CHAPTER-3:

Technical Specification of Schedule items

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INTRODUCTION

This chapter includes detailed technical specifications of scheduled items of three Sub works i.e IP MPLS, VSS and VOIP based communication in the sequence of items of tender schedule in Part I .

The proposed solution must meet all technical and functional specifications as mentioned in the latest Technical specification released by RDSO or otherwise defined in the tender document.

RDSO or TEC specification ,wherever applicable, shall be the base specifications for materials to be supplied.In case if they are not available the equipment/ software/application etc. shall conform to standard ITU/internationally accepted standards. The technical specifications to be followed are as below.

Component	Specification to be adopted
Provision of Multi Protocol Label Switching/Internet Protocol based technology	For Router, and NMS as per RDSO STT/TAN//IP-MPLS/2020Ver 01 dated 16.12.2020 For Layer 3 Switch as per RDSO SPN **RDSO/SPN/TC/83/2020 Rev. 2 or latest**
Provision of VSS	For Camera, Switches, Servers, Software, Work Station, LFD, and NMS as per **RDSO/SPN/TC/65/2021 Version 6.0 wef 20 th May 2021.**
Provision of VOIP based Control Communication	For Servers, Gateway, SIP phones, Switches, Software and NMS as per **RDSO/SPN/TC/99/2012**
Provision of SIP based IP Server Exchanges	IP PABX with Media Gateway No. : TEC/ GR/SW/PBX-005/01/SEP-16 (Latest TEC 60030:2016)

However, in case of any conflict on the solution design parameters, system functional requirements and technical specification of a system/item between RDSO specification and the tender conditions, the tender conditions will prevail over RDSO specifications. It may kindly be noted that in the specification wherever support for a feature has been asked for, it will mean that the feature should be available without Railway requiring any other hardware/software/licenses. Thus all hardware/software/ licenses required for enabling the support/feature shall be included in the offer. **IP-MPLS/ TCCS / IP-EXCH/ VSS, being a turnkey project, any additional hardware, software/license required for integration of the existing TCCS/VSS/SIP Exchange infra with the proposed TCCS/VSS/SIP Exchange infra (to be supplied under this contract) shall be supplied by the selected bidder without any additional cost to Railways for the items not covered in SOQ which is essential required for integration/installation/Commissioning.** The below mentioned technical specifications for the supply items are bare minimum requirements of the purchaser, the supply items quoted by the bidder must comply with these technical specifications mentioned in the latest RDSO Specification or TEC or any other specification according to standards .

However, the bidder can quote the items with higher technical specifications with perpetual licenses catering to the futuristic requirements but in no case the proposed solution be lower than / inferior to latest RDSO/TEC Specification mentioned in schedule, for overall implementation of Project of the proposed solution. Any active products/equipment/item like Routers, Switches, Servers, Gateways, Cameras,IP Phones etc for which the OEM has declared End-of-life or Model is already obsolete, will not be accepted and will be rejected (OEM certificate in this regard shall be submitted). All products/material/items should be purchased through genuine and legal sources, operating and application software supplied should be genuine and licensed, pirated version is not accepted. Servers should be Rack based along with supply rack server channels. Inspection of materials will be by RDSO/RITES and Consignee or as specified by the consignee as per mentioned against each item.

Proof of Concept after award of work :

To ensure security of VSS (Camera & Software) from vulnerabilities & breaches and discourage false undertaking from OEMs, security auditing and testing of equipment including source code of camera and software shall be carried out from STQC (Ministry of Electronics & Information Technology) or any other Government Agency from the list of CERT-In empanelled Information Security Auditing Organization. In order to ensure security of network and other IT equipment of VSS system, purchaser should ensure that security auditing and testing at the time of POC (Proof of Concept) as well as at the time of completion of project are conducted or as specified by the purchaser. In case any security breach is found in the system at any stage including at POC level, the offer will not be considered or once awarded, immediate strict penal action is to be initiated by the purchaser.

OEMs must submit a declaration certificate regarding their genuinity, have their own manufacturing setups and IPR for the hardware(s)/software(s), and shall not have 3rd party manufacturing from any company blacklisted in India or abroad (due to proven backdoor access and data vulnerability) or any company sharing land border with India. The Intellectual Property Rights (IPR) of all manufactured final product and source code of all software including Routers,camera firmware, switch firmware, FRS algorithm, Command Control Centre Software etc. should not reside in countries sharing land borders with India, until unless specifically allowed by the Government of India and is registered with the Competent Authority of Government of India. Proof of IPR & source code residing in which country and requisite permission & registration with Competent Authority of Govt. of India, as applicable to comply with the above, shall be provided by the OEMs. **Guidelines on latest Public Procurement Policy & other related orders regarding "Make in India " issued by Government of India shall be scrupulously followed.** In case any breach or false declaration is found at any stage, immediate strict penal action is to be initiated by the purchaser.

OEM need to confirm that the equipment, like Cameras etc., shall not be installed with standards like - GB28181, GB/T28181-2011, GB/T 28181-2011, GBT 28181- 2011, GBT28181-2011, GB/T28181-2016, etc., protocols/standards and there shall be no option in the camera web page/settings to activate or deactivate such protocols/standards any of their version(s) or any such protocol which allow certain organizations to bypass all security parameters and look into the devices directly.

The MAC address of all cameras should not be registered in the name of any OEM/ company/ entity sharing land border with India until unless specifically allowed by the Government of India.

Mean Time Between Failure (MTBF) calculated at 40°C for each type of camera should not be less than 1,00,000 hours for which OEM shall submit complete and detailed test reports issued from Govt. / NABL Accredited Test Labs / 3rd party test house of International repute such as UL, TUV etc.

The technical specifications for Schedule items are as below:

Sub-Work A:
IP MPLS Routers and Accessories

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Schedule A1: SOR Items		
S.N	**Components/Items**	**Specifications**
	Transportation	
1	Transportation upto 100 Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
2	Transportation more than 100 Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
Schedule A2: IP MPLS Routers, Manageable Switches and Accessories		
	IP MPLS Routers and Accessories	
1	Standard 19" Rack Mountable LER(Label Edge Router Min configuration) as per RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0)	As Per Para No. C of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 or latest. Mounting kit with all necessary accessories , Softwares, Perpetual Licenses etc. Router should support Unicast IP V4 & IP V6 Routing protocols (BGP, OSPF, IS- IS, OSPF V3, Segment Routing or similar protocol and circuit emulation). -Reputed Brand. Railway requirement is the LER minimum configuration. Model supplied shall be the latest one and new one and should have service support upto 8 years.
2	Standard 19" Rack Mountable LSR (Label Switch Router)	As Per Para No. D of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 or latest.Mounting kit with all necessary accessories , Softwares, Perpetual Licenses etc.Router should support Unicast IP V4 & IP V6 Routing protocols (BGP, OSPF, IS- IS, OSPF V3, Segment Routing or similar protocol) Make -Reputed Brand . Model supplied should be the latest one and new one and should have service support upto 8 years
3	Installation, Commissioning and Testing of LER and LSR IP MPLS Routers	MPLS Routers include configuration testing and commissioning including supply and installation of all the accessories like Power Cable from PDU to Routers, Earthing cable from Equipment to Rack bus bar, Optical Patch Cords of 3 Mtrs for LER (6 numbers) & LSR Routers (8 numbers), 4 Nos of Cat 6 Patch Cords of 1 Mtrs length, 6A MCBs each for above LER and LSR Routers, wiring etc required for Routers.
4	16 Port E1 Card for above Routers.	Supply testing, installation and commissioning of 16 Port E1 Card for above LER Routers along with supply fixing, termination and testing of patch panel/krone module, wiring,connectors and cable and all the accessories required for installations. The make of the modules shall be same as that of above LER Routers to ensure reliable function.
5	2 x10G Adapter Module for above Routers.	The make of the modules shall be the same as that of above LER/LSR Routers to ensure reliable functioning and the same shall be supplied with all the accessories. These modules can be supplied separately or in combo.
6	8 x1G (any combination one nos of 8 x 1G or two nos of 4 x 1G) Adapter Module for above Routers.	
7	2 x STM 1 Adapter Module for above Routers.	The make of the modules shall be the same as that of above LER Routers to ensure reliable functioning and the same shall be supplied with all the accessories.
8	10G SFP+ module for above Routers.	The make of the modules shall be the same as that of above LER/LSR to ensure reliable functioning and the same shall be supplied with all the accessories. Specifications are given in Para **3.1.1**
9	1G SFP module with 10 Km range for above Routers.	The make of the modules shall be the same as that of above LER/LSR to ensure reliable functioning and the same shall be supplied with all the accessories. Specifications are given in Para **3.1.2**
10	STM-1 SFP Module with 15 Km	The make of the modules shall be the same as that of above LER to ensure reliable functioning and the same shall be supplied with all the

	range	accessories.
11	10/100/1000 Base-T Copper Ethernet Transceiver SFP module for above Routers.	The make of the modules shall be the same as that of above LER to ensure reliable functioning and the same shall be supplied with all the accessories.
12	Standard 19" Rack Mountable LER(Label Edge Router Max configuration-II) as Per RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0).	As Per Para No. C of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 or latest. Mounting kit with all necessary accessories , Softwares, Perpetual Licenses etc. Router should support Unicast IP V4 & IP V6 Routing protocols (BGP, OSPF, IS- IS, OSPF V3, Segment Routing or similar protocol and circuit emulation)Make -Reputed Brand. Railway requirement is the LER maximum configuration -II configuration. Model supplied shall be the latest one and new one and should have service support upto 8 years.
Schedule A3: Servers, NMS and Workstations		
1	**NMS** System for IP MPLS (Hardware, Software & Perpetual License) in Data Centers & Disaster Recovery	Supply installation and commissioning of NMS System (Hardware, Software and common Perpetual license for Main and standby Server for Minimum 5400 Network Elements(1800 Each Division) including IP MPLS Router, L3 L2 Managed Switches,UPS, Gateways and other network elements etc with SNMP Version 1,2 & 3,MIB-2 or latest,templates etc support to be installed in Data Centers, and it also shall comply with Para no. E & F of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 dated 16.12.2020 or latest. (Indicative breakup of 5400 licence is : 750 nos for Routers and L3 switches, 2500 for L2 switches, 700 for Servers and Gateways and 1450 for IP phones and UPS.) Active and standby server to be supplied at 2 different locations, for main location and another as standby system in physically separated location in all three Divisions and HQ i.e. total 8 servers at 4 locations in 1+1 configuration to be supplied. Each Rack Mountable NMS Server should have a minimum 2 x 10 Core Intel Xeon CPU or higher and 256 GB DRAM or higher and 4 x 1TB hard disk or higher, Licensed Windows/Linux OS and application software with RAID 1 Configuration installation along with controller card, Redundant Power Supply, Dual NIC Card of 1G or higher, Monitor 24 inch or higher, Optical Mouse, KeyBoard, PCI Slots, USB and HDMI Ports Reputed Make AntiVirus with 3 years subscription,etc, along with server genuine licensed OS & NMS/EMS software and all the accessories required for installations and commissioning. This also includes Supply, installation, commissioning and perpetual licenses for 6 Nos of Spine Switch (2 at each Data Centre at Hubballi, Bangalore and Mysuru) and 12 Nos of Leaf Switches (4 at each Data Centre at Hubballi, Bangalore and Mysuru) with all the mounts & accessories at each Data Center as per specification enclosed at Para no. **3.1.5** . This includes supply of Base software and redundant software of Reputed Make. The NMS server at HQ should manage, monitor, control and configure all the NMS servers provided in the respective division in a federated architecture and multi-tenant model. Network Management Software with federated cloud architecture to be provided for scalability and flexibility to support large-sized NMS installations

2	**NMS** System (Hardware, Software & Perpetual License) at Two Data Centers	**Scalability:** Federated cloud architecture greatly should help in designing and implementing large-sized Network management software to support an unlimited number of Network elements like Routers, L3 switches, L2 switches, Gateways, UPS, etc. **Centralized NMS:** Centralized NMS should improve the security of the connected organizational branches/sites, provides transparency and helps in enhancing the business operations. **Independent Site Monitoring:** Federated NMS system also allows individual Divisions to have complete control of their site. For incidents triggered to be quickly responded and resolved from the local site itself, federated NMS system at HQ provides independent control of the NMS at the Divisions **Support for Multi-tenant NMS architecture:** Multi-tenancy and cloud federation should go hand in hand for NMS. While Multi-tenant Network management Software allows NMS infrastructure to be shared with Divisions simultaneously, federation helps in retaining the independent management of each Divisions. Multitenancy supports shared infrastructure and monitoring costs, easy upgrades and customization, whereas federation facilitates authorized access to complete NMS System from a single location ie HQ **Fault Tolerance:** Federated cloud architecture should provide fault tolerance to the large-sized NMS system. It enables the NMS systems of each Divisions to work efficiently even in the case of network failure. Even though the central site may not be able to access the independent Divisions, NMS systems of these divisions can work independently. On resuming connection with the federated architecture, data of each Division can be transferred to the HQ for analysis. Detailed Technical Specification is given at Para No **3.1.5**
3	PC WorkStation for IP MPLS	As Per Para no. G of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 16.12.2020 or latest. Including 24-inch FHD Resolution LED monitor for Viewing, all required Licenced Software like OS, EMS/NMS Client Software. Memory 64 GB,HDMI Port,Dual LAN Port and Graphic Card of 2 GB or higher, Spike Buster, 600 VA UPS with backup for 30 Min. 3 Years Antivirus Subscription of Reputed Brand. It should work as a common/single console for all the applications. Reputed Make.
4	55 Inch LED Ultra HD (4K)TV	Specifications are given in Para **3.1.6.** Includes Supply fixing of Standard OEM Mounting kit along with all the accessories for TV Should be supplied and along with interface cables of sufficient length for connecting to PC WorkStation or NMS.
Schedule A4: Switches		
	Manageable Switches and Accessories	
1	Layer 3, 24 Port Managed Switch	Supply and installation of Standard 19 inch Rack Mountable Layer 3,24 Port Managed Switch with 24 Nos of 10/100/1000 Ethernet Ports POE + Support with Redundant AC Power Supply ,Dedicated Stacking Module 4 x 10 GE SFP+ Ports for uplink including 4 Nos of OEM 10 GE SFP+ Modules, as per para number 4.0 of RDSO SPECIFICATION NO. RDSO/SPN/TC/83/2020 Rev 2 or latest. Better specification will be accepted. Mounting Kit with all necessary accessories.
Schedule A5: FDMS, Cables and U Rack		
	FDMS and Accessories	
1	12 Fiber FDMS	Specifications is given in Para **3.1.8** Reputed Make with mounting kit and all the accessories required for installation.The Fiber termination shall be tested and the test Report (Soft Copy) in CDs or any USB storage shall be submitted to the site Engineer for records.Each fiber shall be properly marked with necessary ferrules/tags.

2	OFC Patch Cords	Specifications are given in Para **3.1.9**. Brand of Reputed Make (3M, TE Connectivity, R&M make or equivalent).
3	Splicing Drooping/Termination of each fiber /Pigtail	Splicing /Drooping/Termination of each fiber /Pigtail in the LIU/FDMS/IO Box/Termination Joints through fusion Splicing of the termination of OFC Cables.The Fiber termination shall be tested and the test Report (Soft Copy)in CDs or any USB Storage shall be submitted to the site Engineer for records.Each fiber shall be properly marked with necessary ferrules/tags.
	Cables	
4	STP CAT- 6 Cable	It should meet the requirements as per Clause no. 17.1 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.Shielded Twisted Pair (STP) Strengthened outdoor CAT-6 cable. 4 twisted pairs, solid bare copper, diameter of 23 AWG, Ethernet speed of 1000Mbps,or higher support PoE of all classes, maximum DC resistance 100 Ohms/Km. jacket should be PVC & lead free, Cable Compliant with EIA/TIA-568-C.2 standard or latest for CAT 6, cable of 305 Mtrs length in box or roll. Reputed Brand Finolex,Fincabe,D-Link or equivalent.
5	12 Core Outdoor Unarmoured Optic Fibre Cable	Specifications are given in Para **3.1.10.** Make -Reputed Brand Finolex,Fincabe,ASKH,Sterlite or equivalent
6	PVC insulated Armoured 3 Core 6 Sq Mm Power cable	It should be PVC insulated armoured 3 core 6 Sqmm,10 AWG,1.1 KV Grade Outdoor Strengthen Copper Confirming to IS:1554 Part-1. It should be BIS/ISI Standard and is to be supplied along with all accessories required for installation.Make -Reputed Brand Finolex,Fincabe or equivalent
7	CAT 6 UTP Patch Cord-2 Mtrs	UTP CAT 6 Cable, cable jacket low Smoke zero halogen (LSZH), conductor dia 24 AWG, confirming to ANSI/TIA/EIA- 568-C.2 or latest .Reputed Brand Finolex,Digisol,D-Link or equivalent
8	Wall Mountable RJ- 45 Socket	Single port CAT 6 Information outlet, Face plate with SMB/wall Box for Data Outlets. Outlets should have inbuilt shutters and Network Keystone Jack. It should comply with the standard colour coding of Ethernet Cat-6 cable including with all the accessories.Reputed Brand Legrand,D-Link or equivalent
9	RJ-45 Connector	RJ-45 modular plug supports 4 twisted pairs, 8 positions, 8 connectors of 100 pcs/Pack. transparent color. Contact Terminal: Copper Alloy. Finished: 03 MU microinch gold plating. Use for 23-26 AWG stranded wires, meet wiring scheme T568A/T568B. It should be suitable for STP/UTP CAT-6 cable as per field requirements.Reputed Brand Phoenix,D-Link or equivalent
	U Rack	
10	19 inch 42 U Rack with 1200 mm Depth.	Specifications are given in Para **3.1.11**. Each rack should be supplied and fixed with 2 Mtrs Steel Cable tray of 150 mm width 1.5 mm thick along with all the bends,fitting required to fix on wall/ceiling/Rack along with all accessories required for installations as per site requirement.Make of Euro/President/HCL/Netrack/Rittel/Legrand or similar).
11	19 inch 42 U Rack with 600 mm Depth.	Specifications are given in Para **3.1.12** Make of Euro/President/HCL/Netrack/Rittel/Legrand or similar)
Schedule A6: Labour portion and Training		
	Labour portion	
1	35mm PVC Conduit pipe	Supply and fixing 35 mm PVC Conduit Pipe ISI Mark . Clamping the same on wall, pole etc with required clamps, bends, couplers, flexible pipes and all other installation material as required .
2	PLB HDPE Duct	Supply of PLB HDPE Duct of Size 40/33 mm dia along with all Accessories required for fixing, Clamping Cutting, on Wall or Structure/in Trench/HDD etc. as per RDSO Spec No RDSO/SPN/TC/45/2013 Rev 2 or latest.

3	Trenching and Laying of HDPE Duct	Excavation of cable trench in all kinds of soils including clearing of roots of trees, rocks, bushes etc. to a depth of 1.0 Mtrs and to a width of 0.3 Mtrs.Laying of telecommunication and power cable in HDPE Duct. Refilling of cable trench 1m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.
4	DWC Pipe 77/63 mm	Supply and Laying of DWC Pipe 77/63 mm dia with couplers as per RDSO Spec No RDSO/SPN/204/2011 Version 1.1 or latest and as per the direction of site Engineer.
5	GI Pipe (50 mm dia 3.65mm thick)	Supply,fixing of GI Pipe (50 mm dia 3.65mm thick) as per IS-1239Part I or latest Medium Grade, including couplers, for laying of Cable to the Platform shelter from ground level. Entry of cables will be advised by the site in charge of the Railway and extended by suitable dia HDPE/Flexible PVC Pipe on either side as required as per site requirement this includes making of bottom concerting for support and required clamps for fixing and accessories as per site requirement .
6	OFC Joint Opening	Opening of existing Joint enclosure and Splicing 2/4 additional fiber Inside already prepared jointing pit and Providing anti termites/ant Powder. Closing of Existing Joint and Backfilling is included. This does not Include provision of joint chambers, top plates.
7	Breaking of Pucca/Concrete road/ Platform	Breaking of Pucca/Concrete Road or Platform (15 Cms depth) Cutting and laying of OFC/Telecom/Power/STP cables etc in Trenches and through all types of protection like HDPE/GI/RCC/DWC Pipes as the case may be .This includes refilling of trench and restoration of surface and stone paved or as per site requirement.
8	Horizontal Boring & Trench	Track/Road crossing by using Horizontal Boring method. Including laying of HDPE OFC duct along with Signaling/Telecom/Power cable under the Track /Road. HDPE PLB pipe supplied by the Railway.
9	Blowing / Drawing of cables through PVC conduit/Pipes	Blowing & Drawing of OFC 24F/12F/6F/ Switchboard telecom cable, CAT-6 and Power Cable (including crimping and termination of copper cables) through PVC Conduit/GI/DWC/HDPE Pipe already installed. OFC should normally be blown through the ducts by blowing through machines; drawing may be adopted in short lengths as decided by the site engineer.
	Training	
10	Training	Onsite or OEM factory training (as decided by Railway Authority) shall be provided to the Railway Officers/staff which shall include complete assembly of the system through the use of various modules, integration of hardware with software and complete installation, configuration,monitoring, operation,maintenance,fault diagnosis of Servers,EMS/NMS,network devices etc of the system, as per the tender schedule and RDSO Specification along with course materials. Sets of training manual in hard copies and Soft copies containing details of technical specifications, installation and commissioning, configurations,troubleshooting,Network diagram as per division & maintenance schedule etc. or as specified by the Railway shall be supplied along with the equipment. Training will include all systems IP MPLS routers,EMS/NMS servers. Training at OEM Factory should provide for Training Materials, Boarding and Lodging facilities for trainees as part of training.

3.1.1 Schedule A2 Item 8 : Single Mode 10 G SFP+ (40 km)

SN	Description
1	SFP modules should comply with multi-source agreement (MSA), enabling compatibility with other vendors' equipment.

2	Should support 40 km optical distance (1550/1310 nm).
3	Should have LC type connector or as per field requirement.
4	Should work on single mode dual fiber.
5	Should have 10 Gigabit Ethernet capacities on single mode fiber.
6	Should support DDMI/DOM features. Option should be available for SFP+/XFP
7	Should be having valid ISO 9000 & ISO 14000 certification on the date of opening of bid.
8	Should have CE and FCC regulatory compliances.
9	Operating Temperature of the SFP Should be mini 0 to 65 °C (23 to 149°F)

3.1.2 Schedule A2 Item 9 : Single mode 1 G SFP-BX (10 km)

SFPs – All SFPs should be bidirectional single Fiber.

SN	Description
1	SFP modules should comply with multi-source agreement (MSA), enabling compatibility with other vendors' equipment.
2	Should support 10 km optical distance on single fiber
3	Should have an LC type connector or as per site requirement
4	Should provide in Pair (BX U & D).One Switch should have BXU other should be BXD
5	Should have 1 Gigabit Ethernet capacity on single mode fiber.
6	Should support DDMI/DOM features. Option should be available for SFP+/XFP
7	OEM should be having valid ISO 9000 & ISO 14000 certification on the date of opening of bid.
8	Should have CE and FCC regulatory compliances.
9	Operating Temperature of the SFP Should be mini 0 to 65 °C (23 to 149 °F)

Note: All SFPs must support DDMI/DOM feature & should be of OEM/Reputed Make

3.1.3 DELETED

3.1.4 DELETED

3.1.5 Schedule A3 Item 1 & 2 : NETWORK MANAGEMENT SYSTEM

Shall comply As Per Para No. E and F of RDSO Document No. STT/TAN/IP-MPLS/2020 Ver 1.0 or latest. In addition, following features to be complied

3.1.5.1 General

i) The NMS Solution (Hardware Software & Perpetual licenses) shall provide monitoring of 5400 devices(around 1800 Devices per Division(UBL,SBC & MYS) with Servers in DC & DR) from day 1 with future scalability upto 2,000 devices per Division/Server(UBL,SBC & MYS) without major architectural changes. Whenever required, the additional device licenses can be procured & added respectively.

ii) Solution shall be open, distributed, scalable, and multi platform and open to third party integration.
iii) Consolidate IT event management activities into a single operations bridge/dashboard that allows NOC operators to quickly identify the cause of the IT incident, reduces duplication of effort and decreases the time it takes to rectify IT issues.
iv) Consolidated dashboard of the proposed EMS solution shall be the manager of managers window and capable of receiving events/alerts from multiple monitoring systems including system, network, storage, hardware, and application.
v) One Mobile app on android/IOS based Platform for event notification to be given for minimum 100 users.

vi) NMS shall monitor all network elements (Routers, Switches, Gateways, Servers, UPS and any device supporting SNMP protocol/MIB etc) given in the scope of the work including existing one.

3.1.5.2 Consolidated Dashboard

SN	Features
1	The tool should provide complete cross domain visibility of IT infrastructure issues
2	Integrate events from ALL Network Domain managers.
3	Automatically relate events to impacted Configuration Items (CIs) like services, servers etc
4	Automated discovery of the infrastructure CIs and relationships
5	The tool should Classify events based on business impact of System service levels
6	Offer relevant tools, run books, graphs in context of a selected event
7	Instruction Text (knowledge base) integrated into events /alarms for which incident tickets were created with ability to define troubleshooting steps.
8	Guided creation of correlation rules for administrators
9	Tool should provide superior view of infrastructure health across system, networks, IT/Network infrastructure and end user into a consolidated, central console
10	Tool should allow for customizable operator perspectives
11	Powerful correlation capabilities to reduce the number of actionable events.Topology based and event stream based correlation should be made available.
12	Tool should provide support for maintenance windows and scheduled downtimes
13	End-to-end visibility of infrastructure and alerts by showing relationships of events to CIs and business service SLAs that are impacted
14	Tool should be able to highlight Priority of an event. Priority is based on both the event severity and the business impact. CI Business Impact is calculated based on Business Criticality of all affected business services, applications and business process CIs and eg. SLAs.
15	The operator should be able to analyze priority, business impact and affected CIs by selecting each event and checking the automatically updated Health Top View, Business Impact View etc.
16	Tool should allow to browse performance metrics by selecting CIs or events. Tool should allow to compare different performance metrics of a device/CI in GUI/ Model Explorer.
17	Ability to launch in context to performance graphs or reports.
18	The adaptive threshold capability automatically calculates a baseline from the historic samples to identify previous trends in performance. Based on these trends the threshold values are automatically and dynamically calculated. Once the automatic threshold values are set, comparing the current performance data with the adaptive thresholds indicates if the current infrastructure resource utilization is normal or not. An alert is generated when abnormal behavior is detected. " (Preferable)
19	The Event Correlation Engine shall use detailed, comprehensive, and automatically updated discovery and relationship information to analyze alerts and events and ultimately determine the event that is most likely the cause of an incident.
20	When a combination of many events occurs in the monitored environment, the system must be able to automatically categorize them into causes and symptoms. The system needs to provide a single

	interface to view multiple layers of cause and symptoms.
21	The system must allow modification and enhancement events during event processing.

3.1.5.3 Service Level Reporting

SN	Features
1	Should provide reporting templates for performance, availability, inventory, operation, virtualization and configuration
2	Should provide reports that can prove IT service quality levels, such as application response times and server resource consumption
3	Reports should be accessible via web browser
4	Reports can be scheduled to publish automatically or they can be produced on demand
5	Reports can be applied to all systems, to a group of systems, to a customer group of systems, or to a single system.
6	Reports can be published in HTML, PDF, Microsoft Word, and Microsoft Excel formats.
7	Should be possible to send reports via email from the Reporter GUI or from the command line.
8	Automated report generation and publishing
9	Server reporting tool should be able to collect and collate specific information regarding the resource utilization, relationship of a business service with infrastructure elements and its SLA performance
10	Tool should be able to report in the context of the business service SLAs that the infrastructure elements support—clearly showing how the infrastructure impacts business service levels
11	Tool should be able to deliver comprehensive, long term, and customizable cross-domain reporting.
12	Tool should support long term data retention and aggregation upto 24 months.
13	Tool should provide a library of predefined reports that can be cross launched in the context of business services.
14	Tool should provide reports from both Network devices and Servers from the same console.
15	Tool should provide a development environment where more Content/Reports can be created and data sources such as — Generic .csv files, and — Databases supporting JDBC. Should also be included to pull data and create reports from such data.
16	Tool should allow to configure downtime for Configuration Items and view the configured downtime in the reports

3.1.5.4 Network Automation

SN	Features
1	Should be able to generate a graphical representation of your network. Identify which devices are inactive or out of compliance. Detecting non compliance, issuing alerts. The ability to compare configurations is invaluable; system changes must be logged.
2	Manage network Compliance by campering devices to defined,best practice standards. Speed audit processes with network compliance reports for ITIL and more. Validate device operating states in real time to stay in compliance.
3	In real time, detect configuration and asset information changes made across a multi vendor device network, regardless of how each change is made and also support configuration deployment/rollback and configuration templates.
4	Recording every access to a device including not only scripted and automated access, but a full keystroke log. Who made what change, the reason for the change and associated ticket number must be captured.

5	Manage dual stack and pure IPv6 environments. Manage SNMPv3 configurations and communicate over SNMPv3.
6	In real time, store a complete audit trail of configuration changes,(hardware, and software,) made to network devices including critical change information.
7	Configure granular, customizable user roles to control permissions on device views, device actions, and system actions. Support common authentication systems, such as TACACS+, Radius, SecurID, Active Directory and LDAP or Equivalent or any other authentication systems.
8	Manage device access and authorization through a centralized control model that is integrated with your standard workflow and approval processes.
9	Automate routine configuration tasks for updates, such as password or community string changes, configuration upload and download, compare configs, bulk configurations, config backup.
10	Deploy and monitor operating system images from a centralized network management system. Create a repository, and synchronize all device software images across the enterprise network.
11	Enforce change processes in real time. Model complex approval processes with flexible rules. Force approvals for changes, including changes made by a direct command line interface (CLI) session.
12	The system must support heavily NAT environments and environments where network devices may have the same IP address.
13	The system must provide an automated method to configure devices for real-time change detection via syslog (either direct syslog or syslog via a relay).
14	Scalability – The network configuration management solution should be highly scalable with the largest tier capable of supporting upto 10K devices and carrying out upto 10K tasks per day.

3.1.5.5 Service Management (Help Desk) and SLA Management

SN	Features
1	The proposed Helpdesk tool should be Axelos Gold level/Pink Elephant/ Service certified on at least 6 ITIL 2011 or any approved lab by Govt of india processes and complying at least 6 **(undertaking on OEM's letterhead to be submitted)**of all the ITIL processes that are the most mature way to demonstrate that at least three IT organizations : Incident management, Problem Management, Change Management, Knowledge Management, Service Level Management, Service Asset and Configuration management, Service Catalogue and Request Fulfillment, etc. The certification copy to be submitted/All functionalities should be met or supported.
2	Should be able to control access rights to modules and information by user profiles.
3	The CMDB should provide visualization (graphical view) as well as support federation (seamlessly federates information from other distributed data sources), reconciliation and synchronization.
4	Should provide predefined categorization, as well as routing and escalation workflows that can be triggered based on criteria such as SLA, impact, urgency, CI, location or customer.
5	The Change Management module should provide a rule based workflow system for controlling changes throughout their lifecycle: from initial request to approval, to planning and implementation, and to monitoring and evaluation.
6	Should include automated impact analysis, calculated risk analysis, collision detection, and unplanned change detection and validation.
7	The tool should automatically alert the responsible persons when a maintenance task is due or a scheduling conflict arises.
8	If multiple SLAs are triggered, the strictest one must drive the workflow
9	The product must monitor SLAs against Service, Problem, and Change Management
10	The solution should show immediate (real time) status of tickets.

11	Should support KCS (Knowledge Centered Support) best practices
12	Provide out of box and customizable reporting and personalized dashboard

3.1.5.6 Network Fault Management

SN	Features
1	The solution should allow for discovery to be run on a continuous basis which tracks dynamic changes near real time; in order to keep the topology always up to date. This discovery should run at a low overhead, incrementally discovering devices and interfaces.
2	The NMS must immediately determine the impact of a component failure and thus help in prioritizing problem solving efforts.
3	The NMS should provide a very powerful event correlation engine and thus must filter, correlate & process the events that are created daily from network devices. It should assist in root cause determination and help prevent flooding of non relevant console messages.
4	Polling intervals should be configurable on a need basis through a GUI tool, to ensure that key systems are monitored as frequently as necessary.
5	The topology of the entire Network should be available in a single map along with a Network state poller with aggressive/customizable polling intervals.
6	The NMS application should provide a Unified Fault, Availability and Performance function from a single station only to reduce network and device loads with unified fault & performance polling.
7	The NMS performance system must provide predefined and highly customizable reporting across the network domain.
8	The Network performance operator console should provide operators with seamless transitions from fault data to performance reports and back. For example- select a node in NMS fault mgmt system and cross launch it for historical and near real time data.
9	Should have MIB browsing, MIB loading, and MIB expression collection features
10	NMS should be cloud ready, should have dynamic Root Cause Analysis capability
11	NMS should have Global Management capability, where it can work in a distributed environment.
12	NMS should support application based failover over the WAN.
13	NMS should have support for SNMPv3 & IPv6, including dual stack IPv4 & IPv6 to provide flexibility in protocol strategy and implementation
14	It should be able to correlate multiple occurrences of a specific fault on a device within a specified time frame to enable detection of chronic problems. At any given point in time there may not exist a fault for a chronic issue, but we need to know that the condition continues to happen. For example: Circuit down 20 times in the last 24 hour, bandwidth thresholds exceeded 30 times in the last month, etc.
15	The system should support a variety of discovery protocols. The system should take advantage of available information to aid in discovery of the network. Similar Protocols like ARP, DNS, SNMP, BGP, EIGRP, OSPF, CDP (Cisco), EDP (Extreme), NDP (SONMP-Nortel), FDPn(Foundry), EnDP (Enterasys), and LLDP (link-level discovery protocol) or equivalent or any other protocols.
16	Support for discovering and monitoring router redundancy groups using HSRP (Hot Standby Router Protocol) / VRRP (Virtual Router Redundancy Protocol) / any Protocol & recognizing situations that can result in multipath conditions.
17	Support for port aggregation protocols similar to LACP (Link Aggregation Control Protocol) including visual map based views & automatic impact assessment based on the relationships between physical and virtual links.
18	Scalability – Network Management Tool should be capable of managing upto 10K devices from a single instance, should be able to have 10k discovered interfaces.

3.1.5.7 Network Performance Management

S.No	Features
1	Should establish the status of network devices and interfaces with unified status calculation and visualization of network fault & performance data.
2	Should enable efficient workflows using contextual navigation between reports and rich interactive report configuration capabilities.
3	Network Performance reporting tool must provide the following capabilities: i) Data collection and thresholding of network device ports (any that support MIB2 including virtual interfaces): Bytes In, Bytes Out, Discards, Errors, Network Delay ii) Data collection and threshold setting of network devices: CPU,Memory, Buffers, Component statistics iii) A variety of reports summarizing the data including: Home page summary/trend summary, Calendar, Heat chart, Headline, Dashboard, Managed inventory report, Top ten, Most changed/occurring events, Data explorer
4	Should honours network fault management tools' secure grouping and multi tenancy settings i) Secure reports by group ii) Secure reports by tenant
5	Should be able to schedule key reports for automated delivery i) Distribute reports by email in HTML, Excel or pdf formats. ii) Single station scalability up to 10,000 performance polled interfaces Store as polled data for up to 12 months

3.1.5.8 Server Monitoring

SN	Features
1	Should offer service driven operations management of the IT environment to manage distributed, heterogeneous systems - Windows, LINUX from a single management station.
2	Centralized view for Agent based and agentless monitoring managed from one central console.
3	Should provide a centralized point of control with predefined policy based management intelligence for easy deployment for the servers, operating systems, applications and services for correlating and managing all the IT infrastructure components of a business service.
4	Should support Virtual platforms - Vmware and Microsoft Virtual Server, Citrix or other and provide capability to manage both Microsoft .NET and J2EE or equivalent applications from the same platform.
5	Should provide inbuilt correlation to reduce the number of messages presented to the operators and to determine the root cause.
6	The system must be agent based for managing the nodes and have the capability of storing events / data locally if communication to the management server is not possible due to some problem. This capability will help to avoid losing critical events.
7	Complex dependencies between managed elements must be captured,allowing IT management staff to interpret lower level data in terms of its importance to the higher level service.
8	Alarms with meaningful message text, instruction text, operator / automatic actions / linked graphs, duplicate message suppression.
9	Should be configurable to suppress events at the agent or managed node level itself and be configurable to suppress events for key systems/devices that are down for routine maintenance or planned outage.
10	The system should allow for enriching of messages with incremental information and should allow for customization of message attributes.

11	There should be a single agent on the managed node that provides the system performance data, and for event management it should be able to prioritize events, do correlation & duplicate suppression ability to buffer alarms and provide automatic actions with capability to add necessary annotations.
12	Should provide a console and a web browser interface that can be accessed from anywhere using industry standard web browsers.
13	Each operator should be provided with user roles that should include operational service views enabling operators to quickly determine impact and root cause associated with events.
14	Highly scalable, and can manage in excess of 5400 managed nodes from a single server.
15	There should be secured communication between Management server and Managed nodes avoiding the need to open unsecure firewall ports.
16	The system should integrate with Helpdesk / Service desk tool for automated incident logging and also notify alerts or events via e-mail or SMS.
17	The system should have management policies to monitor and manage WMI, Performance, SNMP, Application, Log Files and Event logs and support automatic action in various forms like running a script to be taken on alerts from managed nodes.

