

**Request for Proposal
For
*Creation of OFC Network for BRTS Corridor and other
important SMC Locations
Connected Surat Project – Part 1***



Volume 2 – Scope of Work

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Invited by
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Table of Content

1. Disclaimer	4
2. Glossary.....	5
3. Project Background	7
3.1. ABOUT THE PROJECT	7
3.2. PROJECT OBJECTIVES	8
3.3. BENEFITS ENVISAGED	8
4. Solution Architecture	9
4.1. CORE LAYER.....	9
4.2. ACCESS LAYER.....	10
4.3. LAST MILE CONNECTIVITY:.....	11
5. Scope Of Work For The Project.....	12
5.1. Field Survey, Gis Based Network Planning And Mapping Of All Network Elements	13
5.2. Laying Of Underground Optical Fiber Along Brts Corridor	13
5.3. Creation Of Point Of Presence (Pop) At Identified Locations.....	13
5.4. Creation Of Access Layer With Active Components At Identified Locations	14
5.5. Central Infrastructure	14
5.6. Implementation Of Any Application Software.....	16
5.7. Provisioning Of Intranet Services	18
5.8. Provisioning Of Internet Services.....	18
5.9. Integrating Connectivity From Other Service Provider	18
5.10. Monetization Of Network.....	20
5.11. OTHER GENERAL REQUIREMENTS	21
5.12. PROJECT METHODOLOGY	24
5.13. OPTICAL FIBER CABLE EXECUTION METHODOLOGY.....	25
5.13.1. Open Cut Method.....	25
5.13.1.1. Excavation	25
5.13.1.2. Installation Of 40mm Hdpe Pipes	26
5.13.1.3. Color Code For 40mm Hdpe.....	27
5.13.1.4. Installation Of 110mm Dwc Pipes.....	27
5.13.1.5. Installation Of 100mm Gi Pipes.....	27
5.13.1.6. Protection For Ofc.....	27
5.13.1.7. Backfilling And Reinstatement Of Excavated Area.....	28
5.13.2. Laying Of 40mm Hdpe Pipes Using Horizontal Directional Drilling (Hdd).....	28
5.13.3. Pipe Integrity Test.....	30
5.13.4. Installation Of Ofc.....	30
5.13.5. Installation Of Hand Hole.....	30
5.13.6. Splicing Of Ofc And Installation Of Fiber Splice Joint Closure.....	31
5.13.7. Optical Fiber Cable Testing Methodology.....	31
5.14. EARTHING SYSTEM	32
5.15. ACCEPTANCE TESTING	33
5.15.1. Partial Acceptance Testing.....	33
5.15.2. Final Acceptance Testing	33
5.16. SYSTEM DOCUMENTS AND USER MANUALS	34
5.17. OTHER	35
6. Project And Operation & Maintenance Teams	36
6.1. PROJECT MANAGEMENT OFFICE (PMO)	36
6.2. STEERING COMMITTEE	36
6.3. PROJECT TEAM.....	37

6.4.	OPERATION & MAINTENANCE (O&M) TEAM.....	38
7.	Annexure I - Specifications	40
7.1.	CORE SWITCH FOR NOC LOCATIONS	40
7.2.	CORE ROUTER / INTERNET ROUTER	41
7.3.	POP SWITCH.....	43
7.4.	NEXT GENERATION FIREWALL / UNIFIED THREAT MANAGEMENT	53
7.5.	INDOOR ACCESS SWITCH FOR CONNECTING SMC LOCATIONS.....	57
7.6.	FIBER DISTRIBUTION PANEL (FDP).....	61
7.7.	42U RACK CABINETS	61
7.8.	9U RACK CABINETS (INDOOR LOCATIONS)	62
7.9.	OPTICAL FIBER CABLES (OFC)	63
7.10.	96 CORE OFC – CORE LAYER	65
7.11.	48 CORE OFC – ACCESS LAYER	66
7.12.	12 CORE OFC – LAST MILE	66
7.13.	REMOTE FIBER MONITORING SYSTEM	66
7.14.	FIBER PATCH CORDS	67
7.15.	FIBER PIGTAILS	68
7.16.	FIBER SPLICE JOINT CLOSURE	68
7.17.	40 MM HDPE PIPE	69
7.18.	40 MM HDPE COUPLER.....	71
7.19.	END PLUG FOR 40MM HDPE PIPE	71
7.20.	110 MM DWC PIPE.....	72
7.21.	110 MM HDPE COUPLER FOR DWC PIPE	73
7.22.	ROUTE MARKER.....	73
7.23.	UPS FOR ACCESS LOCATIONS.....	74
7.24.	SERVERS (AS BUILDING BLOCK FOR ESTABLISHING COMPUTING SOLUTION)	76
8.	Annexure II - Specifications For Components Of 4 Major Pops.....	77
8.1.	PVC CONDUIT	77
8.2.	WIRING.....	77
8.3.	ELECTRICAL EARTHING	78
8.4.	UPS FOR 4 MAJOR POP LOCATIONS	79
8.5.	SMPS AT POP LOCATIONS	80
8.6.	ACCESS CONTROL SYSTEM FOR POP.....	81
8.6.1.	Access Control Module	81
8.6.2.	Card Reader	81
8.6.3.	Electro Magnetic Lock	82
8.7.	RODENT REPELLENT SYSTEM	82
9.	Annexure III - Common Guidelines Regarding Compliance Of Systems / Equipment.....	83
10.	Annexure IV- Applicable Standards	85
10.1.	PASSIVE COMPONENTS	85
10.2.	ACTIVE COMPONENTS.....	86
10.3.	FIRE-SAFETY RELATED STANDARDS	87
10.4.	OPERATIONAL FACILITIES STANDARDS	88
11.	Annexure V – Other Smart City Project Infrastructure	89
11.1.	EDGE LEVEL NETWORK SWITCH	89
11.2.	FIELD JUNCTION BOX.....	90

1. Disclaimer

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2. Glossary

Terms	Meaning
1CNO	1 Cut Not Out
BOQ	Bill Of Quantity
BW	Bandwidth
CAD	Computer Aided Design
CCTV	Closed Circuit Television
DWC	Double Wall Corrugated
EMI	Electromagnetic Interference
FAT	Final Acceptance Test
FDP	Fiber Distribution Panel
FDU	Fiber Distribution Unit
GI	Galvanized Iron
GIS	Geographical Information System
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
ICT	Information & Communication Technology
IP	Internet Protocol
ISO	International Organization for Standardization
ISP	Internet Service Provider
ITIL	Information Technology Infrastructure Library
ITU	International Telecommunication Union
LoI	Letter of Intent
LSPM	Light Source Power Meter
MAC	Media Access Control
MoUD	Ministry of Urban Development
MSO	Multiple System Operator
NMS	Network Management System
NOC	Network Operations Center
OEM	Original Equipment Manufacturer
OFC	Optical Fiber Cable
OTDR	Optical Time Domain Reflectometer
OTP	One Time Password
PBG	Performance Bank Guarantee
PCC	Plain Cement Concrete
PoP	Point Of Presence
PVC	Polyvinyl Chloride
RCC	Reinforced Cement Concrete

Terms	Meaning
RFP	Request For Proposal
RI	Road Reinstatement
RoW	Right of Way
SCADA	Supervisory Control And Data Acquisition
SI	System Integrator
SLA	Service Level Agreement
SMPS	Switched Mode Power Supply
SPOC	Single Point Of Contact
SPOF	Single Point Of Failure
SSCDL	Surat Smart City Development Limited
TIA	Telecommunications Industry Association
TPA	Third Party Administrator
UPS	Uninterrupted Power Supply

3. Project Background

Surat is currently positioned as one of the most prosperous cities of India owing to its booming industrial landscape, its demographic makeup and entrepreneurial nature of its populace. The city of Surat has won several national as well as international accolades in its economic and infrastructural development since 1994.

Surat is ranked 4th among the top 20 smart cities in India. The smart city proposal of Surat includes several Pan City and Area Based Development initiatives with a focus on both infrastructure and ICT advancements across the city and at strategic locations. The strategic focus of the city has been identified to improve transport & mobility, improvise the city wide IT connectivity and enhance public safety and security. “Connected Surat “is one of the significant projects among the Pan City initiatives toward above said strategic focus.

Connected Surat project aims to improvise and sustain the high levels of citizen satisfaction and promote a better quality of life for residents. SSCDL desires to foster the development of a robust network infrastructure that supports digital applications and ensures network connectivity is available throughout the city and in government offices like Head Office, Zonal Offices, Ward Offices, etc. Network connectivity is also critical at citizen centric locations like BRTS stops, bus depots, health centers, civic centers, community halls, amusement locations, and emergency response units, etc. The Connected Surat will be implemented in two parts as below:

1. Part 1 : Implementation of OFC for BRTS Corridor and other important SMC Locations
2. Part 2: Implementation of Leased Lines / MPLS / Dark Fibre for other locations that are not connected through OFC scope defined in Part 1 RFP

The scope of this RFP is restricted only for implementation of OFC for BRTS Corridor and other important SMC Locations.

3.1. About the Project

SSCDL through this project desires to provide 24*7 uninterrupted network to critical SMC offices and important establishments located along BRTS corridor. This project along with the Leased Line / MPLS / Dark Fiber connectivity (separate Project) will act as a backbone to smart city projects such as Intelligent Transit Management System (ITMS), Intelligent Traffic Control System (ITCS), Automatic Fare Collection System (AFCS), field sensors for Air & Water Quality, Digital Boards, ERP Systems, etc.

To achieve the set objectives – SSCDL desires to create a BRTS corridor wide fiber network which will establish core ring connecting zonal offices in the city, and access rings which connects various points of interest for SSCDL such as traffic junctions, BRTS bus stops and other important locations situated along BRTS corridor. The same fiber optic network will then be lit up using active devices to provide connectivity across selected offices around BRTS corridor and ensure scalability, redundancy and committed uptimes. Moreover, certain other important locations like Hospital, Zonal Offices, Main Office, etc. will also be connected under this project which may not fall around BRTS corridor.

While SSCDL is selecting vendor to lay fiber optic cable and provision connectivity, the focus is on creating a financially sustainable asset, and hence the bidders are encouraged to identify revenue streams for the project which will reduce the total cost of operation for the project. SSCDL desires to lay additional duct across the BRTS corridor network to create a means for revenue generation through duct leasing. SSCDL’s commercial model for the project encourages the bidders to actively participate in creating the network for future with SSCDL investing in the capex for the project and giving the responsibility of monetizing the network

to the selected vendor thus creating a win-win situation for all the stakeholders in the project – SSCDL, SMC, Selected Vendor, Citizens, Businesses, etc.

3.2. Project Objectives

The project objectives broadly are as follows:

- To provide uninterrupted network for 24*7 with fibre optic connectivity at all locations along BRTS corridor like BRTS bus stand, traffic junctions, zone offices, civic centers and other SMC locations.
- To establish a medium for quick data gathering from multiple sources and make faster decisions

3.3. Benefits Envisaged

An optical fiber backbone in the initial phase will support the inclusion of almost all digital assets onto a common platform, which will ensure confluence of data from multiple sources, applications, sensors, objects and people. The establishment of this project will provide high quality, reliable, cost effective and sustainable network to the city administration. The network will be the provider of seamless connectivity solution for all surveillance systems. The provisioning of this network backbone will ensure connectivity to the data centers and control rooms with scalable capacities to allow for expansion in the future. In the long run, the network will also act as a source of opportunities for generating revenue. This project will have multifold benefits across the government departments and the effect will be felt by citizens. Some of the key benefits are:

- Government will have increased operational efficiency and effectiveness.
- Selected City civic and Community center facilities will have improved connectivity for on-line service delivery.
- Traffic management will be improved with automated traffic surveillance systems.
- Selected Healthcare services and hospitals will be able to utilize next generation applications, devices and processes such as tele-medicine to serve the citizens.

4. Solution Architecture

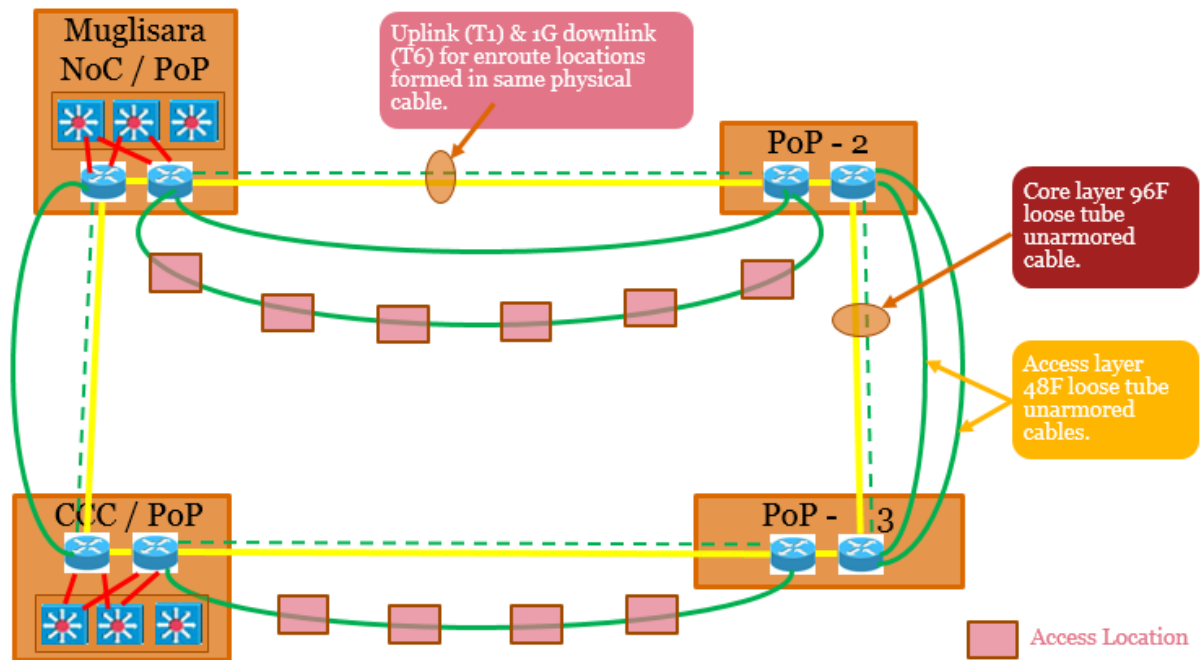


Figure 1 - Conceptual Architecture Diagram for Fiber Optic Network

The above diagram illustrates **FIBER OPTIC NETWORK hybrid topology** comprising of a backbone / Core design along with the access layers in ring topology. Core layer will connect each PoP with CCC / NoC / DC / DR in ring topology. Access layer will facilitate connectivity of all last mile locations with PoP. Each last mile location will be connected to access layer with ring connectivity. The network described in this RFP is illustrative in nature as far as active component is concerned and bidders are free to suggest their network design. Bidders will implement passive fibre network as per the design provided by SMC / SSCDL and are free to provide suggestions for discussion as per the scope defined in this RFP. Below are the design considerations for Fiber Optic Network which shall be followed while designing the RFP:

4.1. Core Layer

The Core backbone ring topology shall meet the following minimum requirements:

- The Core backbone ring topology shall be constructed using 96 Core unarmoured Single mode Optical Fiber Cables (OFC).
- The Core layer shall have 4 POP locations including CCC / DC / DR connecting to each other as backbone of the network for providing bandwidth to the entire network components.
- The Core shall utilize a 10 Gigabit Ethernet / optical technology and shall support 40 Gigabit Ethernet / optical technologies.
- The Core layer shall have 2 numbers of 40mm High Density Polyethylene (HDPE) pipes.
- The Core architecture shall be formed in full ring topology to handle single point of failures (1CNO).
- The maximum fiber distance between two Core / PoP routers in a ring, as measured by optical time domain reflectometer (OTDR) shall not exceed 20 KMs.

- Core router will be installed at all the POP locations, the switching backplane needs to be minimum 1.9 Tbps at every POP location.
- The proposed ring architecture shall support resiliency of sub 50ms ensuring high availability and faster convergence for service continuity.
- The proposed Core layer shall consider 25 % more fibre length than surface length, 15% for looping in chambers, 5% for modulation, 1% for splice joint preparation & remaining 4% for wastage.
- The Core layer shall have chamber at approx. 200 meters and shall have OFC joint splice closure at approx. 300 – 500 meters.
- Additional chambers to be constructed wherever there is a road crossings or at sharp turns.
- A loop of 20 meters of OFC shall be left in every Hand Hole.
- 96 Core Optical Fiber Cable shall consist of 12 Fiber per tube and shall have total 8 numbers of tubes.
- 96 Core Optical Fibre Cable will serve the purpose of both uplink and downlink connectivity from Core routers.
- 1 fibre core from each tube of 96 core fibre cable shall preferably be terminated on RFMS at CCC / NoC / DC / DR for automatic monitoring.
- The detailed specifications for each components (Active + Passive) are provided in Annexure I of this RFP.

4.2. Access Layer

- The access layer comprising of ring topology will be connected to 2 different POP locations. Each POP location will have one end of multiple access rings getting terminated from both directions which will connect locations like BRTS bus stands, SMC offices, traffic Junctions etc. to provide connectivity.
- The Access ring shall be constructed using a 48 Core unarmored Single mode Optical Fiber Cables (OFC).
- It shall utilize a 1 Gigabit / 10 Gigabit Ethernet / optical technology.
- It shall have 2 numbers of 40mm High Density Polyethylene (HDPE) pipes.
- The access architecture shall be formed using ring topology.
- Different physical access rings will utilize different fiber tubes of Core layer to reach to 2 PoPs.
- The access ring is designed so that it can support up to 1 edge switch at every 350 meters.
- The maximum length of one access ring shall not exceed 20 kilometers.
- Maximum 8 Nos. of switches should be considered within a single logical ring on a pair of fiber.
- The distance between two Hand Holes/RCC Chamber should not exceed 200 meters.
- A loop of 20 meters of OFC shall be left in every Hand Hole.
- 48 Core Optical Fiber Cable shall consist of 12 Fiber per tube and shall have total 4 numbers of tubes.
- The proposed Access ring length considered is 25 % more than surface length i.e. 15% for looping in chambers, 5% for modulation, 1% for splice joint preparation & remaining 4% for wastage.
- The detailed specifications for each components (Active + Passive) are provided in

Annexure I of this RFP.

