REQUEST FOR PROPOSAL

FOR

SELECTION OF AGENCY FOR

SETTING UP NETWORK OF SMART ELEMENTS IN PUNE CITY

Volume 2 – Scope of Work

Tender Number: SC3/2016

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Issued By

The Chief Executive Officer

PUNE Smart City Development Corporation Limited (PSCDCL)

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1. Glossary

Terms	Meaning
BOM	Bill of Material
BEC	Bidders Evaluation Committee
CC	Capital Cost (CC1-Capital Cost 1, CC2 - Capital Cost 2)
CCTV	Closed Circuit Television
CEO	Chief Executive Officer
DD	Demand Draft
EMD	Earnest Money Deposit
GIS	Geographical Information Systems
GoM	Government of Maharashtra
GPS	Global Positioning System
HOD	Head of Department
ICT	Information and Communication Technology
INR	Indian Rupee
LoI	Letter of Intent
NPV	Net Present Value
OEM	Original Equipment Manufacture
PBG	Performance Bank Guarantee
PDD	Proposal Due Date
PMC	Pune Municipal Corporation
PoC	Proof of Concept
PQ	Pre-Qualification
PSCDCL	PUNE Smart City Development Corporation Limited
PSU	Public Sector Undertaking
RFP	Request for Proposal
PV	Present Value
RV	Revenue (RV1-Revenue from 1, RV2-Revenue from 2)
SCOC	Smart City Operations Center
SI	System Integrator
SLA	Service Level Agreement
SOP	Standard Operating Procedures
TQ	Technical Qualification
UAT	User Acceptance Testing
VM	Virtual Machine
WSP	Wi-Fi Service Provider
TRV	Total Revenue

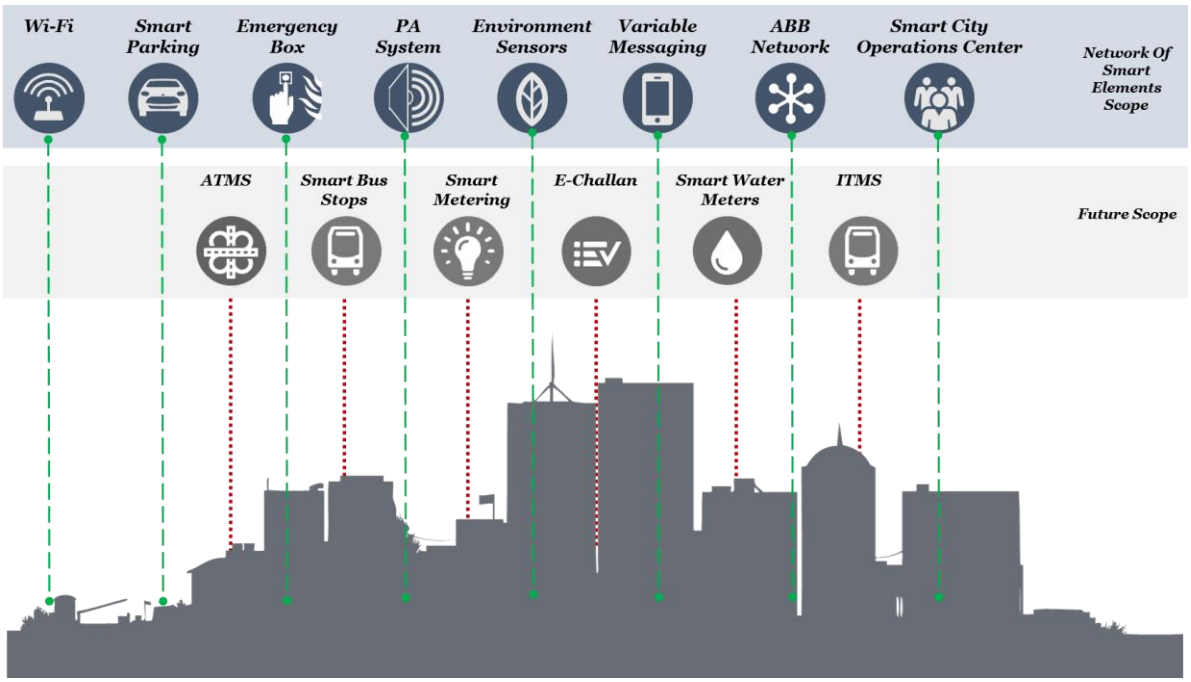
2. Scope of Work

2.1. Project Objectives

The city wide 'Network of Smart Elements' (term used henceforth to imply Smart devices, Smart systems and Wi-Fi network) will accomplish the following broad objectives:

- Pune being selected as #2 in smart cities mission competition, PSCDCL would like to undertake smart city initiatives to make Pune a better place by increasing safety, livability of the people in the city and to effectively provide the delivery of few urban services.
- Improve the situational awareness of the city administrators and residents.
- Provide administrators, citizens, tourists and businesses real time and actionable information to aid their day to day decision making.

The graphic below shows the smart elements currently in scope, along with those which will be in future scope (not part of this tender).



Following Smart elements will be integrated in future as part of Pune Smart city projects:

i. Advanced Traffic Management System (ATMS)
ii. Smart Bus Stops
iii. Smart Street Lighting
iv. E-Challan
v. Smart Meters
vi. Integrated transport Management Systems (ITMS)

PMC intends that all the smart elements getting implemented as part of this scope as well as future scope will get integrated with Smart City Operations Center proposed in this tender document at no extra cost.

2.2. Scope Summary

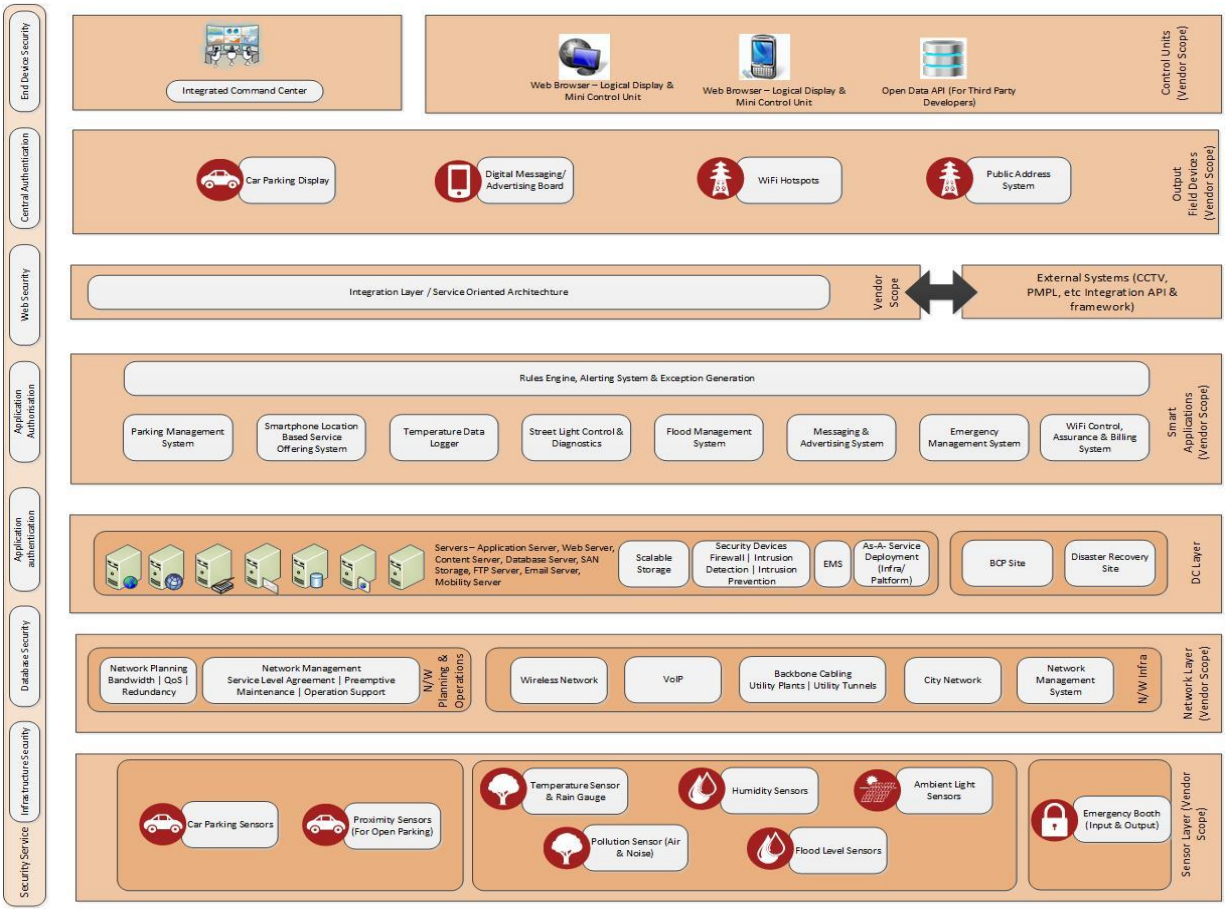
#	Element	Objective	High Level Scope
1	**City Wi-Fi**	Wi-Fi services will provide fast internet connectivity on the go to citizens of Pune. The objective of City Wi-Fi element is to provide: • Free City Wi-Fi (limited usage) • Paid City Wi-Fi	To Set up and provide City Wi-Fi Services at identified locations across the city. **List of locations:** **Hospitals: 47** **Gardens: 82** **Key Road Stretches: 71**
2	**Smart Parking**	Smart Parking will: • Obtain real time situational awareness about the occupancy of parking lot for citizens • Facilitate generation of parking receipts and tickets based on occupancy of parking lots • Provide real time availability of parking lots • Reduce the time required for identifying parking slots • Better utilization of parking areas	Setting up Smart Parking System at identified locations across the city. **List of locations:** **Total 32 locations for bike/ car parks including open/ closed parking spots**
3	**Emergency Box**	Emergency Box will help improve the safety and security of citizens within the city where they can seek assistance from the Smart City Operations Center (Command & Control Center) by pressing a button near them.	Setting up Emergency boxesat identified locations across the city. **Total Locations: 136 spots where emergency boxes to be installed**
4	**Public Address Systems**	Public Address System (voice) will enable civic bodies to respond/ communicate effectively while dealing with emergencies.	Setting up Public addressing systems/ Devices at identified locations across the city. **Total Locations: 136 spots where public address systems to be installed**
5	**Environmental Sensors**	Smart Environmental Sensors should be able to read and report the following parameters: Temperature, Humidity, Radiation and Air Quality in the PMC area.	Setting up Environment Sensors at identified locations across the city. **Total Locations- 50**
6	**Variable Messaging Display**	Variable messaging displays will be used to display the useful information related to: • Traffic congestion	Setting up Variable Messaging Display (VMD) at identified locations across the city. **Total Locations- 161**

		• Accidents incidents • Ongoing Roadwork zones • Speed limits • Key notices or messages from PMC like information about any emergency or disaster • Display the parking availability information, etc.	
7	**ABB Fiber Network Solution**	• Successful Bidderwill lay the ABB fiber network acrossAundh-Baner-Balewadi(identified as area for Area Based Development) for providing connectivity to all smart elements as mentioned in this RFP document • For implementation across the entire city, Successful Bidder can use MPLS or any other network topology for deploying the smart elements as mentioned in this RFP document.	Successful Bidder need to lay down the fiber network in Aundh- Baner- Balewadi (ABB) area.
8	**Smart City Operations Center**	Key Objectives of Smart City Operations Center: • To serve as the centralized monitoring & decision making hub for managing equipment, devices, resources and assets for Smart Elements project • To serve as a centralized decision making center which supports and strengthens coordination in response to incidents/ emergency situations • To serve as central information, communication, incident management hub for PMC • To provide integration points for other existing or proposed command centers from other government agencies e.g. Police, Disaster, etc. Smart City Operations Center(SCOC) will enable city administration and its stakeholders in the following:	Setting up Smart City Operations Center(SCOC) (i.e. Command & control Center) with 25 operators Control Room. SCOCSolution should have central infrastructure and Services management platform to centrally monitor and manage all the services.

		• Effective decision making • Delivering effective governance by aggregating various data feeds from sensors and systems • Providing interface /dashboards to generate alert and notifications in real time • Quick and effective response to emergency or disaster situation	

2.3. Component Architecture

The indicative component architecture for the 'Network of Smart Elements' is shown below. The figure below shows the how the architecture of the complete network of smart elements, organized into the 7+1 layers.



2.3.1. Sensor Layer

The sensor layer will help the city administration gather information about the ambient city conditions. It will include devices such as parking sensors (parking sensors will detect if the parking spot is empty or not), environmental sensors which measure ambient conditions such as light intensity, temperature, water level (for chronic flood spots), air pollution, noise pollution and humidity, surveillance equipment (cameras).

2.3.2. Network Layer

The secured network layer will serve as the backbone for the project and provide connectivity to not only gather data from sensors and communicate messages to display devices and actuators. It will also support the Wi-Fi services at select locations. The network layer will be scalable such that additional sensors, actuators, display devices can be seamlessly added and more Wi-Fi spots created in within the coverage area.

2.3.3. Data Center Layer

The data center layer will house centralized computing power required to store and process the sensor data, and analyze the data to decipher actionable information. This layer includes servers, storage, ancillary network equipment elements, security devices and corresponding management tools. Similar to the network layer, it will be scalable to cater to the increasing computing and storage needs of the solution.

2.3.4. Smart Application Layer

The smart applications layer will contain data aggregation systems, management systems (rules engines, alerting systems, diagnostics systems, control systems, fulfilment, assurance, billing systems, messaging system, and events handling system), and reporting / dashboard system to provide actionable information to city administrators and citizens. It will be an ever evolving layer with applications added and integrated in a seamless manner with the existing applications.

2.3.5. Integration Layer

While aspects of ambient conditions within the city will be gathered through network of smart elements deployed as a part of overall architecture, some city specific data will come from other government and non-government agencies. It is through the integration layer – that data will be exchanged to and from the under lying architecture components and other data from system developed by government (such as traffic police department, meteorological department, irrigation department, home department, etc.) and non-government agencies.

2.3.6. Output Field Devices Layer

The output field devices layer will contain display devices or bi-directional (input & output) devices connected to the network which will be used by citizens to consume - and for administrators to provide - actionable information. Such field devices include parking displays, digital messaging boards, environmental data displays, emergency boxes and digital kiosks.

2.3.7. Control Units & Command Center Layer

The command center and control units will enable citizens and administrators alike to get a holistic view of city conditions. Such control units will take shape of either an exhaustive command center or control applications which can be viewed over a web browser or available in form of a mobile application. The Successful Bidder will have to develop a command center at a site location determined by PSCDCL/PMC and web/ mobile based viewing tools for understanding the ambient city conditions.

2.3.8. Security Layer

As ambient conditions, actuators and display devices are now connected through a network, security of the entire system becomes of paramount significance and the system integrator will have to provide:

- Infrastructure security- including policies for identity and information security policies

- Network security- including policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources, etc.
- Identity and Access Management – including user authentication, authorisation, SSL & Digital Signatures
- Application security- including Hosting of Government Websites and other Cloud based services, connecting to NIXI & Sec. 43A compliance audits, Adoption of Technical Standards for Interoperability Framework and other standards published by GoI for various eGovernance applications
- End device security, including physical security of all end devices such as display boards, emergency boxes, kiosks etc.

Following security parameters should be included for all smart elements, but not limited to:

- Identity and access management
- User/administrator audit log activity (logon, user creation, date-time of PA announcements, voice recording etc.)
- Secured data storage (storage of video/image/voice/location/data captured by various smart elements)
- SSL/TLS encryption for web and mobile application based interfaces for sensitive data transfer
- Protection against Denial of Service (DoS) and Interference attacks to public Wi-Fi Devices

2.4. Project Implementation Timelines

i. PSCDCL/ PMC desires to engage the services of a system integrator for implementing Network of Smart Elements in PMC area. The project is envisaged to be completed as per the following timelines:

- **Implementation Phase:To be implemented in a time period of maximum 6 months**
  - i..1. For Aundh- Baner- Balewadi (ABB) area (All smart elements& ABB Fiber Network)
  - i..2. Entire PMC area(All smart elements)

Note – Selected bidder may implement and monetize the smart elements prior to 6 months if completed successfully.

- **Operations & Maintenance Period (O&M) and Monetization of Smart Elements**
  - i..1. 7 years from Go-Live for all smart elements except ABB Fiber Network
  - i..2. 15 years from Go-Live for ABB Fiber Network

Wi-Fi	*Smart Parking*	*Emergency Box*	*PA System*	*Environment Sensors*	*Variable Messaging*	*ABB Network*	*Smart City Operations Center*	*NETWORK OF SMART ELEMENTS SCOPE*
6 (Six) Months	**6 (Six)** Months	**6 (Six)** Months	**6 (Six)** Months	**6 (Six)** Months	**6 (Six)** Months	**6 (Six)*** Months	**6 (Six)** Months	***Implementation Time for ABB + Pan City***
7 (Seven) Years	**7 (Seven)** Years	**7 (Seven)** Years	**7 (Seven)** Years	**7 (Seven)** Years	**7 (Seven)** Years	**15 (Fifteen)** Years	**7 (Seven)** Years	***Implementation + Operations & Management***

* Only ABB area

ii. The Successful Bidder shall be responsible for operations and management of the entire system including its sub systems, customer support and responsibility as per SLAs.

iii. The Successful Bidder must ensure that the equipment for which the payments are made by the client shall at all times be fully insured and be kept under current of warranty and upgrade support from OEM and the same shall be transferred to client at the end of the term (or the extended term) if any.

iv. During the term of this agreement the Successful Bidder agrees to maintain the equipment in good working order and for this purpose will provide the following repair and maintenance service:

- The Successful Bidder shall correct any faults and failures in the equipment and shall repair and replace worn or defective parts of the equipment during Client's normal working hours on all working days.
- In cases where unserviceable parts of the equipment need replacement the Successful Bidder shall replace such parts, at no extra cost to Client, with brand new parts or those equivalent to new parts in performance.
- The Successful Bidder shall further ensure that the equipment is not down at any time for want of spare parts.

3. Functional & Technical Requirements

The subsequent sub-sections shall give the benchmark specifications for each of the scope elements of the project. The table below gives a summary of the same.

Sr. No	Smart Element	Functional Specifications	Technical Specifications
3.1.	City Wi-Fi	See Section 3.1.1.	See Section 3.1.2.
3.2.	Smart Parking	See Section 3.2.1.	See Section 3.2.2.
3.3.	Emergency Box/ Panic button	See Section 3.3.1.	See Section 3.3.2.
3.4.	Public Address System	See Section 3.4.1.	See Section 3.4.2.
3.5.	Environmental Sensors	See Section 3.5.1.	See Section 3.5.2.
3.6.	Variable Messaging Displays	See Section 3.6.1.	See Section 3.6.2.
3.7.	ABB Fiber Network	See Section 3.7.1.	See Section 3.7.2.
3.8.	Smart City Operations Center	See Section 3.8.1.	See Section 3.8.2.

