REQUEST FOR PROPOSAL (RFP) FOR

SELECTION OF IMPLEMENTATION AGENCY FOR

INTEGRATED COMMAND AND CONTROL CENTRE (CCC) AND

SMART FEATURES IN VADODARA CITY

Volume II: Scope of Work and Specifications

Tender Number: VMC/1093/2016-17

Issued by

The Municipal Commissioner

Vadodara Municipal Corporation

For

Vadodara Smart City Development Limited (VSCDL)

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2. Glossary

Please refer Volume I of this RFP.

3. *Introduction*

3.1. Project Background

One of the primary objective of Vadodara under its smart city mission is to enhance the safety and security, improve efficiency of municipal services and promote a better quality of life for residents. In order to achieve these objectives, Vadodara desires to foster the development of a robust ICT infrastructure that supports digital applications and ensures seamless steady state operations, traffic management, surveillance, emergency response mechanisms and real time tracking of services and vital city metrics throughout the city and in government departments.

VSCDL is considering the appointment of an agency to set up these priority initiatives identified under the Smart City mission which will include Integrated Command and Control Centre (CCC) and smart Feastures.

3.2. Project Objectives

Integrated Command and Control Centre (CCC)

The key objective of this project is to establish a collaborative framework where input from different functional departments such as transport, water, fire, police, meteorology, e-governance, etc. can be assimilated and analysed on a single platform; consequently resulting in aggregated city level information. Further this aggregate city level information can be converted to actionable intelligence, which would be propagated to relevant stakeholders and citizens. Following are the intangibles that should be addressed by this intervention:

- Better management of utilities and quantification of services
- Disaster Management and Emergency Response System
- Efficient traffic management
- Enhanced safety and security
- Asset Management
- Integration with existing control centres in the city & other services (with provision for future scalability)
    - CCTV System (Vadodara Eye Project) and Control Room at Police HQ
    - Water SCADA Project
    - ERP Project
    - GIS Project
    - Public Wi-Fi and iPoles (Smart Poles) project
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Integration of feeds/data from of smart sensor/devices such as CCTV Cameras, ANPR System, ATCS Signals, Variable Messaging Sign Boards, Emergency Call Box, Public Address System, Environmental Sensors, GPS Tracking for fire department vehicles, etc. are also included under project scope. City Wide OFC shall enable connectivity between CCC and field devices/smart sensors.

4. Scope of Services for the Project

Overall scope is described in this section, which needs to be complied by the System Integrator. The detailed scope of work and considerations are defined in Annexure V, that also needs to be adhered to and complied.

4.1. Components & Services Overview

The SI should ensure the successful implementation of the proposed "CCC, Smart DC, DR (on Cloud) and Pan City ICT Infrastructure including smart features/sensors/elements" and provide capacity building support to city authorities as per the scope of services described below. Any functionality not expressly stated in this document but required to meet the needs of the VSCDL to ensure successful operations of the system shall essentially be under the scope of the SI and for that no extra charges shall be admissible. SI shall implement and deliver the systems and components as described in RFP documents

The SI's scope of work shall include but will not be limited to the following broad areas. Details of each of these broad areas have also been outlined in annexure V.

1. **Assessment, Scoping and Feasibility Study:** Conduct a detailed assessment, scoping study and develop a comprehensive project plan, including:
    a. Assess existing systems, street infrastructure and connectivity within the city for the scope items mentioned in section 4.1
    b. Conduct feasibility study for finalization of detailed technical architecture, gap analysis and project plan
    c. Conduct site surveys to identify need for site preparation activities
    d. Obtain site Clearance obligations & other relevant permissions

2. **Design, Supply, Installation and Commissioning of CCC,DC/DR and Field Equipment** which includes, but not limited to the following components:
    a. Integrated Command and Control Centre (CCC Infrastructure)
    b. CCC Operational Facility (Client Side Infrastructure) at CCC building
    c. Smart DC Infrastructure
    d. DR (on cloud) Site Infrastructure
    e. Field devices (such as CCTV Cameras, ANPR Solution, ATCS Signals), Various Sensors, and Displays etc. as indicated in Scope of Work

3. **Forward and backward integration** (in terms of functions - components, applications, devices, geographical coverage and volume) with all smart city components across the 7+1 layers defined in the overall solution architecture. Such forward or backward integration could take place at any of the layers defined in the over architecture viz. sensor and actuator layer, network layer, data centre layer, application layer, integration layer, service delivery layer, command centre layer, visualization layer and security layer.

4. **Design, Supply, Installation and Commissioning of OFC Network and Network Connectivity** which includes
    a. New (i.e. Augmented) OFC Network as per project scope
    b. Integration with Existing OFC Network of Vadodara Eye Project
    c. Integration with GPRS/MPLS Network of Water SCADA project

d. Integration with VMC network (Switch at HO, Khanderrao Market)
e. DR Connectivity
f. Internet Connectivity at Smart DC and DR

5. **Provisioning Hardware and Software Infrastructure** which includes design, supply, installation, and commissioning of IT Infrastructure at command control centre (CCC) and other viewing centre locations. This consist of:
    a. Basic Site preparation services (as required)
    b. IT Infrastructure including server, storage, other required hardware, application portfolio, licenses
    c. Command Centre infrastructure including operator workstations, IP phones, joystick controller etc.
    d. Establishment of LAN and WAN connectivity at command centre and DC/DR limited to scope of infrastructure procured for the project
    e. Application integration services with other VSCDL applications

6. **Capacity Building** for VSCDL which includes preparation of operational manuals, training documents and capacity building support, including:
    a. Training of the city authorities and operators on operationalization of the system
    b. Support during execution of acceptance testing
    c. Preparation and implementation of the information security policy, including policies on backup and redundancy plan
    d. Preparation of revised KPIs for performance monitoring of various urban utilities monitored through the system envisaged to be implemented
    e. Developing standard operating procedures for operations management and other services to be rendered by CCC
    f. Preparation of system documents, user manuals, performance manuals, etc.

7. **Warranty and Annual Maintenance** which includes periodic maintenance services for the software, hardware and other IT infrastructure installed as part of project for a period of 5 years i.e. 3 year default onsite comprehensive warranty with support onhardware/parts/equipment and onsite comprehensive support (AMC) for 4^{th} and 5^{th} year, and conducting periodic audits of the project from a third party, if required or instructed by VSCDL .

4.2. Geographical Scope of services

The following is a summary of the geographical extent of the project.

#	System Description	Number of Locations
1.	Integrated Command and Control Centre (CCC)	01
2.	Smart DC at CCC Building	01
3.	DR Site (Hosted on cloud)	01
4.	Viewing Centre at Police HQ (TCC)	01
5.	Viewing Centre at VMC Main Office	02
6.	Overall Field locations(CCTV/ATCS/Other sensors)	167
7.	Fixed Box Camera	150
8.	PTZ Camera	75
9.	ANPR Camera	25
10.	Adaptive Traffic Control System (Smart Signals)	39
11.	Environmental Sensors	08
12.	Variable Messaging Sign Boards	21
13.	Public Address System	13
14.	Emergency Call Box (ECB)	09
15.	OFC Network as backbone across (Extension of earlier 100 km	150 km approx.
16.	Network PoPs	5 (including central PoP at CCC/DC)

The proposed list of locations to be covered under this project are provided as **Annexure I.**

4.3. Solution Architecture of CCC and Pan-City Smart Solutions/IT Infrastructure

The overall architecture of the components envisaged under the ""Pan City ICT Infrastructure" is as given below.

1.1.1. Sensor and actuator layer

The sensor layer will help the city administration gather information about the ambient city conditions or capture information from the edge level devises like emergency call boxes, cameras, environmental sensors etc. Vadodara city is expected to have multiple environmental sensors across the city, to measure ambient conditions such as light intensity, temperature, water level (for chronic flood spots), air pollution, noise pollution and humidity. Components under this layer will be under the scope of the SI selected through this process.

1.1.2. Network Layer

The secured network layer will serve as the backbone for the project and provide connectivity to gather data from sensors and communicate messages to display devices and actuators. The network layer will be scalable such that additional sensors, actuators, display devices can be seamlessly added and more Wi-Fi spots created in future. Provisioning of network connectivity through city wide OFC Network will be under the scope of the SI selected through this process. Existing OFC Network also needs to be integrated.

1.1.3. Data Centre Layer

The data centre layer will house centralized computing power required to store, process and analyse 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 in future. Provisioning of this layer will under the scope of the selected vendor.

1.1.4. Smart Application and Integration Layer

The smart applications layer will contain data aggregation and management systems (rules engines, alerting systems, diagnostics systems, control systems, messaging system, events handling system), and reporting / dashboard system to provide actionable information to city administrators and citizens. It will be an evolving layer with applications added and integrated as and when new applications are developed at VMC. While aspects of ambient conditions within the city will be gathered through various sensors deployed, 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 police department, meteorological department, street lights department, water department, irrigation department, transport organizations within Vadodara , etc.) and non-government agencies. Provisioning of this layer will be under the scope of the selected vendor

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1.1.5. Service delivery and consumption 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 digital messaging boards, environmental data displays, PA systems and emergency boxes. Components under this layer will be under the scope of the SI selected through this process.

1.1.6. Control Units & Command Centre Layer

The command centre 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 centre or control applications which can be viewed over a web browser or available in form of a mobile application. The implementation vendor will have to develop a command and centre (CCC) at a the Civic Centre building being built by VSCDL (Refer Annexure VIII for plans and 3D artistic views) and web/ mobile based viewing tools for understanding the ambient city conditions.

1.1.7. Security Layer

As ambient conditions, actuators and display devices will be 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
- Identity and Access Management – including user authentication, authorisation, SSL & Digital Signatures
- Application security- including Hosting of Government Websites and other Cloud based services, 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 at command centre.

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

4.4. Solution Architecture of OFC Networ

The diagram below represents the high level network architecture diagram of proposed Fibre Optic Network in Vadodara City:

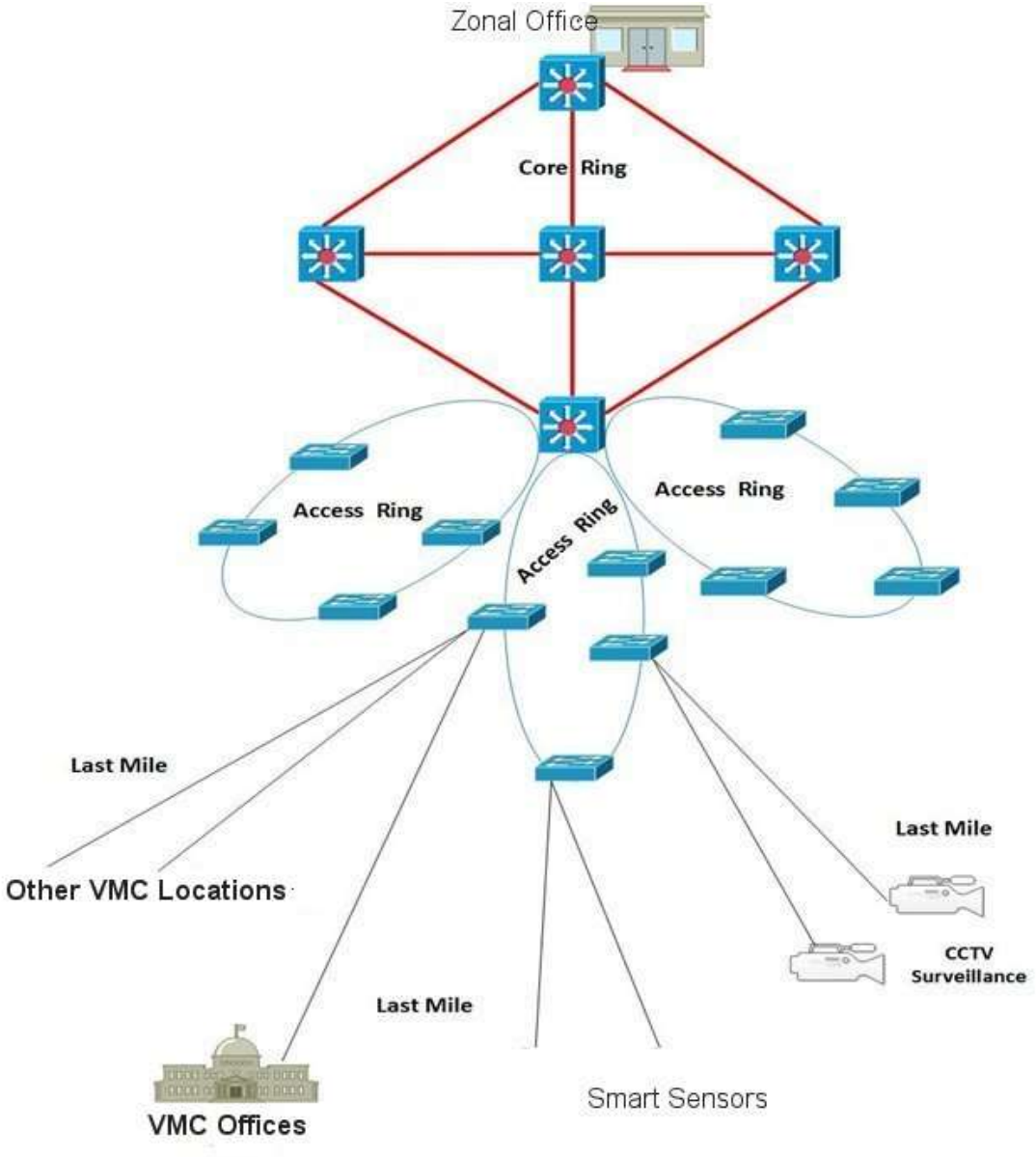


Figure 1 - Conceptual Architecture Diagram for FIBRE OPTIC NETWORK

The above diagram illustrates FIBRE OPTIC NETWORK hybrid 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 Fibre Optic Network:

4.4.1. Core Layer

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

- The Core backbone mesh topology shall be constructed using 24 Core Armoured Single mode Optical Fibre Cables (OFC).
- The Core ring shall have 4 POP locations (at each of zonal offices of VMC) connecting to each other as backbone of the network for providing bandwidth to the entire network components. The main PoP shall be at CCC (DC Area) at Badamadi Baug.

- The Core network shall be highly scalable.
- The Core shall utilize a 10 Gigabit Ethernet/ Optical technology and shall support 40 Gigabit Ethernet/ Optical technologies.
- The Core ring shall have (1 + 1+1) configuration of 40mm High Density Polyethylene (HDPE) pipes. Two ducts shall be kept free, with pulling ropes/strings inserted and properly marked.
- The Core architecture shall be formed in full mesh topology to handle dual point of failures.
- 24 Core Fibre Optic Cable shall be used to build the core network. Out of 12 pairs, 1 pair shall be used to connect all 5 POP locations.
- 3 pairs from remaining pairs shall be used for providing redundancy in the network and for maintenance purposes.
- Remaining 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, or to be utilised for other purposes, such as Wifi, Leasing etc.
- The maximum Fibre distance between two Core Switches in 2 cut redundant mesh, as measured by optical time domain meter (OTDR) shall not exceed 40 KMs.
- Core switch will be installed at all the Main POP location, the switching backplane needs to be as per overall current and future requirement, at every POP location.
- Distribution switches shall be installed at 4 Zonal POP locations
- The proposed ring based architecture shall support resiliency of sub 50ms ensuring high availability and faster convergence for service continuity.
- The proposed Core Ring shall consider 30% more Fibre length than surface length,
    a. 18% for looping in chambers,
    b. 7% for modulation,
    c. 1% for splice joint preparation &
    d. remaining 4% for wastage.
- The Core ring shall have chamber at approx. 200 meters and shall have OFC joint splice closure at approx. 1500 meters.
- Additional chambers to be constructed wherever there is a road crossings or at sharp turns

4.4.2. Access Layer

- The access layer comprising of ring topology design which is connected to each POP location. Each POP location shall have required number of which shall connecting to VMC offices, Junctions, Sensors/Display signs, VMC Hospitals etc. to provide connectivity.
- The Access ring shall be constructed using a 48 Core Armoured Single mode Optical Fibre Cables (OFC).
- It shall utilize a 1 Gigabit / 10 Gigabit Ethernet/Optical technology.
- It shall have (1 + 1+ 1) configuration of 40mm High Density Polyethylene (HDPE) pipes. Two ducts shall be kept free, with pulling ropes/strings inserted and properly marked.
- The access architecture shall be formed using ring topology.
- The access ring is designed so that it can support up to 1 edge switch at every 350 meters.
- The maximum distance of one access ring shall not exceed 80 kilometres.
- Not More than 16 Nos of switches should be considered within a single ring.
- The distance between two Hand Holes/RCC Chamber should not exceed 200 meters.
- A loop of 20 meters of OFC shall be left in every Hand Hole.

- 48 Core Optical Fibre Cable shall consist of 6 Fibre per tube and shall have total 8 numbers of tubes.
- 1 tube shall be utilized to provide connectivity to all smart elements/CCTV Cameras/Sensors/Displays to be connected as part of scope of work of this project.
- 2 tubes shall be kept reserved to provide redundancy in the network and maintenance purposes.
- Remaining tube shall be reserved to provide connectivity to future expansion/usages.
- The proposed Access ring length considered is 30% more than surface length i.e.

    a. 18% for looping in chambers,
    b. 7% for modulation,
    c. 1% for splice joint preparation &
    d. Remaining 4% for wastage.

4.4.3. Color code and marking for 40mm HDPE

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

- The core backbone mesh topology shall be identified by using Green, Navy and Blue colours. The Core backbone mesh Optical Fibre Cables (OFC) shall be placed in Green colour conduit.
- The Access ring shall be identified using Yellow and Pink colours. The Access ring Optical Fibre Cables (OFC) shall be place in a Yellow colour conduit
- All the pipes shall be clearly marked at intervals of 1 meters with the following data with 5 mm (or more) high letter : Client logo, Manufacture's name or trade mark iii) Year of manufacturing iv) Type of HDPE pipe and size v) Running length marking. The details of marking on pipe shall be approved by VSCDL before commencement of manufacturing.

4.4.4. Protection for OFC

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

- **GI Pipe**: GI pipe shall be used to provide additional protection for HDPE ducts at rail/road crossings, built-up area/city limits, on culverts, bridges wherever the depth is less than 0.2Mtr
- **DWC Pipe:** DWC pipe shall be used to provide additional protection for HDPE ducts at rail/road crossings, built-up area/city limits, on culverts, bridges wherever the depth is less than 0.6Mtr but more than 0.5Mtr
- **Concreting:** Concreting shall be used to provide additional protection on bridges, culverts and also on stretches wherever depth of excavation is less than 0.2Mtr.
- **RCC Half round:** Where-ever cables are laid in cities, towns and villages where human habitation exists or where construction activity can happen in near future, Full Round or Half Round, 100mm, NP2 Grade shall be put after 100 mm padding with excavated material over duct, wherever the depth is less than 0.5Mtr but more than 0.4Mtr
- **RCC Full round:** Where-ever cables are laid in cities, towns and villages where human habitation exists or where construction activity can happen in near future, Full

Round or Half Round, 100mm, NP2 Grade shall be put after 100 mm padding with excavated material over duct, wherever the depth is less than 0.4Mtr but more than 0.2Mtr

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

4.4.5. Integration with existing OFC Network

The new OFC network being created under this project shall be integrated with existing OFC Network of Vadodara Eye Project. During the integration time, there can be certain downtime for existing Vadodara Eye project, which needs to be worked out jointly with existing SI of Vadodara Eye Project. Re-configuration of existing switches/routers of Vadodara Eye Project shall be under scope of the successful bidder of this RFP.

4.5. Feasibility study for finalization of detailed technical architecture and project plan

After signing of contract, the Systems Integrator needs to deploy local team (based out of Vadodara) proposed for the project and ensure that a Project Inception Report is submitted to VSCDL which should cover following aspects:

1. Names of the Project Team members, their roles and responsibilities
2. Approach and methodology to be adopted to implement the Project (which should be in line with what has been proposed during bidding stage, but may have value additions / learning in the interest of the project).
3. Responsibility matrix for all stakeholders
4. Risks the SI anticipates and the plans they have towards their mitigation
5. Detailed project plan specifying dependencies between various project activities / sub-activities and their timelines
6. Installation locations geo mapped preferably on google earth to visually identify the geographical area

The SI as part of the feasibility study shall also conduct a comprehensive As-Is study of the existing infrastructure of traffic junctions/intersections (identified for this project) during various time periods of day including peak and non-peak hours to establish the key performance indicators(KPI) for the project. The KPIs of the study shall be included in the feasibility report. The following minimum parameters should be captured during the comprehensive study

1. Volumes of vehicles moving in the road network within the area identified for ATCS implementation
2. Vehicle type distribution

3. Directional distribution
4. Traffic Situation, Lane Marking, One way Traffic etc.
5. Physical and visual characteristics of the area
6. Travel times, delays between different points of the network
7. Additional dependencies with respect to the available infrastructure and geometry at the junctions
8. Any other relevant data which the SI anticipates will assist in establishing the benchmarks for the project

The feasibility report shall also include the expected measurable improvements against each KPI as detailed out in the above 'As-Is' study after implementation of ATCS. The benchmarking data should also be developed to track current situation and desired state.

The System Integrator shall study the existing business processes, functionalities, existing CCTV and traffic Signalling systems and applications including MIS reporting requirements.

Additionally, the System Integrator should provide as part of feasibility report the detailed To-Be designs (Junction layout plans) specifying the following:

1. High Level Design (including but not limited to) Application architecture, Logical and physical database design, Data dictionary and data definitions, ER diagrams and other data modelling documents and Physical infrastructure design for devices on the field
2. Application component design including component deployment views, control flows, etc.
3. Low Level Design (including but not limited to) Application flows and logic including pseudo code, GUI design (screen design, navigation, etc.), Database architecture, including defining data structure, data dictionary as per standards laid-down by Government of India/ Government of Chhattisgarh
4. Location of all field systems and components proposed at the junctions, (KML /KMZ file plotted on GIS platform like google earth etc.)
5. Height and foundation of Cameras, Traffic Signals and Standard Poles for Pedestrian signals, Height and foundation of Poles, cantilevers, gantry and other mounting structures for other field devices
6. Location of Junction Box
7. Location of Network Provider's Point of Presence (PoP)
8. Design of Cables, Ducts routing, digging and trenching
9. Electrical power provisioning

The SI shall also identify the customizations/ workaround that would be required for successful implementation and operation of the project. The feasibility report should take into consideration following guiding principles:

1. Scalability - Important technical components of the architecture must support scalability to provide continuous growth to meet the growing demand of the Vadodara city. The system should also support vertical and horizontal scalability so that depending on changing requirements from time to time, the system may be scaled upwards. There must not be any system imposed restrictions on the upward scalability in number of field devices. Main technological components requiring scalability are storage, bandwidth, computing performance (IT Infrastructure), software / application performance. In quantitative terms, there may not be major change in number of Command Centres.

2. Availability - Components of the architecture must provide redundancy and ensure that are no single point of failures in the key project components. Considering the high sensitivity of the system, design should be in such a way as to be resilient to technological sabotage. To take care of remote failure, the systems need to be configured to mask and recover with minimum outage. The SI shall make the provision for high availability for all the services of the system.

3. Security - The architecture must adopt an end-to-end security model that protects data and the infrastructure from malicious attacks, theft, natural disasters etc. SI must make provisions for security of field equipment as well as protection of the software system from hackers and other threats. Using Firewalls and Intrusion detection systems such attacks and theft should be controlled and well supported (and implemented) with the security policy. The virus and worms attacks should be well defended with gateway level Anti-virus system, along with workstation level anti-virus mechanism. Furthermore, all the system logs should be properly stored & archived for future analysis and forensics whenever desired. VSCDL may carry out the Security Audit of the entire system post acceptance / operationalization through a Third Party Auditor (TPA). The following guidelines need to be observed for security:

    a. Build a complete audit trail of all activities and operations using log reports, so that errors in system – intentional or otherwise – can be traced and corrected.

    b. Access controls must be provided to ensure that the system is not tampered or modified by the system operators.

    c. Implement data security to allow for changes in technology and business needs.

    d. The security of the field devices must be ensured with system architecture designed in a way to secure the field devices in terms of physical damage & unauthorized access.

4. Manageability - Ease of configuration, ongoing health monitoring, and failure detection are vital to the goals of scalability, availability, and security and must be able to match the scalability of the system

5. Interoperability - The system should have capability to take inputs from other third party systems as per situational requirements

6. Open Standards - System should use open standards and protocols to the extent possible without compromising on the security

7. Convergence - VSCDL has already initiated many projects which have state of the art infrastructure at field locations deployed under them. The CCC Infrastructure should be made scalable for future convergence needs. Under the smart city program, VSCDL has envisaged to create a state of the art infrastructure and services for the citizens of Vadodara, hence it is imperative that all infrastructure created under the project shall be leveraged for maximum utilization. Hence the System Integrator is required to ensure that such infrastructure will allow for accommodation of equipment's being procured under other smart city projects. Equipment like Junction Boxes and poles deployed under the CCC project at the field locations will be utilized to accommodate field equipment's created under the other projects of VSCDL. The procedure for utilization of the infrastructure will be mutually agreed between the VSCDL and System Integrator

Sub-contracting / Outsourcing shall be allowed only for the work which is allowed as mentioned in the clause with prior written approval of VSCDL. However, even if the work is sub-contracted / outsourced, the sole responsibility of the work shall lie with the SI. The SI shall be held responsible for any delay/error/non-compliance etc. of its sub-contracted vendor. The details of the sub-contracting agreements (if any) between both the parties would be required to be submitted to VSCDL. Sub-contracting / outsourcing would be allowed only for work such as:

1. Passive Networking & Civil Work during implementation,

2. FMS staff for non- IT support during post-implementation

3. Services of professional architect for design of traffic command / viewing centres

4.6. Scope of Services for the City Wide OFC Project

The scope of work & services covers the design, procurement, supply, installation, construction, testing and commissioning of a city wide Optical Fibre NETWORK (Optical Fibre Cables (OFC) Network) in the *Vadodara city for Building a Smart City*, along with the associated active, passive components, civil, mechanical and power. The SI should ensure the successful implementation of the proposed System and provide capacity building support to city authorities as per the scope of services described below. Any functionality not expressly stated in this document but required to meet the needs of the VSCDL to ensure successful operations of the system shall essentially be under the scope of the SI and for that no extra charges shall be admissible.

SI Shall have to Conduct a detailed assessment, scoping study (Feasibility Study) and develop a comprehensive project plan, including detailed technical architecture and gap analysis.

Following services and applications can be incorporated under project SOW :

- CCTV Existing and new.
- All other smart elements/sensors/displays on field, as part of this project and additional similar installations
- Connectivity for VMC offices, hospitals, police station etc.

The scope of work for FIBRE OPTIC (OFC) NETWORK shall cover the following activities but not limited to:

4.6.1. Inclusions

The scope of project has been designed to include the implementation of following key components

4.6.2. Laying of Underground Optical Fibre across the city

This component of the project would involve laying underground optical Fibre across the City so that the identified project locations are connected with each though OFC. Optical Fibre shall be laid primarily along the road network of the city. This would involve:

- Verification and optimization of routes designed based on GIS data
- Laying of optical Fibre
- Relaying of road

Total length of underground Fibre to be laid across the City for creating the backbone and other rings is estimated to be around **150 km.** This would comprise Core Ring and multiple Access Rings. The same network may also be extended **for further 150 km** in future. Please refer Annexure I for list of locations identified to be included as part of the scope of the project. The SI is required to follow the methodology for Optical Fibre Cable Execution as per Section 5.6 of the RFP.

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

As a part of project implementation, **5 Point of Presence (PoP)** would be created in the city. The objectives of the PoPs would be to enable the customers to have easy access to the network. These PoPs shall be created at locations identified by VSCDL. It is envisaged that the following would form part of PoP infrastructure –

- Passive Fibre termination equipment
- Electronics equipment and related infrastructure
- AC Racks with biometric access control and CCTV Camera

  VSCDL/VMC shall provide physical space and power inside zonal offices which are identified as PoP locations.

4.6.4. Central Infrastructure

Central IT infrastructure will be required to centrally monitor, control and manage the city wide network. This comprises establishment of Network Operations Centre, development and deployment of Operations Support System and Business Support Systems. The required

solutions shall be hosted in Smart DC in CCC Building and with disaster recovery site (DR) on cloud.

4.6.4.1. Data Centre / Disaster Recovery

Data Centre (DC) will host the IT infrastructure required for running the backbone and core applications related to OFC Network. The IT infrastructure and core application will be hosted in Data Centre within CC. The Data Recovery Centre (DR) will prevent service disruption by ensuring the high availability and redundant storage. Infrastructure available at secondary site for business continuity in case of full failure of primary site due to disaster or disaster like situation shall be for all the applications. There shall be fool proof arrangement for complete replication of data on secondary site in the form of back up, storage and replication so that there is minimum loss of data.

4.6.4.2. Central NOC

Network Operations Centre (NOC), to be operated from CCC, would be the central location from which network administrators manage, control and monitor the network. NOC would have the capability of analysing problems, performing troubleshooting, communicating with site technicians and tracking problems until they are resolved. NOC shall also have the capability able to monitor the DC from the central location. The NOC of System Integrator may be utilized to administrators manage, control and monitor the network. System integrator should ensure sufficient qualified man power for NOC operations. NOC should be managed 24x7x365 and accordingly manpower should be planned by the SI.

In order to achieve increased reliability and improved performance by seamless monitoring and management of the network, the common Network Management System (NMS) shall be utilised. The NOC operators would be able to access the network for effective monitoring and management.

4.6.4.3. Operation & Maintenance (O&M)

SI is responsible of O&M for the period of 5 years. O&M would entail undertaking all activities to ensure uptime of the network as per agreed SLAs defined in Volume I. This shall also apply to the entire supporting infrastructure such as NOC, NMS, etc. The O&M shall also entail ensuring timely upgrade of infrastructure (Active + Passive) to meet the changing demand scenarios.

Active Component: Electronic refreshment shall be considered for active component after 5 years. Active component shall be covered under 3 years of warranty & 2 years of Comprehensive AMC.

Passive Component: All the passive component shall be covered under 3 year of warranty & 2 years of Comprehensive AMC.

4.6.5. Integrations

- The solution implemented will be scalable for all future integrations and demands that may arise in the future and will enable VSCDL to provide seamless connectivity for all future projects

- It is required to have protocol level compatibility between devices/electronics installed at BRTS bus stations in order to have one unified seamless network available across the city

- City services such as surveillance, parking sensors, environmental sensors variable sign boards, public address system, self-service kiosks, and FTTH (in future if required) which will utilize this network will be integrated with the city wide OFC

4.6.6. General

- Supply of Fibre and Accessories as per the quantities defined in the BOQ.
- Route Survey using overhead methods and sample digging for detecting Underground Utilities like Water Pipe Line; Drainage Pipes; Gas and Communication Cable Pipes etc., in discussion with respective department of VMC.
- Based on the results of the survey the mode of digging (Automatic or Manual) needs to be decided for each section of the route.
- After finalizing the same the route diagrams prepare a sketch on the AUTOCAD map (if such AUTAOCAD map is available) and submit to the Authority for approval.
- Based on the Route diagram submission, ROW permissions needs to be taken from the VMC authorities.
- Preferably all digging manual or HDD along with Chamber preparations needs to be done on the Footpaths. This will ensure minimal damages to Tar Roads
- Precision in route design has to be kept so that chambers interconnecting Footpaths and BRTS Stations collide with the new route which in turn will ensure lesser labour to chamber fixing etc.
- After the same is over proper Labelling and Feruling as per the design and consent of the Client and Consultants needs to be done so that identification post installation during the maintenance becomes easy
- After the Splicing work is Over Fibre testing needs to be done
- The Report needs to be submitted to the Original Equipment Manufacturer (OEM) of the Fibre and Accessories who in turn will issue performance Warranty Certificate of the Installed Passive Components for a minimum period of 15 years from OEM.
- Apart from this post sign off the Bidder needs to submit in soft and hard formats:
  Details of Survey jotted on CAD Drawings as per the specifications defined
  Drawings of Route Details on the CAD Drawings along with the Survey details
- Post Sign off the Bidder should maintain the Network for the Period of 5 Years.
- During the course of installation, if any utility services or roads or other VMC assets or third party assets etc. are damaged, then the successful bidder has to repair and reinstate the same at his own cost.
- Contractor will be responsible to undertake and complete the works related to **supply installation and commissioning of services as indicated in the bid.**
- The works are to be completed on turnkey basis and the supplied equipment's and Network are required to be maintained for 5 years on comprehensive warranty basis from the date of **Final Approval and Testing** and need to sign SLA. The Bidder shall be responsible for implementation of the work as defined.
- During the installation activities, records must be kept of all items installed. Including reference to cable pathways used, final location, identity of cables and equipment. The

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

- The Optical Fibre cabling shall be installed in accordance with manufacturer's installation instructions. The Contractor will ensure that the manufacturer's specifications for the Optical Fibre cable cables meet the transmission characteristics required by Cabling Standards.
- All installed cables, termination boxes, distribution panels and wall outlets shall be marked and numbered in accordance with Administration Standard for the Telecommunications Infrastructure.
- The documentation required at the completion of the installation phases shall contain all of the following information, together with any other information the installer has acquired during the installation.

a) "As-Installed" documentation, showing total cabling and connections installed using floor space plans and cable record sheets. This documentation must show all cables and outlets incorporating the full numbering and marking convention supplied.

b) All test results and certification information, identified by cable, connection and numbering convention, necessary for all Optical Fibre cables.

4.6.7. Project Methodology

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

Authority and or Authority appointed TPA *reserves the right to redefine the requirement of service within the scope of items specified in the bid as required from time to time.*

4.6.8. Optical Fibre Cable Execution Methodology

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

- The SI shall prepare the list of equipment, number of field employees deployed and the implementation schedule taking into consideration all the requirements of concerned Municipal and Government authorities.
- The SI shall submit the work plan and implementation schedule with list of equipment and personnel to be deployed on field for execution of works for approval of Client.
- The SI shall commence work post approval of work plan and schedule by the Client.
- If the requirements of Concerned Government authorities should supersede any instruction by Client to the SI; the SI shall immediately point out in writing if any such conflict is observed to the attention of the Project Manager. The Project Manager shall issue further necessary instructions.
- The SI shall inform all concerned authorities and obtain NOC or permissions as required before starting the excavation and Hand Hole construction works.
- The SI shall register and get approval from concerned Government authorities to carry out the work as required.
- The SI shall adhere to guidelines issued by concerned Government authorities while executing the work.
- The SI shall lay the underground OFC by Open Cut/Open Trench or Horizontal Directional Drilling (HDD) method as permitted by the concerned Government Authority pertaining to specific road.
- The SI shall lay OFC of 24core/96core through 40mm HDPE pipe.
- The SI shall construct Hand Holes at successive intervals of 200 Meters or less.
- The SI shall obtain all land permits, Permissions, NOC, any land lease rights or as such any licensing requirement that may be necessary to erect the POP's from all the concerned Government authorities.

4.6.9. Open Cut Method

4.6.9.1. Excavation

1. The SI shall undertake the trenching & ducting activity for laying of OFC as per Survey drawings approved by the Client.
2. The SI shall place route marker as per given alignment & maintaining offset distance from road centre as per norms set by concerned government authorities.
3. The SI shall use barricading and signage board as per requirements of concerned Government authority pertaining to specific roads.
4. The SI shall take trial pits before starting trenching / HDD, at every 100m distance to examine position of existing underground utilities. The SI shall align the trench as per observations from the trial pits.
5. The SI shall take precaution during excavation to avoid any possible damage to other underground utilities and shall indemnify the Owner/Employer for damages if any. This includes but not limited to collecting as-build drawings of existing utilities, studying the survey drawings for location of utilities and visual inspection

of site.

6. The SI shall coordinate with the existing utility owners before starting the excavation work. If required the SI shall ensure the presence of representative of existing utility owners.
7. The SI shall achieve minimum depth of 700mm whenever the 40 mm HDPE pipes are to be laid under the road surface and minimum depth of 1000mm whenever 40 mm HDPE pipes are laid on exposed sand or soil surface.
8. The SI shall construct the trench with width of not less than 300mm at the bottom of the trench.
9. The SI shall be responsible for shoring and strutting the walls of the trench on either side of the trench as per the guidelines of concerned Government authorities.
10. The SI shall follow below mentioned norms in case of any deviations in depth of trench.

No.	Depth of Trench	Recommended Protection
1.	1000mm to 1200mm	No protection required
2.	800mm to 1000mm	
3.	500mm to 600mm	110mm DWC pipe
4.	Less than 200mm	100mm GI pipe with 150 mm PCC
5.	Less than 200 mm of above surface of road	300mm x 300mm concrete box culvert to be constructed, at the edge and 100 mm GI shall be laid through the box culvert, 40 mm HDPE pipes to be passed through the same.

4.6.9.2. Installation of 40mm HDPE Pipes

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

4.6.9.3. Installation of 110mm DWC pipes.

7. The SI shall use 110 mm DWC pipe to facilitate adequate protection to 40 mm HDPE pipe and OFC within low depth areas (as specified in Table above).
8. The SI shall insert maximum 3 numbers of 40 mm HDPE pipe in one 110mm DWC pipe.
9. The SI shall use 110 mm DWC coupler to joint 110 mm DWC pipe.
10. The SI shall lay 110 mm DWC pipe on levelled bed of trench.
11. The SI shall ensure that the trench bed is free from sharp edge and debris and stones.

4.6.9.4. Installation of 100mm GI pipes.

12. The SI shall lay 100 mm GI pipe wherever road crossings, bridge crossings are encountered on the route as well as in low depth areas as specified in table above.
13. The SI shall insert 2 Nos. of 40 mm HDPE pipes through one 100 mm GI pipe.
14. The SI shall clamp 100mm GI Pipe with suitable clamps where ever bridge and culvert crossing is to be done and excavation is not possible. The 40mm HDPE Pipes shall be laid through 100mm GI Pipe.
15. The SI shall build a box culvert to protect 100mm GI Pipe in case of lower depth as specified in the above table.
16. The SI shall extend the100 mm GI pipe by at least 1 meter on each side of crossing subject to availability of space.
17. The SI shall join 100 mm GI pipes using 100 mm GI Coupler.

4.6.9.5. Backfilling and reinstatement of excavated area

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

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

20. The SI shall adhere to following guidelines for installation of 40 mm HDPE pipes using Horizontal Directional Drilling (HDD) machine.

4.6.9.7. Horizontal Directional Drilling Equipment

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

4.6.10. Guidance System

24. A magnetic guidance system (MGS), grade beacon or proven gyroscopic system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation.
25. The directional drilling guidance system shall have the capability of measuring vertical and horizontal positions and roll.
26. The system shall obtain an accuracy range within five (5) centimetres of the actual position of the drilling head. It shall enable the driller to guide the drill head by providing immediate information on the tool face, horizontal and vertical

inclination.

27. The SI shall submit the reports obtained from the guidance system specifying the depth and path of HDD bore as part of acceptance testing.

4.6.10.1. Drilling Fluid System

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

4.6.10.2. Execution

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

4.6.10.3. Pipe Integrity test

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

4.6.10.4. Installation of OFC

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

4.6.10.5. Installation of Hand Hole

55. The SI shall provide Hand Holes at a distance of less than 250 meters.
56. The SI shall provide additional Hand Holes at Major Road crossings, Bridges and other location.
57. The SI shall provide Hand Holes/ Mini Hand Holes of sizes given in specifications. The installation of Hand Hole / Mini Hand Hole shall be done in such a manner that top surface of the Hand Hole shall flush with existing Road/Earth Surface.
58. Required excavation and backfilling for the construction of the Hand Hole/Mini Hand Hole shall be carried out adhering to all the requirements of concerned Government authority.

4.6.10.6. Splicing of OFC and Installation of Fibre splice Joint closure

59. The SI shall ensure that the splice loss per joint shall be less than 0.05dB/splicing

joint.

60. The SI shall ensure that during splicing Fibre cores of 0.6 m to 0.8 m Fibre shall be stored in cable tray.
61. The SI shall seal and install the Fibre Splice Joint closure assembly as per instructions of manufacturer.
62. The SI shall carry one hour of leakage/ water penetration test on Fibre Splice Joint closures for before installation.
63. The SI shall attach Cable tags to all OFC which are entering the Fibre Splice Joint Closure and OFC readings shall be recorded for updating in the As-build and Arc-GIS drawings.
64. The SI shall provide an As-build diagram for splicing of OFC. The diagram shall indicate the cores from all OFC with their colour coding and numbering

4.6.11. Optical Fibre Cable Testing Methodology

- The procedure shall comply with the ISO/IEC 14763-3 standard and to the vendor testing procedure.
- The ISO/IEC 14763 standard specifies the implementation and operation of customer premises cabling
- The part 3 of this ISO document (14763-3) details test procedures for optical Fibre cabling designed in accordance with ISO/IEC 11801:2002 and installed according to the recommendations of ISO/IEC 14763-2 (Planning and installation of customer premises cabling).
- Fibre-optic Tests applied to links and exclude equipment and work area cord.
- OF Attenuation testing is used to verify the initial performance of the installed link.
- All 100 % of the installed OF links have to be tested and must pass the acceptance criteria.
- The attenuation of the link is measured using the insertion loss method. This method uses an optical source and an optical power meter to compare the difference between two optical power levels.
- When testing Single Mode optical fibre links with a Light Source and a Power Meter, this measurement kit has to be capable of operating at 1510nm and 1300nm for Single Mode
- The test scenario with a Light Source and a Power Meter shall be one of the following for each link: **Single direction @ 1510nm and @ 1300nm for single mode fibres**
- The use of certification tool is recommended. Those tools are capable of producing a report logging the time of the test the link identification under test, the link length, the attenuation at the window tested and the acceptable link attenuation. The report shall also identify in which direction the testing was implemented.
- When testing with basic optical source and power meter, the operator will fill up a report logging the time of the test, the link identification under test, the link length and attenuation at the window tested in presence of the deputed staff/any person by VSCDL.
- The report shall also identify in which direction the testing was implemented.
- Acceptable link attenuation (To be calculated)
- The measured attenuation of the links shall have a lower value than the acceptable link attenuation calculated

- The Test should be carried out by Certified Engineer and once the report is submitted to the manufacturer he will issue the Warranty Certification which will mention minimum performance warranty of 15 years or higher

4.6.12. Earthing

For the earthing of all the proposed products/circuits, the installer has to closely follow the related recommendations of the supplier, in accordance with local regulations. The earthling procedure that has to be followed shall be put at the disposal by the supplier under an official document

4.6.13. Management of the project

4.6.14. Project Management

- For the complete duration of the project the vendor will appoint a Project Manager, who will work on his behalf. He will be the single point of contact to ensure a smooth co-ordination with the VMC/VSCDL
- The vendor will appoint a Site Manager, who will be permanently present on site on behalf of the vendor. The Site Manager will report to the Project Manager, in order to ensure that the correct information is communicated from the commencement of the project until the hand-over of the network to the client

4.6.15. Design of the Project

- The vendor will first make a site survey. This will allow him to propose a complete turnkey solution without any additional costs for unforeseen labour. If possible, the installer will try to use the existing infrastructure as much as possible. If cable supports or cable trays are lacking, then the vendor will have to evaluate the necessary quantities and price and take up a detailed description in his offer.
- To ensure the transparency of the installation and the maintenance of the structured cabling, the vendor has to develop a numbering and labelling scheme in agreement with the owner or his representative in order to identify all the components without ambiguity. After the temporary reception of the project, all the cabinets' layouts and the drawings of the building will be completed referring to this numbering scheme.

4.6.16. Under Ground Utility Mapping

- Ground Utility Survey to ensure that prior to Cable Laying the UG Services are identified precisely as the same will help to decide the Cable Laying path parameters in terms of depth and width.
- The following input material / data will be supplied by VMC Authorities to selected vendor:
    a) Base Maps (Soft Copy) of Vadodara City (digital base map, best possible scale 1:2000 scale) under GIS project. Out of these details will be used pertaining to the path where the Cable needs to be laid.
    b) Utility layout drawings (hard copies) of utilities to be mapped (provided by respective departments, partially available).

- The Vendor will give the data to VSCDL/VMC Authorities in the following format as mentioned below along with the Copy of the Cable laying route based on which VMC will approve the route and give the vendor the permission to lay the cable using HDD or Manual Digging. The Vendor will provide:
    a) Two sets of vector data processed from the raw data collected in the field using employed survey techniques for each city in .shp and dwg/dgn format.
    b) Two sets of Colour plots of utilities of each city mapped on blown-up base map on 1:1000 scale.
    c) All the field data collected during the utility mapping survey i.e. raw data, processed data will be supplied on two sets of Hard-disks media.
    d) All other maps, charts, drawings etc. used/prepared during the work.
- Each utility should have following attribute data as surveyed attached with it in soft and hard copy data. The selected vendor shall create l
    a) Type of utility (Metallic, Non-metallic).
    b) Depth of Utility.
    c) Size (diameter) of pipe/cable.
- All data collected will be the property of VSCDL and no data will be retained by the vendor
- Scale of Mapping shall be 1:1000
- Mapping accuracy shall be required planimetric / XY accuracy- as per mapping standards. The minimum accepted accuracy for planimetry is 25 cm. The depth of the utility should be accurate within ±50 cm or 10% of the utility depth whichever is less.
- Projection System: All co-ordinates are to be based on the following parameters:
    a) Projection: Universal Transverse Mercator (UTM)
    b) Spheroid: WGS 84
    c) Vertical Datum: Mean Sea Level
- The following Utilities and associated features mentioned below which are coming in the Cable Laying route are to be captured
    a) Water Networks including all Pipe Lines, Valves, Underground storage tanks
    b) Sewerage Networks including man holes, treatment plants and booster pumps
    c) Underground Power Cables: Cable draw pits, man holes including those associated with traffic control and street lighting.
    d) Underground Communication Cables: cable draw pits and man holes.
- All the connections, bends, sudden change in depth /direction should be shown. The Vendor shall locate and identify all underground utilities within the area to be mapped.
- Excavation is excluded in all cases. Underground utilities, associated surface feature, change of direction and bifurcations shall be located and X,Y and depth is recorded at intervals not exceeding 40 metres. Wherever space permits at 1:1,000 scale, each utility shall be annotated with the type of utility, depth and diameter of pipe at appropriate intervals
- All associated surface features having connectivity with underground utilities are to be depicted on the data to be delivered.

- Positions and levels shall be related to the specified grid and datum and shall be related to the centre of metallic pipes or cables, crown of ducts and inverts of sewers and drains.
- Wherever access is available from the surface, the Vendor shall cross check the depth to underground utilities
- Other utilities which are located during field survey would be mapped with any available information regarding the identity or type of utility.
- The selected vendor shall create/update GIS Layer of OFC Network on top of GIS Map.

4.6.17. Acceptance Testing

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

All acceptance testing, project review and monitoring shall be enabled through a Project Management Unit (PMU) nominated by VSCDL prior to certification by VSCDL.

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

4.6.18. Partial Acceptance Testing

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

4.6.19. Final Acceptance Testing

The final acceptance shall cover 100% of the OFC Network being laid as part of CCC Project, after successful testing by the VSCDL or its PMU; a Final Acceptance Test Certificate (FAT) shall be issued by the VSCDL to the SI.

Prerequisite for Carrying out FAT activity:

1. Detailed test plan shall be developed by the SI and approved by VSCDL. This shall be submitted by SI before FAT activity to be carried out.

2. All documentation related to the Project and relevant acceptance test document (including IT Components, Non IT Components etc.) should be completed & submitted before the final acceptance test to the VSCDL

3. The training requirements as mentioned should be completed before the final acceptance test.

4. For both IT & Non-IT equipment's / software manuals / brochures / Data Sheets / CD / DVD / media for all the supplied components.

The FAT shall include the following:

1. All hardware and software items must be installed at respective sites as per the specification.

2. Availability of all the defined services shall be verified.

3. The SI shall be required to demonstrate all the features / facilities / functionalities as mentioned in the RFP.

4. The SI shall arrange the test equipment required for performance verification, and will also provide documented test results.

5. The SI shall be responsible for the security audit of the establishes OFC Network of this project, to be carried out by a certified third party as agreed by VSCDL.

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

4.6.20. System Documents and User Manuals

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

- Project Commencement: Project Plan should provide micro level activities with milestones & deadlines.

- Delivery of Material: Original Manuals from OEMs.

- Training: Training Material will be provided which will include the presentations used for trainings and also the required relevant documents for the topics being covered.

- Process Documentation: The SI shall be responsible for preparing process documentation related to the operation and maintenance of each and every component of the OFC Network being laid as part of this project. The prepared process document shall be formally signed off by VSCDL before completion of final acceptance test.

    a) The SI shall document all the installation and commissioning procedures and provide the same to the VSCDL within one week of the commissioning of the Project

    b) The SI shall submit a complete set of Single Line diagram, a complete cabling system layout (as installed), including cable routing, telecommunication closets and telecommunication outlet/ connector designations. The layout shall detail locations of all components and indicate all wiring pathways.

    c) Manuals for configuring of switches, routers, etc. shall be provided by the selected SI.

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

4.6.21. Other

- SI to ensure that for operation and maintenance team has the uniform with the identity card, safety shoes, helmet, Neon Jackets etc.

- SI will have to carry his own vehicle for carry out implementation and maintenance work (including transportation of items required for Project) during the Contract Period. All the expenses pertaining to vehicle such as driver's expense, fuel, lubricants, maintenance, etc., will have to be borne by the SI.

4.6.22. Implementation and Roll out Plan

The Implementation Schedule is defined in Phases. The phases are defined as below:

Phase	Description	Locations to be covered
1	Core Ring	All on core ring
2	West Zone	As per requirement
3	North Zone	As per requirement
4	East Zone	As per requirement
5	South Zone	As per requirement

Note: Bidder may also suggest more efficient and speedy implementation and roll out plan.

4.7. Site Clearance obligations & other relevant permissions

4.7.1. Survey and Commencement of Works

Prior to starting the site clearance, the SI shall carry out survey of field locations as specified in **Annexure I**, for buildings, structures, fences, trees, existing installations, etc. The VSCDL shall be fully informed of the results of the survey and the amount and extent of the demolition and site clearance shall then be agreed with the VSCDL.

4.7.2. Existing Traffic Signal system

The infrastructure of existing traffic signal systems including the aspects, controllers etc. will be retrofitted with the new systems which are proposed and required under the scope of the ATCS Solution. If any component is not usable in the new system (such as light-bulb based Signal Aspects or old timer-based controllers), they needs to be dismantled in safe manner and replaced with new systems. The dismantled infrastructure shall be delivered at the VSCDL designated location without damage at no extra cost.

4.7.3. Existing CCTV Cameras and OFC network Infrastructure

The infrastructure of existing CCTV System (Vadodara Eye Project) including the Poles, Cameras, Junction Boxes, Active and Passive Network components (wherever possible) needs to be integrated with the new systems which are proposed and required under the scope of the CCC Project.

4.7.4. Road signs

All existing road signs which are likely to be effected by the works are to be carefully taken down and stored. Signs to be re-commissioned shall be cleaned, provided with new fixings where necessary and the posts re-painted in accordance with VSCDL guidelines. Road signs, street name plate, etc. damaged by the SI during their operation shall be repaired or replaced by SI at no additional cost. CCTV Signage as per approved design shall also be commissioned as per BoQ.

4.7.5. Electrical works and power supply

The SI shall directly interact with electricity boards for provision of mains power supply at all desired locations for CCC project field solutions. The SI shall be responsible to submit the electricity bill including connection charge, new meter charge, recurring charges etc. to the electricity board directly. SI shall have to submit the challan of bill submission to VSCDL. VSCDL /VMC will reimburse the amount submitted to the SI after verification in next billing cycle.

4.7.6. Lightning-proof measures

The SI shall comply with lightning-protection and anti –interference measures for system structure, equipment type selection, equipment earthing, power, signal cables laying. The SI shall describe the planned lightning-protection and anti –interference measures in the feasibility report. Corresponding lightning arrester shall be erected for the entrance cables of power line, video line, data transmission cables. All crates shall have firm, durable shell. Shell shall have dustproof, antifouling, waterproof function & should capable to bear certain mechanical external force. Signal separation of low and high frequency; equipment's protective field shall be connected with its own public equal power bodies; small size/equipment signal lightning arrester shall be erected before the earthling. The Internal Surge Protection Device for Data Line Protection shall be selected as per zone of protection described in IEC 62305, 61643-11/12/21, 60364-4/5. Data line protection shall be used for security system, server data

path and other communication equipment. Data line protection shall be installed as per zone defined in IEC 62305.Type 1 device shall be installed between zone 0B and zone 1. Type 2 devices shall be installed before the equipment in zone 2 and 3.

4.7.7. Earthing System

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

1. Earthing should be done for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, AC units, etc. so as to avoid a ground differential. VSCDL shall provide the necessary space required to prepare the earthing pits.

2. All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.

3. There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data.

4. The earth connections shall be properly made.

5. A complete copper mesh earthing grid needs to be installed for the server farm area, every rack need to be connected to this earthing grid. A separate earthing pit needs to be in place for this copper mesh.

6. Provide separate Earthing pits for Servers, & UPS as per the standards.

4.7.8. Junction Box, Poles and Cantilever

1. The System Integrator shall provide the Junction Boxes, poles and cantilever to mount the field sensors like the cameras (PTZ, Fixed ANPR), traffic sensors, traffic light aspects, active network components, controller and UPS at all field locations, as per the specifications given in the RFP.

2. The Junction Box needs to be appropriately sized in-order to accommodate the systems envisaged at the Junctions, and the SI should design the Junction box for 1.5 times the actual size the SI requires for utilization under the CCC project.

3. The Junction Box for UPS with Battery bank can be separate or common junction box. Solar Panels can also be considered as alternate source for power.

4. It should be noted that the SI would have designed the Junction box keeping in mind the scalability requirements of CCC project, and the additional 50%volume needs to considered over and above such requirement. Such additional 50% space

in the Junction Box shall be utilised by VSCDL to accommodate any future requirements under other projects

4.7.9.Cabling Infrastructure

1. The System Integrator shall provide standardized cabling for all devices and subsystems in the field, Viewing Centres and CCC.

2. SI shall ensure the installation of all necessary cables and connectors between the field sensors /devices assembly, outstation junction box, for pole mounted field sensors /devices the cables shall be routed down the inside of the pole and through underground duct to the outstation cabinet.

3. All cables shall be clearly labelled with indelible indications that can clearly be identified by maintenance personnel. The proposed cables shall meet the valid directives and standards.

4. Cabling must be carried out per relevant BIS standards. All cabling shall be documented in a cable plan by the SI.

4.8. Design, Supply, Installation & Commissioning of the Field Equipment

The Scope includes Supply, Installation, commissioning and Customization (as required) of various field systems which include CCTV/ Surveillance Cameras, ANPR Cameras, Adaptive Traffic Control System (ATCS) at Traffic Junctions, PA System, ECB System, Variable Message Signs, Environmental Sensors, and other IT infrastructure required for successful operation of the CCC project.

Based on the approved feasibility report, the SI will undertake the system configuration and customization in line with the changed, improved or specific requirements of Vadodara Police and VSCDL including:

1. The implementation methodology and approach must be based on the global best practices in-order to meet the defined Service Levels during the operation.

2. Best efforts have been made to define major functionalities for each sub- system of CCC Project. However, System Integrator should not limit its offerings to the functionalities proposed in this RFP and is suggested to propose any functionality over and above what has already been given in this tender.

3. The SI shall design the field level equipment architecture to ensure maximum optimization of network equipment, poles, cantilever, mounting infrastructures, power supply equipment including, electric meters and junction box.

4. Finally approved/accepted solution for each component of CCC systems shall be accompanied with “System Configuration” document and the same should be referenced for installation of CCC systems at Junctions that are identified within the scope of this project.

5. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.

6. The SI shall be responsible for obtaining all permits and approvals necessary to install the CCC systems components as per the approved design.

The sub-components included as part of the project for which field equipment needs to be deployed and integrated are given in the subsequent sections.

4.8.1.Adaptive Traffic Control System (ATCS)

The broad scope of work to be covered under ATCS sub module will include the following, but is not limited to:

1. Preparation of Solution Architecture as per project blueprint to develop a final BOQ for installation traffic signalling systems.

2. Retrofitting/Installation of vehicle detectors, controllers, Traffic light aspects, poles, cantilevers, Junction Box and other required accessories at specified traffic junctions for successful operation of the ATCS for VSCDL and Vadodara Traffic Police.

3. Integration of ATCS field infrastructures with the proposed ATCS software application

4. Configuration of traffic signal at each of the junction along with development of signal control plan for individual operations, coordinated signal plan for the junction in sync with the area wide signal plan for different operating conditions. The operating conditions may include different peak and off-peak conditions, special events, contingency plans etc.

5. Third Party Audit of the ATCS implementation and its performance evaluation as per SLA's defined in the RFP.

6. For more details on technical and functional specifications of ATCS, SI should refer to Annexure II, and Annexure III for Functional and Technical specifications respectively.

4.8.2. Surveillance System (CCTV Cameras)

The broad scope of work to be covered under this sub module will include the following, but is not limited to:

1. The SI shall install Surveillance Cameras (Fixed and PTZ) for CCTV monitoring and management at specified locations across the Vadodara city.

2. The SI shall undertake due diligence for selection and placement of surveillance cameras to ensure the optimized coverage of the traffic junction and location along with all associated junction arms, accuracy of the information captured on the field and for rugged operations.

3. The SI shall design, supply, and install the surveillance cameras as defined in the RFP, all wiring connections for the system shall be installed by the SI. The SI shall supply all of the necessary equipment for the camera operations including camera housings and mountings, camera poles, switches, cabling, and shall make the final connections to the junction box.

4. The SI shall be responsible for providing all the necessary IT infrastructure for monitoring, recording, storage & retrieval of the video streams at Viewing Centres, TCC, CCC or any other location as specified in the RFP.

5. For more details on technical and functional specifications of Surveillance Cameras, SI should refer to Annexure II, and Annexure III for Functional and Technical specifications respectively.

4.8.3. ANPR Cameras

The broad scope of work to be covered under this sub module will include the following, but is not limited to:

1. The SI shall install the ANPR Cameras at specified junctions/locations across the city. This system shall automatically capture the license number plate of the vehicle at these junctions.

2. The SI shall design, supply, and install the ANPR camera system as defined in the RFPs, all camera accessories such as IR Illuminators, camera housing and mounting shall be installed by the SI. The SI shall supply all of the necessary equipment for the camera and local processing system, including but not limited to: computers, local storage, and ancillary camera equipment, camera poles, warning signs and shall make the final connections to the camera.

3. The SI shall be responsible for providing all the necessary IT infrastructure for detection, analysis, storage & retrieval of the number plate information at TCC, CCC or any other location as specified in the RFP.

   For more details on technical and functional specifications of ANPR Cameras, SI should refer to Annexure II, and Annexure III for Functional and Technical specifications respectively.

4.8.4. Variable Message Sign (VMS) Boards

The broad scope of work to be covered under this sub module will include the following, but is not limited to:

1. The SI shall install IP based VMS boards on specified locations across city of Vadodara. These VMS boards shall have different characteristics depending upon the location and purpose of installation. VMS board displays are to be controlled by Vadodara Traffic Police / CCC personnel from the TCC/CCC. The purpose of the VMS boards is to provide the commuters with information about traffic conditions and alternate routes in case of high traffic on roads.

2. The SI, in consultation with Traffic Police and VSCDL, can propose alternate locations apart from the locations mentioned in this RFP, or suggest minor modifications in the position of VMS, for installing the VMS boards where their effectiveness in communicating information about traffic conditions in Vadodara will be maximized.

3. Vadodara Traffic Police shall review and approve the proposed locations, at its discretion. The SI shall install the VMS boards on the approved locations.

4. For more details on technical and functional specifications of VMS boards, the SI should refer to Annexure II and Annexure III for functional requirements and technical specifications

4.8.5. Public Address (PA) System, Emergency Call Box (ECB) System, Environmental Sensors, GPS Devices and MDTs

The broad scope of work to be covered under this sub module will include the following, but is not limited to:

1. The System Integrator shall install IP based Public Address System as part of the information dissemination system at specified locations in the city. These systems shall be deployed at identified junction to make public interest announcements. The system deployed shall be IP based and have the capability to be managed and controlled from the TCC/CCC

2. The System Integrator shall also install Emergency Call Box/Panic buttons at specified locations in the city. These systems shall be deployed at identified junction for ease of access by citizens of Vadodara city.

3. The System Integrator shall also install Environmental Sensors at specified locations in the city. These systems shall be deployed on any of the existing or new CCTV Pole, Cantilever, and Gantry etc. The network connectivity can be through OFC Network (junction box switch) or through 3G/4G SIM cards. All cost related to SIM card based connectivity shall be borne by the SI.

4. The System Integrator shall also install GPS Devices and Mobile Data Terminals in identified vehicles of the Vadodara fire Department in the city. The SI shall integrate the same with CCC though GPS tracking software and also provide & install 3G/4G SIM cards. All cost related to SIM card based connectivity shall be borne by the SI.

5. The SI, in consultation with Traffic Police and VSCDL can propose alternate locations apart from the locations mentioned in this RFP, or suggest minor modifications in the locations, for installing the PA system, ECB system & Environmental where their effectiveness / usage will be maximized.

6. Vadodara Traffic Police and VSCDL shall review and approve the proposed locations, at its discretion. The SI shall install the PA, ECB system & Environmental Sensors on the approved locations.

7. For more details on technical and functional specifications of IP based PA system, ECB system and Environmental Sensors, the SI should refer to Annexure II and Annexure III for functional requirements and technical specifications.

4.9. Design, Augmentation, Supply, Installation and Commissioning of Network & Backbone Connectivity for all field devices/Sensors

1. Network & Backbone Connectivity is an important components of the project and needs very careful attention in assessment, planning and implementation. It is important not only to ensure that the required connectivity is provisioned within the required timelines but also ensure that it is reliable, secure and supports the required SLA parameters of Latency, Jitter, Packet Loss and Performance.