4.3. Last Mile Connectivity:

12 core unarmored cable will be laid separately in a duct for last mile connectivity at all SMC locations to be connected on either Core or Access layer fiber. Last mile connectivity will be implemented in ring for all locations. Mid-span splicing will be done between 96F / 48F of Core / Access layer cable and 12F last mile cables.

5. Scope of Work for the Project

The scope of work & services covers the survey, design, procurement, supply, installation, construction, configuration, testing, commissioning and maintenance of a BRTS Corridor wide Optical Fiber Cable Network in the Surat city for Building a Smart City backbone for BRTS corridor, along with the associated active (components including NOC / DC / DR Network components), passive, civil, mechanical and power components. The SI should ensure the successful implementation of the proposed System and provide capacity building support to city authorities as per the scope of services described below. Any functionality not expressly stated in this document but required to meet the needs of the SSCDL to ensure successful operations of the system shall essentially be under the scope of the SI and for that no extra charges shall be admissible.

SI shall ensure that network design and implementation must be free of any SPOF (Single Point of Failure) from perspective of both active and passive elements. Considering the scope set in this RFP, the SI shall carefully consider the solutions it proposes and explicitly mention the same in the technical proposal.

SI shall have to Conduct a detailed assessment, scoping study (Feasibility Study) and develop a comprehensive project plan, including detailed technical architecture and gap analysis. Following services and applications shall be incorporated under project scope:

1. Installation, Configuration, Commissioning & Management of all Active & Passive components covered under this RFP and integration of same with existing SMC network to provide Intranet and Internet connectivity to all SMC offices which will be connected on BRTS fiber network.
2. Access to various SMC applications hosted on CCC / Data Centre / DR from fiber connected SMC offices through Intranet.
3. Integrating leased line / MPLS / Dark Fibre connectivity from other service provider for balance locations which will not be connected on fiber network as mentioned in detail in section 5.9 of this RFP for all services.
4. Configuration, Management of Network components (WAN Router, UTM, Core Switch, Access Switch, Branch Level L3 Switches and other manageable components) of NOC/DC/DR/Branch offices as per instruction/directions from IT Dept. of SMC/SSCDL for optimal utilization of Network available.
5. Monitoring & Fault Management/logging of integrated leased line / MPLS/ Dark Fiber connectivity provided from other service provider for balance locations which will not be connected on BRTS fiber network as mentioned in detail.
6. Configuring the network to establish the redundant functionality between DC and DR (Disaster Recovery) in future. Equivalent equipment may be procured at DR in future through separate tender and it may be from different OEM.
7. Monetization of network by duct leasing.
8. Configuration and management of entire SMC network WAN links (connected through OFC network, LL/MPLS/Dark Fiber) and Internet Leased Line through NOC.

The scope of work for Fiber Optic Network Project shall cover the following activities and key components but not limited to:

5.1. Field Survey, GIS based Network planning and Mapping of All Network Elements

1. This component of the project would involve detailed field survey of all locations specified by SMC / SSCDL & designing / mapping of the Optical Fiber Network on GIS to connect them as part of complete turnkey solution. Nominal design of network would be prepared on GIS using different layers. Changes proposed during survey, execution and maintenance post hand over will also be updated in GIS available with SMC / SSCDL for end to end visibility of network. The SI is required to support/integrate these information on existing GIS platform available with SMC.
2. All important information like no. of ducts, type of fiber, no. of healthy fiber cores, location of chambers, location of rack, model of equipment installed etc. along with location information will be maintained in attributes of different layers in GIS.

5.2. Laying of Underground Optical Fiber along BRTS corridor

This component of the project would involve laying underground optical fiber so that the identified offices, BRTS bus stands, traffic junctions etc. are connected with each other as much as possible. Optical fiber shall be laid primarily along the BRTS corridor of the city and close coordination will have to be done with concerned department for getting permission and deciding execution methodology. This would involve all activities as mentioned in detail in Sr. No. 5.4 and 5.6 and as listed below in brief:

1. Verification and optimization of routes designed based on GIS data as per field condition.
2. Coordinate with SMC for RoW permissions, excavation and laying of optical fibre. SI is required to submit the plan in advance so that necessary RoW permission shall be provided by SMC
3. Reinstatement of roads/Footpath
4. Acceptance testing
5. Submission of required documents, drawings and reports to SMC / SSCDL.

Total length of underground fiber to be laid along the BRTS corridor for creating the backbone is estimated to be around **36 KM of core layer and 82 KM of access layer**. This would comprise Core Ring and multiple Access Rings. Please refer Vol-1 of this RFP for list of locations identified to be included as part of the scope of the project. ***The SI is required to follow the methodology for Optical Fiber Cable Execution as per Section 5.13 of the RFP.***

5.3. Creation of Point of Presence (PoP) at identified locations

As a part of project implementation, **4 Point of Presence (PoP)** shall be created in the city in existing IT rooms of Muglisara Head Quarter, North Zone office, South East Zonal office of SMC and CCC. Muglisara office and Command and Control Centre (CCC) will serve as a PoP collocated with NoC / DC / DR. Temporary PoP will be created in IT room of South West Zone till the time CCC will become operational and it will be migrated to CCC in future.

- SMC / SSCDL will provide space to install 1 no. 42U rack and cooling at above mentioned 2 PoPs (2 permanent PoP at North and South East zone offices).
- SMC / SSCDL will provide space to install 1 no. 42U rack and cooling at temporary PoP (South West Zone office).
- SMC / SSCDL will provide required space (as planned by SI, but jointly to be

discussed and concluded) to install all passive + active equipments (like PoP router, Core router, Core switches, Internet firewall, Internet router etc.) at Muglisara office along with power and cooling.

- SMC / SSCDL will provide space for 2nd rack for installation of UPS and SMPS if sufficient power capacity is not available to cater to additional load wherever required.

It is envisaged that the SI shall supply, install, commission, Go live and maintain the following components as part of PoP infrastructure –

1. 42U racks
2. Passive fibre termination equipment
3. Active equipment and related component. Every PoP should be configured with high availability
4. Power provisioning including UPS for backup power (if required)
5. Temperature sensor & fire sensor
6. Access Control and security through Surveillance

PoP created under this project will be exclusively utilized for the purpose of this network. SI shall not be allowed to terminate fibre cable for monetization at any of the PoP.

The detailed specifications for each components (Active + Passive) are provided in Annexure I & II of this RFP.

5.4. Creation of Access Layer with Active Components at identified locations

As a part of project implementation, access layers would be created in the city using the locations specified in Volume-1 of the RFP. It is envisaged that the SI shall supply, install, commission and Go live the following as part of access layer infrastructure –

1. Racks
2. Passive fibre termination equipment
3. Active equipment and related infrastructure.
4. Power provisioning including backup power

The detailed specifications for each components (Active + Passive) are provided in Annexure I.

5.5. Central Infrastructure

Central IT infrastructure will be required to centrally monitor, control and manage the network. This comprises establishment of Network Operations Centre (NOC), development and deployment of Enterprise Management System (EMS) including SLA, Server performance, Network and Helpdesk Management System. The required solutions shall be initially hosted in existing SMC data center at Muglisara office. This set up will act as DR (Disaster Recovery) when CCC will be ready and operational in future and act as a DC. SI shall be responsible to configure the network after Go Live of CCC such that all locations would be primarily served by CCC for all services and Muglisara office set up / DR will act as back up in case of CCC being down due to any reason.

5.5.1. Central Network Operation Centre (NOC)

1. NOC / DC / DR would be the central location from where network administrators shall manage, control and monitor the network. NOC will host the IT infrastructure required for running the backbone and core applications including EMS.
2. IT infrastructure includes required servers, storage, operating system license, application / system software license, database license etc. SI is required to perform sizing based on the overall requirement in terms of volume and locations.
3. NOC would have the capability of analyzing problems, performing troubleshooting, communicating with site technicians and tracking problems until they are resolved.
4. SI shall ensure sufficient qualified man power for NOC operations. NOC shall be managed 24x7x365 and accordingly manpower shall be planned by the SI. NOC shall always be able to generate inventory report of active elements like port status, port utilization status etc. for future perspective through Network Management System (NMS). NOC would also maintain necessary reports like details of no. of nodes per logical links on any particular fiber route through NMS.

5.5.2. Enterprise Management System (EMS)

To ensure that IT systems are delivered at the performance level envisaged, it is important that an effective monitoring and management system be put in place. It is thus proposed that a proven Enterprise Management System (EMS) is to be proposed by the bidder for efficient management of the system, reporting, SLA monitoring and resolution of issues. Various key components of the EMS to be implemented as part of this engagement are –

1. Network Monitoring System (NMS)
2. Server Performance Monitoring System
3. Centralize Helpdesk System

The solution should provide a unified web based console which allows role based access to the users.

5.5.2.1. Network Monitoring System

Solution should provide fault & performance management of the server side infrastructure and should monitor IP\SNMP enabled devices like Routers, Switches, computers etc. Proposed Network Management shall also help monitor key KPI metrics like availability, in order to measure SLA's. Following are key functionalities that are required which will assist administrators to monitor network faults & performance degradations in order to reduce downtimes, increase availability and take proactive actions to remediate & restore network services:

1. The proposed solution must automatically discover manageable elements connected to the infrastructure and map the connectivity between them. Solution should provide centralized monitoring console displaying network topology map.
2. Proposed solution should provide customizable reporting interface to create custom reports for collected data.
3. The system must use advanced root-cause analysis techniques and policy-based condition correlation technology for comprehensive analysis of infrastructure faults.
4. The system should be able to clearly identify configuration changes and administrators should receive an alert in such cases.
5. The system should provide report on the uptime of various components monitored through the NMS with the input of date range.

5.5.2.2. Server Performance Monitoring System

1. The proposed tool should integrate with network performance management system and support operating system monitoring for various platforms supplied as part of this Project.
2. The proposed tool must provide information about availability and performance for target server nodes.
3. The proposed tool should be able to monitor various operating system parameters such as processors, memory, files, processes, file systems, etc. where applicable.

5.5.2.3. Centralized Helpdesk System

1. Helpdesk system should provide incident management, problem management templates along with helpdesk SLA system for tracking SLA's pertaining to incident resolution time for priority / non-priority incidents.
2. System should also automatically create tickets based on alarm type. All incidences reported by EMS and NMS should be auto registered in the Help Desk with Ticket ID for all locations connected on this OFC network as well as other locations which are / will be connected through leased line / MPLS / Dark Fibre (not part of this RFP).
3. The proposed helpdesk solution must provide flexibility of logging, viewing, updating and closing incident via web interface for issues related to the project.
4. SI will do necessary coordination with his team in case of issue with OFC network or with the other service provider team for all customer complains / tickets for service interruption issues as per the instruction of SMC / SSCDL.

Below figure illustrates different types of locations which will be connected through BRTS OFC + leased circuit network and NMS / help desk ticket management functionality.

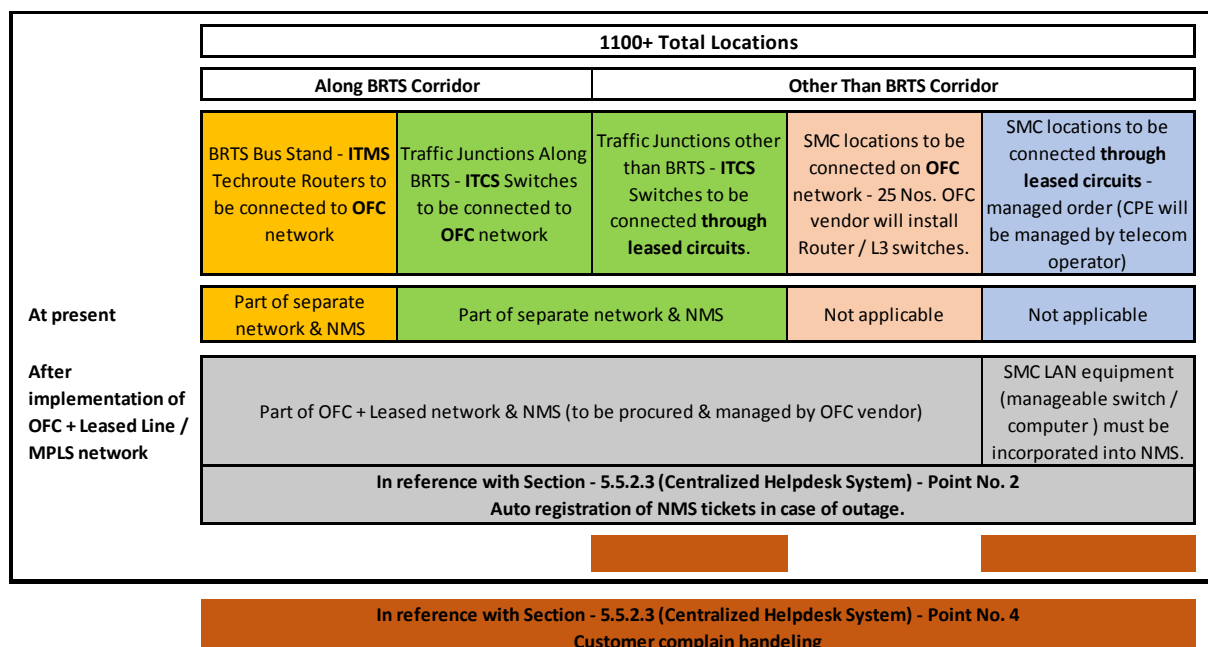


Figure 2 – Types of Locations and NMS / Help Desk Ticket and Complain Management

5.6. Implementation of any Application Software

The implementation of any application software as part of the solution shall follow the

procedure mentioned below.

Software Products (Configuration and Customization): In case SI proposes software products the following need to be adhered:

1. SI will be responsible for supplying the application and licenses (perpetual) of related software products and installing, configuration & commissioned of the same so as to meet project requirements. All licenses shall be in the name of SMC or SSCDL which shall be intimated to SI
2. SI shall have provision for procurement of licenses in a staggered manner as per the actual requirement of the project
3. The SI shall perform periodic audits to measure license compliance against the number of valid End User software licenses consistent with the terms and conditions of license agreements, volume purchase agreements, and other mutually agreed upon licensed software terms and conditions
4. The SI shall report any exceptions to license terms and conditions at the right time to SMC / SSCDL. However, the responsibility of license compliance solely lies with the SI. Any financial penalty imposed on SMC / SSCDL during the contract period due to license non-compliance shall be borne by SI
5. SI shall also supply any other tools & accessories required to make the integrated solution (if any) complete as per requirements. For the integrated solution, the SI shall supply:
 - Software & licenses.
 - Supply tools, accessories, documentation and provide a list of the same. Tools and accessories shall be part of the solution.

System Documentation: System Documentation both in hard copy and soft copy to be supplied along with licenses and shall include but not limited to following. Documentation to be maintained, updated and submitted to SMC / SSCDL regularly:

1. Functional Requirement Specification (FRS)
2. High level design of whole system
3. Low Level design for whole system / Module design level
4. System Requirements Specifications (SRS)
5. Any other explanatory notes about system
6. Traceability matrix
7. Technical and product related manuals
8. Installation guides
9. User manuals
10. System administrator manuals
11. Toolkit guides and troubleshooting guides
12. Other documents / reports as prescribed by SMC / SSCDL
13. Quality assurance procedures
14. Change management histories
15. Version control data
16. SOPs, procedures, policies, processes etc. developed for SMC / SSCDL
17. Programs :
 - All programs must have explanatory notes for understanding
 - Version control mechanism

- All old versions to be maintained
18. These documents need to be updated and maintained during entire project duration. The entire documentation will be the property of SMC / SSCDL.

5.7. Provisioning of Intranet services

All applications / software presently being used by SMC / SSCDL officials including any applications developed in future will be hosted in SMC Data Centre. SI is responsible to make necessary configuration & provision in active elements of Network to enable SMC / SSCDL officials to successfully use these applications / software in various SMC / SSCDL offices as prescribes by SMC / SSCDL in the RFP including any additional locations as and when included in the list of city offices in future.

The scope of work to provision intranet services shall cover following activities but not limited to:

1. Survey of location to decide space and size of rack installation, power availability points and cabling requirement to energize rack.
2. Supply and installation of rack of required size with proper grounding.
3. Installation and configuration of switch / router.
4. Last mile Optical fiber connectivity of switch with nearest router / switch.
5. Service provisioning and testing with required IP schema as requested by SMC / SSCDL for each location.
6. Providing O&M support in case of service failure as per defined SLA.
7. Any other which is necessary for this service

5.8. Provisioning of Internet services

The bandwidth provision is not in the scope of SI. The bandwidth will be procured from the separate vendor through leased line / MPLS / Dark Fibre project. However, the SI is required to ensure the distribution of internet bandwidth to locations covered under this RFP as well as leased line / MPLS / Dark Fibre connected locations by configuration and monitoring of the devices supplied as part of this RFP at the central locations (Muglisara NoC and CCC).

5.9. Integrating connectivity from other service provider

Locations which are not along the BRTS corridor and thus will not be connected on this fibre network will be connected to Muglisara PoP and CCC location through other connectivity options (leased line / MPLS / Dark Fibre). Leased line / MPLS / Dark Fibre vendor will also procure Internet bandwidth at Muglisara PoP and CCC. SI will be responsible to make necessary coordination in future with the leased line / MPLS / Dark Fibre service provider to integrate traffic from all such locations into Core network and make suitable provision for additional configuration required in the PoP and CCC routers.

