Make the following section part of the Standard Specifications:

**"SECTION 627 – TRAFFIC MONITORING AND SIGNAL CONTROL SYSTEM**

**627.01 DESCRIPTION.** This section shall consist of all work and materials necessary to complete a fully operational CCTV and signal control system for traffic control and surveillance of various sites shown on the plans. The work shall involve coordinating all equipment and labor necessary to incorporate and integrate the two new signalized intersections into HDOT's H-3 Traffic Operations Center (TOC) and/or City's Joint Traffic Management Center (JTMC) systems, using Internet Protocol (IP) based communications. The expanded CCTV and signal control system will assist operators at the TOC and/or JTMC to monitor traffic conditions, mitigate traffic congestion, and set the appropriate traffic plans which best suits and improves the traffic progression along Oahu's busiest arterials.

The CCTV and signal control system shall consist of remotely controlled color cameras, remote video switching, IP communications system, cellular modems and a fiber optic interconnect system. The local traffic signal control system will send control data transmitted over two single-mode fibers through a 100/1000/10000base T/FX IP switch. At the Uluoa intersection a cellular modem will transmit the control data to a traffic signal central server located at the JTMC. In addition, the traffic surveillance CCTV cameras will be connected directly to a cellular modem and video data will be transmitted to the TOC servers.

All CCTV camera equipment shall be identical and/or compatible with the City's and HDOT's existing CCTV system in terms of hardware and software.

Due to the intricate nature of HDOT's CCTV and fiber optic cable system, the Bidder's CCTV supplier shall have previous experience working with the City and County of Honolulu or HDOT's existing CCTV system for at least three (3) previous projects. Written documentation confirming previous experience working on either CCTV systems or fiber systems shall be submitted to the project Manager before January 25, 2024, at 3:30 PM (within five (5) working days after bid opening).

The CCTV firm shall be responsible for testing all fiberoptic hardware and cables to provide a documented optical budget loss analysis for each link to and from a hub station. The CCTV supplier will be responsible for all hookup, assignments, dedication, testing, matching, and splicing of the fiberoptic cables. All fiberoptic splice points shall have pigtails on all fiberoptic members which attach to fiberoptic hardware and components with SC-connectors. Six strands of the same buffer tube shall be jumpered color for color using a SC-connectors fiber optic patch panel. Patch cords shall be provided for the six strands connected to the patch panel. All remaining fiber optic strands shall be fusion spliced color for color. The CCTV supplier shall be fully responsible for all splices, budget loss, attenuators, appropriate fiber hardware, accessories, and pigtail connections for a fully operational system. All other hardware, equipment, and labor necessary shall be considered incidental.

The firm shall track and document the installation data and tension measurements when installing the fiberoptic cables. Any tension measurements which exceeds the manufacturer's recommendations will be considered means for the cable rejection. The Fiberoptic Contractor shall be fully responsible for the quality and integrity of the installed cable and the operability of the final fiberoptic cable product. The Fiberoptic Cable Contractor shall be responsible for testing all fiber optic strands and to provide a documented optical budget loss analysis report showing the acceptable budget losses from one end to the other end of all fiber optic strands.

**627.02 TRAFFIC SIGNAL CONTROL SYSTEM.** For bidding purposes, the CCTV Supplier shall furnish and install all the necessary items to provide traffic signal control from the JTMC, to all three traffic signal controllers, utilizing HDOT's existing central server. All other equipment necessary to complete a fully operational system will be considered incidental.

The traffic signal controller will communicate with the JTMC over an Ethernet network.

The Contractor shall at each new signalized intersection furnish and install, but not limited to, the following items:

**(A) Traffic Signal Central Server**. The Contractor shall furnish and install the necessary licenses that will allow the two new signalized intersections to communicate and work with HDOT's traffic signal central server.