2. It is proposed that the SI shall review and augment the OFC network (City wide Fibre cabling network connectivity) that was created as part of Vadodara Eye Project, to extend it to all locations to be covered as part of this project.

3. The SI shall design the overall network for the project, in order to meet the requirements as defined and within the service level agreement.

4. For more details on technical and functional specifications of City Wide OFC Network components, the SI should refer to Annexure II and Annexure III for functional requirements and technical specifications.

5. The provisioning of the PoPs for the City Network Backbone at the Junction and other field locations will be mutually agreed upon by the VSCDL and the SI for the project.

6. The SI should provide a detailed network architecture of the overall system, incorporating findings of site survey exercise. The network so envisaged should be able to provide real time data streams to the Data Centre. All the components of the technical network architecture should be of industry best standard and assist SI in ensuring that all the connectivity SLAs are adhered to during the operational phase.

7. The SI is also responsible for providing network services for integration for below connectivity requirements:

    a. Between Data Centre (at CCC) and DR site

b. Between Data Centre (at CCC) and Viewing centres

8. The network connectivity between Data Centre and Water SCADA Field Devices is being be provided by the supplier of the Water SCADA Project.

9. Surveillance system with City Backbone Network.

10. The SI shall prepare the overall network connectivity plan for this project. The plan shall comprise of deployment of network equipment at the junctions to be connected over network, any clearances required from other government departments for setting up of the entire network. The network architecture proposed should be scalable and in adherence to network security standards. It is necessary that all OFC cabling and proposed last mile connectivity should be underground. Last Mile to be defined as "the access link from the service provider's PoP – (as per Telco Standards) to the field device".

11. SIs are also required to do the estimation of bandwidth requirements considering following benchmark parameters (these considerations are for network sizing perspective and not for hardware/storage sizing):

#	CCC Project component	Consideration
1	Surveillance (CCTV) Cameras	• Minimum 4 Mbps per Fixed Camera • Minimum 5 Mbps per PTZ Camera
2	ANPR System	• Video footage of incident (t-5 seconds to t+5 seconds, where t is time of incident) at required high resolution • Minimum 4 Images of violating vehicle along with Number plate
3	ATCS Signals	• Minimum 1 MB per controller
4	Variable Message Sign Boards	• Minimum 1 MB for each location
5	PA System	• Minimum 1 MB for each location
6	ECB System	• Minimum 1 MB for each location

12. The actual bandwidth requirement to cater the above mentioned bandwidth parameters and to meet SLAs would be calculated by the SI and the same shall be clearly proposed in the technical proposal with detail calculations. VSCDL also requires the SI to meet the parameters of video feed quality, security & performance and thus SIs should factor the same while designing the solution. VSCDL reserves its right to ask the Systems Integrator to increase the bandwidth if the provided bandwidth is not sufficient to give the functionality of the system mentioned in the RFP and adhere to the SLAs.

13. In case the Telecommunication guidelines of Government of India require the purchaser to place Purchase Order to the Service Provider for bandwidth, VSCDL shall do so. However, Systems Integrator shall sign a contract with Telecom Service Provider(s) and ensure the performance. VSCDL shall make payments to the Systems Integrator.

14. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.

4.10. Design, Supply, Installation and Commissioning of IT Infrastructure at Viewing Centre, CCC and Smart DC

1. It is proposed that the SI shall provide the IT hardware infrastructure at the Smart DC (also called DC) for successful operations of the systems. The DC will be hosted within designated area on second floor of the CCC building (Refer floor plan of the CCC Building). The CCC has been envisaged at the second floor of the Civic Centre, CCC Building at Badamadi Baug.. SI has to ensure that redundancy is provided for all the key components to ensure that there is **no single point of failure** in Smart DC that would affect the performance of the overall system. It will be SI's responsibility to:
   a. Supply, Install and Commission of IT Infrastructure including site preparation in CCC.
   b. Supply Viewing screen, workstations, IP Phones, network switch, and required accessories including furniture at 2 viewing centres. The envisaged locations for viewing centres are as below:
      - MC Office, VMC Main Office
      - Dy MC Office, VMC Main Office
   c. Establish LAN connectivity at Badamadi Baug CCC Building across
2. The following systems shall also be available for monitoring at the all viewing centres:
   a. Video feeds from field CCTV cameras (existing cameras as well as new cameras)
   b. Live report on the status of Junctions and traffic signals
   c. Live feeds and two-way operations of all other field devices being provisioned under this project
3. Data Centre should be provided Server/Networking racks as per specifications.
4. Data Centre should be designed developed by SI as per Telecommunications Infrastructure Standard (TIA-942) for Data Centres
5. The SI shall provide system integration services to customize and integrate the applications procured through the project. All the applications proposed by the SI should have open APIs and should be able to integrate and share the data with other third party systems already available or coming up in the near future
6. As part of preparing the final bill of material for the data centre, the successful SI will be required to list all passive & active components required in the data centre.
7. The bill of material proposed by the successful SI will be approved by VSCDL for its supply and installation. Indicative IT Infrastructure to be commissioned as part of the project at Data Centre are as under:
   a. Servers (inclusive of OS) - Application Servers, Database Server, Video Recording Server, Video Management Server, Enterprise Backup Server, Domain Controller, Failover Servers for application and Recording Servers
   b. Application & System Software (with necessary customization) – CCC Application, Adaptive Traffic Control System application, Video Management

System application, Video Analytics, ANPR application, Variable message Sign Board application, PA System application, ECB System application, and E-Challan application etc.

c. RDBMS (if required)
d. Anti-virus Software
e. EMS (including NMS) software
f. Primary and Secondary Storage Solution including storage management
g. Backup Solution
h. Switches
i. KVM Switches
j. Firewall , IPS/IDS, Load Balancer
k. IP Phones
l. Fire proof enclosure
m. Racks (for Servers, Networking and Storage)
n. Other DC Non-IT infrastructure, such as UPS, PAC (Cooling), Fire Suppression, VEDSA, BMS, Rodent Control etc.
o. False Flooring for Smart DC Area
p. All required Passive / Structured cabling Components
q. Electrical Cabling for all IT and supplied components
r. Necessary Illumination Devices in DC area
s. Indoor Surveillance Cameras in CCC Area, IT/SPV area, Smart DC, Ground Floor Reception and Third Floor (Selected areas)
t. Any other Server required to the cater to the scope of work mentioned in RFP

8. The above are only indicative requirements of IT & Non-IT Infrastructure requirements at Smart DC. The exact quantity and requirement shall be proposed as part of the technical proposal of the SI.
9. The SI shall prepare the overall DR hosting(at Third party cloud CSP site) & their operational plan for this project. The plan shall comprise of deployment of all the DR equipment required under the project. The implementation roll-out plan for hosting of the DR shall be approved by VSCDL. The detailed plan shall be also comprise of the scalability, expandability and security of the DR infrastructure under this project.
10. The SI shall also establish a state of the art Integrated Command and Control Centre, the key components of the CCC will be as follows:
    a. Video Wall system (including Integration of Video Panels of Vadodara Eye Project and Water SCADA Project), to make one Single Integrated video wall.
    b. CCC Operator workstations
    c. IP Phones
    d. Active Networking Components (LAN Switches etc.)
    e. Passive Networking Components (Structured cabling)
    f. Electrical Cabling for IT equipment and Necessary Illumination Devices
    g. Operator Workstations Furniture and other furniture as per drawings
11. The SI shall also establish IT Infrastructure for Client Side (Office Environment) at the ground floor, second floor and third floor (as per drafting plans) for IT Dept./SPV Area office staff, :
    a. War Room/Conference Room Infrastructure (like Conference room table, chairs, projector, LED Display) etc.
    b. Client side hardware such as Office PC, Printers, MFP, etc. (as per BoQ) in various rooms/cabins and general IT Area in Ground floor and Second Floor of CCC Building
    c. Office cubical/workstation Furniture, Tables, Chair, Sofa set etc.
    d. IP Phones
    e. Active Networking Components (LAN Switches etc.)
    f. Passive Networking Components (Structured cabling)
    g. Electrical Cabling for IT Equipment

12. The SI shall also establish monitoring stations at 2 viewing centres in Vadodara, the key components of the viewing centre will be as follows:
    a. LED display screens
    b. Operator workstations
    c. IP Phones
    d. Online UPS (1 hour backup)
    e. Furniture and fixtures, if required
13. DG Set shall be provided by VSCDL/VMC at CCC Building, which shall cater to emergency power requirement. However, SI shall revalidate the DG capacity.
14. The system integrator shall be required to submit a detailed installation report post installation of all the equipment at approved locations. The report shall be utilized during the acceptance testing period of the project to verify the actual quantity of the equipment supplied and commissioned under the project.
15. The CSITMS Control Room at Police HQ in Vadodara is to be used as TCC.

4.11. DR Site on third party (Cloud) site

1. The DR Site for this project system shall be hosted in a third party Data Centre (Cloud site). DR site can be selected by the SI, from site of any Cloud Service provider (CSP) empanelled by Meity (Ministry of Electronics and Information Technology). List of CSP can be found on http://meity.gov.in.
2. The Selected site for DR should be in Tier III DC facility, which is ISO 20K and ISO 27K certified. The DR site should not be within 50 km of Smart DC (i.e. CCC Building)
3. The following services shall be provisioned at the DR Site
    a. Virtualised environment (VM Machines)
    b. Storage
    c. Networking
    d. Security
    e. Internet Bandwidth
    f. Hosting Space
    g. Power & Cooling
    h. Secured Data Centre Environment
4. The design rule of *No-Single-Point-of-Failure* shall not apply to DR components.
5. The SI shall borne the charges for hosting data centre services at the DR Site.
6. The SI need to do the sizing of VM Environment and other Infrastructure resources required at facilities based on its capacity planning and sizing for the entire duration of the contract.
7. Compute environment of the following projects shall also be included in DR site for replication and synchronization:
    a. Vadodara eye Project CCTV Infrastructure
    b. GIS Project
    c. Water SCADA Project
    d. ERP Project

    Estimated VM qualities for RFP (commercial evaluation) purpose for above 4 projects shall be 200 VM of Single Core, 64 GB RAM. The same unit rate shall be used for actual DR sizing.
8. DR should be 100% capacity in terms of compute power of the Smart DC compute power. Storage requirement for DR has been specified in section 6.2.1. RPO and RTO shall be designed and configured as per following requirements:

Sr No	Project Compute Infrastructure	RPO	RTO
1	CCC Project (DC Infrastructure being commissioned through this project)	4 Hours	1 hour

2	Vadodara Eye Project (CCTV)	4 Hours	1 hour
3	ERP Project	4 Hours	15 minutes
4	GIS Project	4 Hours	1 hour
5	Water SCADA Project	4 Hours	1 hour

9. All the requisite consumables like tapes, hard disks, etc. for backup shall be provided by the SI as per the project requirements. All the tapes, hard disks, etc. once deployed for the project will become property of VSCDL including corrupted/damaged devices.

4.12. Preparation and implementation of the Information security policy, including policies on backup

The SI shall prepare the Information Security Policy for the overall Project and the same would be reviewed and then finalized by VSCDL & its authorized committees. The Security policy needs to be submitted by the System Integrator within 1st quarter of the successful Final Acceptance Tests.

4.13. Responsibility Matrix

#	Key Activities	Successful Bidder	VMC	VSCDL	Electricity Providers	Other Utilities	Other Departments (Including Police)	Prj Mgmt Consultant	Existing ICT Vendors at VMC
1	Project Kick Off	R/A	C	C	I	I	I	C	I
2	Deployment of manpower	R/A	C	C	I	I	I	C	I
3	Assess the requirement of IT Infrastructure and Non IT Infrastructure	R/A	C	C	C	C	C	C	C
4	Assessment of Business processes	R/A	C	C	I	I	C	C	I
5	Assessment of requirement of Software requirements	R/A	C	C	I	I	C	C	I
6	Assess the Integration requirement	R/A	C	C	C	I	C	C	C
7	Assess the connectivity requirement all locations	R/A	C	C	I	I	C	C	I

	(including Building)								
8	Assessment the Network laying requirement	R/A	C	C	I	I	C	C	I
9	Assessment of training requirement	R/A	C	C	I	I	C	C	I
10	Formulation of Solution Architecture	R/A	C	C	I	I	C	C	I
11	Creation of Detail Drawing	R/A	C	C	I	I	C	C	I
12	Detailed Design of Smart City Solutions	R/A	C	C	I	I	C	C	I
13	Development of test cases (Unit, System Integration and User Acceptance)	R/A	C	C	I	I	C	C	I
14	Preparation of final bill of quantity and material	R/A	C	C	C	I	C	C	I
15	SoP preparation	R/A	C	C	C	C	C	C	I
16	Helpdesk setup	R/A	C	C	I	I	I	C	I
17	Physical Infrastructure setup	R/A	C	C	I	I	I	C	I
18	Procurement of Equipment , Edge devices, Software Licenses etc.	R/A	C	C	I	I	I	C	I
19	IT and Non IT Infrastructure Installation	R/A	C	C	I	I	I	C	I
20	Development, Testing and Production environment setup	R/A	C	C	I	I	I	C	I
21	Software Application	R/A	C	C	I	I	I	C	I

	customization (if any)								
22	Development of Bespoke Solution (if any)	R/A	C	C	I	I	I	C	I
23	Data Migration	R/A	C	C	I	I	I	C	I
24	Integration with Third party services/application (if any)	R/A	C	C	I	I	I	C	I
25	Unit and User Acceptance Testing	R/A	C	C	I	I	I	C	I
26	Implementation of Solutions	R/A	C	C	I	I	I	C	I
27	Preparation of User Manuals , training curriculum and training materials	R/A	C	C	I	I	I	C	I
28	Role based training(s) on the Command Center Software	R/A	C	C	I	I	I	C	I
29	SoP implementation	R/A	C	C	C	C	C	C	I
30	Integration of solutions with Command and Control Centre	R/A	C	C	C	C	C	C	I
31	Integration with Vadodara Eye, GIS, ERP, Water SCADA Projects	R/A	C	C	C	C	C	C	I
32	Go Live	R/A	C	C	I	I	I	C	I
33	Operation and Maintenance of IT, Non IT infrastructure and Applications	R/A	C	C	I	I	I	C	I
34	SLA and Performance Monitoring	R/A	C	C	I	I	I	C	I
35	Logging, tracking and	R/A	C	C	I	I	I	C	I

	resolution of issues.								
36	Application enhancement	R/A	C	C	I	I	I	C	I
37	Patch & Version Updates	R/A	C	C	I	I	I	C	I
38	Helpdesk services	R/A	C	C	I	I	I	C	I

Note: All decisions will be taken by VSCDL which need to be abided by all the stakeholders in the above matrix.

4.14.Project Deliverables

#	Key Activities	Deliverables
1	Project Kick Off	1. Project Plan 2. Risk Management and Mitigation Plan
2	Deployment of manpower	
3	Assess the requirement of IT Infrastructure and Non IT Infrastructure	1. Functional Requirement Specification document 2. System Requirement Specification document 3. Requirements Traceability Matrix 4. Site Survey Report 5. Engineering Drawings for Command Centre 6. Layout drawings for Smart Components to deployed on street
4	Assessment of Business processes	
5	Assessment of requirement of Software requirements	
6	Assess the Integration requirement	
7	Assess the connectivity requirement all locations (including Building)	
8	Assessment of network laying requirement	
9	Assessment of training requirement	
10	Formulation of Solution Architecture	1. Final Bill of Quantity 2. HLD documents 3. LLD documents 4. Application architecture documents. 5. Technical Architecture documents. 6. Network Architecture documents. 7. ER diagrams and other data modelling documents. 8. Logical and physical database design. 9. Data dictionary and data definitions. 10. GUI design (screen design, navigation, etc.). 11. Test Plans 12. SoPs for the command centre 13. Change management Plan
11	Creation of Detail Drawing	
12	Detailed Design of Smart City Solutions	
13	Development of test cases (Unit, System Integration and User Acceptance)	
14	Preparation of final bill of quantity and material	
15	SoP preparation for command centre based on extensive consultation with all stakeholders	
16	Helpdesk setup	1. IT and Non IT'S Infrastructure Installation Report 2. Completion of UAT and closure of observations report 3. Training Completion report 4. Application deployment and configuration report 5. Software License documents
17	Physical Infrastructure setup	
18	Procurement of Equipment , edge devices, COTS software (if any), Licenses	
19	IT and Non IT Infrastructure Installation	
20	Development, Testing and Production environment setup	

21	Software Application customization (if any)	6. Hardware warranty documents
22	Development of Bespoke Solution (if any)	
23	Data Migration	
24	Integration with Third party services/application (if any)	
25	Unit and User Acceptance Testing	
26	Implementation of Solutions	
27	Preparation of User Manuals , training curriculum and training materials	
28	Role based training(s) on the Smart City Solutions	
29	SoP implementation	1. Integration Testing Report
30	Integration with GIS	
31	Integration of solutions with Command and Control Centre	
32	Go Live	1. Go-Live Report
33	Operation and Maintenance of IT, Non IT infrastructure and Applications	1. Detailed plan for monitoring of SLAs and performance of the overall system 2. Fortnightly Progress Report 3. Monthly SLA Monitoring Report and Exception Report 4. Quarterly security Report 5. Issues logging and resolution report 6. Operations manual for all components
34	SLA and Performance Monitoring	
35	Logging, tracking and resolution of issues.	
36	Application enhancement	
37	Patch & Version Updates	
38	Helpdesk services	

4.15. Project Timelines

Services	Approximate Time for Issuance of Request Order	Tentative Scope/ Approximate Sizing	Tentative Lead Time
Request Order 1	One week post issue of LOI/ completion of feasibility study	1. Command and Control Centre (CCC) IT hardware 2. Command and Control Centre (CCC) non-IT equipment 3. Command and Control Centre (CCC) – software 4. Smart DC – Hardware 5. Smart DC – Software 6. Smart DC – non-IT equipment 7. Integration with existing CCTV, GIS, ERP and Water SCADA Project	3 months post issuance of request order
Request Order 2	Three months post issue of LOI or completion of feasibility study	1. OFC Network (Core and Access) 2. CCTV Cameras 3. Viewing Centre at Police HQ 4. Viewing Centre at VMC Main Office 5. Variable Messaging Sign Boards (10 Qty) 6. ATCS System (10 Signals) 7. Environmental Sensors 8. GPS and MDT on Fire dept vehicles 9. Integration of above with CCC software	3 months post issuance of request order
Request Order 3	Six months post issue of LOI or completion of feasibility study	1. ANPR Solution 2. E-Challan System 3. ATCS System (Remaining Signals) 4. Variable Messaging Sign Boards (Remaining) 5. Emergency Call Box 6. Public Address System 7. Integration of above with CCC software 8. DR (hosted on cloud)	3 months post issuance of request order

5. *Annexure I- List of Locations*

This annexure gives the locations which are to be covered as part of Scope of Work for this project:

5.1. Command and Control Centre

Command and Control Centre	
#	Location
1	Second Floor, Badamadi Baug Civic Building, Vadodara

5.2. Smart DC

Smart DC		
#	Location	Sty
1	Second Floor, Badamadi Baug Civic Building, Vadodara	1

5.3. DR

DR		
#	Location	Sty
1	Disaster Recovery Site (On third party premises on CSP site)	1

5.4. TCC (Traffic Control Room)

Traffic Control Room	
#	Location
1	CSITMS Control Room, Vadodara Police HQ, Jail Road, Vadodara

5.5. Viewing Centres at VMC Main Office

Viewing Centres		
#	Location	Qty
1	Municipal Commissioner Office, VMSS, Khanderrao Market, Vadodara	1
2	Dy MC Office, VMSS, Khanderrao Market, Vadodara	1

5.6. VMC Zonal offices (PoP locations)

	East	East Zone Office (Ward No. 1, 2 & 9) Vadodara Municipal Corporation , Nr. Sawad Quarters, Nr Vijaynagar Rour Cross, Harni-Warishya Ring Road, Vadodara
	West	West Zone Office (Ward No. 6, 10 & 11) Vadodara Municipal Corporation Nr. Sahjanand Apartment, Along Old Padra Road, Akota, Vadodara
	North	North Zone Office (Ward No. 5, 7 & 8) Vadodara Municipal Corporation Old VUDA Office, Nr. Petrol Pump, Fatehgunj Circle, Vadodara
	South	South Zone Office (Ward No. 3, 4 & 12) Vadodara Municipal Corporation Sindvaimata Road, Pratapnagar,

5.7. Master BoQ and Location Table for all Field Devices/Sensors

S. No.	Location Name	Location on Ring	CCTV Cameras			Env Sensors	VMS Board	PA	ECB	ATCS			Junction Box
			Fixed	**PTZ**	**ANPR**					**ATCS Controller**	**Arms**	**Type of Head**	
1	Abhilasa Char rasta	To be Laid	2	0	0								1
2	Adaniya pool fatehpura	Phase 1 Ring	2	1	0			1	1				1
3	Airforce station gate	Phase 1 Ring	2	0	0								1
4	Ajwa flood gates	To be Laid	15	8	0								1
5	Ajwa Garden	To be Laid	2	1	0								1
6	Akota cross rd (Dula seth hotel)	To be Laid	4	1	4					1	4	LED	1
7	Akota Garden	To be Laid	2	2	0						3		1
8	Akota mujmahuda road	Phase 1 Ring	1	1	0						3		1
9	Akota stadium	To be Laid	1	1	0						3		1
10	Akota Water Tank	To be Laid	2	1	0						4		1
11	Akshar Chawk	Phase 1 Ring	1	1	0		1				4		1
12	Ambedkar circle , towards vidhyut bhavan	To be Laid			0	1	1	1		1	3	LED	1
13	Amdavadi Pol jubilibaug circle	Phase 1 Ring	1	1	0						4		1
14	Amit nagar	Phase 1 Ring	2	0	4		1				2		1
15	Ayurvedic tran rasta	Phase 1 Ring	1	1	0		1				2		1
16	Baranpura Naka, sant kabir road	To be Laid	1	1	0						4		1

17	Baroda Automobile	Phase 1 Ring	2	1	0					1	3	Conventional	1
18	Baroda Dairy Circle	To be Laid	3	1	0						4		1
19	Bhagat singh chowk	Phase 1 Ring	1	1	0						3		1
20	Bhimnath Bridge	To be Laid			0					1	3	Conventional	1
21	Central bus Depot	To be Laid			0				1		4		1
22	Chakli Circle	Phase 1 Ring	2	1	0						4		1
23	Chhani Jakat naka	Phase 1 Ring	3	1	3		1				4		1
24	Chhani water Tank	Phase 1 Ring	2	1	0						3		1
25	Chipwad	To be Laid	1	1	0						4		1
26	Circet House R. C Road	To be Laid			0					1	4		1
27	Collector office	To be Laid			0				1	1	4	Conventional	1
28	Dandiya Bajar Char Rasta	To be Laid			4					1	4	Conventional	1
29	Dandiya Bazar, VGL office	Phase 1 Ring	1	1	0						4		1
30	Darbar chowkdi	To be Laid	2	0	0						3		1
31	Delux char rasta	Phase 1 Ring	1	1	0								1
32	Dena village NH8 Entry	To be Laid	2	1	2						3		1
33	Diwalipura Garden	To be Laid	2	1	0					1	4	LED	1
34	Dumad chowkdi	To be Laid	1	1	0		1				4		1

35	entrance of padmavati complex	To be Laid			0		1				4		1
36	Fatehgunj Garden	Phase 1 Ring	1	1	0						4		1
37	Fatehgunj nizampura sevenseas crossing	Phase 1 Ring	2	1	0						3		1
38	Fatehgunj Under Bridge	To be Laid	2	1	0						4		1
39	Fatehpura char rasta	Phase 1 Ring	1	1	0						3		1
40	Fruitmarket char rasta	Phase 1 Ring	1	1	0						4		1
41	Fulwadi Charrasta, Navayard	To be Laid	1	1	0						4		1
42	Gajarawadi Gas Station	Phase 1 Ring	1	1	0						4		1
43	Gajarawadi tran rasta	Phase 1 Ring	1	1	0								1
44	Gajarawadi Water Tank	Phase 1 Ring	1	1	0								1
45	GandhiNagar Gruh	Phase 1 Ring	3	1	0				1				1
46	Genda circle to racecourse	To be Laid			0		1						1
47	Genda circle, towards pandya bridge	To be Laid			0		1						1
48	Gorwa ITI char rasta	To be Laid	1	1	0								1
49	Gotri Entry	To be Laid	2	1	0		1						1
50	GSFC	To be Laid			0	1				1	2		1
51	Haran khana road, panigate	To be Laid	1	1	0								1
52	Hari Nagar char rasta	Phase 1 Ring	2	0	0								1

53	Harinagar Water Tank	Phase 1 Ring	2	1	0								1
54	Harni lake nr pumping station	Phase 1 Ring	2	1	0								1
55	Harni Water Tank	To be Laid	1	1	0								1
56	Haveli, nr. Mehta pole	Phase 1 Ring	1	1	0								1
57	Havmour Cicle	Phase 1 Ring	3	1	4								1
58	Indrapuri Atithi Gruh	Phase 1 Ring	1	1	0								1
59	IOC entry	To be Laid			0	1							1
60	Iscon temple	Phase 1 Ring	2	0	0								1
61	Jail Water Tank	To be Laid	2	1	0								1
62	Jambua Crossing	To be Laid			0					1	2		1
63	Jayratna Building Char Rasta	To be Laid	4	0	0					1	4	LED	1
64	Jhansi ki rani circle	To be Laid	1	1	0								1
65	Jimkhana Circle	To be Laid			0					1	4		1
66	Jnurm housing kisanwadi	To be Laid	1	1	0								1
67	JP police station	To be Laid	1	1	0								1
68	Juni gadhi	To be Laid	1	1	0								1
69	Jupiter Char rasta	Phase 1 Ring	1	1	0					1	4	LED	1
70	Kala Ghoda	To be Laid	4	0	4			1		1	3	Conventional	1
71	Kalptaru crossing	Phase 1 Ring	3	0	3					1	3	LED	1
72	Kamlanagar pond	Phase 1 Ring	1	1	0								1

73	Karelibaug panitaki char rasta	Phase 1 Ring	2	1	0								1
74	Karelibaugh Police station, bhutdi jhapa	Phase 1 Ring	1	1	0								1
75	Khanderao Market	To be Laid			0		1						1
76	Khodiyar nagar char rasta	Phase 1 Ring	2	1	0								1
77	Kirti Stambh	To be Laid	2	1	0								1
78	Kisanwadi , Gadheda market	Phase 1 Ring	2	1	0								1
79	Laheripura Gate	To be Laid			0			1					1
80	Lal Baugh Garden	Phase 1 Ring	10	4	0								1
81	Lion Circle Ratri Bazar	To be Laid	2	0	4								1
82	Machhi pith Naka	Phase 1 Ring	1	1	0								1
83	Madhunagar Char rasta	To be Laid	3	0	0								1
84	Mahavir hall char rasta	Phase 1 Ring	4	0	4					1	4	LED	1
85	Makarpura bus depot	To be Laid	1	0	0							LED	1
86	Makarpura GIDC Bridge	To be Laid	2	1	0								1
87	Makarpura-Chowkdi	To be Laid	1	1	0								1
88	Malhar Point Char Rasta	To be Laid			0					1	4	LED	1
89	Mandvi Gate	To be Laid			0			1				LED	1
90	Maneja crossing	To be Laid	1	1	0								1
91	Manek park, opp. airport side to amit nagar	To be Laid			0		1						1
92	Manek park, opp. airport side to Khodiyarnagar	To be Laid			0	1	1						1

93	Manisha Char Rasta	To be Laid			0					1	4	LED	1
94	Manjalpur police station	To be Laid			0							LED	1
95	Manjalpur Rly crossing	Phase 1 Ring	1	1	0					1	3		1
96	Manjalpur Sport Complex	To be Laid	2	2	0								1
97	Mashonic Hall, BPC Road	To be Laid			0					1	4	LED	1
98	Military Boys Hostel	To be Laid			0					1	4	LED	1
99	Motibaug Top Tranrasta	Phase 1 Ring	1	0	0					1	3	LED	1
100	Mujmahuda tran rasta (existing-police)	Phase 1 Ring	1	1	0		1						1
101	Muktanand tran rasta	Phase 1 Ring	1	1	0								1
102	nagarwada (Existing-Police)	To be Laid	1	1	0			1		1	4		1
103	Nandanvan Gas Station	To be Laid	1	1	0								1
104	Nani shak market	Phase 1 Ring	3	0	0								1
105	Narhari hospital circle, Saffron	Phase 1 Ring	5	2	4					1	4	Conventional	1
106	Natubhai circle	To be Laid			0		1	1					1
107	Nava yard	To be Laid	1	1	0								1
108	Navlakhi Ground1	Phase 1 Ring	1	1	0								1
109	Navlakhi Ground2	To be Laid	1	1	0								1
110	Near Atladra store	Phase 1 Ring	1	1	0								1
111	Near gurunanak school crossing	Phase 1 Ring	1	1	0								1

112	NH8 gurukul char rasta entry point	To be Laid	2	1	0								1
113	Nilambar Cross Road	To be Laid	3	1	0								1
114	Nimeta Garden	To be Laid	2	1	0								1
115	Nimeta Water Plant	To be Laid	2	2	0								1
116	Nr New court	Phase 1 Ring	2	1	0								1
117	Nr sarda mandir school	Phase 1 Ring	1	1	0								1
118	Nr swaminarayan mandir	To be Laid	1	1	0								1
119	Nr Transpek circle	To be Laid	1	1	0	1							1
120	Nr. Alpana talkies pratapnagar tran rasta	Phase 1 Ring	1	1	0								1
121	Nr. Harni talav tran rasta	Phase 1 Ring	2	0	0								1
122	Nyaymandir, towards market and sursagar	To be Laid			0		1	1	2				1
123	ONGC Near Sapna Hall	To be Laid			0					1	3	LED	1
124	Opp. Aradhna Cinema Nr. SBI Gate	Phase 1 Ring	1	1	0						3		1
125	Opp. Nursing home	To be Laid			0		1	1		1	3	LED	1
126	Padra Entry/ BAPS HOSPITAL	To be Laid	1	1	0						4		1
127	Padra Entry-Railway Crossing	To be Laid	2	1	0						4		1
128	Pandya Bridge - Gas Store	Phase 1 Ring	1	1	0						4		1
129	Parivar cross road	Phase 1 Ring	2	0	0						4		1
130	Pratap Talkies	Phase 1 Ring	1	1	0						4		1
131	Railway Station - Exit	To be Laid	2	1	0	1	1	1	1	1	3	LED	1

132	Raj Mahal Gate	To be Laid	3	1	0					1	4	LED	1
133	Rajmahal road	Phase 1 Ring	1	1	3						3		1
134	raneshwar petrol pump char rasta, vasna road	To be Laid	4	0	0					1	4	LED	1
135	Raopura Tower Char Rasta	To be Laid			0					1	4	Conventional	1
136	Sama Sports Complex	To be Laid	2	1	0						4		1
137	Sangam	To be Laid			0		1			1	4	Conventional	1
138	sarasiya talav	To be Laid	1	1	0				1				1
139	Saraswati Char rasta	Phase 1 Ring	2	1	4								1
140	Sardar Estate	To be Laid			0					1	4	LED	1
141	Sardar Estate towards mahavir hall	To be Laid			0	1	1						1
142	Satya sai baba circle , deep chamber road	Phase 1 Ring	1	1	0								1
143	Sayaji Ganj dairy den circle	Phase 1 Ring	3	1	0					1	4	Conventional	1
144	Sayaji Gruh	To be Laid	1	1	0								1
145	Sayaji Nagar Water Tank	To be Laid	1	1	0								1
146	Shastribaug garden char rasta	To be Laid	1	1	0								1
147	Shreyas school tran rasta	Phase 1 Ring	2	0	0			1		1	3	LED	1
148	Soma talav char rasta	Phase 1 Ring	2	1	4	1							1
149	SSG Gate 3	To be Laid	2	2	0								1

150	SSG Hospital Gate 1	Phase 1 Ring	2	2	0								1
151	SSG Hospital gate 2	Phase 1 Ring	2	2	0								1
152	Susan Circle	Phase 1 Ring	4	1	4		1			1	4		1
153	T.P. 13 Chhani fire station	Phase 1 Ring	1	1	0								1
154	Tarsali Bus stand	Phase 1 Ring	5	1	0			1					1
155	Tarsali sardar patel staue tran rasta Nr. Talav	Phase 1 Ring	1	1	0				1				1
156	Trident Circle/ Vir savarkar circle	Phase 1 Ring	2	1	0			1		1	3	LED	1
157	Tulsi Dham Char Rasta	To be Laid			0					1	4	LED	1
158	Uma Char Rasta	To be Laid			0					1	4	LED	1
159	Vadi rangmahal tran rasta	To be Laid	1	1	0							LED	1
160	Vadivadi Water Tank	Phase 1 Ring	2	1	0								1
161	Vaikunth end Highway join	Phase 1 Ring	1	1	0								1
162	Vishwamitri bridge-Gujarat Tractor	Phase 1 Ring	2	1	0								1
163	Vishwamitri Railway Station	To be Laid	1	1	0								1
164	Vrundavan cross road	Phase 1 Ring	4	0	0					1	4	LED	1
165	Warasia PS	To be Laid			0							LED	1
166	Warasiya water tank	Phase 1 Ring	1	1	0							LED	1
167	Yash complex char rasta	To be Laid	2	0	0								1

Total	**252**	**129**	**55**	**8**	**21**	**13**	**9**	**39**			**167**
Quantities for RFP	**150**	**75**	**25**	**8**	**21**	**13**	**9**	**39**			**150**

5.8. CCTV Camera Locations

Sr No	Location	Latitude	Longitude
1.	Abhilasa Char rasta	22.3423968161014	73.185457123843
2.	Adaniya pool fatehpura	22.3050209322142	73.2104854320183
3.	Airforce station gate	22.3260943307003	73.2168974554159
4.	Ajwa flood gates	22.4064125352664	73.3800317395195
5.	Ajwa Garden	22.3726542633998	73.3826334324486
6.	Akota cross rd (Dula seth hotel)	22.2978328923229	73.1763759888231
7.	Akota Garden	22.2926619234991	73.1721918063026
8.	Akota mujmahuda road	22.2891067662145	73.1697213618433
9.	Akota stadium	22.2972408399412	73.1718031390107
10.	Akota Water Tank	22.2940647010528	73.1715482655783
11.	Akshar Chawk	22.2822758915689	73.1649625029182
12.	Amdavadi Pol jubilibaug circle	22.3033378649356	73.2036667777682
13.	Amit nagar	22.3275347187633	73.2074979405371
14.	Ayurvedic tran rasta	22.3002245443389	73.2212491755438
15.	Baranpura Naka, sant kabir road	22.2964722367462	73.2068233284637
16.	Baroda Automobile	22.3079153235433	73.1893374591509
17.	Baroda Dairy Circle	22.2721119386096	73.204143852376
18.	Bhagat singh chowk	22.2989915827227	73.2052896059616
19.	Chakli Circle	22.3083130778872	73.1651323126631
20.	Chhani Jakat naka	22.3447272515705	73.175918751841
21.	Chhani water Tank	22.3593464691697	73.1709883545726
22.	Chipwad	22.3026721526537	73.2129614799731
23.	Dandiya Bazar, VGL office	22.300013399783	73.1994376112698
24.	Darbar chowkdi	22.2732156560498	73.1826563508812
25.	Delux char rasta	22.3338227910472	73.1801447923643
26.	Delux char rasta	22.3338227910472	73.1801447923643
27.	Dena village NH8 Entry	22.354602278298	73.2184564637198
28.	Diwalipura Garden	22.2999832927265	73.1563408715996
29.	Dumad chowkdi	22.3625607276746	73.1945665948209
30.	Fatehgunj Garden	22.3236087775109	73.1867700051596
31.	Fatehgunj nizampura sevenseas crossing	22.3230801060593	73.1842436085179
32.	Fatehgunj Under Bridge	22.3233740386682	73.1885734158006
33.	Fatehpura char rasta	22.3075241400307	73.2102987679062
34.	Fruitmarket char rasta	22.296444974511	73.2022714040966
35.	Fulwadi Charrasta, Navayard	22.3438943002276	73.1642639989164
36.	Gajarawadi Gas Station	22.2875853094451	73.2145659690267
37.	Gajarawadi tran rasta	22.2892355661064	73.2150603994609
38.	Gajarawadi Water Tank	22.2894280294984	73.2155365885715
39.	GandhiNagar Gruh	22.3020726783042	73.2052489529646
40.	Gorwa ITI char rasta	22.3350944291294	73.1528743979214
41.	Gotri Entry	22.3177250566488	73.1239701532587
42.	Haran khana road, panigate	22.2981417762414	73.2156820022315
43.	Hari Nagar char rasta	22.3111634175042	73.1531215000234
44.	Harinagar Water Tank	22.3098338111506	73.153421425455

45.	Harni lake nr pumping station	22.3413242577928	73.219114793824
46.	Harni Water Tank	22.3461425979535	73.2140227451032
47.	Haveli, nr. Mehta pole	22.3021745777097	73.2106085905978
48.	Havmour Cicle	22.30168841197	73.1655014441464
49.	Indrapuri Atithi Gruh	22.3025253791354	73.2300760727827
50.	Iscon temple	22.3089207717998	73.1523937736292
51.	Jail Water Tank	22.3011416582684	73.1911140582286
52.	Jhansi ki rani circle	22.3210296870361	73.1500315157794
53.	Jnurm housing kisanwadi	22.3116798955669	73.2295607961028
54.	JP police station	22.2877504164205	73.1526425956113
55.	Juni gadhi	22.3030044896739	73.2141044218315
56.	Jupiter Char rasta	22.2578863009366	73.1937616258674
57.	Kalptaru crossing	22.3151678581693	73.161342730387
58.	Kamlanagar pond	22.3187852285631	73.2490884341757
59.	Karelibaug panitaki char rasta	22.3198813294897	73.2066356218297
60.	Karelibaugh Police station, bhutdi jhapa	22.3068230952625	73.203982880271
61.	Khodiyar nagar char rasta	22.3190699822954	73.2271746804308
62.	Kirti Stambh	22.2955987853856	73.197222723962
63.	Kisanwadi , Gadheda market	22.309197516801	73.2259443560441
64.	Lal Baugh Garden	22.2825125160635	73.1975030935434
65.	Machhi pith Naka	22.3040088127024	73.1978113211837
66.	Madhunagar Char rasta	22.3406143371138	73.15294802608 26
67.	Mahavir hall char rasta	22.3045054885938	73.2290561567506
68.	Makarpura bus depot	22.2488522017831	73.1962884348752
69.	Makarpura GIDC Bridge	22.2597803383139	73.1806392539395
70.	Makarpura-Chowkdi	22.2261017363498	73.1871314223191
71.	Maneja crossing	22.2372788459471	73.1885193345087
72.	Manjalpur Rly crossing	22.2833170599422	73.1877202458298
73.	Manjalpur Sport Complex	22.2712059222043	73.1845656822198
74.	Motibaug Top Tranrasta	22.2902609492574	73.1943742096818
75.	Mujmahuda tran rasta (existing-police)	22.2858337710648	73.1684196961212
76.	Muktanand tran rasta	22.3206309422523	73.19734339682
77.	nagarwada (Existing-Police)	22.3063325216607	73.2002393105292
78.	Nandanvan Gas Station	22.31131279384	73.1685827037197
79.	Nani shak market	22.2932540358807	73.2103818036715
80.	Narhari hospital circle, Saffron	22.3182288586869	73.1874717432761
81.	Nava yard	22.3360257982606	73.174088439722
82.	Navlakhi Ground1	22.2974596972677	73.1946703029414
83.	Navlakhi Ground2	22.2992048260846	73.1912189331229
84.	Near Atladra store	22.2837883121017	73.1677139286835
85.	Near gurunanak school crossing	22.2674229732378	73.223320815845
86.	NH8 gurukul char rasta entry point	22.2865082852249	73.2482767032463
87.	Nilambar Cross Road	22.3020034418065	73.138631091396
88.	Nimeta Garden	22.3569711063746	73.308045724214
89.	Nimeta Water Plant	22.3562148349001	73.3113181312462
90.	Nr New court	22.3033384877208	73.1596787233404
91.	Nr sarda mandir school	22.306027314705	73.197976243638

92.	Nr swaminarayan mandir	22.2959948149109	73.2155279108219
93.	Nr Transpek circle	22.2752205052657	73.1633339389314
94.	Nr. Alpana talkies pratapnagar tran rasta	22.2851151945771	73.2084505266868
95.	Nr. Harni talav tran rasta	22.3376565723823	73.2175244391816
96.	Opp. Aradhna Cinema Nr. SBI Gate	22.3059398694306	73.1915084542808
97.	Padra Entry/ BAPS HOSPITAL	22.2750765951648	73.158385543649
98.	Padra Entry-Railway Crossing	22.2726048209206	73.1483093161569
99.	Pandya Bridge - Gas Store	22.3222643853348	73.1754499168958
100.	Parivar cross road	22.2929255576923	73.2374560554937
101.	Pratap Talkies	22.301576273452	73.2052607269568
102.	Railway Station - Exit	22.311054549025	73.1797780525641
103.	Rajmahal road	22.2955389698845	73.1948208868733
104.	raneshwar petrol pump char rasta, vasna road	22.2945431091115	73.1522700363017
105.	Sama Sports Complex	22.3417200056853	73.1896817118695
106.	sarasiya talav	22.3057332488467	73.213501706767
107.	Saraswati Char rasta	22.272104803469	73.1910576583969
108.	Satya sai baba circle , deep chamber road	22.2701199409566	73.1967264793984
109.	Sayaji Ganj dairy den circle	22.3092044604589	73.1847267922688
110.	Sayaji Gruh	22.301127254733	73.1685938967162
111.	Sayaji Nagar Water Tank	22.3285018189608	73.2466566672473
112.	Shastribaug garden char rasta	22.2948378280859	73.2183116314674
113.	Shreyas school tran rasta	22.2772728960787	73.1982706062412
114.	Soma talav char rasta	22.2790904674836	73.2301194654278
115.	SSG Gate 3	22.3041475271237	73.1894578661117
116.	SSG Hospital Gate 1	22.3073522162687	73.1898883580944
117.	SSG Hospital gate 2	22.3047402034387	73.192359814449
118.	Susan Circle	22.257366208646	73.1990472961702
119.	T.P. 13 Chhani fire station	22.3462021785067	73.1652112216816
120.	Tarsali Bus stand	22.2561485806768	73.216301092777
121.	Tarsali sardar patel staue tran rasta Nr. talav	22.2519551887968	73.2165395405386
122.	Trident Circle/ Vir savarkar circle	22.3140735522772	73.1644236080186
123.	Vadi rangmahal tran rasta	22.2940678091982	73.2152874918627
124.	Vadivadi Water Tank	22.3150436111907	73.1672590584813
125.	Vaikunth end Highway join	22.2924618537781	73.2485805707768
126.	Vishwamitri bridge-Gujarat Tractor	22.2858411703681	73.1755341720901
127.	Vishwamitri Railway Station	22.2826968884338	73.1789605015022
128.	Vrundavan cross road	22.3001200914486	73.2384021489463
129.	Warasiya water tank	22.3087014995593	73.2165466272527
130.	Yash complex char rasta	22.3156682494454	73.1377745880328

5.9. ATCS Signals

Please refer Master BoQ table above for locations and CCTV List for corresponding signal location.

5.10.Variable Messaging Sign Boards

SrNo	Location	Latitude	Longitude
1	Akshar Chawk	22.282093558371	73.1650912934824
2	Ambedkar circle , towards vidhyut bhavan	22.3105431193262	73.1650278221699
3	Amit nagar	22.3289306927015	73.2071492281718
4	Ayurvedic tran rasta	22.3000951191402	73.2213484611763
5	Chhani Jakat naka	22.3457475280977	73.1759748927715
6	Dumad chowkdi	22.3614518892741	73.1944678923158
7	entrance of padmavati complex	22.3007267137497	73.205643305139
8	Genda circle to racecourse	22.3179157577307	73.1702648895097
9	Genda circle, towards pandya bridge	22.3192561344166	73.1713603705773
10	Gotri entry	22.3177522371248	73.1238366161402
11	Khanderao market	22.2975521562735	73.2017850599368
12	Manek park, opp. airport side to amit nagar	22.3273183771504	73.2128474020207
13	Manek park, opp. airport side to Khodiyarnagar	22.3268488477391	73.2150845034045
14	Mujmahuda tran rasta (existing-police)	22.2858229730656	73.1684717684729
15	Natubhai circle	22.309838342808	73.1589403021512
16	Nyaymandir, towards market and sursagar	22.2988943041592	73.2053154590251
17	Opp. Nursing home	22.3000981840725	73.1951732189533
18	Railway Station - Exit	22.310895810334	73.1821008555102
19	Sangam	22.3192031936262	73.2122882548786
20	Sardar Estate towards mahavir hall	22.3091800101917	73.2356690635981
21	Susan Circle	22.2582358251056	73.1994012741987

5.11. Public Address Systems

Sr	Location	Latitude	Longitude
1	Adaniya pool fatehpura	22.3049954016176	73.2104975121887
2	Ambedkar circle , towards vidhyut bhavan	22.3105431193262	73.1650278221699
3	GandhiNagar Gruh	22.3024450122821	73.2052074954671
4	Kala Ghoda	22.3089132283557	73.1879863667316
5	Laheripura Gate	22.3001179371055	73.2066100058925
6	Mandvi Gate	22.3001509065805	73.2106149535508
7	nagarwada (Existing-Police)	22.3063325216607	73.2002393105292
8	Natubhai circle	22.3099275803654	73.1586370743702
9	Opp. Nursing home	22.3000981840725	73.1951732189533
10	Railway Station - Exit	22.3109043930036	73.1820713528602
11	Shreyas school tran rasta	22.2772728960787	73.1982706062412
12	Tarsali Bus stand	22.2561485806768	73.216301092777
13	Trident Circle/ Vir savarkar circle	22.3139585738034	73.1643758875557

5.12. Environmental Sensors

Sr	Location	Latitude	Longitude
1	Ambedkar circle , towards vidhyut bhavan	22.310270636392	73.1650885004956
2	GSFC	22.3746674102184	73.1590915877686
3	IOC entry	22.3427665035621	73.1511658848581
4	Manek park, opp. airport side to Khodiyarnagar	22.3268488477391	73.2150845034045
5	Nr Transpek circle	22.274588404205	73.1634231014359
6	Railway Station - Exit	22.3109272988759	73.1820872449451
7	Sardar Estate towards mahavir hall	22.3092412579017	73.2357303948289
8	Soma talav char rasta	22.2792188625959	73.2302340224564

5.13. Emergency Call Box

Sr NO	Location	Latitude	Longitude
1.	Adaniya pool fatehpura	22.3049954016176	73.2104975121887
2.	Central bus Depot	22.3136825115893	73.1809313775887
3.	Collector office	22.3034959535107	73.1950900490599
4.	GandhiNagar Gruh	22.3024450122821	73.2052074954671
5.	Railway Station - Exit	22.3109043930036	73.1820713528602
6.	sarasiya talav	22.3058264469851	73.2134188133812
7.	Sur sagar lake 1(Nyaymandir, towards market and sursagar)	22.301298965365	73.2052553638003
8.	Sursagar	22.3000006407871	73.2017502559282
9.	Tarsali sardar patel staue tran rasta Nr. talav	22.2522825803977	73.2156871159261

KML /KMZ file plotted on GIS platform like google earth, for majority of above Location can be shared by VSCDL/VMC, upon written request on email.

6. *Annexure II- Functional requirements*

Functional requirements of the Command and Control Centre System

6.1. Command and Control Centre (CCC) Solution

6.1.1. Objectives

1) The vision of the CCC is to have an integrated view of all the smart initiatives undertaken by VMC/VSCDL/ Other City based Organisations, with the focus to serve as a decision support engine for city administrators in day to day operations as well as during exigency situations. This dynamic response to situations, both pre-active and re-active will truly make the city operations "SMART".

2) CCC involves leveraging on the information provided by various departments and providing a comprehensive response mechanism for the day-to-day challenges across the city. CCC shall be a fully integrated, web-based solution that provides seamless incident – response management, collaboration and geo-spatial display.

3) CCC shall facilitate the viewing and controlling mechanism for the selected field locations in a fully automated environment for optimized monitoring, regulation and enforcement of services. The smart city CCC shall be accessible by operators and concerned authorized entities with necessary authentication credentials.

4) 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.

6.1.2. Functional and Technical Specification for CCC Software

#	Functions	Minimum Specifications	Bidder Compliance
1.	Solution & Platform	The Command & Control solution should be implemented and complied to the industry open standards based Commercial-of-the-shelf (COTS) products.	
2.		Must have built-in fault tolerance, load balancing and high availability & must be certified by the OEM.	
3.		Software (Application, Database and any other) must not be restricted by the license terms of the OEM from scaling out on unlimited number of cores and servers during future expansion.	
4.		System must provide a comprehensive API (Application Program Interface) or SDK (Software Development's Kit) to allow interfacing and integration with existing systems, and future application and sensors which will be deployed on the field.	
5.		The solution should be network and protocol agonistic and provide option to connect legacy system through API's with either read, write or	

		both options. It should connect diverse on premise and/or cloud platform's and makes it easy to exchange data and services between them.	
6.		The system shall allow seamless integration with all of the department's existing and future initiatives (e.g. open source intelligence, situation management war room, etc.)	
7.		The platform should be able to integrate with any type of sensor platform being used for the urban services irrespective of the technology used.	
8.		The platform should be able to normalize the data coming from different devices of same type (i.e. Different lighting sensor from different OEMs, different energy meters from different OEMs etc.) and provide secure access to that data using data API(s) to application developers	
9.	Convergence of Multiple feeds / services	System need to have provision that integrates various services and be able to monitor them and operate them. The solution should provide option to integrate existing deployed solution by City and also need to provide scalability option to implement new use cases. System should have capability to source data from various systems implemented in Vadodara City to create actionable intelligence	
10.	Industry Standards for the Command & Control Centre	The solution should adhere to the Industry standards for interoperability, data representation & exchange, aggregation, virtualization and flexibility	
11.		IT Infrastructure Library (ITIL) standards for Standard Operations Plan & Resource Management	
12.		Geo Spatial Standards like GML & KML etc.	
13.		Business Process Model and Notation (BPMN) or equivalent for KPI Monitoring.	
14.	Command & Control Centre Components	**Web server** to manage client requests. Client should provide web-based, one-stop portals to event information, overall status, and details. The user interface (UI) to present customized information in various preconfigured views in common formats. All information to be displayed through easy-to-use dashboards.	

15.		**Application server** to provide a set of services for accessing and visualizing data. Should be able to import data from disparate external sources, such as databases and files. It should provide the contacts and instant messaging service to enable effective, real-time communication. It should provide business monitoring service to monitor incoming data records to generate key performance indicators. It should also provide the users to view key performance indicators, standard operating procedures, notifications, and reports, spatial-temporal data on a geospatial map, or view specific details that represent a city road, building or an area either on a location map, or in a list view. The application server should provide security services that ensure only authorized users and groups can access data. Analytics functionality can be part of application server or separate server	
16.	Incident Management Requirements	The system must provide Incident Management Services to facilitate the management of response and recovery operations:	
17.		Should support comprehensive reporting on event status in real time manually or automatically by a sensor/CCTV video feeds.	
18.		Should support for sudden critical events and linkage to standard operating procedures automatically without human intervention.	
19.		Should support for multiple incidents with both segregated and/or overlapping management and response teams.	
20.		Should support Geospatial rendering of event and incident information.	
21.		Should support plotting of area of impact using polynomial lines to divide the area into multiple zones on the GIS maps.	
22.		Should support incorporation of resource database for mobilizing the resources for response.	
23.		Should provide facility to capture critical information such as location, name, status, time of the incident and be modifiable in real time by multiple authors with role associated permissions (read, write). Incidents should be	

		captured in standard formats to facilitate incident correlation and reporting.	
24.		The system must identify and track status of critical infrastructure / resources and provide a status overview of facilities and systems	
25.		Should provide detailed reports and summary views to multiple users based on their roles.	
26.		A Reference Section in the tool must be provided for posting, updating and disseminating plans, procedures, checklists and other related information.	
27.		Provide User-defined forms as well as Standard Incident Command Forms for incident management.	
28.	Integrated User Specific & Customizable Dashboard	Should provide integrated dashboard with an easy to navigate user interface for managing profiles, groups, message templates, communications, tracking receipts and compliance	
29.		• Collects major information from other integrated City sensors/platforms. • Should allow different inputs beyond cameras, such as, PC screen, web page, and other external devices for rich screen layout • Multi-displays configurations • Use of, GIS tool which allows easy map editing for wide area monitoring (Google map, Bing map, ESRI Arc GIS map, etc.).	
30.		Should provide tools to assemble personalized dashboard views of information pertinent to incidents, emergencies & operations of command center	
31.		Should provide historical reports, event data & activity log. The reports can be exported to pdf or html formats.	
32.		Should provide dashboard filtering capabilities that enable end-users to dynamically filter the data in their dashboard based upon criteria, such as region, dates, product, brands, etc. and capability to drill down to the details	
33.	Integration with Social Media &	Should provide integration of the Incident Management application with the social	

	Open Source Intelligence	media. Should 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.	
34.		Should extract messages and display it in an operational dashboard.	
35.		Should be able to correlate the extracted message from the social media with existing other events and then should be able to initiate an SOP.	
36.		Should be able to identify the critical information and should be able to link it to an existing SOP or a new SOP should be started.	
37.		Should provide notifications to multiple agencies and departments (on mobile) that a new intelligence has been gathered through open source/social media.	
38.	Device Status, Obstruction Detection and Availability Notification	Should provide icon based user interface on the GIS map to report non-functional device.	
39.		Should also provide a single tabular view to list all devices along with their availability status in real time.	
40.		Should provide User Interface to publish messages to multiple devices at the same time.	
41.	Event Correlation	Command & Control Centre should be able to correlate two or more events coming from different subsystems (incoming sensors) based on time, place, custom attribute and provide correlation notifications to the operators based on predefined business and operational rules in the configurable and customizable rule engine.	
42.	Standard Operations Procedures (SOP)	Command & Control Centre should provide for authoring and invoking un-limited number of configurable and customizable standard operating procedures through graphical, easy to use tooling interface.	
43.		Standard Operating Procedures should be established, approved sets of actions considered to be the best practices for responding to a situation or carrying out an operation.	
44.		The users should be able to edit the SOP, including adding, editing, or deleting the activities.	

45.		The users should be able to also add comments to or stop the SOP (prior to completion).	
46.		There should be provision for automatically logging the actions, changes, and commentary for the SOP and its activities, so that an electronic record is available for after-action review.	
47.		The SOP Tool should have capability to define the following activity types:	
48.		**Manual Activity** - An activity that is done manually by the owner and provide details in the description field.	
49.		**Automation Activity** - An activity that initiates and tracks a particular work order and select a predefined work order from the list.	
50.		**If-Then-Else Activity** - A conditional activity that allows branching based on specific criteria. Either enter or select values for Then and Else.	
51.		**Notification Activity** - An activity that displays a notification window that contains an email template for the activity owner to complete, and then sends an email notification.	
52.		**SOP Activity** - An activity that launches another standard operating procedure.	
53.	Key Performance Indicator	Command & Control Centre should be able to facilitate measurement or criteria to assay the condition or performance of departmental processes & policies.	
54.		**Green** indicates that the status is acceptable, based on the parameters for that KPI, no action is required.	
55.		**Yellow** indicates that caution or monitoring is required, action may be required.	
56.		**Red** indicates that the status is critical and action is recommended.	
57.	Reporting Requirements	Command & Control Centre should provide easy to use user interfaces for operators such as Click to Action, Charting, Hover and Pop Ups, KPIs, Event Filtering, Drill down capability, Event Capture and User Specific Setup	

58.		The solution should generate Customized reports based on the area, sensor type or periodic or any other customer reports as per choice of the administrators	
59.	Collaboration Tools	Should provide tools for users to collaborate & communicate in real-time using instant messaging features.	
60.	Communication Requirements	The solution should adhere to the below mentioned communication requirements.	
61.		Provide the ability to search/locate resources based on name, department, role, geography, skill etc. for rapidly assembling a team, across department, divisions and agency boundaries, during emergency	
62.		Provide the capability to Invite - Using information provided during the location of those individuals or roles, invite them to collaborate and to share valuable information.	
63.		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	
64.		The solution should provide Dispatch Console integrates with various communication channels. It should provide rich media support for incidents, giving dispatchers the power to consolidate information relating to an incident and instantly share that information among responder teams. It should assess the common operating picture, identify & dispatch mobile resources available nearby the incident location. Augment resources from multiple agencies for coordinated response.	
65.	Authentication	Use authentication information to authenticate individuals and/or assign roles.	
66.	Instant messaging	Provide ability to converse virtually through the exchange of text, audio, and/or video based information in real time with one or more individuals within the emergency management community.	
67.	Events and Directives control	Should provide the capability for the events that are produced from a sub- system and are forwarded to the Command & Control Centre. Events could be a single system occurrence or complex events that are correlated from multiple systems. Events could be ad hoc, real-	

		time, or predicted and could range in severity from informational to critical. At the Command & Control Centre, the event should be displayed on an operations dashboard and analysed to determine a proper directive.	
68.		Directives issued by the Command & Control Centre should depend on the severity of the monitored event. Directives will be designed and modified based on standard operating procedures, as well as state legislation. A directive could be issued automatically via rules, or it could be created by the operations team manually.	
69.	What-if Analysis Tool	The solution should provide the capability to manage the emergencies and in-turn reducing risks, salvaging resources to minimize damages and recovering the assets that can speed up recovery.	
70.		To take proactive decisions that help minimize risks and damages, the solution should provide Analytical and Simulation systems as part of the Decision Support System. The solution should help simulate what if scenarios. It should help visualize assets/resources at risk due to the pending/ongoing incident, should render impacted region on a GIS/3D map. The solution should help build the list of assets, their properties, location and their interdependence through an easy to use Graphical User Interface. When in What if Analysis mode the solution should highlight not only the primary asset impacted but also highlight the linked assets which will be impacted. The user should be able to run the What-if Analysis mode for multiple types of emergency events such as Bomb Blast, Weather events, Accidents etc.	
71.	Resource and Route Optimisation	The system should provide the software component for the message broadcast and notification solution that allows authorized personal and/or business processes to send large number of messages to target audience (select-call or global or activation of pre-programmed list) using multiple	

		communication methods including SMS, Voice (PSTN/Cellular), Email and Social Media.	
72.	Alert & Mass Notification Requirements	Provide a single web based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Pager, Voice mail, E-mail and Social Media	
73.		Provide function for creating the alert content and disseminating to end users. Provision of alerting external broadcasting organizations like Radio, TV, Cellular, etc., as web-service.	
74.		Provide Role based security model with Single-Sign-On to allow only authorized users to access and administer the alert and notification system.	
75.	Security & Access Control	Provide comprehensive protection of web content and applications on back-end application servers, by performing authentication, credential creation and authorization.	
76.	Internet Security	Comprehensive policy-based security administration to provide all users specific access based on user's responsibilities. Maintenance of authorization policy in a central repository for administration purposes.	
77.	Authorization	Should support to enable assignment of permissions to groups, and administration of access control across multiple applications and resources. Secure, web-based administration tools to manage users, groups, permissions and policies remotely	
78.	User group	Provide policies using separate dimensions of authorization criteria like Traditional static Access Control Lists that describe the principals (users and groups) access to resource and the permissions each of these principals possess.	
79.	Provide multi-dimensional access control	SSO to Web-based applications that can span multiple sites or domains with a range of SSO options.	
80.	Flexible single sign-on (SSO)	Support LDAP authentication mechanism	
81.	Authentication	Should have ability to respond to real-time data with intelligent & automated decisions	

82.	Rule Engine & Optimization	Should provide an environment for designing, developing, and deploying business rule applications and event applications.	
83.		The ability to deal with change in operational systems is directly related to the decisions that operators are able to make	
84.		Should have at-least two complementary decision management strategies: business rules and event rules.	
85.	Situational Awareness COP (Common Operational Picture)	• The CCA should be able to combine data from various sources and present it as different views tailored to different operator's needs. • The CCA should automatically update the information based on alarms and incidents that are presented to it via the business rules engine. The polling and CCA database refresh cycle shall be configurable to match the status of the situation (whether there is an emergency or crisis or just monitoring only). • Common Operational Picture should comprise of a comprehensive view of the incident or a group of related incidents as on a specific date and time which should include but not be limited to the following: o Tasks assignment and their status o Agencies involved o Resources deployed o Incident status across relevant parameters of the incident e.g. household affected by a transformer shut down o Timeline view of the situation Suggested actions from the system with their status	
86.	Task Management	• The system should be able to create, assign, track and report on the lifecycle of tasks during a particular incident. • The system should allow a particular task to be decomposed into sub-tasks. • The system should provide an easy to interpret management dashboard view	

		of the progress of all tasks during an incident. • The system should be able to organise the visual representation of tasks into prioritized list, filtered list, as well as colour coded representation for ease of understanding. • The system should be able to perform the following functions around task management: o Create a task with unique ID. (Subtasks shall follow parent ID with second level numbering). o Assign a target completion date and time for the task, either directly or as a time-span from the task's creation. o Date and time stamp of the creation of the task. o Log and track status of tasks. System should provide capability to define status of tasks during its lifecycle. These status definitions could be mapped to other task attributes such as the task type. o Key-word search against task list. • The above attributes shall be colour coded. • The system shall allow the tasks to be filtered on the real-time dashboard by agency then by task status. This filtering should allow an operator to filter for all tasks of a particular state or a combination of state; and by the time remaining until (or time elapsed since) the target completion time. • The system should allow multiple individual workstations to select specific agencies of interest on each workstation simultaneously. • The system should allow the VSCDL to display all agencies' tasks simultaneously as well. • The tasks should be displayed on a real-time timeline.	