Proposed Leased Line / MPLS Topology

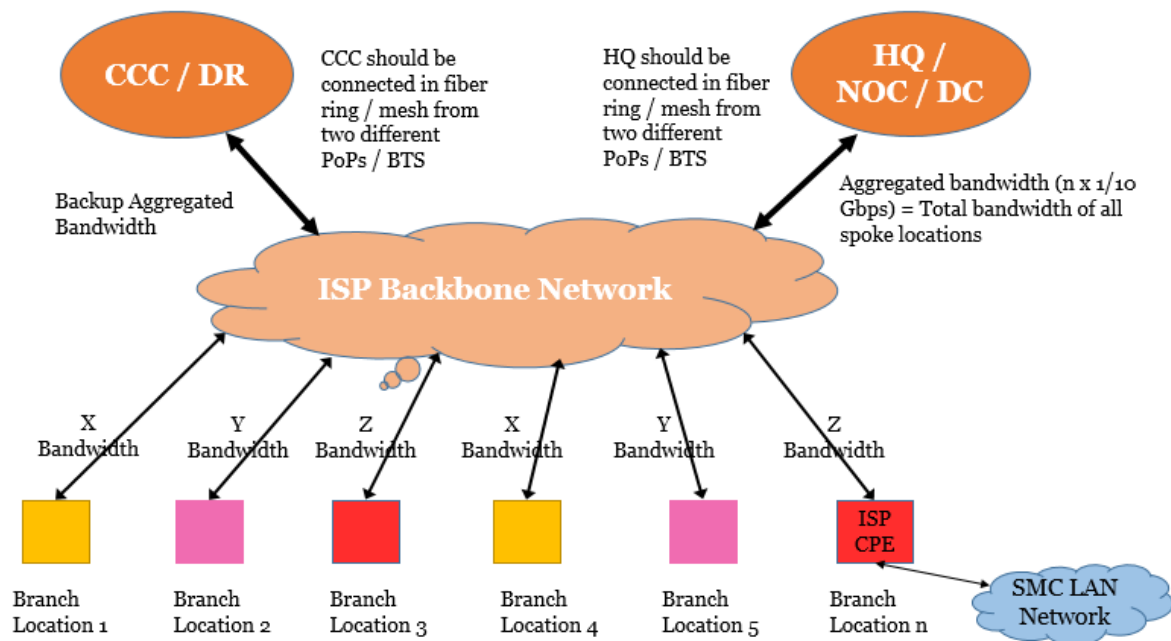


Figure 3 - Conceptual Architecture Diagram for Leased Line / MPLS Network

RACI matrix for this activity would be as per below.

#	Activity	SMC / SSCDL	PMC	OFC Vendor	Leased Circuit Provider
Activities at edge / spoke location for leased circuit					
1	Supplying, installing, configuring, upgrading and maintaining CPE at all edge location under managed leased circuit order.	C	I		R, A
2	Getting approval for space, Raw power and permission to leased circuit provider for installation of rack and equipment.	C	I		R, A
3	Patching and extending connectivity from CPE (provided by leased circuit provider) to LAN.	C	I		R, A
4	Providing access to the existing network infrastructure (Managed switch provided by ITCS vendor through separate tender) for connecting last mile circuit (at the location where SMC has CPE available under ITCS project and required to be connected on leased circuit).	R, A	I		I
5	Providing and maintaining last mile leased circuit connectivity at all required locations with port and IP details.	C	I		R, A

#	Activity	SMC / SSCDL	PMC	OFC Vendor	Leased Circuit Provider
6	Patching between existing network infrastructure (Managed switch provided by ITCS vendor through separate tender) and lease circuit.	C	I		R, A
7	Configuring and maintaining existing network infrastructure (Managed switch provided by ITCS vendor through separate tender) to integrate with leased circuit.	R, A	I		C
8	Maintaining SLA for existing network (Managed switch provided by ITCS vendor through separate tender) infrastructure.	R, A	C		
9	Maintaining SLA for leased circuits.	C	C		R, A
Activities at Muglisara NoC / CCC / DC / DR / hub location for leased circuit					
1	Providing space, power and permission to leased circuit provider for installation of rack and equipment.	R, A	I		C
2	Providing access to the existing network infrastructure (Core and Internet Routers installed by OFC vendor) for connecting last mile and Internet circuits.	I	I	R, A	C
3	Providing and maintaining leased circuit last mile and Internet connectivity at NoC / CCC / DC / DR locations with port and IP details.	I	I	C	R, A
4	Patching between existing network infrastructure (Core and Internet Routers installed by OFC vendor) and lease as well as Internet circuits, configuring, integrating and maintaining existing network infrastructure to integrate with leased and Internet circuits.	I	I	R, A	C
5	Maintaining SLA for existing network infrastructure (Active + passive network installed by OFC vendor).	C	C	R, A	
6	Maintaining SLA for leased and Internet circuits.	C	C		R, A
7	Providing SMC locations' LAN IP pool to leased circuit provider for routing.	R, A	I		C
8	Ensuring successful integration of traffic from all leased and Internet circuits with active equipments of OFC network without any impact on proposed connectivity of OFC network.	I	I	R, A	C

5.10. Monetization of Network

SI will be responsible to monetize the constructed network and generate revenue by leasing of vacant duct to customers like Telecom Service Providers, LCOs etc.

5.11. Other General Requirements

1. Based on the survey results and SMC / SSCDL's requirements (eg.: suggestion from SMC / SSCDL of using HDD methodology to prevent damage to e2e carpeted asphalt / CC road), the mode of digging (Automatic or Manual or clamping) needs to be decided for each section of the route.
2. After finalizing the same the route diagrams / sketch will be prepared on the AUTOCAD map and submit to the Authority for approval
3. Based on the Route diagram submission, ROW permissions needs to be taken from the SMC authorities
4. Preferably all digging manual or HDD along with Chamber preparations needs to be done on the Footpaths (wherever applicable for last mile connectivity). This will ensure minimal damages to Tar Roads.
5. After the same is over proper Labeling and Feruling as per the design and consent of the Client and Consultants needs to be done so that identification post installation during the maintenance becomes easy
6. OFC drums will be tested with OTDR on sampling basis to verify optical loss characteristics and cable length parameters as prescribed by OEM before blowing the cable in duct.
7. After the Splicing work is over, Fiber testing needs to be done.
8. SI will use PC – APC patch cord for connectivity between FDP and active equipment, APC (angular Point Contact) connector at FDP end and PC (Polished Connector) at equipment end.
9. The Report needs to be submitted to the Original Equipment Manufacturer (OEM) of the Fiber and Accessories who in turn will issue performance Certificate of the Installed Components for a minimum period of 15 years.
10. Apart from post sign off, the SI needs to submit following in soft and hard formats:
 - Details of Survey jotted on CAD Drawings as per the specifications defined.
 - Drawings of Route Details on the CAD Drawings along with the Survey details.
11. Post Go Live the SI should maintain the Network for the Period of 7 Years
12. During the course of installation, if any utility services or roads or other SMC assets or third party assets etc. are damaged, then the SI has to repair and reinstate the same at his own cost.
13. SI will be responsible to undertake and complete the works related to **supply installation and commissioning of services as indicated in the RFP**
14. The works are to be completed on turnkey basis and the supplied equipment's and Network are required to be maintained for 7 years on comprehensive AMC basis from the date of **Final Approval and Testing** and need to sign SLA. The SI shall be responsible for implementation of the work as defined.
15. During the installation activities, records must be kept of all items installed. Including reference to cable pathways used, final location, identity of cables and equipment. The

presentation of all of these records will provide the "As-Installed" basis for all future reference to the installation.

16. The Optical Fiber cabling shall be installed in accordance with manufacturer's installation instructions. The Contractor will ensure that the manufacturer's specifications for the Optical Fiber cable meet the transmission characteristics required by Cabling Standards.
17. All installed racks, HHs, cables, termination boxes, distribution panels and wall outlets shall be marked and numbered in accordance with Administration Standard for the Telecommunications Infrastructure. Area based unique entity IDs may be created for all assets deployed for easy identification in field. Specific format of entity ID (for ex. 4 digits for area code, 1 digit for network layer, 2 digits for assets like racks, HHs, 3 digits for unique numbering etc.) may be suggested by SI and jointly agreed.
18. The documentation required at the completion of the installation phases shall contain all of the following information, together with any other information the installer has acquired during the installation
 - "As-Installed" documentation, showing total cabling and connections installed using floor space plans and cable record sheets. This documentation must show all cables and outlets incorporating the full numbering and marking convention supplied.
 - All test results (including OTDR, LSPM & Splice report) and certification information, identified by cable, connection and numbering convention, necessary for all Optical Fiber cables.
 - As – built drawings of all fiber optic routes.
 - Drawings of Each Rack installed on BRTS stations, SMC offices etc.
19. Following services shall be provided by the SI under the basic infrastructure services:
 - Ensure availability of the infrastructure (both physical and IT) including but not limited to Power, Cooling, Racks, Storage and other peripheral equipment installed at the time of Project commissioning as per the SLAs
 - Ensure scalability in terms of availability of racks and supporting infrastructure.
 - Proactive and reactive maintenance, repair and replacement of defective components (physical and other peripheral IT infrastructure) installed for the Project through this RFP. The cost for repair and replacement shall be borne by the SI
 - The SI shall have to stock and provide adequate onsite and offsite spare parts and spare component to ensure that the uptime commitment as per SLA is met. To provide this service it is important for the SI to have back to back arrangement with the OEMs. The SI needs to provide a copy of the service level agreement signed with the respective OEMs
 - Any component (Physical & IT installed at the time of Project commissioning) that is reported to be faulty / non-functional on a given date should be either fully repaired or replaced by temporary substitute (of equivalent configuration) within the time frame agreed upon in the Service Level Agreement (SLA). In case the selected SI fails to meet the above standards of maintenance, there will be a penalty as specified in the SLA.
 - Proactive monitoring of the entire basic infrastructure installed

- SI shall maintain records of the maintenance of the basic infrastructure and shall maintain a logbook on-site that may be inspected by the SMC / SSCDL at any time.
- All the devices that will be installed in the Project as part of the physical infrastructure should be SNMP enabled and shall be centrally and remotely monitored and managed on a 24x7x365 basis.
- All the log files for wireline users / devices directly connected to this OFC network as well as users who will be connected to this OFC network through leased line / MPLS / Dark Fibre (excluding ISP Network/ISP devices) in future to be stored for all services (including Intranet and Internet) for devices like UTM/NGFW, Internet/Core Router, Core Switches, Access Switches for the period of at least one year as well as those stored log files should be made available for analysis and customized reporting solution as per requirement of SMC/SSCDL. Storage space to store these logs will be provided by SMC / SSCDL.
- SI has to ensure confidentiality and integrity of sensitive information and data of users and portal information. A secure solution should be provided at the hardware infrastructure level, software level, and access level. Role based access for all the stake holders should be envisaged to access and use the system as per instruction from SMC / SSCDL.
- SMC / SSCDL may reserve rights for login/access and policy change for devices like UTM/NGFW, Internet/Core Router, Core Switch after successful completion of setup for desired network created with BRTS OFC & Integrated Leased Line/MPOLS/Dark Fiber Model for security reasons however Full/limited rights may be given to SI/ bidder/ its personnel on requirement basis for troubleshooting or optimization of network with seeking necessary permission from SMC/SSCDL Limited viewing rights may be given to SI/bidder/ its personnel for daily/routine monitoring & logging purpose.
- The SI/bidder/ its personnel shall not divulge or disclose to any person, any details of office, operation process technical know-how, administrative/ organizational matters as all are confidential/secret in nature.

20. The OFC network will support following scalability requirement.

- The solution implemented will be scalable for all future integrations and demands that may arise in the future and will enable SMC / SSCDL to provide seamless connectivity for all future projects
- It is required to have protocol level compatibility between devices/electronics installed in order to have one unified seamless network available across the city
- City services such as surveillance, parking sensors, environmental sensors, variable sign boards, public address system and self-service kiosks which will utilize this network will be integrated with the BRTS corridor wide OFC network

21. The City Command Control Center (CCC) is in progress of implementation. SSCDL may ask SI to shift the NOC infrastructure and monitoring facilities along with manpower at that location once the CCC is operational at no extra cost.

22. Currently many Smart city projects are in operational or in phase of implementation like ITMS, ITCS, AFCS etc. where connectivity is already procured from the ISP. Once the Connected Surat is operational, SI is required to provide necessary support and

migrate to propose fiber backbone. In this regard, all required co-ordination and integration shall be the joint responsibility of SI along with the Project Vendor

23. Helpdesk calling infrastructure (exclusive of desktops) shall be provisioned by SI. The workstations /desktops shall be provided by SMC/SSCDL.
24. SI shall also be asked to provide connectivity on temporary basis for public events generally arranged at open grounds, large seminar halls etc. (which are not part of the location list of this RFP) through temporary arrangements like overhead fiber cabling from nearest access switch location to event location or through wireless connectivity based on actual field feasibility and bandwidth requirement.
25. SI is required to utilize the existing infrastructure wherever applicable as below:
 - Junction Boxes and switches at each of traffic junctions – As part of ITCS project a provision is already made to implement the adequate size of junction boxes and other active components like switches etc. SI is required to supply, install and commission all additional components, if any which are not the part of existing infrastructure.
 - At each of BRTS station the edge router is already installed which shall be utilised to connect the stations with fiber. SI is required to supply, install and commission all additional components, if any which are not the part of existing infrastructure.
 - The specifications for existing Infrastructure is provided in Annexure V of this RFP.

5.12. Project Methodology

1. **Turnkey Project Basis:** - The SI shall act as single SI to organize and manage the entire project – including supply, installation and commissioning of all required items which should follow the guidelines and standards mentioned in Annexures III and IV respectively. The SI shall be in a position to test, demonstrate and certify the basic requirements in accordance with the contract.
2. **Technical arrangements:** - The SI shall provide details of site and infrastructure requirements (Power, Earthing etc.) in a layout plan after making a site survey. The SI shall execute Works/Project and Cabling as per the layout plan which will be approved by Authority post Under Ground utilities Survey and Submission by the SI for all routes.
3. **Warranty and Post-Warranty Support:** - The SI shall be responsible for the warranty support and also for the post warranty support as mentioned in this RFP.
4. All goods or materials shall be supplied strictly in accordance with the specifications, Drawings, datasheets, other attachments and conditions stated in the RFP / Agreement / SLA. All materials supplied by the SI shall be guaranteed to be of the best quality of their respective kinds and shall be free from faulty design, workmanship and materials.
5. **Documents:** - The SI shall provide two set of documents and manuals (hard copy, soft copy with each item of the unit supplied.)
6. **Certification:** - The SI shall test and certify the availability and reliability of Fiber Cabling/Accessories of the location and give the connectivity matrix between various locations and get it certified by the Authority.

7. **Reporting:** - Detailed report is required to be submitted for the work under progress and for functional performance of the connectivity, throughput. The same have to be certified by representative of Authority and or Authority appointed TPA.
8. **Safety:** The SI shall carry out all the activities (civil, mechanical, electrical, etc.) as per the RFP as per the safety standards and norms defined by relevant statutory authority(ies).

5.13. Optical Fiber Cable Execution Methodology

The SI shall adhere to the below guidelines while executing the work:

1. The SI shall prepare the list of equipment, number of field employees deployed and the implementation schedule and activities taking into consideration all the requirements of concerned Municipal and Government authorities.
2. The SI shall submit the work plan and implementation schedule with list of equipment and personnel to be deployed on field for execution of works for approval of Client.
3. The SI shall commence work post approval of work plan and schedule by the Client.
4. If the requirements of concerned Government authorities should supersede any instruction by Client to the SI; the SI shall immediately point out in writing if any such conflict is observed to the attention of the Project Manager. The Project Manager shall issue further necessary instructions.
5. The SI shall inform all concerned authorities and obtain NOC or permissions as required before starting the excavation and Hand Hole construction works.
6. The SI shall register and get approval from concerned Government authorities to carry out the work as required.
7. The SI shall adhere to guidelines issued by concerned Government authorities while executing the work.
8. The SI shall lay the underground OFC by Open Cut/Open Trench or Horizontal Directional Drilling (HDD) or manual boring or clamping method as permitted by the concerned Government Authority pertaining to specific road.
9. To reduce the digging work SI will use existing duct / pipe already laid by BRTS authority wherever applicable and feasible.
10. The SI shall lay OFC of 12 core / 48 core / 96 core through 40mm HDPE pipe.
11. The SI shall construct Hand Holes at successive intervals of 200 Meters or less.
12. The SI shall obtain all land permits, Permissions, NOC, any land lease rights or as such any licensing requirement that may be necessary to erect the shelters for Mega POP's from all the concerned Government authorities.

5.13.1. Open Cut Method

5.13.1.1. Excavation

1. The SI shall undertake the trenching & ducting activity for laying of OFC as per Survey drawings approved by the Client.

2. The SI shall place route marker as per given alignment & maintaining offset distance from road center as per norms set by concerned government authorities.
3. The SI shall use barricading and signage board as per requirements of concerned Government authority pertaining to specific roads.
4. The SI shall take trial pits before starting trenching, at every 100m distance to examine position of existing underground utilities. The SI shall align the trench as per observations from the trial pits.
5. The SI shall take precaution during excavation to avoid any possible damage to other underground utilities and shall indemnify the Owner/Employer for damages if any. This includes but not limited to collecting as-build drawings of existing utilities, studying the survey drawings for location of utilities and visual inspection of site.
6. The SI shall coordinate with the existing utility owners before starting the excavation work. If required the SI shall ensure the presence of representative of existing utility owners.
7. The SI shall achieve minimum depth of 1000mm whenever the 40 mm HDPE pipes are to be laid under the road surface and minimum depth of 1200mm whenever 40 mm HDPE pipes are laid on exposed sand or soil surface. In case of existing underground utility requires the digging deeper than the specified above, the SI will do the same without any additional cost.
8. The SI shall construct the trench with width of not less than 300mm at the bottom of the trench.
9. The SI shall be responsible for shoring and strutting the walls of the trench on either side of the trench as per the guidelines of concerned Government authorities.
10. The SI shall follow below mentioned norms in case of any deviations in depth of trench.

No.	Depth of Trench	Recommended Protection
1.	800 mm to 1200 mm	No protection required
2.	500 mm to 800 mm	110 mm DWC pipe
3.	400 mm to 500 mm	100 mm dia RCC half round pipe
4.	200 mm to 400 mm	100 mm dia RCC full round pipe
5.	Less than 200 mm	100 mm GI pipe with 150 mm PCC

5.13.1.2. Installation of 40mm HDPE Pipes

1. The SI shall lay 2 numbers of 40mm HDPE pipes.
2. The SI shall decoil 40 mm HDPE pipe with the help of Mechanical Decoilers.
3. The SI shall lay 40 mm HDPE Pipe in a flat bottom trench free from stones, sharp edged debris. Wherever stones or sharp edged debris exist, sand bedding of 50 mm thickness shall be prepared on which the 40 mm HDPE pipes shall be laid.
4. The SI shall ensure minimum bending radius of pipe and fiber optic cable.
5. The SI shall use end plugs to close the pipe openings to avoid ingress of mud, water or dust.
6. The SI shall use 40mm HDPE couplers to join 40mm HDPE pipe.
7. The SI shall use duct spacers to protect ducts from crossing each other inside the trench.