3.1.5.9 Asset Management

i) Should be able to recover software licenses when hardware is retired, returned (for leases). ii) Should track version, status, and upgrade information for each installed software package. iii) The tool must be able to reconcile the number of installed copies of an application with the number of permitted licenses. iv) Should be able to track the end user's right to utilize software or hardware assets. v) Should be able to manage and count software entitlement separately from license counters as software is installed, removed and auto discovered. vi) Software Asset Management should be capable of doing license compliance for vendors being offered in the subject work.
Auto-Discovery 1. Proposed solution should have the auto-discovery tool, which should have tight Integration with the proposed ITAM (IT Asset Management) solution. 2. Should be able to collect information from routers, switches, load balancers, storage, servers, and firewalls. 3. Should have the ability to verify inventory data changes with current asset details before permanently updating the system of record. 4. Discovery should be automatic and continuous to detect real time changes in the IT infrastructure. 5. Discovery should work without requiring agent installation (that is, agentless discovery) while discovery Layers 2 through Layers 7 of OSI model. 6. Should use Industry standard protocols such as WMI, SNMP, JMX, SSH or equivalent to perform discovery without requiring the installation of an agent. 7. Discovery systems should have the ability to modify out-of-box discovery scripts, create customized discovery scripts. 8. Discovery system should have the ability to capture configuration files for the purposes of comparison and change tracking. 9. Discovery system should be capable of supporting role based access to various aspects of CMDB administration

3.1.5.10 Service Management (Help Desk) and SLA Management under Enterprise Management System (EMS)

i) Offered system must have a mobile web interface (with screen adaptation and notification) or App for field engineers for Work Order Issuance, ERT & resolution.
ii) Solution should provide a Framework to create SLA Templates.Solution should offer a collection framework for ease of integration with Alarm Management.
iii) Solution should provide Hourly, Daily, Weekly, Monthly and yearly asset wise & Station wise failure position along with SLA calculation.

3.1.5.11 Spine and Leaf Architecture is a two-layer, full-mesh topology composed of a leaf layer and a spine layer, with the leaf and spine switches. It will be implemented in data centers to overcome the limitations of the three-tier architecture, where we have more east-west traffic than north-south traffic flow. East-west traffic flows are server-to-server communication within the same data center,

Spine Layer – serves as the backbone of the network similar to the core layer in our three-tier design. It is where we can find the spine switches which can be a Layer 3 switch. Each Layer 3 port is connected to the underlying Layer 2 leaf switch.

Leaf Layer – connects to end devices similar to the access layer in our three-tier design. It is where the leaf switches which connect to all spine switches reside. In our example above, we have servers that connect to leaf switches. In a data center environment, it can be any kind of server, like web server, application server, database server, or storage server.

Leaf switch specification

S. No.	Detailed Technical Specifications
A	**Solution Requirement**
1	The Switch should support non-blocking Layer 2 switching and Layer 3 routing
2	There switch should not have any single point of failure like power supplies and fans etc. should have 1:1/N+1 inbuilt level of redundancy
B	**Hardware and Interface Requirement**
1	Switch should have a minimum 24 ports with support of 100M/1G/10G Base-T ports for host connectivity and 6x 10/40G for spine connectivity, fully loaded with (4 Nos of 40G SFP and 2 Nos of 10G SFP) modules. (For host connectivity SFP modules can also be supplied.)
2	Switch should support Configuration roll-back
3	Switch should support different logical interface types like loopback, VLAN, SVI/RVI, Port Channel, multi chassis port channel/LAG etc.
4	The switch should support 100,000 IPv4 unicast routes and 100,000 IPv6 unicast routes entries in the routing table including 48,000 IPv4 multicast routes and 48,000 IPv6 Multicast Routes.
5	The switch should support hardware based load sharing at wire speed using LACP and multi chassis ether channel/LAG/EVPN-ESI
6	Switch should support minimum 2.4Tbps of switching capacity
C	**Layer2 Features**
1	Spanning Tree Protocol (IEEE 8201.D, 802.1W, 802.1S)
2	Switch should support minimum 100,000 no. of MAC addresses
3	Switch should support 8 Nos. of link or more per Port channel (using LACP) and support minimum 30 number of ports per Link Aggregation Group
4	Support for broadcast, multicast and unknown unicast storm control to prevent degradation of switch performance from storm due to network attacks and vulnerabilities

D	**Layer3 Features**
1	Switch should support static and dynamic routing like Static, OSPF and BGP
2	Should support BGP, MBGP, IS-IS for IPv4 and IPv6
3	Switch should support multicast traffic reachability using PIM-SM and SSM
E	**Availability**
1	Switch should provide gateway level of redundancy in IPv4 and IPv6 using HSRP/ VRRP/anycast gateway or equivalent
2	Switch should support for BFD For Fast Failure Detection
F	**Quality of Service**
1	Switch system should support 802.1P classification and marking of packet CoS, DSCP etc.
2	Switch should support for different type of QoS features for real time traffic differential treatment using WRED and SP Queuing
3	Switch should support Flow control of Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end for receiving traffic as per IEEE 802.3x
G	**Security**
1	Switch should support for deploying different security for each logical and physical interface using Port Based access control lists of Layer-2 to Layer-4 in IP V4 and IP V6 and logging for fault finding and audit trail
2	Switch should support control plane i.e. processor and memory Protection from unnecessary or DoS traffic by control plane protection policy
3	Switch should support for external database for AAA using TACACS+ / Radius
4	Switch should support for Role Based access control (RBAC) for restricting host level network access as per policy defined
5	Switch should support to prevent edge devices in the network from becoming Spanning Tree Protocol root nodes/ should support loop-prevention mechanism and must have enough security mechanisms in place from external networks.
H	**Manageability**
1	Switch should support for embedded RMON/RMON-II/streaming Telemetry gNMI or equivalent for central NMS management and monitoring
2	Switch should provide remote login for administration Telnet, SSHv2
3	Switch should support for management and monitoring status using different type of Industry standard NMS using SNMP V2 and V3/gRPC/gNMI
4	Switch should support for basic administrative tools like Ping and traceroute
5	Switch should support central time server synchronization using Network Time Protocol NTP V4
I	**Certification**
1	The Switch should be EAL 2/EAL 3/NDPP/ NDcPP complied/certified under Common Criteria at the time of supply

3.1.5.12 Spine Switch

S. No.	Detailed Technical Specifications
A	**Solution Requirement**
1	The Switch should support non-blocking Layer 2 switching and Layer 3 routing
2	There switch should not have any single point of failure like power supplies and fans etc. should have 1:1/N+1 inbuilt level of redundancy
B	**Hardware and Interface Requirement**
1	Switch should have minimum 24 ports with support of 100M/1G/10G Base-T ports for host connectivity and 6x 10/40G for spine connectivity, fully loaded with (4 Nos of 40G and 2 Nos of 10G SFP) modules. (For host connectivity SFP modules can also be supplied.)
2	Switch should support Configuration roll-back
3	Switch should support different logical interface types like loopback, VLAN, SVI/RVI, Port Channel, multi chassis port channel/LAG etc.
4	The switch should support 100,000 IPv4 unicast routes and 100,000 IPv6 unicast routes entries in the routing table including 48,000 IPv4 multicast routes and 48,000 IPv6 Multicast Routes.
5	The switch should support hardware based load sharing at wire speed using LACP and multi chassis ether channel/LAG/EVPN-ESI
6	Switch should support minimum 2.4Tbps of switching capacity
C	**Layer2 Features**
1	Spanning Tree Protocol (IEEE 8201.D, 802.1W, 802.1S)
2	Switch should support minimum 100,000 no. of MAC addresses
3	Switch should support 8 Nos. of link or more per Port channel (using LACP) and support minimum 30 number of ports per Link Aggregation Group
4	Support for broadcast, multicast and unknown unicast storm control to prevent degradation of switch performance from storm due to network attacks and vulnerabilities
D	**Layer3 Features**
1	Switch should support static and dynamic routing like Static, OSPF and BGP
2	Should support BGP, MBGP, IS-IS for IPv4 and IPv6
3	Switch should support multicast traffic reachability using PIM-SM and SSM
E	**Availability**
1	Switch should provide gateway level of redundancy in IPv4 and IPv6 using HSRP/ VRRP/anycast gateway or equivalent
2	Switch should support for BFD For Fast Failure Detection
F	**Quality of Service**
1	Switch system should support 802.1P classification and marking of packet CoS, DSCP etc.
2	Switch should support for different type of QoS features for real time traffic differential treatment using WRED and SP Queuing
3	Switch should support Flow control of Ethernet ports to control traffic rates during congestion by allowing congested nodes to pause link operation at the other end for receiving traffic as per IEEE 802.3x
G	**Security**

1	Switch should support for deploying different security for each logical and physical interface using Port Based access control lists of Layer-2 to Layer-4 in IP V4 and IP V6 and logging for fault finding and audit trail
2	Switch should support control plane i.e. processor and memory Protection from unnecessary or DoS traffic by control plane protection policy
3	Switch should support for external database for AAA using TACACS+ / Radius
4	Switch should support for Role Based access control (RBAC) for restricting host level network access as per policy defined
5	Switch should support to prevent edge devices in the network from becoming Spanning Tree Protocol root nodes/ should support loop-prevention mechanism and must have enough security mechanisms in place from external networks.
H	**Manageability**
1	Switch should support for embedded RMON/RMON-II/streaming Telemetry gNMI or equivalent for central NMS management and monitoring
2	Switch should provide remote login for administration Telnet, SSHv2
3	Switch should support for management and monitoring status using different type of Industry standard NMS using SNMP V2 and V3/gRPC/gNMI
4	Switch should support for basic administrative tools like Ping and traceroute
5	Switch should support central time server synchronization using Network Time Protocol NTP V4
I	**Certification**
1	The Switch should be EAL 2/EAL 3/NDPP/ NDcPP complied/certified under Common Criteria at the time of supply

3.1.6 Schedule A3 Item 4 : 55 Inch LED Ultra HD (4K) TV

1. Display Size: 55 inch
2. Screen Type: LED
3. Smart TV: YES
4. Resolution Standard: 4K
5. Resolution (pixels): 3840x2160
6. No of HDMI Port: 3 or more
7. No of USB Port: 3 latest or more
8. Built In Wi-Fi: YES
9. Ethernet (RJ45): 1 or more
10. Analog Audio Input: YES
11. Number of Speakers: 2
12. Speaker Output RMS: 20 W or higher
13. Power Consumption: 172 W, 0.5 W (Standby) or less
14. Remote: YES
15. Supported App-YouTube: YES
16. Supported App -Netflix: YES
17. Operating System Present: Android
18. Screen Mirroring: YES
19. Supported Video Formats: MPEG1/MPEG2TS/AVCHD/MP4/AVI/WMV/LPCM/MP3/WMA/JPEG or any other
20. Refresh Rate (Hz): 50

3.1.7 DELETED

3.1.8 Schedule A5 Item 1 : FDMS and Accessories

Fiber Distribution Management System (FDMS) 12/24 F

The FMS should be confirming to RDSO specification No.RDSO/SPN/TC/37/2020 revision 4 or latest. However, the FMS should have the following:

a. It should be mountable in standard 19" rack and of slider type.
b. There should be an arrangement of termination of 48/24/12/6 Nos. of fibers (as per SOR).
c. It should be supplied with 48/24/12/6 Nos. of pigtails of respective type of connector of minimum 3 meter length.
d. Colour coded pigtails shall be provided for easy identification.
e. The FMS should be supplied with arrangement of required Nos. of adapters (as per SOR).
f. The adaptors shall be fixed in such a way that these shall be easily accessible protecting the eye from direct exposure to laser.
g. There should be no trays or as per site requirement for the provision of termination of the fibers & sufficient space for routing of the fibers in the trays.
h. Trays shall be numbered bottom to top (tray no. 1 is lower most).
i. Pigtails shall follow tray numbering.
j. Pigtails shall be labeled through colour coding/ferruling.
k. Adaptors shall be numbered Bottom to Top or Left to Right in ascending order.
m. All adaptors shall be provided with dust protection caps.
n. Important Do's and Don'ts about the operation of the FMS shall be clearly indicated at a convenient place on the FMS.
o. Insertion Loss: ≤ 0.3 dB or less
p. Return Loss: ≤ 45 dB or less
q. The FMS shall be manufactured as per latest state of art technology.
r. The FMS shall be protected against the entry of dust and insects, rodents etc.
s. Body should be of MS steel; powder coating painting shall be provided with rust resistance paint.
t. Marking: The marking on the system shall be indelible and following minimum information shall be provided by way of engraving or Laser printing method:
i. "SWR" should be written on each FDMS to be visible from front.
ii. Manufacturer's name & date/ year of production.
iii. Model No./Batch No./ Serial No.
iv. Capacity i.e. No. of cables and the fibers.
v. Identification details/ cables/ Fiber/ labelling facility.
u. Preferred type of connector is SC/APC for all connectors.

3.1.9 Schedule A5 Item 2 : OFC Patch Cords:

The Patch cords should be 3 meter length, conforming to TEC NO: TEC/GR/TX OFJ- 01/05/NOV-09 or latest with all amendments. However, the Patch cords should have the following:

S. N	Parameter	Value
A	Operating Temperature	-40ºC to +85ºC
B	Insertion Loss:	
1	Insertion Loss of complete patch cord including adapter when tested from each direction in all conditions of operations	≤ 0.3 dB
2	Insertion Loss of Adaptors	≤ 0.1 dB
C	Return Loss for each connector of patch cord:	

1	Type-I FC-PC	≥ 50 dB
2	Type-II SC-PC	≥ 50 dB
3	Type-III SC-APC	≥ 65 dB
4	Type-IV LC	≥ 50 dB
5	E2K/APC	≥ 60 dB
D	The length and type of connector of each Patch Cord	As per SOR.
E	The connectors must be make of reputed OEMs 3M, Huber-Shuner, R&M, TE Connectivity/Raychem any other CACT approved Manufacturer/s having a valid approval against Specification number TEC/GR/TX/OFJ-01-NOV.09 for the tendered connected type.	
F	Connector Body	
1	FC-PC	Ni plated brass body (Ni plating shall be as per BIS Standards)
2	SC-PC & SC-APC	Engineering thermoplastic (Glass filled PBT:Polybutylene Terephthalate)
3	LC	PEI (Polyetherimide)/ PPS (Polyphenylene Sulphide)
G	Colour of connector body	
1	FC-PC connector	Ni plated Brass
2	SC-PC connector	Blue
3	SC-APC connector	Green
4	LC connector	Blue
H	Radius of curvature	
1	FC-PC	10 to 25 mm
2	SC-PC	10 to 25 mm
3	SC-APC	5 to 12 mm
4	LC	10 to 25 mm

3.1.10 Schedule A5 Item 5: 12 Core Outdoor Unarmoured Optic Fibre Cable

1. NO. OF FIBRES : 12F
2. TYPE OF FIBRE : SM G652 D
3. LOOSE TUBE DIAMETER : 2.00 mm NOMINAL
4. STRENGTH MEMBER : METAL OR GLASS YARN & FRP 2 NOS STRENGTH MEMBER
5. COLOUR OF FIBRE : BLUE, ORANGE, GREEN, BROWN, GREY,WHITE,RED,BLACK,YELLOW,VIOLET
6. PINK, & AQUA
7. OUTER SHEATH MATERIAL : HDPE – BLACK
8. OUTER SHEATH THICKNESS : 1.80 MM NOMINAL OR HIGHER
9. OUTER CABLE DIAMETER : 6.0 + 0.50 mm
10. CABLE WEIGHT : 34 + 10% Kg/Km
11. PRINTING ON CABLE : AS PER CUSTOMER REQUIREMENTS
12. STANDARD LENGTH : 2 + 10% KMS
13. MAX. OPERATING TENSION : 500 N
14. MAX INSTALLATION TENSION : 1000 N / 10 cm
15. They should be compliant with the latest ITU-TG-652-D Standard.
16. All the accessories required for installation should be provided along with the cable.
17. It should be of reputed make.

3.1.11 Schedule A5 Item 10 : 19"42 U 800 mm width X 1200mm depth Rack

SN	Description
1	Racks manufactured out of steel sheet punched, formed, welded and Powder coated
2	Rack should be from ISO 14001 ,27000 Certified Company & UL Listed
3	Standard for Racks configuration will be welded frame with side panel and vented top cover
4	Rack should have Front Transparent Door and Dual Perforated door at Rear.
5	Rack should have 2 no's of removable side panel with slam latch.With key & lock arrangement. With key & lock arrangement.
6	Rack should have provision to mount racks on Floor
7	Rack should be 42U (1U = 44.45 mm) in Height.
8	It should be 800mm width and 1200MM Depth
9	Rack should include adapter kit 1 no (loop type) and rack mount sliding rail for mounting of servers.
10	The Rack unit supported by casters static load of at least 350Kgs and by Levelers should support a static load of at least 750Kgs.
11	Rack should have Minimum IP 20 certified and Conforms to 310 DIN 41494 or Equivalent EIA /ISO / EN Standard
12	Rack should have Adjustable mounting depth,
13	Rack 4 No Adjustable, 19" verticals with Punched 9mm Square Hole and Universal 12.7mm-15.875mm-15.875mm or as per manufacturer alternating hole pattern offers greater mounting flexibility, maximizes usable mounting space.
14	Rack should have Numbered U positions,
15	should have 100% assured compatibility with all equipment's conforming to DIN 41494 (General industrial standard for equipment)
16	Powder coated finish with seven Tanks pre treatment process meeting IS
17	Rack should have Proper Grounding & Bonding
18	Rack should have Fan module Mount Provision on top Cover
19	Rack should have Fan tray with 4 no's 90 CFM Fan
20	Rack should have 1 No Fixed shelf with 715mm depth for mounting NON Rack mountable Equipment & 1 No Sliding Keyboard Tray.
21	Rack should have Server /IT Rack Mount 2 Nos Power Distribution unit, 1Ph, 230V, 8A, 50/60Hz, 2U standard with 8 X Intel Multi Pin 5A, Inlet Plug type 6A Indian Round Pin, 6A Fuse - PDU Rating 1.8KVA/Side or higher feed-1.5Mt/ Black
22	Rack should have 2 No Horizontal Cable & 2 No Vertical Manger/Organizer with Plastic Loops.
23	The earthing kit consisting of copper bus bar with dimensions 20 inch length, 1.0 inch breadth & 5 mm thickness (min.) having appropriate number of M6 tapped holes and 3 brass nut bolts and washers for fixing of earthing cables shall be fixed near the bottom of the rack
24	Rack should have PIS:1554 Part-1.provision for cable entry Exit from Both top & Bottom.
25	INDIAN RAILWAYS Logo along with Year" in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color
26	Rack should have 1 Packet of mounting hardware, Pack of 20 or more.
27	Supply and fixing of Metal Cable tray of 150 mm width and 2 meter length along with all accessories required for fixing from Rack to MDF with laying and bunching of cables neatly,Rack all Doors should be removable type four exhaust fans, Server's mounts and channel, KeyBoard tray, one Horizontal Tray, one AC Multiple (8 Nos of 5A sockets) Earthing Strip (Copper)-1 with Fasteners- 2 Pac.

3.1.12 Schedule A5 Item 11 : 19"42 U 600mm width X 600 mm Depth Rack

SN	Item	Description
1	Dimension	It should be 600mm width and 600MM Depth
2	Side panels	To be provided across the whole height of the rack should be openable with a latching arrangement at top and bottom.With key & lock arrangement.
3	Front door	Rack should have front door tough and transparent glass fitted on S/CRCA sheet on sides with Lock and key.
4	Rear side	Shall be perforated for appropriate levels as per industry standard.
5	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
6	Fan module	Compact fan module of 90CFM working on AC power supply 4 Nos each rack properly fitted at top of rack.
7	Earthing Provision	Rack Should have earthing provisions.
8	Cable manager	2 nos.horizontal and 2 nos.vertical cable managers with cable loops to be provided with each rack with plastic loop.
9	Power Distribution Unit (PDU)	Adequate and Redundant power distribution units with electronically controlled circuits for surge and spike protection,MCBs isolated input to ground and output to ground.
10	Material used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
11	The rack should be fitted with one modem tray 19",Rack should be 42U (1U = 44.45 mm) in Height.	
12	The earthing kit consisting of copper bus bar with dimensions 20 inch length, 1.0 inch breadth & 5mm thickness (min.) having appropriate number of M6 tapped holes and 3 brass nut bolts and washers for fixing of earthing cables shall be fixed near the bottom of the rack.	
13	The good quality powder coating light grey in colour shall be used for painting the rack	
14	The rack should be fitted with a dual source power supply distribution board.	
15	"INDIAN RAILWAYS Logo along with Year" in bold and easily recog- nizable fonts should be written at the front top of the rack preferably in black or blue color.	
16	OEM should have a valid ISO 9001 certification on the date of opening of bid.	
17	Rack should be minimum IP20 certified. Rack should also comply with EIA 310/DIN 41494 standards.	
18	Two Exhaust fans, one Horizontal Tray, One AC Multiple (4 Nos of 5A Sockets) Earthing Strip (copper)-1 with fasteners-2 pack, Rack Mountable DCDB Panel with one Common Copper Strip and 4 Nos MCB 6 Amps.Including all fittings for housing Router and other Equipment including Supply & Laying of Power Cable, Tray & Connectivity to Earthing, Connectivity to MDF using Krone module with Integrated Protection Module of 100 Pairs and Supply of other Accessories(Exchange work).	

Sub-Work B:
Video Surveillance System (VSS)

Sub-Work B: Video Surveillance System (VSS)

Schedule B1: SCHEDULE OF ITEMS, QUANTITIES & RATES (SOR) Items		
1	**Transportation**	
1a	Transportation upto 100 Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
1b	Transportation more than 100 Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
Schedule B2: IP Cameras		
	IP CAMERA	
1	Full HD Fixed Dome Type IP Colour Camera	As per Clause No. 6.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments of any Reputed Make
2	Full HD Bullet type IP Colour Camera	As per Clause No. 5.4 of RDSO Specification IP Based Video Surveillance System, Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 or Latest with all amendments of any Reputed Make
3	Full HD (Pan/Tilt/Zoom) PTZ IP colour Camera	As per Clause No. 7.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments of any Reputed Make
4	4K UHD Bullet type IP Colour Camera	As per Clause No. 5.5 of RDSO Specification of IP Based Video Surveillance System Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments of any Reputed Make
	Spares	
5-8	Spares for Supply of Camera	8% spares are to be provided for all the above mentioned cameras as per schedule description
Schedule B3: Servers and Workstation		
	VMS, VAS & FRS	
1	Command Control Center(CCC).	As per Clause no. 18.6 of RDSO specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. Hardware, software and Perpetual Licenses required for integration of New and Existing VSS infra is part of this item. This includes supply of Hardware, Software, switches,Work station etc and perpetual license for all the cameras and all the accessories required for integration of new VSS Infra in present work and existing VSS infrastructure at stations, RPF Thane, in all Divisional and Zonal security control rooms. Details of stations already commissioned and to be integrated are given along with the details of make/hardware and numbers. Supply of Electrical insulation mat of size 2 Mtrs length and 1 Mtrs width and 25 mm thickness-2Nos each command center.
2	Video Management Software	As per Clause no. 18.1 & 18.2 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. VMS Software shall support minimum 1500 cameras or higher per division on multiple servers (per camera basis Licence means Video Management (Viewing) and (recording) at multiple locations such as Station, RPF Post & DC Server room,Security control by same license) Integrated VMS server in Data Center should manage,monitor, control and configure all the VMS servers provided in the respective division in a federated architecture and multi-tenant model.

		Video Management Software with federated cloud architecture to be provide for scalability and flexibility to support large-sized VMS installations **Scalability:** Federated cloud architecture greatly should help in designing and implementing large-sized Video management software to support an unlimited number of cameras, management servers, and big data. **Centralized Video Surveillance:** Centralized video surveillance should improve the security of the connected organizational branches/sites, provides transparency and helps in enhancing the business operations. Since operations of any connected sites can be monitored from the corporate/main office, management of the enterprise can have a complete hold on the organizational activities. **Independent Site Monitoring:** Federated cloud VMS system also allows individual sites to have complete control of their site. For incidents triggered via video analytics to be quickly responded and resolved from the local site itself, federated VMS system provides independent control of the VMS at the local sites **Support for Multi-tenant VMS architecture:** Multi-tenancy and cloud federation should go hand in hand for Cloud based Video management Software. While Multi-tenant Video management Software allows VMS infrastructure to be shared with multiple clients/sites simultaneously, federation helps in retaining the independent management of the individual sites. Multitenancy supports shared infrastructure and monitoring costs, easy upgrades and customization, whereas federation facilitates authorized access to complete VMS System from a single location. **Fault Tolerance:** Federated cloud architecture should provide fault tolerance to the large-sized VMS system. It enables the VMS systems of the independent sites to work efficiently even in the case of network failure. Even though the central site may not be able to access the independent sites, VMS systems of these sites can record videos and secure their premises with assigned video analytics. On resuming connection with the federated architecture, data of the local sites can be transferred to the main site for analysis. As per Clause no. 18.5 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.
3	VMS Server Hardware/ Redundant Servers	Hardware configuration as per Clause No. 10.1.1.3 of RDSO Specification no. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 or latest with all amendments shall be followed. Memory of 64GB or higher & Graphic card of 4 GB NVIDIA Quadro or Equivalent or higher. Minimum Two 1/10Gbe NIC ports with 10G SFP+ ports loaded along with ofc patch cord. The hardware shall support a minimum 256 cameras or higher. If successful commissioning requires a higher end server, then the same shall be supplied with no additional cost. Alongwith server, genuine licensed OS and application software should be supplied. External DVD R/W drive can be supplied. Acceptable Brand: Reputed like IBM/Dell/HP or Equivalent. As per Clause no. 18.3 of Recording Server in RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.
4	VAS Server Hardware/ Redundant Servers	As per Clause No. 10.1.1.3 of RDSO Specification no. RDSO/SPN/TC/65/2021 or higher of IP Based Video Surveillance System Revision 6.0 or latest with all amendments. Memory of 64GB or higher & Graphic card of 4 GB NVIDIA Quadro or Equivalent or higher. The hardware shall support a minimum 128 cameras or higher. Minimum Two 1/10Gbe NIC ports with two 10G SFP+ ports loaded. If successful commissioning requires a higher end server, then the same shall be

		supplied with no additional cost. Alongwith server genuine licensed OS and application software CD should be supplied. External DVD R/W drive can be supplied. Acceptable Brand: Reputed like IBM/Dell/HP or Equivalent.
5	FRS Server Hardware/ Redundant Servers	As per Clause No. 10.1.1.3 of RDSO Specification no. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 or latest with all amendments. Memory of 64GB or higher & Graphic card of 4 GB NVIDIA Quadro or Equivalent or higher. Minimum Two 1/10Gbe NIC ports with two 10G SFP+ ports loaded.The hardware shall support a minimum 8 cameras or higher. If successful commissioning requires a higher end server, then the same shall be supplied with no additional cost. Alongwith server genuine OS software should be supplied. External DVD R/W drive can be supplied. Acceptable Brand: Reputed like IBM/Dell/HP or Equivalent.
6	VAS SOFTWARE	As per schedule description(Per camera License means Video analytic at multiple locations such as Station, RPF Post & Security control by same license) as per clause No.18.4 RDSO Specification No RDSO/SPN/TC/65/2021 Rev.6 or latest. Inspection RDSO. Tenderer can offer in-built Video analytics in the camera itself. Details of additional,optional features of Video Analytics Software (in addition to RDSO specification) are as under . AI based video analytics should be able to detect Smoke and Fire in a defined area. (Optional) 1. Auto tracking of person whereabouts while movement in Railway Premises through Video analytics in Fixed cameras. (Optional) 2. Auto focussing through PTZ camera of the person under suspicion. (Optional) 3. People counting. (Optional) 4. Face Mask Detection(Optional) and any other analytics.
7	Face Recognition Software	As per Clause no. 19.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments(Per camera License means. By the same license, Face Recognition can be possible at multiple locations such as Station & RPF Thane,CCC and security control room).
8	Graphical User Interface Client Software	As per Clause no. 18.2 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.
	Storage Server	
9	Storage Device for 30 Days	As per RDSO Specification no. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 or latest with all amendments. Reputed Brand: IBM/Dell/HP or Equivalent.(Per camera License means Video recording at multiple locations such as Station, RPF Post & Security control,CCC and DC by same license) Each quantity in the schedule defines storage of 1 TB. Payment shall be made as per each TB storage provided by the tenderer .This includes supply, installation and commissioning of Hardware,Software and perpetual license and all the accessories required for installation. As per RDSO Specification no. RDSO/SPN/TC/65/2021 Revision 6.0, minimum 750GB for 2MP camera and minimum 3 TB for 8 MP camera along with all associated hardware, software and perpetual Licenses, etc is required for storage for 30 days. For A & B category station's cameras, internal Storage may be provided in Server itself. For D & E category station's cameras, external storage shall be provided at RPF post/Thana(List of RPF post enclosed). Better scheme can be suggested by Tenderer and the final decision will be taken by Railways.
10	Disaster Recovery Storage for 15 days Device	As per RDSO Specification no. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 or latest with all amendments. Reputed Brand: IBM/Dell/HP or Equivalent.

		Each quantity in the schedule defines storage of 1 TB. Payment shall be made as per each TB storage provided by the tenderer, This includes supply, installation and commissioning of Hardware,Software and perpetual license and all the accessories required for installation. As per RDSO Specification no. RDSO/SPN/TC/65/2021 Revision 6.0, minimum 750GB for 2MP camera and minimum 3 TB for 8 MP camera along with all associated hardware, software and perpetual Licenses, etc is required for storage for 30 days. Better scheme can be suggested by Tenderer and the final decision will be taken by Railways. At the Data center, Disaster recovery storage shall be provided for a minimum 15 days backup or higher for all cameras in a division. NIC card 1/10 G shall support input traffic from all RPF posts without any lag in recording.
11	Panic Button	As per Clause no 2.14 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. Panic Switch (IK10 and IP66 rated) with Mushroom Cap Push Button in Red Color, DPDT contact, Stainless Steel FacePlate with GI Junction Box of suitable size and flasher cum strobe of min. 100dB including fixing arrangements and suitable protection with all accessories required for installation on platforms at stations and buzzer and flasher at RPF Room.
12	Wireless Transmitter/ Receiver Unit	As per Clause no. 15.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.
	Next Generation Firewall	
13	Next Generation Firewall	Specifications are given in Para **3.2.1.1** .Reputed Make Sophos/Cisco/Juniper or equivalent at each DC.
	WORKSTATION and LFD	
14	Digital Keyboard (Joystick)	As per Clause No. 8.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.
15	PC Workstation	As per Clause No. 11 & 11.3 of RDSO Specification no. RDSO/SPN/TC/65/2021 of IP Based Video Surveillance System Revision 6.0 or latest with all amendments. including 24 inch 4K UHD LED Monitors with all accessories, all required Licensed software,(like Win OS,MS Office, Antivirus-total 3 years security),1TB External Hard Disk along with cable of Reputed make, Spike buster(minimum 5 nos. 6A points with fuse), 600VA UPS , Make IBM/Dell/HP or Equivalent.
16	Large Format Display Monitor	As per Clause No. 9.0 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. Make Sony/LG/Samsung or equivalent. Along with Cables, of sufficient length shall be supplied by the contractor to connect to PC Workstation,Remote controller,Including Supply Fixing of OEM mounting arrangements as per the site conditions shall be carried out by the contractor in consultation with the railway supervisor in-charge.
17	Video Wall 2X2 Matrix of 55 inch TV	Specifications are given in Para **3.2.1.2** Reputed Make Sony/Samsung/LG or equivalent at each Divisional & Zonal Security control Room of Divisions. Along with cables of required length for connecting PC Workstations. This Includes Supply and Fixing OEM mounting arrangements as per the site conditions shall be carried out by the contractor in consultation with the railway supervisor in-charge
Schedule B4: Switches and Accessories		
1	8 Port Layer 2 Managed POE Field Switch	It should meet the requirements as per Clause no. 14.0(III) of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. It should include the required OEM SFP BX SM Modules loaded and all the accessories required for installation.

		Note:-Switch Supplied should be of the latest model of any reputed make. OEM shall certify that service support will be extended upto completion of Codal life & AMC.
2	24 Port layer 2 Managed POE Switch	It should meet the requirements as per Clause No. 14.0(II) of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. It should have PoE 24 x 10/100/1000BASE-T ports and 4x 1G (Minimum) OEM BX SFP+ ports loaded. It should include the required OEM BX SM Modules loaded,Mounting Kit and all the accessories required for installation. Note:-Switch Supplied should be of the latest model of reputed make. OEM shall certify that service support will be extended upto completion of Codal life & AMC.
3	24 Port Managed Aggregation Switch	It should meet the requirements as per Clause No. 14.0(I) of RDSO Specification of IP Based Video Surveillance System Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. It should include the required OEM SFP BX SM Modules loaded,Mounting Kit and all the accessories required for installation. Note:-Switch Supplied should be of the latest model of reputed make. OEM shall certify that service support will be extended upto completion of Codal life & AMC.
4	Single mode 1 G SFP-BX (10 km) module	Specifications are given in Para **3.2.2.**For above switches Make shall be same as that of OEM of above Switches.
5	Single Mode 10 G SFP+ BX (10 km) module	Specifications are given in Para **3.2.3**. For above switches Make shall be same as that of OEM of above Switches.
6	1G Ethernet & E1 to Optical signal and vice versa Managed Media Convertor	Supply and Installation. As per clause option 2 and 3 RDSO Specification No. RDSO/SPN/TC/103/2013 Rev 2 or latest Specifications are given in Para **3.2.4** Note: Media Converter Supplied should be of Latest Model of Reputed Make & should have service Support upto completion of Codal life & AMC as certified by OEM.
7-9	Spares for Supply of switches	8% spares are to be provided for all the above mentioned switches as per schedule description
Schedule B5: FDMS, U Rack and Cables		
1	12 Fiber FDMS	Description is given in Para **3.2.5.1** Make(TVS,Veekay ,R&M or equivalent).The Fiber termination shall be tested and the test Report (Soft Copy) shall be submitted to the site Engineer for records. Each fiber shall be properly marked with necessary ferrules/tags.
2	24 Fiber FDMS	As per schedule Description Make(TVS, Veekay, R & M or equivalent).The Fiber termination shall be tested and the test Report (Soft Copy) shall be submitted to the site Engineer in soft copy for records. Each fiber shall be properly marked with necessary ferrules/tags.
3	Splicing/ Drooping/Termination of each fiber /Pigtail	Splicing /Drooping/Termination of each fiber /Pigtail in the LIU/FDMS/IO Box/Termination Joints through fusion Splicing of the termination of OFC Cables.The Fiber termination shall be tested and the test Report (Soft Copy)shall be submitted to the site Engineer for records.Each fiber shall be properly marked with necessary ferrules/tags.
4	Splicing/Termination of 24 Fiber OFC in FDMS(Splicing of 2 nos. of 12 Fiber/4 nos of 6 Fiber)	As per schedule Description
5	OFC patch cord 3 mtr	Description is given in Para **3.2.5.2** .Single Mode Patch Cord length 3 meters (LC-SC/SC-SC/LC-LC/FC-LC) as per site requirement. As per schedule description Make- 3M, TE Connectivity, R&M make or equivalent.

