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**RDSO SPECIFICATION
OF
IP BASED VIDEO SURVEILLANCE SYSTEM**

SPECIFICATION NO. RDSO/SPN/TC/65/2019

Revision 5.0

Number of Pages: 61

**TELECOM DIRECTORATE
RESEARCH DESIGNS & STANDARDS ORGANISATION
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<p>Abstract</p> <p>This document specifies technical specification of IP Based Video Surveillance System.</p>	

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I. SUMMARY:

This document covers the technical requirements of IP Based Video Surveillance System to be provided at Main entrance/exit, Platforms, Waiting hall, Reservation counter, Parking area, Railway yards, Foot over bridges etc. of Railway stations and others Railway establishments.

II. SOURCE:

1. Specification RDSO/SPN/TC/65/2009, Rev. 1.0 was prepared by RDSO, Lucknow as per Railway Board letter No. 2005/Tele/WE/2 dated 18/08/2006 and 2009/Tele/WW/1/ISSR dated 22/04/2009.
2. Specification No. RDSO/SPN/TC/65/2013, Rev. 2.0 was prepared by RDSO, Lucknow based on the experience gained so far during inspections of ISS projects, feedback by various Zonal Railways and Railway Board vide minutes 2013/Tele/7(3)/1 dated 05/03/2013.
3. Specification No. RDSO/SPN/TC/65/2016, Rev. 3.0 was prepared by RDSO, Lucknow as per Additional Member (Tele)/Railway Board's Inspection note no. 2014/Tele/7(3), dated 25/11/2014 and Railway Board minutes of meeting note no. 2009/Tele/WIP/ISS, dated 24/08/2015.
4. Specification No. RDSO/SPN/TC/65/2016, Rev. 4.0 was prepared by RDSO, Lucknow as per Railway Board letter no. 2010/Tele/9(1)/1Pt./144, dated 08.08.2016, letter no. 2010/Tele/9(1)/1Pt., dated 05/09/2016 and letter no. 2010/Tele/9(1)/1 Pt., dated 13/10/2016.
5. Specification No. RDSO/SPN/TC/65/2019, Revision 5.0 has been prepared by RDSO, Lucknow based on comments received from industry and RAILTEL through Railway Board.

Specification of IP Based Video Surveillance System

RDSO Specification No. RDSO/SPN/TC/65/2019, Revision 5.0

1.0 SCOPE:

The Specification covers technical specification and requirement of IP based Video Surveillance System for Stations and Cluster of Stations consisting of Full HD and Ultra HD IP Cameras, Digital Keyboard, Large Format Display Monitor, PC Workstation, Servers, Network Video Recorders, External Storage Device, Ethernet Switches, Wireless Transmitter/Receiver Unit, Copper to Fiber Media Convertor, Video Management Software, Video Recording Software, Graphical User Interface Client Software, Video Analytics Software and Face Recognition Software (FRS) etc. for surveillance of different locations at Stations and other establishments of Railways from Centralized location.

2.0 SYSTEM DESCRIPTION:

- 2.1 Video Surveillance System shall be suitable for provision at stations (25 KV AC Railway Electrified & Non-Railway Electrified Section) and other Railway establishments.
- 2.2 Video Surveillance System shall be end to end IP based with IP Cameras as per site requirement.
- 2.3 In IP based Video Surveillance System, the Cameras shall be provided at different locations so that the output is available as Ethernet and connected to the Servers/NVRs
- 2.4 It shall be possible to integrate the surveillance system using the existing LAN/WAN infrastructure on Optical Fibre network of Railways.
- 2.5 The system shall be able to work on both wired as well as wireless network. The wireless network is envisaged for extreme areas like, yards, foot over bridges and any other area in the station where cable is difficult to lay and maintain.
- 2.6 Tentative Implementation Schemes of IP based Video Surveillance System are shown in Schematic Diagram-1, Schematic Diagram-2 and Schematic Diagram-3 as applicable. These schematics are indicative in nature. Purchaser may specify any of the schemes or combination of the schemes as applicable or any other scheme of implementation as per site requirement.

2.6 (a) Schematic Diagram-1: (Station only / Standalone architecture):

- i) The proposed implementation scheme of Video Surveillance System is meant for such Stations where Video Management, Video Recording, Video Analytics and Face Recognition Software for the Cameras of a Station are provided in the Station.
- ii) The Cameras of Station Platforms shall be connected to Field Ethernet Switch. The Field Ethernet Switch shall stream Video data to a suitable location at Station such as CCTV Control Room through Aggregation Switch. CCTV Control Room may be connected to MPLS/ IP network through the Core Switch.
- iii) Video Management and Video Recording shall be deployed on Servers/Network Video Recorders. For Viewing and Monitoring of Cameras, requisite numbers of PC Workstations and Large format display monitors shall be provided at Station CCTV Control Room. Required Storage shall be provided on External Storage Devices/Servers/Network Video Recorders.
- iv) Video Analytics and Face Recognition Software shall be deployed on Servers at the Station CCTV Control Room or any other location as specified by the purchaser.
- v) There shall be a provision for Viewing and Monitoring of Camera streams at Divisional HQ/ any other centralized location or other Clients connected to MPLS/ IP network as per requirement of purchaser.

2.6 (b) Schematic Diagram-2: (RPF/GRP Thana/Post Clustered based architecture):

- i) The proposed implementation scheme of Video Surveillance System is meant for Cluster of Stations where Video Streams of Cameras of Stations are aggregated to a nearest suitable location such as RPF/GRP Thana/Posts for Video Management (Viewing and Monitoring) and Video Recording. Video Analytics and Face Recognition Software shall be deployed at Divisional HQ or RPF/GRP Thana/Posts or any other location as specified by the purchaser.
- ii) The Cameras of Station Platforms shall be connected to Field Ethernet Switch. Field Ethernet Switch shall stream Video data to RPF/GRP Thana/Posts through Aggregation Switch. RPF/GRP Thana/Posts shall be connected to MPLS/ IP network through the Core Switch.
- iii) Video Management and Video Recording shall be deployed on Servers/Network Video Recorders at RPF/GRP Thana/Posts, where the Video streams are aggregated. For Viewing and Monitoring of Cameras, requisite numbers of PC Workstations and Large format display monitors

shall be provided at RPF/GRP Thana/Posts. Required Storage shall be provided at RPF/GRP Thana/Posts on External Storage Devices/Servers/ Network Video Recorders. Video Analytics and Face Recognition Software shall be deployed on Servers.

- iv) There shall be a provision for Viewing and Monitoring of Camera streams at Divisional HQ/ any other centralized location or other Clients connected to MPLS/ IP network as per requirement of purchaser.
- v) For centralized management of such multiple Clusters if specified by the purchaser, Video Management Server and Server for Face Image database shall be deployed with N:1 redundancy at Datacenters i.e. Divisional/Zonal HQ or any other centralized location as specified by the purchaser.
- vi) Face Image Database Server at Datacenter shall be in sync with each individual RPF/GRP Thana/Posts local FRS Servers as and when any subject or alarm is generated/updated. Synchronization shall be done at least once daily.
- vii) The System shall have a storage solution at Datacenters for keeping flagged/marked video data by RPF/GRP personnel for longer retention, FRS and Video Analytic alerts across all stations for 30 days, Audit trail logs, application data etc. as per solution requirement or as defined by the purchaser.

2.6 (c) Schematic Diagram-3: (Cloud based architecture):

- i) The proposed implementation scheme of Video Surveillance System is meant for Cluster of Stations where Video Streams of Cameras of Stations are aggregated to a nearest suitable location such as RPF/GRP Thana/Posts for Video Management (Viewing and Monitoring) and Video Recording. Video Analytics and Face Recognition Software shall be deployed at the Cloud. Video Data shall be stored at RPF/GRP Thana/Posts on External Storage Devices/Servers/Network Video Recorders and at Cloud as per requirement.
- ii) The Cameras of Station Platforms shall be connected to Field Ethernet Switch. Field Ethernet Switch shall stream Video data to RPF/GRP Thana/Posts through Aggregation Switch. The RPF/GRP Thana/Posts shall be connected to the MPLS/ IP network and the Cloud through the Core Switch.
- iii) The Video Management and Video Recording shall be deployed on Servers/Network Video Recorders at RPF/GRP Thana/Posts, where the Video streams are aggregated. For Viewing and Monitoring of Cameras,

requisite numbers of PC Workstations and Large format display monitors shall be provided at RPF/GRP Thana/Post. In case VMS (Video Management and Video Recording Software) is required for operation of Video Analytics and Face Recognition Software at Cloud, same may be provided at Cloud or as specified by the purchaser.

- iv) There shall be a provision for Viewing and Monitoring of Camera streams at Divisional HQ/ any other centralized location or other Clients connected to MPLS/ IP network as per requirement of purchaser.
- v) All Video data and alarms generated by Video Analytics and Face Recognition Software at the Cloud shall be available at RPF/GRP Thana/Posts and Divisional HQ/ any other centralized location or any other clients through Cloud.

2.6 (d) In case of any failure or interruption of MPLS/IP network, the Camera shall automatically start recording on Edge Storage Memory Card at resolution and frames per second as required and when the network recovers, the Video data shall automatically be transferred to the External Storage Device/Server/NVR installed at respective Stations or RPF/GRP Thana/Post without any impact on the system operations.

2.6(e) (i) Video Monitoring and Live Viewing: Continuous Video Monitoring/ Live Viewing is required for all the Cameras through PC Workstations and Large Format Display Monitors with Full HD and 4K UHD resolution display support. One such Monitor shall display 16 Cameras on a single unit. For simultaneous viewing of more cameras, more monitors can be provided.

(ii) Video Playback: One 32/64/128 Channel Server/NVR shall support Playback of recorded video for minimum 16 Channels simultaneously @ Full HD or higher.

2.7 The system shall have diagnostics facility for Video & Network interfaces. System logging shall be possible either through system software, remote client or console port on the system.

2.8 a) The Recording shall be stored for at least 30 days at 25 FPS and Full HD resolution for Full HD Cameras and 25 FPS Ultra HD resolution for 4K UHD Cameras with H.265 or higher Video Compression.

b) In case implementation is done as per Schematic Diagram-1, Video data and Alarms shall be stored for at least 30 days or as specified by the purchaser at Stations.

c) In case implementation is done as per Schematic Diagram-2, Video data and Alarms shall be stored for at least 30 days or as specified by the purchaser at RPF/GRP Thana/Posts.

d) In case implementation is done as per Schematic Diagram-3, Video and Alarm data shall be stored for at least 30 days in Cloud and for at least 7 days or as specified by the purchaser at RPF/GRP Thana/Posts.

e) The approximate storage capacities per Camera with H.265 Video Compression and 25 FPS shall be as under:

Days	Full HD Camera (@1920x1080)	4K UHD Camera (@3840x2160)
30 Days or more	750 GB after RAID 5/6	3TB after RAID 5/6

2.9 Full HD Fixed Box type IP Colour Camera/ Full HD Bullet type IP Colour Cameras shall be provided in parking area, entrance/exit points, platforms, yards etc. or any other locations as decided by purchaser as per site requirement.

2.10 Full HD Fixed Dome type IP colour Cameras shall preferably be provided in indoor locations such as waiting halls, ticket counters, offices etc. or any other locations as decided by purchaser as per site requirement.

2.11 Full HD P/T/Z (Pan/Tilt/Zoom) IP colour Cameras shall preferably be provided in parking area, circulating area, platforms, foot over bridges etc. and for general perimeter surveillance or any other locations as decided by purchaser as per site requirement.

2.12 Typically minimum two nos. of 4K UHD Fixed Box Cameras need to be provided on each platform with Face Recognition Software in addition to one such Camera each on entry and exit points to the station or any other location as decided by purchaser as per site requirement.

Note : The above schemes given in Clause No. 2.9, 2.10, 2.11 and 2.12 are tentative in nature, however the scheme may vary as per site condition as specified by purchaser. Similarly, Face Recognition Software is typically installed on 4K UHD Fixed Box Cameras or 4K UHD Bullet type IP Colour Camera, same may also be deployed on Full HD Fixed Box type IP Colour Camera/ Full HD Bullet type IP Colour Cameras as per site requirement as specified by purchaser.

2.13 The power supply available at the stations shall be 220 V / 50 Hz AC nominal. In case of fluctuation in the power supply, suitable stabilisation shall be provided by Railways. Such Provision of UPS etc. are out of the scope of this specification.