8. The SI shall test the continuity of 40 mm HDPE pipes as per the Duct Integrity test for all ducts.

5.13.1.3. Color code for 40mm HDPE

The color code for 40mm High Density Polyethylene (HDPE) pipes shall be as follows:

1. The core backbone ring topology shall be identified by using Green and Blue colours. The Core backbone ring Optical Fiber Cables (OFC) shall be placed in Green colour conduit.
2. The Access ring shall be identified using Yellow and Gray colors. The Access ring Optical Fiber Cables (OFC) shall be place in a Yellow color conduit.

5.13.1.4. Installation of 110mm DWC pipes.

1. The SI shall use 110 mm DWC pipe to facilitate adequate protection to 40 mm HDPE pipe and OFC within low depth areas (as specified in Table above) as well as at rail, road, bridge and culvert crossings.
2. The SI shall insert maximum 2 numbers of 40 mm HDPE pipe in one 110mm DWC pipe.
3. The SI shall use 110 mm DWC coupler to joint 110 mm DWC pipe.
4. The SI shall lay 110 mm DWC pipe on levelled bed of trench.
5. The SI shall ensure that the trench bed is free from sharp edge and debris and stones.

5.13.1.5. Installation of 100mm GI pipes.

1. The SI shall lay 100 mm GI pipe wherever road and culvert crossings are encountered on the route as well as in low depth areas as specified in table above.
2. The SI shall insert 2 Nos. of 40 mm HDPE pipes through one 100 mm GI pipe.
3. The SI shall clamp 100mm GI Pipe with suitable clamps where ever culvert crossing is to be done and excavation is not possible. The 40mm HDPE Pipes shall be laid through 100mm GI Pipe.
4. The SI shall build a box culvert to protect 100mm GI Pipe in case of lower depth as specified in the above table.
5. The SI shall extend the 100 mm GI pipe by at least 1 meter on each side of crossing subject to availability of space.
6. The SI shall join 100 mm GI pipes using 100 mm GI Coupler.

5.13.1.6. Protection for OFC

The Optical Fiber Network shall be built by considering following protection methods to protect the OFC from accidental damage.

1. **Concreting:** Concreting shall be used to provide additional protection on bridges, culverts and also on stretches wherever depth of excavation is less than 0.2Mtr.

2. **RCC Half round:** Where-ever cables are laid in cities, towns and villages where human habitation exists or where construction activity can happen in near future, Full Round or Half Round, 100mm, NP2 Grade shall be put after 100 mm padding with excavated material over duct, wherever the depth is less than 0.5Mtr but more than 0.4Mtr.
3. **RCC Full round:** Where-ever cables are laid in cities, towns and villages where human habitation exists or where construction activity can happen in near future, Full Round or Half Round, 100mm, NP2 Grade shall be put after 100 mm padding with excavated material over duct, wherever the depth is less than 0.4Mtr but more than 0.2Mtr.

5.13.1.7. Backfilling and reinstatement of excavated area

1. The SI shall backfill and reinstate the area to its original condition as per the guidelines issued by the concerned government authorities pertaining to specific road after completion of work.
2. The SI shall dispose the surplus earth material to a suitable location as indicated by concerned Government authorities.

5.13.2. Laying of 40mm HDPE Pipes using Horizontal Directional Drilling (HDD)

1. The SI shall adhere to following guidelines for installation of 40 mm HDPE pipes using Horizontal Directional Drilling (HDD) machine.
2. In case of existing underground utility requires the digging deeper than the specified above, the SI will do the same without any additional cost.

5.13.2.1. Horizontal Directional Drilling Equipment

1. The Horizontal directional drilling equipment shall consist of a horizontal directional drilling machine of sufficient capacity to perform the bore and pullback the specified number of 40 mm HDPE pipes, a drilling fluid to successfully complete the bore, a guidance system to accurately guide boring operations, a truck of sufficient capacity to handle the drilling fluid volume and all other equipment required to complete the installation.
2. HDD machine shall have a system to monitor and record maximum pull-back pressure during pull-back operations.
3. There shall be a system to detect electrical current from the drilling string and an audible alarm which automatically sounds when an electrical current is detected.

Guidance System

1. A magnetic guidance system (MGS) grade beacon or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation.
2. The directional drilling guidance system shall have the capability of measuring vertical and horizontal positions and roll.
3. The system shall obtain an accuracy range within five (5) centimeters of the actual position of the drilling head. It shall enable the driller to guide the drill head by providing immediate information of horizontal and vertical inclination on the tool face.
4. The SI shall submit the reports and graph obtained from the guidance system

specifying the depth and path of HDD bore as part of acceptance testing.

Drilling Fluid System

1. The Drilling Fluid System shall be compliant to the requirements of concerned government authorities.
2. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver boring fluid composed of bentonite clay, potable water and appropriate additives.
3. Drilling Fluid: Suitable drilling fluid shall be used based on existing soil conditions. The SI shall fully determine the soil conditions prior to fluid and additive selection.
4. Delivery System: The drilling fluid pumping system shall have a capacity to provide an adequate flow rate and pressure to facilitate the HDD operation. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and conveyed to the drilling fluid recycling system as per set norms of concerned government authority. Precautionary arrangements to be done to prevent spills into the surrounding environment.
5. Drilling Fluid Recycling System: The SI shall abide by recycling of drilling fluid and disposal guidelines of concerned Government authorities. Environmental guidelines of concerned Government authorities to be adhered while disposing any debris and drilling fluid.

Execution

1. The SI shall fully train all personnel in safety norms as prescribed by concerned Government authorities.
2. The SI shall ensure that the bore path alignment shall be as per Survey drawing approved by the concerned government authorities.
3. Contactor shall coordinate with all utility owners with underground utilities in the work area before starting of work.
4. Once the utilities have been located SI shall physically identify the exact location of the utilities by taking test pits of minimum width of 2 meters across the drill path, in order to determine the actual location and path of any underground utilities. SI shall not commence boring operations until the location of all underground utilities within the work area have been verified.
5. The SI shall use barricading and signage as per requirements of concerned Government authority pertaining to specific roads.
6. The SI shall ream bore hole to a minimum of 125% diameter of outside diameter of specified number of HDPE pipes tied together, using the appropriate tools upon successful completion of pilot bore.
7. The SI shall not apply pressure more than the maximum safe pipe pull pressure at any time.
8. The SI shall de-mobilize equipment and restore the work-site to original condition as per the guidelines of concerned Government authorities.
9. The SI shall test the continuity of 40 mm HDPE pipes as per the Duct Integrity test for all ducts.
10. The SI shall construct a Hand Hole at each entry and exit pit. The SI shall carry on work in both directions from each pit such that the pit serves as entry pit for one HDD bore and exit for other HDD bore.
11. The SI will be completely responsible for damages if any to other utility or SMC during the work and shall resolve all disputes including reimbursement of the

damages.

12. The SI will do necessary co-ordination with other utility companies prior to the excavation works.

5.13.3. Pipe Integrity test

1. The SI shall perform the Duct Integrity test for all 40 mm HDPE pipes with blow compressed air at 5 Kg/Sq-cm for removing sand, mud and other foreign particles crept during laying of pipes.
2. The SI shall carry out Duct integrity test with the help of medium density of sponge at pressure of 5 Kg/Sq-cm.
3. The SI shall perform the Duct Integrity testing from Hand hole to Hand hole. However wherever the site conditions permit SI shall perform the Duct integrity test for several Hand holes together by coupling the 40 mm HDPE pipes within the Hand Holes.
4. The SI shall carry out the Duct Integrity test before pulling/blowing of OFC.
5. The SI shall seal the spare 40 mm HDPE pipes with End plugs immediately after acceptance of Duct integrity test.

5.13.4. Installation of OFC

1. The SI shall install the OFC inside the 40mm HDPE pipe as per design consideration. The OFC shall be installed by compressed air blowing technique. However, for spans up to 250 meter, the SI can manually install the OFC in 40 mm HDPE pipe by pulling it with help of a Duct rodder.
2. The SI shall handle the Optical Fibre Cable Drums as per instructions given by the manufacturer.
3. The SI shall use Duct rodder for pulling OFC from Hand Hole to Hand hole for short spans up to 250 Mtrs.
4. SI shall ensure manufacturer's guidelines for minimum bend radius and tension are followed while installing the OFC.
5. The SI shall keep minimum 20 m loop in each Hand hole, properly coiled and tied with cable ties. Aluminum cable tags with punching to be used for tagging.
6. The SI shall seal both the ends of 40 mm HDPE pipe with cable sealing plugs / simplex plugs after installing OFC.
7. The SI shall pull through 5mm thick Nylon rope in spare 40 mm HDPE pipes and tied properly at both the ends for future cable pulling. The 40 mm HDPE pipe then shall be secured using End plug.

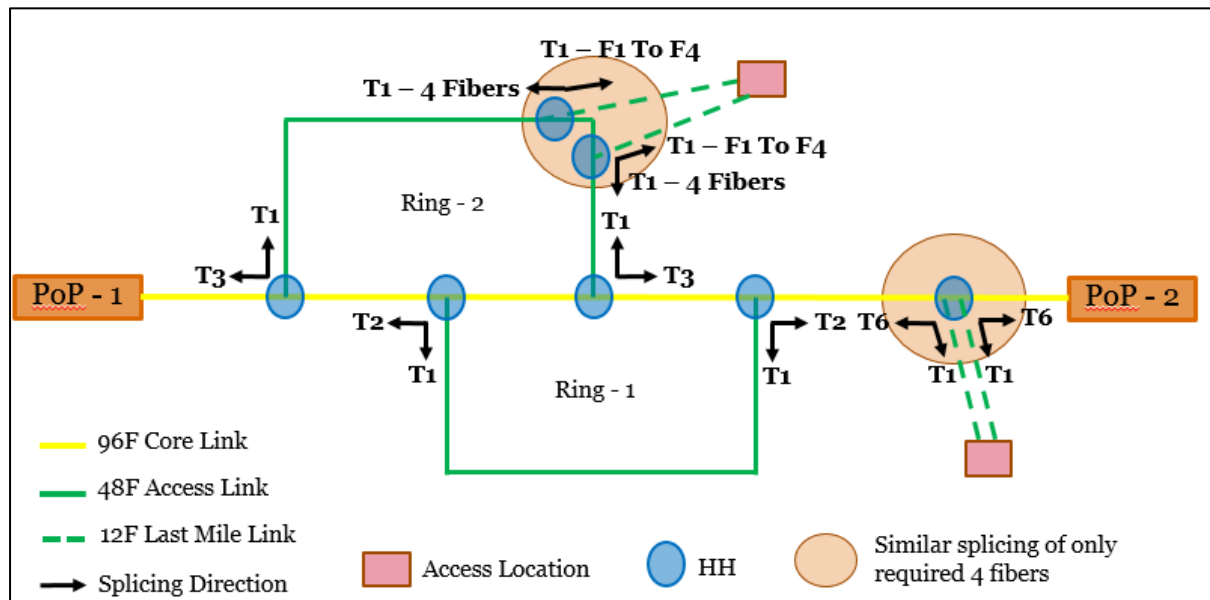
5.13.5. Installation of Hand Hole

1. The SI shall provide Hand Holes at a distance of 200 meters.
2. The SI shall provide additional Hand Holes at Major Road crossings, Bridges and other location.
3. The SI shall provide Hand Holes of size 1M(L)*1M(W)*1.2M(D) with single lid. The installation of Hand Hole shall be done in such a manner that top surface of the Hand Hole lid shall flush with existing Road/Earth Surface.
4. Required excavation and backfilling for the construction of the Hand Hole shall be carried out adhering to all the requirements of concerned Government authority.

5.13.6. Splicing of OFC and Installation of Fiber splice Joint closure

1. The SI shall ensure that the splice loss per joint shall be less than 0.05dB/splicing joint.
2. The SI shall ensure that during splicing fiber cores of 0.6 mtr to 0.8 mtr shall be stored in cable tray.
3. The SI shall seal and install the Fiber Splice Joint closure assembly as per instructions of manufacturer.
4. The SI shall carry one hour of leakage/ water penetration test on Fiber Splice Joint closures after installation.
5. The SI shall attach Cable tags to all OFC which are entering the Fiber Splice Joint Closure and OFC readings shall be recorded for updating in the As-build and GIS drawings.
6. The SI shall provide an As-build diagram for splicing of OFC. The diagram shall indicate the cores from all OFC with their color coding and numbering.
7. The SI shall use Mid-Span Access Buffer Tube Slitter during mid-span splicing (for last mile location connectivity) to ensure that buffer jackets of fiber tubes are cut longitudinally to access all fibers inside tube and then only required fiber cores will be cut for splicing with fiber cores of last mile cable.
8. During maintenance of the network, SI shall ensure that all fibre cores are spliced at the cut location (and not only live fibre cores) during rectification process. SMC / SSCDL / any third party as appointed may audit the health / continuity of all fibre cores at any time and SI shall have to facilitate this exercise by performing LSPM and OTDR testing in presence of this team.

Indicative Physical Ring Connectivity and Fiber Allocation:



5.13.7. Optical Fiber Cable Testing Methodology

1. The procedure shall comply with the ISO/IEC 14763-3 standard and to the vendor testing procedure.

2. The ISO/IEC 14763 standard specifies the implementation and operation of customer premises cabling
3. The part 3 of this ISO document (14763-3) details test procedures for optical fiber cabling designed in accordance with ISO/IEC 11801:2002 and installed according to the recommendations of ISO/IEC 14763-2 (Planning and installation of customer premises cabling).
4. Fibre-optic Tests applied to links and exclude equipment and work area cord.
5. OF Attenuation testing is used to verify the initial performance of the installed link.
6. 100 % of the installed OF links have to be tested and must pass the acceptance criteria.
7. The attenuation of the link is measured using the insertion loss method. This method uses an optical source and an optical power meter to compare the difference between two optical power levels.
8. When testing Single Mode optical fibre links with a Light Source and a Power Meter, this measurement kit has to be capable of operating at 1550 nm and 1310 nm for Single Mode.
9. The test scenario with a Light Source and a Power Meter shall be of the following for each link: **Bidirectional testing @ 1550 nm and @ 1310 nm for single mode fibres and calculating average of both readings.**
10. The use of certification tool is recommended. Those tools are capable of producing a report logging the time of the test the link identification under test, the link length, the attenuation at the window tested and the acceptable link attenuation. The report shall also identify in which direction the testing was implemented.
11. When testing with basic optical source and power meter, the operator will fill up a report logging the time of the test, the link identification under test, the link length and attenuation at the window tested in presence of the deputed staff/any person by SSCDL.
12. The report shall also identify in which direction the testing was implemented.
13. Acceptable link attenuation to be calculated.
14. The measured attenuation of the links shall have a lower value than the acceptable link attenuation calculated.
15. The Test should be carried out by certified Engineer and once the report is submitted to the manufacturer he will issue the Performance Certification which will mention minimum performance of 15 years or higher.
16. The SI shall also provide bidirectional OTDR report for all fibre cores.

5.14. Earthing System

All electrical components are to be earthen by connecting two earth tapes from the frame of the component ring and will be connected via several earth electrodes. The cable arm will be earthen through the cable glands. The entire applicable IT infrastructure shall have adequate earthing. Further, earthing should be done as per Local state national standard in relevance with IS standard.

1. Earthing should be done for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, AC units, etc. so as to avoid a ground differential. SSCDL shall provide the necessary space required to prepare the earthing pits.
2. All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.
3. There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data

4. The earth connections shall be properly made.
5. Provide separate Earthing pits for active equipments & UPS as per the standards.
6. SI will be required to create proper earthing system at PoPs to be created at Zone Office Locations (3 nos.)

5.15. Acceptance Testing

The SSCDL shall review and finalize the detailed acceptance test plan proposed by the SI. The SSCDL would also conduct audit of the process, plan and results of the Acceptance Test carried out by the SI for both IT & non-IT components. If required SSCDL may carry out the testing from the third party. The SSCDL would issue certification of completion for which SSCDL shall verify availability of all the defined services as per the contract signed between the SI and SSCDL. The SI shall be required to demonstrate all the services, features, functionalities as mentioned in the agreement.

Commissioning shall involve the completion of the site preparation, supply and installation of the required components and making the Project available to the SSCDL for carrying out live Operations and getting the acceptance of the same from the SSCDL. Testing and Commissioning shall be carried out before the commencement of Operations.

5.15.1. Partial Acceptance Testing

Partial Acceptance Test shall involve scrutiny of documents for various IT / Non-IT components to verify if the specifications conform to the technical and functional requirements mentioned in the Tender and subsequent corrigendum, if any. SMC / SSCDL reserves right to conduct physical inspection of the equipment delivered to ensure that they arrive at the sites in good condition and are free from physical damage and incomplete shipments and shall return the products to the supplier at the supplier's expenses if required quality is not maintained. Physical inspection of hardware will also include physical checking and counting of the delivered equipment in presence of the successful SI. This equipment will only be acceptable as correct when each received item corresponds with the checklist that will be prepared by the successful SI prior to shipment. Any shortfalls in terms of number of items received may render the delivered equipment incomplete.

5.15.2. Final Acceptance Testing

The final acceptance shall cover 100% of the Connected Surat Project, after successful testing by the SSCDL. The Final Acceptance Test Certificate (FAT) shall be issued by the SSCDL to the SI. ***Prerequisite for carrying out FAT activity:***

1. Detailed test plan shall be developed by the SI and approved by SSCDL. This shall be submitted by SI before FAT activity to be carried out.
2. All documentation related to Project and relevant acceptance test document (including IT Components, Non IT Components etc.) should be completed & submitted before the final acceptance test to the SMC / SSCDL.
3. The training requirements as mentioned should be completed before the final acceptance test.
4. For both IT & Non-IT equipment, software manuals / brochures / Data Sheets / CD / DVD / media for all the Project supplied components should be submitted to the SMC / SSCDL.

The FAT shall include the following:

1. All hardware and software items must be installed at respective sites as per the specification.
2. Availability of all the defined services shall be verified.
3. The SI shall be required to demonstrate all the features / facilities / functionalities as mentioned in the RFP.
4. The SI shall arrange the test equipment required for performance verification, and will also provide documented test results.
5. The SI shall be responsible for the security audit of the established system to be carried out by a certified third party as agreed by SSCDL.

Any delay by the SI in the Final Acceptance Testing shall render him liable to the imposition of appropriate penalties. However, delays identified beyond the control of SI shall be considered appropriately and as per mutual agreement between SSCDL and SI.