**(B) CCTV Cabinet.** A CCTV cabinet with foundation shall be provided at each new signalized intersection. All cabinet shall be furnished assembled and configured with the components stated below:

Cabinet shall be a Traffic Signal 332LS anodized aluminum cabinet with a 19" rack, 50 amp circuit breaker, surge-protected, and thermo-control fan.

Each Model 332LS Cabinet shall meet the following additional requirements:

**(1)** Provide Best Lock (C&C of Honolulu keyed) Security Tumbler Door locks of solid brass rim and include 4 keys.
**(2)** A rack mounted 6 outlet surge protector power strip
**(3)** A 19 inch pull out shelf
**(4)** Remote data port with monitor and control, Stand Alone, all connectors and cables included
**(5)** Rack Mounted 72 fiber optic Splice Capacity Tray
**(6)** Rack Mounted 72 fiber optic SC jumper connector

Surge Protection: Contractor shall install a 120V AC, 3-wire, 20 Amp inline surge protection device. The surge protection device will have an operating temperature of -40 to 85 degree C, maximum surge current of 30,000 amps

and surge voltage of 10,000 volts, 138 Volts for clamping voltage, power indicator, open circuit for fail safe operation, and protection shall be between line to neutral, line to ground, ground to neutral.

Furnish and install power cables from existing traffic signal meter or new Hawaiian Electric service point.

**(C) Hardened Ethernet Switch.** The network managed Layer 2, with light Layer 3 managed switch is a hardened DIN-rail mounted managed PoE++ Ethernet switch equipped with 12 gigabit PoE++ ports along with 360W power and IEEE 802.3.bt protocol support and 4 dual rate 1G/10G SFP ports. The managed switch shall be optically and electrically compatible with any IEEE 802.3 compliant Ethernet devices. The managed Ethernet switch will provide transmission of eight 100/1000 BASE-TX and four 1/10G FX ports. The managed Ethernet switches shall be environmentally hardened units, designed for roadside operating environments, and are available for use with either conventional CAT 6 copper or optical transmission media. CAT 6 cables shall be provided between the switch and the traffic signal controllers. The twelve electrical ports support the 10/100/1000 Mbps Ethernet IEEE 802.3 protocol, auto-negotiating, and auto-MDI/MDIX, four 1/10G FX ports are configurable for copper or fiber media for use with multimode or single mode optical fiber, selected by optional SFP modules, plug-and-play design, and no electrical or optical adjustments required. LED indicators for monitoring the operating status of the managed switch and network and is either DIN-rail or wall mountable.

The hardened managed Ethernet switch shall meet the following minimum requirements:

**(1)** Layer 2 with light Layer 3 managed switch
**(2)** Layer 3 Features at a minimum includes IP Packet Routing (64 hardware routes, Static routing, RIP v1/v2, OSPF v2) and Routing Redundancy
**(3)** Transmission of 4 channels of 1/10G over one or two single-mode fibers respectively.
**(4)** Transmission of 12 channels of 10/100/1000 Mbps over Cat-6 cable.
**(5)** 2 – Hardened Single (LC), 1 Gigabit, 40 Km SFP modules.
**(6)** 2 – Hardened Duplex (LC), 1 Gigabit, 40 Km SFP modules.
**(7)** 2 – Hardened Duplex (LC), 10 Gigabit, 40 Km SFP modules (1310 nm).
**(8)** Up to 90W per PoE port, with a power budget of 360 Watts. Compliance to IEEE 802.3bt type 4.
**(9)** Shall support the Ethernet data IEEE 802.3 protocol using Auto-negotiating for port speed and duplex.
**(10)** Provide power, link speed, and fiber port status indicating LED's for monitoring system operation.

**(11)** Provide 2 - alarm contact closure.
**(12)** Power Supply: 480W / 10A DIN Rail, 48VDC Industrial Power Supply, similar to NDR-480-48 or equal
**(13)** Serial connection with cable for local management of the device.
**(14)** Shall operate in an environment with relative humidity of 5% to 95% (non-condensing).
**(15)** Shall operate in an environment with ambient temperature range of –40° C to +75° C without the assistance of fan-forced cooling.
**(16)** Shall be DIN rail mountable.
**(17)** Lifetime manufactures warranty.