2.14 There shall be provision of Panic Button/Buttons at various locations at Stations. Pressing Panic Button, alarm shall be sent to the central location through available network. Panic Button System shall utilize same network system provided for CCTV system at Stations. Number of Panic Buttons and location of Panic Buttons shall be decided by the purchaser as per site conditions.

3.0 GENERAL REQUIREMENTS:

- 3.1 The Video Surveillance System shall be based on non-proprietary open architecture where the Video Management Software, Video Recording Software, Video Analytics Software and Face Recognition Software can work and integrate with any make of IT hardware like Server, Storage, Workstation, Network Video Recorder and Switches etc.
- 3.2 The System i.e. IP Cameras, Network Video Recorders and Software (Video Management and Video Recording) shall be compliant to global standards ONVIF Profile 'S' & 'G' for the interface of network video product (ONVIF – Open Network Video Interface Forum). The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
- 3.3 IP Camera and Software (Video Management, Video Recording and Video Analytic Software) may be from the same manufacturer or from different manufacturers. In case, IP Cameras and Softwares are from different manufacturers, then all features of Cameras shall be available through the Software for viewing, recording and analytics.
- 3.4 Required number of licenses shall be provided by OEM/Vendor for Video Management, Video Recording, Video Analytics and Face Recognition Software as required by the purchaser as per site requirement. Licenses related compliance shall be ensured by purchaser depending upon the requirement.
- 3.5 Either Server based solution or Network Video Recorder based solution or combination of both can be accepted for Video Management and Video Recording for the implementation schemes as per Schematic Diagram-1, Schematic Diagram-2 & Schematic Diagram-3 as applicable. Software capabilities (as per Clause no. 18.1, 18.2 and 18.3) and Storage capacities shall be same for both the solutions.

Note: In case, Video Management and Video Recording is deployed on Network Video Recorders (NVRs) then NVRs shall integrate seamlessly with Video Analytics and Face Recognition Software deployed on Servers or at Cloud.

- 3.6 The Video Recording and Management System shall provide secured recording for evidence purposes and user authentication to protect data integrity.
- 3.7 Redundant Servers/NVRs may be provided if specified by the purchaser as per Schematic Diagram-1 and Schematic Diagram-2. The Redundancy System shall support defined number of Servers/NVRs in N:1 configuration (Value of N to be specified by the purchaser) so that the recording and playback availability is not affected in case of failure of any Server/NVR. The recording of last 30 days at any given point of time should be available through redundant Server /NVR in case of a Server/NVR failure.

For data stored and computed at Cloud as per Schematic Diagram-3, the Cloud shall provide for protection of data and operation.

3.8 The equipments shall be able to work in the temperature range and humidity as specified in the corresponding clauses of the specification. Purchaser may specify any other temperature requirement and humidity as per site requirement.

4.0 TECHNICAL REQUIREMENTS: The technical requirements for different components of IP based Video Surveillance System shall be as below:

S. No.	Components
i.	Full HD Fixed Box Type IP Colour Camera with Varifocal Lens and Housing & Mount as per Clause no. 5.1 & 5.3
ii.	4K UHD Fixed Box Type IP Colour Camera with Varifocal Lens and Housing & Mount as per Clause no. 5.2 & 5.3
iii.	Full HD Bullet type IP Colour Camera as per Clause no. 5.4
iv.	4K UHD Bullet type IP Colour Camera as per Clause no. 5.5
v.	Full HD Fixed Dome Type IP Colour Camera as per Clause no. 6.0.
vi.	Full HD P/T/Z (Pan/Tilt/Zoom) IP Colour Camera as per Clause no. 7.0.
vii.	Digital Keyboard as per Clause no. 8.0
viii.	Large Format Display Monitor as per Clause no. 9.0.
ix.	Server Hardware as per Clause no. 10.1
x.	Network Video Recorder (NVR) as per Clause no. 10.2
xi.	PC Workstation as per Clause no. 11.0
xii.	External Storage Device as per Clause no. 12.0
xiii.	Core Switches as per Clause no. 13.0
xiv.	(I) Aggregation Switches (II) Layer 2 Switches (24Port) and (III) Field Switches (8 port) as per Clause no. 14.0
xv.	Wireless Transmitter/Receiver Unit as per Clause no. 15.0.
xvi.	Copper to Fiber Media Convertor as per Clause no. 16.0
xvii.	Various types of cables as per Clause no. 17.0
xviii.	Video Management Software as per Clause no. 18.1
xix.	Graphical User Interface Client Software as per Clause no. 18.2
xx.	Video Recording Software as per Clause no. 18.3
xxi.	Video Analytics Software as per Clause no. 18.4
xxii.	Remote viewing on Web and Mobile App as per Clause no. 18.5
xxiii.	Face Recognition Software as per Clause No. 19.0
xxiv.	Software License as per Clause no. 20.0

5.0 Fixed Box Type IP Colour Camera and Bullet Type IP Colour Camera:

5.1 Full HD Fixed Box Type IP Colour Camera:

The Full HD Fixed Box Type IP Colour Camera with Varifocal Lens shall have the following minimum specifications:-

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/ 2.8" or larger, Progressive scan, CMOS sensor
ii.	Pixels	:	2.0 Mega Pixel Full HD (1920x1080)
iii.	Video Compression	:	H.265 or higher
iv.	Dual Stream	:	Dual H.265 or higher Streams
v.	Video resolutions	:	a) For Main stream: i)1920x1080 (Full HD) ii)Configurable from Full HD to other HD/SD resolution b) For Second Stream: Configuration from D1 to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Minimum 25 frames per second (FPS) for both the streams. Full HD@ 25 FPS with H.265 or higher compression on one stream & D1@ 25 FPS with H.265 or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Lens mount	:	CS/C mount or any other mount
xii.	Varifocal Lens	:	8 – 50 mm IR corrected, 1 m minimum object distance, Auto IRIS Control, Manual focus and zoom control Lens suitable for Full HD Box type IP Colour Camera. The Lens may be of same make of Camera or different make.
xiii.	Day/Night Camera	:	Auto Day/Night Configuration
xiv.	Data rate	:	i) 8 Mbps maximum for H.265 or higher Video Compression ii)Shall work on 3 Mbps bit rate or less average for Full HD@ 25 FPS at Variable bit rate (VBR) on individual (Single) stream with H.265 or higher Video Compression
xv.	Video Streaming	:	Unicast and Multicast streams

xvi.	Text Superimposing	:	Camera shall support superimposing the title and date & time on the video
xvii.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xviii.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xix.	Network Connectivity	:	Ethernet, 10/100 Base T
xx.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xxi.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
xxii.	Web Server	:	Internal Web server required with embedded operating system.
xxiii.	Automatic Gain Control	:	Required
xxiv.	Back light Compensation (BLC) or High Light Compensation (HLC)	:	Required
xxv.	Automatic White Balance	:	Required
xxvi.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxvii.	Two way/ Bi-directional Audio Input / Output	:	Required
xxviii.	Alarm Inputs / outputs	:	1 input & 1 output
xxix.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage (Nominal) / 24V AC or DC /12V DC
xxx.	PoE	:	IEEE 802.3af/ at compliant
xxxi.	Operating Temperature	:	0°C to + 50°C
xxxii.	Humidity	:	20 to 80% RH non-condensing
xxxiii.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xxxiv.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF

			website and a confirmation certificate for the offered models should be available at the time of supply.
xxxv.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

5.2 4K UHD Fixed Box Type IP Colour Camera:

The 4K UHD Fixed Box Type IP Colour Camera with Varifocal Lens shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/ 1.8" or larger, Progressive scan, CMOS sensor
ii.	Pixel Resolution	:	8.0 Mega Pixel Ultra HD (3840x2160) or Higher
iii.	Video Compression	:	MJPEG/H.265 or higher
iv.	Streaming Capability	:	Dual streams with one H.265 or higher Stream
v.	Video resolutions	:	a) For Main stream: i) Ultra HD (3840x2160) ii)Configurable from Ultra HD to other HD/SD resolution b) For Second Stream: Configuration from Full HD to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Ultra HD (3840x2160) @ 25 FPS or more with H.265 or higher compression on one stream & Full HD @ 15 FPS or more with H.265/MJPEG or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Lens mount	:	CS or C mount or any other mount
xii.	Varifocal Lens	:	4.5 to 10 mm, IR corrected, 1 m minimum object distance, Auto IRIS Control, Manual focus and zoom control Lens suitable for 4K Ultra HD Fixed Box type

			Camera. The Lens may be of same make of Camera or different make.
xiii.	Day/Night Camera	:	Auto Day/Night Configuration
xiv.	Data rate	:	16 Mbps maximum
xv.	Video Streaming	:	Unicast and Multicast streams
xvi.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xvii.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xviii.	Network Connectivity	:	Ethernet, 10/100 Base T
xix.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xx.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
xxi.	Web Server	:	Internal Web server required with embedded operating system.
xxii.	Automatic Gain Control	:	Required
xxiii.	Back light Compensation (BLC) or High Light Compensation (HLC)	:	Required
xxiv.	Automatic White Balance	:	Required
xxv.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxvi.	Two way/ Bi-directional Audio Input / Output	:	Required
xxvii.	Alarm Inputs / outputs	:	1 input & 1 output
xxviii.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage (Nominal) / 24V AC or DC/ PoE
xxix.	PoE	:	IEEE 802.3af/ at compliant
xxx.	Operating Temperature	:	0°C to + 50°C

xxxi.	Humidity	:	20 to 80% RH non-condensing
xxxii.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xxxiii.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
xxxiv.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

5.3 Housing and Mount for Fixed Box Type IP Colour Camera (Full HD & 4K UHD):

- 5.3.1 Housing arrangement shall be designed for both outdoor and indoor use and shall meet customer requirements for Camera enclosures.
- 5.3.2 It shall protect Camera and lens combination.
- 5.3.3 The Housing and Mount arrangement shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Window	:	3 mm (0.12 inch) glass
ii.	Camera Mounting	:	Removable Camera/lens tray, mounted with two screws or other industry standard arrangement.
iii.	Construction	:	Aluminum/ Fiberglass Reinforced Composite/ Polycarbonate housing & casing, neoprene gaskets, UV-resistant polymer end caps.
iv.	Tamper-resistance	:	Tamper-resistant screws for locking clasps shall be provided.
v.	Enclosure Protection	:	IP66 or NEMA-4 or better.
vi.	Vandal Proofing	:	The housing shall be vandal proof and impact resistant.
vii.	Heater and Blower	:	Inbuilt heater and blower kit shall be provided.
viii.	Power Supply	:	Power supply required for Housing shall be derived from Switch through PoE/PoE+.
ix.	Infra-Red	:	Built-in or External Infra-Red Illuminator complying IP66 or NEMA-4 or better with range 30 m or more. The Infra-Red Illuminator shall be of the same make

			as Housing
x.	Mount	:	Mounts shall be suitable for indoor and outdoor mounting units designed for Fixed box type Cameras or Camera Housing installations. The Mounts shall be of the same make as Housing. The Mount shall have following minimum features: i). Feed-through design for cable management (Entry of Cables/Wires inside Housing through Mount) ii). 360 deg rotation, 180 deg tilt iii). Versatile design iv). Adjustable mount heads v). Corrosion-resistant finish
xi.	Operating Temperature	:	0°C to + 50°C
xii.	Humidity	:	20 to 80% RH non-condensing
xiii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

5.4 Full HD Bullet type IP Colour Camera:

The Full HD Bullet type IP Colour Camera shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/2.8" or larger, Progressive scan, CMOS sensor
ii.	Pixel Resolution	:	2.0 Mega Pixel Full HD (1920x1080)
iii.	Video Compression	:	H.265 or higher
iv.	Dual Stream	:	Dual H.265 or higher Streams
v.	Video resolutions	:	a) For Main stream: i)1920x1080 (Full HD) ii)Configurable from Full HD to other HD/SD resolution b) For Second Stream: Configuration from D1 to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Minimum 25 frames per second (FPS) for both the streams. Full HD@ 25 FPS with H.265 or higher compression

			on one stream & D1@ 25 FPS with H.265 or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Motorized Varifocal Lens	:	4.5 mm – 10 mm, 1 m minimum object distance, IR corrected Lens suitable for 2 Mega Pixel Full HD Camera
xii.	Infra-Red	:	Built-in Infra-Red Illuminator with range 20 m or more
xiii.	Day/Night Camera	:	Auto Day/Night Configuration
xiv.	Data rate	:	i) 8 Mbps maximum for H.265 or higher Video Compression. ii) Shall work on 3 Mbps bit rate or less average for Full HD@ 25 FPS at Variable bit rate (VBR) on individual (Single) stream with H.265 or higher Video Compression.
xv.	Video Streaming	:	Unicast and Multicast streams
xvi.	Text Superimposing	:	Camera shall support superimposing the title and date & time on the video
xvii.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xviii.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xix.	Network Connectivity	:	Ethernet, 10/100 Base T
xx.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xxi.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
xxii.	Web Server	:	Internal Web server required with embedded operating system.
xxiii.	Automatic Gain Control	:	Required
xxiv.	Back light	:	Required.