3.1. Smart Element #1: City Wi-Fi

3.1.1. Functional Requirements: City Wi-Fi

i. The objective is to provide strong, seamless and highly available Wi-Fi for citizens to collaborate and perform business activities on the go. Wi-Fi services will also reduce the digital divide and provide urban dwellers within Pune a better & faster means for connectivity.

ii. City Wi-Fi internet access shall be free in select areas in the city, with a maximum download limit of 50 MB per day per user or free for 30 minutes a day whichever is earlier, after which City Wi-Fi services will be available on a paid basis. Offered solution shall allow wireless access through various kinds of devices such as smart phones, laptops, tablets, and desktops. All e- governance applications by PMC, state government and central government shall be excluded from this download limit.

iii. City Wi-Fi will be made available to citizens at minimum one (1) Mbps speed with a minimum throughput of 100kbps. Free City Wi-Fi facility should be available as per the specified SLAs in the RFP.

iv. Successful Bidder must ensure that the citizen must be able to use same access details (login id/ username and password) even if he/she moves from one wifi spot zone to to another to provide unified experience of connectivity for the citizen.

v. The Successful Bidder shall impose restrictions on access and download from malicious sites for City Wi-Fi users. Such sites shall be as notified by TRAI/ regulatory agencies and also be notified to Successful Bidder from time to time by the client.

vi. A denied URL list should be applied on this City Wi-Fi SSID and should be updated on a run time basis, to self-learn (no human inference shall be required) and automatically update the list. Any malicious user on the City Wi-Fi should be immediately dropped and blocked after appropriate recording of the evidence.

vii. After the free usage of 50 MB per day or 30 minutes of usage, user shall automatically switch over to login page and continue to use by paying as per the data plans else the user will not have the internet access.. The rates for Paid City Wi-Fi and wired internet services should be competitive to the market rates of the leading data service providers in Maharashtra. Successful Bidder must obtain client approval before introducing these rates and any proposed changes in the rates.

viii. Hotspots should cover entire area of places given in RFP document. Successful Bidder will be responsible for design and engineering of all the network components to meet coverage and capacity requirements of hotspots based on following parameters: Area of Wi-Fi hotspot, Peak load and Density of user devices/ concurrent users/Connections required in the area. Successful bidder should test the entire location and ensure availability of the Wi-fi services before declaring it ready for rollout to the client.

ix. Based on the hotspots capacity requirements, Successful Bidder shall determine and provide number of Access points per Hotspot as per the: required Internet bandwidth (both per Hotspot and per user) and aggregated total bandwidth per hotspot. Applicant can consider the contention ratio of 1:10 per user from day 1 of implementation of the project.

x. Successful Bidder must assure compliance with All DoT/ TRAI / statutory guidelines/ court orders including all amendments issued from time to time, for the services rendered by them including and not limited to security, including registration of users for accessing the public Wi-Fi.

xi. Client (PSCDCL/ PMC) shall not be responsible for any violation of guidelines at any given point of time. The Successful Bidder is liable for all compliances as required.

xii. Successful Bidder must ensure appropriate bandwidth allocation for free and paid Wi-Fi users as well for carrying data for all the sub systems with built in scalability for enhanced usage needs as time goes by over the next 10 years. In future if Wi-Fi technology is changed during the contract period to any other technology, the same has to be provided by the Successful Bidder.

xiii. Successful Bidder must ensure the security of the Wi-Fi network and should be able to monitor and manage using appropriate access login controls and audit trails from the Smart City Operations Center. It should be approved by the client before actual implementation of the same.

xiv. All the Applicants are required to conduct a site survey to address coverage and capacity requirements throughout the areas where hotspots are to be created at their own cost. The coverage maps, where hotspot is to be created, shall be prepared by the Successful Bidder It should be approved by the client before actual implementation of the same.

xv. Successful Bidder must ensure to put up a system in place which can control each registered user's access to Wi-Fi network and the MAC address of the device. Necessary

security measures should be enforced along with access control policies and tracking & auditing the usage.

xvi. All Government advertisement and Government schemes must be published free of cost on the login pages/landing pages. Client shall take the control of operations in case of any disaster/emergency situations and the Successful Bidder shall operate under the directions of the appointed authority.

xvii. As part of this implementation exercise, the client must get the intelligence about the Wi-Fi service through statistical data, reports and analysis of User registration, Data Usage under various schemes, Network status across the city, device availability, throughput of the internet, Hardware status across the city etc.

xviii. Successful Bidder must provide a web portal for the client to monitor the mentioned indicators and to conduct the necessary audit of implemented system.

xix. Client web portal should have a functionality to retrieve various MIS reports. E.g.:

a) User wise, Access point wise, connectivity and data usage report in digital format from systems, security events, forensic auditing in given format.

b) Other relevant reports as may be required by client, must have to be provided by the Successful Bidder

c) Blacklisting of users by MAC Address or by checking malicious activity performed by user must be achieved.

xx. Key features of City Wi-Fi mobile application (sub section of PMC umbrella application to be developed as a part of this tender)

Mobile Application and web based user interface (application to be made available across all leading platforms) should be provided with the following features:

a) Citizen should have an option to enable/ disable connection to city Wi-Fi

b) Registration facility for user to enroll as secured registered user for Wi-Fi

c) OTP based authentication

d) Application should have User Access management module (login, logout functionalities)

e) Application to have feature to track the data consumption for free and paid city Wi-Fi

f) Online/ mobile payment facility for availing paid Wi-Fi service

g) Notification/ alerts to notify user regarding crossing of data usage limit

h) Additional features as required for all intended

i) Separate SSID for free and paid city Wi-Fi for security reasons

j) The administrators should be able to generate MIS report to view overall usage, collections and other usage statistics over a defined time period.

Note: All security guidelines by TRAI/ DoT should be followed for Wi-Fi Security including registration of users on City Wi-Fi.

3.1.2. Technical specifications: City Wi-Fi

Components to be provided and installed by the successful bidder should perform following functionsfor throughput and bandwidth requirements.

Component	Function
Access Point	Outdoor Wi-Fi Access Point
Industrial Grade Switch – Type 1	Industrial Ethernet Access Switches
WLAN Controller	Wireless Controller to control and manage Wi-Fi Access Points
Network & WLAN Management System	For Network & WLAN infrastructure Management

i. **Key features of Wi-Fi Access points (AP)**

a) The network and access points should support creation of robust and reliable mesh network topology based on the field surveys of areas of Pune city (PMC Areas).

b) Successful Bidder should perform a detailed survey in PMC area to determine the number of APs required and accordingly configure the number of concurrent users per access point, in a way that there is a fair balance between the hardware costs per AP versus bandwidth cost.

c) The proposed Wired/ wireless and Wi-Fi network architecture should adhere to industry recommended design standards and state of art technology.

d) APs should be installed in outdoor areas and provide last mile connectivity. AP should comply key International and Indian standards for safety, including RF radiations. APs must protect internally stored configuration information.

e) Case-covering must be there for the AP but leaving the antenna out (if external antennas are there) to achieve anti-theft protection.

f) To maintain consistent quality of service for users, network traffic should be prioritized according to applications/users and handled in the AP/Controllers or upstream devices so that critical traffic is processed immediately and network congestions are avoided.

ii. Minimum Requirements of Wi-Fi Network System:

a) Successful Bidder has to offer the Wi-Fi management services. The Wi-Fi management system should be capable of performing the following functions:
- Configuration, enabling-disabling of Access Points as and when required.
- Real-time reporting:

i. Give summary of wireless system status on single management console with graphical user interface which can be customized for future use Inventory of Access Points and their current status.

ii. No of APs connected to the network / switches/ repeaters etc. with hierarchy of controls (with IP) as per the design of the Successful Bidder

iii. No of users connected to AP with IP of access Points.

iii. Key features of Wi-Fi Controllers:

a) The WLAN controllers should be, capable of managing atleast 1500 Wireless AP and should be scalable as and when required.

b) The controller solution should facilitate monitoring, management, control, and up-gradation from the centralized Smart City Operations Center.

c) The controllers should communicate back and forth with the centralized security system and network management system in real time.

iv. Key features of Backbone Network:

a) The public Wi-Fi network architecture design should include latest BIS, DeitY, IEEE guidelines, and WPC standards for access points

b) The network should support mesh technology and provide seamless and connectivity with the controllers and backhaul network.

c) Backbone Network should perform load balancing users' traffic between multiple access points (umbrella coverage) as well as different bands in an access point so that there is a fair allocation of airtime to each user.

d) Backbone Network should have built-in encryption mechanism to encrypt all communications and data transfer over the Wi-Fi for all the users of Wi-Fi, for sake of security and privacy.

3.2. Smart Element #2: Smart Parking

3.2.1. Functional Requirement: Smart Parking

i. The smart parking solution should enable PSCDCL/ PMC to obtain real time situational awareness about the occupancy of parking lot.

ii. The smart parking solution should enable PSCDCL/ PMC or any other appointed third party to facilitate generation of parking receipts and tickets based on occupancy of parking lots.

iii. The smart parking solution should provide real time location based view to citizens about proximity of parking lots and availability of parking lots.

iv. The smart parking solution should enable the above functions with minimum manual intervention. The smart parking solution is envisaged for both closed parking lots and open parking lots.

   a. *Closed Parking Spaces*- Such parking spaces are managed by PMC through sub contracted vendors and the parking lots have boundary walls and a defined entry and exit points.

   b. *Open Parking Spaces*- Such locations are managed by PMC through sub contracted vendors and do not have a boundary wall and defined entry and exit points. These kind of parking spaces have specified number of slots available, typically on an open ground or road.

v. The smart parking solution should enable accounting and mapping of individual parking spots and all such parking spots must have one-to-one mapping with parking sensors.Smart parking sensors can be connected via 3G or 4G wireless network. It is not mandatory to connect all sensors via MPLS fiber network.

vi. The smart parking solution should be able count the number of vehicles entering and exiting any parking structure.

vii. The smart parking solution must geo-reference all the parking lots.

viii. The smart parking solution may use video camera based analytics or other sensor based solutions to determine number of vehicles entering and exiting parking lots. The smart parking solution should do so at each floor, in case of multilevel parking and communicate the data.

ix. The smart parking solution should report occupancy of parking lots to a central software application deployed at the command center using the network laid out as a part of this tender document.

x. The total number of slots and free slots for parking must be displayed on a digital signboard near the entrance of the parking lots. The smart parking solution's integration with other elements within the tender scope must facilitate display of parking information at variable messaging displays deployed at key points of interest in the city.

xi. The smart parking solution needs to have parking ticket vending machine at the entrance where the ticket can be issued by the machine on pressing the button by the

user/ operator. Further, the solution will have provision for a handheld device through which parking receipts can be generated on payment of fees through card or cash.

xii. The payment collection can be done via card as well as cash (manually) at the kiosk where parking ticket can be shown/ given to the staff at the exit. Parking staff should be able to scan the ticket and provide the printed receipt.

xiii. The smart parking solution should facilitate real time revision of parking fees and should enable real time communication of rules to handheld terminal and parking kiosks.

xiv. The smart parking solution should retain videos of car entering /exiting the parking zone as per the security parameters defined in the tender.

xv. The smart parking solution should have a mobile and a web delivery channel for citizens to get real time parking availability and pre book parking lots using online payment of parking charges facilitated through a payment gateway.

xvi. A mobile application (sub section of PMC umbrella application to be developed as a part of this tender) and web based user interface (application to be made available across all leading platforms) should be provided with the following features:

a. The application should have citizen module and officer module.

b. Through the citizen module, the user should be able to locate nearest parking lot and also pre-book based on his geographical coordinates. The same information must be made available on map with routing information.

c. The citizen should be able to see all the parking lots with exact available space in a real time mode.

d. While locating nearest parking lot, the latest parking slot availability should be given to the user.

e. The application should have a compliance officer module where PMC designated inspector / operator will be able to check compliance of slot occupancy against the fees paid by the citizen.

f. The citizens should be able to generate MIS report to view occupancy of parking lots over a defined time period.

g. The administrators should be able to generate MIS report to view occupancy, collection and other usage statistics over a defined time period.

3.2.2. Technical specifications: Smart Parking Solution

The following standards and specification need to be followed:

a) **Entry Device**
- Should be able to generate printed receipts in designated format on selecting the duration of parking
- Conform ISO 9001 Quality Assurance Standard
- CE, FCC, IC, CNRTLUS certified

b) **Exit Device**

- Conform ISO 9001 Quality Assurance Standard

c) **Entry / Exit Barrier**
- The Barrier unit must conform to ISO 9001 Quality Assurance Standard
- CE, Ukr – Sepcro certified
- Degree of Protection: IP34D

d) **Sensors**
- Conform ISO 9001 Quality Assurance Standard
- Protection Level: IP67
- Should be industrial grade to bear the weather conditions and wear tear while being deployed into open.

e) **Display devices**
- Should display double line dynamic display with 24*24 matrix (12 digits) with a minimum size of 1000 mm * 150 mm

3.3. Smart Element #3: Emergency Box

3.3.1. Functional Requirement: Emergency Box/ Panic Button

i. The emergency box (or panic button) will enable citizens to establish a two way audio (microphone and speaker) – video (video camera and a video screen) communication link with operation staff at PSCDCL/ PMC Smart City Operations Center (or other locations where control solutions is deployed) through a press of a button.

ii. Emergency/ Panic buttons to be strategically located, suitably sized and identified/clearly labelled for "Emergency". Emergency button once pressed will send a call to the nearest police station.

iii. The emergency feature must also be available within the mobile app (sub section of PMC umbrella application to be developed as a part of this tender) which will enable the user to initiate a bidirectional audio – video call with operation staff at PSCDCL/ PMC Smart City Operations Center. In absence of connectivity, the application should send the current location and contact number of the citizen using emergency feature through text message to Smart City Operations Center.

3.3.2. Technical Specifications: Emergency Box /Panic Button

i. A high quality digital transceiver, to be placed at certain locations determined by PSCDCL/ PMC.

ii. The unit shall preferably have a single button which when pressed, shall connect to PSCDCL/ PMC over the network developed as a part of this tender.

#	Parameter	Minimum Specifications or better
1.	Construction	Cast Iron/Steel Foundation, Sturdy Body for equipment
2.	Call Button	Watertight Push Button, Visual Feedback for button press
3.	Speaker & Microphone	Watertight and industrial grade equipment
4.	Connectivity	GSM/PSTN/Ethernet as per solution offered
5.	Sensors	For tempering/Vandalism
6.	Battery	Internal Battery with different charging options (Solar/Mains)
7.	Power	Automatic on/off operation
8.	Casing	IP-55 rated for housing
9.	Operating Conditions	0° to 55°C

3.4. Smart Element #4: Public Address System

3.4.1. Functional Requirement:Public Address System

i. The Public Address System (PA) should be capable of addressing citizen at specific locations from Smart City Operations Center.

ii. The proposed system shall contain an IP based announcing control connected to the Smart City Operations Center.

iii. The announcement which is made from the Smart City Operations Center using the IP based announcing console shall be routed via the network designed as a part of this tender to the various PA system end devices deployed across the city.

iv. PA system's master controller should have function keys for selecting the single location, group of locations or all locations, simple operation on broadcasting to any terminal or separated zones.

v. PA system's master controller should facilitate multiple MIC inputs and audio inputs.

3.4.2. Technical Specifications: Public Address System

i. Use of Public Address System at select public locations / junctions

ii. Access control mechanism would be also required to establish so that the usage is regulated.

iii. This is to be IP based and the control room should have the capability to control individual PAS i.e. to make an announcement at select location (1:1) and all locations (1: many) simultaneously. The PAS should also support both, Live and Recorded inputs.

#	Parameter	Minimum Specifications or better
1.	PAS system	Should have the capability to control individual PAS i.e. to make an announcement at select location (1:1) and all locations (1: many) simultaneously. The PAS should also support both, Live and Recorded inputs
2.	Speaker	Minimum 2 speakers, To be used for Public Address System
3.	Connectivity	IP Based
4.	Access Control	Access control mechanism would be also required to establish so that the usage is regulated.
5.	Integration	With Smart City Operations Center
6.	Construction	Cast Iron Foundation and M.S. Pole, Sturdy Body for equipment
7.	Battery	Internal Battery with different charging options (Solar/Mains)
8.	Power	Automatic on/off operation
9.	Casing	IP-55 rated for housing
10.	Operating conditions	0° to 55°C

3.5. Smart Element #5: Environmental Sensors

3.5.1. Functional Requirement:Environmental Sensors

i. Smart environment sensors will gather data about pollution, temperature, rains, levels of gases in the city (pollution) and any other events on a daily basis. It is for information of citizens and administration to further take appropriate actions during the daily course/ cause of any event.

ii. Smart environment sensors will enable citizen to keep a check on their endeavours which impact environment and enable the city to take remedial action if required. These environmental sensors can also be connected via 3G or 4G wireless network. It is not mandatory to connect all sensors via MPLS fiber network.

iii. PMC's Disaster department gets information from Maharashtra's irrigation department on a daily basis at agreed intervals. It currently maintains a real time water level monitoring system which provides information around the following parameters:

- Reservoir water level and storage status
- Rain fall status in the dams
- Dam discharge status
- River discharge status

PMC will make this information available to successful bidder to be integrated with the environmental monitoring system. (Further information can be viewed at: http://punefloodcontrol.com/). Bidder need to make relevant information available on the displays along with other environmental sensor data in consultation with PSCDCL/ PMC.

iv. The environment sensors will measure and log the data from locations described in section 4.6. All such environment sensors will be connected to the network developed as a part of this tender, and communicate information to central command center.

v. The list of existing environmental sensors is given in section 4.6.

3.5.2. Technical Specification: Environmental Sensors

#	Parameter	Specification
1.	Measurement principle	• NOX, SO2, CO, CO2
2.	Measurement component Measurement range	• NOX : 0 to 50ppm , 5000ppm • SO2 : 0 to 50ppm, 5000ppm • CO : 0 to 50ppm, 5000ppm • CO2 : 0 to 10% / 0 to 20% • O2 : 0 to 10% / 0 to 25% (2 ranges each, maximum range ratio 1: 25 except O2) *Optionally, N2O and CH4 can be measured
3.	Repeatability	• ±0.5% FS
4.	Zero drift	• ±1.0% FS max./week (±2.0% FS/week max. if range is less than 200ppm) ±2.0% FS max./month for O2 meter

5.	Temperature and Humidity Sensor	• Real-time Temperature Range: Indoor -10°C ~ +70°C (+14°F ~ +122°F) • Real-time in Air Humidity Level Display
6.	Span drift	• ±2.0% FS max./week ±2.0% FS max./month for O2 meter
7.	Response speed	• 120 seconds max. for 90% response from the analyser inlet
8.	Connectivity (Minimum)	• USB / Ethernet connectively to graphical display
9.	Rain Water measurement	• Rainfall in millimetres (mm)
10.	Water levels (for flood monitoring)	• Data integration with existing system

3.6. Smart Element #6: Variable Messaging Displays

3.6.1. Functional Requirement:Variable Messaging Displays (VMD)

i. VMD will enable PSCDCL/ PMCto communicate effectively with citizens and also improve response while dealing with exigency situations. These will also be used to regulate the traffic situations across the city by communicating right messages at the right time.

ii. The variable message display shall consist of variable message signboard with local controller.

iii. A VMD software system shall be provided to the Smart City Operations Center for message preparation monitoring and control of the variable message signs. IP based Network equipment shall be provided to connect the VMD with the VMD software system.

iv. The VMD software application will allow user to publish specific messages for managing traffic and also general informative messages.

v. VMD software application will provide the normal operator to publish predefined sets of messages. The application shall have an option for supervisor (someone with appropriate authority) to bypass the control during certain situations and to write in free-text mode.

vi. VMD software application will allow an operator to seamlessly toggle between multiple VMS points at each workstation in order to send specific messages to specific locations, as well as sending common message to all VMDs. VMD software application will accommodate different access rights to various control unit functionalities depending on operator status and as agreed with the client. Software should be GUI based, and capable to handle 200 VMS signage, user can select desired location in Map, By selecting the location live status of VMS should be displayed.

3.6.2. Technical Specification: Variable Messaging Displays (VMD)

i. Display

S.N.	Specifications	Minimum Requriements
1.	Source of light	High intensity LEDs
2.	Colour	True Colour
3.	Brightness	>8000 cd/m2
4.	Luminance Class	L-3 as per EN 12966
5.	Contrast Ratio	R2-R3 as per EN 12966
6.	Beam Width	B-3 as per should be wide angle B6 or B7 or B4
7.	Viewing distance	>300 meters
8.	Display capability	Alpha-numeric, Pictorials, Graphical & video
9.	Display Front Panel	100% anti-glare.
10.	Language	Multilingual (Marathi/English/Hindi) and all fonts supported by windows
11.	Auto Dimming	Auto dimming adjusts to ambient light level.