5.16. System Documents and User Manuals

The SI shall provide documentation, which follows the ITIL (Information Technology Infrastructure Library) standards or IEEE/ISO Acceptable Documentation Standards. This documentation should be submitted as the project undergoes various stages of implementation and provide all traceability documentation on changes done on the IT components during the course of the implementation of the solution. Indicative list of documents include:

1. Project Commencement: Project Plan should provide micro level activities with milestones & deadlines.
2. Delivery of material: Original manuals from OEMs.
3. Training: Training material will be provided which will include the presentations used for trainings and also the required relevant documents for the topics being covered.
4. Process Documentation: The SI shall be responsible for preparing process documentation related to the operation and maintenance of each and every component of the Project. The prepared process document shall be formally signed off by SSCDL before completion of final acceptance test.
 - The SI shall document all the installation and commissioning procedures and provide the same to the SSCDL within one week of the commissioning of Project.
 - The SI shall submit a complete set of Network design documents for all core and access rings, AutoCAD drawings for RoW, as – built drawings for all fiber routes, splicing reports, testing reports (OTDR and LSPM reports), bay face diagrams for all PoPs with marking of installed racks etc. to the SMC / SSCDL.
 - The SI shall submit a complete set of Single Line diagram, a complete cabling system layout (as installed), including cable routing, telecommunication closets and telecommunication outlet/ connector designations. The layout shall detail locations of all components and indicate all wiring pathways.
 - Manuals for configuring of switches, routers etc. shall be provided by the selected SI.

The SI shall be responsible for documenting configuration of all devices and keeping back up of all configuration files, so as to enable quick recovery in case of failure of devices.

5.17. Other

- SI to ensure that for operation and maintenance team has the uniform with the identity card, safety shoes, helmet, Neon Jackets etc.
- SI will have to carry his own four wheeler for carry out implementation and maintenance work (including transportation of items required for Project) during the contract Period. All the expenses pertaining to four wheeler such as driver's expense, fuel, lubricants, maintenance etc. will have to be borne by the SI.

6. Project and Operation & Maintenance Teams

6.1. Project Management Office (PMO)

A Project Management office will be set up during the start of the project. The PMO will, at the minimum, include a designated full time Project Manager from SI. It will also include key persons from other relevant stakeholders including members of SMC / SSCDL and other officials / representatives by invitation. The operational aspects of the PMO need to be handled by the SI including maintaining weekly statuses, minutes of the meetings, weekly / monthly project plans, etc.

PMO will meet formally on a weekly basis covering, at a minimum, the following agenda items:

1. Project Progress
2. Delays, if any – Reasons thereof and ways to make-up lost time
3. Issues and concerns
4. Performance and SLA compliance reports;
5. Unresolved and escalated issues;
6. Project risks and their proposed mitigation plan
7. Discussion on submitted deliverable
8. Timelines and anticipated delay in deliverable if any
9. Any other issues that either party wishes to add to the agenda.
10. During the development and implementation phase, there may be a need for more frequent meetings and the agenda would also include:
11. Target dates for connectivity to prioritized locations specified by SMC / SSCDL.
12. Scope / design changes in fiber routes due to any field constraint / feasibility issue.
13. IT infrastructure procurement and deployment status
14. Status of setting up/procuring of the Helpdesk, DC hosting
15. Any other issues that either party wishes to add to the agenda.

The SI shall recommend PMO structure for the project implementation phase and operations and maintenance phase. The SI shall also circulate written progress reports at agreed intervals to SMC / SSCDL and other stakeholders. Project status report shall include Progress against the Project Management Plan, status of all risks and issues, exceptions and issues along with recommended resolution etc.

Other than the planned meetings, in exceptional cases, project status meeting may be called with prior notice to the SI. SMC / SSCDL reserves the right to ask the SI for the project review reports other than the standard weekly review reports.

6.2. Steering Committee

1. The Steering Committee will consist of senior stakeholders from SMC / SSCDL, its nominated agencies and SI. SI will nominate Project Director to be a part of the Project Steering Committee.
2. The SI shall participate in monthly Steering Committee meetings and update Steering Committee on Project progress, Risk parameters (if any), Resource deployment and plan, immediate tasks, and any obstacles in project. The Steering committee meeting

will be a forum for seeking and getting approval for project decisions on major changes etc.

3. All relevant records of proceedings of Steering Committee should be maintained, updated, tracked and shared with the Steering Committee and Project Management Office by SI.
4. During the development and implementation phase of the project, it is expected that there will be at least fortnightly Steering Committee meetings. During the O&M phase, the meetings will be held at least once a quarter.
5. Other than the planned meetings, in exceptional cases, SMC / SSCDL may call for a Steering Committee meeting with prior notice to the SI.

6.3. Project Team

The table below provides the minimum qualification of a Project team for entire Project implementation phase. The below team should be placed onsite for entire Project implementation phase.

#	Designation	Desired Qualification
1	Project Manager	<ul style="list-style-type: none"> • BE /B. Tech with M.Tech/MBA • Minimum 15 Years of Experience in large scale ICT infrastructure projects. • Relevant Exp.: Minimum 7 Years of experience as a project manager of large scale ICT infrastructure or WAN / MAN Projects. • Preference would be given to experts having PMP / Prince2 certification.
2	Network Design Expert / Solution Architect	<ul style="list-style-type: none"> • BE /B. Tech • Minimum 10 Years of Experience in large scale ICT infrastructure projects. • Relevant Exp.: Minimum 7 Years of experience in designing and implementing network solutions for at least 2 WAN / MAN projects. • Preference would be given to experts having CCNP certification.
3	Site Manager	<ul style="list-style-type: none"> • BE / B.Tech • Minimum 5 Years of Experience in WAN / MAN projects.
4	Site Engineers	<ul style="list-style-type: none"> • BE / B.Tech • Minimum 3 Years of Experience in WAN / MAN projects.
5	NoC Experts	<ul style="list-style-type: none"> • BE / B.Tech • Minimum 7 Years of Experience in WAN / MAN projects. • Should have experience in implementing BNG and CGNAT solutions.

The Project Manager should be full time deployed at the Surat for regular co-ordination and monitoring of the Project.

Site Manager will report to the Project Manager, in order to ensure that the correct information is communicated from the commencement of the project until the hand-over of the network to the client. The appropriate number of Site Managers to be deployed by SI as

per the project requirements.

SI will also deploy site engineers and supervisors to continuously monitor the work being executed simultaneously in different areas of the city. The appropriate number of Site Engineers and Supervisors to be deployed by SI as per the project requirements. SI will ensure availability of manpower resources having experience in both domains – Construction of passive network elements like fibre & shelter and installation, commissioning, configuration & integration of all active elements like routers, switches, electrical utilities, core routers in NOC, server in Data Centre etc. They will perform following activities but not limited to:

1. Supervise ongoing work to ensure that all specifications, standards and quality norms are followed.
2. Preparation of ITP (Inspection and Test Plans) reports, splicing reports, LSPM and bi-directional OTDR reports.
3. Provide progress reports to Site Manager along with critical field issues and support required.
4. Coordinate timely active and passive material delivery at site.
5. Coordinate availability of all resources like HDD machine (in fully working condition), OFC blowing machine, splicing machine, testing tools, labours etc. as per requirement.
6. Installation and commissioning of all active elements with required specifications.
7. Supervise establishment of all major PoP inside existing facilities and any additional set up required in existing NOC and Data Centre etc.

6.4. Operation & Maintenance (O&M) Team

SI is responsible of O&M for the period of 7 years. O&M would entail undertaking all activities to ensure uptime of the network as per agreed SLAs defined in Volume -1 of RFP. This shall also apply to the entire supporting infrastructure such as NOC, NMS, etc. The O&M shall also cover the maintenance of infrastructure of any additional locations that may be added to OFC network in future as per SMC's requirement.

Active Component: Active component shall be covered under 3 years of warranty from direct OEM & 4 years of Comprehensive AMC

Passive Component: All the passive component shall be covered under 3 year of warranty & 4 years of Comprehensive AMC.

6.4.1. Provision of the Operational Manpower at Network Operation Centre (NOC)

The SI is required to provide suitable manpower to monitor the data feeds & helpdesk support at NOC as per following:

- 1st shift (6:00 am to 2:00 pm) – 1 operator
- 2nd shift / General Shift (10:30 am to 6:30 pm) – 2 operator
- 3rd shift (2:00 pm to 10:00 pm) – 1 operator

The SI will increase the strength if it is required by SSCDL to do so. The team shall support SMC / SSCDL in operationalization of the project. SI shall be required to provide such manpower meeting following requirements:

1. All such manpower shall be BE / B.Tech / MCA with minimum 3 years of experience in handling NOC operation.
2. System Integrator shall have to replace any person, if not found suitable for the job.

3. All the manpower shall have to undergo training from the System Integrator for at least 15 working days on the working of project.
4. Operational manpower shall work in shifts, with no person being made to see the feeds for more than 8 hours at a stretch.

SI shall prepare the detail operational guideline document during implementation which shall specify detail responsibilities of these resources and their do's & don'ts.

6.4.2. Provision of the Field Operational Manpower and Resources

SI shall work out the model to estimate the required field staff to maintain a BRTS corridor wide Optical Fibre Network including active, passive elements and associated services like Internet and Intranet services. It is proposed to deploy minimum 3 personal in O&M phase, however SI to estimate the exact number of personnel to maintain the SLA requirement mentioned in Volume-1 of the RFP. SI shall also work out the other resources required for maintenance of the network and get it pre-approved from SMC / SSCDL. Resources for Operation and Maintenance of the active and passive network elements would include following but not limited to:

- Field engineers with dedicated FRTs (Field Restoration Team)
- Vehicles (four-wheeler) for routine patrolling and mobilization of resources.
- Communication devices to issue reporting and resolution.
- Equipment like splicing machine, OTDR, LSPM, Visual fault locators, Fibre microscope, Fibre optic cleaning kits etc. required for maintenance.
- Material storage locations with adequate capacity in different areas of the city to speed up material delivery during fault to reduce MTTR.
- Spare material including all required active and passive elements in adequate quantity to be maintained at all time at all storage locations.
- Field engineers with networking certification to maintain active elements of the network including replacement, installation, configuration and integration.

7. Annexure I - Specifications

7.1. Core Switch for NOC locations

#	Parameter	Minimum Specifications	Bidders Compliance (Yes, No)
1	Ports	<ul style="list-style-type: none"> (as per requirements) 10/100/1000 Base-TX/FX ports and extra 2 or 4 nos of 10G Base SX/LX/LR ports as per network solution offered. TX/FX Split as per field/site requirement All ports can auto-negotiate between 10Mbps/ 100Mbps/ 1000Mbps, half-duplex or full duplex and flow control for half-duplex ports. 	
2	Switch type	Layer 3	
3	MAC	32k or more	
4	Backplane	Properly sized Switching fabric capacity (as per network configuration to meet performance requirements of wire speed switching for the connected devices)	
5	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks	
6	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.	
7	Protocols	<ul style="list-style-type: none"> IPV4, IPV6 Support 802.1D, 802.1S, 802.1w, Rate limiting Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping 802.1p Priority Queues, port mirroring, DiffServ DHCP support Support upto 1024 VLANs Support IGMP Snooping and IGMP Querying Support Multicasting Should support Loop protection and Loop detection, Should support Ring protection 	
8	Access Control	<ul style="list-style-type: none"> Support port security Support 802.1x (Port based network access control). 	

#	Parameter	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> Support for MAC filtering. Should support TACACS+ and RADIUS authentication 	
9	VLAN	<ul style="list-style-type: none"> Support 802.1Q Tagged VLAN and port based VLANs and Private VLAN The switch must support dynamic VLAN Registration or equivalent Dynamic Trunking protocol or equivalent 	
10	Protocol and Traffic	<ul style="list-style-type: none"> Network Time Protocol or equivalent Simple Network Time Protocol support Switch should support traffic segmentation Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number 	
11	Management	<ul style="list-style-type: none"> Switch needs to have console port for management via PC Must have support SNMP v1,v2 and v3 Should support 4 groups of RMON Should have accessibility using Telnet, SSH, Console access, easier software upgrade through network using TFTP etc. Configuration management through CLI, GUI based software utility and using web interface 	

7.2. Core Router / Internet Router

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Multi-Services	Should deliver multiple IP services over a flexible combination of interfaces	
2.	Ports	As per overall network architecture proposed by the bidder, the router should be populated with required number of LAN/WAN ports/modules, with cable for connectivity to other network elements.	
3.	Interface modules	Must support up to 10G interfaces as per the design. Must have capability to	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		connect with variety of interfaces.	
4.	Protocol Support	<ul style="list-style-type: none"> • Must have support for TCP/IP, PPP, X.25, Frame relay and HDLC • Must support VPN • Must have support for integration of data and voice services • Routing protocols of RIP, OSPF, and BGP. • Support IPV4, IPV6 • Support load balancing 	
5.	Manageability	Must be SNMP manageable	
6.	Traffic control	Traffic Control and Filtering features for flexible user control policies	
7.	Bandwidth	Bandwidth on demand for cost effective connection performance enhancement	
8.	Remote Access	Remote access features	
9.	Redundancy	<ul style="list-style-type: none"> • Redundancy in terms of Power supply(s). Power supply should be able to support fully loaded chassis • All interface modules, power supplies should be hot-swappable 	
10.	Security features	<ul style="list-style-type: none"> • MD5 encryption for routing protocol • NAT • URL based Filtering • RADIUS/AAA Authentication • Management Access policy • IPSec / Encryption • L2TP 	
11.	QOS Features	<ul style="list-style-type: none"> • RSVP • Priority Queuing • Policy based routing • Traffic shaping • Time-based QoS Policy • Bandwidth Reservation / Committed Information Rate 	