	Compensation (BLC) or High Light Compensation (HLC)		
xxv.	Automatic White Balance		Required.
xxvi.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxvii.	Two way/ Bi-directional Audio Input / Output	:	Required
xxviii.	Alarm Inputs / outputs	:	1 input & 1 output
xxix.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage (Nominal)/ 24V AC or DC/12V DC
xxx.	PoE	:	IEEE 802.3af/ at compliant
xxxi.	Operating Temperature	:	0°C to +50°C
xxxii.	Humidity	:	20 to 80% RH non-condensing
xxxiii.	Ingress Protection	:	IP66 or NEMA-4 or better
xxxiv.	Enclosure Protection	:	Vandal proof and Impact resistant
xxxv.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xxxvi.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
xxxvii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

5.5 4K UHD Bullet type IP Colour Camera:

The 4K UHD Bullet type IP Colour Camera shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/ 1.8" or larger, Progressive scan, CMOS sensor
ii.	Pixel Resolution	:	8.0 Mega Pixel Ultra HD (3840x2160) or Higher
iii.	Video Compression	:	MJPEG/ H.265 or higher

iv.	Streaming Capability	:	Dual streams with one H.265 or higher Stream
v.	Video resolutions	:	a) For Main stream: i) Ultra HD (3840x2160) ii)Configurable from Ultra HD to other HD/SD resolution b) For Second Stream: Configuration from Full HD to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Ultra HD (3840x2160) @ 25 FPS or more with H.265 or higher compression on one stream & Full HD @ 15 FPS or more with H.265/MJPEG or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Motorized Varifocal Lens	:	4.5 mm – 10 mm, 1 m minimum object distance, IR corrected Lens suitable for 4K UHD Bullet type IP Colour Camera
xii.	Infra-Red	:	Built-in Infra-Red Illuminator with range 20 m or more
xiii.	Day/Night Camera	:	Auto Day/Night Configuration
xiv.	Data rate	:	16 Mbps maximum
xv.	Video Streaming	:	Unicast and Multicast streams
xvi.	Text Superimposing	:	Camera shall support superimposing the title and date & time on the video
xvii.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xviii.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xix.	Network Connectivity	:	Ethernet, 10/100 Base T
xx.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xxi.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)

xxii.	Web Server	:	Internal Web server required with embedded operating system.
xxiii.	Automatic Gain Control	:	Required
xxiv.	Back light Compensation (BLC) or High Light Compensation (HLC)	:	Required
xxv.	Automatic White Balance	:	Required
xxvi.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxvii.	Two way/ Bi-directional Audio Input / Output	:	Required for sound detection
xxviii.	Alarm Inputs / outputs	:	1 input & 1 output
xxix.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage(Nominal)/ 24V AC or DC/ 12V DC
xxx.	PoE	:	IEEE 802.3af/ at compliant
xxxi.	Operating Temperature	:	0°C to + 50°C
xxxii.	Humidity	:	20 to 80% RH non-condensing
xxxiii.	Ingress Protection	:	IP66 or NEMA-4 or better
xxxiv.	Enclosure Protection	:	Vandal proof and Impact resistant
xxxv.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xxxvi.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
xxxvii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

6.0 Full HD Fixed Dome Type IP Colour Camera:

The Full HD Fixed Dome Type IP Colour Camera shall have the following minimum specifications:-

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/2.8" or larger, Progressive scan, CMOS sensor
ii.	Pixels	:	2.0 Mega Pixel Full HD (1920x1080)
iii.	Video Compression	:	H.265 or higher
iv.	Dual Stream	:	Dual H.265 or higher Streams
v.	Video resolutions	:	a) For Main stream: i)1920x1080 (Full HD) ii)Configurable from Full HD to other HD/SD resolution b) For Second Stream: Configuration from D1 to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Minimum 25 frames per second (FPS) for both the streams. Full HD@ 25 FPS with H.265 or higher compression on one stream & D1@ 25 FPS with H.265 or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Lens	:	3.8mm - 8mm, 1 m minimum object distance, IR corrected Lens suitable for 2 Mega Pixel Full HD Fixed Dome Type Camera
xii.	Day/Night Camera	:	Auto Day/Night Configuration
xiii.	Infra-Red	:	Built-in Infra-Red Illuminator with range 20 m or more
xiv.	Data rate	:	i) 8 Mbps maximum for H.265 or higher Video Compression. ii) Shall work on 3 Mbps bit rate or less average for Full HD@ 25 FPS at Variable bit rate (VBR) on individual (Single) stream with H.265 or higher Video Compression.
xv.	Video Streaming	:	Unicast and Multicast streams
xvi.	Text Superimposing	:	Camera shall support superimposing the title and date & time on the video
xvii.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xviii.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall

			drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xix.	Network Connectivity	:	Ethernet, 10/100 Base T
xx.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xxi.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
xxii.	Web Server	:	Internal Web server required with embedded operating system.
xxiii.	Automatic Gain Control	:	Required
xxiv.	Back light Compensation (BLC) or High Light Compensation (HLC)	:	Required.
xxv.	Automatic White Balance	:	Required
xxvi.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxvii.	Two way/ Bi-directional Audio Input / Output	:	Required
xxviii.	Alarm Inputs / outputs	:	1 input & 1 output
xxix.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage (Nominal) / 24V AC or DC/12V DC
xxx.	PoE	:	IEEE 802.3af/ at compliant
xxxi.	Operating Temperature	:	0°C to +50°C
xxxii.	Humidity	:	20 to 80% RH non-condensing
xxxiii.	Enclosure Protection	:	Vandal proof and Impact resistant Aluminium enclosure with IP66 or NEMA-4 or better with suitable mounting accessories.
xxxiv.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xxxv.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.

xxxvi.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.
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7.0 Full HD P/T/Z (Pan/Tilt/Zoom) IP Colour Camera:

The Full HD P/T/Z (Pan/Tilt/Zoom) IP Colour Camera shall have the following minimum specifications:-

S. No.	Parameter	:	Specification
i.	Image Sensor	:	1/2.8" or larger, Progressive scan, CMOS sensor
ii.	Pixels	:	2.0 Mega Pixel Full HD (1920x1080)
iii.	Video Compression	:	H.265 or higher
iv.	Dual Stream	:	Dual H.265 or higher Streams
v.	Video resolutions	:	a) For Main stream: i)1920x1080 (Full HD) ii)Configurable from Full HD to other HD/SD resolution b) For Second Stream: Configuration from D1 to other HD/SD resolutions.
vi.	Resolution and Frame Rate	:	Minimum 25 frames per second (FPS) for both the streams. Full HD@ 25 FPS with H.265 or higher compression on one stream & D1@ 25 FPS with H.265 or higher compression on another stream.
vii.	Minimum Illumination :		
	a) Colour Mode	:	0.5 Lux
	b) Night Mode (Black & White)	:	0.05 Lux
viii.	Shutter speed	:	Maximum shutter speed should be 1/8000 sec or higher.
ix.	Signal to Noise Ratio	:	≥ 45 dB
x.	Video Standard	:	PAL
xi.	Lens	:	a) Optical zoom 30x or better IR corrected lens suitable for Full HD PTZ Camera. b) Focal length of lens: Upper range shall be 125 mm or higher. c) 1 m minimum object distance, IR corrected Lens

xii.	Digital zoom	:	12x or better
xiii.	Infra-Red	:	Built-in Infra-Red Illuminator with range 125 m or more
xiv.	Focus & Iris	:	Automatic with manual override
xv.	Pan/Tilt adjustment	:	360° continuous pan; 0° to 90° tilt from horizontal plane
xvi.	Preset speed	:	90°/sec ± 0.5° accuracy
xvii.	Pan/Tilt speed	:	1°/sec to 90°/sec
xviii.	Sector Blanking	:	Required. Camera 360-degree pan rotation to be divided in 8 sectors and any sector shall be blanked as required by the operator
xix.	Preset Titling	:	The Camera shall allow the storage of up to 99 preset scenes with each preset programmable for 16-character titles
xx.	Data rate	:	i) 8 Mbps maximum for H.265 or higher Video Compression ii) Shall work on 3 Mbps bit rate or less average for Full HD@ 25 FPS at Variable bit rate (VBR) on individual (Single) stream with H.265 or higher Video Compression
xxi.	Video Streaming	:	Unicast and Multicast streams
xxii.	Text Superimposing	:	Camera shall support superimposing the title and date & time on the video
xxiii.	Edge Storage	:	Edge Storage slot suitable for 128 GB SD/SDHC/SDXC memory or higher along with memory card.
xxiv.	Activity Controlled Video Recording	:	Required. During periods of negligible motion, the bits rate shall drop and when motion occurs, the bit rate shall return to normal without any perceptible delay.
xxv.	Network Connectivity	:	Ethernet, 10/100 Base T
xxvi.	Discovery Interface	:	OEM interface to detect the Camera automatically and configure network settings
xxvii.	Network Protocols	:	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
xxviii.	Web Server	:	Internal Web server required with embedded operating system.
xxix.	Automatic Gain Control	:	Required
xxx.	Back light Compensation (BLC) or High Light Compensation	:	Required

	(HLC)		
xxxi.	Automatic White Balance	:	Required
xxxii.	Wide Dynamic Range (WDR)	:	≥ 90 dB
xxxiii.	Two way/ Bi-directional Audio Input / Output	:	Required
xxxiv.	Alarm Inputs / outputs	:	1 input & 1 output
xxxv.	Input Voltage	:	Power should be drawn on PoE, 220V AC Voltage (Nominal) / 24V AC or DC/ 12VDC
xxxvi.	PoE	:	IEEE 802.3af/ at compliant
xxxvii.	Operating Temperature	:	0°C to + 50°C
xxxviii.	Humidity	:	20 to 80% RH non-condensing
xxxix.	Enclosure Protection	:	Vandal Proof Impact Resistant Aluminium enclosure with IP66 or NEMA-4 or better with suitable mounting accessories.
xl.	ONVIF Compliance	:	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
xli.	MAC Address	:	The MAC address of the IP Cameras must be registered in the name of OEM supplying the Cameras.
xlii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

8.0 Digital Keyboard:

- 8.1 The Digital Keyboard (Joystick) shall be fully functional, multipurpose keyboard used for controlling of connected P/T/Z Camera.
- 8.2 Digital Keyboard shall include an integral variable speed Pan/Tilt/Zoom joystick and shall be able to select P/T/Z Camera.
- 8.3 Digital Keyboard shall support RS-232/RS-485 or Ethernet or USB port connectivity and shall be supplied along requisite interface units.
- 8.4 Digital Keyboard shall be of same make as P/T/Z Camera.

8.5 The Digital Keyboard shall be able to withstand 0°C to + 50°C temperature and Humidity of 20 to 80% RH non-condensing.

8.6 The Digital Keyboard shall have UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited Labs/Agencies.

9.0 Large Format Display Monitor:

9.1 Large Format Display Monitors shall be used for displaying multiple Camera videos in conjunction with viewing workstation. These monitors shall be suitable for 24x7 (round the clock) use.

9.2 One such Monitor shall display minimum 16 Cameras on a single unit. Selection of these Cameras shall be as per software specifications.

9.3 Large Format Display Monitors shall be LED backlit type and shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Screen Size	:	55" (inches) or larger
ii.	Video Resolution	:	Full HD (1920 x 1080)
iii.	Brightness	:	350cd/m ² or above
iv.	Contrast Ratio	:	1100:1
v.	Viewing angle (H/V)	:	170 ⁰
vi.	Response Time	:	≤ 12 ms
vii.	Digital Input	:	HDMI
viii.	Analog Input	:	RGB/VGA/BNC
ix.	USB Port	:	01 no.
x.	External Control	:	RJ45
xi.	Display Control	:	Monitor control on screen display, programmable with remote.
xii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity.