**(D) Cellular Modem.** Procure, configure, and install a single environmentally hardened cellular modem and all required accessories with static IP addresses at the Uluoa St intersection for traffic signal control system communication only. Cellular modem shall be capable of accessing the FirstNet Band 14 as well as the 5G cellular network when available. The modem shall provide communication between the fiber optic interconnect system and HDOT's traffic signal central system.

The cellular modem shall include or comply with the following:

**(1)** Two Ethernet LAN/WAN ports, minimum.
**(2)** USB 2.0 or better port.
**(3)** Two cellular antenna connectors with antennas and required accessories.
**(4)** GPS antenna connector with antenna and required accessories.
**(5)** Operating temperature range: -22ºF to 158ºF.
**(6)** Storage temperature range: -40ºF to 185ºF.
**(7)** Operating and storage humidity (non-condensing) ranges: 5% to 95%.
**(8)** Ingress protection compliant with IP64.
**(9)** Networking.
1. IPsec Tunnel — up to ten concurrent sessions
2. IKEv2 support (includes MOBIKE)
3. Access Control Lists
4. NAT
5. NAT-less Routing

**(10)** Security.
1. 802.1x authentication for Ethernet
2. Certificate support
3. Application-level gateways
4. MAC Address Filtering

Provide FirstNet cellular modem data service, including activation and monthly data service. When the Engineer has determined the project has reached completion, the Contractor shall coordinate with the Engineer to transfer the cellular service to HDOT.

**(E) Fiber Optic Cable.** The fiber optic cables, which will be used to transmit video and data signals, will consist of 6 or 72 single-mode fibers. See Contract Plans. Cables will be installed.

Armored loose-tube, 6 or 72 single-mode OS2 fiber optic cable suitable for overhead or underground installation. Cable shall be 8.3/125 micron loose buffer, single-mode, step index optical fiber cable containing glass of type, SMF-28e, AFL SR-15e, or approved equal, and that meets the following specifications:

**(1)** ITU-T G.652 (Categories A, B, C and D)
**(2)** IEC Specification 60793-2-50 Type B1.3
**(3)** TIA/EIA 492-CAAB
**(4)** Telecordia GR-20

All cables shall be free of material or manufacturing defects and dimensional non-uniformity that would;

**(1)** Interfere with the cable installation using accepted cable installation practices.
**(2)** Degrade the transmission performance and environmental resistance after installation.
**(3)** Inhibit proper connection to interfacing elements.
**(4)** Otherwise yield an inferior product.

**(1) Mechanical and Performance Requirements.** The cable shall be a rugged all dielectric armored outdoor cable containing color coded buffer tubes with 12 single mode color-coded fibers per- buffer tube, dual window (1310 nm and 1550 nm) fibers with UV acrylate coating in color coded, gel-free, loose buffer tubes.

Strand the loose buffer tubes around an all-dielectric center strength element using a reverseoscillation lay, wrapped by water blocking core separator or functional equivalent. The maximum allowable attenuation of the fiber is .35 dB/km for 1310 nm and .25 dB/km for1550 nm.

Each buffer tube shall contain a water blocking element for water-blocking protection. The water blocking elements shall be non-nutritive to fungus, electrically non-conductive. The buffer-tube shall be gel-free.

Apply water swellable tape longitudinally around the outside of the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, andhomogenous. It shall also be free from dirt and foreign matter. The cable manufacturer shall be TL 9000 registered.

**(2) Outer Jacket.** Cables shall be all dielectric cable (with armoring) and shall be jacketed (sheathed) with black medium density polyethylene as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

Armored cable shall have two jackets, one molded to the outside of the armor and one that floats freely within the armor and contains the buffer tubes and other fiber optic cable construction components as required.

Apply jacketing material directly over the tensile strength members to provide mechanical protection, and to serve as the primary moisture barrier.