		The criticality of tasks should be dynamically changed depending on the performance of the incident response.	
87.	Timeline and Charting	• The system should provide a facility to see incidents and actions (tasks) added to the CCA in a tabular list form as well as Gantt chart format filtered by day, week, month, year or any specific date range. • The system should provide a facility to see incidents, actions and interdependencies between actions in a clear visual graphical manner. • The system should be able to filter the information based on at least the following parameters: ○ Incident information ○ Resources information ○ Agency type ○ Tasks Criticality or priority	•
88.	GIS Display	• Shall view the environment through geospatial or fixed composite computer-generated (JPEG, BMP, AutoCAD, etc.) map • Should allow user to view sensor and related name from the displayed map • Should allow all resources, objects, sensors and elements on the map to be geo-referenced such that they have a real world coordinate. • Should visually display a camera sensor with related camera orientation, camera range and camera field of view angle. • Should visually display an alarming sensor on map • Should visually differentiate sensor alarm severities on map through different color and icon identifiers • Should immediately view alarm details (including description, video, etc.) and investigate the alarm from the map • Should allow user to choose camera and other sensors from map to view live video and the data	•

		• Should allow user to choose camera and take live video image snapshot and save to file from any camera • Should allow user to choose camera from map to move PTZ cameras • Should allow user to choose camera to play, pause, stop, fast-forward, rewind, and play recorded video from preset time • Should allow user to choose camera and take recorded video image snapshot and save to file or print from any live or recorded video • Should allow user to jump from one map to the next with a single click of a mouse with map links • Should allow map information "layers" to be displayed/hidden on items such as – o Sensor names o Sensors o Sensor range (e.g. camera – orientation, range, field of view angle) o Locations and zones o Perimeter ranges o Resource tracks Allow user to zoom in/out on different regions of map graphic	
89.	Video Display	• Shall view live or recorded video from resizable and movable windows • Should have an ability to perform video controls for video systems from workstation • Shall play, fast-forward, rewind, pause, and specify time to play recorded video • Shall take a video still image (snapshot) from live or recorded video • Shall export video for user specified time and duration • Shall have the capability to move PTZ cameras • Shall view Video in Video Matrix • Shall display in 1x1, 2x2, 3x3 and 4x4 window formats • Shall enable operator to specify video windows to be displayed in matrix	•

		• Shall enable matrix settings to be saved per user • Shall view either live or recorded video can be displayed in the video matrix window. • Shall enable video snapshot to be taken and saved from any window pane in the matrix view • Shall rotate video in "virtual" video guard tour • Shall rotate through multiple video views based on predefined video camera sequence and duration. • Shall enable the user to pause the rotation of video and resume the video rotation again • Shall enable times between new video to be adjusted • Shall enable both live video and recorded video to be played through the video guard tour. • Shall enable alarms to be generated from any video pane • Shall enable user to only view and control video for which they have been assigned permissions by the administrator • Shall manually create an alarm from the live or recorded video with specified severity and description	
90.	Alarm Display	• Should have an ability to display alarm condition through visual display and audible tone • Should have an ability to simultaneously handle multiple alarms from multiple workstations • Should have an ability to automatically prioritize and display multiple alarms and status conditions according to pre-defined parameters such as alarm type, location, sensor, severity, etc. • Should display the highest priority alarm and associated data / video in the queue as default, regardless of the arrival sequence	

91.	Historical Alarm Handling	• Should have an ability to view historical alarms details even after the alarm has been acknowledged or closed. • Should have an ability to sort alarms according to date/time, severity, type, and sensor ID or location.	
92.	Alarm Reporting	• Should have an ability to generate a full incident report of the alarm being generated. • Should have an ability to display report on monitor and print report • Should have details of alarm including • severity, time/date, description and location • Captured video image snapshots • Relevant sensor data such as SCADA sensors • Response instructions • Alarm activities (audit trail) • Should have an ability to export alarm report in various formats including pdf, jpeg, html, txt, and mht formats • Should have an ability to generate an alarm incident package including the full incident report and exported sensor data from the incident in a specific folder location.	
93.	Alarm Policies and Business Logic Administration	• The CCA solution should have the following ability to handle the workflow alarms through graphical user interface. • Should have an ability to match keywords or text from the alarming subsystem's incident description to raise an alarm using criteria including exact match, exact NOT match, contains match, wildcard match and regularly expression match (such as forced door alarm, denied access, door open too long, etc.) • Should have an ability to optionally match alarming subsystem's incident status, incident severity, and sensor type • Should have an ability to apply any alarm policy to one or more monitoring area(s) or zone(s) without having to reapplying the policy multiple times.	

		• Should have an ability to apply any alarm policy to one or more sensors without having to reapply the policy multiple times. • Should have an ability to assign specific actions for each alarm • Should have an ability to activate or deactivate alarms as required • Should have an ability to create exceptions • • Should Create batch-wise rules and process them • Should Check and rectify logical errors and contradictory rules • Should have an ability to schedule execution of rules • Should Suspend or Terminate the application of rule Should archive unused or deactivated rules	

6.1.3. Mobile App for Field Staff

The CCC Solution shall have a field level mobile app, through which the field staff can manage and close any task/issues. There would not be more than 1000 field staff using this app. The app should have facility to upload a geo-tagged & time-stamped photograph and remarks text, from mobile device.

6.1.4. Integration Required

1) The CCC 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.
2) The CCC would also equip city administration to respond quickly and effectively to emergency or disaster situation in city through Standard Operating Procedures (SOPs) and step-by-step instructions. The CCC shall support and strengthen coordination in response to incidents/emergencies/crisis situations.
3) Single Dashboard for City Infrastructure Management & Smart City Services for Smart Sensors, Smart Lighting, Smart Parking System, GIS Services and Other 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:
    - 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 Vadodara Traffic police)

- Access information of water management (SCADA) resources as indicated in Annexure VIII
- Information about waste management resources
- Integration with VMC ERP System for various administrative and financial dashboards (including GIS based integration).
- City environmental data
- Take action based on events generated by any city infrastructure device

4) The system shall provide reporting & audit trail functionalities to track all the information and monitor operator interactions with the system and to impart necessary training to the users

6.1.5. Use cases for CCC Implementation

An indicative list of use cases which the SI will be required to implement as part of the CCC system are detailed out below. As and when the system expands and more applications get added the SI is required to be open to all such subsequent additions. Exact definition of the uses cases shall be finalised as SRS stage.

Corresponding feeds/data would be made available from external source-system to be integrated (i.e. from ERP system, Water SCADA System etc.). The SI must carry out complete integration, where source-system is part of the current project scope such as CCTV Cameras, Environmental sensors etc.

#	Function	Use Case	Stakeholder for Use Case
1.	Traffic	View ambient condition at a given ATCS traffic signal. The view would include: Overall 360 degree view, edge view of 180 degree and specific lane views.	Police
2.	Traffic	View ambient condition at a ATCS corridor. The view would include: specific arm of carriage way across multiple signals in a corridor.	Police
3.	Traffic	View cycle times for signals (where adaptive traffic control has been implemented) across all junctions in the city with a facility to drill down.	VSCDL / VMC
4.	Traffic	View ambient volume count across all ATCS junctions in the city with a facility to drill down volume count on each arm.	VSCDL / VMC
5.	Traffic	Track movement of a flagged vehicle (with number tagged as Wanted", "Suspicious", "Stolen") across the city on map with relevant video feeds	Police
6.	Traffic	View the eChallans generated across a region, with a facility to drill down. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	Police
7.	Traffic	View the list of repeat violators. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	Police

8.	Traffic	View the vehicle volumes across ATCS traffic signals. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	Police
9.	Traffic	View traffic violation count super imposed on the map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	Police
10.	Traffic	View traffic volume count super imposed on the map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
11.	Safety	View camera feeds across the city with cameras on a sample basis appearing across the video wall. The view should have provision to auto select new set of cameras after pre configured time.	Police
12.	Safety	View all camera feeds in vicinity of selected camera based on geographical selection of the area. The geographical selection can be in terms of a polygon or could be linear.	Police
13.	Safety	View and playback recording from past (based on availability in storage) of a specific camera or cameras defined in a geography.	Police
14.	Safety	Identify unattended objects, baggage, vehicle in a given camera feed with help of analytics	Police
15.	Safety	View network of cameras on the map, including incidents detected and resolved. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	Police
16.	Safety	Auto identify a specific camera and show the feed based on data / threshold from traffic/ display/ sensor subsystems.	Police
17.	Connectivity	View consumption patterns of data across Wi-Fi access points	VSCDL / VMC
18.	Connectivity	View list of URLs accessed from a public IP based on a given time frame and IP address	VSCDL / VMC
19.	Connectivity	View the coverage and usage patterns superimposed on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
20.	Connectivity	View connectivity status of all field devices/sensors superimposed on the city map.	VSCDL / VMC
21.	Connectivity	View the bandwidth utilization of all field devices superimposed on the city map.	VSCDL / VMC
22.	Display	View the messages displayed at the Variable Messaging Sign Board (display boards) in a specific area of the city. The geographical selection can be in terms of a polygon or could be linear.	VSCDL / VMC
23.	Display	View all the messages displayed on a given Variable Messaging Sign Board (display boards). The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC

24.	Display	Change the message to be displayed on a specific display board, display board in an area or across the city.	VSCDL / VMC
25.	Display	View the advertisements displayed at the display board (Bill Board) on iPoles in a specific area of the city. The geographical selection can be in terms of a polygon or could be linear.	VSCDL / VMC
26.	Display	View all the advertisements displayed on a given iPole Display board (Bill board). The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
27.	Sensor	View NOX levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
28.	Sensor	View SO2 levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
29.	Sensor	View CO2 levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
30.	Sensor	View O2 levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
31.	Sensor	View noise levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
32.	Sensor	View ambient light levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
33.	Sensor	View humidity light levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
34.	Sensor	View UV light levels across the city, view threshold breaches, and view data superimposed on a map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
35.	Transit	View the feeds received from GPS Devices from Public Transport buses) on the city map.	VSCDL / VMC

36.	Civic Center/Ward	View the aggregate transactions performed at a given civic center on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
37.	Civic Center/ Ward	View the rating of civic centers based on collections, services offered and staff availability on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
38.	Civic Center / Ward	View the feeds received from ERP system on the city map.	VSCDL / VMC
39.	Property Tax	View the tax collected on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
40.	Property Tax	View the tax to be collected and shortfall (from tax value) on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
41.	Property Tax	View turnaround times for collection of property tax on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
42.	Property Tax	View the feeds received from ERP system on the city map.	VSCDL / VMC
43.	Birth Registration	View normal births registered on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
44.	Birth Registration	View abnormal births on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
45.	Birth Registration	View turnaround times for issuance of certificate on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
46.	Birth Registration	View the feeds received from ERP system on the city map.	VSCDL / VMC
47.	Death Registration	View deaths registered on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
48.	Death Registration	View turnaround times for issuance of certificate on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
49.	Death Registration	View the feeds received from ERP system on the city map.	VSCDL / VMC

50.	License	View the licenses (unique view for each license type) expired (not renewed) on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
51.	License	View the licenses (unique view for each license type) issued on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
52.	License	View the license turnaround times (unique view for each license type) issued licenses on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
53.	License	View the feeds received from ERP system on the city map.	VSCDL / VMC
54.	Building Permission	View the building permissions (unique view for each license type) issued on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
55.	Building Permission	View the building permission turnaround times (unique view for each license type) issued licenses on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
56.	Building Permission	View the demand required (water, waste, sewerage, etc.) as a result of building permissions given in the city on the city map.	VSCDL / VMC
57.	Building Permission	View the feeds received from ERP system on the city map.	VSCDL / VMC
58.	Water	View water related grievances on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
59.	Water	View the distribution network status on the city map.	VSCDL / VMC
60.	Water	View the distribution volumes on the city map.	VSCDL / VMC
61.	Water	View the feeds received from SCADA system on the city map.	VSCDL / VMC
62.	Water	View the underground utility network on the map.	VSCDL / VMC
63.	Accounts	View the spending pattern across the budget heads with a facility to drill down. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
64.	Accounts	View area wise budget spent across the city on a city map.	VSCDL / VMC
65.	Accounts	View the feeds received from ERP system on the city map.	VSCDL / VMC
66.	Solid Waste	View waste related grievances on the city map. The view should allow the facility to change the time scale	VSCDL / VMC

		from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	
67.	Solid Waste	View movement of Garbage pick up vehicles on the city map.	VSCDL / VMC
68.	Solid Waste	View the feeds received from ERP system on the city map.	VSCDL / VMC
69.	Solid Waste	View the feeds received from Solid Waste Management system on the city map.	VSCDL / VMC
70.	Welfare Schemes	View the benefits issued (unique view for each benefit) issued on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
71.	Welfare Schemes	View the feeds received from ERP system on the city map.	VSCDL / VMC
72.	Project Systems	View the project status (physical completion and financial completion) for each ongoing project in the city.	VSCDL / VMC
73.	Project Systems	View the feeds received from ERP system on the city map.	VSCDL / VMC
74.	Hospital	View the feeds received from HMIS system on the city map.	VSCDL / VMC
75.	Material Management	View the feeds received from ERP system on the city map.	VSCDL / VMC
76.	Procurement	View the feeds received from ERP system on the city map.	VSCDL / VMC
77.	Grievances	View outstanding grievances based on number of outstanding days on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
78.	Grievances	View open grievances, closed grievances, in progress grievances on the city map. The view should allow the facility to change the time scale from 1 hr. to 1 year, with daily, weekly, monthly, quarterly and yearly views available.	VSCDL / VMC
79.	Sewerage	View the underground network on the map.	VSCDL / VMC
80.	Storm Water	View the underground network on the map.	VSCDL / VMC
81.	Assets	View geo tagged movable assets on the map based on their classification.	VSCDL / VMC
82.	Assets	View non-civic infrastructure assets on the map based on their classification.	VSCDL / VMC
83.	Assets	View civic infrastructure assets on map based on their classification	VSCDL / VMC

6.1.6. Other Requirements

1) The CCC 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 VMC network of services through an integration layer.

2) The CCC will be established with all furniture, hardware, software and network infrastructure including switches and routers and will be maintained by the successful bidder throughout the mentioned period. VSDCL takes the responsibility of necessary civil work including electrical, mechanical (AC) etc.
3) All required Servers, Storage, Software, Firewall, Network Switches for entire project shall be installed in the integrated manner.
4) The controls and displays should be mounted in ergonomically designed consoles to keep operator fatigue to a minimum and efficiency high.
5) **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 DC Area located within CCC Building. Further the platform will provide an open standards based integration Bus with API Management, providing full API lifecycle management with governance and security.

6.2. Surveillance (CCTV) Cameras

Functional Requirement of the overall Surveillance System can be categorised into following components:

1. Information to be Captured by Edge Devises
2. Information to be analysed at Command Centre
3. Role Based Access to the Entire System
4. Storage / Recording Requirements
5. Other General Requirements

6.2.1. Information to be captured by Edge Devices

Surveillance Cameras being one of the core sub modules of project, it is important that their selection and placement is carefully done to ensure the maximum coverage. These cameras need to work on 24 X 7 basis and transmit quality video feeds to the CCC and would capture the video feeds

Sr No	CCTV Camera operations (Fixed and PTZ)	FPS	Resolution
1	Normal time / Day time – 18 hours	15	1920x1080
2	Less movement time / Night time – 8 hours	8	1920x1080

However, VSCDL, VMC and Vadodara Traffic Police may take the regular review of the requirements for video resolution, FPS and may change these numbers to suit certain specific requirements (for example, there could be a situation when certain cameras are required to be viewed at higher FPS for specific period. It is estimated that not more than 5% of the cameras would be required to be viewed at higher FPS at a given point of time). Video feeds will be stored as per following:

Sr No	Type of Storage	DC Storage for days	DR storage for days
1	Primary Storage	7 for CCTV feeds, 90 Days for ANPR, ATCS feeds 180 days for rest of sensors	7 for CCTV feeds, 90 Days for ANPR, ATCS feeds 180 days for rest of sensors
2	Secondary Storage	23 days for CCTV Feeds,90 Days for ANPR, ATCS feeds 180 days for rest of sensors	90 Days for ANPR, ATCS feeds 180 days for rest of sensors

It is recommended to clearly identify in SLAs that cameras need to transmit quality video feed (appropriately focused, clear, un-blurred, jitter free, properly lit, unobstructed, etc.). Packet loss is to be less than 0.5 percent.

6.2.2. Information to be analysed at Command Centre

#	Minimum Requirements	Bidder Compliance(Yes/No)
1	The proposed Video Management System should provide a complete end-to-end solution for security surveillance application. The control centre shall allow an operator to view live / recorded video from any traffic surveillance camera on the IP network. The combination of control centre and the IP network would create a virtual matrix, which would allow switching of video streams around the system	

As informed in the Tender, not all the surveillance cameras would be simultaneously viewed at Command Centre. Video management system should have event alert facility over E-Map. Alert Pop-Ups/Notification along with live video stream of the camera (At ECB) will be triggered, if someone activate emergency calling button

6.2.3. Role Based Access to the Entire System

Various users should have access to the system using single sign on and should be role based. Different roles which could be defined (to be finalized at the stage of SRD) could be Administrator, Supervisor, Officer, Operator, etc. Apart from role based access, the system should also be able to define access based on location. Other minimum features required in the role based authentication systems are as follows:

#	Minimum Requirements	Bidder Compliance(Yes/No)
1	The management module should be able to capture basic details (including mobile number & email id) of the Police Personnel & other personnel requiring Viewing / Administration rights to the system. There should be interface to change these details, after proper authentication.	

#	Minimum Requirements	Bidder Compliance(Yes/No)
2	Rights to different modules / sub-modules / functionalities should be role based and proper log report should be maintained by the system for such access.	
3	Biometric standardized coupled with login name & password should be enabled to ensure that only the concerned personnel are able to login into the system	
4	There should be provision to specify hierarchy of operators / officers for control of the cameras from various locations.	
5	The number of users shall increase as per phase wise implementation. SI is expected to estimate and provision the same based on the phase wise requirements given in RFP. Windows Active Directory/LDAP or any such system can be used to design role based access.	

6.2.4. Storage/Recording Requirements

It is proposed that the storage solution shall be modular enough to ensure compliance to the changes in storage / recording policy, to be evolved upon initial deployment of the system. The following storage requirements shall be fulfilled by the SI as scope for the project:

a) 30 days of storage (7 days on primary and 23 days on secondary) for all traffic surveillance camera feeds
b) Data on storage would be over-written automatically by newer data after the stipulated time period. If some data is flagged by police personnel (or by designated personnel) as important data / evidence data due to some reporting of crime or accident in the area or due to court order or due to suspicious activity, it would need to be stored for longer duration, as per requirements. VMC/VSCDL/Vadodara Police would analyse such flagged data every 3 months to take such decisions for preservation of the flagged data beyond 90 days.
c) Full audit trail of reports to be maintained for 90 days.

Please refer **Annexure III** of this document of Tender for specifications for storage.

#	Minimum Requirements	Bidder Compliance (Yes/No)
1	Retrieval time for any data stored on secondary storage should be max. 4 hours for critical data & 8 hours for other data.	
2	The recording servers / system, once configured, shall run independently of the Video Management system and continue to operate in the event that the Management system is off-line.	
3	The system shall support the use of separate networks, VLANs or switches for connecting the cameras to the recording servers	

#	Minimum Requirements	Bidder Compliance (Yes/No)
	to provide physical network separation from the clients and facilitate the use of static IP addresses for the devices.	
4	The system shall support H.264 or better, MPEG-4 and MJPEG compression formats for all analog cameras connected to encoders and all IP cameras connected to the system.	
5	The system shall record the native frame rate and resolution supplied by the camera or as configured by the operator from the system administration server.	
6	The system should not limit amount of storage to be allocated for each connected device.	
7	The on-line archiving capability shall be transparent and allow VSCDL/VMC/Police to browse and archive recordings without the need to restore the archive video to a local hard drive for access.	
8	The system shall allow for the frame rate, bit rate and resolution of each camera to be configured independently for recording. The system shall allow the user to configure groups of cameras with the same frame rate, bit rate and resolution for efficient set-up of multiple cameras simultaneously.	
9	The system shall support archiving or the automatic transfer of recordings from a camera's default database to another location on a time-programmable basis without the need for user action or initiation of the archiving process. Archiving shall allow the duration of the camera's recordings to exceed the camera's default database capacity. Archives shall be located on either the recording server or on a connected network drive. If the storage area on a network drive becomes unavailable for recording the system should have the ability to trigger actions such as the automatic sending of email alerts and sound alerts to necessary personnel.	
	Bandwidth optimization	
10	The Recording Server / System shall offer different codec (H.264, MJPEG, MPEG-4, etc.) frame rate & Resolution (1080P, 960P, 720P, 4CIF, CIF, QCIF) options for managing the bandwidth utilization for live viewing on the Client systems. (through use of multiple systems such as transcoding server)	

6.2.5. Other General Requirements

Management/Integration functionality

#	Minimum Requirements	Bidder Compliance (Yes/No)
1	The Surveillance System shall offer centralized management of all devices, servers and users.	

#	Minimum Requirements	Bidder Compliance (Yes/No)
2	The Surveillance System should not have any limit on the number of cameras to be connected for Surveillance, Monitoring and recording. Any increase in the no. of cameras should be possible by augmentation of Hardware components.	
3	The Surveillance System should have ability to knit the video streams from multiple cameras, based on the date/time stamp. Every video stream shall have date, time, source camera location, FPS etc. water-marked. These attributes shall be finalized at the System Design time. There shall be a centralized NTP server, from which all devices shall synchronize the date and time.	
4	The Surveillance System shall support distributed viewing of any camera in the system using Video walls or big screen displays.	
5	The Surveillance System shall support alarm management. The alarm management shall allow for the continuous monitoring of the operational status and event-triggered alarms from system servers, cameras and other external devices.	
6	It should be possible to integrate the Surveillance System with 3rd-party software, to enable the users to develop customized applications for enhancing the use of video surveillance solution. For e.g., integrating alarm management to initiate SMS, E-Mail, VoIP call etc.	
7	It should be possible to integrate social media platforms to Surveillance System to enable VSCDL/VMC/Police to track and monitor certain trending incident or crime.	
8	The Management system shall store the overall network elements configuration in central database, either on the management server computer or on a separate DB Server on the network.	
9	System should be able to be integrated with Event Management / Incident Management System, if implemented by VSCDL/VMC/Police in future.	
10	From the VSCDL/VMC/Police, the user shall have the option of having video images continually streamed or only updated on motion to conserve bandwidth between the Client systems and the Recording Server.	
11	The Recording Server / System shall support camera (analogue and IP cameras) devices from various manufacturers.	
12	The Recording Server / System shall support the PTZ protocols of the supported devices listed by the camera OEMs.	
13	The system shall support full two-way audio between Client systems and remote devices. (Audio from certain set of cameras can be recorded in future).	

#	Minimum Requirements	Bidder Compliance (Yes/No)
14	**Failover Support**	
a.	The system shall support automatic failover for recording servers. This functionality shall be accomplished by failover server as a standby unit that shall take over in the event that one of a group of designated recording servers fails. Recordings shall be synchronized back to the original recording server once it is back online.	
b.	The system shall support multiple failover servers for a group of recording servers.	
15	**SNMP Support**	
a.	The system shall support Simple Network Management Protocol (SNMP) in order for third-party software systems to monitor and configure the system.	
b.	The system shall act as an SNMP agent which can generate an SNMP trap as a result of rule activation in addition to other existing rule actions.	

Rules

The system shall support the use of rules to determine when specific actions occur. Rules shall define what actions shall be carried out under specific conditions. The system shall support rule initiated actions such as:

#	Supported Rules	Bidder Compliance(Yes/No)
1	Start and stop recording	
2	Set non-default live frame rate	
3	Set non-default recording rate	
4	Start and stop PTZ patrolling	
5	Send notifications via email	
6	Pop-up video on designated Client Monitor recipients	

Client System

The Client system shall provide remote users with rich functionality and features as described below.

#	Functionality	Bidder Compliance (Yes/No)
1	Viewing live video from cameras on the surveillance system	
2	Browsing recordings from storage systems	
3	Creating and switching between multiple of views.	
4	Viewing video from selected cameras in greater magnification and/or higher quality in a designated hotspot.	
5	Controlling PTZ cameras.	
6	Using digital zoom on live as well as recorded video.	

7	Using sound notifications for attracting attention to detected motion or events.	
8	Getting quick overview of sequences with detected motion.	
9	Getting quick overviews of detected alerts or events.	
10	Quickly searching selected areas of video recording for motion (also known as Smart Search).	

Other Miscellaneous Requirements

#	Minimum Requirements	Bidder Compliance (Yes/No)
1	System should have a facility to create CDs or other storage media for submission to Judiciary, which can be treated evidence for legal matters. Such storage media creation should be tamper proof and SI to provide appropriate technology so that integrity and quality of evidence is maintained as per requirements of the judiciary. Bidder is required to specify any additional hardware / software required for this purpose & the same can be listed in miscellaneous section of the commercial bid. SI will also prepare the guideline document to be followed by the Police Personnel for the retrieval of Video / images from the CCTV System so as to maintain integrity of the evidence. Such a guideline document should include methods of retrieval of data, check-list to be followed and flowchart of the entire process to be followed.	
2	Video clips should be converted into .AVI file which can be used by the Police as an evidence	
3	All the systems proposed and operationalization of Video Management System should comply with requirements of IT Acts.	
4	Any hardware or software required to achieve the functional requirement and technical solution of the overall Project (may not be not specified in the schedule) is to be proposed in the Bid and borne by the SI.	
5	Surveillance System being implemented a part of this project, and ensure that all the necessary access is given to these mobile users. Functionalities to be provided through mobile application: Viewing of any video steam from Central VMS, uploading of video / pictures central VMS, Location based GIS Map access, tagging of mobile device/location information for all relevant functionalities.	

6.3. Adaptive Traffic Control System

#	Building Blocks	Bidder Compliance(Yes/No)

1	Traffic Signal Controller	
2	Vehicle Detectors	
3	Communication Network	
4	Software Application	

6.3.1. Traffic Signal Controller

#	Description	Bidder Compliance(Yes/No)
1	The Traffic Signal Controller equipment is a 32 bit or 64 bit microcontroller with solid state traffic signal lamp switching module with the ability to program any combination of traffic signal stages, phases and junction groups. The controller will ideally have a conflict monitoring facility to ensure that conflicting, dangerous are pre-flagged at the programming stage and these are disallowed even during manual override phase.	
2	The Traffic Signal Controller will be adaptive so that it can be controlled through the central traffic control centre as an individual junction or as part of group of traffic junctions along a corridor or a region. The signal controller design must be flexible for the junction could be easily configured to be part of any corridor or group definition and could be changed through central command controller easily	
3	Site specific configuration data shall be stored in a non-volatile memory device (FLASH memory) easily programmable at the site through keypad or laptop. A minimum of 512KB flash memory and 128KB RAM shall be provided. Volatile memory shall not be used for storing the junction specific plans or signal timings.	
4	All timings generated within a traffic signal controller shall be digitally derived from a crystal clock which shall be accurate to plus or minus 100 milliseconds.	
5	The controller shall provide a real time clock (RTC) with battery backup that set and update the time, date and day of the week from the GPS. The RTC shall have minimum of 10 years battery backup with maximum time tolerance of +/- 2 sec per day.	
6	The controller shall have the facility to update the RTC time from ATCS server, GPS and through manual entry.	
7	The controller shall be capable of communicating with the ATCS server through Ethernet on a managed leased line network or any other appropriate stable communication network.	

A) Police Panel

The controller shall provide the following facilities in a separate panel with provision for lock and key arrangements for use by the Traffic Police.

#	Description	Bidder Compliance(Yes/No)
1	Four Hurry Call switches: The Hurry Call mode will provide the means to force the controller to a defined stage, without violating safety clearances. A preemption	

#	Description	Bidder Compliance(Yes/No)
	input may be used to demand the Hurry Call mode to give right of way to emergency vehicles. It should be possible to configure the Hurry Call switches to any stage as per site requirements.	
2	One Forced Flash Switch: Activation of this switch should force the signal to Flashing Amber / Flashing Red.	
3	One Auto / Manual Switch: Activation of this switch should enable manual operation of the controller. Deactivation of the manual switch shall continue from the current stage without interruption.	
4	One Manual Advance Pushbutton Switch: In manual operation mode, the stages appear in the sequence specified in the signal plan timetable. Activating the pushbutton switch shall terminate the currently running stage and start the next, without violating safety clearances.	
5	One Junction OFF Switch: Activating this switch should put OFF all signal lamps. On deactivation of the switch the traffic signal controller shall resume its normal operation without violating any safety clearances.	

B) Modes of Operation

The traffic signal controller shall have the following modes of operation:

#	Description	Bidder Compliance(Yes/No)
1	Fixed Time: In fixed time (pre-timed) mode the traffic signal controller shall execute stage timings according to the site specific timetable maintained in the traffic signal controller FLASH memory. Inputs from vehicle detectors shall be ignored in this mode and no preemption shall be made on any stage. Cycle time remains constant in every cycle execution for a given time period.	
2	Vehicle Actuation with All Stages Preemption: In the vehicle actuation with all stages preemption mode, the traffic signal controller shall execute stage timings as per demand from vehicle detectors within the constraints of Minimum Green, Maximum Green running period for the stage and Cycle time stored in the traffic signal controller FLASH memory. Preemption shall be possible for all demand actuated stages. Cycle time may vary in every cycle execution.	
3	Semi-Actuation: In the semi-actuation mode, the traffic signal controller shall execute stage timings in the vehicle actuated stages as per demand from vehicle detectors within the constraints of Minimum Green, Maximum Green running period for the stage and Cycle time stored in the traffic signal controller FLASH memory. All other stages shall execute the Maximum green time configured for the stage. Preemption shall be possible for all demand	

#	Description	Bidder Compliance(Yes/No)
	actuated stages. Cycle time may vary in every cycle execution.	
4	Stage Skipping: The traffic signal controller shall not execute the stage enabled for skipping when there is no vehicle demand registered for the stage till clearance amber time of the previous stage.	
5	Transit Signal Priority (TSP) for BRT buses: The traffic signal controller shall provide transit signal priority for buses in dedicated lane to ensure minimum stop delay at the intersection, without violating safety clearances.	
6	Vehicle Actuation with Fixed Cycle length: In vehicle actuation with fixed cycle length mode, the traffic signal controller shall execute stage timings as per demand from vehicle detectors within the constraints of Minimum Green, Maximum Green running period for the stage and Cycle time shall be maintained constant during a given timeslot. Preemption for all demand actuated stages except for Priority Stage shall be possible.	
7	Full ATCS (FATCS): In FATCS mode, the traffic signal controller shall execute stage timings as per demand within the constraints of Minimum Green, Maximum Green running period for the stage and Cycle time specified by the Central Computer during every cycle switching. Preemption for all demand actuated stages except Priority Stage shall be possible in this mode. The traffic signal controller shall identify a communication failure with the central computer within a specified time period. In such an event the signal plan timings shall be executed from the local timetable stored in the traffic signal controller FLASH memory. Fallback mode of the traffic signal controller shall be vehicle actuated. On restoration of the communication with central computer the traffic signal controller shall automatically resort to FATCS mode. The traffic signal controller shall accept commands for remote selection / de-selection of the following from the Central Computer at TCC/CCC: Hurry Call Flashing Amber / Flashing Red Junction Off If not reverted to the normal operation within the time period listed below, the traffic signal controllers shall timeout the commands and operate normally Hurry Call – 5 Minutes Flashing Amber / Flashing Red – 30 Minutes Junction Off – 30 Minutes The traffic signal controller shall report the following to the Central Computer through the communication network every cycle or on an event as appropriate. Green time actually exercised for each approach (stage preemption timing) against the Green running period set for the approach by the Central Computer Mode of Operation	

#	Description	Bidder Compliance(Yes/No)
	Lamp failure, if any Output short circuit, if any Detector failure, if any	

C) Traffic Signal Controller Operating Parameters

Phases - The controller shall have facility to configure 32 Phases either for vehicular movement, filter green, indicative green, pedestrian movement or a combination thereof.

#	Description	Bidder Compliance(Yes/No)
1	It shall be possible to operate the filter green (turning right signal) along with a vehicular phase. The filter green signal shall flash for a time period equal to the clearance amber period at timeout when operated with a vehicular phase.	
2	The pedestrian phase signal shall be configured for flashing red or flashing green aspect during pedestrian clearance.	
3	It shall be possible to configure any phase to the given lamp numbers at the site.	
4	Stages – The controller shall have facility to configure 32 Stages	
5	Cycle Plans – The controller shall have facility to configure 24 Cycle Plans and the Amber Flashing / Red Flashing plan. It shall be possible to define different stage switching sequences in different cycle plans. The controller shall have the capability for a minimum of 32 cycle-switching per day in fixed mode of operation.	
6	Day Plans – The controller shall have facility to configure each day of the week with different day plans. It shall also be possible to set any of the day plans to any day of the week. The controller shall have the capability to configure 20 day plans.	
7	Special Day Plans – The controller shall have facility to configure a minimum of 20 days as special days in a calendar year.	
8	Starting Amber – During power up the controller shall initially execute the Flashing Amber / Flashing Red plan for a time period of 3 Seconds to 10 Seconds. The default value of this Starting Amber is 5 Seconds. Facility shall be available to configure the time period of Starting Amber within the given limits at the site.	
9	Inter-green – Normally the inter-green period formed by the clearance Amber and Red extension period will be common for all stages. However, the controller shall have a facility to program individual inter-green period from 3 Seconds to 10 Seconds.	
10	Minimum Green – The controller shall allow programming the Minimum Green period from 5 Seconds to 10 Seconds without violating the safety	

#	Description	Bidder Compliance(Yes/No)
	clearances. It should not be possible to preempt the Minimum Green once the stage start commencing execution.	
11	All Red – Immediately after the Starting Amber all the approaches should be given red signal for a few seconds before allowing any right of way, as a safety measure. The controller shall have programmability of 3 Seconds to 10 Seconds for All Red signal.	
12	Signal lamps monitoring – The controller shall have inbuilt circuitry to monitor the lamp status	
13	Green – Green Conflict Monitoring – The controller shall have a facility to list all conflicting phases at an intersection. The controller should not allow programming of these conflicting phases in a Stage. A hardware failure leading to a conflict condition (due to faulty devices or short circuit in the output) shall force the signal into Flashing Amber / Flashing Red.	
14	Cable less Synchronization – It shall be possible to synchronize the traffic signal controllers installed in a corridor in the following modes of operation, without physically linking them and without communication network. GPS enabled RTC shall be the reference for the cable less synchronization.	
15	Fixed Time mode with fixed offsets	
16	Vehicle Actuated mode with fixed offsets	

D) Input and Output facilities

#	Description	Bidder Compliance(Yes/No)
1	Lamp Switching: The controller shall have maximum 64 individual output for signal lamp switching, configurable from 16 to 32 lamps. The signal lamps shall be operating on appropriate DC/AC voltage of applicable rating	
2	Detector Interface: A minimum of 16 vehicle detector inputs shall be available in the controller. All detector inputs shall be optically isolated and provided with LED indication for detection of vehicle.	
3	Communication Interface: The traffic signal controller shall support Ethernet interface to communicate with the ATCS server	
4	Power Saving: The traffic signal controller shall have a facility to regulate the intensity of signal lamps during different ambient light conditions thereby saving energy.	
5	Real-time Clock (RTC): The GPS receiver for updating time, date and day of the week information of the traffic signal controller should be an integral part of the traffic signal controller.	
	The traffic signal controller shall update the date, time and day of the week automatically from GPS during power ON and at scheduled intervals.	

#	Description	Bidder Compliance(Yes/No)
	Manual entry for date, time and day of week shall be provisioned for setting the traffic signal controller RTC (Real Time Clock).	
	It shall be possible to set the RTC from the Central Server when networked	
6	Keypad (optional): The traffic signal controller shall have a custom made keypad or should have provision for plan upload and download using PC/laptop/Central Server	
7	Operator Display (optional): The traffic signal controller shall optionally have a LED backlit Liquid Crystal Display (LCD) as the operator interface.	

6.3.2. Camera based Vehicle Detector

The detector equipment is a separate logic unit, which may be integrated into the controller, or alternatively mounted in its own housing. The outputs of the detectors indicate the presence of vehicles and are used to influence the operation of the traffic signal controller and shall generate counts, demands and extensions for right-of-way. Means shall be provided so that a detector may be connected to demand and / or extend a phase movement as specified.

#	Description	Bidder Compliance(Yes/No)
1	The SI shall clearly specify the placement of the detector (upstream, downstream, stop-line, exit etc.) for independent straight and right turn signals.	
2	The detector shall be able to count vehicles in non-lane based mixed traffic flow conditions. The accuracy of counts shall be bigger than 90% over all light and weather conditions. The SI shall clearly specify how this is accomplished.	
3	The SI shall give an estimate of the total number of vehicle presence detection zones and vehicle detectors required and the type of detection system recommended.	
4	A detector that does not change its status at least once during a stage execution shall be notified to the Central Computer (in ATCS mode) at the termination of the associated stage.	

6.3.3. Countdown Timer

Existing Countdown Timer to be reused (as far as possible), t each traffic junction under the scope of work.

#	Description	Bidder Compliance(Yes/No)
1	Count Down Timer to be configured in Vehicular Mode.	
2	The Vehicular countdown timer should be dual colour, • Red for Stop or STP • Green colour for Go	
3	There should be alternate Red and Balance phase time for STOP or STP in Flashing	

#	Description	Bidder Compliance(Yes/No)
4	Alternate Green and Balance Phase Time for Go in Flashing	

6.3.4. Other items related to traffic Signals

(As per site conditions – Existing as well as new sites)

Item No: 1 providing and Erecting of 3 core 1.5 sq mm XLPE \PVC Armoured copper cable

- Providing and Erecting of 3 core 1.5 sq mm XLPE \PVC Armoured copper cable with copper conductors ,1100 V grade .confirming .to IS-7098 (part-I)
- Make: CCI / Gloster / Universal / Torrent / Allcab / Avocab / Polycab / Diacab / Havels.]

Item No : 2 Providing and Erecting of 2 core 1.5 sq mm XLPE \PVC Armored copper cable

- Providing and Erecting of 2 core 1.5 sq mm XLPE \PVC Armoured copper cable,1100 V grade .confirming .to IS-7098 (part-I)
- Make: CCI / Gloster / Universal / Torrent / Allcab / Avocab / Polycab / Diacab / Havels.

Item No. 3 :- Excavation of Earth :-

- The contractor have to excavate soft soil 30cm below road (tar) surface as per the site conditions for laying of DWC pipe or any purpose, refilling the same with excavated material & make the ground as per original immediately.

Item No. 4 :- Trenchless for DWC/HDPE pipe laying :-

- Making trench in hard murum/tar road of suitable width at 90 cms deep for laying cable/dwc/hdpe or locating fault all over the run without damaging upper surface of tar road and back filling the same and making the surface proper as per original immediately.

Item No.5 : Laying of DWC/HDPE Pipe :-

- The contractor shall lay 76mm (OD) Double Wall Corrugated pipes (DWC) of polyethylene confirming with necessary connecting accessories of same material for laying of cable from junction box to junction box .DWC/HDPE pipe is to be laid 30cm below road (tar) surface. In any case laying of DWC pipe will not be allowed in the divider above road (tar) surface.

Item No.6 : Excavation of Hard rock :-

- The contractor have to excavate the Road/Hard rock 90cm below road (tar) surface may be required as per the site conditions for laying of DWC/HDPE pipe or any

purpose, refilling the same with excavated material & make the ground as per original immediately.

Item No.7 : Providing & Erecting Junction Box :-

- Providing & Erecting of SMC press moulded composite FRP /DMC loop in loop out 300 mm X 200 mm X 100 mm.

Item No.8 : Providing & Erection of 10 sq.mm 4 core XLPE Cable :-

- The contractor shall provide & erect 10 sq.mm 4 core aluminium conductor, armoured XLPE, LT cable of 1100 V grade laid in DWC pipe in an approved manner as per direction. Make: CCI / Gloster / Universal / Torrent / Allcab / Avocab / Polycab / Diacab.

6.3.5. Communication Network

Function of the Communication network is for remote monitoring of the intersection and its management. Real time data (like RTC time, stage timing, mode, events, etc.) from the traffic signal controller is required to be sent to the Central Computer in CCC running the ATCS application shall calculate and send optimum signal timings to all intersections in the corridor. The SI shall clearly specify the bandwidth requirements and use city wide OFC network being created as part of this project, as well as existing OFC network of Vadodara Eye Project, for connecting ATCS components.

The SI shall design, install, configure and commission the networking hardware requirements at the CCC, TCC and remote intersections for establishing the communication network for ATCS.

6.3.6. ATCS Software Application

Objective of the ATCS is to minimize the stops and delays in a road network to decrease the travel time with the help of state-of-the-art technology. The adaptive traffic control system shall operate in real time with the capacity to calculate the optimal cycle times, effective green time ratios, and change intervals for all system traffic signal controllers connected to it. These calculations will be based up on assessments carried out by the ATCS application software running on a Central Computer based on the data and information gathered by vehicle detectors at strategic locations at the intersections controlled by the system.

The ATCS application software shall do the following:

#	Description	Bidder Compliance (Yes/No)
1.	Identify the critical junction of a corridor or a region based on maximum traffic demand and saturation.	
2.	The critical junction cycle time shall be used as the group cycle time i.e. cycle time common to all intersection in that corridor or region.	
3.	Stage optimization to the best level of service shall be carried out based on the traffic demand.	

#	Description	Bidder Compliance (Yes/No)
4.	Cycle optimization shall be carried out by increasing or decreasing the common corridor cycle time based on the traffic demand within the constraints of Minimum and Maximum designed value of cycle time.	
5.	Offset correction shall be carried out to minimize number of stops and delays along the corridor for the priority route. Offset deviation measured using distance and speed between successive intersections shall be corrected within 5 cycles at a tolerance of +/- 5 seconds maximum.	
6.	The system shall have provision to configure priority for upstream signals as default. The ATCS software shall continuously check the traffic demand for upstream and downstream traffic and automatically assign the priority route to the higher demand direction.	
7.	Develop appropriate stage timing plans for each approach of every intersection under the ATCS, based on real time demand	
8.	Propose timing plans to every intersection under the ATCS in every Cycle	
9.	Verify the effectiveness of the proposed timing plans in every cycle	
10.	Identify Priority routes	
11.	Synchronize traffic in the Priority routes	
12.	Manage and maintain communication with traffic signal controllers under ATCS	
13.	Maintain database for time plan execution and system performance	
14.	Maintain error logs and system logs	
15.	Generate Reports on request	
16.	Graphically present signal plan execution and traffic flow at the intersection on desktop	
17.	Graphically present time-space diagram for selected corridors on desktop	
18.	Graphically present network status on desktop	
19.	Make available the network status and report viewing on Web	
20.	The ATCS shall generate standard and custom reports for planning and analysis	
21.	It shall be possible to interface the ATCS with a popular microscopic traffic flow simulation software for pre and post implementation analysis and study of the proposed ATCS control strategy	
22.	Shall have the ability to predict, forecast and smartly manage the traffic pattern across the signals over the next few minutes, hours or 3-5 days and just in the current real time.	
23.	Shall provide a decision support tool for assessing strategies to minimize congestion, delays and emergency response time to events via simulation and planning tools liked with real time traffic data fusion and control of traffic signalling infrastructure on ground.	

#	Description	Bidder Compliance (Yes/No)
24.	Shall collect continuously information about current observed traffic conditions from a variety of data sources and of different kind (traffic states, signal states, vehicle trajectories, incidents, road works, ...)	
25.	Shall infer a coherent and comprehensive observed traffic state (speeds, vehicular densities, and presence of queues) on all network elements, from abovementioned observations, including vehicle trajectories, through a number of map matching, data validation, harmonization and fusion processes	
26.	Shall extend the measurements made on only a number of elements both on the rest of the unmonitored network, and over time, thus obtaining an estimation of the traffic state of the complete network and the evolution of this traffic state in the future	
27.	Shall forecast the traffic state with respect to current incidents and traffic management strategies (e.g. traffic signal control or variable message signs), improving the decision making capabilities of the operators even before problems occur	
28.	Shall calculate customisable Key Performance Indicators (KPI) to quickly assess the results	
29.	Shall provide calculated traffic flows estimation and forecast, queues and delays to Urban Control and Adaptive Signal Control Systems, allowing for proactive Traffic Management and Control	
30.	Shall generate alerts to the operator that trigger on customizable conditions in the network (starting with simple drops in flow, up to total queue lengths along emission sensitive roads surpassing a definable threshold)	
31.	Shall distribute both collected and calculated traffic information via a variety of communication protocols and channels, ensuring high interoperability degree and thus acting as a “traffic data and information hub”	
32.	Shall create a traffic data warehouse for all historic traffic information gathered from the hardware installed on the road network.	
33.	Shall operate in real time that is continuously updating the estimates on the state of the network and the travel times on the basis of data collected continuously over time.	
34.	Shall operate the traffic lights with the adaptive traffic controls, based on the current and forecasted traffic demand and the current incidents, thus optimizing the green waves continuously throughout the network	
35.	Enable a smart public transport priority respecting the delays for all road users at once with the adaptive signal controller	

A) Reports

System shall generate Corridor based and Intersection based reports. The application software shall generate the following reports, but not limited to the below. All the reports shall be possible for selected dates.

#	Description	Bidder Compliance (Yes/No)
1.	Intersection based reports	
2.	Stage Timing report – The report shall give details of time at which every stage change has taken place. The report shall show the stage sequence, stage timings and stage saturation of all stages of all cycles for a day. The saturation is defined as the ratio between the available stage timings to the actual stage timing executed by the traffic signal controller for the stage (stage preemption time).	
3.	Cycle Timing report – The report shall give details of time at which every cycle has taken place. The report shall show the cycle sequence and cycle timings for all the cycles in a day.	
4.	Stage switching report – The report shall give details of time at which a stage switching has taken place. The report shall show the stage sequence, stage timings and stage saturation for a day.	
5.	Cycle Time switching report – The report shall give details of time at which a cycle switching has taken place. The report shall show the cycle sequence and cycle timings for the cycle in a day.	
6.	Mode switching report – The report shall give details of the mode switching taken place on a day.	
7.	Event Report - The report shall show events generated by the controller with date and time of event.	
8.	Power on & down: The report shall show time when the master is switched on, and last working time of the master controller.	
9.	Intensity Change – The report shall show the brightness of the signal lamp is changed according to the light intensity either manually through keypad or automatically by LDR with time stamp.	
10.	Plan Change – The report shall show the time of change of plan either through keypad or remotely through a PC or Server.	
11.	RTC Failure – The report shall show the time when RTC battery level goes below the threshold value.	
12.	Time Update – The report shall show the time when the Master controller updated its time either manually through keypad, automatically by GPS or through remote server.	
13.	Mode Change – The report shall show the time when Master controller's operating mode is changed either manually through keypad or a remote server. The typical modes are FIXED, FULL VA SPLIT, FULL VA CYCLE, FLASH, LAMP OFF and HURRY CALL.	
14.	Lamp Status Report – The report shall show lamp failure report with date and time of failure, colour of the lamp and associated phase	

#	Description	Bidder Compliance (Yes/No)
15.	Loop Failure Report – The report shall show the date and time of detector failure with detector number and associated phase.	
16.	Conflict – The report shall show the conflict between lamps (RED, AMBER, GREEN) in the same phase or conflict between lamps with other phase.	
17.	Corridor Performance Report – The report shall show the saturation of all the intersections in a corridor for every cycle executed for the corridor and the average corridor saturation for a day	
18.	Corridor Cycle Time Report – The report shall show the Corridor cycle time, Intersection cycle time, Mode of operation and degree of saturation of all the intersections in a corridor for every cycle for a day	

B) Graphical User Interface

The application software shall have the following Graphical User Interface (GUI) for user friendliness.

#	Description	Bidder Compliance (Yes/No)
1.	User login – Operator authentication shall be verified at this screen with login name and password	
2.	Network Status Display – This online display shall indicate with appropriate colour coding on site map whether an intersection under the ATCS is online or off. On double clicking the intersection a link shall be activated for the traffic flow display for the intersection.	
3.	Traffic Flow Display – This online display shall indicate the current traffic flow with animated arrows, mode of operation, stage number being executed and elapsed stage time.	
4.	Saturation Snapshot – This display shall show the current saturation levels of all intersections in a corridor.	
5.	Reports Printing / Viewing – This link shall allow selection, viewing and printing of different reports available under ATCS	
6.	Time-Space Diagram – The time-space diagram shall display the current stages being executed at every intersection in a corridor with immediate previous history.	
7.	Junctions shall be plotted proportional to their distance on Y-axis and time elapsed for the stage in seconds on X-axis.	
8.	Junction names shall be identified with each plot.	
9.	Facility shall be available to plot the time-space diagram from history.	
10.	Currently running stage and completed stages shall be identified with different colours.	
11.	Stages identified for synchronization shall be shown in a different colour.	

#	Description	Bidder Compliance (Yes/No)
12.	Speed lines shall be plotter for stages identified for synchronization to the nearest intersection in both directions.	
13.	It should be possible to freeze and resume online plotting of Time-Space diagram.	
14.	The system shall have other graphical interfaces for configuring the ATCS, as appropriate.	

6.4. Environment Sensors

#	Functional Requirements	Bidder Compliance (Yes/ No)
1	They should be ruggedized enough to be deployed in open air areas, on streets and parks	
2	They should be able to read and report at least the following parameters: Temperature, Humidity, Ambient Light, Sound, CO, NO2, NOX, CO2, and SO2.	
3	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 network.	
4	The data should be collected in a software platform that allows third party software applications to read that data. Various environment sensors shall sense the prevailing environment conditions and send the data to the integrated control system where real time data resides and the same shall be made available to various other departments and applications for decision making.	
5	The sensor management platform should allow the configuration of the sensor to the network and also location details etc.	

6.5. Public Address System

#	Functional Requirements	Bidder Compliance (Yes/ No)
1	The Public Address System (PA) should be capable of addressing citizens at specific locations from the Smart City Operations Centre.	
2	The proposed system shall contain an IP-based announcing control connected to the Smart City Operations Centre.	

3	Public Address system shall be used at intersections, public places, market places or those critical locations as identified by VMC to make important announcements for the public. It shall be able to broadcast messages across all PA systems or specific announcement could be made to a particular location supporting single zone / multi zone operations. The system shall also deliver pre-recorded messages to the loud speakers attached to them from CD/DVD Players & Pen drives for public announcements.	
4	The system shall contain an IP-based amplifier and uses PoE power that could drive the speakers. The system shall also contain the control software that could be used to control/monitor all the components of the system that includes Controller, Calling Station & keypad, Amplifier (Mixing & Booster).	
5	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.	
5	PA system's master controller should facilitate multiple MIC inputs and audio inputs.	

6.6. Emergency Call Box

#	Functional Requirements	Bidder Compliance (Yes/ No)
1	The emergency box (or panic button) will enable citizens to establish a two way audio (microphone and speaker) communication with TCC and/or CCC through a press of a button. It shall also include a static camera for sending still images of caller in the event library at CCC. The event library should store the photo records along with the audio for each event	
2	Emergency/ Panic buttons to be strategically located, suitably sized and identified/clearly labelled for "Emergency".	

6.7. Variable Message Sign Board

a) Variable Message Sign Board (VMSB or VMS referred herein) will be installed at identified strategic locations. The location of VMSB s will be on the key junctions (mostly on the sides without obstructing the traffic) and other strategic locations with large foot fall. The VMSB software application will allow user to publish specific messages for managing traffic and also general informative messages.

b) VMSB will enable VSCDL/VMC/Police to 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.

c) These displays can also be used for advertisement purposes. Approximately 20% of the total running time will be utilized by VSCDL in day-to-day scenario (i.e. normal, non-emergency situations) for its own discretion whereas the remaining time can be used by the SI for advertisement purpose. However during emergency or disaster situations, VMBS would be required to play messages issued by CCC all the time till normal situation is restored. Refer section 9.11 for key terms and conditions for advertising and marketing guidelines.

d) The land for VMSBs will be provided to the SI at no extra cost. Also no rental/lease charges will be levied on the bidder for using the land for Variable Message Signboards. The bidder will also have an option to share part of revenue as mentioned in Commercial Evaluation in Volume 1_ Terms of reference.

#	Description	Bidder Compliance (Yes/No)
1.	**System Requirements**	
a.	The system should be capable to display warnings, traffic advice, route guidance and emergency messages to motorists from the CCC in real time.	
b.	The system should also be capable to display warnings, traffic advice, route guidance and emergency messages to motorist by using local PC/Laptops. The system should display graphical representation of the lanes with directional arrows and colour such as green, yellow, red for depicting density of traffic	
c.	The VMS should display text and graphic messages using Light Emitting Diode (LED) arrays.	
d.	The System should able to display failure status of any LED at CCC.	
e.	The System should support Display characters in true type fonts and adjustable based on the Operating system requirement.	
f.	The CCC workstation at the CCC should communicate with the VMS controller through the network. It should send out command data to the variable message sign controller and to confirm normal operation of the signboard. In return, the CCC workstation should receive status data from the VMS controller.	
g.	VMS controllers should continuously monitor the operation of the VMS via the provided communication network.	
h.	Operating status of the variable message sign should be checked periodically from the CCC.	
i.	It shall be capable of setting an individual VMS or group of VMS's to display either one of the pre-set messages or symbols entered into the computer via the control computer keyboard or by another means.	
j.	It shall be capable of being programmed to display an individual message to a VMS or a group of VMS's at a pre-set date and time.	
k.	A sequence of a minimum of 10 messages/pictures/ pre-decided sign or group of signs shall be possible to assign for individual VMS or group of VMS's.	
l.	It shall also store information about the time log of message displayed on each VMS. The information stored shall contain the identification number of the VMS, content of the message, date and time at which displayed message/picture starts and ends.	

m.	The central control computer shall perform regular tests (pre-set basis) for each individual VMS. Data communication shall be provided with sufficient security check to avoid unauthorized access.	
2.	**Variable Message Sign board application**	
a.	Central Control Software allows controlling multiple VMS from one console.	
b.	Capable of programming to display all types of Message/ advertisement having alphanumeric character in English, Hindi, Gujarati and combination of text with pictograms signs. The system should have feature to manage video / still content for VMS display. The system should have capability to divide VMS screen into multi-parts to display diverse form of information like video, text, still images, advertisements, weather info, city info etc. The system should also provide airtime management and billing system for paid content management	
c.	Capable of controlling and displaying messages on VMS boards as individual/ group.	
d.	Capable of controlling and displaying multiple font types with flexible size and picture sizes suitable as per the size of the VMS.	
e.	Capable of controlling brightness & contrast through software.	
f.	Capable to continuously monitor the operation of the Variable Message sign board, implemented control commands and communicate information to the Traffic Monitoring Centre via communication network.	
g.	Real time log facility – log file documenting the actual sequence of display to be available at central control system.	
h.	Multilevel event log with time & date stamp.	
i.	Access to system only after the authentication and acceptance of authentication based on hardware dongle with its log.	
j.	Location of each VMS will be plotted on GIS Map with their functioning status which can be automatically updated.	
k.	Report generation facility for individual/group/all VMSs with date and time which includes summary of messages, dynamic changes, fault/repair report and system accessed logs, link breakage logs, down time reports or any other customized report.	
l.	Configurable scheduler on date/day of week basis for transmitting pre-programmed message to any VMS unit.	
m.	Various users should access the system using single sign on and should be role based. Different roles which could be defined (to be finalized at the stage of SRS) could be Administrator, Supervisor, Officer, Operator, etc.	
n.	Apart from role based access, the system should also be able to define access based on location.	

o.	Rights to different modules / Sub-Modules / Functionalities should be role based and proper log report should be maintained by the system for such access	
p.	Components of the architecture must provide redundancy and ensure that there are no single points of failure in the key project components. To take care of remote failure, the systems need to be configured to mask and recover with minimum outage.	
q.	The architecture must adopt an end-to-end security model that protects data and the infrastructure from malicious attacks, theft, natural disasters etc. provisions for security of field equipment as well as protection of the software system from hackers and other threats shall be a part of the proposed system. Using Firewalls and Intrusion detection systems such attacks and theft shall be controlled and well supported (and implemented) with the security policy. The virus and worms attacks shall be well defended with Gateway level Anti-virus system, along with workstation level Anti-virus mechanism. There shall also be an endeavour to make use of the SSL/VPN technologies to have secured communication between Applications and its end users. Furthermore, all the system logs shall be properly stored & archived for future analysis and forensics whenever desired.	
r.	Ease of configuration, ongoing health monitoring, and failure detection are vital to the goals of scalability, availability, and security and must be able to match the growth of the environment.	
s.	System shall use open standards and protocols to the extent possible	
t.	Facility to export reports to excel and PDF formats.	
3.	**Remote Monitoring**	
a.	All VMS shall be connected/configured to Traffic Monitoring Centre for remote monitoring through network for two way communication between VMS and control Room to check system failure, power failure & link breakage.	
b.	Remote Diagnostics to allow identifying reason of failure up to the level of failed individual LED.	

6.8. GPS Tracking of Fire Dept. Vehicles

The functional requirements of the GPS based Vehicle Tracking System are as follows:

- Install GPS systems on specified number of Fire Dept. vehicles
- Track & monitor the movement of these vehicles on the GIS map
- GPS location refresh rate of 10 seconds and 100 meters or better
- Two-way communication with Mobile Data Terminal of vehicles
- Integration with CCC Solution
- Dashboard View and Reports for the following
    - Route Details for each vehicle on GIS Map and in tabular form

- Loss-of-connectivity report for the vehicles
- Online status on Map at any point of time
- Distance Covered Reports for each vehicle
- Any other Reports can be added as per the requirement

6.9. E Challan System application

#	Minimum Requirements	Bidder Compliance (Yes/No)
A.	**General**	
1.	E-challan software shall work in client -server mode, where 30 handheld devices units will act as clients connected to the server through cellular network for data transfer. The system should be scalable to 500 devices, which may be added later on, server requirements to be calculated as per scalability for 500 devices, which may be added later on.	
2.	E-challan system shall be able to retrieve vehicle owners details and vehicle data from RTO data base to minimise data entry	
3.	Server should maintain log of all current devices. Any access to the system must be recorded along with date, time, user id and IP address	
4.	Traffic officer should log in to the hand held device through the unique user id and pass word or smart card issued for the purpose	
5.	A unique challan number should be generated through client software for each challan	
6.	As soon as a vehicle registration number is entered , the handheld device should automatically check from the server if the vehicle is stolen , wanted in any criminal case or is in the list of suspicious vehicle	
7.	The most frequent traffic offences should be kept at the top in the drop down menu and offence ingredients should be available if required by officer	
8.	Date, time and GPS coordinates of place of challan should be automatically populated in the relevant fields of client software	
9.	Compounding amount must populate in the field automatically from master table	
10.	The successful bidder should develop the GUI and functionality as per requirements of the Raipur Police	
11.	The GUI should be lingual i.e. English and local state language	
12.	It should be possible to integrate payment gate way operator with the system for felicitation of payment	
B.	**Handheld Device Software**	

#	Minimum Requirements	Bidder Compliance (Yes/No)
13.	Once the application is loaded on the hand-held device there should be no possibilities to modify the application by the user. Reloading and modifying of application should be possible only by an administrator.	
14.	On switching on the hand-held device the system must give access only after validation through user ID and password.	
15.	The communication between the server and hand-held device would be through GSM/GPRS/ 3G/4G or better connectivity etc.	
16.	Every challan created must have a unique self-populated number.	
17.	The Handheld application must be able to access information from the main Server and display upon request, pop- up tables/codes, vehicle and license details, all types of offences, compounding amount, challan types, vehicle details, court calendar etc. in order to minimize the typing by the prosecuting officer.	
18.	The Handheld device should be able to access data/ information on the basis of driving license number, vehicle registration number etc. from the main server data relating to previous offences.	
19.	The hand-held application software should also suggest date of challan, place of challan, name of the Court and court date etc. to further reduce typing by the officer. These fields should be designed in consultation with Raipur Police.	
20.	When a challan is issued, the name and ID of the officer should be printed on the challan.	
21.	The Handheld device must be able to input and print multiple offences on the same challan.	
22.	The Handheld software must validate challan fields automatically before the challan is printed. The system must ensure that certain fields are properly completed before allowing the challan to be printed.	
23.	When downloading application software or pop-up tables or lists to the Handheld, or uploading challan records to the Server, synchronization of Handheld system must be automatic, in order to minimize human intervention.	
24.	Uploading data to the Database Server should be automatic in consistent manner.	
25.	The application should provide features wherein when a driving license/ vehicle registration number is entered, it should be able to pull from the server all the details relating to the driving license holder/ vehicle owner including history of previous offences.	

#	Minimum Requirements	Bidder Compliance (Yes/No)
26.	Software should capture the list of documents seized during prosecution and such list must be reflected on the printed court challan.	
27.	The handheld application software shall allow the user to generate a summary report to facilitate evaluation of his daily work.	
28.	Once the challan is complete and saved any further editing should not be possible unless so authorized by administrator.	
29.	Each hand-held device should be provided with original printed user manual and appropriate carry case for Handheld device with charger.	
30.	The application software should allow online payment	
31.	There should be automatic rejection of payment for the settlement of expired notices or challans. Partial payment of an offence must not be accepted by the system.	
32.	The software should update DL/RC smart card with the booked offence.	
C.	**E-Challan Application Software**	
33.	The Application Software should work in a web based environment.	
34.	The application software should be user friendly, easy to operate even by police personnel with minimum qualification of that of a head constable.	
35.	The software must provide comprehensive data back-up and restoration capability.	
36.	The system will function in web-based system where the hand-held device shall work as a node.	
37.	The application software should maintain the logs of user activities to facilitate the audit trail.	
38.	The system should have sufficient security features such as biometrics, password protection, audit trail, etc.	
39.	The system should be able to handle the activities of all the handheld devices at one time simultaneously with huge database size of prosecution, ownerships, driving license etc. without affecting the performance.	
40.	The software should be able to generate various periodical reports, summaries, MIS reports, query reply etc. as per the requirements of Raipur Police.	
41.	Administrator should be able to modify the master tables as and when required and should have the capability to push the changes to hand-held devices.	