12.	In built Sensor	Photoelectric sensor
13.	Storage capacity	Minimum 100 GB
14.	Display Area	Display size of VMD should be 3x2 mtrs.
15.	Number of Lines &Characters	The number of lines and characters can be customized as per the requirement (Min 3 Lines & 10 Characters)
16.	Brightness & contrast	Controlled through software
17.	Display Driving method	Direct current control driving circuit. Driver card of display applies Direct Current Technology.
18.	Display Style	Stay on and flashing
19.	Connectivity	IP Based
20.	Access Control	Access control mechanism would be also required to establish so that the usage is regulated.
21.	Integration	With Smart City Operations Center and service providers for offering G2C and B2C services
22.	Construction	Cast Iron Foundation and M.S. Pole, Sturdy Body for equipment
23.	Battery	Internal Battery with different charging options (Solar/Mains)
24.	Power	Automatic on/off operation
25.	Casing	IP-55 rated for housing
26.	Operating conditions	0° to 55°C

3.7. Smart Element #7: ABB Fiber Network

3.7.1. Functional Requirement: ABB Fiber Network

i. ABB Fiber will enable city administration to own fiber to provide connectivity across parts of city in order to provide bandwidth as infrastructure to all sections of society and public offices. Successful bidder will lay the fiber network across the ABB area. The fiber network will provide the backbone on which all the other layers can reside for data/ connectivity requirements along with all proposed smart city applications.

ii. The Fiber Optic Network will initially be intended to provide core infrastructure for implementing Smart Solutions. Below are the objectives for building a Fiber Optic Network for ABB area within the city:

- Free & Premium Wi-Fi for end users
- Pollution sensors
- Climate sensors
- Dynamic road messaging system
- Wind direction sensors
- Connectivity to all Government Offices
- Creating unified command structure using IT for disaster management
- Flood sensors
- Automatic traffic control
- CCTV & Surveillance
- Smart Lightning System
- IP Based Lightning System
- IP Based Integrated Communication System
- Provision to provide Fiber To The Home (FTTH) for home users to improve internet speed in home in future

iii. The network shall be designed in such a manner that it shall cover all major municipal corporation roads, junctions, parking area, government offices, ward offices etc. to offer smart components like Free/Premium Wi-Fi zone, FTTH, connectivity between all governments & ward offices in the ABB area.

iv. The entire fiber network will be given for operations, maintenance and monetization to the successful Bidder for the period of 15 years. The entire fiber network will always remain the property of PSCDCL/ PMC.

v. The successful bidder also need to note that PSCDCL/ PMC may undertake project for implementation of Fiber in rest of the city. Successful bidder will have to make necessary provisions assuming the migration of other smart elements to the newly laid fiber by PSCDCL/PMC at no additional cost.

vi. Successful Bidder has to ensure laying of at least 1 duct for the entire network and 96 **core fibers** to ensure provision of required bandwidth is delivered. Any decision of putting more than 1 duct is left to Successful Bidder basis their monetization plan.

vii. PMC currently has plans for laying water pipelines for about 1800 kms across the city. The successful bidder need to consult with Water Department about their digging plans and

check the possibility if that can be clubbed with laying the fiber network across the city. The Successful Bidder need to provide a detailed report of assessment in this regard. In this case successful bidder will have to ensure putting a fiber corridor in conjunction with the water pipelines.

viii. As part of Smart city initiatives, the road department in PMC will be developing new roads in ABB area for approximately 46 kilometers. Road department will carry out necessary ducting work on the proposed road work. The successful bidder need to make use of ducting facilities provided by road department to lay the necessary fiber.

ix. The fiber optic ABB Fiber Network will have to integrate with the MPLS network that will be provisioned by the selected bidder to connect all the end terminating devices (Wi-Fi, smart parking, kiosks, emergency box, environment sensors, variable messaging displays and public address systems) which are included in scope of work for this tender. Such MPLS network will be designed considering the requirement of Wi-Fi access points across the city and will have to ensure committed bandwidth to the Wi-Fi users in case of increased number of users.

x. The bidder will be responsible for procuring the required internet bandwidth for offering Wi-Fi features for all the users across the city, and such bandwidth will have to be burstable (scalable) to offer the minimum throughput specified in the tender to all the users accessing Wi-Fi features.

xi. Following are the possible revenue streams for the successful bidder:

a) Fiber to home (F2H) service
b) Ducts on lease to telecom companies (tenancy model)
c) Leasing of PMC fiber
d) Bandwidth monetization (internet on lease to commercial players)

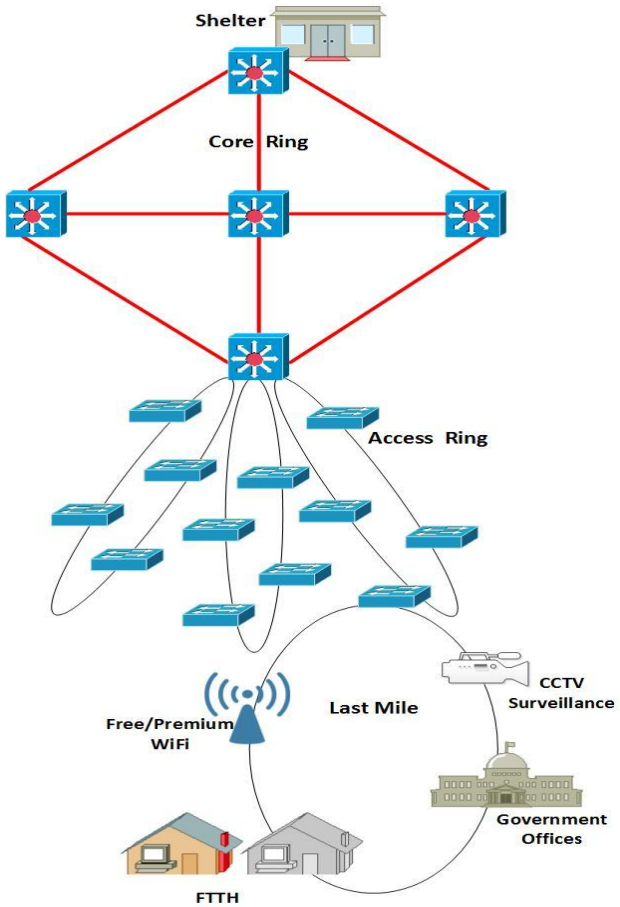
v. System Architecture: The diagram represents the high level network architecture diagram of Fiber Optic Network in the ABB area. The above diagram illustrates hybrid network topology comprising of a full mesh backbone design along with a ring design for the Core and access layers. Below are the design considerations for Fiber Optic Network:

- The Core backbone mesh topology shall meet the following minimum requirements:

a) The Core backbone mesh topology shall be constructed using 96 Core Optical Fiber Cables (OFC).
b) The Core ring shall have 5 POP locations connecting to each other as backbone of the network for providing bandwidth to the entire network components.
c) The Core network shall be highly scalable.
d) The Core shall utilize a 10 Gigabit Ethernet technology and shall support 40 Gigabit Ethernet technologies.
e) The Core ring shall have (1 + 1) configuration of 40mm High Density Polyethylene (HDPE) pipes.
f) The Core architecture shall be formed in full mesh topology to handle dual point of failures.
g) 96Core Fiber Optic Cable shall be used to build the core network. Out of 24 pairs, 1 pair shall be used to connect all 5 POP locations and to provide bandwidth in the network.

h) 3 pairs from remaining pairs shall be used for providing redundancy in the network and for maintenance purposes.
i) 2 pairs shall be kept reserved for future expansion of the core network. It shall be used to add further POP locations in the network to increase the bandwidth capacity.

Conceptual Architecture Diagram for FIBER OPTICNETWORK



j) Remaining 6 pairs of the ring can be leased out to Telco/MSO/ISPs.
k) The maximum fiber distance between two Core Switches in 2 cut redundant mesh, as measured by optical time domain meter (OTDR) shall not exceed 40 KMs.
l) Core switch will be installed at all the POP locations, the switching backplane needs to be minimum 1.9 Tbps.
m) The proposed ring based architecture shall support resiliency of sub 50ms ensuring high availability and faster convergence for service continuity.

vi. The Access ring topology shall meet the following minimum requirements:

a) The Access ring shall be constructed using a 96 Core Optical Fiber Cables (OFC).
b) The Access ring shall utilize a 1 Gigabit Ethernet technology.
c) The Access ring shall have (1 + 1) configuration of 40mm High Density Polyethylene (HDPE) pipes.
d) The access architecture shall be formed using ring topology.
e) 24 pairs out of 48 pairs shall be used in the access ring.
f) The access ring is designed so that it can support up to 1 edge switch at every 350 meters.

g) The maximum distance of one access ring shall not exceed 80 kilometres.
h) In the access network where two or more access rings criss-crosses each other will be marked as Mini POP locations for future expansion.
i) From every edge switch, 70 meter copper cable shall be laid to carry out installation of Wi-Fi access point which will cover 350 meters radius. At most if 350 meters copper cable is not feasible, the same shall be extended by placing additional switch to cover maximum area.
j) 6 Pairs shall be kept for redundancy and maintenance activities of the network.
k) 8 pair of the cores can be leased to Telecom companies.
l) 3 pairs shall be kept for future expansion.
m) 3 pairs can be used as backbone ring for future Mini POP locations.
n) 4 pairs of the ring can be used for connecting government offices.
o) The distance between two Hand Holes/RCC Chamber should not exceed 200 meters.
p) A loop of 20 meters of OFC shall be left in every Hand Hole.

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

a) The core backbone mesh topology shall be identified by using Green, Navy and Blue colours. The Core backbone mesh Optical Fiber Cables (OFC) shall be placed in Green colour conduit.
b) The Access ring shall be identified using Yellow and Pink colours. The Access ring Optical Fiber Cables (OFC) shall be place in a Yellow colour conduit.
c) A 12U rack shall be deployed to house a layer 3 switch for providing connectivity to Smart city components. The 12U rack shall also house a Fiber Distribution Box (FDB) and patch cords for connecting the layer 3 switch to Core switch.

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

a) The core backbone mesh topology shall be identified by using Green, Navy and Blue colours. The Core backbone mesh Optical Fiber Cables (OFC) shall be placed in Green colour conduit.
b) The Access ring shall be identified using Yellow and Pink colours. The Access ring Optical Fiber Cables (OFC) shall be place in a Yellow colour conduit.

ix. A 12U rack shall be deployed to house a layer 3 switch for providing connectivity to Smart city components. The 12U rack shall also house a Fiber Distribution Box (FDB) and patch cords for connecting the layer 3 switch to Core switch.

3.7.2. Technical Specification:ABB Fiber Network

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

i. Passive Components

Standard Reference	Standard Name
ITU-T G652 (11/2009)	96 Core OFC, 24 Core OFC, Fiber Optic Patch cord, Fiber Optic Pigtails

EIA/TIA-598	96 Core OFC, 24 Core OFC , Fiber Optic Patch cord, Fiber Optic Pigtails
IP-65	Field Junction box
Telecommunications Industry Association (TIA), Electronic Industries Alliance (EIA) 568-	Category 6 Ethernet Cable
IEC 61754-20	LC Fiber Connector
IEC 62134-1	Fiber Optic Enclosure, Fiber Distribution Box (FDB), 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	Generic Telecommunications Cabling for Customer Premises
ANSI/TIA-568-C.1	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/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

Table 1: Applicable Standards for Network Passive Components

ii. 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
IEEE 802.3u	100BASE-TX
IEEE 802.1Qbp	Equal Cost Multi Path (ECMP)
SFF-8472	Small Form-Factor Pluggable (SFP), Optical Digital Diagnostic Monitoring

Table 2: Applicable Standards for Network Active Components

iii. Civil

Standard Reference	Standard Name
Pune Municipal Corporation Guidelines	General specifications for Civil works in Utility projects
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

Table 1 - Applicable Standards for Network Civil Components

iv. Power

Standard Reference	Standard Name
International Electro technical Commission (IEC)	Power Cables
IS 732 1989	Electrical Wiring
IS 3043 1987	Electrical Earthing
EIA/ECA-310-E	Overall design requirements for Cabinets, Panels, Racks and Sub-Racks
BS 7671:2008	Laying of PVC Conduits and cables
IS 9537 Part 3, BS;EN61386-21	UPVC Conduits
IS 3419 BS; 4607	For UPVC Fittings

Table 4 - Applicable Standards for Network Power Components

v. Network

a) Active Components:

1. **Core Switch:** The core switches shall meet the following minimum specifications:

S. No.	Form Factor / Dimension	Minimum Specifications
1	**Architecture**	Should be chassis based & modular architecture for scalability with Redundant Route Processor, Power supply, Switching fabric
		Router should be provided with 1+1 route processor, 1+1 or 1+N switch fabric and 1+1 or 1+N power supply redundancy
		Should have two free full width payload slots for future expansion.
		The router shall support following type of interfaces – 100GE, 10GE, 1GE interfaces; POS - OC-3c/STM-1c, STM4, STM16, STM64, channelized STM-1,channelized STM-4, Channelized E1, E3, Circuit emulation E1, Circuit emulation E3, 10GE G.709 OTN, 10GE WAN PHY
		The modular operating system shall run all critical functions like various routing protocol, forwarding plane and management functions in separate memory protected modules. Failure of one module shall not impact operations of rest of the OS. In service bug patching should be available
		Router should support two free slots for future expansion
		The 'slot' for any router means a main slot or full slot on the router chassis. Only such a slot shall be counted towards determining the number of free slots. Any sub slot or daughter slot shall not be considered as a slot.
2	**Performance**	The router shall have minimum of 200Gig Full Duplex capacity per slot with redundancy on day one, which can be upgraded to 400Gbps without changing the hardware. Failure of any switch fabric should not degrade the per slot bandwidth
		Router Shall support non-blocking capacity of 3.2 Tbps.
		The router should have capability of minimum 2 million IPv4 routes
		The router should have capability of minimum 2 Million IPv6 routes
		The router should support minimum 1 million MAC address, minimum 128k Pseudo wires.
		The proposed router should have sufficient DRAM and Flash
		Router should have 96k multicast routes.
		The router should support 32 way BGP load balancing and 32 way ECMP
		Shall support online insertion and removal (OIR) that is non-disruptive in nature. Online insertion and removal of one line card shall not lead to

		ANY packet loss for traffic flowing through other line cards for both unicast and multicast traffic.
		In case of a line card or Route Processor failure on the router; the multicast and Unicast routing, multicast and Unicast distribution and multicast replication architecture of the router shall ensure no impact & zero packet loss of multicast video, audio & data traffic running on rest of the line cards in the system
		If any of the feature and functionality asked in the RFP is achieved using any service module then that should be quoted in 1+1 redundancy.
3	**Protocol Support**	Should have IPv4 Routing, IPv6 Routing, Border Gateway Protocol, Intermediate System-to-Intermediate System [IS-IS], and Open Shortest Path First [OSPF]), DHCPv6 and OSPFv3 for IPv6
		Multicast Protocol: Shall support Multicast routing protocols IGMPv1, v2, v3, PIM-SM (RFC2362) and PIM-SSM, MSDP, IGMP v2 snooping, MPLS mVPN (Multicast VPN)
		MPLS Protocols: Shall Support 6PE & 6VPE, MPLS VPN, Carrier Supporting Carrier (CsC), MPLS TE (Fast re-route), DiffServ (or equivalent)-Aware TE, BGP Prefix Independent Convergence, Inter-AS VPN, Resource Reservation Protocol (RSVP), RFC 3107 of Carrying Label Information in BGP-4.
		Redundancy Protocols: Should support Route Policy Language (RPL), Hot Standby Router Protocol (HSRP)/Virtual Router Redundancy Protocol (VRRP) or equivalent, GRE (Generic Routing Encapsulation) Tunneling,
		Layer 2 VPN Protocols: Shall Support VPLS, HVPLS, Ethernet over MPLS , CESoPSN and SAToP as per RFC 4553
		Router shall support MPLS OAM, Ethernet OAM protocols - CFM (IEEE 802.1ag), Link OAM (IEEE 802.3ah) and ITU Y.1731.
		The routers shall support both L2 and L3 services on all interfaces
		Configuration Roll Back to recover the mis-configured router to last good configuration
4	**QoS Features:**	Shall support the following:
		Traffic Classification using various parameters like source physical interfaces, source/destination IP subnet, protocol types (IP/TCP/UDP), source/destination ports, IP Precedence, 802.1p, MPLS EXP, DSCP and by some well-known application types through Application Recognition techniques.
		Shall support Strict Priority Queuing or Low Latency Queuing to support real time application like Voice and Video with minimum delay and jitter, Congestion Management: WRED, Priority queuing, Class based weighted fair queuing
		Shall support standards based RSVP for voice & video call admission control.

		Ability to configure hierarchical queues in hardware for IP QoS at the egress to the edge. Minimum 128k egress and 64k ingress hardware queues per line card.
		Platform must support nested hierarchical QOS policies. Router should have 4 level of scheduling for HQOS.
5	**Security**	Support Access Control List to filter traffic based on Source & Destination IP Subnet, Source & Destination Port, Protocol Type (IP, UDP, TCP, ICMP etc.) and Port Range etc., Time based ACL, AAA using radius or TACACS
		The routers shall provide hardware accelerated IETF Netflow-v9/J-Flow/equivalent feature. This feature shall be available for all interfaces provisioned on the router with hardware acceleration.
		Should Support MD-5 authentication for RIP, OSPF, IS-IS and BGP. Also support URPF, DHCP snooping , control plane policing ,SNMPv3 authentication, SSHv2
6	**Management**	Should have to support Out of band management through Console / external modem for remote management.
		Event and System logging: Event and system history logging functions shall be available. The Router shall generate system alarms on events. Facility to put selective logging of events onto a separate hardware here the analysis of log shall be available.
7	**Minimum Port requirement from Day 1**	16 x 10G SFP+ Ports Distributed across minimum two or more line cards and 40 x 1G SFP ports Distributed across minimum two or more line cards
		Bidder need to size the port & transceivers requirement as per their solution and if required need to include additional ports for the workability of solution
8	**Certifications**	The Router should be minimum EAL2 / Applicable Protection Profile (NDPP) certified under the Common Criteria Evaluation Program / Equivalent certification

Table 5 - Core Switch Specifications

2. MPLS Access-Layer router/Switch – Type 1

S. No.	Parameter	Minimum Specifications
1	**Architecture:**	Router shall support redundant Data and control Plane. There should not have impact to Data Plane traffic during software upgrade.
		Router should have redundant controller cards and should support stateful switch over, non-stop forwarding, Non-stop routing and Graceful restart.
		Router shall support sync any configurations from previous modules to new modules with hot-swap event occurred
		The router shall support following type of interfaces – 10GE, 1GE interfaces with DWDM. 10GE WAN PHY and 10G DWDM, Ch.STM1 and E1.
		Router shall have minimum 2 free slots for future expansion.
3	**Performance**	Router shall support non-blocking capacity of 128Gbps.
		Backplane of each slot should be minimum 20 Gbps.
		Router shall support 170 Mpps forwarding performance
		Router shall support 16000 Mac addresses
		Router shall support 18000 IPv4 routes
		Router shall support 8000 queues and 128 MPLS VPN's
		Router shall support aggregation of links. Minimum 8 links should be supported as part of single aggregation.
		Router shall support IPSLA or equivalent and Y.1731 for performance monitoring.
4	**High Availability**	Router should support Redundant Power Supply and should also support On line insertion and removal of same.
		All cards should be provided in redundancy.
		Router shall support MPLS-TE with FRR for sub 50 msec protection.
		Router must support Traffic Engineering for node and link protection.
5	**Protocol Support**	Router shall support IPV4, IPV6, ECMP, LDP, BGP, IS-IS, OSPFv2and V3
		Router shall support IGMP V2/V3, MLD, IGMP and PIM, VRRP, Multicast layer3 VPN
		Router shall support 6PE and 6VPE mode for IPV6 transport over IPV4, BGP PIC (EDGE and Core) for IPV4 and IPV6,,Loop free alternate FRR (IPFRR). Traffic Engineering and RSVP. The Router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic

		Router should support high availability for all BFD, BGP ,OSPF and IS-IS and no packet loss during controller switch over.
		Router shall support layer3 and layer2 MPLS VPN.
		Router shall support MPLSOAM, Ethernet OAM protocols- CFM(IEEE 802.1ag), Link OAM (IEEE 802.3ah) and ITU Y.1731
		The router along with respective line cards should be supplied with timing protocol support such as 1588v2 (with boundary clock as well as ordinary clock (master and slave) and syncE
		Router should support RFC 3107 of Carrying Label Information in BGP-4
6	**QoS Features:**	Router shall support HQOS on all kind of interface in both ingress and egress direction. Similar QOS shall be supported for all type of interface including Bundled interfaces. The proposed router shall support 3 level H-QoS
		Shall support Ingress classification, marking and policing on physical interfaces and logical interfaces using source/destination IP subnet, protocol types (IP/TCP/UDP), source/destination ports, IP Precedence, MPLS EXP, DSCP, 802.1p
		Shall support Strict Priority Queuing or Low Latency Queuing to support real time application like Voice and Video with minimum delay and jitter.
		Congestion Management: WRED, Priority queuing, Class based weighted fair queuing
7	**Security & Management**	Support Access Control List to filter traffic based on Source & Destination IP Subnet, Source & Destination Port, Protocol Type (IP, UDP, TCP, ICMP etc) and Port Range etc. Should Support per-user Authentication, Authorization and Accounting through RADIUS or TACACS and SNMPv1/v2/V3
8	**Operating Environmental Requirements:**	For DC : -40°C to 65°C operating temperature and 5 to 95%, noncondensing
9	**Minimum Port requirement from Day 1**	6 x 10G SFP+ Ports Distributed across minimum two or more line cards and 16 x 1G SFP ports Distributed across minimum two or more line cards
		Bidder need to size the port & transceivers requirement as per their solution and if required need to include additional ports for the workability of solution
10	**Certifications**	The Router should be minimum EAL2 / Applicable Protection Profile (NDPP) certified under the Common Criteria Evaluation Program/ Equivalent certification

3. **MPLS Access Router / Switch – Type 2**

S. No.	Minimum Specifications
1	Router should support have 64 Gbps of switching capacity
2	The router should have 4GB DRAM and 2GB flash
3	The Router shall be standalone fixed configuration Chassis or stackable system with redundant power supply.
4	The Router should support multilevel priority scheduling for voice and video applications with minimal jitter, latency and packet loss.
5	The Router shall support fault-tolerant connections to other network or shared media segment to protect against a primary link failure. If the primary link fails, the backup path shall be automatically activated to maintain network connectivity and throughput.
6	It shall support Ethernet Ring protection based on ITU-T G.8032 v2
7	The proposed router shall support 3 level H-QoS
8	The switch shall support both IPv4 and IPv6
9	Internet Group Management Protocol versions 2 and 3 (IGMPv2 and v3), IP/MPLS, IP FRR, BGP PIC, MPLS LDP, MPLS TE
10	The Router should support the following protocols: BGP, MPBGP, OSPF, RFC 3107, OSPFv2 and v3, Loop free alternate, IP FRR, 6PE, 6VPE, VPLS, Layer2 VPN, uRPF, PIMSM and PIM SSM
11	The router should support fast convergence protocols like G.8032, IPFRR,MPLS FRR,BGP prefix independent convergence, VRRP or equivalent and BFD for Routing protocols.
12	The Router should support Point to Point and Point to Multipoint LSP for Unicast and Multicast traffic.
13	The Router should support layer 2 and layer 3 MPLS VPN
14	Shall support Frame sizes from 64 bytes to 1600 and to 9216 bytes on all ports
15	Router shall work as DHCP relay agent
16	The router should support Zero touch provisioning for ease of management
17	Router should support Policy Based QOS, WRED, WFQ, HQOS, Ethernet OAM and Y.1731 performance management
18	The Router along with respective line card should be supplied with timing protocol support such as 1588v2 with Boundary as well as ordinary clock (master and slave) and SyncE
19	The MER switch must support the following security features: -
20	Security through ACL filters for layers 2 and layer 3 traffic, MAC address limits and storm control for broadcast, multicast and unknown unicast, Authentication, authorization, and accounting (AAA) with TACACS+ and RADIUS, URPF
21	The Router should be minimum EAL2 / Applicable Protection Profile certified under the Common Criteria Evaluation Program
22	2 x 10G SFP+ Ports and 8 x 1G SFP ports

23	Bidder need to size the port & transceivers requirement as per their solution and if required need to include additional ports for the workability of solution
24	The Router should be minimum EAL2 / Applicable Protection Profile (NDPP) certified under the Common Criteria Evaluation Program

4. **Access Switches (Industrial Grade):** The minimum technical requirements for Access switch are as follows:

#	Parameter	Minimum Specifications
1.	**Type**	Managed Outdoor Industrial grade switch with industrial grade power supply (AC/DC)
2.	**Total Ports**	• Minimum 8 10/100/1000 TX PoE/PoE+, 2x SFP Ports *(*expected to have 4xSFP Ports in certain locations)* • May require higher port density at some locations, depending upon site conditions • May require fiber ports at some locations, depending upon site conditions/distances.
3.	**PoE Standard**	IEEE 802.3af/IEEE 802.3at or better
4.	**Protocols**	• 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**	• Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering
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) Due to the nature of the network device, and harsh environmental conditions at site locations, the network device implemented shall be easily serviced or replaced when defective or damaged. The access switch shall also be placed in an enclosure that provides protection from humidity, moisture and airborne substances, rain, wind, dust, high temperature, roadside pollutants, vandalism, pests, and theft of equipment.