Design cable sheath to meet or exceed the tensile criteria defined in EIA-455-89a. Ensure the jacket or sheath is free of any holes, splits, or blisters. The cable jacket shall contain no metal elements and shall be of a consistent thickness.The cable shall contain at least one ripcord under the sheath for easy sheath removal.

**(3) Temperature.** The shipping, storage, installation, and operating temperature range of the cableshall meet or exceed -20 °F to +155 °F (-29 °C to +60°C).

**(4) Loose Buffer.** Contain single-mode fibers in a loose buffer tube. The configuration shall be dimensionally sized to minimize local stresses and micro bend losses.

The optical fiber cable shall be an approved product of the U.S. Department of Agriculture, Rural Electrification Administration in accordance with the requirements of REA-PE-90, or as otherwise indicated, and shall conform to EIA/TIA-598.

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding.

Buffer tubes shall be polypropylene. Include fillers in the cable core to lend symmetry to the cable cross section where needed.

**(5) Colors.** All optical fibers shall be identifiable by standard color codes as defined in EIA/TIA-598. Each fiber shall be distinguishable, from others by means of color coding and shall conform to the following EIA/TIA sequence of colors:

| | |
|---|---|
| 1. Blue | 7. Red |
| 2. Orange | 8. Black |
| 3. Green | 9. Yellow |
| 4. Brown | 10. Violet |
| 5. Slate | 11. Rose |
| 6. White | 12. Aqua |

Buffer tubes containing fibers shall also be color-coded with distinct and recognizable colors according to the following sequence of colors:

| |
|---|
| 1. Blue |
| 2. Orange |
| 3. Green |
| 4. Brown |
| 5. Slate |
| 6. White |

The color formulation shall be compatible with the fiber coating and be heat stable. Color formulation shall not fade or smear or be susceptible to migration and it shall not affectthe transmission characteristics of the optical fibers and shall not cause fibers to stick together.

**(6) Cable Marking.** The fiber optic cable outer jacket shall be marked with manufacturer's name, the year of manufacture, the words "optical fiber cable", fiber count, type of fiber, and sequential linear foot markings.

1. Repeat the markings every 3 feet.
2. The actual length of the cable shall be within -0/+1% of the length marking.
3. The marking shall be in a contrasting color to the cable jacket.
4. The marking shall be 2.5 mm in height and must be permanent weatherproof and shall not wearoff during the installation in the underground conduit system.

**(7) Quality Assurance Provision.** The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-455-A:

1. Fiber dimensions
2. Attenuation
3. Numerical aperture
4. Fiber proof test
5. Crush resistance
6. Cable bending
7. Tensile load
8. Impact resistance
9. Attenuation vs. Temperature

**(8) Packaging.** Top and bottom ends of the cable shall be available for testing.

Both ends of the cable shall be sealed to prevent the ingress of moisture. Each reel shall have a weather resistant reel tag attached identifying the reel and cable.

The reel tag shall include the following information:

1. Cable number
2. Gross Weight
3. Shipped length in meters
4. Job order number
5. Product Number
6. Date cable tested

Each cable shall be accompanied by a cable data sheet. Cable data shall include manufacturer number, billable length, bandwidth specs and measured attenuation of each fiber.

**(9) Construction Requirements.**

**Material Sample and Certificate of Compliance.** The Contractor shall submit material samples according to Subsection 106.04 – Material Sample, and any certificates of compliance according to Subsection 106.07 – Certificate of Compliance.