#	Minimum Requirements	Bidder Compliance (Yes/No)
42.	Software up-gradation must be provided by the SI from time to time as per available technology without further cost impact to Raipur Police.	
43.	The Department will provide the entire data of vehicle ownership and driving license for integration with the vendor's application software.	
44.	All database tables, records etc. required for various dropdown menus etc. shall also be created by the SI.	
45.	The application software is to be provided by the SI to handle various processes of the prosecution required by the office of senior police officers, Courts etc.	
46.	The application software should have the capability to export records in CSV, SQL and binary format	

6.10. Integration of Existing and envisaged Smart City Projects

#	Projects	Project Category	Activity/Component	Integration with CCC
1	A41. iPoles	Area Based Development	iPoles implementation in across city	Fixing of Location of approx. 160 iPoles on GIS Map (One time activity) Use of iPoles for installation of CCTV Cameras, Env Sensors, PA, ECB etc. Use of network created through iPoles project.
2	P1.1 HMIS & My City Card (including Health and common payment)-**Under project 'Urban Jeevan'**	PAN City Projects	2 Nos. (SSG and Gotri) 34 UHCs to be covered, City card - cum- health card to citizens	Hospital related information (approx. 50 hospitals) to be integrated with CCC, for use in disaster situation
3	P1.2 Smart Water Solutions (Water SCADA)- **Under project 'Urban Jeevan'**	PAN City Projects	P1.2.1 Bulk Meter P1.2.2 SCADA for STPs	Existing Water SCADA application to be integrated with CCC for Alerts management etc.
4	P2. One Vadodara Mobile App	PAN City Projects	P2.1. Virtual Tour with voice enabled navigation and online booking and information on the number of events held at major convention centers-	Approx. 15 Heritage building to be mapped on GIS Layer Mobile App integration

			approx.200 events in a span of one month across 15 heritage buildings in the city P2.2. Good Citizen Service Delivery (Hu Vadodara Module in app) P2.3 Vadodara Setu, Service Delivery app for Sr. Citizens P2.4 Basic and statutory information dissemination-All statutory documents, tender information, payment of property tax and electricity bills	
6	P3.1 Urban Mobility- Procurement of New CNG Buses , P3.2 and P3.3. Urban Mobility - Smart Bus Terminus and Public Information System + Heritage tour bus	PAN City Projects	120 Bus stops with ETA board, schedule and route display, Smart bus terminus Existing 67 buses + 95 new buses which shall be equipped with On-Board CCTV and GPS tracker +One heritage tour bus	Approx. 175 GPS Enabled buses and Bust Stops to be mapped in GIS Map and in asset/resource database. Alerts management. Buses to be tracked in real time on city map
7	P4.3 ERP for VMC **Under Project 'Utility Plus'**	PAN City Projects	65 public administration departments to be connected by ERP currently for 6500 VMC employees (users)	Integration aspects are specified in ERP RFP, under scope of work of that SI. The selected bidder of CCC needs to coordinate and cooperate for seamless integration
8	P4.2 GIS(On surface and Under ground)- **Under Project 'Utility Plus'**	PAN City Projects	Survey and mapping of 160 sq km to be done and digitized, 1450 km of roads length to be spanned	GIS Map and Layers (7 nos) to be used extensively as baseline resource for CCC application
10	A1. Smart Street lights	Area Based Development	Min. 60-70% Saving in Street light electricity	Provision of open API, for Integration with Smart street light management application which may come up in near future.
11	A13. Wi-Fi Services	Area Based Development	100% Wifi Coverage in the area	Location of approx. 150 Wifi Hot spots to be mapped

12	A14 to A21. Reinvigoration of Vishwamitri Riverfront Influence Area	Area Based Development	Walkway Development, New Street Development, New Bridges, Refurbishment of Bridges, Sayaji Bagh Extension, River Channel widening & construction of Gates behind Kamati bagh,Ecology park	Support to respective vendors, for providing open API for CCTV and GIS Integration and asset database updation.
15	Retrofitting of Fire Station(Retrofitting of Fire Station)	Area Based Development	6 Fire stations, 50 fire-dept vehicles	Fire station resources in assets database, alerts management, event handing/actions management, Fire-trucks/vehicles to be mapped/tracked
16	STP upgradation	Area Based Development	Sewage Treatment Plant upgraration (2 Plants)	Support to respective vendors, for providing open API and GIS Integration and asset database updation
17	Smart water meters	Area Based Development		Support to respective vendors, for providing open API and GIS Integration and asset database updation
18	Smart Electric Meter	Area Based Development		Support to respective vendors, for providing open API and GIS Integration and asset database updation

7. *Annexure III- Technical requirements*

Existing Project Solutions

VMC has procured following major IT Solutions as part of existing Projects. In order to maintain homogenous and integrated environment, the selected bidder is required to offer the same solution (additional licenses/components) or replace/integrate the existing solution with offered solution. There shall not be any degradation of features/facilities of the existing systems

#	Project	Major Solution	Remarks
1	CCTV Project	CCC Software	IBM IOC Software (As per Annexure VI)
2	CCTV Project	VMS Software	Milestone XProtect Corporate for 250 camera licenses
3	CCTV Project	Video Analytics	IBM Intelligent Video Analytics (As per Annexure VI)
4	CCTV Project	Video Wall	4x3 configuration of Christie FHD-552X (55 inch) units with phoenix Christie Controller supporting 16 outputs
5	CCTV Project	EMS Solution	IBM Tivoli EMS (2000 licences)
6	Water SCADA Project	Video Wall	2x2 configuration of Christie FHD-552X (55 inch) units with phoenix Christie Controller supporting 16 outputs

7.1. Video Wall Screen

VMC has purchased following sets of video Walls as part of other project. The successful bidder shall integrate these units into a final video wall of 7x4

#	Project	Specifications	Cubes purchased
1	CCTV Project	4x3 configuration of Christie FHD-552X (55 inch) units with phoenix Christie Controller supporting 16 outputs	12
2	Water SCADA Project	2x2 configuration of Christie FHD-552X (55 inch) units with phoenix Christie Controller supporting 16 outputs	4
3	CCC Project	Balance Cubes to be supplied (in 3x4 format)	12

New Video Wall Configuration (7x4)

Existing Displays of CCTV (4x3)			
Existing Displays of Water SCADA (4x1)			

#	Parameter	Minimum Specifications
1	Technology	HD LED Display, Direct LED Backlight
2	Screen Size	55”
3	Basel Size	1.2 mm (Top/Bottom), 2.3 mm (Left/right)
4	Resolution	Full high definition (1080p) 16:9 Widescreen
5	Contrast ratio	1400:1
6	Brightness	500 nit
7	Viewing angle	178 degree/178 degree (H/V)
8	Response time	12 ms
9	Input	HDMI and other inputs as per Video Wall solution offered
10	Control	- On Screen Display (OSD) - IR remote control
11	Operations	24 x 7
12	LED Lifespan	50000 hours (50% Brightness)

7.2. Video Wall Controller

#	Parameters	Minimum Requirements
1	Controller	5. Controller to control Video wall in a matrix (7x4 output) as per requirement along with software
2	Chassis	6. 19” Rack mount
3	Processor	7. Latest Generation 64 bit x86 Quad Core processor (3.4 Ghz) or better
4	Operating System	8. Pre-loaded 64-bit Operating System Windows / Linux / Equivalent, with recovery disc
5	RAM	9. 16 GB DDR3 ECC RAM
6	HDD	0. 2x500 GB 7200 RPM HDD (Configured in RAID 0)
7	Networking	1. Dual-port Gigabit Ethernet Controller with RJ-45 ports
8	RAID	2. Should support all RAID levels
9	Power Supply	(1+1) Redundant hot swappable
11	Input/ Output support	VI/HDMI/USB/ LAN/ VGA/SATA port
12	Accessories	104 key Keyboard and Optical USB mouse
13	USB Ports	Minimum 4 USB Ports
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	Inputs	To connect to minimum 2 sources through HDMI
18	Output	To connect to minimum 16 Displays through HDMI

19	Operating Temperature	10°C to 35°C, 80 % humidity
20	Cable & Connections	Successful bidder should provide all the necessary cables and connectors, so as to connect Controller with LED Display units

7.3. Video Wall Management Software

#	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 Input Sources, 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
10		Multiple concurrent client
11		KVM support
12	Cube Management	Cube Health Monitoring
13		Pop-Up Alert Service
14		Graphical User Interface

7.4. LED TV (Professional Displays)

#	Parameter	Minimum Specifications
1.	Technology	HD IPS LED Display , Direct LED Backlight
2.	Computer Connectivity	HDMI (Including HDMI cable), VGA
3.	Screen Size	50 inch diagonal
4.	Resolution	Full High Definition (Min 1920 x 1080) 16:9 Widescreen
5.	Contrast ratio	Native (standard) 5000:1 or more
6.	Brightness	350 nit or more
7.	Viewing angle	178 degree/178 degree (H/V)
8.	Response time	8ms or less
9.	Controls	• On Screen Display (OSD) • IR remote control
10.	Operations	Rated for 24x7 operations

7.5. CCC Monitoring Workstations

#	Parameter	Minimum Specifications
1.	Processor	Latest generation 64bit X86 Quad core processor(3.33 Ghz) 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	WHQL certified Graphics card with 2 GB video memory (non-shared). It should supports 4 monitors simultaneously with no degradation in video quality considering HD video quality and 25 fps
6.	HDD	2 TB SATA-3 Hard drive @7200 rpm
7.	Media Drive	NO CD / DVD Drive
8.	Network interface	1000BaseT, Gigabit Ethernet (10/100/1G auto sensing)
9.	Audio	Line/Mic IN, Line-out/Spr Out (3.5 mm)
10.	Ports	Minimum 6 USB ports (out of that 2 in front). These would be disabled for data transfer.
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	Three monitors of 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.
20.	DLP/DRM Software	There would be DRM Software/application installed on these workstations that would prevent unauthorized copying of video feeds and other sensitive data.

7.6. IP Phones

#	Parameter	Minimum Specifications
1	Display	2 line or more, Mo*noc*hrome display for viewing features like messages, directory
2	Integral switch	10/100 mbps for a direct connection to a 10/100BASE-T Ethernet network through an RJ-45 interface
3	Speaker Phone	Yes
4	Headset	Wired, Cushion Padded Dual Ear-Speaker, Noise Cancelling headset with mouthpiece microphone, port compatibility with IP Phone
5	VoIP Protocol	SIP V2
6	POE	IEEE 802.3af or better
7	Supported Protocols	SNMP, DHCP, DNS
8	Codecs	G.711, G.722 including handset and speakerphone
9	Speaker Phone	Full duplex speaker phone with echo cancellation Speaker on/off button, microphone mute
10	Volume control	Easy decibel level adjustment for speaker phone, handset and ringer
11	Phonebook/Address book	Minimum 100 contacts
12	Call Logs	Access to missed, received, and placed calls. (Minimum 20 overall)
13	Clock	Time and Date on display
14	Ringer	Selectable Ringer tone
15	Directory Access	LDAP standard directory

IP PBX Specifications

IP PBX to support minimum 200 IP Phones with at least 75 concurrent sessions with features like –

- Provide reports for calls based on records, calls on a user basis, calls through gateways etc.

- Able to add bulk add, delete, and update operations for devices and users
- Session Initiation Protocol (SIP) Trunk support
- Centralized, configuration database, Web based management
- Lightweight Directory Access Protocol (LDAP) directory interface
- Facilities to users like Call Back, Call Forward, Directory Dial, Last number Redial, etc.
- Calling Line Identification

7.7. Desktop PC

Sr No	Item	Minimum Specifications
1.	Processor	Intel Core i7-latest generation (3.0 Ghz) or higher OR AMD A10 7850B (3.0 Ghz) processor or higher OR Equivalent 64 bit x86 processor
2.	Memory	8 GB DDR3 RAM @ 1600 MHz. One DIMM Slot must be free for future upgrade
3.	Motherboard	OEM Motherboard
4.	Hard Disk Drive	Minimum 1 TB SATA III Hard Disk @7200 RPM or higher
5.	Audio	Line/Mic In, Line-out/Speaker Out (3.5 mm)
6.	Network port	10/100/1000 Mbps auto-sensing on-board integrated RJ-45 Ethernet Port
7.	USB Ports	Minimum 4 USB ports (out of that 2 must be in front)
8.	Display Port	1 Display Port (HDMI/VGA) port
9.	Power supply	Maximum Rating 250 Watts, 80 plus certified power supply
10.	Keyboard	104 keys Heavy Duty Mechanical Switch Keyboard (USB Interface) with 50 million keystrokes life per switch. Rupee Symbol to be engraved.
11.	Mouse	Optical with USB interface (same make as desktop)
12.	Monitor	Minimum 21.5” diagonal LED Monitor with 1366x768 or higher resolution. (Same make as desktop). Must be TCO05 certified
13.	Operation System and Support	Pre-loaded Windows 10 (or latest) Professional 64 bit, licensed copy with certificate of authenticity (or equivalent authenticity information) and all necessary and latest patches and updates. Can be downgraded to Windows 7 Professional (64 bit). All Utilities and driver software, bundled in CD/DVD/Pen-drive media
14.	Certification for Desktop	Energy Star 5.0 or above / BEE star certified
15.	Other pre-loaded software (open source/ free)	Latest version of Libre-office, Latest version of Adobe Acrobat Reader, Scanning Software (as per scanner offered). These software shall be pre-loaded (at the facility of OEM or any other location) before shipment to MCGM offices/locations.

7.8. Laptop

Sr No	Item	Minimum Specifications
1.	Processor	Intel Core i7 with latest generation (1.9 Ghz) or higher OR AMD A10 PRO 7300 (1.9Ghz) Processor or higher OR Equivalent 64 bit x86 processor
2.	Display	Minimum 14" Diagonal TFT Widescreen with minimum 1366 x 768 resolution (16:9 ratio)
3.	Memory	8 GB DDR3 RAM with 1 DIMM Slot free for future upgrade
4.	Graphics Card	3D Graphics card with Minimum Graphics card with minimum 2 GB video memory (non- shared)
5.	Hard Disk Drive	Minimum 1 TB SATA HDD @ 5400 rpm
6.	Ports	3 USB Ports 1- Gigabit LAN (RJ 45); 1- HDMI/Display port, 1- VGA, 1- headphone/Microphone;
7.	Web Camera	Built in web cam
8.	Wireless Connectivity	Wireless LAN - 802.11b/g/n/ Bluetooth 3.0
9.	Audio	Built-in Speakers
10.	Battery backup	Minimum 4 lithium ion or lithium polymer battery with a backup of minimum 4 hours
11.	Keyboard and Mouse	84 Keys Windows Compatible keyboard, Integrated Touch Pad.
12.	Operating System	Pre-loaded Windows 10 (or latest) Professional 64 bit, licensed copy with certificate of authenticity (or equivalent authenticity information) and all necessary and latest patches and updates. Can be downgraded to Windows 7 Professional (64 bit). All Utilities and driver software, bundled in CD/DVD/Pen-drive media
13.	Certification	Energy Star 5.0 or above / BEE star certified
14.	Weight	Laptop with battery (without DVD) should not weigh more than 2 Kg
15.	Accessories	Laptop carrying Back-pack. It must be from same OEM as laptop
16.	Other pre-loaded software (open source/ free)	Latest version of Libre-office, Latest version of Adobe Acrobat Reader Scanning Software (as per scanner offered). These software shall be pre-loaded (at the facility of OEM or any other location) before shipment to MCGM offices/locations.

7.9. Office Productivity suite

#	Items	Minimum technical Specifications
1.	Software OEM	Microsoft
2.	Software	Microsoft Office 2017 Professional
3.	License Type	Perpetual, Not tied to OEM Machine (can be used on any desktop)

7.10. Tablet

#	Items	Minimum technical Specifications
1.	Processor	Dual core (1.1 Ghz or higher)
2.	OS	Android 6.X or later
3.	Display	9 inch or higher, 1280x800 pixels
4.	Internal RAM	2 GB
5.	Internal Storage	16 GB
6.	External Storage	Expandable up-to 64 GB (via microSD card)
7.	Cameras	Front and Rear Camera
8.	USB	Micro USB or USB Port
9.	Wi-Fi	802.11 b/g/n
10.	Cellular Connectivity	4G, 3G, 2G Calling capability, Single or Dual SIM card
11.	GPS	Should be available
12.	Bluetooth	Should be available
13.	Audio	Built in Speaker, 3.5 mm audio jack
14.	Battery	4000 mAh more
15.	Application/Software	PDF reader, office productivity suite, Google maps, video player, etc.
16.	Accessories	Tablet cover (Covering both sides), Headphone/Earphone with mic, Charger,

7.11. MFP

S/N	Parameter	Minimum Specifications
1.	Function	Printer, Scanner, Copier all-in-one
Printer		

2.	Printing Speed	Min. 30ppm or Higher
3.	Print Technology	Laser
4.	Print Quality	1200 x 1200 dpi
5.	Duty Cycle	Min 50000 pages/month
6.	2-Side Printing	Automatic
7.	Automatic Paper Sensor	Yes
Scanner		
8.	Scanner type	Flat Bed with ADF for Duplex documents
9.	Scan File Format	JPEG, PDF, PNG
10.	Resolution	1200 x 1200 dpi
11.	Scan speed	Min. 20 ppm
Copier		
12.	Copy Speed	Min. 20 ppm
Paper Feeder		
13.	Total No. of Trays	1
14.	Input paper Handling	Min. 150-sheet standard
15.	Output Paper Handling	Min. 150-sheet
16.	Media Size Support	A4, A5, Legal, Letter
Network Capabilities		
17.	Network support	Built-in Ethernet 10/100/1000 Base TX
18.	Operating System Support	Windows XP, Vista, 7, 8, 10 Linux/Unix
19.	Memory / Processor	256MB, 600MHz
20.	Cartridge Yield	10000 pages/cartridge

7.12. Network Colour Laser printer

#	Parameter	Minimum Specifications
1.	Print Speed	Black : 16 ppm or above on A3, 24 ppm or above on A4 Colour : 8 ppm or above on A3, 12 ppm or above on A4
2.	Resolution	600 X 600 DPI
3.	Memory	8 MB or more
4.	Paper Size	A3, A4, Legal, Letter, Executive, custom sizes
5.	Paper Capacity	250 sheets or above on standard input tray, 100 Sheet or above on Output Tray
6.	Duty Cycle	25,000 sheets or better per month
7.	OS Support	Linux, Windows 2000, Vista, 7, 8, 8.1
8.	**Interface**	Ethernet Interface

7.13. Network B/W Laser Printer

#	Parameter	Minimum Specifications
1.	Make	Must be specified
2.	Model and Part Code	Must be specified. All relevant technical brochures must be submitted.
3.	Printer type	Monochrome laser
4.	Printer speed	Minimum 27 PPM
5.	Memory	32 MB RAM
6.	Duty cycle	Minimum 12000 monthly
7.	Duplex	Automatic
8.	Input Tray Capacity	Minimum 250 pages
9.	Paper size	A4, Letter, Legal
10.	Paper Types	Plain paper, envelopes
11.	Interface/Connectivity	USB 2.0 and 10/100 Ethernet
12.	OS Compatibility	Windows 7, 8, 8.1 and 10
13.	Accessories	Power cord; Ethernet Cable (patch cord), USB cable; Install Guide; Driver Software CD

7.14. Network B/W Laser Printer (Heavy Duty)

#	Parameter	Minimum Specifications
1.	Make	Must be specified
2.	Model and Part Code	Must be specified. All relevant technical brochures must be submitted.
3.	Printer type	Monochrome laser
4.	Printer speed	Minimum 50 PPM
5.	Memory	32 MB RAM
6.	Duty cycle	Minimum 50000 monthly
7.	Duplex	Automatic
8.	Input Tray Capacity	Minimum 250 pages x 2 Trays
9.	Paper size	A4, Letter, Legal
10.	Paper Types	Plain paper, envelopes
11.	Interface/Connectivity	USB 2.0 and 10/100 Ethernet
12.	OS Compatibility	Windows 7, 8, 8.1 and 10
13.	Accessories	Power cord; Ethernet Cable (patch cord), USB cable; Install Guide; Driver Software CD

7.15. LCD Projector

#	Item	Minimum Specifications
1.	Display Technology	Poly-silicon TFT 3LCD
2.	Resolution	WXGA, 1280x800, 16:10
3.	Colours	16.7 million Colours
4.	Brightness	3000 or more ANSI lumens (in Normal Mode)
5.	Contrast Ratio	2000:1 or more
6.	Video Input	One computer (D-Sub, Standard 15 pin VGA connector) One HDMI
7.	Keystone Correction	Horizontal and vertical
8.	Zoom and Focus	Manual Zoom and Focus
9.	Audio	Internal speaker
10.	Remote Operations	Full function Infrared Remote Control
11.	Other features	Auto source detect, Auto-synchronisation, Keystone Correction
12.	Mounting	Ceiling mount with fixed structure, with all accessories and cables
13.	Lamp Life	4000 hours minimum

7.16. Indoor Wifi Access Point for CCC Building

#	Parameter	Minimum Specifications
1.	Ports	AP should have one Auto-sensing 10/100/1000 port; one serial console port
2.	Connectivity	Support 802.3 standard Power-over-Ethernet (PoE) with full capacity operation at full power of the radios
3.	Mount	Ceiling and/or wall mounting options
4.	Management	The Access Point should have the technology to improve downlink performance to all mobile devices. Real-time, fully integrated spectrum analyser capabilities on the APs that does not required dedicated sensors or separate operating system running on the AP radios
5.	Mobility	Access Point radio should be minimum 2X2 MIMO with minimum 2 spatial streams; Dual Radio access Minimum of 8 SSIDs and BSSIDs available on each AP simultaneously without negatively impacting system performance
6.	High throughput	Access Point should be 802.11ac ready from day one

7.	Diagnostics	Real time packet capture on the APs, without disconnecting clients
8.	Security	Capable of multi-function services including: data access, intrusion detection, intrusion prevention, location tracking, and RF monitoring with no physical "touch" and no additional cost. AP should have lock option for security
9.	Certification	Plenum rated with UL 2043 certification
10.	Other	Access point should be supplied with OEM mounting kit

7.17. Indoor Fixed Dome camera for Surveillance

#	Parameter	Minimum Specifications or better
1.	Video Compression	H.264
2.	Video Resolution	1920 X 1080
3.	Frame rate	Min. 25 fps
4.	Image Sensor	1/3" or 1/4" Progressive Scan CMOS
5.	Lens	Autofocus, Fixed IRIS 2.8-10mm, F1.7, 10x digital zoom
6.	Minimum Illumination	Colour: 0.1 lux, B/W: 0.01 lux (at 30 IRE)
7.	Day/Night Mode	Colour, Mono, Auto
8.	S/N Ratio	≥ 50 Db
9.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Auto back focus
10.	Wide Dynamic Range	True WDR up to 80 db
11.	Audio	Full duplex, line in and line out, G.711, G.726
12.	Local storage	microSDXC memory card of 32GB (Class 10) In the event of failure of connectivity to the central server the camera shall record video locally on the SD card automatically. After the connectivity is restored these recordings shall be automatically merged with the server recording such that no manual intervention is required to transfer the SD card based recordings to server.
13.	Protocol	HTTP, HTTPS, FTP, RTSP, RTP, TCP, UDP, RTCP, DHCP, ONVIF Profile S &G
14.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
15.	Intelligent Video	Motion Detection & Tampering alert

16.	Alarm I/O	Minimum 1 Input & Output contact for 3rd part interface
17.	Operating conditions	0 to 50°C
18.	Casing	IP66 and IK10 rated
19.	Certification	UL2802 / EN, CE ,FCC
20.	Power	802.3af PoE (Class 0) and 12VDC/24AC

7.18. Enterprise Management Systems (EMS)

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

1. SLA and Contract Management System
2. Network Monitoring System
3. Server Monitoring System
4. Helpdesk System

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

1. SLA & Contract management System

The SLA & Contract Management solution should enable the VSCDL/VMC to capture all the System based SLAs defined in this RFP and then calculate quarterly (or for any duration) penalty automatically. Measuring service performance requires incorporation of a wide variety of data sources of the Surveillance project. The SLA solution should support the collection data from various sources in order to calculate Uptime / Performance / Security SLAs. Various features required in this component to EMS are -

- It must be a centralized monitoring solution for all IT assets (including servers, network equipment etc.)
- The solution must have integrated dashboard providing view of non performing components / issues with related to service on any active components
- The solution must follow governance, compliance and content validations to improve standardization of service level contracts
- Application should be pre-configured so as to allow the users to generate timely reports on the SLAs on various parameters.
- The solution must support Service Level Agreements & Lifecycle Management including Version Control, Status Control, Effectively and audit Trail to ensure accountability for the project.
- The solution must have the ability to define and calculate key performance indicators from an End to End Business Service delivery perspective related to Surveillance Project under discussion.

- The solution should support requirements of the auditors requiring technical audit of the whole system
- The solution most have an integrated dashboard, view of Contract Parties & current SLA delivery levels and view of Services & current SLA performance
- The solution should support SLA Alerts escalation and approval process.
- Solution should support effective root cause analysis, support capabilities for investigating the root causes of failed service levels and must make it possible to find the underlying events that cause the service level contract to fail.
- Accept Data from a variety of formats, provide pre-configured connectors and adapters, Ability to define Adapters to data source in a visual manner without coding.
- Support for Defining and Calculating service Credit and Penalty based on clauses in SLAs.

Reporting

- Ability to generate reports on penalty and credit due, to check on non-compliance of SLAs for the surveillance project
- Monetary penalties to be levied for non-compliance of SLA, thus the system must provide Service Level Performance Report over time, contract, service and more.
- The solution should provide historical and concurrent service level reports for the surveillance project in order to ensure accountability of the service provider's performance
- Automatic Report creation, execution and Scheduling, must support variety of export formats including Microsoft Word, Adobe PDF etc.
- The solution must support Templates for report generation, Report Filtering and Consolidation and Context sensitive Drill-down on specific report data to drive standardization and governance of the surveillance project
- The solution must support security for drill-down capabilities in dashboard reports ensuring visibility for only relevant personnel of the surveillance project
- Support real-time reports (like at-a-glance status) as well as historical analysis reports (like Trend, TopN, Capacity planning reports etc.)
    - Resource utilization exceeding or below customer-defined limits
    - Resource utilization exceeding or below predefined threshold limits

A List of SLAs that needs to be measured centrally by SLA contract management system are given in the RFP document. These SLAs must be represented using appropriate customizable reports to ensure overall service delivery.

2. Network Management System

Solution should provide fault & performance management of the server side infrastructure and should monitor IP\SNMP enabled devices like Routers, Switches, PA System, Emergency Call Boxes, Sensors, etc. Proposed Network Management shall also help monitor key KPI metrics like availability, in order to measure SLA's. Following are key functionalities that are required which will assist administrators to monitor network faults & performance degradations in order to reduce downtimes,

increase availability and take proactive actions to remediate & restore network services.

- The proposed solution must automatically discover manageable elements connected to the infrastructure and map the connectivity between them. Solution should provide centralized monitoring console displaying network topology map.
- Proposed solution should provide customizable reporting interface to create custom reports for collected data.
- The system must use advanced root-cause analysis techniques and policy-based condition correlation technology for comprehensive analysis of infrastructure faults.
- The system should be able to clearly identify configuration changes and administrators should receive an alert in such cases.

3. Server Performance Monitoring System

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

4. Centralized Helpdesk System

- Helpdesk system should provide incident management, problem management templates along with helpdesk SLA system for tracking SLA's pertaining to incident resolution time for priority / non-priority incidents.
- System should also automatically create tickets based on alarm type
- The proposed helpdesk solution must provide flexibility of logging, viewing, updating and closing incident via web interface for issues related to the project.

7.19. Centralized Anti-virus Solution

The following features are required for centralized anti-virus solution, to protect all computing resources (servers, desktops, other edge level devices, etc.):

#	Description	Bidder Compliance (Yes/No)
1.	Ability to scan through all file types and various compression formats. Ability to scan for HTML, VBScript Viruses, malicious applets and ActiveX controls.	
2.	Must update itself over internet for virus definitions, program updates etc. (periodically as well as in push-updates in case of outbreaks)	
3.	Able to perform different scan Actions based on the virus type (Trojan/ Worm, Joke, Hoax, Virus, other)	

#	Description	Bidder Compliance (Yes/No)
4.	Shall provide Real-time product Performance Monitor and Built-in Debug and Diagnostic tools, and context- sensitive help.	
5.	The solution must provide protection to multiple remote clients	
6.	Shall provide for virus notification options for Virus Outbreak Alert and other configurable Conditional Notification	
7.	Should be capable of providing multiple layers of defence	
8.	Shall have facility to clean, delete and quarantine the virus affected files.	
9.	Should support online update, where by most product updates and patches can be performed without bringing messaging server off-line.	
10.	Should support in-memory scanning so as to minimize Disk IO.	
11.	Should support Multi-threaded scanning	
12.	Should support scanning of nested compressed files	
13.	Should support heuristic scanning to allow rule-based detection of unknown viruses	
14.	All binaries from the vendor that are downloaded and distributed must be signed and the signature verified during runtime for enhanced security.	
15.	in case of virus outbreak and compromised endpoints (Servers, Desktop etc.), the OEM should provide cure solution within specified SLA (at no extra cost), to remove the virus and clean the system(s) to restore the environment.	

7.20. Call Centre Solution

Minimum Specifications	
1.	The contact centre solution should be able to route voice/ VOIP calls from centralized Interactive Voice Response System (IVRS) to respective call centre (s) along with interaction history of the calling party.
2.	The callers should be able to access the various services through state-of-art centralized integrated Interactive Voice Response System (IVRS). The information is envisaged to be available to the customer through telephone (IVRS) and call centres agents.
3.	The IVRS should establish two way communication on the same channel with customers through recorded synthesized voice in Hindi / English / Regional Language or in combination of languages to give information, reply to queries and provide other.

4.	IVRS should be modular and scalable in nature for easy expansion without requiring any change in the software.
5.	It should be possible to access IVRS through any of the access device such as Landline telephone, Mobile phone (GSM as well as CDMA) etc.
6.	IVRS should support various means of Alarm indications in case of system failures, e.g. Functional error, missing voice message prompt, etc., and shall generate error Logs.
7.	The system should have the ability to define business rules based upon which the system should quickly identify, classify and prioritize callers, and using sophisticated routing, to deliver interactions to the best qualified agent in the any of the connected local/remote call centre, regardless of interaction channel
8.	The application should provide CTI services such as: • Automatic display (screen pop) of information concerning a user/customer on the call agent screen prior to taking the call based on ANI, DNIS or IVR data. • Synchronized transfer of the data and the call to the call centre agent. • Transfer of data corresponding to any query raised by any IP agent regarding a query raised by a customer whose call is being attended by the call IP agent. • Call routing facilities such as business rule based routing, skills-based routing etc.
9.	The application should support integration to leading CTI middleware vendors.
10.	Should provide pre-integration with industry standard IVR servers and enhance routing & screen-pop by passing forward the information.
11.	Should provide facilities for outbound calling list management, and software based predictive or preview dialling.
12.	The application should allow service level plans to be varied by day, time of day, or a specific date.
13.	**Call Centre Agent's Desktop: The agents desktop shall have an application which shall fulfil the following functionalities :** • It should provide consistent agent interface across multiple media types like fax, SMS, telephone, email, and web call back. • The agent's desktop should have a "soft-phone" – an application that enables standard telephony functions through a GUI. • It should provide the agents with a help-desk functionality to guide the agents to answer a specific query intelligently. • It should also provide an easy access to agents to previous similar query which was answered successfully. • It should also be possible to identify a request to be a similar request made earlier. • It should be possible for agents to mark a query as complex/typical and put in to database for future reference by other agents.

	• It should be possible for agents to escalate the query.
14.	System should be able to integrate with e–mail / SMS gateway so that appropriate messages can be sent to the relevant stakeholders after the interaction and any updates thereon.
15.	Should intelligently and automatically responds to email inquiries or routes inquires with skills based routing discipline to agents
16.	Should have an Intelligent distribution of email to agents
17.	CTI Application Requirements • The CTI link should allow a computer application to acquire control of the agent resources on the IP EPABX & change state of the agent phone through commands on the CTI link. • The CTI link should pass events & information of agent states & changes in agent states as well as incoming calls to the computer applications. • The CTI link should allow a computer application to take control of the call flow inside the IP EPABX & also allow the computer application to decide the most suitable action / agent for an incoming call.
18.	**Automatic Call Distribution (ACD) Requirements** • The ACD solution should be able to route the call to any remote call centre agent using IP phones • Should have an ability to queue or hold the call for an agent if none is immediately available. • Should have an ability to keep the callers informed as to the status of the call and providing information to callers while they wait in queue. • System should be able to perform prioritized call routing
19.	Supervisor Module The call centre should provide a graphical console application program for the supervisor's workstation. This position shall facilitate the following features:- • Any supervisor shall be able to monitor or control any group in the call Centre. • It shall show the live activity of each agent in details as well as in a summarized fashion including information like total number of calls received, calls answered, average response time etc. • The Supervisor console shall also graphically display live status of the call session summary, number of call waiting in the queue, call traffic etc. • Live status of the group shall be shown, including waiting calls and calls being answered currently. • Access to the supervisor console shall be restricted. • It shall be possible for a supervisor to attend calls whenever necessary.
20.	Should have a comprehensive audit trail detailing every user activity including system/security administrators with before and after image

7.21. RDBMS Licenses

- Bidder needs to provide Licensed RDBMS, enterprise/full version as required for the proposed system and following all standard industry norms for performance, data security, authentication and database shall be exportable in to XML.

7.22. Directory services

1. Should be compliant with LDAP v3
2. Support for integrated LDAP compliant directory services to record information for users and system resources
3. Should provide authentication mechanism across different client devices / PCs
4. Should provide support for Group policies and software restriction policies
5. Should support security features, such as Kerberos, Smart Cards, Public Key Infrastructure (PKI), etc.
6. Should provide support for X.500 naming standards
7. Should support that password reset capabilities for a given group or groups of users can be delegated to any nominated user
8. Should support that user account creation/deletion rights within a group or groups can be delegated to any nominated user

Should support directory services integrated DNS zones for ease of management and administration/replication.

7.23. Client Access Licenses

Required number of CAL licenses shall be supplied, to connect and operate client computing devices (workstations and desktops etc.) in integrated environment.

7.24. Core Router

- VSCDL shall provide the location to house the compute and storage infrastructure, at the Data Centre facility being built at the Command and Control Centre.
- The DR for the data could be on cloud. The rate card, for various services offered by the cloud vendor will also be available on request.
- Various ICT equipment to be provisioned and maintained by the SI at the Data Centre & DR Sites are given below.

#	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. Must have capability to interface with variety interfaces.
5.	Protocol Support	Must have support for TCP/IP, PPP 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
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
11.	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
12.	Security features	• MD5 encryption for routing protocol • NAT • URL based Filtering • RADIUS Authentication • Management Access policy • IPSec / Encryption • L2TP
13.	QOS Features	• RSVP • Priority Queuing • Policy based routing • Traffic shaping • Time-based QoS Policy • Bandwidth Reservation / Committed Information Rate

7.25.Layer 2 LAN Switch

#	Parameter	Minimum Specifications
1	Ports	• 24 or 48 (as per requirements) 10/100/1000 Base-TX ports and extra 2 or 4 nos of 10G Base SX/LX ports as per network solution offered. • All ports can auto-negotiate between 10Mbps/ 100Mbps/ 1000Mbps, half-duplex or full duplex and flow control for half-duplex ports.
2	Switch type	Layer 2
3	MAC	8 K or more
4	Backplane	56 Gbps capacity (as per network configuration to meet performance requirements of wire speed switching for the connected devices)
5	Forwarding Rate	Packet Forwarding Rate should be 70.0 Mpps or better
5	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks
6	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.
7	Protocols	• IPV4, IPv6 • Support 802.1D, 802.1S, 802.1w, Rate limiting • Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping • 802.1p Priority Queues, port mirroring, DiffServ • DHCP support • Support upto 1024 VLANs
8	Access Control	• Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering. • Should support TACACS+ and RADIUS authentication
9	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
10	Protocol and Traffic	• Network Time Protocol or equivalent Simple Network Time Protocol support • Switch should support traffic segmentation • Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number
11	Management	• Switch needs to have console port for management via PC • Must have support SNMP v1,v2 and v3 • Should support 4 groups of RMON • Should have accessibility using SSH, Console access, easier software upgrade through network using TFTP etc. Configuration management through CLI, GUI based software utility and using web interface

7.26. Layer 3 Switch (Aggregation Switch)

#	Parameter	Minimum Specifications
1	Ports	• 24 or 48 (as per requirements) 10/100/1000 Base-TX/FX ports and extra 2 or 4 nos of 10G Base SX/LX/LR ports as per network solution offered. • TX/FX Split as per field/site requirement • All ports can auto-negotiate between 10Mbps/ 100Mbps/ 1000Mbps, half-duplex or full duplex and flow control for half-duplex ports.
2	Switch type	Layer 3
3	MAC	32K or more
4	Backplane	Properly sized Switching fabric capacity (as per network configuration to meet performance requirements of wire speed switching for the connected devices)
5	Port Features	Must support Port Mirroring, Port Trunking and 802.3ad LACP Link Aggregation port trunks
6	Flow Control	Support IEEE 802.3x flow control for full-duplex mode ports.
7	Protocols	• IPV4, IPv6 • Support 802.1D, 802.1S, 802.1w, Rate limiting • Support 802.1Q VLAN encapsulation, IGMP v1, v2 and v3 snooping • 802.1p Priority Queues, port mirroring, DiffServ • DHCP support • Support upto 1024 VLANs • Support IGMP Snooping and IGMP Querying • Support Multicasting • Should support Loop protection and Loop detection, • Should support Ring protection
8	Access Control	• Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering. • Should support TACACS+ and RADIUS authentication
9	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
10	Protocol and Traffic	• Network Time Protocol or equivalent Simple Network Time Protocol support • Switch should support traffic segmentation • Traffic classification should be based on user-definable application types: TOS, DSCP, Port based, TCP/UDP port number
11	Management	• Switch needs to have console port for management via PC

#	Parameter	Minimum Specifications
		• Must have support SNMP v1,v2 and v3 • Should support 4 groups of RMON • Should have accessibility using SSH, Console access, easier software upgrade through network using TFTP etc. Configuration management through CLI, GUI based software utility and using web interface

7.27. DC Switch/ TOR (Top of the Rack) Switch

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
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	Required throughput to achieve non-blocking performance for switch when all ports are populated.	
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	• IPV4, IPV6 • 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 • DHCP support • Support up to 1024 VLANs • Support IGMP Snooping and IGMP Querying • Support Multicasting • Should support Loop protection and Loop detection, • Should support Ring protection (optional)	
9.	Access Control	• Support port security • Support 802.1x (Port based network access control). • Support for MAC filtering.	

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
		• 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 • 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 power supplies • Redundant fans	

7.28. WAN / Internet Router

#	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.	Interface modules	Must support up to 10G interfaces as per the design. Must have capability to connect with variety of interfaces.
4.	Protocol Support	• Must have support for TCP/IP, PPP, 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

#	Item	Minimum Specifications
		• Support load balancing
5.	Manageability	Must be SNMP manageable
6.	Traffic control	Traffic Control and Filtering features for flexible user control policies
7.	Bandwidth	Bandwidth on demand for cost effective connection performance enhancement
8.	Remote Access	Remote access features
	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
9.	Security features	• MD5 encryption for routing protocol • NAT ,URL based Filtering • RADIUS/AAA Authentication • Management Access policy • IPSec / Encryption • L2TP
10.	QOS Features	• RSVP • Priority Queuing • Policy based routing • Traffic shaping • Time-based QoS Policy • Bandwidth Reservation / Committed Information Rate

7.29. Firewall

#	Item	Minimum Specifications
1.	Physical attributes	• Should be mountable on 19" Rack • Modular Design • Internal redundant power supply
2.	Interfaces	• 4 x GE, upgradable to 8 GE • Console Port 1 number
3.	Performance and Availability	• Encrypted throughput: minimum 1 Gbps • Concurrent connections: up to 100,000 • Simultaneous VPN tunnels: 2000
4.	Routing Protocols	• Static Routes • RIPv1, RIPv2 • OSPF
5.	Protocols	• TCP/IP • RTP

#	Item	Minimum Specifications
		• IPSec, DES/3DES/AES • FTP, HTTP, HTTPS,SNMP, SMTP • DHCP, DNS, Support for IP v4 & IPv6 • IPSEC
6.	Other support	• 802.1Q, NAT, PAT, IP Multicast support, Remote Access VPN, Time based Access control lists, URL Filtering, support VLAN, Radius/ TACACS, Support multilayer firewall protection, Traffic shaping, Bandwidth monitoring
7.	QoS	• QoS features like traffic prioritisation, differentiated services, committed access rate. Should support for QoS features for defining the QoS policies.
8.	Management	• Console, SSHv2, Browser based configuration • SNMPv1, SNMPv2, SNMPv3
9.	Certifications	ICSA

7.30. Intrusion Prevention System

This can be offered as separate unit or as a module in firewall

#	Item	Required Specifications
1.	Performance	Should have an aggregate throughput of no less than 500Mbps Total Simultaneous Sessions – 500,000
2.	Features	• IPS should have Dual Power Supply • IPS system should be transparent to network, not default gateway to Network • IPS system should have Separate interface for secure management • IPS system should be able to protect Multi Segment in the network, should be able to protect 4 segments.
3.	Real Time Protection	• Web Protection • Mail Server Protection • Cross Site Scripting • SNMP Vulnerability • Worms and Viruses • Brute Force Protection • SQL Injection

#	Item	Required Specifications
		• Backdoor and Trojans
4.	Stateful Operation	• TCP Reassembly • IP Defragmentation • Bi-directional Inspection • Forensic Data Collection • Access Lists
5.	Signature Detection	Should have provision for Real Time Updates of Signatures, IPS Should support Automatic signature synchronization from database server on web Device should have capability to define User Defined Signatures
6.	Block attacks in real time	• Drop Attack Packets • Reset Connections • Packet Logging • Action per Attack
7.	Alerts	• Alerting SNMP • Log File • Syslog • E-mail
8.	Management	• SNMP v1, v2, v3 • HTTP, HTTPS • SSHv2, Console
9.	Security Maintenance	• IPS Should support 24/7 Security Update Service • IPS Should support Real Time signature update • IPS Should support Provision to add static own attack signatures • System should show real-time and History reports of Bandwidth • IPS should have provision for external bypass Switch

7.31. Server Load balancer

- Server Load Balancing Mechanism
  - Cyclic, Hash, Least numbers of users
  - Weighted Cyclic, Least Amount of Traffic

  - NT Algorithm / Private Algorithm / Customizable Algorithm / Response Time
- Redundancy Features
  - Supports Active-Active and Active-Standby Redundancy
  - Segmentation / Virtualization support along with resource allocation per segment, dedicated access control for each segment
- Routing Features
  - Routing protocols RIPv1/RIPv2/OSPF
  - Static Routing policy support
- Server Load Balancing Features
  - Server and Client process coexist
  - UDP Stateless
  - Service Failover
  - Backup/Overflow
  - Direct Server Return
  - Client NAT
  - Port Multiplexing-Virtual Ports to Real Ports Mapping
  - DNS Load Balancing
- Load Balancing Applications
  - Application/ Web Server, MMS, RTSP, Streaming Media
  - DNS, FTP- ACTIVE & PASSIVE, REXEC, RSH,
  - LDAP, RADIUS
- Content Intelligent SLB
- HTTP Header Super Farm
- URL-Based SLB
- Browser Type Farm
  - Support for Global Server Load Balancing
  - Global Server Load Balancing Algorithms
  - HTTP Redirection,
  - HTTP
  - DNS Redirection, RTSP Redirection
  - DNS Fallback Redirection, HTTP Layer 7 Redirection
- SLB should support below Management options
  - Secure Web Based Management
  - SSH
  - TELNET
  - SNMP v1, 2, 3 Based GUI
  - Command Line

7.32. Servers

(As Building block, to establishing computing solution for sub-systems/solutions)

#	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

#	Parameter	Minimum Specifications
		Minimum 2 processors per each physical server
2.	RAM	Minimum 128 GB ECC Memory per physical server, upgradable up to 256 GB
3.	Internal Storage	2 x 300 GB SAS (10k rpm) hot swap disks
4.	Network interface	2 X 20GbE LAN ports for providing Ethernet connectivity Optional: 1 X Dual-port 16Gbps FC HBA (or FCoE) for providing FC connectivity If bidder is offering FCoE based solution, corresponding ports must be present in server as well as storage controllers.
5.	RAID support	As per requirement/solution
6.	Operating System	Licensed version of 64 bit latest version of Linux/ Unix/Microsoft® Windows based Operating system)
7.	Form Factor	Blade
8.	Virtualization	Shall support Industry standard virtualization hypervisor like Hyper-V, VMWARE, Oracle VM etc. OEM of the blade chassis and servers offered should in "Validated Configuration" list and certified by OEM to run virtualisation.

7.33. Blade Chassis

#	Minimum Specifications
1	Minimum 6U size, rack-mountable, capable of accommodating minimum 8 or higher hot pluggable blades
2	Dual network connectivity of 10 G speed for each blade server for redundancy shall be provided
3	Backplane shall be completely passive device. If it is active, dual backplane shall be provided for redundancy.
4	Have the capability for installing industry standard flavours of Microsoft Windows, and Enterprise RedHat Linux OS
5	Shall support Industry standard virtualization hypervisor like Hyper-V, VMWARE, Oracle VM etc. OEM of the blade chassis and servers offered should in "Validated Configuration" list and certified by OEM to run virtualization.
6	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
7	Minimum 1 USB port
8	Two hot-plug/hot-swap, redundant 10 Gbps Ethernet or FCoE module with minimum 16 ports (cumulative), having Layer 2/3 functionality. If bidder is offering FCoE based solution, corresponding ports must be present in server as well as storage controller.
9	Two hot-plugs/hot-swap redundant 16 Gbps Fibre Channel module for connectivity to the external Fibre channel Switch and ultimately to the storage device

#	Minimum Specifications
10	Power supplies shall have N+N (Hot Swap/Hot Plug). All power supplies modules shall be populated in the chassis. Required number of PDUs and power cables, to connect all blades, Chassis to Data Centre power outlet.
12	Hot pluggable/hot-swappable redundant cooling unit
13	Provision of systems management and deployment tools to aid in blade server configuration and OS deployment
14	Blade enclosure shall have provision to connect to display console/central console for local management such as troubleshooting, configuration, system status/health display.
15	Single console for all blades in the enclosure, built-in KVM switch or Virtual KVM features over IP
16	Dedicated management network port shall have separate path for remote management.

7.34. Storage (Primary and Secondary)

#	Parameter	Minimum Specifications
1.	Solution/ Type	• Bidder shall provide Unified storage solution (or a Combination of NAS/Scale-out NAS/SAN) supporting all required protocols (IP Based/FC/iSCSI/FC/NFS/CIFS etc.) for the offered storage solution, 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 solution must be provided from day 1. • If bidder is offering FCoE based solution, corresponding ports must be present in server as well as storage controller.
2.	Primary and secondary Storage	• Primary Storage Capacity should be minimum 400 TB (usable, after configuring in offered RAID configuration) • Secondary Storage Capacity should be minimum 1500 TB (usable, after configuring in offered RAID configuration) • RAID solution offered must protect against double disc failure. • Disks should be preferably minimum of 1.2 TB capacity for SAS and 3 TB for SATA (combination as per performance and SLA requirements of overall solution) • To store all types of data (Data, Voice, Images, Video, etc) • Proposed Storage System should be scalable (vertically/horizontally)
3.	Hardware Platform	• Rack mounted form-factor • Modular design to support controllers and disk drives expansion
4.	Controllers	• At least 2 Controllers in active/active mode

#	Parameter	Minimum Specifications
		• The controllers / Storage nodes should be upgradable seamlessly, without any disruptions / downtime to production workflow for performance, capacity enhancement and software / firmware upgrades.
5.	RAID support	• Should support various RAID Levels
6.	Cache	• Minimum 64 GB of useable cache across all controllers. If cache is provided in any additional hardware for the storage solution, then cache must be over and above 64 GB.
7.	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
8.	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, up to 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
9.	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

7.35.Server/Networking Rack

#	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 & 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 Packs, Blanking Panels as per requirements.

		• 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 minimum
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 60% 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)

7.36. KVM Module

#	Item	Minimum Specifications
1.	KVM Requirement	Keyboard, Video Display Unit and Mouse Unit (KVM) for the IT Infrastructure Management at Data Centre
2.	Form Factor	19” rack mountable
3.	Ports	minimum 8 ports
4.	Server Connections	USB or KVM over IP.
5.	Auto-Scan	It should be capable to auto scan servers

6.	Rack Access	It should support local user port for rack access
7.	SNMP	The KVM switch should be SNMP enabled. It should be operable from remote locations
8.	OS Support	It should support multiple operating system
9.	Power Supply	It should have dual power with failover and built-in surge protection
10.	Multi-User support	It should support multi-user access and collaboration

7.37. Tape Drive

Sr No	Item	Minimum Specifications
1	Make	Must be specified
2	Model	Must be specified. All relevant technical information/brochures must be submitted
3	Technology	LTO 6
4	Number Drives	Two LTO 6 Drives
6	Interface	Minimum 4 Gbps FC Interface
7	Power Supplies	Redundant Hot Swap Power supply
8	Fans	Redundant Hot Swap cooling fans
9	Software	Security and Remote Management Software
10	Supported Backup Software	Should support industry leading backup software such as Symantec Net Backup
11	Accessories	With all required cables and accessories to install and configure in standard 19" rack and to connect to Server/SAN switch

7.38. Backup Software

9. The software shall be primarily used to back up the necessary and relevant video feeds from storage that are marked or flagged by the VSCDL . The other data that would require backing up would include the various databases that shall be created for the system. Details of data that would be created are available in the table at section 'Data Requirements'
10. Scheduled unattended backup using policy-based management for all Server and OS platforms
11. The software should support on-line backup and restore of various applications and Databases
12. The backup software should be capable of having multiple back-up sessions simultaneously
13. The backup software should support different types of backup such as Full back up, Incremental back up, Differential back up, Selective back up, Point in Time back up and Progressive Incremental back up and snapshots

- The backup software should support different types of user interface such as GUI, Web-based interface

7.39. Online UPS

#	Parameter	Minimum Specifications
1.	Capacity	Adequate capacity to cover all above IT Components at CCC and Smart DC
2.	Output Wave Form	Pure Sine wave
3.	Input Power Factor at Full Load	>0.90
4.	Input	Three Phase 3 Wire
5.	Input Voltage Range	305-475VAC at Full Load
6.	Input Frequency	50Hz +/- 3 Hz
7.	Output Voltage	400V AC, Three Phase
8.	Output Frequency	50Hz+/- 0.5% (Free running); +/- 3% (Sync. Mode)
9.	Inverter efficiency	>90%
10.	Over All AC-AC Efficiency	>85%
11.	UPS shutdown	UPS should shutdown with an alarm and indication on following conditions 1)Output over voltage 2)Output under voltage 3)Battery low 4)Inverter overload 5)Over temperature 6)Output short
12.	Battery Backup	60 minutes in full load
13.	Battery	VRLA (Valve Regulated Lead Acid) SMF (Sealed Maintenance Free) Battery
14.	Indicators & Metering	Indicators for AC Mains, Load on Battery, Fault, Load Level, Battery Low Warning, Inverter On, UPS on Bypass, Overload, etc. Metering for Input Voltage, Output Voltage and frequency, battery voltage, output current etc.
15.	Audio Alarm	Battery low, Mains Failure, Over temperature, Inverter overload, Fault etc.
16.	Cabinet	Rack / Tower type
17.	Operating Temp	0 to 50 degrees centigrade
18.	Management Protocol	SNMP Support through TCP/IP

7.40. UPS / DC Power Supply for field locations

Sr No	Parameter	Minimum Specifications
1.	Capacity	Adequate capacity to cover all above IT Components at respective location (Minimum 1 hour)
2.	Technology	IGBT based PWM Technology, True Online UPS or DC Power Supply
3.	Input Frequency Range	45 to 55 Hz
4.	Output Frequency Range	45 to 55 Hz
5.	Output Voltage	220VAC - 230VAC

Sr No	Parameter	Minimum Specifications
6.	Voltage Regulation	+/-2% (or better) and with built-in Over Voltage Cut off facility in the Device
7.	Frequency	50 Hz +/- 0.1% (free Run Mode)
8.	Harmonic Distortion (THD)	< 3% (linear load)
9.	Output Waveform	Pure Sine wave
10.	Output Power Factor	0.8 or more
11.	Battery Backup	Adequate and required battery backup to achieve required uptime of field device as well as SLA of the overall solution..
12.	Battery Type	Lead acid, Sealed Maintenance Free (SMF)
13.	General Operating Temperature	0 to 40 Degree Celsius
14.	Alarms & Indications	All necessary alarms & indications essential for performance monitoring of UPS like mains fail, low battery & fault detection
15.	Bypass	Automatic, Manual Bypass Switch
16.	Certifications	For Safety & EMC as per international standard
17.	Overall Protection	IP 55, Junction Box design should ensure to keep the temperature within suitable operating range for equipment's and should also avoid intentional water splash and dust intake

7.41. Fire proof enclosure

Sr NO	Item	Minimum Specifications
1	Design	The overall design of the safe should be suitable for safe storage of computer diskettes, tapes, smart cards and similar devices and other magnetic media, paper documents, etc. the safe should have adequate fire protection.
2	Capacity	300 Litres
3	Temperature to Withstand	1000° C for at least 1 hour
4	Internal Temperature	30° C after exposure to high temperature For 1 hour
5	Locking	2 IO-lever high security cylindrical / Electronic lock

7.42. Video Management System

Video management system shall constitute of a platform which will be designed for viewing, recording and replaying acquired video as part of overall project solution. This platform will be based on the Internet Protocol (IP) open platform concept. Major functionalities are described here:

VMS Overview

#	Description	Bidder Compliance (Yes/No)
1.	VMS shall be used for centralized management of all field camera devices, video servers and client users.	
2.	VMS server shall be deployed in a clustered server environment or support inbuilt mechanism for high availability and failover.	
3.	VMS shall support a flexible rule-based system driven by schedules and events.	
4.	VMS shall be supported for fully distributed solution for monitoring and control function, designed for limitless multi-site and multiple server installations requiring 24/7 surveillance with support for devices from different vendors.	
5.	VMS shall support ONVIF compliant internet protocol (IP) cameras.	
6.	The bidder shall clearly list in their proposal the make and models that can be integrated with the VMS, additionally all the offered VMS and cameras must have Open Network Video Interface Forum (ONVIF) compliance. VMS shall be enabled for any standard storage technologies and video wall system integration.	
7.	VMS shall be enabled for integration with any external Video Analytics Systems both server & edge based.	
8.	VMS shall be capable of being deployed in a virtualized server environment without loss of any functionality.	
9.	All CCTV cameras locations shall be overlaid in graphical map in the VMS Graphical User Interface (GUI). The cameras selection for viewing shall be possible via clicking on the camera location on the graphical map. The graphical map shall be of high resolution enabling operator to zoom-in for specific location while selecting a camera for viewing.	
10.	VMS shall have an administrator interface to set system parameters, manage codecs, manage permissions and manage storage.	
11.	VMS day to day control of cameras and monitoring on client workstations shall be controlled through the administrator interface.	

#	Description	Bidder Compliance (Yes/No)
12.	Whilst live control and monitoring is the primary activity of the monitoring workstations, video replay shall also be accommodated on the GUI for general review and also for pre- and post-alarm recording display.	
13.	The solution design for the VMS shall provide flexible video signal compression, display, storage and retrieval.	
14.	All CCTV camera video signal inputs to the system shall be provided to various command control centre(s), viewing centre etc., and the transmission medium used shall best suit the relative camera deployments and access to the CCTV Network.	
15.	VMS client shall have the capability to work with touch enabled multi-monitor workstations. It shall be capable of displaying videos in up to three (3) monitors simultaneously.	
a.	AVI files	
b.	Motion- Joint Photographic Experts Group (M-JPEG)	
c.	Moving Picture Expert Group-4 (MPEG-4)	
d.	MP4 Export or Latest	
16.	All streams to the above locations shall be available in real-time and at full resolution. Resolution and other related parameters shall be configurable by the administrator in order to provide for network constraints.	
17.	The VMS shall support field sensor settings. Each channel configured in the VMS shall have an individual setup for the following settings, the specific settings shall be determined according to the encoding device:	
18.	The VMS shall support the following operations:	
a.	Adding an IP device	
b.	Updating an IP device	
c.	Updating basic device parameters	
d.	Adding/removing channels	
e.	Adding/removing output signals	
f.	Updating an IP channel	
g.	Removing an IP device	
h.	Enabling/disabling an IP channel	

#	Description	Bidder Compliance (Yes/No)
i.	Refreshing an IP device (in case of firmware upgrade)	
j.	Multicast at multiple aggregation points	
19.	The VMS shall support retrieving data from edge storage. Thus when a lost or broken connection is restored, it shall be possible to retrieve the video from SD card and store it on central storage. System should support to view the recordings available over cameras local storage device (such as an SD card), and copy them to the server.	
20.	The VMS shall support bookmarking the videos. Thus, allowing the users to mark incidents on live and/or playback video streams.	
21.	The VMS shall allow the administrator to distribute camera load across multiple recorders and be able shift the cameras from one recorder to another by simple drag and drop facility.	
22.	VMS shall support automatic failover for recording.	
23.	VMS should also support dual recording or mirroring if required.	
24.	VMS shall support manual failover for maintenance purpose.	
25.	VMS shall support access and view of cameras and views on a smartphone or a tablet (a mobile device).	
26.	VMS shall support integration with the ANPR application.	
27.	VMS shall support integration with other online and offline video analytic applications.	
28.	VMS shall be able to accept alerts from video analytics built into the cameras, other third party systems, sensors etc.	

Client System

The Client system shall provide remote users with rich functionality and features as described below:

#	Functionality	Bidder Compliance (Yes/No)
1.	Viewing live video from cameras on the surveillance system.	
2.	Browsing recordings from storage systems.	
3.	Creating and switching between multiple of views.	
4.	Viewing video from selected cameras in greater magnification and/or higher quality in a designated hotspot.	
5.	Using digital zoom on live as well as recorded video.	
6.	Using sound notifications for attracting attention to detected motion or events.	
7.	Getting quick overview of sequences with detected motion.	
8.	Getting quick overviews of detected alerts or events.	

#	Functionality	Bidder Compliance (Yes/No)
9.	Quickly searching selected areas of video recording for motion (also known as Smart Search).	

Remote Web Client

#	Description	Bidder Compliance (Yes/No)
1.	The web-based remote client shall offer live view of up to 9 / 16 (configurable) cameras, including PTZ control (if applicable) and event / output activation. The Playback function shall give the user concurrent playback of multiple recorded videos with date, alert sequence or time searching.	
2.	User Authentication – The Remote Client shall support logon using the user name and password credentials	

Mobile Client

#	Description	Bidder Compliance (Yes/No)
1.	The bidder shall be required to provide a standardised Mobile Application to integrate smart phones and tablets for 2-way communication with the Video Management System in a secure manner. It will be responsibility of SI to configure such tablets / Smartphone with the Surveillance System and ensure that all the necessary access is given to these mobile users.	
2.	Communication with mobile client and server shall be encrypted with Digital Certificate.	

Matrix Monitor

#	Description	Bidder Compliance (Yes/No)
1.	Matrix Monitor – The Matrix Monitor feature shall allow distributed viewing of multiple cameras on the system on any monitor.	
2.	The Matrix Monitor feature shall access the H.264/MJPEG/MPEG4 stream from the connected camera directly and not sourced through the recording server.	

Alarm Management Module

#	Description	Bidder Compliance (Yes/No)
1.	The alarm management module shall allow for continuous monitoring of the operational status and event-triggered alarms from various system servers, cameras and other devices. The alarm management module shall provide a real-time overview of alarm status or technical problems while allowing for immediate visual verification and troubleshooting.	
2.	The alarm management module shall provide interface and navigational tools through the client including;	
3.	Graphical overview of the operational status and alarms from servers, network cameras and external devices including motion detectors and access control systems.	
4.	Intuitive navigation using a map-based, hierarchical structure with hyperlinks to other maps, servers and devices or through a tree-view format.	
5.	The module shall include flexible access rights and allow each user to be assigned several roles where each shall define access rights to cameras.	
6.	Basic VMS should be capable to accept third party generated events / triggers.	

Management / Integration Functionality

#	Description	Bidder Compliance (Yes/No)
1.	The Surveillance System shall offer centralised management of all devices, servers and users.	
2.	The Surveillance System should not have any limit on the number of cameras to be connected for Surveillance, Monitoring and Recording. Any increase in the no. of cameras should be possible by augmentation of Hardware components.	
3.	The Surveillance System shall support distributed viewing of any camera in the system using Video walls or big screen displays.	
4.	The Surveillance System shall support alarm management. The alarm management shall allow for the continuous monitoring of the operational status and event-triggered alarms from system servers, cameras and other external devices.	
5.	It should be possible to integrate the Surveillance System with 3rd-party software, to enable the users to develop	

#	Description	Bidder Compliance (Yes/No)
	customized applications for enhancing the use of video surveillance solution. For e.g., integrating alarm management to initiate SMS, E-Mail, VoIP call, etc.	
6.	The Management system shall store the overall network elements configuration in central database, either on the management server computer or on a separate DB Server on the network.	
7.	System should be able to be integrated with Event Management / Incident Management System.	

