Technical Specification of Security Cameras and its placement methodology

Power Grid Corporation of India Limited (POWERGRID) intends to install Visual monitoring system (VMS) for security purpose in extra High Voltage (EHV) Sub- station environment (132kV/220kV/400kV/765kV) for surveillance of the premises.

1. Scope

The scope of work of the Bidder shall cover following, but not limited to:

- Design, supply, erect, test and commission the complete system including cameras, Network video recorder system, Storage, mounting arrangement for cameras, cables, LAN Switches, UPS and any other items/accessories required to complete the system.
- Carryout complete application engineering so as to achieve the desired objectives with the stated performance requirement.
- Provide all hardware and latest secured version of software, as necessary, to meet functional requirements of the tender.
- Any hardware, software and firmware required to meet the tender requirements shall be provided by the vendor without any time and cost implication.

System with Color Pure IP based Fixed Cameras for VMS surveillance would be located at various locations as per site condition.

The number of cameras and their locations shall be decided in such a way that it provides detection Capability with minimum detection range of 100 meter and minimum IR range of 50 meters. The following areas are envisaged to be covered in substation:

1. Store Boundary(permanent as well as temporary)
2. Control Room building (Entry and Exit gates)
3. Main Gate of substation & Switchyard
4. Gates of GIS/VALVE hall in GIS/HVDC Substations.
5. LT room (if not the part of main Control Room Building)
6. Gates of Firefighting pump-house
7. Substation Boundary
8. Any other location as per site condition

The cameras can be mounted on structures, buildings, wall, or any other suitable mounting arrangement to avoid any blind zone. Typical architecture of VMS system is attached as **Figure-1 and Annexure 1 to TS (Diagram 1- For ring topology connection of CCTV Security Camera & Diagram 2- For Camera and Junction Box arrangement diagram)**, however the architecture proposed by Bidder shall be got approved by the Engineer -In-Charge.

2. Technical requirements of major equipment of Visual Monitoring System.

2.1. The system should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users.

2.2. The system shall use video signals from color cameras installed at different locations, process them for viewing on workstations/monitors in the specified places as per architecture.

2.3. The System shall provide sufficient storage of all the camera recordings for a minimum period of 15 days @ 15 FPS, at 4 CIF or better quality using necessary compression techniques for all cameras and the Bidder shall calculate the requirement of storage accordingly. It shall be ensured that data once recorded shall not be altered by any means. The recording resolution and frame rate for each camera shall be user programmable.

2.4. The surveillance VMS System shall operate on 230 V(+/- 10%), 50 Hz single- phase power supply.

3. System requirements:

3.1. System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording.

3.2. All cameras may be connected through an LAN which shall be able to perform in EHV class Sub-station environment without fail.

3.3. All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with Password.

3.4. Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination should be available in the system.

3.5. Facility of Camera recording in HD (1280X720p), D1 , 4CIF , CIF, VGA, as well as in any combination i.e. any camera can be recorded in any quality.

3.6. In order to optimize the memory, while recording, video shall be compressed using H 264/MPEG-4 or better standard and streamed over the IP network.

3.7. System shall be triplex i.e. it should provide facility of simultaneously Viewing, Recording & Replay.

3.8. The equipment should generally conform to Electromagnetic compatibility requirements for outdoor equipment in EHV switchyards.

4. VIDEO SURVEILLANCE APPLICATION SOFTWARE

4.1 Digital video surveillance control software should be capable to display and manage the entire surveillance system.

4.2 The software should have inbuilt facility to store configuration of cameras.

4.3 The software should Support flexible 1/2/4/8/16/32 Windows Split screen display mode and scroll mode on the PC monitor.

4.4 The software should be able to control all cameras i.e, Iris control, auto / manual focus, and color balance of camera, Video tour selection etc.

4.5 The software should have user access authority configurable on per device or per device group basis. The system shall provide user activity log with user ID, time stamp, action performed, etc.

4.6 The users should be on a hierarchical basis as assigned by the administrator.

4.7 It should have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera-wise. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.

4.8 The software for clients should also be working on a browser-based system for remote users.

4.9 The software should be capable of integrating ONVIF compliant cameras.

4.10 The VMS application should allow retrieval of data instantaneously or any date / time interval chosen through search functionality of the application software. In case data is older than 15 days and available, even then, the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software.

4.11 VMS shall provide the full functionality reporting tool which can provide reports for user login/logoff, camera accessibility report, and server health check reports etc.

4.12 Software should record in auto FIFO (first In and first out) mode and should maintain minimum storage requirements of 15 days at any given point of time.

5. Network video recorder

Function of Network Video recorder server is to keep the VMS application along with database. The minimum configuration of Network Video recorder shall be as detailed below:

A. Functional Requirement

1	Recording and Display Frame Rate	Real-time 15 frames per second per channel, manual select.
2	Recording resolution	(PAL):1280X720,704(H)X576(V)
3	Compression Method	H.264/MPEG4 or better
4	Video Motion Detection capable	Standard and built-in(Selectable in menu)
5	Monitoring options	Split screen 1,2,4,8,16,32 or more cameras
6	Playback options	Search ,still image capture
7	Alarm/Event recording capable	To be provided with built-in external alarm input/output ports minimum.
8	Network operation capable	To be provided by using WAN or LAN
9	Remote Internet Viewing capable	Using WAN or LAN router
10	HDD storage consumption	As per calculation based on frame speed ,resolution setting ,compression. (Storage shall be in NAS)
11	Operation	Triplex operation (Simultaneous Viewing, recording and replay)

B. Technical Requirements

Sr. No.	Item NVR server	Characteristics
1	**General Features**	
a	Processor and Clock	Processor(Latest Version) and 3.6 GHZ
b	Operating System	Windows Server 2012 R2 or latest / Linux Redhat v7.0 or latest compatible with VMS application
c	Cache	12MB or better
d	RAM	DDR-4, 16 GB
e	DIMM Slots	4
f	Hard Disk	2 TB (SAS)

Sr. No.	Item NVR server	Characteristics
g	Storage Drive	DVD +/- RW
h	Support for both IPv4 and IPv6	Yes(Static IP)
I	CPU core	8Core with a GPU card or better
j	Support SNMP v1/v2/v3	Yes
2	**Interface**	
a	I/O ports	1 x serial port, 1 x parallel port
b	USB ports	USB2.0/USB3.0 supported (Total 4 ports)
c	Ethernet Ports	2 x 10/100 Ethernet ports
d	Expansion Slots	PCIe Slots- 2nos
3	**Power Supply**	Redundant (2 Ports) input Supply 230V AC (+/- 10%) 50Hz
4	**Environmental Aspects**	
a	Temperature	+5°C of Maximum & -5°C of Minimum of climatic condition of place
b	Relative Humidity	+5% of climatic condition of place
5	**User Interface**	
a	**Monitor**	21" Full HD LED
b	Keyboard	Yes
c	Mouse	Yes
d	Speakers with Audible Alarms	USB powered external speakers
6	**Anti-Virus Support**	Yes (licensed), which can be patched offline

6. VMS Camera

6.1. The color IP camera shall be pure IP type.
6.2. The Camera at the gate shall be used for monitoring entry and exit.
6.3. The VMS camera shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting.
6.4. The camera should be able to detect motion in day & night environments having light intensity of 0.5 Lux or better. Camera shall switchover from day to night mode and vice-versa automatically.

