting vehicular speed, volume counts, and lane occupancies. Install in the locations shown on the Plans.

13.2 MATERIALS

13.2.1 RADAR VEHICLE DETECTORS (DETECTORS)
Include all the cables, connectors, and mounting hardware recommended by the manufacturer for proper operation of the system. If required, provide a Wavetronix Smartsensor HD (model SS126) unit or approved equal including lightning surge protection, AC/DC power converter and a media converter for Ethernet communications that meets the following minimum requirements.

13.2.1.1 PERFORMANCE
The following requirements apply:
1. Able to measure volume, occupancy (including slow moving or stationary vehicles), classification counts, and speed, when in a sidefire configuration and mounted as shown on the Plans.
2. Suitable for polled operation using multipoint RS-232 communication at 9600 bits per second.
3. Detection range: 6.0 to 250.0 feet.
4. Detection Zone: Up to 22 traffic lanes simultaneously
5. Operating Frequency: 24.0-24.25 GHz
6. Transmit bandwidth: 245 MHz.
7. Transmitter power: up to 10 W.
8. Operating temperature range: -40°C to +74°C.
9. Operating humidity range from 5 to 95% RH.
10. Meets FCC rules Part 15 for interference.
11. Occupies no more than 0.6 cubic feet.
12. Weighs no more than 15 lbs.
13. Housing sealed to withstand rain (or snow) up to a rate of 2 inches per hour or wind loads up to 90mph.
14. Includes a mounting assembly for each radar detector with the following requirements: stainless steel or all aluminum construction, capable of supporting a load of 20 lb., capable of being mounted on the side of the pole approved by the manufacturer of the microwave detector.
15. Includes a twisted-pair cable between the cabinet and each microwave detector with the following requirements: provides both power and serial communication, UV-resistant and rated for 300 volts, terminate on a single MS connector.

13.2.2 LAPTOP SOFTWARE
Provide vendor software that enables a technician to test all features and functions of the detector, and perform all set-up procedures with a web based interface. Deliver this software on a CD so that it can be installed on other computers. Ensure that the Engineer has the right to make and use an unlimited number of copies of this software.

13.2.3 COMMUNICATION PROTOCOL
Demonstrate that the radar vehicle detector can communicate with KDOT ATMS software or is compliant with the National Transportation Communications for ITS Protocol (NTCIP). To be NTCIP compliant, ensure that the detector adheres to the version of the following standards that is current at the time of bidding:
1. Information level: NTCIP Standard 1209, including implementation of the TSS Data Collection conformance group.
2. Application level: NTCIP Standard 1101, Compliance Level 2.
3. Transport level: Null protocol
4. Subnetwork level: NTCIP Standard 2101

13.2.4 DOCUMENTATION
Supply full documentation of all manufacturer-specific objects supported by the detector. Submit this in the form of a CD containing ASCII versions of a MIB in ASN.1 format. Ensure that the MIB contains accurate and meaningful description fields and supported ranges indicated in the syntax field of the object-type macros. Ensure that the manufacturer will allow the use of any and all of the documentation described above by the Engineer for system integration purposes at any time, regardless of what parties are involved in the system integration effort.

13.2.5 DEVICE SERVER
Provide a Wavetronix Click 301 device server or approved equal (if specified in the plans) which will allow the detector to communicate over the Ethernet IP network when the detector is connected to an Ethernet network device. Provide a device server that meets the following minimum requirements:
1. Able to convert half-duplex serial communication to Ethernet and vice versa
2. Include multiple communication ports: Ethernet, RS-485, RS-232 DTE
3. Use either Ethernet or serial interfaces to configure baud rates
4. Operating temperature range: -34°C to +74°C
5. Operating humidity range from 5 to 95% RH
6. Input voltage range between 10 to 30 VDC

If multiple vehicle detectors are present at one location, ensure physical separation between the click components for each vehicle detector. Ensure no T-bus connections occur between different detector components.

13.2.6 SURGE PROTECTION/POWER CONVERTER
Provide a Wavetronix Click 200 surge protector or approved equal that meets the following minimum requirements:
1. Three-stage surge suppression design over DC, RS-232 and RS-485 lines
2. Meets NEMA TS2-1998 environmental testing and IEC 61000-4-5 electrical surge test
3. Operating temperature range: -30°C to +70°C
4. Operating humidity range from 5 to 95% RH

Use these inside the cabinet in order to protect both the power and the communication lines.

NO.	DATE	REVISIONS	BY	APP'D

KANSAS DEPARTMENT OF TRANSPORTATION

ITS EQUIPMENT SPECIFICATIONS

ITS-S08 VERSION DATE: 05-29-17

APP'D			
DESIGNED	DETAILED	QUANTITIES	TRACED
DESIGN CK.	DETAIL CK.	QUAN. CK.	TRACE CK.

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