7.3. PoP Switch

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	General Requirement	<ul style="list-style-type: none"> • Must have minimum of 04 Modular Slots and Two slot for Supervisor cards. After inserting the IO Modules for the necessary configuration at least 02 slots should be free. If the Bidder has IO Module configuration which consumes more slot bidder should offer chassis with a higher configuration. Switch Fabric Slots should be different • Switch should have distributed switching architecture with passive backplane. Shall have CLOS Architecture or equivalent shared switch fabric capability with minimum four switch fabrics all supporting active switching to support high switching capacity. The switch should support OpenFlow specifications to enable SDN by allowing separation of the data (packet forwarding) and control (routing decision) paths • Switch should support more than 3Tbps switching capacity or greater. • Switch should have a switching throughput which should be atleast 2 Mpps or higher • Switch hardware should be ready to support 40 & 100GE I/O modules. By upgrading the S/w and necessary Switch Fabric the switching capacity should be incremented to support 40 & 100G modules in a non blocking architecture mode. No chassis would be changed at that point of time. The Same Supervisory Modules; Power supply etc would be used. OEM/SI to give specific compliance for the same • Switch should have suitable Visual Indicators for diagnostics and healthy / unhealthy status of Ports & modules. • No Ports or service modules should be populated on Switching Fabric/Management Module • Switch should support IPv4 and IPv6 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> All the interface modules should be hot swappable, therefore, no downtime / reboot should be required for addition / removal / change of any of the interface modules. Switch should support link aggregation across multiple switches in a cluster so as to be considered as single virtual link on switch cluster from access/distribution. Switch should support clustering of at least two switches to work as a single entity for access/distribution switches. Both switches should work in active-active for all the Vlan traffic Two switches when working as a switch cluster as mentioned above should use their own control and data plane. No sharing of control or data plane should happen. There should not be any slot dependency for I/O modules. All kind of I/O modules can go in any of available payload slots 	
2.	Redundancy	<ul style="list-style-type: none"> Must have Redundancy Power Supply Units (PSUs). And preferable these should be Internal redundant power supplies. If Internal Redundant Power supplies are not available then the bidder should specifically offer redundancy and should give the technical note on the same. Must have redundant of other components such as fans within network equipment. Redundant CPU cards must support stateful switchover, ensuring synchronization to allow the standby CPU to immediately take over in sub-second time scales in the event of a failure. This is vitally important with the types of broadcast critical applications that may be running over the infrastructure to ensure that services are unaffected. 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> All components (including elements such as I/O cards, CPUs, power supplies and fans) must be hot swappable with zero disruption to traffic forwarding (Unicast or multicast). 	
3.	Resiliency	<ul style="list-style-type: none"> Shall have the capability to extend the control plane across multiple active switches making it a virtual switching fabric, enabling interconnected switches to perform as single Layer-2 switch and Layer-3 router Should support IEEE 802.1D Spanning Tree Protocol, IEEE 802.1w Rapid Spanning Tree Protocol and IEEE 802.1s Multiple Spanning Tree Protocol IEEE 802.3ad Link Aggregation Control Protocol (LACP) Ring protocol support to provide sub-100 ms recovery for ring Ethernet-based topology Virtual Router Redundancy Protocol (VRRP) to allow a group of routers to dynamically back each other up to create highly available routed environments Graceful restart for OSPF, IS-IS and BGP protocols Bidirectional Forwarding Detection (BFD) for OSPF, IS-IS and BGP protocols 	
4.	Port density	<ul style="list-style-type: none"> Switch should have sufficient number of 10G (SFP+/XFP) / 40G (QSFP+) ports. In case of XFP interface OEM to confirm that the same is compatibility with SFP+ at the other end. Switch should support the following 1000Base Transceivers as mentioned below SX transceiver module for Multimode Fiber for supporting a maximum distance of 550 mtrs LX/BX transceiver module for Single Fiber for supporting a maximum distance of 10Kms 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> • ZX /LH transceiver module for Single Fiber for supporting A maximum distance of 100Kms • Switch should support the following 10G Base Transceivers as mentioned below • SR transceiver module for Multimode Fiber for supporting a maximum distance of 550 mtrs on OM3 and OM4 • LR transceiver module for Single mode fiber for supporting a maximum distance 10 Kms • ER/EW transceiver module for Single mode fiber for supporting a maximum distance 40 Kms • SPF+ Cables for Direct Connectivity on UTP should also be available • Switch should support the following 40G Base Transceivers as mentioned below • SR4 transceiver module for Multimode Fiber for supporting a maximum distance of 550 mtrs on OM3 and OM4 • LR4 transceiver module for Single mode fiber for supporting a maximum distance 10 Kms 	
5.	Layer features 2	<ul style="list-style-type: none"> • IEEE 802.1Q VLAN tagging. • 802. 1Q VLAN on all ports with support for minimum 3500 VLANs. • Support for minimum 400 k MAC addresses • Spanning Tree Protocol as per IEEE 802.1d • Multiple Spanning-Tree Protocol as per IEEE 802.1s • Rapid Spanning-Tree Protocol as per IEEE 802.1w • Self-learning of unicast & multicast MAC addresses and associated VLANs • Jumbo frames up to 9000 bytes • Link Aggregation Control Protocol (LACP) as per IEEE 802.3ad. • Minimum 128 Multi-link Trunks with o8 links per multi-link group. 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> • “Port Mirroring” functionality for measurements using a network analyzer for up to 32 ports. • Broadcast, Multicast and Unicast storm control on per port basis to prevent degradation of overall system performance occurred due to faulty end stations. • Switch hardware should support IEEE 802.1ah MAC-in-MAC encapsulation or IEEE 802.1ad Qin Q. • Should support Ethernet (IEEE 802.3, 10BASE-T) • Should support Fast Ethernet (IEEE 802.3u, 100BASE-TX) • Must support Gigabit Ethernet (IEEE 802.3z, 802.3ab) • Must support Ten Gigabit Ethernet (IEEE 802.3ae) • Software based standards for Network Device • Must support IEEE 802.1d - Spanning-Tree Protocol • Should support IEEE 802.1s - Multiple Spanning Tree Protocol • Must support IEEE 802.1q - VLAN encapsulation • Should support IEEE 802.3x Flow Control • Must support auto-sensing and auto-negotiation (Link Speed/Duplex) 	
6.	Layer 3 features	<ul style="list-style-type: none"> • Inter-VLAN IP routing for full layer 3 routing between two or more VLANs. • IP unicast routing protocols (static, RIPv2, OSPF, BGP). • Support for IPv6 routing in future like Static, OSPFv3, , BGP+ • Virtual Router Redundancy Protocol (VRRP) as per RFC 3768 or equivalent. • VRF/VRF-lite virtualization feature • PIM-SM multicast routing protocol • Minimum 1000 IP interfaces. • Minimum 2000 IP multicast streams and 500 active PIM interfaces. 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> • Minimum 500k IP forwarding table entries. • OSPF Instances: up to 50 • OSPF Adjacencies: up to 200 • OSPF Routes: up to 64k • RIP Instances: up to 64 • RIP Routes: up to 05k • BGP Peers: up to 50 • BGP Routes: up to 128k • VRF instances : up to 512 • PIM Active Interfaces: up to 512 • Should support policy based routing with Flow-based Polices: up to 06k • Switch should support IGMP v1/v2/v3 as well as IGMP v1/v2/v3 snooping. • Switch hardware should support IEEE 802.1aq standard of shortest path bridging or IETF TRILL. Virtualization feature should be supported using SPB or MPLS or any other protocol. OEM/SI to give detailed noting on how virtualization is possible in the offered product. • Switch hardware should support IEEE 802.1ag standard based connectivity fault management (CFM) • Must support Static IP routing • Must support Open Shortest Path First (OSPF) v2 (RFC 2328) • Should support Intermediate system to intermediate system - IS-IS (RFC 1195) • Must support Border Gateway Protocol - BGPv4 (RFC 1771) • Should support Multi-Protocol Border Gateway Protocol - MP-BGP (RFC 2858) • Should support BGP Route Flap Damping (RFC 2439) • Should support Policy Based Routing • Should support Graceful Restart for OSPF (RFC 3623) / OSPFv3 (RFC 5187) • Should support Graceful Restart for IS-IS (RFC 3847 - Restart signaling for IS-IS) 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> Should support Graceful Restart for BGP (RFC 4724) 	
7.	Quality of Service (QoS) Features	<ul style="list-style-type: none"> Must support IEEE 802.1p class-of-service (CoS) prioritization Should have advanced per-port QoS features in both ingress and egress directions. Please specify what is possible for ingress and what is possible for egress. Should be able to classify and mark traffic based on physical port, IP DA/SA, L4 information, IEEE 802.1Q/P COS, IP Precedence (ToS), DSCP, MPLS exp bits switch should support DiffServ as per RFC 2474/2475 Must support a minimum of four levels of prioritization per port Should have per-port queue management and congestion avoidance features (e.g. RED / WRED). Please specify features supported Must support rate limiting (to configurable levels) based on source/destination IP/MAC, L4 TCP/UDP Must have the ability to complete traffic shaping to configurable levels based on source/destination IP/MAC and Layer 4 (TCP/UDP) protocols There should not be any impact to performance or data forwarding when QoS features Must support a "Priority" queuing mechanism to guarantee delivery of highest-priority (broadcast critical/delay-sensitive traffic) packets ahead of all other traffic Must support ability to trust the QoS markings received on an ingress port 	
8.	Security Features	<ul style="list-style-type: none"> Must support multiple privilege levels for remote access (e.g. console or telnet access) Must support Remote Authentication Dial-In User Service (RADIUS) and/or 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<p>Terminal Access Controller Access Control System Plus (TACACS+)</p> <ul style="list-style-type: none"> • Must support AAA using RADIUS (RFC 2138 & 2139) and/or TACACS+, enabling centralized control of the device and the ability to restrict unauthorized users from altering the configuration • Access Control features • Should support Access Control Lists (layers 2-4) in hardware. • Should support both ingress and egress access control lists per port • Should support access list parameters for control based on source and/or destination IP, source and/or destination subnet, protocol type (IP/TCP/UDP etc), source and/or destination port or any combination of these. • By enabling access lists, there should not be any impact on the router performance • Should be able to apply access control for SNMP/NTP access. (to ensure SNMP access only to Network Management Systems) • Should support per-port broadcast, multicast and uni-cast storm control • The router should support MD5 authentication for OSPF, IS-IS and BGP. • DHCP Snooping to prevent Man in the Middle attacks • Switch should support MAC Address based Filters / Access Control Lists (ACLs) on all switch ports • Switch should support Port as well as VLAN based Filters / ACLs. • Secure Shell (SSH) Protocol, HTTP and DoS protection • IP Route Filtering, Anti-spoofing etc. 	
9.	Management Features	<ul style="list-style-type: none"> • Switch should have a console port with RS-232 Interface for configuration and diagnostic purposes. 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> Switch should be SNMP manageable with support for SNMP Version 1, 2 and 3. Switch should support all the standard MIBs (MIB-I & II). Switch should support TELNET and SSH Version-2 for Command Line Management. Switch should support 4 groups of embedded RMON (history, statistics, alarm and events). Switch should support System & Event logging functions as well as forwarding of these logs to upto ten separate syslog server for log management. Switch should support on-line software reconfiguration to implement changes without rebooting. Any changes in the configuration of switches related to Layer-2 & 3 functions, VLAN, STP, Security, QoS should not require rebooting of the switch. Switch should have comprehensive debugging features required for software & hardware fault diagnosis. Switch should support Multiple privilege levels to provide different levels of access. Switch should support NTP (Network Time Protocol) as per RFC 1305. Switch should support FTP and TFTP. Switch should have inbuilt element manager accessed via HTTP (Web GUI) or using external management software "Must support Network Timing Protocol (NTPv3) and should support the following: Configuration of more than one NTP server. Speciation of a local time zone. Configuring automatic time offset adjustment for daylight savings time. NTP authentication" "Extensive debugging capabilities to assist in hardware/software problem 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<p>resolution. At a minimum, debugging support should include:</p> <ul style="list-style-type: none"> • Detailed packet level debugging for troubleshooting purposes • Detailed IGP/EGP (OSPF/IS-IS/BGP) for troubleshooting purposes • Detailed Multicast debugging (e.g. IGMP/ PIM) for troubleshooting purposes • QoS debugging for troubleshooting purposes" • Debugging must not have a impact on performance or data forwarding capabilities of the device • It should be guaranteed that the network switch will not enter it's end of life cycle for a minimum of five years • The network switch should have a 5-10 year roadmap available covering the future of the equipment (this information should be attached) • It is desirable that the device has support for a XML or equivalent interface allowing for future querying, configuration and management options • Hardware modules should be simple to access for removal and replacement, allowing for replacement while ensuring continuous system operations and availability 	
10.	Standards	<ul style="list-style-type: none"> • RoHS Compliant • IEEE 802.1x support • IEEE 802.3x full duplex on 10BASE-T and 100BASE-TX ports • IEEE 802.1D Spanning-Tree Protocol • IEEE 802.1p class-of-service (CoS) prioritization • IEEE 802.1Q VLAN • IEEE 802.3x be on 10 BaseTx / 100 Base Tx / 1000 Base Tx • 10G Base-SR, 10G Base LR, 10G Base CX • IEEE 802.3u 10 BaseT / 100 Base Tx /1000 Base Tx 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> 40G Base-SR, 40G Base LR, 40G Base CX 	

7.4. Next Generation Firewall / Unified Threat Management

SI will have to consider 2 NGFWs / UTM (1+1) at Muglisara PoP for better redundancy.

#	Item	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Basic Criteria	<ul style="list-style-type: none"> OEM should have support Centre in India. Appliance must be ICSA Labs certified for Firewall. The proposed solution should support High Availability Active-Active/Passive mode 	
2.	Minimum Hardware Specification	<ul style="list-style-type: none"> Minimum 2 x 10GbE SFP (Mini GBIC) Ports/SFP+ form day 1 Minimum 10 x 1GbE SFP (Mini GBIC) Ports from day 1 Minimum 10 x 1GbE RJ45/Copper Ports from day 1 Minimum 2 x USB Ports 2 x Integrated and Hot swappable Power Supply Inbuilt Storage with minimum 200 GB Capacity Minimum 1x Console Management Ports (RJ45) & should provide http, https, SSH, Telnet, SNMP based management console for managing and configuring. Ports can be configurable for LAN/WAN/DMZ 	
3.	Appliance Throughput	<ul style="list-style-type: none"> Minimum Firewall throughput of 50 Gbps or higher Minimum 2,50,000 New Sessions/sec Minimum 1,00,00,000 Concurrent sessions Minimum 3.5 Gbps for SSL VPN throughput or higher Minimum 2.2 Gbps Antivirus throughput Should have minimum of 200 GB storage space 	
4.	General Features	<ul style="list-style-type: none"> Should be appliance based and rack mountable. Device in built DNS server for prevention of phishing and pharming scams involving DNS poisoning while 	

#	Item	Minimum Specifications	Bidder Compliance (Yes/No)
		<p>reducing time taken for DNS mapping.</p> <ul style="list-style-type: none"> • Intrusion Prevention System • Gateway Anti-virus • Gateway Anti-spam with DLP functionality • Web Content & Application Filtering • Web Application Firewall • Bandwidth Management/Traffic Shaping capable of setting guarantee bandwidth and maximum bandwidth per firewall policy • High Availability (Active-Active & Active-Passive) • The High Availability should be supported in the Firewall from the day one and without any extra license. • The Firewall should support Static, Policy Base, Identity based, Multicast routing and Dynamic routing for RIP1 & 2, OSPF, OSPFv3, BGP4, RIPv6, Server Load Balancing. • The Firewall should belong to a family of products that attains industry standard Approved Certification and attains IPv6 Ready Phase 2 & IPv6 Certification • Should support IPv6 ACL to implement security Policy for IPv6 traffic. • Support for user authentication over SMS and in built two factor authentication without any additional cost. • The proposed solution should support integration with Windows NTLM, Active Directory, LDAP, Radius, or Local Database for user authentication. • Country Based Blocking, FQDN support and should support MIX mode deployment • Should have an integrated wireless controller and should be able to manage multiple wireless access points centrally from web admin console. 	
5.	Gateway Antivirus, Anti-Spyware and Anti-Spam	<ul style="list-style-type: none"> • Firewall must able to scan http, https, IMAP, IMAPs, FTP, FTPs, POP, POPs, SMTP, SMTPs & MAPI protocols with AV signatures • Virus, Worm, Trojan Detection and Removal, Automatic Virus signature database update, Real-Time blacklist, 	

#	Item	Minimum Specifications	Bidder Compliance (Yes/No)
		MIME header check, and Redirect spam mails to dedicated email address, image-spam filter, Spam Notification, Zero hour Virus outbreak protection.	
6.	Web and Application Filtering	<ul style="list-style-type: none"> The proposed solution should be able to enable or disable Web Filter per firewall policy or based on firewall authenticated user groups for both HTTP and HTTPS Should blocks web plug-ins such as ActiveX, Java Applet, and Cookies & Shall include Web URL block, Web keyword block, Web Exempt List The proposed solution must work as a HTTP proxy server with integrated Firewall, Anti-Virus, Anti-Spam, Content filtering, IPS. The proposed solution should be able to enable or disable Web Filter per firewall policy or based on firewall authenticated user groups for both HTTP and HTTPS The solution shall allow administrators to create multiple new local URL filtering categories besides dynamic categories Application Control Solution must provide option to create custom signature for applications & it should able to understand Well-known application like P2P, Voice, etc without any dependency on the ports 	
7.	Wireless Security and Control	<ul style="list-style-type: none"> Should act as a wireless controller, Simple plug-and-play deployment of wireless access points (APs) - automatically appear on the firewall control centre, Central monitor and manage all APs and wireless clients through the built-in wireless controller, Support for IEEE 802.1X (RADIUS authentication), Wireless repeating with supported Aps. 	
8.	Intrusion Prevention System (IPS)	<ul style="list-style-type: none"> For different attacks like Mail Attack, FTP Attack, HTTP Attack, DNS Attack, ICPM Attack, TCP/IP Attack, DOS and DDOS Attack, TelNet Attack. Signatures: Custom, IPS Policies: Multiple, Custom, User-based policy creation, Automatic real-time updates. Should have a built-in Signature and Anomaly based IPS engine on the 	

#	Item	Minimum Specifications	Bidder Compliance (Yes/No)
		<p>same unit and Anomaly based detection should be based on thresholds.</p> <ul style="list-style-type: none"> • Able to prevent denial of service and Distributed Denial of Service attacks on signature. • Administrator shall be able to configure DoS policies that are used to associate DoS settings with traffic that reaches an interface based on defined services, source and destinations IP/Range. 	
9.	Advance Threat Protection	<ul style="list-style-type: none"> • Advanced Threat Protection (Detect and block network traffic attempting to contact command and control servers). • It also must have facility to block Bot attacks from day 1 & also should scan Mobile devices security from day 1 	
10.	Zero day prevention or Sandboxing	<ul style="list-style-type: none"> • Solution should inspect executables and documents containing executable content including .exe, .com, .dll, .docx, rtx, etc , Should support malware behaviour analysis. 	
11.	VPN	<ul style="list-style-type: none"> • IPsec and SSL must be a part of Basic Appliance. • The SSL VPN should be integrated solution and there should be no user based licensing for SSL VPN with SSL encryption/decryption. • Firewall must have at least 1000 SSL VPN client in Route mode from the day 1. • The system shall support IPSEC site-to-site VPN and remote user VPN in transparent mode without any additional cost for VPN clients. 	
12.	Load Balance	<ul style="list-style-type: none"> • For Automated Failover/Failback, Multi-WAN failover, High availability: Active-Active. QoS, OSPF, RIPv2, BGP, Policy routing based on Application and User support Round Robin Load Balancing. 	
13.	Bandwidth Management	<ul style="list-style-type: none"> • Application and user bandwidth management, Multi WAN bandwidth reporting, guaranteed bandwidth policy. Bandwidth for User, Group, Firewall Rule, URL and Applications. 	
14.	Monitoring and Reporting System	<ul style="list-style-type: none"> • Reports should be accessible through HTTP/HTTPS/Client based. • Should provide reports in Graphical/CSV/PDF format or cloud based. 	

#	Item	Minimum Specifications	Bidder Compliance (Yes/No)
15.	License for UTM/NGFW	<ul style="list-style-type: none"> The proposed solution must be licensed per unit for 7 years & there should not be any license limit on number of sessions, firewall rules, maximum number of connections, no of nodes/desktops, no. of IPs, domains, etc. for all modules. It must include minimum 7 years subscription for IPS & IDS, Gateway Antivirus, Anti-Spyware, Content Filtering System, Log Analysis & Management software. Hardware must be latest product from OEM and it must not be under the list end of sale, end of support from OEM till 7 years from date of commissioning. 	