6.5. All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator.

6.6. Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

6.7. Each camera shall have inbuilt memory feature for back-up configuration/time information when camera is powered off.

6.8. The camera communication port shall be interfaced with media converter (Copper to Fiber) in the junction box. The media converter shall be connected through optical fiber cable to fiber port of LAN switch in control room. The junction box shall be preferred to be mounted on the same/near the structure/wall where camera has been installed.

6.9. Power Supply to camera shall be extended from the 230V AC from nearby distribution board in the switchyard/substation. Bidder shall be responsible for providing all installation accessories including industrial grade power converter, surge arrestor for extending supply to camera and its accessories to ensure trouble free operation. The power supply circuits feeding to VMS equipment as mentioned above shall be provided with MCB. Two MCB are to be provided per circuit (Camera) one at source end and one in camera Junction box.

6.10. The Camera should generally conform to Electromagnetic compatibility requirements for outdoor equipment in EHV switchyards.

IP Fixed Megapixel Camera Specifications

Sr. No.	Parameter	Requirement
1	Image Sensor	2-megapixel Progressive, 1 / 3" or better CMOS/CCD sensor, Minimum illumination 0.5 Lux.
2	Camera Enclosure Type	IP66 Grade
3	Iris/Focus	Auto/Manual
4	IR capability	**50 meters** with automatic switching from Daylight to IR mode.
5	Video Compression	User selectable Dual Stream H.264 and MPEG4

Sr. No.	Parameter	Requirement
6	Video Definition	Primary stream: 1600x1200, 1280x960, 1280x720 or better. Secondary Stream: 800x600, 400x288, 192x144 or better.
7	Video Parameters	Brightness, hue, contrast, saturation and image quality
8	Video Frame Rate	PAL: 1-25 Frames/second or better
9	Video Output	
10	Supported Protocols	TCP,IP,UDP,HTTP,FTP,SMTP,DHCP,DNS,ARP,ICMP,P OP3,NTP, UpnP, RTP, RTCP.
11	Operating Temperature	+5°C of Maximum & -5°C of Minimum of climatic condition of place.
12	Operating Humidity	+5% of climatic condition of place.
13	ONVIF Compliance	The camera should be ONVIF compliant.

7. Client Machine

Client Machine shall be installed in the Control Room, Substation –In-Charge as well as in the security In-charge room. User interface for VMS software shall be provided on client machines and shall have all the features as per authority assigned by the administrator. The minimum Specification for the client machine is as follows: -

Sr. No.	Item	Characteristics
1	**General Features**	
a	Processor	Latest Version
b	Operating System	Windows 10 Pro or better compatible with VMS application
c	CPU/Clock Speed	3.3 GHz or better
d	RAM	16GB-DDR4 or better
e	DIMM Slots	2
f	Hard Disk	1TB (SATA) or better
g	Storage Drive	DVD +/- RW

Sr. No.	Item	Characteristics
h	Support for both IPv4 and IPv6	Yes(Static IP)
2	**Interface**	
a	I/O ports	1 x serial port, 1 x parallel port
b	USB ports	USB2.0/USB3.0 supported (Total 4 ports)
c	Ethernet Ports	2 x 10/100/100 Mbps Ethernet ports
3	**Graphics Card Support**	**2GB or better**
4	**User Interface**	
a	Monitor	32" Full HD LED
b	Keyboard	Yes
c	Mouse	Yes
d	Speakers with Audible Alarms	USB powered external speakers
5	**Power Supply**	
a	Input	230V(+/-10%)AC, 50 Hz
6	**Anti-Virus Support**	Yes (licensed), which can be patched offline

8. Power Supply for NVR and client Machines

UPS having minimum specification as detailed below shall be provided for NVR server, storage and other associated hardware such as Switch, etc.

Sr.No.	Parameter	Requirement
1	**Rating**	5KVA
2	**Type**	Online Microprocessor controlled IGBT based high frequency
3	**Input**	230V AC +/- 10%
4	**Output**	230V AC +/- 1%
5	**Frequency**	50Hz +/- 0.3%
6	**Battery**	Maintenance Free for 30 Min Backup
7	**Total harmonic dist.**	less than 2.5% for linear load

Sr.No.	Parameter	Requirement
8	**Display Metering**	Input AC Voltage, UPS output voltage, UPS output current, UPS output frequency.
9	**Display Indication**	AC Mains "ON", UPS "ON", Overloaded
10	**Alarms(visual and potential free contact)**	DC Under Voltage (Low battery), UPS Overload/Common trouble alarm

9. Storage

Storage having minimum specification as below shall be provided for archiving of 15 days data from all the cameras (at 4CIF resolution @15fps).

Sr. No.	Item: NAS(Network Attached Storage)	Characteristics
1	Features	
a	User Interface	Status and activity provided via management interface. Status Indicators on front of Controller
b	RAID Level	RAID 5
c	Cache Memory	1GB Read/Write or more
d	Upgradable firmware	Yes
e	Network Connectivity and Protocol Support	and Ethernet Support or 2Gbps or better
f	Processor Speed	1.4GHz or better
g	Operating System	Windows Server 2012 or better /Redhat Linux 7.0 or better
2	Interface	2 x 10/100/1000 Mbps Ethernet ports
a	Host port	2Gbps or better SAS ports per controller
b	Management Ethernet Port	Yes
3	No. of Controllers	2
4	Networking	
A	Support for	IP, DHCP and Static IP, Dynamic DNS, Jumbo frames
B	External ports:	Minimum 2 Ethernet Ports of 10/100/1000 Mbps Base-TX

Sr. No.	Item: NAS(Network Attached Storage)	Characteristics
5	HDD	Hot pluggable HDD trays
a	Support for Storage	Minimum 4TB per bay.
b	Minimum Drive Bays	4 No's
6	Power Supply	
a	Input Requirements	230V (+/-10%) AC
7	Operating Temperature	+5°C of Maximum & -5°C of Minimum of climatic condition of place
8	Backup capability	Support for full backup of storage with third party tools

10. Substation Ethernet Switches:

10.1 Ethernet Switches:

The Ethernet Switches shall be required for networking of NVR server and cameras as per conceptual communication architecture suitable for operational requirements in substation environment. It shall operate with rated 230V AC (±10%) power supply. The switches shall be rack mountable in the panel with 19" rack size. Switch shall conform to Electromagnetic compatibility requirements as per Para 6.10.

10.2 Number of ports:

Each switch shall be provided with minimum three types of ports as below.

A. Giga Byte (Gig) copper Ethernet port: For connecting storage in redundant mode on different switches.

B. Fast Ethernet (FE) copper port: For connecting NVR server & client in redundant mode on different switches.

C. Optical Port (FO): For connecting camera and shall be compatible with communication with media converter installed in Camera JB.