10.0 Server Hardware and Network Video Recorders:

10.1 Server Hardware:

10.1.1 Server hardware for Video Management & Recording, Video Analytics and Face Recognition Software shall have the following minimum specifications:

S. No.	Parameter	Specification		
		Server for Video Analytics or	Server for Management	Video and

		FRS	Recording of 32/64/128 Cameras
		Video Analytics Server: one each for 32 nos. of Cameras. and FRS Server: One each for minimum 4 numbers of Cameras.	Video Management and Video Recording of 32/64/128 nos. of Full HD Cameras or 8/16/32 numbers of 4K UHD Cameras or a mix of both on pro-rata basis or more no. of Cameras
i.	Processor	Latest Generation x86 Intel Xeon / AMD Epyc Processor	Latest Generation x86 Intel Xeon/ AMD Epyc Processor
ii.	No. of Cores & No. of Processors	Minimum 16 Cores in Single Processor or 2 nos. of 8 Core Processor (Dual Socket)	i) For 32/64 Cameras: Minimum 8 Cores in Single Processor ii) For 128 Cameras: Minimum 16 Cores in Single Processor or 2 nos. of 8 Core Processor (Dual Socket)
iii.	No. of Threads	2 Threads per Core	2 Threads per Core
iv.	Frequency	2.1 GHz or higher	2.1 GHz or higher
v.	Memory	32 GB or higher, DDR4 SDRAM or latest.	i) For 32/64 Cameras: 16 GB or higher, DDR4 SDRAM or latest. ii) For 128 Cameras: 32 GB or higher, DDR4 SDRAM or latest.
vi.	Operating System	Windows Operating System or Linux, latest with required no. of Client licenses as specified by the purchaser.	
vii.	LAN/ Ethernet	Onboard/ on slot Gigabit Ethernet (RJ45) with Load Balancing and Fail over Support, IPv6 compliant.	
viii.	Interface type	FC or iSCSI or SAS or FCoE or Ethernet interface for connecting External Storage device.	
ix.	Hard Disk Drive	Hot Pluggable SAS HDD, 4x600 GB, 10000 RPM or higher with minimum 06 nos. or higher internal drive bays.	
x.	HDD RAID Controller	SAS RAID Controller with RAID 0/1/5 configuration.	
xi.	DVD R/W Drive (internal) & USB Ports	Required	

xii.	USB/ PS/2 mouse and keyboard	Required
xiii.	Power Supply	Dual and Redundant Power Supply
xiv.	Should be able to run 24x7 at ambient room temperature of 27 °C.	
xv.	Chassis Type	19" Rack mountable with sliding rails and fittings to install into a Rack.
xvi.	Regulatory Approvals/ Certifications	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity.

10.1.2 Server specifications for Face Recognition Software will be same as per clause no. 10.1.1 with any other additional items which can fulfill FRS requirement.

10.1.3 One 17-inch Monitor or as specified by the purchaser with Keyboard, Mouse, KVM Switch along with associated accessories shall be provided for each Rack for Servers.

10.2 Network Video Recorder (NVR):

10.2.1 The Network Video Recorders shall have the following minimum specifications or otherwise as specified by the purchaser:

S. No.	Parameters	Specifications		
		32 Channel NVR	64 Channel NVR	128 Channel NVR
i.	Channels	32 nos.	64 nos.	128 nos.
ii.	Video Management and Recording	One 32/64/128 Channel NVR shall support Video Management and Recording of 32/64/128 nos. of Full HD Cameras or 8/16/32 nos. of 4K UHD Cameras, respectively or a mix of both on pro-rata basis with required Storage		
iii.	Recording Bandwidth	The Average Recording Bandwidth shall be @ 3 Mbps per channel for Full HD Camera. The maximum recording bandwidth shall be as below:		
		256 Mbps or higher	320 Mbps of higher	576 Mbps or higher
		The NVR should be able to record all channels simultaneously at FHD resolution.		
iv.	Storage Capacity (Built in)	As specified in Clause no. 2.8 of the specification i.e. approximately 750 GB per FHD Camera and 3 TB per UHD Camera usable after RAID 5/6 configuration for 30 days.		

v.	Video Playback	16 Channels Simultaneously @ Full HD or higher
vi.	Power Supply	Dual and Redundant Power Supply
vii.	Should be able to run 24x7	at ambient room temperature of 27 °C.
viii.	Camera Type	IP, 2 Mega Pixel Full HD (1920x1080) and 8.0 Megapixel Ultra HD (3840x2160) Cameras
ix.	Recording Resolution and Frame Rate	Support Full HD (1920x1080) @ 25 FPS and 8.0 Megapixel Ultra HD (3840x2160) @ 25 FPS depending on Camera
x.	Supported Image Resolution	Support SD resolutions, HD resolution, Full HD resolution and Ultra HD resolution depending on Camera
xi.	Operating System	Embedded Windows or Linux
xii.	Video Compression	MJPEG/ H.265 or higher
xiii.	Drive	SATA/SAS HDD, 7200 RPM or higher or SSD
xiv.	Network Protocols	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (as required for system working)
xv.	Discovery Interface	OEM interface to detect the camera automatically and configure network settings
xvi.	Network Interface	Ethernet, 10/100/1000 Base T or 10/100/1000 Base X ports
xvii.	Video Output/ Interface (Optional)	HDMI or VGA
xviii.	USB Interface	Required
xix.	Monitoring	USB Mouse Control, Digital Keyboard Control
xx.	Chassis Mounting	19" Rack Mounted
xxi.	Software Features	Video Management Software & Graphic User Interface Client Software and Video Recording Software shall be as per Clause no. 18.1, 18.2 and 18.3 of Software Requirement of the specification.
xxii.	ONVIF Compliance	ONVIF Profile 'S' & 'G'. The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.
xxiii.	Regulatory Approvals/ Certifications	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity. Note: The Regulatory Approvals/ Certifications are to be provided from NABL/NABCB accredited Labs or internationally reputed and accredited

	Labs/Agencies.
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10.2.2 One 17-inch Monitor or as specified by the purchaser with Keyboard, Mouse, KVM Switch along with associated accessories shall be provided for each Rack for NVRs.

11.0 PC Workstation:

11.1 PC Workstations (One Workstation shall be required for two nos. of Large Format Display Monitors) shall be provided for viewing Cameras in multi-screen mode on Large Format Display Monitors.

11.2 The PC Workstation shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Processor	:	Latest generation x86 Intel Processor/ AMD Processor
ii.	No. of Cores	:	6 Cores or higher
iii.	No. of Threads	:	12
iv.	Frequency	:	3.0 GHz or higher
v.	Cache	:	10 MB
vi.	Memory	:	64 GB or higher DDR4 SDRAM or latest
vii.	Operating System	:	Windows Operating System or Linux, latest
viii.	LAN/ Ethernet	:	10/100/1000 base T, Onboard/ on slot Gigabit Ethernet (RJ45), IPv6 compliant.
ix.	Graphics Card	:	One no. of dual Port 4 GB NVIDIA Quadro Graphic Card or dual Port 4 GB AMD Radeon Pro WX Graphic Card or similar with Full HD and 4K UHD resolution display support.
x.	Hard Disk Drive	:	2 x 500GB 5400 RPM or higher
xi.	RAID Controller	:	RAID Controller with RAID 0/1 configuration.
xii.	DVD R/W Drive & USB Ports	:	Required
xiii.	USB/ PS/2 mouse and keyboard	:	Required
xiv.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity.

11.3 4K UHD LED Monitor of 24-inch size or as specified by the purchaser shall be provided along with PC Workstation.

12.0 External Storage Device:

12.1 The Storage Capacity of External Storage Device shall be as specified in Clause no. 2.8 of the specification i.e. approximately 750 GB per FHD Camera and 3 TB per UHD Camera usable after RAID 5/6 configuration for 30 days.

12.2 External Storage Device shall have the following minimum specifications:

S. No.	Parameter	:	Specification
i.	Mounting	:	19" Rack Mounted
ii.	No. of Controllers	:	02 nos. in redundant mode.
iii.	Host interface Type	:	FC or iSCSI or SAS or FCoE or Ethernet
iv.	No of Host interface	:	08
v.	Drive	:	SAS HDD, 7000 RPM or higher
vi.	Cache	:	8GB per Controller
vii.	Storage scalability	:	240 TB Raw or higher as per site requirement
viii.	Power Supply and FAN	:	Dual, Redundant
ix.	RAID configuration	:	RAID 5/6
x.	Virtual Drives/ LUN	:	Maximum 256 virtual drives
xi.	Hot Spare Disk	:	It shall provide at least one hot spare disk.
xii.	Regulatory Approvals/ Certifications	:	UL/EN/CE/IEC/BIS certification for Safety and CE/FCC Certifications for EMC & Immunity.

13.0 Core Switch: The Core Switch shall have the following minimum specifications:-

S. No.	Specification
1.	20x10G SFP+ port and Additional 4x10G (minimum) BASE-T/SFP+ combo ports.
2.	Should have RJ-45 console ports for out - of - band CLI management
3.	One USB Port for easy management for images and configuration files, that can be copied to and from the NVRAM of the Switch
4.	Port Standards & Functions: IEEE 802.3 10BASE-T Ethernet, IEEE 802.3u 100BASE-TX Fast Ethernet, IEEE 802.3ab 1000BASE-T Gigabit Ethernet, 802.3ae 10 GbE, 802.3an 10GBASE-T, IEEE 802.3x Flow Control for Full-Duplex Mode, Auto-negotiation
5.	Should have AC power supply arrangement as given without any external adaptors with redundant power supply: AC power supply 100 to 240 V AC with 50 to 60 Hz.
6.	Switching Capacity should be 480 Gbps or more as per port configuration
7.	64-byte Packet Forwarding rate should be 357 Mpps or more as per port configuration
8.	MAC Address Table should be 48K or more.
9.	Should have 802.1D STP, 802.1w RSTP and 802.1s MSTP Spanning Tree

	Protocol.
10.	Should support Loop guard and Root guard & Loop Back detection
11.	Should support 802.1AX / 802.3ad Link Aggregation Protocol
12.	Should support 4K VLAN Groups and configurable VLAN ID: 0 to 4094 VID's
13.	Should support Port-based VLAN, 802.1v VLAN, Double VLAN (Q-in-Q), Voice VLAN, VLAN trunking, IEEE 802.1Q Tagged VLAN protocol
14.	Should supports 256 IP interfaces.
15.	Should support Loopback Interface.
16.	Should support VRRPV2 and V3.
17.	Should have 4K hardware routing entries for IPv4/IPv6.
18.	Should support Static Route, Default Route, RIP and Policy-based Route (PBR) for IPv4 and IPv6, OSPF for IPv4 and IPv6,PIM-DM/SM/SM v6/SSM/SDM,IGMPv1/v2/v3.
19.	Should support 802.1p Quality of Service with 8 queues per port.
20.	Should support Queue Handling with Strict Priority Queue, Weighted Round Robin/ Shaped Round Robin/ Deficit Round Robin (DRR), SPQ + WRR/SRR and Weighted Deficit Round Robin (WDRR).
21.	Should support QoS based on 802.1p Priority Queues, MAC address, IP address, IPv6 traffic class, IPv6 Flow Label, DSCP, VLAN, TCP/UDP port, ToS/IP Preference, Switch port, Ether Type and Protocol type.
22.	Should support Ingress and Egress ACL.
23.	Should support Access Control List based on 802.1p priority, Protocol type, MAC address, VLAN, Ether type, TCP/UDP port number, DSCP, IP address, IPv6 Traffic Class and IPv6 flow label.
24.	Should have Port Security with 1K or higher MAC addresses per port.
25.	Support per port Broadcast/Multicast/Unicast Storm Control.
26.	Require Dynamic ARP Inspection and ARP Spoofing Prevention.
27.	Should have SSH and SSL for IPv4 and IPv6.
28.	Should support DHCPv6 Guard, IPv6 Route Advertisement (RA) Guard and IPv6 ND Inspection, BPDU Attack Protection, Duplicate Address Detection (DAD)
29.	Should support Compound Authentication with multiple option, which should include 802.1X Port based, 802.1X Host based MAC for access control.
30.	Should support RADIUS and TACACS+ authentication with Authentication Database Failover.
31.	Able to manage through Web-GUI, Fully functional CLI interface and Telnet.
32.	Should support SNMP v1, v2c, v3 and SNMP Traps and RMON v1 and RMON v2.
33.	Should have multiple Image and configuration file support to reduce down time for the switches.
34.	Should support sFlow (RFC3176) or Netflow for monitoring traffic in data networks.
35.	Should have SNTP/NTP protocol for time synchronization.
36.	Should support LLDP or LLDP-MED.