7.5. Indoor Access Switch for connecting SMC locations

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Operating Temperature	0°C to 50°C	
2.	General Requirements	<ul style="list-style-type: none"> The switch should be 19" rack mountable The switch should have sufficient number of 10/100/1000 baseT POE+. All Ports should have POE+ Power from day one and for this additional power supply is required then the same needs to be provided by the Bidder and the cost of the same should be considered per switch The switch should support Auto MDI/MDI-X with Auto-Polarity & Jumbo frames. The switch ports should be 802.3at-compliant PoE+ ports Should reduce power consumption in accordance with IEEE 802.3az The switch should support strict priority queuing configuration that helps in ensuring the highest priority packets are given the highest importance and kept ahead of all traffic. The switch should support configuration of priority level per port and either of three: Low, High, and Critical. Priority can be configured per port The switch should have minimum of 4 SPF+ slots 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> The switch should have support for 1000Base-T, 1000Base-SX, 1000Base-LX The switch should have support for 10G based SR; LRM and CX modules for interconnecting the switch over Multimode OM4 or OM3 grade fiber; Single Mode Fire and Copper media The switch should have stacking capabilities and should support minimum of 04 switches per stack. The switch should have separate stacking module and connectors in addition to the user ports or Uplinks ports mentioned above. All the necessary hardware and software should be provided with the switch. The switch should have minimum stacking bandwidth of 80 Gbps per switch. Switch should support auto unit replacement functionality in the stack which helps in replacing the faulty unit on-line. Switch should have distributed switching architecture with passive backplane. The switch should support OpenFlow specifications to enable SDN by allowing separation of the data (packet forwarding) and control (routing decision) paths. Switch should be AC powered switch. 	
3.	Backplane and throughput	<ul style="list-style-type: none"> Minimum switch bandwidth should be minimum 128 Gbps or higher. The switch should have 90 Mpps or higher packet forwarding throughput The switch should support minimum 15K mac address entries 	
4.	Resiliency / Redundancy	<ul style="list-style-type: none"> The switch should support spanning Tree (802.1d) protocol The switch should support Fast Start with Spanning Tree (802.1d) The switch should support Rapid Spanning Tree (802.1w) The switch should support Multiple Spanning Tree Groups (802.1s) The switch should load-share the traffic on all the uplinks to core switch The switch should support BPDU Filter The switch should be Static 802.3ad compliant The switch should support 802.3ad LACP 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> All the uplinks should be passing all vlans traffic with load sharing model. 	
5.	QoS	<ul style="list-style-type: none"> The switch should support Traffic Policing, DiffServ & 802.1p Prioritisation The switch should support IP Filtering, Policies, & Offset The switch must support configuring QOS features across the entire stack of switches The switch should support minimum of 250 VLANs per switch The switch should support Port-based VLAN The switch should support Protocol-based VLAN The switch should have Per VLAN Tagging Support The switch should support IPv6 vlans The switch should have capability to support static routing, RIPv1/v2 The switch should support BootP & DHCP relay The switch should support Proxy ARP The switch should support UDP Forwarding The switch should support IGMP v1/v2/v3 proxy The switch should support IGMP v1/v2/v3 snooping 	
6.	Security	<ul style="list-style-type: none"> The switch should support RADIUS Authentication The switch should support 802.1x Extensible Authentication The switch should support 802.1x Multiple Host Multiple Authentication per port (MHMA) The switch should support per user ACL support for 802.1x The switch should support Configurable Per VLAN MAC learning The switch should support MAC Authentication Bypass The switch should support DHCP Snooping The switch should support Dynamic ARP Inspection The switch should support IP Source guard The switch should support TACACS+ 	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<ul style="list-style-type: none"> The switch should support Endpoint Security- DHCP / Hub/dot1x mode support The switch should support Multiple authentication methods inclusive of 802.1x, MAC Authentication Bypass and Web Authentication with the same consistent configuration The switch should support Multidomain Authentication or concurrent dot1x/MAC/web schemes per port The switch should support Layer 2 Threat Defense capabilities for MAN in the MIDDLE Attacks like MAC, IP and ARP spoofing The switch should support Policy Based ACL The switch should support Security on Full IPV6 Source and Destination Address 	
7.	Management & Operations	<ul style="list-style-type: none"> The switch should support Multiple Configuration File Support The switch should support Web-based Management The switch should support SNMPv1/v3 The switch should support RADIUS Authentication The switch should have RMON Support per Port (events, alarms, history, statistics) The switch should have SSHv2 support The switch should support Simple Network Time Protocol (SNTP) The switch should support HTTPS (SSL based Browser Support) The switch should support 802.1AB Standards based Auto topology The switch should support Dynamic power management The switch should support Dynamic power management The switch must support encrypting administrator traffic during Telnet and SNMP session there by providing network security The switch must support Location Based Awareness and Mobility thereby, allowing a better Network Visibility and Control as well as Asset Tracking Functionality 	

7.6. Fiber Distribution Panel (FDP)

The suggested technical specifications for the FDP are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Maximum Height	44.45 mm	
2.	Maximum Width	482.6 mm	
3.	Maximum Depth	205 mm	
4.	Capacity	24 Fibers	
5.	Type of Connector	SC/LC/APC (As per field requirement)	
6.	Others	The fiber distribution panel shall be suitable for fixing into IP 65 enclosure which shall be mounted on the pole and would also house access switch and other accessories.	
7.		The fiber distribution panel shall have sufficient glands for entry and exit of optical fiber and pigtails.	

7.7. 42U Rack Cabinets

The suggested technical specifications for the 42U Rack Cabinets are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Depth	1070.00 mm	
2.	Minimum Mounting Depth	191.00 mm	
3.	Maximum Mounting Depth	915.00 mm	
4.	Rack Height	42U	
5.	Rack Width	19"	
6.	Color	Black	
7.	Vertical Post Thickness	16 Gauge	
8.	Front Door	16 gauge	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
9.	Rear Door	18 gauge	
10.	Roof	18 gauge	
11.	EIA Mounting Rails	14 gauge	
12.	Side Panels	18 gauge	
13.	Others	The front door shall be insulated metallic door fitted with rubber gasket and a central glass for clear visibility of all components installed in the rack.	
14.		The 42U rack shall have two cable managers fully separated so they do not cross each other for power and network cables.	
15.		The 42U Rack shall have provision for two separate top entries one for power and one for network cables.	
16.		The 42U Rack shall have sufficient number of shelves to accommodate specified equipment in the Mega Point Of Presence (POP)	
17.		Necessary provisions for PDU/Power strip for high availability.	

7.8. 9U Rack Cabinets (Indoor Locations)

The suggested technical specifications for the 9U Rack Cabinets are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Maximum Depth	400.00 mm	
2.	Maximum Mounting Depth	286.00 mm	
3.	Rack Height	9U	
4.	Rack Width	19"	
5.	Others	The front door shall be insulated metallic door fitted with rubber	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		gasket and a central glass for clear visibility of all components installed in the rack. Fans and PDU / power strip to be provided.	
6.		The 9U rack shall have one cable manager for network cables.	
7.		The 9U Rack shall have provision for four separate bottom entries for power and network cables.	

7.9. Optical Fiber Cables (OFC)

The technical requirements for all type of Fiber Optic Cable (OFC) (96 Core, 48 Core and 12 Core OFC):

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Single Mode Optical Fiber	ITU-T-G.652D	
2.	Maximum Cabled Fiber Attenuation db/Km	1310nm:0.34 and 1550nm:0.20	
3.	Tensile Strength	≥2200N	
4.	Crush Resistance	≥2500N	
5.	Fiber Polarization Mode Dispersion (PMD)	≤0.2 ps/√km	
6.	Impact Strength	25Nm	
7.	Operating Temperature	-20°C to 70°C	
8.	Color Coding of Tubes and Fibers	EIA/TIA-598	
9.	Inner Jacket thickness	≥1.8mm	
10.	Outer Jacket Thickness	≥0.65mm	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
11.	Water Tightness	EIA/TIA-455-81B	
12.	Minimum Continuous Length	2km±10%,	
13.	Cable Design Life	More than 25 Years	
14.	Others	The optical fiber cable shall be made of Germanium doped silica glass or pure silica glass.	
15.		The mode field concentricity shall be less than 1 μ m	
16.		The cladding of the Optical Fiber shall be made of silica glass having lower refractive index. The outside diameter of the cladded fiber shall be 125 μ m with tolerance of \pm 2.0 μ m.	
17.		The non-circularity of cladding surface shall be 2%, maximum.	
18.		The nominal fiber coating diameter shall be in the range of 245 to 400 microns.	
19.		Maximum continuous operating temperature without optical degradation shall be 65°C.	
20.		Maximum optical loss variation at temperature range of -5°C to +70°C shall be \pm 0.05dB/km.	
21.		Water swellable yarns shall be added to prevent water ingress in the core of cable	
22.		The loose tubes carrying the fiber cores shall be made of thermoplastic or equivalent material which will not kink during normal operation of the cable including laying or blowing of cable.	
23.		Outer sheathing shall be made of UV proof black MDPE/HDPE. The sheath shall have smooth finish and shall be termite resistant.	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
24.		<p>All the OFC shall be clearly marked at intervals of 1 meter with the following data which is not less than 5 mm high. The details of marking on cable shall be approved by CLIENT before commencement of manufacturing.</p> <ul style="list-style-type: none"> • Name of Client with logo • No of Fibers (12Core/48Core/96Core) • Type of OFC • Manufacture's name or trade mark • Year of manufacturing • Running length marking • Cable ID 	
25.		<p>All optical fiber cable shall be supplied on strong wooden drums provided with lagging with adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation</p>	

The technical requirements for the 96 / 48 / 12 Core OFC are as follows:

7.10. 96 Core OFC – Core Layer

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Fiber Count	96 nos.	
2.	Fibers per tube	12 nos.	
3.	Tubes	08 nos.	
4.	Diameter of Cable	15mm±5%	
5.	Weight of Cable	160kg/km±10%	

7.11. 48 Core OFC – Access Layer

The technical requirements for the 48 Core OFC are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Fiber Count	48 nos.	
2.	Fibers per tube	12 nos.	
3.	Tubes	04 nos.	
4.	Diameter of Cable	13mm±5%	
5.	Weight of Cable	120kg/km±10%	

7.12. 12 Core OFC – Last Mile

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Fiber Count	12 nos.	
2.	Fibers per tube	6 nos.	
3.	Tubes	02 nos.	
4.	Diameter of Cable	12mm±5%	
5.	Weight of Cable	110kg/km±10%	

7.13. Remote Fiber Monitoring System

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Optical ports	Minimum 16 nos. with SC/LC/PC/APC connectors	
2.	Support of optical test cycle	Minimum 10 million	
3.	Software user interface	Web based	
4.	OTDR dynamic range	30 to 40 dB	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
5.	Wavelength support	1310 nm, 1550 nm, 1625 nm	
6.	Attenuation Dead Zone	<=10 mtr	
7.	Event dead zone	<=3 mtr	
8.	Pulse width	10 ns / 30ns / 100ns / 300ns / 1us / 10 us / 20 us	
9.	Power supply	Should support both AC and DC input power supply	
10.	Storage capacity	Minimum 80 Gb	
11.		Should be compatible with NMS.	

7.14. Fiber Patch Cords

The suggested technical specifications for the Fiber Patch Cords are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Connector	SC/PC/LC/APC (As per field requirement)	
2.	Operating Wavelength	1260 - 1620 nm	
3.	Cutoff Wavelength	<1260 nm	
4.	Mode Field Diameter	9.2 ± 0.4 μm @ 1310 nm 10.5 ± 0.5 μm @ 1550 nm	
5.	Cladding Diameter	125 ± 1.0 μm	
6.	Coating Diameter	245 ± 5 μm	
7.	Insertion Loss	0.3 dB Loss (Connector to Connector) @ 1310 nm	
8.	Operation Temperature	-20°C to 70°C	
9.	Storage Temperature	-40°C to 80°C	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
10.	Cable Jacket Color	Yellow, PVC Material	

7.15. Fiber Pigtails

The suggested technical specifications for the Fiber Pigtails are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Connector	SC/LC/APC (As per field requirement)	
2.	Operating Wavelength	1260 - 1620 nm	
3.	Cutoff Wavelength	<1260 nm	
4.	Mode Field Diameter	9.2 ± 0.4 μm @ 1310 nm 10.5 ± 0.5 μm @ 1550 nm	
5.	Cladding Diameter	125 ± 1.0 μm	
6.	Coating Diameter	245 ± 5 μm	
7.	Insertion Loss	0.3 dB Loss (Connector to Connector) @ 1310 nm	
8.	Operation Temperature	-20°C to 70°C	
9.	Storage Temperature	-40°C to 80°C	
10.	Cable Jacket Color	Yellow, PVC Material	

7.16. Fiber Splice Joint Closure

The technical requirements for the Fiber Splice Joint Closure are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Closure Length	420 mm	
2.	Closure outer diameter including	205 mm	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
	Clamp		
3.	Fiber Tray Capacity	12 cores	
4.	Fiber Capacity	144 nos.	
5.	Cable Ports	4 cable entry ports + 1 no. oval port for branching application.	
6.	Number of Fiber Splice Trays	12 nos.	
7.	Others	The fiber splice joint closure shall have reusable gel end piece that opens and closes easily for adding or removing efficient cable sealing with specific grommets.	
8.		The fiber splice joint closure shall provide splice trays that are hinged to provide access to all splices without disturbing other splice trays for inter-tray fiber management.	
9.		The fiber splice joint closure shall be water-proof and dust-proof.	
10.		The fiber splice joint closure shall have a mechanism to route at least 1 meter of loose tube per tray per optical fiber cable	
11.		The joint closure shall have an earthing stud provided for grounding the armor of fibre cable (for future purpose).	

7.17. 40 mm HDPE Pipe

The minimum technical requirements for 40mm HDPE Pipe are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	40mm HDPE pipe	High Density Polyethylene Pipe with inner layer of solid permanent lubricant	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
2.	Outside Diameter	40mm+0.4mm	
3.	Wall Thickness	3.1mm ±0.4mm	
4.	Standard Length	1000meters±50m	
5.	Thickness of Permanent Lubricant	≥0.4mm	
6.	Visual	Smooth inside and outside surface free from blisters, shrink hole scratches and roughness	
7.	Ovality	Max. 1.4mm	
8.	Operating Temperature	0°C to 70°C	
9.	Underground Life Expectancy	≥25 Years	
10.		Suitable ultra violet stabilizers may be used for manufacture of the PLB HDPE pipe to protect against UV degradation when stored in open for a minimum period of 8 months.	
11.		In the inner layer of PLB HDPE pipe, the friction reducing, polymeric material to be used as the inner layer lubrication material shall be integral with HDPE layer. The lubricant materials shall have no toxic or skin hazards for safe handling	
12.		The finished pipe shall be of good workmanship such that the pipe is free from blisters, shrink holes, flaking, chips, scratches, roughness, break and other defects. The pipe shall be smooth, clean and in round shape, without eccentricity.	
13.		The ends shall be cleanly cut and shall be square with axis of the pipe.	
14.		HDPE pipe shall be supplied in circular coils of 1000m length with End caps fitted with both ends of pipe to prevent the entry	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		of any unwanted elements such as dirt, water, moisture, insects/rodents during transportation and storage.	
15.		<p>All the pipes shall be clearly marked at intervals of 1 meter with the following data which is not less than 5 mm high. The details of marking on pipe shall be approved by Client before commencement of manufacturing.</p> <ul style="list-style-type: none"> • Name of Client with logo • Manufacture's name or trade mark • Year of manufacturing • Type of HDPE pipe and size • Running length marking 	

7.18. 40 mm HDPE Coupler

The minimum technical requirements for the 40 mm HDPE Coupler are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Coupler	Push-Fit type 40mm Dia. Coupler	
2.	Pulling Force	≥330 kgf	
3.	Construction Material	HDPE	
4.		The 40 mm HDPE Coupler shall be able to provide a durable airtight and watertight joint between two pipes without deteriorating the strength of the pipes.	

7.19. End Plug for 40mm HDPE Pipe

The minimum technical requirements for the 40mm End Plug are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of End Plug	Push-Fit type 33mm ± 0.4 mm Dia. Plug	
2.	Material used for manufacturing	HDPE	
3.	Life expectancy	≥ 25 Years	
4.	End Plug	The end plug once installed shall make the laid HDPE duct air tight.	

7.20. 110 mm DWC Pipe

The technical requirements for the 110 mm DWC Pipe are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Pipe	Double Wall Corrugated HDPE pipe	
2.	Outer Diameter	110mm ± 2 mm	
3.	Inner Diameter	82mm ± 2 mm	
4.	Standard Length	6m $\pm 1\%$	
5.	Color	Purple	
6.	Operating Temperature	0°C to 70°C	
7.	Life Expectancy	≥ 25 Years	
8.		The DWC pipe shall consist of two layers, the outer layer shall be corrugated and the inner layer shall be plain and smooth.	
9.		The DWC pipe shall be supplied in straight lengths of 6mtrs, suitable for shipping and handling purpose.	
10.		The DWC pipe shall be checked visually for ensuring good workmanship that the ducts shall be free from holes, breaks and other defects. The ends shall be cleanly cut and shall be square with axis of the ducts.	
11.		All the DWC pipes shall be	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		<p>clearly marked at intervals of minimum 1 meter but not longer than 3 meters with the following data which is not less than 5 mm high. The details of marking on pipe shall be approved by Client before commencement of manufacturing.</p> <ul style="list-style-type: none"> • Name of Client with logo • Manufacture's name or trade mark • Year of manufacturing • Type of DWC pipe and size 	

7.21. 110 mm HDPE Coupler for DWC pipe

The technical requirements for the 110 mm HDPE Coupler are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Coupler	Push-Fit type 110mm Dia. Coupler	
2.	Pulling Force	≥250 kgf	
3.	Construction Material	HDPE	

7.22. Route Marker

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.		<p>Cable route and joint indicators are to be provided to indicate the cable route and location joints. The route indicators are to be placed at every 100 mts. and at every place where the cable changes direction. Joint indicators are to be provided at all joints. For the sake of uniformity and from viewpoint of identification of cable at later date for maintenance, the route / joint indicators shall be provided in the alignment of the trench.</p>	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
2.		Plate type marker Route markers shall be made out of 100mm X 5mm GI/ aluminum plate welded / bolted on 35mm X 35mm X 6mm angle iron, 60cm long. Such plate markers shall be mounted parallel to and at about 0.5m away from the edge of the trench.	
3.		The route/Joint indicators shall be painted with Primer before painting with oil paint. The route indicators shall be painted with yellow paint and joint indicators shall be painted with red paint.	

7.23. UPS for Access Locations

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Output Wave Form	Pure Sine wave	
2.	Input Power Factor at Full Load	>0.90	
3.	Input	Single Phase 1 KVA	
4.	Input Voltage Range	170-270 VAC at Full Load	
5.	Input Frequency	50Hz +/- 3 Hz	
6.	Output Voltage	230V AC, Single Phase for 1 KVA UPS	
7.	Output Frequency	50Hz +/- 0.5% (Free running); +/- 3% (Sync. Mode)	
8.	Inverter efficiency	>90%	
9.	Over All AC-AC Efficiency	>85%	
10.	UPS shutdown	UPS should shutdown with an alarm and indication on following conditions 1)Output over voltage 2)Output under voltage 3)Battery low 4)Inverter overload 5)Over temperature 6)Output short	
11.	Battery Backup	60 minutes in full load	
12.	Battery	VRLA (Valve Regulated Lead Acid) SMF (Sealed Maintenance Free) Battery	

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
13.	Indicators & Metering	Indicators for AC Mains, Load on Battery, Fault, Load Level, Battery Low Warning, Inverter On, UPS on Bypass, Overload, etc. Metering for Input Voltage, Output Voltage and frequency, battery voltage, output current etc.	
14.	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.	
15.	Cabinet	Rack / Tower type	
16.	Operating Temp	0 to 50 degrees centigrade	
17.	Management Protocol	SNMP Support through TCP/IP	

7.24. Servers (As building block for establishing computing solution)

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1	Processor	<ul style="list-style-type: none"> • Latest series/ generation of 64 bit x86 processor(s) with Ten or higher Cores. • Processor speed should be minimum 2.4 GHz. • Minimum 2 processors per physical server. 	
2	RAM	Minimum 64 GB Memory per physical server	
3	Internal Storage	2 x 300 GB SAS (10k rpm) hot swap.	
4	Network interface	2 X 20GbE LAN ports for providing Ethernet connectivity.	
5	RAID support	As per requirement/solution	
6	Operating System	Licensed version of 64 bit latest version of Linux/ Unix/Microsoft® Windows based Operating system)	
7	Form Factor	Rack	
8	Virtualization	Shall support Industry standard virtualization hypervisor like Hyper-V, VMWARE, Oracle VM etc. Blade chassis and servers offered should be in "Validated Configuration" list and certified by OEM to run virtualization.	