Each switch shall have sufficient number of Gig port, FE port and FO ports.

Switches shall be supplied to accommodate all cameras. Cameras are desired be divided equally among switches to extent possible. The architecture shall be got approved by Engineer In-charge during detailed engineering.

10.3 Environmental Requirements:

(a) Operating in temperatures +5°C of Maximum & -5°C of Minimum of climatic condition of place

(b) Relative humidity +5 % of climatic condition of place

10.4 Functional Requirements & Features:

(a) LED indication for port status, supply etc.

(b) Support single mode fiber with 1310 nm wavelength

11. Fiber Optic Cable

The Bidder shall supply & install the optical fiber approach cable as required based on detailed site survey to be carried out by the Bidder during the project execution and

the indicative architecture attached. Fiber Optic Cable shall consist of G.652D DWSM Fibers suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways.

11.1 Optical Electrical and Mechanical Requirements: The cable core shall comprise of tensile strength member(s), fiber support/bedding structure, core wrap/bedding, and an overall impervious jacket. The Fiber Optic cable is of Single Mode communicating at 1310nm. Fiber Cables shall have minimum 4Core as indicated in the Architecture.

11.2 Installation of Fiber Cable: The existing cable trenches/ cable raceways proposed to be used shall be identified in the survey report. The Bidder shall make its best effort to route the cable through the existing available cable trenches. Where suitable existing cable trenches are not available, same shall be laid buried at a depth of 300 mm in HDPE pipes. All required fittings, supports, accessories, ducts, inner ducts, conduits, risers and any item not specially mentioned but required for laying and installation of Fiber Optic cables shall be supplied and installed by the Bidder.

11.3 Optical Fiber Termination and Splicing: Optical fiber terminations shall be done in LIUs/ as indicated in the Architecture .FODP/LIU shall be designed to provide protection for fiber splicing of pre-connectorized pigtails and to accommodate connector termination and coupling of the fiber cables.

12. Power Cable

The power cable shall be 3C x 2.5 sq.mm size with stranded copper conductor. The power cable laid in the outdoor switchyard area shall be PVC insulated 1100V grade, armored, FR type, C1 category confirming to IS:1554 (Part-1) and its amendments.

13. Media converter

Media converter shall be installed preferably in camera JB with suitable mounting arrangement; it will provide interface between camera's Ethernet cables in camera JB to switch installed in control room connected through OFC. It shall have LED indicators showing healthiness of link, power status, etc. It must have suitable Ethernet interface 10/100Mbps, support IEEE 802.3 10Base-T, 802.3u 100Base-TX and 100Base-FX standards, IEEE 802.3x Flow Control & Back Pressure.

Media converter shall be communicating with substation switch through single mode optical fiber cable on 1310nm wavelength.

It should be of industrial grade type with operating temperature range +5°C of Maximum & -5°C of Minimum of climatic condition of place and humidity +5 % of climatic condition of place.

13.1 Cat6 STP cable

Suitable Cat6 STP communication cable for connecting camera with media converter installed in camera junction Box.

13.2 Ethernet LAN cable

Suitable cat6 Ethernet LAN cable for connecting NVR server, Storage and Client machine with LAN switch

14. HDPE pipe

It shall be used for laying power cable, optical fiber cable in buried portion at the depth of 300 mm. It shall also be used for laying Ethernet and power cable from Camera JB to Camera on pole/tower. HDPE pipe installed on pole and tower shall be properly clamped.

15. Junction Box (JB)

Junction box shall be installed on Pole/Tower/wall below camera at suitable height for easy maintenance. Function of Junction box is to accommodate power converter, media converter, LIU, MCB, etc. It should have sufficient space to accommodate all components properly with sufficient space left for maintenance. All components inside JB shall be mounted on DIN rail or screwed. Optical Patch cord inside junction box shall be feruled and dressed properly. Laminated Connection diagram along with port detail shall be pasted inside JB for easy maintenance.

Junction box shall be supplied with sufficient nos. of gland/ gasket for entering power cables, Ethernet cable, optical fiber cable, etc. along with plate/clamp for fastening it with pole/Tower/wall. Junction box should be of IP-66 Type and Test certificate is to be submitted during detailed engineering.

The Junction box shall be earthed to nearest earthing point through 25X6 mm GI flat/ Braided strips.

16. FODP

FODP (Fiber optic distribution panel) shall be supplied and installed at locations to connect multiple optical fiber cable.

17. Power converter

Suitable industrial grade power converter shall be supplied for converting 230 volt AC to rated power supply for camera. Power converter shall be installed in Junction box.

18. MCB

2 Nos MCB with suitable rating shall be used for each camera. One shall be installed inside Camera JB and other at Source end.

19.LIU

LIU shall be supplied with accessories (Suitable Connecters, pig tail, patch cord,etc).LIU shall be used in camera JB and control room. LIU shall be suitable for installation in camera JB and rack at control room. LIU in control room shall have provision to accommodate multiple FO cables.

20.Pole

Bidder shall explore the possibility of installing camera on existing structure (Lighting pole, building structure, etc.), however if suitable structure is not available then pole of suitable height 6m/9m/12m may be chosen depending upon the location. Number of pole requirement shall be earmarked in survey report. Three types of typical pole drawing (6M/9M/12M) are attached as reference.

Bidder shall finalize the poles depending upon the location (Along boundary wall, main gate, store, etc.) of cameras with necessary modification (if any) for installation of camera and Junction box during engineering stage. Approval of modified drawing may be taken by concerned department.

Earthing of the poles should be connected to the switchyard main earth mat wherever it is available, else, the same should be earthed through 3mtr long, 20 mm dia, earth electrode.

21. GI pipe

Suitable GI /HDPE pipe shall be used for laying power cable, OFC cable at road crossing/Culvert.

22: Networking Rack

Bidder in coordination with site personnel shall explore the possibility of installing Ethernet LAN switches and LIUs of control room in existing Rack/Panel available at substation. In case of non-availability of space in existing rack/panel, a networking rack shall be provided on approval of site in-charge of POWERGRID to accommodate Ethernet switches and LIUs as per BOQ and specification enclosed. Also place for installation of networking rack shall be earmarked in survey report.

23: Spares

One sets of supplied cameras along with accessories at each substation, detail BOQ of spare is attached.

Availability of Spares

The Bidder shall ensure the availability of spare parts and service support for all items supplied by the Bidder for a period of 07 years from the issuance of TOC (Taking over certificate).

Anything not mentioned above or in BOQ but required to complete the job and to make the system functional shall be arranged and supplied by the Bidder adhering to the quality norms as per technical specification.

The Bidder shall submit a site survey report along with detailed execution plan and layout drawing to Engineer In-charge for approval.