8.	**Operating Temperature**	0 - 60 C or better Industrial Grade Rating
9.	**Multicast support**	IGMP Snooping V1, V2, V3 MLD Snooping V1, V2
10.	**Management**	Switch needs to have RS-232/USB 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/IEEE 802.3az or equivalent

Table 6 - Access Switch Specifications

b) Passive Components:

1. **42U Rack Cabinets: The suggested technical specifications for the 42U Rack Cabinets are as follows:**

No.	Parameters	Minimum Requirements
1.	Maximum Height	1990 mm
2.	Maximum Width	600 mm
3.	Maximum Depth	1000 mm
4.	Minimum Mounting Depth	190 mm
5.	Maximum Mounting Depth	900 mm
6.	Rack Height	42U
7.	Rack Width	19”
8.	Colour	Black
9.	Vertical Post Thickness	16 Gauge
10.	Front Door	16 gauge
11.	Rear Door	18 gauge
12.	Roof	18 gauge
13.	EIA Mounting Rails	14 gauge
14.	Side Panels	18 gauge

Following are the additional minimum requirements for the 42U Rack:

i. 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

ii. The 42U rack shall have two cable managers fully separated so they do not cross each other for power and network cables.

iii. The 42U Rack shall have provision for two separate top entries one for power and one for network cables.

iv. The 42U Rack shall have sufficient number of shelves to accommodate specified equipment in the Mega/Aggregation Point Of Presence (POP)

2. **12U Rack Cabinets: The suggested technical specifications for the 12U Rack Cabinets are as follows:**

No.	Parameters	Minimum Requirements
1.	Maximum Height	534.00 mm
2.	Maximum Width	600.00 mm
3.	Maximum Depth	913.00 mm
4.	Maximum Mounting Depth	913.00 mm
5.	Rack Height	12U
6.	Rack Width	19”
7.	Colour	Black
8.	Front Door	16 gauge
9.	Rear Door	18 gauge
10.	Roof	18 gauge
11.	Side Panels	18 gauge

Following are the additional minimum requirements for the 12U Rack:

i. 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

ii. The 12U rack shall have one cable manager for network cables.

iii. The 12U Rack shall have provision for two separate top entries one for power and one for network cables.

vi. Operational Facilities

a) Civil Components:

1. **Conduits**

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

No.	Parameters	Minimum Requirements
1.	40mm HDPE pipe	High Density Polyethylene Pipe with inner layer of solid permanent lubricant
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

Table 9 - 40 mm HDPE Pipe Specifications

Following are the additional minimum requirements for the 40 mm HDPE Pipe:

i. 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.
ii. 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.
iii. 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.
iv. The ends shall be cleanly cut and shall be square with axis of the pipe.
v. HDPE pipe shall be supplied in circular coils of 1000m length with End caps fitted with both ends of pipe to prevent the entry of any unwanted elements such as dirt, water, moisture, insects/rodents during transportation and storage.
vi. 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.
    a. Name of Client with logo
    b. Manufacture's name or trade mark
    c. Year of manufacturing
    d. Type of HDPE pipe and size
    e. Running length marking

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

No.	Parameters	Minimum Requirements
1.	Type of Coupler	Push-Fit type 40mm Dia. Coupler
2.	Pulling Force	≥330 kgf
3.	Construction Material	HDPE

Table 10 - 40 mm HDPE Coupler Specifications

Following are the additional minimum requirements for the 40 mm HDPE Coupler: 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.

iii) End Plug for 40mm HDPE Pipe: The minimum technical requirements for the 40mm End Plug are as follows:

No.	Parameters	Minimum Requirements
1.	Type of End Plug	Push-Fit type 33mm ±0.4mm Dia. Plug
2.	Material used for manufacturing	HDPE
3.	Life expectancy	≥25 Years

Table 11 – End Plug for 40mm HDPE Pipe Specifications

Following are the additional minimum requirements for the End Plug: The end plug once installed shall make the layed HDPE duct air tight.

2. **Shelters**

i) Prefabricated Shelter: The minimum technical requirements for the Prefabricated Shelter are as follows:

#	Parameters	Minimum Specifications
1.	Internal dimensions	Length – 4000mm,Width – 3000mm, Height – 2700mm
2.	Thickness of Inner Wall skin	0.6 mm percolated GI sheet
3.	Thickness of Outer Wall skin	0.6 mm percolated GI sheet
4.	Core material between inner wall skin and outer wall skin	a. 60 mm thick Poly Urethane Foam b. Density of 40kg/Cu. m. c. Thermal conductivity: < 0.02 W/m. Degree Kelvin
5.	Superstructure wind load	150 Kmph
6.	Integral projected roof	100 mm on all four sides to give rain Protection
7.	Base Frame Load capacity	3000 kg/Square meter.

#	Parameters	Minimum Specifications
8.	Floor Insulation	55 mm thick PUF
9.	Floor load capacity	2000 kg/Square meter
10.	Door	Insulated Metallic door 920 mm X 2140 mm fitted with EPDM rubber gasket
11.	Door Locks Standard	Single point Mortise lock
12.	Door Hinges	Stainless steel pickproof Hinges (3 Nos.)
13.	Cable tray	a. 250 mm wide powder coated aluminium perforated cable tray b. Thickness 2 mm

Table 12 - Prefabricated Shelter Specifications

Following are the additional minimum requirements for Prefabricated Shelter:

i. Shelter shall be self-standing, self-supporting galvanized steel structure

ii. Shelter roof shall be cambered with a ratio of 1:10 to the side of the shelter

iii. Shelter shall be designed on steel channel frame and secured using foundation bolts.

iv. A 19 mm thick marine ply shall rest on the shelter floor. It shall be fire retardant, fungus proof, termite proof and anti-abrasive.

v. Floor shall be covered with 2 mm thick green colour anti-static mat and aluminium angle of 40 X 40 X 3 mm all around.

vi. Door rain guard to be provided above the door for smooth operations.

vii. Shelter shall have cut-outs for following:

   a. Fiber cable

   b. Power cable

   c. Air Condition inlet & outlet

   d. Earthing/Grounding cable

viii. Shelter shall be water and dust proof.

ix. Shelter shall have adjustable anti-corrosive steel access ladder.

x. Shelter shall have solid hook mounted door stopper

xi. The foundation shall be made of reinforced cement concrete with suitable grade to sustain entire load of shelter and equipment.

xii. The foundation shall be designed in accordance with local rules and regulations and the municipal / concerned government authorities guidelines to be adhered.

xiii. While constructing the foundation bearing capacity of soil, seismic load and wind load to be accounted for.

xiv. The foundation shall support the shelter at least 4 points with vertical RCC Column having arrangement of base plate and foundation bolt to fix the shelter steel I-beams.

xv. The shelter shall have adequate lighting system and safety equipment.

xvi. The Shelter shall have Intelligent Security and loss prevention system (ISLP) addressable fire alarm system, intrusion detection system, access control system and IP based CCTV System. This system shall be centrally integrated with OSS based NMS. The shelter which will be installed in open space needs to have adequate fencing.

xvii. The Fence wall shall be at least at a distance of 3 meters from shelter on all sides.

xviii. There shall be a MS gate with locking arrangement for safety.

xix. The Shelter shall be equipped with sufficient numbers of ABC Powder type fire distinguisher with adequate capacity for fire safety.

xx. The Shelter shall be equipped with emergency lights to provide illumination level of 600 - 750 lux in the shelter for 8 hours in case of power failure.

xxi. The shelter shall have provision for adequate lighting so that illumination level of 750 – 1000 lux is maintained.

xxii. The Entire Power system installed in shelter shall comply with Maharashtra State Electricity Board ("MSEB") for Electrical Earthing. This includes all Earth and Ground pits.

xxiii. The contractor shall install suitable dehumidifiers in the Shelter to maintain the specified humidity levels with atleast (1+1) redundancy.

xxiv. The Contractor shall provide acrylic based polymer coating in three layers to cover entire roof joints to provide rain shield on the shelter and the coating shall withstand UV rays and expansion / contraction under extreme weather condition.

3.8. Smart Element #8: Smart City Operations Center (SCOC)

3.8.1. Functional Requirement:Smart City Operations Center (SCOC)

i. The vision of the Smart City Operations Center (SCOC) is to have an integrated view of all the current smart elements. The future smart elements will also be integrated at the Smart City Operations Center such that SCOC will serve as a decision support engine for city administrators in day to day operations or during exigency situations. This dynamic response to situations, both pre-active and re-active will truly make the city operations "SMART".

ii. This dynamic response can be better understood by the following sample use cases –

1.ii.1. **Urban Flooding Scenario**: The water level sensors (used for flood detection on streets) will send the ambient water levels accumulated on the street to the command center through the fiber network. The command center will baseline the existing water level and rainfall prediction with erstwhile flood levels to generate an alert for flooding. This alert will then be passed over to the citizens through the variable messaging displays and public address system to warn them of possible flooding in a locality.

1.ii.2. **Evacuating Hazardous places in event of fire**: As soon as the command center is intimated of a fire through the panic button or SOS feature available on mobile app, the local IP based public address system will be triggered to vacate the fuel stations to reduce the extent of casualty. This information will be passed over trauma centers in the vicinity to prepare for increased number of emergency care patients.

iii. The center will aggregate various data feeds from sensors and systems and further process information out of these data feeds to provide interface /dashboards for generating alert and notifications in real time.

iv. The Centre would also equip city administration to respond quickly and effectively to emergency or disaster situation in city. The Smart City Operations Center supports and strengthens coordination in response to incidents/emergencies/crisis situations.

v. The various smart elements are able to use the data and intelligence gathered from operations of other elements so that civic services are delivered lot more efficiently and in an informed fashion

vi. The typical components of a Smart City Operations Center are: Video wall, Network and security management system, centralized system for security solution, Core computing and data processing center, Integration with third party shared services, managed hosted data (DC) at PMC Premises.

vii. PMC has selected a vendor for providing colocation, managed hosting and cloud services. The RFP and corrigendum documentscan be downloaded from the following link: https://pmctenders.abcprocure.com/pmctenders/EProc.jsp?CenterPage=bldownload.jsp&showhide=hide&ProcessID=1&objectid=44780&PageType=View&tendertype=null&fromWhere=TenderInfo.

viii. The rate card, for various services offered by the vendorwill also be available on request.

ix. Successful bidder needs to provision required compute and storage infrastructure required for running all smart elements of Smart City, at Data Center selected by PMC as collocated hosting. The bidder also needs to provision of standardized racks (as per specifications provided in this RFP) to house all compute and storage infrastructure proposed by them. The color scheme of the rack should match the requirements of PMC Data center vendor.

x. Successful bidder will have also to setup the necessary network infrastructure, including MPLS/P2P network links (if required) and ILL (Internet links) to connect Smart Elements to the centralized server and storage setup being hosted at Data Center provided by PMCs selected vendor. The network sizing needs to be done by the bidder, in such a way that required SLA are adhered during the entire project duration. All network links should be dual redundant in active-active mode. It may be noted that PMCs Data Center Vendor will provide firewall services (shared firewall), as defined in their scope of work. If the solution required exclusive/internal firewall, the bidder should provision it in the rack(s).

xi. Bidders need to provision a top of the rack switch (TOR switch) which shall connects all servers and/or storage components residing in the same rack and provides a single network connection to a distribution port of PMC's datacenter. The specifications of such interconnections can be sought from PMCs vendor on request.

Centralized Smart City Operations Center must have following features as stated in the items below.

xii. In brief the Smart City Operations Center will be the nodal point of availability of all online data and information related to various current and future smart elements and will be connected to other PMC network of services through an integration layer.

xiii. Smart City Operations Center will be established with all hardware, software and network infrastructure including switches and routers and will be maintained by the successful bidder throughout the mentioned period. PSEDCL/ PMC takes the responsibility of necessary civil work including furniture.

xiv. Video Monitoring & Display: Successful bidder needs to supply and install 4X3 video wall for display of CCTV cameras and other components.

xv. The Smart City Operations Center shall have a console table with seating for twenty five (25) people. The console table shall also be equipped with two connector boxes providing power, audio, video, and data connectors for a laptop / computer to use the display wall for a presentation. The Successful bidder has to provide the feature of Digital Map to have complete details of the installed services and system on the map and on click of the same, the respective camera shall display live video and other events.

xvi. All required Servers, Storage, Software, Firewall, Network Switches for entire project shall be installed in the in the integrated control room.

xvii. Successful bidder needs to provide 6 nos. of operator (8 Hrs. shift) for 24 X 7 X 365 operations along with one no. of Supervisor and other experts in general shift. The Smart City Operations Center shall be located at the Pune Municipal Corporation building.

xviii. The Smart City Operations Center shall provide situational awareness of the security situation across the city. This shall enable the operators to take coordinated and planned response actions. The Command and Control shall be able to integrate with various security systems and sensors and enable the operators to carry out the coordinated response plans effectively.

xix. The solution should have integration & deployment capabilities for web, application, data and analytics in order to provide Real Time Dashboards, Business Intelligence, Predictive Analysis, KPI monitoring and Resource Optimization. It should be able to support a Rule Engine for multiple event correlation, What-if Analysis Tool, Threat Detection Tool, Integration with Social Media platforms, and Integration with Weather Monitoring websites etc. to ensure that real time decisions can be taken by city administrators.

xx. The Smart City Operations Center solution should allow the Control Room operator to monitor the cameras, collect inputs, dissect information and make actionable recommendations. The system should provide configurable rules with tailored alerts, dashboard visualizations, intelligent role based work flow, response tools and situation collaboration. The key features shall be:

a. System should be able to integrate with various application and systems
b. System should be able to prioritize the alarm based on criticality and location (as well as location sensitive plans and procedures). The prioritization must be based on a user pre-defined order that should be open to updating by the user when necessary. The alerts based on such list should be software driven and automatic.
c. System should support on-ground experience by getting nearby video feeds for any alarm
d. System should support with GIS & Video controls to get on-field experience
e. System should support full-fledged video support (Camera List' Live Video' Recorded Video' PTZ controls' Playback' Video Matrix)
f. System should consume Web Map Service or any equivalent which is a Global standard to collect GIS data.
g. System should do health monitoring of sensors and systems

xxi. **Alarm management:**

a. Alarm management function should connect with Core of Smart City Operations Center Server which processes the alerts centrally and consumes the alerts processed and displays at operator console. Alarm Management function should include following functions:
    1) Targeting - Option to locate the sensor in GIS display which has detected the security risk
    2) Alarm Description - Provides the basic text description of alarm
    3) Device - Name of the sensor
    4) Acknowledge - Provision for operator to acknowledge the alert
    5) Dismiss - Provision for operator to close the alert once the required actions are completed
    6) Detail view - Provide the necessary information to understand the situation clearly using correlation from the Video feed. The alarm management system must closely and tightly be integrated with Video management application and the database integration should be the basis. Similarly any incident visually identified from the VMS system should be correlated to a GIS screen by clicking

on the client station. This feature should be demonstrated during POC evaluation.

7) SOP - Provide the list of activities which needs to be carried out by operator for the category of alert and sensor location
8) Filters - Provision to filter the alerts
9) Search - Provision to search particular alert from the complete list of alerts.

a.1. Allow smartphone users to report suspicious activity with the press of a button' leveraging "crowd sourcing" to help handle situations.

a.2. Collection of multiple data sources including photos' descriptions and locations.

a.3. Incident reports can be submitted at any time and from anywhere even discreetly or anonymously

xxii. **Alarm Detail View:**

a. Alarm detailed view should provide 360 degree visibility for the situation around the alert thus equipping the operator to carry out the response without any ambiguity. Detail view' which is invoked from Alert Manager' should comprise of following sections:
   1) Description: Description of the alert.
   2) Video: Video section displays the live and recorded video of the camera/ associated camera immediately.

xxiii. **SOP:**

a. SOP is a standard operating procedure which provides the step-by-step instruction in the shape of drop down menu to Smart City Operations Center operator on how to handle a particular incident in an organized manner. SOP tasks should serve as an instructional resource that allows operator to act without asking for guidance. There shall be the provision to define various SOPs in Smart City Operations Center such as alert category specific SOPs' Location Specific SOPs. It shall have facility to define more than one SOP for the selected alert category or location. There shall be a provision to define multiple tasks under single SOP.

b. The system shall select & present the appropriate SOP automatically based on pre-defined policies actions taken as part of SOP should be logged in audit trail with date time stamp and operator comments. SOP shall contain the lists of tasks to be performed by operator categorized under following headings:
   1) Task: Task to be performed by the operator in the sequential order
   2) Description: Task description
   3) Comments: Space for operator to enter the comments
   4) Action: Actions (like email' SMS escalation) to be initiated by operator
   5) Done: Indication by operator that the task is completed
   6) User: User name of the operator for audit trail
   7) Date & Time: date time of the action

   a.1. SOP section should display list of activities which need to be carried out by an operator for the selected alert. It should be in the form of a drop down menu for ease of operation. The following escalation methods should be supported: Email, SMS and Phone Call

xxiv. **Video Interface:**

a. Video adds another dimension to the situational awareness as it makes the operator aware of the true ground situation and enables him to carry out necessary responses in a more educated manner.

b. At any point of time operator can browse the current video and/or recorded video from video sensor which can be traced geospatially or from the sensor hierarchy list. The following functionalities should be available as a part of Video Integration:
   1) Video matrix: Provision by software to view multiple video streams in a single window
   2) Camera List: List of cameras based on the geographies configured in the system
   3) Live Video: Real time video of the cameras installed and configured
   4) Recorded Video: Provision to browse the archived video for investigation purpose
   5) PTZ controls: Enable the operator to task the cameras enabled with PTZ functions
   6) Playback controls: Provision to control the playback of archived video.
   7) Smart City Operations Center should be interfaced with video management systems and video analytics systems to bring the video feeds from the end cameras installed across the cityscape and events which are configured in video analytics server.

xxv. **Geospatial Display:**

Smart City Operations Center operator console should consume the map data published over WMS (Web Map Service) standard or equivalent which is a global standard and committed to being integrated by the Command and Control software provider. Operator console should provide the map navigation controls (Panning' Zooming) using dedicated control button and mouse operation. Smart City Operations Center Operator console shall also preferably have 2D interactive geo-spatial GIS display that provides situational awareness and real-time location of all sensors (parking and environmental), cameras and alarms.

xxvi. **Municipal Zone Management:**

The system shall have provision to define various zones in the city. There shall be provision to map the sensors with the zones and vice versa so that operator can locate the sensors quickly. The system shall have capability to define various sites. The Site hierarchy preferably shall be displayed in Layer Manager as an additional Layer. This feature shall enable the operators to select the sensors from the hierarchical/organized view' so that he can locate the correct sensor without the need to remember the sensor name or id. Smart City Operations Center shall provide the following hierarchy:

a) Site
b) Zone
c) Area
d) Sensor Type

xxvii. **Archiving and Audit:**

All the alarms' events shall be processed and operator activities shall be captured and recorded for analysis and reporting purpose. Audit trails are very important tool and shall help to learn and realign the process to manage the handling of security incidents. The following information shall be logged in Smart City Operations Center:

a) Event information showing event type' location' date time created' date and time action taken' closed date and time.
b) User Activities
   - Sign On/Off times
   - Activities carried out
   - Response time on events

xxviii. **Reporting:**

Reporting function is part of command and control dashboard visualization tool. It shall provide information about current status of the command and control on managing the security incidents across the locations. Reporting function should enable operator to create reports in either graphical format or flat tabular format. Reports shall be created automatically or manually by operator whenever required. The reports should be generated and exported as a Microsoft word excel format or an acrobat format by operator.

xxix. **Threat Level Indication:**

Smart City Operations Center should display the threat level based on the number of alerts and criticality of the alerts using colour coded display. It should also follow a pre-defined system to alert different users on different hierarchy on the basis of the criticality of alerts.

xxx. **Real Time Dashboard:**

Real time dashboard should provide the real time information about the security situation so called Situational Awareness for the Authorities and senior officials in a single go. Real time dashboard should provide following information

a) Number of alerts and its status
b) Operator Status
c) Performance of the Command Center

xxxi. **Fault Tolerance:**

Smart City Operations Center should provide fault tolerance across the sites. System should be able to find the fault at servers located in different buildings or data centers. Redundancy is required for recorder' master server database for VMS and Command and control server software.

xxxii. **Non Functional Specifications for the Smart City Operations Center:**

a. All CCTV surveillance cameras feed (after integrating with existing systems) shall be integrated with the Smart City Operations Center System
b. Complete Hardware and software along with necessary licenses to be provided
c. Recording of video feeds should be provided for 30 days minimum for all cameras in a resolution ranging from 4 CIF to 2 MP and user programmable.
d. Small Cubicles with smaller display units for location-wise display distribution.
e. The controls and displays should be mounted in ergonomically designed consoles to keep operator fatigue to a minimum and efficiency high.
f. Supervisor seat located in a convenient position to monitor all cubicles.
g. Intercom communication facility between all the operators.

