OCTOBER 17, 2019

NETWORK INFRASTRUCTURE UPGRADE FOR SECURITY
NEW HAVEN LINE
PHASE 3

STAMFORD TO WESTPORT

STATE PROJECT NO. 0300-0202

ADDENDUM NO. 2

This Addendum addresses the following questions and answers contained on the "CT DOT QUESTIONS AND ANSWERS WEBSITE FOR ADVERTISED CONSTRUCTION PROJECTS":

Question and Answers Nos. 65, 68, 75, 78, 79, 82, 85, 86, 90, 91, 96, 97, 107, 109, 117, 127, 128 and 136

SPECIAL PROVISIONS
REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- NOTICE TO CONTRACTOR – CONTRACT TIME AND LIQUIDATED DAMAGES
- NOTICE TO CONTRACTOR – SOLE SOURCE PRODUCTS
- NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS
- NOTICE TO CONTRACTOR – GENERAL REQUIREMENTS AND COVENANTS OF THE CONTRACT
- NOTICE TO CONTRACTOR – METRO NORTH RAILROAD FORCES AND STATE CONTRACTOR WORK DELINEATION MATRIX
- ITEM #0090693A – SPARE PARTS
- ITEM #0100160A – FURNITURE AND EQUIPMENT
- ITEM #0100190A – RAISED FLOOR SYSTEM
- ITEM #0100470A – UNINTERRUPTABLE POWER SUPPLY – 45KVA
- ITEM #0150660A – VIDEO WALL SYSTEM
- ITEM #0150661A – VIDEO DECODING WORKSTATIONS
- ITEM #0150662A – CONSOLE WORKSTATIONS
- ITEM #0150665A – VIDEO DECODER
- ITEM #0150670A – CONSOLE WORKSTATION SOFTWARE LICENSES
- ITEM #0150745A – SECURITY NODE HOUSE
- ITEM #0706001A - MICROPILES
- ITEM #0706002A - VERIFICATION TEST FOR MICROPILES
- ITEM #0706003A - PROOF TEST FOR MICROPILES

- ITEM #0706004A – MICROPILE LENGTH ADJUSTMENT
- ITEM #1008192A – 2" PVC COATED CONDUIT
- ITEM #1108842A – FIBER OPTIC PATCH PANEL - 24 POSITION
- ITEM #1108844A – FIBER OPTIC PATCH PANEL - 72 POSITION
- ITEM #1108876A – INFRARED ILLUMINATOR
- ITEM #1112226A – PTZ DOME CAMERA
- ITEM #1112227A – FIXED MOUNT DOME CAMERA
- ITEM #1112360A – 360 DEGREE DOME CAMER
- ITEM #1112347A – PTZ DOME CAMERA WITH BUILT-IN INFRARED ILLUMINATORS
- ITEM #1113033A - 4 STRAND SINGLE-MODE FIBER OPTIC CABLE
- ITEM #1113043A – 24 STRAND SINGLE-MODE FIBER OPTIC CABLE
- ITEM #0150624A – 24 STRAND SINGLE-MODE FIBER OPTIC CABLE FOR INDOOR USE
- ITEM #1113812A – UNINTERRUPTABLE POWER SUPPLY

Note: The special provision for "Item No. 1008183A thru Item No. 1008189A" has been revised to include the *"corrected"* item number for Item #1008192A - 2" PVC Coated Conduit.

DELETED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety from the Contract:

- NOTICE TO CONTRACTOR – SUBMITTALS (Page No. 8)
  Note: Keep the "Notice To Contractor – Submittals" pages 20 – 21.

- ITEM #1113912A – INSTALL EXISTING FIBER CABLES THROUGH CONDUITS

CONTRACT ITEMS

NEW CONTRACT ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
1008192A	2" PVC COATED CONDUIT	L.F.	500
0150665A	VIDEO DECODER	EA	6

REVISED CONTRACT ITEMS

ITEM NO.	DESCRIPTION	ORIGINAL QUANTITY	REVISED QUANTITY
0150661A	VIDEO DECODING WORKSTATION	5 EA.	4 EA.
0150662A	CONSOLE WORKSTATION	5 EA.	6 EA.
0150670A	CONSOLE WORKSTATION SOFTWARE LICENSES	5 EA.	6 EA.
1008185A	1-1/2" PVC COATED CONDUIT	3,660 L.F.	4,060 L.F.

DELECTED CONTRACT ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
1008189A	2" PVC CONDUIT	L.F.	0
1113912A	INSTALL EXISTING FIBER CABLES THROUGH CONDUITS	L.F.	0

PLANS

REVISED PLANS:

The following Plan Sheets are hereby deleted and replaced with the like-numbered Plan Sheets:

02.01.A2

03.02.A2
03.11.A2
03.13.A2

04.29.A2
04.34.A2

06.04.A2
06.08.A2
06.019.A2

The Bid Proposal Form has been revised to reflect these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

CONTRACT TIME AND LIQUIDATED DAMAGES

Five Hundred Ninety Three (593) calendar days will be allowed for completion of the work on this Contract and the liquidated damages charge to apply will be Four Thousand Five Hundred Dollars ($4,500.00) per calendar day.

No track outages will be approved by Metro North Railroad until cable routing plan and all submittals are approved and necessary material procured.

NOTICE TO CONTRACTOR – SOLE SOURCE PRODUCTS

For operational purposes, the Department has determined the need to sole source products specified in the following Contract provisions:

1. Item #0063538A – Workstation
2. Item #1108676A – Ethernet Switch – Cisco IE5000
3. Item #1108679A – Ethernet Switch – Cisco C2960XR
4. Item #1108675A – Ethernet Switch – Cisco IE3200
5. Item #1108668A – Ethernet Switch – Cisco 4503E
6. Item #1108672A – Cisco Professional Services
7. Item #1113916A – Elevator Demarcation Box
8. Item #1108868A – CCTV Workstation Software Licenses
9. Item #1108881A – Video Management System Software Licenses
10. Item #1112226A – PTZ Dome Camera
11. Item #1112227A – Fixed Mount Dome Camera
12. Item #1108871A – Network Management System
13. Item #1112360A – 360 Degree Dome Camera
14. Item #0150665A – Video Decoder
15. Item #0150662A – Console Workstations
16. Item #0150661A – Video Decoding Workstations
17. Item #0150670A – Console Workstations
18. Item #1108882A – Video Management System Support Services
19. Encoder contained in Item #1113916A – Elevator Demarcation Box
20. Corresponding spares for items listed above as part of Item #0090693A – Spare Parts

No "Or Equals" will be permitted except as provided within each Item. Said products shall be installed only by their factory-authorized installer or service representative. The Contractor shall bid the Project accordingly.

NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS

General: The list of items in the Table below may not be all-inclusive and does not relieve the Contractor from its responsibility to provide spare parts, operation and maintenance manuals, training, and warranties that are required under other Contract provisions.

Spare Parts: The Contractor shall deliver spare parts on products listed in the Table below to the Project Site, to a location(s) determined by the Engineer.

Operation and Maintenance Manuals: See NOTICE TO CONTRACTOR – OPERATION AND MAINTENANCE MANUALS.

Product Maintenance Manual: The Contractor shall provide complete information in the materials and finishes manual on products listed in the Table below.

Equipment and Systems Maintenance Manuals: The Contractor shall provide complete information in the equipment and systems manual on products listed in the Table below.

Training: The Contractor shall provide training on products listed in the Table below.

Warranties: Submit in accordance with Form 817 Article 1.20-1.08.14. The Designer and the Owner will review the warranties for conformance to the Contract.

The Contractor shall provide special warranties on products and installations listed in the Table.

TABLE

Descriptions	Warranties	Spare Parts	Training
Fiber Optic Splice Enclosure	X	X	
CCTV Camera – Fixed Dome	X	X	X
CCTV Camera – PTZ	X	X	X
CCTV Camera – 360 Degree Dome	X	X	X
Video Encoder	X	X	X
IR Power Supply – Rack Mount	X	X	X
60W PoE Injector	X	X	X
PTZ Power Supply	X	X	X
PoE Surge Suppression – Rack Mount	X	X	X
PoE Surge Suppression – Wall Mount	X	X	X
PoE Surge Suppression Module	X	X	X

Descriptions	Warranties	Spare Parts	Training
Single Encoder as Provided by Elevator Demarcation Box Item	X	X	X
Analog Elevator Camera as Provided by Elevator Demarcation Box Item	X	X	X
Camera Power Supply as Provided by Elevator Demarcation Box Item	X	X	X
Ethernet switch - Cisco IE5000	X	X	X
Ethernet Switch - Cisco 4503E	X	X	X
Ethernet switch – Cisco C2960XR	X	X	X
Ethernet Switch - Cisco C9500	X	X	X
Ethernet Switch - Cisco IE3200	X	X	X
High-Voltage AC/DC Power Source	X	X	
1 Gbps and 10 Gbps Single-Mode SFP	X	X	X
Ethernet switch Services License		X	X
Cisco Console Cable, USB Type A to Mini-B	X	X	
SMARTNET Warranty Service, 8x5, Next Business Day	X	X	
Workstations	X		X
CCTV Cabinet – Base	X		X
CCTV Cabinet – SAGA Bridge	X		X
Remote CCTV Cabinet	X		X
Infrared Illuminator	X		X
Video Wall System	X		X
Console Workstation	X		X
Time Server	X	X	X
Cisco Network Management System	X		X
Video Decoder	X		X
Video Decoding Workstation	X		X
Uninterruptable Power Supply	X	X	X
Automatic Transfer Switch	X	X	X
CACP/FACP	X	X	X
Standby Generator	X	X	X

NOTICE TO CONTRACTOR – GENERAL REQUIREMENTS AND COVENANTS OF THE CONTRACT

Division 1 of the document entitled "State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016" including the Division 1 Supplemental Specifications, shall collectively be known as the "General Requirements and Covenants of the Contract."

Section 1.20 General Clauses for Facilities Construction will govern where specifically referred to in the Project Notice to Contractor's (NTC's) or Special Provisions.

NOTICE TO CONTRACTOR – METRO NORTH RAILROAD FORCES AND STATE CONTRACTOR WORK DELINEATION MATRIX

The Contractor is hereby notified that the following table represents construction services and materials to be furnished and completed by both Metro-North Railroad (MNR) Forces and the State's (CTDOT's) Contractor.

The following table may not be all inclusive and does not relieve the Contractor from its responsibility to furnish and complete the work as shown in the Contract Documents and to coordinate said work with MNR that is required under other Contract Provisions.

The Contractor shall also be responsible for the coordination of the work of its various subcontractors. The Contractor shall coordinate his operations with Metro-North Railroad operations associated with Railroad force account work.

Work performed by MNR will directly affect the Contractor's operation. Special coordination efforts by the Contractor will be required in support of MNR force account work which may be executed in multiple stages at various times and locations throughout the duration of the Project.

The Contractor shall provide MNR access to the Project site as required for MNR to complete its work.

Description	Contractor	Metro-North
Station and SAGA Bridge Work		
Procure and Install Cameras, Poles, Conduits and Cable	X	
Procure and Install Camera Communication Cable	X	
Terminate Camera Communication Cable	X	
Procure and Install Camera Poles	X	
Procure and Install Conduits	X	
Procure and Install Electrical Cable	X	
Terminate Electrical Conductors	X	
Connect to Electrical Panels	X	
Procure and Install Security Cabinets	X	
Procure and Install Platform Security Cabinets	X	
Procure and Install Network Equipment	X	
Position Cameras	X	
Approve Camera Positioning and Views		X
Procure, Install, and Configure Workstations including Software	X	
Provide Final Workstation Locations		X
Procure and Install Fiber Patch Panels	X	
Splice Fiber Cables		X
Terminate Fiber Cable		X
Test Fiber Cable	X (1)	X
Right of Way (ROW) Fiber Procurement and Installation		
Procure Cable and Aerial Duct	X	
Verify Locations and Procure Rubber Grade Crossing Materials	X	
Install Rubber Grade Crossings		X
Procure and Install Aerial Figure 8 Duct	X	
Procure and Install Catenary Attachments	X	
Procure and Install Fiber Cable	X	
Procure Fiber Splice Enclosures	X	
Procure Fiber Splicing Materials and Terminations	X	
Install Fiber Splice Enclosures		X
Splice Fiber Cables		X
Terminate Fiber Cable		X
Test Fiber Cable	X (1)	X
CCO Shop		
Power to Racks (Cable and Conduit from Power Panel to Rack)	X	
Power for Equipment (PDU, Cable, Terminations, etc.)	X	
Procure and Install Conduit and Cables	X	
Procure and Install Servers and Server Storage Arrays	X	
Procure and Configure Video Management System	X	
Modify/Upgrade Existing Video Management System	X	
Procure Upgrade & Licenses for Network Management	X	
Install and Configure Network Management		X
Splice Fiber Cable (24-Strand Fiber between RM 416 & 442A)	X	
Termination Fiber Cable (24-Strand Fiber between RM 416 & 442A)	X	
Test Fiber Cable (24-Strand Fiber between RM 416 & 442A)	X	
T&E Building		
Relocate Phase 1 & Phase 2 Redundant NVRs to Security Node House	X(1)	

Modify/Upgrade existing secondary master server	X	
New Security Node House		
Power to Racks (Cable and Conduit from Power Panel to Rack)	X	
Procure and Install Racks for Head-End Equipment	X	
Power for Equipment (PDU, Cable, Terminations, etc.)	X	
Procure and Install Conduit and Cables	X	
Procure and Install Servers and Server Storage Arrays	X	
Procure and Configure Video Management System	X	
Procurement and Installation of Security Node House	X	
Site Work	X	
Utility Work	X	
Procurement and Installation of Network Equipment	X	
Procurement and Installation of UPS	X	
Splice Fiber Cables		X
Terminate Fiber Cable		X
Test Fiber Cable	X (1)	X
Westport Storage Room		
Power to Racks (Cable and Conduit from Power Panel to Rack)	X	
Procure and Install Racks for Head-End Equipment	X	
Power for Equipment (PDU, Cable, Terminations, etc.)	X	
Procure and Install Conduit and Cables	X	
Procure and Install Servers	X	
Procure and Configure Video Management System	X	
Install and Configure existing Westport PD equipment in new Rack	X	
Splice Fiber Cables		X
Terminate Fiber Cable		X
Test Fiber Cable	X (1)	X
Node Houses		
Configure Backbone Network Equipment		X
Procure Fiber Patch Cables for Node Houses	X	
Install Patch Cables		X
All Locations		
Procure Cisco Professional Services for Network Configuration and Commissioning	X	
Procure VMS Profession Services	X	

(1) See equipment specifications for responsibilities of Contractor and coordination with MNR.

NOTES:

Ancillary and miscellaneous items required to implement a complete system as described in the plans and specifications should be considered included in the items listed above.

ITEM #0090693A – SPARE PARTS

Description:

This item consists of furnishing additional quantities of specific items in the Contract to be used as replacement items should one of the installed items fail.

The Contractor shall furnish the additional quantities of each item as indicated in this Specification. It shall be the responsibility of the Contractor to purchase the item, transfer ownership and deliver the items to the Connecticut Department of Transportation (CTDOT) or Metro-North Railroad (MNR), as indicated.

Materials:

Each item furnished shall be new, from the same manufacturer and have the identical model number as each item furnished for installation as described in the Specification for each item.

The Contractor shall deliver the following quantities of each item as a "spare part" for these products specified in the Contract Special Provisions:

	DESCRIPTION	QTY.	Ownership and Delivery
1.	Fiber Optic Splice Enclosure	6	MNR
2.	CCTV Camera – Fixed Dome	12	MNR
3.	CCTV Camera – PTZ	2	MNR
4.	CCTV Camera – 360 Degree Dome	4	MNR
5.	CCTV IR Light	7	MNR
6.	Video Encoder	1	MNR
7.	IR Power Supply – Rack Mount	1	MNR
8.	60W PoE Injector	3	MNR
9.	PTZ Power Supply	3	MNR
10.	PoE Surge Suppression – Rack Mount	1	MNR
11.	PoE Surge Suppression – Wall Mount	1	MNR
12.	PoE Surge Suppression Module	20	MNR
13.	Non-PoE Surge Suppression Module	5*	MNR
14.	Single Encoder as Provided by Elevator Demarcation Box Item	1	MNR
15.	Analog Elevator Camera as Provided by Elevator Demarcation Box Item	1	MNR
16.	Camera Power Supply as Provided by Elevator Demarcation Box Item	1	MNR
17.	PTZ Dome Camera with Built-in IR	2	MNR

*Non-PoE surge suppression modules, such as those used to connect workstations.

Contractor shall provide the following Cisco switch spares and deliver them to MNR:

Cisco Part Number	Description	Quantity
PWR-C45-1400AC	Catalyst 4500 1400W AC Power Supply (Data Only)	2
SFP-10G-LR-X	10GBASE-LR SFP Module Extended Temperature	2

Cisco Part Number	Description	Quantity
WS-C2960XR-48LPS-I	Cisco Catalyst 2960XR 48-port L2/L3 switch	1
PWR-C2-640WAC	640W AC Power Supply	1
GLC-LH-SMD	1000 Mbps SFP	2
C2960X-STACK	FlexStack-Plus hot-swappable stacking module	1
CAB-STK-E-0.5M	Stacking cable with a 0.5 meter length	1
CAB-CONSOLE-USB	Cisco Console Cable 6 ft. USB Type A to Mini-B	1
CAB-TA-NA=	AC Power cord	1
CON-SNT-WS29648	SMARTNET Warranty Service, 8x5x Next Business Day	2*

*SMARTNET support shall be provided for 2 years for each switch

Cisco Part Number	Description	Quantity
IE-5000-12S12P-10G	Rugged Industrial Ethernet switch w/ (4) 1/10 Gigabit Ethernet (GigE) SFP/SFP+ Ports, 12 10/100/1000 PoE/PoE+ ports, and 12 SFP Gigabit Ethernet (GigE)	1
PWR-RGD-AC-DC-250=	High-Voltage AC/DC Power Source, 250W	2
SFP-10G-LR-X	10GBASE-LR SMF Extended Temperature	2
GLC-LX-SM-RGD=	1000 Mbps Single-Mode Rugged SFP, 1300nm	4
L-IE5000-RTU=	Cisco IE 5000 IP Services License	1
CAB-CONSOLE-USB	Cisco Console Cable 6 ft. USB Type A to Mini-B	1
CON-SNT-IES12P50	SMARTNET Warranty Service, 8x5x Next Business Day	2*

*SMARTNET support shall be provided for 2 years for each switch

Cisco Part Number	Description	Quantity
IE-3200-8P2S-E	Rugged Industrial Ethernet switch w/ (2) 1 Gigabit Ethernet (GigE) SFP Ports, (8) 10/100 PoE/PoE+ ports	1
PWR-IE170W-PC-AC=	High-Voltage AC/DC Power Source, 170W	2
GLC-LX-SM-RGD=	1000 Mbps Single-Mode Rugged SFP, 1300nm	4
CON-SNT-IE32008S	SMARTNET Warranty Service, 8x5x Next Business Day	2*

*SMARTNET support shall be provided for 2 years for each switch

Contractor shall provide the following Cisco switch spares and deliver them to CTDOT:

(For Hartford Line)

Cisco Part Number	Description	Quantity
WS-C2960XR-48LPS-I	Cisco Catalyst 2960XR 48-port L2/L3 switch	1
PWR-C2-640WAC	640W AC Power Supply	1
GLC-LH-SMD	1000 Mbps SFP	2
C2960X-STACK	FlexStack-Plus hot-swappable stacking module	1
CAB-STK-E-0.5M	Stacking cable with a 0.5 meter length	1
CAB-CONSOLE-USB	Cisco Console Cable 6 ft. USB Type A to Mini-B	1
CAB-TA-NA=	AC Power cord	1
CON-SNT-WS29648	SMARTNET Warranty Service, 8x5x Next Business Day	2*

*SMARTNET support shall be provided for 2 years for each switch

Construction Method:

All provisions outlined in these Contract Documents shall be complied with for each item furnished from the Spare Parts list.

Method of Measurement:

The Contractor shall submit to the Engineer for acceptance a breakdown of its lump sum bid price for this item. If the lump sum bid price is unacceptable to the Engineer, substantiation showing that the submitted price costs are reasonable shall be required.

The lump sum bid price breakdown shall show Contractor costs per spare part. The Contractor shall be reimbursed for the item after it is furnished and the transfer is carried out as outlined in this specification and approved by the Engineer.

Each item furnished under Spare Parts will be held by the Contractor until after the System Acceptance test is complete. After acceptance of the system, the Contractor shall deliver the items to the Connecticut Department of Transportation or Metro North Railroad at a designated site within the State of Connecticut. Transfer of ownership and delivery shall be coordinated with the Engineer.

Basis of Payment:

The quantity to be paid for under this item(s) will be paid as a lump sum for the total number of spare parts turned over to Connecticut Department of Transportation and Metro-North Railroad as described in this Specification.

Pay Item	**Pay Unit**
Spare parts	Lump Sum

ITEM #0100160A – FURNITURE & EQUIPMENT

Description:
This work shall consist of providing all labor, tools, and equipment necessary for furnishing and installing equipment mountings and furniture in CCO Room 442A. Electronic equipment to be installed will be paid for under other items.

The following specific sections of Division 1 General Requirements and Covenants, Section 1.20 General Clauses for Facilities Construction shall govern for the items in this Special Provision:

1.20–1.00 – General
1.20–1.02.04 – Examination of Plans, Specifications, Special Provisions, and Site Work
1.20–1.02.13 – Knowledge of Applicable Laws
1.20-1.05.02 - Contract Submittals
1.20-1.05.07 – Coordination with work by other parties
1.20-1.05.09 – Authority of Inspectors
1.20-1.05.10 – Inspections
1.20 – 1.05.11 – Removal of Defective or Unauthorized Work
1.20 – 1.08.14 – Facilities Acceptance of Project

Materials:
The Contractor shall provide complete assembly with all mounting hardware necessary to install the items outlined below.