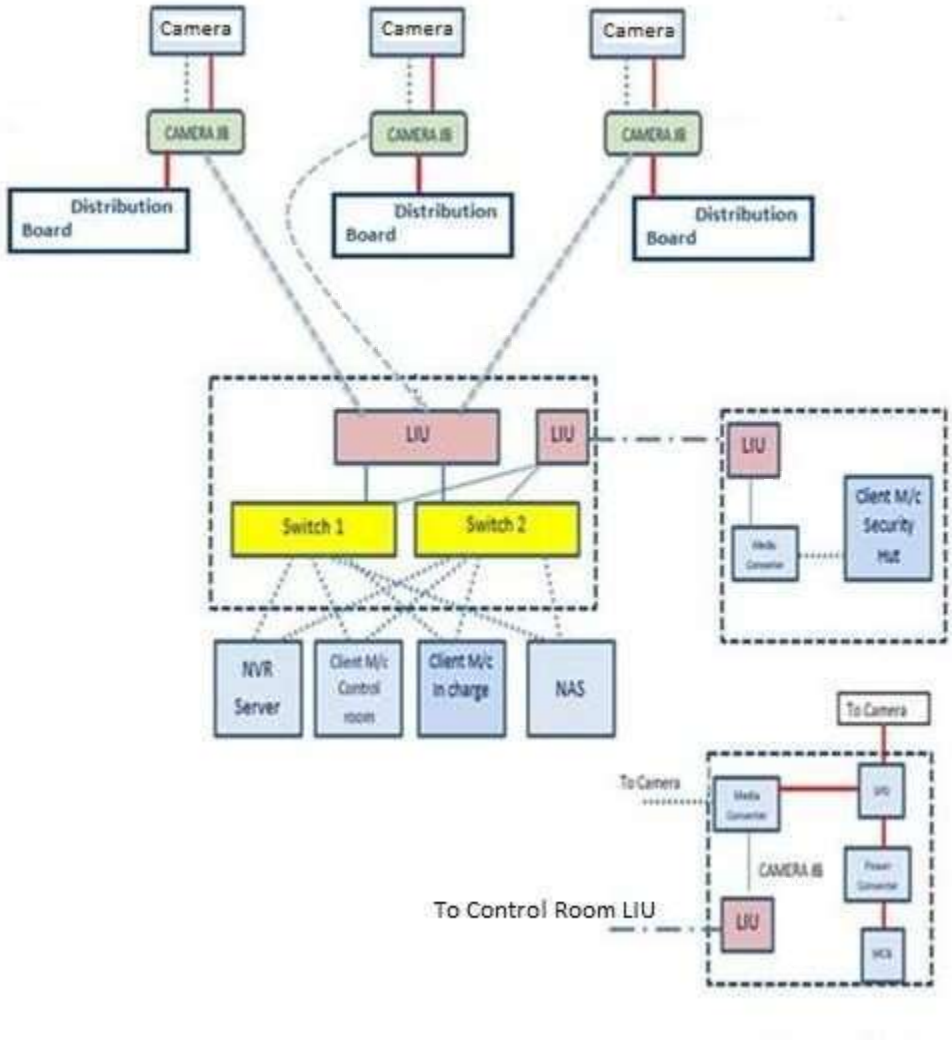
The work shall be executed as per approved site execution plan and layout/Drawing.

Indicative BOQ for supply, Installation & F&I of VMS system					
Sr. No	**Item Description**	**Unit**	**Qty.**	**Unit Price (INR)**	**Total Price**
Supply and Installation as per Technical specification					
1	Fixed Camera	Set			
2	Junction box	nos.			
3	Power converter	nos.			
4	Media converter	nos.			
5	Light interfacing unit at Camera end	nos.			
6	Light interfacing unit at control room end	nos.			
7	Network video recorder with 21" Full HD LED and NVR Application Software	Set			
8	Ethernet LAN Switch	nos.			
9	19 inch Networking Rack	nos.			
10	Optical fiber Cable	meter			
11	Power cable	meter			
12	NAS	set			
13	Pole	nos.			
14	Client Machine	set			
15	UPS(as per technical specification)	set			
Total Price (Supply + Erection + F&I) GST Extra					

Indicative BOQ for Spares including F&I					
Sr. No	**Item Description**	**Unit**	**Qty.**	**Unit Price (INR)**	**Total Price**
Supply of following as per Technical specification					
1	Fixed Camera	Set	1		
2	Power converter	nos.	4		
3	Media converter	nos.	4		
4	Ethernet LAN switch	nos.	1		
Total Price (Supply + F&I) GST Extra					