The Contractor shall submit a fiber optic cable pulling plan for review and approval by the Engineer prior to beginning fiber optic cable installation. The fiber optic cable pulling plan shall include:

**(1)** Location of start and end of pulls,

**(2)** Location of cable reel trailers during installation,

**(3)** Location of any “figure-eight” of fiber optic cable, and

**(4)** Location of staged equipment.

Upon completion of the work, submit an “As Built” or corrected plan showing in detail the following:

**(1)** Construction changes,

**(2)** Location and attenuation of every event along the installed fiber optic cable,

**(3)** Index of refraction of installed fiber,

**(4)** Fiber optic cable index of refraction, and

**(5)** Sequential fiber optic cable markings at each pullbox, cabinet, and splice closure.

The fiber optic cable Subcontractor shall install the new fiber optic cable underground in conduits as shown on the plans. The Contractor will be responsible for furnishing and pulling the new fiber in PVC ductlines using a breakaway swivel to prevent exceeding the tensile load during installation.

All fiber optic splices shall be fusion splices. Mechanical splices shall not be used. Fiber optic splice locations are permitted only at splice points where splice cabinets are shown on the plans. Fiber optic fibers shall be spliced in every splice cabinet location, and it is the responsibility of the Contractor to maintain a continuous run throughout the system. The Contractor shall leave a minimum of 20-feet of cable service loops at every cabinet and 10 feet at every pullbox.

Provide documented historical cable pulling data indicating tensile forces exerted on the cable during the installation. Any tension measurements, which exceed the manufacturer's recommendation, will be considered means for the cable rejection. The fiber optic cable Subcontractor shall be fully responsible for the quality and integrity of the installed cable and the operability of the final fiber optic cable product. All fibers shall be spliced at camera cabinets, hubs, and splice cabinets and shall have no more than 0.07 dB loss per splice based on the appropriate system operating wavelength.

The Contractor shall complete all required fiber optic splices prior to final testing and acceptance. As part of the final testing and acceptance, submit optical time domain reflectometer (OTDR) readings in both hardcopy and electronic formats (such that it can be examined using the manufacturer's OTDR software) to the Engineer for review. Testing shall be conducted on all single mode fibers at 1310 nm and 1550 nm from the beginning and end of entire run; which includes patch panels and splicing. Powermeter attenuation testing should be performed at dual wavelength, bi-directionally.

All necessary equipment and plug-in, fiber optic pigtails, fittings, splice tags, enclosures, and work to complete an operational system shall be furnished and installed by the Contractor, unless otherwise indicated, at no added cost, and will be considered included in the cost of the contract items in this Section.

**(F) Interconnect Fabric Subduct.**

(1) **Description** Raceway Innerduct shall be installed in all new and existing raceways containing 6 and 72 strand fiber optic cables. A non-metallic flexible textile raceway known as interconnect fabric subduct, which is placed within PVC conduits. The interconnect fabric subduct allows for future communication upgrades, including transitioning from multipair copper cables to fiber optic media. To further that effort and achieve maximum conduit utilization, all new and empty existing conduits containing the interconnect/fiber optic cables shall contain an interconnect fabric subduct. The interconnect fabric subduct shall consist of flexible, textile material, sometimes referred to as “fabric duct”.

(2) **Fabric** The interconnect fabric subduct shall consist of the following:

**(a)** Standard Outdoor Textile subduct: Micro (33mm), 2-inch, 3-inch and 4-inch multi-cell polyester/nylon textile subduct containing 1,250 lb polyester flat woven pull tape.

Number of cells shall be the maximum number allowed for the conduit size.

**(b)** Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile subducts within a conduit.

**(c)** C. Pull Tape: The subduct pull tape shall be constructed of synthetic fiber, printed with accurate sequential footage marks and color-coded.

**(d)** D. Duct Water Seal: products suitable for closing underground and entrance conduit openings where subduct is installed, to prevent entry of gases, liquids, or rodents into the structure.

(3) **Installation** The contractor shall protect the interconnect fabric subduct from the effects of moisture, UV exposure, corrosion and physical damage during installation. The contractor shall install the interconnect fabric subduct prior to installing the new interconnect and fiber optic cables.

The contractor shall provide interconnect fabric subduct in conduits using continuous unspliced lengths of interconnect fabric subduct between pull boxes, and/or termination points as indicated on the drawings.