	U Racks	
6	19 inch 42 U Rack with 1200 mm Depth.	Specifications are given in Para **3.2.6.** Each rack should be supplied and fixed with 2 Mtrs Steel Cable tray of 150 mm width 1.5 mm thick along with all the bends,fitting required to fix on wall/ceiling/Rack along with all accessories required for installations as per site requirement. Rack make shall be similar to Euro/President/HCL/Netrack/Rittel or equivalent.
7	19 inch 9 U Rack	19" 9U Rack Wall/Pole Mount ,with all accessories Like Electrical fitting, Fan Tray, Patch Panel, Cable Manager, PDU .Specifications are given in Para **3.2.7 .**Rack make shall be similar to Euro/President/HCL/Netrack/Rittel or equivalent.
8	19 inch 6 U Rack	19" 9U Rack Wall/Pole Mount ,with all accessories Like Electrical fitting, Fan Tray, Patch Panel, Cable Manager, PDU .Specifications are given in Para **3.2.8.** Rack make shall be similar to Euro/President/HCL/Netrack/Rittel or equivalent.
9	Smart Server and Networks Racks with Accessories and PDU.	Specifications are given in Para **3.2.9 including** Supply, installation and Commissioning of 48V SMPS based FR-BC charger with N+1 configuration of 25 Amp basic SMR module equipped with 50 Amps, as per Spec. No. RDSO/SPN/TL/23/99 Ver.4 or latest. Inspection RDSO and VRLA Batteries Bank of 48V, 200AH capacity in charged condition as per technical specification and as per RDSO specification No. IRS: S-93 /96A (with latest Amendment).Inspection RDSO **One Item includes 3 nos of rack of the above mentioned specification.** 3 Nos Rack make shall be similar to the model of Rittel/WQ INDIA or Equivalent.
	CABLES	
10	STP CAT- 6 Cable	It should meet the requirements as per Clause no. 17.1 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. Shielded Twisted Pair (STP) Strengthened outdoor CAT-6 cable. 4 twisted pairs, solid bare copper, diameter of 23 AWG, Ethernet speed of 1000Mbps, support PoE of all classes, maximum DC resistance 100 Ohms/Km. jacket should be PVC & lead free, Cable Compliant with EIA/TIA-568-C.2 standard for CAT 6, cable of 305 Mtrs length in box or roll .Shield should be earthed.Make -D-Link/Finolex or equivalent
11	12 Core Outdoor Unarmoured Optic Fibre Cable	Specifications are given in Para **3.2.9.1** as per latest TEC Specification (Make Finolex, Fincabe, ASKH, Sterlite or equivalent)
12	PVC insulated Armoured 3 Core 2.5 Sq Mm Power cable	It should meet the requirements as per Clause no. 17.3 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. It should be PVC insulated armoured 3 core 2.5 Sqmm, 1.1 KV Grade outdoor strengthened copper for UPS Power Supply,Distribution. a.Outdoor Strengthen Copper Confirming to IS:1554 Part-1. It should be BIS/ISI Standard (Make:Finolex , Fincabe or equivalent)
13	6 Core Armoured Single Mode OFC cable	The 6-core single mode optical fiber cable (OFC).The cable should be armoured. This should be of reputed Make and shall comply Standards i. ISO: 11801 ii TEC specification 85010:2003 Mechanical & environmental Characteristics i. Operating Temperature: -20 deg C to +60 deg C ii. Storage Temperature: -40 deg C to +60 deg C iii. Jacket Material: LSZH / HDPE.shed (Make: Finolex ,Fincabe ,ASKH, Sterlite or equivalent).
14	CAT 6 UTP Patch Cord-2 Mtrs	UTP CAT 6 Cable, cable jacket low Smoke zero halogen (LSZH), conductor dia 23 AWG, confirming to ANSI/TIA/EIA- 568-C.2 Make.D-Link or equivalent

15	CAT-6 UTP Patch Cord-5 mtrs	UTP CAT 6 Cable, Cable jacket low Smoke zero halogen (LSZH), conductor dia 23 AWG, confirming to ANSI/TIA/EIA- 568-C.2 or latest.Make.D-Link or equivalent
16	RJ-45 Connector	RJ-45 modular plug supports 4 twisted pairs, 8 positions, 8 connectors of 100 pcs/Pack. transparent color. Contact Terminal: Copper Alloy. Finished: 03 MU microinch gold plating. Use for 23-26 AWG stranded wires, meet wiring scheme T568A/T568B. It should be suitable for STP/UTP CAT-6 cable as per field requirements.Make.D-Link or equivalent
Schedule B6: Power Supply		
	Power Supply	
1	2 X 10 KVA UPS	Specifications are given in Para **3.2.10.** Make (APC/Numeric/TataLiebert/Emerson libert makes or equivalent) This also includes supply of two set MF battery of suitable AH capacity of make Exide/Amaron/Tata green or better, Rack and one set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement of Make: Havells,Anchor or similar
2	3 KVA UPS	Specifications are given in Para **3.2.11.** Make(APC/Numeric/TataLiebert/Emerson libert makes or equivalent) This also includes supply of one set MF battery of suitable AH capacity of make Exide/Amaron/Tata green or better, Rack and one set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement of Make: Havells,Anchor or similar
3	2 KVA UPS	Specifications are given in Para **3.2.12.** Make (APC/Numeric/Tata Liebert/Emerson libert makes or equivalent)
4	Surge Protection Devices	Specifications are given in Para **3.2.13.** Supply and Provision of indicative type Surge Protection Device, with Potential Free contacts as per RDSO Spec. No.RDSO/SPN/165/2012 (Ver.3) or latest (Lightning and Transient surge protection for power line). The system shall have stage1 (class B) and stage 2 (class C) type against Lightning electromagnetic Impulse configuration. The protection of Type 1 and 2 against Lightning electromagnetic Impulse (LEMP) and other high surge, shall be provided at the incoming of the power line before the power equipment as per the instructions of Engineer incharge at site. (OBO, DEHN, PHOENIX, LPI or better make. All other miscellaneous materials required for installation shall be supplied by the contractor.
5	Ethernet Surge Protector	Specifications are given in Para **3.2.14**
6	ACDB for AC Distribution Box	ACDB for AC Distribution Box with Lock and Key arrangement and it should include supply and installation/fixing of ISI Mark MCBs of Various Rating and protection devices as per site requirement included all parts of this item. It shall have an enclosure with IP67 rating.
Schedule B7: Tools		
	Tools	
1	OFSM	Optical Fusion Splicer Machine along with carrying case and accessories As per description in Para **3.2.15**
2	OTDR	Optical Time Domain Reflectometer along with carry bay and accessories As per description in Para **3.2.16**
3	Network Cable Tester (LAN Tester)	Along with carry Bag and accessories.Specifications are given in Para **3.2.17**
4	Tool Kit	Tool Kit bag or case consisting of 1) Optical Power Meter(Fibershot 9990V) or Equivalent, 2) Multimeter(Fluke 101) or Equivalent, 3) Ethernet Crimping Tool(Standard Make) 4) Console cable(Cisco=RJ45-DB9) or Equivalent , 5) Wrist Ripper(Standard Make), 6) Universal Spanner Set(Taparia) or Equivalent, 7) Screw Driver Set(Taparia-7Pieces set) or Equivalent,

		8) Cutting plier(Taparia) or Equivalent 9) Wire Stripper(Taparia) or Equivalent. 10) Industrial grade standard USB to Serial converter cable.
Schedule B8: Labour and Training		
	Fire Alarm & Detection	Following items should be supplied and installed.
1	Automatic Fire Detection and Alarm System	a) It should be a microprocessor based modular type panel with networking features. b) It should have in built display, charging facility and provision include GSM and LTE suitable module to send SMS to configured mobile numbers c) The panel should be equipped with sufficient nos of loops and provision of expendability as per RDSO specification No.RDSO/SPN/217/2016 ver 2.0 or latest. d) The control panel shall be the central processing unit of the system receiving and analysing signals from probe type bimetallic heat detectors, UV & IR flame detectors, Heat and smoke multi sensors, LHS interface and manual call points, providing audible and visual information to the user. e) The panel shall have provision of connectivity of TCP-IP suitable for programming and remote monitoring through ethernet port. f) The panel shall have dedicated RS232 (or latest) serial port for direct PC or MODEM connection, for interfacing with existing data logger optional remote printer. g) The equipment should be as per RDSO specification no. RDSO/SPN/217/2016/Ver.2.0 or latest.
2	Heat and Smoke Sensor	a) The Heat and Smoke multi sensor should be resettable, and compatible with analogue addressable protocol. b) The sensor should show its status on the control panel and also on itself using LED lights. c) It should follow the specification and testing specified in clause 4.3 RDSO Specification No. RDSO/SPN/217/2016 ver 2.0 or latest.
3	Call Point	a) It should have an LED indication for alarm condition and normal operation. b) It should be easily resettable with a reset key and compatible with analogue addressable protocol. c) It should be rated IP55 or above. d) It should follow the specification and testing specified in clause 4.12 RDSO Specification No. RDSO/SPN/217/2016 ver 2.0 or latest.
4	Sounder Beacon	It should be compatible with analogue addressable protocol. It should follow the specification and testing specified clause 4.10 in RDSO Specification No. RDSO/SPN/217/2016 ver 2.0 or latest.
5	Fire Survival Circuit Integrity Cables	FRLS/ Fire Survival circuit integrity cables shall be used for data and power connection for all fire alarm devices. It should follow the specification and testing specified clause 4.10 in RDSO Specification No. RDSO/SPN/217/2016 ver 2.0 or latest.
6	Fire Extinguisher	It should be a 4.5 kg or more CO2 type Portable, lightweight, Fire Extinguisher suitable for class 13 B/Electrical fires. It should have an operating temperature Range of -20 to 55 degree celsius. It should be easily operable and should be supplied along with wall mount type and discharge pipe with 1 meter length or higher.It should satisfy IS 2878 : 2004.And should be fixed at suitable location as desired by the Railway.
	Earthing	

7	Maintenance Free Earthing	As per RDSO Specification No RDSO/SPN/197/2014 version 1.0 or latest with latest amendment.The complete layout with dimensions of the Earthing & bonding system shall be submitted by the contractor after commissioning. The supplier shall be responsible for complete supply, installation & commissioning of the earthing & bonding system upto Equipment Rack.All the materials required for installation and connecting of earth from earth pit to the Bus Bar of Equipment Room is including like Earth Strip,Cables,Earth Chambers,Nut Bolts etc. The warranty of such a system shall be 60 months from date of commissioning. During this period, any failure of the earthing system due to improper materials & bad workmanship shall be attended free of cost by the supplier.To be installed at DC,DR,RPF Thane,OFC Huts & Stations. Specifications are given in Para **3.2.18**
8	GI Pipe (50 mm dia 3.65mm thick)	GI Pipe (50 mm dia 3.65mm thick) as per IS-1239,Part I,Medium Grade,including couplers for laying of Cable to the Platform shelter from ground level. Entry of cables will be advised by the site in charge of the Railway and extended by suitable dia HDPE/Flexible PVC Pipe on either side as required as per site requirement this includes making of bottom foundation and required clamps for fixing and accessories as per site requirement .
	Furniture	
9	Furniture At each workstation	Desk type table one number with two revolving chairs shall be supplied for each RPF post and data center. Control Command Center shall be provided with two tables (Modular in shape) and four revolving chairs. Sample photo is given as per Para No. **3.2.19**
	Outdoor Networking	
10	35 mm Flexible Pipe	Flexible steel wire reinforced pvc Pipe (This includes all materials, clamps etc required for laying, fixing and clamping) is part of this item.
11	35mm PVC Conduit pipe	35 mm PVC Conduit Pipe ISI Mark Clamping the same on wall, pole etc with required clamps, bends, elbow, couplers, flexible pipes and all other installation material as required is part of this item.
12	PLB HDPE Duct	PLB HDPE Duct of Size 40/33 mm dia along with all Accessories required for fixing, Clamping Cutting, on Wall or Structure/in Trench/HDD etc. as per RDSO Spec No RDSO/SPN/TC/45/2013 Rev 2 .
13	Trenching and Laying of HDPE Duct	Excavation of cable trench in all kinds of soil including clearing of roots of trees, rocks, bushes etc. to a depth of 1.0 Mtrs and to a width of 0.3 Mtrs.Laying of telecommunication and power cable in HDPE Duct. Refilling of cable trench 1m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.
14	Fixing of cameras at station	Bracket/Fixture/Angle is to be supplied and installed for fixing of Cameras at Stations along with all the required accessories. The design of Bracket/Fixture/Angle shall be approved by Railway engineers. Bracket/Fixture/Angle should be isolated from platform shelter/poles etc through insulators.It includes all the accessories required for installation. Tentative design is shown in the picture given **3.2.20**
	Survey, Design and Planning	
15	Documentation/Survey:	The following documents or as specified by the Railway shall be supplied along with the system: i) Schematic Diagram and conducting of Survey . ii) Survey of Station for planning of VSS/IP MPLS/TCCS and submitting of plan for required approvals in required format in required number of copies.

		iii) Designing, Planning of network topology, Migration of Existing Circuits, IP address scheme over SWR, configuring and programming myriad of devices to communicate, configuring the applications iv) Installation and Maintenance Manual v) Operating and troubleshooting manual vi) System commissioning report consisting of complete network diagram of IP MPLS,TCCS,SIP Exchange,Video Surveillance system, Cable route plan, Control/Equipment room layout diagram and Station layout diagram in six sets hard copies and cable tested parameters in soft copy. viii) **Preparation and submission of As made drawings** mentioning the location of cameras, wiring diagrams of UTP, Power, OFC cable etc., OTDR reports of OFC cable, earth resistance test reports, technical details of servers, switches, works stations, media converters, storage etc, of each station. Six copies in neat bound form are required to be submitted. vii) Any other plan required by railways ix) The contractor has to arrange the Road Vehicle/SUV to the use of the Railway Officials for a period of 60 cumulative working days, with a minimum one day period or more days as per site requirement. Necessary Diesel/Petrol & Repairs, Toll etc if any shall be borne by the contractor. viii) The physical location and the site requirement has to be taken into consideration while conducting the site survey. Survey has to be carried out for all the above works to assess actual requirement of site and planning of placing the Cameras,Router,Servers,Racks, Equipments, cables etc.The contractor shall depute adequate number of competent Engineers/qualified staff to survey, install, test and commission the equipment/system at site.
	Cable Trenching & Drawing.	
16	Blowing / Drawing of cables through PVC conduit	Blowing / Drawing of OFC 24F/12F/6F/ Switchboard telecom cable, CAT-6 and Power Cable etc (including crimping and termination of copper cables) through PVC Conduit already installed. OFC should normally be blown through the ducts by blowing through machines; drawing may be adopted in short lengths as decided by the site engineer.
17	DWC Pipes(OD/ID 90/76 mm minimum)	Non flammable, anti-rodent DWC Pipes(OD/ID 90/76 mm minimum)as specification IS 16205 with T Joints, sockets/couplers at both ends as per requirements. Supply of non coupler for 6m of DWC pipe and couplers for suitable length free of cost .
18	PVC Trunking of 50X50 mm or higher with cover of 2 mm thick and 2 mtr length	With all the accessories like bends,couplers and clamps etc.As given in the Schedule description.Similar to legrand make trunking
19	PVC casing/ capping	As per schedule description
20	Fixing of PVC casing/ capping	PVC Casing Capping (2")with cover fixing /laying materials and all accessories as per requirement. (This includes all materials like bends, couplers, clamps, flexible pipe etc required for laying,fixing and clamping, crimping and termination of CAT-6/switch board cable.)

21	RCC Route Markers	Supply, transportation and installation of RCC Route Markers including Painting.The lettering on the cable marker shall be as per the instructions of the Railway representative at site. The cable markers shall be provided at an interval of 20 Mtrs. within station limits and 50 Mtrs. outside station limits throughout the cable route, diversions and also at every track/road/crossing. Concrete Cable markers are projected above the surface level at least 300mm. As the concrete cable markers are visible from the long distance. They shall be of standard RCC with letter SWR/Tele. engraved and suitable painted, with body in Orange, Letters Engraved : White. The letters shall be of about 75mmx 35 mm size. For Telecom the lettering shall be SWR OFC or SWR Quad or SWR OFC & Quad as the case may be. As per drawing enclosed in this document **3.2.21** using 1:3:6 mortars with Concrete Markers.
22	Breaking of Pucca/Concrete road/ Platform	Breaking of Pucca/Concrete Road or Platform Cutting (15 cm depth) and laying of OFC/Telecom/Power/STP cables etc in Trenches and through all types of protection like HDPE/GI/RCC/DWC Pipes as the case may be .This includes refilling of trench and restoration of surface and stone paved
23	Horizontal Boring & Trench	Track/Road crossing by using Horizontal Boring method. Including laying of HDPE OFC duct along with Signaling/Telecom/Power cable under the Track /Road. OFC duct 40/33 dia 3.5mm thickness HDPE PLB pipe is to be supplied by the contractor.
24	Supply and erection of pole for camera installation	15 Feet GI pipe of 4"dia of medium quality ISI no :1230(Part 1) 1990 is to be provided for the fixture and Having iron base plate 10 mm thick x 30 cmx 30cm welded at the bottom of the pipe with four supports of iron bars of sizes 10 mm dia. The 3 feet pipe shall be buried in the ground and 12 feet shall be above the ground. The work includes digging a pit on the platform , laying of cable in between poles in suitable underground GI pipes, erection of the pole and filling the pit with 1:3:4 cement, aggregate and sand. Final plastering should be done on the surface. The iron bracket on the top of the pole shall be provided to fix the CCTV camera and junction box. The work includes supply of all the materials required in this item. It includes supply of camera shelter to prevent it from rain water ingress. As shown in sketch Para No **3.2.22**
25	Ladder	12 feet or higher self supported foldable step Ladder:The 12 feet ladder supplied shall be made from high tensile aluminum alloy C section and step flat corrugated aluminum section.Distance between two steps 12” centre to centre or higher Platform size 16” X 8” or better Steps are made from anti slip aluminium 62 MM wide steps or better Size of section- 2.5/8” X 1.1/4” X 1/8” (10 gauge) (66mm X 32 mm X 3.15mm) or better
	Training	
26	Training	Onsite or OEM factory training (as decided by Railway Authority) shall be provided to the Railway Officers/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, as per the tender schedule. Sets of training manual in two hard copies and two Soft copies containing details of technical specifications, installation and commissioning, troubleshooting & maintenance schedule etc. or as specified by the Railway shall be supplied along with the equipment. Training will include all IP MPLS routers, VoIP based control communication, SIP exchange and VSS module. Training at OEM Factory should provide Boarding and Lodging facilities for trainees as part of training.

3.2.1.1 Schedule B3 Item 13: Next Generation Firewall

Supply Installation and Commissioning of Firewall along with Management Software,License and Hardware and all accessories required for their installation in Data Centers/ any other locations. It should be in 1+1 (HA) configuration with common licenses or licences for both in Active/Passive from day one with automatic takeover. Similar HW appliance with 4x1 GE Ports or more and 4x10 SFP+ Ports with modules loaded, 2 Expansion bays or more/ optional Flexi port modules, 2xSSD+Base license for both the system (incl. NGFW,IPS,AVC, VPN and wireless etc)+ power cable along with UTM license with 5 year subscription for 3000 Users.

Firewall should have following feature enabled from day one without any additional expenditure :

a) Proposed firewall solution must act like an AAA server or should have features to integrate with external AAA servers, because outbound ACLs will be configured based on Identity. Users must have the privilege to change their password through a self service portal and see their upload/download data on a daily basis.

b) Granular traffic shaping features should be available which can be applied on Web traffic, Application traffic, Firewall rule and User/Group based.

c) Proposed firewall should allow admin to set Quota in MB/GB for amount of data in periodical manner such as daily/weekly (this clause is Optional) and Firewall should support creating access-rules with IPv4 & IPv6 objects, user/groups, application, geolocation, url, zones, vlan, etc.

d) Proposed firewall must verify MAC/IP address with IP allocated to user to mitigate IP-MAC Spoofing. It must provide IP/ MAC address spoofing.

e) Proposed firewall must verify username with user's MAC address/username / IP address to strengthen authentication process and allow only authorized, verified user's machine.

f) Should be capable of dynamically tuning IDS/IPS sensors (e.g., selecting rules, configuring policies, updating policies, etc.) with minimal human intervention.

g) Firewall should have million or higher URL in more than 75 or more categories

Sl.N	Item	Description
1	Dimensions	19 Inch Rack Mountable with Mounting kit
2	NGFW/Firewall Throughput(FW+IPS)AVC in same or higher throughput.	30 Gbps or Higher
3	IPSec VPN Throughput	12 Gbps or Higher
4	IPS Throughput	30 Gbps or Higher
5	Antivirus Throughput (Proxy)/Hardware Encryption	7 Gbps or Higher
6	Concurrent Connections	>17,000,000 (17Million)
7	Maximum Licensed users	Unrestricted
8	NGFW Firewall IMIX enterprise throughput	37 Gbps or higher
9	Firewall Latency	4 µs or less
10	Ethernet interfaces included	10G GbE SFP+ fiber port (4 Nos), GbE copper(4 Nos) Or More.Includes Supply and installation of Transceiver SFP Modules & adapter along with Firewall.

11	No of Flexi/Expansion Ports	2 or more
12	Management ports	X RJ45 MGMT,1 x COM RJ45, 1 x Micro-USB (cable incl.) or equivalent.
13	Features/Services	I. Intrusion Prevention System with minimum 7000+ signatures or more II. Anti-Spam Prevention III. Bandwidth Management(optional) IV. Traffic Discovery Application V. Load balancing/ load sharing VI. Inter-VLAN routing VII. Network and threat reporting VIII. Deep-packet inspection IX. It must support preferable concurrent connections up to 17,000,000 or more. Firewall appliances should handle new connections/sec: 2,00,000 or higher. X. Real Time threat protection like Phishing attacks, malware, ransomware, botnet etc. XI. Support of VPN (Virtual Private Network) XII Should support traffic/packet analyzer based on IP address. XIII Proxy features / URL filtering proxy and Any additional or equivalent features /services.
14	RAM	32 Gb DDR4 or Higher
15	Storage	2X min 500 Gb SSD/(SW RAID-1) or higher
16	Power supply	Redundant power supply with hot swappable fans
17	Operating Temperature and Humidity	0°C to +40°C or higher and 5% to 90%, Non-condensing
18	Mounting	Mounting Kit & sliding rail should be supplied along with firewall
19	Warranty and License	5 year subscription, Minimum for 3000 users license.With free security updates/upgradation/patches support of softwares during the warranty period.Model supplied should be latest.
20	Certifications	CB,UL,CE,FCC,BIS or equivalent by any approved labs/agencies by Govt of india.

3.2.1.2 Schedule B3 Item 17: Video wall

Supply,fixing, Calibration, installation and commissioning of Video wall at security control, It shall of latest model, Smart , narrow/less Bezel Video wall for live streaming of cameras from Stations on each/ full or selectable matrix and play back recording of Cameras feed from server with the following specifications:

Video wall displays should have thin bezels (<0.44mm)/ Bezel less. It should provide a wide viewing angle. The screen should have 500 NIT brightness or more , non glare panels and 24/7 reliability. Display should be factory calibrated and meet the industry standards, EMC class B compliant and ISTA-6 certified. Daisy-chain connectivity should be present.This includes Supply, fixing installation, testing Commissioning of 2X2 Video Wall of 55 inch (4 no.s of 55'' TVs)along with all the softwares, accessories like cables, Brackets/Stands etc if any additional hardware is required for installation & commissioning it has to be supplied along with Video Wall. The cost includes supply of Brackets/Stand and fixing of TV on wall or Floor mounting as per site requirement.

Panel	Diagonal Size	55 inch
	Resolution	Full HD or Higher
	Pixel Pitch (mm)	0.63mm(H) * 0.63mm(V) or better
	Active Display Area	1209.6 * 680.4mm or higher
	Brightness(Typ.)	Min 500 nit or higher
	Contrast Ratio (Typ.)	1100:1 or more
	Viewing Angle(H/V)	178 Degree or higher viewing angle with image gap reduction.
	Response Time (G to G)	less than 8ms
	Display Colors	8 bit - 16.7M or higher
	Color Gamut	72% or better
	Haze	28% Non Glare panel or higher
	Backlight Lifetime	10000 hours or higher
	Calibration	Automatic colors & brightness or smart Calibration
	Operation	24x7
Display	Dynamic C/R	30,000:1 or higher
Connectivity	INPUT	
	RGB	DVI-D, DisplayPort 1.2 or higher -2 Nos
	VIDEO	HDMI 2.0 (2 numbers) or more
	HDCP	HDCP 2.2
	AUDIO	Stereo mini Jack
	USB	2 Nos or more or any other ports
	OUTPUT	
	RGB	DP1.2(Loop-out)
	VIDEO	N/A
	AUDIO	Stereo mini Jack or any other ports.
	Power Out	N/A
	Ethernet	RJ45-(2)
Mechanical Specification	VESA Mount included	as per OEM specified Standard mount.OEM Mounting Structure with automatic alignment for ensured precision.
	Bezel Width (Top/Side/Bot) (mm)	0.44mm (Even) or Bezel less
Softwares/Licences	Included	All the Required Operating & Application Softwares/Perpetual license included along with supply for efficient working of the system.
Redundant Hot-swappable Power Supply(External)	Optional	Yes(optional)
Panel Automatic Maintenance	Optional	LCD Panels shall be equipped with built in/eternal sensors,permitting the brightness level of each LED Back light to be controlled and adjusted automatically.
Certification	Special	ACM Support(Advanced Color Management), Auto Source Switching & Recovery, Haze 28% or better, Temperature Sensor,RJ45 MDC,Plug and Play (DDC2B), Video Wall(15x15(OSD)), Video Wall Daisy Chain(10x10), Pivot Display, Image Rotation, Button Lock, DP 1.2 Digital Daisy Chain(Supporting UHD Resolution, HDCP support), Smart F/W update, Clock Battery, IP5X tested, EMC,CE,CB,UL,BIS,EMC Class A/B or equivalent
	IP rating	IP5X

Hardware	Matrix Controller(optional) and accessories.	If functionality is in-built, then a separate Matrix controller is not required. If required this is included in the supply and installation along with all accessories for 2x2 matrix
Accessories	Included	Quick Setup Guide, Warranty Card, DP cable, stereo to DB9, LAN ,HDMI,USB Cable etc, Power Cord, Remote Controller, batteries, Brackets/Stand/Screws,Manuals.External IR and all the accessories required for installation etc.
It should work with WorkStation PC through HDMI or LAN Port or any interface.Supply,Installation,Testing and commissioning Hardware/Software/Cables/accessories required should be supplied as part of this item.		

3.2.2 Schedule B4 Item 4:Single mode 1 G SFP-BX (10 km)

All SFPs should be bidirectional single Fiber.

SN	Description
1	SFP modules should comply with multi-source agreement (MSA), enabling compatibility with other vendors' equipment.
2	Should support 10 km optical distance on single fiber
3	Should have an LC type connector or as per site requirement
4	Should provide in Pair (BX U & D).One Switch should have BXU other should be BXD
5	Should have 1 Gigabit Ethernet capacity on single mode fiber.
6	Should support DDMI/DOM features. Option should be available for SFP+/XFP
7	OEM should be having valid ISO 9000 & ISO 14000 certification on the date of opening of bid.
8	Should have CE and FCC regulatory compliances.
9	Operating Temperature of the SFP Should be mini 0 to 65 °C (23 to 149 °F)

3.2.3 Schedule B4 Item 5: Single Mode 10 G SFP+ (10 km)

SN	Description
1	SFP modules should comply with multi-source agreement (MSA), enabling compatibility with other vendors' equipment.
2	Should support 10 km optical distance (1550/1310 nm).
3	Should have LC type connector or as per field requirement.
4	Should provide in Pair (BX U & D).One Switch should have BXU other should be BXD
5	Should have 10 Gigabit Ethernet capacities on single mode fiber.
6	Should support DDMI/DOM features. Option should be available for SFP+/XFP
7	Should be having valid ISO 9000 & ISO 14000 certification on the date of opening of bid.
8	Should have CE and FCC regulatory compliances.
9	Operating Temperature of the SFP Should be mini 0 to 65 °C (23 to 149°F)

Note: All SFPs must support DDMI/DOM feature & should be of same make as OEM of Router/switch /Reputed Make

3.2.4 Schedule B4 Item 6: 1 Gbps Ethernet & E1 to Fiber Managed Media Convertor

It should meet the requirements as per clause option 2 and 3 RDSO Specification no. RDSO/SPN/TC/103/2013, Rev 2.0 or latest with all amendments.

- Single channel triple speed, stand alone media converter
- Complies to IEEE, IEEE802.3z
- Media Conversion from 100/1000 Base-T to 1000Base-FX
- Auto MDI-I/MDI-X copper Ethernet port
- RJ-45 connector for 1000Base-T port
- E1 Interface as per ITU-T G.703, G.704, Line rate 2048 kbps, Impedance 120 ohms balanced, RJ-45 connector.
- SC connector for 1000Base-X fiber port
- Supports upto 10K jumbo frame @1000Base-T
- Transparent Pass through Tagged & untagged data traffic
- Supports Copper FEF Indication.
- Supports Fiber FEF Indication.
- DIP switch configuration for enabling LFP
- Link/ Activity, LFP/FEF LED indications
- Single fiber support
- LFP (Link Fault Pass through) allows the fiber failure to be propagated to the copper port and vice-versa

3.2.5.1 Schedule B5 Item 1: Fiber Distribution Management System (FDMS) 12/24 F

The FMS should be confirming to RDSO specification No.RDSO/SPN/TC/37/2020 However, the FMS should have the following:

a. It should be mountable in standard 19" rack and of slider type.
b. There should be an arrangement of termination of 48/24/12/6 Nos. of fibers (as per SOR).
c. It should be supplied with 48/24/12/6 Nos. of pigtails of respective type of connector of minimum 3 meter length.
d. Colour coded pigtails (µn tight jacket) shall be provided for easy identification.
e. The FMS should be supplied with arrangement of required Nos. of adapters (as per SOR).
f. The adaptors shall be fixed in such a way that these shall be easily accessible protecting the eye from direct exposure to laser.
g. There should be a nos. of trays or as per site requirement for the provision of termination of the fibers & sufficient space for routing of the fibers in the trays.
h. Trays shall be numbered bottom to top (tray no. 1 is lower most).
i. Pigtails shall follow tray numbering.
j. Pigtails shall be labeled through colour coding/ferruling.
k. Adaptors shall be numbered Bottom to Top or Left to Right in ascending order.
m. All adaptors shall be provided with dust protection caps.
n. Important Do's and Don'ts about the operation of the FMS shall be clearly indicated at a convenient place on the FMS.
o. Insertion Loss: ≤ 0.3 dB or less
p. Return Loss: ≤ 45 dB or less
q. The FMS shall be manufactured as per latest state of art technology.
r. The FMS shall be protected against the entry of dust and insects, rodents etc.
s. Body should be of MS steel; powder coating painting (min. 70 micrometer thickness) shall be provided with rust resistance paint.
t. Marking: The marking on the system shall be indelible and following minimum information shall be provided by way of engraving or Laser printing method:
    i. "SWR" should be written on each FMS to be visible from front.

ii. Manufacturer's name & date/ year of production.
iii. Model No./Batch No./ Serial No.
iv. Capacity i.e. No. of cables and the fibers.
v. Identification details/ cables/ Fiber/ labelling facility.

u. Preferred type of connector is SC/APC for all connectors.

3.2.5.2 Schedule B5 Item 5: OFC Patch Cords:

The Patch cords should be 3 meter length conforming to TEC NO.: TEC/GR/TX OFJ- 01/05/NOV-09 or latest with all amendments. However, the Patch cords should comply the following:

S. N	Parameter	Value
A	Operating Temperature	-40ºC to +85ºC
B	Insertion Loss:	
1	Insertion Loss of complete patch cord including adapter when tested from each direction in all conditions of operations	≤ 0.3 dB
2	Insertion Loss of Adaptors	≤ 0.1 dB
C	Return Loss for each connector of patch cord:	
1	Type-I FC-PC	≥ 50 dB
2	Type-II SC-PC	≥ 50 dB
3	Type-III SC-APC	≥ 65 dB
4	Type-IV LC	≥ 50 dB
5	E2K/APC	≥ 60 dB
D	The length and type of connector of each Patch Cord	As per SOR.
E	The connectors must be make of reputed OEMs 3M, Huber-Shuner, R&M, TE Connectivity/Raychem any other CACT approved Manufacturer/s having a valid approval against Specification number TEC/GR/TX/OFJ-01-NOV.09 for the tendered connected type.	
F	Connector Body	
1	FC-PC	Ni plated brass body (Ni plating shall be as per BIS Standards)
2	SC-PC & SC-APC	Engineering thermoplastic (Glass filled PBT:Polybutylene Terephthalate)
3	LC	PEI (Polyetherimide)/ PPS (Polyphenylene Sulphide)
G	Colour of connector body	
1	FC-PC connector	Ni plated Brass
2	SC-PC connector	Blue
3	SC-APC connector	Green
4	LC connector	Blue
H	Radius of curvature	
1	FC-PC	10 to 25 mm
2	SC-PC	10 to 25 mm
3	SC-APC	5 to 12 mm
4	LC	10 to 25 mm

3.2.6 Schedule B5 Item 6: 19"42 U 800 mm width X 1200mm depth Rack

SN	Description
1	Racks manufactured out of steel sheet punched, formed, welded and Powder coated
2	Rack should be from ISO 14001 ,27000 Certified Company & UL Listed
3	Standard for Racks configuration will be welded frame with side panel and vented top cover
4	Rack should have Front Transparent Door and Dual Perforated door at Rear.
5	Rack should have 2 no's of removable side panel with slam latch.With key & lock arrangement. With key & lock arrangement.
6	Rack should have provision to mount racks on Floor
7	Rack should be 42U (1U = 44.45 mm) in Height.
8	It should be 800mm width and 1200MM Depth
9	Rack should include adapter kit 1 no (loop type) and rack mount sliding rail for mounting of servers.
10	The Rack unit supported by casters static load of at least 350Kgs and by Levelers should support a static load of at least 750Kgs.
11	Rack should have Minimum IP 20 certified and Conforms to 310 DIN 41494 or Equivalent EIA /ISO / EN Standard
12	Rack should have Adjustable mounting depth
13	4 No.s of Adjustable, 19" verticals with Punched 9mm Square Hole and Universal 12.7mm-15.875mm-15.875mm alternating hole pattern offers greater mounting flexibility, maximizes usable mounting space.
14	Rack should have Numbered U positions,
15	should have 100% assured compatibility with all equipment's conforming to DIN 41494 (General industrial standard for equipment)
16	Powder coated finish with seven Tanks pre treatment process meeting IS
17	Rack should have Proper Grounding & Bonding
18	Rack should have Fan module Mount Provision on top Cover
19	Rack should have Fan tray with 4 no's 90 CFM Fan
20	Rack should have 1 No Fixed shelf with 715mm depth for mounting NON Rack mountable Equipment & 1 No Sliding Keyboard Tray.
21	Rack should have Server /IT Rack Mount 2 Nos Power Distribution unit, 1Ph, 230V, 8A, 50/60Hz, 2U standard with 8 X Intel Multi Pin 5A, Inlet Plug type 6A Indian Round Pin, 6A Fuse - PDU Rating 1.8KVA/Side or higher feed-1.5Mt/ Black
22	Rack should have 2 No Horizontal Cable & 2 No Vertical Manger/Organizer with Plastic Loops.
23	The earthing kit consisting of copper bus bar with dimensions 20 inch length, 1.0 inch breadth & 5 mm thickness (min.) having appropriate number of M6 tapped holes and 3 brass nut bolts and washers for fixing of earthing cables shall be fixed near the bottom of the rack
24	Rack should have PIS:1554 Part-1.provision for cable entry Exit from Both top & Bottom.
25	INDIAN RAILWAYS Logo along with Year" in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color
26	Rack should have 1 Packet of mounting hardware, Pack of 20 or more.
27	Supply and fixing of Metal Cable tray of 150 mm width and 2 meter length along with all accessories required for fixing from Rack to MDF with laying and bunching of cables neatly,Rack all Doors should be removable type four exhaust fans, Server's mounts and channel, KeyBoard tray, one Horizontal Tray, one AC Multiple (8 Nos of 5A sockets) Earthing Strip (Copper)-1 with Fasteners- 2 Pac.

3.2.7 Schedule B5 Item 7: 19" 9 U Rack 600 X 600mm Depth Rack (Wall/Pole Mounted)

SN	Specification	Description
1	Type	Closed Telecom Rack Wall/Pole mounted
2	Dimension	9 U 600mm (Width)X 600 mm (Depth)
3	Mounting	Rack should have Wall/Channel/Beam mounting with heavy brackets and fasteners of required shape and size as per site condition. It shall be insulated from the wall/ channel/beam/ shelter through insulators.
4	Front door	Rack should have front door tough and transparent glass fitted on MS/CRCA sheet on sides with Lock and key.
5	Rear door	MS/CRCA Door Plain having ventilation holes bottom side with dust filters.
6	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
7	Fan module	Compact Fan Module of 90 CFM working on 230VAC 2 Nos.with each Rack properly fitted at top of rack.
8	Earthing Provision	Rack Should have earthing provisions.All the required materials for earthing is to be supplied with Rack.
9	Cable manager	1 No .horizontal and 1No.vertical cable manager with cable loops to be provided with each rack and Patch panel.
10	Power Distribution Unit (PDU)	PDU is of 6 Sockets of branded make such as Havells or equivalent with 6 Amp MCB .
11	Materials used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
12	The rack should be fitted with one modem tray19”. Back side of the rack should be closed with a removable panel.	
13	The good quality powder coating light grey in colour shall be used for painting of the rack.	
14	“INDIAN RAILWAYS LOGO along with Year” in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color.	
15	OEM should have a valid ISO 9001 certification on the date of opening of bid.	
16	Rack should be minimum IP54 certified. Rack should also comply with EIA 310/DIN 41494 standards.	

3.2.8 Schedule B5 Item 8: 19" 6 U 350mm X 600mm depth Rack (Wall Mounted)

SN	Specification	Description
1	Type	Closed Telecom Rack Wall/Pole mounted
2	Dimension	350 mm (Height)X600mm (Width)X 600 mm (Depth)
3	Mounting	Rack should have Wall/Channel/Beam Mounting with heavy brackets and fasteners of required shape and size as per site condition. It shall be insulated from the wall/ channel/beam/ shelter through insulators
4	Front Door	Rack should have front door tough and transparent glass fitted on MS/CRCA sheet on sides with Lock and key.

5	Rear Door	MS/CRCA door plain having ventilation holes bottom side with dust filters.
6	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
7	Fan Module	Compact fan module of 90 CFM working on 230VAC 2nos.with each rack properly fitted at top of rack.
8	Earthing Provision	Rack Should have earthing provisions.
9	Cable Manager	1 No.horizontal and 1 No.vertical cable manager with cable loops to be provided with each rack.
10	Power Distribution Unit (PDU)	PDU is of 6 Sockets of branded make with 6 Amp MCB.
11	The rack should be fitted with one modem tray19". Back side of the rack should be closed with a removable panel.	
12	The good quality powder coating light grey in colour shall be used for painting of the Rack.	
13	"INDIAN RAILWAYS LOGO along with Year" in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color.OEM should have a valid ISO 9001 certification on the date of opening of bid.	
14	Rack should be minimum IP54 certified. Rack should also comply with EIA 310/DIN 41494 standards.	