8. Annexure II - Specifications for Components of 4 Major PoPs

8.1. PVC Conduit

#	Parameter	Bidders Compliance (Yes, No)
1.	The conduits for all systems shall be high impact rigid PVC heavy-duty type and shall comply with IEE regulations for non-metallic conduit minimum 1.6 mm thick.	
2.	No conduit less than 20mm external diameter shall be used. Conduit runs shall be so arranged that the cables connected to separate main circuits shall be enclosed in separate conduits, and that all lead and return wire of each circuit shall be run to the same circuit.	
3.	All conduits shall be smooth in bore, true in size and all ends where conduits are cut shall be carefully made true and all sharp edges trimmed. All joints between lengths of conduit or between conduit and fittings boxes shall be pushed firmly together and glued firmly.	
4.	Cables shall not be drawn into conduits until the conduit system is erected, firmly fixed and cleaned out. Not more than two right angle bends or the equivalent shall be permitted between draw and junction boxes. Bending radius shall comply with IEE regulations for PVC pipes.	

8.2. Wiring

#	Parameter	Bidders Compliance (Yes, No)
1.	All PVC conduits and cables shall comply with IEE Wiring regulations BS 7671 for laying cables under floors or above ceilings.	
2.	PVC insulated copper conductor cable shall be used for sub circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be stranded copper conductors with thermoplastic insulation of 650 / 1100 volts grade. Color code for wiring shall be followed.	
3.	Looping system of wiring shall be used, wires shall not be jointed. No reduction of strands is permitted at terminations. No wire smaller than 3.029 sq.mm. shall be used.	
4.	Wherever wiring is run through cable trays, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and Distribution Board (DB) number shall be used for sub main, sub circuit wiring the ferrules shall be provided at	

#	Parameter	Bidders Compliance (Yes, No)
	both end of each sub main and sub-circuit. All electrical joints shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.	
5.	Metal clad sockets shall be of die cast non-corroding zinc alloy and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have push on protective cap.	
6.	All power sockets shall be piano type with associate's switch of same capacity. Switch and socket shall be enclosed in a M. S. sheet steel enclosure with the operating knob projecting. Entire assembly shall be suitable for wall mounting with Bakelite be connected on the live wire and neutrals of each circuit shall be continuous everywhere having no fuse or switch installed in the line excepting at the main panels and boards. Each power plug shall be connected to each separate and individual circuit unless specified otherwise. The power wiring shall be kept separate and distinct from lighting and fan wiring. Switch and socket for light and power shall be separate units and not combined one.	
7.	Balancing of circuits in three phases installed shall be arranged before installation is taken up. Unless otherwise specified not more than ten light points shall be grouped on one circuit. The earth continuity insulated copper wire in Green color shall be run inside the conduit to earth the third pin or socket outlets, earth terminal of light fixtures, fan as required. Lights points shall be either of single control, twin control or multiple points controlled by a single switch / MCB as per scheduled of work. Bare copper wire shall be provided with each circuit from DB as specified in the item of work and terminated in earth bar of DBs and switch boxes with correct lugs as required.	

8.3. Electrical Earthing

The cable arm shall be earthen through the cable glands. Earthing shall be in conformity with **IEC 60364-5-54 Electrical installations of buildings**. The entire applicable active & passive infrastructure in the shelter shall be earthed.

#	Parameter	Bidders Compliance (Yes, No)
1.	Earthing shall be done inside the shelter for the entire power system and provisioning shall be there to earth SMPS systems, Power distribution units and AC units. So as to avoid a ground differential. CLIENT shall provide the necessary space required to prepare the	

#	Parameter	Bidders Compliance (Yes, No)
	earthing pits.	
2.	All metallic objects on the premises that are likely to be energized by electric currents shall be effectively grounded.	
3.	The connection to the earth or the electrode system shall have sufficient low resistance in the range of 0 to 5 Ω to ensure prompt operation of respective protective devices in event of a ground fault, to provide the required safety from an electric shock to personnel and protect the equipment from voltage gradients which are likely to damage the equipment.	
4.	Recommended levels for equipment grounding conductors shall have very low impedance level less than 0.25 ohm.	
5.	The Earth resistance shall be automatically measured on an online basis at a pre-configured interval and corrective action shall be initiated based on the observation.	
6.	There shall be enough space between OFC and power cabling and there shall not be any cross wiring of the two, in order to avoid any interference, or corruption of data.	

8.4. UPS for 4 Major PoP locations

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Capacity	Adequate capacity to cover all above IT Components at respective location	
2.	Output Wave Form	Pure Sine wave	
3.	Input Power Factor at Full Load	>0.90	
4.	Input	Three Phase 3 Wire for minimum 5 KVA	
5.	Input Voltage Range	305-475VAC at Full Load	
6.	Input Frequency	50Hz +/- 3 Hz	
7.	Output Voltage	400V AC, Three Phase for minimum 5 KVA UPS	
8.	Output Frequency	50Hz +/- 0.5% (Free running); +/- 3% (Sync. Mode)	
9.	Inverter efficiency	>90%	

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
10.	Over All AC-AC Efficiency	>85%	
11.	UPS shutdown	UPS should shutdown with an alarm and indication on following conditions 1)Output over voltage 2)Output under voltage 3)Battery low 4)Inverter overload 5)Over temperature 6)Output short	
12.	Battery Backup	60 minutes in full load	
13.	Battery	VRLA (Valve Regulated Lead Acid) SMF (Sealed Maintenance Free) Battery	
14.	Indicators & Metering	Indicators for AC Mains, Load on Battery, Fault, Load Level, Battery Low Warning, Inverter On, UPS on Bypass, Overload, etc. Metering for Input Voltage, Output Voltage and frequency, battery voltage, output current etc.	
15.	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.	
16.	Cabinet	Rack / Tower type	
17.	Operating Temp	0 to 50 degrees centigrade	
18.	Management Protocol	SNMP Support through TCP/IP	

8.5. SMPS at PoP Locations

The requirements for the Switched-Mode Power Supply (if required to be installed in case sufficient power supply is not available) to be deployed are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Three Phase Input	305 - 475 Vac	
2.	Rectifier module / Capacity	Adequate capacity to cover all above IT Components at respective location.	
3.		The SMPS shall have an In-built Class C surge protection device.	
4.		The SMPS shall have advanced intelligent controller for	

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
		overvoltage, under voltage and surge protection with SNMP interface for integration with NMS to monitor specified parameters.	

8.6. Access Control System for POP

The requirements for the POP are as follows:

8.6.1. Access Control Module

Following are the requirements for the sub-components for the ISLP System:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Communication interface	RS 232/485 and TCP/IP	
2.	Event Storage	10,000 card records and 3,000 event storage	
3.		The Controller module shall have capabilities to retain event information In the case of network failure.	
4.		The Controller module shall have antipass back facility.	

8.6.2. Card Reader

Following are the requirements for the sub-components of Access Control Module:

#	Parameters	Bidders Compliance (Yes, No)
1.	The card reader head shall provide a life expectancy greater than one million (1,000,000) reads.	
2.	The card reader shall be capable of interfacing with a range of reader technologies including magnetic stripe, proximity, Wiegand 26-bit, contact and contact-less. chip cards etc.	
3.	The card reader shall be water-proof and tamper proof.	
4.	The card reader shall be equipped with two visual indicators (LEDs) and an audible tone.	

8.6.3. Electro Magnetic Lock

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Holding Force	600 lbs	
2.	Operating Voltage	12V DC	
3.	Current Consumption	480 mA	
4.	Sensor	The Electro Magnetic Lock shall have inbuilt Door Positioning Sensor	
5.	Visual Indicators	RED and GREEN	

8.7. Rodent Repellent System

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.		Rodent repellent system shall be provided in the IT rooms of 3 PoPs (except Muglisra NoC) to cover the entire area of IT room to protect the premises against any rodent infestation.	
2.		The open floor area and the false flooring area is to be covered.	
3.		The Transducers shall produce high decibel sound waves at very high frequency not less than 20 KHz which is not audible to humans.	

9. Annexure III - Common guidelines regarding compliance of systems / equipment

1. The specifications mentioned for various IT / Non-IT components are indicative requirements and should be treated for benchmarking purpose only. SIs are required to undertake their own requirement analysis and may propose higher specifications that are better suited to the requirements.
2. Any manufacturer and product name mentioned in the Tender should not be treated as a recommendation of the manufacturer / product.
3. None of the IT / Non-IT equipment's proposed by the SI should be End of Life product. It is essential that the technical proposal is accompanied by the OEM certificate in the format given in Volume I of this Tender, where-in the OEM will certify that the product is not end of life product & shall support for at least 6 years from the date of Bid submission.
4. All IT Components should support IPv4 and IPv6.
5. Technical Bid should be accompanied by OEM's product brochure / datasheet. SIs should provide complete make, model, part numbers and sub-part numbers for all equipment/software quoted in the technical Bid.
6. SI should ensure that only one make is proposed for one component in Technical Bid.
7. SIs should ensure complete warranty and support for all equipment from OEMs. All the back-to-back service agreements should be submitted along with the technical Bid.
8. All equipment parts should be original and new.
9. The user interface of the system should be a user friendly Graphical User Interface (GUI).
10. Critical core components of the system should not have any requirements to have proprietary platforms and should conform to open standards.
11. All the Clients Machines / Servers shall support static assigned IP addresses or shall obtain IP addresses from a DNS/DHCP server.
12. The successful SI should also propose the specifications of any additional hardware, if required for the system.
13. The indicative architecture of the network is given in this volume. The successful SI must provide the architecture of the solution it is proposing.
14. SI is required to ensure that there is no choking point / bottleneck anywhere in the system (end-to-end) and enforce performance and adherence to SLAs. SLA reports must be submitted as specified in the Bid without fail.
15. All servers, active networking components (Except Industrial Switches), security equipment and storage systems proposed should be from OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC latest published quarterly report presented in the latest Magic Quadrant of Gartner. SI is expected to attach the report along with the technical Bid. OEMs must have support centre in India.
16. SI shall place orders on various OEMs directly and not through any sub-contractor / partner. All licenses should be in the name of the SSCDL / SMC.
17. SI shall have to use existing infrastructure like Pole, Junction Box, Network Switch, Router etc., across the Surat city. The detail specifications of existing infrastructure are mentioned in Annexure-V of this RFP. The make & model shall be provided to selected

bidder. The bidder is required to integrate/ terminate the network at following existing edge level devices:

- BRTS Stations – The edge level routers are already available at each BRTS stations. SI is responsible to terminate the OFC on these routers. Thus, no additional devices are considered. The make and model for this router is Techroutes : TSR-2800-20.
- Traffic Junctions- As part of ITCS Project, a junction box with industrial switch will be installed. SI is required to terminate the OFC on this switch that will be available in the junction box. The RFP is already floated and the specifications are already mentioned in Annexure V. The make & model will be provided to SI once the vendor is selected.

10. Annexure IV - Applicable Standards

The table below provides the list of key standards for the NETWORK. The CONTRACTOR shall be responsible for complying with these standards as well as any relevant standards in conjunction with the scope of work:

10.1. Passive Components

Standard Reference	Standard Name
ITU-T G652 (11/2016)	96 Core OFC, 48 Core OFC, 12 Core OFC, Fiber Optic Patch cord, Fiber Optic Pigtaills
EIA/TIA-598	96 Core OFC, 48 Core OFC, 12 Core OFC, Fiber Optic Patch cord, Fiber Optic Pigtaills
Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA) 568-	Category 6 Ethernet Cable
IEC 61754-20:2012	LC Fiber Connector
IEC 62134-1:2009	Fiber Optic Enclosure, Fiber Distribution Panel (FDP), Fiber Splice Joint Closure
ANSI/ITA/EIA-526-7(OFSTP-7):1998	Optical Power Loss Measurement of Installed Single mode Fiber Cable Plant
ANSI/TIA-568-C.0 including (Addendum 1 & 2)	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568-C.1 including (Addendum 1 & 2)	Commercial Building Telecommunications Cabling Standard
ANSI/TIA-568-C.3	Optical Fiber Cabling Components Standard
ANSI/TIA-568-C.3-1 Addendum 1	Addition of OM4 Cabled Optical Fiber and Array Connectivity (December 2011)
ANSI/TIA/-569-C	Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA/EIA-606-B	Administration Standard for Commercial Telecommunications Infrastructure Standard (June 2012).
ANSI/TIA-607-B	Telecommunications Grounding (Earthing) and Bonding for Customer Premises Standard (August 2012).
ANSI/TIA/EIA-758-B	Customer-Owned Outside Plant Telecommunications Infrastructure Standard
ANSI/TIA-862-A	Building Automation Systems Cabling Standard for Commercial Buildings

ANSI/TIA-1005-A	Telecommunications Infrastructure Standard for Industrial Premises (November 2011).
ISO/IEC 11801 Edition 2.2	Information Technology – Generic Cabling for Customer Premises (June 2011).

10.2. Active Components

Standard Reference	Standard Name
IEEE 802.3af and IEEE 802.3at	Power Over Ethernet (POE) standards
IEEE 802.1D	Media Access Control (MAC) Bridges used with the Rapid Spanning Tree Protocol (RSTP) standards
IEEE 802.1Q	Virtual local area networks (VLANs) standards
IEEE 802.1P	Quality of Service (QoS) standards
IEEE 802.3	LAN and MAN access and physical layer specifications standards
IEEE 802.3x	Full duplex operation standards
IEEE 802.1x	Security standards
IEEE 802.1D/S	Spanning tree (STP) / multiple spanning tree (MST) protocols standards
IEEE 802.3ad/802.1ax	Link aggregation standards
IEEE 802.1Q	Trunking standards
IEEE 802.1v	VLAN classification by protocol and port
IEEE 802.3ac	VLAN tagging
IEEE 802.1x	Authentications
IEEE 802.1AB	Link Layer Discovery Protocol (LLDP)
IEEE 802.3az	Energy Efficient Ethernet (EEE)
IEEE 802.1w	Rapid Spanning Tree (RSTP)
IEEE 802.3ab	1000BASE-T
IEEE 802.3z	1000BASE-X
IEEE 802.3	10BASE-T

Standard Reference	Standard Name
IEEE 802.3u	100BASE-TX
IEEE 802.1Qbp	Equal Cost Multi Path (ECMP)
SFF-8472	Small Form-Factor Pluggable (SFP), Optical Digital Diagnostic Monitoring
IEEE 802.11	Media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network
IEEE 802.11ac	Very High Throughput <6 GHz
IEEE 802.11n/ac	WiFi MIMO
IEEE 802.11e	QoS for wireless networks
IEEE 802.11h	Spectrum and Transmit Power Management Extensions
IEEE 802.11ah	Outdoor Wi-Fi
IEEE 802.11ay	Indoor Wi-Fi

10.3. Fire-Safety related standards

Standard Reference	Standard Name
NFPA 70®	National Electrical Code® (2014 release)
NFPA 70B	Recommended Practice for Electrical Equipment Maintenance
NFPA 70E®	Standard for Electrical Safety in the Workplace®
NFPA 72®	National Fire Alarm and Signaling Code
NFPA 75	Standard for the Fire Protection of Information Technology Equipment
NFPA 76	Standard for the Fire Protection of Telecommunications Facilities
NFPA 77	Recommended Practice on Static Electricity
NFPA 99	Health Care Facilities Code
NFPA 101®	Life Safety Code®
NFPA 101A	Guide on Alternative Approaches to Life Safety
NFPA 110	Standard for Emergency and Standby Power Systems

NFPA 111	Standard on Stored Electrical Energy Emergency and Standby Power Systems
ISO 17398	International Standard for life safety appliance location signs

10.4. Operational Facilities Standards

Standard Reference	Standard Name
ANSI-C2-2012	National Electric Safety Code 2012
IEEE 1100-2005	Powering and Grounding Sensitive Electronic Equipment
UL 467-2012	Grounding and Bonding Equipment
NFPA-2001	Standard on Clean Agent Fire Extinguishing Systems
UL 67-2009	Standards for Panel boards
ISO/TC 71/SC 1	Test methods for concrete
ISO/TC 71/SC 3	Concrete production and execution of concrete structures
ISO/TC 71/SC 4	Performance requirements for structural concrete
ISO/TC 71/SC 5	Simplified design standard for concrete structures

11. Annexure V – Other Smart City Project Infrastructure

The table below provides the list of ITCS project infrastructure.

11.1. Edge Level Network Switch

#	Parameter	Minimum Specifications
1	Type	Managed Outdoor Industrial grade switch
2	Total Ports	<ul style="list-style-type: none"> • Minimum 4 10/100/TX PoE/PoE+, 2x SFP Ports (can have 4xSFP Ports in certain locations) • May require higher port density at some locations, depending upon site conditions • May require fibre ports (for devices or for uplinks) at some locations, depending upon site conditions/distances.
3	PoE Standard	IEEE 802.3af/ IEEE 802.3at or better
4	Protocols	<ul style="list-style-type: none"> • IPV4, IPV6 • Support 802.1Q VLAN • DHCP support • IGMP • SNMP Management • Should support Loop protection and Loop detection • Should support Ring protection • End point Authentication • Should support NTP
5	Access Control	<ul style="list-style-type: none"> • Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering • Support security group access control list
6	PoE Power per port	Sufficient to operate the CCTV cameras/edge devices connected
7	Enclosure Rating	IP 30 or equivalent Industrial Grade Rating(to be housed in Junction box)
8	Operating Temperature	0 -50 C or better Industrial Grade Rating
9	Multicast support	IGMP Snooping V1, V2, V3

#	Parameter	Minimum Specifications
10	Management	Switch needs to have RS-232/USB/RJ45 console port for management via a console terminal or PC, Web GUI NTP, Syslog for log capturing SNMP V1, V2, V3
11	Compliance	UL/EN/IEC or equivalent

11.2. Field Junction Box

#	Parameter	Minimum Specifications
1.	Size	Suitable size as per site requirements to house the field equipment
2.	Cabinet Material	GI
3.	Material Thickness	Min 1.2mm
5.	Number of Locks	Two
6.	Protection	IP 55, Junction Box design should ensure to keep the temperature within suitable operating range for equipment's and should also avoid intentional water splash and dust intake
7.	Mounting	On Camera Pole / Ground mounted on concrete base
8.	Form Factor	Rack Mount/DIN Rail
9.	Other Features	Rain Canopy, Cable entry with glands, proper earthing and Fans/any other accessories as required for operation of equipment's within junction box.