List of Furniture and Equipment Requirements

1. One (1) – Multi Screen Holder; flexible and ergonomic arms for 6 large screens each.
    - Motorized pillars
    - DSLX lighting module
    - Power: 115 - 230 V, 50 - 60 Hz / 340 VA
    - Adjustable VESA monitor mounts
    - Exceeds ISO 11 064 recommendations
    - In accordance with EEMUA 201 recommendations
    - Two Pillars Support
    - Pillar Height-74" min.; Pillar Width-78" min.
    - Total number of monitors: 6-55” monitors (3 top & 3 bottom)

2. Four (4) – Workstation Desks (3-Operator Desks & 1-Supervisor Desk)
    - Load 300kg wide distributed
    - With optional motorized base 100-240V 50-60Hz
    - Frame and columns in silver RAL 9006

- Level adjustable feet in grey RAL 7015
- High pressure laminate top board
- Maximum Height of the work board surface: 30” AFF
- Maximum Width of the Workstation Desk: 77” with 12” Side Board
- Minimum Depth of Workstation Desk: 26” depth Work board with 15” deep monitor board
- Optional curved configuration or rectangular configuration
- Number of monitors required on monitor board on each workstation: 3 - 24” screen monitors

3. Thirteen (13) – Wall mounting bracket with Adjustable arm for Monitors

    - Wall Mount Bracket
        - Stud mounting: M8 x 80mm or 5/16” x 3” and flat washer 8mm or 5/16” (2 places)
    - Technical Requirements for Adjustable Arm
        - Weight Capacity (Min. 40lb), Minimum Arm length (24.5”)
    - Range of motion for Adjustable Arm
        - Tilt (25-degree angle = Forward 15 degrees, Back 10 degrees), Pan (180-degree angle)

4. One (1) – Conference Table for 8 people

    - Bivi Table for Two or Bivi Table for Two with Back Pocket
    - Work as one, but separate. The Table for Two uses a pair of large table tops to make collaboration automatic and solo work an easy option. A center trough hides all your cables and power cords out of the way.
        - Available with or without the "Back Pockets," integrated desktop storage spaces
        - Four laminate colors and three finish options
        - Wire Trough has space for optional Integrated Power packs (two 2-packs or one 4-pack)
        - Sturdy construction stands up to years of daily use
        - Table top: MDF with low-pressure laminate
        - Legs and frame: steel
        - 28.5"h x 62"w x 60"d
    - Bivi Half Round Table Top - 2
    - No legs to add, but plenty of added space. The Half Round Table Top creates more space to work as well as new places to collaborate. If you wish, use one Half Round Table Tops with Bivi Table for Two to make a smaller conference table (as in the Conference for Six).
        - Keeps out of the way when you're not using it; bring it out when you need it
        - Four laminate colors and three finish options
        - Steel attachment hardware for strength and durability
        - 60"w x 27"d x 7.9" thick (including hardware)
        - Table top: MDF with low-pressure laminate
        - Frame: steel

  - 60"w x 27"d x 7.9 thick (including hardware)
- Overall: MDF with low-pressure laminate, steel
- 28.5"h x 116"w x 60"d
- Laminate Color: Virginia Walnut
- Finish: Arctic White
- Table Style: No Back Pockets
- Power Option: 4 tabletop mounted outlets

5. One (1) – Conference Room Cabinet (Six Door Base Cabinet with Three Drawers - 72"W)

   - Laminate construction with chip-resistant edges
   - Recessed toe kick
   - 3.5" backsplash on the top
   - Six doors
   - Three adjustable shelves
   - Three drawers
   - Fully assembled
   - Dimensions: 72"W x 18"D x 35"H
   - Weight: 311 lbs.
   - Color: Wood tone laminates (Maple)

6. Eight (8) – Conference Room Chairs

   - Hammock-style support
   - Swivel mechanism
   - Pneumatic height adjustment
   - Equipped with casters
   - High-back support
   - Frame Color: Black
   - Cushion/back color: Green
   - SCS Indoor Advantage Gold
   - Level 1 Certified to ANSI/BIFMA E3 Standard

7. Four (4) – Supervisor and Operator Chairs

   - Adjustable lumbar support
   - 4d adjustable arms
   - Height/width/pivot/depth adjustable
   - 3D micro knit upholstery
   - Weight-activated mechanism to allow for quick seat adjustments
   - Adjustable seat depth
   - Frame Color: Black
   - Cushion/back color: Gray or charcoal

8. Eight (8) – 18U Rack Enclosure Cabinet 33” Deep with Doors and Sides

- Adjustable mounting depths from 3" to 32.5
- Locking, reversible front door and locking, removable side panels
- Vented panels with cable access openings
- Heavy duty steel construction with support for up to 1000 lbs of equipment
- RoHS and UL 60950 compliant
- Rack Size: 19”
- Rack Units: 18 RU
- Dimensions: 33.5”H x 33.5”D x 23.6”W

9. Eighteen (18) – Electrical / Data Floor Box Outlet System

    - Recessed Plate Mounted on Raised Floor Tiles specified in “Raised Floor System” specification.
    - Shall have 4 electrical receptacles outlets and 4 data jacks per box
    - Four (4) Duplex 15A tamper proof Outlets
    - Four (4) RJ-45 Jacks

10. One (1) – Electrical Sub Panel
    - 208Y/120V, 3Ø, 4W
    - 100A Main Circuit Breaker
    - Neutral Bus: 100A
    - Ground Bus: CV
    - Surface Mounting
    - Minimum Interrupting Rating: 65,000A
    - Branch Circuit Breaker Minimum Interrupting Rating: 65,000A

For alternative furnishings, all of the specified requirements noted herein shall be an approved equal and shall be accepted by the Architect.

The mountings and furniture shall be coordinated with the work of other sections.

Submittals:
Product Data: Submit Manufacturer’s literature and catalog cuts for all products/materials to the Engineer for review and approval.

The Contractor shall submit a detailed layout diagram for each layout specified for review by the Engineer. Only approved layouts will be accepted under this Contract item.

Construction Methods:

The Plans indicate the extent and the general location and arrangement of the work. The Contractor shall study the plans and details so that the work will be properly located and readily accessible. If conflicts occur necessitating departures from the plans, the Contractor shall submit details of departures as soon as practicable for written approval of the Engineer. Contractor shall ensure any rerouting required does not adversely affect the system.

Substitutions of products and materials of other Sections may affect cabinet size, layout, and equipment required in the cabinets. Contractor shall ensure all substitutions are coordinated with the design and the installation conforms to all Contract requirements and local codes.

Make field inspections necessary in order to prepare accurate shop drawings in accordance with existing conditions. Submit shop drawings coordinated with existing conditions and all other work for approval prior to performing any installation. Include plans, elevations, sections, details, and attachments as needed. Drawings should indicate site specific installation details including showing the exact equipment locations, mounting details, conduit runs, conduit entry, riser diagrams, wiring diagrams, and other details necessary for complete review. No cabinet shall be installed without an approved layout, wiring diagrams, and other associated shop drawings.

Method of Measurement:
All furniture and equipment listed herein, including all labor, tools, and equipment required to install this furniture and equipment in CCO Room 442A shall be included in the Lump Sum price for Furniture & Equipment.

Basis of Payment:
Furniture & Equipment shall be paid for at the contract unit price bid. This price shall be full compensation for all furniture, material, tools, equipment, labor, and incidentals to perform this work in CCO Room 442A.

Pay Item	**Pay Unit**
Furniture & Equipment	L.S.

ITEM #0100190A – RAISED FLOOR SYSTEM

Description:

This work shall consist of furnishing and installing a raised floor system in Room 442A of the CCO Shop located at the New Haven Yard as specified herein and on the plans, or as directed by the Engineer. It shall include the floor system panels, finish, understructure, ramps, brushed architectural aluminum floor-mounted handrail, aluminum closure plates (fascia) electrical box cutouts and all associated hardware, appurtenances and labor.

All wiring, electrical boxes, outlets, connections, and related work shall be paid under other items.

Reference

CISCA (Ceilings & Interior Systems Construction Association) - "Recommended Test Procedures for Access Floors" shall be used as a guideline when presenting load performance product information.

Manufacturers

Raised access floor system manufacture/manufacturer's facilities shall be ISO9001: 2000, ISO14001: 2004, and OHSAS 18001:2007 certified.

Submittals

Submit the following to the Engineer for review and approval:

Product Data: Submit Manufacturer's literature and catalog cuts for all products/materials.

Shop Drawings: Submit layout plans showing layout of the access panels, including ramp, fascia, railing, and outlet location. Include shop drawings of railing including all connection and anchoring details.

Manufacturer's installation instructions and guidelines: Manufacturer's Owner Manual outlining recommended care and maintenance procedures.

Test reports: Submit certified test reports by an independent testing laboratory with a minimum of five years' experience testing access floor components in accordance with CISCA Recommended Test Procedures, certifying that component parts perform as specified.

Product tests shall be witnessed and certified by independent engineering and testing laboratory based in the U.S. with a minimum of five years' experience testing access floor components in accordance CISCA "Recommended Test Procedures for Access Floors".

Performance Requirements

The system shall comply to the following load testing:

Design Load: Panel supported on actual understructure system shall be capable of supporting a point load of 1250 lbs. applied on a one square inch area at any location on the panel without experiencing permanent set in excess of 0.010 inches as defined by CISCA. The loading method used to determine design (allowable) load shall be in conformance with CISCA Concentrated Load test method but with panel tested on actual understructure instead of steel blocks.

Safety Factor: Panel supported on actual understructure system shall withstand a point load of no less than (2) two times its design load rating on a one square inch area anywhere on the panel without failure when tested in accordance with CISCA A/F, Section 2, "Ultimate Loading". Failure is defined as the point at which the system will no longer accept the load.

Ultimate Load: Panel supported on actual understructure system shall be capable of supporting a point load of at least 2500 lbs. applied through a load indenter on a one square inch area at any location on the panel without failure (i.e. minimum safety factor of 2) when tested in accordance with CISCA A/F, Section 2, "Ultimate Loading".

Rolling Load: Panel supported on actual understructure system shall be able to withstand the following rolling loads at any location on the panel without developing a local and overall surface deformation greater than 0.040 inches when tested in accordance with CISCA A/F, Section 3, "Rolling Loads".

Note: wheel 1 and wheel 2 tests shall be performed on two separate panels.

CISCA Wheel 1:	Size: 3" dia x 1 13/16" wide	Load: 1000 lbs.	Passes: 10
CISCA Wheel 2:	Size: (A) 6" dia x 2" wide (B) 10" dia. X 4" wide	Load: 800 lbs.	Passes: 10,000

Impact Load: Panel and supporting understructure (the system) shall be capable of supporting an impact load of 150 lbs. dropped from a height of 36 inches onto a one square inch area (using a round or square indenter) at any location on the panel when tested in accordance with CISCA A/F, Section 8, "Drop Impact Load Test".

Panel Drop Test: Panel shall be capable of being dropped face up onto to a concrete slab from a height of 36", after which it shall continue to meet all load performance requirements as previously defined.

Panel Cutout: Panel with an 8" diameter interior cutout supported on actual understructure shall be capable of maintaining its design load strength with a minimum safety factor of 2 anywhere on the panel without the use of additional supports.

Flammability: System shall meet Class A Flame spread requirements for flame spread and smoke development. Tests shall be performed in accordance with ASTM-E84-1998, Standard Test Method for Surface Burning Characteristics for Building Materials.

Combustibility: All components of the access floor system shall qualify as non-combustible by demonstrating compliance with requirements of ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg C.

Recycled Content: Panel and understructure system shall be required to have a minimum post-consumer recycled content of 18% and a minimum total recycled content of 49%.

Axial Load: Pedestal support assembly shall provide a 6000 lb. axial load without permanent deformation when tested in accordance with CISCA A/F, Section 5, "Pedestal Axial Load Test". Overturning Moment: Pedestal support assembly shall provide an average overturning moment of 1000 in-lbs. when glued to a clean, sound, uncoated concrete surface when tested in accordance with CISCA A/F, Section 6, "Pedestal Overturning Moment Test".

Panel shall be easily removed by one person with a suction cup lifting device and shall be interchangeable except where cut for special conditions.

The following specific sections of Division 1 General Requirements and Covenants, Section 1.20 General Clauses for Facilities Construction shall govern for the items in this Special Provision:

1.20–1.00 – General
1.20–1.02.04 – Examination of Plans, Specifications, Special Provisions, and Site Work
1.20–1.02.13 – Knowledge of Applicable Laws
1.20-1.05.02 - Contract Submittals
1.20-1.05.07 – Coordination with work by other parties
1.20-1.05.09 – Authority of Inspectors
1.20-1.05.10 – Inspections
1.20 – 1.05.11 – Removal of Defective or Unauthorized Work
1.20 – 1.08.14 – Facilities Acceptance of Project

Materials:

Raised Floor System

Raised floor system shall consist of ConCore® CC1250 floor system supported by a 4" Low Finished Floor Height (LFFH) Bolted Stringer Understructure as manufactured by Tate Access Floors, Inc. or approved equal.

PosiTile® carpet module system (Color to be determined during the submittal approval process).

Provide manufacturer's standard steps, ramps, fascia plate, perimeter support, and grommets where indicated on the Plans.

Provide twelve (12) spare floor panels and fifty (50) square feet of understructure systems for each type used in the project for maintenance stock. Deliver to project in manufacturer's standard packaging clearly marked with the contents.

Provide two (2) panel lifting devices.

Provide manufacturer's standard underfloor air systems components (including, grilles, diffusers and perforated floor panels) where indicated on the Plans or as recommended by the manufacturer.

Alternative access floor system shall meet or exceed all requirements as indicated herein and must receive prior written approval by the Engineer.

Construction Methods:

Examine structural subfloor for unevenness, irregularities and dampness that would affect the quality and execution of the work. Do not proceed with installation until structural floor surfaces are level, clean, and dry as completed by others.

Concrete sealers, if used, shall be identified and proven to be compatible with pedestal adhesive.

Verify that adhesive achieves bond to slab before commencing work.

Verify dimensions on contract drawings, including level of interfaces including abutting floor, ledges and doorsills.

The General Contractor shall provide clear access, dry subfloor area free of construction debris and other trades throughout installation of access floor system.

Area to receive and store access floor materials shall be enclosed and maintained at ambient temperatures between 35° to 95° F and relative humidity levels between 20 to 80%. At least 24 hrs. before installation begins, all floor panels shall be stored at ambient temperatures between 50° to 90° F and relative humidity levels between 20% to 80% and shall remain within these environmental limits throughout occupancy.

Pedestal locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with pedestal installation.

Installation of access floor shall be coordinated with other trades to maintain the integrity of the installed system. All traffic on access floor shall be controlled by access floor installer. No traffic but that of access floor installers shall be permitted on any floor area for 24 hours to allow the pedestal adhesive to set. Access floor panels shall not be removed by other trades for 72 hours after their installation.

Floor system and accessories shall be installed under the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

No dust or debris producing operations by other trades shall be allowed in areas where access floor is being installed to ensure proper bonding of pedestals to subfloor.

Raised floor installer shall keep the subfloor broom clean as installation progresses.

Partially complete floors shall be braced against shifting to maintain the integrity of the installed system where required.

Additional pedestals as needed shall support panels where floor is disrupted by columns, walls, and cutouts.

Understructure shall be aligned such that all uncut panels are interchangeable and fit snugly but do not bind when placed in alternate positions.

Finished floor shall be level, not varying more than 0.062" in 10 feet or 0.125" overall.

Acceptance: General contractor shall accept floor in whole or in part prior to allowing use by other trades.

Method of Measurement:

The Raised Floor System shall be measured for payment on a Lump Sum basis complete furnished, installed, inspected, and accepted in place.

Basis of Payment:

The work under this item shall be paid for at the lump sum price which price shall include all material, tools, equipment, labor, and work incidental thereto.

Pay Item	**Pay Unit**
Raised Floor System	L.S.

ITEM #0100470A – UNINTERRUPTABLE POWER SUPPLY – 45KVA
ITEM #1113812A – UNINTERRUPTABLE POWER SUPPLY

Description:

This item shall consist of furnishing and installing a continuous-duty three-phase, solid-state, scalable (field-upgradable) uninterruptible power system (UPS) at two locations. The UPS shall provide high-quality AC power for sensitive electronic equipment. One UPS is located at the proposed Security Node House in Norwalk which shall be a 45KVA and the second is in New Haven at CCO Shop, Electrical Room No. 425 shall be a 30KVA.

The following specific sections of Division 1 General Requirements and Covenants, Section 1.20 General Clauses for Facilities Construction shall govern for the items in this Special Provision:

1.20–1.00 – General
1.20–1.02.04 – Examination of Plans, Specifications, Special Provisions, and Site Work
1.20–1.02.13 – Knowledge of Applicable Laws
1.20-1.05.02 - Contract Submittals
1.20-1.05.07 – Coordination with work by other parties
1.20-1.05.09 – Authority of Inspectors
1.20-1.05.10 – Inspections
1.20 – 1.05.11 – Removal of Defective or Unauthorized Work
1.20 – 1.08.14 – Facilities Acceptance of Project

Standards:

The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

1. UL Standard 1778
2. CSA 22.2, No. 107.3, 4th edition
3. FCC Part 15, Class A
4. IEC 61000-3-4,4-4,4-2,4-3,4-6,2-2
5. National Electrical Code (NFPA-70)
6. NEMA PE-1
7. ISTA_1H
8. ANSI C62.41, Categories A3 and B3

The UPS shall be UL and cUL listed per UL Standard 1778.

Materials:

Product Data: Submit Manufacturer's literature and catalog cuts for all products/materials to the Engineer for review and approval.

Uninteruptable Power Supply – 45 KVA

The Uninterruptable Power Supply at the Secuity Node House shall be Liebert APM UPS 45kVA or equivalent meeting the following requirements:

1. The Uninterruptable Power Supply (UPS) shall have a UPS Module with the following requirements:
    i. Voltage Rectifier Input of 208 volts, three-phase, 4-wire-plus-ground, Voltage Bypass input of 208 volts, three-phase, 4-wire-plus-ground, and a Voltage Output of 208 volts, three-phase, 4-wire-plus-ground.
    ii. Output Load Capacity of the UPS shall be 45 kVA at unity power factor.
2. The UPS shall have a Battery system with the following requirements:
    i. Battery cells shall be valve-regulated, lead acid batteries.
    ii. Battery reserve time shall be 20 minutes at 45 KVA, unity power factor, with ambient temperature of 77°F (25°C). Unit shall provide terminal for connection of external batteries.
3. The UPS shall operate as an on-line, double-conversion, reverse-transfer system with the following operating modes:
    i. Normal - The critical AC load is continuously supplied by the UPS inverter. The rectifier/charger derives power from an AC source and supplies DC power to the inverter while simultaneously float-charging the reserve battery.
    ii. Emergency - Upon failure of utility AC power, the critical AC load is supplied by the inverter, which obtains power from the battery. There shall be no interruption in power to the critical load upon failure or restoration of the utility AC source.
    iii. Recharge - Upon restoration of utility AC power after a utility AC power outage, the rectifier/charger shall automatically restart, gradually ramp up output voltage and assume the inverter and battery recharge loads.
    iv. Bypass - If the UPS must be taken out of service for maintenance or repair or if the inverter overload capacity is exceeded, the static transfer switch shall perform a reverse transfer of the load from the inverter to the bypass source with no interruption in power to the critical AC load.
4. The AC Input to the UPS shall confirm to the following performance requirements:
    i. Voltage Configuration for Standard Units: 208V, three-phase, four-wire plus ground
    ii. Voltage Range: +15%, -20% of nominal without derating
    iii. Frequency: 40-70Hz

iv. Power Factor: 0.99 full load, 0.98 half load

v. Inrush Current: UPS inrush current not to exceed 1.5 times rated input current. Maintenance bypass and distribution cabinet inrush current not to exceed 8 times rated input current.

vi. Current Limit: 140% of nominal AC input current maximum

vii. Current Distortion: <3% reflected THD maximum at full load

viii. Surge Protection: Sustains input surges without damage per criteria listed in IEC 1000-4-5

5. The AC Output, UPS Inverter shall conform to the following performance requirements:

i. Voltage Configuration: three-phase, 4-wire plus ground

ii. Voltage Regulation:

iii. ±1% three-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor

iv. ±5% three-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor

v. Frequency:

vi. ±0.1% (single Liebert FlexPower assembly)

vii. ±0.25% (six Liebert FlexPower assemblies)

viii. Frequency Slew Rate: Selectable from 0.1Hz/sec to 3.0Hz/sec maximum for single unit

ix. Phase Balance:

x. 120 degrees ±1 degree for balanced load

xi. 120 degrees ±1.5 degrees for 100% unbalanced load

xii. Voltage Distortion:

xiii. <1% total harmonic distortion (THD) for linear loads

xiv. <5% THD for 100% nonlinear loads (3:1 crest factor) without kVA/kW derating

xv. Load Power Factor Range: 0.7 lagging to 0.9 leading without derating

xvi. Output Power Rating: 0.99 full load. 0.98 half load

xvii. Overload Capability:

xviii. 110% for 60 minutes

xix. 125% for 10 minutes

xx. 150% for 60 seconds

xxi. Voltage Transient Response: 100% load step, ±5.0%

xxii. Transient Recovery Time: to within 5% of steady state output voltage within half a cycle

xxiii. Voltage Unbalance: 100% unbalanced load, ±5%

6. The UPS Module shall have an Operating Ambient Temperature of 32°F to 104°F (0°C to 40°C) and a Storage/Transport Ambient Temperature of -4°F to 158°F (-20°C to 70°C).
7. The Battery shall Module shall have an Operating Ambient Temperature of 77°F ±9°F (25°C ±5°C) and a Storage/Transport Ambient Temperature of -4°F to to 86°F (-20°C to 30°C).
8. All materials of the UPS shall be new, of current manufacture and high grade and shall not have been in prior service except as required during factory testing. All active electronic devices shall be solid-state. All power semi-conductors shall be sealed. Control logic and fuses shall be physically isolated from power train components to ensure operator safety and protection from heat. All electronic components shall be accessible from the front without removing sub-assemblies for service access.

9. The UPS shall be by forced air cooled using a redundant fan configuration. Fan power shall be provided by the UPS. The UPS shall have 12 inches rear clearance for air flow, and 12 inches top clearance for air flow. The thermal design, along with all thermal and ambient sensors, shall be coordinated with the protective devices before excessive component or internal cabinet temperatures are exceeded. Air filters shall be located at the point of air inlet and be changeable.

10. The UPS shall have a rectifier/charger unit to convert AC to regulated DC for input to the inverter and for charging the battery with the following requirements.
    i. The rectifier/charger unit shall be provided with AC input current limiting whereby the maximum input current shall be limited to 140% of the full input current rating.
    ii. The rectifier/charger shall have an output filter to minimize ripple current into the battery. The AC ripple voltage of the rectifier DC output shall not exceed 1% RMS of the float voltage. The filter shall be adequate to ensure that the DC output of the rectifier/charger will meet the input requirements of the inverter without the battery connected.
    iii. Upon restoration of utility AC power, after a utility AC power outage and prior to a UPS automatic end-of-discharge shutdown, the rectifier/charger shall automatically restart, walk-in and gradually assume the inverter and battery recharge loads.
    iv. There shall be DC overvoltage protection so that if the DC voltage rises to the preset limit, the UPS will shut down automatically and initiate an uninterrupted load transfer to the static bypass line.

11. The UPS shall have an inverter to convert DC from the rectifier/charger or battery to precise AC to power the load with the following requirements.

i. The inverter shall be solid-state, capable of providing rated output power, and for increased performance the inverter shall be a pulse-width-modulated design and utilize insulated gate bipolar transistors (IGBTs). The inverter shall be capable of supplying current and voltage for overloads exceeding 100%. The inverter is to provide 150% of full load for 60 seconds, 125% of full load for 10 minutes and 110% of full load for 60 minutes. A status indicator and audible alarm shall indicate overload operation. The UPS shall transfer the load to bypass when overload capacity is exceeded.

ii. The inverter shall be capable of supplying an overload current of 150% of its full-load rating for one minute. For greater currents or longer time duration, the inverter shall have electronic current-limiting protection to prevent damage to components. The critical load will be transferred to the static bypass automatically and uninterrupted. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses.

iii. The Inverter shall have phase balance capability. For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load. For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.

iv. The output frequency of the inverter shall be controlled by a high-speed DSP capable of holding the inverter output frequency to within ±0.1% for a single Liebert FlexPower assembly or ±0.25% for six Liebert FlexPower assemblies during steady state and transient conditions. Total deviation from the rated frequency, including short time fluctuations and drift, shall not exceed 0.1% for a single Liebert FlexPower assembly or 0.25% for six Liebert FlexPower assemblies.