3.2.9 Schedule B5 Item 9: Server and Networks Racks with Accessories and PDU

Smart Rack for the main switches and servers should have the following specification. All dimensions given below are indicative

Sl. No.	Description	Qty	UOM
A)	**Server and Networks Racks with Accessories and PDU**		
1	Frame, 800 W x 2000 H x 1200 D,Front Glass Door with comfort handle with lock insert (130 Degree Hinges)with Rear sheet steel Double door(130 Degree Hinges) with Door vertical and Horizontal Door Stiffener with comfort handle with lock insert , Top cover with cutout with cover plate for cable entry,bottom cover with gland plates for cable entry, 19" angles 2 pairs on 4 nos of cable troughs front and rear, 6 nos of punched sections. with a Levelling Feet pack of 4.	3	EA
2	Frame, 300 W x 2000 H x 1200 D, Front sheet steel Door with comfort handle with lock insert (130 Degree Hinges)with Rear sheet steel door(130 Degree Hinges) with Door vertical and Horizontal Door Stiffener with comfort handle with lock insert , Top cover with cutout with cover plate for cable entry,bottom cover with cutout with cover plate for cable entry. plinth 300Wx100Hx1200D	2	EA
3	Frame, 800W x 2000H x 300D, Top cover Plain. Bottom cover with cutout and cover plate for cable entry. plinth 800Wx100Hx300D , Vertical Shielding - 2nos	3	EA
4	Frame, 300W x 2000H x 300D, Top cover Plain. Bottom cover plain. plinth 300Wx100Hx300D ,	2	EA
5	Side Panel 2000H X 1200D Screw Fixed, unvented (pack of 2)	1	PU
6	Side Panel 2000H X 300D Screw Fixed, unvented (pack of 2) (All dimensions are indicative)	1	PU
7	Metal Shunting rings 90x60 (Pack of 10)	4	EA

8	Component Shelf 720mm Deep	4	EA
9	Captive hardware (Pack of 20)	20	EA
10	Baying kit (Pack of 6)	12	PU
11	Blanking Panel 1 U, ABS Material (Black Colour)(Pack of 20)	80	PU
12	Earth Straps,4Sqm,170mm In length Pack of 5	4	EA
13	Earth rail 15x5x450 with 20 Points	4	EA
14	Cable route 300 Wx1700 H RAL	6	EA
15	Cable Management Duct(90x90)	6	EA
16	plinth 800Wx100Hx1200D ,	2	EA
17	Vertical PDU, 32A, Single Phase, C13 Sockets - 16nos, C19 Sockets - 4nos, 32A DP MCB with cover, Power cord of 6sqmm x 3 core cable with pin type lugs.	8	EA
18	Temperature based lights for racks	4	EA
B)	**Zero U Cooling Unit with Piping and Low side works**		
1	External Condensing Unit (ODU) - 7KW	2	EA
2	Redundancy Controller with Display Unit	2	EA
3	Zero U Rack based Heat Exchanging Unit (IDU)	2	EA
4	Low Side Work for Air-conditioning unit including copper piping & installation of 15 mtr with refrigerant charge,cabling,stand and other low side accessories (cable trough & cabling)	2	Lot
C)	**Environment monitoring system (EMS)**		
1	Processing Unit	1	EA
2	I/0-Unit	1	EA
3	Temperature/humidity sensor	4	EA
4	programming cable USB	1	EA
5	CAN-Bus Unit Access	4	EA
6	Door Kit , 2-piece door	4	EA
7	leakage sensor, 15 m	1	EA
8	Door Control Module	2	EA
9	LTE Unit	1	EA
10	handle (electro-magnetic)	4	EA
11	Door Switch	4	EA
12	power pack	3	EA
13	Connection cable C13/C14	3	EA
14	mounting unit, 1 U	4	EA
15	Cable clamp rail	4	EA
16	CAN-Bus connection cable, 1,5 m	12	EA

17	CAN-Bus connection cable, 2 m	5	EA
18	Mounting component for Signal pillar	1	EA
19	Led Steady light	1	EA
20	Connection component	1	EA
21	Acoustic component for Signal piller (100dB)	1	EA
22	Biometric Reader	4	EA
D	**Cooling unit accessories**		
1	TOP THERM ENCLOSURE HEATER 800 W	2	EA
2	HYGROSTAT SWITCH	2	EA
E	**Electrical Works**		
1	Electrical DB Panel with Raw Power Input and UPS output Distribution System with Electrical Cabling.	1	Lot
F)	**Rack Based Fire Detection & Extinguishing System**		
	Rack based fire detection & suppression system for 4 Rack solution with common cylinder (mounted at end of row) without VESDA 1 Lot	1	LOT
G	**Rodent Repellent system for Racks**		
	Rodent Repellent system for 4 Racks Solution	1	SET
H	**Project Installation and Commissioning**		
	Installation and Commissioning , 3 Years Extended Warranty and Freight Unloading Charges.	1	SET

3.2.9.1 Schedule B5 Item 11: 2 Core Outdoor Unarmoured Optic Fibre Cable

1. NO. OF FIBRES : 12F
2. TYPE OF FIBRE : SM G652 D
3. LOOSE TUBE DIAMETER : 2.00 mm NOMINAL
4. STRENGTH MEMBER : METAL OR GLASS YARN & FRP 2 NOS STRENGTH MEMBER
5. COLOUR OF FIBRE :BLUE, ORANGE, GREEN, BROWN, GREY,WHITE,RED,BLACK,YELLOW VIOLET, PINK, & AQUA
6. OUTER SHEATH MATERIAL : HDPE – BLACK
7. OUTER SHEATH THICKNESS : 1.80 MM NOMINAL OR HIGHER
8. OUTER CABLE DIAMETER : 6.0 + 0.50 mm
9. CABLE WEIGHT : 34 + 10% Kg/Km
10. PRINTING ON CABLE : AS PER CUSTOMER REQUIREMENTS
11. STANDARD LENGTH : 2 + 10% KMS
12. MAX. OPERATING TENSION : 500 N
13. MAX INSTALLATION TENSION : 1000 N / 10 cm
14. They should be compliant with the latest ITU-TG-652-D Standard.
15 All the accessories required for installation should be provided along with the cable.
16 It should be of reputed make.

3. 2.10 Schedule B6 Item 1: 2 X 10 KVA UPS

They are to be connected in parallel redundant mode. Batteries shall be kept in a closed metal rack so that batteries are not visible from outside. Rack body shall be perforated. Rack shall be supplied by the tenderer. These UPS will be installed for VSS/Data Center/Exchange at various Railway stations of Indian Railways.They should have the following specifications:

S.N	Specifications	Value
1	Capacity	10000VA/9000 W
2	Phase	3 phase in / 1 phase out
A	INPUT Characteristics	
1	Power Factor	0.9 or better
2	Voltage Range	175-280 VAC (1-phase) @ 100% load
3	Wave form	Pure Sine wave
4	Nominal Voltage	400 V three phase/ 230 V single phase
B	OUTPUT Characteristics	
1	Output Voltage Rates	**208/220/230/240V(L-N)**
2	Voltage Accuracy	±1%
3	Transfer Time	0
4	Load Crest Ratio	3:1 max
5	AC Mode Efficiency	>90%
6	Output Frequency @ Line mode	50Hz +/-0.5Hz@50Hz system
7	Output Frequency@ Battery mode	50Hz +/-0.5Hz@50Hz system
8	Frequency Converter Mode (CVCF)	50Hz
9	UPS status, Load level, Battery level, Input /Output voltage, Discharge timer, and Fault conditions	Indication required
10	Overload Memory	Default: Yes
11	Transient recovery	100 ms recover to 90% of nominal Voltage
12	Efficiency	>90% Battery Mode @100%R/RCD Load
13	UPS Type	Tower
14	Monitoring software support	Battery, health of UPS, change in any critical parameter
15	Port	USB/RS-232, RJ45
16	Generator Compatible	Yes
17	Battery backup	2 Hrs. on full load with each UPS System with 28800 VAH battery size
18	Acoustic Noise	<60 db
19	Operating Temperature	0-55 deg C
20	Nominal Battery Input Voltage	Vendor to specify
21	Battery Low Warning	10.8V X nos. of batteries
22	Battery Shutdown Voltage	10.5V X nos. of batteries
23	Battery Type	VRLA,12V and suitable MS stand

24	Battery Charger	
25	Nominal Recharging current	minimum 10% of the offered battery AH capacity
26	Maximum Charge Voltage	13.5V X nos. of batteries
27	Regulatory Standards	
28	ESD	IEC/EN 61000-4-2 Level 4 or equivalent BIS/IS standard
29	Safety	IEC/EN 62040-1-1 or equivalent BIS/IS standard
30	Leakage Current	IEC/EN 62040-1-1 or equivalent BIS/IS Standard
31	Protection	IP20
32	Certification	CE or equivalent BIS/IS standard
33	Communication	SNMP V1/V2/V3 along with an interface card and cable.
34	Input AC mains and output power supply surge protection	Inbuilt

3.2.11 Schedule B6 Item 2: 3 KVA UPS

Batteries shall be kept in a closed metal rack so that batteries are not visible from outside. Rack body shall be perforated. Rack shall be supplied by the tenderer. UPS shall be rack mountable

S.N	Specification	Value
1	Capacity	3KVA
i 2	Wave form	Pure Sine wave
3	Rectifier	IGBT based
4	Display	LCD/LED
5	Input power factor correction	0.9
6	Input configuration	1Ph,L-N+PE
7	Output Power factor	0.9 or better
8	Frequency (Input)	50Hz frequency
9	Frequency (output)	50Hz+/- 0.5Hz
10	V threshold	3%max full linear load, 6% max on Nonlinear load
11	Crest factor	3.0 or better
12	AC-AC Efficiency	85% or better
13	Transfer time Main- Battery	0
14	Transfer time Inverter- Bypass	4 m.sec
15	Emergency Power off function	Yes
16	Monitoring software for	Battery, health of UPS, any critical parameter change
17	Communication	SNMP V1/V2/V3
18	Port	USB
19	Battery Type	Sealed maintenance free valve regulated lead acid battery with MS stand for battery
20	Battery backup	7200 VAH or higher
21	Environmental Parameter	
A	Operating Temperature range	0-55 deg

B	Over Temperature,Load on Battery, Battery on Charge,Battery low,Mains on	Indication required
C	EPO function	Yes
D	Input AC mains and output power supply surge protection	Inbuilt
E	Humidity	0% to 95% non-condensing
F	Noise Level	50 dBA max
G	Size	not more than (2U+/-0.5U) rack mountable
22	Protection	IP20
A	Mechanical Parameter	EMI or equivalent BIS/IS standard
B	Safety	EN or equivalent BIS/IS/IEC standard
C	Performance	IEC/EN or equivalent BIS/IS standard
23	Voltage Range (By- pass)	230VAC +/-15%
24	Voltage Range (input)	175-280 VAC (1-phase) @ 100% load
25	Voltage Range (output)	230V AC (1-phase) +/- 1% regulation

3.2.12 Schedule B6 Item 3: 2 KVA UPS

S.N	Technical Parameters	Parameter Description
1	Type	Single phase, IGBT based, True sine wave Online UPS 19 inch Rack Mountable with all mounting accessories.
2	Input	240V±10% V AC, Single phase-three wire (Phase+Neutral+Ground)
		50±5% Hz
		Power factor : ≥ 0.9 Lag
3	Output :	
		2.0KVA
		230V±10% V AC, Single phase-three wire (Phase+Neutral+Ground),
		50Hz
		≤ 0.75 to ≥ 0.95 (Lag)
	Voltage Regulation	≤ ±2%
4	Inverter Efficiency	≥ 85%
5	Crest factor	≥ 3:1
6	Overload Capability	110%: ≥10 Minutes 125%: ≥05 Minutes 150%: ≥30 Seconds
7	Current Harmonic distortion (THDI)	<5% at Full load
8	Transient response & recovery period	-Less than ±10% voltage variation at sudden application/removal of full load -Rated voltage shall be recovered within 500msec.
9	Bypass: Static Switch Transfer /	≤10ms (UPS to static bypass & Vice versa)

	Retransfer Time	Maintenance Bypass: No interruption	
10	Battery Charger	Float / Boost Charging Mode shall be provided	
		Battery Charging Voltage & Current shall be adjustable	
		Line & load Regulation: ≤ ±1%	
		Output Ripple : ≤ 3%	
11	Control Switch (MCB/Fuse/Isolator)	i) Input ON/OFF ii) Output ON/OFF iii) Battery iv) Maintenance Bypass Switch	
12	Battery Backup	1 Hrs. with full load with 2340 VAH or higher battery size (Battery to be installed in separate wall mount cabinet/floor mount with suitable battery stand).	
13	Protections	UPS shall trip on following faults. i) Input AC Under/Over voltage ii) Output overload / Short circuit iii) DC Under/Over voltage iv) Over temperature	
14	Indications & Alarms		
15	Alarms (Audible for Trouble/fault)	Mains fail Charger fail DC Under /Over voltage	Battery Low/ Discharging Output overload Over temperature
16	Battery Type	Sealed maintenance free valve regulated lead acid battery with MS stand for battery	

3.2.13 Schedule B6 Item 4: Surge Protection Device B & C

Stage 1 Protection (at the entry point of input 230V AC supply in the power/ equipment room) (a) The Stage 1 protection shall consist of coordinated Class I/ B & II/ C type SPDs at the entry point of input 230V AC supply in Power /Equipment room in TT configuration in a separate wall mountable box. The Class I/B SPD shall be provided between Line to Neutral & Neutral to Earth. They shall be spark gap type voltage switching devices and tested as per IEC 61643 with the following characteristics and features.Make Havells or Legrand or OBO or Phoenix or Equivalent.

S.N	Parameters	Limits	
		Between Line & Neutral	Between Neutral & Earth
1	Nominal Voltage (U_0)	230V	230V
2	Maximum continuous operating voltage (U_c)	≥ 255V	≥ 255V
3	Lightning Impulse current 10/350ms (I_{mp})	≥ 25KA	≥ 25KA
4	Response time (T_r)	≤100 ns	≤100 ns
5	Voltage protection level (U_p)	≤ 2.5KV	≤ 2.5KV
6	Short circuit withstand and follow	≥ 10 KA	≥ 100 KA

	up current extinguishing capacity without back up fuse (I_{sc} & I_{fi})		
7	Temporary Over Voltage (U_T)	334V min. for 05 secs.	200V min.for 200ms
8	Operating temperature / RH	- 25°C to +80°C/ 95%	- 25°C to +80°C/ 95%
9	Mounted on din rail	din rail	din rail
10	Indication	Mandatory	Optional
11	Pluggability	Optional	Optional
12	Potential free contact for remote monitoring	Optional	Optional
13	Encapsulation	Encapsulated	Encapsulated
14	Degree of protection	IP20	IP20
15	Housing	Fire retardant as per UL 94	Fire retardant as per UL 94

Length of all cable connection from SPDs to earth equi-potential busbar shall be kept less than 0.5mtrs. For this, a sub earth equi-potential busbar shall be installed at approx. 20cm from the SPD box. The details of connection of SPDs for Stage 1, & 2 of a typical installation Batch test report of OEM should be submitted by the manufacturer /supplier of Lightning & Surge protection devices at the time of supply of these devices.

3.2.14 Schedule B6 Item 1: Surge Protection Device for LAN

Similar to RayDat NET 6 POE or latest**.**

Number of Protected Pairs	4 Pairs (8 Conductors)
Nominal Operating Voltage (DC)	48V
Maximum Continuous Operating Voltage (DC) (Line-Line)	50V
Rated Load Current at 25ºC	1 Amp
Nominal Discharge Current (8/20µs)	150A
C2 Total Discharge Current (8/20µs)	10kA
Voltage Protection Level at In	150V
Response Time Overvoltage Protection	<1ns
Cut-off Frequency	250MHz
Connection Type	Input/Output: RJ45 Sockets
Degree of Protection IEC/EN 60529	IP20

3.2.15 Schedule B7 Item 1: Single Fibre Optical Fusion Splicer (OFSM) and Tools

Single Fibre Fusion Splicer Similar to Fujikura 80C with standard accessories : AC Adapter /Battery Charger ADC-18 1PC, AC Power Cord ACC-XX: 1PC spare electrode Elect2-20:1 pair carrying case CC-30:1PC USB cable USB-01: 1PC Sleeve loader SL01:1 PC dispenser AP-01: 1 PC screwdriver SC-01 1PC, Instruction manual: 1 PC Quick reference Guide 1PC warning & cautions: 1 PC ; BATTERY RACK BRT-09, Battery charger cord DCC-18: 1 PC High precision Fibre cleaver CT-06: 1 PC, 3 in-1 Stripper : 1PC,Cable Cutter-1 PC,Cable stripper Knife & Protection sleeves: 25 nos. ISO Propyl Alcohol (250ML)-1 No. or any other material/tool(A demo shall be arranged along with supply) as per TEC Specification G/OSM/01-03 April 2005.

3.2.16 Schedule B7 Item 2: Optical Time Domain Reflectometer (OTDR) and connectors

Optical Time Domain Reflectometer for 1310/1550nm fiber with resolution of 60 Cms,dynamic Range of 314/29 dB with all accessories confirming to TEC Specification No TEC Specification No G/OTD/02-03 March 2009 or latest. Make EXFO Model MAX 720C , AQ-7270+735022.Make Yokogawa Electric Co Ltd Japan or Similar .

- Display: 7 Inch Outdoor enhanced Touch Screen, 800 X 480 TFT or better
- Battery Back - up and charger : Rechargeable lithium-polymer battery 12 hours of operation or better.
- Storage: 2GB Internal memory (20 000 OTDR traces typical) or better or external storage
- Valid TSEC approved certificate against GR No. G/OTD/02-03 March 2009 is required along with a tender otherwise the offer is liable to be rejected.
- Tender specific authorization letters must be enclosed along with tender.

Standard accessories:

- Built in Battery Pack with 12 Hours Backup, Each
- AC Adapter with Power Cord, Each
- SC/APC Connector, Each
- Calibration Certificate, Each
- Soft Carrying Case Each

3.2.17 Schedule B7 Item 3: LAN CABLE TESTER

General Specifications	
Test connectors	Shielded 8-pin modular jack accepts 8-pin modular (RJ45) and 4-pin modular (RJ11) plugs. F-connector for coaxial cable.
Power	Battery type: 2 AA (NEDA 15A, IEC LR6) alkaline batteries Battery life: 20 hours of typical use Other compatible battery types: 2 AA photo lithium, NIMH, NICAD or equivalent
Dimensions and weight (with batteries installed and wiremap adapter attached)	3 in x 6.4in x 1.4 in (7.6 cm x 16.3 cm x 3.6 cm) 10.6 oz (300 g)PoE: 10.6 oz (300 g) or less
Display	Monochrome LCD with backlight or better
Cable test	Should Measure length, verifies wiremap, identifies remote ID locators, and detects Ethernet ports. PoE also shows HIGH Ω when the resistance of the cable is more than 12.5 Ω. Displays results on one screen or better.

Tone	normal analog toning signals or any
POE	Should detect the presence of 802.3af compatible PoE (Power over Ethernet) devices. PoE: Solicits and detects the presence of 802.3af, at, bt, and UPOE (Universal Power over Ethernet) compatible PoE devices or more
Cable types tested	Twisted pair: UTP, FTP, SSTP Coaxial : 75 Ω, 50 Ω, 93 Ω or more
Length test	Range: 460 m (1500 ft) or more Resolution: 0.3 m (1 ft) or more Typical accuracy: ± 4% or 0.6 m (2 ft) whichever is greater. NVP uncertainty is an additional error. Or better Calibration: User-settable NVP for twisted pair and coax or any method Should determine actual NVP with known length of cable.
Wiremap test	Should detect single-wire faults, shorts, miswires, split pairs, and up to seven far-end adapter IDs. The wiremap is drawn with proportional length to visually indicate the approximate location of faults. Or better
Ethernet port detection	Detects the advertised speed of 802.3 Ethernet ports with speeds of 10 Mbps, 100 Mbps, and 1 Gbps or more. PoE: Detects the advertised speed of 802.3 Ethernet ports with speeds of 10 Mbps, 100 Mbps, 1 Gbps, 2.5 Gbps, 5 Gbps, and 10 Gbps.
Tone generator	Should Support toning and cable mapping with a probe. Generates four tones compatible with typical analog probes. Or any method Should give positive identification of cables in bundles when using an IntelliTone or an analog probe or equivalent.
Interface	Should display key test results like wiremap, pair lengths, distance to fault, cable ID, and far end device all on one screen and should display wiremap results graphically or better
Toning	Should have digital and analog toning to precisely locate virtually any cable or wire pair, regardless of work environment. Use digital mode to locate high-grade data cabling (Cat 5e/6/6a) in bundles, or at switches, patch panels, or wall outlets. Digital mode especially performs in environments with high data, RF, or electromagnetic interference.
PoE Verification	The tester should detect the available PoE class (0-8) or more provided by the connected switch in accordance with the latest PoE standards and display the voltage from passive PoE sources.

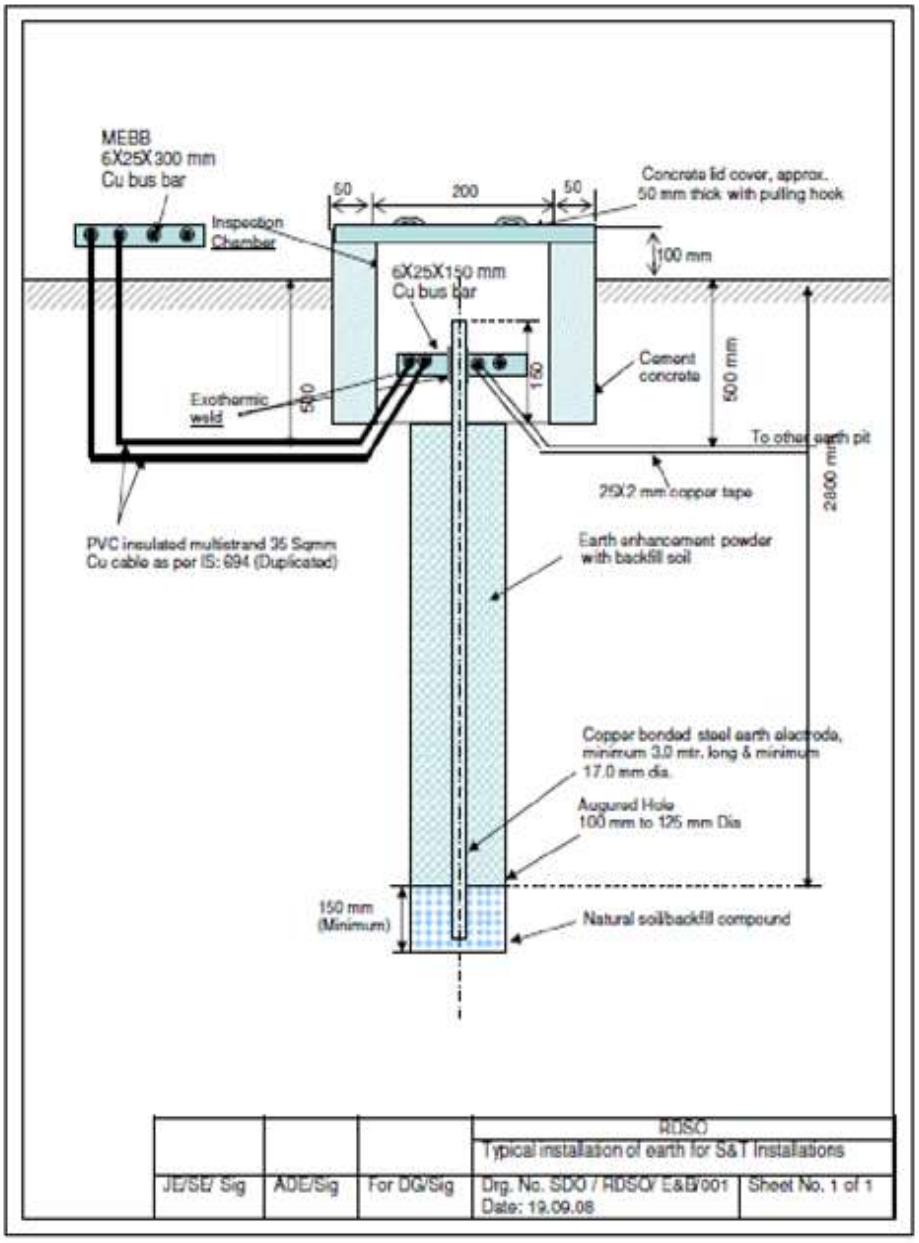
3.2.18 Schedule B8 Item 7: Earthing

Maintenance free earthing

Supply & Installation of maintenance free single earth or combining with the existing earth or Ring earth at DC and DR as per RDSO/SPN/197/2014 with latest amendment and as shown in the Diagram.This includes supply,installation and commissioning with following materials given below and includes all the accessories required for the installations .

a) Copper bonded steel electrode of 3.0m long 17.2mm dia with copper bonding thickness of minimum macrons and UL listed and marked 1 No.
b) Earth enhancement material supplied in a sealed bag of minimum 10Kg= 3No.
c) Copper strip of 150x25x6mm to terminate earth rod=1No.
d) Copper strip of 300x25x6mm (MEEB)=1No.Installation of maintenance free single earth as per technical specification. A) Digging of earth to required depth. B) Insertion of Electrodes. C) Filling of earth enhancing compound (approx. 30 kgs) D) Provision of Exothermic weld connection to copper tape 25mm X 6mmX150mm -01 Nos to earth electrode.(All the materials, tools and features required for welding will be arranged by contractor. E) This includes CC cover with dimension as in the diagram. F) Copper strip of 150X25X6mm to be welded with earth electrode, copper strip of 300X25X6mm for main equipotential busbar, copper strip of 150X25X6mm sub equipotential busbar in DC/DR/RPF/OFC/Station Equipment Room or as decided by the Railway Engineer.
e) Copper strip of 150x25x6mm (SEEB)=1No.
f) Supply of 35Sq mm multi strand single core PVC insulated copper cable as per IS:694 for connecting main earth electrode to MEEB in equipment room in duplicate.
g) Supply of 16Sq mm multi strand single core PVC insulated copper cable as per IS:694 for connecting MEEB to SEEB and SPD to MEEB.
h) Supply of 10Sq mm multi strand single core PVC insulated copper cable as per IS:694 for connecting to Rack or Various Equipments to SEEB.
i) The supplier shall be responsible for complete supply, installation & commissioning of the earthing & bonding system. The warranty of such a system shall be 60 months from date of commissioning. During this period, any failure of the earthing system due to improper materials & bad workmanship shall be attended free of cost by the supplier.
j)Writing of the Value of Earth resistance and Date of installation on the Earth pit CC or on the wall of equipment Room by paint.

Drawing of Earthing and bonding system:



3.2.19 Schedule B8 Item 9: Furniture

Note: RPF Post, A&B stations furniture arrangement should be as under :

a. One Computer Table (Model Stylo of Godrej Make or Similar) of size 1200 x 600 x 750 mm (LxDxH) with block board & Wood top along with cushioned steel chair 2 Nos is to be provided.
b. They should be similar to Godrej Spyder PCH 5602 T or similar.
c. It should be provided with all accessories and fixing materials to the consignee store and transportation to the site.

Table Specification

Number of Drawers : 3
Mounting Type : Tabletop
Raw Material (specs of laminations & thickness): 18mm Prelam Particle Board, 3mm Prelam MDF Board
Metal Parts:
1) BM Slide for Keyboard
2) Castor Mounting Plate, 3) Locking Bracket, 4) Angle Clit
Hardware:
Screw, KD Fitting, Wooden Dowel, PVC Inserts
Construction:
KD fitting , Wooden Dowel & Angle Clit. Colour and design will be decided by railways. Below picture is only indicative.

Chair Specification

Back: (W)47.0 cm x (H)58.0 Cm,
Seat : (W)48.0cm x (D) 47.0 cm
Seat Height - min 42.5 to max 51.5cm
Height - min91.0 to max 100.0cm.
Width & Depth of Chair as measured from pedestal - Width-72.0 cm and Depth-72.0 cm.
The back shall be a fabricated tubular frame assembly; powder coated (DFT 40-60 microns) and upholstered using Net fabric with high tenacity yarn. The back tubular frame shall be made of Dia. 1.9 ±0.02cm x 0.16 ±0.0128cm. thk. M.S. E.R.W. tube and black powder coated (OFT 40-60 microns). The dimensions of the seat shall be- 48cm(W) x 47(D) and the back shall be 47cm. (W) x 58cm(H). The HR polyurethane foam for seat shall be moulded with density= 45 +/-2 Kg./m3 and Hardness load 16 ± 2 kgf as per IS:7888 for 25% compression.The back cover shall be a perforated strip fabricated from 0.08±0.01cm. thk. CR steel and powder coated (DFT 40-60 microns). Colour and design will be decided by railways. Below picture is only indicative.

Furniture : DC/DR,Command Control Center and Test Room furniture arrangement should be as per below mentioned:

Note: 2 No office Desk Cubicle Linear Workstation as shown in picture With 45mm Main and Side Partition, 25mm Thick Table Top and table size of 1200 x 600 x 750 mm (LxDxH) Material Wooden/MS/Aluminium & Wood top ,3 Drawer Fixed Pedestal, CPU Trolley, KeyBoard Tray,Power extension board and under table cable passer. along with cushioned steel chair 4 Nos Better quality Table to be provided for Command Control Centre and Test Room or Contractor can give better design and colour to suit the CCC and Test Room.

Chair Specification

Back: (W)47.0 cm x (H)58.0 Cm,
Seat : (W)48.0cm x (D) 47.0 cm
Seat Height - min 42.5 to max 51.5cm
Height - min91.0 to max 100.0cm.
Width & Depth of Chair as measured from pedestal - Width-72.0 cm and Depth-72.0 cm.
The back shall be a fabricated tubular frame assembly; powder coated (DFT 40-60 microns) and upholstered using Net fabric with high tenacity yarn. The back tubular frame shall be made of Dia. 1.9 ±0.02cm x 0.16 ±0.0128cm. thk. M.S. E.R.W. tube and black powder coated (OFT 40-60 microns). The dimensions of the seat shall be- 48cm(W) x 47(D) and the back shall be 47cm. (W) x 58cm(H). The HR polyurethane foam for seat shall be moulded with density= 45 +/-2 Kg./m3 and Hardness load 16 ± 2 kgf as per IS:7888 for 25% compression.The back cover shall be a perforated strip fabricated from 0.08±0.01cm. thk. CR steel and powder coated (DFT 40-60 microns). Colour and design will be decided by railways. Below picture is only indicative.

3.2.20 Schedule B8 Item 14: Bracket/ Fixtures/Angles

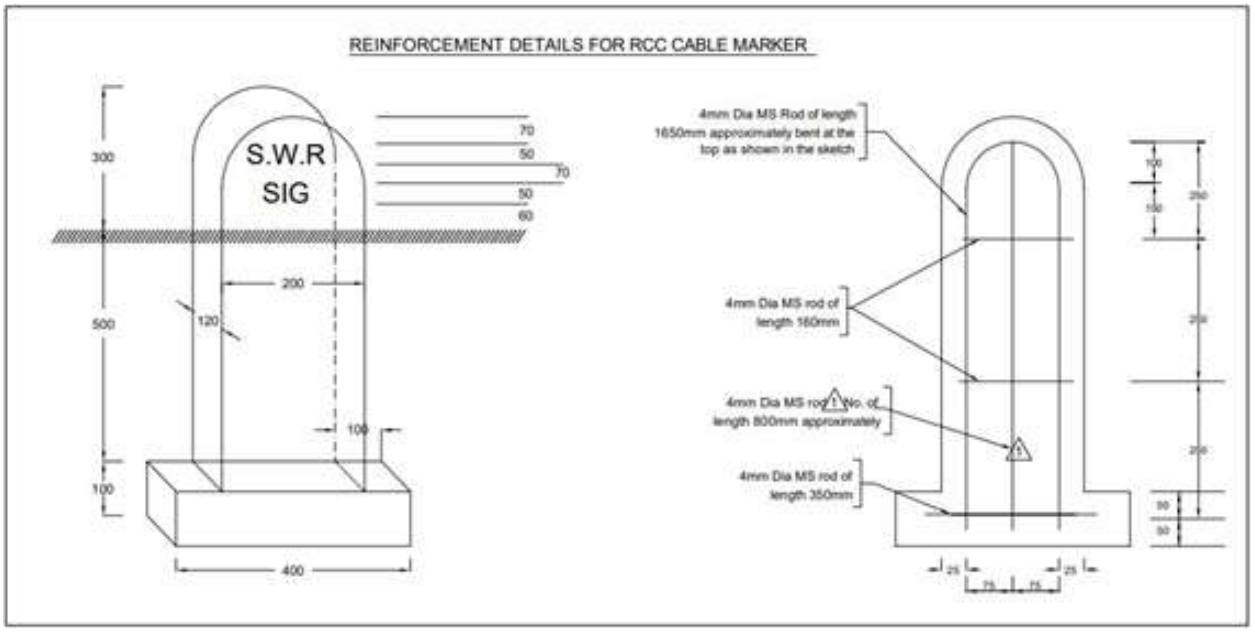
Installation of Cameras

3.2.20.1 At entrances

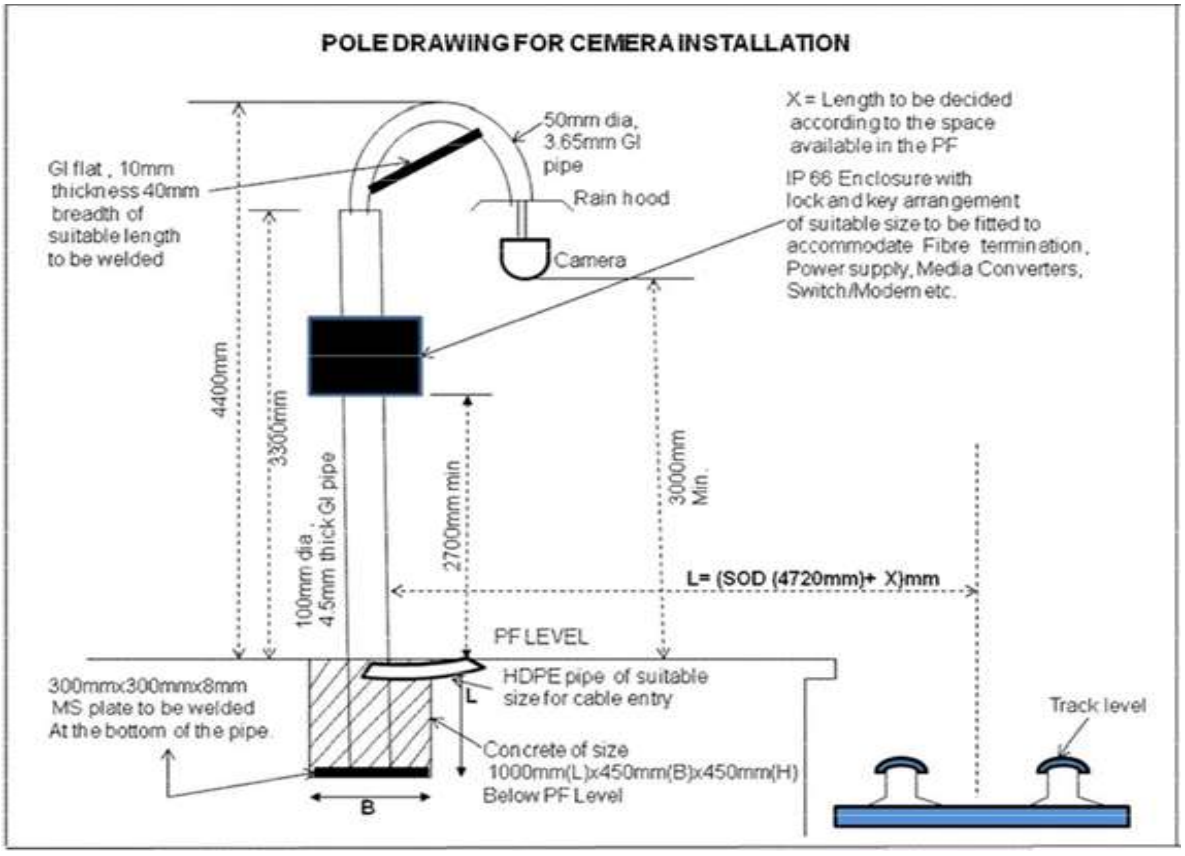
3.2.20.2 In platforms

Above design is only indicative. Better design may also be provided. It shall be approved by Railways

3.2.21 Schedule B8 Item 21: RCC Router Marker



3.2.22 In Platforms without Shelter



Sub-Work C:
VOIP Based TCCS & SIP EXCHANGE

Sub-Work C: VOIP Based TCCS & SIP EXCHANGE

Schedule C1: SCHEDULE OF ITEMS, QUANTITIES & RATES (SOR) Items		
1	Road Track Crossing	As per schedule description
2	**Transportation**	
2a	Transportation upto 100Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
2b	Transportation more than 100 Km	Transportation of Signaling & Telecommunication materials by Road as per instruction of Railway Representative at Site.The work includes loading and unloading of the materials.
Schedule C2: IP Phones and their wiring and termination		
	IP PHONES	
1	Control IP Telephones with Hands set for Way Side Station for control communication.	As per Clause 11 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.
2	SIP Based Basic IP Phone	Specifications are given in Para **3.3.1.** It Shall be of reputed brand
	SIP Phone for SIP EXCHANGE	
3	SIP Based Medium IP Phone	Specifications are given in Para **3.3.2** It Shall be of reputed brand
4	SIP Based Video Phones Capacitive Adjustable Touch LCD screen	Specifications are given in Para **3.3.3** It Shall be of reputed brand
5	Wiring and termination for IP phones	As per schedule description
Schedule C3: Servers, Consoles and Licences		
	Servers	
1	Communication Server (TCCS) at DC & DR	As per Clause No 5.1.1 and 6 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.Communication Server Block shall be provided 1+2 or 1:2 Redundancy. Total 3 servers, 2 numbers at main location and one at remote location. Alongwith server genuine licensed OS/Application software should be supplied. Reputed Make like IBM/Dell/HP or Equivalent.Along with 19 inch monitor,KVM Switch for connecting or higher three servers,Mouse and KeyBoard.
2	Communication Server (TCCS) for DR remote location	As per schedule description and As per Clause No 5.1.1 and 6 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2. Alongwith server genuine licensed OS/Application software should be supplied.Along with 19 inch monitor,KVM Switch for connecting three servers,Mouse and KeyBoard.Reputed Make like IBM/Dell/HP or Equivalent
3	Network Management Server for DC and DR	As per Clause No 5.1.2 and 8 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest. Block shall be provided 1+1 or 1:1 Redundancy. Total 2 servers, 1 number at main location and 1 at remote location. Alongwith server genuine licensed OS/Application software should be supplied. Reputed Make like IBM/Dell/HP or Equivalent

4	Voice Recording Server for DC and DR.	As per Clause No 5.1.3 and 7 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.Block shall be provided 1+1 or 1:1 Redundancy. Total 2 servers, 1 number at main location and 1 at remote location. Alongwith server genuine licensed OS/Application software should be supplied. Reputed Make like IBM/Dell/HP or Equivalent.
5	Desktop Client PC for Voice Record Server	As per Clause 7.6, 8.7 & 8.8 of RDSO Specification of VoIP 11th Gen Intel Core i7 Processor or latest. Operating System: Windows 10 with latest licensed version with client software (Windows 10 PRO-64) & Reputed Brand Anti Virus with Three Year licences, Wired/Wireless Keyboard,Monitor 17 inch with Laser Printer. Acceptable Brand: Reputed like IBM/Dell/HP or Equivalent.
6	Event Notification Gateway	As per Clause No 12.3 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest. Modem provided with the Gateway should support VoLTE and GSM as per site requirement based SIMs.
7	Desktop Client PC for NMS server.	As per Clause 7.6, 8.7 & 8.8 of RDSO Specification of VoIP 11th Gen Intel Core i7 Processor or latest. Operating System: Windows 10 with latest licensed version and client software (Windows 10 PRO-64 and MS office) & Reputed Brand Anti Virus with Three Year licences, LCD monitor 21 inch or higher, Wired/Wireless Keyboard, Laser Printer. Acceptable Brand: Reputed like IBM/Dell/HP or Equivalent.It should be a common console/client for all the Application.
8	Lightweight Portable Maintenance Terminal (Similar to Laptop)	As per Clause 8.7 & 8.9 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest. MS Office with latest licensed version & Reputed Brand Anti Virus with Three Year licences, USB to Serial cable, Monitor size 15.6 inch or better. Shall be of reputed brand with all client software loaded.
9	55-inch TV	Make.Sony/Samsung/LG or equivalent.Along with cables required for connecting PC Workstations.Including cables of sufficient length for connecting PC Workstation shall be supplied by the contractor. 3.3.37 Supply fixing of Standard OEM Mounting kit along with all the accessories for TV Should be supplied and along with interface cables of sufficient length for connecting to PC WorkStation or NMS.Specifications are given in Para **3.3.4**
	Consoles	
10	Controller Console Equipment	As per Clause 9 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.Shall be of reputed brand
11	Test Room Console Equipment.	As per Clause 10 of RDSO Specification +of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.Shall be of reputed brand
12	Emergency Communication Gateway	As per Clause 13 of RDSO Specification of VoIP Based Train Control Communication System Specification No.RDSO/SPN/TC/99/2012 Rev.2 or latest.Shall be of reputed brand
	Licenses	Single license for main location and remote location server/devices.