37.	AC Input: 100 to 240V AC, 50Hz internal universal power supply.
38.	Operating Temp.: 0 °C to 50 °C.
39.	It should have safety certificates as per UL/IEC/EN 60950.
40.	The switch should have EMC certification as per EN/CE/FCC standards
41.	Switch should be supplied with the all necessary hardware accessories like Power cord, Rack-mount bracket, Installation Guide, etc. and necessary software image file to fulfill all above mention feature set from day 1.

14.0 (I) Aggregation Switch: The Aggression Switch shall have following minimum specifications:-

S. No.	Specification
1.	Should have minimum 24 x GE SFP based ports
2.	Should have minimum 4 nos. SFP+ based 10 GE ports.
3.	Should have at least 64 Gbps full duplex line rate traffic.
4.	Should have support for 802.3x flow control.
5.	Should support 802.1D spanning tree control/RSTP support and MSTP support.
6.	Should support management features viz. Web-based GUI/SSH, SNMP, TFTP Client System Log.
7.	Should support Auto MDI-II/MDI-X uplink for all the twisted pair ports.
8.	Should support 802.1Q VLAN, 802.1p Priority queues.
9.	Should support port mirroring, jumbo frame & should have at least 16K MAC address
10.	Should support console port and telnet-based management.
11.	Should have AC power supply arrangement as given below in chassis without any external adaptors with redundant power supply (RPS): AC power supply 100 to 240 V AC with 50 to 60 Hz.
12.	Should support Port-based VLAN, 802.1Q Tagged VLAN along with Management VLAN.
13.	Should support ITU-T G.8032 Ethernet Ring protection for Loop Protection and fast convergence time (Sub 50 ms) in ring topologies/ IEEE 802.1W RSTP for Sub Second failover. Industry Standard IEEE 802.1W RSTP is standard for Ring /STP topology.
14.	Switch should support Surge Protection on power input and on Ethernet ports as per EN61000-4-5 standard and as per requirement at Indian Railway Station.
15.	Should support Quality of Service (QoS) features viz. Priority Queue, Class of Service (CoS), Rate Limiting (Bandwidth Control), Strict Priority Queue (SPQ), Weighted Round Robin (WRR) or better, DOS attack prevention.
16.	IPv6 feature should be ready from day 1.
17.	Minimum Operating Temperature 0 to 50 degree.
18.	It should have safety certificates as per UL/IEC/EN 60950-.

	The switch should have EMC certification as per EN/CE/FCC standards.
19	Switch shall be with Rack Mountable clamps for standard 19-inch rack mountable.
20	The Switch shall be designed for continuous operations.
21	Should support port Trunking of at least 2 Nos. GE/10GE ports.
22	Switch should support LLDP or similar functionality.
23	Should support following security features viz.: i) SSL (HTTPS)/SSH, ii) Broadcast/Multicast/Unicast Storm Control, iii) DoS Attack Prevention/ DAI
24	Switch should support following SNMP traps or syslog i) Interface UP & Down ii) Optical Power SFP threshold alarms iii) STP Topology Changes and New root bridge iv) LLDP table changes

14.0 (II) Layer 2 Switches (24 ports): The Layer 2 Switches shall have following minimum specifications:-

S. No.	Specification
1.	The Switch Should have 24 x 10/100/1000BASE-T PoE ports • 4 x 1G(minimum) SFP+ ports.
2.	PoE Power Budget should be 370 W or better Switching capacity should be 56 Gbps or better; forwarding rate 41.7 MPPS or better
3.	Should have support for 802.3x flow control.
4.	Should support 802.1D spanning tree control / RSTP support, sflow or netflow.
5.	Should support management features like Web-based GUI, SNMP, TFTP Client, System Log, DHCP/BootP.
6.	Should support Auto MDI-II/MDI-X uplink for all the twisted pair ports.
7.	Should support for 802.1Q VLAN, 802.1p Priority queues.
8.	Should support port mirroring.
9.	Should support jumbo frame.
10.	Should support console port or telnet and web GUI based management.
11.	Should have AC power supply arrangement as given below in chassis without any external adaptors with redundant power supply: AC power supply 100 to 240 V AC with 50 to 60 Hz.
12.	Should support at least 16000 entries in the MAC table.
13.	Should support Port-based VLAN, 802.1Q Tagged VLAN & Voice VLAN along with Management VLAN.
14.	Should support spanning-tree root guard or similar functionality.
15.	Should support spanning-tree Port Fast guard for fast convergence or similar functionality.
16.	Should support security features like SSL (HTTPS)/SSH, Broadcast/Multicast/ Unicast Storm Control, DoS Attack Prevention.

17.	Should support Quality of Service (QoS) like Priority Queue, Class of Service (CoS), Rate Limiting (Bandwidth Control), Strict Priority Queue (SPQ), Weighted Round Robin (WRR)/ Shaped Round Robin (SRR).
18.	IPv6 feature should be ready from day 1.
19.	Switch shall be with Rack Mountable clams for standard 19-inch rack mountable.
20.	Minimum Operating Temperature 0 to 50°C.
21.	Switch should support LLDP or similar functionality.
22.	Switch should have EMI CERTIFICATE as per EN/FCC/IC/CE.
23.	Switch should have SAFETY CERTIFICATE as per UL/ IEC/EN 60950
24.	Switch should support following SNMP traps or syslog: i) Interface UP & Down ii) Optical Power SFP threshold alarms iii) STP Topology Changes and New root bridge iv) LLDP table changes v) Threshold alarms for Temperature
25	Should support following for min. 64 Groups: i) IGMP Snooping, ii) IGMP v1/v2/v3 awareness Snooping, iii) IGMP Snooping Queried

14.0 (III) Field Switches (8 ports): The Field Switches shall have following minimum specifications:-

S. No.	Specification
1.	Switch Should Support 8 10/100/1000BASE-T PoE and 2 SFP ports
2.	Switch Should Support Min. 20 Gbps Switching Capacity and Maximum 64 Byte Packet Forwarding Rate is 14.88 MPPS
3.	Switch Should Support IEEE 802.3af & at compliance (for PoE ports) and 120W Power Budget.
4.	Switch should support surge protection of 2kV as per IEC/EN 61000-4-5
5.	Switch should support IGMP Snooping v1, v2 and MLD snooping v1/v2
6.	Switch shall support IEEE 802.1AB Link Layer Discovery Protocol (LLDP) or LLDP-MED.
7.	Switch Should Support 4K VLAN ID's, Min 256 static VLAN and Voice & Video VLAN
8.	Switch should support Port Mirroring One to one/Many to One
9.	Switch should support Quality of Service (QoS), 802.1p, Strict, Weighted Round Robin (WRR)/ Shaped Round Robin (SRR) scheduling.
10.	Switch should support Access Control List (ACL), Port Base, MAC Base, IP Based, L2 & L3 ACL (IPv4 and IPv6)
11.	Switch Should Support Security Features like Broadcast/Multicast/Unicast Storm Control, Traffic segmentation, TLS, DoS attack prevention, 802.1X Port-based Access Control , Port Security, ARP Spoofing Prevention, DHCP Server Screening, IP-MAC-Port Binding, ARP Inspection, DHCP Snooping, 802.1X Authentication local/RADIUS database (IPv4 & IPv6), port-based access control.

12.	Switch Should Support features IPv4 & IPv6 Inspection, SSH v2 feature, Flow Control governed by IEEE 802.3x.
13.	Switch Should Support Management thru console Port, Web-based and CLI.
14.	Switch Should Support SNMP v1/v2c/v3.
15.	Operating temperature/ Humidity: 0°C to 50°C, 10%-90% non-condensation.
16.	The switch should work on 100-240V AC, 50Hz power supply.
17.	Switch should have EMI CERTIFICATE as per EN/FCC/IC/CE.
18.	Switch should have SAFETY CERTIFICATE as per UL/ IEC/EN 60950.

15.0 Wireless Transmitter/Receiver Unit:

- 15.1 Wireless Transmitter/Receiver Unit shall be used to send IP video signals from Cameras to central location switch from extreme areas like yards, foot over bridges and any other area in the station where cabling is difficult to install & maintain.
- 15.2 Wireless Transmitter/Receiver Unit shall be compact in design and shall be easily integrated with Fixed Cameras and PTZ Cameras. It shall enable digital transmission of both video & data for PTZ control over the same frequency channel.
- 15.3 Outdoor Unit of Transmitter/Receiver Unit shall be with enclosure of rating IP66 / NEMA 4 or better with all external connector for easy installation.
- 15.4 Wireless Transmitter/Receiver Unit shall have the following minimum specifications:

S. No.	Parameter	Specification
i.	Frequency Range (License Free Band)	Dual Band
ii.	Throughput	50 Mbps or Higher
iii.	Line of Sight Range	It should be near L.O.S with OFDM technology with 20 dBi or higher antenna.
iv.	Ethernet Interface	10/100 BaseT
v.	Protocols to be Used	Suitable and required network protocol stack to work Camera in TCP/IP based Ethernet network environment. (As required for system working)
vi.	Network Management	HTTP, TELNET, FTP, SNMP
vii.	Standard	AP should have support of 802.11ac
viii.	Transmitted power	Should be max. permitted as per guidelines for license free band.
ix.	Regulatory Approvals/ Certifications	UL or EN or CE or IEC or IS certification for Safety, CE or FCC Certifications for EMC & Immunity.

16.0 Copper to Fiber Media Converter:

Media Converter shall generally be as per RDSO specification no. RDSO/SPN/TC/103/2013, Revision 0.0 (with latest revision/ amendments).

Note: The above specifications for Media Converter are generic. Any deviation/ additional requirements specific to Video Surveillance System installations or as per site requirement can be specified by the purchaser.

17.0 Cables:

Following Cables shall be provided for connectivity of different equipment in the system:

17.1 STP CAT-6 Cable:

STP (Shielded Twisted Pair) CAT-6 Cable shall be compliant with latest EIA/TIA-568-B.2-1 standard for CAT 6 cable or as specified by purchaser.

17.2 Underground Optic Fiber Cable:

Underground Optic Fiber Cable shall be 24 Fibre Armoured Optic Fibre Cable as per RDSO specification no. IRS: TC: 55/2006, Revision 1.0, Amendment 2.0 with latest revision/amendment.

17.3 Power Cable:

Power Cable 3 Core, 2.5 sq mm, multi strand copper conductor, PVC insulated, Armoured, conforming to IS: 1554 Part-I shall be provided or as specified by purchaser.

18.0 SOFTWARE REQUIREMENT:

The software requirements of IP based Video Surveillance System shall be as below:

18.1 Video Management Software:

18.1.1 This shall be a highly scalable enterprise level software solution. It shall offer a complete video surveillance solution that will be scalable to required numbers of Cameras that can be added on a unit-by-unit basis.

18.1.2 The video management software shall be licensed and shall operate on open architecture and shall require no proprietary IT hardware.

18.1.3 The video management software shall allow for video to be streamed on workstation in Matrix or on a video wall.

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- 18.1.4 The user with administrative rights shall create clients (users) and give access to the software client application based on predefined user access rights.
- 18.1.5 The system shall allow the recording, live monitoring, playback of archived video and data simultaneously.
- 18.1.6 The software shall provide the following:
 - 18.1.6.1 Several simultaneous live picture connections of Camera in network.
 - 18.1.6.2 Configuration of monitoring situation (site maps).
 - 18.1.6.3 Programming of alarm-triggered automatic events in various alarms configuration.
 - 18.1.6.4 System set up with limited operation options for clearly defined surveillance tasks.
 - 18.1.6.5 Programming of automatic recording events on a network recorder.
- 18.1.7 The software shall display dual MJPEG/H.265 or higher video streams in real time simultaneously at frame rates ranging from 1 fps to 25 fps and resolution ranging Full HD/Ultra HD to other HD/SD resolution.
- 18.1.8 Each Camera's bit rate, frame rate and resolution shall be set independently from other Cameras in the system, and altering these settings shall not affect the recording and display settings of other Cameras.
- 18.1.9 The software shall provide automatic search and discovery of components of video surveillance system on the network which can be network Cameras.
- 18.1.10 The software shall provide drag & drop functions on the system and also for set up of connection between Cameras and monitors connected to one workstation.
- 18.1.11 The software shall allow:
 - 18.1.11.1 Live display of Cameras.
 - 18.1.11.2 Live display of Camera sequences.
 - 18.1.11.3 Control of PTZ Cameras.
 - 18.1.11.4 Playback of archived video.
 - 18.1.11.5 Retrieval of archived video.
 - 18.1.11.6 Instant Replay of live video.
 - 18.1.11.7 Use of site maps.
 - 18.1.11.8 Configuration of system settings.