System Administration Functionality

#	Description	Bidder Compliance (Yes/No)
1.	The System Administration Server shall provide a feature-rich administration client for system configuration and day-to-day administration of the system.	
2.	The System Administration Server shall support different logs related to the Management Server. • The System Log • The Audit Log • The Alert Log • The Event Log	
3.	Rules: The system shall support the use of rules to determine when specific actions occur. Rules shall define what actions shall be carried out under specific conditions. The system shall support rule initiated actions such as: • Start and stop recording • Set non-default live frame rate • Send notifications via email • Pop-up video on designated Client Monitor recipients	

Major Server components for VMS

Video Management Server(s)	Video Management System Servers will maintain coherent operations between all servers and workstations. It will host Control Centre, where the system is administered, and System database. It will monitor one or more Recorder servers on separate dedicated computers, storage devices, IP-compatible devices, and one or more workstation. All network communication will also be is performed via the Video Management servers.
Video Recording Server(s)	The Video Recorder Server will be a dedicated server that will store and processes video with the help of Video Management System

Video Analytics Server (s)	Video Analytics Software will be installed in the Video Analytics Server, Video Analytics is a software product that will analyse live video in real-time to detect, identify, and track objects of interest. It will automatically issue alerts to the appropriate personnel and initiate appropriate follow-up action according to pre-defined rules. This software will also manage sensors; each sensor will monitor a single video feed for security events. The video feeds will be connected over the network to the Video Analytics Server. Sensors on the Video Analytics Server will perform all event detection functions.
Web Server(s)	It will be used to launch the client application remotely through web browsers.
Gateway Server (s) – If required	A Media Gateway server will be used to establish remote connections to review and transcode the video. Standalone Media Gateway servers can also be installed on separate machines. Standalone servers will be recommended for such large systems that will transfer video data to remote clients.

7.43. ANPR System

The ANPR System shall enable monitoring of vehicle flow at strategic locations. The system shall support real-time detection of vehicles at the deployed locations, recording each vehicle, reading its number plate, database lookup from central server and triggering of alarms/alerts based on the vehicle status and category as specified by the database. The system usage shall be privilege driven using password authentication.

#	Description	Bidder Compliance (Yes/No)
1.	**Vehicle Detection by Color** • The system shall detect the colour of all vehicles in the camera view during daytime and label them as per the predefined list of configured system colours. The system will store the colour information of each vehicle along with the license plate information for each transaction in the database. • The system shall have options to search historical records for post event analysis by the vehicle colour or the vehicle colour with license plate and date time combinations	
2.	**Alert Generation** • The system should have option to input certain license plates according to the hot listed categories like “Wanted”, “Suspicious”, “Stolen”, etc. by authorized personnel. • The system should be able to generate automatic alarms to alert the control room personnel for further action, in the event of detection of any vehicle falling in the hot listed categories.	
3.	**Vehicle Status Alarm Module**	

#	Description	Bidder Compliance (Yes/No)
	• On successful recognition of the number plate, system should be able generate automatic alarm to alert the control room for vehicles which have been marked as "Wanted", "Suspicious", "Stolen", "Expired". (System should have provision/expansion option to add more categories for future need). • The Instantaneous and automatic generation of alarms. In case of identity of vehicle in any category which is define by user.	
4.	**Vehicle Log Module** • The system shall enable easy and quick retrieval of snapshots, video and other data for post incident analysis and investigations. • The system should be able to generate suitable MIS reports that will provide meaningful data to concerned authorities and facilitate optimum utilization of resources. These reports shall include. ○ Report of vehicle flow at each of the installed locations for Last Day, Last Week and Last Month. ○ Report of vehicles in the detected categories at each of the installed locations for Last Day, Last Week and Last Month. ○ Report of Vehicle Status change in different Vehicle Categories. • The system shall have Search option to tune the reports based on license plate number, date and time, site location as per the need of the authorities. • The system shall have option to save custom reports for subsequent use. The system shall have option to export report being viewed to common format for use outside of the ANPRS or exporting into other systems. • The system should provide advanced and smart searching facility of License plates from the database. There should be an option of searching number plates almost matching with the specific number entered (up to 1 and 2 character distance)	
5.	**Vehicle Category Editor** • The system should have option to input certain license plates according to category like "Wanted", "Suspicious", "Stolen", “Expired" etc. by Authorized personnel. • The system should have an option to add new category by authorized personnel. • The system should have option to update vehicle status in specific category by authorized personnel.	

#	Description	Bidder Compliance (Yes/No)
	E.g. on retrieval of stolen vehicle, system entry should be changed from "Stolen" to "Retrieved". • System should have option to specify maximum time to retain vehicle records in specific categories.	
6.	**Central Management Module** • The Central Management Module shall run on the ANPRS Central Server in control booth. It should be possible to view records and edit hotlists from the Central Server. **ANPR Specification** • Base Specification of Fixed Box Cameras (described in Annexure III) must be part of the ANPR specifications. **Camera Housing** • IP66 standard with sunshield vandal proof Housing	
7.	**Systems requirement** • **Local Server at Intersection:** The system must run on a Commercial Off the Shelf Server (COTS). Outdoor IP 66 Quad core processor based server should be able to cover at least 8 lanes. Temperature rating of the server should be at least 60 degree. • **Operating system:** The system must be based on open platform and should run on Linux or windows Operating system. • **Workstation:** The system should run on any CCC Workstation or desktop which is supplied as part of this project.	

7.44. E Challan Handheld device

Sr. No.	Parameter	Description	Bidder Compliance (Yes/No)
1	**Core Board**		
A	Operating System	Latest Windows, Linux or Android OS	
b	Processor	Min 800 MHz	
c	Memory (Flash ROM)	Minimum 512 MB	
d	RAM	256 MB Min	
e	Extend Slot	Micro SD 32 GB	
2	**Motherboard**		
a	Display	Minimum 3.5 inch TFT LCD (Trans reflective screen VGA/QVGA)	

Sr. No.	Parameter	Description	Bidder Compliance (Yes/No)
b	Touch Screen	Yes	
c	Form Factor	Any	
d	GPS	GPS and A GPS	
e	Bluetooth	Yes	
f	Wifi	WiFi (802.11 b/g/n)	
g	Thermal Printer	Direct thermal line printing 3 inch	
h	Barcode scanner	1D and 2 Scanner	
i	External Interface	USB HOST/RS232(Customized)	
j	Protection class	IP54	
k	Drop resistance level	1.5m	
3	**Camera**		
a	Camera	3 MP Min	
b	Camera- Video	Support still image and video capture	
4	**Keypad**		
a	Front	QWERTY 42 Keys function key can be soft key	
5	**Interface**		
a	Mini-USB Connector	USB2.0 connection	
b	SIM card slot	Yes	
c	TF card slot	Yes	
d	power jack	Yes	
e	Audio Jack	Yes	
6	**General**		
a	Battery Type	rechargeable Li-ion battery 3000mAh	
b	Operating temperature	0°C--50°C	
c	Storage temperature	0°C -- 50°C	
d	Operating humidity	10%--80%	
e	Storage humidity	10%--90%	
f	Payment PINPAD	The device should have PCI , EMV certified PINPAD as per RBI guideline for accepting payment through Credit / Debit card	
g	Enclosure	Rugged	

7.45. Edge Level Switch

#	Parameter	Minimum Specifications
1	Type	Managed Outdoor Industrial grade switch
2	Total Ports	• Minimum 4 10/100/TX PoE/PoE+, 2x SFP Ports (can have 4xSFP Ports in certain locations) • May require higher port density at some locations, depending upon site conditions • May require Fibre ports (for devices or for uplinks) at some locations, depending upon site conditions/distances.
3	PoE Standard	IEEE 802.3af/ IEEE 802.3at or better
4	Protocols	• 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 • Support security group access control list
6	PoE Power per port	Sufficient to operate the CCTV cameras/edge devices connected
7	Enclosure Rating	IP 30 or equivalent Industrial Grade Rating(to be housed in Junction box)
8	Operating Temperature	0 -50 C or better Industrial Grade Rating
9	Multicast support	IGMP Snooping V1, V2, V3
10	Management	Switch needs to have RS-232/USB/RJ45 console port for management via a console terminal or PC,Web GUI NTP, Syslog for log capturing SNMP V1,V2,V3
11	Compliance	UL/EN/IEC or equivalent

7.46. Field Junction Box

#	Parameter	Minimum Specifications
1.	Size	Suitable size as per site requirements to house the field equipment
2.	Cabinet Material	GI
3.	Material Thickness	Min 1.2mm
5.	Number of Locks	Two
6.	Protection	IP 55, Junction Box design should ensure to keep the temperature within suitable operating range for equipment's and should also avoid intentional water splash and dust intake
7	Mounting	On Camera Pole / Ground mounted on concrete base

#	Parameter	Minimum Specifications
8.	Form Factor	Rack Mount/DIN Rail
9.	Other Features	Rain Canopy, Cable entry with glands, proper earthing and Fans/any other accessories as required for operation of equipment's within junction box.

7.47. Poles for Camera

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Pole type	Hot Dip Galvanized after Fabrication with Silver coating of 86 micron as per IS:2629; Fabrication in accordance with IS-2713 (1980)	
2.	Height	5-10 Meters (or higher), as-per-requirements for different types of cameras & Site conditions	
3.	Pole Diameter	Min. 10 cm diameter pole (bidder to choose larger diameter for higher height)	
4.	Cantilevers	Based on the location requirement suitable size cantilevers to be considered with the pole	
5.	Bottom base plate	Minimum base plate of size 30x30x1.5 cm	
6.	Mounting facilities	To mount CCTV cameras, RLVD Cameras, Traffic Signals, Pedestrian Signals/ Switch, etc.	
7.	Pipes, Tubes	All wiring must be hidden, through tubes/pipes. No wires shall be visible from outside.	
8.	Foundation	Casting of Civil Foundation with foundation bolts, to ensure vibration free erection (basic aim is to ensure that video feed quality is not impacted due to winds in different climatic conditions). Expected foundation depth of min. 100cms. Please refer to earthing standards mentioned elsewhere in the document.	
9.	Protection	Lightning arrester shall be provided, to protect all field equipment mounted on pole.	

7.48. Fixed Box Camera

#	Parameter	Minimum Specifications or better
1.	Video Compression	H.264
2.	Video Resolution	1920 X 1080
3.	Frame rate	Min. 25 fps
4.	Image Sensor	1/3" Progressive Scan CCD / CMOS

5.	Lens Type	Varifocal, C/CS Mount, IR Correction Full HD lens compatible to camera imager
6.	Lens#	Auto IRIS 8 – 50 mm,
7.	Multiple Streams	Dual streaming with 2nd stream at minimum 720P at 30fps at H.264 individually configurable
8.	Minimum Illumination	Colour: 0.1 lux, B/W: 0.01 lux (at 30 IRE)
9.	IR Cut Filter	Automatically Removable IR-cut filter
10.	Day/Night Mode	Colour, Mono, Auto
11.	S/N Ratio	≥ 50 dB
12.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, Auto back focus
13.	Wide Dynamic Range	True WDR up to 100 db
14.	Audio	Full duplex, line in and line out, G.711, G.726
15.	Local storage	microSDXC memory card of 64GB (Class 10): In the event of failure of connectivity to the central server the camera shall record video locally on the SD card automatically. After the connectivity is restored these recordings shall be automatically merged with the server recording such that no manual intervention is required to transfer the SD card based recordings to server.
16.	Protocol	HTTP, HTTPS, FTP, RTSP, RTP, TCP, UDP, RTCP, DHCP, ONVIF Profile S
17.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
18.	Intelligent Video	Motion Detection & Tampering alert
19.	Alarm I/O	Minimum 1 Input & Output contact for 3rd part interface
20.	Operating conditions	0 to 50°C
21.	Casing	NEMA 4X / IP-66 rated & IK 10
22.	Certification	UL2802 / EN, CE ,FCC
23.	Power	802.3af PoE (Class 0) and 12VDC/24AC

At few places 2.8mm – 11 mm lens would be required depending upon the location of the camera and area to be covered. 2.8mm – 11mm lens requirement can be assumed as 20%.

However the actual type of lens required would depend upon the field-specific user requirement & percentages may vary to some extent.

* All of the camera feeds would be used for Video Analytics while about 50 would be used for ANPR (Automatic Number Plate Recognition). Please note that the exact numbers may change depending upon the survey carried out by the successful bidder along with Police Dept. Bidders would be expected to provide necessary provisions in these cameras to support Analytics.

7.49. PTZ Camera

#	Parameters	Minimum Specifications or better
1.	Video Compression	H.264
2.	Video Resolution	1920 X 1080
3.	Frame rate	Min. 25 fps
4.	Image Sensor	1/3" OR ¼" Progressive Scan CCD / CMOS
5.	Lens	Auto-focus, 4.3 – 129 mm (corresponding to 30 X
6.	Multiple Streams	Dual streaming with 2nd stream at minimum 720P at 30fps at H.264 individually configurable
7.	Minimum Illumination	Colour: 0.05 lux, B/W: 0.01 lux (at 30 IRE, F 1.2) or better
8.	Day/Night Mode	Colour, Mono, Auto
9.	Wide Dynamic Range	True WDR up to 100 db
10.	S/N Ratio	≥ 50dB
11.	PTZ	Pan: 360° endless/continuous, 0.2 to 300°/s (auto), 0.2 to 100°/s (Manual) Tilt: 90°, 0.2 to 100°/s (Auto), 0.2 to 40°/s (Manual) 30X optical zoom and 10x digital zoom Pre-set tour 256 preset positions, Tour recording, Guard tour
12.	Auto adjustment + Remote Control of Image settings	Colour, brightness, sharpness, contrast, white balance, exposure control, backlight compensation, Gain Control, , Electronic Image Stabilisation
13.	Protocol	HTTP, HTTPS, FTP, RTSP, RTP, TCP, UDP, RTCP, DHCP, ONVIF Profile S & G
14.	Security	Password Protection, IP Address filtering, User Access Log, HTTPS encryption
15.	Local Storage	microSDXC memory card of 64GB (Class 10) In the event of failure of connectivity to the central server the camera shall record video locally on the SD card automatically. After the connectivity is restored these recordings shall

		be automatically merged with the server recording such that no manual intervention is required to transfer the SD card based recordings to server.
16.	Intelligent Video	Motion Detection & Tampering alert
17.	Alarm I/O	Minimum 1 Input & Output contact for 3rd part interface
18.	Operating conditions	0 to 50°C
19.	Casing	NEMA 4X / IP-66 rated & IK10
20.	Power	802.3at PoE+ (Class 4) or 24VDC/24AC
21.	Certification	UL2802 / EN, CE ,FCC

7.50. IR Illuminators

The infrared illuminators are to be used in conjunction with the Fix Box / PTZ cameras specified above to enhance the night vision.

#	Parameter	Minimum Specifications
1.	Range	Min. 100 mtrs
2.	Minimum Illumination	High sensitivity at Zero Lux
3.	Angle of illumination	Adjustable
4.	Power	Automatic on/off operation
5.	Casing	NEMA 4X / IP-66 rated
6.	Operating conditions	-5° to 50°C
7.	Certification	UL / CE / FCC / EN

7.51. ATCS Traffic Sensor

Appropriate camera based traffic sensors may be chosen to provide the operational levels and accuracy as required for successful function of the ATCS system as per the SLAs defined.

7.52. ATCS Traffic Controller

Appropriate controller technology may be chosen to provide the operational levels and accuracy as required for successful integration with the ATCS system as per the SLAs defined.

7.53. Traffic Light Aspects

#	Description	Bidder Compliance(Yes/No)
1.	**Key Features:**	

#	Description	Bidder Compliance(Yes/No)
a.	lowest power consumption for all colours	
b.	Meets or exceeds intensity, colour and uniformity specifications	
c.	Temperature compensated power supplies for longer LED life	
d.	Uniform appearance light diffusing	
e.	Should be Intertek/ETL/EN certified	
f.	All units operate at voltage of 230Vac +/- 10% and frequency 50 +/-5Hz	
g.	LED shall be single source narrow beam type with clear lens & Luminance uniformity of 1:15	
h.	Phantom Class 5 or equivalent. IP Rating: IP65	
2	**LED aspects:**	
a.	Red, Amber, Green-Full (300 mm diameter) : Hi Flux	
b.	Green-arrow (300 mm diameter): Hi flux	
c.	Animated Pedestrian-Red and Green Animated c/w countdown (300 mm) Hi Brite with diffusions	
4	**LED Retrofit Specifications:**	
a.	Power supply:230 Vac +/- 10% and frequency 50+/-5Hz	
b.	Standards: EN 12368 certified	
c.	Convex Tinted Lens: Available	
d.	Fuse and Transients: Available	
e.	Operating Temperature Range: 0 degree Celsius to 55 degree Celsius Turn Off/Turn On Time: 75 milli seconds max	
f.	Total Harmonic Distortion: <20%	
g.	Electromagnetic interference: Meets FCC Title 47,Subpart B, Section 15 Regulation or equivalent EN/IRC standard	
h.	Blowing Rain/Dust Spec: MIL 810F or Equivalent EN/IRC standard complaint	
i.	Minimum Luminous Intensity (measured at intensity point)(cd): Red 400	
j.	Amber 400	
k.	Green 400	
l.	Dominant Wavelength (nm): Red 630 Amber 590	
m.	Green 490	
n.	Lamp conflict compatibility system: Compatible with lamp failure and conflict detection	

7.54. Single/Double Arm Cantilever Pole for Traffic Signals

(For new traffic signal Locations)

- 8.5 Mtr Cantilever Traffic Signal Pole Should be made from 'B' class G.I. Pipe in two section, Two Section connect with Flange. Flange should be of 6 mm thick. Base plate size 600mmX600mmX10mm
- Effective length of sections :

	Length in Mtr	Diameter in mm
Bottom	6.096	120
Top	1.22	100
Overhang	3.048	100

- Erection of 8.5 Mtr Single arm GI cantilever pole as per design attached by using 600mm X 600mm X 2000mm size CC foundation of 1: 3: 6 ratio. Poles shall be with plating depth of 2 mtr from ground and should be perpendicular to ground level. Poles shall be erected by using crane only.

7.55. Pole for Pedestrian Signals

(For new traffic signal Locations)

- Galvanised Iron (GI) pipe pole, ~90mm outer dimension, 6mtrs. long duly painted of 300mm x 300mm x4mm thick to be erected as a compound light pole with approx. weight of 45 kg.
- The contractor shall erect G. I. pipe Pole. The foundation shall be of c.c. & bricks pieces of the ratio of 1:2:8 and of size of 60 x 60x 100cms (width x length x Depth) and 30cms x 30cms plinth of C.C. The Plinth shall be painted with white lime.

7.56. General Specifications for Poles & Cables for Traffic Signals

Sr. No	Component	Minimum Specifications	Bidder Compliance (Yes/No)
	Pole	**Applies to all traffic signal poles**	
1	Material	GI Class 'B' pipe	
2	Paint	Pole painted with two coats of zinc chromate primer and two coats of golden yellow paint or otherwise as required by architect and in addition bituminous painting for the bottom 1.5 m portion of pole.	
	Cables	**(Applies to all cabling)**	
1	No's of core	Adequate number of cores and diameter	
2	Materials	PVC insulated and PVC sheathed armoured cable with copper conductor of suitable size as specified in BOQ.	
3	Certification	ISI Marked	
4	Standards	Indian Electricity Act and Rules	

Sr. No	Component	Minimum Specifications	Bidder Compliance (Yes/No)
A		IS:1554: PVC insulated electric cables (heavy duty)	

7.57. Junction Box for Traffic Controller

- Providing and erecting M.S. steel cupboard of the size & 90cm. Height x 60cms width 25cm depth. made out of 18 SWG (1.25mm) black inner sheet. The cupboard shall house the service equipment and have proper latch lock with two louvers and panel type round bar locks with duplicate keys. The cupboard shall be provided with necessary cable entry earthling terminals stud sufficient nos. and size of louvers or air circulation as directed by site Engineer.
- The contractor shall erect the cupboard on pole with two nos. of M.S. clamps make from 40x6mm flat bar with necessary nuts, bolts of not less than 5/8" dia.
- The contractor shall provide and erect wooden jungle plank 25mm thick. The wooden plank with two coats of grey paint.

7.58. Countdown Timer

#	Parameters	Minimum Specifications or better	Bidder Compliance (Yes/No)
1	**CPU**	**Micro Controller**	
2	**Mechanical Specifications**		
a	Structural Material	Polycarbonate strengthened against UV rays	
b	Body Colour	Light Grey/Black	
c	Dimensions	360mm x 370mm x 220mm	
3	**Display Specification**		
a	Lamp Diameter	300mm	
b	Digit Height	150 -165mm	
c	Display Type	Dual Coloured (Red & Green)	
d	No. of Digit	3	
4	**LED Specifications**		
a	LED Diameter	5mm LED	
b	Viewing Angle	30°	
c	LED Wave Length	630-640nm (Red), 505nm - 520nm (Blue-Green)	
d	LED Dice Material	AIInGap (Red), InGaN (Blue-Green)	
e	LED Warranty period	5 years	

#	Parameters	Minimum Specifications or better	Bidder Compliance (Yes/No)
5	**Technical Features**		
a	Power Consumption	20 - 30 Watt Per Lamp	
b	Input Power	85-260V AC, 50Hz	
c	Operating Temperature	-20 to + 60 °C	
d	Humidity	0% to 95% Relative Humidity	
e	Water & Dust Ingress	IP 65	
f	Standard	En12966	

7.59. Public Address System

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
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 VMS and Command and Control Centre	
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 50°C	

7.60. Emergency Call Box

1. A high quality digital transceiver, to be placed at certain traffic junctions determined by the Police Department (mostly at junction boxes / camera poles to avoid any additional investments)
2. Key is to make it easily accessible by public
3. The unit shall preferably have a Double button which when pressed, shall connect to the Command Centre/Police Command Centre/other locations over the existing network infrastructure setup for project.

4. These are to be placed only a select locations such as Police/Traffic islands or pedestals or within the vicinity of constant Police supervision or CCTV field of view to avoid misuse and vandalism of the call box.

Sr. No	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Construction	Cast Iron/Steel Foundation, Sturdy Body for equipment	
2.	Call Button	Watertight Push Button, Visual Feedback for button press	
3.	Speaker	To be used for Public Address System	
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 50°C	

7.61. Environmental Sensors

#	Parameter	Minimum Specification
1.	Measurement principle	• Temperature, Humidity, Ambient Light, Sound, CO, NO2, NOX, CO2, SO2
2.	Measurement component Measurement range	• NO2: 0 to 10 ppm • NOX : 0 to 50ppm , 5000ppm • SO2 : 0 to 500 ppm • CO : 0 to 1000 ppm • O3: up to 1000 ppb • CO2 : 0 to 5% (5000 ppm) • PM 2.5: 0 to 230 micro gms / cu.m • PM 10: 0 to 450 micro gms / cu.m • Light: up to 10,000 Lux • UV: up to 15 mW/ cm2 • Noise: up to 120 dB (A)
3.	Rain Water measurement	• Rainfall in millimetres (mm)
4.	Water levels (for flood monitoring)	• Data integration with existing system (APIs will be provided)
5.	Repeatability	• ±0.5% FS
6.	Zero drift	• ±1.0% FS max./week (±2.0% FS/week max. if range is less than 200ppm)

		• ±2.0% FS max./month
7.	Temperature and Humidity Sensor	• Real-time Temperature Range: 0°C ~ 70°C • Real-time in Air Humidity Level Display (up to 100%)
8.	Span drift	• ±2.0% FS max./week • ±2.0% FS max./month for O2 meter
9.	Response speed	• 120 seconds max. for 90% response from the analyser inlet
10.	Accuracy	• Minimum accuracy: + 1%FS (for NO2, SO2, CO, O3, CO2) • Minimum accuracy: 75% over detection range
11.	Connectivity (Minimum)	• USB / Ethernet connectively to graphical display

7.62. Variable Message Sign Boards

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	**Dimensions**		
a.	Minimum 3.0m length X 1.5m height X 0.2m depth. (3000mm x 1500mm X 200mm approx.)		
2.	**Colour LED**	Full Colour, class designation C2 as per IRC/EN 12966 standard	
3.	**Luminance Class/Ratio**	L3 as per IRC/EN 12966 standards.	
4.	**Luminance Control & auto Diming**		
a.	Should be automatically provide different luminance levels but shall also be controllable from the traffic centre using software.		
b.	Auto dimming capability to adjust to ambient light level (sensor based automatic control)		
c.	Photoelectric sensor shall be positioned at the sign front and sign rear to measure ambient light. Capable of being continually exposed to direct sunlight without impairment of performance.		
5.	**Contrast Ratio**	R3 as per IRC/EN 12966 standard	
6.	**Beam Width**	B6+ as per IRC/EN12966 standards.	
7.	**Pixel Pitch**	12mm or better	
8.	**Picture Display**		
a.	Capable of displaying real time message generated by CCC.		

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
b.	Special frontal design to avoid reflection.		
c.	Display shall be UV resistant		
d.	At least 300mm as per IRC /EN 12966 standards		
e.	Full Matrix: Number of lines & characters adjustable, active area: 2.88mX1.2m at least		
f.	Synchronized Dot to Dot display.		
9.	**Viewing Angle**	B6+ as per IRC/EN12966 standard- Viewing angle shall ensure message readability for motorists in all lanes of the approach road	
10.	**Viewing Distance**	Suitable for readability from 150 Mtrs. or more at the character size of 240mm, from moving vehicles.	
11.	**Self-Test**		
a.	VMS shall have self-test diagnostic feature to test for correct operation.		
b.	Display driver boards shall test the status of all display cells in the sign even when diodes are not illuminated.		
c.	All periodic self-test results shall be relayed to the CCC/TCC in real time to update the status of the VMS		
12.	**Alarms**		
a.	Door Open sensor to Inform Control room during unauthorized access		
b.	LED Pixel failure detection alarm		
13.	**Flicker**	Refresh Frequency should not be less 90 Hz. No visible flicker to naked eye.	
14.	**Multiple Data Communication interface/Port**	RJ45 Ethernet, RS232, RS 485, FC port and any other suitable	
15.	**Communication (connectivity)**	Wired & GPRS based wireless technology with 3G upgradable to 4G capability.	
16.	**Ambient Operating Temperature**	The system should be capable of working in ambient temperature range of 0°C to 55°C.	

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
17.	**Humidity (RH)**	Operating ambient humidity: 10% - 95% Rh or better.	
18.	**Protection against Pollution/dust/water**	Complete VMS should be of IP 65 protection level from front and IP54 from side and rear. As per EN60529 or equivalent Standard.	
19.	**Power**		
a.	170-250V AC (more than 90% power factor) or DC as per equipment requirement.		
b.	Protection for overvoltage/ fluctuation/drop of the nominal voltage (50%) shall be incorporated.		
c.	The enclosure shall contain at least two 15 Amp VAC (industrial grade) outlet socket for maintenance purpose.		
20.	**Power Back-up & its enclosure**	UPS for one hour power back-up with auto switching facility. The enclosure of UPS and battery should be pole mountable with IP 65 protected housing and lockable.	
21.	**Material for VMS frame**	at least 2mm aluminium or Non-corrosive, water resistant or better. Frame of the VMS should be black & Powder coated.	
22.	**Mounting, Installation and finishes**		
a.	Mounting structure shall use minimum 6Mtrs. High Cylindrical GI Pole (Class B) or suitable structure with 5.5 mtr. Minimum vertical clearance under the VMS sign from the Road surface.		
b.	The mounting shall be capable of withstanding road side vibrations at site of installation.		
c.	It shall be provided with suitable walkway for maintenance access.		
d.	The sides interior and rear of enclosures shall be provided in maintenance free natural aluminium finish. All enclosure shall be flat and wipe clean.		
e.	Rugged locking mechanism should be provided for the onsite enclosures and cabinets.		
f .	For Structural safety, the successful bidder has to provide structural safety certificate from qualified structural engineers approved/ certified by Govt. Agency.		
23.	**Wind Load**	WL9 as per EN12966 to withstand high wind speeds and its own load.	
24.	**Cabling, connections and Labelling.**		

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
a.	All cable conductors shall be of ISI marked for quality and safety. It shall be of copper insulated, securely fastened, grouped, wherever possible, using tie warps approximately every 10-20 Cms or cable trays.		
b.	All connections shall be vibration-proof quick release connections except for power cables terminating in terminal blocks, which shall be screwed down.		
c.	All terminal block shall be made from self-extinguishing materials. Terminations shall be logically grouped by function and terminals carrying power shall be segregated from control signal terminals.		
d.	All cables shall be clearly labelled with indelible indication that can clearly be identified by maintenance personnel using "As built : drawings".		
e.	Lightening arrester shall be installed for safety on each VMS.		
f.	The successful bidder has to provide safety certificate from qualified Electrical engineers approved/certified by Govt. Agency.		
26.	**Local Storage in VMS**	Embedded VMS controller should be capable to store at least 100 messages and symbols/pictograms to allow display to run in isolated mode on a predefined structures/timings, in case of connectivity failure.	

7.63. GPS Device for Fire Dept. Vehicles

#	Part	Parameter	Details
1	Connectivity	GSM/GPRS or Higher Modem – Transmitting power Class 4 (2W) at GSM 850 and EGSM 900 Class 1 (1W) at DCS 1800 and PCS 1900 with IMEI	Quad-band GSM/GPRS Modem or higher, Downlink max. Speed 85.6 kbps & Uplink max. speed 42.8 kbps
a		Number	IMEI
b		Frequency	GSM 850, EGSM 900, DCS 1800, PCS 1900
c		Transmitting power	Class 4 (2W) at GSM 850 and EGSM 900 Class 1 (1W) at DCS1800 and PCS 1900
		Connectivity	GPRS or higher multi-slot class 10
		Coding scheme	CS-1, CS-2, CS-3 and CS-4
		SIM interface	External/ Internal SIM card: 1.8V, 3V
2	GPS Navigation	Receiver	42 Channels

a		Frequency	1575.42MHz
b		Acquisition Time	Hot Start – 1 sec, Open Sky, Cold Start - 30 Sec, Open Sky
c		Horizontal Position Accuracy	2.5 meter
d		Tracking Sensitivity	160 dBm
e		Output	NMEA Protocol
f		Antenna	Active GPS Antenna
3	Power	Operating Voltage	8V – 32V
a		Operating current	@24V
b			Ideal Mode: 80m
c			GPRS or higher trans/rec:- 160mA
d		Battery Reverse	Integrated Protection

7.64. Mobile Data Terminal for Fire Dept. Vehicles

#	Parameter	Minimum Specifications
1.	Type	Android based Rugged In-Vehicle Mobile Data Terminal (Special-built)
2.	OS	Android 4.4 or higher
3.	Processor	Quad Core with GPU
4.	Display	7 inch WVGA(800×480) TFT-LCD Multi-touch capacitive touchscreen control
5.	Brightness	450 nits
6.	Contrast Ratio	500:1
7.	GPS	Built-in GPS module for positioning
8.	Cellular Interface	3G/4G for Data exchange via GPRS (SIM card also to be supplied)
9.	Interfaces	USB, OTG, Ethernet(POE)
10.	Camera	Built-in 0.3MP CMOS front camera
11.	Audio	Built-in Speaker, Internal Microphone
12.	Power Supply	DC In (from Vehicle electrical System)
13.	Battery	1 hour operation without external power
14.	Operating Temperature	0 to 60 degree C
15.	Mobile Data Usage	To receive and send data to Control Room via
16.	Mounting	Flexible mounting with VESA and on-dash bracket

7.65. Standardized Signs for CCTV Camera Locations

It is necessary that the CCTV Camera locations put some standardized signs informing the public of the existence of CCTV cameras. This will bring about the transparency on installation of CCTV cameras and no one would be able to later complaint for breach of privacy. Following tables give draft specifications for the signage to be put at the camera locations.

#	Item	Minimum Specifications
1	Size	Board Width = 8" / 12" (For type A and B) Board Width = 12" / 18" / 24" (For type C and D)
2	Plate Material	Corrosion resistant Aluminium Alloy as per IRC 67:2001 (Code of Practice for Road signs)
3	Plate Thickness	Minimum 1.5 mm
4	Retro-Reflective sheeting for sign-plate	Weather-resistant, having colour fastness
5	Other Specifications	As per IRC 67:2001 (Code of Practice for Road signs)
6	Mounting	Can be mounted on wall or pole (appropriate mounting brackets to be provided)
7	Design	As per following signage diagrams

Reference Designs

Type	Sign Design	Remarks
A		To be used at 80% of the Places

B		To be used at select places where text can be read. Text should be in Gujarati at majority of places
C	 e	This may be used on a select few places in the city, usually on the main pole of the location where multiple cameras are installed. Text should be in Gujarati in majority of places.

D		This is an alternative to type C.

7.66. Structured Cabling Components

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Standards	ANSI TIA 568 C for all structured cabling components	
2.	OEM Warranty	OEM Certification and Warranty of 15-/ 20 years as per OEM standards	
3.	Certification	UL Listed and Verified	

7.67. Electrical cabling component

#	Parameter	Minimum Specifications	Bidder Compliance (Yes/No)
1.	Standards	All electrical components shall be design manufactured and tested in accordance with relevant Indian standards IEC's	

7.68. Core Switch

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Switching Backplane	Carry required traffic as per network design	

2.	Ports	10G Ports, Shuld Support 40G Interfaces	
3.	Network Module Slots	As per requirements	
4.	VLAN limit	4000 nos	
5.	VLAN features	• Generic Attribute Registration Protocol (GARP) VLAN Registration Protocol (GVRP) • VLAN creation based on protocol and Ports • Virtual LAN (VLAN) bridges • VLAN classification by protocol and port • VLAN tagging • Q In Q	
6.	Layer 3 features	• Equal Cost Multi Path (ECMP) routing • Policy-based routing • Route redistribution (OSPF, RIP) • User Datagram Protocol (UDP) broadcast helper (IP helper) • Internet Control Message Protocol (ICMP) router discovery messages • Classless Inter-Domain Routing (CIDR) • Domain Name System (DNS) • RIPng for IPv6 • Open Shortest Path First (OSPF) v3 • Virtual Router Redundancy Protocol (VRRP) V3 • Border Gateway Protocol (BGP)4	
7.	Security Feature	• Access Control Lists (ACLs) • Bridge Protocol Data Unit (BPDU) protection • Dynamic Host Configuration Protocol (DHCP) snooping, IP source guard and Dynamic Address Resolution Protocol (ARP) Inspection (DAI) • Dynamic VLAN assignment • Port-based learn limits (intrusion detection) • Media Access Control (MAC) address filtering and MAC address	

		lock-down • Private VLANs provide security and port isolation • Secure Copy (SCP) • Strong password security and encryption • Tri-authentication: MAC-based, web-based IEEE 802.1x • IEEE 802.1x • Secure Shell (SSH), Secure Sockets Layer (SSL)v2 ,SSLv3 , Secure Copy (SCP) • TACACS+ authentication , RADIUS •	
8.	Quality of Service Feature	• IEEE 802.1p • Differentiated Services Code Point (DSCP) Prioritization • Wire speed traffic classification with low latency essential for VOIP and real time streaming media applications • Policy-based QoS based classifying traffic based on MAC, Port, VLAN, Protocol, L3 and L4 Parameters. • Policy-based storm protection • Extensive remarking capabilities • Strict priority weighted round robin or mixed scheduling.	
9.	IPV6 Feature	• Path (Maximum Transmission Unit) MTU discovery for IPv6 • IPv6 Router Discovery • IPv6 Router Advertisement • IPv6 Router Advertisement Guard • Transmission of IPv6 packets over Ethernet networks • Default address selection for IPv6 • Domain Name System (DNS) extensions to support IPv6 • Unique local IPv6 unicast addresses • Internet Control Message Protocol (ICMPv6) • Neighbor discovery for IPv6 • IPv6 Stateless Address Auto-Configuration (SLAAC)	

		• IPv6 Router Advertisement (RA) flags option • IPv6 Router Advertisement (RA) guard • IPv4 and IPv6 Dual stack • DHCP Client / Relay for IPv6 • DHCP server for IPv6 • Simple Network Management Protocol (SNMP) v6 , Telnet v6 , SSH v6 , Network Time Protocol (NTP v6) and Trace Route v6	
10.	Management Feature	• Simple Network Management Protocol (SNMP)v1, v2c and v3 • Link Layer Discovery Protocol (LLDP) • Web GUI • sFlow: a method for monitoring traffic in switched and Routed networks • Industry-standard CLI with context-sensitive help and GUI • Powerful CLI scripting engine • Built-in text editor • User-based Security Model (USM) for SNMPv3 • View-based Access Control Model (VACM) for SNMP • Console management port • TFTP Trivial File transfer protocol • NTP Network Time protocol • Syslog • An USB or equivalent memory card socket , allowing software release files, configuration and other files to be stored for backup and distribution to other switches • DDM – Optical digital monitoring as per SFF – 8472 or equivalent standards.	
11.		• Internet Group Management Protocol (IGMP) query solicitation • IGMP snooping • Multicast Listener Discovery (MLD) snooping (v1 and v2)	

	Multicast Feature	• Bootstrap Router (BSR) mechanism for Protocol Independent Multicast - Sparse-Mode (PIM-SM) • IGMP/MLD multicast forwarding (IGMP/MLD proxy) • IGMP query solicitation • Protocol-Independent Multicast (PIM) for IPv6 • Multicast Listener Discovery v2 (MLDv2) for IPv6 • Source-specific multicast for IP	
12.	Pro Active Intelligence features	• The switch shall support user-defined scripts to be executed pro-actively upon selected system events based on Time, Date, Day and Event based sensitivity • Eco-friendly mode allows ports and LEDs to be disabled to save power • Full environmental monitoring of PSU 's internal temperature and internal voltages for pro-active monitoring	
13.	Voice Over IP Feature	• Link Layer Discovery Protocol (LLDP)- Media Endpoint Discovery (MED) ANSI/TIA-1057 • Voice VLAN	
14.	Compliance	• ROHS compliance • Energy Efficient Ethernet (EEE) • Underwriters Laboratories (UL), Canadian Underwriters Laboratories (cUL) and	
15.	POE Support	Shall support POE and POE + Compliant Hot Swappable Line cards in accordance to IEEE standards 802.3af and 802.3at	
16.		The Core switch shall support active - active clustering	
17.		The Virtual chassis or equivalent technology proposed for core switch shall support high availability for both Layer 2 and Layer 3 Including for IP Multicasting optimized for real time applications like voice and video IP traffic.	

18.		The Active - Active Virtual chassis cluster should support technology functionality locally or over geographically diversified locations For Diversified Data centre high availability operations	
19.		The active - active virtual chassis bandwidth between the 2 high available cluster switches shall be of min of 40Gbps when clustered locally or over geographically diversified locations.	
20.		Shall be populated with dual hot swappable supervisor engines	
21.		The core switch shall support hot swappable network modules and Power Supply Unit (PSU) for high availability.	
22.		The proposed ring protection technology shall be capable of handling data loop whose path traverse more than a single ring and the loop occurs when there is a break in a physical segment that is shared by two rings.	
23.		Shall support loop detection and loop protection.	
24.		The core switch shall support dynamic link failover.	
25.		Shall support Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP) and RSTP Root guard.	
26.		Shall support Hot swappable Network modules and PSU ' s for high	
27.		Shall support In Service software upgrade	
1.	Operating Temperature	0°C to 40°C	

7.69. Indoor Access Switch

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Layer 2 switching capabilities	Quality of Service (QoS) Internet Group Management Protocol (IGMP) v.1/v.2/v.3 to establish multicast group memberships, security filtering, and general management with half, full duplex and auto-sensing switching capabilities.	

2.	Standards	• IEEE 802.3af and IEEE 802.3at power over Ethernet (POE) standards on all ports. • IEEE 802.1D - Media Access Control (MAC) Bridges used with the Rapid Spanning Tree Protocol (RSTP). • IEEE 802.1Q - Virtual local area networks (VLANs). • IEEE 802.3 - LAN and MAN access and physical layer specifications. • IEEE 802.3x - Full duplex operation • IEEE 802.1X - Security standards • IEEE 802.1D/S - Spanning tree (STP) / multiple spanning tree (MST) protocols • IEEE 802.3ad/802.1ax - Link aggregation • IEEE 802.1Q - Trunking	
3.	Resiliency features	• Shall support Rapid Ring Protection technology as per the IEEE 802.17 or equivalent technology providing the convergence time of Sub 50 ms Convergence • Shall support high-speed ring recovery; Fibre access and uplink ports and should seamlessly integrate with the core / Aggregation chassis proposed • Capable of broadcast and multicast storm suppression and rate limiting	
4.	Port Density	• Shall support a minimum of Eight 10/100/1000 Mbps POE+ RJ45 auto-negotiate	

		ports • Shall support a minimum of 2 * uplink optical Fibre ports 100/ 1000/10000 Mbps (Tx & Rx) • Shall be Wire Speed Non-Blocking performance	
5.	General features	• Shall support aggregate uplink connections to provide additional bandwidth through open standard LACP • Shall support DHCP Relay and DHCP Option 82 • Shall support Auto-negotiation of port Speed • Shall support IP Multicasting standards - IGMP Snooping • VLAN Tagging Q in Q • MAC address filtering and notification , Access control list • Port security that secures the port (trunk/access) based on MAC address • Port mirroring for debugging purposes	
6.	Management features	• Management via NMS, , SSH, Web GUI, Local Console port • Simple Network Management Protocol (SNMP) v.1/v.2/v.3 • Port security through controlling access (e.g. MAC address access list) and ensure that the switch has the capability to generate an alarm and shut down ports when an unauthorized accesses the network is detected. • Remote monitoring (RMON 1/2) for Statistics ,	

		History , Alarms and Events • Network Time Protocol (NTP)	
7.	Environmental features	• Shall support diagnostic light emitting diodes (LEDs) indicators for ports and system based that covers but not limited to link, speed, TX, RX, and power LEDs. • The access switch shall be fully resistant to all electromagnetic interference (EMI).	
8.	Operating Temperature	0°C to 50°C	

7.70. Fibre Distribution Box (FDB)

The suggested technical specifications for the FDB are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Maximum Height	270 mm	
2.	Maximum Width	240 mm	
3.	Maximum Depth	80 mm	
4.	Capacity	6 Fibres	
5.	Type of Connector	SC/LC/FC (As per field requirement)	
6.	Others	The Fibre distribution box shall be suitable for fixing into IP 65 enclosure which shall be mounted on the pole and would also house access switch and other accessories.	
7.		The Fibre distribution box shall have sufficient space to route the 4 pigtails which shall be terminated into the access switch.	
8.		The Fibre distribution box shall have sufficient glands for entry and exit of optical Fibre and pigtails.	

7.71. 42U Rack Cabinets

The suggested technical specifications for the 42U Rack Cabinets (to be housed in Mega PoP) are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Height	1900 mm	
2.	Width	600 mm	
3.	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 or Grey	
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	
15.	Others	The front door shall be insulated metallic door fitted with rubber gasket and a central glass for clear visibility of all components installed in the rack	
16.		The 42U rack shall have two cable managers fully separated so they do not cross each other for power and network cables.	
17.		The 42U Rack shall have provision for two separate top entries one for power and one for network cables.	
18.		The 42U Rack shall have sufficient number of shelves to accommodate specified equipment in the Mega Point Of Presence (POP)	

7.72. 6U Rack Cabinets

The suggested technical specifications for the 6U Rack Cabinets are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Maximum Height	330.00 mm	
2.	Maximum Width	560.00 mm	
3.	Maximum Depth	400.00 mm	
4.	Maximum Mounting Depth	286.00 mm	
5.	Rack Height	6U	
6.	Rack Width	19”	
7.	Others	The front door shall be insulated metallic door fitted with rubber gasket and a central glass for clear visibility of all components installed in the rack	
8.		The 6U rack shall have one cable manager for network cables.	
9.		The 6U Rack shall have provision for two separate top entries one for power and one for network cables.	

7.73. Optical Fibre Cables (OFC)

The technical requirements for all type of Fibre Optic Cable (OFC) (48 Core OFC and 24 Core OFC):

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Single Mode Optical Fibre	ITU-T-G.652D	
2.	Maximum Cabled Fibre Attenuation db/Km	1310nm:0.38 and 1550nm:0.25	
3.	Tensile Strength	2200N	
4.	Fibre Polarization Mode Dispersion (PMD)	≤0.4 ps/√km	
5.	Impact Strength	25Nm	
6.	Operating Temperature	-20^{0}C to 70^{0}C	
7.	Colour Coding of Tubes and	EIA/TIA-598	

	Fibres		
8.	Inner Jacket thickness	≥1.8mm	
9.	Outer Jacket Thickness	≥0.65mm	
10	Water Tightness	EIA/TIA-455-81B	
11.	Minimum Continuous Length	2km±10%,	
12	Cable Design Life	More than 25 Years	
13	Others	The optical Fibre cable shall be made of Germanium doped silica glass or pure silica glass.	
14		The mode field eccentricity shall be less than 1 µm	
15		The cladding of the Optical Fibre shall be made of silica glass having lower refractive index. The outside diameter of the cladded Fibre shall be 125 µm with tolerance of ± 2.0 µm.	
16		The non-circularity of cladding surface shall be 2%, maximum.	
17		The nominal Fibre coating diameter shall be in the range of 245 to 400 microns.	
18		Maximum continuous operating temperature without optical degradation shall be 65°C.	
19		Maximum optical loss variation at temperature range of -5°C to +70°C shall be ±0.05dB/km.	
20		Water swellable yarns shall be added to prevent water ingress in the core of cable	
21		The loose tubes carrying the Fibre cores shall be made of thermoplastic or equivalent material which will kink during normal operation of the cable including laying or blowing of cable.	
22		Armor shall be made of corrugated steel tape for 24 Core OFC for stronger protection.	

23		No steel armor to be used for the 96 core OFC for faster splice joint to reduce downtime.	
24		Outer sheathing shall be made of UV proof black MDPE/HDPE. The sheath shall have smooth finish and shall be termite resistant.	
25		All the OFC shall be clearly marked at intervals of 1 meter with the following data which is not less than 5 mm high. The details of marking on cable shall be approved by CLIENT before commencement of manufacturing. • Name of Client with logo • No of Fibres (24Core/96Core) • Type of OFC • Manufacture's name or trade mark • Year of manufacturing • Running length marking	
26		All optical Fibre cable shall be supplied on strong wooden drums provided with lagging with adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation	

7.74. 24 Core OFC – Core Layer

The technical requirements for the 24 Core OFC are as follows:

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Fibre Count	24 nos.	
2.	Fibres per tube	06 nos.	
3.	Tubes	04 nos.	
4.	Diameter of Cable	13mm±5%	
5.	Weight of Cable	150kg/km±10%	

7.75. 48 Core OFC – Access Layer

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

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Fibre Count	48 nos.	
2.	Fibres per tube	06 nos.	
3.	Tubes	08 nos.	
4.	Diameter of Cable	16mm±5%	
5.	Weight of Cable	230kg/km±10%	
6.	Armor	Corrugated steel tape	

7.76. Fibre Patch Cords

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

7.77. Fibre Pigtails

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of	SC/PC/LC (As per field	

	Connector	requirement)	
2.	Operating Wavelength	1260 - 1620 nm	
3.	Cutoff Wavelength	<1260 nm	
4.	Mode Field Diameter	9.2 ± 0.4 µm @ 1310 nm 10.5 ± 0.5 µm @ 1550 nm	
5.	Cladding Diameter	125 ± 1.0 µm	
6.	Coating Diameter	245 ± 5 µm	
7.	Insertion Loss	0.3 dB Loss (Connector to Connector) @ 1310 nm	
8.	Operation Temperature	-20°C to 70°C	
9.	Storage Temperature	-40°C to 80°C	
10	Cable Jacket Colour	Yellow, PVC Material	

7.78. Fibre Splice Joint Closure

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Closure Length	420 mm	
2.	Closure outer diameter including Clamp	205 mm	
3.	Fibre Tray Capacity	12 cores	
4.	Fibre Capacity	144 nos.	
5.	Cable Ports	4 nos.	
6.	Maximum Number of Fibre Splice Trays	12 nos.	
7.	Others	The Fibre splice joint closure shall have reusable gel end piece that opens and closes easily for adding or removing efficient cable sealing with specific grommets.	
8.		The Fibre splice joint closure	

		shall provide splice trays that are hinged to provide access to all splices without disturbing other splice trays for inter-tray Fibre management.	
9.		The Fibre splice joint closure shall be water-proof and dust-proof.	
10.		The number of splice trays to be provided as per field requirement.	
11.		The Fibre splice joint closure shall have a mechanism to route at least 1 meter of loose tube per tray per optical Fibre cable	

7.79. 40 mm HDPE Pipe

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	HDPE pipe Material	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	
10		Suitable ultra violet stabilizers may be used for manufacture of the PLB HDPE pipe to protect against UV degradation when stored in open for a minimum period of 8 months.	
11.		In the inner layer of PLB HDPE pipe, the friction reducing, polymeric material to be used	

		as the inner layer lubrication material shall be integral with HDPE layer. The lubricant materials shall have no toxic or skin hazards for safe handling	
12		The finished pipe shall be of good workmanship such that the pipe is free from blisters, shrink holes, flaking, chips, scratches, roughness, break and other defects. The pipe shall be smooth, clean and in round shape, without eccentricity.	
13		The ends shall be cleanly cut and shall be square with axis of the pipe.	
14		HDPE pipe shall be supplied in circular coils of 1000m length with End caps fitted with both ends of pipe to prevent the entry of any unwanted elements such as dirt, water, moisture, insects/rodents during transportation and storage.	
15		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. • Name of Client with logo • Manufacture's name or trade mark • Year of manufacturing • Type of HDPE pipe and size • Running length marking	

7.80. 40 mm HDPE Coupler

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Coupler	Push-Fit type 40mm Dia. Coupler	
2.	Pulling Force	≥330 kgf	
3.	Construction	HDPE	

	Material		
4.		The 40 mm HDPE Coupler shall be able to provide a durable airtight and watertight joint between two pipes without deteriorating the strength of the pipes.	

7.81. End Plug for 40mm HDPE Pipe

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

7.82. 110 mm DWC Pipe

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

#	Parameters	Minimum Specifications	Bidders Compliance (Yes, No)
1.	Type of Pipe	Double Wall Corrugated HDPE pipe	
2.	Outer Diameter	110mm ±2mm	
3.	Inner Diameter	82mm ±2mm	
4.	Standard Length	6m ±1%	
5.	Colour	Purple	
6.	Operating Temperature	0°C to 70°C	
7.	Life Expectancy	≥25 Years	
8.		The DWC pipe shall consist of two layers, the outer layer shall be corrugated and the inner layer shall be plain and smooth.	
9.		The DWC pipe shall be supplied in straight lengths of 6mtrs,	

		suitable for shipping and handling purpose.	
10		The DWC pipe shall be checked visually for ensuring good workmanship that the ducts shall be free from holes, breaks and other defects. The ends shall be cleanly cut and shall be square with axis of the ducts.	
11.		All the DWC pipes shall be clearly marked at intervals of minimum 1 meter but not longer than 3 meters with the following data which is not less than 5 mm high. The details of marking on pipe shall be approved by Client before commencement of manufacturing. • Name of Client with logo • Manufacture's name or trade mark • Year of manufacturing • Type of DWC pipe and size	

7.83. 110 mm HDPE Coupler

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

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

7.84. Networking Standards

- ANSI/TIA-942, Telecommunications Infrastructure Standard for Data Centres
- ANSI/TIA/EIA/568-C.1, Commercial Building Telecommunications Cabling Standard – 2009
- ANSI/TIA/EIA 568-C.2, Copper Cabling Components Standard
- ANSI/TIA/EIA 568-C.3, Optical Fibre Cabling Components Standard
- ANSI/TIA/EIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/TIA/EIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

- ANSI/J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – Preferred

8. *Annexure IV: Non-IT (Civil, Electrical, Mechanical) Requirements*

The selected bidder should adhere to the specifications given below for Non-IT components. It is essential that Fire Proof material be used as far as possible and Certification from Fire Department be taken for Command Centres before Go-Live.

8.1. Civil and Architectural work

a. Furniture and Fixture

- 6" high laminated strip using 1.5mm thick laminate over 10mm thick commercial board on all vertical surface in the entire server & ancillary areas including low height partition, brick wall, partition wall, cladding etc. complete with French polish in all respect.
- Enclosure for gas cylinder of Shutters and Partitions along with wooden support and 18 mm thick MDF board along with 1.5 mm approved laminate colour outside and 2 coat of enamel paint inside the shutter. The same should be provided with all the required accessories including the handle, lock, loaded hinges, tower bolt and necessary hardware etc. complete with French polish.

b. Partitions (wherever required as per approved drawing)

- Full height partition wall of 125 mm thick fireline gyp-board partition using 12.5 mm thick double fireline gyp-board on both sides with GI steel metal vertical stud frame of size 75 mm fixed in the floor and ceiling channels of 75 mm wide to provide a strong partition. Glass wool insulation inside shall be provided as required. Fixing is by self-tapping screw with vertical studs being at 610 mm intervals. The same should be inclusive of making cutouts for switch board, sockets, grill etc. It shall also include preparing the surface smoothly and all as per manufacture's specification etc. finally finishing with one coat of approved brand of fire resistant coating.
- With glazing including the framework of 4" x 2" powder coated aluminium section complete (in areas like partition between server room & other auxiliary areas).
- Fire Rated Wire Glass minimum 6 mm thick for all glazing in the partition wall complete. (External windows not included in this).
- All doors should be minimum 1200 mm (4 ft.) wide.

c. Painting

- Fire retardant paint of pre-approved make and shade to give an even shade over a primer coat as per manufacturers' recommendations after applying painting putty to level and plumb and finishing with 2 coats of fire retardant paint. Base coating shall be as per manufacturer's recommendation for coverage of paint.
- For all vertical Plain surface.
- For fireline gyp-board ceiling.

- POP punning over cement plaster in perfect line and level with thickness of 10 – 12 mm including making good chases, grooves, edge banding, scaffolding pockets etc.
- Fire retardant coating on all vertical surfaces, furniture etc. as per manufacturer's specification.

8.2. PVC Conduit

#	Description	Bidder Compliance (Yes/No)
1.	The conduits for all systems shall be high impact rigid PVC heavy-duty type and shall comply with I.E.E regulations for non-metallic conduit 1.6 mm thick as per IS 9537/1983.	
2.	All sections of conduit and relevant boxes shall be properly cleaned and glued using appropriate epoxy resin glue and the proper connecting pieces, like conduit fittings such as Mild Steel and should be so installed that they can remain accessible for existing cable or the installing of the additional cables.	
3.	No conduit less than 20mm external diameter shall be used. Conduit runs shall be so arranged that the cables connected to separate main circuits shall be enclosed in separate conduits, and that all lead and return wire of each circuit shall be run to the same circuit.	
4.	All conduits shall be smooth in bore, true in size and all ends where conduits are cut shall be carefully made true and all sharp edges trimmed. All joints between lengths of conduit or between conduit and fittings boxes shall be pushed firmly together and glued properly.	
5.	Cables shall not be drawn into conduits until the conduit system is erected, firmly fixed and cleaned out. Not more than two right angle bends or the equivalent shall be permitted between draw and junction boxes. Bending radius shall comply with I.E.E regulations for PVC pipes.	
6.	Conduit concealed in the ceiling slab shall run parallel to walls and beams and conduit concealed in the walls shall run vertical or horizontal.	
7.	The chase in the wall required in the recessed conduit system shall be neatly made and shall be of angle dimensions to permit the conduit to be fixed in the manner desired. Conduit in chase shall be hold by steel hooks of approved design of 60cm centre the chases shall be filled up neatly after erection of conduit and brought to the original finish of the wall with cement concrete mixture 1:3:6 using 6mm thick stone aggregate and course sand.	

8.3. Wiring

#	Description	Bidder Compliance (Yes/No)
1.	PVC insulated copper conductor cable shall be used for sub circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be stranded copper conductors with thermoplastic insulation of 650 / 1100 volts grade. Colour code for wiring shall be followed.	
2.	Looping system of wring shall be used, wires shall not be jointed. No reduction of strands is permitted at terminations.	
3.	Wherever wiring is run through trunking or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indication the circuit and D.B. number shall be used for sub main, sub circuit wiring the ferrules shall be provided at both end of each sub main and sub-circuit.	
4.	Where, single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain wiring fed from more than one phase in any one room in the premises, where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply.	
5.	Circuits fed from distinct sources of supply or from different distribution boards or M.C.B.s shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phases, no two single-phase switches connected to difference phase shall be mounted within two meters of each other.	
6.	All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.	
7.	Metal clad sockets shall be of die cast non-corroding zinc alloy and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have push on protective cap.	
8.	All power sockets shall be piano type with associate's switch of same capacity. Switch and socket shall be enclosed in a M. S. sheet steel enclosure with the operating knob projecting. Entire assembly shall be suitable for wall mounting with Bakelite be connected on the live wire and neutrals of each circuit shall be continuous everywhere having no fuse or switch installed in the line excepting at the main panels and boards. Each power plug shall be connected to each separate and individual circuit unless specified otherwise. The power wiring shall be kept separate and distinct from lighting and fan wiring. Switch and socket for light and power shall be separate units and not combined one.	
9.	Balancing of circuits in three phases installed shall be arranged before installation is taken up. Unless otherwise specified not	

#	Description	Bidder Compliance (Yes/No)
	more than ten light points shall be grouped on one circuit and the load per circuit shall not exceed 1000 watts.	

8.4. Cable Work

#	Description	Bidder Compliance (Yes/No)
1.	Cable ducts should be of such dimension that the cables laid in it do not touch one another. If found necessary the cable shall be fixed with clamps on the walls of the duct. Cables shall be laid on the walls/on the trays as required using suitable clamping/ fixing arrangement as required. Cables shall be neatly arranged on the trays in such manner that a criss-crossing is avoided and final take off to switch gear is easily facilitated.	
2.	All cables will be identified close to their termination point by cable number as per circuit schedule. Cable numbers will be punched on 2mm thick aluminium strips and securely fastened to the. In case of control cables all covers shall be identified by their wire numbers by means of PVC ferrules. For trip circuit identification additional red ferrules are to be used only in the switch gear / control panels, cables shall be supported so as to prevent appreciable sagging. In general distance between supports shall not be greater than 600mm for horizontal run and 750mm for vertical run.	
3.	Each section of the rising mains shall be provided with suitable wall straps so that same the can be mounted on the wall.	
4.	Whenever the rising mains pass through the floor they shall be provided with a built-in fire proof barrier so that this barrier restricts the spread of fire through the rising mains from one section to the other adjacent section. Neoprene rubber gaskets shall be provided between the covers and channel to satisfy the operating conditions imposed by temperature weathering, durability etc.	
5.	Necessary earthling arrangement shall be made alongside the rising mains enclosure by Mean of a GI strip of adequate size bolted to each section and shall be earthed at both ends. The rising mains enclosure shall be bolted type.	
6.	The space between data and power cabling should be as per standards and there should not be any criss-cross wiring of the two, in order to avoid any interference, or corruption of data.	

8.5. Earthing

All electrical components (whichever supplied as part of SoW of this RFP) are to be earthen by connecting two earth tapes from the frame of the component ring and will

be connected via several earth electrodes. The cable arm will be earthen through the cable glands. Earthling shall be in conformity with provision of rules 32, 61, 62, 67 & 68 of Indian Electricity rules 1956 and as per IS-3043. The entire applicable IT infrastructure in the Control Rooms shall be earthed.

- Earthing should be done for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, AC units etc. so as to avoid a ground differential. State shall provide the necessary space required to prepare the earthing pits.

- All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.

- The connection to the earth or the electrode system should have sufficient low resistance in the range of 0 to 25 ohm to ensure prompt operation of respective protective devices in event of a ground fault, to provide the required safety from an electric shock to personnel & protect the equipment from voltage gradients which are likely to damage the equipment.

- Recommended levels for equipment grounding conductors should have very low impedance level less than 0.25 ohm.

- The Earth resistance shall be automatically measured on an online basis at a pre-configured interval and corrective action should be initiated based on the observation. The automatic Earthing measurements should be available on the UPS panel itself in the UPS room.

- There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data.

- The earth connections shall be properly made .A small copper loop to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastened bolts, when there is a lighting surge, high voltage surge or failure of bushings.

- A complete copper mesh earthing grid needs to be installed for the server farm area, every rack need to be connected to this earthing grid. A separate earthing pit need to be in place for this copper mesh.

- Provide separate Earthing pits for Servers, UPS & Generators as per the standards.

8.6. Fire Alarm System

System Description

- The Fire alarm system shall be a single loop addressable fire detection and alarm system, and must be installed as per NFPA 72 guidelines.

- Detection shall be by means of automatic heat and smoke detectors (multi sensor) located throughout the Control Room (ceiling, false floor and other appropriate areas where fire can take place) with break glass units on escape routes and exits.

Control and indicating component

- The control panel shall be a microprocessor based single loop addressable unit, designed and manufactured to the requirements of UL/EN54 Part 2 for the control and indicating component and UL/EN54 Part 4 for the internal power supply.
- All controls of the system shall be via the control panel only.
- The system status shall be made available via panel mounted LEDs and a backlit 8 line x 40-character alphanumeric liquid crystal display.
- All system controls and programming will be accessed via an alphanumeric keypad. The control panel will incorporate form fill menu driven fields for data entry and retrieval.
- The system will include a detection verification feature. The user shall have the option to action a time response to a fire condition. This time shall be programmable up to 10 minutes to allow for investigation of the fire condition before activating alarm outputs. The operation of a manual call point shall override any verify command.