3.8.2. Technical Specification:Smart City Operations Center(SCOC)

i. Video Wall Screen

#	Parameter	Minimum Specifications
1.	Technology	Solid state LED illumination technology or Direct LED IPS based Technology or equivalent
2.	Display Unit	The Visual Display Unit / Rear Projection Module must be based on Single Chip Rear Projection Technology. Should have the scalability and upgradeability to be made up of multiple rear projection modules stacked up in columns to achieve a display wall for better viewing ability in linear or curved configuration.
3.	Screen Size	3 x 2 configuration of 70" cubes
4.	Resolution	Full high definition (1920X1080)
5.	Brightness	Uniformity of 85%
6.	Contrast Ratio	Min. 1400 : 1
7.	Wall Uptime	Min. 60,000 hours of rated life (Expected to be operational 24X7)
8.	Viewing Angle	180 degree viewing angle
9.	Screen to Screen gap	- The inter screen gap should be <0.6mm.
10.	Input	Analog D-sub/Digital DVI/Digital HDMI (as per solution)
11.	Other Features	- RS232 control (with loop-through) - On Screen Display (OSD) - flicker free image on the Large Screen Graphics Wall - Should be supplied with necessary display controller (if required), to support viewing of the video feeds of multiple cameras

ii. Video Wall Controller

No.	Parameters	Minimum Requirements
1	Controller	Controller to control Video wall in a matrix as per requirement along with software's
2	Chassis	19" Rack mount
3	Processor options	Single Quad Core Intel® CoreTM i7 Quad Core 3.4 GHz processor) or better
4	OS	Supports 64-bit Operating System Windows 7
5	RAM Capacity	16 B or more
6	HDD	500 GB or more
7	Networking	Dual-port Gigabit Ethernet

No.	Parameters	Minimum Requirements
8	RAID	RAID 1, 5, 10 supports
9	Power Supply	(1+1) Redundant hot swappable
10	Cooling	Any Advanced Proven cooling mechanism
11	Input/ Output support	DVI/HDMI/USB/ LAN/ VGA/SATA port
12	Accessories	DVD +RW, Keyboard and mouse
13	Voltage	100-240V @ 50/60 Hz
14	Redundancy support	Power Supply, HDD, LAN port & Controller
15	Scalability	Display multiple source windows in any size, anywhere on the wall
16	Control functions	Brightness/ Contrast/ Saturation/ Hue/ Filtering/ Crop/ Rotate
17	Universal Inputs	Minimum 2
18	Formats	DVI /RGB/Component
19	Input Format	NTSC/ PAL/SECAM
20	Operating Temperature	10°C to 35°C , 80 % humidity
21	Cable & Connections	Successful bidder should provide all the necessary cables and connectors

iii. Video Wall Management Software

Sr. No	Parameter	Minimum Specifications
1	Display & Scaling	Display multiple sources anywhere on display up to any size
2	Input Management	All input sources can be displayed on the video wall in freely resizable and movable windows
3	Scenarios management	Save and Load desktop layouts from Local or remote machines
4	Layout Management	Support all Layout from Video, RGB, DVI, Internet Explorer, Desktop and Remote Desktop Application
5	Multi View Option	Multiple view of portions or regions of Desktop, Multiple Application Can view from single desktop
6	Other features	SMTP support
7		Remote Control over LAN
8		Alarm management
9		Remote management

Sr. No	Parameter	Minimum Specifications
10		Multiple concurrent client
11		KVM support
12	Cube Management	Cube Health Monitoring
13		Pop-Up Alert Service
14		Graphical User Interface
15	Cube, Controller & Wall Management Software	Cube, Controller and Wall management Software should be from the same manufacturer

1. Smart City Operations Center will integrate new and existing security systems into a common platform. It will connect disparate information to mitigate risk across the security environment by providing actionable intelligence and speeding security incident resolution. Mitigate risk across the security environment.

2. Enforce event response processes: Smart City Operations Center will provide greater visibility of all security activity in a real-time single view and helps public safety and security personnel implement and enforce standard operating procedure.

3. Reduce security operations costs: Integrating existing systems (Multiple phased projects) with new technologies into a centralized Smart City Operations Center is one of Smart City Operations Center greatest strengths. This integration will allow City administration to leverage current investments, eliminate custom integration and reduce the cost of false alarms. It also decreases financial loss from incidents and training costs.

iv. Some of features of Integrated Smart City Operations Center shall include

1. Single Dashboard for City Infrastructure Management & Smart City Services for Smart Lighting, Parking System, GIS Services and Other Manual Services of Municipality work visualized real time on 2D/3D map of City. This dashboard can be accessed via web application as well as mobile app. The various information that may be accessed from the system but not limited to are as below:
    a. Parking availability status of automated city parking areas
    b. Visual alerts generated by any endpoint that is part of the city infrastructure e.g. Surveillance cameras, City lights or any other sensors that manages various city management use cases. (integration with existing city surveillance project by Pune Traffic police)
    c. Access information of water management resources (Disaster management cell at PMC will provide the details)
    d. Information about waste management resources
    e. Various citizen services e.g. Land records, Municipality tax, billing etc.
    f. City environmental data
    g. Take action based on events generated by any city infrastructure device

2. **Security:** In no circumstances this data accumulated and processed by Command and Control should be compromised. Hence provisions will be made to keep all the data stored in this platform highly secured with required Security framework implementation. The platform will be hosted in Data center at location decided by PMC to be provided by successful bidder or in

Cloud based on Cities choice. Further the platform will provide an open standards based integration Bus with API Management, providing full API lifecycle management with governance and security.

v. Operation Centre - Command Control Center & Communication System (C4S)

Command Control Center and Communication System should support for software modules.

Sr. No	Parameter	Minimum Specifications
1.	Convergence of multiple feeds	Assimilate and assess inputs from different sources such as CCTV, Video Analytics, and sensors further to assist with actionable intelligence.
2.	Smart City Operations Center Platform	Provide configurable rules with tailored alerts, dashboard visualizations, intelligent role based work flow, response tools and situation collaboration.
3.	Intelligent Dispatch Center	Assess the common operating picture, identify & dispatch mobile resources available nearby the incident location. Augment resources from multiple agencies for coordinated response.
4.	Intelligent Operator Console	Provide configurable intelligent operator console based on the jurisdiction, critical area or sensors to monitor as per situation demands for focused surveillance.
5.	Remote User Module	Supervisors remotely can access the system and monitor the alerts received, action taken status, response etc.
6.	Reporting Module, Mass Notification System, Social Media & Open Source Intelligence	Generate Customized reports based on the area, sensor type or periodic or any other customer reports as per choice of the administrators
		Provide a single web based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Voice mail, E- mail and Social Media
		Provide analytics based on the social media feed collected from the open source intelligence and collate with the surveillance inputs to alert the responders for immediate action on the ground.

vi. WAN Services / Internet router

Sr. No	Item	Minimum Specifications
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.	Speed	As per requirement, to cater to entire bandwidth requirement of the project.
4.	Interface modules	Must support up to 10G interfaces as per the design. Must have capability to connect with variety of interfaces.
5.	Protocol Support	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
6.	Manageability	Must be SNMP manageable
7.	Scalable	• The router should be scalable. For each slot multiple modules should be available. • The chassis offered must have free slots to meet the scalability requirement of expansion of the project in the future.
8.	Traffic control	Traffic Control and Filtering features for flexible user control policies
9.	Bandwidth	Bandwidth on demand for cost effective connection performance enhancement
10.	Remote Access	Remote access features
	Redundancy	• 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
11.	Security features	• MD5 encryption for routing protocol • NAT • URL based Filtering • RADIUS/AAA Authentication • Management Access policy • IPSec / Encryption • L2TP
12.	QOS Features	• RSVP • Priority Queuing • Policy based routing • Traffic shaping • Time-based QoS Policy • Bandwidth Reservation / Committed Information Rate

vii. Video Surveillance Monitoring Workstation

#	Parameter	Minimum Specifications
1.	Processor	Latest generation 64bit X86 Quad core processor(3Ghz) or better

2.	Chipset	Latest series 64bit Chipset
3.	Motherboard	OEM Motherboard
4.	RAM	Minimum 8 GB DDR3 ECC Memory @ 1600 Mhz. Slots should be free for future upgrade. Minimum 4 DIMM slots, supporting up to 32GB ECC
5.	Graphics card	Minimum Graphics card with 2 GB video memory (non shared)
6.	HDD	2 TB SATA-3 Hard drive @7200 rpm with Flash Cache of 64GB SSD. Provision for installing 4 more drives.
7.	Media Drive	NO CD / DVD Drive
8.	Network interface	10/100/1000 Mbps autosensing on board integrated RJ-45 Ethernet port.
9.	Audio	Line/Mic IN, Line-out/Spr Out (3.5 mm)
10.	Ports	Minimum 6 USB ports (out of that 2 in front)
11.	Keyboard	104 keys minimum OEM keyboard
12.	Mouse	2 button optical scroll mouse (USB)
13.	PTZ joystick controller	• PTZ speed dome control for IP cameras • Minimum 10 programmable buttons • Multi-camera operations • Compatible with all the camera models offered in the solution • Compatible with VMS /Monitoring software offered
14.	Monitor	3 x 22" TFT LED monitor, Minimum 1920 x1080 resolution, 5 ms or better response time, TCO 05 (or higher) certified
15.	Certification	Energy star 5.0/BEE star certified
16.	Operating System	64 bit pre-loaded OS with recovery disc
17.	Security	BIOS controlled electro-mechanical internal chassis lock for the system.
18.	Antivirus feature	Advanced antivirus, antispyware, desktop firewall, intrusion prevention (comprising of a single, deployable agent) which can be managed by a central server. (Support, updates, patches and errata for the entire contract/ project period)
19.	Power supply	SMPS; Minimum 400-watt Continuous Power Supply with Full ranging input and APFC. Power supply should be 90% efficient with EPEAT Gold certification for the system.

viii. Specifications for Data Center TOR (Top of the Rack) Switch

(This switch will be placed on top of the rack, which is to be collocated. This rack will contain all server/storage equipment offered by the bidder.)

#	Parameter	Minimum Specifications
1.	Ports	• 24 or 48 (as per density required) 1G/ 10G Ethernet ports (as per internal connection requirements) and extra 2 numbers of Uplink ports (40GE) • All ports can auto-negotiate between all allowable speeds, half-duplex or full duplex and flow control for half-duplex ports.
2.	Switch type	Layer 3
3.	MAC	Support 32K MAC address.
4.	Backplane	Capable of providing wire-speed switching
5.	Throughput	500 Mpps or better
6.	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks
7.	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.
8.	Protocols	• Support 802.1D, 802.1S, 802.1w, Rate limiting • Support 802.1X Security standards • Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping • 802.1p Priority Queues, port mirroring, DiffServ • Support based on 802.1p priority bits with at least 8 queues • DHCP support & DHCP snooping/relay/optional 82/ server support • Shaped Round Robin (SRR) or WRR scheduling support. • Support for IPV6 ready features with dual stack • Support up to 4096 VLANs • Support IGMP Snooping and IGMP Querying • Support Multicasting • Should support Loop protection and Loop detection, • Should support Ring protection
9.	Access Control	• Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering. • Should support TACACS+ and RADIUS authentication
10.	VLAN	• 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
11.	Protocol and Traffic	• Network Time Protocol or equivalent Simple Network Time Protocol support

#	Parameter	Minimum Specifications
		• Switch should support traffic segmentation • Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number
12.	Management	• Switch needs to have a console port for management via a console terminal or 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
13.	Resiliency	• Dual load sharing AC and DC power supplies • Redundant variable-speed fans

ix. Server Specifications (as building block)

#	Parameter	Minimum Specifications
1.	Processor	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 each physical server)
2.	RAM	Minimum 64 GB Memory per physical server
3.	Internal Storage	2x300 GB SAS / SATA (10k rpm) hot swap disk with extensible bays
4.	Network interface	20 Gb Network Interface (2 ports per controller), for providing Minimum 2 1 G Ethernet ports) Optional : Fiber channel adapter (if required for offered solution)
5.	Power supply	Dual Redundant Power Supply
6.	RAID support	As per requirement/solution
7.	Operating System	Licensed version of 64 bit latest version of Linux/ Unix/Microsoft® Windows based Operating system)
8.	Form Factor	Rack mountable/ Blade
9.	Virtualisation	Shall support Industry standard virtualisation hypervisor like Hyper-V, VMWARE and Citrix.

x. Blade Chassis Specifications

The blade chassis shall have the following minimum technical specifications:

1. Minimum 9U size, rack-mountable, capable of accommodating minimum 10 or higher hot pluggable blades
1. Dual network connectivity of 10 G speed for each blade server for redundancy shall be provided
2. Backplane shall be completely passive device. If it is active, dual backplane shall be provided for redundancy.
3. Have the capability for installing industry standard flavors of Microsoft Windows, and Enterprise RedHat Linux Oss as well as virtualization solution such as VMware.
4. DVD ROM shall be available in chassis, can be internal or external, which can be shared by all the blades allowing remote installation of software
5. Minimum 1 USB port
6. Two hot-plug/hot-swap, redundant 1 Gbps (or 10 Gbps if available) Ethernet module with minimum 10 ports (cumulative), having Layer 2/3 functionality
7. Two hot-plugs/hot-swap redundant 4 Gbps Fiber Channel for connectivity to the external Fiber channel Switch and ultimately to the storage device
8. Hot plug/hot-swap redundant power supplies to be provided, along with power cables
9. Power supplies shall have N+N. All power supplies modules shall be populated in the chassis.
10. Required number of PDUs and power cables, to connect all blades, Chassis to Data Center power outlet.
11. Hot pluggable/hot-swappable redundant cooling unit
12. Provision of systems management and deployment tools to aid in blade server configuration and OS deployment
13. Blade enclosure shall have provision to connect to display console/central console for local management such as troubleshooting, configuration, system status/health display.
14. Single console for all blades in the enclosure, built-in KVM switch or Virtual KVM features over IP
15. Dedicated management network port shall have separate path for remote management.

xi. Unified Storage Specifications

#	Parameter	Minimum Specifications
1.	Solution/Type	• Bidder is expected to provide Unified storage solution (or combination of NAS/Scaleout NAS/SAN) supporting all major protocols (IP Based/iSCSI/FC/NFS/CIFF) meeting benchmark performance parameters specified in SLA • Solution proposed should yield low cost per TB, while meeting the performance parameters • Licenses for the actual protocols used in the storage must be provided from Day 1
2.	Storage	• Storage Capacity should be minimum X TB (usable, after

		configuring in offered RAID configuration) • RAID solution offered must protect against double disc failure. • At least 10% of disks to be offered as hot-spare (i.e. 1 disk for every 10 physical disks that does in the RAID setup) • Disks should be preferably minimum of 3 TB capacity • To store all types of data (Data, Voice, Video etc) • The storage design must be based on the expected data volume from the project, including the expansion requirement of O&M Phase • Storage system capable of scaling vertically and horizontally
3.	Hardware Platform	• Rack mounted form-factor • Modular design to support controllers and disk drives expansion
4.	Connectivity	• The storage system shall be capable of providing host connectivity as per solution offered (Unified/SAN/NAS/ScaleoutNAS) as to meet operational SLA requirements.
5.	Controllers	• At least 2 Controllers in active/active mode • The controllers / Storage nodes should be upgradable seamlessly, without any disruptions / downtime to production workflow for performance, capacity enhancement and software / firmware upgrades.
6.	RAID support	• Should support various RAID levels (Minimum RAID6 or equivalent)
7.	Cache	• Minimum 128 GB of useable cache across all controllers. If cache is provided in additional hardware for unified storage solution, then cache must be over and above 128 GB.
8.	Redundancy and High Availability	• The Storage System should be able to protect the data against single point of failure with respect to hard disks, connectivity interfaces, fans and power supplies
9.	Management software	• All the necessary software (GUI Based) to configure and manage the storage space, RAID configuration, logical drives allocation, snapshots etc. are to be provided for the entire system proposed. • Licenses for the storage management software should include disc capacity/count of the complete solution and any additional disks to be plugged in in the future, upto max capacity of the existing controller/units. • A single command console for entire storage system. • Should also include storage performance monitoring and management software • Should provide the functionality of proactive monitoring of Disk drive and Storage system for all possible disk failures • Should be able to take "snapshots" of the stored data to another

		logical drive for backup purposes
10.	Data Protection	The storage array must have complete cache protection mechanism either by de-staging data to disk or providing complete cache data protection with battery backup for up to 4 hours

xii. Server/Networking Rack Specifications

#	Parameter	Minimum Specifications
1.	Type	• 19" 42U racks mounted on the floor • Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminium Frame for rigidity. Top cover with FHU provision. Top & Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. Two pairs of 19" mounting angles with 'U' marking. Depth support channels - 3 pairs with an overall weight carrying Capacity of 500Kgs. • All racks should have mounting hardware 2 Packs, Blanking Panel. • Stationery Shelf (2 sets per Rack) • All racks must be lockable on all sides with unique key for each rack • Racks should have Rear Cable Management channels, Roof and base cable access
2.	Wire managers	Two vertical and four horizontal
3.	Power Distribution Units	• 2 per rack • Power Distribution Unit - Vertically Mounted, 32AMPs with 25 Power Outputs. (20 Power outs of IEC 320 C13 Sockets & 5 Power outs of 5/15 Amp Sockets), Electronically controlled circuits for Surge & Spike protection, LED readout for the total current being drawn from the channel, 32AMPS MCB, 5 KV AC isolated input to Ground & Output to Ground
4.	Doors	• The racks must have steel (solid / grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels. • Front and Back doors should be perforated with at least 63% or higher perforations. • Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools.
5.	Fans and Fan Tray	• Fan 90CFM 230V AC, 4" dia (4 Nos. per Rack) • Fan Housing Unit 4 Fan Position (Top Mounted) (1 no. per Rack) - Monitored - Thermostat based - The Fans should switch on based on the Temperature within the rack. The temperature setting should be factory settable. This unit should also include - humidity

		& temperature sensor
6.	Metal	Aluminium extruded profile
7.	Side Panel	Detachable side panels (set of 2 per Rack)

3.9. Activity Wise Delivery Schedule

3.9.1. Successful Bidder's Major Responsibility

3.9.1.1. Deployment Phase Services

a) Project Management
b) Network Readiness Assessment
c) Network Implementation Development
d) System Acceptance Test Plan Development
e) Onsite Support Services
f) L1 Engineer resource
g) Cabling and Infrastructure support
h) Setting up Command Center as per requirement

3.9.1.2. Support Phase Services:

a) The Successful Bidder Shall be responsible for complete service and support management pertaining to the project as per tender document
b) The Successful Bidderneed to ensure that the entire infrastructure is supported back to back by OEM support services

List of the broad activities to be carried out by the Systems Integrator and the timelines from the date of Work Order are given in the table below. "T" stands for the date of issue of the Work Order.

Sr. No.	Activity	Timelines
1.	Mobilization of Resources, Preparation of the Inception Report	T + 3 weeks
2.	Prepare the Detailed Technical Architecture of the Overall System in consultation with all the Stakeholders	T + 7 weeks
3.	Prepare FRS for all the work streams, Finalize Reporting Formats / Base Rules	T + 10 weeks
4.	Prepare SRS, SDD for all the Software Components	T + 14 weeks
5.	Supply, Installation, Configuration of various equipment, components, systems at Data Center	T+18 weeks
6.	Acceptance Testing (AT) for Data Center Equipment	T+22 weeks
7.	Training and Capacity Building for the relevant PSCDCL / PMC officials	T+22 weeks
8.	Final Acceptance Test (FAT) for overall solution	T+24 weeks
9.	Formal Go Live for the Entire Project	T + 26 weeks
10.	Operations and Maintenance post Go-Live (A) : ABB Fiber Connectivity (B) : Rest all Smart Elements	15 years for (A) 7 years for (B)

Successful Bidder should ensure delivery of all mentioned documents to remain compliant throughout the project duration.