13	Station License of TCCS Communication Server of 1+2 Configuration	As per RDSO/SPN/TC/99/2012 Rev.2. Details given in the Schedule description.
14	Port License of TCCS Communication Server in 1+2 Configuration	As per RDSO/SPN/TC/99/2012 Rev.2. Details given in the Schedule description.
15	Conference Room License of TCCS Cum Server of 1:4 Room in 1+2 Configuration	As per RDSO/SPN/TC/99/2012 Rev.2. Details given in the Schedule description.
16	TCCS VoIP Voice Logger Board License.	As per RDSO/SPN/TC/99/2012 Rev.2.
17	NMS Device License of TCCS VoIP NMS Server 100 Device Pack.	As per RDSO/SPN/TC/99/2012 Rev.2.
18	Event Notification Gateway License of TCCS VoIP NMS Server of 100 Device Pack.	As per RDSO/SPN/TC/99/2012 Rev.2.
19	Mobile Application for Event Notification/NMS/EMS	Mobile APP for all the applications as per scope of the work and RDSO Spec. Against supply of 4 mobile applications, one suitable android based Mobile Tablet with all accessories of screen size 9 inch minimum of reputed make shall be supplied along with loaded APP. Tablet shall have minimum 3 GB RAM, 32 Gb ROM with WiFi support.
	Servers for SIP Exchange	
	Main Server and Perpetual License	
20	Main Server License for SIP Exchange	Specifications are given in Para **3.3.5**
21	Stand by Server License.	Specifications are given in Para **3.3.5**
22	IP Endpoint Licenses (for any SIP Phone)	Specifications are given in Para **3.3.5**
23	Gateway User Licenses (Analog Users).	Specifications are given in Para **3.3.5**
24	SIP Trunk Licenses(for PRI Gateway,NGN & SIP Trunk).	Specifications are given in Para **3.3.5**
25	Supply of Mobility License.	Specifications are given in Para **3.3.6**
26	SoftPhone License	Specifications are given in Para **3.3.7**
27	SIP Communication/Call Server Hardware	Specifications are given in Para **3.3.8** Shall be of reputed brand like IBM/DELL/HP or equivalent.
	Intercom Server and Perpetual License	
28	Intercom Server License.	Specifications are given in Para **3.3.9**
29	Stand by Server License.	Specifications are given in Para **3.3.9**
30	IP Endpoint Licenses (any SIP phone).	Specifications are given in Para **3.3.9**
31	Gateway User Licenses (Analog users).	Specifications are given in Para **3.3.9**
32	SIP Trunk Licenses.	Specifications are given in Para **3.3.9**
	Upgrading of Existing Aeonix Server/Integration with new server at Bengaluru with Additional SIP Licenses-80, Sip Trunk License-30 for DRM Intercom to cater for Bengaluru Cant CAO Office.	As given in the Schedule description.
33	IP Endpoint Licenses to Existing Server/ new server including Technical Support Charges. Inspection Consignee.	Specifications are given in Para **3.3.10**

34	SIP Trunk Licenses.	Specifications are given in Para **3.3.10**
35	Intercom SIP Communication/Call Server hardware.	Specifications are given in Para **3.3.11** Shall be of reputed brand like IBM/Dell/HP or Equivalent.
36	Installation and Commissioning Charges as per Site Requirement at HQ, UBL and MYS	Specifications are given in Para **3.3.12.1**
37	Installation and Commissioning Charges as per Site requirement at Bengaluru and Bengaluru Cant(Upgrading the existing server/Integration with new one)	Specifications are given in Para **3.3.12.2**
Schedule C4: Gateway and Switches		
	Gateways for SIP EXCHANGE	
1	96 Port 19" Rack Mountable FXS Gateway Chassis with 4*24 FXS Gateway cards.	With rack mounting kit and all the accessories required for installation Specifications are given in Para **3.3.13**
2	24 Port Managed Aggregation Switch (MPLS/VSS)	It should meet the requirements as per Clause No. 14.0(I) of RDSO Specification of IP Based Video Surveillance System Specification No. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments. It should include the required SFP BX SM Modules and accessories. Note:-Switch Supplied should be of Latest Model of Reputed Make & should have service Support upto completion of Codal life & AMC.
3	24 Port POE Switch	Standard 19-inch Rack Mountable 24 Port managed POE switch , 24 GE 10/100/1000 BaseX Ethernet port with POE+ support and 4x1GE SFP Port for uplink with 4 nos of 1GE SFP BX SM modules included With rack mounting kit and all the accessories required for installation as per RDSO SPECIFICATION NO. RDSO/SPN/TC/83/2020 Rev 2 or Latest.
4	48 port 19" Rack Mountable FXS Gateway Chassis with 2*24 FXS Gateway cards	With rack mounting kit and all the accessories required for installation Specifications are given in Para **3.3.14**
5	24 Port FXS Rack Mountable Gateway along with Patch Panel for termination	With rack mounting kit and all the accessories required for installation Specifications are given in Para **3.3.15**
6	8 Port FXS Gateway	With rack mounting kit and all the accessories required for installationSpecifications are given in Para **3.3.16**
7	24 Port 19" Rack Mountable FXO Gateway Card suitable for 96 FXS Gateway chassis.	With rack mounting kit and all the accessories required for installation Specifications are given in Para **3.3.17**
8	E1/PRI Gateway	Specifications are given in Para **3.3.18**
9	1G SFP module with 10 Km range	It should be compatible with the switches mentioned above.Brand -OEM Make Switch.Specifications are given in Para **3.3.19**
10	NMS and Emergency Room Communication Console	Specifications are given in Para **3.3.20.1 & 3.3.20.2**

11	PC WorkStation/ Maintenance Console. (Exchange)	● All in One computer 8 GB RAM or Higher ● Processor Generation 11th or higher ● Windows 10 PRO preloaded. ● i7 Processor ● Graphic Card 2GB ● Hard disk 1000GB with 180 GB SSD ● Display 24 inch or Higher and suitable HDMI cable to connect TV. ● WiFi enabled ● Web Cam & Microphone in built ● Anti Virus 3 Years Subscription ● 0.6 KVA UPS. ● MS office preloaded This should work as common console for all the application
12	Programming of Servers	As given in the Schedule description
	Switches and Accessories	
13	Layer 3, 24 Port Managed Switch	It should be 19 inch Rack Mountable Layer 3,24 Port Managed Switch with 24 Nos of 10/100/1000 Ethernet Ports with POE+ Support with Redundant Power Supply ,Dedicated Stacking Module 4 x 10 GbE SFP Ports for uplink including 4 Nos of OEM 10 GbE BX SM SFP Modules loaded along with Mounting Kit with all necessary accessories,as per para number 4.0 of RDSO SPECIFICATION NO. RDSO/SPN/TC/83/2020 Rev 2 or Latest. Mounting Kit with all necessary accessories. Note:-Switch Supplied should be of Latest Model of Reputed Brand and should have service Support upto completion of Codal life & AMC.
14	Layer 2 Switch Minimum 8+2 Port.	Manageable with 8 Nos 10/100/1000 Mbps Ethernet port, POE+ & Single Fiber 2 Nos 1G SFP Port with OEM BX SM SFP Optical Modules loaded. with all accessories etc.As per RDSO/SPN/TC/65/2021, Rev.6.0 or latest. With rack mounting kit and all the accessories required for installation
15	CAT-6 Patch Cord-5 mtrs	UTP CAT 6 Cable, Cable jacket low Smoke zero halogen (LSZH), conductor dia 23 AWG, confirming to ANSI/TIA/EIA- 568-C.2 or latest .Make D-Link or equivalent
16	Wall Mountable RJ- 45 Socket	Single port CAT 6 Information outlet, Face plate with SMB/Gang Box for Data Outlets. Outlets should have inbuilt shutters and network keystone jack including all the accessories It should comply with the standard colour coding of Ethernet Cat-6 cable.Make Legrand,D-Link or equivalent
17	Crimping Tool	As given in the Schedule description
18	RJ-45 Connector	RJ-45 modular plug supports 4 twisted pairs, 8 positions, 8 connectors of 100 pcs/Pack. transparent color. Contact Terminal: Copper Alloy. Finished: 03 MU microinch gold plating. Use for 23-26 AWG stranded wires, meet wiring scheme T568A/T568B. It should be suitable for STP/UTP CAT-6 cable as per field requirements.Make D-Link or equivalent.
19	1G SFP module with 10 Km range	It should be compatible with the above switches mentioned above. Brand shall be of the same make of Switches. Specifications are given bin Para **3.3.19**
Schedule C5: FDMS, U Rack and Cables		
	FDMS and Accessories	
1	12 Fiber FDMS	With rack mounting kit and all the accessories required for installationDescription is given in Para **3.3.22** Make (TVS,Veekay ,R&M or equivalent)

2	OFC Patch Cords	Specifications are given in Para **3.3.23** . Brand of Reputed Make (3M, TE Connectivity, R&M or equivalent)
	19" U Rack	
3	19 inch 42 U Rack with 1200 mm Depth.	Specifications are given in Para **3.3.24** Make (HCL/VERO president/RITTAL/PUNCOM make or similar)
4	19 inch 42 U Rack with 600 mm Depth.	Specifications are given in Para **3.3.25.** Make (HCL/VERO president/RITTAL/PUNCOM make or similar)
5	19 inch 27 U Rack	Specifications are given in Para **3.3.26** Make (HCL/VERO president/RITTAL/PUNCOM make or similar)
6	19 inch 12 U Rack	Specifications are given in Para **3.3.27** Make (HCL/VERO president/RITTAL/PUNCOM make or similar)
7	19 inch 9 U Rack	Specifications are given in Para **3.3.28** Make (HCL/VERO president/RITTAL/PUNCOM make or similar)
8	1G Ethernet & E1 to Optical signal and vice versa Managed Media Convertor	As per clause option 2 and 3 RDSO Specification No. RDSO/SPN/TC/103/2013 Rev 2 or latest Specifications are given in Para **3.3.29** Including all the accessories. Note:-Media Converter Supplied should be of Latest Model of Reputed Make & should have service Support upto completion of Codal life & AMC.
9	LAN Extender 30 Mbps	As per RDSO Specifications RDSO/SPN/TC/82/2020 Rev. 2.0 or Latest.Model similar to Make MROTEK or Equivalent.
	Cables and Accessories	
10	STP CAT- 6 Cable	Shielded Twisted Pair (STP) Strengthened outdoor CAT-6 cable. 4 twisted pairs, solid bare copper, diameter of 23 AWG, Ethernet speed of 1000Mbps, support PoE of all classes, maximum DC resistance 100 Ohms/Km. jacket should be PVC & lead free, Cable Compliant with EIA/TIA-568-C.2 standard for CAT 6, cable of 305 Mtrs length in box or roll . Reputed Brand Finolex,Fincabe,D-Link or equivalent
11	12 Core Metal Strengthened Outdoor Unarmoured Optic Fibre Cable	It should meet the requirements as per Clause no. 17.2 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all amendments.Specifications are given in Para **3.3.30**
12	PVC insulated Armoured 3 Core 6 Sq Mm Power cable	It should be PVC insulated armoured 3 core 6 Sqmm,10 AWG,1.1 KV Grade Outdoor Strengthen Copper Confirming to IS:1554 Part-1. It should be BIS/ISI Standard and is to be supplied along with all accessories required for installation.Make -Reputed Brand Finolex,Fincabe or equivalent
13	6 Fiber Armoured OFC Cable Single Mode	6 Fiber Armoured OFC Cable Single Mode OFC for laying over the Platform Shed (Make Finolex, Fincabe, ASKH, Sterlite or equivalent) as per latest TEC/BSNL Specification. Inspection Consignee
14	Blowing & Drawing of cables through PVC conduit	Blowing & Drawing of OFC 24F/12F/6F/ Switchboard telecom cable, CAT-6 and Power Cable etc (including crimping and termination of copper cables) through PVC Conduit already installed. OFC should normally be blown through the ducts by blowing through machines; drawing may be adopted in short lengths as decided by the site engineer.
15	Surge Protection Devices	Specifications are given in Para **3.3.31**
16	CAT 6 UTP Patch Cord-2 Mtrs	UTP CAT 6 Cable, cable jacket low Smoke zero halogen (LSZH), conductor dia 23 AWG, confirming to ANSI/TIA/EIA- 568-C.2 Reputed Brand Finolex,Digisol,D-Link or equivalent
17	24 Fiber OFC Armoured (Metal free)	As given in the Schedule description
18	PVC insulated Armoured 3 Core 4 Sq Mm Power cable	It should meet the requirements as per Clause no. 17.3 of RDSO Specification of IP Based Video Surveillance System Specification no. RDSO/SPN/TC/65/2021 Revision 6.0 or latest with all

		amendments. It should be PVC insulated armoured 3 core 4 Sqmm,12 AWG,1.1 KV Grade outdoor strengthened copper for UPS Power Supply,Distribution. a.Outdoor Strengthen Copper Confirming to IS:1554 Part-1. It should be BIS/ISI Standard and is to be supplied along with all accessories required for installation. Cable of reputed make.
19	50,25 &10 Pair Switchboard Telephone Cable	No. of Pairs 50/25/10 Pair 1.Conductor Material - Conductor Solid Annealed Tinned Copper 2.Colour - Grey 3.Nominal area of Conductor- 0.5 mm 4.Insulation Thickness- 0.2 mm 5.Insulation Material- High density polyethylene Rip Cord Nylon.
Schedule C6: Power Supply		
	Power Supply	
1	6 KVA UPS	Specifications are given in Para **3.3.32** Make(APC/Numeric/TataLiebert/Emerson libert makes or equivalent)This also includes supply of one set MF battery of suitable AH capacity of make Exide/Amaron/Tata green or better, Rack and one set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement of Make: Havells,Anchor or similar
2	2 X 10 KVA UPS	Specifications are given in Para **3.3.33.**Make (APC/Numeric/Tata Liebert/Emerson libert makes or equivalent)This also includes supply of two set MF battery of suitable AH capacity of make Exide/Amaron/Tata green or better, Rack and set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement of Make: Havells,Anchor or similar
3	-48V DC to 230 AC Inverter	With a rack mounting kit and all the accessories required for installation. Dual DC inputs Specifications are given in Para **3.3.34**
4	2 KVA UPS	Specifications are given in Para **3.3.35** .Make (APC/Numeric/Tata Liebert/Emerson libert makes or equivalent).This also includes supply of one set MF battery of suitable AH capacity of make Exide/Amaron/Tata green or better, Rack and one set compatible MCBs complete with cover & fixing materials, one earth leakage circuit breaker arrangement of Make: Havells,Anchor or similar
5	1KVA UPS	Specifications are given in Para **3.3.36** Make (APC/Numeric/Tata Liebert/Emerson libert makes or equivalent)
Schedule C7: Tools		
	Toolkit	
1	Network LAN Cable Tester	Specifications are given in Para **3.3.37**
2	OTDR	Optical Time Reflectometer along with carry bag/case and accsserioes.As per description in Para **3.3.38**
3	Splicing Machine	Optical fusion splicer machine along with carry case and accessories As per schedule description
Schedule C8 : Labour and Training		
	Labour Portion	
1	35mm PVC Conduit pipe	Supply and fixing of 35 mm PVC Conduit Pipe ISI Mark Clamping the same on wall, pole etc with required clamps, bends, couplers, flexible pipes and all other installation material as required is part of this item.

2	PVC Trunking of 50X50 mm with cover of 2 mm thick and 2 mtr length	Similar to legrend make.As given in the Schedule description
3	PLB HDPE Duct	PLB HDPE Duct of Size 40/33 mm dia along with all Accessories required for fixing, Clamping Cutting, on Wall or Structure/in Trench/HDD etc. as per RDSO Spec No RDSO/SPN/TC/45/2013 Rev 2 .
4	Trenching and Laying of HDPE Duct	Excavation of cable trench in all kinds of soil including clearing of roots of trees, rocks, bushes etc. to a depth of 1.0 Mtrs and to a width of 0.3 Mtrs.Laying of telecommunication and power cable in HDPE Duct. Refilling of cable trench 1m depth by 0.3m width throughout, with earth after laying of cables, and consolidating the trench by ramming and levelling.
5	Breaking of Pucca/Concrete road/ Platform	Breaking of Pucca/Concrete Road or Platform Cutting at depth of 15 cms and laying of OFC/Telecom/Power/STP cables etc in Trenches and through all types of protection like HDPE/GI/RCC/DWC Pipes as the case may be .This includes refilling of trench and restoration of surface .and stone paved
6	Desk Workstation	Computer Table (1 No) and revolving chair (2 Nos) of Godrej make or similar. Sample photo is given as per Para No. **3.3.39**
7	DWC Pipes(OD/ID 90/76 mm minimum)	Non flammable, anti-rodent DWC Pipes(OD/ID 90/76 mm minimum)as specification IS 16205 with T Joints, sockets/couplers at both ends as per requirements. Supply of non coupler for 6m of DWC pipe and couplers for suitable length free of cost .
8	Blowing / Drawing of cables through PVC conduit	Blowing & Drawing of OFC 24F/12F/6F/ Switchboard telecom cable, CAT-6 and Power Cable (including crimping and termination of copper cables) through PVC Conduit already installed. OFC should normally be blown through the ducts by blowing through machines; drawing may be adopted in short lengths as decided by the site engineer.
9	Krone Module	It should be LSA-Krone disconnection module.10 Pair Krone module should be TEC approved.
	Training for TCCS	
10	Training for TCCS	Training of Staff as per RDSO/SPN/TC/ 99/2012 Rev.2 or Latest
	Training for SIP EXCHANGE	
11	Training for SIP Exchange	Onsite or OEM factory training (as decided by Railway Authority) shall be provided to the Railway Officers/staff which shall include functional aspects of the system through the use of various modules, integration of hardware with software and features related to troubleshooting , as per the tender schedule.Along with Course Materials,Sets of training manual in Two hard copies per Division and Soft copies containing details of technical specifications, installation and commissioning, troubleshooting & maintenance schedule etc. or as specified by the Railway shall be supplied along with the equipment. Training at OEM Factory should provide Boarding and Lodging facilities for trainees as part of training.

Note: RDSO Specification with latest amendment,instruction and guidelines has to be followed for these works .Same can be downloaded from RDSO's Website.

3.3.1 Schedule C2 Item 2 : Specifications for BASIC SIP PHONE Entry Level IP Telephone

1. Minimum 128x64 pixel graphical LCD or higher.
2. 2 VoIP account
3. Two port Giga Ethernet Switch , integrated PoE
4. Full-duplex speakerphone
5. Redial, call return, auto answer
6. Call forward, call waiting, call transfer
7. Local 3-way conferencing
8. Busy Lamp Field (BLF)
9. Message Waiting Indicator (MWI)
10. SIP v1 (RFC2543), v2 (RFC3261) or equivalent
11. IPV4 / IPv6
12. NAT transverse: STUN mode/ Secure methods like SBC or VPN
13. Proxy mode and peer-to-peer SIP link mode (Optional)
14. Power over Ethernet (IEEE 802.3af)
15. Should supply suitable POE Injector.
16..The SIP Phone preferable should be of Same OEM as of IP-PBX and should support all features of IP-PBX.

3.3.2 Schedule C2 Item 3 : Specifications for MEDIUM IP PHONE

Enterprise Level IP Telephone (10/100/1000 Speed):
Highlights
• It should have 3.5” or higher, 240 x 120 pixel graphical LCD with backlight or better display
• 6 VoIP accounts or higher
• Two port Giga Ethernet Switch, integrated PoE
• Full-duplex speakerphone
• Headset, wall mountable
• Remote phonebook
• Extended SIP Functionality

Features
• Call hold, mute, DND
• One touch speed dial, hotline
• Redial, call return, auto answer
• Call forward, call waiting, call transfer
• Group listening, emergency call
•Local 3-way conferencing or higher
• Direct IP call without SIP proxy
• Ringtone selection/import/delete
• Keypad lock, emergency call
• Set date time manually or automatically
• Dial Plan, Browser, action URL & action URI
• RTCP-XR or any more features

Codecs and Voice Features:
• Full duplex hands free speakerphone with AEC
• Codecs: G.711(A/μ), G.729AB, G.726, G.723.1 or equivalents or better
• VAD, CNG, AEC, PLC, AJB, AGC Management or better
• Configuration: browser/phone/auto provision
• Auto provision via FTP/TFTP/HTTP/HTTPS for mass deployment
• Auto provision with PnP
• Provisioning server redundancy supported

• Reset to factory, reboot
• Package tracing export, system log
• Zero-sp-touch
• Phone lock for personal privacy protection

Additional Features:

• Busy Lamp Field (BLF)
•Bridged Line Appearance (BLA)
• Anonymous call, anonymous call rejection
• Message Waiting Indicator(MWI)
• Voicemail, call park, call pickup
• Intercom, paging, music on hold, emergency call
• Call completion, call recording
• hot-desking (Optional)

Physical Features:

• Dual Port Gigabit Ethernet
• 8 line keys with LED can be programmed for up to 21 features (3 page view) or more
•8 featurekeys:message,headset,redial,transfer,mute, conference,hold, hands free speakerphone
• 6 navigation keys or more
• Volume control keys
• Paperless label design
• 1xRJ9 handset port
• Wall mountable (optional)
• Power over Ethernet (IEEE802.3af), Class 2 or better
• Should supply suitable POE Injector.
● The SIP Phone preferable should be of Same OEM as of IP-PBX and should support all features of IP-PBX.

3.3.3 Schedule C2 Item 4 : Specifications for IP VIDEO PHONE with POE Injector:

- 7 inch (1024 x 600) capacitive adjustable touch screen, LCD screen, 720p30 HD video or better
- Should Run on latest Android
- Should have a removable two megapixel HD camera or higher
- Built-in Bluetooth 4.0+ or higher for headsets and pairing mobile device
- Built in Wi Fi (802.11b/g/n) or better
- Up to 6 VoIP accounts or more
- minimum 20 on screen soft key or more should be configurable from telephony system web
- USB 2.0 port (2.0 compliant) for USB headset, media and storage applications
- HD voice: HD handset, HD speaker
- Audio codec: Opus, G.722, G.722.1, G.722.1C, G.711(A/μ), G.723, G.726, G.729AB, iLBC or any other protocols
- Full duplex hands free speakerphone with AEC
- SIP v1 (RFC2543), v2 (RFC3261) or better
- UDP/TCP/DNS-SRV (RFC 3263) or better
- QoS: 802.1p/Q tagging (VLAN or better)
- Dual port Gigabit Ethernet
- Power over Ethernet (IEEE 802.3af), class 3
- IPv4/IPv6
- SIP v1 (RFC2543), v2 (RFC3261)
- Call server redundancy supported
- 5 points multi touch surface or more
- Screensaver and Wallpaper
- LED for call and message waiting indication or any other option
- Dual port Gigabit Ethernet
- Power over Ethernet (IEEE 802.3af), class 3
- The SIP Phone preferable should be of Same OEM as of IP-PBX and should support all features of IP-PBX.

Should supply suitable POE Injector.

3.3.4 Schedule C3 Item 9 : 55 Inch LED Ultra HD (4K) TV

Display Size:	55 inch
Screen Type:	LED
Smart TV:	YES
Resolution Standard:	4K
Resolution (pixels):	3840x2160
No of HDMI Port:	3
No of USB Port:	3
Built In Wi-Fi:	YES
Ethernet (RJ45):	1
Analog Audio Input:	YES
Number of Speakers:	2
Speaker Output RMS:	20 W
Power Consumption:	172 W, 0.5 W (Standby)
Remote:	YES
Supported App-YouTube:	YES
Supported App -Netflix:	YES
Operating System Present:	Android
Screen Mirroring:	YES
Supported Video Formats:	MPEG1/MPEG2TS/AVCHD/MP4/AVI/ WMV/LPCM/MP3/WMA/JPEG
Refresh Rate (Hz):	50

Note: Any material which is missing in above description and is essential for installation of this item should be supplied by the contractor at his own cost.

3.3.5 Schedule C3 Item 20-24 : Communication (SIP) Server Services and Licenses

The system must be suitable with adequate interfaces to provide a control of the communication processes and computer telephony integration (CTI).
It should be possible to setup the following functions or web Services:

- Unified Communication Solution
- Recording and analysis of call data and assignment to originate or about all infrastructures
- Voice Mail and unified messaging services
- Call Centre Solutions
- Multimedia workflow solutions
- CTI and presence based communication services
- Soft clients with Video calling and messaging facility.
- Integration of cordless phones according to Wi-fi standard
- Conference Services with GUI Based Conference Manager.
- Special Solutions for the connectivity of front office systems for Service Areas.
- Web Collaboration Solutions, Instant Messaging

3.3.5.1 Standards and guidelines that have to be met

- The communication server must meet the requirements of the regulatory authorities for Telecommunications in India and recommendations of the ITU Standards.
- The Server offered shall be SIP Ready
- The Server should support Open Standards of SIP and VoIP (Voice over Internet Protocol).
- The IP Communication Server should support IPv6 Standards from day 1.
- The System Licenses should be highly Flexible to deploy and it should be dynamic in nature to switch / assign services either for Analog or IP Subscribers or even Trunks.
- The proposed model should be the latest.
- The products must comply with Safety and EMC standards, including FCC, UL/TUV, CE, and the RoHS directive or equivalent.
- The OEM of IP PBX / bidder should have ISO certification as mentioned in TEC No. : TEC/ GR/SW/PBX-005/01/SEP-16 (Latest TEC 60030:2016)
- Vendors must submit TEC Compliant approval certificate for GR issued by Telecommunication Engineering Centre (TEC), Department of Telecommunication, Govt. of India tested with IPv4 & IPv6 for both SIP terminals and SIP Trunks from day 1 for the particular model of IP-PBX with Server & Media Gateway system quoted. Notarised copy of the same is required to submit along with the technical bid.

- Hardware of the offered IP Telephony Exchange of server-Gateway architecture with redundancy system should be from same OEM or compatible, IP telephony system Software, IP/SIP Phones, Media Gateways, Auto attendance, Help Desk and voice mail should be preferably of same OEM of IP Telephony Exchange.
- Dial Digit length should be supported as per DoT/TRAI guidelines.
- At Hubballi Coral Telecom SIP Based Exchange is installed. All the way Stations Gateways covered in this work in Hubballi Division shall be integrated with this Server. Same to be connected to all Divisions and other Zonal HeadQuarters.
- At Bengaluru a new SIP server has to be installed and 8 exchanges have to be connected on PRI by retaining TDM Exchange at SBC and TDM exchange has to be connected through gateway to New SIP Server. Existing SIP based DRM intercom has to be augmented to accommodate CAO/BNC subscribers. All Exchanges should be connected through SIP/PRI connectivity.
- At Mysore Aeonix system Tadiran Make is already installed. The new resources licenses to be added I.e. User licenses, Mobility and SIP trunks licenses etc. in the same Tadiran Aeonix system installed. If any other OEM/vendor wants to give a complete new system, can offer at no additional cost without compromising any of the existing system features and performance required. (Existing server hardware can be utilized if required or completely new hardware and software can be provided at the same location and integrated with the existing exchange without additional cost). In this Railway decision is final

3.3.5.2 Operating Ambient Conditions

- The offered Server shall be compatible with the tropical climate prevalent in India.
- The offered Server shall be able to operate in ambient temperature range 5-40 Degree Celsius.
- The Server shall be able to operate in relative humidity of about 30-85%.

3.3.5.3 System Architecture

- The system server should use an operating system like Windows,or Linux and should not have any additional licensing or proprietary overheads.
- The call servers should work in load sharing mode i.e. user registration should be distributed between 2 or more servers so that in case of failure of one server, the users should automatically register on a secondary server without any manual intervention.
- Programming of servers and gateways should be real-time synchronized.
- The system shall support the latest SNMP (Simple Network Management Protocol) or any other protocol. It shall be possible to have access to systems from remote locations to monitor the status and to update the software or to take system backup.

- System software shall allow independent shutdown of each unit/card. During the demounting and mounting of extension or trunk cards, no other unit/card shall be shut down (hot swapping).
- In case of a capacity expansion or adding another location to the network there should be no Interruption of the central system (reset, shut down etc.)
- Programming changes should immediately become functional and there shall be no need to reset the system after programming. In case, the power supplied to the system is cut off entirely, the data available in the system should be protected and when the power supply is restored, the system should resume operating normally without any intervention and loss of data.
- Any Programming Changes done in any Server Should be synchronised in all Servers in Real time.
- The server topology shall be fully duplicated and decentralized control.
- The Redundancy Architecture should be Active – Active mode so that the server system should be secured from any attack / threat from the network ensuring the High Availability of Communication Services.
- The interruption free switchover from the active - active control must take place without the existing two-way connections being interrupted.
- The server system should have multilevel Secured access for any administration preventing from attack/hack.
- Server system should be enterprise grade with at least 99.9% availability in Redundancy mode.
- Proposed system should be capable of active-active geo-redundant configuration.
- Proposed system should have 100% of the SIP entities and SIP endpoints have their signalling encrypted by TLS / AES128
- Proposed system should be able to work with SIP based Third Party Session Border Controller
- Proposed system should be able to handle up to 250 locations or higher in a full deployment with up to 100,000 BHCC or higher of interlocation calling for Universal Dial plan
- The system architecture should allow for incremental application additions to the enterprise without modification to existing feature server software.
- The system should allow for third party applications to be added in the open architecture.
- System should allow direct registration / profile creation of SIP endpoints onto it and perform all functions of Registrar/ Redirect etc.
- Proposed system should handle all network administration and management of the communications appliance as a single administration point.
- For enhanced security IP PBX should be able to encrypt the IP calls end to end with AES- 128 bit or SRTP. The signalling from gateways to the IP PBX should also be encrypted.

3.3.5.4 Call Detail Record (CDR)

- The telephony system must have a CDR file for all calls made and received by an extension (either internal or external). Server should have CDR backup for all calls for at least one year. CDR should be in CSV /excel format and other formats should be downloadable from the server as and when required.
- In case of server failure and the call passed to another server, the CDR record must continue on the other server with all the information. If the call was disconnected due to server failure, the CDR record for the call must be closed and saved.
- The CDR must provide the following details.
- CDR must indicate the extension ID
- CDR must indicate the call start date
- CDR must indicate the call start time
- CDR must indicate the elapsed time
- CDR must indicate the trunk group ID
- CDR must indicate the trunk ID
- CDR must indicate the caller ID
- CDR must indicate the ring time
- It should be possible to send CDR online for immediate update and to external Windows based Billing system for complete recording of Internal, External and Network calls to generate various types of traffic reports if required.

3.3.5.5 Interfaces for Subscriber & Trunk and System networking to be supported

Server should support standard SIP or H.323 Protocols for IP Phones and Trunks. System should Support all terminals like analog with CLIP, IP, SIP, soft phone, conference room phones.

The IP Telephony Server shall support the following:

- Euro ISDN Standards Interfaces with DSS 1 protocol SIP carrier Gateway
- Analog Protocol Interfaces for connection of Analog Subscribers
- Interfaces for SIP subscribers and SIP Trunks
- Interfaces for Wireless IP Subscribers and Wireless SIP Subscribers
- Communication server should support Soft Client application for Laptop/Desktop with Video Conferencing and messaging capability.

The communication Server must support the open standard SIP (Session Initiation Protocol RFC3261) to support direct IP- links to third party applications and devices.

a) System should support the following SIP RFCs:
b) RFC 3261 (SIP: Session Initiation Protocol)
c) RFC 3262 (Reliability of Provisional Responses in Session Initiation Protocol)
d) RFC 3263 (Location)
e) RFC 2327 (SDP- Session Description Protocol)
f) RFC 1889 and 1890 (RTP/RTCP)
g) RFC 3515 (REFER)
h) RFC 2833 (DTMF over IP)
i) g SIP Servers)
j) RFC 3264 (An Offer/Answer Model with Session Description Protocol (SDP))
k) RFC 3265 (Specific Event Notification)
SIP RFCs shall be latest version

3.3.5.6 Distributed Architecture over IP Network

The Communication Server offered shall support the IP Distributed Architecture Platform.

- The UC platform must have distributed Architecture and Centralized Control for all the sites in the Network.
- The proposed solution must support Hybrid Cloud Solution in order to guarantee business continuity with overall survivability regardless of a failure at any single location.
- The proposed solution must enable part of the cluster to be hosted in private cloud.
- The proposed solution must have built in redundancy using a cloud solution to provide automatic disaster recovery options.

3.3.5.7 Security Features & System Administration

The offered management platform should provide a comprehensive set of applications designed to simplify system administration, provisioning and network management, fault and performance management operations

- The system must incorporate inbuilt advanced Security features like Real-time Media Encryption, and Access Security Gateways.
- All signalling between the server and its Gateway should be encrypted.
- The system shall have inbuilt diagnostic features such as Isolation/detection of faulty line/junction and restoration of faulty lines/junctions after rectification.
- System should have a web & GUI based maintenance feature.

- The system network should be centrally administered and maintained from an appropriately equipped network management system apart from the centrally performed operational tasks which could be performed using onsite operating terminals.
- The offered system must have the ability to record and analyze traffic measurement data so that the quality of the communication network can be checked.
- It must also be possible to integrate the communication server into a super ordinate management system via standardized interfaces (SNMP)
- System should have remote maintenance, administrative and diagnostic capabilities with password protection from off-site locations. It should be possible to administer the system from anywhere in the LAN network.
- Systems should have different levels of maintenance passwords for security purposes.

3.3.5.8 Help Desk Specifications/Complain Management

General capabilities:

The proposed solution must be embedded within the platform, and should be from the same OEM of the telephony system or any third party on existing or new server.

- The system must be an All-in-one solution that provides a solution for UC&C. **Bidders should supply a minimum 5 agent licence, one supervisor and 5 port IVR for the help desk.**
- Single server deployment with intuitive and central management capabilities should support true multimedia.
- Help desk managers must be able to easily prioritize customers and incoming contacts regardless of the media used.
- The same set of business and routing rules can be applied to voice , emails, and faxes if required.
- The help desk must support multi-layer routing including Priority, Skill Based, Statistical, Business Rules, and Customer Defined Values.(Optional)
- Help desk must have embedded IVR, enabling managers to design routing plans and accurately assess help desk activity trends.
- The IVR application must be a GUI application that can be managed by the customer.
- The customer must have the ability to build new self-services applications like new IVR flow for new service.
- Customer must have the ability to define/change routing rules by himself based on the customer's profile.
- The help desk must support Outbound, including preview, progressive and automated outbound dialling.
- The supervisor must be able to see the status of help desk agents in real-time in his PC like logout, busy, free, release, non ACD etc. in graphical form in pie chart / bar chart.(Optional)
- Help desk facilities
- Real-time Monitoring – must provide supervisors with statistical information about the current status of the help desk with on line refresh (1sec). The application must include a predefined list of reports and the customer (end user) should be able to choose reports as needed.
- The Real Time application must provide the ability to build/change the workspace for each user and by user (not vendor or distributor).
- The RT must provide the ability to move agents to/from different groups/queues for current login only.
- Historical Reports – must be able to collect all information from call entry to call termination. Call profile details for internal investigation purposes should be part of the contact centre solution.
- The help desk solution must have an embedded Management Information System (MIS) suite that monitors all help desk activities, generating reports that summarize the past performance of the system over a given time period, and providing statistical analysis of the help desk within a specified period. Real-time and historical reports provide:

Help desk agent should be able to do following activities from agent application installed on PC:

- Login/Logout from group
- Release/Resume
- Ready
- Release for Break
- Release for Meeting

- Supervisor Help
- Agent Board
- Answer
- Hold
- Retrieve
- Hang Up
- Integration Capabilities with Sales Force, Microsoft dynamics, SAP CRM & Oracle & SIEBEL

3.3.5.9 Telephony Minimum Features should be available

a) Class of service for extensions and Trunk groups.
b) Abbreviated dialling (minimum 100 numbers)
d) Call consultation
e) Do not disturb
f) Appointment reminder
g) Call pick up
h) Last number redial
i) Hotline facility - internal and external
j) Call transfer
k) Automatic call back
l) Hunting groups
m) Mobility – The system Should Support Programmable simultaneous ringing at any two or more extensions/PSTN line/Cell phone/other SWR extensions (in any combination as per requirement at site) for incoming calls. As soon as the call is answered in any one of the ringing phones, ring to the other phones should be stopped. Conversation should be private only between calling and answered phones. Also, users should exercise some basic features like receiving the call, transfer to their own desk.
n) Alternate Tie / Trunk routing
o) Discriminative ringing
p) Call forwarding – internal and external.
q) Call parking.
r) CLIP facility with number and name presentation.
s) CLIP on DISA calls and DID / DIL calls
t) Music on hold, Voice prompt instead of dial tone.
u) Call waiting. Voice prompt for call waiting, no answer, faulty telephones etc.
v) DID, DIL, DISA and DOSA
w) System should support MultiMedia Conferencing. Solutions including audio, Video and Data Collaboration applications. The conferences should be password protected and provision for entry exit tones for added security. The list of participants should be visible to the desk phone user.
x) Personal Station Access: System shall give the user complete flexibility to login from any extension (of the same type assigned to him) by dialling his identification code. This shall allow the user to carry all facilities available to him at the earlier location along with him including voice messaging indication to the new destination without affecting the MDF side and requiring any cable changes.
y) The Personal conference solution should be from the same telephony server or any third party and have the facility to automatically dial out to connect up to 30 participants or more in a single conference. System should also have 2*30 or more party managed Conference. It should be possible for any combination of multi party bridges conferences like 12 X 10 party, 6 x 20 party etc. The Conference Bridge should be secured means to enter the conference bridge, the user should enter the password.
z) Selective extension voice logger (conversation recorder). Minimum 15 days storage. concurrent 10 users call can record in the server.
aa) Automatic Call distribution (ACD) should be configured as per site requirement.