Manual Controls

- Start sounders
- Silence sounders
- Reset system
- Cancel fault buzzer
- Display test
- Delay sounder operation
- Verify fire condition
- Disable loop

Smoke detectors – Smoke detectors shall be of the optical or ionization type. Devices shall be compatible with the CIE conforming to the requirements of UL/EN54 Part 7. The detectors shall have twin LEDs to indicate the device has operated and shall fit a common addressable base.

- Heat detectors
- Heat detectors shall be of the fixed temperature (58° C) or rate of temperature rise type with a fixed temperature operating point.
- Devices shall be compatible with the CIE conforming to the requirements of UL/ EN54 Part 5 the detectors shall have a single LED to indicate the device has operated and shall fit a common addressable base.
- All bases shall be compatible with the type of detector heads fitted and the control system component used. Each base shall comprise all necessary electronics including a short circuit isolator.

- The device shall be automatically addressed by the CIE on power up of the loop without the need of the insertion of a pre-programmed EPROM or setting of DIL switches.
- Detector bases shall fit onto an industry standard conduit box.
- Addressable Manual Call points must also be provided
- Control & Monitor module must be provided for integration with 3rd party systems.

Audible Alarms – Electronic sounders shall be coloured red with adjustable sound outputs and at least 3 sound signals. The sounders should be suitable for operation with a 24V DC supply providing a sound output of at least 100dBA at 1 meter and 75 dBA min, for a bed head or sounder base type device. The sounder frequency shall be in the range of 500Hz to 1000Hz.

Commissioning

- The fire detection and alarm system will be programmable and configurable via an alpha numeric keypad on the control panel.

8.7. Aspirating Smoke Detector System

- This specifications covers the requirements of design, supply of materials, installation, testing and commissioning of Aspirating Smoke Detection System. The system shall include all equipment's, appliances and labour necessary to install the system, complete with high sensitive LASER-based Smoke Detectors with aspirators connected to network of sampling pipes.

Codes and standards

- The entire installation shall be installed to comply one or more of the following codes and standards
- NFPA Standards, US
- British Standards, BS 5839 part :1

Approvals

- All the equipment's shall be tested, approved by any one or more:
- LPCB (Loss Prevention Certification Board), UK
- FM Approved for hazardous locations Class 1,Div 2
- UL (Underwriters Laboratories Inc.), U
- ULC (Underwriters Laboratories Canada), Canada
- Vds (Verband der Sachversicherer e.V), Germany

Design Requirements

- The System shall consist of a high sensitive LASER-based smoke detector, aspirator, and filter.
- It shall have a display featuring LEDs and Reset/Isolate button. The system shall be configured by a programmer that is either integral to the system, portable or PC based.

- The system shall allow programming of:
    a) Multiple Smoke Threshold Alarm Levels.
    b) Time Delays.
    c) Faults including airflow, detector, power, filter block and network as well as an indication of the urgency of the fault.
    d) Configurable relay outputs for remote indication of alarm and fault Conditions.
- It shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modelling tool.
- Optional equipment may include intelligent remote displays and/or a high level interface with the building fire alarm system, or a dedicated System Management graphics package.
- Shall provide very early smoke detection and provide multiple output levels corresponding to Alert, Action, Fire 1 & 2. These levels shall be programmable and shall be able to set sensitivities ranging from 0.025 – 20% obscuration / meter.

Displays on the Detector Assembly

- The detector will be provided with LED indicators.
- Each Detector shall provide the following features: Alert, Alarm, Fire 1 and Fire 2 corresponding to the alarm thresholds of the detector/Smoke Dial display represents the level of smoke present, Fault Indicator, Disabled indicator

Sampling Pipe

- The pipe shall be identified as Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.

Installation

The SI shall install the system in accordance with the manufacturer's recommendation.

- Where false ceilings are available, the sampling pipe shall be installed above the ceiling, and Capillary Sampling Points shall be installed on the ceiling and connected by means of a capillary tube.
- Air Sampling Piping network shall be laid as per the approved pipe layout. Pipe work calculations shall be submitted with the proposed pipe layout design for approval.
- The bidder shall submit computer generated software calculations for design of aspirating pipe network, on award of the contract.

8.8. Water leak detection System

- Water leak detection System should be designed to protect the Air-conditioned premises and to alert the personnel about the leak in the AC systems. The system should be capable of interfacing to Water leak detection sensors, condensation sensors & I/O modules.
- Events should be clearly reported on LCD/LED display with full English language description of the nature of the fault in the panel. The successful bidder should make

detailed working drawings and coordinate them with other agencies at site. Water Leak Detection systems should be integrated with BAS.

i. EQUIPMENT

The Water leak detection system should comprise of Tape Sensors, Water Leak detection modules, Condensation detectors, I/O modules and sounders all connected to a Control Panel.

ii. CONTROL PANEL

- The control panel should be computerized 4/8/12 zone multiplex controller with a facility to add on dialer and speech processor. The system should be programmed, armed or disarmed through a control key pad. The control key pad should have a 16 character LCD display for viewing various events. The code to arm or disarm the system should be changed only by entering a master code.
- The system should have 4/8/12 zones and all the detectors should be connected through a 2 core cable. Each area of the premises should be divided into specific zones such that any zone should be isolated by the user if required.
- The entire system should be backed up by a maintenance free rechargeable battery to take care of system's power requirements whenever power fails.
- The system should be totally tamper proof and should activate an alarm if the control panel is opened, the sensors tampered with or if the system cables are cut even in the disarmed state.
- The system should log 500 events and optionally printer should be connected for generating reports.
- The Detectors, I/O Modules, Remote Keypads and other Devices should be connected to a system on a single 2/4/6 Core Cable Bus to avoid individual cabling of zones.
- The system should have a Buffer memory of minimum 250 events and log each event with exact date and time.
- The controller should have a Serial Port for connecting to a computer.
- The controller should work on 220/240V AC power supply and it should also have a built in battery backup.
- The memory inside the controller should be backed up by a lithium battery. The controller should work effectively over a temperature range of -10 Deg. C to + 55 Deg. C. and 0 to 90% of Humidity.

iii. WATER LEAK DETECTION SENSOR

Water Leak Detection sensors should be able to mount in DIN rails, inside AHU's, power distribution units or other equipment where localized leak detection is required. The detectors should be resistant to oxidation and erosion. The detector should have relay output for connection to the controller. LED alarm indication should also be provided. The detectors should operate in AC or DC supply.

iv. TAPE SENSORS

Tape sensors are used to detect water leaks usually under floors. Tape sensors for use with water leak detectors should be covered with plastic netting to prevent short circuits when used in metal trays or conduits, and enables the tape to be folded at right angles to allow easy routing.

v. HOOTER / SOUNDER

The hooter / sounder should give audible alarm when any sensor operates. It should be complete with electronic oscillations, magnetic coil (sound coil) and accessories ready for mounting (fixing). The sound output from the Hooter should not be less than 85 decibels at the source point.

8.9. Access Control System

The Access Control System shall be deployed with the objective of allowing entry and exit to and from the premises to authorized personnel only. The system deployed shall be based on Biometric Technology. An access control system consisting of a central PC, intelligent controllers, power supplies and all associated accessories is required to make a fully operational on line access control system. Access control shall be provided for entry / exit doors. These doors shall be provided with electric locks, and shall operate on fail-safe principle. The lock shall remain unlocked in the event of a fire alarm or in the event of a power failure. The fire alarm supplier shall make potential free contacts available for releasing the locks in a fire condition especially for staircase and main doors. Entry to the restricted area shall be by showing a proximity card near the reader and exit shall be using a push button installed in the secure area. The system shall monitor the status of the doors through magnetic reed contacts. The system should be designed and implemented to provide following functionality:

- Controlled Entries to defined access points
- Controlled exits from defined access points
- Controlled entries and exits for visitors
- Configurable system for user defined access policy for each access point
- Record, report and archive each and every activity (permission granted and / or rejected) for each access point.
- User defined reporting and log formats
- Fail safe operation in case of no-power condition and abnormal condition such as fire, theft, intrusion, loss of access control, etc.
- Day, Date, Time and duration based access rights should be user configurable for each access point and for each user.
- One user can have different policy / access rights for different access points.

8.10. Rodent Repellent

The entry of Rodents and other unwanted pests shall be controlled using non-chemical, non-toxic devices. Ultrasonic pest repellents shall be provided in the false flooring and ceiling to repel the pests without killing them. However periodic pest control using

Chemical spray can be done once in 3 months as a contingency measure to effectively fight the pest menace.

- Configuration : Master console with necessary transducer
- Operating Frequency : Above 20 KHz (Variable)
- Sound Output : 80 dB to 110 dB (at 1 meter)
- Power output : 800 mW per transducer
- Power consumption : 15 W approximately
- Power Supply : 230 V AC 50 Hz
- Mounting : Wall / Table Mounting

8.11. Fire Suppression System

The SI shall design, install, and configure the Fire Suppression System for the Data Center area. The Fire Suppression System shall have a clean agent fire suppression system cylinder, seamless cylinders, discharge hose, fire detectors and panels, and all other accessories required to provide a complete operational system, meeting applicable requirements of NFPA 2001 Clean Agent Fire Extinguishing Systems, NFPA 70 National Electric Code, NFPA 72 National Fire Alarm Code, or ISO standards. These standards shall be used to ensure the performance as a system with UL/FM approvals and installed in compliance with all applicable requirements of the local codes and standards.

Kyoto Protocols

73. The clean agent system considered for total flooding application shall be in compliance with the provisions of Kyoto Protocol.
74. Care shall be taken that none of the greenhouse gases identified in the Kyoto Protocol is used for fire suppression application.

Minimum Specifications

The minimum criteria to select the clean agent shall include following specifications:

- Zero-ozone depleting potential
- Global-warming potential not exceeding one
- Atmospheric lifetime not exceeding one week
- The clean agent fire suppression system with FK-5-1-12 and inert gas-based systems are accepted as a replacement of HCFC and HFC in accordance with Kyoto Protocol.
- The clean agent considered for the suppression system shall be suitable for occupied areas with No Observable Adverse Effect Level of 10% as compared to the design concentration to ensure high safety margin for the human who might be present in the hazard area.
- The minimum design standards shall be in accordance with NFPA 2001, 2004 edition or latest revisions.
- Care shall be given to ensure early warning detection system with minimum sensitivity of 0.03% per foot obscuration in accordance with NFPA 318 and NFPA 72 to ensure a very early warning signal to allow investigation of the incipient fire

with significant time before the other detectors activate the fire suppression system automatically.

- All system components furnished and installed shall be warranted against defects in design, materials, and workmanship for the full warranty period, which is standard with the manufacturer, but in no case less than operational readiness closure period.
- Fire suppression system shall deploy NOVEC-based gas suppression systems with cross-zoned detector systems for all locations. These detectors shall be arranged in a manner such that they activate the suppression system in zones to cater to only the affected area.
- Illuminated signs indicating the location of the extinguishers shall be placed high enough to be seen over tall cabinets and racks across the room. A linear heat detection cable shall be placed along all wire pathways in the ceiling. This cable shall not directly trigger the suppression system; rather, it shall prompt the control system to sound an alarm.
- The SI shall give a certificate stating that their NOVEC system is approved by UL/FM/VdS/LPC/CNPP for use with seamless steel cylinders, including component and system approval.
- The SI shall also provide a letter that the OEM has NOVEC flow calculation software suitable for seamless steel cylinder bided for in accordance with the List of Major Components and that such software shall be type approved by UL/FM/VdS/LPC/CNPP.
- The storage container offered shall be of seamless type, meant for exclusive use in NOVEC systems, with UL/FM/VdS/LPC/CNPP-component approval. Welded cylinders are not permitted.
- The NOVEC valve shall be differential pressure design and shall not require an explosive- or detonation-type consumable device to operate it.
- The NOVEC valve operating actuators shall be of electric (solenoid) type and shall be capable of resetting manually. The valve shall be capable of being functionally tested for periodic servicing requirements and without any need to replace consumable parts.
- The individual NOVEC bank shall also be fitted with a manual mechanism operating facility that shall provide actuation in case of electric failure.
- The system flow calculation is to be carried out on certified software, suitable for the seamless steel cylinder being offered for this project. Such system flow calculations shall be also approved by UL/FM/VdS/LPC/CNPP.
- The system shall utilize 42-bar/high-pressure (600 psi) technology that allows for a higher capacity to overcome frictional losses, higher distances of the agent flow, and better agent penetration in enclosed electronic equipment such as server racks and electrical panels.
- The designer shall study and address possible fire hazards within the protected volume at the design stage. The delivery of the NOVEC system shall provide for the highest degree of protection and minimum extinguishing time. The design shall be strictly in accordance with NFPA standard NFPA 2001.
- The suppression system shall provide for a high-speed release of NOVEC-based on the concept of total flooding protection for enclosed areas. A uniform extinguishing concentration shall be 7% (v/v) of NOVEC for 21 degrees Celsius or higher as recommended by the manufacturer.

- The system discharge time shall be 10 seconds or less, in accordance with NFPA standard 2001.
- Sub-floor and the ceiling void to be included in the protected volume.
- The NOVEC systems to be supplied by The SI shall satisfy all the requirements of the authority having jurisdiction over the location of the protected area and shall be in accordance with the OEM's product design criteria.
- The detection and control system that shall be used to trigger the NOVEC suppression shall employ cross-zoning of photoelectric and ionization smoke detectors. A single detector activated in one zone shall cause an alarm signal to be generated. Another detector activated in the second zone shall generate a pre-discharge signal and start the pre-discharge condition.
- The discharge nozzles shall be located in the protected volume in compliance to the limitation with regard to the spacing, floor and ceiling covering. The nozzle locations shall be such that the uniform design concentration will be established in all parts of the protected volumes. The final number of the discharge nozzles shall be according to the OEM's certified software, which shall also be approved by third-party inspection and certified such as UL/FM/VdS/LPC/CNPP.
- The cylinder shall be equipped with differential pressure valves and no replacement parts shall be necessary to recharge the NOVEC containers.
- NOVEC shall be discharged through the operation of an electric solenoid-operated device or pneumatically operated device, which releases the agent through a differential pressure valve.
- The NOVEC discharge shall be activated by an output directly from the NOVEC gas release control panel, which will activate the solenoid valve. NOVEC agent is stored in the container as a liquid. To aid release and more effective distribution, the container shall be super pressurized to 600 psi (g) at 21°C with dry Nitrogen.
- The releasing device shall be easily removable from the cylinder without emptying the cylinder. While removing from cylinder, the releasing device shall be capable of being operated with no replacement of parts required after this operation.
- Upon discharge of the system, no parts shall require replacement other than gasket, lubricants, and the NOVEC agent. Systems requiring replacement of disks, squibs, or any other parts that add to the recharge cost will not be acceptable.
- The manual release device fitted on the NOVEC cylinders shall be the manual-lever type and a faceplate with clear instruction of how to mechanically activate the system. In all cases, NOVEC cylinders shall be fitted with a manual mechanical operating facility that requires two-action actuation to prevent accidental actuation.
- NOVEC storage cylinder valve shall be provided with a safety rupture disc. An increase in internal pressure due to high temperature shall rupture the safety disc and allow the content to vent before the rupture pressure of the container is reached. The contents shall not be vented through the discharge piping and nozzles.
- NOVEC containers shall be equipped with a pressure gauge to display internal pressure.
- Brass Discharge nozzles shall be used to disperse the NOVEC. The nozzles shall be brass with female threads and available in sizes as advised by the OEM system manufacturer. Each size shall come in 180° and 360° dispersion patterns.
- All the major components of the NOVEC system such as the cylinder, valves and

releasing devices, nozzles, and all accessories shall be supplied by one single manufacturer under the same brand name.

- Manual gas discharge stations and manual abort stations, in conformance with the requirements of NFPA 2001, shall be provided.
- Release of NOVEC agent shall be accomplished by an electrical output from the FM-200 gas release panel to the solenoid valve and shall be in accordance with the requirements set forth in the current edition of NFPA 2001.
- A high-sensitivity smoke-detection system shall provide an early warning of fire in its incipient stage, analyse the risk, and set off an alarm and actions appropriate to the risk. The system shall include, but not be limited to, a display control panel, detector assembly, and properly designed sampling pipe network.

8.12.Precision Air Conditioning

The Data Centres Area shall be provided with fully redundant, microprocessor-based, gas-based, Precision Air-Conditioning system. Cool air feed to the Data Centres shall be bottom-charged or downward flow type using the raised floor as supply plenum through perforated aluminium tiles for airflow distribution. The return airflow shall be through the false ceiling to cater to the natural upwardly movement of hot air. Cooling shall be done by the Precision Air-Conditioning system only. Forced cooling using fans on the false floor is not acceptable. Air conditioning shall be capable of providing sensible cooling capacities at the design ambient temperature and humidity with adequate airflow. The Precision Air-Conditioning system shall capable to be integrated with the BMS for effective monitoring.

The SI shall assess, design, supply, transport, store, unpack, erect, and test the successful commissioning and satisfactory completion of trial operations of the Precision Air-Conditioning system for the Data Centres. The SI shall follow ASHRAE Standard for the HVAC and Ducting. The SI shall be responsible for:

1. Connecting the indoor unit with the mains electrical point
1. Connecting indoor and outdoor units mechanically (with 18-gauge-hard copper piping).
2. Connecting indoor and outdoor unit electrically
3. Nitrogen pressure testing, triple vacuum, and final gas charging
4. Connecting the humidifier feed line with the point provided
5. Connecting the drain line with the point provided
6. Commissioning and handing over the unit to the customer
7. Operation and routine maintenance training for up to two persons nominated by the CLIENT while commissioning the units at site

Temperature Requirements

The environment inside the Primary and Secondary Data Centres shall be continuously maintained at 23 ± 10 degrees Celsius. The temperature and humidity shall be controlled at desired levels. The necessary alarms for variation in temperatures shall be monitored on a 24/7 basis and logged for providing reports.

Indicating Lamps

1. Indicating lamps assembly shall be screw type with built in resistor having non-fading colour lens. LED type lamps are required.
2. Wiring for Remote ON, OFF, TRIP indicating lamps is required.
    a. ON indicating lamp: Red

b. OFF indicating lamp: Green
c. TRIP indicating lamp: Amber
d. PHASE indicating lamp: Red, Yellow, Blue
e. TRIP circuit healthy lamp: Milky

Relative Humidity (RH) requirements

Ambient RH levels shall be maintained at 50% ± 5 non-condensing. Humidity sensors shall be deployed. The necessary alarms for variation in RH shall be monitored on a 24/7 basis and logged for providing reports.

Temperature and Relative Humidity Recorders

Temperature and relative humidity recorders shall be deployed for recording events of multiple locations within the Primary and Secondary Data Centres. Records of events for the past 7 days shall be recorded and presentable whenever required. Sensors shall be located at various locations within the Primary and Secondary Data Centres to record temperature and humidity automatically.

Air Quality Levels

The Primary and Secondary Data Centres shall be kept at highest level of cleanliness to eliminate the impact of air quality on the hardware and other critical devices. The Primary and Secondary Data Centres shall be deployed with efficient air filters to eliminate and arrest the possibility of airborne particulate matter which may cause air-flow clogging, gumming up of components, causing short-circuits, or blocking the function of moving parts.

Additional Points

1. The precision air conditioners shall be capable of maintaining a temperature range of 23 degrees Celsius with a maximum of ±1 degree variation and relative humidity of 50% with a maximum variation of ±5%.
2. The precision air conditioners shall have two (2) independent refrigeration circuits, each comprised of one scroll compressor, refrigeration circuit and condenser, and dual blowers for flexibility of operations and better redundancy.
3. The unit casing shall be in double-skin construction for longer life of the unit and low noise level.
4. For close control of the Data Centres temperature and relative humidity (RH) environment conditions, the controller shall have proportional integration and differential (PID).
5. The precision unit shall be air-cooled, refrigerant-based system to avoid chilled water in critical space.
6. The internal rack layout design shall follow the cold aisle and hot aisle concept as recommended by ASHRAE.
7. The refrigerant used shall be environmentally friendly HFC, R-407-C or equivalent in view of the long-term usage of the Data Centres equipment as well as the availability of spares and refrigerant.
8. The system shall include fully deployed Dynamic Smart Cooling with auto sequencing and auto power management features.
9. Thermal and computational fluid dynamics (CFD) analysis diagrams shall be provided
10. The fan section shall be designed for an external static pressure of 25 Pa. The fans shall be located downstream of the evaporator coil and be of the electronically commuted, backward, curved, centrifugal type, double-width, double-inlet, and statically and dynamically balanced. Each fan shall be direct-driven by a high efficiency direct current (DC) motor.

11. The evaporator coil shall be A-shape coil for down flow, incorporating draw-through air design for uniform air distribution. The coil shall be constructed of rifled bore copper tubes and louvered aluminium fins with the frame and drip tray fabricated from heavy gauge aluminium. Face area of coil shall be selected corresponding to air velocity not exceeding 2.5 m/sec.
12. Dehumidification shall be achieved by either reducing effective coil area by solenoid valve arrangement or using the dew point method of control. Whenever dehumidification is required, the control system shall enable a solenoid valve to limit the exchange surface of the evaporating coil, thereby providing a lower evaporating temperature.
13. The humidifier and heaters shall be built-in features in each machine individually. Humidification shall be provided by boiling water in a high-temperature, polypropylene steam generator. The steam shall be distributed evenly into the bypass airstreams of the environment control system to ensure full integration of the water vapour into the supply air without condensation. The humidifier shall have an efficiency of not less the 1.3 kg/kw and be fitted with an auto-flush cycle activated on demand from the microprocessor control system. The humidifier shall be fully serviceable with replacement electrodes. Wastewater shall be flushed from the humidifier by the initiation of the water supply solenoid water valve via a U-pipe overflow system. Drain solenoid valves shall not be used. A microprocessor shall control the humidification and heating through suitable sensors.
14. The following microprocessor controls features shall be displayed on the units:
    a. Room temperature and humidity
        i. Supply fan working status
        ii. Compressor working status
        iii. Condenser fans working status
        iv. Electric heaters working status
        v. Humidifier working status
        vi. Manual/Auto unit status
        vii. Line voltage value
    b. Temperature set point
        i. Humidity set point
        ii. Working hours of main component i.e. compressors, fans, heater, humidifier.
        iii. Unit working hours
        iv. Current date and time
        v. Type of alarm (with automatic reset or block)
        vi. The last 10 intervened alarms
15. The microprocessor shall be able to perform following functions:
    c. Testing of the working of display system
    d. Password for unit calibration values modification
    e. Automatic restart of program
    f. Cooling capacity control
    g. Compressor starting timer
    h. Humidifier capacity limitation
    i. Date and time of last 10 intervened alarm
    j. Start/Stop status storage
    k. Random starting of the unit.

l. Outlet for the connection to remote system
m. Temperature and humidity set point calibration
n. Delay of general alarm activation
o. Alarm calibration

16. Following alarms shall be displayed on screen of microprocessor unit:
    p. Air flow loss
    q. Clogged filters
    r. Compressor low pressure
    s. Compressor high pressure
    t. Smoke /ire
    u. Humidifier low water level
    v. High/Low room temperature
    w. High/Low room humidity
    x. Spare external alarms
    y. Water under floor
17. The control system shall include the following settable features:
    z. Unit identification number
    aa. Start-up delay, cold start delay, and fan run on timers
    bb. Sensor calibration
    cc. Remote shutdown and general alarm management
    dd. Compressor sequencing
    ee. Return temperature control
    ff. Choice of modulating output types
18. The unit shall incorporate the following protections:
    gg. Single phasing preventers
    hh. Reverse phasing
    ii. Phase misbalancing
    jj. Phase failure
    kk. Overload tripping (MPCB) of all components

8.13.CCC Operator Console (Workspace)

(All photographs for reference purpose, to aid the specification/description)

S/N	Parameter	Minimum Specification
1.	Physical Structure	Ergonomically designed desk to ensure 24x7 desking solution with sufficient knee space (min 450mm) and foot space (min 600 mm).
2.	Working Surface material	The Console Top / working surface should be made of minimum 25 mm thick MDF with High Pressure Laminate finish. The laminate shall be fire retardant, Insulated, Water Proof, Scratch resistant and high hardness. The Table Top (Size 1500 x 750 mm) should be as able to mount three 22 Inches Display monitors

3.	Console Design	Consoles must be of modular design, facilitating future equipment retrofits and full reconfigurations without requiring any major modification to the structure or exterior elements
4.	Equipment Mounting	The workstation shall be able to house computer equipment's, Ethernet Points, Power Distribution Unit. The CPUs shall be mounted on Slide out CPU trays (mounted on Heavy duty slides) for ease in maintenance, all of these equipment's should be concealed from direct human view
5.	Frame material	Made of heavy duty Aluminium. The Extrusions shall be duly powder coated with 40+ micron over all surfaces.
6.	Monitor Arms and Rear Walls	• Die cast mounted Aluminium arm; fixed firmly on MS Pole with powder coating mounted on its rear wall also made of aluminium • Monitor and Functional holder shall guarantee optimum viewing distance. All ergonomic aspects shall be taken in to account. It shall be capable for mounting all type of LCD/LED display with Dimensions between 17" to 27" using suitable brackets/additional base plate • For configuration of working position, it shall allow the technical staff to rotate/ tilt/ raise/the monitors as well as fix their adjustment in a quick and easy manner

8.14. Ergonomic Chair

This chair would be for (a) CCC Operator (b) War Room/Conf Room (c) Managers (in Cabins)

Title Adjustment

Armrest Adjustment

Seat Height

Lumbar Support

S/N	Parameter	Minimum Specification
1.	General	Ergonomic Chair with Arm Rest and castor wheels designed for 24/7 usage
2.	Backrest support	Tilt adjustable, polystyrene support frame with 100% polyester Fibre
3.	Seat Support	Height adjustable, Moulded wood, 10 mm. thick with polyurethane foam, density minimum 70 kg/m3
4.	Seat Adjustment Mechanism	Self-adjustable synchronous mechanism with soft resort. Multi-locking with safe anti-return system.
5.	Armrests	Height adjustable via button, Front/back adjustable with PU pads (50 mm)
6.	Column	Class 3 built-in cartridge cylinder steel tube
7.	Base	Swivel on castor with 5 polyamide double-wheel castors (made of polyamide and Fibre glass)
8.	Colour	Black

8.15.Office Desk (Workspace)

S/N	Parameter	Minimum Specification
Staff /Managers Desk		
1.		750x600 mm for general staff & support area 1500x750 mm for managers 1800x900 for Director's room
2.	Physical Structure	Workstation top made with 1.5mm thick laminate of standard make over 18mm thick commercial board complete with wooden beading including cutting holes & fixing of cable manager etc. complete with Long lasting polish.
3.	Accessories	The desk shall have the necessary drawers, keyboard trays, cabinets etc. along with sliding / opening as per approved design with quality drawer slides, hinges, locks etc.
4.	Storage	Storage unit with 18 mm thick MDF board along with 1.5 mm approved laminate colour outside and 2 coat of enamel paint inside the storage of size 1'6"x1'6"x2'4". The same should be provided with all the required accessories including the handle, lock, sliding channel and necessary hardware, etc. complete with Long lasting polish

8.16. Office Chair

S/N	Parameter	Minimum Specification
1.	General	Office Chair with Arm Rest and castor wheels designed for 24/7 usage
2.	Mechanism	Push Back Mechanism-Reclining should be effortless. Push/Pull the lever in/out to lock/unlock reclining at the upright position.
3.	Backrest support	Tilt adjustable, polystyrene support frame with 100% polyester Fibre
4.	Seat Support	Height adjustable, Moulded wood, 10 mm. thick with polyurethane foam, density minimum 70 kg/m3
5.	Seat Adjustment Mechanism	Self-adjustable synchronous mechanism with soft resort. Multi-locking with safe anti-return system.
6.	Armrests	Fixed arms –Sturdy, comfortable and supports your wrists & arms.
7.	Base	Swivel on castor with 5 polyamide double-wheel castors (made of polyamide and Fibre glass)
8.	Colour	Black

9.	Upholstery	Fabric

8.17. Storage (Under Table)

S/N	Parameter	Minimum Specification
	General	Under Table Storage Cupboard with 3 drawers
2.	Material	Power coated M.S.
3.	Locking	Single Lock for all drawers
4.	Sliding	Sliding mechanism for all drawers
5.	Height	640 mm
6.	Depth	450 mm
7.	Length	400 mm

8.18. Cupboard-Side

<<TBD>>

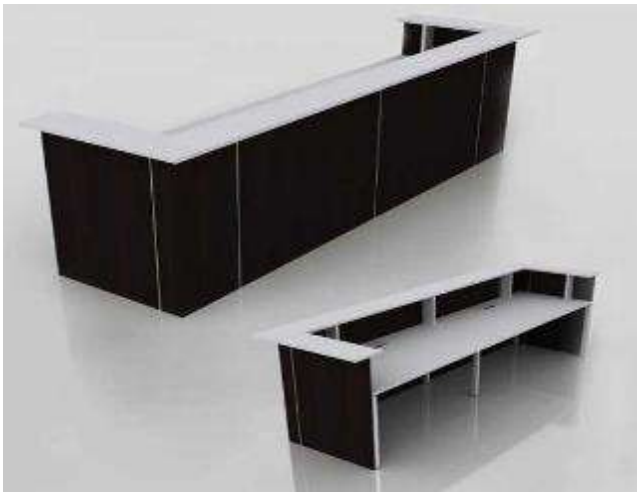
8.19. Cupboard – 5 & 6.5 feet

- Storage flexibility achieved through use of adjustable shelves
- Aesthetically appealing snap-on die-cast lock for security
- Wooden and metal top as per requirements
- Top hanging sliding door prevents derailment
- Plastic roller with steel ball bearings for smoother door movement

8.20. Side Table

As per floor layout

8.21.Reception Desk



S/N	Parameter	Minimum Specification
Staff /Managers Tables		
	Size	As per Reception Area (room) on ground floor
2.	Physical Structure	Workstation top made with 1.5mm thick laminate of standard make over 18mm thick commercial board complete with wooden beading including cutting holes & fixing of cable manager etc. complete with Long lasting polish.
3.	Accessories	Two positions of receptionist shall have the necessary drawers, keyboard trays, cabinets etc. along with sliding / opening as per approved design with quality drawer slides, hinges, locks etc.
4.	Storage	Storage unit with 18 mm thick MDF board along with 1.5 mm approved laminate colour outside and 2 coat of enamel paint inside the storage of size 1'6"x1'6"x2'4". The same should be provided with all the required accessories including the handle, lock, sliding channel and necessary hardware, etc. complete with Long lasting polish

8.22. Sofa -2/3 seater

- **Frame Assembly** : 2 side frames and connecting members - Made from high quality steel tubes (chrome plated), Non-rusting
- **Seat / Back cushions** : polyurethane foam with wood inserts ensuring long life and optimum comfort to the users.
- **Upholstery / Fabric**
  - Composition:
  - Surface – 100% Polyamide
  - Substrate - 65 % polyester, 35% cotton
  - Stain repellent
  - Abrasion Resistance, Vacuum Cleaned
- The cushion covers should be user changeable

8.23. Waiting room chair Set

- Free standing unit two and three seater
- Stainless Steel Design
- Ergonomically designed seat / back
- Square mesh vents

8.24. Conference table

S/N	Parameter	Minimum Specification
1.	General	Conference Table for 8 seats
2.	Height	750 mm
3.	Length	2400 mm
4.	Width	1500 mm
5.	Colour	Walnut and Grey
6.	Top Material	Melamine Polish Marine Ply
7.	Electrical Sockets	Push Open type concealed Electrical power, Telephone and Network Sockets, Flush mounted on top surface and also under the table

8.25. Meeting room table (Round)

S/N	Parameter	Minimum Specification
	General	Discussion Table for 4 seats
2.	Height	750 mm
3.	Diameter	1000 mm or more (as per room fitment)
4.	Colour	Walnut and Grey
5.	Material	Engineer Wood/MDF

9. *Annexure V: Detailed Scope of Work and Considerations*

9.1. Scope of Work

The SI should ensure the successful implementation of the proposed Integrated CCC Project and provide capacity building support to city authorities as per the scope of services described below. Any functionality not expressly stated in this document but required to meet the needs of the VSCDL to ensure successful operations of the system shall essentially be under the scope of the SI and for that no extra charges shall be admissible. SI shall implement and deliver the following systems and capabilities linked with traffic command centre.

1. Integrated Command and Control Centre (CCC)
2. Smart DC (Data Centre) within CCC Building
3. DR Site (hosted on third party /Cloud Service Provider site)
4. CCTV/Surveillance Cameras
5. Automatic Number Plate Recognition (ANPR) System
6. Adaptive Traffic Control System (ATCS) with Signals
7. Variable Message Sign boards
8. Public Address (PA) System
9. Environment Sensors
10. Emergency Call Box (ECB) System
11. Traffic Control Centre (TCC) at Police HQ,
12. Viewing Centre at VMC Main Office
13. Augmentation of City wide OFC Network and field networking components

The SI's scope of work shall include but will not be limited to the following broad areas. Details of each of these broad areas have also been outlined in subsequent sections of this document:

2. **Assessment and Feasibility Study:** Conduct a detailed assessment, feasibility study and develop a comprehensive project plan, including:

    a. Assess the existing infrastructure of CCTV Cameras, Water SCADA Systems, GIS System, ERP system, traffic Signals on junctions etc.

    b. Conduct the site surveys to finalize the location of all field devices including CCTV Cameras, traffic signal controller, number of traffic signal aspects, Camera distribution systems, locations and height of poles, cantilever, junction box, and cable routing etc.

    c. Conduct feasibility study for finalization of detailed technical architecture, gap analysis and project plan

    d. Develop traffic management plans for individual signal controls and groups of signal controllers along with pre-planned intervention strategies for special scenarios

    e. Obtain site Clearance obligations & other relevant permissions

3. **Design, Supply, Installation and Commissioning of Field Equipment** which includes the following components:

    a. Adaptive Traffic Control System (ATCS)

    b. CCTV/Surveillance Cameras

    c. Automatic Number Plate Recognition (ANPR) System

    d. Variable Message Sign boards

    e. Public Address (PA) System

    f. Environmental Systems

    g. Variable Messaging Sign Boards

    h. Emergency Call Box (ECB) System

4. Provisioning **Network Connectivity** which includes design, supply, installation and commissioning of OFC network backbone connectivity for all project systems. This includes augmentation of OFC Network (Active and Passive components) installed across city, as part of Vadodara Eye Project as well as new network to cover all project field locations. This also includes

    a. Procurement of network bandwidth services for connecting Smart DC and DR

    b. Procurement of 50 Mbps (each) Internet bandwidth at Smart DC and DR site, 1:1 unshared premium bandwidth

    c. Integrating live data streams with Smart DC, DR Site, CCC, TCC, Viewing Centres and other project systems

5. Hosting of Hardware and Software Infrastructure which includes design, supply, and installation and commissioning of IT Infrastructure for Data Centre, Viewing Centres and Integrated Command and Centre (CCC). This consist of:

    a. IT Infrastructure including server, storage, other required hardware, application portfolio, licenses at Main DC (Smart DC) within CCC Building as well as DR Site (hosted at third party/cloud)

    b. CCC infrastructure including video walls, operator workstations, IP phones, joystick controller etc.

    c. Viewing Centre infrastructure including LED displays, operator workstations, IP phones etc.

    d. User Site IT Infrastructure, LAN cabling, Electrical cabling (IT related), Office Furniture etc. for IT Dept./SPV area on Second floor and Ground floor of CCC Building

e. Establishment of LAN and WAN connectivity at Viewing Centres, CCC and DC limited to scope of infrastructure procured for the project

f. Application integration services with control centres of Police HQ.

6. **Integration with existing projects and upcoming of VMC:** Integration with current CCTV (Vadodara Eye) Project, GIS Project, ERP Project and Water SCADA project, as per requirement listed out in Section 6.10 of this volume. Also support to vendors of future projects.

7. **Capacity Building** for VSCDL and Vadodara Police which includes preparation of operational manuals, training documents and capacity building support, including:

   a. Training of the city authorities, Vadodara Police personnel and CCC operators on operationalization of the system

   b. Support during execution of acceptance testing

   c. Preparation and implementation of the information security policy, including policies on backup and redundancy plan

   d. Preparation of revised traffic signal control plans, alternate signal control plans, KPIs for performance monitoring of transport network, dashboards for MIS

   e. Developing standard operating procedures for operations management and other technical services to be rendered by CCC

   f. Preparation of system documents, user manuals, performance manuals, etc.

8. Warranty and Annual Maintenance which includes periodic maintenance services for the software, hardware and other IT infrastructure installed as part of CCC project for a period of 5 years i.e. 3 year warranty & 2 years of CAMC and conducting periodic audits of the project from a third party, if required or instructed by VSCDL.

9.1.1. Inception Phase

The SI will be responsible for preparation of detailed project plan. The plan shall address at the minimum the following:

i. Define an organized set of activities for the project and identify the interdependence between them.
ii. Resource planning and loading for each phase/activity. This must also indicate where each resource would be based during that phase, i.e. onsite at the VSCDL office or off site at SI premises.
iii. Establish and measure resource assignments and responsibilities
iv. Highlight the milestones and associated risks
v. Communicate the project plan to stakeholders with meaningful reports.
vi. Measure project deadlines and performance objectives.
vii. Project Progress Reporting. During the implementation of the project, the SI should present weekly reports. This report will be presented in the steering committee

meeting to VSCDL. The report should contain at the minimum the under mentioned:

a. Results accomplished during the period (weekly)
b. Cumulative deviations from the schedule date as specified in the finalized Project Plan
c. Corrective actions to be taken to return to planned schedule of progress
d. Plan for the next week
e. Proposed revision to planned schedule provided such revision is necessitated by reasons beyond the control of SI
f. Support needed
g. Highlights/lowlights
h. Issues/Concerns
i. Risks/Show stoppers along with mitigation

viii. Identify the activities that require the participation of client personnel (including VSCDL, the Program Management Unit etc.) and communicate their time requirements and schedule early enough to ensure their full participation at the required time.

9.1.2. Requirement Phase

The SI must perform the detailed assessment of the business requirements and IT Solution requirements as mentioned in this RFP. Based on the understanding and its own individual assessment, SI shall develop & finalize the System Requirement Specifications (SRS) in consultation with VSCDL and its representatives. While doing so, SI at least is expected to do following:

i. SI shall study and revalidate the requirements given in the RFP with VSCDL and submit as an exhaustive FRS document.
ii. SI shall develop the FRS and SRS documents.
iii. SI shall develop and follow standardized template for requirements capturing and system documentation.
iv. SI must maintain traceability matrix from SRS stage for the entire implementation.
v. SI must get the sign off from user groups formed by VSCDL.
vi. For all the discussion with VSCDL team, SI shall be required to be present at VSCDL office with the requisite team members.
vii. Prior to starting the site clearance, the SI shall carry out survey of field locations as specified in Annexure I, for buildings, structures, fences, trees, existing installations, etc.

9.1.3. Design Phase

The SI shall build the solution as per the Design Considerations detailed in section **9.1.** The solution proposed by SI should comply with the design considerations requirements as mentioned therein**.**

9.1.4. Development Phase

The SI shall carefully consider the scope of work and provide a solution that best meets the project's requirements. Considering the scope set in this RFP, the SI shall carefully consider the solutions it proposes and explicitly mention the same in the technical proposal. The implementation of the application software will follow the procedure mentioned below:

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

a. SI will be responsible for supplying the application and licenses of related software products and installing the same so as to meet project requirements.
b. SI shall have provision for procurement of licenses in a staggered manner as per the actual requirement of the project.
c. The SI shall perform periodic audits to measure license compliance against the number of valid End User software licenses consistent with the terms and conditions of license agreements, volume purchase agreements, and other mutually agreed upon licensed software terms and conditions. The SI shall report any exceptions to license terms and conditions at the right time to VSCDL. However, the responsibility of license compliance solely lies with the SI. Any financial penalty imposed on VSCDL during the contract period due to license non-compliance shall be borne by SI.

ii. SI shall also supply any other tools & accessories required to make the integrated solution complete as per requirements. For the integrated solution, the SI shall supply:
a. Software & licenses.
b. Supply tools, accessories, documentation and provide a list of the same. Tools and accessories shall be part of the solution.
c. System Documentation: System Documentation both in hard copy and soft copy to be supplied along with licenses and shall include but not limited to following. Documentation to be maintained, updated and submitted to VSCDL regularly :
- Functional Requirement Specification (FRS)
- High level design of whole system
- Low Level design for whole system / Module design level
- System Requirements Specifications (SyRS)
- Any other explanatory notes about system
- Traceability matrix
- Technical and product related manuals
- Installation guides
- User manuals
- System administrator manuals
- Toolkit guides and troubleshooting guides
- Other documents as prescribed by VSCDL
- Quality assurance procedures
- Change management histories
- Version control data
- SOPs, procedures, policies, processes, etc. developed for VSCDL
- Programs :
  - Entire source codes
  - All programs must have explanatory notes for understanding
  - Version control mechanism
  - All old versions to be maintained
- Test Environment :
  - Detailed Test methodology document

- Module level testing
- Overall System Testing
- Acceptance test cases

(These documents need to be updated after each phase of project and to be maintained updated during entire project duration. The entire documentation will be the property of VSCDL.)

9.1.5. Integration & Testing Phase

The Command and control centre should be integrated with feeds of all tracks/component deployed under this Vadodara Project. The SI shall provide the testing strategy including traceability matrix, test cases and shall conduct the testing of various components of the software developed/customized and the solution as a whole. The testing should be comprehensive and should be done at each stage of development and implementation.

9.1.6. Go-Live Preparedness and Go-Live

i. SI shall prepare and agree with VSCDL, the detailed plan for Go-Live (in-line with VSCDL's implementation plan as mentioned in RFP).
ii. The SI shall define and agree with VSCDL, the criteria for Go-Live.
iii. The SI shall ensure that all the data migration is done from existing systems.
iv. SI shall submit signed-off UAT report (issue closure report) ensuring all issues raised during UAT are being resolved prior to Go-Live.
v. SI shall ensure that Go –Live criteria as mentioned in User acceptance testing of Project is met and SI needs to take approval from VSCDL team on the same.
vi. Go-live of the application shall be done as per the finalized and agreed upon Go-Live plan.

9.1.7. Operations and Maintenance for a period of 5 years

Success of the Project would lie on how professionally and methodically the entire Project is managed once the implementation is completed. From the System Integrator perspective too this is a critical phase since the quarterly payments are linked to the SLA's in the post implementation phases. System Integrator thus is required to depute a dedicated team of professionals to manage the Project and ensure adherence to the required SLAs. SI shall provide operations and maintenance services for the software, hardware and other IT and Non-IT infrastructure installed as part of project for a period of 5 years i.e. 3 year warranty & 2 years of comprehensive AMC. The SI will have to make provision for power supply and power supply meters at all locations. The electricity charges will have to be borne by the SI and reimbursed by VSCDL based on submission of actual bills.

9.1.8. Project Management & Facilities Management Services

The SI will be required to provide facilities management services to support the VSCDL and Police Department officials in performing their day-to-day functions related to this system. SI is required to depute a dedicated, centralised project management and technical team for the overall project management and interaction with VSCDL.

9.1.9. Provision of the Operational Manpower

The Current estimation of the man-power required from the SI for viewing of the data feeds is as follows:

Sr No	Manpower	Overall Qty.
A	Project Head/Director	1
B	**CCC, DC and CCTV Systems**	
1	Asst. Project Manager	1
2	Technical Expert – N/w and Security	1
3	Technical Expert – Server and storage	1
4	Technical Expert – Video Mgmt	1
5	DC Electrician (1*2)	2
C	**Helpdesk /Call centre and Field Support**	
1	HelpDesk Manager (1*2)	2
2	Helpdesk Staff (4*3)	12
3	Field Staff (3*2)	6
D	**CCC Expert and Supervisors**	
1	CCC Software Expert/Implementer	1
2	CCC Supervisors (2*2)	4

The SI is required to provide suitable manpower to supervise the CCC operators, who will monitor the data feeds at command centre and support VSCDL in operationalisation of the project. The CCC Operators required for operationalization of the project will be provided by VSCDL.

The exact role of these personnel and their responsibilities would be defined and monitored by VSCDL System Integrator shall be required to provide such manpower meeting following requirements:

i. All such manpower shall be minimum graduate pass and having educational qualification a defined in RFP requirements
ii. All such manpower shall be without any criminal background / record.
iii. VSCDL reserves the right to carry out background check of the personnel proposed on the Project for verification of criminal record, at the beginning of deployment or during deployment.
iv. System Integrator shall have to replace any person, if not found suitable for the job.
v. All the manpower shall have to undergo training from the System Integrator for at least 15 working days on the working of project. Training should also cover dos & don'ts and will have few sessions from VSCDL on right approaches for monitoring the feeds & providing feedback to VSCDL and other associated government agencies.
vi. Each person shall have to undergo compulsory 1 day training every month
vii. Operational Manpower shall work in 3 shifts, with no person being made to see the feeds for more than 8 hours at a stretch.

Detail operational guideline document shall be prepared during implementation which shall specify detail responsibilities of these resources and their do's & don'ts.

9.1.9.1. Basic Infrastructure Services

Following services shall be provided by the SI under the basic infrastructure services:

i. Ensure availability of the infrastructure (both physical and IT) including but not limited to Power, Cooling, Racks, Storage and other peripheral equipment installed at the time of Project commissioning as per the SLAs.
ii. Ensure scalability in terms of availability of racks and supporting infrastructure.
iii. Proactive and reactive maintenance, repair and replacement of defective components (physical and other peripheral IT infrastructure) installed for the Project through this RFP. The cost for repair and replacement shall be borne by the SI.
iv. Any component (Physical & IT installed at the time of Project commissioning) that is reported to be faulty / non-functional on a given date should be either fully repaired or replaced by temporary substitute (of equivalent configuration) within the time frame agreed upon in the Service Level Agreement (SLA).
v. Proactive monitoring of the entire basic infrastructure installed.
vi. SI shall maintain records of the maintenance of the basic infrastructure and shall maintain a logbook on-site that may be inspected by the VSCDL at any time.

9.1.9.2. Integration Testing

This shall be a black-box testing role primarily to ensure that the application to be deployed does not disrupt the Vadodara operations and affect other Vadodara infrastructure in terms of performance and security. The technical tasks to be carried out shall be as follows:

i. Functional Testing: Ensuring that the application functionality as described by the VSCDL works adequately. The functional testing of application will necessarily be minimal as this is a core responsibility of the Supplier.
ii. Performance Testing: Ensuring that the application meets expressed performance requirements on the Vadodara servers by using performance test tools and performance monitoring tools.
iii. Security Testing: Testing for exploitable application security weaknesses that undermine the application security or the security of the infrastructure.

9.1.9.3. Vendor Management Services

The activities shall include:

i. Coordination with all the project stakeholders to ensure that all Vadodara activities are carried out in a timely manner.
ii. SI shall coordinate and follow-up with all the relevant vendors to ensure that the issues are resolved in accordance with the SLAs agreed upon with them.
iii. SI shall also ensure that unresolved issues are escalated to respective departments.
iv. SI shall maintain database of the various vendors with details like contact person, telephone nos., escalation matrix, response time and resolution time commitments etc.
v. SI shall draw a consolidated quarterly SLA performance report across vendors for consideration of the VSCDL.

9.1.9.4. Physical Infrastructure Management and Maintenance Services

All the devices that will be installed in the project as part of the physical infrastructure should be SNMP enabled and shall be centrally and remotely monitored and managed on a 24x7x365 basis. Industry leading infrastructure management solution should be deployed to facilitate monitoring and management of the infrastructure on one integrated console. The physical infrastructure management and maintenance services shall include:

i. Proactive and reactive maintenance, repair and replacement of defective components (IT and Non-IT/ Hardware and Software). The cost for repair and replacement shall be borne by the SI.
ii. The SI shall have to stock and provide adequate onsite and offsite spare parts and spare component to ensure that the uptime commitment as per SLA is met. To provide this service it is important for the SI to have back to back arrangement with the OEMs. The SI needs to provide a copy of the service level agreement signed with the respective OEMs.
iii. Component that is reported to be down on a given date should be either fully repaired or replaced by temporary substitute (of equivalent configuration) within the time frame indicated in the Service Level Agreement (SLA). In case the selected SI fails to meet the above standards of maintenance, there will be a penalty as specified in the SLA.
iv. The selected SI shall also maintain records of all maintenance of the system and shall maintain a logbook on-site that may be inspected by the VSCDL at any time.

9.1.10. Exit Management

i. This sets out the provisions, which will apply on expiry or termination of the Master Service Agreement, the Project Implementation, Operation and Management SLA.
ii. In the case of termination of the Project Implementation and/or Operation and Management, the Parties shall agree at that time whether, and if so during what period, the provisions of this Schedule shall apply.
iii. The Parties shall ensure that their respective associated entities carry out their respective obligations set out in this Exit Management Schedule.

9.1.10.1.1. Cooperation and Provision of Information

During the exit management period:

i. The SI will allow the VSCDL or its nominated agency access to information reasonably required to define the then current mode of operation associated with the provision of the services to enable the VSCDL to assess the existing services being delivered;
ii. Promptly on reasonable request by the VSCDL , the SI shall provide access to and copies of all information held or controlled by them which they have prepared or maintained in accordance with this agreement relating to any material aspect of the services (whether provided by the System integrator or sub-contractors appointed by the SI). The VSCDL shall be entitled to copy of all such information. Such information shall include details pertaining to the services rendered and other performance data. The SI shall permit the VSCDL or its nominated agencies to have reasonable access to its employees and facilities, to understand the methods of delivery of the services employed by the SI and to assist appropriate knowledge transfer.

9.1.10.1.2. Confidential Information, Security and Data

i. The SI will promptly on the commencement of the exit management period supply to the VSCDL or its nominated agency the following:

- information relating to the current services rendered and customer and performance data relating to the performance of sub-contractors in relation to the services;
- documentation relating to Intellectual Property Rights;
- documentation relating to sub-contractors;
- all current and updated data as is reasonably required for purposes of *VSCDL* or its nominated agencies transitioning the services to its Replacement *SI* in a readily available format nominated by the *VSCDL or* its nominated agency;
- all other information (including but not limited to documents, records and agreements) relating to the services reasonably necessary to enable *VSCDL* or its nominated agencies, or its Replacement *SI* to carry out due diligence in order to transition the provision of the Services to *VSCDL* or its nominated agencies, or its Replacement *System integrator* (as the case may be).

ii. Before the expiry of the exit management period, the SI shall deliver to the VSCDL or its nominated agency all new or up-dated materials from the categories set out in Schedule above and shall not retain any copies thereof, except that the SI shall be permitted to retain one copy of such materials for archival purposes only.

9.1.10.1.3. Transfer of Certain Agreements

On request by the *VSCDL* or its nominated agency the *SI* shall effect such assignments, transfers, licences and sub-licences *VSCDL* , or its Replacement *SI* in relation to any equipment lease, maintenance or service provision agreement between *SI* and third party lessors, vendors, and which are related to the services and reasonably necessary for the carrying out of replacement services by the *VSCDL* or its nominated agency or its Replacement *SI*.

9.1.10.1.4. General Obligations of the SI

i. The SI shall provide all such information as may reasonably be necessary to effect as seamless a handover as practicable in the circumstances to the VSCDL or its nominated agency or its Replacement SI and which the SI has in its possession or control at any time during the exit management period.

ii. For the purposes of this Schedule, anything in the possession or control of any SI, associated entity, or sub-contractor is deemed to be in the possession or control of the SI.

iii. The SI shall commit adequate resources to comply with its obligations under this Exit Management Schedule.

9.1.10.1.5. Exit Management Plan

i. The SI shall provide the VSCDL or its nominated agency with a recommended exit management plan ("Exit Management Plan") which shall deal with at least the following aspects of exit management in relation to the MSA as a whole and in relation to the Project Implementation, and the Operation and Management SLA.

- A detailed program of the transfer process that could be used in conjunction with a Replacement *SI* including details of the means to be used to ensure continuing provision of the services throughout the transfer process or until the cessation of the services and of the management structure to be used during the transfer;

- plans for the communication with such of the *SI*'s sub-contractors, staff, suppliers, customers and any related third party as are necessary to avoid any material detrimental impact on the *VSCDL* 's operations as a result of undertaking the transfer;
- (if applicable) proposed arrangements for the segregation of the *SI*'s networks from the networks employed by *VSCDL* and identification of specific security tasks necessary at termination;
- Plans for provision of contingent support to *VSCDL* , and replacement *SI* for a reasonable period after transfer.

a. The SI shall re-draft the Exit Management Plan annually thereafter to ensure that it is kept relevant and up to date.
b. Each Exit Management Plan shall be presented by the SI to and approved by the VSCDL or its nominated agencies.
c. The terms of payment as stated in the Terms of Payment Schedule include the costs of the SI complying with its obligations under this Schedule.
d. In the event of termination or expiry of MSA, and Project Implementation, each Party shall comply with the Exit Management Plan.
e. During the exit management period, the SI shall use its best efforts to deliver the services.
f. Payments during the Exit Management period shall be made in accordance with the Terms of Payment Schedule.
g. This Exit Management plan shall be furnished in writing to the VSCDL or its nominated agencies within 90 days from the Effective Date of this Agreement.

9.2. Compliance to Standards & Certifications

a. For a large and complex set up such as the Project, it is imperative that the highest standards applicable are adhered to. In this context, the SI will ensure that the entire Project is developed in compliance with the applicable standards.
b. During project duration, the SI will ensure adherence to prescribed standards as provided below:

Sl. No.	Component/Application/System	Prescribed Standard
1.	Information Security	ISO 27001
2.	IT Infrastructure Management	ITIL specifications
3.	Service Management	ISO 20000 specifications
4.	Project Documentation	IEEE/ISO/CMMi (where applicable) specifications for documentation

c. Apart from the above the SI need to ensure compliance of the project with Government of India IT security guidelines including provisions of:
   - The Information Technology Act, 2000" and amendments thereof and
   - Guidelines and advisories for information security published by Cert-In/DeitY (Government of India) issued till the date of publishing of tender notice. Periodic changes in these guidelines during project duration need to be complied with.

d. While writing the source code for application modules the SI should ensure high-quality documentation standards to improve the readability of the software module. An illustrative list of comments that each module contained within the source file should be preceded by is outlined below:
   - The name of the module
   - The date when module was created
   - A description of what the module does
   - A list of the calling arguments, their types, and brief explanations of what they do
   - A list of required files and/or database tables needed by the module
   - Error codes/Exceptions
   - Operating System (OS) specific assumptions
   - A list of locally defined variables, their types, and how they are used
   - Modification history indicating who made modifications, when the modifications were made, and what was done.

e. Apart from the above SI needs to follow appropriate coding standards and guidelines inclusive of but not limited to the following while writing the source code -
   - Proper and consistent indentation
   - Inline comments
   - Structured programming
   - Meaningful variable names
   - Appropriate spacing

- Declaration of variable names
- Meaningful error messages

f. Quality Audits
   - VSCDL , at its discretion, may also engage independent auditors to audit any/some/all standards/processes. The SI shall support all such audits as per calendar agreed in advance. The result of the audit shall be shared with the SI who has to provide an effective action plan for mitigations of observations/non-compliances, if any.

9.3. Project Management and Governance

9.3.1. Project Management Office (PMO)

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

i. Project Progress
ii. Delays, if any – Reasons thereof and ways to make-up lost time
iii. Issues and concerns
iv. Performance and SLA compliance reports;
v. Unresolved and escalated issues;
vi. Project risks and their proposed mitigation plan
vii. Discussion on submitted deliverable
viii. Timelines and anticipated delay in deliverable if any
ix. Any other issues that either party wishes to add to the agenda.

During the development and implementation phase, there may be a need for more frequent meetings and the agenda would also include:

i. Module development status
ii. Testing results
iii. IT infrastructure procurement and deployment status
iv. Status of setting up/procuring of the Helpdesk, DC hosting
v. Any other issues that either party wishes to add to the agenda.

Bidder shall recommend PMO structure for the project implementation phase and operations and maintenance phase.

9.3.2. Steering Committee

The Steering Committee will consist of senior stakeholders from VSCDL , its nominated agencies and SI. SI will nominate its Smart City vertical head to be a part of the Project Steering Committee. The SI shall participate in monthly Steering Committee meetings and update Steering Committee on Project progress, Risk parameters (if any), Resource deployment and plan, immediate tasks, and any obstacles in project. The Steering committee meeting will be a forum for seeking and getting approval for project decisions on major changes etc. All relevant records of proceedings of Steering Committee should be maintained, updated, tracked and shared with the Steering Committee and Project Management Office by SI. During the development and implementation phase of the project, it is expected that there will be at least fortnightly Steering Committee meetings. During the O&M phase, the meetings will be held at least once a quarter. Other than the planned meetings, in exceptional cases, VSCDL may call for a Steering Committee meeting with prior notice to the SI.

9.3.3. Project Monitoring and Reporting

The SI shall circulate written progress reports at agreed intervals to VSCDL and other

stakeholders. Project status report shall include Progress against the Project Management Plan, status of all risks and issues, exceptions and issues along with recommended resolution etc.
Other than the planned meetings, in exceptional cases, project status meeting may be called with prior notice to the Bidder. VSCDL reserves the right to ask the bidder for the project review reports other than the standard weekly review reports.

9.3.4. Risk and Issue management

The SI shall develop a Risk Management Plan and shall identify, analyse and evaluate the project risks, and shall develop cost effective strategies and action plans to mitigate those risks.
The SI shall carry out a Risk Assessment and document the Risk profile of VSCDL based on the risk appetite and shall prepare and share the VSCDL Enterprise Risk Register. The SI shall develop an issues management procedure to identify, track, and resolve all issues confronting the project. The risk management plan and issue management procedure shall be done in consultation with VSCDL .
The SI shall monitor, report, and update the project risk profile. The risks should be discussed with VSCDL and a mitigation plan be identified during the project review/status meetings. The Risk and Issue management should form an agenda for the Project Steering Committee meetings as and when required.

9.3.5. Governance procedures

SI shall document the agreed structures in a procedures manual.

9.3.6. Planning and Scheduling

The SI will prepare a detailed schedule and plan for the entire project covering all tasks and sub tasks required for successful execution of the project. The SI has to get the plan approved from VSCDL at the start of the project and it should be updated every week to ensure tracking of the progress of the project.
The project plan should include the following:

1. The project break up into logical phases and sub-phases;
2. Activities making up the sub-phases and phases;
3. Components in each phase with milestones;
4. The milestone dates are decided by VSCDL in this RFP. SI cannot change any of the milestone completion dates. SI can only propose the internal task deadlines while keeping the overall end dates the same. SI may suggest improvement in project dates without changing the end dates of each activity.
5. Key milestones and deliverables along with their dates including those related to delivery and installation of hardware and software;
6. Start date and end date for each activity;
7. The dependencies among activities;
8. Resources to be assigned to each activity;
9. Dependency on VSCDL

9.3.7. License Metering / Management

The SI shall track software usage throughout the IT setup so as to effectively manage the risk of unauthorized usage or under-licensing of software installed at the CCC, and DC. This may be carried out through the use of standard license metering tools.

9.4. Change Management & Control

9.4.1. Change Orders / Alterations / Variations

i. The SI agrees that the requirements given in the Bidding Documents are minimum requirements and are only indicative. The vendor would need to etch out the details at the time of preparing the design document prior to actual implementation. It shall be the responsibility of the SI to meet all the requirements of technical specifications contained in the RFP and any upward revisions and/or additions of quantities, specifications sizes given in the Bidding Documents required to be made during execution of the works, shall not constitute a change order and shall be carried out without a change order and shall be carried out without any time and cost effect to Purchaser.

ii. Further upward revisions and or additions required to make SI's selected equipment and installation procedures to meet Bidding Documents requirements expressed and to make entire facilities safe, operable and as per specified codes and standards shall not constitute a change order and shall be carried out without any time and cost effect to Purchaser.

iii. Any upward revision and/or additions consequent to errors, omissions, ambiguities, discrepancies in the Bidding Documents which the SI had not brought out to the Purchaser's notice in his bid shall not constitute a change order and such upward revisions and/or addition shall be carried out by SI without any time and cost effect to Purchaser.

9.4.2. Change Order

i. The Change Order will be initiated only in case (i) the Purchaser directs in writing the SI to include any addition to the scope of work covered under this Contract or delete any part of the scope of the work under the Contract, (ii) SI requests to delete any part of the work which will not adversely affect the operational capabilities of the facilities and if the deletions proposed are agreed to by the Purchaser and for which cost and time benefits shall be passed on to the Purchaser, (iii) the Purchaser directs in writing the SI to incorporate changes or additions to the technical specifications already covered in the Contract.

ii. Any changes required by the Purchaser over and above the minimum requirements given in the specifications and drawings etc. included in the Bidding Documents before giving its approval to detailed design or Engineering requirements for complying with technical specifications and changes required to ensure systems compatibility and reliability for safe operation (As per codes, standards and recommended practices referred in the Bidding Documents) and trouble free operation shall not be construed to be change in the Scope of work under the Contract.

iii. Any change order as stated in Clause 2 a. comprising an alteration which involves change in the cost of the works (which sort of alteration is hereinafter called a "Variation") shall be the Subject of an amendment to the Contract by way of an increase or decrease in the schedule of Contract Prices and adjustment of the implementation schedule if any.

iv. If parties agree that the Contract does not contain applicable rates or that the said

rates are inappropriate or the said rates are not precisely applicable to the variation in question, then the parties shall negotiate a revision of the Contract Price which shall represent the change in cost of the works caused by the Variations. Any change order shall be duly approved by the Purchaser in writing.

v. Within ten (10) working days of receiving the comments from the Purchaser or the drawings, specification, purchase requisitions and other documents submitted by the SI for approval, the SI shall respond in writing, which item(s) of the Comments is/are potential changes(s) in the Scope of work of the RFP document covered in the Contract and shall advise a date by which change order (if applicable) will be submitted to the Purchaser.

vi. Any integrations with future systems at VSCDL (not listed as a part of current scope) will be done through the change management process. The SI will have to quote man month efforts for each of the integration components and the same will be vetted by VSCDL or its appointed PMC.