- 18.1.11.9 Configuration and programming of P/T/Z Cameras, features like auto tours, presets etc.
- 18.1.12 The software shall be able to do video recording on any of the following options - inbuilt hard disks on the server, direct attached storage boxes attached to servers, network attached storage, storage area network.
- 18.1.13 The software shall be capable of handling Camera and alarm icons on area maps. The area map shall be configurable to pop up upon the receipt of an alarm received from a Camera on the map. This can be on the same or other monitors on the PC.
- 18.1.14 The software shall be able to select the required recording based on the time recording was activated, the duration of recording, operator activated recording, event activated recording, scheduled recording.
- 18.1.15 The software shall provide a reporting utility for tracking for the following minimum options. Video clips and image snapshots shall be stored with reports for documenting events.
 - 18.1.15.1 Alarms
 - 18.1.15.2 Incidents
 - 18.1.15.3 Operator logs
- 18.1.16 The software shall have the facility to export the desired portion of clipping of video from a desired date/time to another desired date/time on DVD/ on any client/ network storage device. Viewing of this recording shall be possible on authorized player which shall be provided by software manufacturer or in media player on computer utilizing a Window environment.
- 18.1.17 The Video Management Servers shall not limit the number of Video Recording Servers which can be networked together to form video management and recording system.
- 18.1.18 The Video Management Servers shall maintain a catalog of settings for all the clients, servers, and IP Cameras & IP enabled Cameras in the system. If Video Management servers & recording cannot be managed by single server, in such cases, additional server shall be provided.
- 18.1.19 The software shall enable the client to dynamically create connections between Cameras and clients and view live or recorded video on Monitors.
- 18.1.20 The software shall provide the client seamless operation of all Cameras and clients available in the system regardless of the actual connection to different Network Video Recording servers.

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- 18.1.21 The software shall detect signal loss and have the capability to alert the systems administrator.
- 18.1.22 The software shall receive all incoming events (motion detection and triggered digital input and relay output) in the system and take appropriate actions based on user-defined event/action relationships.
- 18.1.23 The software shall create an audit trail of all events and user activities.
- 18.1.24 The Video Management Software shall support the following:
 - 18.1.24.1 The Video Management Software shall provide a full matrix operation of IP video to display monitors.
 - 18.1.24.2 The Video Management Software shall have the capability of creating Camera sequences with the following functionalities:
 - 18.1.24.2.1 Each Sequence shall have capability up to hundreds of Cameras.
 - 18.1.24.2.2 Each Camera in the sequence shall have its own individual dwell time, from 1 to 60 seconds.
 - 18.1.24.2.3 Multiple users shall be able to view the same Camera sequence simultaneously, not necessarily synchronized one with the other.
- 18.1.25 The software shall provide alarm management module.
 - 18.1.25.1 The alarm management shall be able to set any monitor or groups of monitors to automatically display Cameras in response to alarm inputs.
 - 18.1.25.2 The alarm management shall be able to reset automatically or manually alarmed video.
- 18.1.26 It shall be possible to search for recordings in the software by Camera, date and time. If a data and time is specified, playback shall commence from that date and time. It shall be possible to playback more than one Camera simultaneously.
- 18.1.27 The software shall support at least 128 video streams concurrently. It shall support at least 8 monitors in one server/ workstation for displaying live video. It shall allow minimum 5 levels of user and alarm prioritization. It shall allow minimum 16 Cameras to be replayed simultaneously.
- 18.1.28 The Video Management System shall be seamlessly integrated with Face recognition Software and have capability to receive the alerts.
- 18.1.29 The Video Management Software shall support redundancy with N:1 redundancy configuration for Video Management Servers/ Network Video Recorders.

18.1.30 The Video Management Software shall be compliant to global standards ONVIF Profile 'S' & 'G' for the interface of network video product (ONVIF – Open Network Video Interface Forum). The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.

18.2 Graphic User Interface Client Software Features:

18.2.1 The GUI software shall perform the following applications simultaneously without interfering with any of the storage server operations (recording, alarms, etc.):-

18.2.1.1 Live display of Cameras.

18.2.1.2 Live display of Camera sequences.

18.2.1.3 Control of PTZ Cameras.

18.2.1.4 Playback of archived video.

18.2.1.5 Retrieval of archived video.

18.2.1.6 Instant replay of live video.

18.2.1.7 Use of graphical controls (maps) and alarm management.

18.2.1.8 Configuration of system settings.

18.2.2 The GUI software shall support any form of IP network connectivity including LAN, WAN and wireless LAN technologies.

18.2.3 The GUI software shall support multicast and unicast video streaming.

18.2.4 The GUI software shall provide an authentication mechanism, which verifies the validity of the user.

18.2.5 The GUI software shall allow for live monitoring of video.

18.2.6 It shall enable view of 1 to minimum 16 video tiles simultaneously on a single digital monitor at 25 fps per Camera.

18.2.7 The software shall provide on each of the digital monitors independently the following tile views:

18.2.7.1 Full screen

18.2.7.2 Quad view

18.2.7.3 4x4 (16-view)

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- 18.2.7.4 The Software shall also support any other window division based on the site requirement.
- 18.2.8 The GUI software shall allow operators to view an instant replay of any Camera.
- 18.2.8.1 The operator shall be able to define the amount of time he wishes to go back from a timeline bar or through a custom setup period.
- 18.2.8.2 The operator shall be able to control the playback with play, pause, forward, and speed buttons.
- 18.2.9 The operator shall be able to choose and trigger following minimum action from a macro/site map:
 - 18.2.9.1 View Camera in a video tile.
 - 18.2.9.2 View map or procedure in a video tile.
 - 18.2.9.3 Starting/stopping PTZ pattern.
 - 18.2.9.4 Go to PTZ preset.
- 18.2.10 The GUI software shall provide management and control over the system using a standard PC mouse, keyboard and Digital keyboard.
- 18.2.11 The GUI software shall display all Cameras attached to the system regardless of their physical location on the network.
- 18.2.12 The GUI software shall display all Camera sequences created in the system.
- 18.2.13 The GUI software shall allow operators to control (pause/play, skip forwards, skip backwards) Camera sequences.
- 18.2.14 The GUI software shall display all Cameras, sequences and users in a logical tree.
- 18.2.15 The GUI software operator shall be able to drag and drop a Camera from a tree of available Cameras into any video tile for live viewing.
- 18.2.16 The GUI software operator shall be able to view the Camera from a tree of available Cameras into any video tile for live viewing.
- 18.2.17 The GUI software shall support graphical site representation (map) functionality, where digital maps are used to represent the physical location of Cameras and other devices throughout facility.
- 18.2.18 The maps shall have the ability to contain hyperlinks to create a hierarchy of interlinked maps.

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- 18.2.19 The GUI software operator shall be able to view the Camera from a map into a video tile for live viewing in the same browser without opening a new browser.
- 18.2.20 The operator shall be able to click on an icon in a map to initiate PTZ Camera preset, run PTZ pattern, view Camera in an analog monitor or send an I/O stream.
- 18.2.21 The GUI software shall support digital zoom on a fixed Camera's live video streams.
- 18.2.22 The GUI software shall support digital zoom on a PTZ Camera's live video streams.
- 18.2.23 The operator shall be able to control Pan, Tilt and Zoom patterns of P/T/Z Camera.
- 18.2.24 The software shall be able to display video of Cameras on 55 inch Large Format Display Monitors and Workstation Monitors.
- 18.2.25 The software shall allow the control of display from the client PC.
- 18.2.26 The operator from the GUI software shall be able to decide the screen layout and also the Cameras that shall be displayed on the monitors.
- 18.2.27 The software shall support multicasting.
- 18.2.28 It shall be possible to switch the screen layout in response to an alarm.
- 18.2.29 The GUI Software shall support text superimposing the title and date & time on the video.

18.3 Video Recording Software:

- 18.3.1 Software shall support recording of MJPEG/H.265 or higher video streams. It shall support recording of video and audio for all the channels.
- 18.3.2 Software shall support triplex applications, recording, re-play and backup simultaneously. It shall be compatible with windows Server OS or Linux for highest performance and reliability.
- 18.3.3 The Video Recording Software shall support absolute recording redundancy with N:1 redundancy configuration for Video Recording Servers/ Network Video Recorders.
- 18.3.4 Software shall operate on open architecture and shall not require any proprietary hardware.
- 18.3.5 Software shall be able to record minimum 128 different video streams or more simultaneously. It shall be accessible from any client PC connected to the network.

- 18.3.6 Software shall provide network time server function to ensure the synchronization of the video servers and the recordings.
- 18.3.7 The Servers/NVRs shall be connected to the network so that these can be placed at any location which has network access.
- 18.3.8 The Software shall be able to receive alarms of different types from equipment to start a recording. These alarms can be motion detection, video loss, unified picture and trigger input.
- 18.3.9 The Software alarm recording shall support pre-and post-alarm periods. Both can be configured in duration.
- 18.3.10 The Software shall provide a status of the available recording capacity.
- 18.3.11 Fault Tolerant Recording:
- 18.3.11.1 If Software & Server(s)/ NVRs operation are interrupted, like power disconnection and once the server(s) are restarted, these shall automatically resume recording of any Cameras these were recording prior to the interruption.
- 18.3.11.2 The Software shall support network fault-tolerant recording such that if the network connection becomes unavailable, for example through cable breakage, network congestion or WLAN interruption, the system operation shall automatically recover when the connection is restored.
- 18.3.12 Search & Export:
- 18.3.12.1 It shall be possible to search for recordings in the software by Camera, date and time. If a data and time is specified, playback shall commence from that date and time. It shall be possible to playback more than one Camera simultaneously.
- 18.3.12.2 The Software shall be able to export sections of recordings to a separate Windows folder, which can then be written to CD-ROM, DVD-ROM or USB Flash Drives etc. to be played back at a location not connected to the network video management & recording network. The export process shall make available a player application, which can be provided with the exported video. Export shall be possible in Windows media player or any other media player compatible format. Simultaneous export of multiple Cameras shall also be possible.
- 18.3.13 The Software shall provide secured recording for evidence purposes and user authentication to protect data integrity.
- 18.3.14 The Software shall support activity controlled video recording. This is required to automatically adjust recording bit rate depending on motion & scene. During periods of negligible motion, the recording bits rate shall drop and when motion occurs, the recording bit rate shall return to normal without any perceptible delay.

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18.3.15 The Video Recording Software shall be compliant to global standards ONVIF Profile 'S' & 'G' for the interface of network video product (ONVIF – Open Network Video Interface Forum). The quoted models should appear on the ONVIF website and a confirmation certificate for the offered models should be available at the time of supply.

18.3.16 Edge Storage Recording: In case of any failure or interruption of MPLS/IP network, the Camera shall automatically start recording on Edge Storage Memory Card at resolution and frames per second as required and when the network recovers, the Video data shall automatically be transferred to the Server/External Storage Device/NVR without any impact on the system operations.

18.4 Video Analytics Software:

18.4.1 Possible applications of analytics software over the IP based video surveillance system, for specified number of Cameras for specific stations, as defined by purchaser shall include the following minimum video analytics software.

- i) Intrusion Detection
- ii) Left Object Detection
- iii) Overcrowding
- iv) Camera Tampering

18.4.2 Intrusion Detection:

18.4.2.1 The offered video analytic software shall include a comprehensive intrusion detection feature. The intrusion detection shall be used for generating alarm under following scenarios:

- i) People crossing the tracks at platform ends.
- ii) People entering railways operation areas.
- iii) Object placed on the tracks through Cameras placed at platform ends.
- iv) It shall also generate directional alarms in defined areas like parking places, elevators etc.