12. The UPS shall be provided with a microprocessor-based unit status display and controls section designed for convenient and reliable user operation. A graphical liquid crystal display (LCD) shall be used to show a single-line diagram of the UPS and shall be provided as part of the monitoring and controls sections of the UPS. All operator controls and monitors shall be located on the front of the UPS cabinet. Monitoring functions such as metering, status and alarms shall be displayed on the graphical LCD. Additional features of the monitoring system shall include:

    i. Menu-driven display with pushbutton navigation

    ii. Real-time clock (time and date)

    iii. Alarm history with time and date stamp

    iv. Memory with battery backup

13. The UPS shall have metering with the following parameters shall be displayed:
    i. Input AC voltage line-to-line
    ii. Input AC current for each phase
    iii. Input frequency
    iv. Battery voltage
    v. Battery charge/discharge current
    vi. Output AC voltage line-to-line
    vii. Output AC current for each phase
    viii. Output frequency
    ix. Apparent power
    x. Active power
    xi. Battery time left during battery operation
14. The UPS shall have the following alarm messages displayed:
    i. Mains Voltage Abnormal
    ii. Mains Undervoltage
    iii. Mains Freq. Abnormal
    iv. Charger Fault
    v. Battery Reversed
    vi. No Battery
    vii. Control Power 1 Fail
    viii. Parallel Comm. Fail
    ix. Bypass Unable To Track
    x. Bypass Abnormal
    xi. Inverter Asynchronous
    xii. Fan Fault
    xiii. Control Power 2 Fail
    xiv. Unit Over Load
    xv. System Over Load
    xvi. Bypass Phase Reversed
    xvii. Transfer Time-Out
    xviii. Load Sharing Fault
    xix. Bypass Over Current

xx. Output Ground Fault

15. The following UPS status messages shall be displayed:
    i. Rectifier (Off / Soft Start / Main Input On / Battery Input On)
    ii. Input Supply (Normal Mode / Battery Mode / All Off)
    iii. Battery Self Test (True / False)
    iv. Input Disconnect (Open / Closed)
    v. EPO (True / False)
    vi. Charger (On / Off)
    vii. Output Disconnect (Open / Closed)
    viii. Maint. Disconnect (Open / Closed)
    ix. Bypass Disconnect (Open / Closed)
    x. Inverter (Off / Soft Start / On)
    xi. Bypass (Normal / Unable To Trace / Abnormal)
    xii. Output Supply (All Off / Bypass Mode / Inverter Mode / Output Disable)
    xiii. Inverter On (Enable / Disable)

16. UPS startup, shutdown and static bypass operations shall be accomplished through pushbutton controls on the front panel. Menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Pushbuttons shall be provided to display the status of the UPS and to test and reset visual and audible alarms. A mimic screen shall be available on the LCD to depict a single-line diagram of the UPS with switch positions and power flow.

17. The UPS shall be provided with a menu-driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode.

18. A static transfer switch and bypass circuit shall be provided as an integral part of the UPS with the following requirement:
    i. The static switch shall be a naturally commutated high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating to clear a 20-ampere load branch circuit breaker.
    ii. The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS or to bypass the UPS for maintenance.

iii. The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

a. Inverter overload capacity exceeded

b. Critical AC load overvoltage or undervoltage

c. UPS fault condition

iv. The transfer control logic shall inhibit an automatic transfer of the critical load to the bypass source if any of the following conditions are present:

a. Bypass frequency out of limits

b. Bypass out-of-synchronization range with inverter output

v. Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

a. Bypass out of synchronization range with inverter output

b. Inverter/bypass voltage difference exceeding preset limits

c. Overload condition exists in excess of inverter full load rating

d. UPS fault condition present

19. The UPS battery power pack shall include valve-regulated, lead-acid battery cells housed in a separate cabinet that matches the UPS cabinet styling to form an integral system lineup. Battery cells shall be mounted on slide-out trays for ease of maintenance. A battery disconnect circuit breaker shall be included for isolation of the battery pack from the UPS module. Casters and leveling feet shall also be provided with the battery power pack cabinet for ease of installation. When the application calls for the battery cabinet to be bolted to the UPS cabinet, an interconnecting cable kit will be available, precut and pre-lugged.

<u>Uninterruptable Power Supply</u>

The Uninterruptable Power Supply at the CCO Shop in Room 425 shall be Schneider Electric APC Smart-UPS VT model SUVTR30KG4B5S rack mounted 30KVA 480V in, 208 out w/4 batter modules w/ PDU & startup or approved equal.

1. The UPS shall have the following design requirements:
   i. The UPS shall be sized for 30 kVA and 24 kW load.
   ii. The UPS battery shall be sized for 20 minutes at 45 KVA, unity power factor.
2. The UPS shall have the following characteristics:
   i. System Capacity: The system shall be rated for 30kVA /24kW.
   ii. Input:

a. AC Input Nominal Voltage: 480V, 3 phase 3 wire plus ground, 60Hz.

b. AC Input Voltage Window: +/-15% of nominal (while providing nominal charging to the battery system).

c. Short Circuit Withstand Rating: 30,000 Symmetrical Amperes

d. Maximum Frequency Range: 40-70Hz

e. Input Power Factor: 0.98 for loads greater than 50%

f. Input Current Distortion with no additional filters: < 5% at 100% load

g. Soft-Start: Shall be linear from 0-100% input current and shall not exhibit inrush. This shall take place over a 15 second time period when transferring from battery operation to mains operation

iii. UPS Output:

a. AC Output Nominal Output: 208V, 3 Phase, 4 wire plus ground, 60 Hz.

b. AC Output Voltage Regulation:
+/- 1% For 100 % Linear or Nonlinear Load,
+/- 5% maximum for 100% linear load step

c. Voltage Transient Recovery within <50 milliseconds

d. Output Voltage Harmonic Distortion:
<2% THD maximum for a 100% linear load
<5% THD maximum for a 100% non-linear load

e. Phase Angle Displacement:
120 degrees +/- 1 degree for balanced load
120 degrees +/- 1 degrees for 50% imbalanced load
120 degrees +/- 3 degrees for 100% imbalanced load

f. Overload Rating:

- Normal Operation:
  - 150% for 30 seconds
  - 100% continuous

g. Bypass Operation: 110% continuous

h. System AC-AC Efficiency: >98% for loads higher than 50% of rated system capacity

i. Output Power Factor Rating: .5 leading to .5 lagging.

iv. Environmental

a. Storage Ambient Temperature: -58 degrees F to 122 degrees F (-50 degrees C to 50 degrees C).

b. Operating Ambient Temperature: +32 degrees F to 104 degrees F (0□ degrees C to 40 degrees C). (77 degrees F is ideal for most battery types).

c. Relative Humidity: 0 to 95% Non-condensing

d. Altitude: Maximum installation with no derating of the UPS output shall be 3280 feet (1000m) above sea level. At higher altitudes the following derating shall apply:

- 1500 m derating factor of .95
- 2000 m derating factor of .91
- 2500 m derating factor of .86

e. Audible Noise: The UPS shall not produce audible noise at a distance of 1m (39") in excess of the following:

- 20-30kVA 67dBA

v. Input Power Converter

a. The input power converters of the system shall constantly control the power imported from the mains input of the system, to provide the necessary UPS power for precise regulation of the DC bus voltage, battery charging, and Main Inverter regulated output power..

b. Input Current Total Harmonic Distortion: The input current THDI shall be held to 5% or less at full system, while providing conditioned power to the critical load bus, and charging the batteries under steady-state operating conditions. This shall be true while supporting loads of both a linear or non-linear type. This shall be accomplished with no additional filters, magnetic devices, or other components.

c. Soft-Start Operation: As a standard feature, the UPS shall contain soft-start functionality, capable of limiting the input current from 0-100% of the nominal input over a default 15 second period, when returning to the AC utility source from battery operation. The change in current over the change in time shall take place in a linear manner throughout the entire operation. (di/dt= constant)

d. Magnetization Inrush Current: The UPS shall exhibit 0 inrush current as a standard product. If provided with an optional isolation transformer, inrush shall be limited to 6 times the nominal input current of the transformer.

e. Input Current Limit:

- The system input current limit, shall be designed to provide 100% load will fully charging the batteries at 10% of the system rating. The system shall be capable of this with up to a +/-15% variation of the nominal input voltage.

f. Charging:

- The battery charging shall keep the DC bus float voltage of +/- 220v, +/-1%
- The battery charging circuit shall contain a temperature compensation circuit, which will regulate the battery charging to optimize battery life.
- The battery charging circuit shall remain active when in Static Bypass and in Normal Operation.
- Battery Charge Current Limit: The UPS shall be capable of limiting the energy sourced from the mains for purposes of battery charging. As a default setting, the battery charge energy will be set to 100% of its nominal value. When signaled by a dry contact, (such as from an emergency generator) the UPS shall be capable of limiting the battery charge energy taken from the mains. This shall take place in user selectable increments of 75%, 50%, 25%, 10% and 0% of the nominal charge power. The selection shall be made from the UPS front panel display/control unit.

g. Back-feed Protection: The logic controlled input contactor shall provide the back-feed protection required by UL1778.

vi. Output Inverter

a. The UPS output inverter shall constantly recreate the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT driven power converters. In both normal operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave of the output inverters.

b. Overload Capability: Steady-state overload conditions of up to 150% of system capacity shall be sustained by the inverter for 30 seconds in normal and battery operation. Overloads of 125% shall be sustainable by the inverter for up to 60 seconds. Should overloads persist past the time limitation, the critical load will be switched to the automatic static bypass output of the UPS.

c. Output Contactor: The output inverter shall be provided with an output mechanical contactor to provide physical isolation of the inverter from the critical bus. With this feature a failed inverter shall be removed from the critical bus.

d. Battery Protection: The inverter shall be provided with monitoring and control circuits to limit the level of discharge on the battery system.

vii. Static Bypass

a. As part of the UPS, a system static bypass switch shall be provided. The system static bypass shall provide no break transfer of the critical load from the Inverter output to the static bypass input source during times where maintenance is required or the inverter can not support the critical bus. Such times may be due to prolonged or severe overloads or UPS failure.

b. The design of the static switch power path shall consist of Silicon Controlled Rectifiers (SCR) with a continuous duty rating of 110% of the UPS output rating.

c. Automatic Transfers: An automatic transfer of load to static bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from static bypass back to normal operation shall take place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to static bypass shall also take place if for any reason the UPS cannot support the critical bus.

d. Manual Transfers: Manually initiated transfers to and from static bypass shall be initiated through the UPS display interface.

e. Overloads: The static bypass shall be rated and capable of handling overloads equal to or less than 110% of the rated system output continuously. For instantaneous overloads caused by inrush current from magnetic devices or short circuit conditions, the static bypass shall be capable of sustaining overloads of 800% of system capacity for periods of up to 500 milliseconds.

f. System Protection: As a requirement of UL1778, back-feed protection in the static bypass circuit shall also be incorporated in the system design. To achieve back-feed protection, a mechanical contactor in series with the bypass SCR(s) shall be controlled by the UPS/static switch, to open immediately upon sensing a condition where back-feeding of the static switch by any source connected to the critical output bus of the system is occurring. One such condition could be a result of a shorted SCR.

g. Dual Feed: For purposes of increased reliability, the static bypass shall be capable of being fed from a separate feed from the input power converter.

viii. Display and Controls

a. Display Unit: A microprocessor controlled display unit shall be located on the front of the system. The display shall consist of an alphanumeric display with backlight, an alarm LED, and a keypad consisting of pushbutton switches.

b. Metered Data: The following metered data, shall be available on the alphanumeric display:

- Year, Month, Day, Hour, Minute, Second of occurring events
- Source Input Voltage
- Output AC voltage
- Output AC current
- Input Frequency
- Battery voltage
- Highest Internal Battery temperature

c. Event log: The display unit shall allow the user to display a time and date stamped log of the 64 most recent status and alarm events.

d. Alarms: The display unit shall allow the user to display a log of all active alarms. The following minimum set of alarm conditions shall be available:

- Static bypass switch on
- EPO Active
- Mechanical bypass activated
- External bypass switch (Q3) activated
- Battery discharged
- Return from low battery
- Low battery
- Load not powered from UPS
- UPS in bypass
- Runtime calibration aborted
- Runtime calibration started
- Runtime calibration complete
- Battery self test aborted
- Battery self test started
- Battery self test completed

- Number of battery modules decreased
- Number of battery modules increased
- Fan fault
- SBS fault
- System not in sync.
- Bypass not available, frequency/voltage out of range
- Mains voltage/frequency out of range
- Site wiring fault
- Low battery voltage shut down
- XR battery breaker or fuse open
- Defective battery detected
- Runtime is below alarm threshold
- Load is above alarm threshold
- Battery over-voltage warning
- Battery over-temperature warning
- Emergency power supply fault
- Output overloaded

e. Controls: The following controls or programming functions shall be accomplished by use of the display unit. Pushbutton membrane switches shall facilitate these operations.

- Silence audible Alarm
- Set the alphanumeric display language
- Display or set the date and time
- Enable or disable the automatic restart feature
- Transfer critical load to and from static bypass
- Test battery condition on demand
- Set intervals for automatic battery tests
- Adjust set points for different alarms
- Program the parameters for remote shutdown.

f. Front Panel Interface: The following shall make up the UPS front panel user interface.

- Indicating LED's
  - Load On - When Green, this LED indicates the load is being supported by the UPS output
  - On Battery - When Yellow, this LED indicates the UPS is running from Battery power
  - Bypass - When Yellow, this LED indicates the load is being supported by static bypass/mechanical bypass
  - Fault - When Red, this LED indicates there is a fault condition present in the UPS.
- Push Button User Controls
  - Up Arrow
  - Down Arrow
  - Help Key
  - Escape Key
  - Enter Key

g. Potential Free (Dry) Contacts

- The following potential free contacts shall be available on an optional relay interface board (AP9610 or equivalent). (Note: This may require the use of an external chassis if used in conjunction with web based management or other "smart slot" type devices):
  a. Normal Operation
  b. Battery Operation
  c. Bypass Operation
  d. Common Fault
  e. Low Battery
  f. UPS Off

h. Communication Interface: For purposes of remote communications with the UPS the following shall be available and contained within the UPS on a removable, "hot swappable" "smart slot" interface card:

- RJ-45 Interface port for remote communications with a network via web browser or SNMP, or APC InfraStruXure Manager.
- Environmental monitoring feature, capable of locally monitoring temperature and humidity as well as one additional generic set of user determined dry contacts capable of taking an input signal from any APC or third party on/off signal, such as water detection, smoke detection, motion, or fire detection.

ix. Battery

a. The UPS battery shall be of modular construction made up of user replaceable, hot swappable, fused, battery modules. Each battery module shall be monitored for voltage and temperature for use by the UPS battery diagnostic, and temperature compensated charger circuitry.

b. The battery jars housed within each removable battery module shall be of the Valve Regulated Lead Acid (VRLA) type.

x. Rack Mount Power Distribution Units

a. For purposes of distributing power within an IT enclosure, rack mount power distribution units shall be available. The rack mount power distribution units shall be capable of being installed in the back of the accompanying enclosure.

b. Output Connections - The output of the Rack Mount PDU shall be fed from 208Y120Volts, and shall be distributed to receptacles capable of supplying power to cord connected equipment.

xi. Rack Mount Transfer Switches

a. For purposes of providing redundancy (to single corded loads) as far as the equipment rack, and the load itself, 1U rack mount transfer switches shall be available. Rack mount transfer switches shall be capable of switching a combination of single-phase and three-phase loads up to 5.7kW. The Rack Mount Transfer Switch shall be designed to be fed from a 3 pole 20A circuit breaker via a NEMA L21-20 receptacle or cord cap.

xii. Enclosure

a. The Enclosure shall be designed to provide a secure, managed environment for computer and networking equipment.

b. The Enclosure shall conform to EIA-310 Standard for Cabinets, Racks, Panel and Associated Equipment and accommodate industry standard 19” rack mount equipment.

c. The Enclosure shall be designed with four (4) vertical posts to allow rack mount equipment installation utilizing four (4) vertical mounting rails.

d. The Enclosure shall be available with a vertical equipment mounting space of 25U, 42U or 47U. (1U=1.75” or 44.45mm)

e. A four-post open frame configuration shall be available with 42U vertical equipment mounting space.

f. External Width Dimensions shall be 597mm (23.5”) for 19” rack enclosures, and 747mm (29.4”) for 23” rack enclosure.

g. External Depth Dimensions shall be 900mm (35.4”) or 1070mm (42.2”)

h. Rack enclosures of a 42U design shall have a maximum external height of 2070mm (81.5”) to allow passage through a standard 7ft. (84”) doorway without tipping.

i. Rack enclosure shall support a dynamic load (rolling on castors) of 909kG (2000 lbs.) total weight.

j. Rack enclosure shall also be designed and manufactured to be matching in both color and construction to the UPS, PDU/System bypass and extended runtime battery enclosures to provide a uniform and consistent appearance in a datacenter environment

k. The enclosure shall provide [25U] [42U] [47U] of equipment vertical mounting space.

l. The vertical mounting rails shall be adjustable to allow different mounting depths.

m. Front and rear doors of the enclosure shall be designed with quick release hinges allowing for easy detachment without the use of tools.

n. Floor Anchor brackets shall be available to solidly connect UPS and Battery Enclosure to minimize unintended moving of the equipment.

o. Seismic rated floor stands shall be available to take the place of supporting the system on a raised floor environment. Floor Stands shall be available in custom heights to maintain a flush mount installation adjacent to the raised floor, and shall be designed in accordance to the equipment weight and contact points.

xiii. SOFTWARE AND CONNECTIVITY

a. Network Adaptor: The Ethernet Web/SNMP Adaptor shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. The management information base (MIB) shall be provided in DOS and UNIX "tar" formats. The SNMP interface adaptor shall be connected to the UPS via the RS232 serial port on the standard communication interface board.

b. Unattended Shutdown

- The System, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems during when the UPS is on reserve mode.
- The System shall also be capable of using an RS232 port to communicate by means of serial communications to gracefully

shut down one or more operating systems during an on battery situation.

xiv. REMOTE SYSTEM MONITORING

a. The following three methods of remote UPS monitoring shall be available:

- Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.
- RS232 Monitoring: Remote UPS monitoring shall be possible via either RS232 or contact closure signals from the UPS.
- Simple Network Management Protocol (SNMP): Remote UPS Monitoring shall be possible through a standard MIB II compliant platform.

3. A 40”x42”x4” precast concrete equipment pad shall be installed beneath the UPS cabinet in Room 425 of the CCO Shop. The purpose of this pad is to ensure the floor’s designed live load is not exceeded. The precast concrete pad shall conform to the following:

i. The Contractor shall submit product data and calculations to support this measure.

ii. The Contractor shall design and submit to the Engineer a concrete mix design which shall attain a minimum 28-day strength of 4000 psi.

iii. Reinforcing Bars shall conform to ASTM A 615/A 615M, Grade 60, deformed. Plain-Steel Welded Wire Reinforcement shall conform to ASTM A 185/A 185M.

Construction Method:

The Contractor shall submit shop drawings and product data to the Engineer for approval prior to supplying this item. Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards. All bolted connections of busbars, lugs and cables shall be in accordance with requirements of the National Electrical Code and other applicable standards. All electrical power connections shall be torqued to the required value and marked with a visual indicator.

Provisions shall be made in the cabinets to permit installation of input, output and external control cabling, using raceway or conduit. Provision shall be made for top and bottom access to input, output, bypass and DC connections. In conformance with NEC, connection cabinets shall provide for adequate wire bend radius. All copper busbars for customer power connections shall be tin plated for connection integrity.

The UPS shall be in NEMA Type 1 enclosures, designed for floor mounting. The UPS shall be structurally adequate and have provisions for hoisting, jacking and forklift handling. Maximum cabinet height shall be 78.7 in. (2000mm).

To install the UPS in Room 425 of the CCO Shop, modifications to the layout of existing electrical equipment will be required. The existing equipment which is to be relocated within Room 425 includes (but is not limited to):

- (1) floor mounted transformer
- (2) mechanical control devices
- (1) SC-8 Disconnect switch
- Miscellaneous conduits, control/power cables and mounting assemblies/brackets

Testing:

Refer to "NOTICE TO CONTRACTOR – Acceptance Testing" for overall testing requirements and additional information. At a minimum, the following tests shall be included: verification of proper installation of equipment per approved drawings and manufacturer recommendations, verification of all fiber cables are installed, verification of all port and cable labeling. Any tests recommended by the manufacturer shall also be included.

Method of Measurement:

"UNINTERRUPTABLE POWER SUPPLY UPS - 45KVA (Security Node House)" shall be measured for payment by the number of "Each" unit installed, tested, and accepted.

"UNINTERRUPTABLE POWER SUPPLY UPS (30KVA) (CCO Shop Electrical Room-425)" shall be measured for payment by the number of "Each" unit installed, tested, and accepted, including the fabrication and installation of the UPS Equipment Floor Pad and the relocation of all existing electrical equipment as directed in the plans and in this specification.

Pay Item	**Pay Unit**
Uninterruptable Power Supply – 45KVA	Ea.
Uninterruptable Power Supply (30KVA)	Ea.

ITEM #0150660A – VIDEO WALL SYSTEM

ITEM #0150661A – VIDEO DECODING WORKSTATIONS

ITEM #0150662A – CONSOLE WORKSTATIONS

ITEM #0150665A – VIDEO DECODER

ITEM #0150670A – CONSOLE WORKSTATION SOFTWARE LICENSES

Description:

A new command center shall be installed and outfitted at the CCO Shop in Room 442A. This command center shall have a video wall system (consisting of eighteen (18) 55" monitors), four console workstations (with 24" monitors each), and two separate console workstations and 65" monitor for the conference area. The Contractor shall furnish, install, integrate, and test this system.

The System provides displaying, monitoring and control of the VMS and CCTV cameras installed on the New Haven Line under Phase 1 thru Phase 3 (and future expansion) and the Hartford Line Stations (Berlin, Meriden, Wallingford Stations and future Hartford/Shore Line East) as specified herein, and as indicated on the Contract Drawings. The System shall comprise of, but not be limited to:

1. Displaying, Monitoring and control

2. Networked capability for remote monitoring and control

The System shall include the following: hardware and software licenses, management software, prerequisite software, cabinet, video wall workstations, video wall monitors, console desks, chairs, client workstations and related software, and all brackets, conduits, fittings, cables, connectors, HDMI/DVI/DisplayPort conversion adapters, display controllers, wires, and ancillary equipment required for a fully functioning system described herein. Contractor shall include any other required equipment for a complete and operating system not included in this list. The system shall provide scalability and future expansion capability.

Currently there are two CCTV NVR/VMS systems in use. The New Haven Line (Phase 1 thru Phase 3) utilizes Verint VMS and the Hartford Line stations utilize Pelco VideoXpert Enterprise System. The video wall shall be split into two portions: twelve monitors shall be dedicated to viewing the New Haven Line and six monitors shall be dedicated to viewing the Hartford stations. The conference area 65" video monitor shall be provided with two video workstations (one New Haven Line and one Hartford Line). A two-port KVM switch shall be provided to connect the monitor to the two workstations.