9.5. Testing and Acceptance Criteria

a. SI shall demonstrate the following mentioned acceptance criteria prior to acceptance of the solution as well as during project operations phase, in respect of scalability and performance etc. The SI may propose further detailed Acceptance criteria which the VSCDL will review. Once VSCDL provides its approval, the Acceptance criteria can be finalized. In case required, parameters might be revised by VSCDL in mutual agreement with bidder and the revised parameters shall be considered for acceptance criteria. A comprehensive system should be set up that would have the capability to log & track the testing results, upload & maintain the test cases and log & track issues/bugs identified.

b. The following table depicts the details for the various kinds of testing envisaged for the project:

Type of Testing	Responsibility	Scope of Work
System Testing	SI	1. SI to perform System testing 2. SI to prepare test plan and test cases and maintain it. VSCDL may request the SI to share the test cases and results 3. Should be performed through manual as well as automated methods 4. Automation testing tools to be provided by SI. VSCDL doesn't intend to own these tools
Integration Testing	SI	1. SI to perform Integration testing 2. SI to prepare and share with VSCDL the Integration test plans and test cases 3. SI to perform Integration testing as per the approved plan 4. Integration testing to be performed through manual as well as automated methods 5. Automation testing tools to be provided by SI. VSCDL doesn't intend to own these tools

Performance and load Testing	• SI • VSCDL / Third Party Auditor (to monitor the performance testing)	1. SI to do performance and load testing. 2. Various performance parameters such as transaction response time, throughput, page loading time should be taken into account. 3. Load and stress testing of the Project to be performed on business transaction volume 4. Test cases and test results to be shared with VSCDL . 5. Performance testing to be carried out in the exact same architecture that would be set up for production. 6. SI need to use performance and load testing tool for testing. VSCDL doesn't intend to own these tools. 7. VSCDL if required, could involve third party auditors to monitor/validate the performance testing. Cost for such audits to be paid by VSCDL .
Security Testing (including Penetration and Vulnerability testing)	• SI • VSCDL / Third Party Auditor (to monitor the security testing)	1. The solution should demonstrate the compliance with security requirements as mentioned in the RFP including but not limited to security controls in the application, at the network layer, network, data centre(s), security monitoring system deployed by the SI 2. The solution shall pass vulnerability and penetration testing for rollout of each phase. The solution should pass web application security testing for the portal, mobile app and other systems and security configuration review of the infrastructure. 3. SI should carry out security and vulnerability testing on the developed solution. 4. Security testing to be carried out in the exact same environment/architecture that would be set up for production. 5. Security test report and test cases should be shared with VSCDL 6. Testing tools if required, to be provided by SI. VSCDL doesn't intend to own these tools 7. During O&M phase, penetration testing to be conducted on yearly basis and vulnerability assessment to be conducted on half-yearly basis. VSCDL will also involve third party auditors to perform the audit/review/monitor the security testing carried out by SI. Cost for such auditors to be paid by VSCDL .

User Acceptance Testing of Project	• VSCDL or VSCDL appointed third party auditor	1. VSCDL / VSCDL appointed third party auditor to perform User Acceptance Testing 2. SI to prepare User Acceptance Testing test cases 3. UAT to be carried out in the exact same environment/architecture that would be set up for production 4. SI should fix bugs and issues raised during UAT and get approval on the fixes from VSCDL / third party auditor before production deployment 5. Changes in the application as an outcome of UAT shall not be considered as Change Request. SI has to rectify the observations.

Note:

a. Bidder needs to provide the details of the testing strategy and approach including details of intended tools/environment to be used by SI for testing in its technical proposal. VSCDL does not intend to own the tools.
b. The SI shall work in a manner to satisfy all the testing requirements and adhere to the testing strategy outlined. The SI must ensure deployment of necessary resources and tools during the testing phases. The SI shall perform the testing of the solution based on the approved test plan, document the results and shall fix the bugs found during the testing. It is the responsibility of SI to ensure that the end product delivered by the SI meets all the requirements specified in the RFP. The SI shall take remedial action based on outcome of the tests.
c. The SI shall arrange for environments and tools for testing and for training as envisaged. Post Go-Live; the production environment should not be used for testing and training purpose. If any production data is used for testing, it should be masked and it should be protected. Detailed process in this regard including security requirement should be provided by the SI in its technical proposal. The process will be finalized with the selected bidder.
d. All the Third Party Auditors (TPA) as mentioned above will be appointed and paid by VSCDL directly. All tools/environment required for testing shall be provided by the SI.
e. STQC/Other agencies appointed by VSCDL shall perform the role of TPA. SI needs to engage with the TPA at the requirement formulation stage itself. This is important so that unnecessary re-work is avoided and the audit is completed in time. The audit needs to be completed before Go-Live of different phases. SI needs to prepare and provide all requisite information/documents to third party auditor and ensure that there is no delay in overall schedule.
f. The cost of rectification of non-compliances shall be borne by the SI.

9.6. Factory Testing

Success SI shall have to submit Factory Test Certificate for the below mentioned materials before the actual supply of the items.

1. Work stations
2. Network Printers

9.6.1. Final Acceptance Testing

The final acceptance shall cover 100% of the Vadodara Project, after successful testing by the VSCDL or its PMU; a Final Acceptance Test Certificate (FAT) shall be issued by the VSCDL . Prerequisite for Carrying out FAT activity:

5. Detailed test plan shall be developed by the SI and approved by VSCDL . This shall be submitted by SI before FAT activity to be carried out.
6. All documentation related to Vadodara Project and relevant acceptance test document (including IT Components, Non IT Components etc.) should be completed & submitted before the final acceptance test to the VSCDL .
7. The training requirements as mentioned should be completed before the final acceptance test.
8. Successful hosting of Application, NMS and MIS Software.
9. For both IT & Non-IT equipment's / software manuals / brochures / Data Sheets / CD / DVD / media for all the Vadodara Project supplied components.

The FAT shall include the following:

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

Any delay by the SI in the Final Acceptance Testing shall render him liable to the imposition of appropriate Penalties. However, delays identified beyond the control of SI shall be considered appropriately and as per mutual agreement between VSCDL and SI. In the event the SI is not able to complete the installation due to non-availability of bandwidth from the bandwidth service providers, the Supplier and VSCDL may mutually agree to redefine the Network so the SI can complete installation and conduct the Final Acceptance Test within the specified time.

9.7. Smart City-Design Consideration

9.7.1. Key Design Considerations

Key design considerations taken into account are as follows –

- Designed for 24x7 online availability of application.
- Scalable solution on open protocols
- API based architecture for Integration with other web applications and Mobile applications

The key guiding principles considered for building the integrated solution are the following:

- **Continuous adoption of rapidly evolving Technology** - Technology evolves too fast and Government projects similar to Smart City with its long procurement cycles do not align naturally to adapt to this trend. Also, any changes to existing implementations require contract changes, new RFP (Request for Proposal), etc. Hence the entire system would be built to be open (standards, open API, plug-n-play capabilities), components coupled loosely to allow changes in sub-system level without affecting other parts, architected to work completely within a heterogeneous compute, storage, and multi-vendor environment.
- **Selection of best solution at best rate as and when required** - Large integrated systems of Smart City operations should be designed to get best cost and performance advantages of natural technology curve (constant increase of speed and decrease of cost) and still aligned to open procurement practices of the Government. For this to happen, architecture should be open and vendor neutral, use commodity hardware, and designed for horizontal scale. This allows buying of commodity compute, storage, etc. only when needed at best price.
- **Distributed Access and Multi-channel service delivery -**With high penetration of mobile devices and very large percentage of internet usage using mobile devices, it is imperative that the Smart City applications provide multiple channels of service delivery to its stakeholders. An important consideration is that the access devices and their screen capabilities (including browser variations) are numerous and constantly evolve. Hence, it is imperative to design the system such that the ecosystem of Smart City-integrated mobile apps also evolves.
- **Security and privacy of data** - Security and privacy of data within the integrated Project will be foundational keeping in view of the sensitivity of data and critical nature of the infrastructure envisioned to be built for Smart City operations. Security and privacy of data should be fundamental in design of the system without sacrificing utility of the system. When creating a system of this scale, it is imperative that handling of the sensitivity and criticality of data are not afterthoughts, but designed into the strategy of the system from day one.
- **Provision of a Sustainable, Scalable Solution-** The motive of the technological enhancements to provide a system that would be sustainable for the next few years. The expectation is that the system should sustain at least 7 years from GO-Live. The solution would be done keeping in mind the scalability of the system. The simplified procurement processes and ease of compliance is expected to lead to huge growth in contract's base. Every component of VSCDL system needs to scale horizontally to very large volume of data.

- **API Approach-** VSCDL has decided to adopt Open API as the guiding paradigm to achieve the above goals. Though VSCDL system would develop a portal but that would not be the only way for interacting with the VSCDL system as the stakeholders via his choice of third party applications, which will provide all user interfaces and convenience via desktop, mobile, other interfaces, will be able to interact with the VSCDL system. These applications will connect with the VSCDL system via secure VSCDL system APIs. This architectural approach has been taken as the UI based integration through a ubiquitous web portal requires manual interaction and does not fit most consumption scenarios. The following benefits are envisaged from API based integration,
    - Consumption across technologies and platforms(mobile, tablets, desktops, etc.) based on the individual requirements
    - Automated upload and download of data
    - Ability to adapt to changing taxation and other business rules and end user usage models
    - Integration with customer software (GIS, Accounting systems).
- **Business Rule Driven Approach-**All configurations including policy decisions, business parameters, rules, etc. shall be captured in a central place within the system. The system shall provide facility to the decision makers to add new or edit/delete existing policies or make changes with appropriate permission control and audit trace. Managing these in a central repository ensures only once source of truth is used across many application servers and reduces issues of inconsistent application behaviour. Decoupling of the business parameters/rules/master data from the rest of the solution architecture and making them configurable allows for a great deal of flexibility.
- **Data Distribution Service-**As a future roadmap it is envisaged that the functionalities provided by the VSCDL Project should be available as services that could be offered to other stakeholders on request. Keeping this in mind the system shall be able to provide data on subscription-publication basis. The organization of the information exchange between modules is fundamental to publish-subscribe (PS) systems. The PS model connects anonymous information producers (publishers) with information consumers (subscribers). The overall distributed application (the PS system) is composed of processes. The goal of the DDS architecture is to facilitate efficient distribution of data in a distributed system. Participant using DDS can 'read' or 'write' data efficiently and naturally with a typed interface. Underneath, the DDS middleware will distribute the data so that each reading participant can access the 'most current' values.

9.7.2. Guiding Architecture Principle

The IT architecture principles defined in this section are the underlying general rules and guidelines that will drive the subsequent development, use and maintenance of architectural standards, frameworks and future state target architecture.
VSCDL system will be built on the following core principles:

9.7.2.1. Platform Approach

It is critical that a platform based approach is taken for any large scale application development, to ensure adequate focus and resources on issues related to scalability, security and data management. Building an application platform with reusable components or

frameworks across the application suite provides a mechanism to abstract all necessary common features into a single layer. Hence the VSCDL system is envisaged as a faceless system with 100% API driven architecture at the core of it. VSCDL portal will be one such application on top of these APIs, rather than being fused into the platform as a monolithic system.

Open APIs designed to be used form the core design mechanism to ensure openness, multi-user ecosystem, specific vendor/system independence, and most importantly providing tax payers and other ecosystem players with choice of using innovative applications on various devices (mobile, tablet, etc.) that are built on top of these APIs.

9.7.2.2. Openness

Adoption of open API, open standards and wherever prudent open source products are of paramount importance for the system. This will ensure the system to be lightweight, scalable and secure. Openness comes from use of open standards and creating vendor neutral APIs and interfaces for all components. All the APIs will be stateless. Data access must be always through APIs, no application will access data directly from the storage layer or data access layer. For every internal data access also (access between various modules) there will be APIs and no direct access will be there.

9.7.2.3. Data as an enterprise asset

Information is a high value asset to be leveraged across the organization to improve performance and decision making. Accurate information would ensure effective decision making and improved performance

Effective and careful data management is of high importance and top priority should be placed on ensuring where data resides, that its accuracy can be relied upon, and it can obtained when and where needed.

9.7.2.4. Performance

A best of breed solution using the leading technologies of the domain should be proposed in the solution ensuring the highest levels of performance. It will also ensure that the performance of various modules should be independent of each other to enhance the overall performance and also in case of disaster, performance of one module should not impact the performance other modules.

The solution should be designed in a manner that the following can be achieved:

- Modular design to distribute the appropriate system functions on web and app server
- Increase in-memory Operations (use static operations)
- Reduce number of I/O operations and N/w calls using selective caching
- Dedicated schemas for each function making them independent and avoiding delays due to other function accessing the same schema.
- Solution should provide measurable and acceptable performance requirements for users, for different connectivity bandwidths.
- The solution should provide optimal and high performance Portal Solution satisfying response time for slow Internet connections and different browsers.

9.7.2.5. Scalability

The component in the architecture will be capable of being scaled up to more user requests or handling more no. of input resources in various modules. Even inclusion of additional application functionalities can be catered to by upgrading the software editions with minimal effort.

Forward and backward integration (in terms of functions - components, applications, devices, geographical coverage and volume) with all smart city components across the 7+1 layers defined in the overall solution architecture. Such forward or backward integration could take place at any of the layers defined in the over architecture viz. sensor and actuator layer, network layer, data centre layer, application layer, integration layer, service delivery layer, command centre layer, visualisation layer and security layer.

The design of the system to consider future proofing the systems for volume handling requirements

- The application functions to be divided logically and developed as Modular solution.
- The system should be able to scale horizontally & vertically.
- ***Data Volume-*** Ability to support at least 20 % projected volume growth (year on year) in content post system implementation & content migration.
- ***Functionality*** – Ability to extend functionality of the solution without significant impact to the existing functional components and infrastructure.
- **Loose coupling through layered modular design and messaging** - The architecture would promote modular design and layered approach with clear division of responsibility and separation of concerns at the data storage, service and integration layer in order to achieve desired interoperability without any affinity to platforms, programming languages and network technologies. The architecture has to be scalable, maintainable and flexible for modular expansion as more citizen and business services are provided through the Project. Each of the logical layers would be loosely coupled with its adjacent layers
- **Data partitioning and parallel processing** - Project functionality naturally lends itself for massive parallel and distributed system. For linear scaling, it is essential that entire system is architected to work in parallel within and across machines with appropriate data and system partitioning. Choice of appropriate data sources such as RDBMS, Hadoop, NoSQL data stores, distributed file systems; etc. must be made to ensure there is absolutely no “single point of bottleneck” in the entire system including at the database and system level to scale linearly using commodity hardware.
- **Horizontal scale for compute, Network and storage** – Project architecture must be such that all components including compute, network and storage must scale horizontally to ensure that additional resources (compute, storage, network etc.) can be added as and when needed to achieve required scale.

9.7.2.6. No Vendor lock-in and Replace-ability

Specific OEM products may only be used when necessary to achieve scale, performance and reliability. Every such OEM component/service/product/framework/SI pre-existing product or work must be wrapped in a vendor neutral API so that at any time the OEM product can be replaced without affecting rest of the system. In addition, there must be at least 2 independent OEM products available using same standard before it can be used to ensure system is not locked in to single vendor implementation.

9.7.2.7. Security

The security services will cover the user profile management, authentication and authorization aspects of security control. This service run across all the layers since service components from different layers will interact with the security components. All public contents should be made available to all users without authentication. The service will authenticate users and allows access to other features of the envisaged application for which the user is entitled to.

The system should be designed to provide the appropriate security levels commiserate with the domain of operation. Also the system will ensure data confidentiality and data integrity. The application system should have the following

- A secure solution should be provided at the hardware infrastructure level, software level, and access level.
- Authentication, Authorization & Access Control: 3 factors (User ID & Password, Biometric, and Digital Signature) security mechanisms should be implemented to enable secure login and authorized access to portal information and services.
- Encryption Confidentiality of sensitive information and data of users and portal information should be ensured.
- Appropriate mechanisms, protocols, and algorithms necessary to protect sensitive and confirmation data and information both during communication and storage should be implemented.
- Data security policies and standards to be developed and adopted across the Smart City departments and systems
- In order to adequately provide access to secured information, security needs must be identified and developed at the data level. Database design must consider and incorporate data integrity requirements.
- Role based access for all the stake holders envisaged to access and use the system
- Appropriate authentication mechanism adhering to industry good practice of Password Policies etc.
- Ability to adopt other authentication mechanism such as Electronic Signature Certificates
- Authorization validity to be ensured for the users providing the Data to the system. Data should be accepted only from the entity authorized
- Data should be visible only to the authorized entity
- Audit trails and Audit logging mechanism to be built in the system to ensure that user action can be established and can investigated if any can be aided(e.g. Logging of IP Address etc.)
- Data alterations etc. through unauthorized channel should be prevented.
- Industry good practice for coding of application so as to ensure sustenance to the Application Vulnerability Assessment

System must implement various measures to achieve this including mechanisms to ensure security of procurement data, spanning from strong end-to-end encryption of sensitive data, use of strong PKI national standards encryption, use of HSM (Hardware Security Module) appliances, physical security, access control, network security, stringent audit mechanism, 24x7 monitoring, and measures such as data partitioning and data encryption.

Activities such as anti-spoofing (no one should be able to masquerade for inappropriate access), anti-sniffing (no one should be able get data and interpret it), anti-tampering (no one

should be able to put/change data which was not meant to be put/changed) should be taken care for data in transit, as well as data at rest, from internal and external threats.

9.7.2.8. User Interface

The architecture and application solutions to be designed should promote simplicity and ease of use to the end users while still meeting business requirements. It should provide a simpler and more cost-effective solution. Reduces development time and makes the solution easier to maintain when changes in requirements occur.

This will be accomplished by the implementation of rich User Interfaces along with its integration with the DMS, Relational Data Store, Messaging and other external applications.

- Efficient and layout design are the key considerations that enhance usability which should be factored in while designing the application. Standard and consistent usability criteria must be defined. An intuitive, user friendly, well-articulated navigation method for the applications greatly enhances the usability of the application.
- Effective information dissemination
- Enhanced functionalities including personalized delivery of content, collaboration and enriching GUI features.
- Mobile Application Platform
  - Applications and services including all appropriate channels such as SMS/USSD/IVRS and development of corresponding mobile applications to the applications and services leveraging the Mobile Service Delivery Gateway (MSDG) and Mobile App Store.
  - Application platform should support the following smart phone mobile OS (Android 4.0 and above, iOS 4, 5 and above, Windows Phone OS 8.0 and above, Mobile Web App)
  - Support the target packaging components like (Mobile Website, Hybrid App, Native App, Web App and Application Development, Eclipse tooling platforms)
  - Support the ability to write code once and deploy on multiple mobile operating systems
  - Support integration with native device API
  - Support utilization of all native device features
  - Support development of applications in a common programing language
  - Support integration with mobile vendor SDKs for app development and testing
  - Support HTML5, CSS3, JS features for smartphone devices
  - Support common protocol adapters for connection to back office systems (i.e. HTTP, HTTPS, SOAP, XML for format)
  - Support JSON to XML or provide XHTML message transformations
  - Support multi-lingual and language internalization
  - Support encrypted messaging between server and client components

9.7.2.9. Reliability

This is a very crucial system and data are of high sensitivity, the data transfer and data management should be reliable to keep the confidence of the stakeholders. The system should have appropriate measures to ensure processing reliability for the data received or accessed through the application.

It may be necessary to mainly ensure the following

- Prevent processing of duplicate incoming files/data
- Unauthorized alteration to the Data uploaded in the VSCDL system should be prevented
- Ensure minimum data loss(expected zero data loss)

9.7.2.10. Manageability

It is essential that the application architecture handles different failures properly; be it a hardware failure, network outage, or software crashes. The system must be resilient to failures and have the ability to restart, and make human intervention minimal.
All layers of the system such as application, infrastructure must be managed through automation and proactive alerting rather than using 100's of people manually managing. The entire application must be architected in such a way that every component of the system is monitored in a non-intrusive fashion (without affecting the performance or functionality of that component) and business metrics are published in a near real-time fashion. This allows data centre operators to be alerted proactively in the event of system issues and highlight these issues on a Network Operations Centre (NoC) at a granular level. The solution should be envisaged to utilize various tools and technologies for management and monitoring services. There should be management and monitoring tools to maintain the SLAs.

9.7.2.11. Availability

The solution design and deployment architecture will ensure that the application can be deployed in a centralized environment offering system High Availability and failover.
The solution should meet the following availability requirements

- Load Balanced across two or more Web Server avoiding single point of failure
- Deployment of multiple application instances should be possible
- Distributed or load balanced implementation of application to ensure that availability of services is not compromised at any failure instance.
- Network, DC, DR should be available 99.99 % time.

9.7.2.12. SLA driven solution

Data from connected smart devices to be readily available (real-time), aggregated, classified and stored, so as not to delay the business processes of monitoring and decision making, and will enable appropriate timely sharing across the Smart City organization.
Readily available and consumed device data will facilitate timely access of analytics reports at every level and department of the Smart City and provide timely analysis of data as well as monitoring of KPIs through SLAs resulting in effective service delivery and improved decision making.

9.7.2.13. Reconstruction of truth

System should not allow database/system administrators to make any changes to data. It should ensure that the data and file (data at rest) that is kept in the systems has tamper resistance capacity and source of truth (original data of invoices and final returns) could be used to reconstruct derived data such as ledgers and system generated returns. System should be able to detect any data tampering through matching of hash value and should be able to reconstruct the truth.

- Services/solutions should be flexible and extensible to respond to, accommodate and adapt to changing business needs and unanticipated requirements easily. Consolidate and simplify technology applications wherever possible to minimize complexity. Ongoing application, database and server consolidation may be required.
- Software should use meta-data to configure itself (using declarations rather than coding).
- Avoid proprietary solutions and technologies if possible. Consider adhering to latest industry best practices and technical standards.
- The infrastructure should support an environment that allows applications to start small, grow quickly, and operate inexpensively. An adaptable infrastructure provides the capability to add to the current infrastructure with minimum inconvenience to the user.
- The IT architecture should be designed to support the overall SLA requirements around scalability, availability and performance.
- Each application should be performance tested to identify performance issues. The potential performance bottlenecks need to be identified and cost-effective paths for performance improvements should be provided for these identified problem areas.
- The system infrastructure should be architected considering failover requirements and should ensure that a single server or network link failure does not bring down the entire system.

- The system should be reliable handling every request and yield a response. It should handle error and exception conditions effectively.

9.7.2.14. Integration Architecture

This section recommends the proposed integration architecture aligning with the overarching architectural principles.

The following are the integration specifications for the various integration scenarios -

Real-time integration

All the Smart City applications will be deployed in the Data Centre while any external application of the Smart City ecosystem will reside in outside premises.

The need for a Service Oriented Architecture (SOA) is felt that will facilitate VSCDL in defining an enterprise integration platform. An SOA platform will help in data exchange across applications in real-time mode (both synchronous and asynchronous), promote loose coupling with ease of maintenance and change, facilitate rapid composition of complex services, achieve scalability through modularity, and improved business visibility.

SOA is an architectural style that allows the integration of heterogeneous applications & users into flexible service delivery architecture. Discrete business functions contained in enterprise applications could be organized as layers of interoperable, standards-based shared "services" that can be combined, reused, discovered and leveraged by other applications and processes.

The following are the various integration modes and techniques that could be leveraged -

- SOAP web service based interfacing technique will be leveraged as the real-time point to point synchronous integration mode with external or third party systems. The following integration points could be considered for SOAP web service based interfacing -
  - Payment gateway of the authorized banks to enable authorized users make financial transactions for the Smart City services availed by them. This should support a unified interface to integrate with all Payment Service Providers using web services over secured protocols.
  - SMS application, acting as the SMS Gateway, will make use of APIs for SMS communication to GSM network using the GSM modem, which can be both event-driven as well as time-driven. The API will be exposed to initiate the broadcasting or alert notification.
  - Social Media Apps and NoSQL data stores to exchange photos, videos and message feeds, based on interactions with Citizens and Business as well as comments/posts to inform stakeholders
  - IVR/Customer Support solution with ERP and Transactional Data Repository to exchange citizen and business demographic, registration and payment data as well as transactional data related to citizen services and municipal operations.
- Message based interfacing technique will be leveraged for real-time asynchronous integration mode. The following integration points could be considered for message based interfacing -
  - Central LDAP with ERP to synchronize member and employee user registration data
  - Payment solution and ERP to exchange payment data for tracking of beneficiary's payment transactions against different services (citizen, workers, transporter, vendor), master data (employee, vendor/supplier, location, facilities, price table)
  - Employee attendance data with ERP (HR Module) to capture data pertaining to employee location and attendance

  - Departmental applications with ERP (Asset Management module) to exchange data for procurement and maintenance of any assets or infrastructure items for each department.
  - Municipal operations application with ERP (Material Management module) to capture materials related transaction and inventory data for public works
  - Other government applications with Smart City application to exchange data for government procurement, public health schemes, welfare schemes, citizen health, etc.
- RESTful API service based interfacing technique will be leveraged for the following integration areas-
  - Access and use of various services provided by the different departments for citizens and business community will be done through a RESTful, stateless API layer.
  - Access and use of various internal functions related to operations and administration of Smart City for departmental and VSCDL employees will be done through a RESTful, stateless API layer
- Data integration in batch mode will be through ETL. The following integration points could be considered for ETL based data integration -
  - Initial data migration to cleanse, validate and load the data extracted from source systems into target tables
  - Data load from all the individual transactional systems like ERP, Grievance Redressal to central enterprise data warehouse solution for aggregation, mining, dashboard reporting and analytics.

Process Integration layer of the VSCDL solution will automate complex business processes or provide unified access to information that is scattered across many systems. Process Integration will provide a clean separation between the definition of the process in the process model, the execution of the process in the process manager, and the implementation of the individual functions in the applications. This separation will allow the application functions to be reused in many different processes.

An enterprise service bus (ESB) is a software architecture model used for designing and implementing the interaction and communication between mutually interacting software applications in Service Oriented Architecture. As software architecture model for distributed computing it is a variant of the more general client server software architecture model and promotes strictly asynchronous message oriented design for communication and interaction between applications. Its primary use is in Enterprise Application Integration of heterogeneous and complex landscapes. Following are the requirement for an ESB system:

- The solution should support static/deterministic routing, content-based routing, rules-based routing, and policy-based routing, as applicable in various business cases.
- The solution should have capabilities to receive input message in heterogeneous formats from various different systems, interpret those messages, process and transform those messages to generate output and feed them to various different clients as per formats applicable.
  - The solution should have features to communicate across different services, process them and expose as single aggregate service to facilitate business functionality
  - ESB should support SOA standards such as XML, XSLT, BPEL, web services standards and messaging standards.
  - ESB should support all industry standards interfaces for interoperability between different systems

There are four integration gateways envisaged as part of the solution design. The key requirements with respect to each of these are mentioned below:

SMS Gateway: SMS services are envisaged to be made available as part of the solution design. The service provider may integrate the solution with MSDG (or existing one), and use the services available through it, or deploy its own SMS Gateway services at no extra charge to VSCDL but it is a mandatory requirement that all the SMS based services (alerts and notifications) should be available as part of the solution. Following are some of the key requirements for the SMS services through the solution:

- Should contain required details/information and targeted to the applicant or designated officers of tax departments and other stakeholders and users as per prevailing TRAI norms
- Facilitate access through access codes for different types of services
- Support automated alerts that allows to set up triggers that will automatically send out reminders
- Provide provision for International SMS
- Provide provision to receive messages directly from users
- Provide provision for personalized priority messages
- Resend the SMS in case of failure of the message
- Provide messaging templates

Email Services: Email services are envisaged to be made available as part of the solution design to send alerts/intimations/automated messages to registered email ids, based on preferences set up/opted by individual users. An authenticated SMTP mail service (also known as a SMTP relay or smart host) is envisaged to be integrated with the solution for sending mail from the solution, and delivered to intended inbox. Support antispam features.

Payment Gateway: The solution is envisaged to have integration with payment gateways, to enable authorized Users make financial transactions, as per rights and privileges provided to him/her. The service provider is required to make the provisions for integration with such third party gateways and provide payment services, as per requirement of the <<URBAN LOCAL BODY>>. Some of the key features of payment gateway are mentioned below:

- Should support secure integration with Payment Service Providers
- Should support a unified interface to integrate with all Payment Service Providers
- Should support integration with Payment Service Providers using web services and over HTTP/S protocol
- Should manage messages exchange between UI and payment service providers
- Should support beneficiary's payment transactions tracking against various services
- Should support bank accounts reconciliation
- Should provide logs for all transactions performed through the Payment Gateway for future financial dispute resolution that might arise between entities and either beneficiaries or Payment Service Providers
- Should maintain and keep transactions logs for time period required and specified by the financial regulations followed in country
- Should support redundant Payment Discovery
- Should submit Periodic Reconciliation Report to government entities
- Should support transaction reports to monitor and track payments
- Should support real-time online credit card authorization for merchants

- Should support compliance with emerging trends and multiple payment options such debit card, credit card, cash cards and other payment gateways
- Should provide fraud screening features
- Should support browser based remote administration
- Should support multicurrency processing and settlement directly to merchant account
- Should support processing of one-time or recurring transactions using tokenization
- Should support real time integration with SMS and emails

IVR Services: IVR services are envisaged as part of Call Centre facility, which will be integrated with the solution, to provide information and services to the people who would contact the Call Centre: Some of the key features of the IVR services are mentioned below:

- Should provide multi-lingual content support
- Should facilitate access through access codes for different types of services
- Should support Web Service Integration
- Should support Dual Tone Multi Frequency (DTMF) using telephone touchpad - in-band and out-of-band
- Should support for Voice Extensible Markup Language (VoiceXML)
- Should support speech recognition that interprets spoken words as texts (Advanced Speech Recognition).
- Should support playing of pre-recorded sounds
- Should support redirection to human assistance, as per defined rules
- Should be able to generate Data Records – (CDRs) and have exporting capabilities to other systems
- Should provide provision for voice mailbox and voice recognition

There are multiple ways of integration of the solution with other systems is envisaged. These may be through Web Services, Message Queuing, File based or API based. The integration and data sharing mechanism may be either in Batch Mode or Needs basis (synchronous or asynchronous). Some of the key requirements of the interface/integration are mentioned below:

  - Interface Definition
  - Interface Owner
  - Interface Type
  - Interface Format
  - Frequency
  - Source System
  - API/Service/Store Procedure
  - Entitlement Service
  - Consuming System
  - Interface Layout (or) Schema
- Should have provision for exceptional scenarios
- Should have syntax details such as data type, length, mandatory/option, default values, range values etc.
- Error code should be defined for every validation or business rule
- Inputs and outputs should be defined
- Should be backward compatible to earlier datasets
- Data exchange should provide transactional assurance
- Response time and performance characteristics should be defined for data exchange

- The failover scenarios should be identified
- Data exchange should be auditable

9.8. Security

Data exchange should abide by all laws on privacy and data protection Security Architecture This section recommends the proposed security architecture aligning with the overarching architectural principles. The basic tenets of Smart City security architecture are the design controls that protect confidentiality, integrity and availability of information and services for all the stakeholders.

9.8.1.1. User Security and Monitoring

Authentication & Authorization

A strong authentication mechanism should be considered to protect unauthorized access to the Smart City applications. Consider use of at least two of the following forms of authentication mechanism:

- Something you know, such as a password, PIN etc
- Something you have, such as a smart card, hardware security token etc
- Something you are, such as a fingerprint, a retinal scan, or other biometric methods

Levels of Authentication

Based on the security requirements the following levels of authentication should be evaluated.

- For applications handling sensitive data it is recommended that in the least one factor authentication key in the form of a password is essential. Strong password complexity rules should be enforced to ensure confidentiality and integrity of the data
- For applications handling highly sensitive data it is recommended that two factor authentication mechanisms should be considered. The first line of defence is the password conforming to the password complexity rules'. Along with the password next user has to provide a one-time password which varies for each session. One time passwords are valid for each session and it is not vulnerable to dictionary, phishing, interception and lots of other attacks. A counter synchronized One-Time Password (OTP) solution could be used for this purpose.

Authorization

Authorization of system users should be enforced by access controls. It is recommended to develop access control lists. Consider the following approach for developing access control list -

- Establish groups of users based on similar functions and similar access privilege.
- Identify the owner of each group
- Establish the degree of access to be provided to each group

9.8.1.2. Data Security

Traditional Structured Enterprise Data

VSCDL should protect Integrated Project information against unauthorized access, denial of service, and both intentional and accidental modification. Data security, audit controls and integrity must be ensured across the data life cycle management from creation, accessed, viewed, updated and when deleted (or inactivated). This provides a proactive way to build defences against possible security vulnerabilities and threats, allowing errors to be corrected and system misuse to be minimized.

The implications for adhering to an effective data security and integrity guideline related to the Project are the following –

- Data security policies and standards to be developed and adopted across VSCDL Smart City applications and stakeholders
- Data security controls to be put in place to restrict access to enterprise data based on roles and access privileges. Data audit logs should be maintained for audit trail purposes. Security controls will be able to be reviewed or audited through some qualitative or quantitative means for traceability and to ensure that risk is being maintained at acceptable levels.
- In order to adequately provide access to secured information, security needs must be identified and developed at the data level, not the application level. Database design must consider and incorporate data integrity requirements.
- Procedures for data sharing need to be established. Data integrity during data synchronization needs to be ensured across the enterprise.
- *Audit Capabilities:* The system provides for a system-wide audit control mechanism that works in conjunction with the RDBMS.
- *Maintaining Date/Time Stamp and User Id:* Every transaction, with a date and time and User ID, is captured. The system allows generating various audit reports for verification.
- *Access Log:* The VSCDL Project should have extensive inbuilt security and access control mechanisms. Based on this, the system keeps track of the various functions accessed by any users.

Audit Trail & Audit Log

Audit trails or audit logs should be maintained. Log information is critical in identifying and tracking threats and compromises to the environment.

There are a number of devices and software that should be logged which include hardware & software based firewalls, web servers, authentication servers, central/domain controllers, database servers, mail servers, file servers, routers, DHCP servers etc.

It is essential to decide what activities and events should be logged. The events which ideally should be captured include

- Create, read, update and delete of confidential information;
- User authentication and authorization activities in the system, granting, modification or revoking of user access rights;
- Network or service configuration changes;
- Application process start up, shutdown or restart, abort, failure or abnormal terminations, failure of network services;
- Detection of suspicious activities such as from Intrusion Detection and Prevention system, anti-virus, anti-spyware systems etc.

9.8.1.3. Application Security

- Project must comply with the Application Security Plan and security guidelines of Government of India as applicable
- Secure coding guidelines should be followed. Secure coding guidelines should include controls against SQL injection, command injection, input validation, cross site scripting, directory traversal, buffer overflows, resource exhaustion attacks etc. OWASP Top 10 standard should be mapped in the secure coding guidelines to cover all major vulnerabilities.

- Validation checks should be incorporated into the application to detect any corruption of information through processing errors or deliberate acts.
- Data output from an application should be validated to ensure that the processing of stored information is correct and appropriate to the circumstances
- Should implement secure error handling practices in the application
- Project should have Role based access, encryption of user credentials. Application level security should be provided through leading practices and standards including the following:
  - Prevent SQL Injection Vulnerabilities for attack on database
  - Prevent XSS Vulnerabilities to extract user name password (Escape All Untrusted Data in HTML Contexts and Use Positive Input Validation)
  - Secure Authentication and Session Management control functionality shall be provided through a Centralize Authentication and Session Management Controls and Protect Session IDs from XSS
  - Prevent Security Misconfiguration Vulnerabilities (Automated scanners shall be used for detecting missing patches, misconfigurations, use of default accounts, unnecessary services, etc. maintain Audits for updates
  - Prevent Insecure Cryptographic Storage Vulnerabilities (by encrypt off-site backups, ensure proper key storage and management to protect keys and passwords, using a strong algorithm)
  - Prevent Failure to Restrict URL Access Vulnerabilities (By providing authentication and authorization for each sensitive page, use role-based authentication and authorization and make authentication and authorization policies configurable
  - Prevent Insufficient Transport Layer Protection Vulnerabilities (enable SSL for all sensitive pages, set the secure flag on all sensitive cookies and secure backend connections
  - Prevent Id Redirects and Forwards Vulnerabilities
  - For effective prevention of SQL injection vulnerabilities, SI should have monitoring feature of database activity on the network and should have reporting mechanism to restrict or allow the traffic based on defined policies.

9.8.1.4. Infrastructure Security

The following focused initiatives to discover and remedy security vulnerabilities of the IT systems of VSCDL Smart City should be considered to proactively prevent percolation of any threat vectors -

- Deploy anti-virus software to all workstations and servers to reduce the likelihood of security threats;
- Deploy perimeter security technologies e.g. enterprise firewalls to reduce the likelihood of any security threat;
- Deploy web content filtering solutions to prevent threats from compromised websites to help identify and block potentially risky web pages;
- Install enterprise-level e-mail anti-security software to reduce vulnerability to phishing and other e-mail security spams. This would check both incoming and outgoing messages to ensure that spam messages are not being transmitted if a system becomes compromised.
- Perform periodic scanning of the network to identify system level vulnerabilities

- Establish processes for viewing logs and alerts which are critical to identify and track threats and compromises to the environment. The granularity and level of logging must be configured to meet the security management requirements.
- Deploy technology to actively monitor and manage perimeter and internal information security.
- Deploy network Intrusion Detection System (IDS) on the perimeter and key points of the network and host IDS to critical systems. Establish process to tune, update, and monitor IDS information.
- In case of cloud deployment, cloud services can be disrupted by DDoS attacks or misconfiguration errors which have the potential to cascade across the cloud and disrupt the network, systems and storage hosting the cloud application.
- Deploy security automation techniques like automatic provisioning of firewall policies, privileged accounts, DNS, application identity etc.

9.9. Software Development Lifecycle

Continuous Build

The Vadodara Project should be highly modular and parallel development should be carried out for faster execution using industry's best Software Development Lifecycle practices. All application modules within the same technology platform should follow a standardized build and deployment process.

A dedicated 'development / customization' environment should be proposed and setup. The SI must provision separate development and testing environment for application development and testing. Any change, modifications in any module must follow industry standard processes like change management, version control and release management in large and complex application development environment.

Application source code could be maintained in source control and could be broken up into a number of projects. Source control projects are created to abstract related set of modules or feature that can be independently included in another application.

It is a mandatory to create, update and maintain all relevant documentation throughout the contract duration. Also it should be ensured that a bug tracking toll is maintained for proper tracking of all bugs fixes as per various tests conducted on the application.

9.10. Quality Assurance

A thorough quality check is proposed for the Vadodara Project and its modules, as per standard Software Development Life Cycle (SDLC). SI is expected to lay down a robust Quality Assurance program for testing of the developed application for its functionality, performance and security before putting in production environment. The program must include an overall plan for testing and acceptance of system, in which specific methods and steps should be clearly indicated and approved by <<URBAN LOCAL BODY>>. SI is required to incorporate all suggestions / feedback provided after the elaborate testing of the system, within a pre-defined, mutually agreed timeline. SI must undertake the following:

- Outline the methodology that will be used for testing the system.
- Define the various levels or types of testing that will be performed for system.
- Provide necessary checklist/documentation that will be required for testing the system.
- Describe any technique that will be used for testing the system.
- Describe how the testing methodology will conform to the requirements of each of the functionalities and expected outcome.

- Indicate / demonstrate to VSCDL that all applications installed in the system have been tested.

9.10.1. Performance and Load Testing

SI is expected to implement performance and load testing with following features:

- Testing workload profiles and test scenarios based on the various functional requirements should be defined. Application as well as system resource utilization parameters that need to be monitored and captured for each run also needs to be defined.
- Should support application testing and API testing including HTTP(s), web services, mobile applications and different web 2.0 frameworks such as Ajax/Flex/HTML5.
- SI should perform the load testing of Vadodara Project for multiple workload profiles, multiple scenarios, and user loads to handle the envisaged users of the system.
- Different activities before load testing i.e. identification of work load profiles, scenarios, information capturing report formats, creation of testing scripts, infrastructure detailing and workload profile should be prepared before the start of actual load testing exercise.
- Solution parameters needs to be tuned based on the analysis of the load testing reports. The tuning process could be iterative until the issues are closed. Multiple load runs needs to be executed for users to simulate different scenarios, such as peak load (year end, quarter end, etc.), load generation within the LAN, Load generation across WAN or mobile network simulator while introducing configurable latency/jitter/packet loss etc.
- Should eliminate manual data manipulation and enable ease of creating data-driven tests.
- Should provide capability to emulate true concurrent transactions.
- Should identify root cause of performance issues at application or code level. Include code performance analysis to quickly pinpoint component-level bottlenecks: Slowest classes and methods, most frequently called methods, most costly (aggregate time spent for each method), response time variance etc.
- Should allow selection of different network bandwidth such as analog modems, ISDN, DSL, or custom bandwidth.
- Should be able to monitor various system components e.g. Server (OS, Web, Application & Database) Monitoring, Network (between Client & Server) Delay Monitoring, Network Devices (Firewall, Switch & Router) Monitoring during the load test without having to install any data capturing agents on the monitored servers/components
- Should correlate response times and system performance metrics to provide quick insights in to root cause of performance issues.
- Reports on following parameters (but not limited to) such as transaction response time, transaction per second (Passed), user interface rendering time, transaction per second (Failed), web transaction breakdown graphs, hits per second, throughput, HTTP responses per Second, pages downloaded per second, system infrastructure performance metrics etc.
- Should provide End-to-End system performance analysis based on defined SLAs. Should monitor resource utilization including memory leakage, CPU overload and network overload. Should have the ability to split end-to-end response time for Network & Server(s) and provide drill-down capability to identify and isolate bottlenecks.

9.11. Advertising and Marketing Guidelines

The SI is required to obtain approvals from VSCDL/VMC before undertaking any advertisement and marketing opportunities through any of the Smart Elements. The SI shall follow following guidelines while undertaking such advertisements or marketing strategies:

a) SI shall be responsible for safeguarding the aesthetics of the location and shall not compromise on any tangible or intangible assets of VSCDL/VMC while undertaking these advertising or marketing campaigns.

b) VSCDL will approve SI's advertisement strategy and execution plan keeping in mind that users are not inundated with advertisements to an extent that it impacts user experience.

c) SI shall take approval from VSCDL on the content, design, size, duration of such advertisements / marketing strategies.

d) SI will not self-proclaim the ownership for carrying out activities under the project in the form of advertisement or marketing activities.

e) The revenue generated from advertising and marketing activities need to be reported to VSCDL, in the format & periodicity as decided by VSCDL.

f) SI shall take utmost care not to infringe into the privacy of residents / tourists.

10. Annexure VI- Common guidelines/requirements regarding compliance of systems/ equipment

10.1. OEM Selection Criteria

#	Component	Selection criteria for the OEM
A	**Surveillance/CCTV Components**	
1	**CCTV Cameras**	• Minimum installation base of 50,000 IP based cameras across globe as on 31/03/2016 **and** Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally) of minimum 500 IP based city/outdoor cameras each in last 3 years **OR** • From any of Top 10 OEM from Latest IHS World Report for Network Security Cameras, Report for Security Cameras & Report for Intelligent Cameras
2	**Video Management System Software**	• Minimum installation base of 50 projects across globe as on 31/03/2016 **and** Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally, covering open public places) of minimum 500 city/outdoor cameras each in last 3 years **OR** • From any of Top 10 OEM from Latest IHS World Report for Video Management Software
3	**ANPR Cameras and ANPR Solution**	ANPR Camera • Minimum installation base of 5,000 cameras across globe as on 31/03/2016 **and** Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally) for supporting minimum 50 ANPR solutions in each in last 3 years ANPR Solution • Should have been operational for min. 50 ANPR cameras in City/outdoor CCTV Surveillance projects across India in last 3 years. Out of these projects at least one project should have min. 25 ANPR camera running on the offered ANPR solution.
4	**Other Video Analytics**	• Minimum installation base of 5,000 cameras across globe and Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally) of minimum 100 city/outdoor cameras each in last 3 years **OR** • From any of Top 10 OEM from Latest IHS World Report for Analytics
5	**ONVIF Compliance**	All CCTV Cameras, Video Management System, Video Analytics Solution/Software and any video/image processing solution within overall project offering should be ONVIF Core Specification '2.X' or 'S' compliant and provide support for ONVIF profiles such as Streaming, Storage, Recording, Playback etc.
B	**IT Infrastructure Components**	
1	**Edge Level (Field) Switches**	• Minimum installation base of 5,000 switches across globe as on 31/03/2016 and Should have been operational for at least 2 City/outdoor CCTV Surveillance projects (globally) for

#	Component	Selection criteria for the OEM
		supporting minimum 500 city/outdoor network devices (such as camera, controller etc.) each in last 3 years OR • OEMs who are amongst the top 5 for World-wide Market share in terms of Revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
2	**Other Switches, and Routers**	• OEMs who are amongst the top 5 for World-wide Market share in terms of Revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
3	**Servers, Workstations, Desktop PC and Laptops**	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
4	**Storage Solution**	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
5	**Backup Device and Backup Software**	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
6	**EMS (Enterprise Management System)**	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
7	**Centralised Antivirus Solution**	• OEMs who are amongst the top 5 for world-wide market share in terms of revenue as per IDC / Similar organisation's latest published quarterly report / presence in the latest Magic Quadrant by Gartner.
8	**Other Smart Elements (ATCS, Variable Msg Sign Board, Env Sensor, ECB, PA)**	• Products / Solutions should have been implemented in at least 2 similar projects. Bidder to provide declaration from OEM along with the details of the projects of respective products / solutions are implemented, with following details : City name, Client Name, Duration and Value of the project , Number of sensors implemented etc.

Note: The Bidder shall attach relevant latest report(s), that specifies meeting above OEM selection criteria

10.2. Treatment for existing OEM products/solutions

VMC has purchased certain licenses (as per information given in Annexure IX), for the following major software solutions, as part of Vadodara Eye Project:.

#	Solution Component	OEM of existing solution
1	Video Management System	Milestone XProtect
2	Video Analytics	IBM IVA

#	Solution Component	OEM of existing solution
3	CCC Software	IBM Intelligent Operations Centre (IOC)
4	EMS Solution	IBM Tivoli

The bidder may propose same OEM (Solution) and provide additional license and products from same OEM, to meet the RFP requirements. Or they can offer additional licenses from different OEM and integrate systems with components from both OEM, so as to provide single, integrated solution. In this case, the existing solution implementation/configuration shall not be disturbed.

10.3. Other/General Criteria

1. The specifications mentioned for various IT / Non-IT components are indicative requirements and should be treated for benchmarking purpose only. SIs are required to undertake their own requirement analysis and may propose higher specifications that are better suited to the requirements.
2. In case of addition/update in number of license for the Integrated Command and Control Centre (CCC) software and VMS/VA licenses for Cameras, the SI is required to meet of technical specifications contained in the RFP and for the upward revisions and/or additions of licenses are required. The software licenses provided should be perpetual and at enterprise level such that VSCDL (or any entity as determined by VSCDL) can use the software products irrespective of number of users and number of field devices (Sensors, cameras, etc.) or number of cores of computer. Additions to users or filed devices or number cores will have to be done at no additional cost.
3. Any manufacturer and product name mentioned in the Tender should not be treated as a recommendation of the manufacturer / product, unless specifically mentioned so.
4. None of the IT / Non-IT equipment's proposed by the SI should be End of Life product. It is essential that the technical proposal is accompanied by the OEM certificate in the format given in Volume I of this Tender, where-in the OEM will certify that the product is not end of life product & shall support for at least 6 years from the date of Bid Submission.
5. All IT Components should support IPv4 and IPv6
6. Technical Bid should be accompanied by OEM's product brochure / datasheet. SIs should provide complete Make, model, part numbers and sub-part numbers for all equipment/software quoted, in the Technical Bid, as per section 11.1 (Volume 1)
7. SIs should ensure complete warranty and support for all equipment from OEMs. All the back-to-back service agreements should be submitted along with the Technical Bid.
8. All equipment, parts should be original and new.
9. The user interface of the system should be a user friendly Graphical User Interface (GUI).
10. Critical core components of the system should not have any requirements to have proprietary platforms and should conform to open standards.
11. For custom made modules, industry standards and norms should be adhered to for coding during application development to make debugging and maintenance easier.

Object oriented programming methodology must be followed to facilitate sharing, componentizing and multiple-use of standard code. Before hosting the application, it shall be subjected to application security audit (by any of the CERTIN empanelled vendors) to ensure that the application is free from any vulnerability; and approved by the VSCDL.

12. All the Clients Machines / Servers shall support static assigned IP addresses or shall obtain IP addresses from a DNS/DHCP server.
13. The Successful SI should also propose the specifications of any additional servers / other equipment/hardware/software, if required for the system.
14. The indicative architecture of the system is given in this volume. The Successful SI must provide the architecture of the solution it is proposing.
15. The system servers and software applications will be hosted in Data Centres as specified in the Bid. It is important that the entire set of Data Centre equipment are in safe custody and have access from only the authorized personnel and should be in line with the requirements & SLAs defined in the Tender.
16. The Servers provided should meet industry standard performance parameters (such as CPU Utilisation of 60 percent or less, disk utilisation of 75 percent or less). In case any non-standard computing environment is proposed (such as cloud), detail clarification needs to be provided in form of supporting documents, to confirm (a) how the sizing has been arrived at and (b) how SLAs would be met.
17. SI is required to ensure that there is no choking point / bottleneck anywhere in the system (end-to-end) and enforce performance and adherence to SLAs. SLA reports must be submitted as specified in the Bid without fail.
18. All the hardware and software supplied should be from the reputed Original Equipment Manufacturers (OEMs). VSCDL reserves the right to ask replacement of any hardware / software if it is not from a reputed brand and conforms to all the requirements specified in the tender documents.
19. System Integrator shall place orders on various OEMs directly and not through any sub-contractor / partner. All licenses should be in the name of the VSCDL .

11. *Annexure VII- Minimum Qualifications for Key Project resources*

#	Manpower	Minimum Qualifications
1	Project Head/Director	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 good 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 value of minimum INR 30 crores. 6. Excellent writing, communication, time management and multi-tasking skills 7. Project Experience of managing various components of Smart City Projects, covering at least 3 initiatives mentioned in this RFP.
2	Assistant Project Manager (Dedicated On premise)	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech. / B.E. from a reputed institute 2. Total Exp: At least 7 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 5 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.
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 Experts	1. Minimum Education: MCA/ MBA/M. Tech & B.Tech / B.E. 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 5 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 7 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 8. Projects covering at least the initiatives mentioned in this RFP.
6	Full Time- on project- Functional Manager – CCC Expert	1. Should have fundamental comprehension across areas such as Command and Control Centre Operational Software, Network Infrastructure, CCTV/Surveillance, Security management, ERP, Citizen Portal, Mobile Applications, integration of Third Party Shared Services, Wifi, Smart (IOT) Devices/Sensors etc. 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 Command and Control Centre, CCTV, Smart Sensors and Citizen Portal/Apps. 4. At least 3 years of experience in implementing CCC software from same OEM, which is offered as part of the bid. 5. Proficient in MS Project (Word, Excel, Powerpoint)
	Project Support Staff	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, Gujarati and Hindi).

8	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, Gujarati 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, Gujarati 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, Gujarati 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, Gujarati and Hindi)
15	Database Developer	1. BE Computers or Diploma with specialization in computers with minimum three years of experience in Database development and database management 2. Minimum five years of experience in Database management and 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 with minimum five years' experience in Database Administration 2. Minimum five years of experience in Database management and 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 course duration of minimum 1 year from Govt. recognized institution. 2. Minimum three years of experience in network implementation and network administration 3. Should have experience performing network testing, equipment testing, fault analysis, network repairs, etc. 4. Should have experience in government projects
18	Technical Expert – Network Admin and Security (Dedicated On premise)	1. Master or Engineering Degree in Computer Hardware and Networking 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 complex IT/ITES/Telecom projects, exposure to network security 3. Should have certifications of industry leading network administration solutions 4. Should have experience in government projects
19	Server Administrator	1. Diploma in Computers with minimum three years of experience in server administration for large and complex IT/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)
	Technical Expert (VMS) (Dedicated on site)	1. B.E/ B.Tech/ MCA/ M.Tech with minimum five years of experience in VMS Implementation/management
21	Quality Assurance Manager	1. B.E/ B.Tech/ MCA/ M.Tech with minimum five years of experience in Systems/Software Quality Assurance 2. Experience devising and establishing a project's quality procedures, standards and specifications, increasing operational efficiency, setting up and maintaining controls and standard operating procedures, creating performance matrix and monitoring performance by gathering relevant data and producing statistical reports, etc. 3. Should have experience setting standards for quality as well as health 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, Gujarati and Hindi)

22	Software Developer	1. B.E/ B.Tech/ MCA/ M.Tech with minimum 4 years of experience in Software application development, programming languages and databases 2. Should have experience in government projects 3. Proficient in MS office and MS Project 4. Effective verbal communication skills (English, Gujarati and Hindi)
23	Testing Engineer	1. B.E/ B.Tech/ MCA/ M.Tech with minimum 4 years of experience in Software and Web Application testing, JAVA Applications. 2. Should have experience in government projects 3. Should have experience with different forms of testing like unit testing, system testing, integration testing, performance testing, load testing, network testing, equipment testing, etc. 4. Should have at least 4 years of experience in manual or automated testing 5. Should have knowledge of leading testing tools 6. Proficient in MS office and MS Project 7. Effective verbal communication skills (English, Gujarati and Hindi)
24	Helpdesk Support Staff (Dedicated onsite)	1. Graduate in any discipline with experience of diagnosing hardware and software malfunctions, troubleshooting problems, replacing hardware and installing new software. 2. Minimum years experience in a similar role including for customer support, computers and network. 3. Effective verbal communication skills (English, Gujarati and Hindi)
	DC Electrician (Dedicated onsite)	1. H.Sc. Pass + ITI Electrician Course or Equivalent 2. 2 year experience in data centre electrical works
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, Gujarati and Hindi)