3.3.6 Schedule C3 Item 25: Specifications for Mobility License

Mobility- The system should support programmable simultaneous ringing at any two or more extensions/PSTN line/Cell phone/other SWR extensions (in any combination as per requirement at site) for incoming calls. As soon as the call is answered in any one of the ringing phones, ring to the other phones should be stopped. Conversation should be private only between calling and the answered phones. Also, users should exercise some basic features like receiving the call, Transfer to their own desk.

3.3.7 Schedule C3 Item 26 : Specifications for Soft Phone and its features

1. The soft client should be from the same OEM of IP telephony systems or any third party solution for the new server. Wi-Fi facility for smartphone to be provided by the user.Authentication of soft phone should be done from the server.
2. It should be freely downloadable from Google Play / Apple store
3. Soft client should be available for Windows PC, Android Phone and MacOS/IOS phone
4. Make a call (voice / video)
6. Hold
8. Transfer
9. 3 way audio conference
10. Call forward
11. View missed call
12. Voice mail access
13. Contacts synchronized with the PBX directory
14. "Presences (User Selectable) -
15. Change status to: Available, Busy No Answer, Busy call waiting.
16. At least 20 Speed dial soft buttons for Internal, External, Mobile number should be available
17. Instant messaging to soft client Users
18. "Instant messaging - IM with another soft client User, Search on IM sessions, Save IM sessions
19. Contacts synchronized with the PBX directory
20. Record on Demand (ROD)
21. call divert
22. camp on

3.3.8 Schedule C3 Item 27 :Supply and Installation of (SIP) Server

Physical Attributes of Call(SIP) Server ,shall be of Reputed make.

S. N.	**Parameter**	**Specification**
1	Processor	Latest Generation Intel Xeon or better.
2	No. of Cores & No. of Processors	Minimum 16 Cores in Single Processor or 2 nos. of 8 Core Processor (Dual Socket)
3	No. of Threads	2 Threads per Core
4	Frequency	2.3 GHz or higher
5	Memory	32 GB or higher DDR4 SDRAM or latest
6	Operating System	Windows Operating System or Linux, latest with required no. of Client licenses as specified by the Railway.

7	LAN/ Ethernet	Onboard/ on slot Gigabit Ethernet (RJ45) with Load Balancing and Failover Support, IPv6 compliant.(Minimum 4 nos. of 1G ports should be available as per site requirement)
8.	Interface type	FC or iSCSI or SAS or FCoE or Ethernet interface for connecting External Storage devices.
9	Hard Disk Drive	Hot Pluggable Enterprise SATA HDDs / Hot Pluggable SSD or SAS (7200 RPM or higher for SAS) HDD, 4x1000 GB, with minimum 03 nos. or higher internal drive bays.8GB NV Cache, Mini card
10	HDD RAID Controller	Hardware based - SATA / SAS / SSD – RAID Controller with RAID 0/1/5 configuration.
11	DVD R/W Drive(External/internal) & 3 or more USBPorts	Required
12	USB mouse and keyboard/KVM Connector	Required
13	Power Supply	Dual, Hot-Plug, Redundant -48 Volt DC
14	Expansion slots	Should have 2 PCI express expansion slots of which one should support ver 1.0
15	Should be able to run 24x7 at ambient room temperature .	
16	Software	Factory Generated Password 8 Standard Fans or more Operating System UEFI BIOS Boot Mode with GPT Partition Open Manage Enterprise Advance Power Saving Active Power Controller
17	Chassis Type	19” Rack mountable with sliding rails and fittings to install into a Rack.
18	Regulatory Approvals/ Certifications	BIS/UL/EN/CE/IEC certification for Safety and BIS/CE/FCC Certifications for EMC & Immunity.

3.3.9 Schedule C3 Item 28-32 :Specifications for intercom communication (SIP) services and Licenses

SIP based Unified Communication Server. The System shall be the latest state of the art new generation SIP based server for Converged IP telephony deployment. The IP EPABX system offered should employ VoIP technology with IP as Core Switching Technology. It should be based on server & media gateway architecture, and meet all the relevant ITU-T recommendations. It is so designed and built to operate efficiently with utmost reliability with all the components rated for continuous round the clock operation (99.99% availability).

3.3.9.1 Communication Server capabilities

1. The communication server should support VoIP- technology, integration of IP-based applications, IPv6 from day 1 and the usage of comfortable speech features above all kinds of communication infrastructures and connected voice terminals. The Communication Server has to combine the advantages of worlds (TDM and IP) with networking, carrier access and the flexible connection of analog, TDM- and IP-phones, mobile WLAN- and Wi- Fi devices and softphones within one server.

2. The communication server must build up a high reliability and should support open Standard architecture running on a 64 Bit Linux/windows operating system on an Enterprise grade COTS Server.

3. The offered communication server should provide communication solutions over IP. The IP Phones should register Directly on the server, not on any Gateway / Gatekeeper cards. No restrictions may evolve in terms of quality of service, reliability and security.

4. Quality of service and monitoring options should recognize functional restrictions within the IP network and solve them in a flexible manner.

5. For securing availability, redundancy in network and module level is required for the communication server.

6. The offered communication server should provide multiple IP gateways to implement voice features and applications for IP networks. Therefore this architecture should be able to build up standalone systems, IP distributed Architecture and complex networks uniquely based on identical structures.

7. The IP distributed architecture with Intelligent Branch Solutions should allow the connection of Remote sites / Buildings by a cost effective IP infrastructure and at the same time benefit from central applications and a central management.

8. Providing different solutions to support the availability of voice services

9. Support of CTI-Link according to CSTA

10. Support of the following different standards concerning the connection of VoIP-terminals

a. Voice encoding the standards: G.711, G.729A, G.723.1 and any other standard codes.
b. The Server should support QOS standards Level 2: IEEE 802.1p/Q and Level 3: TOS / Diffserv
c. Echo suppression complaint with G.168
d. DTMF recognition complaint with Q.24
e. NAT-Traversal (Network address translators)

11. STUN –Protocol (Simple Traversal of UDP through NATs)Provide open interfaces and standard protocols for current and future applications
12. Enable networking of systems via TDM and IP infrastructures.

13. Distribution of system components and of remote plant components respectively over IP Infrastructures.

14. Integration of speech and data for multimedia workflow applications.

15. Encryption of signaling and language data of VoIP terminals and VoIP gateways.

16. Administration through network management systems.

17. The offered system must have Session Initiation Protocol (SIP) as core Trunk to provide interface connections to ITSP/ SIP Service Providers, 3rd party applications such and other IP based communication systems.

18. The server system should support the Cluster/two or more communication servers over an IP infrastructure**.** The system should offer maximum availability (99.99%), with the switchover of call control processing functions to an alternate or redundant Server (or softswitch control point) in the event of significant fault. The redundancy scheme should conform to the model used in most computer systems: the complete "mirroring" of the information (both static and dynamic data). There should not be any proxy server to achieve this functionality. The switch over between 2 redundant call control Servers should not interrupt existing and established communications. The complete set of programs and software modules must be duplicated in real time in all geographic redundant

Servers/Standby. In case of failure of the main Server (hardware or software), the standby Server must take over the control of existing and established communications instantaneously.

19. The management Platform must provide a backup mechanism for all critical system information in both a manual and an automatic/scheduled archival

3.3.9.2 Communication Server Services

The system must be suitable with adequate interfaces to provide a control of the communication processes and computer telephony integration (CTI).

It should be possible to set up the following functions or web services:

a. Unified Communication Solution
b. Recording and analysis of call data and assignment to originator about all infrastructures
c. Voice Mail and unified messaging services
d. Call center solutions
e. Multimedia workflow solutions
f. CTI and presence based communication services
g. Soft clients with Video calling and messaging facility.
h. Integration of cordless phones according to Wifi standard
i. Conference Services with GUI Based conference manager.
k. Special solutions for the connectivity of front office systems for service areas.
l. Web collaboration solutionsInstant messaging
m. Video solutions (room and conference systems)
n. Automatic Call Distributions (ACD)

3.3.9.3 Operating Ambient Conditions

The offered server shall be compatible with the tropical climate prevalent in India.

The offered server shall be able to operate in ambient temperature range

The server shall be able to operate in relative humidity of about 30-85%.

3.3.9.4 System Architecture

a. The system server should use an operating system like Windows or Linux and should not have any additional licensing or proprietary overheads.
b. The call servers should work in load sharing mode i.e. user registration should be distributed between 2 or more servers so that in case of failure of one server, the users registered on this server should only register to another server not all the users
c. The server topology shall be fully duplicated and decentralized control.

d. The Redundancy Architecture should be Active – Active mode so that the server system should be secured from any attack / threat from the network ensuring the High Availability of e. Communication Services.
e. The interruption free switchover from the active - active control must take place without the existing two-way connections being interrupted.
f. The server system should have multilevel Secured access for any administration preventing from attack/hack.
g. The IP Communication Server should support both IPv4 &IPv6 from day1.
h. Server system should be enterprise grade with at least 99.9% availability in Redundancy mode.
i. Proposed system should be capable of active-active redundant configuration.

j. Proposed system should have 100% of the SIP entities and SIP endpoints have their signalling encrypted by TLS / AES128
k. Proposed system should be able to work with SIP based Third Party Session Border Controller
l. Proposed system should be able to handle up to 250 locations in a full deployment with up to 100,000 BHCC of interlocation calling for Universal Dial plan
m. The system architecture should allow for incremental application additions to the enterprise without modification to existing feature server software.
n. The system should allow for third party applications to be added in the open architecture.
o. System should allow direct registration / profile creation of SIP endpoints onto it and perform all functions of Registrar/ Redirect etc.
p. Proposed system should handle all network administration and management of the communications appliance as a single administration point.
q. The offered IP PBX should support IPV6 from Day One.
r. For enhanced security IP PBX should be able to encrypt the IP calls end to end with AES- 128 bit or SRTP. The signalling from gateways to the IP PBX should also be encrypted

3.3.9.5 Interfaces for Subscriber & Trunk and System networking to be supported

Server should support standard SIP or H.323 Protocols for IP Phones and Trunks. System should Support all terminals like analog with CLIP, digital, IP, SIP, soft phone, conference room phones.

The IP Telephony Server shall support the following:

- Euro ISDN Standards Interfaces with DSS 1 protocol
- SIP carrier gateway
- Analog Protocol Interfaces for connection of analog subscribers
- Interfaces for SIP subscribers and SIP Trunks
- Interfaces for Wireless IP Subscribers and Wireless SIP Subscribers
- Communication server should support Soft Client application for Laptop/Desktop with Video Conferencing and messaging capability.
- The communication Server must support the open standard SIP (Session Initiation Protocol RFC 3261) to support direct IP- links to third party applications and devices.

System should support the following SIP RFCs:
a) RFC 3261 (SIP: Session Initiation Protocol)
b) RFC 3262 (Reliability of Provisional Responses in Session Initiation Protocol)
c) RFC 3263 (Locating SIP Servers)
d) RFC 3264 (An Offer/Answer Model with Session Description Protocol (SDP))
e) RFC 3265 (Specific Event Notification)
f) RFC 2327 (SDP- Session Description Protocol)
g) RFC 1889 and 1890 (RTP/RTCP)
h) RFC 3515 (REFER)
i) RFC 2833 (DTMF over IP)

3.3.9.6 Distributed Architecture over IP Network

The Communication Server offered shall support the IP Distributed Architecture Platform.

a) The UC platform must have distributed architecture and centralized control for all the sites in the network.
b) The proposed solution must support Hybrid cloud solution in order to guarantee business continuity with overall survivability regardless of a failure at any single location.

b) The proposed solution must enable part of the cluster to be hosted in a public or private cloud.
c) The proposed solution must have built in redundancy using a cloud solution to provide automatic disaster recovery option.

3.3.9.7 Security Features & System Administration

The offered management platform should provide a comprehensive set of applications designed to simplify system administration, provisioning and network management, fault and performance management operations

- The system must incorporate inbuilt advanced Security features like Real-time Media Encryption, and Access Security Gateways.
- All signaling between the server and its Gateway should be encrypted.
- The system shall have in-built diagnostic features such as Isolation/detection of faulty line/junction and restoration of faulty lines/junctions after rectification.
- System should have a web & GUI based maintenance feature.
- The system network should be centrally administered and maintained from an appropriately equipped network management system apart from the centrally performed operational tasks which could be performed using onsite operating terminals.
- The offered system must have the ability to record and analyze traffic measurement data so that the quality of the communication network can be checked.
- It must also be possible to integrate the communication server into a super ordinate management system via standardized interfaces (SNMP)
- System should have remote maintenance, administrative and diagnostic capabilities with password protection from offsite locations. It should be possible to administer the system from anywhere in the LAN network.
- Systems should have different levels of maintenance passwords for security purposes.

3.3.9.8 Unified Messaging System

It is envisaged to provide the users with a true unified communication client with Single Intuitive Interface to Access communications from one client including voice, video, voice messages, audio/video conferencing, Telephony Presence and communication history It should provide the following minimum facilities:
a) The users should have access to all the telephony features available on IP Phones like Multiple call appearances and one button access to frequently used features, such as Answer, Conference, Transfer, Hold, Redial etc.
b) Users should be able to use this client as standalone telephony client with Headset & Mic
c) The user having Integrated Webcams should be able to make video calls as easily as making a phone call. Features should include audio/video features like call, transfer, forward, conference, hold, mute, call coverage
d) The users should be able to observe the presence of other users' telephones on the network.
e) The client should provide a capability to click to call from the numbers highlighted in the web browser
f) The soft phone client should be able to make a HD video call to the SIP based video desk phone

3.3.9.9 Telephony Features

a) Class of service for extensions and Trunk groups.

b) Abbreviated dialing (minimum 100 numbers)
c) Call consultation
d) Do not disturb
e) Appointment reminder
f) Call pick up
g) Last number redial
h) Hotline facility - internal and external
i) Call transfer

j) Automatic call back
k) Hunting groups
l) Mobility - Programmable simultaneous ringing at any two or more of extensions/PSTN line/Cell phone/other SWR extensions (in any combination as per requirement at site) for incoming calls. As soon as the call is answered in any one of the ringing phones, ring to the other phones should be stopped. Conversation should be private only between calling and answered phones.Also users should exercise some basic features like Transfer, Conference etc.
m) Alternate Tie / Trunk routing
n) Discriminative ringing
o) Call forwarding – internal and external.
p) Call parking.
q) CLIP facility with number and name presentation.
r) CLIP on DISA calls and DID / DIL calls
s) Music on hold, Voice prompt instead of dial tone.
t) Call waiting. Voice prompt for call waiting, no answer, faulty telephones etc.
u) DID, DIL, DISA and DOSA
v) System should support MultiMedia Conferencing. Solutions including audio, Video and Data Collaboration applications. The conferences should be password protected and provision for entry exit tones for added security. The list of participants should be visible to the desk phone user
w) Personal Station Access: System shall give the user complete flexibility to login from any extension (of the same type assigned to him) by dialing his identification code. This shall allow the user to carry all facilities available to him at the earlier location along with him including voice messaging indication to the new destination without affecting the MDF side and requiring any cable changes
x) The Personal conference solution should be from the same telephony server and have the facility to automatically dial out to connect up to 30 or more participants in a single conference. System should also have 30 party managed conferences. It should be possible to further divide 125 party conference bridges into any combination like 12 X 10 party, 6 x 20 party etc. if required. The conference should be secured means to enter to the conference bridge; the user should enter the password.

y) The Personal audio conference solution should be from Web Browser/HTML5 based GUI interface using Windows PC or tablet PC.

z) Selective extension voice logger (conversation recorder). Minimum 15 days storage. concurrent 10 users call can record in the server.

a1) Automatic Call distribution (ACD) should be configured as per site requirement

3.3.10 Schedule C3 Item.No 33 & 34: Specifications for Upgradation of Aeonix server / Integration with new one

The Existing R 230 Dell server (Tadiran Aeonix unified communication system)at Bengaluru is equipped with 24 Analog license,100 Tadiran IP endpoint license,10 SIP trunk licenses in Active-active cluster mode. The existing server should be upgraded with additional 100 IP licenses and 30 SIP trunk licenses to cater for intercom provision to construction officers in Bengaluru Cantonment. The bidder is free to install his own software in the existing hardware. The server should be reprogrammed accordingly . The bidder is free to provide new hardwares and software for the remaining licenses and integrate with the existing exchange.

3.3.11 Schedule C3 Item.No 35 : Specifications of (SIP) Server for GM Intercom Exchange

Physical Attributes of Call Server Make:Reputed Make IBM/HP/DELL or Equivalent.

Minimum Server configuration:

Sl. No.	Parameter	Specification
1	Processor	Latest Generation Intel Xeon Processor
2	No. of Cores & No. of Processors	Minimum 4 Cores in Single Processor

3	No. of Threads	2 Threads per Core
4	Frequency	2.3 GHz or higher
5	Memory	8 GB or higher DDR4 SDRAM expandable up to 64GB
6	Operating System	Windows Operating System or Linux, latest with required no. of Client licenses as specified by the Railway.
7	LAN/ Ethernet	Onboard/ on slot 2 Gigabit Ethernet (RJ45) with Load Balancing and Failover Support, IPv6 compliant as per site requirement.Asset Feature tracking and security management, remote wake up
8	Interface type	FC or iSCSI or SAS or FCoE or Ethernet interface for connecting External Storage device.3 USB Ports
9	Hard Disk Drive	Hot Pluggable Enterprise SATA HDDs / Hot Pluggable SSD or SAS (7200 RPM or higher for SAS) HDD, 2x1000 GB or higher, with minimum 04 nos. or higher internal drive bays.
10	HDD RAID Controller	Hardware based - SATA / SAS / SSD – RAID Controller with RAID 0/1/5 configuration.
11	DVD R/W Drive(internal/external) & 3 USB Ports	Required
12	USB mouse and keyboard/KVM	Required
13	Power Supply	Redundant -48 Volt DC Power Supply.
14	Should be able to run 24x7 at ambient room temperature.	
15	Chassis Type	19” Rack mountable with sliding rails and fittings to install into a Rack.
		Slots: 2 PCI/PCI Express,Video Controller: To support VGA or above resolution,18.5 inch LED monitor with industrial grade USB to serial converter.
16	Regulatory/Approvals/ Certifications	BIS/UL/EN/CE/IEC certification for Safety and BIS/CE/FCC Certifications for EMC & Immunity.
17	Power Management	Screen blanking, hard disk and system idle mode in power on, set up password, power supply surge protected, and automatic Server reboot.

3.3.12.1 Schedule C3 Item No 36: Installation and commissioning of servers

Programming of 2 servers for each location at SWR-HQ, UBL division and MYS divisions ,as per the site requirement. Programming of extensions (Analog, IP,SIP trunk) in the servers. Programming of Analog extensions in Gateways (96/48/24/8 port) at different locations over SWR. Programming of PRI gateways and IP/Softphones as per site requirement.

3.3.12.2 Schedule C3 Item No 37: Installation and commissioning of servers

Programming of 2 servers for SBC division as per the site requirement. Programming of extensions (Analog, IP,SIP trunk) in the servers. Programming of Analog extensions in Gateways (96/48/24/8 port) at different locations over SWR. Programming of PRI gateways and IP phones as per site requirement.

3.3.13 Schedule C4 Item No 1: Specifications for 96 Port FXS Gateway

Specifications for Self Survivable Gateway (Analog):

- Gateway should have a minimum 96 Analog Ports slots based with full capacity of concurrent calls and should be from the same OEM of Call Manager .
- Licenses for the same should be on the Main Server Only.
- Voice Processing– Voice Codecs:G.711,G.729A,G.723.1,GSM,iLBC; or any other protocols
- Echo cancellation:G.168with 64ms echo tail or better
- Dynamic jitter buffer; voice activity detector (VAD); and comfort noise generator (CNG) or better
- Call Handling–configurable Dialling Plan up to 500 Routing Rules or more
- Gateway Configuration–Web based user interface
- Remote Provisioning – HTTP/Web; Remote Configuration; Remote Software Upgrade, Alarm, Performance Data
- Protocol - SIP(RFC3261,etc.),MGCP(RFC3435),3GPP TS24.228,TS24.229 or equivalent
- Standards – Caller-ID Detection (FSK/DTMF), Configurable Call progress tone plan
- Primary and Backup – The Gateway can be configured and controlled in Server Clusters/one or more server
- EthernetConnector–RJ-45, 10/100/1000 base-T, 10/100 auto sensing. The Gateway should function as a Self Survivable unit when the Ethernet connectivity at gateway end breaks.
- Power Input – Dual -48 VDC.
- Non-Operating Temperature: -10 to 60ºC; Humidity: 5% to 90% (Non condensing)
- Operating Temperature: 0 to 40ºC; Humidity: 10% to 90%(Non condensing)
- Power Consumption – 125 Watt (max.) or less
- Dual Gigabit Ethernet
- LED Indicators – Power, System Status, Network Status, Line Status (Optional for line status)or as per OEM
- The Preferably Gateway should be of Same OEM as of Call Server.
- Includes supply of Patch panels/Krone for termination .

3.3.14 Schedule C4 Item No 4: Specifications for 48 Port FXS Gateway

Specifications for Self Survivable Gateway (Analog):

- Gateway should have a minimum 48 Analog Ports slots based with full capacity of concurrent calls and should be from the same OEM of Call Manager / Communication Server.
- Licenses for the same should be on the Main Server Only.
- Voice Processing– Voice Codecs:G.711,G.729A,G.723.1,GSM,iLBC; or any other protocols
- Echo cancellation:G.168with 64ms echo tail or better
- Dynamic jitter buffer ;voice activity detector(VAD);and comfort noise generator(CNG) or better
- Call Handling–configurable Dialling Plan up to 500 Routing Rules or more
- Fax Processing–faxrelay
- Gateway Configuration–Web based user interface
- Remote Provisioning – HTTP/Web; Remote Configuration; Remote Software Upgrade, Alarm, Performance Data
- Protocol - SIP(RFC3261,etc.),MGCP(RFC3435),3GPP TS24.228,TS24.229 or equivalent
- Standards – Caller-ID Detection (FSK/DTMF), Configurable Call progress tone plan
- Primary and Backup – The Gateway can be configured and controlled in Server Clusters
- Ethernet Connector–RJ-45, 10/100/1000 base-T, 10/100auto sensing. The Gateway should function as a Self-Survivable unit when the Ethernet connectivity at gateway end breaks.
- Power Input– Dual -48 VDC/AC 230 50Hz for 48 port gateway, (as per site requirement). Non-Operating Temperature: -10 to 60ºC; Humidity: 5% to 90% (Non condensing)
- Operating Temperature: 0 to 40ºC; Humidity: 10% to 90%(Non condensing)
- Power Consumption 125 Watt (max.) or less
- Dual Gigabit Ethernet for 48 port gateway

- LED Indicators – Power, System Status, Network Status, Line Status(Optional for line status).or as per OEM
- The preferable Gateway should be of Same OEM as of Call Server.
- Includes supply of Patch panels/Krone modules for termination .

3.3.15 Schedule C4 Item No 5: Specifications for 24 Port FXS Gateway

Specifications for Self Survivable Gateway (Analog):

- Gateway should have a minimum 24 Analog Ports with full capacity of concurrent calls and should be from the same OEM of Call Manager / Communication Server.
- Licenses for the same should be on the Main Server Only.
- Voice Processing– Voice Codecs:G.711,G.729A,G.723.1,GSM,iLBC; or any Protocols
- Echo cancellation:G.168with 64ms echo tail or better
- Dynamic jitter buffer ;voice activity detector(VAD);and comfort noise generator(CNG) or better
- Call Handling–configurable Dialling Plan up to 500 Routing Rules or more
- Fax Processing–faxrelay
- Gateway Configuration–Web based user interface
- Remote Provisioning – HTTP/Web; Remote Configuration; Remote Software Upgrade, Alarm, Performance Data
- User Features–Caller ID, Call Forward, Call Transfer, Call Forking, Hotline ,CRBT ,Do-not-Disturb, Speed Dialling.
- Protocol - SIP(RFC3261,etc.),MGCP(RFC3435),3GPP TS24.228,TS24.229 or equivalent
- Standards – Caller-ID Detection (FSK/DTMF), Configurable Call progress tone plan
- Primary and Backup – The Gateway can be configured and controlled in Server Clusters/one or two server
- Ethernet Connector–RJ-45, 10/100base-T, 10/100auto sensing. The Gateway should function as a Self Survivable unit when the Ethernet connectivity at gateway end breaks.
- Input– 230V AC/-48 VDC for 24 port gateway(as per site requirement)
- Non Operating Temperature: -10 to 60ºC; Humidity: 5% to 90% (Non condensing)
- Operating Temperature: 0 to 40ºC; Humidity: 10% to 90%(Non condensing)
- Power Consumption – 125 Watt (max.) or less
- Dual Gigabit Ethernet for 48 port gateway and single 10/100 for 24 / 8 port gateway
- LED Indicators – Power, System Status, Network Status, Line Status(Optional for line status).
- The preferable Gateway should be of Same OEM as of Call Server.
- Includes supply of Patch panels/Krone modules for termination .

3.3.16 Schedule C4 Item No 6: Specifications for 8 Port FXS Gateway

- Gateway Cards should have a minimum 8 Ports with full capacity of concurrent calls and should be preferably of the same OEM of Call Manager / Communication Server Licenses for the same should be on the Main Server Only.
- This FXO gateway Card should be Installed in Gateway Chassis
- Voice Processing– Voice Codecs:G.711,G.729A,G.723.1,GSM,iLBC or better
- Echo cancellation:G.168with 64ms echo tail;
- Dynamic jitter buffer ;voice activity detector(VAD);and comfort noise generator(CNG)
- Call Handling–configurable Dialling Plan up to 500 Routing Rules or more
- Fax Processing–faxrelay
- Gateway Configuration–Web based user interface
- Protocol - SIP(RFC3261,etc.),MGCP(RFC3435),3GPP TS24.228,TS24.229 or equivalent
- Single 230V AC for 8 ports.
- 10/100 Single Ethernet for 8 port gateway.
- Standards – Caller-ID Detection (FSK/DTMF), Configurable Call progress tone plan or better
- Non-Operating Temperature: -10 to 60ºC; Humidity: 5% to 90% (Non condensing)
- Operating Temperature: 0 to 40ºC; Humidity: 10% to 90%(Non condensing)
- The preferable Gateway should be of Same OEM as of Call Server.
- Includes supply of Patch panels/Krone modules for termination .

3.3.17 Schedule C4 Item No 7: Specifications for 24 Port FXO Gateway Specifications for FXO Gateway Card

- Gateway Cards should have a minimum 16/24 Ports slot based with full capacity of concurrent calls and should be from the same OEM of Call Manager / Communication Server Licenses for the same should be on the Main Server Only.
- This FXO gateway Card should be Installed in Gateway Chassis
- Voice Processing– Voice Codecs:G.711,G.729A,G.723.1,GSM,iLBC;or any other protocols
- Echo cancellation:G.168with 64ms echo tail or better
- Dynamic jitter buffer ;voice activity detector(VAD);and comfort noise generator(CNG) or other features
- Call Handling–configurable Dialling Plan upto 500 Routing Rules or more.
- Fax Processing–fax relay or other method
- Gateway Configuration–Web based user interface
- Protocol - SIP(RFC3261,etc.),MGCP(RFC3435),3GPP or better
- Dual input Power Supply 230V AC/ 48V DC for 24 port (as per site requirement)
- Standards – Caller-ID Detection (FSK/DTMF), Configurable Call progress tone plan
- Non-Operating Temperature: -10 to 60ºC; Humidity: 5% to 90% (Non condensing)
- Operating Temperature: 0 to 40ºC or higher Humidity: 10% to 90%(Non condensing)
- The preferably Gateway should be of Same OEM as of Call Server .
- Includes supply of Patch panels/Krone modules for termination .

3.3.18 Schedule C4 Item No 8: Specifications for 2 Ports PRI Gateway

- PRI Gateway should have 2 PRI ports and should be from the same OEM of Call Manager / Communication Server.
- PRI Gateway Should embed powerful DSP technology, to support G.711, G.729A, G.723, echo cancellation G.168, DTMF relay RFC2833, fax relay and more.
- PRI Gateway should Support Digit translation, voice announcement, 2nd-stage dialling and RADIUS billing interface. E SIP protocol, frequency domain echo cancellation, iLBC codecs
- Voice Processing – G.711, G.729A, G.723.1, GSM, iLBC; echo cancellation: G.168 with 64ms echo tail; dynamic jitter buffer; VAD and CNG or better
- Calling Control – called/calling party number translation; second stage dialling; voice detection; auto
- dialling with DTMF; ring back tone generation and detection; voice announcement
- Voice Proxy – RTP voice proxy function for NAT/firewall traversal
- Fax Relay – transparent mode, fax relay
- Call Handling – configurable dialling plan, up to 500 routing rules or more
- Configuration Interface – Web Utility
- Remote Management – Telnet, HTTP, TR069 or better
- Signalling:
- PSTN – ISDN PRI standard: ANSI, NI-2, DMS, 5ESS or better
- SIP – RFC3261, RFC2976, RFC3515, RFC3581 or better
- DTMF – tone detection generation and detection; DTMF relay: RFC2833, INFO (SIP) or any protocol
- PRI Gateway supports both Web and text based configuration methods, and it also supports protocol for centralized remote management for configuration, firmware upgrade, log file download, statistics collection and event alarm.
- Hardware:
- Dual Ethernet – RJ-45, 10/100 Base-T
- Trunking Interface – RJ-45
- Power Supply– Dual 48 VDC, 1A (max.)
- The Preferably Gateway should be of Same OEM as of IP PBX UC Call manager application.

3.3.19 Schedule C4 Item No 9: Single mode 1 G SFP-BX (10 km)

SFPs – All SFPs should be bidirectional single Fiber.

SN	Description
1	SFP modules should comply with multi-source agreement (MSA), enabling compatibility with other vendors' equipment.
2	Should support 10 km optical distance on single fiber
3	Should have an LC type connector or as per site requirement
4	Should provide in Pair (BX U & D).One Switch should have BXU other should be BXD
5	Should have 1 Gigabit Ethernet capacity on single mode fiber.
6	Should support DDMI/DOM features. Option should be available for SFP+/XFP
7	OEM should be having valid ISO 9000 & ISO 14000 certification on the date of opening of bid.
8	Should have CE and FCC regulatory compliances.
9	Operating Temperature of the SFP Should be mini 0 to 65 °C (23 to 149 °F)

Note: All SFPs must support DDMI/DOM feature & should be of OEM/Reputed Make

3.3.20 Schedule C4 Item No 10 : Exchange NMS/Emergency Room Communication Console

Includes Hardware/Software and necessary perpetual licenses for NMS and Emergency Room Communication Console. Bidders can give better or higher features than specification given below.

3.3.20.1 Hardware and Software Specification for NMS (Exchange)

- NMS(Network Management Server) Application should be preferably the same make as the OEM of the IP PBX system.
- NMS(Network Management Server) Minimum requirement : 19 inch Rack mountable, Intel Xeon Processor, 2.3 Ghz or higher,4 core or higher, 4MB cache, 8 GB or higher DDR4 RAM, 4 nos of Gigabit ethernet ports, 2x1TB HDD, RAID 1 configuration, USB keyboard, mouse, power supply works on 230 V AC. Windows server 2019 licensed or latest or linux. Standard Accessories should be supplied. Reputed Make: HP/Dell/IBM or equivalent.
- The NMS shall be a multi user system and based on Graphical User Interface.
- The NMS shall be able to diagnose its own faults by running diagnostic software
- The NMS shall provide the complete view of Switches, SIP end phones, and Gateways 400 network elements and the interconnecting links.
- The NMS shall provide Health Monitoring reports of the network with settable periodicity @24 Hrs, 1 week, 1 month or as per site requirement.
- It shall provide the graphical layout of the network element with modules drawn using different colours to indicate their status
- Messaging system –The NMS shall have a messaging system which will generate and send alerts preferably via the internet through email or SMS (GSM and LTE suitable modem should be supplied with necessary perpetual license) to the designated personnel depending upon the location of NE, on generation of alarms.
- It shall be possible to produce pre-defined reports.
- **NMS Licensing should be Device based** :

Network mapping and discovery software using Layer 2/ Layer 3 protocols for devices.

- **Discovery Features :**
- Support for SNMP v1-3, IPv4/IPv6 address range, SNMP Smartscan, hosts file
- Scheduled discovery scans
- Web based discovery

- **Mapping Features:**
- Automated map creation
- Customizable topology maps
- Display of Device dependencies
- Multi level topology views
- **Monitoring Features:**
- SNMP v1-3, SSH and WMI support or better
- Real time monitoring
- MIB Walker, MIB Explorer and MIB Manager
- WMI application monitoring
- Wireless Infrastructure Monitoring, Popup and audio visual Alerting and Reporting
- Custom monitoring with Javascript or VBScript
- Threshold monitoring (Performance, Passive and Flow)
- Blackout period to suspend specific actions during the scheduled period of time
- **Management Console, Alerts Notification and Reporting Features:**
- Web and Windows based management console
- Alert Center for centralized alerts/notification escalation management.
- It should have support Web Alarm and should support & SMS & Email Notification so that it can be augmented in future.
- Configurable Alert with Popup and audio visual mode and Notification escalation policies
- Mobile Interface with one click login
- Configurable role based management
- Dashboard manager
- Real time split second and historical graphs
- Scheduling of recurring reports
- Report export to: email, Excel®, and PDF formats
- Predefined and customizable reports
- Configurable alert thresholds
- Inventory or other device specific information
- **Visual Mapping features:**

Based upon discovery, should be able to automatically generate integrated network topology maps showing both Layer 3 addressing and Layer 2 connectivity.

- **Inventory features**: Agentless scans for inventory.
- **Single point Console features for:**

Managing network discovery, creation and administration of maps, to access detailed device inventory and configuration information.

- **User Defined Device Categories** :

Should provide the users to have the ability to define, edit, add or delete device categories from auto discovered connected devices.

- **Layer 2 Trace :**
  - Should support both LAN or WAN connectivity
  - Should display inbound and outbound interfaces for each network device in the path
  - Should provide Layer 2 trace feature to help network managers to rapidly pinpoint physical layer connectivity issues from the console.
- **IP/Mac Finder features** :

Should provide an IP/Mac finder tool to locate an IP or Mac address on a network from the console.

- **Cloud Monitoring :**
  - Should automatically discovers, maps and monitors cloud environments including Amazon Web Services and Azure servers
  - Solution should monitor, report and alert on the status and performance of every metric your cloud service collects via it's own native API
  - Solution should track cloud billing and show this report on a simple dashboard.

3.3.20.2 Emergency Room Communication Console

Hardware Configuration for Emergency Room Communication Console:

- Core i7, 10th Generation or latest, 500 GB SSD,PC with 2TB HDD/ 8 GB RAM/ Win 10 OS / 21" Touch Screen Monitor, 3 years Antivirus, Standard Accessories,UPS 600VA 30 Mins Backup,Spike Buster .
- Must be supplied with features to rapidly respond to incidents, emergencies and support interoperable communication among users of all devices and also provide control of remote extensions through an easy to use on screen interface.
- It should have features like endpoint status (presence), Priority Answer, Silent Monitor, Voice Reporting, Zone Page.
- Should have Managed Group Call / Conference using a Web based GUI facility.
- The license for the same should be a part of the Main Server.
- The Emergency Room Conference resource should be from the preferably from the same telephony call manager system. Solution should have the facility to automatically dial out to connect up to 30 or more participants in a single conference. System should also have a 2 x 30 party managed conference. It should be possible to further divide 120 party conference bridges into any combination like 12 X 10 party, 6 x 20 party etc. if required. The conference should be secured i.e. the user should enter the password to join the conference.
- Web based GUI should have facility to Program/Define Multiple Emergencies like fire, breakdown and other emergencies and should not have any limitations in terms of creating multiple emergencies in the future.
- It should have the facility to add multiple PreRecorded messages in the application which can be played during emergencies on the phone and announcement system and also in the regular announcements in railways.
- The conference management should be from a web based GUI interface without installing any tool or application on Windows PC. Conference management should be from web based GUI. It should be possible to see the user status in real time like free/ busy / not connected etc. on the screen monitor.
- It should have the ability to view video using streaming with HTML5.
- It should have the ability to view video using Adobe Flash Player
- The conference must be controlled by a user defined as Operator from the web-based GUI.
- The console Operator should have following features as below:
  - o The console Operator must be able to add / remove members
  - o The console Operator must be able to add other conference members
  - o The console Operator must be able to mute / unmute (User, None, All).
  - o The console Operator must be able to lock / unlock the conference
  - o The console Operator must be able to close the conference
- It must be possible to dial out a predefined group (or multi groups) of participants/numbers by simply pressing the preassigned virtual key on PC. During the conference he should be able to view the status of all the participants on a monitor in real time.
- Each preset conference must have its own unique dial number such that when this group number is dialled; all the number stations should ring simultaneously.
- Any combination of stations and external numbers must be able to be defined as members of the Group Call.
- Participants may join a conference in the audible or in the mute mode, if in mute mode, the right to speak must be selectively offered to attendees per their request by a special signal sent to the Group Operator by the attendees.
- Attendees must be able to be added or excluded at any time by the Group Operator
- The conference must be terminated when the Group Operator leaves (auto terminate if all members left are muted).
- The console Operator must be able to barge into an existing user call based on preemption predefined rules
- Mute Ring Button – When a call comes to the Dispatcher phone, the Dispatcher can mute the ring, the call will continue.
- Add Department attribute to user – In the Phone Book, add a department name for the user. The Dispatcher can do a search based on the Department

- Join Incoming Calls to an open Conference – When a call arrives to the Dispatcher, he can add that call to an open conference
- Stage Conference from the Dispatcher screen – the Dispatcher can create an ad hoc conference from the Dispatcher screen
- Change Access Code – The password of a conference can be changed by the Dispatcher to block or allow callers to join a conference.