Contractor shall relocate an existing Pelco CCTV workstation in CCO Shop Room 442B to Room 442A.

This specification covers the Video Wall System (including the Monitors and Workstations) and the Console Workstation computers that will all be integrated with each other to provide a complete system. The locations where the Contractor shall install the equipment for the Video Wall System and the Console Workstations shall be as shown in the Plans.

The Contractor shall retain the services of a System Integrator to perform the integration necessary for the installation and configuration of the Verint and Pelco Client Viewing software.

1. The Contractor shall utilize qualified, certified, and licensed personnel with experience in design of integrated security systems from Verint and Pelco. Prior to commencement of Work, the Contractor shall submit evidence of personnel having recent certifications for the system.
2. Systems Integrator and Installer shall demonstrate a minimum of 7 years of continuous experience and technical expertise in performing contracts comparable in size and complexity, and whose installation and integration work was performed skillfully in a satisfactory manner and on time.
3. The Systems Integrator shall be of established reputation and experience in the field of Video Surveillance Systems and shall be certified by the manufacturers of the proposed equipment to install, service, and maintain each manufacturer's equipment.

Separate integrators may be required for the various systems. The contractor is responsible for coordination between them.

Requirements set forth in this Section shall apply to all Command Center System components (video wall monitors, video wall workstations, console workstations, etc.) working as a complete system.

The following specific sections of Division 1 General Requirements and Covenants, Section 1.20 General Clauses for Facilities Construction shall govern for the items in this Special Provision:

1.20–1.00 – General
1.20–1.02.04 – Examination of Plans, Specifications, Special Provisions, and Site Work
1.20–1.02.13 – Knowledge of Applicable Laws
1.20-1.05.02 - Contract Submittals
1.20-1.05.07 – Coordination with work by other parties
1.20-1.05.09 – Authority of Inspectors
1.20-1.05.10 – Inspections
1.20 – 1.05.11 – Removal of Defective or Unauthorized Work
1.20 – 1.08.14 – Facilities Acceptance of Project

Console Workstation Licenses:

The Contractor shall supply the following items of workstation licenses to meet the requirements as shown in the plans for expansion of the existing CCTV system. These items only shall be paid under Item #0150670A – CONSOLE WORKSTATION LICENSES. All system configuration, other hardware, and other software required for the CCTV workstations shall be paid under Item #0150662A – CONSOLE WORKSTATION.

Verint Part Number	Description
VMS-1RV-S	Five (5) Review/Smart Client License
	Gold Level Maintenance for each review/smart client license furnished under this contract through 12/31/2022.

Video Wall System:

Codes, Standards and Specifications:

A. All items furnished and installed under this Specification shall comply with the latest edition of applicable codes, provisions and all applicable standards issued by the organizations referenced below. The following publications are incorporated herein by reference to the extent applicable:
   1. National Fire Protection Association (NFPA): NFPA 70 National Electrical Code.
   2. Underwriters Laboratories, Inc. (UL) Standards.
   3. National Electrical Manufacturers Association (NEMA) Standards.
   4. American National Standards Institute (ANSI) Standards.
   5. Telcordia Technologies Standards: FR-2063 NEBS Family of Requirements (or equivalent standards, as applicable).
   6. Department of Defense Design Criteria Standard: MIL-STD-1472F – Human Engineering

General Requirements:

A. The Contractor shall ensure the system provided meet all functional requirements specified. In general, the System shall consist of readily available, reliable, and proven hardware, software, and firmware elements, which fully comply with or exceed the requirements of this Section and the Contract Drawings. If the system does not meet a specific requirement, submit to the Engineer explanation and proposed alternative at least 60 days prior to the commencement of Factory Acceptance Testing or on the first production unit.

B. Provide all equipment required to provide a complete system, whether the equipment is

specifically listed in the specification or not. The Contractor shall be responsible for the installation of a completely functional turnkey system.

C. Unless otherwise specified on the Contract Drawings or in this Section, the System shall be manufactured and installed in compliance with NFPA 70, all local codes, and other publications referenced in the Section.

D. All system components, hardware, software, firmware, and equipment furnished under this contract shall conform to the following:
   1. All hardware and software used shall be industry standard and conform to established open architecture standards, allowing for a distributed server architecture. This shall include the use of established programming languages, industry standard and general use database management system and operating systems. All hardware and software utilized shall be the latest commercially available version compatible with the existing systems. The System shall not require any proprietary hardware for video recording and monitoring.
   2. All application software and firmware shall be a standard, commercially available, "off-the-shelf" product.
   3. Hardware and software shall be scalable, allowing for additional servers, storage units, workstations, cameras, and associated software licenses to be connected without replacement of the System. The System shall allow for use of non-proprietary PC storage hardware that shall not limit the storage capacity and shall allow for gradual upgrades of the recording capacity.

E. Licenses, Support agreements, Training, Technical support services shall all reflect the new versions that are being upgraded during Phase 3 of the project.

Functional Requirements:

A. The video wall systems shall consist of eighteen 55" commercial-grade LED monitors and one 65" monitors for the conference area. The 55" monitor shall have full HD resolution (1920x1080 pixels minimum). The 65" monitor shall have ultra HD 4K resolution (3840x2160 pixels minimum). All monitors shall be designed for 24x7 usage.

B. Twelve of the monitors shall be dedicated to display the cameras on the Verint VMS system (New Haven Line). Six of the monitors shall be dedicated to display the cameras on the Pelco VMS system (Hartford Line). The 65" monitor shall be dedicated for the conference area shall be shared by both New Haven and Hartford Lines.

C. The video wall system shall be controlled by Video Decoding Workstations (New Haven Line) or Video Decoders (Hartford Line). Workstations/decoders shall have network connectivity to interface with the VMS and other console workstations in the room. The video wall system shall use local switches and shall be interconnected as shown in the plans.

D. The video workstations on the Verint System shall allow the console operators to display any cameras from the New Haven Line on any of the New Haven Line monitors.

E. The video workstations on the Pelco System shall allow the console operators to display any cameras from the Hartford Line on any of the Hartford Line monitors.

F. The console workstations shall be able to fully control and configure the displays of the video wall with the restriction noted in bullet B of this section.

G. All components of the video wall system shall be located in the CCO Shop Room 442A.

H. The video wall shall be configurable to different grid layouts as set by the Verint and Pelco's video client software and the video controllers/workstations.

I. The video controller/workstation shall allow each physical screen to be partitioned into smaller screens or combined as a larger mosaic/virtual screen consists of multiple monitors.

J. The video wall shall be designed and implemented using modular concepts that provide for ease of expansion, modification and maintenance.

K. The video wall shall meet all legibility and viewing requirements across the entire wall for the operations personnel seated at any of the consoles. All images, brightness, and colors shall be selected and sized so they are sharp, discernible, consistent, and easily read from any viewing position.

L. The video wall shall provide sufficient light intensity through the selection and placement of appropriate graphics to present a display that is readily viewable and bright at each console. The brightness shall be uniform at each console for the entire vertical and horizontal viewing surface.

M. The video wall shall be designed to meet the image luminance and contrast requirements under the existing lighting conditions. All colors shall be visible within the designed room lighting. Displays shall also be viewable in normal room lighting.

N. The video wall shall not contain detectable jitter (random movement of more than two pixels); "color shift" based on viewing angle; or change in intensity or hue.

O. The Contractor shall provide all mounting and/or platform equipment necessary to securely hold the platform display in the proper position. All mounting shall be concealed behind the video monitors. All cables shall be concealed behind wall or approved means.

P. The Contractor shall provide all cables, connectors, mounting and supporting material

necessary to connect and stabilize any element of the display systems.

Q. The display wall shall use a modular mounting system that allow adjustments or service to the individual display equipment from the front without impacting other displays. All mounting shall be hidden behind the monitors.

R. The video wall system, monitors, its components, network switches and all workstations in CCO Room 442A shall operate on 120 VAC.

S. The System shall maintain full functionality and be capable of operating within the environmental conditions encountered in the locations installed.

T. Submit all test procedures in accordance with the "NOTICE TO CONTRACTOR - Acceptance Testing".

Submittals:

A. The plans indicate the extent and the general location and arrangement of the work. The Contractor shall survey the site, study the plans and details so that the work will be properly located and readily accessible. If conflicts occur necessitating departures from the plans, the Contractor shall submit details of departures and reasons therefore shall be submitted as soon as practicable for written approval of the Engineer. Contractor shall ensure all substitutions are coordinated with the design and the installation conforms to all Contract requirements and local codes.

B. Make field inspections necessary in order to prepare accurate shop drawings in accordance with existing conditions. Submit shop drawings coordinated with existing conditions and all other work for approval prior to performing any installation.

C. Submit the following for review and approval as required.
   1. Product data for each product specified; samples as required.
   2. Plans furnished by the manufacturer.
   3. Drawings indicating all work including mounting, riser diagrams, wiring diagrams, and other details.
   4. Tagging/labeling nomenclature and related product data.
   5. Test procedures for all testing and product data for test equipment; forms to be used for test report; test schedule; certified copies of test results; notification of testing four weeks in advance.
   6. Manufacturer's Certification: Signed by the manufacturer certifying that they comply with the specifications requirements. Upon request submit evidence of experience.
   7. Product Certification: Signed by manufacturer certifying that products comply with the specified requirements.

8. Installers Certificates: Signed by the Contractor, certifying that the installers comply with the specifications requirements.
9. Field testing organization certificates, signed by the Contractor, certifying that the organization complies with the specifications requirements.
10. User Manuals and System Documentation
11. Training plans and documentation.

D. Survey the CCO Room 442A and submit, concurrently with product data for the proposed communications room equipment cabinet, a drawing indicating the following:
   1. Architectural plan of the room with dimensions, including elevations.
   2. Locations of all existing (where applicable) and new works, including but not limited to, cabinets, racks, power plants, cables, cable ladders and conduits with sizes and types indicated. Provide existing and proposed locations as determined by field measurements.
   3. A.C. and/or D.C. feeds to equipment cabinets with references to the source locations (A.C. panels, transfer panels).
   4. Submit photographs of the Communications Room and CCO Room 442A for each survey.

E. The Contractor shall coordinate all network topology requirements with Metro-North. Submit a request for IP addresses for all devices to the Engineer in Excel format, or other approved format. Allow a minimum of thirty (30) days for a response.

Materials:

Video Decoding Workstations

A. Video Decoding Workstation shall be in current manufacturing production and meet or exceed the latest Verint VMS system manufacturer's recommended specifications at the time of procurement and the following:
   1. Intel® Core i7-8700K, 6 Core (12MB Cache, 3.7 GHz with HD Graphics 630)
   2. 8GB DDR4 UDIMM Non-ECC RAM
   3. 500 GB, 7,200 RPM, SATA hard drives
   4. 10/100/1000 Ethernet communication port
   5. (1) serial port, (4) USB ports
   6. Dual Nvidia Quadro P620, 2Gb, 4 mDP
   7. Manufactured by Dell
   8. All hardware shall be compatible with the existing Verint Nextiva VMS Platform.
   9. Verint Model number: Verint-HDR-PC

B. The video workstations shall be provided with Verint VMS HDR-PC software and integrated with the Verint Nextiva VMS Platform.

C. Number of workstations shown on the Plans are typical, and based on manufacturer

recommendations. Contractor shall be responsible to furnish controllers to meet Contract requirements, including spare capacity, based on actual performance characteristics of the servers. In no case shall the number of servers be less than shown on the Plans.

Video Decoders

A. Video Decoder shall be in current manufacturing production and meet or exceed the latest Pelco VMS system manufacturer's recommended specifications at the time of procurement and the following:
   1. Intel® Core i7-7700T
   2. 8GB DDR4 RAM
   3. 256 GB Solid State Drive
   4. 10/100/1000 Ethernet communication port
   5. (1) serial port, (4) USB ports
   6. Intel HD Graphic card
   7. All hardware shall be compatible with the existing Pelco VideoXpert VMS Platform.
   8. Pelco Model number: VX-A3-SDD

B. Number of decoders shown on the Plans are typical, and based on manufacturer recommendations. Contractor shall be responsible to furnish decoders to meet Contract requirements, including spare capacity, based on actual performance characteristics of the servers. In no case shall the number of servers be less than shown on the Plans.

Console CCTV Workstations (For Verint System)

A. Workstations shall be in current manufacturing production and meet or exceed the VMS manufacturer's recommended specifications at the time of procurement and the following:
   1. Intel® Core i7-8700K, 6 Core (12MB Cache, 3.7 GHz with HD Graphics 630)
   2. 8GB DDR4 UDIMM Non-ECC RAM
   3. Windows 10 Enterprise
   4. 500 GB, 7,200 RPM, SATA hard drives
   5. Two 10/100/1000 Ethernet communication ports
   6. (1) serial port, (4) USB ports
   7. Nvidia Quadro P620, 2Gb, 4 mDP
   8. Manufactured by Dell
   9. All hardware shall be compatible with the existing Verint Nextiva VMS Platform.
   10. Model shall be the Verint Premium Workstation

B. Provide the workstation with Axis T-8311 joystick. Program the joystick to control cameras of the VMS system.

C. Only that software which is required for video review station functionality shall be provided on the CCTV workstation. Contractor shall prevent other devices, such as thumb drives, hard disks, external networks, etc. from connecting the CCTV workstation in accordance with direction from MNR. The Contractor shall furnish, install, and configure any software required for use of the System. This includes, but is not limited to, operating systems, runtime files, antivirus software (approved by MNR), firewalls, additional media players, etc. All software shall be submitted and approved for use by MNR.

D. Provide a two-port KVM switch with the workstation for the 65" Video Monitor.

1. KVM switch shall support the maximum resolution of the monitor.
2. KVM switch port type shall be compatible with the monitor and the video workstations provided.

Console CCTV Workstations (For Pelco System)

A. Workstations shall be in current manufacturing production and meet or exceed the VMS manufacturer's recommended specifications at the time of procurement and the following:
1. Intel® Core i7-8700K, 6 Core (12MB Cache, 3.7 GHz with HD Graphics 630)
2. 16GB DDR4 RAM
3. Windows 10 IOT Enterprise
4. 500 GB, 7,200 RPM, SATA hard drives
5. Two 10/100/1000 Ethernet communication ports
6. (1) serial port, (4) USB ports
7. Nvidia Quadro P620, 2Gb, 4 mDP
8. All hardware shall be compatible with the existing Pelco VMS Platform.
9. Pelco enhanced keyboard
10. Pelco Model Number: VX-WKS

B. Only that software which is required for video review station functionality shall be provided on the CCTV workstation. Contractor shall prevent other devices, such as thumb drives, hard disks, external networks, etc. from connecting the CCTV workstation in accordance with direction from CTDOT. The Contractor shall furnish, install, and configure any software required for use of the System. This includes, but is not limited to, operating systems, runtime files, antivirus software (approved by MNR), firewalls, additional media players, etc. All software shall be submitted and approved for use by CTDOT.

Video Wall Monitors (55")

A. Contractor shall furnish and install video wall monitors and mounting system for the video wall. It shall meet or exceed the following:

1. Panel technology: In Plane Switching (IPS) LCD with LED backlighting
2. Diagonal: 55 inch
3. Native resolution: 1920 x 1080 pixels
4. Aspect ratio: 16:9
5. Total tiled bezel width: 3.7 mm maximum (when two screens are put next to each other)
6. Power consumption: 200 Watts or less
7. Brightness: 500 cd/m^2 or nits
8. Contrast ratio (typical): 1200:1
9. Response time: 8 ms
10. Full viewing angle: 178 degree (vertical and horizontal)
11. Inputs: 4 HDMI 2.0, 1 DisplayPort 1.2, RJ-45, RS-232C
12. Outputs: DisplayPort
13. Operating temperatures: 5-40 degree Celsius
14. Mounting: VESA mount
15. Power: Remote power preferred
16. Warranty: 3 years minimum

B. Monitors shall be commercial grade LCD designed for 24x7 operations.

C. Monitors shall support chaining of multiple monitors to function as a higher resolution unit, such as chaining 4 monitors acting as a 4K (3840x2160 pixels) monitor. Monitor shall include technology to synchronize the display of videos across the multiple screens as one monitor.

D. Monitors shall include color calibration software to adjust the color uniformity across multiple screens.

E. Provide all required software/hardware for configuration of the video wall system.

Video Wall Monitors (65")

A. Contractor shall furnish and install video wall monitors and mounting system for the video wall. It shall meet or exceed the following:
   1. Panel technology: In Plane Switching (IPS) LCD with LED backlighting
   2. Diagonal: 65 inch
   3. Native resolution: 3840x2160 pixels
   4. Aspect ratio: 16:9
   5. Total tiled bezel width: 3.7 mm maximum (when two screens are put next to each other)
   6. Power consumption: 200 Watts or less
   7. Brightness: 500 cd/m^2 or nits
   8. Contrast ratio (typical): 1200:1
   9. Response time: 8 ms

10. Full viewing angle: 178 degree (vertical and horizontal)
11. Inputs: 4 HDMI 2.0, 1 DisplayPort 1.2, RJ-45, RS-232C, USB-C (Natively or via Adapter)
12. Outputs: DisplayPort
13. Operating temperatures: 5-40 degree Celsius
14. Mounting: VESA mount
15. Power: Remote power preferred
16. Warranty: 3 years minimum

F. Monitors shall be commercial grade LCD designed for 24x7 operations.

Execution:

Installation Requirements:

A. General Installation Requirements

1. Install all equipment to be furnished under this Contract unless otherwise noted. Contractor shall install all equipment and software at the CCO Shop Head End locations and other remote locations as per this Section. All equipment shall be installed in accordance with the manufacturers' recommendations and MNR/CTDOT Policy. This information shall be submitted at the time catalog cuts and shop drawings are submitted for approval.
2. The Contractor shall provide a complete mounting system to securely hold the video wall monitors in the proper position.
3. The Contractor shall provide all cables, connectors, mounting and supporting material necessary to connect and stabilize any element of the display systems.
4. Provide structural calculation for mounting of the video wall system for engineer review.
5. All wall display system equipment shall be installed in accordance with the manufacturer's written instructions in the locations shown on the Contract Drawings.
6. Structural mounting to the floor shall not be necessary, unless approved by the DOT Representative.
7. During the initial installation and alignment phase, it shall be possible to make adjustments to the monitors. A means for future mechanical adjustments of monitor positioning shall be provided.
8. All wires and cables shall be neatly organized with wiring managements and concealed.
9. All wiring shall be clearly labeled with function and wire identification number corresponding to the wiring diagrams provided by the Contractor.
10. Contractor interconnection wiring diagrams shall be clearly identified.
11. Prior to delivery of the equipment to the work site, prepare and submit for approval an equipment placement and staging plan. Plan shall be coordinated with the Engineer and all affected trades. The plan shall indicate:

a. General Schedule, schedule by stage or phase, and schedule for each device. Indicate start dates, end dates, and durations. Include major milestones such as fabrication, production testing, shipment, delivery, inspection, site preparation work, installation, energizing, and testing.
b. Placement drawings, both overall and for each installation stage or phase.
c. The order in which the equipment and devices will be installed. Identify the various installation stages or phases. For each stage or phase, identify which devices will be installed, where they will be installed, and in what order.
d. Step-by-step detailed procedures for installation of the equipment including:
    i. Pre-delivery of the equipment to the Contractor's storage facility or location.
    ii. Inspection at the storage facility or location.
    iii. Pre-delivery assembly and testing.
    iv. All site work and preparation required for installation of the equipment.
    v. Delivery to the work site.
    vi. Work site equipment assembly.
    vii. Equipment installation.
    viii. Procedures for installation, testing, and termination of all power, control, and communications wiring and cabling.
    ix. Qualifications of personnel required.
    x. Estimated dates and times that preparatory work and equipment placement will be performed.
    xi. Identification of interfaces with others (if any).
    xii. List of activities required from the Engineer or others, if any, to perform the work.
    xiii. Contingency plans for placement, testing, or commissioning delays.

12. Installation of all System equipment and materials shall be in accordance with the manufacturer's recommendations, the approved shop drawings, and the requirements of this section and the Contract Drawings.
    a. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions, especially when located in concealed locations.
    b. Minor equipment location deviations from the Contract Drawings may be made to allow for better accessibility, but all such deviations shall be approved by the Engineer prior to any work being performed.
    c. All equipment, except wiring and conduit, shall be completely accessible without the requirement to remove any portion of the building structure or other system component, except an appropriately sized access door or ceiling tile.
    d. Enclosure access doors shall be hinged and arranged to allow full swing open and complete access to all enclosure components and wiring.
    e. Furnish all fittings, conduit associated with panel-to-panel and panel-to-trough/cable tray connections, trough, wireways, boxes, hangers, wiring devices, enclosures, signage, fasteners, connections, control panels, relays,

cable trays, and miscellaneous accessories necessary for the complete installation of the System.

f. Contract Drawings are schematic for systems equipment as exact roughing requirements vary slightly with different manufacturers and job conditions. The Contract Drawings represent a schematic depiction of the CCTV System conduit, cable tray, and wire network layout for the system equipment specified. Final conduit, cable tray, and wire quantity, size and arrangement, as well as final routing and placement shall be based on system equipment, manufacturer's engineering requirements, field coordination with other trade work, and existing site conditions.
g. Carefully coordinate the work of this section with all affected trades.
h. Coordinate all cable, conduit and device identifiers with the Engineer. Ensure uniformity and interrelation of identifiers. Avoid identifier duplication.

13. Perform all setting, adjustment, and programming required for a complete and operational video wall system to allow video display of cameras from the New Haven Line and Hartford Line, as approved and as directed by the Engineer. Submit setting, adjustment, and programming information for approval.
14. Furnish and install all required hardware and brackets to install the equipment as specified and as indicated on the Contract Drawings.

B. A binder with a set of as-built drawings and pictures in a legible 11" x17" laminated print outs shall be placed at the head-end rack locations for quick reference to identify all cameras and camera locations connected to the System.

VMS Manufacturer's Service Technician

A. Testing, checking, system startup, and configuration shall be performed under the technical direction of the manufacturer's service engineer. The Contractor, in conjunction with the manufacturer, shall provide, at no additional cost to the Department, start-up service package including travel.

Programming and System Configuration

A. Perform all programming services required to provide a complete and fully functional system. This shall include all high-level database programming which may be required due to any project specific operational or special 3rd party system interfaces to allow for a fully functional system. Ensure that the entire Video Management System (VMS) and all other interfaces are properly configured and programmed to provide complete operation and monitoring as specified herein and/or as indicated in the Contract Drawings. Functions of the System shall include, at a minimum:
   1. Display live video and display recorded video on one monitor or across multiple monitors
   2. Multiple, simultaneous views of different cameras

3. Program the console workstations with VMS client software and KVM remote control of the video wall workstations.

B. All existing functionality shall remain operational throughout the Contract. Contractor shall document and verify existing operations and functions prior to making any System modifications. Verify all functionality remains after modifications are made. New equipment shall be integrated to the existing System and operate as a single system.