Figure-1

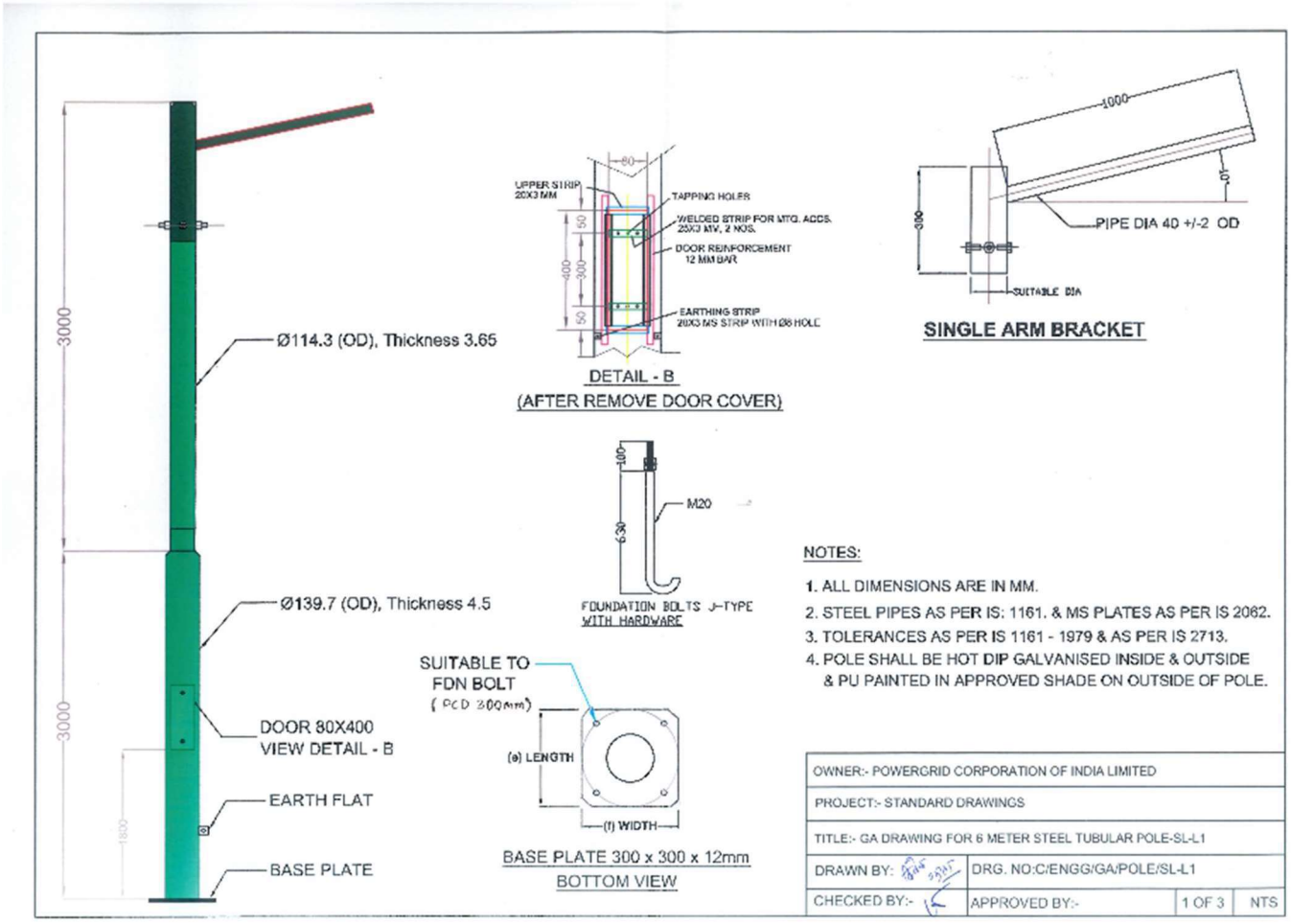
Typical architecture



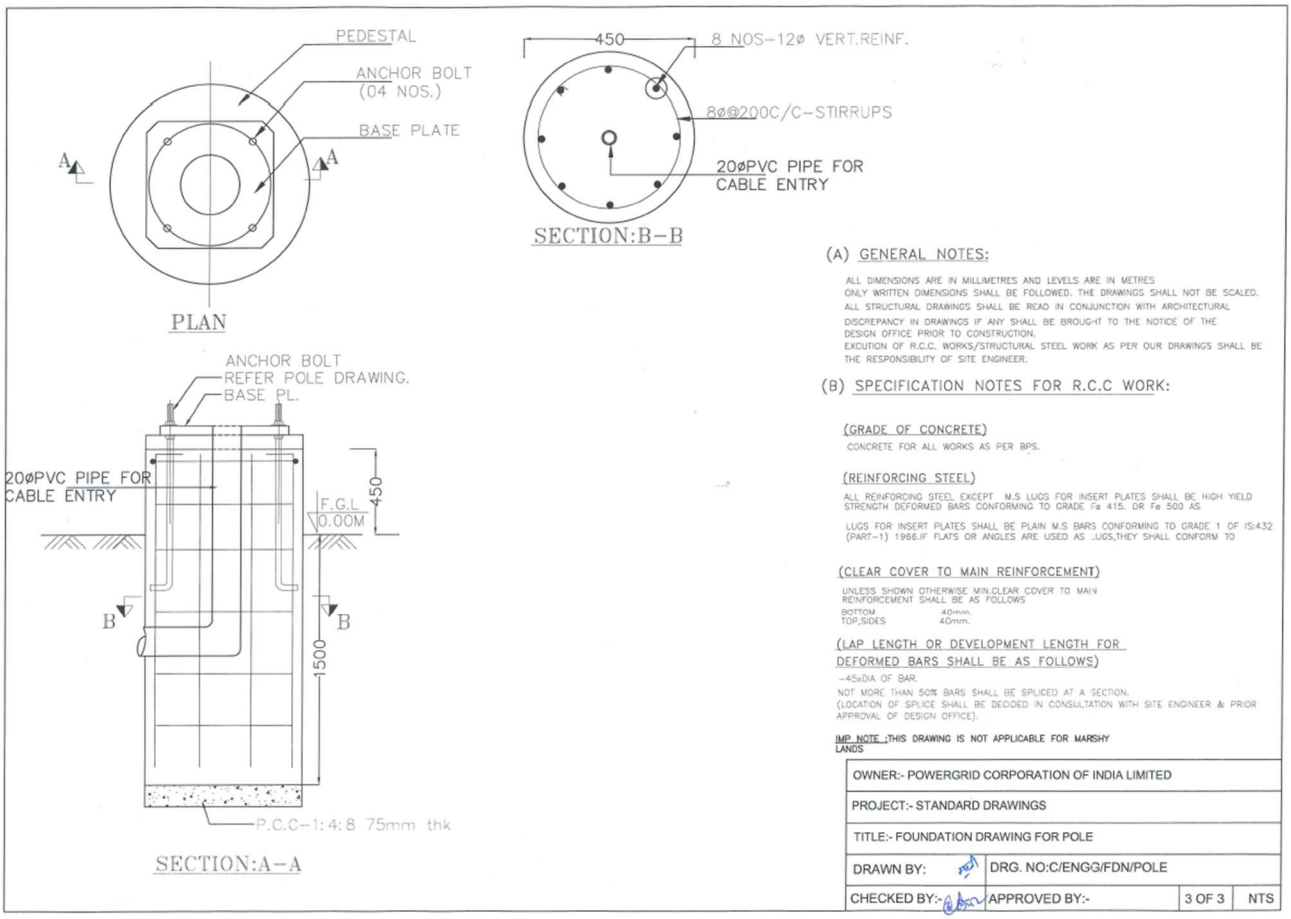
Note: FODP may be used as per Technical specification

Legend:
1.CAT-6
2.FO Cable
3.FO Patch Cord
4.Power Cable
5.NVR –Network Video Recorder
6.NAS- Network Attached Storage
7.LIU-Light Interface Unit
8.JB- Junction Box
9.Client M/c-Client Machine
10 Switch-LAN switch in Control room