3.3.21 Schedule C4 Item No 13 : DELETED

3.3.22 Schedule C5 Item No 1 : FDMS and Accessories
Fiber Distribution Management System (FDMS) 12/24 F

The FMS should be confirming to RDSO specification No.RDSO/SPN/TC/37/2020 However, the FMS should have the following:

a. It should be mountable in standard 19" rack and of slider type.
b. There should be an arrangement of termination of 48/24/12/6 Nos. of fibers (as per SOR).
c. It should be supplied with 48/24/12/6 Nos. of pigtails of respective type of connector of minimum 3 meter length.
d. Colour coded pigtails (µn tight jacket) shall be provided for easy identification.
e. The FMS should be supplied with arrangement of required Nos. of adapters (as per SOR).
f. The adaptors shall be fixed in such a way that these shall be easily accessible protecting the eye from direct exposure to laser.
g. There should be nos. of trays or as per site requirement for the provision of termination of the fibers & sufficient space for routing of the fibers in the trays.
h. Trays shall be numbered bottom to top (tray no. 1 is lower most).
i. Pigtails shall follow tray numbering.
j. Pigtails shall be labeled through colour coding/ferruling.
k. Adaptors shall be numbered Bottom to Top or Left to Right in ascending order.
m. All adaptors shall be provided with dust protection caps.
n. Important Do's and Don'ts about the operation of the FMS shall be clearly indicated at a convenient place on the FMS.
o. Insertion Loss: ≤ 0.3 dB or less
p. Return Loss: ≤ 45 dB or less
q. The FMS shall be manufactured as per latest state of art technology.
r. The FMS shall be protected against the entry of dust and insects, rodents etc.
s. Body should be of MS steel; powder coating painting (min. 70 micrometer thickness) shall be provided with rust resistance paint.
t. Marking: The marking on the system shall be indelible and following minimum information shall be provided by way of engraving or Laser printing method:
i. "SWR" should be written on each FMS to be visible from front.
ii. Manufacturer's name & date/ year of production.
iii. Model No./Batch No./ Serial No.
iv. Capacity i.e. No. of cables and the fibers.
v. Identification details/ cables/ Fiber/ labelling facility.
u. Preferred type of connector is SC/APC for all connectors.

3.3.23 Schedule C5 Item No 2 : OFC Patch Cords
The Patch cords should be 3 mtr length conforming to TEC NO: TEC/GR/TX OFJ- 01/05/NOV-09 or latest with all amendments. However, the Patch cords should have the following:

S. N	Parameter	Value
A	Operating Temperature	-40ºC to +85ºC
B	Insertion Loss:	
1	Insertion Loss of complete patch cord including adapter when tested from each direction in all conditions of operations	≤ 0.3 dB
2	Insertion Loss of Adaptors	≤ 0.1 dB
C	Return Loss for each connector of patch cord:	
1	Type-I FC-PC	≥ 50 dB
2	Type-II SC-PC	≥ 50 dB
3	Type-III SC-APC	≥ 65 dB
4	Type-IV LC	≥ 50 dB
5	E2K/APC	≥ 60 dB
D	The length and type of connector of each Patch Cord	As per SOR.
E	The connectors must be make of reputed OEMs 3M, Huber-Shuner, R&M, TE Connectivity/Raychem any other CACT approved Manufacturer/s having a valid approval against Specification number TEC/GR/TX/OFJ-01-NOV.09 for the tendered connected type.	
F	Connector Body	
1	FC-PC	Ni plated brass body (Ni plating shall be as per BIS Standards)
2	SC-PC & SC-APC	Engineering thermoplastic (Glass filled PBT:Polybutylene Terephthalate)
3	LC	PEI (Polyetherimide)/ PPS (Polyphenylene Sulphide)
G	Colour of connector body	
1	FC-PC connector	Ni plated Brass
2	SC-PC connector	Blue
3	SC-APC connector	Green
4	LC connector	Blue
H	Radius of curvature	
1	FC-PC	10 to 25 mm
2	SC-PC	10 to 25 mm
3	SC-APC	5 to 12 mm
4	LC	10 to 25 mm

3.3.24 Schedule C5 Item No 3 : Specifications for 19"42 U 800 mm width X 1200mm depth Rack

SN	Description
1	Racks manufactured out of steel sheet punched, formed, welded and Powder coated
2	Rack should be from ISO 14001 ,27000 Certified Company & UL Listed
3	Standard for Racks configuration will be welded frame with side panel and vented top cover
4	Rack should have Front Transparent Door and Dual Perforated door at Rear.
5	Rack should have 2 no's of removable side panel with slam latch.With key & lock arrangement.

	With key & lock arrangement.
6	Rack should have provision to mount racks on Floor
7	Rack should be 42U (1U = 44.45 mm) in Height.
8	It should be 800mm width and 1200MM Depth
9	Rack should include adapter kit 1 no (loop type) and rack mount sliding rail for mounting of servers.
10	The Rack unit supported by casters static load of at least 350Kgs and by Levelers should support a static load of at least 750Kgs.
11	Rack should have Minimum IP 20 certified and Conforms to 310 DIN 41494 or Equivalent EIA /ISO / EN Standard
12	Rack should have Adjustable mounting depth,
13	Rack 4 No Adjustable, 19" verticals with Punched 9mm Square Hole and Universal 12.7mm-15.875mm-15.875mm alternating hole pattern offers greater mounting flexibility, maximizes usable mounting space.
14	Rack should have Numbered U positions,
15	should have 100% assured compatibility with all equipment's conforming to DIN 41494 (General industrial standard for equipment)
16	Powder coated finish with seven Tanks pre treatment process meeting IS
17	Rack should have Proper Grounding & Bonding
18	Rack should have Fan module Mount Provision on top Cover
19	Rack should have Fan tray with 4 no's 90 CFM Fan
20	Rack should have 1 No Fixed shelf with 715mm depth for mounting NON Rack mountable Equipment & 1 No Sliding Keyboard Tray.
21	Rack should have Server /IT Rack Mount 2 Nos Power Distribution unit, 1Ph, 230V, 8A, 50/60Hz, 2U standard with 8 X Intel Multi Pin 5A, Inlet Plug type 6A Indian Round Pin, 6A Fuse - PDU Rating 1.8KVA/Side or higher feed-1.5Mt/ Black
22	Rack should have 2 No Horizontal Cable & 2 No Vertical Manger/Organizer with Plastic Loops.
23	The earthing kit consisting of copper bus bar with dimensions 20 inch length, 1.0 inch breadth & 5 mm thickness (min.) having appropriate number of M6 tapped holes and 3 brass nut bolts and washers for fixing of earthing cables shall be fixed near the bottom of the rack
24	Rack should have PIS:1554 Part-1.provision for cable entry Exit from Both top & Bottom.
25	INDIAN RAILWAYS Logo along with Year" in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color
26	Rack should have 1 Packet of mounting hardware, Pack of 20 or more.
27	Supply and fixing of Metal Cable of 150 mm width and 2 meter length along with all accessories required for fixing from Rack to MDF with laying and bunching of cables neatly,Rack all Doors should be removable type four exhaust fans, Server's mounts and channel, KeyBoard tray, one Horizontal Tray, one AC Multiple (8 Nos of 5A sockets) Earthing Strip (Copper)-1 with Fasteners- 2 Pac.

3.3.25 Schedule C5 Item No 4 : Specifications for 19"42 U 600mm width X 600 mm Depth Rack

SN	Item	Description
1	Dimension	It should be 600mm width and 600MM Depth
2	Side panels	To be provided across the whole height of the rack should be openable with a latching arrangement at top and bottom.With key & lock arrangement.
3	Front door	Rack should have front door tough and transparent glass fitted on S/CRCA sheet on sides with Lock and key.

4	Rear side	Shall be perforated for appropriate levels as per industry standard.
5	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
6	Fan module	Compact fan module of 90CFM working on AC power supply 4 Nos each rack properly fitted at top of rack.
7	Earthing Provision	Rack Should have earthing provisions.
8	Cable manager	2 nos.horizontal and 2 nos.vertical cable managers with cable loops to be provided with each rack with plastic loop.
9	Power Distribution Unit (PDU)	Adequate and Redundant power distribution units with electronically controlled circuits for surge and spike protection,MCBs isolated input to ground and output to ground.
10	Material used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
11	The rack should be fitted with one modem tray 19",Rack should be 42U (1U = 44.45 mm) in Height.	
12	The earthing kit consisting of copper bus bar with dimensions 20 inch length, 1.0 inch breadth & 5mm thickness (min.) having appropriate number of M6 tapped holes and 3 brass nut bolts and washers for fixing of earthing cables shall be fixed near the bottom of the rack.	
13	The good quality powder coating light grey in colour shall be used for painting the rack	
14	The rack should be fitted with a dual source power supply distribution board.	
15	"INDIAN RAILWAYS Logo along with Year" in bold and easily recog- nizable fonts should be written at the front top of the rack preferably in black or blue color.	
16	OEM should have a valid ISO 9001 certification on the date of opening of bid.	
17	Rack should be minimum IP20 certified. Rack should also comply with EIA 310/DIN 41494 standards.	
18	Two Exhaust fans, one Horizontal Tray, One AC Multiple (4 Nos of 5A Sockets) Earthing Strip (copper)-1 with fasteners-2 pack, Rack Mountable DCDB Panel with one Common Copper Strip and 4 Nos MCB 6 Amps.Including all fittings for housing Router and other Equipment including Supply & Laying of Power Cable, Tray & Connectivity to Earthing, Connectivity to MDF using Krone module with Integrated Protection Module of 100 Pairs and Supply of other Accessories(Exchange work).	

3.3.26 Schedule C5 Item No 5 : Specifications for 19" 27 U 600 X 600mm Depth Rack

SN	Specification	Description
1	Type	Closed Telecom Rack Floor mounted
2	Dimension	27U 600mm (Width)X 600 mm (Depth)
3	Mounting	Floor Mounting with all the accessories required for installation.
4	Front door	Rack should have front door tough and transparent glass fitted on MS/CRCA sheet on sides with Lock and key.
5	Rear door	MS/CRCA Door Plain having ventilation holes bottom side with dust filters.
6	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
7	Fan module	Compact Fan Module of 90 CFM working on 230VAC 2 Nos.with each Rack properly fitted at top of rack.

8	Earthing Provision	Rack Should have earthing provisions.All the required materials for earthing is to be supplied with Rack.
9	Cable manager	1 No .horizontal and 1No.vertical cable manager with cable loops to be provided with each rack.
10	Power Distribution Unit (PDU)	PDU is of 6 Sockets branded with 6 Amp MCB .
11	Materials used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
12	The rack should be fitted with one modem tray19". Back side of the rack should be closed with a removable panel.	
13	The good quality powder coating light grey in colour shall be used for painting of the rack.	
14	"INDIAN RAILWAYS LOGO along with Year" in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color.	
15	OEM should have a valid ISO 9001 certification on the date of opening of bid.	
16	Rack should be minimum IP54 certified. Rack should also comply with EIA 310/DIN 41494 standards.	
17	Supply and fixing of Metal Cable tray of 100 mm along with all the accessories required for fixing width from Rack to MDF with laying and bunching of cables neatly.	

3.3.27 Schedule C5 Item No 6 : Specifications for 19" 12 U 600 X 600mm Depth Rack (Wall/Pole Mounted)

SN	Specification	Description
1	Type	Closed Telecom Rack Wall/Pole mounted
2	Dimension	12 U 600mm (Width)X 600 mm (Depth)
3	Mounting	Rack should have Wall/Channel/Beam mounting with heavy brackets and fasteners of required shape and size as per site condition. It shall be insulated from the wall/ channel/beam/ shelter through insulators
4	Front door	Rack should have front door tough and transparent glass fitted on MS/CRCA sheet on sides with Lock and key.
5	Rear door	MS/CRCA Door Plain having ventilation holes bottom side with dust filters.
6	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
7	Fan module	Compact Fan Module of 90 CFM working on 230VAC 2 Nos.with each Rack properly fitted at top of rack.
8	Earthing Provision	Rack Should have earthing provisions.All the required materials for earthing is to be supplied with Rack.
9	Cable manager	1 No .horizontal and 1No.vertical cable manager with cable loops to be provided with each rack.
10	Power Distribution Unit (PDU)	PDU is of 6 Sockets of branded make such as Havells or equivalent with 6 Amp MCB .
11	Materials used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
12	The rack should be fitted with one modem tray19". Back side of the rack should be closed with a removable panel.	
13	The good quality powder coating light grey in colour shall be used for painting of the rack.	

14	“INDIAN RAILWAYS LOGO along with Year” in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color.
15	OEM should have a valid ISO 9001 certification on the date of opening of bid.
16	Rack should be minimum IP54 certified. Rack should also comply with EIA 310/DIN 41494 standards.

3.3.28 Schedule C5 Item No 7 : Specifications for 19" 9 U 600 X 600mm Depth Rack (Wall/Pole Mounted)

1	Dimension	9 U 600mm (Width)X 600 mm (Depth)
2	Mounting	Rack should have Wall/Channel/Beam mounting with heavy brackets and fasteners of required shape and size as per site condition. It shall be insulated from the wall/ channel/beam/ shelter through insulators.
3	Front door	Rack should have front door tough and transparent glass fitted on MS/CRCA sheet on sides with Lock and key.
4	Rear door	MS/CRCA Door Plain having ventilation holes bottom side with dust filters.
5	Top & Bottom	Rack top and bottom should be MS/CRCA steel made with cable entry provision with glands at both sides.
6	Fan module	Compact Fan Module of 90 CFM working on 230VAC 2 Nos.with each Rack properly fitted at top of rack.
7	Earthing Provision	Rack Should have earthing provisions.All the required materials for earthing is to be supplied with Rack.
8	Cable manager	1 No .horizontal and 1No.vertical cable manager with cable loops to be provided with each rack and Patch panel.
9	Power Distribution Unit (PDU)	PDU is of 6 Sockets of branded make such as Havells or equivalent with 6 Amp MCB .
10	Materials used	CRCA/MS with Thickness varying from 1.6 Mm to 2.0 mm
11	The rack should be fitted with one modem tray19”. Back side of the rack should be closed with a removable panel.	
12	The good quality powder coating light grey in colour shall be used for painting of the rack.	
13	“INDIAN RAILWAYS LOGO along with Year” in bold and easily recognizable fonts should be written at the front top of the rack preferably in black or blue color.	
14	OEM should have a valid ISO 9001 certification on the date of opening of bid.	
15	Rack should be minimum IP54 certified. Rack should also comply with EIA 310/DIN 41494 standards.	

3.3.29 Schedule C5 Item No 8 : 1 Gbps Ethernet & E1 to Fiber Managed Media Convertor

It should meet the requirements as per clause option 2 and 3 RDSO Specification no. RDSO/SPN/TC/103/2013, Rev 2.0 or latest with all amendments.

- Single channel triple speed, stand alone media converter
- Complies to IEEE, IEEE802.3z

- Media Conversion from 100/1000 Base-T to 1000Base-FX
- Auto MDI-I/MDI-X copper Ethernet port
- RJ-45 connector for 1000Base-T port
- E1 Interface as per ITU-T G.703, G.704, Line rate 2048 kbps, Impedance 120 ohms balanced, RJ-45 connector.
- SC connector for 1000Base-X fiber port
- Supports upto 10K jumbo frame @1000Base-T
- Transparent Pass through Tagged & untagged data traffic
- Supports Copper FEF Indication.
- Supports Fiber FEF Indication.
- DIP switch configuration for enabling LFP
- Link/ Activity, LFP/FEF LED indications
- Single fiber support
- LFP (Link Fault Pass through) allows the fiber failure to be propagated to the copper port and vice-versa

3.3.30 Schedule C5 Item No 11 : 12 Core Outdoor Unarmoured Optic Fibre Cable

1. NO. OF FIBRES : 12F
2. TYPE OF FIBRE : SM G652 D
3. LOOSE TUBE DIAMETER : 2.00 mm NOMINAL
4. STRENGTH MEMBER : METAL OR GLASS YARN & FRP 2 NOS STRENGTH MEMBER
5. COLOUR OF FIBRE : BLUE, ORANGE, GREEN, BROWN, GREY,WHITE,RED,BLACK,YELLOW VIOLET, PINK, & AQUA
6. OUTER SHEATH MATERIAL : HDPE – BLACK
7. OUTER SHEATH THICKNESS : 1.80 MM NOMINAL OR HIGHER
8. OUTER CABLE DIAMETER : 6.0 + 0.50 mm
9. CABLE WEIGHT : 34 + 10% Kg/Km
10. PRINTING ON CABLE : AS PER CUSTOMER REQUIREMENTS
11. STANDARD LENGTH : 2 + 10% KMS
12. MAX. OPERATING TENSION : 500 N
13. MAX INSTALLATION TENSION : 1000 N / 10 cm
14. They should be compliant with the latest ITU-TG-652-D Standard.
15 All the accessories required for installation should be provided along with the cable.
16 It should be of reputed make.

3.3.31 Schedule C5 Item No 15 : Surge Protection Device for LAN

Similar to RayDat NET 6 POE or latest**.**

Number of Protected Pairs	4 Pairs (8 Conductors)
Nominal Operating Voltage (DC)	48V
Maximum Continuous Operating Voltage (DC) (Line-Line)	50V
Rated Load Current at 25ºC	1 Amp
Nominal Discharge Current (8/20µs)	150A
C2 Total Discharge Current (8/20µs)	10kA
Voltage Protection Level at In	150V

Response Time Overvoltage Protection	<1ns
Cut-off Frequency	250MHz
Connection Type	Input/Output: RJ45 Sockets
Degree of Protection IEC/EN 60529	IP20

3.3.32 Schedule C6 Item No 1 : 6 KVA UPS

Batteries shall be kept in a closed metal rack so that batteries are not visible from outside. Rack body shall be perforated. Rack shall be supplied by the tenderer.

S.No	Specifications	Requirement
1	Capacity (in kVA / kW)	6kVA/6kW 1-Phase Input / 1-Phase Output
2	Technology and Capability	
3	Wide Input voltage Range	Wide Input voltage range from (100 ~ 280VAC)
4	Auto Restart & Battery Independent	Auto restart capability with the Independent battery bank operation of the UPS.
5	Designed Power Factor	0.9
A	**Input**	
1	Input facility -Phases / Wires	
2	Nominal Voltage	200/208/220/230/240 VAC
3	Nominal Voltage Range	200/208 (de-rating to 90%) : 100VAC~280 VAC 220/230/240 : 100Vac~280 VAC
4	Nominal Input Frequency	50Hz
5	Input Frequency Range	50 Hz
6	Input Power Factor	> 0.9(full load)
7	Generator Compatibility	Compatibility to genset supply required
8	Input Protection	Should be provided at the input of the UPS suitable for the full rated capacity of the UPS.
B	**Output**	
1	Nominal Output voltage 0/208/220/230/240 VAC	
2	Nominal Output Frequency	50Hz
3	Output Frequency Regulation	± 0.1Hz
4	Output Frequency Slew Rate	< 1Hz/sec
5	Output Waveform	Pure sine wave
6	Output Voltage Distortion (THDu)	< 3% for linear load.
7	Output Short circuit Protection	Electronic Protection
C	**Transfer Time**	
1	Transfer Time (Mode of operation)	
2	Transfer Time (Inverter to Bypass / Bypass to Inverter)	2~4ms
3	Automatic Bypass switch	UPS should be capable of automatic change.

4	Efficiency (At Nominal Voltage & Resistive Load up to kW rating of UPS)	
5	Overall Efficiency (AC to AC) - Online (Double Conversion) Upto 95%(on 100% load)	
D	**Overload**	
1	Inverter Overload capacity	<105%for Continuous, <105~<125 for 2Min, <125~<150for 30 Sec
2	Display Indication	
3	Measurements (On LCD)	Input: Voltage & Frequency ,Bypass:Voltage & Frequency ,Output:Voltage, frequency ,Kilowatt & kVA, Battery: Remaining time & Battery Level Indicator, Load Percentage & Load Level Indicator,Ambient Temperature.
4	Fault Indication (On LCD)	Abnormal I/P,I/P Fuse blown, Rectifier Abnormal, BUS start abnormal, Battery Start Abnormal BUS start abnormal in battery mode, +BUS voltage too high & low, -BUS voltage too high & low,InverterO/P voltage abnormal, Overload shutdown,Charge voltage too high, Damaged Batteries, Battery missing , Battery voltage to low & Over temperature Protection.
5	Indication	Green & Red (For output & Fault)
6	Settable data through (LCD)	Inverter Voltage,Inverter Frequency, Frequency converter, ECO Mode, Overload alarm, Buzzer, Charging current, Battery Capacity, Battery String & Parallel ID
E	**Alarms**	
1	Audible Alarms	Replace Battery,Overload warning shutdown, HighTemp, Low Battery, High Temp warning & shutdown
F	Battery Backup / Battery Bank & Charger for 6 KVA Online UPS	
1	Battery Backup	12480 VAH
2	Battery Bank Voltage	
3	Batteries Type	Sealed Maintenance Free (SMF) - 12V Cells,VRLA,GEL
4	Battery Makes	Amara Raja / Exide / HBL / Amco / Rocket/ Amaron
5	Number of Battery Banks	Single Bank system with suitable MS stand
6	Minimum Charger Rating	The charger should be able to deliver charging current equivalent to 10% of Battery Ah rating offered.(In case of external chargers , suitable monitoring of the chargers should be provided in the UPS. Also all external chargers taking AC input must have PFC - Power factor correction)
7	Charger type / Charging Method & Charging Voltages	Float Cum Boost Voltage Solid state SMPS charger
8	Battery Recharge Time(After Complete Discharge) to 90% capacity	3hour to 90%
9	**Battery End Cell Voltage**	1.75 V/cell

G	Interfaces	
1	Serial Communication RS232 Port	RS232 Port should be provided as standard in the UPS.
2	USB port available	However there should be provision for USB port also in the UPS.
3	Interface to NMS (NetworkManagementSystem)	SNMP (IPV6) Card for connecting the UPS to LAN through Ethernet port & monitoring through NMS should be available(The cost of SNMP Card Card / NMS software is inclusive)
4	Reliability	MTBF greater than 100000 hours
5	Number of Battery Banks	Single Bank system.
6	Charger type / Charging Method & Charging Voltages	Float Cum Boost Voltage Solid state SMPS charger

3.3.33 Schedule C6 Item No 2 : 2 X 10 KVA UPS

They are to be connected in parallel redundant mode in separate chassis. Batteries shall be kept in a closed metal rack so that batteries are not visible from outside. Rack body shall be perforated. Rack shall be supplied by the tenderer. They should have the following specifications:

S.N	**Specifications**	**Value**
1	Capacity	10000VA/9000 W
2	Phase	3 phase in / 1 phase out
A	INPUT Characteristics	
1	Power Factor	0.9 or better
2	Voltage Range	175-280 VAC (1-phase) @ 100% load
3	Wave form	Pure Sine wave
4	Nominal Voltage	400 V three phase/ 230 V single phase
B	OUTPUT Characteristics	
1	Output Voltage Rates	**208/220/230/240V(L-N)**
2	Voltage Accuracy	±1%
3	Transfer Time	0
4	Load Crest Ratio	3:1 max
5	AC Mode Efficiency	>90%
6	Output Frequency @ Line mode	50Hz +/-0.5Hz@50Hz system
7	Output Frequency@ Battery mode	50Hz +/-0.5Hz@50Hz system
8	Frequency Converter Mode (CVCF)	50Hz
9	UPS status, Load level, Battery level, Input /Output voltage, Discharge timer, and Fault conditions	Indication required
10	Overload Memory	Default: Yes
11	Transient recovery	100 ms recover to 90% of nominal Voltage
12	Efficiency	>90% Battery Mode @100%R/RCD Load

13	UPS Type	Tower
14	Monitoring software support	Battery, health of UPS, change in any critical parameter
15	Port	USB/RS-232, RJ45
16	Generator Compatible	Yes
17	Battery backup	2 Hrs. on full load with each UPS System with 28800 VAH battery size
18	Acoustic Noise	<60 db
19	Operating Temperature	0-55 deg C
20	Nominal Battery Input Voltage	Vendor to specify
21	Battery Low Warning	10.8V X nos. of batteries
22	Battery Shutdown Voltage	10.5V X nos. of batteries
23	Battery Type	VRLA,12V and suitable MS stand
24	Battery Charger	
25	Nominal Recharging current	minimum 10% of the offered battery AH capacity
26	Maximum Charge Voltage	13.5V X nos. of batteries
27	Regulatory Standards	
28	ESD	IEC/EN 61000-4-2 Level 4 or equivalent BIS/IS standard
29	Safety	IEC/EN 62040-1-1 or equivalent BIS/IS standard
30	Leakage Current	IEC/EN 62040-1-1 or equivalent BIS/IS Standard
31	Protection	IP20
32	Certification	CE or equivalent BIS/IS standard
33	Communication	SNMP V1/V2/V3 along with an interface card and cable.
34	Input AC mains and output power supply surge protection	Inbuilt

3.3.34 Schedule C6 Item No 3 : Inverter -48V DC to 230 AC 50Hz

Input	Dual DC Input -48 VDC
Output	220 AC, 50Hz +/-5%, 1000VA or higher
Phase	Single Phase
Type of Mounting	Floor
Capacity (KVA)	1KVA
Input Grid	1Φ
Voltage Range	230v ± 20%
Frequency Range	50 Hz/60 Hz ± 4%
OUTPUT	1Φ
Voltage	230v
Tolerance/Regulation	

Static Condition	± 1%
Dynamic Condition	± 4% For 100% Step Load
Frequency(Configurable)	50 Hz/60 Hz ± 0.1Hz
Power Factor	0.8Rated
Admissible Crest Factor	3 ≈ 1
Waveform	Sinusoidal(Pure Sine
THD	≤ 3% for linear loads,≤ 5% for nonlinear loads
Overload	150% for 1 Min.
PEAK Efficiency	>85%
Inverter Topology Control Section	Microcontroller / DSP based
Inverter Topology Power Section	MOSFET based MPWM with instantaneous waveform correction
DC characteristics	
Input	Dual input -48V DC
DC Input range	42-60V
Battery Type	SMF/TUBULAR
Protections	
Battery	Charge over voltage and over current limit, Battery Overcharge trip with latching, Battery deep discharge Cut off, HRC Fuse Protection.
Inverter	O/P Overload , Short circuit , Over temperature, Over Voltage , Pulse by Pulse current limit
Display Parameters	Displays Input voltage, Output Voltage, Battery Voltage, Load Percent , Charging current, Potential free contacts For Low battery (Optional), over voltage , battery low
Environment	
Ambient Temperature	0^0C to 50^0C
Relative Humidity	5% to 95% condensed
Maximum Altitude	6660 ft / 2000m
Sound Level @ 1m	<45dbA <60dBA
Cooling	Forced Air

3.3.35 Schedule C6 Item No 4 : 2 KVA UPS

S.N	Technical Parameters	Parameter Description
1	Type	Single phase, IGBT based, True sine wave Online UPS 19 inch Rack Mountable with all mounting accessories.
2	Input	240V±10% V AC, Single phase-three wire (Phase+Neutral+Ground)
		50±5% Hz

		Power factor : ≥ 0.9 Lag	
3	Output :		
		2.0KVA	
		230V±10% V AC, Single phase-three wire (Phase+Neutral+Ground),	
		50Hz	
		≤ 0.75 to ≥ 0.95 (Lag)	
	Voltage Regulation	≤ ±2%	
4	Inverter Efficiency	≥ 85%	
5	Crest factor	≥ 3:1	
6	Overload Capability	110%: ≥10 Minutes 125%: ≥05 Minutes 150%: ≥30 Seconds	
7	Current Harmonic distortion (THDI)	<5% at Full load	
8	Transient response & recovery period	-Less than ±10% voltage variation at sudden application/removal of full load -Rated voltage shall be recovered within 500msec.	
9	Bypass: Static Switch Transfer / Retransfer Time	≤10ms (UPS to static bypass & Vice versa)	
		Maintenance Bypass: No interruption	
10	Battery Charger	Float / Boost Charging Mode shall be provided	
		Battery Charging Voltage & Current shall be adjustable	
		Line & load Regulation: ≤ ±1%	
		Output Ripple : ≤ 3%	
11	Control Switch (MCB/Fuse/Isolator)	i) Input ON/OFF ii) Output ON/OFF iii) Battery iv) Maintenance Bypass Switch	
12	Battery Backup	1 Hrs. with full load with 2340 VAH or higher battery size (Battery to be installed in separate wall mount cabinet/floor mount with suitable battery stand).	
13	Protections	UPS shall trip on following faults. i) Input AC Under/Over voltage ii) Output overload / Short circuit iii) DC Under/Over voltage iv) Over temperature	
14	Indications & Alarms		
15	Alarms (Audible for Trouble/fault)	Mains fail, Charger fail, DC Under /Over voltage	Battery Low/ Discharging Output overload Over temperature
16	Battery Type	Sealed maintenance free valve regulated lead acid battery with MS stand for battery	

3.3.36 Schedule C6 Item No 5 : 1 KVA UPS Tower type

SN	Description	Specification
1	Technology	True Online UPS with Double Conversion technology Rectifier &Inverter both be IGBT based
2	Power Rating	1000VA/600W
3	Input Voltage & Range	160-280 VAC @100% load
4	Input Freq. Range	45Hz ~ 55 Hz
5	Input Power Factor	>=0.95
6	Output Voltage Range	220 / 230 / 240 VAC ±3%
7	O/p Voltage Distortion	< 6% (Non-linear load) < 3% (linear load)
8	Output Frequency	50Hz
9	Transient Response	Less or equal to 3% for 100% nonlinear load (Battery mode)
10	Battery Type	Inbuilt Sealed maintenance free valve regulated lead acid
11	Backup	168 VAH
12	Power Outlet	Should have programmable power management outlet for control of load segment

3.3.37 Schedule C7 Item No 1 : LAN CABLE TESTER

General Specifications	
Test connectors	Shielded 8-pin modular jack accepts 8-pin modular (RJ45) and 4-pin modular (RJ11) plugs. F-connector for coaxial cable.
Power	Battery type: 2 AA (NEDA 15A, IEC LR6) alkaline batteries Battery life: 20 hours of typical use Other compatible battery types: 2 AA photo lithium, NIMH, NICAD
Dimensions and weight (with batteries installed and wiremap adapter attached)	3 in x 6.4in x 1.4 in (7.6 cm x 16.3 cm x 3.6 cm) 10.6 oz (300 g) PoE: 10.6 oz (300 g)
Display	Monochrome LCD with backlight
Cable test	Should Measure length, verifies wiremap, identifies remote ID locators, and detects Ethernet ports. PoE also shows HIGH Ω when the resistance of the cable is more than 12.5 Ω. Displays results on one screen.
Tone	normal analog toning signals

POE	Should detect the presence of 802.3af compatible PoE (Power over Ethernet) devices. PoE: Solicits and detects the presence of 802.3af, at, bt, and UPOE (Universal Power over Ethernet) compatible PoE devices
Cable types tested	Twisted pair: UTP, FTP, SSTP Coaxial : 75 Ω, 50 Ω, 93 Ω
Length test	Range: 460 m (1500 ft) Resolution: 0.3 m (1 ft) Typical accuracy: ± 4% or 0.6 m (2 ft) whichever is greater. NVP uncertainty is an additional error. Calibration: User-settable NVP for twisted pair and coax. Should determine actual NVP with known length of cable.
Wiremap test	Should detect single-wire faults, shorts, miswires, split pairs, and up to seven far-end adapter IDs. The wiremap is drawn with proportional length to visually indicate the approximate location of faults.
Ethernet port detection	Detects the speed of 802.3 Ethernet ports with speeds of 10 Mbps, 100 Mbps, and 1 Gbps. PoE: Detects the speed of 802.3 Ethernet ports with speeds of 10 Mbps, 100 Mbps, 1 Gbps, 2.5 Gbps, 5 Gbps, and 10 Gbps.
Tone generator	Should Support toning and cable mapping with a probe. Generates four tones compatible with typical analog probes. Should give positive identification of cables in bundles when using an IntelliTone or an analog probe.
Interface	Should display key test results like wiremap, pair lengths, distance to fault, cable ID, and far end device all on one screen and should display wiremap results graphically
Toning	Should have digital and analog toning to precisely locate virtually any cable or wire pair, regardless of work environment. Use digital mode to locate high-grade data cabling (Cat 5e/6/6a) in bundles, or at switches, patch panels, or wall outlets. Digital mode especially performs in environments with high data, RF, or electromagnetic interference.
PoE Verification	The tester should detect the available PoE class (0-8) provided by the connected switch in accordance with the latest PoE standards and display the voltage from passive PoE sources.

3.3.38 Schedule C7 Item No 2 :Optical Time Domain Reflectometer (OTDR)

Optical Time Domain Reflectometer for 1310/1550nm fiber with resolution of 60 Cms,dynamic Range of 314/29 dB with all accessories confirming to TEC Specification No G/OTD/02-03 March 2009 or latest. Make EXFO Model MAX 720C , AQ-7270+735022. Make Yokogawa Electric Co Ltd or Similar .

- Display: 7 Inch Outdoor enhanced Touch Screen, 800 X 480 TFT or better
- Battery Back - up: Rechargeable lithium-polymer battery 12 hours of operation or better.
- Storage: 2GB Internal memory (20 000 OTDR traces typical) or better
- Valid TSEC approved certificate against GR No. G/OTD/02-03 March 2009 is required along with a tender otherwise the offer is liable to be rejected.
- Tender specific authorization letters must be enclosed along with tender.

Standard accessories:

- Built in Battery Pack with 12 Hours Backup, Each
- AC Adapter with Power Cord, Each
- SC/APC Connector, Each
- Calibration Certificate, Each
- Soft Carrying Case Each

3.3.39 Schedule C8 Item No 6 : DESK WORK STATION for TCCS

2 No office Desk Cubicles Linear Workstation as shown in picture With 45mm Main and Side Partition, 25mm Thick Table Top and table size of 1200 x 600 x 750 mm (LxDxH) Material Wooden/MS/Aluminium & Wood top ,3 Drawer Fixed Pedestal, CPU Trolley, KeyBoard Tray,Power extension board and under table cable passer. along with a cushioned steel chair 4 Nos Better quality Table to be provided for the Test Room. Contractor can give better design and colour to suit the CCC and Test Room.

Chair Specification

Back: (W)47.0 cm x (H)58.0 Cm,
Seat : (W)48.0cm x (D) 47.0 cm
Seat Height - min 42.5 to max 51.5cm
Height - min91.0 to max 100.0cm.
Width & Depth of Chair as measured from pedestal - Width-72.0 cm and Depth-72.0 cm.
The back shall be a fabricated tubular frame assembly; powder coated (DFT 40-60 microns) and upholstered using Net fabric with high tenacity yarn. The back tubular frame shall be made of Dia. 1.9 ±0.02cm x 0.16 ±0.0128cm. thk. M.S. E.R.W. tube and black powder coated (OFT 40-60 microns). The dimensions of the seat shall be- 48cm(W) x 47(D) and the back shall be 47cm. (W) x 58cm(H). The HR polyurethane foam for seat shall be moulded with density= 45 +/-2 Kg./m3 and Hardness load 16 ± 2 kgf as per IS:7888 for 25% compression.The back cover shall be a perforated strip fabricated from 0.08±0.01cm. thk. CR steel and powder coated (DFT 40-60 microns). Colour and design will be decided by railways. Below picture is only indicative.

Sample Photograph of Server and Charger Room wiring.

Sample Photograph of 6 U Rack Installation at PF

Chapter 4
TECHNICAL REQUIREMENTS & SUPPLEMENT

4.1 Precautions TO BE TAKEN IN 25 KV A.C. Traction Area:

4.1.1 GENERAL

Any Telecommunication circuits in the vicinity of AC Traction running parallel to 25 KV lines are liable to be affected by AC induced voltage. Therefore, precautions should be taken to eliminate the possibility of induced voltage affecting equipment and humans.

Crossing of track, if any, should be negotiated by underground cables running at right angles to the track as far as practicable.

Special protective measures (viz. provision of G.D tubes, fuses and earthing etc) are required to be taken for telecommunication lines entering 25 KV substation /switching posts.

For the human safety considerations, the safe working voltages should be 60V under normal conditions and 150V with special precautions and 430 V under fault conditions.

Instructions for protection of railway staff/working personnel on signaling and telecommunications installations on 25 kV AC traction shall be strictly adhered to. Precautions are required to be taken on account of following,

(i) Proximity of live conductor.
(ii) Pressure of return current in Rails.
(iii) Induction in all metallic bodies situated closed to overhead equipment.

4.2 PREPARATION OF AS-BUILT ROUTE PLANS

4.2.1 SCOPE

The scope of this is to prepare a final set of As-Built drawings of route plans, based on the actual cable route (which in turn shall be based on a preliminary & approved drawings of route plans, already supplied to the contractor).

4.2.2 Points to be taken care of for laying the OFC cable:

4.2.2.1 Avoid underground structures, signaling cable, power cables and pipelines etc.

4.2.2.2 Avoid rodent/termite infested or infected side of the alignment.

4.2.2.3 Avoiding areas prone to waterlogging.

4.2.2.4 For the straight runs as far as possible a separation of 10 Meter should be kept from the nearest track. This is as per CCITT recommendation K.8.