C. Submit a System Configuration Plan for approval prior to modifying the existing System. System Configuration Plan shall include, at a minimum:
   1. All programming modifications to be made to the existing VMS.
   2. Configuration settings for each device and System interfaces.
   3. System backup and disaster recovery procedures.
   4. Programming and verification procedures.

D. Request the Engineer to schedule a meeting with the user department. At the meeting, inform the user department of available system programming options and obtain their input. Program the system to meet their needs.

Training Program:

Operational, maintenance and software administrative technical training for the Control Room System (all systems installed in the Room 442A) shall be provided to DOT personnel through practical demonstrations and other related technical training conducted for each provided type display system. Contractor shall provide the following:

1. Provide operation and maintenance manuals for operation of all the display and control systems and training materials.
2. Training shall consist of, as a minimum, operation, maintenance and software configuration for the display systems.

Testing:

Refer to "NOTICE TO CONTRACTOR – Acceptance Testing" for overall testing requirements and additional information.

Refer to "NOTICE TO CONTRACTOR"- Labeling Plan" and "NOTICE TO CONTRACTOR" – Basic Electrical Materials and Methods" for additional requirements.

Method of Measurement:

The Video Wall System shall be measured for payment as "lump sum" for complete system installed, tested, made fully operational, with all training completed meeting all requirements described in the Contract. This include relocation of the existing Pelco Workstation in Room

442B.

The Video Decoder Workstation shall be measured for payment by the number of "Each" complete workstations furnished, installed, tested, made fully operation, with all training completed meeting all requirements described in the Contract.

The Video Decoder shall be measured for payment by the number of "Each" complete workstations furnished, installed, tested, made fully operation, with all training completed meeting all requirements described in the Contract.

The Console Workstations shall be measured for payment by the number of "Each" complete system furnished, installed, tested and made fully operational meeting all requirements described in the Contract.

The CCTV Workstation Software Licenses shall be measured for payment by the number of "Each" complete workstation license and associated maintenance furnished.

Basis of Payment:

The Video Wall System shall be paid for as "lump sum" including components all furnished, installed, tested, made fully operation, and accepted. Works for other items shall be paid for at the contract price per each system installed, tested and made fully operational meeting all requirements described in this specification.

Pay Item	**Pay Unit**
Video Wall System	Lump Sum
Video Management System Software Licenses	Each
Video Decoding Workstation	Each
Video Decoder	Each
Console Workstation	Each

ITEM #0150745A – SECURITY NODE HOUSE

Description:

Fabricate, deliver and install a pre-engineered rigid steel frame building assembly over foundation by the Contractor as shown on the plans. Provide all utility and electric connections. Foundation and slab work will not be included in this item. FRP railing system 42" high, along the edge of the concrete walkway as indicated on the plans. Timber stairs leading from the parking lot up to the concrete walkway as well as the required foundation shall be designed and erected in the location as indicated on the plans. Install grounding and bonding system for the fence. Cap and abandon existing Monitoring well (B1) per all applicable state and federal guidelines.

Building dimensions and floor layouts are as shown on the plans. The roof shall have a monoslope of ¼" per foot, sloping towards the north with a minimum 2' overhang on all sides. The minimum eaves height is 9'-8".

The building shall incorporate the following:

The building shall be painted white.

Building shall have insulation R rating: Walls R-21, Ceiling R-38, slab-mass floor R-12.5

2- 3'-0" x 7'-0", 16 gauge, single door, dead bolt, hydraulic closer, weather stripping, door sweep, open and close latch and 3" drip cap.

3 - Forced hot and cold air, vertical cabinet style, Heat Pump; 51K BTU of heat, 5.0 ton of AC and 1750 CFM min; motorized outside air damper via HRV, thermostat controlled, fan motor with 208 volt three phase, 60 hertz operation, typical, or equals; Marvair Model: HVPSA60HP1 or approved equal.

1- 208V AC, 400 amp, Three phase electrical distribution system.

1- 400 amp main breaker.

13- 120 Volt duplex power outlets.

8- 2 bulb 4' LED interior lights and lens, support these pendant hung fixtures from approved and listed for use Unistrut or B-line type channel, spanning and secured to structural roof framing. Fixtures would then be hung from the channel in locations as shown on the lighting plan on an approved and listed for use chain or cable system to a mounting height of 9' AFF.

9- LED wallpack exterior lights with photo cell operator.

1- Standby generator, commercial series 125kW natural gas – 60Hz, 208V three phase, 434A maximum capacity; 6.8L engine, size 142"L x 60"W x 70"H, 3409lbs. empty weight; complete with compatible ATS/controller/genset.

3- Photo electric smoke detector – Ceiling mounted

3- Photo electric smoke detectors – in HP return ducts

3- Heat detectors – Ceiling mounted

2- Fire Extinguishers UL rated – 10 B:C

2- Horn and strobe fire protection system with pull stations, FACP and annunciator.

3- Horn and strobe fire protection system – On external wall rated for outdoor use.

3- Exit LED Signs – Lithonia or approved equal.

1- New clean agent fire suppression system, CACP with interconnection to building FACP, and annunciator.

1- Fire alarm control system, digital addressable system with interface to master FA system.

1- 42" High, FRP Railing system (SAFRAIL as manufactured by STRONGWELL or approved equal).

1- Cable Tray System – Seismically designed, fully grounding, suspended from ceiling

1- Timber Stairs.

Design Loads:

Snow Loads

- Ground Snow Load P_g = 30 PSF
- Snow Importance Factor, I_s 1.0
- Thermal Coefficient factor, C_t 1.0
- Snow Exposure Factor, C_e 1.1

Wind

- Basic Wind Speed (3 second gust) 110 MPH
- Wind Importance Factor, I_w 1.15
- Wind Exposure Category C

Seismic

- Occupancy Category II
- Seismic Importance Factor 1.5
- Site Class E
- Seismic Design Category D
- Short Period Spectral Acceleration, S_s 0.243
- 1-Second Period Spectral Acceleration, S_1 0.062

The structure shall be designed to conform to, but not limited to the following codes:

- Connecticut State Building Code 2016 or Latest Edition with supplements
- ASCE 7, American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures, Latest Edition
- AISC 360, American Institute of Steel Construction Specification for Structural Steel Buildings, Latest Edition
- AISC 341, American Institute of Steel Construction Seismic Provisions for Structural Steel Buildings including Supplement No. 1 dated 2006.
- ACI 318, American Concrete Institute Building Code Requirements for Structural Concrete 2014 or Latest Edition
- ACI 530/530.1, American Concrete Institute Building Code Requirements & Specifications for Masonry Structures 2013 or Latest Edition
- AWS D1.1-04 American Welding Society Structures Welding Code – Steel
- 2015 International Building Code
- 2015 International Energy Conservation Code
- 2015 International Fire Code (Part III)
- 2015 International Plumbing Code
- 2012 International Mechanical Code
- 2015 NFPA 101, Life Safety Code (Part IV)
- 2015 NFPA 1 – Fire Code
- 2017 NFPA 70, National Electrical Code
- 2001 NFPA Standard for Clean Agent Fire Extinguishing system units
- NFPA 72 National Fire Alarm Code
- OSHA 1910.23 with a minimum factor of safety of 2 for the FRP railing
- OSHA 3124 for Stairways and Ladders
- 2018 National Design Specification for Wood Construction

Certification:

Submit written certification and design calculations prepared and signed by a Professional Engineer, registered to practice in the State of Connecticut verifying that the building design meets indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies including year and load applications.

Material Testing:

In addition to mill certifications of structural steel, the manufacturer shall provide, upon request, evidence of compliance with specifications through testing independent of the manufacturer's suppliers. The quality assurance testing to include structural bolts, nuts, screw fasteners, mastic and metal coatings (primary, metallic coated products and painted coil products).

Warranties:

Building Structure

1. Provide manufacturer's written weather tightness warranty for a maximum of twenty (20) years against leaks in roof panels arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions. Warranty shall be signed by both the metal roofing system manufacturer and metal roofing system contractor. Maximum liability of warranty shall be no less than $ 1.00 per square foot of roof area.

2. Provide manufacturer's standard written warranty for twenty (20) years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions. Warranty shall be signed by metal roofing system manufacturer.

3. Provide manufacturer's standard paint film written warranty for twenty (20) years against cracking, peeling, chalking and fading of the coating on painted wall panels, painted roof panels and soffit panels. Warranty shall be signed by the building system or roof system manufacturer. Manufacturer warrants that coating shall not blister, peel, crack, chip or experience material rust through for 20 years. For a period of 20 years chalking shall not exceed #8 – ASTM and fading shall be 5ΔE Hunter units or less.

4. Inspection and Report Services: Metal roof system manufacturer or his authorized agent shall perform inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Inspections and reports shall be performed once every other year over the twenty (20) year weather tightness warranty period. Cost of inspection and Report services shall be included in the contract amount.

5. Manufacturer's Certification: Submit written Certification, by the signed manufacturer one week prior to bid date stating that the metal roof system manufacturer will provide warranties and Inspection and Report service specified herein. NOTE: Warranty terms shall be submitted with the bid. Also included in this submittal will be certification of the manufacturer's compliance with AISC-MB category.

Natural Gas fired Backup Generator

1. The generator manufacturer shall have a local authorized dealer who can provide factory trained servicemen, the required stock of replacement parts, technical assistance, and warranty administration.

2. The manufacturer's authorized dealer shall have a parts and service facility within 130 miles of the jobsite.

3. The generator set supplier shall have factory trained service representatives and tooling necessary to install, test, maintain, and repair all provided equipment.

4. The manufacturer's authorized dealer shall be capable of administering the manufacturer's

and dealer's warranty for all components supplied by the selling dealer (who may or may not be the same as the servicing dealer).

5. The manufacturer's and dealer's extended warranty shall in no event be for a period of less than five (5) years from date of initial start-up of the system or 2500 operating hours, whichever comes first. It shall include repair parts, labor, reasonable travel expense necessary for repairs at the jobsite, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Applicable deductible costs shall be specified in the manufacturer's warranty. Submittals received without written warranties as specified will be rejected in their entirety.

Clean Agent Fire Protection System

1. The manufacturer shall warrant the system equipment for 36-months from the date of shipment from the factory.

2. The contractor shall warrant the installation for 12-months from time of customer acceptance or commissioning.

Heat Pumps

1. The complete package shall be ETL Listed and tested to UL Standard 1995, 2nd Edition and CAN/CSA-C22.2 No. 236-95 2nd Edition for safety. The unit shall be certified to the current version of the Air Conditioning and Refrigeration Institute (ARI) Standard 390. The manufacturer of the heat pump shall be ISO 9001 2000 certified.

ATS – Automatic Transfer Switch

1. The transfer switch, complete with all timers, relays, and accessories, shall be UL-listed under Standard UL-1008 and approved for use on emergency systems. The UL listing shall include the specific amperage ratings that are called for on the drawings.
2. Contain a short circuit withstand capability and closing ratings when coordinated with circuit breakers in excess of the UL minimum requirement of 42,000 RMS amperes symmetrical.
3. Completely wired, assembled, and tested by the manufacturer at the factory to ensure compatibility and to completely test the assembly.

4. Provide the transfer switch as shown on the drawings with full load current rating of amperes at 208/120V, 3-phase, 4-wire, 60 Hertz AC normal and emergency.

5. Capable of switching all classes of load and rated for continuous duty when installed in non-ventilated enclosures.

6. Provide exercise timer, automatically actuated, to permit weekly programming of engine generator test runs under load. If the emergency source should fail during the exercise period, and if normal power is available, the switch shall immediately restore to normal.

7. Auxiliary contacts shall be provided to monitor the status of the ATS.

8. Microprocessor controlled with front accessible HMI interface.

Submittals:

1. Building structure: Submit design calculations and working design drawings for the building structure prepared by a professional engineer licensed in the State of Connecticut.

2. Timber stair structure: Submit design calculations and working design drawings for the timber stairs with foundation details prepared by a professional engineer licensed in the State of Connecticut.

3. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

4. Erection Drawings: Submit complete erection drawings showing roof framing, transverse cross sections, penetrations, covering and trim details and accessory installation details to clearly indicate proper assembly of building components.

5. Submit certification verifying that the metal roofing system has been tested and approved by Underwriter's Laboratory as Class 90. Submit certification that the metal roofing system, has been tested and approved by the US Army Corps of Engineers Guide Specification 07146 (Test Method for Structural Performance of Standing Seam Metal Roof Systems by Uniform Static Air Pressure) (MR-24®, CMR-24® and VSR™).

6. Dealers Certification: Submit certification that the building component system supplier and/or the metal roofing system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished. Certification shall state date on which authorization was granted.

7. Installer Certification: Submit certificate that the building roof system installer has regularly engaged in the installation of building systems of the same or equal construction of the system specified.

8. Samples: Submit samples, two (2) each of the following for Engineer's review. Samples will be used as basis for evaluating quality of finished roof and wall systems.

    a. Twelve inch long by actual width of roofing, liner panel and siding panels with required finishes.
    b. Fasteners (including standing seam roof clips) for application of roofing, sliding and soffit panels.
    c. Twelve (12) inch long (min.) x twelve (12) inch wide (min.) of actual standing seam side lap seams for both sides of a typical panel including sealants and closures.

9. Design calculations and shop drawings as well as flow calculation reports for the Clean agent fire extinguishing system as per NFPA 2001.

10. Shop drawings and product data sheets for the Fire alarm system as per NFPA 2001.

11. Product data sheets and installation details for the items specified for the electrical distribution panel, electrical and light fixtures as indicated on the drawings.

12. Product data sheets and installation details for the heat pumps.

13. Component List - A breakdown of all components and options including switch gear.

14. Technical Data - Manufacturer produced generator set specification or data sheet identifying make and model of engine and generator including relevant component design and performance data. Transient response of frequency and voltage for the generator set:

    a. Auxiliary Equipment - Specification or data sheets, including switchgear, spring type vibration isolators.

    b. Drawings - General dimensions drawings showing overall generator set measurements, mounting location, and interconnect points for load leads, fuel, exhaust, cooling and drain lines.

    c. Wiring Diagrams - Wiring diagrams, schematics and control panel outline drawings published by the manufacturer in Joint Industrial Council (JIC) format for controls and switchgear showing interconnected points and logic diagrams for use by contractor and owner.

    d. Warranty Statements - Warranty verification published by the manufacturer.

    e. Service - Location and description of supplier's parts and service facility including parts inventory and number of qualified generator set service personnel.

15. The Contractor shall submit shop drawings, technical data, and certificates for all items of equipment under this section including manufacturer's descriptive literature, catalog data, and other information required to demonstrate compliance with the Contract Documents.

16. Drawings shall provide locations of grounding rods, connectors, cables, and other related materials along with details of terminations and access points.

17. Manufacturer’s catalog data for all proposed materials with installation recommendations.

18. Procedures and equipment for testing resistances and electrical continuity.

19. Submit product data on the following:

    a. Grounding conductors

b. Connectors, bushings and fittings

c. Exothermic welding process, components, materials, and molds

d. Ground rods, ground rod couplers and driving sleeves

20. Submit grounding system test plan and procedures for review and approval prior to testing. Test procedures submitted for approval shall include test report format and proposed probe placement and spacing intervals relative to the ground grid being tested.

21. Contractor shall perform fall-of-potential tests in accordance with IEEE 81 in at least two (2) different directions (two traverses), resulting in at least two (2) test data plots.

22. Grounding system test reports shall include the following as a minimum:

    a. Sketch of grounding system being tested showing locations of test probes relative to the ground grid under test.

    b. Make, model and calibration date of test instruments.

    c. Weather conditions at time of test.

    d. Plotted "S" curves resulting from the fall-of-potential tests. Shape of curves shall be satisfactory as determined by the Designer, demonstrating adequate probe spacing evidenced by a distinct horizontal section in the middle of the curve (refer to IEEE 81). Unsatisfactory test data plots shall be rejected and retesting shall be required.

    e. Submit samples of mechanical and compression grounding connectors and indicate the intended application.

23. Product data sheets including seismic design data and installation details for the ceiling suspended Cable Tray System.

Materials:

Structural Steel Design:

All structural mill sections or welded plate sections shall be designed in accordance with the latest edition of ASIC "Specifications for Design, Fabrication and Erection of Structural Steel Buildings," and all cold formed steel members shall be designed in accordance with the latest edition of AISI "Specification for the Design of Cold-Formed Steel Structural Members."

Primary Framing:

Rigid Frames: Frame shall consist of welded-up plate section or rolled section columns and roof

beams complete with necessary splice plates for bolted field assembly. All bolts for field assembly of frame members shall be high strength bolts as indicated on the erection drawings.

Endwall Structurals: The endwall structural shall be cold-formed channel members designed in accordance with the latest edition of AISI Specifications or welded-up plates sections designed in accordance with the latest edition AISC Specifications. Endwall frames shall consist of endwall corner posts, endwall roof beams and endwall posts as required by design criteria.

Secondary Structural Members:

Purlins and Girts: Purlins and Girts shall be "Z" shaped, precision roll formed.

Eave Strut: Eave Struts shall be factory pre-punched "C" sections.

Bracing: Bracing shall be located as indicated on the drawings.

Structural Painting:

1. Prior to painting all steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material. Unless otherwise specified, the fabricator shall not sand blast, flame clean or pickle prior to painting.

2. Factory cover all steel with one coat of red oxide primer paint formulated to equal or exceed the performance of Federal Specification TT-P-636D, TT-P-664C and SSPC Paint-25.

Primary Frames:

1. Clean all steel per SSPC-SP2.

2. Apply one coat of water reducible alkyd primer by spray or dip method to a minimum coating thickness of 1.0 mil.

Secondary Structurals:

1. Clean all steel per SSPC-SP8.

2. Apply one coat of coil applied polyester primer to a minimum coating thickness of 0.5 mil (Purlins and Girts).

Roof:

The roof shall be covered with a roof system furnished by the manufacturer and installed in accordance with the manufacturer's instructions.

Component Description:

Roof Panels:

Roof panels shall be roll formed panels 24" wide, with 2 major corrugation, 2" high (2-3/4" including seam) 24" on center. The flat of the panel shall contain cross flutes 6" on center perpendicular to the major corrugations the entire length of the panel to reduce wind noise and improve workability.

Panel material as specified shall be 24 gauge steel coated both sides with a layer of aluminum zinc alloy (approximately 55% aluminum and 45% zinc) applied by the continuous hot dip method. Minimum 0.55 ounce coated weight per square foot as determined by the triple spot test per ASTM Specification A792.

System Design:

All components for the roof paneling system shall be designed in accordance with sound engineering methods and practices.

Roof panels shall be designed in accordance with the latest edition of AISI "Specifications for the Design of Light-Gage, Cold Formed Steel Structural Members."

Paneling system shall be designed to support design live loads.

All endwall trims and roof transition flashings shall allow the roof panel to move relative to the wall panels and/or parapets as the roof expands and contracts with temperature change.

Fasteners:

All connections of panels to structural members, except at eaves, shall be made with clips with moveable tabs that are seamed into the standing seam sidelap.

Panel clips shall be fastened to structural members with fasteners as per manufacturer's erection drawings, using factory pre-punched holes in structural members. Scrubolts™ or approved equal, shall contain a metal backed rubber washer which serves as a torque indicator.

Panel to panel connections shall be made with a positive, field formed standing double lock seam, formed by a special seaming machine. The machine field forms the final 180º of a 360º Pittsburgh double-lock standing seam; all sidelap sealant shall be factory applied.

Fasteners penetrating the metal membrane at the following locations must not exceed the frequency listed:

Basic Panel System	0 per sq. ft.	High Eave (no parapet)	2 per lin. Ft.
Exterior Eave Gutter	2 per sq. ft.	Panel Splices	2 per lin. Ft.
Gable Trim (no parapet)	2 per lin. ft.	High Side Transition	1 per lin. Ft.
Ridge	1 per lin. Ft.		

In lieu of pre-punched secondaries and panels, pre-drilling of the structural members is mandatory in order to maintain proper alignment of the roof system.

Accessories:

The building shall have gutters, downspout, gable trim and eave trim.

Performance Testing:

Underwriters Laboratories – UL Class 90 Rating (UL Test 580)

The roof system shall carry a UL wind uplift classification Class 90 rating to ensure structural integrity.

Provision for Expansion/Contraction:

Provision for thermal expansion movement of the panels shall be accomplished by the use of clips with a moveable tab. The stainless steel tab shall be factory centered on the roof clip when installed to assure full movement in either direction. A force of no more than 8 pounds will be required to initiate tab movement. Each clip shall accommodate a minimum of 1¼" in either direction.

Exterior Wall:

Exterior walls shall be covered with precision roll-formed panels.

Panel Description:

Panel shall be 3' wide with four major corrugations, 1½" high, and 12" on center with two minor corrugations between each of the major corrugations the entire length of the panel.

Panels shall be one piece from base to building eave.

The upper end of panels shall be fabricated with mitered cut to match corrugations of roof panels.

The bottom end of panels shall be straight cut.

Panel Design:

Panel design shall be in accordance with the latest edition of AISI "Specifications for the Design of Light-Gage, Cold-Formed Steel Structural Members," and in accordance with sound engineering methods and practices.

Panel Material and Finish:

26 gage galvanized, per ASTM A525 and painted with exterior color of the manufacturer's finish system, a full strength fluoropolymer coating. Manufacturer warrants that coating shall not blister, peel, crack, chip or experience material rust through for 20 years. For a period of 20 years chalking shall not exceed #8 – ASTM and fading shall be 5ΔE Hunter units or less.

Panels shall be sealed at the base with foam or rubber closures.

Trim material shall be as follows:

All exterior trim shall be of the same finish as the exterior color of the wall panel except the following:

1. All gutters, downspouts, eave trim, gable trim, door side flashings to be pre-painted galvanized steel with fluoropolymer coating.

2. All gutter, downspouts, eave trim and gable trim shall be Charcoal.

3. Door side flashing and door header flashing shall be in Charcoal.

All interior trim shall be painted.

All flashings, trims, closures and similar items shall be detailed on drawings as supplied by the manufacturer of the panel.

Fasteners:

Wall panel to structural connections shall be made with Torx® head fasteners, Torx® head self-drilling screws or Lock-Rivet™ fasteners or approved equal. Panel to Panel connections shall be made with Torx® heads self-drilling screws, or Lock-Rivet™ fasteners or approved equal.

All exposed fasteners shall be pre-painted to match wall color or shall be covered with plastic color caps to match wall color.

Insulation:

The roof and exterior walls shall be made with faced fiberglass insulation blanket with a minimum R-value of 38 and 21 respectively. The insulation facing shall be foil reinforced kraft, 0.00035" minimum thick aluminum foil laminated to kraft paper, reinforced with fiberglass scrim, which is adhered to the blanket insulation. The assembly of blanket and facing shall have a flame spread rating of 25 and U/L label shall be furnished upon request.

Deadbolt Lock:

The door hardware shall have a removable core. Metro-North shall determine the exact brand and model that will be used.

Floor Finish:

The structure shall have a bare concrete floor finish.

Timber Stairs:

Lumber: Framing and decking lumber shall be No. 2 or better Pressure Treated Southern Yellow Pine. Pressure treatment shall be CCA Type C in accordance with AWPA U1, P5 and P23. Use 0.25 lb/cu ft (6.4 kg/m^3) in accordance with AWPA U1. All cut surfaces and holes made subsequent to the pressure treatment shall be treated in accordance with AWPA Standard M4.