18.4.2.2 The software shall have filters to distinguish between humans/animals and vehicles/ objects.

18.4.3 Left Object Detection:

18.4.3.1 The software feature shall include comprehensive left object detection.

18.4.3.2 The left object detection shall be able to detect:

- i) Object/ baggage left behind at platform/ waiting areas/ ticketing counters etc.
- ii) The object detection shall also be used to detect vehicle parked in any location other than the parking areas.

iii) The alarm shall be generated after a pre-determined time decided by the purchaser.

18.4.4 Overcrowding:

18.4.4.1 The software for overcrowding shall be able to give a feedback to the administrator/ operator if the scene is over-crowded. It shall give an alarm as soon as people converge at a single place above a predefined threshold level which shall be adjustable as specified by purchaser.

18.4.5 Camera Tampering:

18.4.5.1 The software shall be able to detect sabotage or tampering to the Cameras. It shall be able to detect Camera blurring, Camera blinding and change of orientation of fixed Cameras.

18.4.5.2 Camera tampering feature shall be provided for all fixed Cameras.

18.4.6 Video Analytics Software can be implemented either at firmware level at fixed IP Cameras or at server level in the control room.

18.4.7 Video analytics software shall be implemented either at firmware level or server level for fixed IP Cameras as per details mentioned in the table or as specified by the purchaser. Purchaser has to specify numbers of Cameras to be provided with different types of video analytics software.

S. No.	Type of Video Analytics	:	Location of Cameras on which Video Analytics is to be provided
i.	Intrusion Detection	:	Cameras at Platform ends, Railway Control Room or as specified by purchaser
ii.	Left Object Detection	:	Cameras on Platforms, ticketing areas & Concourse areas or as specified by purchaser
iii.	Overcrowding	:	Cameras on Platforms, foot-over-bridges or as specified by purchaser
iv.	Camera Tampering	:	All Fixed Cameras or as specified by purchaser

18.4.8 The Video Analytic Software deployed at Cloud as per Schematic Diagram -3, shall be seamlessly integrated with Video Surveillance System for Cluster of Stations aggregated to RPG/GRP Thana.

18.4.9 The Video Analytic Software shall support redundancy with N:1 redundancy configuration for Video Analytic Servers.

18.5 Remote Viewing on Web and Mobile App:

i) The system shall support transcoding to meet the network bandwidth limit between the remote (users on web and mobile App) and recording system as defined under schematic diagram-1, 2 and 3. Transcoder shall be able to access live / playback

video streams from the system and provide transcoded streams to the clients as per network limitations.

Transcoder shall be capable to automatically modify the frame rate, resolution and compression while transcoding the request live/playback stream.

ii) Mobile App for VSS system

VMS system shall also be provided with a mobile app for Android, Windows as well as Apple iOS based smartphones to allow secure access of VMS Server live and recorded video streams using smartphone or a tablet from Divisional HQ/any other centralized location or other clients connected to MPLS/IP network as per requirement of purchaser. Mobile App should be easy to use application allowing simultaneous multiple camera monitoring.

Mobile app should have following minimum functionalities:

- Dashboard: showing various performance/statics reports of the system
- Menu based selection to select and view video feeds on demand/ need based
- Should work on pull based mechanism which will allow authorized user to access the video feeds after user authentication
- Mobile application should allow MAC/IMEI No. binding, role-based user access over secured VPN client on users mobile/smart phone.

19.0 Face Recognition Software:

19.1 Face Recognition System shall work on real time and offline mode.

19.2 The system shall capture face images from live CCTV video feed and generate alerts, if blacklist match is found. FRS alerts should be pushed to the Video Management System/ NVR. (Seamlessly integrated with Video Management System /NVR).

19.3 The system shall have the best suited technology employed for 1:1 (one to one) and 1: N (one to many) matching application, when they enter the field of view of CCTV Cameras.

19.4 The system shall have the provision to take multiple samples of same face belonging to same person.

19.5 The system shall work on partial occlusion of face, glasses, scarfs, changes of facial expression etc.

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- 19.6 The system shall be able work on moderate face rotation either horizontal or vertical.
- 19.7 The system shall be able for matching suspect faces from pre-recorded video feeds obtained for CCTV deployed various identified locations.
- 19.8 The system shall be able to add photographs obtained from law enforcement agencies to the criminals' repositories along with option details for sex, age, scars, tattoos etc for future searches.
- 19.9 The system shall support diverse graphic & video formats as well as live Cameras.
- 19.10 The system administration / user shall have option to customize the GUI for different user.
- 19.11 The identification of faces should be contactless, at a distance and on the move and in the crowded area.
- 19.12 The system shall have any tool for enhancement of quality of image before enrolment. The tool may be either a part of this software or may be provided as an add-on.
- 19.13 The system shall be able to utilize any of the file formats like JPEG, PNG, BMP, TIFF etc. format for enrolment for matching.
- 19.14 The system shall be able to check if new enrolled face is already enrolled in the data base before registering the new enrolled face in the system.
- 19.15 The system shall have option to automatically enroll face images from CCTV Cameras.
- 19.16 The system shall have capacity to create different categories of people with option to customize the matching threshold for different categories.
- 19.17 The system shall be able to work on full HD or Ultra HD Cameras.
- 19.18 The system shall be able to be implemented on IT hardware like Server or Workstation.
- 19.19 The system shall be able to use CPU and GPU based processing for multiple Camera streams in a single Server/Workstation.
- 19.20 If FRS is deployed at stations as per Schematic Diagram-1 and Schematic Diagram-2, the system shall support minimum 4 nos. of Camera streams on Server intended for Face Recognition Software as per Clause No. 10.1.

- 19.21 The system shall be able to work on windows / Linux operating system.
- 19.22 The system shall employ database system like MS SQL or Oracle or Postgre SQL or any other data base system.
- 19.23 The system shall have the capability to have face image data base of 50000 or more for 1 : N matching. The system should be scalable to upgrade for higher data size as and when required with additional license for data base.
- 19.24 The system shall be able to work on ONVIF – profile ‘S’ compliant Cameras.
- 19.25
 - a) The Face Recognition Algorithm vendor should have participated in the latest Face Recognition Algorithm Evaluation conducted by NIST (National Institute of Standards and Technology, U.S. Department of Commerce) for non-co-operative subjects. The benchmarking parameters such as acceptable Error rate/Ranking in NIST report as applicable are to be specified by the purchaser. For assessing the benchmarking criteria, proof of concept trials/ demo etc. may be asked by the purchaser.
 - b) The FRS system shall be enterprise grade highly scalable providing most accurate results for the most demanding real time and post event off line mode).
 - c) The system shall work on partial occlusion of face, glasses scarf changes of facial expression etc. The FRS system should also overcome challenges such as crowded environment, poor lighting, moving subjects, angle and distance.
- 19.26 Face Recognition Software deployed at Cloud as per Schematic Diagram -3, shall be seamlessly integrated with Video Surveillance System for Cluster of Stations aggregated to RPG/GRP Thana.
- 19.27 The image Database Server shall support redundancy with N:1 redundancy configuration.

20.0 Software License:

- 20.1 OEM/Vendor shall offer required number of licenses for Video Management, Video Recording, Video Analytics and Face Recognition Software for all the Cameras, NVRs, Servers, PC workstations, Clients etc. supplied as per site requirement or as specified by the purchaser.
- 20.2 The Licenses shall be of one-time type. Licenses related compliance shall be ensured by purchaser depending upon the requirement.

21.0 TEST REQUIREMENTS:**21.1 Conditions of Tests:**

21.1.1 Unless otherwise specified all tests shall be carried out at ambient atmospheric conditions.

21.1.2 Inspection and testing shall be carried out to the effect that all requirements of this specification are complied with.

21.2 Type Test:

21.2.1 Camera and Software: One complete system consisting of all type of Cameras and Software and other required devices & equipments such as Network Video Recorder (if any) etc. shall be subjected to following tests as applicable:

- i) Visual inspection and Performance test (Clause no. 22.1)
- ii) Endurance test (Clause no. 22.2.1)
- iii) Environmental/Climatic Tests
- iv) Verification of necessary Regulatory approvals/certifications

21.2.2 Only one complete system shall be tested for this purpose. The system shall successfully pass all the type tests for proving conformity with this specification. If any one of the equipment fails in any of the type tests, the purchaser or his nominee at his discretion, may call for another equipment and subject it to all tests or the test(s) in which failure occurred.

21.2.3 Any other tests shall be carried out as considered necessary by the inspecting authority.

21.3 Acceptance Test:

21.3.1 The following shall constitute the acceptance tests which shall be carried out by the inspecting authority for the purpose of acceptance on randomly selected of items offered from the lot as per sampling plan (given below) offered for inspection by the supplier:

- (i) Visual inspection and Performance Test (Clause No. 22.1)
- (ii) Endurance Test (Clause No. 22.2.2)

Sampling Plan:

Quantity offered(Lot Size)			Sample size
2	to	8	2
9	to	15	3
16	to	25	5
26	to	50	8

51	to	90	13
91	to	150	20
151	to	280	32
281	to	500	50
501	to	1200	80
1201	to	3200	125
3201	to	10000	200
10001	to	35000	315
35001	to	150000	500
150001	to	500000	800
500001	and over		1250

For various types of cables as per clause no. 17.0, Acceptance test shall be carried out on randomly selected 10% of items offered from the lot.

21.3.2 Face Recognition Software: The Face Recognition Software shall be tested for its performance as per clause no. 19.0 along with required no. of Cameras, Server and other required devices & equipments.

21.3.3 Any other tests shall be carried out as considered necessary by the inspecting authority.

21.4 List of items on which Type Test / Acceptance Test is applicable:

S. No.	Items	Clause No.
i.	Full HD Fixed Box Type IP Colour Camera with Varifocal Lens and Housing & Mount	5.1 & 5.3
ii.	4K UHD Fixed Box Type IP Colour Camera, Varifocal Lens, Housing and Mount	5.2 & 5.3
iii.	Full HD Bullet type IP Colour Camera	5.4
iv.	4K UHD Bullet type IP Colour Camera	5.5
v.	Full HD Fixed Dome Type IP Colour Camera	6.0
vi.	Full HD P/T/Z (Pan/Tilt/Zoom) IP Colour Camera	7.0
vii.	Digital Keyboard	8.0
viii.	Network Video Recorder (NVR)	10.2
ix.	Copper to Fiber Media Convertor	16.0

21.5 List of items on which only Acceptance Test is applicable:

S. No.	Items	Clause No.
i.	Large Format Display Monitor	9.0
ii.	Server Hardware	10.1
iii.	PC Work Station	11.0
iv.	External Storage Device	12.0
v.	Core Switch	13.0
vi.	(I). Aggregation Switch (II). Field Switch (24Port) (III) Field Switch (8 port)	14.0
	Note: Compliance of Temperature and Humidity in the relevant clauses of Switches shall be verified from documents such as Data sheets/ Test Certificates etc.	
vii.	Wireless Transmitter/Receiver Unit	15.0
viii.	Software Requirement	18.0
ix.	Face Recognition Software	19.0

21.6 Routine Test /Factory Acceptance Test (FAT):

- 21.6.1 Routine test /Factory Acceptance test (FAT) shall be conducted by Original Equipment manufacturer (OEM) on every equipment and the test results shall be submitted to the inspection authority before inspection.
- 21.6.2 Firm shall submit the details such as make, model & version of every equipment including Software to inspection authority before inspection.

22.0 TEST PROCEDURE:

The test procedure shall be based on the system design. The methodologies to be adopted for various tests shall be decided taking into account the system design/configuration.

22.1 Visual Inspection and Performance Test:

- 22.1.1 Each equipment of the system shall be visually inspected to ensure compliance with the requirement of relevant clauses no. 5, 6, 7, 8, 9, 10, 11, 12, 13,14,15,16 & 24 of the specification.
- 22.1.2 The visual inspection shall broadly include:
- i) Constructional details
 - ii) Dimensional check
 - iii) General workmanship
 - iv) Configuration

22.1.3 Performance of each equipment/system shall be tested to ensure compliance with the requirement of relevant clauses no. 5, 6, 7, 8, 9, 10, 11,12,13,14, 15, 16, 18 and 19 of the specification.

22.2 Endurance Test:

22.2.1 During Type Test, Endurance test shall be conducted on complete system for continuous operation which shall be 72 hrs at ambient room temperature without giving any deterioration of equipment performance.