3.10. Key Terms and Conditions

3.10.1. Advertisement and marketing guidelines

There would be opportunities for the Successful bidder to generate revenue from advertisement and marketing strategies from the implementation of network of smart elements. However should obtain approval from PMC before undertaking any advertisement and marketing opportunities related to the project. The Successful bidder is also responsible for safeguarding the aesthetics of PMC and shall not compromise on any tangible or intangible assets of PSCDCL/PMC while undertaking these advertising or marketing campaigns. The SI need to follow following guidelines:

i. Successful bidder will be responsible for advertisement and marketing of Network of Smart elements initiative carried out with due consent and approval from PSCDCL/ PMC

ii. PSCDCL/ PMC will approve Successful bidder's advertisement strategy and execution plan to ensure that users are not inundated with advertisements to an extent that it impacts user experience.

iii. Successful bidder need to take approval from PSCDCL/ PMC before publishing any advertisement in any form and on any physical or virtual space within PMC. PSCDCL/ PMC would supervise the content with respect to violations of DoT guidelines.

iv. Successful bidder will not self-proclaim the ownership for carrying out activities under the network of Smart Elements project in the form of advertisement or marketing activities without the permission from PSCDCL/ PMC.

v. The Successful bidder will not be permitted to use any tangible or intangible assets of PMC for advertisement or marketing purposes without approval from PSCDCL/ PMC. The Successful bidder need to take necessary approvals with respect to the Content, location/ web-space, Size, Duration of the advertisement,

vi. Any damages caused due to advertisement should be borne by the Successful bidder

vii. The revenue generated from advertising and marketing activities need to be reported to PSCDCL/ PMC on a periodic basis as decided by the project implementation committee.

viii. Successful bidder is required to take utmost care of aesthetics of PMC at all the times and acquire appropriate approvals from PSCDCL/ PMC before conducting any public work, advertising, infrastructure, revenue generation mechanism, etc.

ix. Successful bidder should ensure that all manual and digital advertisements, if any placed within the infrastructure created by the Successful bidder as part of the project, should be in accordance with the aesthetics and regulatory norms of PMC. The size location, content and design of any manual and digital advertisement must be reviewed and approved by PSCDCL/ PMC before installation.

x. The Successful bidder can create innovative and incremental revenue streams through advertisements without impacting the privacy of users.

3.10.2. Terms of Operations and Maintenance

i. The entire hardware & software infrastructure required for implementation of Smart Elements must be installed &operationalizedby the successful bidderin the city area as per the timelines specified in the RFP.

ii. It is also the responsibility of the successful bidder to operationalize, maintain and monetize these smart elements for a period of 7 Years, except ABB Fiber Network. The ABB

Fiber Network must be maintained by the successful bidder for period of 15 years. All necessary hardware, software, licenses etc. IPR will be in the name of PMC/ PSCDCL.

iii. Successful bidder must ensure that none of the items/ elements is at its end of life while handing over to PSCDCL/ PMC after completion of designated duration. All the items/ elements should at least have 5 years of life remaining at the time of handover.

iv. While handling over the completely working and functional network and systems, successful bidder must ensure that OEM of all hardware/software/ equipment are contractually bound to provide support for repair/replacement/availability of its spare parts for further five years (total 12 years at similar rates). It shall be part of exit plan to submit letter from OEMs in this regard.

v. Successful bidder shall provide OEM's letter binding them to provide support for repair/replacement/ availability of spare parts for at least 07 years.

vi. Successful bidder shall make the details of new technologies, new hardware available in the market to PSCDCL/ PMC.Both, PMC/PSCDCL and SI, in agreement, will take decision of new technology/ hardware implementation in case any new/ advanced technology comes up during the contract period.

4. Annexure #1: Proposed Locations for Deployment of Smart Elements in Pune City

4.1. City Wi-Fi

List of Hospitals, Gardens and Roads

Assumptions: Consider the distance between Access Points:

1. For gardens: 100 meters
2. For roads: 300 meters
3. For hospitals: 100 meters

Successful bidder should install about 200 hotspot locations (actual number to be assessed after survey) on these mentioned key roads and should provide atleast 3 access points on each of these locations with distance amongst them not more than 300 meters. Under this reference guidelines, only approximate considerations are given but applicant needs to propose the additional quantity as per their site survey and SLA compliances but reduction can be maximum up to 10%. Applicants are advised to conduct a survey and propose the solution as per SLA criteria.

List of Hospitals in Pune City

#	HOSPITALS	Latitude & Longitude
1	G.B.Indumati Manilal Khanna	18.492514, 73.86659600000007
2	Chris Rock Edward Paul	18.577046,73.899023
3	Late.Dadasaheb Gaikwad	18.52478,73.865128
4	Rajarshi Shahu Maharaj	18.527779,73.866596
5	Late. Lokshahir Annabhau Sathe	18.549639,73.890636
6	Dr.Kotnis Health Centre	18.511916,73.857927
7	Late. Babusaheb Genuji Kawde Patil	18.537865,73.898495
8	Kalas Hospital	18.578065,73.874967
9	BharatRatna Dr.Babasaheb Ambedkar	18.496273,73.870225
10	Late. Savitribai Phule	18.504919,73.861017
11	Late. Namdevrao Shivarkar	18.497288,73.899842
12	Late. Annasaheb Magar	18.503137,73.926533
13	Late. Jayabai Nanasaheb Sutar	18.503696,73.807763
14	Late.Kalavatibai Malave	18.514872,73.84675
15	Late.Balaji Rakhmaji Gailkwad	18.509075,73.86526
16	Siddharth Hospital	18.572202,73.878733
17	PMC Hospital, Bibwewadi, Ward no.72, Pune	18.461455,73.868889
18	Bharatratna Late. Rajiv Gandhi	18.545672,73.883888
19	Kamala Nehru Hospital(General Hospital)	18.52283,73.86199

20	Late.Anandibai Narhar Gadgil	18.50236,73.838381
21	lc,vcm,vcm,	18.571113, 73.83828700000004
22	Late.Bindu Madhav Thakare	18.496546,73.816307
23	Aundh Kutir	18.562849,73.810011
24	Chhatrapati Shahu Maharaj	18.485574,73.899034
25	Hutatma Babu Genu	18.515846,73.859785
26	Late. Bartakke	18.488899,73.795546
27	Dr.Naidu Hospital	18.53139,73.869151
28	Late.Shivshankar Pote	18.476546,73.856028
29	Late. Mukundrao Lele	18.519798,73.854413
30	Lions Club Hospital	18.497499,73.853927
31	Late. Vijayabai Shirke Health Centre	18.487144,73.815247
32	Late.Jangalrao Kondiba Amrale	18.522776,73.852546
33	Late.Rohidas Kirad	18.511283,73.868672
34	Late.Damodarraoji Galande Patil	18.551879,73.896929
35	Late. Baburao Genba Shewale	18.56278, 73.83264899999995
36	Late. Minatai Thakre	18.475938,73.889504
37	Late. Mamasaheb Badade	18.515553,73.867725
38	Late. Matoshri Ramabai Ambedkar	18.502957,73.850024
39	Late. Yashwant Vishnu Tharkade	18.506644,73.832802
40	Late. ChanduMama Sonawane	18.505766,73.868816
41	Dr. Homi J. Bhabha	18.529196,73.833358
42	Late. Sakharam Kundlik Kodre	18.533965,73.927263
43	Late. Sahdev Eknath Nimhan	18.53777,73.795969
44	Dr. Dalvi	18.533092,73.848908
45	Late. Sundarabai Ganpat Raut	18.511619, 73.82013699999993
46	PMC Hospital, In front of Gulmohar society, Kharadi	18.551218, 73.93892900000003
47	Dr Sunil Hospital	18.517107048858083, 73.80707312695313

List of Gardens in Pune City

#	Garden	Latitude& Longitude
1	Maharashtra Housing Board No.2	18.5613,73.895327
2	Panchavati	18.532692,73.812921
3	Ganpati Mandir	18.57683,73.89431

4	S.No. 37, Santosh Nagar	18.577593,73.885779
5	Chittaranjan Vatika	18.532534,73.838615
6	Kantishalaka Aruna Asaf Ali Udyan	18.492939,73.863033
7	Dr. Babasaheb Ambedkar	18.524864,73.871661
8	Honble. Jyotiba Phule	18.55896,73.879148
9	Late. Sanjay Mahadev Nimhan	18.546552,73.79855
10	Samartha Ramdas	18.527255,73.83249
11	Chhatrapati Shivaji	18.569863,73.832778
12	Chandan Nagar	18.562398,73.935186
13	Matoshri. Ramabai Bhimrao Ambedkar	18.532901,73.878247
14	Chhatrapati Shivaji Maharaj, Sadashiv Peth	18.504527,73.853345
15	Morya	18.576937,73.892642
16	Sh.Abdul Hamid Ayurvedic Udyan	18.473664,73.895746
17	Viman Nagar	18.566227,73.916326
18	Koregaon Park	18.538348,73.897948
19	Mahatma Gandhi Udyan	18.542025,73.884782
20	Shri.Gajanan Maharaj	18.532046,73.821813
21	Maharashtra Housing Board No.1	18.563375,73.895821
22	Hutatma Smarak	18.555787,73.876789
23	Late. Marutrao Gaikwad	18.562744,73.810137
24	Saras baugh	18.501628,73.852881
25	Kamalnayan Bajaj	18.546185,73.852111
26	Dr. Shama Prasad Mukherjee	18.500285,73.830032
27	Pragati	18.450382,73.863227
28	Late. Smt.Gangubai Bhimale	18.48779,73.87481
29	Dr. Jay Prakash Narayan	18.527092,73.87421
30	Limca Jogging Track	18.541517,73.882701
31	Hazrat Siddiqui Shababa	18.520978,73.874081
32	Shahu Modak	18.533613,73.896112
33	Dr. GaddaSingh Cheema	18.544751,73.883656
34	Anna Hazare Anand Park	18.551302,73.926078
35	Late. Vithabai Pujari	18.493712,73.865995
36	Kishore Udyan	18.579794,73.894407
37	Late. Vitthalrao Shivarkar Udyan Jogging Track	18.498382,73.899974
38	Tirupati Campus, Dhanori	18.577684,73.888441
39	St.Mary Church	18.527458,73.905006

40	Late. Ramchanra Keshav Taware	18.498784,73.852784
41	Ramchandra Mane Rd, Ramkrishna Paramhans Nagar, Kothrud	18.507941, 73.80627000000004
42	Late.Vasantrao Eknath Bagul	18.491361,73.851094
43	Maharshi Valmiki	18.568968,73.880929
44	Late.Madhavrao Shinde	18.540947,73.853379
45	Indraprastha	18.550488,73.879955
46	Sharad Pawar	18.558472,73.898462
47	Lumbini Park	18.561483,73.896486
48	Late. Major Bhaskarrao Sakhojirao Shinde	18.561686,73.925665
49	Late. Prakash Narayan Bahirat	18.53109,73.827861
50	Late.Shakuntala Narayan Nikam	18.526583,73.825372
51	Model Colony Lake	18.529839,73.842468
52	Pankuvar Firodiya Sphurti	18.536298,73.833059
53	Late.Rajiv Gandhi Zoological Park	18.453985,73.860029
54	Shri. Shahu	18.521151,73.868163
55	Gul Poonawala	18.496617,73.876999
56	Late. Shankarrao Ranchandra Kaware	18.487505,73.854858
57	Chhatrapati Sambhaji Raje	18.521304,73.8471550
58	In front of Kalyani Nagar Steel	18.525302,73.909414
59	Late. Kakasaeb Gadgil	18.475986,73.854297
60	Late. Yashwantrao Chavan	18.492979,73.853508
61	Sant. Rohidas Udyan	18.503022,73.873936
62	Okaya Friendship , Late. P.L.Deshpande	18.493,73.837413
63	Lokmanyanagar Jogging Park	18.505412,73.846232
64	Shrimant Bhairavsingh Ghorpade Peth	18.50248,73.862309
65	Aaiappa	18.586318,73.887667
67	Shri. Sachin Tendulkar Jogging Track	18.504476,73.840911
68	Late. Vartak Udyan	18.51847,73.847844
69	Jijamata	18.519045,73.856446
70	Maharana Pratap	18.508292,73.853476
71	Late. Raja Mantri	18.506552,73.833336
72	Major. Shahid Pradip Tathawade	18.493773,73.827046
73	Kamla Nehru Park	18.518679, 73.83480699999996
74	Peshwe Urja	18.50235,73.851609
75	Late.Damodar Raoji Galande Patil	18.550539,73.902988

76	Shivaji Udyan	18.49109801181133, 73.9014217989502
77	Tingare Nagar Lane No. 14.	18.581193, 73.89667899999995
78	sarasbaug	18.507941, 73.80627000000004
79	Late. Tatyasaheb Thorat	18.504008, 73.81228799999997
80	Gandharv garden	18.5185035, 73.90739200000007
81	Katraj Sarpodyan	18.517025661701638, 73.80831767193604
82	Bharatratna Dr. Bhimsen Joshi	18.511476, 73.79134299999998

Key Road (stretches) in each ward office

#	Stretch Details	Start Point	End Point
1	Maldhakka to Sassoon Chowk	18.527664,73.863428	18.523985,73.870163
2	Sassoon Chowk to Railway Station	18.523985,73.870163	18.528207,73.873446
3	Alankar Chowk to Commissioner Police Office	18.528085,73.876209	18.52215,73.876153
4	RTO to Wadia College	18.529892,73.863514	18.533534,73.878803
5	Aurora Towers to Lal Deval	18.518193,73.879758	18.520482,73.872516
6	Blue Nile to Council Hall	18.521448,73.877537	18.528437,73.8792
7	Wadia College to Bund Garden	18.533534,73.878803	18.540888,73.883609
8	Ruby Hall to Akshay Complex	18.532018,73.876807	18.536524,73.875852
9	Ramabai Ambedkar Road	18.534632,73.873803	18.534663,73.879532
10	North Main Road	18.539301,73.885573	18.539118,73.903715
11	Big Cinema Kalyaninagar to Bishops School	18.545832,73.906043	18.554121,73.906118
12	Big Cinema to Central Avenue Kalyaninagar	18.545832,73.906043	18.547388,73.897621
13	Shastrinagar Chowk to Golf Club Chowk	18.552179,73.896473	18.552789,73.879715
14	Shastrinagar Chowk to Weikfield Chowk	18.552179,73.896473	18.558556,73.911172
15	Viman Nagar Chowk to Lunkad Towers	18.560877,73.918344	18.56755,73.918587
16	BSNL Exchange to Symbiosis	18.565079,73.918266	18.565079,73.910826
17	Kharadi Bypass to Sainath Nagar Chowk	18.562159,73.938578	18.539558,73.934566
18	Reilance Mart Kharadi to Kharadi Bus	18.550686,73.937355	18.548448,73.945016

	Depo		
19	Chandan Nagar Water Tank to SundarBai Marathe Vidyalay	18.561194,73.928029	18.557324,73.928206
20	Viman Nagar Chowk to Kharadi Bypass	18.562159,73.938578	18.560877,73.918344
21	Somnath Mandir to Wadgaon Sheri Gaothan	18.55879,73.921182	18.542923,73.923402
22	BT Kawade Road	18.528655,73.90611	18.51718,73.906856
23	Magarpatta Road	18.523544,73.9322	18.502586,73.927501
24	Shankershett Road	18.502159,73.876228	18.50045,73.858772
25	7 Loves Chowk to Power House Chowk	18.501447,73.869243	18.519546,73.868267
26	Narpatgiri Chowk to Apollo Theatre	18.522675,73.867472	18.52031,73.864843
27	Power House Chowk to Apollo Theatre	18.519536,73.868267	18.519526,73.864909
28	Apollo Theatre to Lal Mahal Shaniwarwada	18.519526,73.864909	18.51858,73.856583
29	Quarter Gate to Alpana Theatre	18.516279,73.871134	18.515389,73.864831
30	Ramoshi Gate to Kasturi Chowk	18.510429,73.868329	18.510582,73.8604
31	Ramoshi Gate to Try Luck Restaurant (MG Road)	18.510592,73.868586	18.507067,73.878569
32	Sant Harkadas Vidyamandir to Pudumji Police Chowky	18.505419,73.873178	18.510658,73.872121
33	Pudumji Road	18.510658,73.872121	18.511035,73.876381
34	M G Road	18.507067,73.878569	18.51839,73.87924
35	East Street	18.50695,73.879218	18.518193,73.879758
36	Fulenagar police station to MES Water Pumping Station	18.555107, 73.874342	18.559171,73.875935
37	Agrasen High School to RTO Office Fulenagar	18.557212, 73.876279	18.555631,73.881648
38	Vishrantwadi Police Station to Kalas Bus Stop	18.564475, 73.877515	18.575622,73.876356
39	Vishrantwadi Main Chowk to 509 Chowk	18.57251, 73.878277	18.575358,73.899209
40	Dhanori Lake (Dhanori Main Road) to Dhanori Octroi Naka	18.579831, 73.88182	18.596915,73.906502
41	Appasaheb Betalit Road (Vidyanagar)	18.575152, 73.897298	18.575463,73.8897
42	Gunjan Chowk to Jail Corner	18.545881, 73.888762	18.564774,73.894164
43	Nagpur Chawl Road	18.563091, 73.893161	18.560935,73.897999
44	Gunjan Chowk to Sadalbaba Dargah	18.545881, 73.888762	18.544462,73.87762

45	Loop Road (Golf Course Road Extension)	18.552219, 73.873395	18.55282,73.879747
46	Golf Club Road (Dr. Ambedkar Road)	18.55282, 73.879747	18.552606,73.889671
47	Yerawada Market Road	18.551883, 73.883875	18.549335,73.885811
48	Maharana Pratap Road (Phadke Houd to Kasturi Chowk)	18.519184,73.861537	18.510516,73.862101
49	Alpana Talkies to City Post Office	18.516106,73.862873	18.515664,73.856355
50	Mirza Gailb Road (Govind Halwai Chowk to Shivaji Road)	18.51308,73.861843	18.512652,73.857723
51	Laxminarayan Thetar Chawk to Maharashtra Mandal	18.496608,73.858189	18.496498, 73.867962
52	Poonawala Park to Salisbury Park Road	18.496701,73.877043	18.493384, 73.870874
53	Lullanagar Chowk to Gulmohar Park	18.483917, 73.883936	18.482546, 73.884021
54	Teen Hatti chowk to Panchawati	18.468439, 73.852956	18.473201, 73.855008
55	K.K Market to upper Indira Nagar	18.468337, 73.857929	18.469108, 73.863702
56	Swami Vivekanand Statue to Rajyog Soc Road	18.476995, 73.85716	18.473154, 73.85807
57	Light House to Gangadham (Federal Bank)	18.480866, 73.862874	18.48185, 73.876576
58	Bhagwandas Dugad Chawak to Vasant Bag	18.487081, 73.857585	18.480882, 73.861305
59	Shani Mandir Bibewewadi to State Bank Nagar co. Hsg.Soc	18.468491, 73.864116	18.46249, 73.865197
60	Upper Indiranagar Corner to VIT College Appar Indira Nagar	18.461076, 73.867476	18.464283, 73.867357
61	Dhankwadi Bus Stop to Gulab Nagar Chowk	18.465362, 73.85116	18.46613, 73.853234
62	Vinkar Sabhagraha to Yashwantrao Chavan Kaman	18.474287, 73.853528	18.47448, 73.855762
63	Pune-Satara Road to Balaji Nagar Pawar Hospital Road	18.465713, 73.858125	18.466072, 73.86014
64	Bharti Vidhayapeth (Dental collage) to Shri Ram Mandir	18.46031, 73.858145	18.459867, 73.863044
65	Bharti Vidhayapeth (medical collage road) to Treemurti Chowk	18.457529, 73.853072	18.457037, 73.850355
66	Dhankwadi Road Chaitayan Nagar	18.462464, 73.85668	18.46395, 73.856461
67	Chintamani Dyanepeth Ambegaon Pathar to Tanaji nagar Dhankwadi	18.455994, 73.840035	18.457640, 73.840852

68	Datta Nagar Chowk to Jay Bhavani Chowk	18.449782, 73.849755	18.444592, 73.848465
69	Datta Nagar Bhuyare Marg to Khashaba Jadhav Path	18.450696, 73.851276	18.45404, 73.851103
70	Rajesh Soc to Rajesh Soc BGB Park	18.449491, 73.863102	18.450991, 73.864144
71	Sukhsagar Nagar rod Shri Ambhamata Mandir to Bhairvanath Apartment	18.455781, 73.869464	18.458401, 73.86942

4.2. Smart Parking

Below is the indicative list of locations for existing parking spots managed by PMC.