Hardware: Provide corrosion resistant steel fasteners with hot-dip zinc coating per ASTM A153/A153M.

Mechanical:

- All materials and equipment provided under this section shall be new, first grade, best of their section and shall meet the requirements of all standards set up to govern the manufacture of mechanical components and comply with all applicable codes and standards.

- Heat pump systems, models and capacities shall be as shown on the drawings or approved equal.

- Duct tape shall not be permitted as sealant.

- Grille sizes indicated on the drawings are inner clear dimensions.

- Diffuser neck size shall be same as flexible duct size, unless noted otherwise.

- Heat pumps shall not be run for temporary heating, ventilation testing or otherwise without filter in place. Supply such filters until the system is handed over to Metro North at which time new filter shall be installed.

- Heat Pump shall operate in accordance with an integral time clock. Supply air duct mounted temperature sensor shall control cooling by staging the compressors and control heating by staging unit's heater. Duct mounted return air thermostat and humidistat shall control unit operation to maintain temperature and humidity (dehumidification) setpoints.

Accessories:

- Class 1A fast action dampers shall comply with SMACNA. Provide damper on supply air and return airwall grills interlocked with the clean agent controller to close on delayed action of clean agent. Dampers shall operate with spring return to fail close with power failure.
- Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by the insulation manufacturer for the application indicated.
- Diffusers shall be Titus model TMSA of steel construction with model AG-75 opposed blade damper and adjustable louver vanes. Size and capacity as noted on the drawings or approved equal.
- Return air grilles shall be Titus model 50F Egg-crate type with 1/2" aluminum grid and opposed blade damper. Size and capacity as noted on the drawings or equal.
- Motorized damper shall be Ruskin model CD-40, of all with 120V operator or approved equal. Provide with thermostat.
- Electronic controls shall include thermostats, control panels, relays, transformers, sensors and accessories as required to perform the sequences as described below.

Electrical:

- All materials and equipment provided under this section shall be new, first grade, best of their section and shall meet the requirements of all standards set up to govern the manufacture of electrical materials and comply with all applicable codes and standards.

- All equipment and materials shall be specification grade and bear underwriter's (U.L.) label.

- Conductors shall be U.L. listed, 600 Volts, 90 Deg. C. Single Conductor type THWN/THHN. 98% conductivity annealed uncoated cooper with PVC insulation covered with nylon sheath jacket. Tested in accordance with the requirements of the underwriter's laboratories standard 83. Wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol and type designation. Conductors shall be stranded. Minimum size shall be #12awg unless otherwise indicated as manufactured by Essex, Rome cable, Triangle cable or General cable.

- Electric metallic tubing (EMT) shall be zinc coated steel.

- Armored cable shall be of galvanized steel interlocking armor construction, color coded thermoplastic insulated copper conductors, 90 deg. C, 600 volts. Conductor sizes shall be as indicated on the drawings. If not indicated, the sizes of power and lighting conductors shall not be less than size #12awg as manufactured by American flexible conduit, Triangle or Southwire. Connectors shall be squeeze type, die cast zinc, or malleable iron - cadmium plated as manufactured by Z Gedney, Appleton or Thomas-Betts.

- Conduit straps shall be snap-type, double ribbed steel - zinc plated. Metal clad cable and flexible metallic conduit connectors shall be malleable iron-zinc plated, male hub threads with locknut.

- Recessed outlet boxes shall be drawn steel, galvanized with a minimum depth of 1-1/2inches. Minimum size shall be 4 inch x 4 inch square. Provide and install plaster rings as required.

- Outlet boxes for surface mounted switches and receptacles shall be type FD, cast ferroalloy with threaded hubs. Provide gasketed cover as required.

- Switches shall be 120-277VAC 20 amp, single pole. Color shall be Ivory.

- Receptacle and switch cover plates shall be smooth thermoplastic Ivory.

- Panelboards shall be NEMA PB 1, circuit breaker type.

- Provide and install markers for all conduits. Markers shall be "Brady" type adhesive-backed, plastic-faced of suitable color. Marker shall identify system and electrical characteristics. Install markers at point of origin, termination, adjacent to each intermediate splice, and all boxes in run.

- Identify all conductors at origin, termination and at intermediate boxes by means of "Brady" type, pressure sensitive, plastic coated face, stick-on labels except feeders shall have phenolic tags engraved with circuit designations and attached with plastic tie-wraps.

Natural Gas Powered Generator:

1. Engine-Genset: Factory-assembled and -tested, engine-generator set. Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

2. Capacities and Characteristics: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.

3. Output connections: Three-phase, four wire.

4. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.

5. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.

8. Engine:
   A. Fuel: Natural gas.

   B. Rated Engine Speed: 1200 rpm.

   C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

   D. Lubrication System: The following items are mounted on engine or skid:

      - Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

- Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

- Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

9. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

10. Governor: Adjustable isochronous, with speed sensing.

11. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set mounting frame and integral engine-driven coolant pump.

12. Muffler/Silencer: Sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. Minimum sound attenuation of 18 dB at 500 Hz. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 95dBA or less.

13. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

14. Starting System: 24-V electric, with negative ground.

    - Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
    - Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
    - Cranking Cycle: As required by NFPA 110 for system level specified.
    - Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
    - Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

15. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified. Include accessories required to support and fasten batteries in place.

16. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

17. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

18. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
    - AC voltmeter.
    - AC ammeter.
    - AC frequency meter.
    - DC voltmeter (alternator battery charging).
    - Engine-coolant temperature gage.
    - Engine lubricating-oil pressure gage.
    - Running-time meter.
    - Ammeter-voltmeter, phase-selector switch(es).
    - Generator-voltage adjusting rheostat.
    - Start-stop switch.
    - Overspeed shutdown device.
    - Coolant high-temperature shutdown device.
    - Coolant low-level shutdown device.
    - Oil low-pressure shutdown device.

19. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

20. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems.

    - Engine high-temperature shutdown.
    - Lube-oil, low-pressure shutdown.
    - Overspeed shutdown.
    - Remote emergency-stop shutdown.
    - Engine high-temperature pre alarm.
    - Lube-oil, low-pressure pre alarm.
    - Low coolant level.

21. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering

visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush mounting type to suit mounting conditions indicated.

22. Remote Emergency-Stop Switch; also known as Remote Manual Stop Station: Surface, water proof and exterior; wall mounted, unless otherwise indicated; and labeled per NFPA 110 5.6.5.6. Push or pull button shall be protected from accidental operation.

23. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

24. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

25. Outdoor Generator set enclosure: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure. Structural Design and Anchorage shall comply with ASCE 7 for wind loads.

26. Vibration Isolation Devices: Elastomeric Isolator Pads - Oil and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a non-slip pattern and galvanized-steel base plates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

27. Finishes - Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

Fire Alarm and Firefighting system:

- All materials and equipment provided under this section shall be new, first grade, best of their section and shall meet the requirements of all standards set up to govern the manufacture of fire alarm and firefighting systems and comply with all applicable codes and standards. The fire alarm system shall have the capability of informing Norwalk Fire department and Metro North Railroad in the event of fire.

- All equipment and materials shall be specification grade and bear underwriter’s (U.L.) label.

- Non-coded, UL listed addressable system with multiplexed signal transmission and horn/strobe evacuation.

- Fire alarm system shall initiate the following actions:

    1. Continuously operate the alarm notification system

2. Identify alarm and specific initiating device at fire alarm control panel and remote annunciator.

3. Transmit alarm signal to Norwalk Fire department and Metro North Railroad

4. Switch heat pumps to fire alarm mode.

5. Activate emergency lighting control

6. Close dampers in the heat pumps.

7. Activate emergency shutoffs for gas and fuel supplies.

- Fire alarm control panel shall be as manufactured by Tyco, Honeywell, Gamewell or approved equal.

- Automatic sensitivity control for smoke detectors complying with requirements of UL217. The smoke detector shall have the capability of informing Norwalk Fire department and Metro North Railroad in the event of smoke detection.

- Heat detectors shall comply with requirements of UL 521. The heat detector shall have the capability of communicating with Metro North Railroad if the internal temperature rises above 80 degrees and the heat pumps stop working.

- Manual fire alarm boxes complying with requirements of UL 38.

- Total flooding, FM-200 fire suppression system, super-pressurized with dry nitrogen shall be installed to meet a minimum design concentration of 7%, by volume in all designated spaces to be protected.

- FM-200, fire suppression equipment and accessories shall be as be manufactured by, Kidde Fire Systems or approved equal.

- The total flooding system shall consist of a Kidde FM-200 agent storage cylinder, Kidde actuation hardware and Kidde ECS series system distribution nozzles attached to a pipe network or approved equal.

Grounding and Bonding system:

- The Contractor shall furnish, install, and test a complete grounding system in accordance with the Plans and as specified herein.

- Bare conductors: Class B stranded, annealed, soft-drawn copper cable conforming to ASTM B3. The conductor size shall be as indicated on the Plans.

- Conductors for grounding and bonding shall be ASTM B8, Class B stranded annealed copper, and sized as indicated on the plans. Grounding cable from aerial ground wire to

ground rod shall be 4/0 copper, and fastened with straps (Ransom type or approved equal) to the pole.

- Connectors and Clamps: Bolts, washers and stop nuts shall be of high-copper alloy, Everdur, Durium, Duronze or silicone bronze. Ferrous hardware will not be acceptable

- Ground Rods. UL-listed copper-clad steel rods, ¾ inch diameter, nominal 10 foot sections complying with NEMA GR 1 and UL 467. Carbon steel core and tip, with plated copper cladding of at least 10 mils thickness. Use bronze ground rod couplers, threaded type, if required to provide the total rod lengths indicated on the Plans.

- Fittings. All connections below ground (i.e. buried) shall be exothermic weld type connections. All above-ground connections shall be bolted type. All fittings shall be UL-listed.

The following specific sections of Division 1 General Requirements and Covenants, Section 1.20 General Clauses for Facilities Construction shall govern for the items in this Special Provision:

1.20–1.00 – General
1.20–1.02.04 – Examination of Plans, Specifications, Special Provisions, and Site Work
1.20–1.02.13 – Knowledge of Applicable Laws
1.20-1.05.02 - Contract Submittals
1.20-1.05.07 – Coordination with work by other parties
1.20-1.05.09 – Authority of Inspectors
1.20-1.05.10 – Inspections
1.20 – 1.05.11 – Removal of Defective or Unauthorized Work
1.20 – 1.08.14 – Facilities Acceptance of Project

Construction Methods:

The Contractor shall erect the structure, seal the building after installation of electrical, mechanical and firefighting systems, to form a weather tight enclosure and tie in to existing external utilities. The contractor shall also install the grounding and bonding system and cap and abandon the existing monitoring well.

Method of Measurement:

"Security Node House" will be paid on a lump sum basis and will not be measured for payment. The limits of all underground utilities, to be included in the lump sum price for "Security Node House", shall be 5' from the outside faces of the supporting concrete structure. Foundation and Concrete slab work will not be included in this item.

Basis of Payment:

Payment for this work will be at the contract lump sum price for "Security Node House" complete in place which shall include all work necessary and incidental to fabricate and install the building including all Electrical, Mechanical, FRP Railing, Cable Tray System, Timber stairs, 36" Concrete splash block and Fire protection system and all appurtenances mentioned in these specifications

and drawings and or as needed per building code requirements. Foundation and Concrete slab work shall be paid under "Structure Excavation – Earth (Complete)", "Class "F" Concrete", "Deformed Steel Bars- Epoxy Coated" "Drilled Shaft", and "Welded Wire Fabric – Epoxy Coated" items.

Pay Item	**Pay Unit**
Security Node House	Lump Sum

ITEM #0706001A - MICROPILES

ITEM #0706002A - VERIFICATION TEST FOR MICROPILES

ITEM #0706003A - PROOF TEST FOR MICROPILES

ITEM #0706004A – MICROPILE LENGTH ADJUSTMENT

CTDOT Form 817 Article 7.06.01 – Add the following paragraphs at the end of the section:

"The Contractor shall independently verify the location of the bedrock by installing a soil boring(s) within the footprint of the proposed Security Node House and performing a detailed geotechnical investigation. The boring shall be advanced 10'-0" minimum into bedrock. The purpose of this investigation will be to determine the termination elevation of the micropiles

.

All drilling spoils shall be disposed of by spreading material over the embankment within the work area prior to restoring the slope with ballast and/or spreading the material in the three (3) CT DOT parcels designated as a construction laydown area during the construction of the Security Node House."

CTDOT Form 817 Article 7.06.03 - Add the following paragraph at the end of the section:

"9. Benching: *The Contractor shall provide a benched level work area before the start of drilling operations as per the requirements of the shaft drilling equipment or as directed by the Engineer."*

CTDOT Form 817 Article 7.06.04 1. Micropiles - Add the following paragraph at the end of the section:

"All labor and material associated with preparing the benched area will not be measured for payment because it is considered incidental to the construction of the micropiles.

ITEM #1008183A – ¾" PVC COATED CONDUIT

ITEM #1008184A – 1" PVC COATED CONDUIT

ITEM #1008185A – 1½" PVC COATED CONDUIT

ITEM #1008188A – 1¼" PVC COATED CONDUIT

ITEM #1008192A – 2" PVC COATED CONDUIT

Description:

This work shall consist of furnishing and installing new PVC coated rigid galvanized steel (RGS) conduit system and fittings as indicated on the Plans or as directed by the Engineer.

General:

Coordination:

The plans indicate the extent and the general location and arrangement of the work. The Contractor shall study the plans and details so that the work will be properly located and readily accessible. If conflicts occur necessitating departures from the plans, the Contractor shall submit details of departures and reasons therefore shall be submitted as soon as practicable for written approval of the Engineer. Contractor shall ensure any rerouting required does not adversely affect the circuits inside.

Substitutions of products and materials of other Sections may affect wire sizing and/or conduit fill. Contractor shall ensure all substitutions are coordinated with the design and the installation conforms to all Contract requirements and local codes.

Make field inspections necessary in order to prepare accurate shop drawings in accordance with existing conditions. Submit shop drawings coordinated with existing conditions and all other work for approval prior to performing any installation. Include plans, elevations, sections, details, and attachments as needed. Drawings should indicate site specific installation details including showing the exact equipment locations, mounting details, splice locations, riser diagrams, and capacity for holding slack cable(s).

Materials:

The PVC Coated Conduit system shall include necessary PVC coated fittings, boxes, and covers to form a complete encapsulated conduit system. Conduits, couplings, elbows, bends, and nipples shall meet the requirements of NEC, UL 6, ANSI 80.1, NEMA RN-1 as applicable.

The PVC Coated Conduits shall be rigid steel, hot dip galvanized inside and out with hot dipped

galvanized threads. The interior galvanizing shall be listed per UL 6. The exterior galvanizing shall be listed per UL 6 as primary corrosion protection. Thread protectors shall be used on the exposed threads of the PVC coated conduit.

The PVC coating, in compliance with NEMA RN-1, shall be nominal 40 mils in thickness continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles or pinholes. PVC shall be UL listed as a primary corrosion protection.

A urethane coating shall be uniformly and consistently applied to the interior of conduit. This internal coating shall be a nominal 2-mil thickness. All male threads on elbows and nipples shall be protected by this same application of urethane coating.

Coated couplings shall be used with coated conduit. The thickness of the coating on couplings shall be at least equal to the thickness of the coating on the conduit. Each coated coupling shall have a flexible PVC sleeve which extends from each end of the coupling and which will overlap the PVC coating on the conduit when the coupling has been installed on the conduit. The length of the sleeve extension(s) shall be at least equivalent to the nominal conduit size for sizes up through 2". For sizes 2" – 6", the length of the sleeve extension(s) shall be at least 2 in. The PVC sleeve shall be a nominal thickness of 40 mils in thickness. The inside diameter of the overlapping sleeve shall be less than the outside diameter of the PVC-coated conduit.

Conduit straps and clamps used with PVC coated conduit shall also be PVC coated. Where conduit is installed on strut channel, the channel shall be PVC coated or 316 stainless steel unless otherwise noted on the Plans. 316 stainless steel straps may be used with stainless steel channel but shall not be used with PVC coated strut channel.

Product Data:

> Submit Manufacturer's literature and catalog cuts for all products/materials to the Engineer for review and approval.

Construction Methods:

The Contractor shall adhere to all provisions of the Connecticut DOT Form 817 Standard Specifications.

It shall be responsibility of the Contractor to ensure the PVC coating remains intact on all conduits. Should any of the PVC coating be nicked, scratched or otherwise damaged where the RGS becomes exposed, the Contractor shall be responsible at his expense to repair and restore the PVC coating using a manufacturer approved repair kit and procedure.

To minimize installation damage to the PVC coatings, use tools specially designed for PVC coated conduit or standard tools that have been appropriately modified for installing PVC coated conduit. Standard tools which have not been modified could damage the coatings and shall not

be used to install PVC coated conduit. Follow all manufacturer's recommendations and instructions.

Where conduit is threaded in the field, the thread shall be coated with an approved electrically-conductive, corrosion resistant compound. Compound shall be UL listed "FOIZ".

Bending: Conduit bends shall be made with a bender with shoes specifically designed to bend PVC coated conduit. Small conduit sizes may be bent using an EMT hand bender one size larger than the conduit size. Follow all manufacturer instructions and recommendations.

Method of Measurement:

This work shall be measured for payment by the number of "linear feet" of conduit and all fittings installed in accordance with the Plans, specifications, and/or as ordered by Engineer. Measurement shall be along the centerline of the conduit.

Basis of Payment:

The work under this item shall be paid for at the contract unit price per linear feet for "PVC Coated Conduit size specified" furnished and installed, which price shall include the cost of all labor, material (including fittings) and equipment necessary to complete the work.

Pay Item	**Pay Unit**
¾" PVC Coated Conduit	Linear Foot
1" PVC Coated Conduit	Linear Foot
1 ¼" PVC Coated Conduit	Linear Foot
1 ½" PVC Coated Conduit	Linear Foot
2" PVC Coated Conduit	Linear Foot

ITEM #1108842A – FIBER OPTIC PATCH PANEL - 24 POSITION

ITEM #1108844A – FIBER OPTIC PATCH PANEL - 72 POSITION

Description:

This item shall consist of furnishing and installing 72 and 24 Position Fiber Optic Patch Panels at the locations shown on the plans or as indicated by the Engineer.

Materials:

Product Data: Submit Manufacturer's literature and catalog cuts for all products/materials to the Engineer for review and approval.

A. The Fiber Optic Patch Panels shall be Optical Cable Corporation RTC72B72SMLCPS or equivalent meeting the following requirements:

1. The Fiber Optic Patch Panel shall be a stand-alone unit manufactured for outdoor field cabinets.
2. The Fiber Optic Patch Panel shall include and be capable of accommodating a minimum of 72 terminations as shown in the plans.
3. The Fiber Optic Patch Panel shall include and be capable of terminating up to 72 connectorized pigtails.
4. The Fiber Optic Patch Panel shall incorporate a hinged access door.
5. The Fiber Optic Patch Panel shall be rack, wall, or shelf mountable as required by the specific location. The patch panel shall be securely fastened in place as recommended by the manufacturer.
6. The Fiber Optic Patch Panel shall include splice trays meeting the following requirements:
    i. The splice trays in the Fiber Optic Patch Panel shall be capable of holding a minimum of 24 splices each. Additional splice trays shall be provided to match the port capacity of the fiber patch panel.
    ii. The splice trays shall incorporate a system to retain and provide strain relief to the fiber optic buffers tubes and connector pigtails.
    iii. The splice trays shall incorporate grooves where the fiber optic splice can be held in place
    iv. Each splice tray shall incorporate a clear snap on lid.
7. The Fiber Optic Patch Panel shall include a restraining system to hold the splice trays securely in place.
8. The Fiber Optic Patch Panel shall incorporate cable guides that maintain fiber strands and fiber buffer tubes bending radius greater than the minimum allowed by the manufacturer.
9. The Fiber Optic Patch Panel shall use 72 connectorized pigtails to connect the fiber optic cable to the Fiber Optic Patch Panel.

10. The connectorized pigtails shall meet the following requirements:
    i. All fiber optic connectors shall be provided shall be type “LC”.
    ii. The connector mean insertion loss shall be 0.15 dB and maximum 0.3 dB.
    iii. The connector mean reflectance shall be “≤ -58 dB” typical
    iv. All LC connectors shall have a durability rate of less than 0.2 dB change over 500 rematings per FOTP-21.
    v. Connectors shall meet ANSI/TIA EIA-604-10 requirements.
    vi. The fiber optic strand of the connectorized pigtail shall have matching optical properties as the fiber optic strand used on the fiber optic cable.
11. The Fiber Optic Patch Panel shall incorporate a restraining mechanism to hold the fiber optic cable central member and outside jacket.
12. The Fiber Optical Patch Panel shall fit in a standard 19” rack.
13. 72-port Fiber Optic Patch Panel shall occupy a maximum of 4U.
14. All plastic components shall be high impact, self-extinguishing UL listed 94V-0.

B. The Fiber Optic Patch Panels shall be Panduit FRME1U or equivalent meeting the following requirements:

15. The Fiber Optic Patch Panel shall be a 1 RU Rack mountable unit.
16. The Fiber Optic Patch Panel shall include and be capable of accommodating a minimum of 24 terminations as shown in the plans.
17. The Fiber Optic Patch Panel shall include and be capable of terminating up to 24 connectorized pigtails.
18. The Fiber Optic Patch Panel shall be rack mountable. The patch panel shall be securely fastened in place as recommended by the manufacturer.
19. The Fiber Optic Patch Panel shall include splice trays meeting the following requirements:
    v. The splice trays in the Fiber Optic Patch Panel shall be capable of holding a minimum of 12 splices each. Additional splice trays shall be provided to match the port capacity of the fiber patch panel.
    vi. The splice trays shall incorporate a system to retain and provide strain relief to the fiber optic buffers tubes and connector pigtails.
    vii. The splice trays shall incorporate grooves where the fiber optic splice can be held in place
    viii. Each splice tray shall incorporate a clear snap on lid.
20. The Fiber Optic Patch Panel shall include a restraining system to hold the splice trays securely in place.
21. The Fiber Optic Patch Panel shall incorporate cable guides that maintain fiber strands and fiber buffer tubes bending radius greater than the minimum allowed by the manufacturer.
22. The Fiber Optic Patch Panel shall use 24 connectorized pigtails to connect the fiber optic cable to the Fiber Optic Patch Panel.
23. The connectorized pigtails shall meet the following requirements:
    vii. All fiber optic connectors shall be provided shall be type “LC”.
    viii. The connector mean insertion loss shall be 0.15 dB and maximum 0.3 dB.
    ix. The connector mean reflectance shall be “≤ -58 dB” typical

x. All LC connectors shall have a durability rate of less than 0.2 dB change over 500 rematings per FOTP-21.
xi. Connectors shall meet ANSI/TIA EIA-604-10 requirements.
xii. The fiber optic strand of the connectorized pigtail shall have matching optical properties as the fiber optic strand used on the fiber optic cable.

24. The Fiber Optic Patch Panel shall incorporate a restraining mechanism to hold the fiber optic cable central member and outside jacket.
25. The Fiber Optical Patch Panel shall fit in a standard 19" rack.
26. 24-port Fiber Optic Patch Panel shall occupy a maximum of 1U.
27. All plastic components shall be high impact, self-extinguishing UL listed 94V-0.