The contractor shall make a 2" incision, approximately 18" from the end of interconnect fabric subduct. Pull out and cut off approximately 2 feet of pull-tape. Thus, allowing the pull tape ends to retract back into the cells.

Using approximately 6 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of interconnect fabric subduct. Apply black vinyl tape over all knots and the end of interconnect fabric subduct. Using a Bow Line knot tie a swivel to the end of 3 feet pull

tape. For multi-pack installations one swivel is sufficient but stagger each interconnect fabric subduct.

Using a Bow Line knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install interconnect fabric subduct - ensuring that no twist is introduced to the interconnect fabric subduct.

Provide suitable interconnect fabric subduct slack in the pull boxes, and at turns to ensure there is no kinking or binding of the product.

At locations where interconnect fabric subduct will be continuous through a pullbox, allow sufficient slack so that the interconnect fabric subduct may be secured to the side of the pullbox maintaining the minimum bending radius.

At pullboxes serving as the junction location, pull the exposed end of the interconnect fabric subduct to the far end of the pullbox, install termination bag, and secure to the pullbox.

Seal all conduit and interconnect fabric subduct entering the pullboxes to prevent entrance into the pullboxes of gases, liquids or rodents.

**627.03 EXISTING TRAFFIC SIGNAL CONTROLLER FIBER INTERFACE.** At the Kalanianaole Highway/Kailua Road (Waimanalo Junction) intersection, the Contractor shall install a signal controller fiber interface within the existing traffic signal cabinet. The signal controller fiber interface shall include, but not limited to, a hardened ethernet switch, (see Section 627.02(C)) and a fiber splice enclosure which shall be able to fit in the spare space within the existing traffic signal cabinet. The traffic signal controller fiber interface shall allow the existing traffic signal controller to be interconnected with the two new signals.

**627.04 CCTV TRAFFIC CAMERA ASSEMBLY.** The camera assemblies are for traffic monitoring and traffic signal operations at the H-3 Traffic Operations Center (TOC) and/or Joint Traffic Management Center (JTMC). The CCTV cameras shall be directly connected to the cellular modems via an outdoor rated CAT 6 Ethernet cable. Contractor shall supply two CAT 6 cables between the modem and the CCTV cameras; one as a spare. It shall be an integrated camera unit consisting of a receiver, pan & tilt, housing, and cables built as a single assembly having 360 degree of continuous pan rotation. The camera shall have full HD 1080p 30 image resolution with integral 30x optical zoom lens. The positioning device shall include true day-night with variable speed pan and tilt technology with a minimum sensitivity of 0.0 lux @30 IRE. The camera shall provide up to 5 independent output video streams configurable for H.264 and MJPEG and analog video output, electronic image stabilization, and wide dynamic range. Camera assembly shall be furnished with components assembled, complete, and a ready-to-install system. Camera system shall meet FHWA's Buy America requirement.

**(A) CCTV Camera**

## (1) CAMERA IMAGING

**(a)** Image Sensor: Progressive Scan CMOS
**(b)** Image Size: Diagonal 6mm
**(c)** Image Resolution: 1920 horizontal x 1080 vertical pixels
**(d)** Picture Elements (total) 1920 (H) x 1440 (V)
**(e)** Sensitivity: Scene Illumination; F1.4 @ 50% Video
**(1)** 0.4 Lux (0.04 fc) @ 1/30 shutter, color mode
**(2)** 0.0025 Lux (0.00025 fc) @ ½ shutter, mono mode
**(f)** Day/Night Operation: Adjustable (Auto, Color and Mono Modes)
**(g)** Optical Zoom Range: 30x, minimum
**(h)** Digital Zoom: 1x to 12x in 1x increments. The camera system shall support digital zoom limit setting
**(i)** Auto Focus: Selectable Auto/Manual; Minimum Scene Illumination for Reliable Auto Focus shall be no more than 50% video output.
**(j)** Auto Iris; Selectable auto/manual; Iris shall automatically adjust to compensate for changes in scene illumination to maintain constant video level output.
**(k)** Electronic Image Stabilization: Shall support On/Off mode
**(l)** Backlight Compensation: Shall support On/Off mode
**(m)** White Balance: Shall support Auto/Manual mode
**(n)** IR Correction: Shall support On/Off mode
**(o)** Sharpness: Shall provide user control of increases or decreases in image sharpness through 4 user selectable settings of soft, normal, sharp and sharpest