22.2.2 During Acceptance Test, Endurance test shall be conducted on complete system for continuous operation which shall be 48 hrs at ambient room temperature without giving any deterioration of equipment performance.

23.0 QUALITY ASSURANCE:

23.1 All materials & workmanship shall be of good quality.

23.2 Since the quality of the equipment bears a direct relationship to the manufacturing process and the environment under which it is manufactured, the manufacturer shall ensure Quality Assurance Program of adequate standard.

24.0 MARKING & PACKING:

24.1 The following information shall be clearly marked at a suitable place on each equipment:

- i) Make and Model/Part No. of Equipment
- ii) Serial number of equipment

24.2 The equipment and its sub-assemblies shall be packed in suitable packing so that it can withstand bumps and jerks encountered during transportation.

25.0 INFORMATION TO BE SUPPLIED BY THE PURCHASER:

The purchaser shall clearly indicate details/requirement of items for IP based Video Surveillance System as per site requirement which shall mainly consist of following items:-

S. No.	Description	Clause No.	Quantity
i.	Video Surveillance System as per Schematic Diagram-1 or Schematic Diagram-2 or Schematic Diagram-3	2.6	As specified by the purchaser
ii.	Full HD Fixed Box Type IP Colour Camera with Varifocal Lens and Housing & Mount	5.1 & 5.3	As specified by the purchaser

iii.	4K UHD Fixed Box Type IP Colour Camera with Varifocal Lens and Housing & Mount	5.2 & 5.3	As specified by the purchaser
iv.	Full HD Bullet type IP Colour Camera	5.4	As specified by the purchaser
v.	4K UHD Bullet type IP Colour Camera	5.5	As specified by the purchaser
vi.	Full HD Fixed Dome Type IP Colour Camera	6.0	As specified by the purchaser
vii.	Full HD P/T/Z (Pan/Tilt/Zoom) IP Colour Camera	7.0	As specified by the purchaser
viii.	Digital Keyboard	8.0	As specified by the purchaser
ix.	Large Format Display Monitor	9.0	As specified by the purchaser
x.	Server Hardware and Redundant Servers	10.1	As specified by the purchaser
xi.	32/64/128 Channel Network Video Recorder (NVR) and Redundant NVRs (No. of channels required to be defined)	10.2	No. of channels: As specified by the purchaser with required storage capacity
xii.	PC Workstation	11.0	As specified by the purchaser
xiii.	External Storage Device	12.0	As specified by the purchaser with required storage capacity
xiv.	Core Switch (as required)	13.0	As specified by the purchaser
xv.	(I). Aggregation Switch (II). Layer 2 Switch (24Port) (III) Field Switch (8 port)	14.0	As specified by the purchaser
xvi.	Wireless Transmitter/Receiver Unit if required	15.0	As specified by the purchaser
xvii.	Copper to Fiber Media Convertor	16.0	As specified by the purchaser
xviii.	Video Management Software & Graphical User Interface Client Software	18.1 & 18.2	As specified by the purchaser
xix.	Video Recording Software	18.3	As specified by the purchaser
xx.	Video Analytics Software	18.4	As specified by the purchaser depending on no. of Cameras and no. of

			analytics
xxi.	Face Recognition Software (Acceptable benchmarking performance parameters to be specified by the purchaser)	19.0	As specified by the purchaser
xxii.	Software License	20.0	As specified by the purchaser OR As quoted by the Vendor
xxiii.	Panic Button/Buttons	2.14	As specified by the purchaser
xxiv.	Any other item(s) required for Video Surveillance System.	--	As specified by the purchaser

Note: Detailed warranty clause as required shall be specified by the purchaser. Any maintenance requirement shall also be specified by the purchaser.

26.0 TRAINING:

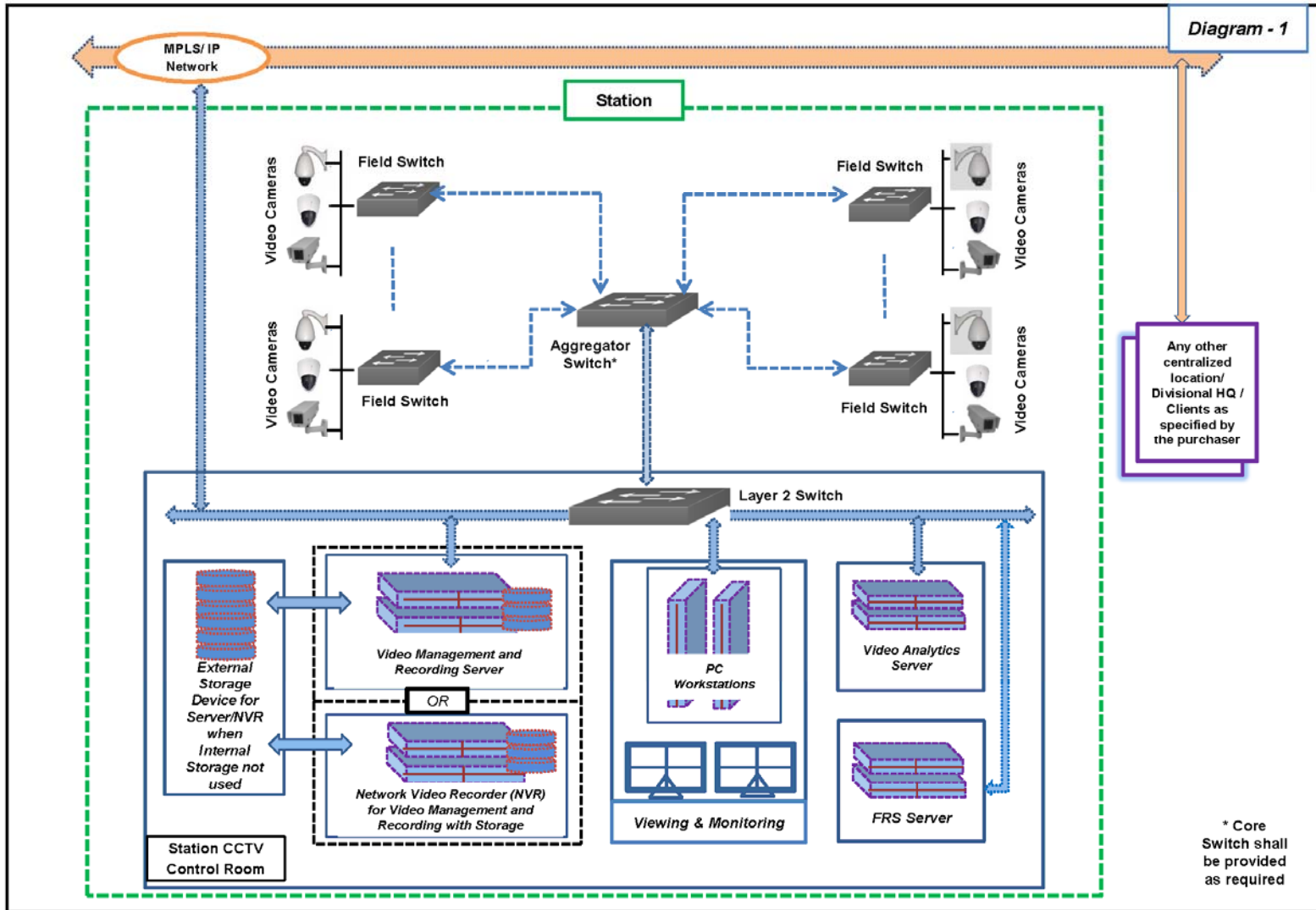
- 26.1 Onsite training or as specified by the purchaser shall be provided to the Railway staff which shall include complete assembly of the system through the use of various modules, integration of hardware with software and complete operation of the system.
- 26.2 Sets of training manual in two hard copies and two Soft copies containing details of technical specifications, installation and commissioning, trouble shooting & maintenance schedule etc. or as specified by the purchaser shall be supplied along with the equipment.

27.0 DOCUMENTATION:

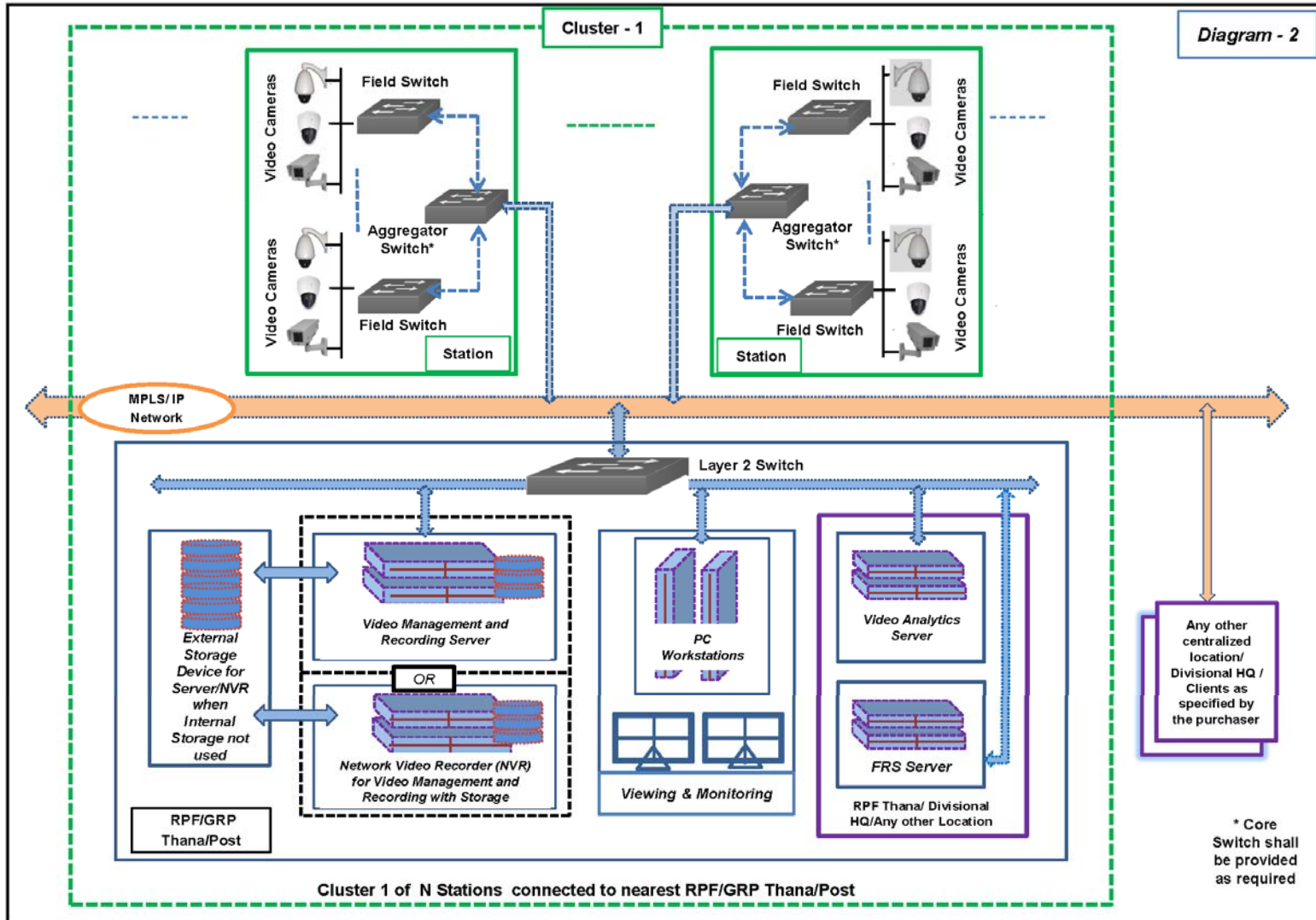
The following documents or as specified by the purchaser shall be supplied along with the system:

- i) Schematic Diagram
- ii) Installation and maintenance manual
- iii) Operating and troubleshooting manual
- iv) System commissioning report consisting of complete network diagram of Video Surveillance system, Cable route plan, Control/Equipment room layout diagram and Station layout diagram.

28.0 Schematic Diagram – 1 : Tentative Schematic Diagram of Video Surveillance System for Stations



29.0 Schematic Diagram – 2 : Tentative Schematic Diagram of Video Surveillance System for Cluster of Stations



30.0 Schematic Diagram – 3 : Tentative Schematic Diagram of Video Surveillance System of Cloud Based Architecture for Cluster of Stations