Contractor shall furnish all patch (jumper) cables required for complete end-to-end network connectivity as part of this Item. Patch cables shall meet the same requirements as the connectorized pigtails described herein except for providing "LC" connectors on each end. Coordinate connector type with final equipment termination. Provide at least 25% spare patch cables.

Construction Method:

The Contractor shall submit shop drawings and product data to the Engineer for approval prior to supplying this item. It shall be responsibility of the Contractor to ensure all connector types are correct and match the communications equipment being installed as shown in the plans. The Contractor shall furnish connectors for each port and provide to MNR for installation at locations where MNR will perform the fiber terminations.

Where installed in a rack without rear access, Contractor shall install patch panel on sliding rails properly designed for the size and weight of the fully loaded panel. A patch panel with integrated sliding tray may be substituted but shall meet all requirements herein.

Refer to "NOTICE TO CONTRACTOR"- Labeling Plan" and "NOTICE TO CONTRACTOR" – Basic Electrical Materials and Methods" for additional requirements.

Testing:

Refer to "NOTICE TO CONTRACTOR – Acceptance Testing" for overall testing requirements and additional information. At a minimum, the following tests shall be included: verification of proper installation of equipment per approved drawings and manufacturer recommendations, verification of all fiber cables are installed, verification of all port and cable labeling. Any tests recommended by the manufacturer shall also be included.

Method of Measurement:

"FIBER OPTIC PATCH PANEL - 72 POSITION" shall be measured for payment by the number of "Each" unit installed, tested, and accepted.

"FIBER OPTIC PATCH PANEL - 24 POSITION" shall be measured for payment by the number of "Each" unit installed, tested, and accepted.

Basis of Payment:

"FIBER OPTIC PATCH PANEL - 72 POSITION" and "FIBER OPTIC PATCH PANEL - 24 POSITION" shall be paid for at the contract unit price bid per "EACH", which price shall include full compensation for all materials including pigtails, patch cables, and other incidentals needed to complete the work.

Pay Item	**Pay Unit**
Fiber Optic Patch Panel, 72 Position	Each
Fiber Optic Patch Panel, 24 Position	Each

ITEM #1108876A – INFRARED ILLUMINATOR

ITEM #1112226A – PTZ DOME CAMERA

ITEM #1112227A – FIXED MOUNT DOME CAMERA

ITEM #1112360A – 360 DEGREE DOME CAMERA

ITEM #1112347A – PTZ DOME CAMERA WITH BUILT-IN INFRARED ILLUMINATORS

Descriptions:

This work shall consist of furnishing and installing Fixed, 360 Degree and PTZ Closed Circuit Television (CCTV) dome camera assemblies, camera mounting devices, infrared lights and other items at the field locations shown in the Plans and in accordance with the Contract Documents.

Analog elevator cameras are specified and provided in other sections.

Materials:

All materials furnished, assembled, fabricated, or installed shall be new, corrosion resistant and in strict accordance with the details shown in the contract documents. The CCTV Dome Cameras and other items shall be fully compatible with each other and shall have the capability of being fully controlled by software and hardware being furnished under other Contract items. All cameras shall be fully compatible with MNR's existing Verint Nextiva Video Management System.

General Requirements:

The equipment shall deliver high quality full-motion video during day or night operation with the video transmitted over fiber optic networks installed as part of this project as indicated in the Contract Documents.

Cameras shall be IP-based and comply with established network and video standards. Cameras shall be powered by the network switch utilizing the network cable as shown on the Contract Drawings. Power injectors (midspans) are not acceptable unless specifically shown. Cameras shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications and ONVIF complaint.

Mounting hardware be provided as part of these Items. The camera assembly shall be designed for mounting on a pole, platform canopy, structure, or wall as specified in the contract documents.

Adapter plates, where required, shall be provided as part of these Items. Connections between the equipment shall be through weather proof connectors to provide easy replacement. All cabling to the cameras shall be in conduit. Servicing of the camera assembly shall be available in the continental United States or Canada.

All conduits, cabling, hardware and other items not specifically called out elsewhere in the Contract Documents that are required for a complete and fully functioning PTZ or Fixed CCTV Dome Camera as described in the Specifications and Contract Documents shall be provided by the Contractor as part of these Items. This shall also include the 6'x6'x4' stainless steel junction boxes to be installed at the SAGA Bridge (which are not part of a conduit system).

Contractor shall relocate static station signage as necessary to avoid conflicts between the camera (including mount assembly) and the signs and as indicated on the Plans or directed by the Engineer. Signs that are clamped to the canopy structure and need to be relocated shall be considered incidental to mounting the camera. Signs that are bolted or otherwise permanently attached to the canopy structure and need to be relocated shall be relocated at the direction of the Engineer will be paid under other Items.

Fixed CCTV Camera Requirements

The fixed CCTV camera shall be Axis model Q3515-LVE or equivalent (see source limitations below) meeting the following requirements:

Camera Image Sensor:	1/2.8" Progressive Scan RGB CMOS, IR-sensitive
Lens:	Varifocal, Remote focus & zoom, IR-corrected, P-iris control
	9 mm: 3-9 mm, F1.3
	Horizontal field of view: 105°-36°
	Vertical field of view: 57°-21°
	22 mm: 9-22 mm lens, F1.6
	Horizontal field of view: 33°-15°
	Vertical field of view: 19°-9°
Zoom:	3x (optical); 2x (digital)
Minimum Illumination:	Color: 0.18 lx at F1.3 (1080p, 30fps, with WDR)
	B/W: 0.04 lx at F1.3 (1080p, 30fps, with WDR)
Day/Night:	Automatically removable infrared-cut filter
Wide Dynamic Range (WDR):	Up to 120dB
Shutter Time:	1/66500 s to 2 s

Video Compression:	H.264 (MPEG-4 Part 10/AVC) Baseline, Main and High Profiles
	Motion JPEG
Resolutions:	1920x1080 to 160x90
Frame Rate:	Up to 50/60 fps with WDR. Up to 100/120 fps without WDR at 1080p resolution.
Video Streaming:	Multiple, individually-configurable streams in H.264 and Motion JPEG
	Axis Zipstream technology in H.264
	Controllable frame rate and bandwidth
	VBR/ MBR H.264
Supported Protocols:	IPv4/v6, USGv6, SSL/TLS, QoS Layer 3 DiffServ, TCP, SFTP, CIFS/SMB, Bonjour, UPnP, SNMP v1/v2c/v3 (MIB-II), DynDNS, UDP, IGMP, ICMP, NTP, RTSP, HTTP, HTTPS, FTP, SMTP, DNS, SOCKS, SSH, RTP, RTCP, DHCP, ARP, LLDP
Camera ID:	Up to 20 characters (alphanumeric characters, marks)
Network Interface:	10Base-T/100Base-TX PoE, RJ-45 connector
Inputs and Outputs:	2 configurable supervised I/O ports, accessible via terminal block. Configurable normally open or normally closed
Power:	Power over Ethernet (PoE) 802.3af/802.3at Type 1 Class 3, typical 5.6W, max 12.5W max.
	8–28VDC, typical 6.3W, max 13.6W
	Power redundancy
Memory:	1 GB RAM, 512 MB Flash
API:	Open API for software integration
	ONVIF Profile S
Event Triggers:	Analytics, supervised external inputs, virtual inputs through API, , edge storage events, shock detection
Image Settings:	Electronic image stabilization, white balance (auto and manual), backlight compensation, image rotation (90 degree increments), low light compensation, exposure control, privacy masks
Video Transmission:	HTTP (Unicast), HTTPS (Unicast), RTP (Unicast & Multicast), RTP over RTSP (Unicast), RTP over RTSP over HTTP (Unicast)

Environmental:	-40°C to +60°C (-40°F to +140°F), 10-100% RH (condensing)
EMC Approvals:	FCC Part 15 - Subpart B Class A + B
Railroad EMC Approvals:	EN 55032 Class A, EN 50121-4, IEC 62236-4
	EN 55024, IEC/EN 61000-6-1, IEC/EN 61000-6-2,
Safety Approvals:	IEC/EN/UL 62368-1, IEC/EN/UL 60950-22, IEC/EN 62471
Environmental Approvals:	IEC 60068-2-1, IEC 60068-2-6, IEC 60068-2-14, IEC 60068-2-27, IEC 60068-2-78
MTBF:	>100,000 hours

The camera shall be an outdoor, vandal-resistant network dome camera designed for 24/7/365 use. The enclosure shall include a polycarbonate and aluminum body with encapsulated electronics, weather shield for vertical installations, and meet the requirements of IEC/EN 60529 IP66/67, NEMA 250 Type 4X, and IEC/EN 62262 IK10+ (50 J). Enclosure shall provide the ability to adjust the camera modules angle with ±80˚ tilt, ±360˚ pan and ±175˚ rotation while maintaining an image that is not interfered by the camera housing. Enclosure shall be equipped with a dehumidifying membrane.

The camera shall feature a black and white mode that may be automatically engaged on low light level and permit the use of an external infrared illuminator or manually selected. The camera shall incorporate independent automatic color-to-black and white switching modes for switchover on light threshold and sensitivity to IR illumination. Automatic color-to-black and white switching shall have selectable light level thresholds (high or low) and duration settings for the selected threshold before automatic switchover occurs.

PTZ Camera Requirements:

The PTZ CCTV camera shall be Axis model Q6054-E Mk III or equivalent (see source limitations below) meeting the following requirements:

Camera Image Sensor:	1/3” Progressive Scan CCD, IR-sensitive
Lens:	4.4 mm - 132 mm, F1.4-4.6, Autofocus
	62.9°-2.2° (horizontal FOV)
	37°-1.2° (vertical FOV)
Pan/Tilt/Zoom:	Pan: endless 360°
	Tilt: 220°
	Zoom: 30x (optical); 12x (digital)
	Pan and tilt speeds adjustable between .05-450˚/sec.

Effective Pixels:	1.3 megapixel (720p)
Minimum Illumination:	Color: 0.2 lx at F1.4 (30 IRE)
	B/W: 0.04 lx at F1.4 (30 IRE)
Day/Night:	Automatically removable infrared-cut filter
Shutter Time:	1/10000 s to 1/4 s
Video Compression:	H.264 (MPEG-4 Part 10/AVC)
	Motion JPEG
Resolutions:	1280x720 to 320x180
Frame Rate:	30 fps
Video Streaming:	Multiple, simultaneous, individually-configurable
	H.264: Main, Baseline Profiles
	Motion JPEG
	The camera shall support both Constant Bit Rate (CBR) and Variable Bit Rate (VBR) in H.264 and provide configurable compression levels.
Supported Protocols:	IPv4/v6, TCP, UDP, NTP, RTSP, HTTP, HTTPS, SSL/TLS, FTP, SMTP, DNS, SOCKS, SSH, RTP, RTCP, DHCP, NTCIP
Camera ID:	Up to 20 characters (alphanumeric characters, marks)
Network Interface:	10Base-T/100Base-TX PoE (60W), RJ-45 connector
Power:	60W PoE
Memory:	512 MB RAM, 128 MB Flash
API:	Open API for software integration
	ONVIF Profile S
Event Triggers:	Video motion detection, External input, Edge storage events, Shock detection, Fan, PTZ moving, PTZ preset
Image Settings:	Electronic image stabilization, automatic defog, white balance (auto and manual), backlight compensation, image rotation, low light compensation, exposure control, privacy masks
Video Transmission:	HTTP (Unicast), HTTPS (Unicast), RTP (Unicast & Multicast), RTP over RTSP (Unicast), RTP over RTSP over HTTP (Unicast)
Environmental:	-40°C to +50°C (-40°F to +122°F), 10-100% RH (condensing)

EMC Approvals:	FCC Part 15 - Subpart B Class A
Railway EMC Approvals:	EN 50121-4, IEC 62236-4

The camera shall be an outdoor, vandal-resistant network dome camera. The enclosure shall include an aluminum casing with encapsulated electronics and meet the requirements of IEC/EN 60529 IP66, NEMA 250 Type 4X, and IEC/EN 62262 IK10. Enclosure shall include sunshield, temperature sensor, heater, and fan.

The camera shall feature a black and white mode that may be automatically engaged on low light level and permit the use of an external infrared illuminator or manually selected. The camera shall incorporate independent automatic color-to-black and white switching modes for switchover on light threshold and sensitivity to IR illumination. Automatic color-to-black and white switching shall have selectable light level thresholds (high or low) and duration settings for the selected threshold before automatic switchover occurs.

Outdoor pendant adaptor kit (Axis T94M01D or as required to match camera and mounts furnished) shall be included.

Camera source limitations: Fixed and PTZ Cameras shall be of sole brand, Axis, as determined for the operational and maintenance needs of Metro-North Railroad. Model number substitutions will be considered for newer models that meet or exceed the technical requirements herein. All substitutions shall be fully coordinated with the overall design by the Contractor. In the event the cameras listed are determined to be end-of-life, or near end-of-life, the Contractor shall propose an alternate that satisfies the technical requirements within. All cameras shall be fully compatible with the existing Verint Nextiva Video Management System. All proposed cameras shall be capable of supporting H.265 at the time of installation. Otherwise, alternative models of cameras that support H.265 and also meet the same product specifications herein shall be proposed.

360 Degree CCTV Camera Requirements

The 360 Degree CCTV camera shall be Panasonic model WV-SFV481 9MP 360-Degree Outdoor Ready Network Camera or equivalent meeting the following requirements:

A. Camera

1.	Image Sensor	1/2 type MOS image sensor
2.	Effective Pixels	Approx. 12.4 megapixels
3.	Scanning Mode	Progressive
4.	Scanning Area	5.54 mm (H) x 5.54 mm (V) {7/32 inches(H) x 7/32 inches(V)}
5.	Minimum Illumination	
a.	Color	0.3 lux (F1.9, Shutter speed of 1/30s, Gain: On(High))
b.	B/W	0.04 lux (F1.9, Shutter speed of 1/30s, Gain : On(High))

B. Lens

1. Focal Length 1.342mm
2. Angular Field of View Horizontal: 180°, Vertical: 180°
3. Focus adjustment Auto Back Focus, Manual

C. Video

1. Compression Format H.264, JPEG
2. Distribution mode 9M Fisheye mode, 4M fisheye mode, Double Panorama mode, Quad PTZ / Single PTZ mode, 8M fisheye + Double Panorama mode, 4M fisheye + Double panorama mode, 8M fisheye + Quad PTZ mode, 4M fisheye + Quad PTZ mode, Quad streams mode, Panorama mode, 8M fisheye + Panorama mode, 4M fisheye + Panorama mode

3. H.264
   a. Transmission Mode Constant bitrate / VBR / Frame rate priority / Best effort / Advanced VBR
   b. Frame Rate 1 / 3 / 5 / 7.5 / 10 / 12 / 15 / 20 / 30 fps (depending on distribution mode.)
   c. Bit Rate/Client 64 / 128 / 256 / 384 / 512 / 768 / 1,024 / 1,536 / 2,048 / 3,072 / 4,096 / 6,144 / 8,192 / 10,240 / 12,288 / 14,336 / 16,384 / 20,480 / 24,576 / 30,720 kbps (depending on distribution mode.)
   d. Transmission type Unicast, Multicast

4. JPEG
   a. Image quality 10 steps
   b. Transmission type Pull, Push

D. Audio

   a. Audio Compression G.726 (ADPCM) 32kbps / 16kbps, G.711 64kbps, AAC-LC
   b. Audio Mode Off / Microphone (Line) input / Audio output / Interactive (Half duplex) / Interactive (Full duplex)

E. Operation

1. Wide Dynamic Range On / Off
2. Adaptive Black Stretch On / Off
3. AGC On (LOW, MID, HIGH) / Off
4. Day & Night On/ Auto1 (Normal) / Auto2 (IR light) / Auto3 (SCC) / Off
5. Digital Noise Reduction High / Low
6. Video Motion Detection 4 areas, Sensitivity:15 steps, Detection size:10 steps
7. Privacy Zone On/Off, up to 8 zones
8. VIQS Up to 8 zones (fisheye mode only)
9. Camera Title (OSD) Up to 20 characters

F.	Network		
	1.	Network Interface	10Base-T / 100Base-TX, RJ-45 connector
	2.	IP	IPv6, IPv4
	3.	Supported Protocols	
		a. IPv6	TCP/IP, UDP/IP, HTTP, HTTPS, RTP, FTP, SMTP, DNS, NTP, SNMP, DHCPv6, MLD, ICMP, ARP
		b. IPv4	TCP/IP, UDP/IP, HTTP, HTTPS, RTSP, RTP, RTP/RTCP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP, UPnP, IGMP, ICMP, ARP
	4.	Max. User access	Up to 14 users
	5.	GUI Language	English, Italian, French, German, Spanish, Portuguese, Russian, Chinese, Japanese
G.	Intelligent function (optional)		
	1.	Intelligent VMD	Intruder detection, Object detection, Cross line detection, Loitering detection, Scene change detection
	2.	Business intelligence	Heat map, People count, Moving Object Remover (MOR)
H.	Interface		
	1.	Monitor Output	VBS : 1.0 V [p-p] / 75 ohm, NTSC / PAL composite, ø3.5mm mini jack, for adjustment(to be used for maintenance/adjustment only)
	2.	Microphone/Line input	ø3.5 mm mini jack
	3.	Audio Output	ø3.5 mm stereo mini jack
	4.	External I/O Terminals	ALARM IN 1/DAY/NIGHT IN, ALARM IN 2/ALARM OUT, ALARM IN 3/AUX OUT
	5.	SD memory card slot	1 slot, SD/SDHC/SDXC
I.	Electrical		
	1.	Power Source	DC 12V, PoE
	2.	Power Consumption	Approx. 10.9W (DC 12V), Approx. 9.6W (PoE)
J.	Safety / EMC		
	1.	Safety	UL (UL60950-1), C-UL (CAN/CSA C22.2 No.60950-1), CE, IEC60950-1
	2.	EMC	FCC (Part15 Class A), ICES003 Class A, EN55022 Class B, EN55024
K.	Mechanical		
	1.	Dimensions (D x H)	ø154 mm x 60.5 mm {ø6-1/16 x 2-3/8 inches) (excluding the base bracket)
	2.	Weight	Approx. 1.3 kg (2.87 lbs.)
	3.	Construction material	
		a. Main body	Aluminum die cast

b.	Dome	Polycarbonate resin

4. Finish

a.	Main body	Light gray
b.	Dome	Clear

L. Environmental

1.	Vandal Resistance	IEC 60068-2-75 50J / IEC 62262 IK10
2.	Ingress Resistance	IP66, IEC60529 measuring standard compatible, Type 4X (UL50), NEMA 4X compliant
3.	Railway application	EN50155, EN50121
4.	Operating Temperature	-40 °C ~ +50 °C (-40 °F ~ 122 °F)
5.	Operating Humidity	10 % ~ 90 % (without condensation)

M. Software Options
1. Extension Software for intelligent function

N. General Characteristics
1. The 360-degree Camera shall produce a resolution of 2,992 x 2,992 pixels at up to 15 fps with a 9MP fisheye mode.
2. The 360-degree Camera shall produce a resolution of 2,048 x 2,048 pixels at up to 30 fps with a 4MP fisheye mode.
3. The 360-degree Camera shall utilize an approximate 1/2-inch high sensitivity MOS image sensor.
4. The 360-degree Camera shall offer Wide Dynamic Range (WDR).
5. The 360-degree Camera shall produce a color image with a minimum illumination of 0.02 lux and a monochrome image with 0.003 lux at F1.9, shutter speed of 16/30s and High gain mode.
6. The 360-degree Camera shall generate multiple simultaneous video streams of JPEG and H.264 high profile.
7. The 360-degree Camera shall be equipped with GOP control and Auto-VIQS as bitrate reducing technology.
8. The 360-degree Camera shall utilize 3D-Digital Noise Reduction (3D-DNR) to remove visual noises in low light conditions.
9. The 360-degree Camera shall be rated to IP66 and NEMA 4X standard against water and dust ingress.
10. The 360-degree Camera shall be rated to IEC 60068-2-75 50J / IEC 62262 IK10 vandal resistance.
11. The 360-degree Camera shall offer Video Motion Detection (VMD) with four (4) programmable detection areas, 15 steps sensitivity level and 10 steps detection size.
12. The 360-degree Camera shall offer an optional intelligent VMD (i-VMD) which provides intruder detection, loitering detection, scene change detection, object detection and cross line detection.
13. The 360-degree Camera shall offer an optional business intelligent functionality which provides heat map, people counting and Moving Object Remover (MOR).

14. The 360-degree Camera shall provide Variable Image Quality on Specified area (VIQS) which sets different image qualities to up to eight (8) areas in the full view to reduce bandwidth and storage capacity requirements.
15. The 360-degree Camera shall have Super Chroma Compensation (SCC) which realizes a better color reproducibility in the low illumination.
16. The 360-degree Camera shall have Lens Distortion Compensation to compensate the barrel distortion.
17. The 360-degree Camera shall provide up to eight (8) areas of electronic privacy masking.
18. The 360-degree Camera shall offer the prioritized stream control which transmits a video stream to the specified client PC or recorder preferentially.
19. The 360-degree Camera shall have a SD memory card slot that supports SD, SDHC and SDXC memory card for local storage.
20. The 360-degree Camera shall offer full-duplex bi-directional audio communication between the camera and monitoring site.
21. The 360-degree Camera shall have a dehumidification unit to keep the camera dry inside.
22. The 360-degree Camera shall conform to the ONVIF standard.

PTZ Camera with Built-In Infrared Illuminator Requirements:

The PTZ CCTV camera with Built-In Infrared Illuminator shall be Axis model Q6125-LE or equivalent (see source limitations below) meeting the following requirements. This camera may not be installed along the trackway. It is intended for use along bridge fenders and areas that are not directly in sight of a train.