As a rule a minimum distance of 5.75 M should be maintained between the OHE masts and the cable. In Yards etc. where observance of this rule may be difficult, a minimum distance of 3 Meter should be maintained. In exceptional cases where the cable trench depth is less than 0.5 M the lateral distance may be reduced to 1 M.Make the route of OFC cable within 1 meter of Railway boundary normally.

4.2.3 As-Built Cable Route plan.

Based on above actual route, the as-built cable route plan should be prepared:

4.2.4 Preparation of Drawings

All the plans and drawings shall be neatly prepared using Computer Aided Design System & plotter etc. The drawings

shall be in A3 size & suitably filed for ease of handling.Further, a soft copy of Auto-CAD drawings in CD shall be submitted.

4.2.5 Information in Cable route plan: -

The cable route plan shall contain following information: -

4.2.5.1 Whether the cable route is on the **up** or **down** side of the Railway Tracks. Exact locations and lengths where the cable is laid in RCC/DWC/G.I. pipes/ troughs and under the bed on culverts. Location of track crossing and the number of tracks being crossed. Location of road crossing and the no. of RCC/DWC/GI pipes provided. Locations of Pull Chambers/Joint Pits.

4.2.6 Protective works for Cable/ Ducts:-

For Building, Masonry Platforms, crossing of tracks and roads etc. special protection for the cables are required. Some of the methods adopted for different types of protective works are specified in the following drawings: -

As per Drawing given in Technical Booklet of South Western Railway has to be followed

Note1: In non-RE areas, wherever distances are reckoned with reference to overhead alignment, the distances from the nearest KM-post provided along the track, may also be mentioned.

Note 2: If any of the above mentioned drawings are eligible or not clear, the clarifications may be sought from the office of Dy CSTE/P/UBL.

4.3 TECHNICAL SPECIFICATION AND INSTRUCTIONS FOR TRENCHING AND LAYING OF OPTICAL FIBRE CABLE

4.3.1 SCOPE:

This chapter deals with the specifications under which the various work for trenching & laying of optical fibre cable coming under the purview of the contract are to be executed by the contractor.

4.3.2 SUPPLY OF ROUTE PLAN

Approved Cable Route plan and jointing schedule for mid section splicing of cable will be prepared and supplied by the Railway. This shall give a preliminary idea of the number & locations and the quantities and type of various equipment to be fixed, wired and commissioned.

4.3.3 LEADING OF CABLE IN MASONRY BUILDINGS

The cable will have to be led inside any masonry building such as Cable hut, ASM's room at a depth of 0.75 meters by cutting the masonry structure of the wall . After the cable has been led inside the masonry wall, the floor inside shall be duly repaired and plastered.

4.3.4 LAYING OF CABLE IN SPECIAL CASES

4.3.4.1 Near Power Cable

When the proposed cable route comes across any other cable already laid, the contractor shall first report the fact

to the Engineer. Should the cable be identified by the Engineer as a power cable (LT or HT), the trench shall be dug as far away from the route of the power cable as practicable.

4.3.4.2 Crossing of Optical Fibre Cable with another cable

Crossing of the Optical Fibre cable with another cable shall be avoided wherever possible. Where, however, this is not possible, the Optical Fibre cable shall be laid in cement or asbestos cement pipes. The length of the pipe to be provided on ei- ther side of the crossing shall be at least one meter.

4.3.4.3 Laying other than optical fibre cables in the same Trench

No cable other than quad cable shall be laid in the trench made for the Optical Fibre cable. Even in such cases, both the cables are to be laid as per approved drawing. Where, however, exceptional circumstances exist, the optical fibre cable may be laid along with another cable in the same trench provided a specific permission of each such case is obtained in writing from the Engineer. When optical fibre cable and L.T. Power cable have to be laid in the same trench they shall be separated by placing a layer of second class bricks between them vertically (approx. 16 bricks/meter) or laid in RCC pipe.

4.3.4.4 Laying of cable through RCC/GI/DWC pipes

The cable shall be laid through RCC/GI/DWC pipes at the locations marked on the route plan and as advised by the Engineer or his representative.

For laying the cable through pipes galvanised steel wires of a cross section not less than 10 SWG shall be used as a lead wire. Two such lengths of wires shall be laid through the pipes, so that after the cable is threaded through the pipe, one lead wire is permanently left in the pipe with a suitable overlay at two ends, to enable the cable to be pulled out at a later stage if required to do so.

On arch bridges and culvert bridges the cables will be threaded through DWC pipes etc. While threading the cable through these pipes the Contractor shall do the trenching to the required depth wherever necessary for which no extra charge will be paid.

4.3.4.5 Laying cable near feeding post:

In the vicinity of feeding posts, as far as possible the cable shall be laid on the side of the track opposite to the feeding post. Further the Optical fibre cable shall be at least one metre away from any metallic part of the O.H.E. and other equipment at the substation which is fixed on the ground and at least one metre away from the substation earthing. In addition, the cable shall be laid in RCC/DWC pipes (standard 2 metre length) complete or capable of being split into two halves for a length of 300 metres on either side of the feeding point.

4.3.4.6 Running of cables at foundations other than OHE Masts and from pipe out- lets.

Damages to cable is likely to occur if care is not taken in laying cable where the bed changes from solid support such as a foundation pipe or bridge to soft support such as soft soil. The cable must not press against the edge of the solid support. The soft soil near the edge must be tamped and the cable raised slightly.

4.3.5 HANDLING OF CABLE DRUMS & PAYING OF CABLES

4.3.5.1 While collecting OFC/HDPE from the Railway depot the contractor must ensure that the materials should be received in good condition. The drums shall be unloaded by the side of the Railway Track/Road from either a crane or any other suitable means very carefully so as not to cause any damage to the cable. The drums at site shall be protected until they are laid. The cable must be tested before and after laying.

4.3.5.2 On each drum there are two ends, A & B. The 'B' end of one cable length shall meet 'A' end of the next cable at a joint. The 'A' end shall be normally on the top unless indicated otherwise on a drum.

4.3.5.3 The drums shall always be kept upright, i.e. axle in parallel position to the base. The drums shall not be set by jerks but shall be handled slowly and with care. The walls of the drums should not be damaged while moving the drums if required for unrolling.

4.3.5.4 The drums shall normally be unrolled at the same place and the cable carried by workmen near the trench. The drums shall not be dragged in any case. But where drums of cable have to be moved, would always be rolled in the direction of the arrow, otherwise the coils tend to unwind and the cable may get battered. In case no direction arrow is marked on the drum, remove several battens and determine the direction in which the cable is coiled. The arrow should then be painted on the drum pointing in the opposite direction in which the upper cable end is coiled so that future handling of the cable drum is facilitated and then replace the battens carefully.

4.3.5.5 The drum should be properly mounted on jacks (or on a cable wheel) making sure that the spindle is large enough to carry the weight without bending and that it is laying horizontally in the bearings so as to prevent the drum creeping to one side or the other while it is rotating. Before attempting to pull off the cable, remove the end protection box attached to the flange of the drum and cut the security ropes so as to leave the cable free to move.

4.3.5.6 If a portion of the cable only is taken out from the cable drum, the battens should be immediately replaced to prevent damage to the balance of the cable. This is important.

4.3.5.7 The use of steel bars between the bolt heads to 'jump' or turn the drum around is dangerous to staff and likely to damage the drums. A better method is to use two steel plates with grease between them. By standing the drum on these greased plates, it can be easily elevated round to the desired position.

4.3.5.8 All care should be taken in handling cable drums with a view to ensure safety not only of the cables but also of the working party handling them. The man should not be allowed to break the cable drum by standing in front but only from the side.

4.3.5.9 Rewinding and Redrumming of cables:

(a) If for any reason it is found necessary to rewind a cable on a drum, a cable drum with a proper barrel diameter not less than of the original drum should be chosen.

(b) The drums should be mounted on cable jacks during rewinding operations using the proper size of spindles passed through the flange holes, which will not buckle under the lead. The cable should not be bent opposite to the set it is having already.

(c) In the re-drumming operations, drums should be turned so that the cable passes from the bottom of the original set with as little gap as possible.

(d) Replace all the lagging on the cable drum.

4.3.6 MINIMUM BENDING RADIUS

Cables should always be bent (or straightened) slowly, they should never be bent to small radius while handling. The minimum safe bending radius for optical fibre cables should be 30 times the diameter of the cable but wherever possible a larger radius should be used.

TOOLS REQUIRED FOR TRENCHING, CABLE LAYING AND FILLING.

TOOL'S NAME

Cable Jack Cable Grip
Reopening Device Free Hood Hook Shackle free head hook Grouling Hook
Pulling Bolt Tension meter Pulley
Anti Twist Device (swivel) Roller
Flexible Cable Pulling Rope Brush Mandrel Chain
Measuring cord for strain gauge Slip Winch
Wire rope Portable VHF set Measuring tape Phowrah
Iron plate
Loader Backhoe for Drilling Warning Tape
Caterpillar tractor Fork Lifter Vehicle Van type Tachometer Road measurer.

4.3.7 Blowing /Drawing of Optical Fibre Cable

OFC should normally be **blown/drawn** through the ducts by standard blowing machines Only in exceptional cases drawing may be adopted in short lengths with the permission of the site engineer of Rail

4.4 JOINTING AND TERMINATION OF FIBRE OPTIC CABLE

4.4.1 TECHNIQUE FOR JOINTING OF OPTICAL FIBRE CABLE

Fusion splicing shall be used for splicing fibres. This is accomplished by applying localized heating (i.e. by electric arc or flame) at the interface between two butted, pre-aligned fibre ends, causing them to soften and fuse together.

4.4.2 STRAIGHT JOINT FOR FIBRE OPTIC CABLE

4.4.2.1 There are various types of joint enclosures available in the market. The procedure for assembly of joint closure is described in the installation manual supplied with straight joint closure. This includes the following:

Material inside joint closure kit Installation tools required

Detailed procedure for cable jointing Procedure for reopening the closure.

4.4.2.2 The Optic Fibre straight through joint closure shall be as per specn. TEC TO 910 G92 (latest) or a proven design approved by the Railway. The joint shall be protected in RCC Joint Pitas per drawing given in Annexure 2.14. (The Optic Fibre straight through joint closure shall be of TVSE, R&M, Raychem, 3M make and shall be approved in advance by Railway. The joint shall be protected in a concrete chamber as approved by engineer- in-charge).

4.4.2.3 Generally, the following steps are involved for jointing of the cable:

- Preparation of cable for jointing
- Stripping/cutting the cable
- Preparation of Cable and joint closure for splicing
- Stripping and Cleaving of Fibres
  -Fibre splicing
  -Organising fibres and Finishing joints
- Sealing of joint closure and
  -Placing joint in the Jointing Chamber/Pit.

4.4.3 STRIPPING/CUTTING OF THE CABLE

The cables are stripped of their outer and inner sheath with each sheath staggered approximately 10mm from the one above it.

Proper care must be taken when removing the inner sheath to ensure the fibres are not scratched or cut with the stripping knife or tool. To prevent this, it is best to only score the inner sheath twice on opposite sides of the cable, rather than cut completely through it. The two scores marking on either side of the cable are then stripped of the inner sheath by hand quite easily.

The fibres are then removed from cable one by one and each fibre is cleaned individually using Kerosene to remove the jelly.

4.4.4 STRIPPING AND CLEAVING OF FIBRE

Prior to splicing each fibre must have approximately 50mm of its primary protective U.V. cured coating removed, using fibre stripper which are manufactured to fine tolerances and only score the coating without contacting the glass fibre.

The bare fibre is then wiped with a lint free tissue doused with ethyl alcohol. Cleaving of the fibre is then performed to obtain as close as possible to a perfect 90 degree face on the fibre.

4.4.5 SPLICING OF THE FIBRES

The fusion splicing shall be used for fibre splicing. Some of the basic steps for fusion splicing are as given in 4.4.6 below.

4.4.6 FUSION SPLICING OF FIBRE

a) Some of the general steps with full automatic microprocessor control splicing machine are as under Wash hands thoroughly prior to commencing this procedure.

b) Dip the clean bare fibre in the beaker of ethyl alcohol of the ultrasonic cleaver. Switch on ultrasonic cleaver for 5-10 seconds (Some of the manufacturers do not prescribe the above cleaning).

c) Place the bare fibre inside 'V' grove of the splicing machine by opening the clamp handle such that the end of fibre is app. 1 mm. over the end of the "V" groove towards the electrodes.

d) Repeat the same procedure for other fibre, however, first insert heat shrink splice protec- tor.Press the start button on the splice controller.

e) The machine will pre fuse, set, align both in 'X' and 'Y' direction and then finally fuse the fibre.

f) Inspect the splice on monitor if provided on the fusion splicing machine and assure no nicking, bulging is there and cores appear to be adequately aligned. If the splice does not visually look good repeat the above procedure.

g) Slide the heat shrink protector over the splice and place in the tube heater. Heat is complete when the soft inner layer is seen to be 'oozing' out of the ends of the outer layer of the protector.
Repeat for other fibres.

4.4.7 FUSION SPLICER AND OTDR

The fusion splicer and Optical Time Domain Reflectometer (OTDR), to be used for splicing and measurements of parameters respectively, shall be of approved design and quality.

4.4.8 ORGANISING FIBRE AND FINISHING JOINTS

After each fibre is spliced, the heat shrink protection sleeve must be slipped over the bare fibre before any handling of fibre takes place, as uncoated fibres are very brittle and cannot withstand small radius bends without breaking.

The fibre is then organized into its tray by coiling the fibres on each side of the protection sleeve using the full tray side to ensure the maximum radius possible for fibre coils.

The tray is placed in the position.

OTDR reading taken for all splices in this organized state and recorded on the test sheet to confirm that all fibres attenuation are within specification. This OTDR test confirms fibres were not subjected to excessive stress during the organizing process.

After this the joint can be closed with necessary sealing etc. and ready for placement in the pit.

4.4.9 TERMINATION JOINT FOR FIBRE OPTIC CABLE

4.4.9.1 This joint is provided in the cable hut for terminating the outdoor fibre optic cable of both the sides, splicing through fibres, connecting fibres to pigtails for connection to Optical Line Terminal Equipment etc.

4.4.9.2 The OFC Cables shall be dressed up on teak wood plank/Aluminum ladder inside cable hut. The armour of the OFC Cable shall be cut before taking the cable in the equipment rack. The cables shall be terminated on FDMS and derive required pigtails.

4.4.9.3 Two pairs of fibres shall be derived from either side cable at every OFC cable hut through pigtails with FC/PC connectors. The remaining fibres shall be looped through.

4.4.9.4 The procedure for installation of the termination joint box depends upon the type of joint enclosure. The installation manual supplied gives the step-by-step procedure for installation. However, the general steps are as under:-

- Marking the cable
- Stripping/cutting the cable
- Gripping cable in sheath/clamp
- Treatment of tension member
- Fibre splicing
- Enclosing fibre
- Fixing strength member
- Closing the cover
- Fixing termination box
- Fixing the cable.

4.4.10 MARKING THE CABLE

Determine the cable length up to the proposed location of the termination box. It is also to be ensured that at least 10 meters of cable is coiled in the cable pit.

Determine the cutting point and mark the cable Determine the sheath peeling point and mark the cable

4.4.11 CUTTING / STRIPPING THE CABLE

Cut the cable as per the marking

Remove the sheath from cable ends. During sheath stripping care should be taken not to damage the fibres.

The length and the steps for various sheath cutting shall be as per the instruction given in the manual.

4.4.12 GRIPPING THE CABLE

Wind PVC tape around the cable core just beside the edge of the sheath.Insert the bushing inside sheath by cutting the cable sheath for about 25mm.Place the sheath grip (lower half and upper half) and tighten it with the help of torque wrench.

4.4.13 FIXING OF TENSION MEMBER

a) Mark the tension member for the specified length and cut it.

b) Clean the tension member thoroughly by Alcohol and cotton cloth.

c) Fix tension member holder with the help of instant adhesive at the end of tension member.

4.4.14 FIBRE SPLICING

The procedure for splicing is the same as described for straight joint closure in Clause 4.7 above.

4.4.15 ENCLOSING FIBRES

a) Set the fibre cassette on the base

b) Arrange excess length of fibre to make a double figure of eight.

c) Enclose the spliced fibre and its excess length carefully.

d) Repeat the procedure for other fibres.

e) After this, the box can be closed. However, a packet of silica gel may be placed inside for protection from entry of moisture.

4.4.16 MOUNTING OF TERMINATION BOX

Termination box can be fixed either on the wall or on the equipment rack. Mark the fixing holes on the walls/bracket/frame

a) Place the termination box and tightened the nuts inside the base box.
b) Put the covers.

4.4.17 FIXING THE CABLE

Secure the cable on the wall/frame at two places within one meter from the termination box keeping in view straight entry of cable in termination box.

4.4.18 ACCEPTANCE TEST FOR FIBRE OPTIC CABLE

The Procedure for Testing of Fibre Optic Cable shall be jointly finalized by Contractor with Engineer of the Railway. The parameters in the concerned specification shall be taken as reference. The Test shall be conducted from cable hut to cable hut, after the Splicing & termination Joints are completed. The length of cable (as per marking in cable & as measured by OTDR), loss in cable, average loss per Km., No. of Splices, Splice loss, etc. shall be recorded and jointly signed as per proforma given in para 4.24 below.

4.4.19 TEST PROTOCOL FOR OPTICAL FIBRE CABLE

SYSTEM TEST PROTOCOL OPTICAL FIBRE CABLE FIELD TEST

Route: ---------- Date: ----------

Station: ---------- No. of mid-section splices: ----------

Section: ---------- Measured by: ----------

Length Length as per meter
(by OTDR): ---------- Marking on cable sheath----------

1)
2) Optical measurements (On Line):

Measurement	Fibre – number 1 2 3 4 .....22 23 24	Accepted Value
1.1 Total attenuation at 1300/1550 nm with OTDR		
1.2 Total attenuation per Km at 1300/1550 nm:		<0.40 dB/Km at 1300 nm &<0.25 at 1550 nm
1.3 Splice Loss in dB with OTDR Location		Average splice loss
OHE Mast No./ Overhead alignment post no. A. B. C. D. E.		
Average Splice Loss		0.15 db, no splice should have loss >0.2 db

NOTE : ALSO ATTACH OTDR RESULTS | |

2) Visual Inspection (On Line):
2.1 No. of Cable drum used in the section: ----------

2.2 S.No. of cable and length of each drum:

S.No. LENGTH

1. _M
2. _M

3. _M

4. _M

5. _M

2.3 Location of Isolation Sleeves:

1.

2.

3.

Contractor's Representative Railway's Representative

4.4.20 TOOLS AND EQUIPMENTS REQUIRED FOR JOINTING AND TERMI- NATION OF FIBRE OPTIC CABLE

S.No.	TOOL's Name
1	Branch Joint Closure
2	Termination Box
3	Rubber end Block
4	Sheath Clamp
5	Bushing
6	Strength Member holder
7	Heat Shrinkage tube
8	Arc fusion splicer machine.
9	Power cord AC/DC
10	Walkie-Talkie 12V DC source
11	Tube heater
12	Precision cleaver
13	Cable sheath stripper
14	Fibre stripper
15	Knife for HDPE cutting
16	Hexa for strength membrane
17	Isopropyl alcohol or methanol of high specific gravity
18	Johnson Buds
19	Tweezers
20	Gun heater Blower type
21	Sleeve for splice protection
22	O.T.D.R.
23	Stickers for numbering of splicers.
24	Portable k. oil generator

25	Umbrella's 2 Nos.
26	Dust protection for splicing machine

Note:- Wherever cable has to be coiled/looped , the diameter of the coil/loop shall be greater than 30 times the diameter of the cable.

4.5 TECHNICAL SPECIFICATION OF MAINTENANCE FREE EARTHING

4.5.1 Maintenance Free Earthing Earthing should be as per RDSO Specification No. RDSO/SPN/197 (Version-1.0) or latest.

Note:- Bidder to ensure appropriate Surge Protection Device (SPD) arrangement to protect IT infrastructure i.e.Routers, switches, server, storage, NGFW etc. system being installed at platforms and RPF Thana/Post. Further, this proposed SPD arrangement should be connected with the earthing system of the stations.

4.6 List of Address for Specification

4.6.1 Address from where specification copy can be purchased:

The copy of IRS, RDSO, TEC and BIS specifications used in the tender documents can be purchased from following sources.

4.6.2 IRS Specification:
4.6.3 i)Manager Publications,
Government of India
Civil Lines, New Delhi- 110054

ii) Government of India Book Depot,
8 - S.K. Roy Road, Calcutta – 700001

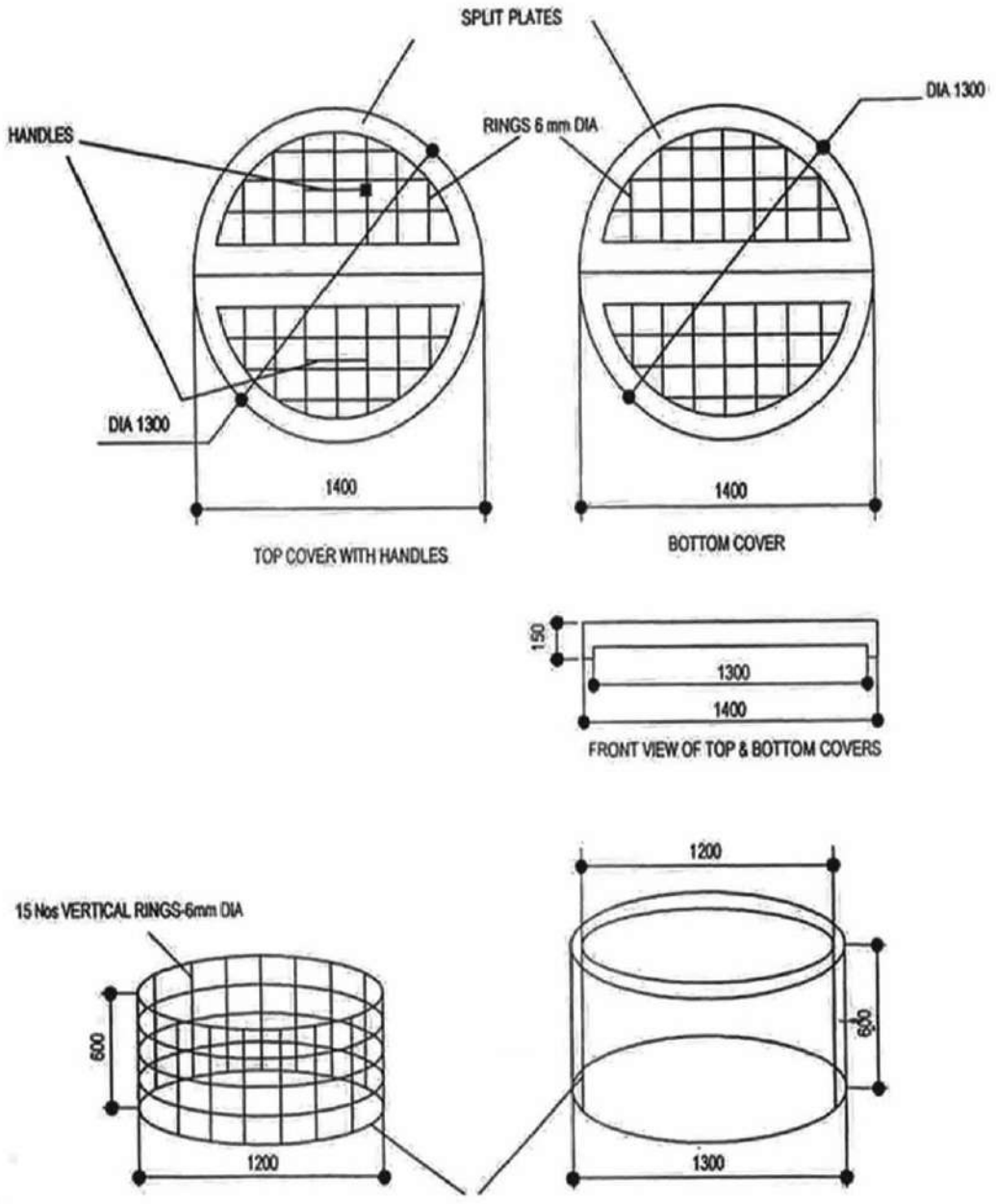
4.6.4 RDSO Specification :
RDSO, Manak Nagar, Lucknow

4.6.5 DOT/TEC/ITD Specification:
Khurshid Lal Bhavan, Janpath,
New Delhi- 110001
4.6.6 B.I.S. Specification:
Directorate General,
Indian Standards Institution, 9- Bahadur Shah Zafar Marg, New Delhi -110002
F- block, Unity Building, Narasimharaja Square, Bangalore- 560002

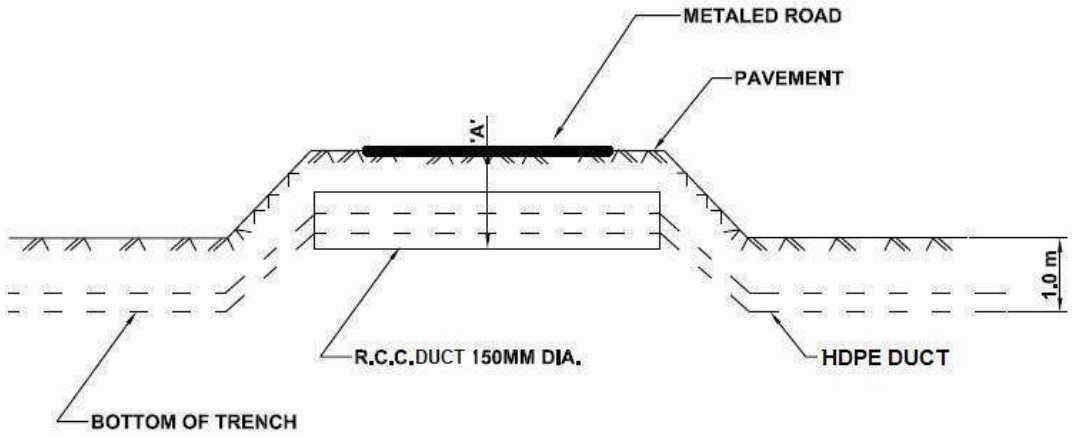
534- Sardar Vallabh Bhai Patel Road , Mumbai.
5- Choweringhee Approach, PO Princep Street, Calcutta- 700072 Ahinsa Building (1st floor) , SCO 82-83, Sector 27-C, Chandi-
garh- 160017
5-8-56/57, L.N. Gupta Marg, Hyderabad- 208005. 117/418-B, Sarvoday Nagar, Kanpur – 208005
C.I.T. Campus, Adyar, Madras – 600020.

If any specifications and drawings referred but not enclosed in the tender documents may be seen in the Railway’s office on any working day.

RCC CIRCULAR OFC JOINT ENCLOSURE



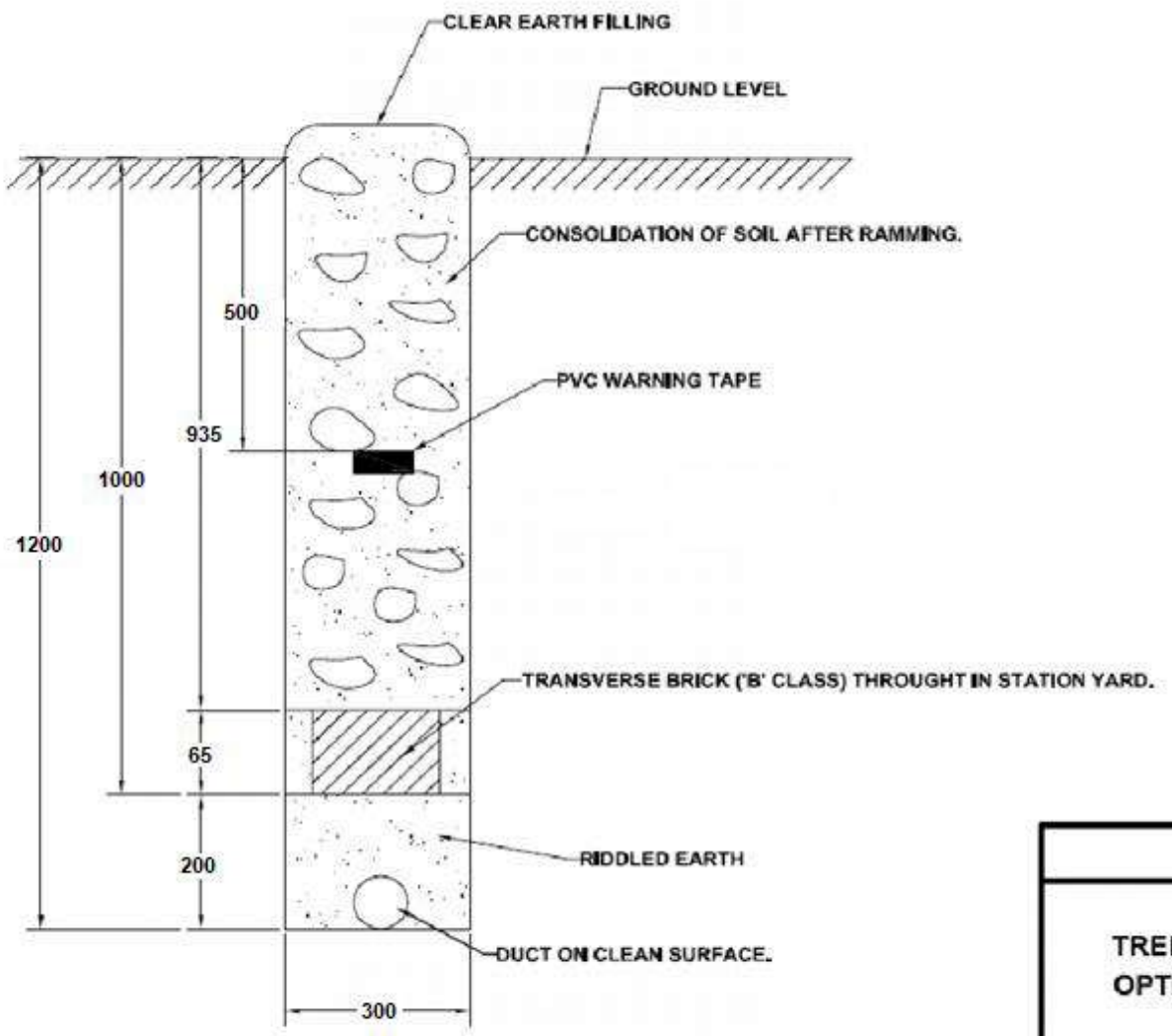
RCC CIRCULAR OFC JOINT ENCLOSURE
DRG. NO. RDSO/TCDO/COP-21(a)



NOTE:
'A' DEPTH WILL BE 1.0 m.
OR OTHERWISE WILL BE
DECIDED BY THE ENGINEERS
AT SITE.

ARRANGEMENT OF R.C.C. DUCT UNDER METALED ROAD

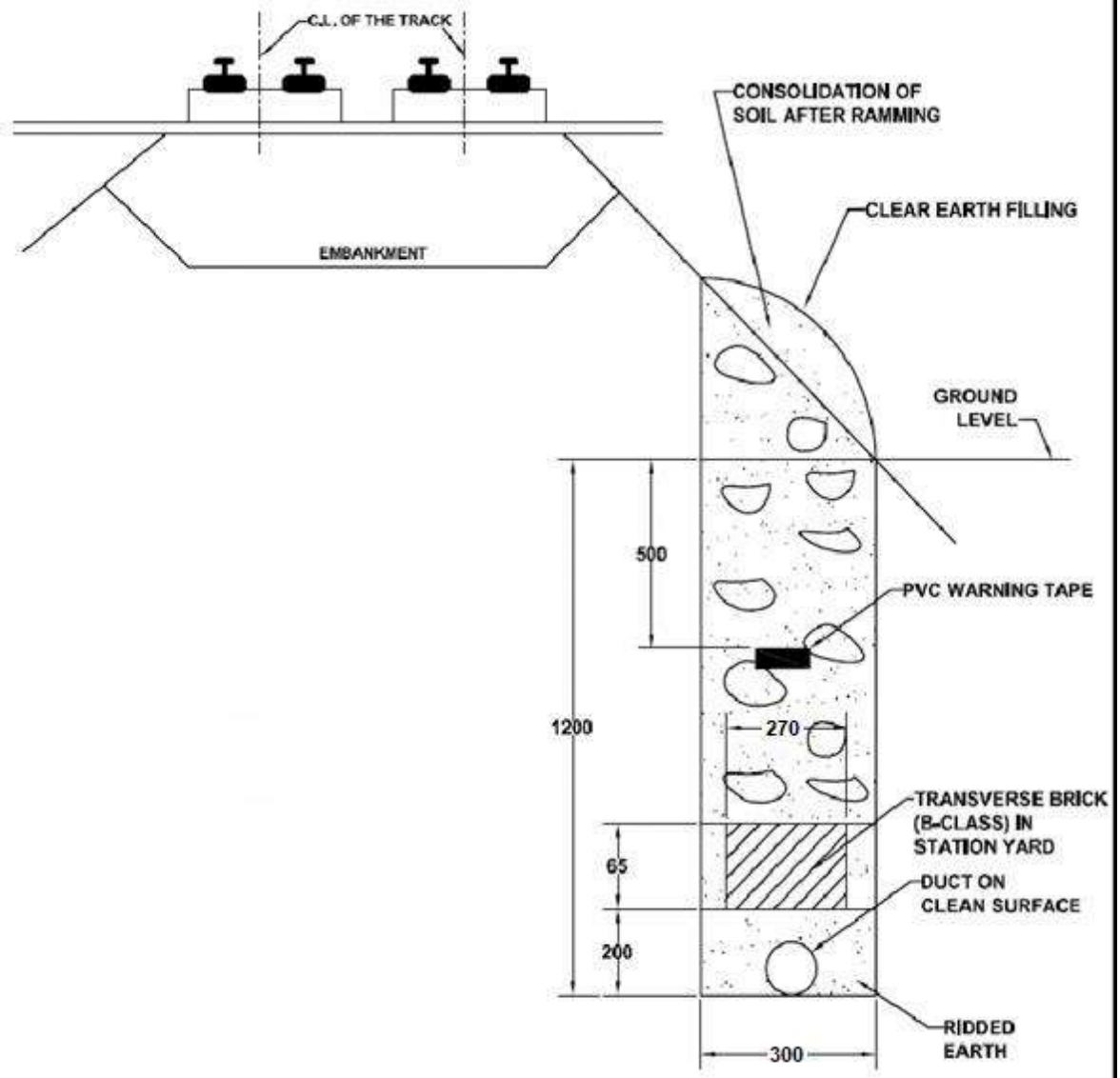
DRG.NO.RDSO/TCDO/COP-20 (a)



NOTE : 1. ALL DIMENSIONS ARE IN mm.

TRENCH FOR LAYING ARMOURED OPTIC FIBRE CABLE .

DRG.NO.RDSO/TCDO/COP-6(a)



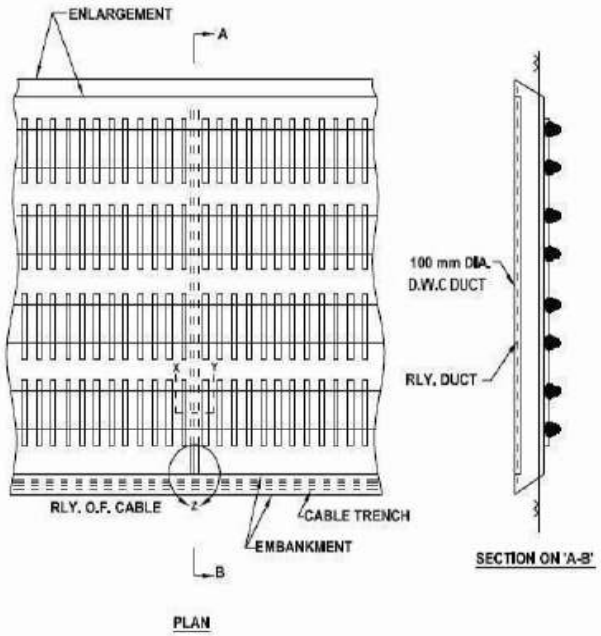
EXCAVATION OF EARTH AND REFILLING

NOTES :

1. ALL DIMENSIONS ARE IN mm.
2. THIS ARRANGEMENT TO BE FOLLOWED IN RARE CASES WHEN CABLE TRENCHING AT END BEYOND TOE OF EMBANKMENT NOT POSSIBLE.
3. APPROVAL OF P-WAY ENGINEERS TO BE OBTAINED AS PER SITE CONDITION.

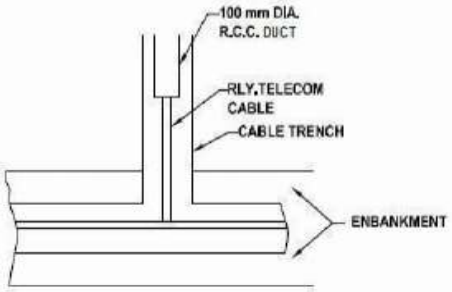
TRENCH ON ENBANKMENT FOR ARMOURED OPTIC FIBRE CABLE .

DRG.NO.RDSO/TCDO/COP-9 (a)

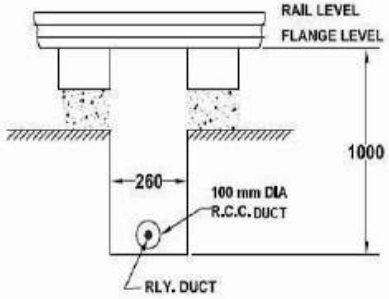


PLAN

SECTION ON 'A-B'



ENLARGED SECTIONAL VIEW AT 'Z'



ENLARGED SECTIONAL VIEW AT 'XY'

ALL DIMENSIONS ARE IN mm.

ARRANGEMENT OF O.F. CABLE R.C.C. / D.W.C. DUCT UNDER TRACK CROSSING.

DRG.NO.RDSO/TCDO/COP/19 (a)