Sr No	Parking Place	Parking spaces as per vehicle type		Bus Spaces	Type	No of Entries	No of Exits	Remarks
		Two wheel	Four Wheel					
1.	Peshve Park Energy Udyan	180	20	-	Closed	1	-	-
2.	Gultekadi S No 699 parking	70	35	-	Closed	1	1	-
3.	Kondhwa Gera center Parking	30	20	-	Closed	1	-	-
4.	Parking in front of Alpana Talkies	100	-	-	Closed	-	-	-
5.	PL Deshmpande Udyan, Sinhgad Road	300	40	-	Closed	1	-	-
6.	Ganesh Kala Krida	700	60	-	Closed	1	1	-
7.	Sarasbaug Navloba Mandir	225	20	-	Closed	1	-	-
8.	Rajashri Shahu Bus stand, Swargate	600	35	10	Closed	1	-	-
9.	Bibwewadi Deision towers Parking			-	Closed	1	-	Used by Ward office for encroac hment storage
10.	LAte Rajiv gandhi Zoo	300	80	8	Closed	1	-	-
11.	Katraj Jakatnaka Parking	75	4	-	Closed	1	-	Not in use
12.	Katraj Dudh Dairy Parking	50	5	-	Closed	1	-	Not in use
13.	Yashwantrao Chavan Natyagruha	150	40	-	Closed	1	-	-
14.	Parking Near Manapa Bhavan			-		1	-	-
15.	Kamala Nehru Udyan Parking	80	46	-	Open	-	-	-
16.	Chhatrapati Sambhaji Raje Udyan Mechanical Parking		80	-	Closed	1	-	-

17.	Balgandharva Parking	140	40	-	Closed	1	-	-
18.	Chittaranjan Watika	15	8	-	Open		-	-
19.	Shivaji Nagar 660 Jangli maharaj Road	125	30	-	Closed	1	-	-
20.	Shivaji nagar, Shirole Road, FC Road Parking	100	35	-	Closed	1	1	-
21.	Parking Near Shivaji Nagar FC Road	494	117	-	Closed	1	-	-
22.	Parking Near Shivaji Nagar, Mosac Commercial Complex	365	17	-	Closed	1	-	-
23.	Rajashri Shahu Udyan, Somwar Peth	30	12	-	Closed	1	-	-
24.	Mahatma Gandhi Udyan, Bund Garden	-	-	-	Closed	1	-	-
25.	Narayan Peth, Velankar School	300	100	-	Closed	1	1	-
26.	Pune Manapa bhavan Parking	125	30	-	Closed	1	1	-
27.	Hamalwada, Narayanpeth Parking	900	180	-	Closed	1	1	-
28.	Babu Genu Parking	1000	200	-	Closed	1	1	-
29.	Mahatma Phule Mandai (Minarva)	350	250	-	Closed	1	-	-
30.	Pune Station, Moledina Road	1350	400	29 Bus + 74 Taxi	Closed	1	1	-
31.	Bopodi Octroi Post	100	50	-	Closed	1	1	-
32.	Sangam Pool	200	20	-	Open	1	-	-

4.3. List of Emergency Box/ Panic Buttons

Below is the indicative list of locations for installation of emergency call box. Some of the locations may change during actual implementation based on communication from PSCDCL/ PMC.

#	Stretch of Road in PMC Limits	#	Locations where PA system required
1	Pune Solapur Road	1	Ravi Darshan
		2	Noble Hopital junction
		3	Bhairoba Nala Square
		4	Mummadevi Square
		5	Golibar Square
2	Magarpatta Road	6	Mundhwa Road Junction
		7	Reliance Mart Junction
3	Pune Saswad Road	8	Hadapsar Gaadital
		9	Fursungi kaman
		10	Matarwadi Phata
4	Bhairoba Nala to Chandralok junction	11	Lulla Nagar Square
		12	Gangadham Square
		13	Chadralok Hospital Square
5	Katraj Mantarwadi Bypass	14	katraj Bypass Square
		15	Khadi machine Square
		16	Undri Junction
		17	Pisoli Square
6	Golibar to Khadi Machine Square	18	Jyoti Hotel Square
7	Seven Loves Square to Gokul Nagar	19	Seven loves Square
		20	Wakhar Mahamandal Square
8	Pune Satara Road	21	Katraj bypass Square
		22	Market Yard Junction
		23	Pushpamangal Square
		24	Jedhe Square
9	Jendhe Chowk Sinhgad Road	25	Sawarkar Square
		26	Sinhgad Road Junction
		27	Rajaram Bridge Junction
		28	Vadgaon Bridge
		29	Nanded City
10	Katraj Mumbai bypass	30	Navale Bridge
		31	Varje Bridge
		32	Chandani Square
		33	Sadanad Hotel Square
		34	Sinhgad Road Junction
		35	Tilak Square
11	Khandojibaba Chowk -Warje junction-Karve Road	36	Khandojibaba Square
		37	Nalstop Square

		38	Karishma Society Square
		39	Karve Statue Square
		40	Ambedkar Square
		41	Warje Square
12	Paud Road- Paud Phata to Chandani Chowk	42	Paud Road junction
		43	Kothrud police Station Junction
13	Nal Stop to Senapati Bapat Road	44	V.S. Khandekar Square
		45	Shivaji Housing Square
14	FC Road Khandojibaba Square to Chafekar Square	46	Goodluck Square
		47	Jnanshware Paduka Square
		48	Chafekar Square
15	JM Road - Sancheti to Khandojibaba Square	49	Sancheti Square
		50	Jhanshi Rani Square
16	Ganeshkhind Road-Simla to University	51	Simla Office Square
		52	Suryamukhi Datta Mandir Square
		53	Range Hills Corner Junction
		54	Pune university Square
17	University Square to Rajic Gandhi Bridge-Aundh Road	55	Bremen Square
		56	Rajiv Gandhi Bridge
18	University Square to Sadanad, Baner Road	57	Abhiman Shree Junction
		58	Baner Phata Junction
		59	Symantec junction
		60	Ganraj Mandal office Junction
19	University Square-Chandani Chowk- Pashan Road	61	Abhiman Shree Junction
		62	Shivaji Square, Pashan
		63	S K Ranwara Square
20	Shivaji Square Pashan - Susgaon, Sus Road	64	Balaji Chowk
		65	Suskhind Bridge
		66	Susgaon
21	Old Pune Mumbai Highway	67	Jahangir Hospital Square
		68	RTO Square
		69	Engineering College Square
		70	Church Khadki Railway Station
		71	Bopodi square
23	Shahir Amar to Lashkar	72	Shahir Amar Shaikh Square
		73	Maldhakka Square
		74	Bolhai Square Collector Office
		75	Nehru Square
		76	Sadhu Wasvani Square
		77	Alankar Square
24	Jedhe Square Tilak Square-Tilak Road	78	Puram Square
		79	SP College Square

25	Jamnalal Bajaj Statue- Gadgil Square Bajiroa Road	80	Bajaj Statue Square
		81	Shanipar Square
		82	Appa Balwant Square
		83	Gadgil Statue Square
26	Gadgil Statue Jedhe Shivaji Road	84	Jijamata Square
		85	Budhwar Square
		86	Belbaug Square
		87	Gotiram Bhaiyya Square
		88	Phadgate Police Station
		89	Raashtrabhushan Square
27	Tilak Square to Nehru Road Junction Laxmi Road	90	Saint Kabir Square
		91	Nanapeth Square
		92	Tamboli Masjid Square
		93	Moti Square
		94	Sevasadan Square
28	Tilak Road Tilak Square to Budhwar Square -Kelkar Square	95	Takle Havli Square
29	Tilak Square to Chitale Bandhu Corner- kumthekar Square	96	Chitale Bandhu Corner
30	Pune Station Seven Loves-Nehru Road	97	Power House Square
		98	Ramoshi Gate Police Station
		99	Bahubali Square
32	Pune Ahmednagar Road (Parnakuti- Kharadi Bypass)	100	Parnakuti Square
		101	Gunjan Square
		102	Shastrinagar Square
		103	Vadgaon Sheri Square
		104	Viman nagar Square
		105	Kharadi Bypass Junction
33	Bund Garden Road- Jahangir Square to Tarkeshwar Square	106	Mangaldas Square
		107	Dr. Ambedkar Setu Square
34	Mobaj Square to koregaon Park junction- mundhwa Junction	108	Hotel blue Diamond Square
		109	Koregaon Park junction
		110	ABC Farm house Square
		111	Tadigutta Square
35	Patil Estate to Dighi -Alandi Road	112	Patil Estate Square
		113	Sadalbaba Square
		114	Chandrama Square
		115	Mental Corner Square
		116	Vishrantwadi junction
36	Gunjan to Airport -New Airport Road	117	Golf Club Junction
		118	in front of Yerwada Post office
		119	509 Square

		120	Petrol Satha Square
		121	Square in front Airport
37	New Airport Road	122	Dorabji mall Square
		123	Symbiosis college Square
		124	Datta Mandir Square
		125	Shri krishna Hotel Square
38	Other Imporatant Locations	126	Dr. Ambedkar College Square, yerwada
		127	In front of PMC
		128	Kumbhar Ves Square
		129	Rajarshi shahu bus Stand, Swargate
		130	PMPML Bus Depot Deccan
		131	PMPML Bus Depot Katraj
		132	Pune Railway Station
		133	Shivaji Nagar Railway Station
		134	Swargate ST Stand
		135	Shivaji Nagar ST Stand
		136	Pune Station ST Stand

4.4. Public Addressing System

Below is the indicative list of locations for installation of public addressing system (actual number to be assessed after survey).

#	Strech of Road in PMC Limits	#	Locations where PA system required
1	Pune Solapur Road	1	Ravi Darshan
		2	Noble Hopital junction
		3	Bhairoba Nala Square
		4	Mummadevi Square
		5	Golibar Square
2	Magarpatta Road	6	Mundhwa Road Junction
		7	Reliance Mart Junction
3	Pune Saswad Road	8	Hadapsar Gaadital
		9	Fursungi kaman
		10	Matarwadi Phata
4	Bhairoba Nala to Chandralok junction	11	Lulla Nagar Square
		12	Gangadham Square
		13	Chadralok Hospital Square
5	Katraj Mantarwadi Bypass	14	katraj Bypass Square
		15	Khadi machine Square
		16	Undri Junction
		17	Pisoli Square
6	Golibar to Khadi Machine Square	18	Jyoti Hotel Square
7	Seven Loves Square to Gokul Nagar	19	Seven loves Square
		20	Wakhar Mahamandal Square
8	Pune Satara Road	21	Katraj bypass Square
		22	Market Yard Junction
		23	Pushpamangal Square
		24	Jedhe Square
9	Jendhe Chowk Sinhgad Road	25	Sawarkar Square
		26	Sinhgad Road Junction
		27	Rajaram Bridge Junction
		28	Vadgaon Bridge
		29	Nanded City
10	Katraj Mumbai bypass	30	Navale Bridge
		31	Varje Bridge
		32	Chandani Square
		33	Sadanad Hotel Square
		34	Sinhgad Road Junction
		35	Tilak Square
11	Khandojibaba Chowk -Warje junction-Karve Road	36	Khandojibaba Square
		37	Nalstop Square
		38	Karishma Society Square
		39	Karve Statue Square
		40	Ambedkar Square
		41	Warje Square

12	Paud Road- Paud Phata to Chandani Chowk	42	Paud Road junction
		43	Kothrud police Station Junction
13	Nal Stop to Senapati Bapat Road	44	V.S. Khandekar Square
		45	Shivaji Housing Square
14	FC Road Khandojibaba Sqaure to Chafekar Sqaure	46	Goodluck Square
		47	Jnanshware Paduka Square
		48	Chafekar Square
15	JM Road - Sancheti to Khandojibaba Square	49	Sancheti Sqaure
		50	Jhanshi Rani Square
16	Ganeshkhind Road-Simla to University	51	Simla Office Square
		52	Suryamukhi Datta Mandir Square
		53	Range Hills Corner Junction
		54	Pune university Square
17	University Square to Rajic Gandhi Bridge-Aundh Road	55	Bremen Square
		56	Rajiv Gandhi Bridge
18	University Square to Sadanad, Baner Road	57	Abhiman Shree Junction
		58	Baner Phata Junction
		59	Symantec junction
		60	Ganraj Mandal office Junction
19	University Square-Chandani Chowk- Pashan Road	61	Abhiman Shree Junction
		62	Shivaji Square, Pashan
		63	S K Ranwara Square
20	Shivaji Sqaure Pashan - Susgaon, Sus Road	64	Balaji Chowk
		65	Suskhind Bridge
		66	Susgaon
21	Old Pune Mumbai Highway	67	Jahangir Hospital Sqaure
		68	RTO Sqaure
		69	Engineering College Square
		70	Church Khadki Railway Station
		71	Bopodi square
23	Shahir Amar to Lashkar	72	Shahir Amar Shaikh Sqaure
		73	Maldhakka Square
		74	Bolhai Sqaure Collector Office
		75	Nehru Square
		76	Sadhu Wasvani Square
		77	Alankar Sqaure
24	Jedhe Sqaure Tilak Square-Tilak Road	78	Puram Sqaure
		79	SP College Square
25	Jamnalal Bajaj Statue- Gadgil Square Bajiroa Road	80	Bajaj Statue Square
		81	Shanipar Square
		82	Appa Balwant Square
		83	Gadgil Statue Square
26	Gadgil Statue Jedhe Shivaji Road	84	Jijamata Square
		85	Budhwar Square
		86	Belbaug Sqaure

		87	Gotiram Bhaiyya Sqaure
		88	Phadgate Police Station
		89	Raashtrabhushan Sqaure
27	Tilak Sqaure to Nehru Road Junction Laxmi Road	90	Saint Kabir Sqaure
		91	Nanapeth Square
		92	Tamboli Masjid Square
		93	Moti Sqaure
		94	Sevasadan Square
28	Tilak Road Tilak Square to Budhwar Sqaure -Kelkar Sqaure	95	Takle Havli Square
29	Tilak Sqaure to Chitale Bandhu Corner- kumthekar Sqaure	96	Chitale Bandhu Corner
30	Pune Station Seven Loves-Nehru Road	97	Power House Square
		98	Ramoshi Gate Police Station
		99	Bahubali Square
32	Pune Ahmednagar Road (Parnakuti- Kharadi Bypass)	100	Parnakuti Sqaure
		101	Gunjan Sqaure
		102	Shastrinagar Sqaure
		103	Vadgaon Sheri Sqaure
		104	Viman nagar Sqaure
		105	Kharadi Bypass Junction
33	Bund Garden Road- Jahangir Sqaure to Tarkeshwar Sqaure	106	Mangaldas Sqaure
		107	Dr. Ambedkar Setu Sqaure
34	Mobaj Square to koregaon Park junction- mundhwa Junction	108	Hotel blue Diamond Sqaure
		109	Koregaon Park junction
		110	ABC Farm house Sqaure
		111	Tadigutta Sqaure
35	Patil Estate to Dighi -Alandi Road	112	Patil Estate Square
		113	Sadalbaba Sqaure
		114	Chandrama Sqaure
		115	Mental Corner Square
		116	Vishrantwadi junction
36	Gunjan to Airport -New Airport Road	117	Golf Club Junction
		118	in front of Yerwada Post office
		119	509 Square
		120	Petrol Satha Sqaure
		121	Square in front Airport
37	New Airport Road	122	Dorabji mall Square
		123	Symbiosis college Square
		124	Datta Mandir Sqaure
		125	Shri krishna Hotel Sqaure
38	Other Imporatant Locations	126	Dr. Ambedkar College Square, yerwada
		127	In front of PMC
		128	Kumbhar Ves Square
		129	Rajarshi shahu bus Stand, Swargate

		130	PMPML Bus Depot Deccan
		131	PMPML Bus Depot Katraj
		132	Pune Railway Station
		133	Shivaji Nagar Railway Station
		134	Swargate ST Stand
		135	Shivaji naagar ST Stand
		136	Pune Station ST Stand

4.5. Environmental Sensors

- **List of exiting environmental sensors installed by IITM, Pune**
  1. **Sensor Locations in PMC Limits: total 5**
     a. IITM Pashan
     b. IMD Shivaji Nagar
     c. Pune Airport- Air Force Base
     d. Katraj- Bhati Vidyapeeth
     e. Hadapsar- Lohiya Garden
  2. **LED Display Board Locations: total 8**
     a. IITM Pashan
     b. IMD Shivaji Nagar
     c. Pune Airport- Air Force Base
     d. Katraj- Rajiv Gandhi Zoo
     e. PMC Main Building
     f. Swargate- PMPML Bus Stand
     g. Alka Talkie Chowk- Sambhaji Police Station
     h. Mandai- Parking, In front of Mandai

- **List of proposed environmental sensors and data LED displays**

Sr. No.	Stretch of Road in PMC Limits	#	Location of required Variable Messaging Display
1.	Pune Solapur Road	1.	Noble Hopital junction
		2.	Golibar Square
2.	Bhairoba Nala to Chandralok junction	3.	Lulla Nagar Square
3.	Seven Loves Square to Gokul Nagar	4.	Seven loves Square
4.	Pune Satara Road	5.	Market Yard Junction
5.	Jendhe Chowk Sinhgad Road	6.	Sinhgad Road Junction
		7.	Nanded City
6.	Katraj Mumbai bypass	8.	Chandani Square (CHANDANI CHOWK)
		9.	Sadanad Hotel Square
7.	Khandojibaba Chowk -Warje junction-Karve Road	10.	Nalstop Square
		11.	Karve Statue Square
8.	Nal Stop to Senapati Bapat Road	12.	V.S. Khandekar Square
9.	FC Road Khandojibaba Square to Chafekar Square	13.	Goodluck Square
10.	JM Road - Sancheti to Khandojibaba Square	14.	Jhanshi Rani Square
11.	Ganeshkhind Road-Simla to	15.	Simla Office Square (IMD, available)

	University	16.	Pune university Square
12.	University Square to Rajic Gandhi Bridge-Aundh Road	17.	Bremen Square
13.	University Square to Sadanad, Baner Road	18.	Symantec junction
14.	Shivaji Square Pashan - Susgaon, Sus Road	19.	Susgaon
15.	Old Pune Mumbai Highway	20.	RTO Square
16.	Shahir Amar to Lashkar	21.	Sadhu Wasvani Square
17.	Jedhe Square Tilak Square-Tilak Road	22.	SP College Square
18.	Jamnalal Bajaj Statue- Gadgil Square Bajirao Road	23.	Bajaj Statue Square
		24.	Appa Balwant Square
19.	Tilak Square to Chitale Bandhu Corner- kumthekar Square	25.	Chitale Bandhu Corner
20.	Pune Station Seven Loves- Nehru Road	26.	Power House Square
21.	Pune Ahmednagar Road (Parnakuti- Kharadi Bypass)	27.	Gunjan Square
		28.	Vadgaon Sheri Square
		29.	Viman nagar Square
22.	Bund Garden Road- Jahangir Square to Tarkeshwar Square	30.	Dr. Ambedkar Setu Square
23.	Mobaj Square to koregaon Park junction- mundhwa Junction	31.	Hotel blue Diamond Square
		32.	ABC Farm house Square
24.	Patil Estate to Dighi -Alandi Road	33.	Vishrantwadi junction
25.	Gunjan to Airport -New Airport Road	34.	Golf Club Junction
		35.	Square in front Airport (already installed)
26.	New Airport Road	36.	Ramwadi Square
		37.	Datta Mandir Square
		38.	Shri krishna Hotel Square
27.	Other Important Locations	39.	Dr. Ambedkar College Square, Yerwada
		40.	Rajarshi shahu bus Stand, Swargate
		41.	PMPML Bus Depot Deccan
		42.	PMPML Bus Depot Kothrud
		43.	PMPML Bus Depot Katraj
		44.	BRTS Terminal 1 Sangamwadi

		45.	BRTS Terminal Vishrantwadi
		46.	Pune Railway Station
		47.	Shivaji Nagar Railway Station
		48.	Swargate ST Stand
		49.	Shivaji Nagar ST Stand
		50.	Pune Station ST Stand

4.6. Variable Messaging Displays

Sr. No.	Stretch of Road in PMC Limits	#	Location of required Variable Messaging Display
1	Pune Solapur Road	1.	Ravi Darshan
		2.	Noble Hopital junction
		3.	Bhairoba Nala Square
		4.	Mummadevi Square
		5.	Golibar Square
2	Magarpatta Road	6.	Mundhwa Road, Magarpatta Square
		7.	Reliance Mart Junction
3	Pune Saswad Road	8.	Hadapsar Gaadital
		9.	Fursungi Kaman
		10.	Matarwadi Phata
4	Bhairoba Nala to Chandralok junction	11.	Lulla Nagar Square
		12.	Gangadham Square
		13.	Chadralok Hospital Square
5	Katraj Mantarwadi Bypass	14.	Katraj Bypass Square
		15.	Khadi machine Square
		16.	Undri Junction
		17.	Pisoli Square
6	Golibar to Khadi Machine Square	18.	Jyoti Hotel Square
		19.	In front of kondhwa Police Station
7	Seven Loves Square to Gokul Nagar	20.	Seven loves Square
		21.	Dayas plot Square
		22.	Wakhar Mahamandal Square
8	Pune Satara Road	23.	Katraj bypass Square
		24.	Market Yard Junction
		25.	Pushpamangal Square
		26.	Jedhe Square
9	Jendhe Chowk Sinhgad Road	27.	Sawarkar Square
		28.	Sinhgad Road Junction
		29.	Rajaram Bridge Junction
		30.	Vadgaon Bridge
		31.	Nanded City
10	Katraj Mumbai bypass	32.	Navale Bridge