Camera Image Sensor:	½.8" Progressive Scan CMOS
Lens:	4.3 mm - 129 mm, F1.6-4.7, Autofocus, auto-iris
	63.5°-2.3° (horizontal FOV)
	384°-1.3° (vertical FOV)
Pan/Tilt/Zoom:	Pan: endless 360°
	Tilt: +20° to -90°
	Zoom: 30x (optical); 12x (digital)
	Pan and tilt speeds adjustable between .05-500˚/sec.
Effective Pixels:	1.3 megapixel (720p)
Minimum Illumination:	Color: 0.1 lx at F1.6 (30 IRE)
	B/W: 0.008 lx at F1.6 (30 IRE), 0 lx with IR on
Day/Night:	Automatically removable infrared-cut filter

Shutter Time:	1/10000 s to 1 s
Video Compression:	H.264 (MPEG-4 Part 10/AVC)
	H.265 (MPEG-H Part 2)
	Motion JPEG
Resolutions:	1920x1080p (HDTV 1080p) to 640x360
Frame Rate:	30 fps
Video Streaming:	Multiple, simultaneous, individually-configurable
	H.264, H.265: Main, Baseline Profiles
	Motion JPEG
	The camera shall support both Constant Bit Rate (CBR) and Variable Bit Rate (VBR) in H.264 and provide configurable compression levels.
Supported Protocols:	IPv4/v6, TCP, UDP, NTP, RTSP, HTTP, HTTPS, SSL/TLS, FTP, SMTP, DNS, SOCKS, SSH, RTP, RTCP, DHCP, NTCIP
Camera ID:	Up to 20 characters (alphanumeric characters, marks)
Network Interface:	10Base-T/100Base-TX PoE (60W), RJ-45 connector
Power:	60W PoE
Memory:	1 GB RAM, 512 MB Flash
API:	Open API for software integration
	ONVIF Profile S
Event Triggers:	Video motion detection, External input, Edge storage events, Shock detection, Fan, PTZ moving, PTZ preset
Image Settings:	Electronic image stabilization, automatic defog, white balance (auto and manual), backlight compensation, image rotation, low light compensation, exposure control, privacy masks
Video Transmission:	HTTP (Unicast), HTTPS (Unicast), RTP (Unicast & Multicast), RTP over RTSP (Unicast), RTP over RTSP over HTTP (Unicast)
Environmental:	-40°C to +50°C (-40°F to +122°F), 10-100% RH (condensing)
EMC Approvals:	FCC Part 15 - Subpart B Class A
Railway EMC Approvals:	EN 50121-4, IEC 62236-4
IR Illumination:	Power Efficient, long life 850 nm IR LEDs

The camera shall be an outdoor, vandal-resistant network dome camera. The enclosure shall include an aluminum casing with encapsulated electronics and meet the requirements of IEC/EN 60529 IP66, NEMA 250 Type 4X, and IEC/EN 62262 IK10. Enclosure shall include sunshield, temperature sensor, heater, and fan.

The camera shall feature a black and white mode that may be automatically engaged on low light level or manually selected. The camera shall incorporate independent automatic color-to-black and white switching modes for switchover on light threshold and sensitivity to built-in IR illumination. Automatic color-to-black and white switching shall have selectable light level thresholds (high or low) and duration settings for the selected threshold before automatic switchover occurs.

Outdoor pendant adaptor kit (Axis T94A01D or as required to match camera and mounts furnished) shall be included.

Infrared (IR) Illuminators:

1. Contractor shall survey all locations that require IR Illuminators and provide a mounting detail for the mounting method for the IR lights. Where required, provide brackets to support the installation method and location. The detailed design shall be approved by the engineer prior to the start of work.

2. Requirements:

   The Infrared (IR) Illuminator shall be Raytec Vario 2 IP (model VAR2-IPPoE-i8-1) or equivalent meeting the following requirements:

Type:	LED
Angle:	10° / 35° / 60° / 80°/ 120° via interchangeable lenses
Wavelength:	940 nm
Dimensions (typ.):	5” x 7” x 2.6”
Voltage Input:	60W PoE
Power Consumed (max.):	49W
Environmental:	IP66 rated, -50˚C to +50˚C (-58˚F to 122˚F)
Illumination Life:	44,000 hours
Number of LEDs:	24

   The illuminator shall be vandal resistant and manufactured using high impact polycarbonate lensing and shall incorporate and aluminum extruded heat sink to aid LED life expectancy.

   The illuminator shall provide photocell-following output.

The illuminator shall permit adjustment of the following parameters and functions:

a. Power select: 20, 40, 60, 80, and 100% power
b. Photocell adjust: 3 sensitivity levels
c. Photocell disable
d. Restore factory defaults
e. LED status indicator on/off toggle

Use of separate remote control is permitted for these functions. Remote control setup shall be able to be disabled to prevent tampering. At least five (5) remote controls shall be provided.

Product Data: Submit Manufacturer's literature and catalog cuts for all products/materials to the Engineer for review and approval.

Contractor shall ensure all substitutions are coordinated with the design and the installation conforms to all Contract requirements and local codes.

Construction Methods:

The plans indicate the extent and the general location and arrangement of the work. The Contractor shall study the plans and details so that the work will be properly located, readily accessible, and with the best possible view. If conflicts occur necessitating departures from the plans, the Contractor shall submit details of departures and reasons therefore shall be submitted as soon as practicable for written approval of the Engineer. Contractor shall ensure any rerouting required does not adversely affect the communications circuits.

Contractor shall survey all camera locations and provide a mounting detail for the mounting method for the cameras and IR illuminators. Mounting details shown on the Plans are typical and will require variations based on site conditions. Provide brackets to support camera installation location. Provide manufacturer recommended pads and/or vibration dampeners at locations subject to high winds and other vibrations (e.g. SAGA Bridge cameras). The detailed mounting design shall be approved by the Engineer prior to the start of work. No items shall be attached to catenary poles unless specifically shown on the Plans and subsequently approved in shop drawings.

Pre-Installation:

Prior to installation, each camera location, lens setting, and mounting type shall be field confirmed by generation of a still image (screen shot from a camera and lens configuration identical to that submitted - on a pole, with laptop to capture a picture of the field of view) to be submitted for approval before the camera mount and conduit is installed at each location. Contractor shall provide the Engineer at least two (2) weeks' notice prior to performing surveys to allow Department or Railroad personnel to attend at their option. Coordinate camera locations and field of views with all obstructions such as signage,

speakers, lights, poles, catenary structures, etc. Overall camera coverage shall be coordinated to provide as close to 100% platform and entryway coverage as possible.

At the request of MNR Security, the Contractor shall also provide a night-time demonstration of the proposed cameras at the end of a station platform (site to be chosen by MNR). The Contractor shall demonstrate the capabilities and various setting options of the proposed camera under low-light conditions typical of the end-of-platform cameras that will be installed looking out towards the track. The Contractor shall engage the manufacturer representative to assist with this demonstration if requested.

Contractor shall be responsible to furnish all equipment required for the surveys described above. Such equipment shall remain property of the Contractor. Equipment loaned from the camera manufacturer is acceptable, if available.

Make field inspections necessary in order to prepare accurate shop drawings in accordance with existing conditions and approved field of views. Submit shop drawings coordinated with existing conditions and all other work for approval prior to performing any installation. Note any nearby obstructions that could impact the field of view. Include plans, elevations, sections, details, and attachments as needed. Drawings should indicate site specific installation details including showing the exact equipment locations, mounting details, riser diagrams, mounting heights, distance from edge of platform, and side of pole (where pole mounted).

Installation:

Contractor shall verify all field conditions, ensuring no new obstructions are present. If new obstruction affects the camera view, immediately notify the Engineer.

Camera installation and Field of View adjustment: All cameras shall be located, position confirmed, rotated, and calibrated to provide for optimal fields of view.

Coordination of IR illuminators with cameras: All IR illuminators shall be located, position confirmed, rotated, and calibrated to provide for optimal illumination for the associated camera's field-of-view. Coordinate beam angle and power intensity with camera field-of-view and nearby IR illuminators. Ensure IR illuminators do not blind cameras. Furnish and install any lens changes required to achieve the desired illumination at no additional cost. Adjust photocell to ensure illuminator is coordinated to turn on prior to camera switching to night mode. Hard-wired connection between the camera and IR for day/night function coordination is also be acceptable. The IR illuminators shall be configured to turn off when not needed.

PTZ cameras shall be programmed with all preset locations. At a minimum, presets shall include default view, reverse view, entry points at each facility, and views of opposite platforms (where applicable). Coordinate all preset requirements with MNR Security.

Camera Housings and Mounts:

A. General Requirements for Camera Housings and Mounts

1. Furnish a complete mount for every camera being furnished and installed under this Contract. The mount shall be designed for use with the camera, and for conditions at the installation location. Camera mounts and mounting method shall be rated for heavy duty and be of sturdy construction. It shall be suitable for indoor and outdoor applications, and have an appearance which matches the surrounding area. The mount shall be made of steel, unless otherwise noted, and painted to match the surrounding area as approved by the Engineer. All hardware shall be tamper resistant. Furnish all accessories required for a complete installation.
2. Furnish conduit adapters and related items as required.
3. Furnish smoked domes where shown on the Contract Drawings.
4. Where indicated on the plans, furnish and install an outdoor gooseneck bracket. Where attached to poles, mount shall not extend past the edge of the pole. Coordinate attachments to new poles with pole manufacturer. Submit mounting/attachment details for approval. Outdoor gooseneck wall bracket shall be Videolarm WM20G or approved equal.
5. Where indicated on the plans, furnish outdoor camera backboxes required for attachment of outdoor gooseneck bracket. Backbox shall be compatible with the approved mount and mounting surface. Backbox shall act as a sealed junction box for routing of cables to the camera, and attachment of conduit, and be able to mount to pole or wall. Plug all unused openings in accordance with manufacturer instructions. Backbox shall be Videolarm APM6 or approved equal.
6. All cameras and other devices, mounts, etc. shall maintain at least 6’-8” clearance above platforms, walkways, stairs, etc.

B. Special Provisions for SAGA Bridge Cameras

1. Install bird barrier strips on cameras and IR lights located on the SAGA Bridge fenders. Barrier strips shall be high-grade stainless steel and shall allow for easy cutting and surface shape memory. Finish color shall be natural stainless steel. Provide all mounting hardware per manufacturer’s recommendations or as shown in the Plans.

Environmental:

Wind: Meet all performance requirements when subjected to a 90 mph wind and able to withstand a 127 mph wind.

Documentation

Six (6) advance copies of equipment manuals furnished by the manufacturer shall be submitted to the Engineer for review at least ten (10) days prior to the scheduled start of the first Stand-Alone

Test. The Engineer will verify the manufacturer's equipment manual as part of the test and integration process. The equipment manual incorporating the Engineer's corrections and comments shall be integrated by the Contractor into the operations and maintenance manual as described in the contract documents. The manuals shall, as a minimum, include the following:

1. Complete and accurate schematic diagrams.
2. Complete installation and operation procedures.
3. Complete performance specifications (functional, electrical, mechanical and environmental) of the unit.
4. Complete list of replaceable parts including names of vendors for parts not identified by universal part numbers such as JEDEC, RETMA or EIA.
5. Complete maintenance and troubleshooting procedures.
6. Setup and configuration data for each camera location including the camera address, day/night threshold setting, horizontal and vertical limit settings and shutter speed.

Contractor shall use a GPS device to locate all devices at their final installation location. Furnish all GPS coordinates to the Engineer in Microsoft Excel format, along with a complete device schedule to include location description, device ID, mounting type, direction, preset locations, and all other descriptive information.

Upon completion of the installation and testing, prior to acceptance, thoroughly clean (internally and externally) all equipment furnished and/or installed under these Items.

Refer to "NOTICE TO CONTRACTOR"- Labeling Plan" and "NOTICE TO CONTRACTOR" – Basic Electrical Materials and Methods" for additional requirements.

Training:

Refer to "NOTICE TO CONTRACTOR – Training" for overall training requirements and additional information.

Testing:

Refer to "NOTICE TO CONTRACTOR – Acceptance Testing" for overall testing requirements and additional information. Prior to purchase of the proposed CCTV camera, contractor shall test the compatibility of the cameras with the existing VMS.

Method of Measurement:

The Fixed Mount Dome Camera will be measured for payment as the number of "Each" satisfactorily furnished, installed, tested and approved by the Engineer.

The PTZ Dome Camera will be measured for payment as the number of "Each" satisfactorily furnished, installed, tested and approved by the Engineer.

The 360 degree Camera will be measured for payment as the number of "Each" satisfactorily furnished, installed, tested and approved by the Engineer.

The Infrared Illuminator will be measured for payment as the number of "Each" satisfactorily furnished, installed, tested and approved by the Engineer.

The PTZ Dome Camera With Built-In Infrared Illuminators will be measured for payment as the number of "Each" satisfactorily furnished, installed, tested and approved by the Engineer.

Basis of Payment:

The unit price bid for each Fixed Mount Dome Camera, PTZ CCTV Dome Camera, 360 Degree CCTV Dome Camera, Infrared Illuminator, PTZ Dome Camera with Built-In Infrared Illuminators shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work including testing.

Pay Item	**Pay Unit**
Fixed Mount Dome Camera	Each
PTZ Dome Camera	Each
360 Degree Dome Camera	Each
Infrared Illuminator	Each
PTZ Dome Camera With Built-In Infrared Illuminators	Each

ITEM #1113033A – 4 STRAND SINGLE-MODE FIBER OPTIC CABLE

ITEM #1113043A – 24 STRAND SINGLE-MODE FIBER OPTIC CABLE

ITEM #0150624A – 24 STRAND SINGLE-MODE FIBER OPTIC CABLE FOR INDOOR USE

Description:

The Contractor shall furnish and install the fiber optic cabling at the locations shown on the plans or as indicated by the Engineer. 4-fiber cables shall be tight buffered construction. 24-fiber cable for outdoor use shall be Gel-Free Loose Tube construction. 24-fiber cable for indoor use shall be tight buffered construction and plenum rated.

Any other ancillary components required to form a complete fiber optic cable plant, including but not limited to, moisture and water sealants, cable caps, fan-out kits, etc., shall be supplied under these items for fiber optic cable and will not be paid for separately.

All materials required for complete installation shall be provided by the Contractor unless otherwise noted. Fiber optic splicing and field-connectorizing will be performed by Metro-North. The Contractor shall furnish all consumables required for fiber optic splicing and terminating. Provide at least 20% spare. All other work shall be performed by the Contractor unless specifically noted otherwise.

Available Standards:

ANSI/IDEA, IEC, RUS, Telcordia GR-20

Materials:

Product Data: Submit Manufacturer's literature and catalog cuts for all products/materials to the Engineer for review and approval.

The 4 Strand Single-Mode Fiber Cables shall be Corning FREEDM® p/n 004E8F-31131-29 or approved equal.

The 24 Strand Single-Mode Fiber Cable for outdoor use shall be Corning ALTOS® p/n 024EU4-T4101D20 or approved equal.

The 24 Strand Single-Mode Fiber Cable for indoor use shall be Corning MIC Plenum ® p/n 024E8P-31131-29 or approved equal.

Functional Requirements:

All fibers within a cable must be usable and meet required specifications.

A. Single Mode Loose Tube

1. Optical Requirements

Fiber Type	Single-mode
Fiber Core Diameter	9 µm (nominal)
Fiber Category	OS2
Fiber Code	E
Performance Option Code	01
Wavelengths	1310 nm / 1383 nm / 1550 nm
Maximum Attenuation	0.4 dB/km / 0.4 dB/km / 0.3 dB/km

2. Mechanical Requirements

Max. Tensile Strengths, Short-Term	600 lbf
Max. Tensile Strengths, Long-Term	200 lbf
Weight	24 Fiber – 49 lb/1000ft
Nominal Outer Diameter	24 Fiber – 0.41 in
Min. Bend Radius Installation	24 Fiber – 6.2 in
Min. Bend Radius Operation	24 Fiber – 4.1 in

Central Element	Dielectric
Fiber Count	24
Fiber Coloring	Blue, Orange, Green, Brown, Slate, White, Red, Black, Yellow, Violet, Rose, Aqua
Fibers per Tube	12
Number of Active Tubes	2
Buffer Tube Color Coding	24 Fiber - Blue, Orange

Buffer Tube Diameter	0.1 in
Number of Filling Elements	24 Fiber – 4

Tape	Water-swellable
Number of Ripcords	1
Outer Jacket Material	Polyethylene (PE)
Outer Jacket Color	Black

3. Environmental Characteristics

Storage	-40°C to 70°C (-40°F to 158°F)
Installation	-30°C to 70°C (-22°F to 158°F)
Operation	-40°C to 70°C (-40°F to 158°F)

B. Single Mode Tight Buffered

1. Optical Requirements

Fiber Type	Single-mode
Fiber Core Diameter	9 µm (nominal)
Fiber Category	OS2
Fiber Code	E
Performance Option Code	31
Wavelengths	1310 nm / 1383 nm / 1550 nm
Maximum Attenuation	0.65 dB/km / 0.65 dB/km / 0.5 dB/km

2. Mechanical Requirements

Max. Tensile Strengths, Short-Term	4-strand: 150 lbf, 24-strand: 100 lbf
Max. Tensile Strengths, Long-Term	4-strand: 45 lbf, 24-strand: 30 lbf
Weight	4-strand: 16 lb/1000 ft, 24-strand: 45 lb/1000 ft
Nominal Outer Diameter	4-strand: 0.22 in, 24-strand: 0.31 in
Min. Bend Radius Installation	4-strand: 3.2 in, 24-strand: 4.6 in
Min. Bend Radius Operation	4-strand: 1.1 in, 24-strand: 3.1 in

Central Element	Dielectric
Fiber Count	4-strand: 4, 24-strand: 24
Tight Buffer Coloring	Blue, Orange, Green, Brown
Tensile Strength Elements	Water-Swellable Strength Yarns
Number of Active Tubes	2 or 12
Cladding	125 µm
Tight Buffer Diameter	900 ± 50 µm
Outer Jacket Material	Flame-Retardant, UV-Resistant
Outer Jacket Color	Black

3. Environmental Characteristics

Storage	-40°C to 70°C (-40°F to 158°F)
Installation	-10°C to 60°C (14°F to 140°F)
Operation	-40°C to 70°C (-40°F to 158°F)

C. Field-Terminated LC Connectors (for tight buffered cable)

1. Verify type of connector required for all field devices. Contractor shall provide fiber connectors compatible with approved fiber and attached devices.

Fiber Category	OS2
Nominal Fiber Outer Diameter	125 µm
Insertion Loss	0.2 dB typical, 0.5 dB max
Reflectance	<= -55dB
Operating Temp	-40°C to 75°C (-40°F to 167°F)
Durability	<= 0.2dB change by 500 rematings
Intermateability	TIA/EIA 604-10 and IEC61754-20
Approvals	EIA/TIA 568-B.3
Material	Ceramic Ferrule, Composite Housing

Corning UniCam Connector, LC (OS2) or approved equal.

Construction Method:

The Contractor shall adhere to the following guidelines for installation, testing and documentation.

Installation in Conduit or Aerial Innerduct

The cable pulling operation shall be performed such that a minimum bending of the cable shall occur in the unreeling and pulling operations. Entry guide chutes shall be used to guide the cable into the pullbox conduit ports. Lubricating compound shall be used to minimize friction. Corner rollers (wheels), if used, shall not have radii less than the minimum installation bending radius of the cable. A series array of smaller wheels can be used for accomplishing the bend if the array is specifically approved by the cable manufacturers. The pulling tension shall be continuously measured and shall not be allowed to exceed the maximum tension specified by the manufacturer of the cable, or fuse links and breaks shall be used to ensure that the cable tensile strength is not exceeded. The pulling system shall have an audible alarm that shall sound whenever a preselected tension level is reached. Tension levels shall be recorded continuously and shall be given to the Engineer upon request.

Pullboxes shall be installed by the Contractor as needed and as indicated on the Plans. The Contractor may be required to install the cable one pullbox at a time. The direction of the cable pull shall be determined by the Contractor with adherence to any staging and sequencing plans and track outage requirements dictated by MNR and shall require the approval of the Engineer.

Pullboxes shall be considered incidental to the associated conduit system. No additional payment will be made.

Connectorizing the fibers and splicing to patch panel pigtails will be performed by Metro-North. It shall be responsibility of the Contractor to provide all materials including connectors, sleeves, and hardware and ancillary items as required for a complete installation as shown in the plans.

Cables shall be left in an accessible location for MNR to perform splicing or connectorizing. Provide slack at each splice/termination point.

Documentation Requirements

Installation Practices for Outdoor Fiber Optic Cable Systems Documentation

The Contractor shall examine the proposed cable plant design. At least one month prior to starting installation of the fiber optic cable plant, the Contractor shall submit to the Engineer for approval ten (10) copies of the Contractor's "Installation Practices for Outdoor Fiber Optic Cable Systems" manual. This manual shall address the Contractor's proposed practices covering all aspects of the fiber optic cable plant.

This submittal shall include all proposed procedures and list of installation equipment. Test and quality control procedures shall be detailed as well as procedures for corrective action.

Shop Drawings

Submit shop drawings coordinated with conduit/innerduct layout shop drawings and all other work for approval prior to performing any installation.

Test Procedures

In accordance with these Specifications, and the "NOTICE TO CONTRACTOR – ACCEPTANCE TESTING", submit test plan and procedures for approval prior to testing.

Operation and Maintenance Documentation

After the fiber optic cable plant has been installed, ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

Complete and accurate as-built diagrams showing the entire fiber optic cable plant including locations of all splices.

Complete parts list including names of vendors.

Testing:

Refer to "NOTICE TO CONTRACTOR – Acceptance Testing" for overall testing requirements and additional information.

Contractor shall provide all labor, material, instruments, and apparatus for all tests. Fiber optic testing personnel shall be experienced, trained, and certified to perform fiber optic tests. All work shall be performed in accordance with these guidelines, current industry testing standards, and the test equipment manufacturer's recommendations. Testing equipment shall have valid calibration certificate.

Factory Tests:

Fiber optic cables shall be tested by the manufacturer prior to shipping. This does not apply for existing cables furnished by others.

Pre-Installation Tests:

Prior to installation, the contractor shall inspect the cable for visual damage. The Contractor shall perform an OTDR test on any new reel of fiber optic cable before it is installed. These measurements shall ensure that all strands have continuity for the full length of the reel and proper loss requirements.

Tests shall also be performed on existing fibers to establish baseline performance. Pre-installation tests for existing cables (or cables provided by others) shall mimic post-installation test described below. Should the Contractor not perform pre-installation testing, the Contractor shall be responsible to replace the damaged cable at their expense if it is found to be defective after installation.

If pre-installation testing indicates any potential break, failure, or other compromise, immediately notify the Engineer. Do not install any damaged cables.

Post-Installation Test:

The Contractor shall test the fiber bi-directionally with both Light Source/Power Meter (LS/PM) method (Optical Loss Test Set may be substituted for LS/PM) and OTDR method after installation, prior to splicing and termination by MNR. Should it be determined by the Engineer that the fiber cable was damaged during installation, it shall be replaced at the Contractor's expense. Certified test reports shall be provided for each test. The results shall meet EIA/TIA 568 recommended standards for fiber optics at the minimum. Tests shall be performed at 1310nm, 1550nm, and 1625nm frequencies in both directions for single mode fiber. Overall loss profile of the cable span should be preserved and recorded by obtaining hard copy and electronic copy from the test equipment.

Contractor shall supply Certified Test Results all test results in electronic form and paper form.

Refer to "NOTICE TO CONTRACTOR"- Labeling Plan" and "NOTICE TO CONTRACTOR" – Basic Electrical Materials and Methods" for additional requirements.

Method of Measurement:

The Fiber Optic Cables shall be measured for payment by the actual number of "Linear Foot" for each type installed, tested, and accepted as outlined in these Specifications and elsewhere in the Contract Documents.

The Contractor shall be responsible for testing the fiber optic cable and providing test results to the Engineer for approval as outlined in the Specifications and elsewhere within the Contract Documents.

Basis of Payment:

Fiber Optic Cables shall be paid at the contract unit price per "LF", which price shall include all materials, labor, equipment and incidentals required to install the 4 and 24 strand Fiber Optic Cables and complete the work as shown in the Plans or as directed by the Engineer.

Pay Item	**Pay Unit**
4 Strand Single-Mode Fiber Optic Cable	LF
24 Strand Single-Mode Fiber Optic Cable	LF
24 Strand Single-Mode Fiber Optic For Indoor Use	LF