## (2) H.264/MJPEG ENCODING ENGINE

**(a)** The video encoding shall allow the following possible video stream configurations:
**(1)** H.264 Streams: (1) 1920x1080 @ 30fps, (1) 1280x720 @ 30 fps, 720x480 @ 15 fps
**(2)** MJPEG Streams: 1920x1080 @ 10 fps, 1280x720 @ 20 fps
**(3)** Analog Video Output: (1).
**(b)** Each video encoder channel shall provide the following configurable properties;
**(1)** Codec.
**(2)** Video frame shall be adjustable from 30 fps to 1 fps in increments of 1 fps.
**(3)** Bite Rate control
**(c)** Video Stream Protocols; the camera system shall support the following protocols:
**(1)** RTSP/RTP; The RTSP communication shall occur over a TCP socket. RTP video packets shall be sent over UDP.
**(2)** RTSP Interleaved; RTSP commands and the RTP video packets shall be transmitted over a single TCP connection.

**(3)** HTTP tunneling; this mode shall use two separate TCP connections for sending and the other for received data from the client over port 80

**(4)** RTP multicast; this mode shall send RTP video packets to the user assigned multicast destination. This mode shall be required to be enabled or disabled.

**(d)** Network Protocol Layers: TCP, UDP, IPv4, IGMP, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, HTTPS, ARP, and ONVIF Profile S as a minimum.

## (3) PAN AND TILT DRIVE UNIT SPECIFICATIONS

**(a)** Pan Movement; 360 degrees continuous rotation.
**(b)** Pan Speed; Variable from 0.05 to 45 degrees/second .
**(c)** Pan Repeatability; +/- 0.05 degree precision.
**(d)** Pan Preset Speed; 180 degree movement 2.5 < Seconds.
**(e)** Tilt Movement; Minimum of +90 to –90 degrees.
**(f)** Tilt Speed; Variable from 0.05 to 45 degrees/second.
**(g)** Tilt Repeatability; +/- 0.05 degree precision.
**(h)** Tilt Preset Speed; 180 degree movement < 2.5 Seconds.
**(i)** Proportional Zoom Control; Positioning control shall allow variable pan/tilt. speeds based on zoom position.
**(j)** Home Position: Shall be a user defined point.
**(k)** The Inter Process Communication System (IPCS) shall not have any exposed wiring from the positioning drive to the camera head enclosure.

## (4) Electrical

Operating Voltage; The camera system shall provide flexible power input as required by the installation to include:

**(a)** Power over Ethernet, LTPoE++.
**(b)** Power injector

## (5) Certifications/Ratings

**(a)** FCC Class A.
**(b)** International Electrotechnical Commission (IEC) / European Conformity (CE) cover product emission and immunity requirements (CISPR) 22 24.
**(c)** Restriction of Certain Hazardous Substances (RoHs)

## (6) Enclosure

**(a)** Aluminum

**(b)** Dust-tight
**(c)** Waterproof & Pressurized

**(7) Controls**

Shall be controllable or interoperable by a Pelco analog switcher and control System using Pelco P protocol IP protocol shall be controllable by either Pelco P or Onvif protocol.

**(8) Adapter Plate**

A Stainless Steel, ¼" minimum, adapter plate shall be provided to integrate the supplied camera mounting to the existing mounting.

**(9) Warranty**

Manufacturer's warranty period shall be three (3) years minimum.