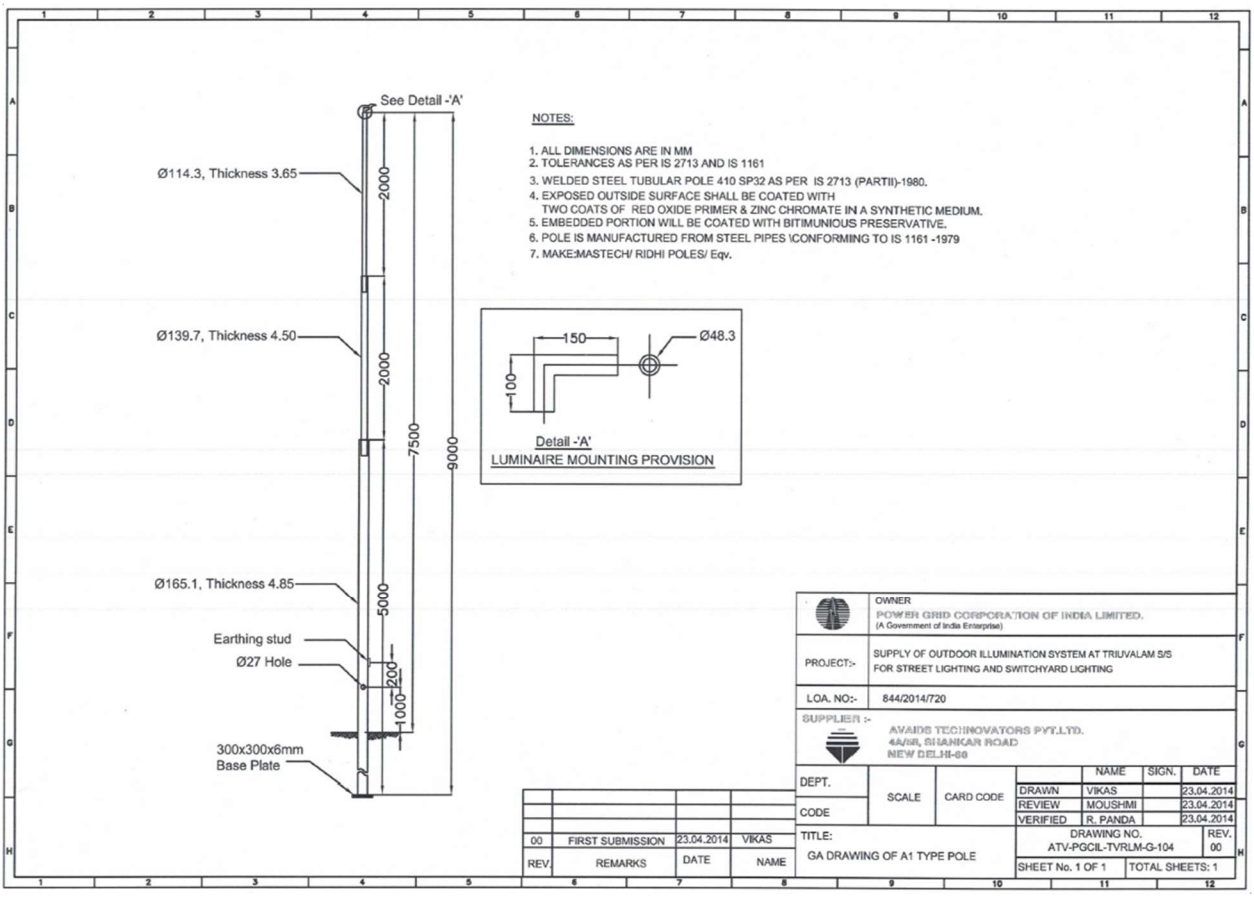
GA drawing of 6 meter Steel Tubular pole



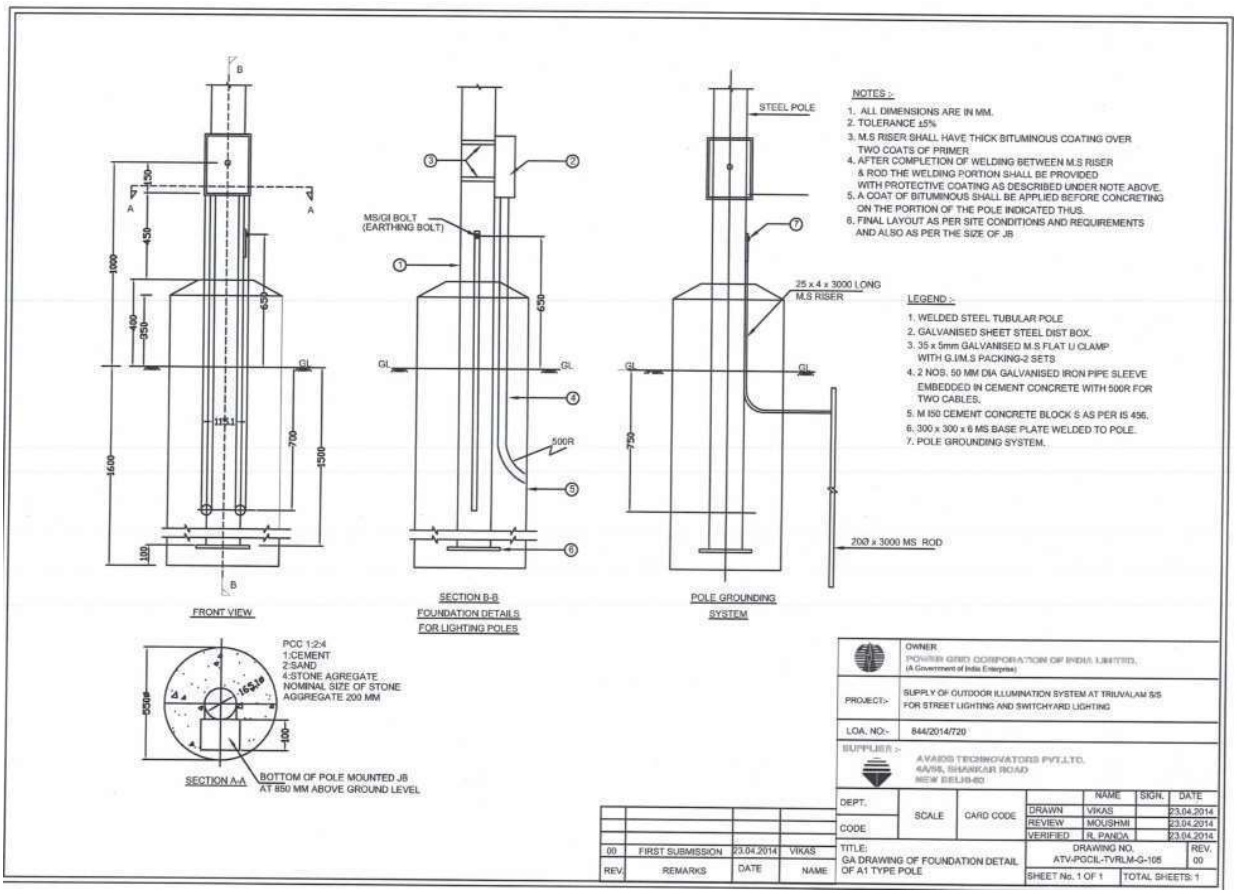
Foundation drawing of 6 meter pole.