		33.	Varje Bridge
		34.	Chandani Square
		35.	Sadanad Hotel Square
		36.	River Bridge, opposite to Holiday Inn Hotel
		37.	Sinhgad Road Junction
		38.	Sendatta Square
		39.	Tilak Square
11	Khandojibaba Chowk -Warje junction-Karve Road	40.	Khandojibaba Square
		41.	Nalstop Square
		42.	Karishma Society Square
		43.	Karve Statue Square
		44.	Ambedkar Square
		45.	Warje Square
		46.	Ganapati Matha Square
12	Paud Road- Paud Phata to Chandani Chowk	47.	Paud Road junction
		48.	Anand Nagar Square
		49.	Kothrud police Station Junction
13	Nal Stop to Senapati Bapat Road	50.	V.S. Khandekar Square
		51.	Shivaji Housing Square
14	FC Road Khandojibaba Square to Chafekar Square	52.	Goodluck Square
		53.	Jnanshware Paduka Square
		54.	Chafekar Square
15	JM Road - Sancheti to Khandojibaba Square	55.	Sancheti Square
		56.	Jhanshi Rani Square
		57.	Natraj Square
16	Ganeshkhind Road-Simla to University	58.	Simla Office Square
		59.	Suryamukhi Datta Mandir Square
		60.	Range Hills Corner Junction
		61.	Pune university Square
17	University Square to Rajic Gandhi Bridge-Aundh Road	62.	Bremen Square
		63.	Rajiv Gandhi Bridge
18	University Square to Sadanad, Baner Road	64.	Abhiman Shree Junction
		65.	Baner Phata Junction
		66.	Symantec junction
		67.	Balewadi Junction

		68.	Ganraj Mandal office Junction
19	University Square-Chandani Chowk- Pashan Road	69.	Abhiman Shree Junction
		70.	Shivaji Square, Pashan
		71.	S K Ranwara Square
20	Shivaji Square Pashan - Susgaon, Sus Road	72.	Balaji Chowk
		73.	Suskhind Bridge
		74.	Susgaon
21	Old Pune Mumbai Highway	75.	Jahangir Hospital Square
		76.	RTO Square
		77.	Engineering College Square
		78.	Poultry farm Square
		79.	Church Khadki Railway Station
		80.	Bopodi square
22	Bopodi Holkar Bridge- Khadki Bajar	81.	Aathmula Road Junction
		82.	Holkar Bridge
23	Shahir Amar to Lashkar	83.	Shahir Amar Shaikh Square
		84.	Maldhakka Square
		85.	Bolhai Square Collector Office
		86.	Nehru Square
		87.	Sadhu Wasvani Square
		88.	Alankar Square
24	Jedhe Square Tilak Square-Tilak Road	89.	Puram Square
		90.	SP College Square
		91.	Sahitya Parishad Square
25	Jamnalal Bajaj Statue- Gadgil Square Bajiroa Road	92.	Bajaj Statue Square
		93.	Maharana Pratap Garden
		94.	Shanipar Square
		95.	Appa Balwant Square
		96.	Gadgil Statue Square
26	Gadgil Statue Jedhe Shivaji Road	97.	Jijamata Square
		98.	Budhwar Square
		99.	Belbaug Square
		100.	Gotiram Bhaiyya Square
		101.	Phadgate Police Station
		102.	Raashtrabhushan Square

27	Tilak Square to Nehru Road Junction Laxmi Road	103.	Saint Kabir Square
		104.	Nanapeth Square
		105.	Tamboli Masjid Square
		106.	Moti Square
		107.	Sevasadan Square
		108.	Vijay Talkies
28	Tilak Road Tilak Square to Budhwar Square -Kelkar Square	109.	Takle Havli Square
29	Tilak Square to Chitale Bandhu Corner- kumthekar Square	110.	Chitale Bandhu Corner
30	Pune Station Seven Loves-Nehru Road	111.	Power House Square
		112.	Ramoshi Gate Police Station
		113.	Bahubali Square
31	Ramoshi Gate, Gotiram Bhaiyya Square- Mirza Galib Square	114.	Govind Halwai Square
		115.	Dawre Square
32	Pune Ahmednagar Road (Parnakuti- Kharadi Bypass)	116.	Parnakuti Square
		117.	Gunjan Square
		118.	Shastrinagar Square
		119.	Vadgaon Sheri Square
		120.	Viman nagar Square
		121.	Kharadi Bypass Junction
		122.	Old Kharadi Jakat Naka
33	Bund Garden Road- Jahangir Square to Tarkeshwar Square	123.	Mangaldas Square
		124.	Dr. Ambedkar Setu Square
		125.	Tarkeshwar Square
34	Mobaj Square to koregaon Park junction- mundhwa Junction	126.	Hotel blue Diamond Square
		127.	Koregaon Park junction
		128.	ABC Farm house Square
		129.	Tadigutta Square
35	Patil Estate to Dighi -Alandi Road	130.	Patil Estate Square
		131.	Sadalbaba Square
		132.	Chandrama Square
		133.	Mental Corner Square
		134.	Vishrantwadi junction
36	Gunjan to Airport -New Airport	135.	Golf Club Junction

	Road	136.	In front of Yerwada Post office
		137.	In front of Jail Road Police Station
		138.	509 Square
		139.	Petrol Satha Square
		140.	Square in front Airport
37	New Airport Road	141.	Dorabji mall Square
		142.	Symbiosis college Square
		143.	Ramwadi Square
		144.	CCD Square , Vimannagar
		145.	Datta Mandir Square
		146.	Shri krishna Hotel Square
38	Other Important Locations	147.	Dr. Ambedkar College Square, yerwada
		148.	In front of PMC
		149.	Kumbhar Ves Square
		150.	Rajarshi shahu bus Stand, Swargate
		151.	PMPML Bus Depot Deccan
		152.	PMPML Bus Depot Kothrud
		153.	PMPML Bus Depot Katraj
		154.	BRTS Terminal 1 Sangamwadi
		155.	BRTS Terminal Vishrantwadi
		156.	BRTS Terminal Old Kharadi Octroi Post
		157.	Pune Railway Station
		158.	Shivaji Nagar Railway Station
		159.	Swargate ST Stand
		160.	Shivaji naagar ST Stand
		161.	Pune Station ST Stand

Indicative List of Signals in PMC Area		
Sr No	**Particulars**	**PMC**
1	No of Signals for Vehicles	200
2	Pedestrian Signals	15
3	Proposed Signals	33

5. Annexure #2: BoM for Elements in RFP

5.1. City Wi-Fi

#	Item Description	Quantity / Unit Required	OEM Make	OEM Model / Version	Compliance (Y/N)
1	Wi-Fi Indoor Access Points (AP)				
2	Wi-Fi Outdoor Access Points (AP)				
3	**Wireless Controller (WLC)**				
	Hardware				
	Software				
	Licenses				
4	**Network Management System (NMS)**				
	Hardware				
	Software				
	Licenses (wired & wireless devices)				
5	**Centralized Authentication System**				
	Hardware				
	Software				
	Licenses				
6	Managed Gigabit LAN Switch 8 ports 802.3af				
7	Managed Gigabit LAN Switch 16 ports 802.3af				
8	Laptop				
9	PC				
10	PON Meter				
11	Power Meter				
12	Printer (Laser – All in One)				
13	UPS For Data Centre				
14	Integration of NMS (Sl. No. 4) with FTTH EMS				
15	**Miscellaneous & Documentation**				
15.1	Documentation Hard Copy (one set for each component)				
15.2	Documentation Soft Copy (CDs) (one set for each component)				

16	Any other Hardware required for successful commissioning of Wi-Fi Network (Item list to be included)				
17	Any other Software required for successful commissioning of Wi-Fi Network (Item list to be included)				

5.2. Smart Parking

#	Item Description	Quantity / Unit Required	OEM Make	OEM Model / Version	Compliance (Y/N)
1	Parking Sensors				
2	Cameras				
3	Booths				
4	Entry Devices				
5	Indicators				
6	Displays				
7	Barriers				
8	NFC Equipment				
9	Any other Hardware required for successful commissioning of Smart Parking System (Item list to be included)				
10	Any other Software required for successful commissioning of Smart Parking System (Item list to be included)				
11	Any other Miscellaneous item required for successful commissioning of Smart Parking System (Item list to be included)				

5.3. Variable Messaging Displays

#	Item Description	Quantity / Unit Required	OEM Make	OEM Model / Version	Compliance (Y/N)
1	Supply of full matrix, true colour, VMS to display text, pictogram and video play with suitable metal cabinet. (display size : 3x2 meters)				
2	Electrical connection at VMS site with required armored cable with laying complete.				
3	Supply of Suitable Mounting Structure to support the display unit (VMS) with proper Earthing.				
4	VMS work stations with UPS, GSM				
5	Modem and *Necessary Software* for VMS at Control Room				
6	Any other items if required for complete operation of VMS				
7	Installation &Commissioning Charge with proper earthing.				
8	Three years Onsite warranty with complete maintenance for Entire systems from the Date of Check Test &handover Of Entire Systems				

5.4. ABB Fiber Network

#	Item Description	Quantity / Unit Required	OEM Make	OEM Model / Version	Compliance (Y/N)
OFC & Closure					
1	Supply of Un-Armored Optical Fiber Cable (G.652 d, 96F)				
2	Supply of Armored Optical Fiber Cable (G.652 d, 24F)				
3	Supply of Splice Closure - 96F				
4	Supply of Splice Closure - 24F				
Protection					
5	Supply of warning tape for Laying underground				
6	Supply of 1* 100 mm GI steel Pipe for road crossing				
7	Supply of material for Concrete envelop for protection (Including construction material) (thickness = 15 cm)				
8	Supply of 150 mm dia half round				
9	Supply of 150 mm dia full round				
Ducts, DWC & Rope					
10	Supply HDPE sub duct (40/33 mm) and accessory materials				
11	Supply of 110mm DWC Pipe with accessories				
12	Supply of Nylon rope 6mm dia				
FDU & FDB					

13	Supply of wall mount Fiber Distribution Box (FDB) with pigtails				
14	Supply of Fiber Distribution Box (FDB) - 96 Port Rack Mount				
15	Supply of Fiber Distribution Box (FDB) - 288 Port Rack Mount				
Racks & Cabinets					
16	Supply of 6U Rack				
17	Supply of Rack - 42U with accessories				
18	Supply of IP 66 Rated Cabinet				
Shelter, UPS & Accessories					
19	Supply of Prefabricated Shelter as per specification, with Air conditioner				
20	Supply of Access Control System				
21	Supply of VSS				
22	10KVA Online Rackmount UPS with 8 Hours Backup				
23	200AH Batteries				
24	Battery Rack & Links & Battery Charger				
Switches					
	Mega Pop Switches				
25	Core Switch/Router				
26	MPLS Access-Layer router/Switch – Type 1				
27	1000BaseLX (10km) SFP (10km with SMF, 1310nm)				
28	LC-LC Fiber Patch Cord				

	10 Mtrs				
	Outdoor Rugged Switches				
29	Access Switch (Industrial)				
30	1000BaseLX (10km) SFP (10km with SMF, 1310nm)				
Miscellaneous					
31	Supply PVC pipe (OD = 25 mm) and accessory materials				
32	Supply flexible corrugated pipe (OD = 25 mm) and accessory materials				

5.5. Smart City Operations Center

#	Item Description	Quantity / Unit Required	OEM Make	OEM Model / Version	Compliance (Y/N)
1	LED based redundant video panel (3x2) (40 inches)				
2	Video Controller				
3	Operator Terminals (2x1) (23 inches)				
4	Fire and Smoke Detectors				
5	Workstations				
6	Access Control				
7	Furniture				
8	Integration with Police CCTV system for Camera feed				
9	Any other Miscellaneous item required for successful commissioning of Command Centre (Item list to be included)				
Data Center for Smart City Operations Center					
10	DC: Application & System Software				
11	DC: Management Application Software for Smart Parking				
12	Wi-Fi: Management Application Software for Wi-Fi (OSS/ BSS)				
13	DC - CCTV feed from Pune traffic police department				
14	DC - Onboard/Server Based Advanced Video Analytics Package				

15	DC - Onboard/Server Based Advanced Video Analytics Package Software for Crowd Monitoring (if not part of Pune Traffic Police surveillance)				
16	DC - Operation Center Software including sub module for incident management				
17	DC- Blade Chassis				
18	DC- • Application Servers • Recording Servers • Analytics Servers • Database Servers • Management Server				
19	DC- Operating Systems & DB License				
20	DC - CCTV- Monitoring Workstations				
21	Control Room- Control Room Video-wall Solution 70inch x8 Cubes				
22	DC- Data Center TOR Switch				
25	DC- WAN Services / Internet Router				
26	Wi-Fi- WLAN Controller				
27	DC- Network Management System and WLAN Management System				
28	DC- EMS				
29	DC- Networking Cost (Passive Components)				
30	DC- Access Control System for Control Room				
31	DC- Electrical Cabling & Necessary Illumination Devices				
32	DC- UPS (30 minute				

	backup) - 20 KVA				

6. Annexure #3: List of required manpower/ resources on the project

#	Manpower	Minimum Qualifications
1	Program Director	1. Minimum Education: MCA/ MBA/ M.Tech. from a reputed institute 2. Total Exp: At least 20 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computersandnetworking 5. Prior project management experience of at least 15 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 30 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of Smart City 8. Projects covering at least the initiatives mentioned in this RFP.
2	Program Manager	1. Minimum Education: MCA/ MBA/ M.Tech. from a reputed institute 2. Total Exp: At least 15 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computers and networking 5. Prior project management experience of at least 10 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 20 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of Smart City 8. Projects covering at least the initiatives mentioned in this RFP.
3	Functional Lead	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech / B.E. from a reputed institute 2. Total Exp: At least 10 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computers and networking 5. Prior project management experience of at least 8 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of Smart City Projects covering at least the initiatives mentioned in this RFP. 8. Proficient in MS Project (Word, Excel, PowerPoint)
4	Subject Matter	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech / B.E.

	Experts	from a reputed institute 2. Total Exp: At least 12 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have expert subject matter knowledge of Smart City related components 5. Prior project management experience of at least 8 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of Smart City Projects covering at least the initiatives mentioned in this RFP.
5	Technical lead	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech. / B.E. from a reputed institute 2. Total Exp: At least 10 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computers and networking 5. Prior project management experience of at least 8 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 6. Excellent writing, communication, time management andmulti-tasking skills 7. Project Experience of managing components of Smart City 8. Projects covering at least the initiatives mentioned in this RFP.
6	Full Time- on project- Project Manager	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech. / B.E. from a reputed institute 2. Total Exp: At least 10 yrs. 3. Languages known (Read, Write and Speak): Hindi, English 4. Should have operating knowledge of computers and networking 5. Prior project management experience of at least 7 years of handling large and complex projects, with at least one large scale project with Project Cost of minimum INR 10 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing components of Smart City Projects covering at least the initiatives mentioned in this RFP.
7	Full Time- on project- Functional Manager	1. Should have fundamental comprehension across areas such as Integrated Industry Standard Open Platform, Database management Systems, Wi-Fi, and related wired network infrastructure implementation and management, network management, security management, design and deployment of Citizen App and Citizen Portal, integration of Third Party Shared Services, Help-desk Services Management, Smart Parking, Command and Control Centre.

		2. Should be BE / B. Tech or higher from a premier institute with more than 7 years of work experience 3. Should have experience of at least three projects in the area of Public Wi-Fi, Smart Streetlights, Smart Parking, Command and Control Centre and Citizen Apps. 4. Proficient in MS Project (Word, Excel, Powerpoint)
8	Full Time- on project-Technical Manager	5. Should be BE / B. Tech or higher from a premier institute with more than 8 years of work experience 6. Should have fundamental comprehension across areas such as Integrated Industry Standard Open Platform, Database management Systems, Wi-Fi, and related wired network infrastructure implementation and management, network management, security management, design and deployment of Citizen App and Citizen Portal, integration of Third Party Shared Services, Help-desk Services Management, Smart Parking, Command and Control Centre. 7. Should have experience of at least three projects in the area of Public Wi-Fi, Smart Streetlights, Smart Parking, Command and Control Centre, CCTV Surveillance and Citizen Apps. 8. Proficient in MS Project (Word, Excel, Powerpoint)
9	Project Support	1. Should be BE / B. Tech or higher from a premier institute with more than 5 years of experience in technology projects 2. Proficient in MS office and MS Project. 3. Should have experience in government projects. 4. Should have worked in similar roles and at large scale IT/ITES Setup. 5. Should have experience in government projects. 6. Effective verbal communication skills (English, Marathi and Hindi).
10	Helpdesk Manager (Dedicated On premise)	1. Should have Bachelors in Computer Science or an equivalent IT degree 2. Should have working knowledge of technical support services IT, Service desk model and software 3. Proficient in MS office and MS Project 4. Should have experience in government projects 5. Should have worked in similar roles and at large scale IT Setup. 6. Effective verbal communication skills (English, Marathi and Hindi)
11	System Analyst	1. Should have Bachelors in Computer Science OR an equivalent IT degree and should have minimum one year experience in software project operations and maintenance 2. Proficient in MS office and MS Project 3. Effective verbal communication skills (English, Marathi and Hindi)

12	Security Engineer	1. MCA/ BE/ B.Tech with specialization in computers with minimum five year experience in Security Administration of large and complex IT/ITES/Telecom projects 2. Should have industry certifications for Security Administration 3. Should have experience in government projects 4. Effective verbal communication skills (English and Hindi)
13	Security Administrator	1. BE/ B.Tech or Diploma with specialization in computers with minimum three year experience in Security Administration of large and complex IT/ITES/Telecom projects 2. Should have industry certifications for Security Administration 3. Should have experience in government projects 4. Effective verbal communication skills (English, Marathi and Hindi)
14	Solution Architect	1. B.E/ B.Tech/ MCA/ M.Tech. with minimum 8 years of experience involving solution design, Should have been involved in installation of hardware and operating system, database and configuration, system maintenance 2. Should have experience in government projects 3. Should have worked in similar roles and at large scale IT Setup. 4. Proficient in MS office and MS Project 5. Effective verbal communication skills (English, Marathi and Hindi)
15	Database Developer	1. BE Computers or Diploma with specialization in computerswith minimum three years of experience in Databasedevelopment and database management 2. Minimum five years of experience in Database managementand administration 3. Should have experience in government projects. 4. Effective verbal communication skills (English and Hindi)
16	Database Administrator	1. MCA/ BE/ B.Tech with specialization in computers withminimum five years' experience in Database Administration 2. Minimum five years of experience in Database managementand administration 3. Should have experience in government projects. 4. Effective verbal communication skills (English and Hindi)
17	Network Engineer	1. Diploma in Computer Hardware and Networking with courseduration of minimum 1 year from Govt. recognized institution. 2. Minimum three years of experience in network implementationand network administration 3. Should have experience performing network testing,equipment testing, fault analysis, network repairs, etc. 4. Should have experience in government projects

18	Network Administrator	1. Master or Engineering Degree in Computer Hardware andNetworking with course duration of minimum 1 year from Govt.recognized institution. 2. Minimum five years of experience in network implementation and network administration of large and complexIT/ITES/Telecom projects 3. Should have certifications of industry leading networkadministration solutions 4. Should have experience in government projects
19	Server Administrator	1. Diploma in Computers with minimum three years of experiencein server administration for large and complexIT/ITES/Telecom projects 2. Should have OEM certification in server administration (Windows/ Linux) 3. Should have experience in government projects 4. Effective verbal communication skills (English and Hindi)
20	Server Engineer	1. BCA/ BE/ B.Sc in Computers with minimum five years ofexperience in server administration for large and complexIT/ITES/Telecom projects 2. Should have OEM certification in server administration (Windows/ Linux) 3. Should have experience in government projects 4. Effective verbal communication skills (English and Hindi)
21	Quality Assurance Manager	1. B.E/ B.Tech/ MCA/ M.Tech with minimum five years ofexperience in Systems/Software Quality Assurance 2. Experience devising and establishing a project's qualityprocedures, standards and specifications, increasingoperational efficiency, setting up and maintaining controls andstandard operating procedures, creating performance matrixand monitoring performance by gathering relevant data andproducing statistical reports, etc. 3. Should have experience setting standards for quality as well ashealth and safety of the project and its resources 4. Should have experience in government projects 5. Should have knowledge of leading testing tools 6. Proficient in MS office and MS Project 7. Effective verbal communication skills (English, Marathi and Hindi)
22	Software Developer	1. B.E/ B.Tech/ MCA/ M.Tech with minimum 4 years ofexperience in Software application development, programminglanguages and databases 2. Should have experience in government projects 3. Proficient in MS office and MS Project 4. Effective verbal communication skills (English, Marathi andHindi)

23	Testing Engineer	1. B.E/ B.Tech/ MCA/ M.Tech with minimum 4 years ofexperience in Software and Web Application testing, JAVAApplications. 2. Should have experience in government projects 3. Should have experience with different forms of testing like unittesting, system testing, integration testing, performancetesting, load testing, network testing, equipment testing, etc. 4. Should have at least 4 years of experience in manual orautomated testing 5. Should have knowledge of leading testing tools 6. Proficient in MS office and MS Project 7. Effective verbal communication skills (English, Marathi andHindi)
24	Helpdesk Support	1. Graduate in any discipline with experience of diagnosing hardware and software malfunctions, troubleshooting problems, replacing hardware and installing new software. 2. Should have experience in government projects 3. Proficient in MS office and MS Project 4. Effective verbal communication skills (English, Marathi and Hindi)
25	Web/ Portal Designer	1. Should be a Graduate with 1 year Web designing and graphic designing diploma course from a Government recognized Institute and should have minimum 3 years of experience and proficiency in working with software such as Adobe Photoshop, Coral Draw, Macromedia Flash, and Dreamweaver 2. Should have experience in design and development software like Macromedia Flash, Photoshop, Corel Draw, Dreamweaver, etc. 3. Should have experience in government projects 4. Proficient in MS office and MS Project 5. Effective verbal communication skills (English, Marathi and Hindi)