**Mount**

- Outdoor type
- Aluminum or stainless steel components
- Mount cantilever style on pole shafts using straps, or on horizontal mast arm shaft
- Constructed of marine grade stainless steel
- Has cable feed-through
- Supports up to 100 lbs
- Painted White
- Wall to pole mount adapter, as required
- Provide ability to level and adjust camera to plumb

**(B) Cellular Modem**

Procure, configure, and install environmentally hardened cellular modems and all required accessories with static IP addresses. Cellular modems shall be capable of accessing the FirstNet Band 14 as well as the 5G cellular network when available. The modem shall provide communication between the CCTV cameras and HDOT's CCTV systems up at the H-3 TOC. A modem specifically designated for CCTV communication only will be installed for each new CCTV camera. One modem will be installed at the Uluoa St intersection and another will be installed at the Ulumanu Dr intersection.

All cellular modems shall include or comply with the following:
**(1)** Two Ethernet LAN/WAN ports, minimum.
**(2)** USB 2.0 or better port.
**(3)** Two cellular antenna connectors with antennas and required accessories.
**(4)** GPS antenna connector with antenna and required accessories.
**(5)** Operating temperature range: -22°F to 158°F.
**(6)** Storage temperature range: -40°F to 185°F.

**(7)** Operating and storage humidity (non-condensing) ranges: 5% to 95%.
**(8)** Ingress protection compliant with IP64.
**(9)** If wifi capable, the modem shall be able to disable the wifi capabilities.
**(10)** Networking.
- **(a)** IPsec Tunnel — up to ten concurrent sessions
- **(b)** IKEv2 support (includes MOBIKE)
- **(c)** Access Control Lists
- **(d)** NAT
- **(e)** NAT-less Routing

**(11)**Security.
- **(a)** 802.1x authentication for Ethernet
- **(b)** Certificate support
- **(c)** Application-level gateways
- **(d)** MAC Address Filtering

Provide FirstNet cellular modem data service, including activation and monthly data service to provide 24/7 video to the H-3 TOC. When the Engineer has determined the project has reached completion, the Contractor shall coordinate with the Engineer to transfer the cellular service to HDOT.

**627.05 MEASUREMENT.** Traffic Signal Control System and Existing Traffic Signal Controller Fiber Interface will be paid on a lump sum basis. Measurement for payment will not apply.

The Engineer will measure CCTV Traffic Camera Assembly per each, in accordance with the contract documents, complete in place.

**627.06 PAYMENT.** The Engineer will pay for the accepted Traffic Signal Control System, complete in place, on a lump sum basis. The price shall include furnishing and installing server licenses; CCTV cabinets, conduits and foundations; modems; switches with SFP modules; fiber optic cables and splice trays; cables; splicing; OTDR testing and furnishing results; furnishing and installing any additional items and all tools, labor, equipment, and incidentals necessary to complete the work.

The Engineer will pay for the accepted Existing Traffic Signal Controller Fiber Interface, complete in place, on a lump sum basis. The price shall include furnishing and installing the items, and all tools, labor, equipment, and incidentals necessary to complete the work.

The Engineer will pay for accepted quantities of the CCTV Traffic Camera Assembly at the contract unit price per each completed in place. The price shall include CCTV cameras; modems; cables; splicing; making the connections; testing; providing turn-on service; furnishing and installing any additional items, and all tools, labor, equipment, and incidentals necessary to complete the work.

The Engineer will pay for the FirstNet cellular modem data service activation and the three cellular modem data service monthly costs. These items will be paid for on a force account basis in accordance with Subsection 109.6 – Force Account Provisions and Compensation.

The Engineer will consider full compensation for additional materials and labor not specifically shown or called for that are necessary to complete the work incidental to the various contract items in the proposal. The Engineer will pay for each of the following pay items when included in the proposal schedule:

| **Pay Item** | **Pay Unit** |
|---|---|
| Traffic Signal Control System | Lump Sum |
| Existing Traffic Signal Controller Fiber Interface | Lump Sum |
| CCTV Traffic Camera Assembly | Each |
| Cellular Modem Data Service | Force Account |

**END OF SECTION 627**