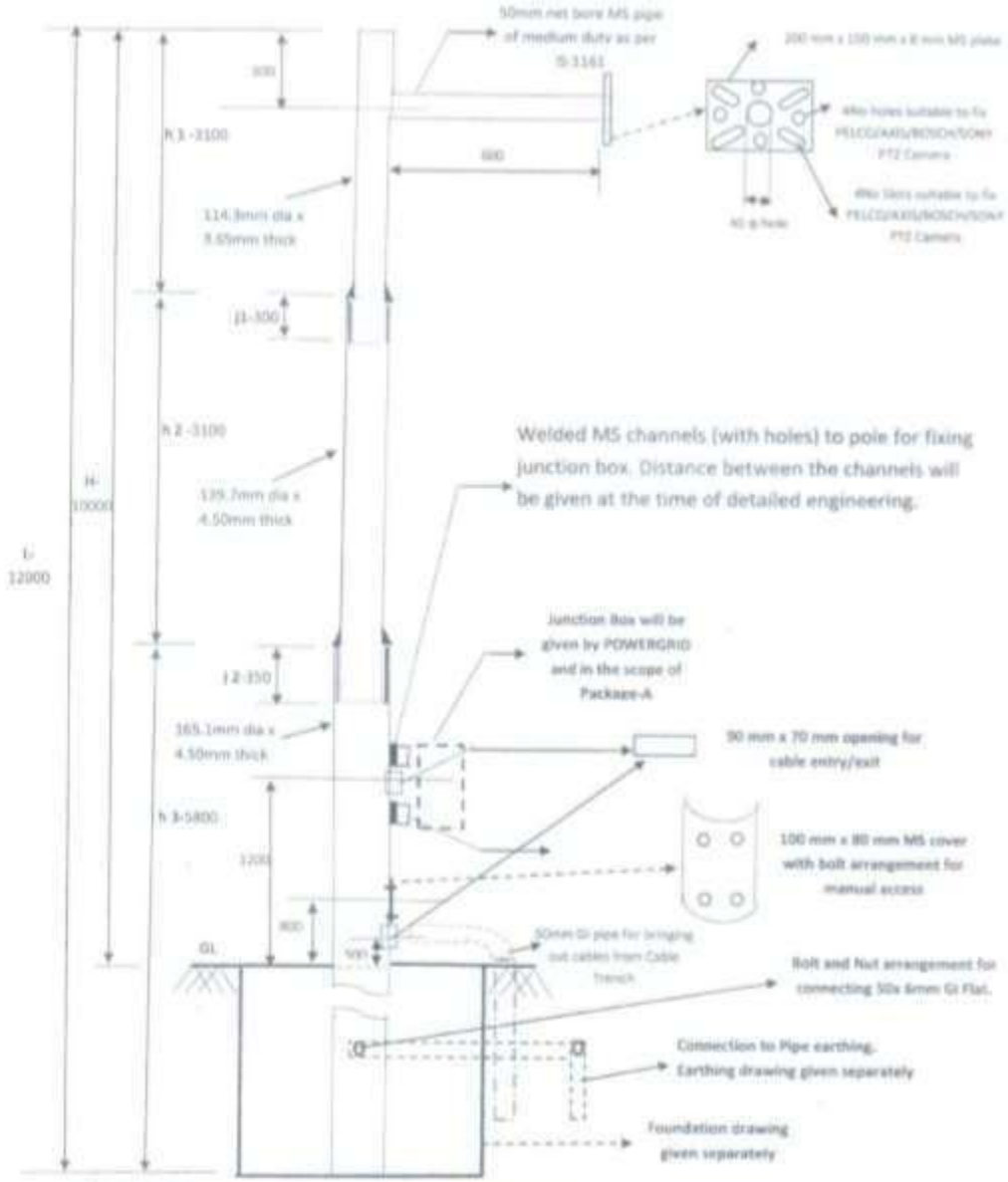
GA drawing of A1 type pole (9 meter)



Foundation drawing of A1 type pole (9 meter)



GA drawing of 12 m Pole



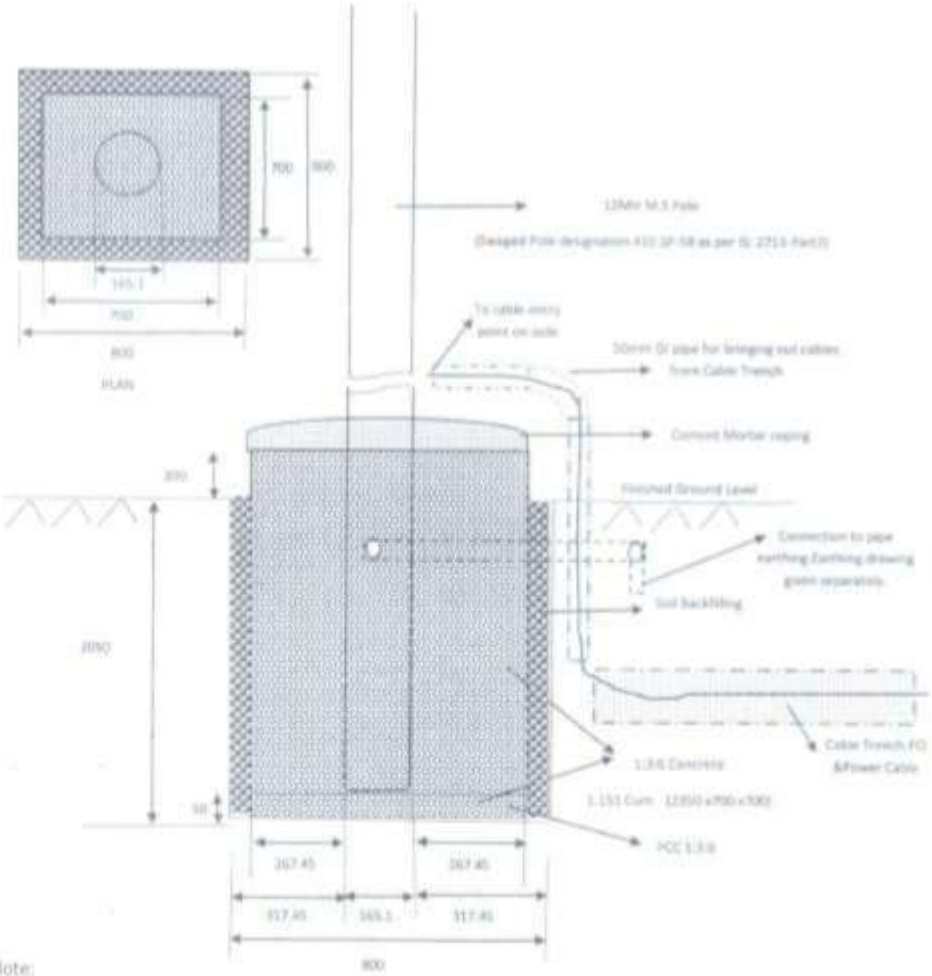
Note: 1. All dimensions are in mm and drawing is not to scale.

2. TATA/ JINDAL/POWERGRID approved/ISI Mark MS Tube shall be used in pole fabrication.

Foundation drawing of 12 m Pole

Drawing No: SRTS-1/PG/CCTV Boundary wall/Pole Foundation/002

POLE FOUNDATION DRAWING:

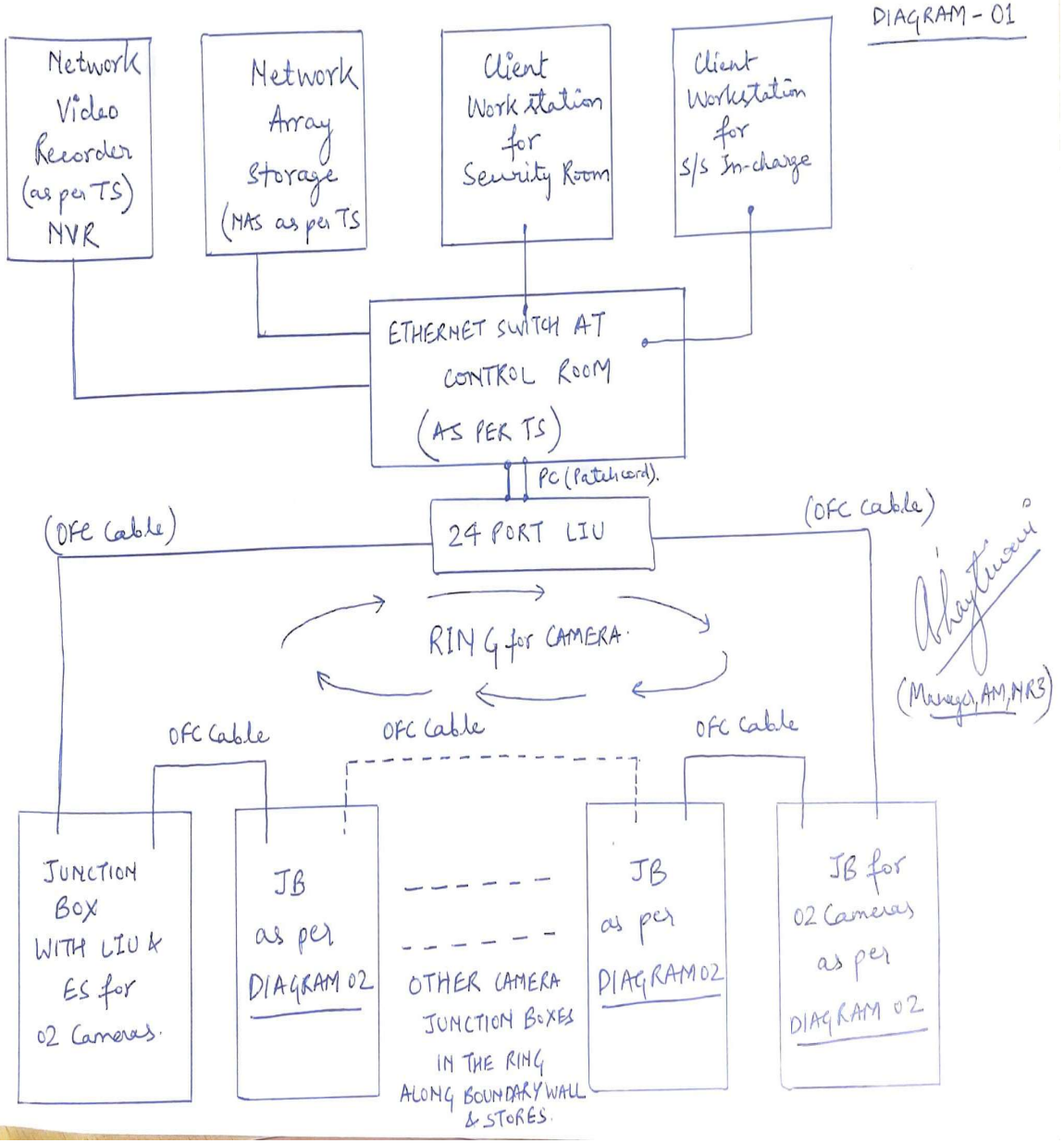


Note:

1. All dimensions are in mm.
2. Drawing is not to scale.
3. 40mm/20mm Coarse aggregate in 1:3:6 Concrete
4. FO Cable and Power Cable shall be brought through a 50mm dia GI from cable trench.

RING TOPOLOGY CONNECTION OF CCTV CAMERAS (SECURITY)

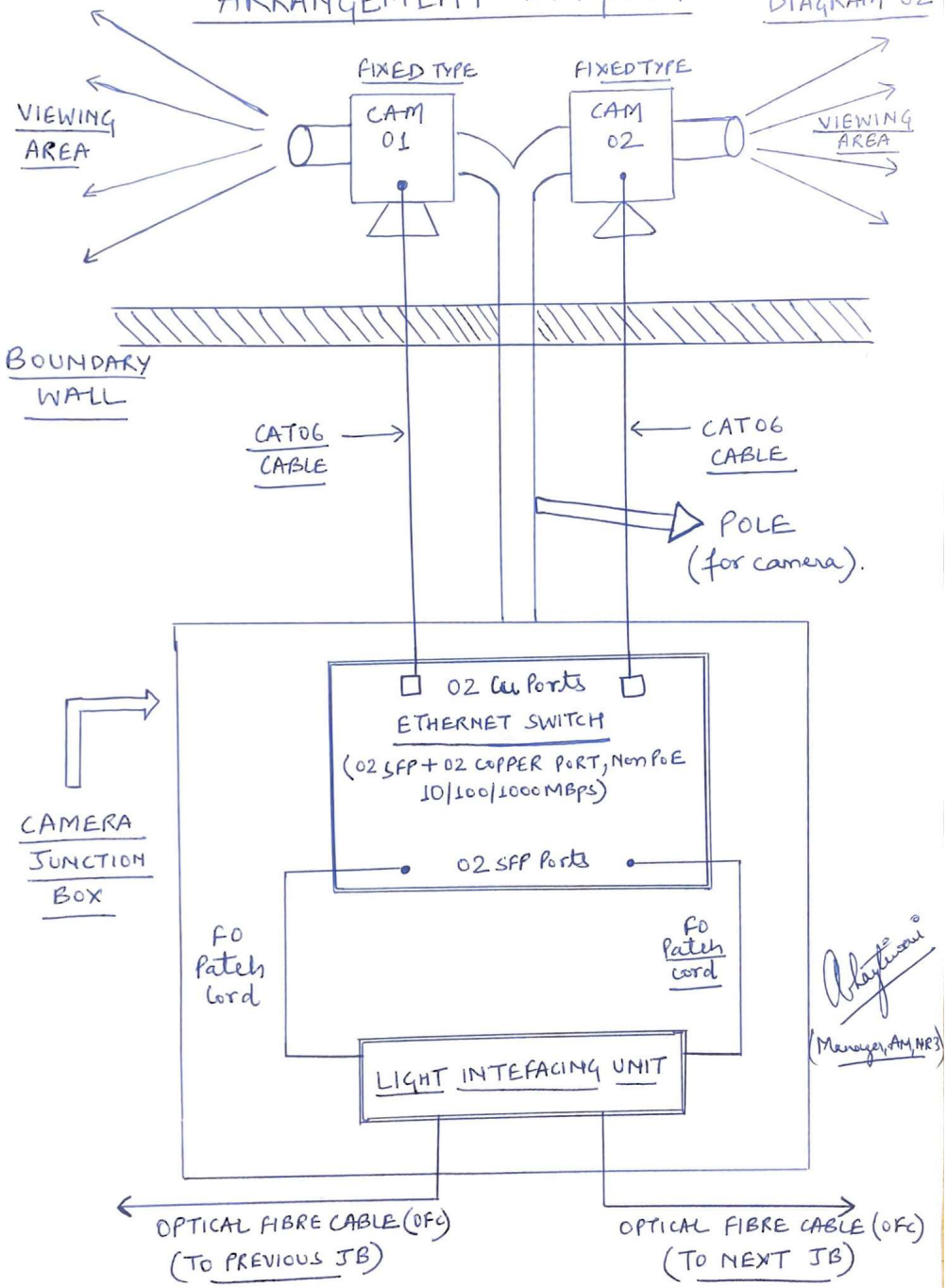
Annexure-01 to TS
DIAGRAM-01



(Manager, AM, MRB)

CAMERA & JUNCTION BOX ARRANGEMENT DIAGRAM

Annexure-1 to TS DIAGRAM 02



(Manager, AM, NR3)