12. *Annexure VIII: Drawings of CCC Building at Badamadi Baug*

12.1. 3D Elevations of the CCC Building

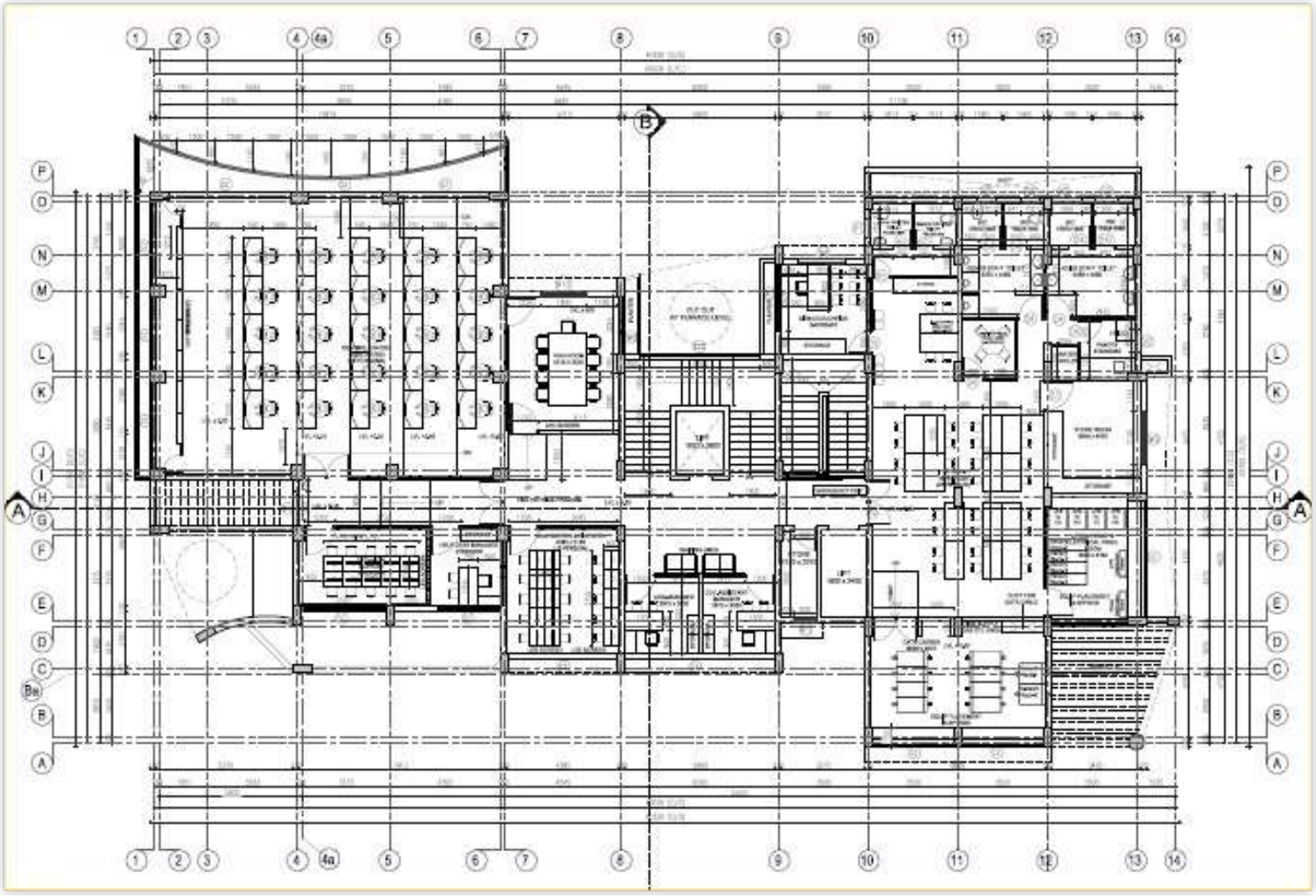
Front View

Left Side View

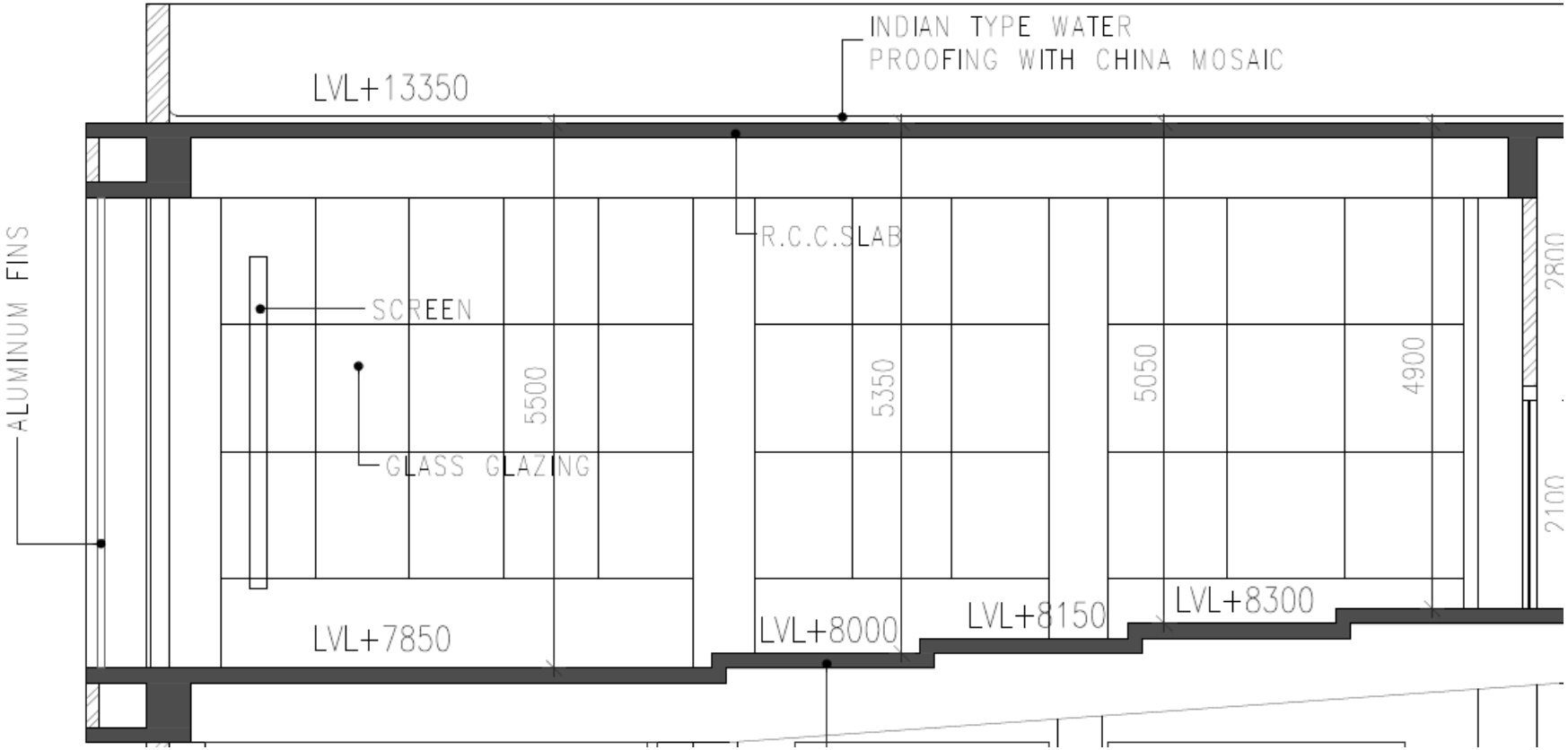
Rear View

Right Side View

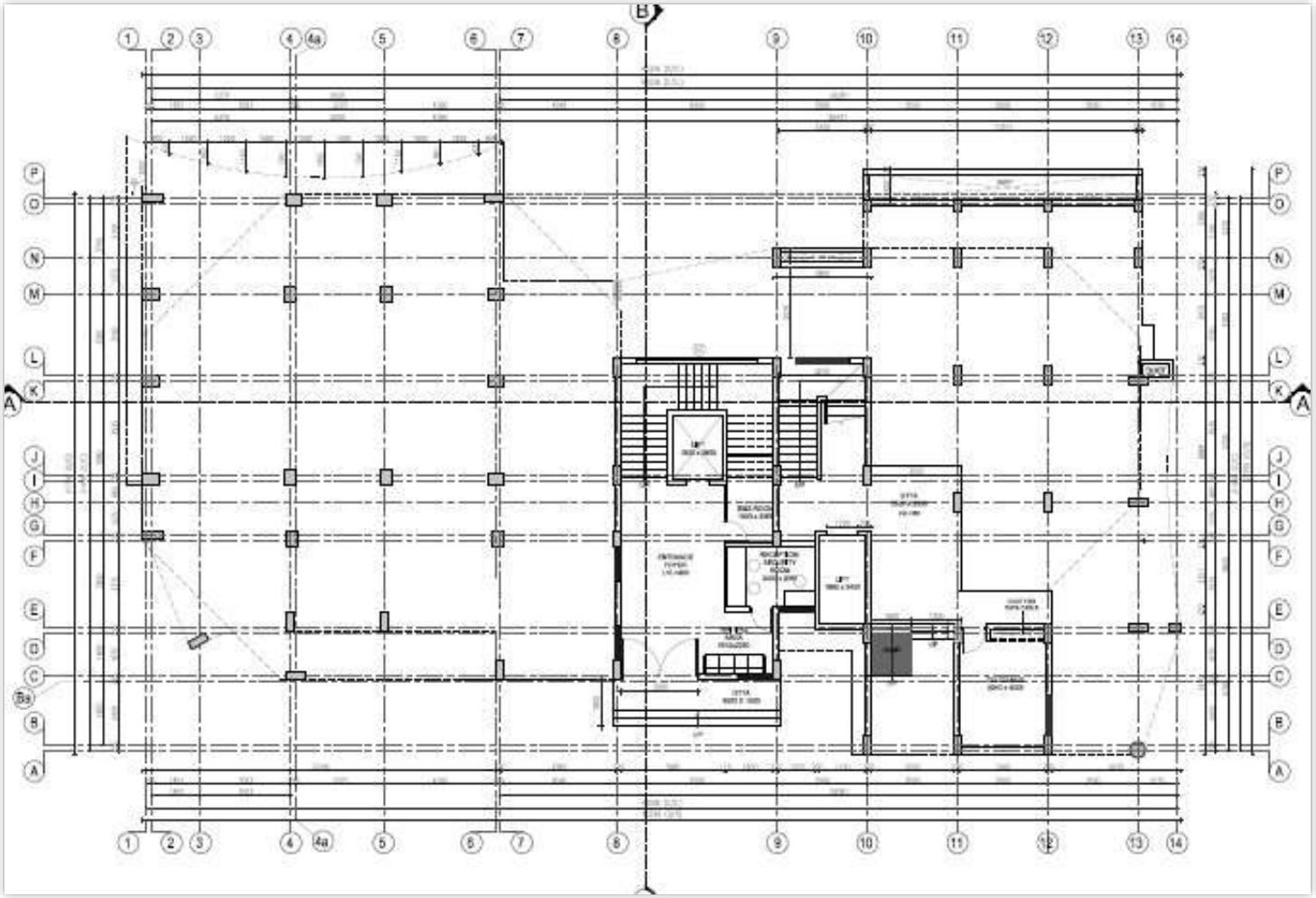
12.2.Second Floor of CCC Building



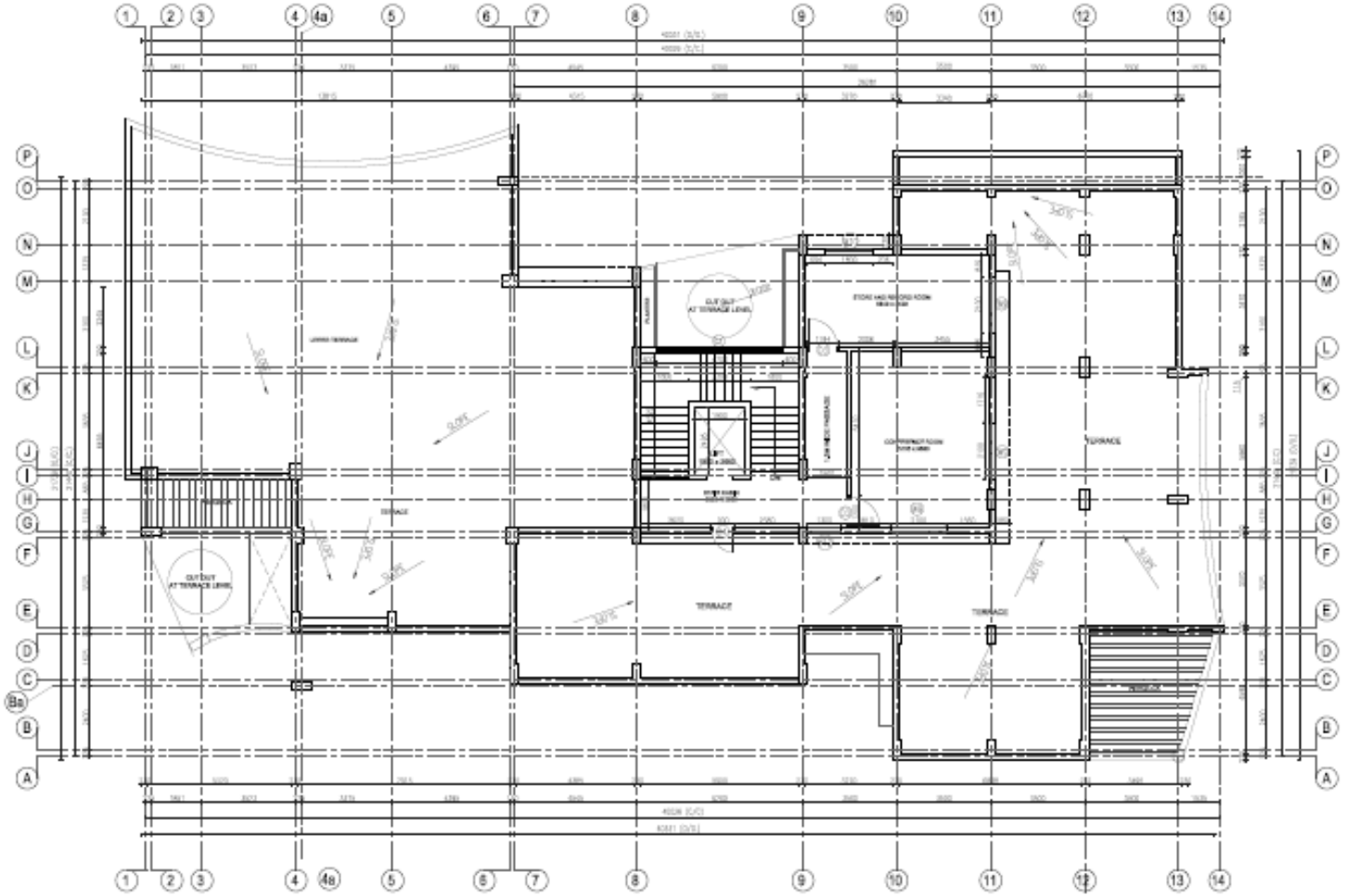
12.3.Sectional view of the CCC Room



12.4.Ground Floor (Reception) of CCC Building

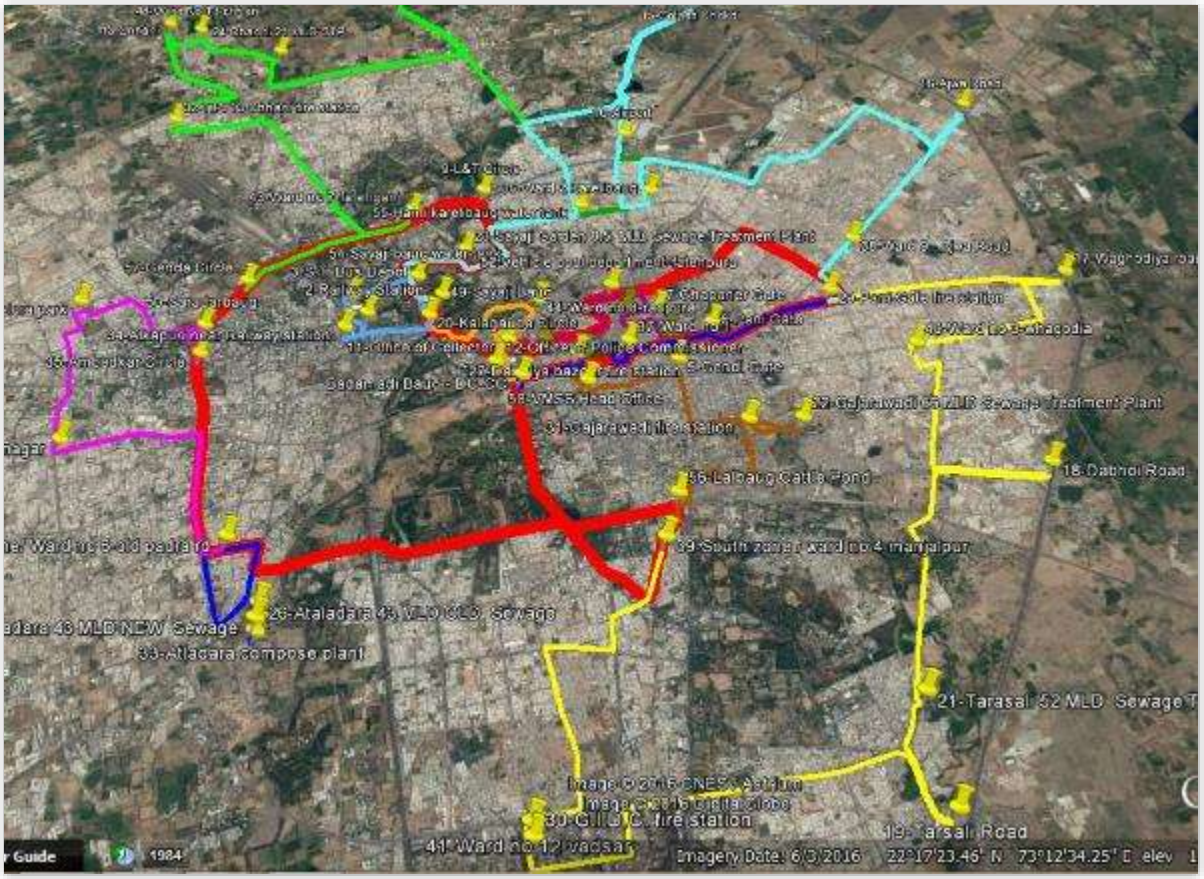


12.5. Third Floor of CCC Building

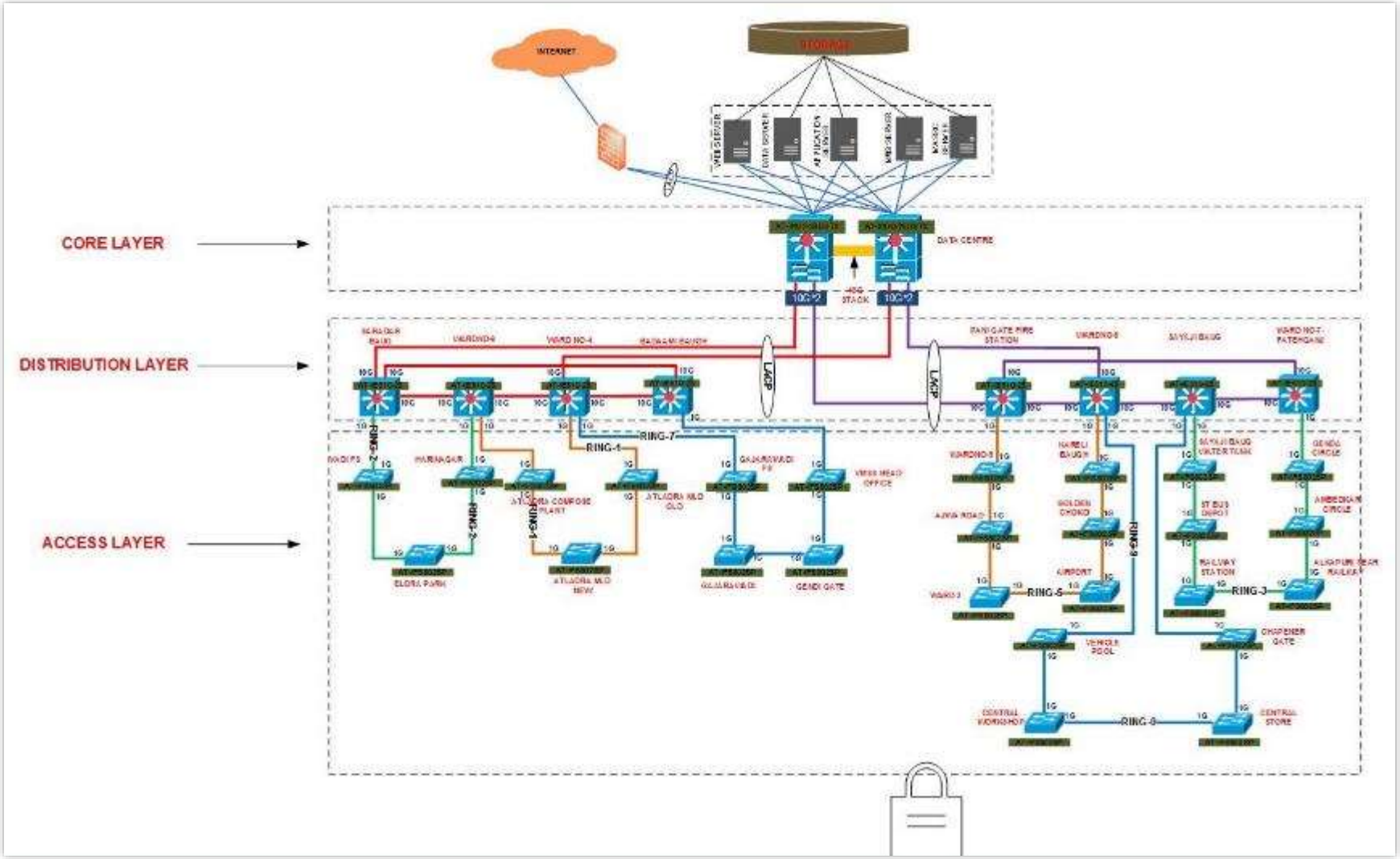


13. *Annexure IX : Information about CCTV (Vadodara Eye Project) and Signals*

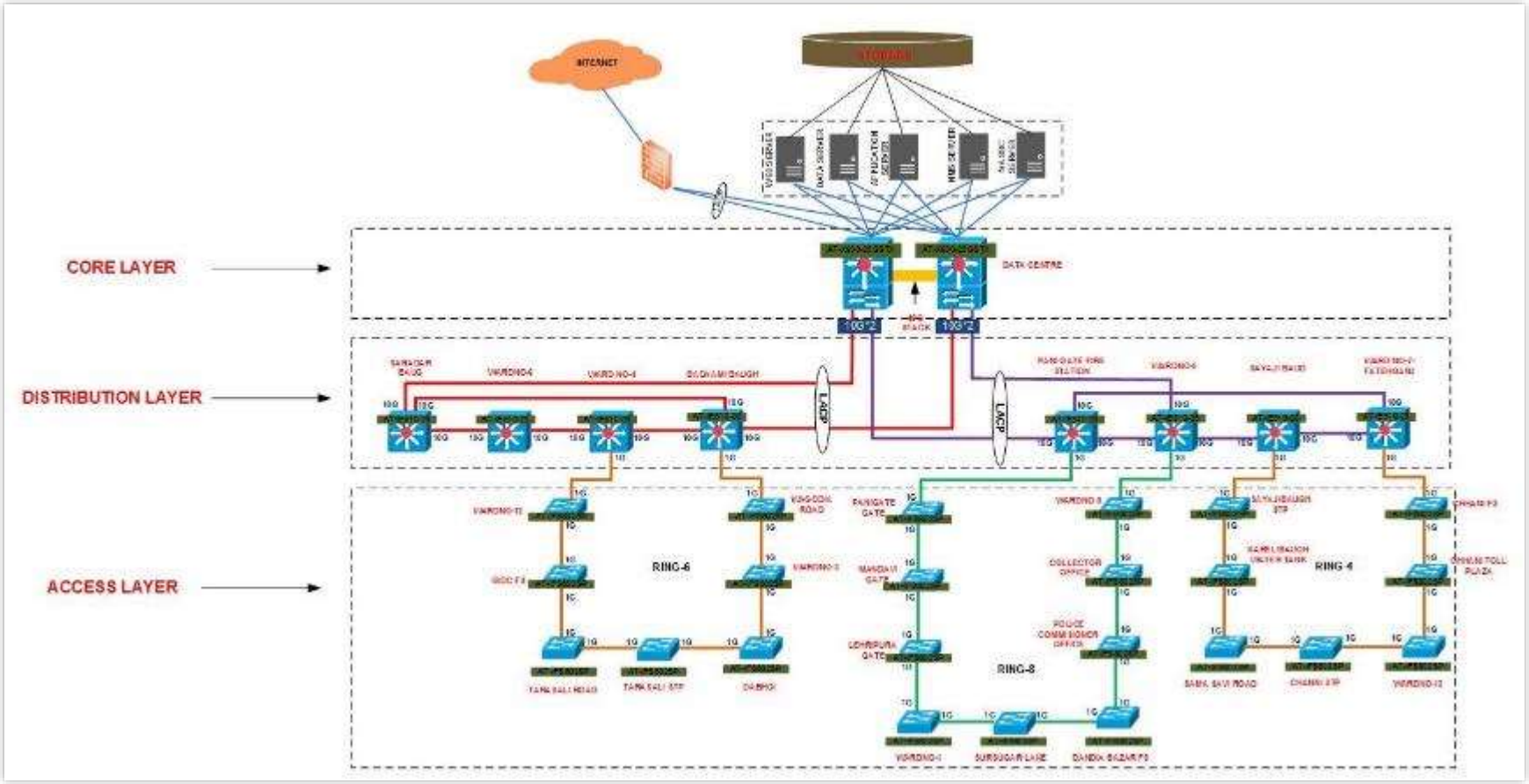
13.1. CCTV Network Ring Overview



13.2. CCTV Network Architecture



I. Diagram 2


INTERNET
CORE LAYER
DISTRIBUTION LAYER
ACCESS LAYER
DATA CENTRE
RING-6
RING-8
RING-4

13.3. Network Components of CCTV Project

Sr.	Description	Make & Model	Specification	Qty.
1.	Core Network Switches	Allied Telesis Core Switch-AT-x930-28GSTX	10/100/1000T (RJ-45) Copper Ports – 24 (Combo) 100/1000X SFP Ports – 24 (Combo) 1/10 Gigabit SFP+ Ports – 4 (2 if stacked) 10 Gigabit Stacking Ports – 2 Switching Fabric – 288 Gbps Forwarding Rate – 214.3 Mbps	2
2.	Distribution Switches	Allied Telesis AT-IE510-28GSX-80		As per diagram and list
3.	Access Switches	Allied Telesis AT-IFS802SP/POE (W)		As per diagram and list

13.4. OFC Network – Ring Route Details

Sr.	Ring Name	Location		Length (in KM)	No. of Ducts	Cores Used (Out of 24)
		From	To			
1.	**Core Ring**	Mujmahuda Teen Rasta	Ward No. 6	0.65	3	2
2.		Ward No. 6	OP Road T-Point (Opp. Toran Building)	0.15	3	6
3.		OP Road T-Point (Opp. Toran Building)	Havmor Circle Ring 2 Tapping	1.45	3	4
4.		Havmor Circle Ring 2 Tapping	Ambedkar Circle Ring 3 Tapping	1	3	2
5.		Ambedkar Circle Ring 3 Tapping	Sardaar Baugh T-Point Ring 2 Tapping	0.6	3	4
6.		Sardaar Baugh T-Point Ring 2 Tapping	Genda Circle	0.7	3	8
7.		Genda Circle	Fatehgunj Circle Ring 4 Tapping	1.53	3	8
8.		Fatehgunj Circle Ring 4 Tapping	Ward No. 7 T-Point	0.55	3	10
9.		Ward No. 7 T-Point	L&T Circle	0.85	3	10
10.		L&T Circle	Muktanand T-Point Ring 4/5 Tapping	0.48	3	10
11.		Muktanand T-Point Ring 4/5 Tapping	Sayaji Baugh STP	1.14	3	8
12.		Sayaji Baugh STP	Sayaji Baugh Amul Parlour Ring 3 Tapping	0.89	3	8
13.		Sayaji Baugh Amul Parlour Ring 3 Tapping	Sayaji Baugh Water Tank	0.15	3	10
14.		Sayaji Baugh Water Tank	Sayaji Baugh	0.44	3	10
15.		Sayaji Baugh	Opp. SSG Hospital Ring 8 Tapping	0.78	3	6
16.		Opp. SSG Hospital Ring 8 Tapping	Ward No. 5	1.05	3	8
17.		Ward No. 5	Vehicle Pool Dept.	1.6	3	6
18.		Vehicle Pool Dept.	Fatehpura Cross Road Ring9 tapping	0.35	3	4
19.		Fatehpura Cross Road Ring 9 Tapping	Mahavir Hall Cross Road Ring5 tapping	2.66	3	2
20.		Mahavir Hall Cross Road Ring 5 Tapping	UMA cross road Ring 6 Tapping	0.52	3	6
21.		UMA Cross Road Ring 6 Tapping	Panigate Fire Station	0.27	3	8
22.		Panigate Fire Station	Panigate	1.45	3	8
23.		Panigate	Mandvi Ring 9 Tapping	0.55	3	8
24.		Mandvi Ring 9 Tapping	Ward No. 1	0.45	3	6

25.		Ward No. 1	Nyay Mandir Ring 8 Tapping	0.13	3	6
26.		Nyay Mandir Ring 8 Tapping	Sursagar Ring 8 Tapping	0.4	3	4
27.		Sursagar Ring 8 Tapping	Dandiya Bazar Ring 7 Tapping	0.1	3	6
28.		Dandiya Bazar Ring 7 Tapping	Badamdi Baugh Ring8 Tapping	0.6	3	8
29.		Badamdi Baugh Ring 8 Tapping	Lalbaugh Cattle pong Ring 7 Tapping	3.1	3	10
30.		Lalbaugh Cattle Pong Ring 7 Tapping	Ward No. 4	0.6	3	4
31.		Ward No. 4	Spandan Cross Road Ring 6 Tapping	0.57	3	6
32.		Spandan Cross Road Ring 6 Tapping	Mujmahuda Teen Rasta	4.15	3	2
33.	**Ring - 1**	Mujmahuda Teen Rasta	Atladara Compose Plant	1.58	3	2
34.		Atladara Compose Plant	Atladara New STP	0.3	3	2
35.		Atladara New STP	Atladara Old STP	0.28	3	2
36.		Atladara Old STP	OP Road T-Point (OPP. Toran Building)	2	3	2
37.	**Ring - 2**	Havmor Circle Ring 2 Tapping	Ward No. 11	1.47	3	2
38.		Ward No. 11	Ward No. 10	2.14	3	2
39.		Ward No. 10	Vadivadi Fire Station	1.88	3	2
40.		Vadivadi Fire Station	Sardarbaugh	0.08	3	2
41.	**Ring - 3**	Sayaji Baugh Amul Parlour Ring 3 Tapping	S.T. Depot	0.93	3	2
42.		S.T. Depot	Railway Station	0.36	3	2
43.		Railway Station	Alkapuri Underpass	0.3	3	2
44.		Alkapuri Underpass	Ambedkar Circle Ring 3 Tapping	1.79	3	2
45.	**Ring - 4**	Fatehgunj Circle Ring 4 Tapping	Channi Fire Station	3.85	3	2
46.		Channi Fire Station	Channi toll plaza	2.97	3	2
47.		Channi Toll Plaza	Ward No. 13	0.59	3	2
48.		Ward No. 13	Channi STP	1.38	3	2
49.		Channi STP	Samasavali Road	4.18	3	2
50.		Samasavali Road	EME Ring 5 Tapping	3.1	3	2
51.		EME Ring 5 Tapping	Karelibaugh Water Tank	1.87	3	6
52.		Karelibaugh Water Tank	Muktanand T-Point Ring 4/5 tapping	1	3	6
53.	**Ring - 5**	EME Ring 5 Tapping	Golden Chokdi	3.54	3	4
54.		Golden Chokdi	Airport	2.9	3	4
55.		Airport	Ward No.2	1.4	3	4
56.		Ward No. 2	Ajwa Road	6.18	3	4
57.		Ajwa Road	Ward No. 9	2.8	3	4
58.		Ward No. 9	Mahavir Hall Cross Road Ring 5 Tapping	0.6	3	4

59.	**Ring - 6**	UMA Cross Road Ring 6 Tapping	Waghodia Road	2.42	3	2
60.		Waghodia Road	Ward No. 3	2.66	3	2
61.		Ward No. 3	Dabhoi Road	2.7	3	2
62.		Dabhoi Road	Tarsali STP	3.59	3	2
63.		Tarsali STP	Tarsali Road	1.22	3	2
64.		Tarsali Road	GIDC Fire station	4.33	3	2
65.		GIDC Fire station	Ward No. 12	0.1	3	2
66.		Ward No. 12	Spandan Cross Road Ring 6 Tapping	3.52	3	2
67.	**Ring - 7**	Lalbaugh Cattle Pong Ring7 tapping	Gajarawadi FS	1.6	3	2
68.		Gajarawadi FS	Gajarawadi STP	0.79	3	2
69.		Gajarawadi STP	Gendi Gate	2	3	2
70.		Gendi Gate	VMSS Office	1.12	3	2
71.		VMSS Office	Dandiya Bazar Ring 7 Tapping	0.41	3	2
72.	**Ring - 8**	Opp. SSG Hospital Ring 8 Tapping	Ward No. 8	0.99	3	6
73.		Ward No. 8	Collector Office	0.93	3	6
74.		Collector Office	Police Commissioner Office	0.57	3	6
75.		Police Commissioner Office	Badamadi Baugh Ring 8 Tapping	0.49	3	6
76.		Sursagar Ring 8 Tapping	Nyay Mandir Ring 8 Tapping	0.78	3	2
77.	**Ring - 9**	Fatehpura Cross Road Ring 9 Tapping	Central Workshop	0.67	3	2
78.		Central Workshop	Central Store	0.08	3	2
79.		Central Store	Chapener Gate	0.43	3	2
80.		Chapener Gate	Mandvi Ring 9 Tapping	0.38	3	2
81.	**Sayaji Baugh Internal Ring**	White House	Kalaghoda	0.24	3	2
82.		Kalaghoda	Bird House	0.37	3	2
83.		Bird House	Rinchh Ghar	0.16	3	2
84.		Rinchh Ghar	Chikhaliya Office	0.29	3	2
85.		Chikhaliya Office	Commissioner Bungalow	1.1	3	2
86.		Commissioner Bungalow	Amul Parlour	0.19	3	2
87.		Amul Parlour	Music Room	0.37	3	2
88.		Music Room	Canteen	0.21	3	2
89.		Canteen	White House	0.52	3	2

13.5. Current CCTV Location List

Sr.	CCTV Location	No. of Fix Cameras - New		No. of IP Dome Cameras - New		No. of PTZ Cameras - New	Port Details	
		Without IR	With IR	Without IR	With IR		Distribution Switch	Edge Switch
		46	18	59	2	128		
1.	Sursagar Lake					7		1
2.	Railway Station					3		1
3.	S.T. Bus Depot					1		1
4.	Mandavi Gate					4		1
5.	Gendi Gate					2		1
6.	Pani Gate					3		1
7.	Chapaner Gate					2		1
8.	Laheripura Gate					2		1
9.	L&T Circle					2		1
10.	Airport					2		1
11.	Office of Collector					2		1
12.	Office of Police Commissioner					2		1
13.	Chhani	1				1		1
14.	Sama–Savli Road	1				1		1
15.	Golden Chokdi	1				1		1
16.	Ajwa Road	1				1		1
17.	Waghodiya road	1				1		1
18.	Daboi road	1				1		1
19.	Tarsali Road	1				1		1
20.	Kalagoda Circle					3		1
21.	Tarasali 52 MLD Sewage Treatment Plant		1	2		2		1
22.	Gajarawadi 66 MLD Sewage Treatment Plant	1				5		1
23.	Sayaji Garden 8.5 MLD Sewage Treatment Plant	1		1		2		1
24.	Chhani 21 MLD STP	1	2	2		2		1
25.	Ataladara 43 MLD NEW Sewage Treatment Plant		1			2		1
26.	Ataladara 43 MLD OLD Sewage Treatment Plant		1	2		2		1
27.	Dandiya Bazaar Fire Station			1		1		1

28.	Vadi-Vadi Fire Station			1		1		1		
29.	Pani-Gate Fire Station			1		1	1	1		
30.	G.I.D.C. Fire Station			1		1		1		
31.	Gajarawadi Fire Station			1		1		1		
32.	T.P. 13 Chhani Fire Station			1		1		1		
33.	Atladara Compose Plant					2		1		
34.	Alkapuri near Railway Station					2		1		
35.	Ambedkar Teen Rasta					2		1		
36.	East Zone/Ward 2	3		6				2		
37.	Ward No. 1			4		1		1		
38.	Ward No. 9	1		3		2		1		
39.	South Zone/Ward no. 4	2		3		2	1	1		
40.	Ward No. 3			3		1		1		
41.	Ward No. 12	2		3				1		
42.	North Zone/Ward No. 5			3		1	1	1		
43.	Ward No. 7	2		3		1	1	1		
44.	Ward No. 8			4		1		1		
45.	West Zone/Ward No. 6	2				1	1	1		
46.	Ward No. 10	1		4		1		1		
47.	Ward No. 11	1		4		1		1		
48.	Ward No. 13	1		4		1		1		
49.	Sayajibaug	16	8			25	1			
	a. White House							1		
	b. Kalagoda							1		
	c. Bird House							1		
	d. Rinch House							1		
	e. Chikhaliya office							1		
	f. Canteen							1		
	g. Music Room							2		
	h. Amul Parlour							2		
	i. Commissioner House							1		
50.	Sardarbaug		3			7	1	2		
51.	Central Workshop, Navabazar	1				1		1		
52.	Vehicle Pool Department	1				3		1		
53.	Central Store	1				1		1		
54.	Sayajibaug Water Tank	1			2	1		1		
55.	Harni (Karelibaug) Water Tank		2	2		2		1		
56.	Lalbaug Cattle Pond					2		1		
57.	Genda Circle					2		1		
58.	Vadodara Municipal Corp - Office	1				2		1		
59.	Badamadibaug						1	1		

13.6. List of Hardware and Software Purchased as part of CCTV Project

DC Components

Sr. No	Description	Make & Model	Specification	Quantity
1	Servers	DELL, Power EDGE R820	Dell Poweredge R820 Intel Xeon E5-4640 v2; 4 Processor, 10 Cores 128GB memoy (8x 16GB) 3x600GB HDD (Usable 2x600GB per server) PERC H710 integrated RAID controller 1xQlogic 10Gb DA/SFP+ 2x SFP+ Short range optical transceiver LC connector 10Gb	4
2	Storage	IBM, IBM V7000 Storewize Unified	Storage - Min 500TB, Array should support , 10krpm of SAS-2 drives and 7.2k rpm of NL-SAS-2/SATA drives (maximum HDD capacity of 3/4 TB each), Memory - Min. 64GB upgradable to 128 GB or Higher per controller ,Front-end iscsi/SAS/FC/NAS(CISF/NFS)[All the required protocol should be enabled and made available for the system from day one] using special purpose storage controller for NAS protocols, 4 X 10 Gbps iSCSI / NAS (CIFS/ NFS) [for connectivity to Layer-3 switches] / 8 X 6 Gbps SAS [for direct connectivity to NVR, if required] / 4X 8 Gbps FC IBM Storewize V7000- Control Unit -1 IBM Storewize V7000- File Module -2 IBM Storewize V7000- Expansion -9	1
3	SAN Switch	CISCO DS-C9148S-12PK9	Ports per chassis: 12 port Port speed: 8-, 4-, 2-, and 1-Gbps autosensing with 8 Gbps of dedicated bandwidth per port	2
4	Work Station	DELL OPTIPLEX 7040 MTCPU	Processors1- Intel® 6th generation Core™ i5-i7 Quad Core, Core™ i3 Dual Core (65W for MT/SFF and 35W for Micro), Chipset - Intel® Q170 Chipset, Operating System- Microsoft® Windows 10 Home 64 - bit, Microsoft® Windows 10 Pro 64 - bit Microsoft® Windows 8.1 Standard 64-bit, Microsoft ® Windows 8.1 Pro 64-bit Microsoft® Windows 7® Professional SP1 (32/64 bit) Ubuntu®Neokylin® (China only), Integrated Intel® HD Graphics 530 Supports optional discrete graphics	20

			MT/SFF: nVIDIA GeForce GTX 745 (MT only), AMD Radeon™ R7 350X, AMD Radeon™ R5 340X, Up to 4 DIMM slots (2 for Micro); Non-ECC dual-channel 2133MHz DDR4 SDRAM, up to 32GB (16GB for Micro),	
5	Video Wall	Phoenix christie Controller + FHD552-X Ultra-narrow bezel 55" LCD display	Display technology screen size (diagonal) 55" Resolution 1920 x 1080 Direct LED	1 Lot (4x3)
6	Server Racks	Rittal - 42 U	Height-2100 Width-800 Depth-1150	6
7	80 KVA DG	CUMMINS, 125KVA	125KVA DG, Height : 1639mm, Width : 948mm, Length : 2509mm	1
8	80 KVA UPS	APC , MGE Galaxy 5500	Input voltage- 250V to 470V, Three Phase, Normal and bypass AC inputs-Separate Frequency (Hz)- 45 – 66 Hz, Input power factor- > .99,	1
9	PAC	Emerson PeX135 EC	On Kept Hold As per VMC instruction.	1

Sr No	Part No.	Part Description	Remarks	Charge Unit	Users	License Details
1	D0WBNLL	IBM Intelligent Operations Centre Consumer User per Resource Value Unit License + SW Subscription & Support 12 Months	Primarily view-based access with no update or edit capability of operational data. Going forward entire police and administration forces need to send the data through any means. We are factoring 5000 People	Resource Value Unit	5	Year 1 License + 12 Months Support + Subscription
2	E0FXCLL	IBM Intelligent Operations Centre Consumer User per Resource Value Unit Annual SW Subscription & Support Renewal 12 Months		Resource Value Unit	5	Year 2 Support & Subscription
3	E0FXCLL	IBM Intelligent Operations Centre Consumer User per Resource Value Unit Annual SW Subscription & Support Renewal 12 Months		Resource Value Unit	5	Year 3 Support & Subscription

4	D1JXYLL	IBM Intelligent Operations Centre Managed Object Resource Value Unit License + SW Subscription & Support 12 Months	An IBM Intelligent Operations Centre Managed Object allows the system to ingest data and optionally take action against a tangible object that is individually identified in the program. Considering 500 numbers devices including - Camers/Sensors/Switches/ Communication	Resource Value Unit	500	Year 1 License + 12 Months Support + Subscription
5	E0M4JLL	IBM Intelligent Operations Centre Managed Object Resource Value Unit Annual SW Subscription & Support Renewal Reseller authorization required	1 Mobile User Licenses for Department User	Resource Value Unit	500	Year 2 Support & Subscription
6	E0M4JLL	IBM Intelligent Operations Center Managed Object Resource Value Unit Annual SW Subscription & Support Renewal Reseller authorization required		Resource Value Unit	500	Year 3 Support & Subscription
7	D1FWNLL	IBM Intelligent Operations Center Mobile User User Value Unit License + SW Subscription & Support 12 Months	1 Mobile User Licenses for Department User	User Value Unit	1	Year 1 License + 12 Months Support + Subscription
8	E0LGYLL	IBM Intelligent Operations Center Mobile User User Value Unit Annual SW Subscription & Support Renewal 12 Months Reseller authorization required		User Value Unit	1	Year 2 Support & Subscription

9	E0LGYLL	IBM Intelligent Operations Center Mobile User User Value Unit Annual SW Subscription & Support Renewal 12 Months Reseller authorization required		User Value Unit	1	Year 3 Support & Subscription
10	D0WBQLL	IBM Intelligent Operations Center Standard User per Concurrent User License + SW Subscription & Support 12 Months	No. of Operators in the Command Center & External Viewing Centers @ 50 % Concurrency for 20 Operators in C&C. This user has all the capabilities of premium and developer capabilities. 2 Premium & 2 Developer.-10 Standard Users	Concurrent User	14	Year 1 License + 12 Months Support + Subscription
11	E0FXDLL	IBM Intelligent Operations Center Standard User per Concurrent User Annual SW Subscription & Support Renewal 12 Months		Concurrent User	14	Year 2 Support & Subscription
12	E0FXDLL	IBM Intelligent Operations Center Standard User per Concurrent User Annual SW Subscription & Support Renewal 12 Months		Concurrent User	14	Year 3 Support & Subscription
13	D140CLL	IBM Intelligent Video Analytics Resource Value Unit License + SW Subscription & Support 12 Months	66 Cameras = 58 RVU (as per IBM License Policy)	Resource Value Unit	58	Year 1 License + 12 Months Support + Subscription
14	E0J96LL	IBM Intelligent Video Analytics Resource Value Unit Annual SW Subscription & Support Renewal 12 Months		Resource Value Unit	58	Year 2 Support & Subscription

15	E0J96LL	IBM Intelligent Video Analytics Resource Value Unit Annual SW Subscription & Support Renewal 12 Months		Resource Value Unit	58	Year 3 Support & Subscription
16	D03LALL	IBM Sametime Unified Telephony Call Authorized User License + SW Subscription & Support 12 Months	Instant Messaging and Unified Communication. SI to ensure its usage as per TRAI Guidelines	Authorized User	30	Year 1 License + 12 Months Support + Subscription
17	E04KFLL	IBM Sametime Unified Telephony Call Authorized User SW Subscription & Support Renewal		Authorized User	30	Year 2 Support & Subscription
18	E04KFLL	IBM Sametime Unified Telephony Call Authorized User SW Subscription & Support Renewal		Authorized User	30	Year 3 Support & Subscription
19	D092ULL	IBM Sametime Unified Telephony Connect Authorized User License + SW Subscription & Support 12 Months	Instant Messaging and Unified Communication. SI to ensure its usage as per TRAI Guidelines	Authorized User	30	Year 1 License + 12 Months Support + Subscription
20	E06WELL	IBM Sametime Unified Telephony Connect Authorized User SW Subscription & Support Renewal		Authorized User	30	Year 2 Support & Subscription
21	E06WELL	IBM Sametime Unified Telephony Connect Authorized User SW Subscription & Support Renewal		Authorized User	30	Year 3 Support & Subscription
22	D11DJLL	IBM Sametime Communicate Authorized User License + SW Subscription & Support 12 Months	Instant Messaging and Unified Communication. SI to ensure its usage as per TRAI Guidelines	Authorized User	30	Year 1 License + 12 Months Support + Subscription
23	E0IC5LL	IBM Sametime Communicate Authorized User Annual SW Subscription & Support Renewal		Authorized User	30	Year 2 Support & Subscription

24	E0IC5LL	IBM Sametime Communicate Authorized User Annual SW Subscription & Support Renewal		Authorized User	30	Year 3 Support & Subscription

EMS Software Details

Sr No	Part Codes	Part Description	Qty
	Systems & Applications Monitoring		
	D0Q3VLL	IBM SMARTCLOUD APPLICATION PERFORMANCE MANAGEMENT ENTRY MANAGED VIRTUAL SERVER LICENSE + SW SUBSCRIPTION	**26**
	Network & Event Management		
	D15J0LL	IBM NETCOOL OPERATIONS INSIGHT NETWORK MANAGEMENT PA MANAGED VIRTUAL NETWORK DEVICE LIC + SW	**100**
	D15ITLL	IBM NETCOOL OPERATIONS INSIGHT NETWORK MANAGEMENT PA MANAGED VIRTUAL SERVER LIC + SW	**26**
	D1421LL	IBM NETCOOL OPERATIONS INSIGHT OPERATIONS MANAGEMENT MANAGED VIRTUAL NETWORK DEVICE LICENSE + SW SUBSCRIPTION	**#**
	D141VLL	IBM NETCOOL OPERATIONS INSIGHT OPERATIONS MANAGEMENT PA MANAGED VIRTUAL SERVER LIC + SW	**26**
	D1KITLL	IBM NETCOOL OPERATIONS INSIGHT PERFORMANCE MANAGEMENT MANAGED VIRTUAL NETWORK DEVICE LICENSE + SW SUBSCRIPTION	**20**
	D0TCFLL	IBM TIVOLI NETCOOL PERFORMANCE MANAGER BASE INSTALL	**1**
	D0TCPLL	IBM TIVOLI NETCOOL PERFORMANCE MANAGER BASE RESOURCE VALUE	**#**
	D0TCILL	IBM TIVOLI NETCOOL PERFORMANCE MANAGER TECHPACKS TIER 1 INSTALL	2
	D0TCQLL	IBM TIVOLI ELITE SUPPORT FOR IBM NETCOOL PERFORMANCE MANAGER BASE INSTALL	1
	D0TCZLL	IBM TIVOLI ELITE SUPPORT FOR IBM NETCOOL PERFORMANCE MANAGER BASE RESOURCE VALUE UNIT	#
	D0TCTLL	IBM TIVOLI ELITE SUPPORT FOR IBM NETCOOL PERFORMANCE MANAGER TECHPACKS TIER 1 INSTALL	2

13.7. Information about existing Traffic Signals

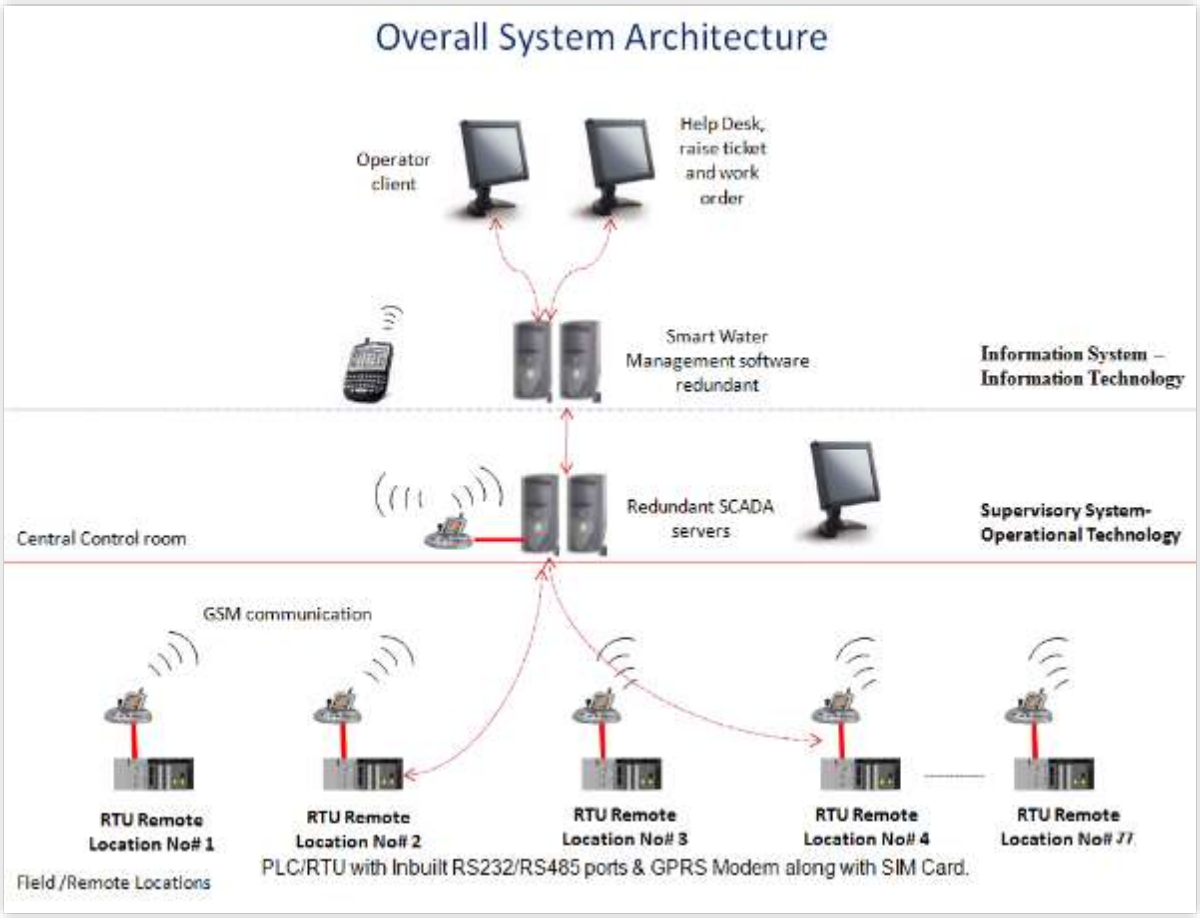
The following table provides the details of the existing Traffic signals in Vadodara which are installed by VMC.

#	Type of Traffic Signal System	Number of Junctions
1	Fixed Time Traffic Signals – LED Head/Signal	29
2	Fixed Time Traffic Signals- Conventional Head/Signal	9

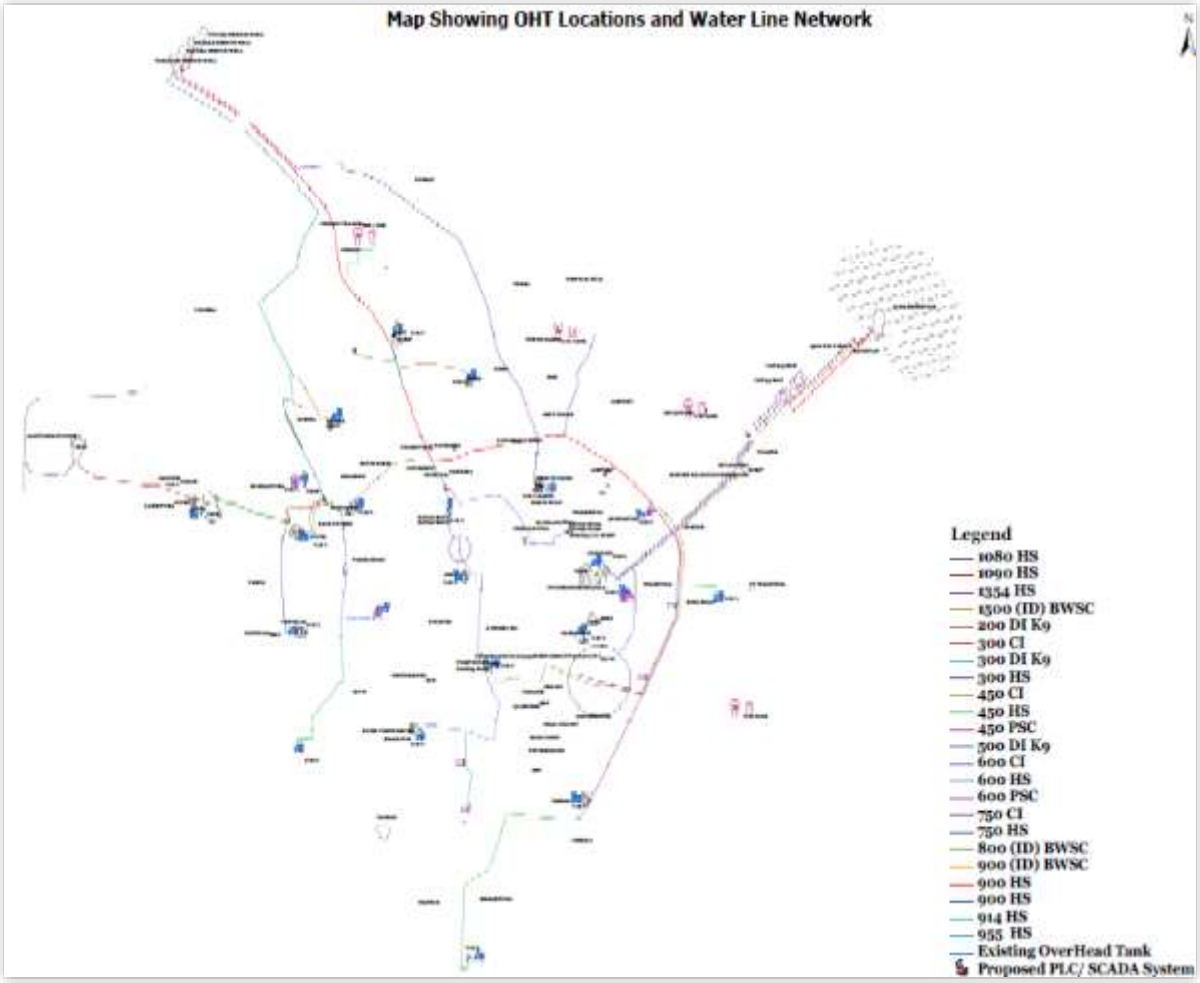
It will be the responsibility of the System Integrator (SI) to retrofit these traffic signals without any damage, with new ATCS Elements (using maximum existing infrastructure). The detailed locations are provided in the **Annexure I** of this document.

14. Annexure X : Information about Water SCADA Project

14.1. System Architecture



14.2.OHT Locations and Water Line Network



14.3.BOQ of SCADA Operational Components

Sr.	Item	Qty.	Make	Model
1.	Level Transmitters	98	Masibus	-
2.	Flow Meters	97		
3.	Pressure Transmitters	131		
4.	Chlorine Analyzer	42		
5.	pH Analyzer	42		
6.	Turbidity Analyzer	4		
7.	Earthling Pit	73		
8.	Cabling and Allied Accessories Works at 73 Locations (Elect./ Mech.) in LOT	1		
9.	Butterfly Valves & Actuators	91	AUMA	SA
10.	PLC/RTU	77	Pyrotech	-

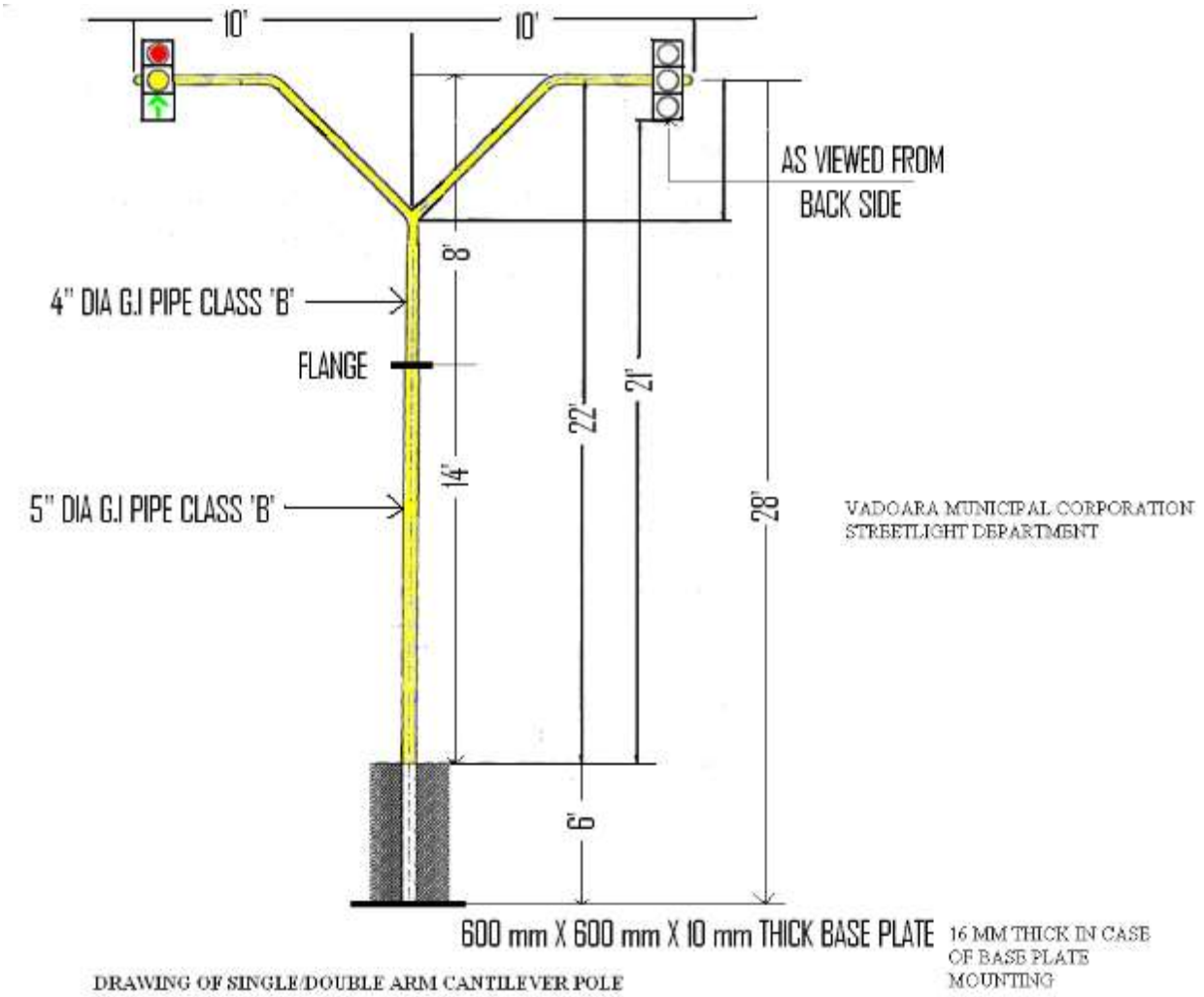
14.4.BOQ of SCADA IT Components

Sr.	Item	Location	Qty.	Make	Model
1.	Smart Water Management Redundancy Software (ICT) Licenses with 15 clients integration with SCADA system	CCC DC	1	Siemens	WinCC OA (iVisionmax)
2.	Communication and Messaging Software	CCC DC	1	Siemens	WinCC OA (iVisionmax)
3.	GIS Layer for Water Assets on 1:2500 Vector Map (in Sq. Kms.)	CCC DC	200		
4.	Mobile Application License for Work Force Management (Based on user requirement for each work force. Users to be considered 100 Nos).	CCC DC	1	Siemens	WinCC OA (iVisionmax)
5.	Local Control System as per specification PLC/RTU	Field	77	Schneider	M340 Series CPU Model: BMXP342020H
6.	SCADA Application Software with Redundancy	CCC DC	1	Siemens	WinCC OA (iVisionmax)
7.	Servers for Smart Water Management Database	CCC DC	2	Dell	PowerEdge R730
8.	Servers for GIS and Communication Messaging Software	CCC DC	2	Dell	PowerEdge R730
9.	Help Desk Application with Servers	CCC DC	2	Dell	PowerEdge R730
10.	Disk Storage System SAN 10 TB	CCC DC	1	Dell	PowerVault MD3820F
11.	SAN Switch – 8 Port	CCC DC	2	Dell	Brocade 6505
12.	Layer 3 Switch	CCC DC	2	Dell	Brocade ICX7450-48
13.	SCADA Primary Server	CCC DC	1	Dell	PowerEdge R730
14.	SCADA Redundant Server	CCC DC	1	Dell	PowerEdge R730
15.	Layer 2 Switch	CCC DC	1	Dell	Brocade ICX7450-24
16.	UPS 3 KVA with 1 Hour Backup	Field	77	APC	SRC3kUXI
17.	Video Wall (55” LED cube in 4 x 2 configurations)	CCC DC	1	Christie	FHD552-X

18.	Work Stations and Software	CCC	6	Dell	Optiplex 3040 SFF Monitor: E2216H
19.	20 KVA UPS with 10 Min Back up		2		Yet to be supplied

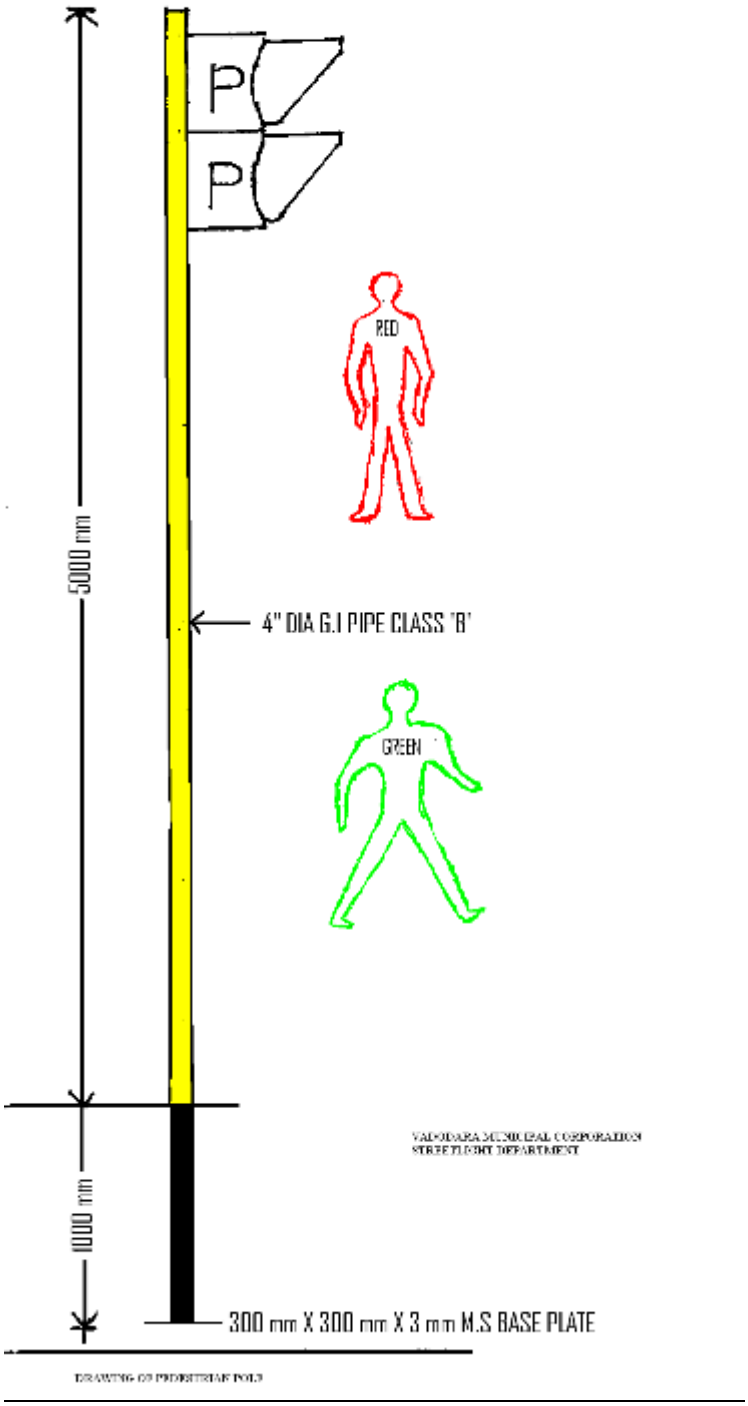
15. Annexure XI- Traffic Signal Poles Drawings

15.1. Cantilever Pole (Single / Double Arm) Design



DRAWING OF SINGLE/DOUBLE ARM CANTILEVER POLE

15.2. Pedestrian Pole Design



15.3. Field Devices and Sensors Maintenance

The following maintenance activities are to be performed by SI during project implementation and O&M Period. The list features most salient activities and not an exhaustive list.

- Prompt attendance and compliance OR any complain of any CCTV Camera/traffic signal/Sensors/Junction Box etc given by VSCDL/VMC Staff or from Traffic Police Staff.
- Site visit by technician of all the junction/field locations on specified scheduled intervals and he should get the signature of traffic police staff in his diary. The dairy shall be submitted to the Engineer-in-charge of the VSCDL/VMC as and when asked.
- In case of emergency, the SI should attend the site immediately.
- The SI has to carry out Replacement/Maintenance of the field devices within specified SLA duration, from the receipt of the complaints.
- Periodical checking and cleaning of all field equipment such as Camera, ANPR systems, Sensors, LED Signboards/Display boards, Controllers, signal head, Signal Lamps, its accessories specifically the cleaning of reflector and polycarbonate glass should be done fortnightly.
- Checking & tighting of cable terminals, replacement of wiring of field poles and to attend cable faults.
- Painting of all poles, signal heads and junction boxes etc. once a year with approved/specified colour as directly by Engineer-in-charge.
- Muffing of poles should be done as and when suggested by Engineer-in-charge.
- Traffic signal shall be programmed (when operating in Non ATCS Mode) as per instruction of traffic Police Department and it shall be informed to the VSCDL/VMC.
- Contractor shall submit programmed of traffic cycle including Sundays & Holiday to the VSCDL/VMC.
- Date wise fault attend, material replaced and replacement of accessories statement shall be prepared fort nightly and submit monthly in the Performa prepared by the department.
- Non availability of electric power at signals should be immediately informed to Engineer-in-charge and concerned sub division of electric utility company.
- Project Manager or other Senior level Officer of SI shall take joint round of all field devices with the Engineer of the VSCDL/VMC as and when required or at every two months.
- No Extra charge will be paid to SI on account of any additional material and labour.
- All precautionary measures must be taken by the successful bidder to safe guard life of residents/citizens/pedestrian.
- Poster, Banner or any advertisement will not be allowed on any field device or poles (unless , the contractor shall take enough care in this regard.